CLEANING OF WIRE HARNESSES

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CLEANING OF WIRE HARNESSES

This Subject gives the procedures to the remove the contamination from these wire harness components:

- A wire
- A cable
- A wire harness support
- The external surface of a connector
- A connector backshell
- A strain relief clamp.

1. GENERAL DATA

A. Necessary Conditions for Fire Safety

Refer to Subject 20-00-10 for more safety conditions.

These conditions are applicable for a solvent or a flammable aqueous cleaner:

- The conditions for fire safety specified by the manufacturer must be obeyed
- The necessary local conditions for fire safety must be obeyed
- The airplane must be electrostatically grounded; refer to the Aircraft Maintenance Manual
- The material must be kept in an approved closed container
- Only the quantity of material that is necessary to clean the wire harness or wire harness components must be kept near the airplane
- A wiper or a cloth that is made from a synthetic material is not permitted.

WARNING: CAREFULLY READ THE INSTRUCTIONS AND CAUTIONS FROM THE MANUFACTURER OF THE MATERIAL FOR MORE SAFETY CONDITIONS. IF ALL OF THE SPECIFIED CONDITIONS ARE NOT OBEYED, INJURY TO PERSONNEL CAN OCCUR.

CAUTION: CAREFULLY READ THE INSTRUCTIONS AND CAUTIONS FROM THE MANUFACTURER OF THE MATERIAL FOR MORE SAFETY CONDITIONS. IF ALL OF THE SPECIFIED CONDITIONS ARE NOT OBEYED, DAMAGE TO EQUIPMENT CAN OCCUR.

B. Necessary Conditions for Personnel Safety

These conditions are applicable for a cleaning material:

- The conditions for personnel safety specified by the manufacturer must be obeyed
- The necessary local conditions for personnel safety must be obeyed
- A cleaner must not touch the skin or the eyes
- The vapors from a cleaner must not be breathed.

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WARNING: CAREFULLY READ THE INSTRUCTIONS AND CAUTIONS FROM THE MANUFACTURER OF THE MATERIAL FOR MORE SAFETY CONDITIONS. IF ALL OF THE SPECIFIED CONDITIONS ARE NOT OBEYED, INJURY TO PERSONNEL CAN OCCUR.

These equipment are recommended for protection:

- An apron
- Boots
- Coveralls
- Rubber gloves
- Chemical goggles
- An approved eye protection.

To make sure that fumes are not breathed, one of these conditions must occur:

- The area has a good airflow
- The personnel have sufficient respiratory protection.

C. General Conditions for Cleaning a Wire Harness

These conditions are applicable:

- Equipment or a component that is sensitive to contamination, solvents, or water and that is near the area that must be cleaned, must have satisfactory protection
- All disconnected connectors in the area must have protection
- A solvent, a cleaner, contamination, or water must not go into a connector
- A paint, a plastic, a polymeric material, or an adhesive must be fully cured before it can be cleaned.

CAUTION: FLUID OR CONTAMINATION IN A CONNECTOR CAN CAUSE UNSATISFACTORY PERFORMANCE OF THE CONNECTOR.

D. General Conditions for Cleaning with a Solvent

These conditions are applicable:

- The mixture of the solvent and the contamination must be a safe mixture
- Different solvents must not be mixed
- A solvent must not be mixed with an aqueous cleaner
- The solvent must be a permitted cleaner for the materials in a wire harness
- The local environmental laws must be obeyed
- The solvent must be applied only with the procedure that is permitted or specified.

WARNING: IT CAN BE DANGEROUS TO MIX SOME TYPES OF SOLVENTS WITH SOME TYPES OF CONTAMINATION. MAKE SURE THAT THE MIXTURE OF THE SOLVENT AND THE CONTAMINATION IS PERMITTED. INJURY TO PERSONNEL CAN OCCUR.

CAUTION: A SOLVENT THAT IS NOT SPECIFIED FOR THE MATERIALS AND THE COMPONENTS IN A WIRE HARNESS MUST NOT BE APPLIED TO THE WIRE HARNESS. DAMAGE TO THE WIRE HARNESS CAN OCCUR.

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E. General Conditions for Cleaning with an Aqueous Cleaner

These conditions are applicable:

- The mixture of the aqueous cleaner and the contamination must be a safe mixture
- The maximum permitted pH of a cleaner is 9.0
- Different cleaners must not be mixed
- An aqueous cleaner must not be mixed with a solvent
- The cleaner must be a permitted cleaner for the materials in a wire harness
- The area that must be cleaned must sufficiently drain large volumes of liquid
- The sensitive components in the area must have satisfactory protection; refer to the Aircraft Maintenance Manual
- The local environmental laws must be obeyed
- The cleaner must be applied only with the procedure that is permitted or specified.

WARNING: IT CAN BE DANGEROUS TO MIX SOME TYPES OF AQUEOUS CLEANERS WITH SOME TYPES OF CONTAMINATION. MAKE SURE THAT THE MIXTURE OF THE CLEANER AND THE CONTAMINATION IS PERMITTED. INJURY TO PERSONNEL CAN Ooccur.

CAUTION: AN AQUEOUS CLEANER THAT HAS A PH MORE THAN 9.0 MUST NOT BE APPLIED TO THE WIRE HARNESS. DAMAGE TO THE WIRE HARNESS AND OTHER EQUIPMENT CAN OCCUR.

CAUTION: AN AQUEOUS CLEANER THAT IS NOT SPECIFIED FOR THE MATERIALS AND THE COMPONENTS IN A WIRE HARNESS MUST NOT BE APPLIED TO THE WIRE HARNESS. DAMAGE TO THE WIRE HARNESS CAN OCCUR.

CAUTION: A HIGH VOLUME OF AQUEOUS CLEANER MUST NOT BE APPLIED TO AN AREA UNLESS THE LIQUID CAN DRAIN SUFFICIENTLY. IF THE LIQUID DOES NOT DRAIN SUFFICIENTLY, DAMAGE TO THE EQUIPMENT OR A STRUCTURE CAN OCCUR.

F. Necessary Materials and Tools

Table 1
RECOMMENDED SOLVENTS

Solvent	Specification	Supplier
Alcohol, Isopropyl	TT-I-735 Grade A	An available source
	TT-I-735 Grade B	An available source
Alcohol, Denatured, Ethyl	O-E-760	An available source
Naphtha, Aliphatic	TT-N-95, Type II	An available source

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Table 2
NECESSARY TOOLS

Material or Tool	Description	Part Number or Specification	Supplier
Brush	1. The bristles are soft and not abrasive; 2. The bristle retainer is not metal; 3. The cleaners do not cause damage to the brush materials	Specified by supplier	An available source
Cloth, Cleaning	Cotton, non-woven	CCC-C-46	An available source
Compressed Gas	Air, Clean and dry	Specified by supplier	An available source
	Nitrogen, Clean and dry	Specified by supplier	An available source
Swabs	Cotton, lint free	Specified by supplier	An available source
Vacuum	The brush has soft bristles	Specified by supplier	An available source
Wiper	Cotton, low lint	Specified by supplier	An available source
	Cotton, non-woven Grade 142951	BMS15-5 Class A	BBA Nonwovens Walpole
	Cotton, cheesecloth No. 10, 20, 40	BMS15-5 Class A	American Fiber & Finishing
	Cotton, cheesecloth No. 9017	BMS15-5 Class A	DeRoyal Textiles
	Cotton, gauze sponge No. 582556	BMS15-5 Class A	American Fiber & Finishing
	Cotton, gauze sponge No. 9405	BMS15-5 Class A	DeRoyal Textiles
	Cotton, HAN SIN SANG SA Fabric Code No. 3030	BMS15-5 Class A	HO CHANG Medical Company
	Cotton, Hermitex No. 300, 400	BMS15-5 Class A	DeRoyal Textiles
	Cotton, Rymplecloth No. 201, 300, 301	BMS15-5 Class A	American Fiber & Finishing
	Cotton, Weston cloth No. 8000	BMS15-5 Class A	Nippon Weston Company

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2. SELECTION OF A CLEANING PROCEDURE

A. Selection of an Applicable Cleaning Procedure

NOTE: Connectors can be environmentally sealed or unsealed. Each type has a different cleaning procedure. Environmentally sealed connectors are identified in Subject 20-60-08.

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Table 3
SELECTION OF A CLEANING PROCEDURE FOR THE PRESSURIZED AREA

Contamination				Cleaning Procedure
Location	**Form**	**State**	**Example**	
A wire, a cable, or a wire harness support clamp	Fluid, petroleum based or a hydraulic fluid	Wet or dry	BMS3-11, chemical, chemical cleaner, corrosion inhibiting compound, fuel, hydraulic fluid, oil, paint	Paragraph 3.A.
	Fluid, not petroleum based	Wet or dry	Chemical, chemical cleaner, de-icing fluid, food products, lavatory waste water, urine, salt water, soft drink, solvent	Paragraph 3.D.
	Solid, not petroleum based	Dry	Dirt, fecal matter, food, soot	Paragraph 3.C.
	Solid, not petroleum based	Loose particles, abrasive	Dirt, foreign object, metal particle, corrosion particle that falls from a part, sand	Paragraph 3.C.
	Solid, not petroleum based	Loose particles, not abrasive	Dust, lint, food, foreign object	Paragraph 4.A.
	Semi-solid	Wet or dry	Adhesive, grease, mud, sealant	Paragraph 3.A.
	Mixture of fluid and solid, petroleum based or hydraulic fluid	Wet or dry	Oil and dirt	Paragraph 3.A.
	Mixture of fluid and solid, not petroleum based	Wet or dry	Lavatory waste water and dirt	Paragraph 3.D.
The external surface of an unsealed connector, a backshell, a strain relief clamp	Fluid; solid; mixture of a fluid and a solid; semi-solid	Wet or dry	All types	Paragraph 4.C.
The external surface of an environmentally sealed connector, a backshell, a strain relief clamp	Fluid; solid; mixture of a fluid and a solid; semi-solid	Wet or dry	All types	Paragraph 4.B.
The internal surface of a connector	Fluid; solid; mixture of a fluid and a solid; semi-solid	Wet or dry	All types	Subject 20-60-01

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Table 4
SELECTION OF A CLEANING PROCEDURE FOR THE UNPRESSURIZED AREA

Contamination				Cleaning Procedure
Location	**Form**	**State**	**Example**	
A wire, a cable, or a wire harness support clamp	Fluid, petroleum based or a hydraulic fluid	Wet or dry	BMS3-11, chemical, chemical cleaner, corrosion inhibiting compound, fuel, hydraulic fluid, oil, paint	Paragraph 3.A.
				Paragraph 3.B.
	Fluid, not petroleum based	Wet or dry	Chemical, chemical cleaner, de-icing fluid, food products, lavatory waste water, urine, salt water, soft drink, solvent	Paragraph 3.D.
	Solid, not petroleum based	Dry	Dirt, fecal matter, food, soot	Paragraph 3.C.
	Solid, not petroleum based	Loose particles, abrasive	Dirt, foreign object, metal particle, corrosion particle that falls from a part, sand	Paragraph 3.C.
	Solid, not petroleum based	Loose particles, not abrasive	Dust, lint, food, foreign object	Paragraph 4.A.
	Semi-solid	Wet or dry	Adhesive, grease, mud, sealant	Paragraph 3.A.
	Mixture of fluid and solid, petroleum based or hydraulic fluid	Wet or dry	Oil and dirt	Paragraph 3.A.
	Mixture of fluid and solid, not petroleum based	Wet or dry	Lavatory waste water and dirt	Paragraph 3.D.
The external surface of an environmentally sealed connector, a backshell, a strain relief clamp	Fluid; solid; mixture of a fluid and a solid; semi-solid	Wet or dry	All types	Paragraph 4.B.
The internal surface of a connector	Fluid; solid; mixture of a fluid and a solid; semi-solid	Wet or dry	All types	Subject 20-60-01

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3. CLEANING OF A WIRE HARNESS THAT HAS CONTAMINATION ON THE INTERNAL SURFACES

A. Removal of Heavy Contamination with a Solvent

Heavy contamination can be:

- A petroleum based material
- A hydraulic fluid
- A wet or dried mixture of a fluid and a solid
- A wet or dried semi-solid.

Refer to Paragraph 2.A. for the conditions that are applicable for this procedure.

(1) Identify the electrical system that must be cleaned.

(2) Open all circuit breakers and all switches for the wire harness and the equipment in the area that must be cleaned. Refer to Subject 20-00-10.

Make sure that the applicable wire harness or wire harnesses are de-energized.

(3) Electrostatically ground the airplane. Refer to the Aircraft Maintenance Manual.

(4) Install the necessary protection for all equipment and all components that are sensitive to contamination and solvents.

Make sure that all disconnected connectors in the area have sufficient protection.

(5) Make a selection of:

- An aliphatic naphtha from Table 1
- An isopropyl alcohol from Table 1
- A wiper or a cloth from Table 2.

WARNING: SOLVENTS ARE FLAMMABLE. MAKE SURE THAT THE QUANTITY OF SOLVENT NEAR THE AIRPLANE IS NOT MORE THAN THE QUANTITY THAT IS NECESSARY TO CLEAN THE WIRE HARNESS.

CAUTION: A SOLVENT THAT IS NOT SPECIFIED FOR THE MATERIALS AND THE COMPONENTS IN A WIRE HARNESS MUST NOT BE APPLIED. DAMAGE TO THE WIRE HARNESS CAN OCCUR.

(6) Disassemble a short length of the wire harness:

(a) Remove the necessary wire harness supports to get access to the contamination.

Make sure that the wire harness has sufficient support after the supports are removed.

(b) Remove the wire harness ties along the free length.

(c) Move the wires apart.

CAUTION: A WIRE OR A CABLE MUST NOT BE MOVED MORE THAN IT IS NECESSARY TO CLEAN IT. DAMAGE TO THE WIRE OR THE CABLE CAN OCCUR.

(7) Remove the contamination.

Refer to Paragraph 4. for the procedure to remove the contamination from:

- A backshell
- The external surface of the connector
- An area of a wire that is less than 6 inches from the end of a connector.

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CLEANING OF WIRE HARNESSES

CAUTION: MAKE SURE TO PREVENT THE MOVEMENT OF THE CONTAMINATION TO A DIFFERENT WIRE HARNESS COMPONENT. DAMAGE TO THE COMPONENT CAN OCCUR.

CAUTION: A WIRE MARK OR AN IDENTIFICATION TAPE MUST NOT BE CLEANED WITH TOO MUCH FORCE. DAMAGE TO THE WIRE IDENTIFICATION CAN OCCUR.

CAUTION: SURFACES WITH PROTECTIVE FINISHES MUST BE CLEANED CAREFULLY. REMOVAL OF THE PROTECTIVE FINISH CAN CAUSE UNSATISFACTORY PERFORMANCE OF THE EQUIPMENT OR THE STRUCTURE.

(a) Put the sufficient quantity of aliphatic naphtha on the wiper to make it moist.

CAUTION: THE WIPER MUST NOT HAVE TOO MUCH ALIPHATIC NAPHTHA. THE NAPHTHA CAN GET INTO A WIRE HARNESS COMPONENT AND DAMAGE TO THE COMPONENT CAN OCCUR.

(b) Carefully remove the contamination from each component with the wiper.

NOTE: A moist brush can help loosen the particles.

CAUTION: ALIPHATIC NAPHTHA MUST NOT BE APPLIED ON CONTROL CABLES, ACRYLIC SURFACES, DECALS, OR FINISHES THAT ARE NOT MADE FROM CLASS 1 MATERIALS. DAMAGE TO THE COMPONENT CAN OCCUR.

CAUTION: ALIPHATIC NAPHTHA MUST NOT BE APPLIED ON A SURFACE THAT HAS A CORROSION INHIBITING COMPOUND UNLESS THE CORROSION INHIBITING COMPOUND MUST BE REMOVED AND THEN APPLIED AGAIN.

CAUTION: ALIPHATIC NAPHTHA MUST NOT STAY ON A WIRE HARNESS COMPONENT. REMAINING NAPTHA CAN CAUSE UNSATISFACTORY PERFORMANCE OF THE WIRE HARNESS COMPONENT.

(c) Dry the cleaned area with a new wiper.

NOTE: As an alternative, compressed gas at 30 PSI can be applied to remove the remaining naptha. Refer to Table 2.

WARNING: COMPRESSED GAS CAN BE DANGEROUS. TO PREVENT AN INJURY, CAREFULLY APPLY THE GAS IN A DIRECTION AWAY FROM THE EYES, THE FACE, AND OTHER PERSONNEL.

(d) Do Step (a) through Step (c) again until all of the contamination is removed.

(e) Put the sufficient quantity of isopropyl alcohol on the wiper to make it moist.

(f) Carefully clean the areas where the naptha was applied.

(g) Dry the cleaned area with a new wiper.

NOTE: As an alternative, compressed gas at 30 PSI can be applied to remove the remaining naptha. Refer to Table 2.

WARNING: COMPRESSED GAS CAN BE DANGEROUS. TO PREVENT AN INJURY, CAREFULLY APPLY THE GAS IN A DIRECTION AWAY FROM THE EYES, THE FACE, AND OTHER PERSONNEL.

(8) Examine the wire harness components and supports.

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Make sure that the components and supports are clean and fully dry.

(9) Assemble the wire harness to make it the same as the initial configuration.

(10) Install the wire harness supports.

(11) Do Step (6) through Step (10) again until all of the contamination on the wire harness is removed.

B. Removal of Heavy Contamination with an Aqueous Cleaner

This procedure is recommended for the unpressurized areas where a high volume of liquid can drain sufficiently. Refer to Paragraph 2.A.

CAUTION: A HIGH VOLUME OF AQUEOUS CLEANER MUST NOT BE APPLIED TO AN AREA UNLESS THE LIQUID CAN DRAIN SUFFICIENTLY. IF THE LIQUID DOES NOT DRAIN SUFFICIENTLY, DAMAGE TO THE EQUIPMENT OR A STRUCTURE CAN OCCUR.

Heav contamination can be:

- A petroleum based material
- A hydraulic fluid
- A wet or dried mixture of a fluid and a solid
- A wet or dried semi-solid.

(1) Identify the electrical system that must be cleaned.

(2) Open all circuit breakers and all switches for the wire harness and the equipment in the area that must be cleaned. Refer to Subject 20-00-10.

Make sure that the applicable wire harness or wire harnesses are de-energized.

(3) Electrostatically ground the airplane. Refer to the Aircraft Maintenance Manual.

(4) Install the necessary protection for all equipment and the components that are sensitive to contamination and cleaners. Refer to the Aircraft Maintenance Manual.

Make sure that all of the disconnected connectors in the area have sufficient protection.

CAUTION: COVERS, BLACK POLYETHYLENE SHEET, AND VINYL ADHESIVE TAPE MUST BE INSTALLED TO KEEP LIQUIDS OUT OF AREAS THAT CONTAIN MECHANICAL, ELECTRICAL, OR HYDRAULIC COMPONENTS. LIQUIDS THAT GO INTO THESE AREAS CAN CAUSE CORROSION, CAN FREEZE DURING AIRPLANE FLIGHT, OR CAN REMOVE NECESSARY LUBRICANTS.

(5) Make a selection of:

- An aqueous cleaner; refer to Paragraph 1.E.
- A brush from Table 2
- A wiper or a lint free cloth from Table 2.

WARNING: SOME CLEANERS ARE FLAMMABLE. MAKE SURE THAT THE QUANTITY OF A FLAMMABLE CLEANER NEAR THE AIRPLANE IS NOT MORE THAN THE QUANTITY THAT IS NECESSARY TO CLEAN THE WIRE HARNESS.

CAUTION: A CLEANER THAT IS NOT SPECIFIED FOR THE MATERIALS AND THE COMPONENTS IN A WIRE HARNESS MUST NOT BE APPLIED. DAMAGE TO THE WIRE HARNESS CAN OCCUR.

(6) Disassemble a short length of the wire harness:

(a) Remove the necessary wire harness supports to get access to the contamination.

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Make sure that the wire harness has sufficient support after the supports are removed.

(b) Remove the wire harness ties along the free length.

(c) Move the wires apart.

CAUTION: A WIRE OR A CABLE MUST NOT BE MOVED MORE THAN IT IS NECESSARY TO CLEAN IT. DAMAGE TO THE WIRE OR THE CABLE CAN OCCUR.

(7) Make a mixture of the cleaner and water. Refer to the instructions of the manufacturer of the cleaner.

(8) Measure the pH level of the mixture.

Make sure the pH level is 9.0 or less.

CAUTION: AN AQUEOUS CLEANER MIXTURE WITH A PH THAT IS MORE THAN 9.0 MUST NOT BE APPLIED. DAMAGE FROM CORROSION CAN OCCUR.

(9) Remove the contamination.

Refer to Paragraph 4. for the procedure to remove the contamination from:

- A backshell
- The external surface of the connector
- An area of a wire that is less than 6 inches from the end of a connector.

CAUTION: MAKE SURE TO PREVENT THE MOVEMENT OF THE CONTAMINATION TO A DIFFERENT WIRE HARNESS COMPONENT. DAMAGE TO THE COMPONENT CAN OCCUR.

CAUTION: A WIRE MARK OR AN IDENTIFICATION TAPE MUST NOT BE CLEANED WITH TOO MUCH FORCE. DAMAGE TO THE WIRE IDENTIFICATION CAN OCCUR.

CAUTION: SURFACES WITH PROTECTIVE FINISHES MUST BE CLEANED CAREFULLY. REMOVAL OF THE PROTECTIVE FINISH CAN CAUSE UNSATISFACTORY PERFORMANCE OF THE EQUIPMENT OR THE STRUCTURE.

(a) Apply the mixture with one of these tools:

- A hose
- A wiper
- A brush.

CAUTION: THE FLOW OF CLEANING MIXTURE MUST NOT BE APPLIED LESS THAN 6 INCHES FROM A CONNECTOR. THE MIXTURE CAN GO INTO THE CONNECTOR AND DAMAGE TO THE CONNECTOR CAN OCCUR.

CAUTION: WATER PRESSURE OF 80 PSI OR LESS MUST BE APPLIED. HIGHER PRESSURE WATER CAN MOVE MOISTURE INTO THE COMPOSITE PARTS OR ELECTRICAL COMPONENTS THAT DO NOT HAVE SUFFICIENT PROTECTION AND CAUSE DAMAGE.

(b) Let the cleaner stay on wire harness components for approximately ten minutes.

Make sure that the cleaner does not dry on the surface of a component.

(c) If the contamination is not removed with the flow of the mixture, loosen the contamination with a brush or a wiper.

NOTE: To prevent scratches on the surfaces, the brush can be soaked in the cleaner.

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(d) Flush the areas with clean warm water that is 160 degrees F or less.

Make sure that all of the mixture is removed.

CAUTION: THE SURFACES MUST BE SUFFICIENTLY FLUSHED TO REMOVE ALL OF THE MIXTURE. IF ALL OF THE MIXTURE IS NOT REMOVED, DAMAGE FROM CORROSION CAN OCCUR.

(e) Let the wire harness dry.

NOTE: As an alternative, compressed gas at 30 PSI can be applied or the harness can be dried with wipers. Refer to Table 2.

WARNING: COMPRESSED GAS CAN BE DANGEROUS. TO PREVENT AN INJURY, CAREFULLY APPLY THE GAS IN A DIRECTION AWAY FROM THE EYES, THE FACE, AND OTHER PERSONNEL.

(10) Make an inspection of the wire harness for remaining contamination.

(11) If all of the contamination is not removed with the mixture, remove the contamination with solvent. Refer to Paragraph 3.A.

(12) Examine the wire harness components and supports.

Make sure that the components and supports are clean and fully dry.

(13) Assemble the wire harness to make it the same as the initial configuration.

(14) Install the wire harness supports.

(15) Do Step (6) through Step (14) again until all of the contamination on the wire harness is removed.

C. Removal of Solid Contamination

Contamination from solids can be:

- An abrasive particle
- A small foreign object
- A particle with a sharp edge.

(1) Identify the electrical system that must be cleaned.

(2) Open all circuit breakers and all switches for the wire harness and the equipment in the area that must be cleaned. Refer to Subject 20-00-10.

Make sure that the applicable wire harness or wire harnesses are de-energized.

(3) Electrostatically ground the airplane. Refer to the Aircraft Maintenance Manual.

(4) Install the necessary protection for all equipment and all components that are sensitive to contamination.

Make sure that all of the disconnected connectors in the area have sufficient protection.

(5) Make a selection of these tools from Table 2:

- A brush
- A vacuum
- A wiper or a cloth.

(6) Remove the loose particles on the external surface of the wire harness.

(7) Disassemble a short length of the wire harness.

(a) Remove the necessary wire harness supports to get access to the contamination.

Make sure that the wire harness has sufficient support after the supports are removed.

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(b) Remove the wire harness ties along the free length.

(c) Move the wires apart.

CAUTION: A WIRE OR A CABLE MUST NOT BE MOVED MORE THAN IT IS NECESSARY TO CLEAN IT. DAMAGE TO THE WIRE OR THE CABLE CAN OCCUR.

(8) Remove the remaining contamination.

CAUTION: MAKE SURE TO PREVENT THE MOVEMENT OF THE CONTAMINATION TO A DIFFERENT WIRE HARNESS COMPONENT. DAMAGE TO THE COMPONENT CAN OCCUR.

(a) Put the sufficient quantity of water on the wiper to make it moist.

(b) Carefully remove the contamination from each component with the wiper.

NOTE: A moist brush can help loosen the particles.

(c) Dry the cleaned area with a new wiper.

NOTE: As an alternative, compressed gas at 30 PSI can be applied or the harness can be dried with wipers. Refer to Table 2.

WARNING: COMPRESSED GAS CAN BE DANGEROUS. TO PREVENT AN INJURY, CAREFULLY APPLY THE GAS IN A DIRECTION AWAY FROM THE EYES, THE FACE, AND OTHER PERSONNEL.

(9) Examine the wire harness components and supports.

Make sure that the components and supports are clean and fully dry.

(10) Assemble the wire harness to make it the same as the initial configuration.

(11) Install the wire harness supports.

(12) Do Step (7) through Step (11) again until all contamination on the wire harness is removed.

D. Removal of Light Fluid Contamination

A light fluid is a fluid that is not petroleum based or a hydraulic fluid. The contamination can be a wet or dried mixture of the fluid and a solid.

(1) Identify the electrical system that must be cleaned.

(2) Open all circuit breakers and all switches for the wire harness and the equipment in the area that must be cleaned. Refer to Subject 20-00-10.

Make sure that the applicable wire harness or wire harnesses are de-energized.

(3) Electrostatically ground the airplane. Refer to the Aircraft Maintenance Manual.

(4) Install the necessary protection for all equipment and all components that are sensitive to contamination.

Make sure that all of the disconnected connectors in the area have sufficient protection.

(5) Make a selection of a wiper or a lint free cloth from Table 2.

(6) Disassemble a short length of the wire harness.

(a) Remove the necessary wire harness supports to get access to the contamination.

Make sure that the wire harness has sufficient support after the supports are removed.

(b) Remove the wire harness ties along the free length.

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(c) Move the wires apart.

CAUTION: A WIRE OR A CABLE MUST NOT BE MOVED MORE THAN IT IS NECESSARY TO CLEAN IT. DAMAGE TO THE WIRE OR THE CABLE CAN OCCUR.

(7) Remove the contamination.

Refer to Paragraph 4. for the procedure to remove contamination from:

- A backshell
- The external surface of the connector
- An area of a wire that is less than 6 inches from the end of a connector.

CAUTION: MAKE SURE TO PREVENT THE MOVEMENT OF THE CONTAMINATION TO A DIFFERENT WIRE HARNESS COMPONENT. DAMAGE TO THE COMPONENT CAN OCCUR.

CAUTION: A WIRE MARK OR AN IDENTIFICATION TAPE MUST NOT BE CLEANED WITH TOO MUCH FORCE. DAMAGE TO THE WIRE IDENTIFICATION CAN OCCUR.

CAUTION: SURFACES WITH PROTECTIVE FINISHES MUST BE CLEANED CAREFULLY. REMOVAL OF THE PROTECTIVE FINISH CAN CAUSE UNSATISFACTORY PERFORMANCE OF THE EQUIPMENT OR THE STRUCTURE.

(a) Put the sufficient quantity of water on the wiper to make it moist.

(b) Carefully remove the contamination from each component with the wiper.

NOTE: A moist brush can help loosen the particles.

(8) If the contamination is not removed with the water:

(a) Make a selection of an isopropyl alcohol from Table 1

WARNING: SOLVENTS ARE FLAMMABLE. MAKE SURE THAT THE QUANTITY OF SOLVENT NEAR THE AIRPLANE IS NOT MORE THAN THE QUANTITY THAT IS NECESSARY TO CLEAN THE WIRE HARNESS.

(b) Put the sufficient quantity of the alcohol on a new wiper to make it moist.

(c) Carefully remove the contamination from each component with the wiper.

NOTE: A moist brush can help loosen the particles.

(9) If the contamination is not removed with the water followed by the alcohol:

(a) Make a selection of an aliphatic naphtha from Table 1.

WARNING: SOLVENTS ARE FLAMMABLE. MAKE SURE THAT THE QUANTITY OF SOLVENT NEAR THE AIRPLANE IS NOT MORE THAN THE QUANTITY THAT IS NECESSARY TO CLEAN THE WIRE HARNESS.

(b) Put the sufficient quantity of aliphatic naphtha on a new wiper to make it moist.

CAUTION: THE WIPER MUST NOT HAVE TOO MUCH ALIPHATIC NAPHTHA. THE NAPHTHA CAN GET INTO A WIRE HARNESS COMPONENT AND DAMAGE TO THE COMPONENT CAN OCCUR.

(c) Carefully remove the contamination from each component with the wiper.

NOTE: A moist brush can help loosen the particles.

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CAUTION: ALIPHATIC NAPHTHA MUST NOT BE APPLIED ON CONTROL CABLES, ACRYLIC SURFACES, DECALS, OR FINISHES THAT ARE NOT MADE FROM CLASS 1 MATERIALS. DAMAGE TO THE COMPONENT CAN OCCUR.

CAUTION: ALIPHATIC NAPHTHA MUST NOT BE APPLIED ON A SURFACE THAT HAS A CORROSION INHIBITING COMPOUND UNLESS THE CORROSION INHIBITING COMPOUND MUST BE REMOVED AND THEN APPLIED AGAIN.

CAUTION: ALIPHATIC NAPHTHA MUST NOT STAY ON A WIRE HARNESS COMPONENT. REMAINING NAPTHA CAN CAUSE UNSATISFACTORY PERFORMANCE OF THE WIRE HARNESS COMPONENT.

(d) Dry the cleaned area with a new wiper.

NOTE: As an alternative, compressed gas at 30 PSI can be applied to remove the remaining water or solvent. Refer to Table 2.

WARNING: COMPRESSED GAS CAN BE DANGEROUS. TO PREVENT AN INJURY, CAREFULLY APPLY THE GAS IN A DIRECTION AWAY FROM THE EYES, THE FACE, AND OTHER PERSONNEL.

(e) Put the sufficient quantity of isopropyl alcohol on a wiper to make it moist.

(f) Carefully clean the areas where the naphtha was applied.

(10) Dry the cleaned area with a new wiper.

NOTE: As an alternative, compressed gas at 30 PSI can be applied to remove the remaining water or solvent. Refer to Table 2.

WARNING: COMPRESSED GAS CAN BE DANGEROUS. TO PREVENT AN INJURY, CAREFULLY APPLY THE GAS IN A DIRECTION AWAY FROM THE EYES, THE FACE, AND OTHER PERSONNEL.

(11) Examine the wire harness components and supports.

Make sure that the components and supports are clean and fully dry.

(12) Assemble the wire harness to make it the same as the initial configuration.

(13) Install the wire harness supports.

(14) Do Step (7) through Step (13) again until all of the contamination on the wire harness is removed.

4. CLEANING OF A WIRE HARNESS THAT HAS CONTAMINATION ON THE EXTERNAL SURFACE

A. Removal of Light Particle Contamination

Contamination from light particles is made of loose particles that are not too abrasive.

(1) Identify the electrical system that must be cleaned.

(2) Open all circuit breakers and all switches for the wire harness and the equipment in the area that must be cleaned. Refer to Subject 20-00-10.

Make sure that the applicable wire harness or wire harnesses are de-energized.

(3) Install the necessary protection for all equipment and all components that are sensitive to contamination.

Make sure that all disconnected connectors in the area have sufficient protection.

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(4) Make a selection of these tools from Table 2:
- A brush
- A vacuum
- A wiper or a lint free cloth.

(5) If it is necessary to get access to the contamination, remove the wire harness supports from a short length of the wire harness.

Make sure that the wire harness has sufficient support after the supports are removed.

CAUTION: A WIRE OR A CABLE MUST NOT BE MOVED MORE THAN IT IS NECESSARY TO CLEAN IT. DAMAGE TO THE WIRE OR THE CABLE CAN OCCUR.

(6) Remove the loose particles on the external surface of the wire harness.

CAUTION: MAKE SURE TO PREVENT THE MOVEMENT OF THE CONTAMINATION TO A DIFFERENT WIRE HARNESS COMPONENT. DAMAGE TO THE COMPONENT CAN OCCUR.

(7) Examine the wire harness components and supports.

Make sure that the components and supports are clean.

(8) If the wire harness supports are removed, install them again.

B. Removal of Contamination on or near Environmentally Sealed Connectors

This paragraph gives the procedure to remove all types of contamination from:
- The external surface of an environmentally sealed connector
- A connector grommet
- A backshell
- A strain relief clamp
- An area of wire that is less than 6 inches from the end of an environmentally sealed connector.

NOTE: Connectors can be environmentally sealed or unsealed. Each type has a different cleaning procedure. Environmentally sealed connectors are identified in Subject 20-60-08.

CAUTION: IF THE CONTAMINATION GOES INTO A CONNECTOR, THE INTERNAL SURFACES MUST BE CLEANED. REFER TO SUBJECT 20-60-01.

(1) Identify the electrical system that must be cleaned.

(2) Open all circuit breakers and all switches for the wire harness and the equipment in the area that must be cleaned. Refer to Subject 20-00-10.

Make sure that the applicable wire harness or wire harnesses are de-energized.

(3) Electrostatically ground the aircraft. Refer to the Aircraft Maintenance Manual.

(4) Install the necessary protection for all equipment and all components that are sensitive to contamination and solvents.

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Make sure that:

- If a connector must be cleaned, it is connected
- All disconnected connectors in the area have sufficient protection.

(5) Make a selection of:

- An isopropyl alcohol from Table 1
- A brush from Table 2
- A swab from Table 2
- A wiper or a lint free cloth from Table 2.

WARNING: SOLVENTS ARE FLAMMABLE. MAKE SURE THAT THE QUANTITY OF SOLVENT NEAR THE AIRPLANE IS NOT MORE THAN THE QUANTITY THAT IS NECESSARY TO CLEAN THE WIRE HARNESS.

(6) If it is necessary to get access to the contamination:

(a) Remove all wire harness ties from the wire harness near the rear end of the connector.

(b) Remove the backshell or the strain relief clamp.

(c) Move the wires apart.

CAUTION: A WIRE OR A CABLE MUST NOT BE MOVED MORE THAN IT IS NECESSARY TO CLEAN IT. DAMAGE TO THE WIRE OR THE CABLE CAN OCCUR.

(7) Remove the contamination.

Make sure that:

- The contamination does not go into an empty contact cavity
- The grommet holes are not opened by the movement of the wires.

CAUTION: CONTAMINATION IN AN EMPTY CONTACT CAVITY OR ON A WIRE IN THE GROMMET HOLE CAN CAUSE UNSATISFACTORY PERFORMANCE OF THE CONNECTOR.

(a) If a contact cavity is empty, seal the contact cavity. Refer to Subject 20-60-08.

(b) Carefully apply the isopropyl alcohol until the contamination is loosened.

(c) Flush the area with the sufficient quantity of alcohol to remove the contamination.

(d) Examine the grommet and the wires for remaining contamination.

(e) If the contamination is not removed, do Step (b) through Step (d) again.

(f) Dry the components with a new wiper or a new swab.

(g) Let the connector dry for one hour.

NOTE: As an alternative, compressed gas at 30 PSI can be applied to remove the remaining solvent. Refer to Table 2.

WARNING: COMPRESSED GAS CAN BE DANGEROUS. TO PREVENT AN INJURY, CAREFULLY APPLY THE GAS IN A DIRECTION AWAY FROM THE EYES, THE FACE, AND OTHER PERSONNEL.

(8) Examine the connector assembly components and wires.

Make sure that the components are clean and fully dry.

(9) If the connector components or wire harness ties are disassembled, assemble them again.

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C. Removal of Contamination on or near Unsealed Connectors

This paragraph gives the procedure to remove all types of contamination from:

- The external surface of an unsealed connector
- A connector grommet
- A backshell
- A strain relief clamp
- An area of wire that is less than 6 inches from the end of an unsealed connector.

NOTE: The environmentally sealed connectors are identified in Subject 20-60-08. If a connector is not specified in Subject 20-60-08, the connector is unsealed.

CAUTION: IF THE CONTAMINATION GOES INTO A CONNECTOR, THE INTERNAL SURFACES MUST BE CLEANED. REFER TO SUBJECT 20-60-01.

(1) Identify the electrical system that must be cleaned.

(2) Open all circuit breakers and all switches for the wire harness and the equipment in the area that must be cleaned. Refer to Subject 20-00-10.

Make sure that the applicable wire harness or wire harnesses are de-energized.

(3) Electrostatically ground the aircraft. Refer to the Aircraft Maintenance Manual.

(4) Install the necessary protection for all equipment and all components that are sensitive to contamination and solvents.

Make sure that all disconnected connectors in the area have sufficient protection.

(5) Make a selection of:

- An isopropyl alcohol from Table 1
- A swab from Table 2
- A wiper or a lint free cloth from Table 2.

WARNING: SOLVENTS ARE FLAMMABLE. MAKE SURE THAT THE QUANTITY OF SOLVENT NEAR THE AIRPLANE IS NOT MORE THAN THE QUANTITY THAT IS NECESSARY TO CLEAN THE WIRE HARNESS.

(6) If it is necessary to get access to the contamination:

(a) Remove all wire harness ties from the wire harness near the rear end of the connector.

(b) Remove the backshell or the strain relief clamp.

(c) Move the wires apart.

CAUTION: A WIRE OR A CABLE MUST NOT BE MOVED MORE THAN IT IS NECESSARY TO CLEAN IT. DAMAGE TO THE WIRE OR THE CABLE CAN OCCUR.

(7) Remove the contamination.

Make sure that the contamination does not go into an empty contact cavity.

CAUTION: CONTAMINATION IN AN EMPTY CONTACT CAVITY CAN CAUSE UNSATISFACTORY PERFORMANCE OF THE CONNECTOR.

(a) Carefully apply the isopropyl alcohol until the contamination is loosened.

(b) Remove the contamination and the remaining isopropyl alcohol with a new wiper or a new swab.

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(c) Examine the components for remaining contamination.

(d) If the contamination is not removed, do Step (a) through Step (c) again.

(e) Let the connector dry for one hour.

NOTE: As an alternative, compressed gas at 30 PSI can be applied to remove the remaining solvent. Refer to Table 2.

WARNING: COMPRESSED GAS CAN BE DANGEROUS. TO PREVENT AN INJURY, CAREFULLY APPLY THE GAS IN A DIRECTION AWAY FROM THE EYES, THE FACE, AND OTHER PERSONNEL.

(8) Examine the connector assembly components and wires.

Make sure that the components are clean and fully dry.

(9) If the connector components or wire harness ties are disassembled, assemble them again.

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INSPECTION OF WIRING

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INSPECTION OF WIRING

1. GENERAL DATA

A. Applicable Conditions

These conditions are applicable:

- The components, materials, and installation equipment must be sufficiently clean for visual inspection; refer to Subject 20-10-04 for the procedure to clean a wire harness
- Before a wire harness is examined, it must be de-energized
- When damage of a wiring component is seen, the cause of the damage must be removed and the component must be repaired
- When a condition that can cause damage of a wiring component is seen, the condition must be removed.

WARNING: THE WIRING MUST BE DE-ENERGIZED BEFORE AN INSPECTION. IF THE WIRING IS NOT DE-ENERGIZED, INJURY TO PERSONNEL CAN OCCUR.

CAUTION: THE WIRING MUST BE DE-ENERGIZED BEFORE AN INSPECTION. IF THE WIRING IS NOT DE-ENERGIZED, DAMAGE TO EQUIPMENT OR THE AIRPLANE CAN OCCUR.

2. CIRCULAR CONNECTORS

A. Special Conditions

Some connectors must have special protection from corrosion. Refer to Subject 20-60-03.

B. Visual Inspection - Corrosion

(1) If it is necessary to remove dirt or other contamination to examine the external surfaces for corrosion, clean the connector. Refer to Subject 20-10-04.

CAUTION: MAKE SURE TO REMOVE ONLY THE CONTAMINATION THAT PREVENTS THE INSPECTION FOR CORROSION. THE CORROSION MATERIAL MUST NOT BE REMOVED AT THIS TIME.

(2) Examine the external surface of the connector for:

- Corrosion material
- Damage to the plated finish
- Damage to the base metal
- Damage to the threads or coupling mechanism.

(3) Find the damage conditions and the repair conditions of the external surface of the connector. Refer to Table 1.

(4) If the connector has a backshell, then disconnect the backshell. Refer to the applicable connector subject.

NOTE: Corrosion can make the operation of the backshell threads or coupling mechanism difficult or impossible.

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(5) Examine the internal and the external surfaces of the backshell for:
- Corrosion material
- Damage to the plated finish
- Damage to the base metal
- Damage to the threads.

(6) Find the damage condition and the repair condition of the coupling mechanism. Refer to Table 3.

(7) Find the damage conditions and the repair conditions of the internal and external surfaces of the backshell. Refer to Table 3.

(8) Disconnect the plug and the receptacle. Refer to the applicable subject for the connector and the AMM.

NOTE: Corrosion can make the operation of the connector coupling mechanism impossible.

(9) Find the damage condition and the repair condition of the connector coupling mechanism. Refer to Table 1.

(10) Examine the internal surface of the connector receptacle for:
- Corrosion materials
- Damage to the plated finish
- Damage to the base metal.

(11) Examine the connector contacts in the receptacle for:
- Base metal that can be seen
- Blue-green deposits
- Black stains or red stains
- Pits in the base metal.

(12) Examine the internal surface of the connector plug for:
- Corrosion materials
- Damage to the plated finish
- Damage to the base metal.

(13) Examine the connector contacts in the plug for:
- Base metal that can be seen
- Blue-green deposits
- Black stains or red stains
- Pits in the base metal.

(14) Examine the internal surfaces of the connector for moisture.

(15) Find the damage condition and the repair condition for the internal surfaces of the connector. Refer to Table 2.

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C. Damage Conditions and Repair Conditions - Corrosion

Table 1
CORROSION DAMAGE AND REPAIR CONDITIONS - CONNECTOR EXTERNAL SURFACES

Type of Damage	Damage Condition	Repair Condition	Reference
Layer of corrosion material	A heavy layer of white corrosion materials in most areas	Replacement of the connector	The applicable subject for the connector
	A medium layer of white corrosion materials in some areas	Replacement of the connector recommended	The applicable subject for the connector
	A light layer of white corrosion materials in some areas	Examine at regular intervals	Paragraph 2.B.
Damage to the plated finish	The color of the finish is completely gone in the areas with corrosion	Replacement of the connector	The applicable subject for the connector
	The color of the finish is faded in some areas	Replacement of the connector recommended	The applicable subject for the connector
Damage to the base metal	Many pits or holes in the connector shell	Replacement of the connector	The applicable subject for the connector
	Some pits in the connector shell	Replacement of the connector recommended	The applicable subject for the connector
Damage to the coupling mechanism	The coupling mechanism is impossible to operate because of the corrosion	Replacement of the connector	The applicable subject for the connector
	The coupling mechanism does not operate easily because of the corrosion	Replacement of the connector recommended	The applicable subject for the connector
	The coupling mechanism operates easily	Examine at regular intervals	Paragraph 2.B.
Damage to the threads	The threads are impossible to engage or disengage because of the corrosion	Replacement of the connector	The applicable subject for the connector
	The threads do not engage or disengage easily because of the corrosion	Replacement of the connector recommended	The applicable subject for the connector
	The threads engage and disengage easily	Examine at regular intervals	Paragraph 2.B.

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Table 2
CORROSION DAMAGE AND REPAIR CONDITIONS - CONNECTOR INTERNAL SURFACES

Type of Damage	Damage Condition	Repair Condition	Reference
Damage to the connector shell	Corrosion materials on the surface of the shell	Replacement of the connector	The applicable subject for the connector
	Damage to the plated finish	Replacement of the connector	The applicable subject for the connector
	Pits in the base metal	Replacement of the connector	The applicable subject for the connector
Damage to a contact	The plating is completely gone in some areas	Replacement of the contact	The applicable subject for the connector
	Pits in the base metal	Replacement of the contact	The applicable subject for the connector
	Blue-green contamination	Replacement of the contact	The applicable subject for the connector
	Black stains or red stains	Replacement of the contact	The applicable subject for the connector
Contamination from moisture	Moisture in the connector	Clean the internal surfaces with isopropyl alcohol	Subject 20-60-01
		Examine at regular intervals	Paragraph 2.B.

Table 3
CORROSION DAMAGE AND REPAIR CONDITIONS - CONNECTOR BACKSHELLS

Type of Damage	Damage Condition	Repair Condition	Reference
Damage to the backshell	A heavy layer of white corrosion materials in most areas	Replacement of the backshell	Subject 20-60-09
	A medium layer of white corrosion materials	Replacement of the backshell recommended	Subject 20-60-09
	A light layer of white corrosion materials in some areas	Examine at regular intervals	Paragraph 2.B.
Damage to the plated finish	The color of the finish is completely gone in the areas with corrosion	Replacement of the backshell	Subject 20-60-09
	The color of the finish is faded in some areas	Replacement of the backshell recommended	Subject 20-60-09

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Table 3 (continued)

Type of Damage	Damage Condition	Repair Condition	Reference
Damage to the base metal	Many pits or holes in the connector shell	Replacement of the backshell	Subject 20-60-09
	Some pits in the connector shell	Replacement of the backshell recommended	Subject 20-60-09
Damage to the coupling mechanism	The coupling mechanism is impossible to operate because of the corrosion	Replacement of the backshell	Subject 20-60-09
	The coupling mechanism cannot operate easily because of the corrosion	Replacement of the backshell recommended	Subject 20-60-09
	The threads or the coupling mechanism operate easily	Examine at regular intervals	Paragraph 2.B.
Damage to the threads	The threads are impossible to engage or disengage because of the corrosion	Replacement of the backshell	Subject 20-60-09
	The threads cannot engage or disengage easily because of the corrosion	Replacement of the backshell recommended	Subject 20-60-09
	The threads engage and disengage easily	Examine at regular intervals	Paragraph 2.B.

3. CLAMPS AND WIRING SUPPORTS

A. Damage Conditions and Repair Conditions - Metallic Clamps, Clips and Brackets

These items are:

- Used to support a wire harness or a connector
- Components of the electrical wiring interconnect system.

Examine the surfaces of the item for corrosion or damage. If it is necessary, clean the item. Refer to Subject 20-10-04.

Refer to Table 4 for the damage conditions and the repair conditions of the surface of the item.

Table 4
CORROSION DAMAGE AND REPAIR CONDITIONS

Type of Damage	Damage Condition	Repair Condition	Notes
Damage to the plated finish	The color of the finish is completely gone or shows light corrosion.	Examine at regular intervals	-
Damage to the base metal	Corrosion, pitting corrosion, holes, or cracks.	Replace the item.	If the item is part of a component installation, it should be replaced at the next repair or overhaul of the component installation.

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WIRING ASSEMBLY AND INSTALLATION CONFIGURATION

1. GENERAL DATA

A. High Vibration Areas

Refer to Subject 20-02-30 for the locations of the high vibration areas by their specified Vibration Level.

2. CAUSES OF DAMAGE

A. Damage by Vibration from a Mechanical Source

Damage to a wire harness can occur by vibration from these sources:

- An engine
- A flap drive motor
- A fuel pump
- A gear mechanism
- Turbulence from the wind.

B. Damage from Environmental Conditions

Damage to a wire harness can occur from:

- Heat
- Cold
- Fuel
- Dirt
- Moisture
- Hydraulic fluid.

C. Damage from an Incorrect Installation

Damage to a wire harness can occur from:

- A clamp that is loose
- A clamp that is the incorrect size
- A wire harness branch that is made incorrectly
- The incorrect quantity of wire harness ties or installed plastic tie straps
- Wire harness tension that is too loose or too tight.

3. APPLICABLE CONDITIONS FOR WIRE HARNESS ASSEMBLY

A. General Conditions

This paragraph gives the general conditions that are applicable:

- During the assembly of a wire harness
- When a wire harness is moved from one location to a different location
- While a wire harness is kept in storage.

For the assembly of a wire harness, these conditions are applicable:

- Strain must not be put on the terminations of the wires or the cables
- A bend that is less than the minimum bend radius must not occur; refer to Paragraph 3.B.

For the general conditions that are applicable for a wire harness that has a BACC69A fiber optic cable assembly, refer to Paragraph 3.G.

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B. Bend Radius

This paragraph gives the values of the minimum bend radius for a wire, a cable, a coax cable, and a wire harness. For the minimum bend radius of the fiber optic cable of the BACC69A fiber optic cable assembly, refer to Paragraph 3.G..

The minimum bend radius of a single wire or a single cable is ten times the O.D. of the wire or the cable.

The minimum bend radius of a single coaxial cable is the larger value of 1.5 inches or six times the O.D. of the coaxial cable.

The minimum bend radius of a wire harness is the same as the minimum bend radius of the largest diameter wire or cable in the harness.

The minimum bend radius of a harness that has an overall shield is the larger value of 1.5 inches or six times the the O.D. of the harness.

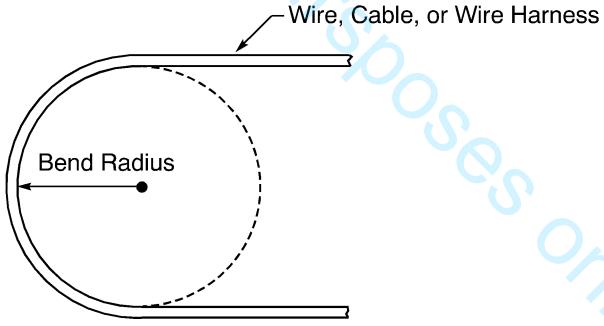
The minimum bend radius of a harness that has two or more harnesses is the larger value of 1.5 inches or six times the the O.D. of the harness.

For wire and cable in these areas, a minimum bend radius of three times the O.D. of the wire or cable is satisfactory:

- Restricted space
- At breakouts
- At supported bends.

Figure 1 shows the bend radius of a wire, a cable, or a wire harness

Figure 2 shows the minimum bend radius of wire and cable in a restricted space, at breakouts, or at supported bends:



BEND RADIUS OF A WIRE, A CABLE, OR A WIRE HARNESS
Figure 1

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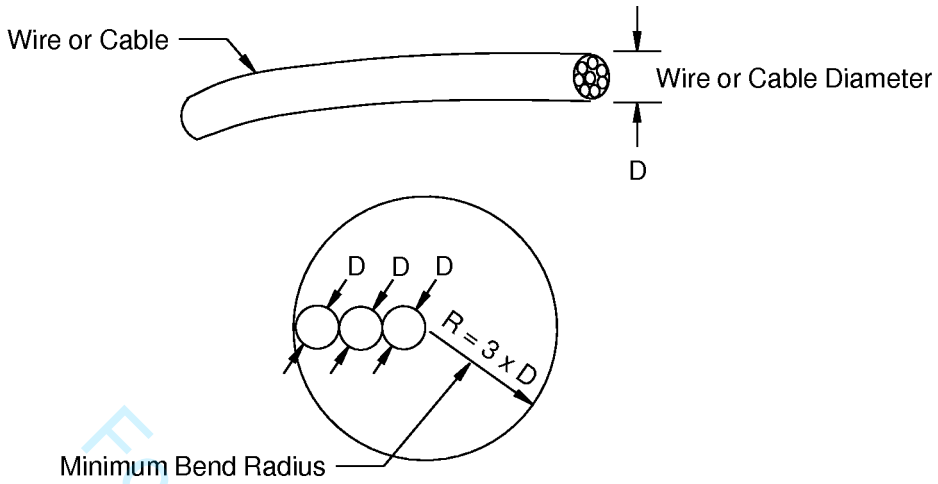

MINIMUM BEND RADIUS IN RESTRICTED SPACE, AT BREAKOUTS, AND AT SUPPORTED BENDS
Figure 2

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C. Wire Harness Ties

These general conditions are applicable:

- If it is possible, all wires must be parallel before a wire harness tie is assembled on the wire harness
- A wire harness tie must be made from colored tie material when the identification of the wire harness separation is necessary; refer to Subject 20-10-19
- If it is necessary to replace a plastic tie strap wire harness tie on a wire harness in the unpressurized area, only a lacing tape wire harness tie is permitted; refer to Paragraph 5.C.
- It is not permitted to use an adhesive tape wire harness tie to identify circuit separation categories
- It is not permitted to tie more than one wire harness together with an adhesive tape wire harness tie.

These conditions are applicable for the location of a wire harness tie on the wire harness:

- If it is possible, a wire harness tie must not be assembled where wires go across each other
- A wire harness tie must not be assembled on a repair of a wire or a cable unless it is assembled on top of the metal conductor splice of a splice assembly
- A wire harness tie must be assembled on a splice assembly that has more than one AWG 16 or smaller wire if the splice assembly does not have the protection of a sleeve or insulation sleeve that is installed on the wire harness
- A wire harness tie can be assembled on a shield ground wire assembly.

NOTE: Wire harness ties are not necessary between the external surface of the wire harness and an insulation sleeve or a protection sleeve that is installed on the harness.

D. Wire Harness Ties in a High Vibration Area

The conditions in this paragraph apply only to the outer wire harness ties on the harness.

For the locations of the high vibration areas, refer to Subject 20-02-30.

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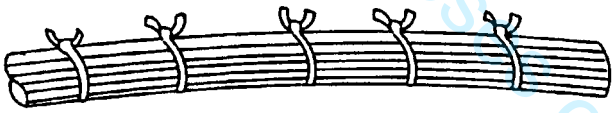
These conditions are applicable for the wire harness in a high vibration area, Vibration Level 3 and those parts of the wire harnesses that go from the wing seal rib into the strut or the sailboat areas:

- For a wire harness that goes through the leading edge gap, but does not go into the strut, the conditions for all other high vibration areas are applicable
- Lacing tape wire harness ties must be assembled at intervals of a maximum of 2 inches
- The necessary number of lacing tape wire harness ties must be assembled on the wire harness to make sure that the wires harness does not bend between the wire harness ties; refer to Figure 3
- The necessary number of lacing tape wire harness ties must be assembled on the wire harness to make sure that the outer diameter of the wire harness does not become larger between the wire harness ties; refer to Figure 3

For a high vibration area, Vibration Level 2, these conditions are applicable:

- For the 737 model only, the lacing tape wire harness ties on a power feeder wire harness on the leading edge of the wing must be assembled at intervals of a maximum of 2 inches
- Lacing tape wire harness ties must be assembled at intervals between 6 inches and 8 inches
- The necessary number of lacing tape wire harness ties must be assembled on the wire harness to make sure that the wires harness does not bend between the wire harness ties; refer to Figure 3
- The necessary number of lacing tape wire harness ties must be assembled on the wire harness to make sure that the outer diameter of the wire harness does not become larger between the wire harness ties; refer to Figure 3

Not Acceptable



Acceptable

INTERVALS FOR WIRE HARNESS TIES
Figure 3

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E. Plastic Tie Strap and Adhesive Tape Wire Harness Ties

For the conditions that are applicable for a plastic tie strap wire harness ties on a wire harness with coax cable, refer to Paragraph 3.F.

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Plastic tie strap and adhesive tape wire harness ties are not permitted:

- In a fuel tank
- In the unpressurized area
- In a high vibration area; refer to Subject 20-02-30
- On a wire harness that has a Temperature Grade C or Temperature Grade D
- Where a broken tie strap can let the wire harness move against an abrasive surface
- Where a broken tie strap can let the wire harness cause an interference with mechanical linkage.

Plastic tie strap and adhesive tape wire harness ties are a satisfactory alternative to lacing tape wire harness ties when these conditions occur:

- The wire harness is installed in the pressurized area of the airplane
- The wire harness has a Temperature Grade A or Temperature Grade B.

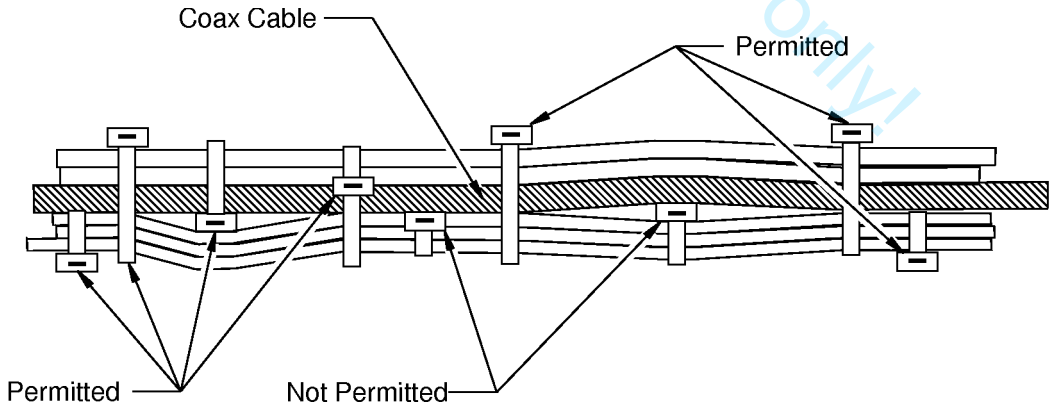
NOTE: Boeing Service Engineering can supply more data about the temperature grade of a wire harness.

NOTE: In the production of some airplanes, plastic tie strap wire harness ties have been installed on wire harnesses in the unpressurized area and in high vibration areas. These installations are satisfactory. If it is necessary to replace a plastic tie strap wire harness tie on one of these wire harnesses, only a lacing tape wire harness tie is permitted.

F. Wire Harnesses that have Coax Cable

These conditions are applicable:

- The outside of the head of a plastic tie strap must not be against a coax cable
- It is necessary to move the head of a plastic tie strap away from a coax cable when the outside of the head of the plastic tie strap touches the coax cable
- The inside of the head of a plastic tie strap is permitted to be against a coax cable
- It is not necessary to move the head of the plastic tie strap away from a coax cable when the inside of the head of the plastic tie strap touches the coax cable
- When a coax cable or a wire harness that contains a coax cable is added to a wire harness that has a plastic tie strap, it is not necessary to remove the plastic tie strap.



PERMITTED CONFIGURATIONS OF PLASTIC TIE STRAPS ON A WIRE HARNESS THAT HAS A COAX CABLE
Figure 4

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G. A Wire Harnesses that has a BACC69() Fiber Optic Cable Assembly

CAUTION: A HEAT GUN OR A HOT AIR GUN MUST NOT BE USED NEAR THE CABLE ASSEMBLY. IF TOO MUCH HEAT IS APPLIED TO THE CABLE, DAMAGE TO THE CABLE CAN OCCUR.

After a fiber optic cable assembly is replaced, make an inspection of the continuity of the fiber optic segments.

Make sure that:

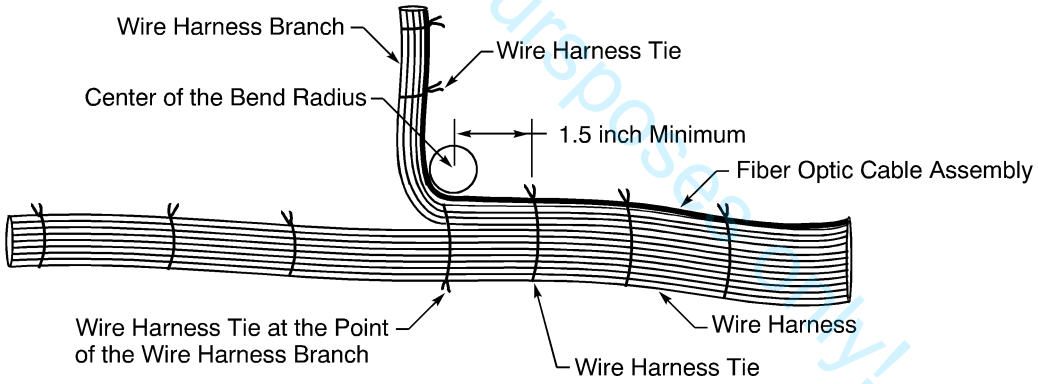
- Light from a flashlight is visible at the other end of each fiber optic segment
- If light is not visible at the opposite end, the link is broken and must be replaced.

For the configuration of the fiber optic cable in a wire harness:

- The cable must not have a bend radius that is less than 0.75 inch
- The cable must not make a loop unless the cable is held in its position with a wire harness tie
- The wire harness tie at the point of a wire harness branch must not go on the fiber optic cable; refer to Figure 5
- A wire harness tie must be a minimum of 1.5 inches from the center of the bend radius of a wire harness branch where it makes a curve from the wire harness; refer to Figure 5.

CAUTION: IF THE BEND RADIUS IS LESS THAN 0.75 INCH, THE BEND CAN CAUSE UNSATISFACTORY PERFORMANCE OF THE CABLE.

CAUTION: AS THE BEND RADIUS OF THE CABLE BECOMES MUCH LESS THAN 0.75 INCH, THE RISK OF DAMAGE TO THE CABLE INCREASES.



LOCATION OF THE WIRE HARNESS TIES AT A BRANCH
Figure 5

A deformation of the jacket of the cable from an assembled wire harness tie or plastic tie strap is permitted, if each of these conditions occur:

- The deformation does not go through the surface of the jacket
- The diameter of the cable at the maximum depth of the deformation is more than 85 percent of the diameter of the cable.

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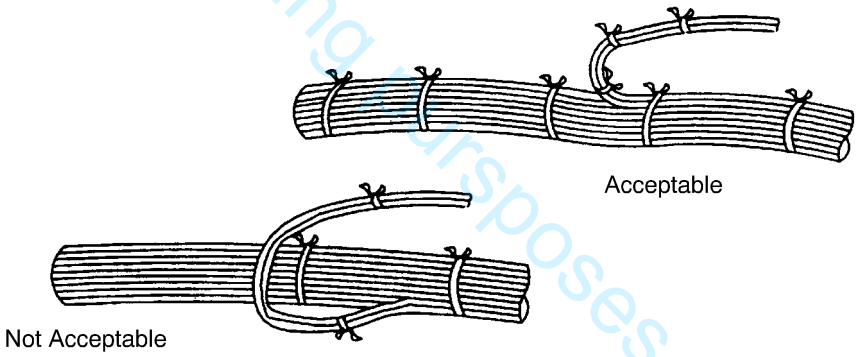
H. Wire Harness Branches

These conditions are applicable:

- If it is possible, a wire harness branch must make a smooth curve from the harness in the same plane as the centerline of the wire harness; refer to Figure 6
- If it is possible, all wires must be parallel and adjacent to each other and the wire harness before the wire harness branch is made
- If it is possible, a wire harness tie must be assembled or a plastic tie strap installed a maximum of 1 inch in front of the wire harness branch
- If it is possible, a wire harness tie must be assembled or a plastic tie strap installed a maximum of 1 inch behind the wire harness branch
- If it is possible, the wire harness branch must not go across other wires when it makes a curve from the wire harness; refer to Figure 7
- When a wire harness has a small number of wires that go to the branch point from opposite directions, a wire harness tie must be assembled or a plastic tie strap installed on the wire harness and the wires at the point of the branch; refer to Figure 8
- If the wire harness branch must go across the wire harness, the wire harness must have protection; refer to Figure 9 and Figure 10.
- Adhesive tape wire harness ties are not permitted on a wire harness branch.



ONE BRANCH ON A WIRE HARNESS
Figure 6

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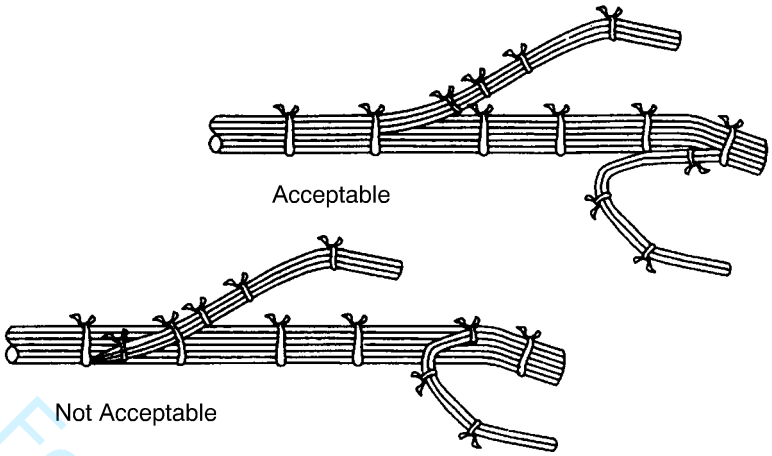
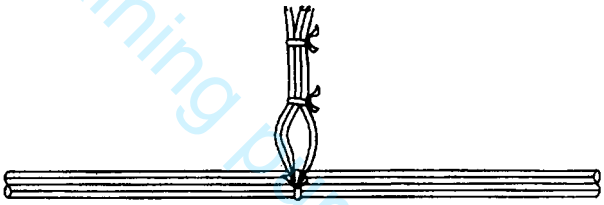
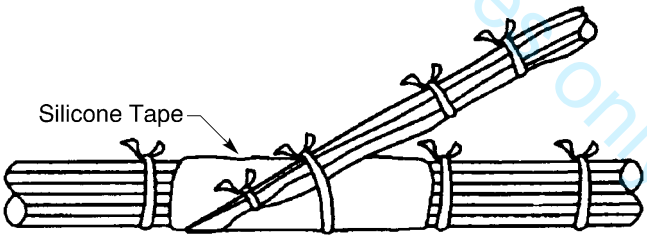


MORE THAN ONE BRANCH ON A WIRE HARNESS
Figure 7



A BRANCH WITH WIRES THAT COME FROM OPPOSITE DIRECTIONS
Figure 8



WIRE HARNESS PROTECTION WITH TAPE
Figure 9

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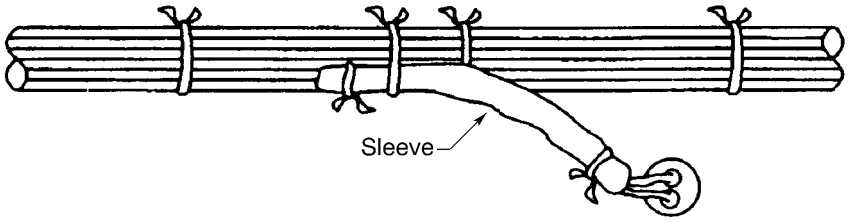

WIRE HARNESS PROTECTION WITH A SLEEVE
Figure 10

I. Wire Harnesses in Conduits or Tubes

These conditions are applicable for a wire harness assembled in a conduit or a tube:

- The wires must be parallel
- The wire harness must not have a wire harness tie
- The wire harness must not have a plastic tie strap.

For the procedures to repair a flexible conduit on the landing gear, refer to Subject 20-10-91.

J. Conditions for Drain Holes in a Protective Wire Harness Sleeve

It is necessary for a sleeve designated for wire protection to have drain holes if:

- The sleeve is longer than 12 inches in length, and
- The sleeve is not an open weave or expandable sleeve.

NOTE: Drain holes are not to be used in a sleeve designated for wire separation. Refer to Subject 20-10-19.

Unless it is specified, It is not necessary for a protective sleeve to have drain holes if the sleeve has an inside diameter of 0.16 inch or smaller.

It is not necessary for a protective sleeve to have drain holes if:

- The sleeve is an open weave or is an expandable sleeve or
- The sleeve is 12 inches or less in length.

K. Necessary Conditions for Connector Jumper Wires

A connector jumper wire is a wire that goes between two contact cavities in the same connector.

The length of a connector jumper wire must be a minimum of 5 inches and a maximum of 10 inches.

It is necessary to hold a jumper wire to the wire harness with one or more wire harness ties. The distance between the wire harness ties on the jumper wire must be the same or smaller than the distance between the wire harness ties on the wire harness. If the jumper wire is in a high vibration area, refer to Subject 20-10-11.

For a wire harness that is in the pressurized area, the distance between the wire harness ties should be a minimum of 6 inches and a maximum of 12 inches.

If the connector does not have a backshell, the wire harness must have a wire harness tie assembled 2.25 inches ± 0.75 inch from the connector grommet.

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L. Assembly and Installation of a Stub Wire

Table 1
CONFIGURATION OF A STUB WIRE

Contact Cavity Size	Stub Wire					
	Specification	Temp Grade	Wire Type Code	Size (AWG)	Length (inch)	
					Minimum	Maximum
16	BMS13-58 Type 1 Class 1	D	CQ	16	5	10
	BMS13-60 Type 7 Class 1	D	HA	16	5	10
20	BMS13-58 Type 1 Class 1	D	CQ	20	5	10
	BMS13-60 Type 7 Class 1	D	HA	20	5	10

Table 2
END CAP TERMINALS FOR HIGH TEMPERATURE WIRE

Wire Type Code	Size (AWG)	Part Number	Insulation Diameter Color Code A	End Cap Terminal Crimp Tool Color Code B	Crimp Tool Part Number	Actual Crimp Tool Color Code	Crimp Tool Manufacturer
CQ	16	328860	Gray	Orange	69272-1	Orange	AMP
CQ	16	328860	Gray	Orange	WA27XE-EP with T/P918 Locator	Orange	Daniels
HA	16	328859	Black	Orange	69272-1	Orange	AMP
HA	16	328859	Black	Orange	WA27XE-EP with T/P918 Locator	Orange	Daniels
HA	16	328860	Gray	Orange	69272-1	Orange	AMP
HA	16	328860	Gray	Orange	WA27XE-EP with T/P918 Locator	Green	Daniels
CQ	20	328859	Black	Orange	69272-1	Orange	AMP
CQ	20	328859	Black	Orange	WA27XE-EP with T/P918 Locator	Green	Daniels
HA	20	328859	Black	Orange	69272-1	Orange	AMP
HA	20	328859	Black	Orange	WA27XE-EP with T/P918 Locator	Green	Daniels

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Table 3
NECESSARY MATERIAL

Material	Part Number	Supplier
Sealant	DC3145	Dow Corning

These conditions are applicable for stub wires:

- Identification of a stub wire is not necessary
- One end of the stub wire must have an end cap
- The end of the stub wire with the end cap must not be installed in conduit
- If an overall shield is specified, the stub wire must be between the wire harness and the shield.

These conditions are applicable for large number of stub wires:

- The wires must be put into small groups
- The wires of each small group must have different lengths
- The small group are put at different positions around the circumference of the wire harness.

(1) Make a selection of wire stub. Refer to Table 1.

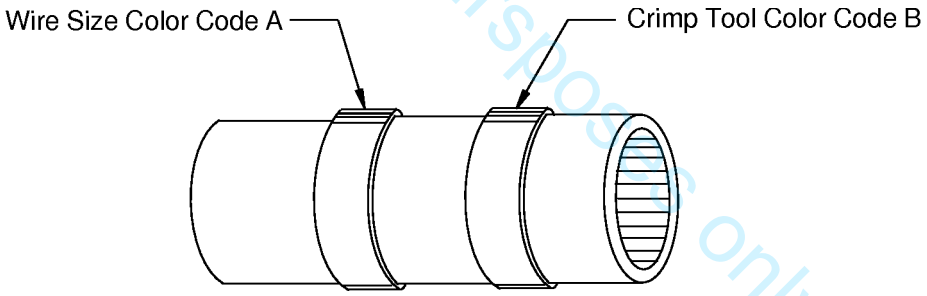
NOTE: Do not install 20 AWG wire in connectors that have size 16 contacts.

(2) It is not necessary to put a wire identification code on spare wire stubs

(3) Assemble a contact with the stub wire.

(4) Assemble a crimp type end cap without insulation removal on the end of the stub wire:

(a) Configuration of the end cap terminal is shown in Figure 11.



END CAP TERMINAL
Figure 11

(b) Table 2 gives these procedure details:

- The correct part number for the end cap terminal to use for the different wire type codes
- The correct tool part numbers to use to crimp the end cap terminal on the wire
- Approved manufacturers of the crimp tools.

(c) Put the end cap terminal in the correct location in the crimp tool.

NOTE: Make sure that the rounded end of the end cap terminal touches the crimp tool.

NOTE: Make sure that the crimp rings on the end cap terminal are in the correct positions.

(d) Put a small amount of sealant in the crimp barrel of the end cap terminal. Refer to Table 3.

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(e) Push the wire into the crimp barrel of the end cap terminal until the end of the wire touches the bottom of the crimp barrel.

(f) Crimp the end cap terminal to the wire.

(g) Wipe off the unwanted sealant.

(5) Install the spare wire stub wires in the correct contact cavities of the connector

(6) Repeat Step (1) through Step (5) again for each remaining empty contact cavity.

(7) Attach the stub wires to the surface of the wire harness.

WARNING: DO NOT PUT THE END OF A STUB WIRE IN A CONDUIT. DAMAGE TO THE WIRE CAN OCCUR.

NOTE: If it is applicable, small groups of stub wires that have different lengths can be put in different positions around the circumference of the wire harness.

(a) Assemble a wire harness tie 0.75 inch from the end of each stub wire or group of stub wires.

(b) Assemble the necessary number of wire harness ties on each stub wire or group of stub wires.

NOTE: Make sure that two harness ties, at the minimum, are installed between the connector and the end of the shortest group of stub wires.

M. Assembly of 1/0 Stub Wires

Table 4
NECESSARY MATERIALS

Material	Part Number	Supplier
Sealant	DC3145	Dow Corning
Alcohol, Isopropyl	-	An available source

Table 5
3M COLD SHRINKABLE SLEEVE

Wire Size (AWG)	Part Number	Supplier
2	8445-2.5	3M
2/0	8445-3.2	3M

(1) Use Wire Type Code "HA" (BMS 13-60, Type 7, Class 1.)

(2) Cut wire between 5 to 10 inches in length.

(3) Clean exposed stub wire with isopropyl alcohol, refer to Table 4.

(4) Apply small amount of sealant, refer to Table 4, on exposed stub wire end. Ensure all exposed wire strands are covered.

(5) Push cold shrinkable sleeve, refer to Table 5, a minimum of 1 inch onto the exposed stub wire end.

(6) Remove the spring from the shrinkable sleeve until the sleeve begins to shrink around the wire leaving approximately 0.5 inch of sleeve beyond the end of the wire.

(7) Cure the sealant for 8 hours minimum at room temperature.

(8) Make a selection of high temperature lacing tape. Refer to Table 6.

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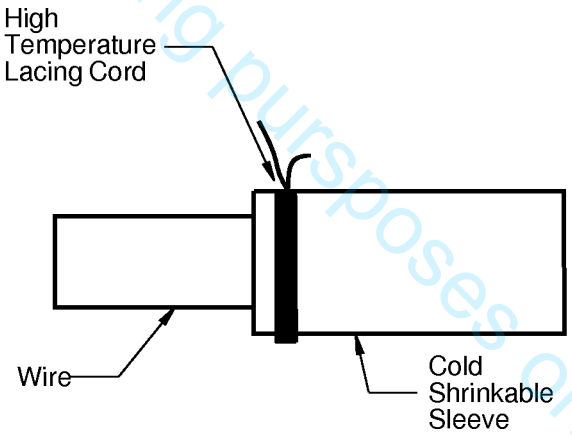
Table 6
HIGH TEMPERATURE LACING TAPE

Material Key Characteristics	Temp Grade	Fluid Class	Specification	Designation/Part Number	Supplier
Lacing	D	1	BMS 13-54	Type II, Finish C or D/C	BMS13-54 QPL
				Type III, Finish C	BMS13-54 QPL
				Type IIIB, Finish C	BMS13-54 QPL
			MIL-T-43435 Type V, Finish C	Series Z	Gudebrod
				Style HOF, Finish Code G	Western Filament
			MIL-T-43435 Type IV Finish D	Style TG	Bentley Harris
				Style E779	Fluorglas
				Style T	Gudebrod
				Style LOF, Finish Code G	Western Filament

(9) Tie the shrinkable sleeve with high temperature lacing tape 0.25 inch from the end of the shrinkable sleeve. Refer to Figure 12.



1/0 STUB WIRE ASSEMBLY
Figure 12

4. SLEEVE PERFORATION

A. Drain Holes in Protective Sleeves

(1) When it is necessary, make holes in protective sleeves:

(a) Make 0.06 inch ±0.03 inch diameter holes in a sleeve that has an inside diameter of 0.16 inch or smaller.

(b) Make 0.12 inch ±0.03 inch diameter holes in a sleeve that has an inside diameter of 0.19 inch or larger.

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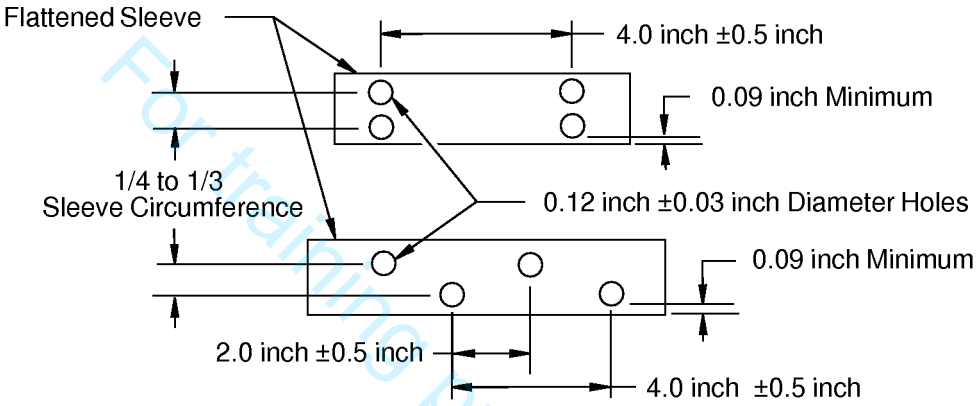
Make sure that the configuration of the holes is one of these:

- Pairs of holes in which the holes of a pair are on opposite sides of the sleeve, and the distance along the length of the sleeve between the pairs of holes is 2.0 inches ±0.5 inch, and each subsequent pair of holes is turned approximately 90 degrees on the longitudinal axis of the sleeve from the last pair
- Groups of four evenly spaced holes around the circumference of the sleeve where the distance along the length of the sleeve between each group of holes is 4.0 inches ±0.5 inch
- The hole configurations shown in Figure 13 can be used for flattened sleeves that have a diameter of 0.50 inch diameter and larger.



FLATTENED SLEEVE HOLE PATTERN
Figure 13

NOTE: Holes that do not have a circular shape are permitted.

NOTE: BMS 13-52, Type IV Teflon expandable sleeve is a satisfactory alternative to a teflon sleeve that has holes.

5. ASSEMBLY OF WIRE HARNESS TIES

A. Wire Harness Tie Materials

Table 7
WIRE HARNESS TIE LACING TAPES

Temperature Grade	Class	Specification	Description
A	1	MIL-T-43435 Type II Finish C	Polyester, flat braid; 0.085 inch ±0.010 inch wide, 0.014 inch ±0.003 inch thick
B	1	BMS13-54 Type I Finish C	Polyester, flat braid, self-extinguishing finish; 0.085 inch ±0.010 inch wide, 0.014 inch ±0.003 inch thick

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Table 7 (continued)

Temperature Grade	Class	Specification	Description
D	1	BMS13-54 Type II Finish C	Teflon coated fiberglass; flat braid; 0.100 inch ±0.010 inch wide, 0.016 inch ±0.003 inch thick
		BMS13-54 Type II Finish D/C	Teflon coated fiberglass; flat braid; 0.100 inch ±0.010 inch wide, 0.016 inch ±0.003 inch thick
		BMS13-54 Type III Finish C	Nomex, flat braid; 0.075 inch ±0.010 inch wide, 0.012 inch ±0.003 inch thick
			Nomex, flat braid; 0.110 inch ±0.010 inch wide, 0.014 inch ±0.003 inch thick
		MIL-T-43435 Type IV Finish D	Teflon coated fiberglass; flat braid; 0.110 inch ±0.010 inch wide, 0.016 inch ±0.003 inch thick
		MIL-T-43435 Type V Finish C	Nomex, flat braid; 0.110 inch ±0.010 inch wide, 0.014 inch ±0.003 inch thick

Table 8
ALTERNATIVE WIRE HARNESS TIE LACING TAPES

Temperature Grade	Class	Description	Specified Lacing Tape			Alternative Lacing Tape	
			Specification	Type	Finish	Specification	Finish
A	1	Polyester, flat braid; 0.085 inch ±0.010 inch wide, 0.014 inch ±0.003 inch thick	MIL-T-43435	II	C	A-A-52081	C
D	1	Teflon coated fiberglass; flat braid; 0.110 inch ±0.010 inch wide, 0.016 inch ±0.003 inch thick	MIL-T-43435	IV	D	A-A-52083	D
D	1	Nomex, flat braid; 0.110 inch ±0.010 inch wide, 0.014 inch ±0.003 inch thick	MIL-T-43435	V	C	A-A-52084	C

Table 9
APPROVED SUPPLIERS OF BOEING STANDARD LACING TAPES

Boeing Specification	Approved Supplier
BMS13-54 Type I	Gudebrod
	Western Filament

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Table 9 (continued)

Boeing Specification	Approved Supplier
BMS13-54 Type II	Western Filament
BMS13-54 Type III	Gudebrod
	Western Filament

Table 10
WIRE HARNESS TIE PLASTIC TIE STRAPS

Maximum Wire Harness Diameter (inch)	Tie Strap	
	Part Number	Supplier
0.75	ATTIE9	Tyton
	BACS38K4	Boeing
0.82	BACS38K8	Boeing
	BACS38K9	Boeing
1.25	BACS38K5	Boeing
	PLT1.5M	Panduit
	SST1.5I-()	Panduit
1.75	BACS38K1	Boeing
	SST2S-()	Panduit
2.00	BACS38K10	Boeing
	SST2I-()	Panduit
3.00	BACS38K7	Boeing
4.00	BACS38K2	Boeing
	BACS38K3	Boeing
8.00	BACS38K6	Boeing
2.0	BACS38W1	Boeing
3.0	BACS38W4	Boeing

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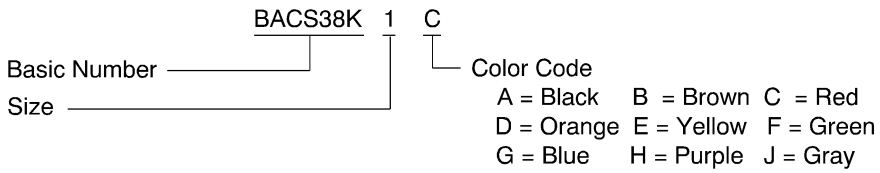

BACS38K TIE STRAP PART NUMBER STRUCTURE
Figure 14

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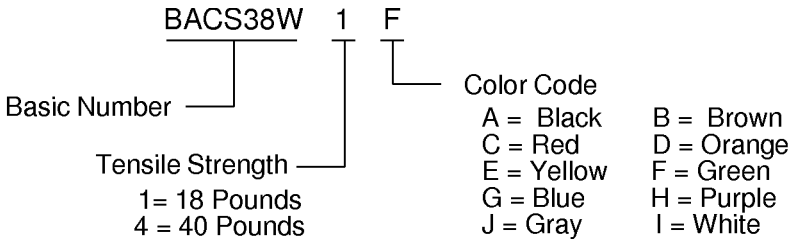
WIRING ASSEMBLY AND INSTALLATION CONFIGURATION



BACS38W TIE STRAP PART NUMBER STRUCTURE
Figure 15

Table 11
APPROVED SUPPLIERS OF BOEING STANDARD PLASTIC TIE STRAPS

Plastic Tie Strap	Supplier
BACS38K	Panduit
	Tyton
BACS38W	Panduit

Table 12
APPROVED SUPPLIER OF ADHESIVE TAPE WIRE HARNESS TIE

Part Number	Supplier
Scotch Super 20	3M

B. Selection of a Wire Harness Tie Configuration

For the conditions that are applicable for:

- The assembly of a wire harness tie, refer to Paragraph 3.C.
- A wire harness tie in a high vibration area, refer to Paragraph 3.D.
- A plastic tie strap and adhesive tape wire harness tie, refer to Paragraph 3.C.

Table 13
WIRE HARNESS TIE ASSEMBLY CONFIGURATIONS

Maximum Temperature Grade	Applicable Area	Tie Assembly	
		Configuration	Reference
A	No High Vibration	Plastic Tie Strap	Paragraph 5.F.
		Lacing Tape	Paragraph 5.C.
		Adhesive Tape Tie	Paragraph 5.F.
B	High Vibration	Lacing Tape	Paragraph 5.D.
	No High Vibration	Lacing Tape	Paragraph 5.C.
		Adhesive Tape Tie	Paragraph 5.F.

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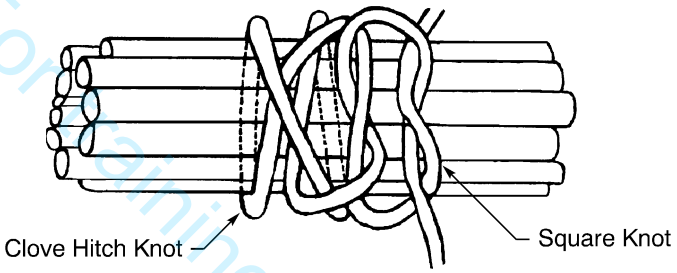
Table 13 (continued)

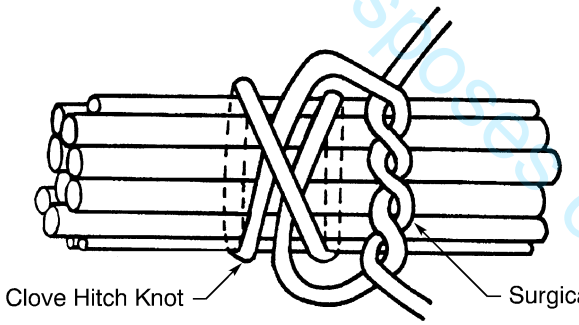
Maximum Temperature Grade	Applicable Area	Tie Assembly	
		Configuration	Reference
D	High Vibration	Lacing Tape	Paragraph 5.D.
	No High Vibration	Lacing Tape	Paragraph 5.C.

C. Assembly of a Lacing Tape Wire Harness Tie

For the conditions that are applicable for this procedure, refer to Paragraph 5.B.



SQUARE KNOT OF A WIRE HARNESS TIE
Figure 16



SURGICAL KNOT OF A WIRE HARNESS TIE
Figure 17

(1) Make a selection of a lacing tape from Table 7.
Make sure that the temperature grade of the lacing tape is applicable for the location on the airplane.

(2) Make a clove hitch knot on the wire harness. Refer to Figure 18.
Make sure that:
- All of the wires are parallel
- The knot is tight.

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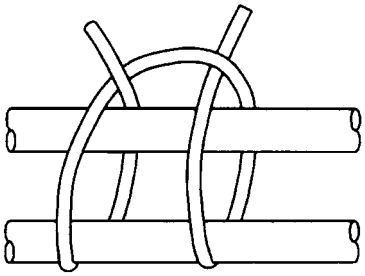
CAUTION: THE WIRES OR THE CABLES MUST NOT GO ACROSS EACH OTHER. DAMAGE TO THE WIRE OR THE CABLES CAN OCCUR.

CAUTION: DO NOT CAUSE DEFORMATION OF THE INSULATION OF THE WIRE OR THE CABLE DURING THE ASSEMBLY OF THE CLOVE HITCH. DAMAGE TO THE WIRE OR THE CABLE CAN OCCUR.



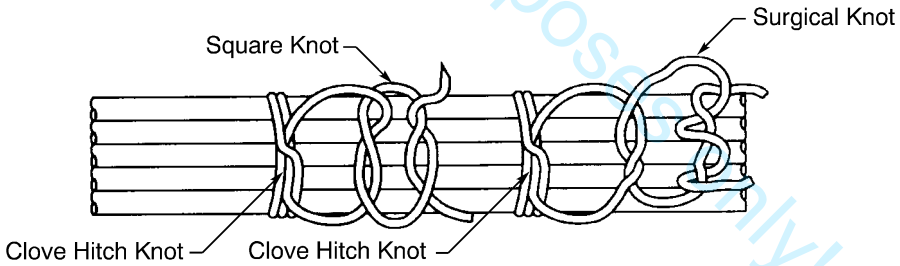
CLOVE HITCH KNOT
Figure 18

(3) Make one of these knots on top of the clove hitch:
- A square knot; refer to Figure 16
- A surgical knot; refer to Figure 17.

(4) Cut the free ends of the lacing tape.

D. Assembly of a Lacing Tape Wire Harness Tie - High Vibration Area

For the conditions that are applicable for this procedure, refer to Paragraph 5.B.



SQUARE AND SURGICAL KNOTS OF A WIRE HARNESS TIE
Figure 19

(1) Make a selection of a lacing tape from Table 7.

Make sure that the temperature grade of the lacing tape is applicable for the location on the airplane.

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(2) Make one of these knots on the wire harness:

- A special cloce hitch knot. Refer to Figure 20
- An alternative knot to the special clove hitch knot. Refer to Figure 21.

Make sure that:

- A loop is made around a minimum of one of the wires of the harness for the special clove hitch knot
- All of the wires are parallel
- The knot is tight.

CAUTION: THE WIRES OR THE CABLES MUST NOT GO ACROSS EACH OTHER. DAMAGE TO THE WIRE OR THE CABLES CAN OCCUR.

CAUTION: DO NOT CAUSE DEFORMATION OF THE INSULATION OF THE WIRE OR THE CABLE DURING THE ASSEMBLY OF THE CLOVE HITCH. DAMAGE TO THE WIRE OR THE CABLE CAN OCCUR.

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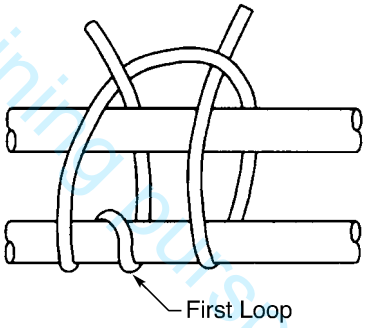
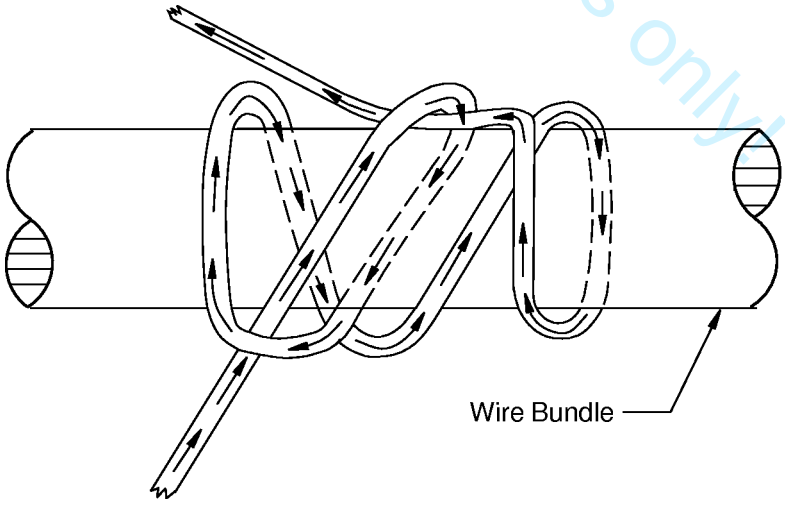


SPECIAL CLOVE HITCH KNOT
Figure 20



ALTERNATIVE KNOT TO THE SPECIAL CLOVE HITCH KNOT
Figure 21

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(3) Make one of these knots on top of the knot:
- A square knot; refer to Figure 19
- A surgical knot; refer to Figure 19.

(4) Cut the free ends of the lacing tape.

NOTE: To assemble wire harness ties on AWG 22 or larger, secure the loop around a single wire.

To assemble wire harness ties on size smaller than AWG 22, secure the loop around a minimum of 3 wires in order to prevent deformation of wire.

E. Assembly of a Plastic Tie Strap Wire Harness Tie

For the conditions that are applicable for this procedure, refer to Paragraph 5.B..

Table 14
PLASTIC TIE STRAP TOOLS

Plastic Tie Strap	Tool			
	Part Number	Recommended Tool Tension Setting		Supplier
		Dial	Fine Adjust	
ATTIE9	AT101	-	-	Tyton
BACS38AB	GS4H	STD	Max.	Panduit
	GTH	STD	Max.	Panduit
	GTS	STD	Max.	Panduit
	GTSL	STD	Max.	Panduit
	MS90387-1	STD	Max.	QPL
BACS38K1	GS2B	-	-	Panduit
	WT193	-	-	Thomas & Betts
BACS38K10	GS2B	-	-	Panduit
	WT193	-	-	Thomas & Betts
BACS38K2	GS2B	-	-	Panduit
	WT193	-	-	Thomas & Betts
BACS38K3	GS4H	-	-	Panduit
BACS38K4	GS2B	-	-	Panduit
	WT193	-	-	Thomas & Betts
BACS38K5	GS2B	-	-	Panduit
	WT193	-	-	Thomas & Betts
BACS38K6	GS4H	-	-	Panduit
BACS38K7	GS2B	-	-	Panduit
	WT193	-	-	Thomas & Betts

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Table 14 (continued)

Plastic Tie Strap	Tool			
	Part Number	Recommended Tool Tension Setting		Supplier
		Dial	Fine Adjust	
BACS38K8	GS2B	-	-	Panduit
	GTS	-	-	Panduit
	PSA-1M	-	-	Panduit
BACS38K9	GS2B	-	-	Panduit
	GTS	-	-	Panduit
	PAT-1M	-	-	Panduit
	PAT-1M2	-	-	Panduit
	PAT-1.5-M2	-	-	Panduit
BACS38W1	GTS	INT	4	Panduit
	MS90387-1	INT	4	QPL
BACS38W2	GS4H	STD	Max.	Panduit
	GTH	STD	Max.	Panduit
	GTS	STD	Max.	Panduit
	GTSL	STD	Max.	Panduit
	MS90387-1	STD	Max.	QPL
BACS38W3	GS4H	HVY	Max.	Panduit
		STD	Max.	Panduit
	GTH	HVY	Max.	Panduit
		STD	Max.	Panduit
	GTS	STD	Max.	Panduit
	GTSL	STD	Max.	Panduit
	MS90387-1	STD	Max.	QPL
BACS38W4	GS4H	STD	Max.	Panduit
	GTH	STD	Max.	Panduit
	GTS	STD	Max.	Panduit
	GTSL	STD	Max.	Panduit
	MS90387-1	STD	Max.	QPL
PLT1.5M	GS2B	-	-	Panduit
	GS2BL	-	-	Panduit

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Table 14 (continued)

Plastic Tie Strap	Tool			
	Part Number	Recommended Tool Tension Setting		Supplier
		Dial	Fine Adjust	
SST1.5I-()	GS2B	-	-	Panduit
	GS2BL	-	-	Panduit
SST2I-()	GS2B	-	-	Panduit
	GS2BL	-	-	Panduit
SST2S-()	GS2B	-	-	Panduit
	GS2BL	-	-	Panduit

(1) Make a selection of a plastic tie strap from Table 10.

(2) Make a selection of a tie strap tool from Table 14.

A different tool is a satisfactory alternative if it can give equivalent results.

NOTE: A pair of long nose pliers is a satisfactory alternative to a tie strap tool when the clearance is not sufficient for the tie strap tool.

(3) Put the tie strap on the wire harness and push the tapered tip of the plastic tie strap through the slotted head of the strap.

(4) Pull the loose end of the tie strap tight.

Make sure that all of the wires are parallel to each other.

CAUTION: THE WIRES OR THE CABLES MUST NOT GO ACROSS EACH OTHER. DAMAGE TO THE WIRE OR THE CABLES CAN OCCUR.

(5) If the head of a plastic tie strap is against an adjacent coax cable, turn the head of the plastic tie strap away from the coax cable.

CAUTION: THE HEAD OF A PLASTIC TIE STRAP MUST NOT TOUCH A COAX CABLE. DAMAGE TO THE CABLE CAN OCCUR.

(6) Tighten the tie strap sufficiently.

CAUTION: DO NOT TIGHTEN THE TIE STRAP MORE THAN THE NECESSARY AMOUNT TO HOLD THE HARNESS TOGETHER. IF THE TIE STRAP IS TOO TIGHT, DAMAGE TO THE WIRES OR THE CABLES CAN OCCUR.

(7) Cut the unwanted length from the end of the tie strap at the head.

Make sure that the end of the tie strap:

- Is a maximum of 0.01 inch from the head of the strap
- Does not have sharp edges.

F. Assembly of an Adhesive Tape Wire Harness Tie

For the conditions applicable for this procedure, refer to Paragraph 3.C., Paragraph 3.E., and Paragraph 3.H..

(1) Make a selection of adhesive tape wire harness tie from Table 12.

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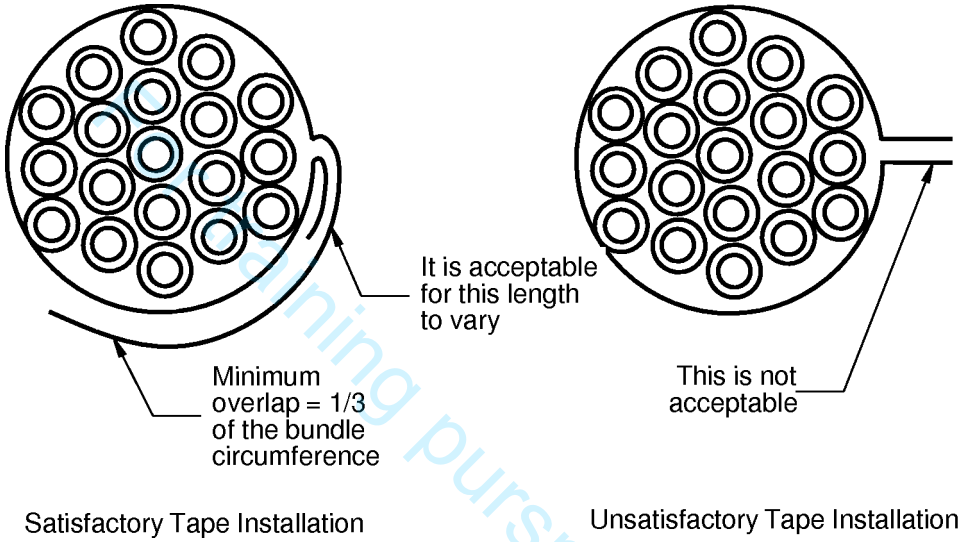
CAUTION: DO NOT USE SCOTCH SUPER 20 MATERIAL FOR THESE APPLICATIONS:

- ATTACHING SLEEVES OR HOLDING SLEEVES IN PLACE
- ATTACHING A WIRE BUNDLE TO A SINGLE LEG BACKSHELL.

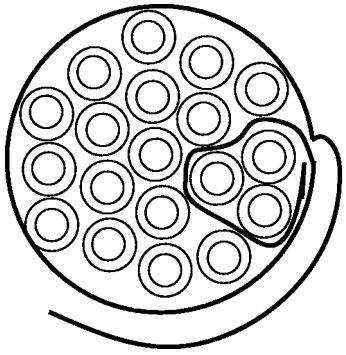
(2) Install the adhesive tie tightly around the wire bundle. Refer to Figure 22.

NOTE: The manual installation of adhesive tape wire harness tie is a satisfactory procedure.

NOTE: It is satisfactory to wind the adhesive tie around two or more wires in the wire bundle and the wind the adhesive tie around the circumference of the wire bundle. Refer to Figure 23.



INSTALLATION OF ADHESIVE TIE ON A WIRE BUNDLE
Figure 22



ALTERNATIVE METHOD OF STARTING ADHESIVE TIE
Figure 23

(3) If it is necessary, open the adhesive tie for rework, relocation, or for another reason, and the close the adhesive tie again. This operation can be done one time only.

If the operation has to be done a second time, replace the adhesive tie with a new adhesive tie.

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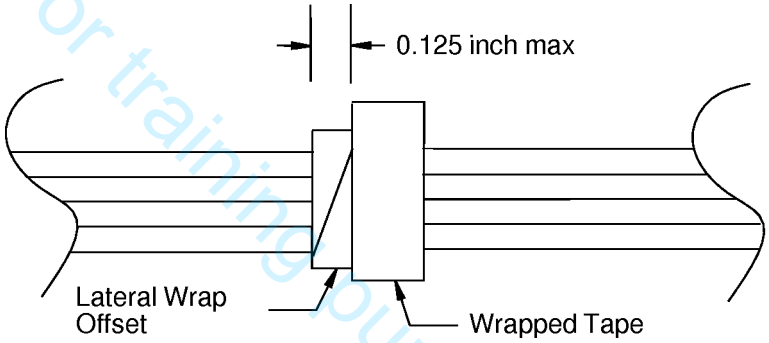
(4) Make sure that:

- The end of the tape bonds to the surface of the layer below it, with no edges or corners that are folded back
- The adhesive tie does not have cuts or tears
- The adhesive tie does not move along the longitudinal axis of the wire bundle
- The maximum distance between the edges of the tape is not lager than 0.125 inch
- There is an additional overlap layer of tape tie that has a minimum length of 1/3 the circumference of the wire bundle and a maximum length of three times the length of the circumference of the wire bundle
- There is a minimum of three layers of adhesive tie material
- There is a maximum of five layers of adhesive tie material.

Refer to Figure 24.



MAXIMUM ALLOWABLE DISTANCE BETWEEN THE EDGES OF THE ADHESIVE TIE LAYERS
Figure 24

6. APPLICABLE CONDITIONS - INSTALLATION OF A WIRE HARNESS

A. General Conditions

This paragraph gives the general conditions that are applicable:

- While a wire harness is kept in storage
- When a wire harness is moved from one location to a different location
- During the installation of a wire harness
- After a wire harness is installed.

For the installation of a wire harness, these conditions are applicable:

- Strain must not be put on the terminations of the wires or the cables
- A bend that is less than the minimum bend radius must not occur; refer to Paragraph 3.B.

For the general conditions that are applicable for a wire harness that has a BACC69A fiber optic cable assembly, refer to Paragraph 7.A.

For the general conditions that are applicable for Critical Design Configuration Control Limitation (CDCCL) wiring, refer to Paragraph 6.B.

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B. Airworthiness Limitations

These wire configurations are controlled by Critical Design Configuration Control Limitations (CDCCL) requirements.

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

CDCCLs identify certain design configuration features intended to prevent a fuel tank ignition source for the operational life of the airplane. CDCCLs are mandatory and cannot be changed or deleted without the approval of the FAA office that is responsible for the airplane model Type Certificate, or applicable regulatory agency.

WARNING: OBEY THE MANUFACTURER'S PROCEDURES WHEN YOU DO MAINTENANCE THAT HAS AN EFFECT ON A CDCCL. IF YOU DO NOT OBEY THE PROCEDURES, IT CAN INCREASE THE RISK OF A SOURCE OF FUEL TANK IGNITION. INJURIES TO PERSONNEL AND DAMAGE TO EQUIPMENT CAN OCCUR IF THERE IS A FIRE OR EXPLOSION.

The use of parts, methods, techniques or practices not contained in the applicable CDCCL must meet the approval of the FAA office that is responsible for the airplane model Type Certificate, or applicable regulatory agency.

Design features that are CDCCLs are defined and controlled by Special Federal Aviation Regulation (SFAR) 88. For more information, refer to the applicable Airworthiness Limitation, Certification Maintenance Requirements, or Maintenance Planning Document.

To find more data about CDCCL wiring, refer to Table 15 for the document that is applicable for the airplane model.

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Table 15
BOEING DOCUMENTS FOR AIRWORTHINESS LIMITATIONS

Airplane Model	Boeing Document
707	D6-7552-AWL
727	D6-8766-AWL
737-100,-200,-200C,-300,-500	D6-38278-CMR
747-100,-200,-300,-SP	D6-13747-CMR
737-600,-700,-800 and later 737 models	Boeing Aircraft Maintenance Manual 28-00-00
747-400 and later 747 models	
757	
767	
777	
787	D011Z009-03-04

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C. Wire Harness Clearance - Separation Distance

This paragraph gives the minimum distance between a wire harness and:

- An airplane structure
- A piece of equipment
- Other components.

Refer to Table 16.

If it is possible, the clearance between the wire harness and a flammable material line must be the maximum possible distance.

Table 16
MINIMUM CLEARANCE

Airplane Component	Minimum Separation Distance (inch)	Special Instructions
New Wire Installations	2	Routing and installation of new wiring must use wire types BMS13-60, BMS13-48 or BMS13-58, and for 787 only BMS13-78 for wiring greater than 115 VAC, and not be within a 2-inch radius of the FQIS wiring. If a clamp or bracket fails, a separation greater than 0.5 inch must be maintained from FQIS wiring. For the general conditions that are applicable for Critical Design Configuration Control Limitation (CDCCL) wiring, refer to Subject 20-10-11 Paragraph 6.B..
Side of Bleed Air Duct	1	None
Top of Bleed Air Duct	2	None
Control Cable	2	If the separation distance is made sure by mechanical support, the minimum clearance can be decreased.
Fuel Line	2	If the separation distance is made sure by mechanical support, the minimum clearance can be decreased. Refer to Figure 25.
Heat Equipment	0.2	Fiberglass conduit must have the minimum clearance specified.
Hydraulic Fluid Line	0.5	If the separation distance is made sure by mechanical support, the minimum clearance can be decreased. Refer to Figure 25.
Oxygen Line	2	If the separation distance is made sure by mechanical support, the minimum clearance can be decreased. Refer to Figure 25.
Pitot Static Line	0.5	If the separation distance is made sure by mechanical support, the minimum clearance can be decreased. Refer to Figure 25.
Sharp Edge of Structure and Equipment	0.13	As an alternative to the minimum clearance, use a continuous Teflon or Expando sleeve for protection.
Smooth Metal or Plastic with 0.13 inch minimum radius	0.0	In pressurized areas only, the length of the wire harnesses between clamps can touch smooth flat surfaces and smooth 0.13 inch minimum radius.
Water Line	0.5	If the separation distance is made sure by mechanical support, the minimum clearance can be decreased. Refer to Figure 25.

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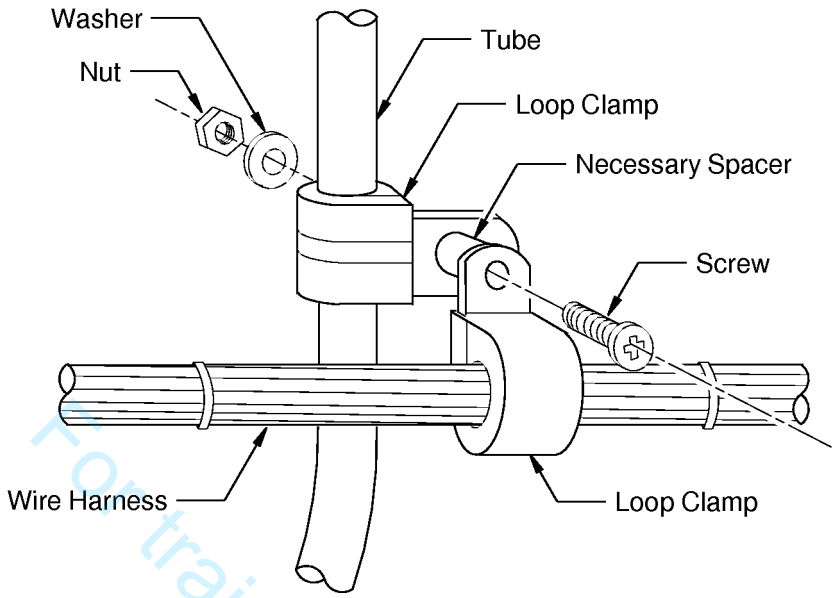

SEPARATION BETWEEN A TUBE AND A WIRE HARNESS BY MECHANICAL SUPPORT
Figure 25

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D. Support of a Wire Harness

These conditions are applicable:

- Many wire harnesses can be put in the same raceway or in one clamp if the separation conditions are satisfactory; refer to Subject 20-10-19
- All channel separation conditions must be obeyed; refer to Subject 20-10-19
- A wire harness must be perpendicular to the longitudinal axis of the clamp
- More than one wire harness must not be attached with a wire harness tie unless support for a small wire harness is necessary
- An unshielded AWG 22 or smaller wire must be attached to the structure with a clamp at intervals of 6 inches or less
- Three or more AWG 22 or smaller wire wires can be put into a harness
- A 66-3539-() insulated retainer ring must not be installed where an electrical wire harness has a routing through an insulation blanket.

Refer to Subject 20-10-12 for:

- The general conditions for the selection of a clamp
- The conditions that are applicable for the replacement of a clamp
- The conditions that are applicable for the installation of a clamp.

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E. Control of Wire Harness Slack

These conditions are applicable:

- A wire harness must have sufficient slack, but not too much
- A wire harness must have slack that is equal along the length of the harness; refer to Figure 26
- If a wire harness has too much slack between the wire harness supports, more wire harness supports must be installed.

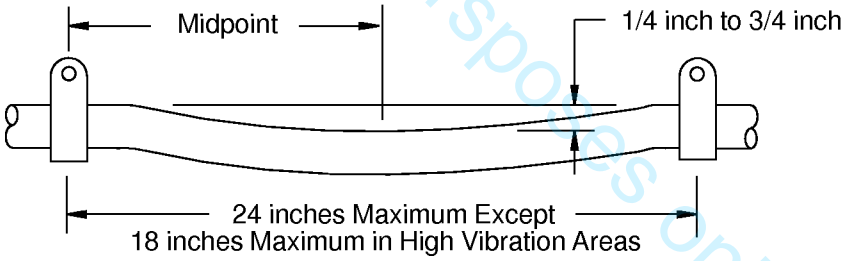
NOTE: In production, the design of a wire harness usually includes 1 inch to 1-1/2 inches of slack to make sure that a wire can be terminated a minimum of two times in service.

CAUTION: THE CONTROL OF SLACK IN A WIRE HARNESS IS VERY IMPORTANT IN A HIGH VIBRATION AREA BECAUSE:

- A WIRE CAN BE BROKEN IF THE SLACK IS NOT SUFFICIENT
- A WIRE CAN HAVE DAMAGE FROM ABRASION OR BREAK IF THE WIRE HARNESS HAS TOO MUCH SLACK.

A wire harness has sufficient slack when:

- Connectors can be connected and disconnected easily
- Strain is not put on a wire, a cable, or a wire harness
- Strain is not put on the termination of a wires or a cable
- Strain does not pull a connector grommet out of its shape
- Hinge joints can move freely
- Equipment can be removed easily
- The expansion of the airframe does not put strain on the wire, the cable, or the wire harness.



SLACK BETWEEN WIRE HARNESS CLAMPS
Figure 26

If a wire harness is replaced, make sure that:

- The wire harness slack is satisfactory
- The distance between the wire harness supports is the same as the initial installation
- The positions of the wire harness supports are the same as the initial installation.

NOTE: For a wire harness that has been replaced, if the wire harness slack is satisfactory, and the distance between the wire harness supports and the positions of the supports are the same as the initial installation, then the condition of the wire harness installation is satisfactory.

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If a new wire harness is installed, make sure that:

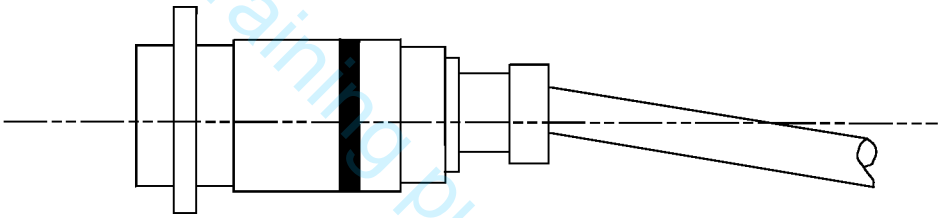
- The wire harness slack is satisfactory
- The distance between the wire harness supports is the same as other wire harnesses in the area
- The wire harness routing prevents damage to the wire harness.
- The wire harness supports keep the wire harness routing
- The wire harness supports prevent damage to the wire harness.

NOTE: For a wire new harness, if the wire harness slack is satisfactory, the distance between the wire harness supports is the same as other wire harnesses in the area, the wire harness routing and the positions of the wire harness supports prevent damage to the wire harness, then the condition of the wire harness installation is satisfactory.

F. Drip Loops

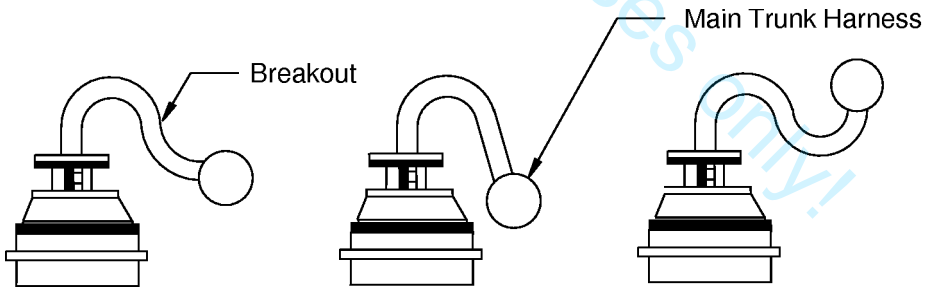
A drip loop is assembled on a wire harness to make sure that water does not go down the wires of the harness and in the connector. Refer to Figure 29.

For horizontally mounted connectors, position the bundles as shown in Figure 27 for drip proofing.



WIRE BUNDLE POSITION OF DRIP PROOFING
Figure 27

Additional drip loop configuration for vertically mounted connectors are shown in Figure 28.



DRIP LOOP CONFIGURATIONS FOR VERTICALLY MOUNTED CONNECTORS
Figure 28

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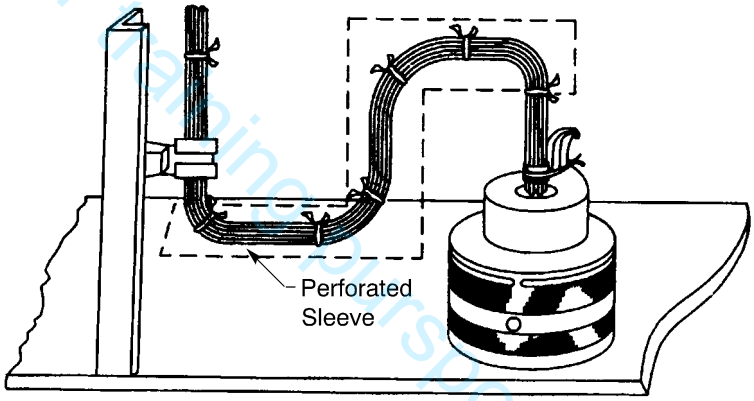
These conditions are applicable:

- A drip loop must be assembled correctly to decrease the movement of the loop
- A drip loop must not rub an adjacent structure or equipment
- If the drip loop can rub against an adjacent structure or equipment, the wire harness must have protection
- A drip loop must not be assembled to control wire slack; refer to Paragraph 6.E. for the general conditions to control slack.
- Drip loops shall not be used in unpressurized areas unless the bundle routing will permit water to run down the wiring into the connector.

A satisfactory sleeve or tape for wire harness protection is:

- A Ben-Har 1151-FRB sleeve
- A perforated Teflon sleeve or an equivalent sleeve
- Scotch 70 tape or an equivalent tape.



DRIP LOOP
Figure 29

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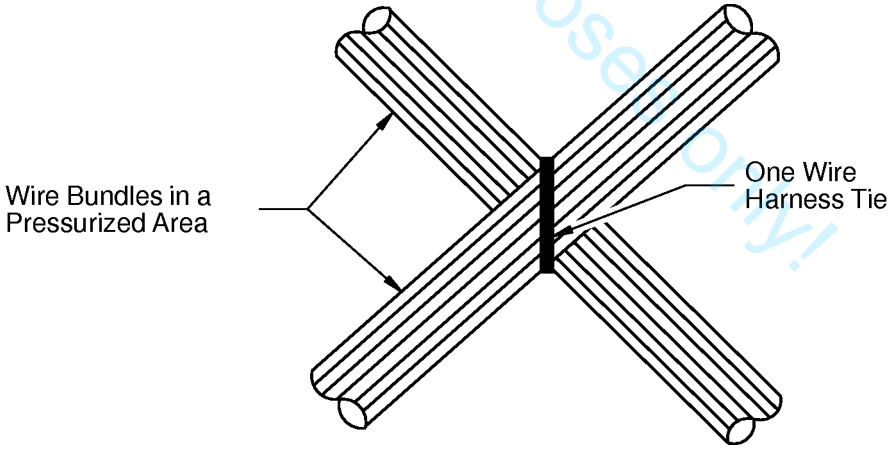
G. Wire Harnesses that Touch at an Intersection

These conditions are applicable:

- Usually, if two wire harnesses touch at an intersection, they must have positive separation with clamps and spacers to prevent damage from abrasion
- When positive separation is not possible, wire harness ties must be assembled at the intersection of the harnesses
- If two wire harnesses touch, the necessary conditions for circuit separation must be obeyed. Refer to Subject 20-10-19
- The wire harness ties must prevent the movement of the harnesses
- For harnesses that touch in a panel or on a shelf, only one wire harness tie is necessary; refer to Figure 30
- Wire harnesses that touch at an intersection are tied together using lacing tape wire harness ties or plastic ties; Refer to Paragraph .5.A.

For two wire harnesses that touch at an intersection in a pressurized area, these conditions are applicable:

- If there is no sleeve on the wire bundles, or if there is a protective sleeve that is not fiberglass, then only one wire harness tie is necessary; Refer to Figure 30
- If one wire bundle has fiberglass sleeve, the other wire bundle must have a layer of self bonding silicone tape with a 50 per cent overlap or a split sleeve at the intersection, and two wire harness ties are necessary; Refer to Figure 38, Figure 39, Paragraph 10.B. for the procedure to install a split sleeve and Subject 20-00-11 for the selection of a self bonding silicone tape
- If both wire bundles have sleeving, only one wire harness tie is necessary; Refer to Figure 33
- When wire bundles that touch are not at 90 degrees to each other, it is recommended to put the wire harness tie around the wire bundles where the angle is larger than 90 degrees; Refer to Figure .34.



WIRE HARNESSES THAT TOUCH IN A PRESSURIZED AREA AND DO NOT HAVE A FIBERGLASS SLEEVE
Figure 30

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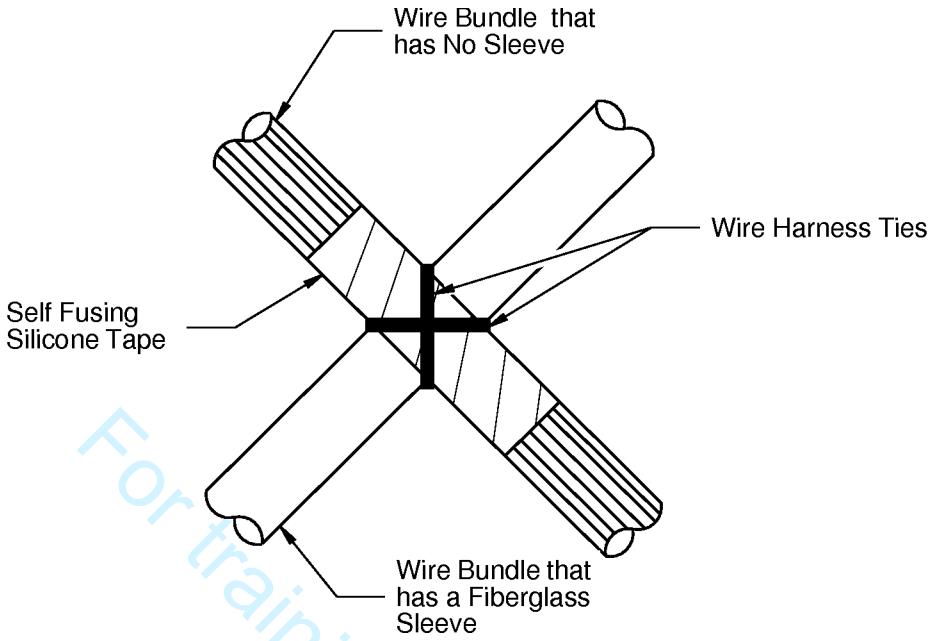
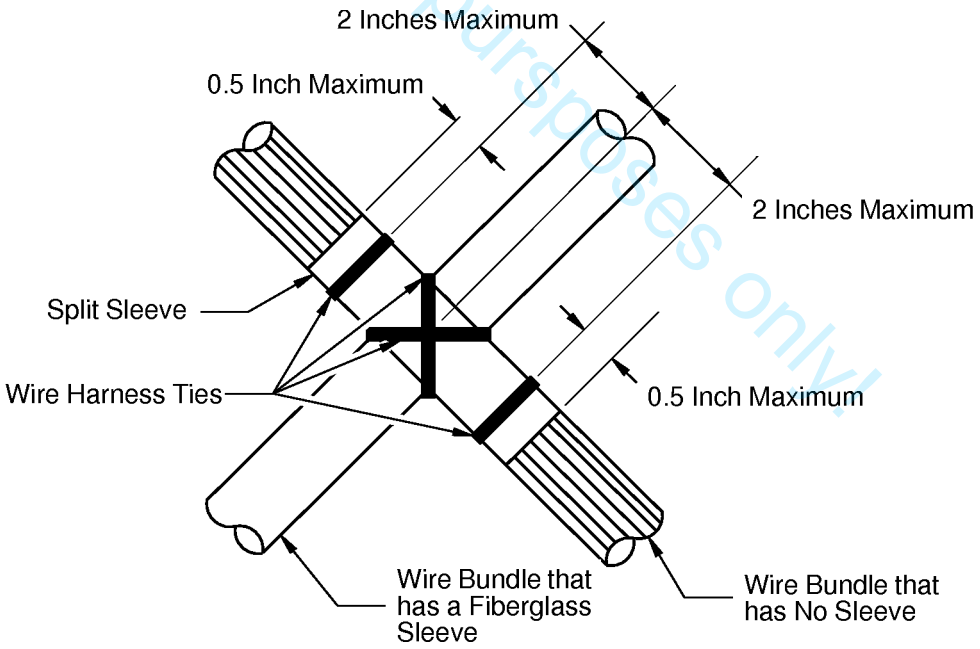
WIRING ASSEMBLY AND INSTALLATION CONFIGURATION



WIRE HARNESSES THAT TOUCH IN A PRESSURIZED AREA AND ARE PROTECTED WITH TAPE
Figure 31



WIRE HARNESSES THAT TOUCH IN A PRESSURIZED AREA AND ARE PROTECTED WITH A SPLIT SLEEVE
Figure 32

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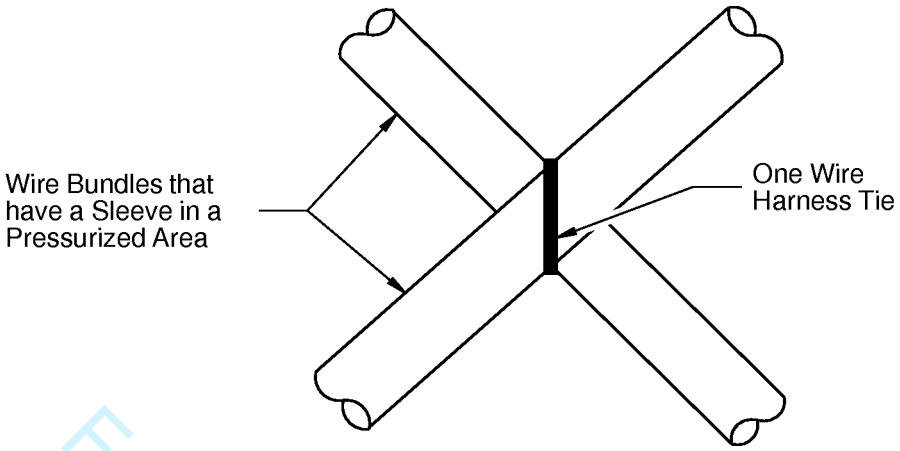
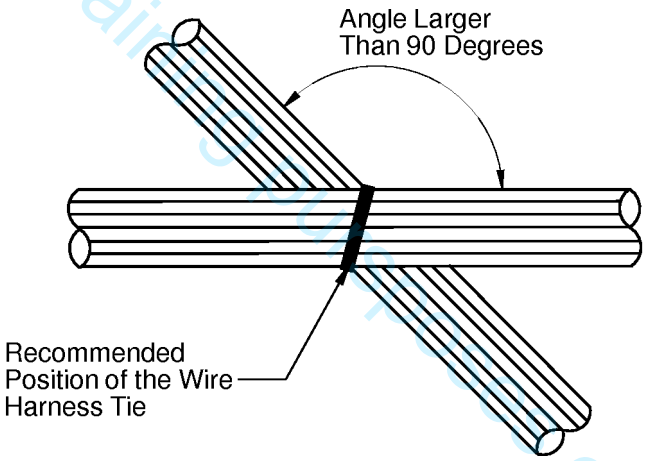
WIRING ASSEMBLY AND INSTALLATION CONFIGURATION



WIRE HARNESSES THAT TOUCH IN A PRESSURIZED AREA AND BOTH HAVE A SLEEVE
Figure 33



RECOMMENDED POSITION OF THE WIRE HARNESS TIE WHEN THE WIRE BUNDLES ARE NOT AT 90 DEGREES AND ONE WIRE HARNESS TIE IS USED
Figure 34

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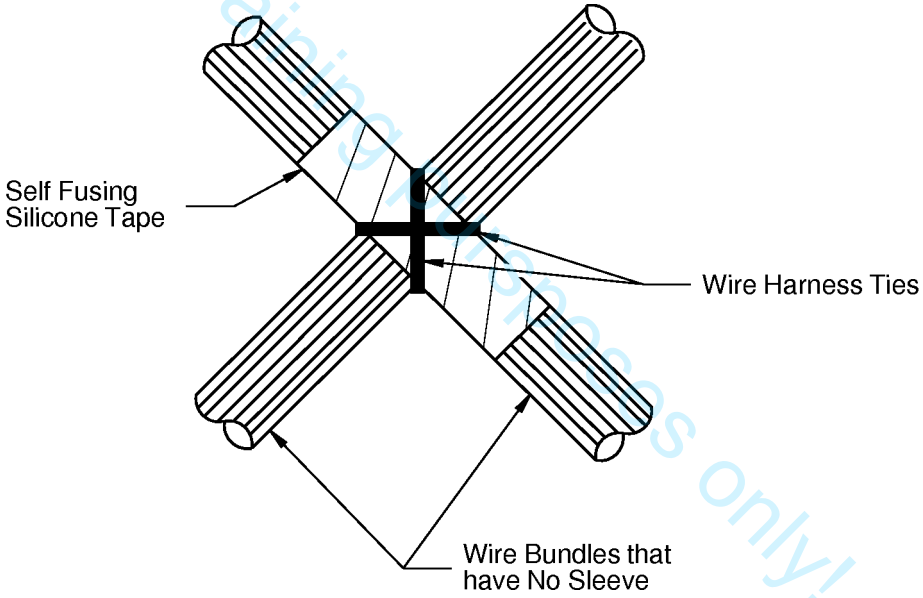
WIRING ASSEMBLY AND INSTALLATION CONFIGURATION

For two wire harnesses that touch at an intersection in an unpressurized area, these conditions are applicable:

- Two wire harness ties are necessary
- Plastic wire harness ties are not permitted; Refer to Paragraph 3.F.
- One of the wire harnesses must have a layer of self bonding silicone tape with 50 per cent overlap or a split sleeve at the intersection; refer to Figure 35, Figure 36, Figure 37, Paragraph 10.B. for the procedure to install a split sleeve and Subject 20-00-11 for the selection of a self bonding silicone tape
- If one wire bundle has a sleeve that is not fiberglass and the other wire bundle has no sleeve, two wire harness ties are necessary; Refer to Figure 37
- If one of wire bundle has a fiberglass sleeve and the other wire bundle has no sleeve, protect the wire bundle without a sleeve with a layer of tape with a 50 per cent overlap or a split sleeve; Refer to Figure 38, Figure 39, and Paragraph 10.B. for the procedure to install a split sleeve and Subject 20-00-11 for the selection of a self bonding silicone tape
- If both wire harnesses have protective sleeves, two wire harness ties are necessary; Refer to Figure 40.



WIRE HARNESSES THAT TOUCH IN AN UNPRESSURIZED AREA PROTECTED WITH TAPE
Figure 35

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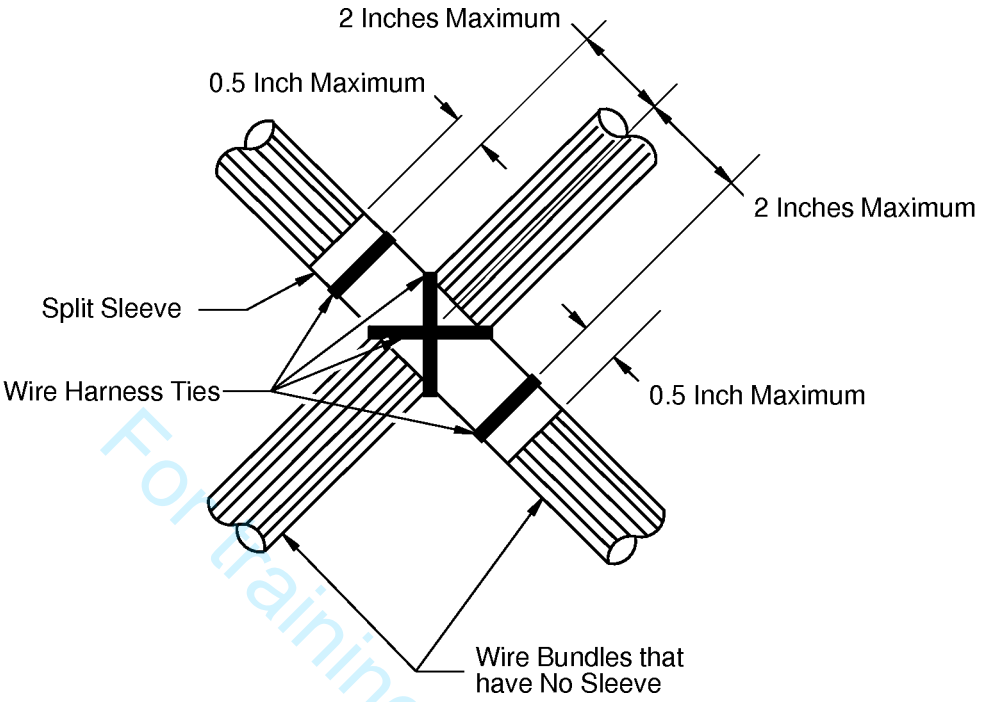
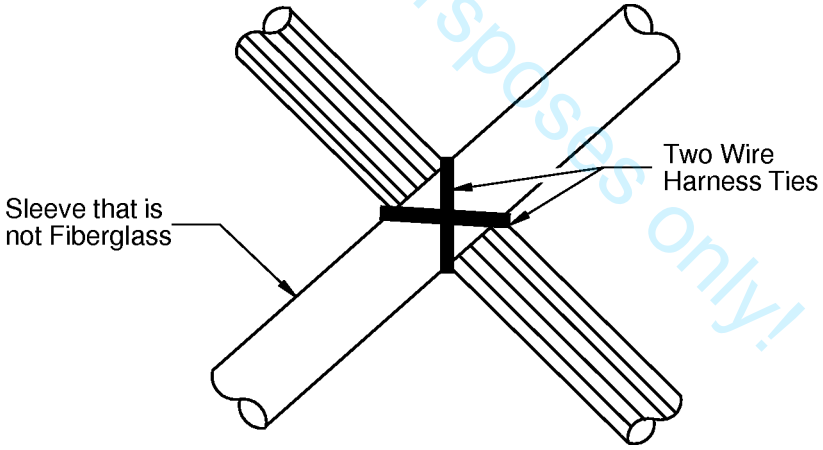
WIRING ASSEMBLY AND INSTALLATION CONFIGURATION



WIRE HARNESSES THAT TOUCH IN AN UNPRESSURIZED AREA PROTECTED WITH A SPLIT SLEEVE
Figure 36



WIRE HARNESSES THAT TOUCH IN AN UNPRESSURIZED AREA PROTECTED WITH A SLEEVE THAT IS NOT FIBERGLASS
Figure 37

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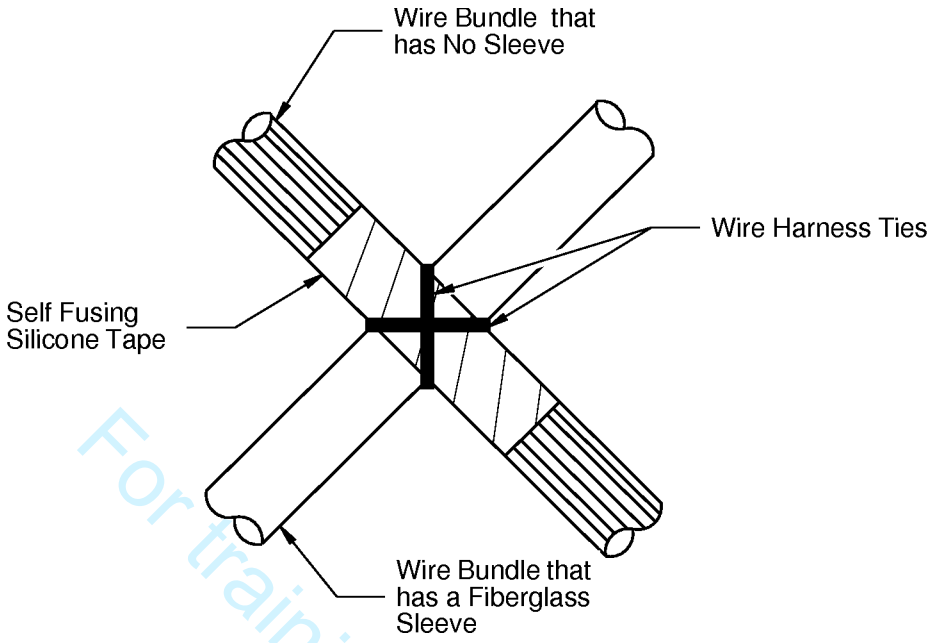
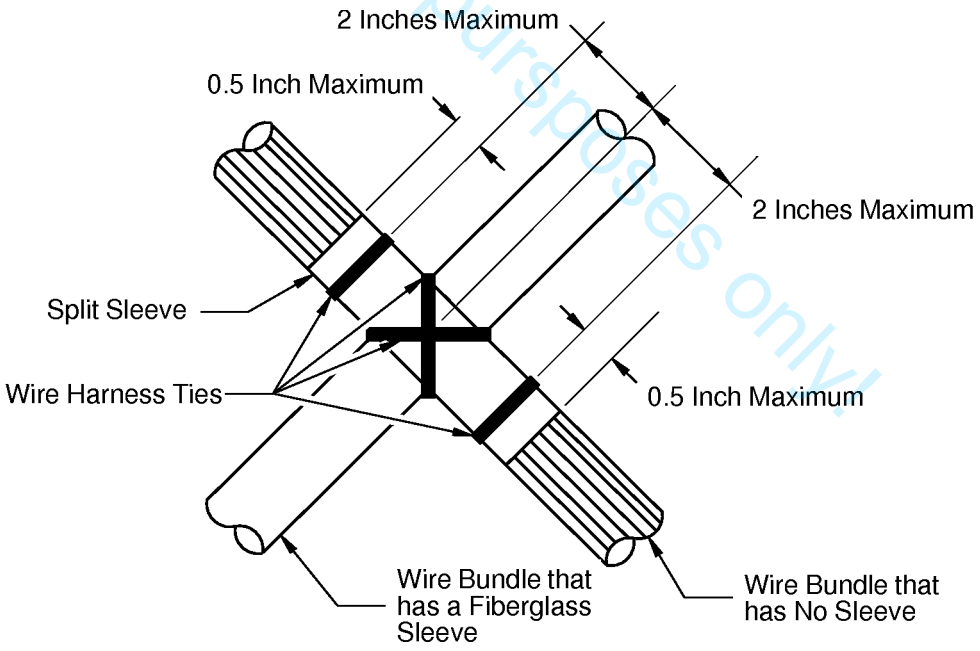
WIRING ASSEMBLY AND INSTALLATION CONFIGURATION



WIRE HARNESSES THAT TOUCH IN AN UNPRESSURIZED AREA AND ARE PROTECTED WITH TAPE
Figure 38



WIRE HARNESSES THAT TOUCH IN AN UNPRESSURIZED AREA AND ARE PROTECTED WITH A SPLIT SLEEVE
Figure 39

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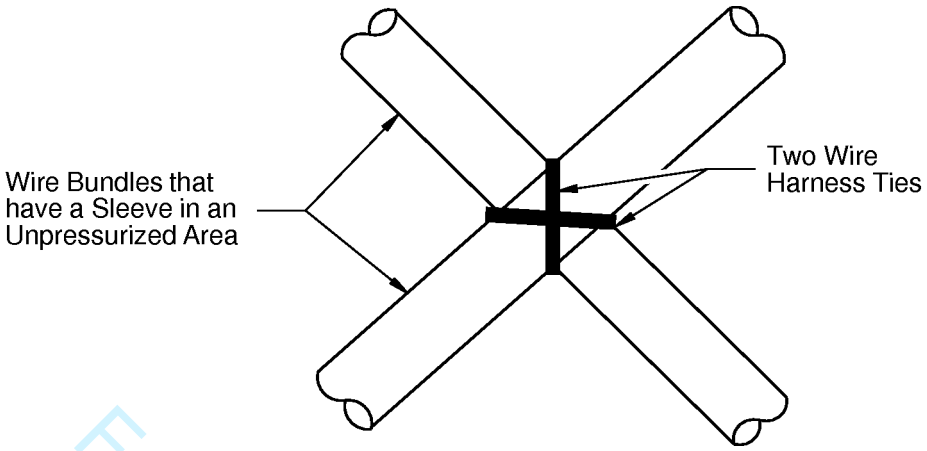


WIRE HARNESSES THAT TOUCH IN AN UNPRESSURIZED AREA AND BOTH HAVE A SLEEVE
Figure 40

H. Protection from Abrasion in a High Vibration Area

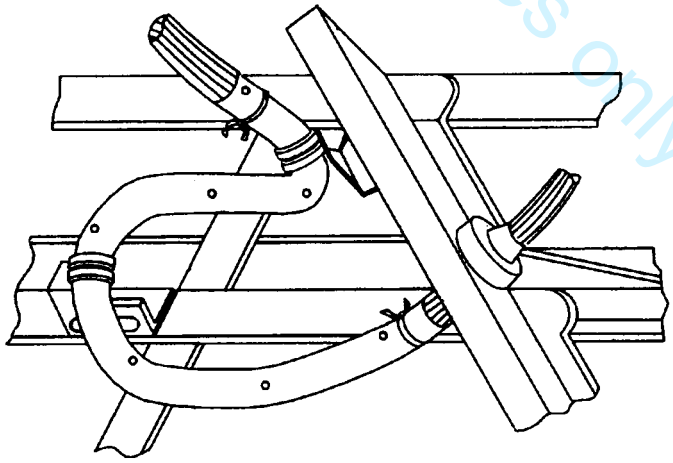
Protection is necessary for:

- A wire harness that is near the aircraft structure; refer to Figure 41
- A wire harness that is near a maintenance traffic area
- An uninsulated ground lug unless it is a flag terminal lug.

Satisfactory protection can be:

- A fiberglass protective sleeve for a wire harness
- A perforated Teflon sleeve or an equivalent sleeve for a wire harness
- A TFE heat shrinkable sleeve for an uninsulated ground lug.

Refer to Subject 20-00-11 for the specified sleeves.



PROTECTION FROM ABRASION FOR A WIRE HARNESS NEAR THE STRUCTURE
Figure 41

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I. Production Illustration Flag Markers

Pink Flag Markers:

Pink (Starting) Flag markers (Mock Up/Engineering control) are used as a manufacturing routing aid and to initially locate the wire bundle during pre-routing and final clamp up.

Pink flag markers shall be within 0.50 inch from the location shown on the P.I. drawing.

Purple Flag Markers:

Purple flag markers (Reference Only-Engineering Control) are used as manufacturing routing aid and by Engineering to control slack across hinge points adjacent to moveable parts, for face removable modules or in areas subject to wind buffeting.

Purple flag markers shall be within 0.50 inch from the location shown on the P.I. drawing.

Green Flag Markers:

Green flag markers (Reference Only) are used as a manufacturing routing aid and paper development tool for wire bundle configuration design.

Green flag markers used on engine bundles shall be within 1.00 inch from the P.I. location. All other green flag markers shall be witnin 2.00 inches from location shown on the P.I. drawing.

Yellow Flag Markers:

Yellow flag markers (Reference Only) are used as a manufacturing routing aid and paper development tool for wire bundle configuration design.

Yellow is an option to green on the 737-300, -400, and -500.

A tolerance measurement is not required for yellow flag markers.

NOTE: Flag markers other than pink, purple, or green are used as a manufacturing routing aid and the location tolerances are defined on the P. I. drawing.

NOTE: Pre-routing flag markers for jumper bundles/shelf shall be colored yellow. The location of the marker is not critical.

J. BACG20Z Nylon or PTFE Caterpillar Grommets

NOTE: An installed BACG20Z grommet must not touch a wire harness. The grommet is intended to provide abrasion protection only in the case of the failure of a wire support or a clamp.

A BACG20Z caterpillar grommet is in strip form and must be cut to the correct size for installation.

Several lengths can be used for larger holes. These must be cemented in place.

BACG20Z grommets are intended to be cemented in place. Refer to Table 17 for the recommended adhesives.

Table 17
RECOMMENDED ADHESIVES FOR BACG20Z GROMMETS

Condition	Recommended Adhesive	Supplier
General Purpose Use	BAC5010, Type 82	Boeing
Exposure to Fuel of Phosphate Esters	BAC5010, Type 70	Boeing

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7. APPLICABLE CONDITIONS - INSTALLATION OF A WIRE HARNESS THAT HAS A FIBER OPTIC CABLE

A. General Conditions

For the configuration of the fiber optic cable in the wire harness, the cable:

- Must not have a bend radius that is less than ten times the outer diameter of the fiber optic cable
- Must not make a loop unless the cable is held in its position with a wire harness tie
- Must have a drip loop at the rear of the connector
- Must not have strain where the cable is attached to the backshell or the connector
- Can have a BACS38W2 or a BACS38W3 plastic tie strap wire harness support.

A fiber optic cable must not have a kink, a dent or a deformation.

CAUTION: A FIBER OPTIC CABLE MUST NOT HAVE A KINK, A DENT OR A DEFORMATION. A KINK, A DENT OR A DEFORMATION OF A FIBER OPTIC CABLE CAN CAUSE UNSATISFACTORY PERFORMANCE OF THE CABLE.

CAUTION: IF THE BEND RADIUS OF A FIBER OPTIC CABLE IS LESS THAN TEN TIMES ITS OUTER DIAMETER, THE BEND CAN CAUSE UNSATISFACTORY PERFORMANCE OF THE CABLE.

CAUTION: AS THE BEND RADIUS OF A FIBER OPTIC CABLE BECOMES MUCH LESS THAN TEN TIMES ITS OUTER DIAMETER, THE RISK OF DAMAGE TO THE CABLE INCREASES.

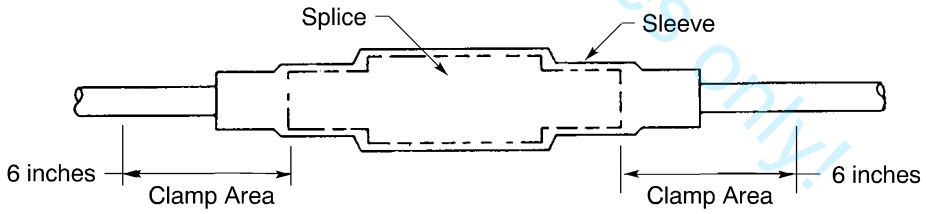
8. APPLICABLE CONDITIONS - INSTALLATION OF A POWER FEEDER WIRE HARNESS

A. General Conditions

A power feeder wire harness must have clamps installed at a maximum interval of:

- 6 inches from the end of a splice in the unpressurized area; refer to Figure 42
- 18 inches in the pressurized area.

For the configuration of splices on adjacent wires of an aluminum power feeder wire harness, refer to Subject 20-30-13.



POSITION OF THE CLAMPS NEAR THE SPLICE
Figure 42

B. Splices at Intervals

Splices at intervals must be held with a clamp between each splice. Refer to Figure 43.

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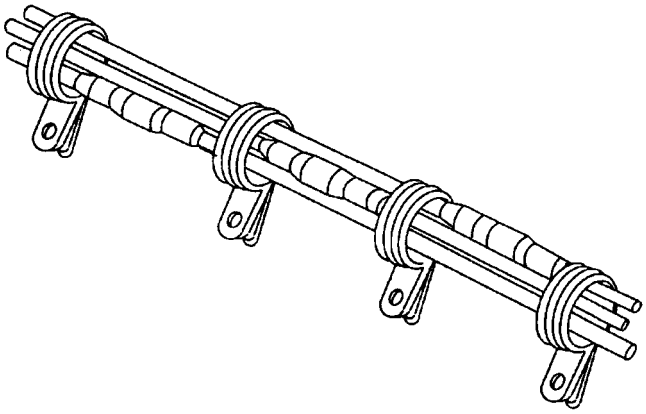

POSITION OF THE CLAMP FOR POWER FEEDER SPLICES AT INTERVALS
Figure 43

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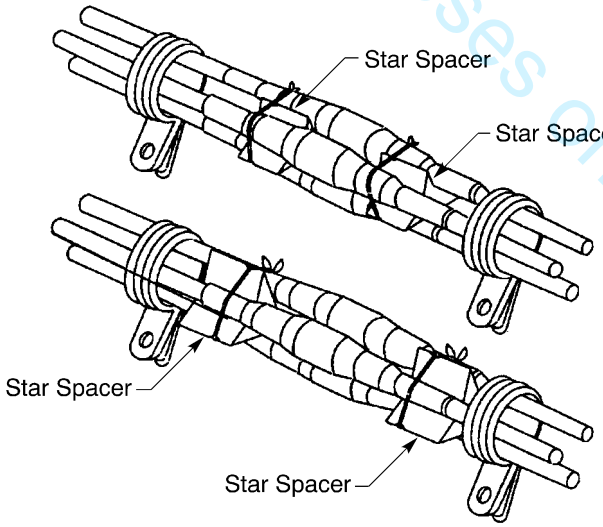
C. Splices That Have 100 Percent Overlap

Adjacent wires with splices that have 100 percent overlap must:

- Be held together with clamps and wire harness ties
- Have positive separation between the splices.

These conditions are applicable:

- The minimum distance for positive separation between each splice is 0.1 inch
- Positive separation is done with spacers; refer to Figure 44 and Table 18
- The temperature grade and the class of the spacers is equal to or higher than the grade and the class of the wire harness.



POSITIVE SEPARATION OF ADJACENT SPLICES THAT HAVE 100 PERCENT OVERLAP
Figure 44

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Table 18
SPACER PART NUMBERS

Material	Temperature Grade	Class	Part Number	Supplier
Spacer	C	1	63-9273	Plexus
Spacer, Star	C	1	BACS18AX()	Boeing

9. WIRE HARNESS SUPPORTS

A. General Conditions

Clamps must hold the wire harness tightly to prevent the movement of the wire harness in the clamp during vibration while in service.

B. Necessary Conditions for Clamp Replacement

Refer to Subject 20-10-12.

C. Necessary Conditions for Clamp Installation

Refer to Subject 20-10-12.

D. Selection of a Clamp Size

Refer to Subject 20-10-12.

E. Pull Cord Installation in a Conduit or Raceway

If it is necessary, install a pull cord in the conduit or in the raceway:

(1) Print the words "PULL-CORD" on one side of the cord at 15 inch maximum intervals throughout its length.

A hot embossing machine with marking foil should be used. Refer to Subject 20-10-11 for the marking machine and marking foil.

(2) Cut the necessary length of the pull cord.

Make sure that the pull-cord is 12 inches ±2 inches longer than the length of the conduit or the raceway.

(3) Install the pull-cord in the conduit or raceway. Refer to Figure 45.

Make sure that the excess pull cord length at each end is:

- Approximately the same
- Coiled.

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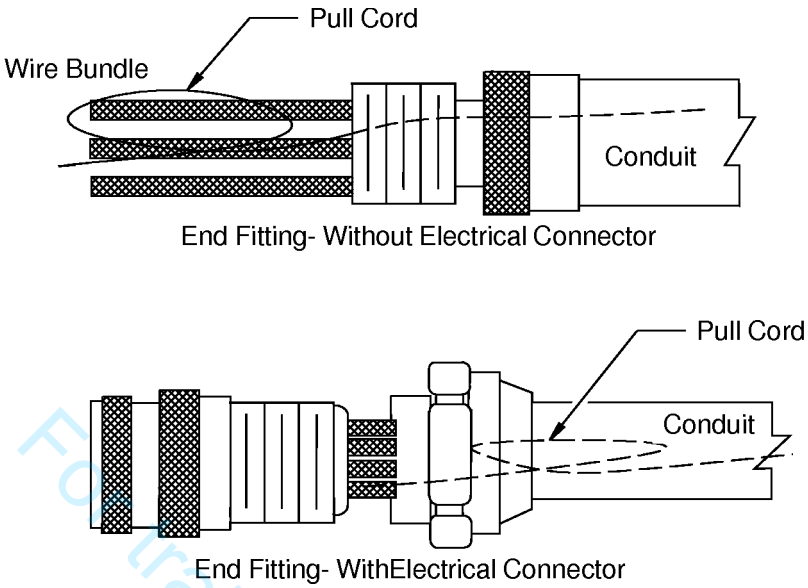

PULL-CORD INSTALLED WITHIN CONDUIT
Figure 45

(4) Tie the two coils to the harness with which it is routed.

(5) Do not include the pull-cord under a wire harness tie or clamp.

F. Installation of STBP19H1 and MB310M4 Wire Bundle Mounting Platforms

Table 19
WIRE BUNDLE MOUNTING PLATFORMS

Part Number	Material	Description
MB310M4	Polyamide 6.6 (PA66)	MB3 Type; 4 - way screw; white;L:0.75 inch W:0.75 inch; H:0.15 inch
STBP19H-1(A)	Aluminum Alloy	L:0.5 inch; W:1 inch; letter "A" after desh number designates adhesive backing on the plate. No suffix designates no adhesive backing on the plate.

NOTE: These mounting platforms are limited to pressurized areas only.

NOTE: These mounting platforms shall not be installed on aircraft primary structure.

NOTE: These mounting platforms shall be limited to wire bundles 0.38 inch or less in diameter.

NOTE: These mounting platforms may be used at manufacturing discretion to prevent chafing of wire bundles against interior panels and/or structure.

Prepare mounting surface and install mounting platform:

(1) Make a selection of adhesive. Refer to Table 20.

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Table 20
ADHESIVE

Type	Class	Designation	Description	Visual Inspection	Supplier
89	A	BMS5-105, Type II, Class 1	A two component 70 ± 10 F curing urethane adhesive FL 10	Base: a two off-white/pink viscous liquid. Activator: Brown viscous liquid	Boeing
		BMS5-105, Type II, Class 2			
		BMS5-105, Type II, Class 3			

(2) Clean faying surfaces. Refer to Subject 20-20-00.

(3) Mix base resin and activator in accordance with the manufacturer's instruction. Useful work life at 70 to 80 F is 5 to 15 minutes for Class 1 material, 15 to 70 minutes for Class 2 material, and 1 to 4 minutes for Class 3 material.

NOTE: The work life may be shortened by age of material or other factors. The work life may be extended by chilling both components prior to mixing (do not chill below dew point) or by spreading the adhesive on a cool, heat conductive surface, such as a metal caul plate, immediately after blending. A thin disposable film, such as polyethylene, may be used between the adhesive and the plate to facilitate clean-up.

(4) Apply a thin, continuous coat of blended adhesive to both faying surfaces by brush, spatula, or suitable dispensing gun. One surface application may be used on smooth faying surfaces of less than 12 square inches providing mating surfaces fit intimately. Bring the faying surfaces together and apply pressure to ensure contact.

(5) When the bondline is adjacent to decorative surfaces, wipe off excess adhesive before it has cured by a clean wiper with solvent. Do not allow the solvent to flow into the bondline.

(6) Cure in accordance with the following schedule in Table 21

Table 21
CURE TIME FOR TYPE 89 ADHESIVE

Adhesive	Full Cure Time (Minimum)	Handling Time (MInimum)	Cure Temperature (Degrees F)
BMS5-105, Type II, Class 1	24 hours	3 hours	65 (minmum)
	3 hours	-	120
	2 hours	20 minutes	140
BMS5-105, Type II, Class 2	7 days	16 hours	65 (minimum)
BMS5-105, Type II, Class 3	8 hours	50 minutes	65 (minimum)

(7) For STBP19H1 only:

(a) Make a selection of build-up material. Refer to Table 22.

Table 22
NECESSARY MATERIALS

Material	Temperature Grade	Description	Part Number	Supplier
Tape	D	Silicone	Scotch 70	3M
Heat shrinkable sleeve	B	Irradiated Polyolefin	RT-876	Raychem

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(b) Apply the build-up material over the wire bundle at the attach point.

(c) The tape or sleeve shall extend a minimum of 0.25 inch beyond the edge of mounting platform.

(d) The sleeving may be slit and tied in place with a 50% minimum overlap around the bundle.

(e) Attach wire bundle to mounting platform using a plastic tie. Refer to Table 23.

Table 23
NECESSARY MATERIALS

Parts	Part Number	Supplier
Plastic Tie Strap	BACS38K1	Boeing
	BACS38K4	Boeing

10. SPLIT SLEEVE INSTALLATION

A. Necessary Materials

Table 24
NECESSARY MATERIALS

Material	Part Number	Supplier
Nylon Varnish	Nycote 88	Nycote Laboratories
Sleeve	AMS-DTL-23053/12 Class 2	An available source
	AMS-DTL-23053/12 Class 5	An available source
	TFE 2X Standard Wall	Chemplast
	TFE 2X Standard Wall	Zeus Industrial Products
	TFE 2XTW Thin Wall	Zeus Industrial Products
	TFE 4X	Chemplast
	TFE 4X	Zeus Industrial Products
	TFE Perforated	Zeus Industrial Products

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B. Installation of a Split Sleeve For Protection of a Wire Harness

(1) Make a selection of a sleeve from Table 24.

If the sleeve gives protection for wire bundles that touch and are tied together, a 5 inch length minimum of sleeve is necessary.

NOTE: The sleeve must have the sufficient diameter to make a 0.5 inch minimum overlap on the wire harness.

NOTE: For alternative heat shrinkable sleeves, refer to Subject 20-00-11.

(2) Cut the sleeve longitudinally in a straight line.

(3) Put the sleeve around the wire harness.

If the diameter of the wire harness is larger than 0.32 inch, make sure one edge of the sleeve makes a 0.5 inch minimum overlap with the other edge of the sleeve.

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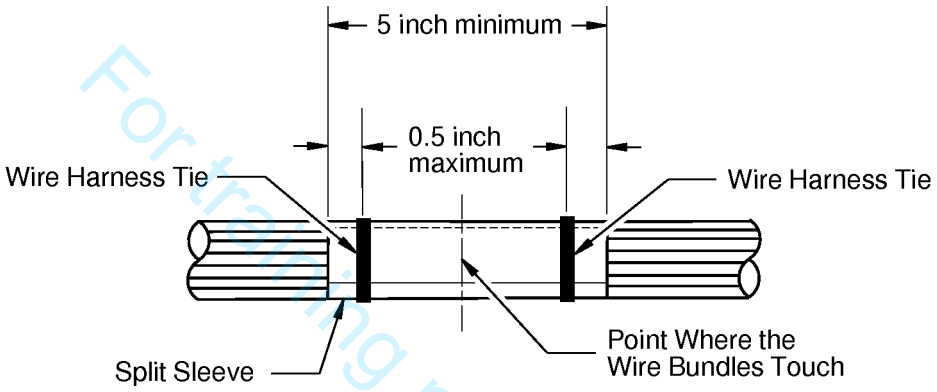
If the diameter of the wire harness is 0.32 inch or smaller, make sure that the longitudinal edges of the sleeve make an overlap of not less than 50 percent of the circumference of the wire harness.

(4) If the sleeve gives protection for wire bundles that touch and are tied together, assemble a wire harness tie at the ends of the sleeve. Refer to Paragraph 5. and Figure .46.

CAUTION: DO NOT ASSEMBLE A WIRE HARNESS TIE AT THE CENTER OF THE SLEEVE WHEN THE SLEEVE GIVES PROTECTION FOR WIRE BUNDLES THAT TOUCH. A WIRE HARNESS TIE PUT AT THE CENTER OF THE SLEEVE WHEN A WIRE HARNESS TOUCHES ANOTHER WIRE HARNESS WILL CAUSE UNSATISFACTORY PERFORMANCE OF THE WIRE HARNESSES.



SPLIT SLEEVE INSTALLATION WHEN WIRE BUNDLES TOUCH
Figure 46

Make sure that:.

- The overlap of the sleeve stays in its position. Refer to Step (3)
- The last wire harness tie on each end of the sleeve is a maximum of 0.5 inch from the end of the sleeve.

(5) If the sleeve does not give protection for wire bundles that touch, assemble a wire harness tie at the center of the sleeve and assemble wire harness ties at 2.00 inches ±0.25 inch intervals from the center wire harness tie to each end of the sleeve. Refer to Paragraph 5.. Refer to Paragraph 5.

Make sure that:.

- The overlap of the sleeve stays in its position. Refer to Step (3)
- The last wire harness tie on each end of the sleeve is a maximum of 0.5 inch from the end of the sleeve.

C. Installation of a Split Sleeve For Wire or Cable Separation

For the conditions that are applicable for wire and cable separation, refer to Subject 20-10-19.

(1) Make a selection of a sleeve:

NOTE: The sleeve must have the sufficient diameter to make a 0.5 inch minimum overlap on the wire harness.

(a) If the sleeve is specified, use the specified sleeve.

(b) If the sleeve is not specified, refer to Subject 20-10-19 for the applicable conditions for the selection of a sleeve.

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(2) Cut the sleeve longitudinally in a straight line.

(3) If the sleeve is made of fiberglass:

(a) Make a selection of a nylon varnish from Table 24.

(b) Apply the nylon varnish to the ends of the sleeve that have been cut.

(4) Put the sleeve around the wire harness.

If the diameter of the wire harness is larger than 0.32 inch, make sure one edge of the sleeve makes a 0.5 inch minimum overlap with the other edge of the sleeve.

If the diameter of the wire harness is 0.32 inch or smaller, make sure that the longitudinal edges of the sleeve make an overlap of not less than 50 percent of the circumference of the wire harness.

(5) Assemble a wire harness tie at the center of the sleeve. Refer to Paragraph 5.

Make sure that the overlap of the sleeve stays in its position. Refer to Step (4).

(6) Assemble wire harness ties at 4 inch intervals from the center wire harness tie to each end of the sleeve. Refer to Paragraph 5.

Make sure that:

- The last wire harness tie on each end of the sleeve is a maximum of 0.5 inch from the end of the sleeve
- The overlap of the sleeve stays in its position. Refer to Step (4).

11. CHANGE OF WIRING

A. Selection of a Configuration of a New Wire Installation

For the conditions that are applicable for the data in this paragraph, refer to Paragraph 6.B.

A new wire:

- Must have the correct wire identification
- Must have EMI protection if it is necessary
- Can be installed on top of a wire harness tie, a plastic ties strap, a tape, or an identification marker that is installed on a wire harness
- Must be installed in the same clamps as the those of the main wire harness.

Table 25
SELECTION OF A CONFIGURATION OF A NEW WIRE INSTALLATION

Applicable Conditions	Configuration	Installation Procedure
The main wire harness does not have an overall shield.	The new wire is installed on top of the main wire harness.	Paragraph 11.C.
The main wire harness has an overall shield and EMI protection for the new wire is not necessary.	The new wire is installed on top of the overall shield of the main wire harness.	Paragraph 11.D.
The main wire harness has an overall shield and the new wire must have EMI protection.	The new wire is installed between the external surface of the wire harness and the overall shield.	Paragraph 11.E.
	An overall shield is installed on the new wire and the new wire is installed on top of the overall shield of the main wire harness.	Paragraph 11.F.

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B. Identification of a New Wire

NOTE: A new wire can be identified by one of these types of a wire identification:

- A direct mark
- An indirect mark.

(1) If the new wire has an old identification that is a direct mark, install a sleeve or a tape with the new identification:

- On each end of the harness
- On all branches that are longer than two feet.

Refer to Table 26

(2) If the wire has an old identification that is an indirect mark, replace the identification sleeve or tape with a sleeve or tape that has the new identification.

Refer to Table 26

(3) If the new wire does not have an old identification mark, put the full identification on the wire. Refer to Table 26

The full identification includes:

- The wire harness number
- The wire number
- The color code
- The wire size.

C. Installation of a New Wire on a Wire Harness that does not have an Overall Shield

For the conditions that are applicable for the data in this paragraph, refer to Paragraph 11.A.

(1) Put the correct identification on the new wire. Refer to Paragraph 11.B.

(2) Remove the necessary clamps along the main wire harness where the wire must be installed.

(3) Install the wire on the external surface of the main harness.

Refer to Paragraph 3. for the general conditions that are applicable for wire harness assembly.

NOTE: The wire can be installed on top of a wire harness tie, a plastic tie strap, a tape, or a marker that is installed on the wire harness.

(4) If the harness is installed in the airplane, assemble wire harness ties or install plastic tie straps at approximately one foot intervals between the clamps. Paragraph 5.

(5) If the harness is not installed in the airplane, assemble wire harness ties or install plastic tie straps at the same intervals as the intervals of the wire harness ties on the harness. Paragraph 5.

(6) Put the wire in the same clamps as those of the main harness.

(7) Install the clamps in their initial configuration. Refer to Subject 20-10-12.

D. Installation of a New Wire on a Wire Harness that has an Overall Shield

For the conditions that are applicable for the data in this paragraph, refer to Paragraph 11.A.

(1) Put the correct identification on the new wire. Refer to Paragraph 11.B.

(2) Remove the necessary clamps along the main wire harness where the wire must be installed.

(3) Install the wire on top of the overall shield.

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Refer to Paragraph 3. for the general conditions that are applicable for wire harness assembly.

NOTE: The wire can be installed on top of a wire harness tie, a plastic tie strap, a tape, or a marker that is installed on the wire harness.

(4) Install a wire harness tie or a plastic strap on the new wire and the main harness at four inch intervals. Refer to Paragraph 5.

(5) Put the wire in the same clamps as those of the main harness.

(6) Install the clamps in their initial configuration. Refer to Subject 20-10-12.

E. Installation of a New Wire between the Overall Shield and the Wire Harness

For the conditions that are applicable for the data in this paragraph, refer to Paragraph 11.A.

(1) Put the correct identification on the new wire. Refer to Paragraph 11.B.

(2) Remove the necessary clamps along the main wire harness where the wire must be installed.

(3) If it is necessary, remove the overall shield from the wire harness.

(4) Install the wire between the external surface of the harness and the shield.

Refer to Paragraph 3. for the general conditions that are applicable for wire harness assembly.

NOTE: The wire can be installed on top of a wire harness tie, a plastic tie strap, a tape, or a marker that is installed on the wire harness.

(5) If the harness is installed in the airplane, assemble wire harness ties or install plastic tie straps at approximately one foot intervals between the clamps. Refer to Paragraph 5.

(6) If the harness is not installed in the airplane, assemble wire harness ties or install plastic tie straps at the same interval as the interval of the wire harness ties on the harness. Refer to Paragraph 5.

(7) Put the overall shield of the harness in its initial configuration.

(8) Install the clamps in their initial configuration. Refer to Subject 20-10-12.

F. Installation of a New Wire and an Overall Shield on a Wire Harness that has an Overall Shield

For the conditions that are applicable for the data in this paragraph, refer to Paragraph 11.A.

(1) Put the correct identification on the new wire. Refer to Paragraph 11.B.

(2) Remove the necessary clamps along the main wire harness where the wire must be installed.

(3) Remove the wire harness ties along the harness where the wire is to be added.

NOTE: Do not remove the wire harness ties from the area of the harness near the shield ground wire of the overall shield.

(4) Install an overall shield on the wire. Refer to Subject 20-25-11.

(5) Install the wire on top of the overall shield of the main harness.

Refer to:

- Paragraph 3. for the general conditions that are applicable for wire harness assembly
- Subject 20-25-11 for the modification of a wire harness with an overall shield.

NOTE: The wire can be installed on top of a wire harness tie, a plastic tie strap, a tape, or a marker that is installed on the wire harness.

(6) Put the wire in the same clamps as those of the main harness.

(7) Install the clamps in their initial configuration. Refer to Subject 20-10-12.

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G. Removal of a Wire or Wire Harness from Operation

CAUTION: FLUID OR CONTAMINATION ON THE FREE END OF A WIRE, A CABLE, OR A WIRE HARNESS CAN CAUSE UNSATISFACTORY PERFORMANCE OF THE WIRE, THE CABLE, OR THE CONNECTOR.

CAUTION: UNWANTED MOVEMENT OF THE FREE END OF A WIRE, A CABLE, OR A WIRE HARNESS CAN CAUSE DAMAGE TO ADJACENT WIRES OR EQUIPMENT.

If the removal, or the removal of the function of a wire, a cable, or a wire harness from the airplane is specified and the removal of the wire, cable or wire harness can cause damage to adjacent wires or equipment, these precautions are recommended:

- Removal of all the termination points on the wire, cable, or wire harness.
- Installation of the necessary insulation on the end of the wire, the cable, or the wire harness; refer to Paragraph 13.
- The stow of the free end of the wire, the cable, or the wire harness; refer to Paragraph 14.

12. REPAIR OR REPLACEMENT OF WIRE HARNESS IDENTIFICATION

This paragraph gives:

- The general conditions for wire identification marks
- The procedures to make an indirect mark for wire identification.

A. General Data

These types of marks can make wire identification:

- A direct mark which is a mark that is printed directly on the wire insulation
- An indirect mark which is a mark that is printed on a sleeve, a tape, a boot, or a stainless steel band that is installed on the wire, the cable, or the wire harness.

A direct mark can be used to identify:

- A wire
- A cable that is not a coax cable or a BMS13-71 fiber optic cable.

An indirect mark can be used to identify:

- A wire
- A cable
- A coax cable
- A fiber optic cable
- A wire harness.

CAUTION: A DIRECT MARK MUST NOT BE PUT ON A COAX CABLE. DAMAGE TO THE CABLE CAN OCCUR AND CAUSE UNSATISFACTORY PERFORMANCE OF THE CABLE.

CAUTION: A DIRECT MARK MUST NOT BE PUT ON A BMS13-71 FIBER OPTIC CABLE. DAMAGE TO THE CABLE CAN OCCUR AND CAUSE UNSATISFACTORY PERFORMANCE OF THE CABLE.

CAUTION: A DIRECT MARK MUST NOT CAUSE DAMAGE TO THE WIRE OR CABLE INSULATION. DAMAGE CAN CAUSE UNSATISFACTORY PERFORMANCE OF THE WIRE OR CABLE.

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B. General Conditions for Wire Identification Marks

A wire identification mark:

- Must be in upper case letters and Arabic numerals
- Must be easily read at a distance of 15 inches with ambient room light
- Must have a minimum contrast measurement of 55 percent
- Is not necessary on a wire that is less than 6 inches long.

These conditions are applicable for indirect marks:

- The maximum interval for the mark is 72 inches ±1 inch
- The mark must be installed approximately 4 inches from the end of a wire, a cable, or a wire harness
- The mark must be installed approximately 4 inches from the end of a wire harness branch, if the branch is longer than 6 feet.

C. Wire Identification Materials

Table 26
SLEEVES FOR WIRE IDENTIFICATION

Temperature Grade	Class	Specification or Part Number	Description	Supplier
A	1	BMS13-69()A	Heat Shrinkable, Wire Identifications	Boeing
B	1	AMS-DTL-23053/5	Insulation Sleeve, Electrical, Heat Shrinkable, Polyolefin, Flexible, Crosslinked	An available source
		AMS-DTL-23053/6	Insulation Sleeve, Electrical, Heat Shrinkable, Polyolefin, Semi-Rigid, Crosslinked	An available source
		AMS-DTL-23053/8	Insulation Sleeve, Electrical, Heat Shrinkable, Polyvinylidene Fluoride, Semi-Rigid, Crosslinked; applicable for ground support equipment only	An available source
		AMS-DTL-23053/18	Insulation Sleeve, Electrical, Heat Shrinkable, Modified Fluoropolymer, Crosslinked	An available source
		BMS13-69()B	Heat Shrinkable, Wire Identifications	Boeing
	2	AMS-DTL-23053/14	Insulation Sleeve, Electrical, Heat Shrinkable, Ethylenetetrafluoroethylene Fluoropolymer, Semi-Rigid	An available source
C	1	BMS13-69()C	Heat Shrinkable, Wire Identifications	Boeing
	2	MIL-I-3190/6	Insulation Sleeve, Electrical, Flexible	An available source
D	1	AMS-DTL-23053/12	Insulation Sleeve, Electrical, Heat Shrinkable, Polytetrafluoroethylene	An available source
		BMS13-69()D	Heat Shrinkable, Wire Identifications	Boeing

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Table 27
APPROVED SUPPLIERS OF BOEING HEAT SHRINKABLE IDENTIFICATION SLEEVES

Boeing Standard	Supplier
BMS13-69	Critchley
	Raychem

Table 28
TAPES FOR WIRE IDENTIFICATION

Temperature Grade	Class	Specification or Part Number	Description	Supplier
B	1	MIL-M-87958	Marker Blanks, Pressure Sensitive Adhesive, Wire or Cable Marker and Identification Label	QPL
		TMS-WM	Wrap around tape	Raychem
	2	BACT19B-T	Wire identification tape, Tedlar; pressure sensitive adhesive	Critchley
				W.H. Brady
		BACT19C-T	Wire identification tape, Tedlar; pressure sensitive adhesive	Critchley
				W.H. Brady
		BACT19E-T	Wire identification tape, Tedlar; pressure sensitive adhesive	Critchley
				W.H. Brady
		BMS 13-47	Tape, Label Stock, Wire and Harness Identification	Critchley
				W.H. Brady
	3	BACT19J	Panel Identification Tape; Pressure Sensitive Adhesive	Critchley
				W.H.Brady
D	1	HT-SCE-WM	Wrap around tape	Raychem
		HT-TMS-WM	Wrap around tape	Raychem

Table 29
TAPES FOR WIRE IDENTIFICATION NO LONGER MANUFACTURED

Specification or Part Number	Supplier
TMS-WM	Tyco/Raychem
HT-SCE-WM	Tyco/Raychem
HT-TMS-WM	Tyco/Raychem

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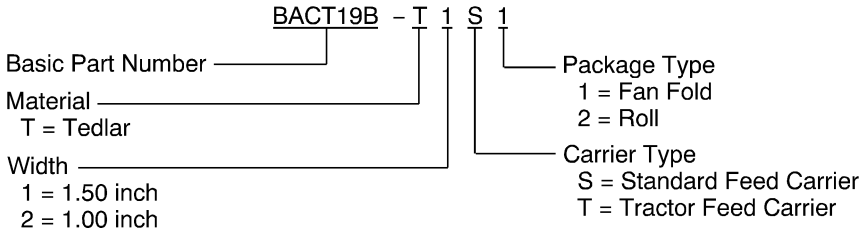
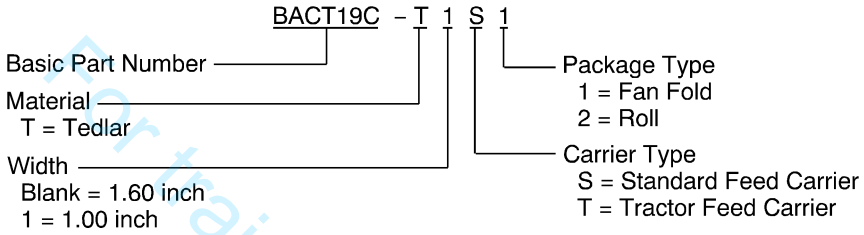
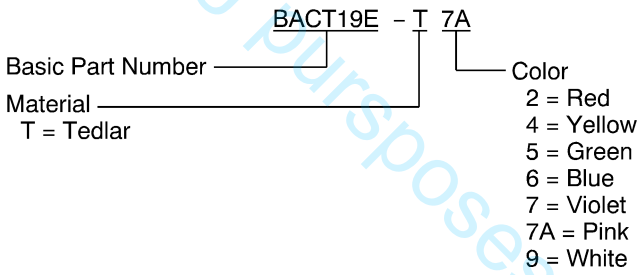
WIRING ASSEMBLY AND INSTALLATION CONFIGURATION



BACT19B-T IDENTIFICATION TAPE
Figure 47



BACT19C-T IDENTIFICATION TAPE
Figure 48



BACT19E-T IDENTIFICATION TAPE
Figure 49

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Table 30
FOILS FOR HOT STAMP

Class of the Mark	Sleeve and Tape Material	Foil		
		Part Number	Color	Supplier
1	Fiberglass	C40114	Black	Swift
		K-496	Purple	Kingsley
	Nylon	No Fault	Black	Kingsley
	Polyolefin	C40114	Black	Swift
		K-486	Black	Kingsley
		K-496	Purple	Kingsley
		No Fault	Black	Kingsley
	Silicone Fiberglass Reinforced	K-486	Black	Kingsley
2	Nylon	K-496	Purple	Kingsley
	Tedlar	C40114	Black	Swift
		K-486	Black	Kingsley
		No Fault	Black	Kingsley
	Vinyl	K-486	Black	Kingsley

Table 31
ELECTRO-CHEMICAL ETCH MARK MATERIALS FOR CONDUITS

Material	Type	Part Number of Specification	Supplier
Electrolyte	Alternating Current Formula	MSC-1	Marking Methods
	Direct Current Formula	MSC-1	Marking Methods
Felt	Type 55, 0.087 to 0.101 inches thick	MIL-F-5656	An available source
Solvent	Isopropyl Alcohol	TT-I-735	An available source
	Cleaner	APC Cleaner	Marking Methods

D. Wire Identification Equipment

Table 32
INDIRECT WIRE MARK DATA FOR BOOTS

Class of the Mark	Wire Identification			
	Mark Procedure	Mark Equipment	Mark Material	
			Part Number	Supplier
1	Rubber Stamp	A Rubber Stamp	W.E. 42 White Paste	General Printing Ink

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Table 33
INDIRECT WIRE MARK DATA FOR CLASS 1 SLEEVES

Class of the Mark	Wire Identification			
	Mark Procedure	Mark Equipment	Mark Material	
			Part Number	Supplier
1	Thermal Transfer	Intermec 4100	R430()	Brady
		Sumitomo Sumimark System, Model 1	Sumitomo ESM01SR()	Sumitomo
		Zebra 105 Series	1330-3300-()	Critchley
			TMS-RJS-Ribbon	Raychem
		Zebra 140XI Series	1330-3300-()	Critchley
			1330-5100-()	Critchley
			TMS-RJS-Ribbon	Raychem
			1901 0000	Critchley
		Sato CL408	1330-3300()	Critchley
			TMS-RJS-Ribbon	Raychem
1	Thermal Transfer	Sato CL412	1330-3300()	Critchley
			TMS-RJS-Ribbon	Raychem
		Tyco T312M	1901 0000	Critchley
			TMS-RJS-Ribbon	Raychem
		Zebra 170XI Series	1330-3300-()	Critchley
			1330-5100-()	Critchley
			1901 0000	Critchley
			TMS-RJS-Ribbon	Raychem
		Zebra TLP-2742, Tyco T208, Tyco T208M	1330-3300-101TT	Critchley
			TMS-101-Ribbon-()	Raychem
		Raychem RJS System	TMS-RJS-Ribbon	Raychem

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Table 33 (continued)

Class of the Mark	Wire Identification			
	Mark Procedure	Mark Equipment	Mark Material	
			Part Number	Supplier
1	Daisy Wheel	Raychem TMS System	RPN310347-000	Raychem
			RPN774017-000	Raychem
		Lexmark 3500	1356000	Brady
			1136391	Brady
			1337765	Brady
			2000 Series	Brady
		IBM Typewriter (Wheelprinter E1337765)	1337765	IBM
			1356000	IBM
		IBM Selectric II Typewriter	1136391	IBM
		Trojan Marking Machine	2000 Series	Brady
1	Dot Matrix	Critchley 395 Printers	1890BK05	Critchley
			2000 Series	Brady
		Epson Printers	7762L	Epson
			2000 Series	Brady
		Brady LS2000	2000 Series	Brady
		Brady SLV-DAT-PTR	R2080	Brady
			R5390	Brady
	Hot Stamp	Ackerman-Gould Hot Stamp	-	-
		Kingsley Hot Stamp Machine	Refer to Table 30 for a foil	-

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Table 34
INDIRECT WIRE MARK DATA FOR CLASS 2 SLEEVES

Class of the Mark	Wire Identification			
	Mark Procedure	Mark Equipment	Mark Material	
			Part Number	Supplier
2	Thermal Transfer	Intermec 4100	R430()	Brady
		Sumitomo Sumimark System, Model 1	Sumitomo ESM01SR()	Sumitomo
		Zebra 105 Series	1330-3300-()	Critchley
			TMS-RJS-Ribbon	Raychem
		Zebra 140XI Series	1330-3300-()	Critchley
			1330-5100-()	Critchley
			TMS-RJS-Ribbon	Raychem
			1901 0000	Critchley
		Sato CL408	1330-3300()	Critchley
			TMS-RJS-Ribbon	Raychem
2	Thermal Transfer	Sato CL412	1330-3300()	Critchley
			TMS-RJS-Ribbon	Raychem
		Zebra 170XI Series	1330-3300-()	Critchley
			1330-5100-()	Critchley
			1901 0000	Critchley
			TMS-RJS-Ribbon	Raychem
		Zebra TLP-2742, Tyco T208, Tyco T208M	1330-3300-101TT	Critchley
			TMS-101-Ribbon-()	Raychem
		Raychem RJS System	TMS-RJS-Ribbon	Raychem

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Table 34 (continued)

Class of the Mark	Wire Identification			
	Mark Procedure	Mark Equipment	Mark Material	
			Part Number	Supplier
2	Daisy Wheel	Raychem TMS System	RPN310347-000	Raychem
			RPN774017-000	Raychem
			TMS-System-Six-Ribbon-A	Raychem
		Lexmark 3500	1356000	Brady
			1136391	Brady
			1337765	Brady
			2000 Series	Brady
		IBM Typewriter (Wheelprinter E1337765)	1337765	IBM
			1356000	IBM
		IBM Selectric II Typewriter	1136391	IBM
		Trojan Marking Machine	2000 Series	Brady
2	Dot Matrix	Critchley 395 Printers	1890BK05	Critchley
			2000 Series	Brady
		Epson Printers	7762L	Epson
			2000 Series	Brady
		Brady LS2000	2000 Series	Brady
		Brady SLV-DAT-PTR	R2080	Brady
			R5390	Brady
	Hot Stamp	Ackerman-Gould Hot Stamp	-	-
		Kingsley Hot Stamp Machine	Refer to Table 30 for a foil	-

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Table 35
INDIRECT WIRE MARK DATA FOR TAPES

Class of the Mark	Wire Identification			
	Mark Procedure	Mark Equipment	Mark Material	
			Part Number	Supplier
2	Daisy Wheel	Trojan Marking Machine	2000 Series	Brady
		IBM Typewriter (Wheelprinter E1337765)	1337765	IBM
				Lexmark
			1136391	IBM
				Lexmark
			1356000	IBM
				Lexmark
			2000 Series	Brady
2	Thermal Transfer	Brady 300X Thermal Marker	4300 Series	Brady
		Brady TLS2200 or TLSPC	4300 Series	Brady
		Sato CL408	1330-3300-()	Critchley
			TMS-RJS-RIBBON-()	Raychem
		Sato CL412	1330-3300-()	Critchley
			TMS-RJS-RIBBON-()	Raychem
		Zebra 105 Series	1330-3300-()	Critchley
			TMS-RJS-RIBBON-()	Raychem
		Zebra 110xiIII +	1330-3300-(66-ZR-GFHA)	Critchley
2	Thermal Transfer	Zebra 140XI Series	1330-3300-()	Critchley
			1330-5100-()	Critchley
			TMS-RJS-RIBBON-()	Raychem
		Zebra 170XI Series	1330-3300-()	Critchley
			1330-5100-()	Critchley
			TMS-RJS-RIBBON-()	Raychem
		Zebra TLP-2742, Tyco T208, Tyco T208M	1330-3300-101TT	Critchley
			TMS-101-RIBBON-()	Raychem

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Table 35 (continued)

Class of the Mark	Wire Identification			
	Mark Procedure	Mark Equipment	Mark Material	
			Part Number	Supplier
2	Dot Matrix	Facit Printers	55368504	Facit
		Epson FX-870	R2052	Brady
		Epson LQ870	2000 Series	Brady
		Printech Dot Matrix Printer	2000 Series	Brady
		Brady LS2000	2000 Series	Brady
		Brady SLV-DAT-PTR	R2080	Brady
			R5390	Brady

Table 36
INDIRECT STAINLESS STEEL IDENTIFICATION TAG MARK DATA FOR CONDUITS

Class of the Mark	Wire Identification		
	Mark Procedure	Mark Equipment	Mark Material Part Number
1	Electro-Chemical Etch	Marking Methods Mark 300 Power Supply	Refer to Table 31.

E. Repair of an Indirect Wire Identification Mark

This paragraph gives the procedure to repair an indirect mark that cannot be read easily. For all other conditions, the wire identification mark must be replaced; refer to Table 33.

(1) Make a selection of a pen or an ink. Refer to Subject 20-00-11.

(2) If it is necessary, find the specified wire identification.

Refer to:

- The Wire List in the Wiring Diagram Manual (WDM)
- The Equipment Hookup List in the WDM.

(3) Make the necessary correction of the mark.

F. Wire Identification that is an Indirect Mark

Table 37
CHARACTER HEIGHTS FOR DIFFERENT MATERIALS

Material	Character Height (inch)	
	Minimum	Maximum
Boot	0.10	0.25
Sleeve	0.10	0.25
Tape	0.13	0.50

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Table 38
APPLICABLE CONDITIONS FOR AN OVERCOAT

Material	Type of Mark	Applicable Condition
Boot	Rubber Stamp	An overcoat is necessary
Sleeve	All types that are not made by a thermal transfer or a rubber stamp	An overcoat is necessary
	Thermal Transfer	An overcoat is not necessary
Tape	All types that are not made by a thermal transfer or a rubber stamp	An overcoat is optional
	Thermal Transfer	An overcoat is not necessary

Table 39
OVERCOAT MATERIALS

Application	Material	Part Number of Specification	Supplier
Fluid Class 1	Top Coat	EC-776-SR	3M
	Top Coat	683-3-20 and X-310A Clear Skydrol Resistant Topcoating	Akzo Coatings, Inc.
Fluid Class 2	Top Coat	Tartan Clear	Rudd Paint and Varnish Company
	Aerosol Spray	Krylon 1303	Borden

(1) Make a selection of one of these identification materials:
- A sleeve from Table 26
- A tape from Table 28.

Make sure that:
- The temperature grade and the class of the sleeve or the tape is equal to or higher than the temperature grade and the class of the wire harness
- If the material is a sleeve, the sleeve is a size that can be moved easily on the wire or wire harness.

NOTE: As an alternative, the selection can be a larger sleeve that can be held in position with wire harness ties.

(2) Make a selection of the equipment and the applicable material to make a mark.

Refer to:
- Table 32 for the necessary equipment and material to make a mark on a boot
- Table 33 for the necessary equipment and material to make a mark on a Class 1 sleeve
- Table 34 for the necessary equipment and material to make a mark on a Class 2 sleeve
- Table 35 for the necessary equipment and material to make a mark on a tape.

Make sure that the class of the mark is equal to or higher than the class of the wire harness.

(3) Make a mark on the material.

Refer to Table 37 for the necessary character height of the mark.

NOTE: For a small component, a 0.06 inch character height is satisfactory.

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(4) If the material is a tape:

(a) For a wire harness or a cable, cut a minimum 6 inch length.

(b) For one wire or one cable, cut a length that is equal to 1.5 or 2 times the wire circumference.

(5) If an overcoat is necessary, apply an overcoat. Refer to Table 38.

(a) Make a selection of an overcoat material from Table 39.

(b) Apply a thin layer of overcoat on the wire mark.

(c) Let the overcoat dry for a minimum of 10 minutes.

Make sure that the overcoat extends 0.05 inch minimum farther than each end of the mark.

(d) When the overcoat is not tacky, apply one more layer.

(6) Put the wire identification on the wire, the cable, or the wire harness.

Make sure that a clamp, a shield, a tie, or a piece of equipment does not have to be removed to read the mark.

(a) If the material is a sleeve, shrink the sleeve in position. Refer to Subject 20-10-14.

Make sure that the sleeve cannot be moved.

NOTE: As an alternative, the sleeve can be cut and held in position with wire harness ties.

CAUTION: DO NOT SPILL OR SPRAY THE OVERCOAT ON ELECTRICAL COMPONENTS. THE OVERCOAT ON CONDUCTIVE COMPONENT CAN CAUSE UNSATISFACTORY PERFORMANCE OF THE COMPONENT.

CAUTION: DO NOT APPLY HEAT TO A SLEEVE NEAR A PRESSURE SEAL OR VAPOR SEAL. DAMAGE TO THE SEAL CAN OCCUR.

CAUTION: DO NOT USE A HEAT GUN OR A HOT AIR GUN TO INSTALL HEAT SHRINKABLE MATERIALS ON A FIBER OPTIC CABLE. DAMAGE TO THE CABLE ASSEMBLY CAN OCCUR AND CAUSE UNSATISFACTORY PERFORMANCE OF THE CABLE ASSEMBLY.

(b) If the material is a heat shrinkable boot, shrink the boot in position. Refer to Subject 20-10-14.

CAUTION: DO NOT APPLY HEAT TO A BOOT NEAR A PRESSURE SEAL OR VAPOR SEAL. DAMAGE TO THE SEAL CAN OCCUR.

(c) If the material is a tape, fold the tape around the wire, the cable, or the wire harness.

(d) If the material is a wrap around identification tape, assemble a wire harness tie 0.25 inch from each end of the tape. Refer to Paragraph 5.C.

G. Identification of a BACC69A Fiber Optic Cable Assembly that is an Indirect Mark

The indirect mark must be made with a tape. Refer to Paragraph 12.F.

H. Indirect Mark Identification and Installation Procedures of Stainless Steel Identification Tag on Conduits

Table 40
CHARACTER HEIGHTS FOR DIFFERENT MATERIALS

Material	Character Height	
	Minimum	Maximum
Stainless Steel Tag	0.10	0.25

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Table 41
APPLICABLE CONDITIONS FOR AN OVERCOAT

Material	Type of Mark	Applicable Condition
Stainless Steel Tag	Electro-Chemical Etch	An overcoat is not necessary

Table 42
STAINLESS STEEL IDENTIFICATION TAG PART NUMBER

Part Number	Description	Supplier
CM-LAB-SS627	Conduit Identification Tag	Cable Markers Co

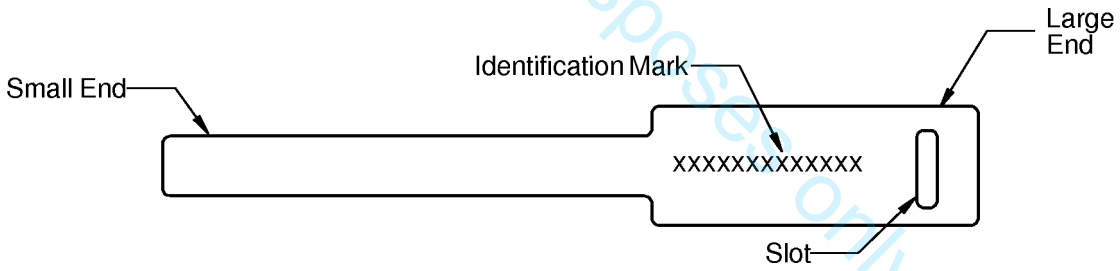
Table 43
TAG IDENTIFICATION TOOLS

Tool	Type	Supplier
Cutter	Sheet Metal	An available source
File	Metal, Fine	An available source
Pliers	-	An available source

(1) Make a selection of an electro-chemical etch equipment from Table 35.

(2) Make a selection of the electro-chemical etch materials from Table 31.

(3) Make a selection of the stainless steel tag from Table 42. Refer to Figure 50.



STAINLESS STEEL IDENTIFICATION TAG
Figure 50

(4) Use the equipment manufacturer's instructions to make the mark on the identification tag. Make sure that the mark is made on the tag where it can be seen when the band is installed.

(5) Make a selection of these tools. Refer to Table 43:
- A pair of pliers
- A cutter
- A file.

(6) Align the sides of the identification tag between the front edge and rear edge of the conduit end fitting.

(7) Bend the tag around the end fitting.

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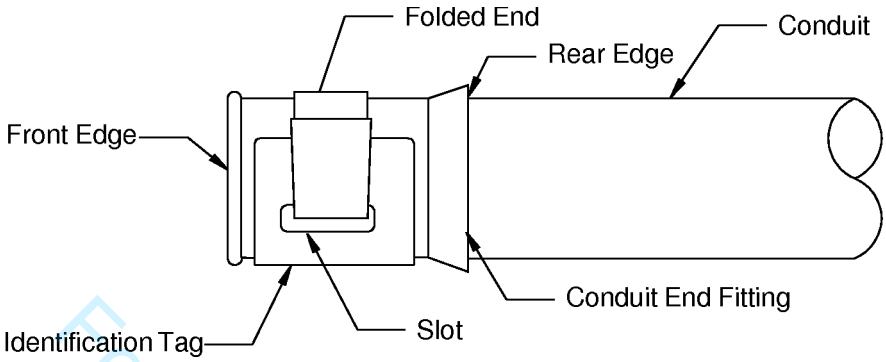
Make sure that the identification mark can be seen.

(8) Put the small end of the tag through the slot. Refer to Figure 51.



IDENTIFICATION TAG ON THE CONDUIT FITTING
Figure 51

(9) Put the small end of the tag with the pliers and fold the end toward the edge of the large end.

(10) Remove the necessary length from the small end of the tag to make the distance from the small end of the tag to large end of the tag equal to approximately 0.25 inch.

(11) Remove the sharp edges from the small end of the tag with the file.

(12) Fold the small end of the tag down and back.

Make sure that the small end of the tag is between the large end and the body of the tag that is against the conduit end fitting.

13. INSULATION OF THE FREE END OF A WIRE OR CABLE

This paragraph gives the procedures to install insulation on these configurations of wire harness components:

- The free end of a wire
- The free end of a wire with an assembled contact or terminal
- The free end of a wire with an overall shield
- The free end of a shielded wire or a cable
- The free end of a coax cable
- The free end of a wire harness with an assembled connector.

A. Conditions for the Insulation of a Free End of a Wire or Cable

The temperature grade and the class of the insulation material must be applicable for the location on the airplane. Refer to Subject 20-00-11.

These types of insulation can be installed:

- A flexible sleeve
- A heat shrinkable sleeve
- A crimp type end cap
- A heat shrinkable end cap
- A dust cap with a polyethylene bag
- A polyethylene bag.

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B. Insulation of the Free End of a Wire

(1) Move each wire away from the wire harness.

(2) Install the insulation.

For the installation of:

- A crimp type end cap, refer to Subject 20-30-16
- A flexible sleeve, refer to Paragraph 13.K.
- A heat shrinkable end cap, refer to Subject 20-30-16
- A heat shrinkable sleeve, refer to Paragraph 13.L.

C. Insulation of the Free End of a Wire that has an Assembled Contact or Terminal

(1) Move each wire away from the wire harness.

(2) Install the insulation.

For the installation of:

- A flexible sleeve, refer to Paragraph 13.K.
- A heat shrinkable sleeve, refer to Paragraph 13.L.

D. Insulation of the Free End of a Shielded Wire or Cable

(1) Move each wire or cable away from the wire harness.

(2) Assemble a shield dead end 3.00 inches ±0.25 inch from the end of the wire or the cable that is disconnected. Refer to Subject 20-10-15.

(3) Install the insulation.

For the installation of:

- An end cap, refer to Subject 20-30-16
- A flexible sleeve, refer to Paragraph 13.K.
- A heat shrinkable sleeve, refer to Paragraph 13.L.

E. Insulation of the Free End of a Coax Cable

(1) Move each cable away from the wire harness.

(2) If the coax cable has an assembled connector, install the insulation. Refer to Paragraph 13.F.

(3) If the coax cable does not have an assembled connector, install the insulation.

For the installation of:

- A flexible sleeve, refer to Paragraph 13.K.
- A heat shrinkable sleeve, refer to Paragraph 13.L.
- A heat shrinkable end cap, refer to Subject 20-30-16.

F. Insulation of the Free End of a Wire Harness that has an Assembled Connector

(1) Identify the ESD sensitivity of the equipment that is attached to the other end of the wire harness. Refer to Subject 20-41-01.

(2) If the equipment is ESD sensitive:

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(a) Make a selection of a ESDS protective dust cap that has a tight fit on the connector. Refer to Subject 20-41-01.

NOTE: A satisfactory alternative for a dust cap is an ESDS protective bag. These conditions are applicable:

- The bag is the smallest size bag that can go on the connector
- A wire harness tie is assembled on the bag and the connector shell to hold the bag tightly.

(b) Install the dust cap.

Refer to:

- A circular connector, refer to Paragraph 13.G.
- An ARINC 600 connector, refer to Paragraph 13.H.
- Other rectangular connectors, refer to Paragraph 13.I.

(3) If the equipment is not ESD sensitive:

(a) Make a selection of a dust cap that has a tight fit on the connector.

NOTE: A satisfactory alternative for a dust cap is a 0.012 inch thick polyethylene bag. These conditions are applicable:

- The bag is the smallest size bag that can go on the connector
- A wire harness tie is assembled on the bag and the connector shell to hold the bag tightly.

(b) Install the dust cap.

Refer to:

- A circular connector, refer to Paragraph 13.G.
- An ARINC 600 connector, refer to Paragraph 13.H.
- Other rectangular connectors, refer to Paragraph 13.I.

G. Insulation of the Free End of a Wire Harness that has a Circular Connector

(1) Push the dust cap on the connector until it stops.

CAUTION: DO NOT PUSH THE PLASTIC DUST CAP AGAINST THE INNER SURFACE OF THE CONNECTOR COUPLING RING. DAMAGE TO THE GROUND SPRINGS THAT ARE IN THE COUPLING RING CAN OCCUR.

(2) Make a selection of a 0.012 inch thick polyethylene bag.

Make sure that the bag is the smallest size that can go on the connector.

(3) Put the bag on the connector and the wire harness.

(4) Assemble a wire harness tie to hold the bag tightly in position. Refer to Paragraph 5.C.

Make sure that the tie is assembled on the bag and the connector shell.

H. Insulation of the Free End of a Wire Harness that has an ARINC 600 Connector

(1) Align the walls of the cap with the connector inserts.

(2) With light, equal pressure on all sides of the dust cap, push the dust cap forward against the connector shell.

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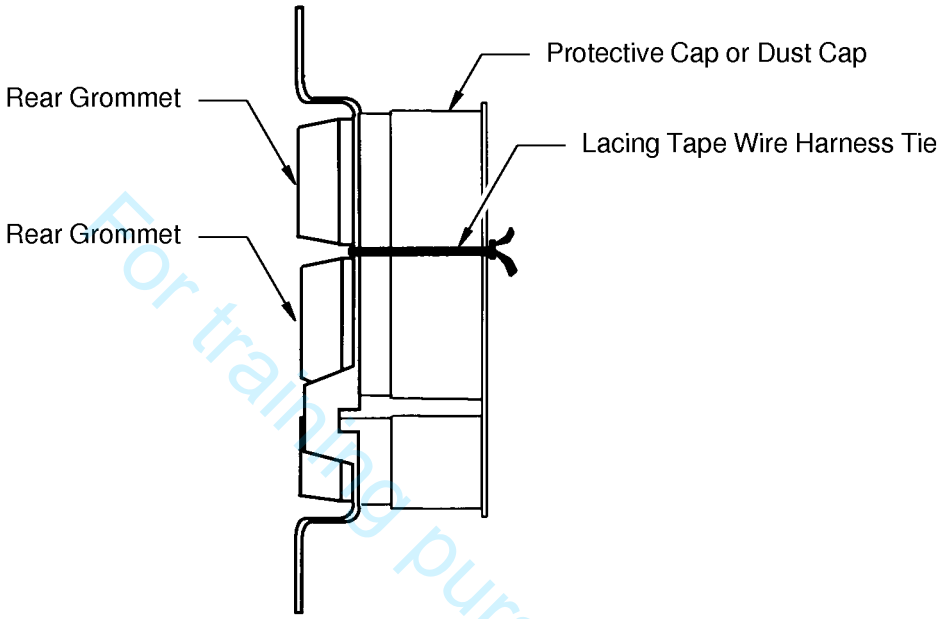
CAUTION: MORE THAN THE NECESSARY FORCE TO INSTALL THE DUST CAP MUST NOT BE APPLIED. IF THE CONNECTOR HAS GROUND SPRINGS, DAMAGE TO THE GROUND SPRINGS CAN OCCUR.

(3) Assemble a wire harness tie tightly on the dust cap between the rear grommets of the inserts of the connector. Refer to Figure 52 and Paragraph 5.C.



INSTALLATION OF A DUST CAP ON AN ARINC 600 CONNECTOR
Figure 52

Make sure that:

- The tie is between the rear grommets of the top and bottom inserts
- The tie is not on the rear grommets.

CAUTION: DO NOT USE A PLASTIC TIE STRAP TO ATTACH THE DUST CAP TO THE CONNECTOR. DAMAGE TO THE REAR GROMMET OF THE CONNECTOR CAN OCCUR.

(4) Make a selection of a 0.012 inch thick polyethylene bag.

Make sure that the bag is the smallest size that can go on the connector.

(5) Put the bag on the connector and the wire harness.

(6) Assemble a wire harness tie to hold the bag tightly in position. Refer to Paragraph 5.C.

Make sure that the tie is assembled on the bag and the connector shell.

I. Insulation of the Free End of a Wire Harness a that has a Rectangular Connector

For the installation of an ARINC 600 connector, refer to Paragraph 13.H.

(1) Push the dust cap on the connector until it stops.

(a) For a plug connector, install the dust cap on the outer surface of the shell.

(b) For a receptacle connector, install the dust cap into the inner surface of the shell.

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(2) Make a selection of a 0.012 inch thick polyethylene bag.
Make sure that the bag is the smallest size that can go on the connector.
(3) Put the bag on the connector and the wire harness.
(4) Assemble a wire harness tie to hold the bag tightly in position. Refer to Paragraph 5.C.
Make sure that the tie is assembled on the bag and the connector shell.

J. Insulation of the Free End of a Splice Plug

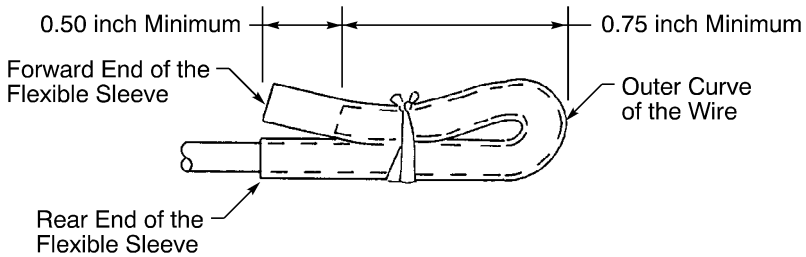
Table 44
SPLICE RECEPTACLE PART NUMBERS

Splice Plug		Splice Receptacle	
Part Number	**Supplier**	**Part Number**	**Supplier**
48-7190-()	Amphenol	48-7191-()	Amphenol
AIS16P-()	AIE	AIS16R-()	AIE

(1) Make a selection of the applicable splice receptacle from Table 44.
(2) Make a selection of a 0.012 inch thick polyethylene bag.
(3) Engage the splice receptacle and the splice plug:
(a) Align the keys of the plug with the keyways of the receptacle.
(b) Push the plug forward into the receptacle until it is fully latched.
(4) Put the bag on the splice assembly.
Make sure that the bag is the smallest size that can move over the splice plug.
(5) Assemble a wire harness tie to hold the bag tightly in position. Refer to Paragraph 5.C.

K. Installation of a Flexible Sleeve

(1) Make a selection of a heat shrinkable sleeve or a sleeve that is flexible.
Refer to Subject 20-00-11.
(2) Examine the end of the wire.
Make sure that the end of the wire is flat.
(3) For an AWG 14 and smaller wire without an assembled terminal or contact, install the sleeve. Refer to Figure 53.



POSITION OF THE FLEXIBLE SLEEVE ON THE WIRE
Figure 53

(a) Cut a 2.7 inch length of sleeve.

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(b) Put the sleeve on the wire.

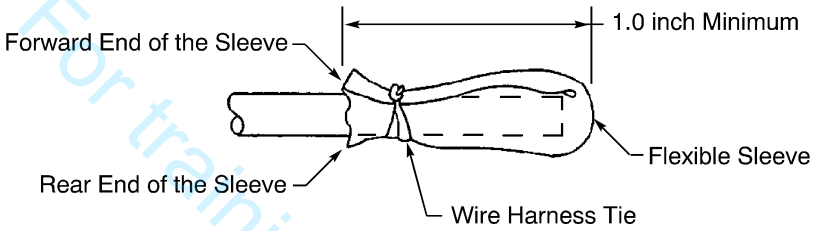
Make sure that the distance from the end of the wire to the forward end of the sleeve is a minimum of 0.50 inch.

(c) Fold the end of the wire back.

Make sure that the distance from the end of the wire to the outer curve of the wire is a minimum of 0.75 inch.

(d) Assemble a wire harness tie to hold the sleeve in position. Refer to Paragraph 5.C.

(4) For an AWG 12 and larger wire without an assembled terminal or contact, install the sleeve. Refer to Figure 54.



POSITION OF THE FLEXIBLE SLEEVE ON THE WIRE
Figure 54

(a) Cut the necessary length of sleeve.

Make sure that the sleeve has the sufficient length to extend 1.0 inch from the end of the wire to the rear end of the sleeve after the sleeve is installed and folded in half.

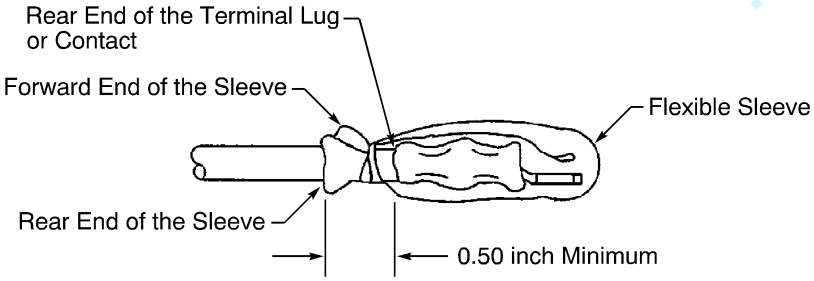
(b) Put the sleeve on the wire.

Make sure that the distance from the end of the wire to the rear end of the sleeve is a minimum of 1.0 inch.

(c) Fold the sleeve and align the ends.

(d) Assemble a lacing tape wire harness tie to hold the sleeve in its position. Refer to Paragraph 5.C.

(5) For a wire with an assembled terminal or contact, install the sleeve. Refer to Figure 55.



POSITION OF THE FLEXIBLE SLEEVE ON THE ASSEMBLED TERMINAL
Figure 55

(a) Cut the necessary length of sleeve.

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Make sure that the sleeve has the sufficient length to extend 0.50 inch from the rear end of a terminal or contact after the sleeve is installed and folded in half.

(b) Put the sleeve on the wire.

Make sure that the distance from the rear of terminal or contact to the rear end of the sleeve is a minimum of 0.50 inch.

(c) Fold the sleeve and align the ends.

(d) Assemble a lacing tape wire harness tie to hold the sleeve in its position. Refer to Paragraph 5.C.

L. Installation of a Heat Shrinkable Sleeve

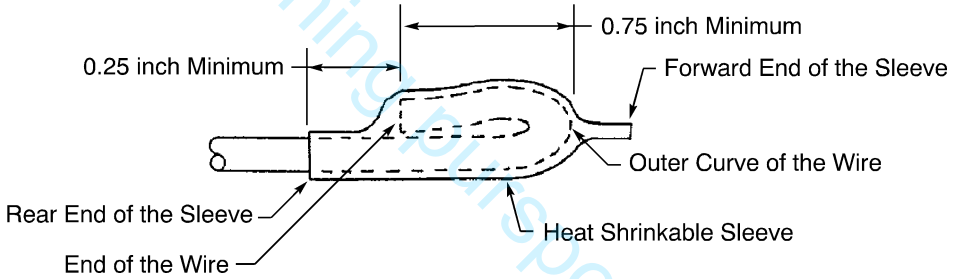
(1) Make a selection of a heat shrinkable sleeve.

Refer to Subject 20-00-11.

(2) Examine the end of the wire.

Make sure that the end of the wire is flat.

(3) For an AWG 14 and smaller wire without an assembled terminal or contact, install the sleeve. Refer to Figure 56.



POSITION OF THE HEAT SHRINKABLE SLEEVE ON THE WIRE
Figure 56

(a) Cut the necessary length of sleeve.

Make sure that:

- The sleeve has the sufficient length to extend a minimum of 1.0 inches from the end of the folded wire to the rear end of the sleeve
- The sleeve has the sufficient length to make a seal on the forward end of the sleeve.

(b) Fold the end of the wire back.

Make sure that the distance from the end of the wire to the outer curve of the wire is a minimum of 0.75 inch.

(c) Put the sleeve on the wire.

Make sure that the distance from the end of the wire to the rear end of the sleeve is a minimum of 0.25 inch.

(4) For AWG 12 and larger wire without an assembled terminal or contact, install the sleeve. Refer to Figure 57.

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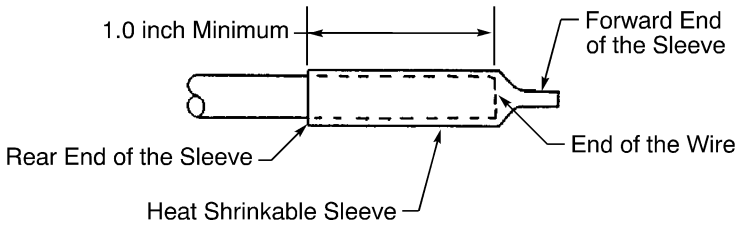


POSITION OF THE HEAT SHRINKABLE SLEEVE ON THE WIRE
Figure 57

(a) Cut the necessary length of sleeve.

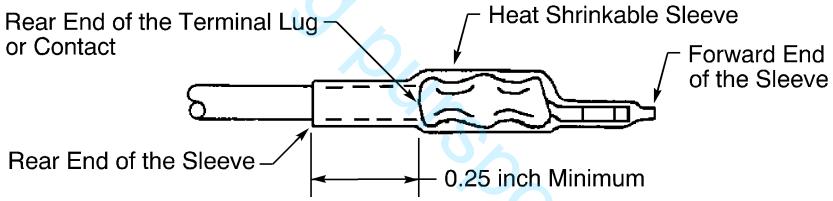
Make sure that:

- The sleeve has the sufficient length to make a seal on the forward end of the sleeve
- The sleeve has the sufficient length to extend a minimum of 1.0 inch from the end of the wire to the rear end of the sleeve.

(b) Put the sleeve on the wire.

Make sure that the distance from the end of the wire to the rear end of the sleeve is a minimum of 1.0 inch.

(5) For all wires with an assembled terminal or contact, install the sleeve.



POSITION OF THE HEAT SHRINKABLE SLEEVE ON A TERMINAL
Figure 58

(a) Cut the necessary length of sleeve.

Make sure that:

- The sleeve has the sufficient length to make a seal on the forward end of the sleeve
- The sleeve has the sufficient length to extend 0.25 inch from the rear end of a terminal or contact.

(b) Put the sleeve on the wire.

Make sure that the distance from the rear end of the terminal or contact to the rear end of the sleeve is a minimum of 0.25 inch.

(6) Shrink the sleeve into position. Refer to Subject 20-10-14.

(7) Compress the forward end of the sleeve with flat jawed pliers or an equivalent tool while the sleeve is hot. Refer to Figure 58.

Make sure that the end of the sleeve is closed.

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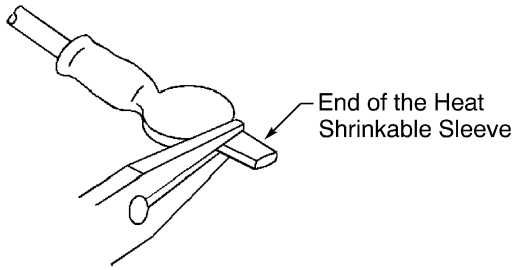

SEAL OF THE HEAT SHRINKABLE SLEEVE
Figure 59

14. STOW OF THE FREE END OF A WIRE OR CABLE

This paragraph gives the procedures for the stow of the free end of:

- A wire or a cable without a contact, a terminal lug, or a connector
- A wire or a cable in a wire harness that has an overall shield
- A wire or cable with a contact or a terminal lug
- A cable or a wire harness with a connector.

A. Selection of a Stow Configuration

CAUTION: THE STOW OF A WIRE OR CABLE IN A CONDUIT IS NOT PERMITTED. DAMAGE FROM ABRASION CAN OCCUR.

Table 45
SELECTION OF A STOW CONFIGURATION

Wiring		Stow		
Configuration	**Applicable Conditions**	**Configuration Selection**	**Configuration**	**Procedure**
A wire or a cable without a contact, a terminal, or a connector	The end of the wire or cable must have the necessary insulation; refer to Paragraph 13..	Recommended	Parallel configuration; end of the wire or cable attached to the wire harness	Paragraph 14.B.
	1. The end of the wire or cable must have the necessary insulation; refer to Paragraph 13.. 2. The wire or cable has too much length for a parallel stow.	Alternative	Wire coil configuration; end of the wire or cable attached to the wire harness	Paragraph 14.C.
	1. The end of the wire or cable must have the necessary insulation; refer to Paragraph 13.. 2. The wire or cable has too much length for a parallel stow. 3. The cable is not a coax cable.	Alternative	Folded wire configuration; end of the wire or cable attached to the wire harness	Paragraph 14.D.

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Table 45 (continued)

Wiring		Stow		
Configuration	Applicable Conditions	Configuration Selection	Configuration	Procedure
AWG 16 or smaller wire with a contact or a terminal lug	The end of the wire must have the necessary insulation; refer to Paragraph 13..	Recommended	Parallel configuration; end of the wire attached to the wire harness	Paragraph 14.B.
	1. The end of the wire must have the necessary insulation; refer to Paragraph 13.. 2. The wire has too much length for a parallel stow.	Alternative	Wire coil configuration; end of the wire attached to the wire harness	Paragraph 14.C.
	1. The end of the wire must have the necessary insulation; refer to Paragraph 13.. 2. The wire has too much length for a parallel stow.	Alternative	Folded wire configuration; end of the wire attached to the wire harness	Paragraph 14.D.
AWG 14 or larger wire with a contact or a terminal lug	The end of the wire must have the necessary insulation; refer to Paragraph 13..	Recommended	Parallel configuration; end of the wire attached to a structure	Paragraph 14.I.
	1. The end of the wire must have the necessary insulation; refer to Paragraph 13.. 2. The wire has too much length for a parallel stow.	Alternative	Wire coil configuration; end of the wire attached to the structure	Paragraph 14.J.
	The end of the wire must have the necessary insulation; refer to Paragraph 13..	Alternative	Parallel configuration; end of the wire attached to the wire harness	Paragraph 14.E.
	1. The end of the wire must have the necessary insulation; refer to Paragraph 13.. 2. The wire has too much length for a parallel stow.	Alternative	Wire coil configuration; end of the wire attached to the wire harness	Paragraph 14.F.

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Table 45 (continued)

Wiring		Stow		
Configuration	Applicable Conditions	Configuration Selection	Configuration	Procedure
A cable or a wire harness with a connector	The end of the cable or wire harness must have the necessary insulation; refer to Paragraph 13..	Recommended	Parallel configuration; the cable or wire harness attached to the structure	Paragraph 14.I.
	1. The end of the cable or wire harness must have the necessary insulation; refer to Paragraph 13.. 2. The cable or wire harness has too much length for a parallel stow.	Alternative	Wire coil configuration; end of the cable or wire harness attached to the structure	Paragraph 14.J.
	1. The end of the cable or wire harness must have the necessary insulation; refer to Paragraph 13.. 2. The cable or wire harness has too much length for a parallel stow. 3. The cable is not a coax cable. 4. The size of the largest wire is AWG 16 or smaller.	Alternative	Folded wire configuration; end of the cable or wire harness attached to the structure	Paragraph 14.K.
	The end of the cable or wire harness must have the necessary insulation; refer to Paragraph 13..	Alternative	Parallel configuration; end of the cable or wire harness attached to the wire harness	Paragraph 14.G.
	1. The end of the cable or wire harness must have the necessary insulation; refer to Paragraph 13.. 2. The cable or wire harness has too much length for a parallel stow.	Alternative	Wire coil configuration; end of the cable or wire harness attached to the wire harness	Paragraph 14.H.
AWG 16 or smaller wire or a cable in a wire harness that has an overall shield	1. The end of the wire or cable must have the necessary insulation; refer to Paragraph 13.. 2. The cable is not a coax cable. 3. The size of the largest wire is AWG 16 or smaller.	Recommended	Folded wire configuration; end of the wire or cable attached to the wire harness	Paragraph 14.D.
	The end of the wire or cable must have the necessary insulation; refer to Paragraph 13..	Alternative	Parallel configuration; end of the wire or cable attached to the wire harness	Paragraph 14.B.

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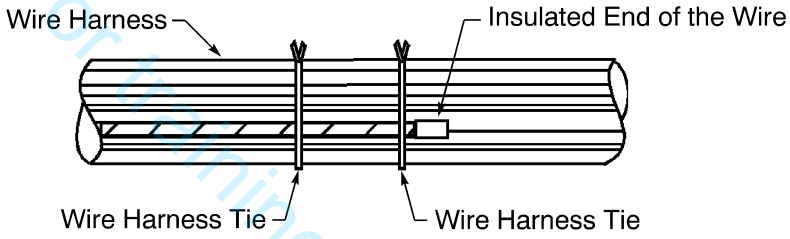
Table 45 (continued)

Wiring		Stow		
Configuration	Applicable Conditions	Configuration Selection	Configuration	Procedure
AWG 14 or larger wire or a cable in a wire harness that has an overall shield	The end of the wire or cable must have the necessary insulation; refer to Paragraph 13..	Recommended	Parallel configuration; end of the wire or cable attached to the wire harness	Paragraph 14.E.

B. A Wire or Cable in a Parallel Configuration that has its End Attached to the Wire Harness



PARALLEL STOW CONFIGURATION
Figure 60

Refer to Paragraph 5. for the procedure to assemble a wire harness tie.

(1) If the wire harness has an overall shield, push the shield away from the end of the wire.

(2) Move the wire away from the wire harness.

(3) If more than one wire makes an exit from the same area of the wire harness:

(a) Put the wires together.

(b) Assemble a wire harness tie on the wires near the wire harness.

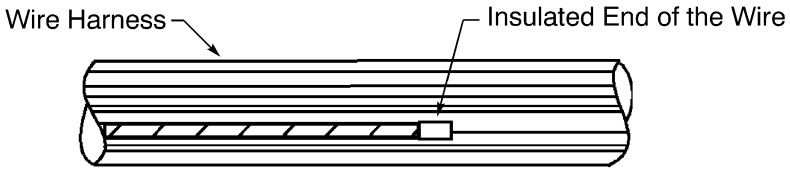
(4) If the wire harness has a sleeve:

(a) Make a selection of a sleeve that is the same material as the sleeve on the wire harness. Refer to Subject 20-00-11.

(b) Put the necessary length of sleeve on the wire.

Make sure that the sleeve extends from the point where the wire makes an exit from the wire harness to a maximum of 2 inches from the end of the wire.

(5) Align the wire with the longitudinal axis of the wire harness. Refer to Figure 61.



ALIGNMENT OF THE WIRE AND THE WIRE HARNESS
Figure 61

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(6) Assemble the necessary wire harness ties at intervals along the wire harness and near the end of the wire. Refer to Figure 60.

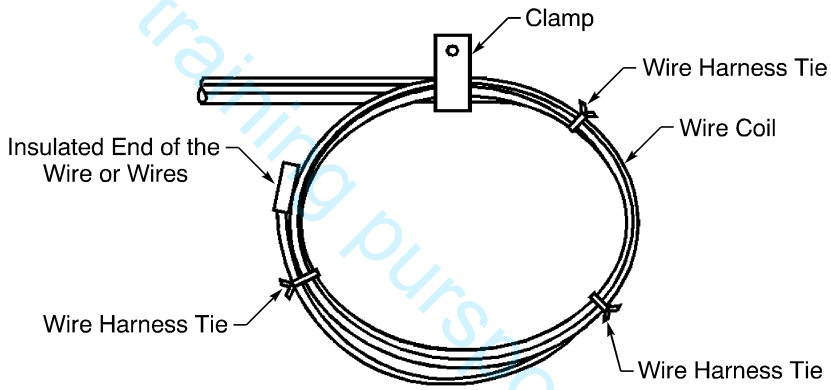
Make sure that:

- The intervals between wire harness ties on the wire are the same as the intervals of the ties on the wire harness
- Fluids cannot drain into the insulation on the end of the wire
- Contamination cannot go into the insulation on the end of the wire or cable
- The end of the wire or cable cannot be moved easily.

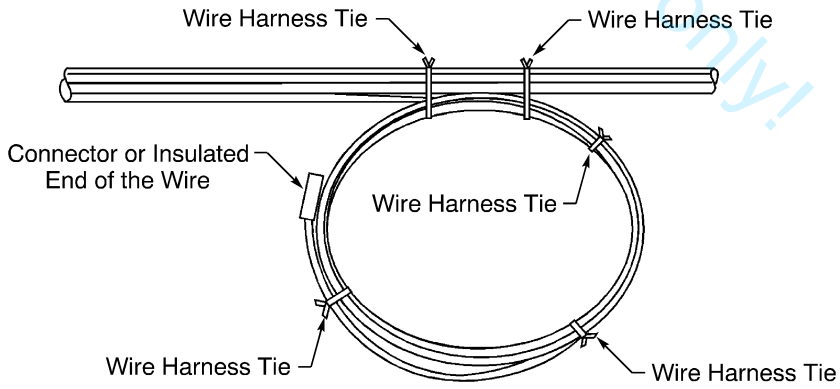
CAUTION: FLUID OR CONTAMINATION ON THE END OF A WIRE CAN CAUSE UNSATISFACTORY PERFORMANCE OF THE WIRE.

