

# Terminating Power Cable Using Compression Connectors and Lugs

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# 1. General

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## 1.1

### Purpose

This practice describes:

- H-taps.
- C-taps.
- Lugs
- Straight-through compression connectors.

The application of compression connectors using the manually and electrically operated hydraulic compression tool method is also presented.

Compression connectors are intended to:

- Provide DC power and/or ground to a designated connection point.
- Ensure a good electrical connection.

Exhibits are provided to help match connectors with cables and connectors with tool and dies. Ordering information for compression connectors and covers is also provided in the exhibits. See Exhibit 1 for tool selection.

## 1.2

### Filing Instructions and Supersedures

Discard all previous issues and associated addenda of this practice and file this issue numerically in your GTE Telephone Operations practices set.

This practice supersedes and cancels:

- All policies, procedures, general instructions, letters, and memoranda which address this subject.
- Any document which provides information contrary to the information contained in this practice.

## 1.3

### Reason for Reissuing

This practice is reissued to provide:

- Current procedural and ordering information for the use of compression connectors and protective covers.
- Charts that contain specifications for flex cable (KS specification only) installations.

## 1.4

### Responsibility

This practice was written by the Network Provisioning Support Staff – GTE Telephone Operations, and published by the Telephone Operations Administrative Service Group. For more information about this practice, contact the Central Office Equipment (COE) Construction Support Department Headquarters, Irving, Texas, Manager – COE Construction Support.

## 1.5

### Disclaimer

This practice was prepared solely for the use of GTE Telephone Operations. It must be used only by its employees, customers, and end users when installing, operating, maintaining, and repairing GTE Telephone Operations' equipment, facilities, and services. Any other use of this practice is forbidden. The information contained in this practice may not be applicable in all circumstances and is subject to change without notice. By using this practice the user agrees that GTE Telephone Operations will have no liability (to the extent permitted by applicable law) for any consequential, incidental, special, or punitive damages that may result.

## 2. Overview

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### 2.1 Definitions

The following chart provides definitions for the acronyms used in this practice.

<b>Acronym</b>	<b>Definition</b>
BDFB	Battery Distribution Fusing Board
CO	Central Office
COE	Central Office Equipment
COEI	Central Office Equipment Installation
ERO	Equipment Repair Order
ERS	Equipment Repair Service
FGB	Floor Ground Bar
GTEAMS	GTE Advanced Materials System
IAP	Investment Area Plan
JIM	Job Information Memorandum
kcmil	Thousand Circular Mils (formerly MCM)
MCM	Thousand Circular Mils (known as kcmil)
MGB	Master Ground Bar
OSP	Outside Plant
PABX	Private Automatic Branch Exchange
PDUF	Power Distribution Unit Frame
PSB	Product Standardization Bulletin

### 2.2 References

The following chart provides sources of supplementary information relating to this practice. The documents could be required for performing certain tasks.

<b>See...</b>	<b>For Information About...</b>
205-000-500	Power Equipment – Power Connections – CO Inspection and Tightening Procedures
220-001-002	High Risk Activity Notice
256-050-206	Power Cable Methods

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## 2. Overview, continued

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### 2.2 References, continued

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See...	For Information About...
PSB 2241*	Compression Tools, Dies, and Connectors
PSB 4441*	Crimping Tool and Die Set

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\* Product Standardization Bulletins (PSBs) are published by the GTE Telephone Operations Standardization Management Department.

## 3. General Rules

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### 3.1 Rules

An inventory of the TBM5S meets tool requirements for most Outside Plant (OSP) applications. A mixture of the TBM6S, TBM14, and TBM15 compression tools and associated dies will meet most requirements for Central Office (CO) use.

The manual TBM5S and TBM6S tool should be used for those cases of a small quantity of splices or taps. For the larger power connections (i.e., H-taps) and/or volume use, the TBM14 or TBM15 electrically operated pump is recommended.

The 6-foot hose used with the TBM14 and 15 is noninsulated and is used only for floor or bench work. Use the 20-foot insulated hose when the tap or splice is made on the equipment or grid.

The following chart provides general guidelines.

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Guidelines for...	Are...
Power cable end caps	Power cable end caps are required on the end of all DC power and ground cable sizes #8 through 1000 kcmil (see Section 11.1 ordering information).
H-tap and C-tap placement	H-taps and C-taps must be placed between slats/rungs of cable support devices.
Screw-on type lugs	If a screw-on type ground lug is provided with the equipment, and a compression lug can be used in its place, the compression lug should be used.
No ground bar provided	In a power distribution frame, if no ground bar is provided and an overhead bus bar is used as the power board return ground bar, two-hole lugs are used.

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### 3. General Rules, continued

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#### 3.1 Rules, continued

Guidelines for...	Are...
Insulating negative leads	<p>To prevent a possible electrical short circuit, the barrel portion of all negative lead power lugs must be insulated with heat shrink tubing. It is acceptable to use 3M LR (linerless) splicing tape (Item ID 528233) when rework is involved.</p> <p>Two-hole ground lugs do not require the barrel portion to be insulated unless a quality compression has not been made (see Section 8.1).</p>
Nonoxidizing grease	<p>All lug connections and their mating surfaces are to be clean and lightly coated with nonoxidizing grease. Copper and steel surfaces are coated with the appropriate grease, such as Kopr-Shield® (Item ID 760293) or its equivalent. Aluminum surfaces are coated with Aluma Shield® grease (Item ID 760294) or its equivalent.</p>
Stud space	<p>Connections to power board terminal studs are placed on the stud to allow for an additional compression lug and nut. This allows for placement of a bridge cable when maintenance is required on an in-service fuse. Refer to GTE Telephone Operations Practice 205-000-500 for the procedure of working on in-service fuses.</p>
Proper torque values	<p>Tighten power board terminal stud nuts to the proper torque value as defined in GTE Telephone Operations Practice 205-000-500 and Section 8.5.</p>
Number of cables that can be tapped on a BDFB	<p>Two power cables can be tapped on a Battery Distribution Fusing Board (BDFB) or the Power Distribution Unit Frame (PDUF) for any single fuse. Both power cables should be the same size, but should be no larger than a #1 power cable.</p> <p>The maximum size of a single cable tapped to a 60-ampere fuse stud is a No. 4/0 power cable.</p>

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Kopr-Shield and Aluma Shield are registered trademarks of Thomas & Betts.

### 3. General Rules, continued

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#### 3.1 Rules, continued

Guidelines for...	Are...
Running power cable	The term <i>power cable</i> refers to the type of cable being used, not how the cable is used. Refer to GTE Telephone Operations Practice 256-050-206 for methods for running and securing power cable.

**NOTE:** C- and H-taps are matched by color to the colors of the installing dies to provide positive matching of the C- or H-tap with the correct colors of the installing dies (Exhibit 19).

### 4. Precautions

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#### 4.1 Live Circuits

Guidelines for working with live circuits are as follows:

- Use Rubber Insulating Blankets (Item ID 571030) to insulate the immediate metallic area of the power connection. There is a possibility of short-circuiting the hydraulic head between the live cable and grounded framework. Use only insulated hydraulic heads.
- The 20-foot hydraulic connecting hose is nonconductive; therefore, the head is not affected if the associated pump becomes grounded.
- In some cases, it might be necessary to temporarily remove power cable sewing to gain working room for the hydraulic compression head tool.

#### 4.2 High-Risk Activity Notification

When working on live circuits, refer to procedures outlined in GTE Telephone Operations Practice 220-001-002 to ensure proper notification is given.

Power cables expose personnel to a certain amount of danger. Take every precaution to ensure the safety of all personnel.

- Electrical gloves and rubber blankets must be available and used whenever equipment, power cables, etc. are exposed to:
  - Voltages greater than 50 volts (peak).
  - Lightning.
  - Possible contact with power conductors.
  - A transient rise in ground potential voltages.
  - Steady state induced voltages.
- Some types of power cable work must not be performed when thunderstorms are in the vicinity.

## 5. H-Tap—Description and Installation

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### 5.1 Description

Thomas & Betts H-taps are made of high-conductivity aluminum. The H-taps are intended for use on all cables in sizes 10 through 1000 kcmil (main) and 14 through 1000 kcmil (branch).

All H-taps are prefilled with a special oxide inhibitor for maximum joint conductivity. They also include a FILLER-LOK® tab design, an integral part of the connection that acts as a metal filler and locks itself in place upon compression. The table plus the deep grooves permit each tap to accept a wide range of cable sizes.

Because some H-taps are built with both bottom grooves for large tap sizes and side grooves for smaller tap sizes, extreme care must be used to ensure that the tap cable is being placed in the proper groove (Exhibit 2, Item C).

The following chart provides general guidelines for making quality H-tap connections.

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<b>Guidelines for...</b>	<b>Are...</b>
Selecting the correct die	Refer to Exhibit 2 to select the proper size H-tap. Locate the main cable size in the left-hand column and read down until the branch size is reached. The correct H-tap Part Number and Item ID is shown as you read across the table.  Exhibit 2 outlines the proper H-tap to be used on cable sizes #14 through 1000 kcmil. Exhibit 2 must be used in all cases to identify the proper H-tap to be used. In some cases, the manufacturer specifies on either the H-tap container or the H-tap itself, some sizes for reference only. This can be an incomplete listing. If you do not find the required cable, contact the Headquarters Staff Group (Irving, Texas) for assistance.
Proper strip length	Determine the proper strip length from Exhibit 2.
Installing the H-tap	Install the H-tap on main cable, pressing the FILLER-LOK tab with finger pressure. Repeat for branch cable. For styles without a FILLER-LOK tab for the branch cable, exercise care to ensure that the cable remains inside the groove during crimping. Branch cables can be inserted from either side.

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FILLER-LOK is a registered trademark of Thomas & Betts.

## 5. H-Tap—Description and Installation, continued

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### 5.1

#### Description, continued

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**Guidelines for...****Are...**

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Ensuring proper tensile and electrical values

To ensure proper tensile pull-out values and electrical connections, wire sizes 10, 12, and 14 (as shown in Exhibit 2, Item A for H-tap 63118) must be doubled in the tap before crimping.

A double tap can be made using the same conductor through an H-tap or C-tap (Exhibit 17). In addition, two or more branch cables can be served by a main cable under one H-tap or C-tap.

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### 5.2

#### Make

#### Compressions between Color Bands

Make compressions between color bands with a color-keyed die. Start in the center and work out. Refer to Exhibit 2 for the required number of crimps.

**NOTE: C- and H-taps are matched by color to the colors of the installing dies to provide positive matching of the C- or H-tap with the correct colors of the installing dies (Exhibit 19).**

### 5.3

#### H-Tap Ordering Information

Refer to Exhibit 2 for H-tap and cover ordering information.

## 6. C-Tap—Description and Installation

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### 6.1

#### Description

C-taps are made of high-conductivity wrought copper with heavy reinforced ribs that:

- Locate the compression dies.
- Straighten the compressed joint.

C-taps are intended for use on all cable in sizes #10 through 500 kcmil (main) and #12 through 400 kcmil (branch).

## 6. C-Tap—Description and Installation, continued

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### 6.1 Description, continued

The following chart provides general guidelines for making quality C-tap connections.

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<b>Guidelines for...</b>	<b>Are...</b>
Selecting the correct dies	<p>Select the correct compression die and determine the number of compressions needed to complete the C-tap according to Exhibit 3.</p> <p>Exhibit 3 illustrates main to branch-size cable. Several smaller size branch cables might be grouped under one C-tap to one main:</p> <ul style="list-style-type: none"><li>• Two #10 to one #6 main.</li><li>• Three #10 to one #5 main.</li><li>• Four #10 to one #4 main.</li></ul>
Proper strip length	Determine proper strip length by removing a section of the cable sheath 1/8-inch longer than the C-tap used.
Placing branch cables in the C-tap	<p>Branch cables must be placed in the C-tap opposite the opening (Exhibit 13). Before power tool crimping, use adjustable pump-type pliers such as a D502-10, Klein (Item ID 576469) to slightly precrimp the C-tap. This also temporarily holds the branch cable or wires in place during crimping.</p> <p><b>NOTE: Failure to precrimp results in the tool dies improperly rolling the C-tap opening to a closed configuration. Position the C-tap opening toward one of the dies before compression.</b></p>
Making a double tap	A double tap can be made using the same conductor through a C-tap.
Removing flash (sharp edges)	Even under ideal circumstances, a certain amount of "flash" (sharp edges) might be experienced when making a C-tap compression crimp. Use a file to remove the sharp edges. Prevent any metal particles from falling into the equipment below.

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**NOTE: C- and H-taps are matched by color to the colors of the installing dies to provide positive matching of the C- or H-tap with the correct colors of the installing dies (Exhibit 19).**

### 6.2 Ordering Information

Refer to Exhibit 3 for C-tap ordering information.

