	CLEARANCES AND LOCATION REQUIREMENTS FOR ENCLOSURES, PADS, AND UNDERGROUND EQUIPMENT		051122
	Asset Type: Electric Distribution	Function: Design	
Issued by: Carlos Araquistain (CJA8) <i>C. Araquistain</i>	Date: 07-31-15		
Rev. #21: This document replaces PG&E Document 051122, Rev. #20 For a description of the changes, see Page 28.			

This document is also included in the following manual:

- *Electric and Gas Service Requirements Manual (Greenbook)*

Purpose and Scope

This document contains information relating to the placement of electric underground equipment and enclosures. This includes pad-mount, subsurface, and vault installations with or without equipment.

References	Location	Document
Marking, Numbering, and Identification of Line Structures	OH: Marking	022168
<u>Concrete Pad for Three-Phase, Loop-Style, Pad-Mounted Transformers</u>	UG-1: Transformers/Greenbook	045292
Pad-Mounted, Load-Break Switches and Fuses	UG-1: Switches	053318
Pad-Mounted Transformers Installed Indoors	UG-1: Transformers/Greenbook	057521
Landscape Screen for Pad-Mounted Transformers	UG-1 Transformers/Greenbook	063422
Box-Pad for Pad-Mounted Transformers	UG-1: Transformers/Greenbook	064309
Pad-Mount Capacitor	UG-1: General	066197
PG&E Approved Manufacturers	Greenbook	066211
Installation of Pad-Mounted, Load-Break Junction	UG-1: Switches	066212
<i>General Order (G.O.) 128</i>	TIL	<i>G.O. 128</i>

California Administrative Code:

[Title 8 – Industrial Relations, Chapter 4, Sub-Chapter 5, Electrical Safety Orders](#)

[Title 24 – State Building Standards, Part 3 – California Code of Regulations, California Electric Code](#)

1. Clearances

Clearances are divided into the following sections:

- Building clearances.
- Clearances to foreign substructure.
- Horizontal work space clearances.
- Hazardous locations.

Underground equipment, pads and enclosures shall be located so that they meet or exceed the required clearances in each of the clearances sections **and** in each of their subsections.

Clearances and Location Requirements for Enclosures, Pads, and Underground Equipment

2. Building Clearances

- A. Clearances from building surfaces (see Figure 1): Oil filled pad-mount equipment shall have the following clearances (based on *G.O. 128, Rule 34.3 [D]*):
- a) 3-foot minimum from combustible building surfaces to the edge of the pad.
 - b) 2-foot minimum from non-combustible building surfaces to the edge of the pad. Non-combustible materials include brick, clay, concrete, steel, stone, and stucco.
- B. Doorway clearance (see Figure 1): Pad-mounted equipment shall not be placed where it impedes the flow of traffic through a doorway. In general, 4 feet of doorway clearance is sufficient (based on the [Uniform Building Code](#)).