(7) If the wire harness has an overall shield, push the overall shield back into the initial position.

C. A Wire or Cable in a Wire Coil Configuration that has its End Attached to the Wire Harness



WIRE COIL STOW CONFIGURATION
Figure 62



ALTERNATIVE WIRE COIL STOW CONFIGURATION
Figure 63

Refer to Paragraph 5. for the procedure to assemble a wire harness tie.

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(1) Move the wire away from the wire harness.

(2) If more than one wire makes an exit from the same area of the wire harness:

(a) Put the wires together.

(b) Assemble a wire harness tie on the wires near the point where the wires make an exit from the wire harness.

(3) If the wire harness has a sleeve:

(a) Make a selection of a sleeve that is the same material as the sleeve on the wire harness. Refer to Subject 20-00-11.

(b) Put the necessary length of sleeve on the wire.

Make sure that the sleeve extends from the point where the wire makes an exit from the wire harness to a maximum of 2 inches from the end of the wire.

(4) Put the wire in the coil configuration. Refer to Figure 62 and Figure 63.

Make sure that the diameter of the coil is a minimum of six times larger than the diameter of the largest wire in the coil.

(5) Assemble the necessary wire harness ties at intervals along the coil. Refer to Figure 62.

Make sure that the intervals between the wire harness ties on the coil are the same as the intervals of the ties on the wire harness.

NOTE: More wire harness ties can be assembled to hold the shape of the coil.

(6) Attach the coil at the location of the nearest clamp on the wire harness. Refer to Figure 62.

NOTE: A satisfactory alternative is to put the coil against the wire harness and assemble the necessary wire harness ties. Refer to Figure 63.

(7) Assemble the necessary wire harness ties near the end of the wire and the wire coil.

Make sure that:

- Fluids cannot drain into the insulation on the end of the wire or cable
- Contamination cannot go into the insulation on the end of the wire or cable
- The end of the wire or cable cannot be moved easily.

CAUTION: FLUID OR CONTAMINATION ON THE END OF A WIRE CAN CAUSE UNSATISFACTORY PERFORMANCE OF THE WIRE.

D. A Wire or Cable in a Folded Wire Configuration that has its End Attached to the Wire Harness

CAUTION: A COAX CABLE MUST NOT BE FOLDED BACK. DAMAGE TO THE COAX CABLE OCCURS.

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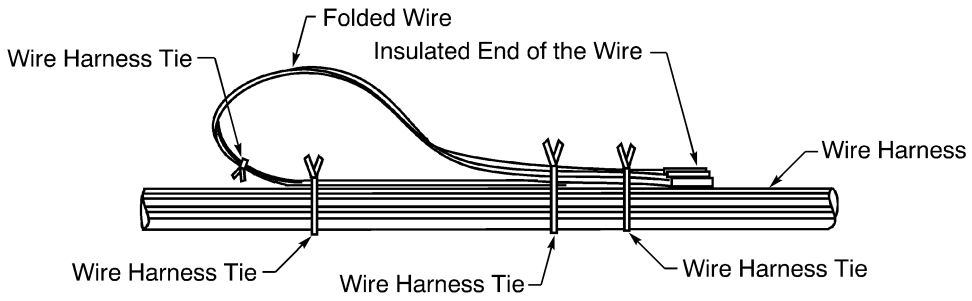


FOLDED WIRE STOW CONFIGURATION
Figure 64

Refer to Paragraph 5. for the procedure to assemble a wire harness tie.

(1) If the wire harness has an overall shield, push the shield away from the end of the wire.

(2) Move the wire away from the wire harness.

(3) If more than one wire makes an exit from the same area of the wire harness:

(a) Put the wires together.

(b) Assemble a wire harness tie on the wires a maximum of 5 inches from the point where the wires make an exit from the wire harness; refer to Figure 64.

(4) Assemble a wire harness tie on the wire harness and the wire where the wire makes an exit from the wire harness. Refer to Figure 64.

(5) If the wire harness has a sleeve:

(a) Make a selection of a sleeve that is the same material as the sleeve on the wire harness. Refer to Subject 20-00-11.

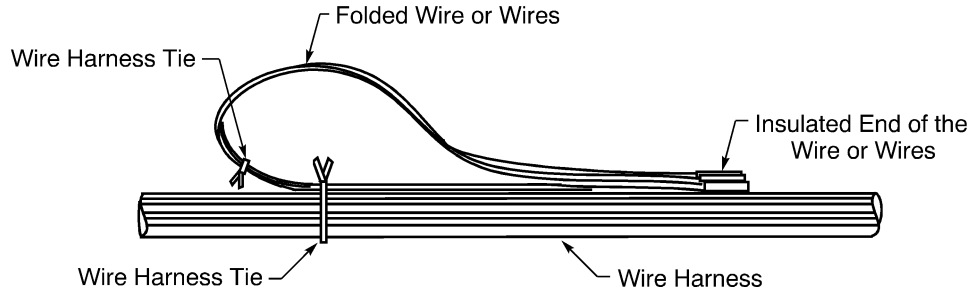
(b) Put the necessary length of sleeve on the wire.

Make sure that the sleeve extends from the point where the wire makes an exit from the wire harness to a maximum of 2 inches from the end of the wire.

(6) Fold the wire back against the wire harness. Refer to Figure 65 and Figure 66.

Make sure that:

- The diameter of the inner curve of the wire or wires is a minimum of six times larger than the diameter of the largest wire
- The outer curve of the wire is a minimum of 3.0 inches and a maximum of 6.0 inches from the rear of the cable clamp for a folded wire on a wire harness that has an overall shield.



POSITION OF THE FOLDED WIRE
Figure 65

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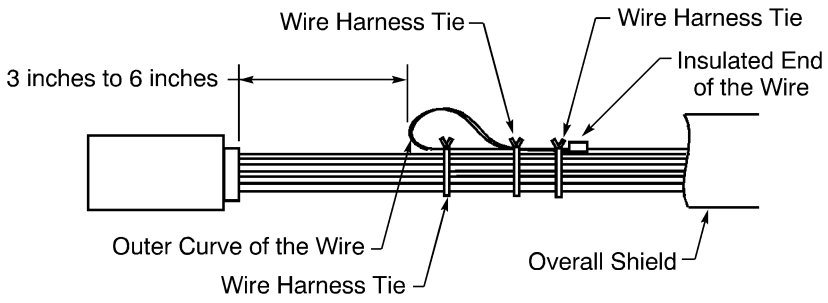


POSITION OF THE FOLDED WIRE ON A WIRE HARNESS WITH AN OVERALL SHIELD
Figure 66

(7) Assemble the necessary wire harness ties at intervals along the wire harness and near the end of the wire. Refer to Figure 64.

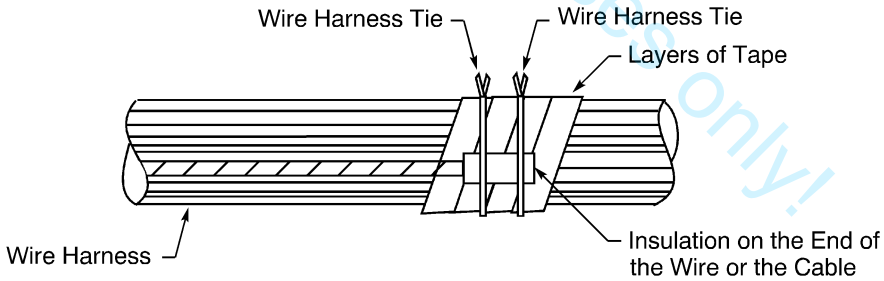
Make sure that:

- The intervals between wire harness ties on the wire are the same as the intervals of the ties on the wire harness
- Fluids cannot drain into the insulation on the end of the wire or cable
- Contamination cannot go into the insulation on the end of the wire or cable
- The end of the wire or cable cannot be moved easily.

CAUTION: FLUID OR CONTAMINATION ON THE END OF A WIRE CAN CAUSE UNSATISFACTORY PERFORMANCE OF THE WIRE.

(8) If the wire harness has an overall shield, push the overall shield back into the initial position.

E. An AWG 14 or Larger Wire in a Parallel Configuration that has its End Attached to the Wire Harness



PARALLEL STOW CONFIGURATION
Figure 67

Refer to Paragraph 5. for the procedure to assemble a wire harness tie.

(1) If the wire harness has an overall shield, push the overall shield away from the end of the wire.

(2) Move the wire away from the wire harness.

(3) If more than one wire makes an exit from the same area of the wire harness:

(a) Put the wires together.

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(b) Assemble a wire harness tie on the wires near the point where the wires make an exit from the wire harness.

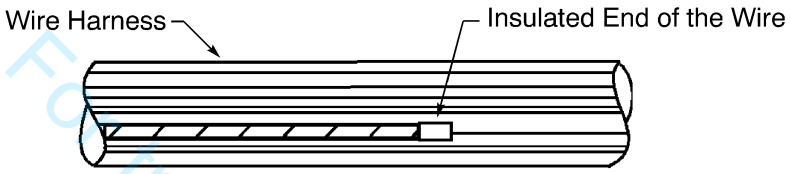
(4) If the wire harness has a sleeve:

(a) Make a selection of a sleeve that is the same material as the sleeve on the wire harness. Refer to Subject 20-00-11.

(b) Put the necessary length of sleeve on the wire.

Make sure that the sleeve extends from the point where the wire makes an exit from the wire harness to a maximum of 2 inches from the end of the wire.

(5) Align the wire with the longitudinal axis of the wire harness. Refer to Figure 68.



ALIGNMENT OF THE WIRE AND THE WIRE HARNESS
Figure 68

(6) Make a selection of a tape. Refer to Subject 20-00-11.

(7) Put a layer of tape on the wire harness where the contact or terminal lug is against the wire harness. Refer to Figure 67.

Make sure that the layer of tape:

- Makes a 50 percent overlap
- Extends approximately 0.5 inches farther than the forward end and the rear end of the contact or terminal lug.

(8) Assemble the necessary wire harness ties:

- At intervals along the wire harness
- On the contact or terminal lug.

Refer to Figure 67.

NOTE: A satisfactory alternative to the wire harness ties on the connector is one wire harness tie 2 to 3 inches from rear of the contact or terminal lug.

Make sure that:

- The intervals between wire harness ties on the wire are the same as the intervals of the ties on the wire harness
- Fluids cannot drain into the insulation on the end of the wire
- Contamination cannot go into the insulation on the end of the wire
- The end of the wire cannot be moved easily.

CAUTION: FLUID OR CONTAMINATION ON THE END OF A WIRE CAN CAUSE UNSATISFACTORY PERFORMANCE OF THE WIRE.

(9) If the wire harness has an overall shield, push the overall shield back into the initial position.

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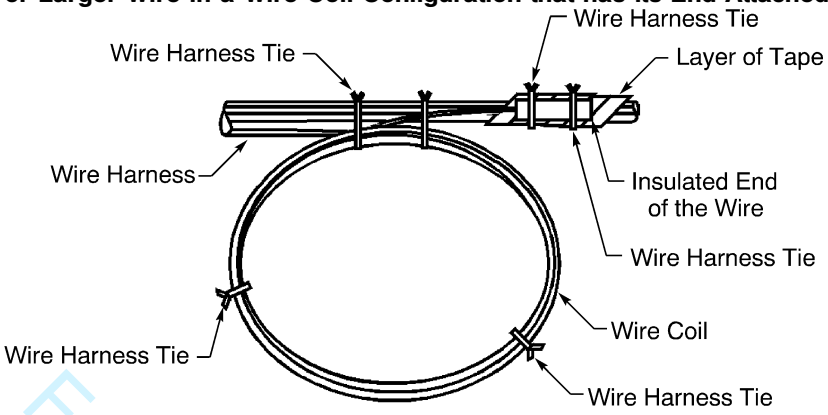
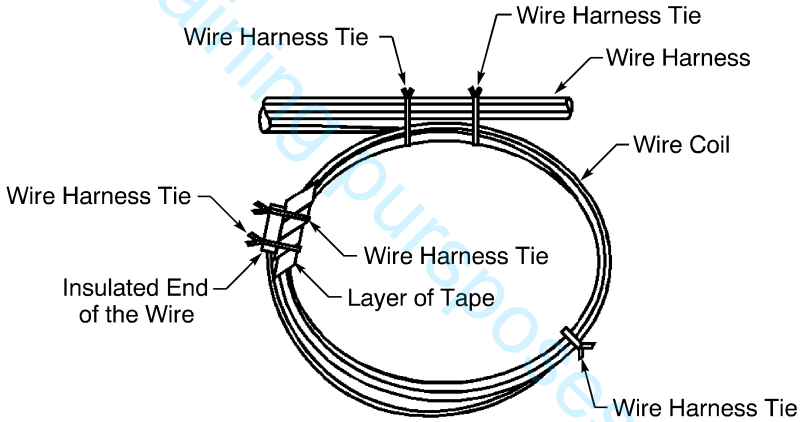
F. An AWG 14 or Larger Wire in a Wire Coil Configuration that has its End Attached to the Wire Harness



WIRE COIL STOW CONFIGURATION
Figure 69



ALTERNATIVE WIRE COIL STOW CONFIGURATION
Figure 70

Refer to Paragraph 5. for the procedure to assemble a wire harness tie.

(1) Move the wire away from the wire harness.

(2) If more than one wire makes an exit from the same area of the wire harness:

(a) Put the wires together.

(b) Assemble a wire harness tie on the wires near the point where the wires make an exit from the wire harness.

(3) If the wire harness has a sleeve:

(a) Make a selection of a sleeve that is the same material as the sleeve on the wire harness. Refer to Subject 20-00-11.

(b) Put the necessary length of sleeve on the wire.

Make sure that the sleeve extends from the point where the wire makes an exit from the wire harness to a maximum of 2 inches from the end of the wire.

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(4) Put the wire in a coil configuration. Refer to Figure 69 and Figure 70.

Make sure that:

- The diameter of the coil is a minimum of six times larger than the diameter of the largest wire or cable in the coil
- The end of the wire is in the position where it can be attached to the wire harness.

NOTE: A satisfactory alternative is to put the end of the wire against the wire coil. Refer to Figure 70.

(5) Assemble the necessary wire harness ties at intervals along the coil. Refer to Figure 69.

Make sure that the intervals between the wire harness ties on the coil are the same as the intervals of the ties on the wire harness.

NOTE: More wire harness ties can be assembled to hold the shape of the coil.

(6) Make a selection of a tape. Refer to Subject 20-00-11.

(7) Put a layer of tape on the coil or the wire harness where the contact or terminal lug is against the coil or the wire harness. Refer to Figure 69 and Figure 70.

Make sure that the layer of tape:

- Makes a 50 percent overlap
- Extends approximately 0.5 inches farther than the forward end and the rear end of the contact or terminal lug.

(8) Attach the coil at the location of the nearest clamp on the wire harness.

NOTE: A satisfactory alternative is to put the coil against the wire harness and assemble the necessary wire harness ties. Refer to Figure 69 and Figure 70.

(9) Assemble two wire harness ties on the contact or the terminal lug. Refer to Figure 69 and Figure 70.

NOTE: A satisfactory alternative is to assemble a wire harness tie 2 to 3 inches from the rear of the contact or the terminal lug. Refer to Figure 71.

Make sure that:

- Fluids cannot drain into the insulation on the end of the wire
- Contamination cannot go into the insulation on the end of the wire
- The end of the wire cannot be moved easily.

CAUTION: FLUID OR CONTAMINATION ON THE END OF A WIRE CAN CAUSE UNSATISFACTORY PERFORMANCE OF THE WIRE.

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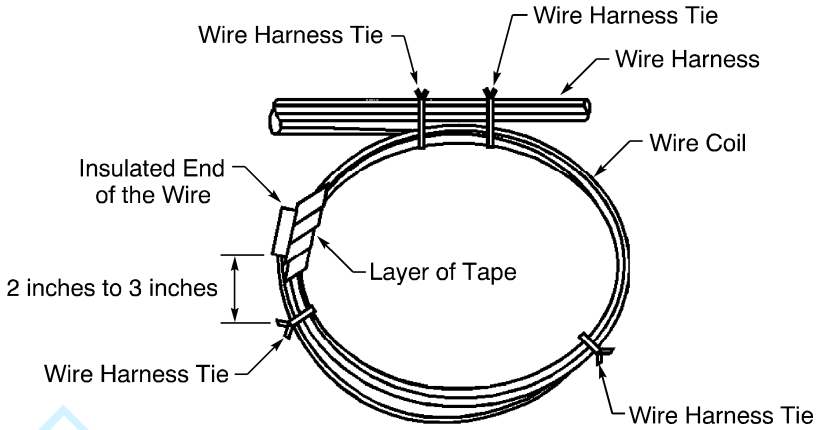
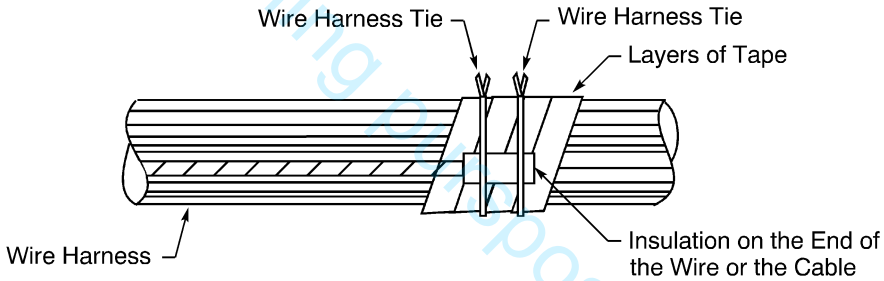


ALTERNATIVE POSITION OF THE WIRE HARNESS TIE
Figure 71

G. A Cable or a Wire Harness that has an Assembled Connector in a Parallel Configuration that has its End Attached to the Wire Harness



PARALLEL STOW CONFIGURATION
Figure 72

Refer to Paragraph 5. for the procedure to assemble a wire harness tie.

(1) If the wire harness has an overall shield, push the overall shield away from the end of the wire.

(2) Move the cable away from the wire harness.

(3) If more than one cable makes an exit from the same area of the wire harness:

  (a) Put the cables together.

  (b) Assemble a wire harness tie on the wires near the point where the wires make an exit from the wire harness.

(4) If the wire harness has a sleeve:

  (a) Make a selection of a sleeve that is the same material as the sleeve on the wire harness. Refer to Subject 20-00-11.

  (b) Put the necessary length of sleeve on the cable.

  Make sure that the sleeve extends from the point where the cable makes an exit from the wire harness to a maximum of 2 inches from the end of the cable.

(5) Align the cable with the longitudinal axis of the wire harness. Refer to Figure 73.

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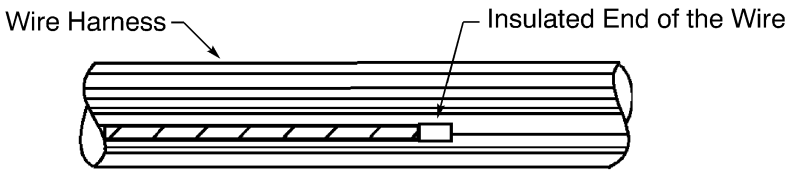

ALIGNMENT OF THE WIRE AND THE WIRE HARNESS
Figure 73

(6) Make a selection of a tape. Refer to Subject 20-00-11.

(7) Put a layer of tape on the wire harness where the connector is against the wire harness. Refer to Figure 72.

Make sure that the layer of tape:

- Makes a 50 percent overlap
- Extends approximately 0.5 inches farther than the forward end and the rear end of the connector.

(8) Assemble the necessary wire harness ties:

- At intervals along the wire harness
- On the connector.

Refer to Figure 72.

NOTE: A satisfactory alternative to the wire harness ties on the connector is one wire harness tie 2 to 3 inches from rear of the connector.

Make sure that:

- The intervals between wire harness ties on the cable are the same as the intervals of the ties on the wire harness
- Fluids cannot drain into the insulation on the connector
- Contamination cannot go into the insulation on the connector
- The connector cannot be moved easily.

CAUTION: FLUID OR CONTAMINATION IN THE CONNECTOR CAN CAUSE UNSATISFACTORY PERFORMANCE OF THE CONNECTOR.

(9) If the wire harness has an overall shield, push the overall shield back into the initial position.

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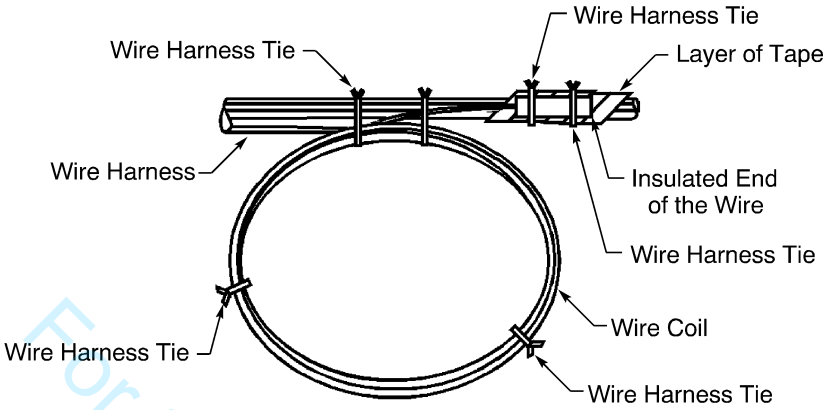
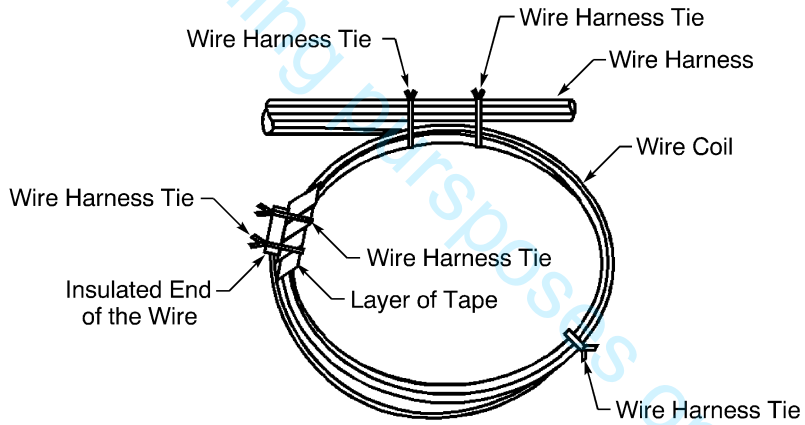
H. A Cable or a Wire Harness that has an Assembled Connector in a Wire Coil Configuration that has its End Attached to the Wire Harness



WIRE COIL STOW CONFIGURATION
Figure 74



ALTERNATIVE WIRE COIL STOW CONFIGURATION
Figure 75

Refer to Paragraph 5. for the procedure to assemble a wire harness tie.

(1) Move the cable away from the wire harness.

(2) If more than one cable makes an exit from the same area of the wire harness:

  (a) Put the cables together.

  (b) Assemble a wire harness tie on the wires near the point where the wires make an exit from the wire harness.

(3) If the wire harness has a sleeve:

  (a) Make a selection of a sleeve that is the same material as the sleeve on the wire harness. Refer to Subject 20-00-11.

  (b) Put the necessary length of sleeve on the cable.

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Make sure that the sleeve extends from the point where the cable makes an exit from the wire harness to a maximum of 2 inches from the end of the cable.

(4) Put the cable in a coil configuration. Refer to Figure 74 and Figure 75.

Make sure that:

- The diameter of the coil is a minimum of six times larger than the diameter of the largest cable in the coil
- The connector is in the position where it can be attached to the wire harness.

NOTE: A satisfactory alternative is to put the connector against the wire coil. Refer to Figure 75.

(5) Assemble the necessary wire harness ties at intervals along the coil. Refer to Figure 74.

Make sure that the intervals between the wire harness ties on the coil are the same as the intervals of the ties on the wire harness.

NOTE: More wire harness ties can be assembled to hold the shape of the coil.

(6) Make a selection of a tape. Refer to Subject 20-00-11.

(7) Put a layer of tape on the coil or the wire harness where the connector is against the coil or the wire harness. Refer to Figure 74 and Figure 75.

Make sure that the layer of tape:

- Makes a 50 percent overlap
- Extends approximately 0.5 inches farther than the forward end and the rear end of the connector.

(8) Attach the coil at the location of the nearest clamp on the wire harness.

NOTE: A satisfactory alternative is to put the coil against the wire harness and assemble the necessary wire harness ties. Refer to Figure 74 and Figure 75.

(9) Assemble two wire harness ties on the connector. Refer to Figure 74 and Figure 75.

NOTE: A satisfactory alternative is to assemble a wire harness tie 2 to 3 inches from the rear of the connector. Refer to Figure 76.

Make sure that:

- Fluids cannot drain into the insulation on the connector
- Contamination cannot go into the insulation on the connector
- The connector cannot be moved easily.

CAUTION: FLUID OR CONTAMINATION IN THE CONNECTOR CAN CAUSE UNSATISFACTORY PERFORMANCE OF THE CONNECTOR.

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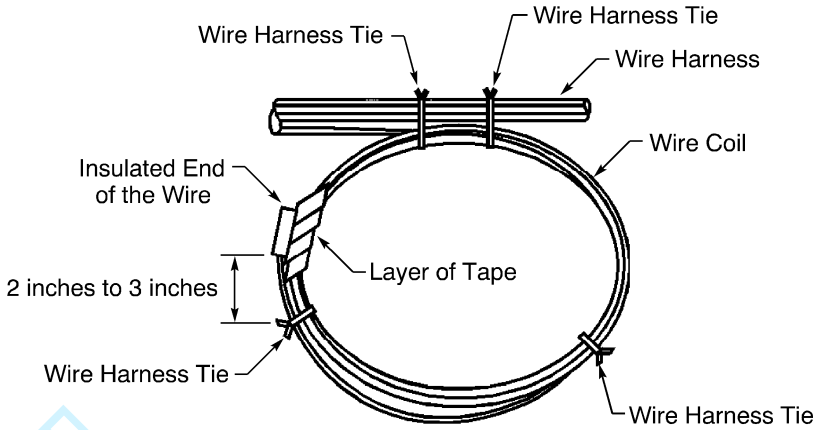
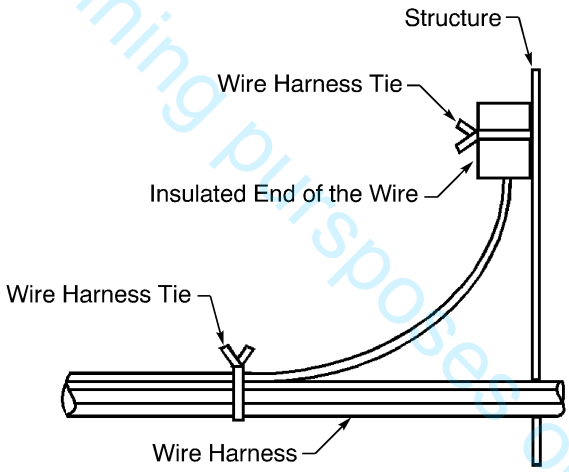


ALTERNATIVE POSITION OF THE WIRE HARNESS TIE
Figure 76

I. A Wire or Cable in a Parallel Configuration that has its End Attached to the Structure



PARALLEL STOW CONFIGURATION
Figure 77

Refer to Paragraph 5. for the procedure to assemble a wire harness tie.

(1) Move the wire away from the wire harness.

(2) If more than one wire makes an exit from the same area of the wire harness:

  (a) Put the wires together.

  (b) Assemble a wire harness tie on the wires near the point where the wires make an exit from the wire harness.

(3) If the wire harness has a sleeve:

  (a) Make a selection of a sleeve that is the same material as the sleeve on the wire harness. Refer to Subject 20-00-11.

  (b) Put the necessary length of sleeve on the wire.

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Make sure that the sleeve extends from the point where the wire makes an exit from the wire harness to a maximum of 2 inches from the end of the wire.

(4) Put the end of the wire against the applicable structure. Refer to Figure 77.

Make sure that the end of the wire is pointed up.

(5) Assemble a wire harness tie on the contact, the terminal lug, or the connector and the applicable structure. Refer to Figure 77.

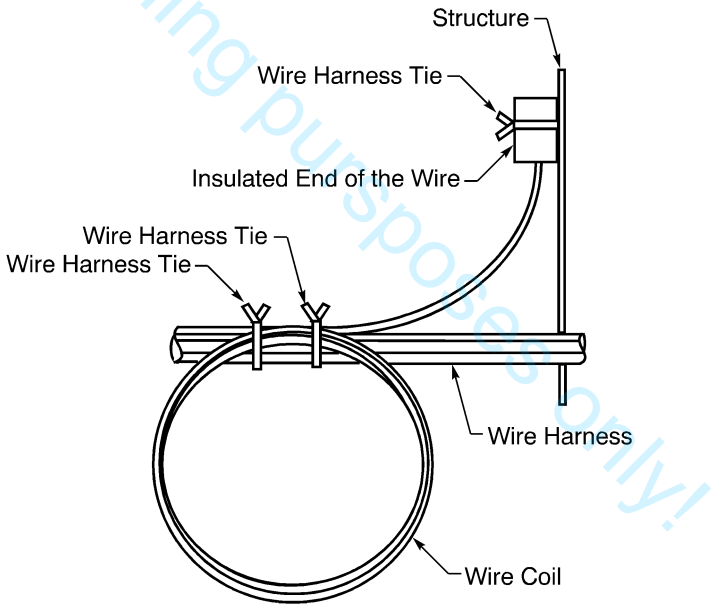
NOTE: For a large contact, a large terminal lug, or a large connector, two wire harness ties are necessary.

Make sure that:

- Fluids cannot drain into the insulation on the end of the wire
- Contamination cannot go into the insulation on the end of the wire
- The end of the wire cannot be moved easily.

CAUTION: FLUID OR CONTAMINATION ON THE CONTACT, THE TERMINAL LUG, OR THE CONNECTOR CAN CAUSE UNSATISFACTORY PERFORMANCE OF THE PART.

J. A Wire or Cable in a Wire Coil Configuration that has its End Attached to the Structure



WIRE COIL STOW CONFIGURATION
Figure 78

Refer to Paragraph 5. for the procedure to assemble a wire harness tie.

(1) Move the wire away from the wire harness.

(2) If more than one wire makes an exit from the same area of the wire harness:

(a) Put the wires together.

(b) Assemble a wire harness tie on the wires near the point where the wires make an exit from the wire harness.

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(3) If the wire harness has a sleeve:

(a) Make a selection of a sleeve that is the same material as the sleeve on the wire harness. Refer to Subject 20-00-11.

(b) Put the necessary length of sleeve on the wire.

Make sure that the sleeve extends from the point where the wire makes an exit from the wire harness to a maximum of 2 inches from the end of the wire.

(4) Put the wire in a coil configuration. Refer to Figure 78.

Make sure that:

- The diameter of the coil is a minimum of six times larger than the diameter of the largest wire or cable in the coil
- The wire coil is in a position where it can be attached with a clamp
- The end of the wire has the sufficient length to be attached to the applicable structure.

(5) Assemble the necessary wire harness ties at intervals along the coil.

Make sure that the diameter of the coil is a minimum of six time larger than the diameter of the largest wire or cable in the coil.

NOTE: More wire harness ties can be assembled to hold the shape of the coil.

(6) Attach the coil at the location of the nearest clamp on the wire harness.

NOTE: A satisfactory alternative is to put the coil against the wire harness and assemble the necessary wire harness ties.

(7) Put the end of the wire against the applicable structure. Refer to Figure 78.

Make sure that the end of the wire is pointed up.

(8) Assemble a wire harness tie on the contact, the terminal lug, or the connector and the applicable structure. Refer to Figure 78.

NOTE: For a large contact, a large terminal lug, or a large connector, two wire harness ties are necessary.

Make sure that:

- Fluids cannot drain into the insulation on the end of the wire
- Contamination cannot go into the insulation on the end of the wire
- The end of the wire cannot be moved easily.

CAUTION: FLUID OR CONTAMINATION ON THE CONTACT, THE TERMINAL LUG, OR THE CONNECTOR CAN CAUSE UNSATISFACTORY PERFORMANCE OF THE PART.

K. A Cable or a Wire Harness in a Folded Wire Configuration that has its End Attached to the Structure

CAUTION: A COAX CABLE MUST NOT BE FOLDED BACK. DAMAGE TO THE COAX CABLE OCCURS.

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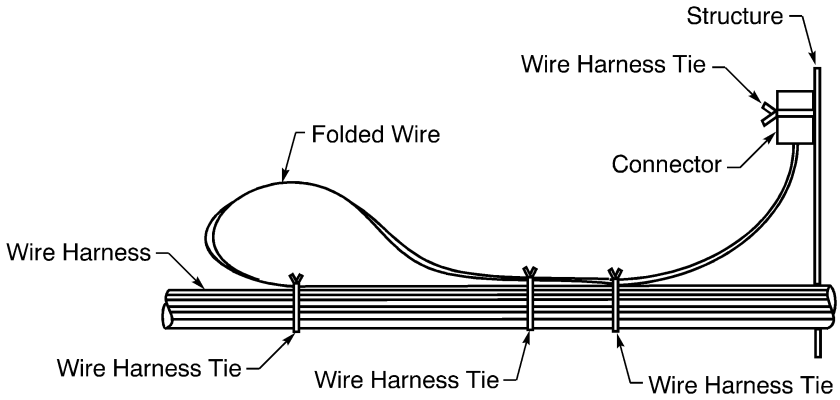

FOLDER WIRE STOW CONFIGURATION
Figure 79

Refer to Paragraph 5. for the procedure to assemble a wire harness tie.

(1) Move the cable away from the wire harness.

(2) If more than one cable makes an exit from the same area of the wire harness:

(a) Put the cables together.

(b) Assemble a wire harness tie on the cables a maximum of 5 inches from the point where the cables make an exit from the wire harness.

(3) Assemble a wire harness tie on the wire harness and the cable where the cable makes an exit from the wire harness. Refer to Figure 79.

(4) If the wire harness has a sleeve:

(a) Make a selection of a sleeve that is the same material as the sleeve on the wire harness. Refer to Subject 20-00-11.

(b) Put the necessary length of sleeve on the cable.

Make sure that the sleeve extends from the point where the cable makes an exit from the wire harness to a maximum of 2 inches from the end of the cable.

(5) Fold the cable back against the wire harness. Refer to Figure 79.

Make sure that the diameter of the inner curve of the cable or cables is a minimum of six times larger than the diameter of the largest cable.

(6) Put the end of the cable against the applicable structure. Refer to Figure 79.

Make sure that the end of the cable is pointed up.

(7) Assemble a wire harness tie on the connector and the applicable structure. Refer to Figure 79.

NOTE: For a large connector, two wire harness ties are necessary.

Make sure that:

- Fluids cannot drain into the insulation on the connector
- Contamination cannot go into the insulation on the connector
- The connector cannot be moved easily.

CAUTION: FLUID OR CONTAMINATION IN THE CONNECTOR CAN CAUSE UNSATISFACTORY PERFORMANCE OF THE CONNECTOR.

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WIRE HARNESS SUPPORTS

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WIRE HARNESS SUPPORTS

1. GENERAL DATA

A. Necessary Conditions for Selection of a Clamp

For the necessary conditions for clamp replacement, refer to Paragraph 2.A.

These conditions are applicable for all wire and cable:

- The clamp must be the correct type of clamp
- The maximum diameter of a wire harness that can be supported with a nylon loop clamp is 1.25 inches
- The clamp must have the correct size; refer to Paragraph 1.B. for the necessary conditions for selection of a clamp size

These clamps are permitted for a wire harness with a diameter greater than 1.25 inches:

- A metal loop clamp with a cushion
- BACC10NA
- BACC10NB

For coax cable in the unpressurized area, these clamps are permitted:.

- BACC10GE
- BACC10NA
- BACC10NB

B. Necessary Conditions for Selection of a Clamp Size

For the identification of the correct size of a clamp, refer to Paragraph 1.E.

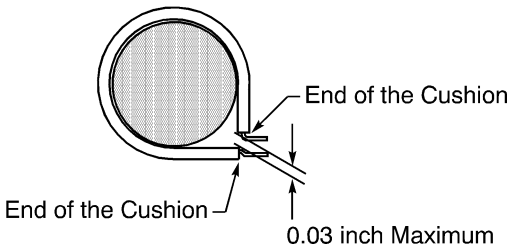
These conditions are applicable for all wire and cable:

- The clamp must hold the wire harness tightly
- If the clamp crushes or pinches the wires, a larger clamp must be installed
- A clamp must not let the wire harness move laterally in the clamp; refer to Figure 2
- A block clamp must not let the wire harness move or turn in the clamp
- If the smallest possible size of clamp lets the harness move laterally in the clamp, the diameter of the harness must be increased with a filler material
- For a loop clamp with a cushion, if the distance between the ends of the cushion is more than 0.03 inch, a larger clamp must be installed; refer to Figure 1.

For a wire harness in a loop clamp, these conditions are applicable:

- The wire harness is permitted to move in the longitudinal direction
- The wire harness is permitted to turn clockwise and counterclockwise.

Refer to Figure 2.



CORRECT FIT OF A LOOP CLAMP WITH A CUSHION
Figure 1

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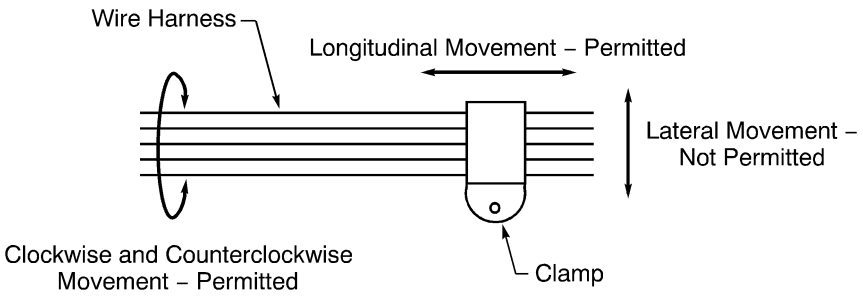

PERMITTED MOVEMENT OF A WIRE HARNESS IN A CLAMP
Figure 2

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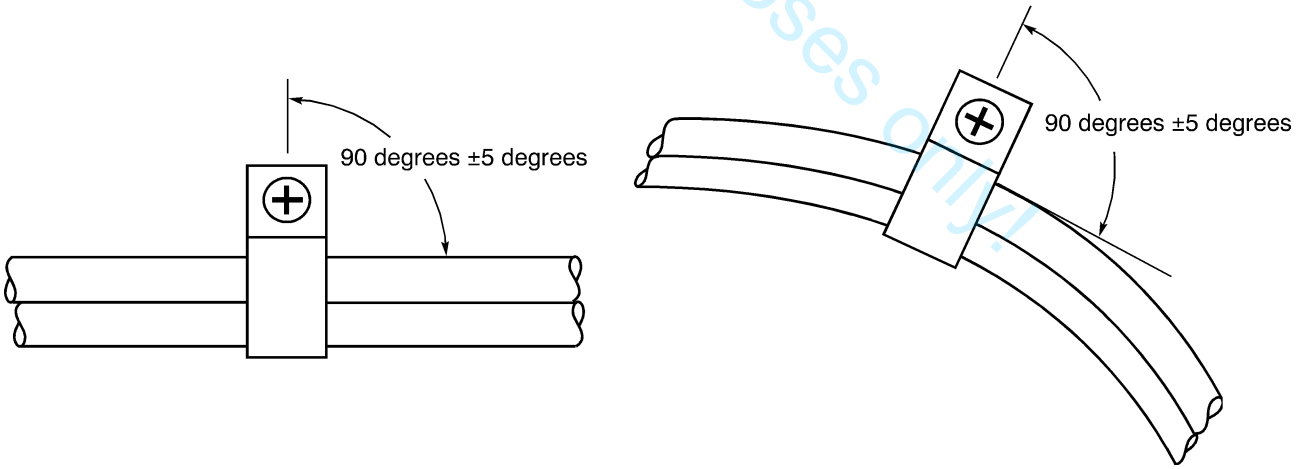
C. General Conditions for Clamp Installation

For the conditions that are applicable for wire harness installation, refer to Subject 20-10-11.

These conditions are applicable for all wire and cable:

- The clamp must be the correct size; refer to Paragraph 1.B. for the conditions for the selection of a clamp size
- The clamp must be perpendicular to the wire harness; refer to Figure 3
- A clamp must not be installed on a wire harness where the wires go across each other
- A clamp must not be installed on a repair of a wire or a cable
- A clamp must not be installed on a lacing tape or a plastic tie strap wire harness tie
- A clamp must not be installed on a shield ground wire assembly
- If a spacer is used for a standoff to install a nylon clamp, only an NAS42() spacer is permitted
- Do not use NAS43() spacers with nylon clamps.



POSITION OF THE CLAMP IN RELATION TO THE WIRE HARNESS
Figure 3

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These are more conditions that are applicable for coax cable:

- A clamp must not be installed on the bend of a coax cable if radius of the bend is less than 6 inches
- When two coax cables are installed in a 287T0011 clamp, a BACC10DK clamp, or BACC10GE clamp, the diameter of the wire harness must be increased with one or more BMS1-52 or 69B47961-() filler rods

.

D. General Conditions for an STBP19M or a BACM14L Wire Harness Mounting Platform Installation

These conditions are applicable for an STBP19M or a BACM14L wire harness mounting platform installation:

- Do not install an STBP19M or a BACM14L wire harness mounting platform in the unpressurized area.
- If a fiber optic cable is against the support or against the tie strap, a minimum of 2 layers of silicone tape must be wrapped on the harness at that location before the tie strap is installed.
- Do not install an STBP19M or a BACM14L mounting platform on a wire harness that has size 10 AWG through 4/0 AWG wires.
- Do not install an STBP19M or a BACM14L mounting platform on a wire harness that has one or more of the wires shown in Table 1.

Table 1
WIRES NOT PERMITTED ON A STBP19M MOUNTING PLATFORM

Gage (AWG)	Specification	Wire Type Code	Supplier
10 AWG through 4/0 AWG	BMS 13-35 Type 1 Class 1	43	QPL
	BMS 13-35 Type 1 Class 3	T4	QPL
	BMS 13-48 Type 8 Class 1	UA	QPL
	BMS 13-48 Type 10 Class 1	PA	QPL
	BMS 13-58 Type 1 Class 1	CQ	QPL
	BMS13-60 Type 1 Class 1	GA	QPL
	BMS13-60 Type 7 Class 1	HA	QPL
	BMS 13-60 Type 22 Class 1	QY	QPL
	08766/01147 KE-3	A9	Tinsolite
	1/0TLA/02101E-6	QH	Tinsolite
	1/0766/9D032E-6	TB	Tinsolite
	4/0591/31886PT-1	K1	Tinsolite
	557-392	A8	Thermax
	621-1292	TG	Thermax

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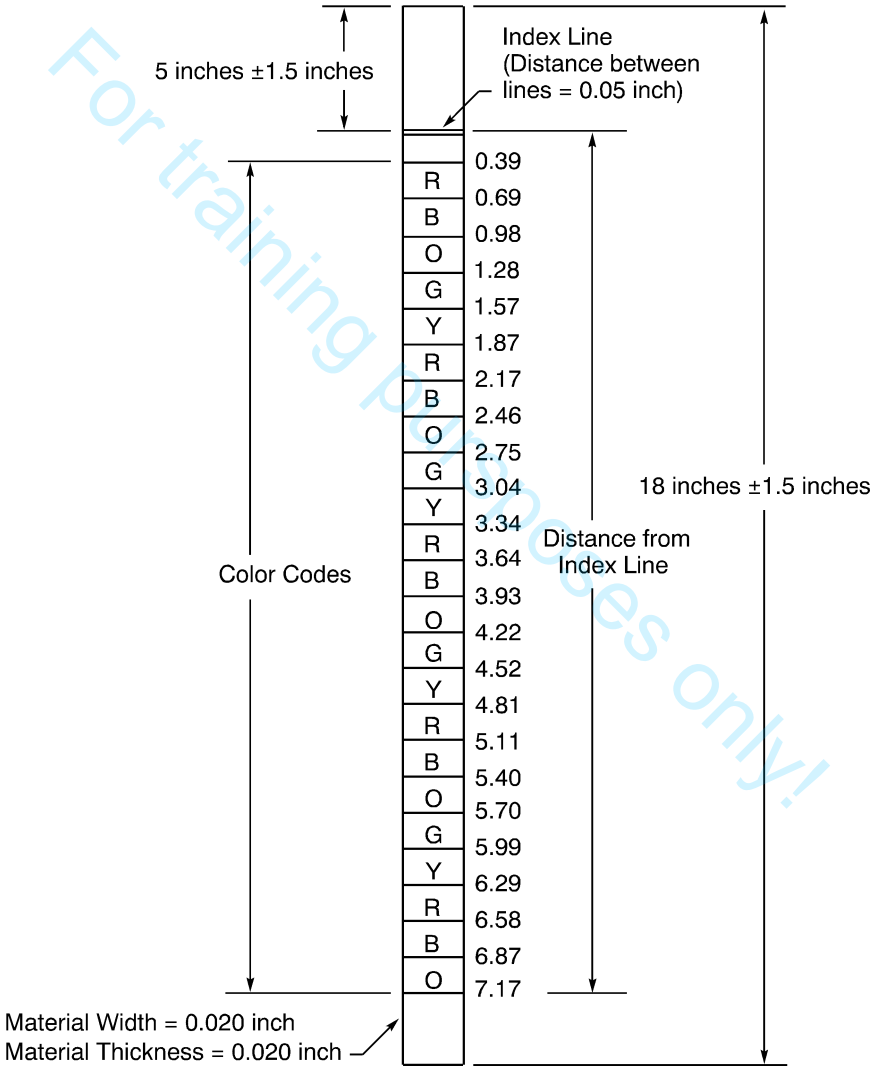
WIRE HARNESS SUPPORTS

The STBP19M mounting platform can be a barrier that prevents damage to the wire harness from the structure.

- It is not necessary to attach these mounting platforms to the structure or to panels for this application.
- Do not install an STBP19M mounting platform on a harness for this application in a stowage bin, or on ceiling liner panels.

NOTE: STBP19M mounting platforms that are not attached to the structure in these locations can cause unwanted noise.

E. Identification of the Correct Size of a Loop Clamp or a Block Clamp



DIMENSIONS OF THE ST2323B TOOL
Figure 4

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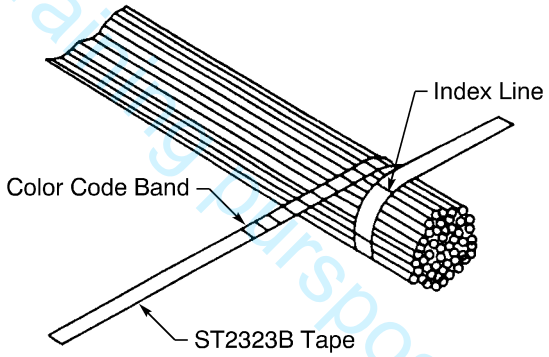
Table 2
COLOR CODES OF THE ST2323B TOOL

Code	Color
R	Red
B	Blue
O	Orange
G	Green
Y	Yellow

NOTE: If an ST2323B tool is not available, make an equivalent tool. Refer to Figure 4 and Table 2.

(1) Wind the ST2323B tool around the wire harness at the location of the installation of the clamp.

(2) Pull the tool tight around the wire harness and align the index line with one of the color code bands. Refer to Figure 5.



POSITION OF THE ST2323B TOOL ON THE WIRE HARNESS
Figure 5

(3) Read the approximate diameter of the wire harness and the color from the tool. Refer to Figure 4 and Table 2.

NOTE: If the index is aligned between two of the color bands, read the smaller size and the color.

(4) If the clamp is identified with a color, use the color for selection.

(5) If the clamp is not identified with a color, use the diameter for selection.

F. Damage Conditions for BACS31H Ring Posts and BACS31J Support Assemblies

The ring post or the support assembly must be replaced if one of these conditions occur:

- A sharp edge is against a wire harness
- The integral screw of a ring post has a crack or is broken.

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2. WIRE HARNESS SUPPORT REPLACEMENT

A. Necessary Conditions for Clamp Replacement

These conditions are applicable when a clamp must be replaced:

- The clamp must be replaced with a clamp that has the same part number unless an alternative wire harness support is specified
- The clamp must be replaced with a clamp that has the same part number unless the specified clamp is too small to make a correct fit
- If the specified clamp is too small to make a correct fit, a clamp that is the same type and is one size larger can be installed.

B. Necessary Conditions for Replacement of a Wire Harness Support with a BACS31H Ring Post

A wire harness support can be replaced with a BACS31H ring post if these conditions are applicable:

- The ring post is a specified alternative; refer to Paragraph 3.S.
- The location of the support is a pressurized area
- The wire harness is Temperature Grade A or Temperature Grade B
- The wire harness has a maximum diameter of 1.25 inches

A wire harness support must not be replaced with a BACS31H ring post if the support:

- Is in a fuel tank
- Is in a high vibration area
- Holds a power feeder wire.

If a fiber optic cable is against the support or against the tie strap, a minimum of 2 layers of silicone tape must be wrapped on the harness at that location before the tie strap is installed.

These conditions must occur after the wire harness is installed on the ring post:

- The wire harness separation is satisfactory; refer to Subject 20-10-19
- The clearance between the wire harness and a structure, equipment and other items is satisfactory; refer to Subject 20-10-11.

C. Necessary Conditions for Replacement of a Wire Harness Support with a BACS31J Support Assembly

A wire harness support can be replaced with a BACS31J support assembly if these conditions are applicable:

- The support assembly is a specified alternative; refer to Paragraph 3.T.
- The location of the support is a pressurized area
- The wire harness is Temperature Grade A or Temperature Grade B
- The wire harness has a maximum diameter of 1.25 inches
- The support assembly is installed on a BAC1510-407 channel bracket.

A wire harness support must not be replaced with a BACS31J support assembly if the support:

- Is in a fuel tank
- Is in a high vibration area
- Holds a power feeder wire.

If a fiber optic cable is against the support or against the tie strap, a minimum of 2 layers of silicone tape must be wrapped on the harness at that location before the tie strap is installed.

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These conditions must occur after the wire harness is installed on the support assembly:

- The wire harness separation is satisfactory; refer to Subject 20-10-19
- The clearance between the wire harness and a structure, equipment and other items is satisfactory; refer to Subject 20-10-11.

3. PART NUMBERS AND DESCRIPTION

A. Wire Harness Support Part Numbers

Table 3
WIRE HARNESS SUPPORT PART NUMBERS

Part Number	Description	Supplier	Reference
287T0011-()	Loop Clamp, Nylon	Boeing	Table 5
69B90483-()	Block Clamp	Boeing	Table 6
BACB20VB	FQIS Wire Harness Bracket, without Carrier	Boeing	Paragraph 3.D.
BACB20VE	FQIS Wire Harness Bracket, with Carrier	Boeing	Paragraph 3.E.
BACB20VG	Raceway Bracket	Boeing	Paragraph 3.F.
BACC10BU()	Loop Clamp	Boeing	Table 8
BACC10DK()	Loop Clamp, Nylon	Boeing	Table 9
BACC10DR()	Wire Harness Channel	Boeing	Table 11
BACC10DS()	Raceway Clamp	Boeing	Table 12
BACC10GE()	Loop Clamp	Boeing	Table 14
BACC10GU()	Loop Clamp	Boeing	Table 15
BACC10HS()	Loop Clamp	Boeing	Table 16
BACC10JU()	Loop Clamp	Boeing	Table 17
BACC10KL()	Loop Clamp, Three Wire	Boeing	Table 20
BACC10NA()	Clamp, Cushion, Single Leg Assembly, High Performance Plastic	Boeing	Table 18
BACC10NB()	Clamp, Cushion, Double Leg Assembly, High Performance Plastic	Boeing	Table 19
BACM14L()	Mount, Cable Tie, Adhesive Bonded	Boeing	Table 23
BACS31H()	Ring Post, Nylon	Boeing	Table 25
BACS31J()	Support Assembly, Nylon	Boeing	Table 28
BACS31K()	Raceway Wiring Support	Boeing	Paragraph 3.U.
BACS31M()	Raceway Channel Support	Boeing	Paragraph 3.V.
BACS38AA()	Plastic Tie Strap Mounting Plate	Boeing	Table 31

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Table 3 (continued)

Part Number	Description	Supplier	Reference
BACS38AB()	Spacer Tie Strap	Boeing	Table 32
BACS38J()	Stringer Clip	Boeing	Table 35
BMS8-389	Adhesive Tape, Wire Harness Tie	Boeing	Paragraph 3.Z.
CR2	Spacer	Panduit	Table 36
CR4H	Spacer	Panduit	Table 36
CSCS	Tie Strap Mounting Platform	Panduit	Paragraph 3.AA.
STBP19M	Tie Strap Mounting Platform	Boeing	Table 21
TA025041-()	Loop Clamp, Sawtooth	TA Manufacturing	Table 43
TA025097()	Loop Clamp	TA Manufacturing	Table 44
TA0930034-()	Saddle Clamp	TA Manufacturing	Table 45

Table 4
APPROVED SUPPLIERS FOR BOEING STANDARD WIRE HARNESS SUPPORTS

Boeing Standard	Supplier
BACC10BU	J&M Products
	TA Manufacturing
	Transdigm, Adel Fasteners Division
	Umpco
BACB20VB	Amphenol
BACB20VE	Amphenol
BACB20VG	An available satisfactory source
BACC10DK	Nylon Molding Corporation
	Peco Manufacturing
BACC10DR	Nylon Molding Corporation
BACC10DS	Nylon Molding Corporation
	Umpco
BACC10GE	J&M Products
	Umpco
	TA Manufacturing
	Transdigm, Adel Fasteners Division
BACC10GU	J&M Products
	Transdigm, Adel Fasteners Division
	Umpco

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Table 4 (continued)

Boeing Standard	Supplier
BACC10HS	J&M Products
	Umpco
	TA Manufacturing
	Transdigm, Adel Fasteners Division
BACC10JU	Dexter-Wilson
	J&M Products
	Umpco
	Transdigm, Adel Fasteners Division
BACC10KL	J&M Products
	Umpco
	TA Manufacturing
	Transdigm, Adel Fasteners Division
BACC10NA	Amphenol PCD Inc.
BACC10NB	Amphenol PCD Inc.
BACM14L	Click Bond or NMC Group Inc.
BACS31H	Nylon Molding Corporation
BACS31J	Nylon Molding Corporation
BACS31K	Nylon Molding Corporation
BACS31M	Nylon Molding Corporation
BACS38AA	Panduit Corp.
BACS38AB	Panduit Corp.
BMS8-389	Hi-Tech Products
CR2	Panduit Corp.
CR4H	Panduit Corp.
CSCS	Panduit Corp.
STBP19M	Panduit Corp.
	Thomas & Betts Corp.

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B. 287T0011 Loop Clamps

The 287T0011 clamp:

- Is a general purpose loop clamp made of nylon
- Is held closed with a wire harness tie
- Is adjustable
- Is not permitted in a fuel cell
- Is a satisfactory alternative for the BACC10DK clamp.

The 287T0011 loop clamp is installed in the pressurized area of the airplane to hold:

- A wire harness that is less than 1.25 inches in diameter
- A wire harness that is installed in an area where the temperature is 275 degrees F or less. (Temperature Grade A and B areas.)

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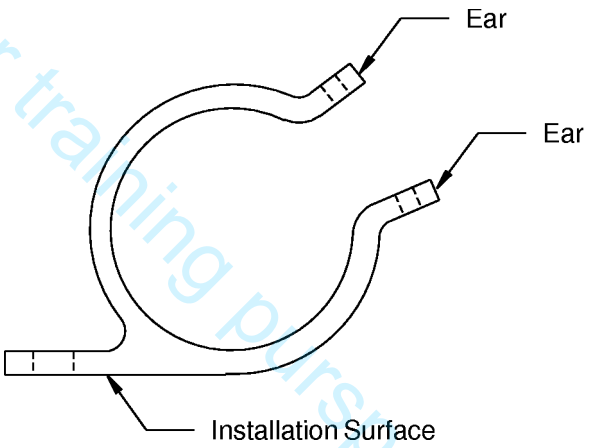
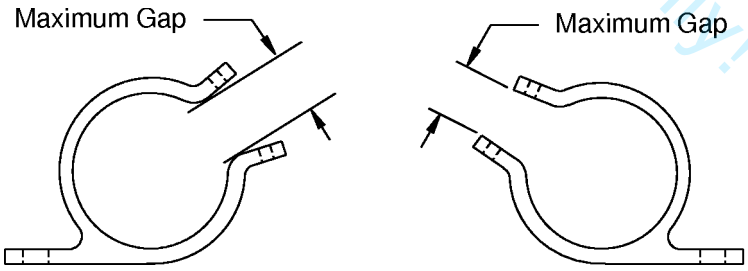


287T0011 LOOP CLAMP
Figure 6

The maximum permitted gap on 287T0011 clamps is shown in Figure 7 and Table 5.

Use one of the two views in Figure 7.



MAXIMUM ALLOWABLE GAP ON 287T0011 CLAMP
Figure 7

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Table 5
287T0011 LOOP CLAMP PART NUMBERS

Wire Harness Diameter (inch)		Maximum Gap (inch)	Boeing Standard
Minimum	Maximum		
0.250	0.375	0.32	287T0011-1
0.375	0.500	0.42	287T0011-2
0.500	0.688	0.55	287T0011-3
0.688	0.938	0.68	287T0011-4
0.875	1.250	1.00	287T0011-5

Assemble a lacing tape tie or use a plastic tie strap to hold the clamp ears together.

Make sure that the lacing tape tie or the plastic tie strap goes through the holes in the clamp ears.

It is not necessary that the clamp ears touch each other.

It is permitted for the clamp ears to touch each other.

Washers are not necessary for 287T0011 clamps.

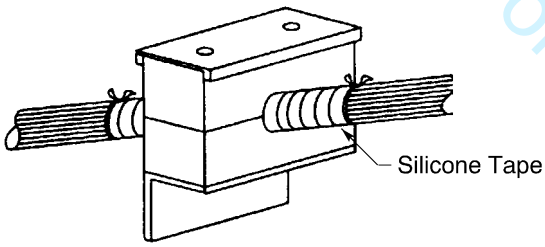
If filler rod is necessary, put BMS1-52 or 69B47961 filler rod in the clamp with the wires.

Make sure that the filler rod:

- Is on the side of the clamp that has the gap
- Has the smallest diameter that will make a tight fit.
- Extends 0.04 inch minimum to 0.75 inch maximum on each side of the clamp

It is permitted for the 287T0011 clamp to turn on its mount. If this condition lets wires stay in a position that is not permitted by the necessary wire separation or clearance, then use a BACC10DK clamp as an alternative to the 287T0011 clamp.

C. 69B90483 Block Clamps



69B90483 BLOCK CLAMP
Figure 8

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Table 6
69B90483-() BLOCK CLAMP PART NUMBERS

Inner Diameter (inch)	Boeing Standard
0.750	69B90483-1
0.876	69B90483-2
0.876	69B90483-3
0.968	69B90483-8
1.000	69B90483-4
1.125	69B90483-5
1.250	69B90483-6
1.300	69B90483-7

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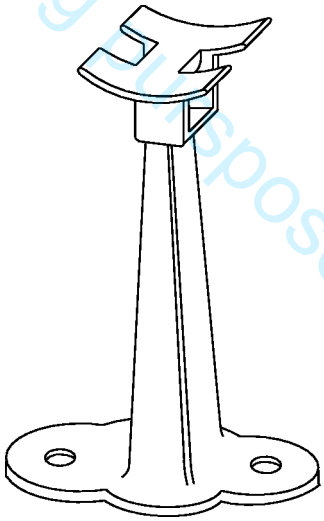
D. BACB20VB FQIS Wire Support Brackets

NOTE: BACB20VB support brackets are permitted for 787 FQIS only.



BACB20VB3A FQIS WIRE SUPPORT BRACKET
Figure 9

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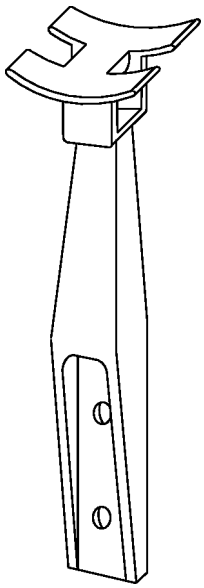
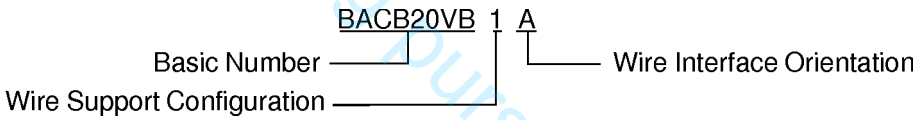


BACB20VB7A FQIS WIRE SUPPORT BRACKET
Figure 10



BACB20VB PART NUMBER STRUCTURE
Figure 11

E. BACB20VE FQIS Wire Support Brackets

NOTE: BACB20VE support brackets are permitted for 787 FQIS only.

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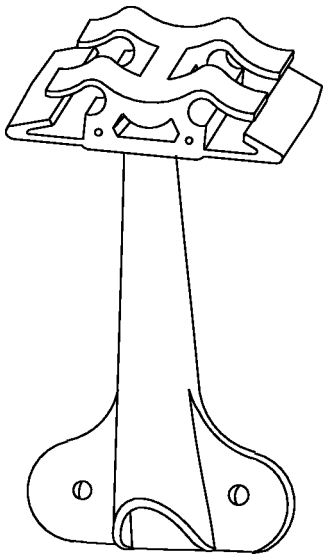
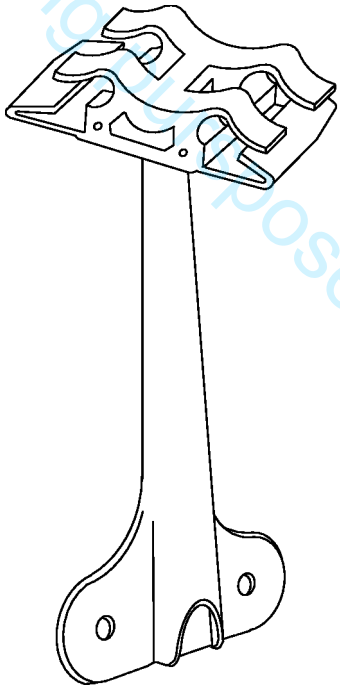


BACB20VE1A FQIS WIRE SUPPORT BRACKET
Figure 12



BACB20VE2B FQIS WIRE SUPPORT BRACKET
Figure 13

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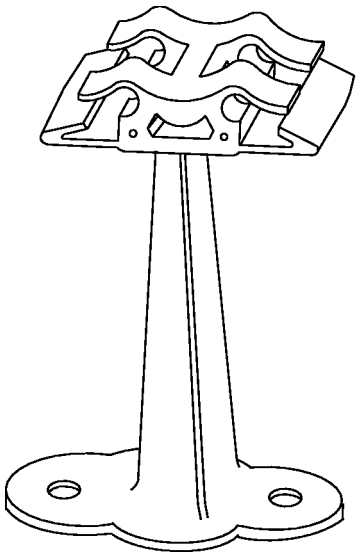
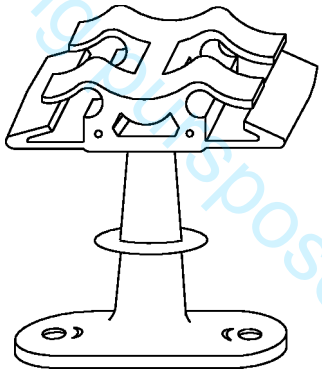
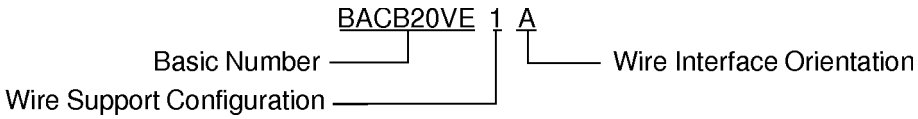
WIRE HARNESS SUPPORTS



BACB20VE7A FQIS WIRE SUPPORT BRACKET
Figure 14



BACB20VE8A FQIS WIRE SUPPORT BRACKET
Figure 15



BACB20VE PART NUMBER STRUCTURE
Figure 16

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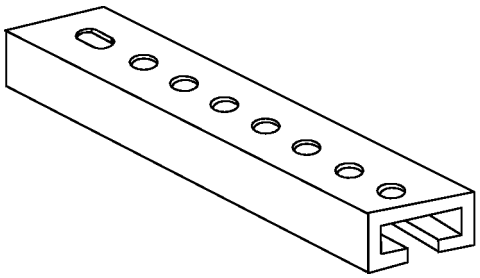
F. BACB20VD and BACB20VG Raceway Brackets, and 287W4115-() Channels

These brackets or channels:

- Are made of aluminum
- Have evenly spaced holes down the length of the part.
- Are available in various lengths.



BACB20VD OR BACB20VG RACEWAY BRACKET, AND 287W4115-() CHANNEL
Figure 17

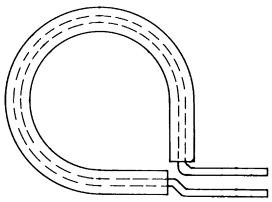
Table 7
ALTERNATIVE PART NUMBERS

Specified Bracket	Alternative Bracket
BACB20VD-()	BACB20VG-()

G. BACC10BU Loop Clamps

The BACC10BU clamp a general purpose loop clamp.

NOTE: The BACC10GE clamp is a satisfactory alternative for the BACC10BU clamp.



BACC10BU LOOP CLAMP
Figure 18

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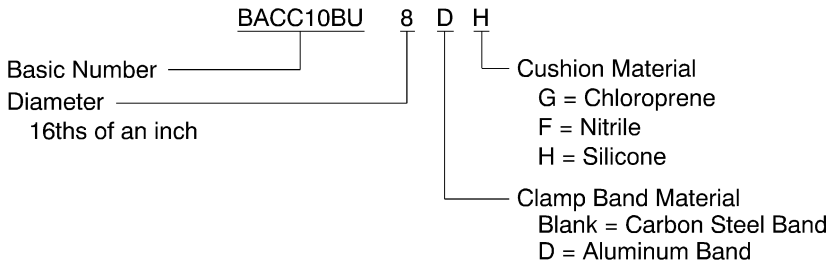
WIRE HARNESS SUPPORTS



BACC10BU LOOP CLAMP PART NUMBER STRUCTURE
Figure 19

Table 8
BACC10BU LOOP CLAMP PART NUMBERS

Inner Diameter (inch)	Boeing Standard
0.125	BACC10BU2
0.188	BACC10BU3
0.250	BACC10BU4
0.313	BACC10BU5
0.375	BACC10BU6
0.438	BACC10BU7
0.500	BACC10BU8
0.563	BACC10BU9
0.625	BACC10BU10
0.688	BACC10BU11
0.750	BACC10BU12
0.813	BACC10BU13
0.875	BACC10BU14
0.938	BACC10BU15
1.000	BACC10BU16
1.063	BACC10BU17
1.125	BACC10BU18
1.188	BACC10BU19
1.250	BACC10BU20
1.313	BACC10BU21
1.375	BACC10BU22
1.438	BACC10BU23
1.500	BACC10BU24
1.563	BACC10BU25

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Table 8 (continued)

Inner Diameter (inch)	Boeing Standard
1.625	BACC10BU26
1.688	BACC10BU27
1.750	BACC10BU28
1.813	BACC10BU29
1.875	BACC10BU30
1.938	BACC10BU31
2.000	BACC10BU32
2.062	BACC10BU33
2.125	BACC10BU34
2.188	BACC10BU35
2.250	BACC10BU36
2.312	BACC10BU37
2.375	BACC10BU38
2.500	BACC10BU40
2.625	BACC10BU42
2.688	BACC10BU43
2.812	BACC10BU45
2.875	BACC10BU46
3.000	BACC10BU48

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H. BACC10DK Loop Clamps

The BACC10DK clamp:

- Is a general purpose loop clamp made of nylon
- Can be installed in a fuel cell.

The BACC10DK loop clamp is installed in the pressurized area of the airplane to hold:

- A wire harness that is less than 1.25 inches in diameter
- A wire harness that is in an area where the temperature is 275 degrees F or less. (Temperature Grade A and B areas.)

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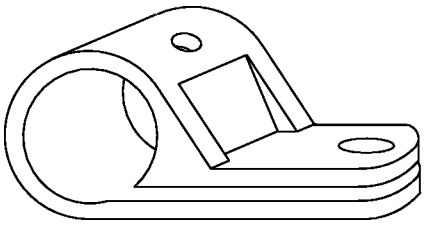
WIRE HARNESS SUPPORTS



BACC10DK LOOP CLAMP
Figure 20

Table 9
BACC10DK LOOP CLAMP PART NUMBERS

Inner Diameter (inch)	Boeing Standard	Color
0.125	BACC10DK2	Brown
0.187	BACC10DK3	Orange
0.250	BACC10DK4	Pink
0.312	BACC10DK5	Natural
0.375	BACC10DK6	Gray
0.437	BACC10DK7	Blue
0.500	BACC10DK8A	Yellow
0.562	BACC10DK9A	Brown
0.625	BACC10DK10	Orange
0.687	BACC10DK11	Pink
0.750	BACC10DK12	Natural
0.812	BACC10DK13	Gray
0.875	BACC10DK14	Blue
0.973	BACC10DK15	Yellow
1.000	BACC10DK16	Brown
1.062	BACC10DK17	Orange
1.125	BACC10DK18	Pink
1.187	BACC10DK19	Natural
1.250	BACC10DK20	Gray
1.500	BACC10DK24	Blue

Refer to Table 10 for clamps that are satisfactory alternatives for the BACC10DK clamp

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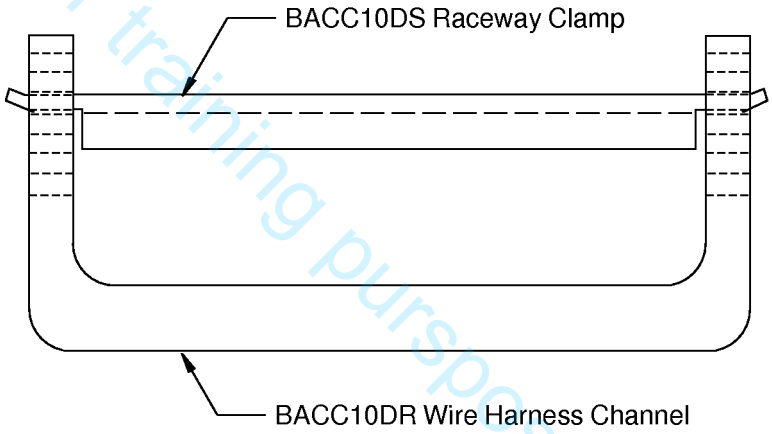
Table 10
ALTERNATIVE CLAMPS

Specified Clamp	Alternative Clamp	Note
BACC10DK	BACC10GE	The BACC10GE clamp is not permitted in a fuel cell.
	287T0011	-

I. BACCC10DR Wire Harness Channel and BACC10DS Raceway Clamp

The BACC10DS raceway clamp and the BACC10DR wire harness channel are:

- The two parts that make a wire harness support
- Installed in the pressurized area of the airplane.



BACC10DR WIRE HARNESS CHANNEL AND BACC10DS RACEWAY CLAMP
Figure 21

Table 11
BACC10DR WIRE HARNESS CHANNEL PART NUMBERS

Height (inch)	Number of Slots	Boeing Standard	Color
1.20	1	BACC10DR2S	Natural
		BACC10DR6	Natural
		BACC10DR10	Black
1.50	2	BACC10DR3S	Natural
		BACC10DR7	Natural
		BACC10DR11	Black
1.80	3	BACC10DR4S	Natural
		BACC10DR8	Natural
		BACC10DR12	Black

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Table 11 (continued)

Height (inch)	Number of Slots	Boeing Standard	Color
2.10	4	BACC10DR5S	Natural
		BACC10DR9	Natural
		BACC10DR13	Black

Table 12
BACC10DS RACEWAY CLAMP PART NUMBERS

Boeing Standard	For Use With
BACC10DS3	BACC10DR6
	BACC10DR7
	BACC10DR8
	BACC10DR9
	BACC10DR10
	BACC10DR11
	BACC10DR12
	BACC10DR13

Table 13
RECOMMENDED RACEWAY CLAMP PART NUMBERS

Specified Raceway Clamp	Recomended Raceway Clamp
BACC10DS4	BACC10DS3

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J. BACC10GE Loop Clamps

The BACC10GE clamp:

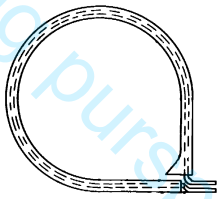
- Is a general purpose loop clamp
- Must not be installed in a fuel cell
- Is a satisfactory alternative for the BACC10BU clamp
- Is a satisfactory alternative for the BACC10DK clamp.

The BACC10GE loop clamp is installed in the pressurized area of the airplane to hold:

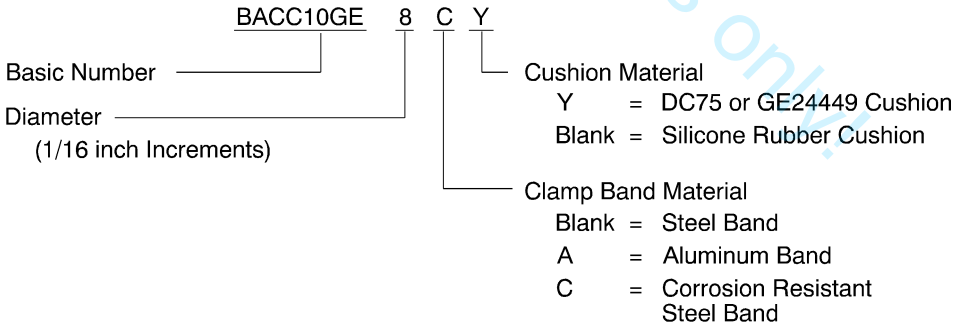
- A wire harness that is less than 1.25 inches in diameter
- A wire harness in an area where the temperature is 275 degrees F or less
- A power feeder wire harness where a BACC10KL clamp cannot be installed
- A wire harness that goes across a hinge point
- A wire harness that has a routing on an electronic shelf
- A wire harness that is installed in a panel of electrical equipment
- A flexible conduit.

The BACC10GE loop clamp is installed in these areas to hold a coax cable:

- The unpressurized area
- A high vibration area.



BACC10GE LOOP CLAMP
Figure 22



BACC10GE LOOP CLAMP PART NUMBER STRUCTURE
Figure 23

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Table 14
BACC10GE LOOP CLAMP PART NUMBERS

Inner Diameter (inch)	Boeing Standard
0.188	BACC10GE3
0.250	BACC10GE4
0.313	BACC10GE5
0.375	BACC10GE6
0.438	BACC10GE7
0.500	BACC10GE8
0.563	BACC10GE9
0.625	BACC10GE10
0.688	BACC10GE11
0.750	BACC10GE12
0.812	BACC10GE13
0.875	BACC10GE14
0.938	BACC10GE15
1.000	BACC10GE16
1.063	BACC10GE17
1.125	BACC10GE18
1.188	BACC10GE19
1.250	BACC10GE20
1.313	BACC10GE21
1.375	BACC10GE22
1.438	BACC10GE23
1.500	BACC10GE24

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K. BACC10GU Loop Clamps

The BACC10GU clamp is:

- A general purpose loop clamp
- Installed in the unpressurized area of the airplane.

NOTE: The BACC10JU clamp is a satisfactory alternative for the BACC10GU clamp.

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BACC10GU LOOP CLAMP
Figure 24

Table 15
BACC10GU LOOP CLAMP PART NUMBERS

Wire Harness Diameter (inch)		Boeing Standard	Color
Minimum	Maximum		
0.125	0.218	BACC10GU101	Red
0.219	0.312	BACC10GU102	Blue
0.313	0.406	BACC10GU103	Orange
0.407	0.500	BACC10GU104	Green
0.501	0.593	BACC10GU105	Yellow
0.594	0.688	BACC10GU106	Red
0.689	0.781	BACC10GU107	Blue
0.782	0.875	BACC10GU108	Orange
0.876	0.968	BACC10GU109	Green
0.969	1.062	BACC10GU110	Yellow
1.063	1.156	BACC10GU111	Red
1.157	1.250	BACC10GU112	Blue
1.251	1.343	BACC10GU113	Orange
1.344	1.437	BACC10GU114	Green
1.438	1.531	BACC10GU115	Yellow
1.532	1.625	BACC10GU116	Red
1.626	1.718	BACC10GU117	Blue
1.719	1.812	BACC10GU118	Orange
1.813	1.906	BACC10GU119	Green
1.907	2.000	BACC10GU120	Yellow
2.001	2.093	BACC10GU121	Red
2.094	2.187	BACC10GU122	Blue
2.188	2.281	BACC10GU123	Orange
2.282	2.375	BACC10GU124	Green

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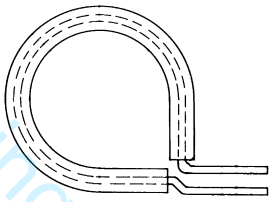
Table 15 (continued)

Wire Harness Diameter (inch)		Boeing Standard	Color
Minimum	Maximum		
2.376	2.468	BACC10GU125	Yellow

L. BACC10HS Loop Clamps

The BACC10HS loop clamp is installed in the airplane to hold:

- A wire harness that is in a high vibration area
- A wire harness that is in a high temperature area
- A wire harness that is on the engine or the landing gear.



BACC10HS LOOP CLAMP
Figure 25

Table 16
BACC10HS LOOP CLAMP PART NUMBERS

Inner Diameter (inch)	Boeing Standard
0.188	BACC10HS03
0.250	BACC10HS04
0.312	BACC10HS05
0.375	BACC10HS06
0.438	BACC10HS07
0.500	BACC10HS08
0.562	BACC10HS09
0.625	BACC10HS10
0.687	BACC10HS11
0.750	BACC10HS12
0.812	BACC10HS13
0.875	BACC10HS14
0.938	BACC10HS15
1.000	BACC10HS16

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Table 16 (continued)

Inner Diameter (inch)	Boeing Standard
1.062	BACC10HS17
1.125	BACC10HS18
1.188	BACC10HS19
1.250	BACC10HS20
1.312	BACC10HS21
1.375	BACC10HS22
1.438	BACC10HS23
1.500	BACC10HS24
1.562	BACC10HS25
1.625	BACC10HS26
1.687	BACC10HS27
1.750	BACC10HS28
1.812	BACC10HS29
1.875	BACC10HS30
1.938	BACC10HS31
2.000	BACC10HS32
2.375	BACC10HS38
2.500	BACC10HS40
2.875	BACC10HS46
3.000	BACC10HS48

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M. BACC10JU Hinged Loop Clamps

The BACC10JU loop clamp:

- Has a metal band that has a hinge
- Has an elastomer cushion
- Can be installed in the unpressurized area of the airplane.
- Is a satisfactory alternative for the BACC10GU clamp.

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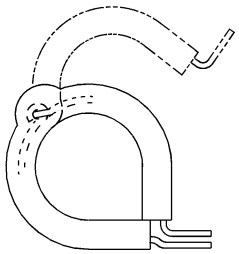
WIRE HARNESS SUPPORTS



BACC10JU LOOP CLAMP
Figure 26

Table 17
BACC10JU LOOP CLAMP PART NUMBERS

Wire Harness Diameter (inch)		Boeing Standard	Color
Minimum	Maximum		
0.313	0.406	BACC10JU103	Orange
0.407	0.500	BACC10JU104	Green
0.501	0.593	BACC10JU105	Yellow
0.594	0.688	BACC10JU106	Red
0.689	0.781	BACC10JU107	Blue
0.782	0.875	BACC10JU108	Orange
0.876	0.968	BACC10JU109	Green
0.969	1.062	BACC10JU110	Yellow
1.063	1.156	BACC10JU111	Red
1.157	1.250	BACC10JU112	Blue
1.251	1.343	BACC10JU113	Orange
1.344	1.437	BACC10JU114	Green
1.438	1.531	BACC10JU115	Yellow

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N. BACC10NA Hinged Composite Loop Clamps

The BACC10NA loop clamp:

- Has a lightweight composite body that has a hinge
- Has an elastomer cushion
- Has one fastener installation hole

The BACC10NA loop clamp can be installed in pressurized or unpressurized areas of the airplane to hold:

- A coax cable or a wire harness that is less than 1.5 inches in diameter
- A coax cable or a wire harness that is installed in an area where the temperature is 275 degrees F or less.

(Temperature Grade A and B areas)

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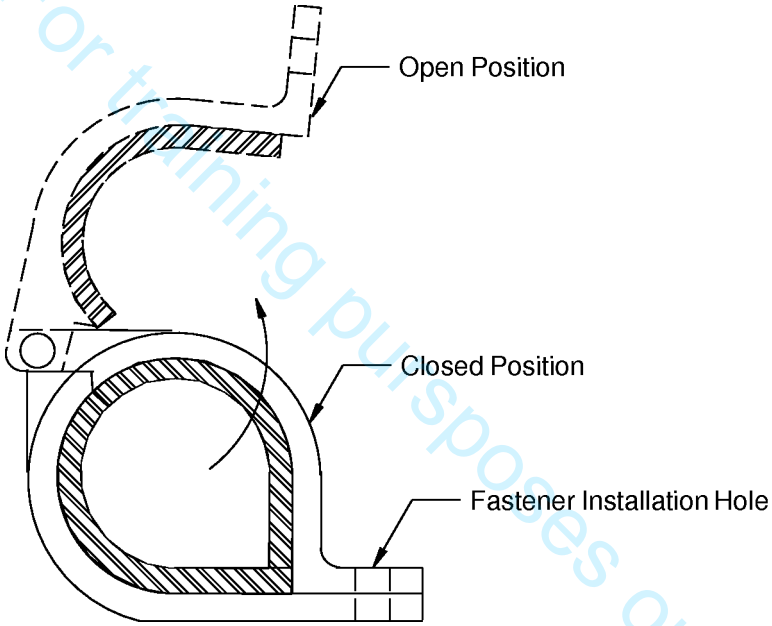

BACC10NA LOOP CLAMP
Figure 27

Table 18
BACC10NA LOOP CLAMP PART NUMBERS

Wire Harness Diameter (inch)		Boeing Standard
Minimum	Maximum	
0.125	0.218	BACC10NA101
0.219	0.312	BACC10NA102
0.313	0.406	BACC10NA103
0.407	0.500	BACC10NA104
0.501	0.593	BACC10NA105

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Table 18 (continued)

Wire Harness Diameter (inch)		Boeing Standard
Minimum	Maximum	
0.594	0.688	BACC10NA106
0.689	0.781	BACC10NA107
0.782	1.875	BACC10NA108
0.876	0.968	BACC10NA109
0.969	1.062	BACC10NA110
1.063	1.156	BACC10NA111
1.157	1.250	BACC10NA112
1.251	1.343	BACC10NA113
1.344	1.437	BACC10NA114
1.438	1.531	BACC10NA115

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O. BACC10NB Hinged Composite Loop Clamps

The BACC10NB loop clamp:

- Has a lightweight composite body that has a hinge
- Has an elastomer cushion
- Has two fastener installation holes

The BACC10NB loop clamp can be installed in pressurized or unpressurized areas of the airplane to hold:

- A coax cable or a wire harness that is less than 2.0 inches in diameter
- A coax cable or a wire harness that is installed in an area where the temperature is 275 degrees F or less.

(Temperature Grade A and B areas)

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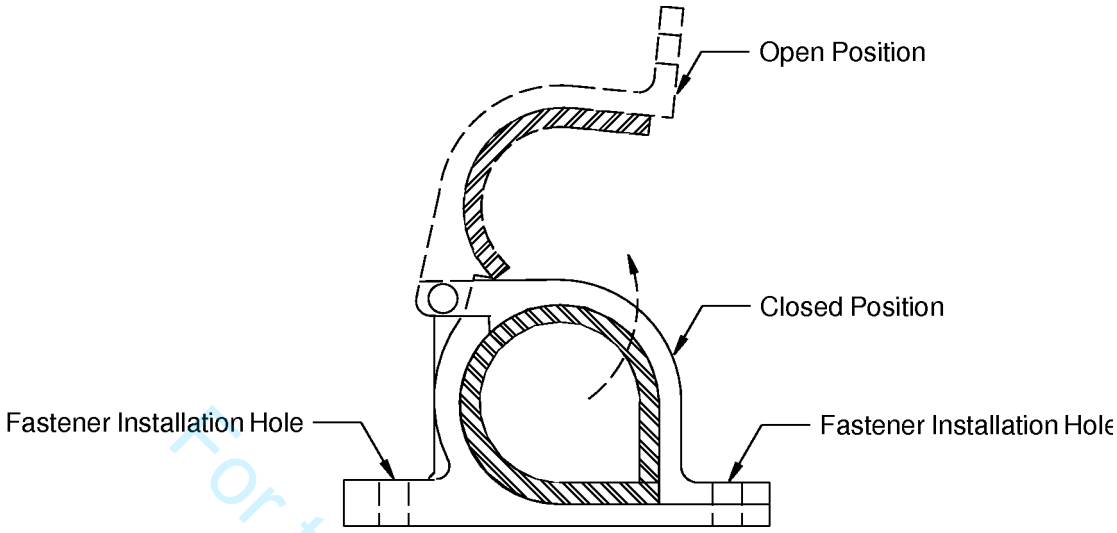
WIRE HARNESS SUPPORTS



BACC10NB LOOP CLAMP
Figure 28

Table 19
BACC10NB LOOP CLAMP PART NUMBERS

Wire Harness or Power Feeder Diameter (inch)		Boeing Standard
Minimum	Maximum	
0.45	0.55	BACC10NB8
0.51	0.61	BACC10NB9
0.57	0.67	BACC10NB10
0.63	0.73	BACC10NB11
0.70	0.80	BACC10NB12
0.77	0.87	BACC10NB13
0.83	0.93	BACC10NB14
0.89	0.99	BACC10NB15
0.95	1.05	BACC10NB16
1.01	1.11	BACC10NB17
1.07	1.17	BACC10NB18
1.13	1.23	BACC10NB19
1.20	1.30	BACC10NB20
1.26	1.36	BACC10NB21
1.33	1.43	BACC10NB22
1.39	1.49	BACC10NB23
1.45	1.55	BACC10NB24

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Table 19 (continued)

Wire Harness or Power Feeder Diameter (inch)		Boeing Standard
Minimum	Maximum	
1.51	1.61	BACC10NB25
1.57	1.67	BACC10NB26
1.63	1.73	BACC10NB27
1.70	1.80	BACC10NB28
1.95	2.05	BACC10NB32

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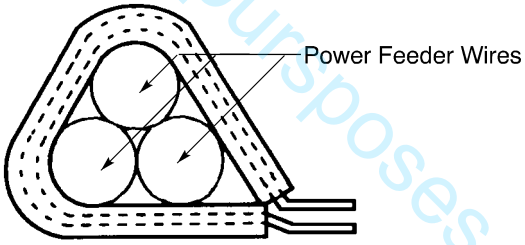
P. BACC10KL Three Wire Clamps

The BACC10KL loop clamp is installed as a support for:

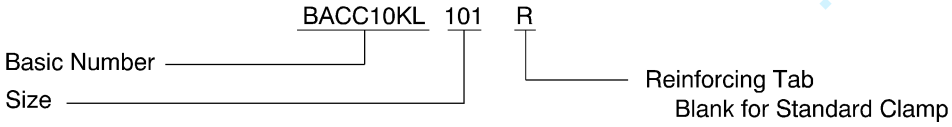
- A power feeder wire harness with three wires
- A power feeder wire harness that has a straight routing through the clamp.

The BACC10KL loop clamp with a support tab is installed:

- In a high vibration area
- On the leading edge of the wing.



BACC10KL THREE WIRE CLAMP
Figure 29



BACC10KL CLAMP PART NUMBER STRUCTURE
Figure 30

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Table 20
BACC10KL THREE WIRE CLAMP PART NUMBERS

Wire Size (AWG)	Boeing Standard
4	BACC10KL101
2	BACC10KL102
1	BACC10KL103
1/0	BACC10KL104
2/0	BACC10KL105
3/0	BACC10KL106
4/0	BACC10KL107

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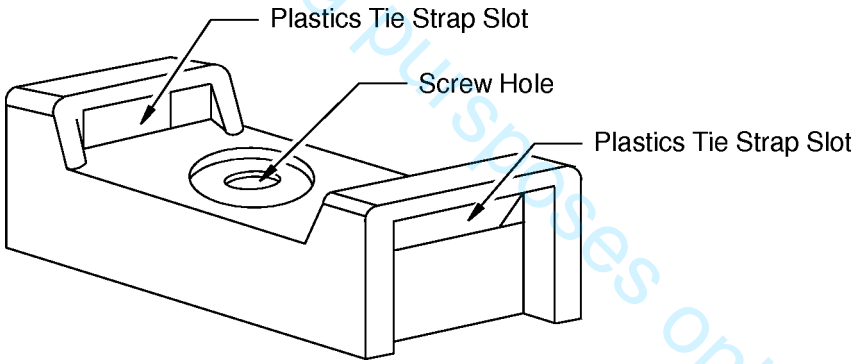
Q. STBP19M Wire Harness Mounting Platforms

The STBP19M

- Is made of nylon
- Uses a BACS38K() or BACS38W() plastic tie strap to hold the wire harness.



STBP19M WIRE HARNESS SCREW MOUNTING PLATFORM
Figure 31

Table 21
STBP19M WIRE HARNESS MOUNTING PLATFORM PART NUMBERS

Boeing Standard	Mounting Platform Configuration	
	Mounting Type	Mount Screw Nominal Diameter (inch)
STBP19M1	Screw Mounting	0.112
STBP19M2	Screw Mounting	0.138
STBP19M3	Screw Mounting	0.164
STBP19M4	Adhesive Mounting	-
STBP19M5	Screw Mounting	0.120

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Table 21 (continued)

Boeing Standard	Mounting Platform Configuration	
	Mounting Type	Mount Screw Nominal Diameter (inch)
STBP19M6	Screw Mounting	0.138
STBP19M7	Adhesive Mounting	-
STBP19M8	Screw Mounting	0.138
STBP19M9	Screw Mounting	0.164
STBP19M10	Adhesive Mounting	-
STBP19M11	Screw Mounting	0.164
STBP19M12	Screw Mounting	0.190
STBP19M13	Screw Mounting	0.250
STBP19M14	Screw Mounting	0.190
STBP19M15	Adhesive Mounting	-

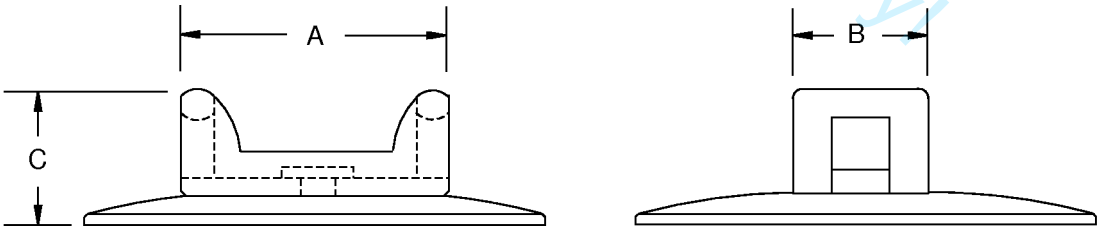
Table 22
PLASTIC TIE STRAP PART NUMBER

Boeing Standard	Supplier
BACS38K()	Boeing
BACS38W()	Boeing

R. BACM14L Wire Harness Mounting Platforms

The BACM14L wire harness mounting platform

- Is made of nylon
- Uses a BACS38K() or BACS38W() plastic tie strap to hold the wire harness.



BACM14L WIRE HARNESS MOUNTING PLATFORM
Figure 32

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Table 23
BACM14L WIRE HARNESS MOUNTING PLATFORM PART NUMBERS

Boeing Standard	Dimensions		
	A (inch)	B (inch)	C (inch)
BACM14L1	0.560	0.340	0.37
BACM14L2	0.668	0.440	0.43
BACM14L3	0.925	0.562	0.52

Table 24
PLASTIC TIE STRAP PART NUMBERS

Boeing Standard	Supplier
BACS38K()	Boeing
BACS38W()	Boeing

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S. BACS31H Ring Posts

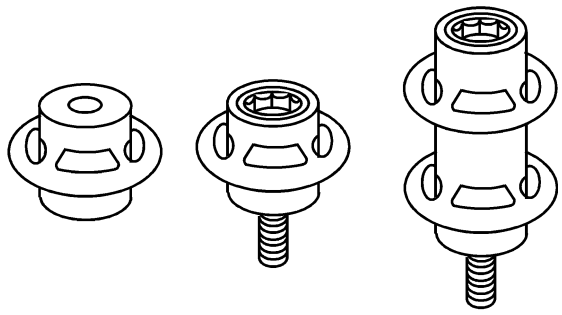
The BACS31H ring post:

- Is made of nylon
- Uses a BACS38W3 plastic tie strap to hold the wire harness
- Can hold a wire harness that is 1.25 inches or less in diameter
- Can be installed with other ring posts that are the same type.

The BACS31H ring post can replace:

- A spacer that is the same length
- A BACC10DK clamp
- A BACC10GE clamp
- A BACC10GU clamp
- A 287T0011 clamp.

Refer to Paragraph 2.B. for the necessary conditions to replace a clamp.



BACS31H RING POST
Figure 33

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Table 25
BACS31H RING POST PART NUMBERS

Boeing Standard	Ring Post Configuration		
	Fastener Type	Length (inch)	Number of Rings
BACS31H1A	Through hole	0.75	1
BACS31H1B	Integral Screw	0.75	1
BACS31H2B	Integral Screw	1.50	2

Table 26
PLASTIC TIE STRAP PART NUMBERS

Boeing Standard	Supplier
BACS38W3	Boeing

Table 27
COMPONENT PART NUMBERS

Component	Boeing Standard or Specification	Supplier
Nut	BACN10YR3CD	Boeing
Screw	BACS12GU3K()	Boeing
Spacer	NAS42DD6()	A Qualified Source
Washer	NAS1149D0332J	A Qualified Source

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T. BACS31J Support Assemblies

The BACS31J support assembly:

- Is a made of nylon
- Uses a BACS38W3 plastic tie strap to hold the wire harness
- Is installed on a channel bracket made to the BAC1510-407 specification.

The BACS31J support assembly has these components:

- A support
- A clip.

The BACS31J support assembly can replace:

- A spacer that is the same length
- A BACC10DK clamp
- A BACC10GE clamp
- A BACC10GU clamp
- A 287T0011 clamp.

Refer to Paragraph 2.C. for the necessary conditions to replace a clamp.

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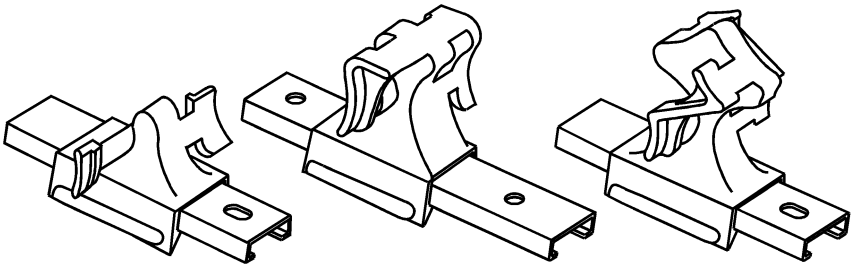
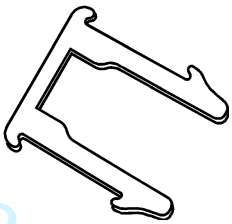
WIRE HARNESS SUPPORTS



BACS31J SUPPORT
Figure 34



BACS31J5 CLIP
Figure 35

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Table 28
BACS31J SUPPORT PART NUMBERS

Boeing Standard	Support Configuration	
	Wire Harness Maximum Diameter (inch)	Maximum Number of Wire Harnesses
BACS31J2	1.25	2
BACS31J3	1.25	3
BACS31J4	1	4

Table 29
BACS31J CLIP PART NUMBERS

Boeing Standard	Supplier
BACS31J5	Boeing

Table 30
PLASTIC TIE STRAP PART NUMBERS

Boeing Standard	Supplier
BACS38W3	Boeing

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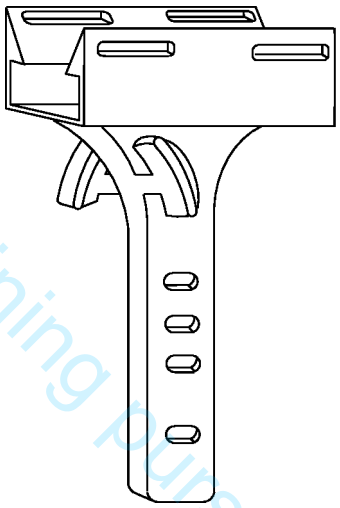
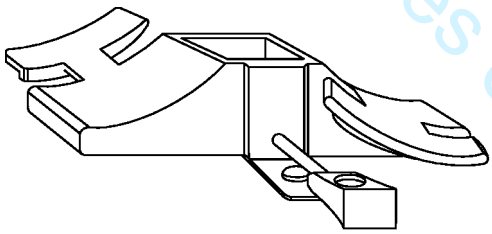
U. BACS31K Raceway Wiring Supports

BACS31K Raceway Wiring Supports:

- BACS31K1 is a post with 4 slots
- BACS31K2 is an mount with an alignment pin
- BACS31K3 is a post with 3 slots
- Are made of polyamide
- The metal pin on BACS31K2 is made of aluminum rod
- Are available only in one size.



BACS31K1 WIRING SUPPORT POST WITH FOUR SLOTS
Figure 36



BACS31K2 WIRING SUPPORT MOUNT
Figure 37

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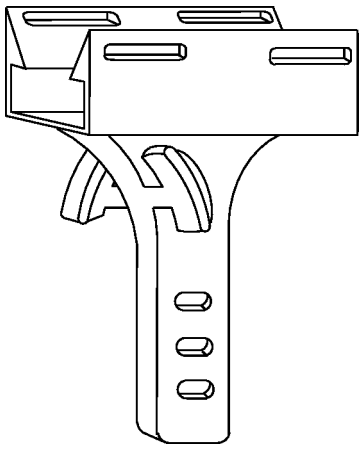
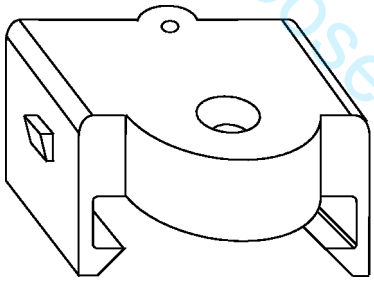


BACS31K3 WIRING SUPPORT POST WITH THREE SLOTS
Figure 38

V. BACS31M Raceway Channel Supports

BACS31M Raceway Channel Supports:

- BACS31M1 is a channel support base
- BACS31M2 is a channel support cap
- Are made with nylon
- Have a metal pin on BASC31M2 that is made of aluminum rod
- Are used with raceway brackets
- Are available only in one size.



BACS31M1 BRACKET SUPPORT BASE
Figure 39

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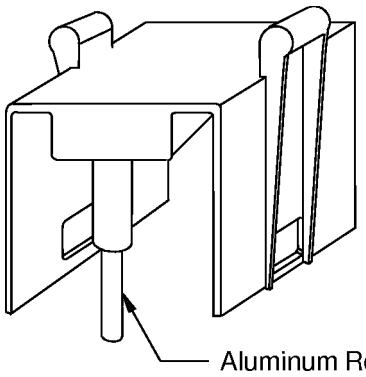
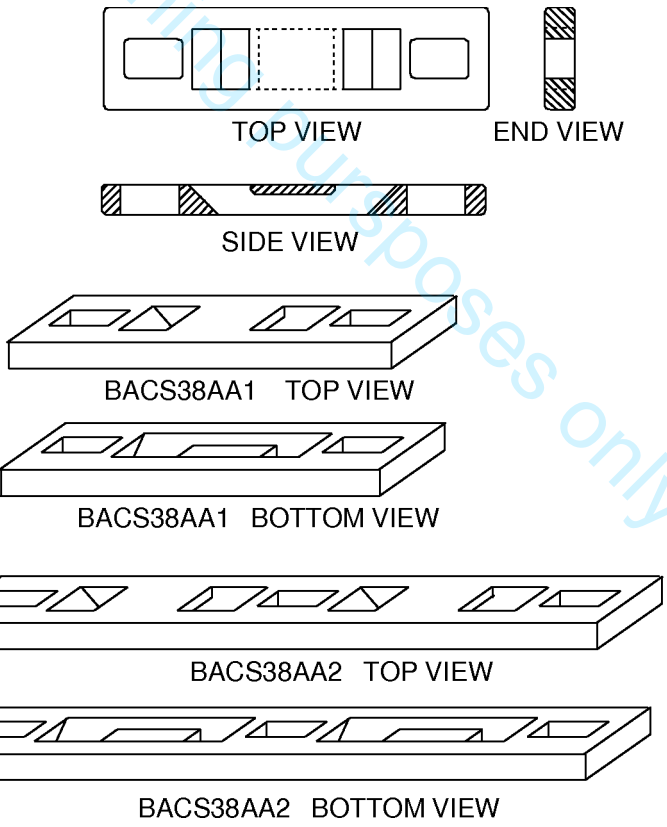
WIRE HARNESS SUPPORTS



BACS31M2 BRACKET SUPPORT CAP
Figure 40

W. BACS38AA Tie Strap Mounting Plate

The BACS38AA mounting plate is used with a tie strap to attach wire bundles to structures, brackets and standoffs in the pressurized area of the aircraft:



BACS38AA TIE STRAP MOUNTING PLATE
Figure 41

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BACS38AA 7

Basic Number — Number of Tie Strap Mount Posistions

BACS38AA TIE STRAP MOUNTING PLATE PART NUMBER STRUCTURE
Figure 42

Table 31
BACS38AA PART NUMBERS

Boeing Standard	Number of Tie Strap Mount Positions	Part Length (inches)
BACS38AA1	1	2.1
BACS38AA2	2	3.6
BACS38AA3	3	5.1
BACS38AA4	4	6.6
BACS38AA5	5	8.1
BACS38AA6	6	9.6
BACS38AA7	7	11.1

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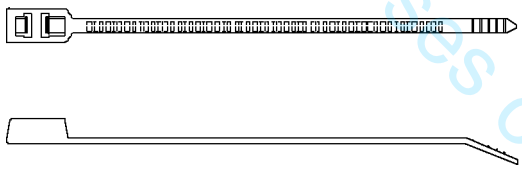
X. BACS38AB and Panduit PLB4 Spacer Tie Straps

The BACS38AB spacer tie straps are used to hold wire harnesses together, and to attach wire harnesses to structures, brackets, rods and standoffs in the pressurized area of the aircraft:



BACS38AB SPACER TIE STRAP
Figure 43

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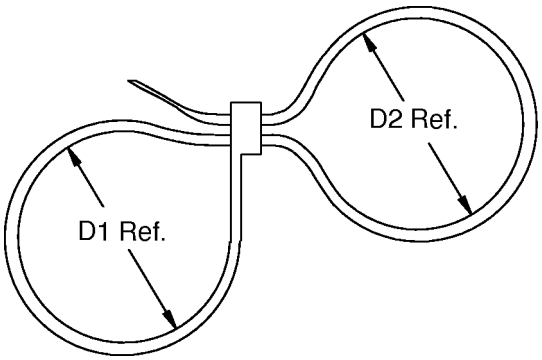
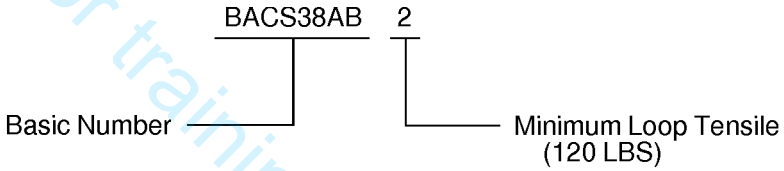


BACS38AB OR PANDUIT PLB4 SPACER TIE STRAP ON TWO WIRE HARNESSES
Figure 44



BACS38AB SPACER TIE STRAP PART NUMBER STRUCTURE
Figure 45

Table 32
BACS38AB SPACER TIE PART NUMBERS

Boeing Part Number	Maximum Combined Diameter (D1 + D2) (Inches)	Supplier Part Number	Supplier
BACS38AB1	4.1	PLB4H	Panduit
BACS38AB2	3.6	PLB4S	Panduit

Table 33
ALTERNATIVE SPACER TIE STRAP PART NUMBERS

Specified Spacer Tie Strap		Alternative Spacer Tie Strap	
Part Number	**Supplier**	**Part Number**	**Supplier**
PLB4H	Panduit	BACS38AB1	Panduit
PLB4S	Panduit	BACS38AB2	Panduit
BACS38AB1	Panduit	PLB4H	Panduit
BACS38AB2	Panduit	PLB4S	Panduit

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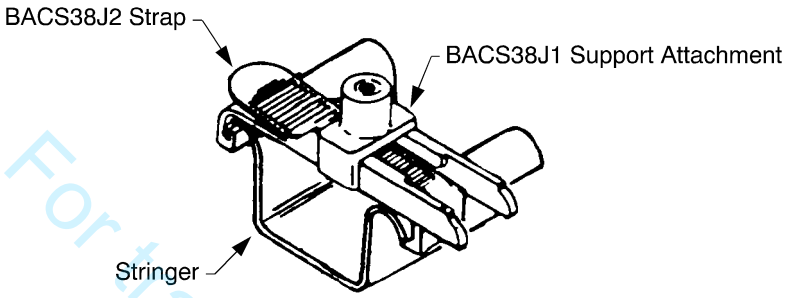
Y. BACS38J Stringer Clips

A BACS38J stringer clip assembly is made from these two parts:

- A support attachment
- A strap.

Refer to Figure 46 and Table 35.

The stringer clip is installed to hold a wire harness or an insulation blanket on an airframe stringer.



BACS38J4 STRINGER CLIP ASSEMBLY
Figure 46

Table 34
BACS38J STRINGER CLIP PART NUMBERS

Boeing Standard	Description
BACS38J4	Stringer Clip, Single Insert
BACS38J5	Stringer Clip, Dual Insert
BACS38J7	Stringer Clip, Long Single Insert

Table 35
BACS38J STRINGER CLIP ASSEMBLY COMPONENTS

Boeing Standard	Description
BACS38J1	Single Insert Support Attachment
BACS38J2	Strap
BACS38J3	Dual Insert Support Attachment
BACS38J6	Long Single Insert Support Attachment

Z. BMS8-389 Adhesive Wire Installation Tape

The BMS8-389 tape is:

- A pressure sensitive adhesive (PSA) tape
- Used for bonding wires and other system transport elements (STE) to airplane substrates.

Refer to Figure 47 for the adhesive tape composition. Refer to Figure 48 for the adhesive tape part number structure.

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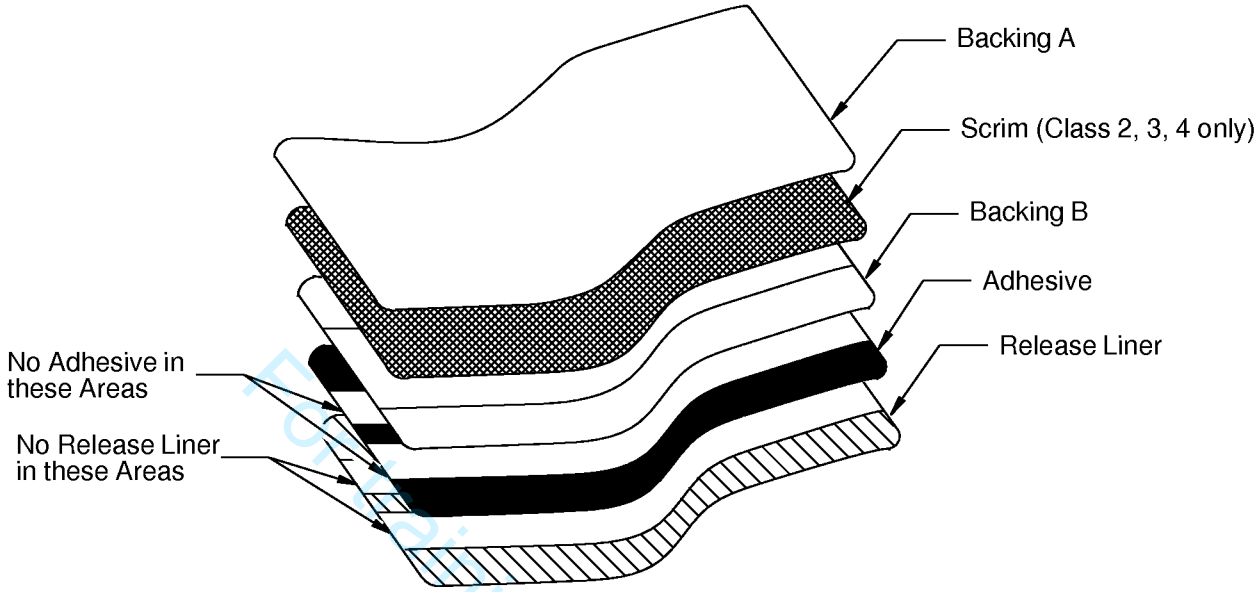
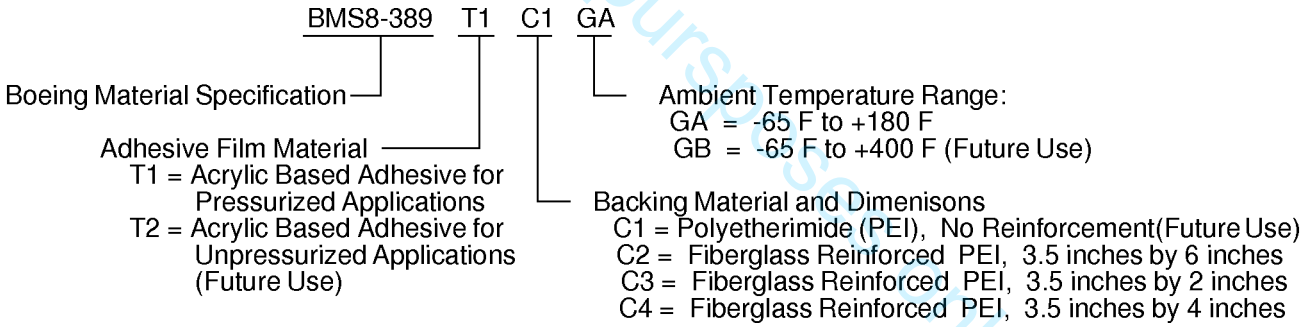


CONSTRUCTION OF ADHESIVE WIRE INSTALLATION TAPE
Figure 47



BMS8-389 ADHESIVE WIRE INSTALLATION TAPE
Figure 48

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AA. CSCS Tie Strap Mounting Platform

The CSCS Tie Strap Mounting Platform:

- Is made of nylon 6.6
- Is held closed with a wire harness tie
- Connects two bundles at 90 degrees. (Perpendicular Bundles.)
- Provides 0.19 inch space between upper and lower bundles.

The CSCS Tie Strap Mounting Platform is installed in the pressurized area of the airplane to hold:

- wire harness that is less than 0.625 inch in diameter.

NOTE: If a fiber optic cable is against the support or against the tie strap, a minimum of 2 layers of silicone tape must be wrapped on the harness at that location before the tie strap is installed.

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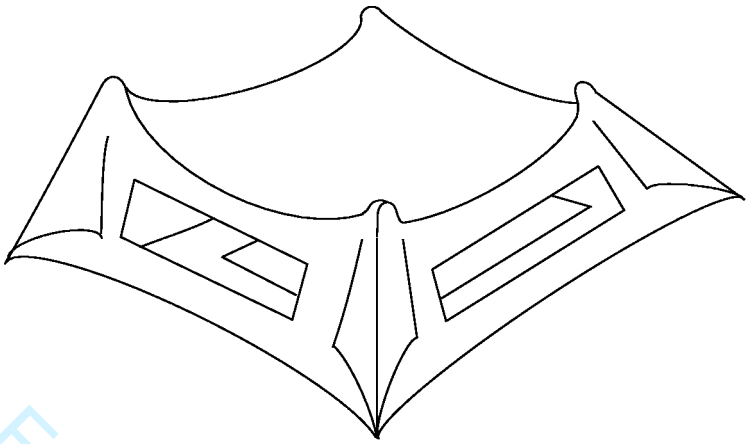


CSCS TIE STRAP MOUNTING PLATFORM
Figure 49

AB. CR2 and CR4H Wire Spacers (Connector Ring)

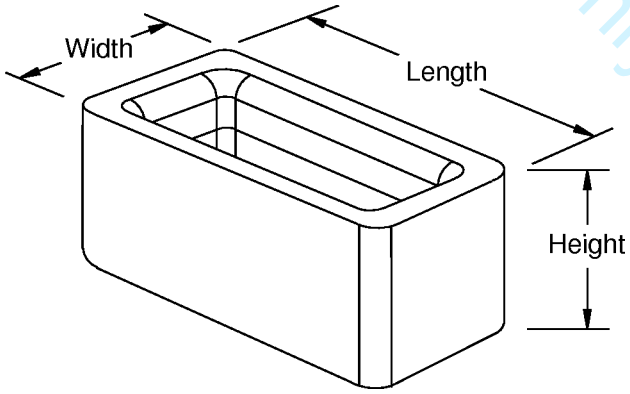
These parts hold one wire harness to another wire harness.

Adjacent wire harness ties of two adjacent, parallel wire harnesses go through these rings.

Refer to Paragraph 6.W. for the procedure to install these parts.

Table 36
WIRE SPACERS (CONNECTOR RINGS)

Part Number	Material	Dimensions (inch)			Supplier
		Width	Length	Height	
CR2	Nylon	0.24	0.33	0.20	Panduit
CR4H	Nylon	0.36	0.57	0.30	Panduit



CONFIGURATION OF CR2 AND CR4H SPACERS
Figure 50

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Table 37
ALTERNATIVE WIRE SPACERS

Specified Part	Alternative Part
CR2	CR4H

AC. JM44LC39S( )RG Loop Clamps

The JM44LC39S( )RG clamp is:

- A general purpose loop clamp
- Installed in the unpressurized area of the airplane.

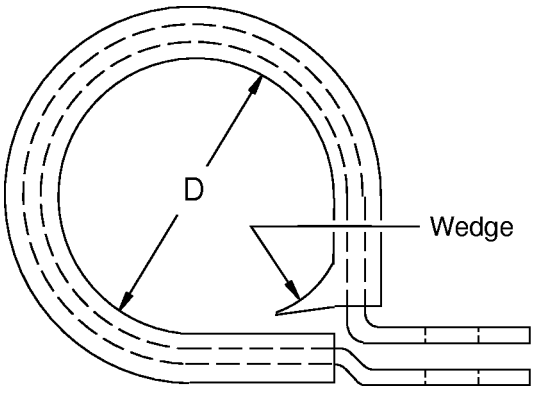
NOTE: The JM44LC39S( )RG clamp is a satisfactory alternative for the BACC10GU clamp.

JM44LC39S( )RG LOOP CLAMP
Figure 51

Table 38
JM44LC39S( )RG LOOP CLAMP PART NUMBERS

Wire Harness Diameter (inch)		Part Number	Color
Minimum	Maximum		
2.448	2.510	JM44LC39S( )RG	Grey

AD. MS21919 or AS21919 Loop Clamps



AS21919 OR MS21919 LOOP CLAMP
Figure 52

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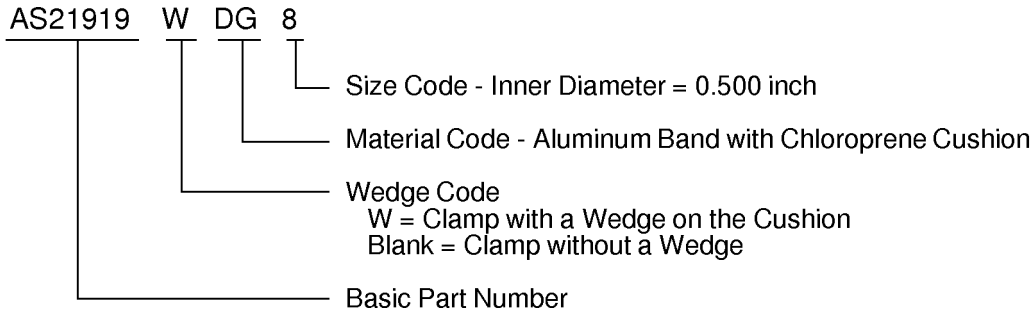

AS21919 LOOP CLAMP PART NUMBER STRUCTURE
Figure 53

NOTE: Sizes -2 through -48 have a wedge.

Table 39
AS21919 BAND AND CUSHION MATERIAL CODES

Band Material	Cushion Material	Material Code
Aluminum	Ethylene Propylene	DE
	Nitrile	DF
	Chloroprene	DG
Cres	Ethylene Propylene	CE
	Nitrile	CF
	Chloroprene	CG
	Silicone	CH
	Fluorosilicone	CJ

Table 40
AS21919 LOOP CLAMP SIZE CODES

Inner Diameter (inch)	Size Code
0.062	-1
0.125	-2
0.188	-3
0.250	-4
0.313	-5
0.375	-6
0.438	-7
0.500	-8
0.563	-9

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Table 40 (continued)

Inner Diameter (inch)	Size Code
0.625	-10
0.688	-11
0.750	-12
0.813	-13
0.875	-14
0.938	-15
1.000	-16
1.063	-17
1.125	-18
1.188	-19
1.250	-20
1.313	-21
1.375	-22
1.438	-23
1.500	-24
1.563	-25
1.625	-26
1.688	-27
1.750	-28
1.813	-29
1.875	-30
1.938	-31
2.000	-32
2.062	-33
2.125	-34
2.188	-35
2.250	-36
2.312	-37
2.375	-38
2.500	-40
2.625	-42
2.688	-43

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Table 40 (continued)

Inner Diameter (inch)	Size Code
2.750	-44
2.812	-45
2.875	-46
3.000	-48
3.125	-50
3.250	-52
3.375	-54
3.500	-56
3.625	-58
4.000	-64
4.125	-66

Table 41
ALTERNATIVE PART NUMBERS

Specified Clamp		Alternative Clamp	
Part Number	Supplier	Part Number	Supplier
MS21919()	J & M Products	AS21919()	J & M Products
	Umpco		Umpco
AS21919()	J & M Products	MS21919()	J & M Products
	Umpco		Umpco

AE. S717-( ) Loop Clamps

The S717-( ) clamp is:

- A general purpose loop clamp
- Installed in the unpressurized area of the airplane.

NOTE: The S717-( ) clamp is a satisfactory alternative for the BACC10GU clamp.

S717-( ) LOOP CLAMP
Figure 54

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Table 42
S717-( ) LOOP CLAMP PART NUMBERS

Wire Harness Diameter (inch)		Dash Number	Color
Minimum	Maximum		
0.125	0.218	-101	Red
0.219	0.312	-102	Blue
0.313	0.406	-103	Orange
0.407	0.500	-104	Green
0.501	0.593	-105	Yellow
0.594	0.688	-106	Red
0.689	0.781	-107	Blue
0.782	0.875	-108	Orange
0.876	0.968	-109	Green
0.969	1.062	-110	Yellow
1.063	1.156	-111	Red
1.157	1.250	-112	Blue
1.251	1.343	-113	Orange
1.344	1.437	-114	Green
1.438	1.531	-115	Yellow
1.532	1.625	-116	Red
1.626	1.718	-117	Blue
1.719	1.812	-118	Orange
1.813	1.906	-119	Green
1.907	2.000	-120	Yellow
2.001	2.093	-121	Red
2.094	2.187	-122	Blue
2.188	2.281	-123	Orange
2.282	2.375	-124	Green
2.376	2.468	-125	Yellow

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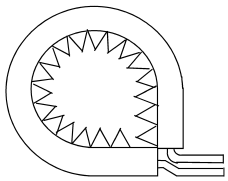
AF. TA025041 Sawtooth Loop Clamps

The TA025041 loop clamp is installed:

- In a high vibration area
- In a high temperature area
- On the engine.



TA025041 LOOP CLAMP
Figure 55

Table 43
TA025041-() LOOP CLAMP PART NUMBERS

Inner Diameter (inch)	Part Number
0.063	TA025041-01
0.125	TA025041-02
0.188	TA025041-03
0.250	TA025041-04
0.313	TA025041-05
0.375	TA025041-06
0.438	TA025041-07
0.500	TA025041-08
0.562	TA025041-09
0.625	TA025041-10
0.688	TA025041-11
0.750	TA025041-12
0.813	TA025041-13
0.875	TA025041-14
0.938	TA025041-15
1.000	TA025041-16
1.062	TA025041-17
1.125	TA025041-18
1.188	TA025041-19
1.250	TA025041-20

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Table 43 (continued)

Inner Diameter (inch)	Part Number
1.313	TA025041-21
1.375	TA025041-22
1.438	TA025041-23
1.500	TA025041-24
1.562	TA025041-25
1.625	TA025041-26
1.688	TA025041-27
1.750	TA025041-28
1.813	TA025041-29
1.875	TA025041-30
1.938	TA025041-31
2.000	TA025041-32

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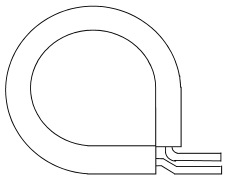
AG. TA025097 Loop Clamps

The TA025097 loop clamp is installed to hold:

- A power feeder wire harness that does not have a straight routing through the clamp
- A power feeder wire harness that has more than or less than three power feeder wires.

A replacement clamp must have the same part number as the clamp of the initial installation.



TA025097 LOOP CLAMP
Figure 56

Table 44
TA025097 LOOP CLAMP PART NUMBERS

Inner Diameter (inch)	Part Number
0.938	TA025097-15
0.375	TA025097L06
0.438	TA025097L07
0.500	TA025097L08

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Table 44 (continued)

Inner Diameter (inch)	Part Number
0.562	TA025097L09
0.625	TA025097L10
0.688	TA025097L11
0.750	TA025097L12
0.812	TA025097L13
0.875	TA025097L14
0.938	TA025097L15
1.000	TA025097L16
1.062	TA025097L17
1.125	TA025097L18
1.188	TA025097L19
1.250	TA025097L20
1.312	TA025097L21
1.375	TA025097L22
1.438	TA025097L23
1.500	TA025097L24

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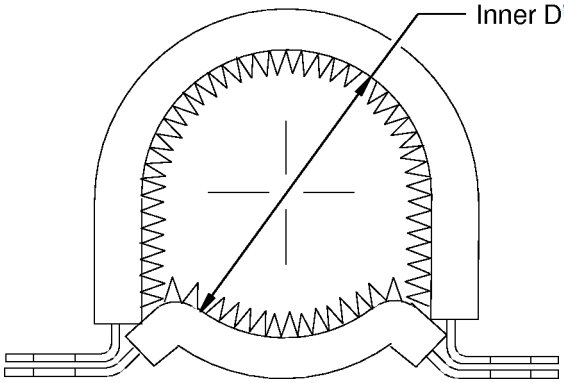
AH. TA0930034 Saddle Clamps

A replacement clamp must have the same part number as the clamp of the initial installation.



TA0930034 SADDLE CLAMP
Figure 57

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Table 45
TA0930034 SADDLE CLAMP PART NUMBERS

Inner Diameter (inch)	Part Number
0.375	TA0930034-06
0.500	TA0930034-08
0.562	TA0930034-09
0.625	TA0930034-10
0.688	TA0930034-11
0.750	TA0930034-12
0.812	TA0930034-13
0.875	TA0930034-14
0.938	TA0930034-15
1.000	TA0930034-16
1.062	TA0930034-17
1.125	TA0930034-18
1.188	TA0930034-19
1.250	TA0930034-20
1.312	TA0930034-21
1.375	TA0930034-22
1.438	TA0930034-23
1.500	TA0930034-24
1.600	TA0930034-26

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4. REMOVAL OF WIRE HARNESS SUPPORTS

A. Removal of a BACS31J Support Assembly

(1) At the same time, push the ends of the clip together and push the clip back through the slots in the side of the support. Refer to Figure 58 and Figure 59.

NOTE: It is not necessary to fully remove the clip from the support assembly.

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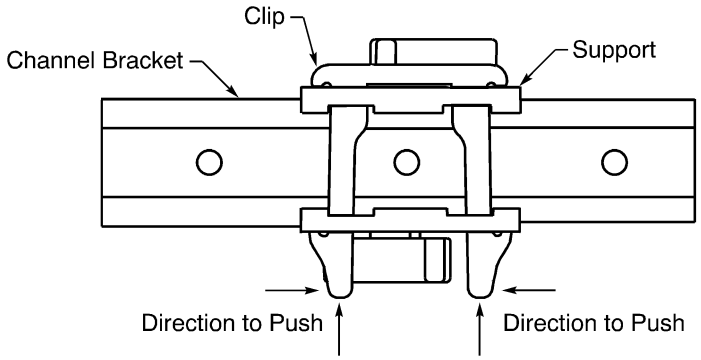
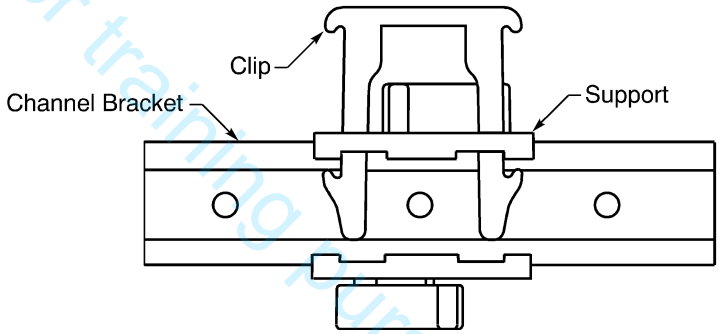
WIRE HARNESS SUPPORTS

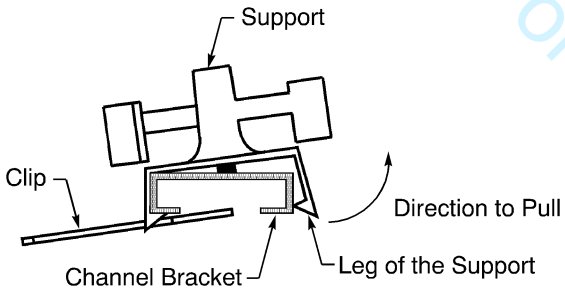


INITIAL POSITION OF THE CLIP
Figure 58



FINAL POSITION OF THE CLIP
Figure 59

(2) At the same time, pull one leg of the support out from the bracket and turn the support on the bracket. Refer to Figure 60.



REMOVAL OF THE SUPPORT
Figure 60

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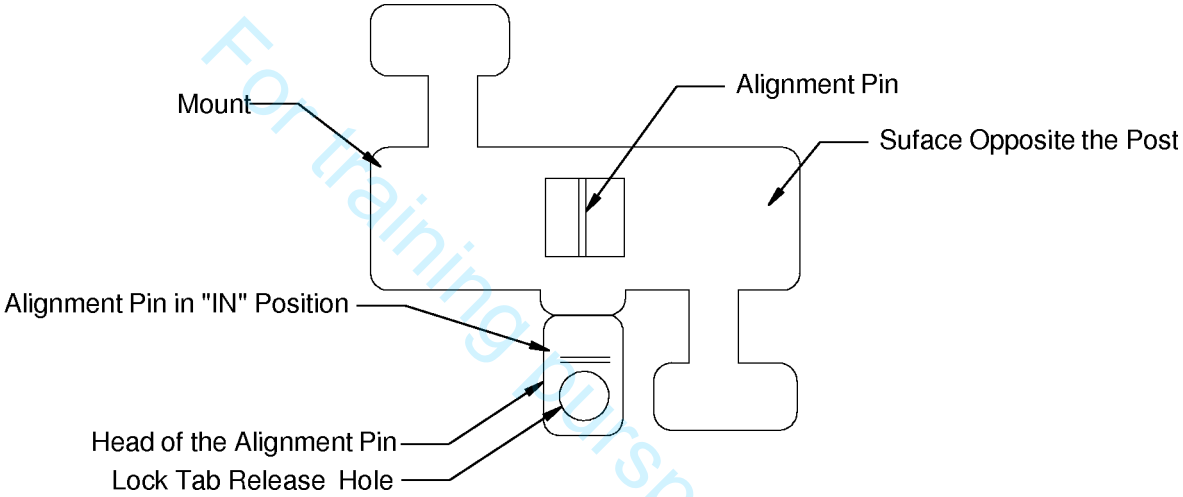
B. Removal of a BACS31K2 Raceway Mount Support

Table 46
NECESSARY TOOL

Tool	Description
Screwdriver	Phillips Head, Small

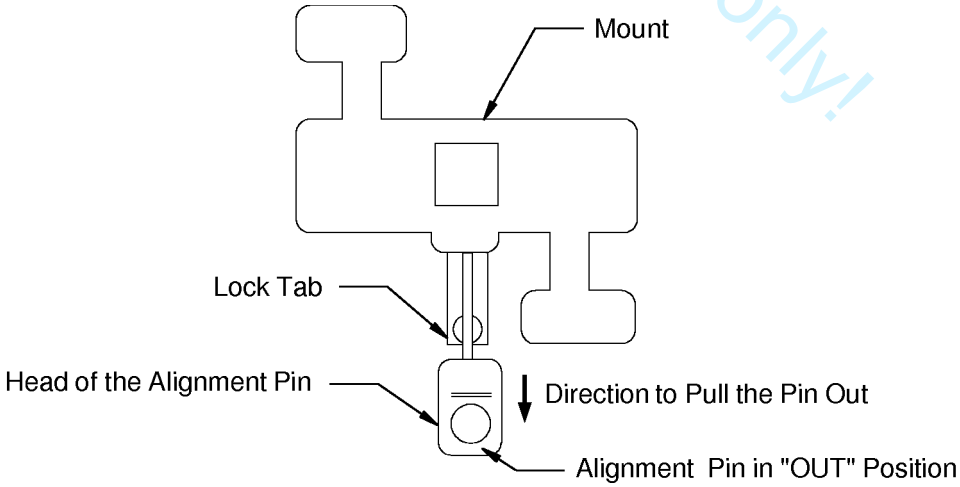
(1) Make a selection of a small screwdriver from Table 46.

(2) Push the lock tap through the release hole in the head of the alignment pin with the screwdriver. Refer to Figure 61.



LOCATION OF THE LOCK TAB RELEASE HOLE
Figure 61

(3) Hold the lock tab in its release position and pull the pin out. Refer to Figure 62.



POSITION OF THE ALIGNMENT PIN
Figure 62

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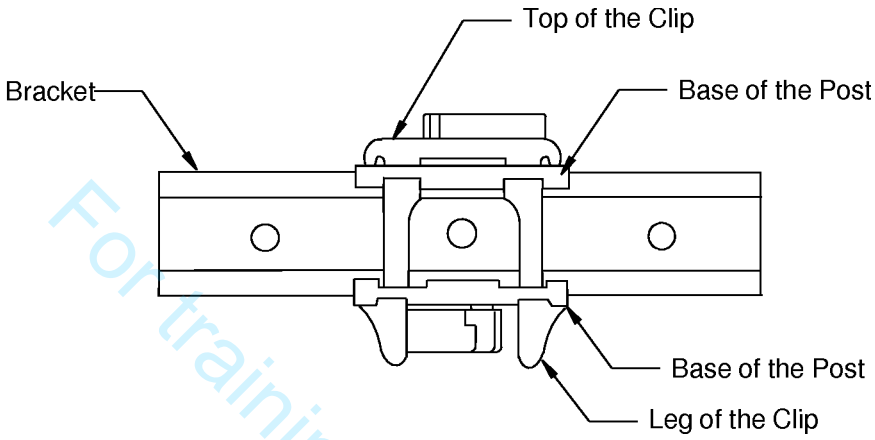
(4) Pull the BACS31K2 mount from the BACS31K1 or BASC31K3 post.

C. Removal of a BACS31K1 or BCAS31K3 Raceway Post Support

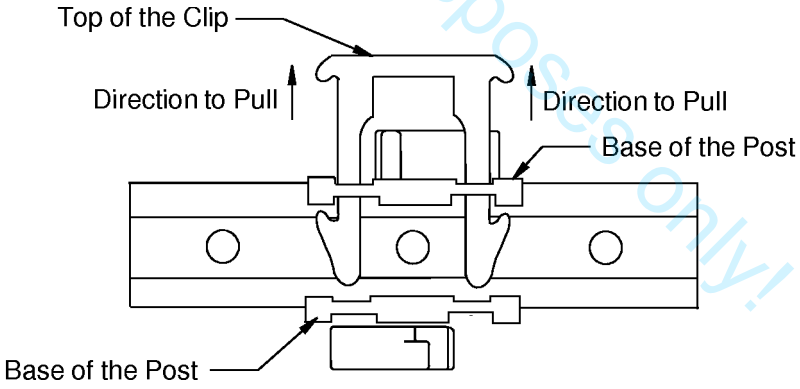
(1) Push the ends of the legs of the clip together. Refer to Figure 63.

NOTE: It is not necessary to fully remove the clip from the support assembly.



RELEASE OF THE CLIP
Figure 63

(2) Hold the legs together and push the clip through the installation holes in the base of the post. Refer to Figure 64.



REMOVAL OF THE CLIP
Figure 64

(3) Hold the legs together and push the clip through the installation holes in other side of the base. Refer to Figure 64.

(4) Pull one side of the base away from the edge of the bracket. Refer to Figure 65.

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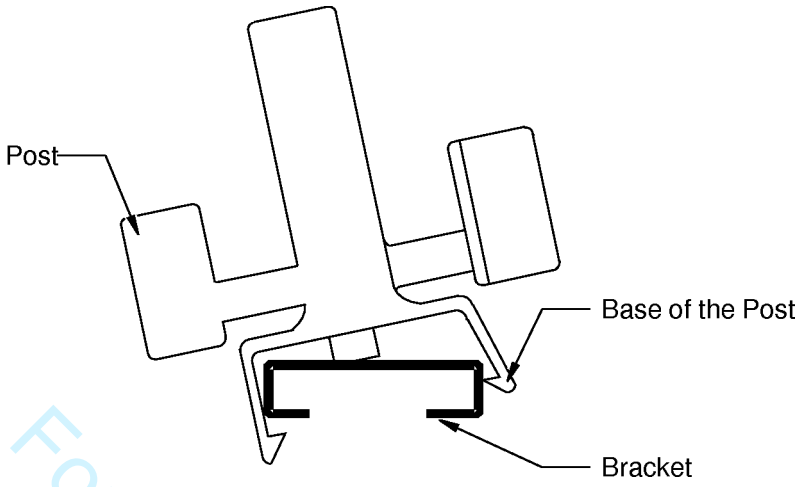
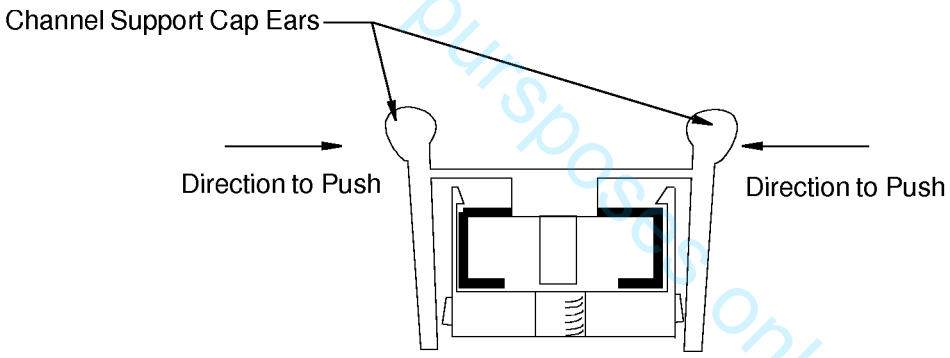


POSITION OF THE POST ON THE BRACKET
Figure 65

(5) Twist the top of the post to fully remove it from the bracket.

D. Removal of a BACB20VG Raceway Bracket

(1) Push the ears of the channel support cap together. Refer to Figure 66.



DIRECTION TO PUSH THE EARS OF THE CHANNEL SUPPORT CAP
Figure 66

(2) At the same time, hold the ears of the channel support cap together and pull the cap away from the channel support. Refer to Figure 67.

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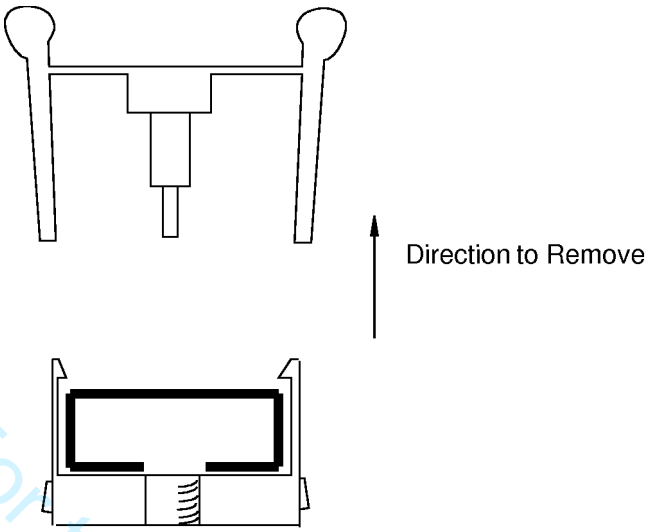
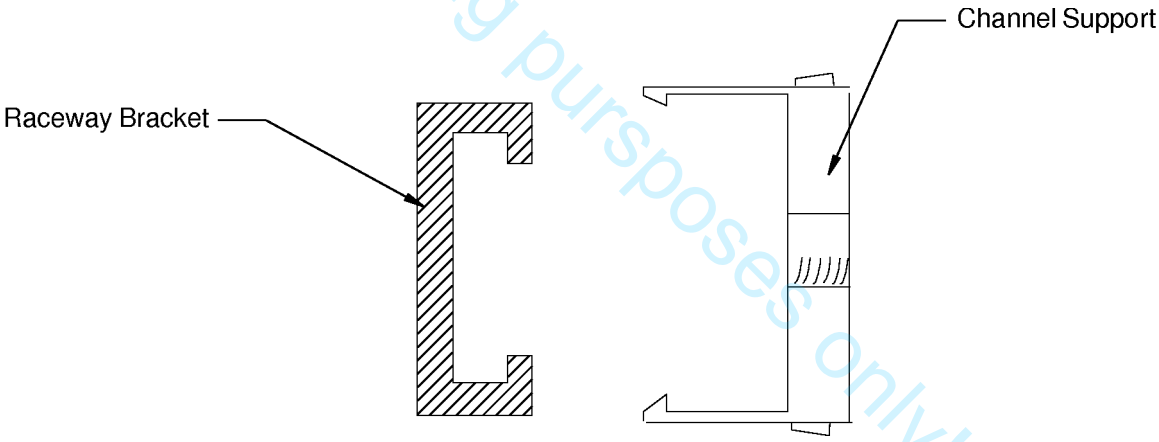


REMOVAL OF CHANNEL SUPPORT CAP
Figure 67

(3) Pull the raceway bracket from the channel support. Refer to Figure 68.



REMOVAL OF THE RACEWAY BRACKET FROM THE CHANNEL SUPPORT
Figure 68

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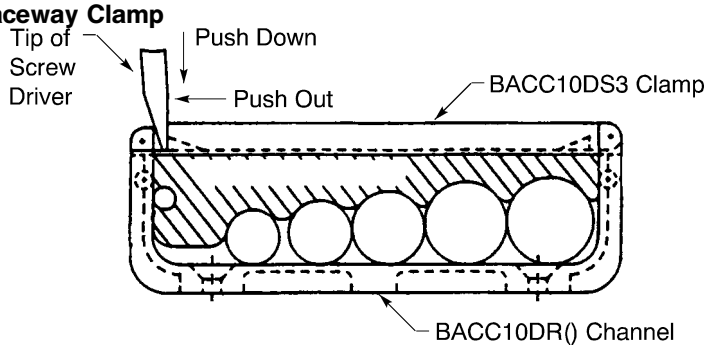
E. Removal of a Raceway Clamp



REMOVAL OF THE RACEWAY CLAMP
Figure 69

Refer to Figure 69.

(1) Put the end of a flat blade screwdriver or an equivalent tool between the clamp and the top edge of the channel.

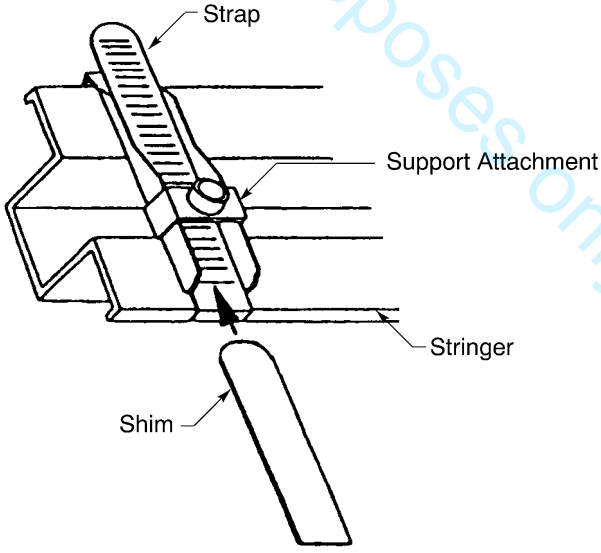
(2) Push one side of the channel away from the clamp until the clamp hook disengages from the slot in the side of the channel.

(3) Pull clamp out from the slot on the other side of the clamp.

F. Removal of a Stringer Clip

(1) Make a selection of a shim that is 0.032 inch thick and 0.5 inch wide.

(2) Push the shim between the strap and the support attachment. Refer to Figure 70.



POSITION OF THE SHIM TO REMOVE THE STRINGER CLIP
Figure 70

(3) Pull the strap out of the support attachment.

(4) Discard the stringer clip assembly to make sure that it is not installed again.

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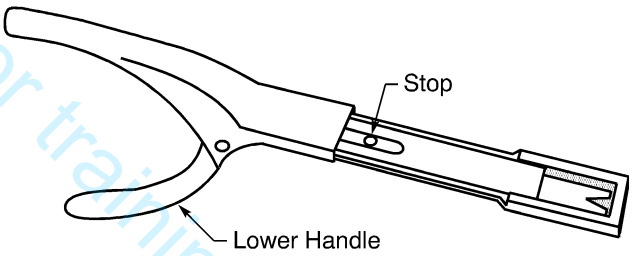
5. REMOVAL OF PLASTIC TIE STRAPS

A. Removal of a Plastic Tie Strap with an ST2318PC-() Tool

Table 47
PLASTIC TIE STRAP REMOVAL TOOLS

Part Number	Description
ST2318PC-6	Regular Length
ST2318PC-13	Short Length

(1) Make a selection of a plastic tie strap removal tool from Table 47.

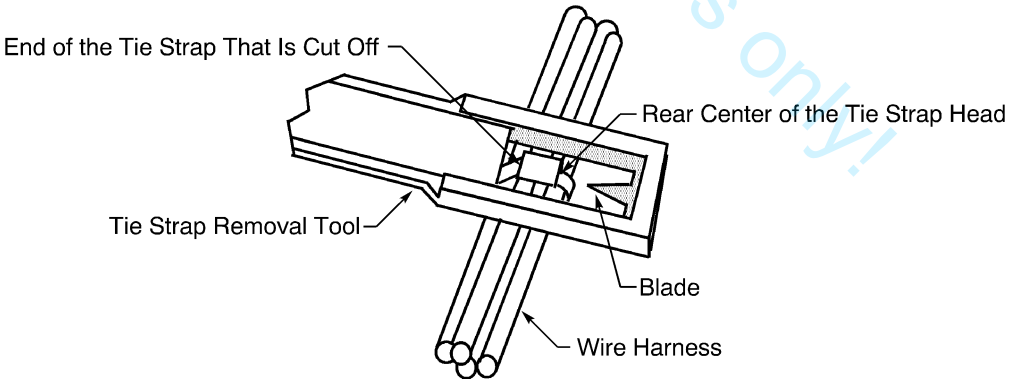


PLASTIC TIE STRAP REMOVAL TOOL
Figure 71

(2) Put the tool on the head of the tie. Refer to Figure 71 and Figure 72.

Make sure that:

- The tool is level with the tie strap head
- The end of the tie that is cut off is pointed to the handle of the tool
- The center of the blade is aligned with the rear center of the tie strap head.



POSITION OF THE REMOVAL TOOL
Figure 72

(3) Close the handle until it stops.

(4) Remove the tool.

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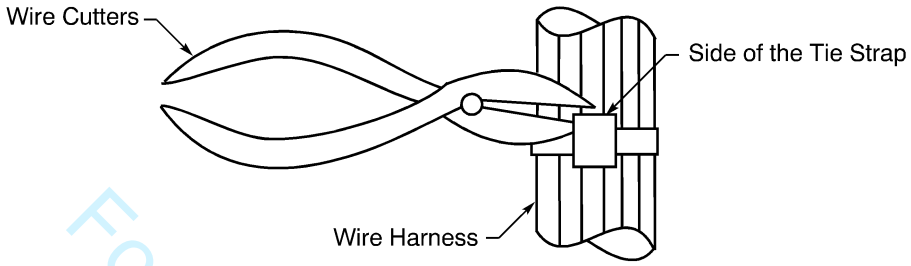
(5) Remove the tie strap.

NOTE: A soft tool can be used to open the tie strap if the strap does not open easily.

B. Removal of a Plastic Tie Strap with a Wire Cutter

(1) Cut one side of the tie strap head. Refer to Figure 73.



POSITION OF THE WIRE CUTTER
Figure 73

(2) Twist the tie strap head to release the tie strap.

(3) Pull the tie strap off the wire harness.

6. INSTALLATION OF WIRE HARNESS SUPPORTS

A. Necessary Materials

Table 48
NECESSARY MATERIALS

Material	Temperature Grade	Class	Part Number or Specification	Supplier
Bushing	C	2	8507	Component Products
Film Strip	D	1	E125-2	Fluorglas
				Saint-Gobain Performance Plastics
			E125-3	Fluorglas
				Saint-Gobain Performance Plastics
			Scotch 3082	3M
Grommet	C	2	35450-()	Fenwal Electronics
Plug, Filler	A	2	BACP20BA-1	Boeing
Rod, Filler	C	1	BMS1-52	Boeing
			69B47961-()	Boeing
Seal Ring	A	1	MS29513-012	Porter Seal
			MS29513-111	Porter Seal
Strap	B	1	BACS38C100C2	Boeing
Tape	D	2	Scotch 70	3M

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Table 48 (continued)

Material	Temperature Grade	Class	Part Number or Specification	Supplier
Tape, U Shaped Filler	C	1	10-62034-1	Boeing
			10-62034-2	Boeing

Table 49
APPROVED SUPPLIERS OF BOEING STANDARD MATERIALS

Boeing Standard	Approved Supplier
10-62034-()	Kirkhill Rubber
69B47961-()	Burke Industries
	FlexFab
	Rainier Rubber
	Rubber Teck
	Silicone Rubber Specialties
	Kirkhill Rubber
BACP20BA-1	American United Seal, Stillman Seal Division
	Kirkhill Rubber
BMS1-52	Burke Industries
	FlexFab
	Rainier Rubber
	Rubber Teck
	Silicone Rubber Specialties
	Kirkhill Rubber

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B. Installation of a 69B90483-() Block Clamp

(1) If the clamp size is not specified, make a selection of a clamp that has the correct size.

(a) Find the correct clamp size.

Refer to:

- Paragraph 1.B. for the necessary conditions for the selection of a clamp size
- Paragraph 1.E. for the procedure for the identification of the correct size of a loop clamp or a block clamp.

(b) Make a selection of a clamp from Table 6.

(2) Put the wire harness in the clamp. Refer to Figure 74.

Make sure that the wires and cables in the harness are parallel to each other at the location of the clamp.

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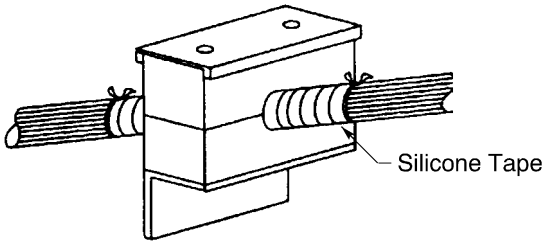
CAUTION: IF A CLAMP IS INSTALLED WHERE WIRES OR CABLES GO ACROSS EACH OTHER, DAMAGE TO THE WIRES OR THE CABLES CAN OCCUR. THIS CONDITION IS NOT APPLICABLE FOR MULTIPLE CONDUCTOR, TWISTED WIRE CABLES.



POSITION OF THE WIRE HARNESS IN THE BLOCK CLAMP
Figure 74

(3) Tighten the clamp screws.

Make sure that these conditions occur:

- The necessary conditions for the selection of a clamp size, refer to Paragraph 1.B.
- The necessary conditions for clamp installation, refer to Paragraph 1.C.

(4) If the clamp does not hold the wire harness tightly, increase the diameter of the wire harness with tape. Refer to Figure 74.

(a) Remove the wire harness from the clamp.

(b) Make a selection of a tape from Table 48.

NOTE: For an equivalent tape, refer to Subject 20-00-11.

Make sure that the Temperature Grade and the Class of the material are equal to or higher than the Temperature Grade and the Class of the wire harness. Refer to Subject 20-00-11.

(c) Wind one or more layers of tape around the clamp area on the wire harness.

Make sure that each layer:

- Extends a minimum of 1 inch farther than the edge of the block clamp cushion
- Has a minimum 50 percent overlap.

(d) Assemble a wire harness tie on each end of the layers of tape.

C. Installation of a Loop Clamp or a Three Wire Clamp

For the installation of:

- Two coax cables in a loop clamp, refer to Paragraph 6.D.
- A 287T0011 loop clamp, refer to Paragraph 6.E.
- Two coax cables in a 287T0011 loop clamp, refer to Paragraph 6.F.
- A BACC10DK loop clamp, refer to Paragraph 6.G.

(1) If the clamp size is not specified, make a selection of a clamp that has the correct size.

(a) Find the correct clamp size.

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Refer to:

- Paragraph 1.B. for the necessary conditions for the selection of a clamp size
- Paragraph 1.E. for the procedure for the identification of the correct size of a loop clamp or a block clamp.

(b) Make a selection of a clamp from:

- Table 8 for a BACC10BU() clamp
- Table 14 for a BACC10GE() clamp
- Table 15 for a BACC10GU() clamp
- Table 16 for a BACC10HS() clamp
- Table 17 for a BACC10JU() clamp
- Table 18 for a BACC10NA() clamp
- Table 19 for a BACC10NB() clamp
- Table 20 for a BACC10KL() three wire clamp
- Table 38 for a JM44LC39S( )RG clamp
- Table 42 for a S717-( ) clamp
- Table 43 for a TA025041-() clamp
- Table 44 for a TA025097() clamp.

(2) Put the wire harness in the clamp.

(3) If a fiber optic cable is against the clamp:

(a) Make a selection of a silicone tape. Refer to Subject 20-00-11.

(b) Remove the wire harness from the clamp.

(c) Make sure that the wires and cables in the harness are parallel to each other at the location of the clamp.

CAUTION: IF A CLAMP IS INSTALLED WHERE WIRES OR CABLES GO ACROSS EACH OTHER, DAMAGE TO THE WIRES OR THE CABLES CAN OCCUR. THIS CONDITION IS NOT APPLICABLE FOR MULTIPLE CONDUCTOR, TWISTED WIRE CABLES.

(d) Wind a minimum of 2 layers of silicone tape on the harness at the location of the clamp.

(e) Put the wire harness in the clamp again.

NOTE: A larger clamp size is possibly necessary.

(4) Make sure that the wires and cables in the harness are parallel to each other at the location of the clamp.

CAUTION: IF A CLAMP IS INSTALLED WHERE WIRES OR CABLES GO ACROSS EACH OTHER, DAMAGE TO THE WIRES OR THE CABLES CAN OCCUR. THIS CONDITION IS NOT APPLICABLE FOR MULTIPLE CONDUCTOR, TWISTED WIRE CABLES.

(5) Attach the clamp to the structure.

(a) If it is necessary, install a spacer.

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Refer to:

- Paragraph 1.C. for the general conditions for clamp installation
- Subject 20-10-11 for the necessary conditions for wire harness installation.

(b) Put a washer between the structure and the nut or the screw head to give protection to the structure.

(c) Tighten the screw.

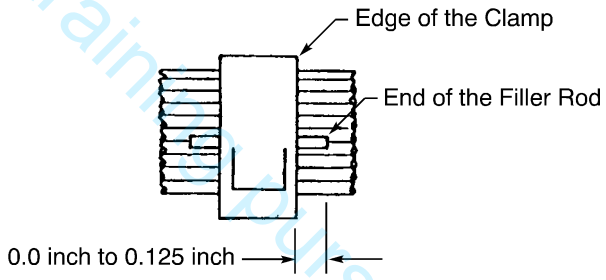
Make sure that these conditions occur:

- The necessary conditions for the selection of a clamp size, refer to Paragraph 1.B.
- The necessary conditions for clamp installation, refer to Paragraph 1.C.

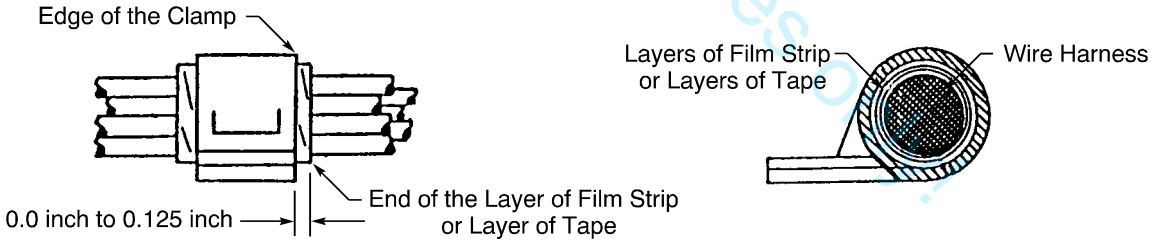
(6) If the clamp does not hold the wire harness tightly, increase the diameter of the wire harness with a filler material.

Refer to:

- Figure 75 for the position of a filler rod
- Figure 76 for the position of a film strip or a tape.



POSITION OF A FILLER ROD
Figure 75



POSITION OF A FILM STRIP OR A TAPE
Figure 76

(a) Make a selection of one of these filler materials from Table 48:

- A filler rod
- A film strip
- A grommet
- A tape.

NOTE: For an equivalent film strip or an equivalent tape, refer to Subject 20-00-11.

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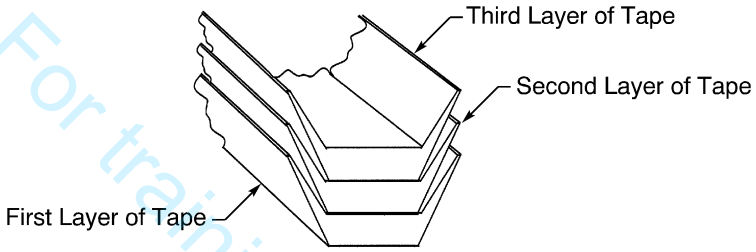
Make sure that the Temperature Grade and the Class of the material are equal to or higher than the Temperature Grade and the Class of the wire harness. Refer to Subject 20-00-11.

(b) Install the filler material.

Make sure that:

- For coax cable, the distance from the edge of the clamp to the end of a layer of film strip or a layer of tape is 0.0 inch to 0.5 inch
- The distance from the edge of the clamp to the end of a filler rod, a layer of film strip, or a layer tape is 0.0 inch to 0.125 inch
- For U shaped filler tape, each layer of tape makes a 100 percent overlap; refer to Figure 77.



CONFIGURATION OF THE LAYERS OF THE U SHAPED FILLER TAPE
Figure 77

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D. Installation of a Two Coax Cables in a Loop Clamp

For the installation of two coax cables in a 287T0011 loop clamp, refer to Paragraph 6.F.

(1) If the clamp size is not specified, make a selection of a clamp that has the correct size.

(a) Find the correct clamp size.

Refer to:

- Paragraph 1.B. for the necessary conditions for the selection of a clamp size
- Paragraph 1.E. for the procedure for the identification of the correct size of a loop clamp or a block clamp.

(b) Make a selection of a clamp from:

- Table 8 for a BACC10BU() clamp
- Table 9 for a BACC10DK() clamp
- Table 14 for a BACC10GE() clamp
- Table 15 for a BACC10GU() clamp
- Table 16 for a BACC10HS() clamp
- Table 17 for a BACC10JU() clamp
- Table 18 for a BACC10NA() clamp
- Table 19 for a BACC10NB() clamp
- Table 38 for a JM44LC39S( )RG clamp
- Table 42 for a S717-( ) clamp
- Table 43 for a TA025041-() clamp
- Table 44 for a TA025097() clamp.

(2) Make a selection of a filler rod from Table 48.

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(3) Put the wire harness in the clamp.

Make sure that the cables in the harness are parallel to each other at the location of the clamp.

CAUTION: IF A CLAMP IS INSTALLED WHERE CABLES GO ACROSS EACH OTHER, DAMAGE TO THE CABLES CAN OCCUR.

(4) Install the necessary quantity of filler rod to make a tight fit in the clamp.

Make sure that the distance from the edge of the clamp to the end of the filler rod is 0.0 inch to 0.125 inch.

(5) Attach the clamp to the structure.

(a) If it is necessary, install a spacer.

Refer to:

- Paragraph 1.C. for the general conditions for clamp installation
- Subject 20-10-11 for the necessary conditions for wire harness installation.

(b) Put a washer between the structure and the nut or the screw head to give protection to the structure.

(c) Tighten the screw.

Make sure that these conditions occur:

- The necessary conditions for the selection of a clamp size, refer to Paragraph 1.B.
- The necessary conditions for clamp installation, refer to Paragraph 1.C.

E. Installation of a 287T0011 Loop Clamp

For the installation of two coax cables in a 287T0011 clamp, refer to Paragraph 6.F.

CAUTION: THE 287T0011 CLAMP MUST NOT BE INSTALLED IN A FUEL CELL. IF A PLASTIC TIE STRAP, A LENGTH OF LACING TAPE, OR A FILLER ROD BECOMES FREE, A FUEL FILTER CAN BECOME CLOGGED.

(1) If the clamp size is not specified, make a selection of a clamp that has the correct size.

(a) Find the correct clamp size.

Refer to:

- Paragraph 1.B. for the necessary conditions for the selection of a clamp size
- Paragraph 1.E. for the procedure for the identification of the correct size of a loop clamp.

(b) Make a selection of a clamp from Table 5.

(2) Attach the clamp to the structure.

NOTE: Washers are not necessary.

(3) Put the wire harness in the clamp.

Make sure that the wires and cables in the harness are parallel to each other at the location of the clamp.

CAUTION: IF A CLAMP IS INSTALLED WHERE WIRES OR CABLES GO ACROSS EACH OTHER, DAMAGE TO THE WIRES OR THE CABLES CAN OCCUR. THIS CONDITION IS NOT APPLICABLE FOR MULTIPLE CONDUCTOR, TWISTED WIRE CABLES.

(4) Close the clamp.

(5) Assemble a wire harness tie through the holes in the ends of the clamp. Refer to Subject 20-10-11.

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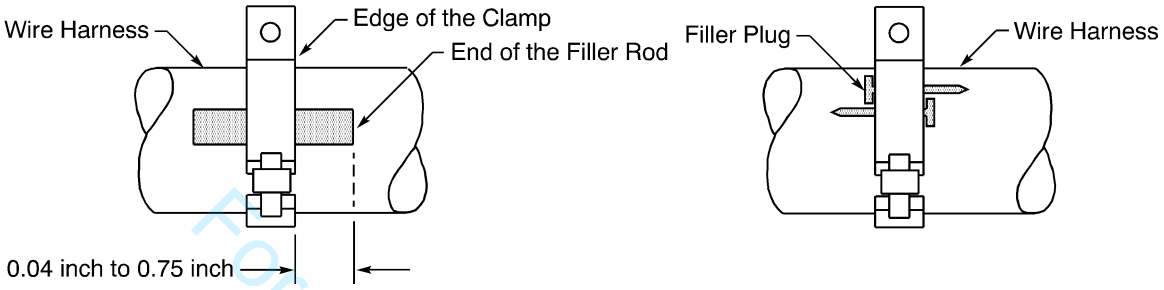
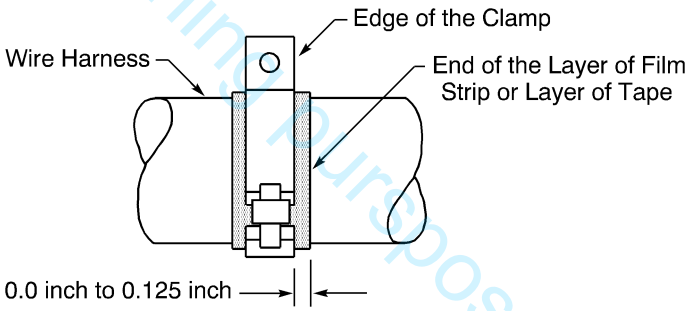
(6) If the clamp does not hold the wire harness tightly in the clamp, increase the diameter of the wire harness with a filler material.

Refer to:

- Figure 78 for the position of a filler rod or a filler plug
- Figure 79 for the position of a film strip or a tape.



POSITION OF A FILLER ROD OR A FILLER PLUG
Figure 78



POSITION OF A FILM STRIP OR A TAPE
Figure 79

(a) Make a selection of a filler material from Table 48.

Make sure that the Temperature Grade and the Class of the material are equal to or higher than the Temperature Grade and the Class of the wire harness. Refer to Subject 20-00-11.

(b) Remove the tie at the ends of the clamp.

(c) Install the filler material.

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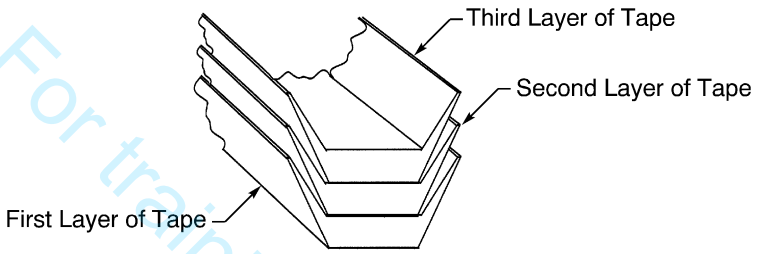
Make sure that:

- For a filler rod, the filler rod is on the same side as the ears of the clamp
- For a filler rod, the distance from the edge of the clamp to the end of the filler rod is 0.40 inch to 0.75 inch
- For coax cable, the distance from the edge of the clamp to the end of the layer of tape is 0.0 inch to 0.5 inch
- The distance from the edge of the clamp to the end of the layer of film strip or layer of tape is 0.0 inch to 0.125 inch
- For U shaped filler tape, each layer of tape makes a 100 percent overlap; refer to Figure 80.



CONFIGURATION OF THE LAYERS OF U SHAPED FILLER TAPE
Figure 80

(7) Do Step (3) through Step (4) again.

F. Installation of Two Coax Cables in a 287T0011 Loop Clamp

For the installation of two coax cables in a loop clamp, refer to Paragraph 6.D.

(1) If the clamp size is not specified, make a selection of a clamp that has the correct size.

(a) Find the correct clamp size.

Refer to:

- Paragraph 1.B. for the necessary conditions for the selection of a clamp size
- Paragraph 1.E. for the procedure for the identification of the correct size of a loop clamp.

(b) Make a selection of a clamp from Table 5.

(2) Make a selection of a filler rod from Table 48.

(3) Attach the clamp to the structure.

NOTE: Washers are not necessary.

(4) Put the wire harness in the clamp.

Make sure that the cables in the harness are parallel to each other at the location of the clamp.

CAUTION: IF A CLAMP IS INSTALLED WHERE CABLES GO ACROSS EACH OTHER, DAMAGE TO THE CABLES CAN OCCUR.

(5) Install the necessary quantity of filler rod to make a tight fit in the clamp.

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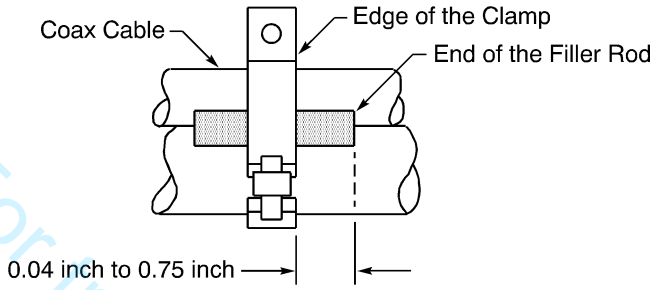
Make sure that:

- The rod is on the same side as the ears of the clamp
- The distance from the edge of the clamp to the end of the rod is 0.40 inch to 0.75 inch.

Refer to:

- Figure 81
- Paragraph 1.C. for the applicable conditions for installation of a clamp.



POSITION OF A FILLER ROD
Figure 81

(6) Close the clamp.

(7) Assemble a wire harness tie through the holes in the ends of the clamp. Refer to Subject 20-10-11.

G. Installation of a BACC10DK Loop Clamp

(1) If the clamp size is not specified, make a selection of a clamp that has the correct size.

(a) Find the correct clamp size.

Refer to:

- Paragraph 1.B. for the necessary conditions for the selection of a clamp size
- Paragraph 1.E. for the procedure for the identification of the correct size of a loop clamp or a block clamp.

(b) Make a selection of a clamp from Table 9.

(2) Put the clamp on the wire harness.

Make sure that the wires and cables in the harness are parallel to each other at the location of the clamp.

CAUTION: IF A CLAMP IS INSTALLED WHERE WIRES OR CABLES GO ACROSS EACH OTHER, DAMAGE TO THE WIRES OR THE CABLES CAN OCCUR. THIS CONDITION IS NOT APPLICABLE FOR MULTIPLE CONDUCTOR, TWISTED WIRE CABLES.

(3) Attach the clamp to the structure.

(a) If it is necessary, install a spacer.

Refer to:

- Paragraph 1.C. for the general conditions for clamp installation
- Subject 20-10-11 for the necessary conditions for wire harness installation
- Paragraph 6.S. for the installation of a spacer.

(b) Tighten the screw.

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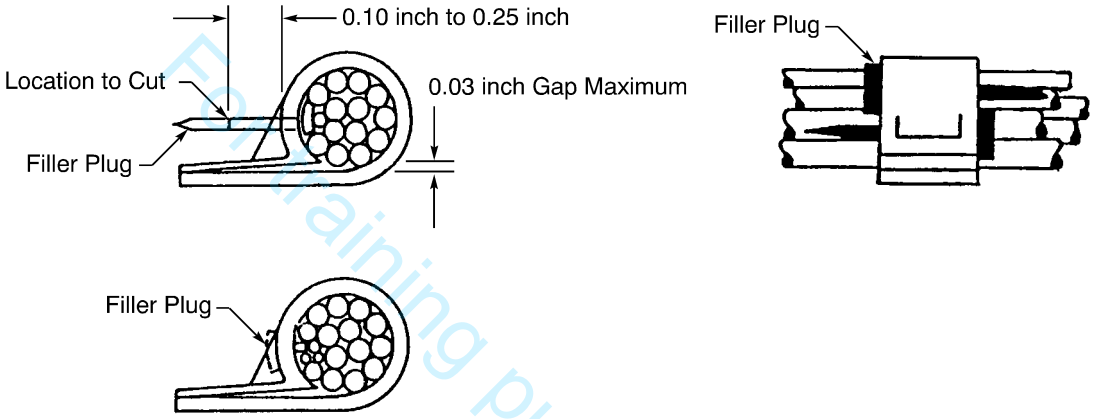
Make sure that these conditions occur:

- The necessary conditions for the selection of a clamp size, refer to Paragraph 1.B.
- The necessary conditions for clamp installation, refer to Paragraph 1.C.

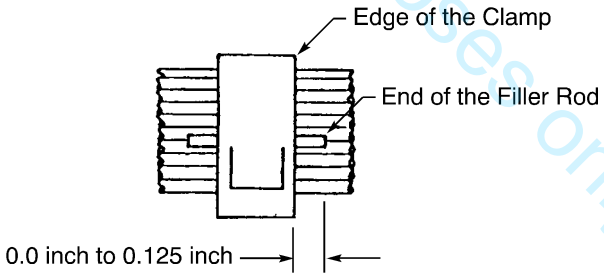
(4) If the clamp does not hold the wire harness tightly, increase the diameter of the wire harness with a filler material.

Refer to:

- Figure 82 for the installation configurations of a filler plug
- Figure 83 for the position of a filler rod
- Figure 84 for the position of a film strip or a tape.



INSTALLATION CONFIGURATIONS OF A FILLER PLUG
Figure 82



POSITION OF A FILLER ROD
Figure 83

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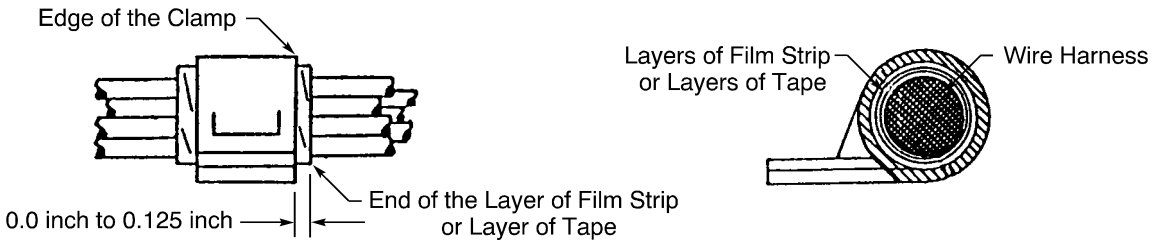
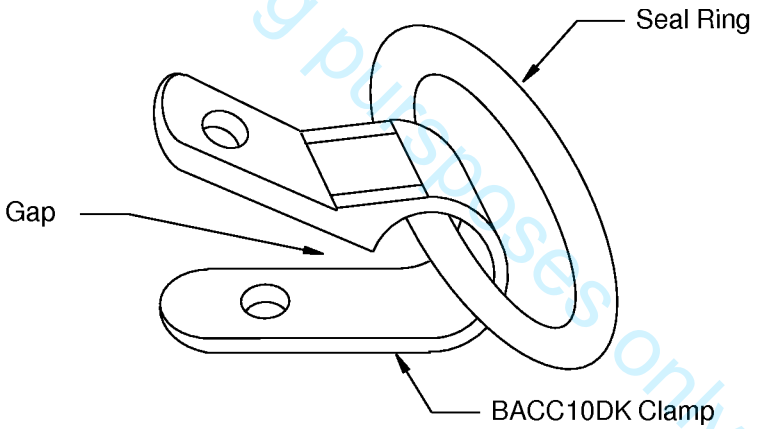


POSITION OF A FILM STRIP OR A TAPE
Figure 84

(a) If the clamp installation is in a fuel cell, make a selection of one or more seal rings from Table 48.

CAUTION: A SEAL RING IS THE ONLY MATERIAL TO INCREASE THE DIAMETER OF THE WIRE HARNESS THAT IS PERMITTED IN A FUEL CELL. A BUSHING, A FILM STRIP, A GROMMET, A FILLER PLUG, A FILLER ROD, OR TAPE ARE NOT PERMITTED IN THE FUEL CELL. IF ONE OF THESE MATERIALS BECOMES FREE, A FUEL FILTER CAN BECOME CLOGGED.

Make sure that the seal rings are not in the gap of the clamp, or between the clamp and its installation surface. Refer to Figure 85.



SEAL RING INSTALLATION ON BACC10DK CLAMPS IN A FUEL CELL
Figure 85

(b) If the clamp installation is not in a fuel cell, make a selection of one of these filler materials from Table 48:

- A bushing
- A filler plug
- A filler rod
- A film strip
- A tape
- A strap.

NOTE: It is permitted to use BACS38C100C2 straps and BACP20BA-1 filler plugs together in the same clamp.

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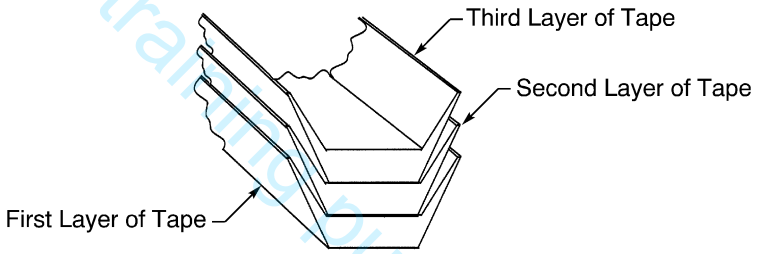
NOTE: For an equivalent film strip or an equivalent tape, refer to Subject 20-00-11.

Make sure that the Temperature Grade and the Class of the material are equal to or higher than the Temperature Grade and the Class of the wire harness. Refer to Subject 20-00-11.

(c) Install the filler material.

Make sure that:

- For a seal ring, the seal ring is installed on the side of the clamp that is opposite from the gap of the clamp
- For coax cable, the distance from the edge of the clamp to the end of the layer of tape is 0.0 inch to 0.5 inch
- The distance from the edge of the clamp to the end of the filler rod, layers of film strip, or layers of tape is 0.0 inch to 0.125 inch
- For a filler rod, the filler rod is on the same side as the gap of the clamp
- For U shaped filler tape, each layer of tape makes a 100 percent overlap; refer to Figure 86.



CONFIGURATION OF THE LAYERS OF U SHAPED FILLER TAPE
Figure 86

H. Installation of a BACS31H1A Ring Post

NOTE: The maximum recommended number of BACS31H1A ring posts that can be assembled as one wire support is six.

CAUTION: THE BACS31H RING POST MUST NOT BE USED AS A SPACER IF A SPACER THAT HAS A DIFFERENT LENGTH IS SPECIFIED. IF THE WIRE HARNESS CLEARANCE IS NOT SATISFACTORY, DAMAGE TO THE WIRE HARNESS CAN OCCUR.

Table 50
PLASTIC TIE STRAP INSTALLATION TOOLS

Part Number	Tool Description
GS4H	Heavy Duty
GTS	Standard Duty, Ergonomic

(1) Make a selection of a washer from Table 27.

(2) If a spacer is necessary or specified, make a selection of a spacer. Refer to Table 27.

(3) If the bracket does not have a nut plate, make a selection of a nut from Table 27.

(4) Make a selection of a screw from Table 27. Refer to Figure 87.

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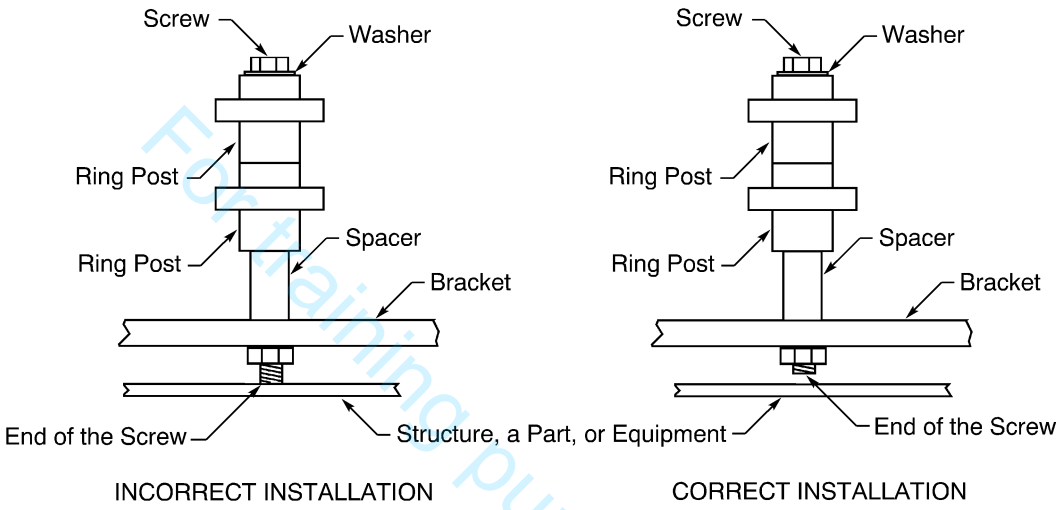
Make sure that the length of the screw:

- Is sufficient to engage the nut correctly
- Can not make an interference with a structure or other items when the ring post is fully installed.

(5) Make a selection of a plastic tie strap from Table 26.

(6) Make a selection of a tie strap installation tool from Table 50.

(7) Install the ring post or ring posts. Refer to Figure 87.



RING POST INSTALLATION
Figure 87

(a) Put the washer on the on the screw.

(b) Put the necessary number of ring posts and the spacers on the screw.

(c) Engage the threads of the screw and the installation hole.

(d) Tighten the screw until the ring post is tight against the bracket.

Make sure that the end of the screw does not make an interference with structure, a part, or equipment.

CAUTION: DO NOT APPLY TOO MUCH TORQUE. DAMAGE TO THE RING POST CAN OCCUR.

(8) Attach the wire harness to the ring post. Refer to Figure 88.

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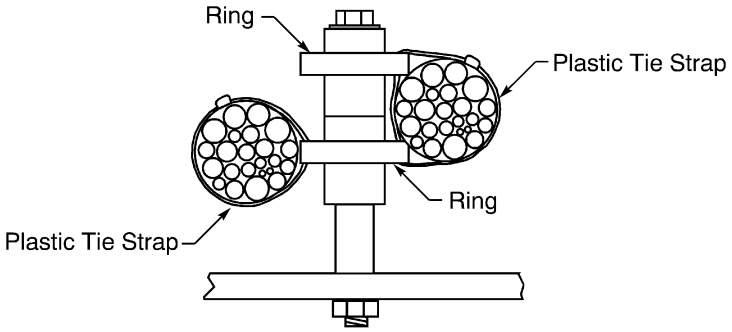
WIRE HARNESS SUPPORTS



WIRE HARNESS INSTALLATION
Figure 88

(a) Put a plastic tie strap through the applicable slot in the ring or rings.

If the tie strap goes through two rings, make sure that:

- The minimum diameter of the wire harness is 0.75 inch
- The slots in the top ring post are approximately aligned with the slots in the bottom ring post
- The ribbed side of the tie strap is pointed away from the wire harness.

(b) If a fiber optic cable is against the support or the tie strap:

- Make a selection of a silicone tape. Refer to Subject 20-00-11.
- Wind a minimum of 2 layers of silicone tape on the harness at that location.

(c) Put the tie strap around the wire harness.

Make sure that all of the wires are parallel.

CAUTION: THE WIRES OR THE CABLES MUST NOT GO ACROSS EACH OTHER WHERE THE PLASTIC TIE STRAP GOES AROUND THE WIRE HARNESS. DAMAGE TO THE WIRES OR THE CABLES CAN OCCUR.

(d) Put the end of the tie strap through the tie strap head.

(e) Tighten the tie strap.

Make sure that the wire harness is held tightly.

CAUTION: THE TIE STRAP MUST HOLD THE WIRE HARNESS TIGHTLY, BUT IT MUST NOT CRUSH THE WIRES. IF THE TIE STRAP IS TOO TIGHT OR TOO LOOSE, DAMAGE TO THE WIRES OR THE CABLES CAN OCCUR.

(9) Examine the plastic tie strap.

Make sure that:

- The end of the strap does not have a sharp edge
- The end of the strap is a maximum of 0.01 inch from the head of the strap.

(10) If the wire harness cannot be held tightly with the plastic tie strap, increase the diameter of the wire harness:

(a) Remove the tie strap. Refer to Paragraph 5.

(b) Make a selection of a filler rod from Table 48.

(c) Install the necessary quantity of the filler rod to make a tight fit.

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Make sure that the distance from the edge of the tie strap to the end of the filler rod is between 0.0 inch and 0.125 inch.

(d) Do Step (8) and Step (9) again.

I. Installation of a BACS31H()B Ring Post

NOTE: The maximum recommended number of BACS31H1A ring posts that can be assembled as one wire support is six.

CAUTION: THE BACS31H RING POST MUST NOT BE USED AS A SPACER IF A SPACER THAT HAS A DIFFERENT LENGTH IS SPECIFIED. IF THE WIRE HARNESS CLEARANCE IS NOT SATISFACTORY, DAMAGE TO THE WIRE HARNESS CAN OCCUR.

Table 51
PLASTIC TIE STRAP INSTALLATION TOOLS

Part Number	Tool Description
GS4H	Heavy Duty
GTS	Standard Duty, Ergonomic

Table 52
RING POST INSTALLATION TOOLS

Tool Description	Size (inch)
Allen Wrench	7/32
Hex Head Driver	7/32

(1) If the bracket does not have a nut plate, make a selection of a nut from Table 27.

(2) Make a selection of a plastic tie strap from Table 26.

(3) Make a selection of a tie strap installation tool from Table 51.

(4) Make a selection of a ring post installation tool from Table 52.

(5) Engage the threads of the screw with the installation hole.

(6) Tighten the screw with the ring post installation tool until the ring post is tight against the bracket.

Make sure that the length of the integral screw:

- Is sufficient to engage the nut correctly
- Can not make an interference with a structure or other items when the ring post is fully installed.

CAUTION: DO NOT APPLY TOO MUCH TORQUE. DAMAGE TO THE RING POST CAN OCCUR.

(7) If more ring posts are necessary:

(a) Engage the threads of a new ring post with the threads of the top ring post. Refer to Figure 89.

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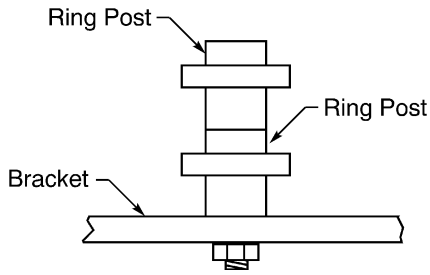


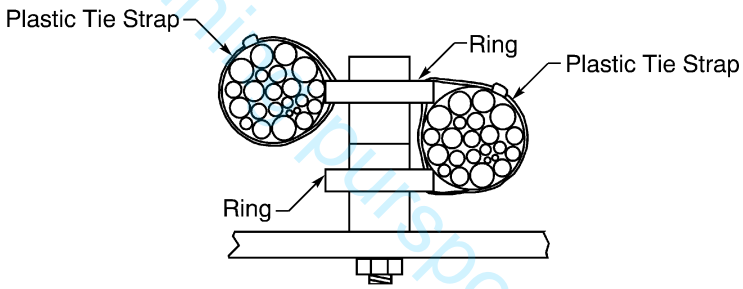
RING POST INSTALLATION
Figure 89

(b) Tighten the screw until the ring post is tight.

Make sure that the end of the screw does not make an interference with structure, a part, or equipment.

CAUTION: DO NOT APPLY TOO MUCH TORQUE. DAMAGE TO THE RING POST CAN OCCUR.

(8) Attach the wire harness to the ring post or ring posts. Refer to Figure 90.



WIRE HARNESS INSTALLATION
Figure 90

(a) Put a plastic tie strap through the applicable slot in the ring or rings.

If the tie strap goes through two rings, make sure that:

- The minimum diameter of the wire harness is 0.75 inch
- The slots in the top ring post are approximately aligned with the slots in the bottom ring post
- The ribbed side of the tie strap is pointed away from the wire harness.

(b) If a fiber optic cable is against the support or the tie strap:

- Make a selection of a silicone tape. Refer to Subject 20-00-11.
- Wind a minimum of 2 layers of silicone tape on the harness at that location.

(c) Put the tie strap around the wire harness.

Make sure that all of the wires are parallel.

CAUTION: THE WIRES OR THE CABLES MUST NOT GO ACROSS EACH OTHER WHERE THE PLASTIC TIE STRAP GOES AROUND THE WIRE HARNESS. DAMAGE TO THE WIRES OR THE CABLES CAN OCCUR.

(d) Put the end of the tie strap through the tie strap head.

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(e) Tighten the tie strap.

CAUTION: THE TIE STRAP MUST HOLD THE WIRE HARNESS TIGHTLY, BUT IT MUST NOT CRUSH THE WIRES. IF THE TIE STRAP IS TOO TIGHT OR TOO LOOSE, DAMAGE TO THE WIRES OR THE CABLES CAN OCCUR.

(9) Examine the plastic tie strap.

Make sure that:

- The end of the tie strap does not have a sharp edge
- The end of the strap is a maximum of 0.01 inch from the head of the strap.

(10) If the wire harness cannot be held tightly with the plastic tie strap, increase the diameter of the wire harness:

(a) Remove the tie strap. Refer to Paragraph 5.

(b) Make a selection of a filler rod from Table 48.

(c) Install the necessary quantity of the filler rod to make a tight fit.

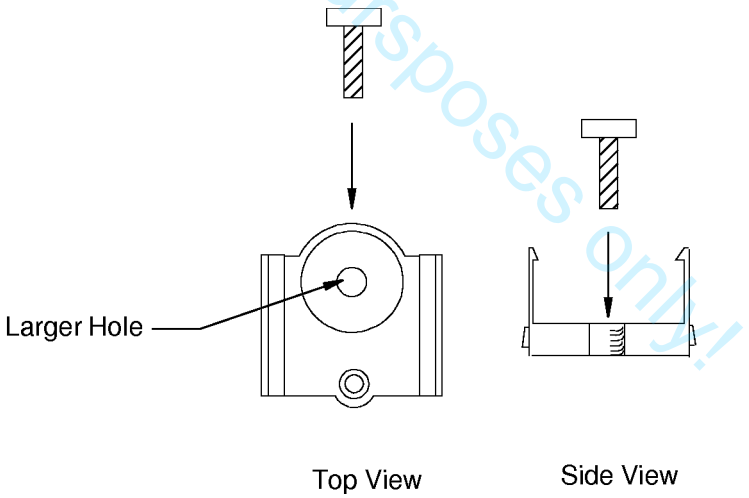
Make sure that the distance from the edge of the tie strap to the end of the filler rod is between 0.0 inch and 0.125 inch.

(d) Do Step (8) and Step (9) again.

J. Installation of a BACB20VG Channel Bracket and BACS31M Raceway Channel Supports

(1) Put the installation screw through the larger hole in the channel support. Refer Figure 91.

NOTE: Make sure the screw is in the large hole in the channel support.



LOCATION OF THE LARGER HOLE ON THE CHANNEL SUPPORT
Figure 91

(2) Torque the screw onto the structure.

NOTE: Make sure that the BACS31M1 channel support has no crack after the torque is applied.

(3) Align the hole or slot in the raceway bracket with the hole in the channel supports. Refer to Figure 92.

NOTE: The alignment hole in the raceway channel support is the smaller hole.

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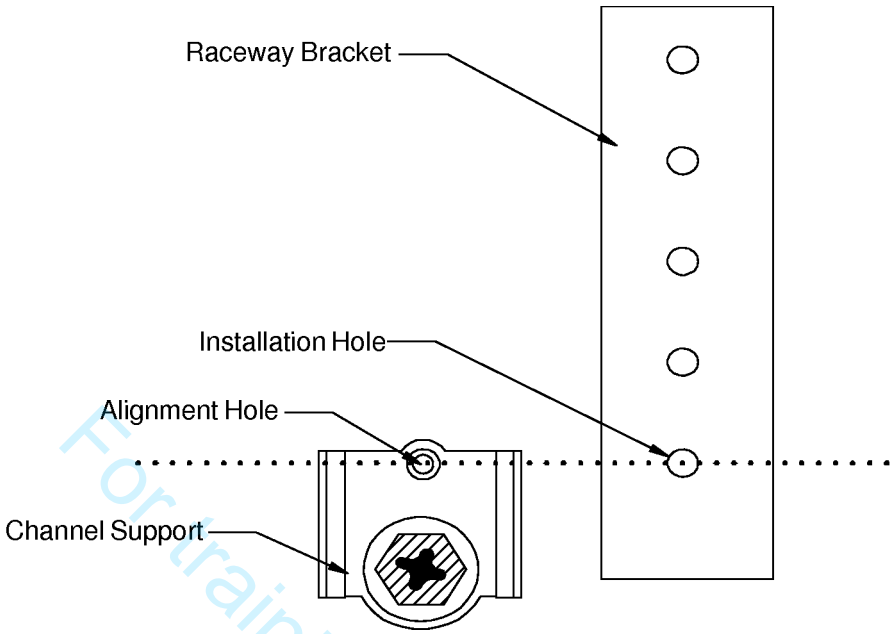
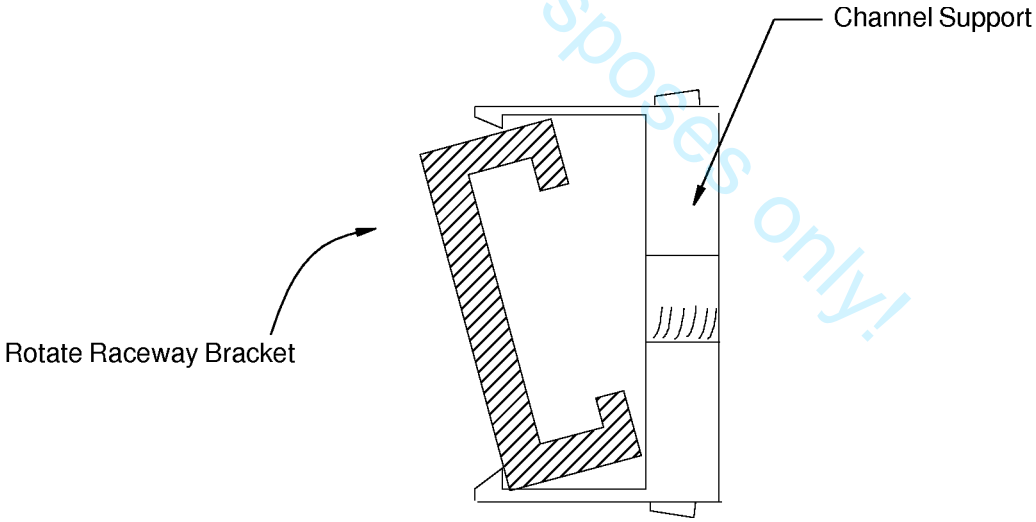


ALIGNMENT OF THE RACEWAY BRACKET AND THE CHANNEL SUPPORT
Figure 92

(4) Rotate the raceway bracket to engage one side of the raceway bracket with the channel supports. Refer to Figure 93.



ALIGNMENT OF THE RACEWAY BRACKET AND THE CHANNEL SUPPORT
Figure 93

(5) Continue to rotate the raceway bracket towards the channel support. At the same time, apply pressure until the raceway bracket is fully engaged with the channel support. Refer to Figure 94

NOTE: A click can be heard if the raceway bracket is fully engaged with the channel support.

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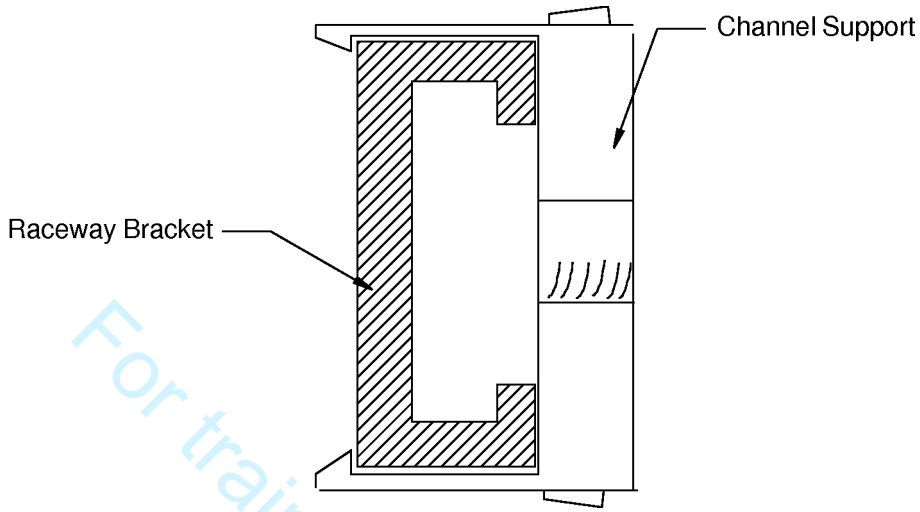
NOTE: Make sure that the BACS31M1 channel support has no damage caused by the installation of the BACB20VG raceway into the BACS31M1 channel support.



POSITION OF THE RACEWAY BRACKET IN THE CHANNEL SUPPORT
Figure 94

(6) Align the alignment pin of the BACS31M2 support cap with:

- The hole or slot in the raceway bracket
- The alignment hole in the channel support.

Refer to Figure 95.

NOTE: The alignment hole in the channel support is the smaller hole.

NOTE: The hole in the BACB20VG raceway bracket must be aligned with the smaller hole on the BACS31M1 channel support before the installation of the BACS31M2 channel support cap.

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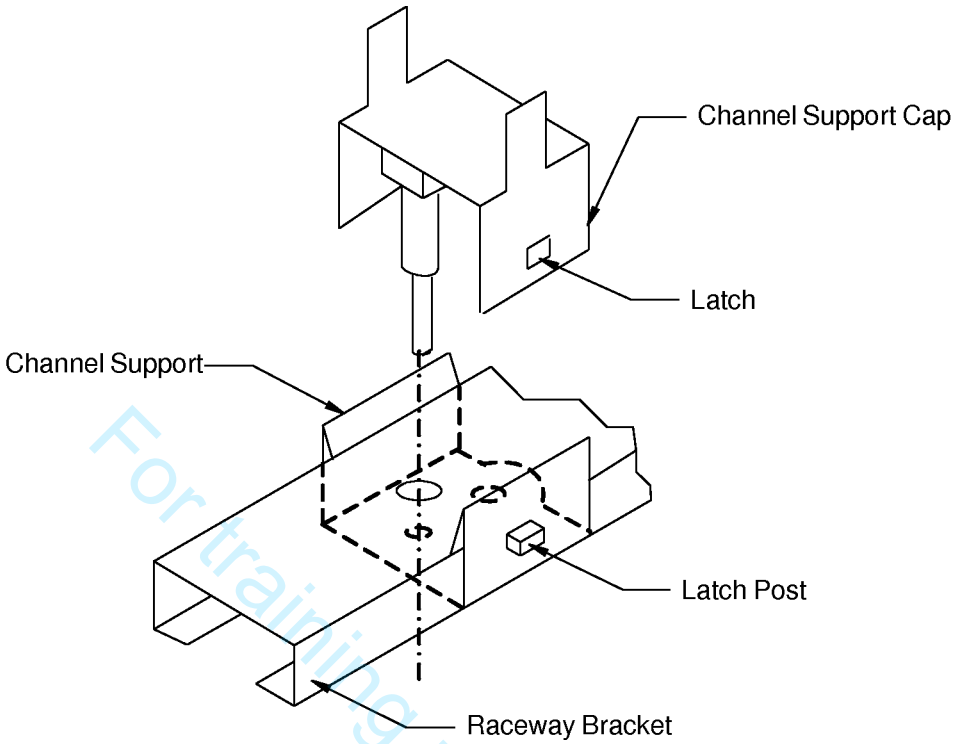

ALIGNMENT OF THE CHANNEL SUPPORT CAP AND THE CHANNEL SUPPORT
Figure 95

(7) Push the channel support cap into the channel support until the latches engage with the latch posts on the channel support. Refer to Figure 95.

Make sure that:

- The alignment pin goes through the smaller hole in the channel support
- The latch on each side of the channel support cap fully engaged with the latch posts on the channel support.

NOTE: Make sure that the BACS31M2 channel support cap is locked in position in the BACS31M1 channel support.

K. Installation of BACS31K1 and BACS31K3 Raceway Post Support

(1) One the flat side of the bracket, align the knob in the base of the post and the hole in the bracket. Refer to Figure 96.

NOTE: Alignment knob of the post mush align with alignment hole in the bracket.

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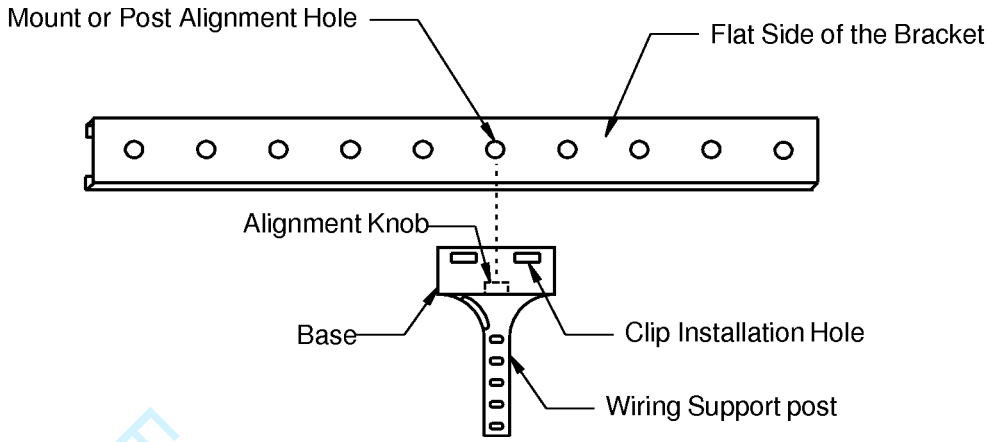
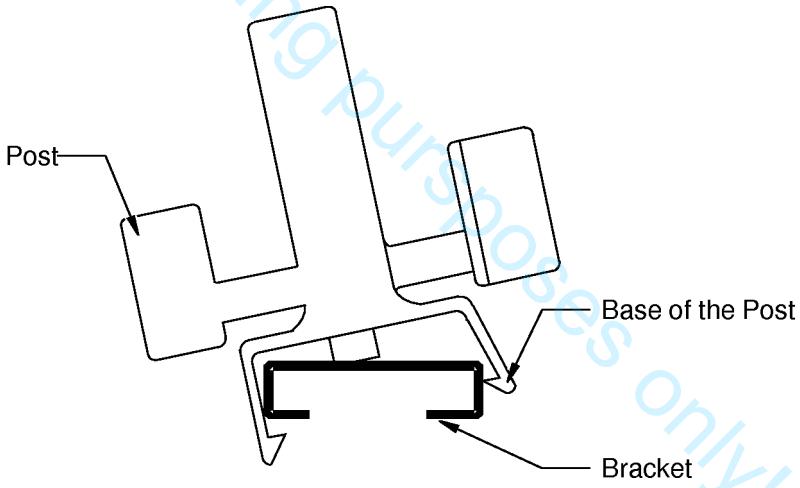


ALIGNMENT OF THE KNOB AND THE HOLE IN THE BRACKET
Figure 96

(2) Put one side of the base of the post on the edge of the bracket. Refer to Figure 97.

NOTE: Make sure that the knob of the base and the hole in the bracket stay aligned.



POSITION OF THE POST ON THE EDGE OF THE BRACKET
Figure 97

(3) Push the post support against the bracket. Refer to Figure 98.

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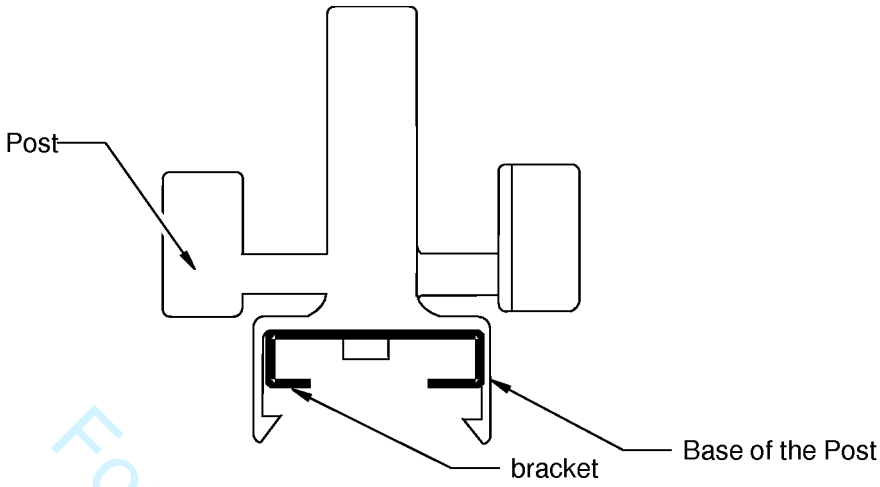
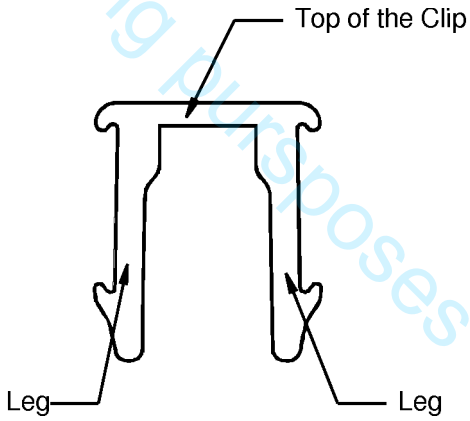


POSITION OF THE POST ON THE BRACKET
Figure 98

(4) On the opposite side of the bracket, align the ends of the legs of the clip to the clip installation holes in the base of the post. Refer to Figure 96 and Figure 99.



INSTALLATION CLIP
Figure 99

(5) Push the legs of the clips through the clip installation holes in the base of the post. Refer to Figure 100

NOTE: Make sure that the legs of the clip go through the clip installation holes in each side of the base.

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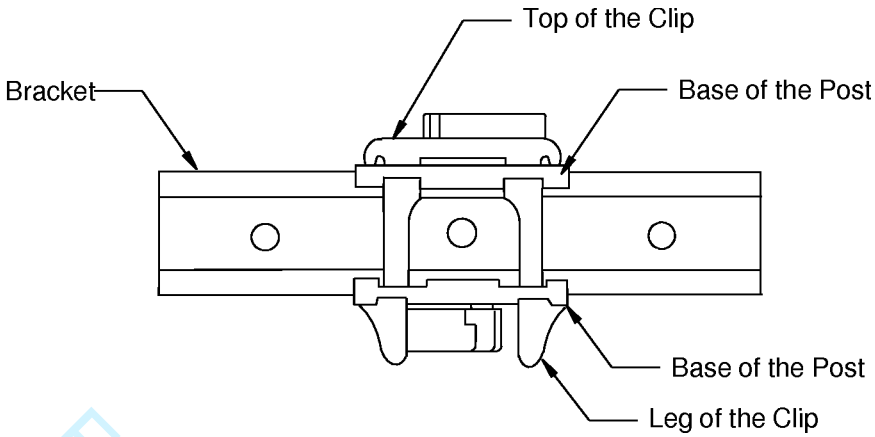
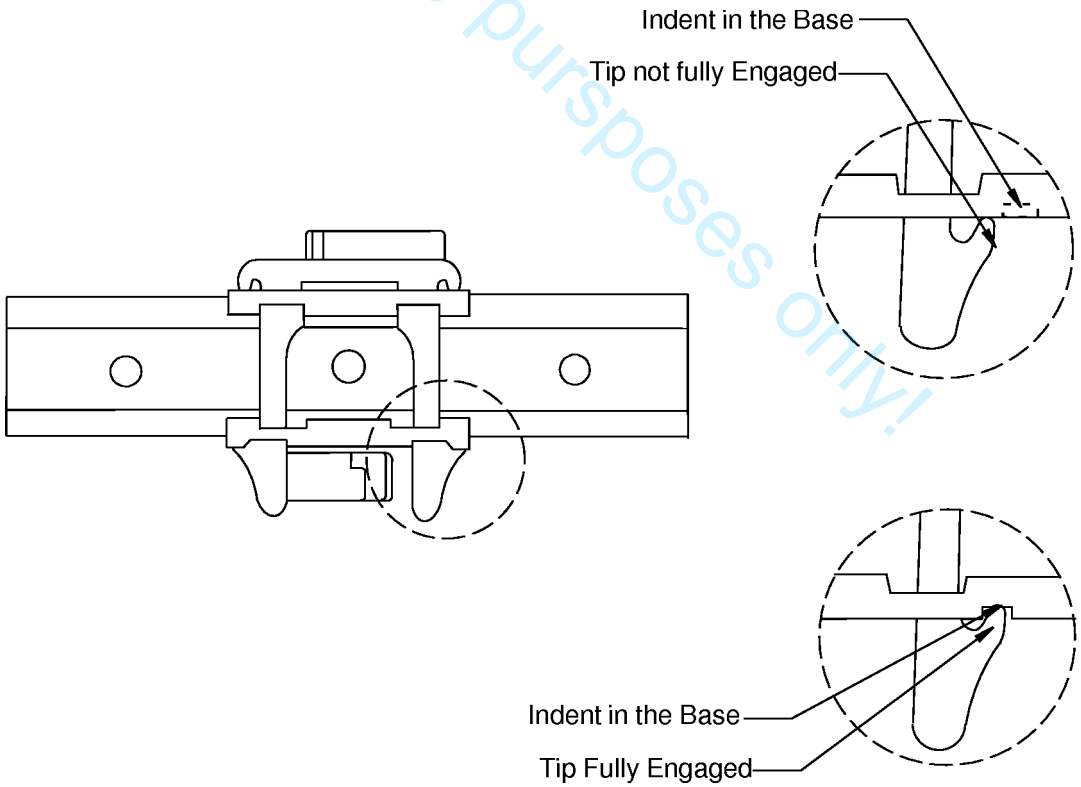


POSITION OF CLIP IN THE BASE OF THE POST
Figure 100

(6) Lightly push the legs of the clip back until the tip of the clip is fully engaged with the indent in the base. Refer to Figure 101.

NOTE: Make sure that each leg of the installation clip is locked in the position.

NOTE: Make sure that the post does not have damage.



POSITION OF THE TIP OF THE CLIP IN THE INDENT OF THE BASE
Figure 101

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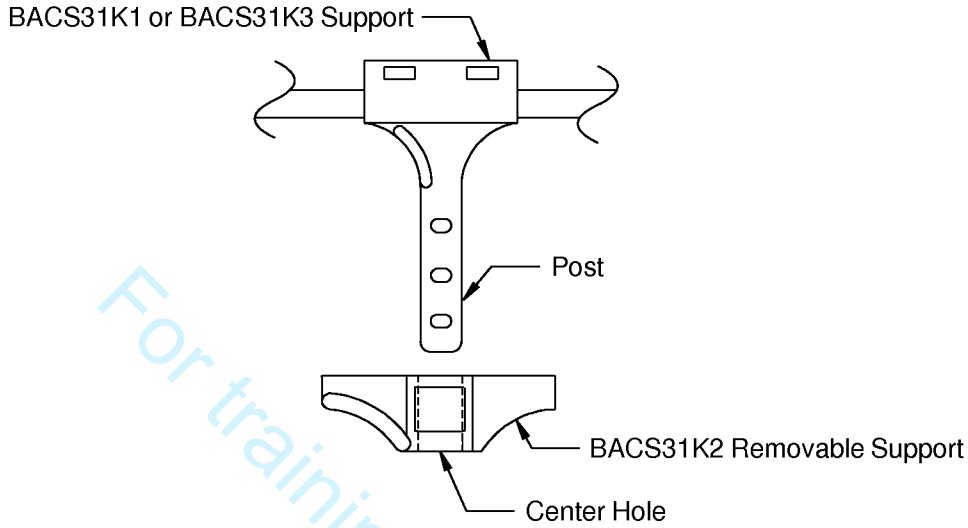
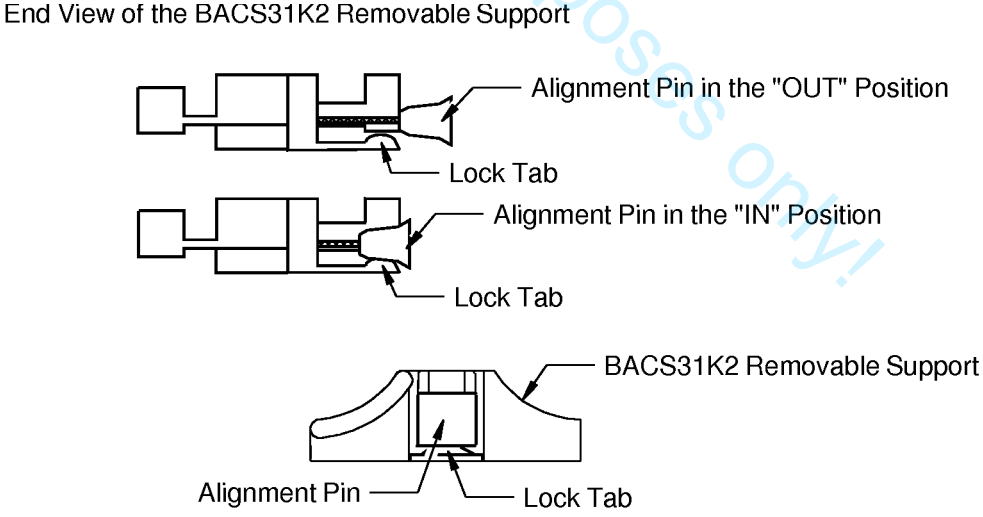
L. Installation of a BACS31K2 Wire Harness Support

(1) Align the hole in the center of the BACS31K2 support and the post. Refer to Figure 102



ALIGNMENT OF THE MOUNT AND THE POST
Figure 102

NOTE: Make sure that the alignment pin on the BACS31K2 support is in the "OUT" position. Refer to Figure 103.



POSITION OF THE ALIGNMENT PIN ON BACS31K2 POST
Figure 103

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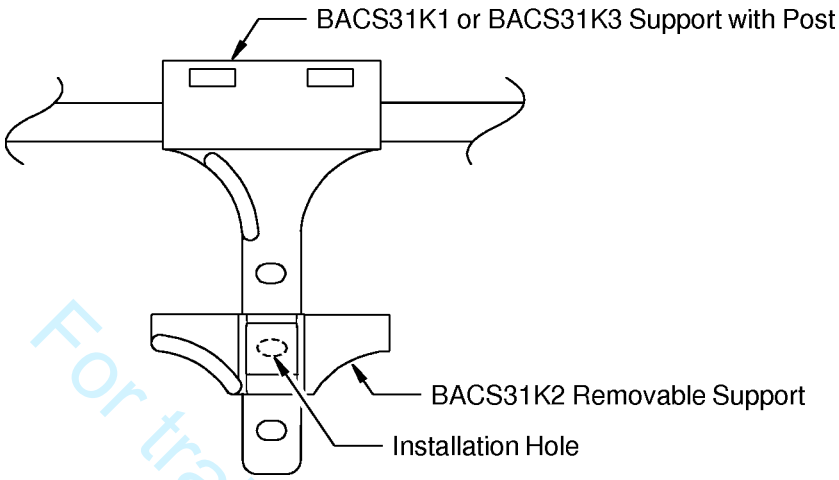
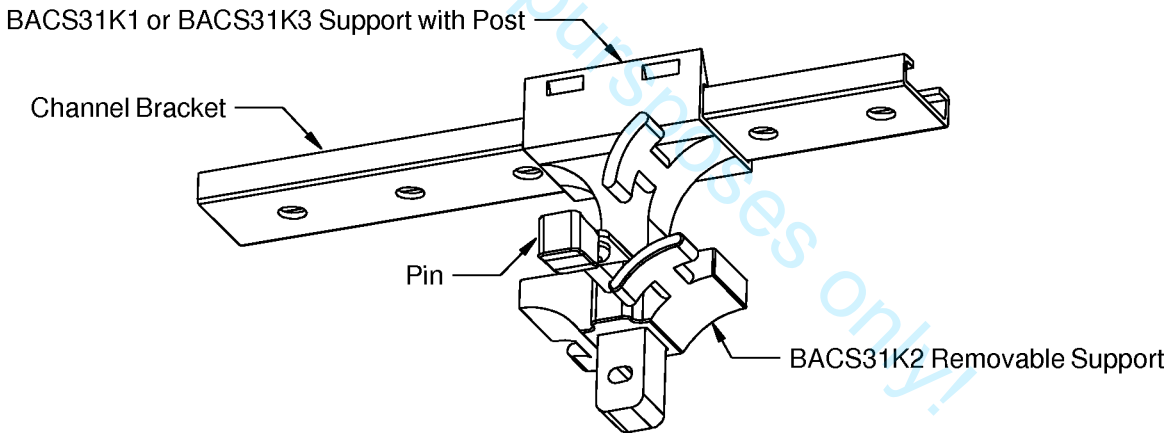
(2) Move the BACS31K2 support toward the base of the post until the pin of the mount is aligned with the applicable installation hole in the post. Refer to Figure 104



ALIGNMENT OF THE PIN OF THE MOUNT AND THE HOLE IN THE POST
Figure 104

(3) Push the pin toward the post until it stops. Refer to Figure 105.



POSITION OF THE PIN IN THE MOUNT
Figure 105

NOTE: Make sure that the lock tab on the BACS31K2 support is fully engaged with the cavity in the head of the pin.

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M. Installation of Wire Harnesses with BACS31K() Supports

Table 53
WIRE INSTALLATION COMPONENTS

Component	Type	Maximum Wire Harness O.D. (Inch)	Part Number
Wire Harness Tie	Plastic Tie Strap	0.5	BACS38W2
		1.25	BACS38W3

(1) Make a selection of a wire harness tie from Table 53.

(2) For each wire harness, put the wire harness against the mount at the base of the BACS31K1 or BACS31K3 support

Refer to Figure 106 and Figure 107.

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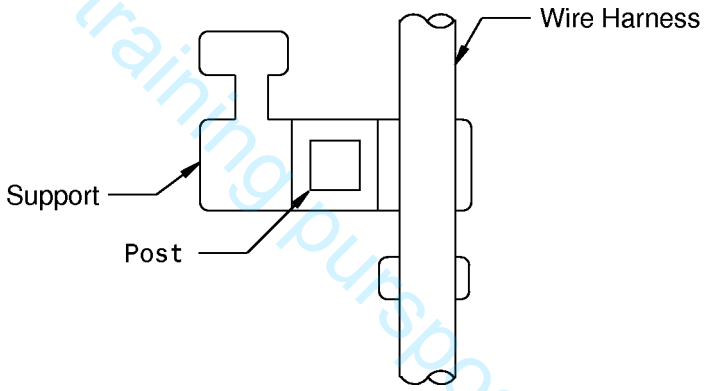
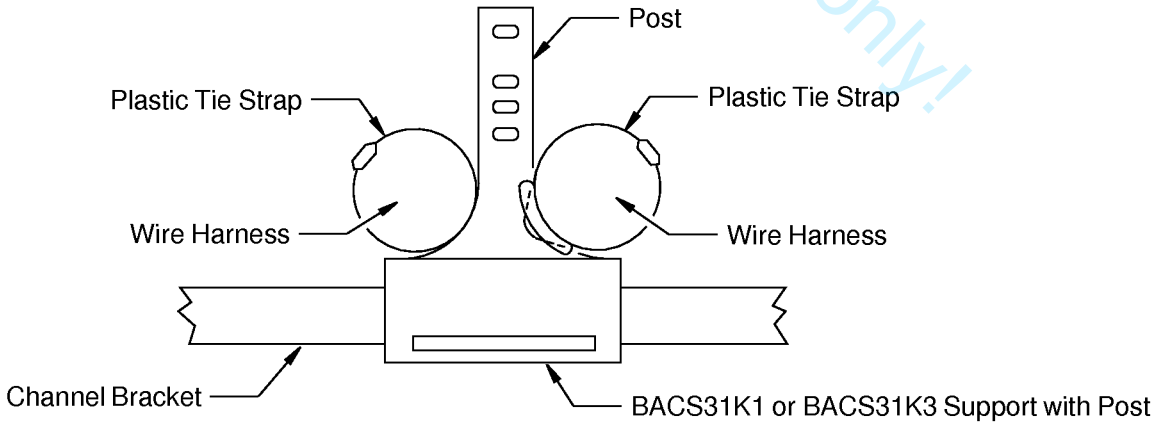


POSITION OF THE WIRE HARNESS ON THE SUPPORT
Figure 106



SIDE VIEW OF THE POSITION OF THE WIRE HARNESS ON THE SUPPORT
Figure 107

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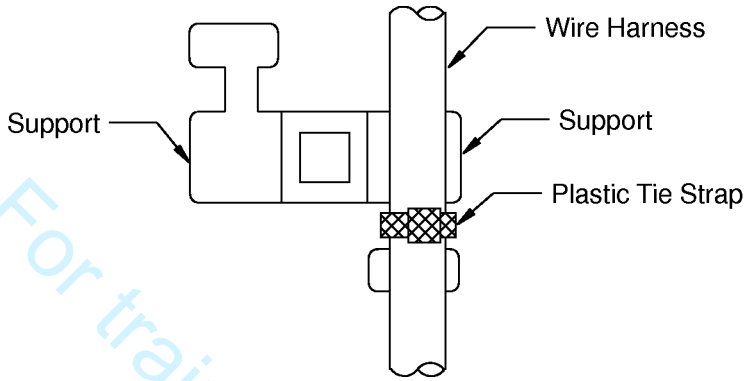
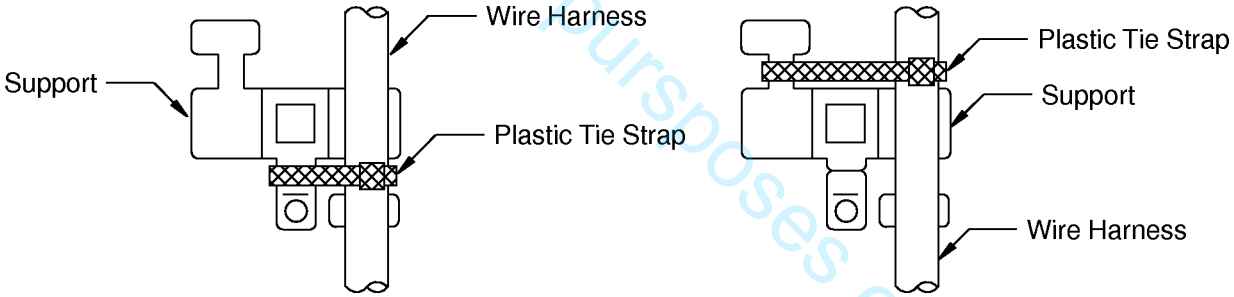
(3) For each wire harness, put a plastic tie strap on the wire harness and the BACS31K1 or BACS31K3 support.

Refer to Figure 108 and Figure 109.

NOTE: If a fiber optic cable is against the support or against the tie strap, a minimum of 2 layers of silicone tape must be wrapped on the harness at that location before the tie strap is installed.



CORRECT LOCATION OF THE PLASTIC TIE STRAP ON THE WIRE HARNESS AND THE SUPPORT
Figure 108



INCORRECT LOCATIONS OF THE PLASTIC TIE STRAP ON THE WIRE HARNESS AND THE SUPPORT
Figure 109

(4) If the tie strap does not hold the wire harness tightly, increase the diameter of the wire harness with silicone tape or with a filler rod.

(5) Put the BACS31K2 removable support on the post of the BACS31K1 or BACS31K3 support.

Make sure that the removable support is installed in the hole of the post that puts its base close to the wire harnesses installed before.

Refer to Figure 110.