# 7. Straight Splice—Description and Installation

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## 7.1 Description

Straight-through splices are made from high-conductivity copper. These splices are tin plated and are intended for use on all cables in sizes from 8 through 800 kcmil.

All connector splices are constructed with a built-in center stop that prevents improper positioning of the cable before crimping.

## 7.2 Installing the Correct Die

To select the proper-size straight-through connector splice, use Exhibit 4. Follow the installation procedures below.

**NOTE: Only two straight connector splices may be placed in any one DC power cable run with the splice placed between the slats/rungs of the cable rack, grid, or any other support.**

**Straight splices are not allowed on ground cable.**

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Step	Installing the Die
1	Place the installing die in the head.
2	Strip cable ends to proper length as indicated in Exhibit 4.
3	Insert HS-type tubular insulator over cable near the splice. Cable ends must be set against the center stop in the splice
4	Insert the cable end in the splice.
5	Locate the die between color bands or dented rings closest to the center of the splice
6	Compress the splice until the pump bypasses. Repeat the compressing procedure for the second crimp, if required. See Exhibit 4 for the required number of crimps on each end of the splice.

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**NOTE: Section 8.8 contains the current installation procedures for a straight splice on flex power cable.**

## 7.3 Ordering Information

See Exhibits 4 and 5 for connector and heat shrink ordering information.

## 8. Lugs—Description and Installation

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### 8.1 Description

This section describes compression terminal lugs that are used to terminate power cable sizes 8 through 1000 kcmil. The application of compression terminal lugs using the manually and electrically operated hydraulic compression tool method is also presented.

Compression lugs are made from high-conductivity copper and are tin plated. These compression lugs are intended for use on all cables in sizes #8 through 1000 kcmil.

The following chart provides general guidelines for making quality compression lug connections.

---

Guidelines for...	Are...
When to use compression lugs	<p>All #8 through 1000 kcmil power cable lugs installed for COs and Private Automatic Branch Exchange (PABX) equipment are the compression type. Solder and solderless-type lugs in this range are no longer standard.</p> <p><b>NOTE: The exception to this is special multiple-type terminations equipped in some main power boards and Dossert Company lugs that come installed in the battery chargers.</b></p> <p>These instructions apply to all new installations and any power cable reterminations due to rearrangements. This applies to all:</p> <ul style="list-style-type: none"><li>• DC power connectors.</li><li>• Ground cable terminations.</li></ul> <p>Any deviation from this standard must be authorized by Area Engineering through a Job Information Memorandum (JIM).</p> <p>Compression-type terminal lugs are used on all new terminations of power cable; this includes bus bar(s) and main power boards. The Area Power Engineer orders bus bar(s) when compression terminal lugs must be used. Because of unusual situations, installers cut, bend, and drill bus bar(s) for any special application of the compression lugs.</p>

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(continued)

## 8. Lugs—Description and Installation, continued

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### 8.1

#### Description, continued

Guidelines for...	Are...
Selecting the proper lug for ground bars	<p>Select the proper-size lug from Exhibits 6, 7, and 8. To eliminate confusion as to the type of compression lug to use on ground bars, the following rules apply:</p> <ul style="list-style-type: none"><li>● The DC power and grounding bars that are not drilled for two-hole lugs use single-hole lugs (Exhibits 6 and 8).</li><li>● All universal DC power and ground bars use two-hole lugs (Exhibits 6, 7, and 8).</li><li>● All Master Ground Bars (MGBs) and Floor Ground Bars (FGBs) use two-hole lugs (Exhibits 6, 7, and 8).</li><li>● In a power distribution frame, if no ground bar is provided and the overhead bus is used as the power board ground bar, two-hole lugs are used (Exhibits 6, 7, and 8).</li><li>● Use only Thomas &amp; Betts or Burndy compression lugs when provided by the manufacturer. If no lug is provided, use the type of lug for which the ground bar is drilled, such as a single- or two-hole lug.</li></ul>
Required tools	<p>The hand-operated manual hydraulic pump should be used when small quantities of lugs are involved. For the largest lugs and/or for volume use, the electrically operated pump is recommended. The 6-foot noninsulated hose is used only for floor or bench work. Use the 20-foot insulated hose when the lug is installed above the equipment, rack, or grid level.</p> <p>The TBM6S and TBM50S are ratchet-controlled, hand-operated compression tools. The ratchet guarantees that a complete crimp is made each time, because the handle is not open until the ratchet releases (Exhibit 11).</p>

(continued)

## 8. Lugs—Description and Installation, continued

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### 8.1

#### Description, continued

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**Guidelines for...****Are...**

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Preventing an electrical short

To prevent a possible electrical short circuit, the barrel portion of all negative lead power lugs must be insulated with shrink tubing material. It is, however, acceptable to use 3M (Item ID 528233), rubber linerless splicing tape when it would not be cost-effective (i.e., rework) to use shrink tubing material. Grounding lugs do not require that the barrel portion be insulated.

See Exhibits 6–8 for insulating material ordering information. A quality compression connection should exhibit no more than 1/16 inch of bare wire between the end of the lug barrel and the cable insulation.

**NOTE: Always install the appropriate size heat shrink over the cable end before attaching the lug.**

---

Applying light coat of grease

Clean all lug connections and their mating surfaces, then coat them with nonoxidizing type grease. Coat copper and steel surfaces with Kopr-Shield or equivalent. Coat aluminum surfaces with Aluma Shield or its equivalent.

**NOTE: Do not apply any grease to the bolts; doing so changes torque values.**

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Fuse maintenance  
installation requirements

Place connections made to power board terminals studs on the stud to allow for an additional connection and nut. This allows for the placement of bridge cable when maintenance is required on an in-service fuse. Refer to GTE Telephone Operations Practice 205-000-500 for the procedure covering in-service fuses

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### 8.2

#### Lug Styles

Compression lugs are available in the following styles:

- Long barrel with single and double mounting holes and standard spacing (refer to Exhibit 6 or 7).
- Short barrel with single and double mounting holes and standard spacing (refer to Exhibit 8).

### 8.3

#### Lugs Color- Coded to Match Dies

The lugs are color coded and matched to the colors of the installing dies to provide positive matching of the lug with the correct installing dies (Exhibit 19).

In addition, the dies emboss a die code number on the surface of the lug during the crimping operation. This die code number indicates that the:

- Proper die was used.
- Crimp was fully completed.

## 8. Lugs—Description and Installation, continued

### 8.4 Installing the Correct Die

Select the proper installing die from Exhibits 6, 7, and 8 and proceed as described in the following chart.

Step	Installing the Die
1	Strip the cable insulation to the correct length for the lug being used to ensure full insertion into the lug barrel. Cable insulation must be placed against the barrel end (see Exhibit 21).
2	Strip the insulation carefully to avoid nicking or cutting conductors (see Exhibit 20).
3	Insert the cable end fully into the lug and locate the die between color bands or dented rings closest to the tongue of the lug (see Exhibit 18).
4	Compress the lug until the pump bypasses. Repeat the compressing procedure for the successive crimp, if required.
5	See Exhibits 6, 7, and 8 for the correct number of crimps required on each lug. The amount of crimps listed in Exhibits 6, 7, and 8 represents the minimum electrical requirements. Use only the recommended number of crimps.

### 8.5 Power Board Stud Torque

Tighten power board terminal studs with the proper tools in accordance with the manufacturer's specifications for torquing requirements. The following chart provides generic information in case the equipment manufacturer does not supply any specifications.

Stud Size	Torque (Ft Lbs)	Inspect (Ft Lbs)
1/4"	6	4
5/16"	11	8
3/8"	15	11
1/2"	40	30
5/8"	93	70

## 8. Lugs—Description and Installation, continued

### 8.6

#### MGB Nut and Bolt Torque Information

The following is ordering information for the nuts and bolts used on the MGB.

Nut/Bolt	Bolt Item ID	Nut Item ID	Torque (Ft Lbs)	Inspect (Ft Lbs)
1/4"	884463	884471	6	4
5/16"	884466	884472	11	8
3/8"	884467	884473	15	11
1/2"	884468	884474	40	30
5/8"	884469	884475	93	70

The following is ordering information for the washers for the bolts listed in the preceding chart.

Washer	Item ID
1/4"	884479
5/16"	884480
3/8"	884481
1/2"	884482
5/8"	884483

Each compression lug attached to the ground bar should have:

- Two bolts (hex head).
- Two nuts.
- Four washers (one on the front and back side of the MGB for each bolt).

**NOTE:** See GTE Telephone Operations Practice 795-805-071 for ground bar size and hole spacing information.

## 8. Lugs—Description and Installation, continued

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8.7

### Using KS Specification Flex Cable

The following chart provides guidelines for using KS flex cable.

Guidelines for...	Are...
Which flex cable can be used	Only KS specification flex cable is to be used in the switching network.
Identifying KS specification cable	All power cables that meet KS specification are identified every few feet on the cable with a KS-20921.
Where flex cable can be used	Flex cable can only be used in the power room area (primary power) (e.g., from batteries to power bus bars, from batteries to main power distribution boards). It should <u>not</u> be used to power equipment bays, frames, or racks (no H-taps).  <b>NOTE: The GTE Engineering Staff is evaluating the use of flex cable in the secondary distribution area, but the results of this evaluation are incomplete.</b>
Securing flex cable to cable rack	Without proper protection, the stitch can cut through the insulation. This is referred to as <i>cold migration</i> . To eliminate this problem, all stitches should be covered with a 1" fiber sheet (Item ID 388464). The stitch should cover the sheet and the cable, with approximately 1/2" of fiber sheet on both sides of the stitch.

8.8

### Ordering Information

Refer to Exhibits 6, 7, and 8 for compression lug and heat shrink ordering information.

# 9. Tools

---

## 9.1

Tools used in this practice include those shown in the following chart.

### Description/ Uses

Catalog Number	Item ID	Description
TBM5-S	631899	Includes dies to install copper conductors from #8 to 250 kcmil: <ul style="list-style-type: none"><li>● Lugs.</li><li>● Splices.</li><li>● C-taps.</li></ul> Comes with SHURE STAKE® feature.
TBM6-S Insulated P/N 292-31625	637504	Installs copper conductors from #8 to 500 kcmil: <ul style="list-style-type: none"><li>● Lugs.</li><li>● Splices.</li><li>● C-taps.</li></ul> Comes with SHURE STAKE feature. Installs H-taps 63105 thru 63140. Dies must be ordered separately. Order die kit TBM6D-1 (see below) for lugs, splices, and C-taps. H-tap dies must be ordered separately. They are not included in the TBM6D-1 die kit.
TBM6D-1	582315	TBM6 die kit. Includes dies to install #8 thru 500 kcmil: <ul style="list-style-type: none"><li>● Lugs.</li><li>● Splices.</li><li>● C-taps.</li></ul>
TBM14M Insulated P/N 297-31858	324787	Installs copper: <ul style="list-style-type: none"><li>● Lugs to 750 kcmil.</li><li>● H-taps thru 63150.</li><li>● Splices to 750 kcmil.</li><li>● C-taps thru #54775.</li></ul> Comes with SHURE STAKE feature. Uses TBM15 dies that must be ordered separately.

(continued)

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SHURE STAKE is a registered trademark of Thomas & Betts.

## 9. Tools, continued

### 9.1

#### Description/ Uses, continued

Catalog Number	Item ID	Description
TBM15PF Insulated P/N 297-53614	632521	Hydraulic insulated head installs copper up to 1000 kcmil. Dies must be ordered separately.
13610	635872	Electric hydraulic pump is for use with all Thomas & Betts hydraulic heads. Consists of: <ul style="list-style-type: none"> <li>● Pump.</li> <li>● SHURE STAKE.</li> <li>● Pressure gauge.</li> <li>● Pioneer-type male connector.</li> </ul> Order switch and hose separately.
13620	578432	10-foot hand switch.
13618	575111	20-foot nonmetallic hose.
13619	575110	10-foot nonmetallic hose.
15500	580405	TBM15 die adaptor for 15500 series dies.
DIES		See Exhibit 9 for ordering information on individual dies referenced in this practice. With the exception of the TBM6D-1 die set, all dies must be ordered separately.
21061	585501	Quart of hydraulic fluid.

**NOTE:** The TBM5S, TBM6S, and TBM50S are ratchet-controlled, hand-operated compression tools. The ratchet guarantees that a complete crimp is made each time because the handle does not open until the ratchet releases (Exhibit 11).

