DE HAVILLAND AIRCRAFT OF CANADA LIMITED

PPS 9.01

PRODUCTION PROCESS STANDARD

PROPRIETARY INFORMATION

CRIMPING ELECTRICAL TERMINAL LUGS TO COPPER WIRE

Issue 31
- This standard supersedes PPS 9.01, Issue 30.
- Vertical lines in the left hand margin indicate technical changes over the previous issue.
- Direct PPS related questions to christie.chung@dehavilland.com or (416) 375-7641.
- This PPS is effective as of the distribution date.

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	Quality	

Signed original on file. Validation of paper prints is the responsibility of the user.

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Issue 31 - Summary of Changes (over the previous issue)

The following summaries are not detailed and are intended only to assist in alerting PPS users to changes which may affect them. Refer to the applicable sections of this PPS for detailed procedure and requirements.

- Replaced throughout PPS where “Bombardier” is specified with “De Havilland Aircraft of Canada Limited” or “De Havilland Canada”.
- Added figure to define part number for heat shrinkable tubing, M23053/5 and M23053/8.
- Added details for TE Connectivity RT555 heat shrinkable tubing.
- Specified lugs in Table II are copper/tin lugs.
- Added new table, Table III, for copper/nickel lugs (i.e, TE Connectivity 50831-1, 50832 and 50832-1 Strato-Therm terminal copper/nickel lugs).
- Added 3D pictorial of indentor and nest to Figure 5.
- Specified orientation of lugs depicted in Figure 5 applies to TE Connectivity crimp tool 1490749-1 (i.e., the importance of positioning terminal lugs into the crimp tool).
- Added non-insulated TE Connectivity Solistrand terminal lug 1-331420-0 for 4 AWG wire crimps. Tool installation shall be 1490749-1 crimp tool with 1-1490413-1 nest and 1490414-2 indenter.
- Modified crimp instructions for TE Connectivity 1490749-1 hydraulic crimp tool to reflect that of the current manufacturer’s technical data sheet.

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Tables

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1 SCOPE

1.1 This Production Process Standard (PPS) specifies the procedure and requirements for crimping terminal lugs to copper wire.

1.1.1 This PPS complements the engineering drawings that specify its use as an authorized instruction. The procedure specified in this PPS shall be followed to ensure compliance with all applicable specifications. In general, if this PPS conflicts with the engineering drawing, follow the engineering drawing. The requirements specified in this PPS are necessary to fulfil the engineering design and reliability objectives.

1.1.2 Refer to PPS 9.35 for crimping terminal lugs to aluminum wire.

1.1.3 Refer to PPS 13.26 for the subcontractor provisions applicable to this PPS.

2 HAZARDOUS MATERIALS

2.1 Before receipt at De Havilland Canada, all materials shall be approved and assigned Material Safety Data Sheet (MSDS) numbers by the De Havilland Canada Environment, Health and Safety Department. Refer to the manufacturer's MSDS for specific safety data on any of the materials specified in this PPS. If the MSDS is not available, contact De Havilland Canada Environment, Health and Safety Department.

3 REFERENCES

3.1 PPS 9.24 - Wire Stripping.

3.2 PPS 9.35 - Terminating and Splicing Aluminum Wire.

3.3 PPS 9.55 - Qualification of crimp Tools

3.4 PPS 10.16 - Installation of Heat Shrinkable Identification Tubing, Tape and Sleeves.

3.5 PPS 13.26 - General Subcontractor Provisions.

3.6 PPS 13.39 - Bombardier Toronto Engineering Process Manual.

4 MATERIALS, EQUIPMENT AND FACILITIES

4.1 Materials

4.1.1 Unless otherwise specified in this section, use only the materials specified; use of superseding or alternative materials is not allowed.

4.1.2 Heat shrinkable tubing, bulk length, M23053/5 (135°C max.) or M23053/8 (175°C max.). See Figure 1 for a part number breakdown.

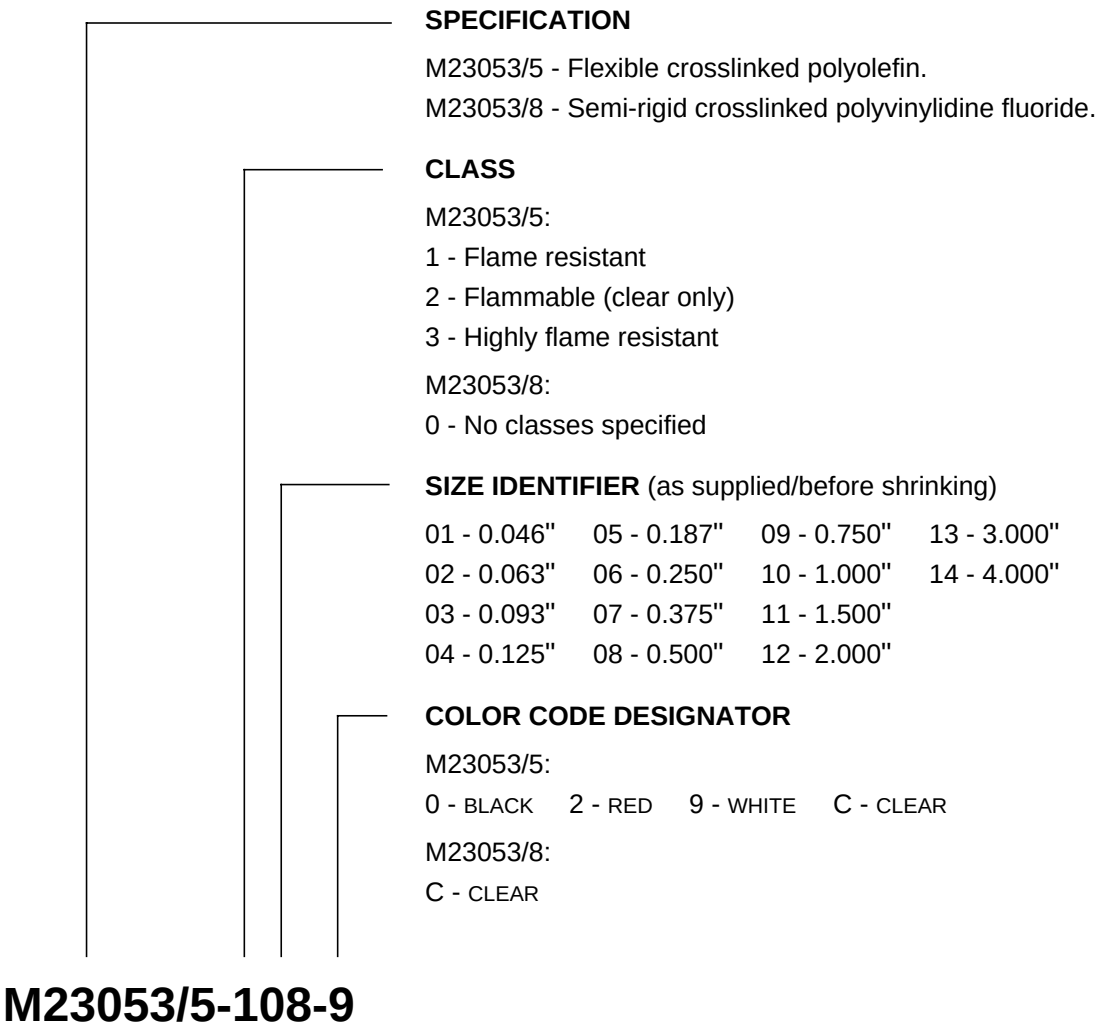


FIGURE 1 - PART NUMBER BREAKDOWN FOR HEAT SHRINKABLE TUBING

4.1.3 Heat shrinkable tubing, high temperature, TE Connectivity RT555, as specified on the engineering drawing or wiring list.

4.1.4 Crimp style electrical terminal lugs as specified on the engineering drawing or wiring list (see Figure 2).

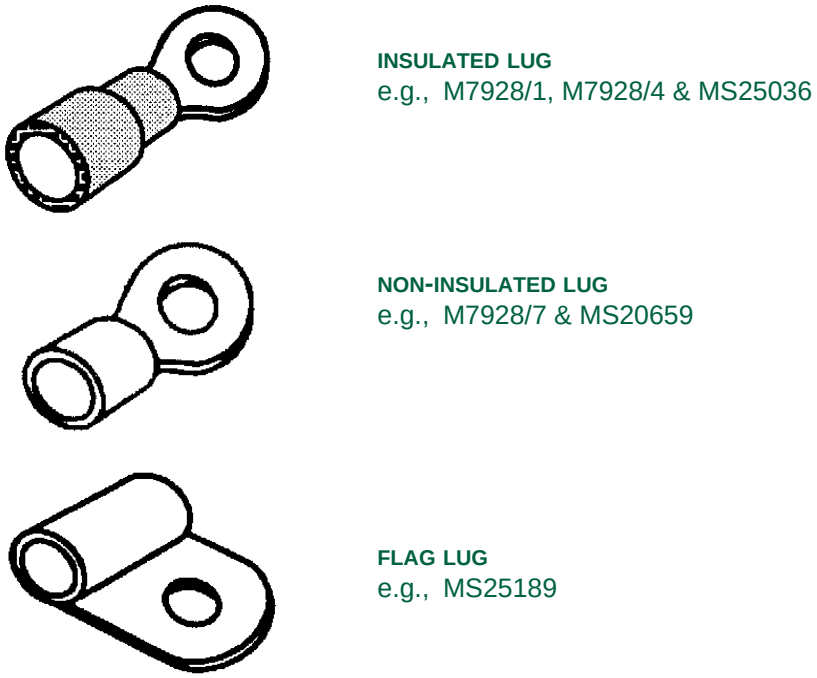


FIGURE 2 - CRIMP STYLE TERMINAL LUGS

4.2 Equipment

4.2.1 Crimping tools as listed in Table II and Table IV.

4.2.2 Crimp dies as specified in Table V, Table VI and Table VII.

4.3 Facilities

4.3.1 This PPS has been categorized as a Controlled Special Process according to PPS 13.39 and as such only facilities specifically approved according to PPS 13.39 are authorized to perform crimping terminal lugs to copper wire according to this PPS.