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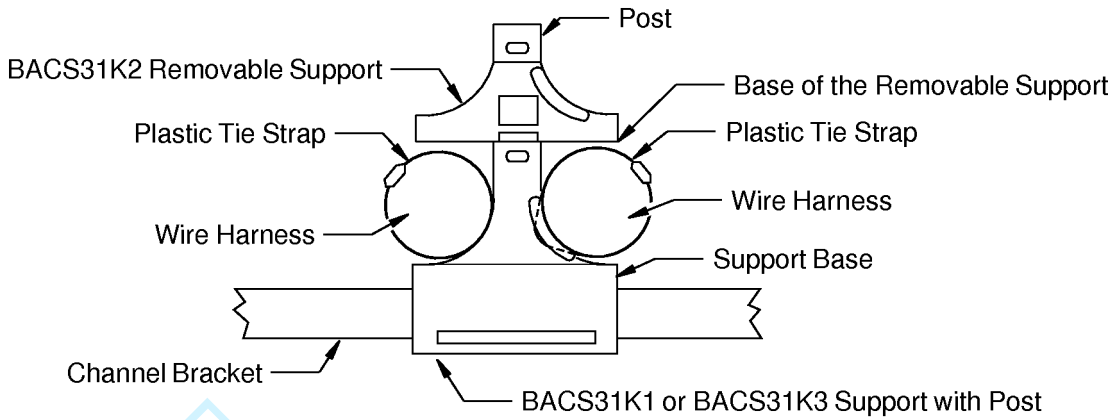
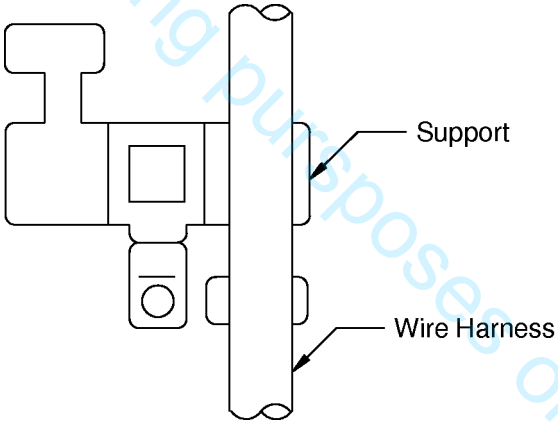
WIRE HARNESS SUPPORTS



POSITION OF THE BACS31K2 REMOVABLE SUPPORT ON THE POST OF THE BACS31K1 or BACS31K3 SUPPORT
Figure 110

(6) For each wire harness, put the wire harness against the BACS31K2 removable support. Refer to Figure 111 and Figure 112.



POSITION OF THE WIRE HARNESS ON THE REMOVABLE SUPPORT
Figure 111

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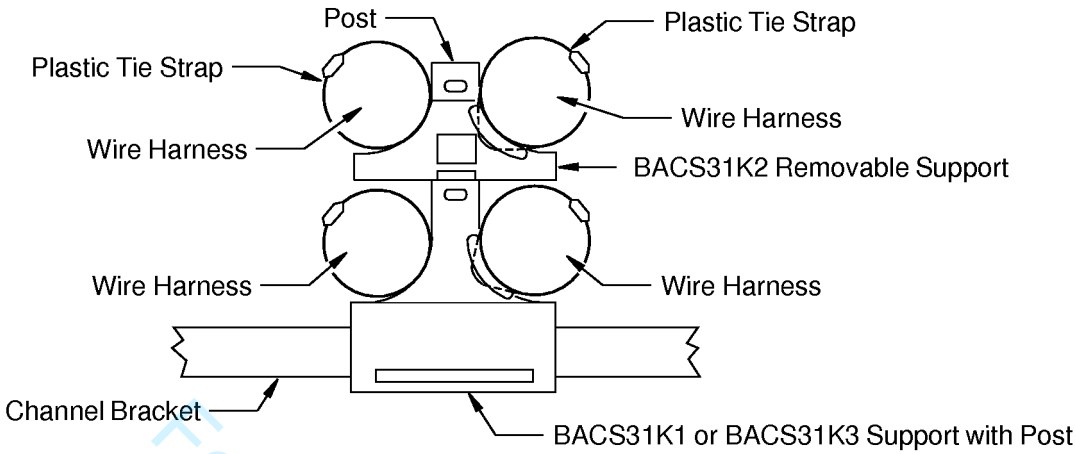
WIRE HARNESS SUPPORTS



POSITION OF THE WIRE HARNESS ON THE REMOVABLE SUPPORT
Figure 112

(7) Do step (3) again for each wire harness on the BACS31K2 removable support.

NOTE: If a fiber optic cable is against the support or against the tie strap, a minimum of 2 layers of silicone tape must be wrapped on the harness at that location before the tie strap is installed.

N. Installation of a Wire Harness on a STBP19M or a BACM14L Wire Harness Mount Platform

Refer to Paragraph 1.D. for general requirements for these parts.

NOTE: The BACM14L mount has a STBP19M interface with the wire harness.

Table 54
PLASTIC TIE STRAP INSTALLATION TOOLS

Part Number	Tool Description
GS4H	Heavy Duty
GTS	Standard Duty, Ergonomic

(1) Make a selection of a plastic tie strap from Table 22.

(2) Use a plastic tie strap to attach the wire bundle loosely to the STBP19M mount platform:

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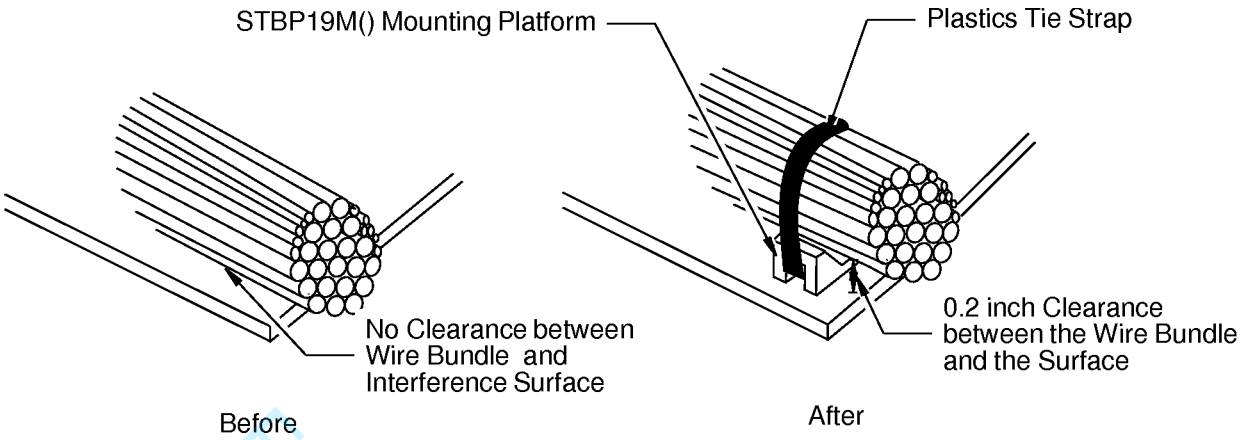
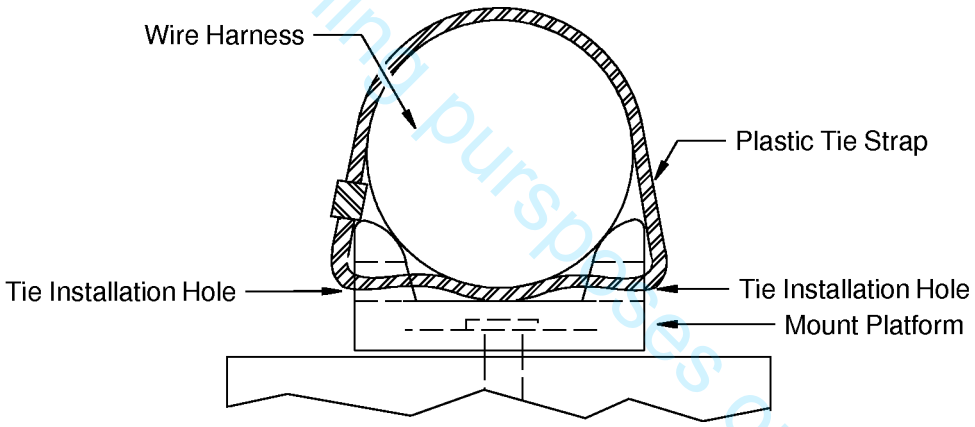


INSTALLATION OF STBP19M WIRE BUNDLE MOUNT PLATFORM
Figure 113

(a) If the wire harness has a diameter that is equal to or larger than 0.875 inch, put the plastic tie through each of the tie installation holes on the mount.



POSITION OF THE WIRE HARNESS ON THE MOUNT PLATFORM
Figure 114

(b) If the wire harness has a diameter that is smaller than 0.875 inch, put the plastic tie through one tie installation hole on the mount.

(3) If a wire harness tie or a wiring identification is between the wire harness and the support or a support component, remove the tie or the wiring identification.

(a) If the wire harness cannot be held firmly, and the diameter is less than 0.875 inch, increase the O.D. of the wire harness with silicone tape or a filler rod.

(4) Rotate the mounting platform around the wire harness until the base of the mounting platform is aligned with the surface that the wire harness lies on. Refer to Figure 113.

(5) Make sure that the bottom surface of the mounting platform is flat on the surface of the panel or the structure.

(6) Put the wire harness on the plastic tie and the platform

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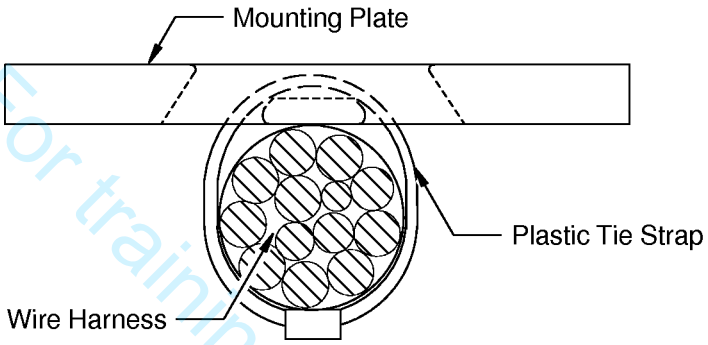
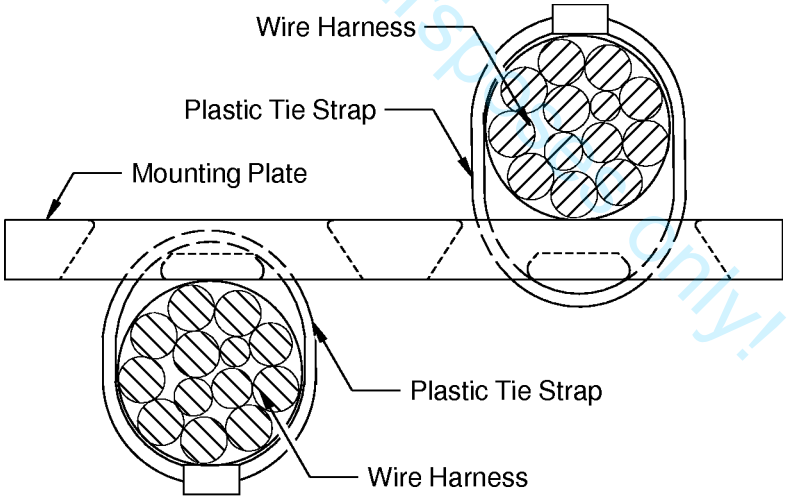
(7) If a fiber optic cable is against the support or the tie strap:
  (a) Make a selection of a silicone tape. Refer to Subject 20-00-11.
  (b) Wind a minimum of 2 layers of silicone tape on the harness at that location.
(8) Make a selection of a tie strap installation tool from Table 54.
(9) Use the strap installation tool to pull the plastic tie strap around the wire harness.
(10) Tighten the plastic tie.

O. Installation of a Wire Harness with a BACS38AA Mount Plate



POSITION OF THE WIRE HARNESS ON ONE SIDE OF THE PLATE
Figure 115



POSITION OF THE WIRE HARNESSES ON EACH SIDE OF THE PLATE
Figure 116

Refer to Figure 115 and Figure 116.

(1) Make a selection of a plastic tie strap from Table 26.
(2) Put a plastic tie through the applicable tie installation hole.
(3) Put the wire harness on the mounting plate.

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(4) If a wire harness tie or a wiring identification is between the wire harness and the support or a support component, remove the tie or the wiring identification.

(5) If a fiber optic cable is against the support or the tie strap:

(a) Make a selection of a silicone tape. Refer to Subject 20-00-11.

(b) Wind a minimum of 2 layers of silicone tape on the harness at that location.

(6) Tighten the plastic tie.

P. Installation of a BACS31J Support Assembly

Table 55
PLASTIC TIE STRAP INSTALLATION TOOLS

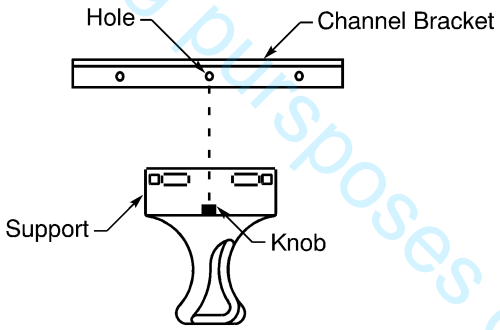
Part Number	Tool Description
GS4H	Heavy Duty
GTS	Standard Duty, Ergonomic

(1) Make a selection of a plastic tie strap from Table 30.

(2) Make a selection of a tie strap installation tool from Table 55.

(3) Install the support:

(a) Align the knob on the support with the hole in the bracket. Refer to Figure 117.



ALIGNMENT OF THE SUPPORT AND THE BRACKET
Figure 117

(b) Push the support against the channel bracket until the legs of the support engage the bracket. Refer to Figure 118.

Make sure that the knob goes into the hole in the bracket.

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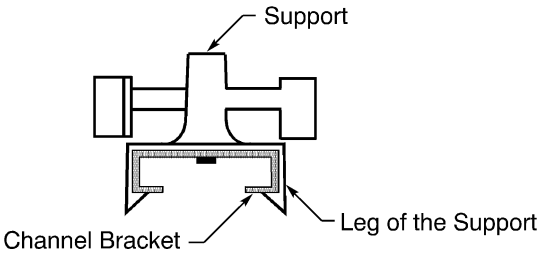
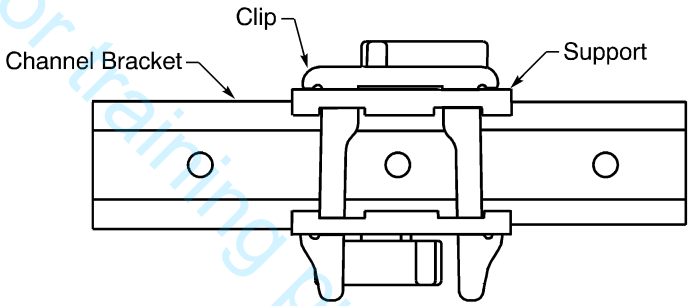
WIRE HARNESS SUPPORTS

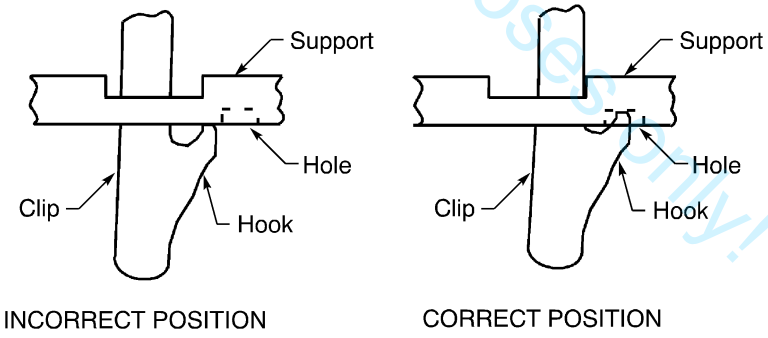


POSITION OF THE SUPPORT
Figure 118

(c) Push the clip into the support. Refer to Figure 119 and Figure 120.
Make sure that the hooks on side of the clip engage with the holes in the support.



POSITION OF THE CLIP
Figure 119



POSITION OF THE HOOKS IN THE SUPPORT
Figure 120

(4) Attach the wire harness to the support: Refer to Figure 121.

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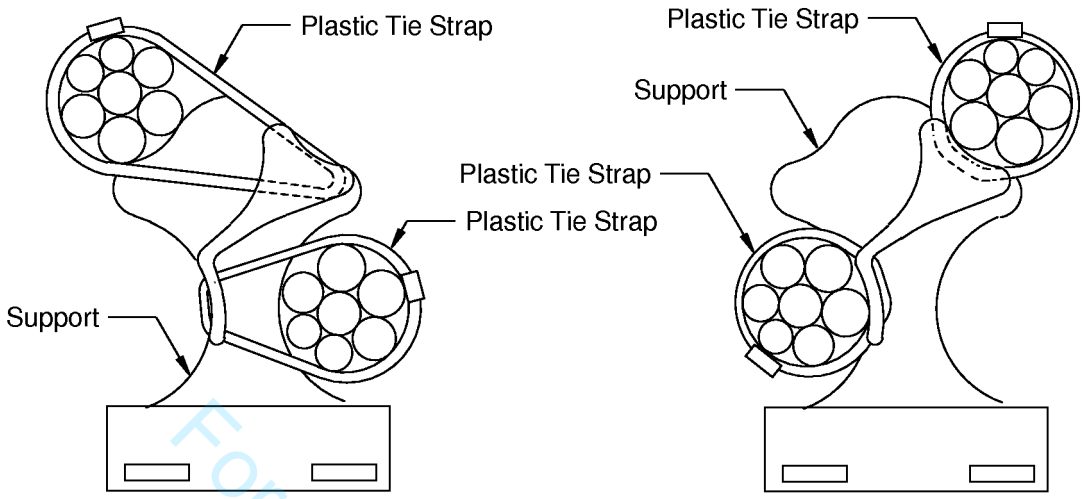
WIRE HARNESS SUPPORTS



WIRE HARNESS INSTALLATION
Figure 121

(a) Put a plastic tie strap through the applicable slots in the support.

Make sure that:

- The ribbed side of the tie strap is pointed away from the wire harness
- The plastic tie strap has the correct routing.

(b) Put the tie strap around the wire harness.

Make sure that all of the wires are parallel.

CAUTION: THE WIRES OR THE CABLES MUST NOT GO ACROSS EACH OTHER WHERE THE PLASTIC TIE STRAP GOES AROUND THE WIRE HARNESS. DAMAGE TO THE WIRES OR THE CABLES CAN OCCUR.

(c) If a fiber optic cable is against the support or the tie strap:

- Make a selection of a silicone tape. Refer to Subject 20-00-11.
- Wind a minimum of 2 layers of silicone tape on the harness at that location.

(d) Put the end of the tie strap through the tie strap head.

(e) Tighten the tie strap.

Make sure the wire harness is held tightly.

CAUTION: THE TIE STRAP MUST HOLD THE WIRE HARNESS TIGHTLY, BUT IT MUST NOT CRUSH THE WIRES. IF THE TIE STRAP IS TOO TIGHT OR TOO LOOSE, DAMAGE TO THE WIRES OR THE CABLES CAN OCCUR.

(f) Examine the plastic tie strap.

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Make sure that:

- The end of the strap does not have a sharp edge
- The end of the strap is a maximum of 0.01 inch from the head of the strap.

(5) If the wire harness cannot be held tightly with the plastic tie strap, increase the diameter of the wire harness:

(a) Remove the tie strap. Refer to Paragraph 5.

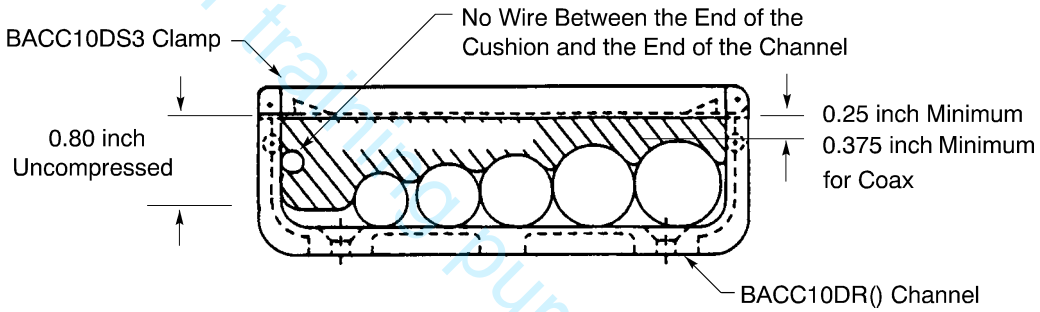
(b) Make a selection of a filler rod from Table 48.

(c) Install the necessary quantity of the filler rod to make a tight fit.

Make sure that the distance from the edge of the tie strap to the end of the filler rod is between 0.0 inch and 0.125 inch.

(d) Do Step (4) again.

Q. Installation of a Raceway Clamp



POSITION OF THE WIRES OR CABLES IN A RACEWAY CLAMP
Figure 122

Refer to Figure 122.

(1) Put the wires or cables in the wire harness channel.

Make sure that:

- The wire harness is straight
- The wires or cables of the wire harness are parallel with the longitudinal axis of the channel.

(2) Put the raceway clamp on the channel.

Make sure that:

- The cushion of the clamp is against the wires
- The center of the clamp is aligned with the center of the channel
- A wire or a cable is not between the end of the clamp cushion and the side of the channel.

(3) Push the center of the clamp in the direction of the channel until the hooks move into the slots on each side of the channel.

(4) Examine the installation.

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Make sure that:

- The distance from the largest wire or cable to the clamp is 0.25 inch minimum for wire
- The distance from the largest cable to the clamp is 0.375 inch minimum for coax cable
- The wires or cables in the channel cannot be moved
- The clamp cushion does not extend farther than each edge of the clamp.

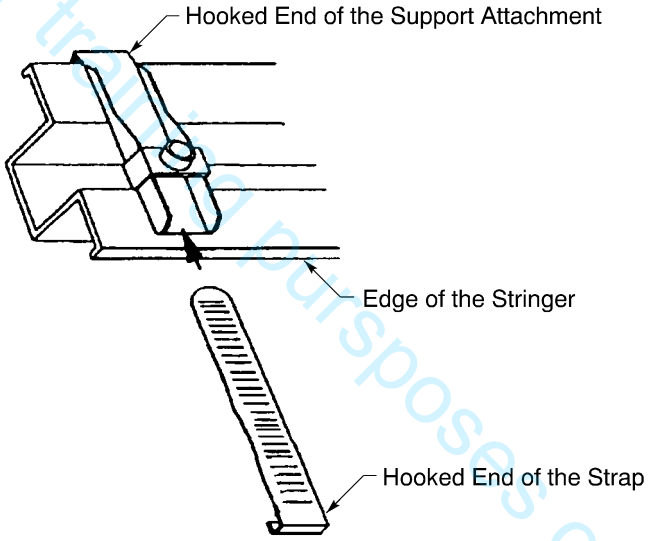
R. Installation of a Stringer Clip

(1) Make a selection of a stringer clip from Table 34.

CAUTION: DO NOT USE A STRINGER CLIP THAT HAS BEEN INSTALLED BEFORE. IT IS POSSIBLE THE CLIP CANNOT HOLD THE WIRE OR INSULATION BLANKET.

(2) Put the end of the strap into the support attachment.

(3) Put the ends of the strap with hooks and the support attachment over each edge of stringer. Refer to Figure 123.



POSITION OF THE STRINGER CLIP ON THE STRINGER
Figure 123

(4) Pull the strap through the support attachment. Refer to Figure 46.

S. Installation of a BACC10DK Loop Clamp with a NAS42() Spacer

BACC10DK clamps can be used with NAS42() spacers to make sure that the distance between wire harnesses in pressurized areas is a minimum 0.13 inch.

Table 56
WASHER PART NUMBERS

Washer	Supplier
AN960JD10	QPL
AN960JD10L	QPL
NAS1149D0316H	QPL

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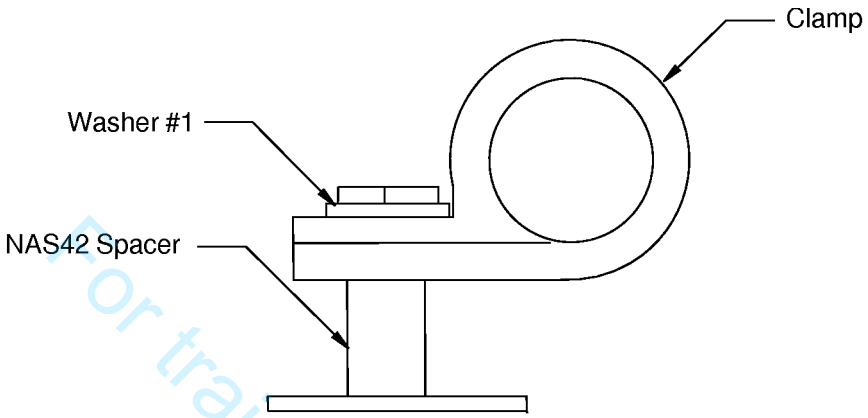
Table 56 (continued)

Washer	Supplier
NAS1149D0363H	QPL



NAS42() SPACER AND WASHER INSTALLATION WITH A BACC10DK LOOP CLAMP
Figure 124

Refer to Figure 124.

(1) Make a selection of a NAS42() spacer.

(2) If the clamp is not in a fuel tank, make a selection of a washer from Table 56.

CAUTION: WASHERS ARE NOT PERMITTED IN A FUEL TANK. IF A WASHER BECOMES FREE, A FUEL FILTER CAN BECOME CLOGGED.

(3) Put the washer on the screw.

(4) Put the screw through the hole in the clamp.

(5) Put the screw through the hole in the spacer.

(6) Engage the threads of the screw with the threads of the nut.

T. Installation of a BACC10DK Loop Clamp with a BACN10DX-3, BACN10NX, BACN10H, BACN10T, or CB40() Click Bond Nut Plate

Table 57
WASHER PART NUMBERS

Description	Part Number	Supplier
Washer	NAS1149D0316H	QPL
	NAS1149D0363H	QPL

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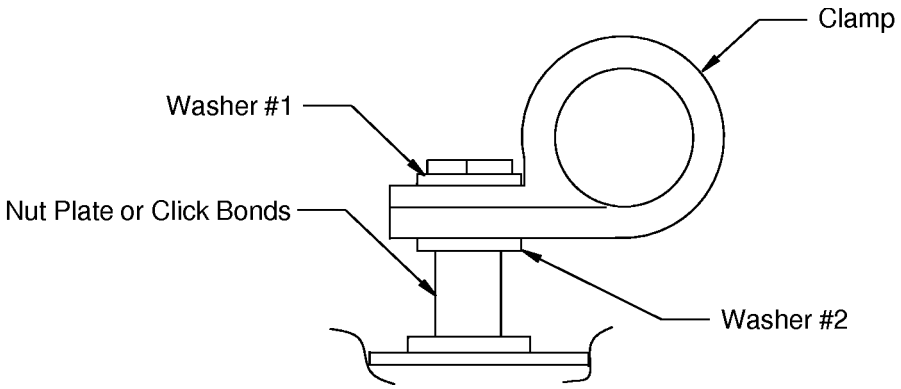
WIRE HARNESS SUPPORTS



WASHER INSTALLATION WITH BACC10DK CLAMPS
Figure 125

Refer to Figure 125.

(1) If the clamp is not in a fuel tank, make a selection of two washers from Table 57.

CAUTION: WASHERS ARE NOT PERMITTED IN A FUEL TANK. IF A WASHER BECOMES FREE, A FUEL FILTER CAN BECOME CLOGGED.

(2) Put a washer on the screw.

(3) Put the screw through the hole in the BACC10DK() clamp.

(4) Put the other washer on the screw.

NOTE: No washer is necessary between the clamp and spacer when a BACN10DX-3 nut spacer plate is used.

(5) Put the screw through the hole in the CB40() Series Click Bond, BACN10T, BACN10H, BACN10DX-3, or BACN10NX Nut Plate.

(6) Engage the threads of the screw with the threads of the nut.

U. Installation of Wire Harness with BMS8-389 Adhesive Wire Installation Tape

Table 58
SOLVENTS

Material	Specification	Supplier
Alcohol, Isopropyl	TT-I-735	An available source

Table 59
NECESSARY TOOLS

Tool	Specification or Part Number	Supplier
Applicator, Plastic	J5-0275-0210	General Tools
	PA-1	3M
	ST983K-8-12	Boeing
Wiper	BMS15-5 Class A	QPL
	BMS15-5 Class B	QPL

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(1) Make a selection of a solvent from Table 58.

(2) Make a selection of a wiper from Table 59.

NOTE: An equivalent wiper is a satisfactory alternative.

(3) Clean the wire harness with isopropyl alcohol and a wiper.

CAUTION: IF THE SURFACE HAS CONTAMINATION, THE TAPE WILL NOT HAVE A SATISFACTORY BOND TO THE SURFACE.

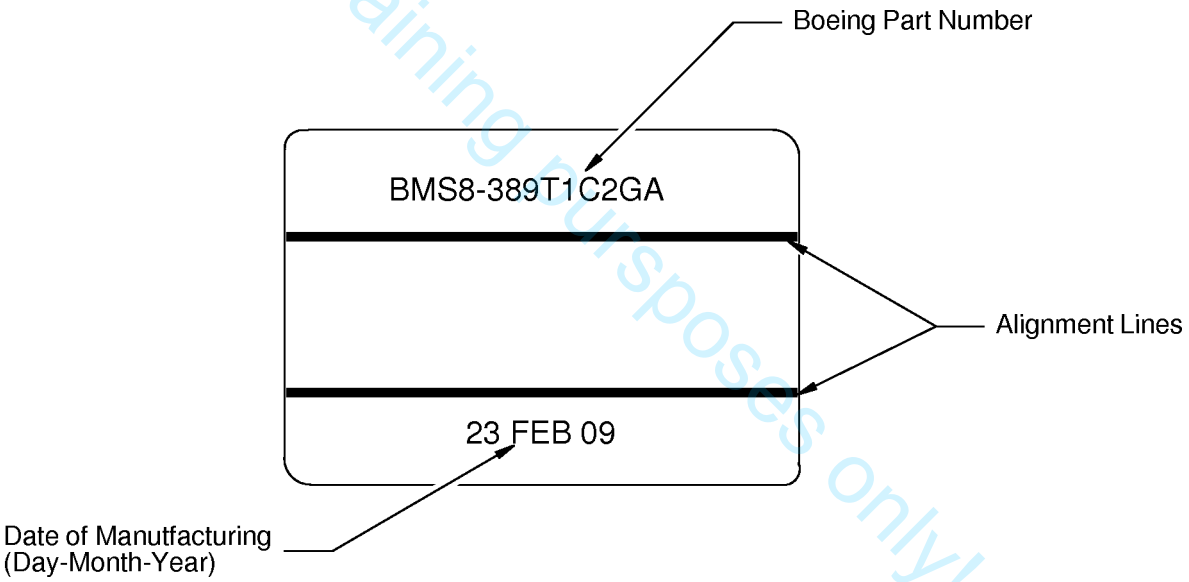
(4) Clean the installation surface with isoproply alcohol and a wiper.

CAUTION: IF THE SURFACE HAS CONTAMINATION, THE TAPE WILL NOT HAVE A SATISFACTORY BOND TO THE SURFACE.

(5) Align the wire harness and the wire harness location mark on the equipment or structure.

(6) Remove the release liner from the tape.

(7) Align the tape and the wire harness on the surface. Make sure the centering alignment lines align with wire bundles. Refer to Figure 126 and Figure 127.



MARKINGS ON THE BMS8-389 ADHESIVE WIRE INSTALLATION TAPE
Figure 126

(8) Put the wire harness and the tape against the surface. Refer to Figure 127.

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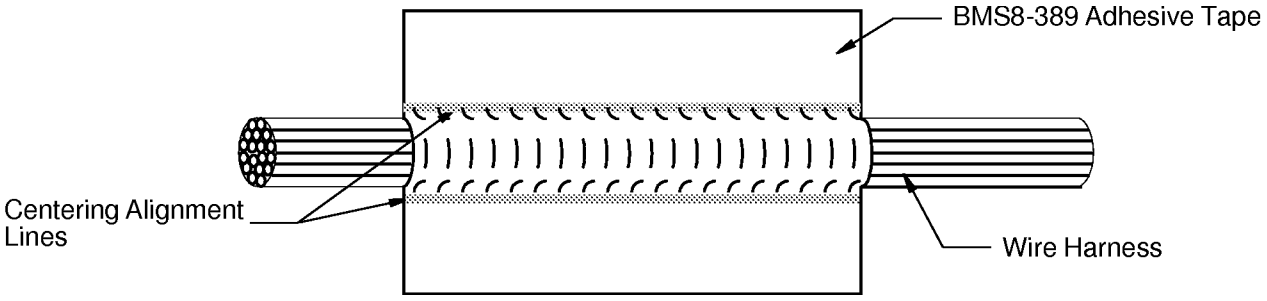


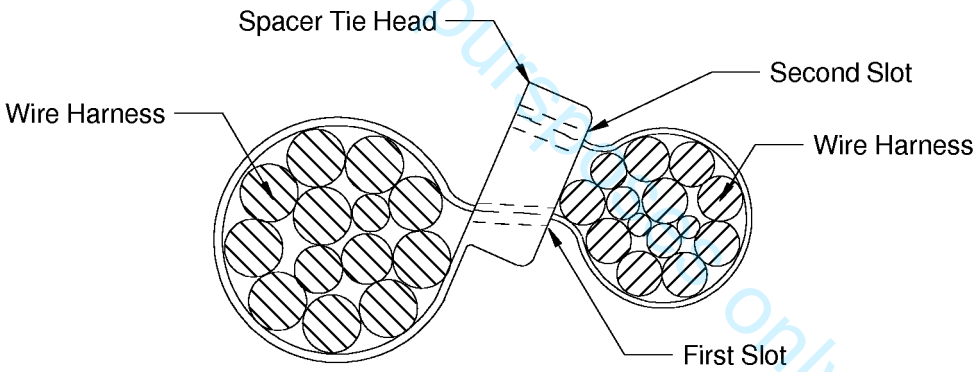
POSITION OF THE BMS8-389 ADHESIVE TAPE ON THE WIRE HARNESS
Figure 127

(9) Rub on the surface of the tape on each side of the wire harness.
Make sure that the tape is fully bond to the surface.

NOTE: If it is necessary, use a plastic applicator to make the installation of the tape easier. Refer to Table 59.

CAUTION: DO NOT APPLY PRESSURE TO THE WIRE HARNESS WITH THE APPLICATOR. DAMAGE TO THE WIRING CAN OCCUR.

V. Installation of a BACS38AB() or a PLB4() Spacer Tie



INSTALLATION OF A BACS38AB SPACER TIE
Figure 128

Refer to Figure 128.

(1) Wrap the end of the spacer tie around one of the wire harnesses.
(2) Push the end of the spacer tie through the first slot in the head.
(3) If a fiber optic cable is against the support or the tie strap:
  (a) Make a selection of a silicone tape. Refer to Subject 20-00-11.
  (b) Wind a minimum of 2 layers of silicone tape on the harness at that location.
(4) Pull the end of the spacer tie until the tie is tight around the wire harness.
(5) Wrap the end of the spacer tie around the second wire harness.
(6) Push the end of the spacer tie through the second slot of the head.

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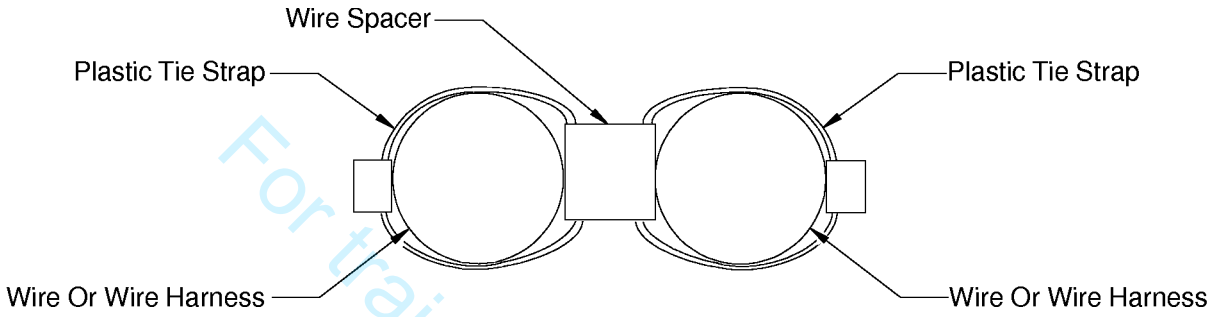
(7) If a fiber optic cable is against the support or the tie strap:
  (a) Make a selection of a silicone tape. Refer to Subject 20-00-11.
  (b) Wind a minimum of 2 layers of silicone tape on the harness at that location.
(8) Pull the end of the spacer tie until the tie is tight around the wire harness.
(9) Tighten the spacer tie around each wire harness.

W. Installation of a CR2 or a CR4H Wire Spacer (Connector Ring)



INSTALLATION OF A CR2 OR A CR4H WIRE SPACER WITH PLASTIC TIE STRAPS
Figure 129

Refer to Figure 129.

(1) Wrap a plastic tie strap around the first wire or wire harness and through the wire spacer. Make sure the surface of tie strap with the ribs is pointed out.
(2) Push the tapered tip of the plastic tie strap through the slot in head of the strap.
(3) If the tie strap is against a fiber optic cable:
  (a) Make a selection of a silicone tape. Refer to Subject 20-00-11.
  (b) Wind a minimum of 2 layers of silicone tape on the wire or harness at that location.
(4) Pull the end of the tie strap until it is tight around the wire or the wire harness.
(5) Do Step 1 through Step 4 again for the other wire or wire harness.
(6) Align the wire spacer and the two plastic tie straps.
(7) Tighten the ties.

7. APPROVED TOOL SUPPLIERS

A. Plastic Tie Strap Tools

Table 60
PLASTIC TIE STRAP TOOL SUPPLIERS

Part Number	Supplier
GS4H	Panduit
GTS	Panduit
ST2318PC-6	Boeing
ST2318PC-13	Boeing

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REPAIR OF ELECTRICAL WIRE AND CABLE

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REPAIR OF ELECTRICAL WIRE AND CABLE

This Subject gives:

- The damage conditions of wire, cable, coax cable, and cable assemblies
- The repair conditions for damaged wire, cable, coax cable, and cable assemblies
- The repair procedures for damaged wire, cable, and coax cable.

1. GENERAL DATA

A. Applicable Repair Conditions for Wire and Cable

For the general conditions that are applicable for:

- The repair of wire and cable, refer to Paragraph 1.B.
- The repair of Airworthiness Limitation wiring, refer to Paragraph 1.C.
- The repair of Fuel System wiring that has Airworthiness Limitations, refer to Paragraph 1.C.
- The repair of wiring that is adjacent to a fuel tank, refer to Paragraph 1.C.
- The selection of parts and materials for a repair, refer to Paragraph 1.D.
- The repair of wire and cable with a splice, refer to Paragraph 1.E.

For the applicable damage and repair conditions of:

- Wire and cable in special systems, refer to Table 1
- Special wire and cable, refer to Table 2
- Other types of wire and cable, refer to Table 3.

Table 1
CONDITIONS FOR WIRE AND CABLE IN SPECIAL SYSTEMS

System Wire and Cable	Damage and Repair Conditions
Engine Wire Harness Wire or Cable	Paragraph 2.T.
Fuel Quantity Indicator System Wire and Cable that are installed in a Fuel Tank	Paragraph 2.V.
Fuel Quantity Indicator System Wire and Cable that are not installed in a Fuel Tank	Paragraph 2.W.
Other Fuel System Wiring	Paragraph 2.U.
777 Primary Flight Control System	Subject 20-14-11

Table 2
CONDITIONS FOR SPECIAL WIRE AND CABLE

Special Wire or Cable	Damage and Repair Conditions
Aluminum Wire	Paragraph 2.J.
Bond and Ground Jumper Assembly	Paragraph 2.L.
Coax Cable	Paragraph 2.M.
Copper Power Feeder Wire	Paragraph 2.K.
Fire Resistant Wire	Paragraph 2.N.
Flat Conductor Cable Assembly	Paragraph 2.O.
S280W502-1 ARINC 629 Stanchion to LRU Stub Cable	Paragraph 2.P.
S280W502-4 ARINC 629 Panel to Stanchion Stub Cable	Paragraph 2.P.

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Table 2 (continued)

Special Wire or Cable	Damage and Repair Conditions
S280W651-() ARINC 629 Data Bus Cable Assembly	Paragraph 2.Q.
Shield Pull Through Shield Ground Wire	Paragraph 2.R.
Thermocouple Wire	Paragraph 2.S.
Overheated or Arcing Wire	Paragraph 2.X.

Table 3
CONDITIONS FOR WIRE AND CABLE TYPES

Wire or Cable Type	Damage and Repair Conditions
Unshielded Wire	Paragraph 2.A.
Unshielded Cable	Paragraph 2.B.
Shielded Wire	Paragraph 2.C.
Shielded Wire - Two Adjacent Shields	Paragraph 2.D.
Shielded Wire - Two Shields That Are Not Adjacent	Paragraph 2.E.
Shielded Cable	Paragraph 2.F.
Shielded Cable - Two Adjacent Shields	Paragraph 2.G.
Shielded Cable - Two Shields That Are Not Adjacent	Paragraph 2.H.
Wire or Cable with a Non-Metallic Braid	Paragraph 2.I.
BMS 13-51 Wire that has Missing Topcoat	Paragraph 2.Y.

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B. General Conditions for the Repair of Wire and Cable

These conditions are applicable for all repairs:

- The condition that is the cause of the damage must be removed to prevent subsequent damage
- A repair must be done with clean hands and clean tools to prevent contamination that can cause a bad seal of the insulation materials
- The repair is permanent, unless it is specified differently in the applicable repair conditions or in the applicable repair procedure
- A repair done in a fuel vapor area must be applicable for a fuel vapor area.

NOTE: A fuel vapor area is an area where fuel vapors are present. Refer to Subject 20-00-10 for safety practices for fuel vapors.

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WARNING: HEAT SOURCES OR OTHER IGNITION SOURCES MUST NOT BE USED WHEN FUEL VAPORS ARE PRESENT. INJURY TO PERSONNEL FROM FIRE OR EXPLOSION CAN OCUUR.

CAUTION: HEAT SOURCES OR OTHER IGNITION SOURCES MUST NOT BE USED WHEN FUEL VAPORS ARE PRESENT. DAMAGE TO EQUIPMENT FROM FIRE OR EXPLOSION CAN OCUUR.

These conditions are applicable for the location of the repair:

- A repair must not be put in a conduit
- A repair must not be put in a connector backshell or a backshell adapter
- A repair must not be put on a bend of a wire or a cable
- A repair must not be put on a wire harness where the wire harness is frequently bent; for example, an instrument panel or a hinged door.

C. Airworthiness Limitations

These wire configurations are controlled by Critical Design Configuration Control Limitations (CDCCL) requirements.

- Fuel System Wiring that has Airworthiness Limitations
- Wiring that is installed adjacent to the fuel tank. Refer to Subject 20-10-11.

CDCCLs identify certain design configuration features intended to prevent a fuel tank ignition source for the operational life of the airplane. CDCCLs are mandatory and cannot be changed or deleted without the approval of the FAA office that is responsible for the airplane model Type Certificate, or applicable regulatory agency.

WARNING: OBEY THE MANUFACTURER'S PROCEDURES WHEN YOU DO MAINTENANCE THAT HAS AN EFFECT ON A CDCCL. IF YOU DO NOT OBEY THE PROCEDURES, IT CAN INCREASE THE RISK OF A SOURCE OF FUEL TANK IGNITION. INJURIES TO PERSONNEL AND DAMAGE TO EQUIPMENT CAN OCCUR IF THERE IS A FIRE OR EXPLOSION.

The use of parts, methods, techniques or practices not contained in the applicable CDCCL must meet the approval of the FAA office that is responsible for the airplane model Type Certificate, or applicable regulatory agency.

Design features that are CDCCLs are defined and controlled by Special Federal Aviation Regulation (SFAR) 88. For more information, refer to the applicable Airworthiness Limitation, Certification Maintenance Requirements, or Maintenance Planning Document.

To find more data about CDCCL wiring, refer to Table 4 for the document that is applicable for the airplane model.

Table 4
BOEING DOCUMENTS FOR AIRWORTHINESS LIMITATIONS

Airplane Model	Boeing Document
707	D6-7552-AWL
727	D6-8766-AWL
737-100,-200,-200C,-300,-500	D6-38278-CMR
747-100,-200,-300,-SP	D6-13747-CMR

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Table 4 (continued)

Airplane Model	Boeing Document
737-600,-700,-800 and later 737 models	Boeing Aircraft Maintenance Manual 28-00-00
747-400 and later 747 models	
757	
767	
777	
787	D011Z009-03-04

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D. General Conditions for the Selection of Parts and Materials for a Repair

These conditions are applicable for the selection of the parts and materials for a repair:

- The Temperature Grade of the insulation materials for the repair the insulation of a wire or the jacket of a cable must be the same as or higher than the Temperature Grade of the wire or the cable
- The Temperature Grade of the metal components for the repair of a wire or a cable must be the same as the Temperature Grade of the wire or the cable
- The Temperature Grade of the materials used for the repair of a wire or a cable in a high temperature area must be Temperature Grade D; refer to Subject 20-02-20
- If it is necessary to repair damage of a wire or a cable with a segment of wire or cable, the segment must have the same part number as the damaged wire or cable. Refer to Subject 20-00-13 for wire data.

E. General Conditions for the Repair of Wire and Cable with a Splice

The replacement of a damaged wire or a damaged cable is recommended.

NOTE: The repair of a damaged wire or a damaged cable with a splice is a satisfactory alternative unless it is specified differently in the applicable repair conditions or in the applicable repair procedure.

These conditions are applicable:

- The general conditions for the repair or wire and cable; refer to Paragraph 1.B.
- All splice assemblies must have a sealed configuration
- The maximum number of new splices that a wire can have is three. Refer to Figure 1
- It is permitted to remove three or more splices and replace them with two new splices. Refer to Figure 2 and Figure 3
- When the repair of more than one wire in a wire harness is necessary, the minimum distance between the end of the splice on one wire and the opposite end of the splice on an adjacent wire must be 0.25 inch; refer to Figure 4
- When the number of splices and the lengths of the wires prevent the separation that is specified in Figure 4, the splices can be installed with a maximum of 0.25 inch from the end of the splice on one wire to the same end of the splice on an adjacent wire; refer to Figure 5.

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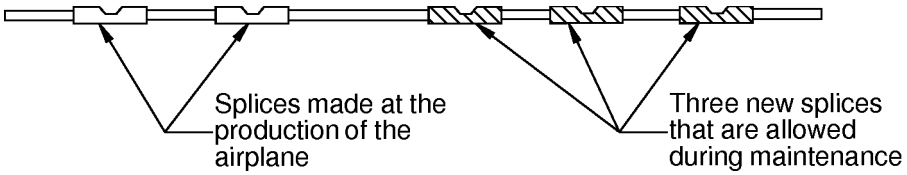

THREE NEW SPLICES ALLOWED
Figure 1

NOTE: The three new splices do not include the splices that were made during the production of the airplane.

NOTE: Yellow flag markers near splices may be found on the airplane wiring that indicate rework that occurred during airplane production prior to delivery. The splice data is on the flag marker. These splices are not shown on the wiring diagram.

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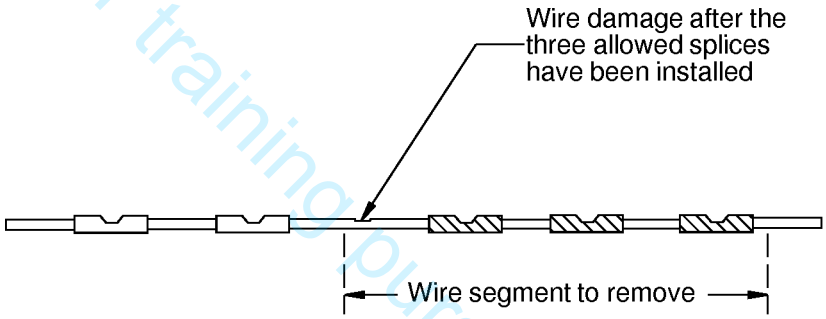
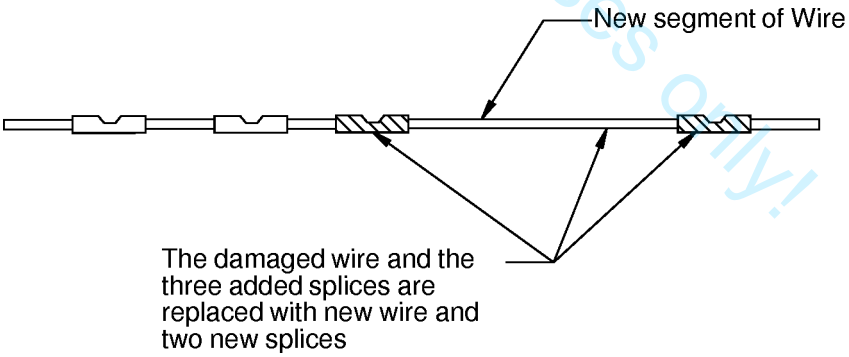


THE REMOVAL OF DAMAGED WIRE AND ALLOWED SPLICES
Figure 2



THE RESULT OF THE REPLACED WIRE AND SPLICES
Figure 3

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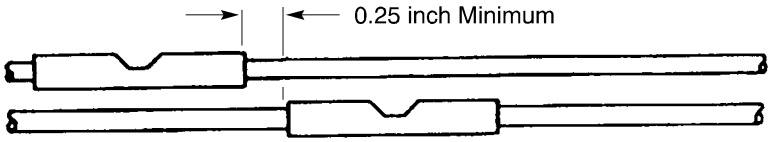
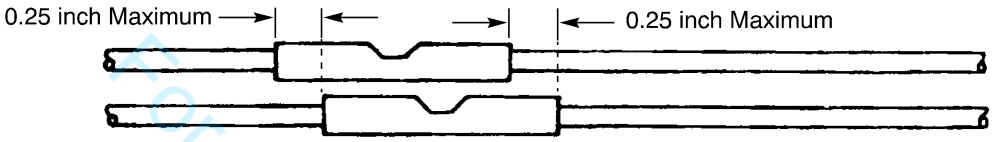


LOCATION OF SPLICES
Figure 4

NOTE: The location of the splices in Figure 4 can be used when it is necessary to keep the diameter of the wire harness, if not, the location of the splices in Figure 5 can be used.



ALTERNATIVE LOCATION OF SPLICES
Figure 5

For the general conditions that are applicable for:

- Splice assemblies and wire harness assembly, refer to Subject 20-10-11
- Splice assemblies and wire harness installation, refer to Subject 20-10-11.

F. Applicable Conditions for the Repair of a Splice Assembly

These conditions are applicable:

- The damage and repair conditions for a splice assembly are the same as the conditions for the type of wire or cable; refer to Paragraph 2.
- If it is necessary to replace a sealed splice assembly, the replacement must be a sealed splice assembly
- If it is necessary to replace an unsealed splice assembly, the replacement can be an unsealed splice assembly, but a sealed splice assembly is recommended.

G. Necessary Materials

Table 5
HEAT SHRINKABLE SLEEVES

Temperature Grade	Description
B	Refer to Heat Shrinkable Sleeves in Subject 20-00-11.
D	Refer to Heat Shrinkable Sleeves in Subject 20-00-11.

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Table 6
INSULATION MATERIALS

Material	Description	Temperature Grade	Class	Part Number	Supplier
Film Strip	TFE	D	1	E125-2	Fluorglas
					Saint-Gobain Performance Plastics
				E125-3	Fluorglas
					Saint-Gobain Performance Plastics
				P-412	Permacel
				Scotch 48	3M
				Scotch 3082	3M

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Table 6 (continued)

Material	Description	Temperature Grade	Class	Part Number	Supplier
Tape	Polyester	A	2	M765	Connecticut Hard Rubber
					Furon
					Saint-Gobain Performance Plastics
	Silicone	D	2	Scotch 70	3M
	TFE	B	1	Scotch 63	3M
				2242-2	Fluorglas
					Saint-Gobain Performance Plastics
		C	2	Mystick 7505	Fluorglas
					Saint-Gobain Performance Plastics
				Scotch 61	3M
		D	2	P-421	Permacel
				2045-5	Fluorglas
					Saint-Gobain Performance Plastics
				2245-5	Fluorglas
					Saint-Gobain Performance Plastics
				SG015-06	Saint-Gobain Performance Plastics
				SG016-05	Saint-Gobain Performance Plastics

Table 7
PROTECTIVE MATERIALS

Material	Description	Part Number	Supplier
Tape	TFE, Glass Supported	P-440	Permacel
		SG015-06	Saint-Gobain Performance Plastics
		SG016-05	Saint-Gobain Performance Plastics

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Table 8
COATING MATERIALS

Part Number	Supplier
Type 88	Nycote Laboratories
Vyna-Kote No. 6	Nylon Spectra-Strip

Table 9
SHIELD MATERIALS

Temperature Grade	Boeing Standard
B	BAC3108-()
D	BAC3106-()

NOTE: For sizes and suppliers of shield materials, refer to Subject 20-00-11.

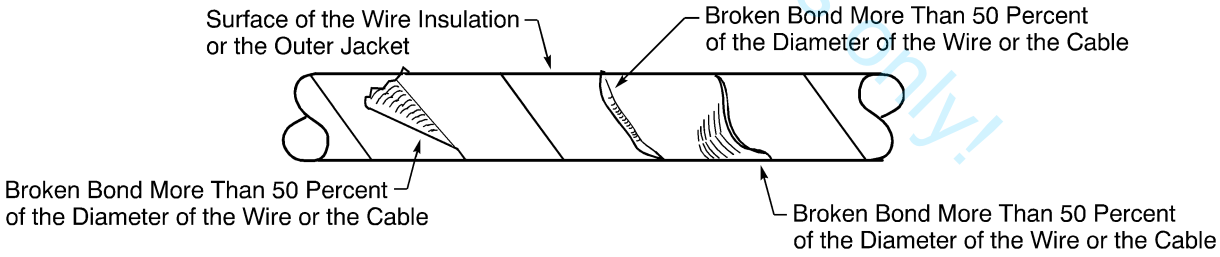
2. WIRE AND CABLE DAMAGE AND REPAIR CONDITIONS

A. Unshielded Wire

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

Repair is necessary when these types of damage occur:

- Damage to the conductor; refer to Paragraph 4.A.
- Damage that goes through the primary insulation; refer to Paragraph 3.A.
- Damage that goes into the primary insulation; refer to Paragraph 3.A.
- The bond between the overlaps of the tape of the insulation is broken for a length more than 50 percent of the diameter of the wire; refer to Figure 6 and Paragraph 3.C.
- Damage that goes into or through the insulation of a splice assembly when the conductor splice does not have damage; refer to Figure 7 and Paragraph 3.F.



UNSERVICEABLE BROKEN BONDS
Figure 6

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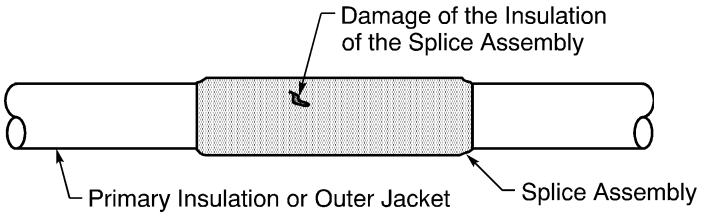
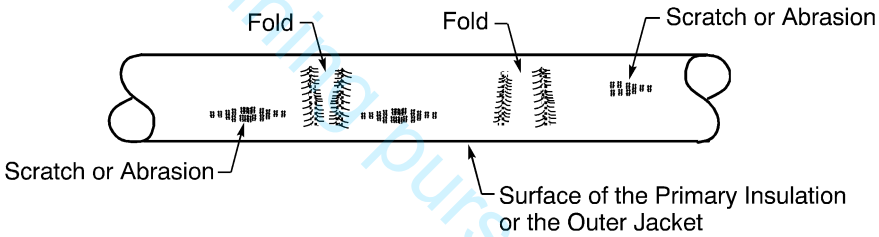


UNSERVICEABLE DAMAGE OF THE INSULATION OF A SPLICE ASSEMBLY
Figure 7

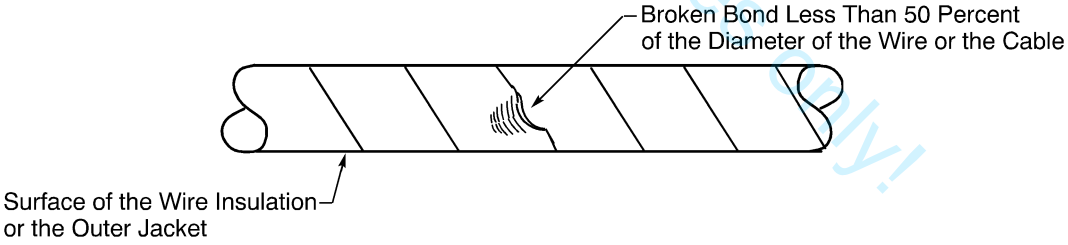
Repair is not necessary when these types of damage occur:

- A fold in the insulation at a bend
- A small scratch on the surface of the insulation
- Abrasion that makes the surface of the insulation rough
- The bond between the overlaps of the tape of the insulation is broken for a length that is less than 50 percent of the diameter of the wire.

Refer to Figure 8 and Figure 9.



SERVICEABLE SCRATCHES, FOLDS, AND ABRASION
Figure 8



SERVICEABLE BROKEN BONDS
Figure 9

B. Unshielded Cable

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

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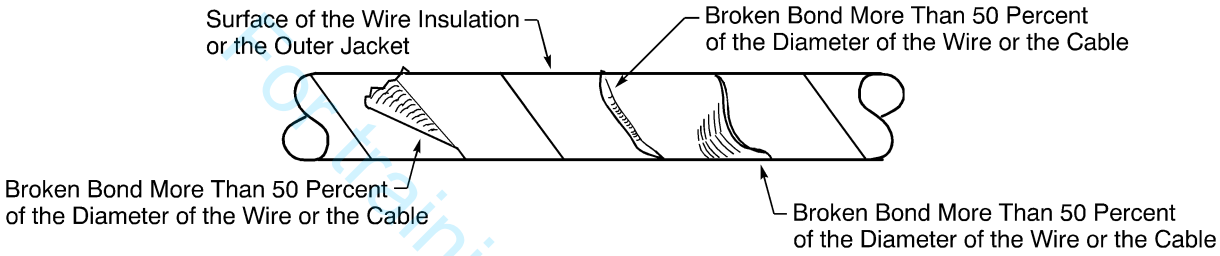
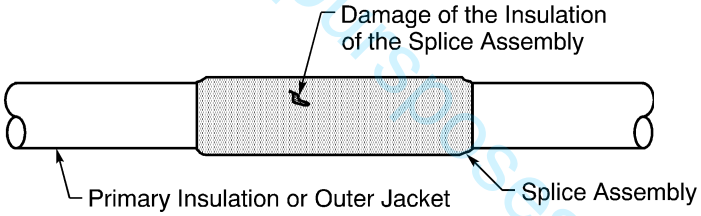
Repair is necessary when these types of damage occur:

- Damage to the conductor; refer to Paragraph 4.B.
- Damage that goes through the primary insulation of a wire in the cable; refer to Paragraph 3.D.
- Damage that goes into the primary insulation of a wire in the cable; refer to Paragraph 3.D.
- Damage that goes through the jacket; refer to Paragraph 3.B.
- Damage that goes into the jacket; refer to Paragraph 3.B.
- The bond between the overlaps of the tape of a jacket is broken for a length more than 50 percent of the diameter of the wire; refer to Figure 10 and Paragraph 3.C.
- Damage that goes into or through the insulation of a splice assembly when the component wires do not have damage; refer to Figure 11 and Paragraph 3.F.



UNSERVICEABLE BROKEN BONDS
Figure 10



UNSERVICEABLE DAMAGE OF THE INSULATION OF A SPLICE ASSEMBLY
Figure 11

Repair is not necessary when these types of damage occur:

- A fold in the jacket at a bend
- A small scratch on the surface of the jacket or primary insulation
- Abrasion that makes the surface of the jacket or primary insulation rough
- The bond between the overlaps of the tape of a jacket is broken for a length that is less than 50 percent of the diameter of the wire.

Refer to Figure 12 and Figure 13.

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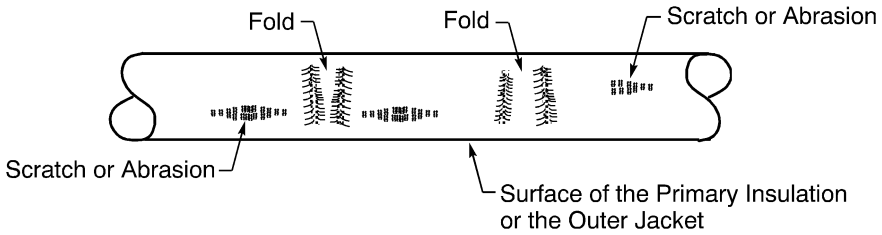
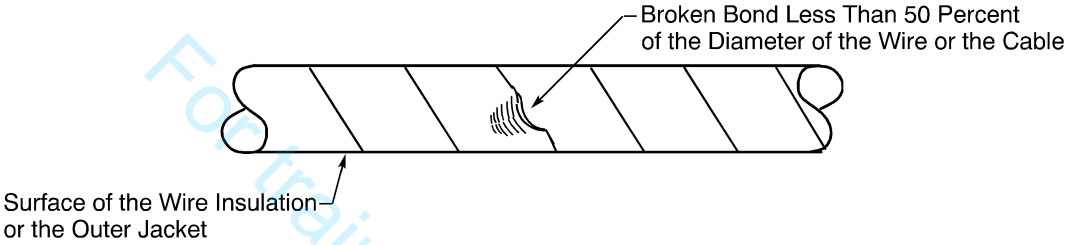


SERVICEABLE SCRATCHES, FOLDS, AND ABRASION
Figure 12



SERVICEABLE BROKEN BONDS
Figure 13

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C. Shielded Wire

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

Repair is necessary when these types of damage occur:

- Damage to the conductor; refer to Paragraph 5.A.
- Damage to the primary insulation; refer to Paragraph 5.A.
- Damage to the shield is more than 1 inch in length or more than 25 percent of the circumference of the shield, and near the end of the wire; refer to Paragraph 6.A.
- Damage to the shield is more than 1 inch in length or more than 25 percent of the circumference of the shield; refer to Paragraph 5.A.
- Damage to the shield is less than 1 inch in length and less than 25 percent of the circumference of the shield; refer to Paragraph 6.C.
- Damage that goes through the jacket, but the shield has no damage; refer to Paragraph 3.B.
- Damage that goes into the jacket; refer to Paragraph 3.B.
- The bond between the overlaps of the tape of a jacket is broken for a length more than 50 percent of the diameter of the wire; refer to Figure 15 and Paragraph 3.C.
- Damage that goes into the insulation of the shield splice assembly, but the shield has no damage; refer to Figure 16 and Paragraph 3.F.

Refer to Figure 14.

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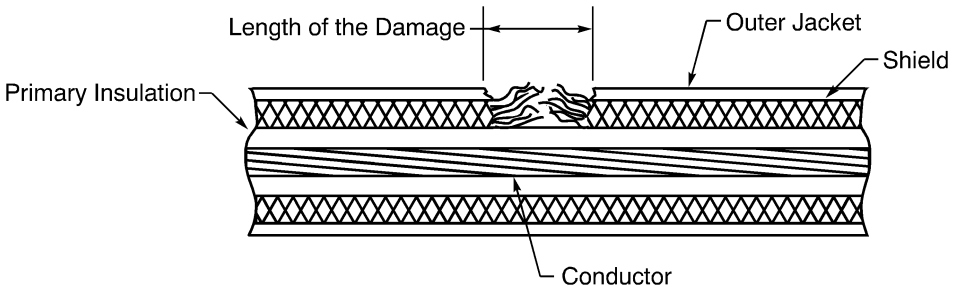
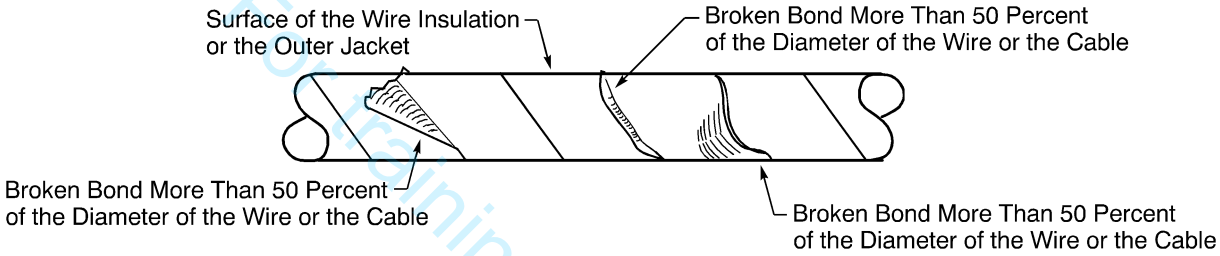
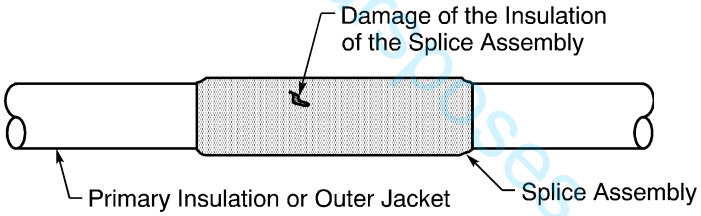


UNSERVICEABLE JACKET AND SHIELD DAMAGE
Figure 14



UNSERVICEABLE BROKEN BONDS
Figure 15



UNSERVICEABLE DAMAGE OF THE INSULATION OF A SHIELD SPLICE ASSEMBLY
Figure 16

Repair is not necessary when these types of damage occur:

- A fold in the jacket or the primary insulation at a bend
- A small scratch on the surface of the jacket or the primary insulation
- Abrasion that makes the surface of the jacket or the primary insulation rough
- The bond between the overlaps of the tape of the jacket is broken for a length that is less than 50 percent of the diameter of the wire.

Refer to Figure 17 and Figure 18.

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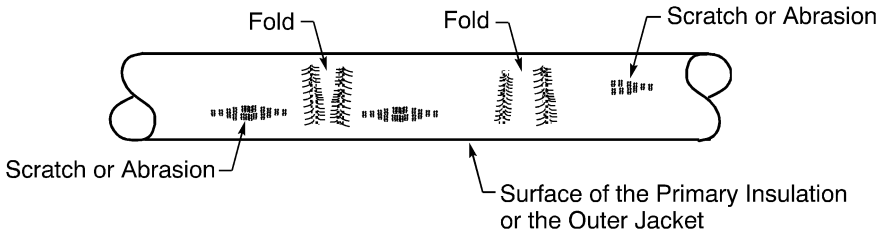
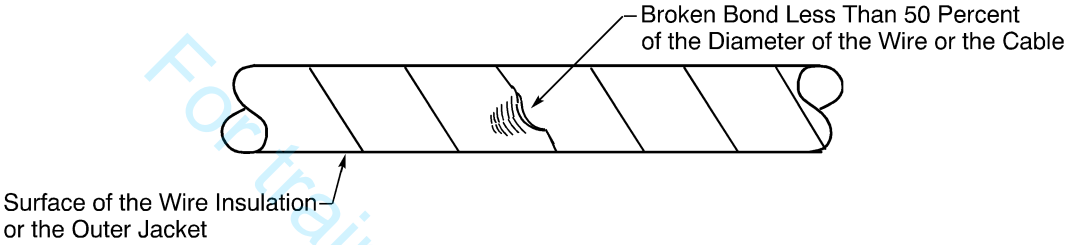


SERVICEABLE SCRATCHES, FOLDS, AND ABRASION
Figure 17



SERVICEABLE BROKEN BONDS
Figure 18

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D. Shielded Wire - Two Adjacent Shields

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

Repair is necessary when these types of damage occur:

- Damage to the conductor; refer to Paragraph 5.B.
- Damage to the primary insulation; refer to Paragraph 5.B.
- Damage to the shield is more than 1 inch in length or more than 25 percent of the circumference of the shield, and near the end of the wire; refer to Paragraph 6.A.
- Damage to the shield is more than 1 inch in length or more than 25 percent of the circumference of the shield; refer to Paragraph 5.B.
- Damage to the shield is less than 1 inch in length and less than 25 percent of the circumference of the shield; refer to Paragraph 6.C.
- Damage that goes through the jacket, but the shield has no damage; refer to Paragraph 3.B.
- Damage that goes into the jacket; refer to Paragraph 3.B.
- The bond between the overlaps of the tape of a jacket is broken for a length more than 50 percent of the diameter of the wire; refer to Figure 20 and Paragraph 3.C.
- Damage that goes into the insulation of the shield splice assembly, but the shield has no damage; refer to Figure 21 and Paragraph 3.F.

Refer to Figure 19.

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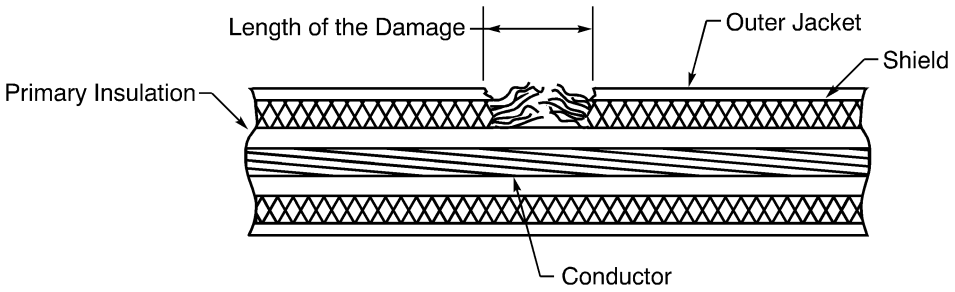
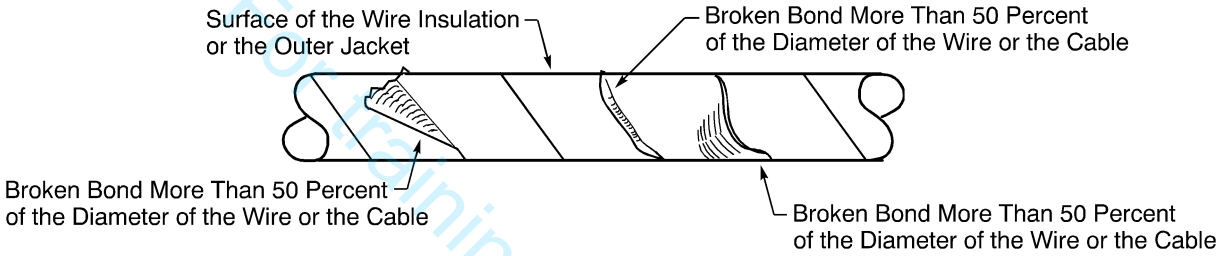
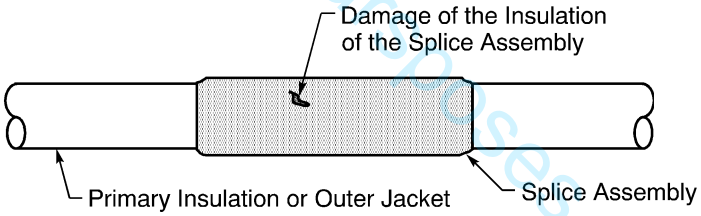


UNSERVICEABLE JACKET AND SHIELD DAMAGE
Figure 19



UNSERVICEABLE BROKEN BONDS
Figure 20



UNSERVICEABLE DAMAGE OF THE INSULATION OF A SHIELD SPLICE ASSEMBLY
Figure 21

Repair is not necessary when these types of damage occur:

- A fold in the jacket or the primary insulation at a bend
- A small scratch on the surface of the jacket or the primary insulation
- Abrasion that makes the surface of the jacket or the primary insulation rough
- The bond between the overlaps of the tape of the jacket is broken for a length that is less than 50 percent of the diameter of the wire.

Refer to Figure 22 and Figure 23.

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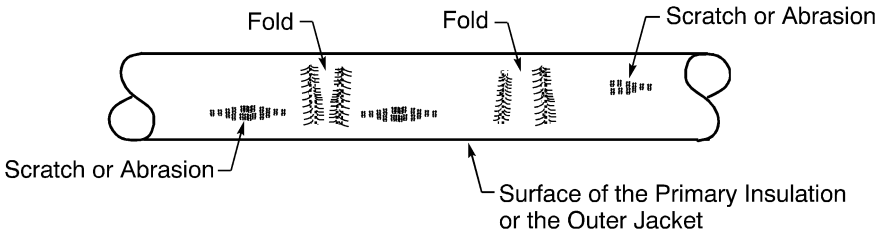
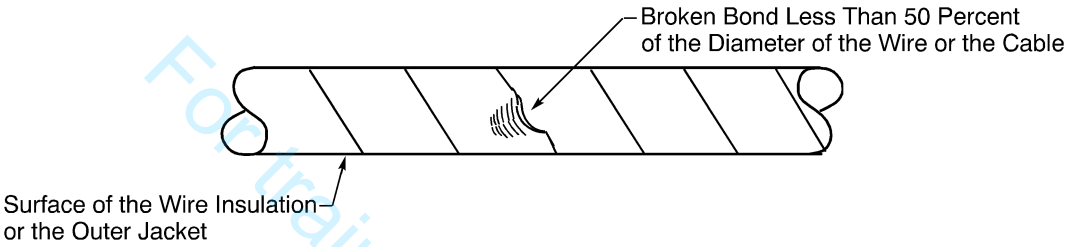


SERVICEABLE SCRATCHES, FOLDS, AND ABRASION
Figure 22



SERVICEABLE BROKEN BONDS
Figure 23

E. Shielded Wire - Two Shields That Are Not Adjacent

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

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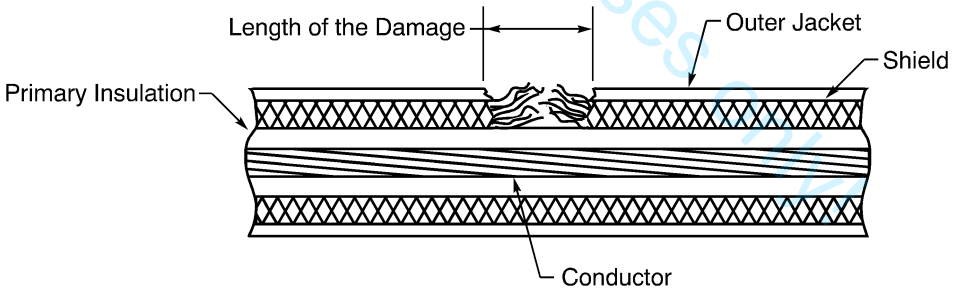
Repair is necessary when these types of damage occur:

- Damage to the conductor; when the repair is done in a fuel vapor area, refer to Paragraph 5.C.
- Damage to the conductor; refer to Paragraph 5.D.
- Damage to the primary insulation; when the repair is done in a fuel vapor area, refer to Paragraph 5.C.
- Damage to the primary insulation; refer to Paragraph 5.D.
- Damage to the inner shield; when the repair is done in a fuel vapor area, refer to Paragraph 5.C.
- Damage to the inner shield; refer to Paragraph 5.D.
- Damage to the inner insulation; when the repair is done in a fuel vapor area, refer to Paragraph 5.C.
- Damage to the inner insulation; refer to Paragraph 5.D.
- Damage to the outer shield is more than 1 inch in length or more than 25 percent of the circumference of the shield, and near the end of the wire; refer to Paragraph 6.A.
- Damage to the outer shield is more than 1 inch in length or more than 25 percent of the circumference of the shield; when the repair is done in a fuel vapor area, refer to Paragraph 5.C.
- Damage to the outer shield is more than 1 inch in length or more than 25 percent of the circumference of the shield; refer to Paragraph 5.D.
- Damage to the outer shield is less than 1 inch in length and less than 25 percent of the circumference of the shield; refer to Paragraph 6.C.
- Damage that goes through the jacket, but the shield has no damage; refer to Paragraph 3.B.
- Damage that goes into the jacket; refer to Paragraph 3.B.
- The bond between the overlaps of the tape of a jacket is broken for a length more than 50 percent of the diameter of the wire; refer to Figure 25 and Paragraph 3.C.
- Damage that goes into the insulation of the shield splice assembly, but the shield has no damage; refer to Figure 26 and Paragraph 3.F.

Refer to Figure 24.



UNSERVICEABLE JACKET AND SHIELD DAMAGE
Figure 24

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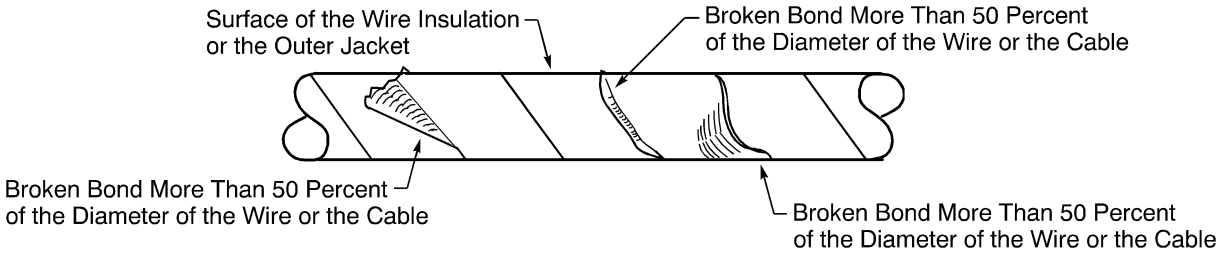
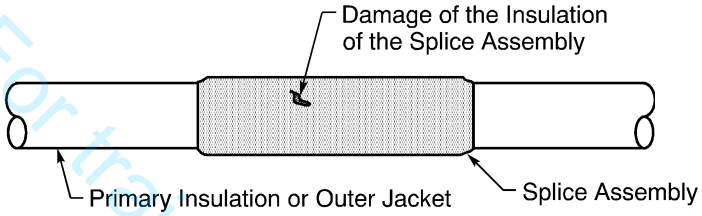


UNSERVICEABLE BROKEN BONDS
Figure 25

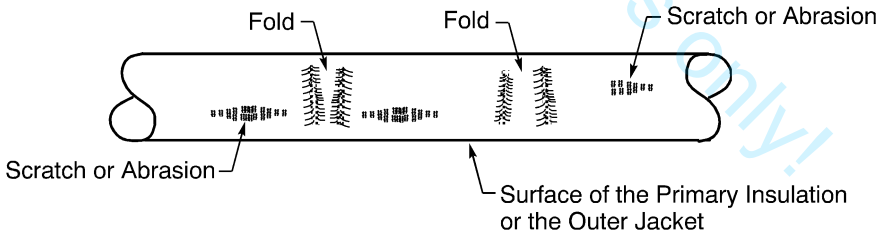


UNSERVICEABLE DAMAGE OF THE INSULATION OF A SHIELD SPLICE ASSEMBLY
Figure 26

Repair is not necessary when these types of damage occur:

- A fold in the jacket or the primary insulation at a bend
- A small scratch on the surface of the jacket or the primary insulation
- Abrasion that makes the surface of the jacket or the primary insulation rough
- The bond between the overlaps of the tape of the jacket is broken for a length that is less than 50 percent of the diameter of the wire.

Refer to Figure 27 and Figure 28.



SERVICEABLE SCRATCHES, FOLDS, AND ABRASION
Figure 27

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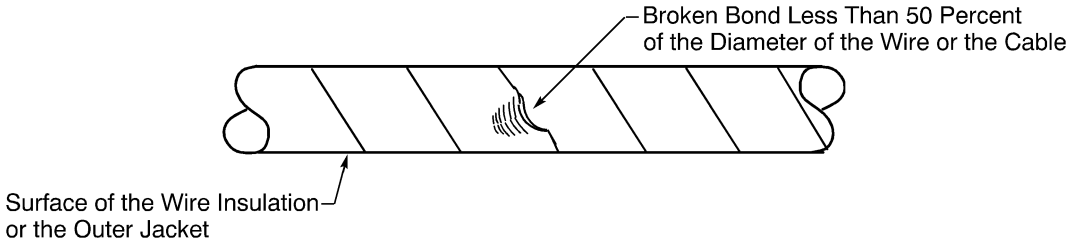


SERVICEABLE BROKEN BONDS
Figure 28

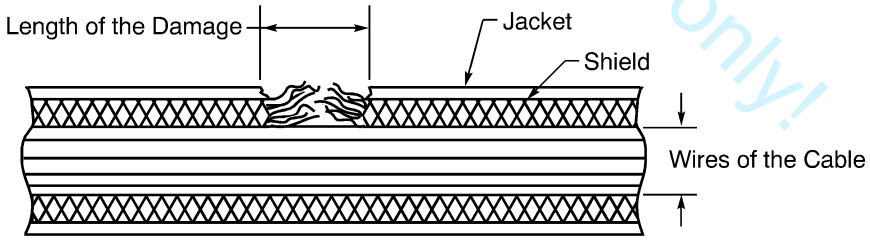
F. Shielded Cable

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

Repair is necessary when these types of damage occur:

- Damage to the conductor; refer to Paragraph 5.E.
- Damage to the primary insulation; refer to Paragraph 5.E.
- Damage to the shield is more than 1 inch in length or more than 25 percent of the circumference of the shield, and near the end of the cable; refer to Paragraph 6.A.
- Damage to the shield is more than 1 inch in length or more than 25 percent of the circumference of the shield; refer to Paragraph 5.E.
- Damage to the shield is less than 1 inch in length and less than 25 percent of the circumference of the shield; refer to Paragraph 6.C.
- Damage that goes through the jacket, but the shield has no damage; refer to Paragraph 3.B.
- Damage that goes into the jacket; refer to Paragraph 3.B.
- The bond between the overlaps of the tape of a jacket is broken for a length more than 50 percent of the diameter of the wire; refer to Figure 30 and Paragraph 3.C.
- Damage that goes into the insulation of the shield splice assembly, but the shield has no damage; refer to Figure 31 and Paragraph 3.F.

Refer to Figure 29.



UNSERVICEABLE JACKET AND SHIELD DAMAGE
Figure 29

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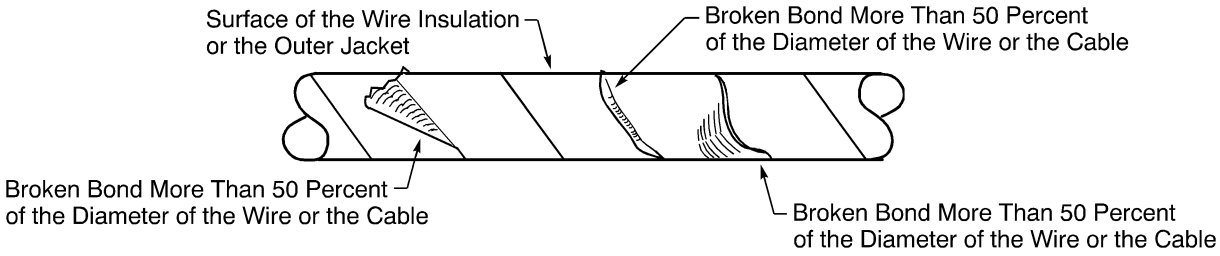
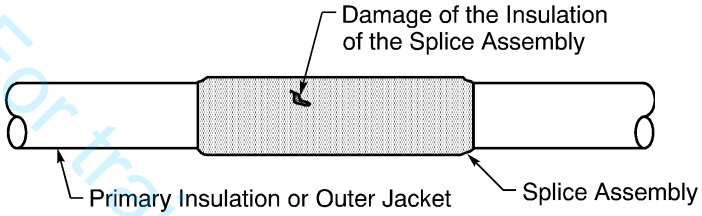


UNSERVICEABLE BROKEN BONDS
Figure 30

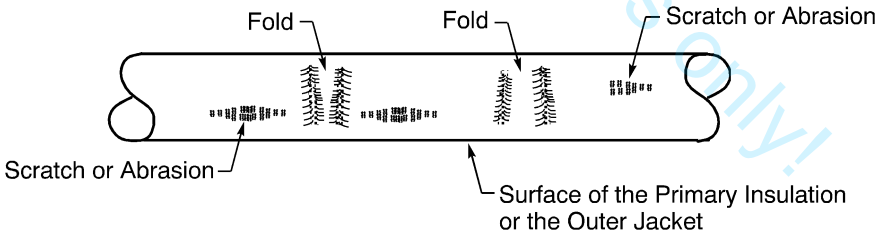


UNSERVICEABLE DAMAGE OF THE INSULATION OF A SHIELD SPLICE ASSEMBLY
Figure 31

Repair is not necessary when these types of damage occur:

- A fold in the jacket or the primary insulation at a bend
- A small scratch on the surface of the jacket or the primary insulation
- Abrasion that makes the surface of the jacket or the primary insulation rough
- The bond between the overlaps of the tape of the jacket is broken for a length that is less than 50 percent of the diameter of the wire.

Refer to Figure 32 and Figure 33.



SERVICEABLE SCRATCHES, FOLDS, AND ABRASION
Figure 32

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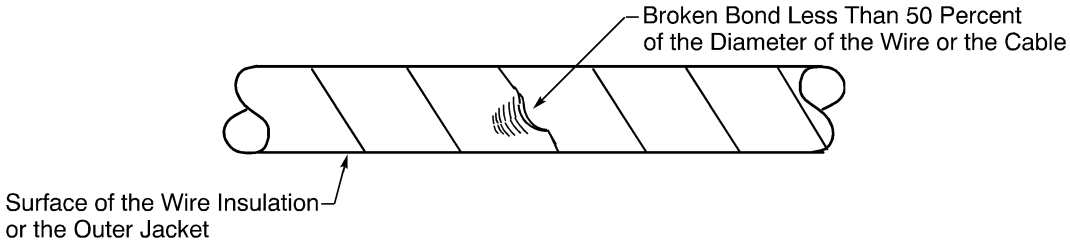


SERVICEABLE BROKEN BONDS
Figure 33

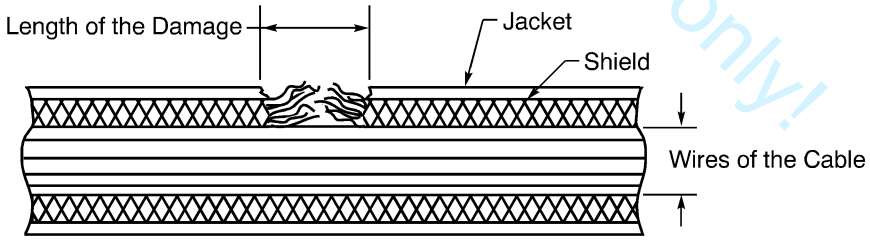
G. Shielded Cable - Two Adjacent Shields

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

Repair is necessary when these types of damage occur:

- Damage to the conductor; refer to Paragraph 5.F.
- Damage to the primary insulation; refer to Paragraph 5.F.
- Damage to the shield is more than 1 inch in length or more than 25 percent of the circumference of the shield, and near the end of the cable; refer to Paragraph 6.A.
- Damage to the shield is more than 1 inch in length or more than 25 percent of the circumference of the shield; refer to Paragraph 5.F.
- Damage to the shield is less than 1 inch in length and less than 25 percent of the circumference of the shield; refer to Paragraph 6.C.
- Damage that goes through the jacket, but the shield has no damage; refer to Paragraph 3.B.
- Damage that goes into the jacket; refer to Paragraph 3.B.
- The bond between the overlaps of the tape of a jacket is broken for a length more than 50 percent of the diameter of the wire; refer to Figure 35 and Paragraph 3.C.
- Damage that goes into the insulation of the shield splice assembly, but the shield has no damage; refer to Figure 36 and Paragraph 3.F.

Refer to Figure 34.



UNSERVICEABLE JACKET AND SHIELD DAMAGE
Figure 34

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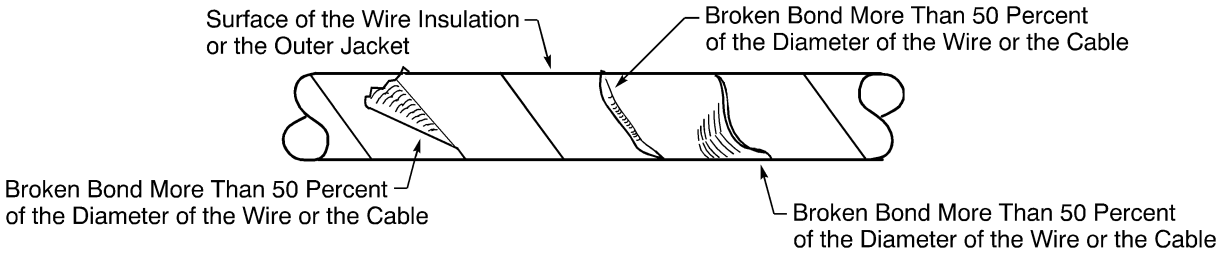
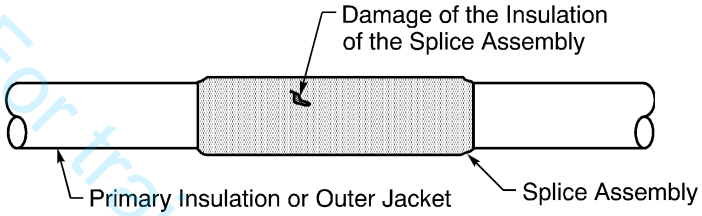


UNSERVICEABLE BROKEN BONDS
Figure 35

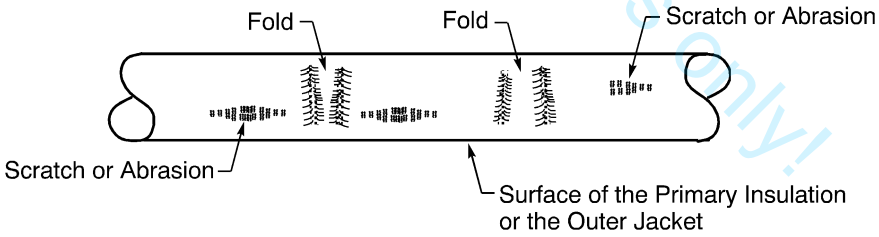


UNSERVICEABLE DAMAGE OF THE INSULATION OF A SHIELD SPLICE ASSEMBLY
Figure 36

Repair is not necessary when these types of damage occur:

- A fold in the jacket or the primary insulation at a bend
- A small scratch on the surface of the jacket or the primary insulation
- Abrasion that makes the surface of the jacket or the primary insulation rough
- The bond between the overlaps of the tape of the jacket is broken for a length that is less than 50 percent of the diameter of the wire.

Refer to Figure 37 and Figure 38.



SERVICEABLE SCRATCHES, FOLDS, AND ABRASION
Figure 37

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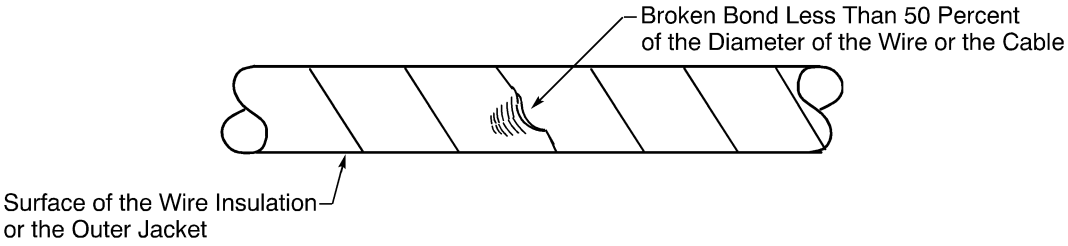

SERVICEABLE BROKEN BONDS
Figure 38

H. Shielded Cable - Two Shields That Are Not Adjacent

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

Repair is necessary when these types of damage occur:

- Damage to the conductor; when the repair is done in a fuel vapor area, refer to Paragraph 5.G.
- Damage to the conductor; refer to Paragraph 5.H.
- Damage to the primary insulation; when the repair is done in a fuel vapor area, refer to Paragraph 5.G.
- Damage to the primary insulation; refer to Paragraph 5.H.
- Damage to the inner shield; when the repair is done in a fuel vapor area, refer to Paragraph 5.G.
- Damage to the inner shield; refer to Paragraph 5.H.
- Damage to the inner insulation; when the repair is done in a fuel vapor area, refer to Paragraph 5.G.
- Damage to the inner insulation; refer to Paragraph 5.H.
- Damage to the outer shield is more than 1 inch in length or more than 25 percent of the circumference of the shield, and near the end of the wire; refer to Paragraph 6.A.
- Damage to the outer shield is more than 1 inch in length or more than 25 percent of the circumference of the shield; when the repair is done in a fuel vapor area, refer to Paragraph 5.G.
- Damage to the outer shield is more than 1 inch in length or more than 25 percent of the circumference of the shield; refer to Paragraph 5.H.
- Damage to the outer shield is less than 1 inch in length and less than 25 percent of the circumference of the shield; refer to Paragraph 6.C.
- Damage that goes through the jacket, but the shield has no damage; refer to Paragraph 3.B.
- Damage that goes into the jacket; refer to Paragraph 3.B.
- The bond between the overlaps of the tape of a jacket is broken for a length more than 50 percent of the diameter of the wire; refer to Figure 40 and Paragraph 3.C.
- Damage that goes into the insulation of the shield splice assembly, but the shield has no damage; refer to Figure 41 and Paragraph 3.F.

Refer to Figure 39.

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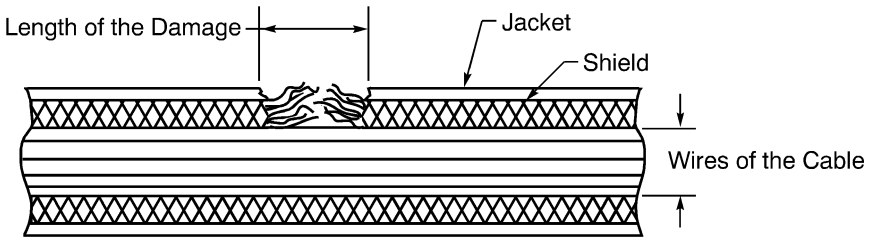
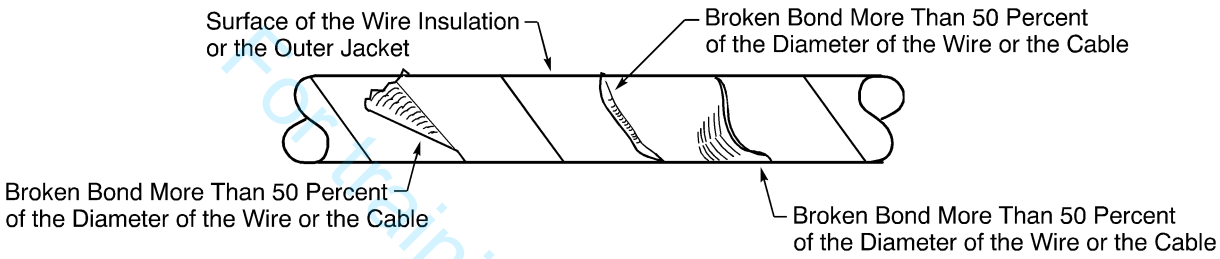
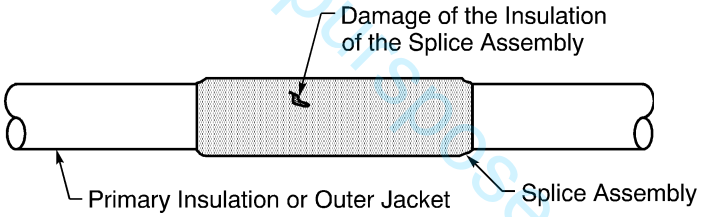


UNSERVICEABLE JACKET AND SHIELD DAMAGE
Figure 39



UNSERVICEABLE BROKEN BONDS
Figure 40



UNSERVICEABLE DAMAGE OF THE INSULATION OF A SHIELD SPLICE ASSEMBLY
Figure 41

Repair is not necessary when these types of damage occur:

- A fold in the jacket or the primary insulation at a bend
- A small scratch on the surface of the jacket or the primary insulation
- Abrasion that makes the surface of the jacket or the primary insulation rough
- The bond between the overlaps of the tape of the jacket is broken for a length that is less than 50 percent of the diameter of the wire.

Refer to Figure 42 and Figure 43.

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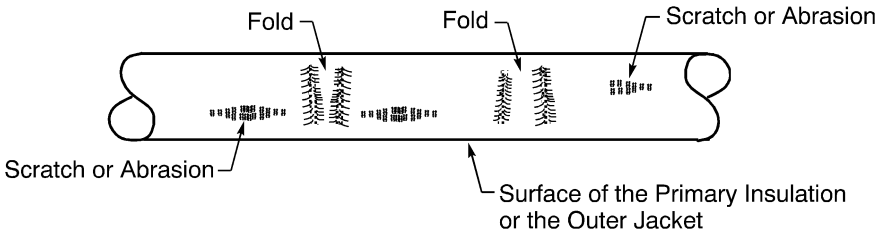
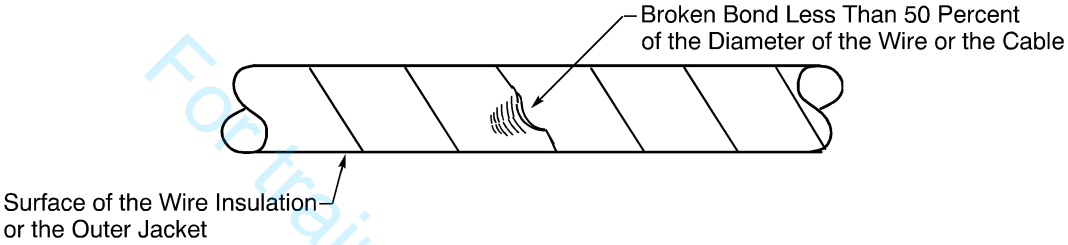


SERVICEABLE SCRATCHES, FOLDS, AND ABRASION
Figure 42



SERVICEABLE BROKEN BONDS
Figure 43

I. Wire or Cable With a Non-Metallic Braid

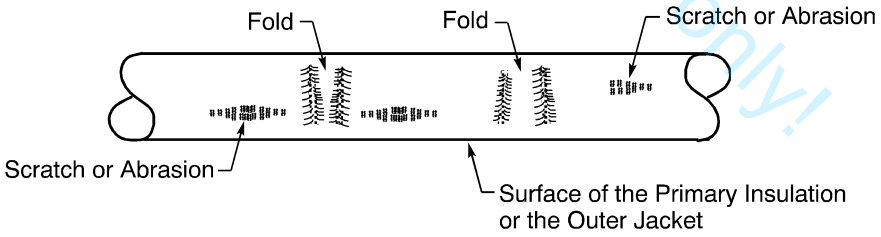
For the conditions that are applicable to the data in this paragraph, refer to Paragraph 1.A.

Repair of the braid is necessary when the damage goes through the braid; refer to Paragraph 3.E.

Repair is not necessary when these types of damage occur:

- A fold in the braid at a bend
- Abrasion that makes the surface of the braid rough.

Refer to Figure 44.



SERVICEABLE FOLDS AND ABRASION
Figure 44

If there is damage to the wire or cable, refer to the wire and cable damage conditions for the applicable wire or cable configuration.

J. Aluminum Wire

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

This paragraph is applicable for wires with an aluminum conductor. Refer to Subject 20-00-13.

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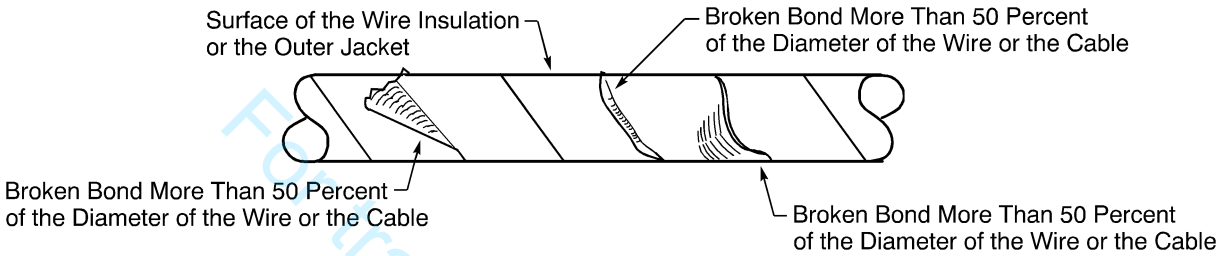
REPAIR OF ELECTRICAL WIRE AND CABLE

Repair is necessary when these types of damage occur:

- Damage to the conductor; repair with a splice, refer to Subject 20-30-13
- Damage that goes through the primary insulation; refer to Paragraph 3.A.
- Damage that goes into the primary insulation; refer to Paragraph 3.A.
- The bond between the overlaps of the tape of the insulation is broken for a length more than 50 percent of the diameter of the wire; refer to Figure 45 and Paragraph 3.C.
- Damage to the insulation of a splice assembly when the conductor splice does not have damage; refer to Paragraph 3.F.

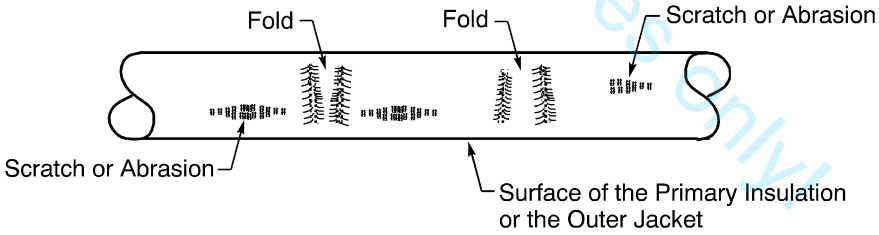


UNSERVICEABLE BROKEN BONDS
Figure 45

Repair is not necessary when these types of damage occur:

- A fold in the insulation at a bend
- A small scratch on the surface of the insulation
- Abrasion that makes the surface of the insulation rough
- The bond between the overlaps of the tape of the insulation is broken for a length that is less than 50 percent of the diameter of the wire.

Refer to Figure 46 and Figure 47.



SERVICEABLE SCRATCHES, FOLDS, AND ABRASION
Figure 46

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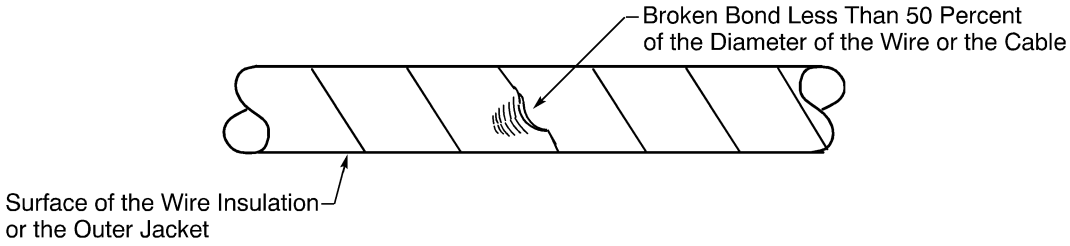


SERVICEABLE BROKEN BONDS
Figure 47

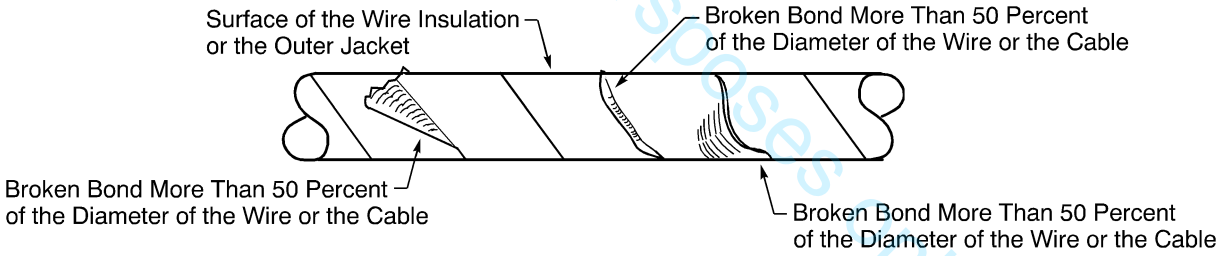
K. Copper Power Feeder Wire

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

This paragraph is applicable for copper AWG 8 through AWG 4/0 wires that supply large quantities of power to equipment during normal airplane operation.

Repair is necessary when these types of damage occur:

- Damage to the conductor; repair with a splice, refer to Subject 20-30-13
- Damage that goes through the primary insulation; refer to Paragraph 3.A.
- Damage that goes into the primary insulation; refer to Paragraph 3.A.
- The bond between the overlaps of the tape of the insulation is broken for a length more than 50 percent of the diameter of the wire; refer to Figure 48 and Paragraph 3.C.
- Damage to the insulation of a splice assembly when the conductor splice does not have damage; refer to Paragraph 3.F.



UNSERVICEABLE BROKEN BONDS
Figure 48

Repair is not necessary when these types of damage occur:

- A fold in the insulation at a bend
- A small scratch on the surface of the insulation
- Abrasion that makes the surface of the insulation rough
- The bond between the overlaps of the tape of the insulation is broken for a length that is less than 50 percent of the diameter of the wire.

Refer to Figure 49 and Figure 50.

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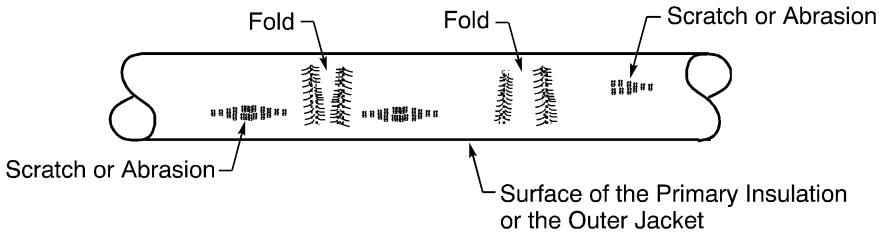
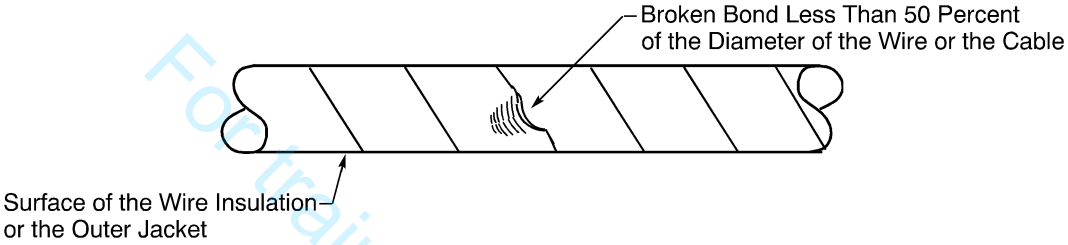


SERVICEABLE SCRATCHES, FOLDS, AND ABRASION
Figure 49



SERVICEABLE BROKEN BONDS
Figure 50

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L. Bond and Ground Jumper Assembly

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

Replacement of the jumper assembly can be necessary if there are broken strands of the conductor. Refer to Subject 20-20-00 for the damage limits and service conditions.

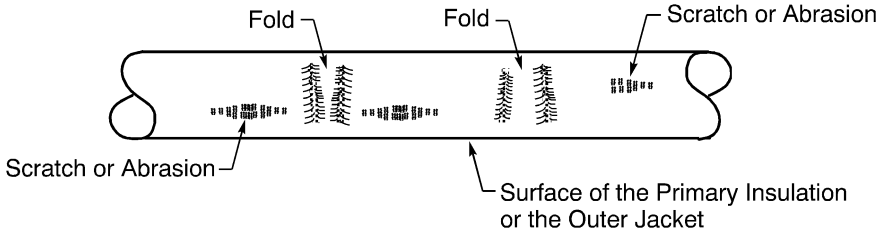
Repair of an insulated jumper is necessary when these types of damage occur:

- Damage that goes through the insulation; refer to Paragraph 3.A.
- Damage that goes into the insulation; refer to Paragraph 3.A.

Repair is not necessary when these types of damage occur:

- A fold in the insulation at a bend
- A small scratch on the surface of the insulation
- Abrasion that makes the surface of the insulation rough
- The bond between the overlaps of the tape of the insulation is broken for a length that is less than 50 percent of the diameter of the wire.

Refer to Figure 51.



SERVICEABLE SCRATCHES, FOLDS, AND ABRASION
Figure 51

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M. Coax Cable

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

The replacement of a coax cable is recommended if the damage to the shield or the dielectric is high.

Replacement of a coax cable is necessary when one of these conditions occurs:

- A coax cable that has a splice, has more damage that makes it necessary to repair the cable with a splice again
- The cable is in the Low Range Radio Altimeter Antenna System
- The cable is a tuned capture or tracking antenna cable that are connected to the Collins 51RV1, 51RV2, or 51RV4 VOR/ILS receivers.

CAUTION: COAX CABLES IN THESE SYSTEMS ARE SENSITIVE TO REPAIRS. IF THESE CABLES HAVE DAMAGE, THEY CANNOT BE REPAIRED AND MUST BE REPLACED:

- THE CABLES OF THE LOW RANGE RADIO ALTIMETER ANTENNA SYSTEM
- THE TUNED CAPTURE AND TRACKING ANTENNA CABLES THAT ARE CONNECTED TO THE COLLINS 51RV1, 51RV2, OR 51RV4 VOR/ILS RECEIVERS.

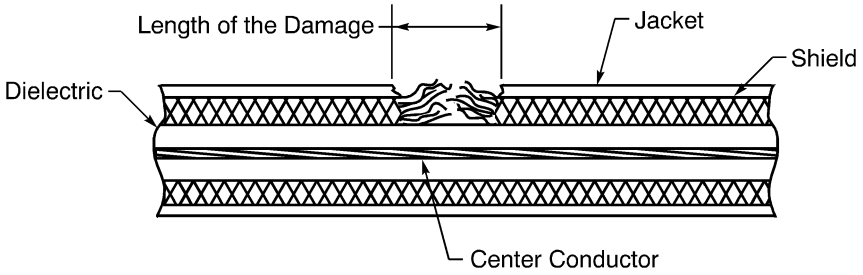
Repair is necessary when these types of damage occur:

- Damage to the shield is more than 1 inch in length; refer to Paragraph 7.B. or Paragraph 7.C. for a repair with a splice
- Damage to the shield is more than 25 percent of the circumference of the shield; refer to Paragraph 7.B. or Paragraph 7.C. for a repair with a splice
- Damage to the shield is less than 1 inch in length and less than 25 percent of the circumference of the shield; refer to Paragraph 7.A.
- Damage that goes through the jacket; refer to Paragraph 3.B.
- Damage that goes into the jacket; refer to Paragraph 3.B.

Refer to Figure 52.

CAUTION: COAX CABLES IN SOME SYSTEMS ARE SENSITIVE TO REPAIRS WITH A SPLICE. BEFORE A REPAIR WITH A SPLICE IS MADE ON A CABLE, AN ANALYSIS OF THE SYSTEM MUST BE DONE TO FIND THE APPLICABLE REPAIR CONDITIONS FOR THAT COAX CABLE IN THAT SYSTEM.

NOTE: Boeing Service Engineering can answer questions about the damage and repair conditions applicable for coax cables in a system.



UNSERVICEABLE JACKET AND SHIELD DAMAGE
Figure 52

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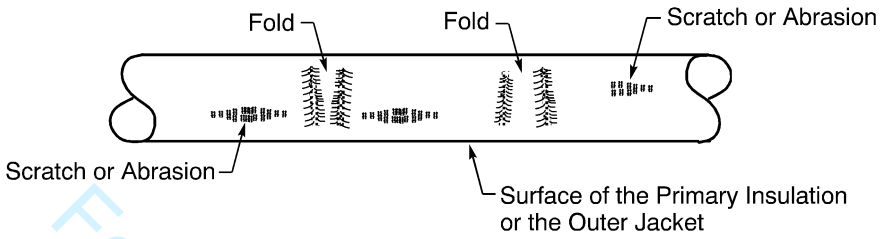
Repair is not necessary when these types of damage occur:

- A fold in the jacket at a bend
- A small scratch on the surface of the jacket
- Abrasion that makes the surface of the jacket rough.

Refer to Figure 53.



SERVICEABLE SCRATCHES AND ABRASION ON A COAX CABLE JACKET
Figure 53

N. Fire Resistant Wire

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

Replacement of a fire resistant wire is necessary when one of these conditions occurs:

- A wire that has a temporary repair, has more damage that makes it necessary to repair the wire again
- The wire has a temporary repair it has been a maximum of 500 flight hours subsequent to the repair
- A BMS 13-67 wire has damage that goes into the shield.

CAUTION: REPLACEMENT OF THE FIRE RESISTANT WIRE THAT HAS TEMPORARY REPAIR IS NECESSARY. THE WIRE MUST BE REPLACED AT A MAXIMUM OF 500 FLIGHT HOURS SUBSEQUENT TO THE REPAIR.

CAUTION: REPLACEMENT OF A BMS 13-67 WIRE THAT HAS DAMAGE TO THE SHIELD IS NECESSARY.

These conditions are applicable for unshielded fire resistant wire:

- If the conductor has damage, a temporary repair can be made; refer to Paragraph 9.B.
- If the damage goes through all the layers of insulation and the conductor can be seen, but the conductor does not have damage a temporary repair can be made; refer to Paragraph 9.A.
- If the bond between the overlaps of the tape of the insulation is broken for a length more than 50 percent of the diameter of the wire, a permanent repair can be made; refer to Figure 54 and Paragraph 9.A.
- If the damage goes into the outer layer of insulation but not through the outer layer of insulation, a permanent repair can be made; refer to Paragraph 9.A.

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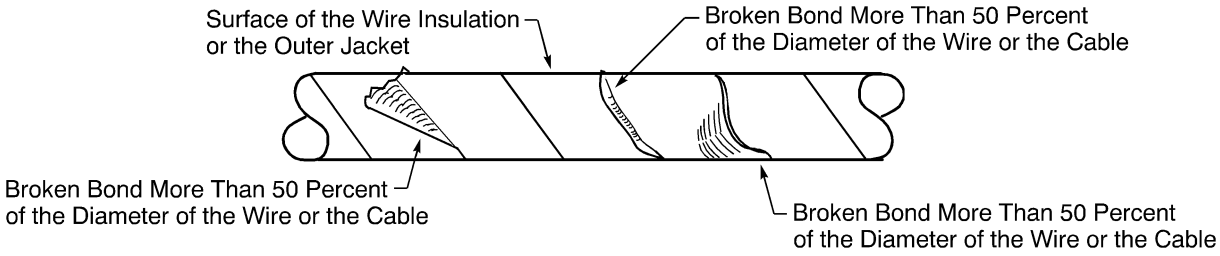


UNSERVICEABLE BROKEN BONDS
Figure 54

These conditions are applicable for BMS 13-67 fire resistant wire and cable:

- If the damage goes into the shield, the wire or cable must be replaced
- If the damage goes through all the layers of insulation and the shield can be seen, but the shield does not have damage, a temporary repair can be made; refer to Paragraph 9.A.
- If the damage goes into the outer layer of insulation, but not through the outer layer of insulation, a temporary repair can be made; refer to Paragraph 9.A.

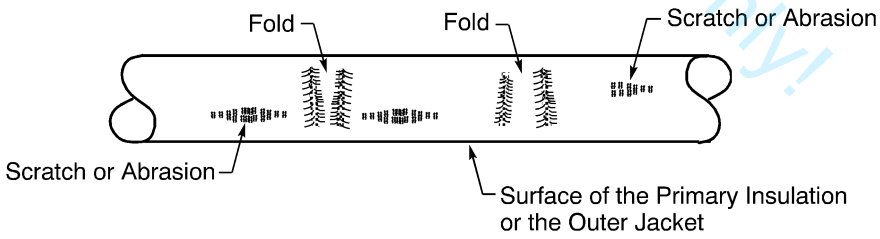
These conditions are applicable for other shielded fire resistant wire and cable:

- If the damage goes into the shield, the wire or cable must be replaced
- If the damage goes through all the layers of insulation and the shield can be seen, but the shield does not have damage, a temporary repair can be made; refer to Paragraph 9.A.
- If the damage goes into the outer layer of insulation, but not through the outer layer of insulation, a permanent repair can be made; refer to Paragraph 9.A.

Repair is not necessary when these type of damage occur:

- A fold in the insulation at a bend
- A small scratch on the surface of the insulation
- Abrasion that makes the surface of the insulation rough
- The bond between the overlaps of the tape of the insulation is broken for a length that is less than 50 percent of the diameter of the wire.

Refer to Figure 55 and Figure 56.



SERVICEABLE SCRATCHES, FOLDS, AND ABRASION
Figure 55

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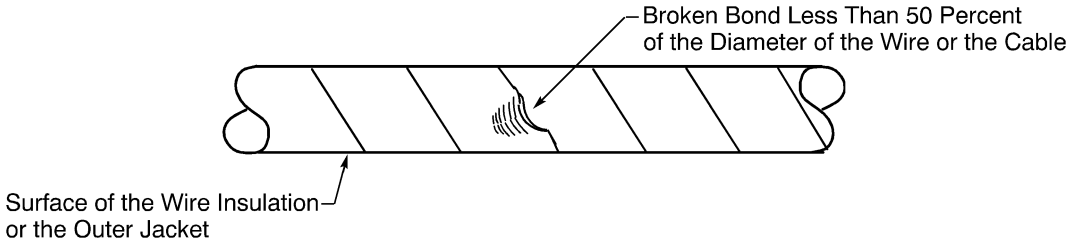
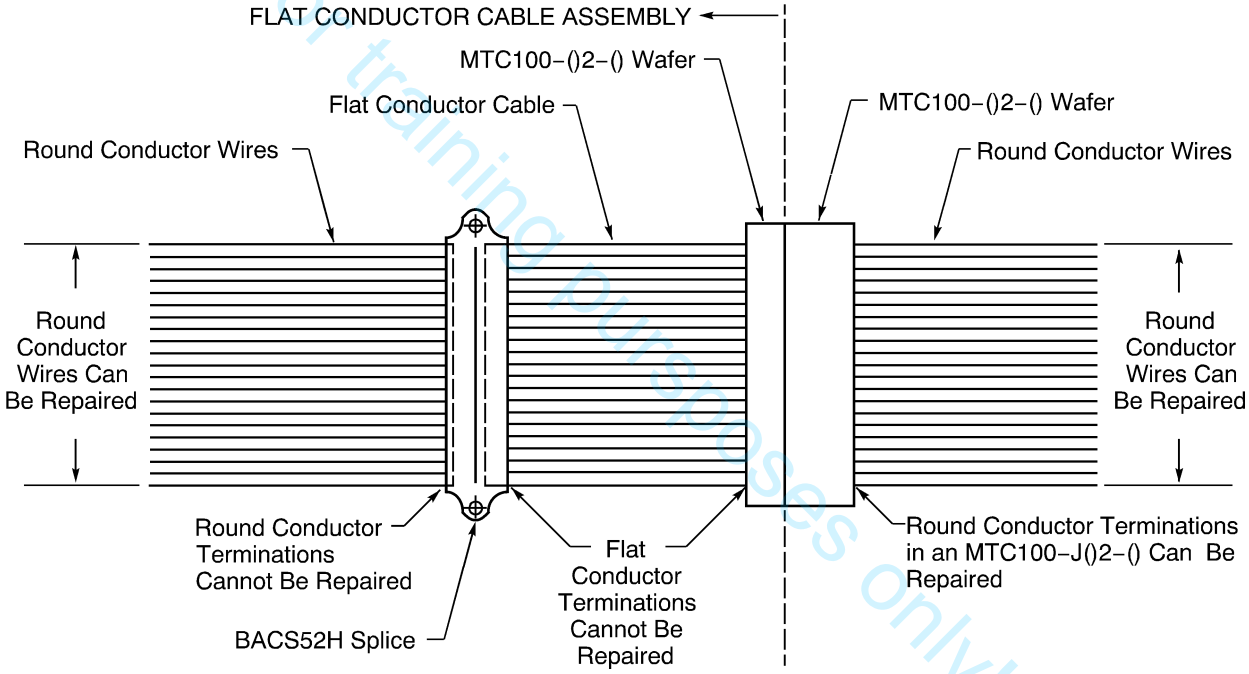


SERVICEABLE BROKEN BONDS
Figure 56

O. Flat Conductor Cable Assembly

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



FLAT CONDUCTOR CABLE ASSEMBLY
Figure 57

Refer to Figure 57.

Replacement of the cable assembly is necessary if these components have damage:

- The flat conductor cable
- The wafer of the connector
- The termination of the flat conductor cable
- The termination of a round conductor wire in the splice
- The BACS52H splice.

NOTE: The Boeing Spares Organization supplies the flat conductor cable assembly.

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Repair is possible if these components have damage:

- A round conductor wire; refer to Paragraph 2.A.
- The termination of a round conductor wire in an MTC100-J()2-() wafer of the connector; refer to Subject 20-73-00 to replace the round conductor wire.

P. ARINC 629 S280W502-() Stub Cable

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

Replacement is necessary when:

- Damage to the conductor of a cable that has a repair
- Damage to the shield of a cable that has a repair
- Damage to the primary insulation of a cable that has a repair.

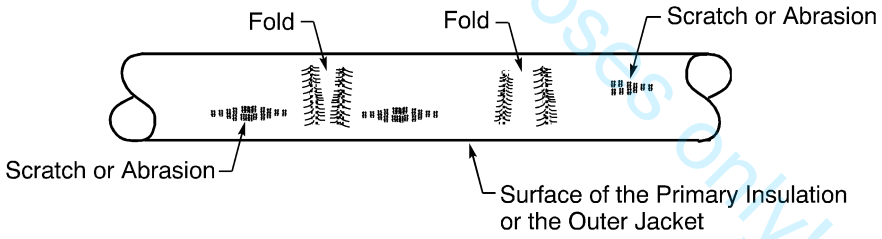
Repair is necessary when these types of damage occur:

- Damage to the conductor; repair with a splice, refer to Subject 20-11-11
- Damage to the shield that is more than 1 inch in length or more than 25 percent of the circumference of the shield; repair with a splice, refer to Subject 20-11-11
- Damage to the shield that is less than 1 inch in length and less than 25 percent of the circumference of the shield; refer to Paragraph 6.C. for the repair of the shield
- Damage to the primary insulation; repair with a splice, refer to Subject 20-11-11
- Damage to the jacket of the cable; refer to Paragraph 3.B. for the repair of the jacket.

Repair is not necessary when these types of damage occur:

- A fold in the jacket or the primary insulation at a bend
- A small scratch on the surface of the jacket or the primary insulation
- Abrasion that makes the surface of the jacket or the primary insulation rough.

Refer to Figure 58.



SERVICEABLE SCRATCHES, FOLDS, AND ABRASION
Figure 58

Q. ARINC 629 S280W651-() Data Bus Cable Assembly

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

Replacement is necessary when a cable, that has four splice assemblies on the same wire, has a damage condition that makes it necessary to repair that wire with a splice again.

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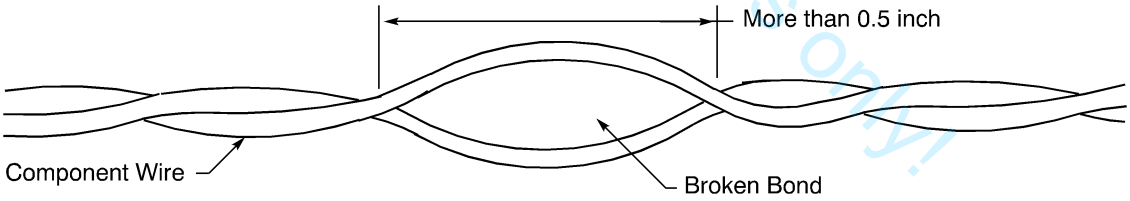
REPAIR OF ELECTRICAL WIRE AND CABLE

Repair of an unshielded cable is necessary when these types of damage occur:

- Damage to the conductor; refer to Subject 20-11-11 for the repair with a splice
- Damage that goes through the primary insulation; refer to Subject 20-11-11 for the repair of the primary insulation of the wire
- Damage that goes into the primary insulation; refer to Subject 20-11-11 for the repair of the primary insulation of a wire
- The bond between the component wires is broken for a distance more than 0.5 inch at a location that is not at a coupler, a suppressor, or a clamp; refer to Figure 59 for the unserviceable condition and Subject 20-11-11 for the repair of the broken bond
- The bond between the overlaps of the tape of the insulation is broken for a length more than 50 percent of the diameter of the wire; refer to Figure 60 for the unserviceable condition and Subject 20-11-11 for the repair of the broken bonds.

Repair of a shielded cable is necessary when these types of damage occur:

- Damage to the conductor; refer to Subject 20-11-11 for the repair with a splice
- Damage to the primary insulation; refer to Subject 20-11-11 for the repair with a splice
- Damage to the shield that is more than 1 inch in length or more than 25 percent of the circumference of the shield; refer to Subject 20-11-11 for the repair with a splice
- Damage to the shield that is less than 1 inch in length and less than 25 percent of the circumference of the shield; refer to Paragraph 6.C. for the repair of the shield
- Damage that goes through the jacket, but the shield has no damage; refer to Paragraph 3.B. for the repair of the jacket
- Damage that goes into the jacket; refer to Paragraph 3.B. for the repair of the jacket
- The bond between the component wires is broken for a distance more than 0.5 inch at a location that is not at a coupler, a suppressor, or a clamp; refer to Figure 59 for the unserviceable condition and Subject 20-11-11 for the repair of the broken bond
- The bond between the overlaps of the tape of the jacket is broken for a length more than 50 percent of the diameter of the wire; refer to Figure 60 for the unserviceable condition and Paragraph 3.C. for the repair of the broken bonds.



UNSERVICEABLE BROKEN BOND OF THE COMPONENT WIRES
Figure 59

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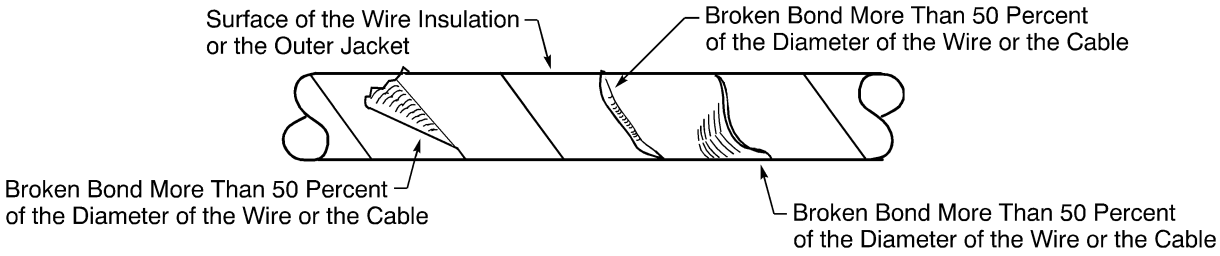
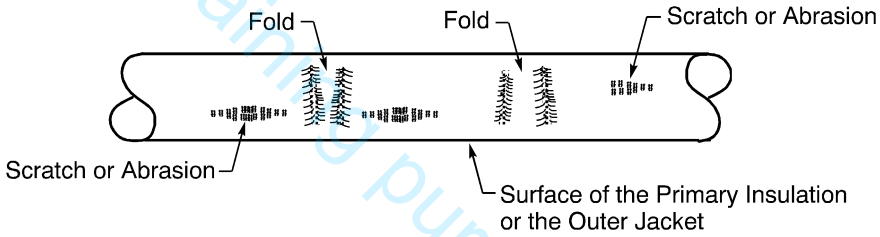


UNSERVICEABLE BROKEN BONDS OF THE TAPE
Figure 60

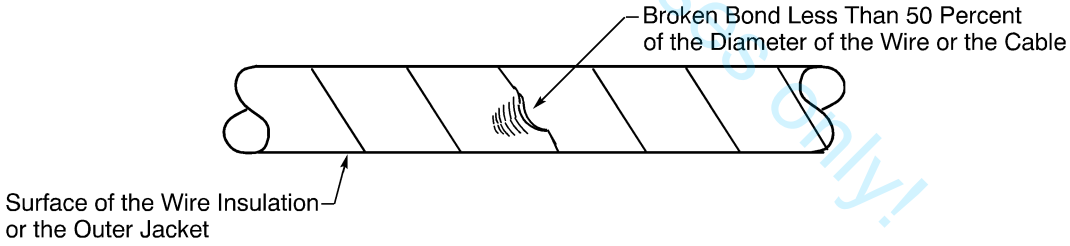
Repair is not necessary when these types of damage occur:

- A fold in the jacket or the primary insulation at a bend
- A small scratch on the surface of the jacket or the primary insulation
- Abrasion that makes the surface of the jacket or the primary insulation rough.

Refer to Figure 61 and Figure 62.



SERVICEABLE SCRATCHES, FOLDS, AND ABRASION
Figure 61



SERVICEABLE BROKEN BONDS
Figure 62

R. Shield Pull Through Shield Ground Wire

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

Repair is necessary when one or more of the strands of the shield conductor are damaged; refer to Figure 63 and Paragraph 8.A.

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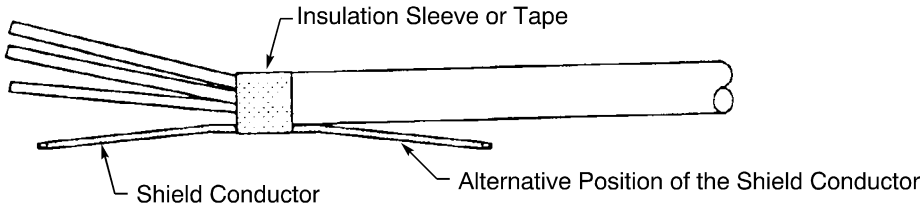


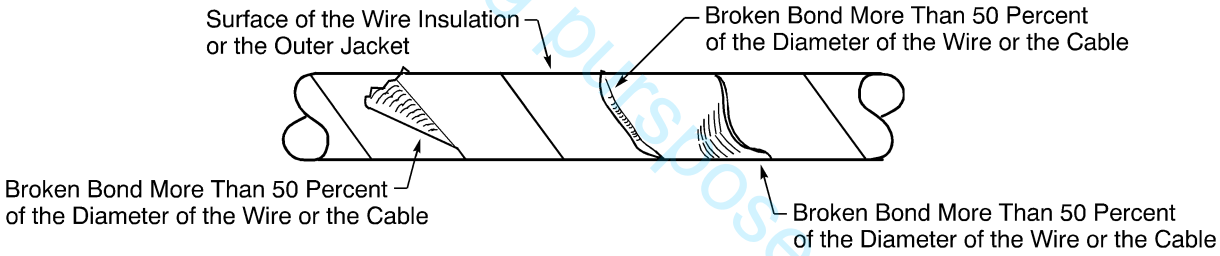
SHIELD PULL THROUGH SHIELD GROUND WIRE
Figure 63

S. Thermocouple Wire

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

Repair is necessary when these types of damage occur:

- Damage to the conductor; refer to Paragraph 10.A.
- Damage that goes through the primary insulation; refer to Paragraph 3.A.
- Damage that goes into the primary insulation; refer to Paragraph 3.A.
- The bond between the overlaps of the tape of the insulation is broken for a length more than 50 percent of the diameter of the wire; refer to Figure 64 and Paragraph 3.C.
- Damage to the insulation of a splice assembly when the conductor splice does not have damage; refer to Paragraph 3.F.



UNSERVICEABLE BROKEN BONDS
Figure 64

Repair is not necessary when these types of damage occur:

- A fold in the insulation at a bend
- A small scratch on the surface of the insulation
- Abrasion that makes the surface of the insulation rough
- The bond between the overlaps of the tape of the insulation is broken for a length that is less than 50 percent of the diameter of the wire.

Refer to Figure 65 and Figure 66.

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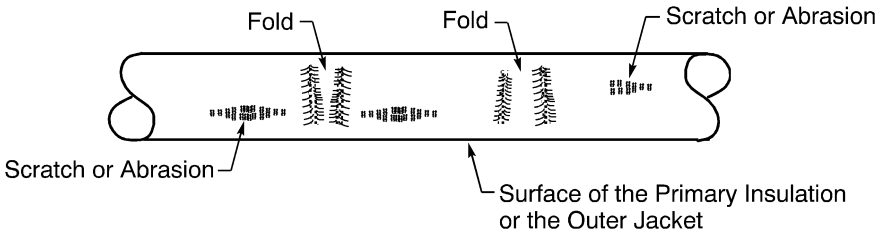
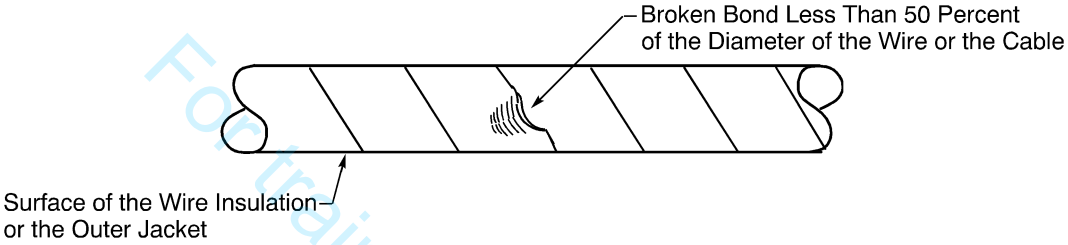


SERVICEABLE SCRATCHES, FOLDS, AND ABRASION
Figure 65



SERVICEABLE BROKEN BONDS
Figure 66

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T. Engine Wire Harness Wire and Cable

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

Refer to Table 3 for the applicable paragraph in this document for the wire and cable damage conditions.

An engine wire harness wire or cable that is repaired with a splice:

- Is a temporary repair
- Must be replaced at a maximum of 500 flight hours subsequent to the repair.

CAUTION: REPLACEMENT OF THE WIRE THAT HAS TEMPORARY REPAIR IS NECESSARY. THE WIRE MUST BE REPLACED AT A MAXIMUM OF 500 FLIGHT HOURS SUBSEQUENT TO THE REPAIR.

U. Fuel System Wiring

Fuel Systems Wiring is specified as a Critical Design Configuration Control Limitation (CDCCL).

WARNING: IT IS MANDATORY THAT THE SPECIFIED REPAIR PROCEDURES ARE OBEYED FULLY.

For the conditions that are applicable for:

- The data in this paragraph, refer to Paragraph 1.A.
- Fuel Quantity Indicator System wiring that is in the fuel tank, refer to Paragraph 2.V.
- Fuel Quantity Indicator System wiring that is not in the fuel tank, refer to Paragraph 2.W.

V. Fuel Quantity Indicator System Wire and Cable that are Installed in a Fuel Tank

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

Fuel Quantity Indicator System Wire and Cable is specified as Critical Design Configuration Limitation (CDCCL).

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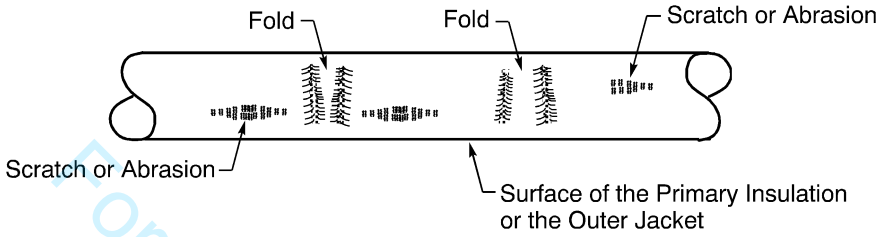
REPAIR OF ELECTRICAL WIRE AND CABLE

WARNING: IT IS MANDATORY THAT THE SPECIFIED REPAIR PROCEDURES ARE OBEYED FULLY.

Repair is not is necessary when these types of damage occur:

Refer to Figure 67.

- A fold in the insulation at a bend
- A small scratch on the surface of the insulation
- Abrasion that makes the surface of the insulation rough.



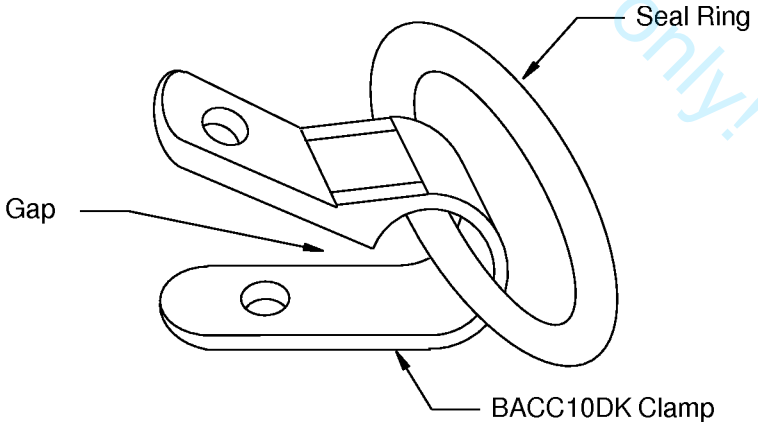
SERVICEABLE SCRATCHES, FOLDS, AND ABRASION
Figure 67

The following conditions are specific to FQIS fuel tank wiring:

- Do not use wire harness ties in fuel tanks
- Do not use tapes or tied-on markers on wire harnesses in fuel tanks
- Do not use washers in fuel tanks
- Do not use 287T0011 clamps in fuel tanks
- Do not use BACS38C rubber straps, BACP20BA filler plugs or Fenwal 35450-1bushings in fuel tanks.

When BACC10DK Clamps are used on the fuel tank wire assembly:

- Use MS29513-012 or MS29513-111 seal rings as filler materials
- When a seal ring is installed in a clamp, make sure that the seal ring is not in the gap, or between the clamp and the mounting surface. Refer to Figure 68.



CORRECT INSTALLATION OF A SEAL RING AS A FILLER IN A BACC10DK CLAMP
Figure 68

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Table 10 gives the damage conditions and repair procedures for the specified fuel quantity indicator system wire and cable that are installed in the fuel tank.

CAUTION: A FQIS CABLE WITH A GREEN OUTER BRAID THAT HAS A TEMPORARY REPAIR MUST BE REPLACED AT A MAXIMUM OF 4000 FLIGHT HOURS SUBSEQUENT TO THE REPAIR.

NOTE: The replacement of the wire or cable is a satisfactory alternative to the repair of the wire or cable.

Table 10
DAMAGE CONDITIONS AND REPAIR PROCEDURES

Fuel Quantity Indicator System	Damage Condition	Repair Condition	Reference
Hi-Z	The conductor has damage	Assembly of a splice	Subject 20-14-12
	The conductor insulation has damage	Assembly of a splice	Subject 20-14-12
	The shield has damage	Assembly of a splice	Subject 20-14-12
	The damage goes through the outer jacket	Assembly of a splice	Subject 20-14-12
	The outer jacket has damage	Assembly of a splice	Subject 20-14-12
	The bond between the overlaps of the tape of the outer jacket is broken	Assembly of a splice	Subject 20-14-12
	The green outer braid has damage, the cable jacket has no damage	Repair of the green outer braid - Permanent Repair	Subject 20-14-12
	The green outer braid has damage less than one inch in length, the cable jacket has no damage	Repair of the green outer braid - Temporary Repair	Subject 20-14-12
Low-Z	The conductor has damage	Assembly of a splice	Subject 20-14-12
	The damage goes through the insulation	Assembly of a splice	Subject 20-14-12
	The insulation has damage	Assembly of a splice	Subject 20-14-12
	The bond between the overlaps of the insulation tape is broken	Assembly of a splice	Subject 20-14-12
	The green outer braid has damage, the cable jacket has no damage	Repair of the green outer braid - Permanent Repair	Subject 20-14-12
	The green outer braid has damage less than one inch in length, the cable jacket has no damage	Repair of the green outer braid - Temporary Repair	Subject 20-14-12

W. Fuel Quantity Indicator System Wire and Cable that are not Installed in a Fuel Tank

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

Fuel Quantity Indicator System Wire and Cable is specified as Critical Design Configuration Limitation (CDCCL).

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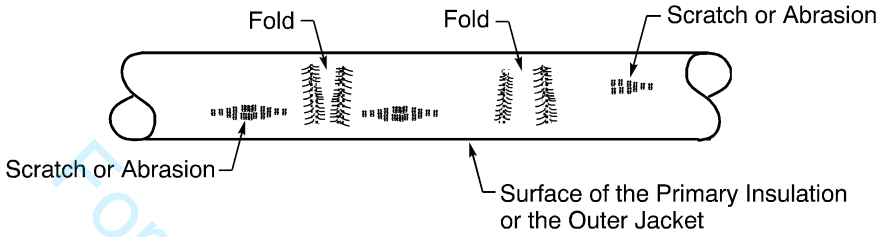
REPAIR OF ELECTRICAL WIRE AND CABLE

WARNING: IT IS MANDATORY THAT THE SPECIFIED REPAIR PROCEDURES ARE OBEYED FULLY.

Repair not is necessary when these types of damage occur:

Refer to Figure 69.

- A fold in the insulation at a bend
- A small scratch on the surface of the insulation
- Abrasion that makes the surface of the insulation rough.



SERVICEABLE SCRATCHES, FOLDS, AND ABRASION
Figure 69

Table 11 gives the damage conditions and repair procedures for the specified fuel quantity indicator system wire and cable that is external to the fuel tank.

NOTE: The replacement of the wire or cable is a satisfactory alternative to the repair of the wire or cable.

Table 11
DAMAGE CONDITIONS AND REPAIR PROCEDURES

Wire or Cable	Damage Condition	Applicable Condition	Repair Procedure
BMS13-60T27	Damage to the inner jacket	Fuel Vapor	Paragraph 5.C.
		No Fuel Vapor	Paragraph 5.C.
			Paragraph 5.D.
	Damage to the outer shield is more than 1 inch in length, or more than 25 percent of the circumference of the shield	Fuel Vapor	Paragraph 5.C.
		No Fuel Vapor	Paragraph 5.C.
			Paragraph 5.D.
	Damage to the shield is less than 1 inch in length and less than 25 percent of the circumference of the shield	Fuel Vapor	Paragraph 6.C.
		No Fuel Vapor	Paragraph 6.C.
	Damage goes into or through the outer jacket, but the outer shield has no damage	Fuel Vapor	Paragraph 3.B.
		No Fuel Vapor	Paragraph 3.B.

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Table 11 (continued)

Wire or Cable	Damage Condition	Applicable Condition	Repair Procedure
BMS13-48T12	Damage to the inner jacket	Fuel Vapor	Paragraph 5.C.
		No Fuel Vapor	Paragraph 5.C.
			Paragraph 5.D.
	Damage to the outer shield is more than 1 inch in length, or more than 25 percent of the circumference of the shield	Fuel Vapor	Paragraph 5.C.
		No Fuel Vapor	Paragraph 5.C.
			Paragraph 5.D.
	Damage to the shield is less than 1 inch in length and less than 25 percent of the circumference of the shield	Fuel Vapor	Paragraph 6.C.
		No Fuel Vapor	Paragraph 6.C.
	Damage goes into or through the outer jacket, but the outer shield has no damage	Fuel Vapor	Paragraph 3.B.
		No Fuel Vapor	Paragraph 3.B.
10-60816-61	Damage to the inner jacket	Fuel Vapor	Paragraph 5.C.
		No Fuel Vapor	Paragraph 5.C.
			Paragraph 5.D.
	Damage to the outer shield is more than 1 inch in length, or more than 25 percent of the circumference of the shield	Fuel Vapor	Paragraph 5.C.
		No Fuel Vapor	Paragraph 5.C.
			Paragraph 5.D.
	Damage to the outer shield is less than 1 inch in length and less than 25 percent of the circumference of the shield	Fuel Vapor	Paragraph 6.C.
		No Fuel Vapor	Paragraph 6.C.
	Damage goes into or through the outer jacket, but the outer shield has no damage	Fuel Vapor	Paragraph 3.B.
		No Fuel Vapor	Paragraph 3.B.

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Table 11 (continued)

Wire or Cable	Damage Condition	Applicable Condition	Repair Procedure
55A6087-20	Damage to the inner jacket	Fuel Vapor	Paragraph 5.C.
		No Fuel Vapor	Paragraph 5.C.
			Paragraph 5.D.
			Paragraph 11.B.
	Damage to the outer shield is more than 1 inch in length, or more than 25 percent of the circumference of the shield	Fuel Vapor	Paragraph 5.C.
		No Fuel Vapor	Paragraph 5.C.
			Paragraph 5.D.
			Paragraph 11.B.
	Damage to the outer shield is less than 1 inch in length and less than 25 percent of the circumference of the shield	Fuel Vapor	Paragraph 6.C.
		No Fuel Vapor	Paragraph 6.C.
	Damage goes through the outer jacket, but the outer shield has no damage	Fuel Vapor	Paragraph 3.B.
		No Fuel Vapor	Paragraph 3.B.
	Damage goes into the outer jacket	Fuel Vapor	Paragraph 3.B.
			Paragraph 11.A.
		No Fuel Vapor	Paragraph 3.B.
			Paragraph 11.A.

Table 12
APPROVED SUPPLIERS FOR FQIS WIRE AND CABLE

Wire or Cable	Supplier
BMS13-60T27C01G20	Tensolite
10-60816-61	Tensolite
	Thermax
55A6087-20	Raychem

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X. Overheated or Arcing Wire

Remove the terminal and inspect the wire insulation and conductor for damage. Damage from arcing could include:

- overheated insulation
- discoloration of the insulation
- pits in the insulation
- hardened insulation
- blackened or charred insulation
- damage to the conductor from too much heat.

For the damage and repair conditions for unshielded wires, refer to:

- Paragraph 1.A.
- Paragraph 1.B.
- Paragraph 2.A.
- Paragraph 3.A..

If the wire has damage, remove the damaged length of wire.

If the wire has sufficient length to terminate the wire after the damaged length is removed, assemble a new terminal lug on the wire. Refer to Subject 20-30-11.

If the wire does not have the sufficient length to install a new termination, repair the wire with a splice, or replace the wire.

To repair the wire with a splice:

- Make a selection of a new length of wire that has the same type (specification) and size (AWG). Refer to Subject 20-00-14
- Assemble the splice. Refer to Subject 20-30-12
- Assemble the terminal lug on the end of the wires. Refer to Subject 20-30-11.

Y. BMS 13-51 Wire that has Missing Topcoat

NOTE: The white or yellow topcoat on BMS13-51 wire:

- Is not a part of the primary wire insulation
- Is intended to provide a wire color for the contrast of the wire mark
- Can be repaired for cosmetic purposes.

Table 13
BMS13-51 DAMAGE AND REPAIR CONDITIONS

Damage Condition	Neccessary Action	Reference
Topcoat is missing or has damage	No action is necessary. Topcoat can be replaced.	You can refer to Step (1) thru Step (9) below for the procedure for the cosmetic repair of the missing topcoat.
Underlying polyimide tape wrapped insulation layer has damage	Wire must be repaired or replaced.	Refer to Paragraph 1.A.

If the underlying polyimide tape wrapped insulation layer has damage, repair or replace the wire. Refer to Paragraph 1.A..

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Cosmetic Repair of Missing Topcoat:

NOTE: This procedure:

- Is for cosmetic purposes only
- Is not necessary
- Does not improve the integrity of the wire.

Table 14
MATERIALS

Material	Part Number	Description	Supplier
Solvent	-	Isopropyl Alcohol	Refer to Subject 20-00-11
Topcoat, Polymer, Brush, for wire repair	1599-1	-	Imitec
Acid Resistant Brush	-	-	An available source

(1) From Table 14, make a selection of:
- A solvent
- An acid resistant brush
- A topcoat material.

(2) Remove the loose topcoat material from the wire.

Make sure that you do not cause damage to the underlying polyimide tape wrapped insulation layers.

(3) Use the solvent to clean the area of the wire that will be repaired.

(4) Allow the cleaned area to dry.

(5) Use the brush to apply the topcoat material on the wire.

(6) Allow a minimum of 5 minutes for the topcoat material to dry.

(7) It is permitted to apply a second layer of the topcoat material.

(8) If a second layer is applied, allow a minimum of 5 minutes for the topcoat material to dry.

(9) If it is necessary, refer to Subject 20-10-11 for the procedures to mark the wire.

3. REPAIR OF THE INSULATION OF WIRE AND CABLE

A. Repair of the Primary Insulation of a Wire

Refer to:
- Paragraph 1.B. for the applicable conditions for the repair of wire
- Paragraph 2. for the damage and repair conditions for the wire that must have a repair.

(1) Remove loose pieces of insulation and rough edges at the area of the damage.

Make sure that the insulation has a smooth surface.

(2) Clean the insulation with isopropyl alcohol. Refer to Figure 70.

Make sure:
- To clean the damaged area of the insulation
- To clean the insulation approximately 3 inches on each side of the damage
- That the cleaned area is dry.

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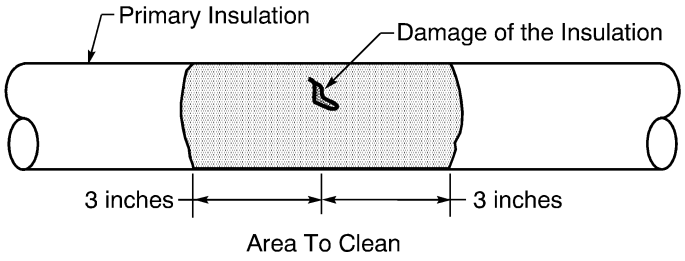


AREA TO CLEAN
Figure 70

(3) If the damage is a cavity in the insulation, fill in the cavity.

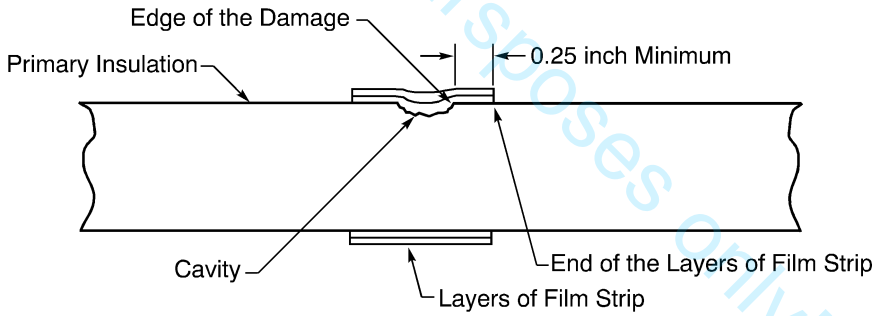
(a) Make a selection of a Temperature Grade D film strip from Table 6.

NOTE: A Temperature Grade D TFE tape from Table 6 is a satisfactory alternative to the film strip.

(b) Wind the necessary layers of film strip on the insulation to fill the cavity and make a smooth surface. Refer to Figure 71.

Make sure that each layer of film strip:

- Extends a minimum of 0.25 inch farther than each end of the damaged area
- Makes a 50 percent minimum circumferential overlap
- Is wound a minimum of two times on the insulation
- Is wound in the opposite direction of the layer before.



CAVITY FILLED WITH FILM STRIP
Figure 71

(4) Make a selection of one of these tapes from Table 6:

- Temperature Grade D TFE tape
- Temperature Grade C silicone tape.

Make sure that the tape has a temperature grade that is applicable for the location at the wire installation.

NOTE: A heat shrinkable sleeve is a satisfactory alternative to the tape.

Make sure that the heat shrinkable sleeve has a temperature grade that is applicable for the location at the wire installation.

(5) Wind two layers of the tape on the damaged area. Refer to Figure 72.

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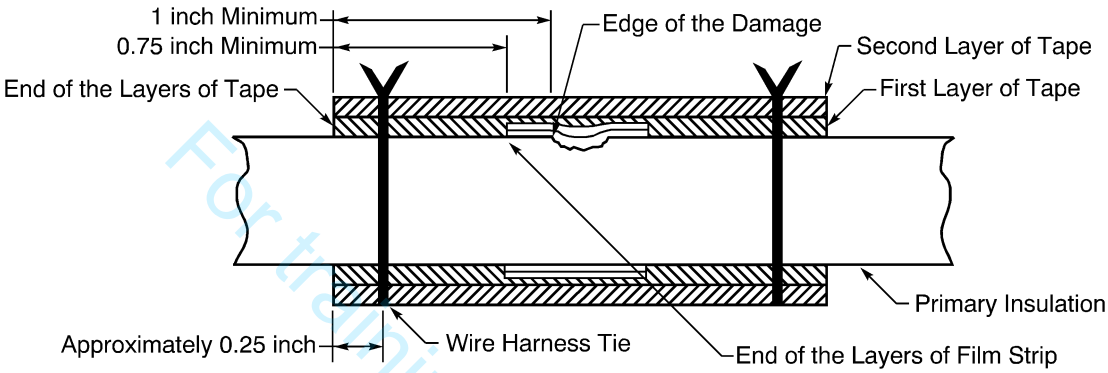
Make sure that:

- If film strip is used to fill the cavity, each end of the tape extends a minimum of 0.75 inch farther than each end of the film strip
- Each end of the tape extends a minimum of 1 inch farther than each end of the damaged area
- Each layer of tape makes a 50 percent minimum circumferential overlap
- Each layer of tape is wound a minimum of two times on the wire
- The second layer of tape is wound in the opposite direction of the first layer.



TAPE AND WIRE HARNESS TIES ON THE INSULATION WITH DAMAGE
Figure 72

(6) Assemble a lacing tape wire harness tie on each end of the repair approximately 0.25 inch from the end of the tape.

Make sure that the lacing tape is the correct Temperature Grade.

Refer to:

- Figure 72
- Subject 20-10-11 for the procedure to assemble a wire harness tie.

B. Repair of the Outer Jacket of a Cable

Refer to:

- Refer to Paragraph 1.B. for the applicable conditions for the repair of cable
- Paragraph 2. for the damage and repair conditions for the cable that must have a repair.

(1) Make a selection of one of these tapes from Table 6:

- Temperature Grade D TFE tape
- Temperature Grade C silicone tape.

Make sure that the tape has a temperature grade that is applicable for the location at the wire installation.

NOTE: A heat shrinkable sleeve is a satisfactory alternative to the tape.

Make sure that the heat shrinkable sleeve has a temperature grade that is applicable for the location at the wire installation.

(2) Remove loose pieces of insulation and rough edges at the area of the damage.

Make sure that the insulation has a smooth surface.

(3) Clean the outer jacket with isopropyl alcohol. Refer to Figure 73.

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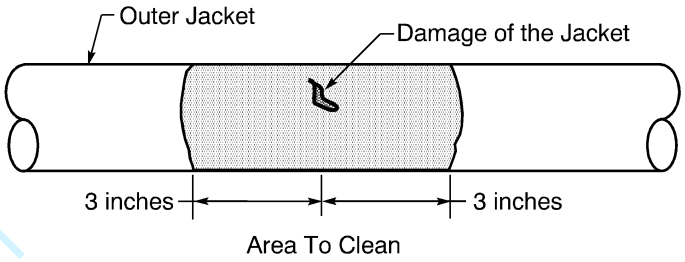
Make sure:

- To clean the damaged area of the outer jacket
- To clean the outer jacket approximately 3 inches on each side of the damage
- That the cleaned area is dry.

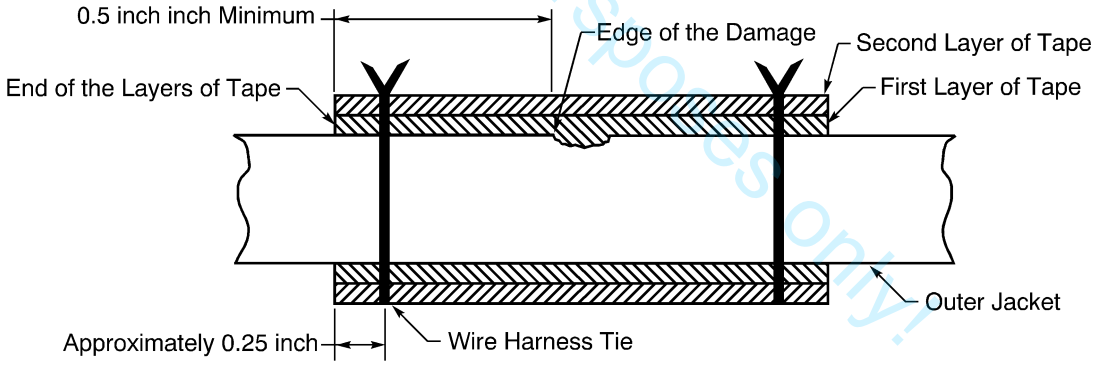


AREA TO CLEAN
Figure 73

(4) Wind two layers of the tape on the damaged area. Refer to Figure 74.

Make sure that:

- Each end of the tape extends a minimum of 0.5 inch farther than each end of the damaged area
- Each layer of tape makes a 50 percent minimum circumferential overlap
- Each layer of tape is wound a minimum of two times on the cable
- The second layer of tape is wound in the opposite direction of the first layer.



TAPE AND WIRE HARNESS TIES ON THE CABLE
Figure 74

(5) Assemble a lacing tape wire harness tie on each end of the repair approximately 0.25 inch from the end of the tape.

Make sure that the lacing tape is the correct Temperature Grade.

Refer to:

- Figure 74
- Subject 20-10-11 for the procedure to assemble a wire harness tie.

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C. Repair of a Broken Bond Between Overlaps in the Primary Insulation and Outer Jacket

Refer to:

- Paragraph 1.B. for the applicable conditions for the repair of wire and cable
- Paragraph 2. for the damage and repair conditions for the wire or the cable that must have a repair.

(1) Make a selection of one of these insulation materials from Table 6:

- Temperature Grade D TFE tape
- Temperature Grade D film strip
- Temperature Grade C silicone tape.

Make sure that the insulation material is the correct Temperature Grade.

NOTE: A heat shrinkable sleeve is a satisfactory alternative to the tape.

Make sure that the heat shrinkable sleeve material is the correct Temperature Grade.

(2) Remove loose pieces of insulation and rough edges at the area of the broken bond.

Make sure that the insulation has a smooth surface.

(3) Clean the insulation with isopropyl alcohol.

Make sure:

- To clean the damaged area of the insulation
- To clean the insulation approximately 3 inches on each side of damage
- That the cleaned area is dry.

(4) Wind two layers of the insulation material on the wire.

Make sure that:

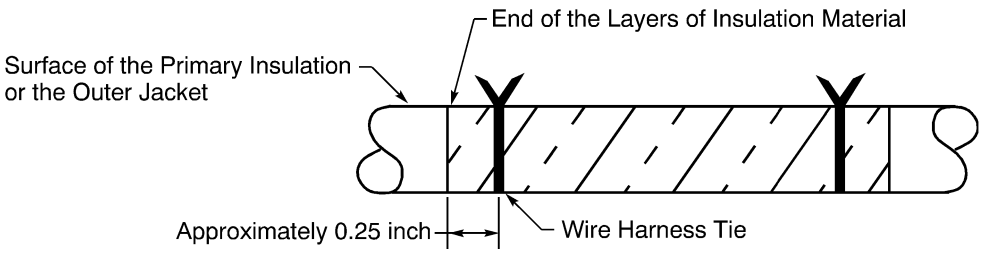
- Each end of the insulation material extends a minimum of 1 inch farther than each end of the damaged area
- Each layer makes a 50 percent minimum circumferential overlap
- Each layer is wound a minimum of two times on the wire
- The second layer of tape is wound in the opposite direction of the first layer.

(5) Assemble a lacing tape wire harness tie on each end of the repair approximately 0.25 inch from the end of the insulation material.

Make sure that the lacing tape is the correct Temperature Grade.

Refer to:

- Figure 75
- Subject 20-10-11 for the procedure to assemble a wire harness tie.



LOCATION OF WIRE HARNESS TIES
Figure 75

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D. Repair of the Primary Insulation of a Wire in a Cable

Refer to Paragraph 1.B. for the applicable conditions for the repair of wire and cable.

(1) Make a selection of a Temperature Grade D film strip from Table 6.

NOTE: A Temperature Grade D TFE tape from Table 6 is a satisfactory alternative to the film strip.

(2) Make a selection of one of these tapes from Table 6:

- Temperature Grade D TFE tape
- Temperature Grade C silicone tape.

Make sure that the tape has a temperature grade that is applicable for the location at the wire installation.

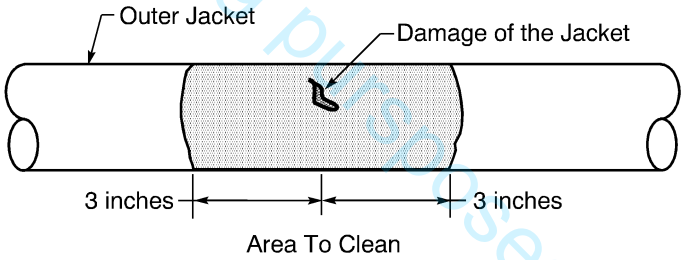
(3) Remove loose pieces of insulation and rough edges at the area of the damage.

Make sure that the insulation has a smooth surface.

(4) Clean the jacket with isopropyl alcohol. Refer to Figure 76.

Make sure:

- To clean the damaged area of the jacket
- To clean the jacket from the damaged area to a minimum of 3 inches on each side of the damage
- That the cleaned area is dry.



AREA TO CLEAN
Figure 76

(5) Remove the necessary length of the jacket on each side of the damage.

Make sure a sufficient length is removed to repair the wires in the cable.

CAUTION: DO NOT CUT THE PRIMARY INSULATION ON THE WIRES IN THE CABLE WHEN THE LENGTH OF THE JACKET IS REMOVED. DAMAGE CAN CAUSE UNSATISFACTORY PERFORMANCE OF THE SYSTEM.

(6) Repair the primary insulation of each wire with damage. Refer to Paragraph 3.A.

(7) Wind the necessary layers of film strip on the cable to fill the cavity where the jacket is removed and to make a smooth surface. Refer to Figure 77.

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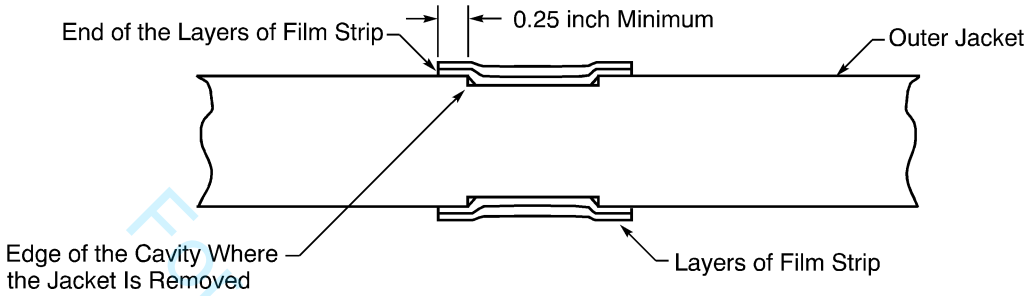
Make sure that each layer of film strip:

- Makes an overlap of 0.25 inch minimum on each end of the outer jacket
- Makes a 50 percent minimum circumferential overlap
- Is wound a minimum of two times on the cable
- Is wound in the opposite direction of the layer before.

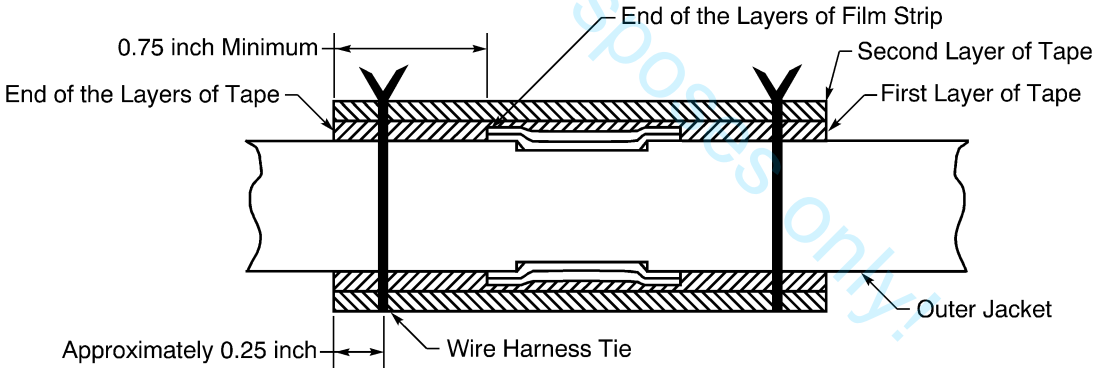


FILM STRIP ON THE CABLE
Figure 77

(8) Put two layers of the tape on the damage. Refer to Figure 78.

Make sure that:

- Each end of the tape extends a minimum of 0.75 inch from each end of the film strip
- Each layer makes a 50 percent circumferential overlap
- The second layer of tape is in the opposite direction of the first layer.



TAPE AND WIRE HARNESS TIES ON THE CABLE
Figure 78

(9) Assemble a lacing tape wire harness tie on each end of the repair approximately 0.25 inch from the end of the tape.

Make sure that the lacing tape is the correct Temperature Grade.

Refer to:

- Figure 78
- Subject 20-10-11 for the procedure to assemble a wire harness tie.

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E. Repair of a Non-Metallic Braid

Refer to Paragraph 1.B. for the applicable conditions for the repair of wire and cable.

(1) Make a selection of one of these tapes from Table 6:
- Temperature Grade C or D TFE tape
- Temperature Grade C silicone tape
- Temperature Grade A polyester tape.

Make sure that the tape has a temperature grade that is applicable for the location at the wire installation.

(2) Make a selection of a coating material from Table 8.

(3) Prepare the end of the braid:

(a) Cut the ends of the damaged area of the braid.

Make sure that the ends of the braid are smooth and straight.

(b) Apply a layer of the varnish on the end of the braid.

(c) Cure the varnish at room temperature.

(4) If it is necessary, do Step (3) again.

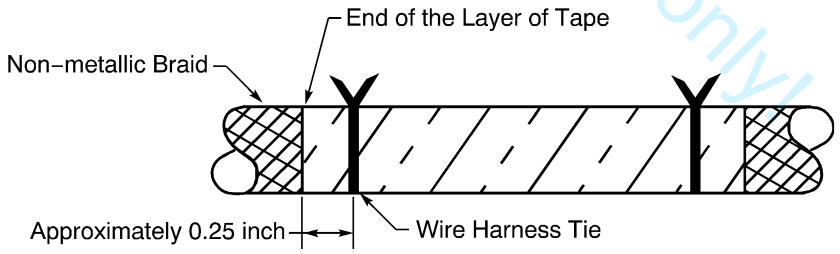
(5) Wind a layer of the tape on the damaged area of the wire or cable.

Make sure that:
- Each end of the tape extends a minimum of 0.75 inch farther than each end of the damaged area
- The tape makes a 50 percent circumferential overlap.

(6) Assemble a lacing tape wire harness tie on each end of the repair approximately 0.25 inch from the end of the tape.

Make sure that the lacing tape is the correct Temperature Grade.

Refer to:
- Figure 79
- Subject 20-10-11 for the procedure to assemble a wire harness tie.



TAPE AND WIRE HARNESS TIE ON THE WIRE OR CABLE
Figure 79

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F. Repair of the Insulation of a Splice Assembly

For the damage and repair conditions that are applicable for:

- Wire and cable, refer to Paragraph 1.B.
- A splice assembly, refer to Paragraph 1.F.

(1) Make a selection of a Temperature Grade C silicone tape from Table 6.

Make sure that the tape has a temperature grade that is applicable for the location at the wire installation.

(2) Remove loose pieces of insulation and rough edges at the area of the damage.

Make sure that the insulation has a smooth surface.

(3) Clean the insulation of the splice assembly and the insulation of the wire or cable with isopropyl alcohol.

Make sure:

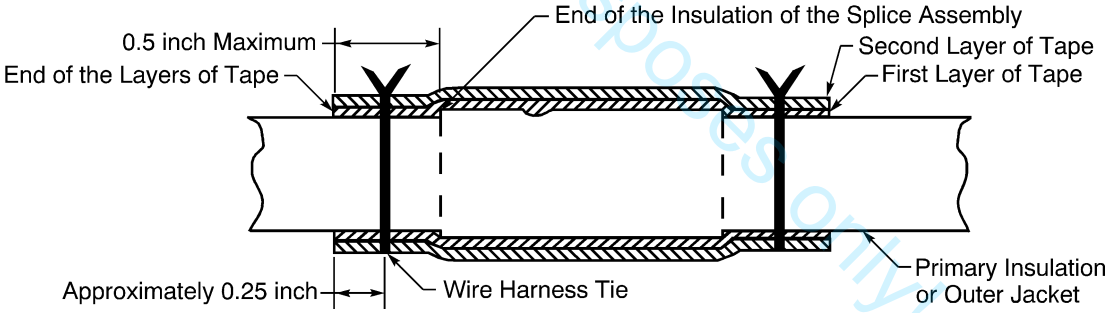
- To clean all of the insulation of the splice
- To clean the insulation of the wire or cable a minimum of 1 inch farther than each end of the splice.

(4) Let the cleaned areas dry.

(5) Wind a minimum of two layers of tape on the splice. Refer to Figure 80.

Make sure that each layer of tape:

- Extends a minimum of 0.5 inch farther than each end of the splice
- The tape makes 50 percent circumferential overlap
- The second layer of tape is in the opposite direction of the first layer.



POSITION OF THE TAPE AND THE WIRE HARNESS TIES
Figure 80

(6) Assemble a lacing tape wire harness tie on each end of the repair approximately 0.25 inch from the end of the tape.

Make sure that the lacing tape is the correct Temperature Grade.

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Refer to:

- Figure 80
- Subject 20-10-11 for the procedure to assemble a wire harness tie.

4. REPAIR OF UNSHIELDED WIRE AND UNSHIELDED CABLE WITH A SPLICE ASSEMBLY

A. Repair of a Wire

Refer to Paragraph 1.E. for the applicable conditions for the repair of wire with a splice.

(1) Remove the damaged length of the wire.

(a) On one side of the damage, cut the wire.

Make sure that the end of the wire is perpendicular to the longitudinal axis of the wire.

(b) On the other side of the damage, cut the wire.

Make sure that the end of the wire is perpendicular to the longitudinal axis of the wire.

(2) Clean the insulation with isopropyl alcohol.

Make sure:

- To clean the area of the insulation from the end of each wire to a minimum of 3 inches from the end
- That the cleaned area is dry.

(3) Assemble a sealed splice.

For the splice of:

- An AWG 8 or larger high temperature wire, refer to Subject 20-30-13
- All other wires, refer to Subject 20-30-12 for the selection of a sealed splice configuration.

Make sure that the configuration is applicable for the wire.

B. Repair of a Cable

Refer to Paragraph 1.E. for the applicable conditions for the repair of cable with a splice.

(1) Remove the damaged length of the cable.

(a) On one side of the damage, cut the cable.

Make sure that the end of the cable is perpendicular to the longitudinal axis of the cable.

(b) On the other side of the damage, cut the cable.

Make sure that the end of the cable is perpendicular to the longitudinal axis of the cable.

(2) Clean the jacket with isopropyl alcohol.

Make sure:

- To clean the area of the jacket from the end of each cable to a minimum of 3 inches from the end
- That the cleaned area is dry.

(3) Assemble a sealed splice.

Refer to the selection of a sealed splice configuration in Subject 20-30-12.

Make sure that the configuration is applicable for the cable.

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5. REPAIR OF SHIELDED WIRE AND SHIELDED CABLE WITH A SPLICE ASSEMBLY

A. Repair of a Shielded Wire with a Splice Assembly

Refer to Paragraph 1.E. for the applicable conditions for the repair of wire with a splice.

(1) Remove the damaged length of the shielded wire.

(a) On one side of the damage, cut the shielded wire.

Make sure that the end of the shielded wire is perpendicular to the longitudinal axis of the wire.

(b) On the other side of the damage, cut the shielded wire.

Make sure that the end of the shielded wire is perpendicular to the longitudinal axis of the wire.

(2) Clean the jacket with isopropyl alcohol.

Make sure:

- To clean the area from the end of each wire to a minimum of 3 inches from the end.
- That the cleaned area is dry.

(3) Assemble a sealed splice.

Refer to the selection of a sealed splice configuration in Subject 20-30-12.

Make sure that the configuration is applicable for the shielded wire.

B. Repair of a Shielded Wire with a Splice Assembly - Two Adjacent Shields

Refer to Paragraph 1.E. for the applicable conditions for the repair of wire with a splice.

(1) Remove the damaged length of the shielded wire.

(a) On one side of the damage, cut the shielded wire.

Make sure that the end of the shielded wire is perpendicular to the longitudinal axis of the wire.

(b) On the other side of the damage, cut the shielded wire.

Make sure that the end of the shielded wire is perpendicular to the longitudinal axis of the wire.

(2) Clean the outer jacket with isopropyl alcohol.

Make sure:

- To clean the area from the end of each wire to a minimum of 3 inches from the end.
- That the cleaned area is dry.

(3) Assemble a sealed splice.

Refer to the selection of a sealed splice configuration in Subject 20-30-12.

Make sure that the configuration is applicable for the shielded wire.

C. Repair of a Shielded Wire with a Splice Assembly in a Fuel Vapor Area - Two Round Conductor Shields That Are Not Adjacent

Refer to Paragraph 1.E. for the applicable conditions for the repair of wire with a splice.

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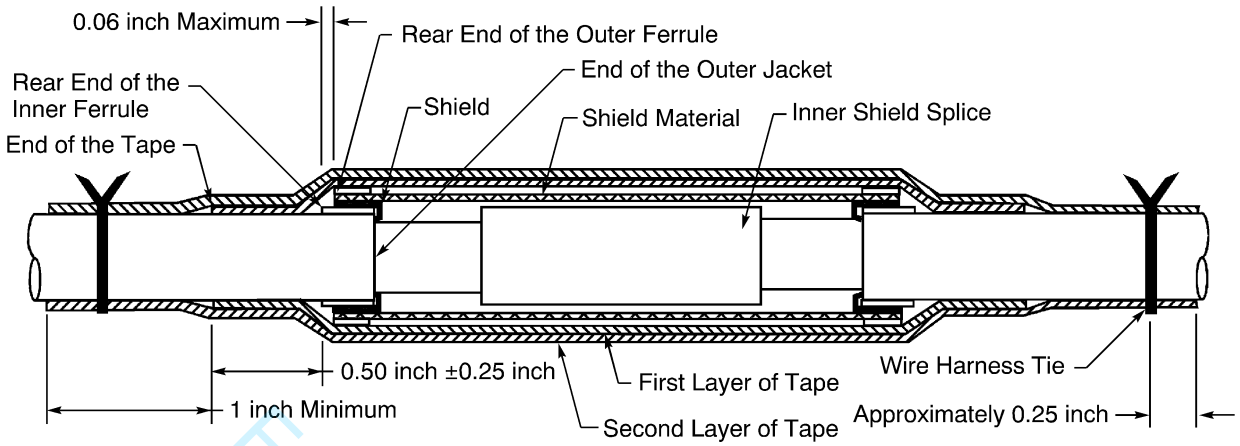


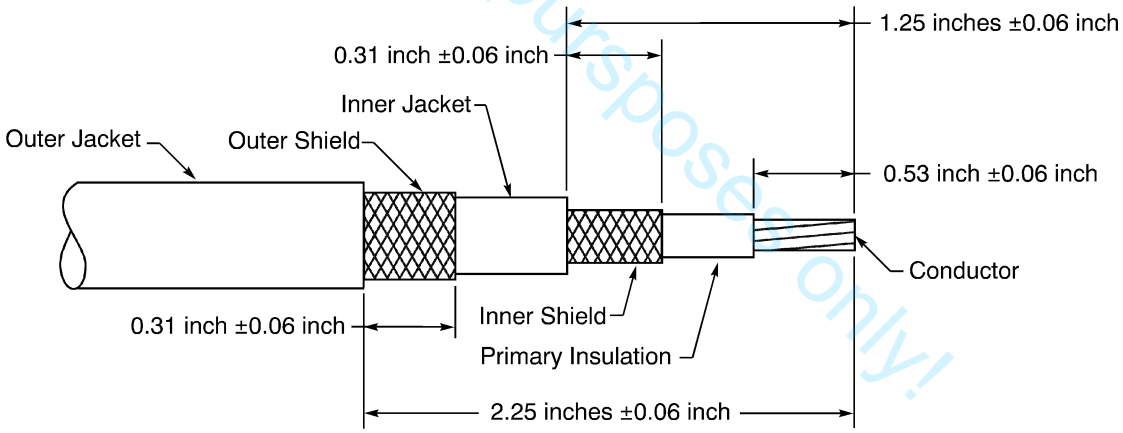
CONFIGURATION OF THE SPLICE ASSEMBLY
Figure 81

Refer to Figure 81.

(1) Prepare each end of the shielded wire.

Refer to:

- Figure 82
- Subject 20-00-15 for the outer jacket and insulation removal procedures.



SHIELDED WIRE PREPARATION
Figure 82

(a) Remove 2.25 inches ±0.06 inch of the outer jacket from the end of the wire.

(b) Remove the necessary length of the outer shield from the end of the wire.

Make sure that the distance between the end of the outer jacket and the end of the outer shield is 0.31 inch ±0.06 inch.

(c) Remove 1.25 inch ±0.06 inch of the inner jacket from the end of the wire.

(d) Remove the necessary length of the inner shield from the end of the wire.

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Make sure that the distance between the end of the inner jacket and the end of the inner shield is 0.31 inch ±0.06 inch.

(e) Remove 0.53 inch ±0.06 inch of the primary insulation from the end of the wire.

(2) Make a selection of a shield material for the outer shield from Table 9.

Make sure that the shield material has:

- The applicable Temperature Grade
- The smallest diameter that can go on the folded back outer shield of the wire.

NOTE: For alternative shield materials, refer to Subject 20-00-11.

(3) Cut a 5.5 inch ±0.1 inch length of the shield material for the outer shield.

(4) Make a selection of a shield material for the inner shield from Table 9.

Make sure that the shield material has:

- The applicable Temperature Grade
- The smallest diameter that can go on the folded back inner shield of the wire.

NOTE: For alternative shield materials, refer to Subject 20-00-11.

(5) Cut a 3.5 inch ±0.1 inch length of the shield material for the inner shield.

(6) Make a selection of two sets of inner ferrules and outer ferrules for the outer shield. Refer to Subject 20-30-12.

Make sure that:

- The ferrules have the applicable Temperature Grade
- The inner ferrule is the smallest ferrule that can move freely on the outer jacket
- The outer ferrule is the smallest ferrule that can move freely on the inner ferrule, the folded back outer shield, and the shield material.

(7) Put one inner ferrule on the outer jacket of each wire.

(8) Put the shield material for the outer shield on the outer jacket of one wire.

NOTE: If it is necessary, the strands at the end of the shield material can be moved apart to make it easier to put the shield material on the wire.

(9) Put the 2 outer ferrules on the shield material for the outer shield.

(10) Make a selection of two sets of Temperature Grade D inner ferrules and outer ferrules for the inner shield. Refer to Subject 20-30-12.

Make sure that:

- The inner ferrule is the smallest ferrule that can move freely on the inner jacket
- The outer ferrule is the smallest ferrule that can move freely on the inner ferrule, the folded back inner shield, and the shield material.

(11) Put one inner ferrule on the inner jacket of each wire.

(12) Put the shield material for the inner shield on the inner jacket of one wire.

NOTE: If it is necessary, the strands at the end of the shield material can be moved apart to make it easier to put the shield material on the wire.

(13) Put the two outer ferrules on the shield material for the inner shield.

(14) Make a selection of an applicable butt splice assembly configuration for a wire. Refer to Subject 20-30-12.

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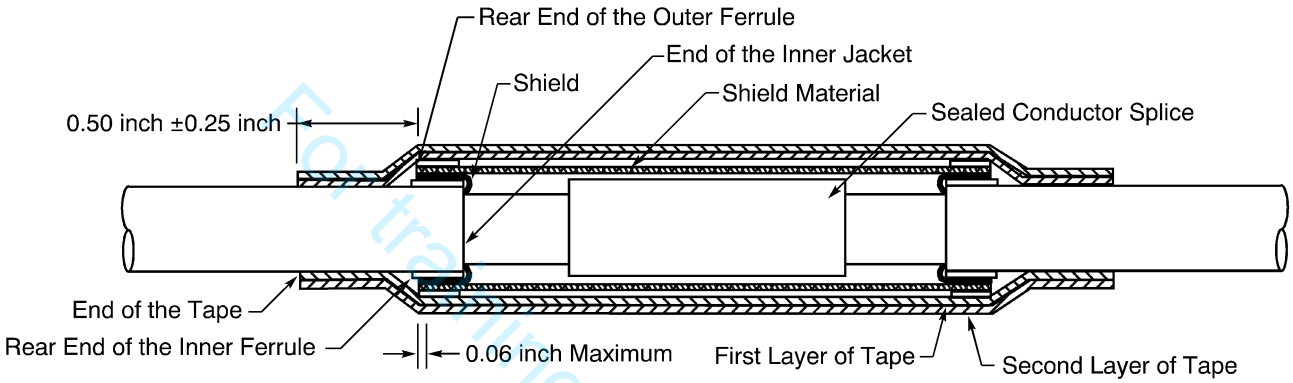
(15) Assemble the splice of the wire. Refer to the assembly procedure for the butt splice assembly configuration.

Make sure to cut the conductor to the correct length specified in the assembly procedure for the splice.

(16) Make a selection of the necessary ferrule crimp tools for the outer and inner shield splice. Refer to Subject 20-30-12.

(17) Assemble the end of the inner shield splice opposite the end with the shield material. Refer to Figure 83.



CONFIGURATION OF THE INNER SHIELD SPLICE ASSEMBLY
Figure 83

(a) Move the strands of the shield apart and make them straight.

(b) Align the forward end of the inner ferrule with the end of the inner jacket.

(c) Fold the strands of the shield back on the inner ferrule.

Make sure that the strands of the shield are symmetrical around the circumference of the ferrule.

(d) Align the end of the shield material with the end of the strands of the shield that are folded back.

(e) Align the rear end of the outer ferrule with the rear end of the inner ferrule.

Make sure that:

- The outer ferrule goes around the shield material
- The rear end of the outer ferrule does not extend farther than the rear end of the inner ferrule
- The rear end of the outer ferrule is a maximum of 0.06 inch from the rear end of the inner ferrule.

(f) Crimp the ferrules.

(18) Do Step (17) again to assemble the other end of the inner shield splice. Refer to Figure 83.

Make sure that the shield material is pulled tight before the ferrules are crimped.

(19) Remove the shield and the shield material that extend farther than the rear end of the inner ferrule on each end of the inner shield splice.

(20) Make a selection of an insulation tape from Table 6.

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Make sure that the tape has a temperature grade that is applicable for the location at the wire installation.

(21) Put insulation tape on the inner shield splice. Refer to Figure 83.

(a) Tightly wind a layer of the tape on the splice assembly.

Make sure that the layer of tape:

- Starts 0.50 inch ±0.25 inch farther than the rear end of the ferrule at one end of the splice
- Stops 0.50 inch ±0.25 inch farther than the rear end of the ferrule at the other end of the splice
- Makes a 50 percent overlap.

(b) Tightly wind a second layer of the tape on the splice assembly.

Make sure that the layer of tape:

- Starts where the first layer of tape stops
- Stops where the first layer of tape starts
- Makes a 50 percent overlap.

(22) Assemble the end of the outer shield splice opposite the end with the shield material.

(a) Move the strands of the shield apart and make them straight.

(b) Align the forward end of the inner ferrule with the end of the inner jacket.

(c) Fold the strands of the shield back on the inner ferrule.

Make sure that the strands of the shield are symmetrical around the circumference of the ferrule.

(d) Align the end of the shield material with the end of the strands of the shield that are folded back.

(e) Align the rear end of the outer ferrule with the rear end of the inner ferrule.

Make sure that:

- The outer ferrule goes around the shield material
- The rear end of the outer ferrule does not extend farther than the rear end of the inner ferrule
- The rear end of the outer ferrule is a maximum of 0.06 inch from the rear end of the inner ferrule.

(f) Crimp the ferrules.

(23) Do Step (22) again to assemble the other end of the outer shield splice.

Make sure that the shield material is pulled tight before the ferrules are crimped.

(24) Remove the shield and the shield material that extend farther than the rear end of the inner ferrule on each end of the outer shield splice.

(25) Put insulation tape on the outer shield splice.

(a) Tightly wind a layer of the tape on the splice assembly.

Make sure that the layer of tape:

- Starts 0.50 inch ±0.25 inch farther than the rear end of the ferrule at one end of the splice
- Stops 0.50 inch ±0.25 inch farther than the rear end of the ferrule at the other end of the splice
- Makes a 50 percent overlap.

(b) Tightly wind a second layer of the tape on the splice assembly.

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Make sure that the layer of tape:

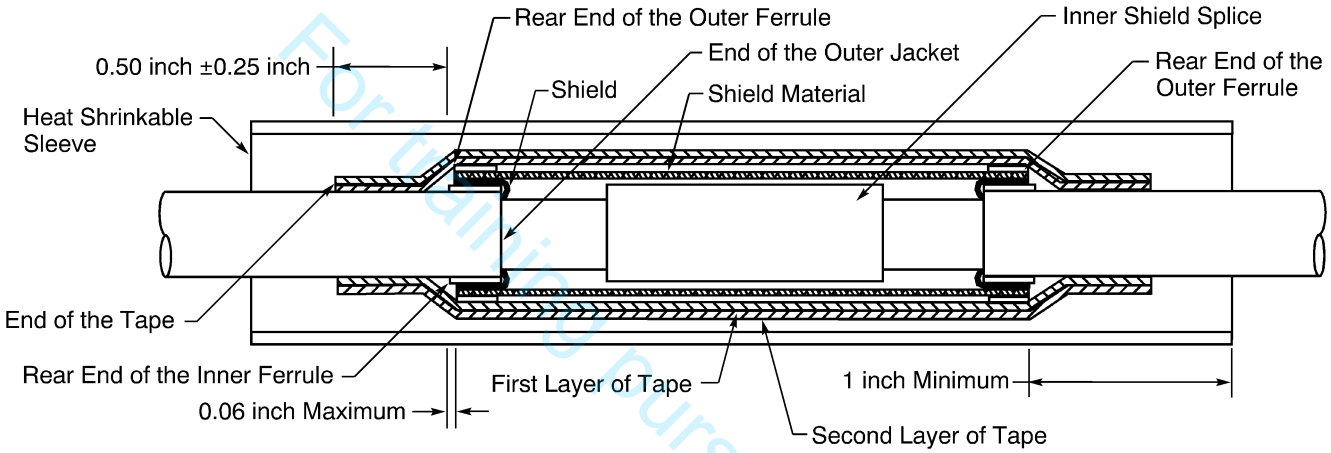
- Starts 1 inch minimum farther than where the first layer of tape stops
- Stops 1 inch minimum farther than where the first layer of tape starts
- Makes a 50 percent overlap.

(26) Assemble a lacing tape wire harness tie on each end of the splice assembly approximately 0.25 inch from the end of the tape. Refer to Subject 20-10-11.

Make sure that the tie material is the correct Temperature Grade.

D. Repair of a Shielded Wire with a Splice Assembly - Two Round Conductor Shields That Are Not Adjacent

Refer to Paragraph 1.E. for the applicable conditions for the repair of wire with a splice.



CONFIGURATION OF THE SPLICE ASSEMBLY
Figure 84

Refer to Figure 84.

(1) Prepare each end of the shielded wire.

Refer to:

- Figure 85
- Subject 20-00-15 for the outer jacket and insulation removal procedures.

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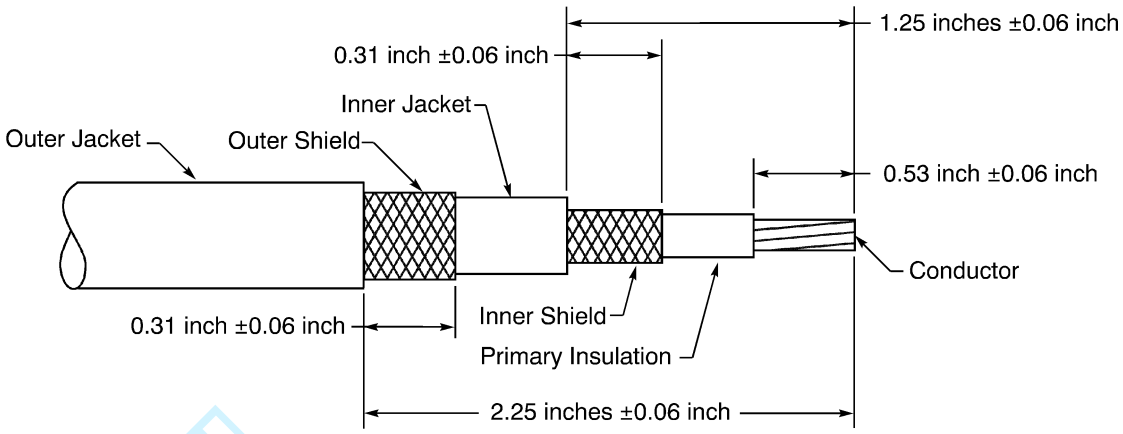

SHIELDED WIRE PREPARATION
Figure 85

(a) Remove 2.25 inches ±0.06 inch of the outer jacket from the end of the wire.

(b) Remove the necessary length of the outer shield from the end of the wire.

Make sure that the distance between the end of the outer jacket and the end of the outer shield is 0.31 inch ±0.06 inch.

(c) Remove 1.25 inch ±0.06 inch of the inner jacket from the end of the wire.

(d) Remove the necessary length of the inner shield from the end of the wire.

Make sure that the distance between the end of the inner jacket and the end of the inner shield is 0.31 inch ±0.06 inch.

(e) Remove 0.53 inch ±0.06 inch of the primary insulation from the end of the wire.

(2) Make a selection of a shield material for the outer shield from Table 9.

Make sure that the shield material has:

- The applicable Temperature Grade
- The smallest diameter that can go on the folded back outer shield of the wire.

NOTE: For alternative shield materials, refer to Subject 20-00-11.

(3) Cut a 5.5 inch ±0.1 inch length of the shield material for the outer shield.

(4) Make a selection of a shield material for the inner shield from Table 9.

Make sure that the shield material has:

- The applicable Temperature Grade
- The smallest diameter that can go on the folded back inner shield of the wire.

NOTE: For alternative shield materials, refer to Subject 20-00-11.

(5) Cut a 3.5 inch ±0.1 inch length of the shield material for the inner shield.

(6) Make a selection of a heat shrinkable sleeve from Table 5.

Make sure that the sleeve has:

- The applicable Temperature Grade
- The smallest diameter that can move freely on the outer jacket.

NOTE: For alternative heat shrinkable sleeves, refer to Subject 20-00-11.

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(7) Cut a 7.5 inch minimum length of the heat shrinkable sleeve.

(8) Put the sleeve on the outer jacket of one of the wires.

(9) Make a selection of two sets of inner ferrules and outer ferrules for the outer shield. Refer to Subject 20-30-12.

Make sure that:

- The ferrules have the applicable Temperature Grade
- The inner ferrule is the smallest ferrule that can move freely on the outer jacket
- The outer ferrule is the smallest ferrule that can move freely on the inner ferrule, the folded back outer shield, and the shield material.

(10) Put one inner ferrule on the outer jacket of each wire.

(11) Put the shield material for the outer shield on the outer jacket of one wire.

NOTE: If it is necessary, the strands at the end of the shield material can be moved apart to make it easier to put the shield material on the wire.

(12) Put the 2 outer ferrules on the shield material for the outer shield.

(13) Make a selection of two sets of Temperature Grade D inner ferrules and outer ferrules for the inner shield. Refer to Subject 20-30-12.

Make sure that:

- The inner ferrule is the smallest ferrule that can move freely on the inner jacket
- The outer ferrule is the smallest ferrule that can move freely on the inner ferrule, the folded back inner shield, and the shield material.

(14) Put one inner ferrule on the inner jacket of each wire.

(15) Put the shield material for the inner shield on the inner jacket of one wire.

NOTE: If it is necessary, the strands at the end of the shield material can be moved apart to make it easier to put the shield material on the wire.

(16) Put the two outer ferrules on the shield material for the inner shield.

(17) Make a selection of an applicable butt splice assembly configuration for a wire. Refer to Subject 20-30-12.

(18) Assemble the splice of the wire. Refer to the assembly procedure for the butt splice assembly configuration.

Make sure to cut the conductor to the correct length specified in the assembly procedure for the splice.

(19) Make a selection of the necessary ferrule crimp tools for the outer and inner shield splice. Refer to Subject 20-30-12.

(20) Assemble the end of the inner shield splice opposite the end with the shield material. Refer to Figure 86.

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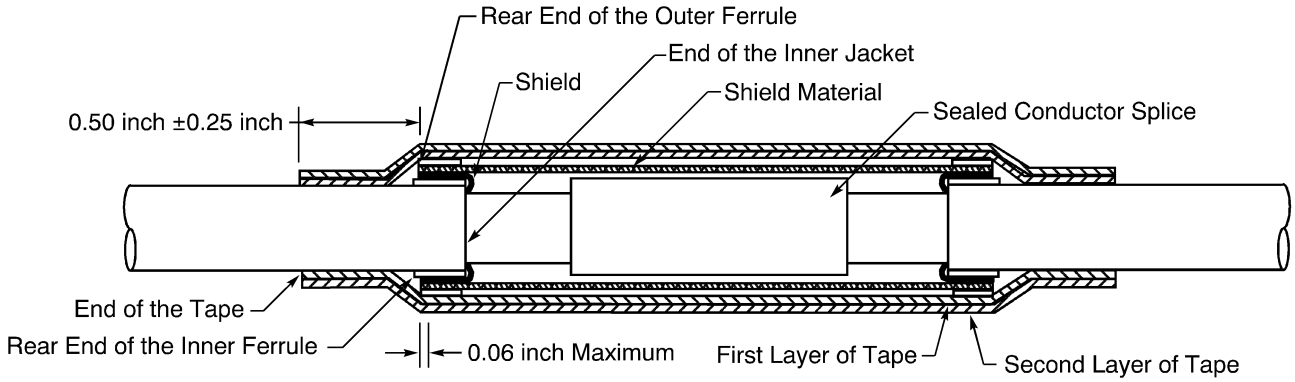

CONFIGURATION OF THE INNER SHIELD SPLICE ASSEMBLY
Figure 86

(a) Move the strands of the shield apart and make them straight.

(b) Align the forward end of the inner ferrule with the end of the inner jacket.

(c) Fold the strands of the shield back over the inner ferrule.

Make sure that the strands of the shield are symmetrical around the circumference of the ferrule.

(d) Align the end of the shield material with the end of the strands of the shield that are folded back.

(e) Align the rear end of the outer ferrule with the rear end of the inner ferrule.

Make sure that:

- The outer ferrule goes around the shield material
- The rear end of the outer ferrule does not extend farther than the rear end of the inner ferrule
- The rear end of the outer ferrule is a maximum of 0.06 inch from the rear end of the inner ferrule.

(f) Crimp the ferrules.

(21) Do Step (20) again to assemble the other end of the inner shield splice. Refer to Figure 86.

Make sure that the shield material is pulled tight before the ferrules are crimped.

(22) Remove the shield and the shield material that extend farther than the rear end of the inner ferrule on each end of the inner shield splice.

(23) Make a selection of an insulation tape from Table 6.

Make sure that the tape has a temperature grade that is applicable for the location at the wire installation.

(24) Put insulation tape on the inner shield splice. Refer to Figure 86.

(a) Tightly wind a layer of the tape on the splice assembly.

Make sure that the layer of tape:

- Starts 0.50 inch ±0.25 inch farther than the rear end of the ferrule at one end of the splice
- Stops 0.50 inch ±0.25 inch farther than the rear end of the ferrule at the other end of the splice
- Makes a 50 percent overlap.

(b) Tightly wind a second layer of the tape on the splice assembly.

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Make sure that the layer of tape:

- Starts where the first layer of tape stops
- Stops where the first layer of tape starts
- Makes a 50 percent overlap.

(25) Assemble the end of the outer shield splice opposite the end with the shield material.

(a) Move the strands of the shield apart and make them straight.

(b) Align the forward end of the inner ferrule with the end of the inner jacket.

(c) Fold the strands of the shield back on the inner ferrule.

Make sure that the strands of the shield are symmetrical around the circumference of the ferrule.

(d) Align the end of the shield material with the end of the strands of the shield that are folded back.

(e) Align the rear end of the outer ferrule with the rear end of the inner ferrule.

Make sure that:

- The outer ferrule goes around the shield material
- The rear end of the outer ferrule does not extend farther than the rear end of the inner ferrule
- The rear end of the outer ferrule is a maximum of 0.06 inch from the rear end of the inner ferrule.

(f) Crimp the ferrules.

(26) Do Step (25) again to assemble the other end of the outer shield splice.

Make sure that the shield material is pulled tight before the ferrules are crimped.

(27) Remove the shield and the shield material that extend farther than the rear end of the inner ferrule on each end of the outer shield splice.

(28) Put insulation tape on the outer shield splice.

(a) Tightly wind a layer of the tape on the splice assembly.

Make sure that the layer of tape:

- Starts 0.50 inch ±0.25 inch farther than the rear end of the ferrule at one end of the splice
- Stops 0.50 inch ±0.25 inch farther than the rear end of the ferrule at the other end of the splice
- Makes a 50 percent overlap.

(b) Tightly wind a second layer of the tape on the splice assembly.

Make sure that the layer of tape:

- Starts where the first layer of tape stops
- Stops where the first layer of tape starts
- Makes a 50 percent overlap.

(29) Align the center of the heat shrinkable sleeve with the center of the splice assembly.

(30) Shrink the sleeve into its position. Refer to Subject 20-10-14.

E. Repair of a Shielded Cable with a Splice Assembly

Refer to Paragraph 1.E. for the applicable conditions for the repair of cable with a splice.

(1) Remove the damaged length of the shielded cable.

(a) On one side of the damage, cut the shielded cable.

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Make sure that the end of the cable is perpendicular to the longitudinal axis of the cable.

(b) On the other side of the damage, cut the shielded cable.

Make sure that the end of the cable is perpendicular to the longitudinal axis of the cable.

(2) Clean the jacket with isopropyl alcohol.

Make sure:

- To clean the area of the jacket from the end of each cable to a minimum of 3 inches from the end
- That the cleaned area is dry.

(3) Assemble a sealed splice.

Refer to the selection of a sealed splice configuration in Subject 20-30-12.

Make sure that the configuration is applicable for the shielded cable.

F. Repair of a Shielded Cable with a Splice Assembly - Two Adjacent Shields

Refer to Paragraph 1.E. for the applicable conditions for the repair of cable with a splice.

(1) Remove the damaged length of the shielded cable.

(a) On one side of the damage, cut the shielded cable.

Make sure that the end of the cable is perpendicular to the longitudinal axis of the cable.

(b) On the other side of the damage, cut the shielded cable.

Make sure that the end of the cable is perpendicular to the longitudinal axis of the cable.

(2) Clean the outer jacket with isopropyl alcohol.

Make sure:

- To clean the area of the jacket from the end of each cable to a minimum of 3 inches from the end
- That the cleaned area is dry.

(3) Assemble a sealed splice.

Refer to the selection of a sealed splice configuration in Subject 20-30-12.

Make sure that the configuration is applicable for the shielded cable.

G. Repair of a Shielded Cable with a Splice Assembly in a Fuel Vapor Area - Two Round Conductor Shields That Are Not Adjacent

Refer to Paragraph 1.E. for the applicable conditions for the repair of cable with a splice.

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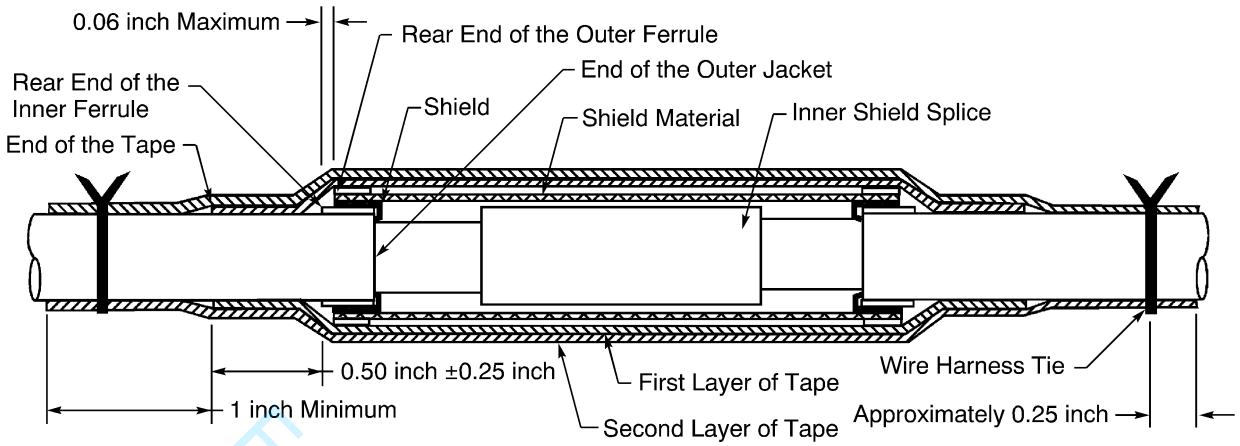


CONFIGURATION OF THE SPLICE ASSEMBLY
Figure 87

Refer to Figure 87.

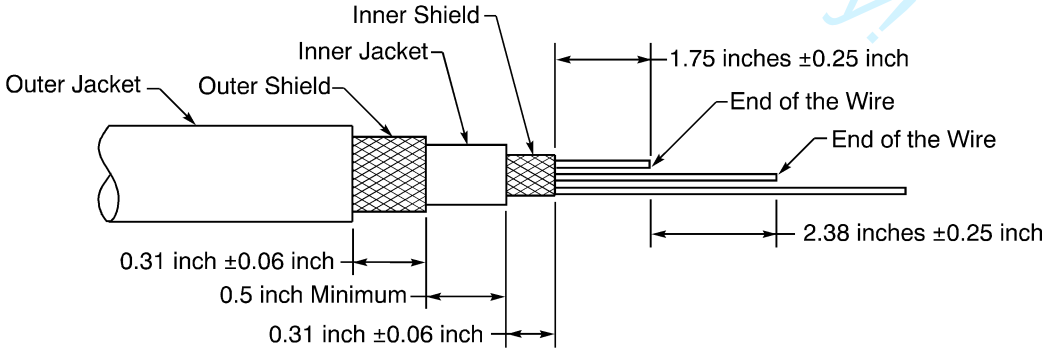
(1) Prepare each end of the shielded cable.

Refer to:

- Figure 88
- Subject 20-00-15 for the outer jacket and insulation removal procedures.

Make sure that:

- The distance from the end of the outer jacket to the end of the outer shield is 0.31 inch ±0.06 inch
- The minimum distance from the end of the outer shield to the end of the inner jacket is 0.50 inch
- The distance from the end of the inner jacket to the end of the inner shield is 0.31 inch ±0.06 inch
- The distance from the end of the inner shield to the end of the nearest wire is 1.75 inches ±0.25 inch
- The distance from the end of a wire to the end of a different wire is 2.38 inches ±0.25 inch.



SHIELDED CABLE PREPARATION
Figure 88

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(2) Make a selection of a shield material for the outer shield from Table 9.

Make sure that the shield material has:

- The applicable Temperature Grade
- The smallest diameter that can go on the folded back outer shield of the cable.

NOTE: For alternative shield materials, refer to Subject 20-00-11.

(3) Cut a 5.5 inch ±0.1 inch length of the shield material for the outer shield.

(4) Make a selection of a shield material for the inner shield from Table 9.

Make sure that the shield material has:

- The applicable Temperature Grade
- The smallest diameter that can go on the folded back inner shield of the cable.

NOTE: For alternative shield materials, refer to Subject 20-00-11.

(5) Cut a 3.5 inch ±0.1 inch length of the shield material for the inner shield.

(6) Make a selection of two sets of inner ferrules and outer ferrules for the outer shield. Refer to Subject 20-30-12.

Make sure that:

- The ferrules have the applicable Temperature Grade
- The inner ferrule is the smallest ferrule that can move freely on the outer jacket
- The outer ferrule is the smallest ferrule that can move freely on the inner ferrule, the folded back outer shield, and the shield material.

(7) Put one inner ferrule on the outer jacket of each cable.

(8) Put the shield material for the outer shield on the outer jacket of one cable.

NOTE: If it is necessary, the strands at the end of the shield material can be moved apart to make it easier to put the shield material on the cable.

(9) Put the 2 outer ferrules on the shield material for the outer shield.

(10) Make a selection of two sets of Temperature Grade D inner ferrules and outer ferrules for the inner shield. Refer to Subject 20-30-12.

Make sure that:

- The inner ferrule is the smallest ferrule that can move freely on the inner jacket
- The outer ferrule is the smallest ferrule that can move freely on the inner ferrule, the folded back inner shield, and the shield material.

(11) Put one inner ferrule on the inner jacket of each cable.

(12) Put the shield material for the inner shield on the inner jacket of one cable.

NOTE: If it is necessary, the strands at the end of the shield material can be moved apart to make it easier to put the shield material on the cable.

(13) Put the two outer ferrules on the shield material for the inner shield.

(14) Make a selection of an applicable butt splice assembly configuration for a wire. Refer to Subject 20-30-12.

(15) Assemble the splices of the wires. Refer to the assembly procedure for the butt splice assembly configuration.

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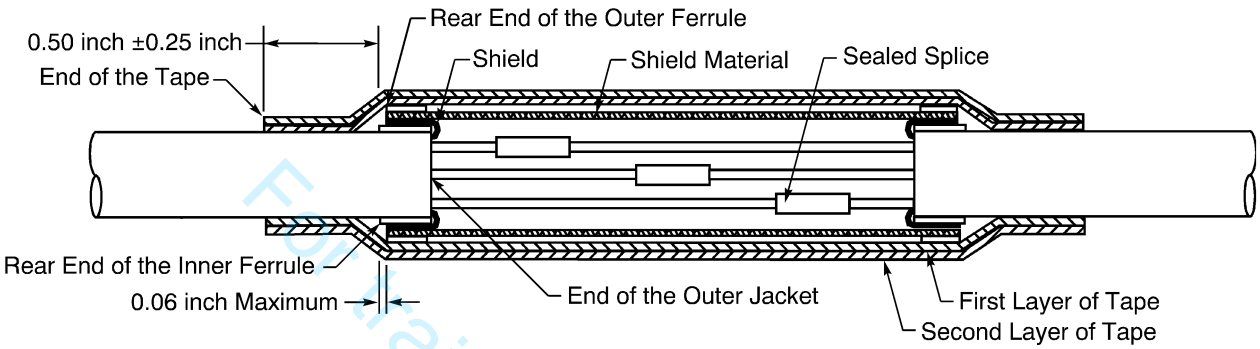
Make sure to cut the conductor to the correct length specified in the assembly procedure for the splice.

(16) Make a selection of the necessary ferrule crimp tools for the outer and inner shield splice. Refer to Subject 20-30-12.

(17) Assemble the end of the inner shield splice opposite the end with the shield material. Refer to Figure 89.



CONFIGURATION OF THE INNER SHIELD SPLICE ASSEMBLY
Figure 89

(a) Move the strands of the shield apart and make them straight.

(b) Align the forward end of the inner ferrule with the end of the inner jacket.

(c) Fold the strands of the shield back on the inner ferrule.

Make sure that the strands of the shield are symmetrical around the circumference of the ferrule.

(d) Align the end of the shield material with the end of the strands of the shield that are folded back.

(e) Align the rear end of the outer ferrule with the rear end of the inner ferrule.

Make sure that:

- The outer ferrule goes around the shield material
- The rear end of the outer ferrule does not extend farther than the rear end of the inner ferrule
- The rear end of the outer ferrule is a maximum of 0.06 inch from the rear end of the inner ferrule.

(f) Crimp the ferrules.

(18) Do Step (17) again to assemble the other end of the inner shield splice. Refer to Figure 89.

Make sure that the shield material is pulled tight before the ferrules are crimped.

(19) Remove the shield and the shield material that extend farther than the rear end of the inner ferrule on each end of the inner shield splice.

(20) Make a selection of an insulation tape from Table 6.

Make sure that the tape has a temperature grade that is applicable for the location at the wire installation.

(21) Put insulation tape on the inner shield splice. Refer to Figure 89.

(a) Tightly wind a layer of the tape on the splice assembly.

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Make sure that the layer of tape:

- Starts 0.50 inch ±0.25 inch farther than the rear end of the ferrule at one end of the splice
- Stops 0.50 inch ±0.25 inch farther than the rear end of the ferrule at the other end of the splice
- Makes a 50 percent overlap.

(b) Tightly wind a second layer of the tape on the splice assembly.

Make sure that the layer of tape:

- Starts where the first layer of tape stops
- Stops where the first layer of tape starts
- Makes a 50 percent overlap.

(22) Assemble the end of the outer shield splice opposite the end with the shield material.

(a) Move the strands of the shield apart and make them straight.

(b) Align the forward end of the inner ferrule with the end of the inner jacket.

(c) Fold the strands of the shield back on the inner ferrule.

Make sure that the strands of the shield are symmetrical around the circumference of the ferrule.

(d) Align the end of the shield material with the end of the strands of the shield that are folded back.

(e) Align the rear end of the outer ferrule with the rear end of the inner ferrule.

Make sure that:

- The outer ferrule goes around the shield material
- The rear end of the outer ferrule does not extend farther than the rear end of the inner ferrule
- The rear end of the outer ferrule is a maximum of 0.06 inch from the rear end of the inner ferrule.

(f) Crimp the ferrules.

(23) Do Step (22) again to assemble the other end of the outer shield splice.

Make sure that the shield material is pulled tight before the ferrules are crimped.

(24) Remove the shield and the shield material that extend farther than the rear end of the inner ferrule on each end of the outer shield splice.

(25) Put insulation tape on the outer shield splice.

(a) Tightly wind a layer of the tape on the splice assembly.

Make sure that the layer of tape:

- Starts 0.50 inch ±0.25 inch farther than the rear end of the ferrule at one end of the splice
- Stops 0.50 inch ±0.25 inch farther than the rear end of the ferrule at the other end of the splice
- Makes a 50 percent overlap.

(b) Tightly wind a second layer of the tape on the splice assembly.

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Make sure that the layer of tape:

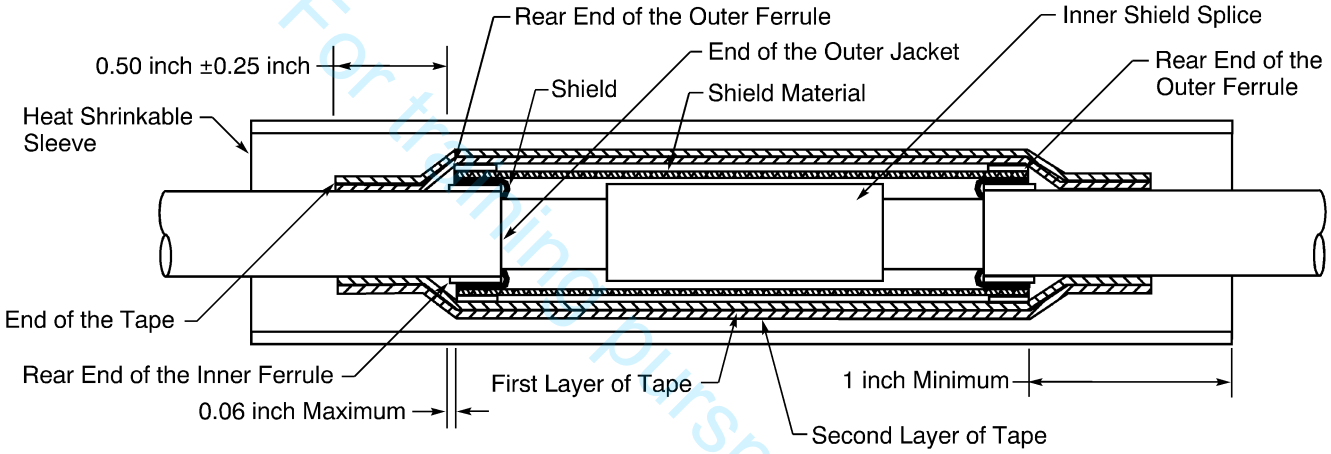
- Starts 1 inch minimum farther than where the first layer of tape stops
- Stops 1 inch minimum farther than where the first layer of tape starts
- Makes a 50 percent overlap.

(26) Assemble a lacing tape wire harness tie on each end of the splice assembly approximately 0.25 inch from the end of the tape. Refer to Subject 20-10-11.

Make sure that the tie material is the correct Temperature Grade.

H. Repair of a Shielded Cable with a Splice Assembly - Two Round Conductor Shields That Are Not Adjacent

Refer to Paragraph 1.E. for the applicable conditions for the repair of cable with a splice.



CONFIGURATION OF THE SPLICE ASSEMBLY
Figure 90

Refer to Figure 90.

(1) Prepare each end of the shielded cable.

Refer to:

- Figure 91
- Subject 20-00-15 for the outer jacket and insulation removal procedures.

Make sure that:

- The distance from the end of the outer jacket to the end of the outer shield is 0.31 inch ±0.06 inch
- The minimum distance from the end of the outer shield to the end of the inner jacket is 0.50 inch
- The distance from the end of the inner jacket to the end of the inner shield is 0.31 inch ±0.06 inch
- The distance from the end of the inner shield to the end of the nearest wire is 1.75 inches ±0.25 inch
- The distance from the end of a wire to the end of a different wire is 2.38 inches ±0.25 inch.

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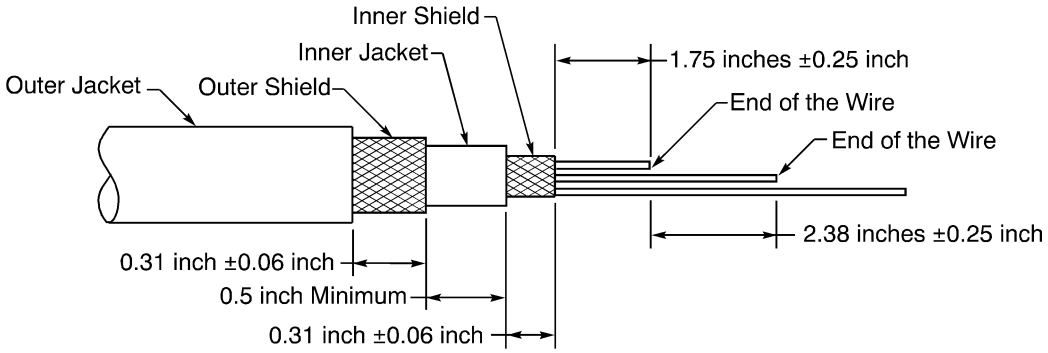

SHIELDED CABLE PREPARATION
Figure 91

(2) Make a selection of a shield material for the outer shield from Table 9.

Make sure that the shield material has:

- The applicable Temperature Grade
- The smallest diameter that can go on the folded back outer shield of the cable.

NOTE: For alternative shield materials, refer to Subject 20-00-11.

(3) Cut a 5.5 inch ±0.1 inch length of the shield material for the outer shield.

(4) Make a selection of a shield material for the inner shield from Table 9.

Make sure that the shield material has:

- The applicable Temperature Grade
- The smallest diameter that can go on the folded back inner shield of the cable.

NOTE: For alternative shield materials, refer to Subject 20-00-11.

(5) Cut a 3.5 inch ±0.1 inch length of the shield material for the inner shield.

(6) Make a selection of a heat shrinkable sleeve from Table 5.

Make sure that the sleeve has:

- The applicable Temperature Grade
- The smallest diameter that can move freely on the outer jacket.

NOTE: For alternative heat shrinkable sleeves, refer to Subject 20-00-11.

(7) Cut the necessary length of the heat shrinkable sleeve.

Make sure that the sleeve extends one inch farther than the rear end of the outer ferrule on each side of the splice assembly.

(8) Put the sleeve on the outer jacket of one of the cables.

(9) Make a selection of two sets of inner ferrules and outer ferrules for the outer shield. Refer to Subject 20-30-12.

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Make sure that:

- The ferrules have the applicable Temperature Grade
- The inner ferrule is the smallest ferrule that can move freely on the outer jacket
- The outer ferrule is the smallest ferrule that can move freely on the inner ferrule, the folded back outer shield, and the shield material.

(10) Put one inner ferrule on the outer jacket of each cable.

(11) Put the shield material for the outer shield on the outer jacket of one cable.

NOTE: If it is necessary, the strands at the end of the shield material can be moved apart to make it easier to put the shield material on the cable.

(12) Put the 2 outer ferrules on the shield material for the outer shield.

(13) Make a selection of two sets of Temperature Grade D inner ferrules and outer ferrules for the inner shield. Refer to Subject 20-30-12.

Make sure that:

- The inner ferrule is the smallest ferrule that can move freely on the inner jacket
- The outer ferrule is the smallest ferrule that can move freely on the inner ferrule, the folded back inner shield, and the shield material.

(14) Put one inner ferrule on the inner jacket of each cable.

(15) Put the shield material for the inner shield on the inner jacket of one cable.

NOTE: If it is necessary, the strands at the end of the shield material can be moved apart to make it easier to put the shield material on the cable.

(16) Put the two outer ferrules on the shield material for the inner shield.

(17) Make a selection of an applicable butt splice assembly configuration for a wire. Refer to Subject 20-30-12.

(18) Assemble the splices of the wires. Refer to the assembly procedure for the butt splice assembly configuration.

Make sure to cut the conductor to the correct length specified in the assembly procedure for the splice.

(19) Make a selection of the necessary ferrule crimp tools for the outer and inner shield splice. Refer to Subject 20-30-12.

(20) Assemble the end of the inner shield splice opposite the end with the shield material. Refer to Figure 92.

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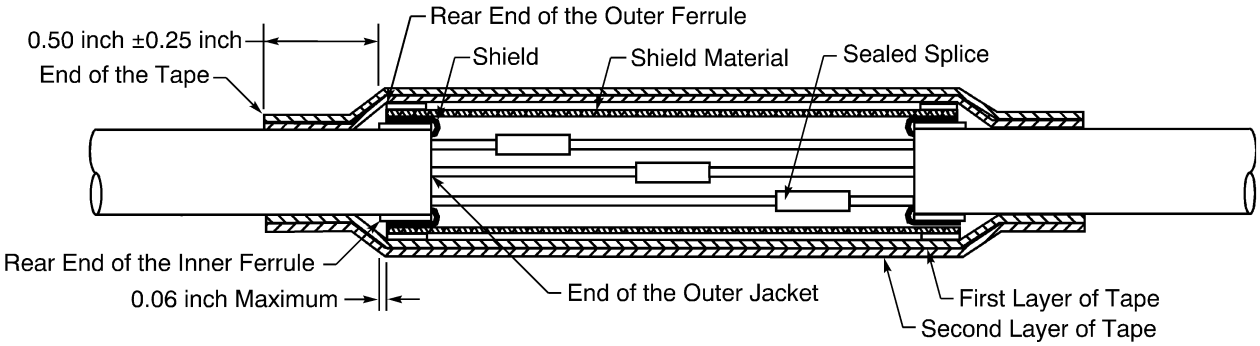

CONFIGURATION OF THE INNER SHIELD SPLICE ASSEMBLY
Figure 92

(a) Move the strands of the shield apart and make them straight.

(b) Align the forward end of the inner ferrule with the end of the inner jacket.

(c) Fold the strands of the shield back on the inner ferrule.

Make sure that the strands of the shield are symmetrical around the circumference of the ferrule.

(d) Align the end of the shield material with the end of the strands of the shield that are folded back.

(e) Align the rear end of the outer ferrule with the rear end of the inner ferrule.

Make sure that:

- The outer ferrule goes around the shield material
- The rear end of the outer ferrule does not extend farther than the rear end of the inner ferrule
- The rear end of the outer ferrule is a maximum of 0.06 inch from the rear end of the inner ferrule.

(f) Crimp the ferrules.

