

Avionics Trade Skill

Content

- Manual Familiarization
- Introduction to Wire/Cable
- Wiring Termination Process
- Introduction to Connector
- Wire Routing Techniques and installation
- Handling Electrostatic Sensitive Devices (**ESDS**)
- Multimeter and Basic of Troubleshooting
- Information About Circuit Breaker Reset
- Electrical Wiring Interconnnsct System (**EWIS**)

Standard Practices Manual - ATA 20

Boeing and Airbus had developed their own set of manual for performing maintenance or repair for avionics related defects.

BOEING Standard Wiring Practices Manual (SWPM)



AIRBUS Electrical Standard Practices Manual (ESPM)

Note: Some electrical standard practices can also be found in AMM chapter 20-60 of Standard Practices (Airframe)



Customer : GEN	Manual : ESPM
Type : ALL	Selected applicability :
Rev. Date : Apr 01, 2013	
INTRODUCTION - DESCRIPTION AND OPERATION	

INTRODUCTION - DESCRIPTION AND OPERATION

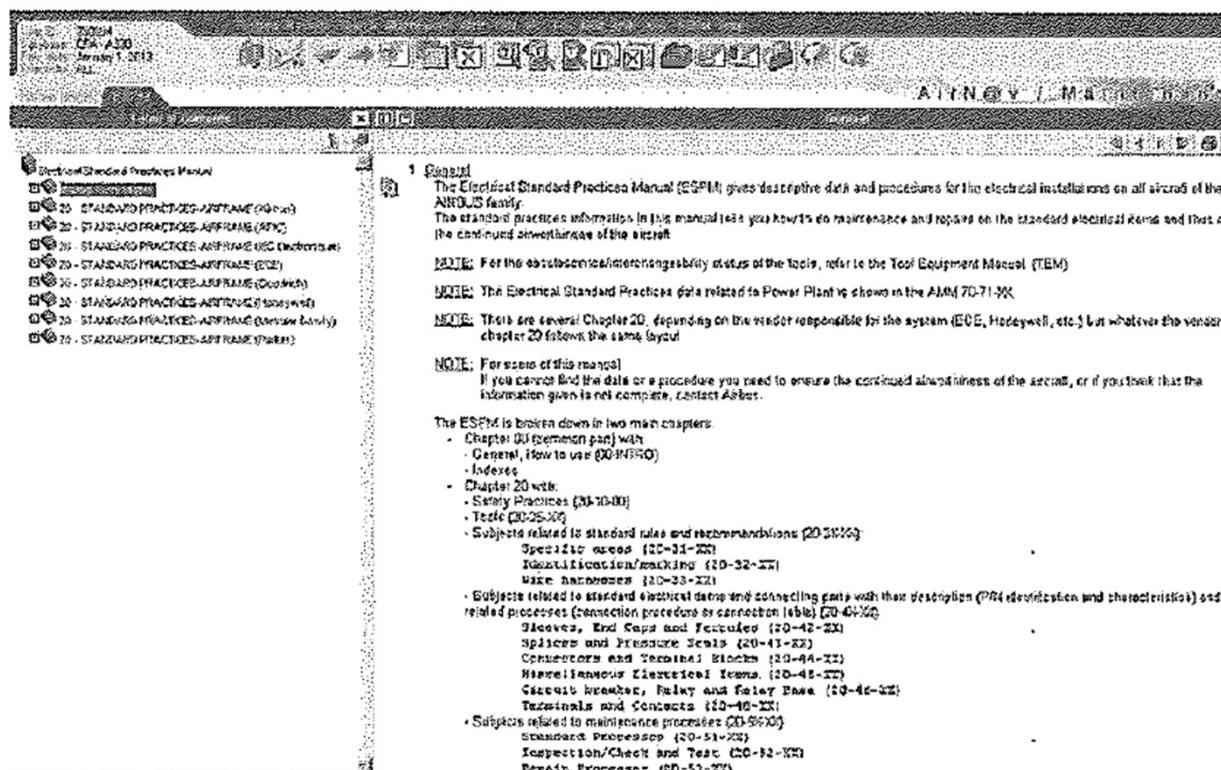
BOEING - Standard Wiring Practices Manual (SWPM)

- Reference for methods on how to perform wiring, routing, electrical connection, removal and installation, identification, etc.

BOEING 737-700/800 STANDARD WIRING PRACTICES MANUAL	
CHAPTER INDEX	
CHAPTER SECTION SUB-SECTION	TITLE
29-00	GENERAL DATA
29-01-01	SAFETY PRACTICES
29-01-02	MATERIALS
29-01-03	CONTACT CLAMP, BULK, CROSS-REFERENCE
29-01-04	WIRE TIE CODES
29-01-05	SHIELDING-WIRE FIBER-REINFORCEMENT
29-01-06	NAME INSULATORS REMOVAL
29-01-07	OUTER BUNDLES OF WIRE
29-02	TIME PROTECTION ZONES AND ENVIRONMENTAL AREAS
29-02-01	AIRPLANE FLAMMABLE LEAKAGE ZONES
29-02-02	AIRPLANE TEMPERATURE AREAS
29-02-03	AIRPLANE VIBRATION AREAS
29-03	WIRING INSTALLATION
29-03-01	CLEANING OF WIRE HARNESSES
29-03-02	INSPECTION OF WIRES
29-03-03	WIRES ASSEMBLY AND INSULATION CONFIGURATION
29-03-04	WIRES KNOTTED EQUIMENT
29-03-05	PREPARATION OF ELECTRICAL WIRE AND CABLE
29-03-06	INSTALLATION OF SHIMMABLE SLEEVES
29-03-07	ASSEMBLY OF SHIMS-BRIDGE PAPER
29-03-08	ASSEMBLY OF INSULATED FITTINGS AND HEAT SHRINKABLE INSUL.
29-03-09	INSTALLATION OF THERMOFUSIBLE
29-03-10	INSTALLATION OF METAL STRIPS ON WIRES
29-03-11	WIRE SEPARATION
29-03-12	INSTALLATION OF PRESTRETCHED FOAM-SEAL
29-03-13	POWER FEEDER WIRE HARNESS (FOAM-SEAL)
29-03-14	DISASSEMBLY, ASSEMBLY, AND INSTALLATION OF BACKUP SEAL FITTINGS
29-03-15	REPAIR OF FLEXIBLE ELECTRICAL CORDSETS
29-04	FLAME RETARDANT WIRING
29-04-01	ARM AND SPlicing
29-04-02	FIBER OPTIC CABLE
29-04-03	DISASSEMBLY-FIRE RETARDANT CABLE, ADDITIVE
29-04-04	DISASSEMBLY AND ASSEMBLY OF FIBER OPTIC CABLE ASSEMBLIES
29-04-05	DISASSEMBLY, REASSEMBLY, REPAIR, AND BACKUP FIBER OPTIC CONNECTORS
29-04-06	PRIMARY FLIGHT CONTROL, FUEL QUANTITY INDICATION SYSTEM (FQIS), AND FLIGHT RECORDER WIRE HARNESSES
29-04-07	REPAIRS OF PRIMARY FLIGHT CONTROL SYSTEM WIRE HARNESSES
29-04-08	REPAIRS OF FUEL QUANTITY INDICATOR SYSTEM (FQIS) WIRE HARNESSES
29-04-09	ASSEMBLY OF THE FLIGHT RECORDER WIRE HARNESSES WITH A BACKUP-FIREWALL CONNECTOR
20-CONTENTS	
Page 1 Page 2	

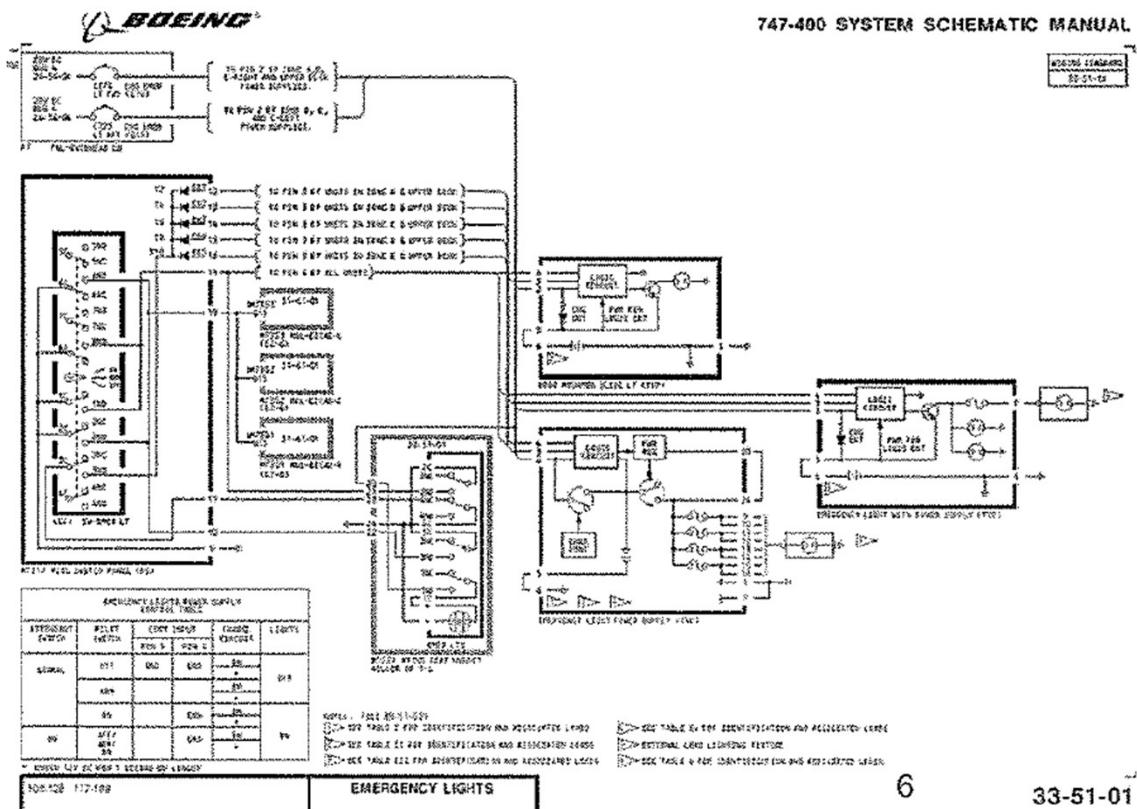
AIRBUS - Electrical Standard Practices Manual (ESPM)

- Provides information and procedures for electrical installation, removal, repair and maintenance techniques



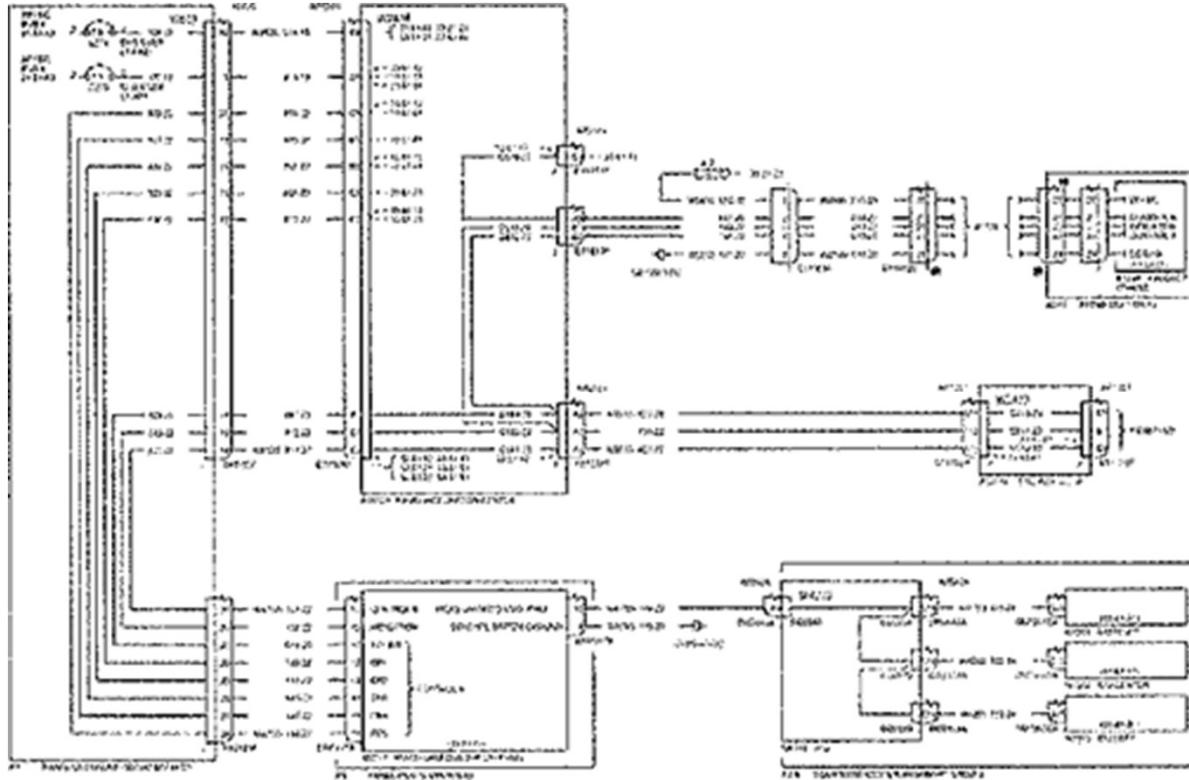
System Schematic Manual

- Provide an overview for the whole circuit / system



Wiring Diagram Manual

- Provide detailed circuit information



Maintenance Performance Toolbox (BOEING)

The screenshot shows the Boeing Maintenance Performance Toolbox software. The main window has tabs for Main, Systems, Directories, Library, and Document Viewer. The Systems tab is active, displaying a table of contents for the CAT 747-400 WDM D390U186 Rev 51, dated 28 Jan 2014. The table of contents includes sections like Ignition, Air, Engine Controls, Engine Indicating, Exhaust, Oil, Starting, Charts, and lists for Equipment, Circuit Breaker, Bracket, Wire, Spare Wire, Master Bundle, Ground, Splice, Term Strip, and Hookup. To the right of the table of contents, there is a large list of performance checklist items, each with a checkbox and a brief description. Some items are grouped under section headings A through E.

A. Terminal Block

- (1) Sheet 1 - Effectivity: ALL
- (2) Terminal Blocks
- Sheet 1 - Effectivity: ALL

B. Relays (The Mechanical Linkage is referenced)

- (3) Relays (The Mechanical Linkage is referenced)
- Sheet 1 - Effectivity: ALL

C. Power and Ground Indication

- (1) **Power Source Indication**
The circuit breaker symbol, equipment designation, splices and terminals.
 Sheet 1 - Effectivity: ALL
- (2) **Ground Indication**
The diagram detailing the complete ground circuit.
 Sheet 1 - Effectivity: ALL

D. Connector Symbols

- Connector symbols are shown broken when the same wire connects two different components.
 Sheet 1 - Effectivity: ALL
- Connector symbols are shown complete when all user-defined connection points are connected.
 Sheet 1 - Effectivity: ALL

E. Galleys and Lavatories

- Wiring Diagrams will show Boeing wiring to the intent.

Maintenance Performance Toolbox -- system

BOEING Maintenance Performance Toolbox

Main Systems Structures Library Document Viewer Authoring Tasks Training

Select an Airplane:
Airplane: 737-700, ILF Customer Effectivity Code 685 show more info

Select a Function:
Function: Synoptics

Select a Synoptic:
36-00 Pneumatic

Select an LRU:
Synoptic Controls: show controls

Select LRU Link:
View Document

Copyright (c) 2005 The Boeing Company. - All rights reserved. [Terms of Use](#)

Wire List(WDM)

 Maintenance Performance Toolbox

Main Systems Library Document Viewer Help Contact Us MyBoeingFleet

747- CAT 747-400 WDM D280U106 Rev 51, 20 Jan 2014

History Search Find It Reset Print

Table of Contents DB LRR CH-AU

WIRE LIST

Wire Bundle No.: W1324
Description: LIFERAFT BOX DR 5-LEFT
Part Number: 61B41324

Bundle-Wire-Gauge	TY	FA	Length		Diagram Reference	From:				To:				Effectivity
			Ft	In		Equip	Term	TT	SP	Equip	Term	TT	SP	
W1324 - 001 - 24	PK		2	3	23-24-41	DB7472C	12			D11514J	26		D11-012, 014-022, 029, HOO-HOT, HOV-HOY, HUA-HUG, HUI-HUJ	
W1324 - 002 - 24	PK		2	3	23-24-41	DB7472C	22			D11514J	33		D11-012, 014-022, 029, HOO-HOT, HOV-HOY, HUA-HUG, HUI-HUJ	
W1324 - 005 - 22	PA		1	3	33-21-71	D11514J	5			SM00012	5		D11-012, 014-022, 029, HOO-HOT, HOV-HOY,	

Hookup List(WDM)

 Maintenance Performance Toolbox

Main Systems Library Document Viewer History Find It Reset Print

ALL CAT 747-400 WDM D288U106 Rev 51, 28 Jan 2014

Type of Contents DB List Filter All

D43200
D43400
D43600
D43700
D43800
D43900
D44000
D44100
D44200
D44300
D44400
D44500
D44600
D44631J D44631P
D44631P D44632J
D44632J D44632P
D44632P D44633J
D44633J D44633P
D44633P D44634J
D44634J D44634P
D44634P D44635J
D44635J D44636J
D44636P D44636P
D44637J D44638J
D44638J D44639P
D44639P D44639P

HOOKUP LIST

Equipment No.: D44632J
Location (STA-WL-BL): AP2305 - P183
Description: RECP Effectivity: ALL

Term	Bundle - Wire - Gauge	TT	Diagram Reference	Effectivity
1	W3880 - 017 - 14		24-54-06	ALL
2	.	UNUSED		ALL
3	-	UNUSED		ALL
4	-	UNUSED		ALL
5	-	UNUSED		ALL
6	-	UNUSED		ALL
7	-	UNUSED		ALL
8	-	UNUSED		ALL
9	W3880 - 101 - 18	OK	24-33-11	ALL
10	W3880 - 003 - 22		24-33-31	001-002, HCR-HZ2, LIA-LZZ
11	-	UNUSED		008-099, HOC-HOP
12	W3880 - 008 - 24		24-31-21	ALL

Equipment Diagram Manual (WDM)

The screenshot shows a software application window titled "Maintenance Performance Toolbox". The top menu bar includes "Main", "Systems", "Library", "Document Viewer", "History", "Find It", "Reset", "Print", and "Logout". The left sidebar displays a "Table of Contents" with a hierarchical tree structure, including categories like M02900 through M04900, and further sub-categories under M04900. The main content area is titled "747-400 Wiring Diagram Manual" and features a section header "EQUIPMENT LIST". A table titled "M04900" lists three equipment items:

Description	Op t	Part Number	Used On Drawing	Ch 20 Ref	Location STA/WLJBL	Vendo r Qty	Diagram Reference	Effectivit y
DET B-AFT CARGO SMK-ZONE 2		2166-656HS	453U4152		1877/193/R 23	03972	1	<u>26-16-20</u>
DET B-AFT CARGO SMK-ZONE 2		2166-756	453U4152		1877/193/R 23	03972	1	<u>26-16-20</u>
DET B-AFT CARGO SMK-ZONE 2		2166-756A	453U4152		1877/193/R 23	03972	1	<u>26-16-20</u> , HUL-HZZ, LIA-LZZ

Misc information (WDM)

The screenshot shows a software application window titled "Maintenance Performance Toolbox". The top menu bar includes "Main", "Systems", "Library", "Document Viewer", "Help", "Logout", and "MyBoeingFleet". The left sidebar displays a "Table of Contents" with various sections like Legal Notice, EFFECTIVE AIRCRAFT, TRANSMITTAL LETTER, SERVICE BULLETIN LIST, CUSTOMER CHANGE LIST, INTRODUCTION, GENERAL INFORMATION, DEFINITIONS, EQUIPMENT LIST, WIRING DIAGRAMS, CHARTS AND LISTS, CODES, MANUAL USAGE, and STANDARD WIRING PRACTICES. Below this is a list of categories such as GENERAL, AIR CONDITIONING, AUTOCFLIGHT, COMMUNICATIONS, ELECTRICAL POWER, EQUIPMENT/FURNISHINGS, FIRE PROTECTION, FLIGHT CONTROLS, FUEL, HYDRAULIC POWER, ICE AND RAIN PROTECTION, INDICATING/RECORDING SYSTEMS, and LANDING GEAR, each with a corresponding CAT number. The main content area is titled "3. TERMINAL INFORMATION" and contains a list of terminal stud sizes and part numbers. A legend at the bottom defines the symbols used in the table.

3. TERMINAL INFORMATION

The following index of "Term Type Codes" lists the code, a description of the code and, as applicable, the terminal stud size and/or part number. The code index is arranged in the following order:

- Single alphabetical letter
- Double alphabetical letters
- Single alphabetical letter + symbol
- Single alphabetical letter + number
- Number + alphabetical letter
- Numbers
- Symbols

See Standard Wiring Practices (Chapter 20) for maintenance or repair information.

A. Single alphabetical letter

TERM TYPE CODE	DESCRIPTION OF THE CODE	STUD SIZE/PART NUMBER
A	Terminal	2 BACT12AC43
B	Terminal, General Purpose	4
C	Terminal, General Purpose	6
D	Terminal, General Purpose	8
E	Terminal, General Purpose	10
F	Terminal, General Purpose	1/4
G	Terminal, General Purpose	5/16

Wire and Cable p.1

single wire



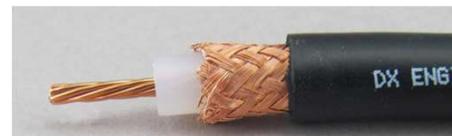
Twisted Pair wire



Shielded Pair wire



Coaxial cable



Wire Gage

Thickness of conductor of a wire is represented by Wire Gage Number, for aviation, American Wire Gage is used.

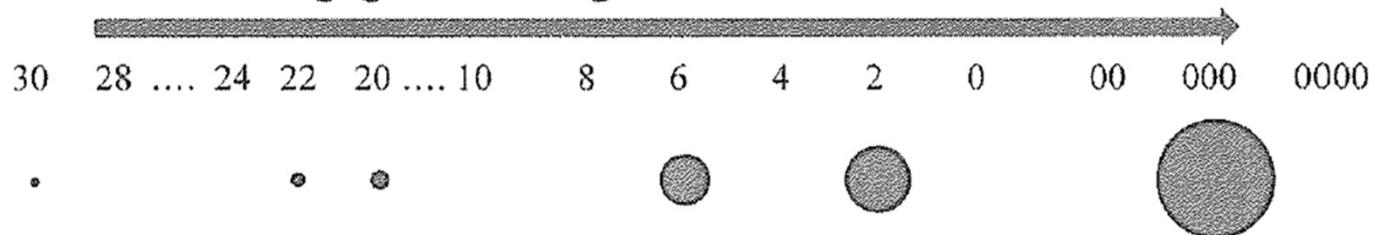
American Wire Gage

AWG

Standard Wire Gage

SWG

Smaller gage no. = larger cross section of conductor



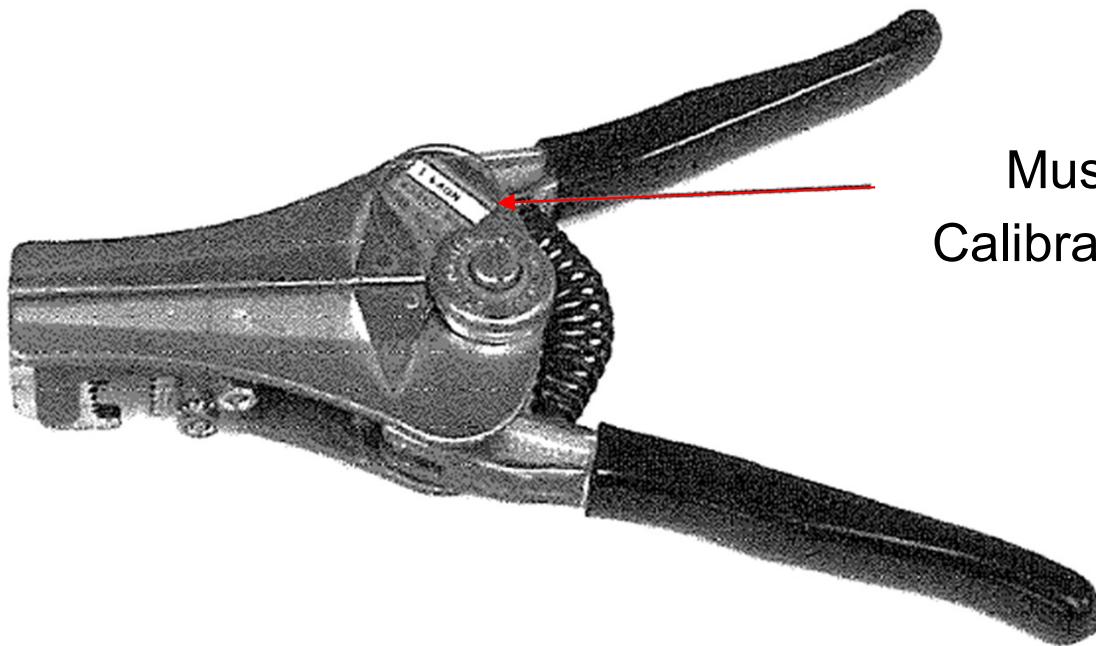
Wire Stripper

For wire # 10 or thinner,

use wire stripper

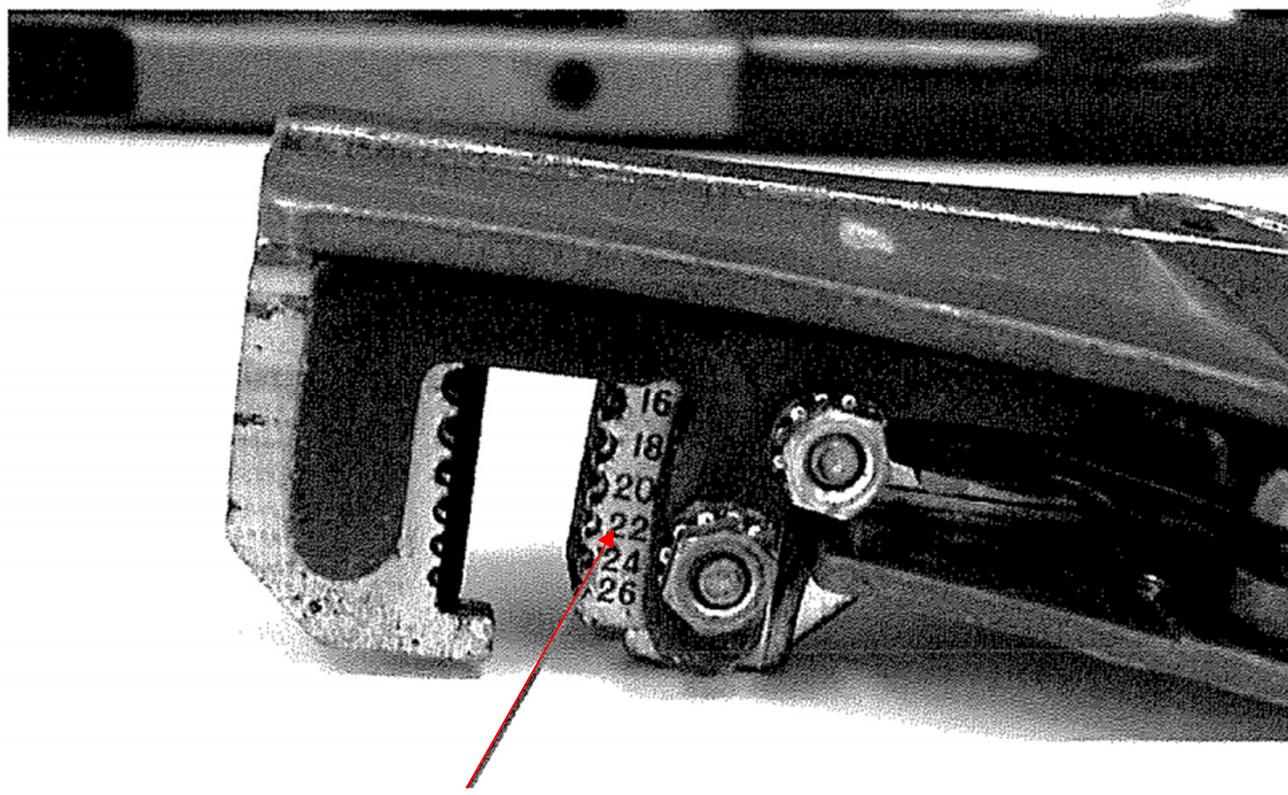
For wire thicker than # 10 (8 / 6 / 4 ...),

use hand knife



Must check for
Calibration Due Date

Wire Stripper



Cutting Blade with Wire Gage No. Selection

Note: - Must Check the condition of the Blades and the operation of the stripper before performing Wiring Stepping