4.3.2 Subcontractors shall direct requests for approval to De Havilland Canada Supplier Quality Management.

4.3.3 Facility approval shall be based on a facility report, a facility survey and completion of a qualification test program, if required. The facility report shall detail the materials and equipment to be used, the process sequence to be followed and the laboratory facilities used to show compliance with the requirements of this PPS. Any deviation from the procedure or requirements of this PPS shall be detailed in the facility report. Based upon the facility report, De Havilland Canada Engineering may identify additional qualification and/or process control test requirements. During the facility survey, the facility requesting qualification shall be prepared to demonstrate their capability. Once approved, no changes to subcontractor facilities may be made without prior written approval from De Havilland Canada Supplier Quality Management.

4.3.3.1 For approval of subcontractor facilities to perform crimping terminal lugs to copper wire according to this PPS completion of a test program and submission of suitable test samples representative of production parts is required. Test samples must meet the requirements specified in section 6.

5 PROCEDURE

5.1 General

5.1.1 Solderless crimp type electrical terminal lugs, as specified herein, are used as a means of connecting electrical wires to terminal boards, bus bars and other electrical equipment utilizing screw or stud type termination posts.

5.1.2 Solderless terminal lugs, as specified herein, are made of tin or nickel plated copper alloy and are either pre-insulated or non-insulated, depending on the application requirements.

5.1.3 The wire size or range of wire sizes which can be accommodated by a particular pre-insulated terminal lug is identified by means of wire size markings on the tongue and by colour coding of the insulation sleeve. Refer to Table I for a listing of wire sizes and colour codes.

5.1.4 TE Connectivity is the new name for the company previously known as Tyco Electronics which purchased/merged with AMP.

TABLE I - COLOUR CODING OF COPPER TERMINAL LUG INSULATION

WIRE SIZE (AWG)	M7928/1 TERMINAL LUGS	M7928/4 & MS25036 TERMINAL LUGS	TE CONNECTIVITY 6049XX TERMINAL LUGS
26	YELLOW WITH A BLACK BAND	YELLOW	N/A
24	YELLOW WITH A DARK BLUE BAND		
22	PINK WITH A GREEN BAND	RED	RED
20	PINK WITH A RED BAND		
18	PINK WITH A WHITE BAND		
16	BLUE WITH A DARK BLUE BAND	BLUE	BLUE
14	BLUE WITH A GREEN BAND		
12	YELLOW WITH A DARK YELLOW BAND	YELLOW	YELLOW
10	YELLOW WITH A BROWN BAND		
8	N/A	RED	N/A
6	N/A	BLUE	N/A
4	N/A	YELLOW	N/A
2	N/A	RED	N/A
1	N/A	CLEAR TO WHITE	N/A
0	N/A	BLUE	N/A
2/0	N/A	YELLOW	N/A
3/0	N/A	RED	N/A
4/0	N/A	BLUE	N/A

5.1.5 Terminal lugs are available in three basic configurations: straight, right-angle and flag type. The type of terminal lug selected for each application, as specified by the engineering drawing, will depend on the installation configuration and space limitations of the particular assembly.

5.1.6 If the engineering drawing or wiring list specifies installation of a terminal lug along with filler wire or an adapter, crimp the lead wire(s) with the filler wire or adapter specified by the engineering drawing or wiring list. Before crimping, insert the filler wire or adapter with the wire lead(s); after crimping, trim filler wire so that it protrudes from the lug wire barrel 0" - 1/32". If there is a relatively large difference between the total circular mil area (CMA) of the lead wire(s) and the CMA of the lug wire barrel, and use of filler wire or an adapter is not specified, refer to Liaison Engineering for disposition.

5.1.7 If the engineering drawing or wiring list specifies crimping a terminal lug with a smaller wire barrel (AWG) to a wire with a larger AWG size, refer to Liaison Engineering for disposition.

5.1.8 Crimping tools/dies must be qualified according to PPS 9.55 before use on Production parts. For additional details regarding tool operation, refer to the manufacturers' instructions.

5.1.9 Terminal lugs are crimped to the wire using hand operated, portable or stationary power tools. These tools crimp the terminal barrel to the wire conductor and, if applicable, simultaneously form the insulation support to the wire insulation.

- Hand operated, plier type crimping tools are the standard tools used to crimp wire barrel size 22 - 10 terminal lugs. Plier type tools are portable and are used for bench assembly in the electrical shop and final assembly on the aircraft.
- Pneumatic power tools are used to crimp wire barrel size 22 - 8 terminal lugs. Pneumatic tools are bench mounted and are generally used either for crimping the larger size terminal lugs, or for a production lot involving a large quantity of lugs.
- Hydraulic power crimping tools are the standard tools used to crimp terminal lugs (except flag type terminal lugs) from 8 to 4/0 wire size. These tools are bench mounted in the electrical shop.
- Mechanical press type tools are hand operated tools used to crimp terminal lugs and flag lugs from 8 to 4/0 wire size. These tools are portable and are used in the electrical shop for crimping flag lugs and in final assembly to crimp large lugs (including flag type terminal lugs) in the aircraft.

5.2 Stripping of Wire Insulation

5.2.1 Refer to PPS 9.24 for stripping methods and lengths.

5.3 Installation of Terminal Lugs

5.3.1 General

5.3.1.1 Except as noted below, refer to Table II, Table III and Table IV for a listing of preferred and alternate crimping tools.

- For military related contracts, crimp M7928 terminal lugs using a M22520/5-01 tool with a M22520/5-100 die.
- For TE Connectivity Ampli-Bond and Terminyl lugs to MS25036, use either a 59974-1 or 1490749-1 crimp tool. Refer to Table V for a listing of TE Connectivity crimping dies for use with 59974-1 and 1490749-1 crimp tools.

5.3.1.2 If the engineering drawing or wiring list does not specify a particular class for MS20659 and MS25036 terminal lugs, install either a Class 1 or Class 2 lug. Install Class 1 lugs according to the procedure specified herein; crimp Class 2 lugs using the lug manufacturer's instructions and crimp tool/dies (e.g., crimp TE Connectivity Class 2 terminal lugs using the TE Connectivity crimp tool and dies specified by TE Connectivity).

TABLE II - CRIMPING TOOLS FOR USE WITH INSULATED TERMINAL LUGS (Copper-Tin)

INSULATED TERMINAL LUG	WIRE BARREL (AWG)	CRIMP TOOL/DIE PART NUMBER
Insulated Lugs to: • M7928/1 • M7928/4 • MS25036 Class 1 (Note 1) • Burndy YAEV-RS lugs	26 - 24	TE Connectivity 59300 “T” Head plier type tool
		TE Connectivity 59170 “T” Head plier type tool
	22 - 18	Hollingsworth H270 with #27000B die set, pneumatic type tool
		TE Connectivity 2614 pneumatic tooling assembly with 314595-1 power unit & 314270-1 head
		TE Connectivity 626 pneumatic tooling assembly with 189721-1 power unit, 356302-1 head, & 679305-1 die
		TE Connectivity 47386 plier type tool
	22 - 16	TE Connectivity 59250 “T” Head plier type tool
		Western Industrial Products (WIP) W400-1020 pneumatic type tool
	16 - 14	Hollingsworth H270 with #27001B die set, pneumatic type tool
		TE Connectivity 2614 pneumatic tooling assembly with 314595-1 power unit & 314269-1 head
		TE Connectivity 626 pneumatic tooling assembly with 189721-1 power unit, 356302-1 head, & 679305-1 die
		Western Industrial Products (WIP) W400-1020, pneumatic type tool
		TE Connectivity 59250 “T” Head plier type tool
		TE Connectivity 47387 plier type tool
	12 - 10	TE Connectivity 314281 with a 314268 crimp head, pneumatic type tool
		TE Connectivity 2614 pneumatic tooling assembly with 314281-1 power unit & 314268-1 head
		TE Connectivity 626 pneumatic tooling assembly with 189721-1 power unit, 356302-1 head, & 679300-1 die
		TE Connectivity 59236 or TE Connectivity 59239-4 plier type tool
	8	Hollingsworth H270 with #27082B die set, pneumatic type tool
	8 - 2/0	Burndy Y35, hydraulic type tool
		Burndy Y39BH with die as listed in Table VI, hydraulic type tool
		Burndy MY28, press type tool
	8 - 4/0	Thomas & Betts 13642M with die as listed in Table VII, hydraulic type tool

Note 1. If the engineering drawing or wiring list does not specify a particular class for a MS25036 terminal lug, install either a Class 1 or a Class 2 lug. Crimp Class 1 lugs using the tooling specified in this table; crimp Class 2 lugs using the lug manufacturer’s instructions and crimp tool/dies.

TABLE II - CRIMPING TOOLS FOR USE WITH INSULATED TERMINAL LUGS (Copper-Tin)

INSULATED TERMINAL LUG	WIRE BARREL (AWG)	CRIMP TOOL/DIE PART NUMBER
TE Connectivity Plasti-Grip 53978-1 Lugs	8	TE Connectivity 59974-1 plier type tool with a 48752-1 die
		TE Connectivity 1490749-1 plier type tool with a 1490534-1 die
TE Connectivity Ampli-Bond & Terminyl Lugs (as per Table V)	8 - 2	TE Connectivity 59974-1 or 1490749-1 with die as listed in Table V, hydraulic hand tool
TE Connectivity 6409XX PIDG Faston Receptacles	22 - 18	TE Connectivity 59824-1 (Tetra-Crimp) plier type tool
	16 - 14	
	12 - 10	

Note 1. If the engineering drawing or wiring list does not specify a particular class for a MS25036 terminal lug, install either a Class 1 or a Class 2 lug. Crimp Class 1 lugs using the tooling specified in this table; crimp Class 2 lugs using the lug manufacturer's instructions and crimp tool/dies.

TABLE III - CRIMPING TOOLS FOR USE WITH INSULATED TERMINAL LUGS (Copper-Nickel)

TERMINAL LUG	WIRE BARREL (AWG)	CRIMP TOOL PART NUMBER
TE Connectivity Strato-Therm 50831-1, 50832, 50832-1	24 - 20	TE Connectivity 1901611-2 (see Note 1)

Note 1. Alternate Crimp Tool: 69692-1 T-Head Crimper (for 26 - 20 AWG wire); 69710-1 Hand Crimper with 69732 Head (for 22 - 20 AWG wire). Strato-Therm nickel terminal lugs shall be used for nickel copper wire only.

