

DISTRIBUTING FRAME PROCEDURES

1. GENERAL

- 1.01 This practice explains and illustrates approved distributing frame procedures (jumper work) required to provide customer service, and replaces CTSP 400-300-400.
- 1.02 In a Central Office, the automatic switching and other equipment is maintained by craftsmen. In most instances, central office distributing frames are the initial training grounds for these craftsmen. In all cases, a contact memo is issued to authorize every installation, move, change, and discontinuance of service. These orders are submitted to the frame forces as work assignments in several different forms, such as contact memo, rack sheet, read order, read-out install order, etc. This practice provides a method of handling these orders, symbols to be used to denote work progress or completion, and special conditions sometimes involved in frame procedures.
- 1.03 *Every precaution shall be taken not to impair or disrupt existing service* and all employees should be familiar with Continental Telephone System Practices regarding special circuit protection. Other CTSP's used for reference and training purposes are:

CTSP 400-300-019 -- Monitoring of Working Lines
CTSP 400-405-001 -- First Aid
CTSP 400-450-110 -- Central and PABX Office Safety Precautions
CTSP 400-700-100 -- Special Safeguarding Measures (SSM) for Leased Circuits
CTSP 400-700-101 -- Safeguarding Special Service Circuits-Clip Type
 Connecting Blocks
CTSP 400-905-070 -- Contact Memo Order--Form CM 1066
CTS 405-700-xxx -- Soldering Irons and Wire Wrap Tools
 (series)
CTSP 410-650-410 -- Soldering Methods
CTSP 430-905-804 -- Rolling Ladders - Inspection
CTSP 430-906-303 -- Intercept Strapping -- Description and Methods
CTS 490-700-xxx -- Main Frame Terminations
 (series)

2. TOOLS AND MATERIALS

- 2.01 The following tools and materials are required when running jumpers:
- a. Iron, soldering.
 - b. Holder, soldering iron.
 - c. Stick, probing (orange stick).
 - d. Pliers, longnose.
 - e. Pliers, oblique cutting.
 - f. Stripper.
 - g. Brush, rubberset.
 - h. Pouch, tool.

- i. Rubber gloves and canvas bag holder.
- j. Frame Bag (for wire clippings and jumper scraps).
- k. Wiping cloth (for copper tip).

2.02 The following tools are required when making solderless wrapped connections:

- a. Electric wrapping tool.
- b. Hand wrapping tool.
- c. Combination 22-24 gauge bit.
- d. Combination 22-24 gauge sleeve.
- e. Unwrapping tool.
- f. Holder for wrapping tool.

3. SAFETY PRECAUTIONS

3.01 Employees are expected to make use of all safeguards provided for their protection and that of their fellow employees and to observe the following precautions:

- a. When using a rolling ladder, make sure the brake is set.
- b. When pulling or passing jumper wire, take care to avoid injury to hands and arms.
- c. Double back the end of the jumper wire before unreeling. This will reduce the risk of puncture wounds and aid in preventing the free ends from sagging.
- d. Do not stand or climb on the transverse arms of distributing frames.
- e. While working on or near distributing frames, eye protection must be worn at all times.
- f. Use rubber gloves when working near breakdown voltage tests.

4. FRAMES AND ASSOCIATED EQUIPMENT

4.01 Distributing frames are open metal frameworks which provide neat, accessible terminating facilities for outside cable pairs, central office line circuits, and other central office equipment. Connections can be made by simply changing jumpers, which allows the central office cabling to be largely a permanent installation.

4.02 Main distributing frames (MDF) are frames on which the outside telephone lines terminate on one side; the multiple cabling of the lines and trunks of the office terminate on the other side. The central office protective equipment is usually mounted on the MDF, which serves as a test point between the individual telephone lines and the central office. There are two types of MDF:

- a. *Type A* has all outside lines and cables terminated on the horizontal side; the vertical side has all connections to central office equipment and protective devices for the lines or cable pairs.

