

Cabling Methods

Running and Securing Power Cable

Contents

| Subject | Page |
|---|-----------|
| 1. General | 2 |
| 1.1 Purpose | 2 |
| 1.2 Filing instructions and Supersedures | 2 |
| 1.3 Reason for Reissuing | 2 |
| 1.4 Responsibility | 2 |
| 1.5 Disclaimer | 2 |
| 2. Overview | 2 |
| 2.1 Introduction | 2 |
| 2.2 Definitions | 3 |
| 2.3 References | 3 |
| 3. Cable Running. | 5 |
| 3.1 Planning | 5 |
| 3.2 General Guidelines | 5 |
| 3.3 Cable Separation..... | 6 |
| 3.4 Polarity Control | 7 |
| 3.5 Temporarily Securing Cables While Running | 7 |
| 3.6 Power Cable Runs Between Floors | 7 |
| 3.7 Closing Cable Holes | 8 |
| 4. Cutting and Forming | 8 |
| 4.1 Cutting | 8 |
| 4.2 Forming | 9 |
| 4.3 Allowable Bending Radius | 9 |
| 4.4 Radius Template | 10 |
| 5. Securing | 11 |
| 5.1 General Instructions | 11 |
| 5.2 Horizontal Runs | 11 |
| 5.3 Cable Brackets | 11 |
| 5.4 Vertical Runs | 11 |
| 6. Stripping, Tapping, and Covering | 11 |
| 6.1 Reference | 11 |
| 6.2 Stripping | 11 |
| 6.3 Covering | 12 |
| 6.4 Future Taps | 12 |
| 7. Power and Ground Cable Identification | 13 |
| 7.1 General Instructions | 13 |

1. General

- 1.1 Purpose** This practice provides information required to handle, run, and secure main power cables and frame lineup power cables in both non-electronic and electronic installations.
- 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 has been reissued to incorporate multiple changes in the content. Read this entire practice to ensure your familiarity with the new information.
- This practice:
- Correct reference from GTE Telephone Operations 237-050-200 to 742-200-070 in Section 2.3.
 - Update Section 3.3 to include paired DC power feeder separation requirements.
 - Furnishes P-wire guidelines in Section 3.2.
- 1.4 Responsibility** This practice was published by the GTE Telephone Operations Enterprise Services Department. For more information about this practice, contact the GTE Telephone Operations Headquarters Central Office Equipment Construction Department.
- 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

- 2.1 Introduction** This practice provides power cable running and securing specifics. The generic cable running practice (GTE Telephone Operations Practice 256-050-203) covers planning, precautions, and safeguards which must be followed.
- NOTE: Compression H taps replaced the use of guttertaps. This practice does not cover guttertap installation. (Refer to GTE Telephone Operations Practice 256-050-207.)**

2. Overview. continued

2.2 Definitions

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

| Acronym | Definition |
|---------|--------------------------------------|
| AC | Alternating Current |
| AGCS | AG Communication Systems |
| CO | Central Office |
| COE | Central Office Equipment |
| DC | Direct Current |
| EAX | Electronic Automatic Exchange |
| GTD-5 | General Telephone Digital (System) 5 |
| MCM | Thousand Circular Mils |
| NEC | National Electric Code |

2.3 References

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

| See... | For Information About... |
|-------------|--|
| 075-170-100 | Cable and Support Ties Description and Use |
| 061-115-100 | Model 750 Cable Bender |
| 061-170-100 | Hydraulic Cable Cutter Description and Use |
| 244-251-200 | Numbering and Lettering - Power and Lighting |
| 256-050-203 | Cabling Methods Installation Planning and Safeguards |
| 256-050-207 | Terminating Power Cable Using Compression Connectors and Lugs |
| 742-200-070 | Sealing Cable Openings and Penetrations - Fire Protection Measures |
| 795-605-071 | AC Service Grounding Engineering Applications |

(continued)

2. Overview, continued

2.3 References, continued

| See... | For Information About... |
|--|---|
| 795-805-072 | AC Service Grounding Engineering Applications |
| 795-805-073 | Central Office Grounding Transmission Equipment |
| 256-224-216* | GTD-5 EAX cable separation rules. |
| Methods of Installing Drawing H-40-A-S) * | Installing hardware. |
| GTE Supply Products Catalog** | Cable tools and materials. |

* Available from AG Communication Systems.

** Available from GTE Supply.

NOTE: Cable tools and materials required to complete the CO power cabling procedures are listed in GTE Telephone Operations Practice 256-050-203.

