HANDLING WORKING TELEPHONE CIRCUITS

SAFETY PRECAUTIONS

GENERAL METHODS

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1. GENERAL

1.01 This Bell Service Practice (BSP) covers safety precautions that are to be followed by technicians while handling working telephone circuits.

1.02 When this BSP is reissued, the reason for reissue will be listed in this paragraph.

1.03 Experience has shown that technicians may safely handle working telephone circuits using the basic precautions discussed in this practice. Circuit voltages are no higher now than voltages used in the past.

1.04 By its nature, the telephone system must be reconfigured, tested, and maintained while the system is in operation. Accordingly, rearrangements and maintenance must often be done bare-handed on working circuits. Basic precautions while handling working telephone circuits are:

(a) Avoid creating current paths through the body.

(b) Minimize the area of contact.

1.05 The precautions described in Part 2 are consistent with working voltages which are used on the telephone network.

1.06 Insulating gloves are used in certain work operations to avoid contact with hazardous voltages (See BSP 081-710-200). The precautions described in Part 3 are not intended to replace the use of insulating gloves in these work operations. The use of insulating gloves is not normally called for when working on telephone circuits, which are carrying standard telephone voltages. Because of the limited nature of these voltages, the precautions of Part 2 are appropriate. Insulating gloves are required when working on cable pairs at High Voltage Protection Locations, see Part 4.

1.07 One step toward minimizing contact with excessive voltage is by testing for potential hazards (e.g., mobile homes, power-down leads, newly driven ground rods, streetlight brackets, etc.) with the 188A test set. For detailed information on the use of this test set, see BSP 081-705-102. The 081 Division of the Practices also covers descriptions and uses of other voltage protection devices (e.g., insulating gloves, insulating blanket, etc.).

2. RECOMMENDED WORK PROCEDURES FOR NORMAL VOLTAGE SYSTEMS (0 - 140 Volts dc to Ground, 0 - 50 Volts rms ac to Ground)

A. Avoid Creating Current Paths

2.01 There are two types of current paths, **conductor to conductor** and **conductor to ground**.

2.02 **Conductor to Conductor:** Technicians can avoid exposure to the conductor to conductor voltage (which may be double the conductor to ground voltage) by contacting one conductor at a time. Accordingly, if possible, expose only one conductor at a time. Attach test clip leads first to one conductor of a line, then to the other. In short, a fundamental precaution is to avoid simultaneous contact with two conductors.

2.03 **Conductor to Ground:** If only one conductor is contacted, the only current path which could be established is from conductor to ground. This current path may be interrupted either by avoiding electrical contact with ground or grounded objects while working on the energized conductor or, if contact with ground is unavoidable, by using insulated tools to contact the energized conductor.

2.04 The use of insulated tools is highly recommended for interrupting the current path from conductor to ground. A few turns of electrical tape on the clip leads of a test set or dipping the handles of a tool into an insulating coating can help control the area of energized metal in contact with the hand and therefore help maintain the body's resistance.

2.05 Most insulated, taped or dipped tools will offer very effective protection from normal system voltages. This is despite minor voids, imperfections, or openings in the insulation since these provide only very small area contacts. However, these tools are not the equivalent of standard insulating gloves.

2.06 **Insulated Tools:** Examples of other standard insulated tools are:

- Insulated screwdrivers
- Insulated pliers
- 216 tool
- Wire cutters
- D impact tool
- 788-type insertion tool.

B. Where Insulated Tools Cannot Be Used

2.07 Where insulated tools cannot be used, the current path to ground may be minimized by:

- Keeping the area of contact small
- Keeping the area of contact dry.

2.08 Small Area: The area of contact is important. A large area (full-hand) contact may offer five to ten times less resistance than would a small area (finger) contact.

Danger: If the ground is wet, take special care to use insulated tools, wear rubber boots, or stand on a rubber mat or dry boards.

2.09 Dry Versus Wet Areas: Another factor, which can lower body resistance, is moisture. Not only does moisture reduce resistance at the point of contact, a wet area tends to effectively enlarge the area of contact. In wet areas or rainy weather, rubber footwear may be necessary to prevent good contact to ground while handling working circuits.

C. Ground

2.10 Where practical, avoid contact with ground or grounded objects when bare-handed contact with working conductors is necessary. In most cases where contact with ground or grounded objects is difficult to avoid, the use of insulated tools is the preferred method of working. Typical grounded objects are:

- Bare ground
- Concrete floors, sidewalks, etc.
- Cable shield or sheath
- Building framework
- Support Strand
- Electrical conduit
- Anchor guys
- Plumbing
- Manhole floors, walls, hardware
- Trees, shrubs, vines
- Large appliances or electric apparatus cases.

Note: When working in outside plant cables, continuity of the cable's shield at terminal and splice locations must be maintained at all times.