TABLE IV - CRIMPING TOOLS FOR USE WITH NON-INSULATED AND FLAG TERMINAL LUGS (COPPER-TIN)

TERMINAL LUG	WIRE BARREL (AWG)	CRIMP TOOL/DIE PART NUMBER
Burndy YAV27-RS	3/0	Thomas & Betts 13642M with 11788M die, hydraulic type tool
M7928/7 non-insulated lugs	14 - 24	TE Connectivity 49935 plier type tool
	10 - 20	Schleuniger CT32 with a CT1-310100 die holder and a CT1-111020 die set, pneumatic type tool
MS20659 Class 1 non-insulated lugs (Note 3)	22 - 10	TE Connectivity 69005 with a 300454 crimp head, pneumatic type tool
	8 - 2	TE Connectivity 59975-1, hydraulic type tool
	8 - 4/0	Burndy Y35, hydraulic type tool
		Burndy MY29 press type tool
		TE Connectivity 58422-1 (Note 1), pneumatic type tool
		Thomas & Betts 13642M with die per Table VII, hydraulic type tool
MS25189 flag lugs	18 - 14	T&P WT175 plier type tool
	12 - 10	TE Connectivity 49965 plier type tool
	8 - 2/0	Burndy MY29 press type tool
TE Connectivity 1-331420-0 Solistrand non-insulated lugs	4	TE Connectivity 1490749-1 tool with 1-1490413-1 (Nest, U-Die, HD) and 1490414-2 (Indenter, U-Die), hydraulic type tool
TE Connectivity 321875 Solistrand non-insulated lugs	3/0	TE Connectivity 1490749-1 tool with 1490413-7 nest and 1490414-3 indenter, hydraulic type tool
TE Connectivity 322∗ (Note 2) non-insulated lugs	22 - 10	TE Connectivity 46447 plier type tool
		TE Connectivity 69005 with a 45133 crimp head, pneumatic type tool

Note 1. Only use TE Connectivity 58422-1 pneumatic tools on size 4 - 2/0 non-insulated lugs.
Note 2. Where ∗ represents the remainder of the lug part number (e.g., part number 322797).
Note 3. If the engineering drawing or wiring list does not specify a particular class for a MS20659 terminal lug, install either a Class 1 or a Class 2 lug. Install Class 1 lugs using the tooling specified in this table; crimp Class 2 lugs using the lug manufacturer's instructions and crimp tool/dies.

TABLE V - CRIMP DIES FOR CRIMPING TE CONNECTIVITY AMPLI-BOND & TERMINYL LUGS

Ampli-Bond Lug Part Number	MS25036 Part Number	Die for use with 59974-1 Crimp Tool	Die for use with 1490749-1 Crimp Tool
322003	-117	48752-1	1490534-1
322004	-118		
322006	-121	48753-1	1490535-1
322007	-122		
322010	-124	48754-1	1490536-1
322011	-125		
322016	-128	48755-1	1490410-1
322049	-116	48752-1	1490534-1
322051	-120	48753-1	1490535-1
322053	-123	48754-1	1490536-1
322055	-127	48755-1	1490410-1
322125	-126		
322128	-115	48752-1	1490534-1
322153	-119	48753-1	1490535-1

Terminyl Lug Part Number	MS25036 Part Number	Die for use with 59974-1 Crimp Tool	Die for use with 1490749-1 Crimp Tool
324043	-115	47820	1490597-1
324044	-117		
324045	-118		
324046	-119	47821	1490598-1
324047	-120		
324048	-121		
324049	-122		
324050	-123	47822	1490599-1
324051	-124		
324052	-125		
324053	-126	47823	1490406-1
324054	-127		
324055	-128		
324082	-116	47820	1490597-1

TABLE VI - DIES USE IN BURNDY Y39BH HYDRAULIC CRIMPING TOOL

Wire Gauge (AWG)	Burndy Part Number	An Part Number
8	U8 CET	AN 8
6	U6 CET	AN 6
4	U4 CE	AN 4

Wire Gauge (AWG)	Burndy Part Number	AN Part Number
2	U2 CE	AN 2
1/0	U25 ET	AN 1/0
2/0	U26 ET	AN 2/0

Table VII - Dies Use in Thomas & Betts 13642M Hydraulic Crimping Tool

Wire Barrel (AWG)	M7928/1, M7928/4, & MS25036 Lugs		MS20659 Lugs	
	T&B Part Number	MS Part Number	T&B Part Number	MS Part Number
8	21707M	MS23002-8	11781M	MS90485-8
6	21708M	MS23002-6	11782M	MS90485-6
4	21709M	MS23002-4	11783M	MS90485-4
2	21710M	MS23002-2	11784M	MS90485-2
1	21711M	MS23002-1	11785M	MS90485-1
1/0	21712	MS23002-01	11786M	MS90485-01
2/0	21713M	MS23002-02	11787M	MS90485-02
3/0	21714M	MS23002-03	11788M	MS90485-03
4/0	21715M	MS23002-04	11789M	MS90485-04

5.3.2 Use of Hollingsworth H270 Automatic Crimper (see Figure 3)

5.3.2.1 Insert the tape of terminal lugs into the crimping machine as follows:

Step 1. Disconnect the air supply to the crimping machine and switch off the electrical supply.

Step 2. Remove the clear plastic safety shield from the machine.

Step 3. To facilitate tape insertion, cut the front of the tape at an angle of approximately 45°. Lift the “Hold Down Lever” and insert the tape, ensuring that the tape location holes fit onto the drive wheel sprocket. Lower the hold down lever onto the tape.

Step 4. Ensure that the “Double Index Switch” is in the off position. This allows the machine to be indexed manually.

Step 5. Connect the air supply and switch on the electrical power supply.

Step 6. Feed the tape around the tape wheel by depressing the “Manual Index Button”. The tape should index one position each time the index button is depressed. Index the tape until a terminal is located between the crimping dies.

Step 7. Disconnect the air supply to the crimping machine and switch off the electrical supply.

Step 8. Replace the clear plastic safety shield.

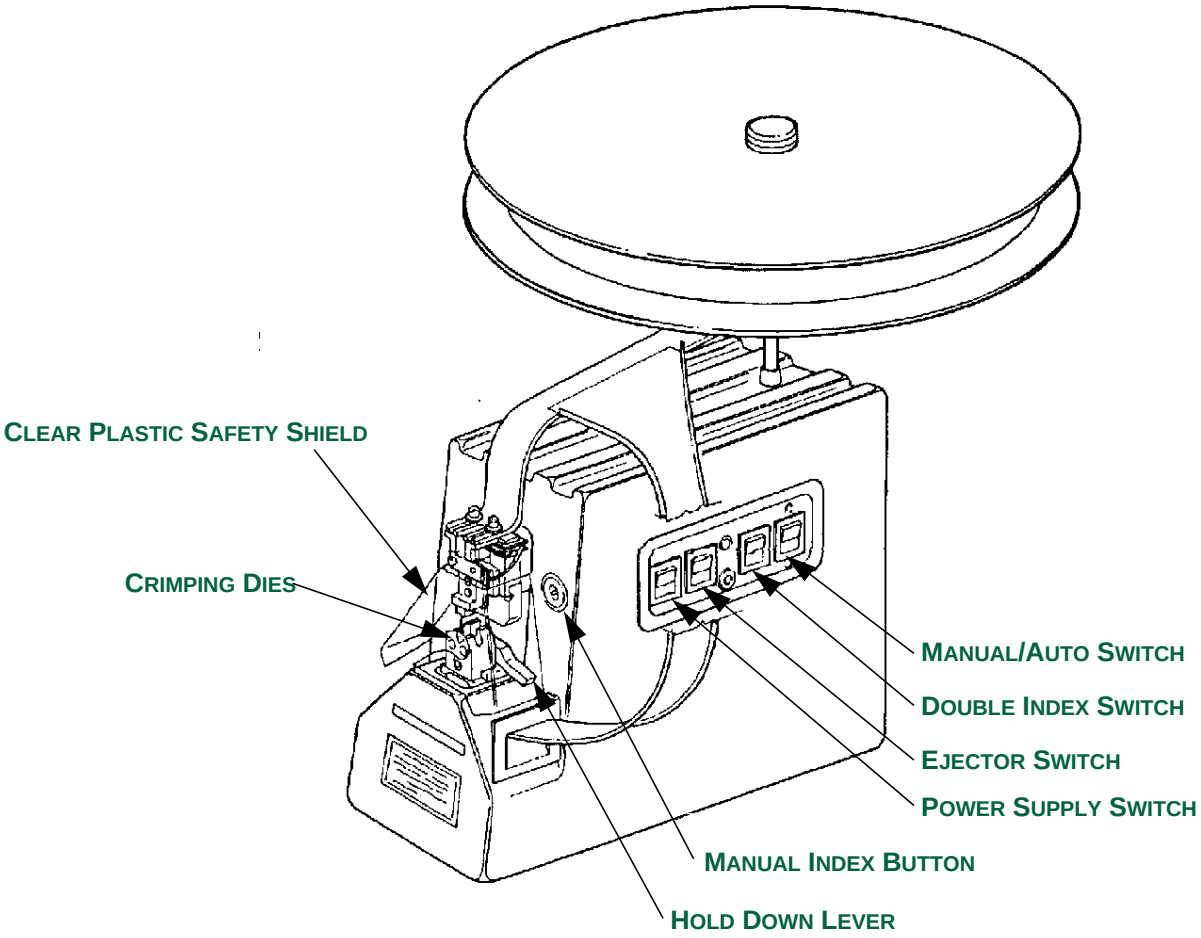


FIGURE 3 - HOLLINGSWORTH H270 CRIMPING MACHINE

5.3.2.2 Crimp the terminal lugs in place as follows:

Step 1. Set the “Ejector Switch” to the required mode. When the switch is in the on position, the ejector will remove the crimped terminal after the machine has cycled through the crimping operation.

Step 2. Switch to single or double index as required.

Step 3. Switch the “Manual/Auto Switch” to the automatic mode.

Step 4. Fully insert the wire into the barrel of the lug and press the foot switch causing the machine to run through a complete crimping cycle.