3. Cable Running

3.1 Planning

Careful planning of the CO power cabling process is required to determine:

- When, where, and how the power cables are run.
- The specific order that cables run in.
- Cable separation and zoning requirements.

3.2 General Guidelines

Observe the following primary considerations before starting the actual cable running.

- When running cables from one piece of equipment to another, run the larger and longer cables first, whenever possible. Follow these cables with any successive large uniform cables and by smaller and shorter cable runs. This allows the smaller, lighter-weight cables to be on top of the stack to minimize potential damage.
- Run cables parallel in horizontal cable runs. If it is necessary to cross a cable or cables from one side of the trough or runway, the crossover must be gradual, in order to avoid unnecessary pile-up or twisting of the cables. Planning is required to keep cable crossover at a minimum when accomplishing vertical dropoffs from the runway or trough.
- If any cables require zoning or separation, they must cross at 90-degree angles (Le., transmission, digital, etc.) while maintaining the minimum cable radius bends. Different cables requiring separation (i.e., GTD-05 EAX; refer to AG Communication Systems Practice 256-224-216) must not run parallel to each other outside the rack/trough/grid zone unless the minimum cable separation requirements are maintained. Do not tie wrap or bundle different cable types together (e.g., power and ground, signal, transmission, loose wires, etc.).
- At the intersections of trough or cable runway, plan the cable run with all cables running in the same direction will cross over at one time, keeping cable interweaving to a minimum.
- If the working space available in the trough or runway is limited, it is difficult to make long, straight cable runs, especially when shorthanded. In this case, the pulley method in GTE Telephone Operations Practice 256-050-203 can be used.
- Ensure that all sharp edges of the runway (trough, threaded rods, etc.) are protected from accidental wire or cable cutting when running and housing the wire and cable.

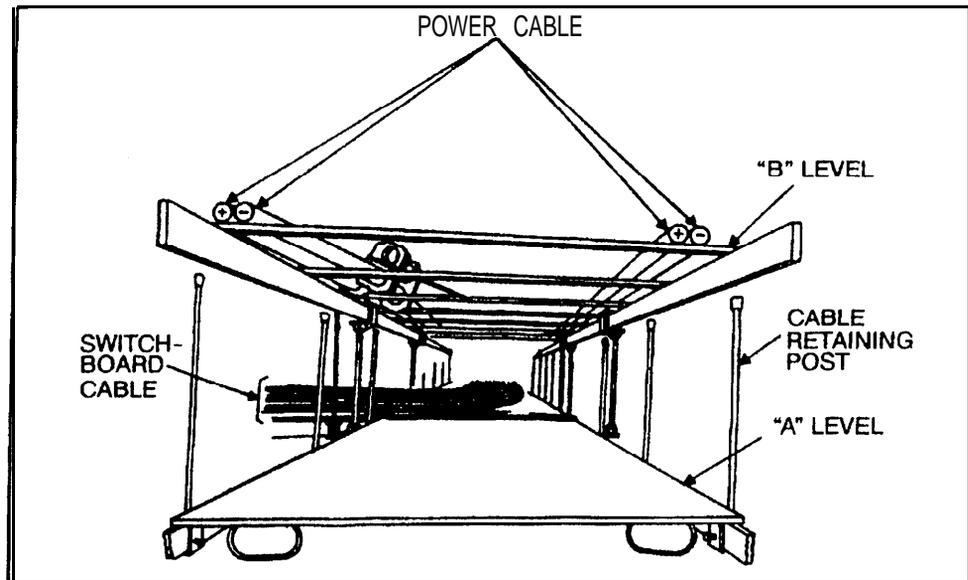
CAUTION: Exercise caution when running cable on CO cable rack and grid. Never step, sit, or kneel on cables as the direct pressure could cause damage to the cable conductors. When there is a need to enter into a cable area, use plywood or other supportive materials to distribute any weight. Be aware of the potential for dislodging or damaging cables when contact is made.

- Do not intermix P-wire runs with sheath cable runs. They must be run on goal posts, P-wire rings, or loosely secured with cable ties underneath the cable rack.

3. Cable Running, continued

3.3 Cable Separation

Run all power cables separately from switchboard cables (e.g., power cable) on the B level and switchboard cable on the A level of the double cable rack (see illustration).

