# Chapter 14
# Conduit and Tray Systems

## 14-1. General

The conduit and tray system is intended to form a permanent pathway and to provide maximum protection for the conductors. The system design should allow for reasonable expansion of the number of leads and circuits.

## 14-2. Conduit

*a. Design.* Where practicable, all conduits should be concealed. In cases in which allowance must be made for circuits to future equipment, the conduit extension may be exposed. Connections to equipment should not be made with flexible conduit if suitable connections can be made with rigid conduit.

(1) Conduit size is determined by the type of wire and number of circuits in the run, the length of run and the number and degree of bends in the run.

(2) Where conduits cross building contraction joints, the conduit runs should be perpendicular to the joint and expansion fittings, such as dresser couplings with grounding straps, installed to provide for movement of the conduit and to maintain an unbroken ground path. The fitting, installed on one side of the contraction joint, should be protected with a suitable neoprene sleeve to accommodate differential movement of the concrete.

(3) Conduit should be installed in a manner to permit condensed water to drain whenever possible. When self-draining is not possible, a suitable drain should be installed in the low point of the run. Threaded joints in metal conduit and terminations in cast boxes should be coated with an approved joint compound to make the joints watertight and provide electrical continuity of the conduit system.

(4) The conduit should provide a ground for the frames or housings of equipment to which it is connected, thereby providing a backup for the ground wire connection to the main grounding system. All conduits except lighting branch circuit conduits should be listed in the conduit and cable schedule.

*b. Conduit types.*

(1) Rigid steel conduit should be hot-dip galvanized on inside and outside surfaces, conforming to ANSI C80.1.

(2) For powerhouse substructure work, if conditions are such that embedded galvanized conduit might rust out, consideration should be given to installing exposed runs which can be replaced. Galvanized conduit buried in the switchyard should be protected with a coat of bituminous paint or similar material, unless experience at the particular site has demonstrated that no special protection is needed on the galvanized conduit.

(3) Unjacketed type MC or type MV cables, meeting the requirements of UL 1569 or UL 1072, may be used to avoid installing a cable tray carrying only a few conductors or where the installed cost would be substantially less than installing rigid steel conduit. Compatible connectors should be used to bond the sheath to the ground system and to the equipment served. The copper sheath version is preferable for corrosive environments. MC or MV cables with PVC insulation or jacketing should not be used.

*c. Boxes and cabinets.*

(1) The materials used for boxes and cabinets should conform to those used for the conduit system. Cast iron boxes should be used with galvanized conduit in embedded and exposed locations at and below the generator room floor level. Galvanized sheet steel boxes are acceptable in locations above the generator room floor. Suitable extension rings should be specified for outlet boxes in walls finished with plaster or tile. Large cabinets used for pull boxes, distribution centers, and terminal cabinets are usually constructed of heavy-gauge, galvanized sheet steel. Because it is impracticable to galvanize large sheet metal boxes and fronts after fabrication without severe warping, galvanized steel sheets should be used in the fabrication. Box corners should be closed by welds after bending, and the galvanizing repaired by metallized zinc spray.

(2) If a cabinet is embedded in a wall finished with plaster or tile, special precautions should be observed to ensure that the face of the installed cabinet is flush with

the finished wall. Front covers are generally mounted with machine screws through a box flange drilled and tapped in the field to facilitate proper alignment. The requirements of UL 50 should be considered as minimum in the design of such cabinets. Provision should be made for internal bracing of large cabinets to prevent distortion during concreting operations.

(3) Pull boxes for telephone circuits should be large enough to provide adequate space for fanning-out and connecting cables to the terminal blocks.

## 14-3. Cable Trays

*a. General*. Cable trays are commonly used to carry groups of cables from generating units, the switchyard, and accessory equipment that terminates in the control room. Trays in place of conduit provide flexibility, accessibility, and space economy. Trays are also used for the interconnecting cables between switchboards in the control room, and from switchboards to the terminations of embedded conduits running to equipment. Short runs of trays may be used to connect two groups of conduit runs where it is not practicable to make the conduit runs continuous. The designed tray system should provide the maximum practicable segregation between control circuits and power and lighting circuits. Appropriate guidelines for cable tray design considerations are contained in IEEE 422.

*b. Fabrication*. Cable trays are fabricated from extruded aluminum, formed sheet metal, or expanded metal. Material costs for the expanded metal trays may be slightly higher, but a greater selection of joining devices, greater distance between supports, and special sections and fittings minimize field labor costs and generally result in lowest installed cost.

*c. Tray supports*. The trays are installed on fabricated galvanized steel supports designed and anchored to the powerhouse walls and/or ceiling to provide a rigid structure throughout. In the cable spreading room, the tray supports may extend from the floor to the ceiling to give the necessary rigidity. Supports similar to cable racks and hooks are suitable for supporting cable trays on cable tunnel walls. If trays run through the center of a tunnel, they should be supported on structural members such as channel with angle cross-pieces. Metal tray sections 8 ft long require supports on 8-ft centers. Splices should be made at supports to provide proper anchorage for the tray sections.

*d. Cable supports*. Split hardwood blocks drilled to fit cables or accessories for the metal trays should be provided as necessary to support cables entering and leaving the trays. The tray system should be designed to avoid long steep runs requiring anchoring of the cables to prevent movement.