Hardware for termination

Red: for wire gage 22, 20 , 18



Solder sleeve
Ring-tongue terminals / Terminal Lug

Blue: for wire gage 16, 14

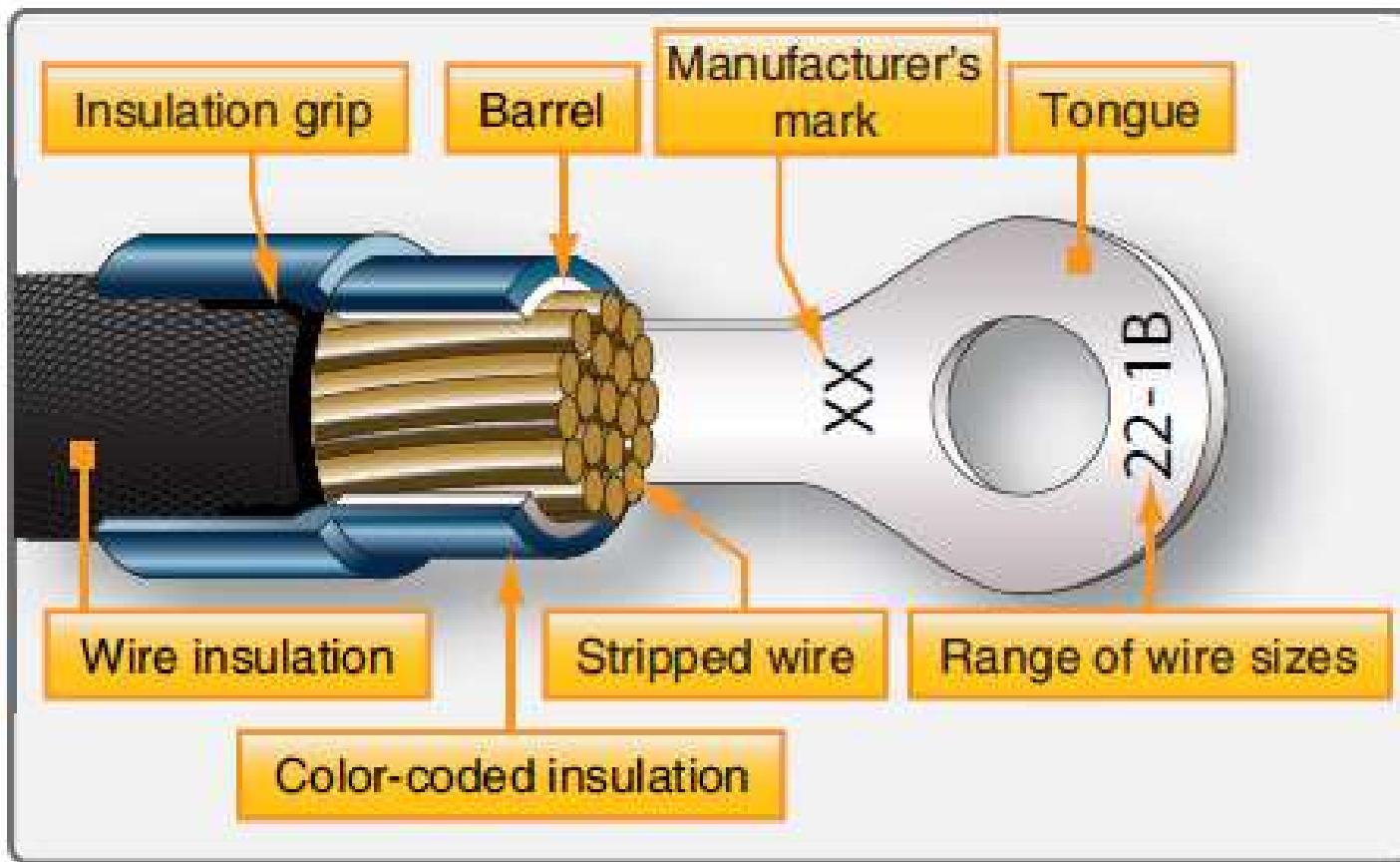


Yellow: for wire gage 14, 12

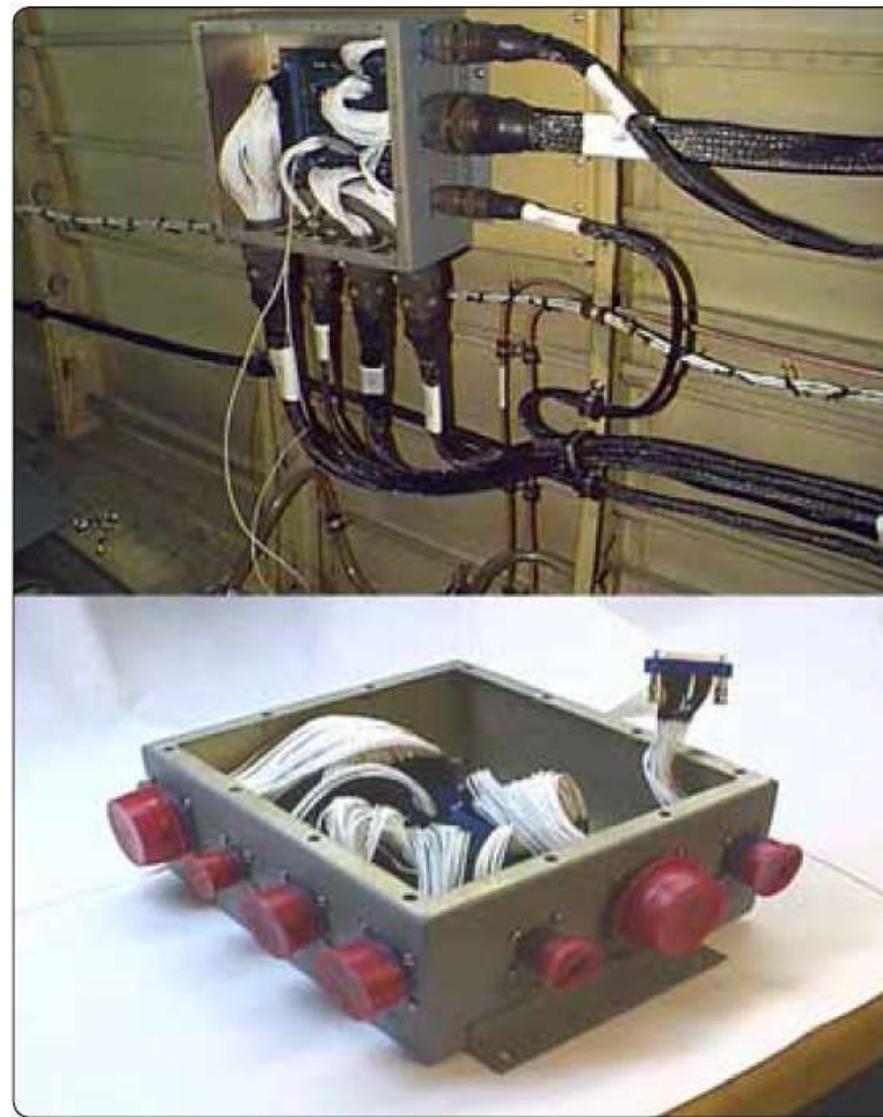


Terminal splices

Hardware for termination



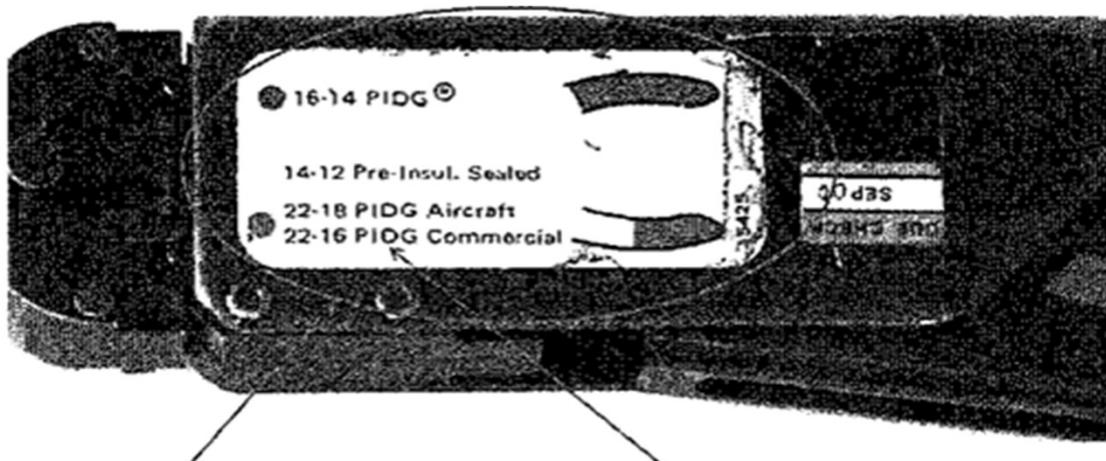
Junction Boxes



Terminal ? Splice Crimping Tool (P/N: 59250)



Terminal / Splice Crimping Tool (P/N: 59250)



Color Ident for different
wire gauges

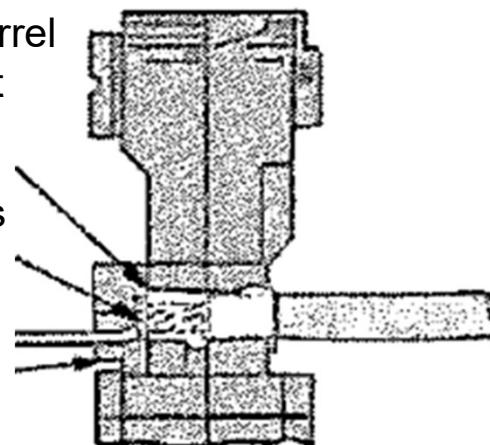
Pre-Insulated Diamond Grip or PiDG
Terminals and Splices - are the pre-
insulated terminal

Terminal / Splice Crimping Tool (P/N: 59250)

- Terminal Barrel Rests Against Locator

-Conductor Butts Against Locator

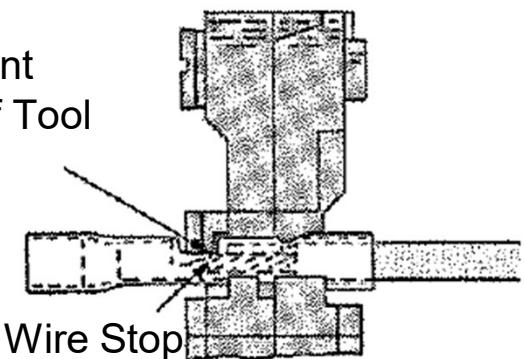
-Terminal Toague Slides Under Locator



Crimping a terminal lug

First Crimp

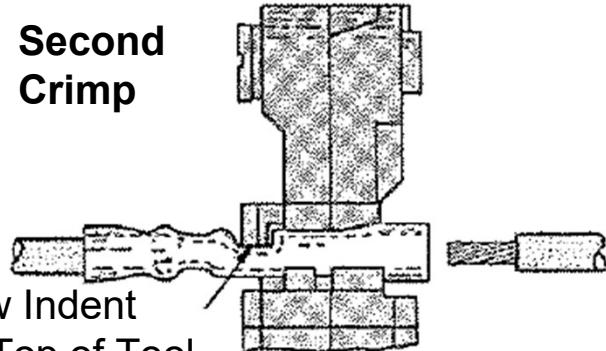
Window Indent Faces Top of Tool



Conductor Butts Against Wire Stop

Second Crimp

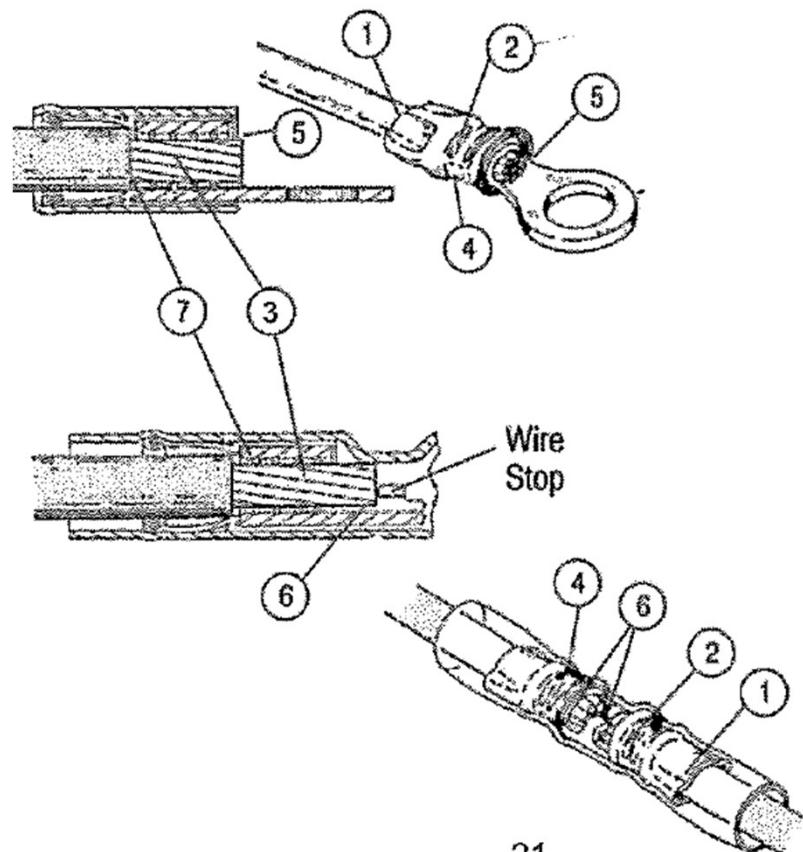
Window Indent Faces Top of Tool



Crimping a splice

Terminal / Splice Crimping Tool (P/N: 59250}

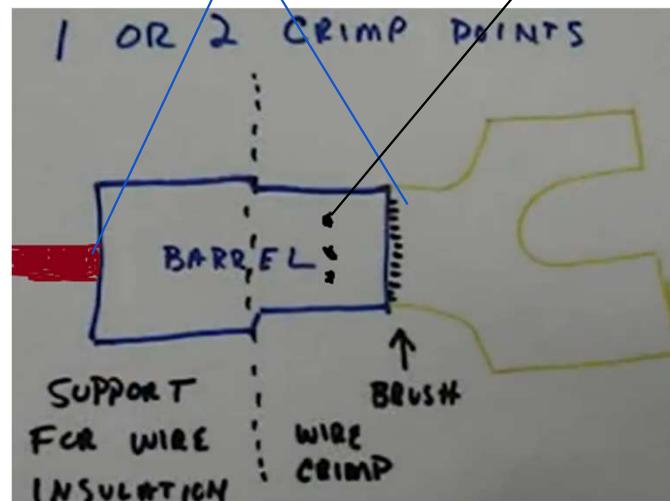
1. insulation barrel is in firm contact with the wire insulation
2. Correct color code match the dot code
3. No nicked or missing conductor strands
4. Crimp centered on wire barrel
5. End of conductor should be flush with, or extends beyond wire barrel
6. End of conductor against wire stop of splice, or at (east flush with, or extended slightly beyond wire barrel
7. Wire insulation does not enter wire barrel



Inspection after Crimping

must see wire
strands protrude

Dot mark of the
correct tool



Crimped Terminal

<https://youtu.be/xhPM5-JbRtA?t=5m>

Splice Crimping Tool (P/N; AD1377)

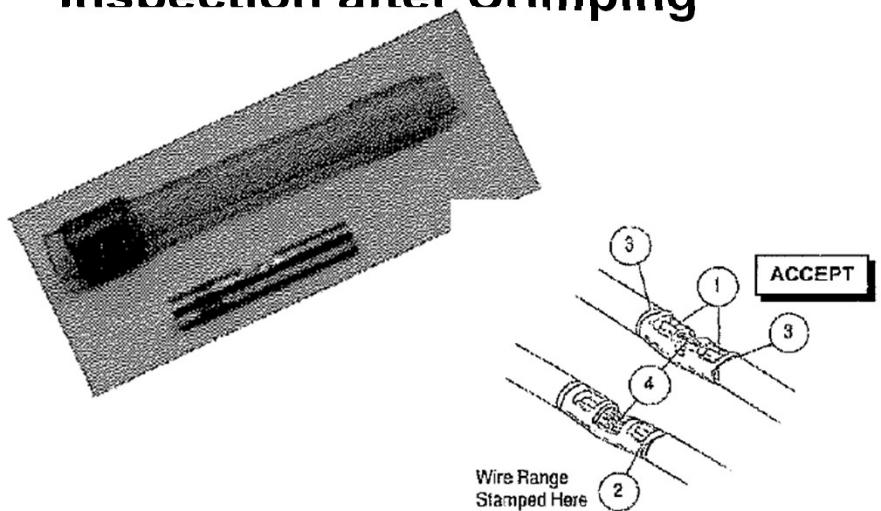
Use for crimping the barrel of the environmental splice

Colour Coded for selection of the correct barrel size

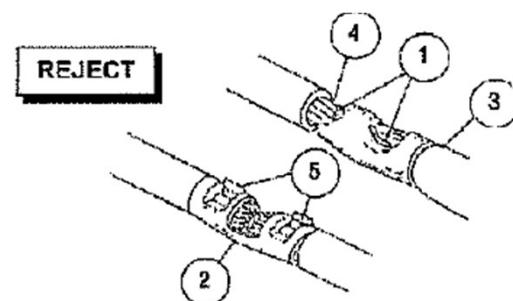
Colour Code



Inspection after Crimping

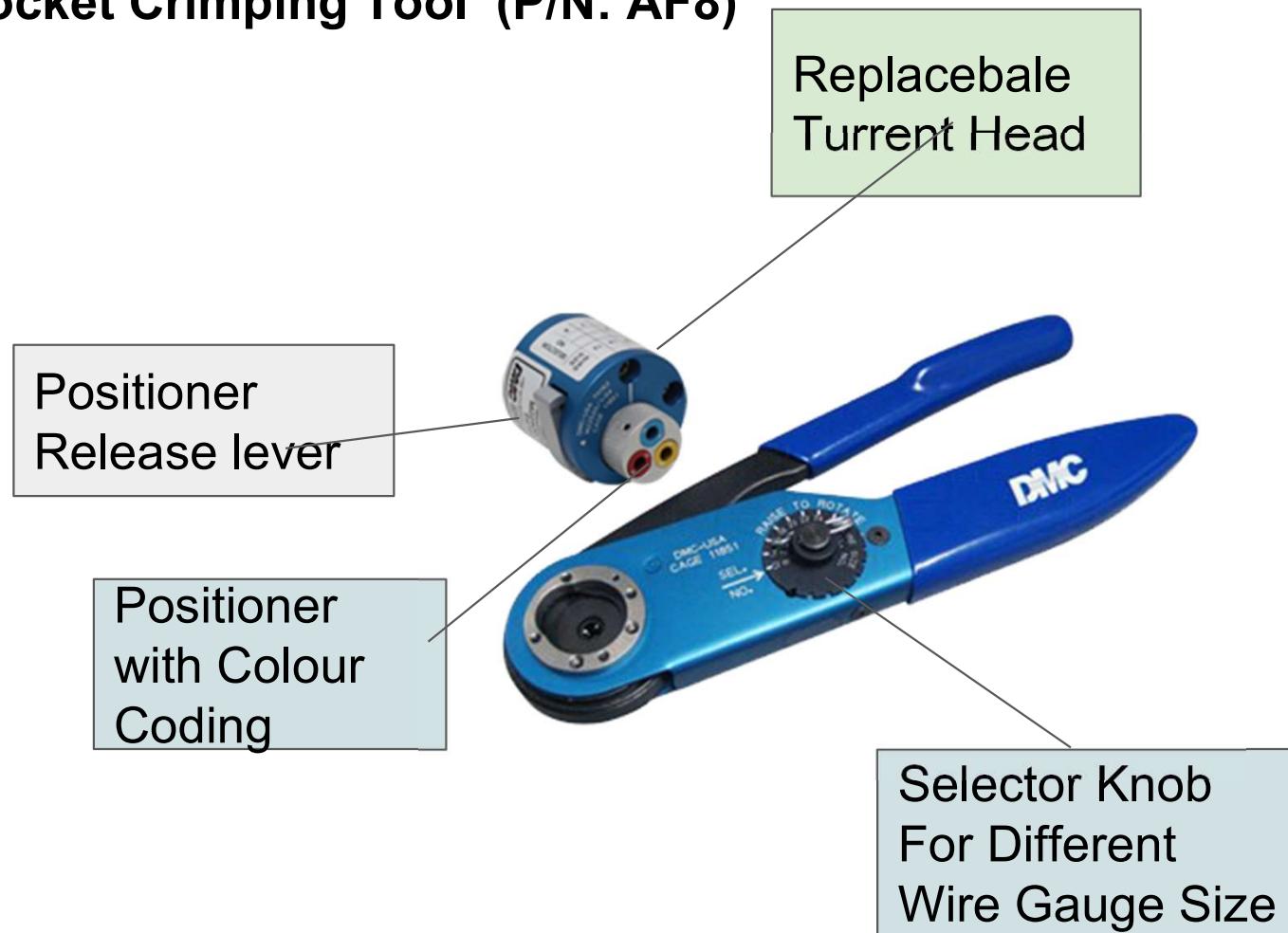


1. Crimps centered. Crimps may be off center BUT NOT OFF END OF WIRE BARREL.
2. Wire size matches wire color range on splice and tool.
3. Wire insulation does not enter wire barrel.
4. Wire is visible through inspection hole of bull splices. Wire is flush with or extends slightly beyond end of wire barrel
5. On parallel splices, bare wire ends must be flush with or extended slightly beyond end of wire barrel.

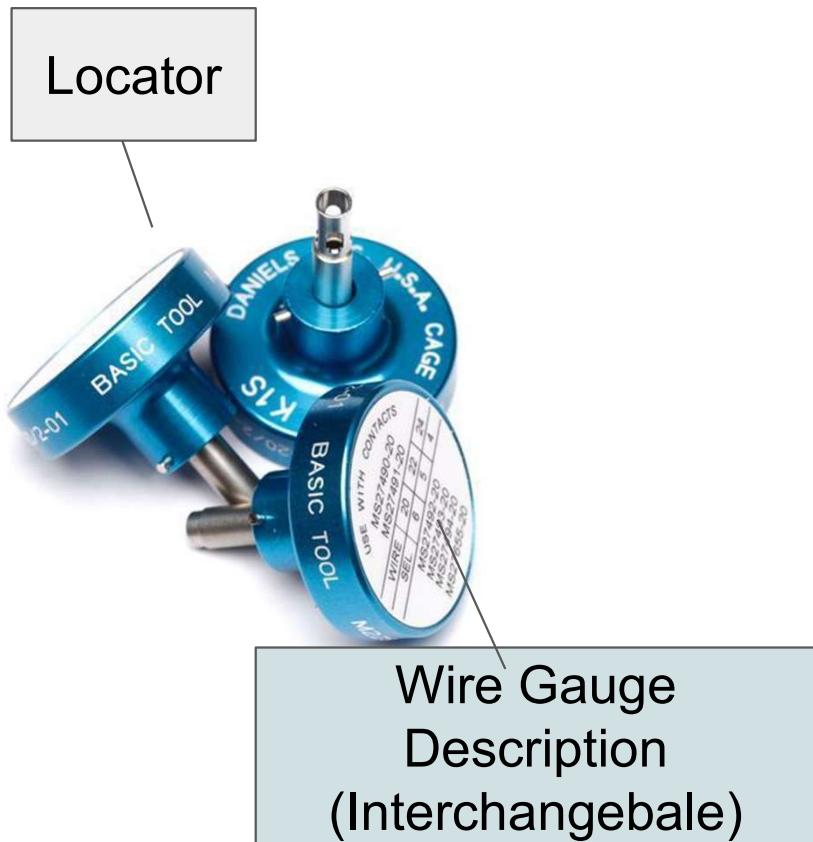


1. Crimped off end of splice or terminal wire barrel.
2. Wire size does not match wire size or color range on splice or tool.
3. Wire insulation entered wire barrel of terminal or splice. **CHECK FOR INCORRECT STRIP LENGTH.**
4. wire not inserted far enough in terminal hole of butt splices, and be flush with or extend slightly beyond end of wire barrel.
5. Excessive "flash" on terminal or splice indicates damaged jaws or wrong wire, splice, or tooling combination was used.
6. Nicked or missing strands.