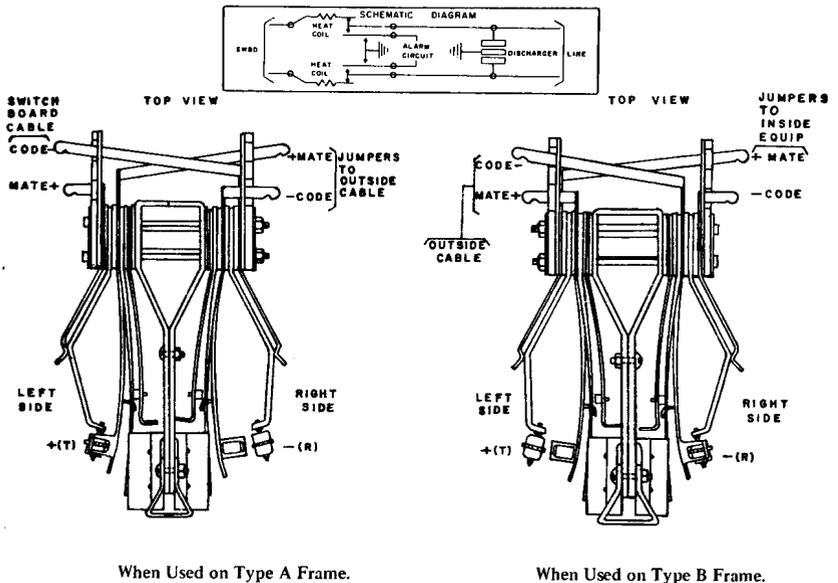
- b. *Type B* has all outside lines for cables and their protective devices terminated on the vertical side; the central office equipment terminates on the horizontal side. *Type B* is the more commonly used.
- 4.03 Line intermediate distributing frames (LIDF) are used to provide neat and flexible facilities for terminations and cross-connections that are intermediate in the switching sequence. The frames are similar to the MDF in construction and cross-sectional dimensions, but do not have protectors. On one side, wiring is terminated to terminal blocks mounted horizontally. Jumpers between terminal blocks permit the adjustment of trunking arrangements.
- 4.04 Combined distributing frames (CDF) are usually located close to the cable vault. The CDF is designed for type B protection, with the outside cable pairs terminated on protectors mounted vertically on one side of the frame, and central office equipment on terminal blocks mounted horizontally on the other side. A CDF combines the functions of an MDF and LIDF; therefore, no separate LIDF is required.
- 4.05 The trunk intermediate distributing frame (TIDF) is similar to the CDF in construction and cross-sectional dimensions, but terminal blocks are mounted vertically on one side and horizontally on the other. Many of the central office trunk circuits are terminated on these blocks and are crossconnected by means of jumpers. The TIDF is designed to be lined up with and connected to the CDF to form a single assembly. This permits the running of jumpers from either side of the TIDF to either side of the CDF, and vice versa.
- 4.06 The major components of the frame are:
- a. *Jumper rings* serve to guide jumpers where they make sharp changes in direction and have an insulated cover to protect the jumper wire insulation from chafing against the framework.
 - b. *Guard rails* and end guard rails are lengths of angle iron used to protect the terminal blocks from damage by rolling ladders and other floor equipment. End guards are similarly mounted to protect the ends of the frame. These guards form a continuous protection, extending slightly beyond the fronts of the terminal blocks and protectors.
 - c. A *ground bus bar* of flat, hard, drawn copper is furnished with each vertical assembly. When connected, the entire frame is equipped with a continuous ground connection that is both electrically and mechanically strong. A ground lead connects the ground bus bar to the central office ground.
 - d. The *central office protector* (spring and terminal assembly) provides cable termination and protects central office equipment and personnel from excessive, high foreign voltages and/or *sneak* currents. There are several different types in general use but their function is the same.
 - (1) One type of protector, the Cook 3800 central office protector, is shown in Figure 1. In operation, the protector opens the switchboard circuit, grounds the outside line, and operates an alarm circuit. It provides for temporary disconnect, and the self-soldering heat coils can be reset easily without changing the coil. Line connections are on one side of the protector and switchboard connections are on the other side. The protector is reset after operation simply by relatching the operating spring over the heat coil.
 - (2) The *test plug* (shoe) shown in Figure 2 is designed to fit the type 3800 protector. Test plugs are used to test line circuits through or around the heat coils. The test plug divides the circuit so that tests can be made looking either to the outside plant or to the central office equipment.

- (3) *Carbon protector blocks* (also known as carbon blocks, protector blocks, open space cutouts, or carbons) are essentially lightning arresters. They serve to protect the central office equipment from excessive voltages which might result from power contacts and protect the outside plant from the effects of lightning.
- (4) The plain carbon block fits into a groove of the protector mounting base which is grounded. If the line becomes crossed with a power circuit or is hit by lightning, the high voltage impressed on the line causes an arc to form across the air gap to the grounded block, effectively shunting the line to ground and dissipating the voltage. Frequently the protector blocks show marks of arcing after a foreign voltage has been discharged through the blocks to ground. Whenever heat coils are replaced, remove and inspect the protector blocks and inner surfaces for discoloration or pitting. Discolored, pitted or broken blocks should be replaced.

e. *Heat Coils:*

- (1) Heat coils are used in conjunction with carbon protector blocks to protect the central office equipment from small values of continuous current called *sneak* currents. The heat coils, which are directly in each side of the line, will operate whenever a faulty condition occurs which permits a small value of current to flow in the circuit for any length of time. These heat coils are rated to ensure operation at a current of .35 A for three hours at 68° F. or .5 A for 210 seconds at 68° F.
- (2) When operated, the Cook type 3800 heat coil opens and grounds the line. The heat coil is self-soldering and contains two small triggers. The circuit normally passes through the springs, through the heat coils, and then through the heavily tensioned spring which rests against the triggers when the coils are normal. When too much current flows through the coil, solder in the coil is melted, which in turn causes a trigger to rotate. The rotating alarm spring is pressed against the grounded protector mounting plate, while the heavily tensioned spring rests against the carbon protector blocks. After a heat coil has become hot enough to melt the solder and then cool, the solder hardens and holds the trigger so that the trigger cannot rotate. A heat coil of this type can be used repeatedly by removing it and reinserting it so that the trigger engages the heavily tensioned spring. An alarm lamp (called the *telltale* alarm lamp), is associated with each vertical. One side of this lamp is connected through a switch to battery. The other side is connected through the alarm spring of the protector to ground. Any heat coil operating will cause the lamp to light.

- f. *Fanning strips* are mounted on each vertical. The left-hand fanning strip has staggered holes, one for each of the cable pairs terminated on the left side of the protectors. The right-hand side also has staggered holes, one for each jumper that can be terminated on that side. The holes are positioned so that each is opposite a pair of terminals on the protector assembly.
- g. *Terminal boards (or blocks)* are generally defined as T-bar sections of wood and other insulation such as molded, hard black rubber. The stem of the T carries double ended terminals held transversely in rows. The base of the T (called the mounting base) has holes opposite both ends of the terminals which serve as a fanning strip for cables or jumpers. Terminal boards provide terminating facilities on the horizontal side of the CDF, and both the vertical and horizontal sides of the IDF.
- h. *Distributing blocks* are similar in construction to terminal boards. One side is permanently wired, while the wiring on the other side can be changed.



NOTE: Cable wires connected to left side of protector block.
 Jumper wires connected to right side of protector block.

FIGURE 1. Cook 3800 Central Office Protector

5. DISTRIBUTING FRAME CROSS-CONNECTIONS

- 5.01 The terms *cross-connection* or *jumper* are applied to twisted insulated conductors used to provide flexible assignment of inside plant equipment. Generally, all fixed plant is permanently cabled to a distributing frame. Connections between various equipment are then made with jumpers. *Cross-connection work is one of the most important operations performed in the central office.* Before running any jumpers, verify all terminal locations to avoid errors and save time. Refer to paragraph 6.01.
- 5.02 Twenty-two gauge distributing frame wire should be used on all frames, except for single conductor jumpers. Because of its increased mechanical strength, 20-gauge wire should be used for single conductor jumpers.
 - a. Two-conductor jumpers have white and red insulated wire. The white wire, called the *tip*, is used to connect to the positive ground (+) side of the line. The red wire, called the *ring*, is used to connect to the negative battery (-) side of the line.
 - b. Three-conductor jumpers have white, red, and blue wires. The third (blue) wire is called the *sleeve*; it is the control (C) lead wire and controls the guarding, holding, and releasing of switches, and holds switches operated to guard them against seizure by other calls.

