GV 001 Equipment Bases and Enclosures—General Information

Scope

This standard provides information for the selection and application of pads, box pads, padvaults, manholes, and vaults in the distribution underground system. Included in this chapter are standards for concrete and polymer concrete pads, nonconcrete box pads, and concrete padvaults, manholes, and vaults. Material specifications for individual pieces are located in distribution specifications chapter ZG, Underground.

General

1. Applications

Precast pads, box pads, padvaults, manholes, and vaults are preferred wherever field conditions allow proper site preparation. Field-poured pads, manholes, and vaults may be used where existing conditions require. All new pad, box pad, padvault, manhole, or vault insulations for pad-mounted transformers shall be installed by the customer. Nonetheless, the requirements listed in this chapter shall be adhered to whether the material is installed by the customer, contractor, vendor or the company. Structures which do not meet the minimum requirements listed in this standard will not be accepted.

2. Descriptions

a. Pads

A flat pad is a concrete base for pad-mounted transformers. Flat pads support the mounted equipment's weight without deflection (see Figure 1). Flat pads are to be used for replacement of old flat pads under single- and three-phase transformers. Flat pads may also be used for new three-phase transformer installations in irrigated or chemically contaminated areas, where chemicals may seep into the padvault or box pad.

Flat pads are acceptable for use in direct-buried systems, and in conduit systems in irrigated or chemically-contaminated areas. Flat pads shall be used only where the ground is both level and sufficiently firm to prevent future shifting or tipping of the transformer. If the installation site foundation is not sufficiently firm, a box pad may be used in place of the flat pad with field engineer approval.

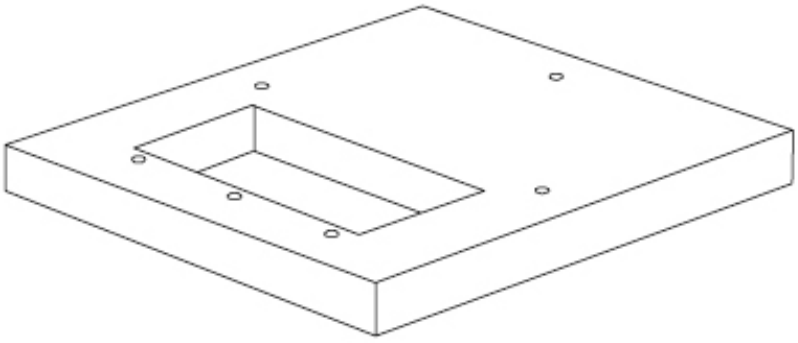

Figure 1—Typical Equipment Flat Pad

b. Box Pad

A box pad is a fiberglass or polymer-concrete base for pad-mounted equipment, with sufficient space inside for training cables. Polymer-concrete box pads weigh more than fiberglass, but are generally less expensive, more UV-resistant, and less likely to suffer buckling in areas where there is a high probability of incidental traffic. Box pads do not have bottoms and have no pulling eyes for cable pulling (see Figure 2). Box pads can be used with conduit by terminating the conduit with an elbow, or by stubbing up the conduit; however, padvaults are the first choice in conduit systems.