(21) Do Step (20) again to assemble the other end of the inner shield splice. Refer to Figure 92.

Make sure that the shield material is pulled tight before the ferrules are crimped.

(22) Remove the shield and the shield material that extend farther than the rear end of the inner ferrule on each end of the inner shield splice.

(23) Make a selection of an insulation tape from Table 6.

Make sure that the tape has a temperature grade that is applicable for the location at the wire installation.

(24) Put insulation tape on the inner shield splice. Refer to Figure 92.

(a) Tightly wind a layer of the tape on the splice assembly.

Make sure that the layer of tape:

- Starts 0.50 inch ±0.25 inch farther than the rear end of the ferrule at one end of the splice
- Stops 0.50 inch ±0.25 inch farther than the rear end of the ferrule at the other end of the splice
- Makes a 50 percent overlap.

(b) Tightly wind a second layer of the tape on the splice assembly.

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Make sure that the layer of tape:

- Starts where the first layer of tape stops
- Stops where the first layer of tape starts
- Makes a 50 percent overlap.

(25) Assemble the end of the outer shield splice opposite the end with the shield material.

(a) Move the strands of the shield apart and make them straight.

(b) Align the forward end of the inner ferrule with the end of the inner jacket.

(c) Fold the strands of the shield back over the inner ferrule.

Make sure that the strands of the shield are symmetrical around the circumference of the ferrule.

(d) Align the end of the shield material with the end of the strands of the shield that are folded back.

(e) Align the rear end of the outer ferrule with the rear end of the inner ferrule.

Make sure that:

- The outer ferrule goes around the shield material
- The rear end of the outer ferrule does not extend farther than the rear end of the inner ferrule
- The rear end of the outer ferrule is a maximum of 0.06 inch from the rear end of the inner ferrule.

(f) Crimp the ferrules.

(26) Do Step (25) again to assemble the other end of the outer shield splice.

Make sure that the shield material is pulled tight before the ferrules are crimped.

(27) Remove the shield and the shield material that extend farther than the rear end of the inner ferrule on each end of the outer shield splice.

(28) Put insulation tape on the outer shield splice.

(a) Tightly wind a layer of the tape on the splice assembly.

Make sure that the layer of tape:

- Starts 0.50 inch ±0.25 inch farther than the rear end of the ferrule at one end of the splice
- Stops 0.50 inch ±0.25 inch farther than the rear end of the ferrule at the other end of the splice
- Makes a 50 percent overlap.

(b) Tightly wind a second layer of the tape on the splice assembly.

Make sure that the layer of tape:

- Starts where the first layer of tape stops
- Stops where the first layer of tape starts
- Makes a 50 percent overlap.

(29) Align the center of the heat shrinkable sleeve with the center of the splice assembly.

(30) Shrink the sleeve into its position. Refer to Subject 20-10-14.

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6. REPAIR OF THE SHIELD OF A SHIELDED WIRE AND A SHIELDED CABLE

A. Selection of a Sealed Shield Splice Configuration

Refer to:

- Paragraph 2. for the damage and repair conditions of the applicable shielded wire or shielded cable
- Paragraph 1.E. for the applicable conditions for the repair of wire and cable with a splice.

Table 15
SEALED SHIELD SPLICE CONFIGURATIONS

Maximum Temperature Grade	Number of Shields	Shield Conductor	Applicable Condition	Shield Splice Assembly	
				Configuration	Procedure
B	1	Flat	No Fuel Vapor	Solder Shield Splice Sleeve	Paragraph 6.D.
				Solder Sleeves, Tape, Sleeve	Paragraph 6.E.
				Solder Sleeves, Tape, Ties	Paragraph 6.F.
		Round	No Fuel Vapor	Solder Shield Splice Sleeve	Paragraph 6.D.
				Solder Sleeves, Tape, Sleeve - No Shield Fold Back	Paragraph 6.E.
				Solder Sleeves, Tape, Ties - No Shield Fold Back	Paragraph 6.F.
				Solder Sleeves, Tape, Sleeve - Shield Fold Back	Paragraph 6.G.
				Solder Sleeves, Tape, Ties - Shield Fold Back	Paragraph 6.H.
B	2	Flat Round	No Fuel Vapor	Solder Shield Splice Sleeve	Paragraph 6.D.
	2	Flat Round	No Fuel Vapor	Solder Sleeves, Tape, Sleeve	Paragraph 6.E.
	2	Flat Round	No Fuel Vapor	Solder Sleeves, Tape, Ties	Paragraph 6.F.

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Table 15 (continued)

Maximum Temperature Grade	Number of Shields	Shield Conductor	Applicable Condition	Shield Splice Assembly	
				Configuration	Procedure
B	2	Round Round	No Fuel Vapor	Solder Shield Splice Sleeve	Paragraph 6.D.
	2	Round Round	No Fuel Vapor	Solder Sleeves, Tape, Sleeve - No Shield Fold Back	Paragraph 6.E.
	2	Round Round	No Fuel Vapor	Solder Sleeves, Tape, Ties - No Shield Fold Back	Paragraph 6.F.
	2	Round Round	No Fuel Vapor	Solder Sleeves, Tape, Sleeve - Shield Fold Back	Paragraph 6.G.
	2	Round Round	No Fuel Vapor	Solder Sleeves, Tape, Ties - Shield Fold Back	Paragraph 6.H.
D	1	Round	Fuel Vapor	Mechanical Ferrules, Tape, Ties	Paragraph 6.J.
				Shield-Kon, Tape, Ties	Paragraph 6.L.
			No Fuel Vapor	Mechanical Ferrules, Tape, Sleeve	Paragraph 6.I.
				Mechanical Ferrules, Tape, Ties	Paragraph 6.J.
				Shield-Kon, Tape, Sleeve	Paragraph 6.K.
				Shield-Kon, Tape, Ties	Paragraph 6.L.
D	2	Round Round	Fuel Vapor	Mechanical Ferrules, Tape, Ties	Paragraph 6.J.
	2	Round Round	Fuel Vapor	Shield-Kon, Tape, Ties	Paragraph 6.L.
	2	Round Round	No Fuel Vapor	Mechanical Ferrules, Tape, Sleeve	Paragraph 6.I.
	2	Round Round	No Fuel Vapor	Mechanical Ferrules, Tape, Ties	Paragraph 6.J.
	2	Round Round	No Fuel Vapor	Shield-Kon, Tape, Sleeve	Paragraph 6.K.
	2	Round Round	No Fuel Vapor	Shield-Kon, Tape, Ties	Paragraph 6.L.

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B. Selection of a Solder Sleeve

Table 16
SOLDER SLEEVE PART NUMBERS

Maximum O.D. of the Jacket (inch)	Minimum O.D. of the Shield (inch)	Solder Sleeve	
		Part Number	Supplier
0.095	0.020	D-144-25	Raychem
0.105	0.020	BACS13CT1N	Boeing
0.145	0.030	BACS13CT2N	Boeing
0.145	0.030	M83519/1-2	QPL
0.200	0.050	BACS13CT3N	Boeing
0.200	0.050	M83519/1-3	QPL
0.255	0.070	BACS13CT4N	Boeing
0.255	0.070	M83519/1-4	QPL
0.300	0.100	BACS13CT5N	Boeing
0.300	0.100	M83519/1-5	QPL

Table 17
APPROVED SUPPLIERS OF BOEING STANDARD SOLDER SLEEVES

Boeing Standard	Supplier
BACS13CT	Raychem

C. Shield Repair - Tape and Ties

Refer to Paragraph 1.B. for the applicable conditions for the repair of wire and cable.

(1) Make a selection of one of these tapes from Table 6:

- Temperature Grade C or D TFE Tape
- Temperature Grade A polyester tape.

Make sure that the tape has a temperature grade that is applicable for the location at the wire installation.

(2) Clean the jacket with isopropyl alcohol. Refer to Figure 93.

Make sure:

- To clean the damaged area of the jacket
- To clean the jacket approximately 3 inches on each side of the damage
- That the cleaned area is dry.

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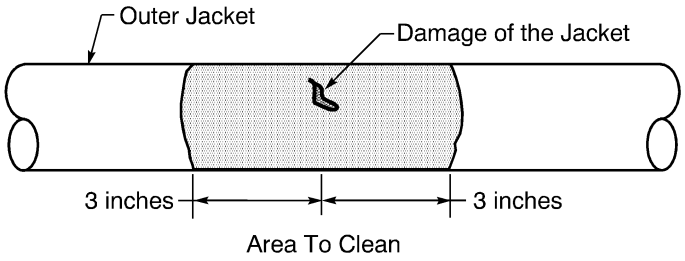
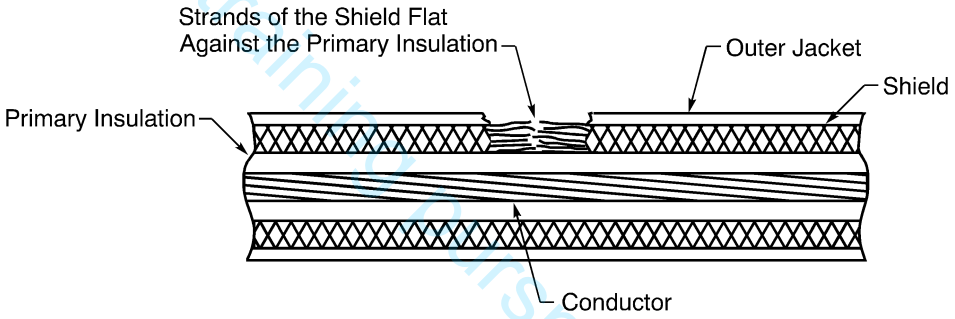


AREA TO CLEAN
Figure 93

(3) Put the strands of the damaged shield:

- Flat against the primary insulation
- Even and symmetrical around the circumference of the area with damage.

Refer to Figure 94.



POSITION OF THE SHIELD FOR REPAIR
Figure 94

(4) Put a minimum of two layers of the tape on the damaged area. Refer to Figure 95.

Make sure that:

- Each end of the tape extends a minimum of 0.5 inch farther than each end of the damaged area
- The tape makes 50 percent circumferential overlap
- The second layer of tape is in the opposite direction of the first layer.

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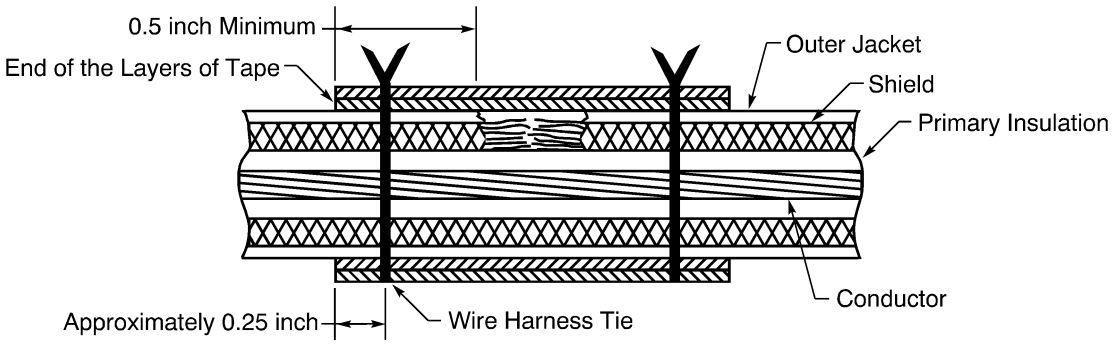

TAPE AND WIRE HARNESS TIES ON THE SHIELDED WIRE OR SHIELDED CABLE
Figure 95

(5) Assemble a lacing tape wire harness tie on each end of the repair approximately 0.25 inch from each end of the tape.

Make sure that the lacing tape is the correct Temperature Grade.

Refer to:

- Figure 95
- Subject 20-10-11 for the procedure to assemble a wire harness tie.

D. Shield Repair - Solder Shield Splice Sleeve

Table 18
SOLDER SHIELD SPLICE SLEEVE

Jacket O.D. (inch)		Part Number	Supplier
Maximum	Minimum		
0.11	0.06	D-155-0350	Raychem
0.15	0.08	D-155-0450	Raychem
0.15	0.08	D-155-0475	Raychem
0.19	0.09	D-155-0550	Raychem
0.19	0.09	D-155-0575	Raychem
0.23	0.12	D-155-0675	Raychem
0.35	0.18	D-155-0975	Raychem

Table 19
LENGTH OF THE JACKET TO REMOVE

Solder Shield Splice Sleeve	Jacket Removal Length L (inch)	
	Target	Tolerance
D-155-0350	2.18	±0.04
D-155-0450	2.18	±0.04

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Table 19 (continued)

Solder Shield Splice Sleeve	Jacket Removal Length L (inch)	
	Target	Tolerance
D-155-0475	3.16	±0.04
D-155-0550	2.18	±0.04
D-155-0575	3.16	±0.04
D-155-0675	3.16	±0.04
D-155-0975	3.16	±0.04

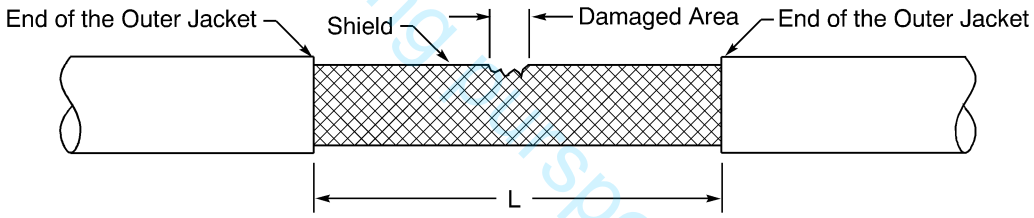
Refer to Paragraph 1.E. for the applicable conditions for the repair of wire and cable with a splice.

(1) Make a selection of a solder shield splice sleeve from Table 18.

Make sure that the O.D of the wire or cable is:

- Near but not more than the maximum jacket O.D for the sleeve
- More than the minimum jacket O.D. for the sleeve.

(2) Remove the necessary length of the outer jacket. Refer to Figure 96.



JACKET REMOVAL
Figure 96

(a) Find the length of the jacket to remove from Table 19.

(b) Carefully cut the jacket around the circumference of the wire or the cable on each side of the damaged area of the shield.

Make sure that:

- The distance between the two ends of the jacket is equal to the jacket removal length
- The damaged area is in the center of the two ends of the jacket.

CAUTION: DO NOT CUT ALL THE WAY THROUGH THE JACKET. DAMAGE CAN OCCUR TO THE SHIELD OR WIRE.

(c) Cut the jacket lightly along the length of the jacket to be removed.

CAUTION: DO NOT CUT ALL THE WAY THROUGH THE JACKET. DAMAGE CAN OCCUR TO THE SHIELD OR WIRE.

(d) Pull the jacket apart at the lines where it is cut.

NOTE: If it is necessary, the wire or the cable can be bent at the lines where the jacket was cut.

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CAUTION: DO NOT BEND THE WIRE OR THE CABLE MORE THAN 3 TIMES THE DIAMETER. DAMAGE TO THE WIRE OR THE CABLE CAN OCCUR.

(3) Clean the jacket with isopropyl alcohol.

Make sure:

- To clean the outer jacket approximately 3 inches from each end of the jacket
- That the cleaned area is dry.

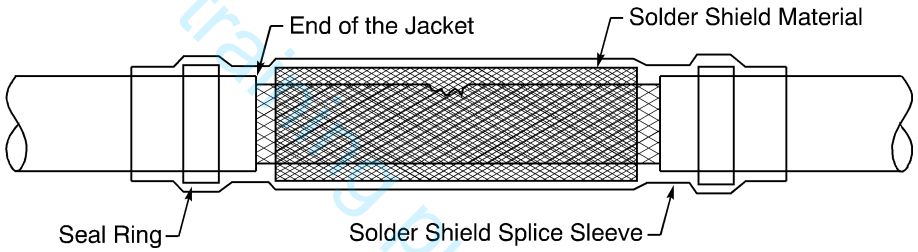
(4) Put the strands of the damaged shield:

- Flat against the primary insulation
- Even and symmetrical around the circumference of the area with damage.

(5) Put the sleeve on the wire or cable.

(6) Push the sleeve on the area where the jacket is removed. Refer to Figure 97.

Make sure that each end of the jacket is between the seal ring and the solder shield material in the sleeve.



POSITION OF THE SOLDER SHIELD SPLICE SLEEVE
Figure 97

(7) Shrink one end of the shield splice sleeve. Refer to Subject 20-10-14.

(a) Apply heat at the center of the sleeve until the solder melts and the sleeve begins to shrink.

(b) Continue to apply heat from the center of the sleeve to one end of the sleeve until the solder melts and flows.

(8) Do Step (7) again for the other end of the sleeve.

E. Shield Repair - Solder Sleeves, Shield Material, Tape, and a Sleeve without Shield Folded Back

Refer to:

- Paragraph 1.E. for the applicable conditions for the repair of wire and cable with a splice
- Figure 98 for the configuration of the splice assembly.

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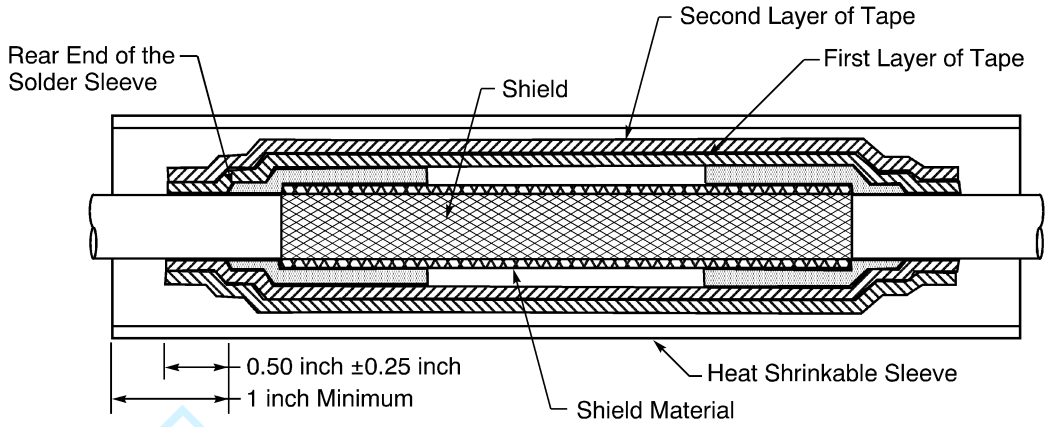
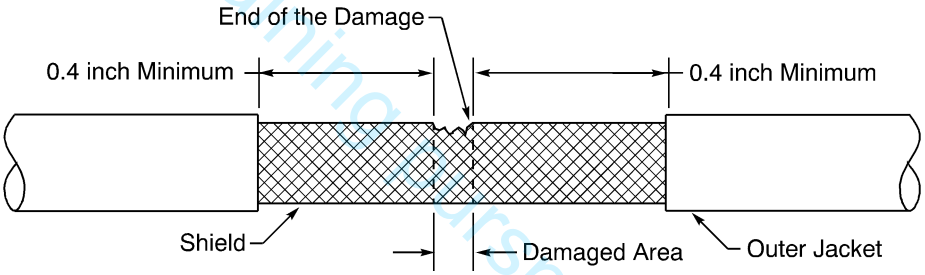


CONFIGURATION OF THE SPLICE ASSEMBLY
Figure 98

(1) Remove the necessary length of the outer jacket. Refer to Figure 99.



JACKET REMOVAL
Figure 99

(a) On one side of the damaged area, carefully cut the jacket around the circumference of the wire or the cable a minimum of 0.4 inch from the end of the damage, away from the damaged area.

CAUTION: DO NOT CUT ALL THE WAY THROUGH THE JACKET. DAMAGE CAN OCCUR TO THE SHIELD OR WIRE.

(b) On the other side of the damaged area, carefully cut the jacket around the circumference of the wire or the cable a minimum of 0.4 inch from the end of the damage, away from the damaged area.

CAUTION: DO NOT CUT ALL THE WAY THROUGH THE JACKET. DAMAGE CAN OCCUR TO THE SHIELD OR WIRE.

(c) Cut the jacket lightly along the length of the jacket to be removed.

CAUTION: DO NOT CUT ALL THE WAY THROUGH THE JACKET. DAMAGE CAN OCCUR TO THE SHIELD OR WIRE.

(d) Pull the jacket apart at the lines where it is cut.

NOTE: If it is necessary, the wire or the cable can be bent at the lines where the jacket was cut.

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CAUTION: DO NOT BEND THE WIRE OR THE CABLE MORE THAN 3 TIMES THE DIAMETER. DAMAGE TO THE WIRE OR THE CABLE CAN OCCUR.

(2) Clean the jacket with isopropyl alcohol.

Make sure:

- To clean the area from each end of the jacket to a minimum of 3 inches to the rear
- That the cleaned area is dry.

(3) Make a selection of a Temperature Grade B shield material from Table 9.

Make sure that the shield material has the smallest diameter that can be put on the shield.

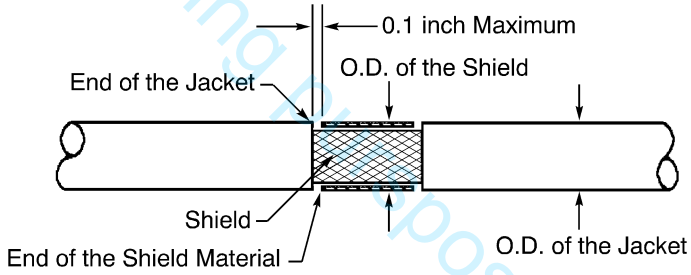
NOTE: For alternative shield materials, refer to Subject 20-00-11.

(4) Put the strands of the damaged shield:

- Flat against the primary insulation
- Even and symmetrical around the circumference of the area with damage.

(5) Cut a length of the shield material that is equal to the length of the jacket that is removed from the wire or the cable. Refer to Figure 100.

Make sure that each end of the shield material is a maximum of 0.1 inch from the nearest end of the jacket.



POSITION OF THE SHIELD MATERIAL
Figure 100

(6) Put the shield material on the wire or cable. Refer to Figure 100.

(7) Make a selection of two solder sleeves from Table 16.

Refer to Figure 100 for the applicable dimensions of the shield splice assembly.

(8) Assemble one end of the shield splice.

(a) Put the solder sleeve on the wire or cable. Refer to Figure 101.

Make sure that:

- The end of the shield material is a maximum of 0.1 inch from the end of the jacket
- The inner edge of the rear seal ring is aligned with the end of the jacket
- The seal ring does not make an overlap with the shield.

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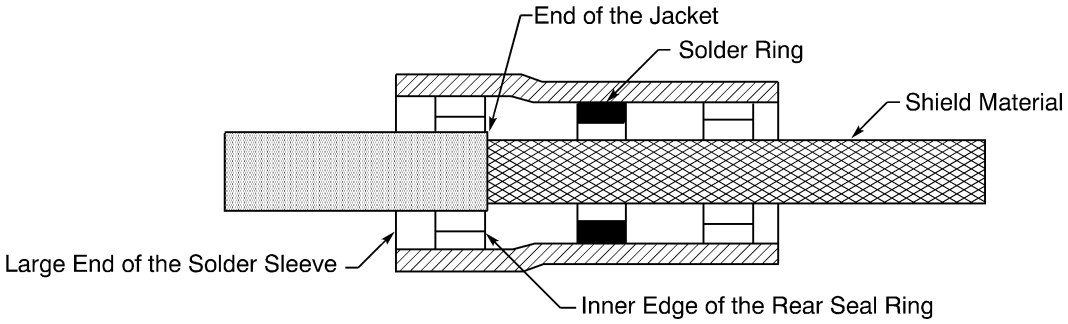

POSITION OF THE SOLDER SLEEVE
Figure 101

(b) Shrink the solder sleeve into position.

Make sure that:

- The solder sleeve stays in the correct position
- A minimum of 75 percent of the indicator ring on top of the solder ring is melted.

(9) Do Step (8) again to assemble the other end of the shield splice.

Make sure the shield material is pulled tight before the end of the splice is assembled.

(10) Make a selection of a Temperature Grade B or higher heat shrinkable sleeve from Table 5.

Make sure that the sleeve has the smallest diameter that can be put on the splice assembly.

NOTE: For alternative heat shrinkable sleeves, refer to Subject 20-00-11.

(11) Cut the necessary length of the heat shrinkable sleeve.

Make sure that the length is a minimum of 1 inch farther than the rear end of the solder sleeve on each end of the splice assembly.

(12) Make a selection of a Temperature Grade B or higher TFE insulation tape from Table 6.

(13) Tightly wind a layer of the tape on the splice assembly.

Make sure that the layer of tape:

- Starts 0.50 inch ±0.25 inch farther than the rear end of the solder sleeve at one end of the splice
- Stops 0.50 inch ±0.25 inch farther than the rear end of the solder sleeve at the other end of the splice
- Makes a 50 percent overlap.

(14) Tightly wind a second layer of the tape on the splice assembly.

Make sure that the layer of tape:

- Starts where the first layer of tape stops
- Stops where the first layer of tape starts
- Makes a 50 percent overlap.

(15) Put the sleeve on the shield splice assembly.

Make sure that each end of the sleeve is a minimum of 0.25 inch farther than the end of the tape on each end of the splice assembly.

(16) Shrink the sleeve into position. Refer to Subject 20-10-14.

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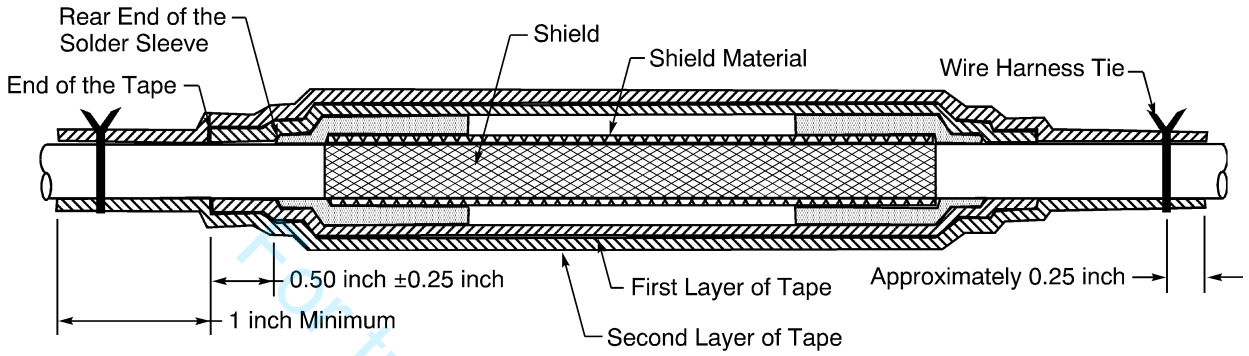
F. Shield Repair - Solder Sleeves, Shield Material, Tape, and Ties without Shield Folded Back

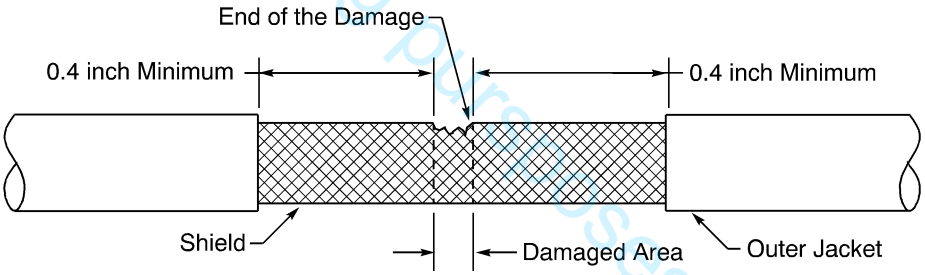
Refer to:

- Paragraph 1.E. for the applicable conditions for the repair of wire and cable with a splice
- Figure 102 for the configuration of the splice assembly.



CONFIGURATION OF THE SPLICE ASSEMBLY
Figure 102

(1) Remove the necessary length of the outer jacket. Refer to Figure 103.



JACKET REMOVAL
Figure 103

(a) On one side of the damaged area, carefully cut the jacket around the circumference of the wire or the cable a minimum of 0.4 inch from the end of the damage, away from the damaged area.

CAUTION: DO NOT CUT ALL THE WAY THROUGH THE JACKET. DAMAGE CAN OCCUR TO THE SHIELD OR WIRE.

(b) On the other side of the damaged area, carefully cut the jacket around the circumference of the wire or the cable a minimum of 0.4 inch from the end of the damage, away from the damaged area.

CAUTION: DO NOT CUT ALL THE WAY THROUGH THE JACKET. DAMAGE CAN OCCUR TO THE SHIELD OR WIRE.

(c) Cut the jacket lightly along the length of the jacket to be removed.

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CAUTION: DO NOT CUT ALL THE WAY THROUGH THE JACKET. DAMAGE CAN OCCUR TO THE SHIELD OR WIRE.

(d) Pull the jacket apart at the lines where it is cut.

NOTE: If it is necessary, the wire or the cable can be bent at the lines where the jacket was cut.

CAUTION: DO NOT BEND THE WIRE OR THE CABLE MORE THAN 3 TIMES THE DIAMETER. DAMAGE TO THE WIRE OR THE CABLE CAN OCCUR.

(2) Clean the jacket with isopropyl alcohol.

Make sure:

- To clean the outer jacket approximately 3 inches from each end of the jacket
- That the cleaned area is dry.

(3) Make a selection of a Temperature Grade B shield material from Table 9.

Make sure that the shield material has the smallest diameter that can be put on the shield.

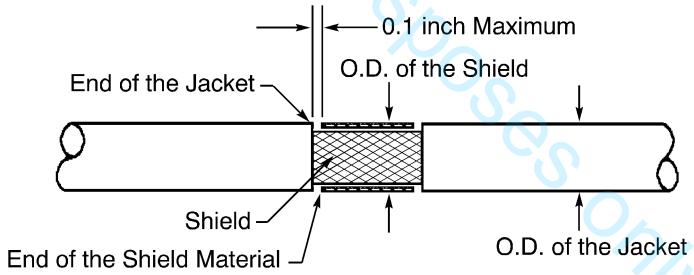
NOTE: For alternative shield materials, refer to Subject 20-00-11.

(4) Put the strands of the damaged shield:

- Flat against the primary insulation
- Even and symmetrical around the circumference of the area with damage.

(5) Cut a length of the shield material that is equal to the length of the jacket that is removed from the wire or the cable. Refer to Figure 104.

Make sure that each end of the shield material is a maximum of 0.1 inch from the nearest end of the jacket.



POSITION OF THE SHIELD MATERIAL
Figure 104

(6) Put the shield material on the wire or cable. Refer to Figure 104.

(7) Make a selection of two solder sleeves from Table 16.

Refer to Figure 104 for the applicable dimensions of the shield splice assembly.

(8) Assemble one end of the shield splice.

(a) Put the solder sleeve on the wire or cable. Refer to Figure 105.

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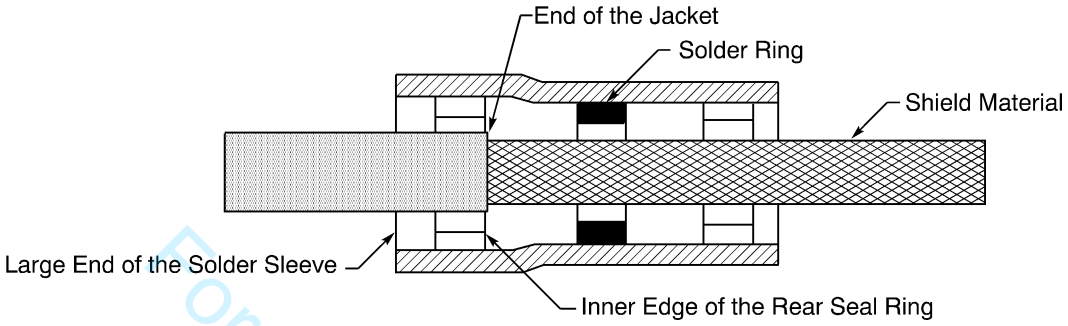
Make sure that:

- The end of the shield material is a maximum of 0.1 inch from the end of the jacket
- The inner edge of the rear seal ring is aligned with the end of the jacket
- The seal ring does not make an overlap with the shield.



POSITION OF THE SOLDER SLEEVE ON THE SHIELD MATERIAL
Figure 105

(b) Shrink the solder sleeve into position.

Make sure that:

- The solder sleeve stays in the correct position
- A minimum of 75 percent of the indicator ring on top of the solder ring is melted.

(9) Do Step (8) again to assemble the other end of the shield splice.

Make sure the shield material is pulled tight before the end of the splice is assembled.

(10) Make a selection of a Temperature Grade B or higher TFE insulation tape from Table 6.

(11) Tightly wind a layer of the tape on the splice assembly.

Make sure that the layer of tape:

- Starts 0.50 inch ±0.25 inch farther than the rear end of the solder sleeve at one end of the splice
- Stops 0.50 inch ±0.25 inch farther than the rear end of the solder sleeve at the other end of the splice
- Makes a 50 percent overlap.

(12) Tightly wind a second layer of the tape on the splice assembly.

Make sure that the layer of tape:

- Starts 1 inch minimum farther than where the first layer of tape stops
- Stops 1 inch minimum farther than where the first layer of tape starts
- Makes a 50 percent overlap.

(13) Assemble a lacing tape wire harness tie on each end of the splice assembly approximately 0.25 inch from the end of the tape. Refer to Subject 20-10-11.

Make sure that the Temperature Grade of the lacing tape is Temperature Grade B or higher.

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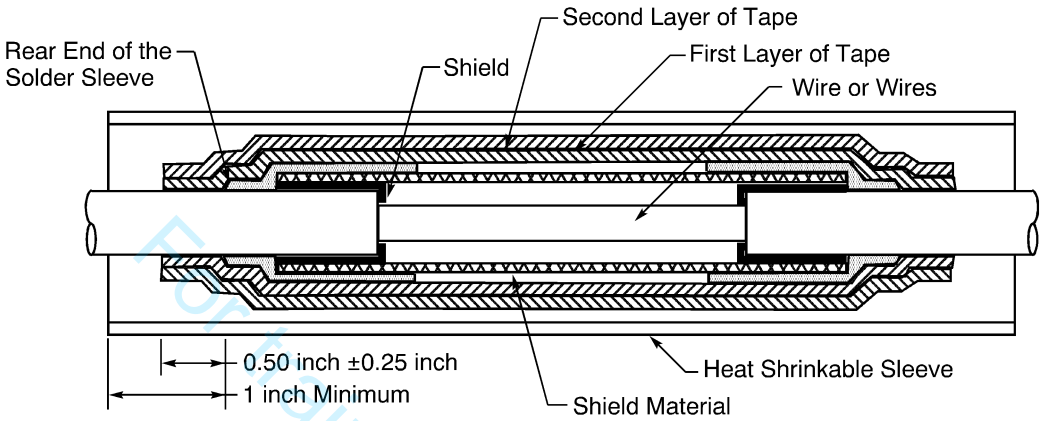
G. Shield Repair - Solder Sleeves, Shield Material, Tape, and a Sleeve with Shield Folded Back

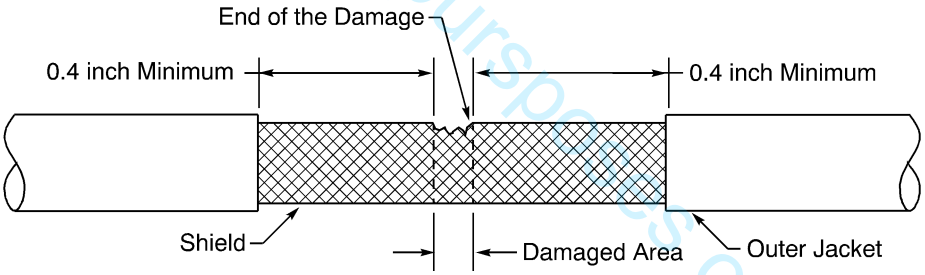
Refer to:

- Paragraph 1.E. for the applicable conditions for the repair of wire and cable with a splice
- Figure 106 for the configuration of the splice assembly.



CONFIGURATION OF THE SPLICE ASSEMBLY
Figure 106

(1) Remove the necessary length of the outer jacket. Refer to Figure 107.



JACKET REMOVAL
Figure 107

(a) On one side of the damaged area, carefully cut the jacket around the circumference of the wire or the cable a minimum of 0.4 inch from the end of the damage, away from the damaged area.

CAUTION: DO NOT CUT ALL THE WAY THROUGH THE JACKET. DAMAGE CAN OCCUR TO THE SHIELD OR WIRE.

(b) On the other side of the damaged area, carefully cut the jacket around the circumference of the wire or the cable a minimum of 0.4 inch from the end of the damage, away from the damaged area.

CAUTION: DO NOT CUT ALL THE WAY THROUGH THE JACKET. DAMAGE CAN OCCUR TO THE SHIELD OR WIRE.

(c) Cut the jacket lightly along the length of the jacket to be removed.

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CAUTION: DO NOT CUT ALL THE WAY THROUGH THE JACKET. DAMAGE CAN OCCUR TO THE SHIELD OR WIRE.

(d) Pull the jacket apart at the lines where it is cut.

NOTE: If it is necessary, the wire or the cable can be bent at the lines where the jacket was cut.

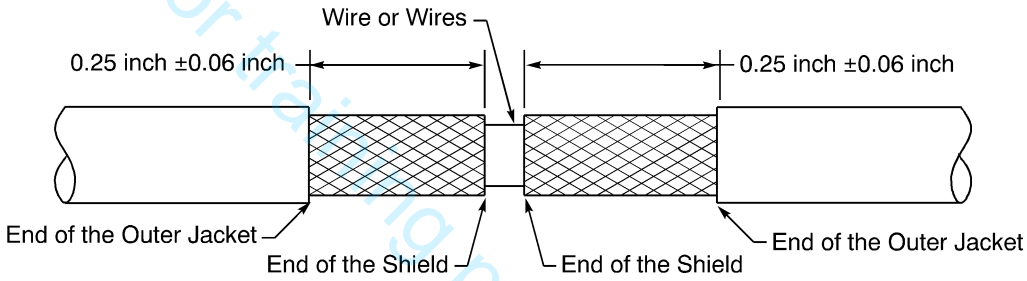
CAUTION: DO NOT BEND THE WIRE OR THE CABLE MORE THAN 3 TIMES THE DIAMETER. DAMAGE TO THE WIRE OR THE CABLE CAN OCCUR.

(2) Clean the jacket with isopropyl alcohol.

Make sure:

- To clean the jacket approximately 3 inches from each end of the jacket
- That the cleaned area is dry.

(3) Prepare the shield. Refer to Figure 108.



SHIELD PREPARATION
Figure 108

(a) Carefully cut around the circumference of the shield on each side of the damaged area.

Make sure that the distance from the end of the jacket to the end of the shield is 0.25 inch ± 0.06 inch.

(b) Remove the unwanted shield with the damage.

(4) Fold the shield back against the jacket on the rear end of the splice assembly.

(5) Make a selection of a Temperature Grade B shield material from Table 9.

Make sure that the shield material has the smallest diameter that can be put on the folded back shield.

NOTE: For alternative shield materials, refer to Subject 20-00-11.

(6) Cut the necessary length of the shield material.

Make sure that the length of the shield material is a minimum of 0.5 inch more than the length of the jacket that is removed from the wire or the cable.

(7) Put the shield material on the wire or cable. Refer to Figure 109.

Make sure that the rear end of the shield material is aligned with the end of the folded back shield.

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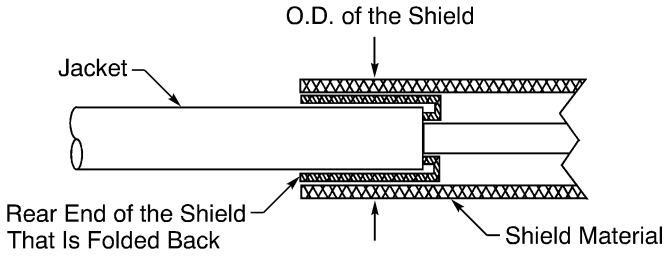


POSITION OF THE SHIELD MATERIAL
Figure 109

(8) Make a selection of two solder sleeves from Table 16.

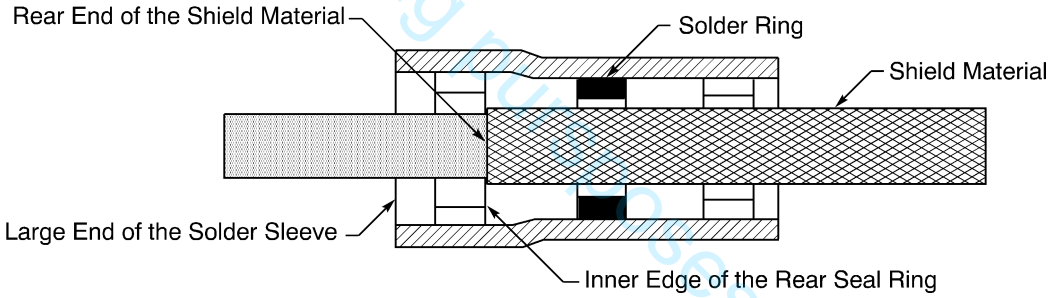
Refer to Figure 109 for the applicable dimensions of the shield splice assembly.

(9) Assemble one end of the shield splice.

(a) Put the solder sleeve on the wire or cable. Refer to Figure 110.

Make sure that:

- The inner edge of the rear seal ring is aligned with the end of the shield and the shield material
- The seal ring does not make an overlap with the shield and the shield material.



POSITION OF THE SOLDER SLEEVE ON THE SHIELD MATERIAL
Figure 110

(b) Shrink the solder sleeve into position.

Make sure that:

- The solder sleeve stays in the correct position
- A minimum of 75 percent of the indicator ring on top of the solder ring is melted.

(10) Fold the shield back against the jacket on the forward end of the splice assembly.

(11) If it is necessary, cut the shield material.

Make sure that the shield material is aligned with the end of the folded back shield.

(12) Do Step (9) again to assemble the other end of the shield splice.

Make sure the shield material is pulled tight before the end of the splice is assembled.

(13) Make a selection of a Temperature Grade B or higher heat shrinkable sleeve from Table 5.

Make sure that the sleeve has the smallest diameter that can be put on the splice assembly.

NOTE: For alternative heat shrinkable sleeves, refer to Subject 20-00-11.

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(14) Cut the necessary length of the heat shrinkable sleeve.

Make sure that the length is a minimum of 1 inch farther than the rear end of the solder sleeve on each end of the splice assembly.

(15) Make a selection of a Temperature Grade B or higher TFE insulation tape from Table 6.

(16) Tightly wind a layer of the tape on the splice assembly.

Make sure that the layer of tape:

- Starts 0.50 inch ±0.25 inch farther than the rear end of the solder sleeve at one end of the splice
- Stops 0.50 inch ±0.25 inch farther than the rear end of the solder sleeve at the other end of the splice
- Makes a 50 percent overlap.

(17) Tightly wind a second layer of the tape on the splice assembly.

Make sure that the layer of tape:

- Starts where the first layer of tape stops
- Stops where the first layer of tape starts
- Makes a 50 percent overlap.

(18) Put the sleeve on the shield splice assembly.

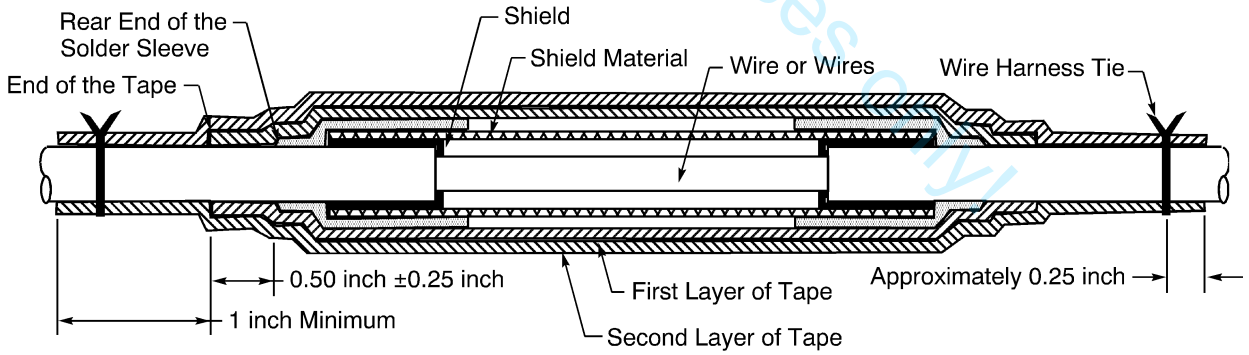
Make sure that each end of the sleeve is a minimum of 0.25 inch farther than the tape on each end of the splice assembly.

(19) Shrink the sleeve into position. Refer to Subject 20-10-14.

H. Shield Repair - Solder Sleeves, Shield Material, Tape, and Ties with Shield Folded Back

Refer to:

- Paragraph 1.E. for the applicable conditions for the repair of wire and cable with a splice
- Figure 111 for the configuration of the splice assembly.



CONFIGURATION OF THE SPLICE ASSEMBLY
Figure 111

(1) Remove the necessary length of the outer jacket. Refer to Figure 112.

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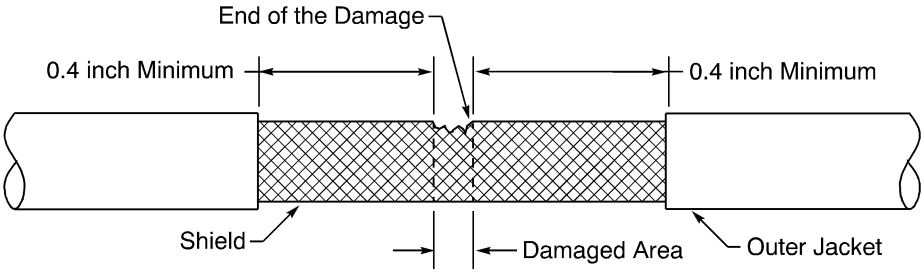

JACKET REMOVAL
Figure 112

(a) On one side of the damaged area, carefully cut the jacket around the circumference of the wire or the cable a minimum of 0.4 inch from the end of the damage, away from the damaged area.

CAUTION: DO NOT CUT ALL THE WAY THROUGH THE JACKET. DAMAGE CAN OCCUR TO THE SHIELD OR WIRE.

(b) On the other side of the damaged area, carefully cut the jacket around the circumference of the wire or the cable a minimum of 0.4 inch from the end of the damage, away from the damaged area.

CAUTION: DO NOT CUT ALL THE WAY THROUGH THE JACKET. DAMAGE CAN OCCUR TO THE SHIELD OR WIRE.

(c) Cut the jacket lightly along the length of the jacket to be removed.

CAUTION: DO NOT CUT ALL THE WAY THROUGH THE JACKET. DAMAGE CAN OCCUR TO THE SHIELD OR WIRE.

(d) Pull the jacket apart at the lines where it is cut.

NOTE: If it is necessary, the wire or the cable can be bent at the lines where the jacket was cut.

CAUTION: DO NOT BEND THE WIRE OR THE CABLE MORE THAN 3 TIMES THE DIAMETER. DAMAGE TO THE WIRE OR THE CABLE CAN OCCUR.

(2) Clean the jacket with isopropyl alcohol.

Make sure:

- To clean the jacket approximately 3 inches from each end of the jacket
- That the cleaned area is dry.

(3) Prepare the shield. Refer to Figure 113.

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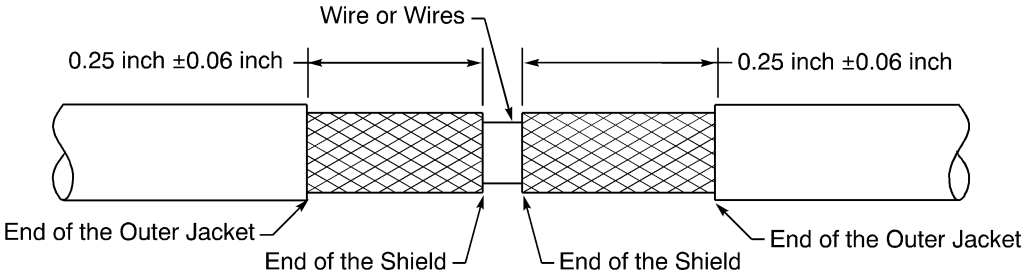


SHIELD PREPARATION
Figure 113

(a) Carefully cut around the circumference of the shield on each side of the damaged area.

Make sure that the distance from the end of the jacket to the end of the shield is 0.25 inch ±0.06 inch.

(b) Remove the unwanted shield with the damage.

(4) Fold the shield back against the jacket on the rear end of the splice assembly.

(5) Make a selection of a Temperature Grade B shield material from Table 9.

Make sure that the shield material has the smallest diameter that can be put on the folded back shield.

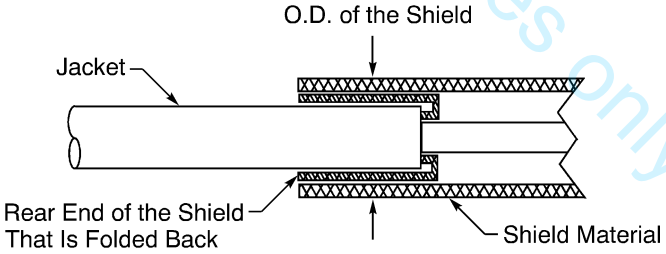
NOTE: For alternative shield materials, refer to Subject 20-00-11.

(6) Cut the necessary length of the shield material.

Make sure that the length of the shield material is a minimum of 0.5 inch more than the length of the jacket that is removed from the wire or the cable.

(7) Put the shield material on the wire or cable. Refer to Figure 114.

Make sure that the rear end of the shield material is aligned with the end of the folded back shield.



POSITION OF THE SHIELD MATERIAL
Figure 114

I (8) Make a selection of two solder sleeves from Table 16.

Refer to Figure 114 for the applicable dimensions of the shield splice assembly.

(9) Assemble one end of the shield splice.

(a) Put the solder sleeve on the wire or cable. Refer to Figure 115.

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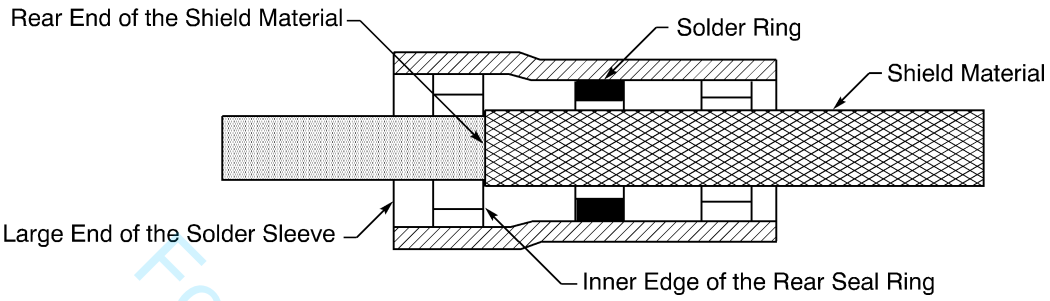
Make sure that:

- The inner edge of the rear seal ring is aligned with the end of the shield and the shield material
- The seal ring does not make an overlap with the shield and the shield material.



POSITION OF THE SOLDER SLEEVE ON THE SHIELD MATERIAL
Figure 115

(b) Shrink the solder sleeve into position.

Make sure that:

- The solder sleeve stays in the correct position
- A minimum of 75 percent of the indicator ring on top of the solder ring is melted.

(10) Fold the shield back against the jacket on the forward end of the splice assembly.

(11) If it is necessary, cut the shield material.

Make sure that the shield material is aligned with the end of the folded back shield.

(12) Do Step (9) again to assemble the other end of the shield splice.

Make sure the shield material is pulled tight before the end of the splice is assembled.

(13) Make a selection of a Temperature Grade B or higher heat shrinkable sleeve from Table 5.

Make sure that the sleeve has the smallest diameter that can be put on the splice assembly.

(14) Cut the necessary length of the heat shrinkable sleeve.

Make sure that the length is a minimum of 1 inch farther than the rear end of the solder sleeve on each end of the splice assembly.

(15) Make a selection of a Temperature Grade B or higher TFE insulation tape from Table 6.

(16) Tightly wind a layer of the tape on the splice assembly.

Make sure that the layer of tape:

- Starts 0.50 inch ±0.25 inch farther than the rear end of the solder sleeve at one end of the splice
- Stops 0.50 inch ±0.25 inch farther than the rear end of the solder sleeve at the other end of the splice
- Makes a 50 percent overlap.

(17) Tightly wind a second layer of the tape on the splice assembly.

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Make sure that the layer of tape:

- Starts 1 inch minimum farther than where the first layer of tape stops
- Stops 1 inch minimum farther than where the first layer of tape starts
- Makes a 50 percent overlap.

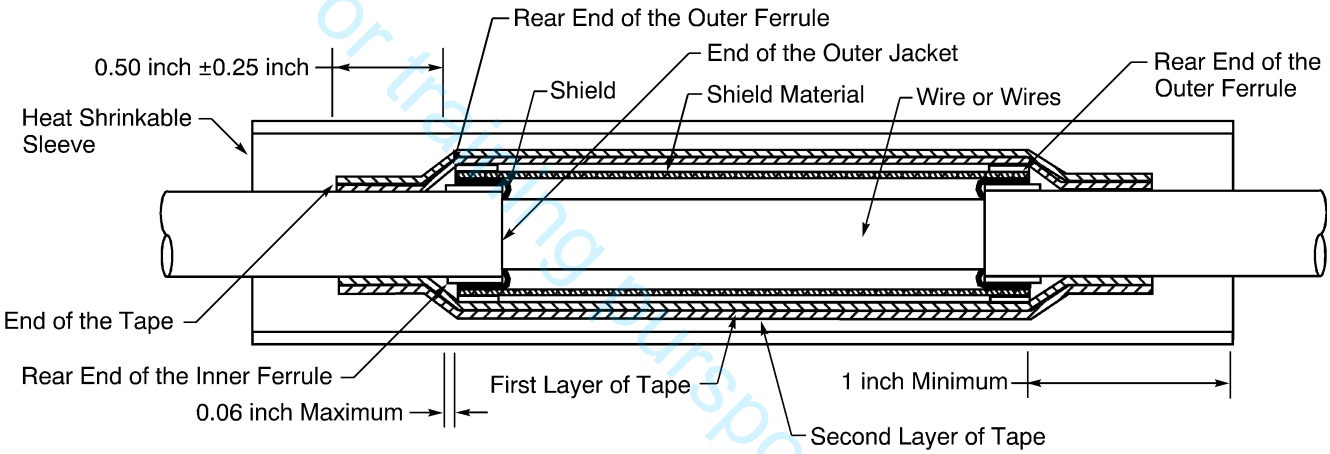
(18) Assemble a lacing tape wire harness tie on each end of the splice assembly approximately 0.25 inch from the end of the tape. Refer to Subject 20-10-11.

Make sure that the Temperature Grade of the lacing tape is Temperature Grade B or higher.

I. Shield Repair - Mechanical Ferrules, Shield Material, Tape, and a Sleeve

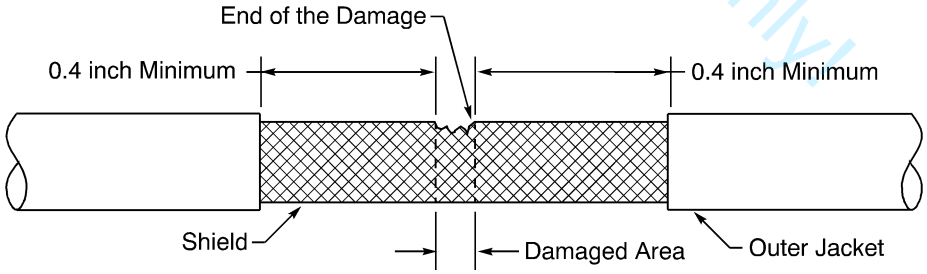
Refer to:

- Paragraph 1.E. for the applicable conditions for the repair of wire and cable with a splice
- Figure 116 for the configuration of the splice assembly.



CONFIGURATION OF THE SPLICE ASSEMBLY
Figure 116

(1) Remove the necessary length of the outer jacket. Refer to Figure 117.



JACKET REMOVAL
Figure 117

(a) On one side of the damaged area, carefully cut the jacket around the circumference of the wire or the cable a minimum of 0.4 inch from the end of the damage, away from the damaged area.

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CAUTION: DO NOT CUT ALL THE WAY THROUGH THE JACKET. DAMAGE CAN OCCUR TO THE SHIELD OR WIRE.

(b) On the other side of the damaged area, carefully cut the jacket around the circumference of the wire or the cable a minimum of 0.4 inch from the end of the damage, away from the damaged area.

CAUTION: DO NOT CUT ALL THE WAY THROUGH THE JACKET. DAMAGE CAN OCCUR TO THE SHIELD OR WIRE.

(c) Cut the jacket lightly along the length of the jacket to be removed.

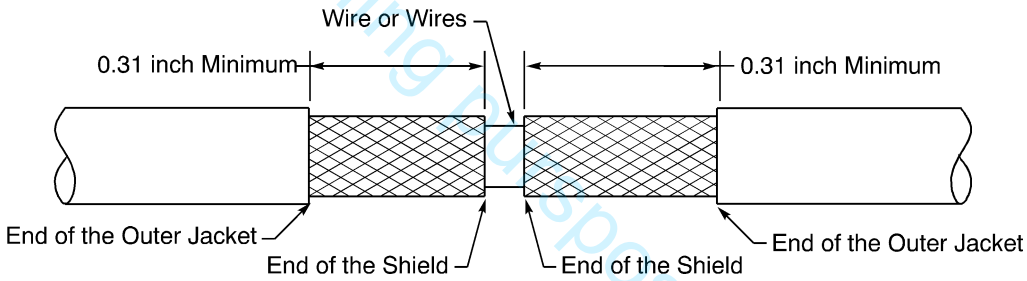
CAUTION: DO NOT CUT ALL THE WAY THROUGH THE JACKET. DAMAGE CAN OCCUR TO THE SHIELD OR WIRE.

(d) Pull the jacket apart at the lines where it is cut.

NOTE: If it is necessary, the wire or the cable can be bent at the lines where the jacket was cut.

CAUTION: DO NOT BEND THE WIRE OR THE CABLE MORE THAN 3 TIMES THE DIAMETER. DAMAGE TO THE WIRE OR THE CABLE CAN OCCUR.

(2) Prepare the shield. Refer to Figure 118.



SHIELD PREPARATION
Figure 118

(a) Carefully cut around the circumference of the shield on each side of the damaged area.

Make sure that the distance from the end of the jacket to the end of the shield is a minimum of 0.31 inch.

(b) Remove the unwanted shield with the damage.

(3) Make a selection of two sets of inner and outer mechanical ferrules. Refer to Subject 20-30-12.

Make sure that:

- The ferrules are the correct Temperature Grade
- The inner ferrule has the smallest diameter that can move freely on the jacket
- The outer ferrule has the smallest diameter that can be put on the inner ferrule and shield.

(4) Make a selection of a ferrule crimp tool. Refer to Subject 20-30-12.

(5) Put one inner ferrule on the jacket of the wire or cable, to the rear of the area to repair.

(6) Move the strands of the rear shield apart and make them straight.

(7) Align the forward end of the inner ferrule with the end of the jacket.

(8) Fold the strands of the rear shield back on the inner ferrule.

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Make sure that the strands of the shield are symmetrical around the circumference of the ferrule.

(9) Make a selection of a shield material from Table 9.

Make sure that the shield material has:

- The correct Temperature Grade
- The smallest diameter that can be put on the folded back shield.

NOTE: For alternative shield materials, refer to Subject 20-00-11.

(10) Cut the necessary length of the shield material.

Make sure that the length of the shield material is a minimum of 0.62 inch more than the length of the jacket that is removed from the wire or the cable.

(11) Put the shield material on the wire or cable.

(12) Put the two outer ferrules on the shield material.

(13) Align the end of the shield material with the end of the shield that is folded back.

(14) Align the rear end of one of the outer ferrules with the rear end of the inner ferrule.

Make sure that:

- The outer ferrule goes around the shield material
- The rear end of the outer ferrule does not extend farther than the rear end of the inner ferrule
- The rear end of the outer ferrule is a maximum of 0.06 inch from the rear end of the inner ferrule.

(15) Crimp the ferrules.

(16) Put the other inner ferrule on the jacket of the wire or cable forward of the area to repair.

(17) Move the strands of the forward shield apart and make them straight.

(18) Align the forward end of the inner ferrule with the end of the jacket.

(19) Fold the strands of the forward shield back over the inner ferrule.

Make sure that the strands of the shield are symmetrical around the circumference of the ferrule.

(20) Put the end of the shield material on the folded back shield.

(21) Align the rear end of the other outer ferrule with the rear end of the inner ferrule.

Make sure that:

- The outer ferrule goes around the shield material
- The shield material is pulled tight
- The rear end of the outer ferrule does not extend farther than the rear end of the inner ferrule
- The rear end of the outer ferrule is a maximum of 0.06 inch from the rear end of the inner ferrule.

(22) Crimp the ferrules.

(23) Remove the shield and the shield material that extend farther than the rear end of the inner ferrule on each end of the shield splice.

(24) Make a selection of a heat shrinkable sleeve from Table 5.

Make sure that the sleeve has:

- The correct Temperature Grade
- The smallest diameter that can be put on the splice assembly.

NOTE: For alternative heat shrinkable sleeves, refer to Subject 20-00-11.

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(25) Cut the necessary length of the sleeve.

Make sure that the length is a minimum of 1 inch farther than the rear end of the ferrules on each end of the splice assembly.

(26) Make a selection of a TFE insulation tape from Table 6.

Make sure that the insulation tape is the correct Temperature Grade.

(27) Tightly wind a layer of the tape on the splice assembly.

Make sure that the layer of tape:

- Starts 0.50 inch ±0.25 inch farther than the rear end of the ferrule at one end of the splice
- Stops 0.50 inch ±0.25 inch farther than the rear end of the ferrule at the other end of the splice
- Makes a 50 percent overlap.

(28) Tightly wind a second layer of the tape on the splice assembly.

Make sure that the layer of tape:

- Starts where the first layer of tape stops
- Stops where the first layer of tape starts
- Makes a 50 percent overlap.

(29) Put the sleeve on the shield splice assembly.

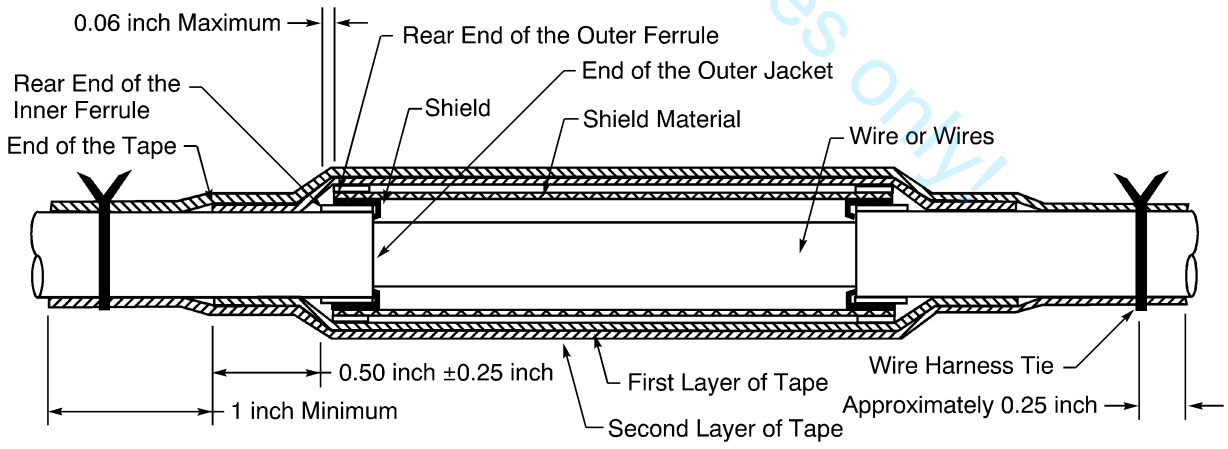
Make sure that each end of the sleeve is a minimum of 0.25 inch farther than the tape on each end of the splice assembly.

(30) Shrink the sleeve into its position. Refer to Subject 20-10-14.

J. Shield Repair - Mechanical Ferrules, Shield Material, Tape, and Ties

Refer to:

- Paragraph 1.E. for the applicable conditions for the repair of wire and cable with a splice
- Figure 119 for the configuration of the splice assembly.



CONFIGURATION OF THE SPLICE ASSEMBLY
Figure 119

(1) Remove the necessary length of the outer jacket. Refer to Figure 120.

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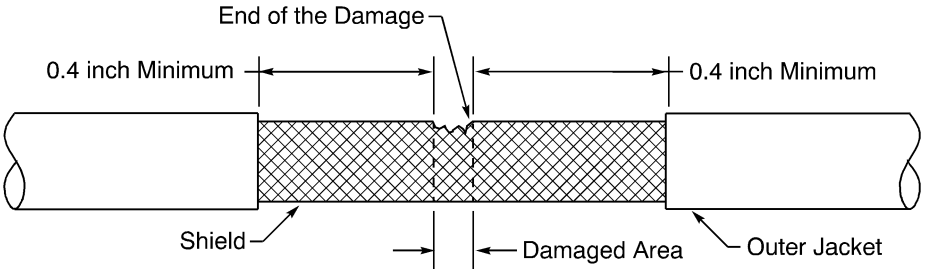


JACKET REMOVAL
Figure 120

(a) On one side of the damaged area, carefully cut the jacket around the circumference of the wire or the cable a minimum of 0.4 inch from the end of the damage, away from the damaged area.

CAUTION: DO NOT CUT ALL THE WAY THROUGH THE JACKET. DAMAGE CAN OCCUR TO THE SHIELD OR WIRE.

(b) On the other side of the damaged area, carefully cut the jacket around the circumference of the wire or the cable a minimum of 0.4 inch from the end of the damage, away from the damaged area.

CAUTION: DO NOT CUT ALL THE WAY THROUGH THE JACKET. DAMAGE CAN OCCUR TO THE SHIELD OR WIRE.

(c) Cut the jacket lightly along the length of the jacket to be removed.

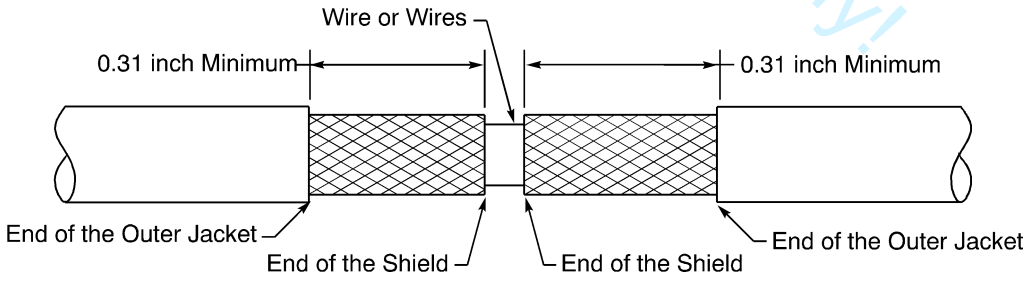
CAUTION: DO NOT CUT ALL THE WAY THROUGH THE JACKET. DAMAGE CAN OCCUR TO THE SHIELD OR WIRE.

(d) Pull the jacket apart at the lines where it is cut.

NOTE: If it is necessary, the wire or the cable can be bent at the lines where the jacket was cut.

CAUTION: DO NOT BEND THE WIRE OR THE CABLE MORE THAN 3 TIMES THE DIAMETER. DAMAGE TO THE WIRE OR THE CABLE CAN OCCUR.

(2) Prepare the shield. Refer to Figure 121.



SHIELD PREPARATION
Figure 121

(a) Carefully cut around the circumference of the shield on each side of the damaged area.

Make sure that the distance from the end of the jacket to the end of the shield is a minimum of 0.31 inch.

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(b) Remove the unwanted shield with the damage.

(3) Make a selection of two sets of inner and outer mechanical ferrules. Refer to Subject 20-30-12.

Make sure that:

- The ferrules are the correct Temperature Grade
- The inner ferrule has the smallest diameter that can move freely on the jacket
- The outer ferrule has the smallest diameter that can be put on the inner ferrule and shield.

(4) Make a selection of a ferrule crimp tool. Refer to Subject 20-30-12.

(5) Put one inner ferrule on the jacket of the wire or cable, to the rear of the area to repair.

(6) Move the strands of the rear shield apart and make them straight.

(7) Align the forward end of the inner ferrule with the end of the jacket.

(8) Fold the strands of the rear shield back on the inner ferrule.

Make sure that the strands of the shield are symmetrical around the circumference of the ferrule.

(9) Make a selection of a shield material from Table 9.

Make sure that the shield material has:

- The correct Temperature Grade
- The smallest diameter that can be put on the folded back shield.

NOTE: For alternative shield materials, refer to Subject 20-00-11.

(10) Cut the necessary length of the shield material.

Make sure that the length of the shield material is a minimum of 0.62 inch more than the length of the jacket that is removed from the wire or the cable.

(11) Put the shield material on the wire or cable.

(12) Put the two outer ferrules on the shield material.

(13) Align the end of the shield material with the end of the shield that is folded back.

(14) Align the rear end of one of the outer ferrules with the rear end of the inner ferrule.

Make sure that:

- The outer ferrule goes around the shield material
- The rear end of the outer ferrule does not extend farther than the rear end of the inner ferrule
- The rear end of the outer ferrule is a maximum of 0.06 inch from the rear end of the inner ferrule.

(15) Crimp the ferrules.

(16) Put the other inner ferrule on the jacket of the wire or cable forward of the area to repair.

(17) Move the strands of the forward shield apart and make them straight.

(18) Align the forward end of the inner ferrule with the end of the jacket.

(19) Fold the strands of the forward shield back over the inner ferrule.

Make sure that the strands of the shield are symmetrical around the circumference of the ferrule.

(20) Put the end of the shield material on the folded back shield.

(21) Align the rear end of the other outer ferrule with the rear end of the inner ferrule.

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Make sure that:

- The outer ferrule goes around the shield material
- The shield material is pulled tight
- The rear end of the outer ferrule does not extend farther than the rear end of the inner ferrule
- The rear end of the outer ferrule is a maximum of 0.06 inch from the rear end of the inner ferrule.

(22) Crimp the ferrules.

(23) Remove the shield and the shield material that extend farther than the rear end of the inner ferrule on each end of the shield splice.

(24) Make a selection of a TFE insulation tape from Table 6.

Make sure that the insulation tape is the correct Temperature Grade.

(25) Tightly wind a layer of the tape on the splice assembly.

Make sure that the layer of tape:

- Starts 0.50 inch ±0.25 inch farther than the rear end of the ferrule at one end of the splice
- Stops 0.50 inch ±0.25 inch farther than the rear end of the ferrule at the other end of the splice
- Makes a 50 percent overlap.

(26) Tightly wind a second layer of the tape on the splice assembly.

Make sure that the layer of tape:

- Starts 1 inch minimum farther than where the first layer of tape stops
- Stops 1 inch minimum farther than where the first layer of tape starts
- Makes a 50 percent overlap.

(27) Assemble a lacing tape wire harness tie on each end of the splice assembly approximately 0.25 inch from the end of the tape. Refer to Subject 20-10-11.

Make sure that the lacing tape is the correct Temperature Grade.

K. Shield Repair - Shield-Kons, Shield Material, Tape, and a Sleeve

NOTE: Temperature grade D Shield-Kons are no longer manufactured. For the procedure to assemble a temperature grade D shielded splice, refer to Subject 20-30-12, Sealed Splice Configurations with Shield Termination Rings and Shield Terminator Bands for Shielded Wire and Shielded Cable for High Temperature.

NOTE: If a temperature grade D shield repair is necessary, and temperature grade D Shield-Kons are available, this procedure can be used:

Refer to:

- Paragraph 1.E. for the applicable conditions for the repair of wire and cable with a splice
- Figure 122 for the configuration of the splice assembly.

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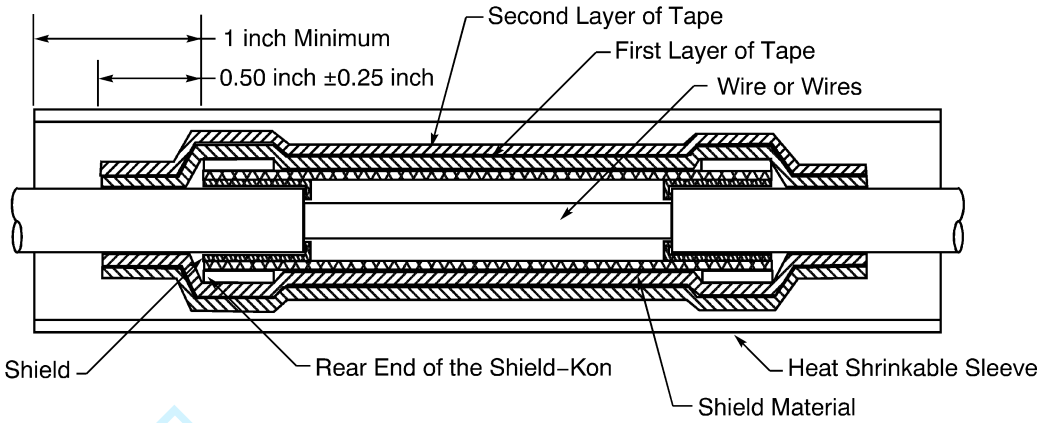
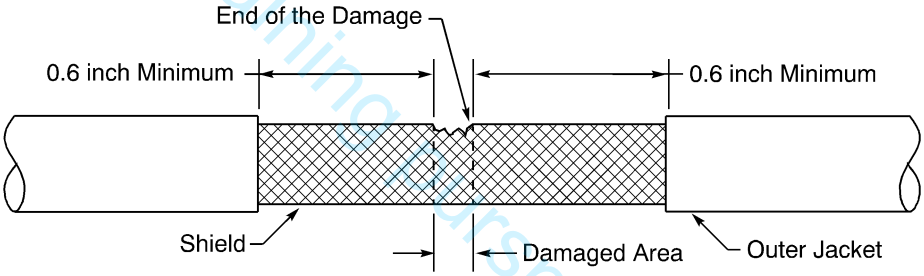


CONFIGURATION OF THE SPLICE ASSEMBLY
Figure 122

(1) Remove the necessary length of the outer jacket. Refer to Figure 123.



JACKET REMOVAL
Figure 123

(a) On one side of the damaged area, carefully cut the jacket around the circumference of the wire or the cable a minimum of 0.6 inch from the end of the damage, away from the damaged area.

CAUTION: DO NOT CUT ALL THE WAY THROUGH THE JACKET. DAMAGE CAN OCCUR TO THE SHIELD OR WIRE.

(b) On the other side of the damaged area, carefully cut the jacket around the circumference of the wire or the cable a minimum of 0.6 inch from the end of the damage, away from the damaged area.

CAUTION: DO NOT CUT ALL THE WAY THROUGH THE JACKET. DAMAGE CAN OCCUR TO THE SHIELD OR WIRE.

(c) Cut the jacket lightly along the length of the jacket to be removed.

CAUTION: DO NOT CUT ALL THE WAY THROUGH THE JACKET. DAMAGE CAN OCCUR TO THE SHIELD OR WIRE.

(d) Pull the jacket apart at the lines where it is cut.

NOTE: If it is necessary, the wire or the cable can be bent at the lines where the jacket was cut.

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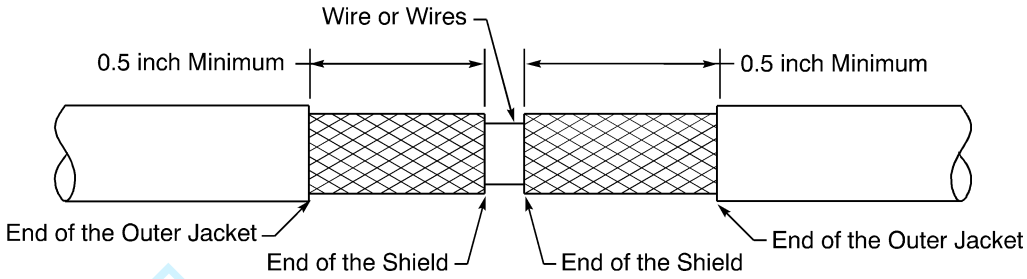
CAUTION: DO NOT BEND THE WIRE OR THE CABLE MORE THAN 3 TIMES THE DIAMETER. DAMAGE TO THE WIRE OR THE CABLE CAN OCCUR.

(2) Prepare the shield. Refer to Figure 124.



SHIELD PREPARATION
Figure 124

(a) Carefully cut around the circumference of the shield on each side of the damaged area.

Make sure that the distance from the end of the jacket to the end of the shield is a minimum of 0.5 inch.

(b) Remove the unwanted shield with the damage.

(3) Fold the end of each shield against the outer jacket.

(4) Make a selection of a shield material from Table 9.

Make sure that the shield material has:

- The correct Temperature Grade
- The smallest diameter that can be put on the folded back shield.

NOTE: For alternative shield materials, refer to Subject 20-00-11.

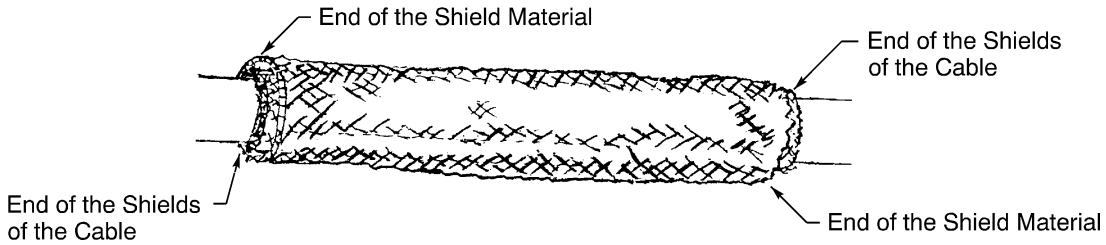
(5) Cut the necessary length of the shield material.

Make sure that the minimum length is the distance between the two ends of the folded back shields.

(6) Put a temporary layer of tape around the end of each shield to make sure that the shields do not move.

(7) Put the shield material on the wire or cable.

(8) Align one end of the shield material with the end of the folded back shield. Refer to Figure 125.



POSITION OF THE SHIELD MATERIAL
Figure 125

(9) Measure the outer diameter of the shield assembly. Refer to Figure 126.

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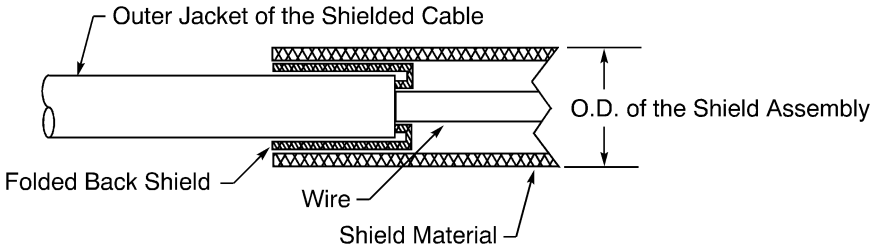


MEASUREMENT OF THE SHIELD ASSEMBLY OUTER DIAMETER
Figure 126

(10) Make a selection of two Shield-Kons that have the correct dimensions. Refer to Subject 20-30-12.
Make sure that the Shield-Kons are the correct Temperature Grade.

(11) Assemble the splice of the shield.

(a) Make a selection of a Shield-Kon crimp tool. Refer to Subject 20-30-12.

(b) Remove the temporary layer of tape around the end of each shield.

(c) Align one end of the shield material with the end of the shield. Refer to Figure 125.

(d) Put one of the Shield-Kons into the die of the crimp tool.
Make sure that the center of the Shield-Kon is aligned with the center of the die.

(e) Put the crimp tool and the Shield-Kon on the shield material.
Make sure that the rear end of the Shield-Kon is aligned with the ends of the shield and the shield material.

(f) Crimp the Shield-Kon.

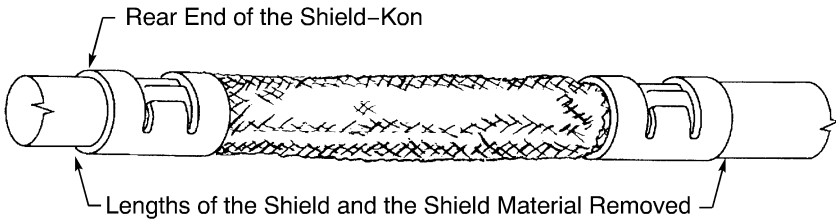
(g) Put the other Shield-Kon into the die of the crimp tool.
Make sure that the center of the Shield-Kon is aligned with the center of the die.

(h) Make the shield material smooth and tight.

(i) Put the crimp tool and the Shield-Kon on the other end of the shield material.
Make sure that the rear end of the Shield-Kon is aligned with the ends of the shield and the shield material.

(j) Crimp the Shield-Kon.

(k) Remove the shield and the shield material that extend farther than the rear end of the Shield-Kon on each end of the shield splice. Refer to Figure 127.



SHIELD SPLICE ASSEMBLY
Figure 127

(12) Make a selection of a heat shrinkable sleeve from Table 5.

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Make sure that the sleeve has:

- The correct Temperature Grade
- The smallest diameter that can be put on the splice assembly.

NOTE: For alternative heat shrinkable sleeves, refer to Subject 20-00-11.

(13) Cut the necessary length of the sleeve.

Make sure that the length is a minimum of 1 inch farther than the rear end of the Shield-Kon on each end of the splice assembly.

(14) Make a selection of a TFE insulation tape from Table 6.

Make sure that the insulation tape is the correct Temperature Grade.

(15) Tightly wind a layer of the tape on the splice assembly.

Make sure that the layer of tape:

- Starts 0.50 inch ±0.25 inch farther than the rear end of the Shield-Kon at one end of the splice
- Stops 0.50 inch ±0.25 inch farther than the rear end of the Shield-Kon at the other end of the splice
- Makes a 50 percent overlap.

(16) Tightly wind a second layer of the tape on the splice assembly.

Make sure that the layer of tape:

- Starts where the first layer of tape stops
- Stops where the first layer of tape starts
- Makes a 50 percent overlap.

(17) Put the sleeve on the shield splice assembly.

Make sure that each end of the sleeve is a minimum of 0.25 inch farther than the tape on each end of the splice assembly.

(18) Shrink the sleeve into its position. Refer to Subject 20-10-14.

L. Shield Repair - Shield-Kons, Shield Material, Tape, and Ties

NOTE: Temperature grade D Shield-Kons are no longer manufactured. For the procedure to assemble a temperature grade D shielded splice, refer to Subject 20-30-12, Sealed Splice Configurations with Shield Termination Rings and Shield Terminator Bands for Shielded Wire and Shielded Cable for High Temperature.

NOTE: If a temperature grade D shield repair is necessary, and temperature grade D Shield-Kons are available, this procedure can be used:

Refer to:

- Paragraph 1.E. for the applicable conditions for the repair of wire and cable with a splice
- Figure 128 for the configuration of the splice assembly.

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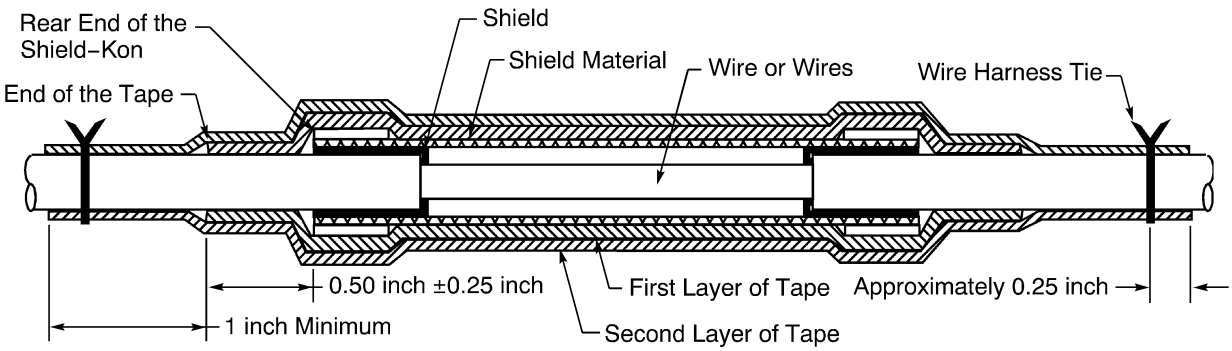
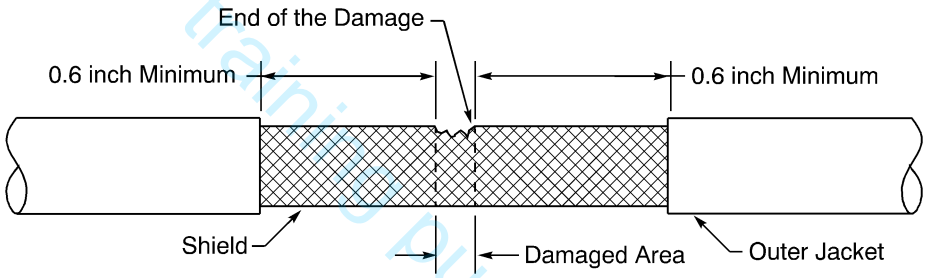


CONFIGURATION OF THE SPLICE ASSEMBLY
Figure 128

(1) Remove the necessary length of the outer jacket. Refer to Figure 129.



JACKET REMOVAL
Figure 129

(a) On one side of the damaged area, carefully cut the jacket around the circumference of the wire or the cable a minimum of 0.6 inch from the end of the damage, away from the damaged area.

CAUTION: DO NOT CUT ALL THE WAY THROUGH THE JACKET. DAMAGE CAN OCCUR TO THE SHIELD OR WIRE.

(b) On the other side of the damaged area, carefully cut the jacket around the circumference of the wire or the cable a minimum of 0.6 inch from the end of the damage, away from the damaged area.

CAUTION: DO NOT CUT ALL THE WAY THROUGH THE JACKET. DAMAGE CAN OCCUR TO THE SHIELD OR WIRE.

(c) Cut the jacket lightly along the length of the jacket to be removed.

CAUTION: DO NOT CUT ALL THE WAY THROUGH THE JACKET. DAMAGE CAN OCCUR TO THE SHIELD OR WIRE.

(d) Pull the jacket apart at the lines where it is cut.

NOTE: If it is necessary, the wire or the cable can be bent at the lines where the jacket was cut.

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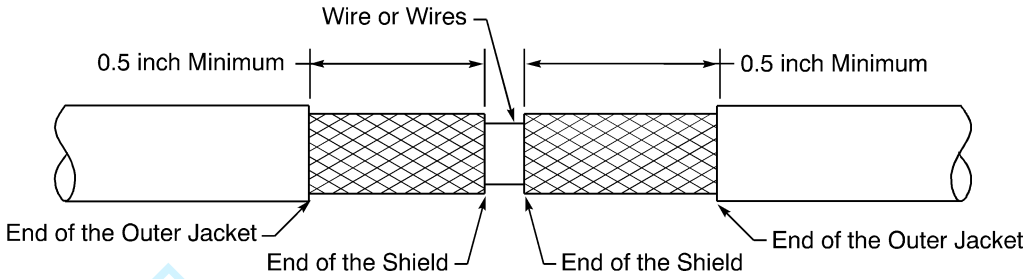
CAUTION: DO NOT BEND THE WIRE OR THE CABLE MORE THAN 3 TIMES THE DIAMETER. DAMAGE TO THE WIRE OR THE CABLE CAN OCCUR.

(2) Prepare the shield. Refer to Figure 130.



SHIELD PREPARATION
Figure 130

(a) Carefully cut around the circumference of the shield on each side of the damaged area.

Make sure that the distance from the end of the jacket to the end of the shield is a minimum of 0.5 inch.

(b) Remove the unwanted shield with the damage.

(3) Fold the end of each shield against the outer jacket.

(4) Make a selection of a shield material from Table 9.

Make sure that the shield material has:

- The correct Temperature Grade
- The smallest diameter that can be put on the folded back shield.

NOTE: For alternative shield materials, refer to Subject 20-00-11.

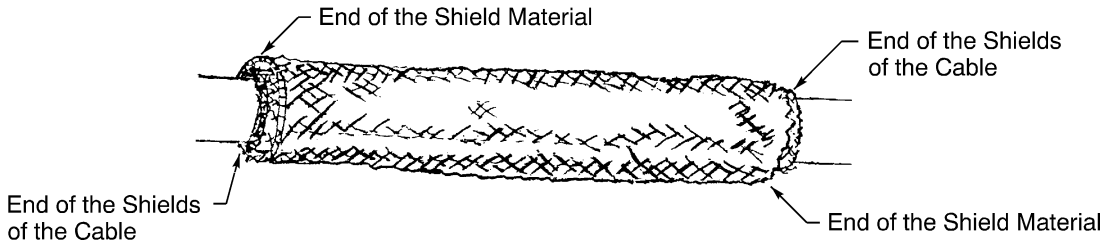
(5) Cut the necessary length of the shield material.

Make sure that the minimum length is the distance between the two ends of the folded back shields.

(6) Put a temporary layer of tape around the end of each shield to make sure that the shields do not move.

(7) Put the shield material on the wire or cable.

(8) Align one end of the shield material with the end of the folded back shield. Refer to Figure 131.



POSITION OF THE SHIELD MATERIAL
Figure 131

(9) Measure the outer diameter of the shield assembly. Refer to Figure 132.

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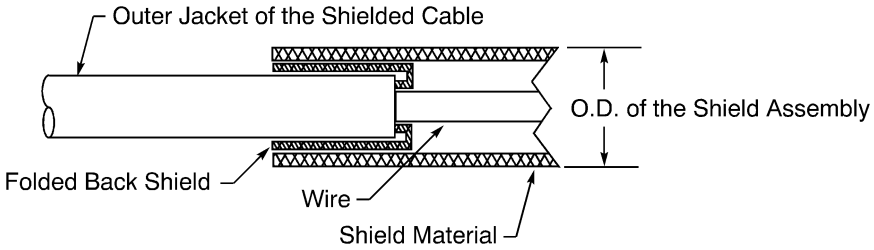


MEASUREMENT OF THE SHIELD ASSEMBLY OUTER DIAMETER
Figure 132

(10) Make a selection of two Shield-Kons that have the correct dimensions. Refer to Subject 20-30-12.
Make sure that the Shield-Kons are the correct Temperature Grade.

(11) Assemble the splice of the shield.

(a) Make a selection of a Shield-Kon crimp tool. Refer to Subject 20-30-12.

(b) Remove the temporary layer of tape around the end of each shield.

(c) Align one end of the shield material with the end of the shield. Refer to Figure 131.

(d) Put one of the Shield-Kons into the die of the crimp tool.
Make sure that the center of the Shield-Kon is aligned with the center of the die.

(e) Put the crimp tool and the Shield-Kon on the shield material.
Make sure that the rear end of the Shield-Kon is aligned with the ends of the shield and the shield material.

(f) Crimp the Shield-Kon.

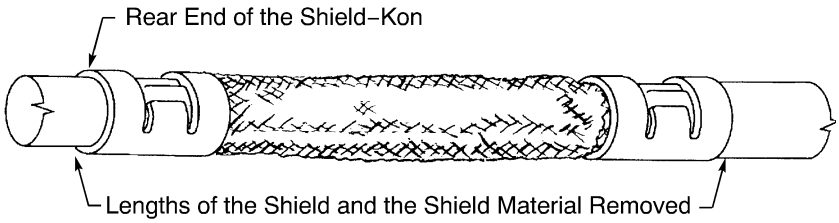
(g) Put the other Shield-Kon into the die of the crimp tool.
Make sure that the center of the Shield-Kon is aligned with the center of the die.

(h) Make the shield material smooth and tight.

(i) Put the crimp tool and the Shield-Kon on the other end of the shield material.
Make sure that the rear end of the Shield-Kon is aligned with the ends of the shield and the shield material.

(j) Crimp the Shield-Kon.

(k) Remove the shield and the shield material that extend farther than the rear end of the Shield-Kon on each end of the shield splice. Refer to Figure 133.



SHIELD SPLICE ASSEMBLY
Figure 133

(12) Make a selection of a TFE insulation tape from Table 6.

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Make sure that the insulation tape is the correct Temperature Grade.

(13) Tightly wind a layer of the tape on the splice assembly.

Make sure that the layer of tape:

- Starts 0.50 inch ±0.25 inch farther than the rear end of the Shield-Kon at one end of the splice
- Stops 0.50 inch ±0.25 inch farther than the rear end of the Shield-Kon at the other end of the splice
- Makes a 50 percent overlap.

(14) Tightly wind a second layer of the tape on the splice assembly.

Make sure that the layer of tape:

- Starts 1 inch minimum farther than where the first layer of tape stops
- Stops 1 inch minimum farther than where the first layer of tape starts
- Makes a 50 percent overlap.

(15) Assemble a lacing tape wire harness tie on each end of the splice assembly approximately 0.25 inch from the end of the tape. Refer to Subject 20-10-11.

Make sure that the lacing tape is the correct Temperature Grade.

7. REPAIR OF COAX CABLE

A. Repair of the Shield of a Coax Cable

For the conditions that are applicable for the repair of coax cable, refer to Paragraph 2.M.

(1) Make a selection of one of these tapes from Table 6:

- Temperature Grade C or D TFE Tape
- Temperature Grade A polyester tape

Make sure that the tape has a temperature grade that is applicable for the location at the wire installation.

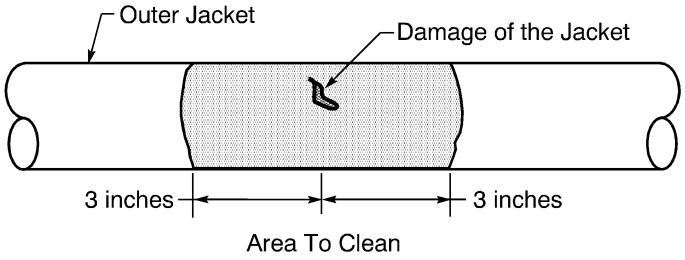
(2) Remove loose pieces of insulation and rough edges at the area of the damage.

Make sure that the insulation has a smooth surface.

(3) Clean the jacket with isopropyl alcohol. Refer to Figure 134.

Make sure:

- To clean the damaged area of the jacket
- To clean the jacket approximately 3 inches on each side of the damage.



AREA TO CLEAN
Figure 134

(4) Let the cleaned area dry.

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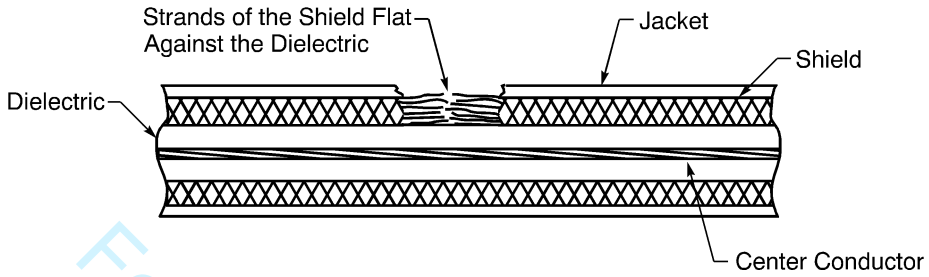
(5) Put the strands of the damaged shield:

- Flat against the primary insulation
- Even and symmetrical around the circumference of the area with damage.

Refer to Figure 135.

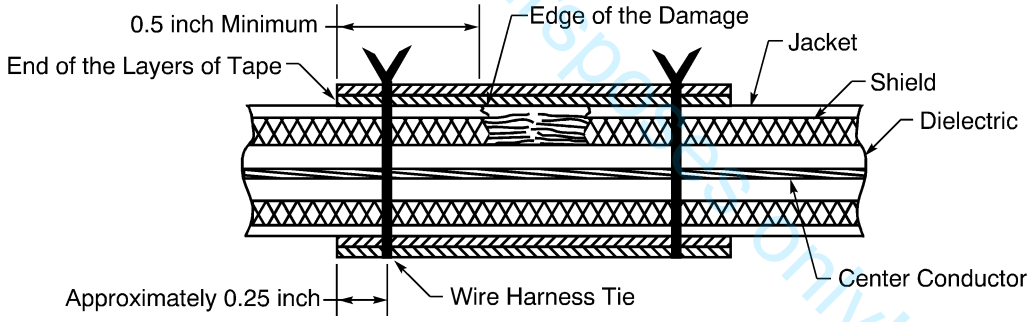


POSITION OF THE SHIELD FOR REPAIR
Figure 135

(6) Put a minimum of two layers of the tape on the damaged area. Refer to Figure 136.

Make sure that:

- Each end of the tape extends a minimum of 0.5 inch farther than each end of the damaged area
- The tape makes 50 percent circumferential overlap
- The second layer of tape is in the opposite direction of the first layer.



POSITION OF THE LAYERS OF TAPE AND THE WIRE HARNESS TIES
Figure 136

(7) Assemble a lacing tape wire harness tie on each end of the repair approximately 0.25 inch from the end of the tape.

Make sure that the lacing tape is the correct Temperature Grade.

Refer to:

- Figure 136
- Subject 20-10-11 for the procedure to assemble a wire harness tie.

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B. Repair of a Coax Cable with a Splice

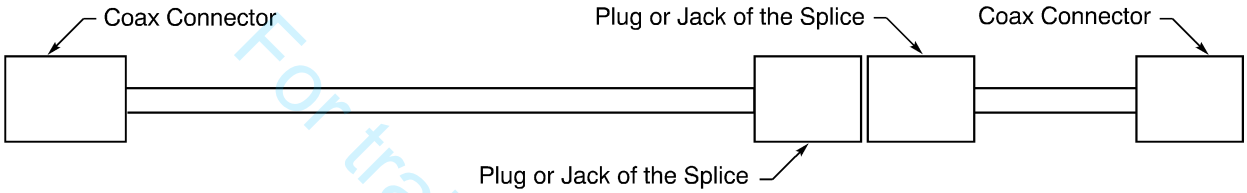
For the conditions that are applicable for the repair of coax cable, refer to Paragraph 2.M.

NOTE: If the coax cable does not have the sufficient length to make a jack connector and a plug connector, a repair can be made with a splice and a new length of coax cable. Refer to Paragraph 7.C.

(1) Make a selection of a jack connector and a straight plug connector that are specified for the coax cable. Refer to Subject 20-51-00.

(2) Remove the length of the damaged coax cable.

(3) Assemble the splice. Refer to Figure 137.



COAX CABLE SPLICE
Figure 137

(a) Assemble the jack connector on the end of one length of the cable. Refer to the Subject that is applicable for the assembly of the jack.

(b) Assemble the plug connector on the end of the other length of the cable. Refer to the Subject that is applicable for the assembly of the jack.

(4) Engage the jack connector and the plug connector for the splice.

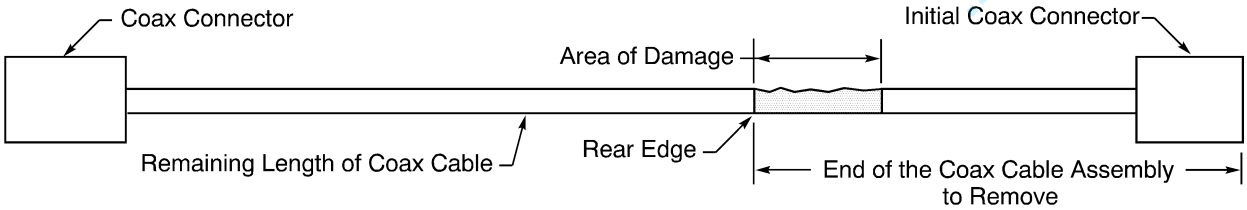
C. Repair of a Coax Cable with a Splice and a New Length of Coax Cable

For the conditions that are applicable for the repair of coax cable, refer to Paragraph 2.M.

(1) Find the part number or the specification of the coax cable. Refer to the WDM and Subject 20-00-13.

(2) Make a selection of a jack connector and a straight plug connector that are specified for the coax cable. Refer to Subject 20-51-00.

(3) Make a selection of the end of the coax cable assembly to remove. Refer to Figure 138.



REMOVAL OF ONE END OF THE COAX CABLE ASSEMBLY
Figure 138

(4) Cut the coax cable at the rear edge of the area of damage. Refer to Figure 138.

(5) Cut a new length of the same type of coax cable that is as long as the length of coax cable that is removed.

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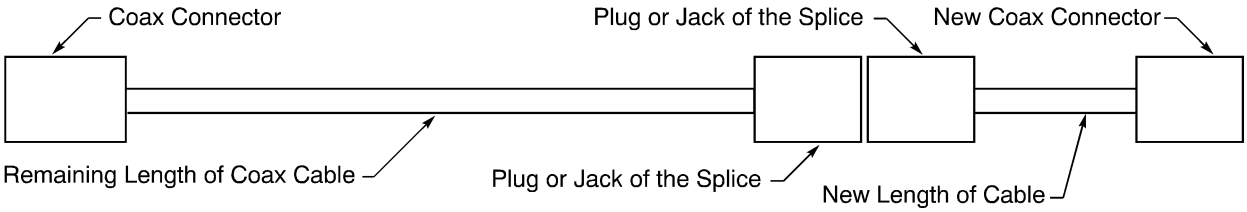
(6) Assemble the splice. Refer to Figure 139.



SPLICE OF THE NEW LENGTH OF COAX CABLE
Figure 139

(a) Assemble the jack or the plug connector on the end of the remaining length of coax cable. Refer to the Subject that is applicable for the connector.

(b) Assemble the other connector on one end of the new length of coax cable. Refer to the Subject that is applicable for the connector.

(7) Assemble a new coax connector on the other end of the new length of coax cable. Refer to the Subject that is applicable for the connector.

Make sure that:

- The new connector has the same part number as the initial coax connector; refer to Figure 138 and Figure 139
- The new length of coax cable is equal to the length of coax cable that is removed.

(8) Engage the jack connector and the plug connector for the splice.

8. REPAIR OF SHIELD GROUND WIRE

A. Repair of a Shield Pull Through Shield Ground Wire

This paragraph gives the procedure to repair a damaged shield pull through shield ground wire with a shield extension and a shield ground wire.

Table 20
NECESSARY LENGTH OF THE SHIELD EXTENSION

Shield Ground Wire Assembly Configuration	Necessary Length of the Shield Extension
Mechanical Ferrule, Shield Folded Back	Distance from the end of the jacket to the mark plus 0.35 inch
Mechanical Ferrule, Shield Not Folded Back	Distance from the end of the jacket to the mark
Shield-Kon, Shield Folded Back	Distance from the end of the jacket to the mark plus 0.35 inch
Shield Pull Through	Distance from the end of the jacket to the mark plus the length of the shield ground wire
Solder Sleeve, Shield Folded Back	Distance from the end of the jacket to the mark plus 0.35 inch
Solder Sleeve, Shield Not Folded Back	Distance from the end of the jacket to the mark

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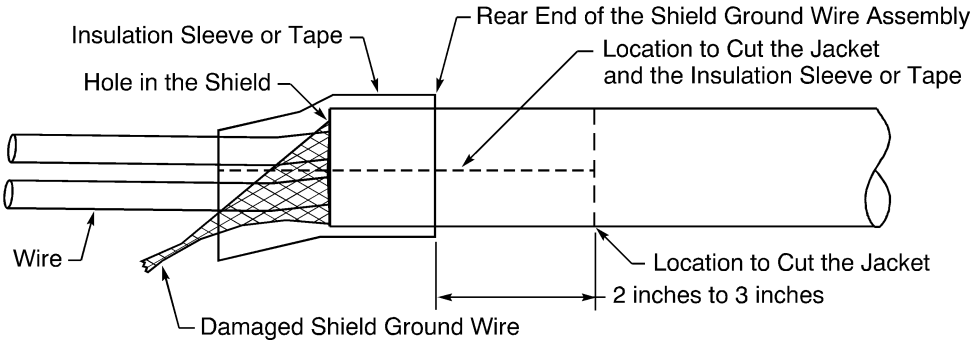

CABLE PREPARATION
Figure 140

Refer to Figure 140.

(1) If it is necessary remove the contact assemblies from the connector.

Refer to the Subject that is applicable for the connector.

(2) Cut the jacket around the circumference of the wire or the cable, 2 inches to 3 inches from the rear end of the shield ground wire assembly.

(3) Carefully cut the jacket and the insulation sleeve or tape lightly along the length of the cable.

Make sure cut the jacket and the sleeve or the tape from the location the jacket is cut circumferentially to the end of the sleeve or the tape.

CAUTION: DO NOT CUT THE SHIELD. DAMAGE TO THE SHIELD OR THE WIRES CAN OCCUR.

(4) Remove the unwanted jacket and the unwanted insulation sleeve or tape from the wires.

(5) Make a mark on a wire where the wires are pulled through the shield.

(6) At the end of the jacket, carefully cut the shield around the circumference of the wire or the cable.

CAUTION: DO NOT CAUSE DAMAGE TO THE WIRES OF THE CABLE. DAMAGE CAN CAUSE UNSATISFACTORY PERFORMANCE OF THE CABLE.

(7) Remove the unwanted length of the shield.

(8) Make a selection of a shield ground wire assembly configuration. Refer to Subject 20-10-15.

(9) Assemble a shield extension. Refer to Subject 20-10-15.

Make sure that the length of the shield extension is correct for the shield ground wire assembly configuration. Refer to Table 20 and Figure 141.

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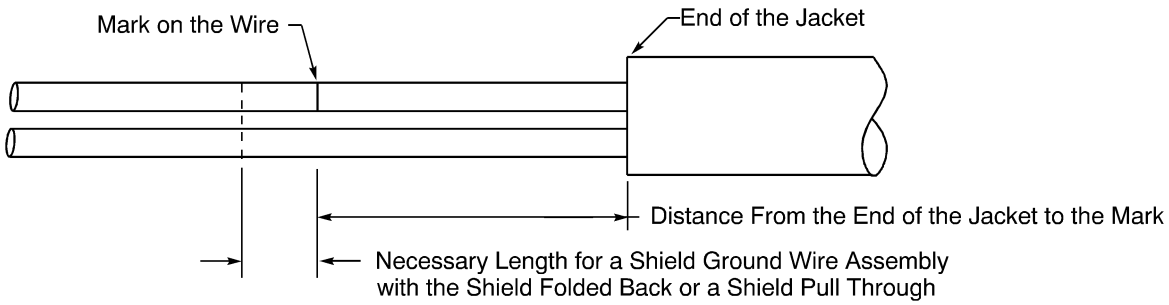

NECESSARY LENGTH OF THE SHIELD EXTENSION
Figure 141

(10) Assemble a shield ground wire at the end of the shield extension. Refer to Subject 20-10-15.

(11) Assemble a terminal lug on the end of the shield ground wire. Refer to Subject 20-30-11.

9. REPAIR OF A FIRE RESISTANT WIRE

A. Repair of the Insulation of a Fire Resistant Wire

For the damage and repair conditions that are applicable for the repair of fire resistant wire, refer to Paragraph 2.N.

CAUTION: IF THE REPAIR IS A TEMPORARY REPAIR, THE WIRE MUST BE REPLACED AT A MAXIMUM OF 500 FLIGHT HOURS SUBSEQUENT TO THE REPAIR.

I **CAUTION:** THIS PROCEDURE IS APPLICABLE ONLY FOR THE FIRE RESISTANT WIRES IN TABLE 21. IF THIS PROCEDURE IS USED TO REPAIR OTHER FIRE RESISTANT WIRES, THE REPAIR CAN GIVE AN UNSATISFACTORY PERFORMANCE.

Table 21
FIRE RESISTANT WIRES

Part Number or Specification	Supplier
24-00033	Champlain
24-00034	Champlain
BMS 13-55	QPL
BMS 13-67	QPL
BMS 13-8	QPL
M25038/1-()-()	QPL

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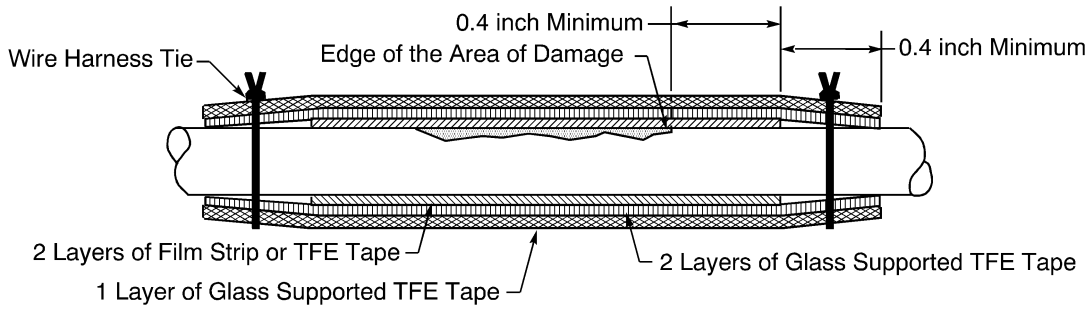

INSULATION REPAIR
Figure 142

Refer to Figure 142.

(1) Make a selection of one of these insulation materials from Table 6:
- Temperature Grade D film strip
- Temperature Grade D TFE tape.

(2) Make a selection of a glass supported TFE tape from Table 7.

(3) Remove loose pieces of insulation and rough edges at the area of the damage.
Make sure that the insulation has a smooth surface.

(4) Wind a layer of TFE tape or film strip on the wire.
Make sure that:
- The end of the tape is a minimum of 0.4 inch farther than the end of the damaged area
- The tape or film strip makes a 50 percent overlap

(5) Wind a second layer of TFE tape or film strip on the wire.
Make sure that:
- The layer of tape is wound in the opposite direction of the first layer of tape
- The end of the tape is aligned with the end of the first layer of tape
- The tape or film strip makes a 50 percent overlap.

(6) Wind a layer of glass supported TFE tape on the wire.
Make sure that:
- The end of the tape is a minimum of 0.4 inch farther than the end of the first layers of tape
- The tape makes a 50 percent overlap

(7) Wind a second layer of glass supported TFE tape on the wire.
Make sure that:
- The layer of tape is wound in the opposite direction of the first layer of tape
- The end of the tape is aligned with the end of the first layer of tape
- The tape makes a 50 percent overlap.

(8) Wind a third layer of glass supported TFE tape on the wire.

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Make sure that:

- The layer of tape is wound in the opposite direction of the last layer of tape
- The end of the tape is a minimum of 0.25 inch farther than the end of the first two layers of glass supported tape
- The tape makes a 50 percent overlap

(9) Assemble a lacing tape wire harness tie on each end of the repair approximately 0.35 inch from the end of the sleeve.

Refer to Subject 20-10-11 for the procedure to assemble a lacing tape wire harness tie in a high vibration area.

Make sure that:

- The Temperature Grade of the lacing tape is Temperature Grade D
- The tie is on the end of the first two layers of glass supported tape.

B. Repair of an Unshielded Fire Resistant Wire with a Splice

For the damage and repair conditions that are applicable for the repair of fire resistant wire, refer to Paragraph 2.N..

CAUTION: THE REPAIR OF FIRE RESISTANT WIRE WITH A SPLICE IS A TEMPORARY REPAIR ONLY. THE WIRE:

- CAN BE REPAIRED ONCE WITH A MAXIMUM OF TWO SPLICES FOR EACH WIRE SEGMENT
- MUST BE REPLACED AT A MAXIMUM OF 500 FLIGHT HOURS SUBSEQUENT TO THE REPAIR.

I **CAUTION:** THIS PROCEDURE IS APPLICABLE ONLY FOR THE FIRE RESISTANT WIRES IN TABLE 22. IF THIS PROCEDURE IS USED TO REPAIR OTHER FIRE RESISTANT WIRES, THE REPAIR CAN GIVE AN UNSATISFACTORY PERFORMANCE.

Table 22
FIRE RESISTANT WIRES

Part Number or Specification	Wire Size (AWG)	Supplier
24-00033	18	Champlain
24-00034	16	Champlain
81993	18	Filotex
85842	16	Filotex
BMS 13-55	18	QPL
	16	QPL
BMS 13-8	18	QPL
H22-4000	18	Rockbestos
M25038/1-( )-( )	18	QPL
	16	QPL

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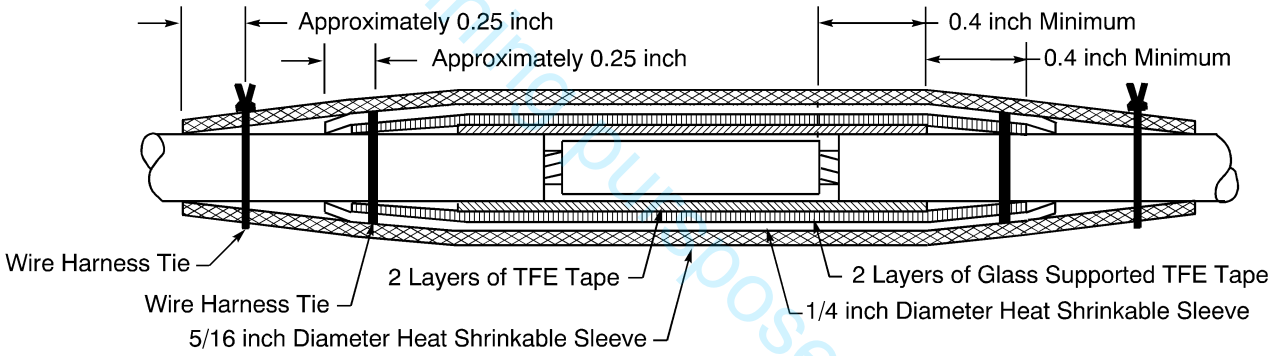
Table 23
SPLICE PART NUMBERS

Wire Size (AWG)	Splice	
	Part Number	Supplier
18	BACT12C20	QPL
16	BACT12C15	QPL

Table 24
SPLICE CRIMP TOOLS

Wire Size (AWG)	Splice	Crimp Tool	
		Part Number	Supplier
18	BACT12C20	46673	AMP
16	BACT12C15	46988	AMP



CONFIGURATION OF THE SPLICE ASSEMBLY
Figure 143

Refer to Figure 143.

(1) Make a selection these Temperature Grade D heat shrinkable sleeves from Table 5:
- A 3.00 inch ±0.25 inch length of 1/4 inch diameter sleeve
- A 4.00 inch ±0.25 inch length of 5/16 inch diameter sleeve.

NOTE: An equivalent sleeve is a satisfactory alternative. Refer to Subject 20-00-11.

(2) Make a selection of a Temperature Grade D TFE tape from Table 6.

(3) Make a selection of a glass supported TFE tape from Table 7.

(4) Make a selection of a splice from Table 23.

(5) Make a selection of a crimp tool Table 24.

(6) Put the lengths of the heat shrinkable sleeve on the end of the wire in this sequence:
- The 5/16 inch diameter sleeve
- The 1/4 inch diameter sleeve.

(7) Remove the necessary length of the insulation from the end of each wire. Refer to Table 25.

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Table 25
INSULATION REMOVAL LENGTH

Wire Size (AWG)	Removal Length (inch)		
	Minimum	Target	Maximum
18	0.22	0.25	0.28
16	0.22	0.25	0.28

(8) Assemble one end of the splice:

(a) Put the end of a wire into the crimp barrel of the splice.

Make sure that all of the strands of the conductor are in the crimp barrel of the splice.

(b) Crimp the splice.

(9) Do Step (8) again for the other wire in the other end of the splice.

(10) Wind a layer of TFE tape on the wire.

Make sure that:

- The end of the tape is a minimum of 0.4 inch farther than the end of the damaged area
- The tape makes a 50 percent overlap

(11) Wind a second layer of TFE tape on the wire.

Make sure that:

- The layer of tape is wound in the opposite direction of the first layer of tape
- The end of the tape is aligned with the end of the first layer of tape
- The tape makes a 50 percent overlap.

(12) Wind a layer of glass supported TFE tape on the wire.

Make sure that:

- The end of the tape is a minimum of 0.4 inch farther than the end of the first layers of tape
- The tape makes a 50 percent overlap

(13) Wind a second layer of glass supported TFE tape on the wire.

Make sure that:

- The layer of tape is wound in the opposite direction of the first layer of glass supported TFE tape
- The end of the tape is aligned with the end of the first layer of tape
- The tape makes a 50 percent overlap.

(14) Align the center of the 1/4 inch diameter heat shrinkable sleeve with the center of the splice.

(15) Assemble a lacing tape wire harness tie on each end of the sleeve approximately 0.25 inch from the end of the sleeve. Refer to Subject 20-10-11.

Refer to Subject 20-10-11 for the procedure to assemble a lacing tape wire harness tie in a high vibration area.

Make sure that the Temperature Grade of the lacing tape is Temperature Grade D.

(16) Align the center of the 5/16 inch diameter heat shrinkable sleeve with the center of the splice.

(17) Assemble a lacing tape wire harness tie on each end of the sleeve approximately 0.25 inch from the end of the sleeve.

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Refer to Subject 20-10-11 for the procedure to assemble a lacing tape wire harness tie in a high vibration area.

Make sure that the Temperature Grade of the lacing tape is Temperature Grade D.

10. REPAIR OF A THERMOCOUPLE WIRE WITH A Ssplice

A. Repair of Alumel and Chromel Thermocouple Wires with a Splice

Table 26
ALUMEL AND CHROMEL SPLICE PART NUMBERS

Wire Material	Splice		
	Part Number	Color	Supplier
Alumel	1-322325-0	Green	AMP
Chromel	1-322325-1	Grey	AMP

Table 27
SPLICE CRIMP TOOLS

Basic Unit	Setting	Supplier
46673	3	AMP

(1) Make a selection of a splice from Table 26.

Make sure to use:

- The alumel splice with alumel wire
- The chromel splice with chromel wire.

(2) Make a selection of a crimp tool from Table 27.

(3) Make a selection of a Temperature Grade D heat shrinkable sleeve from Table 5.

Make sure that the heat shrinkable sleeve has the smallest diameter that can be installed on the splice assembly.

NOTE: For alternative heat shrinkable sleeves, refer to Subject 20-00-11.

(4) Cut a 2.50 inch ±0.25 inch length of the heat shrinkable sleeve.

(5) Make a selection of one of these two insulation materials from Table 6:

- Temperature Grade D TFE tape
- Temperature Grade D film strip.

(6) Make a selection of a protective tape from Table 6.

(7) Remove the damaged length of the wire.

(a) On one side of the damage, cut the wire.

Make sure that the end of the wire is perpendicular to the longitudinal axis of the wire.

(b) On the other side of the damage, cut the wire.

Make sure that the end of the wire is perpendicular to the longitudinal axis of the wire.

(8) Clean the insulation with isopropyl alcohol.

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Make sure:

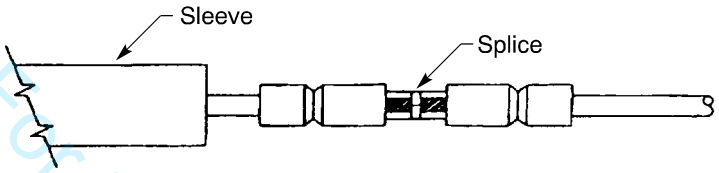
- To clean the area of the insulation from the end of each wire to a minimum of 3 inches from the end
- That the cleaned area is dry.

(9) Put the heat shrinkable sleeve on the wire.

(10) Remove 0.25 inch ±0.06 inch of the insulation from the end of the wire.

(11) Put the wire into the splice until it stops.

(12) Crimp the splice. Refer to Figure 144.

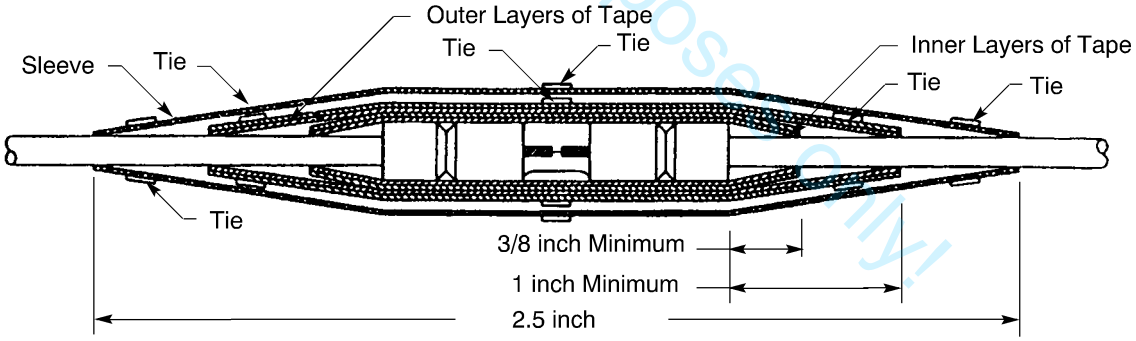


ALUMEL AND CHROMEL SPLICE ASSEMBLY
Figure 144

(13) Put two layers of the insulation tape or the insulation film strip on the splice assembly. Refer to Figure 145.

Make sure that:

- Each end of each layer extends a minimum of 0.38 inch farther than each end of the splice
- The tape makes a 50 percent overlap
- The second layer is wound in the opposite direction of the first layer.



INSULATION OF THE SPLICE
Figure 145

(14) Put two layers of the protective tape on the splice assembly.

Make sure that:

- Each end of each layer extends a minimum of 1 inch farther than each end of the splice
- The tape makes a 50 percent overlap
- The second layer is wound in the opposite direction of the first layer.

Refer to Figure 145.

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(15) Assemble a lacing tape wire harness tie:
- At each end of the tape
- In the middle of the tape.

Refer to:
- Figure 145
- Subject 20-10-11 for the procedure to assemble a wire harness tie.

Make sure that the Temperature Grade of the lacing tape is Temperature Grade D.

(16) Align the center of the heat shrinkable sleeve with the center of the splice.

Refer to Figure 145.

(17) Assemble a lacing tape wire harness tie:
- At each end of the sleeve
- In the middle of the sleeve.

Refer to:
- Figure 145
- Subject 20-10-11 for the procedure to assemble a wire harness tie.

Make sure that the Temperature Grade of the lacing tape is Temperature Grade D.

11. REPAIR OF FUEL QUANTITY INDICATOR SYSTEM CABLE

A. Repair of the Jacket of Hi Z Cables External to the Fuel Tank

Table 28
NECESSARY MATERIALS

Material	Part Number	Supplier
Naphtha, aliphatic	TT-N-95	An available Source
Sealant	E.C. 776SR	3M Company
	Nycote Type 7-11	Nycote Laboratories
	Nycote Type 88	Nycote Laboratories

(1) Make a selection of a sealant from Table 28.

(2) Remove loose pieces of insulation and rough edges at the area of the damage.

Make sure that the insulation has a smooth surface.

(3) Clean the damaged area of cable with aliphatic naphtha.

(4) Apply one layer of primer.

(5) Cure the primer at room temperature.

(6) Apply a layer of sealant.

B. Repair of Hi Z Cables External to the Fuel Tank with a Splice

This paragraph gives the procedure that can be used to:
- Repair an isolated, damaged point on a cable
- Replace a section of a damaged cable.

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Table 29
SPLICE KIT PART NUMBERS

Part Number	Supplier
D-150-0194	Raychem

Table 30
RAYCHEM D-150-0194 SPLICE KIT COMPONENTS

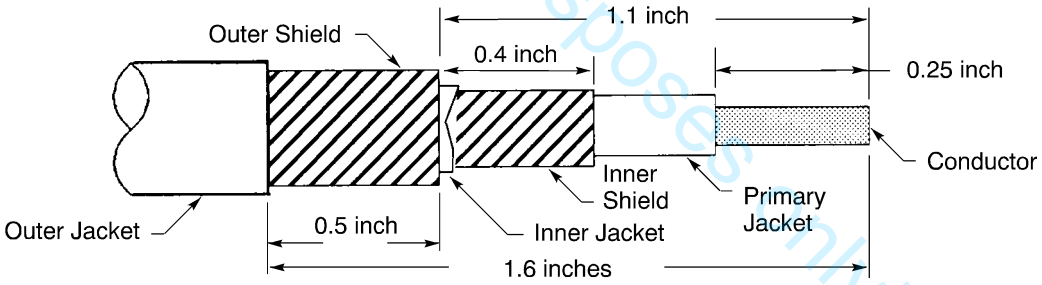
Description	Part Number	Supplier
Solder Shield Splice, Inner Shield	D-155-0450	Raychem
Solder Shield Splice, Outer Shield	D-155-0575	Raychem
Splice, Miniseal (2 pieces)	D-436-37	Raychem

Table 31
NECESSARY TOOLS

Tool	Description	Supplier
AD-1377	Splice Crimp Tool	Raychem
CV-5300	Minigun with MG-1 Reflector	Raychem

(1) Remove the damaged length of cable.

(2) Prepare each end of the remaining cable. Refer to Figure 146.



HI Z CABLE TRIM DIMENSIONS
Figure 146

(a) Remove 1.6 inches of the outer jacket from the end of the cable.

(b) Remove the necessary length of the outer shield.
Make sure that the end of the shield is 0.5 inch from the end of the jacket.

(c) Fold the shield back over the jacket.

(d) Remove 1.1 inches of the inner jacket from the end of the cable.

(e) Push the inner shield toward the outer jacket to open the strands of the inner shield.

(f) Pull the inner shield back to its initial position.

(g) Remove the length of the inner shield so that the end of the shield is 0.4 inch from the end of the inner jacket.

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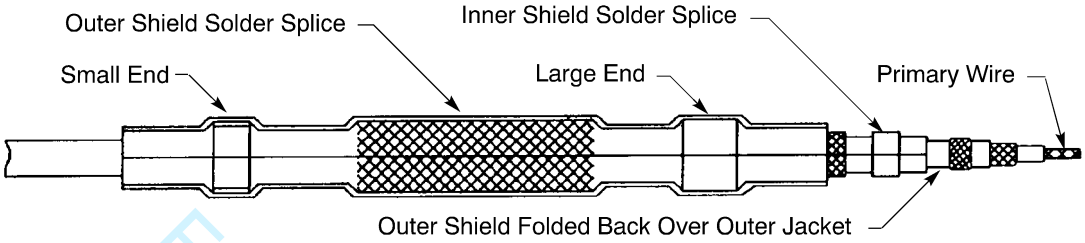
(h) Remove 0.25 inch of the primary jacket from the end of the cable.

(3) Assemble the miniseal splice. Refer to Figure 147 and Table 29.

NOTE: To make the steps of this procedure more clear, one end of the cable is Cable A and the other end is Cable B.



POSITION OF THE SOLDER SHIELD SPLICES ON CABLE A
Figure 147

(a) Put an outer shield solder splice and an inner shield solder splice on Cable A.

Make sure to put the small end of the splice on the cable first.

(b) Make a selection of a crimp tool from Table 31.

(c) Put the crimp barrel component of the miniseal splice on the primary wire.

(d) Crimp the component on the wire.

(e) Put the sleeve component of the miniseal splice on the cable so that it extends farther than the crimp barrel.

(f) Put the primary wire of Cable B into the crimp barrel component of the miniseal splice.

(g) Crimp the component on the wire.

(h) Make a selection of a hot air gun from Table 31 or an equivalent source of heat.

Make sure that the hot air gun:

- Has a reflector
- Is ready for operation; refer to Paragraph 12.B.

WARNING: THE OPERATION OF A HOT AIR GUN CAN CAUSE AN EXPLOSION. REFER TO THE SAFETY PRACTICES IN SUBJECT 20-00-10 FOR THE NECESSARY PRECAUTIONS TO PREVENT:

- DAMAGE TO THE EQUIPMENT
- INJURY TO THE PERSON.

(i) Move the sleeve component of the miniseal splice.

Make sure that the center of the sleeve is aligned with the center of the crimp barrel.

(j) Apply heat to the miniseal splice until the inserts melt and the solder flows.

CAUTION: DO NOT APPLY TOO MUCH HEAT TO THE ADJACENT WIRES. DAMAGE TO THE WIRES CAN OCCUR.

(4) Push the inner shield solder splice so that the center of the splice is aligned with the center of the miniseal splice.

(5) Shrink the inner shield solder splice:

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(a) Apply heat to the center of the splice until the solder melts and the sleeve shrinks.

(b) Move the heat to one end slowly so that the solder melts and the sleeve shrinks.

NOTE: Before the end of the splice is reached, approximately 1/4 inch, shrink the end of the sleeve to make a seal.

(c) Start at the edge of the center of the splice that is not melted and slowly move the heat to the other end so that the solder melts and the sleeve shrinks.

NOTE: Before the end of the splice is reached, approximately 1/4 inch, shrink the end of the sleeve to make a seal.

(6) Fold the outer shield wire back into position over the end of the inner splice.

(7) Put the outer solder shield splice over the inner shield splice and end of the outer shield.

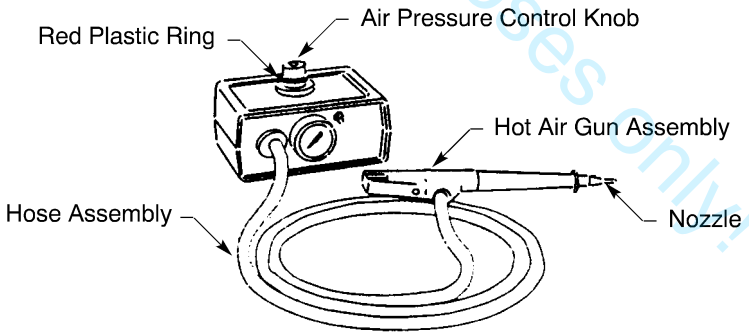
(8) Do Step (5) to shrink the outer shield solder splice.

12. HOT AIR GUNS

A. Part Numbers and Description

Table 32
HOT AIR GUN PART NUMBERS

Part Number	Description	Power Supply	Supplier
AA-400	Super Heater Mark II Hot Air Gun	115 VAC, 60 Hz	Tyco/Raychem
HT-900	Hot Air Gun	115 VAC, 50 Hz to 400 Hz	Tyco/Raychem
HT-900A	Hot Air Gun	115 VAC, 50 Hz to 400 Hz	Tyco/Raychem
HT-900B	Hot Air Gun	115 VAC, 50 Hz to 400 Hz	Tyco/Raychem



RAYCHEM MODEL AA-400 HOT AIR GUN
Figure 148

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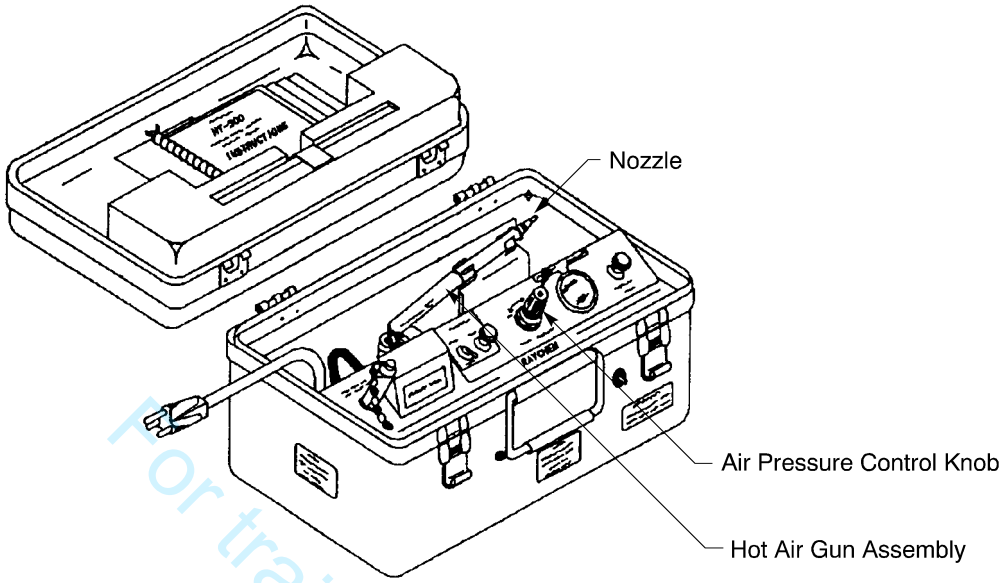

RAYCHEM MODEL HT-900 HOT AIR GUN
Figure 149

B. Operation of the Hot Air Gun

WARNING: DO NOT OPERATE THE HOT AIR GUN ON OR NEAR THE AIRPLANE WHEN THERE ARE FLAMMABLE:

- LIQUIDS
- VAPORS
- GASES.

WARNING: A HOT WORK PERMIT MUST BE RECEIVED FROM THE FIRE DEPARTMENT BEFORE THE HOT AIR GUNS ARE USED ON OR NEAR THE AIRPLANE.

(1) Make a selection of a hot air gun from Table 32.

WARNING: THE RAYCHEM AA-400 HOT AIR GUN MUST NOT BE USED ON OR NEAR THE AIRPLANE.

NOTE: To do work on or near the airplane, the Raychem HT-900, HT-900A, or HT-900B hot air gun must be used.

(2) To operate the Raychem AA-400 hot air gun:

(a) Turn the air pressure control knob fully to the counterclockwise position. Refer to Figure 148.

NOTE: The red plastic ring below the knob must be raised to unlock the knob.

(b) Attach a source of compressed air to the fitting on the control unit.

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Make sure that the source of the compressed air:

- Is clean
- Is dry
- Is free of oil
- Can supply a minimum of 4 CFM at 60 psi.

(3) To operate the Raychem HT-900, HT-900A, or HT-900B hot air gun:

(a) Turn the air pressure control knob fully to the counterclockwise position. Refer to Figure 149.

(b) Attach a source of compressed air or compressed nitrogen to the fitting on the control unit.

Make sure that the source of the compressed air or compressed nitrogen:

- Is clean
- Is dry
- Is free of oil
- Can supply a minimum of 4 CFM at 80 psi to 200 psi.

(4) Connect the power cord to the power supply.

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INSTALLATION OF SHRINKABLE SLEEVES

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	A.	Cold Shrinkable Sleeves	3

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INSTALLATION OF SHRINKABLE SLEEVES

1. PART NUMBERS AND DESCRIPTION

A. Shrinkable Sleeve Part Numbers

Refer to the shrinkable sleeves shown in Subject 20-00-11.

2. INSTALLATION OF HEAT SHRINKABLE SLEEVES

WARNING: THE OPERATION OF A HOT AIR GUN OR A HEAT GUN CAN CAUSE AN EXPLOSION. REFER TO THE SAFETY PRACTICES IN SUBJECT 20-00-10 FOR THE NECESSARY PRECAUTIONS TO AVOID:

- DAMAGE TO THE EQUIPMENT
- INJURY TO THE PERSON.

A. General Conditions for the Installation

Make sure that the sleeve can be:

- Moved easily over the component
- Held in position permanently after the heat is applied.

After the heat is applied, the sleeve must make 3/16 inch to 1/2 inch overlap with the insulation of the wire or cable on these assemblies:

- A contact
- A shield termination
- A splice
- A terminal
- A wire bundle breakout.

B. Installation of Heat Shrinkable Sleeves

(1) Make a selection of a Grade B, Class 1 heat shrinkable sleeve. Refer to Subject 20-00-11.

(2) Cut the sleeve so that the length of the sleeve is the sufficient length.

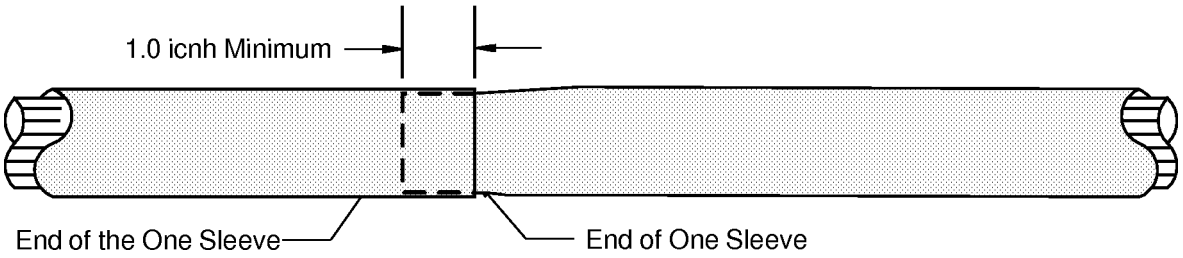
NOTE: The sufficient length is the necessary length plus a maximum 10 percent of the necessary length because of the longitudinal shrinkage of the sleeve.

(3) Make a selection of a hot air gun or a heat gun. Refer to Subject 20-10-13.

(4) Put the sleeve in the specified location.

Refer to:

- Figure 1 for the overlap of the sleeves of the same wire harness segment.
- Figure 2 and Figure 3 for the overlap of the sleeves of the wire harness trunk and a branch.



OVERLAP OF SLEEVES ON THE SAME WIRE HARNESS SEGMENT
Figure 1

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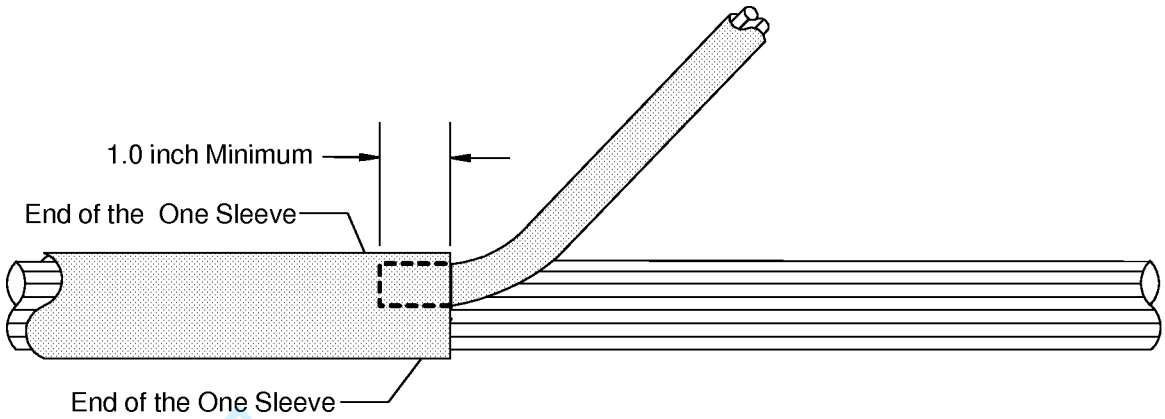
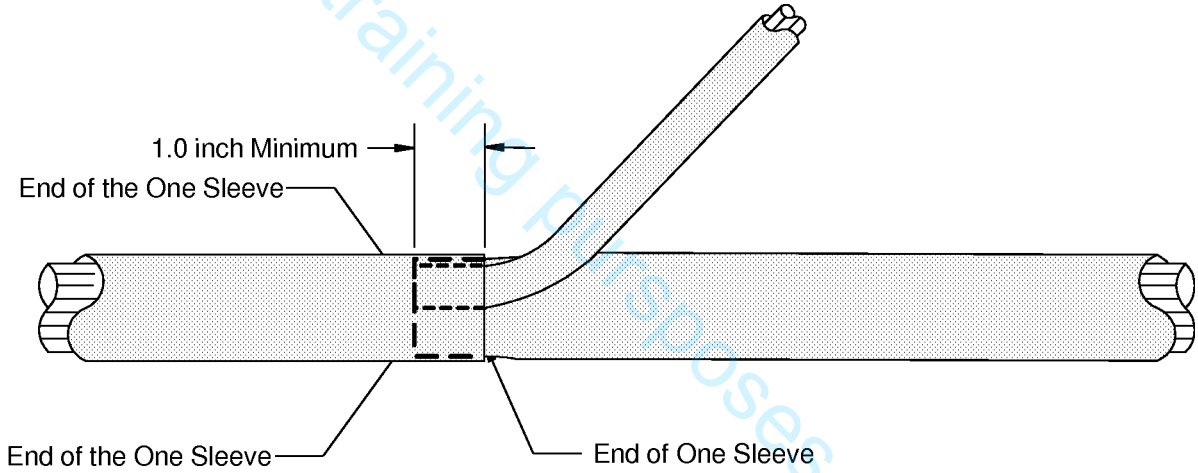


OVERLAP OF SLEEVES AT A BREAKOUT-TWO SLEEVES
Figure 2



OVERLAP OF SLEEVES AT A BREAKOUT-THREE SLEEVES
Figure 3

(5) To prevent heat damage, put a split Teflon sleeve or fish paper on the wire at each end of the heat shrinkable sleeve so that:
- The end of the protection touches the end of the sleeve
- The protection extends a minimum 1 inch from the end of the sleeve.

(6) To prevent heat damage to all of the adjacent wires with shields, put the protection on those wires.

(7) Heat the hot air gun for 15 seconds minimum.

(8) Shrink the sleeve in position:

(a) Hold the gun 3 inches minimum from the sleeve

(b) Point the gun at the sleeve for 5 to 10 seconds.

Make sure that all of the sleeve shrinks in its position.

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CAUTION: DO NOT APPLY THE HEAT IN ONE LOCATION FOR MORE THAN 20 SECONDS.

(9) If the sleeve does not fully shrink:

(a) Wait for of 5 minutes minimum or until the cable is cool to touch.

(b) Do Step (8) again.

(10) Examine the sleeve.

Make sure that:

- The sleeve is not charred
- Wires do not go through the sleeve
- The sleeve does not have a hole or a tear.

NOTE: A small quantity of sleeve discoloration is permitted.

3. INSTALLATION OF COLD SHRINK SLEEVES

A. Cold Shrinkable Sleeves

Cold shrinkable sleeves are used in:

- The assembly of copalum splices; refer to Subject 20-30-13
- The assembly of copalum terminals; refer to Subject 20-30-14.

(1) Make a selection of a cold shrinkable sleeve from Subject 20-00-11.

(2) Put the sleeve on the wire.

(3) Hold the sleeve in position with one hand.

(4) Pull the core off in a counterclockwise direction with the other hand.

The sleeve shrinks over the wire as the core is removed.

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ASSEMBLY OF SHIELD GROUND WIRES

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ASSEMBLY OF SHIELD GROUND WIRES

This Subject gives the procedures to assemble:

- A shield ground wire
- A shield dead end
- A shield extension.

1. APPLICABLE CONDITIONS FOR SHIELD TERMINATION

A. General Data

For the conditions that are applicable for:

- Shield terminations and wire harness assembly, refer to Subject 20-10-11
- Shield terminations and wire harness installation, refer to Subject 20-10-11.

B. Airworthiness Limitations

These wire configurations are controlled by Critical Design Configuration Control Limitations (CDCCL) requirements.

- Fuel System Wiring that has Airworthiness Limitations
- Wiring that is installed adjacent to the fuel tank. Refer to Subject 20-10-11.

CDCCLs identify certain design configuration features intended to prevent a fuel tank ignition source for the operational life of the airplane. CDCCLs are mandatory and cannot be changed or deleted without the approval of the FAA office that is responsible for the airplane model Type Certificate, or applicable regulatory agency.

WARNING: OBEY THE MANUFACTURER'S PROCEDURES WHEN YOU DO MAINTENANCE THAT HAS AN EFFECT ON A CDCCL. IF YOU DO NOT OBEY THE PROCEDURES, IT CAN INCREASE THE RISK OF A SOURCE OF FUEL TANK IGNITION. INJURIES TO PERSONNEL AND DAMAGE TO EQUIPMENT CAN OCCUR IF THERE IS A FIRE OR EXPLOSION.

The use of parts, methods, techniques or practices not contained in the applicable CDCCL must meet the approval of the FAA office that is responsible for the airplane model Type Certificate, or applicable regulatory agency.

Design features that are CDCCLs are defined and controlled by Special Federal Aviation Regulation (SFAR) 88. For more information, refer to the applicable Airworthiness Limitation, Certification Maintenance Requirements, or Maintenance Planning Document.

To find more data about CDCCL wiring, refer to Table 1 for the document that is applicable for the airplane model.

Table 1
BOEING DOCUMENTS FOR AIRWORTHINESS LIMITATIONS

Airplane Model	Boeing Document
707	D6-7552-AWL
727	D6-8766-AWL
737-100,-200,-200C,-300,-500	D6-38278-CMR
747-100,-200,-300,-SP	D6-13747-CMR

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Table 1 (continued)

Airplane Model	Boeing Document
737-600,-700,-800 and later 737 models	Boeing Aircraft Maintenance Manual 28-00-00
747-400 and later 747 models	
757	
767	
777	
787	D011Z009-03-04

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C. Selection of a Shield Ground Wire Configuration

For the shield termination of special shielded wires and shielded cables, refer to Paragraph 3.

For the applicable conditions related to:

- The maximum length of a shield ground wire, refer to Paragraph 1.D.
- The maximum length of wire without a shield, refer to Paragraph 1.E.
- The configuration of shield ground wires on adjacent wires, refer to Paragraph 1.F.
- Shield ground wires with the same ground connection, refer to Paragraph 1.G.

Table 2
SELECTION OF A SHIELD GROUND WIRE CONFIGURATION

Shield Configuration	Maximum Temperature Grade	Shield Ground Wire Configuration		Assembly Procedure
		Insulation	Shield Connection	
Shield with Flat Conductors	B	-	Shield Dead End	Paragraph 12.B.
		Insulated	Solder Sleeve, No Integral Wire, Shield Not Folded	Paragraph 8.C.
			Solder Sleeve with Integral Wire, Shield Not Folded	Paragraph 9.C.
			Solder Sleeve with Integral Wire and Shield Extension, Shield Not Folded	Paragraph 11.D.
		Uninsulated	Solder Sleeve with Integral Wire, Shield Not Folded	Paragraph 10.C.

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Table 2 (continued)

Shield Configuration	Maximum Temperature Grade	Shield Ground Wire Configuration		Assembly Procedure
		Insulation	Shield Connection	
Shield with Round Conductors	B	-	Shield Dead End	Paragraph 12.A.
		Insulated	Mechanical Ferrules, Shield Folded	Paragraph 6.B.
			Mechanical Ferrules, Shield Not Folded	Paragraph 6.D.
			Mechanical Ferrules and Shield Extension	Paragraph 11.A.
			RSK Shield-Kon	Paragraph 7.A.
			RSK Shield-Kon and Shield Extension	Paragraph 11.B.
			Solder Sleeve, Shield Folded	Paragraph 8.B.
			Solder Sleeve with Integral Wire, Shield Folded	Paragraph 9.B.
			Solder Sleeve with Integral Wire and Shield Extension, Shield Folded	Paragraph 11.C.
			Solder Sleeve, Shield Not Folded	Paragraph 8.C.
			Solder Sleeve with Integral Wire, Shield Not Folded	Paragraph 9.C.
			Solder Sleeve with Integral Wire and Shield Extension, Shield Not Folded	Paragraph 11.D.
		Uninsulated	Shield Pull Through, Sleeve Strain Relief	Paragraph 5.A.
			Shield Pull Through, Tape Strain Relief	Paragraph 5.B.
			Solder Sleeve with Integral Wire, Shield Folded	Paragraph 10.B.
			Solder Sleeve with Integral Wire, Shield Not Folded	Paragraph 10.C.

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ASSEMBLY OF SHIELD GROUND WIRES

Table 2 (continued)

Shield Configuration	Maximum Temperature Grade	Shield Ground Wire Configuration		Assembly Procedure
		Insulation	Shield Connection	
Shield with Round Conductors	D	-	Shield Dead End	Paragraph 12.A.
		Insulated	Mechanical Ferrules, Shield Folded	Paragraph 6.B.
			Mechanical Ferrules, Shield Not Folded	Paragraph 6.D.
			Mechanical Ferrules and Shield Extension	Paragraph 11.A.
			RSK Shield-Kon	Paragraph 7.A.
			RSK Shield-Kon and Shield Extension	Paragraph 11.B.
		Uninsulated	Shield Pull Through, Sleeve Strain Relief	Paragraph 5.A.
			Shield Pull Through, Tape Strain Relief	Paragraph 5.B.
Two Shields, Adjacent, Outer with Round Conductors, Inner with Flat Conductors	B	-	Shield Dead End	Paragraph 12.B.
		Insulated	Mechanical Ferrules, Outer Shield Folded	Paragraph 6.C.
			Solder Sleeve, No Integral Wire, Shield Not Folded	Paragraph 8.C.
			Solder Sleeve with Integral Wire, Shield Not Folded	Paragraph 9.C.
			Solder Sleeve with Integral Wire and Shield Extension, Shield Not Folded	Paragraph 11.D.

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ASSEMBLY OF SHIELD GROUND WIRES

Table 2 (continued)

Shield Configuration	Maximum Temperature Grade	Shield Ground Wire Configuration		Assembly Procedure
		Insulation	Shield Connection	
I Two Shields, Adjacent, Outer with Round Conductors, Inner with Round Conductors	B	-	Shield Dead End	Paragraph 12.A.
		Insulated	Mechanical Ferrules, Shield Folded	Paragraph 6.B.
			Mechanical Ferrules, Shield Not Folded	Paragraph 6.D.
			Mechanical Ferrules and Shield Extension	Paragraph 11.A.
			RSK Shield-Kon	Paragraph 7.A.
			RSK Shield-Kon and Shield Extension	Paragraph 11.B.
			Solder Sleeve, Shield Folded	Paragraph 8.B.
			Solder Sleeve with Integral Wire, Shield Folded	Paragraph 9.B.
			Solder Sleeve with Integral Wire and Shield Extension, Shield Folded	Paragraph 11.C.
			Solder Sleeve, Shield Not Folded	Paragraph 8.C.
			Solder Sleeve with Integral Wire, Shield Not Folded	Paragraph 9.C.
			Solder Sleeve with Integral Wire and Shield Extension, Shield Not Folded	Paragraph 11.D.
		Uninsulated	Shield Pull Through, Sleeve Strain Relief	Paragraph 5.A.
			Shield Pull Through, Tape Strain Relief	Paragraph 5.B.
			Solder Sleeve with Integral Wire, Shield Folded	Paragraph 10.B.
			Solder Sleeve with Integral Wire, Shield Not Folded	Paragraph 10.C.

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Table 2 (continued)

Shield Configuration	Maximum Temperature Grade	Shield Ground Wire Configuration		Assembly Procedure
		Insulation	Shield Connection	
Two Shields, Adjacent, Outer with Round Conductors, Inner with Round Conductors	D	-	Shield Dead End	Paragraph 12.A.
		Insulated	Mechanical Ferrules, Shield Folded	Paragraph 6.B.
			Mechanical Ferrules, Shield Not Folded	Paragraph 6.D.
			Mechanical Ferrules and Shield Extension	Paragraph 11.A.
			RSK Shield-Kon	Paragraph 7.A.
			RSK Shield-Kon and Shield Extension	Paragraph 11.B.
		Uninsulated	Shield Pull Through, Sleeve Strain Relief	Paragraph 5.A.
			Shield Pull Through, Tape Strain Relief	Paragraph 5.B.
Two Shields, Not Adjacent, Outer with Round Conductors, Inner with Round Conductors	B	Insulated	Mechanical Ferrules, Shields Not Folded	Paragraph 6.F.
	D	Insulated		
	B	-	Shield Dead Ends	Paragraph 12.C.
	D	-		

D. Maximum Length of a Shield Ground Wire

Table 3
SHIELD GROUND WIRE MAXIMUM LENGTH

Ground Connection	Maximum Length (inches)	Special Conditions
Contact, ARINC Connector Ground Block	3	-
Contact, Connector Insert	2	-
Terminal Lug to Connector Strain Relief Backshell	2	-
Terminal Lug to Structure	6	-
Data Bus	18	757 Data Bus Cables (5000 series wire numbers)

E. Maximum Length of Wire without a Shield

The connection of the shield and the shield ground wire must be as close as possible to the point of the termination of the wire.

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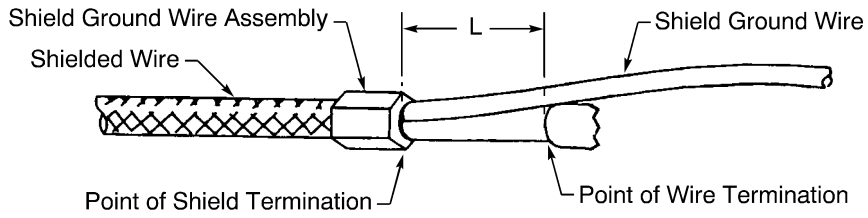
ASSEMBLY OF SHIELD GROUND WIRES

Refer to Table 4 and Figure 1 for the maximum length of wire without a shield.

NOTE: The point of the shield termination is the end of the continuous metal around the primary insulation of the conductor.



LENGTH OF THE WIRE WITHOUT A SHIELD
Figure 1

Table 4
LENGTH OF THE WIRE WITHOUT A SHIELD

Type of Wire Termination	Point of Wire Termination	Length L (inch)	
		Minimum	Maximum
Connector with Integral Grommet and Strain Relief	Rear of Strain Relief	-	1.5
Connector with Integral Grommet and no Strain Relief	Connector Grommet or Potting	-	1.5
Connector with Removable Grommet and Strain Relief	Rear of the Strain Relief	-	1.5
Connector with Removable Grommet and no Strain Relief	Rear of the Connector Shell	-	4
Splice	Rear of the Conductor Splice	0.5	1.5
Terminal Lug	Rear of the Crimp Barrel	0.5	0.75
Terminal Module	Surface of the Module	1.5	2.0

F. Configuration of Shield Ground Wires on Adjacent Wires

Refer to Figure 2.

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ASSEMBLY OF SHIELD GROUND WIRES

For shield ground wire assemblies on adjacent wires, these conditions are applicable:

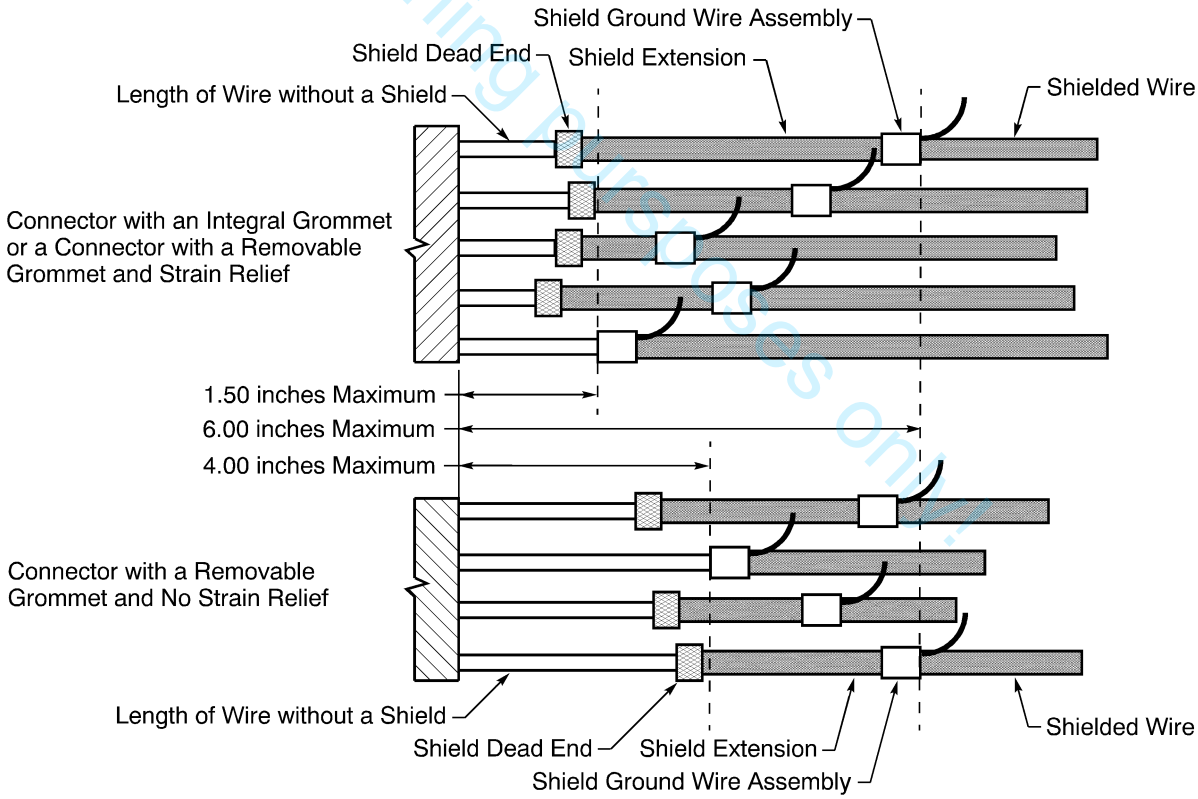
- The shield ground wire assemblies must not be put in adjacent locations
- A shield extension can be assembled when the number of shield ground wires makes it necessary to put a shield ground wire assembly at a location where the length of wire without a shield is greater than the maximum length for the type of wire termination; refer to Table 4

If a shield extension is necessary, these conditions are applicable:

- The shield ground wire assembly must not be put farther than 6 inches from the point of the wire termination
- The end of the shield extension, that is opposite of the end with the shield ground wire, must be a dead end
- The shield dead ends must not be put in adjacent locations
- If the point of wire termination is the potting of a connector, the shield dead end must not extend into the area where sealant must be applied.

If the necessary distance for all of the shield ground wire assemblies on the wire harness is greater than 6 inches, these conditions are applicable:

- The shield ground wire assemblies can be put in adjacent locations
- The number of adjacent shield ground wire assemblies must be kept to a minimum.



POSITION OF SHIELD GROUND WIRE ASSEMBLIES ON ADJACENT WIRES
Figure 2

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G. Shield Ground Wires with the Same Ground Connection

For two or more shield ground wires that have the same connection to ground, these conditions are applicable:

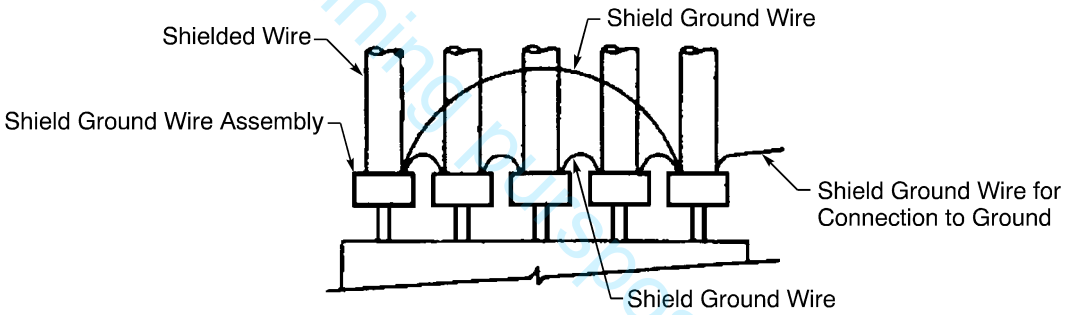
- The number of shield ground wires can be decreased to one shield ground wire with a splice; refer to Subject 20-30-12 and 20-10-15.
- The one shield ground wire must be an AWG 20 wire; refer to Table 5.

If the connection of the shield ground wire to ground is a ground stud, these conditions are applicable:

- The shield ground wires must be attached to the ground stud with a terminal lug
- The maximum number of shield ground wires for one terminal lug is 6.

For 5 or more shield ground wires of a wire harness that can have the same connection to ground, these conditions are applicable:

- A closed loop configuration of shield ground wires can be made; refer to Figure 3
- As an alternative, the shield ground wires between adjacent shield ground wire assemblies can be connected to each other with a closed end splice; refer to Subject 20-30-12 and 20-10-15.
- If a closed end splice is used to connect the shield ground wires of shield ground wire assemblies, the splice assembly must be attached to the wire harness with a wire harness tie.



CLOSED LOOP CONFIGURATION OF SHIELD GROUND WIRES
Figure 3

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2. SELECTION OF SHIELD GROUND WIRE ASSEMBLY COMPONENTS

A. Selection of a Shield Ground Wire

Table 5
SHIELD GROUND WIRES

Environment		Wire				
Area of the Airplane	Temperature Grade	Size (AWG)	Specification	Wire Type Code	Color	Supplier
Pressurized	A	20	55PC6121-20-900	-	White with a double black stripe	Raychem/Tyco
			BMS13-48 Type 10, Class 1	PJ	White with a double black stripe	Boeing
			BMS13-16 Type 1	-	Black	Boeing
					White with a black stripe	Boeing
Pressurized	B	20	55PC6121-20-900	-	White with a double black stripe	Raychem/Tyco
			BMS13-48 Type 10, Class 1	PJ	White with a double black stripe	Boeing
			BMS13-16 Type 1	-	Black	Boeing
					White with a black stripe	Boeing
Pressurized	C	20	BMS13-60 Type 4, Class 1	GK	White	Boeing
			BMS13-60 Type 7, Class 1	HA	White	Boeing
			BMS13-16 Type 1	-	Black	Boeing
					White with a black stripe	Boeing
Pressurized	D	20	BMS13-60 Type 4, Class 1	GK	White	Boeing
			BMS13-60 Type 7, Class 1	HA	White	Boeing

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Table 5 (continued)

Environment		Wire				
Area of the Airplane	Temperature Grade	Size (AWG)	Specification	Wire Type Code	Color	Supplier
Unpressurized	A	18	55PC6121-18-900	-	White with a double black stripe	Raychem/Tyco
			BMS13-48 Type 10, Class 1	PJ	White with a double black stripe	Boeing
			BMS13-16 Type 1	-	Black	Boeing
					White with a black stripe	Boeing
Unpressurized	B	18	55PC6121-18-900	-	White with a double black stripe	Raychem/Tyco
			BMS13-48 Type 10, Class 1	PJ	White with a double black stripe	Boeing
			BMS13-16 Type 1	-	Black	Boeing
					White with a black stripe	Boeing
Unpressurized	C	18	BMS13-60 Type 4, Class 1	GK	White	Boeing
			BMS13-60 Type 7, Class 1	HA	White	Boeing
			BMS13-16 Type 1	-	Black	Boeing
					White with a black stripe	Boeing
Unpressurized	D	18	BMS13-60 Type 4, Class 1	GK	White	Boeing
			BMS13-60 Type 7, Class 1	HA	White	Boeing
			BMS13-31 Type 1	-	Gray	Boeing

(1) If the type, the color, and the size of the old shield ground wire are known, use a shield ground wire that is the same as the old wire.

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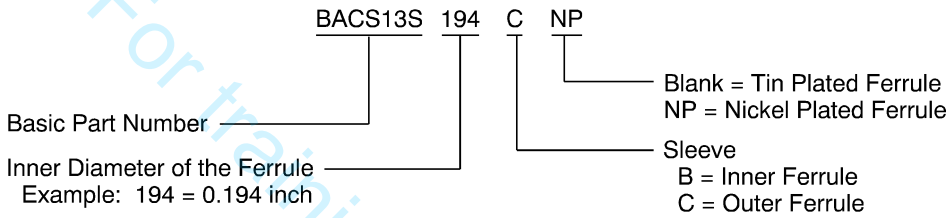
(2) If the type, the color, and the size of the old shield ground wire are not known, make a selection of a wire from Table 5.

NOTE: AWG 22 wire can only be used for shield ground wires inside these assemblies that have wire wrap in the pressurized area:

- An electronic module
- A Survivability or a Vulnerability box
- A junction box.

NOTE: Do not use temperature grade C or D wire as an alternative wire for a temperature grade A or B wire if the shield ground wire attaches to the shield with a solder sleeve.

B. Selection of Mechanical Ferrules



BACS13S FERRULE PART NUMBER STRUCTURE
Figure 4

Table 6
TEMPERATURE GRADE OF FERRULES

Maximum Temperature Grade	Ferrule
B	BACS13S()
D	BACS13S()NP

Table 7
APPROVED SUPPLIERS OF BOEING STANDARD MECHANICAL FERRULES

Boeing Standard	Supplier
BACS13S()	Thomas & Betts
BACS13S()NP	Thomas & Betts

NOTE: The mechanical ferrules specified in Table 8 are Temperature Grade B.

NOTE: For the part numbers of the mechanical ferrules that are Temperature Grade D, NP is added to the end of the part number specified in Table 8. Refer to Figure 4 and Table 6.

NOTE: Temperature Grade D mechanical ferrules do not have color codes. If NP is added to the end of the part number, the color codes that are specified in Table 6 are not applicable. Refer to Figure 4.

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Table 8
SELECTION OF AN INNER FERRULE AND AN OUTER FERRULE

Inner Ferrule		Shield Ground Wire		Outer Ferrule	
Part Number	**Color**	**Quantity**	**Size (AWG)**	**Part Number**	**Color**
BACS13S046B	Tin	0 or 1	22	BACS13S128C	Blue
		2 or 3	24		
BACS13S058B	Yellow	0 or 1	24	BACS13S128C	Blue
			22		
			20	BACS13S128C	Blue
				BACS13S149C	Purple
			18	BACS13S128C	Blue
				BACS13S149C	Purple
		2 or 3	22	BACS13S149C	Purple
			20		
BACS13S063B	Red	0 or 1	22	BACS13S128C	Blue
				BACS13S149C	Purple
			20	BACS13S128C	Blue
				BACS13S149C	Purple
			18	BACS13S128C	Blue
				BACS13S149C	Purple
		2 or 3	22	BACS13S156C	Yellow
			20		
BACS13S071B	Green	0 or 1	24	BACS13S128C	Blue
				BACS13S149C	Purple
			22	BACS13S149C	Purple
				BACS13S156C	Yellow
			20	BACS13S149C	Purple
			18		
		2 or 3	24	BACS13S156C	Yellow
			22		
			20	BACS13S175C	Blue

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ASSEMBLY OF SHIELD GROUND WIRES

Table 8 (continued)

Inner Ferrule		Shield Ground Wire		Outer Ferrule	
Part Number	**Color**	**Quantity**	**Size (AWG)**	**Part Number**	**Color**
BACS13S080B	Blue	0 or 1	22	BACS13S156C	Yellow
			20	BACS13S149C	Purple
				BACS13S156C	Yellow
			18	BACS13S149C	Purple
				BACS13S156C	Yellow
		2 or 3	22	BACS13S175C	Blue
			20		
BACS13S090B	Orange	0 or 1	24	BACS13S156C	Yellow
			22	BACS13S175C	Blue
			20	BACS13S156C	Yellow
				BACS13S175C	Blue
			18	BACS13S156C	Yellow
				BACS13S175C	Blue
		2 or 3	22	BACS13S175C	Blue
			20		
BACS13S096B	Purple	0 or 1	24	BACS13S156C	Yellow
			22	BACS13S175C	Blue
			20		
			18		
		2 or 3	22	BACS13S175C	Blue
			20	BACS13S175C	Blue
				BACS13S187C	Orange
BACS13S101B	Yellow	0 or 1	24	BACS13S175C	Blue
			22		
			20		
			18		
		2 or 3	24	BACS13S175C	Blue
			20	BACS13S187C	Orange

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ASSEMBLY OF SHIELD GROUND WIRES

Table 8 (continued)

Inner Ferrule		Shield Ground Wire		Outer Ferrule	
Part Number	**Color**	**Quantity**	**Size (AWG)**	**Part Number**	**Color**
BACS13S109B	Red	0 or 1	24	BACS13S175C	Blue
			22	BACS13S187C	Orange
			20	BACS13S175C	Blue
				BACS13S187C	Orange
			18	BACS13S175C	Blue
				BACS13S187C	Orange
				BACS13S194C	Red
		2 or 3	24	BACS13S187C	Orange
			22		
			20	BACS13S199C	Tin
BACS13S124B	Green	0 or 1	24	BACS13S199C	Tin
			22	BACS13S187C	Orange
				BACS13S199C	Tin
			20	BACS13S194C	Red
				BACS13S199C	Tin
			18	BACS13S194C	Red
				BACS13S199C	Tin
				BACS13S205C	Yellow
		2 or 3	24	BACS13S205C	Yellow
			22		
			20		
BACS13S128B	Tin	0 or 1	24	BACS13S199C	Tin
			22	BACS13S205C	Yellow
			20	BACS13S199C	Tin
				BACS13S205C	Yellow
			18	BACS13S199C	Tin
				BACS13S205C	Yellow
		2 or 3	22	BACS13S219C	Green
			20		

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ASSEMBLY OF SHIELD GROUND WIRES

Table 8 (continued)

Inner Ferrule		Shield Ground Wire		Outer Ferrule	
Part Number	**Color**	**Quantity**	**Size (AWG)**	**Part Number**	**Color**
BACS13S134B	Orange	0 or 1	22	BACS13S205C	Yellow
				BACS13S219C	Green
			20	BACS13S199C	Tin
				BACS13S205C	Yellow
			18	BACS13S199C	Tin
				BACS13S205C	Yellow
		2 or 3	22	BACS13S219C	Green
			20		
BACS13S149B	Blue	0 or 1	24	BACS13S219C	Green
			22	BACS13S219C	Green
				BACS13S232C	Orange
			20	BACS13S219C	Green
				BACS13S225C	Purple
			18	BACS13S219C	Green
				BACS13S225C	Purple
		2 or 3	22	BACS13S232C	Orange
BACS13S156B	Red	0 or 1	22	BACS13S232C	Orange
			20		
			18		
BACS13S165B	Tin	0 or 1	20	BACS13S232C	Orange
BACS13S175B	Green	0 or 1	22	BACS13S275C	Tin
			20	BACS13S261C	Yellow
			18		
		2 or 3	22	BACS13S281C	Purple
			20		

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Table 8 (continued)

Inner Ferrule		Shield Ground Wire		Outer Ferrule	
Part Number	Color	Quantity	Size (AWG)	Part Number	Color
BACS13S187B	Yellow	0 or 1	22	BACS13S281C	Purple
			20	BACS13S275C	Tin
				BACS13S287C	Blue
			18	BACS13S275C	Tin
				BACS13S287C	Blue
		2 or 3	22	BACS13S287C	Blue
			20		
BACS13S194B	Blue	0 or 1	22	BACS13S287C	Blue
			20	BACS13S281C	Purple
				BACS13S287C	Blue
			18	BACS13S275C	Tin
				BACS13S287C	Blue
		2 or 3	22	BACS13S287C	Blue
			20	BACS13S297C	Green
BACS13S205B	Orange	0 or 1	22	BACS13S312C	Yellow
			20	BACS13S287C	Blue
			18		
		2 or 3	22	BACS13S312C	Yellow
			20		
BACS13S219B	Tin	0 or 1	20	BACS13S297C	Green
				BACS13S312C	Yellow
			18	BACS13S297C	Green
				BACS13S312C	Yellow
		2 or 3	22	BACS13S327C	Tin
			20		
BACS13S225B	Yellow	0 or 1	20	BACS13S297C	Green
				BACS13S312C	Yellow
			18	BACS13S297C	Green
				BACS13S312C	Yellow
		2 or 3	22	BACS13S327C	Tin
			20		

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ASSEMBLY OF SHIELD GROUND WIRES

Table 8 (continued)

Inner Ferrule		Shield Ground Wire		Outer Ferrule	
Part Number	Color	Quantity	Size (AWG)	Part Number	Color
BACS13S232B	Red	0 or 1	20	BACS13S312C	Yellow
			18		
		2 or 3	20	BACS13S327C	Tin
BACS13S250B	Green	0 or 1	22	BACS13S348C	Orange
			20	BACS13S327C	Tin
			18		
		2 or 3	22	BACS13S348C	Orange
			20		
BACS13S261B	Blue	0 or 1	22	BACS13S359C	Purple
			20	BACS13S348C	Orange
			18		
		2 or 3	22	BACS13S359C	Purple
			20		
BACS13S266B	Tin	0 or 1	22	BACS13S359C	Purple
			20	BACS13S348C	Orange
				BACS13S359C	Purple
			18	BACS13S348C	Orange
				BACS13S359C	Purple
		2 or 3	22	BACS13S359C	Purple
			20		
BACS13S275B	Orange	0 or 1	20	BACS13S359C	Purple
			18		
		2 or 3	22	BACS13S375C	Yellow
BACS13S281B	Yellow	0 or 1	22	BACS13S405C	Red
			20	BACS13S375C	Yellow
			18		
		2 or 3	22	BACS13S405C	Red
			20		
BACS13S287B	Tin	0 or 1	22	BACS13S405C	Red
		2 or 3	22	BACS13S405C	Red
			20		

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Table 8 (continued)

Inner Ferrule		Shield Ground Wire		Outer Ferrule	
Part Number	Color	Quantity	Size (AWG)	Part Number	Color
BACS13S297B	Red	0 or 1	20	BACS13S375C	Yellow
			18		
		2 or 3	20	BACS13S405C	Red
BACS13S312B	Purple	0 or 1	22	BACS13S425C	Tin
		2 or 3	22	BACS13S425C	Tin
			20		
BACS13S375B	Blue	0 or 1	22	BACS13S460C	Tin
			20		
			18		
		2 or 3	22	BACS13S460C	Tin

NOTE: Refer to the D-590 Boeing to Vendor Cross Reference Index for the Supplier Part Numbers for the BACS13S Ferrules.

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C. Selection of an RSK Shield-Kon

Table 9
SELECTION OF AN RSK SHIELD-KON

Maximum Temperature Grade	Shield O.D. (inch)		Shield Ground Wire		Part Number	Color	Supplier
	Minimum	Maximum	Count	Size (AWG)			
B	0.05	0.09	0	-	RSK101	Red	Thomas & Betts
			1	24	RSK101	Red	Thomas & Betts
			1	22	RSK101	Red	Thomas & Betts
			2	24	RSK101	Red	Thomas & Betts
	0.09	0.145	0	-	RSK201	Blue	Thomas & Betts
			1	22	RSK201	Blue	Thomas & Betts
			1	20	RSK201	Blue	Thomas & Betts
			2	22	RSK201	Blue	Thomas & Betts
	0.144	0.200	0	-	RSK301	Yellow	Thomas & Betts
			1	22	RSK301	Yellow	Thomas & Betts
			1	20	RSK301	Yellow	Thomas & Betts
			2	22	RSK301	Yellow	Thomas & Betts
			2	20	RSK301	Yellow	Thomas & Betts
	0.200	0.300	0	-	RSK401	Green	Thomas & Betts
			1	20	RSK401	Green	Thomas & Betts
			1	18	RSK401	Green	Thomas & Betts
			2	20	RSK401	Green	Thomas & Betts

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Table 10
RSK SHIELD-KON PART NUMBERS NO LONGER MANUFACTURED

Maximum Temperature Grade	Shield O.D. (inch)		Shield Ground Wire		Part Number	Color	Supplier
	Minimum	Maximum	Count	Size (AWG)			
D	0.301	0.325	0	-	SK501HT	-	Thomas & Betts
			1	22	SK501HT	-	Thomas & Betts
			1	20	SK501HT	-	Thomas & Betts
			2	22	SK501HT	-	Thomas & Betts
			2	20	SK501HT	-	Thomas & Betts
	0.401	0.425	0	-	SK601HT	-	Thomas & Betts
			1	20	SK601HT	-	Thomas & Betts
			1	18	SK601HT	-	Thomas & Betts
			2	20	SK601HT	-	Thomas & Betts
			2	20	SK601HT	-	Thomas & Betts

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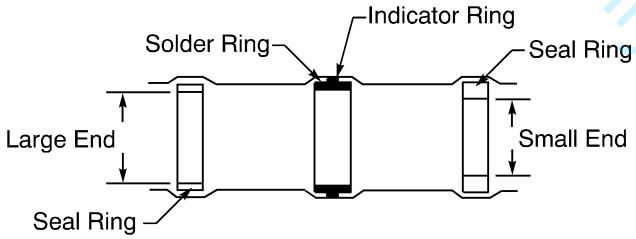
D. Selection of a Solder Sleeve without an Integral Wire



BACS13CT()N SOLDER SLEEVE
Figure 5

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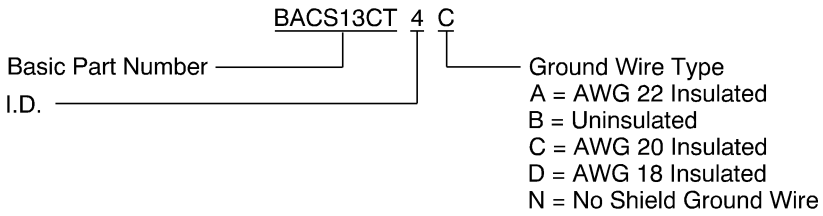
ASSEMBLY OF SHIELD GROUND WIRES



BACS13CT PART NUMBER STRUCTURE
Figure 6

Table 11
SELECTION OF A SOLDER SLEEVE - NO INTEGRAL WIRE

Maximum O.D. of the Shield Ground Wire Assembly (inch)	Minimum O.D. (inch)		Solder Sleeve		
	Shield	Wire	Part Number	Maximum Temperature Grade	Supplier
0.095	0.020	0.075	D-144-25	B	Tyco/Raychem
0.105	0.020	0.035	BACS13CT1N	B	Boeing
	0.030	0.040	BACS13BH1	B	Boeing
0.145	0.030	0.055	BACS13CT2N	B	Boeing
			M83519/1-2	B	QPL
0.175	0.050	0.080	BACS13BH2	B	Boeing
0.200	0.050	0.085	BACS13CT3N	B	Boeing
			M83519/1-3	B	QPL
0.255	0.070	0.130	BACS13CT4N	B	Boeing
			M83519/1-4	B	QPL
0.275	0.100	0.150	BACS13BH3	B	Boeing
0.300	0.100	0.170	BACS13CT5N	B	Boeing
			M83519/1-5	B	QPL

Table 12
APPROVED SUPPLIERS OF BOEING STANDARD SOLDER SLEEVES

Boeing Standard	Supplier
BACS13CT	Tyco/Raychem

Table 13
ALTERNATIVE SOLDER SLEEVE PART NUMBERS

Specified Solder Sleeve		Alternative Solder Sleeve	
Part Number	Supplier	Part Number	Supplier
D-144-25	Tyco/Raychem	BACS13CT1N	Boeing

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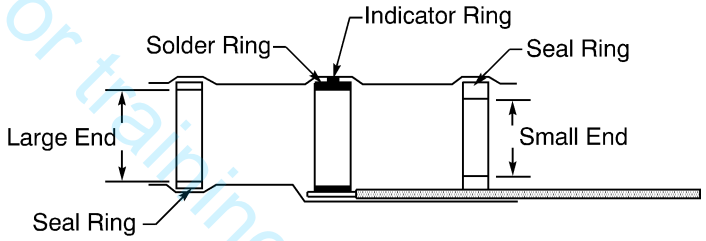
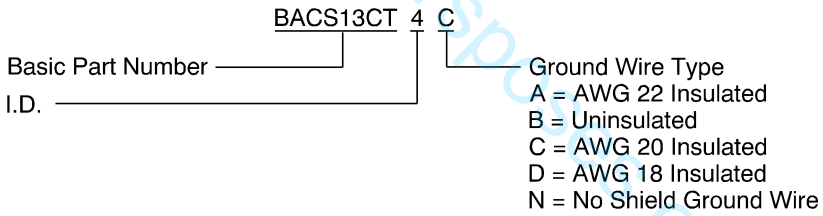
Table 13 (continued)

Specified Solder Sleeve		Alternative Solder Sleeve	
Part Number	Supplier	Part Number	Supplier
BACS13BH1	Boeing	BACS13CT2N	Boeing
BACS13BH2	Boeing	BACS13CT3N	Boeing
BACS13BH3	Boeing	BACS13CT5N	Boeing
BACS13BH4	Boeing	BACS13CT4N	Boeing

E. Selection of a Solder Sleeve with an Insulated Integral Wire



BACS13CT()A, BACS13CT()C, AND BACS13CT()D SOLDER SLEEVES
Figure 7



BACS13CT PART NUMBER STRUCTURE
Figure 8

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Table 14
SELECTION OF A SOLDER SLEEVE - INSULATED INTEGRAL WIRE

Shield Ground Wire Size (AWG)	Maximum O.D. of the Jacket (inch)	Minimum O.D. (inch)		Solder Sleeve		
		Shield	Wire	Part Number	Maximum Temperature Grade	Supplier
22	0.105	0.035	0.020	BACS13CT1A	B	Boeing
				M83519/2-6	B	QPL
	0.145	0.055	0.030	BACS13CT2A	B	Boeing
	0.200	0.085	0.050	BACS13CT3A	B	Boeing
	0.255	0.130	0.070	BACS13CT4A	B	Boeing
	0.300	0.170	0.100	BACS13CT5A	B	Boeing
20	0.105	0.035	0.020	BACS13CT1C	B	Boeing
	0.145	0.055	0.030	BACS13CT2C	B	Boeing
				M83519/2-2	B	QPL
	0.200	0.085	0.050	BACS13CT3C	B	Boeing
				M83519/2-3	B	QPL
	0.255	0.130	0.070	BACS13CT4C	B	Boeing
	0.300	0.170	0.100	BACS13CT5C	B	Boeing
				M83519/2-5	B	QPL
18	0.145	0.055	0.030	BACS13CT2D	B	Boeing
	0.200	0.085	0.050	BACS13CT3D	B	Boeing
	0.255	0.130	0.070	BACS13CT4D	B	Boeing
	0.300	0.170	0.100	BACS13CT5D	B	Boeing

Table 15
APPROVED SUPPLIERS OF BOEING STANDARD SOLDER SLEEVES

Boeing Standard	Supplier
BACS13CT	Tyco/Raychem

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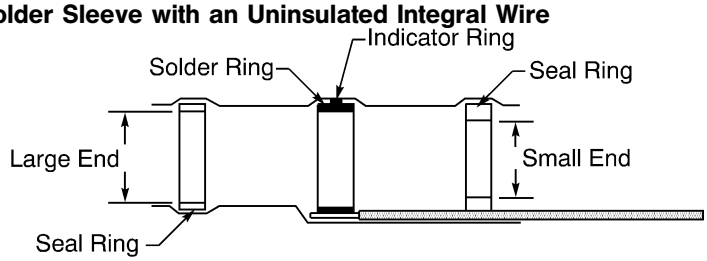
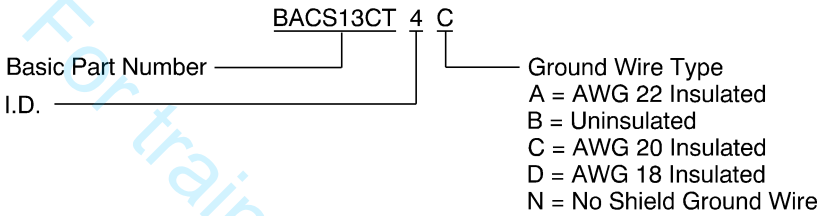
ASSEMBLY OF SHIELD GROUND WIRES

F. Selection of a Solder Sleeve with an Uninsulated Integral Wire



BACS13CT()B SOLDER SLEEVE
Figure 9



BACS13CT PART NUMBER STRUCTURE
Figure 10

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Table 16
SELECTION OF A SOLDER SLEEVE - UNINSULATED INTEGRAL WIRE

Maximum O.D. of the Jacket (inch)	Minimum O.D. (inch)		Shield Ground Wire Size (CAU)	Solder Sleeve	
	Shield	Wire		Boeing Standard	Maximum Temperature Grade
0.105	0.035	0.020	10	BACS13CT1B	B
0.145	0.055	0.030	10	BACS13CT2B	B
0.200	0.085	0.050	10	BACS13CT3B	B
0.255	0.130	0.070	10	BACS13CT4B	B
0.300	0.170	0.100	10	BACS13CT5B	B

Table 17
APPROVED SUPPLIERS OF BOEING STANDARD SOLDER SLEEVES

Boeing Standard	Supplier
BACS13CT	Tyco/Raychem

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G. Selection of a Shield Material

Table 18
SHIELD MATERIALS

Maximum Temperature Grade	Boeing Standard
B	BAC3108-()
D	BAC3106-()

NOTE: For sizes and suppliers of shield materials, refer to Subject 20-00-11.

H. Selection of an Insulation Material

Table 19
INSULATION MATERIALS

Material	Maximum Temperature Grade	Part Number	Supplier
Sleeve, Heat Shrinkable	B	AMS-DTL-23053/5 Class 1	An available source
		MIL-LT	Tyco/Raychem
	D	TFE 2X	Chemplast
		TFE 4X	Chemplast
Tape	D	Scotch 70	3M
		912-10X2	Arlon

3. SHIELD TERMINATION FOR SPECIAL CABLES

A. Selection of a Shield Termination Procedure

Table 20
SHIELD TERMINATION PROCEDURES FOR SPECIAL SHIELDED CABLES

Cable	Description	Supplier	Shield Termination Procedure
10-60875-1	Unshielded Cable with a 10-60875-4 Component Wire	Boeing	Paragraph 3.D.
10-60875-2	Unshielded Cable with a 10-60875-4 Component Wire	Boeing	Paragraph 3.D.
10-60875-4	Shielded Wire	Boeing	Paragraph 3.E.
10-60875-5	Shielded Cable with a 10-60875-4 Component Wire	Boeing	Paragraph 3.C.
10-60875-8	Shielded Wire	Boeing	Paragraph 3.E.
10-60875-9	Shielded Cable with a 10-60875-4 Component Wire	Boeing	Paragraph 3.C.
44A7620-20	Shielded Thermocouple Cable	Raychem	Paragraph 3.B.
44A7620-22	Shielded Thermocouple Cable	Raychem	Paragraph 3.B.

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B. Shield Termination for Raychem 44A7620 Thermocouple Cables

The paragraph gives the procedure to assemble these shield terminations for the Raychem 44A7620-22 and 44A7260-20 shielded cables:

- A shield dead end
- A shield ground wire with mechanical ferrules.

NOTE: A satisfactory alternative for the shield ground wire termination is the assembly of a shield ground wire with a solder sleeve. Refer to Paragraph 8. or Paragraph 9.

Table 21
MECHANICAL FERRULE PART NUMBERS

Cable	Shield Termination	Ferrule		
		Type	Boeing Standard	Color
44A7620-22	Shield Dead End	Inner	BACS13S-124B	Tin
		Outer	BACS13S-175C	Blue
	Shield Ground Wire	Inner	BACS13S-124B	Tin
		Outer	BACS13S-199C	Tin
44A7620-20	Shield Dead End	Inner	BACS13S-128B	Tin
		Outer	BACS13S-175C	Blue
	Shield Ground Wire	Inner	BACS13S-128B	Tin
		Outer	BACS13S-199C	Tin

(1) Make a selection of an inner ferrule from Table 21.

(2) Make a selection of an outer ferrule from Table 21.

Make sure that outer ferrule is applicable for the type of shield termination.

(3) Make a selection of a ferrule crimp tool from Table 24.

(4) Make a selection of a heat shrinkable sleeve from Table 19.

NOTE: For alternative heat shrinkable sleeves, refer to Subject 20-00-11.

(5) Prepare the cable. Refer to Paragraph 4.

(6) Remove the necessary length of shield from the end of the cable to make the distance from the end of the jacket to the end of the shield equal to 0.62 inch ±0.06 inch.

(7) If the shield termination is a shield ground wire:

(a) Make a selection of a shield ground wire from Table 5.

Make sure that the length of the shield ground wire is the minimum length that is necessary to attach the wire to the specified ground.

(b) Remove 0.3 inch ±0.1 inch of insulation from one end of the shield ground wire. Refer to Subject 20-00-15.

(8) Put the inner ferrule on the cable.

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Make sure that the inner ferrule is:

- Between the shield and the wires of the cable
- Against the end of the cable jacket.

(9) Put the outer ferrule on the cable.

Make sure that:

- The shield is between the inner ferrule and the outer ferrule
- The center of the outer ferrule is aligned with the center of the inner ferrule
- The forward end of the inner ferrule does not extend more than 0.06 inch farther than the forward end of the outer ferrule.

(10) If the shield termination is a shield ground wire, put the bare conductor of the shield ground wire between the outer ferrule and the shield.

Make sure that the length of the bare conductor of the shield ground wire:

- Extends the full length of the outer ferrule
- Extends a small amount farther than the rear end of the outer ferrule.

(11) Crimp the outer ferrule.

(12) Remove the unwanted length of the shield that extends farther than the forward edge of the outer ferrule.

NOTE: The outer surface of the inner ferrule can be used to cut against.

(13) Put the necessary length of heat shrinkable sleeve on the cable.

Make sure that the distance:

- From the end of the sleeve to the end of the ferrule where the shield ground wire makes an exit from the assembly is 0.5 inch minimum
- From the other end of the sleeve to the other end of the ferrule is 0.25 inch minimum.

(14) Shrink the sleeve into its position. Refer to Subject 20-10-14.

C. Shield Termination for 10-60875 FQIS Cables and Component Wires

The paragraph gives the procedure to assemble these shield terminations for the Boeing 10-60875 FQIS shielded cables and component wires:

- A shield dead end
- A shield ground wire with mechanical ferrules.

Table 22
MECHANICAL FERRULE PART NUMBERS

Cable	Shield Termination	Ferrule		
		Type	Boeing Standard	Color
10-60875-5	Shield Dead End	Inner	BACS13S-219B	Green
		Outer	BACS13S-281C	Blue
	Shield Ground Wire	Inner	BACS13S-219B	Green
		Outer	BACS13S-297C	Tin

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Table 22 (continued)

Cable	Shield Termination	Ferrule		
		Type	Boeing Standard	Color
10-60875-9	Shield Dead End	Inner	BACS13S-219B	Green
		Outer	BACS13S-281C	Blue
	Shield Ground Wire	Inner	BACS13S-219B	Green
		Outer	BACS13S-297C	Tin

(1) Make sure that the cable has a shield.

NOTE: The 10-60875 cable and component wires are specified as having Critical Design Configuration Control Limitations (CDCCL). Refer to Paragraph 1.B.

WARNING: IT IS MANDATORY THAT THE SPECIFIED REPAIR PROCEDURES ARE OBEYED FULLY.

(2) Make a selection of an inner ferrule from Table 22.

(3) Make a selection of an outer ferrule from Table 22.

Make sure that the outer ferrule is applicable for the type of shield termination.

(4) Make a selection of a ferrule crimp tool from Table 24.

(5) Prepare the cable. Refer to Paragraph 4.

(6) Remove the necessary length of shield from the end of the cable to make the distance from the end of the jacket to the end of the shield equal to 0.62 inch ±0.06 inch.

(7) If the shield termination is a shield ground wire:

(a) Make a selection of a shield ground wire from Table 5.

Make sure that the length of the shield ground wire is the minimum length that is necessary to attach the wire to the specified ground.

(b) Remove 0.3 inch ±0.1 inch of insulation from one end of the shield ground wire. Refer to Subject 20-00-15.

(8) Put the inner ferrule on the cable.

Make sure that the inner ferrule is:

- Between the shield and the wires of the cable
- Against the end of the cable jacket.

(9) Put the outer ferrule on the cable.

Make sure that:

- The shield is between the inner ferrule and the outer ferrule
- The center of the outer ferrule is aligned with the center of the inner ferrule
- The forward end of the inner ferrule does not extend more than 0.06 inch farther than the forward end of the outer ferrule.

(10) If the shield termination is a shield ground wire, put the bare conductor of the shield ground wire between the outer ferrule and the shield.

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Make sure that the length of the bare conductor of the shield ground wire:

- Extends the full length of the outer ferrule
- Extends a small amount farther than the rear end of the outer ferrule.

(11) Crimp the outer ferrule.

(12) Remove the unwanted length of the shield that extends farther than the forward edge of the outer ferrule.

NOTE: The outer surface of the inner ferrule can be used to cut against.

(13) Assemble the shield termination of the 10-60875-4 component wire. Refer to Paragraph 3.E.

D. Shield Termination for Component Wires of Unshielded 10-60875 FQIS Cables

The paragraph gives the procedure to assemble these shield terminations for a shielded component wire of a Boeing 10-60875 FQIS unshielded cable:

- A shield dead end
- A shield ground wire with mechanical ferrules.

(1) Make sure that the component wire has a shield.

NOTE: The 10-60875 cable and component wires are specified as having Critical Design Configuration Control Limitations (CDCCL). Refer to Paragraph .1.B.

WARNING: IT IS MANDATORY THAT THE SPECIFIED REPAIR PROCEDURES ARE OBEYED FULLY.

(2) Prepare the cable. Refer to Paragraph 4.

NOTE: The 10-60875 cable and component wires are specified as having Critical Design Configuration Control Limitations (CDCCL). Refer to Paragraph .1.B.

WARNING: IT IS MANDATORY THAT THE SPECIFIED REPAIR PROCEDURES ARE OBEYED FULLY.

(3) Assemble the shield termination of the 10-60875-4 component wire. Refer to Paragraph 3.E..

E. Shield Termination for 10-60875 FQIS Wires

The paragraph gives the procedure to assemble these shield terminations for the Boeing 10-60875 FQIS shielded wires:

- A shield dead end
- A shield ground wire with mechanical ferrules.

Table 23
MECHANICAL FERRULE PART NUMBERS

Cable	Shield Termination	Ferrule		
		Type	Boeing Standard	Color
10-60875-4	Shield Dead End	Inner	BACS13S-080B	Blue
		Outer	BACS13S-128C	Blue
	Shield Ground Wire	Inner	BACS13S-080B	Blue
		Outer	BACS13S-156C	Yellow

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Table 23 (continued)

Cable	Shield Termination	Ferrule		
		Type	Boeing Standard	Color
10-60875-8	Shield Dead End	Inner	BACS13S-080B	Blue
		Outer	BACS13S-128C	Blue
	Shield Ground Wire	Inner	BACS13S-080B	Blue
		Outer	BACS13S-156C	Yellow

(1) Make sure that the wire has a shield.

NOTE: The 10-60875 cable and component wires are specified as having Critical Design Configuration Control Limitations (CDCCL). Refer to Paragraph 1.B.

WARNING: IT IS MANDATORY THAT THE SPECIFIED REPAIR PROCEDURES ARE OBEYED FULLY.

(2) Make a selection of an inner ferrule from Table 23.

(3) Make a selection of an outer ferrule from Table 23.

Make sure that the outer ferrule is applicable for the type of shield termination.

(4) Make a selection of a ferrule crimp tool from Table 24.

(5) Prepare the wire. Refer to Paragraph .4.

(6) Remove the necessary length of shield from the wire to make the distance from the end of the jacket to the end of the shield equal to 0.62 inch ±0.06 inch.

(7) If the shield termination is a shield ground wire:

(a) Make a selection of a shield ground wire from Table 5.

Make sure that the length of the shield ground wire is the minimum length that is necessary to attach the wire to the specified ground.

(b) Remove 0.3 inch ±0.1 inch of insulation from one end of the shield ground wire. Refer to Subject 20-00-15.

(8) Put the inner ferrule on the wire.

Make sure that the inner ferrule is:

- Between the shield and the primary insulation of the wire
- Against the end of the jacket of the wire.

(9) Put the outer ferrule on the wire.

Make sure that:

- The shield is between the inner ferrule and the outer ferrule
- The center of the outer ferrule is aligned with the center of the inner ferrule
- The forward end of the inner ferrule does not extend more than 0.06 inch farther than the forward end of the outer ferrule.

(10) If the shield termination is a shield ground wire, put the bare conductor of the shield ground wire between the outer ferrule and the shield.

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Make sure that the length of the bare conductor of the shield ground wire:

- Extends the full length of the outer ferrule
- Extends a small amount farther than the rear end of the outer ferrule.

(11) Crimp the outer ferrule.

(12) Remove the unwanted length of the shield that extends farther than the forward edge of the outer ferrule.

NOTE: The outer surface of the inner ferrule can be used to cut against.

4. WIRE AND CABLE PREPARATION

A. Jacket Removal from the End of a Wire or Cable

(1) Make a selection of a wire or cable jacket removal tool. Refer to Subject 20-00-15.

NOTE: One of these tools is a satisfactory alternative:

- A sharp knife
- A thermal tool for insulation removal
- The Reon Manufacturing R-720 cable jacket removal tool for BMS13-51 cable.

(2) Make a selection of the location on the jacket of the wire or cable to make the shield termination.

Refer to Paragraph 1. for the conditions that are applicable for shield termination.

(3) Carefully cut the jacket around the circumference of the wire or cable at that location.

CAUTION: DO NOT CUT ALL OF THE WAY THROUGH THE JACKET. DAMAGE TO THE SHIELD OR THE COMPONENT WIRES CAN OCCUR.

(4) If it is necessary, carefully cut the jacket longitudinally the location to the end of the wire or cable.

CAUTION: DO NOT CUT ALL OF THE WAY THROUGH THE JACKET. DAMAGE TO THE SHIELD OR THE COMPONENT WIRE CAN OCCUR.

(5) Pull the jacket apart at the lines where it is cut.

NOTE: If it is necessary, the wire or cable can be bent to make the removal easier.

CAUTION: DO NOT BEND THE WIRE OR CABLE MORE THAN THE POINT WHERE THE RADIUS OF THE BEND IS LESS THAN 3 TIMES THE DIAMETER OF THE WIRE OR CABLE. DAMAGE TO THE WIRE OR CABLE CAN OCCUR.

(6) Examine the jacket, the shield, and primary insulation of the component wires for damage.

For the conditions that are applicable after the removal of a jacket from the end of a wire or cable, refer to Subject 20-00-15.

5. ASSEMBLY OF A SHIELD GROUND WIRE WITH A SHIELD PULL THROUGH

A. Shield Pull Through with Sleeve Strain Relief

This paragraph gives the procedure to assemble a shield ground wire on a wire or cable that has:

- A shield with round conductors
- An outer shield with round conductors and an adjacent inner shield with round conductors.

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ASSEMBLY OF SHIELD GROUND WIRES

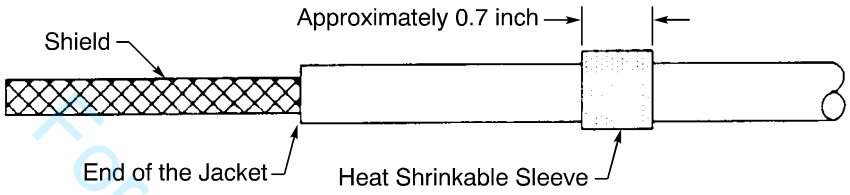
CAUTION: THIS PROCEDURE CAUSES DAMAGE TO A SHIELD THAT HAS FLAT CONDUCTORS. DAMAGE TO THE FLAT CONDUCTORS OF A SHIELD CAN CAUSE UNSATISFACTORY PERFORMANCE OF THE CONNECTION OF THE SHIELD TO GROUND.

(1) Make a selection of a heat shrinkable sleeve from Table 19.

NOTE: For alternative heat shrinkable sleeves, refer to Subject 20-00-11.

(2) Put an approximate 0.7 inch length of heat shrinkable sleeve on the wire or cable.

(3) Prepare the wire or cable. Refer to Figure 11 and Paragraph 4.A.



JACKET REMOVAL
Figure 11

(4) If the wire or cable has adjacent shields, remove the outer shield.

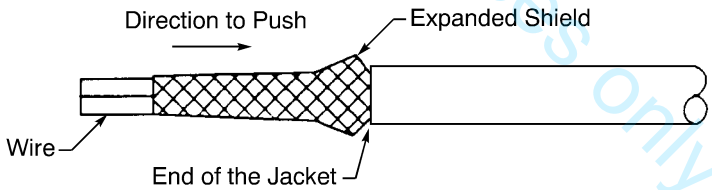
CAUTION: DAMAGE TO THE REMAINING INNER SHIELD MUST BE PREVENTED. DAMAGE TO THE CONDUCTORS OF THE SHIELD CAN CAUSE UNSATISFACTORY PERFORMANCE OF THE CONNECTION OF THE SHIELD TO GROUND.

(a) Move the strands of the outer shield apart.

(b) Carefully cut the strands of the shield at the end of the jacket.

Make sure that the end of the outer shield is aligned with the end of the jacket.

(5) Push the shield rearward to expand it at the end of the jacket. Refer to Figure 12.



EXPANDED SHIELD
Figure 12

(6) Make a hole in the shield with a nylon awl or an equivalent tool. Refer to Figure 13.

Make sure that the center of the hole is approximately 0.5 inch from the end of the cable jacket.

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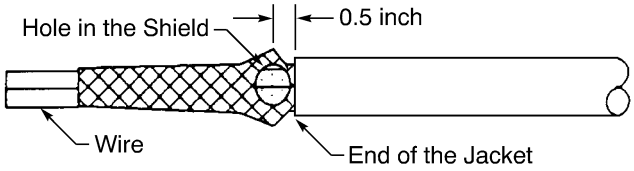
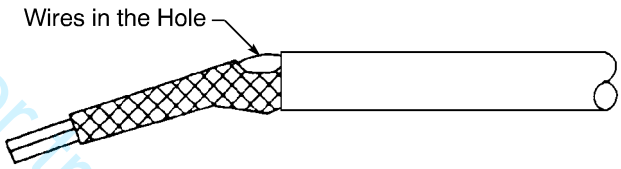
ASSEMBLY OF SHIELD GROUND WIRES



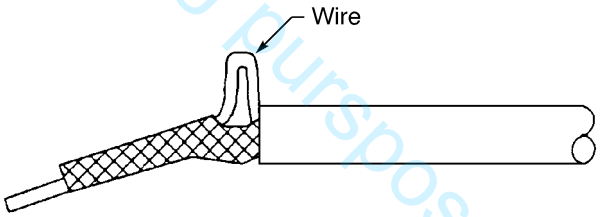
LOCATION OF THE HOLE IN THE SHIELD
Figure 13

(7) Carefully bend the wire or cable until the component wires can be seen in the hole. Refer to Figure 14.



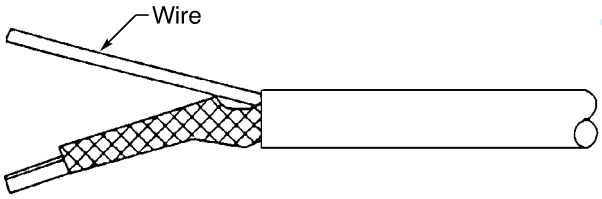
POSITION OF THE HOLE ON THE BEND OF THE CABLE
Figure 14

(8) Carefully pull a wire through the hole in the shield with the nylon awl. Refer to Figure 15.



POSITION OF THE WIRE THROUGH THE HOLE IN THE SHIELD
Figure 15

(9) Pull the wire out of the hole. Refer to Figure 16.



POSITION OF THE WIRE OUT OF THE SHIELD
Figure 16

(10) Do Step (8) and Step (9) again for each wire in the cable.

(11) Pull the end of the shield tight to make a flat and symmetrical conductor.

(12) Remove the necessary length from the end of the shield conductor to make the distance from the end of the conductor to the end of the jacket equal to 1.7 inches to 2.0 inches. Refer to Figure 17.

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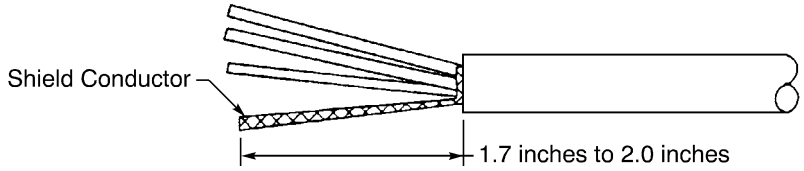
ASSEMBLY OF SHIELD GROUND WIRES



LENGTH OF THE SHIELD CONDUCTOR
Figure 17

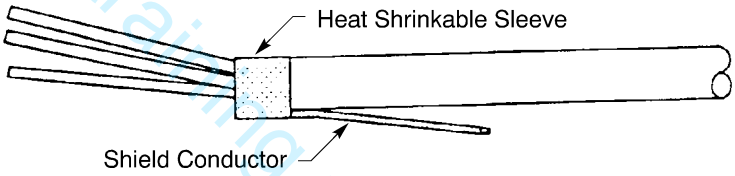
(13) Fold the shield conductor back on the jacket of the wire or cable.

Make sure that the free end of the conductor is pointed away from the end of the cable.

(14) Align the center of the sleeve with the end of the shield. Refer to Figure 18.

Make sure that:

- The rear end of the sleeve makes an overlap with the end of the jacket
- The free end of the shield conductor is pointed in the correct direction out of the sleeve.



POSITION OF THE HEAT SHRINKABLE SLEEVE
Figure 18

(15) Shrink the sleeve into its position. Refer to Subject 20-10-14.

B. Shield Pull Through with Tape Strain Relief

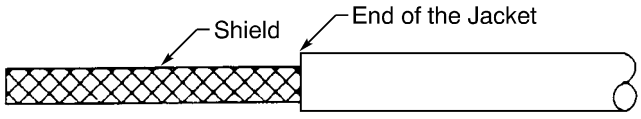
This paragraph gives the procedure to assemble a shield ground wire on a wire or cable that has:

- A shield with round conductors
- An outer shield with round conductors and an adjacent inner shield with round conductors.

CAUTION: THIS PROCEDURE CAUSES DAMAGE TO A SHIELD THAT HAS FLAT CONDUCTORS. DAMAGE TO THE FLAT CONDUCTORS OF A SHIELD CAN CAUSE UNSATISFACTORY PERFORMANCE OF THE CONNECTION OF THE SHIELD TO GROUND.

(1) Make a selection of tape from Table 19.

(2) Prepare the wire or cable. Refer to Figure 19 and Paragraph 4.A.



JACKET REMOVAL
Figure 19

(3) If the wire or cable has adjacent shields, remove the outer shield.

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ASSEMBLY OF SHIELD GROUND WIRES

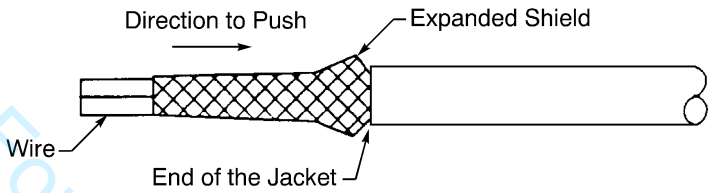
CAUTION: DAMAGE TO THE REMAINING INNER SHIELD MUST BE PREVENTED. DAMAGE TO THE CONDUCTORS OF THE SHIELD CAN CAUSE UNSATISFACTORY PERFORMANCE OF THE CONNECTION OF THE SHIELD TO GROUND.

(a) Move the strands of the outer shield apart.

(b) Carefully cut the strands of the shield at the end of the jacket.

Make sure that the end of the outer shield is aligned with the end of the jacket.

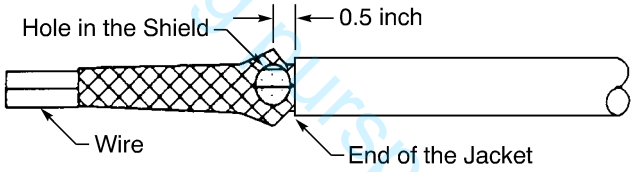
(4) Push the shield rearward to expand it at the end of the jacket. Refer to Figure 20.



EXPANDED SHIELD
Figure 20

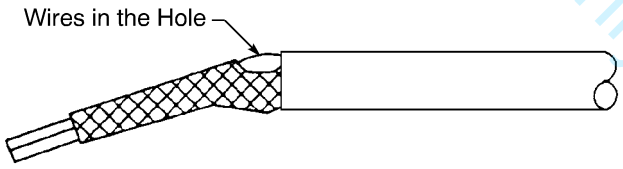
(5) Make a hole in the shield with a nylon awl or an equivalent tool. Refer to Figure 21.

Make sure that the center of the hole is approximately 0.5 inch from the end of the cable jacket.



LOCATION OF THE HOLE IN THE SHIELD
Figure 21

(6) Carefully bend the wire or cable until the component wires can be seen in the hole. Refer to Figure 22.



POSITION OF THE HOLE ON THE BEND OF THE CABLE
Figure 22

(7) Carefully pull a wire through the hole in the shield with the nylon awl. Refer to Figure 23.

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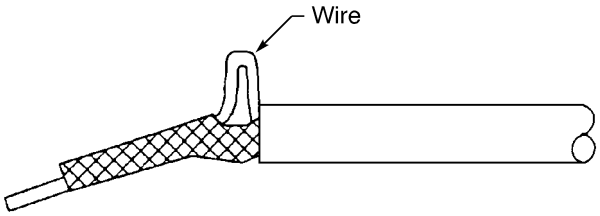
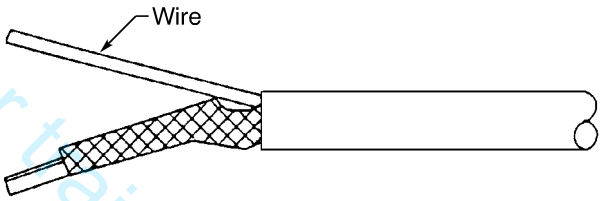
ASSEMBLY OF SHIELD GROUND WIRES



POSITION OF THE WIRE THROUGH THE HOLE IN THE SHIELD
Figure 23

(8) Pull the wire out of the hole. Refer to Figure 24.

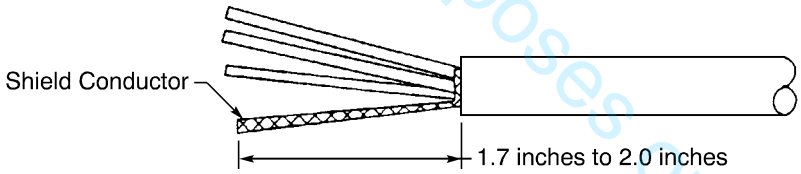


POSITION OF THE WIRE OUT OF THE SHIELD
Figure 24

(9) Do Step (7) and Step (8) again for each wire in the cable.

(10) Pull the end of the shield tight to make a flat and symmetrical conductor.

(11) Remove the necessary length from the shield conductor to make the distance from the end of the conductor to the end of the jacket equal to 1.7 inches to 2.0 inches. Refer to Figure 25.



LENGTH OF THE SHIELD CONDUCTOR
Figure 25

(12) Fold the shield conductor back on the jacket of the wire or cable.

Make sure that the free end of the conductor is pointed away from the end of the cable.

(13) Put two layers of tape on the shield conductor, the jacket, and the wires of the cable. Refer to Figure 26.

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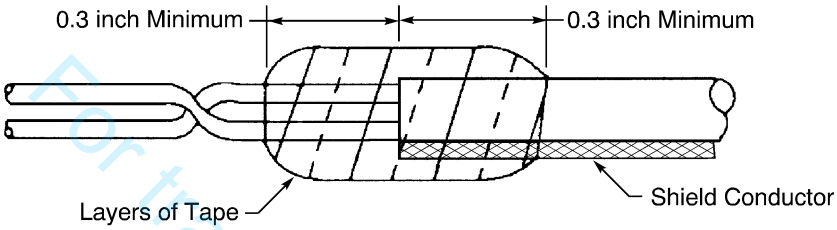
Make sure that:

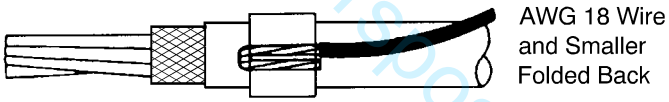
- Each layer has a 0.25 inch overlap
- The rear end of each each layer extends a minimum of 0.3 inch farther than the rear end of the shield
- The forward end of each each layer extends a minimum of 0.3 inch farther than the forward end of the shield
- The second layer is wound in the opposite direction of the first layer
- The free end of the shield conductor is pointed in the correct direction out of the layers of tape.



POSITION OF THE LAYERS OF TAPE
Figure 26

6. ASSEMBLY OF A SHIELD GROUND WIRE WITH MECHANICAL FERRULES

A. Shield Ground Wire Configurations



CONFIGURATION OF ONE SHIELD GROUND WIRE
Figure 27

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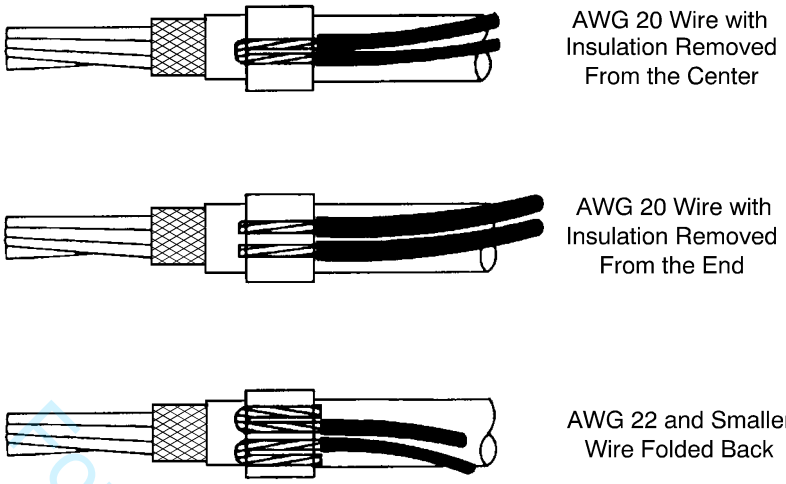
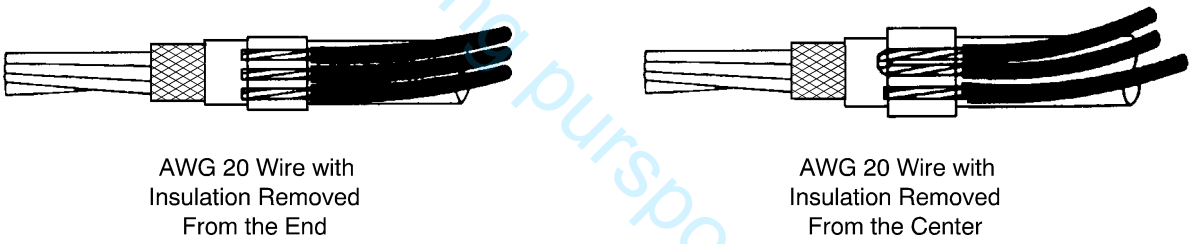
ASSEMBLY OF SHIELD GROUND WIRES



CONFIGURATION OF TWO SHIELD GROUND WIRES
Figure 28



CONFIGURATION OF THREE SHIELD GROUND WIRES
Figure 29

B. Shield Ground Wire - Shield Folded Back

This paragraph gives the procedure to assemble a shield ground wire on a wire or cable that has:

- A shield with round conductors
- An outer shield with round conductors and an adjacent inner shield with round conductors.

CAUTION: THIS PROCEDURE CAUSES DAMAGE TO A SHIELD THAT HAS FLAT CONDUCTORS. DAMAGE TO THE FLAT CONDUCTORS OF A SHIELD CAN CAUSE UNSATISFACTORY PERFORMANCE OF THE CONNECTION OF THE SHIELD TO GROUND.

(1) Prepare the wire or cable. Refer to Paragraph 4.A.

(2) Make a selection of a shield ground wire from Table 5.

(3) Make a selection of a tape from Table 19.

Make sure the tape has the correct Temperature Grade.

(4) Cut the minimum length of the shield ground wire that is necessary to attach the wire to the specified ground.

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For the maximum length of the shield ground wire, refer to Paragraph 1.D.

NOTE: If two shield ground wires are specified, a satisfactory alternative to the minimum length is two times the minimum length from which the insulation can be removed at the center. Refer to Figure 28.

(5) Measure the O.D. of the wire or cable.

(6) Make a selection of an inner ferrule from Table 8.

NOTE: The applicable ferrule has an I.D. that is a small amount larger than the O.D. of the wire or cable. Refer to Figure 4.

Make sure that the ferrule has the correct Temperature Grade; refer to Figure 4 and Table 6.

(7) Make a selection of an outer ferrule that is specified for the inner ferrule from Table 8.

NOTE: In Table 8, more than one outer ferrule can be specified for one inner ferrule. It is possible that shields of different wires and cables have different thicknesses. This can make it necessary to use a smaller or a larger outer ferrule.

Make sure that the ferrule has the correct Temperature Grade; refer to Figure 4 and Table 6.

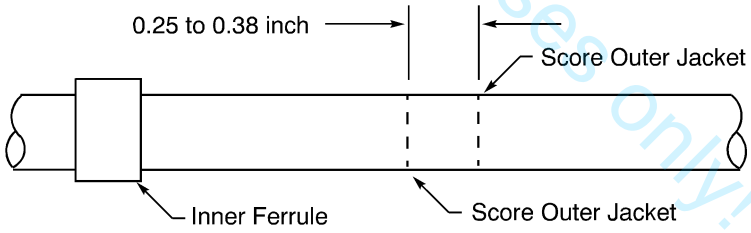
(8) Put the inner ferrule on the wire or cable.

Make sure that the ferrule is the smallest ferrule that can be moved freely on the jacket of the wire or cable.

(9) Remove the necessary length of the shield:

(a) Use a sharp knife to score around the outer jacket at two positions. Make the distance between the scores 0.25 - 0.38 inches. Refer to Figure 30.

CAUTION: DO NOT CUT FULLY THROUGH THE CABLE JACKET. CUTTING THROUGH THE CABLE JACKET CAN DAMAGE THE SHIELD AND THE INTERNAL CONDUCTORS AND CAUSE UNSATISFACTORY PERFORMANCE OF THE CABLE.



DIMENSION BETWEEN THE SCORES IN THE OUTER JACKET
Figure 30

(b) Tear or pull the outer jacket at the first score line until the first piece of outer jacket is not attached. Refer to Figure 31.

NOTE: The cable can be bent to help remove the first piece of the outer jacket.

CAUTION: DO NOT BEND THE CABLE TO A RADIUS THAT IS LESS THAN 3 TIMES THE CABLE DIAMETER. DAMAGE TO THE CABLE CAN OCCUR.

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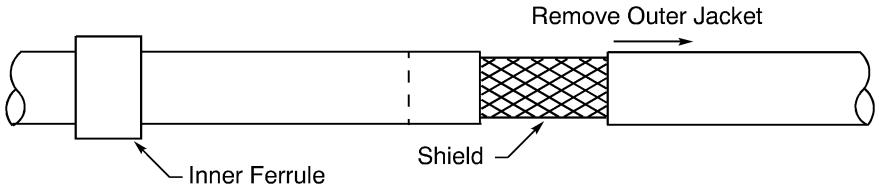
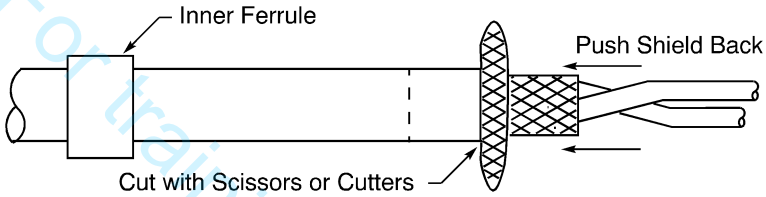
ASSEMBLY OF SHIELD GROUND WIRES



REMOVAL OF THE FIRST PIECE OF OUTER JACKET
Figure 31

(c) Remove the first piece of the outer jacket. Refer to Figure 31.

(d) Push the shield back to make a ring against the second piece of the outer jacket. Refer to Figure 32.



SHIELD PUSH BACK AND TRIM
Figure 32

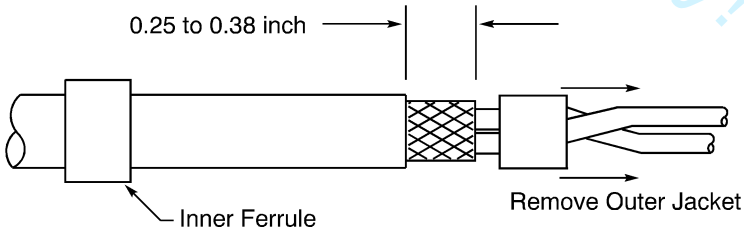
(e) Cut the shield with scissors or cutters. Refer to Figure 32.

CAUTION: DO NOT CUT THE SHIELD WITH A KNIFE AGAINST THE CABLE. DAMAGE TO THE INNER CONDUCTORS CAN CAUSE UNSATISFACTORY PERFORMANCE OF THE CABLE.

(f) Tear or pull the outer jacket at the second score line until the second piece of outer jacket is not attached. Refer to Figure 33.

NOTE: The cable can be bent to help remove the second piece of the outer jacket.