5.3.3 Setting Insulation Grip Adjustment Pins on TE Connectivity Crimping Tools

5.3.3.1 If crimping insulated lugs, form a test crimp to check the insulation grip adjustment of TE Connectivity plier, pneumatic and hydraulic crimping tools (if applicable) as follows:

Step 1. If crimping M7928/1 terminal lugs to high temperature wire, shrink a 1/2" length of clear heat shrinkable sleeving (see paragraph 4.1.2) onto the wire insulation at the termination end according to PPS 10.16. This increases the outside diameter of the wire so as to obtain an acceptable insulation grip.

Step 2. Insert an un-stripped piece of wire just into the insulation support of the terminal lug.

Step 3. Set the insulation grip adjustment pins in the loosest setting.

Step 4. Crimp the lug in place.

Step 5. Bend the wire back and forth once and check that the terminal lug retains its grip on the insulation. If the wire pulls out of the test crimp, set the adjustment pins in the next tighter position and perform a new test crimp until the required insulation grip is determined. Do not use a tighter insulation grip setting than required.

5.3.3.2 Before starting to crimp insulated terminal lugs with TE Connectivity crimping tools, ensure that both insulating grip adjustment pins are located in the same numeric position.

5.3.4 Use of TE Connectivity and T&B Plier Type Crimping Tools

5.3.4.1 TE Connectivity hand crimping tools are equipped with a Certi-Crimp ratchet. Once engaged, the ratchet will not release until the tool handles have been fully closed. The crimping areas bottom before the ratchet releases. This assures maximum tensile performance of the crimp and is NOT cause to adjust the ratchet.

5.3.4.2 Crimp the terminal lug in place as follows:

Step 1. Open the jaws of the tool by squeezing the handles fully together until the ratchet mechanism releases.

Step 2. For TETRA-CRIMP type tools, push the locator assembly away from the upper crimping die and hold until after placing the terminal lug into the die as follows.

Step 3. Place the terminal lug into the die corresponding to the wire size. If using a TE Connectivity 59170, 59250 or 59300 “T” Head crimping tool, place the terminal so that the tongue slides under the locator. Otherwise, place the terminal so that the terminal barrel is approximately centred on the barrel crimp die and the terminal tongue is parallel to the die faces (see Figure 4-A). If crimping flag type terminal lugs, ensure that the flag portion of the lug rests on the cutaway of the die face (see Figure 4-B). If using a TE Connectivity 49935 crimping tool, position the terminal with the seam (if visible) toward the indentor and the flat side of terminal tongue facing the anvil (see Figure 5).

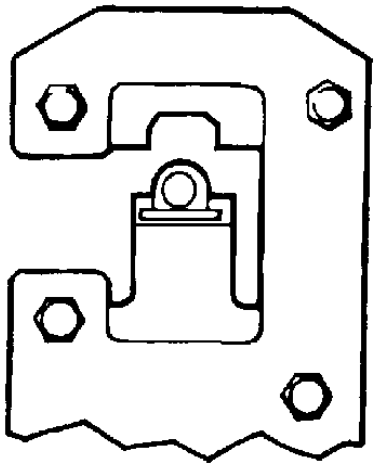


Figure 4-A - STANDARD TERMINAL LUG
Tongue parallel to die faces

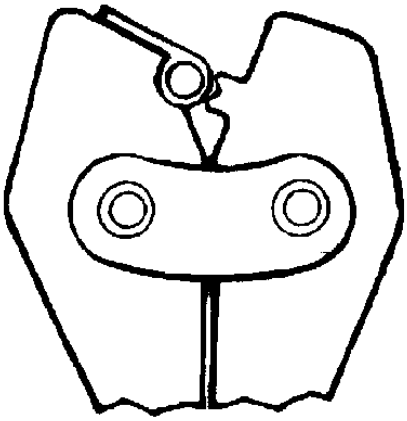


Figure 4-B - FLAG TERMINAL LUG
Tongue positioned on cutaway die face

FIGURE 4 - PLACEMENT OF TERMINAL LUGS IN PLIER TYPE CRIMPING TOOLS

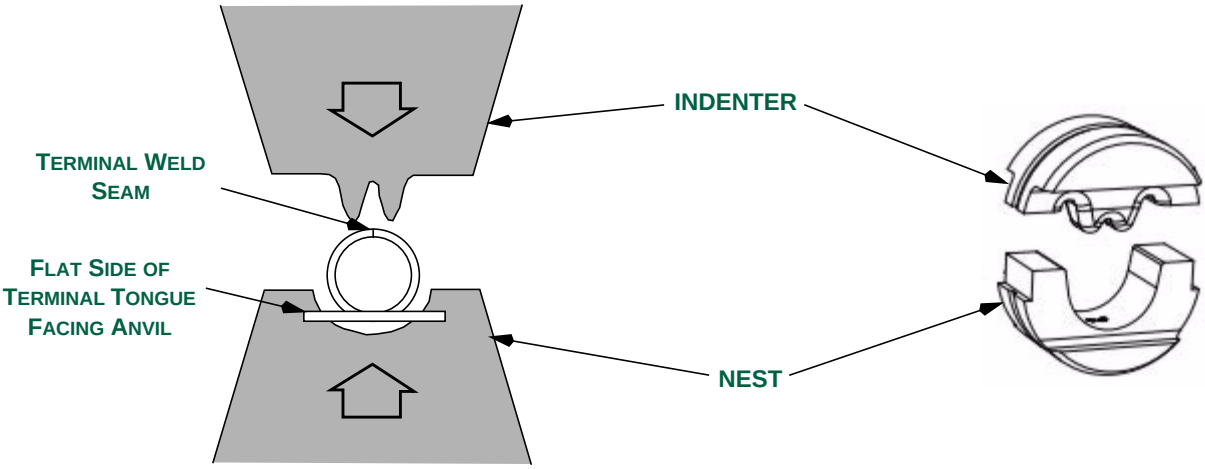


FIGURE 5 - POSITIONING TERMINAL LUGS IN TE CONNECTIVITY 49935, 69005 AND 1490749-1 CRIMPING TOOLS

Step 4. Insert the stripped wire fully into the terminal barrel so that it bottoms in the wire barrel.

Step 5. Hold the wire firmly in place and crimp the terminal lug by squeezing the tool handles together until the ratchet releases. Allow tool handles to open fully.

5.3.5 Use of TE Connectivity Pneumatic Crimping Tools

5.3.5.1 Crimp the terminal lug in place as follows:

Step 1. Insert the stripped wire fully into the terminal and place the assembly into the jaws of the crimping head.

- If using a TE Connectivity 314268-1, 314269-1 or 314270-1 crimping head or a 679300-1 die, position the lug so that the tongue is under the locator and the wire barrel is against the locator.
- If using a TE Connectivity 679305-1 die, position the lug so that the wire barrel butts up against the stop and the flat side of the terminal faces away from the stop.
- If the crimping tool does not have a locator, position the terminal barrel so that it is centred on the barrel crimp die and the terminal tongue is parallel to the die faces.
- If using a TE Connectivity 69005 crimping tool, position the terminal with the seam (if visible) toward the indentor and the flat side of terminal tongue facing the anvil (see Figure 5).

Step 2. Place the terminal lug/wire assembly into the die corresponding to the wire size.

Step 3. Press the trigger to operate the tool and hold until the crimping stroke is complete.

Step 4. Release the trigger and remove the crimped assembly from the jaws.

5.3.5.2 Remove crimp heads from the TE Connectivity **69005** pneumatic crimping tool as follows:

Step 1. Disconnect the tool from the air supply.

Step 2. Remove the assembly pins from the mounting lugs and lower the head lock until the lock screw in the toggle arm is visible.

Step 3. Loosen the lock screw and pull the crimp head out of the toggle arm.

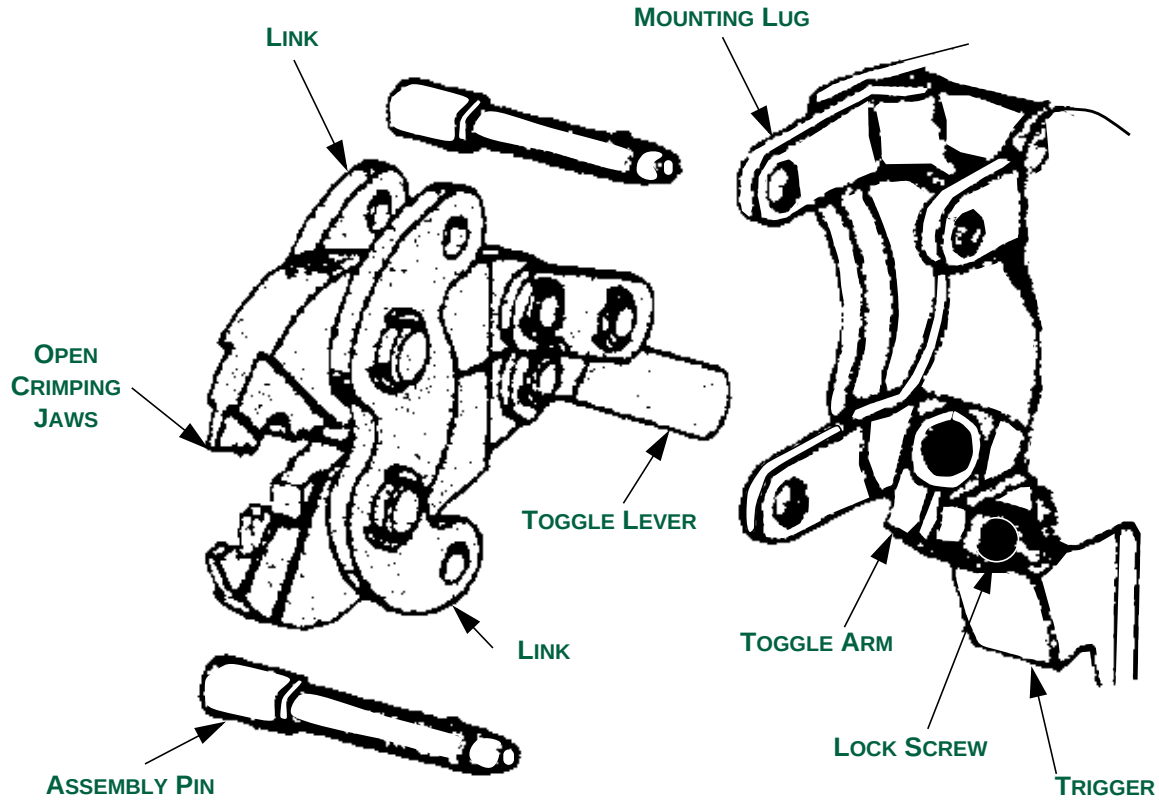


FIGURE 6 - TE CONNECTIVITY 69005 PNEUMATIC CRIMPING TOOL

5.3.5.3 Install crimp heads in the TE Connectivity **69005** pneumatic crimping tool as follows:

Step 1. Disconnect the tool from the air supply.