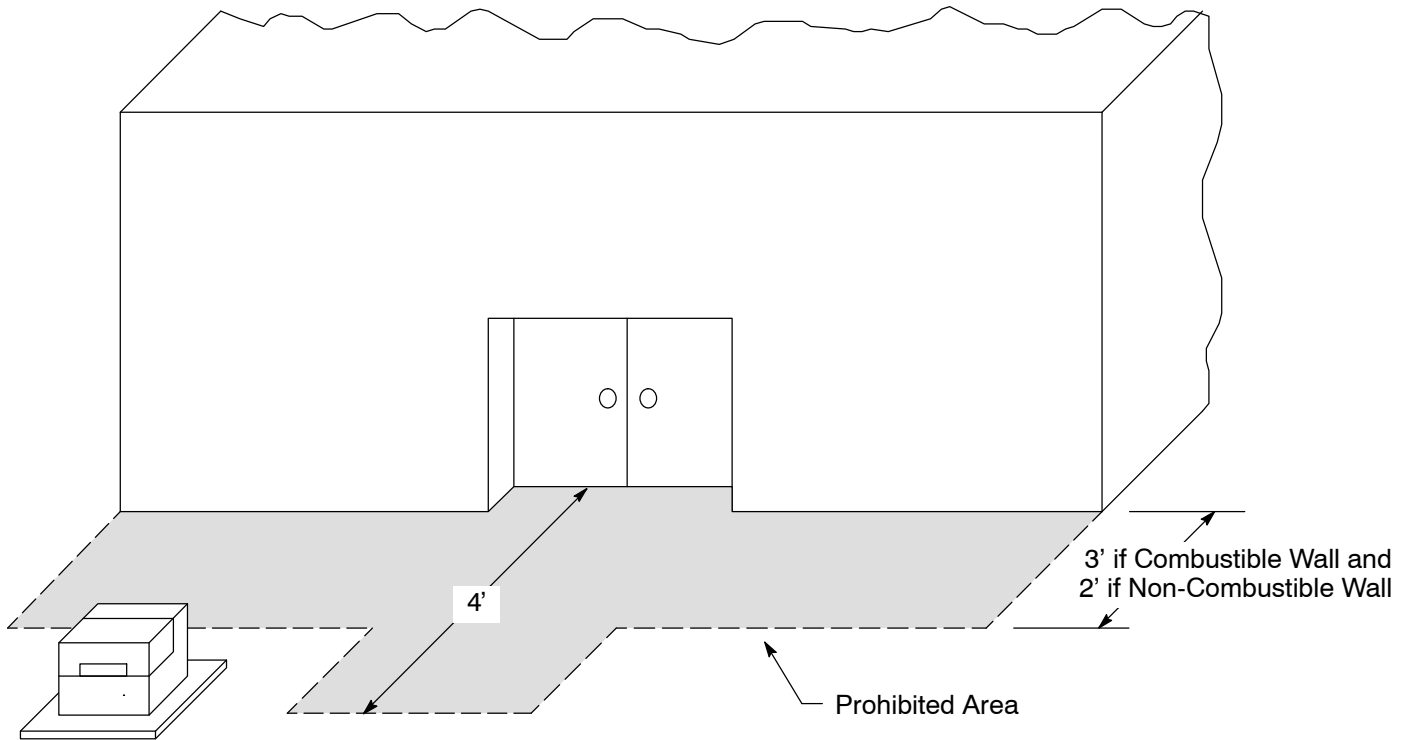


Figure 1
Building and Doorway Clearances
(see Notes 2.A and 2.B)

Clearances and Location Requirements for Enclosures, Pads, and Underground Equipment

2. Building Clearances (continued)

C. Vertical clearance from overhangs (see Figure 2): To provide space for hoisting equipment so that equipment can be replaced, the following vertical clearances from the top of the pad for pad-mounted equipment or top of the enclosure for subsurface equipment are required (based on *G.O. 128, Rules 17.3 and 34.2*).

a) 20-foot minimum for:

- 1Ø pad-mount equipment.
- Subsurface equipment.
- Style MTP 3Ø transformer.

b) 30-foot minimum for:

- 3Ø pad-mount equipment except style MTP transformers.

c) When required for installations such as in dry vaults (Document 057521), the vertical clearance outside the doorway may be reduced to 10 feet from ground level. This reduced clearance will greatly expand the replacement time, since the equipment must be jacked and rolled out to a position where the clearance is adequate to hoist it.

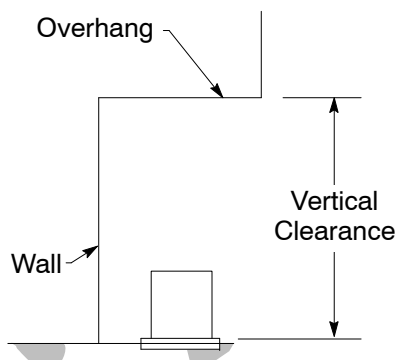


Figure 2
Clearances for Pad-Mounted
or Subsurface Equipment
(see Note 2.C)

D. Railroad or streetcar track clearance: 6-foot minimum clearance is required from the rail to the nearest edge of any manhole, enclosure, or secondary box (*G.O. 128, Rule 31.5 [D]*).

Clearances and Location Requirements for Enclosures, Pads, and Underground Equipment

3. Clearances to Foreign Substructures

- A. Pad-Mounted Equipment:
The area 1 foot around and 6 feet below the pad or pedestal shall be kept free of foreign substructures.
- B. Subsurface Equipment or Enclosures:
The area 1 foot around and 6 feet below the enclosure shall be kept free of foreign substructures.