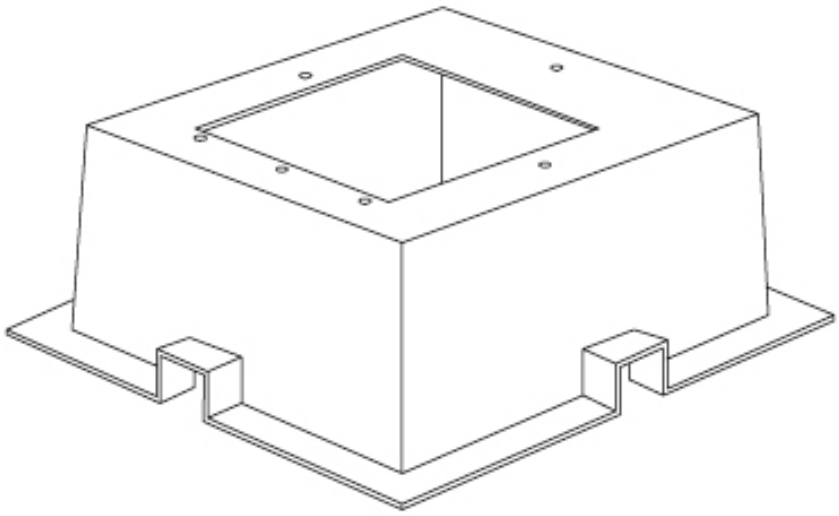

Figure 2—Typical Equipment Box Pad

c. Padvault

A padvault is a two-part concrete base for pad-mounted equipment, consisting of a pad and an open vault. Padvaults are the preferred base for pad-mounted equipment in conduit systems. Padvaults are designed to be set such that the top of the pad is three inches above the final grade in non-pedestrian areas, and flush with the final grade in pedestrian areas. Access is provided on the larger vaults; however, padvaults are not designed for routine operations work to be conducted inside. Additional cables may be pulled after equipment has been set. Cable pulling provisions are included (see Figure 3). Ground inserts, sumps, pulling eyes, and cable support brackets are supplied as required.

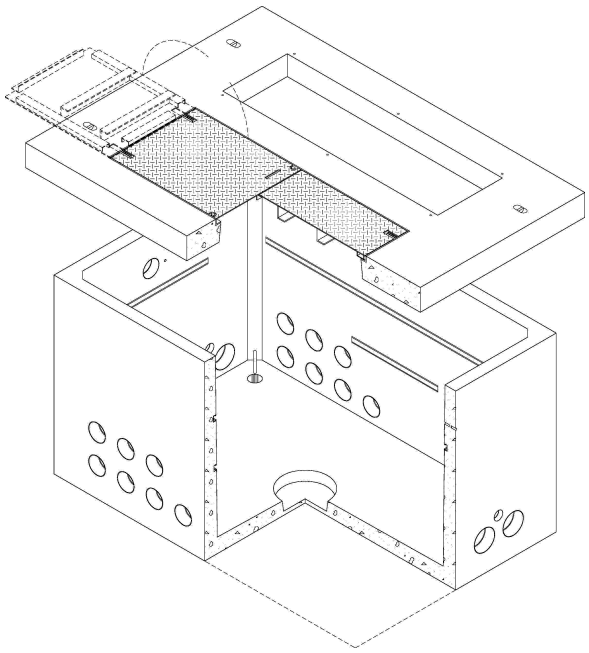

Figure 3—Typical Equipment Padvault

d. Manhole

A manhole is a subsurface enclosure that contains submersible junctions and splices. The equipment is installed and maintained by personnel inside the enclosure. Any switching is operated from the surface of the manhole. Depending on site requirements, a manhole may have a round cast-iron cover, or a door made of steel, composite, or polymer-concrete (see Figure 4).