Step 2. Remove the assembly pins from the mounting lugs.

Step 3. Pull the toggle arm forward and release the lock screw in the toggle arm. Do not remove the lock screw.

Step 4. Open the jaws and insert the toggle lever of the crimping head all the way into the hole in the toggle arm.

Step 5. Tighten the lock screw just enough to hold the toggle lever in the toggle arm.

Step 6. Move the crimp head so that the links align between the mounting lugs of the tool.

Step 7. After the head is aligned, lower it to provide access to the lock screw on the toggle arm. Tighten the lock screw.

Step 8. Move the head back between the mounting lugs and insert the assembly pins. To avoid damage to the tool, ensure that the pins are fully inserted.

Step 9. Re-connect the air supply.

5.3.6 Use of TE Connectivity Hydraulic Crimping Tools

5.3.6.1 Crimp using the TE Connectivity **59974-1** hydraulic crimping tool (see Figure 7) as follows:

Step 1. Remove the latch pin on the tool head and open the yoke.

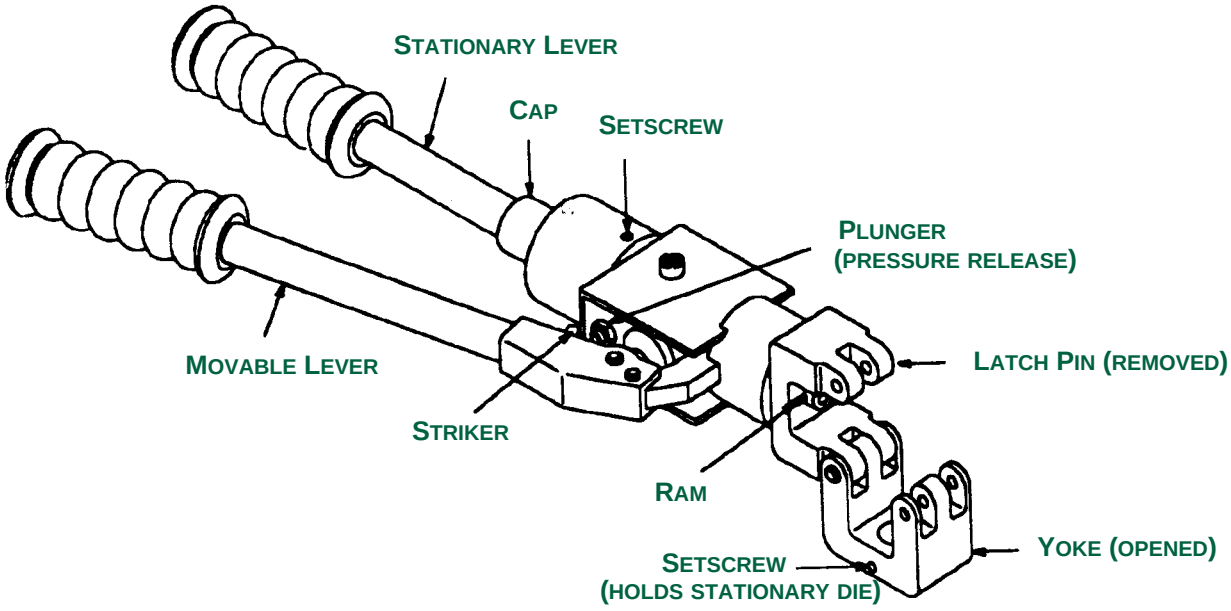


FIGURE 7 - TE CONNECTIVITY 59974-1 HYDRAULIC CRIMPING TOOL

Step 2. Change the dies if necessary. To change the stationary die, loosen the setscrew in the yoke, remove the stationary die to be changed, insert the new stationary die into the yoke and then re-tighten the setscrew. Note that the stationary die of the die set has a large shank and the moving die has a small shank. To replace the moving die activate the tool to advance the ram until the setscrew is visible, loosen the setscrew in the ram, remove the moving die to be changed, insert the moving die into the ram well and tighten the setscrew. For 48752-1 through 48755-1 dies only (not applicable to 47820 through 47823 dies), it may be necessary to loosen the socket head cap screws on the moving die; if these screws are not loosened the dies may not fit into the head of the tool because of close tolerance. After changing the dies, activate the tool to allow the ram to return to the “down” position and adjust the insulation grip pins according to section 5.3.3.

Step 3. Insert the stripped wire into the lug. The end of the wire must be flush with or extend slightly (0.063" maximum) beyond the end of the wire barrel.

Step 4. With the yoke open, position the lug in the die with the spring loaded locator (depending on the die type, may be the stationary die or the moving die) so that the bottom of the lug tongue faces the stationary die and the wire barrel rests against the spring loaded locator.

Step 5. Close the yoke and insert the latch pin.

Step 6. Hold the lug in place and pump the tool to complete the crimp. Continue pumping the movable lever of the tool until the dies have bottomed.

Step 7. Retract the movable die by turning the movable handle to actuate the striker and compress the lever to de-compress the plunger.

Step 8. Remove the latch pin, open the yoke and remove the crimped terminal lug/wire assembly.

5.3.6.2 Crimp using the TE Connectivity **59975-1** hydraulic crimping tool as follows:

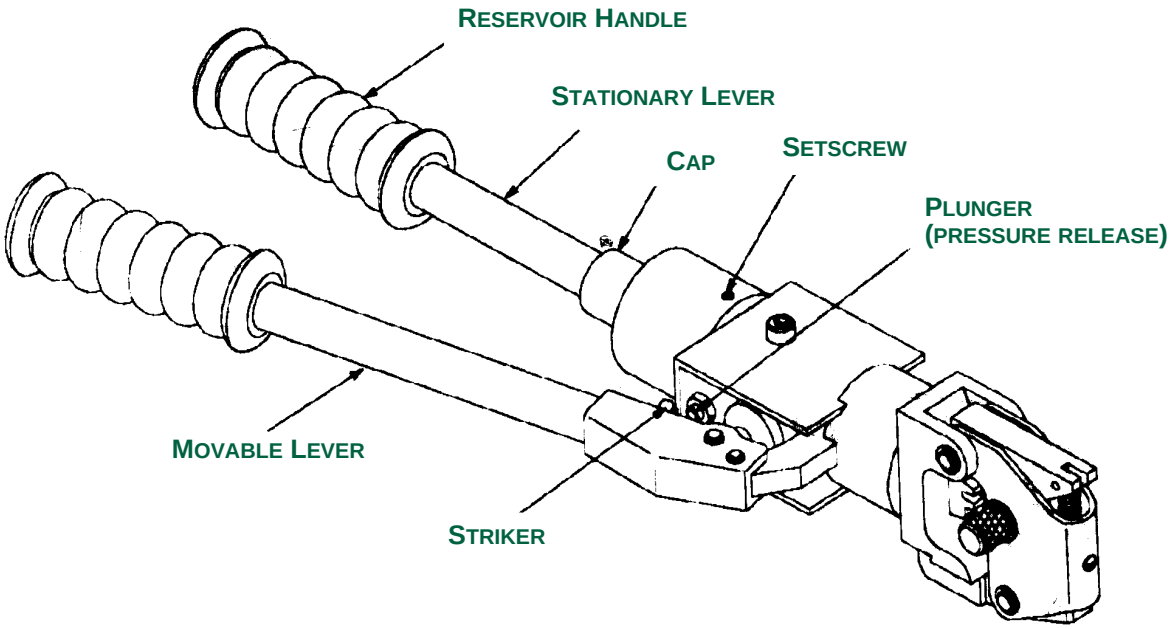
Step 1. Press the head latch and open the crimping head (see Figure 8-A).

Step 2. Pull back the die latch and turn the thumb knob until the desired die size locks in place.

Step 3. Close the crimping head such that the die latch “snaps” into the locked position.

Step 4. Insert the terminal lug into the upper die as shown in Figure 8-B.

Step 5. Pump the movable lever until the moving (lower) die contacts the terminal lug, gripping it without deforming it.



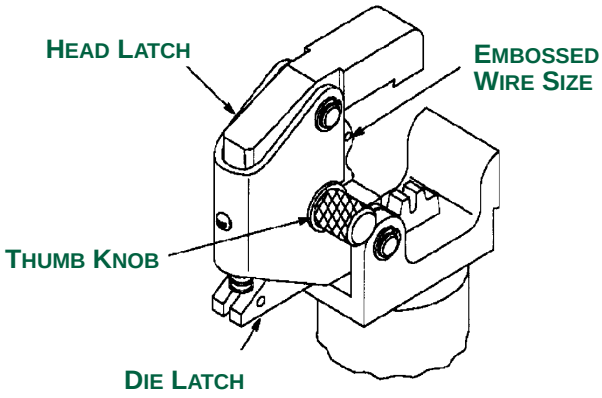


FIGURE 8-A - SETTING DIES

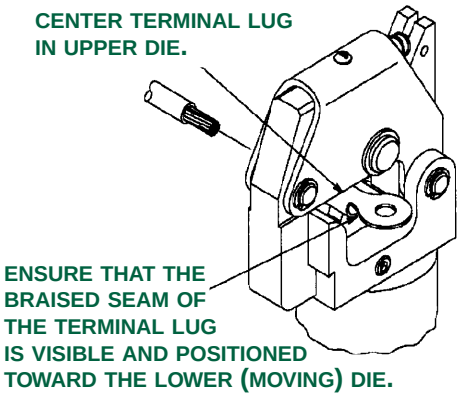


FIGURE 8-B - TERMINAL LUG PLACEMENT

FIGURE 8 - USE OF TE CONNECTIVITY 59975-1 HYDRAULIC CRIMPING TOOL

Step 6. Insert the stripped wire into the wire barrel of the terminal lug.