Pin / Socket Crimping Tool (P/N: AF8)

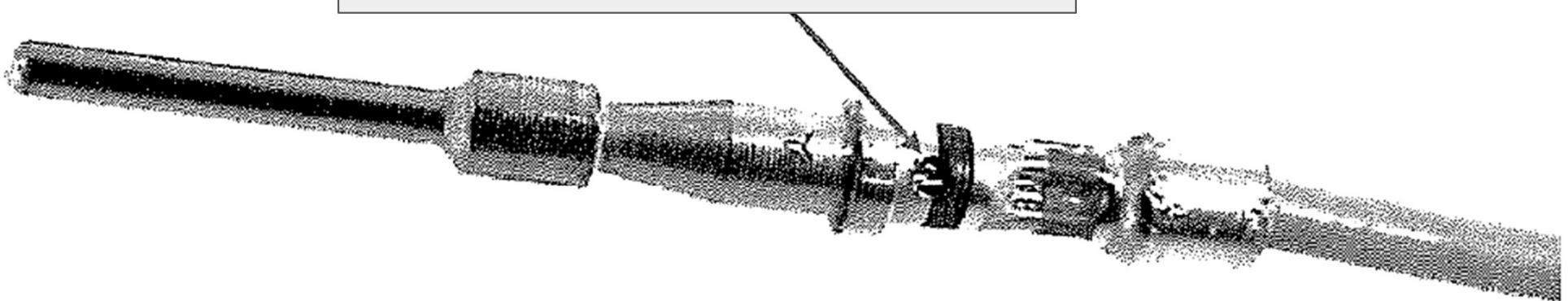


Pin / Socket Crimping Tool (P/N: AF8)



Inspection after Crimping

Wire strands should be seen
through the inspection hole

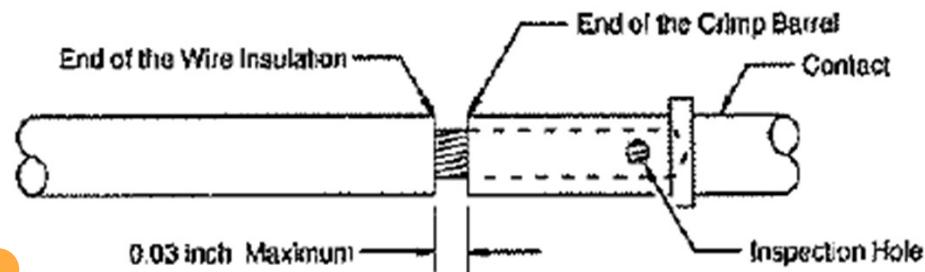


Crimped pin

Crimping of Pin/Socket

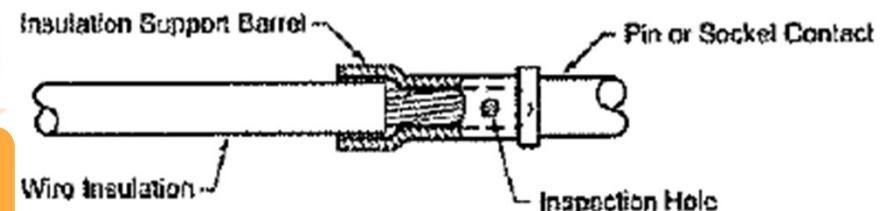
Strip Wire

- Strip the wire jacket to an allowable length
- Insert the wire into the contact
(pin/socket) barrel



Full Engagement

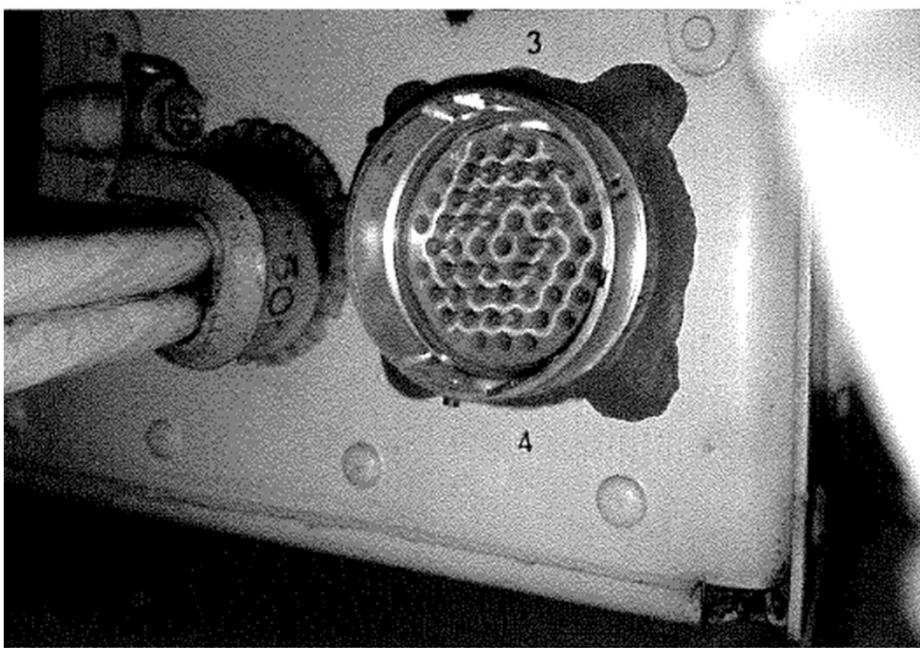
- Inspect for proper engagement by looking at the inspection hole
- Check if the insulation is either striped to an allowable length for the wire strands to show or not



Setting and Crimp

- Set the correct positioner (AF8) or locator (AFM8)
- Insert the contact with the striped wire and apply pressure to the handle

Connector Pairs



**Connector
arrangement to
avoid wrong
connection**



Caution for Extraction and Insertion of Contacts

Extract

Must perform in a straight line motion with the probe sit against the stop within the connector assembly

Don't force it with too much power, or else the lock latch will be damaged

insertion

Contact barrel support or shoulder must sit tight against the tool tip during the straight line insertion motion

Once the insertion procedures are done, pull on the wire to assure the proper locking and function of the lock

Contact Removal and Insertion Tools (P/N AT20XX AT1000-XX)



DRK83-12B

DRK95-16

Contact Removal tools



Coaxial/Shielded Contact Tool Selection Guide

SHIELDED CONTACTS AND CONNECTOR SERIES	BIN CODE	CONTACT CAVITY SIZE	INNER CONTACT		SHIELD CRIMP SLEEVE		OUTER CONTACT		INSTALLING TOOL	REMOVAL TOOL
			CRIMPING TOOL	POSITIONER	CRIMPING TOOL	POSITIONER OR DIE (CAVITY)	CRIMPING TOOL	POSITIONER OR DIE (CAVITY)		
M39029/25-PIN CONTACT	204	12	AFM8	K496	HX4	Y189			DAK12B	DRK12B



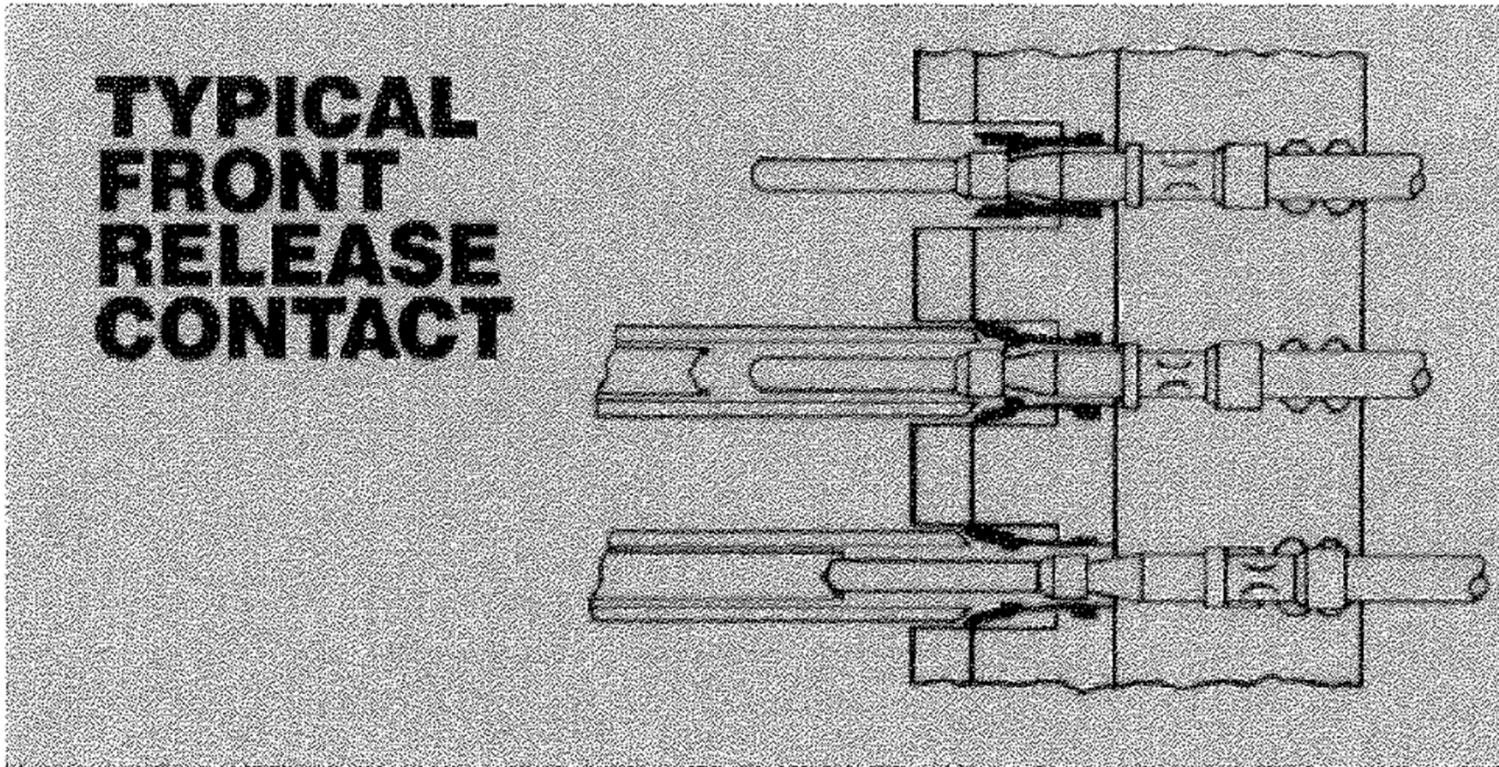
DAK83-20B



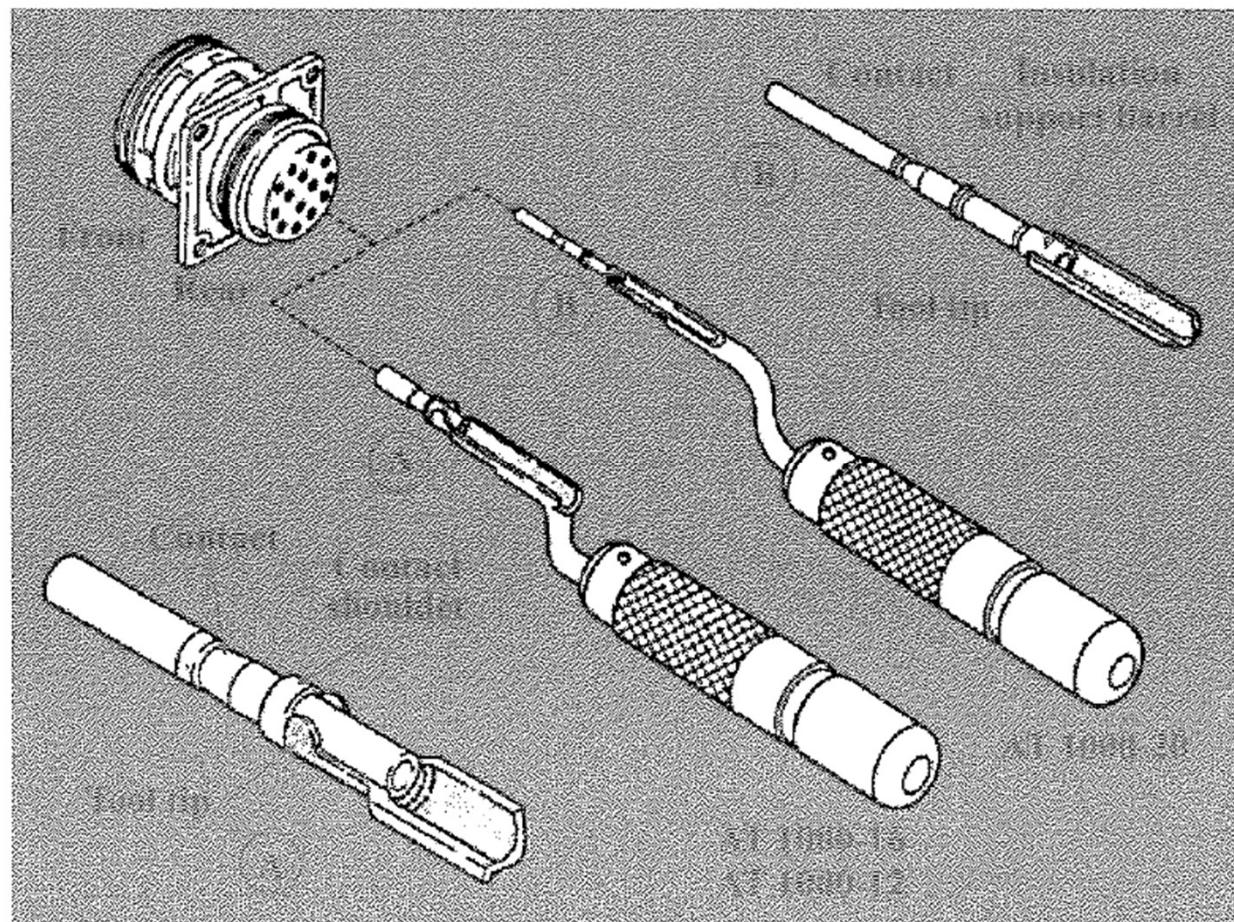
DAK20

Contact Insertion tools

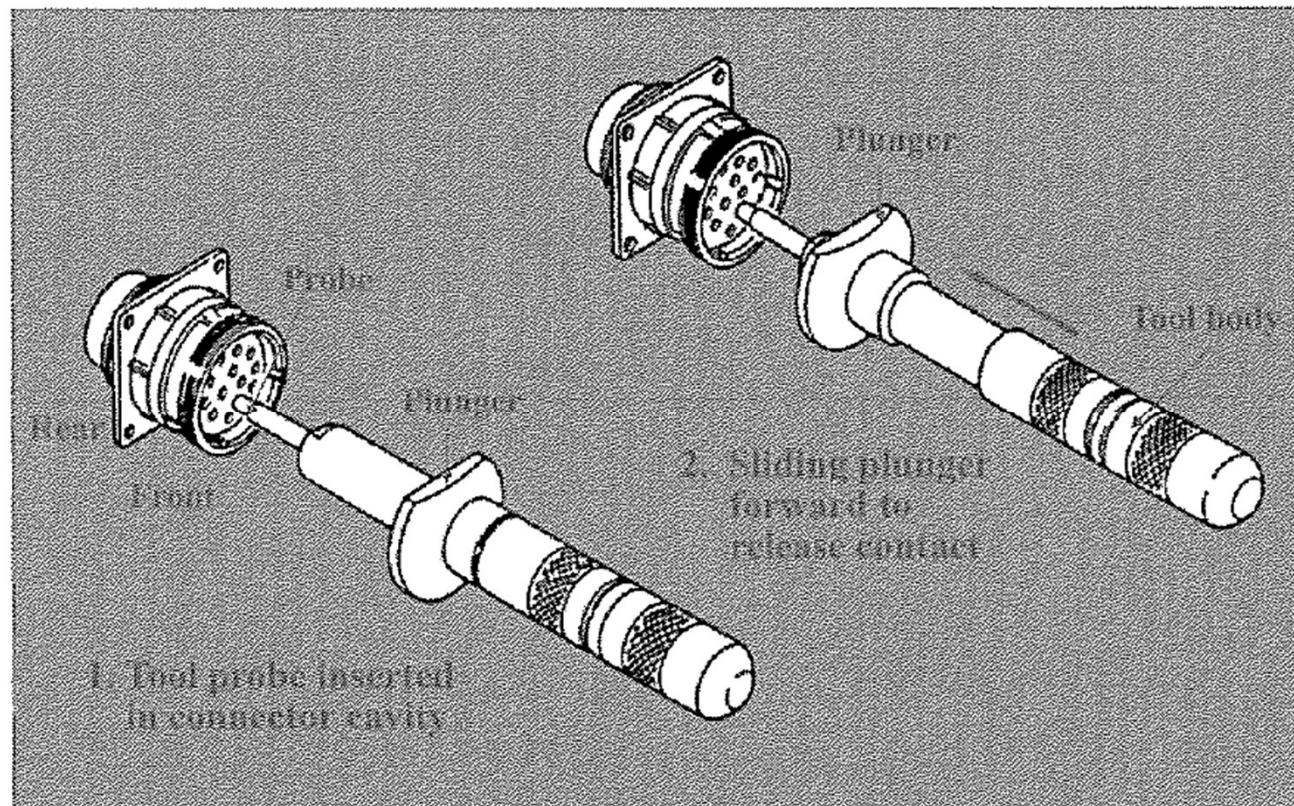
Front release contact



Contact insertion tool



Contact Removal (Front release)



Plastic Insert and Extract Tool

- Have both insert and extract head in one detachable assembly
- The white side is for extract and the coloured side is for insert in MOST (Not all) of the cases
- Used widely for contacts in computer racks, terminal blocks, and cardfile connectors

M81969-14-03



PLASTIC TOOL

M15570-22-1



M81969-14-04



M81969-14-06



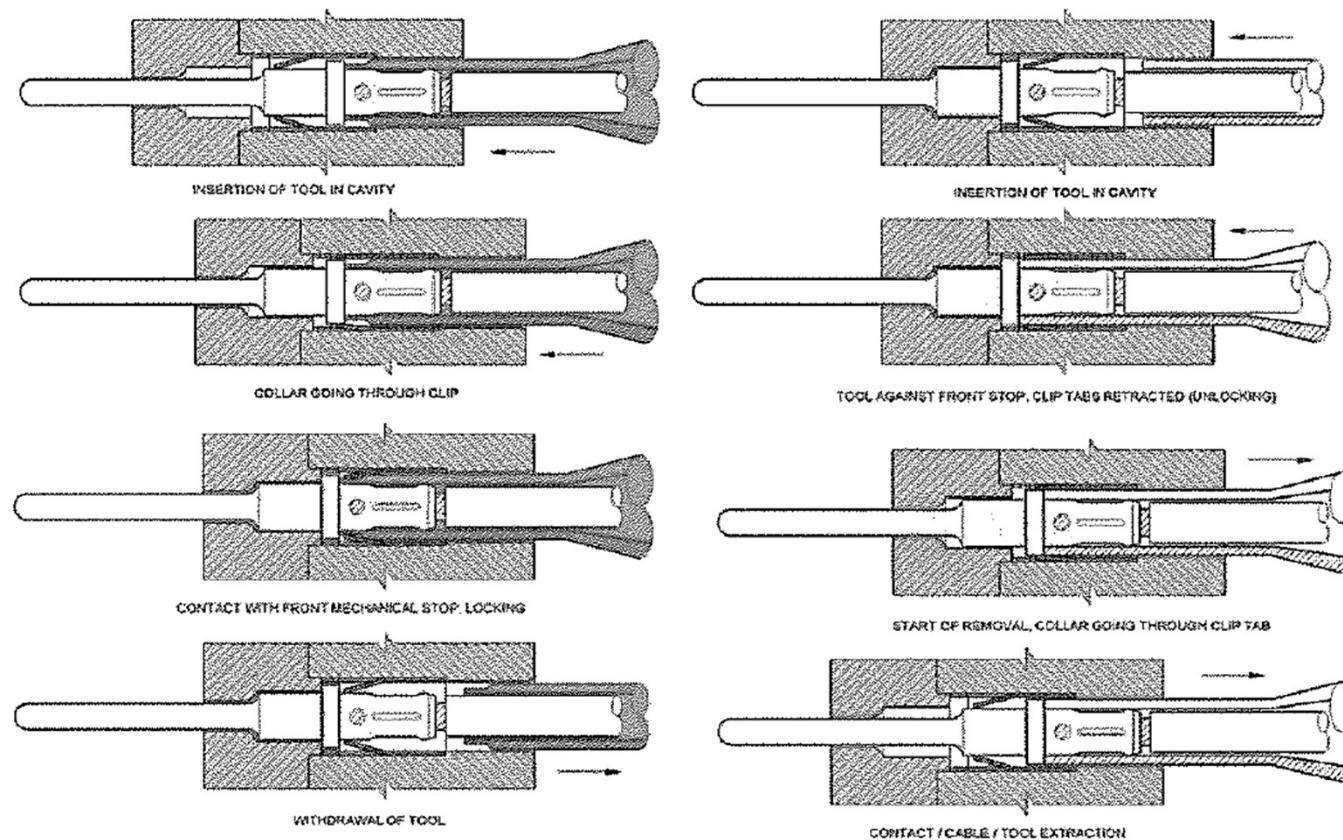
M81969-39-1



282549001



Insert / Extract Process

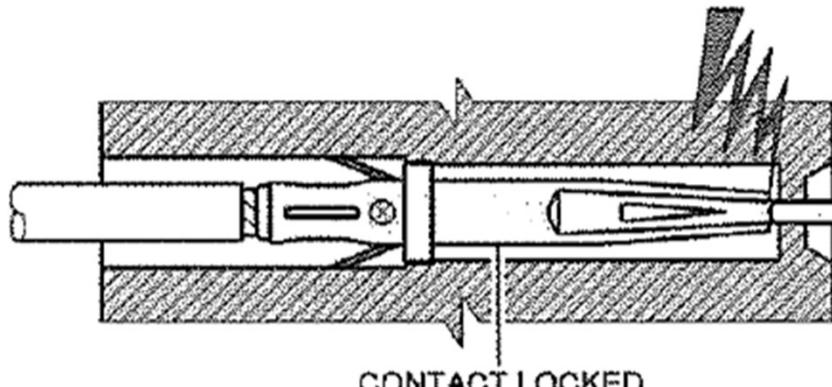


Refer to EPSM 20-25-41

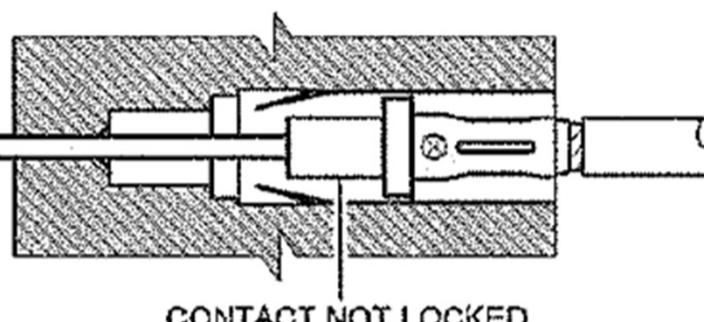
<https://youtu.be/PEi7wWG29hE?t=29s>

Improper Engagement

INTERMITTENT CONTACT



RANDOM MOVEMENT



What will this cause

- Unreliable resistance reading
- Loss of electrical continuity
- Random loss of contact
- Eventually, erratic system response

How to ensure proper insertion?