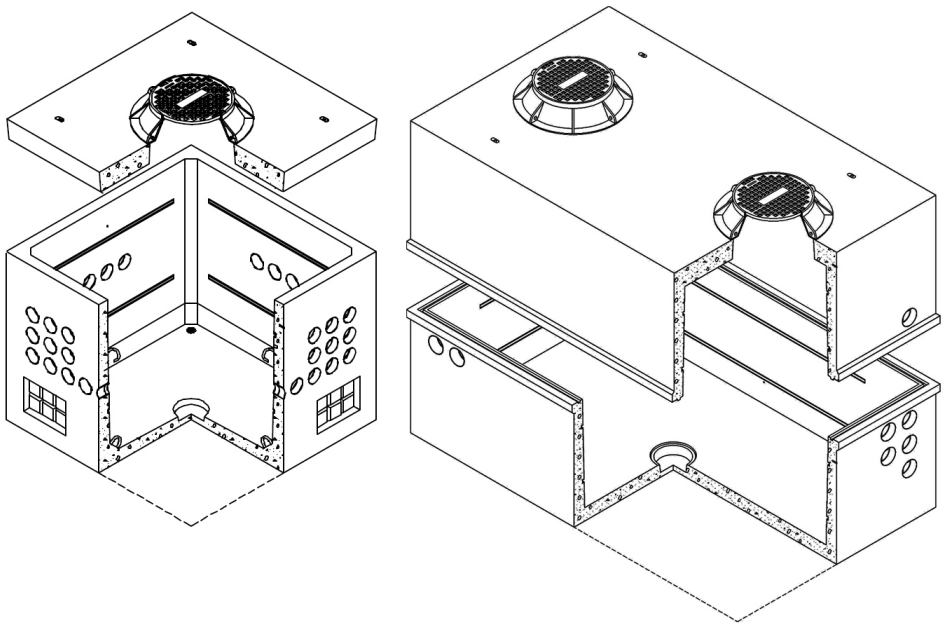

Figure 4—Typical Manholes

e. Vault

A vault is an above- or below-grade enclosure into which personnel may enter for the purpose of installing, maintaining, or operating equipment. Vaults are usually custom designed for a particular application. Vaults have more than one opening from the top or sides (see Figure 5). Vaults shall be used whenever equipment is to be operated from within the enclosure. Vaults typically contain transformers, switching equipment, or both, and are equipped with forced air ventilation, lighting, and sump pumps. For more information on specialty vaults, refer to construction standards GV 061, GV 071, GV 081.

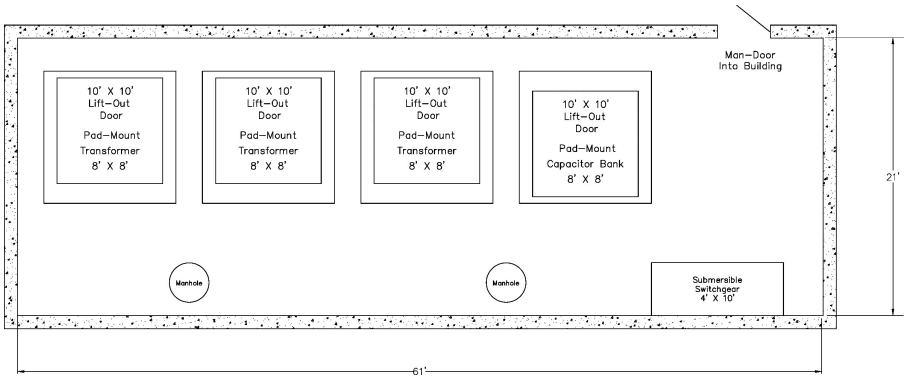

Figure 5—Example of Underground 3-Transformer Vault with Capacitor Bank and Switch