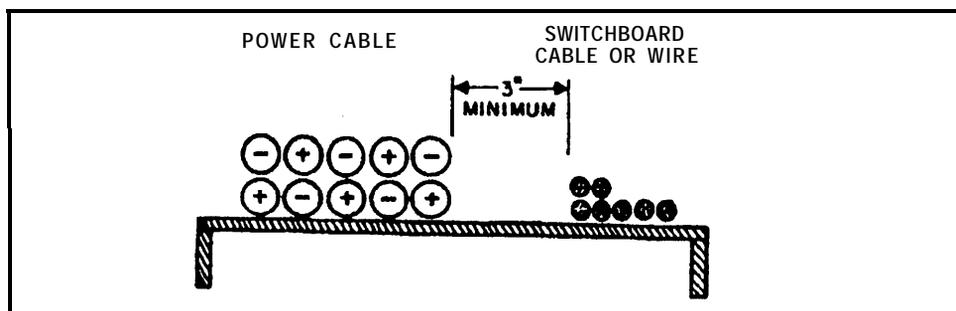


Power cables are run:

- On goal posts as described by:
 - GTE Telephone Operations Practice 256-224-050.AND
 - Methods of Installing Drawing H-440000-A-S.
- In accordance with the switch manufacturer's equipment design and application engineering standards.
- Paired DC power feeders for switching systems (e.g., GTD5) are separated from paired DC power feeders or other switching systems and transmission equipment by approximately three inches.

NOTE: Separate the DC power feeders by 12 Inches if paired and dedicated DC Power feeders are not being used.

Running power cables and switchboard cables on the same level of cable rack or cable grid violates the insurance underwriters' requisites for both analog and electronic offices. However, if main power cables must be run on the same rack as the switchboard cables, use three-inch minimum cable separation methods. (Refer to AG Communication Systems Practice 256-224-216). See the following illustration.



3. Cable Running, continued

3.4 Polarity Control

Polarity run all dc power cables (see illustration, bottom of page 6, and AGCS Practice 256-224-216). "Polarity run" means running the conductors of opposite polarity of a given circuit close together so that the magnetic flux from currents moving in opposite directions is neutralized. Cut the dc power cable positive end approximately one inch longer than the negative polarity end.

3.5 Temporarily Securing Cables While Running

**When power cables
are being run...**

As a temporary measure...

Horizontally

Secure each cable under a temporary cable tie at the bends and approximately every 20 feet on the cable rack. Refer to paragraph 5.2 of this practice for information regarding permanent cable securing methods.

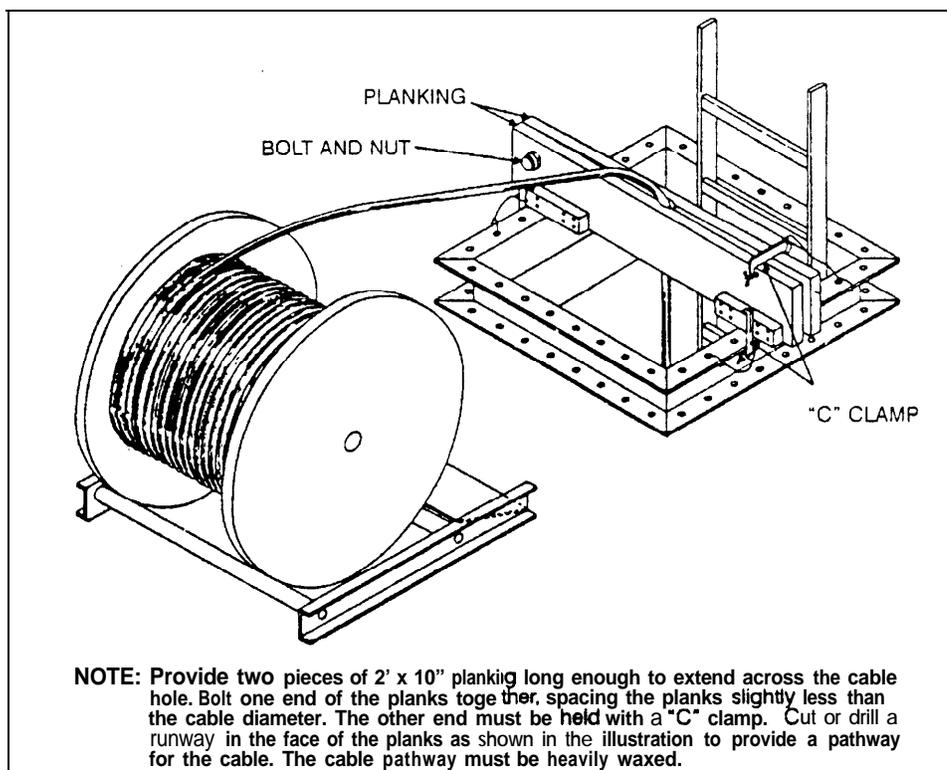
Vertically

Support the cable using cable lacing cord every five to eight feet. Refer to paragraph 5.4 of this practice for information regarding permanent cable securing methods.