- One can slightly pull on the wire to assure
- Or, perform the contact retention test to confirm it is locked
- Refer to SWPM 20-61-11 or other applicable documents

Connector Part Number Explanation

Contact style-Pin

MS24266R20B41S7 - Circular Connector, MIL-DTL-26500 Series, Straight Plug, 41 Contacts, Crimp Socket, Bayonet, 20-41



shell size=20
41 contacts



MS24266 R 22 T 55 P 6

Military Designation
MS24264 -- Square-Flange Receptacle
MS24265 -- Single-Hole Mounting Receptacle
MS24266 -- Straight Plug

Environmental Class
R -- Meets MIL-C-26500 (USAF)

Shell Size
8, 10, 12, 14, 16, 18, 20, 22, or 24

Add to compare   Write A Review

Alternate Shell Positions
N, 6, 7, 8, 9, Y per table on page 3-4

Contact Style
P -- Pin
S -- Socket

Insert Arrangements
(See page 3-4)

Coupling Style
T -- Threaded
B -- Bayonet

Contact style-Pin

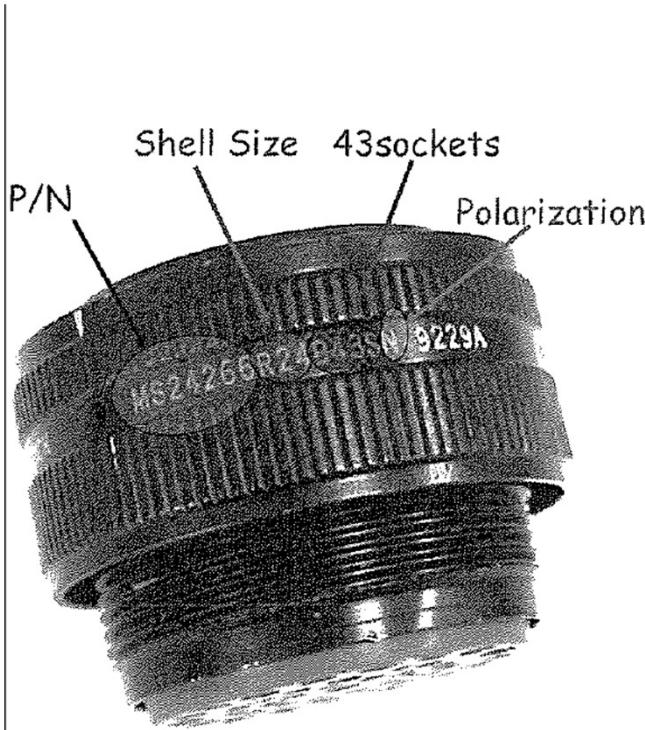
Manufacturer: CINCH CONNECTIVITY SOLUTIONS

Manufacturer Part No: MS24266R20B41S7

Order Code: 2111729

[Technical Datasheet](#)  [MS24266R20B41S7 Datasheet](#)

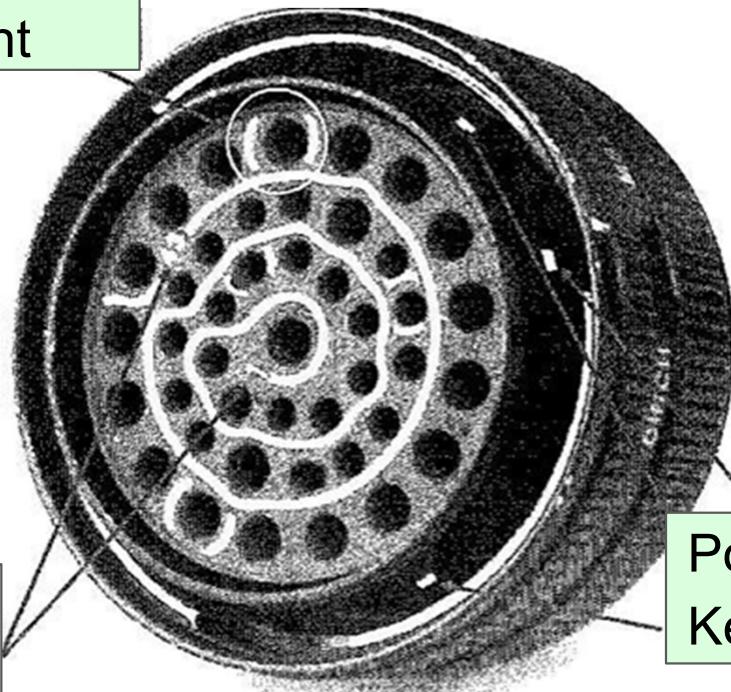
See all Technical Docs



Code are printed on product

Connector Features

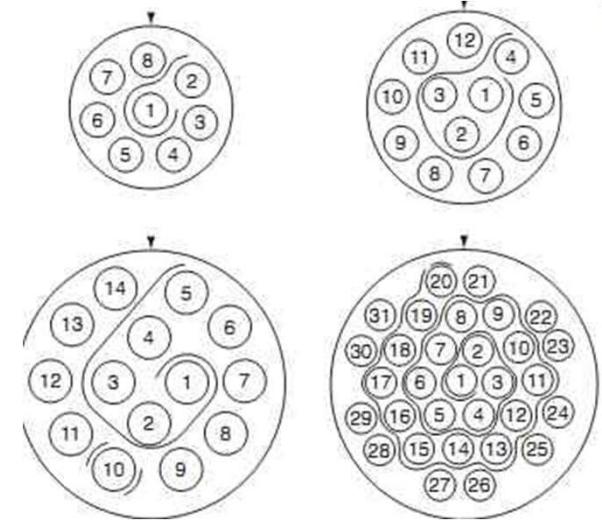
Every Tenth Increment



Socket assignment

Polarization Keys

Note: Always read along the line



Part number structure

- For the above mention connector P/N, an equivalent P/N can always be found within **SWPM** or **EPSM**

BOEING®
707, 727-787
STANDARD WIRING PRACTICES MANUAL
MIL-C-26500 FRONT RELEASE CONNECTORS

Table 1 (continued)

Boeing Standard	Boeing Specification	Part Number	Supplier	Applicable Paragraph
BACCAFSF0	-	43-1570	Amphenol	Paragraph 2.C.
		B4824250P1-B0	Deutsch	Paragraph 2.C.
		C48-15R()	Cinch	Paragraph 2.C.
		M48-2650P(B-B)	OPL	Paragraph 2.C.
		P67140	RAE	Paragraph 2.C.
		22W-0-100	Pyle-National	Paragraph 2.C.
BACCAFSI	-	FPK-110	Pyle-National	Paragraph 2.E
BAFPAM0	-	FPK-113	Pyle-National	Paragraph 2.E

BOEING®
707, 727-787
STANDARD WIRING PRACTICES MANUAL
MIL-C-26500 FRONT RELEASE CONNECTORS

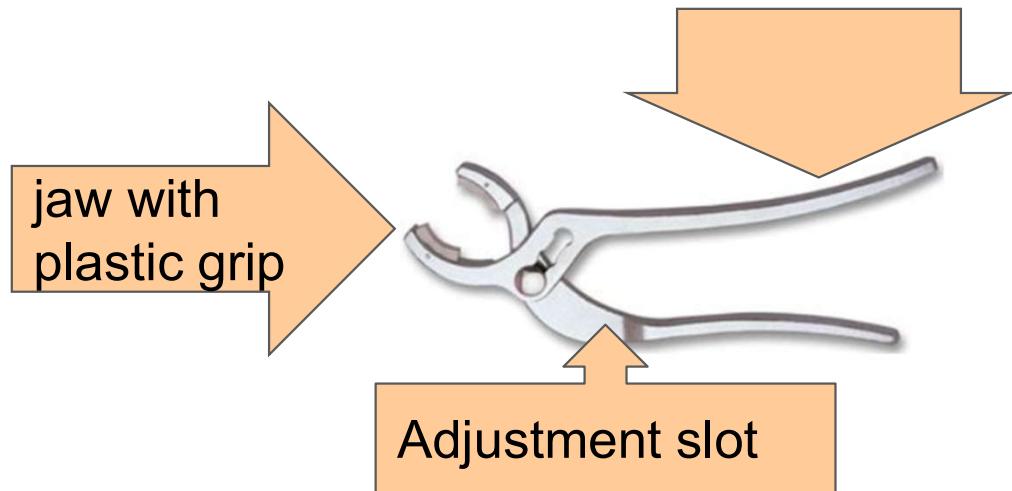
Basic Number	43-001	4 - P	6 (102)
Order Code	(102) = Without Cable Support with Contacts and Seal Plug (103) = With M6701 Cable Support, without Contacts in Seal Plug (104) = With 1 Cable Support, without Contacts and Seal Plug (105) = With 2 Cable Support, with Contacts and Seal Plug		
Shut Size			
Insert Configuration			
Contact Type			
Altimate Key Position			

AMPHENOL BACCAFSM AND BACCAFS CONNECTOR PART NUMBER STRUCTURE
Figure 3

Basic Number	43-001	4 - P	6 (102)
Order Code	(102) = Without Cable Support with Contacts and Seal Plug (103) = With M6701 Cable Support, without Contacts in Seal Plug (104) = With 1 Cable Support, without Contacts and Seal Plug (105) = With 2 Cable Support, with Contacts and Seal Plug		
Shut Size			
Insert Configuration			
Contact Type			
Altimate Key Position			

CINCH BACCAFSM AND BACCAFS CONNECTOR PART NUMBER STRUCTURE
Figure 4

Connector Pliers (Soft Jaw)

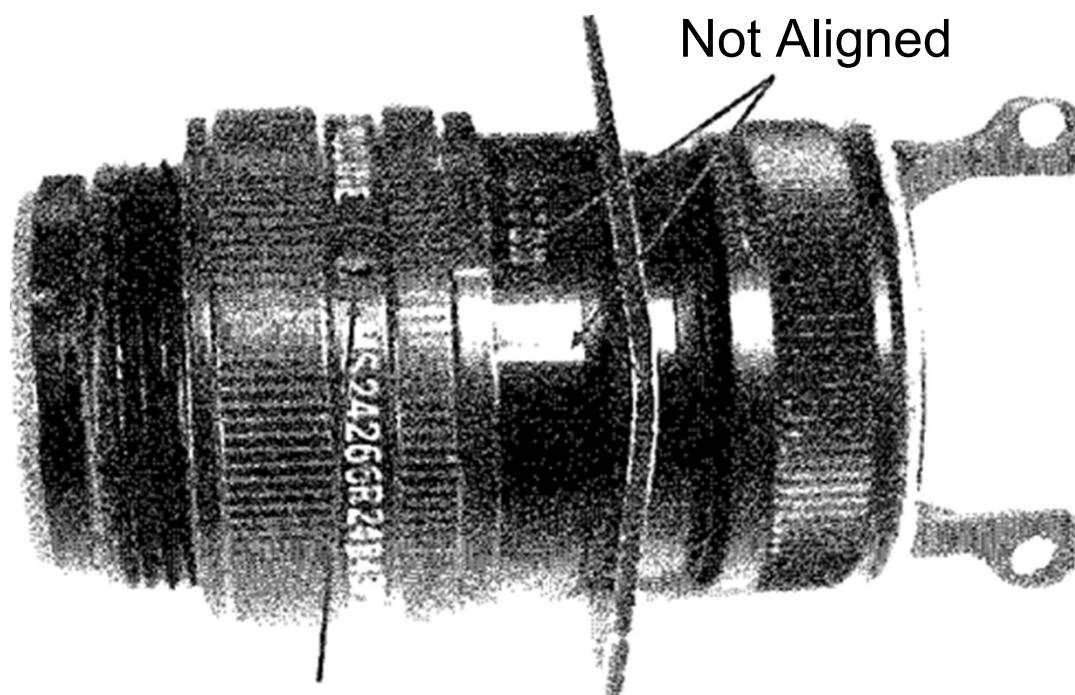


- Use for tightening or loose sis rig of connector or backshell!
- Soft plastic used for provide positive gripping surface
- Soft plastic will not Induced any damage mark on connector or backshell surface

Backshells with
strain relief



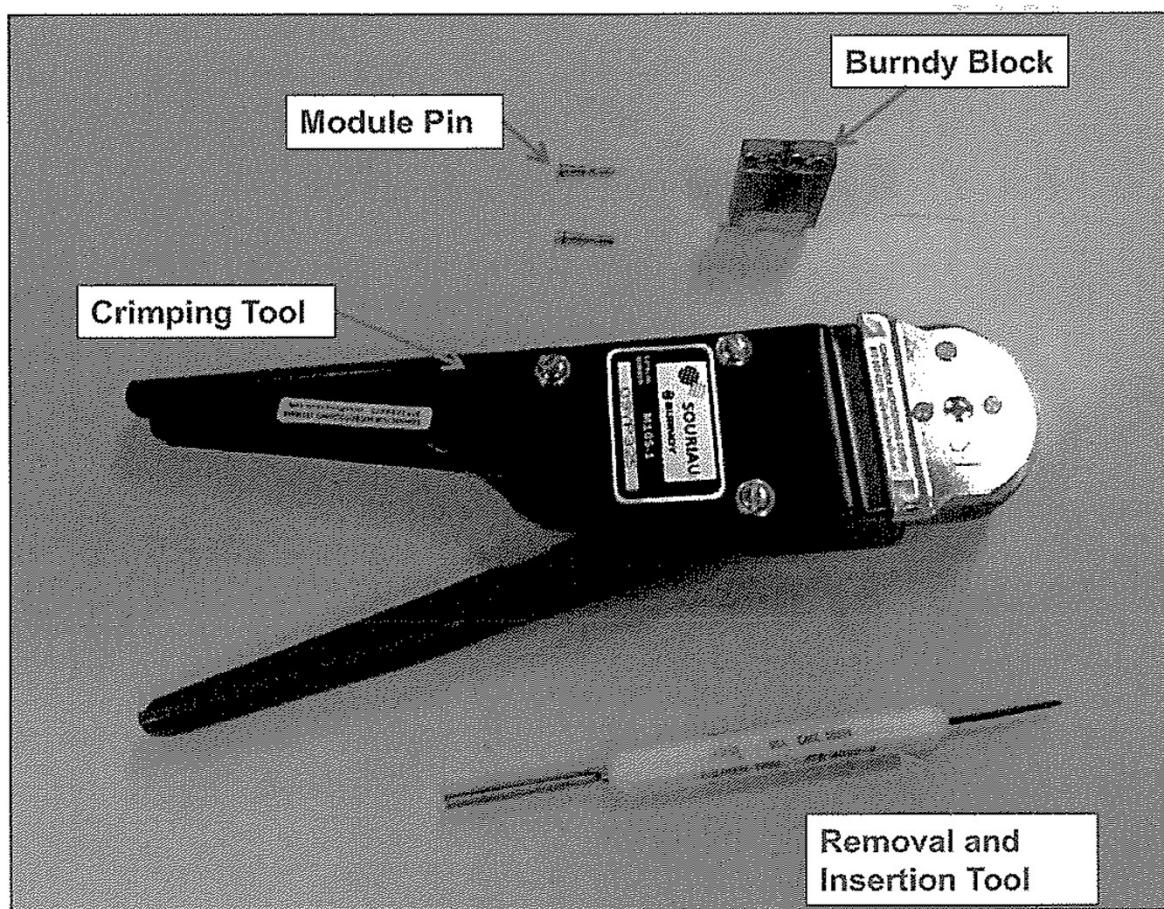
Improper Connection



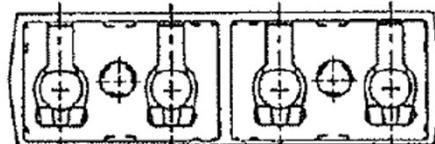
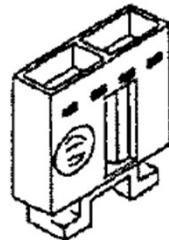
Inspection hole without alignment key
visible (3 places)



Terminal module, pin, and tools

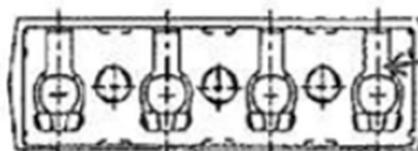


Terminal module (Burndy Block)



Four Sockets, Two Sockets In
Each Section Are Bussed Together

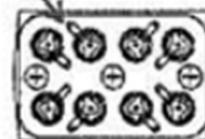
TYPE F TERMINAL BLOCK



Four Sockets All Bussed Together

Hole for inserting the release tool

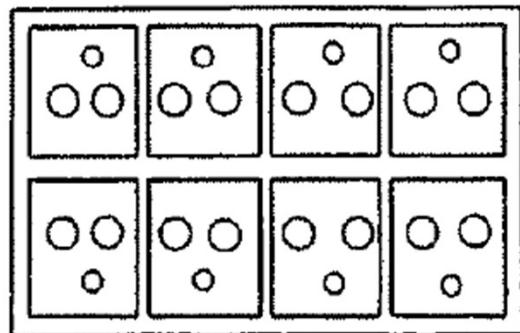
TYPE G TERMINAL BLOCK



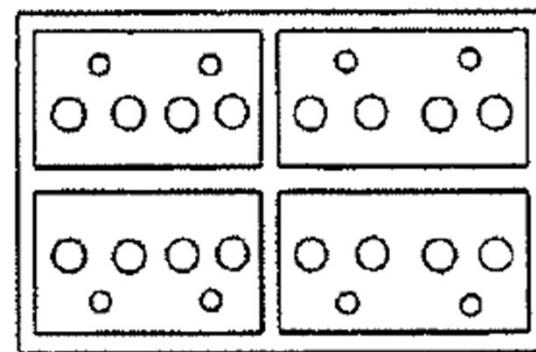
Eight Sockets All Bussed Together

TYPE H TERMINAL BLOCK

High Density Terminal module (Burndy Block)

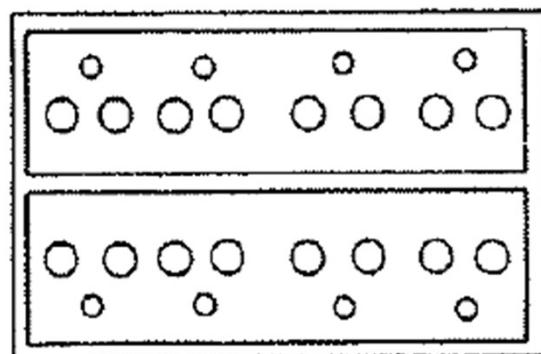


16 Sockets Divided Into 8 sections,
2 Sockets in Each Section
Are Bussed Together



16 Sockets Divided Into 4
Sections, 4 Sockets In Each
Section Are Bussed Together

TYPE X TERMINAL
BLOCK

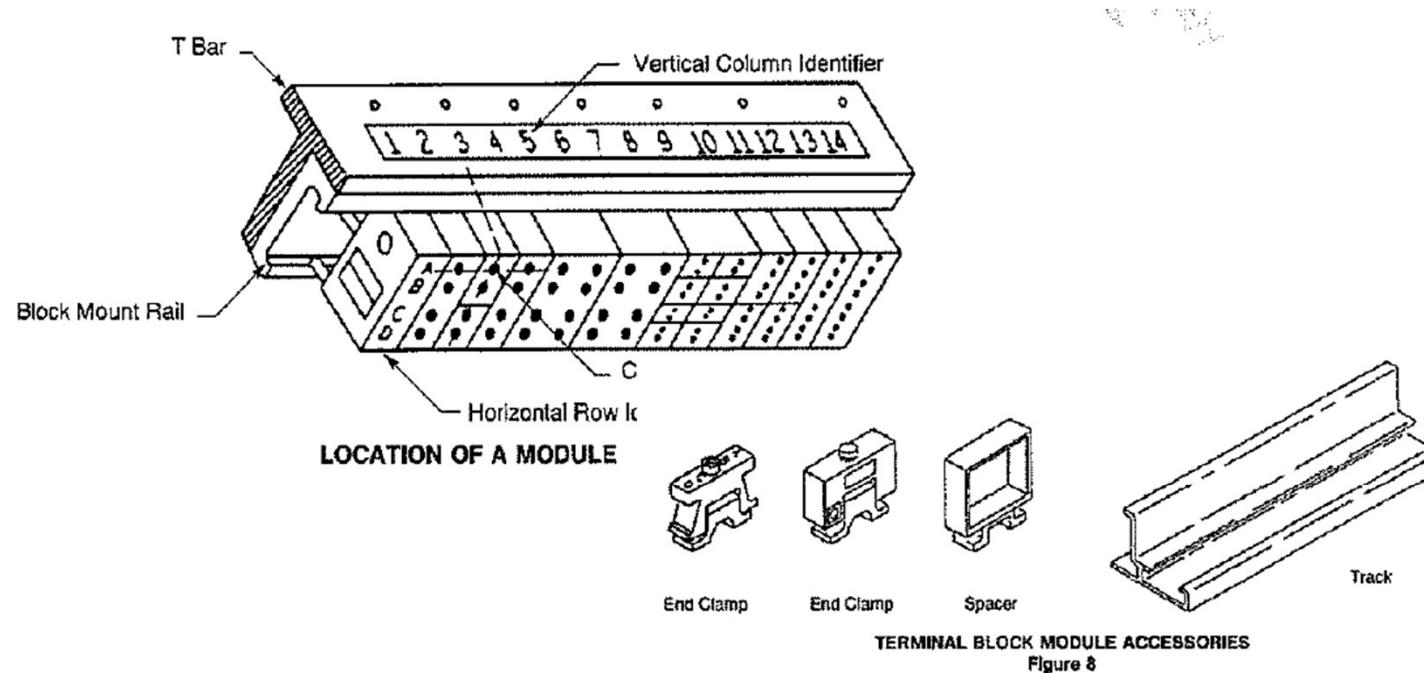


TYPE Z TERMINAL BLOCK

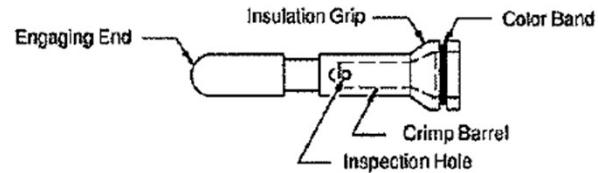
TYPE Y TERMINAL
BLOCK

16 Sockets Divided into 2
Sections, 8 Sockets In Each
Section Are Bussed Together

Terminal module Installation



D. Contact Part Numbers for the Standard Density Terminal Blocks



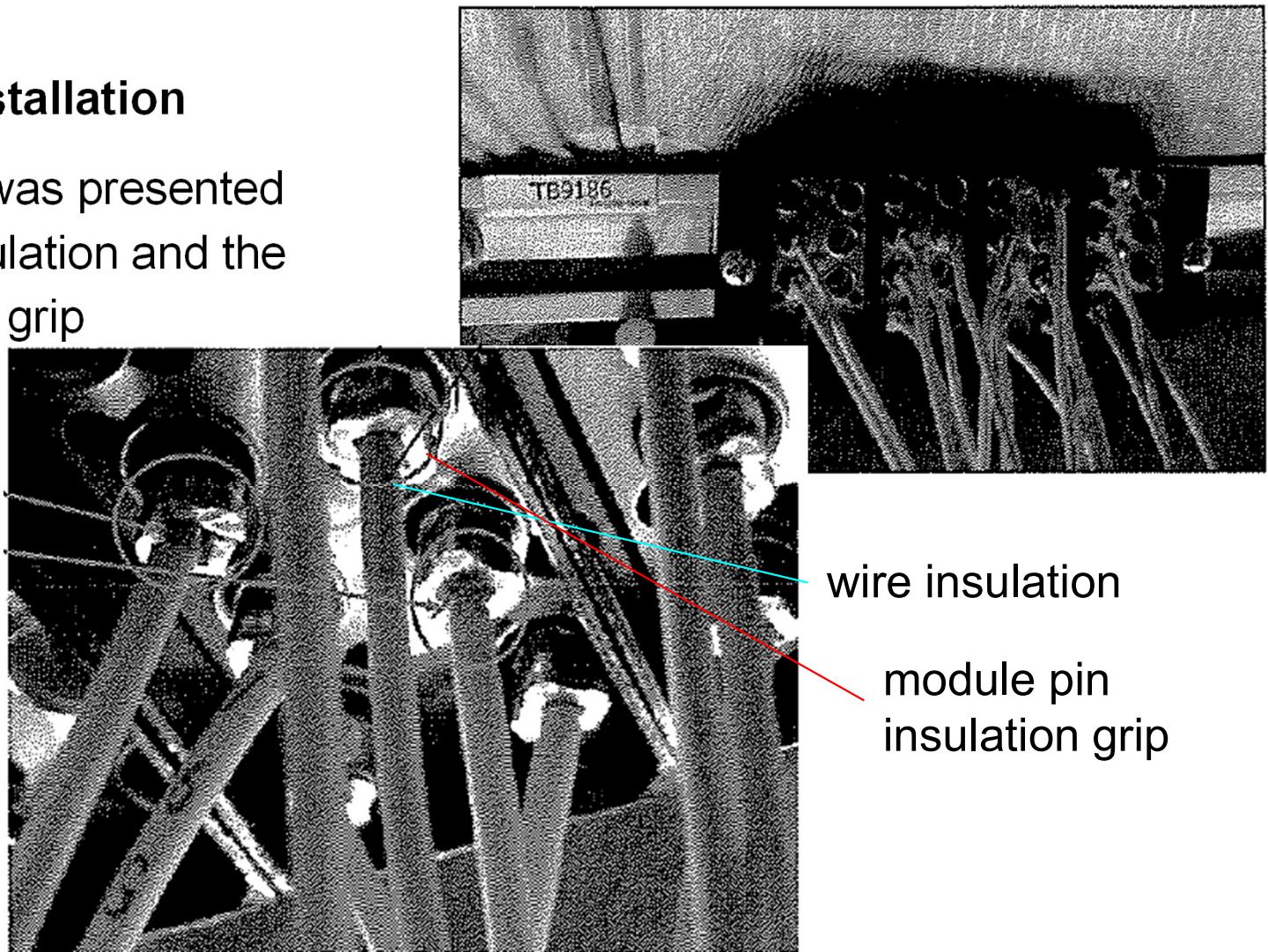
BACC47DE CONTACTS FOR THE STANDARD DENSITY TERMINAL BLOCKS

Terminal Module installation

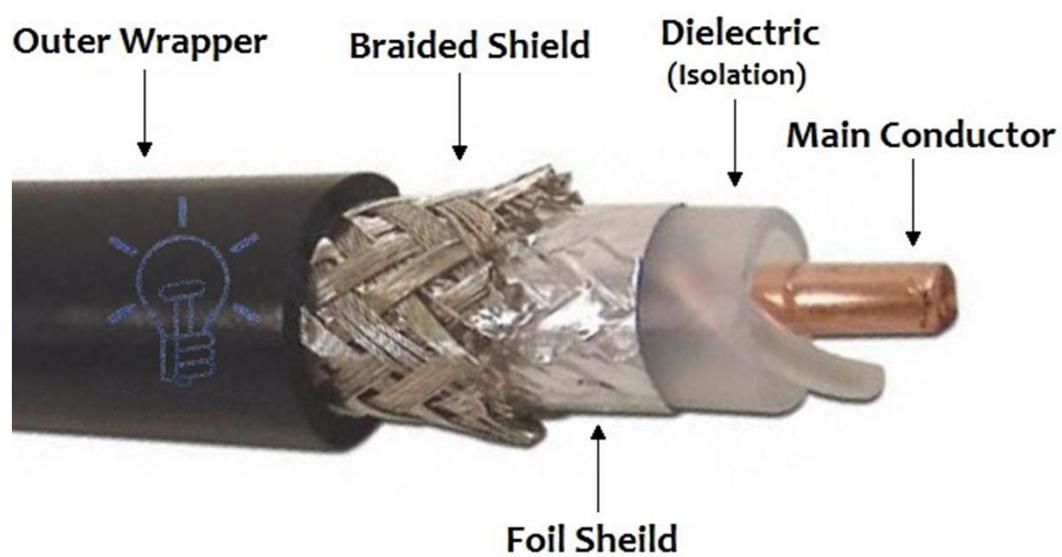
A notable clearance was presented between the wire insulation and the module pin insulation grip

According to SWPM 20-90-11

"IF only one wire is in the crimp barrel of the contact, the wire insulation is against the bottom of the insulation grip of the contact."