Site Selection and Preparation

1. The site shall be inspected prior to selecting the equipment base or enclosure type or determining the installation details. The following items should be included in the inspection:
   a. Soil class. Excavation equipment and drainage requirements are determined by soil class. Soil stability, including the consequences of inclement weather, shall be determined, and recommendations made on shoring or sloping requirements.
   b. Water table. All openings and conduits shall be sealed where a possibility of flooding exists. Precautions should be taken to prevent any flooding from affecting customer-owned equipment in adjacent structures. Refer to Construction Standards chapter GC for details.
   c. Final Grade. If final grade has not yet been established, measures must be made to allow for anticipated grade changes. Where radical changes in grade are anticipated, installation should be delayed until near-final grade has been achieved.
   d. Site accessibility. The site location for any piece of pad-mounted equipment shall be within 15 feet of a gravel or paved surface. Future access requirements for operation and maintenance of equipment shall be considered when determining equipment location. For example, if the site is in or near a traffic area, loading issues or barriers should be considered.
   e. Required clearances and oil spill procedures, if oil-filled equipment is to be installed at the site.
2. Excavations should be no deeper than is necessary to install conductors or conduit, and set the equipment base or enclosure. All soil beneath any type of equipment base or enclosure shall be compacted in six-inch lifts, and leveled to within 2% slope prior to setting or pouring at the site. Customer shall supply a six-inch base of 3/4-inch-minus gravel compacted to 90% of dry density under the equipment base or enclosure, and under any portion of the pad not situated directly atop the equipment base or enclosure. Flat pads for three-phase transformers shall be placed on 18 inches of compacted 3/4-inch-minus gravel compacted to 90% of dry density. In marshy areas, where an adequate foundation cannot be created through normal methods, pilings may be required.
3. In locations where equipment damage due to vehicular traffic may occur, protective barriers shall be installed by the customer (see the Barrier Posts section of this document for barrier post requirements). If standard steel or concrete posts are unacceptable, alternate design barriers may be installed by the customer upon approval of the area engineer.

Concrete

Standard materials and methods of construction shall be used for all concrete pads, padvaults, manholes, and vaults, whether precast or poured on site. Where required to provide equipment bases or enclosures, customers shall be given a list of acceptable suppliers. If the structure is to be poured on site, a licensed contractor shall certify adherence to all requirements. Final inspection will be made by company personnel prior to acceptance.

Concrete structures for use in the company distribution system must meet specified construction criteria. See Material Specifications ZG 301 and ZG 311 for more information.

Access Lids

Access covers made of steel, polymer-concrete, composite or cast iron may be used, depending on site requirements. See Material Specification chapter ZG for details.

Access covers made of steel, polymer-concrete or composite may be used for incidental-traffic or non-traffic applications such as lawns, sidewalks, or patios (see Figure 6).

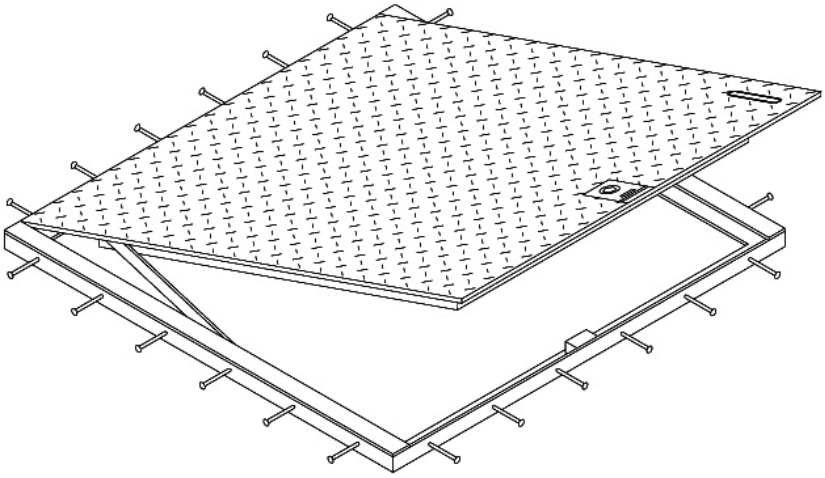

Figure 6—Incidental-Traffic Access Cover

Cast-iron access covers shall be applied in full-traffic areas, such as streets, driveways, alleys, or parking lots (see Figure 7). Full-traffic lids should not be used in conjunction with bases supporting pad-mounted equipment.