## 9. Tools, continued

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### 9.2 Ordering Information

Tools and miscellaneous items used to install compression connector splices, H-taps, lugs, and C-taps include:

- Manually operated hydraulic compression tooling:
  - TBM14M.
  - TBM8-750M-1.
- Electrically operated hydraulic compression tooling:
  - TBM15PF.
  - TBM8-750.
  - Hose.
  - Hand switch.
  - Electric or hand pump.
- No. 13600, electrically operated pump.
- TBM5S or TBM6S hand-operated compression.
- Typical dies.
- Heat gun, Model PA1871 (Item ID 574310) heat gun or equivalent.

For ordering information on the above items and items not listed, refer to PSBs 2241 and 4441.

Item ID (material code) information is included in this practice to facilitate end-user ordering. The item IDs in this practice are subject to change, but should have "Change To" information in the item description in the GTE Advanced Materials System (GTEAMS).

Inform Central Office Equipment Installation (COEI) Headquarters Staff of any ordering information discrepancies.

### 9.3 Typical Tools

Typical manually operated pumps are shown in Exhibit 15. They remain assembled when not in use.

An electrically operated pump is shown in Exhibit 12. The remote control handle is equipped with a twist-type cap which must be securely attached in the receptacle provided on the pump.

**NOTE: If the hydraulic hose must be disconnected from the head or pump, the components must be properly capped.**

### 9.4 Inserting Dies

All 155XX series dies in the insulated TBM15 (Catalog No. 297-53614) hydraulic head (see Exhibit 14) require die adapter number 15500.

The installation dies for the TBM5 and TBM6S (Exhibit 11) hand-operated compression tools are color-keyed, matched by color to a color reference on the H-tap, C-tap, or splice. Some die blocks contain more than one die area, and care must be taken to ensure that the proper die is in position. Follow the directions provided with the die boxes.

# 10. Covers—Description and Installation

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## 10.1 Using Heat Shrink Covers

Type HS Thomas & Betts covers are heat-shrink treated, thick-wall insulators designed to provide a mechanically rugged insulation over-straight-through connectors and C-taps. They have an ordering range of #12 through 1000 kcmil. Ordering information follows:

- HS12-6 – length 3 inches; serves #12 through 6 gauge (Item ID 767665).
- HS4-30 – length 5 inches; serves #4 through 3/0 gauge (Item ID 767576).
- HS40-400 – length 8 inches; serves 4/0 through 400 kcmil (Item ID 769819).
- HS500-1000 – length 9 inches; serves 500 through 1000 kcmil (Item ID 767667).

Type HS covers are tubular and must be placed over the cables before splicing or crimping a lug.

## 10.2 Shrinking the Covers

After the HS covers are in place, begin shrinking by heating at the center of the sleeve and proceed toward both ends. Keep the heat gun about one inch from the surface, and keep the heat gun moving to avoid local overheating. Continue until no more shrinking is observed.

**NOTE: See heat gun precautions in Section 12.**

Use a drop cloth under shrinking cover to:

- Avoid burns as the glue gets hot.
- Prevent glue from dripping into equipment.

## 10.3 Snap-On Covers

Hard shell covers are made of:

- A high-impact black thermoplastic with a neoprene interseal sponge.
- Fire-retardant materials.

Hard shell covers may be placed over either H- or C-taps (refer to Exhibits 2 and 3).

## 10.4 Installing the Covers

When cable size is between 400 and 1000 kcmil, tear out appropriate filler tabs to reduce installation force. This also provides a positive seal around the cables.

Align cover halves centrally over the connector so that the:

- Inner and outer teeth interlock.
- Body of the connector lies between the pads (Exhibit 16).

With the palm of your hands, squeeze the cover until the teeth fully engage. Verify that the ends are sealed.

**NOTE: It may be necessary to remove a small section of sponge to install the cover. The ends must be sealed upon completion.**

# 11. End Caps—Description and Installation

---

## 11.1 Description

This part covers the method of installing the Raychem Corporation type heat-shrinkable cable end caps.

End caps provide a mechanically rugged insulation cover for stub-ended power cables, sizes #8 through 1000 kcmil, up to 600 volts in indoor, dry locations.

Ordering information is shown in the following chart.

---

Part #	Item ID	Range
HSC8-4	768815	#6-#4
HSC2-20	769823	#2-#2/0
HSC30-250	769824	#3-250 kcmil
HSC300-600	769825	300-600 kcmil
HSC700-1000	769826	700-1000 kcmil

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**NOTE:** End caps provided have filler material within the end cap.

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## 11.2 Installing the End Cap

Cut the cable end squarely and remove any sharp protrusions, such as wire strands that might damage the shrinkable cap during installation.

Remove the end cap from the package and place it over the end of the cable conductor strands. Using a heat gun, begin heating the cap from the closed end toward the open end. Keep the heat gun about one inch from the surface. Heat uniformly around the entire circumference of the cap. Do not direct the head of the gun on any other object other than the heat-shrink end cap. Heat until the cap conforms (tightly) to the cable and no more shrinking is observed.

See Section 12 for the proper use of a heat gun.

# 12. Proper Use of a Heat Gun

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## 12.1 Proper Use

The Model PA1871 heat gun or equivalent should be used with an optional reflector. Do not direct the gun toward any object other than the head-shrink tubing or end cap materials. If this is unavoidable because of closeness of the working area, insulate the affected area with a fireproof canvas.

**CAUTION:** While working in close proximity to a fire-detection head such as Pyr-a-larm® or Fenwal Detect-A-Fire®, drape fireproof canvas around the head to prevent the movement of air produced by the heat gun from contacting the unit. Do not point the heat gun toward any detection head.

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Pyr-a-larm is a registered trademark of Pyrotronics, a division of Baker Industries.  
Detect-A-Fire is a registered trademark of Fenwal Incorporated.

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## 12. Proper Use of a Heat Gun, continued

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### 12.2 Avoiding Burns

As the barrel and reflector of the heat gun become hot, use caution to prevent personal and material burns.

**CAUTION: Always keep the head of the gun moving to avoid local overheating.**

### 12.3 Eye Protection

Eye protection goggles must be worn while using a heat gun.

### 12.4 Working around Fire Detection Equipment

A new fire detection system is being installed in the COs. This new system:

- Continually takes air samples.
- Is more sensitive to any change in temperature and smoke than are the current fire detection systems.

Because the new system does not use detection heads, only piping with air sample ports is visible. When using a heat gun close to the sample ports, contact the local building maintenance department for assistance. They can desensitize or deactivate the fire detection system.

When using a heat gun near fire detection heads, be sure that any heat and smoke produced is directed away from the heads. Use a fan on low speed to direct the heat and smoke away from the detection heads.

## 13. Compression Tool Maintenance and Repair

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### 13.1 Care of Hydraulic Equipment

Dirt is the greatest cause of failure in hydraulic equipment. Be careful not to introduce foreign matter into the unit.

- Use only clean hydraulic oil.
- Be careful when making hose connections. Protect couplers with dust covers when not in use.
- Be sure that the equipment to which the tool is to be connected is free of dirt and grit.

**WARNING: Disconnect the pump from its power supply for all maintenance and service except when it is required to operate the pump.**

Ensure that all hoses, fittings, couplers, accessories, etc. are the proper size and pressure rating. Tighten them fully.

# 13. Compression Tool Maintenance and Repair, continued

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## 13.2

### Sealing Threaded Joints

Connections should be tight enough to be snug and leak free. Do not overtighten. Overtightening can distort the threads and weaken the fittings.

**CAUTION:** Teflon® tape can be used if properly applied. One layer should be applied to the male thread. The tape must not extend past the end of the pipe because the excess might break off into the hydraulic system and clog or damage the pump or tool.

## 13.3

### Adding Hydraulic Fluid

Check the hydraulic oil level in the pump before use. Refer to the pump manual for additional instructions.

- Use only approved hydraulic fluid Thomas & Betts Catalog No. 21061 or its equivalent. Do not use:
  - Hydraulic brake fluid.
  - Motor oil.
  - Silicone oil.
  - Synthetic fluids.

These materials have poor lubricating qualities and are not compatible with the materials used in these tools.

- Do not add oil while the pump is connected to its electrical supply.
- Make sure the tool is fully retracted when adding fluid.

## 13.4

### Removing Air from the System

When the tool is connected to the hose or pump, some air is introduced into the hydraulic system. For satisfactory operation, this air must be removed. Sluggish or erratic cylinder action is a sign of air in the system.

Air can generally be removed by operating the system several times.

- Fully advance and retract the ram of the tool.
- Install a die in the tool when cycling.
- Place the pump in the highest point of the system for optimum removal.

## 13.5

### Cycle System before Use

Cycle the pump and tool several times:

- Before using it the first time.  
OR
- After the unit has not been used for awhile.

This warms the fluid and lubricates the system before being heavily loaded.

## 13.6

### How to Send In for Repair

The Equipment Repair Order (ERO) system should be used for all equipment repair. Return it to your local Equipment Repair Service (ERS). Attach an ERO tag describing any problems found or repairs required.

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Teflon is a registered trademark of Dupont Co.

# 14. Troubleshooting

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## 14.1

### Problems and Possible Causes

Use the following chart to troubleshoot any problems that occur with the pump.

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<b>Problem</b>	<b>Possible Cause</b>
Piston does not advance.	<ul style="list-style-type: none"><li>● No oil or low oil in pump.</li><li>● Air in system.</li><li>● Couplers not fully tightened.</li><li>● Defective coupler.</li><li>● Blockage in hydraulic lines.</li><li>● Defective pump.</li><li>● Improper oil used (e.g., viscosity too heavy).</li></ul>
Piston advances slowly.	<ul style="list-style-type: none"><li>● Low oil level in pump.</li><li>● Air in system.</li><li>● Tool piston binding.</li><li>● Leakage of hydraulic fluid.</li><li>● Loose coupler.</li><li>● Blockage in hydraulic lines.</li></ul>
Piston does not retract, does not release pressure, or retracts erratically.	<ul style="list-style-type: none"><li>● Defective pump.</li><li>● Defective coupler.</li><li>● Weak or broken return spring in tool.</li><li>● Binding tool piston or sticking dies.</li><li>● Loose coupler.</li><li>● Excess oil in pump.</li><li>● Ram not properly lubricated.</li><li>● Blockage in hydraulic pump.</li></ul>
Pump develops excessive pressure.	<ul style="list-style-type: none"><li>● Defective pump.</li></ul>
Pump does not develop full pressure.	<ul style="list-style-type: none"><li>● Defective pump.</li><li>● Air in system.</li><li>● Fluid leakage.</li><li>● Low oil.</li><li>● Dirt in hydraulic system.</li></ul>

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# Exhibits

WIRE/CA. SIZE	TYPE OF FITTING	637792 TBM20S	631899 TBM5S-OSP	340709 OSP 637504 ISP TBM6S	631678 TBM14M	TBM16PF 632521 297-53614	←- ITEM ID ←- CAT #
#8	H-TAP	*	*	*	*	*	
	C-TAP	*	*	*	*	*	
	LUG	*	*	*	*	*	
	SPLICE	*	*	*	*	*	
#6	H-TAP	*	*	*	*	*	
	C-TAP	*	*	*	*	*	
	LUG	*	*	*	*	*	
	SPLICE	*	*	*	*	*	
#4	H-TAP	*	*	*	*	*	
	C-TAP	*	*	*	*	*	
	LUG	*	*	*	*	*	
	SPLICE	*	*	*	*	*	
#3#2	H-TAP	*	*	*	*	*	
	C-TAP	*	*	*	*	*	
	LUG	*	*	*	*	*	
	SPLICE	*	*	*	*	*	
#1	H-TAP	*	*	*	*	*	
	C-TAP	*	*	*	*(1)	*(1)	
	LUG	*	*	*	*	*	
	SPLICE	*	*	*	*	*	
1/0	H-TAP	*	*	*	*	*	
	C-TAP	*	*	*	*(1)	*(1)	
	LUG	*	*	*	*	*	
	SPLICE	*	*	*	*	*	
2/0	H-TAP	*	*	*	*	*	
	C-TAP	*	*	*	*(1)	*(1)	
	LUG	*	*	*	*	*	
	SPLICE	*	*	*	*	*	
3/0	H-TAP	*	*	*	*	*	
	C-TAP	*	*	*	*(1)	*(1)	
	LUG	*	*	*	*	*	
	SPLICE	*	*	*	*	*	
4/0	H-TAP	*	*	*	*	*	
	C-TAP	*	*	*	*(1)	*(1)	
	LUG	*	*	*	*	*	
	SPLICE	*	*	*	*	*	

(1) LARGE C-TAPS ONLY

Exhibit 1 - Tool Selection (Small Size Wire/Cable)