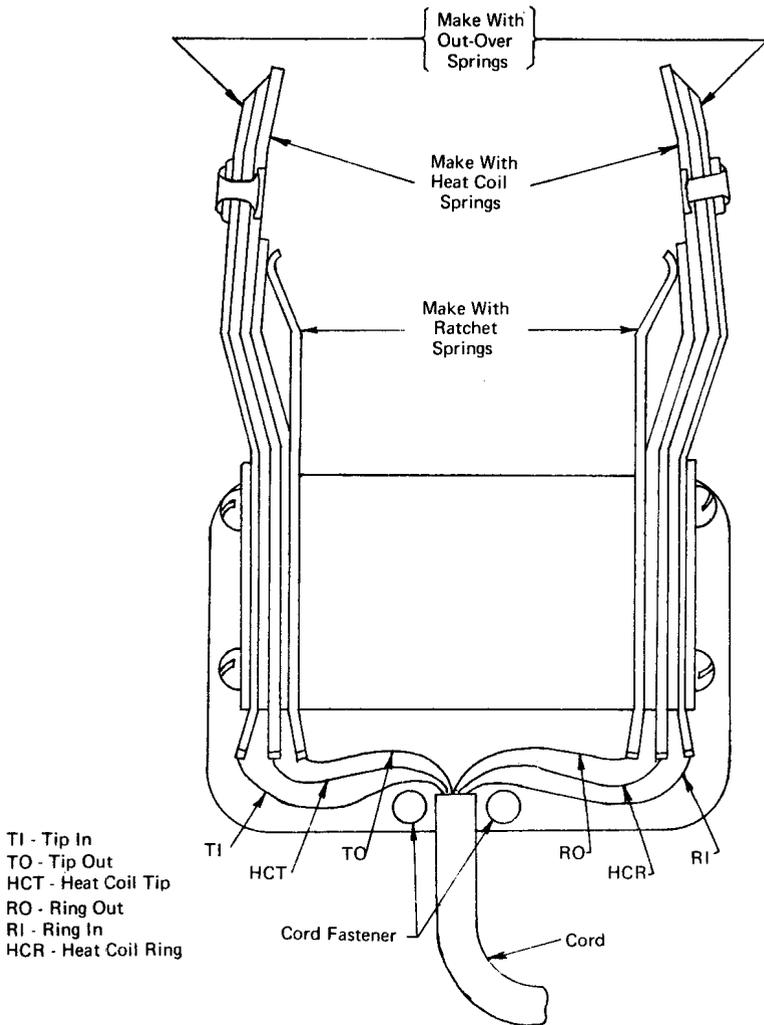


FIGURE 2. Cook 3800 Test Plugs (Shoes)

The test plugs (shoes) are used to test line circuits through or around the heat coils dividing the circuit into its compound parts, thereby simplifying the testing operation. The test plug (shoe) is designed to fit the Central Office Protector (3800).

- c. Four-conductor jumpers have white, red, blue, and black wires. The white wire is the *tip (+)*, the red is the *ring (-)*, the blue is the control (C, S, or B₁) lead and the black is the extra control (EC, HS, or B₂) lead. The fourth (EC, HS, or B₂) wire is used in making connections to equipment such as the distributing terminal assembly (DTA) frame and the trunk intermediate distribution frame (TIDF).
- 5.03 Jumpers are usually run from the horizontal side of a frame to the vertical side. When running in or handling jumpers, do not allow the wires to become kinked. At the point where a jumper enters a jumper ring, place it in such a way that it will neither bind against nor cross over other jumpers or jumper ring bars.
- 5.04 Figure 3 is a line drawing of jumpers entering and leaving a ring and is being used *only* to illustrate the distribution of jumpers to different sections of the ring, depending on the direction of origin and termination. Figures 4, 5, and 6 illustrate the correct use of rings when running jumpers, i.e., with the wire slack and *resting lightly* against the rings.

NOTE: Continuous jumper activity may loosen jumper rings. Loose rings should be tightened as soon as possible to prevent complications in jumper running.

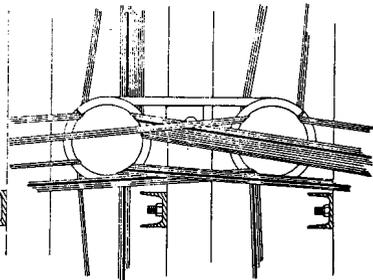


FIGURE 3. Line Drawing Designed to Illustrate How Jumpers, Ideally, Should Enter and Leave Rings.

- 5.05 The majority of unacceptable (crossed and poorly placed) jumpers are those run from right to left on the horizontal side. These jumpers are run through rings on their particular horizontal levels, then to connecting blocks on the vertical side. Proper procedures are:
- a. Run the jumper into a ring on the same horizontal level with the jumper wire entering near the top inside edge. See Figure 4.
 - b. If the jumper is to go to a connecting block three or more levels below its horizontal level, use the right hand to bring it around inside and to the bottom of the ring. Place the left hand under and behind the ring to receive the jumper (see Figure 5) and place it in a downward position (see Figure 6). This type of jumper may be run in front of existing jumpers on the vertical side. Run as directly as possible into the proper connecting block hole.
 - c. If the jumper is to go to a connecting block three or more levels *above* its horizontal level, proceed as in paragraph 5.05 a. Then bring the jumper out *in front* of existing jumpers on the vertical side and run it as directly as possible into the proper connecting block hole.