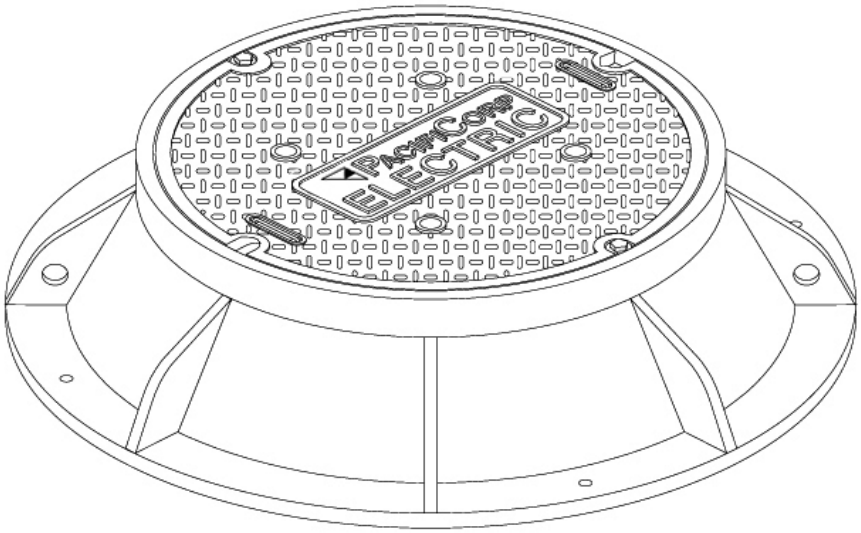

Figure 7—Full Traffic Access Cover

Conduit Entry

Term-A-Duct conduit entrances are positioned in the walls of precast concrete padvaults for conduit entry. Existing Term-A-Ducts shall be used if possible. Where conduit diameter is smaller than that of the Term-A-Duct, reducer/adaptors found in Construction Standards chapter GC shall be used. The lowest possible Term-A-Ducts in the bank should always be used first, in order to accommodate future installations. To prevent pull-out, conduit ends shall be glued in place in the Term-A-Ducts using the glue found in chapter GC. The estimator may contact the vault manufacturer if an application requires a number or size of Term-A-Duct different from the standard. Holes may also be drilled in the side of the enclosure to accommodate unusual conduit entries.

Conduits entering an equipment base or enclosure without Term-A-Ducts shall be terminated with bell ends. Conduits shall be sealed with spray foam to prevent water from running through the conduit into the enclosure or equipment base. See Construction Standard GC 121, Conduit and Cable Pulling—Conduit Sealing, for conduit sealing procedures.

Cable Training

Cables pulled into equipment bases or enclosures, and routed to pad-mounted equipment or primary junctions, shall be looped once around the inside of the base or enclosure before exiting to the equipment. This method produces a large bend-radius in the cable (preferred) and allows for thermal expansion in the cable. Cables being looped in an enclosure shall be supported on cable support brackets, which are described in chapter GV (see Figure 8).

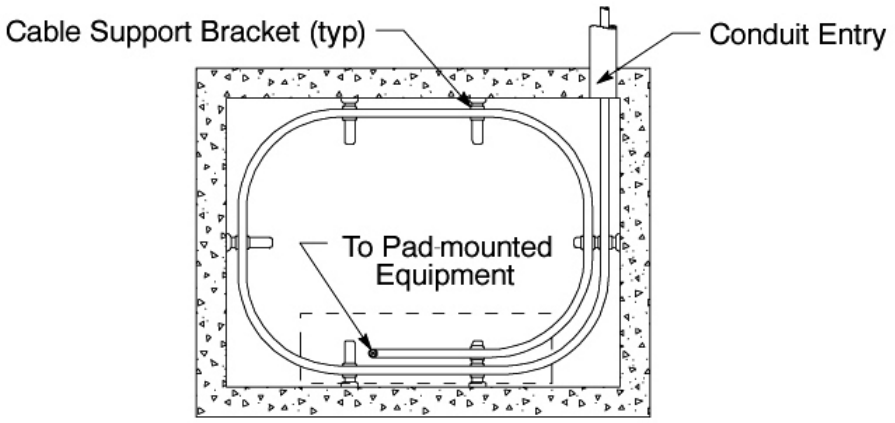

Figure 8—Equipment Base Cable Training and Support

Cables which only pass through an enclosure without terminating at a piece of equipment, including those having been spliced in the enclosure, shall be run along the wall in as simple a routing as possible to avoid congestion and tripping hazards. In large vaults, where several cables are to be run, cables shall be supported on cable support brackets (see Figure 9).