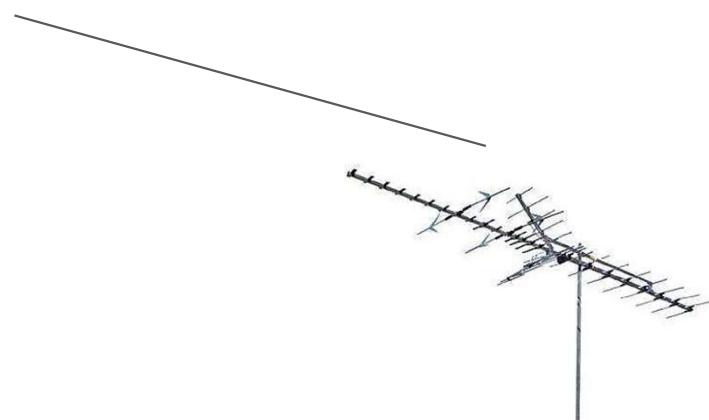
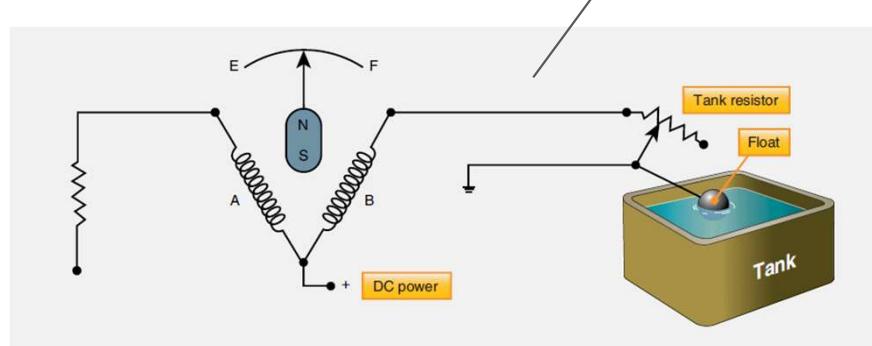


Coaxial cables



Advantages of coaxial cable

- They are **shielded against electrostatic and magnetic fields**. The fields due to current flow in inner and outer conductors cancelled each other.
 - As they do not radiate (no EM-wave interference=no noise), they are most commonly employed for the connection of **antennae** and capacitance type fuel quantity indicating system.



Installation precaution of coaxial cable (1)

Care should be taken when handling the coaxial cable:

- Routing should **run downwards** away from the equipment.
- Appropriate number of cable clamps must be provided to support the coaxial cable. Bending radius of the coaxial cable should **not be less than 6 times its diameter**.

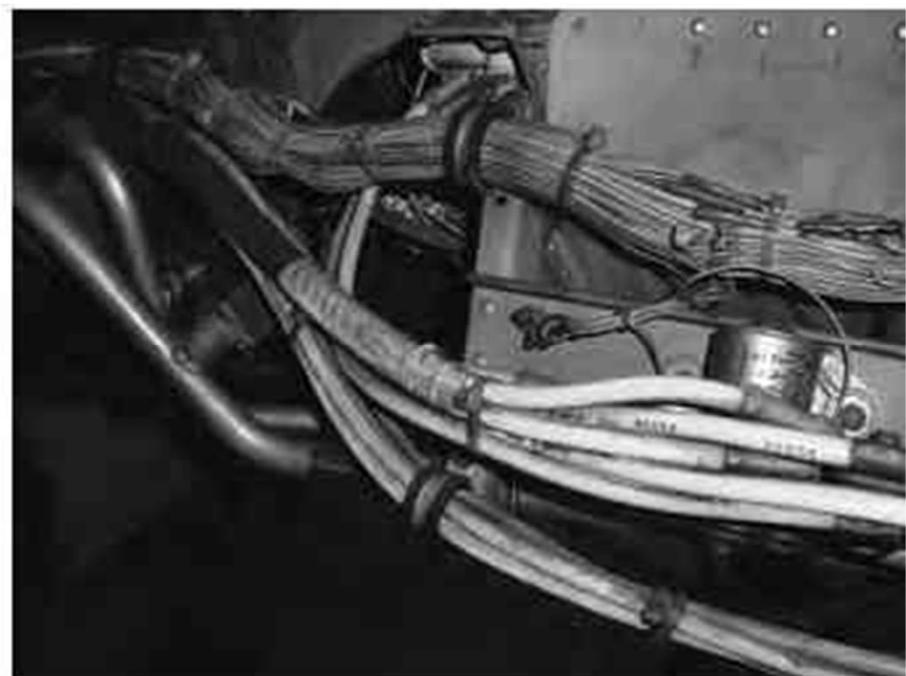
Installation precaution of coaxial cable (2)

- Conduit, duct and trunking must be used when running through poor environment, e.g. landing gear wheel well, hydraulic bay.
- Possible electrical interference between aerial cables or from other systems must be prevented by suitable screening. If screening is not possible, the unscreened radio or signal aerial cable must be away from other unscreened cable by at least 18 inches.
- Broken or damaged coaxial cable must be replaced by a new cable with the same or equivalent part number

Wire Routing and Installation

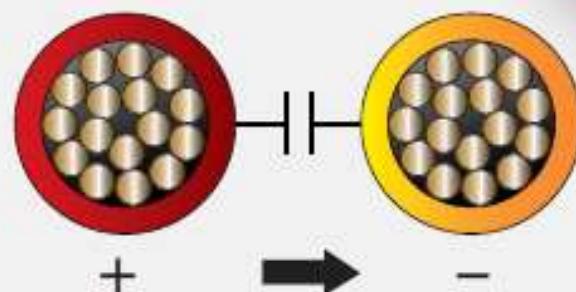
- Wiring Installation and Support
- Lacing and Tying of wire bundles
- Avoidance from Contamination

Wire Routing and Installation

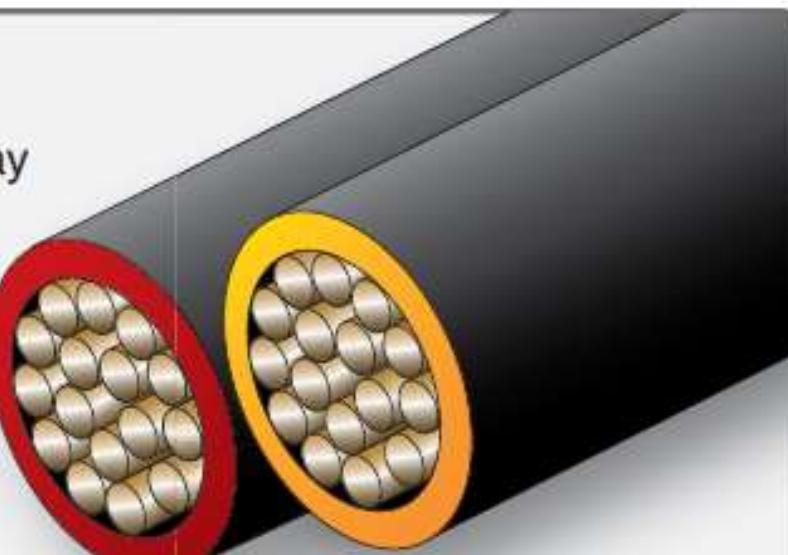


Crosstalk

Two wires in free air may couple capacitively, resulting in crosstalk.



A charge on the 1st wire induces an opposite charge on the 2nd wire.



Wire Routing and Installation

Harness support, clamp usage and proper installation

Removal of original tie in an unharmed fashion

Attention

Security, using tie wraps and lacing cord

Avoidance (Separation) from adjacent wing, metallic; or abrasive, or adjacent structure and material

Security

- Wire bundle can simply assembled by electrical wires and ties
- As a bundle, it can be prevented from damages, which is categorized to vibration, environmental condition, and incorrect installation
- As a bundle, lose wire(s) can be easily identified and avoid interfering with other harnesses or system
- Refer to SWPM 20-10-11

Causes of Damages

Vibration from Mechanical Source

Engine

Fuel Pump

Flap Drive Motor

Gear Mechanism

Environmental Condition

Heat

Cold

moisture

dirt

Incorrect Installation

Incorrect quantities of tie

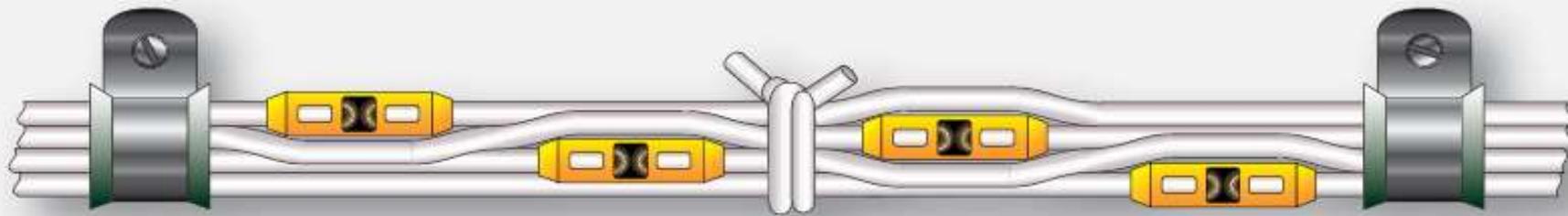
Incorrect use of tie wrap

Incorrect clamp sizes used or too loose

Incorrect branching

Spliced connections in bundle

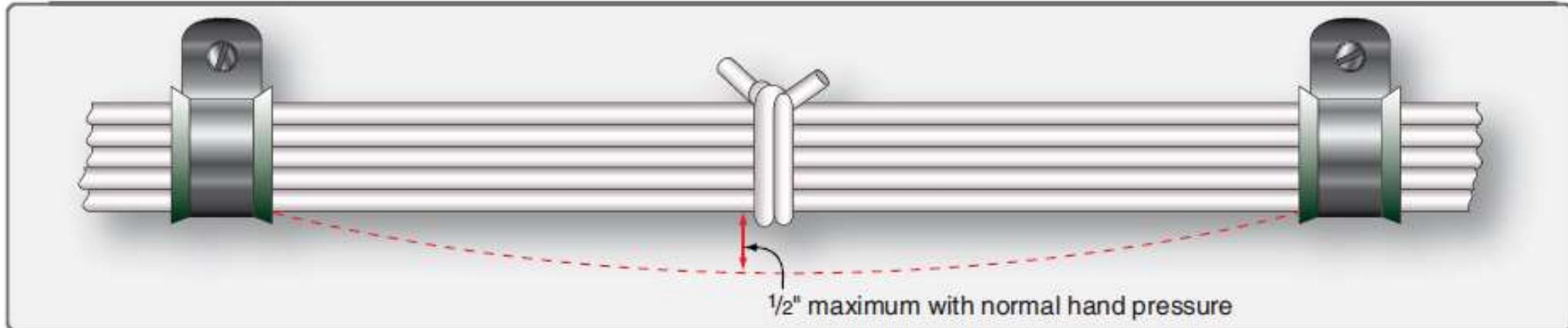
- Spliced connections in wire groups or bundles should be located.
- Splice should be staggered.
- All non-insulated splices should be covered with plastic, securely at both ends.
- Recommended minimum distance between 2 in-line crimp is 2 feet.
(Maximum 3 splices in a wire (SWPM 20-10-13, ESPM 20-43-10))



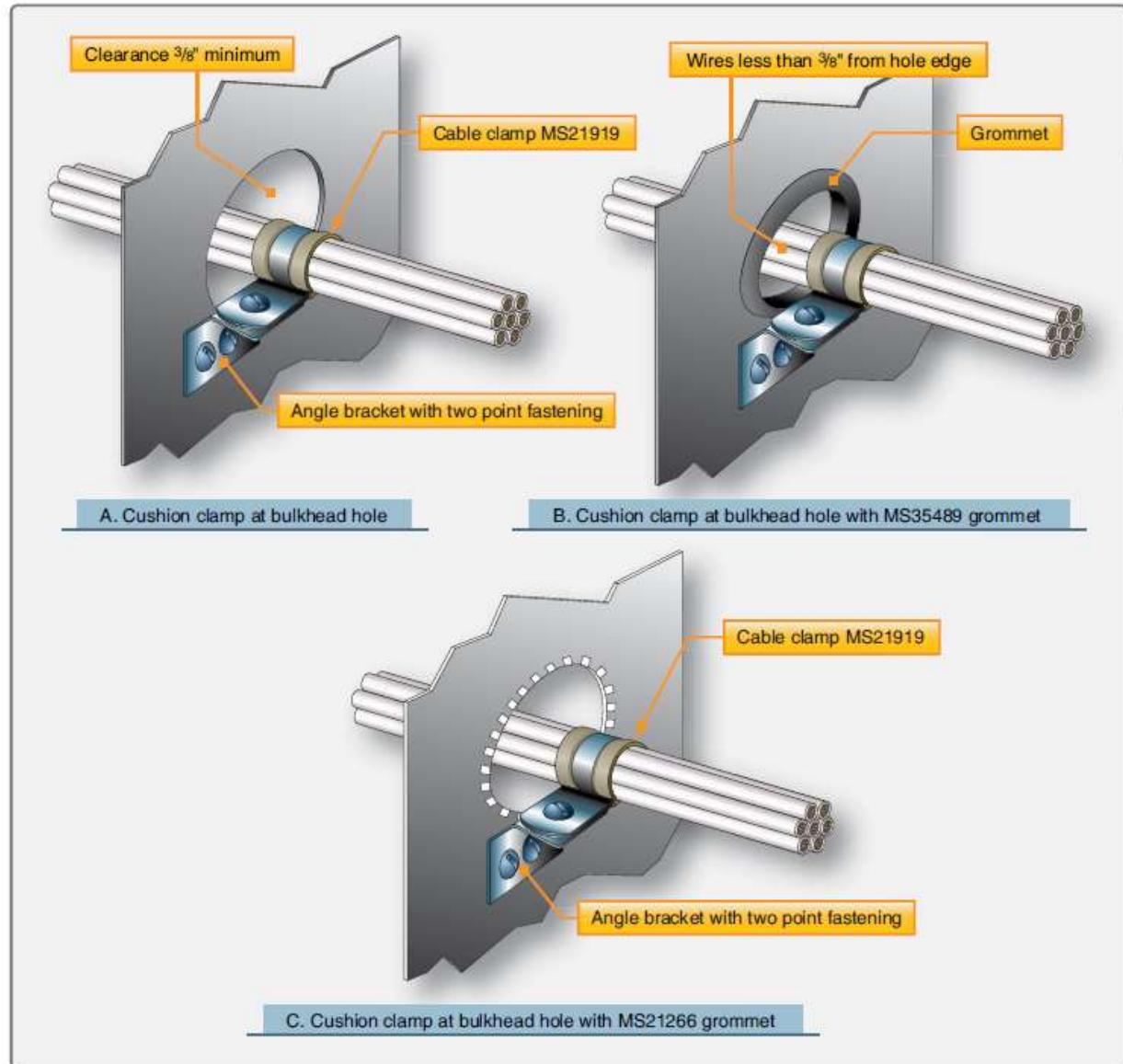
Staggered splices in a wire bundle

Slack in wiring bundles

- Prevent mechanical strain on the wires, wire junction and support
- $\frac{1}{2}$ inch maximum with normal hand pressure



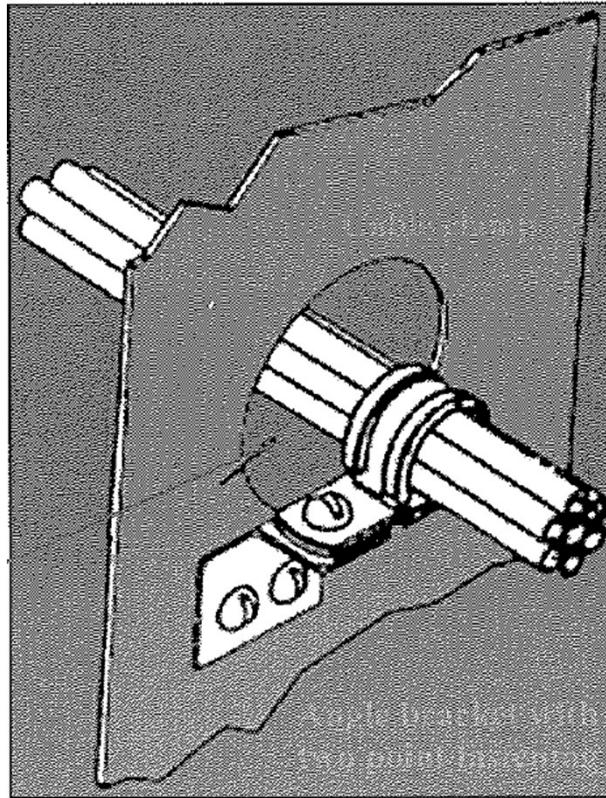
Clamping at a bulkhead hole.



Protection against chafing (1)

- Wires and Bundles should be routed parallel with, or at right angles to, the stringers or ribs.

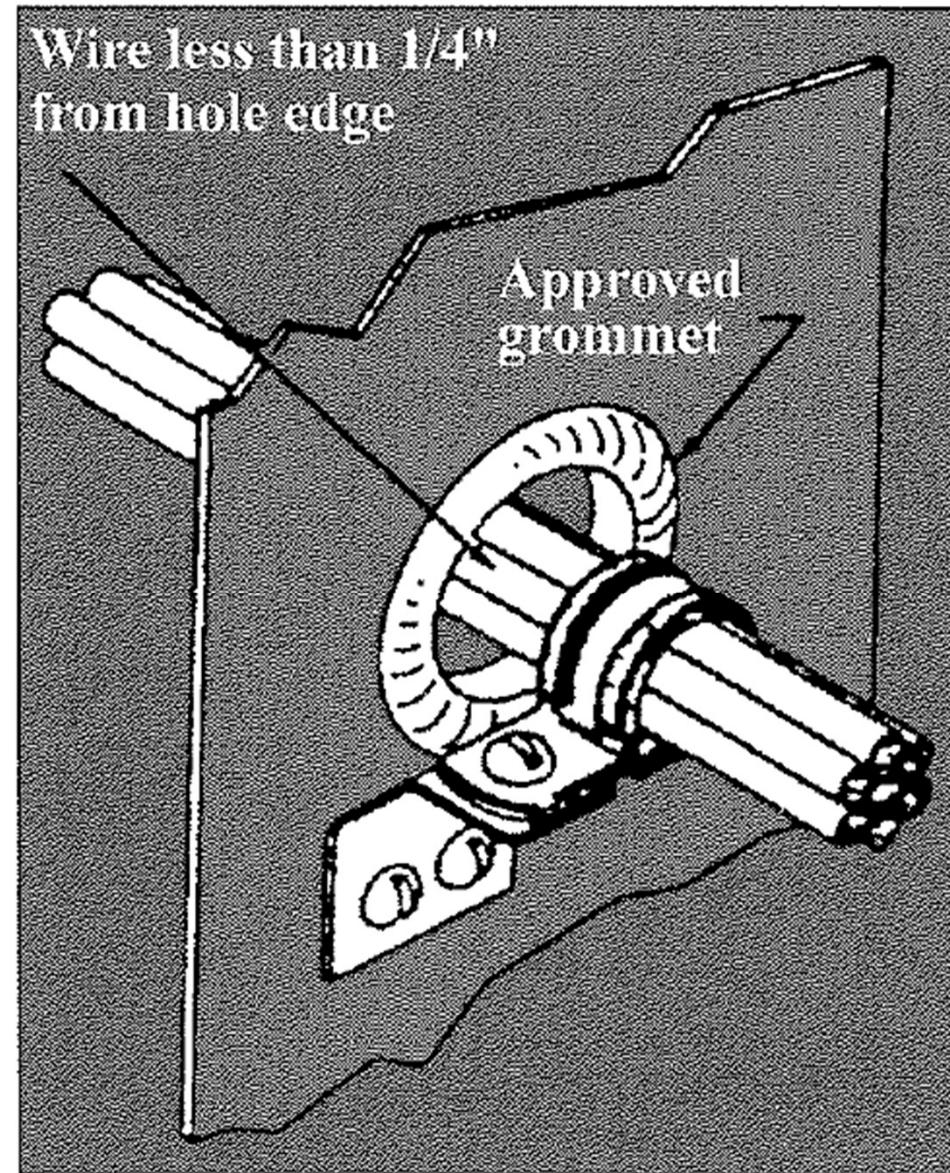
Min $\frac{1}{4}$ " clearance



Cable clamp at cut-out

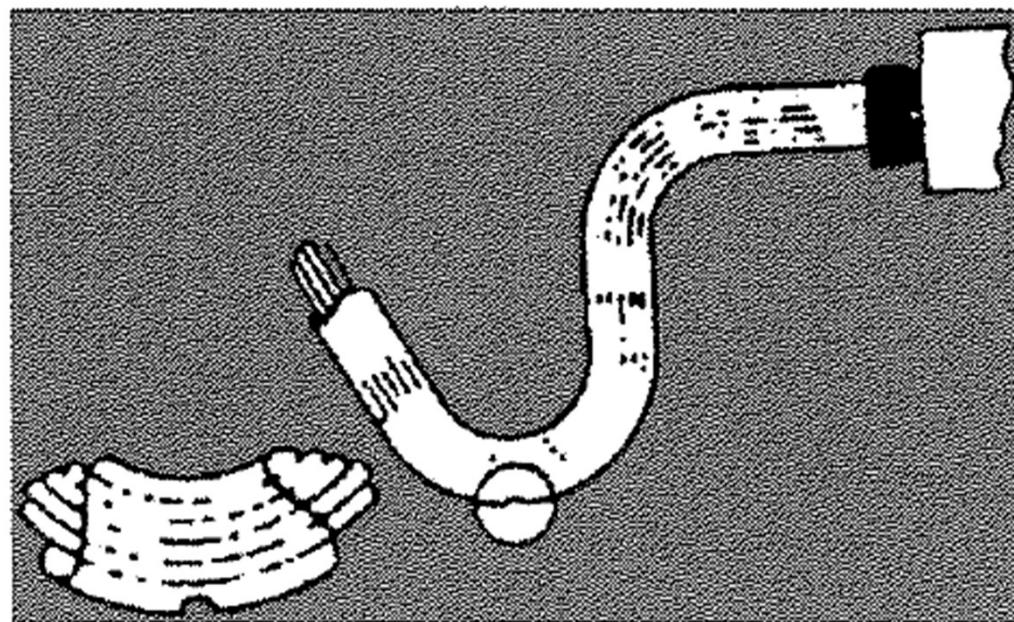
Protection against solvents and fluids

- Use a grommet when wires come closer than 1/4".
- Sometimes it is necessary to cut nylon or rubber grommets to facilitate installation.



Protection against solvents and fluids

- Wire should not be installed in areas
 - subjected to damage from fluids
 - in the lowest point of an fuselage
 - below an battery
- Use plastic tubing to protect the wire.
- Make a 1/8 in. drain hole at lowest point of tubing.

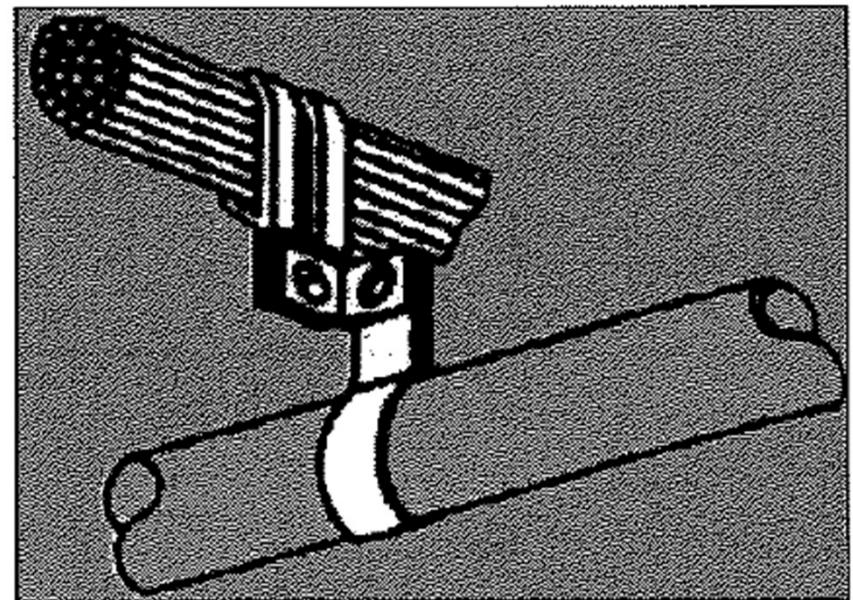


Drainage hole at lowest point of tubing

Routing precautions

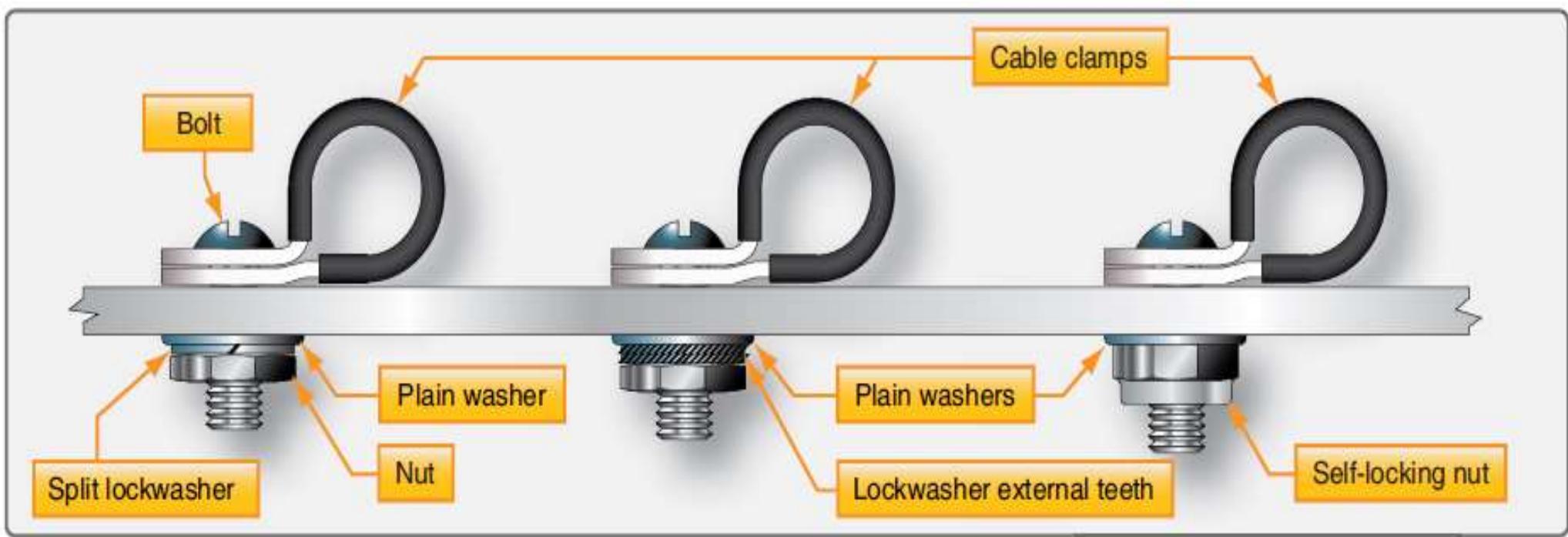
Maintain fixed separation when wire routed parallel to combustible fluid line.