- d. If the jumper is to go from its horizontal level *straight across* (or less than three levels up or down), proceed as in paragraph 5.05 a. Then bring the jumper around the inside edge of the ring to a point where it can run as directly as possible into the proper connecting block hole. Run it *behind* the existing jumper on the vertical side.
- 5.06 Run jumpers from *left to right* as described in paragraph 5.05. Jumpers should be placed *in front* of existing jumpers on the vertical side. As stated in paragraph 4.04, the jumpers should lie against the jumper rings when they have been run and tied down.
- 5.07 Run short horizontal jumpers (within three verticals of straight across) *underneath* all other jumpers but *on top of* the ironwork of their respective levels (see Figure 7). In most instances, they will then cause the least possible interference with other jumpers in the rings through which they are run. Run these jumpers through the rings so that they pull on the inside edge of the rings and go as directly as possible to the proper connecting block holes.
- 5.08 A contact memo (or rack sheet) may require that a jumper be run from one block on a horizontal level to another block on the same level. This type of jumper should be run through a ring at least one vertical to the *right of the right-hand* block of the two on which it is to terminate. The jumper will then lie against the ring when it is tied down to the connecting block.
- 5.09 An order may require that a jumper be run from one block on a vertical to another block on the same vertical. This type of jumper should be run through a ring at least one level *above* the *higher* of the two blocks on which it is to terminate. The jumper will then lie against the ring when it is tied down to the connecting block.
- 5.10 Avoid weaving jumpers through existing jumpers or between the individual conductors of an existing jumper. Be sure to keep jumpers above the horizontal ironwork and inside the vertical ironwork of the frames (see Figure 7).
- 5.11 Run lineswitch-to-X-block jumpers as directed by the central office foreman. Allow approximately 5 inches of slack (measured from the point of tying down), so that jumpers can be pulled.
- 5.12 To prevent a congestion of jumpers on one level and one ring, run cable ties on different levels.
- 5.13 When running used jumpers, remove all kinks and knots. Inspect the wire and discard any with damaged insulation.
- 5.14 Be sure to run the jumpers through the correct holes in the fanning strips of connection blocks (see Figure 8). Avoid crossing jumpers at the holes of blocks on the vertical side of the LIDF. If a jumper comes to a block (vertical) from a higher (horizontal) level, do *not* run it around existing jumpers in the outer row of holes (see Figure 8) to get to the inner row. Pull existing jumpers in the outer row toward the outer edge of the block. This will clear a *straight run* to the hole in the inner row. Make every effort to avoid running a jumper in such a way that it will interfere with another jumper.

6. TYING DOWN JUMPERS

- 6.01 If a jumper is working on a location assigned for a new jumper to be run, verify the assignment. If the assignment is correct, pull the old jumper and give the complete information to Line Assignment forces. This ensures that if the assignment is incorrect, corrections will be made before work is called for by outside plant forces.

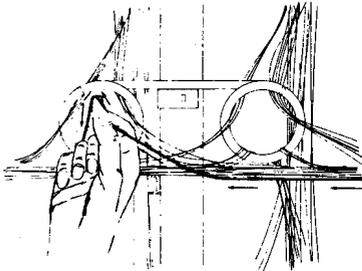


FIGURE 4. Right Hand Receiving a Right-to-Left Jumper (HLIDF) and Placing It Into Ring at the Top Inside Edge.

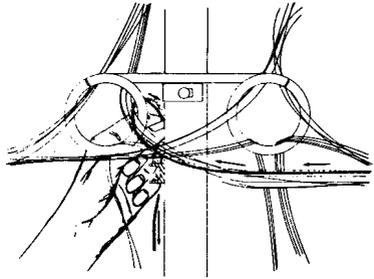


FIGURE 5. Left Hand Placed Under and Back of a Ring to Receive a Right-to-Left Jumper (HLIDF).

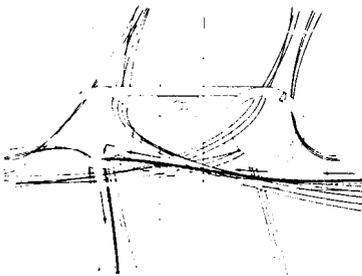


FIGURE 6. Tied-Down Jumper Correctly Placed Against the Bottom Inside Edge of a Ring.

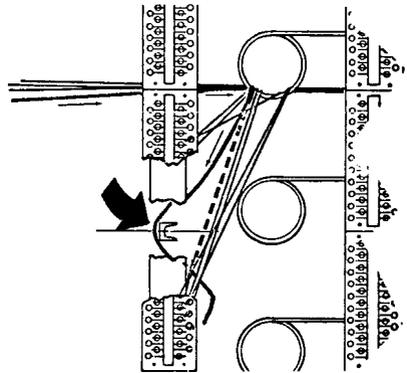


FIGURE 7. Large Arrow Points to Jumper Run Outside Vertical Ironwork. Broken Line Represents Correct Run.

- 6.02 Before stripping insulation from jumper wire, place the distributing frame bag on the shelf below the shelf where the work is to be done. Make sure there will be approximately 4 inches of slack in the jumper when it is tied down. Measure the slack by making sure the jumper length will extend the width of a hand beyond the front edge of the block. (An exception to the 4-inch slack requirement applies to jumpers run directly across the horizontal side; in this case, allow only enough slack for pulling and to prevent binding.)
- 6.03 Untwist the jumper back far enough so the wires will come through the fanning strip parallel to each other. Wrap the wires so that insulation comes just to the notch of the pin as shown in Figure 9. Allow for stretch in the case of plastic insulation. Figures 9 through 17 show typical terminations.