CAUTION: DO NOT BEND THE CABLE TO A RADIUS THAT IS LESS THAN 3 TIMES THE CABLE DIAMETER. DAMAGE TO THE CABLE CAN OCCUR.



REMOVAL OF THE SECOND PIECE OF OUTER JACKET
Figure 33

(10) If the cable has adjacent shields, remove the outer shield. Refer to Figure 34.

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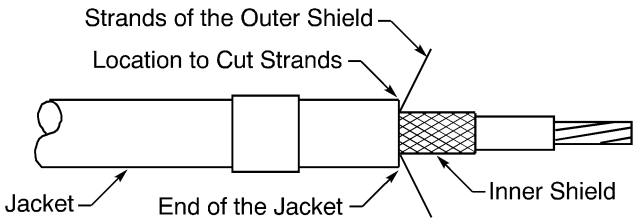
ASSEMBLY OF SHIELD GROUND WIRES



REMOVAL OF THE OUTER SHIELD
Figure 34

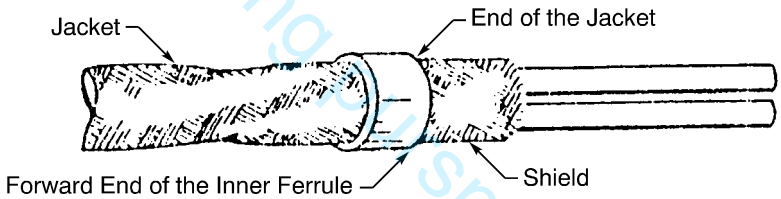
(a) Move the strands of the outer shield apart and make them straight.

(b) Cut the strands of the outer shield at the end of the jacket.

CAUTION: THE STRANDS OF THE OUTER SHIELD MUST BE CUT CAREFULLY. DAMAGE TO THE INNER SHIELD OR THE WIRE CAN CAUSE UNSATISFACTORY PERFORMANCE OF THE CABLE.

(11) Move the strands of the remaining shield apart and make them straight.

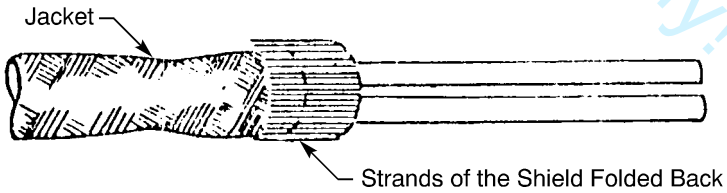
(12) Push the inner ferrule forward until the forward end of the ferrule is aligned with the end of the jacket. Refer to Figure 35.



POSITION OF THE INNER FERRULE
Figure 35

(13) Fold the strands of the shield back on the inner ferrule. Refer to Figure 36.

Make sure that the strands of the shield are smooth and symmetrical around the circumference of the inner ferrule.



STRANDS OF THE SHIELD FOLDED BACK
Figure 36

(14) Remove the necessary length of insulation from one end of each shield ground wire. Refer to Subject 20-00-15.

Make sure that the conductor of each shield ground wire has the sufficient length to extend the full length of the outer ferrule.

(15) Put the conductor of each shield ground wire on the shield and the inner ferrule.

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ASSEMBLY OF SHIELD GROUND WIRES

Make sure that each shield ground wire is pointed in the correct direction.

CAUTION: MORE THAN THREE SHIELD GROUND WIRES MUST NOT BE INSTALLED IN ONE SHIELD GROUND WIRE ASSEMBLY. MORE THAN THREE SHIELD GROUND WIRES CAN CAUSE UNSATISFACTORY PERFORMANCE OF THE CONNECTION OF THE SHIELD TO GROUND.

For the configuration of:

- One shield ground wire, refer to Figure 27
- Two shield ground wires, refer to Figure 28
- Three shield ground wires, refer to Figure 29.

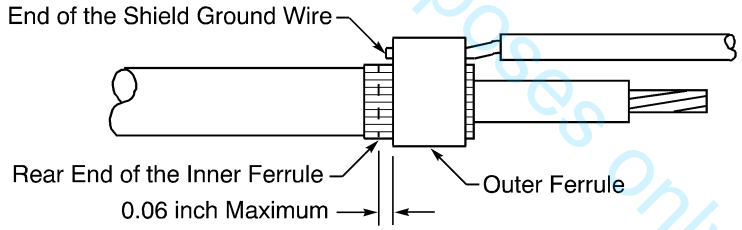
(16) Put the outer ferrule on the inner ferrule.

Refer to:

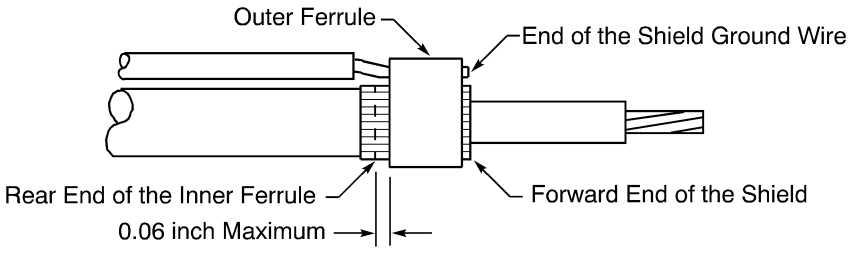
- Figure 37 for a shield ground wire that is pointed forward
- Figure 38 for a shield ground wire that is pointed rearward.

Make sure that:

- The outer ferrule is the smallest that can be crimped on the inner ferrule and the shield ground wires
- The rear end of the inner ferrule does not extend farther than 0.06 inch from the rear end of the outer ferrule
- The end of each shield ground wire extends farther than the end of the outer ferrule
- For a shield ground wire that is pointed forward, the end of each shield ground wire does not extend farther than the rear end of the inner ferrule
- For a shield ground wire that is pointed rearward, the end of each shield ground wire does not extend farther than the forward end of the shield.



POSITION OF THE OUTER FERRULE - SHIELD GROUND WIRE POINTED FORWARD
Figure 37



POSITION OF THE OUTER FERRULE - SHIELD GROUND WIRE POINTED REARWARD
Figure 38

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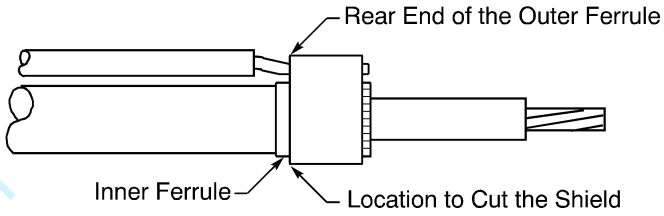
(17) Make a selection of a ferrule crimp tool from Table 24.

(18) Crimp the outer ferrule.

(19) Remove the unwanted length of the shield that extends farther than the rear end of the outer ferrule. Refer to Figure 39.

NOTE: The outer surface of the inner ferrule can be used to cut against.



REMOVAL OF THE UNWANTED LENGTH OF SHIELD
Figure 39

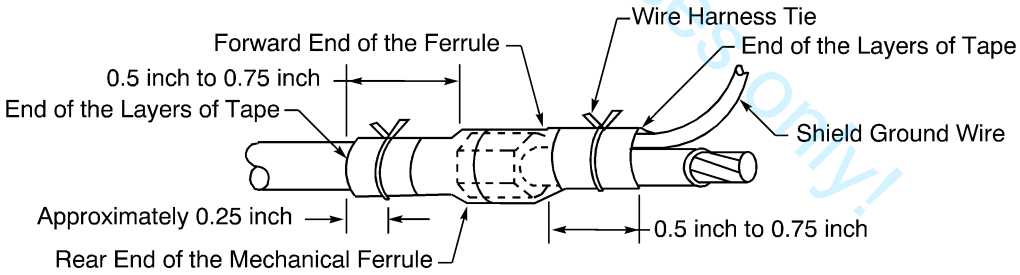
(20) Put two layers of tape on the shield ground wire assembly.

Refer to:

- Figure 40 for a shield ground wire that is pointed forward
- Figure 41 for a shield ground wire that is pointed rearward.

Make sure that:

- Each layer has a 50 percent overlap
- The rear end of each layer extends 0.5 inch to 0.75 inch from the rear end of the outer ferrule
- The forward end of each layer extends 0.5 inch to 0.75 inch from the forward end of the outer ferrule
- The second layer is wound in the opposite direction of the first layer.



POSITION OF THE LAYERS OF TAPE - SHIELD GROUND WIRE POINTED FORWARD
Figure 40

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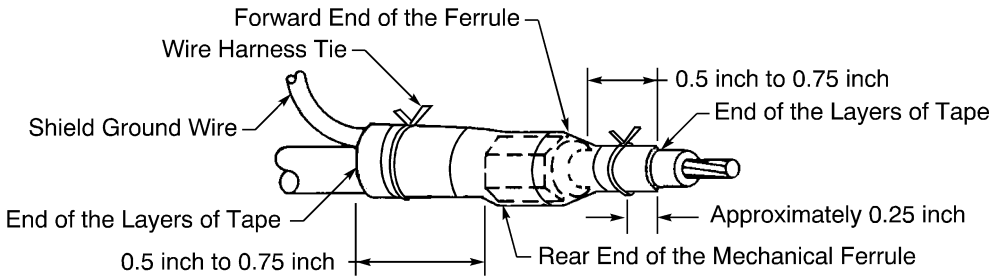
ASSEMBLY OF SHIELD GROUND WIRES



POSITION OF THE LAYERS OF TAPE - SHIELD GROUND WIRE POINTED REARWARD
Figure 41

(21) Assemble a wire harness tie on each end of the shield ground wire assembly approximately 0.25 inch from the end of the layers of tape.

Refer to:

- Figure 40 for a shield ground wire that is pointed forward
- Figure 41 for a shield ground wire that is pointed rearward
- Subject 20-10-11 for the procedure to assemble a wire harness tie.

C. Shield Ground Wire - Outer Shield Folded Back

This paragraph gives the procedure to assemble a shield ground wire on a wire or cable that has an outer shield with round conductors and an adjacent inner shield with flat conductors.

(1) Prepare the wire or cable. Refer to Paragraph 4.A.

(2) Make a selection of a shield ground wire from Table 5.

(3) Make a selection of a tape from Table 19.

Make sure the tape has the correct Temperature Grade.

(4) Cut the minimum length of the shield ground wire that is necessary to attach the wire to the specified ground.

For the maximum length of the shield ground wire, refer to Paragraph 1.D.

NOTE: If two shield ground wires are specified, a satisfactory alternative to the minimum length is two times the minimum length from which the insulation can be removed at the center. Refer to Figure 28.

(5) Cut the minimum length of the shield ground wire that is necessary to attach the wire to the specified ground.

For the maximum length of the shield ground wire, refer to Paragraph 1.D.

NOTE: If two shield ground wires are specified, a satisfactory alternative to the minimum length is two times the minimum length from which the insulation can be removed at the center. Refer to Figure 28.

(6) Measure the O.D. of the wire or cable.

(7) Make a selection of an inner ferrule from Table 8.

NOTE: The applicable ferrule has an I.D. that is a small amount larger than the O.D. of the wire or cable. Refer to Figure 4.

Make sure that the ferrule has the correct Temperature Grade; refer to Figure 4 and Table 6.

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(8) Make a selection of an outer ferrule that is specified for the inner ferrule from Table 8.

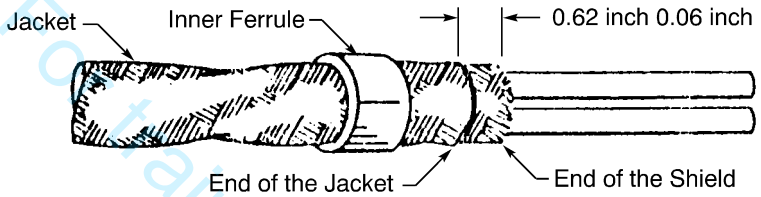
NOTE: In Table 8, more than one outer ferrule can be specified for one inner ferrule. It is possible that shields of different wires and cables have different thicknesses. This can make it necessary to use a smaller or a larger outer ferrule.

Make sure that the ferrule has the correct Temperature Grade; refer to Figure 4 and Table 6.

(9) Put the inner ferrule on the wire or cable.

Make sure that the ferrule is the smallest ferrule that can be moved freely on the jacket of the wire or cable.

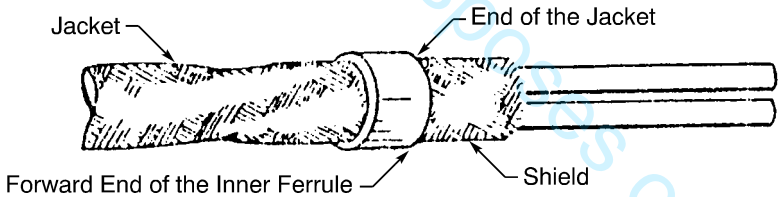
(10) Remove the necessary length of the shield or adjacent shields to make the distance from the end of the shield to the end of the jacket equal to 0.62 inch ±0.06 inch. Refer to Figure 42.



LENGTH OF THE SHIELD
Figure 42

(11) Move the stands of the outer shield apart and make them straight.

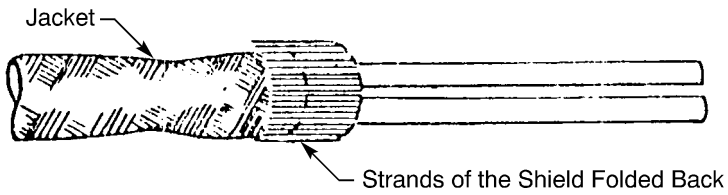
(12) Push the inner ferrule forward until the forward end of the ferrule is aligned with the end of the jacket. Refer to Figure 43.



POSITION OF THE INNER FERRULE
Figure 43

(13) Fold the strands of the outer shield back on the inner ferrule. Refer to Figure 44.

Make sure that the strands of the shield are smooth and symmetrical around the circumference of the inner ferrule.



STRANDS OF THE SHIELD FOLDED BACK
Figure 44

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(14) Remove the necessary length of insulation from one end of each shield ground wire. Refer to Subject 20-00-15.

Make sure that the conductor of each shield ground wire has the sufficient length to extend the full length of the outer ferrule.

(15) Put the conductor of each shield ground wire on the shield and the inner ferrule.

Make sure that each shield ground wire is pointed in the correct direction.

CAUTION: MORE THAN THREE SHIELD GROUND WIRES MUST NOT BE INSTALLED IN ONE SHIELD GROUND WIRE ASSEMBLY. MORE THAN THREE SHIELD GROUND WIRES CAN CAUSE UNSATISFACTORY PERFORMANCE OF THE CONNECTION OF THE SHIELD TO GROUND.

For the configuration of:

- One shield ground wire, refer to Figure 27
- Two shield ground wires, refer to Figure 28
- Three shield ground wires, refer to Figure 29.

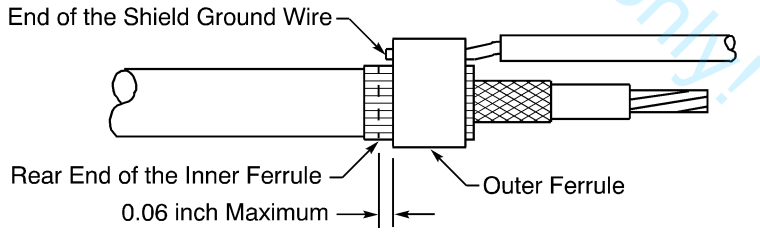
(16) Put the outer ferrule on the inner ferrule.

Refer to:

- Figure 45 for a shield ground wire that is pointed forward
- Figure 46 for a shield ground wire that is pointed rearward.

Make sure that:

- The outer ferrule is the smallest that can be crimped on the inner ferrule and the shield ground wires
- The rear end of the inner ferrule does not extend farther than 0.06 inch from the rear end of the outer ferrule
- The end of each shield ground wire extends farther than the end of the outer ferrule
- For a shield ground wire that is pointed forward, the end of each shield ground wire does not extend farther than the rear end of the inner ferrule
- For a shield ground wire that is pointed rearward, the end of each shield ground wire does not extend farther than the end of the forward end of the shield.



POSITION OF THE OUTER FERRULE - SHIELD GROUND WIRE POINTED FORWARD
Figure 45

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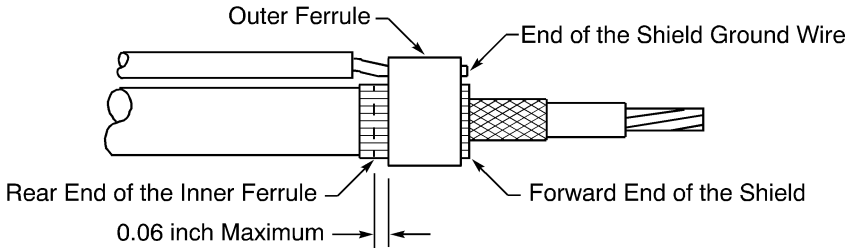
ASSEMBLY OF SHIELD GROUND WIRES



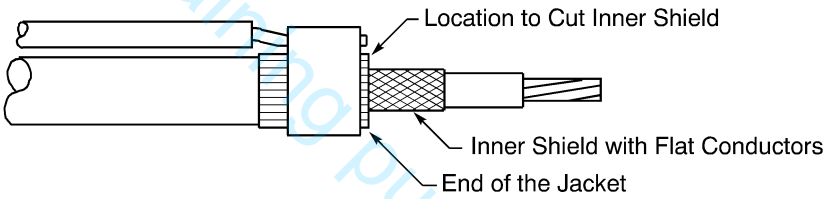
POSITION OF THE OUTER FERRULE - SHIELD GROUND WIRE POINTED REARWARD
Figure 46

(17) Make a selection of a ferrule crimp tool from Table 24.

(18) Crimp the outer ferrule.

(19) Remove the length of the inner shield at the end of the jacket. Refer to Figure 47.

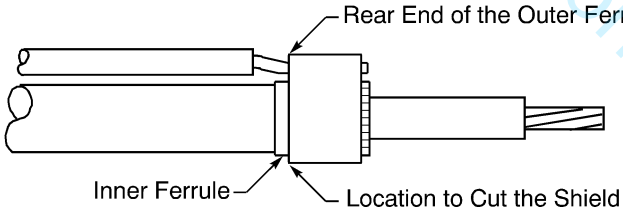
CAUTION: THE INNER SHIELD MUST BE CUT CAREFULLY. DAMAGE TO THE OUTER SHIELD OR THE WIRE CAN CAUSE UNSATISFACTORY PERFORMANCE OF THE CABLE.



REMOVAL OF THE INNER SHIELD
Figure 47

(20) Remove the unwanted length of the shield that extends farther than the rear end of the outer ferrule. Refer to Figure 48.

NOTE: The outer surface of the inner ferrule can be used to cut against.



REMOVAL OF THE UNWANTED LENGTH OF SHIELD
Figure 48

(21) Put two layers of tape on the shield ground wire assembly.

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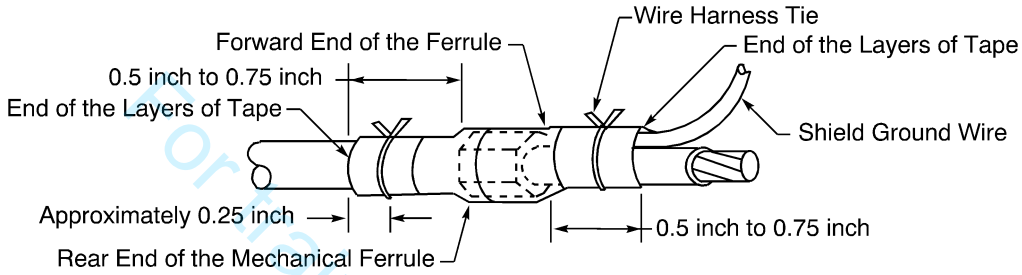
Refer to:

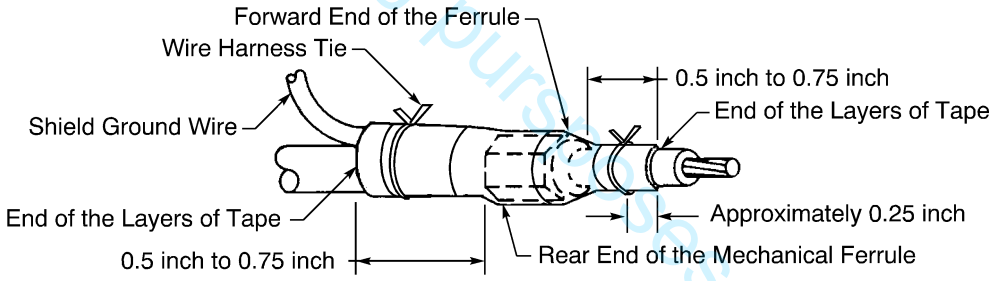
- Figure 49 for a shield ground wire that is pointed forward
- Figure 50 for a shield ground wire that is pointed rearward.

Make sure that:

- Each layer has a 50 percent overlap
- The end of each layer extends 0.5 inch to 0.75 inch from the rear end of the outer ferrule
- The end of each layer extends 0.5 inch to 0.75 inch from the forward end of the outer ferrule
- The second layer is wound in the opposite direction of the first layer.



POSITION OF THE LAYERS OF TAPE - SHIELD GROUND WIRE POINTED FORWARD
Figure 49



POSITION OF THE LAYERS OF TAPE - SHIELD GROUND WIRE POINTED REARWARD
Figure 50

(22) Assemble a wire harness tie on each end of the shield ground wire assembly approximately 0.25 inch from the end of the layers of tape.

Refer to:

- Figure 49 for a shield ground wire that is pointed forward
- Figure 50 for a shield ground wire that is pointed rearward
- Subject 20-10-11 for the procedure to assemble a wire harness tie.

D. Shield Ground Wire - Shield Not Folded Back

This paragraph gives the procedure to assemble a shield ground wire on a wire or cable that has:

- A shield with round conductors
- An outer shield with round conductors and an adjacent inner shield with round conductors.

For the procedure to assemble a shield ground wire that is not at the end of a cable, refer to Paragraph 6.E.

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ASSEMBLY OF SHIELD GROUND WIRES

CAUTION: THIS PROCEDURE CAUSES DAMAGE TO A SHIELD THAT HAS FLAT CONDUCTORS. DAMAGE TO THE FLAT CONDUCTORS OF A SHIELD CAN CAUSE UNSATISFACTORY PERFORMANCE OF THE CONNECTION OF THE SHIELD TO GROUND.

NOTE: If the wire or the cable has two adjacent shields, the shields are prepared as one shield.

(1) Prepare the wire or cable. Refer to Paragraph 4.A.

(2) Make a selection of a shield ground wire from Table 5.

(3) Cut the minimum length of the shield ground wire that is necessary to attach the wire to the specified ground.

For the maximum length of the shield ground wire, refer to Paragraph 1.D.

NOTE: If two shield ground wires are specified, a satisfactory alternative to the minimum length is two times the minimum length from which the insulation can be removed at the center. Refer to Figure 28.

(4) Measure the O.D. of the shield.

(5) Make a selection of an inner ferrule from Table 8.

NOTE: The applicable ferrule has an I.D. that is a small amount larger than the O.D. of the shield of the cable. Refer to Figure 4.

Make sure that the ferrule has the correct Temperature Grade; refer to Figure 4 and Table 6.

(6) Make a selection of an outer ferrule that is specified for the inner ferrule from Table 8.

NOTE: In Table 8, more than one outer ferrule can be specified for one inner ferrule. It is possible that shields of different wires and cables have different thicknesses. This can make it necessary to use a smaller or a larger outer ferrule.

Make sure that the ferrule has the correct Temperature Grade; refer to Figure 4 and Table 6.

(7) Make a selection of a ferrule crimp tool from Table 24.

(8) Put the outer ferrule on the cable.

(9) Put the inner ferrule on the cable. Refer to Figure 51.

Make sure that:

- The inner ferrule is the smallest ferrule that can be moved freely on the primary insulation of the wire
- The inner ferrule is between the shield and the primary insulation
- The rear end of the innner ferrule is tight against the end of the cable jacket.

CAUTION: THE INNER FERRULE MUST BE LARGE ENOUGH TO PREVENT DAMAGE TO THE PRIMARY INSULATION OF THE WIRE. DAMAGE TO THE PRIMARY INSULATION CAN CAUSE UNSATISFACTORY PERFORMANCE OF THE WIRE.

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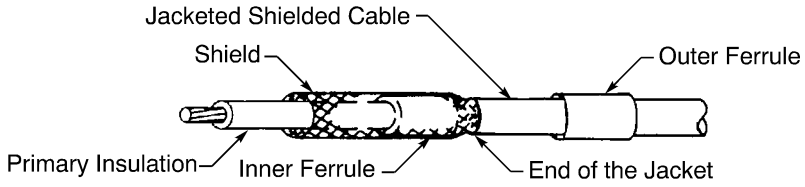
ASSEMBLY OF SHIELD GROUND WIRES



POSITION OF THE INNER FERRULE
Figure 51

(10) Remove the necessary length of insulation from one end of each shield ground wire. Refer to Subject 20-00-15.

NOTE: Removal of the necessary length of the insulation from the center of the shield ground wire is an acceptable alternative if the length of the ground wire is two times the minimum length. Refer to Step (3).

(11) Put the conductor of each shield ground wire between the jacket and the outer ferrule.

Make sure that:

- The free end of the shield ground wire is pointed in the correct direction
- The length of bare conductor extends the full length of the outer ferrule
- The bare conductor extends a small amount farther than the rear end of the outer ferrule.

CAUTION: MORE THAN THREE SHIELD GROUND WIRES MUST NOT BE INSTALLED IN ONE SHIELD GROUND WIRE ASSEMBLY ON A CABLE WITH ONE SHIELD. MORE THAN THREE SHIELD GROUND WIRES CAN CAUSE UNSATISFACTORY PERFORMANCE OF THE CONNECTION OF THE SHIELD TO GROUND.

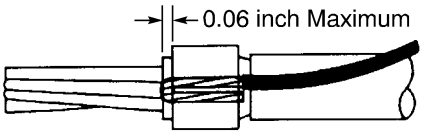
CAUTION: MORE THAN TWO SHIELD GROUND WIRES MUST NOT BE INSTALLED IN ONE SHIELD GROUND WIRE ASSEMBLY ON A CABLE WITH ADJACENT SHIELDS. MORE THAN TWO SHIELD GROUND WIRES CAN CAUSE UNSATISFACTORY PERFORMANCE OF THE CONNECTION OF THE SHIELD TO GROUND.

For the configuration of:

- One shield ground wire, refer to Figure 27
- Two shield ground wires, refer to Figure 28
- Three shield ground wires, refer to Figure 29.

(12) Push the outer ferrule and the shield ground wires forward until the center of the outer ferrule is aligned with the center of the inner ferrule. Refer to Figure 52.

Make sure that the forward end of the inner ferrule does not extend farther than 0.06 inch from the forward end of the outer ferrule.



POSITION OF THE OUTER FERRULE ON THE INNER FERRULE
Figure 52

(13) Crimp the outer ferrule.

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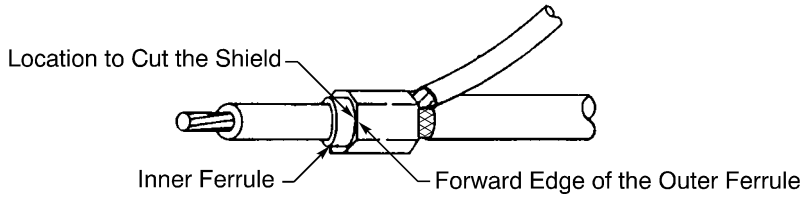
(14) Remove the unwanted length of the shield that extends farther than the forward edge of the outer ferrule. Refer to Figure 53.

NOTE: The outer surface of the inner ferrule can be used to cut against.



REMOVAL OF THE UNWANTED LENGTH OF SHIELD
Figure 53

(15) Make a selection of a heat shrinkable sleeve from Table 19.

Make sure that the sleeve has the smallest diameter that can be moved freely on the shield ground wire assembly.

NOTE: For alternative heat shrinkable sleeves, refer to Subject 20-00-11.

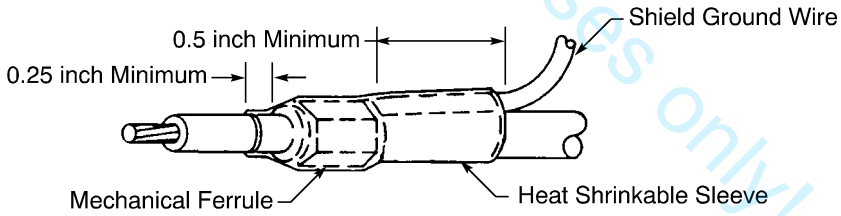
NOTE: As an alternative, a layer of tape can be put on the shield ground wire assembly. Refer to Table 19.

(16) If the shield ground wire is pointed away from the end of the wire or cable:

(a) Put the necessary length of heat shrinkable sleeve on the wire or cable. Refer to Figure 54.

Make sure that the distance:

- From the rear end of the ferrule to the rear end of the sleeve is 0.25 inch minimum
- From the forward end of the ferrule to the forward end of the sleeve is 0.5 inch minimum.



POSITION OF THE HEAT SHRINKABLE SLEEVE
Figure 54

(b) Shrink the sleeve into its position. Refer to Subject 20-10-14.

(17) If the shield ground wire is pointed forward to the end of the wire or cable:

(a) Put the necessary length of heat shrinkable sleeve on the wire or cable. Refer to Figure 55.

Make sure that the distance:

- From the rear end of the ferrule to the rear end of the sleeve is 0.25 inch minimum
- From the forward end of the ferrule to the forward end of the sleeve is 0.5 inch minimum.

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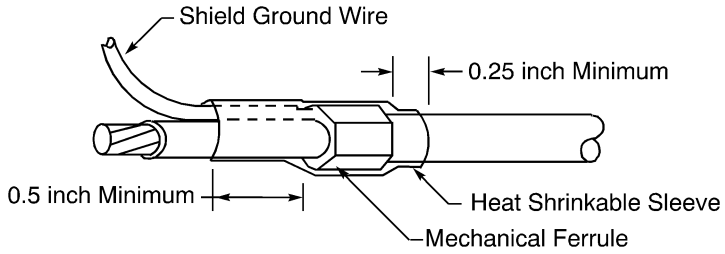
ASSEMBLY OF SHIELD GROUND WIRES



POSITION OF THE HEAT SHRINKABLE SLEEVE
Figure 55

(b) Shrink the sleeve into its position. Refer to Subject 20-10-14.

E. Shield Ground Wire - Not at the End of a Wire or Cable

This paragraph gives the procedure to assemble a shield ground wire on a wire or cable that has:

- A shield with round conductors
- An outer shield with round conductors and an adjacent inner shield with round conductors.

CAUTION: THIS PROCEDURE CAUSES DAMAGE TO A SHIELD THAT HAS FLAT CONDUCTORS. DAMAGE TO THE FLAT CONDUCTORS OF A SHIELD CAN CAUSE UNSATISFACTORY PERFORMANCE OF THE CONNECTION OF THE SHIELD TO GROUND.

NOTE: If the wire or the cable has two adjacent shields, the shields are prepared as one shield.

(1) Prepare the wire or cable. Refer to Paragraph 4.A.

(2) Make a selection of a shield ground wire from Table 5.

(3) Cut the minimum length of the shield ground wire that is necessary to attach the wire to the specified ground.

For the maximum length of the shield ground wire, refer to Paragraph 1.D.

(4) Remove the necessary length of insulation from one end of each shield ground wire.

(5) Measure the O.D. of the shield.

(6) Make a selection of an inner ferrule from Table 8.

NOTE: The applicable ferrule has an I.D. that is a small amount larger than the O.D. of the shield of the cable. Refer to Figure 4.

Make sure that the ferrule has the correct Temperature Grade; refer to Figure 4 and Table 6.

(7) Make a selection of an outer ferrule that is specified for the inner ferrule from Table 8.

NOTE: In Table 8, more than one outer ferrule can be specified for one inner ferrule. It is possible that shields of different wires and cables have different thicknesses. This can make it necessary to use a smaller or a larger outer ferrule.

Make sure that the ferrule has the correct Temperature Grade; refer to Figure 4 and Table 6.

(8) Make a selection of a ferrule crimp tool from Table 24.

(9) Put the outer ferrule on the cable.

(10) Push the shield in the direction of the end of the jacket to make the shield loose.

(11) Put the inner ferrule on the cable. Refer to Figure 56.

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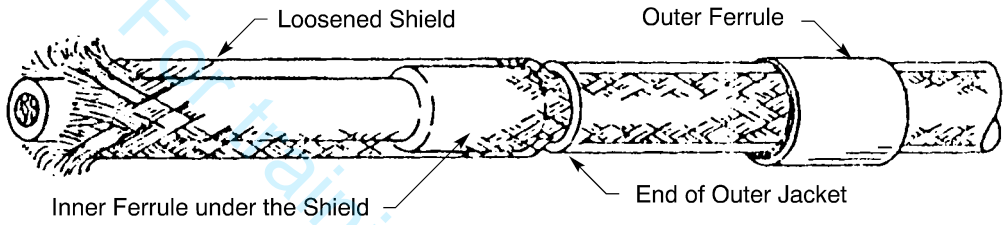
ASSEMBLY OF SHIELD GROUND WIRES

Make sure that:

- The inner ferrule is the smallest ferrule that can be moved freely on the primary insulation of the wire
- The inner ferrule is between the shield and the primary insulation
- The rear end of the innner ferrule is tight against the end of the cable jacket.

NOTE: A rigid tube that has the same diameter and thickness as the ferrule can be used to push the ferrule into the correct position.

CAUTION: THE INNER FERRULE MUST BE LARGE ENOUGH TO PREVENT DAMAGE TO THE PRIMARY INSULATION OF THE WIRE. DAMAGE TO THE PRIMARY INSULATION CAN CAUSE UNSATISFACTORY PERFORMANCE OF THE WIRE.



POSITION OF THE INNER FERRULE
Figure 56

(12) Put the conductor of each shield ground wire between the shield and the outer ferrule.

Make sure that:

- The free end of the shield ground wire is pointed in the correct direction
- The length of bare conductor extends the full length of the outer ferrule
- The bare conductor extends a small amount farther than the rear end of the outer ferrule.

CAUTION: MORE THAN THREE SHIELD GROUND WIRES MUST NOT BE INSTALLED IN ONE SHIELD GROUND WIRE ASSEMBLY ON A CABLE WITH ONE SHIELD. MORE THAN THREE SHIELD GROUND WIRES CAN CAUSE UNSATISFACTORY PERFORMANCE OF THE CONNECTION OF THE SHIELD TO GROUND.

CAUTION: MORE THAN TWO SHIELD GROUND WIRES MUST NOT BE INSTALLED IN ONE SHIELD GROUND WIRE ASSEMBLY ON A CABLE WITH ADJACENT SHIELDS. MORE THAN TWO SHIELD GROUND WIRES CAN CAUSE UNSATISFACTORY PERFORMANCE OF THE CONNECTION OF THE SHIELD TO GROUND.

(13) Push the outer ferrule and the shield ground wires forward until the center of the outer ferrule is aligned with the center of the inner ferrule.

Make sure that the forward end of the inner ferrule does not extend farther than 0.06 inch from the forward end of the outer ferrule.

(14) Crimp the outer ferrule.

(15) Pull the end of the loose shield forward to the end of the cable.

(16) Assemble a shield dead end at the end of the wire or cable.

Refer to Figure 57 and Paragraph 12.A.

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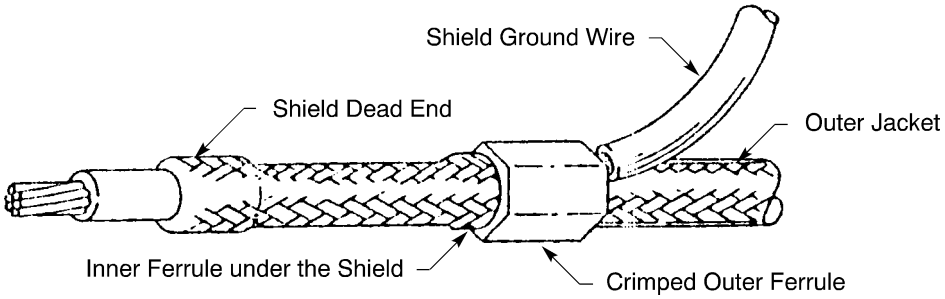
ASSEMBLY OF SHIELD GROUND WIRES



SHIELD DEAD END
Figure 57

(17) Make a selection of a heat shrinkable sleeve from Table 19.

Make sure that the sleeve has the smallest diameter that can be moved freely on the shield ground wire assembly.

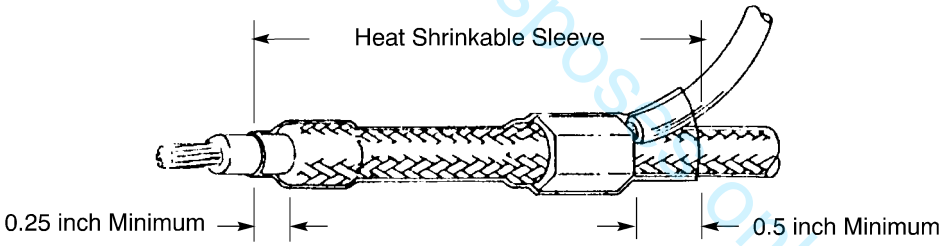
NOTE: For alternative heat shrinkable sleeves, refer to Subject 20-00-11.

(18) If the shield ground wire is pointed away from the end of the wire or cable:

(a) Put the necessary length of heat shrinkable sleeve on the wire or cable. Refer to Figure 58.

Make sure that the distance:

- From the rear end of the ferrule to the rear end of the sleeve is 0.5 inch minimum
- From the forward end of the dead end to the forward end of the sleeve is 0.25 inch minimum.



POSITION OF THE FIRST HEAT SHRINKABLE SLEEVE
Figure 58

(b) Shrink the sleeve into its position. Refer to Subject 20-10-14.

(19) If the shield ground wire is pointed forward to the end of the wire or cable:

(a) Put the necessary length of heat shrinkable sleeve on the forward end of the shield ground wire assembly. Refer to Figure 59.

Make sure that:

- The distance from the forward end of the dead end to the forward end of the sleeve is 0.25 inch minimum
- The rear end of the sleeve is aligned with the forward end of the ferrule.

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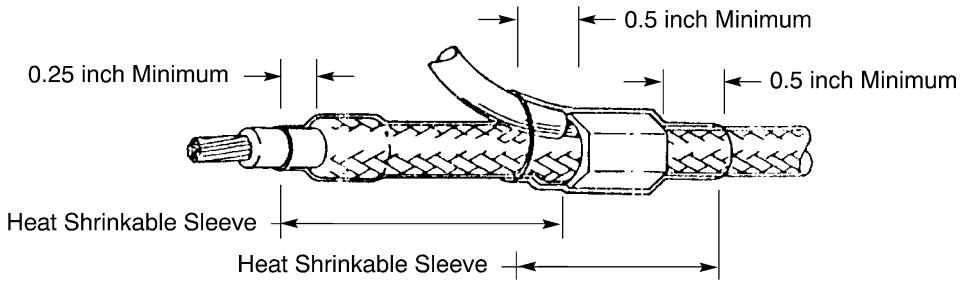
ASSEMBLY OF SHIELD GROUND WIRES



POSITION OF THE SECOND HEAT SHRINKABLE SLEEVE
Figure 59

(b) Shrink the sleeve into its position. Refer to Subject 20-10-14.

(c) Put the necessary length of heat shrinkable sleeve on the ferrule and the shield ground wire. Refer to Figure 59.

Make sure that the distance:

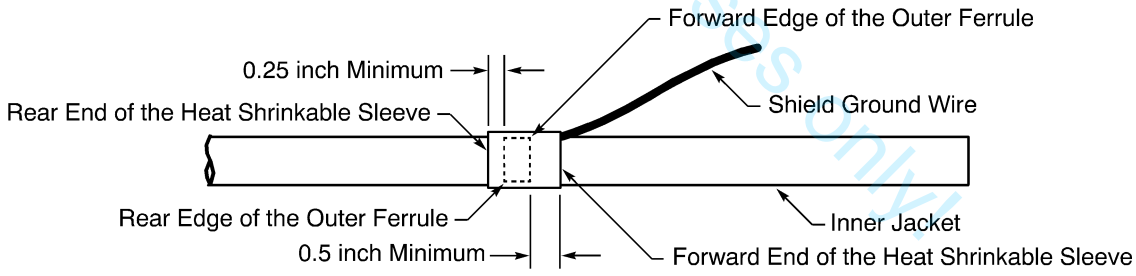
- From the rear end of the ferrule to the rear end of the sleeve is 0.5 inch minimum
- From the forward end of the ferrule to the forward end of the sleeve is 0.5 inch minimum.

(d) Shrink the sleeve into its position. Refer to Subject 20-10-14.

F. Shield Ground Wires - Shields Not Folded Back

This paragraph gives the procedure to assemble the shield ground wires of a cable that has two shields that are not adjacent.

CAUTION: THIS PROCEDURE CAUSES DAMAGE TO A SHIELD THAT HAS FLAT CONDUCTORS. DAMAGE TO THE FLAT CONDUCTORS OF A SHIELD CAN CAUSE UNSATISFACTORY PERFORMANCE OF THE CONNECTION OF THE SHIELD TO GROUND.



SHIELD GROUND WIRE OF THE OUTER SHIELD
Figure 60

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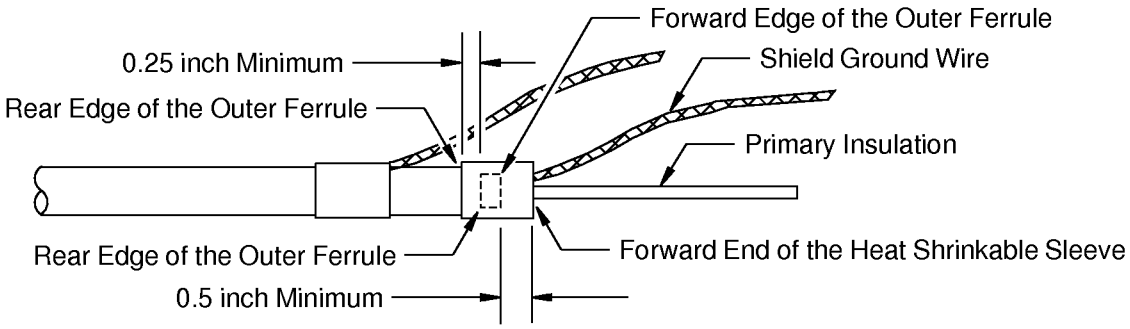
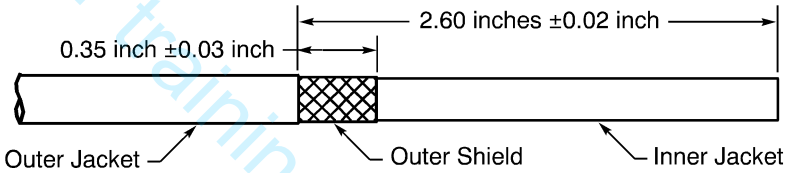
ASSEMBLY OF SHIELD GROUND WIRES



SHIELD GROUND WIRE OF THE INNER SHIELD
Figure 61

(1) Prepare the cable for the shield ground wire of the outer shield. Refer to Figure 62.



OUTER JACKET AND OUTER SHIELD REMOVAL
Figure 62

(a) Remove 2.60 inches ±0.02 inch of the outer jacket from the end of the cable. Refer to Paragraph 4.A.

(b) Remove the necessary length of the outer shield to make the distance from the end of the shield to the end of the outer jacket equal to 0.35 inch ±0.03 inch.

(2) Make a selection of a shield ground wire from Table 5.

(3) Cut the minimum length of the shield ground wire that is necessary to attach the wire to the specified ground.

For the maximum length of the shield ground wire, refer to Paragraph 1.D.

(4) Measure the O.D. of the shield.

(5) Make a selection of an inner ferrule from Table 8.

NOTE: The applicable ferrule has an I.D. that is a small amount larger than the O.D. of the shield of the cable. Refer to Figure 4.

Make sure that the ferrule has the correct Temperature Grade; refer to Figure 4 and Table 6.

(6) Make a selection of an outer ferrule that is specified for the inner ferrule from Table 8.

NOTE: In Table 8, more than one outer ferrule can be specified for one inner ferrule. It is possible that shields of different wires and cables have different thicknesses. This can make it necessary to use a smaller or a larger outer ferrule.

Make sure that the ferrule has the correct Temperature Grade; refer to Figure 4 and Table 6.

(7) Make a selection of a ferrule crimp tool from Table 24.

(8) Put the outer ferrule on the cable.

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(9) Put the inner ferrule on the cable. Refer to Figure 62.

Make sure that:

- The inner ferrule is the smallest ferrule that can be moved freely on the inner jacket of the cable
- The inner ferrule is between the outer shield and the inner jacket
- The rear end of the innner ferrule is tight against the end of the outer jacket.

CAUTION: THE INNER FERRULE MUST BE LARGE ENOUGH TO PREVENT DAMAGE TO THE INNER JACKET OF THE CABLE. DAMAGE TO THE INNER JACKET CAN CAUSE UNSATISFACTORY PERFORMANCE OF THE CONNECTION OF THE SHIELD TO GROUND.

(10) Remove the necessary length of insulation from one end of the shield ground wire. Refer to Subject 20-00-15.

(11) Put the conductor of the shield ground wire between the jacket and the outer ferrule.

Make sure that:

- The free end of the shield ground wire is pointed forward to the end of the cable
- The length of bare conductor extends the full length of the outer ferrule
- The bare conductor extends a small amount farther than the rear end of the outer ferrule.

(12) Push the outer ferrule and the shield ground wire forward until the center of the outer ferrule is aligned with the center of the inner ferrule.

Make sure that the forward end of the inner ferrule does not extend farther than 0.06 inch from the forward end of the outer ferrule.

(13) Crimp the outer ferrule.

(14) Remove the unwanted length of the shield that extends farther than the forward edge of the outer ferrule.

NOTE: The outer surface of the inner ferrule can be used to cut against.

(15) Make a selection of a heat shrinkable sleeve from Table 19.

Make sure that the sleeve has the smallest diameter that can be moved freely on the shield ground wire assembly.

NOTE: For alternative heat shrinkable sleeves, refer to Subject 20-00-11.

NOTE: As an alternative, a layer of tape can be put on the shield ground wire assembly. Refer to Table 19.

(16) Put the necessary length of heat shrinkable sleeve on the wire or cable.

Make sure that the distance:

- From the rear end of the ferrule to the rear end of the sleeve is 0.25 inch minimum
- From the forward end of the ferrule to the forward end of the sleeve is 0.5 inch minimum.

Refer to:

- Figure 60 for the shield ground wire of the outer shield
- Figure 61 for the shield ground wire of the inner shield.

(17) Shrink the sleeve into its position. Refer to Subject 20-10-14.

(18) Prepare the cable for the shield ground wire of the inner shield. Refer to Figure 63.

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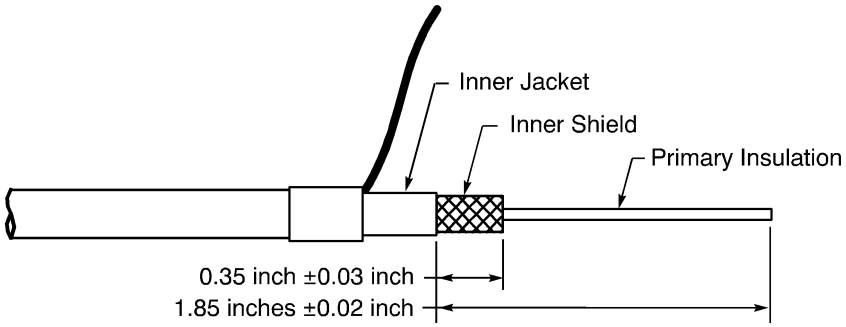
ASSEMBLY OF SHIELD GROUND WIRES



INNER JACKET AND INNER SHIELD REMOVAL
Figure 63

(a) Remove 1.85 inches ±0.02 inch of the inner jacket from the end of the cable. Refer to Paragraph 4.A.

(b) Remove the necessary length of the inner shield to make the distance from the end of the shield to the end of the jacket equal to 0.35 inch ±0.03 inch.

(19) Do Step (2) through Step (8) for the shield ground wire of the inner shield.

(20) Put the inner ferrule on the cable. Refer to Figure 63.

Make sure that:

- The inner ferrule is the smallest ferrule that can be moved freely on the primary insulation of the wire
- The inner ferrule is between the shield and the primary insulation
- The rear end of the innner ferrule is tight against the end of the inner jacket.

CAUTION: THE INNER FERRULE MUST BE LARGE ENOUGH TO PREVENT DAMAGE TO THE PRIMARY INSULATION OF THE WIRE. DAMAGE TO THE PRIMARY INSULATION CAN CAUSE UNSATISFACTORY PERFORMANCE OF THE WIRE.

(21) Do Step (10) through Step (17) for the shield ground wire of the inner shield.

7. ASSEMBLY OF A SHIELD GROUND WIRE - RSK SHIELD-KON

A. Shield Ground Wire Assembly

This paragraph gives the procedure to assemble a shield ground wire on a wire or cable that has:

- A shield with round conductors
- An outer shield with round conductors and an adjacent inner shield with round conductors.

CAUTION: THIS PROCEDURE CAUSES DAMAGE TO A SHIELD THAT HAS FLAT CONDUCTORS. DAMAGE TO THE FLAT CONDUCTORS OF A SHIELD CAN CAUSE UNSATISFACTORY PERFORMANCE OF THE CONNECTION OF THE SHIELD TO GROUND.

NOTE: If the wire or the cable has two adjacent shields, the shields are prepared as one shield.

(1) Prepare the wire or cable. Refer to Paragraph 4.A.

(2) Make a selection of a shield ground wire from Table 5.

(3) Cut the minimum length of the shield ground wire that is necessary to attach the wire to the specified ground.

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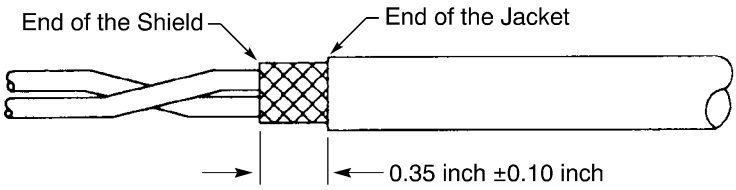
For the maximum length of the shield ground wire, refer to Paragraph 1.D.

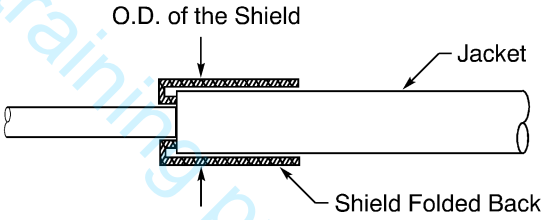
(4) Remove the necessary length of the shield from the end of the wire or cable to make the length of the shield equal to 0.35 inch ±0.10 inch. Refer to Figure 64.



LENGTH OF THE SHIELD
Figure 64

(5) Fold the shield back on the jacket of the wire or cable. Refer to Figure 65.

Make sure that the shield is even and symmetrical around the circumference of the wire or cable.



SHIELD FOLDED BACK
Figure 65

(6) Make a selection of an RSK Shield-Kon from Table 9.

Refer to Figure 65 for the applicable dimensions of the shield ground wire assembly.

(7) Make a selection of crimp tool from Table 25.

(8) Remove 0.3 inch ±0.1 inch of insulation from one end of the shield ground wire. Refer to Subject 20-00-15.

(9) Put the Shield-Kon in the jaws of the upper and lower dies of the crimp tool. Refer to Figure 66.

Make sure that:

- The shield ground wire clip is pointed up
- The center of the Shield-Kon is aligned with the center of the die.

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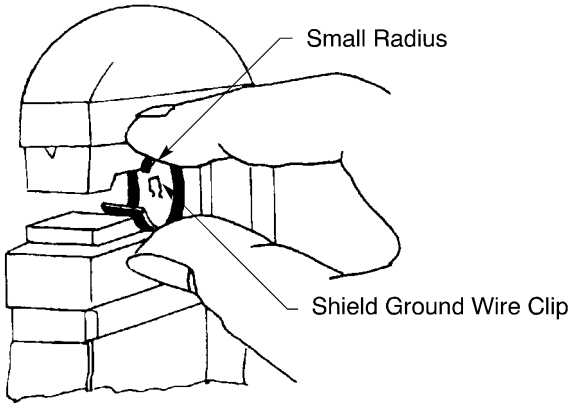
ASSEMBLY OF SHIELD GROUND WIRES

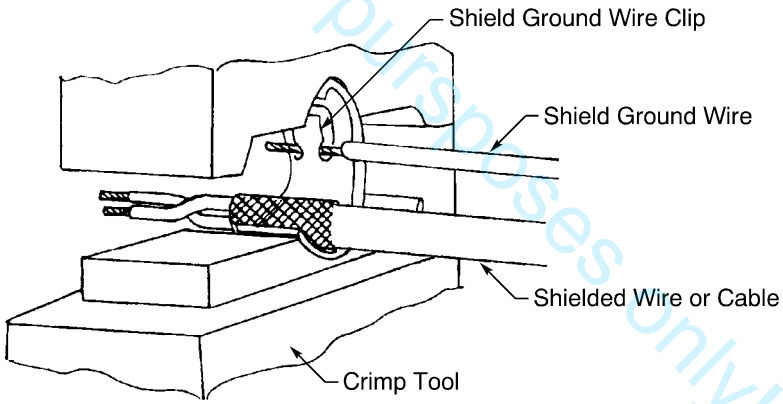


POSITION OF THE SHIELD-KON IN THE CRIMP TOOL
Figure 66

(10) Put the conductor of the shield ground wire in the shield ground wire clip of the Shield-Kon. Refer to Figure 67.

Make sure that:

- The shield ground wire is pointed in the correct direction
- The conductor of the shield ground wire is in the correct position in the shield ground clip.



POSITION OF THE SHIELD GROUND WIRE AND THE WIRE OR CABLE
Figure 67

(11) Put the wire or cable in the bottom of the Shield-Kon. Refer to Figure 67.

Make sure that the rear end of the Shield-Kon is aligned with the rear end of the shield.

(12) Crimp the Shield-Kon.

(13) Install the insulation of the shield ground wire assembly.

For insulation with:

- A heat shrinkable sleeve, refer to Paragraph 7.B.
- A tape, refer to Paragraph 7.C.

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B. Insulation with Heat Shrinkable Sleeve

(1) Make a selection of a heat shrinkable sleeve from Table 19.

Make sure that the sleeve has the smallest diameter that can be moved freely on the shield ground wire assembly.

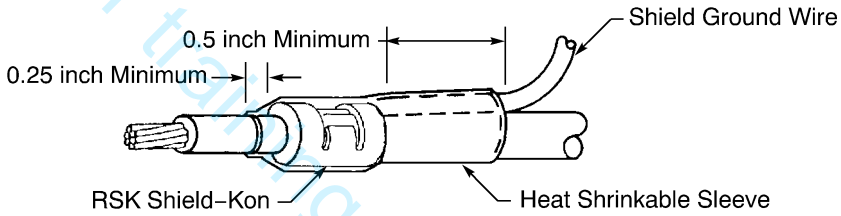
NOTE: For alternative heat shrinkable sleeves, refer to Subject 20-00-11.

(2) If the shield ground wire is pointed away from the end of the wire or cable:

(a) Put the necessary length of heat shrinkable sleeve on the wire or cable. Refer to Figure 68.

Make sure that:

- The distance from the forward end of the Shield-Kon to the forward end of the heat shrinkable sleeve is 0.25 inch minimum
- The distance from the rear end of the Shield-Kon to the rear end of the heat shrinkable sleeve is 0.5 inch minimum.



POSITION OF THE HEAT SHRINKABLE SLEEVE
Figure 68

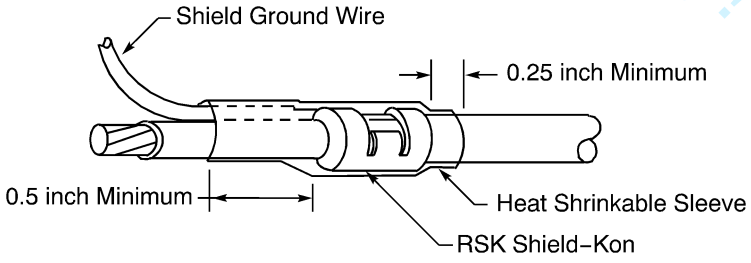
(b) Shrink the sleeve into its position. Refer to Subject 20-10-14.

(3) If the shield ground wire is pointed forward to the end of the wire or cable:

(a) Put the necessary length of heat shrinkable sleeve on the wire or cable. Refer to Figure 69.

Make sure that:

- The distance from the forward end of the Shield-Kon to the forward end of the heat shrinkable sleeve is 0.5 inch minimum
- The distance from the rear end of the Shield-Kon to the rear end of the heat shrinkable sleeve is 0.25 inch minimum.



POSITION OF THE HEAT SHRINKABLE SLEEVE
Figure 69

(b) Shrink the sleeve into its position. Refer to Subject 20-10-14.

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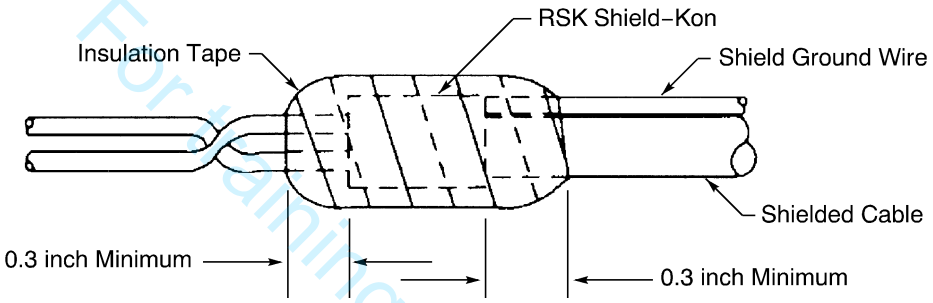
C. Insulation with Tape

(1) Make a selection of a tape from Table 19.

(2) Put two layers of tape on the shield ground wire assembly. Refer to Figure 70.

Make sure that:

- Each layer has a 0.25 inch overlap
- The rear end of each each layer extends a minimum of 0.3 inch farther than the rear end of the Shield-Kon
- The forward end of each each layer extends a minimum of 0.3 inch farther than the forward end of the Shield-Kon
- The second layer is wound in the opposite direction of the first layer.



POSITION OF THE LAYERS OF TAPE
Figure 70

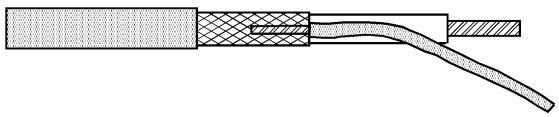
8. ASSEMBLY OF A SHIELD GROUND WIRE - SOLDER SLEEVE WITHOUT AN INTEGRAL WIRE

This paragraph gives the procedures to assemble a shield ground wire with a solder sleeve that does not have an integral wire.

For the assembly of a shield ground wire with a solder sleeve that has:

- An insulated integral wire, refer to Paragraph 9.
- An uninsulated integral wire, refer to Paragraph 10.

A. Shield Ground Wire Configurations



POSITION OF ONE SHIELD GROUND WIRE
Figure 71

ALTERNATIVE POSITION OF ONE SHIELD GROUND WIRE
Figure 72

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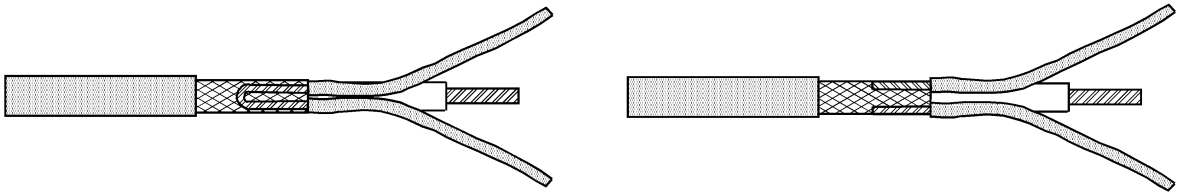
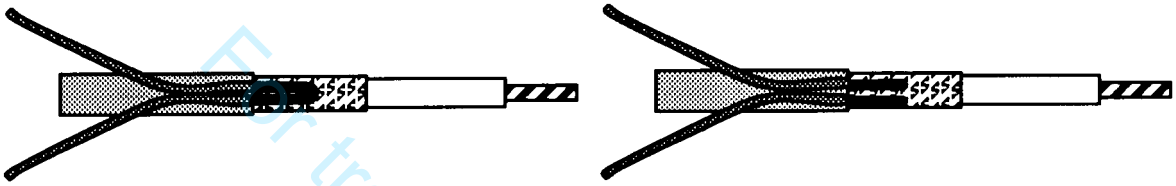
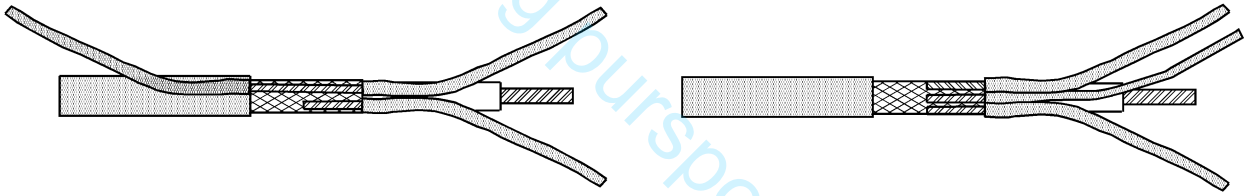
ASSEMBLY OF SHIELD GROUND WIRES



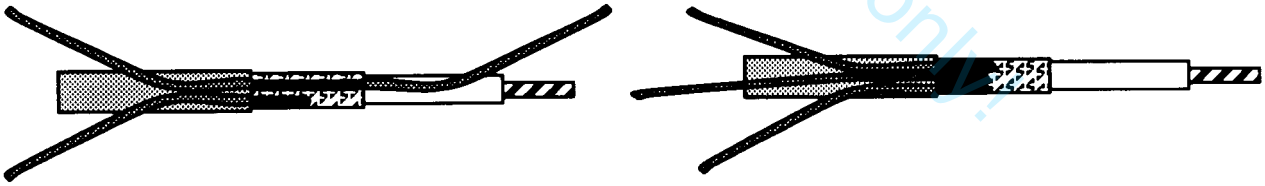
POSITIONS OF TWO SHIELD GROUND WIRES
Figure 73



ALTERNATIVE POSITIONS OF TWO SHIELD GROUND WIRES
Figure 74



POSITIONS OF THREE SHIELD GROUND WIRES
Figure 75



ALTERNATIVE POSITIONS OF THREE SHIELD GROUND WIRES
Figure 76

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B. Shield Ground Wire - Shield Folded Back

This paragraph gives the procedure to assemble a shield ground wire on a wire or cable that has:

- A shield with round conductors
- An outer shield with round conductors and an adjacent inner shield with round conductors.

For the procedure to assemble a shield ground wire:

- With a shield that is not folded back, refer to Paragraph 8.C.
- That is not at the end of a wire or cable, refer to Paragraph 8.D.

CAUTION: A SHIELD GROUND WIRE ASSEMBLY WITH A SOLDER SLEEVE IS NOT APPLICABLE FOR A WIRE OR A CABLE THAT HAS A SHIELD WITH NICKEL PLATED CONDUCTORS. THE SOLDER SLEEVE CAN CAUSE UNSATISFACTORY PERFORMANCE OF THE CONNECTION OF THE SHIELD TO GROUND.

CAUTION: THIS PROCEDURE CAUSES DAMAGE TO A SHIELD THAT HAS FLAT CONDUCTORS. DAMAGE TO THE FLAT CONDUCTORS OF A SHIELD CAN CAUSE UNSATISFACTORY PERFORMANCE OF THE CONNECTION OF THE SHIELD TO GROUND.

NOTE: If the wire or the cable has two adjacent shields, the shields are prepared as one shield.

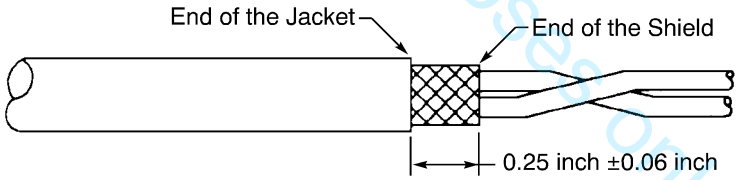
(1) Prepare the wire or cable. Refer to Paragraph 4.A.

(2) Make a selection of a shield ground wire from Table 5.

(3) Cut the minimum length of the shield ground wire that is necessary to attach the wire to the specified ground.

For the maximum length of the shield ground wire, refer to Paragraph 1.D.

(4) Remove the necessary length of shield from the wire or cable to make the length of the shield equal to 0.25 inch ±0.06 inch. Refer to Figure 77.



LENGTH OF THE SHIELD
Figure 77

(5) Fold the shield back on the jacket of the wire or cable.

Make sure that the shield is even and symmetrical around the circumference of the wire or cable.

(6) Remove 0.25 inch ±0.06 inch of insulation from one end of each shield ground wire.

(7) Make a selection of a solder sleeve from Table 11.

Refer to Figure 78 for the applicable dimensions of the shield ground wire assembly.

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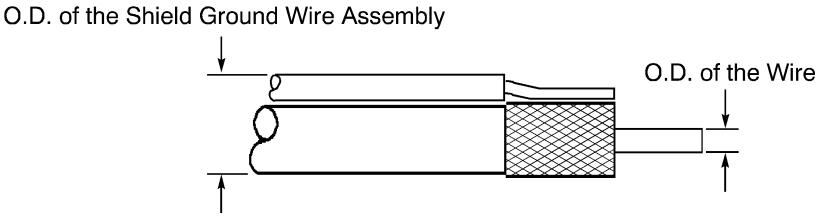
ASSEMBLY OF SHIELD GROUND WIRES



DIMENSIONS FOR SOLDER SLEEVE SELECTION
Figure 78

(8) Put the conductor of each shield ground wire against the shield of the wire or cable.

For the position of:

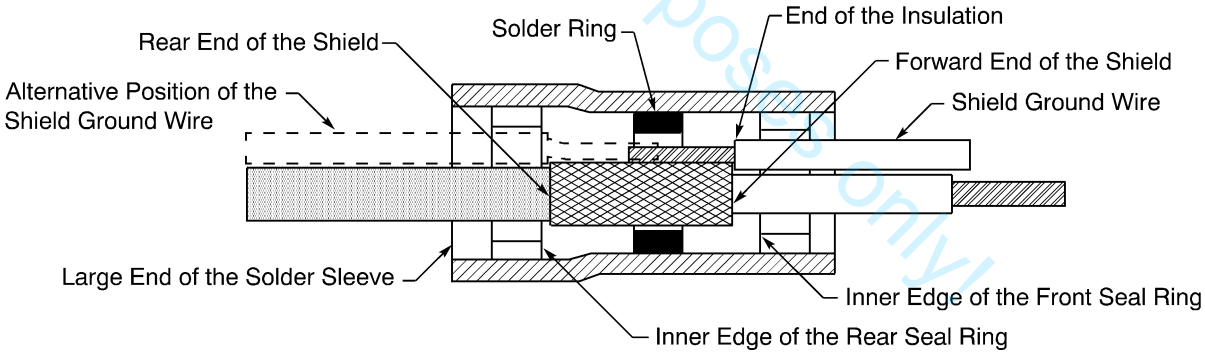
- One shield ground wire, refer to Figure 71 and Figure 72
- Two shield ground wires, refer to Figure 73 and Figure 74
- Three shield ground wires, refer to Figure 75 and Figure 76.

CAUTION: THE STRANDS OF THE SHIELD GROUND WIRE MUST NOT GO INTO THE SHIELD OF THE CABLE. A SHORT CIRCUIT BETWEEN THE CONDUCTOR OF THE WIRE AND THE SHIELD CAN OCCUR.

(9) Put the solder sleeve on the wire or cable. Refer to Figure 5 and Figure 79.

Make sure that:

- The large end of the solder sleeve is put on the wire or cable first
- The end of the insulation of the shield ground wire is aligned with the end of the shield
- The inner edge of the rear seal ring is aligned with the rear end of the shield.



POSITION OF THE SOLDER SLEEVE AND THE SHIELD GROUND WIRE
Figure 79

(10) Shrink the solder sleeve into its position. Refer to Subject 20-10-14.

Make sure that:

- The solder sleeve and the shield ground wire stay in the correct position
- A minimum of 75 percent of the indicator ring on top of the solder ring is melted.

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C. Shield Ground Wire - Shield Not Folded Back

This paragraph gives the procedure to assemble a shield ground wire on a wire or cable that has:

- A shield with round conductors
- A shield with flat conductors
- An outer shield with round conductors and an adjacent inner shield with round conductors
- An outer shield with round conductors and an adjacent inner shield with flat conductors.

For the procedure to assemble a shield ground wire:

- With a shield that is folded back, refer to Paragraph 8.B.
- That is not at the end of a wire or cable, refer to Paragraph 8.D.

CAUTION: A SHIELD GROUND WIRE ASSEMBLY WITH A SOLDER SLEEVE IS NOT APPLICABLE FOR A WIRE OR A CABLE THAT HAS A SHIELD WITH NICKEL PLATED CONDUCTORS. THE SOLDER SLEEVE CAN CAUSE UNSATISFACTORY PERFORMANCE OF THE CONNECTION OF THE SHIELD TO GROUND.

NOTE: If the wire or the cable has two adjacent shields, the shields are prepared as one shield.

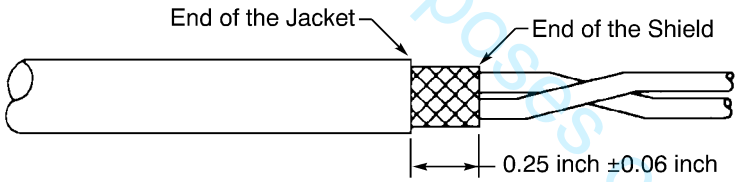
(1) Prepare the wire or cable. Refer to Paragraph 4.A.

(2) Make a selection of a shield ground wire from Table 5.

(3) Cut the minimum length of the shield ground wire that is necessary to attach the wire to the specified ground.

For the maximum length of the shield ground wire, refer to Paragraph 1.D.

(4) Remove the necessary length of shield from the wire or cable to make the length of the shield equal to 0.25 inch ±0.06 inch. Refer to Figure 80.



LENGTH OF THE SHIELD
Figure 80

(5) Remove 0.25 inch ±0.06 inch of insulation from one end of each shield ground wire.

(6) Make a selection of a solder sleeve from Table 11.

Refer to Figure 81 for the applicable dimensions of the shield ground wire assembly.

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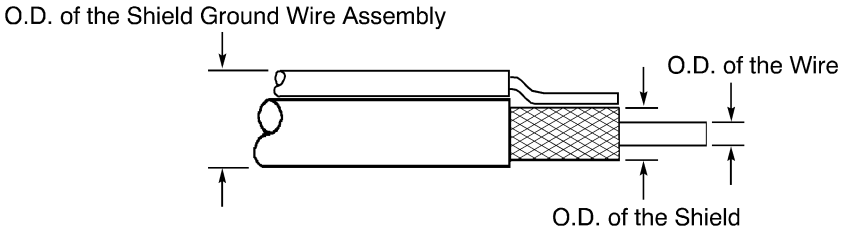
ASSEMBLY OF SHIELD GROUND WIRES



DIMENSIONS FOR SOLDER SLEEVE SELECTION
Figure 81

(7) Put the conductor of each shield ground wire against the shield of the wire or cable.

For the position of:

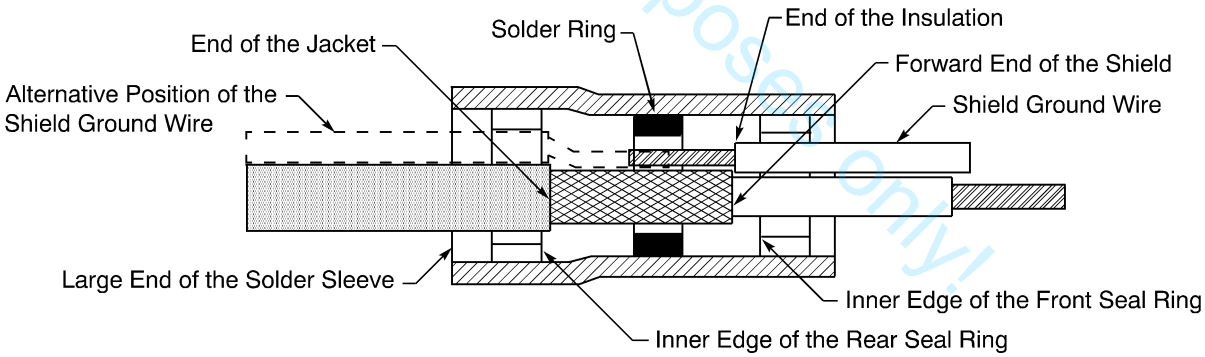
- One shield ground wire, refer to Figure 71 and Figure 72
- Two shield ground wires, refer to Figure 73 and Figure 74
- Three shield ground wires, refer to Figure 75 and Figure 76.

CAUTION: THE STRANDS OF THE SHIELD GROUND WIRE MUST NOT GO INTO THE SHIELD OF THE CABLE. A SHORT CIRCUIT BETWEEN THE CONDUCTOR OF THE WIRE AND THE SHIELD CAN OCCUR.

(8) Put the solder sleeve on the wire or cable. Refer to Figure 5 and Figure 82.

Make sure that:

- The large end of the solder sleeve is put on the wire or cable first
- The end of the insulation of the shield ground wire is aligned with the end of the shield
- The inner edge of the rear seal ring is aligned with the end of the jacket.



POSITION OF THE SOLDER SLEEVE AND THE SHIELD GROUND WIRE
Figure 82

(9) Shrink the solder sleeve into its position. Refer to Subject 20-10-14.

Make sure that:

- The solder sleeve and the shield ground wire stay in the correct position
- A minimum of 75 percent of the indicator ring on top of the solder ring is melted.

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D. Shield Ground Wire - Not at the End of a Wire or Cable

This paragraph gives the procedure to assemble a shield ground wire on a wire or cable that has:

- A shield with round conductors
- A shield with flat conductors
- An outer shield with round conductors and an adjacent inner shield with round conductors
- An outer shield with round conductors and an adjacent inner shield with flat conductors.

(1) Remove 0.25 inch ±0.06 inch of the jacket from the wire or cable at the location of the shield termination.

Refer to Paragraph 4.A. for the applicable jacket removal tool.

(2) Make a selection of a shield ground wire from Table 5.

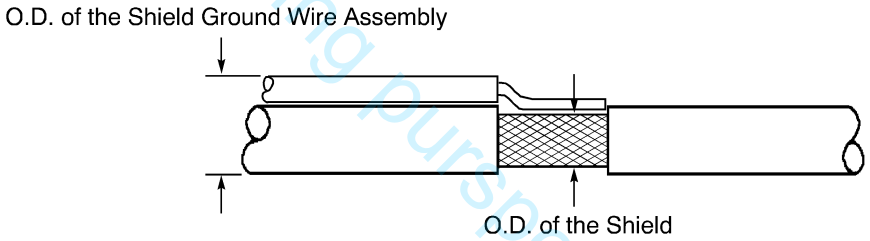
(3) Cut the minimum length of the shield ground wire that is necessary to attach the wire to the specified ground.

For the maximum length of the shield ground wire, refer to Paragraph 1.D.

(4) Remove 0.25 inch ±0.06 inch of insulation from the one end of each shield ground wire.

(5) Make a selection of a solder sleeve from Table 11.

Refer to Figure 83 for the applicable dimensions of the shield ground wire assembly.



DIMENSIONS FOR SOLDER SLEEVE SELECTION
Figure 83

(6) Put the conductor of each ground wire against the shield of the cable.

For the position of:

- One shield ground wire, refer to Figure 71 and Figure 72
- Two shield ground wires, refer to Figure 73 and Figure 74
- Three shield ground wires, refer to Figure 75 and Figure 76.

CAUTION: THE STRANDS OF THE SHIELD GROUND WIRE MUST NOT GO INTO THE SHIELD OF THE CABLE. A SHORT CIRCUIT BETWEEN THE CONDUCTOR OF THE WIRE AND THE SHIELD CAN OCCUR.

(7) Put the solder sleeve on the wire or cable. Refer to Figure 5 and Figure 84.

Make sure that:

- The large end of the solder sleeve is put on the wire or cable first
- The end of the insulation of the shield ground wire is aligned with the end of the jacket
- The inner edge of the rear seal ring is aligned with the rear end of the jacket

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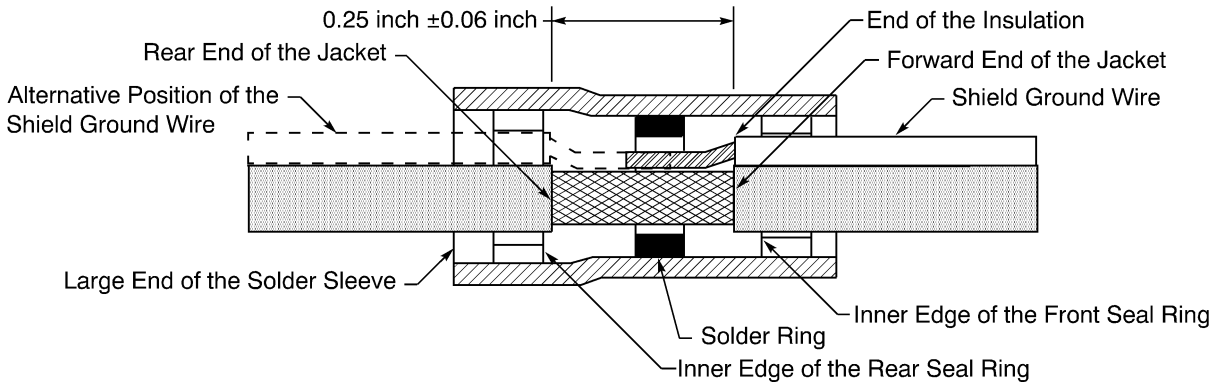
ASSEMBLY OF SHIELD GROUND WIRES



POSITION OF THE SOLDER SLEEVE AND THE SHIELD GROUND WIRE
Figure 84

(8) Shrink the solder sleeve into its position. Refer to Subject 20-10-14.

Make sure that:

- The solder sleeve and the shield ground wire stay in the correct position
- A minimum of 75 percent of the indicator ring on top of the solder ring is melted.

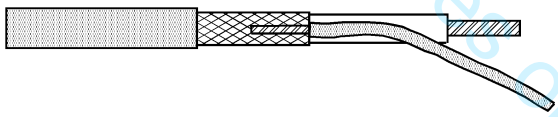
9. ASSEMBLY OF A SHIELD GROUND WIRE - SOLDER SLEEVE WITH AN INSULATED INTEGRAL WIRE

This paragraph gives the procedures to assemble a shield ground wire with solder sleeve that has an insulated integral wire.

For the assembly of a shield ground wire with a solder sleeve that:

- Does not have an integral wire, refer to Paragraph 8.
- Has an uninsulated integral wire, refer to Paragraph 10.

A. Shield Ground Wire Configurations



POSITION OF ONE SHIELD GROUND WIRE
Figure 85

B. Shield Ground Wire - Shield Folded Back

This paragraph gives the procedure to assemble a shield ground wire on a wire or cable that has:

- A shield with round conductors
- An outer shield with round conductors and an adjacent inner shield with round conductors.

For the procedure to assemble a shield ground wire:

- With a shield that is not folded back, refer to Paragraph 9.C.
- That is not at the end of a wire or cable, refer to Paragraph 9.D.

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ASSEMBLY OF SHIELD GROUND WIRES

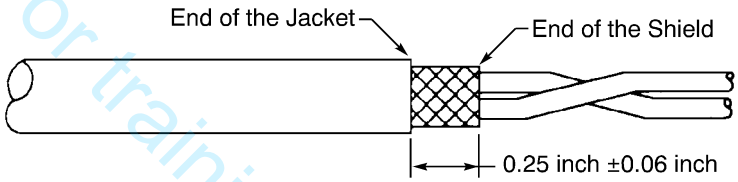
CAUTION: A SHIELD GROUND WIRE ASSEMBLY WITH A SOLDER SLEEVE IS NOT APPLICABLE FOR A WIRE OR A CABLE THAT HAS A SHIELD WITH NICKEL PLATED CONDUCTORS. THE SOLDER SLEEVE CAN CAUSE UNSATISFACTORY PERFORMANCE OF THE CONNECTION OF THE SHIELD TO GROUND.

CAUTION: THIS PROCEDURE CAUSES DAMAGE TO A SHIELD THAT HAS FLAT CONDUCTORS. DAMAGE TO THE FLAT CONDUCTORS OF A SHIELD CAN CAUSE UNSATISFACTORY PERFORMANCE OF THE CONNECTION OF THE SHIELD TO GROUND.

NOTE: If the wire or the cable has two adjacent shields, the shields are prepared as one shield.

(1) Prepare the wire or cable. Refer to Paragraph 4.A.

(2) Remove the necessary length of shield from the wire or cable to make the length of the shield equal to 0.25 inch ±0.06 inch. Refer to Figure 86.



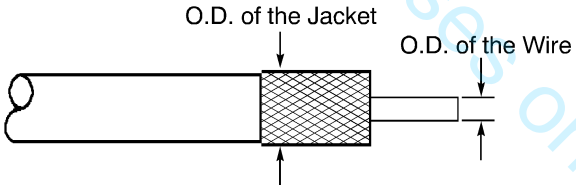
LENGTH OF THE SHIELD
Figure 86

(3) Fold the shield back on the jacket of the wire or cable.

Make sure that the shield is even and symmetrical around the circumference of the wire or cable.

(4) Make a selection of a solder sleeve from Table 14.

Refer to Figure 87 for the applicable dimensions of the shield ground wire assembly.



DIMENSIONS FOR SOLDER SLEEVE SELECTION
Figure 87

(5) Put the solder sleeve on the wire or cable. Refer to Figure 7 and Figure 88.

Make sure that:

- The large end of the solder sleeve is put on the wire or cable first
- The inner edge of the rear seal ring is aligned with the rear end of the shield.

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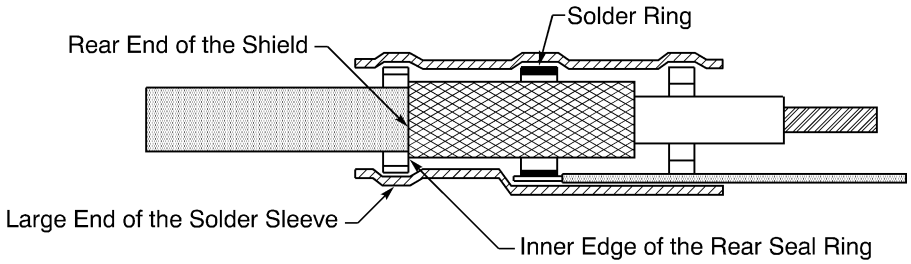
ASSEMBLY OF SHIELD GROUND WIRES



POSITION OF THE SOLDER SLEEVE AND THE SHIELD GROUND WIRE
Figure 88

(6) Shrink the solder sleeve into its position. Refer to Subject 20-10-14.

Make sure that:

- The solder sleeve stays in the correct position
- A minimum of 75 percent of the indicator ring on top of the solder ring is melted.

(7) Remove the necessary length from the end of the shield ground wire.

Make sure that:

- The length of the shield ground wire is sufficient to attach the wire to the specified ground
- The length of the shield ground wire is not more than the maximum length; refer to Paragraph 1.D.

C. Shield Ground Wire - Shield Not Folded Back

This paragraph gives the procedure to assemble a shield ground wire on a wire or cable that has:

- A shield with round conductors
- A shield with flat conductors
- An outer shield with round conductors and an adjacent inner shield with round conductors
- An outer shield with round conductors and an adjacent inner shield with flat conductors.

For the procedure to assemble a shield ground wire:

- With a shield that is folded back, refer to Paragraph 9.B.
- That is not at the end of a wire or cable, refer to Paragraph 9.D.

CAUTION: A SHIELD GROUND WIRE ASSEMBLY WITH A SOLDER SLEEVE IS NOT APPLICABLE FOR A WIRE OR A CABLE THAT HAS A SHIELD WITH NICKEL PLATED CONDUCTORS. THE SOLDER SLEEVE CAN CAUSE UNSATISFACTORY PERFORMANCE OF THE CONNECTION OF THE SHIELD TO GROUND.

NOTE: If the wire or the cable has two adjacent shields, the shields are prepared as one shield.

(1) Prepare the wire or cable. Refer to Paragraph 4.A.

(2) Remove the necessary length of shield from the wire or cable to make the length of the shield equal to 0.25 inch ±0.06 inch. Refer to Figure 89.

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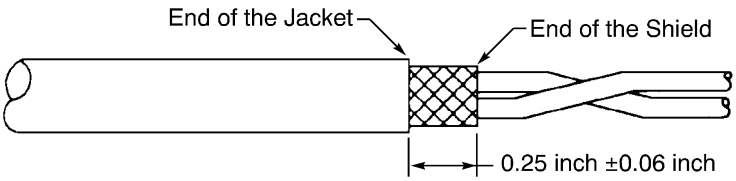
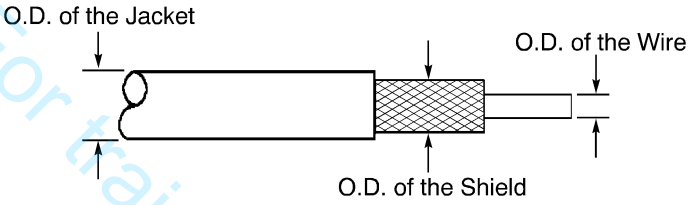
ASSEMBLY OF SHIELD GROUND WIRES



LENGTH OF THE SHIELD
Figure 89

(3) Make a selection of a solder sleeve from Table 14.

Refer to Figure 90 for the applicable dimensions of the shield ground wire assembly.

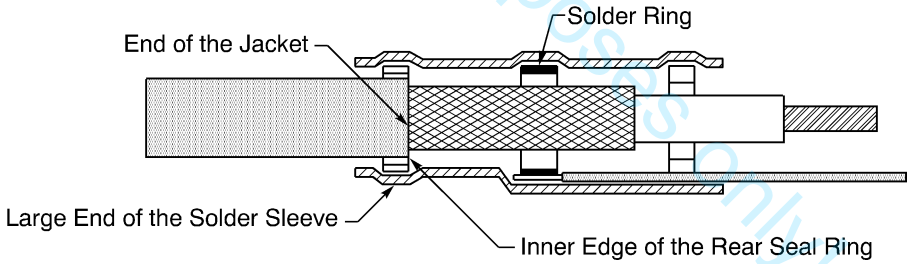


DIMENSIONS FOR SOLDER SLEEVE SELECTION
Figure 90

(4) Put the solder sleeve on the wire or cable. Refer to Figure 7 and Figure 91.

Make sure that:

- The large end of the solder sleeve is put on the wire or cable first
- The inner edge of the rear seal ring is aligned with the end of the jacket.



POSITION OF THE SOLDER SLEEVE AND THE SHIELD GROUND WIRE
Figure 91

(5) Shrink the solder sleeve into its position. Refer to Subject 20-10-14.

Make sure that:

- The solder sleeve stays in the correct position
- A minimum of 75 percent of the indicator ring on top of the solder ring is melted.

(6) Remove the necessary length from the end of the shield ground wire.

Make sure that:

- The length of the shield ground wire is sufficient to attach the wire to the specified ground
- The length of the shield ground wire is not more than the maximum length; refer to Paragraph 1.D.

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D. Shield Ground Wire - Not at the End of a Wire or Cable

This paragraph gives the procedure to assemble a shield ground wire on a wire or cable that has:

- A shield with round conductors
- A shield with flat conductors
- An outer shield with round conductors and an adjacent inner shield with round conductors
- An outer shield with round conductors and an adjacent inner shield with flat conductors.

CAUTION: A SHIELD GROUND WIRE ASSEMBLY WITH A SOLDER SLEEVE IS NOT APPLICABLE FOR A WIRE OR A CABLE THAT HAS A SHIELD WITH NICKEL PLATED CONDUCTORS. THE SOLDER SLEEVE CAN CAUSE UNSATISFACTORY PERFORMANCE OF THE CONNECTION OF THE SHIELD TO GROUND.

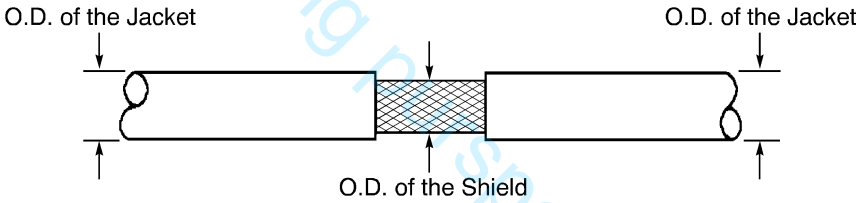
NOTE: If the wire or the cable has two adjacent shields, the shields are prepared as one shield.

(1) Remove 0.25 inch ±0.06 inch of the jacket from the wire or cable at the location of the shield termination.

Refer to Paragraph 4.A. for the applicable jacket removal tool.

(2) Make a selection of a solder sleeve from Table 14.

Refer to Figure 92 for the applicable dimensions of the shield ground wire assembly.

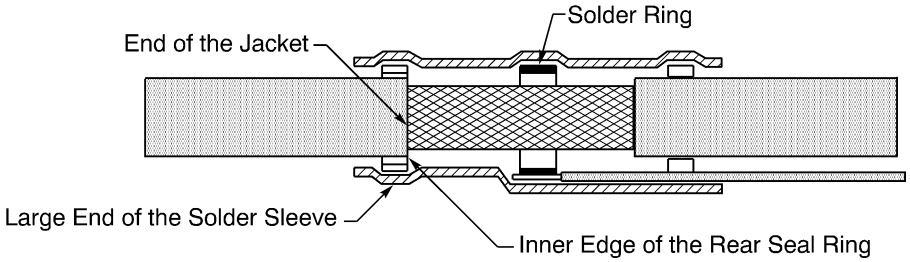


DIMENSIONS FOR SOLDER SLEEVE SELECTION
Figure 92

(3) Put the solder sleeve on the cable. Refer to Figure 7 and Figure 93.

Make sure that:

- The large end of the solder sleeve is put on the wire or cable first
- The inner edge of the rear seal ring is aligned with the end of the jacket.



POSITION OF THE SOLDER SLEEVE AND THE SHIELD GROUND WIRE
Figure 93

(4) Shrink the solder sleeve into its position. Refer to Subject 20-10-14.

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Make sure that:

- The solder sleeve stays in the correct position
- A minimum of 75 percent of the indicator ring on top of the solder ring is melted.

(5) Remove the necessary length from the end of the shield ground wire.

Make sure that:

- The length of the shield ground wire is sufficient to attach the wire to the specified ground
- The length of the shield ground wire is not more than the maximum length; refer to Paragraph 1.D.

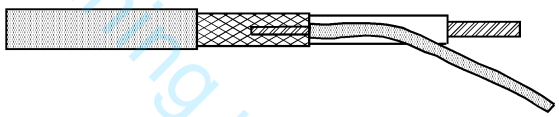
10. ASSEMBLY OF A SHIELD GROUND WIRE - SOLDER SLEEVE WITH AN UNINSULATED INTEGRAL WIRE

This paragraph gives the procedures to assemble a shield ground wire with a solder sleeve that has an uninsulated integral wire.

For the assembly of a shield ground wire with a solder sleeve that:

- Does not have an integral wire, refer to Paragraph 8.
- Has an insulated integral wire, refer to Paragraph 9.

A. Shield Ground Wire Configurations



POSITION OF ONE SHIELD GROUND WIRE
Figure 94

B. Shield Ground Wire - Shield Folded Back

This paragraph gives the procedure to assemble a shield ground wire on a wire or cable that has:

- A shield with round conductors
- An outer shield with round conductors and an adjacent inner shield with round conductors.

For the procedure to assemble a shield ground wire:

- With a shield that is not folded back, refer to Paragraph 10.C.
- That is not at the end of a wire or cable, refer to Paragraph 10.D.

CAUTION: A SHIELD GROUND WIRE ASSEMBLY WITH A SOLDER SLEEVE IS NOT APPLICABLE FOR A WIRE OR A CABLE THAT HAS A SHIELD WITH NICKEL PLATED CONDUCTORS. THE SOLDER SLEEVE CAN CAUSE UNSATISFACTORY PERFORMANCE OF THE CONNECTION OF THE SHIELD TO GROUND.

CAUTION: THIS PROCEDURE CAUSES DAMAGE TO A SHIELD THAT HAS FLAT CONDUCTORS. DAMAGE TO THE FLAT CONDUCTORS OF A SHIELD CAN CAUSE UNSATISFACTORY PERFORMANCE OF THE CONNECTION OF THE SHIELD TO GROUND.

NOTE: If the wire or the cable has two adjacent shields, the shields are prepared as one shield.

(1) Prepare the wire or cable. Refer to Paragraph 4.A.

(2) Remove the necessary length of shield from the wire or cable to make the length of the shield equal to 0.25 inch ±0.06 inch. Refer to Figure 95.

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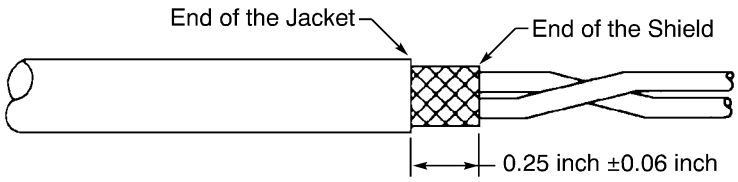
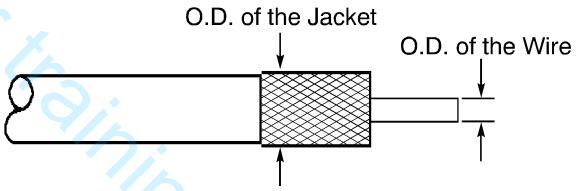
ASSEMBLY OF SHIELD GROUND WIRES



LENGTH OF THE SHIELD
Figure 95

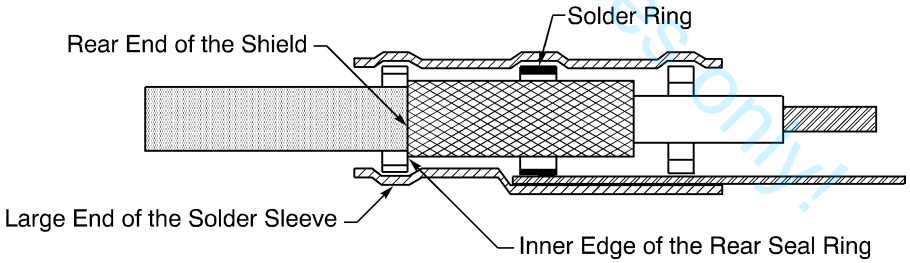
(3) Fold the shield back on the jacket of the wire or cable.
Make sure that the shield is even and symmetrical around the circumference of the wire or cable.

(4) Make a selection of a solder sleeve from Table 16.
Refer to Figure 96 for the applicable dimensions of the shield ground wire assembly.



DIMENSIONS FOR SOLDER SLEEVE SELECTION
Figure 96

(5) Put the solder sleeve on the wire or cable. Refer to Figure 9 and Figure 97.
Make sure that:
- The large end of the solder sleeve is put on the wire or cable first
- The inner edge of the rear seal ring is aligned with the rear end of the shield.



POSITION OF THE SOLDER SLEEVE AND THE SHIELD GROUND WIRE
Figure 97

(6) Shrink the solder sleeve into its position. Refer to Subject 20-10-14.
Make sure that:
- The solder sleeve stays in the correct position
- A minimum of 75 percent of the indicator ring on top of the solder ring is melted.

(7) Remove the necessary length from the end of the shield ground wire.

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Make sure that:

- The length of the shield ground wire is sufficient to attach the wire to the specified ground
- The length of the shield ground wire is not more than the maximum length; refer to Paragraph 1.D.

C. Shield Ground Wire - Shield Not Folded Back

This paragraph gives the procedure to assemble a shield ground wire on a wire or cable that has:

- A shield with round conductors
- A shield with flat conductors
- An outer shield with round conductors and an adjacent inner shield with round conductors
- An outer shield with round conductors and an adjacent inner shield with flat conductors.

For the procedure to assemble a shield ground wire:

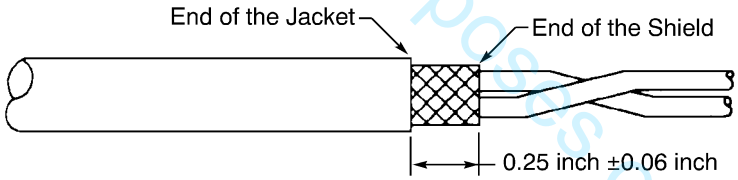
- With a shield that is folded back, refer to Paragraph 10.B.
- That is not at the end of a wire or cable, refer to Paragraph 10.D.

CAUTION: A SHIELD GROUND WIRE ASSEMBLY WITH A SOLDER SLEEVE IS NOT APPLICABLE FOR A WIRE OR A CABLE THAT HAS A SHIELD WITH NICKEL PLATED CONDUCTORS. THE SOLDER SLEEVE CAN CAUSE UNSATISFACTORY PERFORMANCE OF THE CONNECTION OF THE SHIELD TO GROUND.

NOTE: If the wire or the cable has two adjacent shields, the shields are prepared as one shield.

(1) Prepare the wire or cable. Refer to Paragraph 4.A.

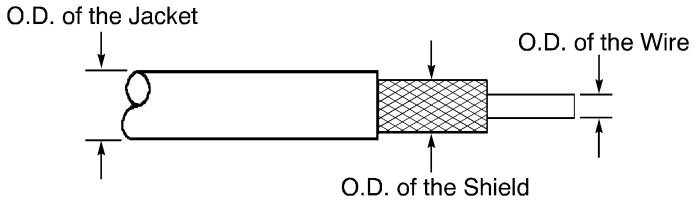
(2) Remove the necessary length of shield from the wire or cable to make the length of the shield equal to 0.25 inch ±0.06 inch. Refer to Figure 98.



LENGTH OF THE SHIELD
Figure 98

(3) Make a selection of a solder sleeve from Table 16.

Refer to Figure 99 for the applicable dimensions of the shield ground wire assembly.



DIMENSIONS FOR SOLDER SLEEVE SELECTION
Figure 99

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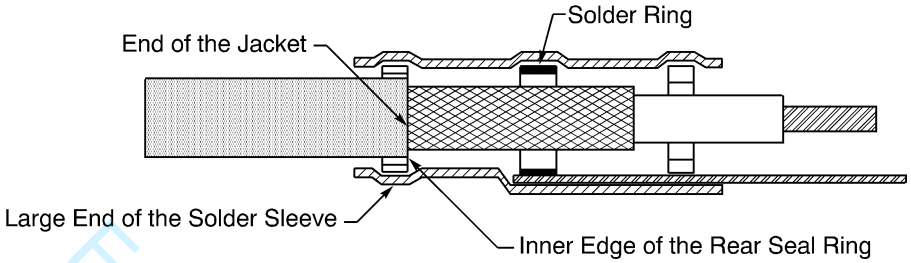
(4) Put the solder sleeve on the wire or cable. Refer to Figure 9 and Figure 100.

Make sure that:

- The large end of the solder sleeve is put on the wire or cable first
- The inner edge of the rear seal ring is aligned with the end of the jacket.



POSITION OF THE SOLDER SLEEVE AND THE SHIELD GROUND WIRE
Figure 100

(5) Shrink the solder sleeve into its position. Refer to Subject 20-10-14.

Make sure that:

- The solder sleeve stays in the correct position
- A minimum of 75 percent of the indicator ring on top of the solder ring is melted.

(6) Remove the necessary length from the end of the shield ground wire.

Make sure that:

- The length of the shield ground wire is sufficient to attach the wire to the specified ground
- The length of the shield ground wire is not more than the maximum length; refer to Paragraph 1.D.

D. Shield Ground Wire - Not at the End of a Wire or Cable

This paragraph gives the procedure to assemble a shield ground wire on a wire or cable that has:

- A shield with round conductors
- A shield with flat conductors
- An outer shield with round conductors and an adjacent inner shield with round conductors
- An outer shield with round conductors and an adjacent inner shield with flat conductors.

CAUTION: A SHIELD GROUND WIRE ASSEMBLY WITH A SOLDER SLEEVE IS NOT APPLICABLE FOR A WIRE OR A CABLE THAT HAS A SHIELD WITH NICKEL PLATED CONDUCTORS. THE SOLDER SLEEVE CAN CAUSE UNSATISFACTORY PERFORMANCE OF THE CONNECTION OF THE SHIELD TO GROUND.

NOTE: If the wire or the cable has two adjacent shields, the shields are prepared as one shield.

(1) Remove 0.25 inch ±0.06 inch of the jacket from the wire or cable at the location of the shield termination.

Refer to Paragraph 4.A. for the applicable jacket removal tool.

(2) Make a selection of a solder sleeve from Table 16.

Refer to Figure 101 for the applicable dimensions of the shield ground wire assembly.

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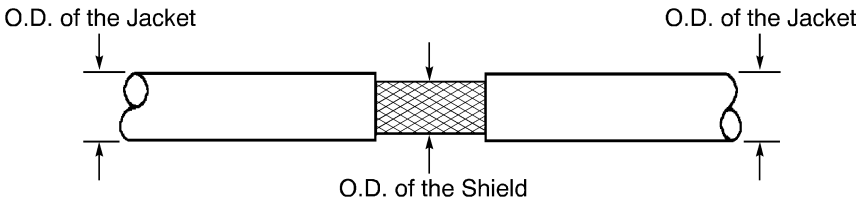
ASSEMBLY OF SHIELD GROUND WIRES

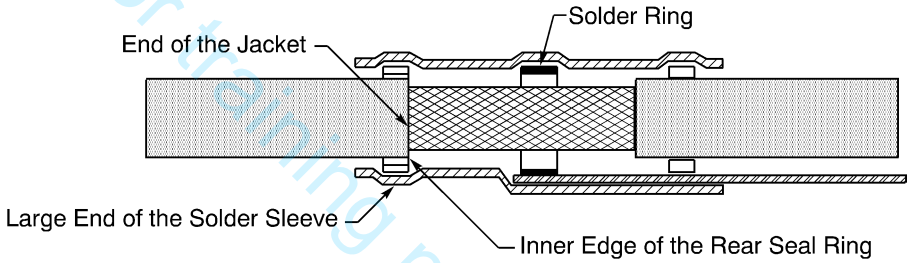


DIMENSIONS FOR SOLDER SLEEVE SELECTION
Figure 101

(3) Put the solder sleeve on the wire or cable. Refer to Figure 9 and Figure 102.

Make sure that:

- The large end of the solder sleeve is put on the wire or cable first
- The inner edge of the rear seal ring is aligned with the end of the jacket.



POSITION OF THE SOLDER SLEEVE AND THE SHIELD GROUND WIRE
Figure 102

(4) Shrink the solder sleeve into its position. Refer to Subject 20-10-14.

Make sure that:

- The solder sleeve stays in the correct position
- A minimum of 75 percent of the indicator ring on top of the solder ring is melted.

(5) Remove the necessary length from the end of the shield ground wire.

Make sure that:

- The length of the shield ground wire is sufficient to attach the wire to the specified ground
- The length of the shield ground wire is not more than the maximum length; refer to Paragraph 1.D.

11. ASSEMBLY OF A SHIELD GROUND WIRE AND A SHIELD EXTENSION

A. Shield Ground Wire and a Shield Extension - Mechanical Ferrules

This paragraph gives the procedure to assemble a shield ground wire and a shield extension on a wire or cable that has:

- A shield with round conductors
- An outer shield with round conductors and an adjacent inner shield with round conductors.

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ASSEMBLY OF SHIELD GROUND WIRES

CAUTION: THIS PROCEDURE CAUSES DAMAGE TO A SHIELD THAT HAS FLAT CONDUCTORS. DAMAGE TO THE FLAT CONDUCTORS OF A SHIELD CAN CAUSE UNSATISFACTORY PERFORMANCE OF THE CONNECTION OF THE SHIELD TO GROUND.

NOTE: If the wire or the cable has two adjacent shields, the shields are prepared as one shield.

(1) Prepare the wire or cable. Refer to Paragraph 4.A.

(2) Make a selection of a shield ground wire from Table 5.

(3) Cut the minimum length of the shield ground wire that is necessary to attach the wire to the specified ground.

For the maximum length of the shield ground wire, refer to Paragraph 1.D.

CAUTION: MORE THAN TWO SHIELD GROUND WIRES MUST NOT BE INSTALLED IN ONE SHIELD GROUND WIRE ASSEMBLY. MORE THAN TWO SHIELD GROUND WIRES CAN CAUSE UNSATISFACTORY PERFORMANCE OF THE CONNECTION OF THE SHIELD TO GROUND.

(4) Measure the O.D. of the wire or cable.

(5) Make a selection of an inner ferrule from Table 8.

NOTE: The applicable ferrule has an I.D. that is a small amount larger than the O.D. of the wire or cable. Refer to Figure 4.

Make sure that the ferrule has the correct Temperature Grade; refer to Figure 4 and Table 6.

(6) Make a selection of an outer ferrule that is specified for the inner ferrule from Table 8.

NOTE: In Table 8, more than one outer ferrule can be specified for one inner ferrule. It is possible that shields of different wires and cables have different thicknesses. This can make it necessary to use a smaller or a larger outer ferrule.

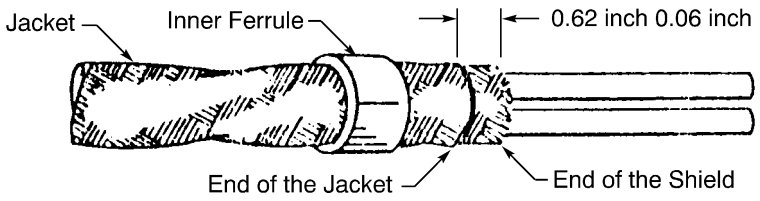
Make sure that the ferrule has the correct Temperature Grade; refer to Figure 4 and Table 6.

(7) Put the inner ferrule on the wire or cable.

(8) Put the inner ferrule on the wire or cable.

Make sure that the ferrule is the smallest ferrule that can be moved freely on the jacket of the wire or cable.

(9) Remove the necessary length of the shield to make the distance from the end of the shield to the end of the jacket equal to 0.62 inch ±0.06 inch. Refer to Figure 103.



LENGTH OF THE SHIELD
Figure 103

(10) Push the inner ferrule forward until the forward edge of the ferrule is aligned with the end of the jacket. Refer to Figure 104.

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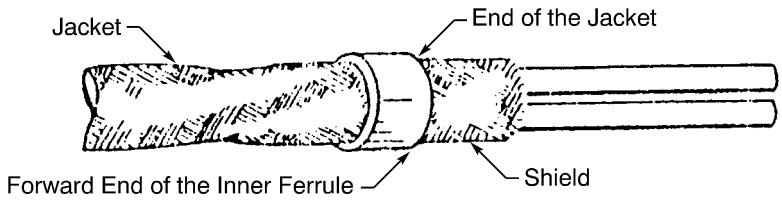
ASSEMBLY OF SHIELD GROUND WIRES

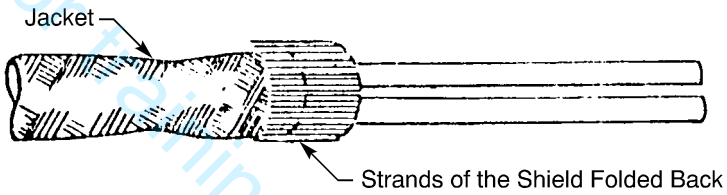


POSITION OF THE INNER FERRULE
Figure 104

(11) Move the stands of the shield apart and make them straight.

(12) Fold the strands of the shield back on the inner ferrule. Refer to Figure 105.

Make sure that the strands of the shield are even and symmetrical around the circumference of the wire or cable.



SHIELD FOLDED BACK
Figure 105

(13) Remove the necessary length of insulation from one end of each shield ground wire. Refer to Subject 20-00-15.

(14) Make a selection of a shield material from Table 18.

Make sure that the shield has the smallest diameter that can be put on the inner ferrule and the strands of the shield.

NOTE: A length of shield from a larger size of the same type of wire or cable is a satisfactory alternative.

NOTE: For other alternative shield materials, refer to Subject 20-00-11.

(15) Cut the necessary length of the shield material.

Make sure that the length of the shield material is sufficient:

- To align one end with the rear end of the shield that is folded back
- To assemble a shield dead end on the other end in the correct position; refer to Paragraph 1.F.

(16) Put the shield material on the wire or cable. Refer to Figure 106.

Make sure that the rear end of the shield material is aligned with the rear end of the shield that is folded back.

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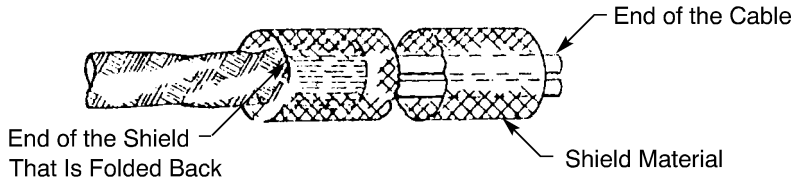
ASSEMBLY OF SHIELD GROUND WIRES



POSITION OF THE SHIELD MATERIAL
Figure 106

(17) Put the conductor of each shield ground wire on the shield material and the inner ferrule.

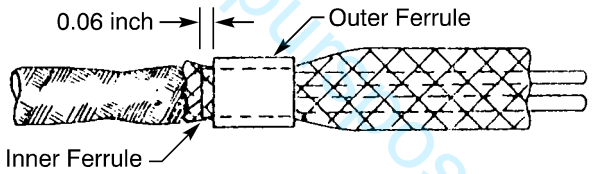
Make sure that:

- Each shield ground wire is pointed in the correct direction
- The conductor of each shield ground wire extends the full length of the ferrules.

(18) Put the outer ferrule on the inner ferrule. Refer to Figure 107.

Make sure that:

- The outer ferrule is the smallest that can be crimped on the inner ferrule and the shield ground wires
- The rear end of the inner ferrule does not extend farther than 0.06 inch from the rear end of the outer ferrule
- The shield ground wires extend farther than the end of the outer ferrule
- The shield ground wires do not extend farther than the end of the inner ferrule.



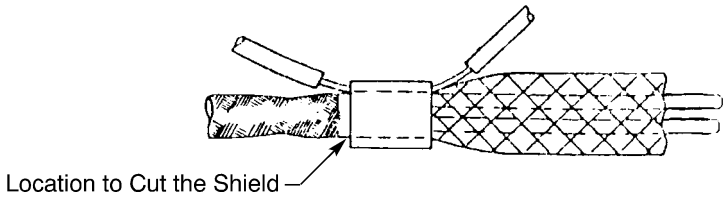
POSITION OF THE OUTER FERRULE
Figure 107

(19) Make a selection of a ferrule crimp tool from Table 24.

(20) Crimp the outer ferrule.

(21) Remove the unwanted length of the shield that extends farther than the rear edge of the outer ferrule. Refer to Figure 108.

NOTE: The outer surface of the inner ferrule can be used to cut against.



REMOVAL OF THE UNWANTED LENGTH OF SHIELD
Figure 108

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(22) Assemble a shield dead end on the opposite end of the shield material. Refer to Paragraph 12.A.

(23) Make a selection of a heat shrinkable sleeve from Table 19.

Make sure that the sleeve has the smallest diameter that can be moved freely on the shield ground wire assembly.

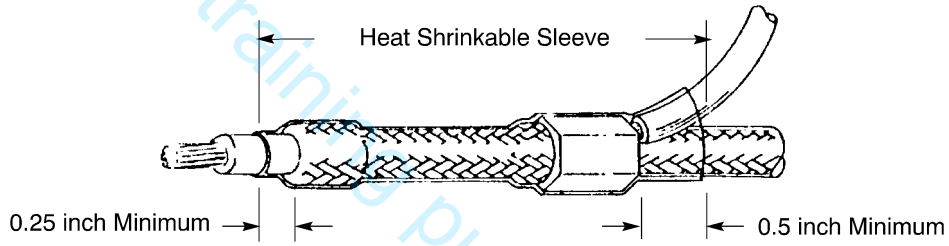
NOTE: For alternative heat shrinkable sleeves, refer to Subject 20-00-11.

(24) If the shield ground wire is pointed away from the end of the wire or cable:

(a) Put the necessary length of heat shrinkable sleeve on the ferrule, the shield ground wire, the extension, and the dead end. Refer to Figure 109.

Make sure that:

- The distance from the rear end of the ferrule to the rear end of the sleeve is 0.5 inch minimum
- The distance from the forward end of the dead end to the forward end of the sleeve is 0.25 inch minimum.



POSITION OF THE HEAT SHRINKABLE SLEEVE
Figure 109

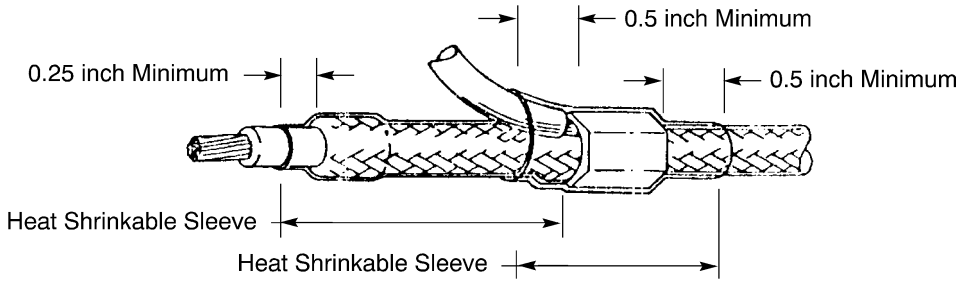
(b) Shrink the sleeve into its position. Refer to Subject 20-10-14.

(25) If the shield ground wire is pointed forward to the end of the wire or cable:

(a) Put the necessary length of heat shrinkable sleeve on the extension and the dead end. Refer to Figure 110.

Make sure that:

- The distance from the forward end of the dead end to the forward end of the sleeve is 0.25 inch minimum
- The rear end of the sleeve is aligned with the forward end of the ferrule.



POSITION OF THE HEAT SHRINKABLE SLEEVES
Figure 110

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(b) Shrink the sleeve into its position. Refer to Subject 20-10-14.

(c) Put the necessary length of heat shrinkable sleeve on the ferrule and the shield ground wire. Refer to Figure 110.

Make sure that:

- The distance from the rear end of the ferrule to the rear end of the sleeve is 0.5 inch minimum
- The distance from the forward end of the ferrule to the forward end of the sleeve is 0.5 inch minimum.

(d) Shrink the sleeve into its position. Refer to Subject 20-10-14.

B. Shield Ground Wire and a Shield Extension - RSK Shield-Kon

This paragraph gives the procedure to assemble a shield ground wire and a shield extension on a wire or cable that has:

- A shield with round conductors
- An outer shield with round conductors and an adjacent inner shield with round conductors.

CAUTION: THIS PROCEDURE CAUSES DAMAGE TO A SHIELD THAT HAS FLAT CONDUCTORS. DAMAGE TO THE FLAT CONDUCTORS OF A SHIELD CAN CAUSE UNSATISFACTORY PERFORMANCE OF THE CONNECTION OF THE SHIELD TO GROUND.

NOTE: If the wire or the cable has two adjacent shields, the shields are prepared as one shield.

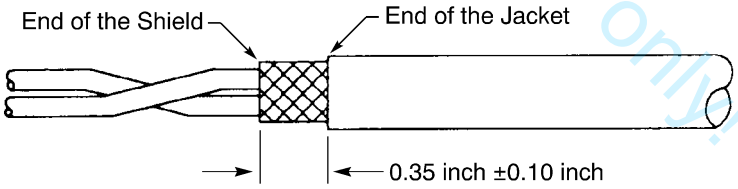
(1) Prepare the wire or cable. Refer to Paragraph 4.A.

(2) Make a selection of a shield ground wire from Table 5.

(3) Cut the minimum length of the shield ground wire that is necessary to attach the wire to the specified ground.

For the maximum length of the shield ground wire, refer to Paragraph 1.D.

(4) Remove the necessary length of the shield from the end of the wire or cable to make the length of the shield equal to 0.35 inch ±0.10 inch. Refer to Figure 111.



LENGTH OF THE SHIELD
Figure 111

(5) Fold the shield back on the jacket of the wire or cable.

Make sure that the shield is even and symmetrical around the circumference of the wire or cable.

(6) Remove 0.3 inch ±0.1 inch of insulation from one end of the shield ground wire. Refer to Subject 20-00-15.

(7) Make a selection of a shield material from Table 18.

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Make sure that the shield material has the smallest diameter that can be put on the shield and the jacket of the wire or cable.

NOTE: A length of shield from a larger size of the same type of wire or cable is a satisfactory alternative.

NOTE: For other alternative shield materials, refer to Subject 20-00-11.

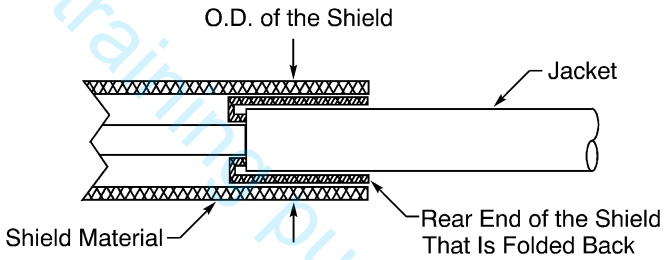
(8) Cut the necessary length of the shield material.

Make sure that the length of the shield material is sufficient:

- To align one end with the rear end of the shield that is folded back
- To assemble a shield dead end on the other end in the correct position; refer to Paragraph 1.F.

(9) Put the shield material on the wire or cable. Refer to Figure 112.

Make sure that the rear end of the shield material is aligned with the rear end of the shield that is folded back.



POSITION OF THE SHIELD MATERIAL
Figure 112

(10) Make a selection of an RSK Shield-Kon from Table 9.

Refer to Figure 112 for the applicable dimensions of the shield ground wire assembly.

(11) Make a selection of an RSK Shield-Kon crimp tool from Table 25.

(12) Put the Shield-Kon in the jaws of the upper and lower dies of the crimp tool. Refer to Figure 113.

Make sure that:

- The shield ground wire clip is pointed up
- The center of the Shield-Kon is aligned with the center of the die.

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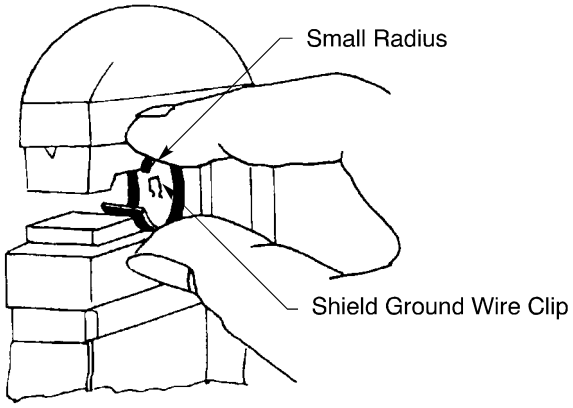
ASSEMBLY OF SHIELD GROUND WIRES

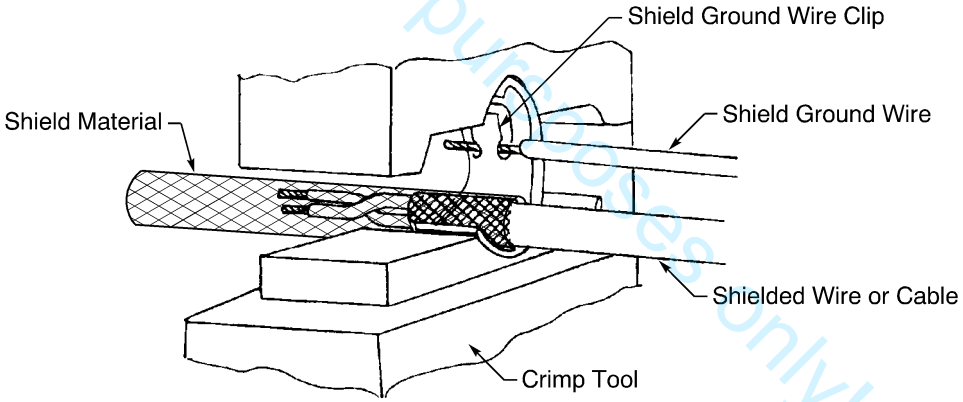


POSITION OF THE SHIELD-KON IN THE CRIMP TOOL
Figure 113

(13) Put the conductor of the shield ground wire in the shield ground clip of the Shield-Kon. Refer to Figure 114.

Make sure that:

- The shield ground wire is pointed in the correct direction
- The conductor of the shield ground wire is in the correct position in the shield ground clip.



POSITION OF THE SHIELD GROUND WIRE, THE WIRE OR CABLE, AND THE SHIELD MATERIAL
Figure 114

(14) Put the wire or cable and the shield material in the bottom of the Shield-Kon. Refer to Figure 114.

Make sure that the rear end of the Shield-Kon is aligned with the rear end of the shield material.

(15) Crimp the Shield-Kon.

(16) Assemble a shield dead end on the opposite end of the shield material. Refer to Figure 115 and Paragraph 12.A.

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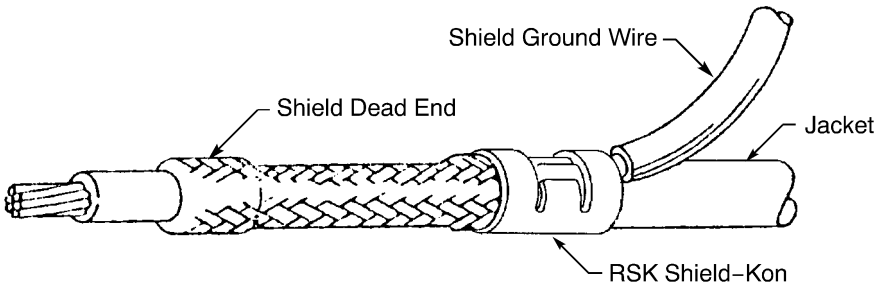
ASSEMBLY OF SHIELD GROUND WIRES



SHIELD EXTENSION AND SHIELD DEAD END
Figure 115

(17) Make a selection of a heat shrinkable sleeve from Table 19.

Make sure that the sleeve has the smallest diameter that can be moved freely on the shield ground wire assembly.

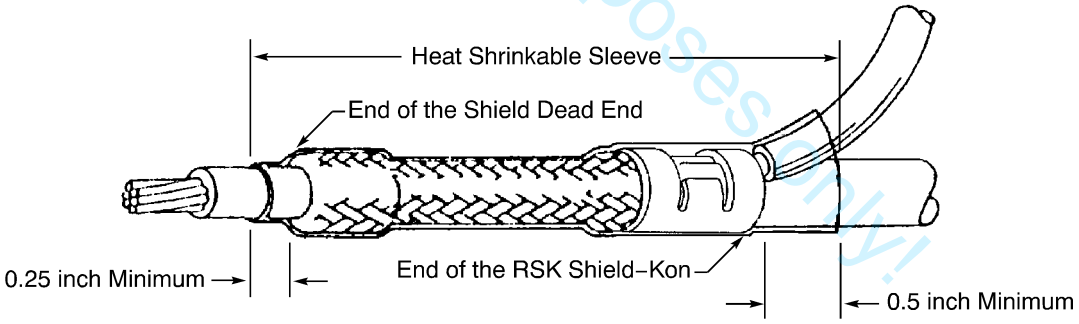
NOTE: For alternative heat shrinkable sleeves, refer to Subject 20-00-11.

(18) If the shield ground wire is pointed away from the end of the wire or cable:

(a) Put the necessary length of heat shrinkable sleeve on the Shield-Kon, the shield ground wire, the extension, and the dead end. Refer to Figure 116.

Make sure that:

- The distance from the rear end of the Shield-Kon to the rear end of the sleeve is 0.5 inch minimum
- The distance from the forward end of the dead end to the forward end of the sleeve is 0.25 inch minimum.



POSITION OF THE HEAT SHRINKABLE SLEEVE
Figure 116

(b) Shrink the sleeve into its position. Refer to Subject 20-10-14.

(19) If the shield ground wire is pointed forward to the end of the wire or cable:

(a) Put the necessary length of heat shrinkable sleeve on the extension and the dead end. Refer to Figure 117.

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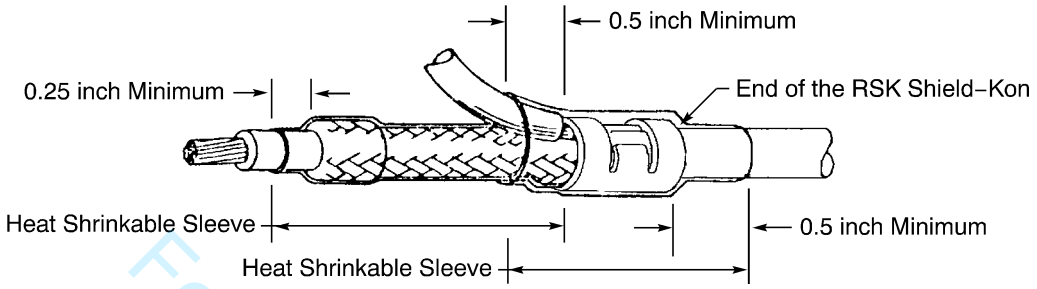
Make sure that:

- The distance from the forward end of the dead end to the forward end of the sleeve is 0.25 inch minimum
- The rear end of the sleeve is aligned with the forward end of the Shield-Kon.



POSITION OF THE HEAT SHRINKABLE SLEEVES
Figure 117

(b) Shrink the sleeve into its position. Refer to Subject 20-10-14.

(c) Put the necessary length of heat shrinkable sleeve on the Shield-Kon and the shield ground wire. Refer to Figure 117.

Make sure that:

- The distance from the rear end of the Shield-Kon to the rear end of the sleeve is 0.5 inch minimum
- The distance from the forward end of the Shield-Kon to the forward end of the sleeve is 0.5 inch minimum.

(d) Shrink the sleeve into its position. Refer to Subject 20-10-14.

C. Shield Ground Wire and a Shield Extension - Solder Sleeve, Shield Folded Back

This paragraph gives the procedure to assemble a shield ground wire and a shield extension on a wire or cable that has:

- A shield with round conductors
- An outer shield with round conductors and an adjacent inner shield with round conductors.

CAUTION: A SHIELD GROUND WIRE ASSEMBLY WITH A SOLDER SLEEVE IS NOT APPLICABLE FOR A WIRE OR A CABLE THAT HAS A SHIELD WITH NICKEL PLATED CONDUCTORS. THE SOLDER SLEEVE CAN CAUSE UNSATISFACTORY PERFORMANCE OF THE CONNECTION OF THE SHIELD TO GROUND.

CAUTION: THIS PROCEDURE CAUSES DAMAGE TO A SHIELD THAT HAS FLAT CONDUCTORS. DAMAGE TO THE FLAT CONDUCTORS OF A SHIELD CAN CAUSE UNSATISFACTORY PERFORMANCE OF THE CONNECTION OF THE SHIELD TO GROUND.

NOTE: If the wire or the cable has two adjacent shields, the shields are prepared as one shield.

(1) Prepare the wire or cable. Refer to Paragraph 4.A.

(2) Remove the necessary length of shield from the wire or cable to make the length of the shield equal to 0.25 inch ±0.06 inch. Refer to Figure 118.

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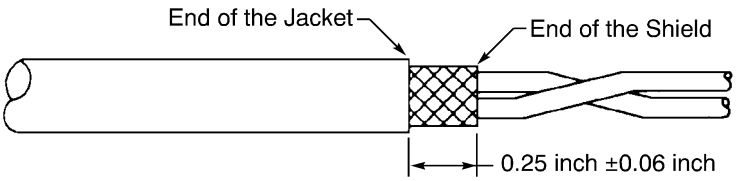
ASSEMBLY OF SHIELD GROUND WIRES



LENGTH OF THE SHIELD
Figure 118

(3) Fold the shield back on the jacket of the wire or cable.

Make sure that the shield is even and symmetrical around the circumference of the wire or cable.

(4) Make a selection of a shield material from Table 18.

Make sure that the shield material has:

- The correct Temperature Grade
- The smallest diameter that can be put on the shield and the jacket of the wire or cable.

NOTE: A length of shield from a larger size of the same type of wire or cable is a satisfactory alternative.

NOTE: For other alternative shield materials, refer to Subject 20-00-11.

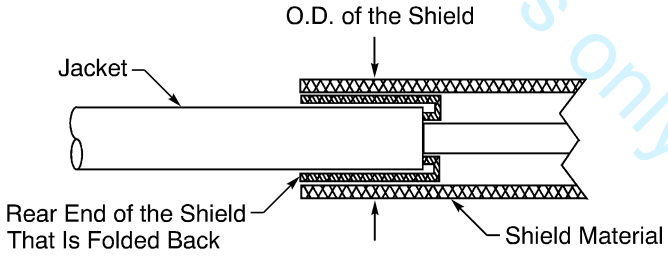
(5) Cut the necessary length of shield material.

Make sure that the length of the shield material is sufficient:

- To align one end with the rear end of the shield that is folded back
- To assemble a shield dead end on the other end in the correct position; refer to Paragraph 1.F.

(6) Put the shield material on the wire or cable. Refer to Figure 119.

Make sure that the rear end of the shield material is aligned with the rear end of the shield that is folded back.



POSITION OF THE SHIELD MATERIAL
Figure 119

(7) Make a selection of a solder sleeve from Table 14.

Refer to Figure 119 for the applicable dimensions of the shield ground wire assembly.

(8) Put the solder sleeve on the wire or cable. Refer to Figure 120.

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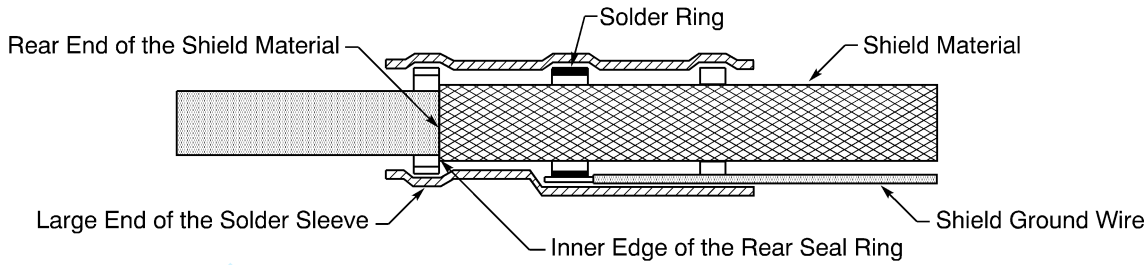
Make sure that:

- The shield ground wire is pointed in the correct direction
- The inner edge of the rear seal ring is aligned with the rear end of the shield material.



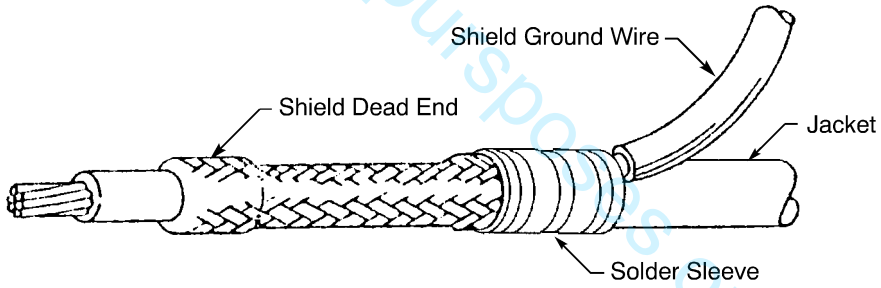
POSITION OF THE SOLDER SLEEVE
Figure 120

(9) Shrink the solder sleeve into its position. Refer to Subject 20-10-14.

Make sure that:

- The solder sleeve stays in the correct position
- A minimum of 75 percent of the indicator ring on top of the solder ring is melted.

(10) Assemble a shield dead end on the opposite end of the shield material. Refer to Figure 121 and Paragraph 12.A.



SHIELD EXTENSION AND SHIELD DEAD END
Figure 121

(11) Make a selection of a heat shrinkable sleeve from Table 19.

NOTE: For alternative heat shrinkable sleeves, refer to Subject 20-00-11.

(12) If the shield ground wire is pointed away from the end of the wire or cable:

(a) Put the necessary length of heat shrinkable sleeve on the solder sleeve, the shield ground wire, the extension, and the dead end. Refer to Figure 122.

Make sure that:

- The distance from the rear end of the solder sleeve to the rear end of the sleeve is 0.5 inch minimum
- The distance from the forward end of the dead end to the forward end of the sleeve is 0.25 inch minimum.

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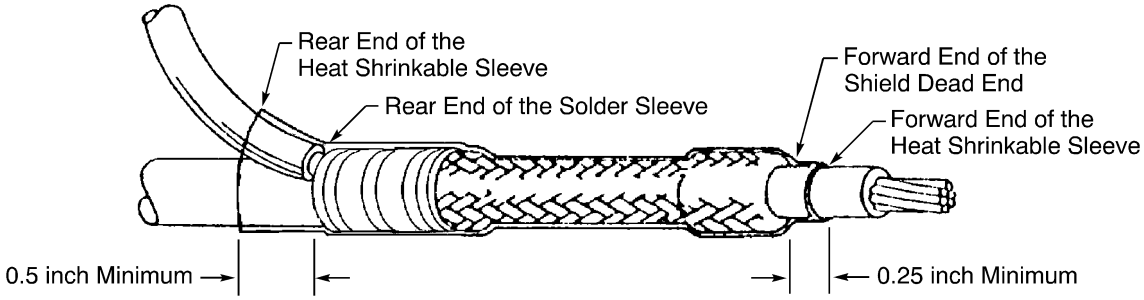
ASSEMBLY OF SHIELD GROUND WIRES



POSITION OF THE HEAT SHRINKABLE SLEEVE
Figure 122

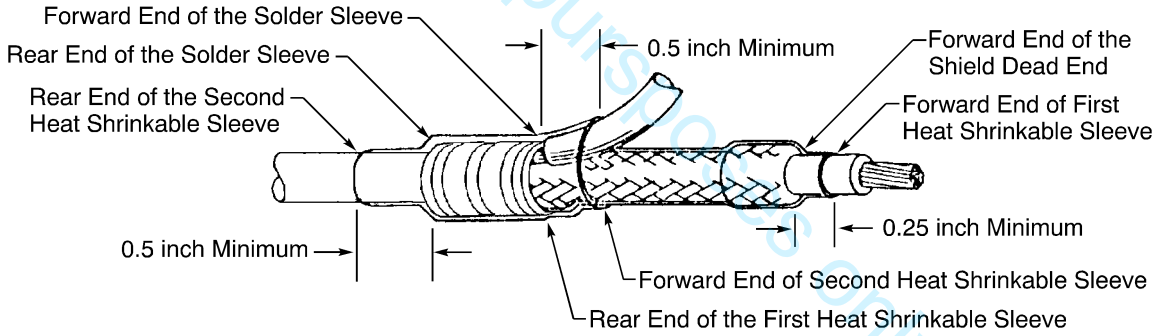
(b) Shrink the sleeve into its position. Refer to Subject 20-10-14.

(13) If the shield ground wire is pointed forward to the end of the wire or cable:

(a) Put the necessary length of heat shrinkable sleeve on the extension and the dead end. Refer to Figure 123.

Make sure that:

- The distance from the forward end of the dead end to the forward end of the sleeve is 0.25 inch minimum
- The rear end of the heat shrinkable sleeve is aligned with the forward end of the solder sleeve.



POSITION OF THE HEAT SHRINKABLE SLEEVES
Figure 123

(b) Shrink the sleeve into its position. Refer to Subject 20-10-14.

(c) Put the necessary length of heat shrinkable sleeve on the solder sleeve and the shield ground wire. Refer to Figure 123.

Make sure that:

- The distance from the rear end of the solder sleeve to the rear end of the heat shrinkable sleeve is 0.5 inch minimum
- The distance from the forward end of the solder sleeve to the forward end of the heat shrinkable sleeve is 0.5 inch minimum.

(d) Shrink the sleeve into its position. Refer to Subject 20-10-14.

(14) Remove the necessary length from the end of the shield ground wire.

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Make sure that:

- The length of the shield ground wire is sufficient to attach the wire to the specified ground
- The length of the shield ground wire is not more than the maximum length; refer to Paragraph 1.D.

D. Shield Ground Wire and a Shield Extension - Solder Sleeve, Shield Not Folded Back

This paragraph gives the procedure to assemble a shield ground wire and a shield extension on a wire or cable that has:

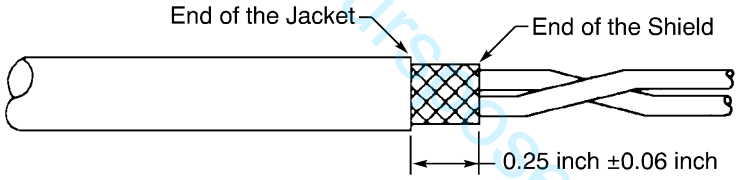
- A shield with round conductors
- A shield with flat conductors
- An outer shield with round conductors and an adjacent inner shield with round conductors
- An outer shield with round conductors and an adjacent inner shield with flat conductors.

CAUTION: A SHIELD GROUND WIRE ASSEMBLY WITH A SOLDER SLEEVE IS NOT APPLICABLE FOR A WIRE OR A CABLE THAT HAS A SHIELD WITH NICKEL PLATED CONDUCTORS. THE SOLDER SLEEVE CAN CAUSE UNSATISFACTORY PERFORMANCE OF THE CONNECTION OF THE SHIELD TO GROUND.

NOTE: If the wire or the cable has two adjacent shields, the shields are prepared as one shield.

(1) Prepare the wire or cable. Refer to Paragraph 4.A.

(2) Remove the necessary length of shield from the wire or cable to make the length of the shield equal to 0.25 inch ±0.06 inch. Refer to Figure 124.



LENGTH OF THE SHIELD
Figure 124

(3) Make a selection of a shield material from Table 18.

Make sure that the shield material has:

- The correct Temperature Grade
- The smallest diameter that can be put on the shield of the wire or cable.

NOTE: A length of shield from a larger size of the same type of wire or cable is a satisfactory alternative.

NOTE: For other alternative shield materials, refer to Subject 20-00-11.

(4) Cut the necessary length of shield material.

Make sure that the length of the shield material is sufficient:

- To align one end with the rear end of the shield
- To assemble a shield dead end on the other end in the correct position; refer to Paragraph 1.F.

(5) Put the shield material on the wire or cable. Refer to Figure 125.

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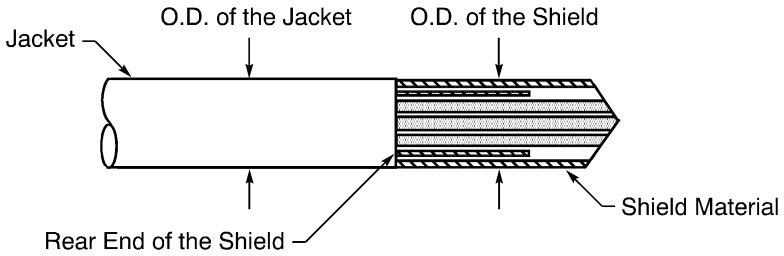
ASSEMBLY OF SHIELD GROUND WIRES

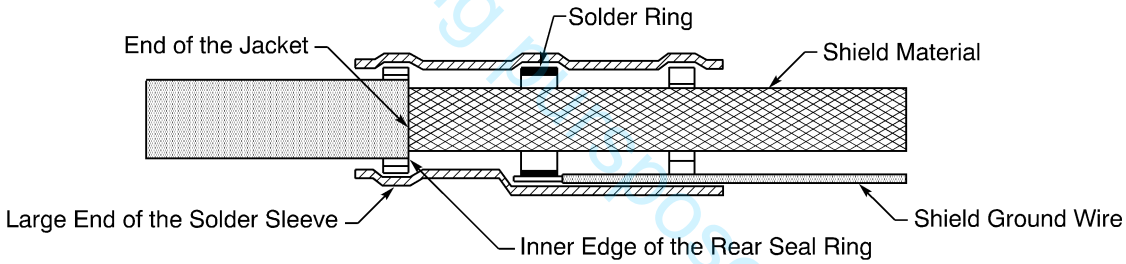
Make sure that the rear end of the shield material is aligned with the rear end of the shield.



POSITION OF THE SHIELD MATERIAL
Figure 125

(6) Make a selection of a solder sleeve from Table 14.
Refer to Figure 125 for the applicable dimensions of the shield ground wire assembly.

(7) Put the solder sleeve on the wire or cable. Refer to Figure 126.
Make sure that:
- The shield ground wire is pointed in the correct direction
- The inner edge of the rear seal ring is aligned with the end of the jacket.



POSITION OF THE SOLDER SLEEVE
Figure 126

(8) Shrink the solder sleeve into its position. Refer to Subject 20-10-14.
Make sure that:
- The solder sleeve stays in the correct position
- A minimum of 75 percent of the indicator ring on top of the solder ring is melted.

(9) Assemble a shield dead end on the opposite end of the shield material. Refer to Paragraph 12.A.

(10) Install a shield dead end on the opposite end of the shield extension, refer to Paragraph 12.A.

(11) Make a selection of a heat shrinkable sleeve from Table 19.

(12) If the shield ground wire is pointed away from the end of the wire or cable:

(a) Put the necessary length of heat shrinkable sleeve on the solder sleeve, the shield ground wire, the extension, and the dead end. Refer to Figure 127.

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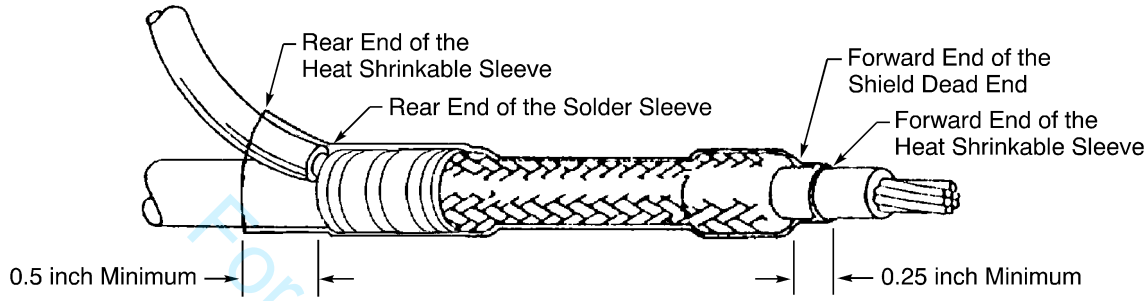
Make sure that:

- The distance from the rear end of the solder sleeve to the rear end of the sleeve is 0.5 inch minimum
- The distance from the forward end of the dead end to the forward end of the sleeve is 0.25 inch minimum.



POSITION OF THE HEAT SHRINKABLE SLEEVE
Figure 127

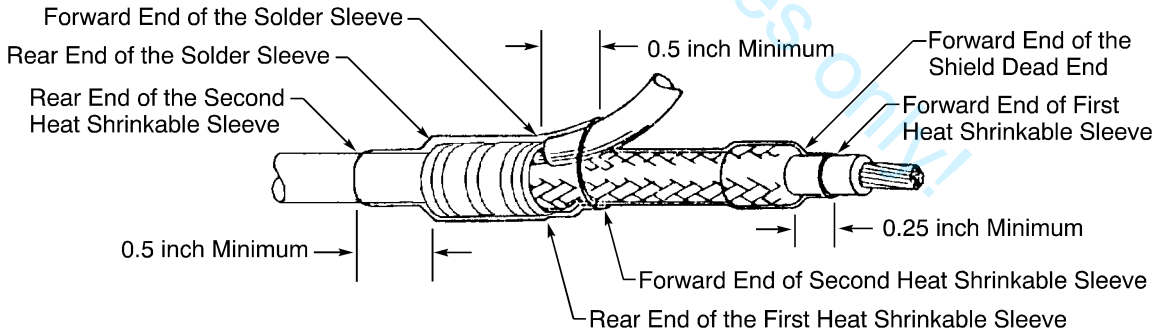
(b) Shrink the sleeve into its position. Refer to Subject 20-10-14.

(13) If the shield ground wire is pointed forward to the end of the wire or cable:

(a) Put the necessary length of heat shrinkable sleeve on the extension and the dead end. Refer to Figure 128.

Make sure that:

- The distance from the forward end of the dead end to the forward end of the sleeve is 0.25 inch minimum
- The rear end of the heat shrinkable sleeve is aligned with the forward end of the solder sleeve.



POSITION OF THE HEAT SHRINKABLE SLEEVES
Figure 128

(b) Shrink the sleeve into its position. Refer to Subject 20-10-14.

(c) Put the necessary length of heat shrinkable sleeve on the solder sleeve and the shield ground wire. Refer to Figure 128.

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Make sure that:

- The distance from the rear end of the solder sleeve to the rear end of the heat shrinkable sleeve is 0.5 inch minimum
- The distance from the forward end of the solder sleeve to the forward end of the heat shrinkable sleeve is 0.5 inch minimum.

(d) Shrink the sleeve into its position. Refer to Subject 20-10-14.

(14) Remove the necessary length from the end of the shield ground wire.

Make sure that:

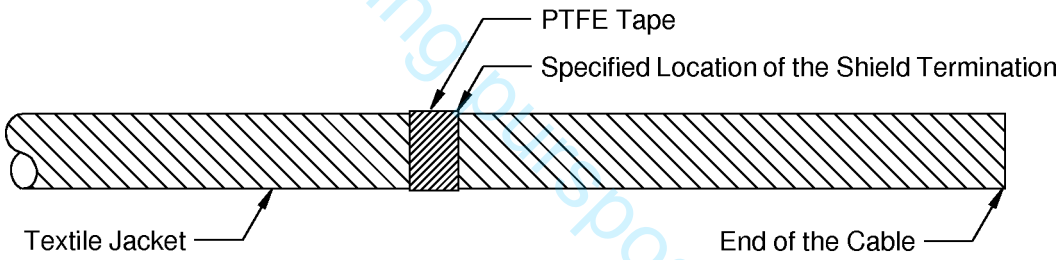
- The length of the shield ground wire is sufficient to attach the wire to the specified ground
- The length of the shield ground wire is not more than the maximum length; refer to Paragraph 1.D.

12. ASSEMBLY OF A SHIELD GROUND WIRE WITH A SHIELD TERMINATION RING

A. Cable Preparation for the Assembly of a Shield Ground Wire with a Shield Termination Ring

(1) Put a minimum of 1-1/2 layers of 0.5 inch wide PTFE tape on the jacket at the specified location of the shield termination. Refer to Figure 129.

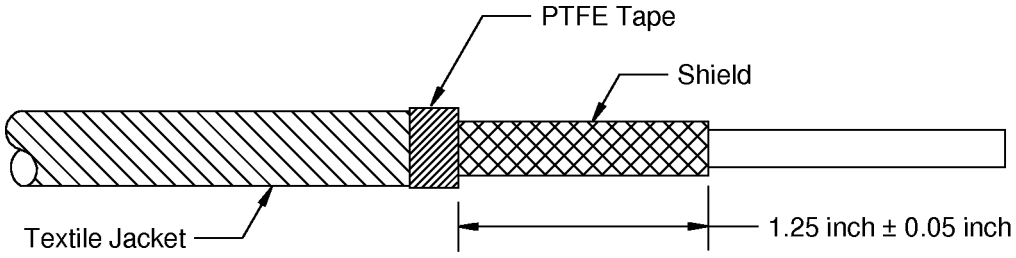
Make sure the forward edge of the PTFE tape is aligned with the location of the shield termination.



POSITION OF THE PTFE TAPE ON THE JACKET
Figure 129

(2) Remove the length of the jacket from the forward edge of the PTFE tape to the end of the cable.

(3) Remove the necessary length of the shield to make the distance from the end of the jacket to the end of the shield equal to 1.25 inches ±0.05 inch. Refer to Figure 130.



SHIELD REMOVAL
Figure 130

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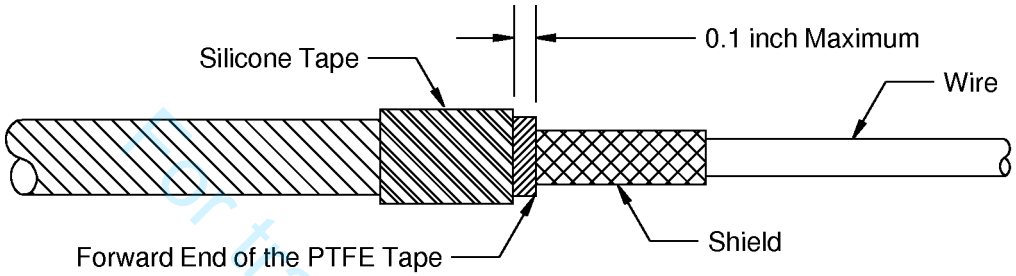
B. Assembly of a Shield Ground Wire with a Shield Termination Ring - AWG 18 or Smaller Shield Ground Wire

(1) Remove 0.7 inch ±0.1 inch of the insulation from the end of the shield ground wire.

(2) Put a minimum of 1-1/2 layers of 1.0 inch wide Type I silicone tape on the PTFE tape and the jacket of the cable. Refer to Figure 131.

Make sure that the forward edge of the silicone tape is not farther than 0.1 inch from the forward end of the PTFE tape.



POSITION OF THE SILICONE TAPE ON THE CABLE
Figure 131

(3) If a shield termination ring is not specified, make a selection of a shield termination ring from Subject 20-00-11.

Make sure that the shield termination ring has the smallest diameter that will make a fit with the cable.

(4) Assemble the two halves of the shield termination ring on the center of the silicone tape.

Make sure that:

- The keys of one half are aligned with the keyholes of the other half
- A minimum of one side of the shield termination ring has a key and key hole that does not have damage
- The shield termination ring is fully closed
- The shield termination ring does not move on the cable.

NOTE: The shield termination ring makes a click when it is assembled correctly.

(5) If the fit of the shield termination ring and the cable is not correct, more layers of the silicone tape can be put on the cable.

Make sure that the shield termination ring does not move on the cable after the two halves of the ring are assembled on the tape layers.

(6) Move the strands of the shield apart. Refer to Figure 132.

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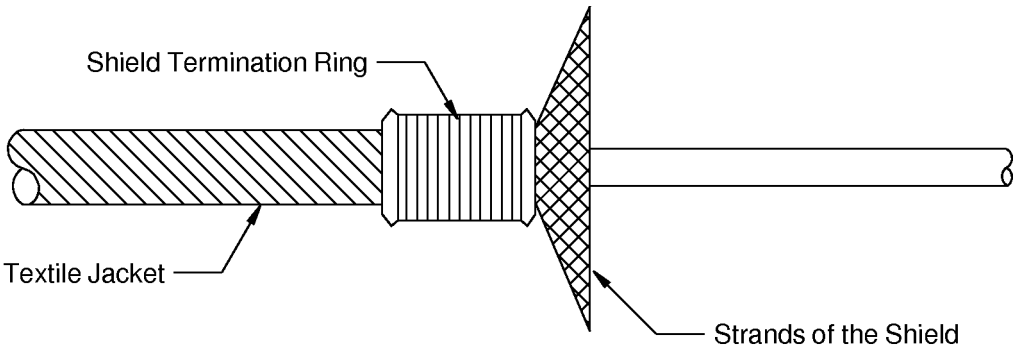
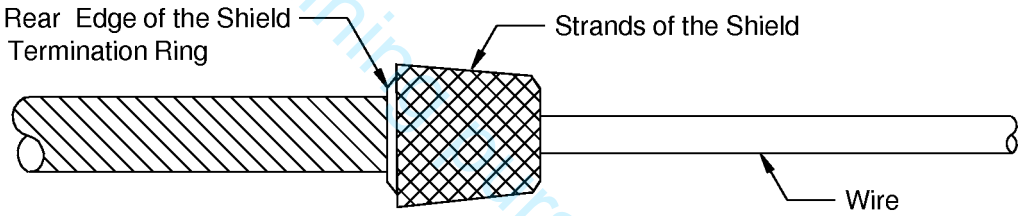
ASSEMBLY OF SHIELD GROUND WIRES



SEPARATION OF THE STRANDS OF THE SHIELD
Figure 132

(7) Put the strands of the cable shield on the shield termination ring. Refer to Figure 133

Make sure that the strands of the shield are even and symmetrical around the circumference of the shield termination ring.



POSITION OF THE STRANDS OF THE SHIELD ON THE SHIELD TERMINATION RING
Figure 133

(8) If the shield terminator band is not specified, make a selection of a BACB42F4 shield terminator band from Subject 20-00-11.

(9) Assemble a shield ground wire with the shield terminator band.

Refer to:

- Figure 134
- Subject 20-25-14 for the procedure to install the band.

Make sure that the center of the length of conductor without insulation is approximately aligned with the center of the shield termination ring.

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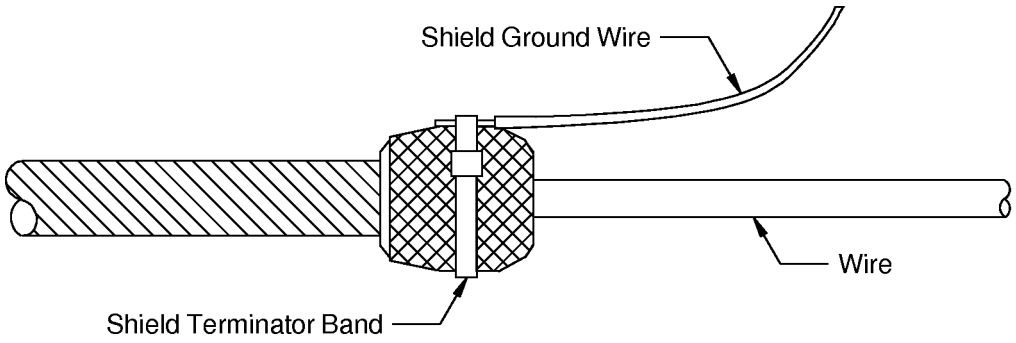
ASSEMBLY OF SHIELD GROUND WIRES



POSITION OF THE SHIELD GROUND WIRE
Figure 134

(10) Put 1 to 2 layers of 0.5 inch wide PTFE tape on the shield terminator band.

Make sure that:

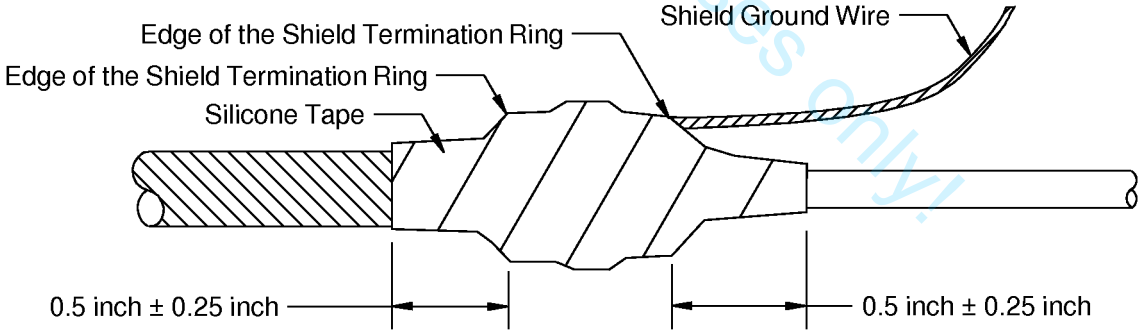
- The center of the tape is aligned with the center of the band
- The edges of the tape are approximately aligned
- The surface of the band cannot be seen.

(11) If the strands of the shield make an overlap with the cable jacket, remove the unwanted length with scissors or an equivalent tool.

(12) Put a layer of Type II silicone tape on the shield termination. Refer to Figure 135.

Make sure that the layer of tape

- The tape makes approximately a 50 percent overlap with itself
- Extends 0.50 inch ±0.25 inch from each end of the shield termination ring
- Is between the wire harness and the shield ground wire.



POSITION OF THE LAYER OF THE SILICONE TAPE
Figure 135

C. Assembly of a Shield Ground Wire with a Shield Termination Ring - AWG 16 or Larger Shield Ground Wire

(1) Remove 0.7 inch ±0.1 inch of the insulation from the end of the shield ground wire.

(2) Move the strands of the conductor of the shield ground wire apart.

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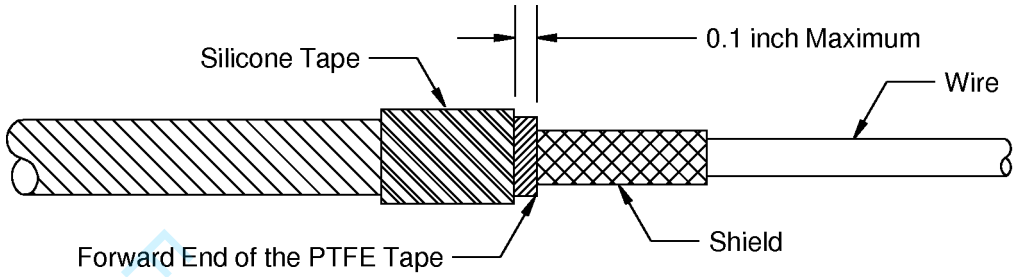
(3) Put a minimum of 1-1/2 layers of 1.0 inch wide Type I silicone tape on the PTFE tape and the jacket of the cable. Refer to Figure 136.

Make sure that the forward edge of the silicone tape is not farther than 0.1 inch from the forward end of the PTFE tape.



POSITION OF THE SILICONE TAPE ON THE CABLE
Figure 136

(4) If a shield termination ring is not specified, make a selection of a shield termination ring from Subject 20-00-11.

Make sure that the shield termination ring has the smallest diameter that will make a fit with the cable.

(5) Assemble the two halves of the shield termination ring on the center of the silicone tape.

Make sure that:

- The keys of one half are aligned with the keyholes of the other half
- A minimum of one side of the shield termination ring has a key and key hole that does not have damage
- The shield termination ring is fully closed
- The shield termination ring does not move on the cable.

NOTE: The shield termination ring makes a click when it is assembled correctly.

(6) If the fit of the shield termination ring and the cable is not correct, more layers of the silicone tape can be put on the cable.

Make sure that the shield termination ring does not move on the cable after the two halves of the ring are assembled on the tape layers.

(7) Move the strands of the shield apart. Refer to Figure 137.

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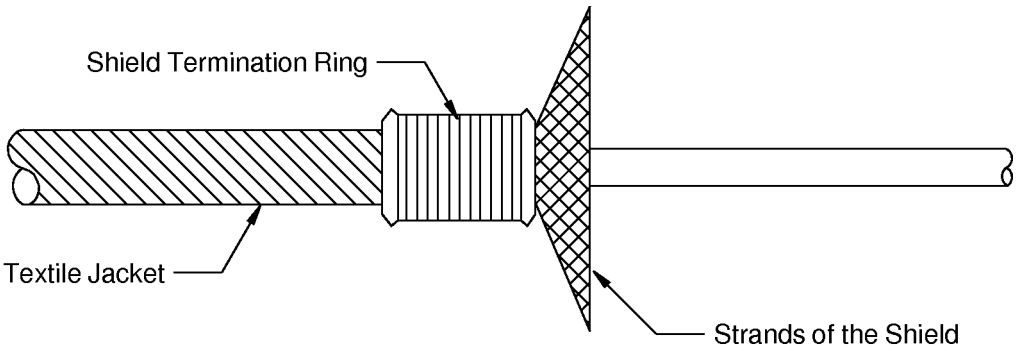
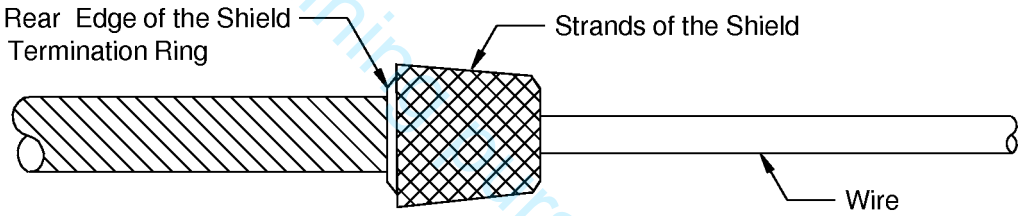
ASSEMBLY OF SHIELD GROUND WIRES



SEPARATION OF THE STRANDS OF THE SHIELD
Figure 137

(8) Put the strands of the cable shield on the shield termination ring. Refer to Figure 138

Make sure that the strands of the shield are even and symmetrical around the circumference of the shield termination ring.



POSITION OF THE STRANDS OF THE SHIELD ON THE SHIELD TERMINATION RING
Figure 138

(9) If the shield terminator bands are not specified, make a selection of two BACB42F4 shield terminator bands from Subject 20-00-11.

(10) Assemble a shield ground wire with the two shield terminator bands.

Refer to:

- Figure 139
- Subject 20-25-14 for the procedure to install the bands.

Make sure that the center of the length of conductor without insulation is approximately aligned with the center of the shield termination ring.

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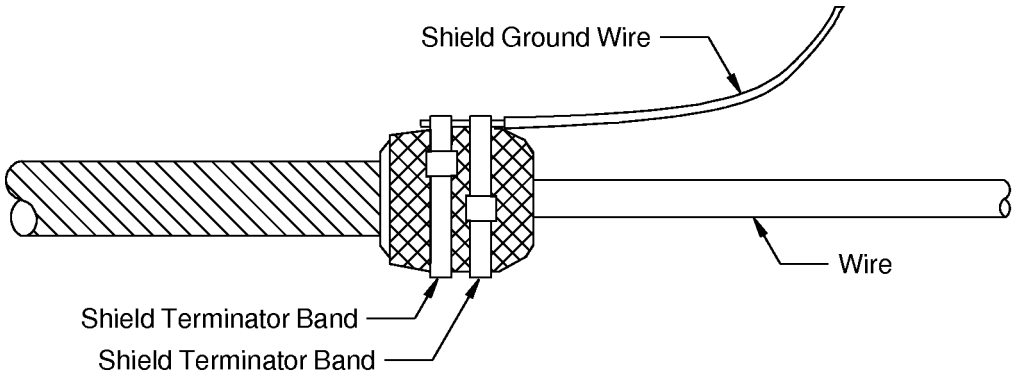
ASSEMBLY OF SHIELD GROUND WIRES



POSITION OF THE SHIELD GROUND WIRE
Figure 139

(11) Put one to two layers of the PTFE tape on each shield terminator band.

Make sure that:

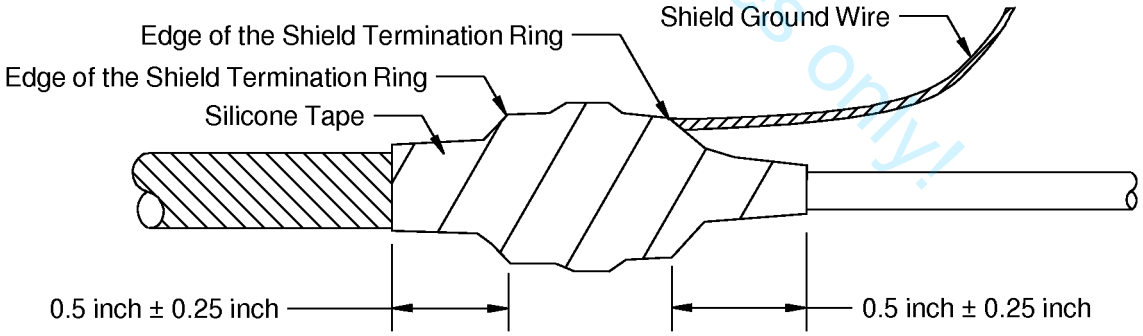
- The center of the tape is aligned with the center of the band
- The edges of the tape are approximately aligned
- The surface of the band cannot be seen.

(12) If the strands of the shield make an overlap with the cable jacket, remove the unwanted length with scissors or an equivalent tool.

(13) Put a layer of Type II silicone tape on the shield termination. Refer to Figure 140

Make sure that the layer of tape:

- The tape makes approximately a 50 percent overlap with itself
- Extends 0.50 inch ±0.25 inch from each end of the shield termination ring
- Is between the wire harness and the shield ground wire.



POSITION OF THE LAYER OF THE SILICONE TAPE
Figure 140

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13. ASSEMBLY OF A SHIELD DEAD END

A. Shield Dead End - Shield Folded Back

This paragraph gives the procedure to assemble a shield dead on a wire or cable that has:

- A shield with round conductors
- An outer shield with round conductors and an adjacent inner shield with round conductors.

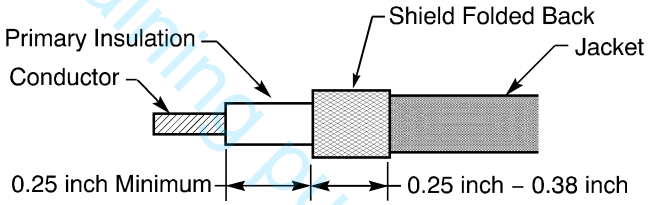
CAUTION: THIS PROCEDURE CAUSES DAMAGE TO A SHIELD THAT HAS FLAT CONDUCTORS. DAMAGE TO THE FLAT CONDUCTORS OF A SHIELD CAN CAUSE UNSATISFACTORY PERFORMANCE OF THE SHIELD DEAD END.

NOTE: If the wire or the cable has two adjacent shields, the shields are prepared as one shield.

(1) If the wire or cable does not have a jacket, fold the shield back at the specified point of the shield termination.

Make sure that the length of the shield that is folded back is between 0.25 inch and 0.38 inch.

(2) If the wire or cable has a jacket, prepare the shield. Refer to Figure 141.



LENGTH OF THE SHIELD
Figure 141

(a) Prepare the wire or cable. Refer to Paragraph 4.A.

(b) Push the end of the shield in the direction of the end of the jacket to expand the shield at the end of the jacket.

(c) Cut the shield with scissors or wire cutters where the circumference is largest to make the length of the shield equal to 0.25 inch to 0.38 inch.

CAUTION: DO NOT A USE KNIFE TO CUT AGAINST THE PRIMARY INSULATION. DAMAGE TO THE INSULATION CAN CAUSE UNSATISFACTORY PERFORMANCE OF THE WIRE OR CABLE.

(d) Fold the shield back on the jacket.

Make sure that the length of the shield is between 0.25 inch and 0.38 inch.

NOTE: As an alternative, the strands of the shield can be moved apart and folded back symmetrically against the jacket.

(3) Make a selection of an insulation material from Table 19.

Make sure that the material has the correct Temperature Grade.

(4) If the insulation material is a heat shrinkable sleeve:

(a) Put a length of the sleeve that is 0.5 inch longer than the length of the shield on the wire or cable.

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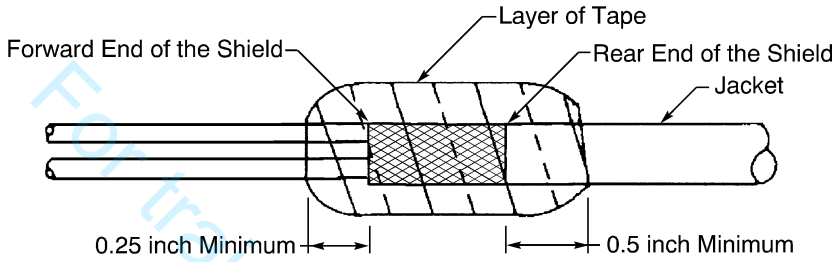
(b) Align the center of the sleeve and the center of the shield.

(c) Shrink the sleeve into its position. Refer to Subject 20-10-14.

(5) If the insulation material is tape, put two layers of tape on the wire or cable. Refer to Figure 142.

Make sure that:

- Each layer of tape makes a 0.25 inch overlap
- The end of each layer is 0.25 inch minimum farther than the forward end of the shield
- The end of each layer is 0.5 inch minimum farther than the rear end of the shield
- The second layer is wound in the opposite direction of the first layer.



POSITION OF THE LAYERS OF TAPE
Figure 142

B. Shield Dead End - Shield Not Folded Back

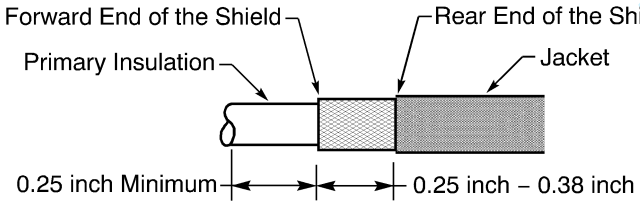
This paragraph gives the procedure to assemble a shield dead end on a wire or cable that has:

- A shield with round conductors
- A shield with flat conductors
- An outer shield with round conductors and an adjacent inner shield with round conductors
- An outer shield with round conductors and an adjacent inner shield with flat conductors.

NOTE: If the wire or the cable has two adjacent shields, the shields are prepared as one shield.

(1) Prepare the wire or cable. Refer to Paragraph 4.A.

(2) Remove the necessary length of shield to make the distance from the end of the shield to the end of the jacket equal to 0.25 inch to 0.38 inch. Refer to Figure 143.



LENGTH OF THE SHIELD
Figure 143

(3) Make a selection of an insulation material from Table 19.

Make sure that the material has the correct Temperature Grade.

(4) If the insulation material is a heat shrinkable sleeve:

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(a) Put a length of the sleeve that is 0.5 inch longer than the length of the shield on the wire or cable.

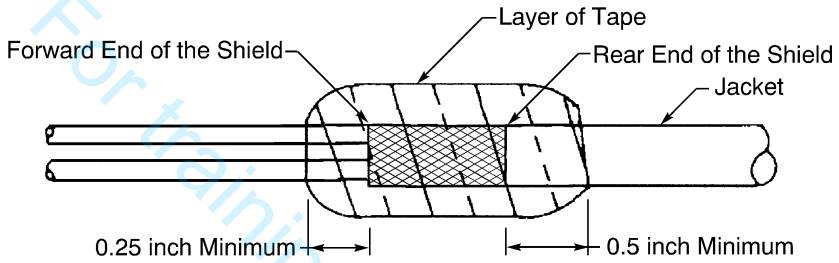
(b) Align the center of the sleeve and the center of the shield.

(c) Shrink the sleeve into its position. Refer to Subject 20-10-14.

(5) If the insulation material is tape, put two layers of tape on the wire or cable. Refer to Figure 144.

Make sure that:

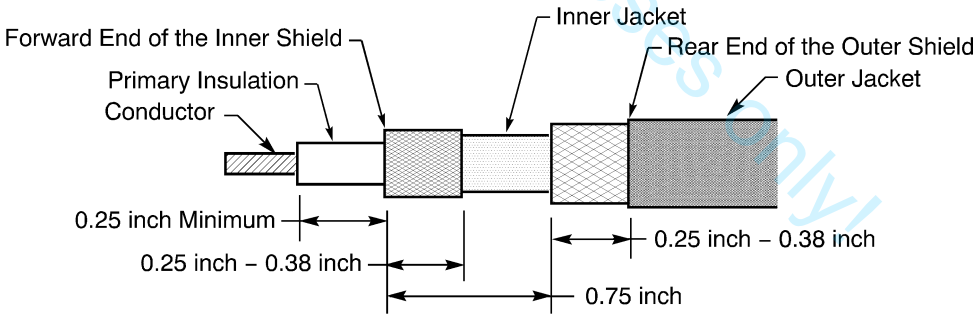
- Each layer of tape makes a 0.25 inch overlap
- The end of each layer is 0.25 inch minimum farther than the forward end of the shield
- The end of each layer is 0.5 inch minimum farther than the rear end of the shield
- The second layer is wound in the opposite direction of the first layer.



POSITION OF THE LAYERS OF TAPE
Figure 144

C. Shield Dead End - Shields Not Adjacent

This paragraph gives the procedure to assemble a shield dead on a wire or cable that has and outer jacket, an outer shield, an inner jacket, and an inner shield.



LENGTH OF THE SHIELDS
Figure 145

Refer to Figure 145.

(1) Remove the necessary length of outer jacket from the end of the wire or cable. Refer to Paragraph 4.A.

(2) Push the end of the outer shield in the direction of the end of the jacket to expand the shield at the end of the jacket.

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(3) Cut the outer shield with scissors or wire cutters to make the length of the shield between 0.25 inch and 0.38 inch.

CAUTION: DO NOT A USE KNIFE TO CUT AGAINST THE INNER JACKET. DAMAGE TO THE JACKET CAN CAUSE UNSATISFACTORY PERFORMANCE OF THE WIRE OR CABLE.

(4) Remove the necessary length of the inner jacket to make the length from the end of the jacket to the end of the outer shield equal to 0.75 inch. Refer to Paragraph 4.A.

(5) Push the end of the inner shield in the direction of the end of the inner jacket to expand the shield at the end of the jacket.

(6) With a pair of scissors or wire cutters, cut the shield where the circumference is largest to make the length of the shield equal to 0.25 inch to 0.38 inch.

CAUTION: DO NOT A USE KNIFE TO CUT AGAINST THE PRIMARY INSULATION. DAMAGE TO THE INSULATION CAN CAUSE UNSATISFACTORY PERFORMANCE OF THE WIRE OR CABLE.

(7) Fold the shield back on the jacket.

Make sure that the length of the shield is between 0.25 inch and 0.38 inch.

NOTE: As an alternative, the strands of the shield can be moved apart and folded back symmetrically against the jacket.

(8) Make a selection of an insulation material from Table 19.

Make sure that the material has the correct Temperature Grade.

(9) If the insulation material is a heat shrinkable sleeve:

(a) Put a length of the sleeve that is 0.5 inch longer than the distance from the forward end of the inner shield to the rear end of the outer shield.

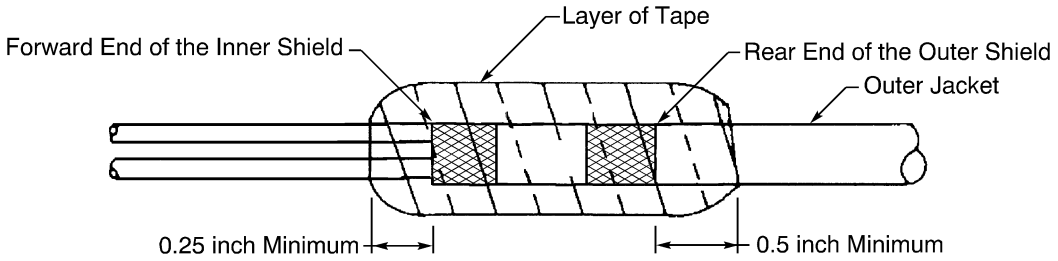
(b) Align the center of the sleeve and the center point between the two shields.

(c) Shrink the sleeve into its position. Refer to Subject 20-10-14.

(10) If the insulation material is tape, put two layers of tape on the wire or cable. Refer to Figure 146.

Make sure that:

- Each layer of tape makes a 0.25 inch overlap
- The end of each layer is 0.25 inch minimum farther than the forward end of the inner shield
- The end of each layer is 0.5 inch minimum farther than the rear end of the outer shield
- The second layer is wound in the opposite direction of the first layer.



POSITION OF THE LAYERS OF TAPE
Figure 146

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14. ASSEMBLY OF A SHIELD EXTENSION

A. Shield Extension - Mechanical Ferrules

This paragraph gives the procedure to assemble a shield extension on a wire or cable that has:

- A shield with round conductors
- An outer shield with round conductors and an adjacent inner shield with round conductors.

CAUTION: THIS PROCEDURE CAUSES DAMAGE TO A SHIELD THAT HAS FLAT CONDUCTORS. DAMAGE TO THE FLAT CONDUCTORS OF A SHIELD CAN CAUSE UNSATISFACTORY PERFORMANCE OF THE CONNECTION OF THE SHIELD TO GROUND.

NOTE: If the wire or the cable has two adjacent shields, the shields are prepared as one shield.

(1) Prepare the wire or cable. Refer to Paragraph 4.A.

(2) Measure the O.D. of the wire or cable.

(3) Make a selection of an inner ferrule from Table 8.

NOTE: The applicable ferrule has an I.D. that is a small amount larger than the O.D. of the wire or cable. Refer to Figure 4.

Make sure that the ferrule has the correct Temperature Grade; refer to Figure 4 and Table 6.

(4) Make a selection of an outer ferrule that is specified for the inner ferrule and 2 or 3 shield ground wires from Table 8.

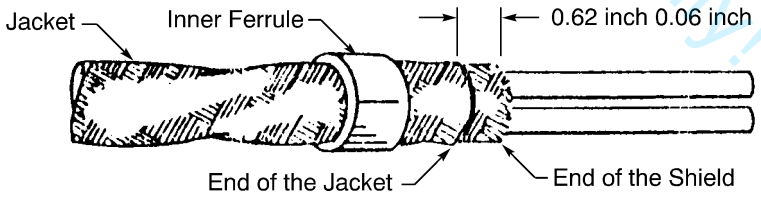
NOTE: In Table 8, more than one outer ferrule can be specified for one inner ferrule. It is possible that shields of different wires and cables have different thicknesses. This can make it necessary to use a smaller or a larger outer ferrule.

Make sure that the ferrule has the correct Temperature Grade; refer to Figure 4 and Table 6.

(5) Put the inner ferrule on the wire or cable.

Make sure that the ferrule is the smallest ferrule that can be moved freely on the jacket of the wire or cable.

(6) Remove the necessary length of the shield to make the distance from the end of the shield to the end of the cable jacket equal to 0.62 inch ±0.06. Refer to Figure 147.



LENGTH OF THE SHIELD
Figure 147

(7) Push the inner ferrule forward until the forward edge of the ferrule is aligned with the end of the jacket. Refer to Figure 148.

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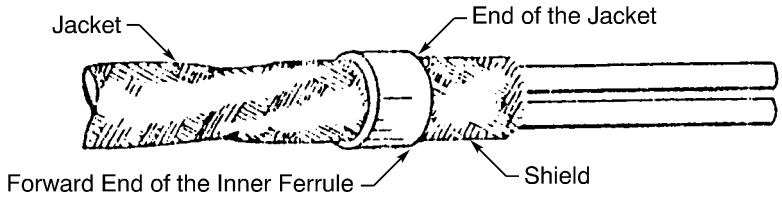
ASSEMBLY OF SHIELD GROUND WIRES

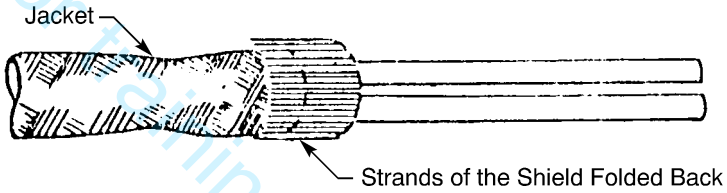


POSITION OF THE INNER FERRULE
Figure 148

(8) Move the stands of the shield apart and make them straight.

(9) Fold the strands of the shield back on the inner ferrule. Refer to Figure 149.

Make sure that the strands of the shield are even and symmetrical around the circumference of the wire or cable.



SHIELD FOLDED BACK
Figure 149

(10) Make a selection of shield material from Table 18.

Make sure that the shield material has the smallest diameter that can be put on the inner ferrule and the strands of the shield.

NOTE: A length of shield from a larger size of the same type of wire or cable is a satisfactory alternative.

NOTE: For other alternative shield materials, refer to Subject 20-00-11.

(11) Cut the necessary length of shield material.

Make sure that the length of the shield material is sufficient:

- To align one end with the rear end of the shield that is folded back
- To assemble a shield dead end or a shield ground wire on the other end in the correct position; refer to Paragraph 1.F.

(12) Put the shield material on the cable. Refer to Figure 150.

Make sure that the rear end of the shield material is aligned with the rear end of the shield that is folded back.

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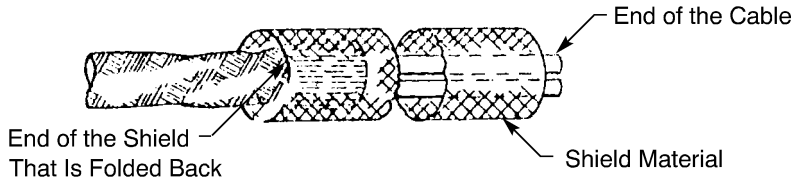
ASSEMBLY OF SHIELD GROUND WIRES

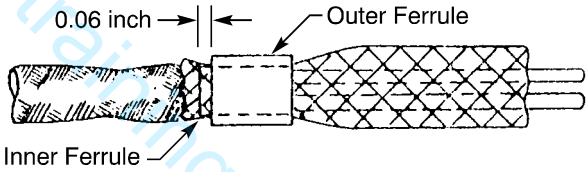


POSITION OF THE SHIELD MATERIAL
Figure 150

(13) Put the outer ferrule on the inner ferrule. Refer to Figure 151.

Make sure that:

- The outer ferrule is the smallest that can be crimped on the inner ferrule and the shield material
- The rear end of the inner ferrule does not extend farther than 0.06 inch from the rear end of the outer ferrule.



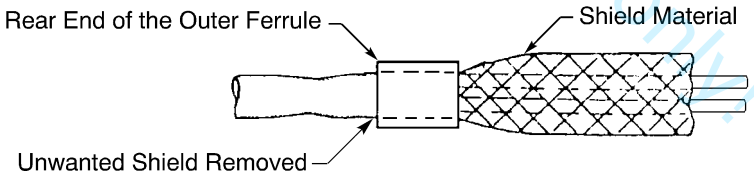
POSITION OF THE OUTER FERRULE
Figure 151

(14) Make a selection of a ferrule crimp tool from Table 24.

(15) Crimp the outer ferrule.

(16) Remove the unwanted length of the shield that extends farther than the rear edge of the outer ferrule. Refer to Figure 152.

NOTE: The outer surface of the inner ferrule can be used to cut against.



REMOVAL OF THE UNWANTED LENGTH OF SHIELD
Figure 152

(17) Make a selection of a heat shrinkable sleeve from Table 19.

Make sure that the sleeve has the smallest diameter that can be moved freely on the outer ferrule and the extension.

(18) Put the necessary length of heat shrinkable sleeve on the shield extension assembly. Refer to Figure 153.

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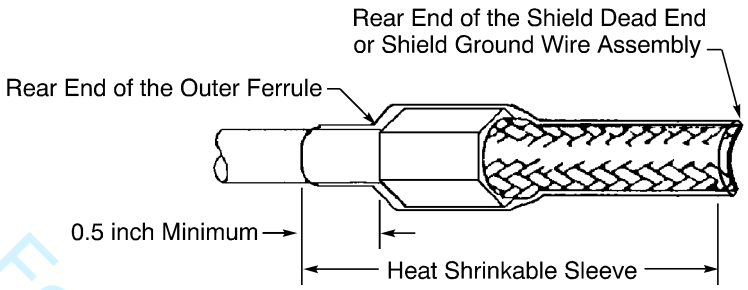
ASSEMBLY OF SHIELD GROUND WIRES

Make sure that the length of the sleeve is sufficient to put:

- The rear end of the sleeve 0.5 inch minimum to the rear of the rear end of the outer ferrule
- The forward end of the sleeve at the location where the rear end of the shield dead end or the shield ground wire assembly must be put.



POSITION OF THE HEAT SHRINKABLE SLEEVE
Figure 153

(19) Shrink the sleeve into its position. Refer to Subject 20-10-14.

B. Shield Extension - RSK Shield-Kon

This paragraph gives the procedure to assemble a shield extension on a wire or cable that has:

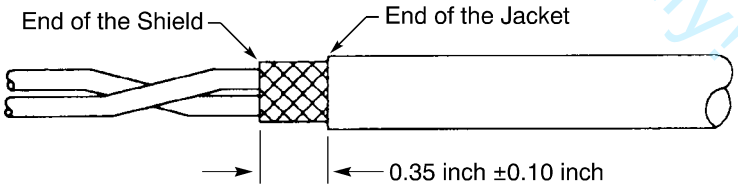
- A shield with round conductors
- An outer shield with round conductors and an adjacent inner shield with round conductors.

CAUTION: THIS PROCEDURE CAUSES DAMAGE TO A SHIELD THAT HAS FLAT CONDUCTORS. DAMAGE TO THE FLAT CONDUCTORS OF A SHIELD CAN CAUSE UNSATISFACTORY PERFORMANCE OF THE CONNECTION OF THE SHIELD TO GROUND.

NOTE: If the wire or the cable has two adjacent shields, the shields are prepared as one shield.

(1) Prepare the wire or cable. Refer to Paragraph 4.A.

(2) Remove the necessary length of the shield from the end of the wire or cable to make the length of the shield equal to 0.35 inch ±0.10 inch. Refer to Figure 154.



LENGTH OF THE SHIELD
Figure 154

(3) Fold the shield back on the jacket of the wire or cable.

Make sure that the shield is even and symmetrical around the circumference of the wire or cable.

(4) Make a selection of a shield material from Table 18.

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Make sure that the shield material has:

- The correct Temperature Grade
- The smallest diameter that can be put on the shield and the jacket of the wire or cable.

NOTE: A length of shield from a larger size of the same type of wire or cable is a satisfactory alternative.

NOTE: For other alternative shield materials, refer to Subject 20-00-11.

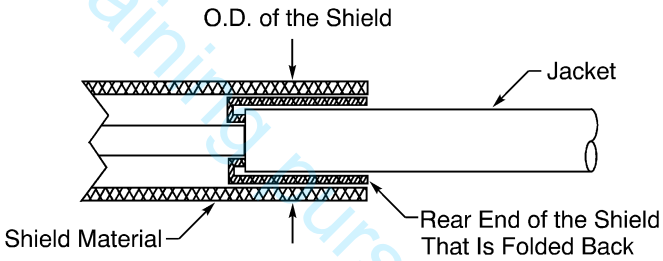
(5) Cut the necessary length of shield material.

Make sure that the length of the shield material is sufficient:

- To align one end with the rear end of the shield that is folded back
- To assemble a shield dead end or a shield ground wire on the other end in the correct position; refer to Paragraph 1.F.

(6) Put the shield material on the cable. Refer to Figure 155.

Make sure that the rear end of the shield material is aligned with the rear end of the shield that is folded back.



POSITION OF THE SHIELD MATERIAL
Figure 155

(7) Make a selection of an RSK Shield-Kon from Table 9.

Refer to Figure 155 for the applicable dimensions of the shield extension assembly.

(8) Make a selection of an RSK Shield-Kon crimp tool from Table 25.

(9) Put the Shield-Kon into the jaws of the upper and lower dies of the crimp tool. Refer to Figure 156.

Make sure that:

- The shield ground wire clip is pointed up
- The center of the Shield-Kon is aligned with the center of the die.

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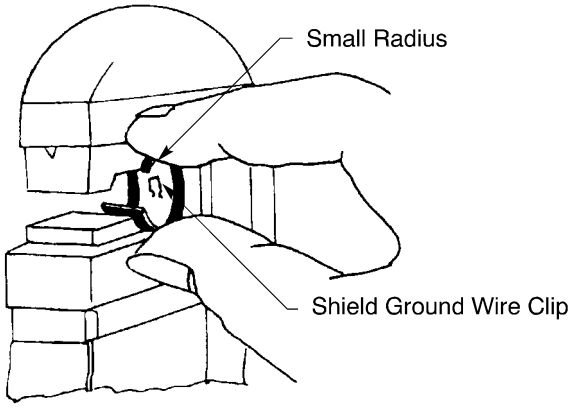
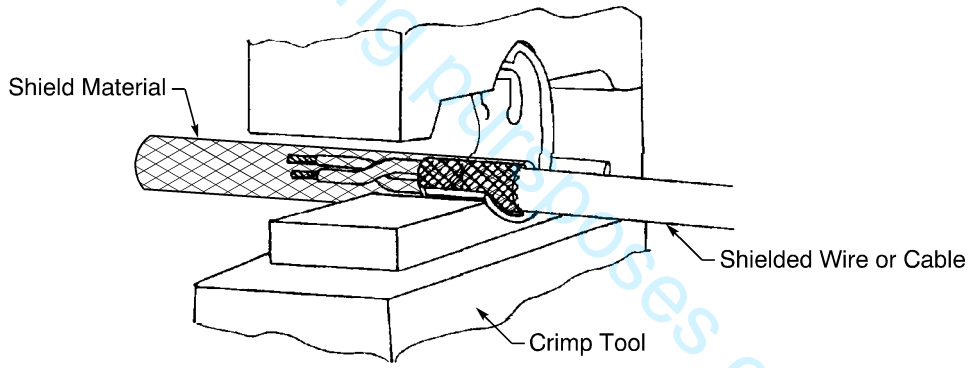


POSITION OF THE SHIELD-KON IN THE CRIMP TOOL
Figure 156

(10) Put the wire or cable and the shield material in the bottom of the Shield-Kon. Refer to Figure 157.
Make sure that the rear end of the Shield-Kon is aligned with the rear end of the shield material.



POSITION OF THE WIRE OR CABLE AND THE SHIELD MATERIAL
Figure 157

(11) Crimp the Shield-Kon.

(12) Make a selection of a heat shrinkable sleeve from Table 19.
Make sure that the sleeve has:
- The correct Temperature Grade
- The smallest diameter that can be moved freely on the Shield-Kon and the extension.

(13) Put the necessary length of heat shrinkable sleeve on the shield extension assembly. Refer to Figure 158.
Make sure that the length of the sleeve is sufficient to put:
- The rear end of the sleeve 0.5 inch minimum to the rear of the rear end of the Shield-Kon
- The forward end of the sleeve at the location where the rear end of the shield dead end or the shield ground wire assembly must be put.

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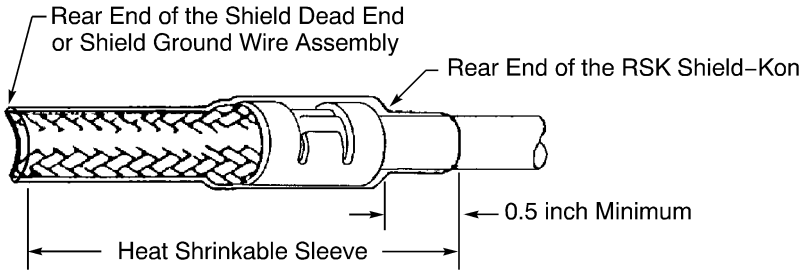
ASSEMBLY OF SHIELD GROUND WIRES



POSITION OF THE HEAT SHRINKABLE SLEEVE
Figure 158

(14) Shrink the sleeve into its position. Refer to Subject 20-10-14.

C. Shield Extension - Solder Sleeve, Shield Folded Back

This paragraph gives the procedure to assemble a shield extension on a wire or cable that has:

- A shield with round conductors
- An outer shield with round conductors and an adjacent inner shield with round conductors.

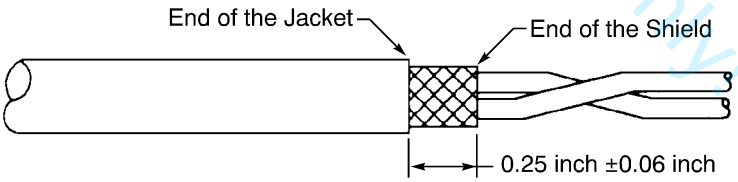
CAUTION: A SHIELD EXTENSION ASSEMBLY WITH A SOLDER SLEEVE IS NOT APPLICABLE FOR A WIRE OR A CABLE THAT HAS A SHIELD WITH NICKEL PLATED CONDUCTORS. THE SOLDER SLEEVE CAN CAUSE UNSATISFACTORY PERFORMANCE OF THE CONNECTION OF THE SHIELD TO GROUND.

CAUTION: THIS PROCEDURE CAUSES DAMAGE TO A SHIELD THAT HAS FLAT CONDUCTORS. DAMAGE TO THE FLAT CONDUCTORS OF A SHIELD CAN CAUSE UNSATISFACTORY PERFORMANCE OF THE CONNECTION OF THE SHIELD TO GROUND.

NOTE: If the wire or the cable has two adjacent shields, the shields are prepared as one shield.

(1) Prepare the wire or cable. Refer to Paragraph 4.A.

(2) Remove the necessary length of shield from the wire or cable to make the length of the shield equal to 0.25 inch ±0.06 inch. Refer to Figure 159.



LENGTH OF THE SHIELD
Figure 159

(3) Fold the shield back on the jacket of the wire or cable.

Make sure that the shield is even and symmetrical around the circumference of the wire or cable.

(4) Make a selection of a shield material from Table 18.

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Make sure that the shield material has:

- The correct Temperature Grade
- The smallest diameter that can be put on the shield and the jacket of the wire or cable.

NOTE: A length of shield from a larger size of the same type of wire or cable is a satisfactory alternative.

NOTE: For other alternative shield materials, refer to Subject 20-00-11.

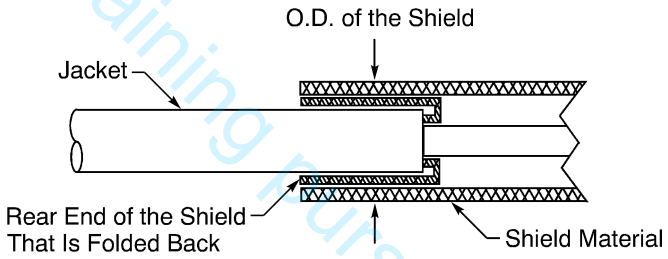
(5) Cut the necessary length of shield material.

Make sure that the length of the shield material is sufficient:

- To align one end with the rear end of the shield that is folded back
- To assemble a shield dead end or a shield ground wire on the other end in the correct position; refer to Paragraph 1.F.

(6) Put the shield material on the wire or cable. Refer to Figure 160.

Make sure that the rear end of the shield material is aligned with the rear end of the shield that is folded back.



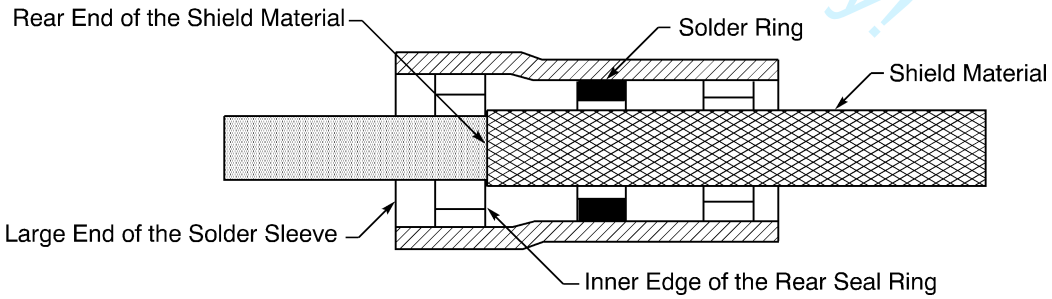
POSITION OF THE SHIELD MATERIAL
Figure 160

(7) Make a selection of a solder sleeve from Table 11.

Refer to Figure 160 for the applicable dimensions of the shield extension assembly.

(8) Put the solder sleeve on the wire or cable. Refer to Figure 161.

Make sure that the inner edge of the rear seal ring is aligned with the rear end of the shield material.



POSITION OF THE SOLDER SLEEVE
Figure 161

(9) Shrink the solder sleeve into its position. Refer to Subject 20-10-14.

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Make sure that:

- The solder sleeve stays in the correct position
- A minimum of 75 percent of the indicator ring on top of the solder ring is melted.

(10) Make a selection of a heat shrinkable sleeve from Table 19.

Make sure that the sleeve has:

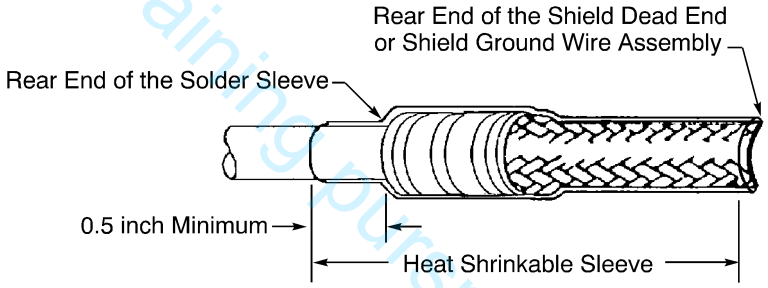
- The correct Temperature Grade
- The smallest diameter that can be moved freely on the solder sleeve and the extension.

NOTE: For alternative heat shrinkable sleeves, refer to Subject 20-00-11.

(11) Put the necessary length of heat shrinkable sleeve on the shield extension assembly. Refer to Figure 162.

Make sure that the length of the sleeve is sufficient to put:

- The rear end of the sleeve 0.5 inch minimum to the rear of the rear end of the solder sleeve
- The forward end of the sleeve at the location where the rear end of the shield dead end or the shield ground wire assembly must be put.



POSITION OF THE HEAT SHRINKABLE SLEEVE
Figure 162

(12) Shrink the sleeve into its position. Refer to Subject 20-10-14.

D. Shield Extension - Solder Sleeve, Shield Not Folded Back

This paragraph gives the procedure to assemble a shield extension on a wire or cable that has:

- A shield with round conductors
- A shield with flat conductors
- An outer shield with round conductors and an adjacent inner shield with round conductors
- An outer shield with round conductors and an adjacent inner shield with flat conductors.

CAUTION: A SHIELD EXTENSION ASSEMBLY WITH A SOLDER SLEEVE IS NOT APPLICABLE FOR A WIRE OR A CABLE THAT HAS A SHIELD WITH NICKEL PLATED CONDUCTORS. THE SOLDER SLEEVE CAN CAUSE UNSATISFACTORY PERFORMANCE OF THE CONNECTION OF THE SHIELD TO GROUND.

NOTE: If the wire or the cable has two adjacent shields, the shields are prepared as one shield.

(1) Prepare the wire or cable. Refer to Paragraph 4.A.

(2) Remove the necessary length of shield from the wire or cable to make the length of the shield equal to 0.25 inch ±0.06 inch. Refer to Figure 163.

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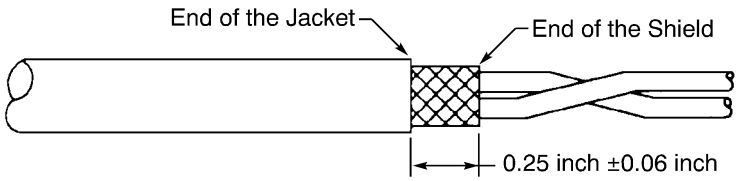
ASSEMBLY OF SHIELD GROUND WIRES



LENGTH OF THE SHIELD
Figure 163

(3) Make a selection of a shield material from Table 18.

Make sure that the shield material has:

- The correct Temperature Grade
- The smallest diameter that can be put on the shield of the wire or cable.

NOTE: For alternative shield materials, refer to Subject 20-00-11.

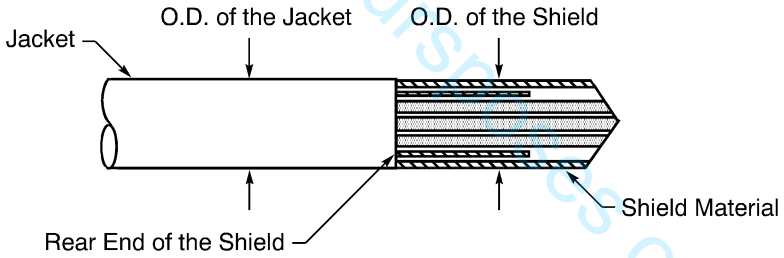
(4) Cut the necessary length of shield material.

Make sure that the length of the shield material is sufficient:

- To align one end with the rear end of the shield
- To assemble a shield dead end or a shield ground wire on the other end in the correct position; refer to Paragraph 1.F.

(5) Put the shield material on the wire or cable. Refer to Figure 164.

Make sure that the rear end of the shield material is aligned with the rear end of the shield.



POSITION OF THE SHIELD MATERIAL
Figure 164

(6) Make a selection of a solder sleeve from Table 11.

Refer to Figure 164 for the applicable dimensions of the shield extension assembly.

(7) Put the solder sleeve on the wire or cable. Refer to Figure 165.

Make sure that the inner edge of the rear seal ring is aligned with the end of the jacket.

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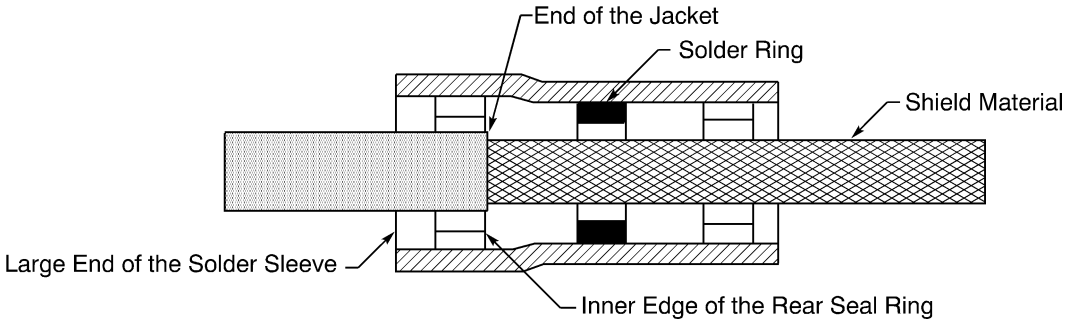
ASSEMBLY OF SHIELD GROUND WIRES



POSITION OF THE SOLDER SLEEVE
Figure 165

(8) Shrink the solder sleeve into its position. Refer to Subject 20-10-14.

Make sure that:

- The solder sleeve stays in the correct position
- A minimum of 75 percent of the indicator ring on top of the solder ring is melted.

(9) Make a selection of a heat shrinkable sleeve from Table 19.

Make sure that the sleeve has:

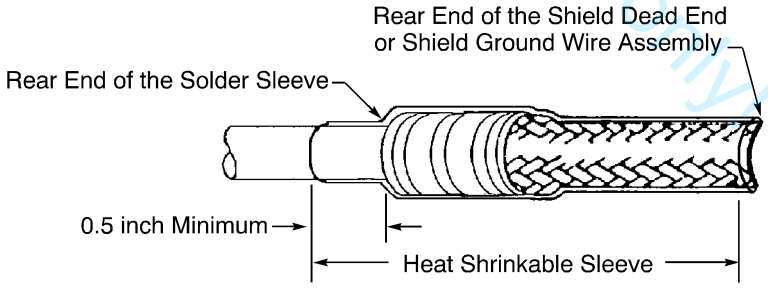
- The correct Temperature Grade
- The smallest diameter that can be moved freely on the solder sleeve and the extension.

NOTE: For alternative heat shrinkable sleeves, refer to Subject 20-00-11.

(10) Put the necessary length of heat shrinkable sleeve on the shield extension assembly. Refer to Figure 166.

Make sure that the length of the sleeve is sufficient to put:

- The rear end of the sleeve 0.5 inch minimum to the rear of the rear end of the solder sleeve
- The forward end of the sleeve at the location where the rear end of the shield dead end or the shield ground wire assembly must be put.



POSITION OF THE HEAT SHRINKABLE SLEEVE
Figure 166

(11) Shrink the sleeve into its position. Refer to Subject 20-10-14.

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15. CRIMP TOOLS

A. Mechanical Ferrule Crimp Tools

Table 24
MECHANICAL FERRULE CRIMP TOOLS

Outer Ferrule	Crimp Tool			
	Basic Unit	Die		
		Part Number	Cavity	Dimension (inch)
BACS13S101C	44-000	44-136	B	0.105
	612648	612734	-	
	613214	613812	-	
	620175	620304	B	
	HX4	Y136	B	
	M22520/5-01	M22520/5-33	B	
	ST2966M	-	-	
	ST965-19	-	-	
	ST965A-19	-	-	
	ST965B	ST965B-19	-	
	WT219	-	-	
	WT419	-	-	
	WT440	4419	-	
BACS13S128C	44-000	44-137	B	0.128
	612648	612778	-	
	613214	613848	-	
	620175	620305	B	
	HX4	Y137	B	
	M22520/5-01	M22520/5-35	B	
	ST2966M	-	1	
	ST965-5	-	-	
	ST965A-0	-	-	
	ST965B	ST965B-0	-	
	WT200	-	-	
	WT200-12	-	S	
	WT400	-	-	
	WT440	4400	-	

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Table 24 (continued)

Outer Ferrule	Crimp Tool			
	Basic Unit	Die		
		Part Number	Cavity	Dimension (inch)
BACS13S149C	44-000	44-138	B	0.151
	612648	612981	-	
	612648	613844	S	
	613214	613003	-	
	620175	620306	B	
	HX4	Y138	B	
	M22520/5-01	M22520/5-37	B	
	ST2966M	-	2	
	ST965-4	-	S	
	ST965A-1	-	-	
	ST965B	ST965B-1	-	
	WT201	-	-	
	WT201-03-10	-	S	
	WT401	-	-	
	WT440	4401	-	
BACS13S156C	44-000	44-139	B	0.160
	612648	612661	-	
	612648	613844	L	
	613214	613847	-	
	620175	620307	B	
	HX4	Y139	B	
	M22520/5-01	M22520/5-39	B	
	ST2966M	-	3	
	ST965-1	-	S	
	ST965A-2	-	-	
	ST965B	ST965B-2	-	
	WT202	-	-	
	WT202-06-08	-	S	
	WT402	-	-	
	WT440	4402	-	

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Table 24 (continued)

Outer Ferrule	Crimp Tool			
	Basic Unit	Die		
		Part Number	Cavity	Dimension (inch)
BACS13S175C	44-000	44-140	B	0.178
	612648	612663	S	
	612648	612742	-	
	613214	613849	-	
	620175	620308	B	
	HX4	Y140	B	
	M22520/5-01	M22520/5-41	B	
	ST2966M	-	4	
	ST965-4	-	M	
	ST965A-3	-	-	
	ST965B	ST965B-3	-	
	WT201-03-10	-	M	
	WT203	-	-	
	WT403	-	-	
	WT440	4403	-	
BACS13S187C	44-000	44-141	B	0.197
	612648	612746	-	
	612648	620467	S	
	613214	613810	-	
	620175	620309	B	
	HX4	Y141	B	
	M22520/5-01	M22520/5-43	B	
	ST2966M	-	5	
	ST965-1	-	M	
	ST965A-6	-	-	
	ST965B	ST965B-6	-	
	WT202-06-08	-	M	
	WT206	-	-	
	WT406	-	-	
	WT440	4406	-	

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Table 24 (continued)

Outer Ferrule	Crimp Tool			
	Basic Unit	Die		
		Part Number	Cavity	Dimension (inch)
BACS13S194C	44-000	44-141	B	0.197
	612648	612746	-	
	612648	620467	S	
	613214	613810	-	
	620175	620309	B	
	HX4	Y141	B	
	M22520/5-01	M22520/5-43	B	
	ST2966M	-	5	
	ST965-1	-	M	
	ST965A-6	-	-	
	ST965B	ST965B-6	-	
	WT202-06-08	-	M	
	WT206	-	-	
	WT406	-	-	
	WT440	4406	-	
BACS13S199C	44-000	44-141	B	0.197
	612648	612746	-	
	612648	620467	S	
	613214	613810	-	
	620175	620309	B	
	HX4	Y141	B	
	M22520/5-01	M22520/5-43	B	
	ST2966M	-	5	
	ST965-1	-	M	
	ST965A-6	-	-	
	ST965B	ST965B-6	-	
	WT202-06-08	-	M	
	WT206	-	-	
	WT406	-	-	
	WT440	4406	-	

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Table 24 (continued)

Outer Ferrule	Crimp Tool			
	Basic Unit	Die		
		Part Number	Cavity	Dimension (inch)
BACS13S205C	44-000	44-142	B	0.213
	612648	612763	-	
	612648	620467	L	
	613214	613851	-	
	620175	620299	B	
	HX4	Y142	B	
	M22520/5-01	M22520/5-19	B	
	ST2966M	-	6	
	ST965-1	-	L	
	ST965A-8	-	-	
	ST965B	ST965B-8	-	
	WT202-06-08	-	L	
	WT208	-	-	
	WT408	-	-	
	WT440	4408	-	
BACS13S219C	44-000	44-142	B	0.213
	612648	612763	-	
	612648	620467	L	
	613214	613851	-	
	620175	620299	B	
	HX4	Y142	B	
	M22520/5-01	M22520/5-19	B	
	ST2966M	-	6	
	ST965-1	-	L	
	ST965A-8	-	-	
	ST965B	ST965B-8	-	
	WT202-06-08	-	L	
	WT208	-	-	
	WT408	-	-	
	WT440	4408	-	

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Table 24 (continued)

Outer Ferrule	Crimp Tool			
	Basic Unit	Die		
		Part Number	Cavity	Dimension (inch)
BACS13S225C	44-000	44-143	B	0.218
	612648	612971	-	
	613214	613005	-	
	620175	620310	B	
	HX4	Y143	B	
	M22520/5-01	M22520/5-45	B	
	ST2966M	-	-	
	ST965-9	-	-	
	ST965A-9	-	-	
	ST965B	ST965B-9	-	
	WT209	-	-	
	WT409	-	-	
	WT440	4409	-	
BACS13S232C	44-000	44-143	A	0.231
	612648	612663	L	
	612648	612675	S	
	612648	612748	-	
	613214	613846	-	
	620175	620310	A	
	HX4	Y143	A	
	M22520/5-01	M22520/5-45	A	
	ST2966M	-	7	
	ST965-4	-	L	
	ST965A-10	-	-	
	ST965B	ST965B-10	-	
	WT201-03-10	-	L	
	WT210	-	-	
	WT410	-	-	
	WT440	4410	-	

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Table 24 (continued)

Outer Ferrule	Crimp Tool			
	Basic Unit	Die		
		Part Number	Cavity	Dimension (inch)
BACS13S261C	44-000	44-142	A	0.255
	612648	612675	L	
	612648	612766	-	
	613214	613850	-	
	620175	620299	A	
	HX4	Y142	A	
	M22520/5-01	M22520/5-19	A	
	ST2966M	-	8	
	ST965-2	-	S	
	ST965A-11	-	-	
	ST965B	ST965B-11	-	
	WT211	-	-	
	WT211-14	-	S	
	WT411	-	-	
	WT440	4411	-	
BACS13S275C	44-000	44-141	A	0.268
	612648	612776	-	
	613214	613009	-	
	620175	620309	A	
	HX4	Y141	A	
	M22520/5-01	M22520/5-43	A	
	ST2966M	-	9	
	ST965-12	-	-	
	ST965A-12	-	-	
	ST965B	ST965B-12	-	
	WT200-12	-	L	
	WT212	-	-	
	WT412	-	-	
	WT440	4412	-	

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Table 24 (continued)

Outer Ferrule	Crimp Tool			
	Basic Unit	Die		
		Part Number	Cavity	Dimension (inch)
BACS13S281C	44-000	44-140	A	0.290
	612648	612893	-	
	613214	613011	-	
	620175	620308	A	
	HX4	Y140	A	
	M22520/5-01	M22520/5-41	A	
	ST2966M	-	10	
	ST965-2	-	L	
	ST965A-14	-	-	
	ST965B	ST965B-14	-	
	WT211-14	-	L	
	WT214	-	-	
	WT414	-	-	
	WT440	4414	-	
BACS13S287C	44-000	44-140	A	0.290
	612648	612893	-	
	613214	613011	-	
	620175	620308	A	
	HX4	Y140	A	
	M22520/5-01	M22520/5-41	A	
	ST2966M	-	10	
	ST965-2	-	L	
	ST965A-14	-	-	
	ST965B	ST965B-14	-	
	WT211-14	-	L	
	WT214	-	-	
	WT414	-	-	
	WT440	4414	-	

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Table 24 (continued)

Outer Ferrule	Crimp Tool			
	Basic Unit	Die		
		Part Number	Cavity	Dimension (inch)
BACS13S297C	44-000	44-140	A	0.290
	612648	612893	-	
	613214	613011	-	
	620175	620308	A	
	HX4	Y140	A	
	M22520/5-01	M22520/5-41	A	
	ST2966M	-	10	
	ST965-2	-	L	
	ST965A-14	-	-	
	ST965B	ST965B-14	-	
	WT211-14	-	L	
	WT214	-	-	
	WT414	-	-	
	WT440	4414	-	
BACS13S312C	44-000	44-139	A	0.309
	612648	612973	-	
	613214	613013	-	
	620175	620307	A	
	HX4	Y139	A	
	M22520/5-01	M22520/5-39	A	
	ST2966M	-	11	
	ST965-6	-	S	
	ST965A-15	-	-	
	ST965B	ST965B-15	-	
	WT215	-	-	
	WT215-16	-	S	
	WT415	-	-	
	WT440	4415	-	

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Table 24 (continued)

Outer Ferrule	Crimp Tool			
	Basic Unit	Die		
		Part Number	Cavity	Dimension (inch)
BACS13S327C	44-000	44-138	A	0.314
	612648	612899	-	
	620175	620306	A	
	HX4	Y138	A	
	M22520/5-01	M22520/5-37	A	
	ST2966M	-	-	
	ST965A-16	-	-	
	ST965B	ST965B-16	-	
	WT215-16	-	L	
	WT216	-	-	
	WT416	-	-	
	WT440	4416	-	
BACS13S348C	44-000	44-137	A	0.324
	612648	612989	-	
	620175	620305	A	
	HX4	Y137	A	
	M22520/5-01	M22520/5-35	A	
	ST2966M	-	12	
	ST965-3	-	S	
	ST965A-17	-	-	
	ST965B	ST965B-17	-	
	WT217	-	-	
	WT217-18	-	S	
	WT417	-	-	
	WT440	4417	-	

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Table 24 (continued)

Outer Ferrule	Crimp Tool			
	Basic Unit	Die		
		Part Number	Cavity	Dimension (inch)
BACS13S359C	44-000	44-136	A	0.343
	612648	612992	-	
	620175	620304	A	
	HX4	Y136	A	
	M22520/5-01	M22520/5-33	A	
	WT221	-	-	
	WT221-22	-	S	
	WT540	5450	-	
BACS13S375C	44-000	44-144	-	0.359
	612648	612969	-	
	620175	620311	-	
	HX4	Y144	-	
	M22520/5-01	M22520/5-47	-	
	WT221-22	-	L	
	WT222	-	-	
	WT540	5451	-	
BACS13S405C	44-000	44-145	-	0.384
	612648	612739	-	
	620175	620301	-	
	HX4	Y145	-	
	M22520/5-01	M22520/5-23	-	
	ST2966M	-	13	
	ST965-3	-	L	
	WT217-18	-	L	
	WT218	-	-	
	WT540	5452	-	

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Table 24 (continued)

Outer Ferrule	Crimp Tool			
	Basic Unit	Die		
		Part Number	Cavity	Dimension (inch)
BACS13S415C	44-000	44-145	-	0.384
	612648	612739	-	
	620175	620301	-	
	HX4	Y145	-	
	M22520/5-01	M22520/5-23	-	
	ST2966M	-	13	
	ST965-3	-	L	
	WT217-18	-	L	
	WT218	-	-	
	WT540	5452	-	
BACS13S425C	44-000	44-178	-	0.429
	612648	612807	-	
	620175	620316	-	
	HX4	Y178	-	
	M22520/5-01	M22520/5-61	-	
	ST2966M	-	16	
	ST965-29	-	-	
	WT229	-	-	
	WT540	5454	-	
BACS13S460C	44-000	44-148	-	0.454
	612648	612909	-	
	620175	620314	-	
	HX4	Y148	-	
	M22520/5-01	M22520/5-53	-	
	ST2966M	-	14	
	ST965-6	-	L	
	WT215-20	-	L	
	WT220	-	-	
	WT540	5456	-	

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Table 24 (continued)

Outer Ferrule	Crimp Tool			
	Basic Unit	Die		
		Part Number	Cavity	Dimension (inch)
BACS13S500C	44-000	44-149	-	0.475
	612648	612977	-	
	620175	620300	-	
	HX4	Y149	-	
	M22520/5-01	M22520/5-21	-	
	ST2966M	-	15	
	ST965-23	-	-	
	WT223	-	-	
	WT540	5457	-	

B. RSK Shield-Kon Crimp Tools

Table 25
RSK SHIELD-KON CRIMP TOOLS

RSK Shield-Kon	Shield Diameter (inch)		Crimp Tool	
	Minimum	Maximum	Basic Unit	Die Set
RSK101	0.050	0.070	13300	101A
			WT740	101A
	0.070	0.090	13300	101B
			WT740	101B
RSK201	0.090	0.100	13300	201C
			WT740	201C
	0.100	0.118	13300	201D
			WT740	201D
	0.119	0.131	13300	201E
			WT740	201E
	0.132	0.143	13300	201F
			WT740	201F

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Table 25 (continued)

RSK Shield-Kon	Shield Diameter (inch)		Crimp Tool	
	Minimum	Maximum	Basic Unit	Die Set
RSK301	0.143	0.185	13300	301H
			WT740	301H
	0.144	0.162	13300	301G
			WT740	301G
	0.186	0.201	13300	301J
			WT740	301J
RSK401	0.200	0.230	13300	401K
			WT740	401K
	0.231	0.250	13300	401L
			WT740	401L
	0.251	0.275	13300	401M
			WT740	401M
	0.276	0.300	13300	401N
			WT740	401N
SK501HT	0.301	0.325	HX4	501P
			M22520/5-01	501P
SK601HT	0.401	0.425	HX4	601Q
			M22520/5-01	601Q

NOTE: SK501HT and SK601HT are no longer manufactured.