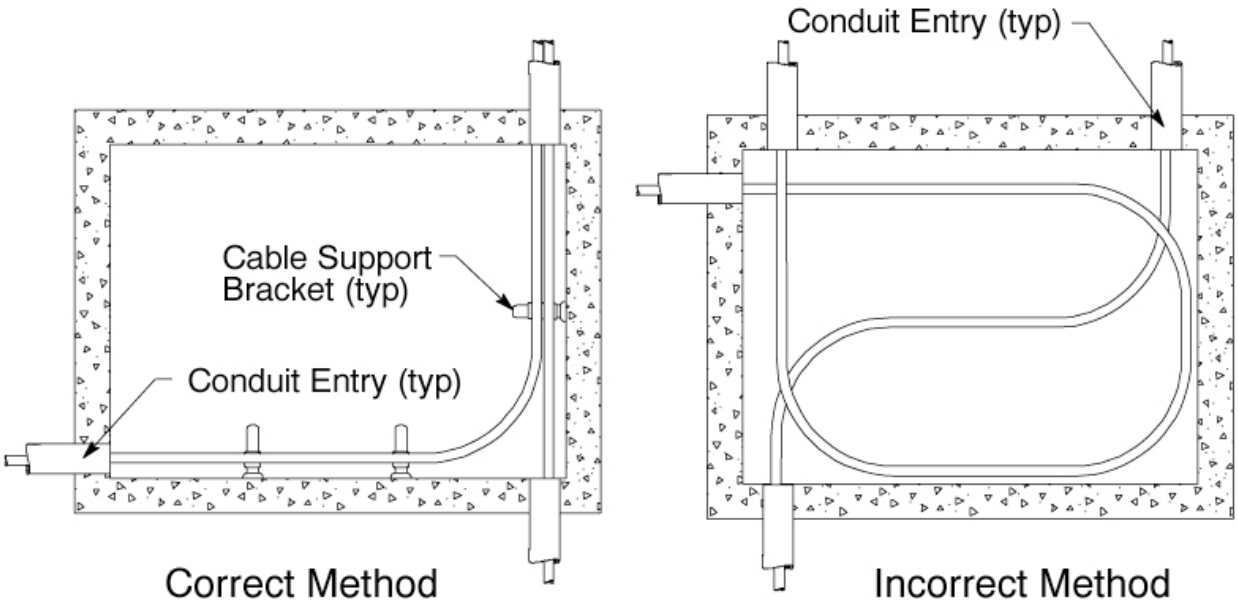

Figure 9—Enclosure Cable Training and Support

To maintain cable integrity and to prevent tripping hazards, cables inside a padvault with an access panel shall never rest on the floor, and are to be racked in accordance with NESC 341.B.1.

Barrier Posts

Six-inch steel or concrete barrier posts shall be provided by the customer wherever vehicular traffic may pose a threat to pad-mounted equipment. Steel posts shall be painted or galvanized, and may be filled with concrete. Concrete posts shall be painted. The posts shall have a domed top, and be free of burrs and sharp edges. Each barrier post shall be set in a concrete foundation at least 12 inches in diameter and 24 inches in depth below grade (see Figure 10).