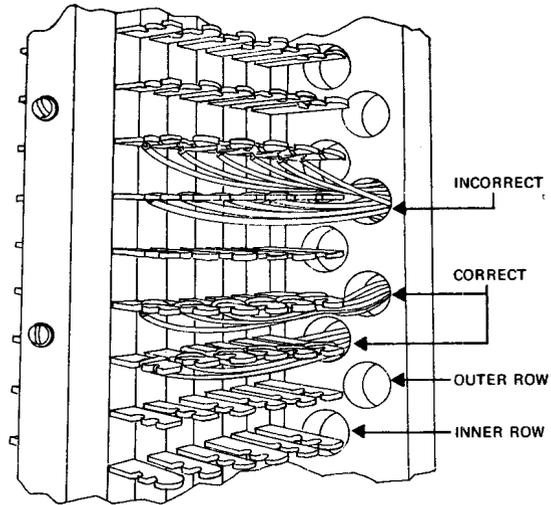


FIGURE 8.

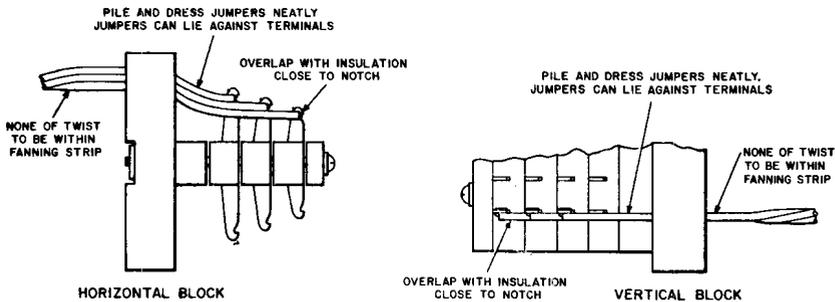
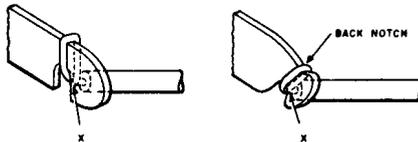


FIGURE 9. Termination of Wire on Terminal Strip

6.04 With the jumper supported against the fanning strip, break off the wire on the terminal by a series of up and down motions for *horizontal* terminal strips, or left and right motions for *vertical* terminal strips. The motions should be in a direction parallel to the flat surface of the terminal to avoid strain on the terminal. This method avoids crossing the wires with other terminals of the terminal strip, or crossing the pliers with terminals when cutting the wire.

NOTE: Twenty-gauge wire may be cut instead of broken. Excess cut or broken wire should not be allowed to fall on terminal strips, protectors, floor, etc.

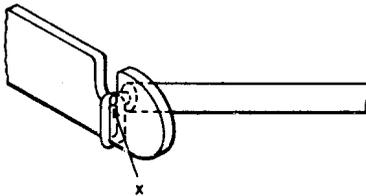
- 6.05 To terminate a wire on the terminal of a protector where the notch appears on the *underside* of the terminal (as shown in Figure 10), bring the wire under the terminal, up through the notch, along the front of the terminal, over the top edge (or through the back notch, where provided), and down the rear side, making one complete turn of bare wire around the terminal. Cut or break the excess wire at point X.



**FIGURE 10. Termination of Wire on Protector
with Notch on Underside of Terminal**

- 6.06 To terminate a wire on the terminal of a protector where the notch appears on the *upper side* of the terminal (as shown in Figure 11) bring the wire through the notch, down the front side, and up the rear side, making one complete turn of bare wire around the terminal. Cut or break the excess wire at point X.

NOTE: If a protector is broken, replace the defective terminal (or spring), using a spring bender or appropriate size wrench. Do not terminate the jumper wire on the spring on the cable side of the protector as this will remove the protection on the side of the line affected and create a fire hazard.



**FIGURE 11. Termination of Wire on Protector
with Notch on Upper side of Terminal**

- 6.07 To terminate a wire on a type 444 jack, pass the wire through the proper hole in the fanning strip (as shown in Figure 12), bring the wire under the terminal, up through the notch, across the top of the terminal, and down through the back notch (as shown in Figure 13). Cut or break the excess wire at point X.
- 6.08 To terminate a wire on a terminal of a type 65 (or similar) terminal strip, bring the wire along the left side of the terminal, through the notch, back along the right side of the terminal, and across the top (as shown in Figure 14). Cut or break the excess wire at point X.
- 6.09 When terminating jumpers on terminal strips of the type shown in Figure 10, first connect the wire on the terminal nearest the front and then work toward the rear of the block.

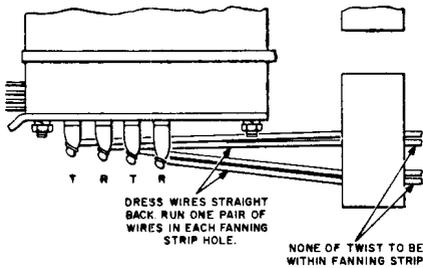


FIGURE 12. Termination of Wire on Type 444 Jack at MDF

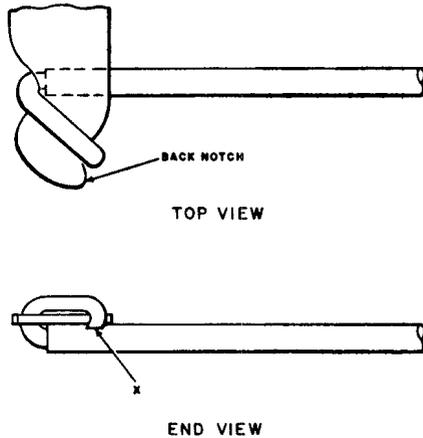


FIGURE 13. Termination of Wire on Terminal with a Back Notch

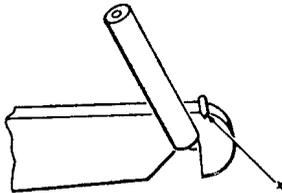


FIGURE 14. Termination of Wire on Terminal of Type 65 (or Similar) Terminal Strip

6.10 To terminate a wire on a terminal which is in a vertical position (horizontal IDF), with a single notch (either with or without a back notch), bring the wire along the left side of the terminal, through the notch, along the right side of the terminal, and across the back (or through the back notch, where provided). See Figure 15. Cut or break the excess wire at point X.