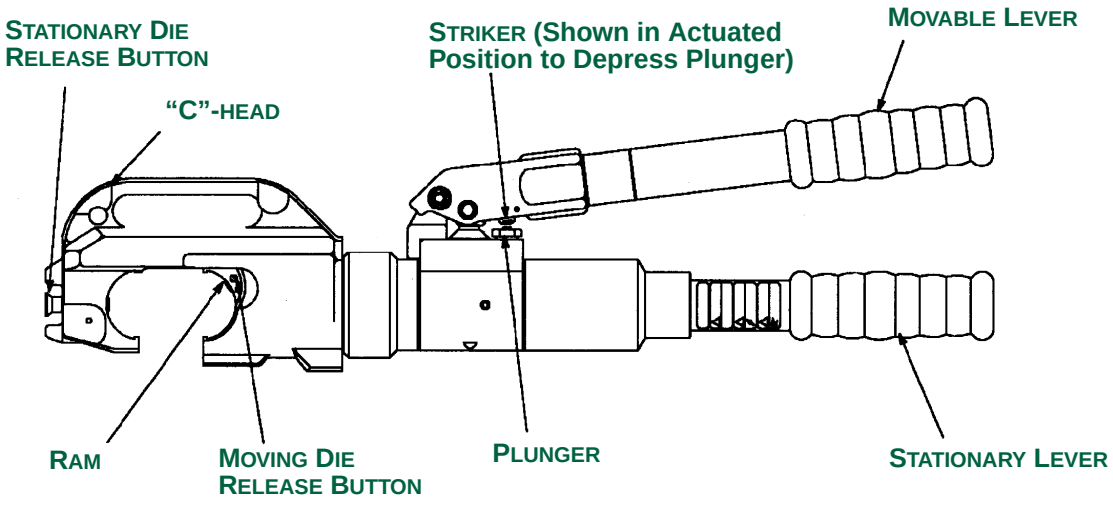
Step 7. Continue pumping the movable lever until the dies have bottomed and an audible “pop” is heard indicating that the crimp is complete.

Step 8. Retract the movable die by turning the movable handle to actuate the striker and compress the lever to de-compress the plunger.

Step 9. Remove the crimped terminal lug/wire assembly.

5.3.6.3 Crimp using the TE Connectivity **1490749-1** hydraulic crimping tool (see Figure 9) as specified below. The hand tool has a stationary lever and a movable lever. These levers are compressed to pump hydraulic fluid behind the ram, moving it forward and thereby closing the dies. After the crimping is complete, the movable lever is turned to depress the plunger. The moving die retracts to its original position, completing the crimping cycle. The TE Connectivity **1490749-1** hydraulic crimping tool may require two operators to terminate heavy gauge wires, one to support the wire and lug and the other to position and pump the crimper.

Step 1. If necessary change the dies. Replace the stationary die by depressing the upper release button located in the C-head, sliding the stationary die out of the head and replacing it with the stationary die of the replacement die set; after insertion, rock the stationary die back and forth until it snaps into place. Replace the moving die by actuating the tool until the lower die release button in the ram is exposed, depressing the release button, sliding the moving die out of the ram and replacing it with the moving die of the replacement die set. For 1490410-1 and 1490534-1 through 1490536-1 dies only, it may be necessary to loosen the socket head cap screws on the moving die; if these screws are not loosened the dies may not fit into the head of the tool because of close tolerance. After changing the dies, activate the tool to allow the ram to return to the “down” position and adjust the insulation grip pins according to section 5.3.3.



Note: To avoid damage to the crimp tool, never operate the tool with the dies removed. Failure to insert the dies before operation can result in damage to the “C”-Head or the tool ram.

FIGURE 9 - TE CONNECTIVITY 1490749-1 HYDRAULIC CRIMPING TOOL

Step 2. Insert the stripped wire into the lug. The end of the wire must be flush with or extend slightly (0.063" maximum) beyond the end of the wire barrel.

Step 3. Position the lug in the die with the spring loaded locator (depending on the type of die, may be the stationary die or the moving die) so that the bottom of the lug tongue faces the stationary die and the wire barrel rests against the spring loaded locator. Position the terminal lug with the seam (if visible) toward the indentor, see Figure 5. Hold the lug in place and pump the “Movable Lever” until moving die grips terminal. To avoid personal injury, be sure to exercise caution while holding terminals in the crimping area.

Step 4. Continue pumping “Movable Lever”. A slight click may be heard, indicating the pump has shifted into the high-pressure stage. Continue pumping “Movable Lever” to complete the crimp. This tool has a built-in by-pass cartridge that will automatically activate when full pressure is reached. There will be a noticeable decrease in handle pressure when the by-pass is reached. Note that a high pitched squeaking sound is normal when the tool is operating in the high pressure stage.

Step 5. Turn movable lever (to actuate striker), and compress levers to depress plunger. Movable die will now retract. See Figure 9.

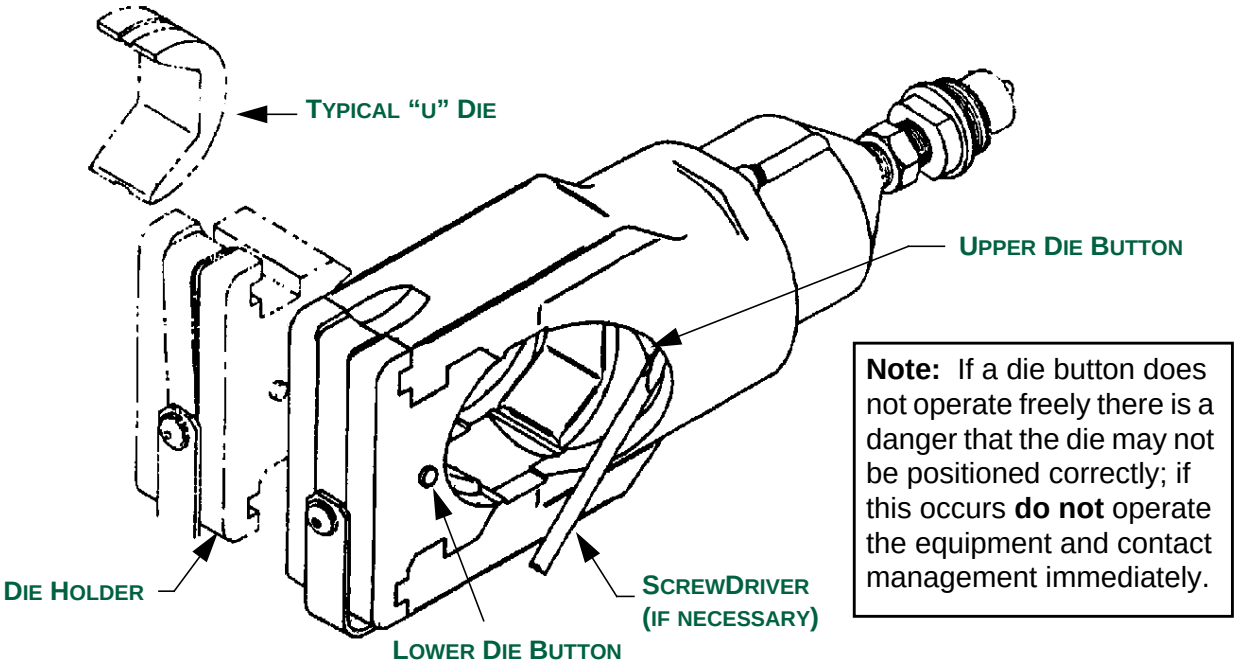
Step 6. Remove the crimped terminal lug/wire assembly. If crimped terminal sticks in die after crimping, apply a rocking action to remove it from the die.

5.3.7 Use of Burndy Hydraulic Crimping Tools (see Figure 10)

5.3.7.1 The “U” dies used by the Burndy Y39BH Hydraulic Hypress are identical halves. Each half can be installed in either the head or the ram. Replace dies as follows:

Step 1. Turn **off** the hydraulic power unit.

Step 2. Remove the ram (lower) die by pushing the “Lower Die Button” and sliding the die out.



Note: If a die button does not operate freely there is a danger that the die may not be positioned correctly; if this occurs **do not** operate the equipment and contact management immediately.

FIGURE 10 - BURNDY Y39BH HYDRAULIC HYPRESS CRIMPING TOOL

Step 3. Turn on the hydraulic power unit.

Step 4. "Run" the machine in order to cause the upper die to descend to its lowest position (this makes the upper die button more accessible).

Step 5. Turn **off** the hydraulic power unit.

Step 6. Remove the upper die by pushing the "Upper Die Button" and sliding the die out. If the die button is still difficult to access, use a screwdriver or similar tool to depress the button.

Step 7. Slide the new upper die into position until it stops. Insert the die from the side opposite the die button.

Step 8. Depress the "Upper Die Button" and slide the die in further.

Step 9. Release the button and continue sliding the die until the retainer clicks into place.

Step 10. Turn on the hydraulic power unit.

Step 11. Bring the upper die up to its highest position by pressing the "dump" button.

Step 12. Turn **off** the hydraulic power unit.

Step 13. Slide the new lower ram die into position until it stops. Insert the die from the side opposite the die button.

Step 14. Depress the lower die button and slide the die in further.

Step 15. Release the button and continue sliding the die until the retainer clicks into place.

5.3.7.2 Crimp the terminal lug in place as follows:

Step 1. Place the terminal lug so that it is centred in the die set with the eyelet pointing toward the positioning mechanism. Adjust the positioning mechanism so that it butts up against the lug. Remove the terminal lug.

Step 2. Insert the stripped wire fully into the terminal and place the assembly into the crimp head with the wire barrel centred in the die set and the terminal lug tongue parallel to the die faces.

Step 3. Press the “reset” button.

Step 4. Being careful not to have your fingers in the way of the dies, use one hand to hold the assembly in place against the positioning mechanism and press the “run” button with the other hand.

Step 5. When the crimping operation is complete, remove the crimped assembly.