D. Summary

2.11 The following set of precautions are recommended while handling working telephone circuits.

(1) Whenever possible, work with one conductor at a time.

(2) Avoid creation of current paths through the body by:

(a) Avoiding bare-handed contact with the working conductor by using insulated tools.

(b) If bare-handed contact is necessary:

- Whenever possible, avoid contact with grounded objects.
- Make the smallest area of direct contact possible to ground and conductor.
- Make ground and conductor contacts as dry as possible.

3. UNINTENTIONAL ELECTRICAL POTENTIALS ON TELEPHONE CIRCUITS

3.01 Some electrical potentials on telephone plant are unintentional, such as lightning and voltages from commercial ac power systems. Also, special procedures must be observed when using the Breakdown or Tonearc test sets.

A. Lightning

3.02 Lightning strikes to or near aerial or below ground telephone plant can produce momentary hazardous voltages in a cable. **During an electrical storm, work on exposed telephone plant should be avoided until lightning activity in the immediate area stops. Personnel should retreat to a company vehicle or move indoors while a lightning storm is in progress.**

B. Commercial AC Power Systems

3.03 Commercial ac power systems may couple electrical energy into telephone facilities in the course of normal operations and also under fault conditions. Under normal conditions, the only significant coupling of the two systems is electromagnetic in origin. Two forms of coupling are commonly referred to as magnetic and electrostatic.

3.04 Magnetic Coupling: Significant magnetic coupling can occur under normal conditions when power lines and telephone lines run long distances together and imbalances exist on power lines. The precautions recommended in Part 2 should be sufficient in all but extreme cases. Induced voltages may vary by as much as a factor of two in a few hours and shift location as the load on the power system changes. Therefore, continue to observe normal precautions throughout work operations even though initial procedures indicated that the induction is low. When working in outside plant cables, continuity of the cable's shield at terminal and splice locations must be maintained at all times. When the cable shield must be opened, arcing may occur due to magnetic coupling. This arcing, in all but the most extreme cases, is normal and the precautions recommended in Part 2 should be sufficient.

3.05 Electrostatic Coupling: Significant electrostatic coupling occurs only near large, high voltage power lines and may produce painful electrical shock. Procedures for working in the vicinity of such structures involve maintaining a ground connection to all conductors during installation and removal. In addition, poles carrying telephone facilities in these areas may be equipped with special grounded lines to prevent craft persons who are working aloft from becoming energized. Details of these procedures are contained in BSP 620-100-015. Also, technicians should ground themselves with a wrist strip prior to handling circuit packs or telephone equipment.

3.06 Power Faults: Power faults are typically of short duration (less than five seconds), but occasionally may last for longer periods if power company circuit breakers do not open. As with lightning, these fault-induced voltage levels are high enough so that the best protection is avoiding contact. Inspect for sagging or downed power lines, which may be contacting telephone plant, particularly following a heavy wind or ice storm. Remember, damage may not be evident or local. **In situations where extensive storm damage occurs, insulating gloves should be used until testing has determined the telephone plant is free from hazardous voltages.**

C. Breakdown and Tonearc Test Sets

3.07 Where the Breakdown or Tonearc test set is being used, it must be handled with caution. Contact with energized lines must be avoided. For details, consult BSP 634-305-502.

4. CONSIDERATIONS FOR INDIVIDUAL CIRCUMSTANCES

Danger: In wet conditions, wearing rubber footwear, standing on rubber blankets or dry boards may be necessary to isolate the individual from ground and permit working bare-handed on labeled system voltages.

4.01 The recommendations in Part 2 should be followed at all times. Technicians must follow these measures if a label with words such as "CAUTION, LIVE DC VOLTAGE" is present (Fig. 1). This label indicates a circuit in the upper range of the normal system voltages and serves as a reminder that these precautions are especially necessary.

4.02 Working Outdoors at Ground Level or in Wet Indoor Locations: Low resistance contact with ground is difficult to avoid in these circumstances if footwear becomes wet. With bare-handed contact (particularly with labeled voltages), the use of rubber footwear, standing on insulating mats, or dry boards to isolate the individual from ground is required.

4.03 Working Outdoors Aloft: Contact with ground is most likely to occur from contacting a cable shield, down guy, or support strand. Simultaneous contact with these grounded objects should be avoided while working on telephone circuits. In situations where significant contact with grounded objects cannot be avoided and labeled telephone circuits are involved, insulated tools are recommended.

Danger: Care should be exercised to avoid contact with grounded objects when bare-handed contact is necessary with labeled circuits.