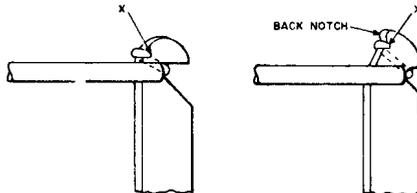


FIGURE 15. Termination of Wire on Vertical Terminal with a Single Notch

- 6.11 To terminate a wire on a terminal which is in a *horizontal* position (vertical IDF), with a single notch (either with or without a back notch), bring the wire along the bottom of the terminal, through the notch, back along the top of the terminal, and terminate at the back (or back notch, where provided). See Figure 16. Cut or break the excess wire at point X.

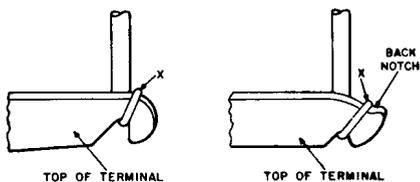


FIGURE 16. Termination of Wire on Horizontal Terminal with a Single Notch (Top View)

- 6.12 To terminate wires on a terminal strip where the terminals have twin notches or double twin notches and only one set of leads is required, connect them in the outer notches unless it is necessary to reserve these notches for strapping, subject to change in service. The jumpers should be terminated as described in paragraphs 6.10 and 6.11 and as shown in Figure 17.

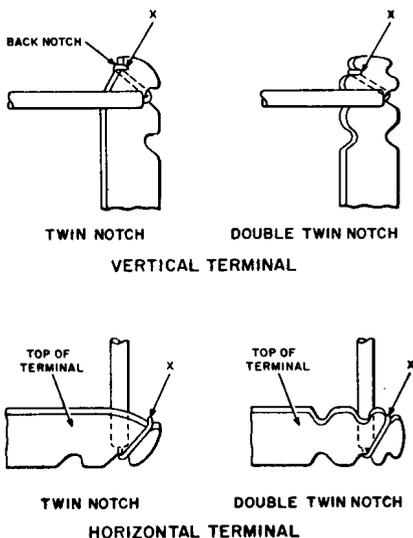


FIGURE 17. Termination of Wire on Terminal with a Twin Notch or Double Twin Notch

- 6.13 Where a second jumper is to be terminated on the same terminal with another jumper, the first jumper should be unsoldered and removed and both the terminal and the notch in the terminal freed from all excess solder. The two jumpers should then be terminated in the same notch.
- 6.14 Immediately after wire is connected to the terminal, it should be soldered.
- 6.15 Tie down as many jumpers as possible called for on rack sheets, but do not connect normals until called for by the installer.
- 6.16 The frameman on the vertical side should tie down all jumpers as he receives them. If jumpers cannot be tied down at the time they are caught, tie them in the wood. Pull out the loose ends for easy visibility, except when jumpers are *hold sheet* items. In such cases, tie the jumpers in the wood and tuck the loose ends back into existing jumpers. (The frameman should be able to look down the frame and easily detect the jumpers to be tied down and the tails of kills to be cleaned off.)
- 6.17 When a jumper is to be terminated on the back pins, tie a knot in the loose end.

7. WRAPPED CONNECTIONS

- 7.01 *Solderless Wrapped Connections:* The *minimum* number of turns around the terminal shall be 6 complete turns for 24-gauge wire, and 5 complete turns for 22-gauge wire. A skinned length of 1-5/8 inches should be sufficient for 22- and 24-gauge wire to permit the required number of turns around the terminal. See Figure 18. More than the required number of turns is permissible. To be sure satisfactory connections are being made, check them periodically.
- 7.02 *Soldered Wrapped Connections:* A *minimum* of three complete turns around the terminal shall be made for soldered wrapped connections. A skinned length of 3/4 inch should be sufficient to permit the required number of turns around the terminal. See Figure 19. More than the required number of turns is permissible.
- 7.03 *Skinning Leads:* Care must be taken when skinning leads for wrapped connections. It is important that the leads are not *nicked* or *flattened*. Do not bend the wires as this makes it difficult to insert the wire ends into the wire feed slot of the bit.

NOTE: Before skinning cable conductors on the equipment side of terminal strips, the wires shall be in their final position.

- 7.04 *Wrapping Leads:* Wrap leads as follows:

- a. Insert the skinned portion of the lead into the feed slot of the wrapping bit; ensure that no bare wire is showing. Bond the insulated portion of the lead into the anchoring notch as illustrated in Figure 20. Hold the wire taut in the anchoring notch and push the tool onto the terminal. Use of the left or right anchoring notch is determined by the direction of approach:

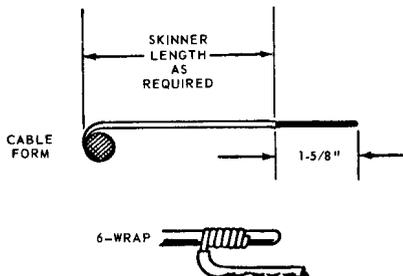


FIGURE 18. Skinned Wire Required for a Solderless Connection

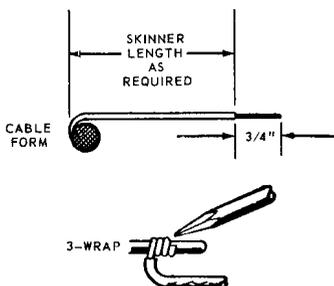


FIGURE 19. Skinned Wire Required for a Soldered Connection

- (1) A lead dressed to the left of the terminal is placed in the left anchoring notch.
- (2) A lead dressed to the right of the terminal is placed in the right anchoring notch.

NOTE: If the wire is not inserted up to the insulation, a shiner may result. A shiner shall not be longer than 1/8 inch. A longer length shiner is potential trouble.

- b. The tool shall be inserted over the terminal as far as it will go without touching the terminal molding.