- The wire should be on a level with or above the plumbing lines.
- Clamp and mechanical guards can be used to prevent contact.
- Two clamps back-to-back is used to maintain separation, not for support of the bundle.



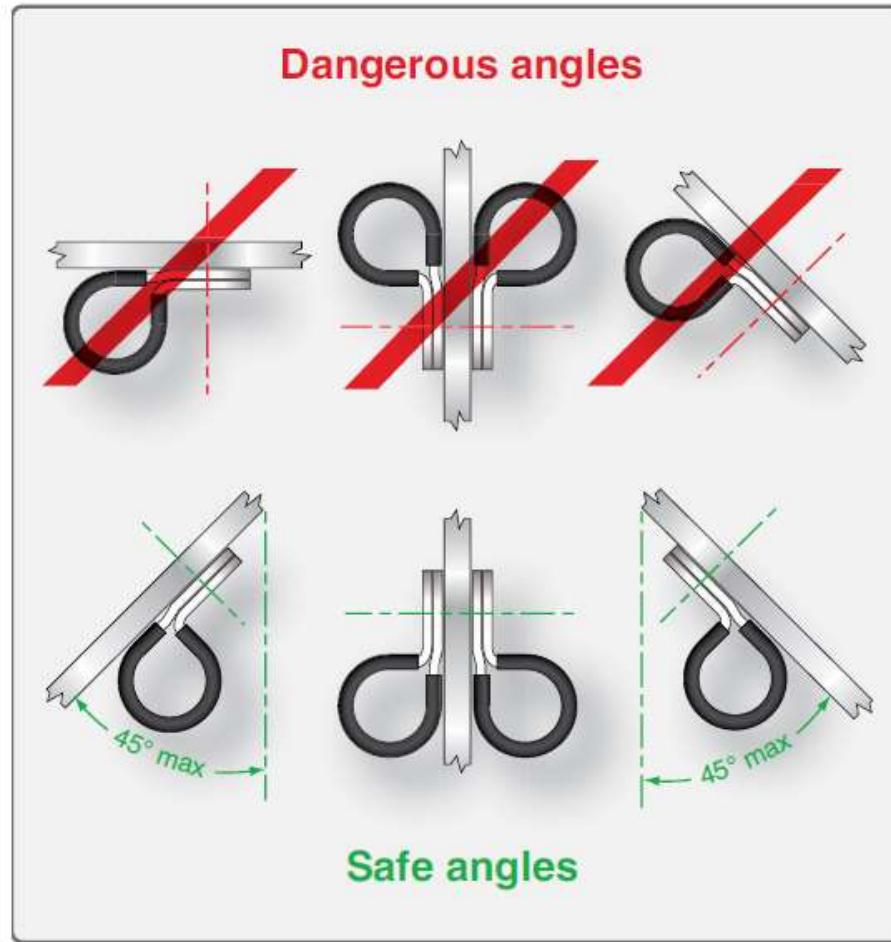
Separation of wires from plumbing lines

Installation of cable clamp



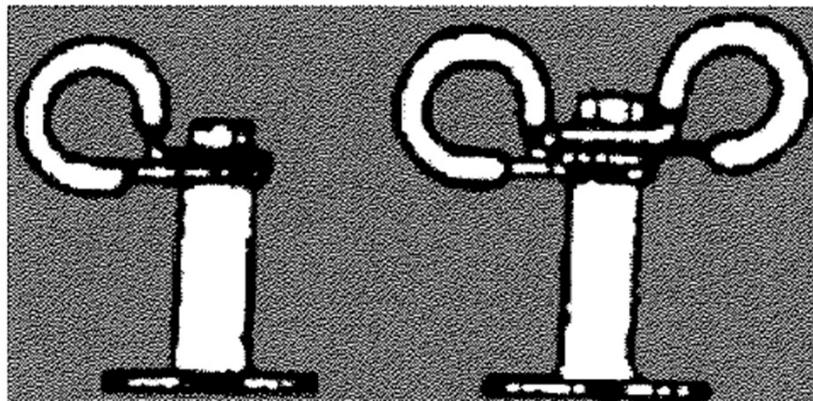
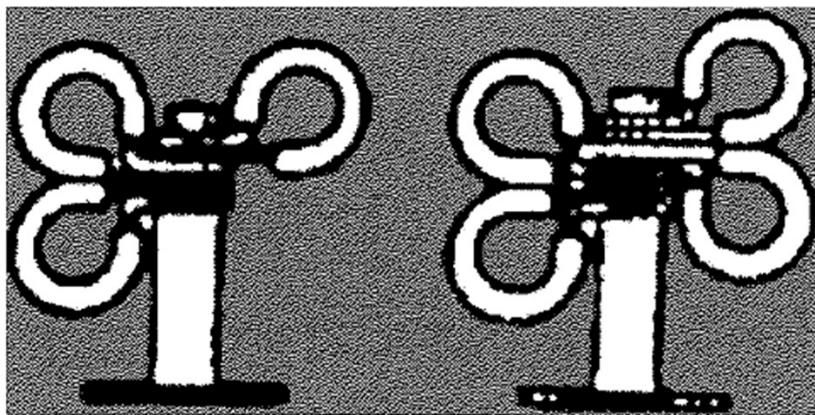
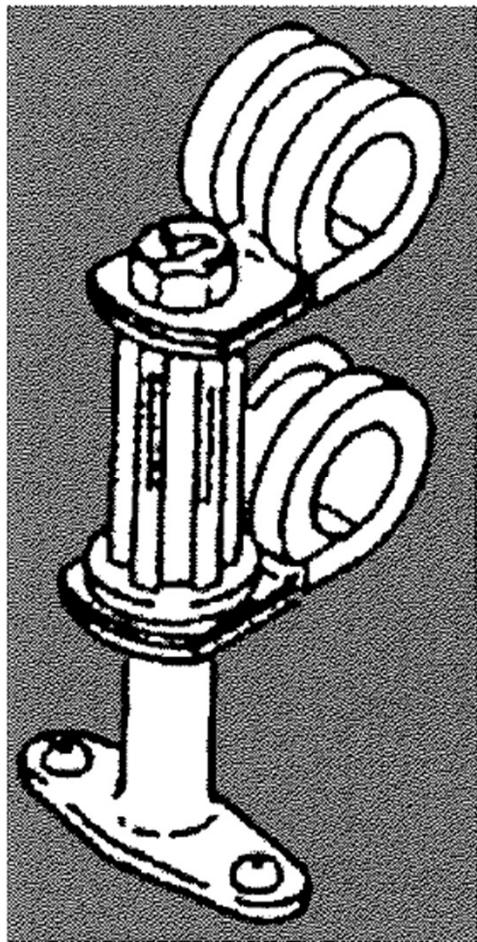
Typical mounting hardware for cable clamps

Installation of cable clamp

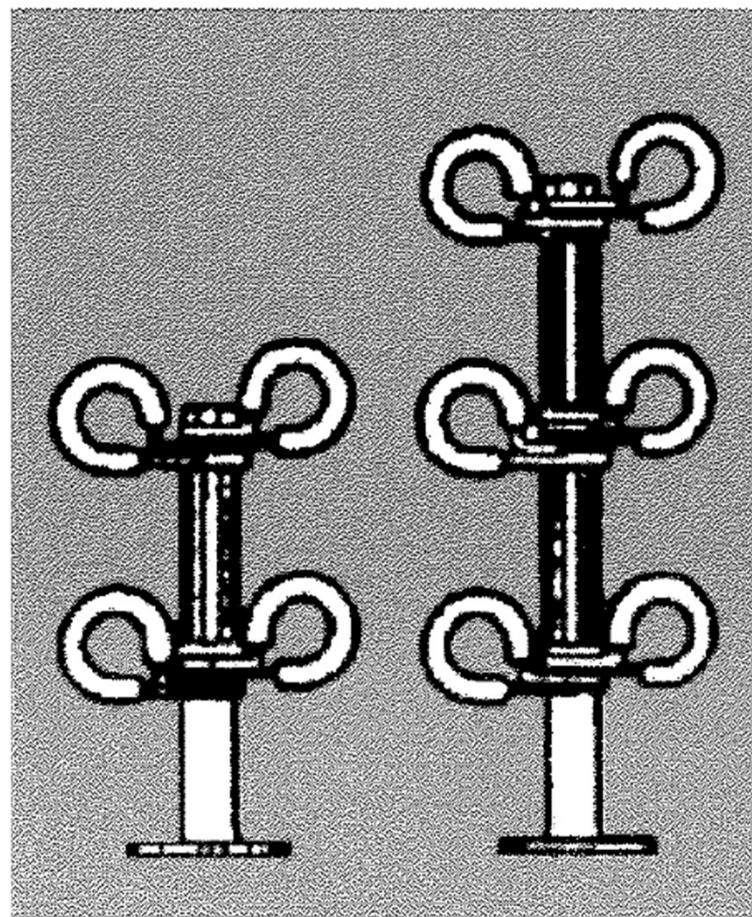


Typical mounting hardware for cable clamps

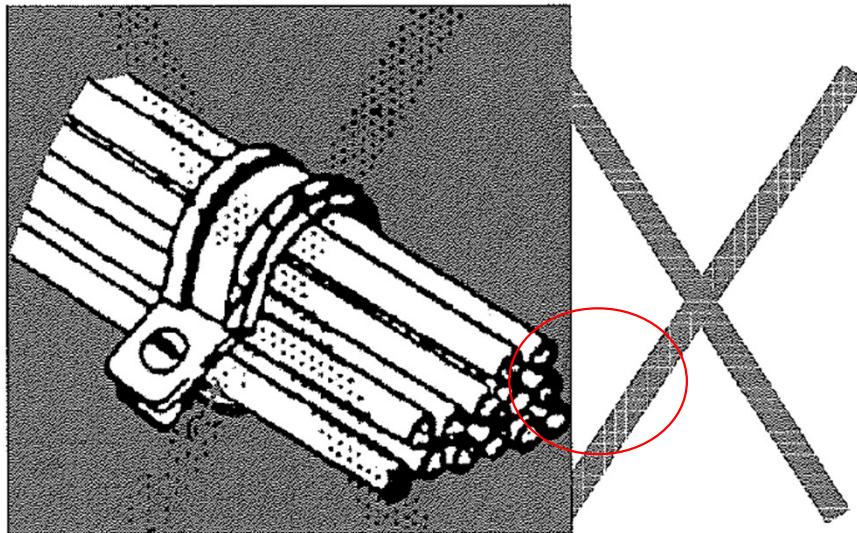
Typical cable clamps applications (1)



Typical cable clamps applications (2)

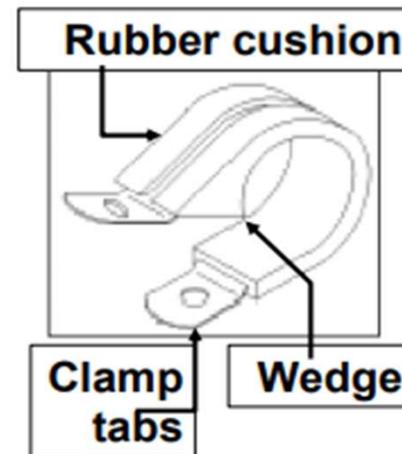


Installation of cable clamp

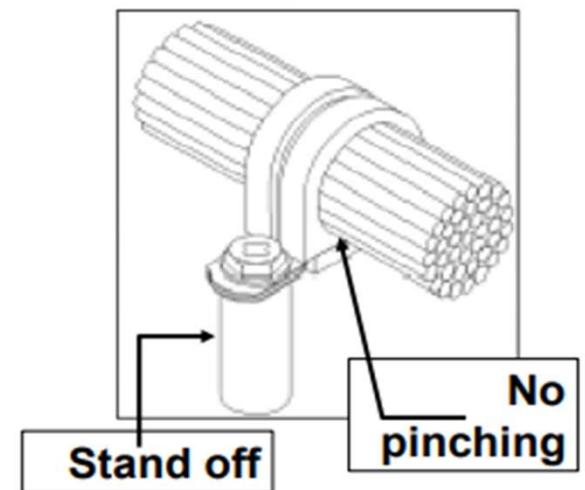


Wire is pinched/ squeezed in clamp

Typical Rubber Clamp

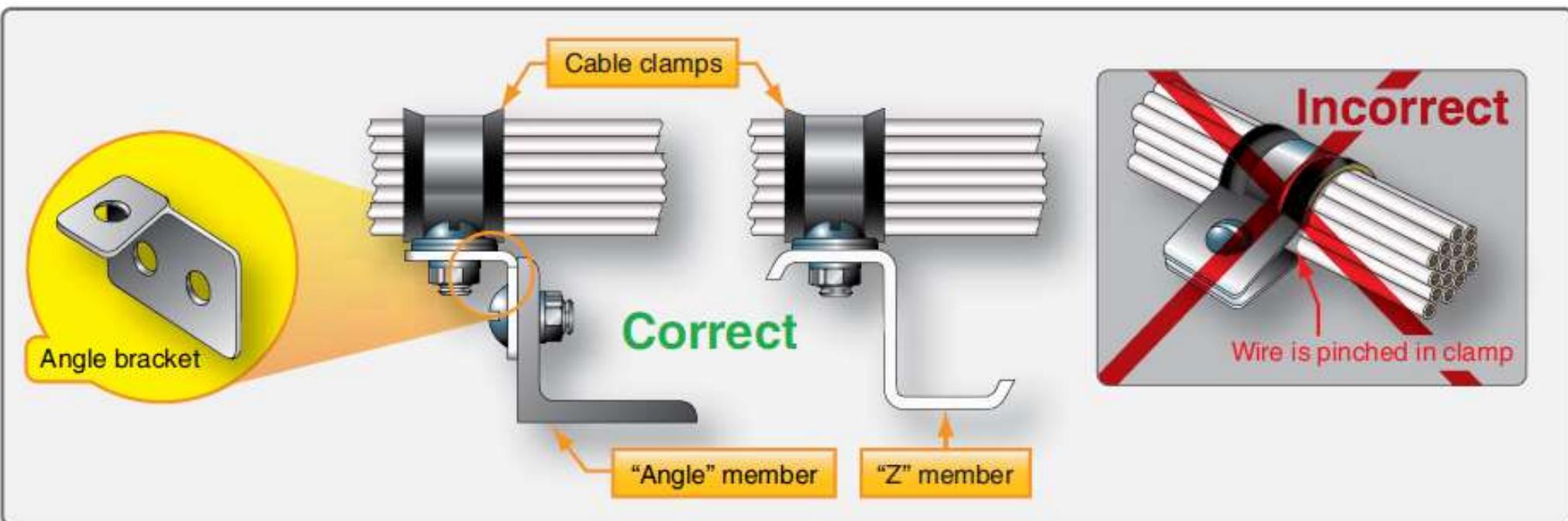


All wires contained
in rubber cushion



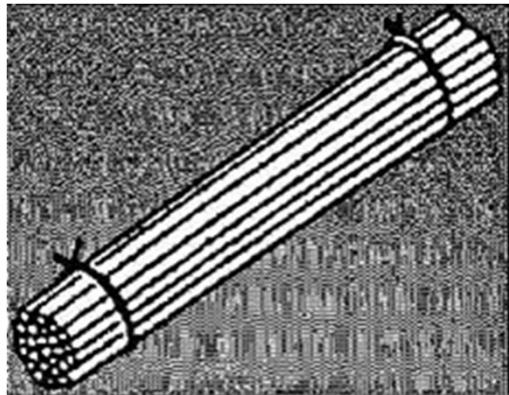
Mounting cable clamp should be mounted to structure

Installation of cable clamp

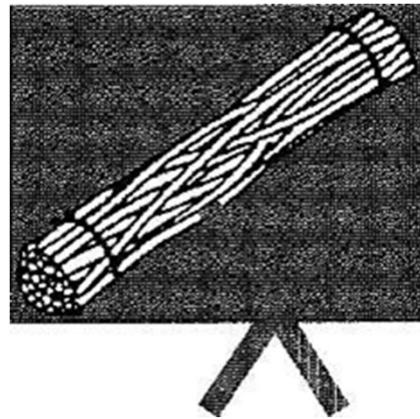


Wire installation

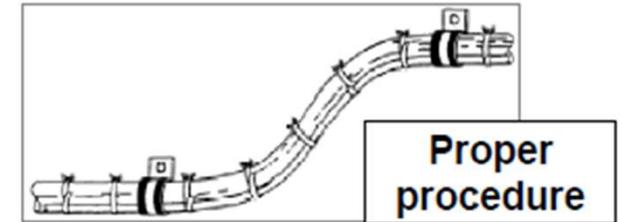
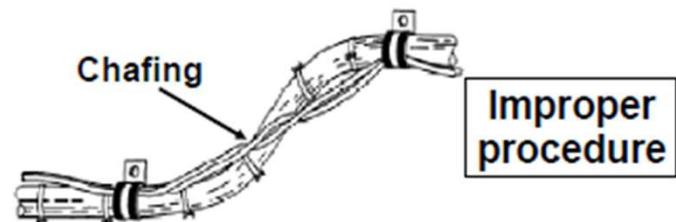
Ensure wires are combed out and are parallel to each other.



Combed wire bundle

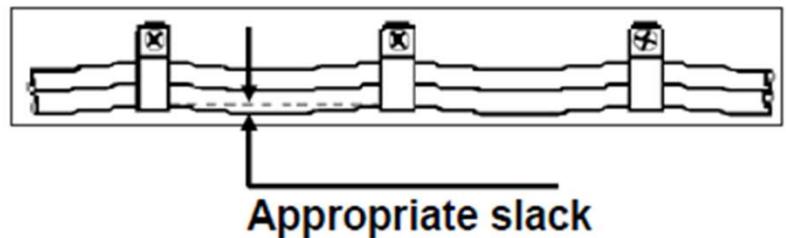
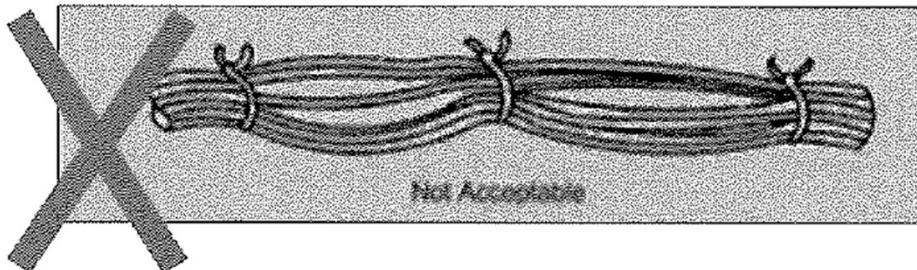
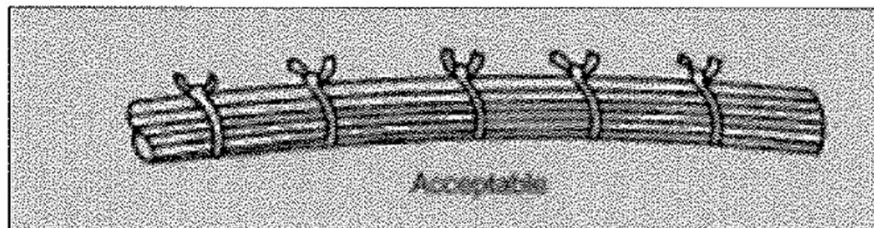


Wire crossovers



Wire installation

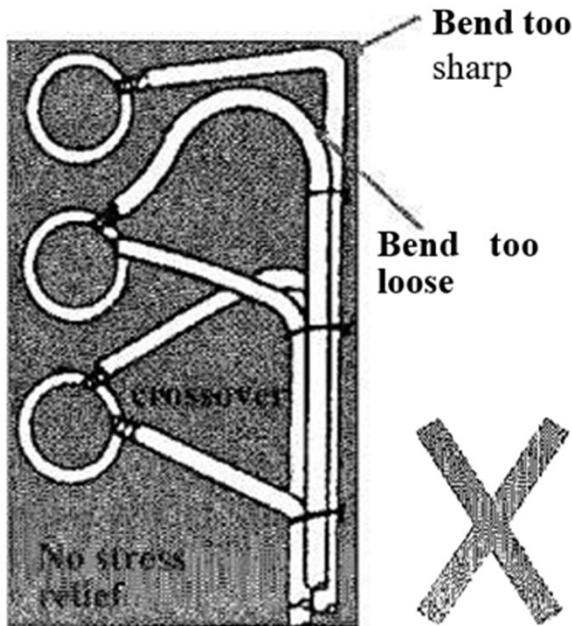
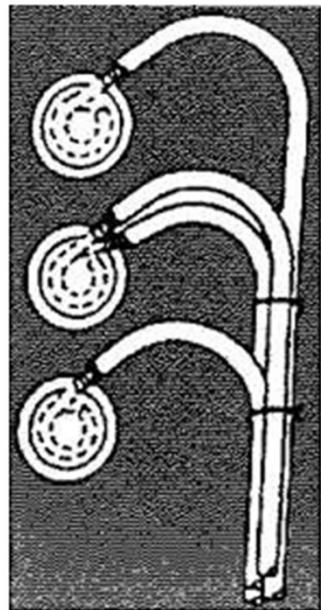
- Maximum distance of ties: (SWPM 20-10-11)
 - 2 inches for High Vibration Area,
 - 12 inches for Pressurized Area



sufficient slack should be left between the last clamp and the termination or electrical equipment to:

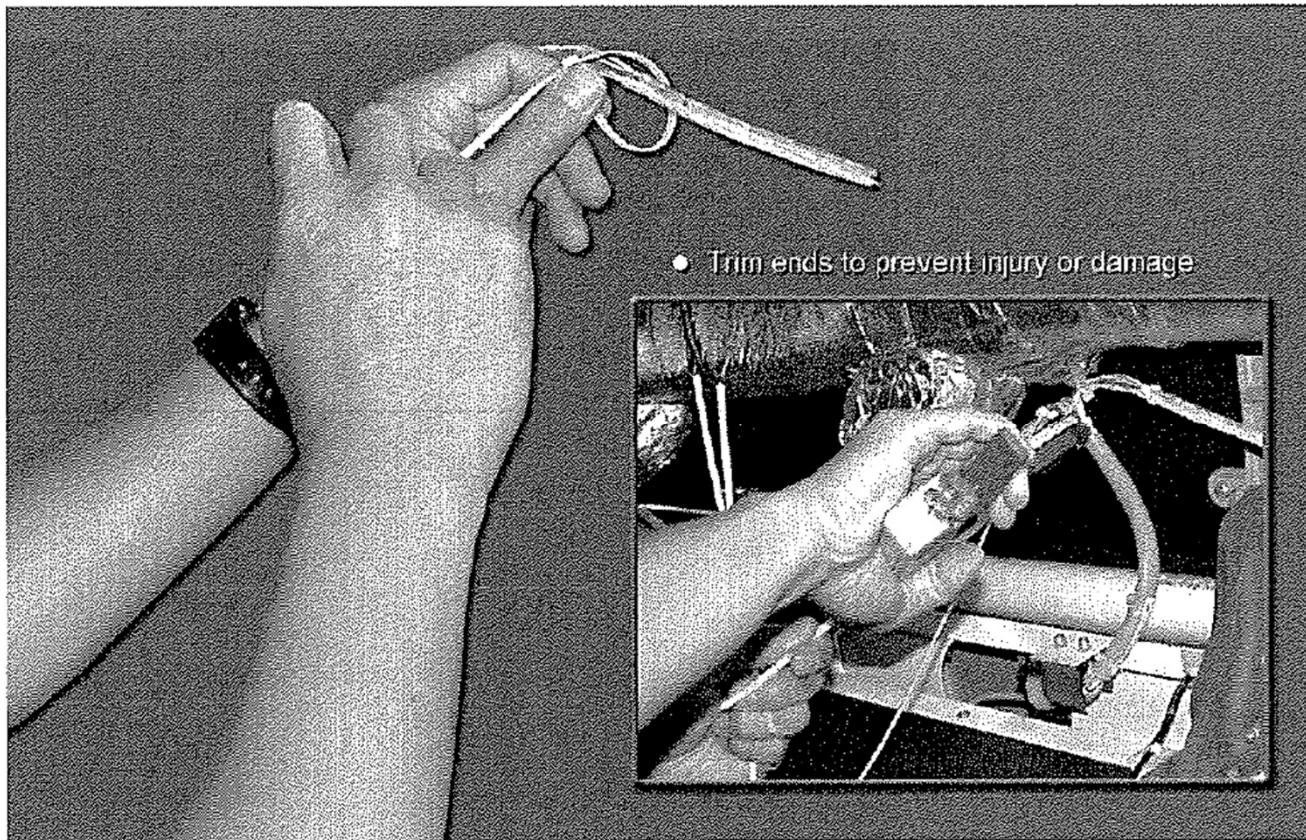
- prevent strain at the terminal
- minimize adverse effects of shock-mounted equipment.