16. APPROVED TOOL SUPPLIERS

A. Mechanical Ferrule Crimp Tools

Table 26
MECHANICAL FERRULE CRIMP TOOL SUPPLIERS

Crimp Tool	Supplier
44-000	Balmar
44-136	Balmar
44-137	Balmar
44-138	Balmar
44-139	Balmar
44-140	Balmar
44-141	Balmar

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Table 26 (continued)

Crimp Tool	Supplier
44-142	Balmar
44-143	Balmar
44-144	Balmar
44-145	Balmar
44-148	Balmar
44-149	Balmar
44-178	Balmar
4400	Thomas & Betts
4401	Thomas & Betts
4402	Thomas & Betts
4403	Thomas & Betts
4406	Thomas & Betts
4408	Thomas & Betts
4409	Thomas & Betts
4410	Thomas & Betts
4411	Thomas & Betts
4412	Thomas & Betts
4414	Thomas & Betts
4415	Thomas & Betts
4416	Thomas & Betts
4417	Thomas & Betts
4419	Thomas & Betts
5450	Thomas & Betts
5451	Thomas & Betts
5452	Thomas & Betts
5454	Thomas & Betts
5456	Thomas & Betts
5457	Thomas & Betts
612648	Buchanan
612661	Buchanan
612663	Buchanan
612675	Buchanan
612734	Buchanan

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Table 26 (continued)

Crimp Tool	Supplier
612739	Buchanan
612742	Buchanan
612746	Buchanan
612748	Buchanan
612763	Buchanan
612766	Buchanan
612776	Buchanan
612778	Buchanan
612807	Buchanan
612893	Buchanan
612899	Buchanan
612909	Buchanan
612969	Buchanan
612971	Buchanan
612973	Buchanan
612977	Buchanan
612981	Buchanan
612989	Buchanan
612992	Buchanan
613003	Buchanan
613005	Buchanan
613009	Buchanan
613011	Buchanan
613013	Buchanan
613214	Buchanan
613810	Buchanan
613812	Buchanan
613844	Buchanan
613846	Buchanan
613847	Buchanan
613848	Buchanan
613849	Buchanan
613850	Buchanan

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Table 26 (continued)

Crimp Tool	Supplier
613851	Buchanan
620175	Buchanan
620299	Buchanan
620300	Buchanan
620301	Buchanan
620304	Buchanan
620305	Buchanan
620306	Buchanan
620307	Buchanan
620308	Buchanan
620309	Buchanan
620310	Buchanan
620311	Buchanan
620314	Buchanan
620316	Buchanan
620467	Buchanan
HX4	Daniels
M22520/5-01	QPL
M22520/5-19	QPL
M22520/5-21	QPL
M22520/5-23	QPL
M22520/5-33	QPL
M22520/5-35	QPL
M22520/5-37	QPL
M22520/5-39	QPL
M22520/5-41	QPL
M22520/5-43	QPL
M22520/5-45	QPL
M22520/5-47	QPL
M22520/5-53	QPL
M22520/5-61	QPL
ST2966M	Boeing
ST965-1	Boeing

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Table 26 (continued)

Crimp Tool	Supplier
ST965-2	Boeing
ST965-3	Boeing
ST965-4	Boeing
ST965-5	Boeing
ST965-6	Boeing
ST965-9	Boeing
ST965-12	Boeing
ST965-19	Boeing
ST965-23	Boeing
ST965-29	Boeing
ST965A-0	Boeing
ST965A-1	Boeing
ST965A-2	Boeing
ST965A-3	Boeing
ST965A-6	Boeing
ST965A-8	Boeing
ST965A-9	Boeing
ST965A-10	Boeing
ST965A-11	Boeing
ST965A-12	Boeing
ST965A-14	Boeing
ST965A-15	Boeing
ST965A-16	Boeing
ST965A-17	Boeing
ST965A-19	Boeing
ST965B	Boeing
ST965B-0	Boeing
ST965B-1	Boeing
ST965B-2	Boeing
ST965B-3	Boeing
ST965B-6	Boeing
ST965B-8	Boeing
ST965B-9	Boeing

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Table 26 (continued)

Crimp Tool	Supplier
ST965B-10	Boeing
ST965B-11	Boeing
ST965B-12	Boeing
ST965B-14	Boeing
ST965B-15	Boeing
ST965B-16	Boeing
ST965B-17	Boeing
ST965B-19	Boeing
WT200	Thomas & Betts
WT200-12	Thomas & Betts
WT201	Thomas & Betts
WT201-03-10	Thomas & Betts
WT202	Thomas & Betts
WT202-06-08	Thomas & Betts
WT203	Thomas & Betts
WT206	Thomas & Betts
WT208	Thomas & Betts
WT209	Thomas & Betts
WT210	Thomas & Betts
WT211	Thomas & Betts
WT211-14	Thomas & Betts
WT212	Thomas & Betts
WT214	Thomas & Betts
WT215	Thomas & Betts
WT215-16	Thomas & Betts
WT215-20	Thomas & Betts
WT216	Thomas & Betts
WT217	Thomas & Betts
WT217-18	Thomas & Betts
WT218	Thomas & Betts
WT219	Thomas & Betts
WT220	Thomas & Betts
WT221	Thomas & Betts

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Table 26 (continued)

Crimp Tool	Supplier
WT221-22	Thomas & Betts
WT222	Thomas & Betts
WT223	Thomas & Betts
WT229	Thomas & Betts
WT400	Thomas & Betts
WT401	Thomas & Betts
WT402	Thomas & Betts
WT403	Thomas & Betts
WT406	Thomas & Betts
WT408	Thomas & Betts
WT409	Thomas & Betts
WT410	Thomas & Betts
WT411	Thomas & Betts
WT412	Thomas & Betts
WT414	Thomas & Betts
WT415	Thomas & Betts
WT416	Thomas & Betts
WT417	Thomas & Betts
WT419	Thomas & Betts
WT440	Thomas & Betts
WT540	Thomas & Betts
Y136	Daniels
Y137	Daniels
Y138	Daniels
Y139	Daniels
Y140	Daniels
Y141	Daniels
Y142	Daniels
Y143	Daniels
Y144	Daniels
Y145	Daniels
Y148	Daniels
Y149	Daniels

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Table 26 (continued)

Crimp Tool	Supplier
Y178	Daniels

B. RSK Shield-Kon Crimp Tools

Table 27
RSK SHIELD-KON CRIMP TOOL SUPPLIERS

Crimp Tool	Supplier
101A	Thomas & Betts
101B	Thomas & Betts
13300	Thomas & Betts
201C	Thomas & Betts
201D	Thomas & Betts
201E	Thomas & Betts
201F	Thomas & Betts
301H	Thomas & Betts
301G	Thomas & Betts
301H	Thomas & Betts
301J	Thomas & Betts
401K	Thomas & Betts
401L	Thomas & Betts
401M	Thomas & Betts
401N	Thomas & Betts
501P	Thomas & Betts
601Q	Thomas & Betts
HX4	Daniels
M22520/5-01	QPL
WT740	Thomas & Betts

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ASSEMBLY OF MOLDED TEE FITTINGS AND HEAT SHRINKABLE BOOTS

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ASSEMBLY OF MOLDED TEE FITTINGS AND HEAT SHRINKABLE BOOTS

1. PART NUMBERS AND DESCRIPTION

A. Molded Tee Fitting Part Numbers

Table 1
MOLDED TEE FITTING PART NUMBERS

Part Number	Supplier
301A022	Raychem

B. Heat Shrinkable Boot Part Numbers

Table 2
HEAT SHRINKABLE BOOT PART NUMBERS

Part Number	Description	Supplier
202A()-3-00	Straight Boot	Raychem
202K132-25-0	Straight Boot	Raychem
202K132-25/255-0	Straight Boot	Raychem
222A()-3-00	90 Degree Boot	Raychem

C. Convoluted Teflon Tube Part Numbers

Table 3
CONVOLUTED TEFLON TUBE PART NUMBERS

Inner Diameter (inch)	Part Number	Supplier
3/16	CFT-06-0-00	Icore
3/16	C10000-012	Simmonds Precision
9/32	CFT-09-0-00	Icore

Table 4
ALTERNATIVE CONVOLUTED TEFLON TUBE PART NUMBERS

Specified Part Number	Alternative Part Number
CFT-06-0-00	ZCT TS-012
CFT-09-0-00	ZCT TS-018

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D. Necessary Materials

Table 5
NECESSARY MATERIALS

Material	Specification or Part Number	Supplier	Notes
Adhesive	S-1006	Raychem	-
	S-1009	Raychem	-
Catalyst, RTV	F	Dow Corning	Only For 3110 RTV Potting Compound
	S	Dow Corning	Only For 3110 RTV Potting Compound
Emery Cloth	No. 240	An available Source	-
	No. 320	An available Source	-
Masking Tape	1/2 Inch Width	An available Source	-
Naptha, aliphatic	TT-N-95	An available Source	-
Solvent	BMS 11-7	Boeing	-

Table 6
APPROVED SUPPLIERS OF BOEING STANDARD SOLVENTS

Boeing Specification	Approved Supplier
BMS 11-7	AZKO/Dexter Aerospace Finishes
	Barton Solvents
	Elf Atochem Turco Products
	Pratt and Lambert Industrial Coating

Table 7
POTTING COMPOUNDS

Temperature Grade	Cure Time (hours)	Part Number or Specification	Supplier	Description
A	48	MIL-S-8516	QPL	Polysulfide
	48	WS 516	J and R Industries	Polysulfide
C	2 (10 Percent Catalyst F)	3110 RTV	Dow Corning	Silicone
	6.5 (10 Percent Catalyst S)	3110 RTV	Dow Corning	Silicone
	48	Silastic-738	Dow Corning	Silicone

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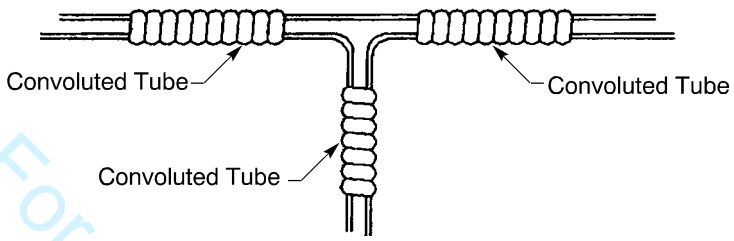
2. ASSEMBLY OF MOLDED TEE FITTINGS

A. Convoluted Tube Installation

(1) Make a selection of a convoluted Teflon tube from Table 3.

(2) Make a selection of a masking tape from Table 5.

(3) Put the tube on the wire in 3 locations. Refer to Figure 1.

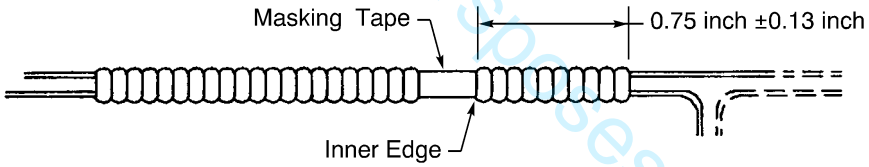


POSITION OF THE CONVOLUTED TUBES
Figure 1

(4) Wind two layers of the tape around each tube as a mark for the position of the molded tee. Refer to Figure 2.

Make sure that:

- The inner edge of the tape is 0.75 inch ±0.13 inch from the end of the tube that is near the tee
- The edge of the tape is parallel to the edge of the tube.



POSITION OF THE TAPE ON THE TUBE
Figure 2

B. Molded Tee Installation

(1) Make a selection of a 500 degree F hot air gun without a reflector. Refer to Subject 20-10-14.

(2) Put the wire harness or cable through the molded tee.

Refer to Figure 3 and Figure 4.

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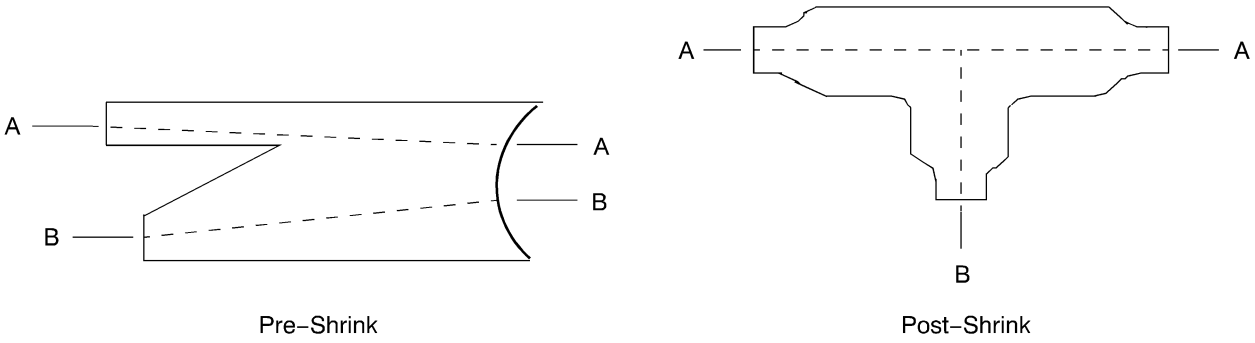
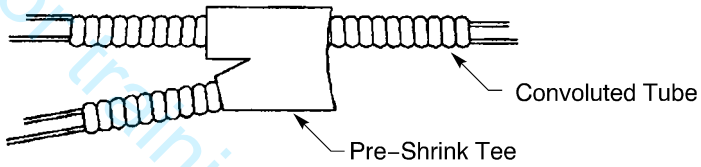
ASSEMBLY OF MOLDED TEE FITTINGS AND HEAT SHRINKABLE BOOTS



CONFIGURATION OF THE MOLDED TEE
Figure 3



POSITION OF THE TEE ON THE TUBES
Figure 4

(3) Push each tube into the molded tee until the inner edge of the tape is at the edge of the each tee.

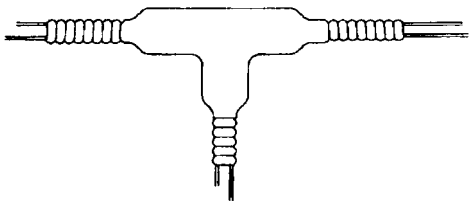
(4) Shrink the center of the molded tee.

CAUTION: DO NOT APPLY TOO MUCH HEAT TO THE MOLDED TEE. DAMAGE TO THE MOLDED TEE CAN OCCUR.

(5) Shrink each end of a tee until the tee is tight against the tube. Refer to Figure 5.

CAUTION: DO NOT APPLY TOO MUCH HEAT TO THE MOLDED TEE. DAMAGE TO THE MOLDED TEE CAN OCCUR.

Make sure that after the tee is in its shrunk state, the contour of the tubes can be seen.



FINAL CONFIGURATION OF THE MOLDED TEE
Figure 5

(6) Remove all of the tape.

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3. ASSEMBLY OF A STRAIGHT HEAT SHRINKABLE BOOT

A. Boot Installation

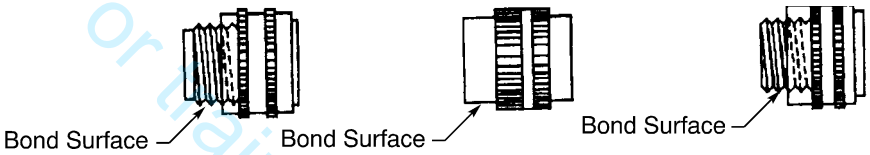
(1) For a wire harness that contains a wire or a cable with Teflon insulation, make a selection of a 750 degree F hot air gun. Refer to Subject 20-10-14.

NOTE: A reflector is recommended.

(2) For a wire harness that contains a wire or a cable with insulation that is not Teflon, make a selection of a 500 degree F hot air gun. Refer to Subject 20-10-14.

NOTE: A reflector is recommended.

(3) Prepare the surfaces of the connector and the boot to make a bond with an adhesive. Refer to Figure 6 and Paragraph 3.B.



BOND SURFACES ON CONNECTORS
Figure 6

(4) Put the boot on the cable or the wire harness.

(5) Assemble the connector. Refer to the applicable Subject for the connector.

(6) Apply the adhesive:

(a) Make a selection of an adhesive from Table 5.

(b) Make a selection of a solvent from Table 5.

(c) Apply the adhesive on the bond surface of these components:

- The boot
- The connector
- The cable or harness jacket.

Make sure that the adhesive extends 0.13 inch farther than the bond surface.

(7) Move the boot into its position on the threads of the connector. Refer to Figure 7.

Make sure that:

- The coupling nut can be turned freely
- The distance between the forward end of the boot and the rear end of the coupling nut is 0.13 inch maximum.

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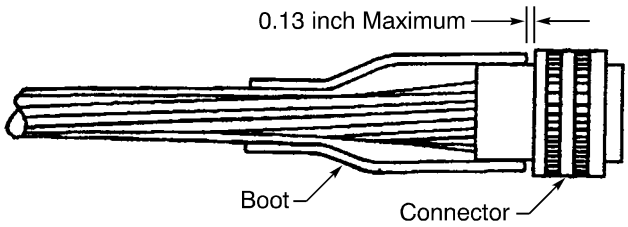

INSTALLATION OF A BOOT THAT IS BONDED TO THE CONNECTOR
Figure 7

(8) Shrink the boot.

Make sure that:

- The intake air vent on the hot air gun is open
- The hot air gun is at the full operation temperature
- A heat shield is used to give the insulation of the wire or cable protection from damage
- Heat is applied for no longer than 40 seconds at one time
- The distance between the forward end of the boot and the rear end of the coupling nut is 0.13 inch maximum.

NOTE: If all of the wires in the harness or cable have Teflon insulation, the heat can be applied for a maximum of 3 minutes.

(9) If unwanted adhesive is on the boot or the connector, remove the unwanted adhesive immediately with a clean wiper and solvent.

(10) If it is necessary to apply heat again, let the boot cool for 5 minutes before the heat is applied again.

(11) Seal the boot with potting compound if:

- The potting compound is specified
- The initial installation had potting compound.

Refer to Paragraph 3.C.

B. Bond Surface Preparation

For the conditions that are applicable for this procedure, refer to Paragraph 3.A.

(1) Make a selection of an aliphatic naptha from Table 5.

(2) Prepare the surfaces of the boot that must make a bond with the adhesive.

(a) Wind a piece of emery cloth around an applicable rod or tool.

(b) Make the bond surfaces rough.

(c) Shake the loose particles out of the boot.

(d) Clean the bond surfaces with a clean wiper and naptha.

(e) Dry the boot with a wiper immediately.

CAUTION: DO NOT LET THE NAPTHA DRY ON THE BOOT. WHEN NAPTHA DRIES, AN UNWANTED FILM STAYS ON THE CLEAN SURFACES.

(3) Clean the other surfaces that must make a bond with the adhesive.

(a) Clean the bond surfaces of the connector with a clean wiper and naptha. Refer to Figure 6.

(b) Dry the connector with a wiper immediately.

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CAUTION: DO NOT LET THE NAPTHA DRY ON THE CONNECTOR. WHEN NAPTHA DRIES, AN UNWANTED FILM STAYS ON THE CLEAN SURFACES.

(c) Clean the bond surface of each wire or cable with a clean wiper and naptha.

Make sure to clean the insulation of each wire or cable approximately 1 inch farther than the bond surface.

(d) Dry the insulation with a wiper immediately.

CAUTION: DO NOT LET THE NAPTHA DRY ON THE INSULATION. WHEN NAPTHA DRIES, AN UNWANTED FILM STAYS ON THE CLEAN SURFACES.

C. Seal of the Boot with Potting Compound

For the conditions that are applicable for this procedure, refer to Paragraph 3.A.

(1) Make a selection of a potting compound from Table 7.

(2) If the potting compound is a silicone compound, make a selection of a catalyst from Table 5.

Refer to the manufacturer's instructions to mix the compound with the catalyst.

(3) Fill the boot with potting compound.

Make sure that air is not caught in the boot.

NOTE: To make a continuous flow of the potting compound, a constant pressure is recommended.

(4) Lightly tap the boot on a solid surface or shake the boot to release air that is caught in the boot.

(5) Let the potting compound cure for the specified time. Refer to Table 7.

4. ASSEMBLY OF A 90 DEGREE HEAT SHRINKABLE BOOT

A. Boot Installation

(1) Make a selection of an adhesive from Table 5.

(2) For a wire harness that contains a wire or a cable with Teflon insulation, make a selection of a 750 degree F hot air gun. Refer to Subject 20-10-14.

NOTE: A reflector is recommended.

(3) For a wire harness that contains a wire or a cable with insulation that is not Teflon, make a selection of a 500 degree F hot air gun. Refer to Subject 20-10-14.

NOTE: A reflector is recommended.

(4) Prepare the boot. Refer to Paragraph 4.B.

(5) Prepare the bond surface. Refer to Paragraph 4.C.

(6) Put the boot on the cable or the wire harness.

(7) Assemble the connector components. Refer to the applicable Subject for the connector.

(8) Put the cable or wire harness in an approximate 90 degree position. Refer to Figure 9.

(9) Apply the adhesive on the bond surface of these components:

- The boot
- The connector
- The cable or harness jacket.

Make sure that the adhesive extends 0.13 inch farther than the bond surface.

(10) Move the boot into its position on the threads of the connector. Refer to Figure 8.

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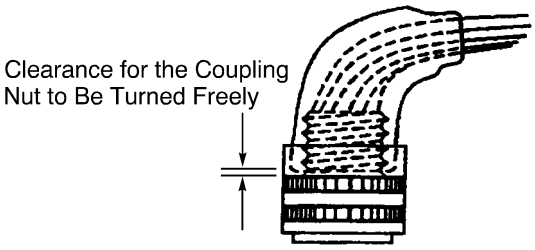
Make sure that:

- The coupling nut can be turned freely
- The boot assembly is in the correct clock position on the connector.



INSTALLATION OF A 90 DEGREE BOOT
Figure 8

(11) Shrink the boot.

Make sure that:

- The intake air vent on the hot air gun is open
- The hot air gun is at the full operation temperature
- A heat shield is used to give the insulation of the wire or cable protection from damage
- Heat is applied for no longer than 40 seconds at one time.

NOTE: If all of the wires in the harness or cable have Teflon insulation, the heat can be applied for a maximum of 3 minutes.

(12) Remove the unwanted adhesive immediately with a clean wiper and solvent.

(13) If it is necessary to apply heat again, let the boot cool for 5 minutes before the heat is applied again.

(14) Seal the boot with potting compound if:

- The potting compound is specified
- The initial installation had potting compound.

Refer to Paragraph 4.D.

B. Boot Preparation

For the conditions that are applicable to this procedure, refer to Paragraph 4.A.

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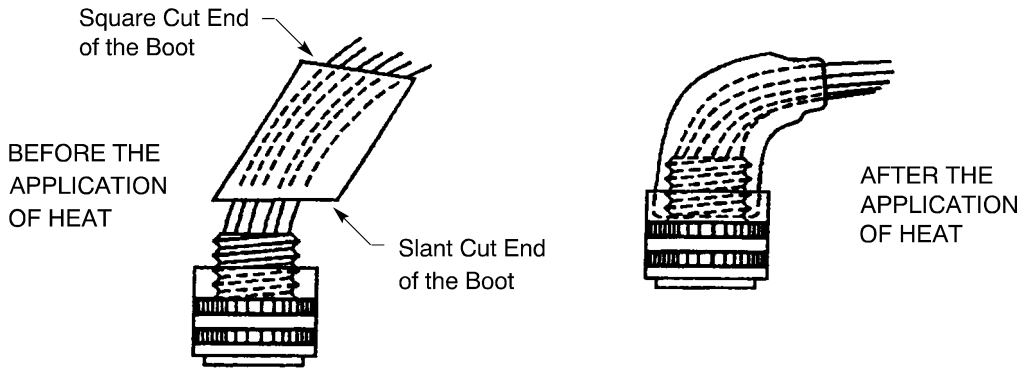
ASSEMBLY OF MOLDED TEE FITTINGS AND HEAT SHRINKABLE BOOTS



PREPARATION OF A 90 DEGREE BOOT
Figure 9

Refer to Figure 9.

(1) Put a 1/4 to 5/16 inch diameter rod approximately 0.5 inch into the square cut end of the boot. Refer to Figure 9.

(2) Shrink the boot on the rod.

(3) Let the boot cool.

(4) Remove the rod from the boot.

C. Bond Surface Preparation

For the conditions that are applicable for this procedure, refer to Paragraph 4.A.

(1) Make a selection of an aliphatic naptha from Table 5.

(2) Prepare the surfaces of the boot that must make a bond with the adhesive.

(a) Wind a piece of emery cloth around an applicable rod or tool.

(b) Make the bond surfaces rough.

(c) Shake the loose particles out of the boot.

(d) Clean the bond surfaces with a clean wiper and naptha.

(e) Dry the boot with a wiper immediately.

CAUTION: DO NOT LET THE NAPTHA DRY ON THE BOOT. WHEN NAPTHA DRIES, AN UNWANTED FILM STAYS ON THE CLEAN SURFACES.

(3) Clean the other surfaces that must make a bond with the adhesive.

(a) Clean the bond surfaces of the connector with a clean wiper and naptha. Refer to Figure 6.

(b) Dry the connector with a wiper immediately.

CAUTION: DO NOT LET THE NAPTHA DRY ON THE CONNECTOR. WHEN NAPTHA DRIES, AN UNWANTED FILM STAYS ON THE CLEAN SURFACES.

(c) Clean the bond surface of each wire or cable with a clean wiper and naptha.

Make sure to clean the insulation of each wire or cable approximately 1 inch farther than the bond surface.

(d) Dry the insulation with a wiper immediately.

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CAUTION: DO NOT LET THE NAPTHA DRY ON THE INSULATION. WHEN NAPTHA DRIES, AN UNWANTED FILM STAYS ON THE CLEAN SURFACES.

D. Seal of the Boot with Potting Compound

For the conditions that are applicable for this procedure, refer to Paragraph 4.A.

(1) Make a selection of a potting compound from Table 7.

(2) If the potting compound is a silicone compound, make a selection of a catalyst from Table 5.
Refer to the manufacturer's instructions to mix the compound with the catalyst.

(3) Fill the boot assembly with potting compound.
Make sure that air is not caught in the boot.

NOTE: To make a continuous flow of the potting compound, a constant pressure is recommended.

(4) Lightly tap the boot on a solid surface or shake the boot to release air that is caught in the boot.

(5) Let the potting compound cure for the specified time. Refer to Table 7.

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INSTALLATION OF ZIPPERTUBING

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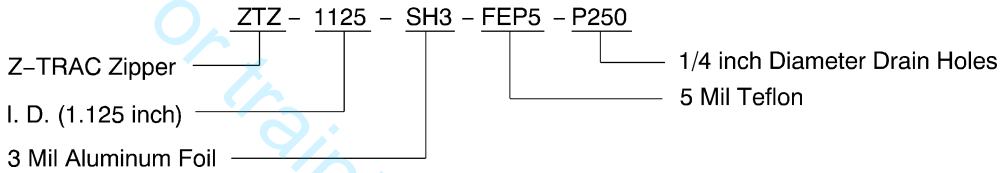
INSTALLATION OF ZIPPERTUBING

1. PART NUMBERS AND DESCRIPTION

A. Zippertubing Part Numbers

Table 1
ZIPPERTUBING PART NUMBERS

Part Number	I.D. (inch)	Supplier
ZTZ-1125-SH3FEP5-P250	1.125	Zippertubing Company
ZTZ-1380-SH3FEP5-P250	1.380	Zippertubing Company
ZTZ-1500-SH3FEP5-P250	1.500	Zippertubing Company



ZTZ-() ZIPPERTUBING PART NUMBER STRUCTURE
Figure 1

B. Description

Zippertubing:

- Has a 3 mil aluminum foil layer that is laminated with a 5 mil teflon layer.
- Has an integral, full length ground shield that is included in the foil
- Has a Z-Trac zipper closure that is included in the teflon tubing
- Is supplied in a length that can be cut for the correct fit in the installation.

2. INSTALLATION OF ZIPPERTUBING

A. Assembly of the Shield Ground Terminals

(1) Cut the Zippertubing so that the length is 12 inches more than the necessary length.
The greater length permits the assembly of the shield ground terminals at each end.

(2) Loosen 6 inches ±1/4 inch of the stitches of the shield at both ends. Refer to Figure 2.
Make sure that:

- The shield is not damaged
- The threads of the stiches have the sufficient length so that they can be tightly attached after the tube has been cut.

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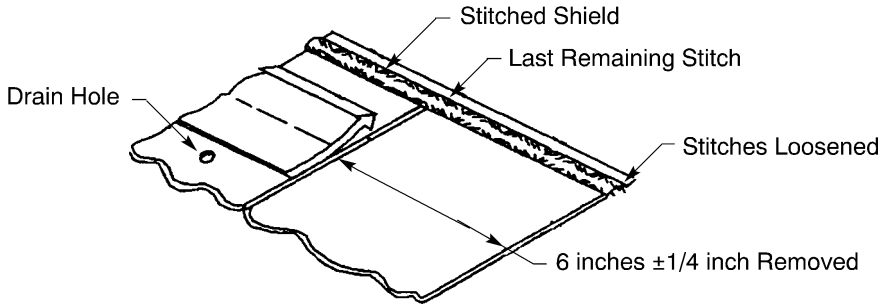


PREPARATION OF THE ZIPPERTUBING
Figure 2

(3) Move the shield out of the way.

(4) Cut the Zippertubing up to 1/8 inch from the last remaining stitch of the shield.

(5) Attach the threads of the stiches to each other tightly and permanently.

(6) Remove the unwanted length of the threads.

(7) Make a selection of a BACT12AC-() terminal with a size 14-16 wire barrel. Refer to Subject 20-30-11.

(8) Assemble a terminal on both ends of the shield:

(a) On the last 1/2 inch at the end of the shield, move the strands of the shield apart.

(b) Lightly twist the strands together.

(c) Put the end of the shield in the crimp barrel of the terminal.

(d) Crimp the terminal.

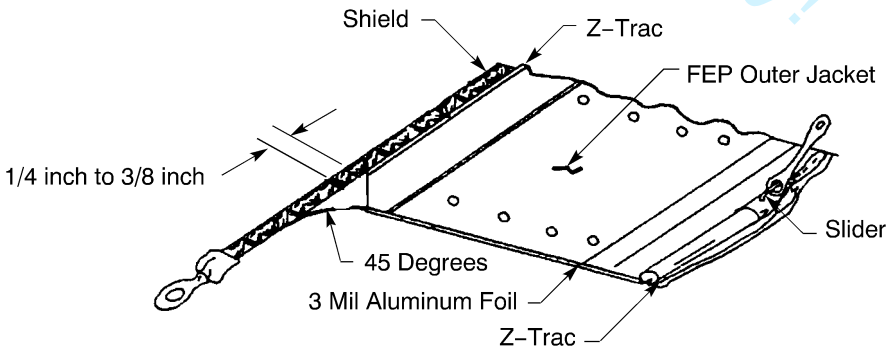
B. Zippertubing Installation

(1) Put the Zippertubing in the position so that:

- The aluminum foil side is down
- The shield ground terminal is to the left.

(2) Cut a 1/4 inch to 3/8 inch width of the front edge the necessary length so that the front edge and the shield make an approximate 45 degree angle.

Refer to Figure 3.



PREPARATION OF THE ZIPPERTUBING FOR INSTALLATION
Figure 3

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(3) Pull the slider down approximately one inch.

(4) Turn the Zippertubing over.

(5) Put the Zippertubing into a trough form.

(6) Put the cable into the trough.

(7) Put the remaining Zippertubing around the cable so that:
- The ends of the Zippertubing make an overlap
- The end with the shield is under the end with the slider.

(8) Put the 45 degree angle edge, that is adjacent to the shield, into the slider.

(9) Make the Zippertubing straight and symmetrical along the Z-Trac.

(10) Pull the slider to the other edge of the Zippertubing.

NOTE: To close the Zippertubing smoothly, make sure to keep each Z-Trac low and parallel.

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INSTALLATION OF SLEEVES ON WIRING

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	C.	Fiberglass Sleeves	2

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INSTALLATION OF SLEEVES ON WIRING

This Subject gives the general conditions for the installation of sleeves for the protection and support of electrical wiring.

1. GENERAL DATA

A. General Conditions

Only Skydrol resistant materials are used on wire bundles in specified Skydrol areas.

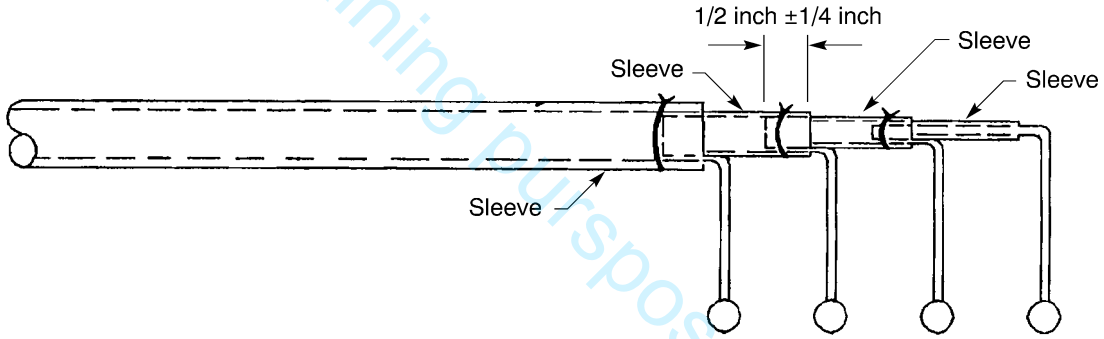
B. Configuration of Sleeves on Wire Bundles

Figure 1 shows a wire bundle that has many breakouts and is a usual configuration of the sleeves when the wires are attached to circuit breakers.

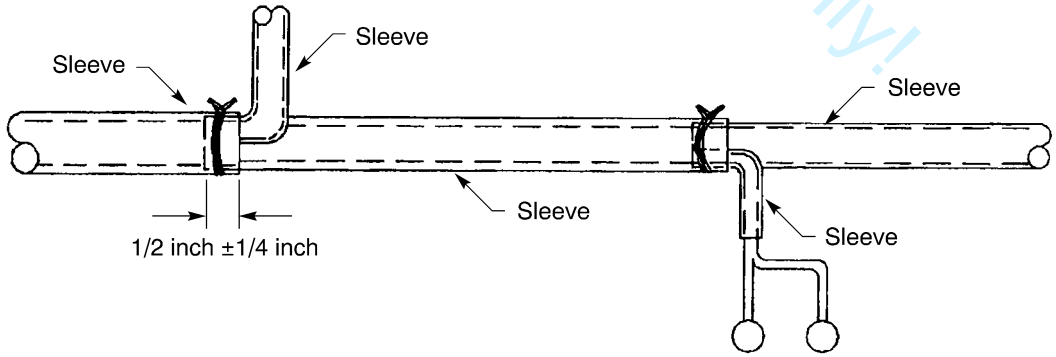
Figure 2 shows an alternative configuration.

NOTE: It is:

- Not necessary to install a sleeve on the breakout wire since the wire is controlled when it is attached to the circuit breaker
- Necessary to assemble a wire bundle tie only at the location of the breakout when the breakout wire is 6 inches or less in length.



SLEEVES ON A WIRE BUNDLE WITH CONTROLLED BREAKOUTS
Figure 1



ALTERNATIVE CONFIGURATION OF SLEEVES ON WIRE BUNDLE BREAKOUTS
Figure 2

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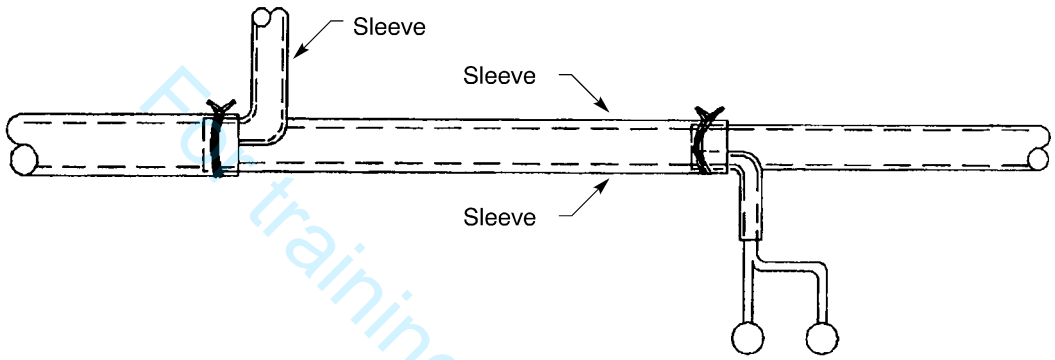
NOTE: If having difficulty to pull sleeve through wire due to a tight fit, lubricant could be used as an aid. Refer to lubricant table in Subject 20-00-11.

When it is necessary to install a TFE 2XTW or a TFE 2XSW sleeve on a wire bundle and the diameter of an available TFE sleeve is not sufficient, these conditions are applicable:

- The wires of the wire bundle can be divided into groups
- The size of the groups can be the size of the available sleeves
- The necessary number of wire harness ties can be assembled to make a single wire bundle.

Refer to Figure 3.



ALTERNATIVE CONFIGURATION OF TFE SLEEVES
Figure 3

When a sleeve is installed on the wire or wire bundle at a connector, these conditions are applicable:

- If the connector has a cable clamp, put the end of the sleeve under the clamp
- If the connector does not have a cable clamp, assemble a wire bundle tie on the sleeve a minimum of 1.0 inch from the connector.

C. Fiberglass Sleeves

The ends of all fiberglass sleeves must have a coating of Nycote 88 varnish or an equivalent varnish so that the strands of the fiberglass are held together.

NOTE: Blue dye can be added to the varnish so that the varnish can be seen.

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INSTALLATION OF SLEEVES ON WIRING

When a fiberglass sleeve is installed on a group of wires and at least one shield ground wire is not terminated in a connector, the conditions for the installation of the sleeve are different for:

- A connector with a backshell
- A connector without a backshell.

For the connectors with backshells, the end of the sleeve:

- Is not under the cable clamp of the connector
- Is as close as possible to the cable clamp of the connector
- Does not extend past the shield ground wire breakout
- Has a wire bundle tie.

For the connectors without backshells, the end of the sleeve:

- Is approximately two inches from the connector
- Does not extend past the shield ground wire breakout
- Has a wire bundle tie.

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WIRE SEPARATION

This Subject gives:

- The general conditions for wire separation
- The special conditions for wire separation in the specified models.

1. GENERAL CONDITIONS FOR THE SEPARATION OF CIRCUITS

A. General Data

The airplane wiring is designed and installed:

- To prevent the propagation of the effects of electrical faults to other independent power sources
- To prevent possibility that the failure of a component in a redundant system can disable another related, redundant system
- To avoid electromagnetic interference (EMI) between electromagnetic compatibility (EMC) circuits that are not compatible.

B. Necessary Conditions of Separation for Wire Harness Design

These are the applicable types of separation:

- Separation between independent power sources (Functional Separation)
- Separation between redundant system circuits (Functional Separation)
- Separation between EMC circuits that are not compatible (Electromagnetic Separation).

To obey these conditions:

- Electrical circuits, for which separation is necessary, are put in different wire harness assemblies
- If the circuits cannot be put in different wire harnesses, separation is done within the same wire harness with sleeves and shielded wire except in the case where the EMC circuits are not compatible.

C. Functional Separation Group

The primary conditions for the functional separation of circuits are:

- Separation between the independent power sources for a single system
- Separation between the redundant system circuits.

NOTE: In relation to functional separation, the airplane engine systems are redundant for each engine.

D. EMC Separation Group

These are the 3 basic separation codes:

- Code 1 for circuits that contain noisy interference wiring; usually power lines
- Code 2 for all the wiring that satisfies the conditions of EMC
- Code 3 for the sensitive, susceptible circuits; such as audio or analog.

E. EMC Separation Group Code 1 - Source of Interference Circuits

These are system wires that carry power current or other EMI offensive circuits. Examples of these are:

- Both AC and DC generator and power feeders
- Other 400 Hz power wires that go beyond 12000V-ft or 400A-ft of potential coupling
- Automatically switching DC circuits that switch 5 amps or more
- Both AC and DC inductive load turnoff transients that are not suppressed.

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F. EMC Separation Group Code 2 - Passive Circuits

These are systems wires which are expected to tolerate and not degrade the electromagnetic environment in the airplane. Examples of these are:

- AC signal or control circuits that are not susceptible to common mode coupling of 100 mV RMS or less
- 400 Hz power wires do not go beyond 12000V-ft or 400A-ft when they are located with their own Category 2 system harness.

G. EMC Separation Group Code 3 - Sensitive or Susceptible Circuits

These are system wires that cannot satisfy the limits of Category 2 susceptibility.

H. Sub-Functional Separation Category

Some more separation may be necessary within a functional separation code because of special system functional conditions. Decisions for sub-functional conditions are made in relation to:

- The airplane model
- The system.

NOTE: When a sub-functional separation is given, that separation must be kept.

2. WIRE HARNESS IDENTIFICATION FOR FUNCTIONAL SEPARATION

A. Functional/EMC/Sub-Functional Separation Code

The separation code has these properties:

- A separation code is assigned to each wire harness
- When the sub-functional separation is not necessary for 737, 747, 757, and 767 airplane models, the third digit is removed; only 2 digits are necessary
- When the sub-functional separation is not necessary for 777 airplane model, the fourth digit is removed; only 3 digits are necessary
- For 707, 737, 747, 757, 767, and 777, an N code identifies a wire that does not have separation conditions and can have the same routing as a wire harness from another functional separation group.

B. Color Codes of the Separation Groups

NOTE: Refer to the specified model for the color codes that are used for each functional separation code.

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A color code system is used so that:

- The separation group of a wire harness can be identified
- The installation and inspection of a wire harness on the airplane is easier.

For the 737, 747, 757, and 767 airplane models, all wire harnesses have color codes except these types:

- A coax cable that is installed as a single cable and does not have wire harness ties
- Wire harnesses in which all wires are covered with sleeves (white tie material)
- Wire harnesses which that contain only shielded wires (white tie material)
- Shelf harnesses (white tie material)
- Wire harnesses that are identified as neutral (N).

For the 777 airplane model, all wires harnesses have color codes except these types:

- A coax cable that is installed as a single cable and does not have wire harness ties
- Shelf harnesses (white tie material)
- Wire harnesses that are identified as neutral (N).

For the 787 airplane model, no color codes are applied:

- Wire harness compatibility is based on primary functional code, EMC susceptibility, and internal system redundancy requirements.

3. WIRE HARNESS FUNCTIONAL SEPARATION

A. Separation by a Distance

Refer to Table 1 and Table 2 to find the minimum distance for the specified separation code of each model.

NOTE: In the areas where a turbine burst occurs, a larger physical separation is necessary between the specified engine functions.

NOTE: More protection or a larger physical separation, or both are given in the areas where damage, that is caused by a mechanical failure, can occur to the primary and the redundant wiring. Some types of mechanical failures are:

- The rupture of a pneumatic duct
- A tire tread that is thrown.

For 707. 737, 747, 757, 767, and 777 airplane models these standby system power wires must be isolated from all other wiring through separation by distance:

- Battery to hot battery bus
- Hot battery bus to battery bus and static inverter
- Static inverter to standby AC bus.

CAUTION: THE STANDBY SYSTEM POWER WIRES MUST NOT HAVE THE SAME ROUTING AS OTHER WIRING. DAMAGE, THAT IS CAUSED BY THE FAILURE OF THE OTHER WIRING, CAN OCCUR TO THE STANDBY SYSTEM POWER WIRES.

For the 787 airplane model, the following conditions apply:

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WIRE SEPARATION

Left distributed power wiring must be isolated from:

- Right distributed power, standby, flight control, and high power wiring.

Right distributed power wiring must be isolated from:

- Left distributed po9wer, standby, flight control, and high power wiring.

Flight control wiring must be isolated from:

- Distributed, standby, and high power wiring.

Left high voltage wiring must be isolated from:

- Right high voltage, distributed power, flight control, and standby wiring.

Right high voltage wiring must be isolated from:

- Left high voltage, distributed power, flight control, and standby wiring.

Left standby wiring must be isolated from:

- Right standby, distributed power, flight control, and high power wiring.

Right standby wiring must be isolated from:

- Left standby, distributed power, flight control, and high power wiring.

More protection and/or a larger physical separation are necessary between:

- High voltage wiring (greater than 115 volts) and signal/data wiring
- High voltage wiring (greater than 115 volts) and in-tank wiring
- Power wiring (greater than 28 volts) and Oxygen cylinder, regulators, and initiator wiring.

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Table 1
FUNCTIONAL WIRE SEPARATION BY MINIMUM DISTANCE - MODELS 737, 747, 757, 767, AND 777

Separation Code	Area	Model	Minimum Separation Distance (inch)
1	Not Pressurized	747	0.50
	Pressurized	747	0.25
2	Not Pressurized	747	0.50
	Pressurized	747	0.25
3	Not Pressurized	747	0.50
	Pressurized	747	0.25
4	Not Pressurized	747	0.50
	Pressurized	747	0.25
A	Not Pressurized	737	0.25
		757	0.25
		767	0.25
	Pressurized	737	0.25
		757	0.25
		767	0.25

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Table 1 (continued)

Separation Code	Area	Model	Minimum Separation Distance (inch)
AK	Not Pressurized	777	0.50
	Pressurized	777	0.25
BK	Not Pressurized	777	0.50
	Pressurized	777	0.25
C	Not Pressurized	757	0.25
		767	0.25
		777	0.50
	Pressurized	757	0.25
		767	0.25
		777	0.25
CP	Not Pressurized	777	0.50
	Pressurized	777	0.25
H	Not Pressurized	757	0.25
		767	0.25
	Pressurized	757	0.25
		767	0.25
L	Not Pressurized	737	0.25
		747	0.50
		757	0.25
		767	0.25
		777	0.50
	Pressurized	737	0.25
		747	0.25
		757	0.25
		767	0.25
		777	0.25
LM	Not Pressurized	777	0.50
	Pressurized	777	0.25
LP	Not Pressurized	777	0.50
	Pressurized	777	0.25
LR	Not Pressurized	777	0.50
	Pressurized	777	0.25

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Table 1 (continued)

Separation Code	Area	Model	Minimum Separation Distance (inch)
LS	Not Pressurized	777	0.50
	Pressurized	777	0.25
NN	Not Pressurized	777	0.50
	Pressurized	777	0.25
R	Not Pressurized	737	0.25
		747	0.50
		757	0.25
		767	0.25
		777	0.50
	Pressurized	737	0.25
		747	0.25
		757	0.25
		767	0.25
		777	0.25
RM	Not Pressurized	777	0.50
	Pressurized	777	0.25
RP	Not Pressurized	777	0.50
	Pressurized	777	0.25
RR	Not Pressurized	777	0.50
	Pressurized	777	0.25
RS	Not Pressurized	777	0.50
	Pressurized	777	0.25
S	Not Pressurized	737	0.25
		747	0.50
		757	0.25
		767	0.25
		777	0.50
	Pressurized	737	0.25
		747	0.25
		757	0.25
		767	0.25
		777	0.25

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Table 1 (continued)

Separation Code	Area	Model	Minimum Separation Distance (inch)
SY	Not Pressurized	777	0.50
	Pressurized	777	0.25

Table 2
FUNCTIONAL AND EMC WIRE SEPARATION BY MINIMUM DISTANCE - MODEL 787

Separation Code	Wire Size Range	Compatible/Incompatible Separation Codes	Area	Minimum Separation Distance (inch)
BK1	26 AWG - 12 AWG	Separate from: DL1, DR1, GL1, GR1, HL1, HR1, ML1, MR1, NE1, SL1, SR1	Not Pressurized	3.00
			Pressurized	
		Separate From: BK2, DL2, DR2, FC2, HL2, HR2, ML2, MR2, NE2, NR2, NS2, PL1, PR1, SL2, SR2	Not Pressurized	0.50
			Pressurized	0.25
		Separate from: FX2	Not Pressurized	4.00
			Pressurized	
		Separate From: DL3, DR3, FC3, NE3, NS3, SL3, SR3	Not Pressurized	2.00
			Pressurized	
		Compatible with: None	Not Pressurized	-
			Pressurized	
BK2	26 AWG - 12 AWG	Separate from: DL1, DR1, GL1, GR1, HL1, HR1, ML1, MR1, NE1, SL1, SR1	Not Pressurized	3.00
			Pressurized	
		Separate from: BK1, DL2, DL3, DR2, DR3, FC2, FC3, HL2, HR2, ML2, MR2, NE2, NE3, NR2, NS2, NS3, PL1, PR1, SL2, SL3, SR2, SR3	Not Pressurized	0.50
			Pressurized	0.25
		Separate from: FX2	Not Pressurized	4.00
			Pressurized	
		Compatible With: None	Not Pressurized	-
			Pressurized	

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Table 2 (continued)

Separation Code	Wire Size Range	Compatible/Incompatible Separation Codes	Area	Minimum Separation Distance (inch)
DL1	10 AWG - 4/0 AWG	Separate from: DR1, GL1, GR1, HL1, HR1, ML1, MR1, SL1, SR1	Not Pressurized	0.50
			Pressurized	
		Separate from: BK1, BK2, DL2, DL3, DR2, DR3, FC2, FC3, HL2, HR2, ML2, MR2, NE2, NE3, NR2, NS2, NS3, PL1, PR1, SL2, SL3, SR2, SR3	Not Pressurized	3.00
			Pressurized	
		Separate from: FX2	Not Pressurized	4.00
			Pressurized	
		Compatible With: NE1	Not Pressurized	Contact Permitted
			Pressurized	
DL2	26 AWG - 12 AWG	Separate from: DL1, DR1, GL1, GR1, HL1, HR1, ML1, MR1, NE1, SL1, SR1	Not Pressurized	3.00
			Pressurized	
		Separate from: BK1, BK2, DL3, DR2, DR3, FC2, FC3, HL2, HR2, ML2, MR2, NE3, NS3, PL1, PR1, SL2, SL3, SR2, SR3	Not Pressurized	0.50
			Pressurized	0.25
		Separate from: FX2	Not Pressurized	4.00
			Pressurized	
		Compatible With: NE2, NR2, NS2	Not Pressurized	Contact Permitted
			Pressurized	
DL3	26 AWG - 12 AWG	Separate from: BK1, PL1, PR1	Not Pressurized	2.00
			Pressurized	
		Separate from: DL1, DR1, GL1, GR1, HL1, HR1, ML1, MR1, SL1, SR1	Not Pressurized	3.00
			Pressurized	
		Separate from: BK2, DL2, DR2, DR3, FC2, FC3, HL2, HR2, ML2, MR2, NE2, NE3, NR2, NS2, NS3, SL2, SL3, SR2, SR3	Not Pressurized	0.50
			Pressurized	0.25
		Separate from: FX2	Not Pressurized	4.00
			Pressurized	
		Compatible With: NE1	Not Pressurized	Contact Permitted
			Pressurized	

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Table 2 (continued)

Separation Code	Wire Size Range	Compatible/Incompatible Separation Codes	Area	Minimum Separation Distance (inch)
DR1	10 AWG - 4/0 AWG	Separate from: DL1, GL1, GR1, HL1, HR1, ML1, MR1, SL1, SR1	Not Pressurized	0.50
			Pressurized	
		Separate from: BK1, BK2, DL2, DL3, DR2, DR3, FC2, FC3, HL2, HR2, ML2, MR2, NE2, NE3, NR2, NS2, NS3, PL1, PR1, SL2, SL3, SR2, SR3	Not Pressurized	3.00
			Pressurized	
		Separate from: FX2	Not Pressurized	4.00
			Pressurized	
		Compatible With: NE1	Not Pressurized	Contact Permitted
			Pressurized	
DR2	26 AWG - 12 AWG	Separate from: DL1, DR1, GL1, GR1, HL1, HR1, ML1, MR1, NE1, SL1, SR1	Not Pressurized	3.00
			Pressurized	
		Separate from: BK1, BK2, DL2, DL3, DR3, FC2, FC3, HL2, HR2, ML2, MR2, NE3, NS3, PL1, PR1, SL2, SL3, SR2, SR3	Not Pressurized	0.50
			Pressurized	0.25
		Separate from: FX2	Not Pressurized	4.00
			Pressurized	
		Compatible With: NE2, NR2, NS2	Not Pressurized	Contact Permitted
			Pressurized	
DR3	26 AWG - 12 AWG	Separate from: BK1, PL1, PR1	Not Pressurized	2.00
			Pressurized	
		Separate from: DL1, DR1, GL1, GR1, HL1, HR1, ML1, MR1, NE1, SL1, SR1	Not Pressurized	3.00
			Pressurized	
		Separate from: BK2, DL2, DL3, DR2, FC2, FC3, HL2, HR2, ML2, MR2, NE2, NR2, NS2, SL2, SL3, SR2, SR3	Not Pressurized	0.50
			Pressurized	0.25
		Separate from: FX2	Not Pressurized	4.00
			Pressurized	
		Compatible With: NE3, NS3	Not Pressurized	Contact Permitted
			Pressurized	

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Table 2 (continued)

Separation Code	Wire Size Range	Compatible/Incompatible Separation Codes	Area	Minimum Separation Distance (inch)
FC2	26 AWG - 12 AWG	Separate from: DL1, DR1, GL1, GR1, HL1, HR1, ML1, MR1, NE1, SL1, SR1	Not Pressurized	3.00
			Pressurized	
		Separate from: BK1, BK2, DL2, DL3, DR2, DR3, FC3, HL2, HR2, ML2, MR2, NE2, NE3, NR2, NS2, NS3, PL1, PR1, SL2, SL3, SR2, SR3	Not Pressurized	0.50
			Pressurized	0.25
		Separate from: FX2	Not Pressurized	4.00
			Pressurized	
		Compatible With: None	Not Pressurized	-
			Pressurized	
FC3	26 AWG - 12 AWG	Separate from: BK1, PL1, PR1	Not Pressurized	2.00
			Pressurized	
		Separate from: BK2, DL1, DL2, DR1, DR2, GL1, GR1, HL1, HL2, HR1, HR2, ML1, ML2, MR1, MR2, NE1, NE2, NR2, SL1, SL2, SR1, SR2	Not Pressurized	3.00
			Pressurized	
		Separate from: DL3, DR3, FC2, NE3, NS2, NS3, SL3, SR3	Not Pressurized	0.50
			Pressurized	0.25
		Separate from: FX2	Not Pressurized	4.00
			Pressurized	
		Compatible With: None	Not Pressurized	-
			Pressurized	
FX2	26 AWG - 12 AWG	Separate from: BK1, BK2, DL1, DL2, DL3, DR1, DR2, DR3, FC2, FC3, GL1, GR1, HL1, HL2, HR1, HR2, ML1, ML2, MR1, MR2, NE1, NE2, NE3, NR2, NS2, NS3, PL1, PR1, SL1, SL2, SL3, SR1, SR2, SR3	Not Pressurized	4.00
			Pressurized	
		Compatible With: None	Not Pressurized	-
			Pressurized	

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Table 2 (continued)

Separation Code	Wire Size Range	Compatible/Incompatible Separation Codes	Area	Minimum Separation Distance (inch)
GL1	10 AWG - 4/0 AWG	Separate from: DL1, DR1, GR1, HL1, HR1, ML1, MR1, NE1, SL1, SR1	Not Pressurized	0.50
			Pressurized	
		Separate from: BK1, BK2, DL2, DL3, DR2, DR3, FC2, FC3, HL2, HR2, ML2, MR2, NE2, NE3, NR2, NS2, NS3, PL1, PR1, SL2, SL3, SR2, SR3	Not Pressurized	3.00
			Pressurized	
		Separate from: FX2	Not Pressurized	4.00
			Pressurized	
		Compatible With: None	Not Pressurized	-
			Pressurized	
GR1	10 AWG - 4/0 AWG	Separate from: DL1, DR1, GL1, HL1, HR1, ML1, MR1, NE1, SL1, SR1	Not Pressurized	0.50
			Pressurized	
		Separate from: BK1, BK2, DL2, DL3, DR2, DR3, FC2, FC3, HL2, HR2, ML2, MR2, NE2, NE3, NR2, NS2, NS3, PL1, PR1, SL2, SL3, SR2, SR3	Not Pressurized	3.00
			Pressurized	
		Separate from: FX2	Not Pressurized	4.00
			Pressurized	
		Compatible With: None	Not Pressurized	-
			Pressurized	
HL1	10 AWG - 4/0 AWG	Separate from: DL1, DR1, GL1, GR1, HR1, ML1, MR1, NE1, SL1, SR1	Not Pressurized	0.50
			Pressurized	
		Separate from: BK1, BK2, DL2, DL3, DR2, DR3, FC2, FC3, HL2, HR2, ML2, MR2, NE2, NE3, NR2, NS2, NS3, PL1, PR1, SL2, SL3, SR2, SR3	Not Pressurized	3.00
			Pressurized	
		Separate from: FX2	Not Pressurized	4.00
			Pressurized	
		Compatible With: None	Not Pressurized	-
			Pressurized	

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Table 2 (continued)

Separation Code	Wire Size Range	Compatible/Incompatible Separation Codes	Area	Minimum Separation Distance (inch)
HL2	26 AWG - 12 AWG	Separate from: DL1, DR1, GL1, GR1, HL1, HR1, ML1, MR1, NE1, SL1, SR1	Not Pressurized	3.00
			Pressurized	
		Separate from: BK1, BK2, DL2, DL3, DR2, DR3, FC2, FC3, HL2, HR2, ML2, MR2, NE2, NE3, NR2, NS2, NS3, PL1, PR1, SL2, SL3, SR2, SR3	Not Pressurized	0.50
			Pressurized	0.25
		Separate from: FX2	Not Pressurized	4.00
			Pressurized	
		Compatible With: None	Not Pressurized	-
			Pressurized	
HR1	10 AWG - 4/0 AWG	Separate from: DL1, DR1, GL1, GR1, HL1, ML1, MR1, NE1, SL1, SR1	Not Pressurized	0.50
			Pressurized	
		Separate from: BK1, BK2, DL2, DL3, DR2, DR3, FC2, FC3, HL2, HR2, ML2, MR2, NE2, NE3, NR2, NS2, NS3, PL1, PR1, SL2, SL3, SR2, SR3	Not Pressurized	3.00
			Pressurized	
		Separate from: FX2	Not Pressurized	4.00
			Pressurized	
		Compatible With: None	Not Pressurized	-
			Pressurized	
HR2	26 AWG - 12 AWG	Separate from: DL1, DR1, GL1, GR1, HL1, ML1, MR1, NE1, SL1, SR1	Not Pressurized	3.00
			Pressurized	
		Separate from: BK1, BK2, DL2, DL3, DR2, DR3, FC2, FC3, HL2, HR2, ML2, MR2, NE2, NE3, NR2, NS2, NS3, PL1, PR1, SL2, SL3, SR2, SR3	Not Pressurized	0.50
			Pressurized	0.25
		Separate from: FX2	Not Pressurized	4.00
			Pressurized	
		Compatible With: None	Not Pressurized	-
			Pressurized	

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Table 2 (continued)

Separation Code	Wire Size Range	Compatible/Incompatible Separation Codes	Area	Minimum Separation Distance (inch)
ML1	10 AWG - 4/0 AWG	Separate from: DL1, DR1, GL1, GR1, HL1, HR1, MR1, NE1, SL1, SR1	Not Pressurized	0.50
			Pressurized	
		Separate from: BK1, BK2, DL2, DL3, DR2, DR3, FC2, FC3, HL2, HR2, ML2, MR2, NE2, NE3, NR2, NS2, NS3, PL1, PR1, SL2, SL3, SR2, SR3	Not Pressurized	3.00
			Pressurized	
		Separate from: FX2	Not Pressurized	4.00
			Pressurized	
		Compatible With: None	Not Pressurized	-
			Pressurized	
ML2	26 AWG - 12 AWG	Separate from: DL1, DR1, GL1, GR1, HL1, HR1, ML1, MR1, NE1, SL1, SR1	Not Pressurized	3.00
			Pressurized	
		Separate from: BK1, BK2, DL2, DL3, DR2, DR3, FC2, FC3, HL2, HR2, MR2, NE2, NE3, NR2, NS2, NS3, PL1, PR1, SL2, SL3, SR2, SR3	Not Pressurized	0.50
			Pressurized	0.25
		Separate from: FX2	Not Pressurized	4.00
			Pressurized	
		Compatible With: None	Not Pressurized	-
			Pressurized	
MR1	10 AWG - 4/0 AWG	Separate from: DL1, DR1, GL1, GR1, HL1, HR1, ML1, NE1, SL1, SR1	Not Pressurized	0.50
			Pressurized	
		Separate from: BK1, BK2, DL2, DL3, DR2, DR3, FC2, FC3, HL2, HR2, ML2, MR2, NE2, NE3, NR2, NS2, NS3, PL1, PR1, SL2, SL3, SR2, SR3	Not Pressurized	3.00
			Pressurized	
		Separate from: FX2	Not Pressurized	4.00
			Pressurized	
		Compatible With: None	Not Pressurized	-
			Pressurized	

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Table 2 (continued)

Separation Code	Wire Size Range	Compatible/Incompatible Separation Codes	Area	Minimum Separation Distance (inch)
MR2	26 AWG - 12 AWG	Separate from: DL1, DR1, GL1, GR1, HL1, HR1, ML1, MR1, NE1, SL1, SR1	Not Pressurized	0.50
			Pressurized	
		Separate from: BK1, BK2, DL2, DL3, DR2, DR3, FC2, FC3, HL2, HR2, ML2, NE2, NE3, NR2, NS2, NS3, PL1, PR1, SL2, SL3, SR2, SR3	Not Pressurized	0.50
			Pressurized	0.25
		Separate from: FX2	Not Pressurized	4.00
			Pressurized	
		Compatible With: None	Not Pressurized	-
			Pressurized	
NG	-	Separate From: None	Not Pressurized	Contact Permitted
			Pressurized	
		Compatible With: All Separation codes	Not Pressurized	
			Pressurized	
NE1	10 AWG - 4/0 AWG	Separate from: GL1, GR1, HL1, HR1, ML1, MR1, SL1, SR1	Not Pressurized	0.50
			Pressurized	
		Separate from: BK1, BK2, DL2, DL3, DR2, DR3, FC2, FC3, HL2, HR2, ML2, MR2, NE2, NE3, NR2, NS2, NS3, PL1, PR1, SL2, SL3, SR2, SR3	Not Pressurized	3.00
			Pressurized	
		Separate from: FX2	Not Pressurized	4.00
			Pressurized	
		Compatible With: DL1, DR1	Not Pressurized	Contact Permitted
			Pressurized	

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Table 2 (continued)

Separation Code	Wire Size Range	Compatible/Incompatible Separation Codes	Area	Minimum Separation Distance (inch)
NE2	26 AWG - 12 AWG	Separate from: DL1, DR1, GL1, GR1, HL1, HR1, ML1, MR1, NE1, SL1, SR1	Not Pressurized	3.00
			Pressurized	
		Separate from: BK1, BK2, FC2, HL2, HR2, ML2, MR2, PL1, PR1, SL2, SR2	Not Pressurized	0.50
			Pressurized	0.25
		Separate from: FX2	Not Pressurized	4.00
			Pressurized	
		DL3, DR3, FC3, NE3, NS3, SL3, SR3	Not Pressurized	2.00
			Pressurized	
		Compatible With: DL2, DR2, NE2, NS2	Not Pressurized	Contact Permitted
			Pressurized	
NE3	26 AWG - 12 AWG	Separate from: DL1, DR1, GL1, GR1, HL1, HR1, ML1, MR1, NE1, SL1, SR1	Not Pressurized	3.00
			Pressurized	
		Separate from: BK1, PL1, PR1,	Not Pressurized	2.00
			Pressurized	
		BK2, DL2, DR2, FC2, FC3, HL2, HR2, ML2, MR2, NE2, NR2, NS2, SL2, SL3, SR2, SR3	Not Pressurized	0.50
			Pressurized	0.25
		Separate from: FX2	Not Pressurized	4.00
			Pressurized	
		Compatible With: DL3, DR3, NS3	Not Pressurized	Contact Permitted
			Pressurized	
NR2	26 AWG - 12 AWG	Separate from: DL1, DR1, GL1, GR1, HL1, HR1, ML1, MR1, NE1, SL1, SR1	Not Pressurized	3.00
			Pressurized	
		Separate from: BK1, BK2, DL3, DR3, FC2, FC3, HL2, HR2, ML2, MR2, NE3, NS3, PL1, PR1, SL3, SR3	Not Pressurized	0.50
			Pressurized	0.25
		Separate from: FX2	Not Pressurized	4.00
			Pressurized	
		Compatible With: DL2, DR2, NE2, NS2, SL2, SR2	Not Pressurized	Contact Permitted
			Pressurized	

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Table 2 (continued)

Separation Code	Wire Size Range	Compatible/Incompatible Separation Codes	Area	Minimum Separation Distance (inch)
NS2	26 AWG - 12 AWG	Separate from: DL1, DR1, GL1, GR1, HL1, HR1, ML1, MR1, NE1, SL1, SR1	Not Pressurized	3.00
			Pressurized	
		Separate from: BK1, BK2, DL3, DR3, FC2, FC3, HL2, HR2, ML2, MR2, NE3, NS3, PL1, PR1, SL3, SR3	Not Pressurized	0.50
			Pressurized	0.25
		Separate from: FX2	Not Pressurized	4.00
			Pressurized	
		Compatible With: DL2, DR2, NE2, NR2, SL2, SR2	Not Pressurized	Contact Permitted
			Pressurized	
NS3	26 AWG - 12 AWG	Separate from: DL1, DR1, GL1, GR1, HL1, HR1, ML1, MR1, NE1, SL1, SR1	Not Pressurized	3.00
			Pressurized	
		Separate from: BK1, PL1, PR1,	Not Pressurized	2.00
			Pressurized	
		BK2, DL2, DR2, FC2, FC3, HL2, HR2, ML2, MR2, NE2, NR2, SL2, SL3, SR2, SR3	Not Pressurized	0.50
			Pressurized	0.25
		Separate from: FX2	Not Pressurized	4.00
			Pressurized	
		Compatible With: DL3, DR3, NE3	Not Pressurized	Contact Permitted
			Pressurized	
PL1	26 AWG - 12 AWG	Separate from: DL1, DR1, GL1, GR1, HL1, HR1, ML1, MR1, NE1, SL1, SR1	Not Pressurized	3.00
			Pressurized	
		Separate From: BK1, BK2, DL2, DR2, FC2, HL2, HR2, ML2, MR2, NE2, NR2, NS2, PR1, SL2, SR2	Not Pressurized	0.50
			Pressurized	0.25
		Separate from: FX2	Not Pressurized	4.00
			Pressurized	
		Separate From: DL3, DR3, FC3, NE3, NS3, SL3, SR3	Not Pressurized	2.00
			Pressurized	
		Compatible with: None	Not Pressurized	-

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Table 2 (continued)

Separation Code	Wire Size Range	Compatible/Incompatible Separation Codes	Area	Minimum Separation Distance (inch)
PR1	26 AWG - 12 AWG	Separate from: DL1, DR1, GL1, GR1, HL1, HR1, ML1, MR1, NE1, SL1, SR1	Not Pressurized	3.00
			Pressurized	
		Separate From: BK1, BK2, DL2, DR2, FC2, HL2, HR2, ML2, MR2, NE2, NR2, NS2, PL1, SL2, SR2	Not Pressurized	0.50
			Pressurized	0.25
		Separate from: FX2	Not Pressurized	4.00
			Pressurized	
		Separate From: DL3, DR3, FC3, NE3, NS3, SL3, SR3	Not Pressurized	2.00
			Pressurized	
		Compatible with: None	Not Pressurized	-
SL1	10 AWG - 4/0 AWG	Separate from: DL1, DR1, GL1, GR1, HL1, HR1,ML1, MR1, NE1, SR1	Not Pressurized	0.50
			Pressurized	
		Separate from: BK1, BK2, DL2, DL3, DR2, DR3, FC2, FC3, HL2, HR2, ML2, MR2, NE2, NE3, NR2, NS2, NS3, PL1, PR1, SL2, SL3, SR2, SR3	Not Pressurized	3.00
			Pressurized	
		Separate from: FX2	Not Pressurized	4.00
			Pressurized	
		Compatible With: None	Not Pressurized	-
			Pressurized	
SL2	26 AWG - 12 AWG	Separate from: DL1, DR1, GL1, GR1, HL1, HR1, ML1, MR1, NE1, SL1, SR1	Not Pressurized	3.00
			Pressurized	
		Separate from: BK1, BK2, DL2, DL3, DR2, DR3, FC2, FC3, HL2, HR2, ML2, MR2, NE2, NE3, NS3, PL1, PR1, SL3, SR2, SR3	Not Pressurized	0.50
			Pressurized	0.25
		Separate from: FX2	Not Pressurized	4.00
			Pressurized	
		Compatible With: NR2, NS2	Not Pressurized	Contact Permitted
			Pressurized	

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Table 2 (continued)

Separation Code	Wire Size Range	Compatible/Incompatible Separation Codes	Area	Minimum Separation Distance (inch)
SL3	26 AWG - 12 AWG	Separate from: DL1, DR1, GL1, GR1, HL1, HR1, ML1, MR1, NE1, SL1, SR1	Not Pressurized	3.00
			Pressurized	
		Separate from: BK1, BK2, DL2, DL3, DR2, DR3, FC2, FC3, HL2, HR2, ML2, MR2, NE2, NR2, NS2, NS3, PL1, PR1, SL2, SR2, SR3	Not Pressurized	0.50
			Pressurized	0.25
		Separate from: FX2	Not Pressurized	4.00
			Pressurized	
		Compatible With: NS3	Not Pressurized	Contact Permitted
			Pressurized	
SR1	10 AWG - 4/0 AWG	Separate from: DL1, DR1, GL1, GR1, HL1, HR1,ML1, MR1, NE1, SL1	Not Pressurized	0.50
			Pressurized	
		Separate from: BK1, BK2, DL2, DL3, DR2, DR3, FC2, FC3, HL2, HR2, ML2, MR2, NE2, NE3, NR2, NS2, NS3, PL1, PR1, SL2, SL3, SR2, SR3	Not Pressurized	3.00
			Pressurized	
		Separate from: FX2	Not Pressurized	4.00
			Pressurized	
		Compatible With: None	Not Pressurized	-
			Pressurized	
SR2	26 AWG - 12 AWG	Separate from: DL1, DR1, GL1, GR1, HL1, HR1, ML1, MR1, NE1, SL1, SR1	Not Pressurized	3.00
			Pressurized	
		Separate from: BK1, BK2, DL2, DL3, DR2, DR3, FC2, FC3, HL2, HR2, ML2, MR2, NE2, NE3, NS3, PL1, PR1, SL2, SL3, SR3	Not Pressurized	0.50
			Pressurized	0.25
		Separate from: FX2	Not Pressurized	4.00
			Pressurized	
		Compatible With: NR2, NS2	Not Pressurized	Contact Permitted
			Pressurized	

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Table 2 (continued)

Separation Code	Wire Size Range	Compatible/Incompatible Separation Codes	Area	Minimum Separation Distance (inch)
SR3	26 AWG - 12 AWG	Separate from: DL1, DR1, GL1, GR1, HL1, HR1, ML1, MR1, NE1, SL1, SR1	Not Pressurized	3.00
			Pressurized	
		Separate from: BK1, BK2, DL2, DL3, DR2, DR3, FC2, FC3, HL2, HR2, ML2, MR2, NE2, NR2, NS2, NS3, PL1, PR1, SL2, SR2, SL3	Not Pressurized	0.50
			Pressurized	0.25
		Separate from: FX2	Not Pressurized	4.00
			Pressurized	
		Compatible With: NS3	Not Pressurized	Contact Permitted

B. Separation by an Insulation Material

Insulation sleeves or insulation tubes are used to give the specified separation for the wire harness when these conditions occur:

- For the 707, 727, 737, 747, 757, 767, and 777 airplane models, the 1/4 inch distance of separation in the pressurized area is not possible
- For the 707, 727, 737, 757, and 767 airplane models, the 1/4 inch distance of separation in the area that is not pressurized is not possible
- For the 747 and 777 airplane models, the 1/2 inch distance of separation in the area that is not pressurized is not possible.

To give the specified separation in the areas that are:

- In the pressurized area of the 707, 727, 737, 747, 757, 767, and 777 airplane models, Varglas non-fray, Type HO or Type Hp insulation sleeves are used
- In the not pressurized area of the 707, 727, 737, 747, 757, 767, and 777 airplane models, TFE Teflon sleeves or TFE tubes with a wall thickness of 9.0 mils or larger are used.

NOTE: For the 707, 727, 737, 747, 757, 767, and 777 airplane models, the separation by an insulation material is not necessary where a BACC18AD type of fusible link, single-phase circuit breaker is used to protect the circuit in the wiring that is:

- In the flight deck
- In the E/E compartment
- In between the flight deck and the E/E compartment.

NOTE: For the 787 airplane model, wire separation by an insulation material is not permitted.

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C. Separation by a Fusible Link Circuit Breaker for the 707, 727, 737, 747, 757, 767, and 777 Airplane Models

NOTE: Separation by a fusible link circuit breaker is not sufficient when a wire harness is in a location where it is open to:

- A turbine burst
- The failure of a pneumatic duct
- A tire tread that is thrown
- Other types of physical damage.

If wires with different functional separation codes come directly from a circuit breaker source and are protected with a fusible link circuit breaker:

- The separation by an insulation material is not necessary
- The wires can have the same routing.

A wire, that has the same routing as another wire, must have a insulation sleeve or insulation tube if all of these conditions occur:

- The wires have different functional separation codes
- The wire is not protected with a fusible link circuit breaker
- The other wire is protected with a fusible link circuit breaker.

4. WIRE HARNESS EMC SEPARATION

A. Separation Between EMC Groups

An analysis of the EMC codes is made for the routing of each specified wire harness.

As a general rule, the EMC wire harnesses with:

- Code 1 and Code 3 do not have the same routing
- Code 2 can have the same routing as a wire harness Code 1 or Code 3 after sufficient analysis.

5. MODIFICATION OF AIRPLANE WIRING

This paragraph gives the procedures to keep the correct separation of wire harnesses when a modification is made to the wiring of an airplane.

A. A Change in the Routing of a Wire Harness

(1) Refer to the specified conditions for the airplane model.

(2) If the conditions for separation by distance in Paragraph 3.A. cannot be obeyed, put a sleeve on either:

- The full harness, if it is necessary
- Only at the point where the wire harnesses touch, if it is sufficient.

Refer to Paragraph 3.B.

B. A Wire That Is Added to a Wire Harness

(1) Find the separation group of the wire harness from the applicable chart in the Wiring Diagram Manual Chapter 91.

(2) Find the separation group of the new wire from its function and its EMC condition.

(3) If it is necessary, make a selection of either of these types of separation:

(a) Use a shielded wire.

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(b) Put a sleeve on the wire. Refer to Paragraph 3.B.

NOTE: It is not necessary to put a sleeve on each individual wire, if the wires are in the same separation group.

(4) Put the wires of the redundant circuits through the different connectors.

(5) Assemble the wire harness ties again with the same color of tie material.

Make sure that the wire harness with the new wire does not touch another wire harness that has a color code that does not agree with the color code of the new harness.

C. A New Wire Harness

(1) Find the separation group of the new harness from its function and its EMC condition.

NOTE: A wire harness can have only one functional separation group code.

(2) Examine every circuit or wire in the new harness.

For circuits that do not agree with the selection of the separation group for the harness, make sure that these conditions for separation are obeyed:

- The separation by distance; refer to Paragraph 3.A.
- The separation by insulation material; refer to Paragraph 3.B.
- The separation with shielded wire.

CAUTION: AN INSULATION SLEEVE DOES NOT GIVE THE SUFFICIENT SEPARATION FOR THE CIRCUITS OF THE EMC GROUPS THAT ARE NOT COMPATIBLE.

(3) Put the wires of the redundant circuits through the different connectors.

(4) Examine the physical location of the installation of a new harness in relation to the wire harnesses that are installed on the airplane.

(a) Assemble the wire harness ties of the new harness with the correct color of tie material for the identification of the separation group of the wire harness. Refer to Subject 20-10-11.

(b) Obey the specified conditions for separation. Refer to Paragraph 3.

(5) Add this data to the applicable charts in the Wiring Diagram Manual Chapter 91:

- The new harness number
- The separation group
- The routing.

6. MODEL 737-300, MODEL 737-400, AND MODEL 737-500

A. Functional Separation of the Fail-Passive Autoland System

NOTE: The 737 Wiring Diagram Manual 91-06-() Subjects give the functional separation codes.

These are the conditions for the autoland system:

- All circuits are given a separation code
- A color code system is used in airplane wiring, shelve wiring, and panel wiring; refer to Table 3.

The codes A, B, E, and F identify the necessary separation between:

- Independent power sources
- Redundant system circuits.

The code N identifies circuits for which separation is not necessary.

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Table 3
COLOR CODES FOR 737 SEPARATION

Autoland Channel Code	Circuit	Tie Material Color
A	System A power, logic, excitation; sensor instrument	Red
B	System B power, logic, excitation; sensor instrument	Yellow
E	Cross channel wires; buffer protected	Blue
F	Common cruise wires	Orange
N	Other systems; identification of wires is not necessary	White

7. MODEL 737-600, MODEL 737-700, MODEL 737-800, MODEL 737-900, AND MODEL 737-900ER

A. Wire Harness Separation

Refer to Table 4 for the Power Source Separation Codes for the 737-600, 737-700, 737-800, 737-900 and 737-900ER.

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Table 4
COLOR CODES FOR 737-600, 737-700, 737-800, 737-900, AND 737-900ER SEPARATION

Power Source Separation Code	Circuit	Tie Material Color
L	Left Generator feeders and controls. Circuits which are powered from the left power system, and do not meet the requirements for Category N shall be assigned a power separation code of L.	White
R	Right generator feeders and controls. Circuits which are powered from the right power system, and do not meet the requirements for Category N shall be assigned a power separation code of R.	White
S	Circuits which are dependent upon power from the battery, hot battery, and AC or DC standby busses, and do not meet the requirements for Category N shall be assigned a power separation code of S.	White
A	Circuits which are associated with APU power feeders and controls, and do not meet the requirements of Category N shall be assigned a power separation code of A.	White
N	Neutral circuits.	White

NOTE: Category "N" neutral circuits are one of these types of circuits:

a. Circuits protected by the following primary distribution circuit breaker size or smaller and are not associated with Standby and APU power sources and controls.

- DC-2.5 Amp
- 1-Phase AC-5.0 Amp
- 3-Phase AC-3.0 Amp.

b. Circuits that are current limited by circuit impedance or transformer action to values equal to or less than those in (a) above.

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c. Circuits that are energized only on the ground.

NOTE: Neutral circuits are exempt from separation requirements and can be routed with another power source if the redundant system separation and EMC requirements are obeyed.

8. MODEL 747-100, MODEL 747-200, AND MODEL 747-300

When the Fail-Operational Autoland System is installed, the separation of the wire harnesses by auto pilot channel is necessary.

A. Functional Separation for the Fail-Operational Autoland System

NOTE: The 747 Wiring Diagram Manual 91-00-() Subjects give the functional separation codes.

When separation by distance is used, a minimum of 1/4 inch of separation is necessary.

When the necessary distance of separation of different wire harnesses between the wire harness clamps cannot be kept, one or more of these alternatives are satisfactory:

- More wire harness clamps must be installed
- More insulation material must be installed
- Another type of physical separation must be used.

When insulation sleeves are used for separation:

- Varglas Type HO or Type HP sleeves are used in the other areas
- TFE sleeves are used in areas where resistance to high abrasion is necessary.

B. Identification of Wire Harnesses

The wire harnesses of the Fail-Operational Autoland System are identified by color codes:

- So that the correct separation of channels is kept after rework or modification
- With colored lacing tape or colored plastic ties
- That are given in Table 5.

NOTE: Color identification if the channel is not applicable to:

- Coax cables
- Shelf and panel integration wire harnesses.

Table 5
COLOR CODES FOR 747 SEPARATION

Autopilot Channel Code	Tie Material Color
A	Red
B	Yellow
C	Green
D	Orange
E	Blue
F	Brown
G	Black

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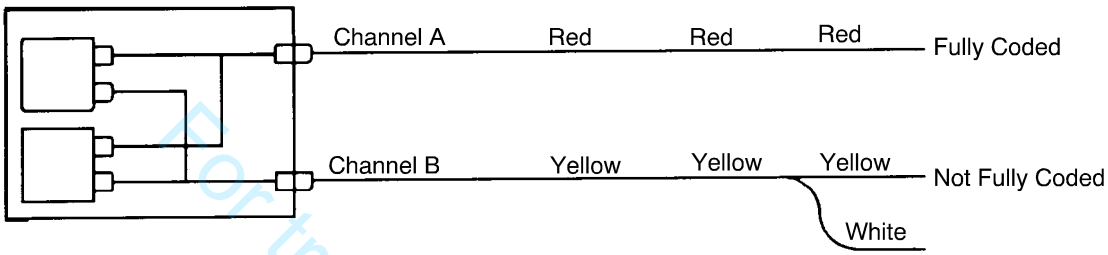
C. Wire Harnesses Identified by Color Codes

A wire harness:

- Can be either fully color coded or not fully color coded; refer to Figure 1
- That has a Fail-Operational Autoland System circuit in every of the branch of the harness are fully color coded
- That has one of more branches that do not have a Fail-Operational Autoland System circuit is not fully color coded.



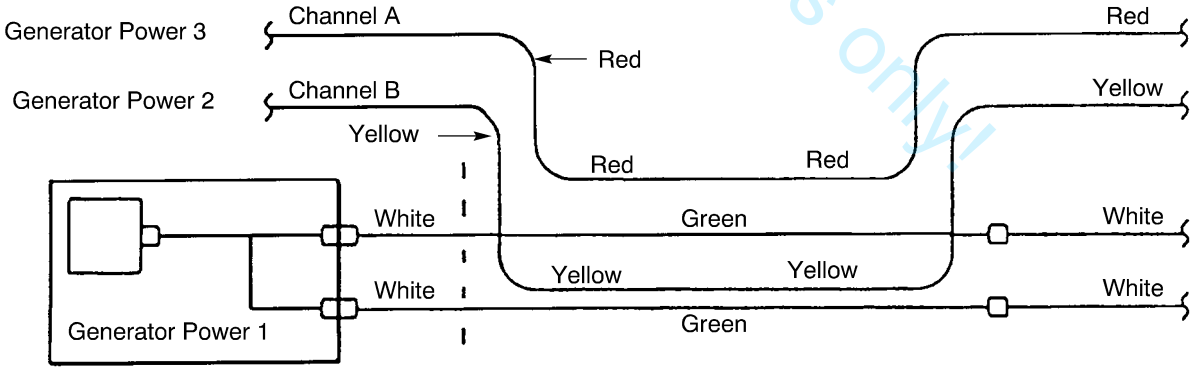
COLOR CODED WIRE HARNESS
Figure 1

Wire harnesses that do not have Fail-Operational Autoland System wires can be called Associated Fail-Operational Autoland System wire harnesses when both of these conditions occur:

- They have routing that is near a Fail-Operational Autoland System wire harness
- They have a different generator power source than the Fail-Operational Autoland System wire harness.

To make sure that the different power sources are correctly isolated, the Associated wire harnesses are color coded for the part that has the routing that is near Fail-Operational Autoland System wire harness.

Refer to the Generator Power 1 in Figure 2.



COLOR CODED ASSOCIATED WIRE HARNESS
Figure 2

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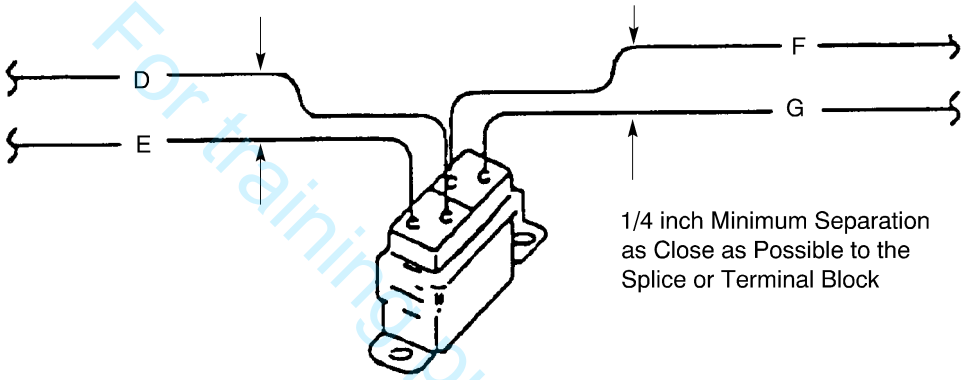
It is necessary to keep the specified separation as close as possible to the termination when two or more Fail-Operational Autoland System wire harnesses:

- Have different channel assignments
- Have wires that are spliced together or are electrically common.

Refer to Figure 3.

This configuration:

- Is functionally correct
- Keeps the specified separation of channels
- Occurs where the stabilizer trim control circuits of both the Captain and the First Officer are in parallel.



ELECTRICALLY COMMON TERMINATION
Figure 3

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9. MODEL 747-400

A. Functional Separation

NOTE: The 747-400 Wiring Diagram Manual 91-06-() and 91-07-() Subjects give the functional separation codes.

These conditions are applicable:

- All circuits are given a separation code; refer to Table 6
- The necessary separation between independent power sources and redundant system circuits is identified by Codes 1, 2, 3, and 4
- The necessary separation between EMC circuits that are not compatible is identified by Codes 1, 2, and 3
- Circuits for which separation is not necessary are identified by Code N.

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Table 6
COLOR CODES FOR 747-400 FUNCTIONAL SEPARATION

Functional Separation Code	Circuit	Tie Material Color
1	All electrical and avionic circuits that are powered from bus Number 1 and do not have N or S standby codes	Green
2	All electrical and avionic circuits powered from bus Number 2 that do not have N or S standby codes	Yellow
3	All electrical and avionic circuits powered from Number 3 that do not have N or S standby codes	Red
4	All electrical and avionic circuits powered from Number 4 that do not have N or S standby codes	Brown
N	Power circuits and other circuits in which current is kept to a limit; refer to Table 7	White
SCd	Circuits that are supplied power from the battery; DC Standby, Hot Battery, or AC Standby	Blue

Table 7
CODE N, NON-REDUNDANT CIRCUITS OR NON-REDUNDANT POWER CIRCUITS IN 747-400 FUNCTIONAL SEPARATION

Circuit or Component	Note
DC 2.5 amperes or smaller circuit breaker, BACC18Z type	Does not apply to battery bus, DC Standby Bus, and Hot Battery Bus unless the load is not critical and is not necessary during Standby Power Only operation
1 Phase AC 5.0 amperes or smaller circuit breaker, BACC18Z type	Does not apply to AC Standby
3 Phase AC 3.0 amperes or smaller circuit breaker, BACC18AC type	-
Current is kept to a limit by circuit impedance or transformer action	Current is less than or equal to DC 2.5 amperes, 1 Phase AC 5.0 amperes, or 3 Phase AC 3.0 amperes
Power is supplied from the ground handling bus and are not energized during flight	-
Ground seeking circuits that use Master Dim and Test Power	Neutral on the ground side of lamps

10. MODEL 747-8

A. Functional Separation

These conditions are applicable:

- All circuits are given a separation code; refer to Table 8
- Colored tie material cannot be used for the colored wire specified for wire bundles with separation code F.

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Table 8
COLOR CODES FOR 747-8 FUNCTIONAL SEPARATION

Functional Separation Code	Circuit	Tie Material Color
1	All electrical and avionic circuits that are powered from bus Number 1 and do not have N or S standby codes	Green
2	All electrical and avionic circuits powered from bus Number 2 that do not have N or S standby codes	Yellow
3	All electrical and avionic circuits powered from Number 3 that do not have N or S standby codes	Red
4	All electrical and avionic circuits powered from Number 4 that do not have N or S standby codes	Brown
S	Standby Circuits - All Electrical and Avionics Circuits dependant upon power from the main/APU battery (Hot Battery Busses, Bqttery Busses and AC Standby Busses)	Blue
N	Neutral Circuits; Refer to Table 9	White
F	Circuits associated with Fuel Quantity Indication System (FQIS) and Single Point System (SPS).	Pink Color Wire

NOTE: Colored tie material cannot be used for the colored wire specified for wire bundles with separation code F.

Table 9
CODE N, NON-REDUNDANT CIRCUITS OR NON-REDUNDANT POWER CIRCUITS IN 747-8 FUNCTIONAL SEPARATION

Circuit or Component	Note
DC 2.5 amperes or smaller circuit breaker, BACC18Z type	Does not apply to battery bus, DC Standby Bus, and Hot Battery Bus unless the load is not critical and is not necessary during Standby Power Only operation
1 Phase AC 5.0 amperes or smaller circuit breaker, BACC18Z type	Does not apply to AC Standby
3 Phase AC 3.0 amperes or smaller circuit breaker, BACC18AC type	-
Current is kept to a limit by circuit impedance or transformer action	Current is less than or equal to DC 2.5 amperes, 1 Phase AC 5.0 amperes, or 3 Phase AC 3.0 amperes
Power is supplied from the ground handling bus and are not energized during flight	-
Ground seeking circuits that use Master Dim and Test Power	Neutral on the ground side of lamps
Circuits associated with APU 1 and 2 Power and Control	-

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11. MODEL 757

A. Functional Separation

NOTE: The 757 Wiring Diagram Manual 91-05-() Subjects give the functional separation codes.

These conditions are applicable:

- All circuits are given a separation code; refer to Table 10
- The necessary separation between independent power sources is identified by Codes A, C, H, L, R, and S
- The necessary separation between redundant system circuits is identified by Codes C, H,. L, and R
- The necessary separation between EMC circuits that are not compatible is identified by Codes 1, 2, or 3
- Circuits for which separation is not necessary are identified by Code N.

Table 10
COLOR CODES FOR 757 FUNCTIONAL SEPARATION

Functional Separation Code	Circuit	Tie Material Color
A	Circuits that are related to the APU Electrical Power and the APU Control and can cause shutdown of the auxiliary generator power	Orange
C	Circuits that are related to the power that is supplied by the center bus powered circuits; redundant system circuits are included	Yellow
H	Circuits that are related to the Extended Range Operations (EROPS); the Hydraulic Motor Driven AC and DC Generator Systems, electrical power feeders, control and protection	Purple
L	Circuits that are related to the power that is supplied by the left power system and do not have N codes; redundant system circuits are included	Red
N	Power circuits and other circuits in which current is kept to a limit; refer to Table 11	White
R	Circuits that are related to the power supplied by the right power system and do not have N codes; redundant system circuits are included	Green
S	Circuits that are supplied power from the battery; DC Standby, Hot Battery, or AC Standby	Blue

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NOTE: For Code C circuits, power is supplied to the center buses:

- From the left power system during normal operations
- From the standby power system during a Category III Autoland; in this mode, can have the same routing as Code S circuits.

Table 11
CODE N, NON-REDUNDANT CIRCUITS OR NON-REDUNDANT POWER CIRCUITS IN 757 FUNCTIONAL SEPARATION

Circuit or Component	Note
DC 2.5 amperes or smaller circuit breaker, BACC18Z type	Does not apply to battery bus, DC Standby Bus, and Hot Battery Bus unless the load is not critical and is not necessary during Standby Power Only operation
1 Phase AC 5.0 amperes or smaller circuit breaker, BACC18Z type	Does not apply to AC Standby
3 Phase AC 3.0 amperes or smaller circuit breaker, BACC18AC type	-
Current is kept to a limit by circuit impedance or transformer action	Current is less than or equal to DC 2.5 amperes, 1 Phase AC 5.0 amperes, or 3 Phase AC 3.0 amperes
Power is supplied from the ground handling bus and are not energized during flight	-
Ground seeking circuits that use Master Dim and Test Power	Neutral on the ground side of lamps

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B. Engine Wire Harness Separation

Installation of the wire harnesses that have engine control and indication circuits must be kept as they are supplied:

- To make sure that separation of redundant engine systems is correct
- To keep engine to engine separation.

12. MODEL 767

A. Functional Separation

NOTE: The 767 Wiring Diagram Manual 91-06-() Subjects give the functional separation codes.

These conditions are applicable:

- All circuits are given a separation code; refer to Table 12
- The necessary separation between independent power sources is identified by Codes A, C, H, L, R, and S
- The necessary separation between redundant system circuits is identified by Codes C, H,. L, and R
- The necessary separation between EMC circuits that are not compatible is identified by Codes 1, 2, or 3
- Circuits for which separation is not necessary are identified by Code N.

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Table 12
COLOR CODES FOR 767 FUNCTIONAL SEPARATION

Functional Separation Code	Circuit	Tie Material Color
A	Circuits that are related to the APU Electrical Power and the APU Control and can cause shutdown of the auxiliary generator power	Orange
C	Circuits that are related to the power that is supplied by the center bus powered circuits; redundant system circuits are included	Yellow
H	Circuits that are related to the Extended Range Operations (EROPS); the Hydraulic Motor Driven AC and DC Generator Systems, electrical power feeders, control and protection	Purple
L	Circuits that are related to the power that is supplied by the left power system and do not have N codes; redundant system circuits are included	Red
N	Power circuits and other circuits in which current is kept to a limit; refer to Table 13	White
R	Circuits that are related to the power supplied by the right power system and do not have N codes; redundant system circuits are included	Green
S	Circuits that are supplied power from the battery; DC Standby, Hot Battery, or AC Standby	Blue

NOTE: For Code C circuits, power is supplied to the center buses:

- From the left power system during normal operations
- From the standby power system during a Category III Autoland; in this mode, can have the same routing as Code S circuits.

Table 13
CODE N, NON-REDUNDANT CIRCUITS OR NON-REDUNDANT POWER CIRCUITS IN 767 FUNCTIONAL SEPARATION

Circuit or Component	Note
DC 2.5 amperes or smaller circuit breaker, BACC18Z type	Does not apply to battery bus, DC Standby Bus, and Hot Battery Bus unless the load is not critical and is not necessary during Standby Power Only operation
1 Phase AC 5.0 amperes or smaller circuit breaker, BACC18Z type	Does not apply to AC Standby
3 Phase AC 3.0 amperes or smaller circuit breaker, BACC18AC type	-
Current is kept to a limit by circuit impedance or transformer action	Current is less than or equal to DC 2.5 amperes, 1 Phase AC 5.0 amperes, or 3 Phase AC 3.0 amperes
Power is supplied from the ground handling bus and are not energized during flight	-
Ground seeking circuits that use Master Dim and Test Power	Neutral on the ground side of lamps

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13. MODEL 777

A. Functional Separation

NOTE: The 777 Wiring Diagram Manual 91-05-() Subjects give the functional separation codes.

These conditions are applicable:

- All circuits are given a separation code; refer to Table 14
- Wire harnesses that have different functional separation codes have the same routing only if the Wiring Diagram Manual shows the same routing
- If wire harnesses that have different functional separation codes have the same routing, the harnesses are held together with white lacing tape or natural color plastic ties.

It is not necessary to identify these wire harnesses with a color code:

- Wire harnesses installed in the location of the engine
- Wire harnesses installed in the struts
- Wire harnesses installed in the shelves and panels
- Coax cables.

NOTE: Coax cables and wire harnesses that contain coax cables for which a color code is not necessary must be held together or installed with white lacing tape.

NOTE: Wire harnesses and cables for which a color code is not necessary can be held together or installed with either of these tie materials:

- White lacing tape
- Natural color plastic ties.

Table 14
COLOR CODES FOR 777 FUNCTIONAL SEPARATION

Functional Separation Code	Circuit	Tie Material Color
AK	Auxiliary Power Unit	Orange
BK	Back-up Power; Variable Speed Constant Frequency	Magenta
CP	Center Primary; Flight Control DC Permanent Magnet Generator	Blue
LM	Left Main; Left Integrated Drive Generator	Yellow
LP	Left Primary; Flight Control DC Permanent Magnet Generator	Red
LR	Left Redundant	Grey
LS	Left Secondary	Black
NN	Neutral	White
RM	Right Main; Right Integrated Drive Generator	Brown
RP	Right Primary; Flight Control DC Permanent Magnet Generator	Green
RR	Right Redundant	Light Pink
RS	Right Secondary	Light Brown
SY	DC Standby, AC Standby, or Hot Battery Bus	Purple

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14. MODEL 787

A. Functional Separation - 787

NOTE: The 787 Wiring Diagram manual 99-xx-xx Subjects give the functional separation codes.

These conditions are applicable:

- All circuits are given a separation code: refer to Table 15
- Wire harnesses that have different separation codes have the same routing only if the Wiring Diagram Manual shows the same routing.

Table 15
787 FUNCTIONAL SEPARATION CODES

Functional Separation Code	Circuit	Description	Tie Material Color
BK	RAM Air Turbine (RAT) Backup Power	Applies to: 230Vac RAT to Backup bus and associated loads	White
DL	Left Distributed Power	Applies to: All 115Vac & 28Vdc loads powered from the L-TRU and L-ATU	White
DR	Right Distributed Power	Applies to: All 115Vac & 28Vdc loads powered from the R-TRU and R-ATU	White
FC	FCE Wiring	Applies to: Flight Control signal and data wiring	White
FF	Fuel Tank Wiring	Applies to: All Intrinsically Safe Wiring entering the Center, Main and Auxiliary Fuel Tanks	White
FX	Converted Power greater than 115 Volts (non ATA 24)	Applies to: Converted Power with Voltages greater than 115 Volts	White
GL	Left Generator Bus L1 (235Vac)	Applies to: Left Generator L1 to the P100 Distribution Panel	White
	Left Generator Bus L2 (235Vac)	Applies to: Left Generator L2 to the P100 Distribution Panel	
	Left APU Bus 3 (235Vac)	Applies to: Left APU to the P150 Distribution Panel	
GR	Right Generator Bus R1 (235Vac)	Applies to: Right Generator R1 to the P200 Distribution Panel	White
	Right Generator Bus R2 (235Vac)	Applies to: Right Generator R2 to the P200 Distribution Panel	
	Right APU Bus 3 (235Vac)	Applies to: Right APU to the P150 Distribution Panel	
HL	Left High Voltage (235Vac Distribution)	Applies to: All Left Bus 235Vac loads (P100 Panel), Left 235Vac to ATRU, and Left 235Vac to 28Vdc/115Vac TRU/ATU.	White

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Table 15 (continued)

Functional Separation Code	Circuit	Description	Tie Material Color
HR	Right High Voltage (235Vac Distribution)	Applies to: All Right Bus 235Vac loads (P200 Panel), Right 235Vac to ATRU, and Right 235Vac to 28Vdc/115Vac TRU/ATU.	White
ML	Left Motor Controller	Applies to: All loads from left HVDC motor controllers	White
MR	Right Motor Controller	Applies to: All loads from right HVDC motor controllers	White
NG	Static Grounds	Applies to: All static ground wiring	White
NE	Non-Redundant 115Vac or 28Vdc Power	Applies to: All non-redundant signal or data 28Vdc wiring greater than 2.5 amp and less than 35 amps, 3 phase 115Vac wiring greater than 3 amps and less than 35 amps, single phase 115Vac wiring greater than 5 amps and less than 35 amps, and Circuits not powered in flight (external power, ground handling)	White
NR	Low Power, Redundant Signal or Data	Applies to: All critical or essential redundant signal or data 28Vdc wiring greater than 2.5 amp and less than 35 amp, 3 phase 115Vac wiring greater than 3 amp and less than 35 amp, single phase 115Vac wiring greater than 5 amp and less than 35 amp	White
NS	Low Power, Non-Redundant Signal or Data	Applies to: All non- redundant signal or data wiring 28Vdc greater than or equal to 2.5 amps, 3 phase 115Vac wiring greater than or equal to 3 amps, and single phase 115Vac wiring greater than or equal to 5 amps	White
PL	PMG/Exciter Left 1	Applies to: Left VSFG. L1 PMG to loads/Exciter	White
	PMG/Exciter Left 2	Applies to: Left VSFG. L2 PMG to loads/Exciter	
PR	PMG/Exciter Right 1	Applies to: Right VSFG. R1 PMG to loads/Exciter	White
	PMG/Exciter Right 2	Applies to: Right VSFG. R2 PMG to loads/Exciter	
SL	Standby Power Right Main Battery (28Vdc)	Applies to: Captains Instrument Bus and Hot Battery Bus	White
SR	Standby Power Left Main Battery (28Vdc)	Applies to: First Officer Instrument Bus	White

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INSTALLATION OF PRESSURE BULKHEAD SEALS

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20-10-20 CONTENTS

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INSTALLATION OF PRESSURE BULKHEAD SEALS

This Subject gives the procedures to seal a wire harness that has a routing through the pressure bulkhead.

1. PART NUMBERS AND DESCRIPTION

A. Wire Harness Seal Part Numbers

Table 1
WIRE HARNESS SEAL PART NUMBERS

Flange Shape	Dimensions (inch)			Boeing Standard	Reference
	A	B	C		
Circular	2.78	3.42	1.90	287T0031-1	Figure 1
	2.78	3.42	1.90	287T0031-7	Figure 1
	1.60	2.12	1.62	287T0031-13	Figure 1
	2.78	3.42	1.94	287T0031-14	Figure 1
	0.60	1.00	N/A	287U0125-()	Figure 4
	0.48	0.88	1.20	BACS45B1	Figure 1
	0.78	1.18	1.20	BACS45B2	Figure 1
	1.16	1.56	1.40	BACS45B3	Figure 1
	1.34	1.74	1.62	BACS45B4	Figure 1
	1.50	2.12	1.62	BACS45B5	Figure 1
Oval	0.50	0.75	N/A	2055019-1	Figure 5
	0.50	0.75	1.00	BACS45A12	Figure 2
	0.50	0.75	1.50	BACS45A212	Figure 2
	0.75	1.00	1.00	BACS45A13	Figure 2
	0.75	1.00	1.50	BACS45A213	Figure 2
Square	1.16	1.56	1.40	BACS45A11	Figure 3
	1.34	1.80	1.62	BACS45A14	Figure 3

Table 2
WIRE HARNESS SEAL DESCRIPTION

Part Number	Description
287U0125-1	45 Degree Fitting
287U0125-2	45 Degree Fitting
287U0125-3	30 Degree Fitting
287U0125-4	30 Degree Fitting

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Table 3
APPROVED SUPPLIERS OF BOEING STANDARD WIRE HARNESS SEALS

Boeing Standard	Supplier
2055019-()	Western Sky Industries, Hayward, CA
287U0125-()	Accra Manufacturing, Lynnwood, WA
BACS45A()	An available source
BACS45B()	An available source

Table 4
RECOMMENDED SUPPLIERS OF BOEING STANDARD WIRE HARNESS SEALS

Boeing Standard	Recommended Supplier
287T0031-()	Nylon Molding Corp, Monrovia, CA
BACS45A()	Component Products Corp. - Mukilteo, WA
	Nylon Molding Corp. - Monrovia, CA
	WSI Technologies - Hayward, CA
BACS45B()	Component Products Corp. - Mukilteo, WA
	Nylon Molding Corp. - Monrovia, CA
	WSI Technologies - Hayward, CA

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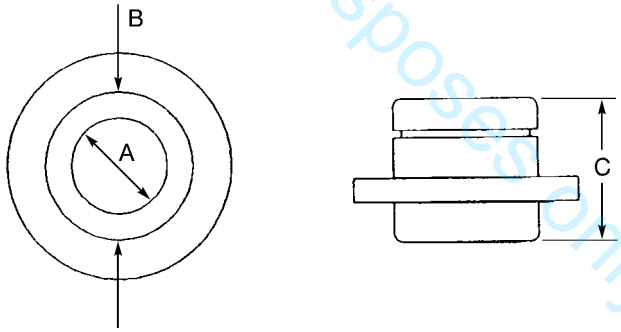

BACS45() AND 287T0031-() WIRE HARNESS SEAL WITH A CIRCULAR FLANGE
Figure 1

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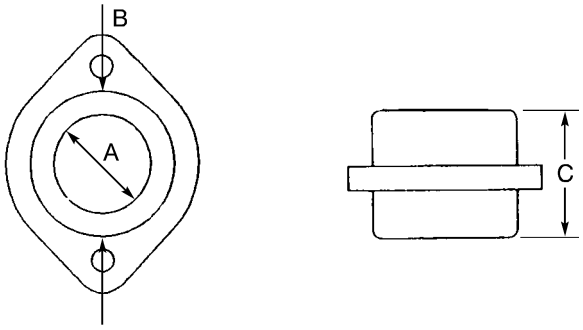
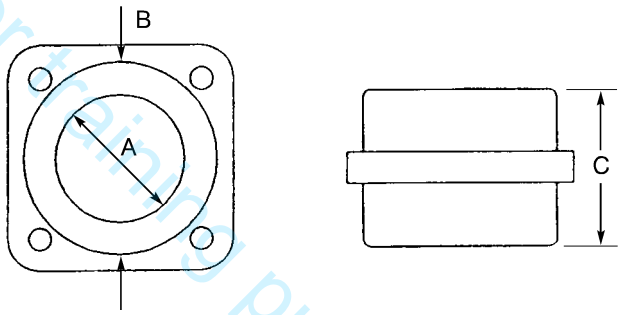
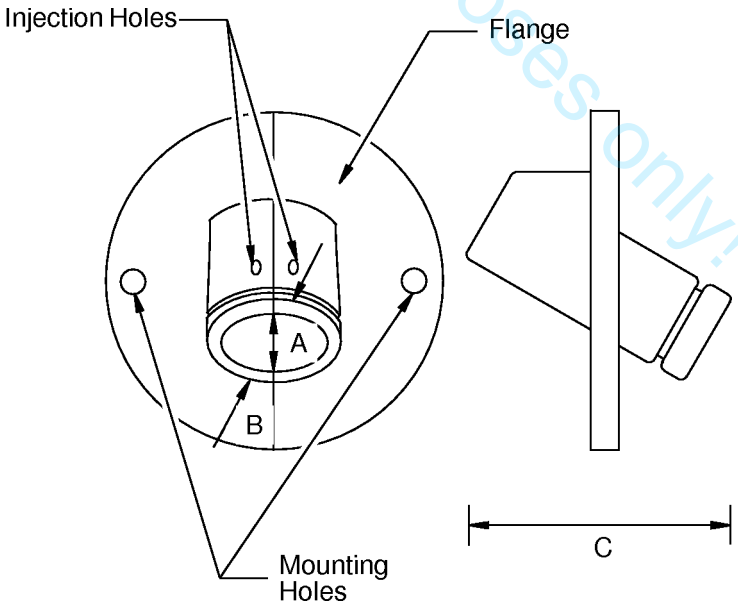
INSTALLATION OF PRESSURE BULKHEAD SEALS



BACS45() WIRE HARNESS SEAL WITH AN OVAL FLANGE
Figure 2



BACS45() WIRE HARNESS SEAL WITH A SQUARE FLANGE
Figure 3



287U0125-1 AND 287U0125-2 WIRE HARNESS SEAL WITH A CIRCULAR FLANGE
Figure 4

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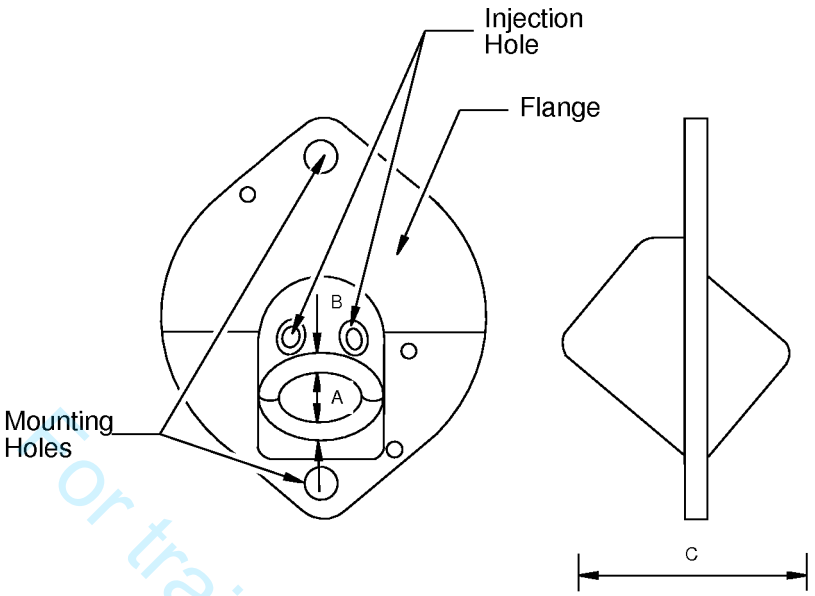

2055019-1 WIRE HARNESS SEAL WITH AN OVAL FLANGE
Figure 5

B. Pressure Bulkhead Seal Assembly Component Part Numbers

Table 5
SEAL RING PART NUMBERS

Wire Harness Seal	Seal Ring	
	Thickness (inches)	Boeing Standard
BACS45B1	0.025	BACS11BD1
		BACS45B70
	0.040	BACS11BD2
		BACS45B71
BACS45B2	0.025	BACS11BD3
		BACS45B72
	0.040	BACS11BD4
		BACS45B73
BACS45B3	0.025	BACS11BD5
		BACS45B74
	0.040	BACS11BD6
		BACS45B75

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Table 5 (continued)

Wire Harness Seal	Seal Ring	
	Thickness (inches)	Boeing Standard
BACS45B4	0.025	BACS11BD7
		BACS45B76
	0.040	BACS11BD8
		BACS45B77
BACS45B5	0.025	BACS11BD9
		BACS45B78
	0.040	BACS11BD10
		BACS45B79
BACS45B6	0.25	BACS11BD11
BACS45B7	0.40	BACS11BD12
BACS45B8	0.40	BACS11BD13
BACS45B9	0.40	BACS11BD14
BACS45B10	0.25	BACS11BD15
BACS45B11	0.25	BACS11BD16
	0.40	BACS11BD17
287T0031-()	0.25	287T0031-4
	0.40	287T0031-5

Table 6
ALTERNATIVE SEAL RING PART NUMBERS

Specified Seal Ring	Alternative Seal Ring
BACS45B70	BACS11BD1
BACS45B71	BACS11BD2
BACS45B72	BACS11BD3
BACS45B73	BACS11BD4
BACS45B74	BACS11BD5
BACS45B75	BACS11BD6
BACS45B76	BACS11BD7
BACS45B77	BACS11BD8
BACS45B78	BACS11BD9
BACS45B79	BACS11BD10

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Table 7
APPROVED SUPPLIERS OF BOEING STANDARD SEAL RINGS

Boeing Standard	Supplier
BACS11BD()	An available source

Table 8
PRESSURE BULKHEAD SEAL ASSEMBLY COMPONENT PART NUMBERS

Component Type	Standard	Supplier
Cover Plate	BACS45A26	Boeing
	BACP19R1()	Boeing
Filler	BACF3J1	Boeing
	BACF3J2	Boeing
	BACF3J3	Boeing
	BACF3J4	Boeing
	BACF3J5	Boeing
	BACF3K1	Boeing
	BACF3K2	Boeing
	BACF3K3	Boeing
	BACF3K4	Boeing
	BACF3K5	Boeing
	BACS45A36	Boeing
	BACS45A37	Boeing
	BACS45A38	Boeing
	BACS45A39	Boeing
	BACS45A40	Boeing
	BACS45B50	Boeing
	BACS45B51	Boeing
	BACS45B52	Boeing
	BACS45B53	Boeing
	BACS45B54	Boeing
Screw	BACS12CB3-10	Boeing
	BACS12HN3-10	Boeing

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Table 8 (continued)

Component Type	Standard	Supplier
Seal Plate	BACP19N1	Boeing
	BACP19N2	Boeing
	BACP19P1	Boeing
	BACS45A34	Boeing
	BACS45B30	Boeing
	BACS45B40	Boeing
Snap Ring	MS16624	QPL

Table 9
ALTERNATIVE COMPONENT PART NUMBERS

Component Type	Specified Component	Alternative Component
Cover Plate	BACS45A26	BACP19R1()
Filler	BACS45A36	BACF3K2
	BACS45A37	BACF3K3
	BACS45A38	BACF3K4
	BACS45A39	BACF3K5
	BACS45A40	BACF3K1
	BACS45B50	BACF3J1
	BACS45B51	BACF3J2
	BACS45B52	BACF3J3
	BACS45B53	BACF3J4
	BACS45B54	BACF3J5
Screw	BACS12CB3-10	BACS12HN3-10
Seal Plate	BACS45B30	BACP19N2
	BACS45B34	BACS19P1
	BACS45B40	BACP19N1

Table 10
APPROVED SUPPLIERS OF BOEING STANDARD PRESSURE BULKHEAD SEAL ASSEMBLY COMPONENTS

Component	Boeing Standard	Supplier
Cover plate	BACP19R1()	An available source
	BACS45A26	An available source
Filler	BACF3J()	An available source
	BACF3K()	

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Table 10 (continued)

Component	Boeing Standard	Supplier
Screw	BACS12CB()	An available source
	BACS12HN3-10	An available source
Seal Plate	BACP19N()	An available source
	BACP19P()	

C. Coil Spacer Part Numbers

Table 11
COIL SPACER PART NUMBERS

Inner Diameter (inch)	Boeing Standard
0.03	BACS18AY1
	BACS45A18
0.05	BACS18AY2
0.06	BACS18AY3
	BACS45A20
0.09	BACS18AY4
	BACS45A221
0.12	BACS18AY5
	BACS45A23
0.25	BACS18AY6
	BACS45A24

Table 12
ALTERNATIVE COIL SPACER PART NUMBERS

Specified Coil Spacer	Alternative Coil Spacer
BACS45A18	BACS18AY1
BACS45A20	BACS18AY3
BACS45A221	BACS18AY4
BACS45A23	BACS18AY5
BACS45A24	BACS18AY6

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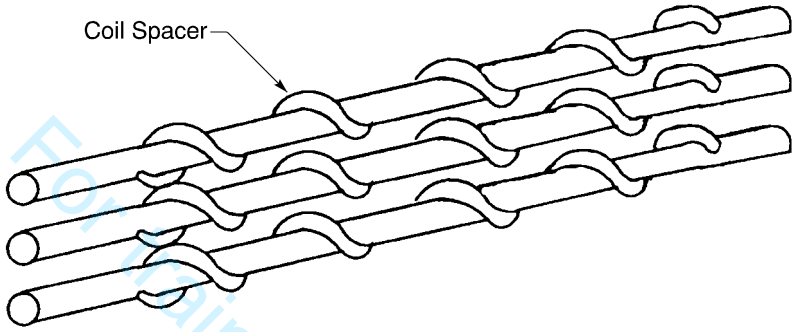
Table 13
APPROVED SUPPLIERS OF BOEING STANDARD COIL SPACERS

Boeing Standard	Supplier
BACS18AY()	An available source
BACS45A()	An available source



COIL SPACERS
Figure 6

D. Star Spacer Part Numbers

Table 14
WIRE HARNESS STAR SPACER PART NUMBERS

Configuration	Dimension A (inch)	Boeing Standard	Reference
3 Separations	0.68	BACS18AX2	Figure 7
		BACS45A115	Figure 7
	0.88	BACS18AX1	Figure 7
		BACS45A105	Figure 7
	1.06	BACS18AX7	Figure 7
		BACS45A206	Figure 7
	1.32	BACS18AX8	Figure 7
		BACS45A207	Figure 7
	1.68	BACS18AX9	Figure 7
		BACS45A208	Figure 7

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Table 14 (continued)

Configuration	Dimension A (inch)	Boeing Standard	Reference
4 Separations	0.75	BACS18AX4	Figure 8
		BACS45A30	Figure 8
	1.00	BACS18AX5	Figure 8
		BACS45A31	Figure 8
	1.25	BACS18AX6	Figure 8
		BACS45A32	Figure 8
6 Separations	1.40	BACS18AX3	Figure 9
		BACS45A29	Figure 9

Table 15
ALTERNATIVE STAR SPACER PART NUMBERS

Specified Star Spacer	Alternative Star Spacer
BACS45A29	BACS18AX3
BACS45A30	BACS18AX4
BACS45A31	BACS18AX5
BACS45A32	BACS18AX6
BACS45A105	BACS18AX1
BACS45A115	BACS18AX2
BACS45A206	BACS18AX7
BACS45A207	BACS18AX8
BACS45A208	BACS18AX9

Table 16
APPROVED SUPPLIERS OF BOEING STANDARD STAR SPACERS

Boeing Standard	Supplier
BACS18AX()	An available source
BACS45A()	An available source

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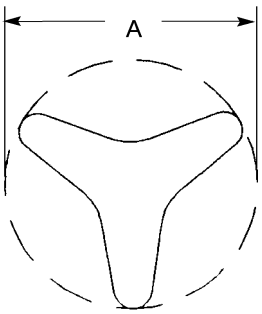
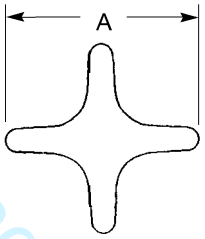
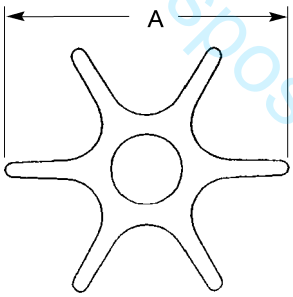


STAR SPACER WITH THREE SEPARATIONS
Figure 7



STAR SPACER WITH FOUR SEPARATIONS
Figure 8



STAR SPACER WITH SIX SEPARATIONS
Figure 9

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E. Necessary Materials

Table 17
NECESSARY MATERIALS

Material	Specification	Manufacturer's Part Number	Description or Special Instructions	Supplier
Adhesion Promoter	-	PR-187	For polythioether sealant on a cured polysulfide sealant.	PRC-Desoto International
Sealant	BMS 5-37	PR-1428 B-2	Polysulfide sealant for insulated wire	PRC-Desoto International
	BMS 5-45	PR-1776	Polysulfide sealant for insulated wire. For use in integral fuel tanks.	PRC-Desoto International
	BMS 5-95	Pro-Seal 870 B-1/2	Polysulfide sealant for seal fillets	PRC-Desoto International
		Pro-Seal 870 B-2	Polysulfide sealant for seal fillets	PRC-Desoto International
		PR-1436G E-2	Polysulfide sealant for seal fillets	PRC-Desoto International
	BMS 5-142	Pro-Seal 875 B - 1/2	Low density synthetic rubber sealant for seal fillets	PRC-Desoto International
		Pro-Seal 875 B -2	Low density synthetic rubber sealant for seal fillets	PRC-Desoto International
		PR 1772	Filled modified polysulfide sealant for seal fillets	PRC-Desoto International
	-	PR-1828 B-1/2	Polythioether sealant for insulated wire and seal fillets	PRC-Desoto International

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Table 17 (continued)

Material	Specification	Manufacturer's Part Number	Description or Special Instructions	Supplier
Solvent	O-E-760	-	Ethyl Alcohol	An available source
	TT-I-735	-	Isopropyl Alcohol	An available source
	BMS 11-7	-	Mixture of Naphtha, Ethyl Acetate, MEK, Isopropyl Alcohol	Pratt and Lambert Industrial Coating Division
		-	Mixture of Naphtha, Ethyl Acetate, MEK, Isopropyl Alcohol	Elf Atochem
		-	Mixture of Naphtha, Ethyl Acetate, MEK, Isopropyl Alcohol	AZKO/Dexter Aerospace Finishes
		-	Mixture of Naphtha, Ethyl Acetate, MEK, Isopropyl Alcohol	Barton Solvents
	BMS11-9	-	Methyl Propyl Ketone(MPK)	Eastman Chemical Co.
	P-D-680	-	Type I Stoddard Solvent	An available source
	-	4460 BK	Mixture of toluene, petroleum naphtha, ethyl acetate, methyl isobutyl ketone, and isopropyl alcohol	Turco Products Inc.
Wiper	BMS15-5	-	Absorbent wiper	American Fiber & Finishing Inc.
Plastic Tape, Temporary	-	P-29	Flame retarding, weather resistant, vinyl tape	Permacel
		P-29 Plus	Flame retarding, weather resistant, vinyl tape	Permacel
		BMS-346, Type 1, Class 1	Polyurethane Tape	QPL
Paper Tape, Temporary	-	P-70	High Temperature Masking Tape	Permacel
		P-781	High Temperature Masking Tape	Permacel
		Scotch 2693	High Temperature Masking Tape	3M

Table 18
SEALANT CURE TIMES

Manufacturer's Part Number	Cure Time (hours)
PR-1428 B-2	24
PR-1436G E-2	48

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Table 18 (continued)

Manufacturer's Part Number	Cure Time (hours)
PR-1772	48
PR-1776 A-2	48
PR-1828 B-1/2	3
Pro-Seal 870 B-1/2	20
Pro-Seal 870 B-2	48
Pro-Seal 875 B-1/2	12
Pro-Seal 875 B-2	48
Pro-Seal 890 B-2	48

Table 19
WIRE WITH TEFLON INSULATION

Type of Wire	Insulation Material
BMS 13-16	PTFE
BMS 13-28	TFE
BMS 13-29	TFE
BMS 13-31	TFE
BMS 13-48	ETFE
BMS 13-55	PTFE
BMS 13-58	PTFE
BMS 13-60	PTFE

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2. REMOVAL OF THE PRESSURE BULKHEAD SEAL

A. Seal Removal

CAUTION: DO NOT CAUSE DAMAGE TO:
- THE STRUCTURE
- THE WIRE HARNESS, IF THE WIRE HARNESS MUST BE USED AGAIN.

(1) Make a selection of a scraper made of wood or plastic.

CAUTION: DO NOT USE A WOODEN OR PLASTIC SCRAPER THAT IS HARDER THAN 2024-T3 ALUMINUM. A HARDER SCRAPER CAN CAUSE DAMAGE TO THE SURFACE OF THE STRUCTURE.

(2) Make a selection of a solvent from Table 17.

(3) Remove the sealant on and around the installation hardware of the seal fitting.

(4) Remove the installation hardware.

(5) Remove the seal fitting from the structure:

(a) Carefully put the scraper between the seal fitting and the structure.

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(b) Move the two halves of the seal apart.

(6) If the fitting must be replaced, discard the seal fitting.

(7) If the wire harness must be installed again:

(a) Carefully remove the sealant from each wire or cable.

CAUTION: DO NOT USE A SHARP TOOL OR TOO MUCH FORCE TO REMOVE SEALANT. DAMAGE TO THE WIRES CAN OCCUR.

(b) Clean the wire or cable with solvent.

(8) Remove the sealant from each side of the structure with the scraper.

CAUTION: DO NOT USE A WOODEN OR PLASTIC SCRAPER THAT IS HARDER THAN 2024-T3 ALUMINUM. A HARDER SCRAPER CAN CAUSE DAMAGE TO THE SURFACE OF THE STRUCTURE.

(9) Clean each side of the structure with solvent.

(10) Remove the remaining solvent with a clean, dry cloth.

3. INSTALLATION OF A NEW WIRE OR CABLE IN THE PRESSURE BULKHEAD SEAL

A. Seal Preparation

This paragraph gives the procedure to make a groove or a hole through the sealant for a new wire or cable.

CAUTION: A HOLE SHOULD BE MADE THROUGH A SEAL, ONLY IF IT IS NECESSARY. THIS PROCEDURE HAS A HIGH RISK OF DAMAGE TO THE WIRE.

CAUTION: CORROSION INHIBITING COMPOUND (CIC) SHOULD BE REMOVED BEFORE THE SEALANT APPLICATION. CIC ON A SURFACE CAN CAUSE AN UNSATISFACTORY BOND BETWEEN THE SEALANT AND THE SURFACE.

(1) Examine the wire harness on each side of the pressure bulkhead seal.

(2) Remove the seal from the bulkhead but do not remove the sealant around the wires. Refer to Paragraph 2.

(3) Make a groove in the seal.

NOTE: As an alternative, a hole can be made through the sealant. Refer to Step (4).

(a) If a spacer is installed in the seal, find the section that has the smallest number of wires.

(b) Find an area near the edge of the seal that has no wires.

(c) Cut a groove in the edge of the sealant. Refer to Figure 10.

Make sure that the groove has a sufficient depth for the wire.

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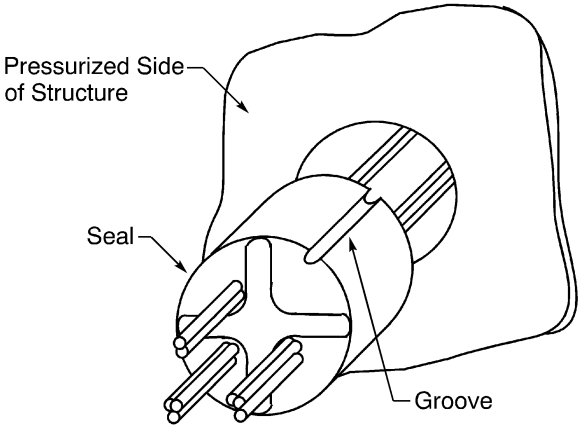

PREPARATION OF THE GROOVE
Figure 10

(4) If the alternative procedure to make a hole is necessary, make a hole with a circular tool:

(a) Find a location to make a hole in the sealant where damage to the wires or the cables cannot occur.

(b) Make a selection of one of these tools:

- A drill
- A small hollow tube that removes a core of the sealant
- A 0.125 inch diameter stainless steel rod that has a point.

(c) Carefully push the tool through the sealant.

NOTE: The hole is easier to make if the tool is lubricated while it goes through the sealant.

WARNING: IF THE TOOL IS NOT CAREFULLY CONTROLLED AS IT GOES THROUGH, IT CAN CAUSE INJURY TO A PERSON ON THE OTHER SIDE OF THE SEALANT.

CAUTION: IF THE TOOL IS NOT CAREFULLY CONTROLLED AS IT GOES THROUGH, IT CAN CAUSE DAMAGE TO A WIRE OR A CABLE IN THE SEALANT.

(5) Examine the wires that are installed in the pressure seal.

Make sure that the wires do not have damage.

B. Wire Installation

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

Refer to Table 18 for the cure time of each sealant.

(2) If the sealant is a polythioether type sealant make a selection of an adhesion promoter from Table 17.

(3) Make a selection of a solvent from Table 17.

(4) With a clean wipe and solvent, clean these surfaces:

- The groove in the seal
- The end of the seal on the pressurized side of structure.

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INSTALLATION OF PRESSURE BULKHEAD SEALS

CAUTION: A SURFACE THAT SEALANT MAKES A BOND WITH MUST BE CLEAN. A CONTAMINATION ON A SURFACE CAN CAUSE AN UNSATISFACTORY BOND BETWEEN THE SEALANT AND THE SURFACE.

CAUTION: CORROSION INHIBITING COMPOUND (CIC) SHOULD BE REMOVED BEFORE THE SEALANT APPLICATION. CIC ON A SURFACE CAN CAUSE AN UNSATISFACTORY BOND BETWEEN THE SEALANT AND THE SURFACE.

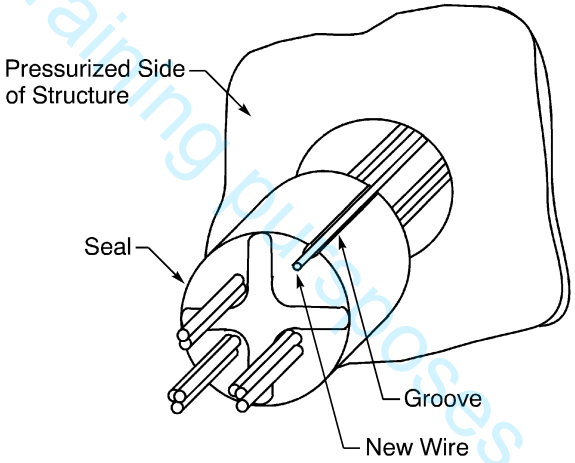
(5) If the sealant is a polythioether type sealant:

(a) Apply the adhesion promoter to:

- The groove or the hole in the seal
- The end of the seal on the pressurized side of structure.

(b) Let the adhesion promoter dry for a minimum of 30 minutes before the polythioether sealant is applied.

(6) Carefully put the end of the wire through the groove or the hole in the sealant from the pressurized side of the structure. Refer to Figure 11.



POSITION OF THE NEW WIRE IN THE GROOVE
Figure 11

(7) Pull the wire through the seal until the wire is approximately 4 inches from the final position.

(8) Put a layer of sealant around the new wire or the new cable. Refer to Figure 12.

Make sure that the new sealant on the wire can make an overlap with the old sealant when the wire is in the final position.

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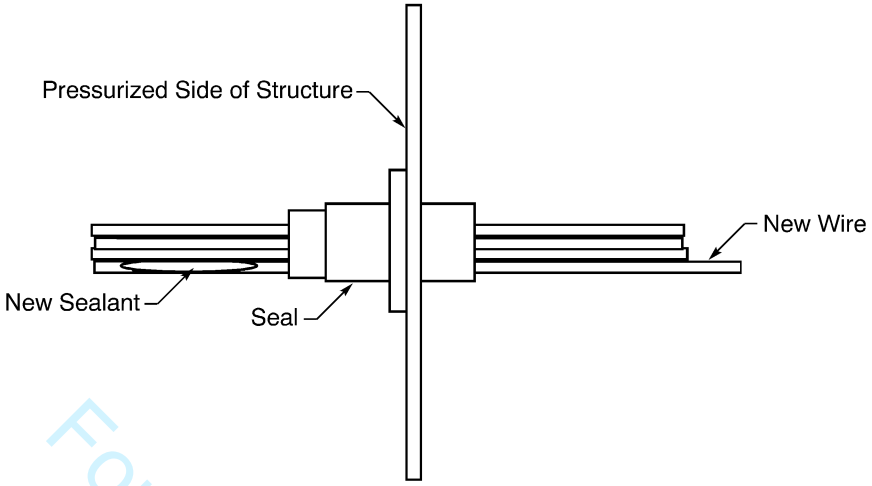


SEAL OF THE NEW WIRE
Figure 12

(9) Put the seal assembly back in the structure.

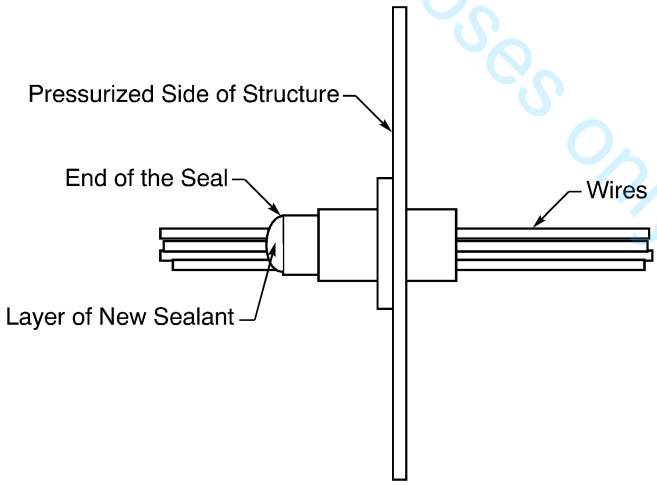
(10) Pull the wire into the final position.

Make sure that the layer of new sealant on the wire makes an overlap with the old sealant.

(11) On the pressurized side of the seal, put a layer of sealant around:

- The new wire or the new cable
- All of the wires that go through the seal.

Refer to Figure 13.



SEAL OF WIRES
Figure 13

(12) Let the sealant cure for the specified time. Refer to Table 18.

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4. ASSEMBLY OF A PRESSURE BULKHEAD SEAL

A. Wire Preparation

(1) Make a selection of a wire harness seal from Table 1.

(2) Make a selection of a solvent from Table 17.

(3) Put the wires, the cables, or the wire harness through the cutout.

(4) Install the wires, or the cables, or the wire harness.

Make sure that the wire harness has 2 inches of slack on the pressurized side of the cutout so that the assembly of the seal is easier.

(5) Clean all of the surfaces where the sealant must be applied.

(6) Remove the remaining solvent with a clean, dry cloth.

B. Spacer Installation

To fill the area between the wires, cables, or wire harness with sealant, it is necessary to install one of these types of spacers:

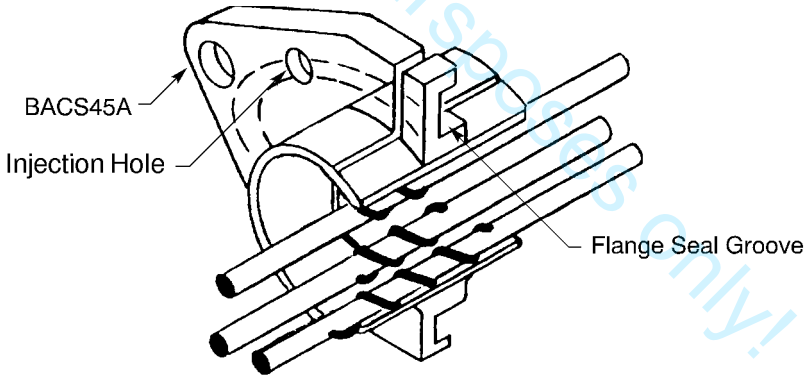
- A coil spacer
- A star spacer.

(1) To install a coil spacer:

(a) Make a selection of a coil spacer from Table 12. Refer to Figure 6.

(b) Put a coil spacer on each wire and each multiconductor cable. Refer to Figure 14.

Make sure that the spacer is in the center of the cutout.



COIL SPACERS IN THE CENTER OF THE SEAL
Figure 14

(2) To install a star spacer:

(a) Make a selection of a star spacer from Table 15.

Refer to:

- Figure 7.
- Figure 8
- Figure 9

(b) Put the star spacer between the wires, the cables, or the wire harness. Refer to Figure 15.

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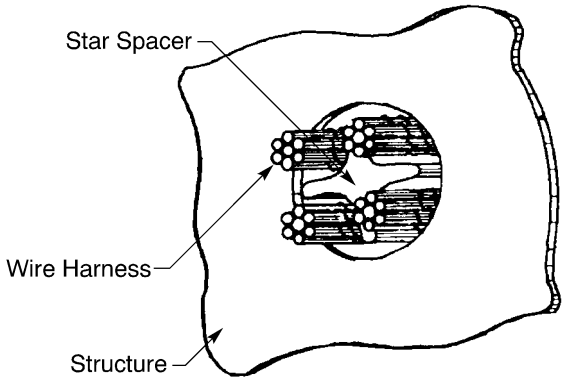
Make sure that the spacer is in the center of the cutout.



STAR SPACER IN THE CENTER OF THE CUTOUT
Figure 15

(3) Remove all wire harness ties that are 3 inches or less from the cutout to make sure that the sealant can fill the area around the wires or the group of wires in the harness.

C. Assembly of a Seal for a Single Cutout

(1) Make a selection of the necessary components for the seal installation from Table 8.

(2) To assemble a BACS45A seal:

(a) Make a selection of a solvent. Refer to Table 17.

(b) With a clean wipe and solvent, clean the surface that the sealant must touch.

CAUTION: A SURFACE THAT SEALANT MAKES A BOND WITH MUST BE CLEAN. CONTAMINATION ON A SURFACE CAN CAUSE AN UNSATISFACTORY BOND BETWEEN THE SEALANT AND THE SURFACE.

CAUTION: CORROSION INHIBITING COMPOUND (CIC) SHOULD BE REMOVED BEFORE THE SEALANT APPLICATION. CIC ON A SURFACE CAN CAUSE AN UNSATISFACTORY BOND BETWEEN THE SEALANT AND THE SURFACE.

(c) Immediately dry the surfaces with a clean, dry wiper.

Make sure that the solvent applied on the surfaces are not dry into air after the clean.

(d) If it is necessary, remove the remaining solvent with a second dry, clean wipe.

(e) Make a selection of BMS5-37 sealant. Refer to Table 17.

For the cure time of each sealant, refer to Table 18.

(f) Fill the seal groove on each flange half with sealant. Refer to Figure 16.

NOTE: Sealant may be injected through the injection holes, into the seal fitting groove, after installing the seal fitting.

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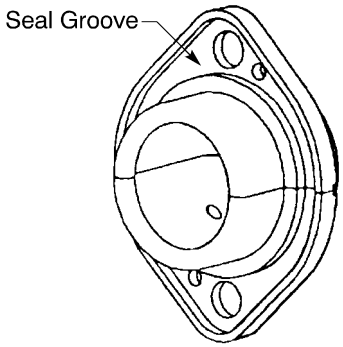
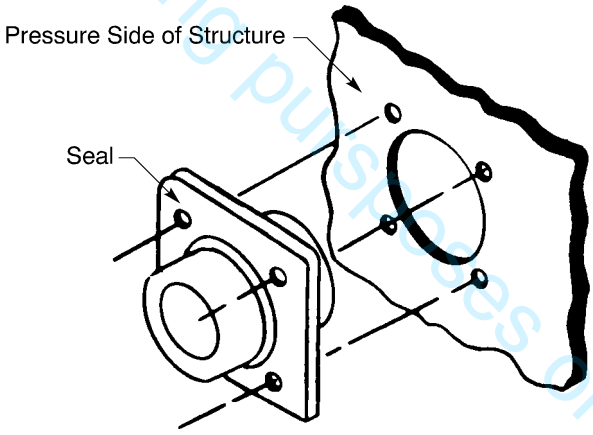


SEAL GROOVE OF THE BACS45A() SEAL
Figure 16

(g) Put the halves of the seal around the wires on the pressurized side of the cutout so that:
- The seal groove is turned to the cutout
- The center of the seal is aligned with the center of the spacers.

(h) Attach the seal to the pressurized side of the structure. Refer to Figure 17.



ASSEMBLY OF THE BACS45A() SEAL
Figure 17

(3) To assemble a BACS45B seal:

(a) Make a selection of a seal ring from Table 5.

(b) Make a selection of a snap ring from Table 8.

(c) Make a selection of a solvent. Refer to Table 17.

(d) With a clean wipe and solvent, clean the surface that the sealant must touch.

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INSTALLATION OF PRESSURE BULKHEAD SEALS

CAUTION: A SURFACE THAT SEALANT MAKES A BOND WITH MUST BE CLEAN. CONTAMINATION ON A SURFACE CAN CAUSE AN UNSATISFACTORY BOND BETWEEN THE SEALANT AND THE SURFACE.

CAUTION: CORROSION INHIBITING COMPOUND (CIC) SHOULD BE REMOVED BEFORE THE SEALANT APPLICATION. CIC ON A SURFACE CAN CAUSE AN UNSATISFACTORY BOND BETWEEN THE SEALANT AND THE SURFACE.

(e) Immediately dry the surfaces with a clean, dry wiper.

Make sure that the solvent applied on the surfaces are not dry into air after the clean.

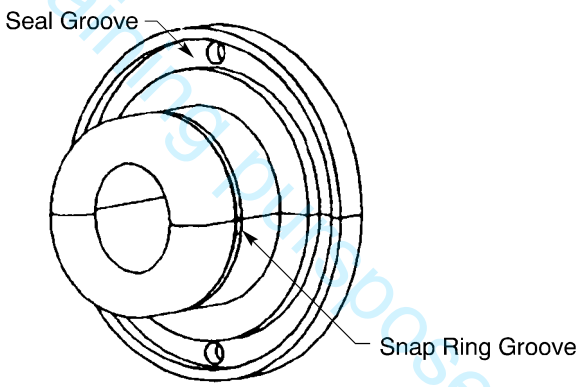
(f) If it is necessary, remove the remaining solvent with a second dry, clean wipe.

(g) Make a selection of BMS5-37 sealant. Refer to Table 17.

For the cure time of each sealant, refer to Table 18.

(h) Fill the seal groove on each flange half with the sealant. Refer to Figure 18.

NOTE: Sealing may be injected through the injection holes, into the seal fitting groove, after installing the seal fitting.



SEAL GROOVE OF THE BACS45B() SEAL
Figure 18

(i) Put the halves of the seal around the wires on the pressurized side of the cutout so that:

- The seal groove is turned to the cutout
- The center of the seal is aligned with the center of the spacers.

(j) Put the necessary number of seal rings between the snap ring groove and the structure to make a tight fit when the snap ring is installed. Refer to Figure 19.

Make sure that the maximum distance the seal can move in the longitudinal direction is 0.010 inch.

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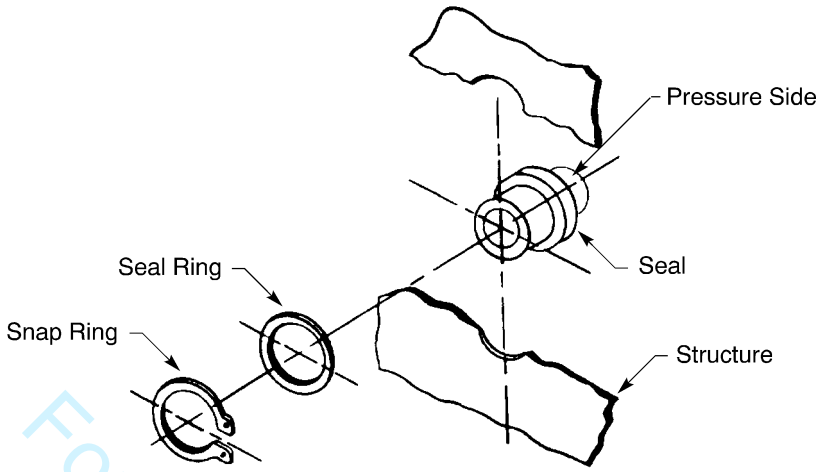

ASSEMBLY OF THE BACS45B() SEAL
Figure 19

(k) Put the snap ring in the snap ring groove. Refer to Figure 18.

D. Assembly of BACS45A Seals with a BACS45A or BACS19P Seal Plate

Table 20
SEAL PLATE ASSEMBLY COMPONENTS

Component	Boeing Standard
Cover Plate	BACP19R1()
Filler	BACF3K1
	BACF3K2
	BACF3K3
	BACF3K4
	BACF3K5
	BACS45A36
	BACS45A37
	BACS45A38
	BACS45A39
	BACS45A40
Screw	BACS12CB3-10

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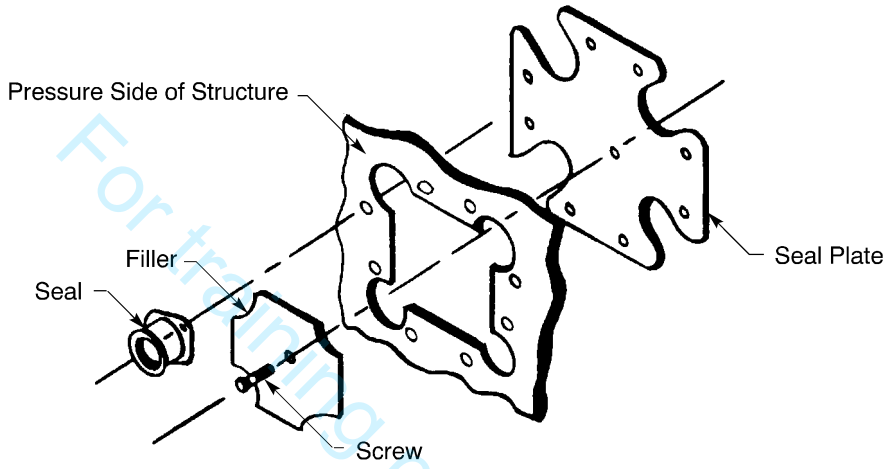
Table 21
ALTERNATIVE SEAL COVER PLATES

Specified Seal Cover Plate		Alternative Seal Cover Plate	
Part Number	**Supplier**	**Part Number**	**Supplier**
BACS45A26	Boeing	BACP19R1()	Boeing



ASSEMBLY OF THE BACS45A SEAL AND SEAL PLATE
Figure 20

Refer to:

- Figure 20
- Table 20 for the correct cover plate, filler, and screw.

(1) Put the seal plate on the unpressurized side of the structure.

(2) Put the wires or wire harness in the correct positions.

(3) Align the correct filler in the structure hole from the pressurized side.

(4) Install the center screw.

(5) Install the cover plates over all the holes in the seal plate that are not used.

(6) Install a seal around each harness in the remaining holes.
Refer to Paragraph 4.C.

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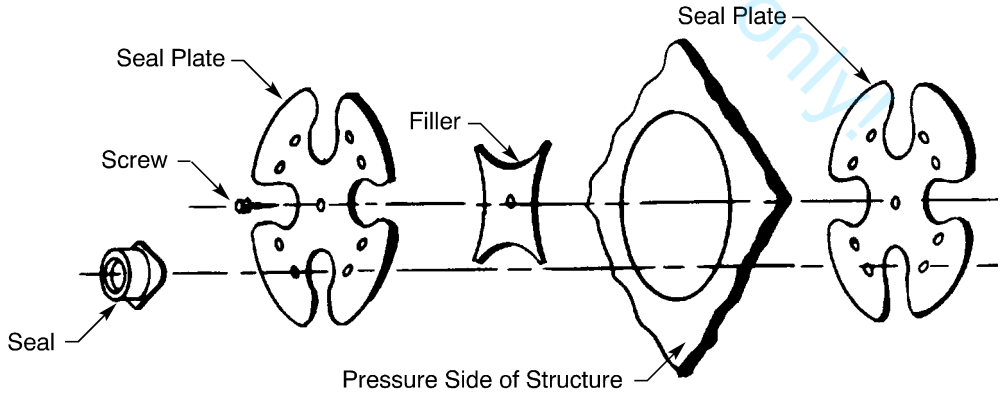
E. Assembly of BACS45A Seals with the BACS45B or BACS19N Seal Plates

Table 22
BACS45B SEAL PLATE ASSEMBLY COMPONENTS

Component	Boeing Standard
Cover Plate	BACP19R1()
Filler	BACF3J1
	BACF3J2
	BACF3J3
	BACF3J4
	BACF3J5
	BACS45B50
	BACS45B51
	BACS45B52
	BACS45B53
	BACS45B54
Screw	BACS12CB3-10

Table 23
ALTERNATIVE SEAL COVER PLATES

Specified Seal Cover Plate		Alternative Seal Cover Plate	
Part Number	Supplier	Part Number	Supplier
BACS45A26	Boeing	BACP19R1()	Boeing



ASSEMBLY OF THE SEAL PLATES
Figure 21

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Refer to:

- Figure 21
- Table 22 for the correct cover plate, filler, and screw.

(1) Put the seal plate on the unpressurized side of the structure.

(2) Put the wires or wire harness in the correct positions.

(3) Align the correct filler in the structure hole from the pressurized side.

(4) Put the seal plate in position over the filler on the pressurized side of the structure hole.

(5) Align the screw holes.

(6) Install the center screw.

(7) Install the cover plates over all the holes in the seal plate that are not used.

(8) Install a seal around each harness in the remaining holes.

Refer to Paragraph 4.C.

F. Assembly of 2055019-() Seal Fitting

(1) Make a selection of a solvent. Refer to Table 17.

(2) With a clean wipe and solvent, clean the surface that the sealant must touch.

CAUTION: A SURFACE THAT SEALANT MAKES A BOND WITH MUST BE CLEAN. CONTAMINATION ON A SURFACE CAN CAUSE AN UNSATISFACTORY BOND BETWEEN THE SEALANT AND THE SURFACE.

CAUTION: CORROSION INHIBITING COMPOUND (CIC) SHOULD BE REMOVED BEFORE THE SEALANT APPLICATION. CIC ON A SURFACE CAN CAUSE AN UNSATISFACTORY BOND BETWEEN THE SEALANT AND THE SURFACE.

(3) Immediately dry the surfaces with a clean, dry wiper.

Make sure that the solvent applied on the surfaces are not dry into air after the clean.

(4) If it is necessary, remove the remaining solvent with a second dry, clean wipe.

(5) Make a selection of BMS5-37 sealant. Refer to Table 17. For the cure time of each sealant, refer to Table 18.

(6) Fill the seal groove on each flange half completely with the sealant. Refer to Figure 22.

NOTE: Sealant may be injected through the injection holes, into the seal groove, after installing the seal fitting. Refer to Figure 22.

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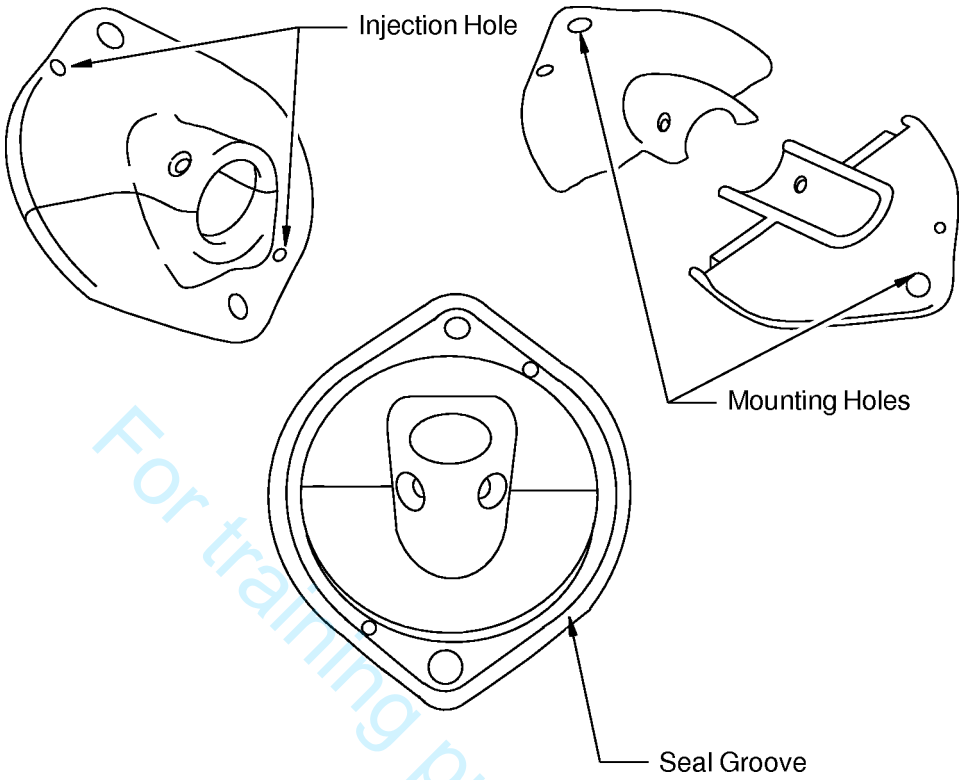

2055019-() SEAL FITTING
Figure 22

(7) Put the seal fitting halves around the wires on the pressurized side of the cutout.
Make sure that the seal groove faces the cutout.
Make sure that the center of the seal is aligned with the center of the spacers.

(8) Attach the seal fitting to the pressurized side of the structure.
Make sure that:
- the seal fitting is attached to the structure within the sealant cure time
- fasteners are tightened.

(9) Make a sealing mold. Refer to Paragraph 5.A..

G. Assembly of 287T0031-() Seal Fitting

Table 24
SNAP RING PART NUMBERS

Component Name	Part Number	Description
Snap Ring	MS16624-2343	Aluminum
	MS16624-4343	CFRP, CRES, Ti

(1) Make a selection of a solvent. Refer to Table 17.

NOTE: Coil Spacers are not required for this installation.

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(2) With a clean wipe and solvent, clean the surface that the sealant must touch.

(3) Immediately dry the surfaces with a clean, dry wiper.

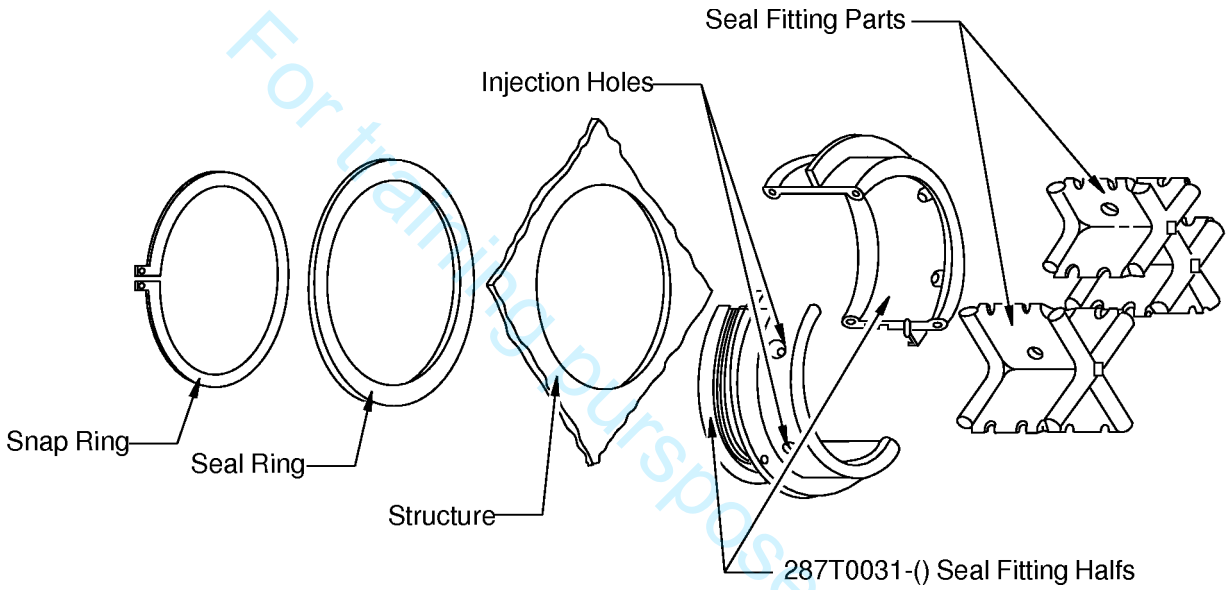
Make sure that the solvent applied on the surfaces are not dry into air after the clean.

(4) If it is necessary, remove the remaining solvent with a second dry, clean wipe.

(5) Make a selection of BMS5-37 sealant. Refer to Table 17. For the cure time of each sealant, refer to Table 18.

(6) Fill the seal groove of each flange half completely with the sealant. Refer to Figure 22.

NOTE: After installing the seal fitting, sealant can be put through the injection holes into the seal groove. Refer to Figure 23.



280T0031-() SEAL FITTING COMPONENTS
Figure 23

(7) Put the seal fitting halves around the wires on the pressurized side of the cutout.

Make sure that the seal groove faces the cutout.

(8) Attach the seal fitting to the pressurized side of the structure.

Make sure that:

- The seal fitting is attached to the structure within the sealant cure time
- Any wire separators required have been installed.

(9) Make a selection of snap ring. Refer to Table 24.

(10) Install the snap ring in the snap ring groove on the seal fitting. Refer to Figure 24.

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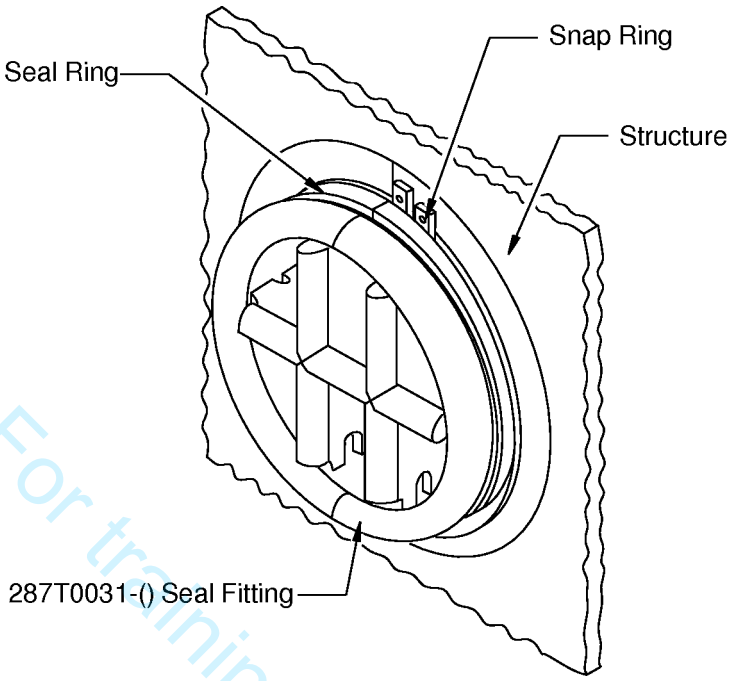

ASSEMBLY OF 280T0031-() SEAL FITTING
Figure 24

(11) Make a selection of seal ring. Refer to Table 5.

(12) Install necessary number of seal rings between the snap ring and the structure on seal fitting. Refer to Figure 24.

Make sure that the snap ring has a tight fit when it is installed on the seal fitting.

Make sure that the maximum distance that the seal fitting can move in the longitudinal direction is 0.010 inch.

(13) Make a sealing mold. Refer to Paragraph 5.A..

(14) Make a sealant potting assembly. Refer to Subject 20-10-22

H. Assembly of 287U0125 Seal Fitting

Table 25
SNAP RING PART NUMBERS

Component Name	Part Number	Description
Snap Ring	MS16624-2100	45 Degrees
	MS16624-2125	30 Degrees

(1) Make a selection of a solvent. Refer to Table 17.

(2) With a clean wipe and solvent, clean the surface that the sealant must touch.

(3) Immediately dry the surfaces with a clean, dry wiper.

(4) If it is necessary, remove the remaining solvent with a second dry, clean wipe.

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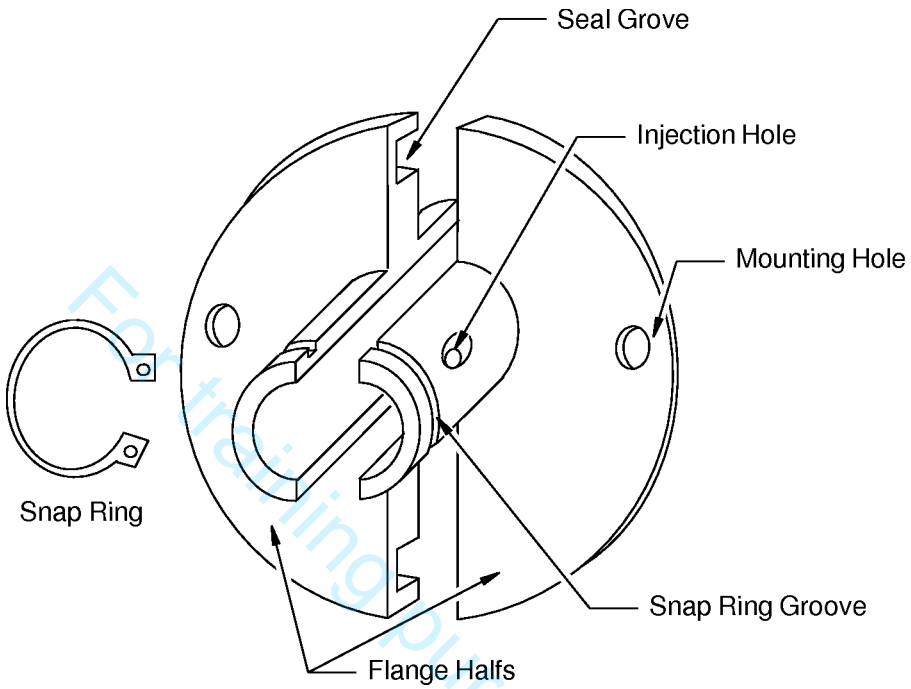
(5) Make a selection of BMS5-37 sealant. Refer to Table 17. For the cure time of each sealant, refer to Table 18.

(6) Fill the seal groove of each flange half completely with the sealant. Refer to Figure 25.



287U0125 SEAL FITTING
Figure 25

(7) Put the seal fitting halves around the wires on the pressurized side of the cutout.
Make sure that the seal groove faces the cutout.
Make sure that the center of the seal is aligned with the center of the spacers.

(8) Make a selection of snap ring. Refer to Table 25.

(9) Install the snap ring on the snap ring groove.

(10) Attach the seal fitting to the pressurized side of the structure.
Make sure that:
- The seal fitting is attached to the structure within the sealant cure time
- Fasteners are tightened.

(11) Make a sealing mold. Refer to Paragraph 5.A..

5. INSTALLATION OF THE PRESSURE BULKHEAD SEAL

A. Assembly of the Sealant Mold

The sealant mold made with:
- Plastic tape is recommended
- Paper tape is the satisfactory alternative.

(1) To make a sealant mold with plastic tape:

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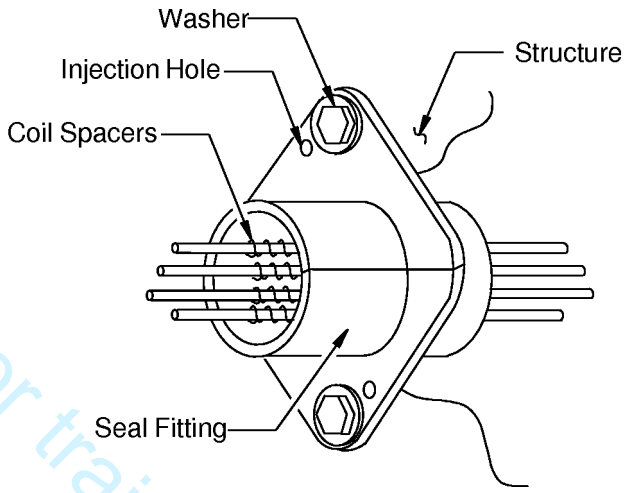
INSTALLATION OF PRESSURE BULKHEAD SEALS

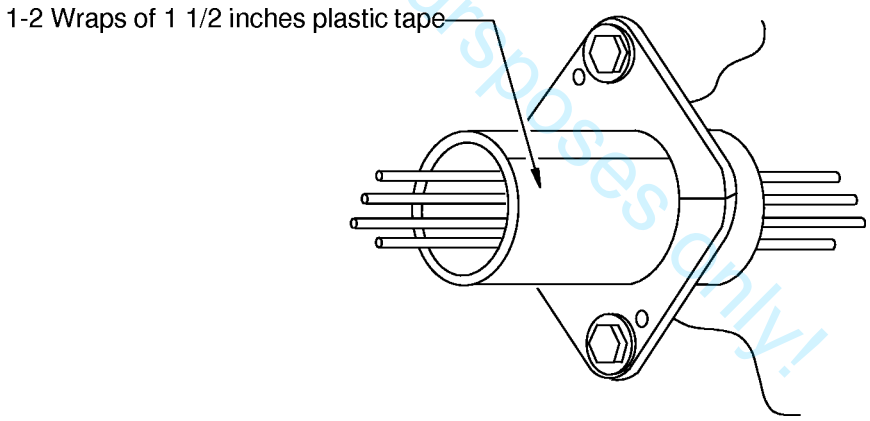
(a) Make a selection of a plastic tape from Table 17.

Make sure that the washers do not cause a blockage of the injection holes. Refer to Figure 26.



PLASTIC TAPE SEALING MOLD-STEP 1
Figure 26

(b) Wind approximately 1-2 wraps of the plastic tape around the end of the mold assembly. Refer to Figure 27



PLASTIC TAPE SEALING MOLD-STEP 2
Figure 27

(c) Make a symmetrical form with the tape against the end of the seal that is adjacent to the wires or wire harness. Refer to Figure 28

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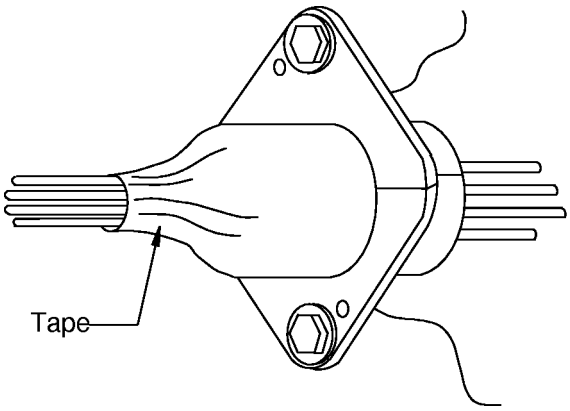
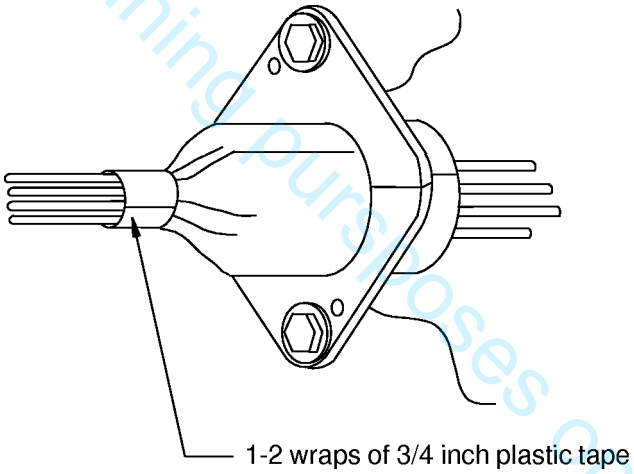


PLASTIC TAPE SEALING MOLD-STEP 3
Figure 28

(d) Wind 1 to 2 wraps of 3/4 inch wide plastic tape around the end of the paper tape. Refer to Figure 29



PLASTIC TAPE SEALING MOLD-STEP 4
Figure 29

(2) To make a sealant mold with paper tape:

(a) Make a selection of a paper tape from Table 17.

(b) On the pressurized side, put an 8 inch length of string on the seal assembly so that it is parallel to the wires or wire harness. Refer to Figure 30.

The string is used to remove the tape after the sealant has cured.

(c) Put three equal and symmetrical layers of 1 1/2 inch wide tape around the end of the assembly. Refer to Figure 30.

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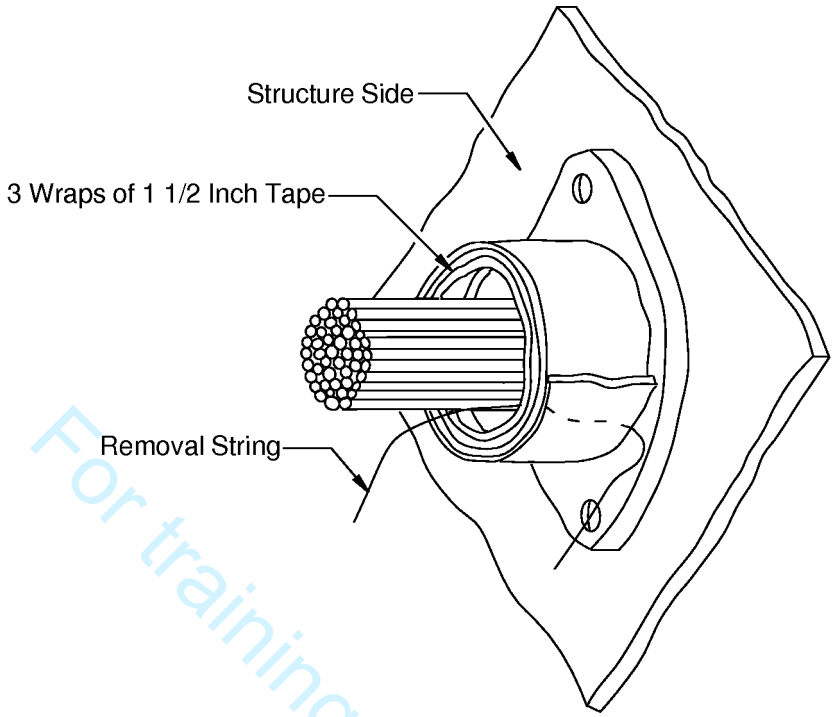

PAPER TAPE SEALING MODE-STEP 1
Figure 30

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(d) Make a symmetrical form with the tape against the end of the seal that is adjacent to the wires or wire harness. Refer to Figure 31.

(e) Wind three layers of 3/4 inch masking tape around the end of the paper tape. Refer to Figure 31.

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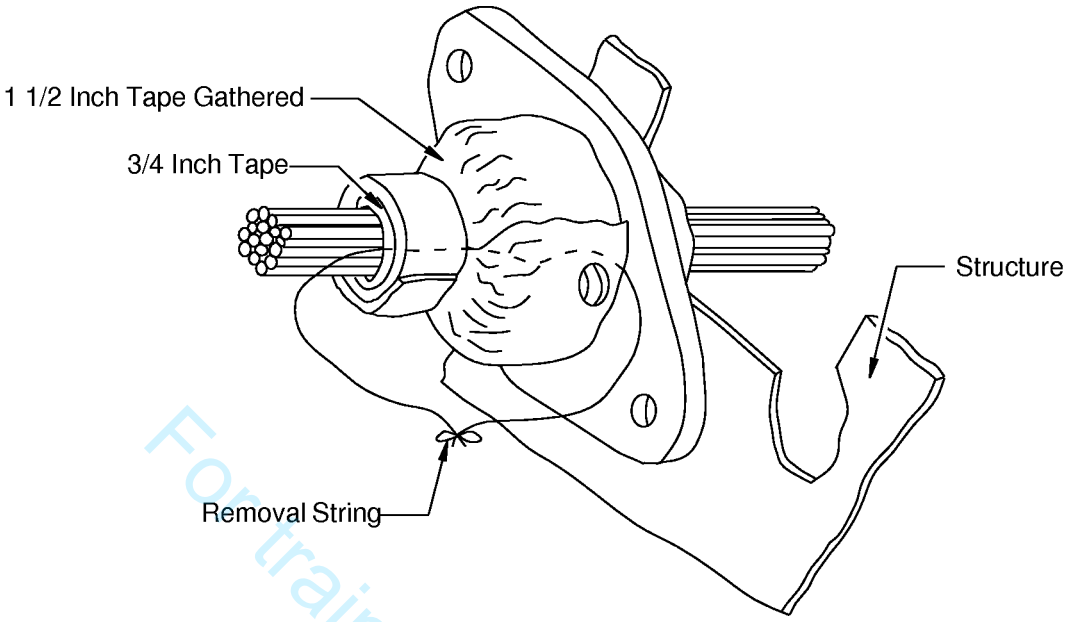

PAPER TAPE SEALING MODE-STEP 2
Figure 31

(f) Do Step (a) through Step (e) again for the seal that is on the unpressurized side of the structure.

B. Installation of the Sealant

(1) Make a selection of a sealant from Table 17.
Refer to Table 18 for the cure time of each sealant.
(2) Make a selection of a solvent. Refer to Table 17.
(3) With a clean wipe and solvent, clean the surface that the sealant must touch.
(4) Immediately dry the surfaces with a clean, dry wiper.
(5) If it is necessary, remove the remaining solvent with a second dry, clean wipe.
(6) Make a hole in the sealant mold over all of the injection hole of the seal. Refer to Figure 32.

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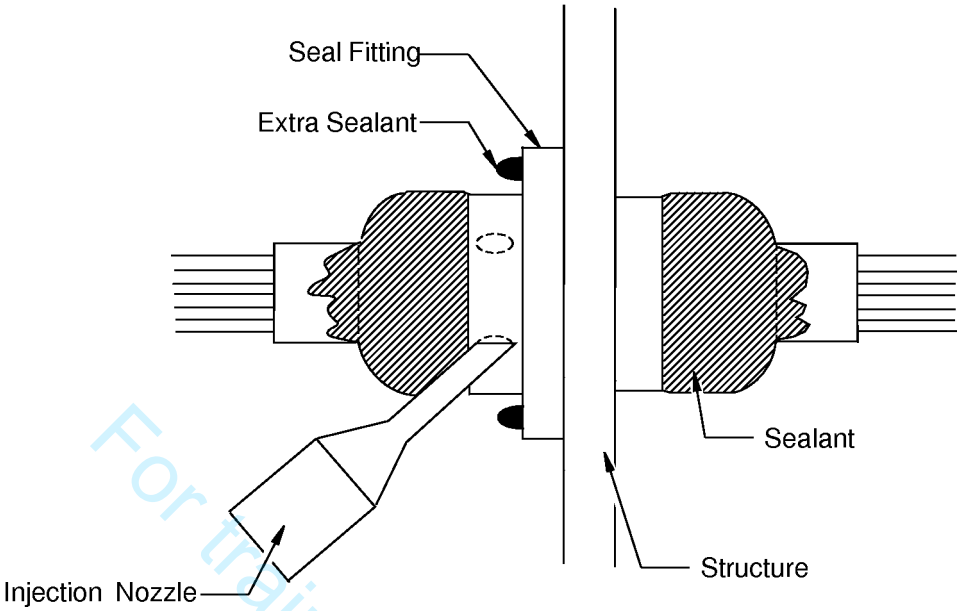
INSTALLATION OF PRESSURE BULKHEAD SEALS



SEALANT INSTALLATION METHOD I
Figure 32

NOTE: As an alternative, a hole can be made at the end of the mold that is adjacent to the wires or wire harness.

NOTE: Sealant can be injected into the injection holes of the flange. Refer to Figure 33.

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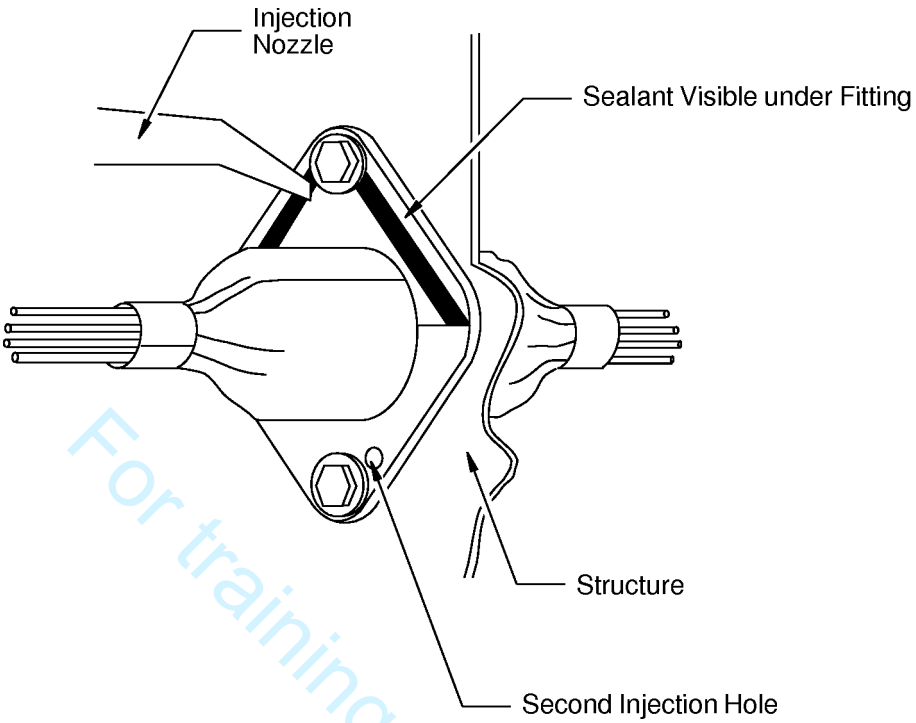
INSTALLATION OF PRESSURE BULKHEAD SEALS



SEALANT INSTALLATION METHOD II
Figure 33

(7) Put the sealant into each injection hole with a sealant gun at 80 psi to 100 psi pressure.

Make sure that:

- The sealant comes out from around the wires at the edges of the mold
- To complete the injection of the sealant within the cure time of the sealant.
- That the sealant is continuous and has no voids, holes, bubbles, cracks, unwanted objects, used sealant, or metal particles.

(8) Let the sealant cure for the specified time. Refer to Table 18.

(9) Remove all of the sealant molds.

(10) Make a selection of a fillet sealant from Table 17.

Refer to Table 18 for the cure time of each sealant.

(11) Put a layer of the fillet sealant:

- On the heads of the screws
- Around the outer edges of the seal fitting flanges
- Around the edges of the cover plates
- Around the edges of the seal plates.

NOTE: The fillet sealant should be only applied on pressurized side of the structure.

Refer to Figure 34 for BACP19P seal plate and Figure 35 for BACP19N seal plate.

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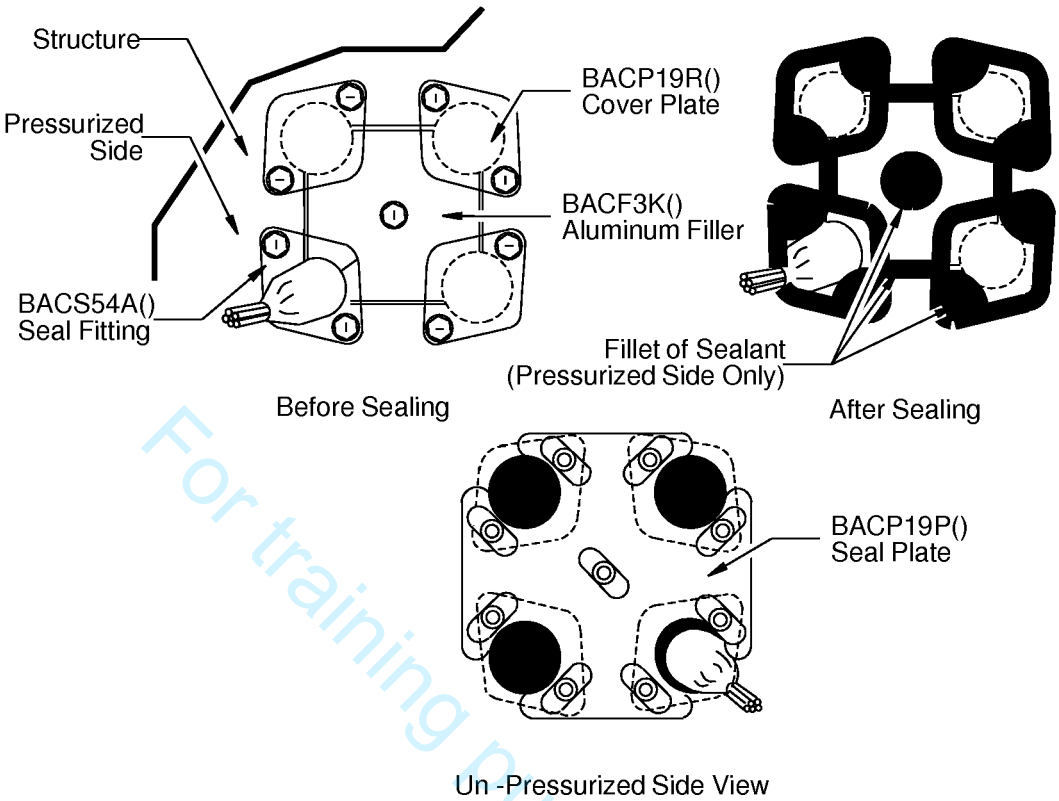
INSTALLATION OF PRESSURE BULKHEAD SEALS



SEALING ON BACP19P SEAL PLATES
Figure 34

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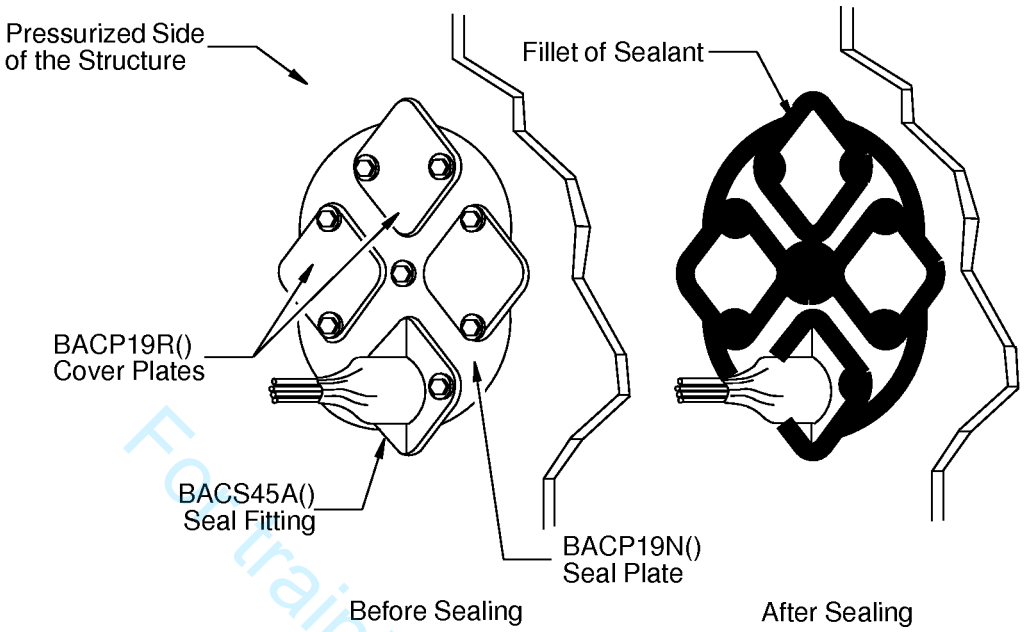
INSTALLATION OF PRESSURE BULKHEAD SEALS



SEALING ON BACP19N SEAL PLATES
Figure 35

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312T2202-1 FEEDTHROUGH ASSEMBLY FOR THE POWER FEEDER WIRE HARNESS

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1.	**PART NUMBERS**		**1**
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2.	**REMOVAL OF THE FEEDTHROUGH**		**1**
	A.	Preparation for Removal	1
	B.	Removal of the Feedthrough Seal	2
3.	**ASSEMBLY OF THE FEEDTHROUGH**		**2**
	A.	Feedthrough Seal Assembly	2
	B.	Assembly of the Power Feeder Cable Terminals	3

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312T2202-1 FEEDTHROUGH ASSEMBLY FOR THE POWER FEEDER WIRE HARNESS

This Subject gives the procedures to remove and install the strut raceway feedthrough assembly for the power feeder wire harness.

1. PART NUMBERS

A. Component Part Numbers

Table 1
COMPONENT PART NUMBERS FOR THE WIRE HARNESS FEEDTHROUGH

Description	Quantity	Part Number	Supplier
Cover Plate	2	312N5204-1	Boeing
Seal	1	312N5205-1	Boeing
Seal Housing	1	312T2202-1	Boeing
Bolt	1	BACB30LE5U18	Boeing
Nut	1	NAS1805-5	QPL
Washer	1	NAS1144C0563R	QPL
Screw	4	NAS1802-3-10	QPL
		BACS12HN3U10	Boeing
Washer	4	AN960CIOL	QPL

NOTE: BACS12HN()U() is a satisfactory alternative to NAS1802-()-().

2. REMOVAL OF THE FEEDTHROUGH

A. Preparation for Removal

(1) Determine if the wire harness is controlled by a Critical Design Configuration Control Limitation (CDCCL).

Refer to Subject 20-10-11.

(2) At the end of the power feeder wire harness, remove the fanning strip from the power feeder cables near the power feeder terminals.

(3) Remove the terminals from the ends of the power feeder cables.

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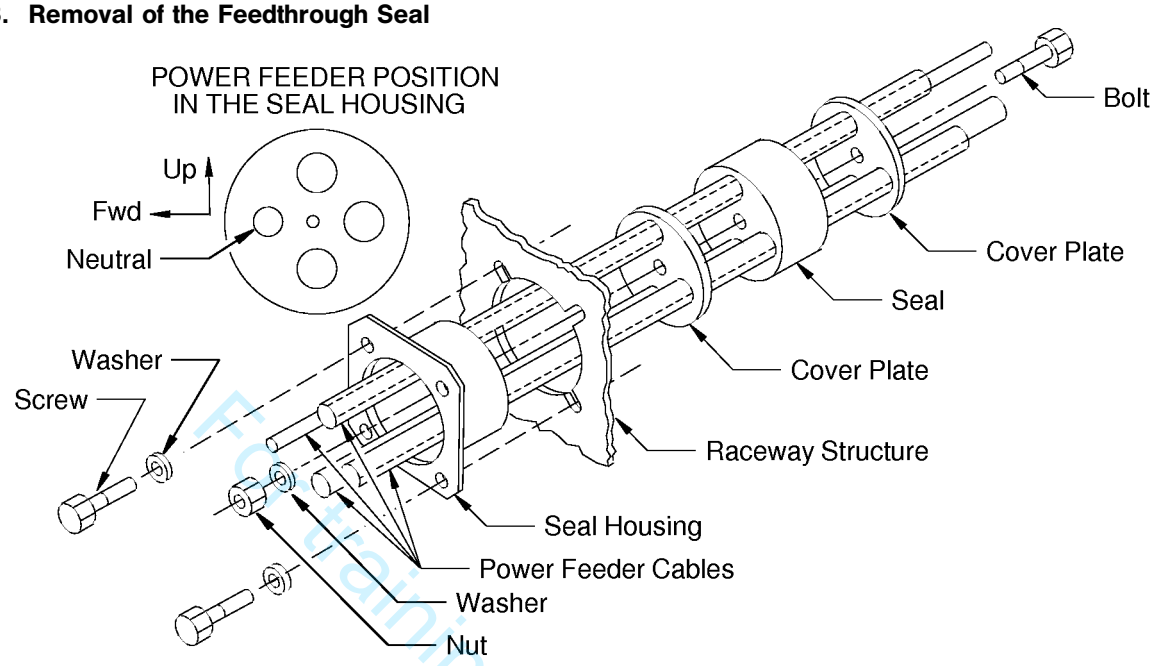
B. Removal of the Feedthrough Seal



POWER FEEDER CABLE FEEDTHROUGH SEAL ASSEMBLY
Figure 1

Refer to Figure 1.

(1) Remove these components from the seal assembly:
- The bolt
- The nut
- The washer.

(2) Pull the power feeder cables through the seal housing.

(3) Remove the cover plates and the seal from the power feeder cables.

3. ASSEMBLY OF THE FEEDTHROUGH

A. Feedthrough Seal Assembly

(1) Put the power feeder cables through the cover plates and the seal.
Make sure the cables are in their correct positions. Refer to Figure 1.

(2) Put the seal and the cover plates inside the seal housing.

(3) Put the bolt through:
- The seal housing
- The cover plates
- The seal.

NOTE: The bolt can be installed from either side.

(4) Put the washer and the nut on the bolt.

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(5) Torque the nut to whichever occurs first:
- 75 inch-pounds to 90 inch-pounds
- The nut is against the end of the threads of the bolt.

Make sure that both cover plates are inside the seal housing after the the bolt is tightened.

CAUTION: MAKE SURE THAT THE COVER PLATES DO NOT CATCH ON THE SEAL HOUSING.

(6) Examine the assembly.

Make sure that:
- The seal comes out of the cover plate at the wire penetration holes
- A cover plate is not caught on the edge of the seal housing
- Both cover plates are inside the seal housing.

B. Assembly of the Power Feeder Cable Terminals

(1) Assemble a terminal on the end of each power feeder cable.

Refer to Subject 20-30-11 or Subject 20-30-14.

Make sure that:
- A new terminal is assembled on the end of each power feeder cable
- Each terminal is the specified terminal.

(2) Put the fanning strip on the wire harness next to the terminal lugs. Refer to Table 2.

Table 2
POWER FEEDER TERMINAL LUGS

Description	Wire Color
T1	Red
T2	Yellow
T3	Blue
N	Neutral

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DISASSEMBLY, ASSEMBLY, AND INSTALLATION OF BACS31T SEAL FITTINGS

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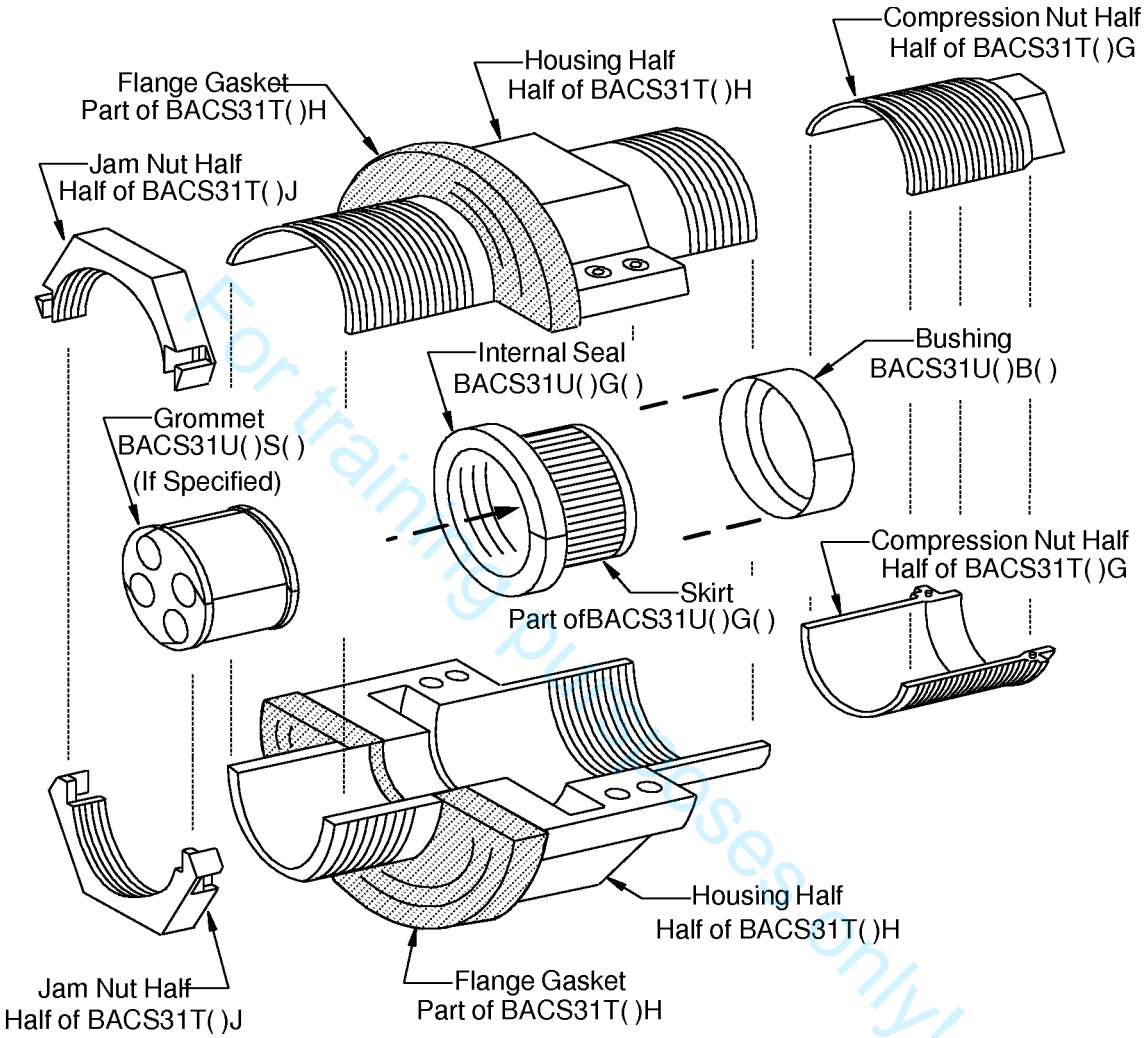
DISASSEMBLY, ASSEMBLY, AND INSTALLATION OF BACS31T SEAL FITTINGS

1. GENERAL DATA

A. Seal Fitting Part Numbers



SHELL SIZE 24 AND 36 SEAL FITTING COMPONENTS
Figure 1

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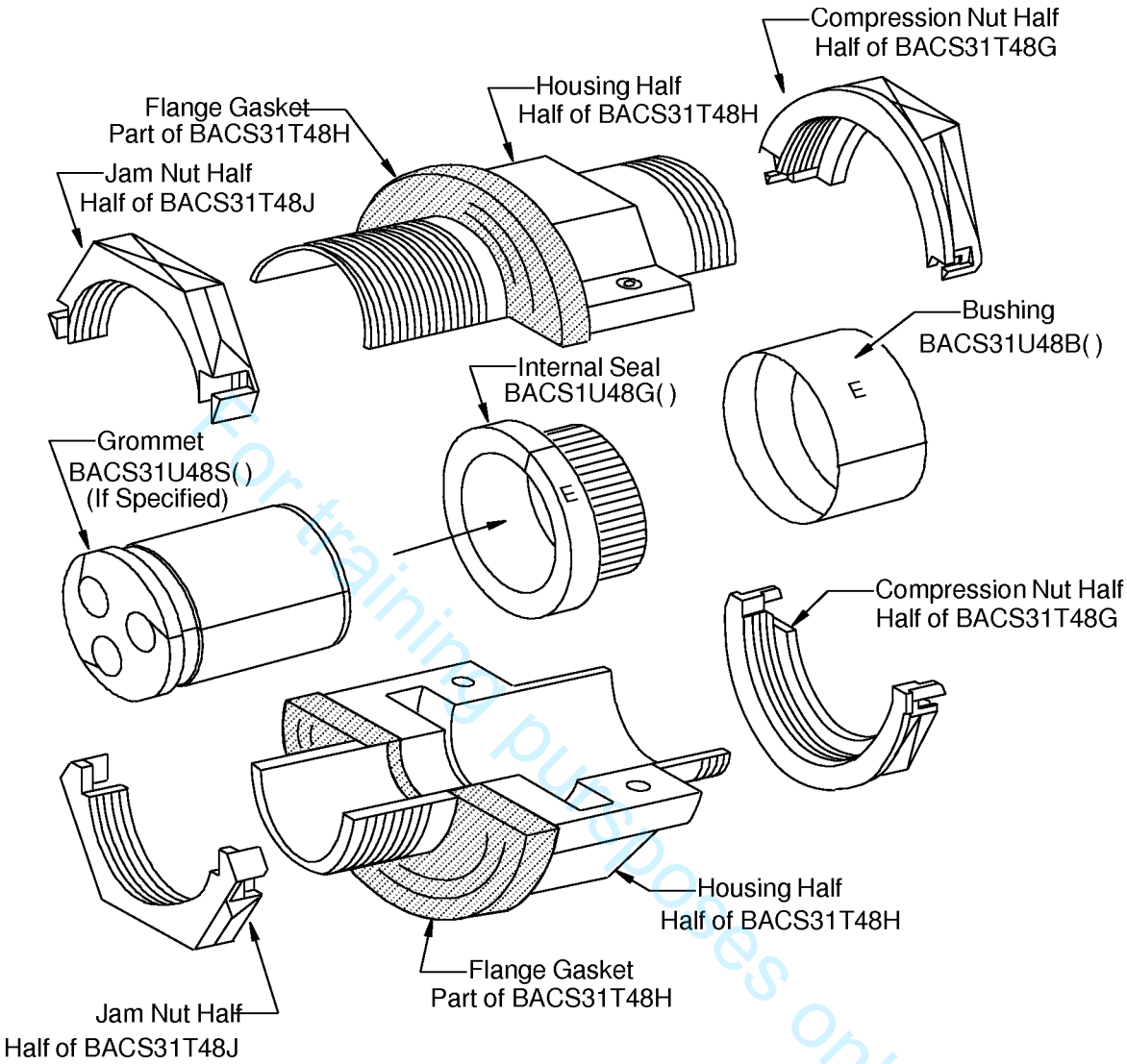

SHELL SIZE 48 SEAL FITTING COMPONENTS
Figure 2

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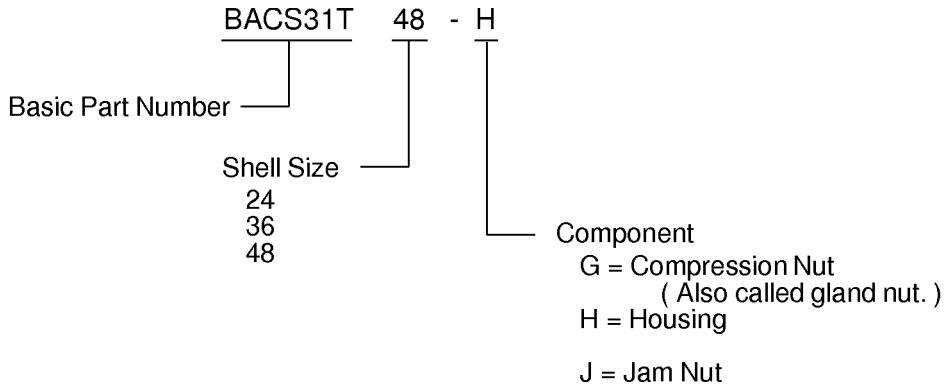
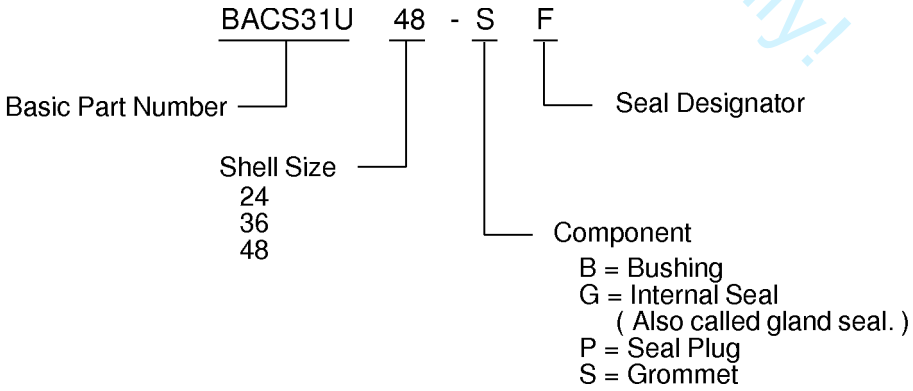


PART NUMBER STRUCTURE FOR THE HOUSING COMPONENTS OF THE SEAL FITTING
Figure 3

Table 1
Seal Fitting Housing Component Part Numbers

Shell Size	Part	Part Number
24	Housing	BACS31T24H
	Jam Nut	BACS31T24J
	Compression Nut	BACS31T24G
36	Housing	BACS31T36H
	Jam Nut	BACS31T36J
	Compression Nut	BACS31T36G
48	Housing	BACS31T48H
	Jam Nut	BACS31T48J
	Compression Nut	BACS31T48G

NOTE: For the seal fitting assembly, one housing, one jam nut, and one compression nut are necessary.



PART NUMBER STRUCTURE FOR THE INTERNAL COMPONENTS OF THE SEAL FITTING
Figure 4

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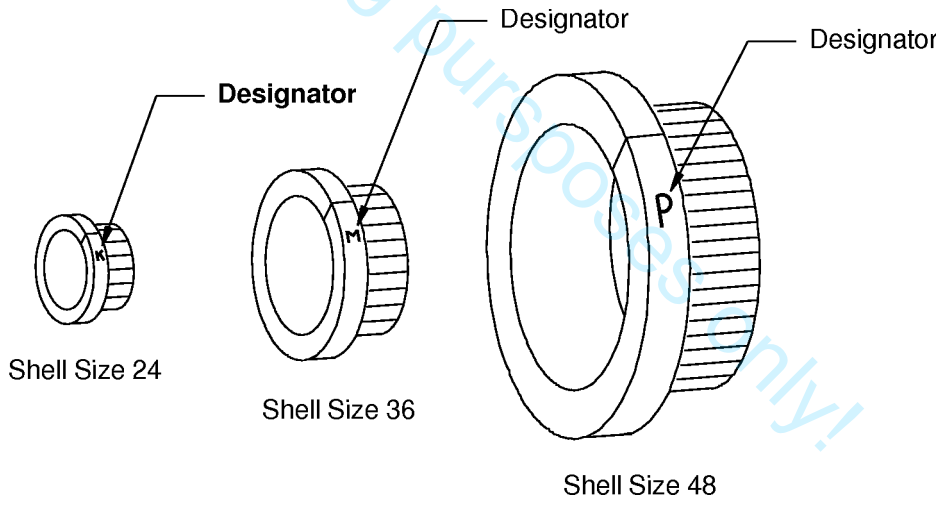
Table 2
Seal Fitting Internal Component Part Numbers

Shell Size	Part	Part Number
24	Grommet	BACS31U24S( )
	Internal Seal	BACS31U24G( )
	Bushing	BACS31U24B( )
36	Grommet	BACS31U36S( )
	Internal Seal	BACS31U36G( )
	Bushing	BACS31U36B( )
48	Grommet	BACS31U48S( )
	Internal Seal	BACS31U48G( )
	Bushing	BACS31U48B( )

Refer to Paragraph 1.B. for the Seal Designator for the Grommet.

NOTE: If a grommet is not used, one internal seal, and one bushing are necessary.

NOTE: If a grommet is used, one internal seal, one bushing, and one grommet are necessary.



INTERNAL SEALS
Figure 5

Type A Grommets are used with shell size 24 and 36 seal fittings. Type B Grommets are used with shell size 48 seal fittings. Refer to Figure 6.

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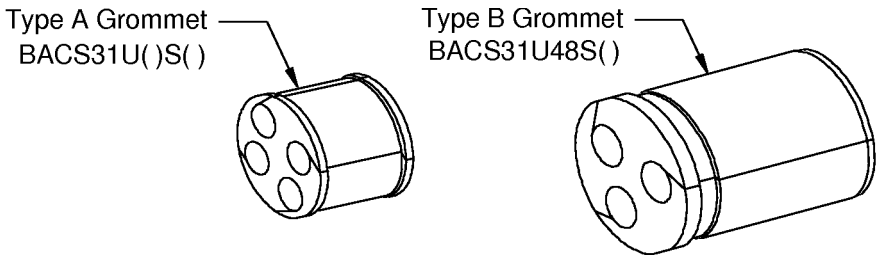
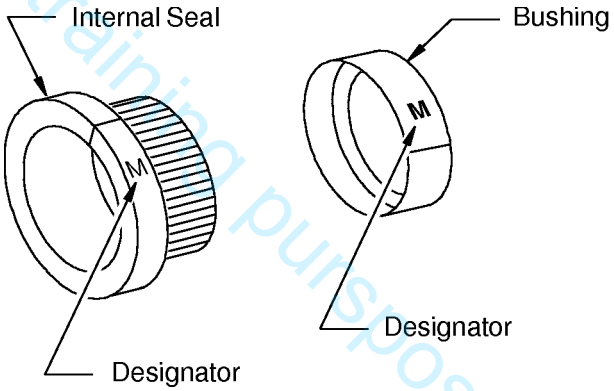
DISASSEMBLY, ASSEMBLY, AND INSTALLATION OF BACS31T SEAL FITTINGS



TYPE A AND TYPE B GROMMETS
Figure 6

NOTE: The bushing and the internal seal must have the same designator. Refer to figure 7.

Make sure that the Designator on the replacement Bushing and the Designator on the replacement Internal Seal is the same as the Designator on the Bushing and on the Internal Seal of the original configuration.



LOCATION OF THE DESIGNATOR ON THE INTERNAL SEAL AND ON THE BUSHING
Figure 7

Table 3
Seal Plug Part Numbers

Seal Plug Part Number	Grommet Hole Letter Designator	Grommet Hole Diameter Range (inch)
BACS31UP1	A	0.250 to 0.315
BACS31UP2	B	0.375 to 0.440
BACS31UP3	C	0.500 to 0.560
BACS31UP4	D	0.625 to 0.690
BACS31UP5	E	0.750 to 0.815
BACS31UP6	F	0.950 to 1.015

NOTE: Only the grommet holes of the diameter ranges that are given in Table 3 can have a seal plug.

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B. Grommet Configurations for the Seal Fittings

Table 4
BACS31U()S Grommet Configurations for The BACS31T Seal Fittings

Grommet			Reference
Shell Size	Seal Designator	Part Number	
24	K1	BACS31U24SK1	Figure 8
	K3	BACS31U24SK3	Figure 9
	K4	BACS31U24SK4	Figure 10
	K5	BACS31U24SK5	Figure 11
	K6	BACS31U24SK6	Figure 12
36	M1	BACS31U36SM1	Figure 13
	M2	BACS31U36SM2	Figure 14
	M3	BACS31U36SM3	Figure 15
	M4	BACS31U36SM4	Figure 16
48	P1	BACS31U48SP1	Figure 17
	P2	BACS31U48SP2	Figure 18
	P3	BACS31U48SP3	Figure 19
	P4	BACS31U48SP4	Figure 20
	P5	BACS31U48SP5	Figure 21
	P6	BACS31U48SP6	Figure 22
	P7	BACS31U48SP7	Figure 23
	P8	BACS31U48SP8	Figure 24
	P9	BACS31U48SP9	Figure 25
	P10	BACS31U48SP10	Figure 26
	P11	BACS31U48SP11	Figure 27
	P12	BACS31U48SP12	Figure 28
	P13	BACS31U48SP13	Figure 29
	P14	BACS31U48SP14	Figure 30
	P15	BACS31U48SP15	Figure 31
	P16	BACS31U48SP16	Figure 32
	P17	BACS31U48SP17	Figure 33
	P18	BACS31U48SP18	Figure 34
	P19	BACS31U48SP19	Figure 35

NOTE: Figure 8 through Figure 35 show the diameter limits for sealed wire harnesses, single wires, or single cables that go through the wire cavity holes in the grommet.

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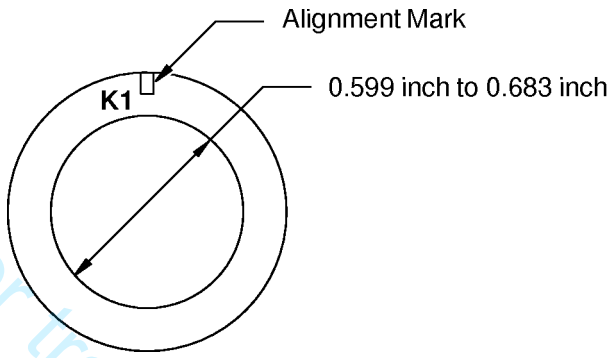
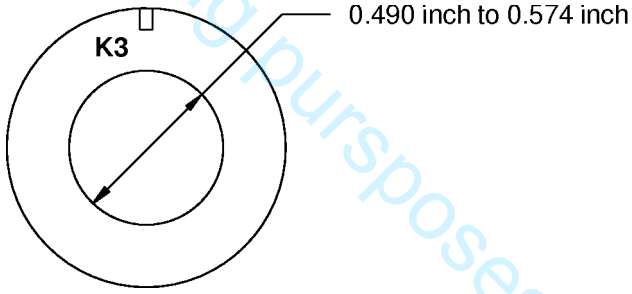
NOTE: Each grommet arrangement has an alignment mark. refer to Figure 8.

NOTE: Grommet holes have a letter designator that defines the wire harness diameter range for that hole. Refer to Table 3.

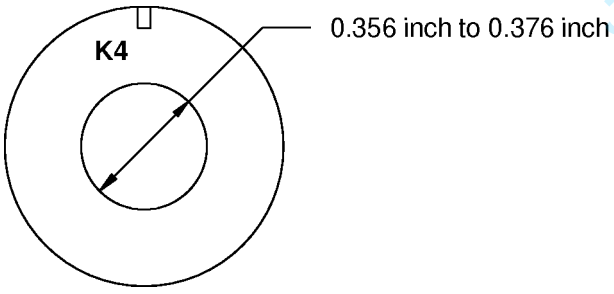
NOTE: Only the grommet holes of the diameter ranges that are given in Table 3 can have a seal plug.