# Exhibits, continued

WIRE/CA. SIZE	TYPE OF FITTING	637792 TBM20S	631899 TBM5S	637504 TBM6S	631678 TBM14M	TBM15PF 632521 287-53614	← ITEM ID ← CAT #
250MCM	H-TAP					*	
	C-TAP		*		*(1)	*(1)	
	LUG		*	*	*	*	
	SPLICE		*	*	*	*	
300MCM	H-TAP					*	
	C-TAP				*(1)	*(1)	
	LUG			*	*	*	
	SPLICE			*	*	*	
400MCM	H-TAP					*	
	C-TAP				*(1)	*(1)	
	LUG			*	*	*	
	SPLICE			*	*	*	
500MCM	H-TAP					*	
	C-TAP				*(1)	*(1)	
	LUG			*	*	*	
	SPLICE			*	*	*	
600MCM	H-TAP					*	
	C-TAP				*(1)	*(1)	
	LUG			*	*	*	
	SPLICE			*	*	*	
700MCM	H-TAP					*	
	C-TAP				*(1)	*(1)	
	LUG			*	*	*	
	SPLICE			*	*	*	
750MCM	H-TAP					*	
	C-TAP					*(1)	
	LUG			*	*	*	
	SPLICE			*	*	*	
900MCM	H-TAP					*	
	C-TAP					*(1)	
	LUG			*	*	*	
	SPLICE			*	*	*	
1000MCM	H-TAP					*	
	C-TAP					*(1)	
	LUG			*	*	*	
	SPLICE			*	*	*	

(1) LARGE C-TAPS ONLY

Exhibit 1 - Tool Selection (Larger Size Cables)

Exhibit 2 - Thomas & Betts H-Tap Information (Aluminum)

CABLE SIZES		USE TAP CAT. #	S T Y L E	ITEM ID	CABLE STRIP LENGTH (INCHES)	COLOR KEY	HAND TBM6S DIE	(1) NO OF CRIMPS	15-TON TBM15 DIE	(1) NO OF CRIMPS	14-TON TBM15 DIE	(1) NO OF CRIMPS	USE COVER CAT. #	ITEM ID
MAIN	BRANCH													
6-2	14-8	63105**	3	763212	7/8	ORANGE	U13474 L13477	2	15530 (2)	2	15530 (2)	2	HTC2	768899
6-4	6-4	63110	1	763213	1-11/16	GREEN	13470	6	15501A(2)	2	15501A(2)	2	HTC40	768336
2-2/0	14-8	63118**	3	768897	7/8	GREEN	13470	2	15501A(2)	1	15501A(2)	1	HTC40	768336
2-2/0	6-2/0	63125	1	763216	1-11/16	GREEN	13470	6	15501A(2)	2	15501A(2)	2	HTC40	768336
2/0-4/0	2-10	63140	1	763219	1-11/16	BLUE	13471	6	15502 (2)	1	15502 (2)	1	HTC40	768336
2/0-4/0	1-3/0	63148*	2	768898	3-5/16	BLUE	N/A	N/A	15502 (2)	3	15502 (2)	3	HTC500	768893
4/0-500	2/4/0	63180*	2	763223	3	RED	N/A	N/A	15612	2	N/A	N/A	HTC500	768893
4/0-750	4/0-750	63169	1	EPR	3-5/16	BLACK	N/A	N/A	15620	6	N/A	N/A	HTC1000	768895
500-1000	1/0-1000	63170	1	763225	6-5/8	BLACK	N/A	N/A	15620	6	N/A	N/A	HTC1000L	768895
250-750	1/0-350	63180*	2	747508	3-5/16	BLACK	N/A	N/A	15620	3	N/A	N/A	HTC1000	768895

(1) Back of the H-tap box will provide number of crimps required for each tool type used.

NOTES: All 155XX die series require adapter no. 15500.

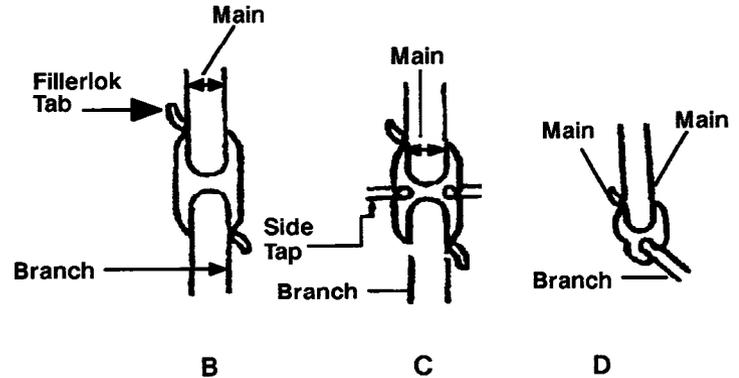
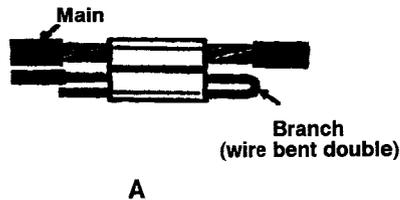
See Exhibit 9 for die to Item ID (material code) cross-reference information.

\* Tap had additional side tap (branch + side tap) as follows:

63148: 14-8, 63160: 6-2, 63180: 6-1

!!!! CAUTION !!!!

\*\* Branches that are #14 through #10 should be doubled to ensure that proper tensile pull-out and electrical connection values are met.



# Exhibits, continued

CABLE SIZES			S T Y L E	I T E M I D	C O L O R K E Y	H A N D T B M S			15-TON T B M S D I E	U S E C O V E R		O R U S E P A D	
M A I N	B R A N C H	C A T. #				D I E U P P E R	D I E L O W E R	N O O F C R I M P S		C A T. #	I T E M I D	C A T. #	I T E M I D
14-12	16-14	54705	4	304423	RED	13475	13477	2		HTC2S	769336	ACSX3	887805
10	10	54710	1	768707	BLUE	13475	13477	2	U	HTC2S	769336	ACSX3	887805
8	12	54710	1	768707	BLUE	13475	13477	2	S	HTC2S	769336	ACSX3	887805
6	10-12	54715	1	772844	GRAY	13472	13476	2	E	HTC40	769336	ACSX3	887805
8	8-10	54715	1	772844	GRAY	13472	13476	2		HTC40	769336	ACSX3	887805
4-5	8-10	54720	2	767654	BROWN	13474	13477	2	H	HTC40	769336	ACSX3	887805
6	6-8	54720	2	767654	BROWN	13474	13477	2	A	HTC40	769336	ACSX3	887805
4-5	6-5	54725	2	760450	GREEN	13474	13477	2	N	HTC40	769336	ACSX3	887805
2	6-12	54730	2	767655	PINK	13475	13477	2	D	HTC40	769336	ACSX3	887805
3	5	54730	2	767655	PINK	13475	13477	2		HTC40	769336	ACSX3	887805
4	4	54730	2	767655	PINK	13475	13477	3	T	HTC40	769336	ACSX3	887805
1	5-12	54735	3	768947	BLACK	13474	13477	3	O	HTC40L2	769336	ACSX3	887805
2	4-5	54735	3	768947	BLACK	13474	13477	3	O	HTC40L2	769336	ACSX3	887805
3	3-4	54735	3	768947	BLACK	13474	13477	3	L	HTC40L2	769336	ACSX3	887805
1-1/0	4-12	54740	3	767577	ORANGE	13474	13477	3	S	HTC40L2	769336	ACSX3	887805
1	3-4	54740	3	767577	ORANGE	13474	13477	3		HTC40L2	769336	ACSX3	887805
2	2-3	54740	3	767577	ORANGE	13474	13477	3		HTC40L2	769336	ACSX3	887805
2/0	3-12	54745	3	767578	PURPLE	13475	13477	3		HTC40L2	769336	ACSX3	887805
1/0	2-3	54745	3	767578	PURPLE	13475	13477	3		HTC40L2	769336	ACSX3	887805
1	1-2	54745	3	767578	PURPLE	13475	13477	3		HTC40L2	769336	ACSX3	887805
3/0	2-12	54750	3	760452	YELLOW	13473	13476	3		HTC40L2	769336	ACSX3	887805
2/0	1-2	54750	3	760452	YELLOW	13473	13476	3		HTC40L2	769336	ACSX3	887805
1/0	1/0-1	54750	3	760452	YELLOW	13473	13476	3		HTC40L2	769336	ACSX3	887805



Style 1



Style 2



Style 3



Style 4

**NOTE: See Exhibit 9 for die part number Item ID (material code) cross-reference information.**

Exhibit 3 - Thomas & Betts C-Tap Information (Copper) (Page 1 of 2)

# Exhibits, continued

CABLE SIZES			S T Y L E	ITEM ID	COLOR KEY	15-TON TBM15 DIE *	** NO OF GRIMPS	TBM6S HAND DIES	USE COVER CAT. #	ITEM ID
MAIN	BRANCH	USE TAP CAT. #								
1	1	54755	4	769956	BLUE	15512	2	U	HTC40	769336
1/0	1/0-2	54755	4	769956	BLUE	15512	2	S	HTC40	769336
2/0	2/0-4	54755	4	769958	BLUE	15512	2	E	HTC40	769336
2/0	2/0-1	54760	4	769957	BROWN	15506	2		HTC40	769336
2/0	2/0-1	54765	4	769958	PINK	15506	2	H	HTC500	768893
3/0	1/0-6	54755	4	769956	BLUE	15512	2	Y	HTC40	769336
3/0	3/0-3	54760	4	769957	BROWN	15506	2	D	HTC40	769336
3/0	3/0-2	54765	4	769958	PINK	15506	2	R	HTC500	768893
4/0	1-8	54755	4	769958	BLUE	15512	2	A	HTC40	769336
4/0	4/0-4	54760	4	769957	BROWN	15506	2	U	HTC40	769336
4/0	4/0-4	54765	4	769958	PINK	11505	2	L	HTC500	768893
4/0	4/0-2/0	54770	4	769959	BLACK	15515	2	I	HTC500	768893
250	1/0-8	54760	4	769957	BROWN	15506	2	C	HTC40	769336
250	3/0-6	54765	4	769958	PINK	11505	2		HTC500	768893
250	250-1	54770	4	769959	BLACK	15515	2	T	HTC500	768893
250	250	54775	4	769960	YELLOW	15504	2	O	HTC500	768893
300	2/0-8	54765	4	769958	PINK	11505	2	O	HTC500	768893
300	4/0-4	54770	4	769959	BLACK	15515	2	L	HTC500	768893
300	300-3/0	54775	4	769960	YELLOW	15504	2		HTC500	768893
350	3/0-6	54770	4	769959	BLACK	15515	2		HTC500	768893
350	350-1/0	54775	4	769960	YELLOW	15504	2		HTC500	768893
350	350-4/0	54780	4	769961	WHITE	15603	2		HTC500	768893
400	300-2	54775	4	769960	YELLOW	15504	2		HTC500	768893
400	400-2/0	54780	4	769961	WHITE	15603	2		HTC500	768893
450	250-4	54775	4	769960	YELLOW	15504	2		HTC500	768893
450	450-1	54780	4	769961	WHITE	15603	2		HTC500	768893
500	250-6	54775	4	769960	YELLOW	15504	2		HTC500	768893
500	500-2	54780	4	769961	WHITE	15603	2		HTC500	768893
500-750	4/0-6	54785	4		WHITE	15603	3		HTC500	768893
750	750-4/0	54790	4		WHITE	15603	3		HTC1000	768895



Style 1



Style 2



Style 3



Style 4

**NOTE: See Exhibit 9 for die part number Item ID (material code) cross-reference information.**

Exhibit 3 - Larger Size Thomas & Betts C-Tap Information (Copper) (Page 2 of 2)

Exhibit 4 – Thomas & Betts Straight Splice Information (Copper)

CABLE SIZE	USE CONNECTOR CAT. #	ITEM ID	COLOR KEY	CABLE STRIP LENGTH	TBMGS DIE UPPER	DIE LOWER	NO OF CRIMPS	15-TON TBM15 DIE	NO OF CRIMPS	USE HEAT SHRINK CAT. #	ITEM ID
#8	54504	767824	RED	9/16	13475	13477	1	15520	1	HS12-6	767665
#6	54505	767825	BLUE	9/16	13475	13477	1	15522	1	HS12-6	767665
#4	54506	765031	GREY	9/16	13472	13476	1	15527	1	HS4-30	767576
#2-#3	54507	765032	BROWN	11/16	13474	13477	1	15528	1	HS4-30	767576
#1	54508	761609	GREEN	13/16	13474	13477	1	15513	1	HS4-30	767576
1/0	54509	762028	PINK	13/16	13475	13477	1	15508	2	HS4-30	767576
2/0	54510	762029	BLACK	7/8	13474	13477	2	15526	1	HS4-30	767576
3/0	54511	762030	ORANGE	15/16	13474	13477	2	15530	1	HS40-400	769819
4/0	54512	762031	PURPLE	1	13475	13477	2	15511	2	HS40-400	769819
250MCM	54513	767828	YELLOW	1-3/16	13473	13476	2	15510	2	HS40-400	769819
300MCM	54514	762032	WHITE	1-1/8	13473	13476	2	15534	2	HS40-400	769819
350MCM	54515	767829	RED	1-3/16	13472	13476	2	15514	2	HS40-400	769819
400MCM	54516	762033	BLUE	1-1/2	13472	13476	2	15512	2	HS500-1000	767667
500MCM	54518	762034	BROWN	1-1/2	13478	N/A	2	15506	2	HS500-1000	767667
600MCM	54520	762035	GREEN	1-5/8	N/A	N/A	N/A	15536	2	HS500-1000	767667
700MCM	54522	762036	PINK	1-3/4	N/A	N/A	N/A	15505	2	HS500-1000	767667
750MCM	54523	761610	BLACK	1-3/4	N/A	N/A	N/A	15515	2	HS500-1000	767667

1) See Exhibit 9 for die code cross-reference information.