5.3.7.3 Press the dump button at any time during the crimping operation to immediately abort the operation.

5.3.8 Use of Burndy Mechanical Press Type Tools

5.3.8.1 Crimp the terminal lug in place as follows:

Step 1. Using the adjustment knob on top of the tool, align the index mark on the die nest with the wire size graduation shown on the data plate. If using the MY29 tool, use the Data Plate designed for MINE COPPER CABLE (do not use the Data Plate for COMMERCIAL COPPER CABLE).

Step 2. Open the tool handles to retract the die indentor.

Step 3. Insert the stripped wire fully into the terminal barrel and place the assembly into the die nest so that the indentor is centred on the wire barrel and the terminal lug tongue is perpendicular to the tool. For standard type terminal lugs, the position the indentor on either the top or the bottom of the lug as necessary to properly locate the lug in the die nest during the crimping operation (see Figure 11). For flag type terminal lugs, position the lug so that the tongue rests flat against the upper die nest as shown in Figure 11.

Step 4. Close the tool handles fully together until they bottom against the fixed stop in the tool head.

Step 5. Open tool handles fully and remove crimped assembly.

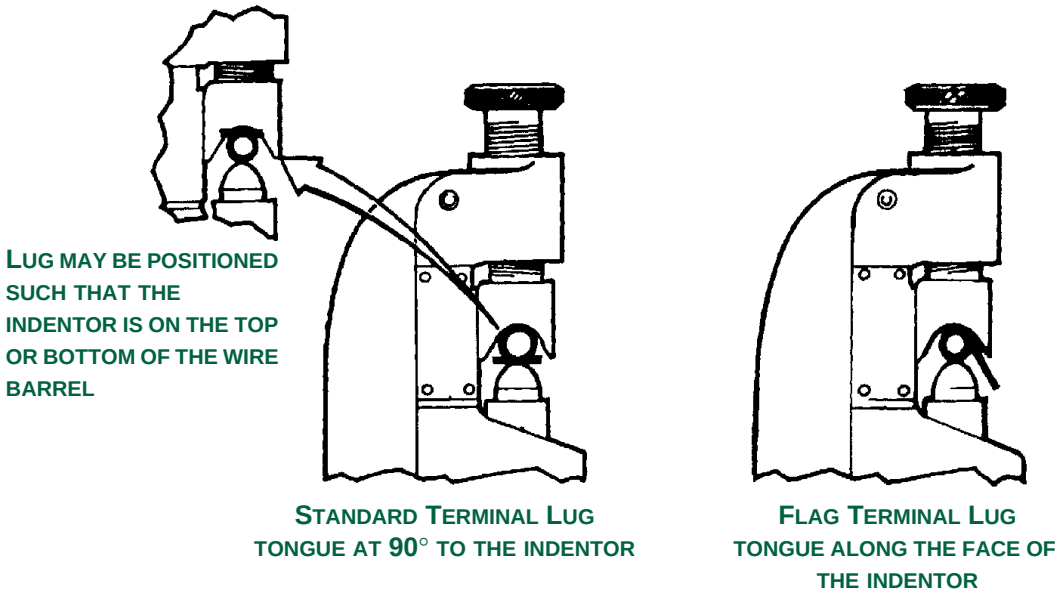


FIGURE 11 - PLACEMENT OF TERMINAL LUGS IN BURNDY PRESS TYPE TOOLS

5.3.9 Use of Thomas & Betts #13642M Hydraulic Installing Tool (see Figure 12)

5.3.9.1 Remove dies from the tool as follows:

Step 1. Turn **off** the hydraulic power unit.

Step 2. Pull the locking pin from the tool guard and swing open the top half of the guard.

Step 3. Hold the yoke and rotate the yoke cap until the cap is perpendicular to the upper die.

Step 4. Slide the upper die and yoke cap from the yoke and snap the die off of the cap.

Step 5. Slide the lower die half from the yoke.

Step 6. If a new die is not going to be installed right away, replace the yoke cap on the yoke, close the tool guard, and insert the locking pin.

5.3.9.2 Install dies in the tool as follows:

Step 1. Ensure the hydraulic power unit is turned **off**.

Step 2. Pull the locking pin from the tool guard and swing open the top half of the guard.

Step 3. Hold the yoke and rotate the yoke cap until the cap releases from the yoke.

Step 4. Place lower, movable die half (die half without die plate) in the grooves of the yoke.

Step 5. Press the lower die half home against the ram. Ensure that the button snap on the bottom of the die is firmly engaged with the mating snap on the yoke.

Step 6. Snap the upper die half onto the yoke cap and rotate it so that it is perpendicular to the cap.

Step 7. Slide the die into the groove of the yoke.

Step 8. Rotate the cap until the friction catches engage the notches in the yoke.

Step 9. Swing the top half of the tool guard closed, align the locking pin holes, and insert the locking pin.

5.3.9.3 Use the Thomas & Betts #13642M Installing Tool to crimp terminal lugs as follows:

Step 1. Insert the stripped cable into the terminal lug so that the wires butt up against the end of the terminal lug barrel.

Step 2. Place the terminal lug, with the wire inserted, in the lower die so that the lip of the terminal lug butts up against the terminal locator (see Figure 12).

Step 3. Hold the protruding end of the terminal lug in one hand and the cable in the other and depress the foot pedal until the crimp is complete. Be careful not to get hands between the crimping dies.

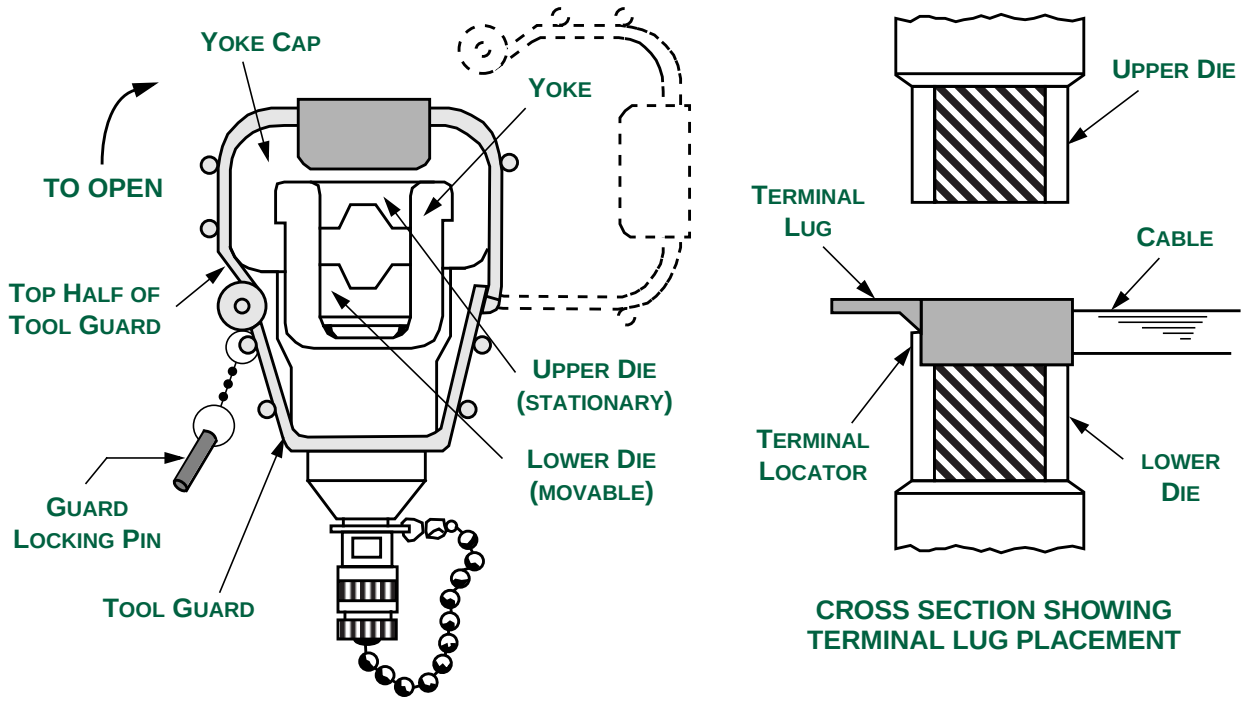


FIGURE 12 - THOMAS & BETTS #13642M INSTALLING TOOL

5.3.10 Use of Western Industrial Products (WIP) W400-1020 Pneumatic Crimp Tool

5.3.10.1 Crimp size 22 - 18 terminal lugs using the WIP W400-1020 crimping tool as follows:

Step 1. Ensure the air supply to the tool is disconnected.

Step 2. Adjust the insulation support setting for the wire insulation diameter.

Step 3. Connect the tool to the air supply (90 psi minimum).

Step 4. Insert the terminal lug into the appropriate crimp die so that the terminal tongue slides under the locator.

Step 5. Push the upper head of the tool against the tool while the terminal lug is pushed up against the locator.

Step 6. Insert the stripped wire into the terminal.

Step 7. While holding the wire in position, activate the tool trigger.

Step 8. Release the trigger (the tool head should return to the open position automatically; however, if the terminal has a thicker insulation, it may stick in the dies).

5.3.11 Use of Schleuniger CT32 Pneumatic Crimp Tool

5.3.11.1 Install upper and lower die holders as follows (see Figure 13):

Step 1. Press and hold down the pneumatic foot pedal. This will stop the machine in a full stroke position.

Step 2. Disconnect the compressed air supply.

Step 3. Unscrew the screws holding the lower and upper plates and slide the plates to the side.

Step 4. Mount the upper die holder on to the upper T-Bolt.

Step 5. Mount the lower die-holder on to the lower T-Bolt.

Step 6. Slide the lower and upper plates back into position

Step 7. Screw in the screws holding the lower and upper plates.

Step 8. Tighten the upper and lower T-Bolts by turning the nut with a hex driver.