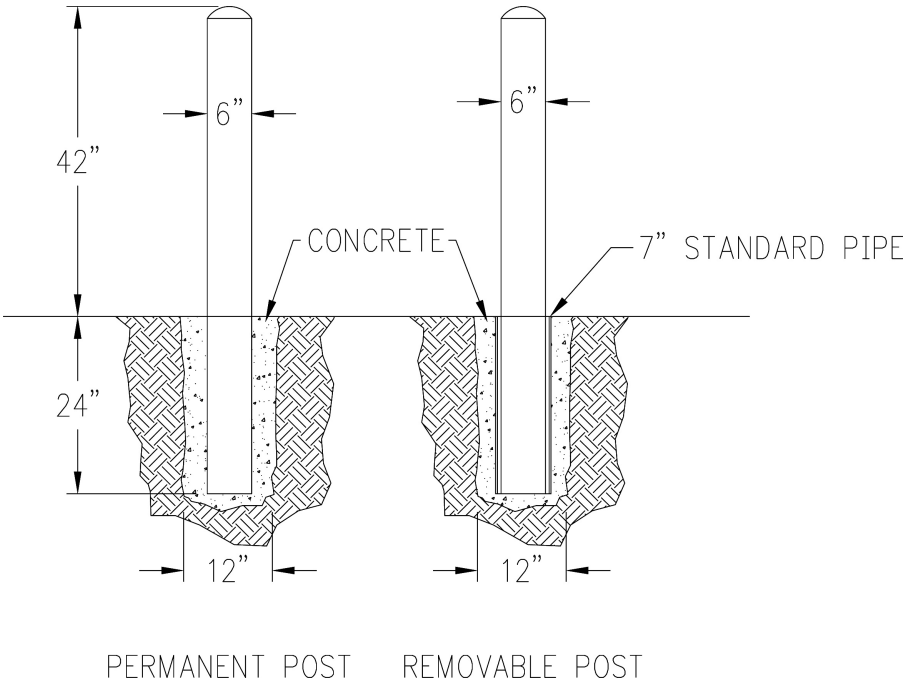

Figure 10—Barrier Post Details

Posts shall meet the following additional requirements:

1. In areas where construction equipment traffic poses a temporary threat to equipment, barrier posts shall be provided by the customer, and shall remain in place until the threat has been eliminated.
2. Enough barrier posts shall be installed to adequately protect the pad-mounted equipment from vehicular traffic.
3. If the distance between two posts, or between a post and a non-traffic area, is greater than six feet, an intermediate post shall be installed (see Figure 11).
4. Barrier posts shall be placed so as not to obstruct the opening of the equipment doors, nor to impede the operation of the equipment. If this is not possible, removable posts shall be used in the obstructive location(s) (see Figure 12).

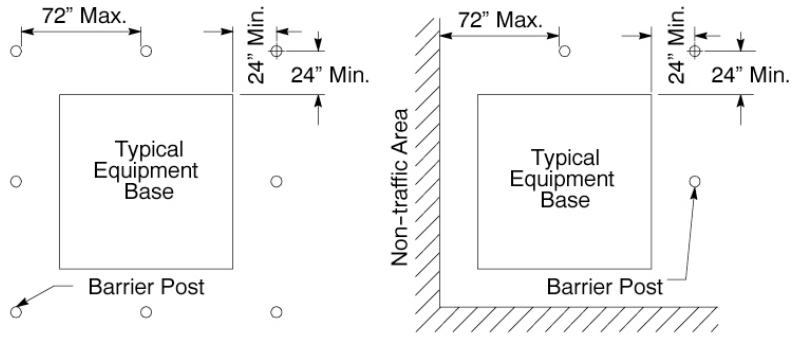

Figure 11—Typical Barrier Post Layouts

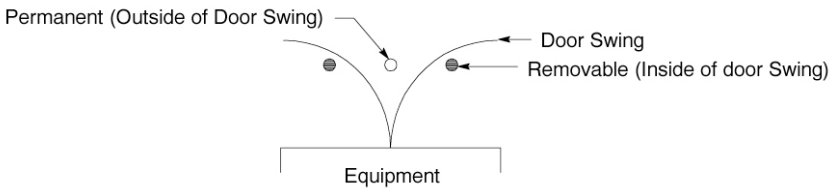

Figure 12—Equipment Door and Barrier Post Positioning Detail