Wire installation



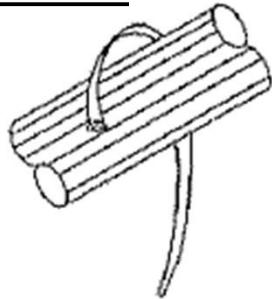
Proper wire installation

Wire bundle lacing - Plastic cable tie

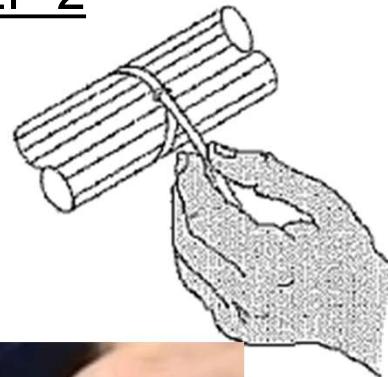


Wire bundle lacing - cable tie gun

STEP 1



STEP 2

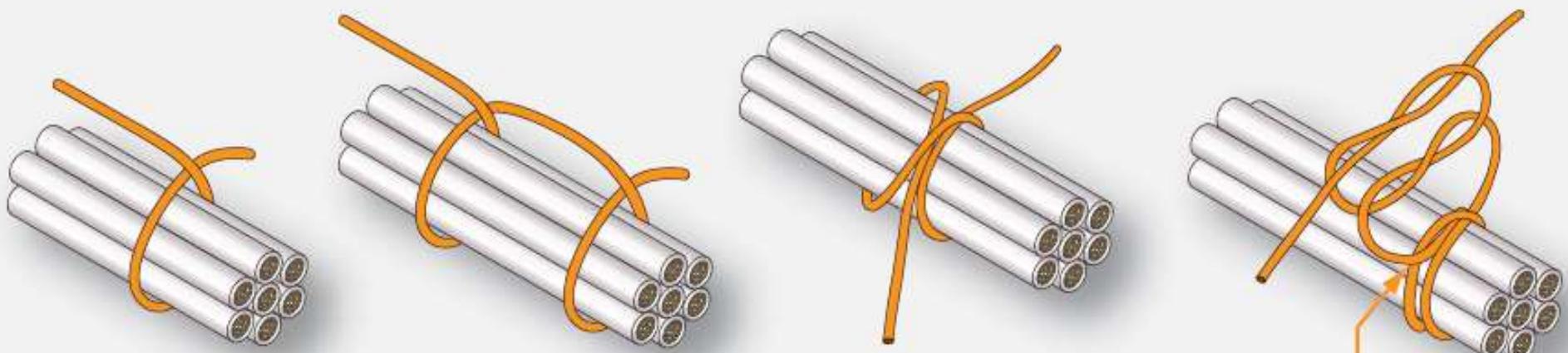


STEP 3



Wire Bundle Lacing

The locked clove hitch is used. The clove hitch is formed and it is then locked with a square knot.

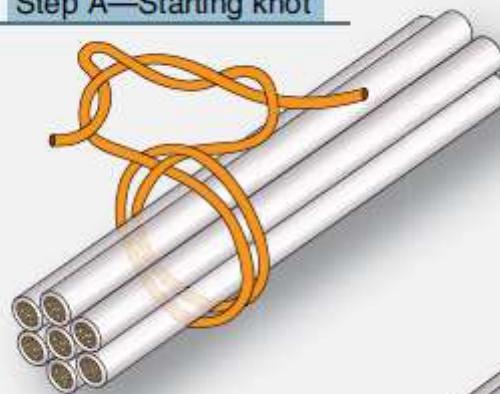


Wrap cord twice over bundle

Clove hitch and square knot

Tying a wire group or bundle

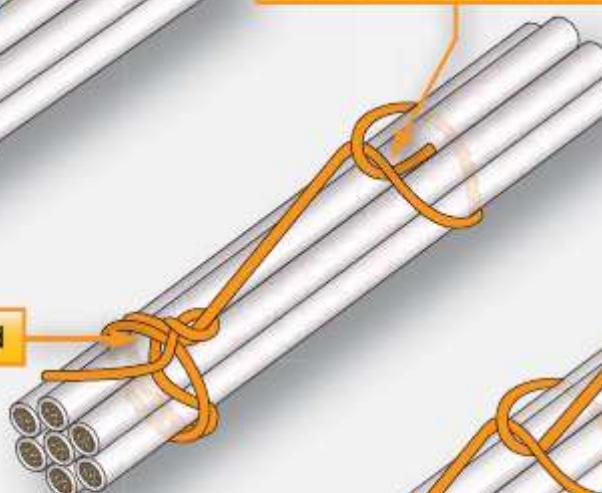
Step A—Starting knot



Pull here until tight before finishing knot

Cord crosses under loop

Starting knot tightened



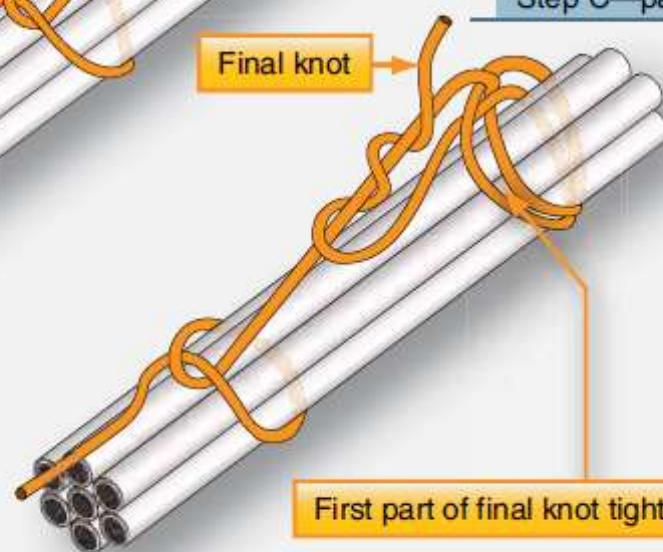
Step B—Intermediate half hitches

Trim to $3/8"$ minimum



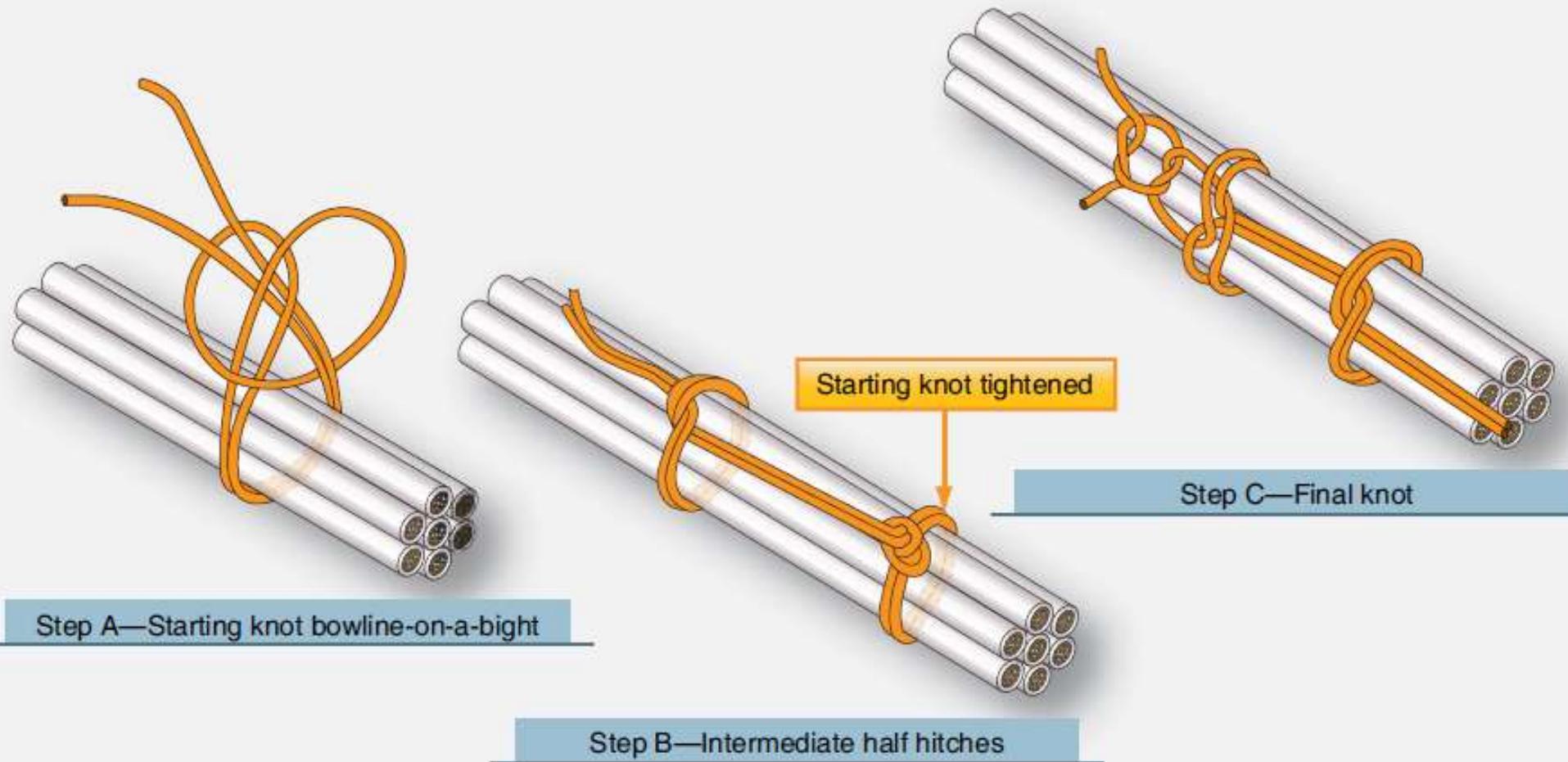
Step C—part I

Final knot



First part of final knot tightened

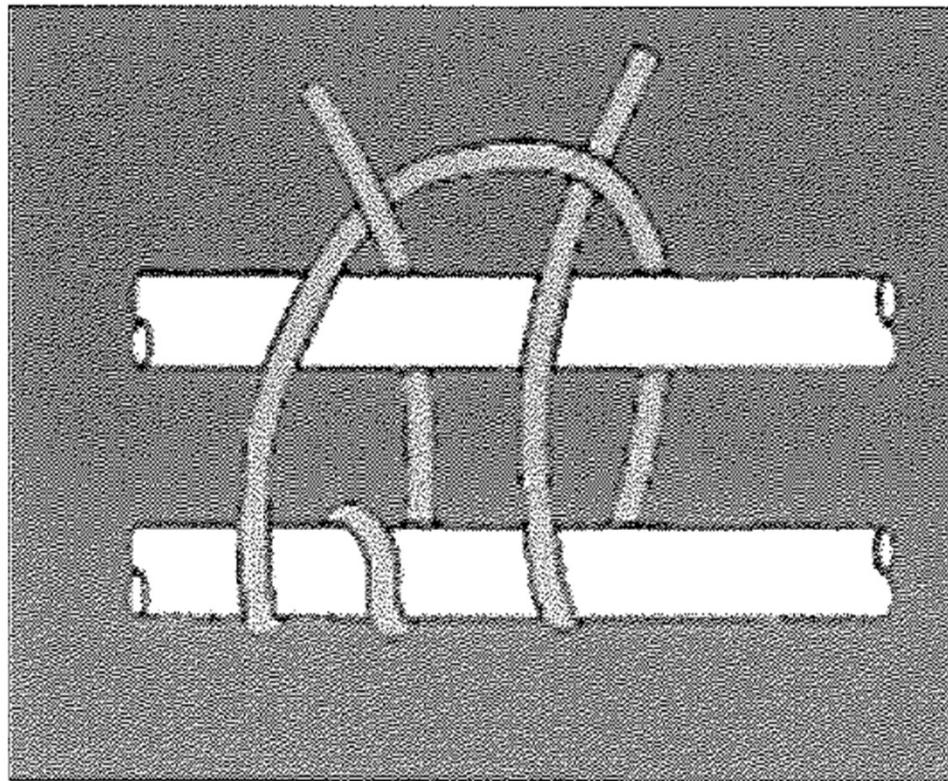
Single cord lacing method.



Double cord lacing.

Lacing at high vibration area

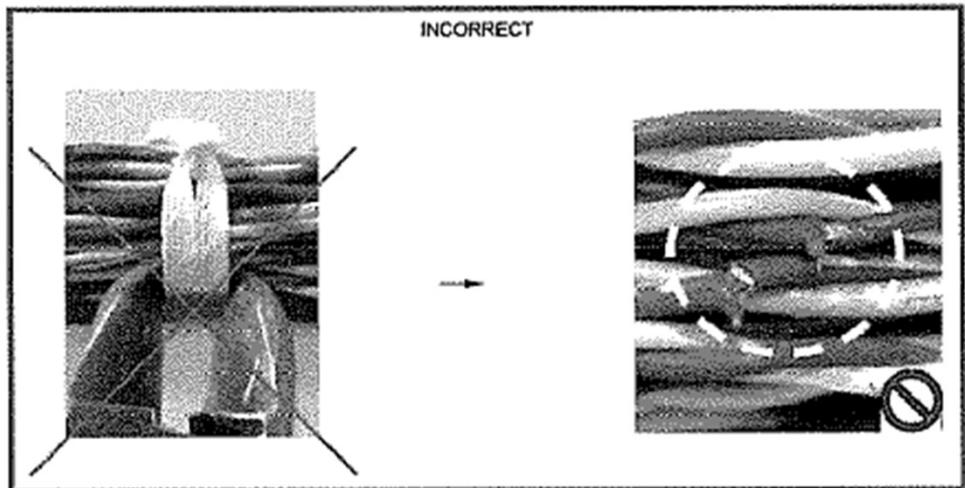
Make a special clove hitch knot on the harness, then a square knot



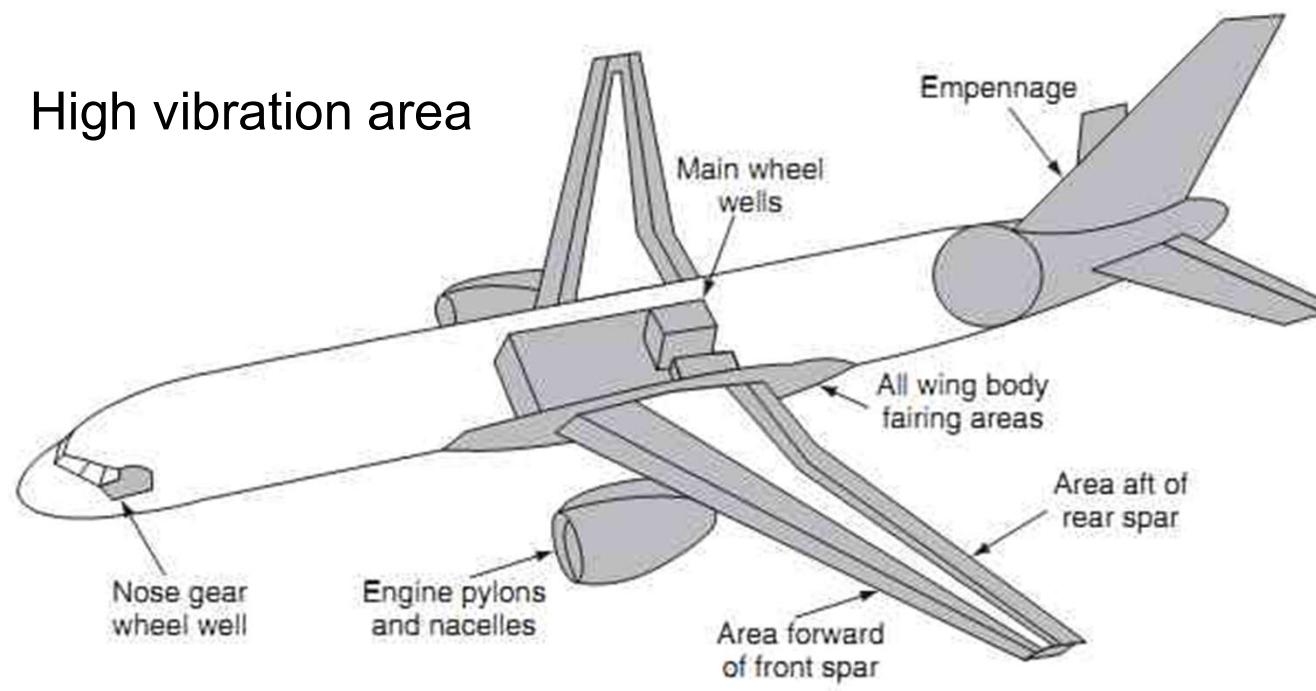
Remove a Lacing cord



←Never use the
sharp tip pointing
towards the bundle



Make lacing on high vibration or excessive heat area



Limitation to the use of plastic tie strap (SWPM 20-10-11)

Plastic tie strap and adhesive tape wire harness ties are

NOT PERMITTED:

- In a fuel tank (except specified)
- 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.

Handling ESDS component

- ESDS stands for Electro-Static Discharge Sensitive
- ESDS component is identified with an ESDS label
- Do not touch the connector pins
- Use ESDS cap (conductive cap) to protect the connector
- In the event of cardfile, use ESDS antistatic bag for protection



ESDS labels

ESDS - Continue



- Awareness
- Recognition
- Understanding

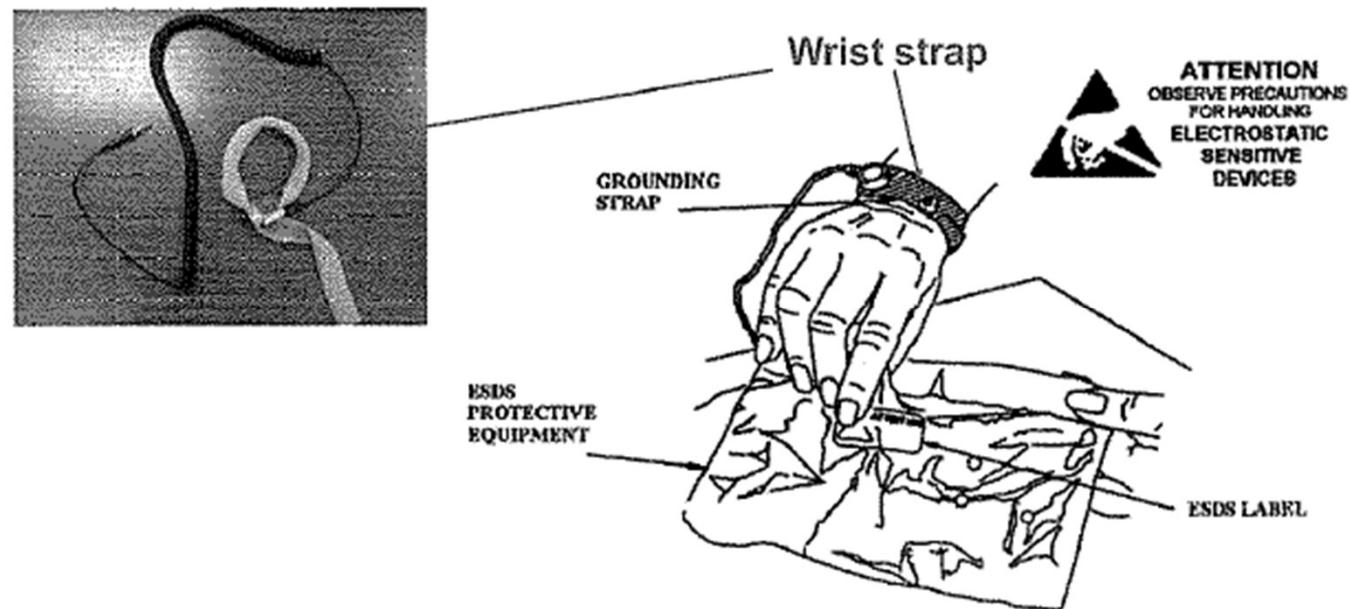


- Maintenance Preventive Action
- Avoidance



- Antistatic Plastic Wrap or Bag
- ESDS tape
- ESDS Blank Cap

Handling ESDS component



Handling ESDS component

Wrist strap checker M-3, the trigger resistance for HI is when system resistance is in excess of 10 Megohms and for LO is 800K Ohm



Wrist strap resistance is:

0.25 Megohms - 1.5Megohms



Wrist Strap Tester

Handling ESDS component

For Boeing, (**SWPM 20-41-01**)

- Always handling the ESDS component with wrist strap on
- Put ESDS printed wiring board into conductive bag and close it with
 - A fold lock
 - A zip lock
 - An ESDS label
 - An approved tie material
- For Metal encased Assembly
 - Put the dust cap on the connector of the LRU or
 - Put the LRU into a conductive bag

Handling ESDS component

For Airbus, (AMM 20-15-00)

- No specific procedures or instructions related to this subject because the LRUs have sufficient built-in protection to prevent electrostatic discharge damage (standard dust cap is already sufficient)
- All PCB are NOT LRU.
- The necessary standard precaution for each LRU are specified in the AMM in the applicable removal/installation section

Circuit Testing

Continuity test

Insulation test

Multimeter

- Avomoter
- Analog

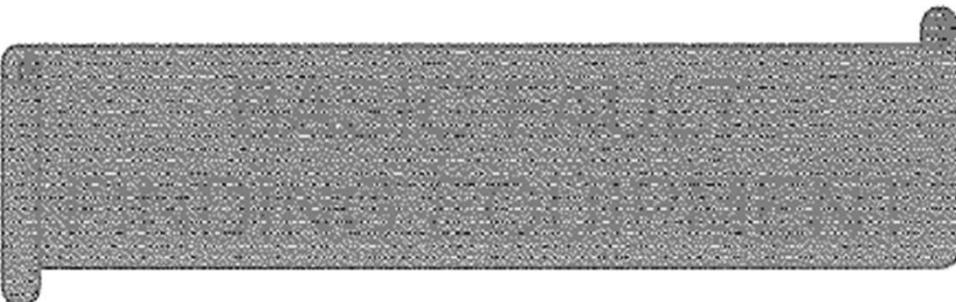
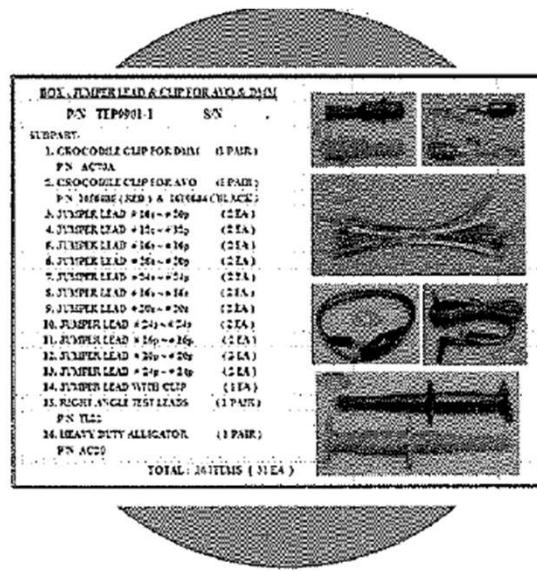


- Digital
- Multifunction



- Electrical Measurement instrument Device
- Several Function includes checking of Amps, Volts, Ohms, and Continuity
- Digital Multimeter (DMM) will be discussed in the following pages

multimeter



Basic Troubleshooting

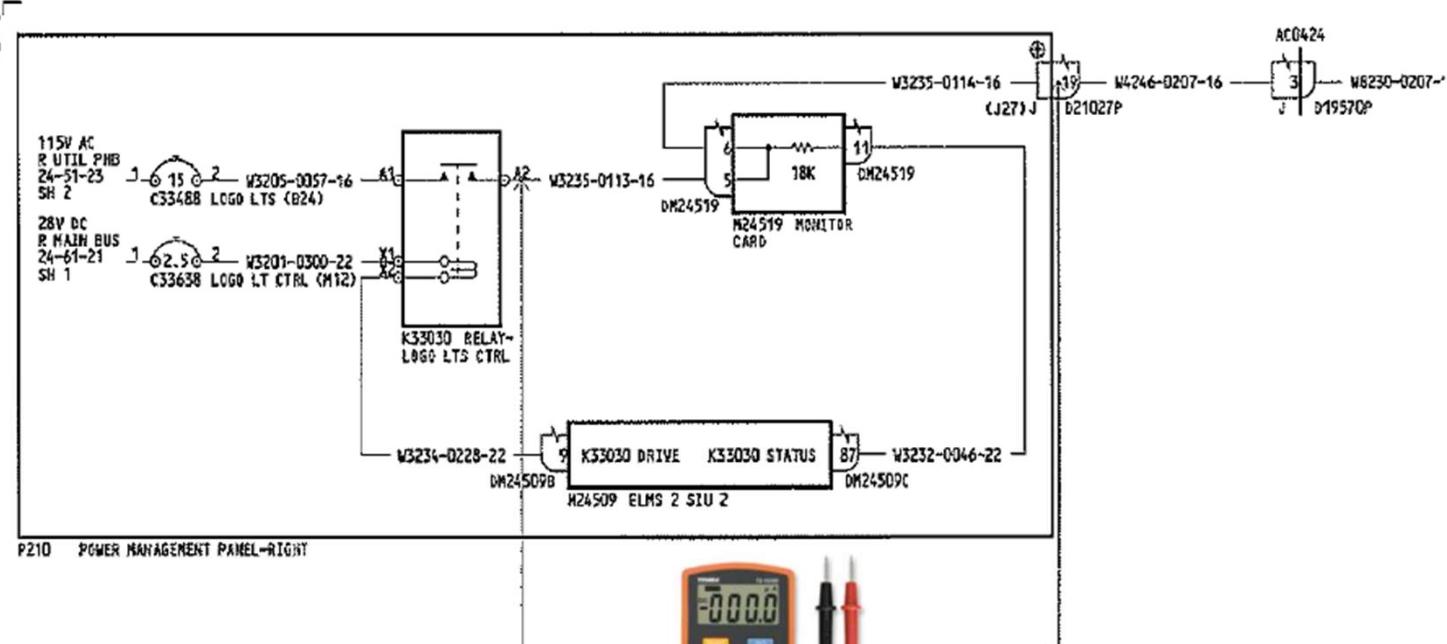
- Once a defect is found, a rectification might need some basic troubleshooting for identification, isolation and confirmation
- Use applicable manuals as a guidance,
for example: TSM, FIM, WDM, SSM, and et cetera
- Using DMM and Jumper Kit (loan from tool room) to check the system integrity, for example, the circuitry, the component's internal circuit and the continuity of the system is a common practice

Using DMM

DMM requires two test points to work,
Voltage, Current or
Resistance may be
checked.