2) #10 and 1/4" bolt sizes on 5/8" centers.

3/8" bolts on 1" centers.

1/2" bolts on 1 3/8" centers.



\* indicates the number of compressions with half width die.

KS-20921 CABLE SIZE	FLEX CABLE SIZE	USE CONNECTOR CAT. #	ITEM ID	COLOR KEY	CABLE STRIP LENGTH	TBM6S DIE UPPER	DIE LOWER	NO OF CRIMPS	15-TON TBM15 DIE	NO OF CRIMPS	USE HEAT SHRINK CAT. #	ITEM ID
2/0	325/24	54811	385022	ORANGE	15/16	13474	13477	3	15530	1	HS40-400	768619
3/0	450/24	54812	385023	PURPLE	1	13475	13477	4	15511	2	HS40-400	768619
4/0	550/24	54813	385024	YELLOW	1-3/16	13473	13476	4	15510	2	HS40-400	768619
250MCM	NONE	54814	385025	WHITE	1-1/8	13473	13476	4	15534	2	HS40-400	768619
300MCM	650/24	54815	385028	RED	1-3/16	13472	13476	4	15514	2	HS40-400	768619
350MCM	775/24	54816	385027	BLUE	1-1/2	13472	13476	4	15512	2	HS500-1000	767667
400MCM	925/24	54818	385032	BROWN	1-1/2	13478	13478	4	15506	2	HS500-1000	767667
500MCM	1100/24	54820	385033	GREEN	1-5/8	N/A	N/A	N/A	15536	2	HS500-1000	767667
750MCM	1925/24	54823	385034	BLACK	1-3/4	N/A	N/A	N/A	15515	2	HS500-1000	767667

1) See Exhibit 9 for die code cross-reference information.

2) #10 and 1/4" bolt sizes on 5/8" centers.

3/8" bolts on 1" centers.

1/2" bolts on 1 3/8" centers.

\* indicates the number of compressions with half width die.



Exhibit 5 - Thomas & Betts Flex Cable Straight Splice Information (Copper)

HEAT SHRINK	CABLE SIZES	1 HOLE LUG		2 HOLE LUG		COLOR KEY	STRIP LENGTH	HEX DIE(1) CODE	1 HOLE BOLT SIZE	2 HOLE BOLT SIZE	# OF COMPRESSIONS			
		CAT #	ITEM ID	CAT #	(2) ITEM ID						HAND TOOLS TBM20S	TBM6S	HYDRAULIC HEAD 12TON	15TON
HS12-5	#8	54830BE	749154	54850BE	749169	RED	3/4"	21	1/4"	1/4"	4	2	2	2
	#6	54905BE	749155	54852BE	749158	BLUE	3/4"	24	1/4"	1/4"	4	2	2	2
	#4	54906BE	749156	54854BE	749159	GREY	3/4"	29	1/4"	1/4"	4	2	2	2
HS4-30	#3/2	54942BE	749157	54856BE	749160	BROWN	7/8"	33	5/16"	5/16"	4	2	2	2
	#1	54947BE	749164	54858BE	749161	GREEN	1"	37	5/16"	5/16"	N/A	2	2	2
	1/0	U	U	54860BE	314398	PINK	1"	42	U	5/16"	N/A	2	2	2
	2/0	S	S	54862BE	749162	BLACK	1"	45	S	1/2"	N/A	3	2	2
	3/0	E	E	54864BE	749163	ORANGE	1 1/8"	50	E	1/2"	N/A	3	2	2
	4/0			54866BE	749170	PURPLE	1 5/16"	54		1/2"	N/A	4	4	4
	250	2	2	54868BE	749171	YELLOW	1 9/16"	62	2	1/2"	N/A	4	2	2
	350			54872BE	749172	RED	1 7/8"	71		1/2"	N/A	4	4	4
HS40-400	400	H	H	54874BE	831385	BLUE	1 7/8"	76	H	1/2"	N/A	4	2	2
	500	O	O	54876BE	749173	BROWN	2 3/8"	87	O	1/2"	N/A	4	4	4
	600	L	L	54878BE	831386	GREEN	2 1/8"	94	L	1/2"	N/A	N/A	4	4
	750	E	E	54880BE	749174	BLACK	2 7/16"	106	E	1/2"	N/A	N/A	4	4

1) See Exhibit 9 for die code cross-reference information.

2) #10 and 1/4" bolt sizes on 5/8" centers.

3/8" bolts on 1" centers.

1/2" bolts on 1 3/8" centers.

\* indicates the number of compressions with half width die.



Exhibit 6 - Long Barrel Thomas & Betts Lug Information (Copper)

HEAT SHRINK	KS-20921 CABLE SIZE	FLEX CABLE SIZE	2 HOLE LUG CAT #	(2) ITEM ID	COLOR KEY	STRIP LENGTH	HEX DIE(1) CODE	1 HOLE BOLT SIZE	2 HOLE BOLT SIZE	# OF COMPRESSIONS			
										HAND TOOLS		HYDRAULIC HEAD	
										TBM20S	TBM6S	12TON	15TON
HG4-30	20	325/24	54864BE	749183	ORANGE	1 1/8"	50	U	1/2"	N/A	3	2	2
	30	450/24	54866BE	749170	PURPLE	1 5/16"	54	S	1/2"	N/A	4	4	4
	40	550/24	54868BE	749171	YELLOW	1 9/16"	62	E	1/2"	N/A	4	2	2
	300	650/24	54872BE	749172	RED	1 7/8"	71	2	1/2"	N/A	4	4	4
HS40-400	350	775/24	54874BE	831385	BLUE	1 7/8"	76		1/2"	N/A	4	2	2
	400	825/24	54876BE	749173	BROWN	2 3/8"	87	H	1/2"	N/A	4	4	4
	500	1100/24	54878BE	831386	GREEN	2 1/8"	84	O	1/2"	N/A	N/A	4	4
	600	1325/24	54880BE	749174	BLACK	2 7/16"	106	L	1/2"	N/A	N/A	4	4
	750	1825/24	58826BE	377579	YELLOW	2 11/16"	115	E	1/2"	N/A	N/A	2	4

1) See Exhibit 9 for die code cross-reference information.

2) #10 and 1/4" bolt sizes on 5/8" centers.

3/8" bolts on 1" centers.

1/2" bolts on 1 3/8" centers.

\* indicates the number of compressions with half width die.



Exhibit 7 - Long Barrel Thomas & Betts Flex Cable Lug Information (Copper)

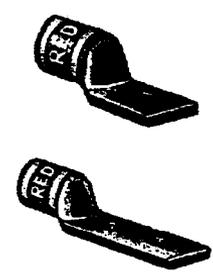
Exhibit 8 - Short Barrel Thomas & Betts Lug Information (Copper) (Page 1 of 3)

HEAT SHRINK	CABLE SIZES	1 HOLE LUG		2 HOLE (2) LUG		COLOR KEY	1 OR 2 HOLE STRIP LENGTH	HEX DIE (1) CODE	BOLT SIZE	NUMBER OF COMPRESSIONS			
		CAT #	ITEM ID	CAT #	(2) ITEM ID					HAND TOOLS		HYDRAULIC HEAD	
										TBMS20	TBM6S	12TON	15TON
HS12-5 (ID 767665)	#8	54104	747511	54204	769830	RED	7/16	21	#10	2	1	1	2*
	#8	54130	749148	--	--	RED	7/16	21	1/4"	2	1	1	2*
	#8	54131	769911	--	--	RED	7/16	21	5/16"	2	1	1	2*
	#8	54132	760447	--	--	RED	7/16	21	3/8"	2	1	1	2*
	#6	54134	749155	--	--	BLUE	7/16	24	#10	2	2	1	1
	#6	54105	747370	54205	769776	BLUE	7/16	24	1/4"	2	2	1	1
	#6	54135	769762	--	--	BLUE	7/16	24	5/16"	2	2	1	1
	#6	54136	747517	--	--	BLUE	7/16	24	3/8"	2	2	1	1
	#4	54138	769763	--	--	GREY	5/8"	29	#10	2	2	1	1
	#4	54106	747512	54206	769778	GREY	5/8"	29	1/4"	2	2	1	2*
	#4	54139	769764	--	--	GREY	5/8"	29	5/16"	2	2	1	2*
	#4	54140	760448	--	--	GREY	5/8"	29	3/8"	2	2	1	2*
	#2	54107	749027	54207	769778	BROWN	5/8"	33	1/4"	2	2	1	2*
	#2	54142	749149	--	--	BROWN	5/8"	33	5/16"	2	2	1	1
	#2	54143	769828	--	--	BROWN	5/8"	33	3/8"	2	2	1	1
	#2	54145	760449	--	--	BROWN	5/8"	33	1/2"	2	2	1	1
	#1	54108	749164	54208	769779	GREEN	3/4"	37	1/4"	N/A	2	2*	1
	#1	54147	749150	--	--	GREEN	3/4"	37	5/16"	N/A	2	2*	1
	#1	54148	764891	--	--	GREEN	3/4"	37	3/8"	N/A	2	2*	1
	#1	54150	747518	--	--	GREEN	3/4"	37	1/2"	N/A	2	2*	1

1) See Exhibit 10 for die code cross-reference information.

2) #10 and 1/4" bolt sizes on 5/8" centers.  
 3/8" bolts on 1" centers.  
 1/2" bolts on 1 3/8" centers.

\* indicates the number of compressions with half width die.



HEAT SHRINK	CABLE SIZES	1 HOLE LUG		2 HOLE LUG		COLOR KEY	1 OR 2 HOLE STRIP LENGTH	HEX DIE (1) CODE	BOLT SIZE	NUMBER OF COMPRESSIONS		
		CAT #	ITEM ID	CAT #	(2) ITEM ID					HAND		HYDRAULIC HEAD
										TBM6S	12TON	15TON
HS4-30 (ID 767576)	1/0	54152	769785	---	---	PINK	3/4"	42	1/4"	1	1	2*
	1/0	54153	769786	54255	769896	PINK	3/4"	42	5/16"	1	1	2*
	1/0	54109	747513	54209	769780	PINK	3/4"	42	3/8"	1	1	2*
	1/0	54155	760402	---	---	PINK	3/4"	42	1/2"	1	1	2*
	2/0	54157	769767	---	---	BLACK	3/4"	45	1/4"	2	1	1
	2/0	54158	769768	54261	752007	BLACK	3/4"	45	5/16"	2	1	1
	2/0	54110	747321	54210	769781	BLACK	3/4"	45	3/8"	2	1	1
	2/0	54180	760443	54260	769782	BLACK	3/4"	45	1/2"	2	1	1
	3/0	54162	769789	---	---	ORANGE	1"	50	1/4"	2	1	1
	3/0	54163	769770	---	---	ORANGE	1"	50	5/16"	2	1	1
	3/0	54111	769771	54211	769897	ORANGE	1"	50	3/8"	2	1	1
	3/0	54165	760444	54265	769783	ORANGE	1"	50	1/2"	2	1	1
	4/0	54167	769772	---	---	PURPLE	1"	54	1/4"	2	1	1
	4/0	54168	769773	---	---	PURPLE	1"	54	5/16"	2	1	2*
	4/0	54112	747541	54212	769816	PURPLE	1"	54	3/8"	2	1	2*
	4/0	54170	760445	54270	769784	PURPLE	1"	54	1/2"	2	1	2*
	250MCM	54172	769913	---	---	YELLOW	1 1/8"	62	1/4"	2	1	2*
	250MCM	54173	769914	---	---	YELLOW	1 1/8"	62	5/16"	2	1	1
	250MCM	54174	749151	54213	769898	YELLOW	1 1/8"	62	3/8"	2	1	1
	250MCM	54113	747515	54275	769785	YELLOW	1 1/8"	62	1/2"	2	1	1
	300MCM	54178	768834	---	---	WHITE	1 1/8"	66	5/16"	2	2*	1
	300MCM	54179	769915	54214	769902	WHITE	1 1/8"	66	3/8"	2	2*	1
	300MCM	54114	747516	54280	769786	WHITE	1 1/8"	66	1/2"	2	2*	1
	300MCM	54181	749548	---	---	WHITE	1 1/8"	66	5/8"	2	2*	1

1) See Exhibit 10 for die code cross-reference information.