3.6 Power Cable Runs Between Floors

If power cables are to be run from one floor of a building to another, locate the cable reels on the higher floor and feed the cables downward. When feeding heavy cables to lower floors of the building, do not allow the weight of long vertical cable runs to place a strain on the cable reel and possibly cause a loss of control.

The following illustration shows a typical method of controlling power cable runs between floors using the Roll-A-Reel unit.



3. Cable Running, continued

3.7 Closing Cable Holes

If it is necessary to open cable holes, close them as soon as practical following installation of the cable. Do **not** leave the cable hole open:

- Beyond working hours.
- OR
- When work has been temporarily suspended.

Cable holes must be closed in order to contain:

- Smoke and fire in the specific room/floor.
- The Halon fire extinguishing chemical when activated in the sized area.

NOTE: Refer to GTE Telephone Operations Practice 237-050-200 for information on closing cable holes.

4. Cutting and Forming

4.1 Cutting

After the power cable is run to its final destination, perform the following steps.

| Step | Cutting the Cable |
|------|--|
| 1 | Position and form the cable end (butt). |
| 2 | If kinks occur, use a cable bender or rubber mallet to straighten. |
| 3 | Mark the cable butt sufficiently to allow the cable to be inserted to the maximum depth in a compression type of connector. The insulating sheath must be flush with the entrance face of the terminal. |
| 4 | Cut the power cable (up to and including No. 1 gauge) with standard cable cutters. Cut all cables larger than No. 1 with a hydraulic cable cutter or equivalent (see GTE Telephone Operations Practices 081-170-100 and 256-050-203). If a hydraulic tool is not available, use a hacksaw. |

NOTE: When cutting cables with a hacksaw, place a drop cloth, tarpaulin, or similar item under the cable to prevent filings from dropping into the equipment or onto the floor.

To help prevent personal injury and damage to equipment, protect all cable ends:

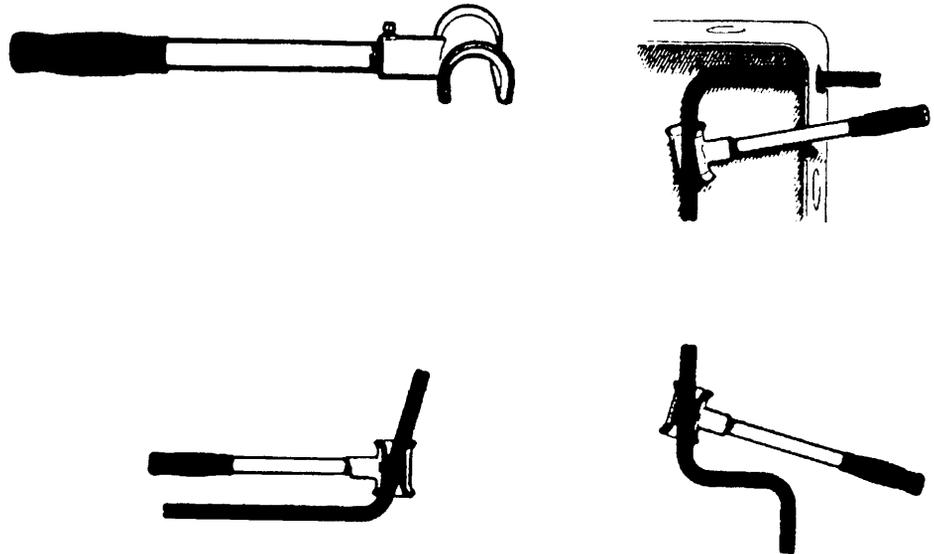
- With a permanent heat shrink end cap or (on a temporary basis) a heavy-gauge rubber linerless tape.
- Immediately after cutting the required cable length.
- Before running the power cable off the cable reel.

NOTE: Do not allow copper to remain exposed.