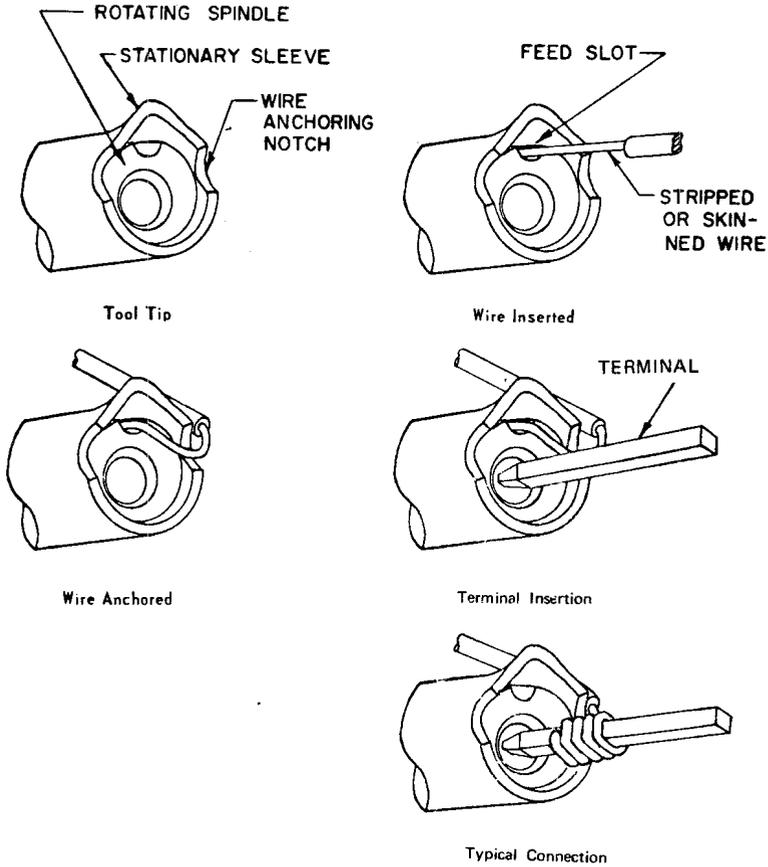


FIGURE 20. Solderless Wrapped Connection Process.

- c. The tool shall be in a direct line with the terminal before being operated.
- d. Operation of the trigger will wrap the wire on the terminal. The tool will automatically move backward as the wire coils on the terminal, producing a finish connection.
- e. Insufficient pressure on the tool when wrapping may cause separation as shown Figure 21.



FIGURE 21. Separated Turns Resulting from Insufficient Pressure

- f. Excessive pressure on the tool when wrapping can cause overriding (overlapping) turns as shown in Figure 22.

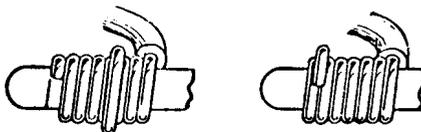


FIGURE 22. Overriding (Overlapping) Turns Resulting from Excessive Pressure

- g. While it is not necessary for the wire end to be flat against the terminal, in no case should it project to the extent that the required 1/64-inch clearance between the wire and an adjacent terminal cannot be maintained. In addition, the wire end must not extend over 1/8 inch.
- h. Where the clearance between the wire end and the adjacent terminal is not the required 1/64 inch (or the wire end extends 1/8 inch), the wire end can be wrapped down using the wire wrapping tool, pliers, spudger or similar tool. This connection shall be soldered.

7.05 More than one wire per terminal:

- a. Where more than one connection per terminal is necessary, the method of wrapping the second or third connection is determined by the remaining terminal length after the first connection has been made. Each 6-turn connection takes approximately 1/4 inch of the terminal. In order to make a second or third connection, at least 1/4 or 1/2 inch of the terminal must be available. See Figure 23.

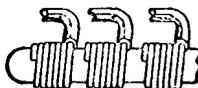


FIGURE 23.

- b. If there is not sufficient terminal length available for solderless connecting, a 1-1/4 to 3-turn connection may be made, but must be soldered. See Figures 24A and 24B.
- c. If there is not sufficient terminal length for a 1-1/4 inch turn connection, wrap the lead over the previous connection and solder. See Figure 25.



FIGURE 24A.



FIGURE 24B.

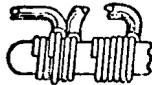


FIGURE 25.

- d. Where it is not practical to apply solderless wire wrapped connections on terminal strips, the soldering operation can be facilitated if the wrapping tool is not placed on the terminal as far as it will go. A depth guide (as shown in Figure 26 and used as illustrated in Figure 27) will position the wrapping tool to leave sufficient space for three connections of three turns each. After the first horizontal row of connections has been made on a group of terminal strips, the remaining terminals can be gauged by eye rather than repositioning the guide on each succeeding row of terminals.

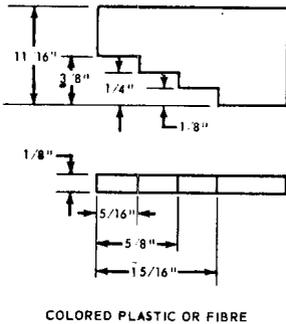


FIGURE 26. Depth Guide for Soldered Connections on Terminal Strips

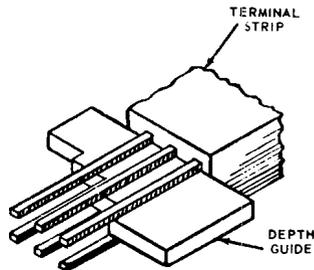


FIGURE 27. Method of Using Depth Guide for Soldered Connections on Terminal Strips

7.06 Soldering Wrapped Connections:

- a. When a terminal contains solder, either on an existing connection or resulting from a previously soldered connection, all connections added to this terminal shall be soldered.
- b. When soldering a wrapped connection, a minimum of two adjacent turns of the connection shall be soldered.

- c. Where a connection requiring solder is added to a terminal, all connections on that terminal shall be soldered.

7.07 Removing Wrapped Connections:

- a. The spiral may be unwound with an unwrapping tool or pliers (see Figure 28), or by hand if there is sufficient slack.