2) #10 and 1/4" bolt sizes on 5/8" centers.

3/8" bolts on 1" centers.

1/2" bolts on 1 3/8" centers.

\* indicates the number of compressions with half width die.



HEAT SHRINK	CABLE SIZES	1 HOLE		2 HOLE		COLOR KEY	1 OR 2 HOLE STRIP LENGTH	HEX DIE(1) CODE	BOLT SIZE	NUMBER OF COMPRESSIONS		
		LUG CAT.#	ITEM ID	LUG CAT.#	(2) ITEM ID					HAND TBM6S	12TON	15TON
HS40-400 (ID 766819)	350MCM	--	--	54215	769902	RED	1 1/8"	71	3/8"	2	2	2
	350MCM	54115	747514	54282	769786	RED	1 1/8"	71	1/2"	2	2	2
	350MCM	54183	749152	--	--	RED	1 1/8"	71	5/8"	2	2	2
	400MCM	54116	752001	--	--	BLUE	1 5/16"	76	1/2"	2	2	2
	400MCM	--	--	54216	752008	BLUE	1 5/16"	76	3/8"	2	2	2
	400MCM	54185	760446	--	--	BLUE	1 5/16"	76	1/2"	2	2	2
	500MCM	--	--	54218	769903	BROWN	1 5/16"	87	3/8"	2	2	2
	500MCM	54118	765370	54286	769787	BROWN	1 5/16"	87	1/2"	2	2	2
	500MCM	54187	749153	--	--	BROWN	1 5/16"	87	5/8"	N/A	2	2
	600MCM	--	--	54220	752009	GREEN	1 1/2"	94	3/8"	N/A	2	2
	600MCM	--	--	54289	752010	GREEN	1 1/2"	94	1/2"	N/A	2	2
	600MCM	54120	752003	--	--	GREEN	1 1/2"	94	5/8"	N/A	2	2
	700MCM	--	--	54291	752001	PINK	1 1/2"	99	1/2"	N/A	2	2
	700MCM	54122	752004	--	--	PINK	1 1/2"	99	5/8"	N/A	2	2
	750MCM	--	--	54223	769788	BLACK	1 5/8"	106	1/2"	N/A	2	2
	750MCM	54123	760315	--	--	BLACK	1 5/8"	106	5/8"	N/A	2	2
	800MCM	--	--	54224	752012	ORANGE	1 3/4"	107	1/2"	N/A	2	2
	800MCM	54124	752005	--	--	ORANGE	1 3/4"	107	5/8"	N/A	2	2
	900MCM	--	--	54226	326954	YELLOW	1 5/8"	115	1/2"	N/A	2	2
	HS500-1000	1000MCM	--	--	54228	752013	SEE BOX	1 3/4"	125	1/2"	N/A	N/A

1) See Exhibit 10 for die code cross-reference information.

2) #10 and 1/4" bolt sizes on 5/8" centers.

3/8" bolts on 1" centers.

1/2" bolts on 1 3/8" centers.

\* indicates the number of compressions with half width die.



Exhibit 8 - Short Barrel Thomas & Betts Lug Information (Copper) (Page 3 of 3)

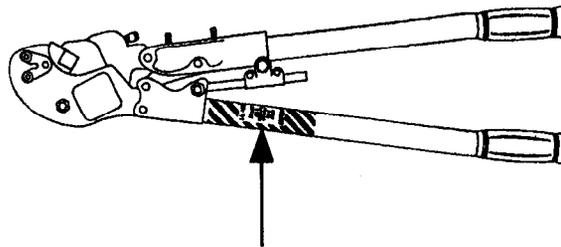
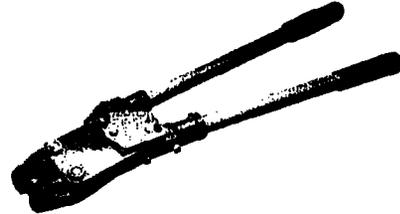
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13478	638787
15314	581191
15500	580405
15501	581109
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15527	581183
15528	581184
15530	581108
15534	581190
15603	529080
15612	581107
15620	639091

**Exhibit 9 - Die Part Number Item ID Cross-Reference**

CABLE SIZES	COLOR KEY	DIE CODE	TBM20S INFORMATION			TBM6S INFORMATION				TBM 14/15 INFORMATION TBM15 CAT. # 297-53614		
			DIE	# OF CRIMPS		UPPER DIE	LOWER DIE	# OF CRIMPS		DIE	# OF CRIMPS	
				LONG BARREL	SHORT BARREL			LONG BARREL	SHORT BARREL		LONG BARREL	SHORT BARREL
#8	RED	21	N	4	2	13475	13477	2	1	15520	2	1
#6	BLUE	24	O	4	2	13475	13477	2	1	15522	2	1
#4	GREY	29	N	4	2	13472	13476	2	1	15527	2	1
#2	BROWN	33	E	4	2	13474	13477	2	1	15528	2	1
#3/2	BROWN	33		4	2	13474	13477	2	1	15528	2	1
#1	GREEN	37	R	N/A	N/A	13474	13477	2	1	15513	2	1
1/0	PINK	42	E	N/A	N/A	13475	13477	2	1	15508	2	2
2/0	BLACK	45	Q	N/A	N/A	13474	13477	3	2	15526	2	1
3/0	ORANGE	50	U	N/A	N/A	13474	13477	3	2	15530	2	1
4/0	PURPLE	54	I	N/A	N/A	13475	13477	4	2	15511	4	2
250	YELLOW	62	R	N/A	N/A	13473	13476	4	2	15510	2	1
300	WHITE	66	E	N/A	N/A	13473	13476	4	2	15534	2	1
350	RED	71	D	N/A	N/A	13472	13476	4	2	15514	4	2
400	BLUE	76		N/A	N/A	13472	13476	4	2	15512	2	1
500	BROWN	87		N/A	N/A	13478	13478	4	2	15506	4	2
600	GREEN	94		N/A	N/A			N/A		15611	4	2
750	BLACK	106		N/A	N/A			N/A		15515	4	2

NOTE: See Exhibit 9 for die code part number and Item ID (material code) cross-reference.

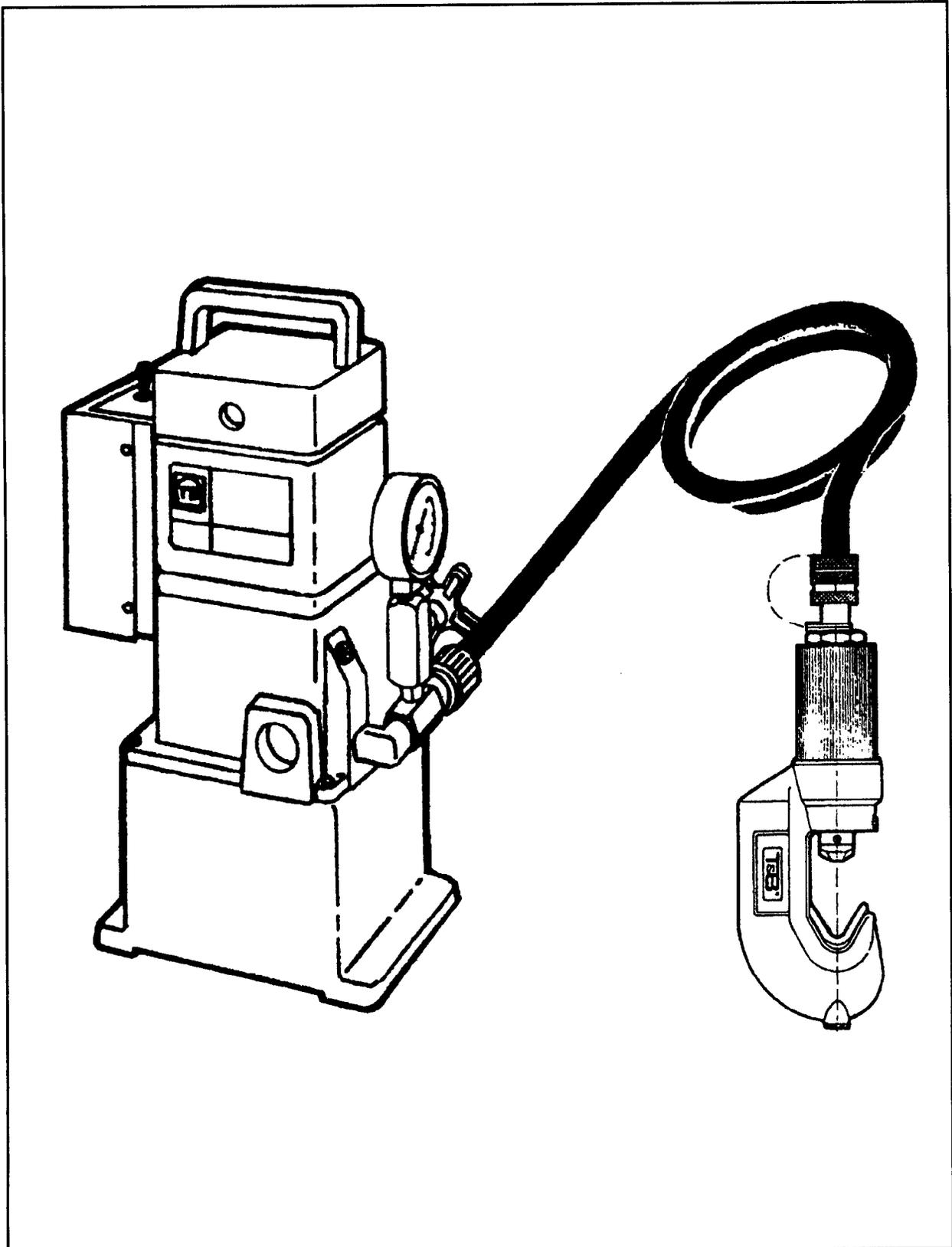
Exhibit 10 - Die Code Cross-Reference and Die-to-Tool Cross-Reference



**CAUTION: DO NOT HOLD HANDLES WITHIN THIS AREA.**

**NOTE:** TBM6S tools are to be equipped with a Caution decal stating **DO NOT HOLD HANDLES WITHIN THIS AREA.** Placing one's hands in the area of the decal during the activation of the tool can cause a finger to be squeezed. Decals may be obtained from your Headquarters Construction Staff.