4. Cutting and Forming, continued

4.2 Forming

Form power cables carefully to fit a rack, runway, or drop configuration. Do **not** damage the insulating sheath in the process. Use the cable bender to form cables that are too large for forming by hand or model 750 cable bender (refer to GTE Telephone Operations Practice 081-I 15-100. These cable benders will form cables up to 750 MCM. The cable benders form the cable into any configuration that may be required. These illustrations depict methods of bending cable.



4.3 Allowable Bending Radius

Table 1 provides information regarding allowable forming radii for various sizes of power cable. Form the cables so that the bends are made on a radius that is equal to or greater than the specifications given in Table 1; otherwise, the insulating sheath or the conductors of the cable may be crimped or damaged.

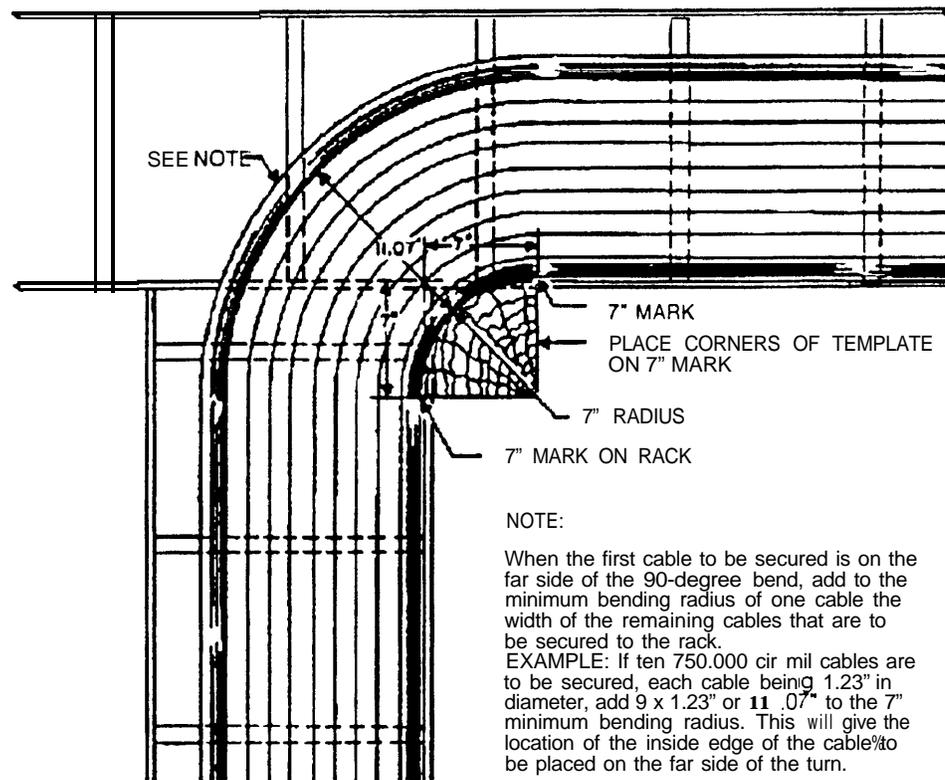
Table 1. Allowable Bending Radius for Copper Power Cable

| SIZE OF WIRE OR CABLE AWG (+ G, -MB AND LVG) | MINIMUM RADIUS INSIDE EDGE (INCHES) |
|--|--|
| 16 and smaller | 1/8 |
| 14 | 1/4 |
| 12-10 | 1/2 |
| 8-4 | 1 |
| 2-0 | 1-1/2 |
| 2/0-4/0 | 3-1/2 |
| 250 MCM | 4-1/4 |
| 350-500 MCM | 5 |
| 600-750-MCM | 7 |

4. Cutting and Forming, continued

4.4 Radius Template

As an aid to the installer, it is recommended that a wood or fiber template be made corresponding to the radius information provided in Table 1 (paragraph 4.3). Use the template as shown below. With the template, bend the inside form of the cable to conform to the outside curvature of the template.



5. Securing

5.1 General Instructions

When power cable is secured by sewing, use the Kansas City stitch. When power cable needs support between points of attachment, use the Chicago stitch or cable ties. Refer to GTE Telephone Operations Practices 256-050-204 and 075-170-100.

5.2 Horizontal Runs

On horizontal runs, sew all power cables to the rack or frame lineup details two straps before and after each bend. Use cable ties to secure power cable on all other horizontal racks and frame lineup details. Do not place more than two cables under a stitch or cable tie.