4.04 Working in Dry Indoor Locations or Central Offices: Most dry footwear will effectively insulate from grounded flooring. Contacts (e.g., from resting or leaning against large appliances or metal equipment cases) with grounded surfaces present the most likely means of completing a circuit path while working in bare-handed contact with working telephone circuits. Central office workers are cautioned that all central office equipment frames are grounded. When working in or around isolated ground plane equipment, technicians should be aware of metallic objects (equipment frames, air conditioning ducts, electrical conduits, etc.) that are part of the central office's integrated ground plane. If possible, the required bonds between the integrated grounded equipment and the isolated grounded equipment should be verified if simultaneous contact between these two ground planes is necessary.

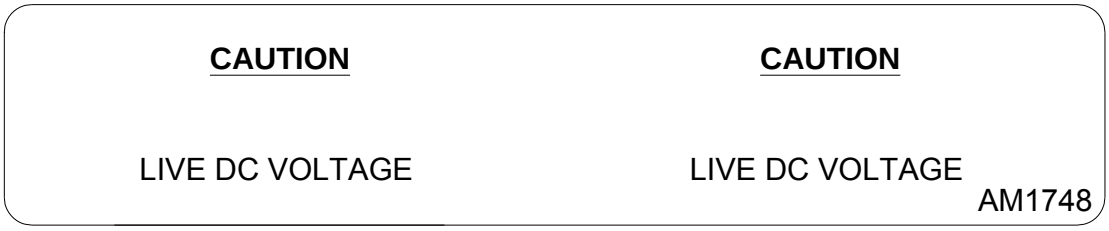

Figure 1- Elevated Voltage Label

4.05 Working in High Voltage Protection Locations: Electric power stations, substations, high voltage towers and poles and co-generation sites, are constructed on top of an extensive grid of driven ground rods and interconnecting copper conductors. All metal structures, buildings, fences, conduits and other ironwork are solidly connected (bonded) to this grid. This bonding equalizes potentials and provides a safe work environment for power utility personnel and others who might enter the site.

4.06 Communications circuits serving electric power stations are referenced to ground at a location remote from the power station for example, central office or remote terminal. Cable shields are bonded and grounded at various intervals along the cable route. Since these grounds are remote from the electric power station grid, the cable conductors and shield are at remote ground potential.

4.07 The presence of two different ground references does not cause any problems when the electric power station is operating normally. However, when a power line extending from the electric power station faults, the ground grid at the power station will rise in potential with respect to the remote ground. The voltage appears between the electric power station grid and the communications circuits and shields at the power station. This voltage, while only present for a short period, represents a potential hazard to personnel and the communications network. Due to this possibility, all telecommunications personnel that work on these circuits (construction, provisioning, special services and maintenance) are required to use the proper personal protective equipment for example, insulating gloves, insulating blankets, hardhats and safety eyewear.

4.08 At these locations, High Voltage Protection Devices (HVPD) are required on all working cable pairs and cable shields to provide for personnel safety and reliable service.

4.09 To prevent coming into contact with both the remote and local grounds simultaneously, the following safety steps must be followed:

1. Educate personnel regarding the unusual hazards of working with communication facilities serving power generating stations, substations, switch yards and co-generation sites.

2. When working at an electric power station, telephone technicians shall be escorted in and out of the facility.

    - Do Not work inside or near power company facilities during lightning storms or high wind conditions or if there is a threat of distant storms moving quickly into the area.

    - Do not make contact with anyone not standing on an insulating blanket when performing work.

3. Minimize the possibility of simultaneous contact with remote and local grounds by:

    a. Wearing eye protection and hard hat at all times.

    b. Using an iInsulating blanket to stand on and to cover metallic structures, preventing accidental body contact while performing work operations with the Network facility cable pairs.

c. Wearing F insulating gloves while terminating or making any contact with the Network cable sheath or conductors or working on the central office. side of the HVPD.

NOTE: E INSULATING GLOVES ARE NOT ACCEPTABLE

d. Provisioning all interior wire work and material before connecting to HVPD(s). Connecting to the Network facility should be the LAST TASK PERFORMED. For new installations, the splice connection between the new high dielectric entrance cable and the general use cable should be completed last.

e. Ensuring that entrance conduit is non-metallic and intra-building conduit is metallic.

f. Always wiring a high voltage protection device so that the station wiring never crosses the network wiring / cable (central office side wiring / cable). Maintain a minimum separation of 4 inches.

g. Verifying that all bonding and grounding meets the following:

- Telcordia Practice 638-600-200, titled “Installation of Isolation Systems Communication Facilities Servicing Power Stations”.
- SBC’s Practice 876-310-100, titled “Electrical Protection of Communication Facilities Serving Power Stations”.

h. Using test equipment that is battery operated and placed on an insulating blanket when testing. i.e. cable pairs, transmission parameters, etc..

- If pairs need to be tested or toned, this activity should occur at the Service Area Interface (SAI) or central office / remote towards the high voltage location - NOT at the high voltage location back out to the SAI or central office / remote.
- When testing cable pairs at a high voltage location, do not reference (ground) the test meter to the high voltage station ground.