SHELL SIZE 24 GROMMET ARANGEMENT - SEAL DESIGNATOR K1
Figure 8



SHELL SIZE 24 GROMMET ARANGEMENT - SEAL DESIGNATOR K3
Figure 9



SHELL SIZE 24 GROMMET ARANGEMENT - SEAL DESIGNATOR K4
Figure 10

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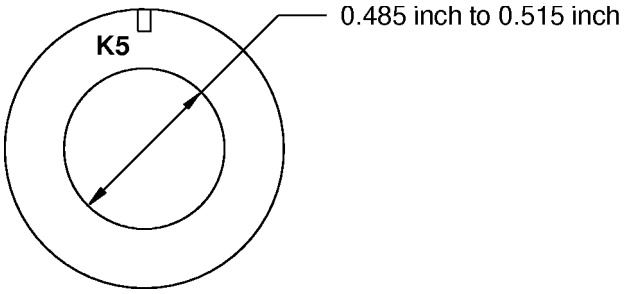
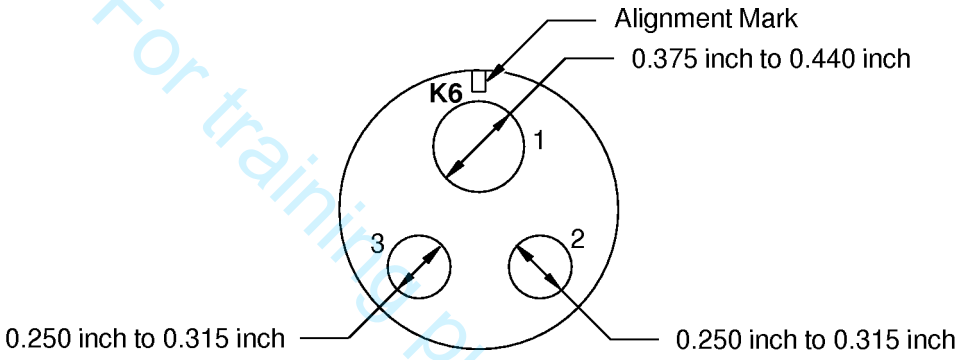
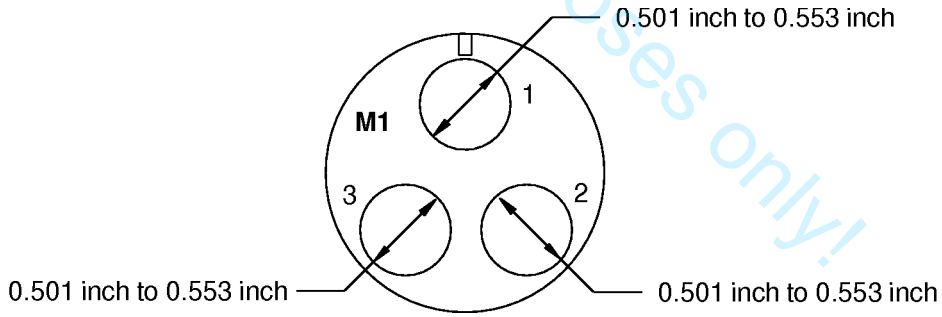


SHELL SIZE 24 GROMMET ARANGEMENT - SEAL DESIGNATOR K5
Figure 11



SHELL SIZE 24 GROMMET ARANGEMENT - SEAL DESIGNATOR K6
Figure 12



SHELL SIZE 36 GROMMET ARANGEMENT - SEAL DESIGNATOR M1
Figure 13

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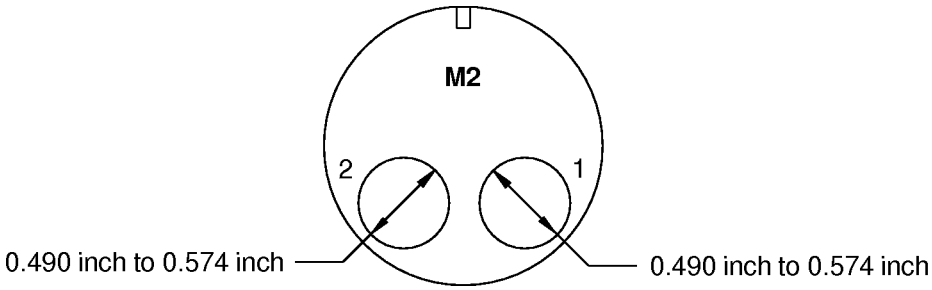
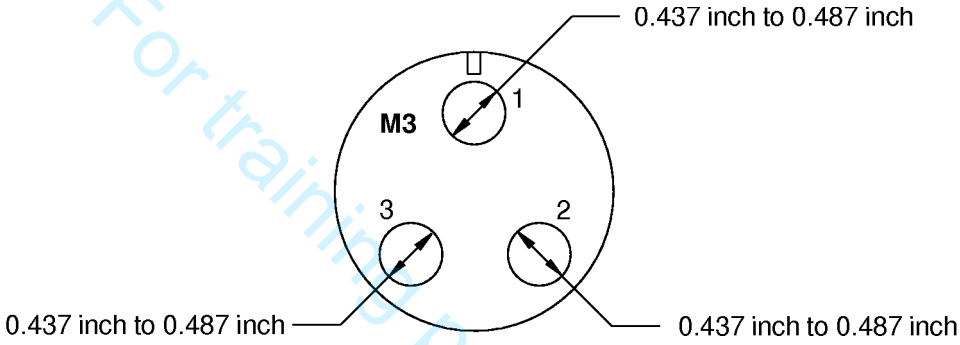
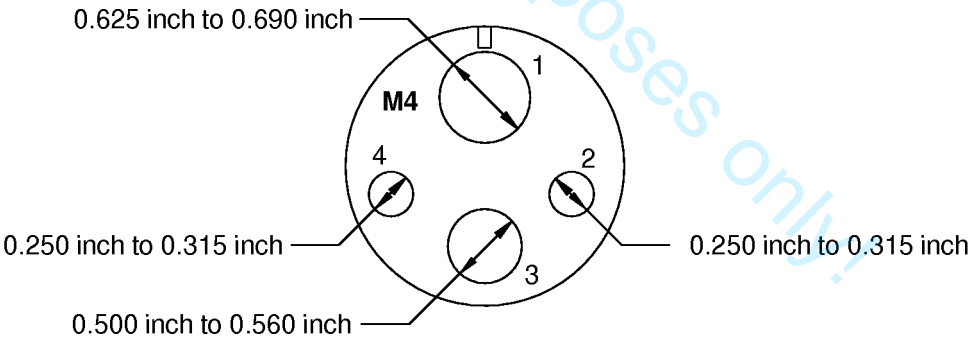


SHELL SIZE 36 GROMMET ARANGEMENT - SEAL DESIGNATOR M2
Figure 14



SHELL SIZE 36 GROMMET ARANGEMENT - SEAL DESIGNATOR M3
Figure 15



SHELL SIZE 36 GROMMET ARANGEMENT - SEAL DESIGNATOR M4
Figure 16

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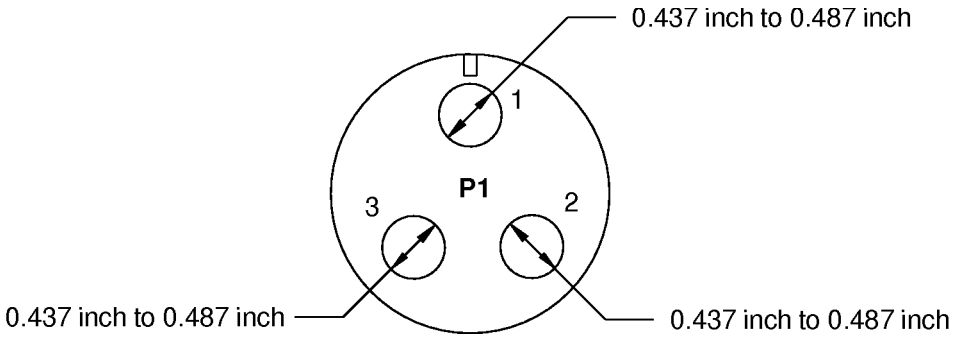
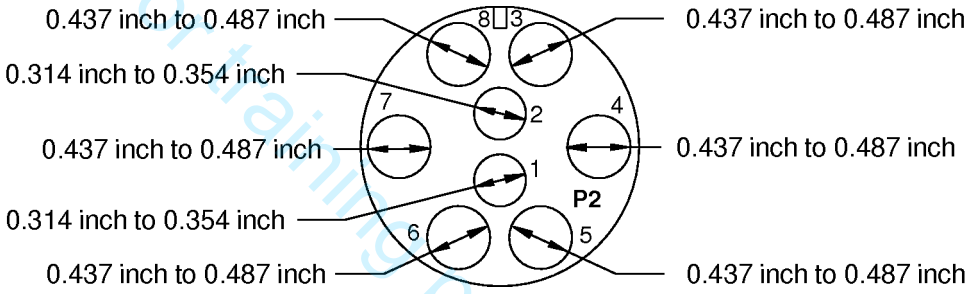
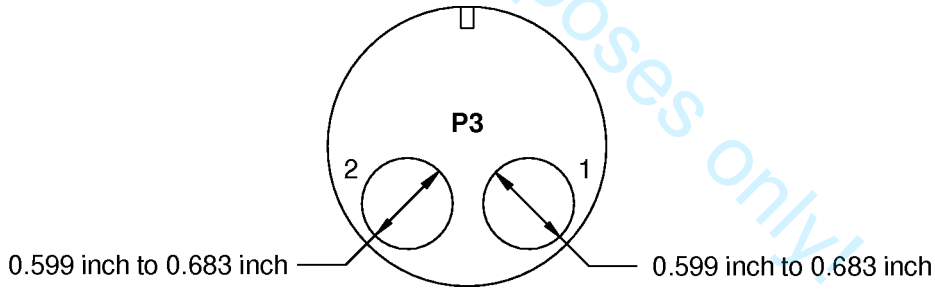


SHELL SIZE 48 GROMMET ARANGEMENT - SEAL DESIGNATOR P1
Figure 17



SHELL SIZE 48 GROMMET ARANGEMENT - SEAL DESIGNATOR P2
Figure 18



SHELL SIZE 48 GROMMET ARANGEMENT - SEAL DESIGNATOR P3
Figure 19

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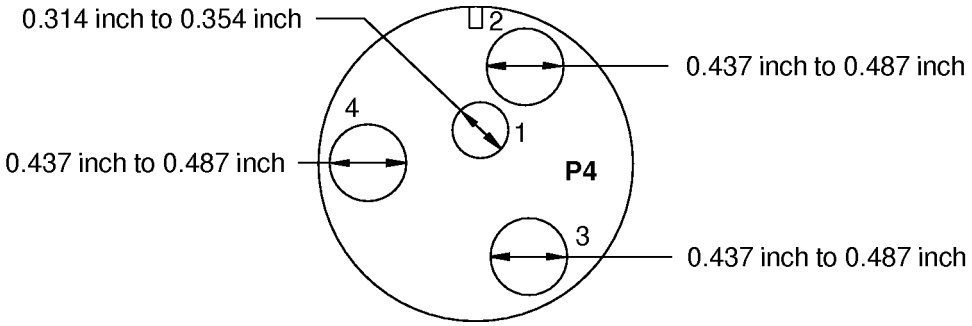
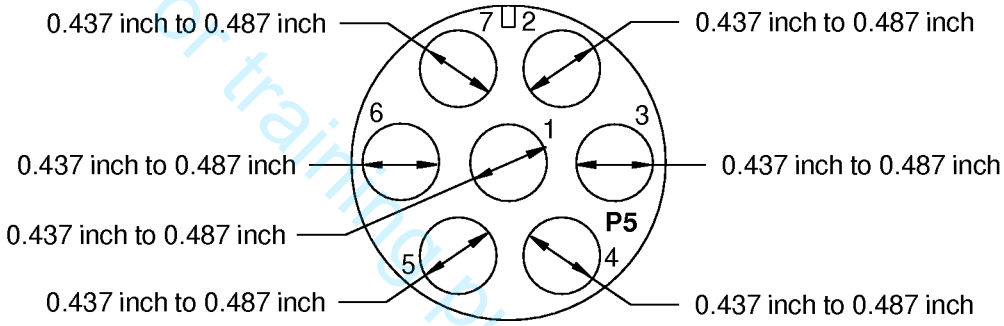
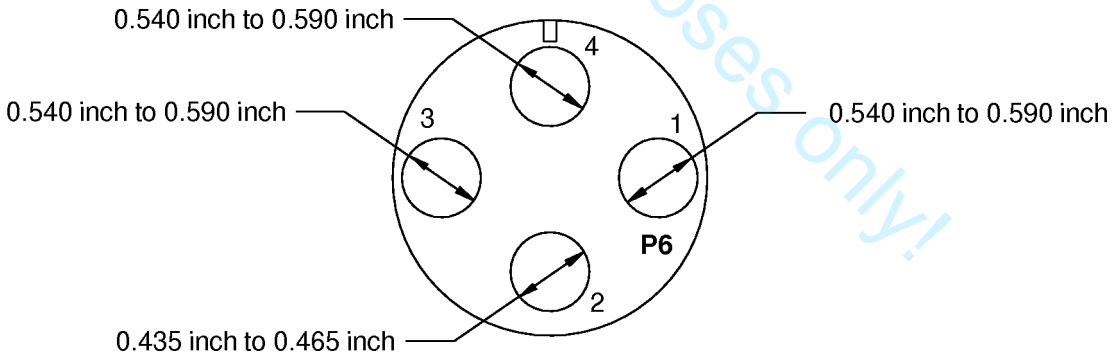


SHELL SIZE 48 GROMMET ARANGEMENT - SEAL DESIGNATOR P4
Figure 20



SHELL SIZE 48 GROMMET ARANGEMENT - SEAL DESIGNATOR P5
Figure 21



SHELL SIZE 48 GROMMET ARANGEMENT - SEAL DESIGNATOR P6
Figure 22

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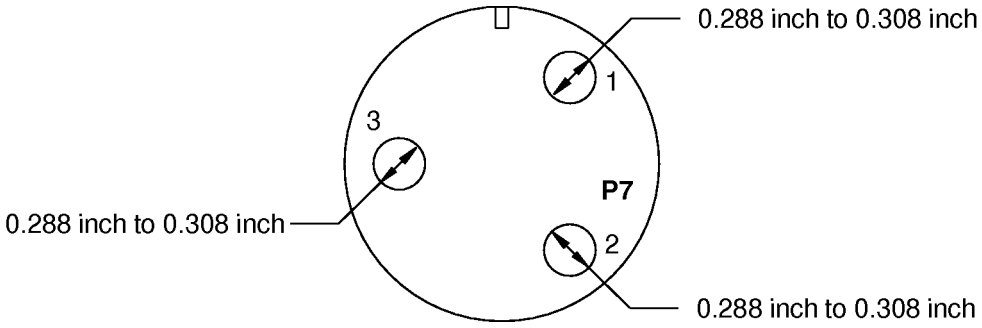
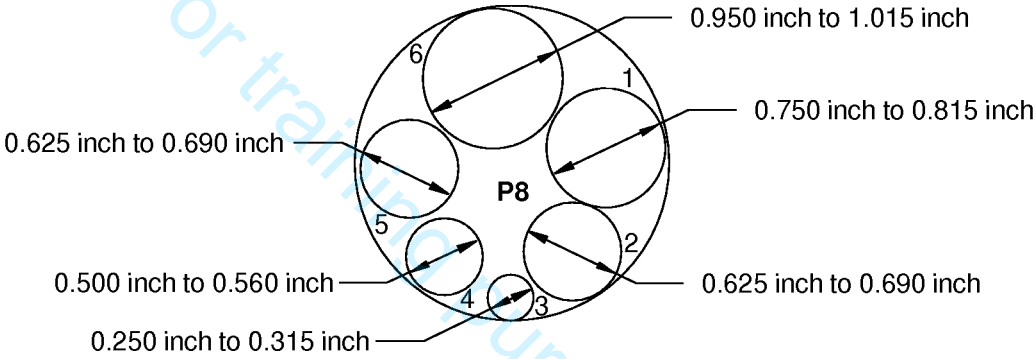
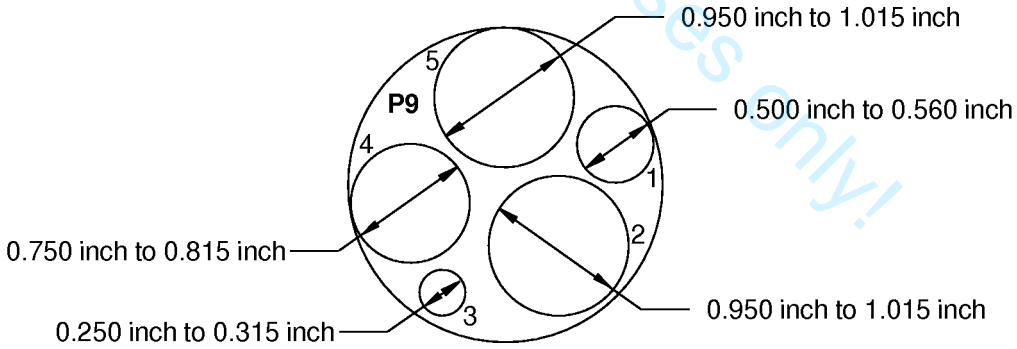


SHELL SIZE 48 GROMMET ARANGEMENT - SEAL DESIGNATOR P7
Figure 23



SHELL SIZE 48 GROMMET ARANGEMENT - SEAL DESIGNATOR P8
Figure 24



SHELL SIZE 48 GROMMET ARANGEMENT - SEAL DESIGNATOR P9
Figure 25

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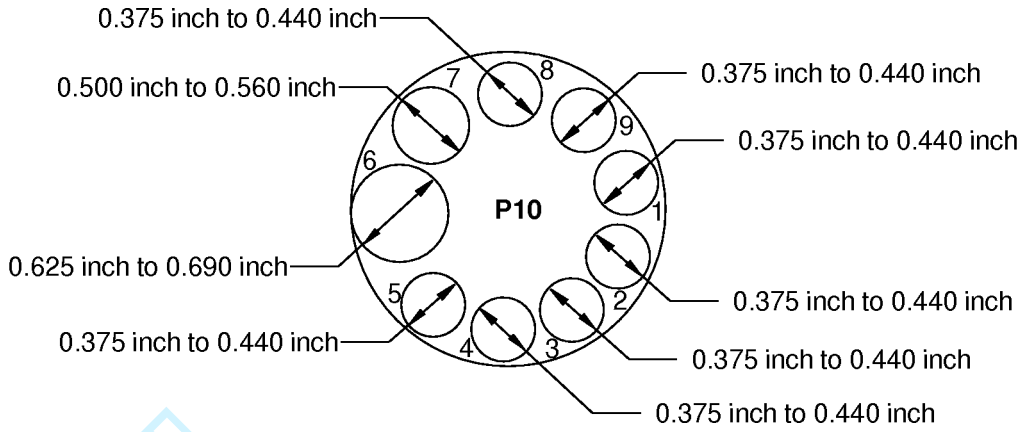
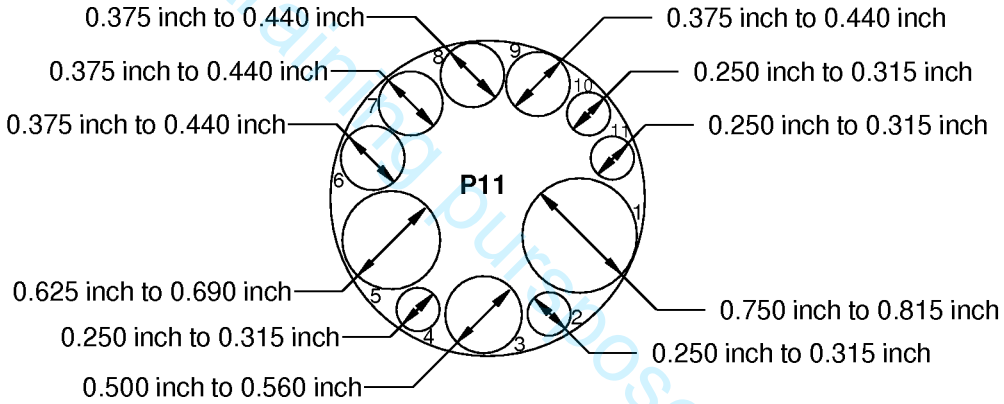
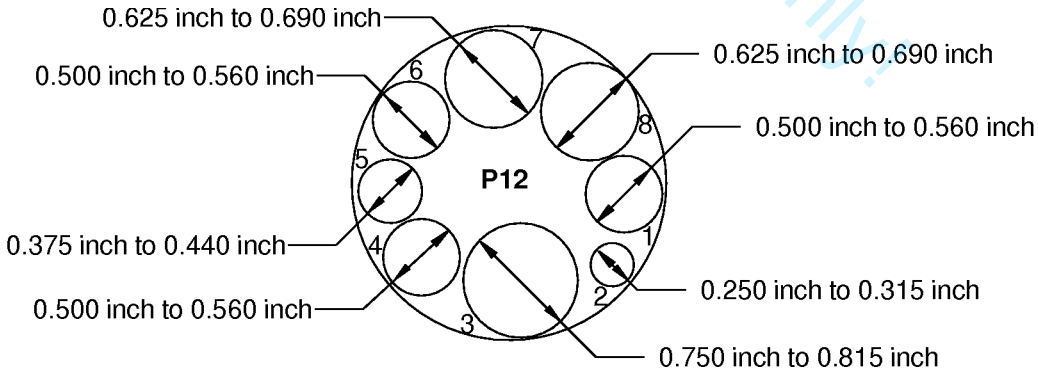


SHELL SIZE 48 GROMMET ARANGEMENT - SEAL DESIGNATOR P10
Figure 26



SHELL SIZE 48 GROMMET ARANGEMENT - SEAL DESIGNATOR P11
Figure 27



SHELL SIZE 48 GROMMET ARANGEMENT - SEAL DESIGNATOR P12
Figure 28

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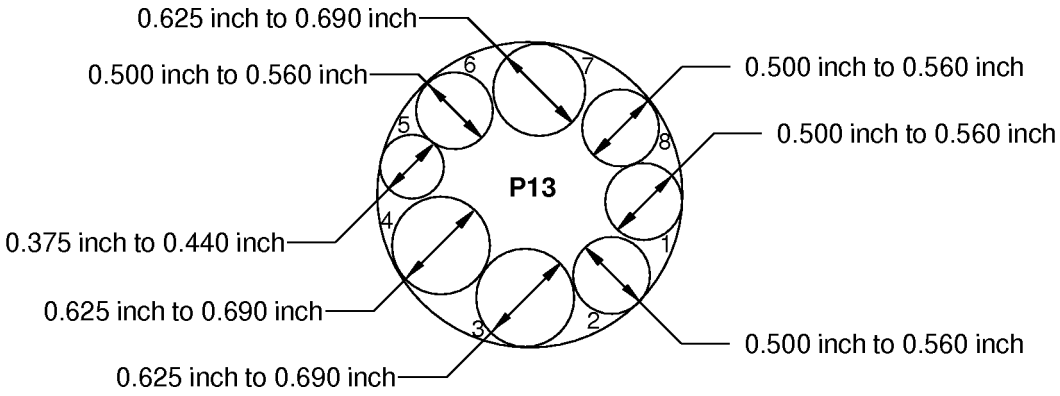
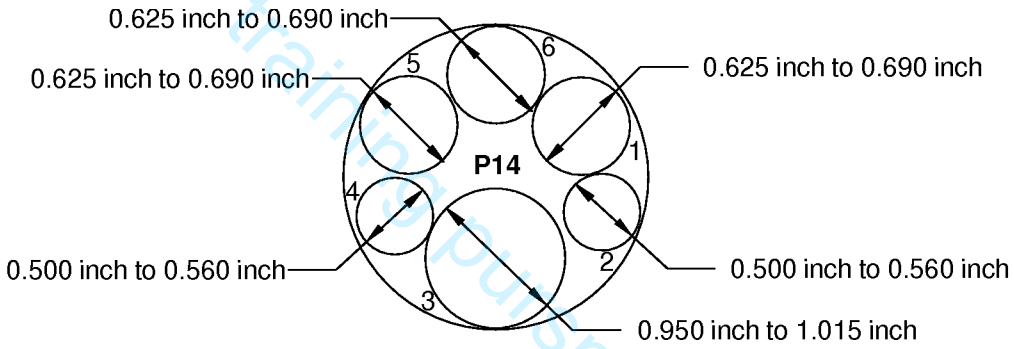
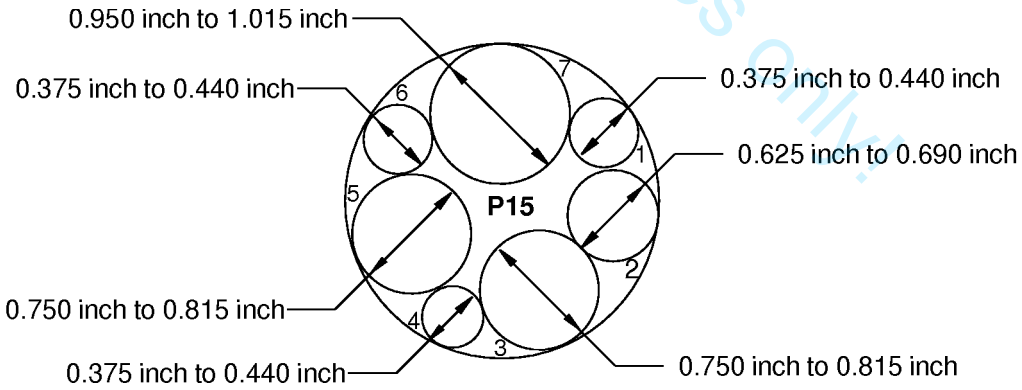


SHELL SIZE 48 GROMMET ARANGEMENT - SEAL DESIGNATOR P13
Figure 29



SHELL SIZE 48 GROMMET ARANGEMENT - SEAL DESIGNATOR P14
Figure 30



SHELL SIZE 48 GROMMET ARANGEMENT - SEAL DESIGNATOR P15
Figure 31

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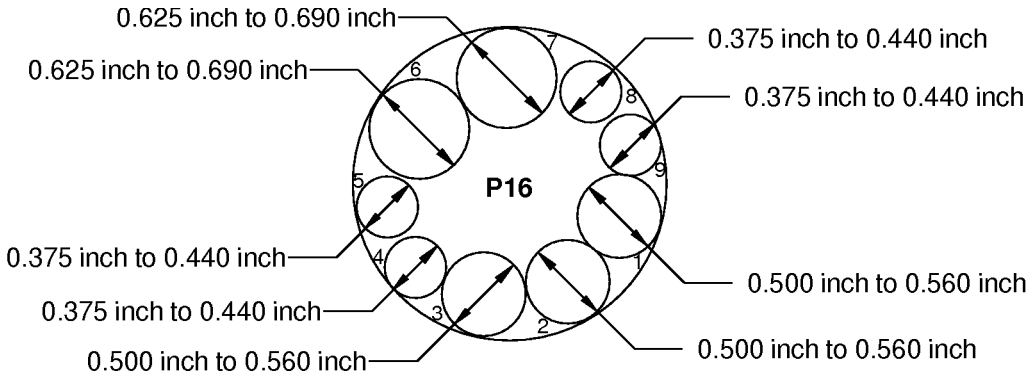
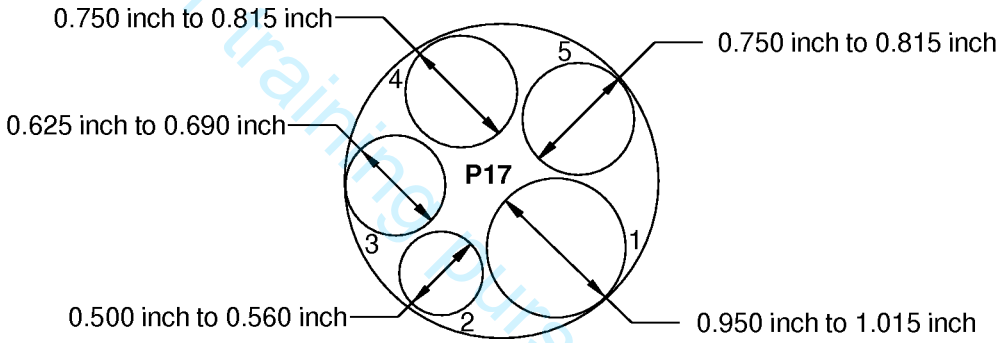
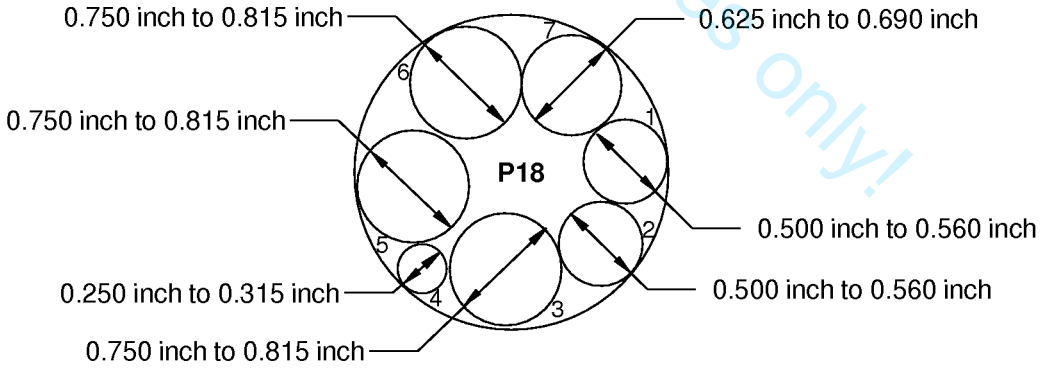


SHELL SIZE 48 GROMMET ARANGEMENT - SEAL DESIGNATOR P16
Figure 32



SHELL SIZE 48 GROMMET ARANGEMENT - SEAL DESIGNATOR P17
Figure 33



SHELL SIZE 48 GROMMET ARANGEMENT - SEAL DESIGNATOR P18
Figure 34

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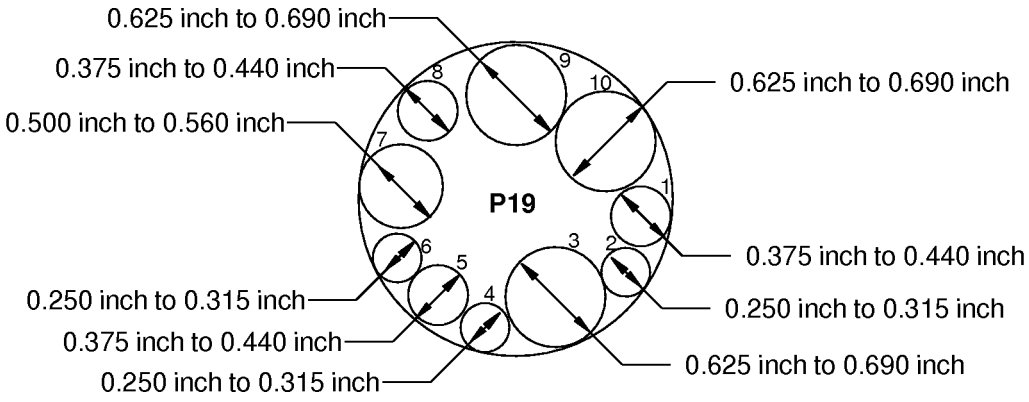

SHELL SIZE 48 GROMMET ARANGEMENT - SEAL DESIGNATOR P19
Figure 35

2. REMOVAL AND DISASSEMBLY OF THE SEAL FITTING

A. Removal of the Seal Fitting from the Structure

Table 5
Necessary Tools

Tool	Description	Shell Size	Size (inches)	Part Number
Wrench	Crowfoot, Jam Nut	24	2.0	AN850832B
				ST2580-343A-17
		36	2-5/8	AN850842B
				ST2580-343A-15
		48	3-1/2	057-0919-05
Wrench	Socket, Jam nut, Unpressurized Side	48	3-1/2	057-0898-05

(1) Make a selection of a crowfoot jam nut wrench from Table 5. On the unpressurized side of the structure, turn the jam nut in the counterclockwise direction to loosen it from the seal fitting.

(2) Push on the two halves of the jam nut to separate the two halves of the jam nut. Refer to Figure 36.

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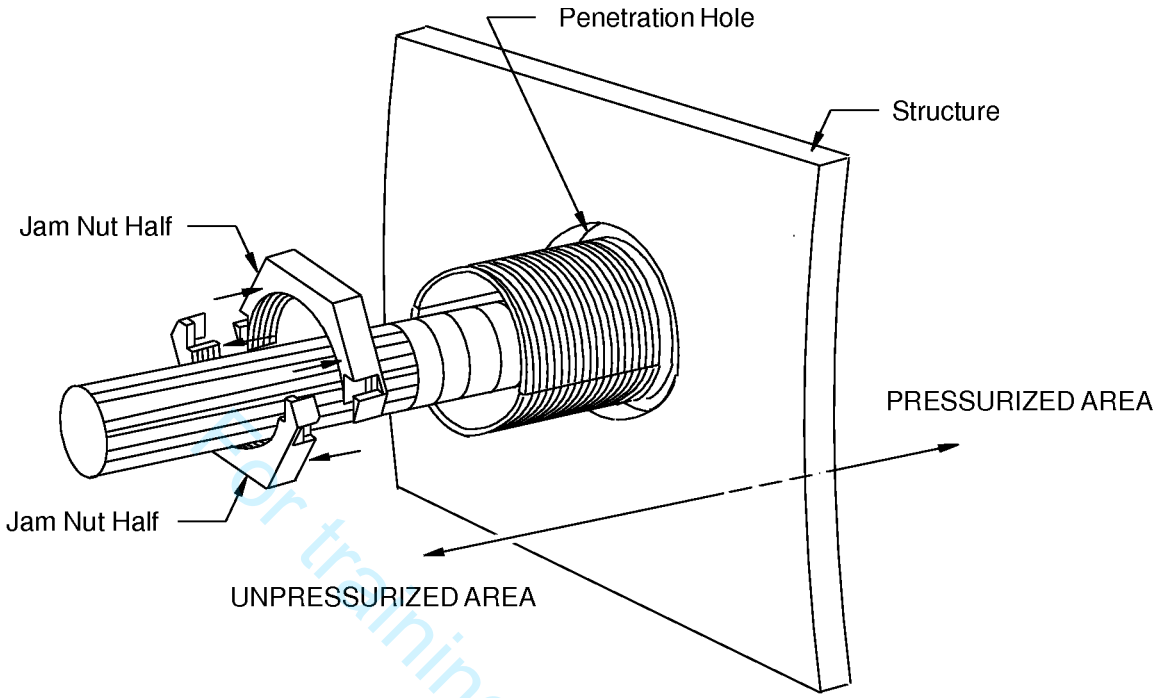
DISASSEMBLY, ASSEMBLY, AND INSTALLATION OF BACS31T SEAL FITTINGS



REMOVAL OF THE JAM NUT AND SEPARATION OF THE JAM NUT HALVES
Figure 36

(3) On the pressurized side of the structure, pull the seal fitting and the wire harness from the penetration hole.

CAUTION: DO NOT CAUSE DAMAGE TO THE INSULATION OF THE WIRES.

B. Disassembly of Shell Size 24 and 36 Seal Fittings

Table 6
NECESSARY TOOLS

Tool	Description	Shell Size	Size (inch)	Part Number
Wrench	Allen	24	7/64	-
		36	7/64	-
Wrench	Crow Foot, Compression Nut	24	1-1/2	AN850824B
				ST2580-343A-20
		36	1-5/8	AN850826B
				ST2580-343A-18
Holding Tool	-	24	2	ST2580-343A-23
		36	2-5/8	ST2580-343A-21

(1) Make a selection of an allen wrench from table 6.

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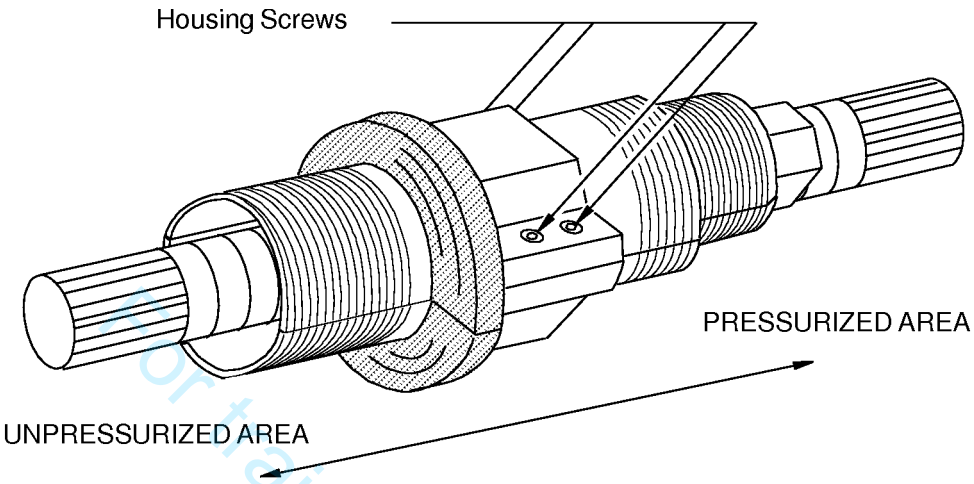
(2) Disengage the housing screws. Refer to Figure 37.

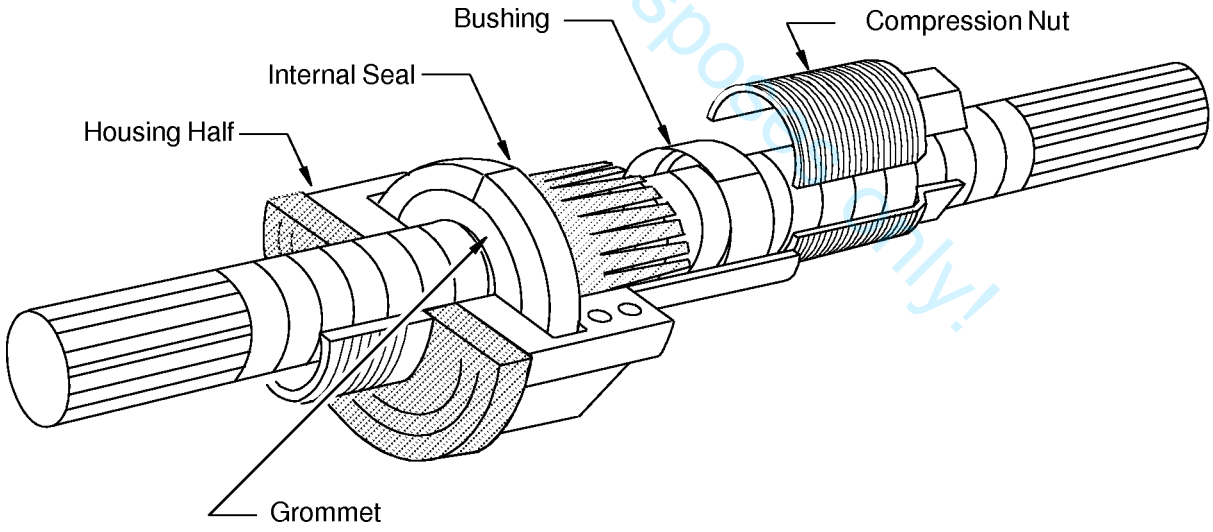
NOTE: These screws hold the two halves of the housing together.



LOCATION OF THE HOUSING SCREWS
Figure 37

(3) Separate the two halves of the housing.

(4) Pull the wire harness, the internal seal, the bushing, and the compression nut from the housing. Refer to Figure 38.



HALF OF THE HOUSING, THE WIRE HARNESS, INTERNAL SEAL, BUSHING, AND COMPRESSION NUT
Figure 38

(5) If the seal fitting has a grommet:

(a) Remove the grommet from the internal seal.

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(b) Remove the wires from the grommet.

(6) If the seal fitting does not have a grommet, remove the wire harness from the internal seal.

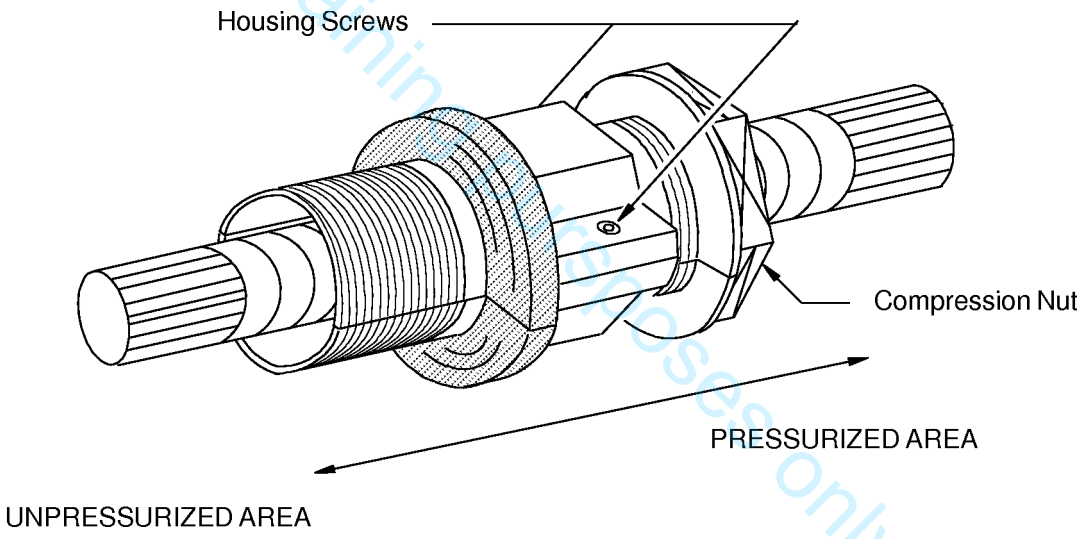
C. Disassembly of the Shell Size 48 Seal Fitting

Table 7
Necessary Tools

Seal Fitting Shell Size	Tool	Description	Size (inch)	Part Number
48	Wrench	Allen	9/64	-
		Crow Foot, Compression Nut	3-1/2	ST2580-343A-19
	Holding Tool	-	3-1/2	ST2580-343A-22

(1) Make a selection of crow foot compression nut wrench from Table 7.

(2) Remove the compression nut from the seal fitting. Refer to Figure 39.



SHELL SIZE 48 SEAL FITTING REMOVED FROM THE STRUCTURE
Figure 39

(3) Make a selection of allen wrench from Table 6.

(4) Disengage the screws that hold the two housing halves together. Refer to Figure 39.

(5) Separate the two halves of the housing.

(6) Pull the wire harness, the internal seal and grommet, and the bushing from the housing.

(7) If the seal fitting does not have a grommet, remove the wire harness from the internal seal.

(8) If the seal fitting has a grommet:

(a) Remove the grommet from the internal seal.

(b) Remove the wires from the grommet.

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D. Removal of the Sealant Tape from the Harness

Table 8
Necessary Materials

Material	Description	Part Number	Supplier
Solvent	Isopropyl Alcohol	TT-I-735	An available source
	Naptha, Aliphatic	TT-N-95 Type I	An available source

Table 9
Necessary Tools

Description	Notes	Supplier
Gloves	Powder Free	An available source
Scissors	-	An available source
Wiper	-	An available source

NOTE: Use gloves to touch or move the adhesive sealant tape. Refer to Table 9.

(1) Make a selection of:
- A solvent from Table 8
- A pair of Scissors from Table 9
- A wiper from Table 9.

(2) Cut the outer wrap of tape with the scissors.

NOTE: To make the operation easier, the tape can be lifted as it is cut.

CAUTION: DO NOT CAUSE DAMAGE TO THE INSULATION OF THE WIRES. DAMAGE TO THE INSULATION OF THE WIRE CAN CAUSE UNSATISFACTORY PERFORMANCE OF THE WIRE.

(3) Use a sealant stick to move the tape apart

(4) Remove the tape from the harness.

(5) Put the solvent on the wiper.

(6) Use the wiper to remove the adhesive sealant from the wire harness.

NOTE: It is not necessary to remove all of the sealant if the sealant does not touch something before the wire harness is taped again.

3. PREPARATION OF A WIRE HARNESS SEAL FITTING

A. Preparation of a Wire Harness for Installation in a Grommet

Table 10
Necessary Materials

Material	Description	Part Number	Supplier
Adhesive Sealant Tape	0.50 inch wide, Black	5313	3M
Flag Marker Tape	-	BACT19ET-5	Boeing

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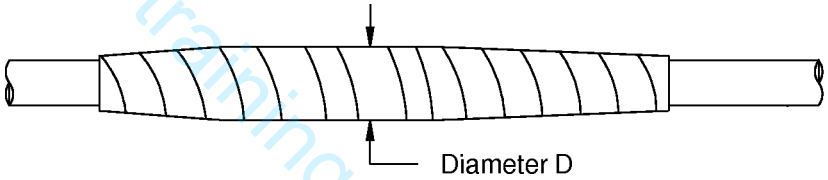
Table 10 (continued)

Material	Description	Part Number	Supplier
Silicone Tape	0.57 inch wide, Black	67N	Federal Mogul

Table 11
Necessary Tools

Tool	Description	Part Number
Marker	Temporary	-
Wrench, Compression Strap	-	057-0750-00
Wrench, Torque	50 inch-pound	-
Ruler	-	-



DIAMETER D OF THE FINISHED WIRE HARNESS AFTER THE INSTALLATION OF THE SEALANT TAPE
Figure 40

Table 12
Wire Harness Diameters

Specified Diameter (inch)	Assembly Diameter D (inch) Refer to Figure 40	
	Minimum	Maximum
0.250	0.19	0.250
0.375	0.32	0.375
0.500	0.44	0.500
0.625	0.57	0.625
0.750	0.69	0.750
0.950	0.89	0.950

(1) Find the Controlled Diameter Area on the wire harness:

(a) Put one seal fitting housing half in the penetration hole in the structure.

Make sure that the flange gasket is against the structure on the pressurized area side.

(b) Put the wire harness in the housing.

(c) Make a selection of a Marker from Table 11.

(d) Make a temporary mark on the wire harness approximately in the center of the Controlled Diameter Area.

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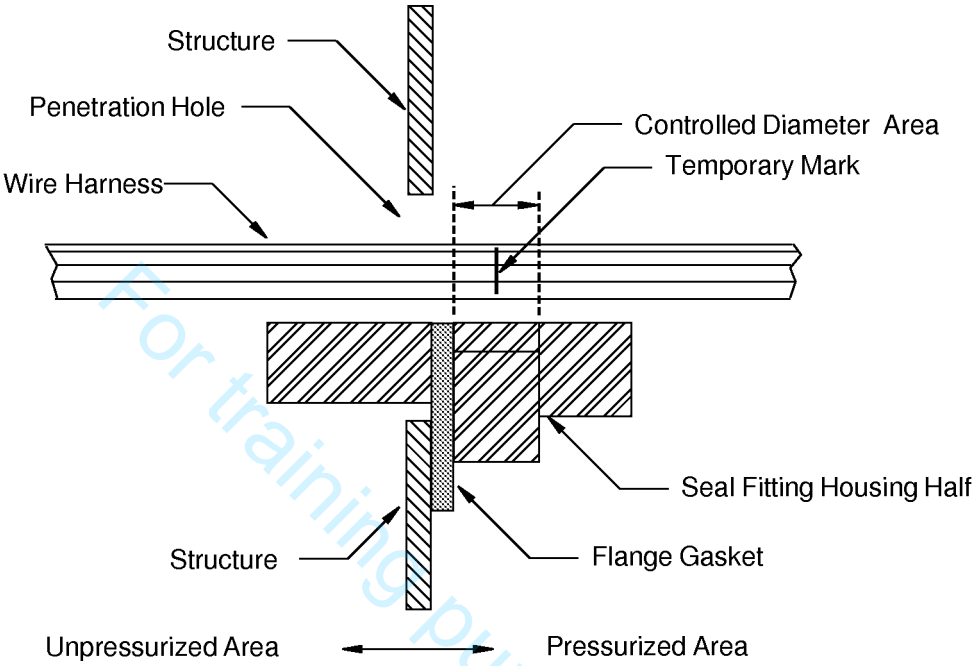
DISASSEMBLY, ASSEMBLY, AND INSTALLATION OF BACS31T SEAL FITTINGS

Refer to:

- Figure 41 for shell size 24 and shell size 36 seal fittings
- Figure 42 for shell size 48 seal fittings.



POSITION OF THE TEMPORARY MARK ON THE HARNESS FOR THE SHELL SIZE 24 AND 36 SEAL FITTINGS
Figure 41

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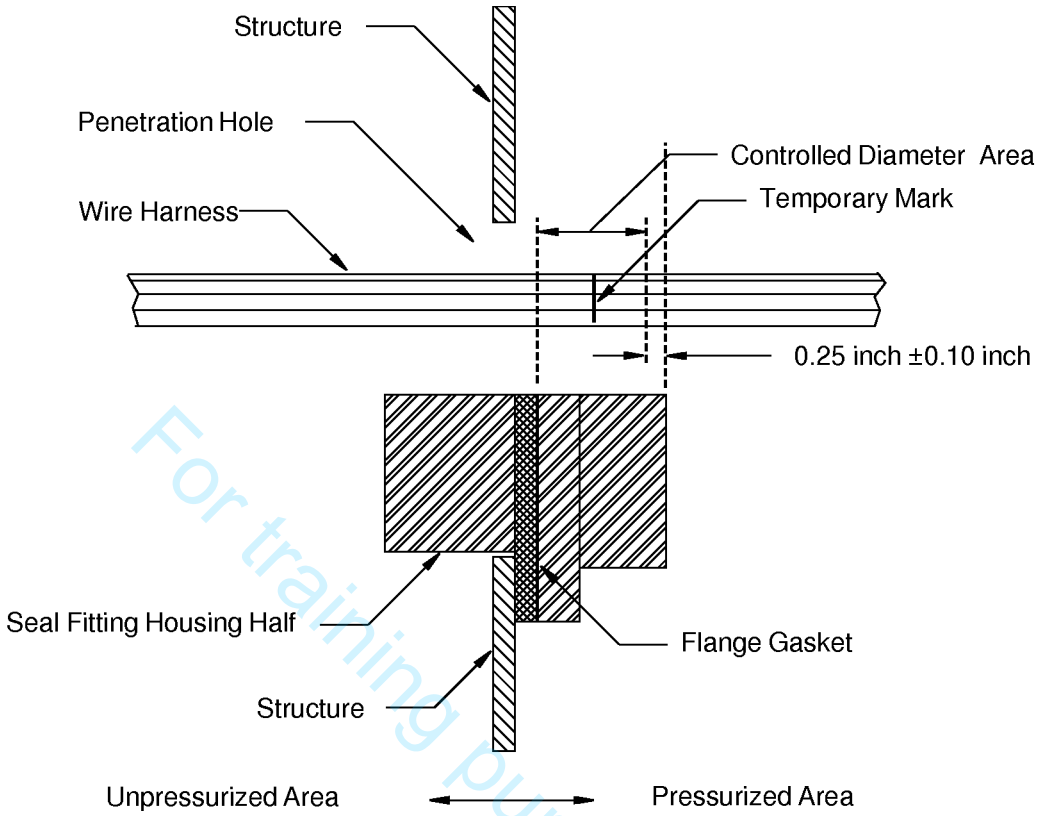
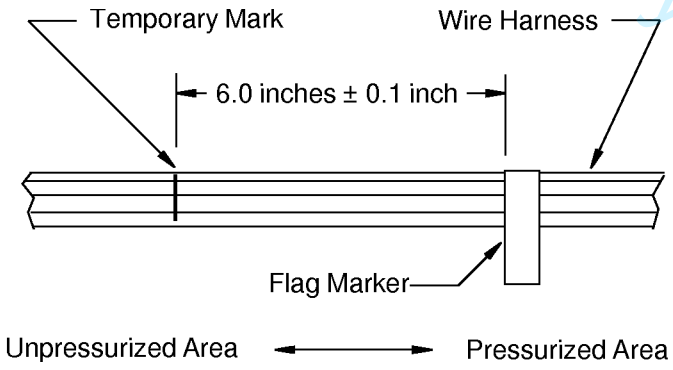


POSITION OF THE TEMPORARY MARK ON THE HARNESS FOR THE SHELL SIZE 48 SEAL FITTING
Figure 42

(e) Do Step (b) through Step (d) again for each wire harness that must be installed in the seal fitting.

(2) Make a selection of a Flag Marker Tape from Table 10.

(3) For each wire harness that will be installed in the seal fitting, put a length of Flag Marker Tape on the harness 6.0 inches ±0.1 inch from the temporary mark in the direction of the pressurized area. Refer to Figure 43.



POSITION OF THE FLAG MARKER
Figure 43

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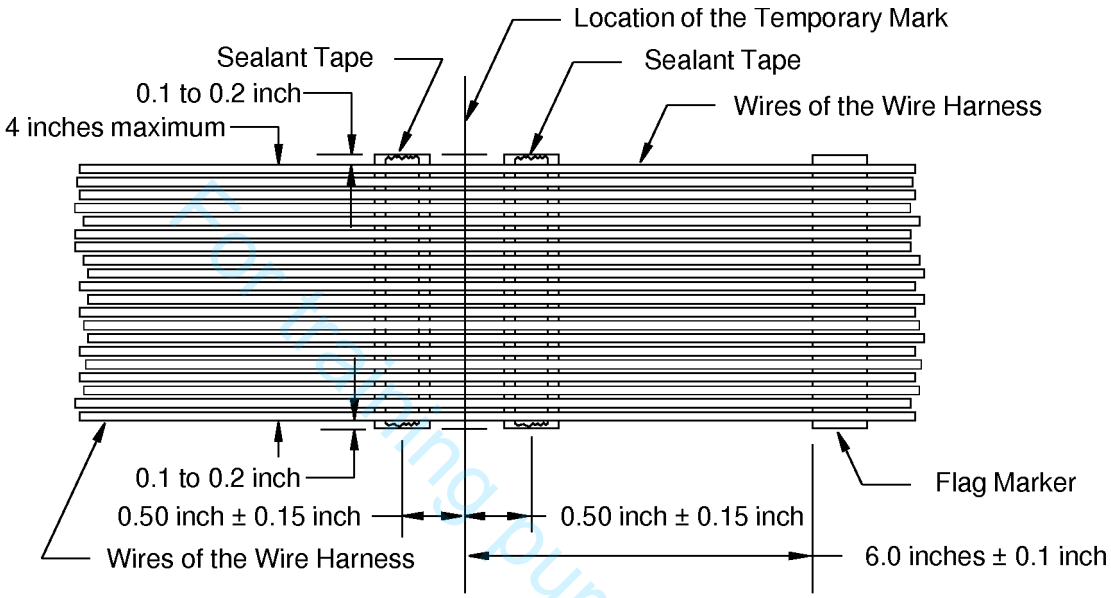
(4) Make a selection of an Adhesive Sealant Tape from Table 10.

(5) Cut two lengths of the Adhesive Sealant Tape.

Make sure that the lengths of the sealant tape are not longer than 4.4 inches. Refer to Figure 44.

(6) Move all or some of the wires of the wire harness to make one layer of wires not more than 4 inches wide. Refer to Figure 44.



CONFIGURATION OF THE WIRES ON THE FIRST LENGTH OF SEALANT TAPE
Figure 44

(7) Put the layer of the wires on the sealant tapes and push each wire into the sealant. Refer to Figure 44

Make sure that the position of the temporary mark on the wires is located at half the distance between the lengths of the sealant tape.

Where the wires touch the sealant, make sure that:

- The width of the layer of wires is 4 inches maximum
- The wires are all adjacent to each other
- One of the wires is not on another wire
- The end of the length of sealant tape extends approximately 0.1 inch to 0.2 inch beyond the wires.

(8) Put an additional length of the sealant tape on the wires above each layer of sealant tape. Refer to Figure 45.

Make sure that the sealant on these lengths of sealant tape touches the wires.

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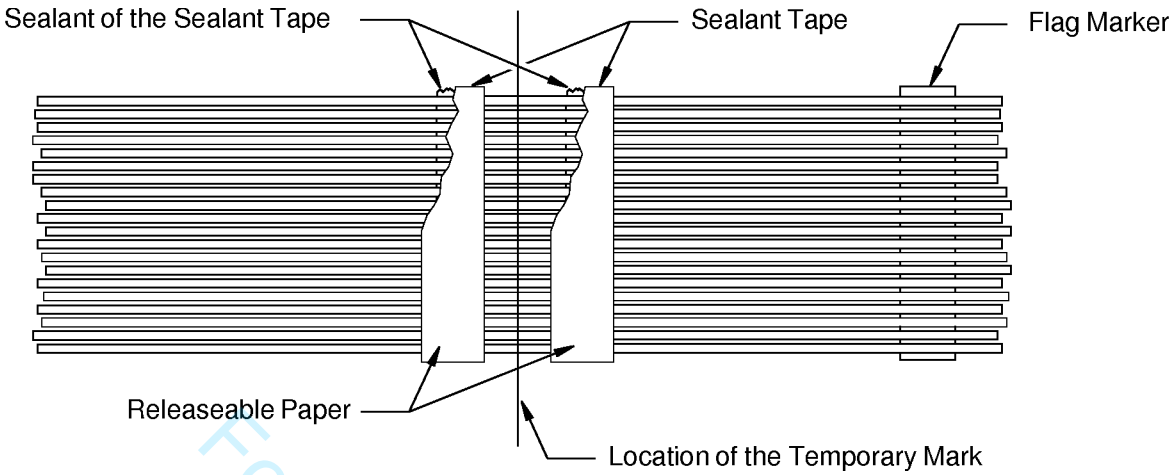
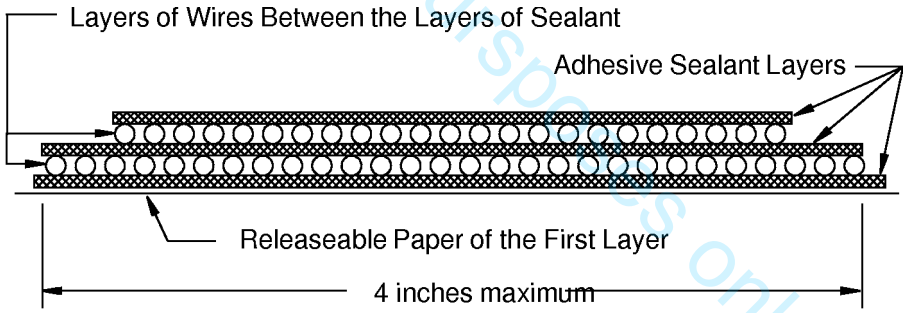


THE SECOND LENGTH OF SEALANT TAPE ON THE LAYER OF WIRES
Figure 45

(9) Remove the releasable paper from these additional layers of sealant tape.

(10) If more layers of wires are necessary, do Step (6) through Step (9) again for each additional layer of wires. Refer to Figure 46.

Make sure that no lengths of the releaseable paper are between the layers of the wires and the sealant.



CONFIGURATION OF THE LAYERS OF THE SEALANT TAPE AND THE LAYERS OF THE WIRES
Figure 46

(11) Wind the layers of sealant and wire on itself, and at the same time, remove the remaining length of releasable paper from the first layer of sealant tape. Refer to Figure 46 and Figure 47.

Make sure that the wire harness now has a circular shape.

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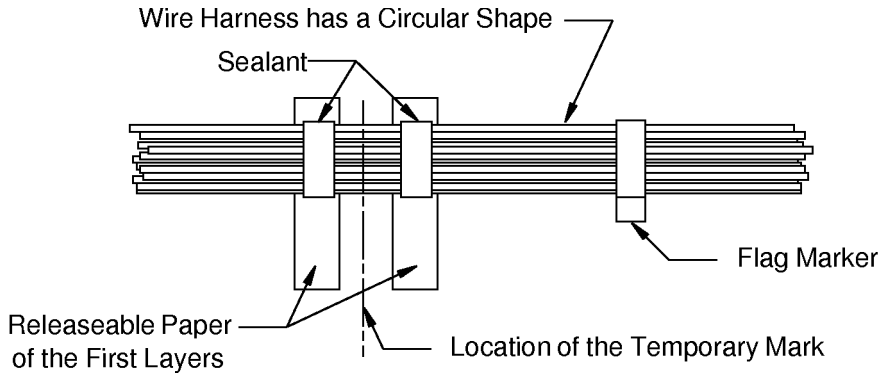
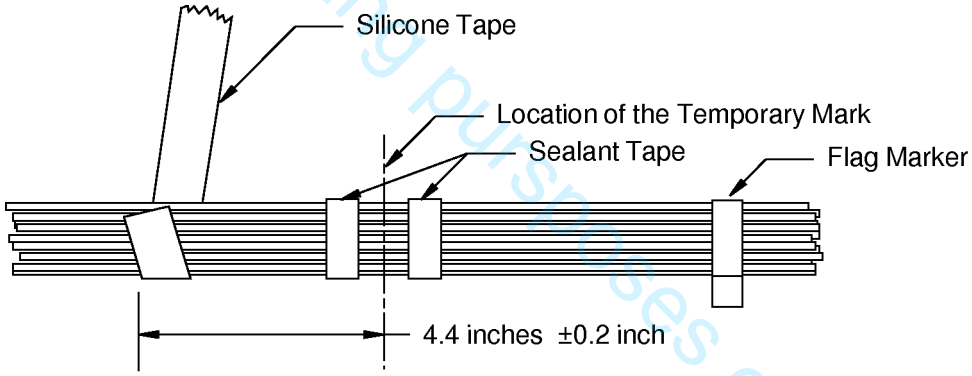


CONFIGURATION OF THE WIRE HARNESS AFTER IT IS WOUND
Figure 47

(12) Make a selection of silicone tape from Table 10.

(13) Wrap a minimum of one layer of the silicone tape on the harness at approximately a 60 degree angle from the unpressurized side to the pressurized side. Refer to Figure 48.

Make sure that the wrap starts at 4.4 inches ±0.2 inch from the temporary mark.



POSITION OF THE OUTER LAYER OF TAPE ON THE WIRE HARNESS
Figure 48

(14) Continue to apply the necessary layers of silicone tape until the wire harness diameter is sufficiently increased.

For the length of the wrap, refer to Figure 49.

For the outer diameter of the wrap, refer to:

- Paragraph 1.B. for the grommet cavity diameter
- Table 12 and Figure 40 for the applicable harness assembly diameter.

Make sure that while the silicone tape is put on:

- Each tape wrap makes a 40 percent to 50 percent overlap
- The tape is stretched
- The sealant is not pushed out
- The tension is smooth and even.

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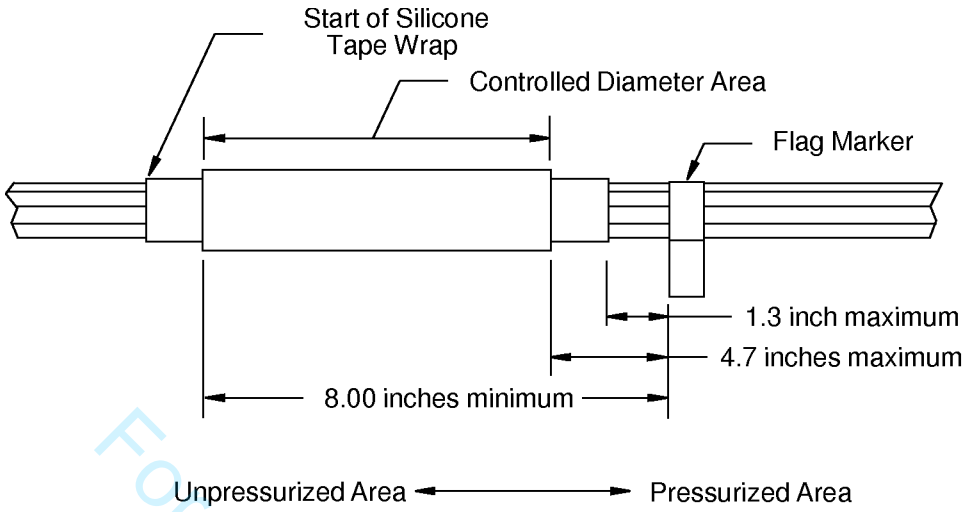


LOCATION OF THE CONTROLLED DIAMETER AREA OF THE WIRE HARNESS
Figure 49

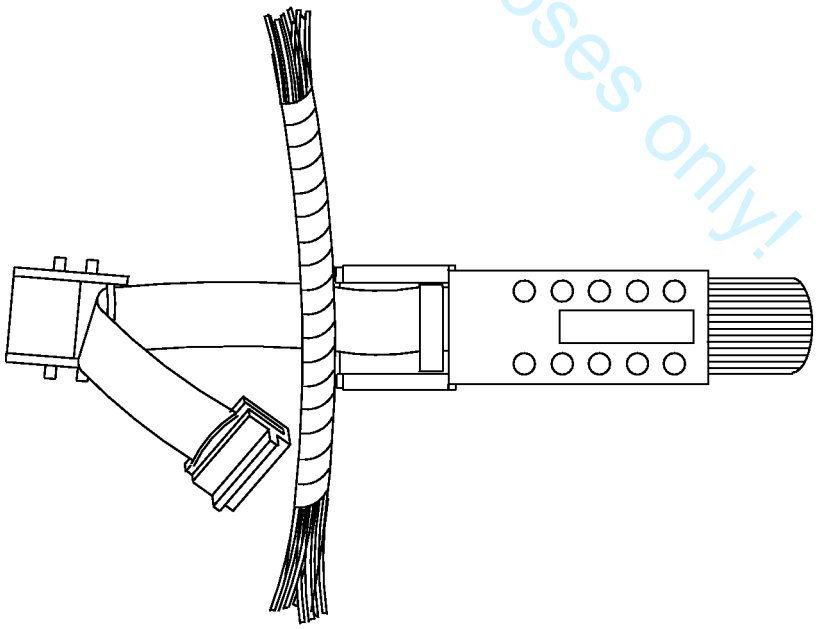
(15) Make a selection of a compression strap wrench from Table 11.

(16) Make a selection of a torque tool from Table 11.

(17) Align one edge of the strap with the approximate center of the taped area.

Refer to:

- Figure 50
- Figure 51
- Figure 52.



POSITION OF THE HARNESS IN THE COMPRESSION STRAP WRENCH
Figure 50

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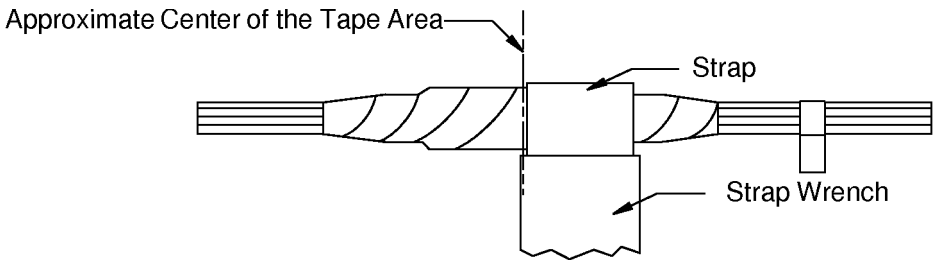
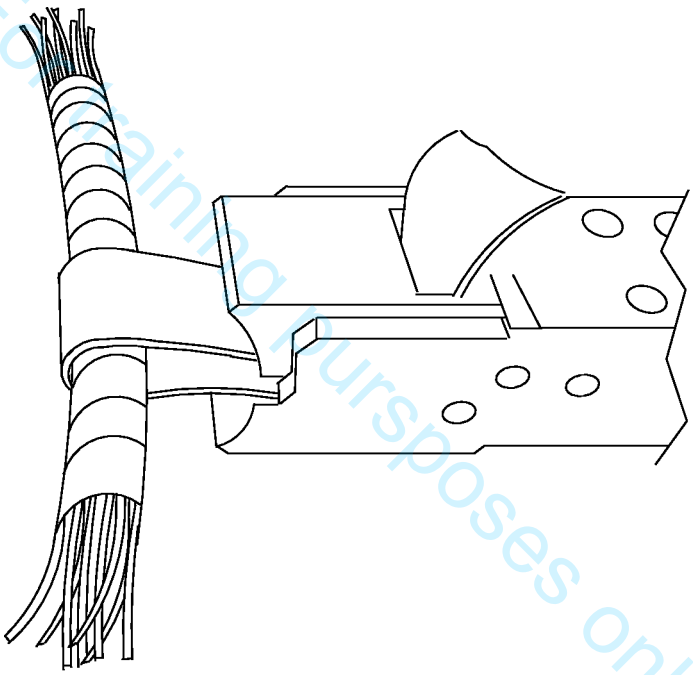


POSITION OF THE COMPRESSION STRAP WRENCH ON THE HARNESS
Figure 51



STRAP OF THE COMPRESSION STRAP WRENCH AROUND THE WIRE HARNESS
Figure 52

(18) Put the torque tool on the end of the compression strap wrench. Refer to Figure 53.

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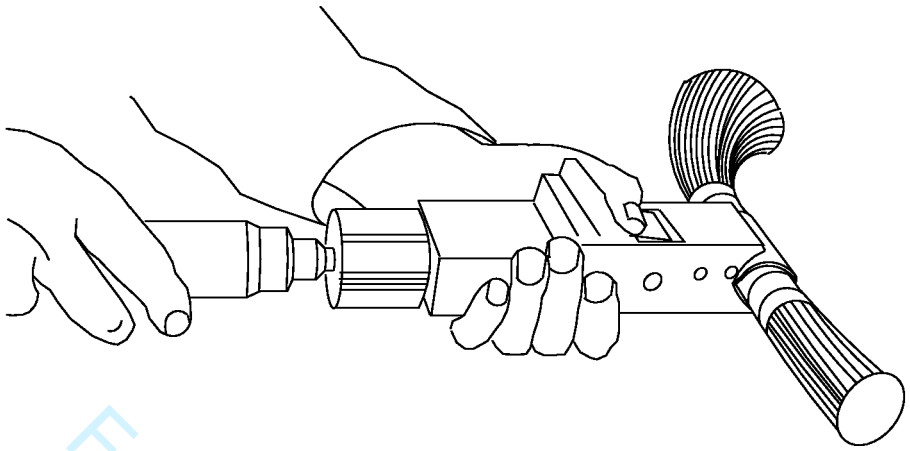


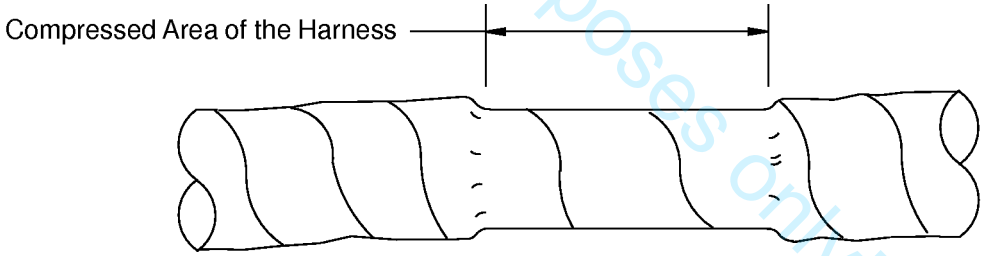
POSITION OF THE TORQUE TOOL ON THE COMPRESSION STRAP WRENCH
Figure 53

(19) Apply from 16 inch-pounds to 29 inch-pounds of torque to compress the harness in the strap wrench tool.

Refer to Figure 53 and Figure 54.

CAUTION: DO NOT TIGHTEN THE MECHANISM TOO MUCH.

CAUTION: DO NOT TIGHTEN THE MECHANISM FARTHER THAN THE RED REFERENCE MARK ON THE TOOL. IF THE MECHANISM IS TIGHTENED FARTHER THAN THE RED REFERENCE MARK, THE TORQUE INDICATION WILL NOT BE ACCURATE.



A COMPRESSED AREA OF THE HARNESS
Figure 54

(20) Put the strap on the other side of the center of the tape area.

(21) Do Step (17) through Step (19) again.

Make sure that

- This side of the tape area is compressed to the same diameter as in Step (19)
- The sealant does come out from between the tape wraps.

(22) Measure the compressed diameter of the harness.

(23) If the measured diameter is specified:

(a) Get the assembly diameter.

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Refer to:

- Table 12
- Figure 40.

(b) If the compressed diameter of the tape area is less than the minimum, add more layers of tape.

Make sure that, while the tape is put on:

- Each tape wrap makes a 40 percent to 50 percent overlap
- The tape is stretched
- The sealant is not pushed out
- The tape tension is smooth and even.

Make sure that the harness diameter is the same throughout the controlled diameter area.

Refer to:

- Figure 49
- Figure 55.

(24) If the diameter is not specified or not within an assembly diameter range, add layers of tape to meet the first larger assembly diameter.

Make sure that, while the tape is put on:

- Each tape wrap makes a 40 percent to 50 percent overlap
- The tape is stretched
- The sealant is not pushed out
- The tape tension is smooth and even.

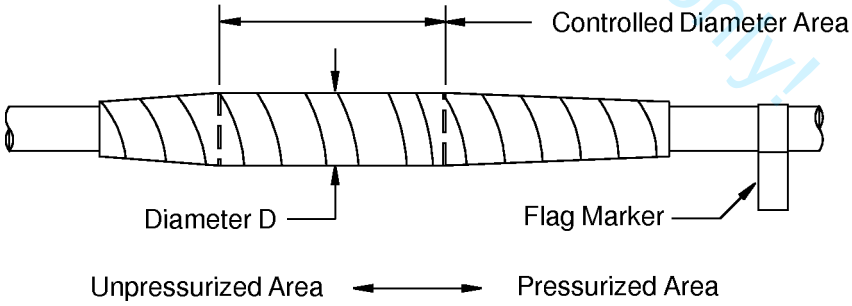
Refer to:

- Table 12
- Figure 40.

Make sure the harness diameter is the same throughout the controlled diameter area.

Refer to:

- Figure 49
- Figure 55.



CONFIGURATION OF THE COMPRESSED, WRAPPED WIRE HARNESS
Figure 55

(25) Do Step (5) through Step (24) again for each wire harness that will be installed in the seal fitting grommet.

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B. Preparation of One Wire or One Cable for Installation in a Grommet Hole

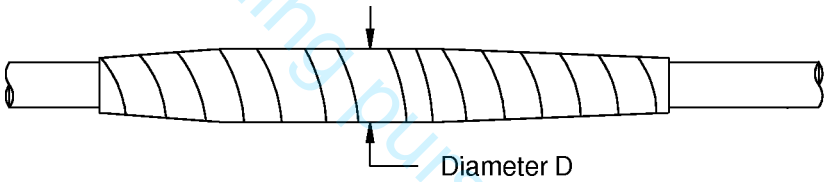
NOTE: This procedure applies to a single wire or cable that will go through the seal fitting in a grommet hole where this wire or cable is the only wire or cable in that hole.

Table 13
Necessary Materials

Material	Description	Part Number	Supplier
Flag Marker Tape	-	BACT19ET-5	Boeing
Silicone Tape	0.57 inch wide, Black	67N	Federal Mogul

Table 14
Necessary Tools

Tool	Description	Part Number
Marker	Temporary	-
Ruler	-	-



DIAMETER D OF THE FINISHED WIRE OR CABLE AFTER THE INSTALLATION OF THE SILICONE TAPE
Figure 56

Table 15
Wire Harness Diameters

Specified Diameter (inch)	Assembly Diameter D (inch) Refer to Figure 56	
	Minimum	Maximum
0.250	0.19	0.250
0.375	0.32	0.375
0.500	0.44	0.500
0.625	0.57	0.625
0.750	0.69	0.750
0.950	0.89	0.950

(1) Find the Controlled Diameter Area on the wire or cable:

(a) Put one seal fitting housing half in the penetration hole in the structure.

Make sure that the flange gasket is against the structure on the pressurized area side.

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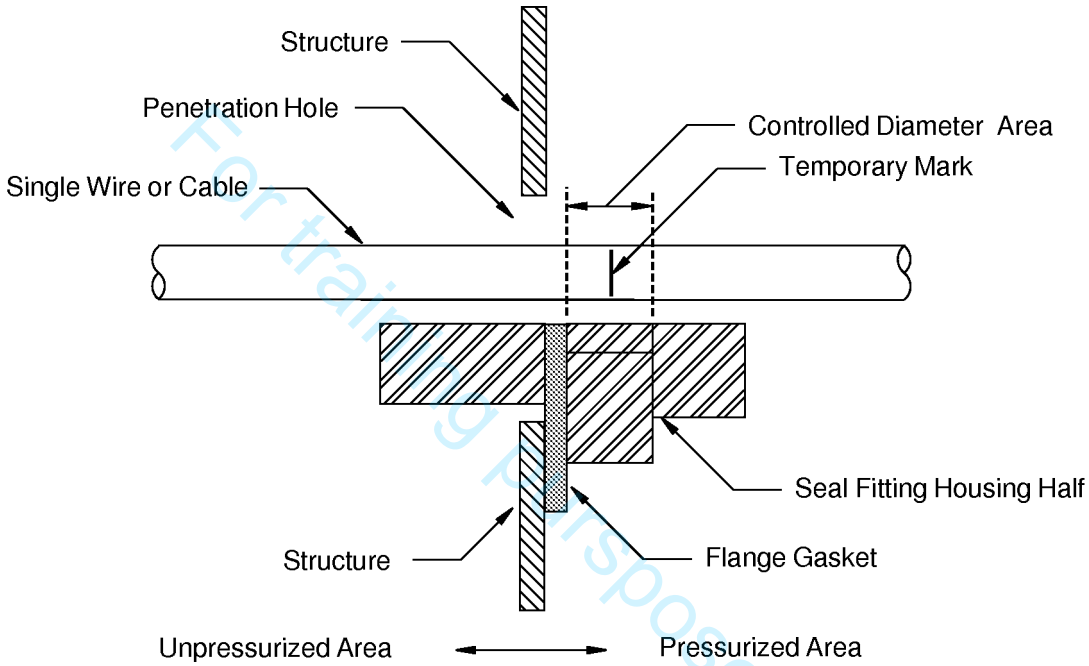
(b) Put the wire or cable in the housing.

(c) Make a selection of a Marker from Table 14.

(d) Make a temporary mark on the wire or cable approximately in the center of the Controlled Diameter Area.

Refer to:

- Figure 57 for shell size 24 and shell size 36 seal fittings
- Figure 58 for shell size 48 seal fittings.



POSITION OF THE TEMPORARY MARK ON THE HARNESS FOR THE SHELL SIZE 24 AND 36 SEAL FITTINGS
Figure 57

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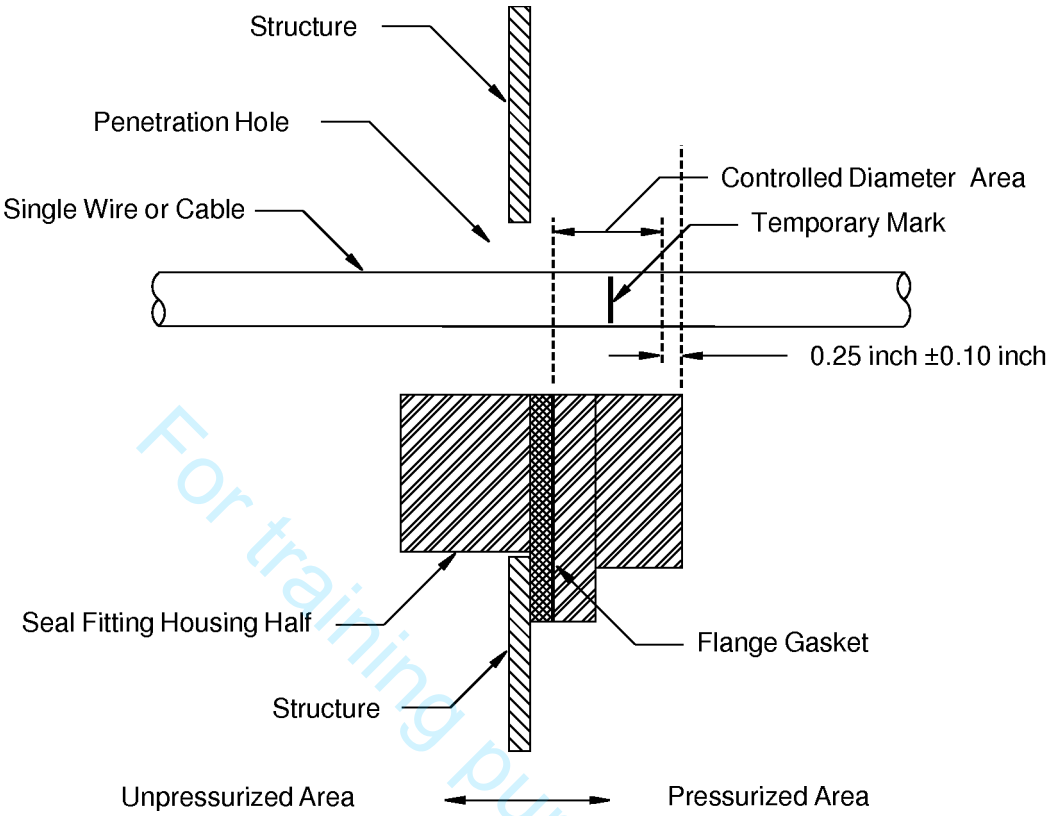
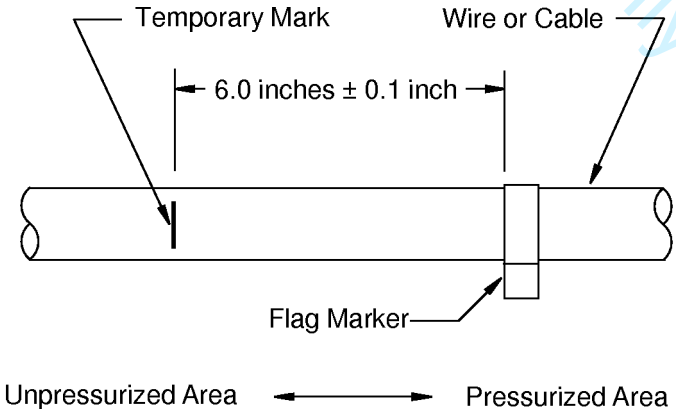


POSITION OF THE TEMPORARY MARK ON THE HARNESS FOR THE SHELL SIZE 48 SEAL FITTING
Figure 58

(e) Do Step (b) through Step (d) again for each wire harness that must be installed in the seal fitting.

(2) Make a selection of a Flag Marker Tape from Table 13.

(3) Put a length of Flag Marker Tape on each wire or cable 6.0 inches ±0.1 inch from the temporary mark in the direction of the pressurized area. Refer to Figure 59.



POSITION OF THE FLAG MARKER
Figure 59

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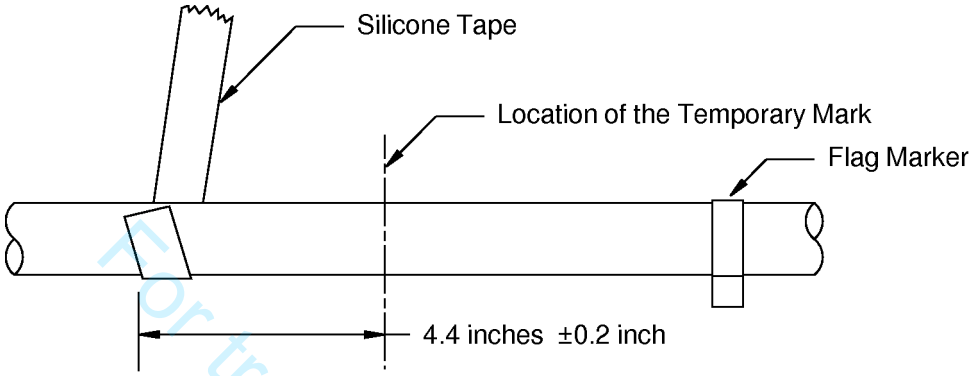
(4) Make a selection of silicone tape from Table 13.

(5) Wrap the silicone tape on the harness at approximately a 60 degree angle from the unpressurized side to the pressurized side. Refer to Figure 60.

Make sure that the wrap starts at 4.4 inches ±0.2 inch from the temporary mark.



POSITION OF THE OUTER LAYER OF TAPE ON THE WIRE HARNESS
Figure 60

(6) If the diameter is specified, apply the necessary layers of silicone tape until the outer diameter is within the assembly diameter range shown in Table 15.

Make sure that while the silicone tape is put on:

- Each tape wrap makes a 40 percent to 50 percent overlap
- The tape is stretched
- The tension is smooth and even
- The harness diameter is the same throughout the controlled diameter area.

For the length of the wrap, refer to:

- Figure 61
- Figure 62.

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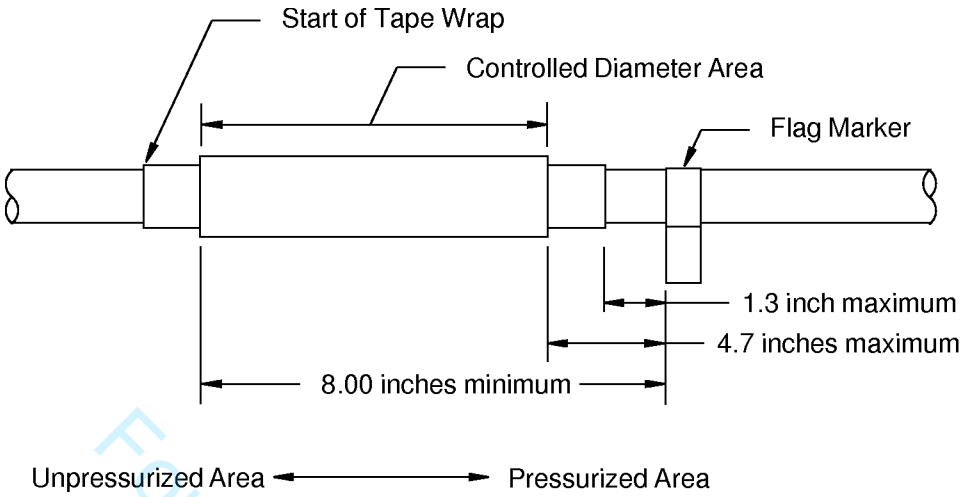


LOCATION OF THE CONTROLLED DIAMETER AREA OF THE WIRE OR CABLE
Figure 61

(7) If the diameter is not specified or not within an assembly diameter range, add layers of tape to meet the first larger assembly diameter.

Make sure that, while the tape is put on:

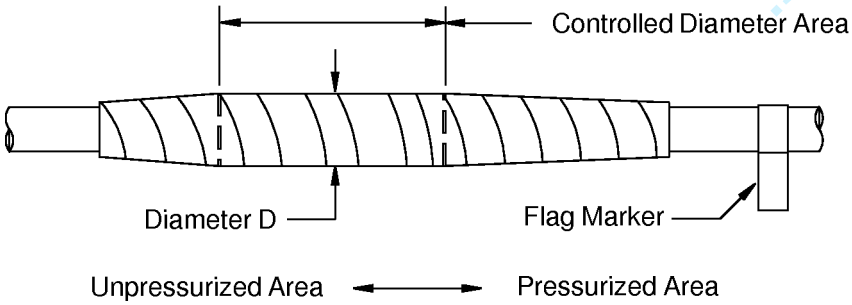
- Each tape wrap makes a 40 percent to 50 percent overlap
- The tape is stretched
- The tape tension is smooth and even
- The harness diameter is the same throughout the controlled diameter area.

For the outer diameter of the wrap, refer to:

- Paragraph 1.B. for the grommet cavity diameter
- Table 15 for the applicable harness assembly diameter range
- Figure 56.

For the length of the wrap, refer to:

- Figure 61
- Figure 62.



CONFIGURATION OF THE COMPRESSED, WRAPPED WIRE HARNESS
Figure 62

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(8) Do Step (1) through Step (7) again for each wire or cable that will go through the seal fitting in a grommet hole and be the only wire or cable in that hole.

C. Preparation of a Wire Harness for Installation in Sealant

Table 16
NECESSARY MATERIALS

Material	Description	Part Number	Supplier
Adhesive Sealant Tape	0.50 inch wide, Black	5313	3M
Silicone Tape	0.57 inch wide, Black	67N	Federal Mogul

Table 17
NECESSARY TOOLS

Tool	Description	Part Number
Marker	Temporary	-
Wrench, Compression Strap	-	057-0750-00
Wrench, Torque	50 inch-pound	-

(1) Find the Sealant Tape Area on the wire harness for the new sealant tape:

(a) Put one seal fitting housing half in the penetration hole in the structure.
Make sure that the flange gasket is against the structure on the pressurized area side.

(b) Put the wire harness in the housing.

(c) Make a selection of a Marker from Table 17.

(d) Make an End Mark on the wire harness 0.25 inch to 0.38 inch from each end of the housing. Refer to Figure 63.

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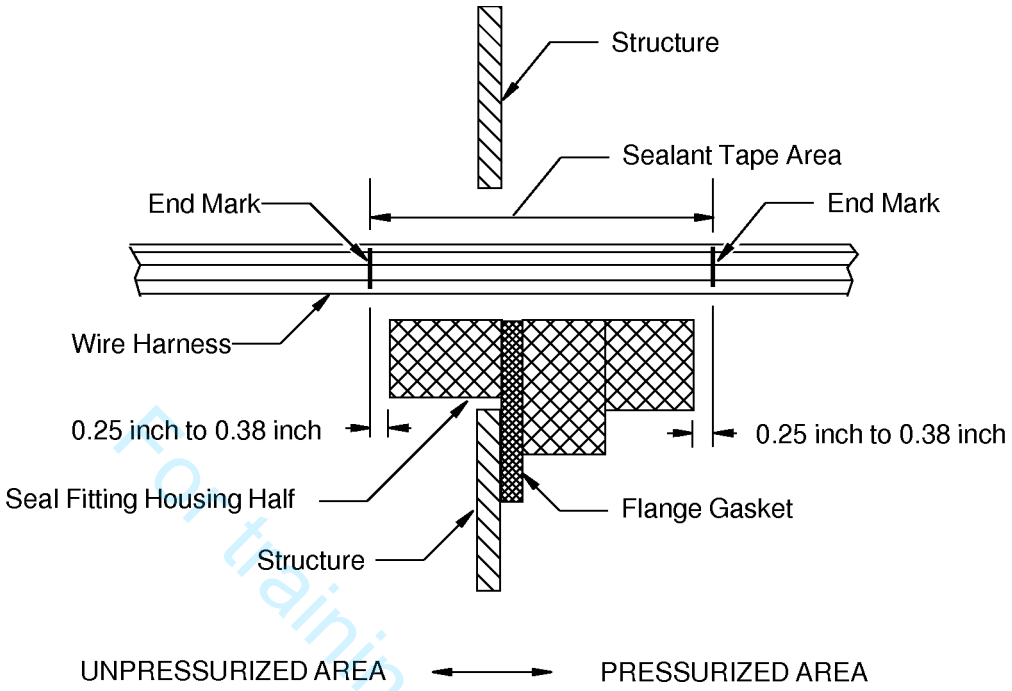
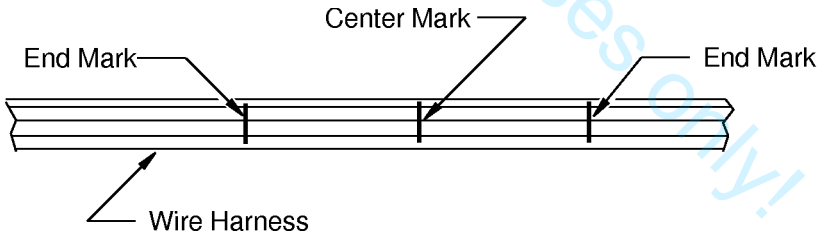


POSITION OF THE TEMPORARY MARK ON THE HARNESS FOR THE SHELL SIZE 24 AND 36 SEAL FITTINGS
Figure 63

(e) Do Step (b) through Step (d) again for each wire harness that must be installed in the seal fitting.

(2) Make a third temporary mark on the wire harness at a location half the distance between the two End Marks. Refer to Figure 64.



POSITION OF THE TEMPORARY MARKS ON THE HARNESS
Figure 64

(3) Make a selection of an Adhesive Sealant Tape from Table 16.

(4) Cut two lengths of the Adhesive Sealant Tape.

Make sure that the lengths of the sealant tape are not longer than 4.4 inches.

(5) Move all or some of the wires of the wire harness to make one layer of wires not more than 4 inches wide.

(6) Put each of the wires of the layer of wires on the sealant of the sealant tapes and push each wire into the sealant. Refer to Figure 65.

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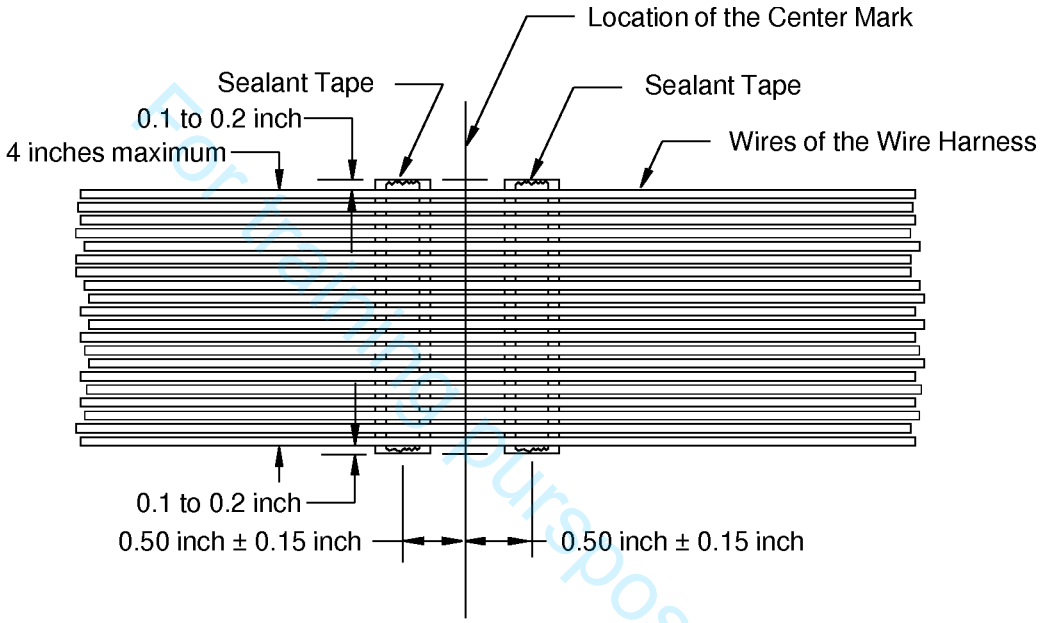
Make sure that the position of the center mark on the wires is located at half the distance between the lengths of the sealant tape.

Where the wires touch the sealant, make sure that:

- The width of the layer of wires is 4 inches maximum
- The wires are all adjacent to each other
- One of the wires is not on another wire
- The end of the length of sealant tape extends approximately 0.1 inch to 0.2 inch beyond the wires.



CONFIGURATION OF THE WIRES ON THE FIRST LENGTH OF SEALANT TAPE
Figure 65

(7) Put an additional length of the sealant tape on the wires above each layer of sealant tape. Refer to Figure 66.

Make sure that the sealant on these lengths of sealant tape touches the wires.

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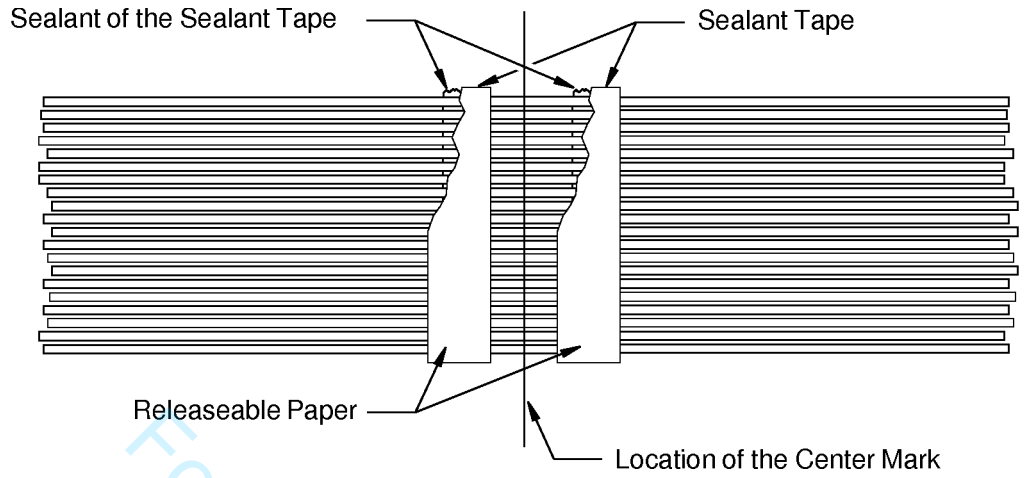
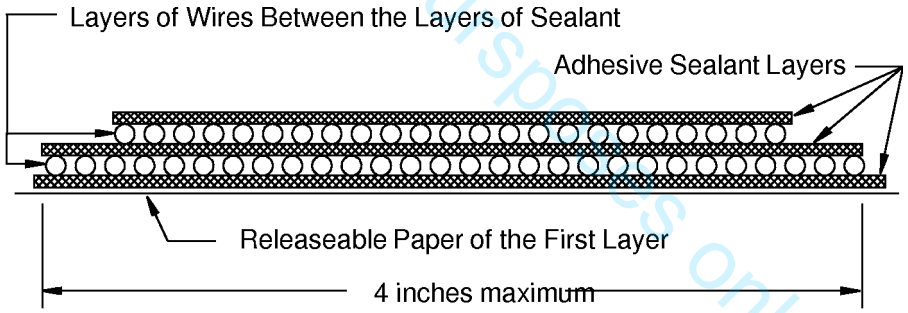


THE SECOND LENGTH OF SEALANT TAPE ON THE LAYER OF WIRES
Figure 66

(8) Remove the releasable paper from these additional layers of sealant tape.

(9) If more layers of wires are necessary, do Step (6) through Step (8) again for each additional layer of wires. Refer to Figure 67.

Make sure that no lengths of the releaseable paper are between the layers of the wires and the sealant.



CONFIGURATION OF THE LAYERS OF THE SEALANT TAPE AND THE LAYERS OF THE WIRES
Figure 67

(10) Wind the layers of sealant and wire on itself, and at the same time, remove the remaining length of releasable paper from the first layer of sealant tape. Refer to Figure 67 and Figure 68.

Make sure that the wire harness bundles now has a circular shape.

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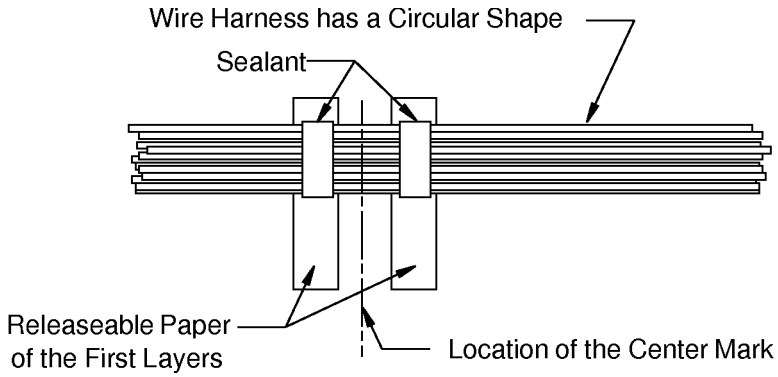


CONFIGURATION OF THE WIRE HARNESS AFTER IT IS WOUND
Figure 68

(11) Make a selection of silicone tape from Table 16.

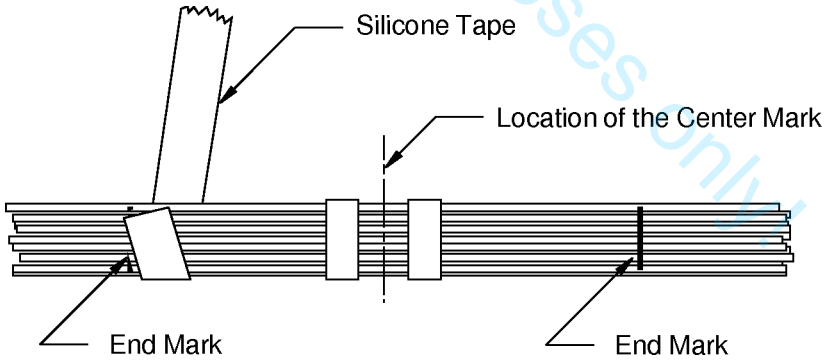
(12) Wrap a minimum of one layer of the silicone tape on the harness at approximately a 60 degree angle from the unpressurized side to the pressurized side. Refer to Figure 69 and Figure 70.

Make sure that:

- The wrap starts at an End Mark
- The wrap ends at the other End Mark.

Make sure that while the silicone tape is put on:

- Each tape wrap makes a 40 percent to 50 percent overlap
- The tape is stretched
- The sealant is not pushed out
- The tension is smooth and even.



POSITION OF THE OUTER LAYER OF TAPE ON THE WIRE HARNESS
Figure 69

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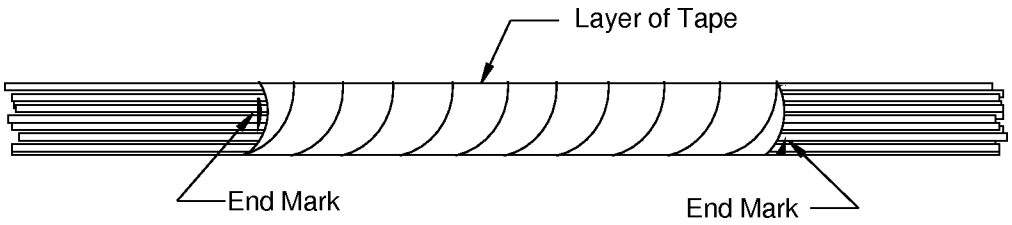

LOCATION OF THE SEALANT TAPE AREA OF THE WIRE HARNESS
Figure 70

(13) Make a selection of a compression strap wrench from Table 17.

(14) Make a selection of a torque tool from Table 17.

(15) Align one edge of the strap with the approximate center of the taped area.
Refer to:

- Figure 71
- Figure 72
- Figure 73.

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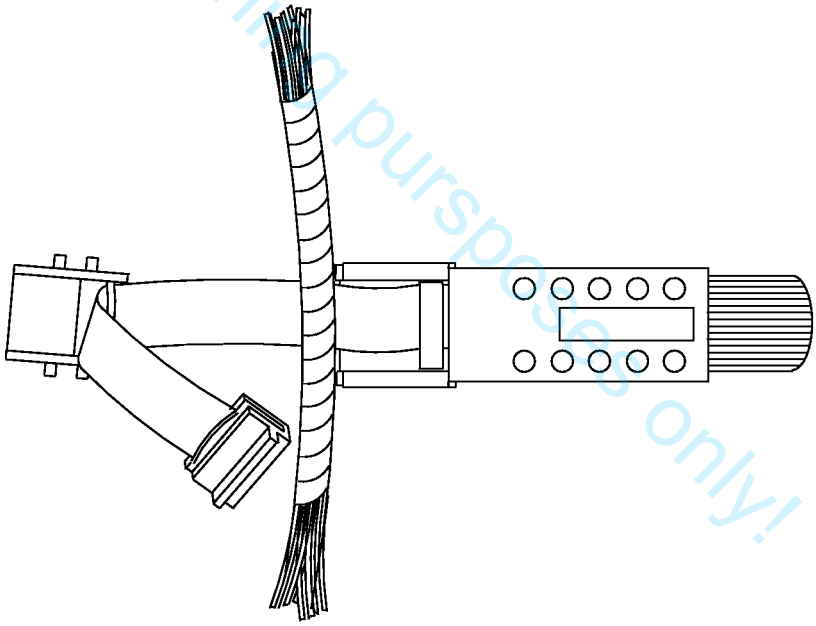

POSITION OF THE HARNESS IN THE COMPRESSION STRAP WRENCH
Figure 71

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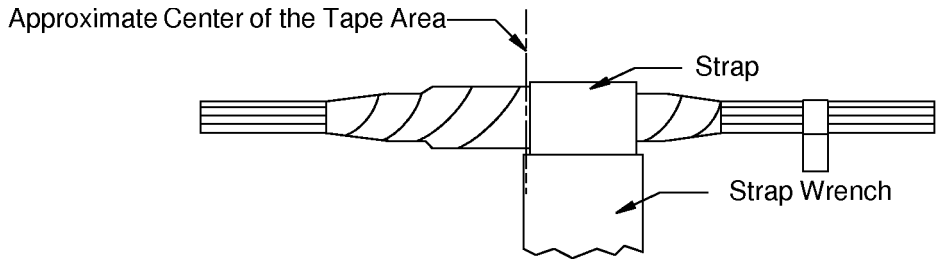
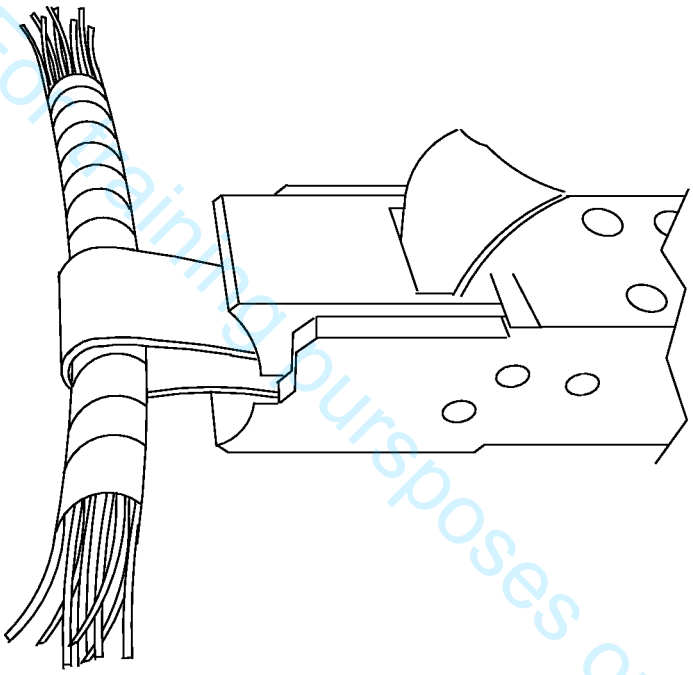


POSITION OF THE COMPRESSION STRAP WRENCH ON THE HARNESS
Figure 72



STRAP OF THE COMPRESSION STRAP WRENCH AROUND THE WIRE HARNESS
Figure 73

(16) Put the torque tool on the end of the compression strap wrench. Refer to Figure 74.

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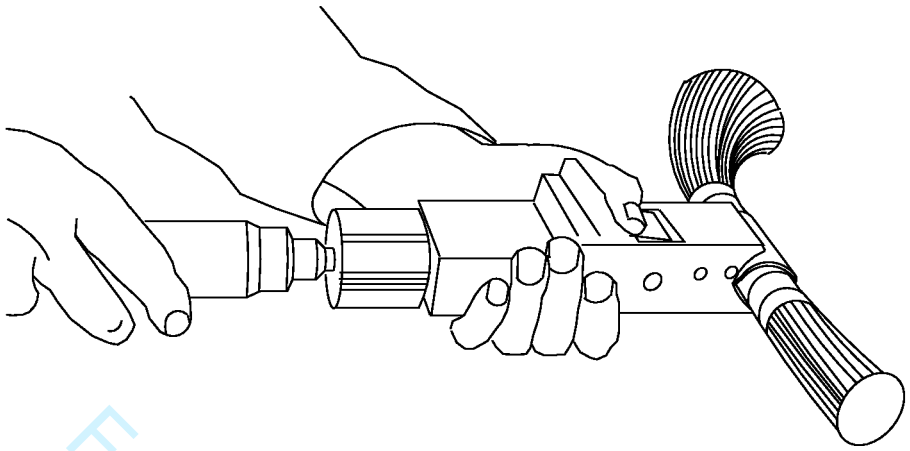


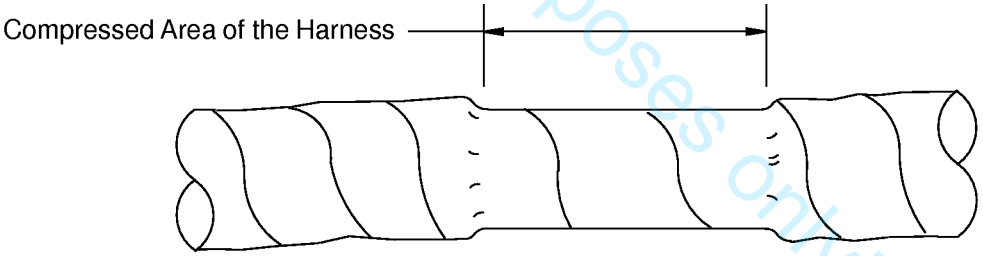
POSITION OF THE TORQUE TOOL ON THE COMPRESSION STRAP WRENCH
Figure 74

(17) Apply from 16 inch-pounds to 29 inch-pounds of torque to compress the harness in the strap wrench tool.

Refer to Figure 74 and Figure 75.

CAUTION: DO NOT TIGHTEN THE MECHANISM TOO MUCH.

CAUTION: DO NOT TIGHTEN THE MECHANISM FARTHER THAN THE RED REFERENCE MARK ON THE TOOL. IF THE MECHANISM IS TIGHTENED FARTHER THAN THE RED REFERENCE MARK, THE TORQUE INDICATION WILL NOT BE ACCURATE.



A COMPRESSED AREA OF THE HARNESS
Figure 75

(18) Put the strap on the other side of the center of the tape area.

(19) Do Step (15) through Step (17) again.

Make sure that the sealant does come out from between the tape wraps.

4. ASSEMBLY OF THE SEAL FITTING

A. Shell Size 24 and 36 Grommet and Internal Seal Assembly

(1) On the side of the grommet, pull a slot in the grommet to an open position, and at the same time, from the side of the grommet, push a large gage wire or a sealed wire harness into the correct hole in the grommet. Refer to Figure 76 and Figure 77.

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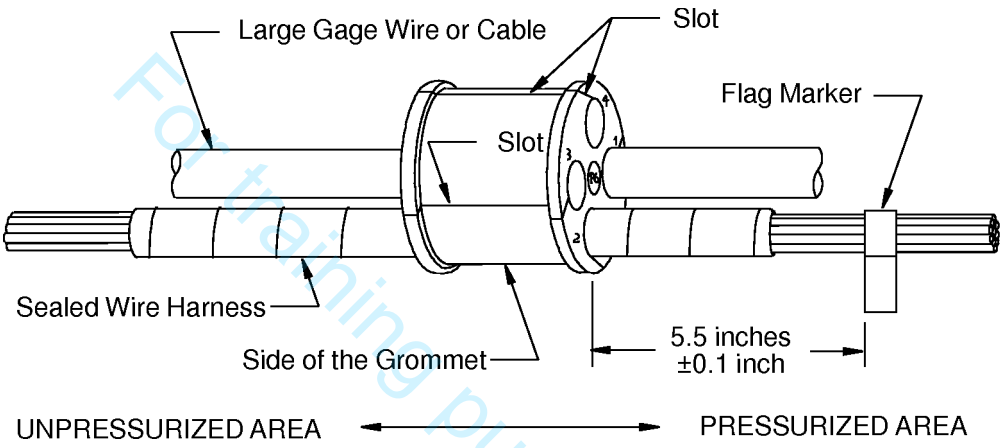
Make sure that:

- The end of the grommet that has the cavity identification points to the pressurized side of the panel
- The wire harness diameter has a close fit in the grommet opening
- The wire harness diameter does not force the slot to remain open
- The wire harness diameter does not have a loose fit
- The wire or wire harness is in the correct grommet hole
- For a sealed wire harness, the distance from the flag marker to the edge of the grommet is 5.5 inches ± 0.1 inch.



POSITION OF A WIRE HARNESS IN THE GROMMET
Figure 76

NOTE: If the wire harness does not have a good fit, it is possible that the wire harness is not in the correct hole or that more layers of tape are necessary. Refer to Paragraph 3.A. for the procedure to wrap and seal a wire harness.

NOTE: One large gage wire, one large diameter cable, or one sealed wire harness can be installed in each grommet hole.

(2) Repeat Step (1) for each wire or cable that will go through the seal fitting.

(3) If a hole in the grommet is not used, push a seal plug into each unused hole until it stops. Refer to Figure 77.

Make sure that:

- The end of the seal plug that has the cavity identification points to the pressurized side of the panel
- The seal plugs are in the end of the grommet that points to the pressurized side of the panel
- The end of the seal plug is flush with the end of the grommet.

NOTE: If the grommet cavity has a two digit designator. The second digit is the seal plug designator. For example, if the cavity designator is 2C, the seal plug that has designator C fits that cavity.

NOTE: If the grommet cavity does not have a seal plug designator, a seal plug is not available for that cavity.

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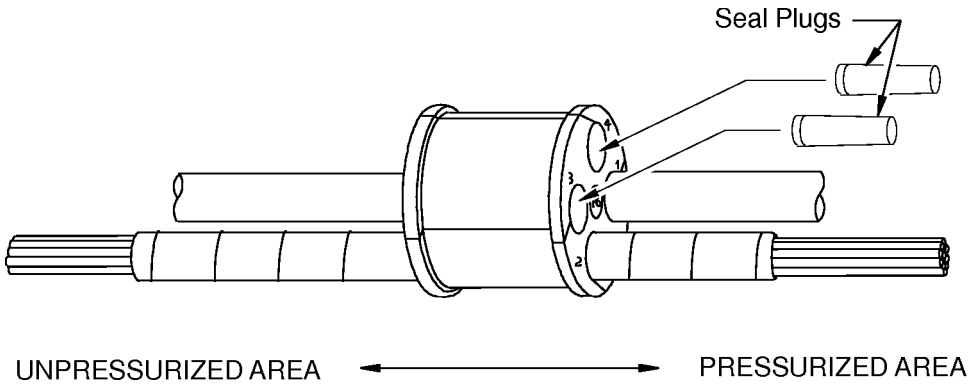
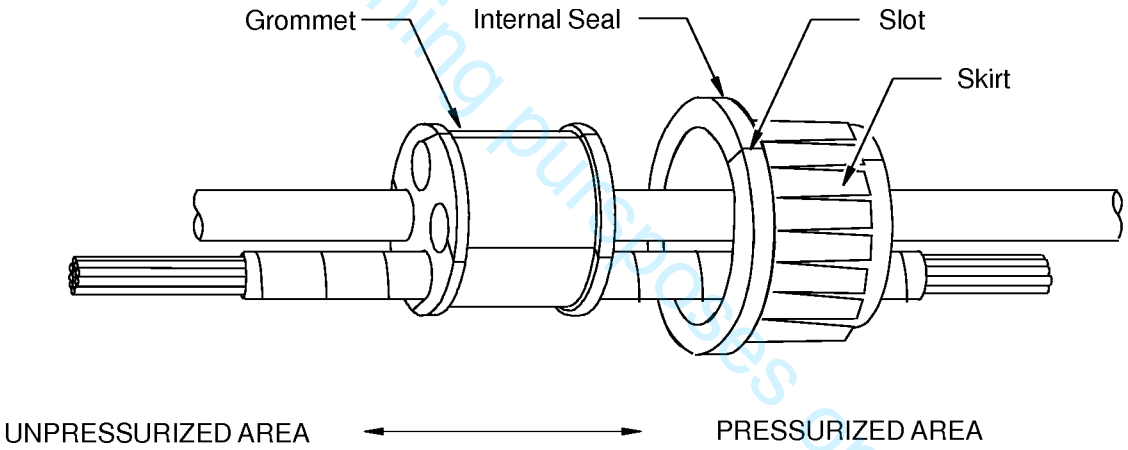


INSTALLATION OF THE SEAL PLUGS
Figure 77

(4) At the slot in the internal seal, pull the internal seal to an open position, and at the same time, put the internal seal on all of the wires and cables that go through the grommet. Refer to Figure 78.

Make sure that the skirt of the internal seal points to the pressurized side of the panel.



ALIGNMENT OF THE INTERNAL SEAL AND THE GROMMET
Figure 78

(5) Push the internal seal on the grommet. Refer to Figure 79.

Make sure that:

- The edges of the grommet and the edges of the internal seal are approximately aligned
- The controlled diameter area of the wire harnesses and the middle of the grommet are aligned.

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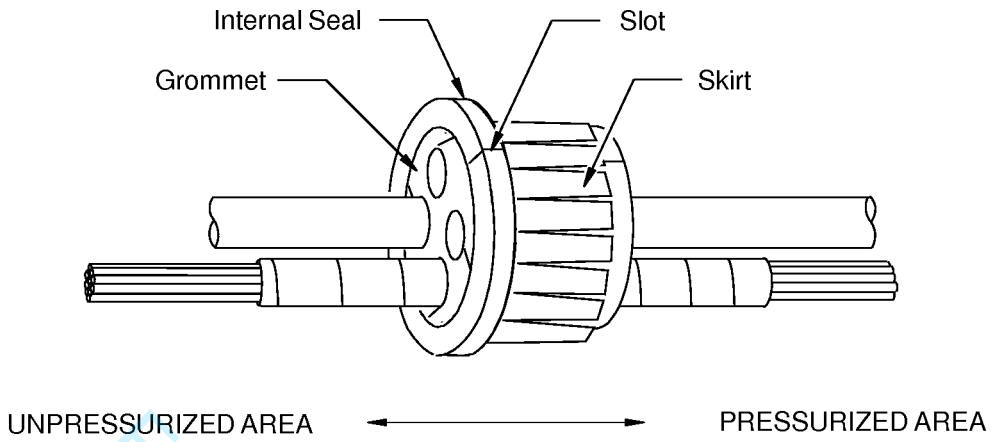
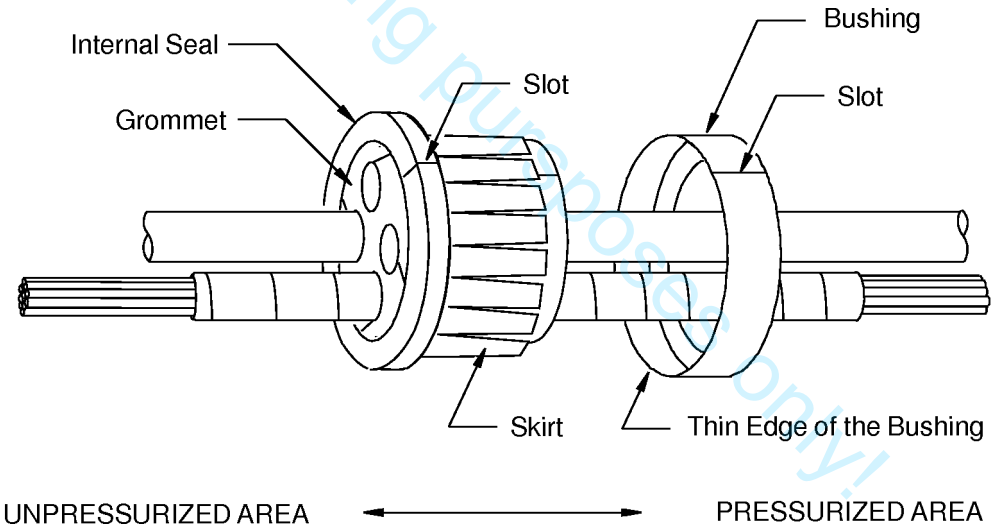


ALIGNMENT OF THE BUSHING AND THE INTERNAL SEAL
Figure 79

(6) At the slot in the bushing, pull the bushing to an open position, and at the same time, put the bushing on all of the wires and cables that go through the grommet. Refer to Figure 80.

Make sure that the thin edge of the bushing points toward the skirt of the internal seal.



ALIGNMENT OF THE BUSHING AND THE INTERNAL SEAL
Figure 80

B. Shell Size 24 and 36 Housing and Grommet Assembly

Table 18
Necessary Tools

Tool	Description	Shell Size	Size (inch)	Part Number	Notes
Holding Tool	-	24	2	ST-2580-343A-23	-
		36	2-5/8	ST-2580-343A-21	

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Table 18 (continued)

Tool	Description	Shell Size	Size (inch)	Part Number	Notes
Torque Tool	-	-	-	-	Accuracy of ±6 percent
Wrench	Allen	24	7/64	-	-
		36	7/64	-	-
Wrench	Crowfoot, Compression Nut	24	1-1/8	-	-
		36	1-5/8	-	-

Table 19
Necessary Materials

Material	Description	Part Number	Supplier
Silicone Tape	0.57 inch wide, Black	67N	Federal Mogul

Table 20
Compression Nut Torque Values

Shell Size	Torque (foot-pounds)
24	15
36	18

(1) Put the assembled internal seal, bushing and wire into one of the two housing halves. Refer to Figure 81 and Figure 82.

Make sure that:

- The controlled diameter area of the wire harness and the center of the internal seal area aligned
- The skirt of the internal seal points to the pressurized side of the panel
- The thin edge of the bushing is adjacent to the skirt of the internal seal
- The end of the internal seal with the largest diameter fits tightly against the gasket in the housing.

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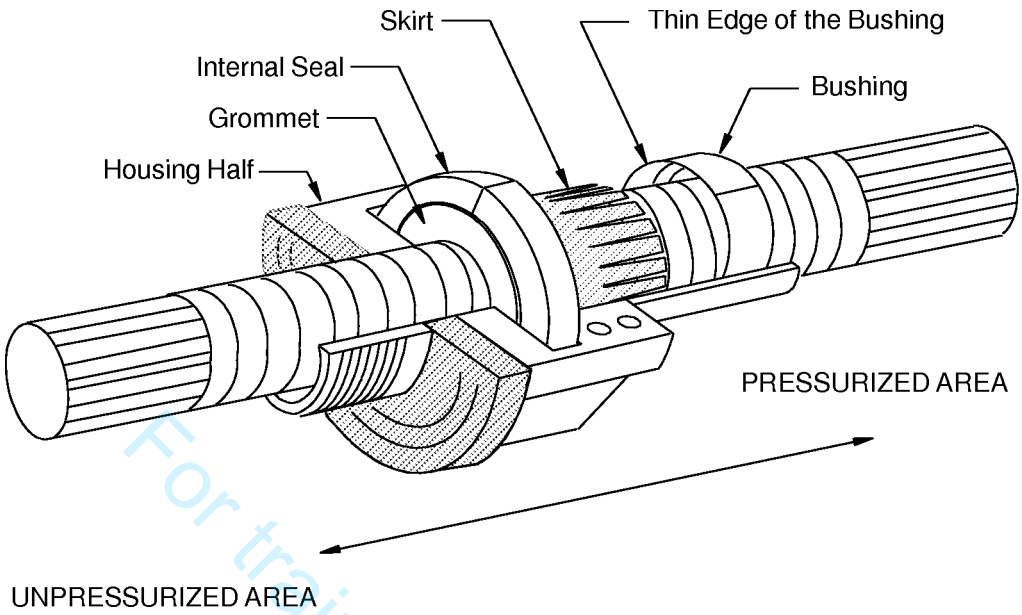
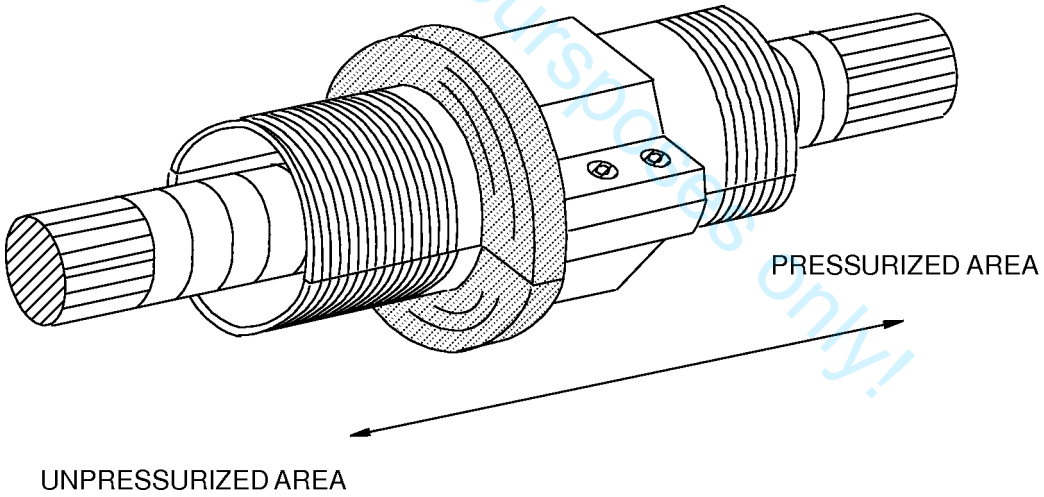


ASSEMBLY OF A HOUSING HALF, THE WIRE HARNESS, THE INTERNAL SEAL, AND THE BUSHING
Figure 81

(2) Put other housing half on the assembly. Refer to Figure 82.



CONFIGURATION OF THE TWO HALVES OF THE HOUSING
Figure 82

(3) Make a selection of an allen wrench from Table 18.

(4) Engage the four housing screws in one housing half with the nuts in the other housing half. Refer to Figure 83.

NOTE: The nuts are not removable.

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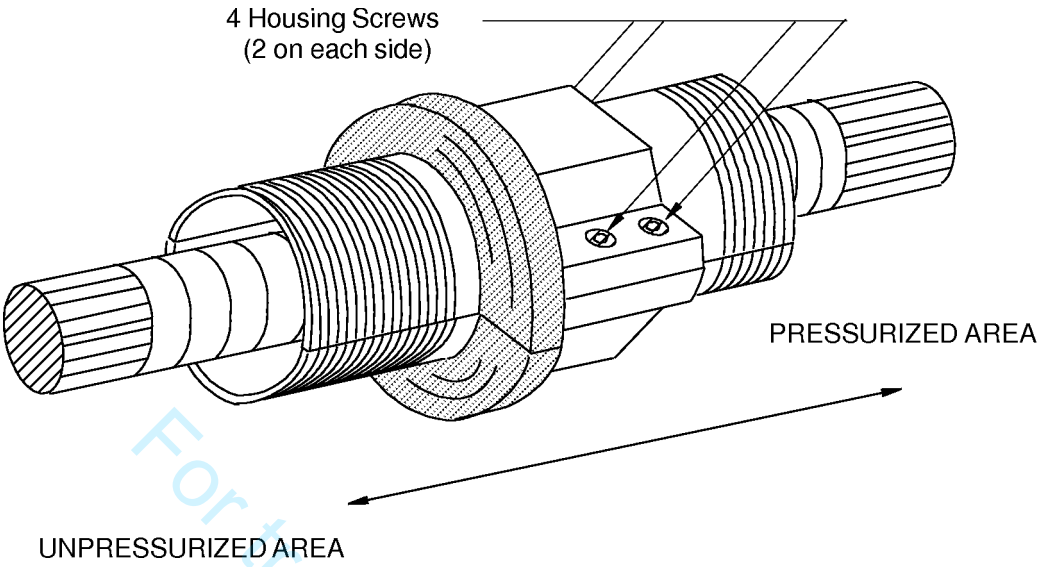
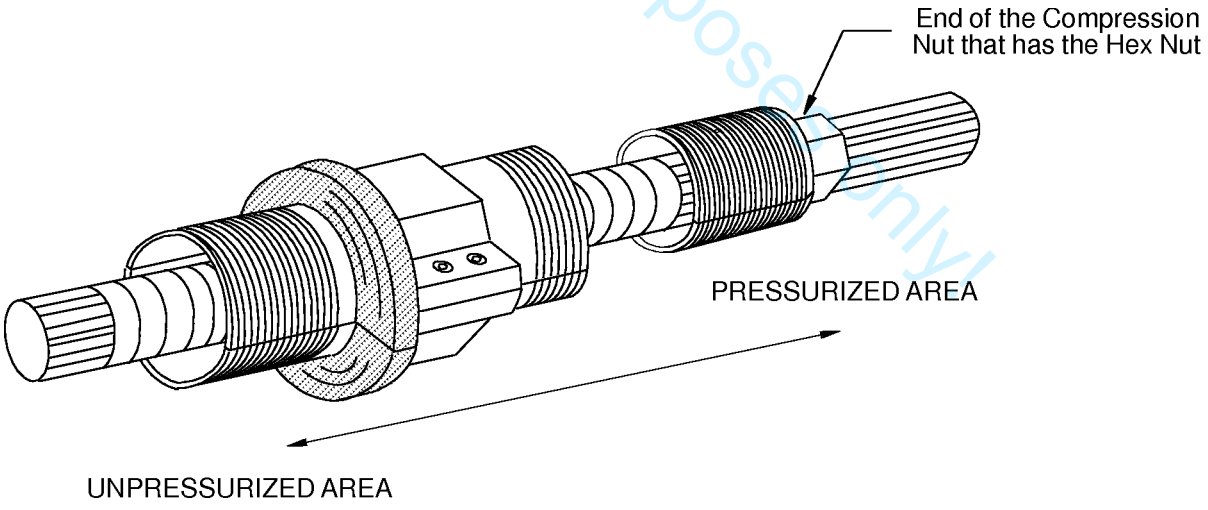


LOCATION OF THE HOUSING SCREWS
Figure 83

(5) Tighten the housing screws to 12 inch-pounds ± 2 inch-pounds.

(6) Put the two halves of the compression nut together on the wire harness on the pressurized side of the assembly. Refer to Figure 84.

Make sure that the end of the compression nut that has the hex nut is pointed to the pressurized side of the harness.



POSITION OF THE COMPRESSION NUT
Figure 84

(7) Engage the outer threads of the compression nut with the inner threads of the housing.

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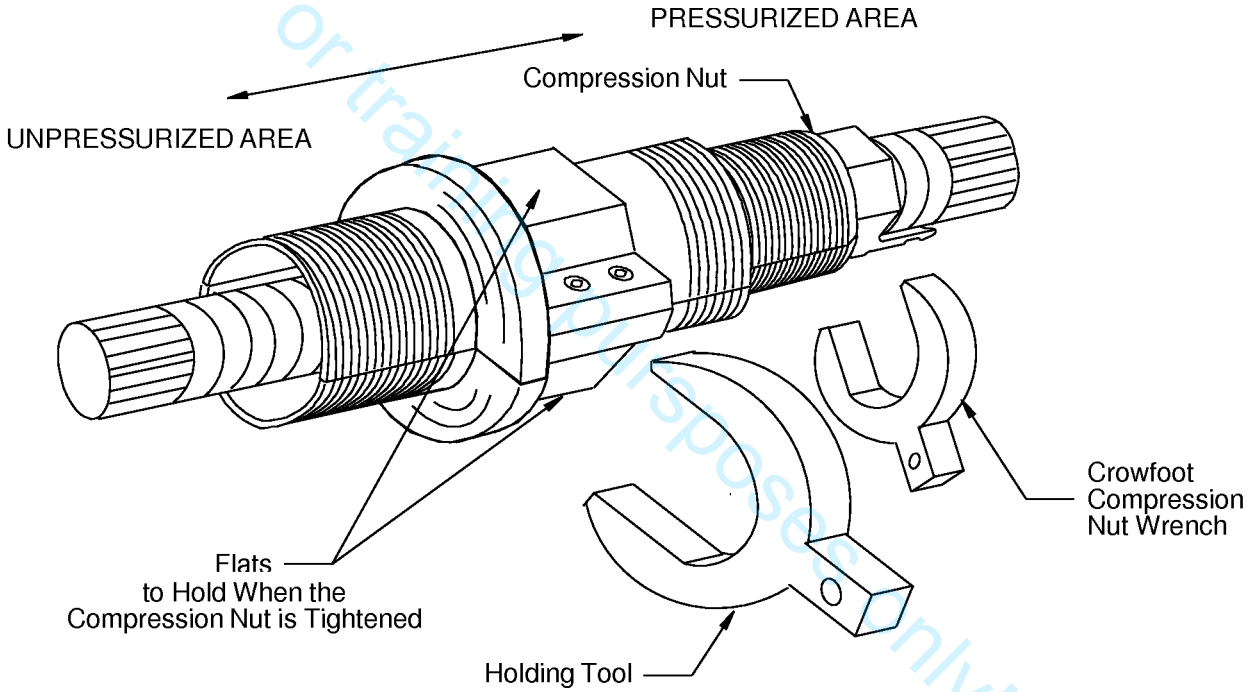
(8) From Table 18, make a selection of:
- A holding tool
- A torque tool
- A compression nut crowfoot wrench.

(9) Hold the assembly by the housing flats and, at the same time, toque the compression nut. Refer to Table 20 for the torque value.

Make sure that the holding tool:
- Fully spans the width of flats
- Does not squeeze the part
- Has a tight fit
- Does not scratch or dent the housing.



POSITION OF THE HOLDING TOOL ON THE ASSEMBLY
Figure 85

(10) Examine the assembly. Refer to Figure 86.

Make sure that the tape on the wire harness extends a minimum of 0.375 inch farther than the edge of the seal fitting shell on each side.

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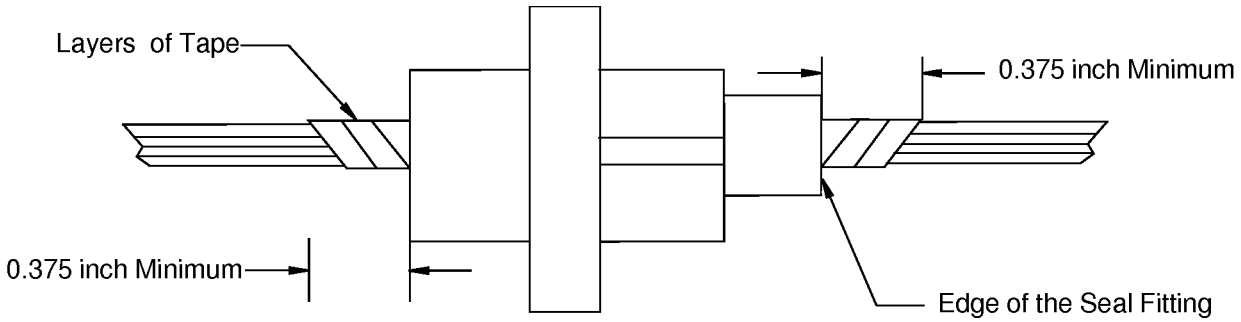


CONFIGURATION OF THE SEAL FITTING AND THE TAPE
Figure 86

(11) If the tape does not extend a minimum of 0.375 inch farther than the edges of the seal fitting:

(a) Make a selection of a silicone tape from Table 19.

(b) Wrap two layers of the specified silicone tape around the wire harness with tension on the tape.

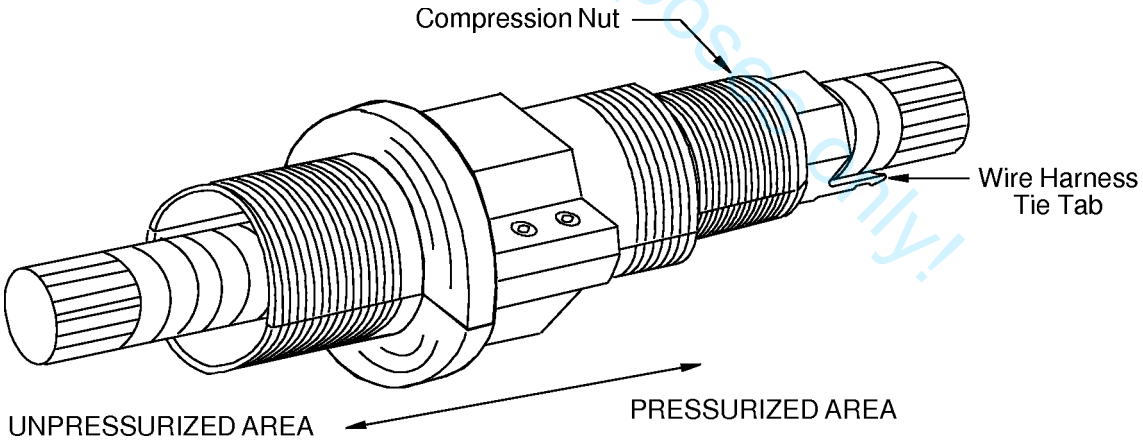
Make sure that:

- The layers of tape have a 50 percent overlap
- The tape wraps extend more than 0.375 inch beyond each end of the seal fitting.

(12) Assemble a lacing tape wire harness tie on the wire harness and the wire harness tie tab on the compression nut. Refer to Figure 87 and Subject 20-10-11.

Make sure that the wire harness tie does not put strain on the wires or on the wire harness.

NOTE: If it is necessary, layers of tape can be used to increase the diameter of the wire harness where the wire harness tie is installed to prevent strain on the wire harness.



POSITION OF THE COMPRESSION NUT
Figure 87

C. Shell Size 48 Grommet and Internal Seal Assembly

(1) Pull a slot in the grommet to an open position and push a large gage wire or a sealed wire harness into the hole in the grommet. Refer to Figure 88.

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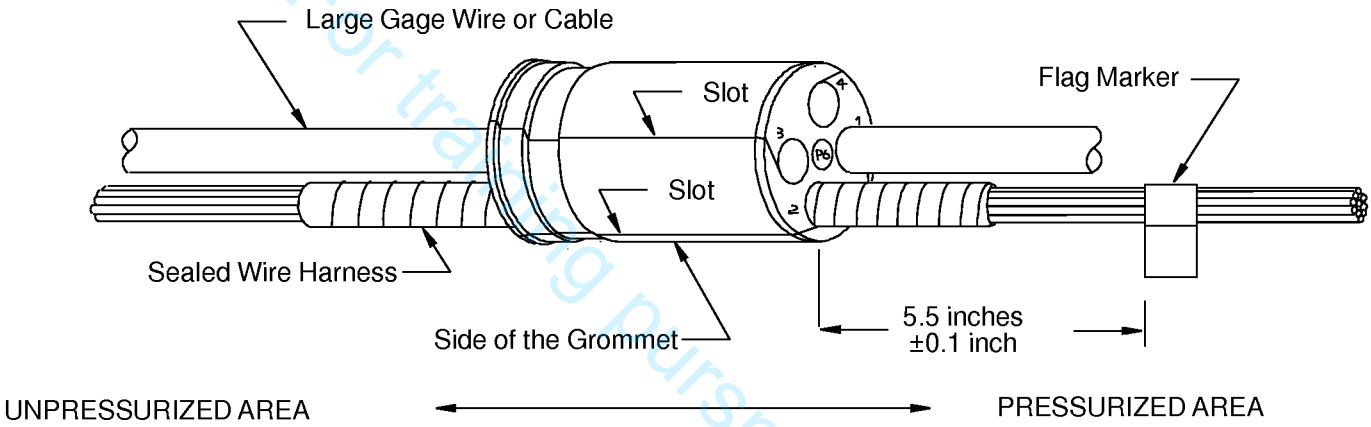
Make sure that:

- The edge of the grommet stays aligned with the temporary mark on the sealed length of the wire harness
- The wire harness diameter is a close fit to the grommet cavity
- The wire harness diameter does not force the slot to remain open
- The wire harness diameter does not have a loose fit in the grommet cavity.

NOTE: If the wire harness does not have a good fit, it is possible that the wire harness is not in the correct hole or that more layers of tape are necessary. Refer to Paragraph 3.A. for the procedure to seal and wrap a wire harness.

NOTE: One large gage wire, one large diameter cable, or one sealed wire harness can be installed in each grommet hole.



POSITION OF A WIRE HARNESS IN THE GROMMET
Figure 88

(2) Do Step (1) again for each wire harness or cable that must go through the seal fitting.

(3) Push a seal plug in each unused hole until it stops. Refer to Figure 89

Make sure that:

- The end of the seal plug that has the identification mark points to the pressurized side of the panel
- The seal plugs are in the end of the grommet that points to the pressurized side of the panel
- The end of the seal plug is flush with the end of the grommet.

NOTE: If the grommet cavity has a two digit designator, the second digit is the seal plug designator.

For example, if the cavity identification is 2C, the seal plug that has designator C fits that cavity.

NOTE: If the grommet cavity does not have a seal plug designator, a seal plug is not available for that cavity.

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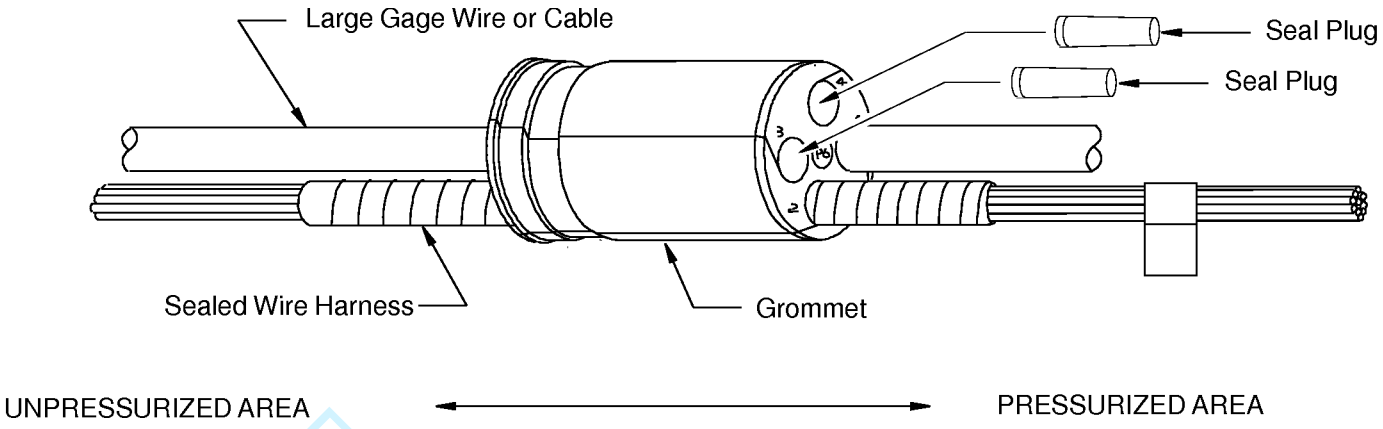
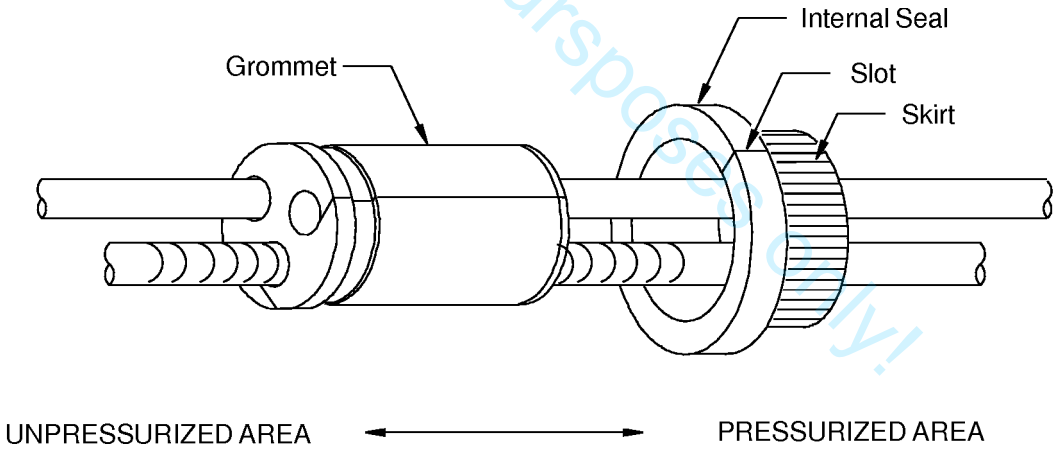


INSTALLATION OF THE SEAL PLUGS
Figure 89

(4) At the side of the internal seal, pull the slot in the internal seal to an open position, and at the same time, put the internal seal on all of the wires and cables that must go through the seal fitting. Refer to Figure 90

Make sure that:

- The internal seal is adjacent to the end of the grommet that is pointed to the pressurized side of the panel
- The skirt of the internal seal points to the pressurized side of the panel.



ALIGNMENT OF THE INTERNAL SEAL AND THE GROMMET
Figure 90

(5) Push the internal seal on the grommet. Refer to Figure 91.

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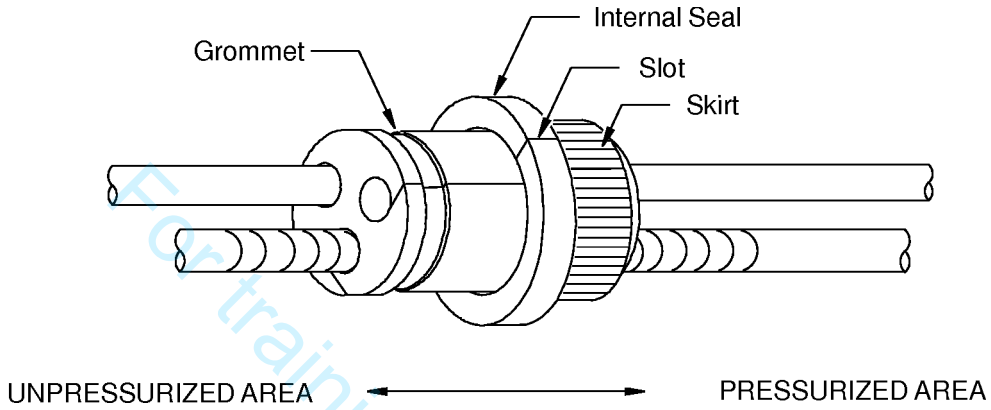
Make sure that:

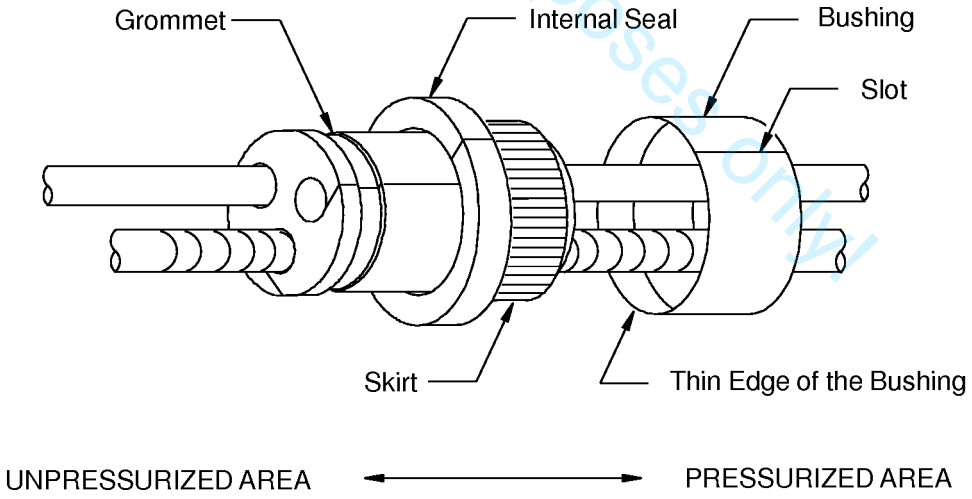
- The middle of the controlled diameter area of the wire harnesses and the middle of the internal seal are aligned
- The skirt of the internal seal is pointed to the pressurized side of the panel
- The edge of the internal seal adjacent to the skirt and the edge of the grommet are approximately aligned.



POSITION OF THE INTERNAL SEAL ON THE GROMMET
Figure 91

(6) At the slot in the bushing, pull the bushing to an open position, and at the same time, put the bushing on all of the wires and cables that must go through the seal fitting. Refer to Figure 92.

Make sure that the thin edge of the bushing is adjacent to the skirt of the internal seal.



ALIGNEMENT OF THE BUSHING AND THE INTERNAL SEAL
Figure 92

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D. Shell Size 48 Housing and Grommet Assembly

Table 21
Necessary Tools

Tool	Description	Shell Size	Size (inch)	Part Number	Notes
Holding Tool	-	48	3-1/2	ST2580-343A-22	-
Torque Tool	-	-	-	-	Accuracy of ± 6 percent
Wrench	Allen	48	9/64	-	-
Wrench	Crowfoot, Compression Nut	48	3-1/2	ST2580-343A-19	-

Table 22
Necessary Materials

Material	Description	Part Number	Supplier
Silicone Tape	0.57 inch wide, Black	67N	Federal Mogul

(1) Put the assembled internal seal, bushing and wire into one of the two housing halves. Refer to Figure 93.

Make sure that:

- If there is a grommet, the grommet is in the internal seal
- The controlled diameter area of the wire harness and the center of the internal seal are aligned
- The skirt of the internal seal points to the pressurized side of the panel
- The thin edge of the bushing is adjacent to the skirt of the internal seal.

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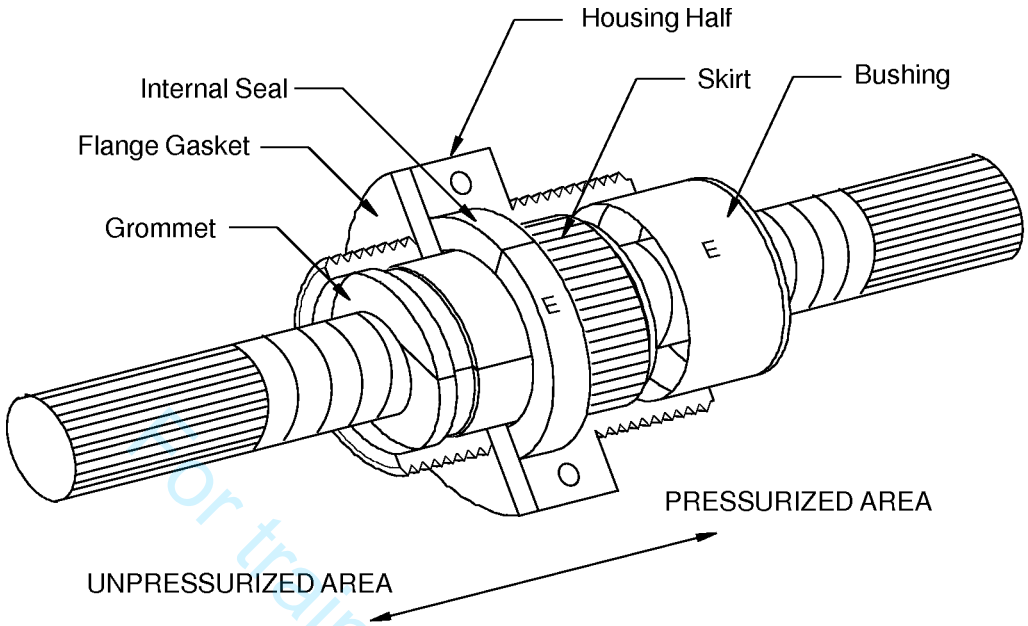
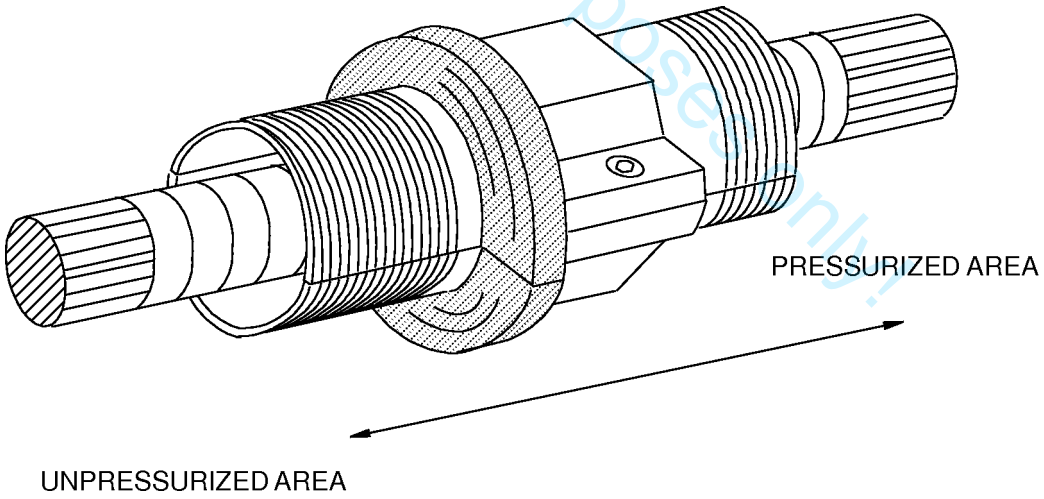
DISASSEMBLY, ASSEMBLY, AND INSTALLATION OF BACS31T SEAL FITTINGS



ASSEMBLY OF A HOUSING HALF, THE WIRE HARNESS, THE INTERNAL SEAL, AND THE BUSHING
Figure 93

(2) Put the other housing half on the assembly. Refer to Figure 94.

Make sure that the center of the tape wrapped area of the wire harness and the center of the internal seal are aligned.



CONFIGURATION OF THE TWO HALVES OF THE HOUSING
Figure 94

(3) Make selection of an allen wrench from Table 21.

(4) Engage the two housing screws in one housing half and the captivated nuts in the other housing half. Refer to Figure 95.

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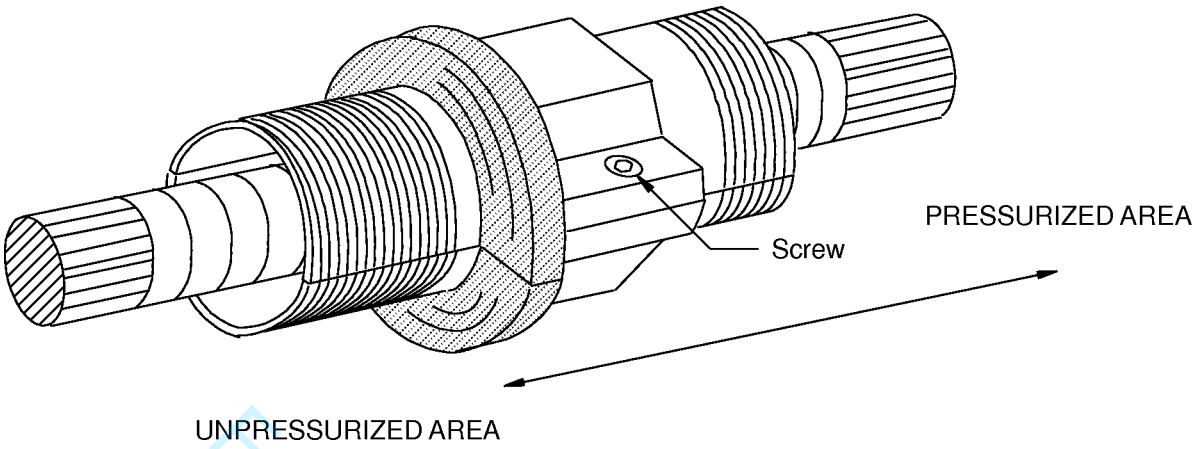
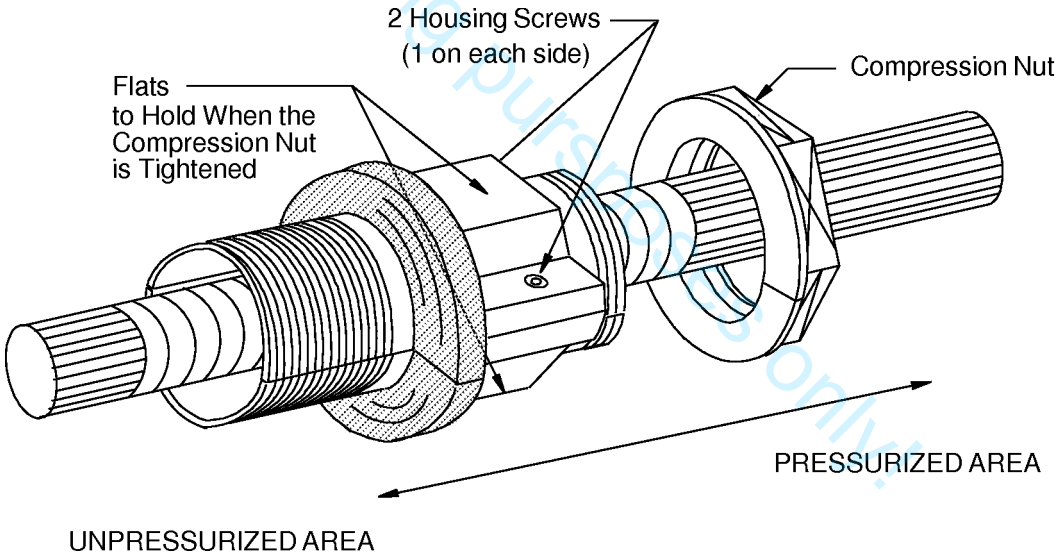


LOCATION OF THE HOUSING SCREWS
Figure 95

(5) Tighten the housing screws to 16 inch-pounds ±2 inch-pounds.

(6) Put the two halves of the compression nut together on the wire harness on the pressurized side of the assembly. Refer to Figure 96.



POSITION OF THE COMPRESSION NUT ON THE WIRE HARNESS
Figure 96

(7) Engage the inner threads of the compression nut and the outer threads of the housing.

(8) From Table 21, make a selection of:

- A holding tool
- A torque tool
- A compression nut crowfoot wrench.

(9) Hold the assembly by the housing flats, and at the same time, torque the compression nut to 22 foot-pounds ±1 foot-pound.

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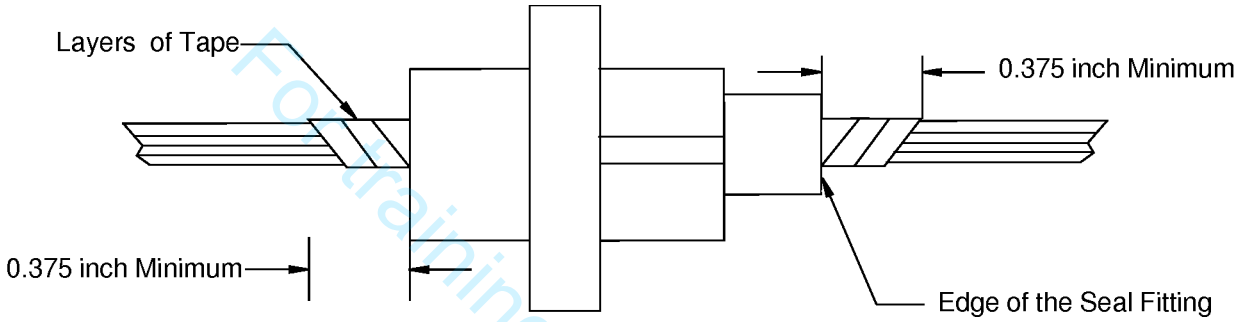
Refer to Figure 96.

Make sure that the holding tool:

- Fully spans the width of the flats
- Does not squeeze the part
- Has a tight fit
- Does not scratch or dent the housing.

(10) Examine the assembly. Refer to Figure 97.

Make sure that the tape on the wire harness extends a minimum of 0.375 inch farther than the edge of the seal fitting shell on each side.



CONFIGURATION OF THE SEAL FITTING AND THE TAPE
Figure 97

(11) If the tape does not extend a minimum of 0.375 inch farther than the edge of the shell:

(a) Make a selection of a silicone tape from Table 22.

(b) Wrap two layers of the tape around the wire harness with tension

Make sure that:

- The layers of the tape have a 50 percent overlap
- The tape wraps extend more than 0.375 inch farther than each end of the seal fitting.

E. Installation of the Seal Fitting in the Panel

Table 23
Necessary Tools

Tool	Description	Shell Size	Size (inch)	Part Number	Notes
Torque Tool	-	-	-	-	Accuracy of ±6 percent
Wrench	Crowfoot, Jam Nut	24	2.0	AN850832B	-
				ST2580-343A-17	-
		36	2-5/8	AN850842B	-
				ST2580-343A-15	-
		48	3-1/2	057-0919-05	-

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Table 23 (continued)

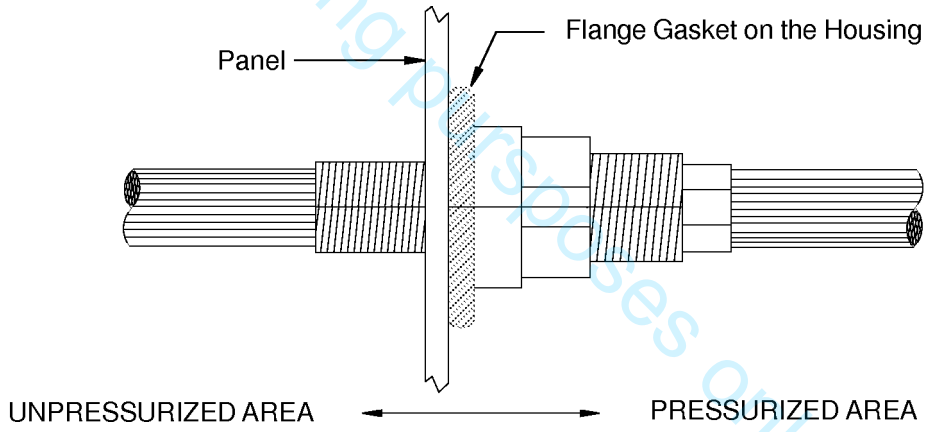
Tool	Description	Shell Size	Size (inch)	Part Number	Notes
Wrench	Socket, Jam Nut, Unpressurized Side	48	3-1/2	057-0898-05	-

Table 24
Jam Nut Torque Values

Shell Size	Jam Nut Torque (foot-pounds)
24	15
36	18
48	22

(1) From the pressurized side of the panel, carefully put the wire harness and the seal fitting in the hole in the panel until the flange gasket on the housing touches the panel. Refer to Figure 98.

Make sure that damage to the wire insulation does not occur.



POSITION OF THE SEAL FITTING IN THE HOLE IN THE PANEL
Figure 98

(2) On the un-pressurized side of the panel, put the two jam nut halves together on the wire harness. Refer to Figure 99.

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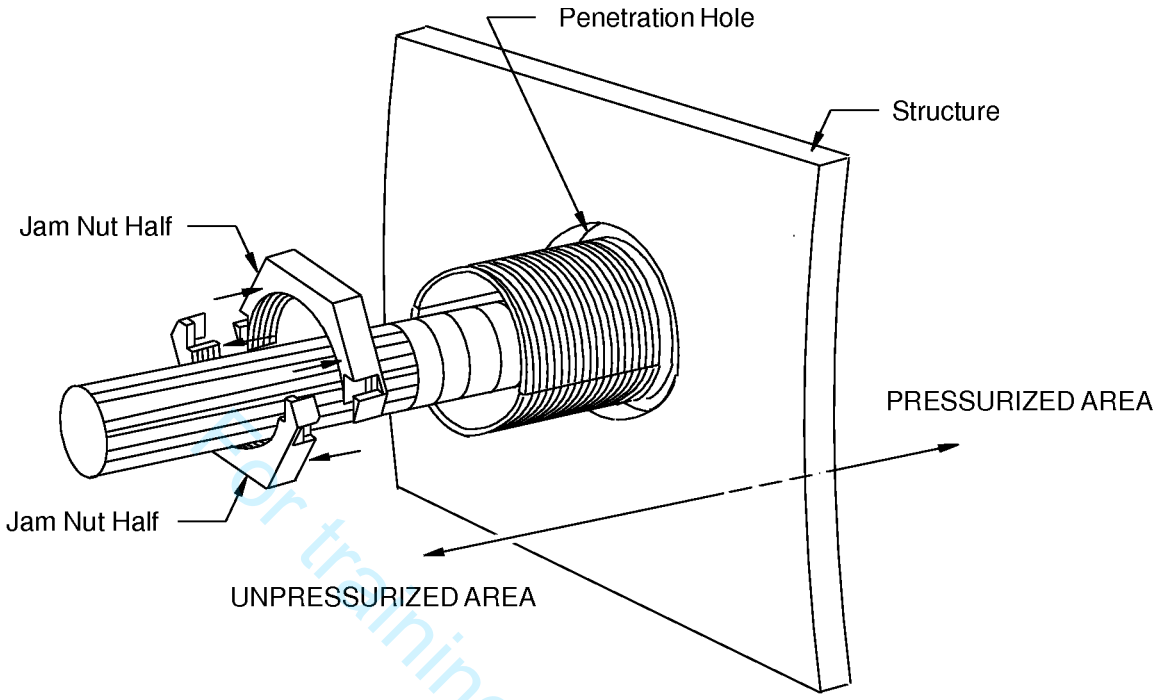
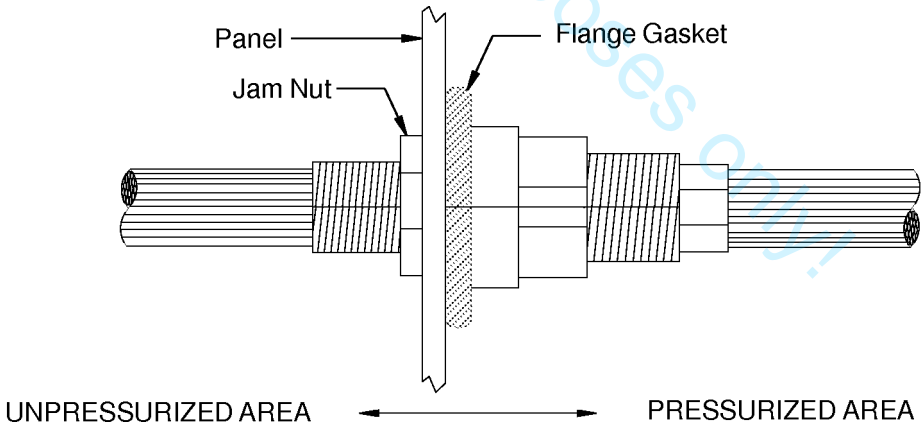


ASSEMBLY OF THE JAM NUT ON THE WIRE HARNESS
Figure 99

(3) Engage the threads of the assembled jam nut and the threads of the seal fitting that extend through the panel. Refer to Figure 100.



POSITION OF THE JAM NUT ON THE SEAL FITTING
Figure 100

(4) Make a selection of a crowfoot wrench. Refer to Table 23.

(5) Hold the seal fitting with the hand and, at the same time, use the crowfoot wrench to tighten the jam nut.

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Make sure that the seal fitting housing does not turn while the jam nut is tightened.

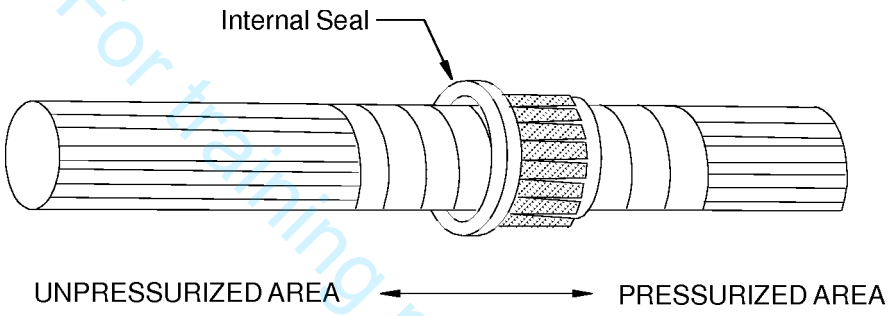
NOTE: If it is necessary, the seal fitting housing on the pressurized side can be held with a holding tool for the pressurized side.

NOTE: If it is necessary, the jam nut on the unpressurized side of a shell size 48 seal fitting can be held with the jam nut socket wrench.

(6) Torque the jam nut. Refer to Table 24.

F. Internal Seal Assembly without a Grommet

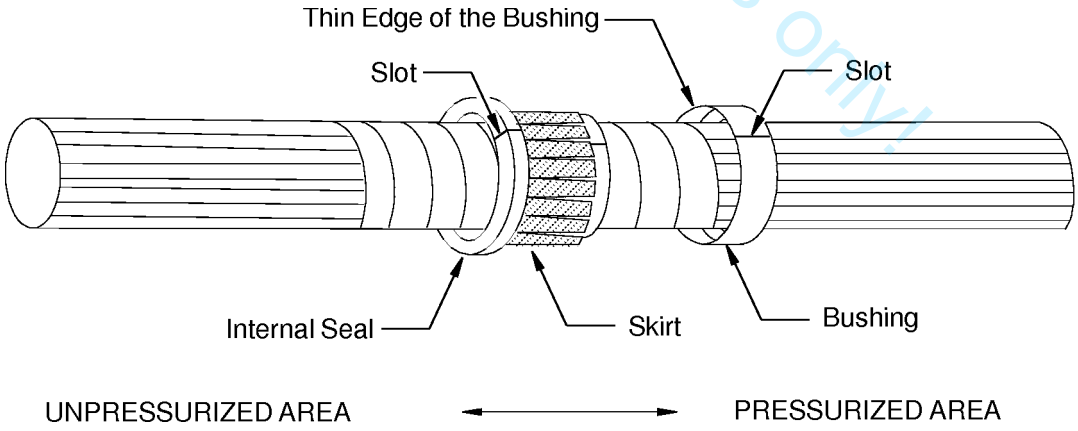
(1) At the side of the internal seal, pull the slot in the internal seal to an open position and at the same time, put the internal seal on the prepared wire harness or cable that must go through the seal fitting. Refer to Figure 101.



POSITION OF THE INTERNAL SEAL ON THE SEALED WIRE HARNESS
Figure 101

(2) At the side of the bushing, pull the slot in the bushing to an open position, and at the same time, put the bushing on the prepared wire harness or cable that must go through the seal fitting. Refer to Figure 102.

Make sure that the thin edge of the bushing is adjacent to the skirt of the internal seal.



POSITION OF THE BUSHING AND THE INTERNAL SEAL ON THE WIRE HARNESS
Figure 102

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G. Shell Size 24 and 36 Housing Assembly for a Sealant Filled Seal Fitting

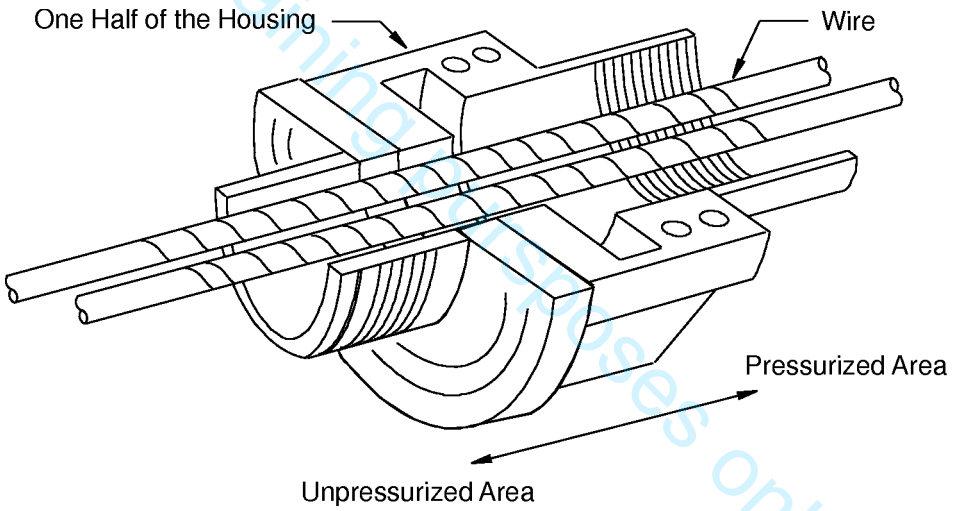
Table 25
Necessary Tools

Tool	Description	Shell Size	Size (inch)
Wrench or Driver	Allen	24	7/64
		36	7/64

Table 26
Necessary Materials

Material	Description	Part Number	Supplier
Silicone Tape	0.57 inch wide, Black	67N	Federal Mogul

(1) Put the sealed wires or wire harnesses into one of the two housing halves. Refer to Figure 103.



POSITION OF THE WIRE HARNESSES IN THE HOUSING HALF
Figure 103

(2) Put the other housing half on the assembly. Refer to Figure 104.

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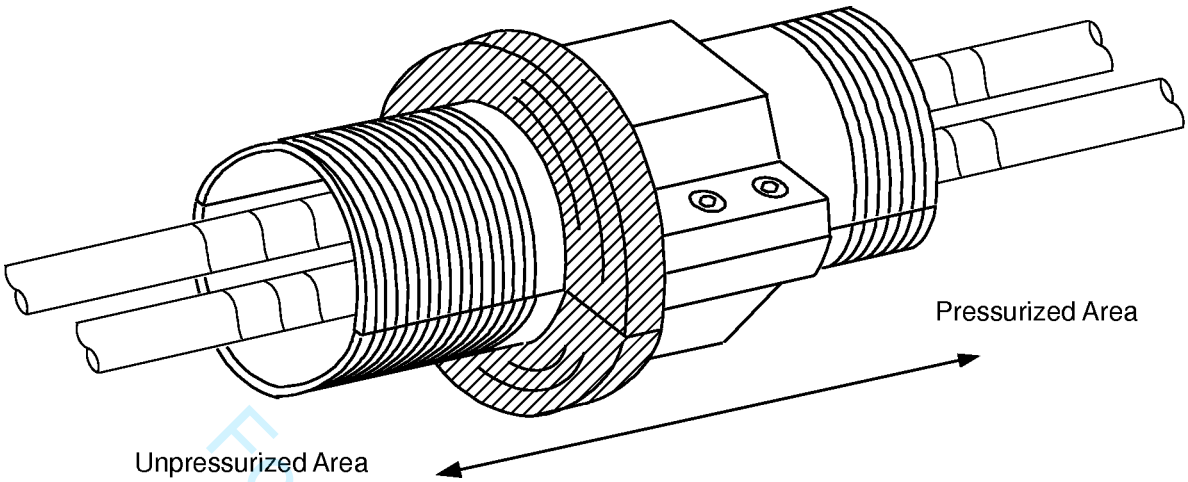
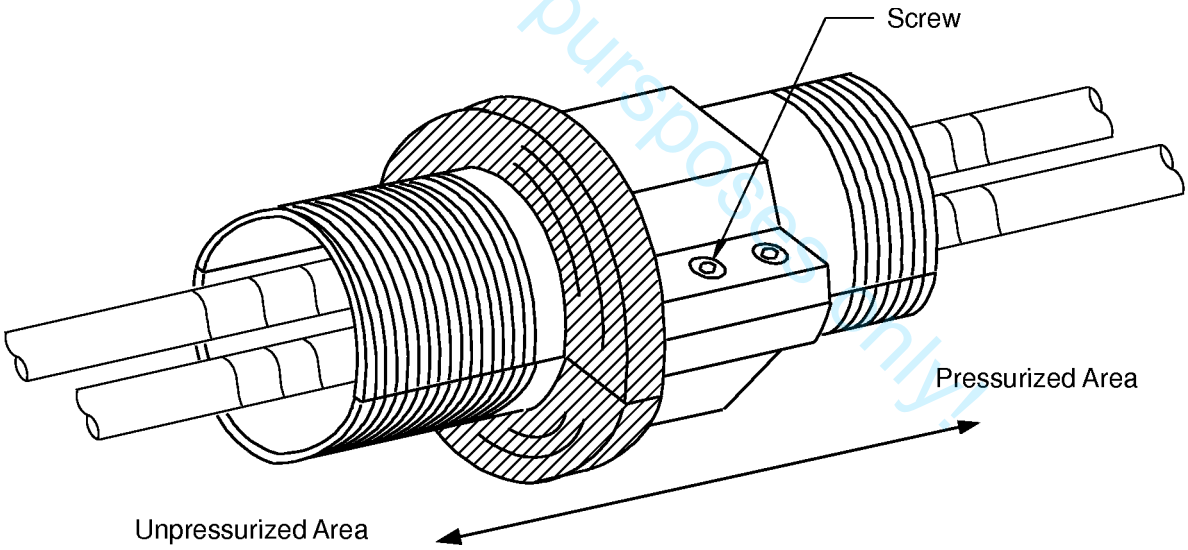


POSITION OF THE TWO HALVES OF THE HOUSING
Figure 104

(3) Make a selection of an allen wrench from Table 25.

(4) Engage the four screws in one housing half with nuts in the other housing half. Refer to Figure 105.

NOTE: These nuts cannot be removed from the housing half.



LOCATION OF THE HOUSING SCREWS
Figure 105

(5) Tighten the housing screws to 12 inch-pounds ±2 inch-pounds.

(6) Put the two halves of the compression nut together on the wire harness on the pressurized side of the seal fitting. Refer to Figure 106.

Make sure that the end of the compression nut that has the hex nut points to the pressurized side.

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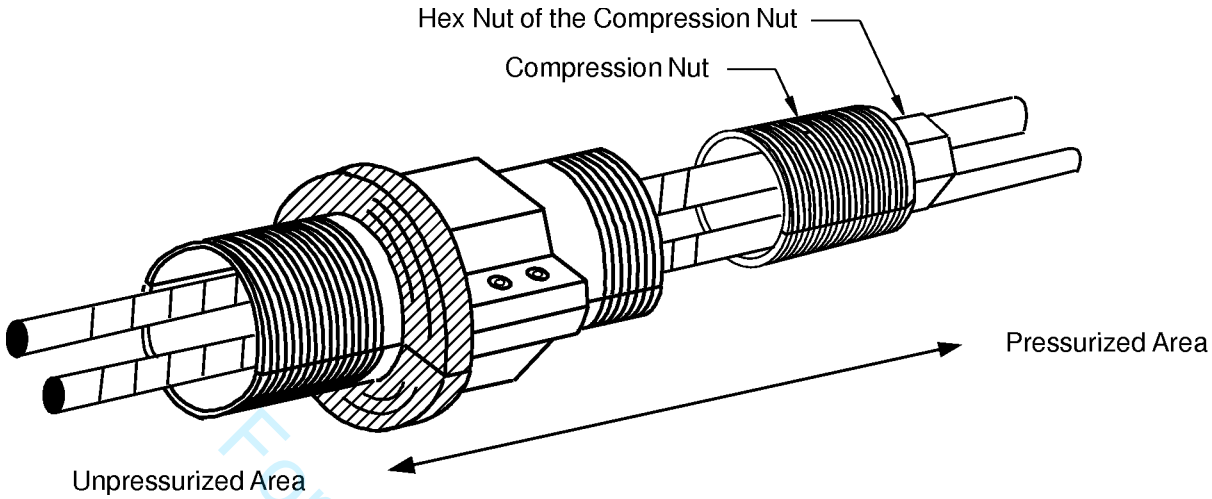

POSITION OF THE COMPRESSION NUT ON THE WIRE HARNESS
Figure 106

(7) Engage the outer threads of the compression nut and the inner threads of the housing.

(8) Tighten the compression nut with the fingers until it stops.

(9) Install the seal fitting in the panel. Refer to Paragraph 4.E..

(10) Examine the wire harness in the seal fitting.

Make sure that the tape on the wire harness extends an equal distance from each side of the seal fitting.

(11) If the tape does not extend an equal distance from each end of the seal fitting:

(a) Make a selection of silicone tape from Table 26.

(b) Wrap more layers of tape on the wire harness at each end of the seal fitting.

Make sure that the tape extends an equal distance from each end of the seal fitting.

(12) Assemble a lacing tape wire harness tie around the wire harness and the tie tab on the compression nut. Refer to Subject 20-10-11.

Make sure that the wire harness tie does not put strain on the wires or on the wire harnesses.

NOTE: If it is necessary, layers of tape can be installed to increase the diameter of the wire harness at the location of the wire harness tie to prevent strain on the wire harnesses.

(13) Fill the seal fitting with sealant. Refer to Paragraph 5.A..

H. Shell Size 48 Housing Assembly for Sealant

Table 27
Necessary Tools

Tool	Description	Shell Size	Size (inch)
Wrench	Allen	48	9/64

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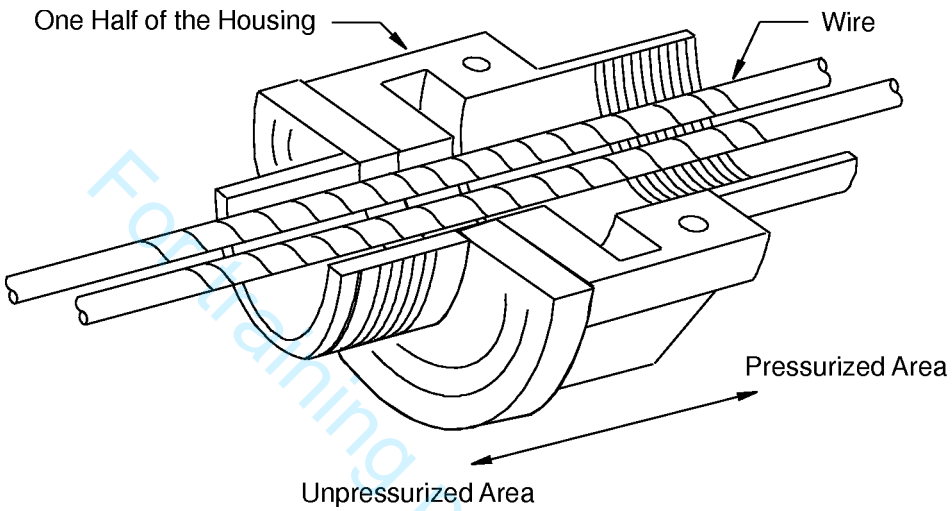
Table 28
Necessary Materials

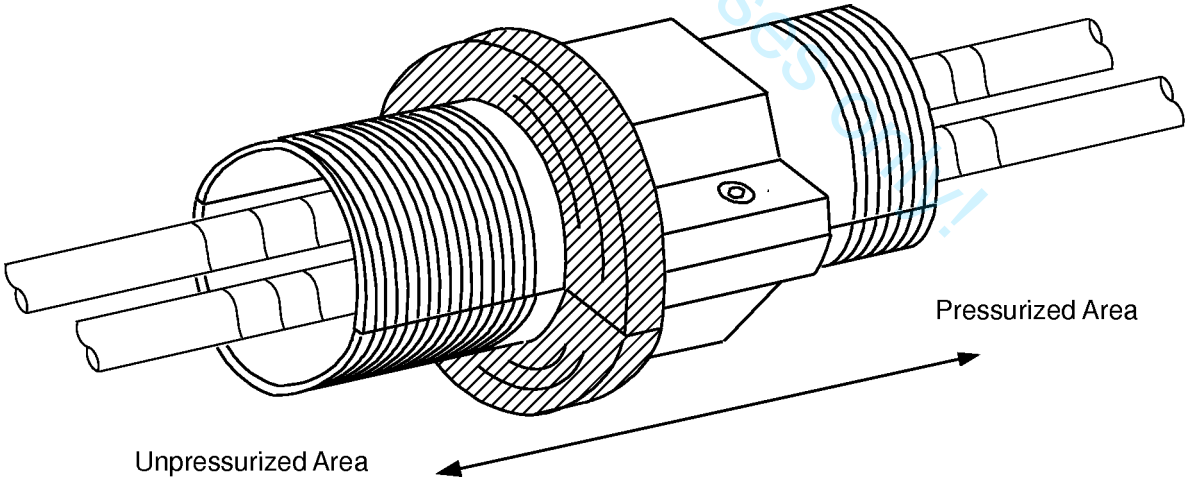
Material	Description	Part Number	Supplier
Silicone Tape	0.57 inch wide, Black	67N	Federal Mogul

(1) Put the sealed wires or wire harnesses into one of the two housing halves. Refer to Figure 107.



POSITION OF THE WIRE HARNESSES IN THE HOUSING HALF
Figure 107

(2) Put the other housing half on the assembly. Refer to Figure 108.



POSITION OF THE TWO HALVES OF THE HOUSING
Figure 108

(3) Make a selection of an Allen wrench from Table 27.

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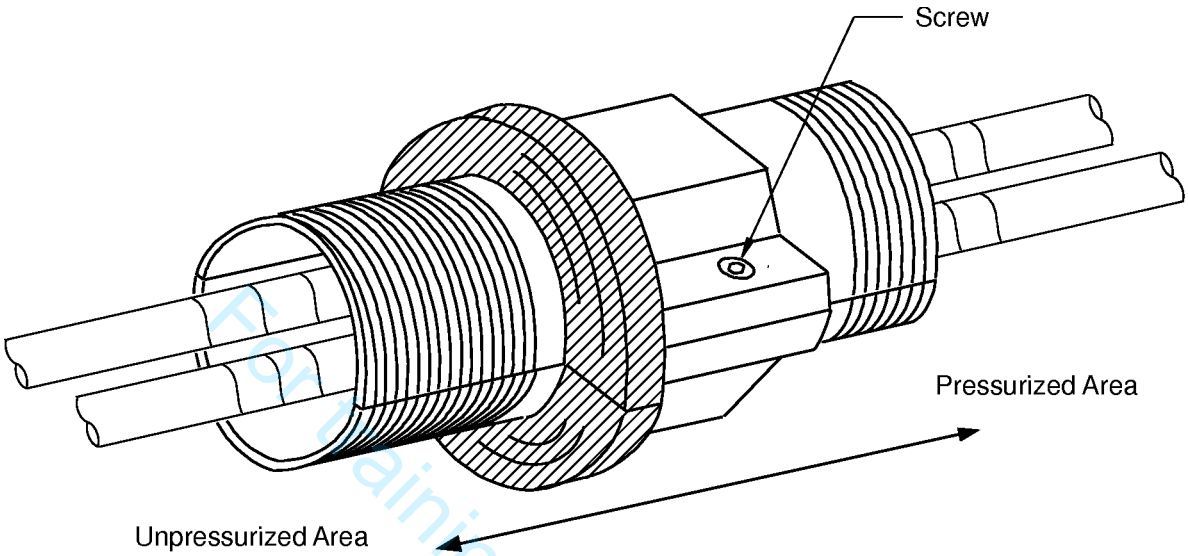
(4) Engage the two screws in one housing half with the nuts in another housing half. Refer to Figure 109.

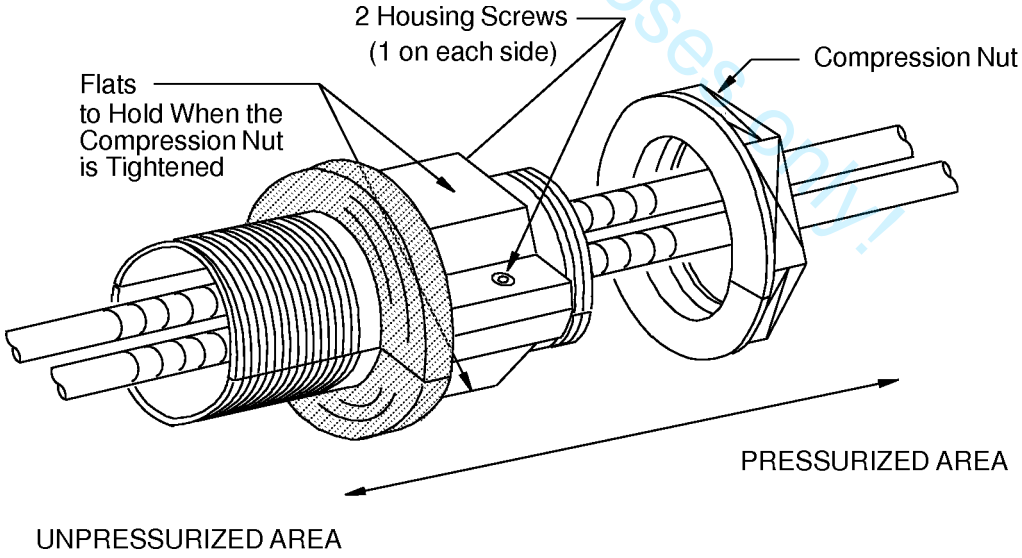
NOTE: THE NUTS CAN NOT BE REMOVED FROM THE HOUSING HALF.



LOCATION OF THE HOUSING SCREWS
Figure 109

(5) Tighten the housing screws to 16 inch-pounds ±2 inch-pounds.

(6) Put the two halves of the compression nut together on the wire harness on the pressurized side of the assembly. Refer to Figure 110.



ALIGNMENT OF THE COMPRESSION NUT AND THE HOUSING
Figure 110

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(7) Engage the inner threads of the compression nut and the outer threads of the housing.

(8) Tighten the compression nut with the fingers until it stops.

(9) Install the seal fitting in the panel. Refer to Paragraph 4.E..

Make sure that the tape on the wire harness extends an equal distance on each side of the seal fitting.

(10) If the tape does not extend an equal distance from each end of the seal fitting:

(a) Make a selection of a silicone tape from Table 28.

(b) Add more layers of tape on the wire harness at each end of the seal fitting until the tape extends an equal distance from each end.

(11) Fill the seal fitting with sealant. Refer to Paragraph 5.A..

5. ASSEMBLY OF THE SEALANT POTTING

A. Assembly of Sealant Potting-Method I

NOTE: This process is used when the original installation included sealant.

Table 29
NECESSARY TOOLS

Tool	Note	Part Number	Supplier
Sealant Injection Tool	-	-	An available source
Wiper	-	BMS15-5 Class A	QPL
		BMS15-5 Class B	QPL
Gloves	Powder Free	-	An available source

Table 30
NECESSARY MATERIALS

Material	Description	Part Number or Specification	Supplier
Sealant	An available Grade	BMS 5-37	QPL
Solvent	Isopropyl Alcohol	TT-I-735	An available source
	Naptha, Aliphatic	TT-N-95, Type I	An available source
Plastic Tape	2.0 inches wide	P-29	Permacel

NOTE: Use gloves to touch or apply sealant. Refer to Table 29.

(1) Make a selection of these materials from Table 30:
- Sealant
- A plastic tape.

(2) Make a selection of a sealant injection tool from Table 29.

(3) Wrap plastic tape flat around the wire bundles to seal the open area on the pressurized side. Refer to Figure 111

(4) Make a hole in the tape on each wire harness on the unpressurized side of the seal fitting. Refer to Figure 111.

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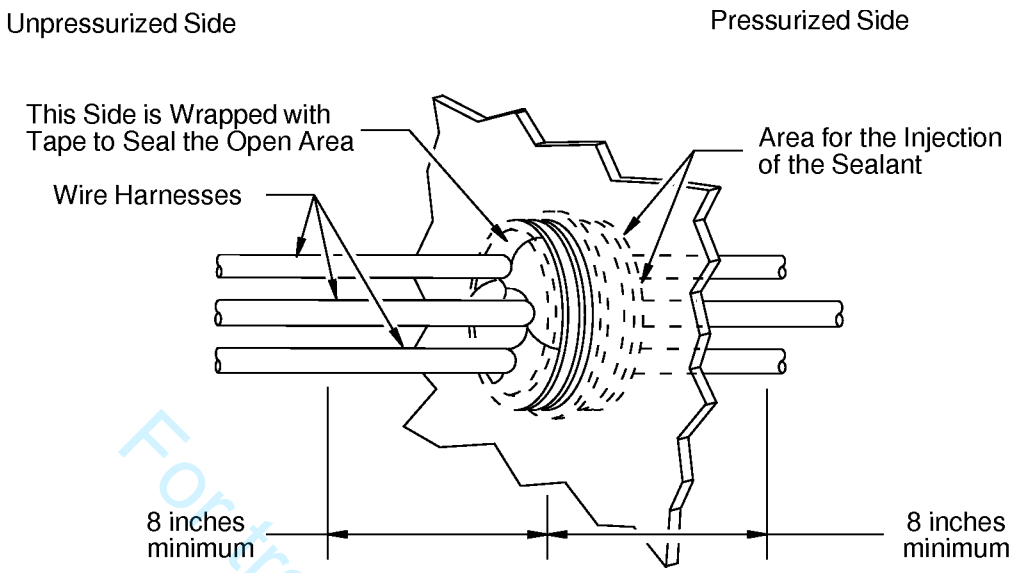
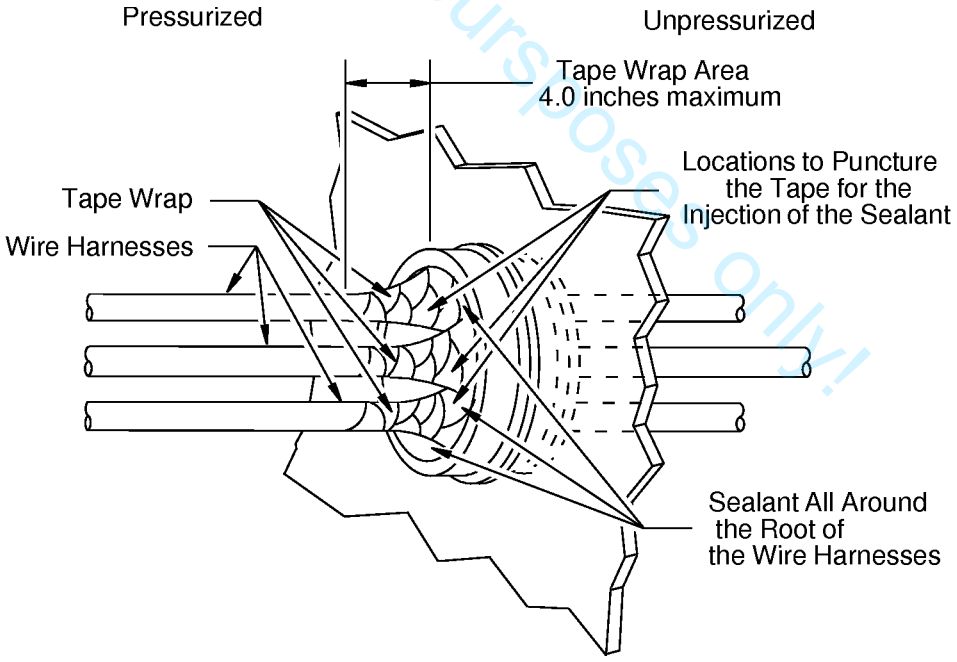


METHOD I -UNPRESSURIZED SIDE
Figure 111

(5) Wrap plastic tape around each wire harness on the pressurized side of the seal fitting.

(6) Make a hole in the base of the tape on each wire harness with the injection tool. Refer to Figure 112.



METHOD I -PRESSURIZED SIDE
Figure 112

(7) Apply the sealant on all sides of each wire or wire harness from the pressurized side of the seal fitting.

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(8) Apply the sealant to completely cover the each wire harness and the outer surface and edges of the seal fitting on the pressurized side of the bulkhead.

Make sure that each of the wire harnesses is separated from each other from the seal fitting to the clamp nearest to the seal fitting.

(9) If too much sealant is applied:

(a) Make a selection of a solvent from Table 30.

(b) Make a selection of wiper from Table 29.

(c) Remove the unwanted sealant from the assembly.

(d) Remove the remaining solvent with a clean wiper.

B. Assembly of Sealant Potting-Method II

Table 31
NECESSARY TOOLS

Tool	Note	Part Number	Supplier
Sealant Injection Tool	-	-	An available source
Wiper	-	BMS15-5 Class A	QPL
		BMS15-5 Class B	QPL
Gloves	Powder Free	-	An available source

Table 32
NECESSARY MATERIALS

Material	Description	Part Number or Specification	Supplier
Sealant	An available Grade	BMS 5-37	QPL
Solvent	Isopropyl Alcohol	TT-I-735	An available source
	Naptha, Aliphatic	TT-N-95, Type I	An available source
Plastic Tape	2.0 inches wide	P-29	Permacel

NOTE: Use gloves to touch or apply sealant. Refer to Table 31.

(1) Make a selection of these materials from Table 32:

- Sealant
- A plastic tape.

(2) Make a selection of a sealant injection tool from Table 31.

(3) Wrap plastic tape around the individual wire bundles on the unpressurized side. Refer to Figure 113.

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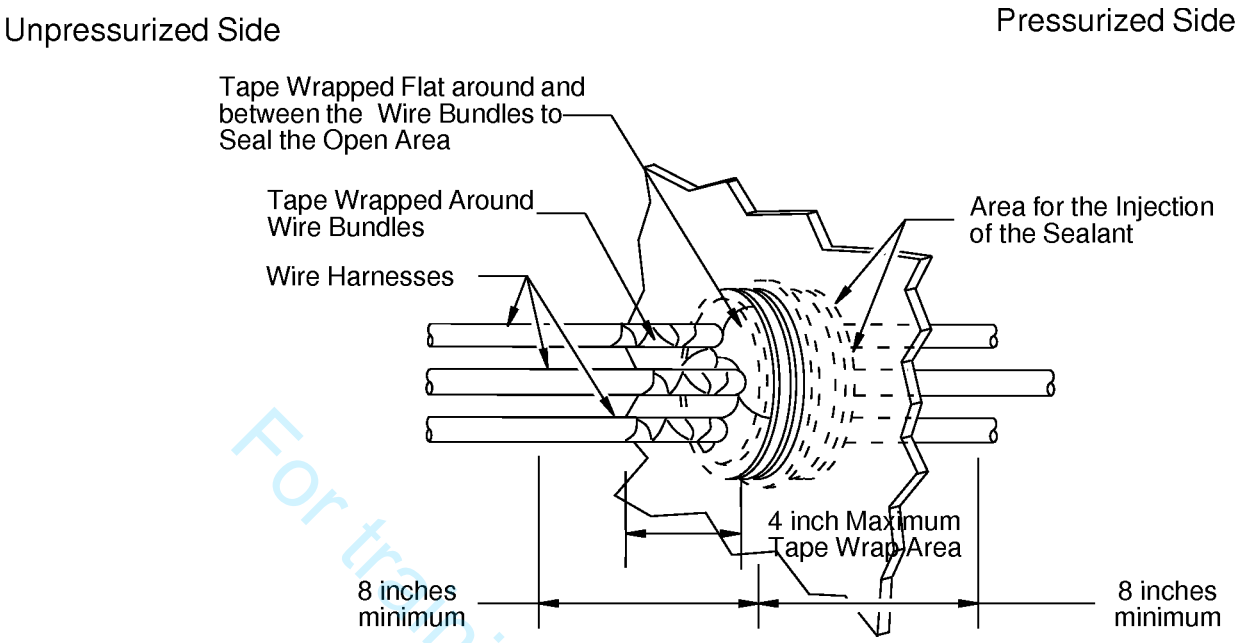

METHOD II - UNPRESSURIZED SIDE
Figure 113

(4) Wrap plastic tape flat around and between the wire bundles to seal the open area on the unpressurized side of the seal. Refer to Figure 113.

(5) Apply the sealant on all sides of each wire or wire harness from the pressurized side of the seal fitting to fill all the voids and gaps on the unpressurized side.

(6) Apply sealant into each chamber from the pressurized side of the seal fitting.

(7) Apply the sealant to completely cover the each wire harness and the outer surface and edges of the seal fitting on the pressurized side of the seal fitting.

Make sure that each of the wire harness is separated from each other from the seal fitting to the nearest clamp from the seal fitting.

(8) If too much sealant is applied:

(a) Make a selection of wiper. Refer to Table 31.

(b) Make a selection of solvent. Refer to Table 32.

(c) Remove the unwanted sealant from the assembly

(d) Remove the remaining solvent with a clean wiper.

6. APPROVED TOOL SUPPLIERS

A. Approved Tool Suppliers

Table 33
Approved Tool Suppliers

Part Number	Supplier
057-0750-00	Deutsch
057-0898-05	Deutsch

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Table 33 (continued)

Part Number	Supplier
057-0919-05	Deutsch
AN850824B	Snap-On
AN850826B	Snap-On
AN850832B	Snap-On
AN850842B	Snap-On
ST2580-343A-15	Boeing
ST2580-343A-17	Boeing
ST2580-343A-18	Boeing
ST2580-343A-19	Boeing
ST2580-343A-20	Boeing
ST2580-343A-21	Boeing
ST2580-343A-22	Boeing
ST2580-343A-23	Boeing

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INSTALLATION OF BACF39A AND BACF39B FEED THROUGH FITTINGS

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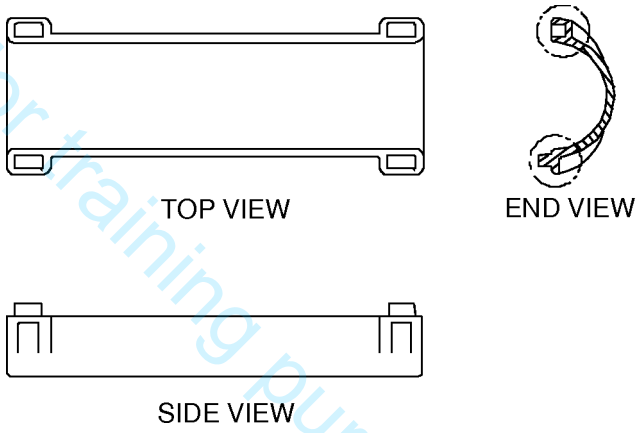
INSTALLATION OF BACF39A AND BACF39B FEED THROUGH FITTINGS

1. PART NUMBERS AND DESCRIPTION

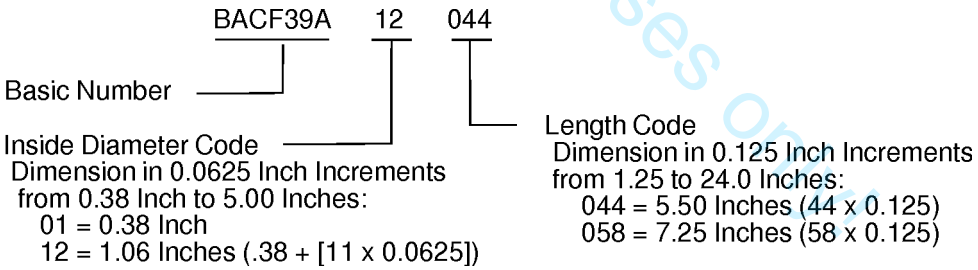
A. Feed Through Fitting Assembly Part Numbers

Table 1
FEED THROUGH FITTING ASSEMBLY PART NUMBERS

Feed Through Fitting Type	Part Number	Supplier
Single	BACF39A()	Amphenol
Dual	BACF39B()	Amphenol



BACF39A() SINGLE FEED THROUGH ASSEMBLY
Figure 1



BACF39A PART NUMBER STRUCTURE
Figure 2

Table 2
BACF39A INSIDE DIAMETER AND LENGTH CODES

Inside Diameter (Refer to Figure 2)		Length (Refer to Figure 2)	
Code	**Diameter (Inches)**	**Code**	**Length (Inches)**
01	0.3800	001	0.125

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Table 2 (continued)

Inside Diameter (Refer to Figure 2)		Length (Refer to Figure 2)	
Code	Diameter (Inches)	Code	Length (Inches)
02	0.4425	002	0.250
03	0.5050	003	0.375
04	0.5675	004	0.500
05	0.6300	005	0.625
06	0.6925	006	0.750
07	0.7550	007	0.875
08	0.8175	008	1.000
09	0.8800	009	1.125
10	0.9425	010	1.250
11	1.0050	011	1.375
12	1.0675	012	1.500
13	1.1300	013	1.625
14	1.1925	014	1.750
15	1.2550	015	1.875
16	1.3175	016	2.000
17	1.3800	017	2.125
18	1.4425	018	2.250
19	1.5050	019	2.375
20	1.5675	020	2.500
21	1.6300	021	2.625
22	1.6925	022	2.750
23	1.7550	023	2.875
24	1.8175	024	3.000
25	1.8800	025	3.125
26	1.9425	026	3.250
27	2.0050	027	3.375
28	2.0675	028	3.500
29	2.1300	029	3.625
30	2.1925	030	3.750
31	2.2550	031	3.875
32	2.3175	032	4.000

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Table 2 (continued)

Inside Diameter (Refer to Figure 2)		Length (Refer to Figure 2)	
Code	Diameter (Inches)	Code	Length (Inches)
33	2.3800	033	4.125
34	2.4425	034	4.25
35	2.5050	035	4.375
36	2.5675	036	4.500
37	2.6300	037	4.625
38	2.6925	038	4.750
39	2.7550	039	4.875
40	2.8175	040	5.000
41	2.8800	041	5.125
42	2.9425	042	5.250
43	3.0050	043	5.375
44	3.0675	044	5.500
45	3.1300	045	5.625
46	3.1925	046	5.750
47	3.2550	047	5.875
48	3.3175	048	6.000
49	3.3800	049	6.125
50	3.4425	050	6.25
51	3.5050	051	6.375
52	3.5675	052	6.500
53	3.6300	053	6.625
54	3.6925	054	6.750
55	3.7550	055	6.875
56	3.8175	056	7.000
57	3.8800	057	7.125
58	3.9425	058	7.250
59	4.0050	059	7.375
60	4.0675	060	7.500
61	4.1300	061	7.625
62	4.1925	062	7.750
63	4.2550	063	7.875

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Table 2 (continued)

Inside Diameter (Refer to Figure 2)		Length (Refer to Figure 2)	
Code	Diameter (Inches)	Code	Length (Inches)
64	4.3175	064	8.000
65	4.3800	065	8.125
66	4.4425	066	8.250
67	4.5050	067	8.375
68	4.5675	068	8.500
69	4.6300	069	8.625
70	4.6925	070	8.750
71	4.7550	071	8.875
72	4.8175	072	9.000
73	4.8800	073	9.125
74	4.9425	074	9.250
75	5.0050	075	9.375
-	-	076	9.500
-	-	077	9.625
-	-	078	9.750
-	-	079	9.875
-	-	080	10.000
-	-	081	10.125
-	-	082	10.250
-	-	083	10.375
-	-	084	10.500
-	-	085	10.625
-	-	086	10.750
-	-	087	10.875
-	-	088	11.000
-	-	089	11.125
-	-	090	11.250
-	-	091	11.375
-	-	092	11.500
-	-	093	11.625
-	-	094	11.750

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Table 2 (continued)

Inside Diameter (Refer to Figure 2)		Length (Refer to Figure 2)	
Code	Diameter (Inches)	Code	Length (Inches)
-	-	095	11.875
-	-	096	12.000
-	-	097	12.125
-	-	098	12.250
-	-	099	12.375
-	-	100	12.500
-	-	101	12.625
-	-	102	12.750
-	-	103	12.875
-	-	104	13.000
-	-	105	13.125
-	-	106	13.250
-	-	107	13.375
-	-	108	13.500
-	-	109	13.625
-	-	110	13.750
-	-	111	13.875
-	-	112	14.000
-	-	113	14.125
-	-	114	14.250
-	-	115	14.375
-	-	116	14.500
-	-	117	14.625
-	-	118	14.750
-	-	119	14.875
-	-	120	15.000
-	-	121	15.125
-	-	122	15.250
-	-	123	15.375
-	-	124	15.500
-	-	125	15.625

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Table 2 (continued)

Inside Diameter (Refer to Figure 2)		Length (Refer to Figure 2)	
Code	Diameter (Inches)	Code	Length (Inches)
-	-	126	15.750
-	-	127	15.875
-	-	128	16.000
-	-	129	16.125
-	-	130	16.250
-	-	131	16.375
-	-	132	16.500
-	-	133	16.625
-	-	134	16.750
-	-	135	16.875
-	-	136	17.000
-	-	137	17.125
-	-	138	17.250
-	-	139	17.375
-	-	140	17.500
-	-	141	17.625
-	-	142	17.750
-	-	143	17.875
-	-	144	18.000
-	-	145	18.125
-	-	146	18.250
-	-	147	18.375
-	-	148	18.50
-	-	149	18.625
-	-	150	18.750
-	-	151	18.875
-	-	152	19.000
-	-	153	19.125
-	-	154	19.250
-	-	155	19.375
-	-	156	19.500

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Table 2 (continued)

Inside Diameter (Refer to Figure 2)		Length (Refer to Figure 2)	
Code	Diameter (Inches)	Code	Length (Inches)
-	-	157	19.625
-	-	158	19.750
-	-	159	19.875
-	-	160	20.000
-	-	161	20.125
-	-	162	20.250
-	-	163	20.375
-	-	164	20.500
-	-	165	20.625
-	-	166	20.750
-	-	167	20.875
-	-	168	21.000
-	-	169	21.125
-	-	170	21.250
-	-	171	21.375
-	-	172	21.500
-	-	173	21.625
-	-	174	21.750
-	-	175	21.875
-	-	176	22.000
-	-	177	22.125
-	-	178	22.250
-	-	179	22.375
-	-	180	22.500
-	-	181	22.625
-	-	182	22.750
-	-	183	22.875
-	-	184	23.000
-	-	185	23.125
-	-	186	23.250
-	-	187	23.375

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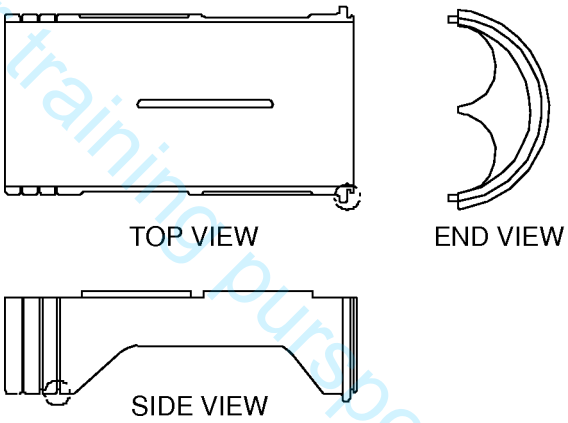
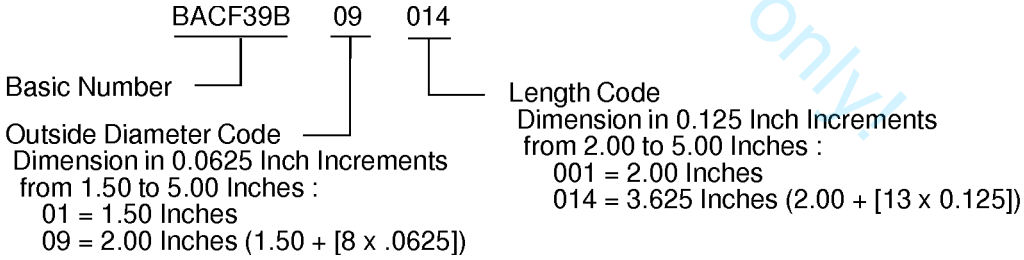
Table 2 (continued)

Inside Diameter (Refer to Figure 2)		Length (Refer to Figure 2)	
Code	Diameter (Inches)	Code	Length (Inches)
-	-	188	23.500
-	-	189	23.625
-	-	190	23.750
-	-	191	23.875
-	-	192	24.000



BACF39B() DUAL FEED THROUGH ASSEMBLY
Figure 3



BACF39B PART NUMBER STRUCTURE
Figure 4

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Table 3
BACF39B OUTSIDE DIAMETER AND LENGTH CODES

Outside Diameter (Refer to Figure 4)		Length (Refer to Figure 4)	
Code	Diameter (Inches)	Code	Length (Inches)
01	1.5000	001	2.000
02	1.5625	002	2.125
03	1.6250	003	2.250
04	1.6875	004	2.375
05	1.7500	005	2.500
06	1.8125	006	2.625
07	1.8750	007	2.750
08	1.9375	008	2.875
09	2.0000	009	3.000
10	2.0625	010	3.125
11	2.1250	011	3.250
12	2.1875	012	3.375
13	2.2500	013	3.500
14	2.3125	014	3.625
15	2.3750	015	3.750
16	2.4375	016	3.875
17	2.5000	017	4.000
18	2.5625	018	4.125
19	2.6250	019	4.250
20	2.6875	020	4.375
21	2.7500	021	4.500
22	2.8125	022	4.625
23	2.8750	023	4.750
24	2.9375	024	4.875
25	3.0000	025	5.000
26	3.0625	-	-
27	3.1250	-	-
28	3.1875	-	-
29	3.2500	-	-
30	3.3125	-	-

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Table 3 (continued)

Outside Diameter (Refer to Figure 4)		Length (Refer to Figure 4)	
Code	Diameter (Inches)	Code	Length (Inches)
31	3.3750	-	-
32	3.4375	-	-
33	3.5000	-	-
34	3.5625	-	-
35	3.6250	-	-
36	3.6875	-	-
37	3.7500	-	-
38	3.8125	-	-
39	3.8750	-	-
40	3.9375	-	-
41	4.0000	-	-
42	4.0625	-	-
43	4.1250	-	-
44	4.1875	-	-
45	4.2500	-	-
46	4.3125	-	-
47	4.3750	-	-
48	4.4375	-	-
49	4.5000	-	-
50	4.5625	-	-
51	4.6250	-	-
52	4.6875	-	-
53	4.7500	-	-
54	4.8125	-	-
55	4.8750	-	-
56	4.9375	-	-
57	5.0000	-	-

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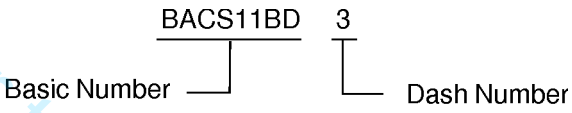
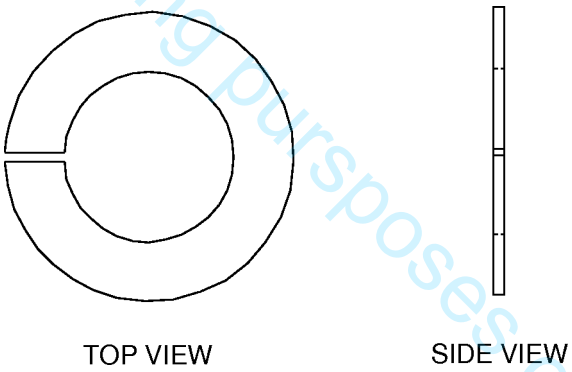
B. Feed Through Fitting Component Part Numbers

Table 4
BACF39B DUAL FEED THROUGH FITTING COMPONENTS

Fitting	Component			
	Name	Quantity	Part Number	Supplier
BACF39A()	-	-	-	-
BACF39B()	Retaining Ring	2	MS16624-()	QPL
	Seal Ring	2	BACS11BD()	Boeing



BACS11BD SEAL RING PART NUMBER STRUCTURE
Figure 5



BACS11BD SEAL RING
Figure 6

Table 5
BACS11BD SEAL RING DASH NUMBERS

Seal Ring Dash Number	Outside Diameter (inch)	Hole Diameter (inch)	Thickness (inch)
1	1.56	0.90	0.025
2	1.56	0.90	0.040
3	1.86	1.20	0.025
4	1.86	1.20	0.040
5	2.24	1.58	0.025
6	2.24	1.58	0.040

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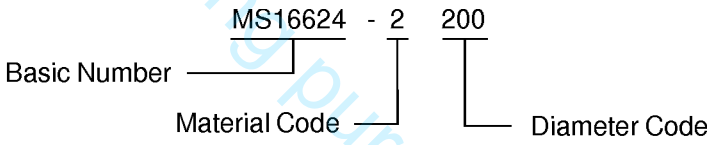
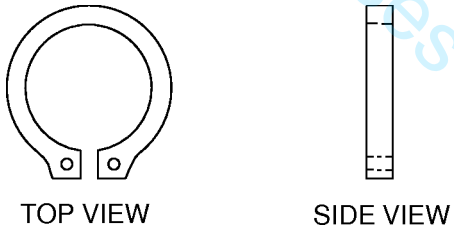
Table 5 (continued)

Seal Ring Dash Number	Outside Diameter (inch)	Hole Diameter (inch)	Thickness (inch)
7	2.44	1.76	0.025
8	2.44	1.76	0.040
9	2.82	2.12	0.025
10	2.82	2.12	0.040
11	2.34	1.73	0.025
12	2.34	1.73	0.040
13	3.22	2.42	0.040
14	3.25	2.56	0.040
15	3.25	2.56	0.025
16	2.60	2.00	0.025
17	2.60	2.00	0.040



MS16624 RETAINING RING PART NUMBER STRUCTURE
Figure 7



MS16624 RETAINING RING
Figure 8

Table 6
MS16624 RETAINING RING MATERIAL CODES

Material Code	Material
1	Carbon Steel
2	Zinc Coated Carbon Steel
3	Phosphate Coated Carbon Steel
4	CRES

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Table 6 (continued)

Material Code	Material
5	Be Copper

Table 7
MS16624 RETAINING RING DIAMETER CODES

Diameter Code	Diameter (inch)
012	0.125
015	0.156
018	0.188
019	0.197
021	0.219
023	0.236
025	0.250
027	0.276
028	0.281
031	0.312
034	0.344
035	0.354
037	0.375
039	0.394
040	0.406
043	0.438
046	0.469
050	0.500
055	0.551
056	0.562
059	0.594
062	0.625
066	0.669
067	0.672
068	0.688
075	0.750
078	0.781
081	0.812

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Table 7 (continued)

Diameter Code	Diameter (inch)
087	0.875
093	0.938
098	0.984
100	1.000
102	1.023
106	1.062
112	1.125
118	1.188
125	1.250
131	1.312
137	1.375
143	1.438
150	1.500
156	1.562
162	1.625
168	1.688
175	1.750
177	1.772
181	1.812
187	1.875
196	1.969
200	2.000
206	2.062
212	2.125
215	2.156
225	2.250
231	2.312
237	2.375
243	2.438
250	2.500
255	2.559
262	2.625

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Table 7 (continued)

Diameter Code	Diameter (inch)
268	2.688
275	2.750
287	2.875
293	2.938
300	3.000
306	3.062
312	3.125
315	3.156
325	3.250
334	3.346
343	3.438
350	3.500
354	3.543
362	3.625
368	3.688
375	3.750
387	3.875
393	3.938
400	4.000
425	4.250
437	4.375
450	4.500
475	4.750
500	5.000
525	5.250
550	5.500
575	5.750
600	6.000
625	6.250
650	6.500
675	6.750
700	7.000

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Table 7 (continued)

Diameter Code	Diameter (inch)
750	7.500
800	8.000
850	8.500
900	9.000
950	9.500
000	10.000

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C. Necessary Materials

Table 8
NECESSARY MATERIALS

Material	Specification	Part Number	Description or Special Instructions	Supplier
Adhesion Promoter	-	PR-187	For polythioether sealant on a cured polysulfide sealant	PRC-Desoto International
Sealant	BMS 5-37	PR-1428 B-2	Polysulfide sealant for insulated wire	PRC-Desoto International
	BMS 5-45	PR-1776	Polysulfide sealant for insulated wire	PRC-Desoto International
	BMS 5-95	Pro-Seal 870 B-1/2	Polysulfide sealant for seal fillets	PRC-Desoto International
		Pro-Seal 870 B-2	Polysulfide sealant for seal fillets	PRC-Desoto International
		PR-1436G E-2	Polysulfide sealant for seal fillets	PRC-Desoto International
	-	PR-1828 B-1/2	Polythioether sealant for insulated wire and seal fillets	PRC-Desoto International

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Table 8 (continued)

Material	Specification	Part Number	Description or Special Instructions	Supplier
Solvent	O-E-760	-	Ethyl Alcohol	An available source
	TT-I-735	-	Isopropyl Alcohol	An available source
	BMS 11-7	-	Mixture of Naphtha, Ethyl Acetate, MEK, Isopropyl Alcohol	Pratt and Lambert Industrial Coating Division
		-	Mixture of Naphtha, Ethyl Acetate, MEK, Isopropyl Alcohol	Elf Atochem
		-	Mixture of Naphtha, Ethyl Acetate, MEK, Isopropyl Alcohol	AZKO/Dexter Aerospace Finishes
		-	Mixture of Naphtha, Ethyl Acetate, MEK, Isopropyl Alcohol	Barton Solvents
	P-D-680	-	Type I Stoddard Solvent	An available source

Table 9
SEALANT CURE TIMES

Sealant Part Number	Cure Time (hours)
PR-1428 B-2	24
PR-1436G E-2	48
PR-1828 B-1/2	3
Pro-Seal 870 B-1/2	30
Pro-Seal 870 B-2	48
Pro-Seal 890 B-2	48

Table 10
WIRE THAT HAS TEFLON INSULATION

Wire	Insulation Material
BMS 13-16	PTFE
BMS 13-28	TFE
BMS 13-29	TFE
BMS 13-31	TFE
BMS 13-55	PTFE
BMS 13-58	PTFE
BMS 13-60	PTFE

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2. REMOVAL OF A FEED THROUGH FITTING

A. Feed Through Fitting Removal

CAUTION: DO NOT CAUSE DAMAGE TO:
- THE STRUCTURE
- THE WIRE HARNESS, IF THE WIRE HARNESS MUST BE USED AGAIN.

(1) Make a selection of a scraper made of wood or plastic.

CAUTION: DO NOT USE A SCRAPER THAT IS MADE OF A MATERIAL THAT IS HARDER THAN THE STRUCTURE. A HARDER MATERIAL CAN CAUSE DAMAGE TO THE STRUCTURE.

(2) Make a selection of a solvent from Table 8.

(3) Remove the sealant on and around the installation hardware of the feed through fitting.

(4) Remove the installation hardware.

(5) Remove the feed through fitting from the structure:

(a) Carefully put the scraper between the feed through fitting and the structure.

(b) Move the two halves of the seal apart.

(6) If the fitting must be replaced, discard the feed through fitting.

(7) If the wire harness must be installed again:

(a) Carefully remove the sealant from each wire or cable.

CAUTION: DO NOT USE A SHARP TOOL OR TOO MUCH FORCE TO REMOVE SEALANT. DAMAGE TO THE WIRES CAN OCCUR.

(b) Clean the wire or cable with solvent.

(8) Remove the sealant from each side of the structure with the scraper.

CAUTION: DO NOT USE A SCRAPER THAT IS MADE OF A MATERIAL THAT IS HARDER THAN THE STRUCTURE. A HARDER MATERIAL CAN CAUSE DAMAGE TO THE STRUCTURE.

(9) Clean each side of the structure with solvent.

(10) Remove the remaining solvent with a clean, dry cloth.

3. ASSEMBLY OF A FEED THROUGH FITTING

A. BACF39A Single Feed Through Fitting Installation

These conditions are applicable:-
- The area of the wire harness installed in the feed through fitting does not have wire harness ties.
- One half of the feed through is aligned with the other half of the feed through fitting.

B. BACF39B Dual Feed Through Fitting Installation

These conditions are applicable:-
- The area of the wire harness installed in the feed through fitting does not have wire harness ties.
- One half of the feed through is aligned with the other half of the feed through fitting.
- The retaining rings are in the retaining ring grooves and hold the feed through fitting tightly against the structure.

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4. INSTALLATION OF A FEED THROUGH FITTING

A. INSTALLATION OF A BACF39A SINGLE FEED THROUGH FITTING:

(1) If the wire harness is not installed, put the correct end of the wire harness assembly through the penetration hole.

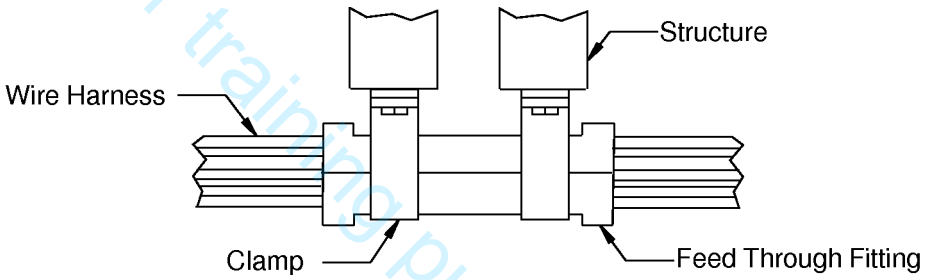
(2) If a sleeve is specified, install the specified sleeve on the wire harness.

(3) Put the feed through halves around the wire harness.

Make sure that:

- The area of the wire harness installed in the feed through assembly does not have wire harness ties
- The tabs on one half of the feed through are aligned with the slots on the other half of the feed through.

(4) Install the specified clamp on the feed through assembly on each side of structure. Refer to Figure 9.



POSITION OF THE FEED THROUGH FITTING IN THE CLAMPS
Figure 9

B. INSTALLATION OF A BACF39B DUAL FEED THROUGH FITTING

(1) If the wire harnesses are not installed, put the correct end of the wire harnesses assembly through the penetration hole.

Make sure that the flag markers on the wire harnesses are in the correct location.

(2) If a sleeve is specified, install a sleeve on the wire harness.

(3) Put the halves of the assembly around the two wire harnesses.

Make sure that:

- The area of the wire harness installed in the feed through assembly does not have wire harness ties.
- The tabs on one half of the feed through are aligned with the slots on the other half of the feed through.

(4) Push the retaining ring into the retaining ring grove near the flange of the feed through assembly. Refer to Figure 10.

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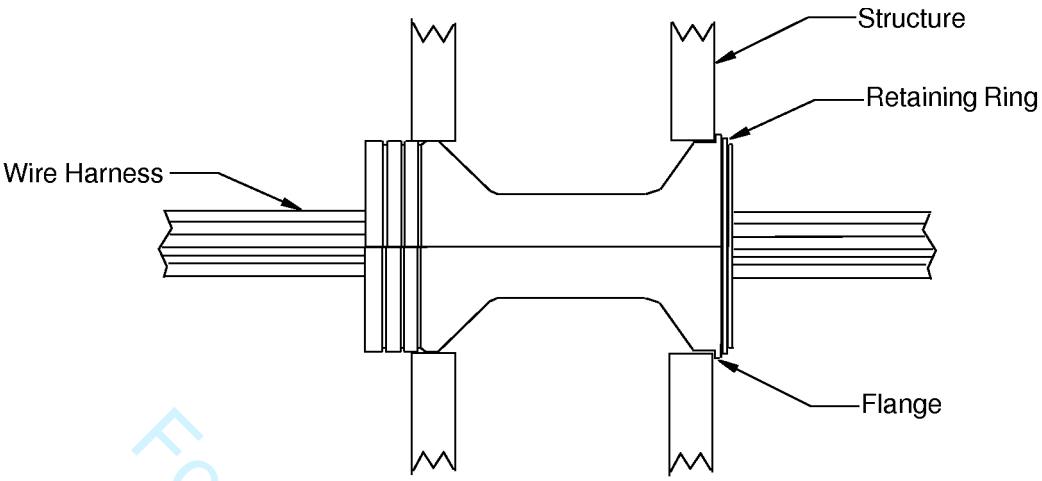
INSTALLATION OF BACF39A AND BACF39B FEED THROUGH FITTINGS

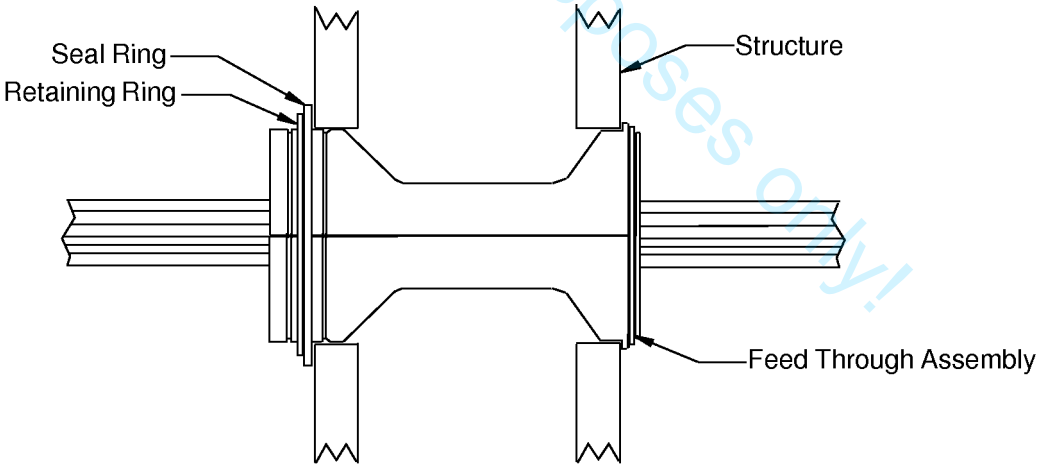


POSITION OF THE RETAINING RING ON THE FEED THROUGH FITTING
Figure 10

(5) Push the feed through assembly into the penetration hole until the flange is against the structure. Make sure that the flag markers on the wire harnesses are in the correct location.

(6) Push the retaining ring into the applicable retaining ring groove of the assembly. Refer to Figure 11. Make sure that the feed through is held tightly against the structure.

NOTE: If the feed through is not held tightly against the structure, more seal rings are necessary or the retaining ring must be installed in a different retaining ring groove.



POSITION OF THE SEAL RING AND THE RETAINING RING ON THE FEED THROUGH FITTING
Figure 11

(7) If the feed through assembly is not held tightly against the structure.

(a) Remove the retaining ring.

(b) Install the specified seal ring on the assembly. Refer to Figure 11.

(c) Install the retaining ring.

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5. SEALANT INSTALLATION

A. Installation of the Sealant

(1) Make a selection of a fillet sealant from Table 8.

Refer to Table 9 for the cure time of each sealant.

(2) Make a selection of a sealant from Table 8.

(3) With a clean wipe and solvent, clean the surfaces that the sealant must make a bond with.

CAUTION: A SURFACE THAT SEALANT MAKES A BOND WITH MUST BE CLEAN. A CONTAMINATION ON A SURFACE CAN CAUSE AN UNSATISFACTORY BOND BETWEEN THE SEALANT AND THE SURFACE.

(4) Put a layer of the sealant on:

- The joints of the filler
- The center screw
- The edges of the BACF39B dual feed through fitting assembly.

Refer to Figure 11.

(5) Make a hole in the sealant mold over all of the injection hole of the seal.

NOTE: As an alternative, a hole can be made at the end of the mold that is adjacent to the wires or wire harness.

(6) Put the sealant into each injection hole with a sealant gun at 80 psi to 100 psi pressure.

Make sure:

- That the sealant comes out from around the wires at the edges of the mold
- To complete the injection of the sealant in the specified time for the sealant
- That the sealant is continuous and has no voids, holes, bubbles, cracks, unwanted objects, used sealant, or metal particles.

(7) Let the sealant cure for the specified time. Refer to Table 9.

(8) Remove all of the sealant molds.

(9) Put a layer of the fillet sealant:

- On the heads of the screws
- Around the outer edges of the seal flange.

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ASSEMBLY AND INSTALLATION OF EMI WRAPPABLE SLEEVES

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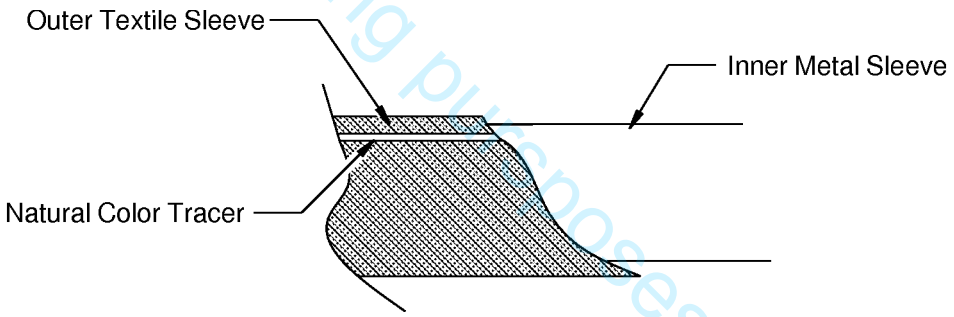
ASSEMBLY AND INSTALLATION OF EMI WRAPPABLE SLEEVES

1. PART NUMBERS AND MATERIALS

A. EMI Wrappable Sleeve Part Numbers

Table 1
EMI WRAPPABLE SLEEVE PART NUMBERS

Part Number	Wire Harness O.D (inch)		Supplier
	Minimum	Maximum	
5678300607	0.04	0.24	Federal Mogul
5678101107	0.24	0.43	Federal Mogul
5678101407	0.43	0.55	Federal Mogul
5678101707	0.43	0.67	Federal Mogul
5678102307	0.67	0.91	Federal Mogul
5678103007	0.91	1.18	Federal Mogul
5678103807	1.18	1.5	Federal Mogul



COMPONENT LAYERS OF THE EMI WRAPPABLE SLEEVE
Figure 1

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B. Necessary Materials

Table 2
NECESSARY MATERIALS

Component	Tape	Specification
Tape	PTFE	A-A-59474
	Silicone, Type I	A-A-59163
	Silicone, Type II	A-A-59163

2. INSTALLATION OF THE EMI WRAPPABLE SLEEVE

A. General Conditions

On a wire harness with one or more branches, the sleeves can be installed on the smallest branch first and then largest to permit the overlap of the larger sleeve on top of the smaller sleeve at the breakout.

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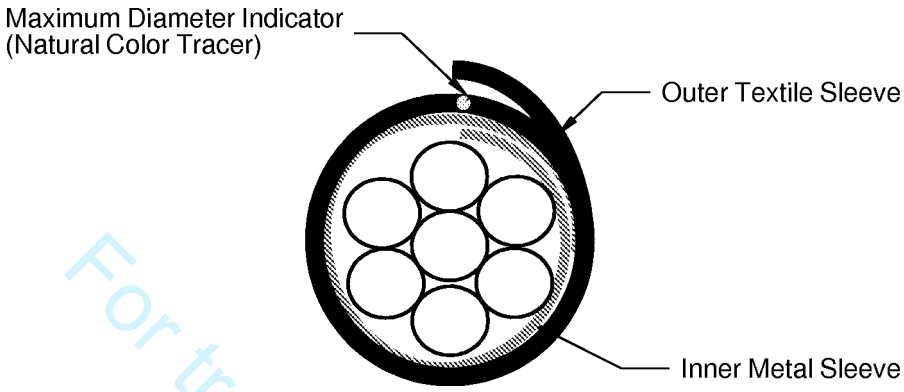
These conditions are applicable:

- The sleeve must be installed on the wire harness tightly to prevent a fold
- To use the maximum diameter indicator correctly, the edge of the sleeve that has the natural color tracer must be put against the wire harness first. Refer to Figure 2.



MAXIMUM HARNESS DIAMETER INDICATOR
Figure 2

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B. Sleeve Installation

This section gives the procedure to install the sleeve on a wire harness that does not have:

- A branch
- A branch on which a sleeve must also be installed.

For the procedure to install the sleeves on the main trunk of a wire harness and the wire harness branches that make:

- Symmetrical breakouts, refer to Paragraph 2.C.
- Asymmetrical breakout, refer to Paragraph 2.D..

NOTE: The removal of the specified length of the outer textile sleeve before the sleeve is installed on the wire harness is a satisfactory alternative.

(1) Install the necessary length of the sleeve on the main trunk of the wire harness. Refer to Paragraph 2.E..

(2) If the wire harness has a breakout, assemble the necessary wire harness ties. Refer to Figure 3.

Make sure that a wire harness tie is assembled on the sleeve:

- Approximately 1 inch from the rear end of the breakout
- Approximately 0.5 inch from the forward end of the breakout
- At a 4 inch maximum interval on the length of the sleeve.