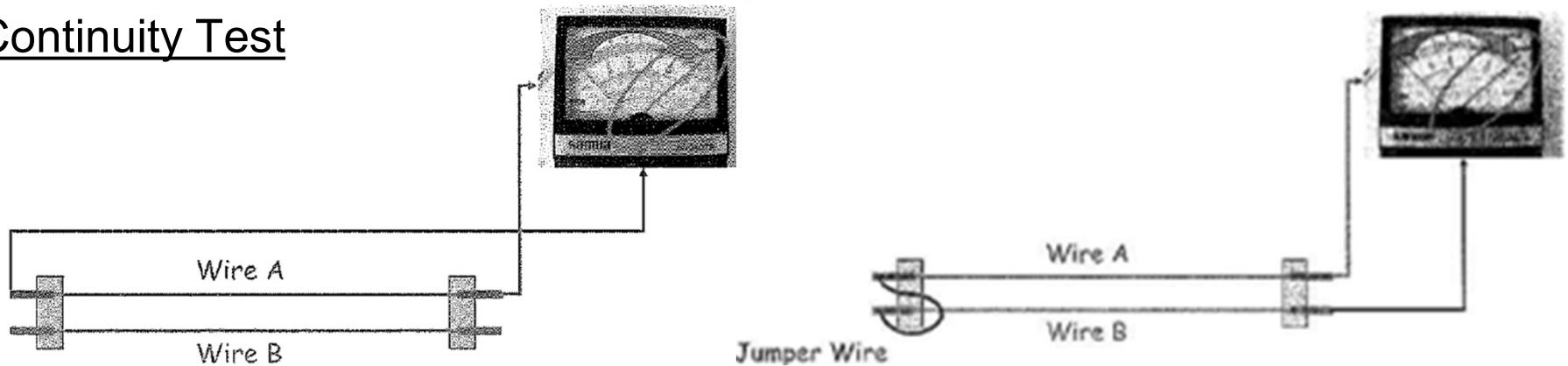


777-200 WIRING DIAGRAM MANUAL



Circuit Testing

Wire Continuity Test

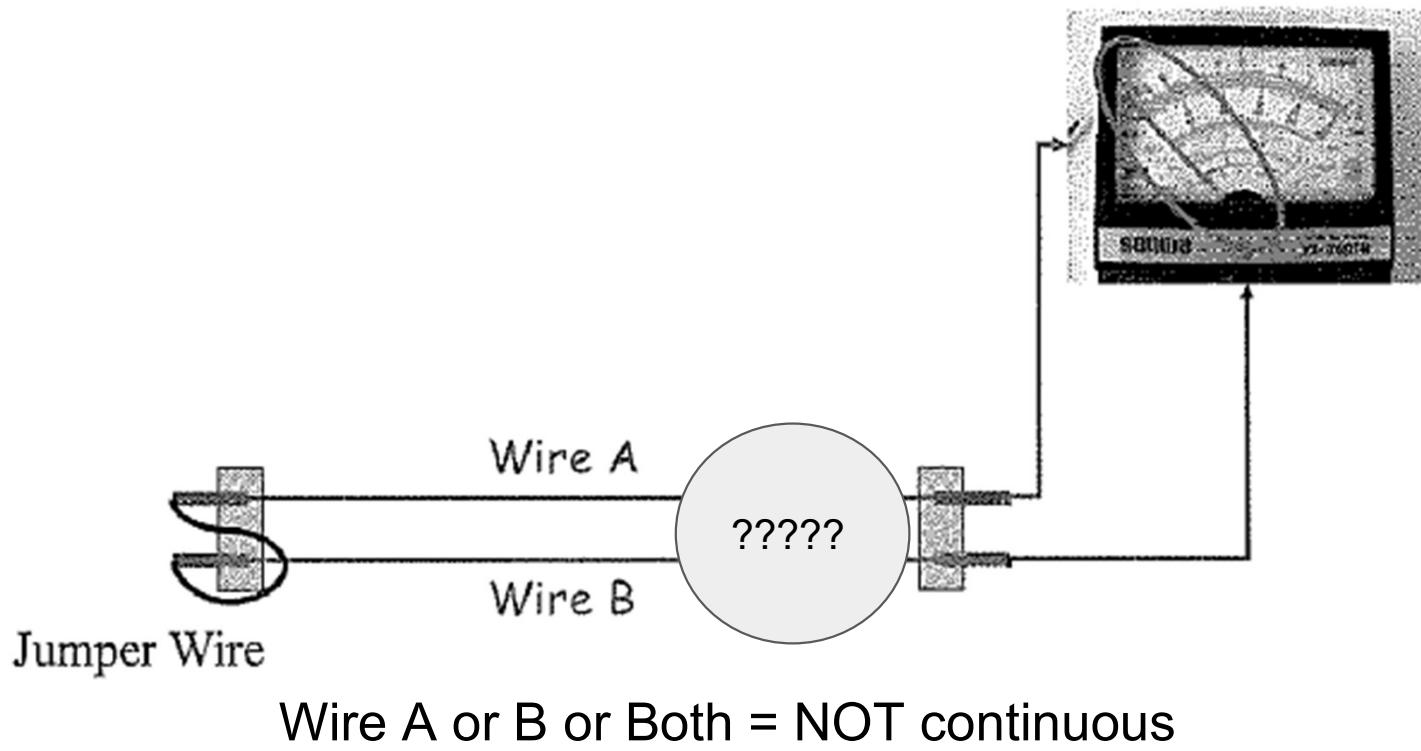


Wire A = Continuous

Wire A & B = continuous

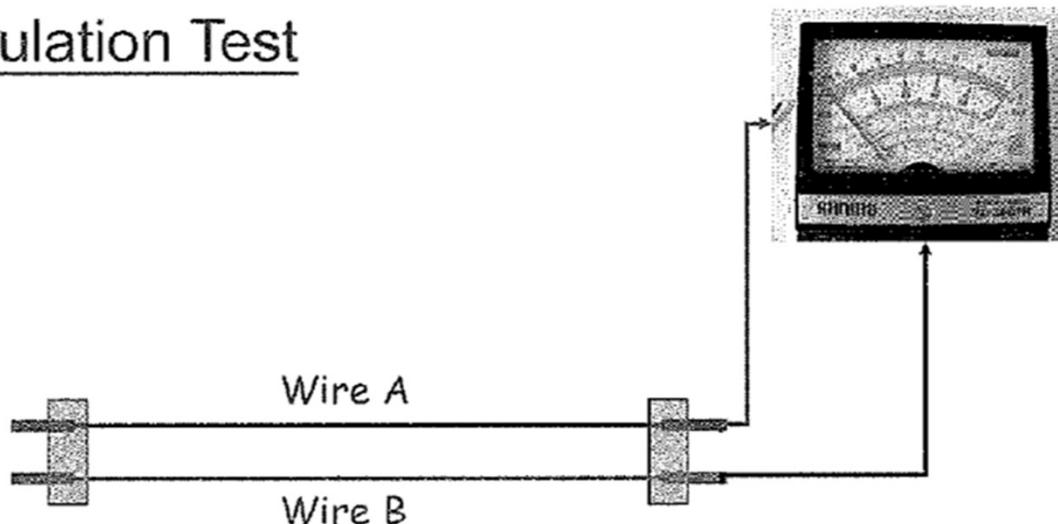
Circuit Testing

Wire Continuity Test



Circuit testing

Insulation Test



Wire A & B not shorted

whether the insulation between wire is good
under high voltage condition

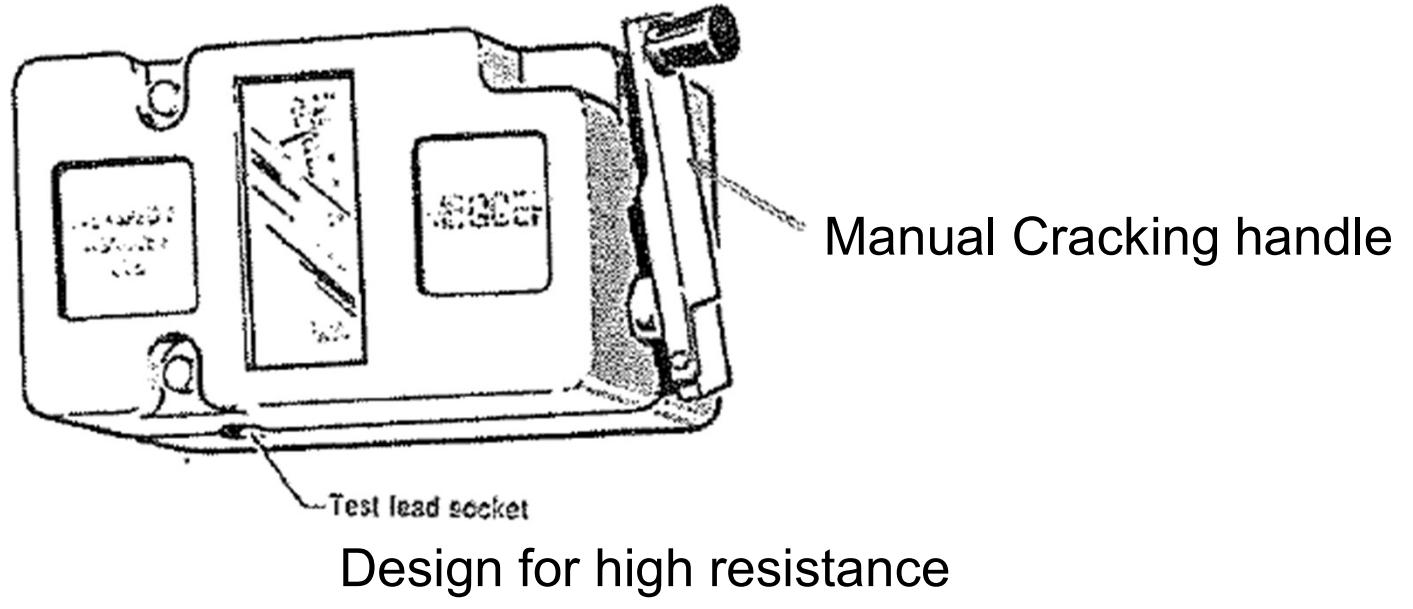


megger test/ insulation tester can
deliver up to 500V is commonly
used for insulation check

Circuit testing

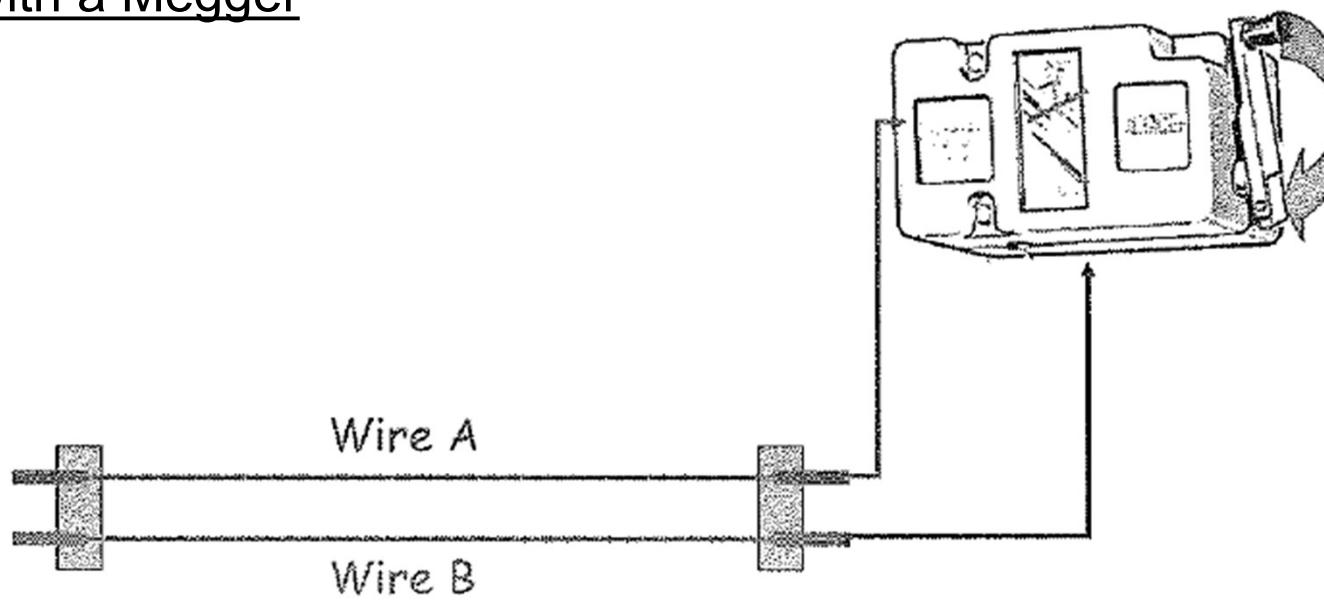
Insulation test with Megger

High output testing
voltage up to 500V
for insulation test



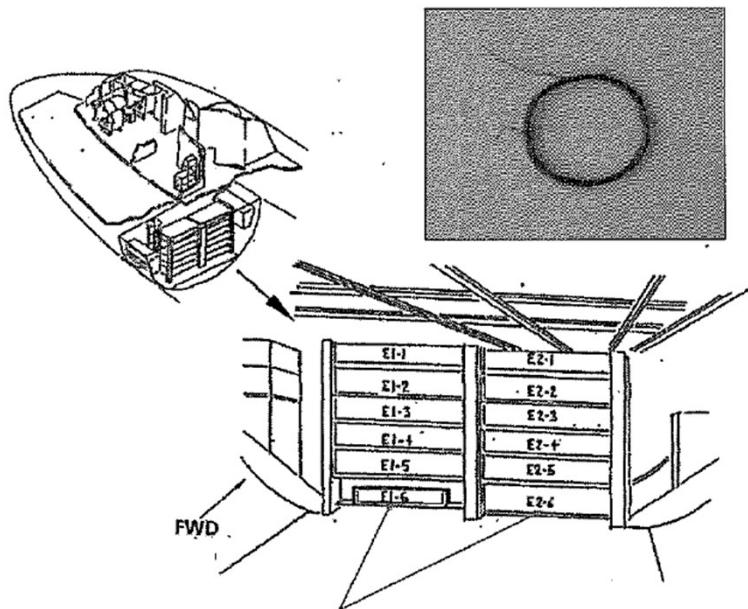
Circuit testing

Insulation Test with a Megger

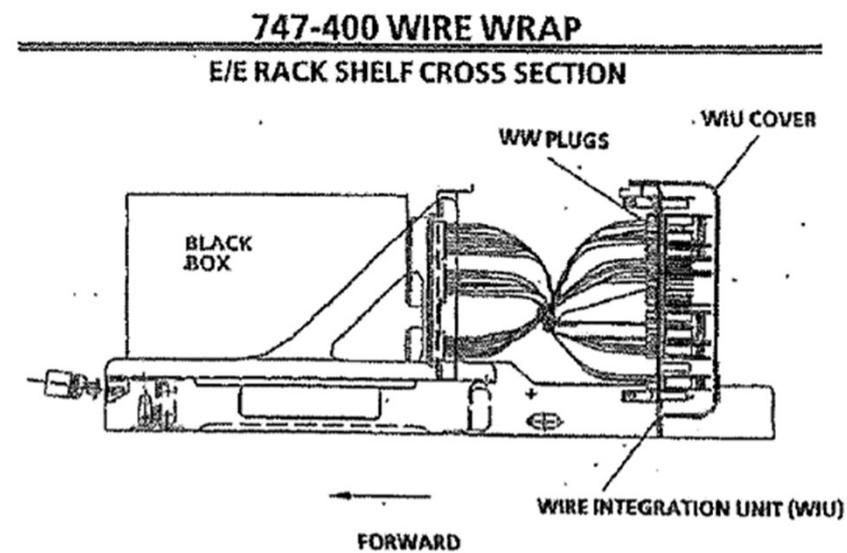


Small or no deflection = good insulation

Wire Wrap (B747- 400) used by Boeing 747 airplane



Wire integration unit



Requirement

- All power must be OFF
- ESD wrist strap must be ON
 - protects personnel
 - protects equipment

747-400 WIRE WRAP

E/E WIU CODING

GDX0101 - GDX0115 (GROUNDS)

RECEPTACLE LEGEND

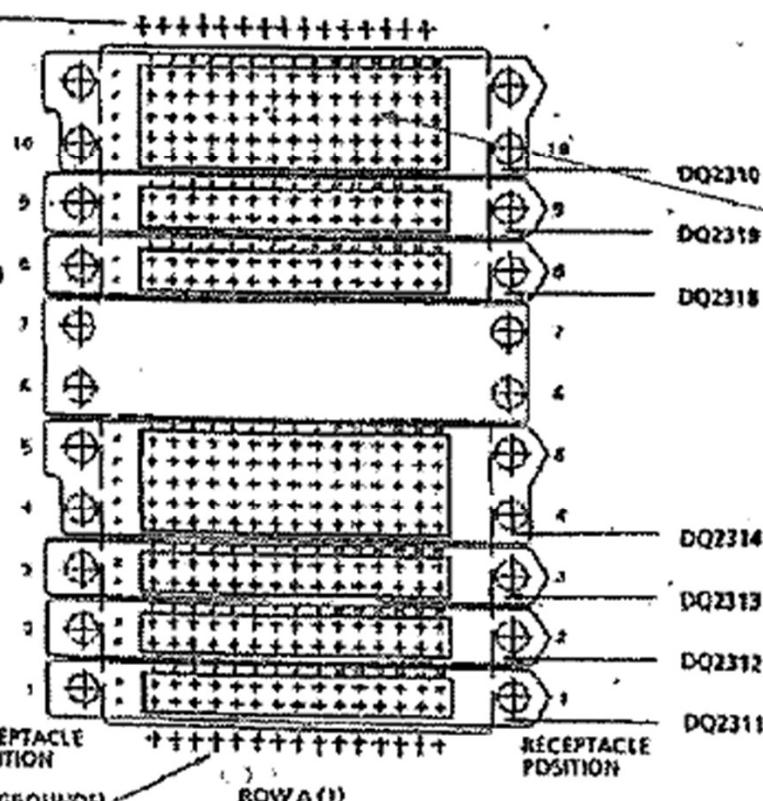
DQ2318

VERT POS - 1 THRU 0
(VERT POS # 8 IS SHOWN)

HORIZ ROW - 1 THRU 8
(HORIZ ROW 1 (A) IS SHOWN)

SHELF - E/E/E2 1 THRU 6
(E2-3 SHELF SHOWN)

E/E WIU RECEPTACLE

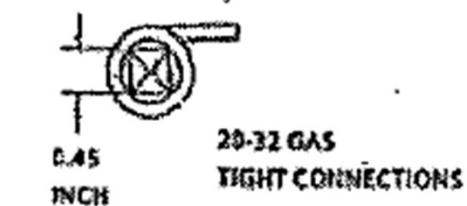
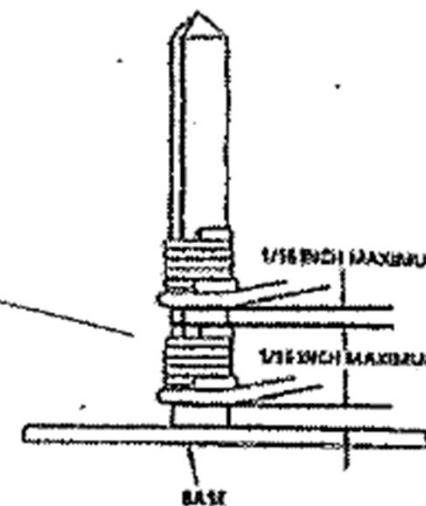


GDY0101 - GDY0115 (GROUNDS)

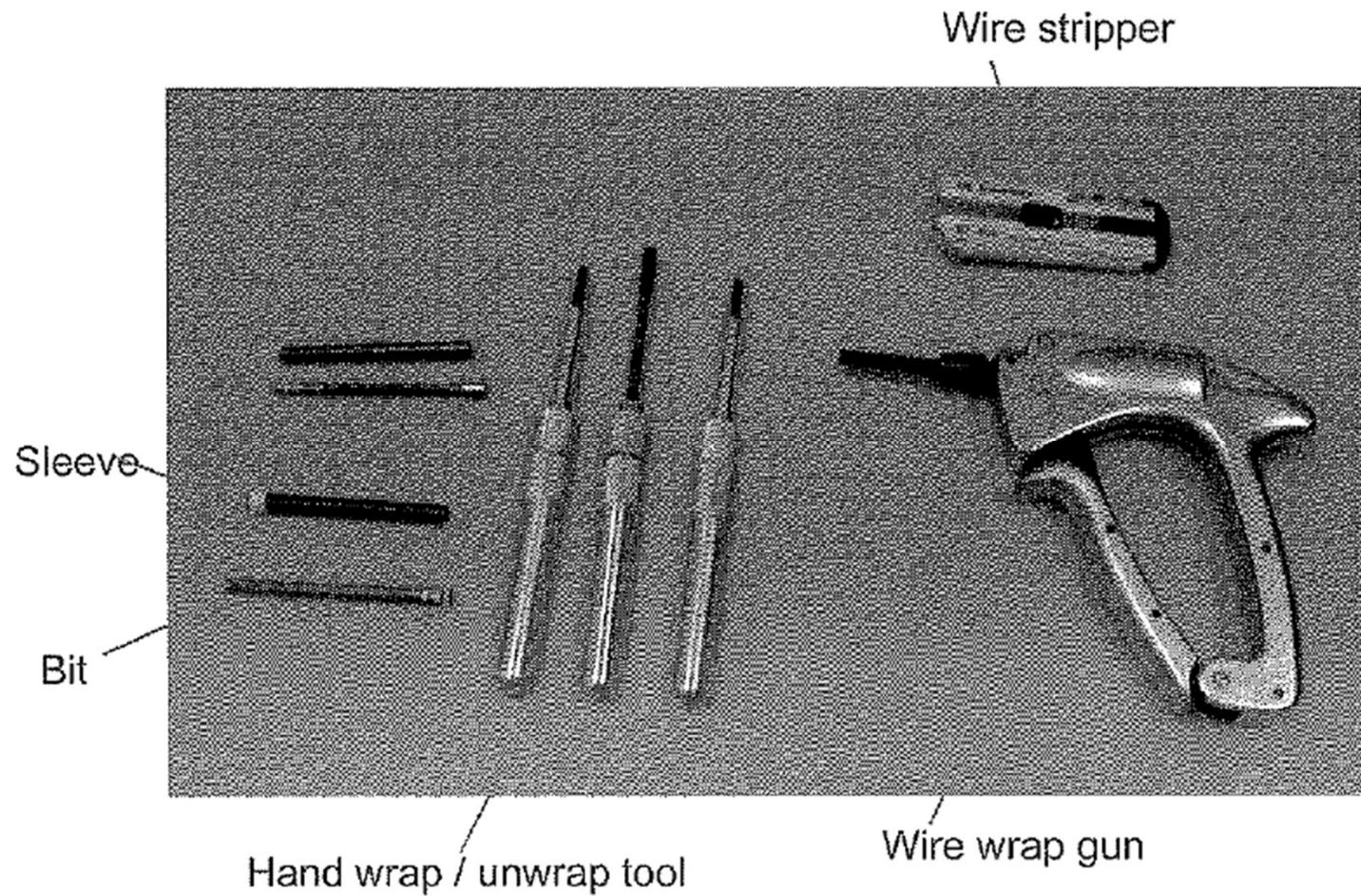
RECEPTACLE POSITION

ROW A (1)

RECEPTACLE POSITION



Wire Wrap Tool



Circuit Breaker Basic

- Circuit breaker(s) open when there is an electrical overload within an airplane system or during maintenance activities, a system is deactivate for safety
- The phenomenon due to electrical overload is commonly known as “tripped” circuit breaker
- If the circuit breaker is tripped or opened, DO NOT TRY TO RESET IT!!

Circuit Breaker Reset

- When system is deactivated, either due to overload or manual override, the system involved should be sought by an individual for the causation
- If the system which is deactivated is related to Fuel, Flight Controls, Electrical, Hydraulic, Pneumatic, Engine, Landing Gear, then a higher priority in terms of awareness and vigilance(=caution) should be given

Circuit Breaker Reset

- Due to the fact that the fuel system is a critical design configuration control limitation (CDCCL) item, then one must use the Fault Isolation Manual (FIM) for troubleshooting first prior to the circuit breaker reset procedure
- In the case of maintenance activities and troubleshooting procedures, the instructional manuals should be followed

Cause of Tripping

Be cautious that circuit breaker itself might have been defective and is causing the 'open' condition, therefore, it is considered to be unserviceable

The interconnected wiring might have been shorted or opened, which lead to tripping

The component that is connected to the system is probably at fault or a possible condition of internally shorted

Reset Procedures

Use the following procedure for reset a

tripped circuit breaker, ***Only IF:***

The circuit
breaker is
serviceable

This procedure is
in agreement
with the
associated
airline policy that
you are working
on

Can determine
the root cause
for the tripped
circuit breaker

Can determine
whether it is safe
to reset the
circuit breaker

**Make sure that
NO ONE is
standing next to
the system which
is controlled by
the circuit
breaker**