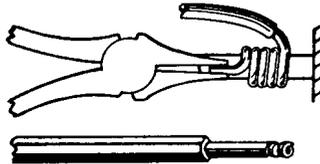


FIGURE 28. Removing Wrapped Connection

- b. Where a connection has been soldered, a soldering iron should be applied to the connection and the spiral unwound with pliers or by hand. *Do not use the unwrapping tool.*
- c. No attempt shall be made to pull the wrap from the terminal by pulling on the lead. This may break the wire and make the wrap difficult to remove.
- d. If a wrap must be removed and then reconnected, proceed as follows:

- (1) When there is sufficient slack in the lead to obtain the proper skinned length, cut the previously connected lead back, skin and reconnect. Do not rewrap a previously wrapped skinned length; the tensile strength of the lead has been reduced by the first wrapping operation.
- (2) Where there is insufficient slack to make a normal connection, skin 1/4 inch of insulation from the lead and wrap at least 1-1/4 turns of wire, using the wrapping tool or pliers. This wrap shall be soldered.

NOTE: This does not apply to jumpers. If there is not enough slack, replace the jumper.

- (3) Rewrapped connections made on a terminal that was not previously soldered do not require soldering.

8. SOLDERING REMINDERS

8.01 Soldering methods are covered in CTSP 410-650-410.

8.02 The soldering iron should be hot before an attempt is made to solder a connection. Test for heat by touching a piece of solder to the copper tip, *never by holding the iron near the hand or face.*

8.03 Take care not to melt the plastic insulation with the soldering iron. Place the iron tip against the pin and wire. Hold the tip against the pin until solder flows freely on the pin. Use as little solder as possible to cover the wire and weld it to the pin. The use of excessive heat and solder causes solder runs on pins.

- 8.04 Excess solder should be removed from the hot tip *only* by wiping on the wiping pad. *Never flip solder from the iron; solder splashes can be very dangerous.*
- 8.05 Examine the pins and blocks around the work for excess solder and splashes. Remove excess solder with a spudger and correct any potential trouble. A short-bristled, nonmetallic brush is useful for cleaning between the pins after excess solder has been loosened. Hold the free hand under the block (or use a wiping cloth) and make sure the distributing frame bag is properly placed to catch the excess solder.
- 8.06 All loose solder, loose wire, bits of insulation, etc., *must* be placed in the distributing frame bag as work is being performed. This is most important to reduce the chances of accidents caused by slipping on bits of material and to maintain a neat appearance.

9. ORDERS

9.01 *Removing Jumpers:*

- a. When removing jumpers, make sure that the jumper to be cut is clear of other jumpers.
- b. Before cutting a jumper, monitor the line to make sure it is not busy. Do not cut a jumper if the line is in use.
- c. Immediately place all disconnected normals on intercepting service (operator or mechanical, depending on the order being worked). This action is important as it reduces no-ring complaints. When cutting other jumpers, leave a *tail* at least 3 inches long attached to those pins which are not to be cleaned immediately. Pull such tails out from the block so that they can be easily seen. Remove tails each day (with a hot iron) and clean the pins.

9.02 *Out (O) Orders:*

- a. After cutting long jumpers, remove (pull) them from the horizontal rather than the vertical side. If a long jumper is removed from the vertical side, it may rub on and melt the plastic coating on the conductors of a working circuit.
- b. If two men work together on O orders, any error is likely to be found and can be corrected, which will reduce the possibility of a customer complaint. If a frameman is working alone, he can pull up the slack on one side to mark the jumpers to be cut, or he can go up on the test turret and short the pins at the X-block or lineswitch before cutting the jumpers.
- c. Any orders, whether connect, remove, F&T, or C, may or may not be designated HOLD (to be completed at a specified time). Do the preparatory work (running jumpers, etc.) on HOLD orders as soon as possible. However, do not complete a HOLD order until the installer calls in and requests it.
- d. Immediately correct any errors found when working or trying to work HOLD orders. Call Line Assignment and get a correction as soon as possible.
- e. Complete *all* work on disconnect orders designated as HOLD at the time specified to prevent disconnecting in error.

9.03 *Testing:* Test all orders (whether hold or nonhold) immediately after the normal is connected. Test by dialing the connector normal on the test turret and shorting the cable pair on the cable side of the VMDF (the test will then include a check of the protector springs).

9.04 *Intercept Service:*

- a. Orders requiring intercept service will state the method to be used in intercepting disconnected normals (mechanical or operator). Do not solder intercept straps; make a good mechanical connection.
- b. When disconnected, rotary or level hunting connector groups should have the strapping removed at the connector board terminal block. Connect the first number of a group to be intercepted to the intercept pins of the block involved. If intercept of additional numbers is required, jumper the second number to another convenient connector board intercept block. This will ensure access to the intercept operator if a second call is being answered. On dial PBX equipment, restore ground to the disconnected line equipment.

9.05 *Completion Symbols:* To indicate the progress of work on an order, the following symbols can be used to mark the order:

- | | |
|-------------------------------------|--------------|
| a. Jumper run. | O |
| b. Jumper run and tied in the wood. | O_w |
| c. Jumper tied vertical. | O |
| d. Jumper tied horizontal. | \ominus |
| e. Completed. | \oplus |
| f. Disconnected. | + |

10. **SPECIAL CONDITIONS**

- 10.01 Write up on the job order special cuts or trouble cuts received from the testboard. Show the date, time, and name of testboardman; also show the name of the person who is to do the work.
- 10.02 If the testboard requests a jumper to be reversed at a protector to compensate for a reversed pair, inform the foreman and place a tag on the pair. Write on the tag the date, the reason for reversal, and the name of the testboardman.
- 10.03 Place dummy carbons and dummy heat coils in special lines *only* when an order specified them. Make sure the carbons are marked and the cable is tagged. Cover the protector with a protector guard. When the line is disconnected, remove the dummy carbons, heat coils, and the tag; replace with standard protection.
- 10.04 Run a jumper tied to the cable side of the protector (bypassing the protection) as follows:
 - a. Run the jumper as usual in the fanning strip and then run it behind the fanning strip and through the hole for the cable pair.
 - b. Tag the jumper on the right-hand side to avoid any assumption that the pair is vacant.