5.3 Cable Brackets

Power cable bracket placement must be consistently and uniformly spaced at approximately 12 inches when used in normal equipment lineups. A Chicago stitch or cable tie between brackets may be necessary for added support to prevent more than 1/2-inch cable sag between brackets. Closer spacing may be required to prevent cable sag greater than 1/2 inch.

5.4 Vertical Runs

Secure vertical power cables no less than every 12 inches. Sew all vertical cables with lacing twine (do not use cable ties) one cable under a stitch. Use four strands of lacing twine when lacing 300 MCM cables or larger.

6. Stripping, Tapping, and Covering

6.1 Reference

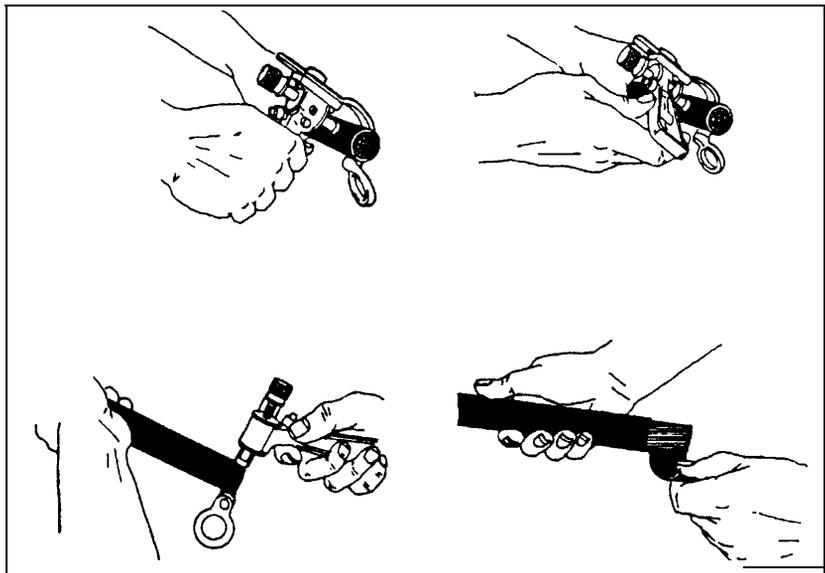
Refer to GTE Telephone Operations Practice 256-050-207 for information regarding:

- Compression connectors.
- Heat shrink.
- Types of taps.

6.2 Stripping

Use the cable sheath stripper to cut the insulating sheath. These illustrations depict removing insulating sheath from power cable.

CAUTION: Overtightening of the cutter on the cable sheathing can result in damage to the conductors within.



6. Stripping, Tapping, and Covering, continued

6.2 Stripping, continued

Cut the insulating sheath according to the following instructions.

| Step | Cutting the Insulating Sheath |
|------|-------------------------------|
|------|-------------------------------|

- | | |
|---|---|
| 1 | Make a circular cut through the cable insulating sheath at the point marked for skinning and insertion into the connector. |
| 2 | Make a lateral cut through the cable insulating sheath from the skinning point to the cable end. |
| 3 | Remove the cut insulating sheath from the cable. |
| 4 | Clean all corrosion or oxidation off the contact surfaces of the wire and connector with a fine abrasive paper, and dust them with a dry cloth. |

NOTE: If particles of the removed insulating sheath adhere to the wire after stripping, scrape the wire clean with a wire skinning knife. Do not damage the wire strands.

6.3 Covering

Cover the free ends of any conductors or taps:

- With heat shrink materials.
 - On a temporary basis only, with:
 - Insulation equivalent to that of the cable itself.
- OR
- Heavy gauge black rubber linerless tape.
- In accordance with the National Electric Code (NEC).

NOTE: Refer to GTE Telephone Operations Practice 256-050-207 for information regarding insulating power cable ends using heat-shrinkable cable end caps.

6.4 Future Taps

H taps and tap wire may require connecting to the main power feeder for lineups that are allocated as future. This procedure may be necessary as a safety precaution for the individual. There is the possibility of difficult installation of the taps at a later date, since the 500 MCM or 750 MCM cable may be buried among other 500 MCM and 750 MCM cables within the runway.

Do not place taps for future frames within an equipment lineup except in instances where:

- A known requirement exists.
- AND
- Placement for these future taps will best serve tooling and service requirements.

7. Power, Return, and Ground Cable Identification

7.1 General Information

Refer to GTE Telephone Operations Practice 244-251-200 for power, return, and ground cable labeling standards.