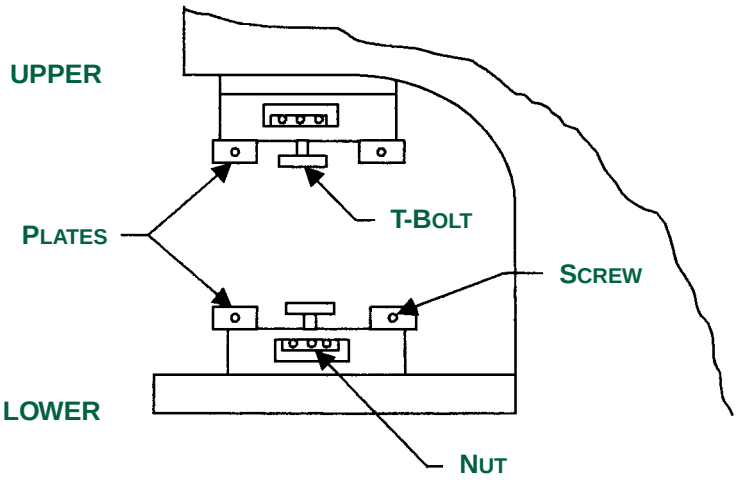


FIGURE 13 - SCHLEUNIGER CT32: INSTALLATION OF DIE HOLDERS

5.3.11.2 Except when changing from one Schleuniger die to another Schleuniger die, adjust the crimp height whenever a die or die holder is changed as follows:

Step 1. Disconnect the machine from the compressed air supply.

Step 2. Loosen the two front set screws.

Step 3. Pull the machine approximately 2” over the edge of the workbench.

Step 4. Turn the adjustment screw counter clockwise and manually position (push down) the lower jaw until it is at the lower most position.

Step 5. Install the appropriate die set (upper and lower dies).

Step 6. Reconnect the compressed air supply.

Step 7. Fully close the speed control valve.

Step 8. Press and hold the foot pedal.

Step 9. Slowly open the speed control valve until the full crimping position has been reached. Press the release button **immediately** if the two die halves do not line up.

Step 10. Turn the adjustment screw clockwise until the die halve “bottom out” against each other.

Step 11. Release the foot pedal to complete the cycle.

Step 12. Turn the adjustment screw an additional 1/4 turn clockwise (90°) **and no more**.

Step 13. Re-tighten the two front set screws.

Step 14. Push the machine back into its operating position.

5.3.11.3 If the dies become blocked during the crimp cycle and the machine does not complete the crimp the dies will remain closed until the release button is pressed.

5.3.11.4 Operate the Schleuniger CT32 crimping machine as follows:

Step 1. If necessary, install the appropriate die holders and dies as specified in paragraph 5.3.11.1.

Step 2. If necessary, adjust the crimp height as specified in paragraph 5.3.11.2.

Step 3. Using the locating device, position the terminal lug to be crimped in the die.

Step 4. Insert the stripped wire into the wire barrel of the terminal lug.

Step 5. Press the foot pedal to actuate the crimp machine. If the dies become blocked during the crimp cycle and the machine does not complete the crimp, press the release button to release the dies; the crimps formed in such a case are not acceptable.

Step 6. When the crimp cycle is complete, remove the crimped terminal/wire assembly from the crimping machine.

5.4 Over-Sleeving Large Size Terminal Lugs

5.4.1 Visually examine the crimp as specified in section 6 before over-sleeving.

5.4.2 Cover all pre-insulated lugs (wire barrel size 0 or larger) and all non-insulated terminal lugs (wire barrel size 8 or larger) by pulling a 2 1/2" length of white heat shrinkable sleeving (see Materials section, paragraph 4.1.2) over the shank of the terminal lug, allowing the sleeving to overlap onto the wire insulation. Shrink the sleeving in place according to PPS 10.16 (see Figure 14). Ensure not to cover the terminal lug tongue (flat section).

5.4.2.1 For TE Connectivity 1-331420-0 Solistrand non-insulated lugs, use RT-555 as the heat shrinkable tubing (see paragraph 4.1.3).

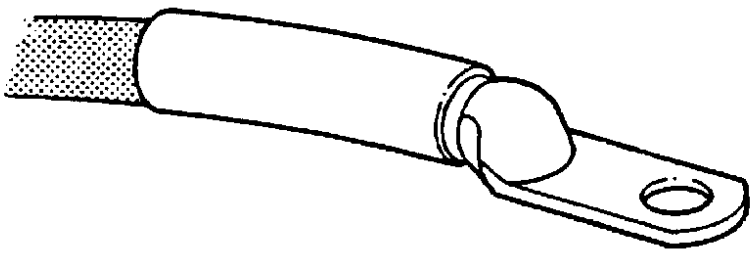


FIGURE 14 - OVER-SLEEVING OF LARGE SIZE TERMINAL LUGS

6 REQUIREMENTS

6.1 Ideally, the crimp indentation should be approximately centred on the terminal barrel as shown in Figure 15; however, the crimp is considered acceptable provided the crimp indentation is entirely contained on the wire barrel (i.e., the crimp indentation must not extend to, or beyond, either end of the terminal wire barrel). If the terminal lug has been crimped using the Burndy MY28 or MY29 press type crimping tool, the crimp must also be on the top or the bottom of the terminal lug.

6.2 Ensure that the wire protrusion through the terminal barrel meets the requirements of Figure 16.

6.3 Ensure that the terminal barrel and insulation sleeve (if applicable) is free of cracks.

6.4 For size 10 and smaller terminal lugs, if the terminal lug is equipped with an insulation grip, ensure that the wire insulation is securely held in the insulation support. For size 8 and larger terminal lugs, no insulation grip is required.

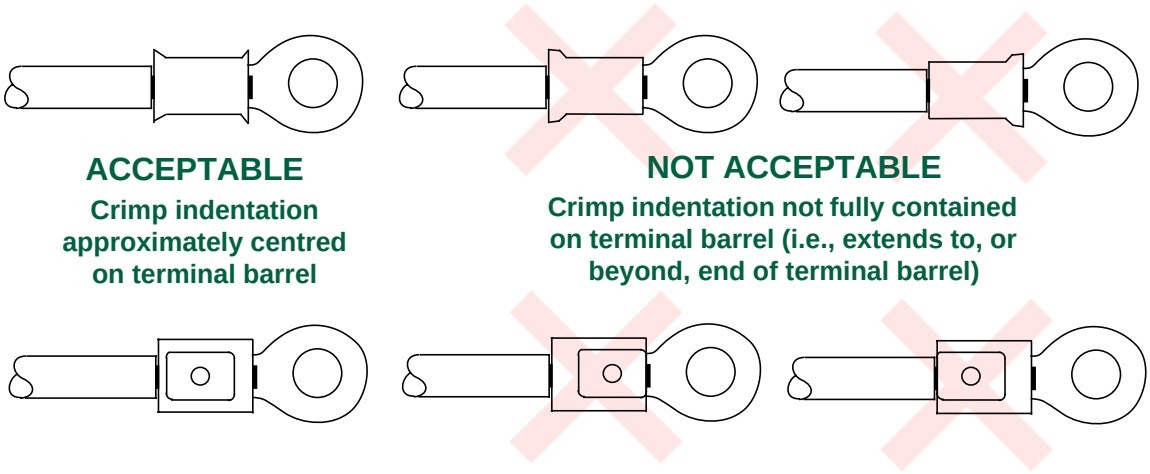


FIGURE 15 - CRIMP INDENTATION ON WIRE BARREL

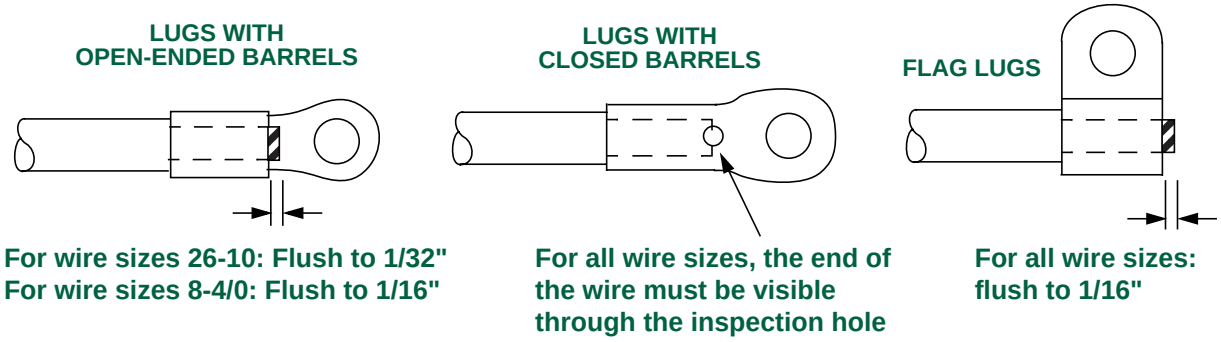


FIGURE 16 - WIRE EXTENSION INTO TERMINAL BARREL

7 DE HAVILLAND CANADA SAFETY PRECAUTIONS

7.1 The safety precautions specified herein are specific to De Havilland Canada to meet Canadian Federal and Provincial government environmental, health and safety regulations. It is strongly recommended that other facilities consider these safety precautions; however, suppliers, subcontractors and partners are responsible for ensuring that their own environmental, health and safety precautions satisfy the appropriate local government regulations.

7.2 Observe standard plant safety precautions when performing the procedure specified herein.

7.3 Crimping equipment must only be operated by employees that are trained (ref. section 8) and authorized.

7.4 For all crimping tools, if a malfunction occurs do not operate the equipment and contact management immediately.

7.5 For all crimp tools, if the die set or crimp head cannot be securely locked in place do not operate the equipment and contact management immediately.

7.6 For hydraulic crimp tools, ensure that the hydraulic power unit is off at all times when tools are not in use and also when inserting or removing die sets or crimp head.

7.7 For pneumatic crimp tools, ensure that the air supply is disconnected at all times when tools are not in use and also when changing the crimp head.

7.8 Except as noted herein, do not operate crimp tools without the appropriate guards in place. Do not operate the Thomas & Betts Installation tool without the guard in the locked position, a die set in the tool and the cap in place.

8 PERSONNEL REQUIREMENTS

8.1 This PPS has been categorized as a Controlled Special Process according to PPS 13.39. Refer to PPS 13.39 for personnel requirements.

9 MAINTENANCE OF EQUIPMENT

9.1 Periodically, perform gauging checks on all crimping tools to ensure that the closed dimension between the die faces is within the manufacturer's specified limits. Submit crimp tools which fail to meet the dimensional gauging requirements for adjustment or repair by authorized personnel.