**Exhibit 11 - Compression Tools**



**Exhibit 12 - Electrically Operated Hydraulic Compression Tool**

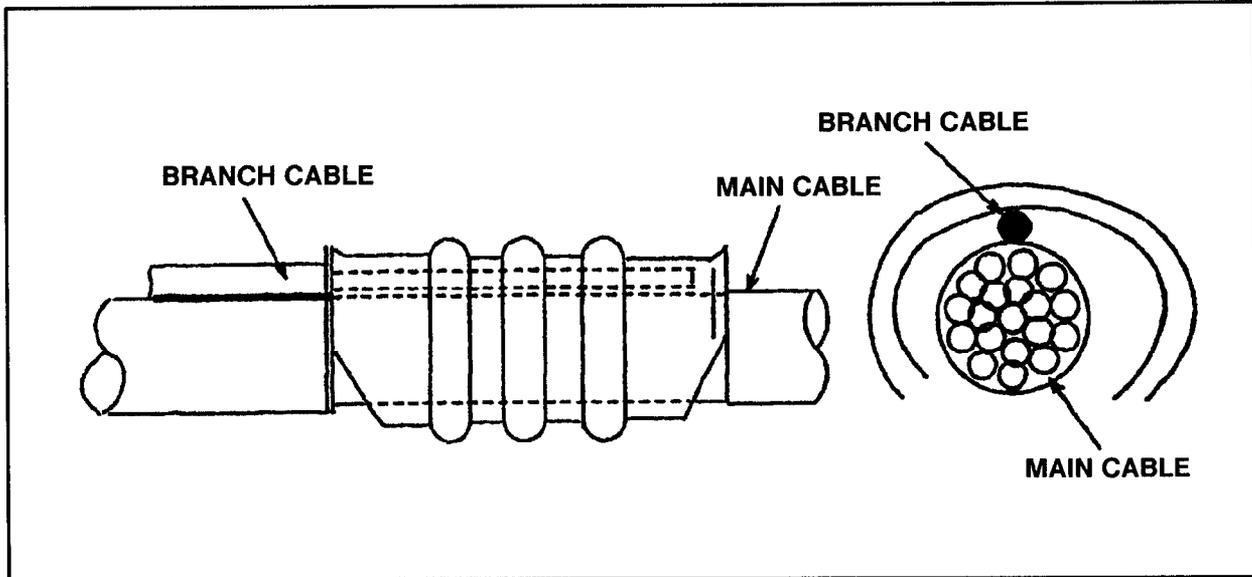


Exhibit 13 - C-Tap Branch Cable Position

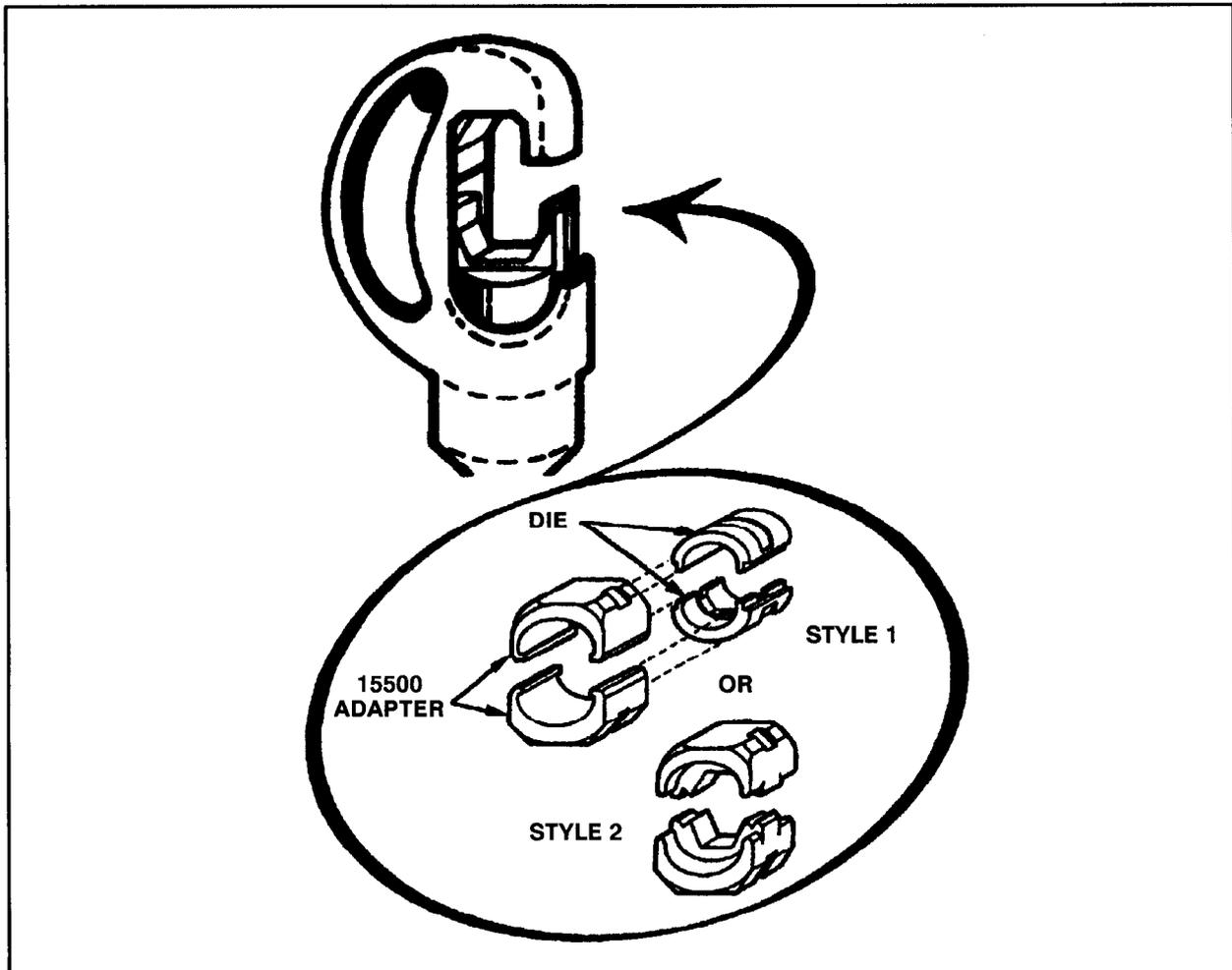


Exhibit 14 - Typical Die Insertion and Removal

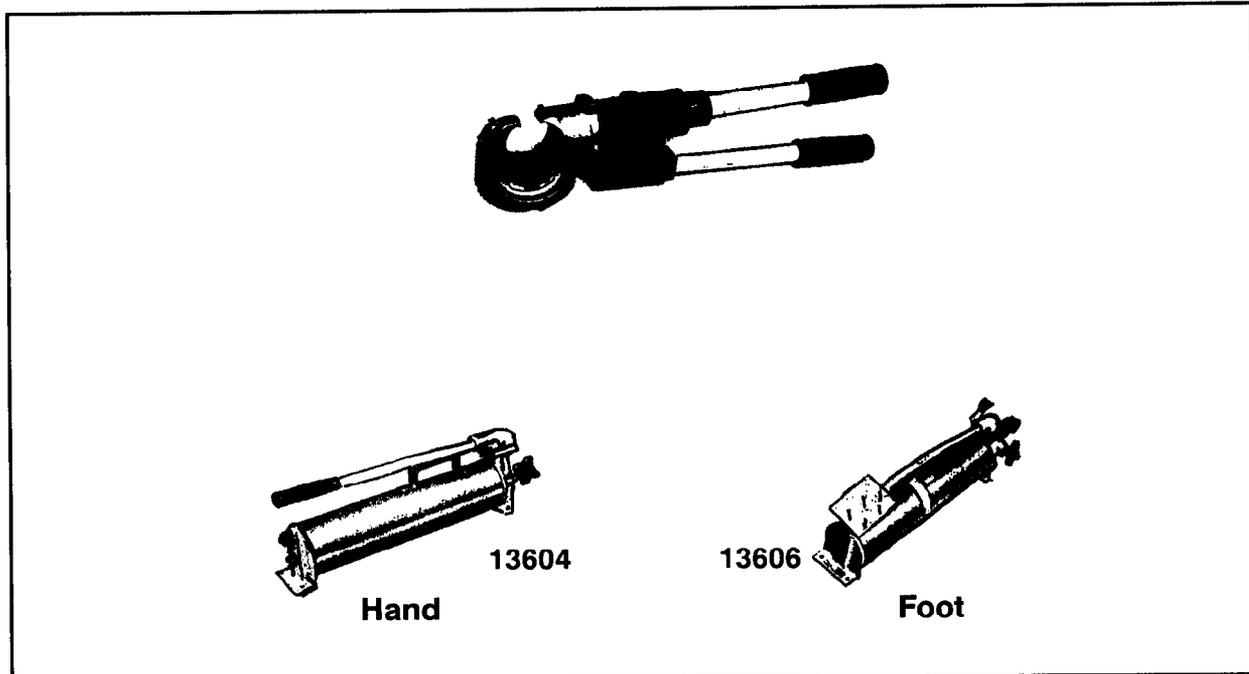
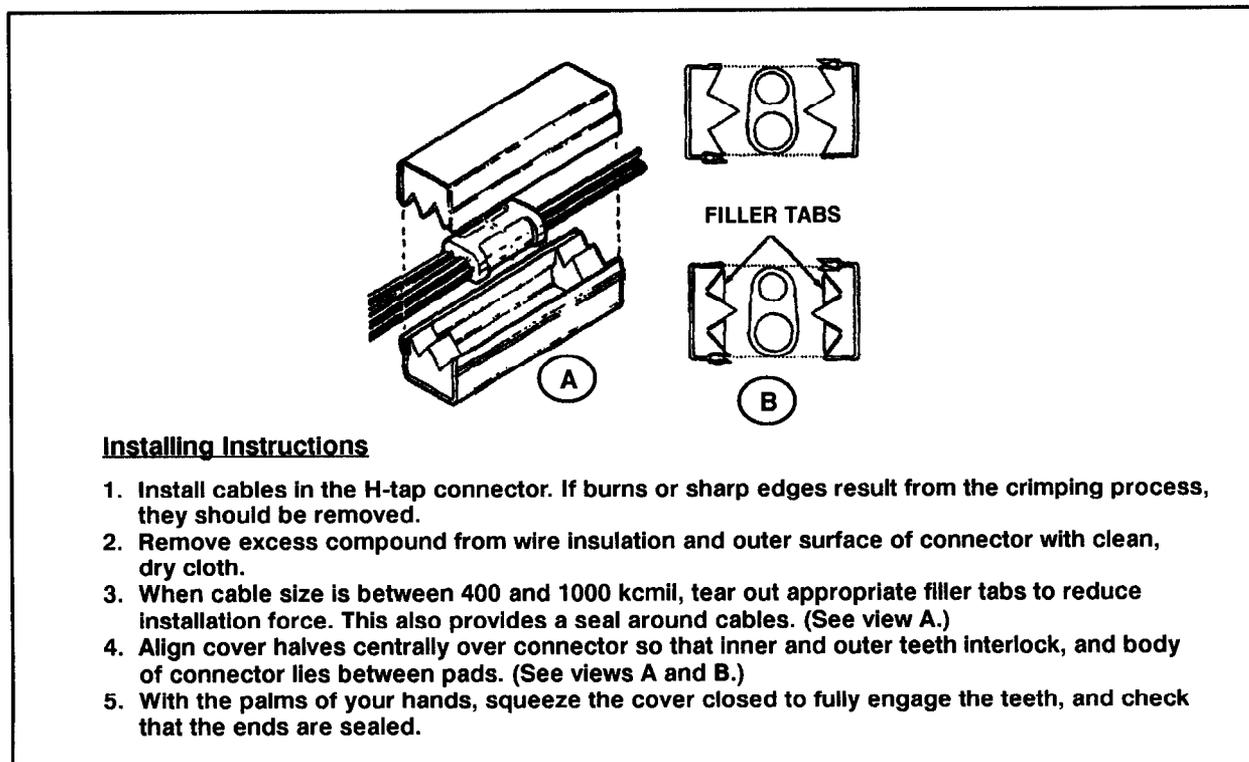


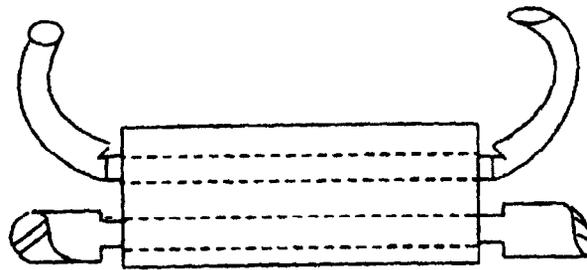
Exhibit 15 - Manually Operated Compression Tools



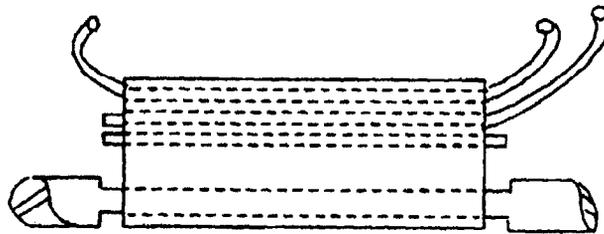
### Installing Instructions

1. Install cables in the H-tap connector. If burns or sharp edges result from the crimping process, they should be removed.
2. Remove excess compound from wire insulation and outer surface of connector with clean, dry cloth.
3. When cable size is between 400 and 1000 kcmil, tear out appropriate filler tabs to reduce installation force. This also provides a seal around cables. (See view A.)
4. Align cover halves centrally over connector so that inner and outer teeth interlock, and body of connector lies between pads. (See views A and B.)
5. With the palms of your hands, squeeze the cover closed to fully engage the teeth, and check that the ends are sealed.