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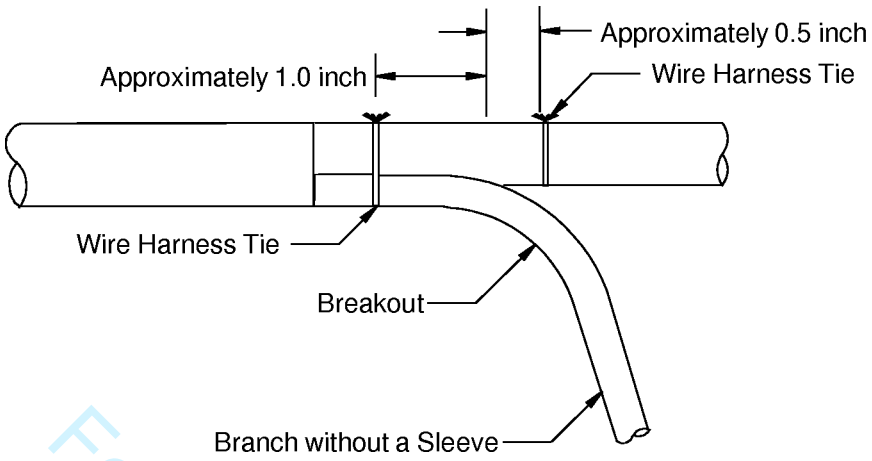

POSITION OF THE WIRE HARNESS TIES ON THE WIRE HARNESS
Figure 3

(3) If there is a specification to use a shield termination, at each applicable end of the wire harness:
   (a) Prepare the sleeve for termination. Refer to Paragraph 3.A..
   (b) Assemble the specified sleeve termination. Refer to Paragraph 3.B..

(4) If there is a specification to use a sleeve dead end, at each applicable end of the wire harness:
   (a) Prepare the end of the sleeve. Refer to Paragraph 3.B..
   (b) Assemble the sleeve dead end. Refer to Paragraph 4.F..

C. Sleeve Installation on a Wire Harness with Symmetrical Breakouts

For the conditions that are applicable for this procedure, refer to Paragraph 2.B..

NOTE: The removal of the specified length of the outer textile sleeve before the sleeve is installed on the wire harness is a satisfactory alternative.

(1) Install the necessary length of the sleeve on the main trunk of the wire harness. Refer to Paragraph 2.E..

(2) Fold the outer textile layer and the inner metal sleeve back away from the breakout.

(3) Install shield termination ring on the main trunk of the harness approximately 2 inches farther than the breakout.

Refer to

- Figure 4
- Paragraph 3.B. for the procedure to install the shield termination ring.

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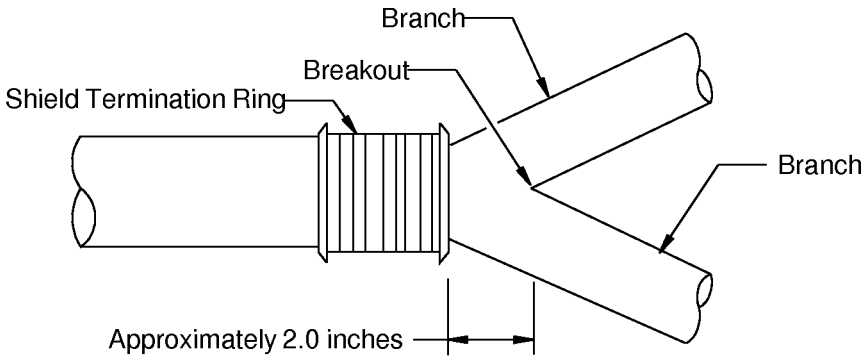


POSITION OF THE SHIELD TERMINATION RING ON THE WIRE HARNESS
Figure 4

(4) Install the necessary length of the sleeve on the branch that has the smallest diameter. Refer to Paragraph 2.E..

NOTE: Make sure that the sleeve has sufficient length to extend 3.5 inches ±0.5 inch farther than the breakout.

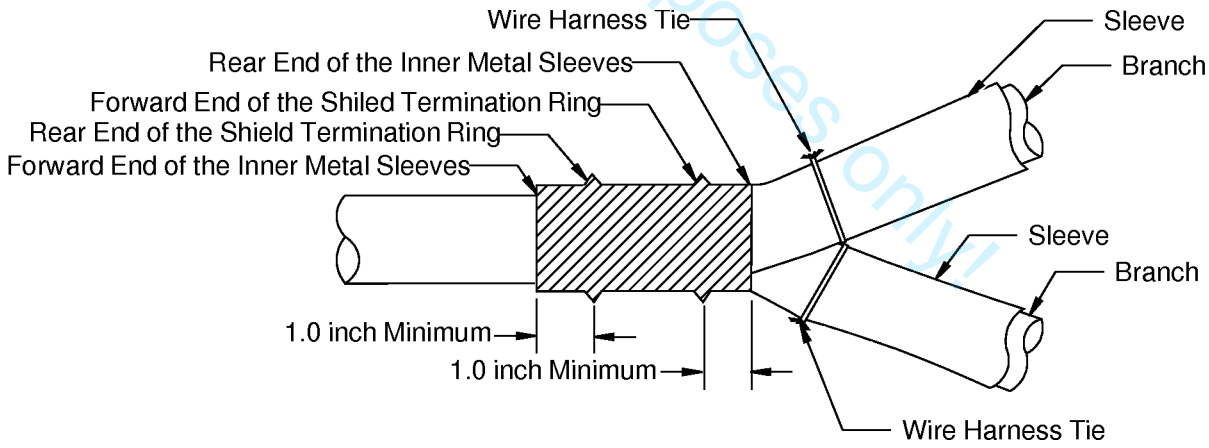
(5) Remove approximately 3.0 inches of the inner layer of tape from the breakout end of the sleeve.

(6) Remove approximately 3.0 inches of outer textile sleeve from the breakout end of the sleeve.

(7) Assemble a wire harness tie on the breakout 0.5 inch to 1 inch from the end of the textile sleeve.

(8) Do Step (4) to Step (7) again for the sleeve of the other branch.

(9) Wrap the inner metal sleeves of the each breakout around the shield termination ring. Refer to Figure 5.



POSITION OF THE INNER METAL SLEEVES ON THE SHIELD TERMINATOR RING
Figure 5

(10) Assemble a wire harness tie 0.5 inch to 1.0 inch from the shield termination ring on each side of the ring. Refer to Figure 6.

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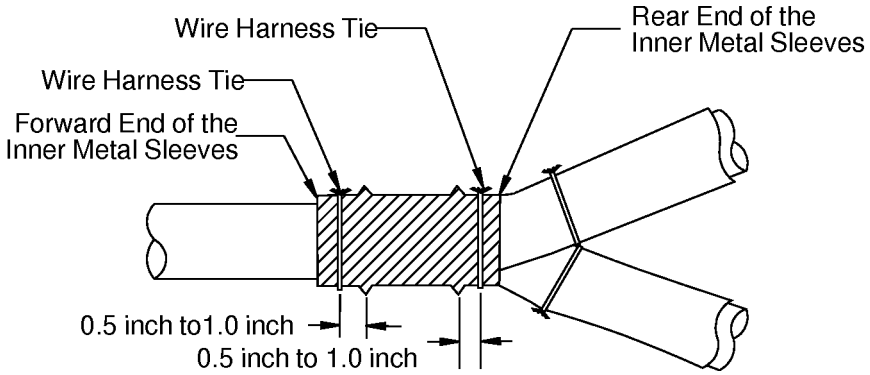


POSITION OF THE WIRE HARNESS TIES ON THE INNER METAL SLEEVES
Figure 6

(11) Assemble the termination of the sleeve on the main trunk of the wire harness:

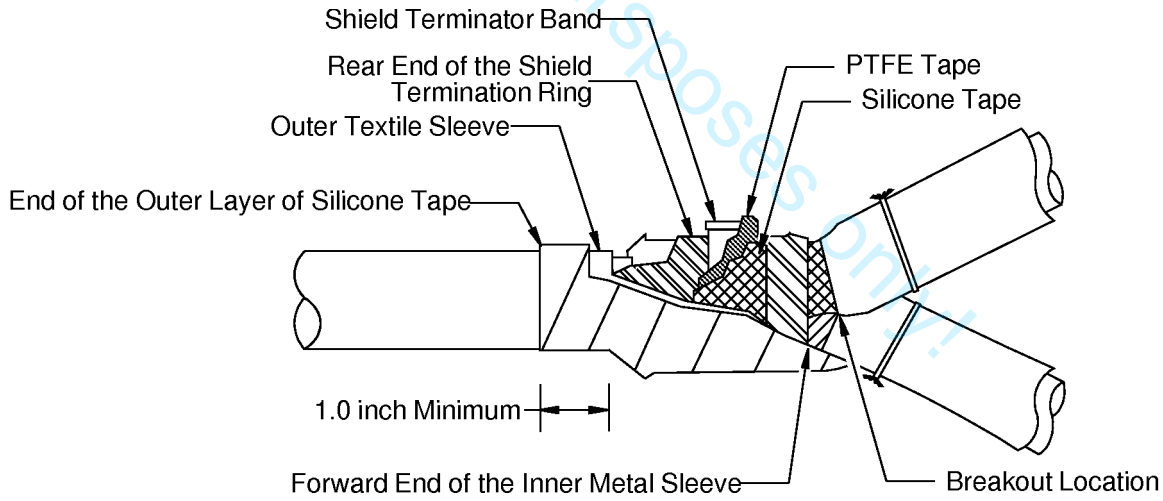
(a) Remove approximately 4 inches of the inner layer of tape from the end of the sleeve of the main trunk of the harness.

(b) Wrap the inner metal sleeve around the shield termination ring.

(c) Install the shield terminator band on the shield termination ring.

Refer to:

- Figure 7
- Subject 20-74-13 for the procedure to install the shield terminator band.



POSITION OF THE SHIELD TERMINATOR BAND ON THE INNER METAL SLEEVES
Figure 7

(d) Make a selection of PTFE tape from Table 2.

(e) Put 1 to 2 layers of the PTFE tape on the shield terminator band. Refer to Figure 7.

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Make sure that:

- The center of the tape is aligned with the center of the band
- The edges of the tape are approximately aligned
- The PTFE tape covers he shield terminator band completely.

(f) Make a selection of Type I silicone tape from Table 2.

(g) Put a layer of the Type I Silicone tape on the layers of the PTFE tape. Refer for Figure 7.

(h) Close the outer textile sleeve of the main trunk of the harness around the termination of the inner metal sleeves.

(i) Assemble a wire harness tie 0.5 inch to 1.0 inch from the shield termination of the inner metal sleeves.

(j) Make a selection of Type II Silicone tape from Table 2

(k) Put a layer of the Type II silicone tape on the termination of the sleeves. Refer to Figure 7

make sure that:

- The tape starts a minimum of 1 inch from the forward end of the shield termination ring
- The tape stops at the location of the breakout
- The tape makes a 50 percent overlap.

(12) At each applicable end of the wire harness:

(a) Prepare the sleeve for termination. Refer to Paragraph 3.A..

(b) Assemble the specified sleeve termination. Refer to Paragraph 3.B..

D. Sleeve Installation on a Wire Harness with Asymmetrical Breakouts

For the conditions that are applicable for this procedure, refer to Paragraph 2.B..

NOTE: The removal of the specified length of the outer textile sleeve before the sleeve is installed on the wire harness is a satisfactory alternative.

(1) Install the necessary length of the sleeve on the main trunk of the wire harness and the larger wire harness branch. Refer to Paragraph 2.E..

(2) Open the necessary length of the outer textile layer and the inner metal sleeve at the breakout.

(3) Install the shield termination ring on the main trunk of the harness 2 inches to 6 inches farther than the breakout.

Refer to:

- Figure 8
- Paragraph 3.B. for the procedure to install the shield termination ring.

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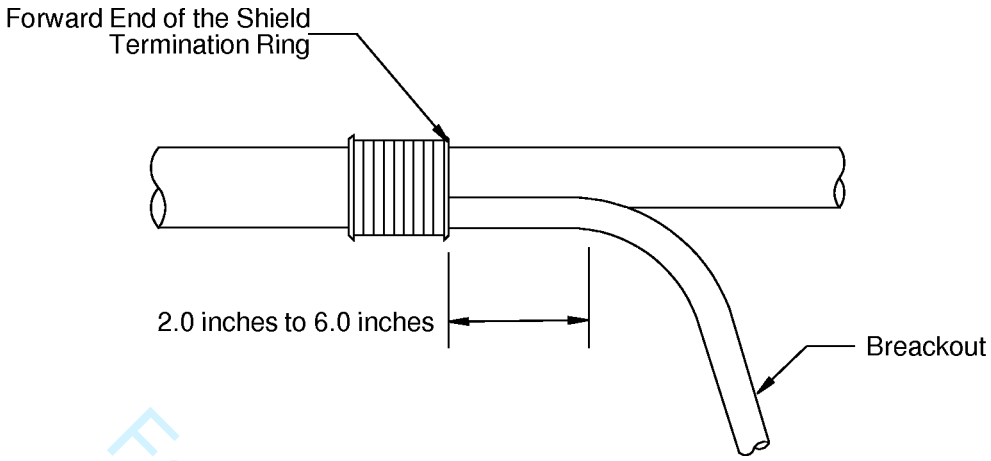
ASSEMBLY AND INSTALLATION OF EMI WRAPPABLE SLEEVES



POSITION OF THE SHIELD TERMINATION RING ON THE WIRE HARNESS
Figure 8

(4) Install the necessary length of the sleeve on the branch that has the smallest diameter. Refer to Paragraph 2.E..

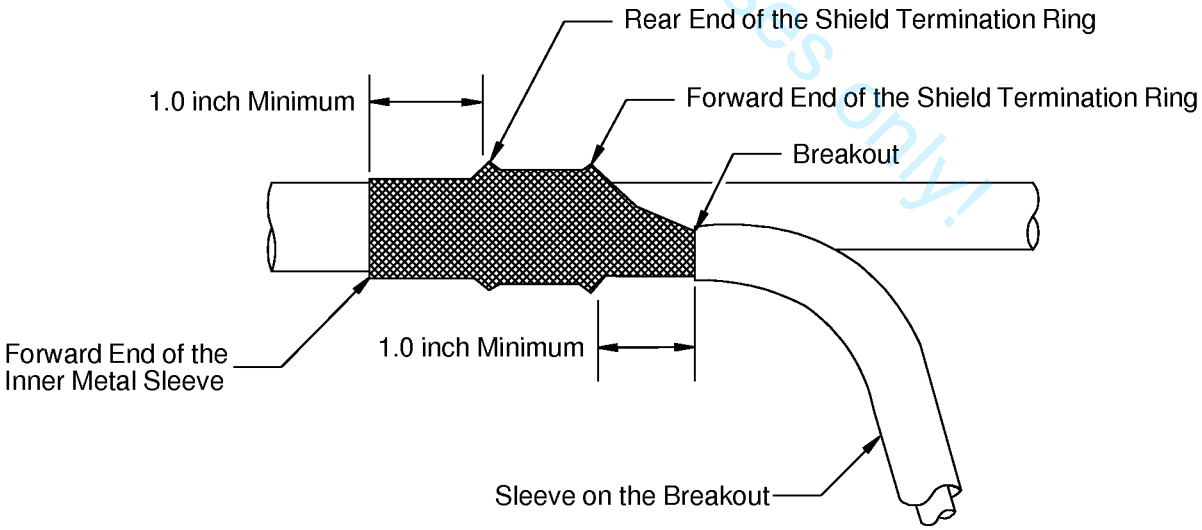
Make sure that the sleeve has sufficient length to extend 2.0 inches ±0.25 inch farther than the shield termination ring.

(5) Remove 3.0 inches to 3.5 inches of the inner layer of tape from the breakout end of the sleeve.

(6) Remove 3.0 inches to 3.5 inches of the outer textile sleeve from the breakout end of the sleeve.

CAUTION: DO NOT CUT THE INNER METAL SLEEVE. DAMAGE TO THE SLEEVE CAN CAUSE UNSATISFACTORY PERFORMANCE OF THE SHIELD.

(7) Wrap the inner metal sleeve around the shield termination ring. Refer to Figure 9.



POSITION OF THE INNER METAL SLEEVE ON THE SHIELD TERMINATOR RING
Figure 9

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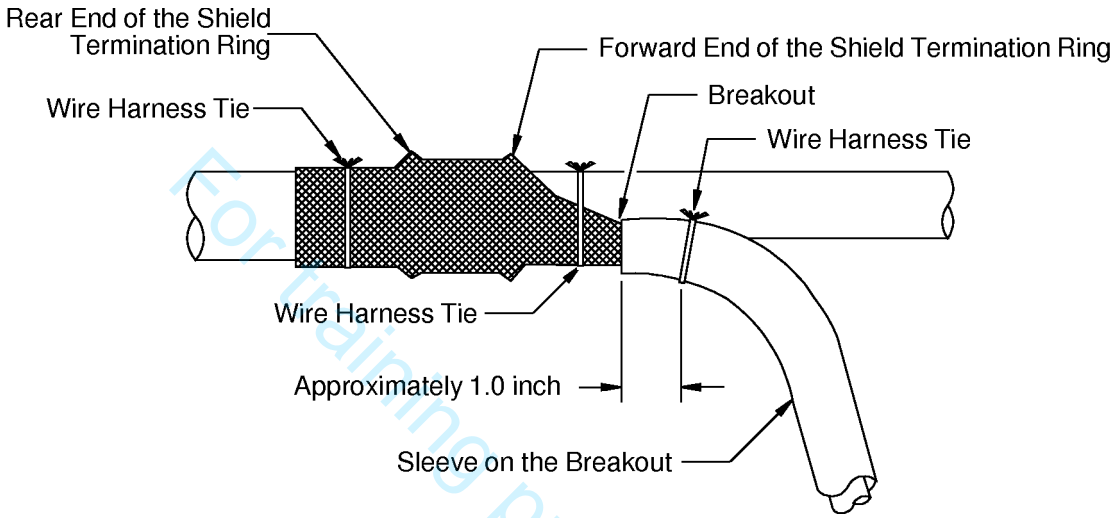
(8) Assemble the wire harness ties on:

- The inner sleeve at each end of the shield termination ring
- The breakout approximately 1.0 inch from the end of the outer sleeve.

Refer to:

- Figure 10
- Subject 20-10-11 for the procedure to assemble the ties.



POSITION OF THE WIRE HARNESS TIES ON THE SLEEVE
Figure 10

(9) Open the sleeve of the main trunk of the harness at the shield termination ring.

(10) Lay the sleeve flat with the outer sleeve turned down.

(11) Remove a 2.25 inch ±0.25 inch length of the inner layer of tape from the inner surface of the sleeve. Refer to Figure 11.

Make sure that the center of the length of tape is approximately aligned with the center the shield termination ring.

CAUTION: DO NOT CUT THE INNER METAL SLEEVE. DAMAGE TO THE SLEEVE CAN CAUSE UNSATISFACTORY PERFORMANCE OF THE SHIELD.

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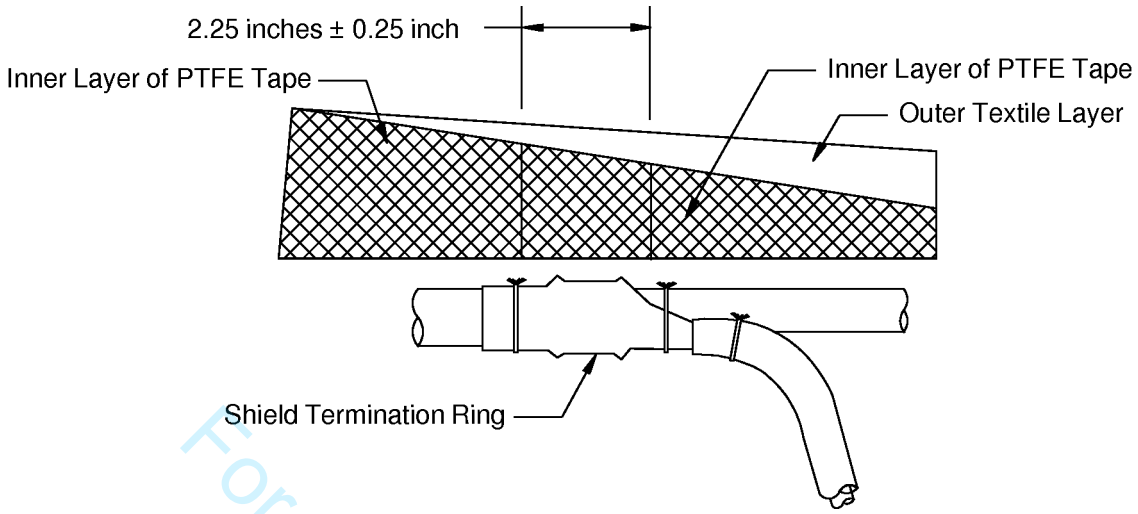
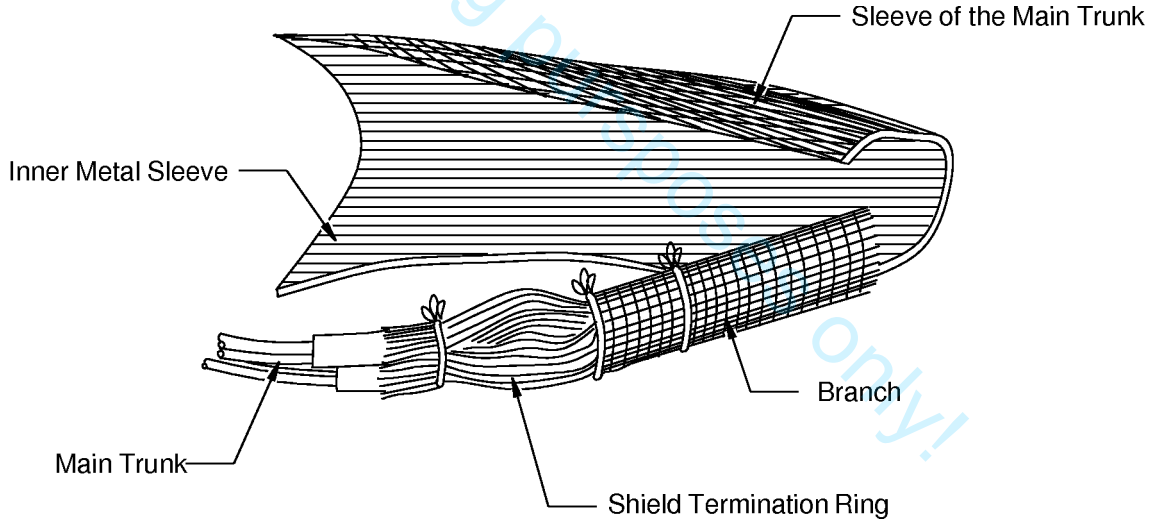
ASSEMBLY AND INSTALLATION OF EMI WRAPPABLE SLEEVES



REMOVAL OF THE INNER LAYER OF PTFE TAPE
Figure 11

(12) Align the center of the shield termination platform and the center of the length sleeve of the harness main trunk that has the inner tape removed. Refer to Figure 12.



ALIGNMENT OF BREAKOUT SLEEVE AND THE SLEEVE OF THE MAIN TRUNK OF THE HARNESS
Figure 12

(13) Assemble the termination of the sleeve on the main trunk of the wire harness. Refer to Figure 13

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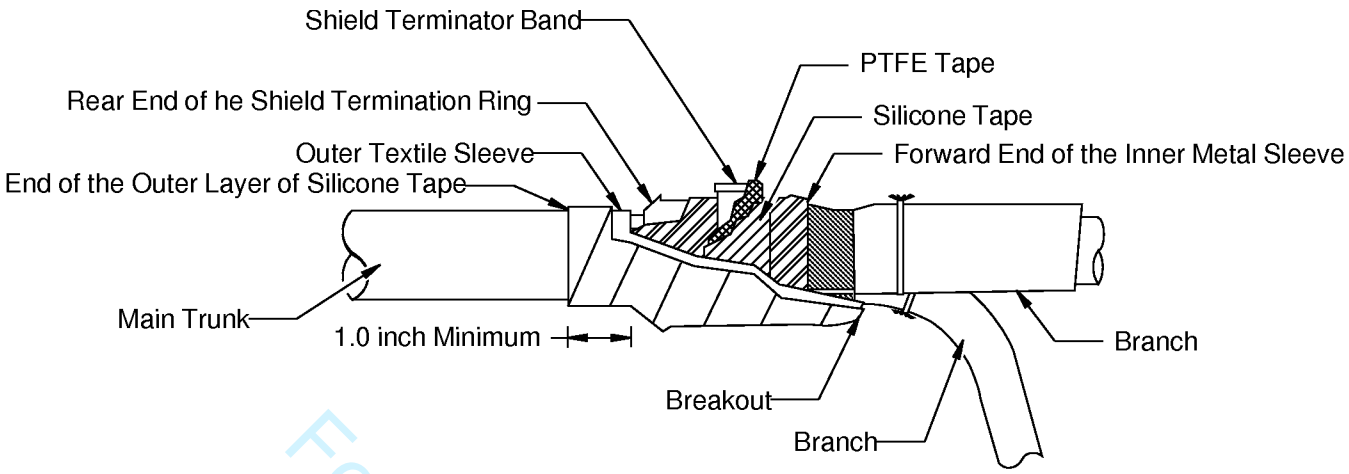
ASSEMBLY AND INSTALLATION OF EMI WRAPPABLE SLEEVES



TERMINATION OF THE SLEEVE OF THE MAIN TRUNK
Figure 13

(a) Close the sleeve of the main trunk along the end of the breakout sleeve.

(b) Install the shield terminator band on the shield terminator ring.

Refer to Subject 20-74-13 for the procedure to install the band.

(c) Make a selection of PTFE tape from Table 2

(d) Put 1 to 2 layers of the PTFE tape on the shield terminator band.

Make sure that:

- The center of the tape is aligned with the center of the band
- The edges if the tapes are approximately aligned
- The PTFE tape completely covers the shield terminator band.

(e) Assemble a wire harness tie 0.5 inch to 1 inch from the shield termination ring on each side of the ring.

(f) Assemble a wire harness tie on the main trunk of the harness 0.2 inch to 0.5 inch from the breakout.

(g) Make a selection of Type II silicone tape from Table 2

(h) Put a layer of Type II Silicone Tape on the on the termination of the sleeve.

Make sure that:

- The tape starts at 1.0 inch minimum from the split ring
- The tape stops at the end of the main harness sleeve
- The tape makes a 50 percent overlap.

(14) At each applicable end of the wire harness:

(a) Prepare the sleeve for termination. Refer to Paragraph 3.A..

(b) Assemble the specified sleeve termination. Refer to Paragraph 3.B..

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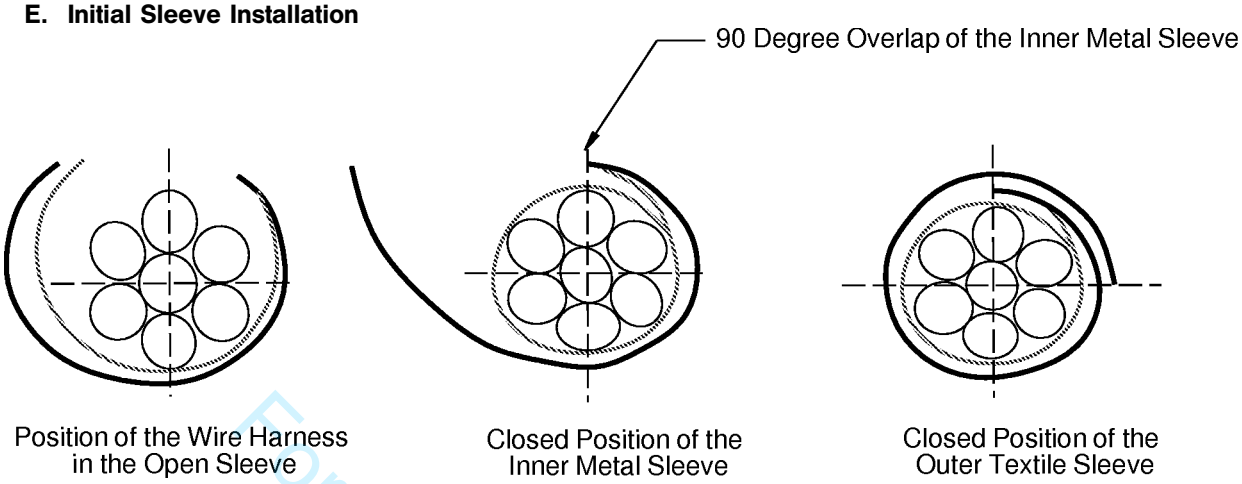
E. Initial Sleeve Installation



POSITION OF THE COMPONENT SLEEVES
Figure 14

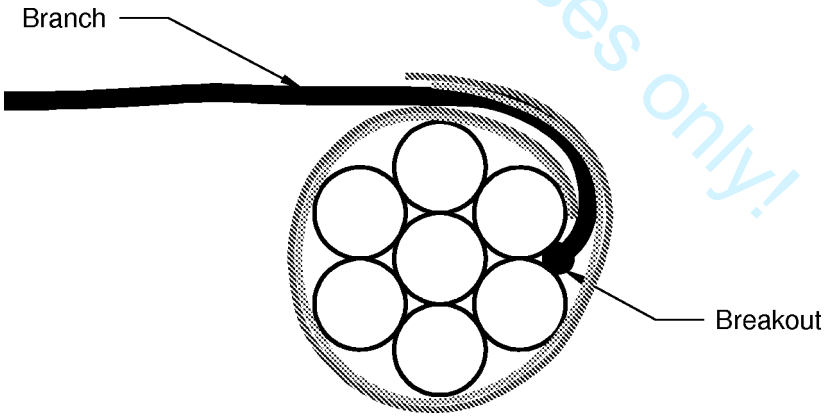
(1) Put the sleeve on the specified length of the wire harness. Refer to Figure 14.

(2) Close the inner metal sleeve.

Make sure that:

- The inner metal sleeve makes an overlap with itself.
- The initial edge of the inner metal sleeve starts at the breakout on a harness that has a branch. Refer to Figure 15.

CAUTION: IF THE INNER METAL SLEEVE DOES NOT MAKE AN OVERLAP WITH ITSELF, UNSATISFACTORY PERFORMANCE OF THE SHIELD OCCURS.



POSITION OF THE INNER METAL SLEEVE ON A BREAKOUT
Figure 15

(3) Close the outer textile sleeve.

Make sure that the overlap is between 65 degrees and 130 degrees.

(4) Twist the sleeve on the wire harness 1 to 2 turns every 3 feet.

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CAUTION: DO NOT PUT MORE THAN 2 TWISTS EVERY 3 FEET. UNSATISFACTORY PERFORMANCE OF THE SHIELD CAN OCCUR.

(5) Assemble the wire harness ties at a 4 inch maximum interval on the length of the sleeve. Refer to Subject 20-10-11 for the procedure to assemble the ties.

NOTE: To make the assembly of the sleeve termination at a breakout or at the end of a wire harness or a wire harness branch easier, the ties can start a minimum of 12 inches from:

- Each side of a breakout
- The end of the sleeve at the end of the wire harness or branch.

(6) If the blue tracer on the sleeve has loose ends, remove the loose ends.

(7) If more separation of the blue tracer and the sleeve occurs, remove the loose length of the tracer at the nearest wire harness tie or the location where the separation stops.

F. Assembly of a Shield Termination Ring

(1) Make a selection of Type I silicone tape from Table 2.

(2) Wind a minimum of one layer of the 1.0 inch wide Type I silicone tape around the wire harness at the location for the shield termination ring. Refer to Table 2.

Make sure that the edges of the tape are approximately aligned.

(3) Assemble the two halves of the shield termination ring on the center of the tape.

- The keys of one half are aligned with the keyholes of the other half
- At least one side of the shield termination ring has a key and keyhole without damage
- The shield termination ring is fully closed
- The shield termination ring does not move on the wire harness.

NOTE: The shield termination ring makes a click when it is correctly assembled.

3. SLEEVE PREPARATION

A. Preparation of the Sleeve of the Outer Textile Sleeve

NOTE: The sleeve has an anti-fray system with knots at the edges of the textile fabric.

(1) Make a selection of good quality paper scissors. Refer to Figure 16.

Make sure that the scissors have no space between the cutting blades.

CAUTION: GOOD QUALITY PAPER SCISSORS ARE NECESSARY TO PREVENT DAMAGE TO THE SLEEVE DURING THE CUT OPERATION.

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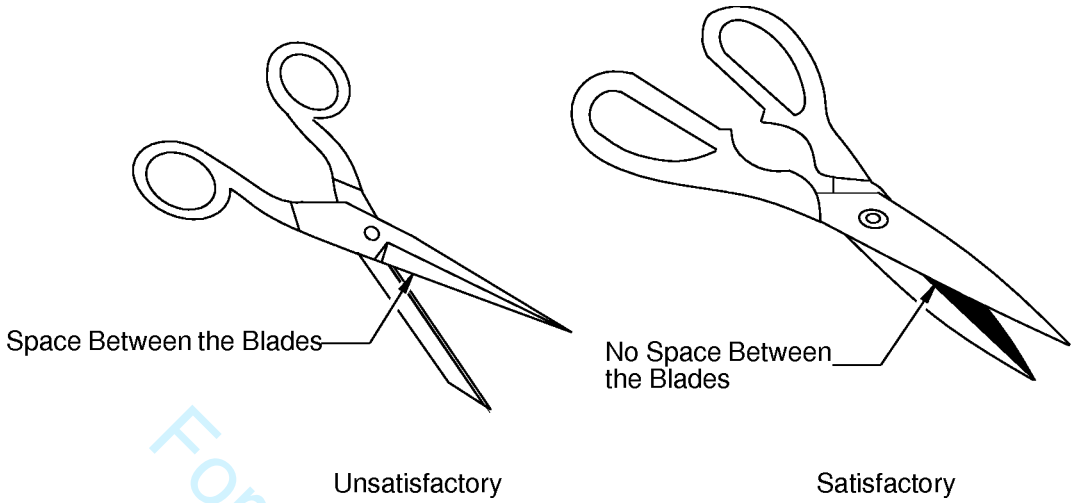
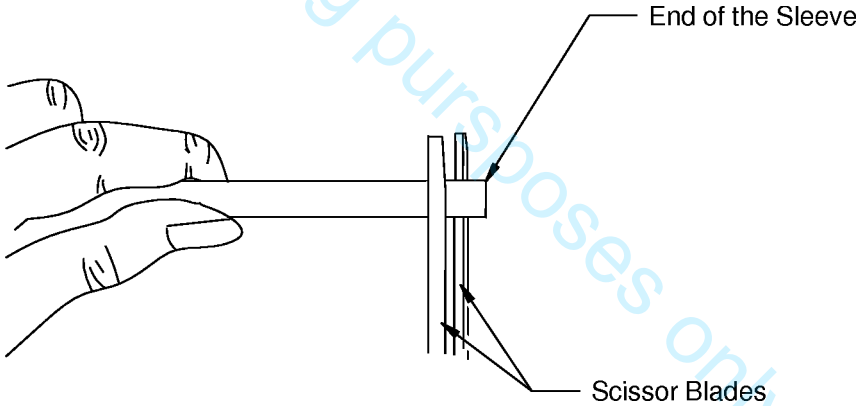


SCISSORS FOR THE CUT OPERATION
Figure 16

(2) Make one straight cut across the width of the sleeve at the end. Refer to Figure 17
Make sure that the 2 layers of the sleeve are cut perpendicular to the longitudinal axis of the sleeve.



STRAIGHT CUT WITH THE SCISSORS
Figure 17

(3) Remove the loose fibers from the end of he sleeve. Refer to Figure 18.

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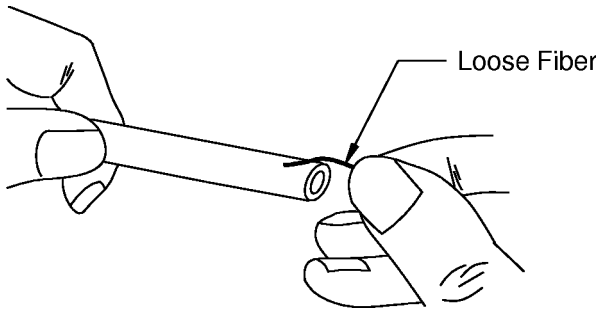
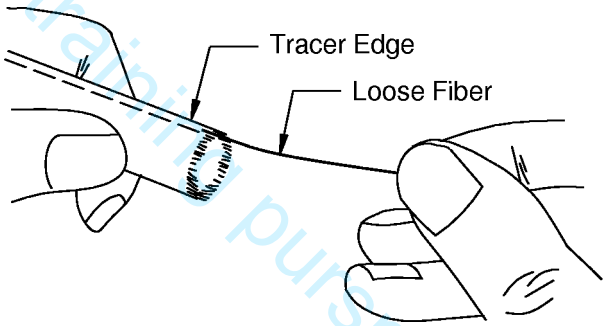


PULL FIBERS MANUALLY BY HAND
Figure 18

(4) Pull the remaining loose fiber toward the tracer edge of the outer sleeve. Refer to Figure 19.

NOTE: The filaments stop unraveling at the tracer edge.



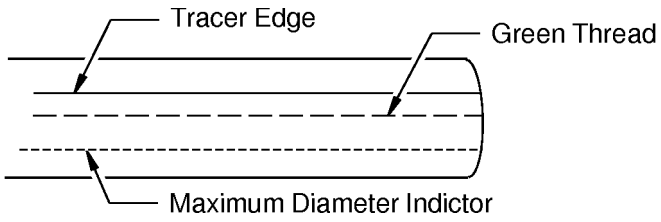
POSITION OF THE LOOSE FIBER AT THE TRACER EDGE
Figure 19

(5) Cut the length of the loose fiber at the tracer edge.

B. Separation of the Layers of Sleeve for Sleeve Termination

(1) Find the green thread where the outer sleeve makes an overlap. Refer to Figure 20.

NOTE: The green thread holds the outer textile sleeve and inner metal shield together.



WRAPPABLE SHIELDED SLEEVE
Figure 20

(2) Cut through the green thread with a sharp blade 2 inches ±0.2 inch from the end of the sleeve. Refer to Figure 21.

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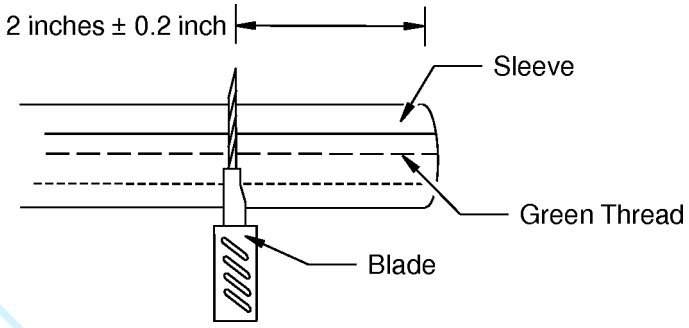
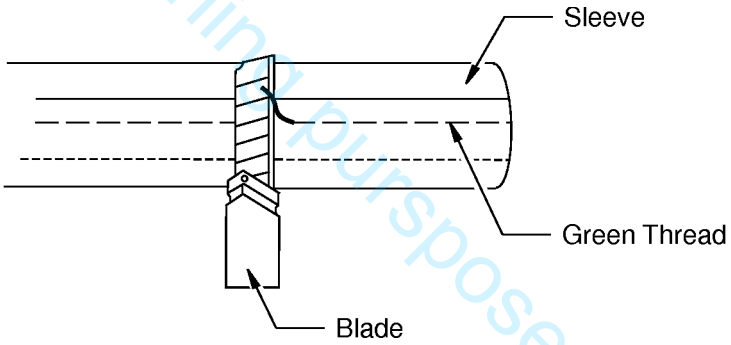
ASSEMBLY AND INSTALLATION OF EMI WRAPPABLE SLEEVES

CAUTION: DO NOT CUT THE INNER METAL SHIELD. DAMAGE TO THE METAL SHIELD CAN CAUSE UNSATISFACTORY PERFORMANCE OF THE SHIELD.



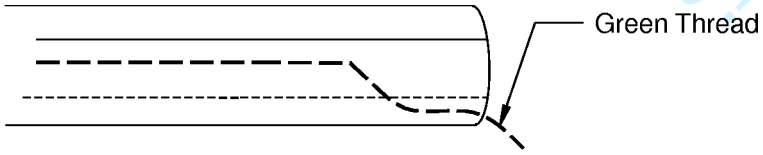
LOCATION OF THE CUT OF THE OUTER SLEEVE
Figure 21

(3) In the direction that is parallel to the axis of the sleeve, scrape the green thread back and forth with a sharp blade. Refer to Figure 22.



REMOVAL OF THE THREAD
Figure 22

(4) Remove the pieces of thread. Refer to Figure 23.



REMOVAL OF THE PIECES OF THE THREAD
Figure 23

(5) Open the sleeve and lay it flat with the outer sleeve facing down.

(6) Make a selection a PTFE tape from Table 2.

(7) With a sharp blade, cut the inner layer of PTFE tape at 0.2 inch to 0.25 inch from the end of the sleeve. Refer to Figure 24.

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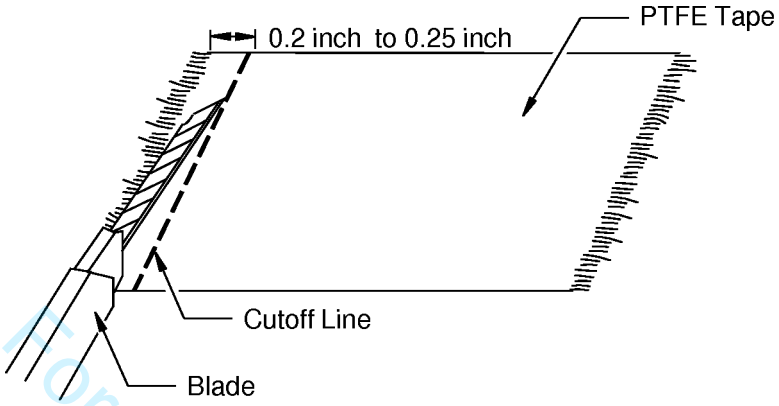
ASSEMBLY AND INSTALLATION OF EMI WRAPPABLE SLEEVES

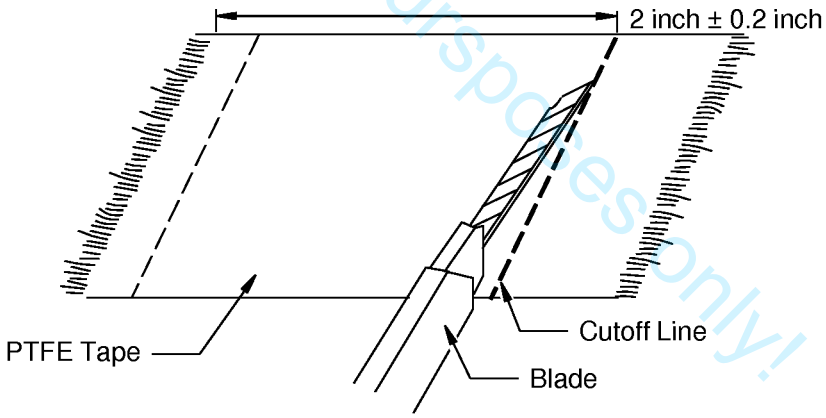
CAUTION: DO NOT CUT THE INNER METAL SLEEVE OR THE OUTER TEXTILE SLEEVE. DAMAGE TO THE SLEEVES CAN CAUSE UNSATISFACTORY PERFORMANCE.



FIRST LOCATION TO CUT ON THE INNER LAYER OF THE TAPE
Figure 24

(8) With a sharp blade, cut the inner layer of PTFE tape at 2 inches ±0.2 inch from the end of the sleeve. Refer to Figure 25.

CAUTION: DO NOT CUT THE INNER METAL SLEEVE OR THE OUTER TEXTILE SLEEVE. DAMAGE TO THE SLEEVES CAN CAUSE UNSATISFACTORY PERFORMANCE.



SECOND LOCATION TO CUT ON THE INNER LAYER OF THE TAPE
Figure 25

(9) Carefully remove the 2 inch length of the inner layer of tape from the end of the sleeve. Refer to Figure 26.

CAUTION: DO NOT REMOVE THE 0.2 INCH TO 0.25 INCH STRIP AT THE END. THIS WILL HELP KEEP THE STRANDS OF THE METAL INNER SLEEVE TOGETHER.

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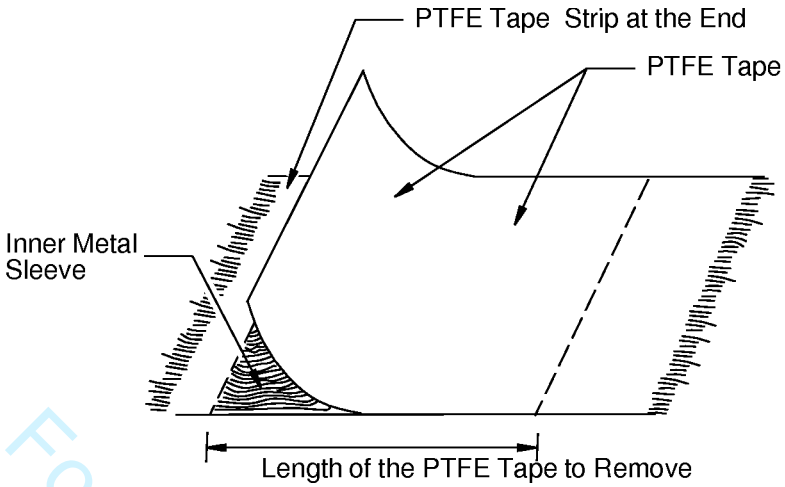
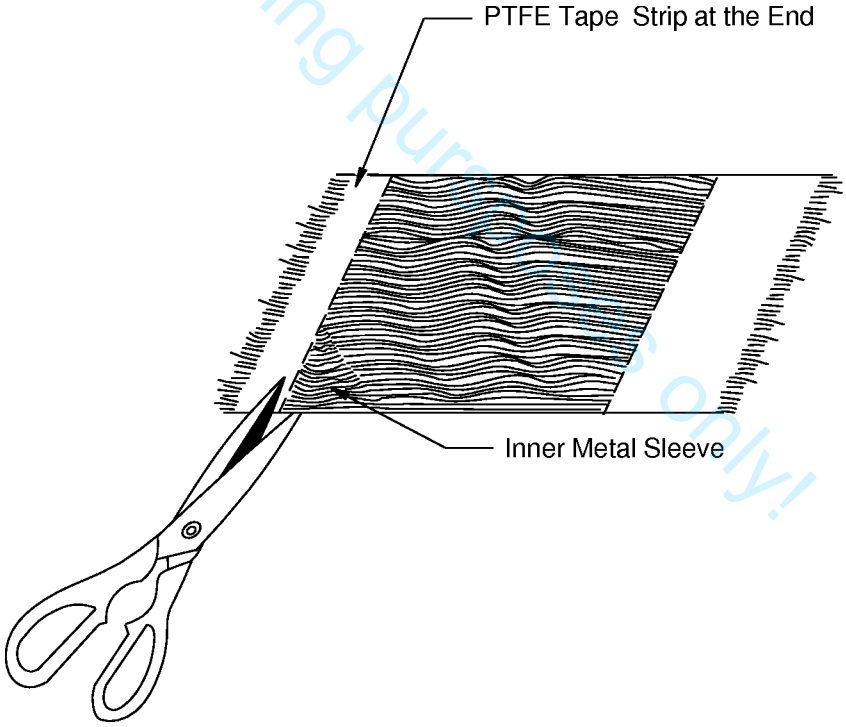
ASSEMBLY AND INSTALLATION OF EMI WRAPPABLE SLEEVES



REMOVAL OF THE INNER LAYER OF THE TAPE
Figure 26

(10) Cut 0.2 inch to 0.25 inch of the sleeve from the end to remove the PTFE strip. Refer to Figure 27



REMOVAL OF THE PTFE STRIP FROM THE END OF THE SLEEVE
Figure 27

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4. TERMINATION OF AN EMI WRAPPABLE SLEEVE

A. Sleeve Termination on a Shield Sock Shield Termination

(1) If the shield termination ring has a shield terminator band, remove it. Refer to Subject 20-74-13.

(2) Move the outer textile sleeve away from the shield sock.

(3) Wrap the inner metal sleeve around the shield sock on the shield termination ring.

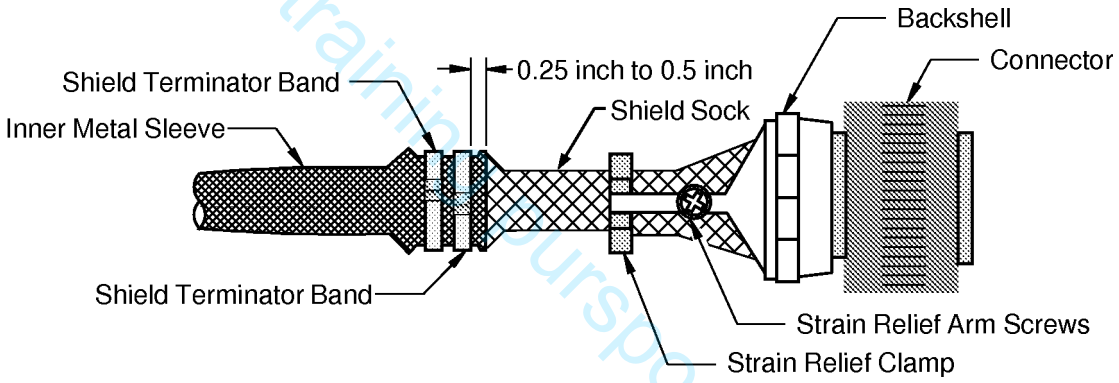
Make sure that the inner metal sleeve makes an overlap with itself on the shield sock.

CAUTION: IF THE INNER METAL SLEEVE DOES NOT MAKE AN OVERLAP WITH ITSELF, UNSATISFACTORY PERFORMANCE OF THE SHIELD OCCURS.

(4) Install the 2 shield terminator bands on the shield termination ring.

Refer to:

- Figure 28
- Subject 20-74-13 for the procedure to install the bands.



SLEEVE TERMINATION ON A SHIELD SOCK SHIELD TERMINATION
Figure 28

(5) Make a selection of the PTFE tape from Table 2.

(6) Put 2 out of 3 layers of the PTFE tape on each band. Refer to Figure 29.

Make sure:

- The center of the tape is aligned with the center of the band
- The edges of the tape are approximately aligned
- The surface of the band cannot be seen.

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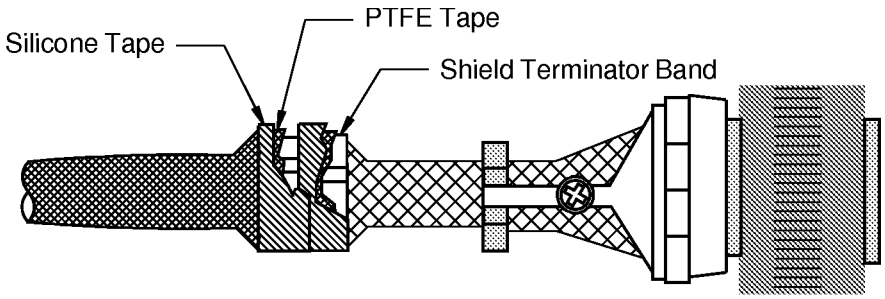
ASSEMBLY AND INSTALLATION OF EMI WRAPPABLE SLEEVES



POSITION OF THE LAYERS OF TAPE ON THE SHIELD TERMINATOR BANDS
Figure 29

(7) Make a selection of Type I silicone tape from Table 2.

(8) Put 2 to 3 layers of the Type I silicone tape on top of the PTFE tape on each band. Refer to Figure 29.

(9) Close the outer textile sleeve around the shield sock.

(10) Assemble a wire harness tie 0.5 inch to 0.75 inch from the end of the outer textile sleeve.

B. Sleeve Termination on a Shield Termination Platform

(1) Fold the outer textile layer back approximately 2 inches.

(2) Put the inner metal sleeve on the shield termination platform of the backshell.

Make sure that:

- The end of the sleeve is against the rear of the backshell
- The sleeve does not make an overlap with the rear of the backshell.

(3) Install the shield terminator band.

Refer to:

- Figure 30
- Subject 20-74-13 for the procedure to install the bands.

Make sure that the buckle on the band:

- Is flat against the shield termination platform
- Does not make an overlap withe the flat side of the shield termination platform
- Does not make an overlap with the collar of the shield termination platform.

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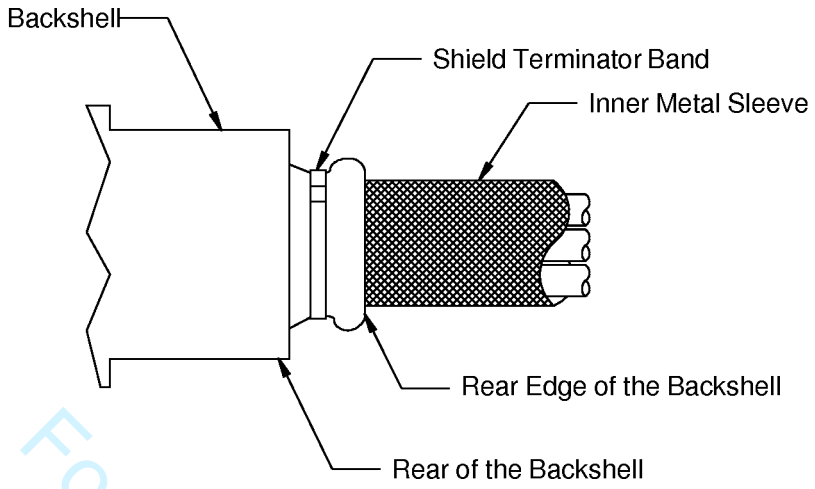


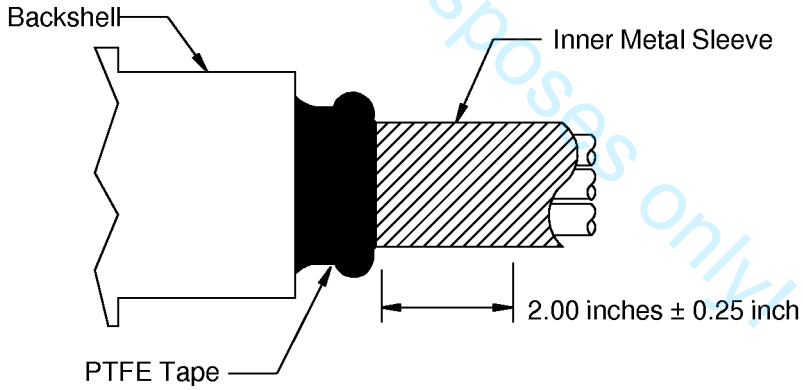
POSITION OF THE BAND ON THE SHIELD TERMINATION PLATFORM
Figure 30

(4) Make a selection of PTFE Tape from Table 2.

(5) Put 2 to 3 layers of the PTFE tape on the shield terminator band. refer to Figure 31.

Make sure that:

- The center of the tape is aligned with the center of the band
- The edges of the tape are approximately aligned
- The surface of the band cannot be seen.



POSITION OF THE LAYER OF TAPE ON THE SHIELD TERMINATOR BAND
Figure 31

(6) Put a layer of 0.5 inch wide Tape I silicone tape on the layers of the PTFE tape.

(7) Fold the outer textile layer forward on the shield terminator band.

Make sure that:

- The end of the sleeve is against the rear of the backshell
- The sleeve does not make an overlap with the rear of the backshell.

NOTE: The flare of the outer textile sleeve at the rear of the backshell is a satisfactory condition.

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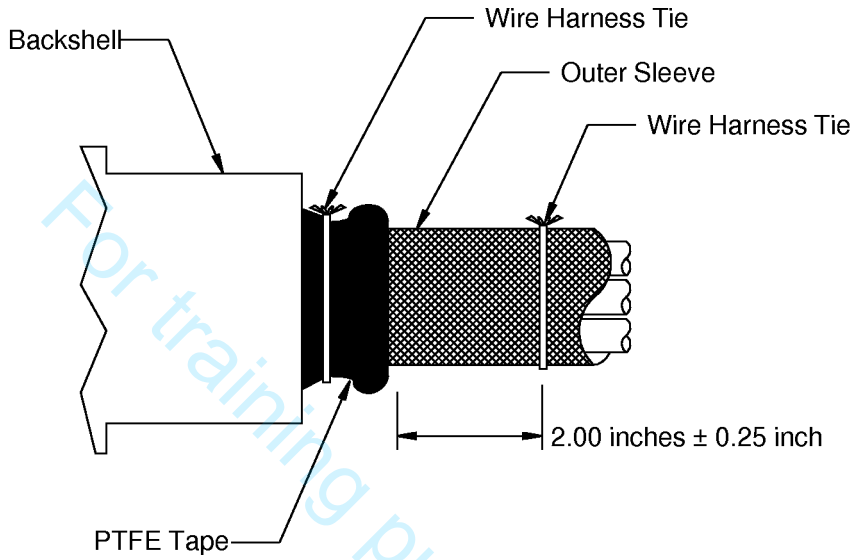
(8) Assemble a wire harness tie on top of outer textile sleeve and the shield terminator band.

Refer to:

- Figure 32
- Subject 20-10-11 for the procedure to assemble the ties.

Make sure that the tie is approximately aligned with the center of the shield terminator band.



POSITION OF THE WIRE HARNESS TIES ON THE OUTER SLEEVE
Figure 32

(9) Assemble a wire harness tie 2.00 inches ±0.25 inch rearward from the collar of the shield termination platform of the backshell.

Refer to:

- Figure 32
- Subject 20-10-11 for the procedure to assemble the ties.

C. Installation of a Shield Ground Wire at the End of the Sleeve - AWG 18 or Smaller Shield Ground Wire

(1) If the shield ground wire is insulated, remove 0.7 inch ±0.1 inch of insulation from the end of the wire. Refer to Subject 20-00-15 for insulation removal procedures.

(2) Fold the outer textile sleeve and the inner metal sleeve back away from the location for the shield termination ring.

(3) Install the shield termination ring at the specified location on the wire harness. Refer to Paragraph 3.B..

(4) Close the inner metal sleeve around the shield termination platform.

(5) Assemble a shield ground wire with a shield termination band.

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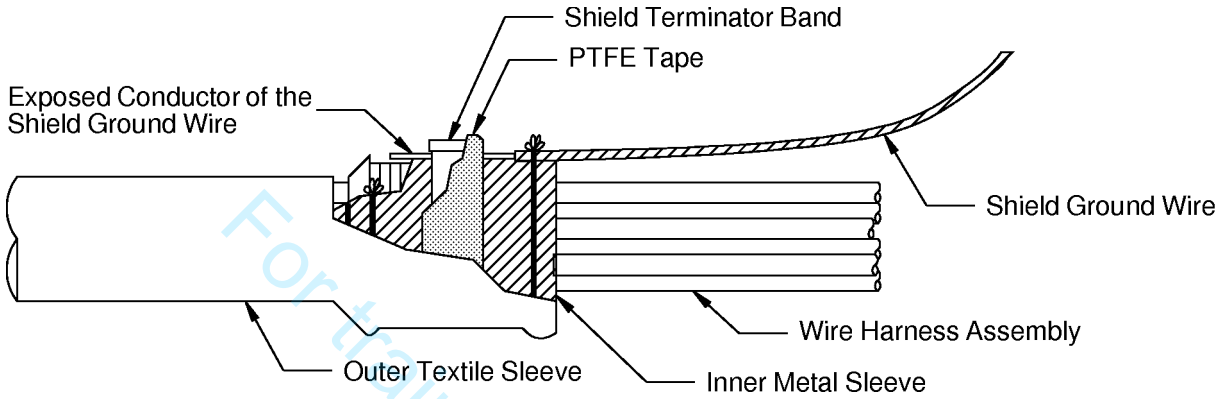
Refer to:

- Figure 33
- Subject 20-74-13 for the procedure to install the bands.

Make sure that the center of the length of conductor without insulation is approximately aligned with the center of the shield termination ring.



POSITION OF THE SHIELD GROUND WIRE
Figure 33

(6) Make a selection of PTFE tape from Table 2.

(7) Put 1 to 2 layers of the PTFE tape on the shield terminator band. Refer to Figure 33.

Make sure that:

- The center of the tape is aligned with the center of the band
- The edges of the tape are approximately aligned
- The surface of the band cannot be seen.

(8) Close the outer textile sleeve around the wire harness.

(9) Make a selection of Type II silicone tape from Table 2.

(10) Put a layer of Type II silicone tape on the sleeve termination. Refer to Figure 34

Make sure that the layer of tape:

- Starts 1.00 inch ± 0.25 inch rearward from the shield terminator band
- Ends 0.50 inch ± 0.25 inch forward from the end of the outer textile sleeve.

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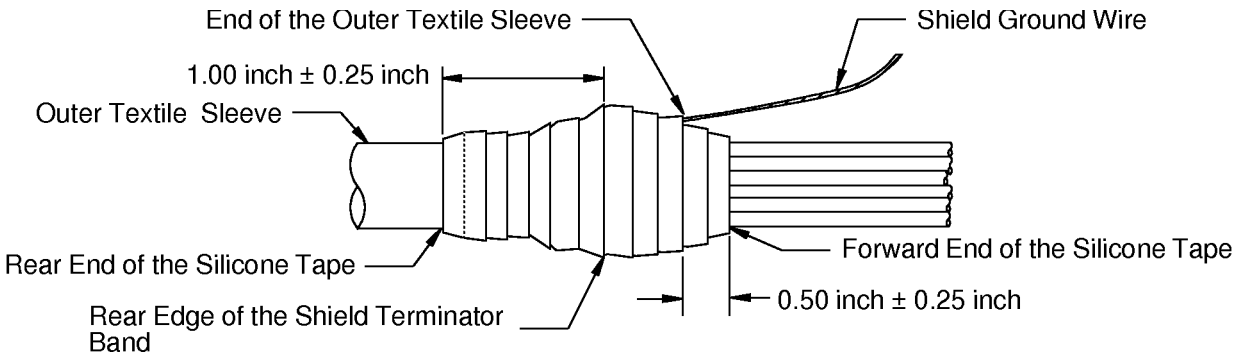


POSITION OF THE LAYER OF THE SILICONE TAPE
Figure 34

D. Installation of a Shield Ground Wire at the End of the Sleeve - AWG 16 or Larger

(1) Remove 1.1 inch ± 0.1 inch of insulation from the end of the wire. Refer to Subject 20-00-15 for insulation removal procedures.

(2) Move the strands of the conductor apart.

(3) Fold the outer textile sleeve and the inner metal sleeve back away from the location for the shield termination ring.

(4) Install the shield termination ring at the specified location on the wire harness. Refer to Paragraph 3.B..

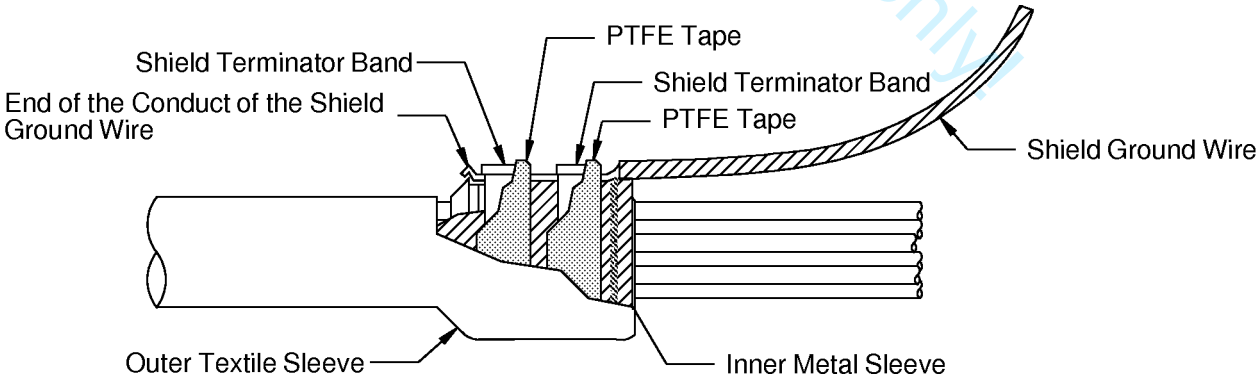
(5) Close the inner metal sleeve around the shield termination platform.

(6) Assemble a shield ground wire with two shield termination bands.

Refer to:

- Figure 35
- Subject 20-74-13 for the procedure to install the bands.

Make sure that the center of the length of conductor without insulation is approximately aligned with the center of the shield termination ring.



POSITION OF THE SHIELD GROUND WIRE
Figure 35

(7) Make a selection of PTFE tape from Table 2.

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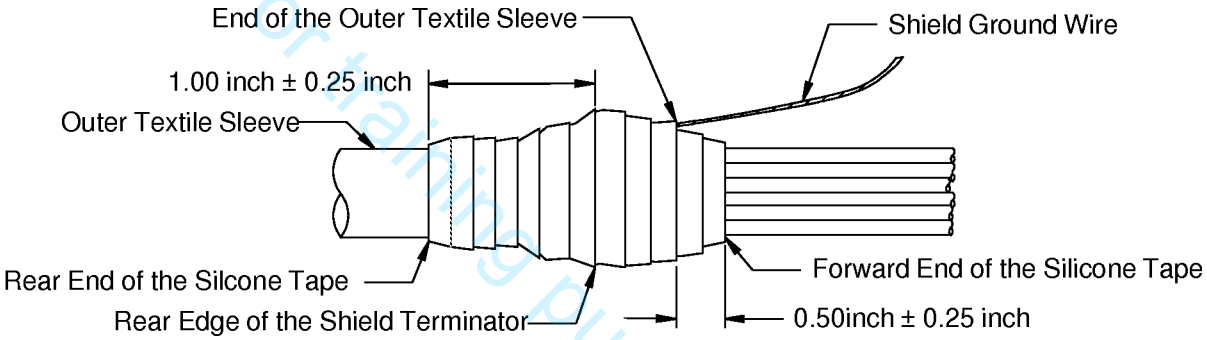
(8) Put 1 to 2 layers of the PTFE tape on each shield termination band. Refer to Figure 35.
Make sure that:
- The center of the tape is aligned with the center of the band
- The edges of the tape are approximately aligned
- The PTFE tape covers the shield terminator band completely.

(9) Close the outer textile layer around the wire harness.

(10) Make a selection of Type II silicone tape from Table 2.

(11) Put a layer of Type II silicone tape on the sleeve termination. Refer to Figure 36.
Make sure that:
- Starts 1.00 inch ± 0.25 inch rearward from the rear shield terminator band
- Ends 0.50 inch ±0.25 inch forward from the end of the outer textile sleeve.

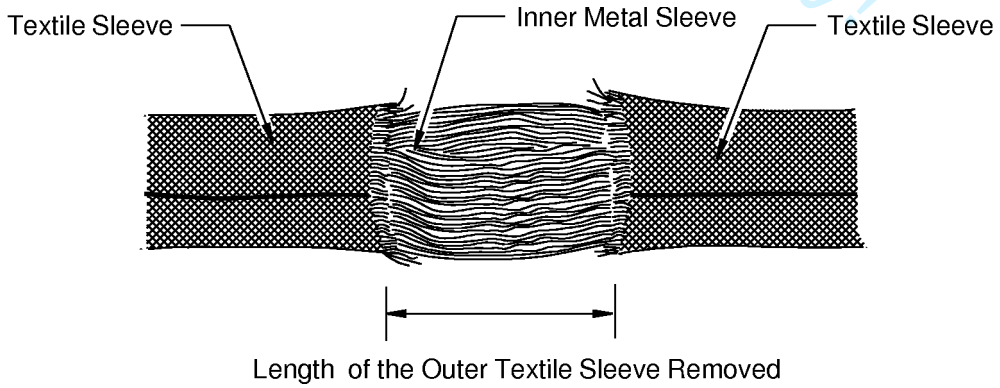


POSITION OF THE LAYERS OF THE SILICONE TAPE
Figure 36

E. Sleeve Termination with a Shield Ground Wire- Not at the End of the Sleeve

(1) Remove the length of the outer textile sleeve that is equal to the length of the shield termination ring + 0.25 inch, -0.0 inch. Refer to Figure 37

CAUTION: DO NOT CUT THE INNER METAL SLEEVE. DAMAGE TO THE SLEEVE CAN CAUSE UNSATISFACTORY PERFORMANCE OF THE SHIELD



REMOVAL OF THE LENGTH OF THE OUTER TEXTILE SLEEVE
Figure 37

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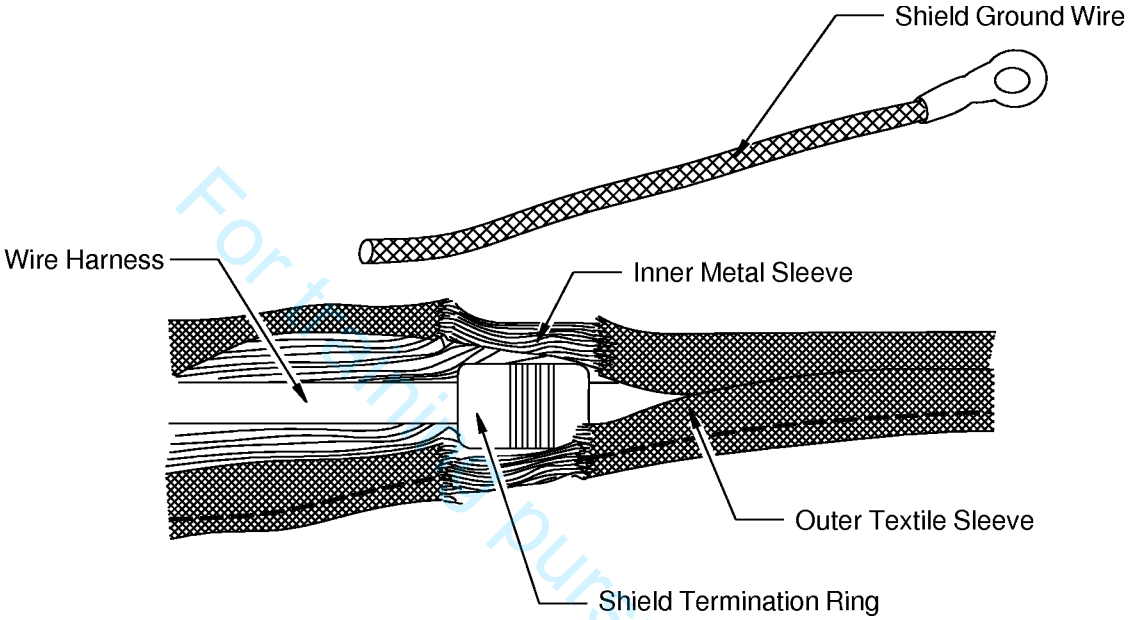
(2) Open the inner metal sleeve.

(3) Install the shield termination ring on the wire harness.

Refer to:

- Figure 38
- Paragraph 3.B. for the procedure to install the shield termination ring.



POSITION OF THE SHIELD TERMINATION RING
Figure 38

(4) Close the sleeve around the shield termination ring.

(5) If the shield ground wire is insulated, remove 1.0 inch ± 0.2 inch of insulation from the end of the wire. Refer to Subject 20-00-15 for insulation removal procedures.

(6) Assemble a shield ground wire with a shield termination band.

Refer to:

- Figure 39 and Figure 40
- Subject 20-74-13 for the procedure to install the bands.

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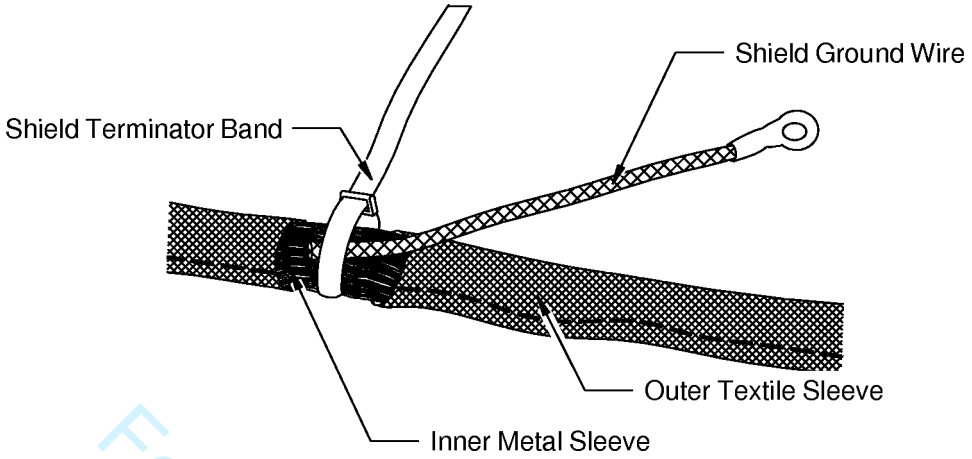
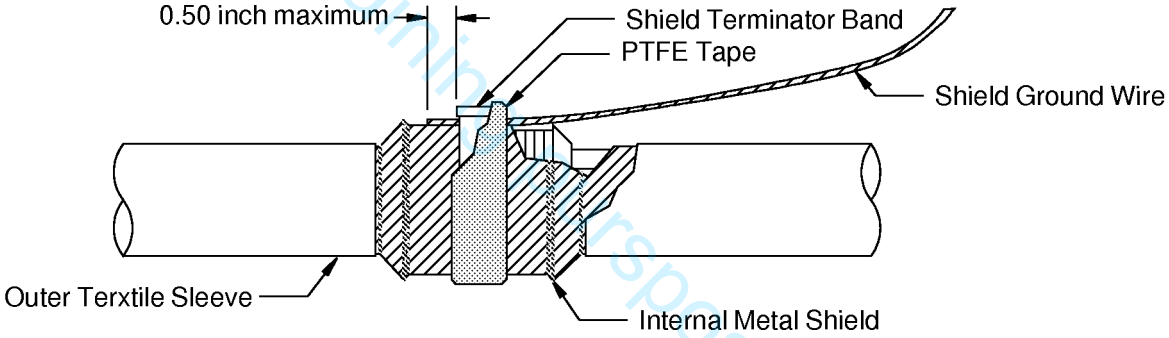


POSITION OF THE SHIELD TERMINATOR BAND
Figure 39



POSITION OF SHIELD GROUND WIRE
Figure 40

(7) Make a selection of PTFE tape from Table 2.

(8) Put 1 to 2 layers of the PTFE tape on the shield terminator band. Refer to Figure 40
Make sure that:
- The center of the tape is aligned with the center of the band
- The edges of the tape are approximately aligned
- The PTFE tape covers the shield terminator band completely.

(9) Make a selection of Type I silicone tape from Table 2.

(10) Put 2 to 3 layers of the Type I silicone tape on the layers of the PTFE tape.

(11) Put 1.5 to 3 layers of the Type I silicone tape on:
- Each end of the outer textile sleeve that is adjacent to the inner metal sleeve
- The end of the shield ground wire at the shield terminator band.

(12) Make a selection of Type II silicone tape from Table 2.

(13) Put a layer of the Type II silicone tape on the sleeve termination. Refer to Figure 41

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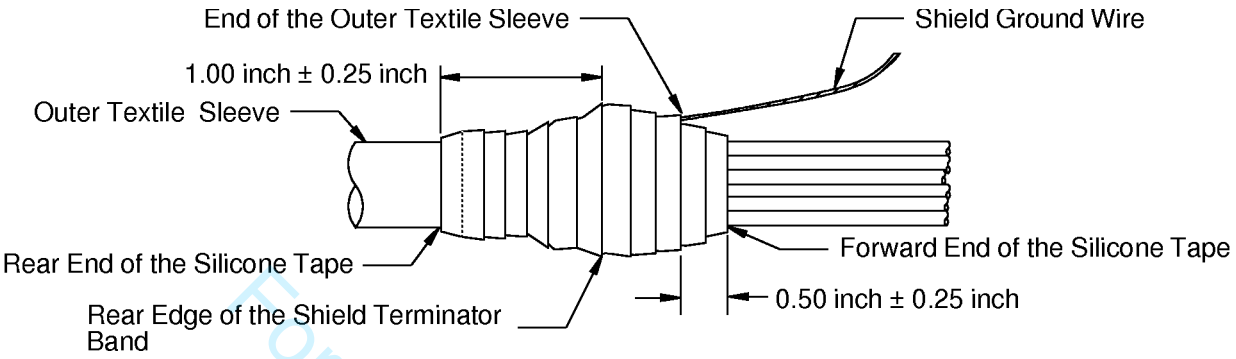
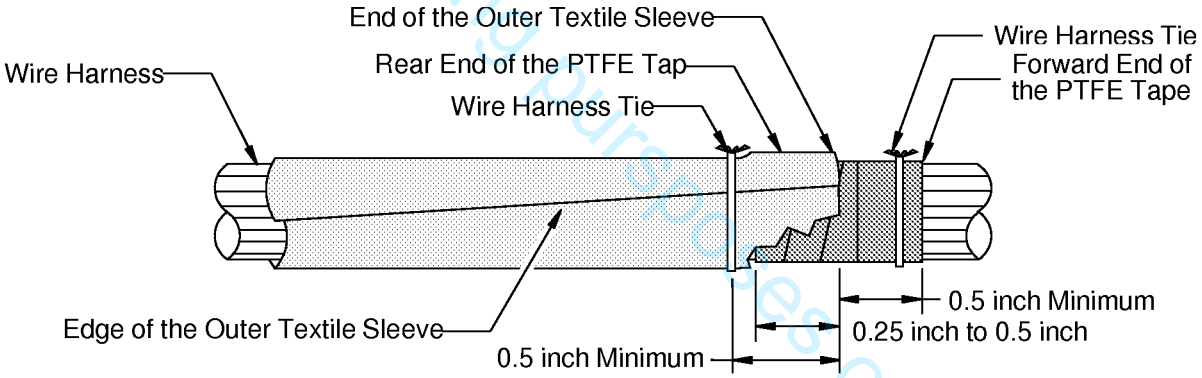
Make sure that:

- Starts 1.00 inch ± 0.25 inch rearward from the rear shield terminator band
- Ends 0.50 inch ± 0.25 inch forward from the end of the outer textile sleeve.



POSITION OF THE LAYERS OF THE SILICONE TAPE
Figure 41

F. Sleeve Termination - Sleeve Dead End



SLEEVE DEAD END
Figure 42

(1) Put 2 to 3 layers of PTFE tape on the wire harness at the end of the sleeve. Refer to Figure 42

Make sure that:

- The forward end of the tape extends forward a minimum 0.5 inch from the end of the sleeve
- The rear end of the tape extends rearward 0.25 inch to 0.5 inch from the end of the sleeve
- The tape makes a 100 percent overlap at the forward end.

(2) Assemble a wire harness tie on the sleeve 0.5 inch minimum from the end of the sleeve.

(3) Assemble a wire harness tie on the tape approximately 0.25 inch rearward from the forward end of the tape.

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5. REMOVAL OF THE EMI WRAPPABLE SLEEVE

A. Sleeve Removal

NOTE: The tools for the removal of the tape, the shield terminator band, and the wire harness ties can cause damage to the sleeve.

(1) Remove the tape on the shield terminator band.

(2) Remove the shield terminator band.

(3) Remove the wire harness tie on the sleeve.

(4) Remove the tape the shield terminator band at the breakouts.

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INSTALLATION OF BMS13-82 PROTECTIVE SLEEVES

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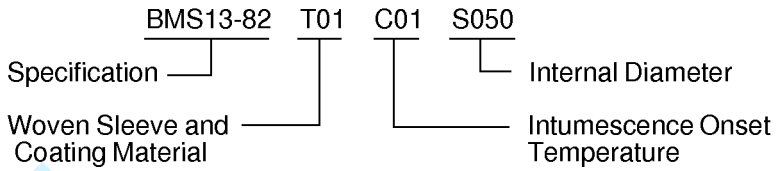
INSTALLATION OF BMS13-82 PROTECTIVE SLEEVES

1. PART NUMBER AND DESCRIPTION

A. Thermal Protective Sleeve Part Number

BMS 13-82 thermal protective sleeve is a woven sleeve that uses the intumescent properties of the sleeve coating material to protect enclosed electrical wire from the effects of thermal environments in which the temperature exceeds 230C.



BMS13-82 PART NUMBER STRUCTURE
Figure 1

Table 1
DEFINITIONS

Technical Term	Definition
Intumescent Coating	A coating that is applied to a surface for the purpose of providing a heat resistant barrier. In the presence of a sufficient amount of heat, the coating generates carbonaceous foam, which provides a thermal barrier against heat penetration.
Intumescence Onset Temperature	The temperature at which the carbonaceous foam begins to generate when an intumescent material is exposed to a high temperature environment.

2. INSTALLATION OF BMS13-82 PROTECTIVE SLEEVES

A. Sleeve Installation Preparation

Table 2
NECESSARY TOOLS

Tool	Supplier
Scissors	An available source
Cutter	An available source

(1) Make a selection of one of these tools from Table 2.
- A pair of scissors
- A cutter with a sharp blade.

(2) Cut the necessary lengths of the sleeve. Refer to Table 3.

Table 3
CONFIGURATION OF THE SLEEVE

Applicable Conditions	Assembly Procedure
At the rear of a connector that has a backshell without a shield sock	Paragraph 3.A.
At the rear end of a shield termination ring of a shield sock backshell assembly	Paragraph 3.C.
At the rear end of a wire seal of a BACS31T seal fitting assembly	Paragraph 3.E.

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Table 3 (continued)

Applicable Conditions	Assembly Procedure
At a breakout where the wires of the breakout come from the same direction	Paragraph 3.H.
At a breakout where the wires of the breakout come from different directions	Paragraph 3.I.

B. Sleeve Installation-Wire Harness without a Branch

(1) Put the sleeve on the wire harness.

(2) Assemble the sleeve termination at one end of the wire harness. Refer to Table 4.

Table 4
SLEEVE TERMINATION CONFIGURATION

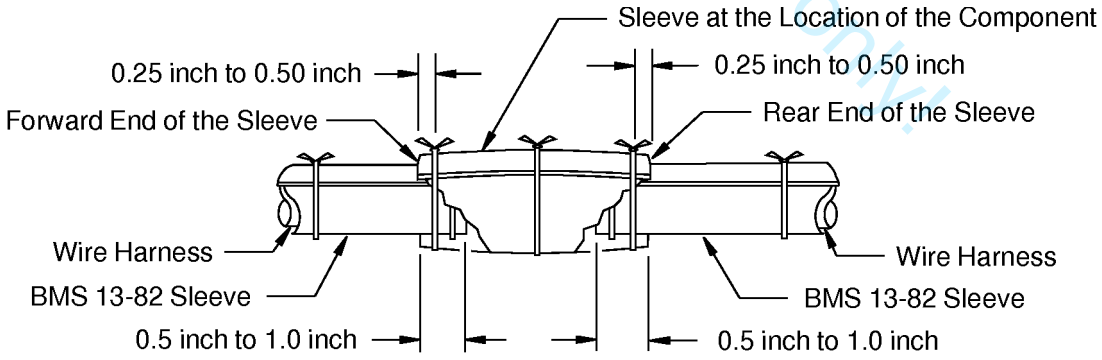
Termination Configuration	Assembly Procedure
Sleeve termination at a circular strain relief backshell that does not have a shield sock	Paragraph 3.A.
Sleeve termination at a circular strain relief backshell that has a shield sock	Paragraph 3.C.
Sleeve termination at the end of a wire seal for a BACS31T seal fitting assembly	Paragraph 3.E.
Sleeve termination at a wire termination	Paragraph 3.F.
Sleeve termination at a location on the length of a wire harness or branch	Paragraph 3.G.

(3) Assemble the temperature grade D lacing tape wire harness ties on the length of the sleeve toward the other sleeve termination at a maximum interval of 2 inches.

Make sure that the sleeve makes a circumferential overlap with itself that is not less than 0.125 inch.

(4) If the wire harness has an electronics component:

(a) Cut the necessary length of the sleeve that has the correct fit on the component. Refer to Figure 2.



POSITION OF THE SLEEVE ON THE COMPONENT
Figure 2

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Make sure that:

- The forward end of the sleeve makes a 0.5 inch to 1.0 inch overlap with the rear end of the short sleeve
- The rear end of the sleeve makes a 0.5 inch to 1.0 inch overlap with the forward end of the long sleeve
- The sleeve can make a circumferential overlap with itself that is not less than 0.125 inch.

(b) Assemble a temperature grade D lacing tape wire harness tie 0.25 inch to 0.5 inch from each end of the sleeve. Refer to Figure 2.

Make sure that the sleeve makes a circumferential overlap with itself that is not less than 0.125 inch.

(5) Assemble the sleeve termination at the end of the wire harness. Refer to Table 4.

(6) For a wire harness that has a backshell at each end:

(a) Wind a layer of tape tightly around the wire harness from approximately 0.5 inch from the rear edge of the strain relief clamp on one end to approximately 0.5 inch from the rear edge of the strain relief clamp on the other end.

Make sure that:

- Continuous tension is applied to the tape
- Each layer of the tape makes a 50 percent to 60 percent overlap
- The tape is installed on the full length of the sleeve.

(b) Assemble a lacing tape wire harness tie on the layer of tape at 0.25 inch to 0.50 inch from the each end of the tape.

(7) For a wire harness that has a wire seal at one end:

(a) Wind a layer of tape tightly around the wire harness from approximately 0.5 inch from the rear edge of the strain relief clamp to a distance that makes a 0.50 inch to 0.75 inch overlap with the forward end of the tape of the wire seal.

Make sure that:

- Continuous tension is applied to the tape
- Each layer of the tape makes a 50 percent to 60 percent overlap.
- The tape is installed on the full length of the sleeve.

(b) Assemble a lacing tape wire harness tie on the layer of tape at 0.25 inch to 0.50 inch from the each end of the tape.

(8) For a wire or a wire harness that does not have termination at the end of the sleeve:

(a) Wind a layer of tape tightly around the wire harness from 0.5 inch to 1 inch farther than the end of the sleeve to:

- 0.5 inch to 1 inch from the rear edge of the strain relief clamp of a backshell on the other end
- 0.5 inch to 0.75 inch farther than the nearest end of the tape of a wire seal on the other end.

Make sure that:

- The last 1.5 to 2.0 layers of the tape make approximately a 100 percent overlap
- The tape installed on the full length of the sleeve.

(b) Assemble a string tie on the layer of the tape 0.25 inch to 0.5 inch from the end of the tape.

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C. Sleeve Installation-Wire Harness with a Branch

(1) Put the sleeves on the wire harness.

(2) Assemble the sleeve termination at the end of the breakout. Refer to Table 5.

Table 5
SLEEVE TERMINATION CONFIGURATION

Termination Configuration	Assembly Procedure
Sleeve termination at a circular strain relief backshell that does not have a shield sock	Paragraph 3.A.
Sleeve termination at a circular strain relief backshell that has a shield sock	Paragraph 3.C.
Sleeve termination at the end of a wire seal for a BACS31T seal fitting assembly	Paragraph 3.E.
Sleeve termination at a wire termination	Paragraph 3.F.
Sleeve termination at a location on the length of a wire harness or branch	Paragraph 3.G.

(3) Assemble the temperature grade D wire harness ties on the length of the sleeve toward the breakout at a maximum interval of 2 inches. Refer to Subject 20-10-11.

Make sure that the sleeve makes a circumferential overlap with itself that is not less than 0.125 inch.

(4) Assemble the sleeve termination at the end of the main wire harness that is forward from the breakout. Refer to Table 5.

(5) Assemble with the temperature grade D wire harness ties on the length of the sleeve toward the breakout at a maximum interval of 2 inches. Refer to Subject 20-10-11.

Make sure that the sleeve makes a circumferential overlap with itself that is not less than 0.125 inch.

(6) Assemble the sleeve termination at the end of the main wire harness rearward from the breakout. Refer to Table 5.

(7) Assemble the sleeve terminations at the breakout.

- For a wire harness where the wires of the breakout come from the same direction, refer to Paragraph 3.H.
- For a wire harness where the wires of the breakout come from the different directions, refer to Paragraph 3.I.

(8) if the branch has a backshell at the end:

(a) Wind a layer of tape tightly around the branch approximately 0.5 inch from the rear edge of the strain relief clamp toward the breakout.

Make sure that:

- Continuous tension is applied to the tape
- Each layer of the tape makes a 50 percent to 60 percent overlap
- The tape is installed on the full length of the sleeve.

(b) Continue to wind the tape around the branch until the tape is against the breakout.

(c) For a branch where the wires of the breakout come from one direction, continue to wind the tape around the wire harness until the tape makes an overlap with the initial end of the breakout. Refer to Figure 3.

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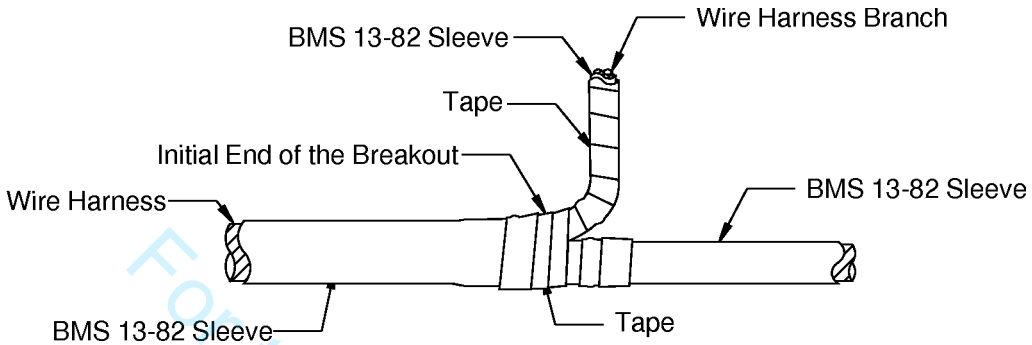
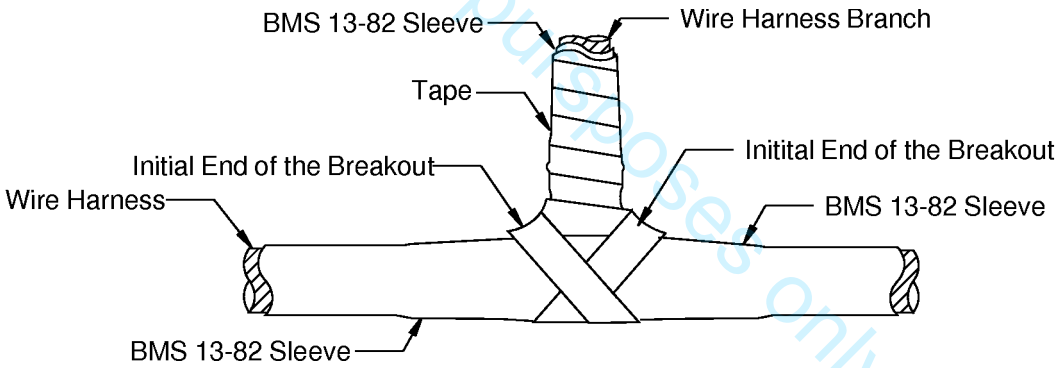
Make sure that:

- Continuous tension is applied to the tape
- Each layer of the tape makes 50 percent to 60 percent overlap
- The tape is installed on the full length of the sleeve on the branch.



WIRE HARNESS BRANCH-BREAKOUT FROM ONE DIRECTION
Figure 3

(d) For a branch where the wires of the breakout come from two directions, continue to wind the tape around the wire harness from the initial end of the one breakout to the initial end of other breakout. Refer to Figure 4.



WIRE HARNESS BRANCH-BREAKOUT FROM TWO DIRECTIONS
Figure 4

(9) If the branch has a wire seal at the end:

(a) Wind a layer of tape tightly around the branch 0.50 inch to 0.75 inch rearward from the forward end of the tape of the wire seal toward the breakout.

Make sure that:

- Continuous tension is applied to the tape
- Each layer of the tape makes a 50 percent to 60 percent overlap
- The tape is on the full length of the sleeve.

(b) Continue to wind the tape around the branch until the tape is against the initial end of the breakout.

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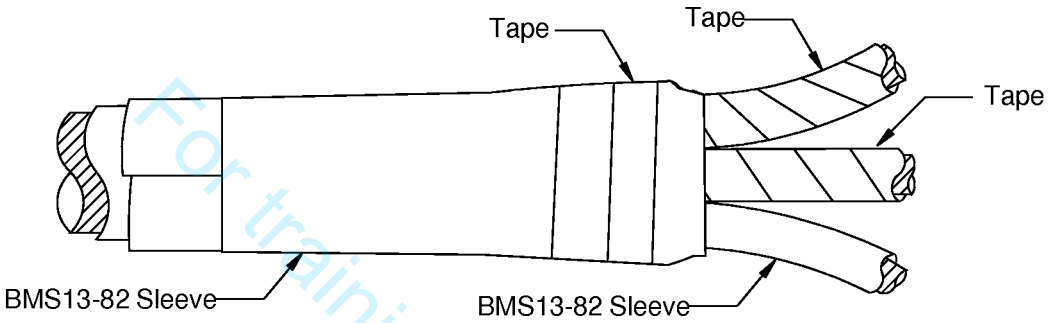
(c) Continue to wind the tape around the wire harness until the tape makes an overlap with the initial end of the breakout. Refer to Figure 3.

Make sure that:

- Continuous tension is applied to the tape
- Each layer of the tape makes a 50 percent to 60 percent overlap
- The tape is installed on the full length of the sleeve on the branch.

(d) For a breakout with 3 branches, repeat step (a) and Step (b) again for the second branch. Refer to Figure 5



WIRE HARNESS BRANCH-BREAKOUT FROM ONE DIRECTION
Figure 5

(10) If the branch has a wire termination at the end:

(a) Wind a layer of tape tightly around the branch 0.2 inch to 0.3 inch rearward from the forward end of the termination toward the breakout.

Make sure that:

- Continuous tension is applied to the tape
- Each layer of the tape makes a 50 percent to 60 percent overlap.

(b) Continue to wind the tape around the branch until the tape is against the initial end of the breakout.

(c) Wind the tape around the wire harness from the initial end of one breakout to the initial end of the other breakout. Refer to Figure 4.

(11) For a wire harness branch that has a wire termination at the end of the branch:

(a) Wind a layer of tape tightly around the branch 0.2 inch to 0.3 inch rearward from the forward end of the termination toward the breakout.

Make sure that:

- Continuous tension is applied to the tape
- Each layer of the tape makes a 50 percent to 60 percent overlap
- The tape is on the full length of the sleeve.

(b) Continue to wind the tape around the branch until the tape is against the initial end of the breakout.

(c) For a branch where the wires of the breakout come from one direction, continue to wind the tape around the wire harness until the tape makes an overlap with the initial end of the breakout. Refer to Figure 3.

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Make sure that:

- Continuous tension is applied to the tape
- Each layer of the tape makes a 50 percent to 60 percent overlap
- The tape is installed on the full length of the sleeve on the branch.

(d) For a branch where the wires of the breakout come from two directions, continue to wind the tape around the wire harness from the initial end of one breakout to the initial end of the other breakout. Refer to Figure 4.

(12) For a wire harness that has a backshell at each end:

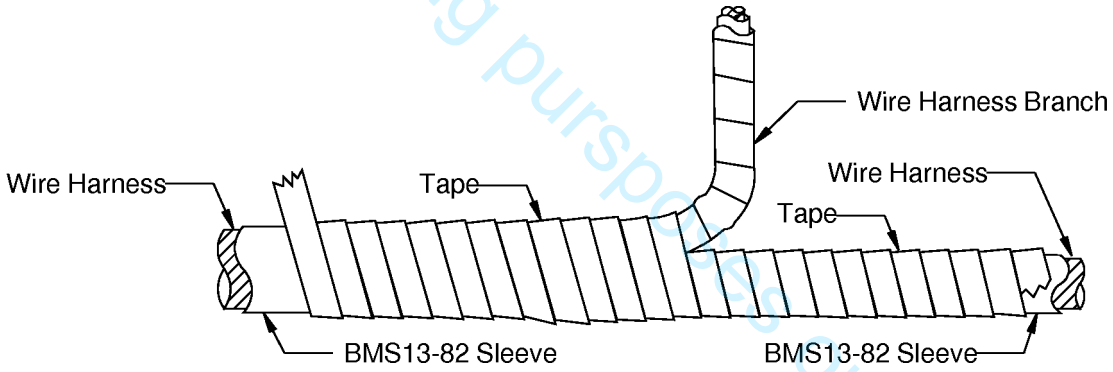
(a) Wind a layer of tape tightly around the wire harness from 0.5 inch to 1 inch from the rear edge of the strain relief clamp on one end to 0.5 inch to 1 inch from the rear edge of the strain relief clamp on the other end.

Make sure that:

- Continuous tension is applied to the tape
- Each layer of the tape makes a 50 percent to 60 percent overlap
- The tape is installed on the full length of the sleeve.

Refer to:

- Figure 6 for a branch where the wires of the breakout come from the same direction
- Figure 7 for a branch where the wires of the breakout come from the different directions.



WIRE HARNESS-BREAKOUT FROM ONE DIRECTION
Figure 6

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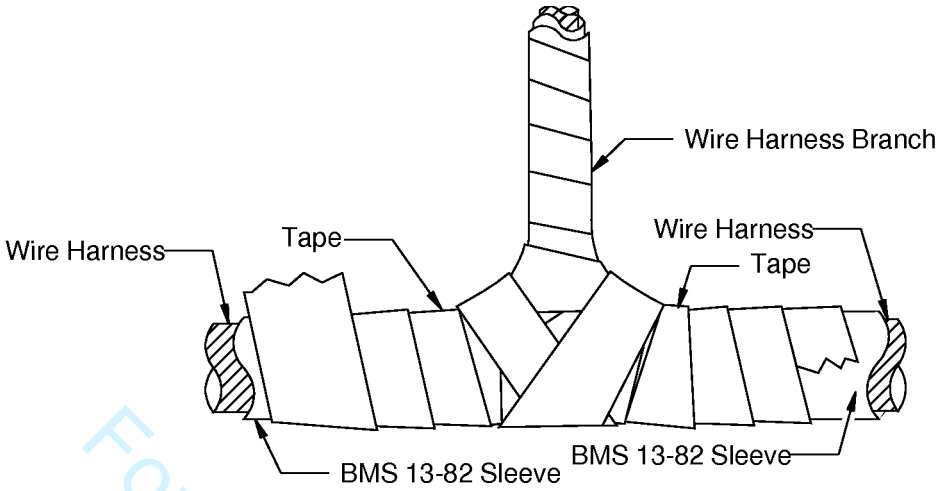

WIRE HARNESS-BREAKOUT FROM TWO DIRECTIONS
Figure 7

(b) Assemble a string tie on the layer of tape at 0.25 inch to 0.5 inch from each end of the tape.

(13) For a wire harness that has a wire seal at one end:

(a) Wind a layer of tape tightly around the wire harness from 0.5 inch to 1 inch from the rear edge of the strain relief clamp to 2.6 inches to 2.8 inches from the center line of the sealant tape of the wire seal.

Make sure that:

- Continuous tension is applied to the tape
- Each layer of the tape makes a 50 percent to 60 percent overlap
- The tape is installed on the full length of the sleeve.

Refer to:

- Figure 6 for a branch where the wires of the breakout come from the same direction
- Figure 7 for a branch where the wires of the breakout come from the different directions.

(b) Assemble a string tie on the layer of tape at 0.25 inch to 0.5 inch from each end of the tape.

(14) For a wire or a wire harness that does not have termination at the end of the sleeve:

(a) Wind a layer of tape tightly around the wire harness from 0.5 inch to 1 inch farther than the end of the sleeve to:

- 0.5 inch to 1 inch from the rear edge of the strain relief clamp of a backshell on the other end
- 0.5 inch to 0.75 inch farther than the nearest end of the tape of a wire seal on the other end.

Make sure that:

- The last 1.5 to 2 layers of the tape make approximately a 100 percent overlap
- The tape is installed on the full length of the sleeve.

Refer to:

- Figure 6 for a branch where the wires of the breakout come from the same direction
- Figure 7 for a branch where the wires of the breakout come from the different directions.

(b) Assemble a string tie on the layer of tape at 0.25 inch to 0.5 inch from each end of the tape.

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3. TERMINATION OF BMS13-82 PROTECTIVE SLEEVES

A. Sleeve Termination at a Circular Strain Relief Backshell - On the Wire Harness

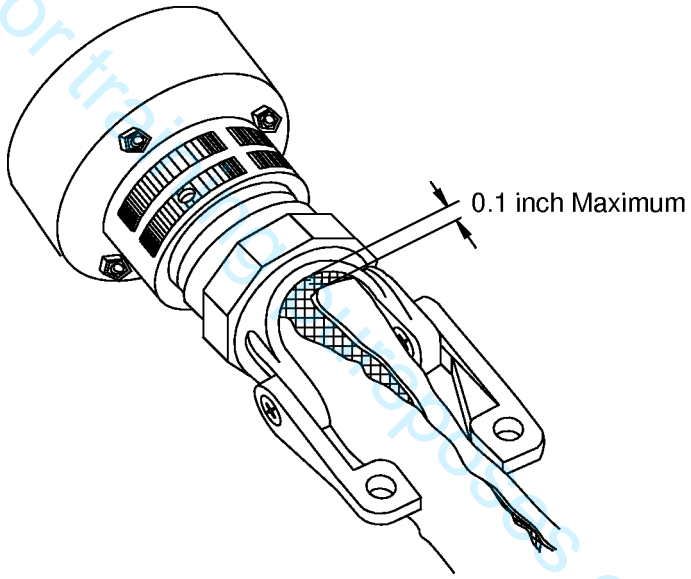
This paragraph gives the procedure to put the sleeve termination between the wire harness and the strain relief of the backshell. If the area between the wire harness and the strain relief of the backshell is not sufficient for the layers of the sleeve, the sleeve termination can be put on the strain relief of the backshell. Refer to paragraph 3.B..

(1) If the strain relief clamp is installed, remove the clamp.

(2) Align the end of the sleeve and the rear end of the connector. Refer to Figure 8.

Make sure that:

- The end of the sleeve is not farther than 0.10 inch from the rear end of the connector
- The sleeve can make a circumferential overlap with itself that is not less than 0.125 inch.



POSITION OF THE SLEEVE ON THE WIRE HARNESS
Figure 8

(3) If the circumferential overlap of the sleeve at the strain relief clamp is more than 0.2 inch and the saddle bars of the clamp cannot go against the legs of the backshell, do the following steps:

(a) Put the sleeve on the wire harness between the shield termination ring and rear end of the connector.

(b) Make a mark on the end of the inner layer of the sleeve 0.16 inch ±0.03 inch from the edge of the outer layer.

(c) Remove the sleeve from the wire harness.

(d) Make a longitudinal cut on the sleeve at the mark.

(e) Put the sleeve on the wire harness.

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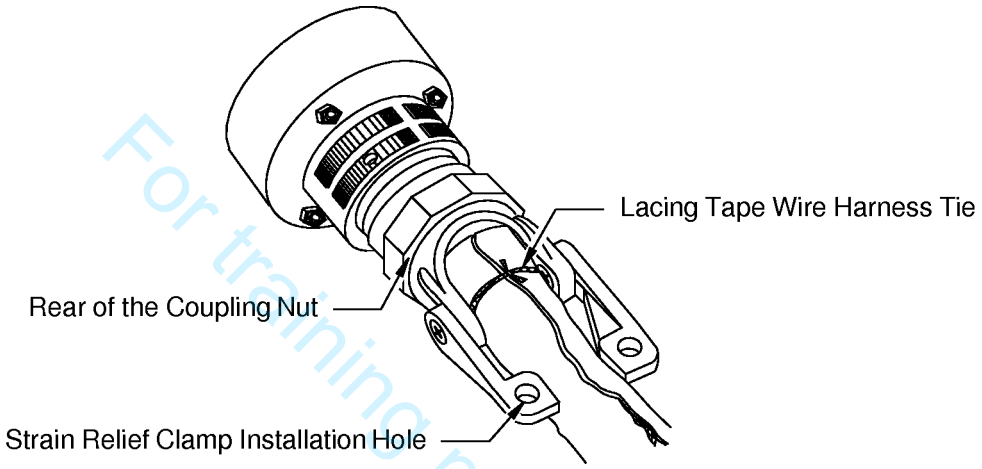
Make sure that:

- The edge that is cut is adjacent to the wire harness
- The sleeve can make a circumferential overlap with itself that is not less than 0.125 inch.

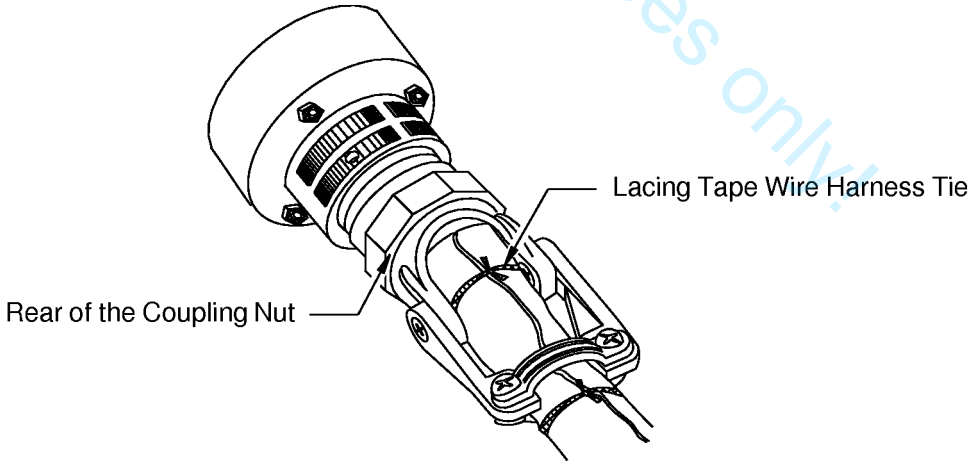
(4) Assemble a temperature grade D lacing tape wire harness tie on the sleeve between the installation holes for the strain relief clamp and the rear of the backshell coupling nut. Refer to Subject 20-10-11 and Figure 9.

Make sure that the sleeve makes a circumferential overlap with itself that is not less than 0.125 inch.



POSITION OF THE LACING TAPE WIRE HARNESS TIE ON THE SLEEVE
Figure 9

(5) Assemble a temperature grade D lacing tape wire harness tie approximately 0.5 inch from the rear of the location of the strain relief clamp installation. Refer to Subject 20-10-11 and Figure 10.



POSITION OF THE SECOND LACING TAPE WIRE HARNESS TIE ON THE SLEEVE
Figure 10

(6) Install the strain relief clamp.

(7) Install the protective tape. Refer to Paragraph 4.A..

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B. Sleeve Termination at a Circular Strain Relief Backshell - On the Strain Relief

The paragraph is applicable if the space between the wire harness and the strain relief of the backshell is not sufficient for the layers of the sleeve, then the sleeve termination can be put on the strain relief of the backshell.

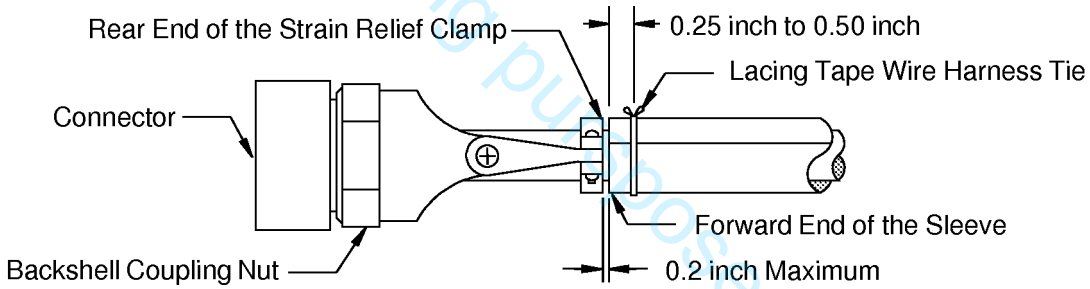
Table 6
NECESSARY TOOLS

Tool	Supplier
Scissors	An available source
Cutter	An available source

(1) Make a selection of one of the these tool from Table 6.
- A pair of scissors
- A cutter with a sharp blade.

(2) Align the end of the sleeve and the rear end of the strain relief clamp. Refer to 11.

Make sure that:
- The end of the sleeve is not farther than 0.2 inch from the rear end of the strain relief clamp
- The sleeve can make a circumferential overlap with itself that is not less than 0.125 inch.



POSITION OF THE END OF THE SLEEVE ON THE WIRE HARNESS
Figure 11

(3) Assemble a temperature grade D lacing tape wire harness tie on the sleeve 0.25 inch to 0.5 inch from the forward end of the sleeve. Refer to Subject 20-10-11 and Figure 11.

(4) If one sleeve can make a minimum 0.125 inch circumferential overlap with itself on the backshell:

(a) Cut the necessary length of a sleeve that has the correct fit on the backshell.

(b) Put the sleeve on the backshell.

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INSTALLATION OF BMS13-82 PROTECTIVE SLEEVES

Refer to:

- Figure 12 for the overlap of the sleeve around the strain relief
- Figure 13 for the position of the sleeve on a straight backshell
- Figure 14 for the position of the sleeve on a 45 degree backshell
- Figure 15 for the position of the sleeve on a 90 degree backshell.

Make sure that:

- The sleeve makes a circumferential overlap with itself that is not less than 0.125 inch
- The forward end of the sleeve is 0.1 inch to 0.3 inch from the rear edge of the connector coupling nut
- The rear end of the sleeve makes a 0.5 inch to 1 inch overlap with the wire harness sleeve.

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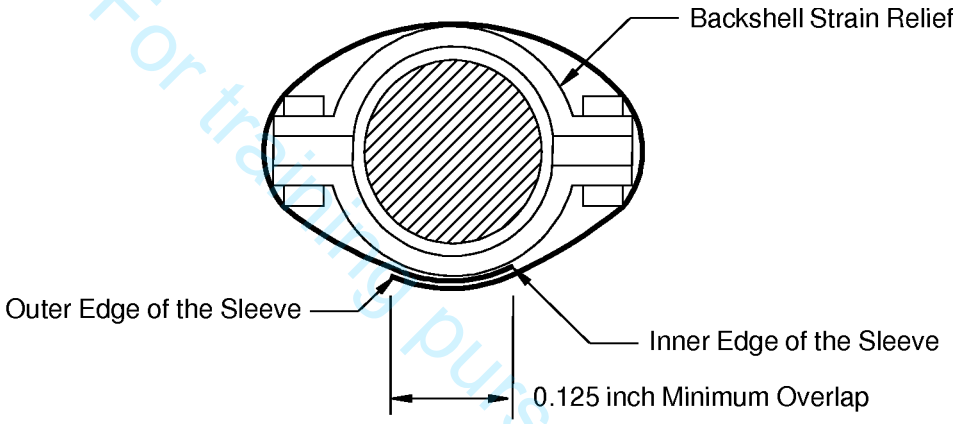
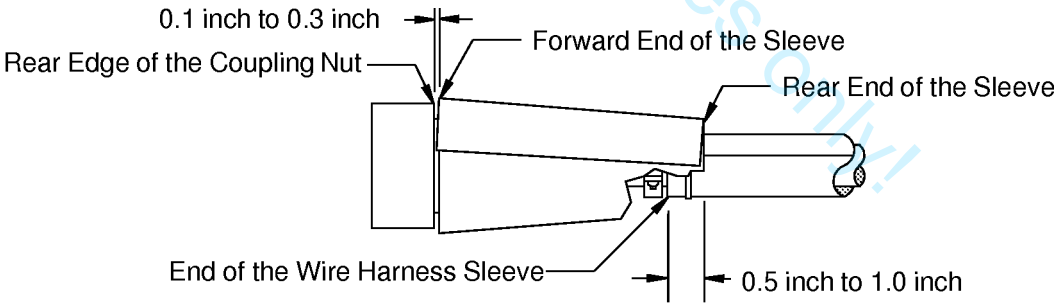


POSITION OF THE SLEEVE ON THE BACKSHELL STRAIN RELIEF
Figure 12



POSITION OF THE SLEEVE ON A STRAIGHT BACKSHELL
Figure 13

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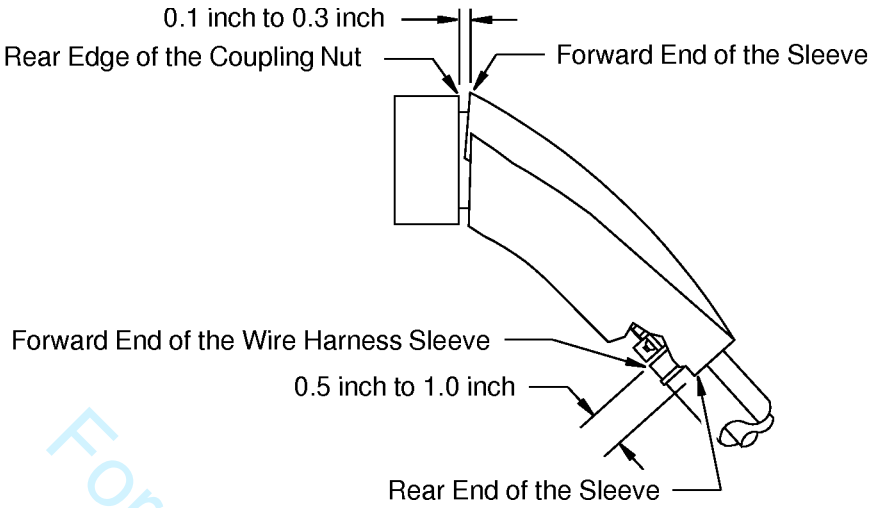
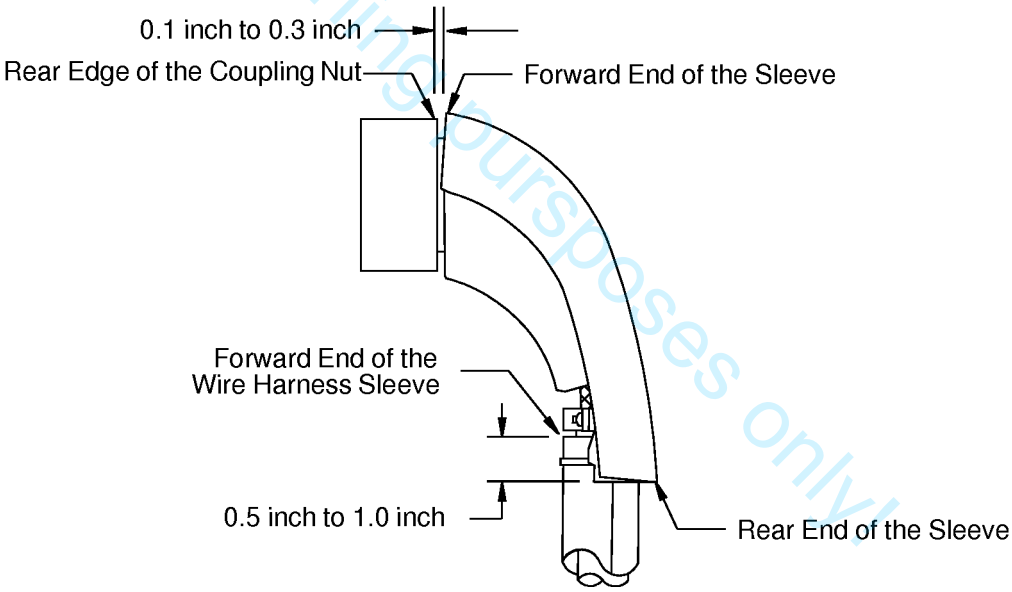


POSITION OF THE SLEEVE ON A 45 DEGREE BACKSHELL
Figure 14



POSITION OF THE SLEEVE ON A 90 DEGREE BACKSHELL
Figure 15

(c) Assemble the temperature grade D lacing tape wire harness ties on the sleeve. Refer to Subject 20-10-11 and Figure 16.

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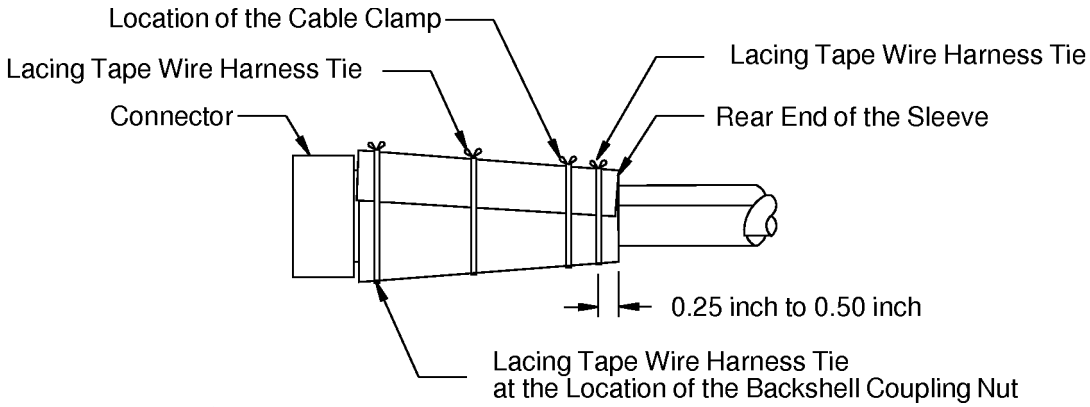

POSITION OF THE LACING TAPE WIRE HARNESS TIE ON THE SLEEVE
Figure 16

(5) If one sleeve cannot make a minimum 0.125 inch circumferential overlap with itself on the backshell.

(a) Cut the necessary length of two sleeves that have the correct fit on the backshell.

(b) Put the sleeves on the backshell.

Refer to:

- Figure 17 for the overlap of the sleeves around the strain relief
- Figure 18 for the position of the sleeves on the backshell.

Make sure that:

- Each edge of a sleeve makes an overlap with the edges of the other sleeve that is not less than 0.125 inch
- The forward end of the sleeves are 0.1 inch to 0.3 inch from the rear edge of the connector coupling nut
- The rear end of the sleeves make a 0.5 inch to 1 inch overlap with the wire harness sleeve.

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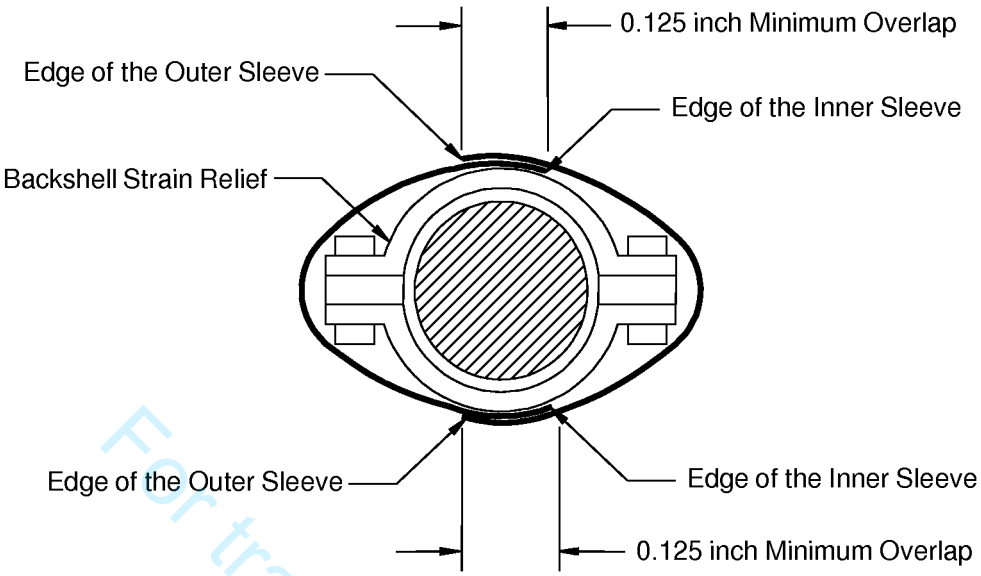
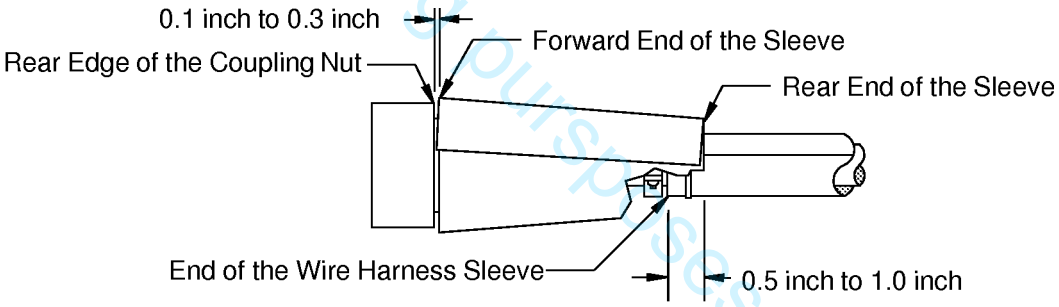
INSTALLATION OF BMS13-82 PROTECTIVE SLEEVES



POSITION OF THE SLEEVES ON THE BACKSHELL STRAIN RELIEF
Figure 17



POSITION OF THE SLEEVES ON THE BACKSHELL
Figure 18

(c) Assemble the temperature grade D lacing tape wire harness ties on the sleeves. Refer to Subject 20-10-11 and Figure 19.

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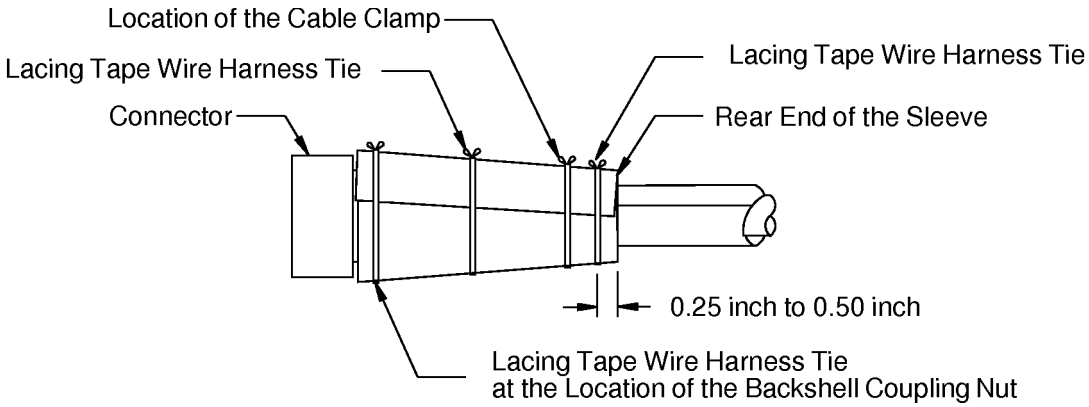

POSITION OF THE LACING TAPE WIRE HARNESS TIES ON THE SLEEVE
Figure 19

(6) Install the protective tape. Refer to paragraph 4.B..

C. Sleeve Termination at a Circular Shield Sock Backshell - On the Wire Harness

This paragraph gives the procedure to put the sleeve termination between the wire harness and the strain relief of the backshell.If the area between the wire harness and the strain relief of the backshell is not sufficient for the layers of the sleeve, the sleeve termination can be put on the strain relief of the backshell. Refer to Paragraph 3.D..

Table 7
NECESSARY TOOLS

Tool	Supplier
Scissors	An available source
Cutter	An available source

(1) Make a selection of one of these tools from Table 7.
- A pair of scissors
- A cutter with a sharp blade.

(2) Cut the necessary length of the sleeve that has the correct fit between the rear of the connector and shield termination ring.

Refer to:
- Figure 20 for the position of the rear end of the sleeve
- Figure 21 for the position of the sleeve in a straight backshell
- Figure 20 for the position of the sleeve in a 45 degree backshell
- Figure 20 for the position of the sleeve in a 90 degree backshell.

Make sure that:
- The forward end of the sleeve is not farther than 0.2 inch from the rear face of the connector
- The rear end of the sleeve is 0.25 inch to 0.5 inch from the forward edge of the shield termination ring
- The sleeve can make a circumferential overlap with itself that is not less than 0.125 inch.

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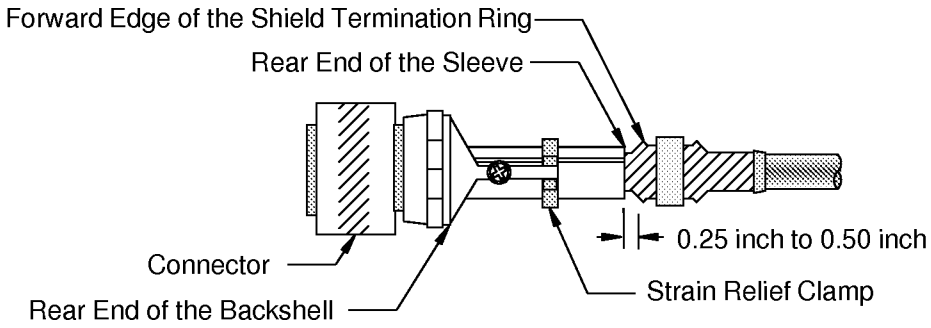
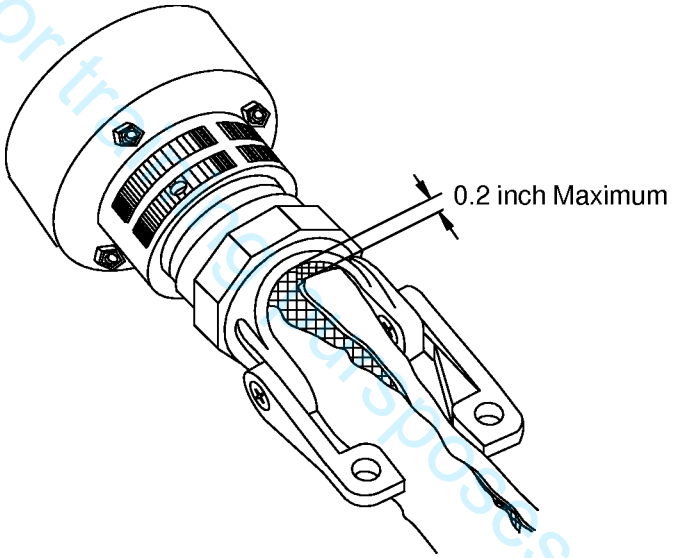
INSTALLATION OF BMS13-82 PROTECTIVE SLEEVES



POSITION OF THE REAR END OF THE SLEEVE
Figure 20



POSITION OF THE FORWARD END OF THE SLEEVE IN A STRAIGHT BACKSHELL
Figure 21

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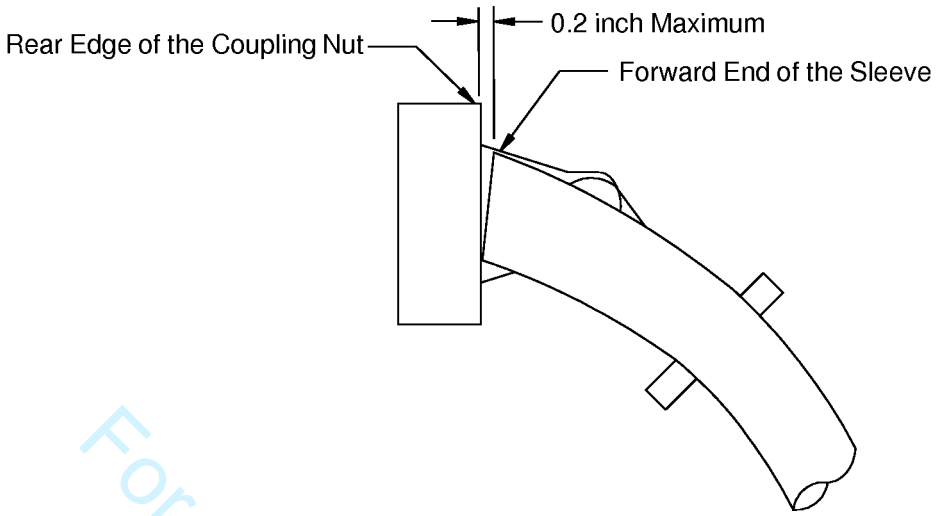
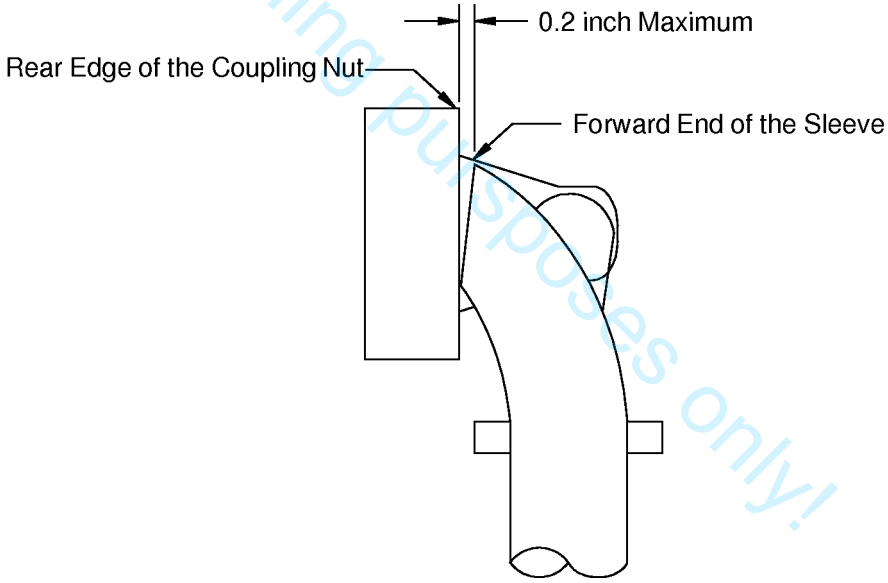


POSITION OF THE FORWARD END OF THE SLEEVE IN A 45 DEGREE BACKSHELL
Figure 22



POSITION OF THE FORWARD END OF THE SLEEVE IN A 90 DEGREE BACKSHELL
Figure 23

(3) Put the sleeve on the wire harness between the connector and the shield termination ring.

(4) If the circumferential overlap of the sleeve at the strain relief clamp is more than 0.2 inch and the saddle bars of the clamp cannot go against the legs of the backshell, do the following steps:

(a) Put the sleeve on the wire harness in between the shield termination ring and the rear end of the connector.

(b) Make a mark on the end of the inner layer of the sleeve 0.16 inch ±0.03 inch from the edge of the outer layer.

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(c) Remove the sleeve from the wire harness.

(d) Make a longitudinal cut on the sleeve at the mark.

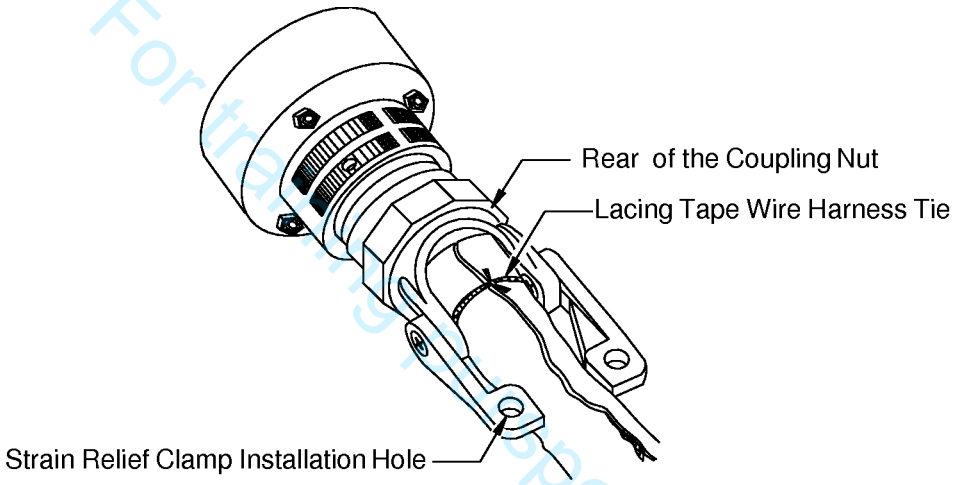
(e) Put the sleeve on the wire harness.

Make sure that:

- The edge that is cut is adjacent to the wire harness
- The sleeve can make a circumferential overlap with itself that is not less than 0.125 inch.

(5) Assemble a temperature grade D lacing tape wire harness tie on the sleeve between the installation holes for the strain relief clamp and the rear of the backshell coupling nut. Refer to Subject 20-10-11 and Figure 24.

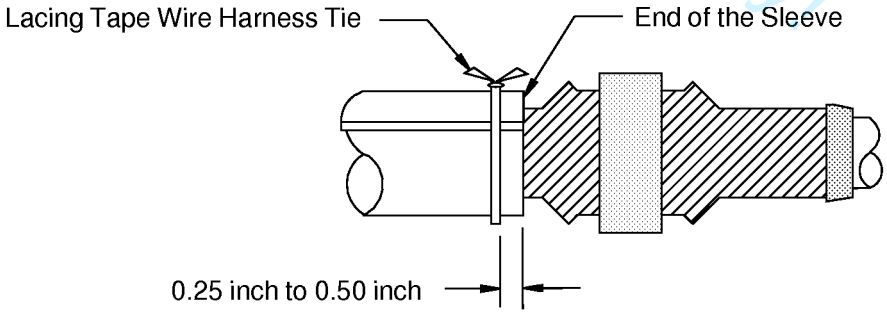
Make sure that the sleeve makes a circumferential overlap with itself that is not less than 0.125 inch.



POSITION OF THE LACING TAPE WIRE HARNESS TIE ON FORWARD END OF THE SLEEVE
Figure 24

(6) Assemble a temperature grade D lacing tape wire harness tie on the rear end of the sleeve. Refer to Subject 20-10-11 and Figure 25.

Make sure that the sleeve makes a circumferential overlap with itself that is not less than 0.125 inch.



POSITION OF THE LACING TAPE WIRE HARNESS TIE ON THE REAR END OF THE SLEEVE
Figure 25

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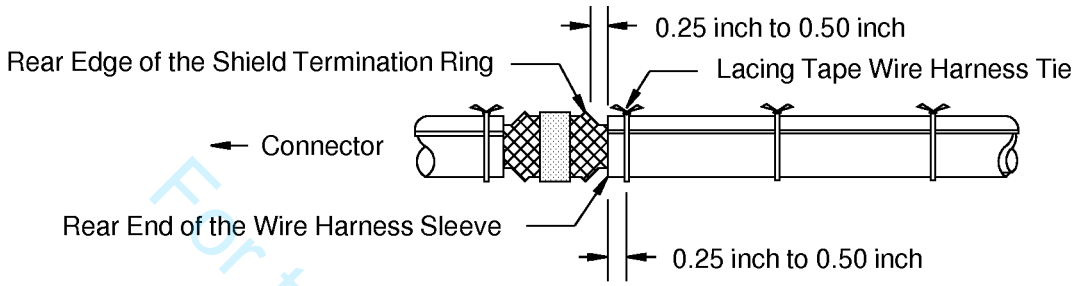
(7) Assemble a temperature grade D lacing tape wire harness tie on the wire harness sleeve 0.125 inch to 0.5 inch rearward from the forward end of sleeve. Refer to Subject 20-10-11 and Figure 26.

Make sure that:

- The forward end of the sleeve is 0.25 inch to 0.5 inch rearward from the rear edge of the shield termination ring
- The sleeve makes a circumferential overlap with itself that is not less than 0.125 inch.



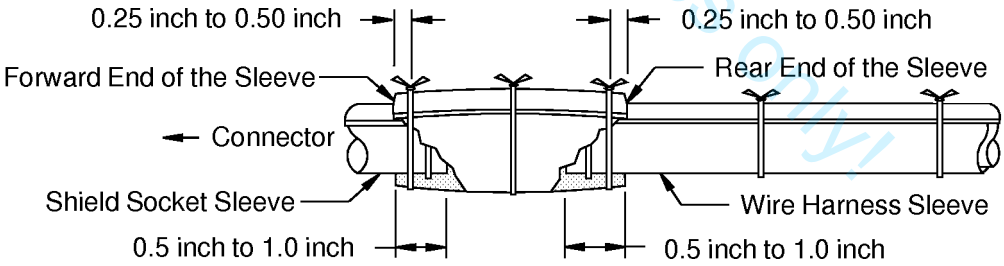
POSITION OF THE LACING TAPE WIRE HARNESS TIE ON THE WIRE HARNESS SLEEVE
Figure 26

(8) Install the strain relief clamp.

(9) Cut the necessary length of the sleeve that has the correct fit on the shield termination ring. Refer to Figure 27.

Make sure that:

- The forward end of the sleeve makes a 0.5 inch to 1 inch overlap with the rear end of the shield sock sleeve
- The rear end of the sleeve makes 0.5 inch to 1 inch overlap with the forward end of the wire harness sleeve
- The sleeve makes a circumferential overlap with itself that is not less than 0.125 inch.



POSITION OF THE SLEEVE ON THE SHIELD TERMINATION RING
Figure 27

(10) Assemble a lacing tape wire harness tie on the sleeve at both ends of the sleeve. Refer to Figure 27.

Make sure that:

- Each tie is 0.25 inch to 0.5 inch from the end of the sleeve
- The sleeve makes a circumferential overlap with itself that is not less than 0.125 inch.

(11) Install the protective tape. Refer to Paragraph 4.A..

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D. Sleeve Termination at a Circular Shield Sock Backshell- On the Strain Relief

The paragraph is applicable if the space between the wire harness and the strain relief of the backshell is not sufficient for the layers of the sleeve, then the sleeve termination can be put on the strain relief of the backshell.

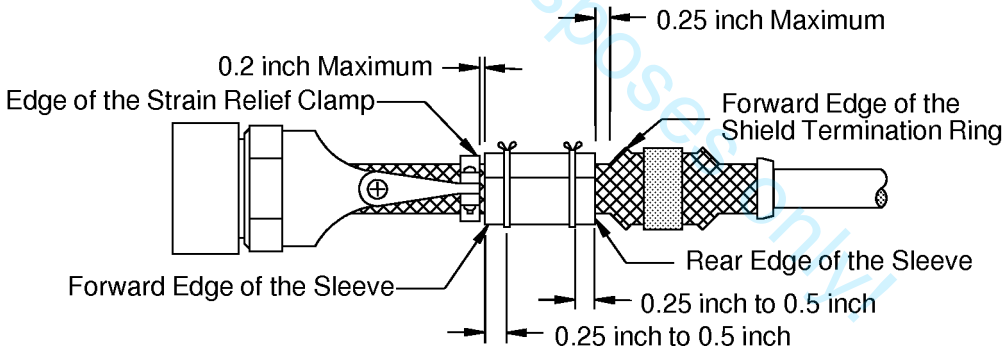
Table 8
NECESSARY TOOLS

Tool	Supplier
Scissors	An available source
Cutter	An available source

(1) Make a selection of one of these tools from Table 8:
- A pair of scissors
- A cutter with a sharp blade.

(2) Cut the necessary length of a sleeve that has the correct fit for the length of the shield sock between the rear edge of the strain relief clamp and the forward end of the shield termination ring. Refer to Figure 28.

Make sure that:
- The forward end of the short sleeve is not farther than 0.20 inch from the rear edge of the train relief clamps
- The rear end of the sleeve is not more than 0.25 inch from the forward edge of the shield termination ring
- The sleeve can make a circumferential overlap with itself that is not less than 0.125 inch.



POSITION OF THE SLEEVE ON THE SHIELD SOCK
Figure 28

(3) Assemble a temperature grade D lacing tape wire harness tie at each end of the sleeve. Refer to Subject 20-10-11 and Figure 28.

NOTE: If the length of the sleeve between the strain relief and the shield termination platform is less than 1 inch, one lacing tape wire harness tie at the approximately center of the sleeve is satisfactory.

(4) If one sleeve can make a minimum 0.125 inch circumferential overlap with itself on the backshell:

(a) Cut the necessary length of a sleeve that has the correct fit on the backshell.

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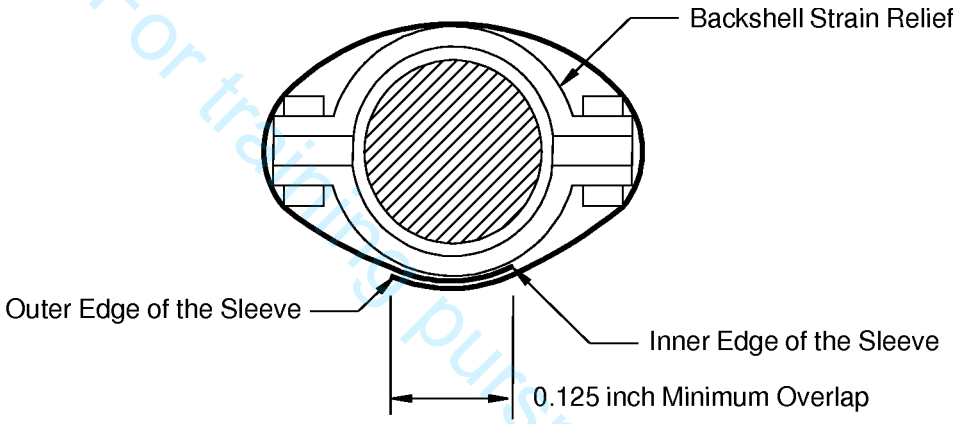
(b) Put the sleeve on the backshell.

Refer to:

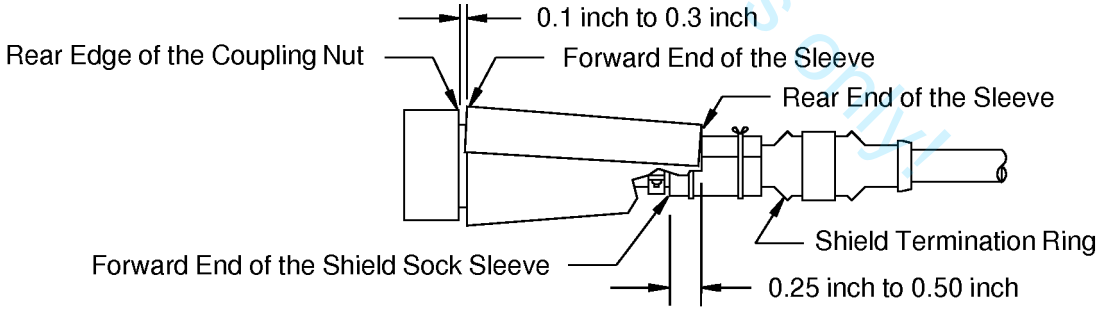
- Figure 29 for the overlap of the sleeve around the strain relief
- Figure 30 for the position of the sleeve on a straight backshell
- Figure 31 for the position of the sleeve on a 45 degree backshell
- Figure 32 for the position of the sleeve on a 90 degree backshell.

Make sure that:

- The sleeve makes a circumferential overlap with itself that is not less than 0.125 inch
- The forward end of the sleeve is 0.1 inch to 0.3 inch from the rear edge of the connector coupling nut
- The rear end of the sleeve makes a 0.5 inch to 1 inch overlap with the shield sock sleeve.



POSITION OF THE SLEEVE ON THE BACKSHELL STRAIN RELIEF
Figure 29



POSITION OF THE SLEEVE ON A STRAIGHT BACKSHELL
Figure 30

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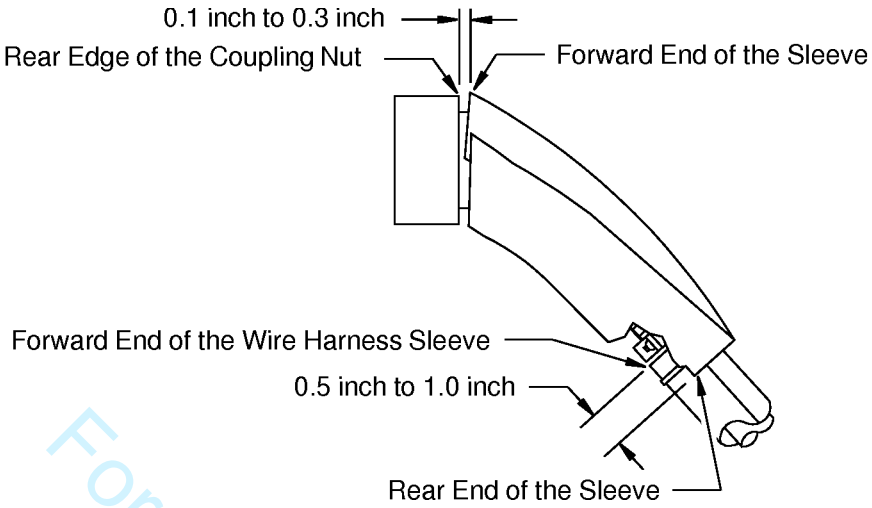
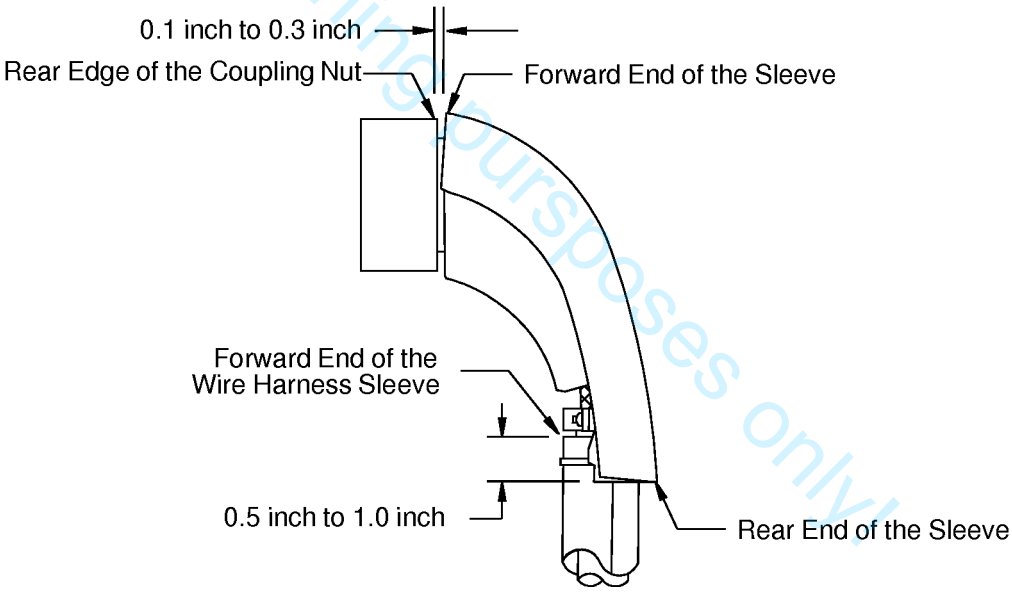


POSITION OF THE SLEEVE ON A 45 DEGREE BACKSHELL
Figure 31



POSITION OF THE SLEEVE ON A 90 DEGREE BACKSHELL
Figure 32

(c) Assemble the temperature grade D lacing tape wire harness ties on the sleeve. Refer to Subject 20-10-11 and Figure 33.

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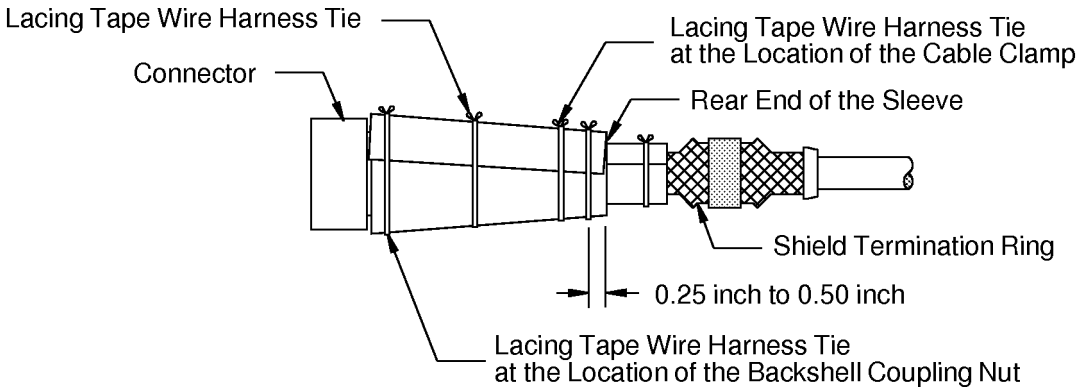
INSTALLATION OF BMS13-82 PROTECTIVE SLEEVES



POSITION OF THE THE LACING TAPE WIRE HARNESS TIE ON THE SLEEVE
Figure 33

(5) If one sleeve cannot make a minimum 0.125 inch circumferential overlap with itself on the backshell, do the following steps:

(a) Cut the necessary length of two sleeves that have the correct fit on the backshell.

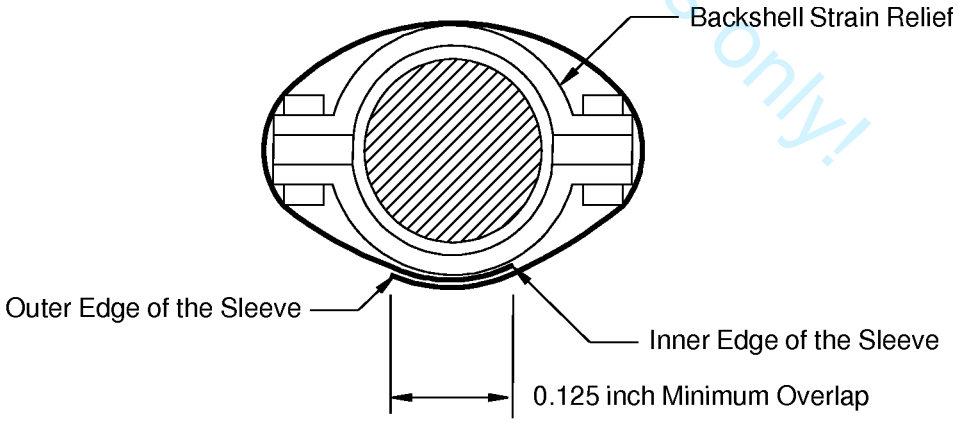
(b) Put the sleeves on the backshell.

Refer to:

- Figure 34 for the overlap of the sleeves around the strain relief
- Figure 35 for the position of the sleeves on the backshell.

Make sure that:

- Each edge of a sleeve makes an overlap with the edges of the other sleeve that is not less than 0.125 inch
- The forward end of the sleeves are 0.1 inch to 0.3 inch from the rear edge of the connector coupling nut
- The rear end of the sleeves make 0.5 inch to 1 inch overlap with the shield sock sleeve.



POSITION OF THE SLEEVES ON THE BACKSHELL STRAIN RELIEF
Figure 34

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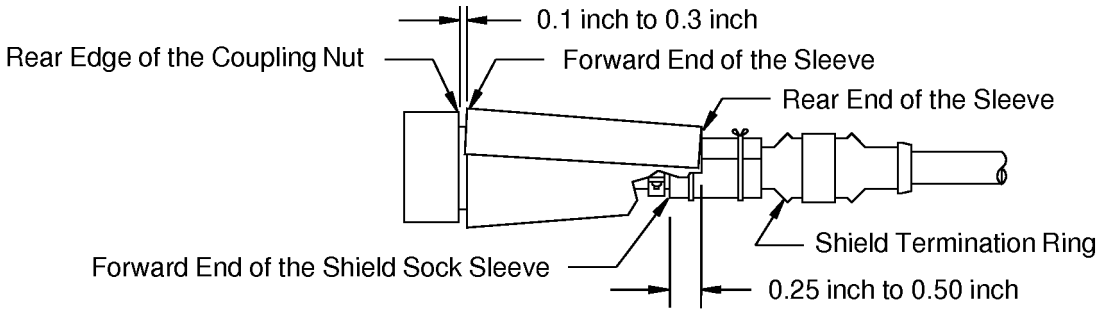
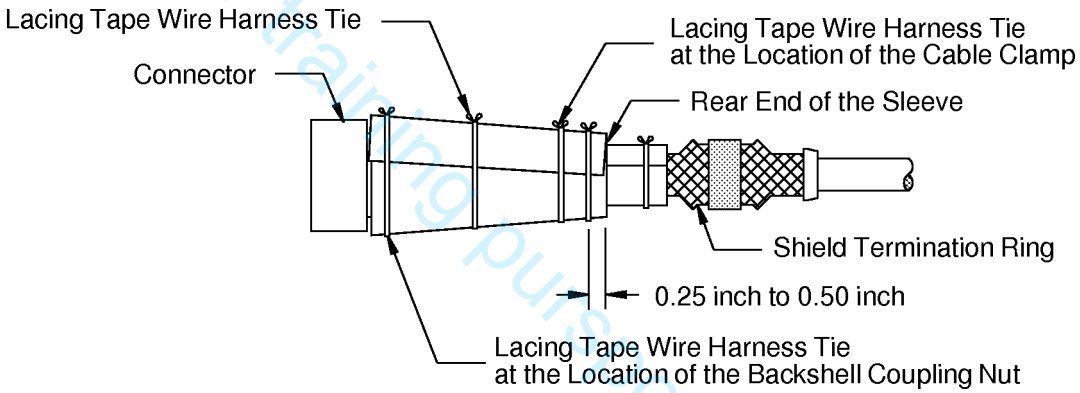
INSTALLATION OF BMS13-82 PROTECTIVE SLEEVES



POSITION OF THE SLEEVES ON THE BACKSHELL
Figure 35

(c) Assemble the temperature grade D lacing tape wire harness tie on the sleeves. Refer to Subject 20-10-11 and Figure 36.



POSITION OF THE LACING TAPE WIRE HARNESS TIES ON THE SLEEVES
Figure 36

(6) Assemble a temperature grade D lacing tape wire harness tie on the wire harness sleeve 0.25 inch to 0.5 inch rearward from the forward end of the sleeve. Refer to Subject 20-10-11 and Figure 37.

Make sure that:

- The forward end of the sleeve is 0.25 inch to 0.5 inch rearward from the rear edge of the shield termination ring
- The sleeve makes a circumferential overlap with itself that is not less than 0.125 inch.

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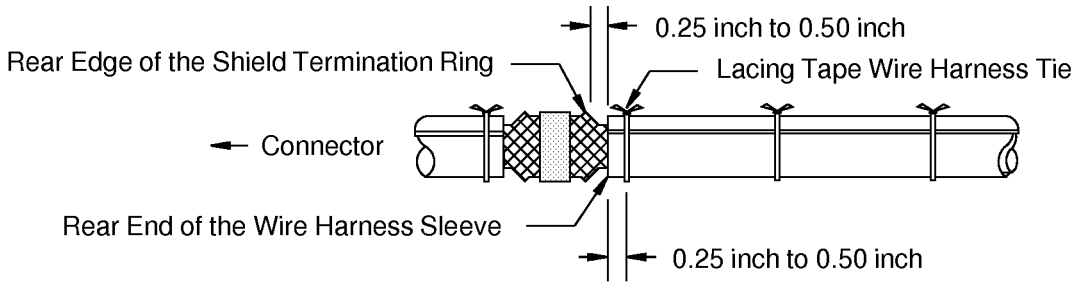
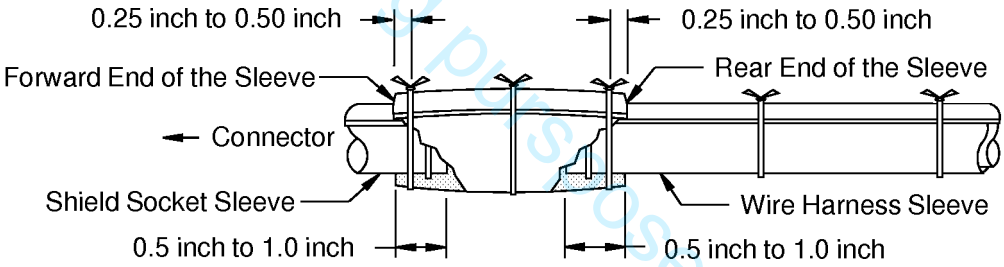


POSITION OF THE LACING TAPE WIRE HARNESS TIES ON THE WIRE HARNESS SLEEVE
Figure 37

(7) Cut the necessary length of the sleeve that has the correct fit on the shield termination ring. Refer to Figure 38.

Make sure that:

- The forward end of the sleeve makes 0.5 inch to 1 inch overlap with the rear end of the shield sock sleeve
- The rear end of the sleeve makes a 0.5 inch to 1 inch overlap with the forward end of the wire harness sleeve
- The sleeve makes a circumferential overlap with itself that is not less than 0.125 inch.



POSITION OF THE SLEEVE ON THE SHIELD TERMINATION RING
Figure 38

(8) Assemble a temperature grade D lacing tape wire harness tie on the sleeve at both ends of the sleeve. Refer to Subject 20-10-11 and Figure 38.

Make sure that:

- Each tie is 0.25 inch to 0.5 inch from the end of the sleeve
- The sleeve makes a circumferential overlap with itself that is not less than 0.125 inch.

(9) Install the protective tape. Refer to Paragraph 4.B..

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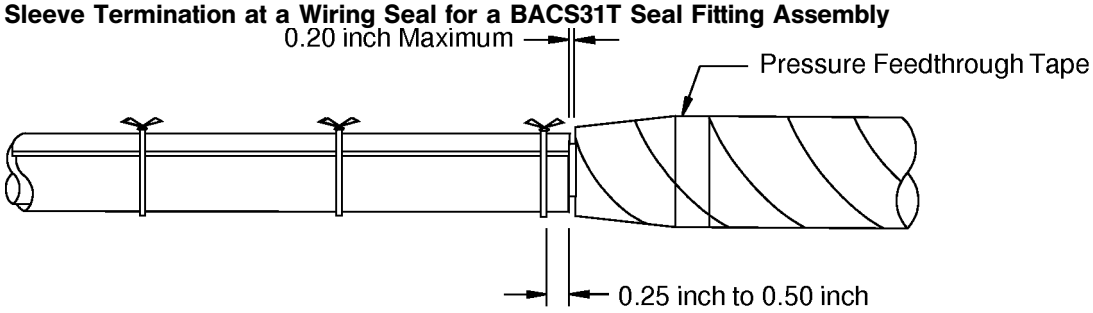
E. Sleeve Termination at a Wiring Seal for a BACS31T Seal Fitting Assembly



POSITION OF THE SLEEVE ON THE WIRE HARNESS
Figure 39

(1) Put the sleeve on the wire harness. Refer to Figure 39.

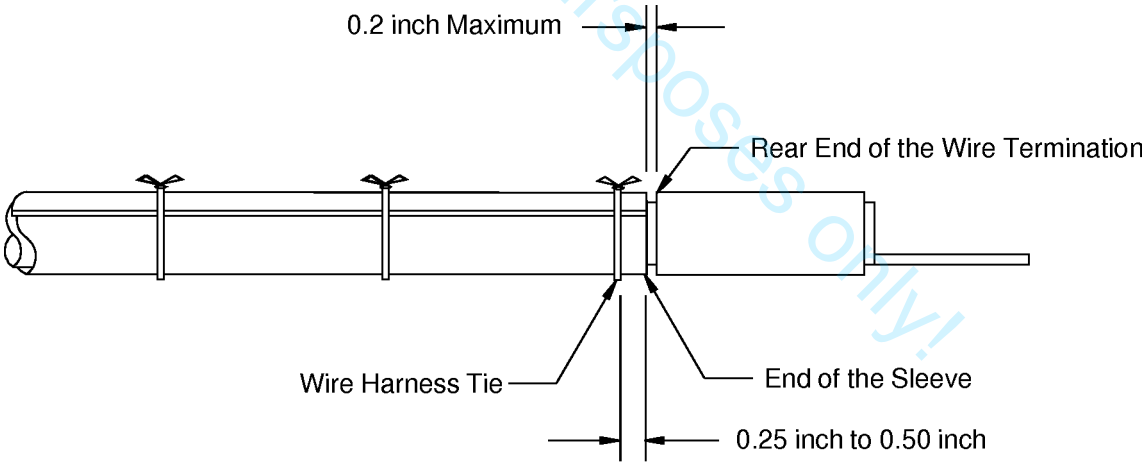
Make sure that:

- The end of the sleeve is not farther than 0.20 inch from the forward end of the seal fitting wire seal
- The sleeve makes a circumferential overlap with itself that is not less than 0.125 inch.

(2) Assemble a temperature grade D lacing tape wire harness tie on sleeve 0.25 inch to 0.5 inch from the rear end of the sleeve. Refer to Subject 20-10-11 and Figure 39.

Make sure that the sleeve makes a circumferential overlap with itself that is not less than 0.125 inch.

F. Sleeve Termination at a Wire Termination



SLEEVE TERMINATION AT A WIRE TERMINATION
Figure 40

(1) Put the sleeve on the wire. Refer to Figure 40.

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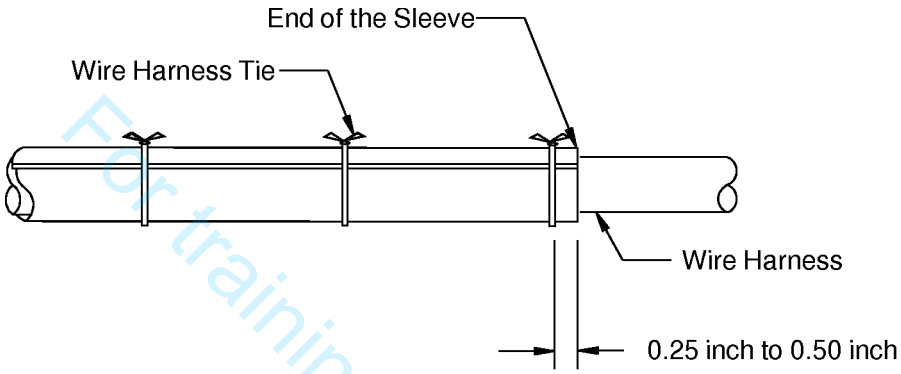
Make sure that:

- The end of the sleeve is not farther than 0.25 inch from the end of the wire termination
- The sleeve makes a circumferential overlap with itself that is not less than 0.125 inch.

(2) Assemble a temperature grade D lacing tape wire harness tie on the sleeve 0.25 inch to 0.5 inch from the end of the sleeve. Refer to Subject 20-10-11 and Figure 40.

Make sure that the sleeve makes a circumferential overlap with itself that is not less than 0.125 inch.

G. Sleeve Termination at a Location on the Length of a Wire Harness or Branch



SLEEVE TERMINATION AT A LOCATION ON THE WIRE HARNESS
Figure 41

(1) Put the sleeve on the wire. Refer to Figure 41.

Make sure that:

- The end of the sleeve is not farther than ± 0.2 inch from the end of the specified location
- The sleeve makes a circumferential overlap with itself that is not less than 0.125 inch.

(2) Assemble a temperature grade D lacing tape wire harness tie on the sleeve 0.25 inch to 0.5 inch from the end of the sleeve. Refer to Subject 20-10-11 and Figure 41.

Make sure that the sleeve makes a circumferential overlap with itself that is not less than 0.125 inch.

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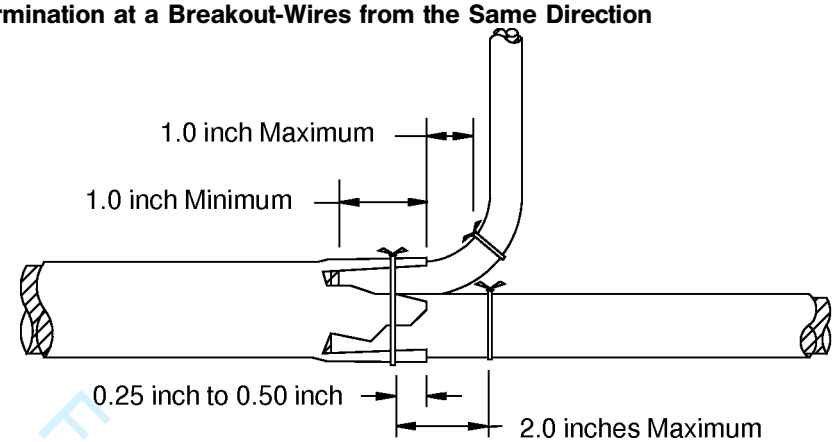
H. Sleeve Termination at a Breakout-Wires from the Same Direction



WIRE HARNESS BRANHC-BREAKOUT FROM ONE DIRECTION
Figure 42

(1) Put the necessary length of sleeve on the main harness that extends farther than the breakout. Refer to Figure 42.

(2) Put the necessary length of sleeve on the breakout. Refer to Figure 42.

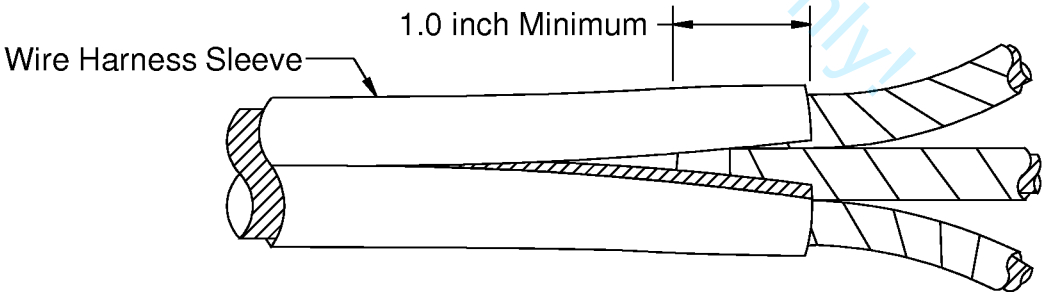
Make sure that the sleeve makes a minimum 1.0 inch overlap with the sleeve of the main harness before the breakout.

(3) If the sleeve on the main harness cannot make a 0.125 inch circumferential overlap with itself, install an outer length sleeve on the length of the main harness sleeve that does not make the overlap.

Refer to Figure 43 and Figure 44.

Make sure that the outer sleeve:

- Starts 1.5 inches to 2.0 inches rearward from the location where the main harness sleeve does not make an overlap with itself
- Makes a 1.0 inch minimum overlap with the sleeves of the branches
- Makes a circumferential overlap with the main harness sleeve that is not less than 0.125 inch.



MAIN HARNESS SLEEVE WITHOUT AN OVERLAP
Figure 43

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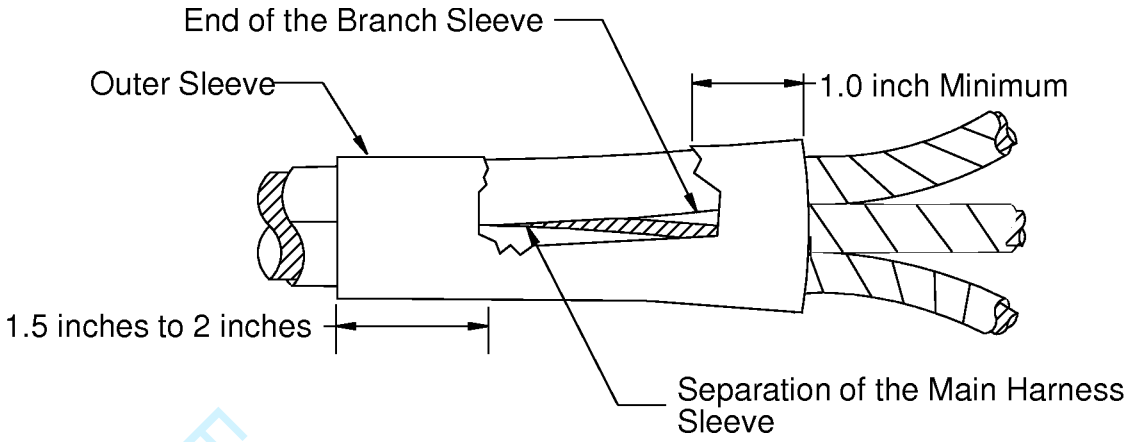
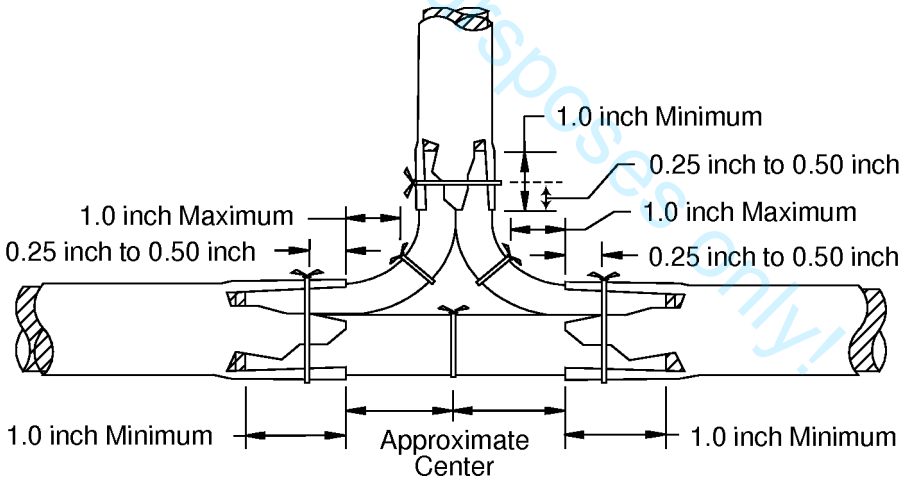


LENGTH OF OUTER SLEEVE ON THE MAIN HARNESS SLEEVE
Figure 44

(4) Assemble a string tie on:

- The overlap of the sleeve 0.25 inch to 0.5 inch from the end of the main harness sleeve
- The breakout sleeve 1.0 inch maximum from the end of the main harness sleeve
- The sleeve of the main harness after the breakout 2.0 inches maximum from the end of the sleeve of the main harness before the breakout.

I. Sleeve Termination at a Breakout-Wires from Different Directions



WIRE HARNESS BRANCH-BREAKOUT FROM TWO DIRECTIONS
Figure 45

(1) Put the necessary length of the sleeve on the main harness between the breakouts. Refer to Figure 45.

Make sure that the sleeve makes a minimum 1.0 inch overlap with the sleeves of the main harness on the outer side of each breakout.

(2) Put the necessary lengths of the sleeve on the breakouts. Refer to Figure 45.

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Make sure that the sleeves make a minimum 1.0 inch overlap with:

- The sleeve of the main harness on the outer side of each breakout
- The sleeve of the branch.

(3) Assemble a temperature grade D lacing tape wire harness tie on:

- Each overlap of the sleeves 0.25 inch to 0.5 inch from the end of the breakout sleeves
- Each breakout sleeve 1.0 inch maximum from the end of the main harness sleeves
- The approximately center of the main harness sleeve between the breakouts.

Refer to Subject 20-10-11.

4. PROTECTIVE TAPE INSTALLATION

A. Protective Tape Installation - Sleeve Termination on the Wire Harness

This paragraph gives the procedure to install the protective tape for a sleeve termination that is on the wire harness.

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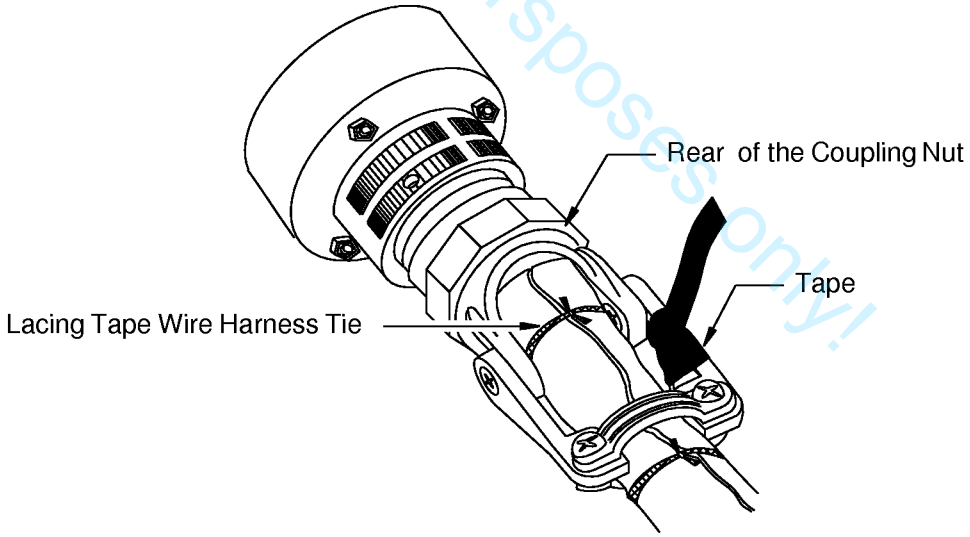
Table 9
NECESSARY MATERIAL

Component	Type	Part Number of Specification
Tape	Silicone, Self-Fusing, Fire Retardant	RL600FR

(1) Make a selection of tape from Table 9.

(2) Wind a minimum of one layer of the tape around one of the arms of the strain relief clamp. Refer to Figure 46.



LAYER OF TAPE ON THE ARM OF THE STRAIN RELIEF CLAMP
Figure 46

(3) Continue to wind the tape tightly around the backshell assembly toward the coupling nut of the backshell until the forward edge of the tape extends a small around farther than the forward edge of the coupling nut. Refer to Figure 47.

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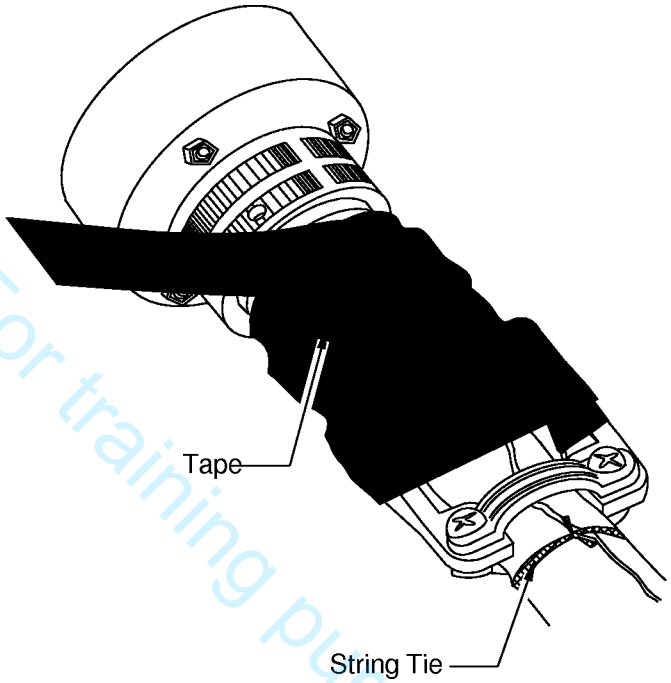
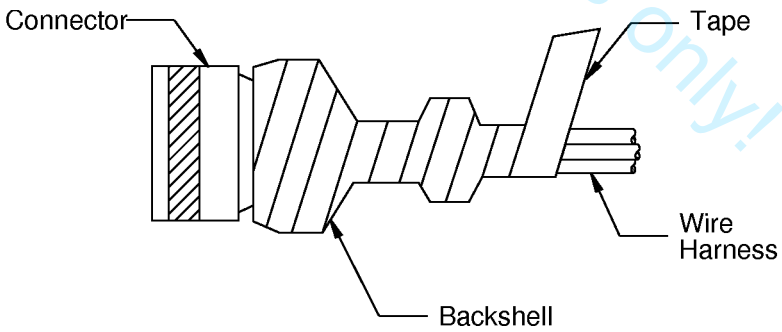
Make sure that:

- Continuous tension is applied to the tape
- Each layer of the tape makes a 50 percent to 60 percent overlap.



LAYER OF TAPE ON THE ARM OF THE STRAIN RELIEF CLAMP
Figure 47

(4) Wind the tape tightly around the backshell assembly rearward toward the wire harness until the layer of tape extends 4 inches to 6 inches from the strain relief clamp. Refer to Figure 48.



POSITION OF THE TAPE ON THE BACKSHELL ASSEMBLY
Figure 48

(5) Assemble a lacing tape wire harness tie on the tape approximately at the center of the coupling nut.

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B. Protective Tape Installation-Sleeve Termination on the Strain Relief

This paragraph gives the procedure to install the protective tape for a sleeve termination that is on the backshell strain relief.

Table 10
NECESSARY MATERIAL

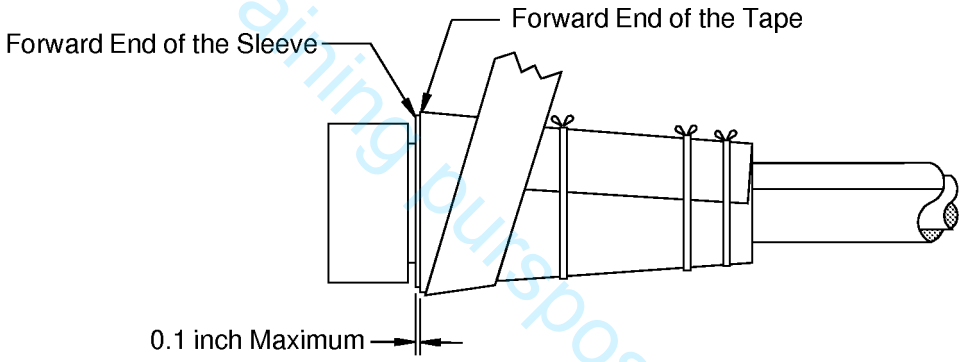
Component	Type	Part Number of Specification
Tape	Silicone, Self-Fusing, Fire Retardant	RL600FR

(1) Make a selection of tape. Refer to Table 10.

(2) Start the layer of the specified tape 0.1 inch or less from the forward end of the sleeve. Refer to Figure 49.

Make sure that:

- The first 1-1/2 to 2 layers of tape make approximately a 100 percent overlap
- The forward end of the tape is not farther than 0.1 inch from the forward end of the sleeve.



LAYERS OF TAPE ON THE END OF THE SLEEVE
Figure 49

(3) Wind the tape tightly around the backshell assembly rearward toward the wire harness until the layer of tape extends 4 inches to 6 inches from the strain relief clamp. Refer to Figure 50.

Make sure that:

- Continuous tension is applied to the tape
- Each layer of the tape makes a 50 percent to 60 percent overlap.

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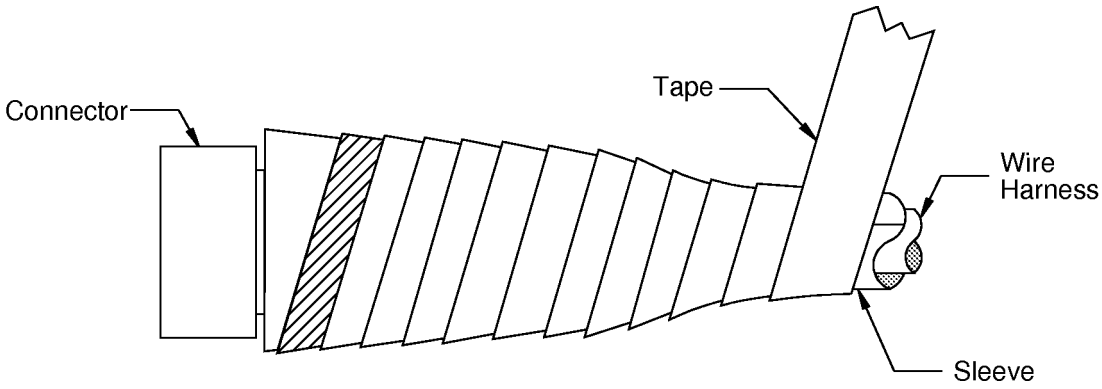
INSTALLATION OF BMS13-82 PROTECTIVE SLEEVES



POSITION OF THE TAPE ON THE BACKSHELL ASSEMBLY
Figure 50

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Installation of Expandable and Wrappable Sleeves

Paragraph			Page
1.	INSTALLATION OF EXPANDABLE SLEEVES		1
	A.	Overlap Configuration of Protective Sleeves	1
	B.	Installation of the Sleeve	1
2.	INSTALLATION OF WRAPPABLE SLEEVES		4
	A.	Installation of the Sleeve	4

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20-10-27 CONTENTS

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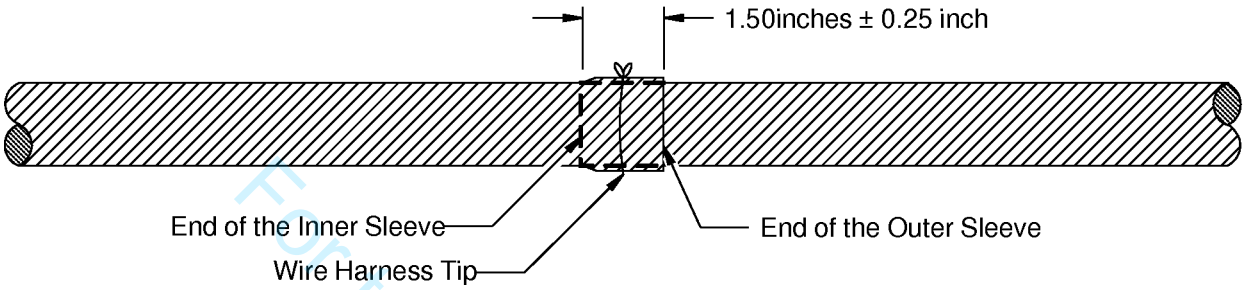
Installation of Expandable and Wrappable Sleeves

1. INSTALLATION OF EXPANDABLE SLEEVES

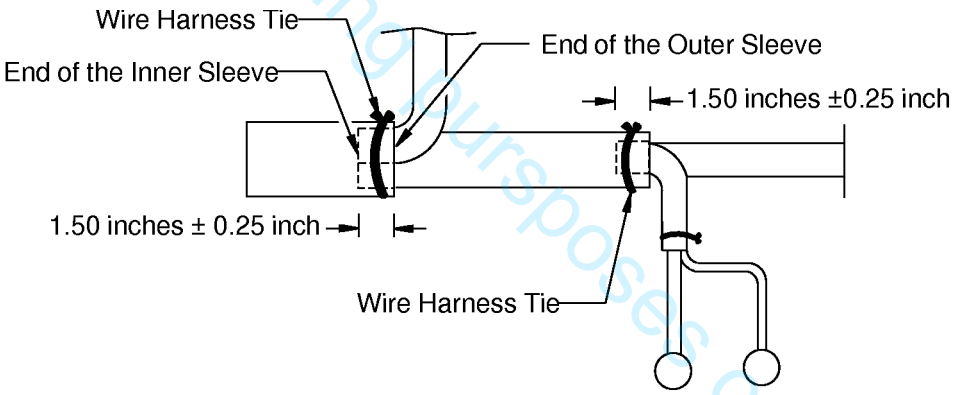
A. Overlap Configuration of Protective Sleeves

These conditions are applicable for the overlap of protective sleeves:

- The overlap is 1.5 inches ±0.25 inch
- A wire harness tie is assembled approximately at the center of the overlap.



OVERLAP OF SLEEVES ON THE SAME SEGMENT OF THE WIRE HARNESS
Figure 1



OVERLAP OF SLEEVES AT A BREAKOUT
Figure 2

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B. Installation of the Sleeve

Table 1
NECESSARY TOOLS

Tool	Description	Supplier
Cutter	With a Sharp Blade	An available source
Hot Knife	Tool with heated tips	Meisei Corp.
Hot Tweezers	Tool with heated tips	Meisei Corp.
Scissors	-	An available source

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Installation of Expandable and Wrappable Sleeves

(1) Make a selection of these tools from Table 1:
- A tool to cut the sleeve
- A tool to melt the filaments at the end of the sleeve.

(2) Cut the length of the sleeve approximately 2 inches ±0.25 inch longer than it is needed.

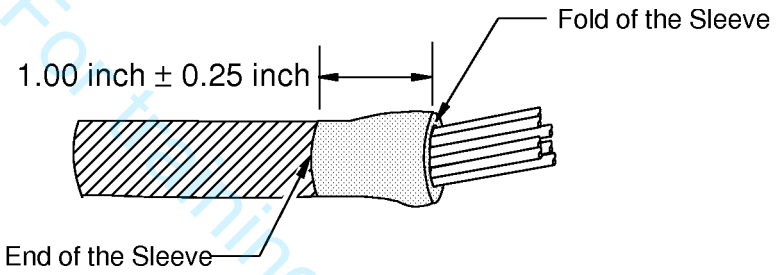
(3) Melt the loose filaments at the end of the sleeve together with adjacent loose filaments.

(4) If the sleeve has broken filaments:

(a) Remove them with the tool with the heated tip.

(b) Melt the ends into their position.

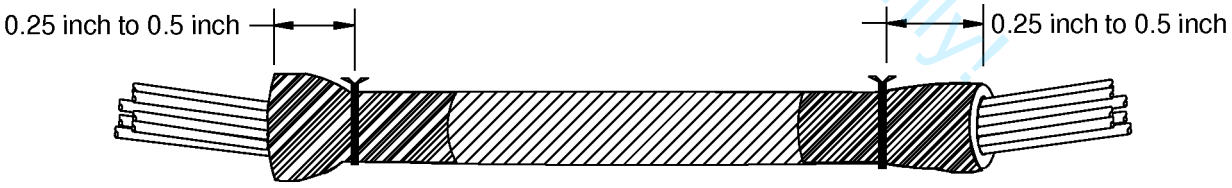
(5) Fold approximately 1 inch ±0.25 inch of the sleeve back on each end that does not make an overlap with a different sleeve. Refer to Figure 3.



POSITION OF THE SLEEVE FOLDED BACK
Figure 3

(6) Put the sleeves in the specified positions on the harness.

Refer to:
- Figure 4 for the configuration of the ends of a sleeve
- Figure 5 and Figure 6 for the configuration of the sleeves at a breakout with wires from the same direction
- Figure 7 for the configuration of the sleeves at a breakout with wires from different directions.
- Paragraph 1.A. for the configuration of the overlap of sleeves.



CONFIGURATION OF THE ENDS OF THE SLEEVE
Figure 4

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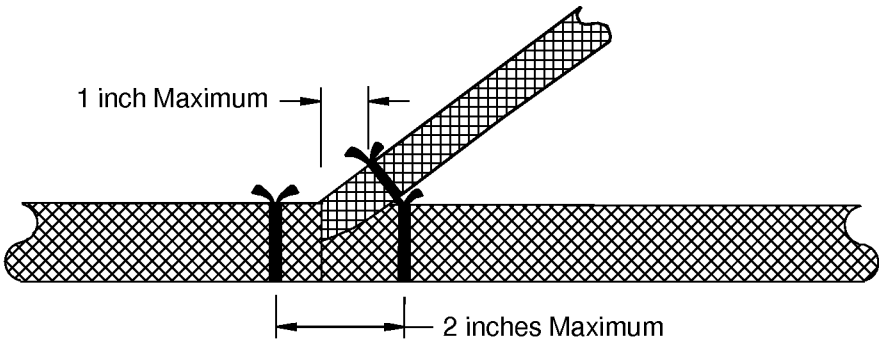
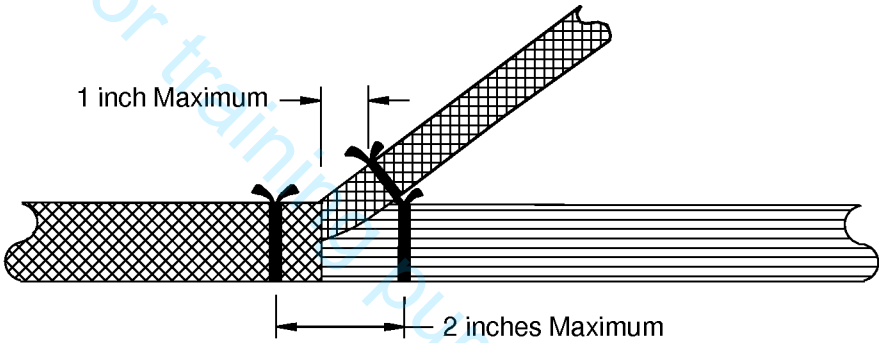
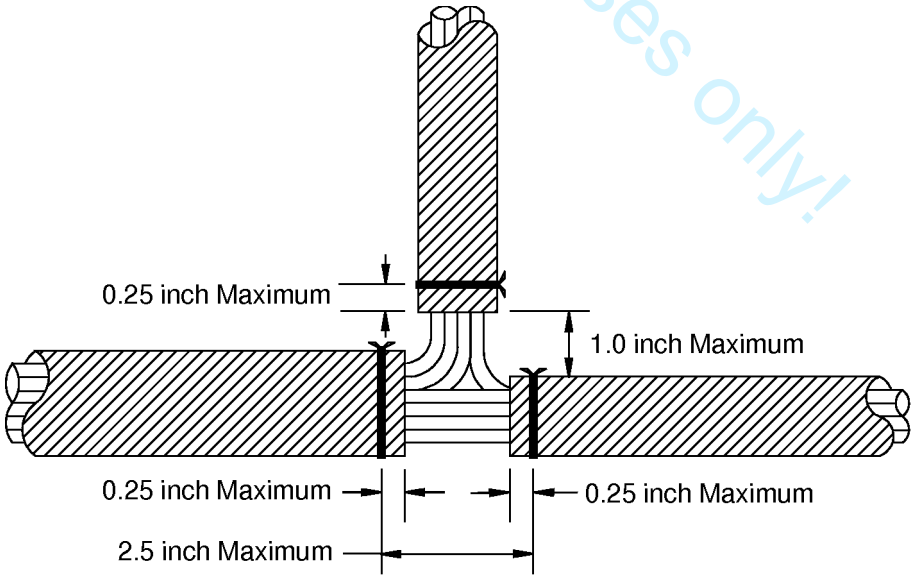


CONFIGURATION OF THE SLEEVES AT A BREAKOUT WITH WIRES FROM THE SAME DIRECTION
Figure 5



CONFIGURATION OF THE SLEEVES AT A BREAKOUT WITH WIRES FROM THE SAME DIRECTION
Figure 6



CONFIGURATION OF THE SLEEVES AT A BREAKOUT WITH WIRES FROM DIFFERENT DIRECTIONS
Figure 7

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Make sure that:

- The sleeve does not have more than 3 broken filaments of the braid
- The end of the sleeve is not closed
- A sufficient number of loose filaments on the end are melted together with adjacent loose filaments to prevent more fraying of the sleeve.
- For the sleeves at a breakout, the ends of the different sleeves make a 1.5 inch ±0.25 inch overlap.

(7) Assemble the necessary wire harness tie on the sleeve or sleeves.

Refer to:

- Figure 4 for the configuration of the ends of a sleeve
- Figure 5 and Figure 6 for the configuration of the sleeves at a breakout with wires from the same direction
- Figure 7 for the configuration of the sleeves at a breakout with wires from different directions.
- Paragraph 1.A. for the configuration of the overlap of sleeves.

2. INSTALLATION OF WRAPPABLE SLEEVES

A. Installation of the Sleeve

Table 2
NECESSARY TOOLS

Tool	Type	Part Number	Supplier
Cutter	Knife with a sharp blade	-	An available source
	Scissors	-	An available source
Roundit Tool	Plastic	RDTOOL	Federal Mogul
	Aluminum	RDTOOL-AL	Federal Mogul

(1) Make a selection of these tools from Table 2:

- A cutter
- A Roundit Tool.

NOTE: The sleeve can be installed without a Roundit Tool.

(2) Cut the length of the sleeve approximately 2 inches ± 0.25 inch longer than the specified length.

(3) Remove the loose fibers from the end of the sleeve. Refer to Figure 8.

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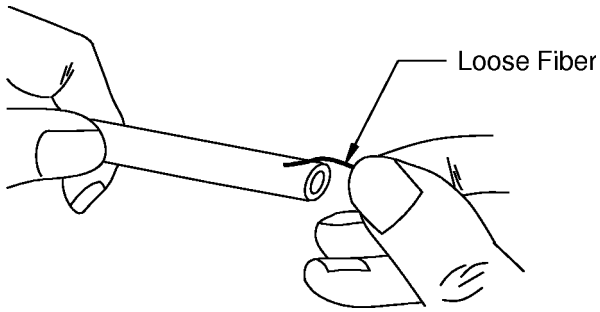
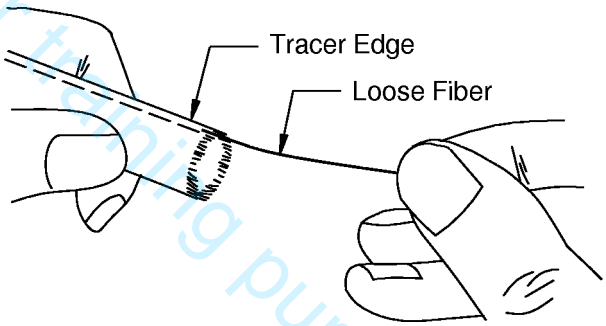


REMOVAL OF THE LOOSE FIBERS FROM THE END OF THE SLEEVE
Figure 8

(4) Pull the loose ends of the remaining fibers toward the tracer edge of the sleeve. Refer to Figure 9.

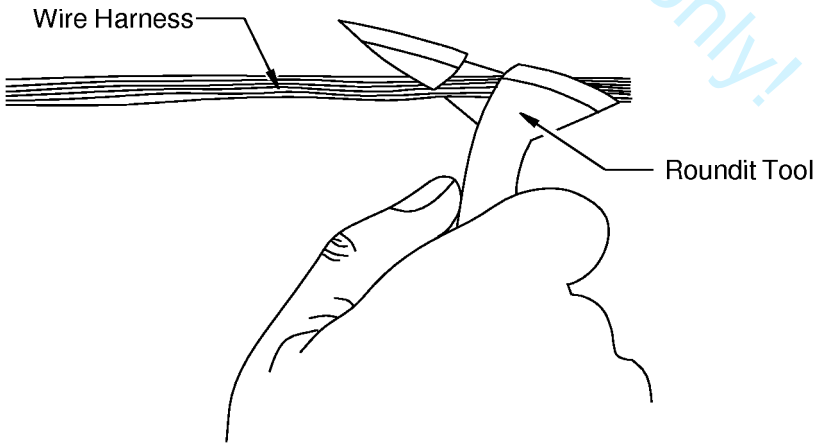


LOOSE END OF A FIBER AT THE TRACER EDGE IF THE SLEEVE
Figure 9

(5) Cut the loose fiber at the tracer edge of the sleeve.

(6) For the installation of the sleeve with a Roundit tool:

(a) Put the Roundit tool on the wire harness. Refer to Figure 10.



POSITION OF THE ROUNDIT TOOL ON THE WIRE HARNESS
Figure 10

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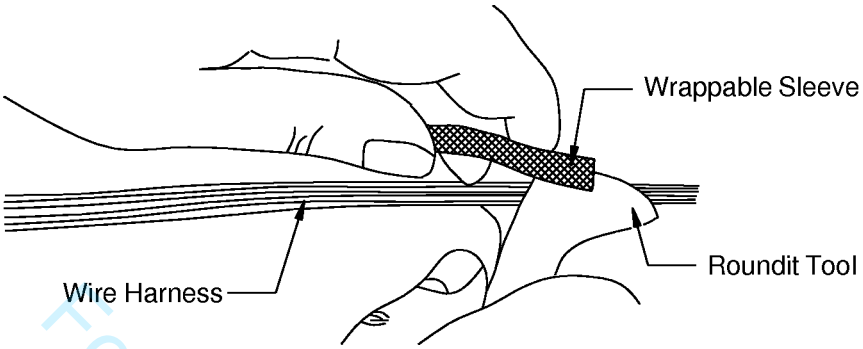
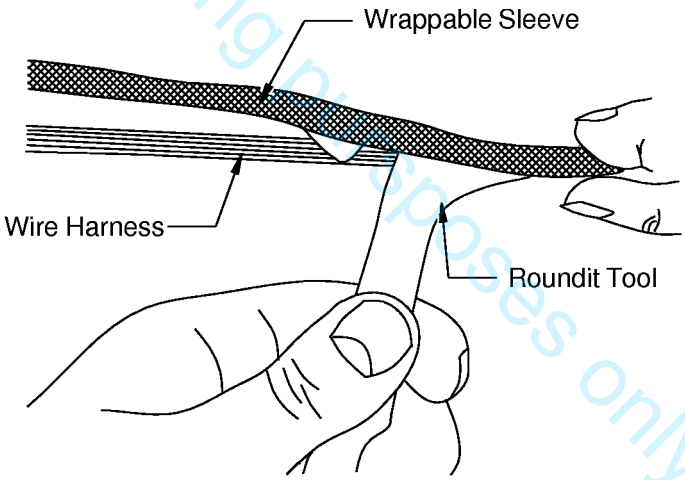
(b) Put the end of the sleeve on the head of the tool. Refer to Figure 11.
Make sure that the sleeve is on top of the side opening of the tool.



POSITION OF THE SLEEVE ON THE HEAD OF THE TOOL
Figure 11

(c) Move the tool on the length of the wire harness and the sleeve until the length of the sleeve is on the wire harness. Refer to Figure 12.



POSITION OF THE ROUNDIT TOOL AND THE SLEEVE ON THE WIRE HARNESS
Figure 12

(d) Remove the tool from the sleeve. Refer to Figure 13

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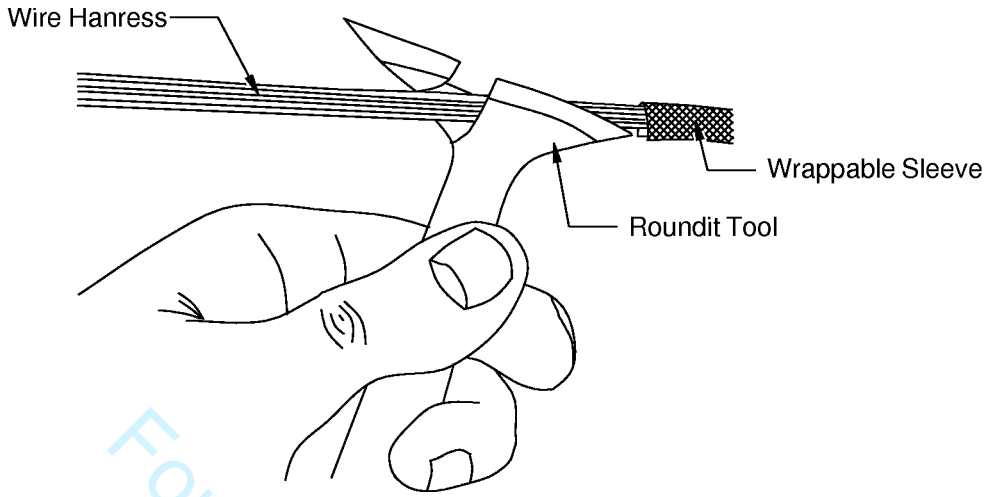
Installation of Expandable and Wrappable Sleeves



REMOVAL OF THE ROUNDIT TOOL FROM THE WIRE HARNESS
Figure 13

(7) For the installation of the sleeve without a Roundit tool:

(a) Move the edges of the sleeve apart at one end.

(b) Put the end of the sleeve on wire harness.

Make sure that the inner edge of the sleeve is the tracer edge

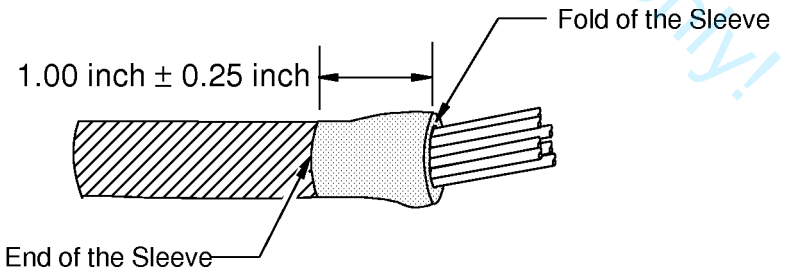
(c) Put the remaining length of the sleeve on the wire harness.

Make sure that the inner edge of the sleeve is the tracer edge.

(8) On each end of the sleeve that does not make an overlap with a different sleeve, fold approximately one inch of the sleeve back.

NOTE: If the fibers at the end of the sleeve are not loose, it is not necessary to fold the end of the sleeve back.

(a) Fold 1.00 inch ±0.25 inch of the end of the sleeve back. Refer to Figure 14.



POSITION OF THE SLEEVE FOLDED BACK
Figure 14

(b) Wind 1 to 2 layers of Type I silicone tape on the wire harness at the specified location of the end of the sleeve. Refer to Figure 15.

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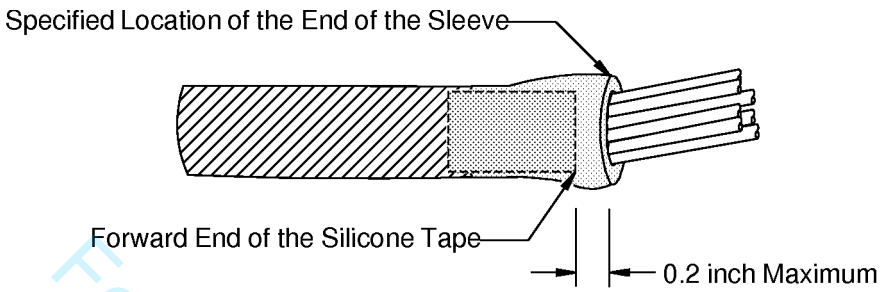
Make sure that:

- The forward end of the layers of tape is not farther than 0.2 inch from the specified location of the end of the sleeve
- The layers of the tape make an approximately 100 percent overlap.



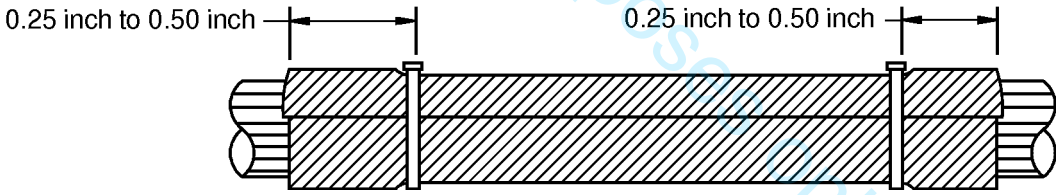
POSITION OF THE SILICONE TAPE
Figure 15

(9) Put the sleeve or sleeves in the specified position on the harness.

Refer to:

- Figure 16 for the configuration of the ends of a sleeve
- Figure 17 and Figure 18 for the configuration of the sleeves at a breakout with wires from the same direction
- Figure 19 for the configuration of the sleeves at a breakout with wires from different directions.

Make sure that the adjacent ends of the sleeves make a 1.5 inches ±0.25 inch overlap at a breakout.



CONFIGURATION OF THE ENDS OF THE SLEEVE
Figure 16

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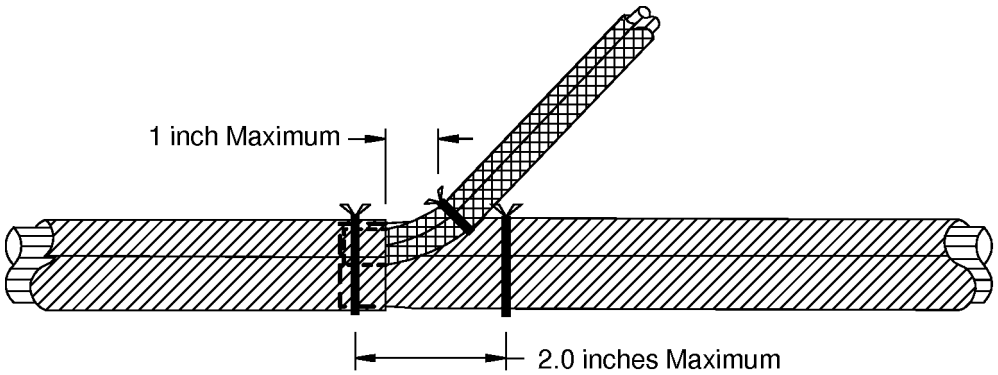
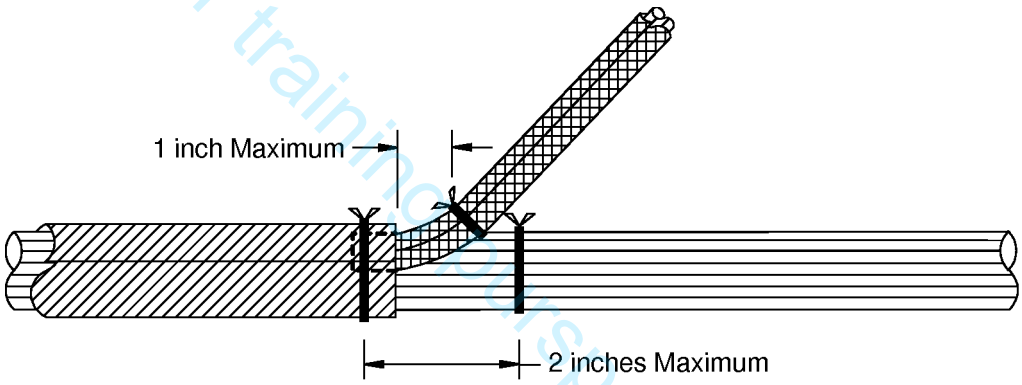


CONFIGURATION OF THE SLEEVES AT A BREAKOUT WITH WIRES FROM THE SAME DIRECTION
Figure 17



CONFIGURATION OF THE SLEEVES AT A BREAKOUT WITH WIRES FROM THE SAME DIRECTION
Figure 18

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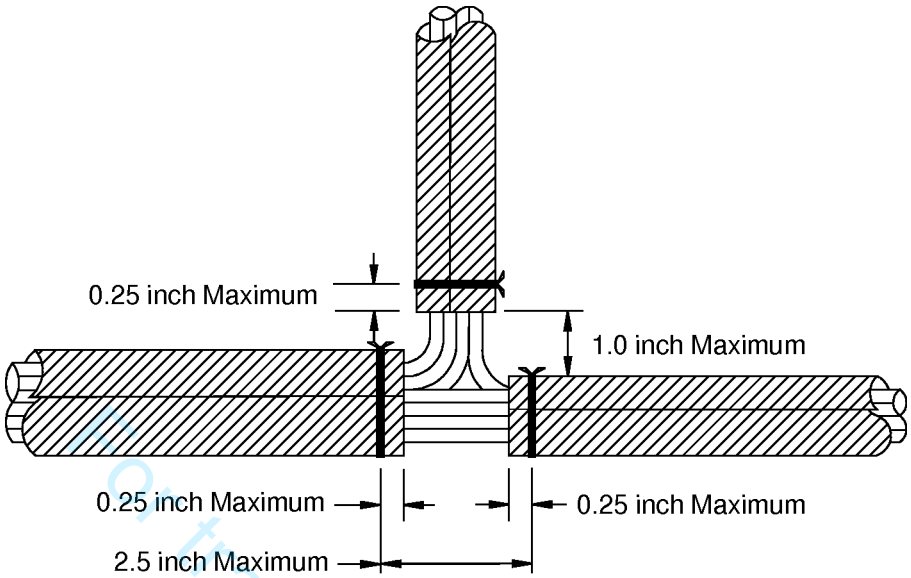
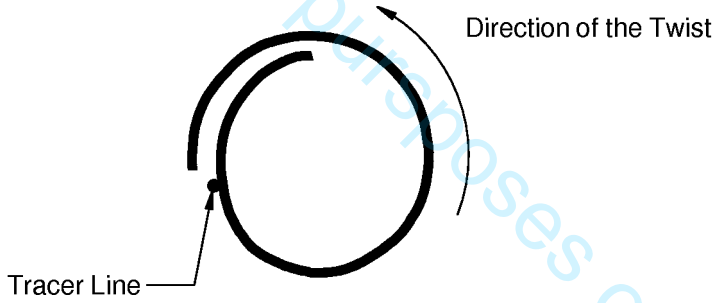


CONFIGURATION OF THE SLEEVES AT A BREAKOUT WITH WIRES FROM DIFFERENT DIRECTIONS
Figure 19

(10) Twist the sleeve on the wire harness a minimum of 1 turn per foot. Refer to Figure 20



POSITION OF THE TRACER IN RELATION TO THE OUTER EDGE OF THE SLEEVE
Figure 20

Make sure that:

- The twist is in the same direction as the outer edge of the sleeve
- The tracer line on the sleeve cannot be seen.

(11) Assemble the necessary wire harness ties at the ends of the sleeve or sleeves.

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Refer to:

- Figure 16 for the configuration of the ends of a sleeve
- Figure 17 and Figure 18 for the configuration of the sleeves at a breakout with wires from the same direction
- Figure 19 for the configuration of the sleeves at a breakout with wires from different directions.
- Paragraph 1.A. for the configuration of the overlap of sleeves.

Make sure that the distance between a tie and a terminal junction module or a connector without a backshell is 1.75 inches ± 0.25 inch.

(12) Assemble wire harness ties at a maximum interval of 6 inches along the length of the sleeve or sleeves

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REPAIR OF FLEXIBLE ELECTRICAL CONDUITS

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20-10-91 CONTENTS

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REPAIR OF FLEXIBLE ELECTRICAL CONDUITS

This Subject gives the procedures to repair these configurations of flexible conduits that are not made with metal:

- A convoluted tube
- A convoluted tube with a metal overbraid shield.

1. REPAIR OF A FLEXIBLE CONDUIT

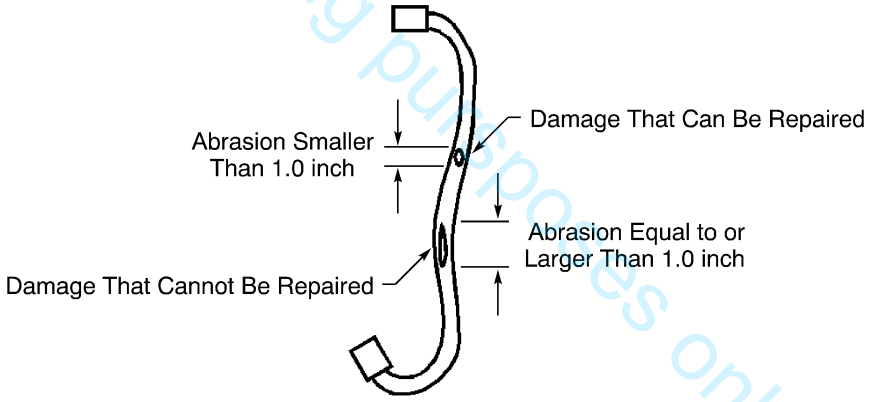
A. General Conditions

A conduit assembly must be replaced when:

- A wire in the convoluted tube has damage
- The convoluted tube has a crack
- The convoluted tube has damage that is equal to or larger than 1 inch in length; refer to Figure 1
- The convoluted tube has damage that is equal to or larger than 15 percent of the circumference of the tube; refer to Figure 2
- The inner PTFE or ETFE surface of the convoluted tube is not smooth and continuous
- The inner PTFE or ETFE surface of the convoluted tube has a blockage or a sharp edge.

A convoluted tube with abrasive damage can be repaired if:

- The tube has damage that is smaller than 1 inch in length; refer to Figure 1
- The tube has damage that is smaller than 15 percent of the circumference of the tube; refer to Figure 2.



LONGITUDINAL DAMAGE LIMITS OF A FLEXIBLE CONDUIT
Figure 1

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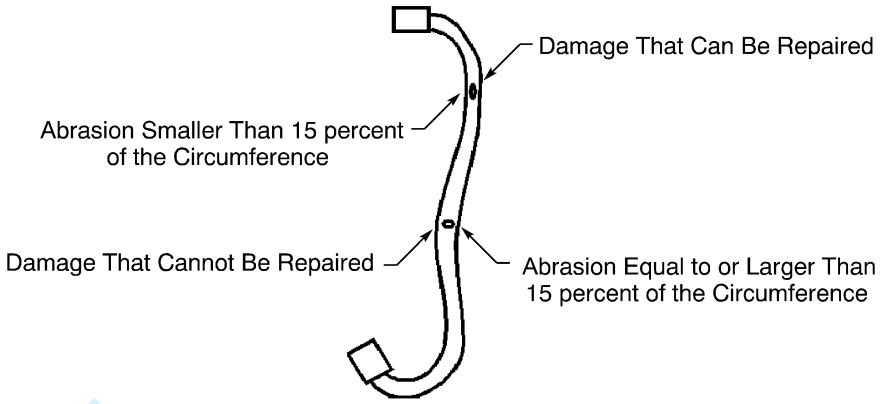

CIRCUMFERENTIAL DAMAGE LIMITS OF A FLEXIBLE CONDUIT
Figure 2

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B. Repair of a Convoluted Tube

(1) Make an inspection of the wires in the convoluted tube.

(2) If a wire has damage to the insulation, the shield, or the conductor:

(a) Remove the wire harness from the conduit assembly.

(b) Replace or repair the wire. Refer to Subject 20-10-13 for the applicable conditions.

CAUTION: A SPLICE ON A WIRE IN A CONDUIT IS NOT PERMITTED.

(c) Replace the conduit assembly.

(3) If the wires do not have damage, and the damage to the convoluted tube is not greater than the limits specified in Paragraph 1.A., repair the convoluted tube.

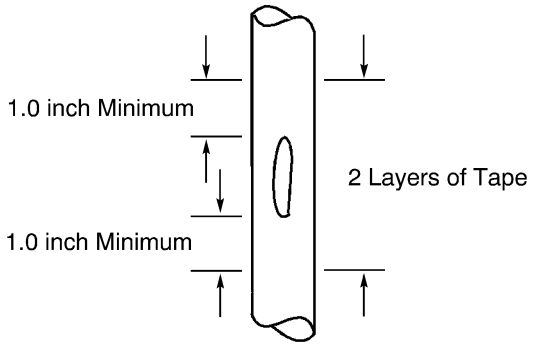
(a) Make a selection of a Teflon silicone adhesive tape. Refer to Subject 20-00-11.

Make sure that the tape has the applicable Temperature Grade and Class for the location of the repair.

(b) If applicable, remove sharp or rough edges from the damaged area.

(c) Clean the area with isopropyl alcohol. Refer to Subject 20-00-11.

(d) Put a minimum of 2 layers of tape on the damaged area. Refer to Figure 3.



LOCATION OF THE LAYERS OF TAPE
Figure 3

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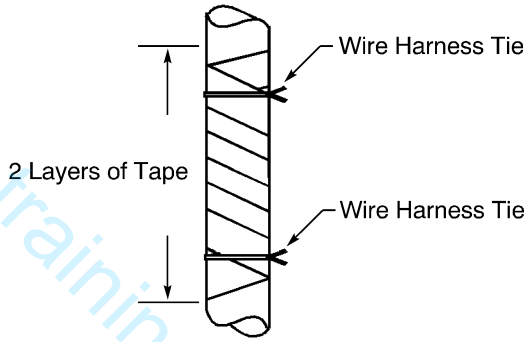
Make sure that:

- The end of each layer of tape makes a 1 inch minimum overlap with each end of the damaged area
- The tape makes 50 percent overlap on each layer
- The second layer of tape is in the opposite direction of the first layer.

(e) Assemble a wire harness tie on the tape at each end of the repair area. Refer to:

- Figure 4
- Subject 20-10-11 for the procedure to assemble a wire harness tie.



POSITION OF THE WIRE HARNESS TIES
Figure 4

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(4) If the damage to the convoluted tube is greater than the limits specified in Paragraph 1.A., replace the damaged convoluted tube with a new convoluted tube. Refer to Subject 20-00-11.

2. REPAIR OF A FLEXIBLE CONDUIT WITH A METAL OVERBRAID SHIELD

A. General Conditions

A conduit assembly must be replaced when:

- A wire in the convoluted tube has damage
- The convoluted tube has damage
- The inner PTFE or ETFE surface of the convoluted tube is not smooth and continuous
- The inner PTFE or ETFE surface of the convoluted tube has a blockage or a sharp edge
- The overbraid shield has damage that is equal to or larger than 1 inch in length; refer to Figure 5
- The overbraid shield has damage that is equal to or larger than 25 percent of the circumference of the conduit; refer to Figure 6
- The electrical bond between the two end fittings has a resistance that is greater than 10 milliohms.

A conduit assembly with abrasive damage of the metal overbraid shield can be repaired if:

- The shield has damage that is smaller than 1 inch in length; refer to Figure 5
- The shield has damage that is smaller than 25 percent of the circumference of the shield; refer to Figure 6
- The electrical bond between the two end fittings has a resistance that is less than or equal to 10 milliohms.

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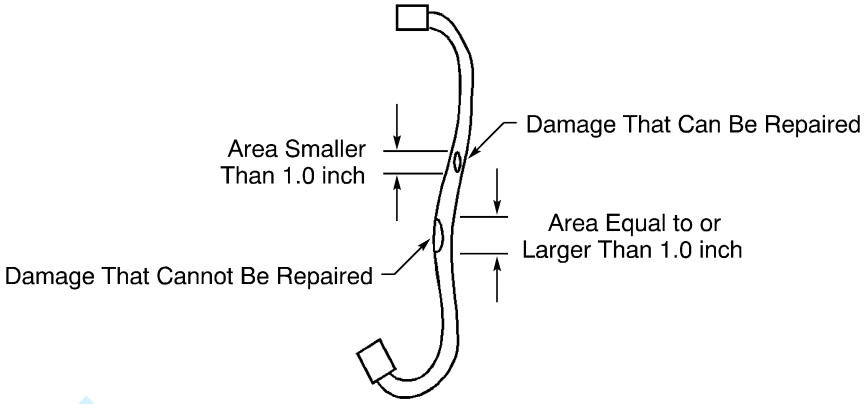
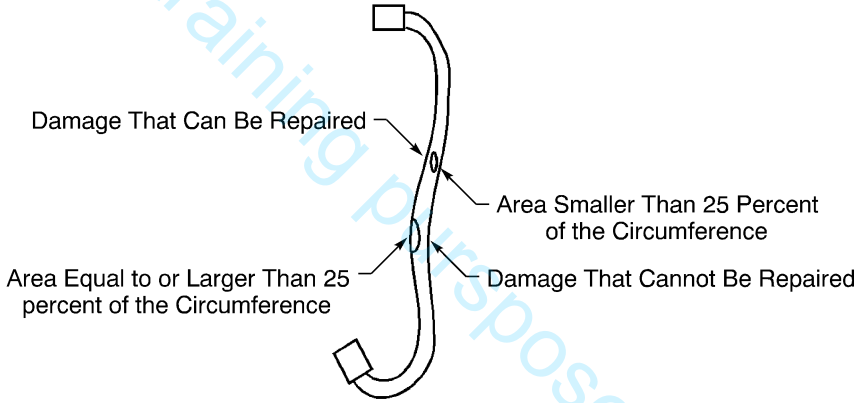


LONGITUDINAL DAMAGE LIMITS OF A FLEXIBLE CONDUIT WITH A METAL OVERBRAID SHIELD
Figure 5



CIRCUMFERENTIAL DAMAGE LIMITS OF A FLEXIBLE CONDUIT WITH A METAL OVERBRAID SHIELD
Figure 6

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B. Repair of a Metal Overbraid Shield

(1) Make an inspection of the wires in the convoluted tube.

(2) If a wire has damage to the insulation, the shield, or the conductor:

(a) Remove the wire harness from the conduit assembly.

(b) Replace or repair the wire. Refer to Subject 20-10-13 for the applicable conditions.

(c) Replace the conduit assembly.

(3) If the convoluted tube has damage:

(a) Remove the wire harness from the conduit assembly.

(b) Replace the conduit assembly.

(4) If the wires or the convoluted tube do not have damage, repair the overbraid shield.

Make sure that the damage of the shield is not greater than the limits that are specified in Paragraph 2.A.

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REPAIR OF FLEXIBLE ELECTRICAL CONDUITS

(a) Make a selection of a Teflon silicone adhesive tape. Refer to Subject 20-00-11.

Make sure that the tape has the applicable Temperature Grade and Class for the location of the repair.

(b) If applicable, remove broken strands and rough edges of the shield from the damaged area.

(c) Clean the area with isopropyl alcohol.

(d) Put a minimum of 2 layers of tape on the damaged area. Refer to Figure 3.

Make sure that:

- The end of each layer of tape makes a 1 inch minimum overlap with each end of the damaged area
- The tape makes 50 percent overlap on each layer
- The second layer of tape is in the opposite direction of the first layer.

(e) Assemble a wire harness tie on the tape at each end of the repair area. Refer to:

- Figure 4
- Subject 20-10-11 for the procedure to assemble a wire harness tie.

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