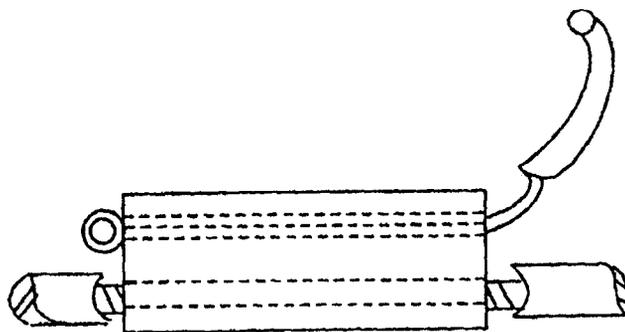
Exhibit 16 - Snap-On Insulating Covers for H-Taps and C-Taps



**Double Tap Using Same Conductor  
(H-Tap or C-Tap)**

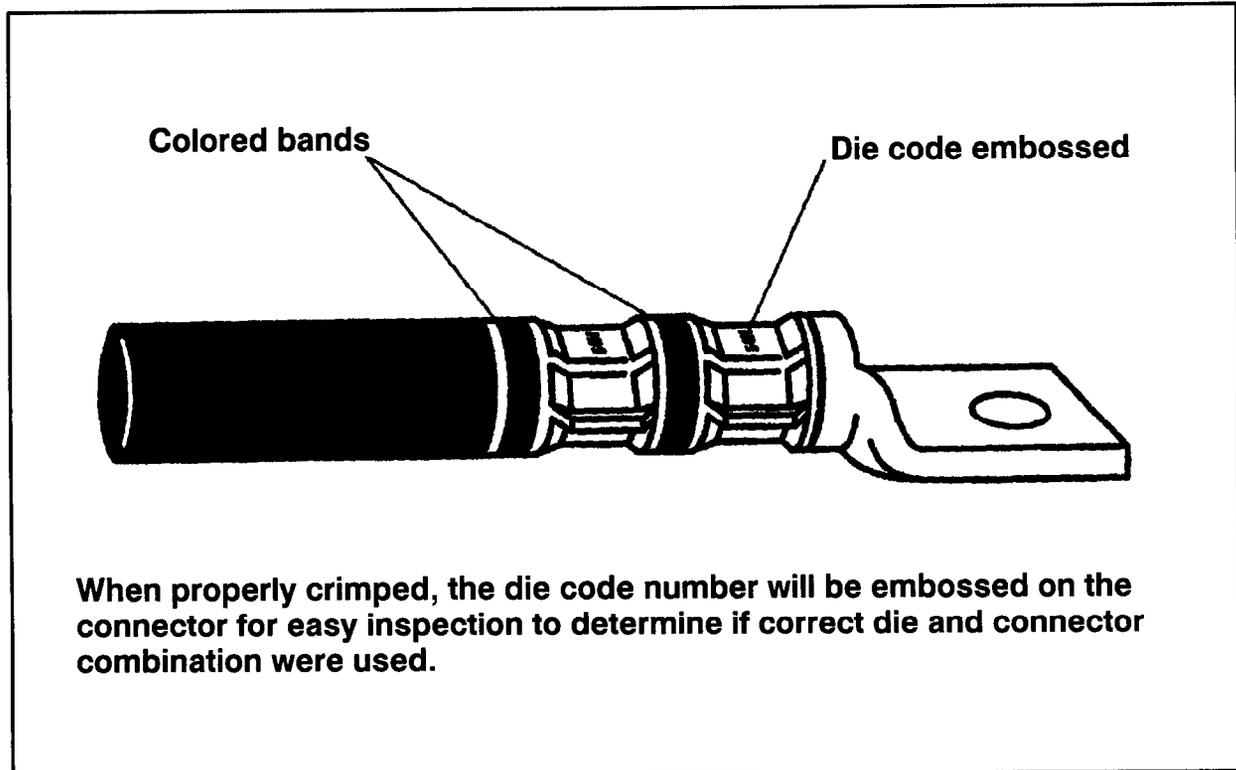


**Multiple Tap Using Several Conductors  
(H-Tap or C-Tap)**

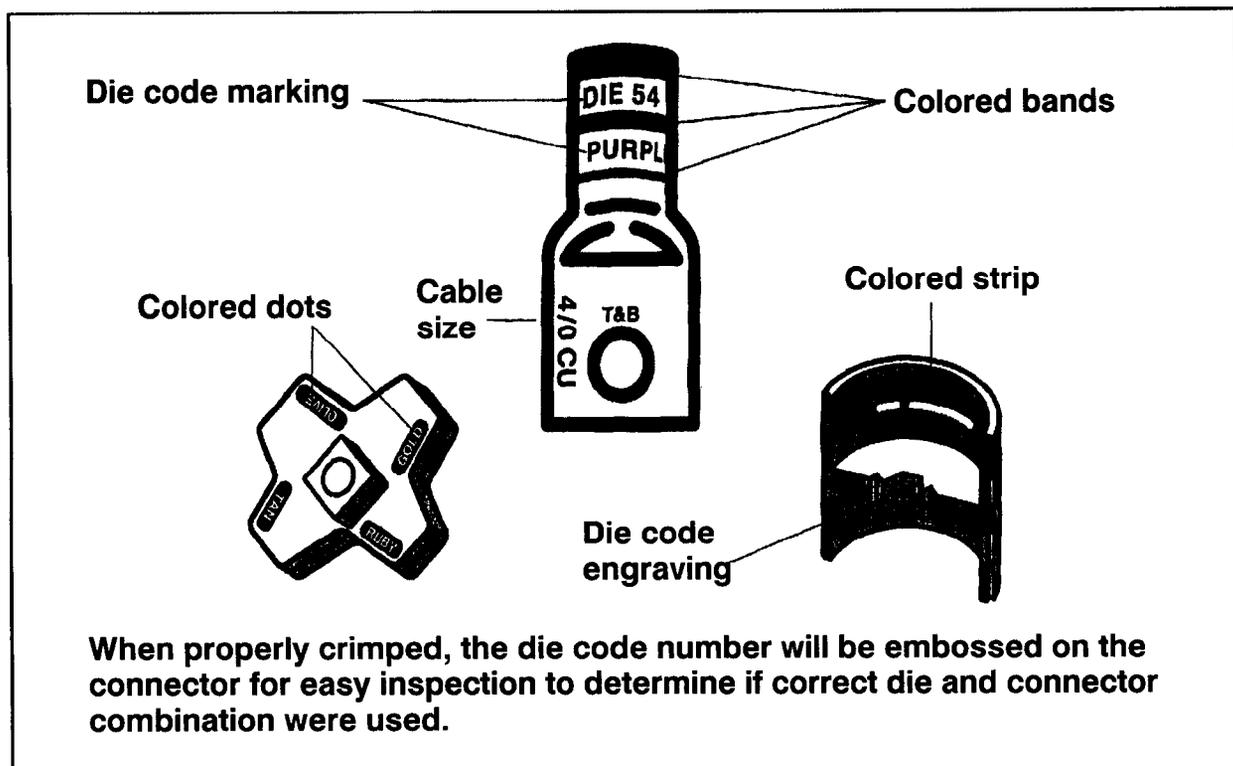


**H-Tap With Doubled Wire**

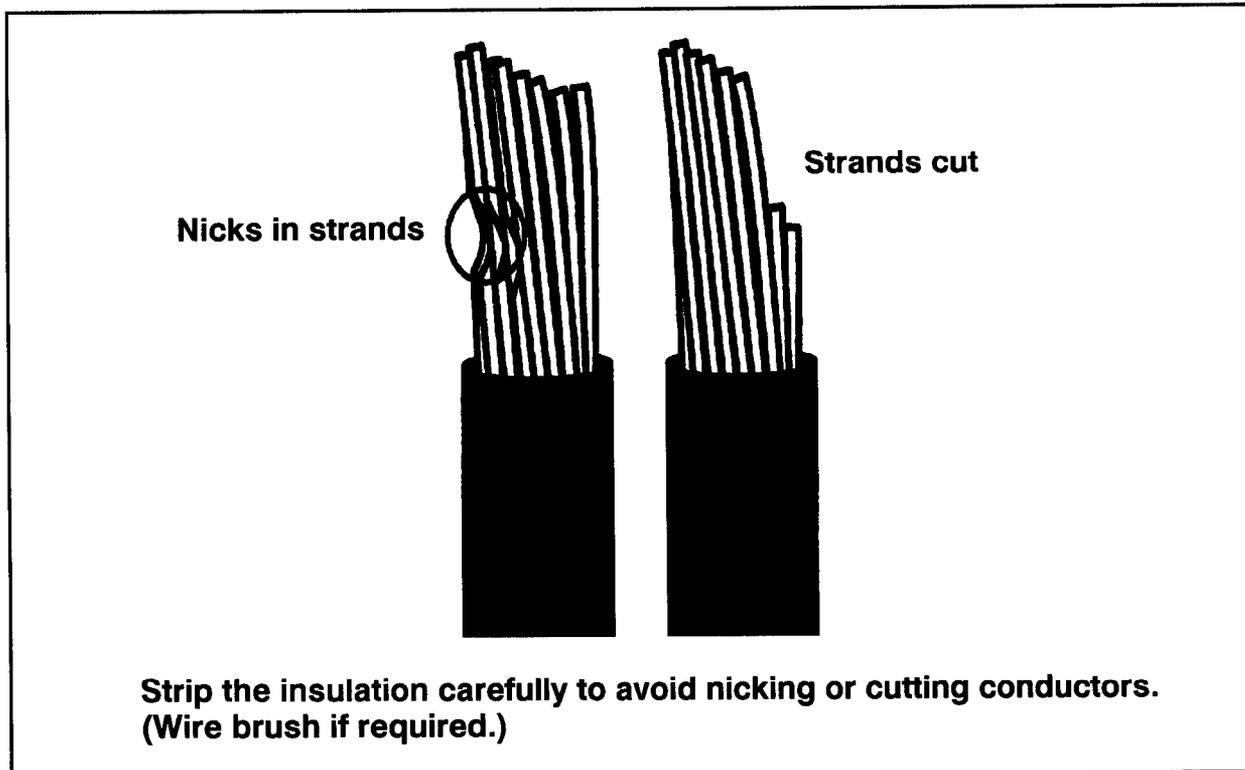
**Exhibit 17 - Multiple Tap Configurations**



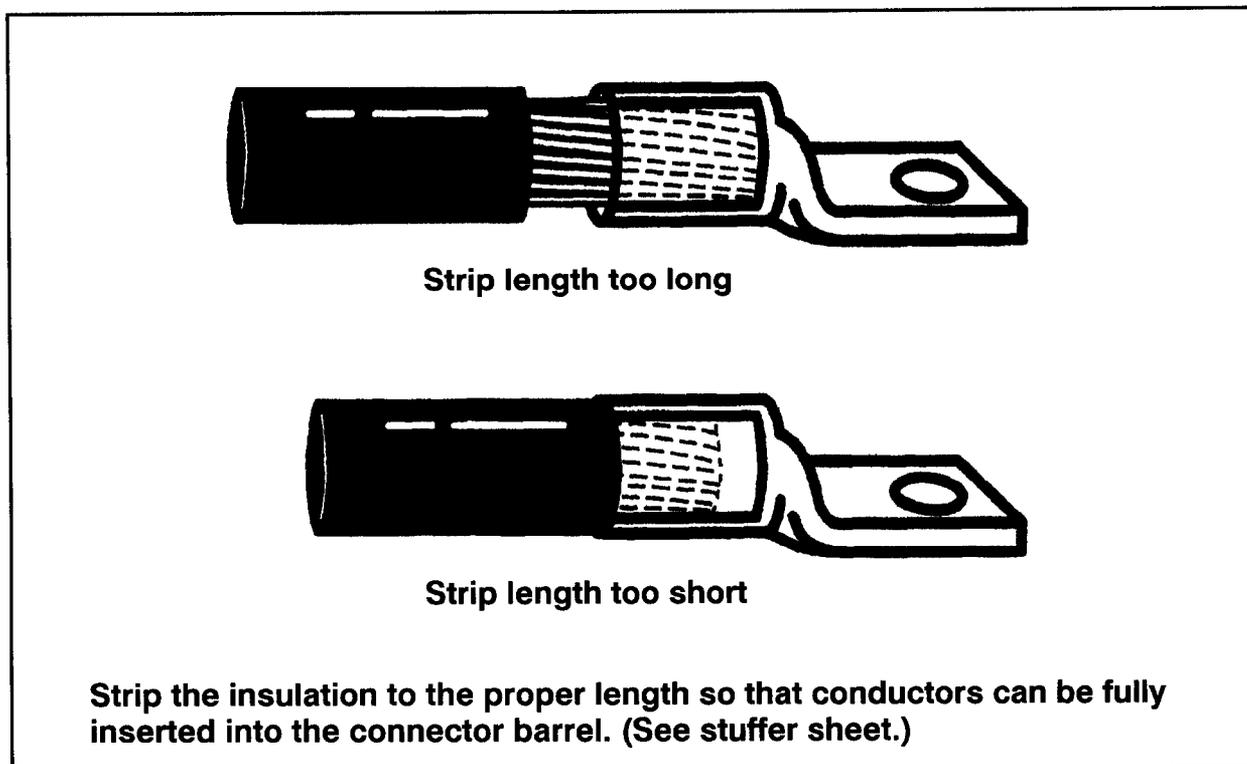
**Exhibit 18 - Die Code Embossed**



**Exhibit 19 - Connector Die Color Coding**



**Exhibit 20 - Incorrect Cable Stripping Methods**



**Exhibit 21 - Cable Insertion into Lug Barrel**