4. Work Space Requirements

Maintain work space requirements as indicated on all new installations. Exercise judgement on existing installations where encroachment has occurred. For example, a fire hydrant located within the work space that does not adversely affect operations is not a concern. Clear and level work areas are required around underground equipment and enclosures to provide an adequate safe working space for operation or maintenance. Obstructions and elevation changes, other than a standard city/county street curb, are not allowed in the work space. (Based on G.O. 128, Rule 17.3 and 34.2) .

- A. Primary enclosures (see Table 1 below and Figure 3 on Page 5): Sufficient clearance to remove covers, operate with hot sticks, replace equipment and cable, etc., is required. Field conditions and the specific equipment may allow some of the clearances to be reduced.

Table 1 Primary Enclosure Clearances

Primary Enclosures	Required Clearances
Round or Square 3' x 5' (interior dimensions)	3' From Outside Edges
4' x 6' 6" (interior dimensions)	3' From the Outside Edge of the Long Side / 4' From the Outside Edge of the Short Side
4' 6" x 8' 6" (interior dimensions)	3' From the Outside Edge of the Long Side / 5' From the Outside Edge of the Short Side
J-Box in 3' x 5'	3' on short sides, 2' on long side adjacent to the junction bars (the non-operable side), 5' on the long side opposite the junction bars (the operable side)
J-Box in 4' x 6' 6"	4' on short sides, 2' on long side adjacent to the junction bars (the non-operable side), 5' on the long side opposite the junction bars (the operable side)
J-Box in 4' 6" x 8' 6"	5' on short sides, 2' on long side adjacent to the junction bars (the non-operable side), 5' on the long side opposite the junction bars (the operable side)

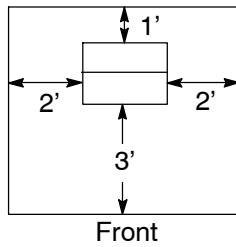
- B. Pad-Mounted Equipment (see Figure 4 and Figure 5 on Page 6).
 - a) 8-foot minimum (measured from the edge of the pad) in front of all equipment doors to provide room to operate with hot sticks and to replace the equipment. Note: Some equipment types have operable doors in both the front and the rear, and both require 8 feet of operating room.
 - b) 3-foot minimum from non-operable sides.
Exceptions:
 - (1) Landscaping obstructions (decorative walls, planters, rocks, etc.) that are up to about 1 foot wide and 2 feet tall may be placed next to the pad on non-operable sides (refer to Document 063422).
 - (2) One of the 3-foot dimensions may be reduced to 2 feet where Note 2.A.b on Page 2 applies, except for pad-mount switchgear.

Clearances and Location Requirements for Enclosures, Pads, and Underground Equipment

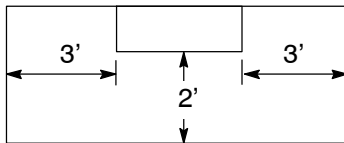
C. Secondary Enclosures – Minimum Work Space Required:

- a) Pedestal: 3 feet in front, 2 feet to the side, and 1 foot to the back.

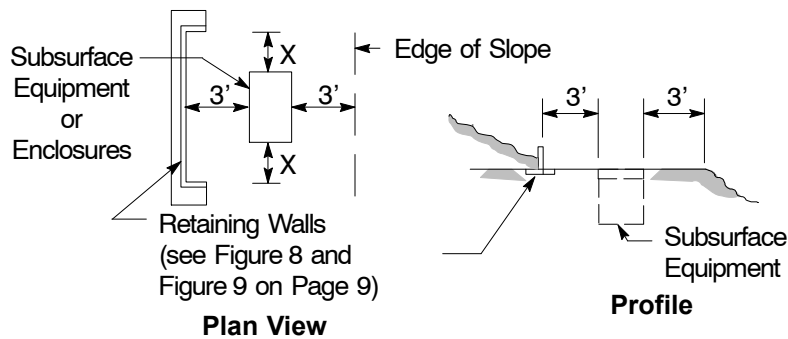
4. Work Space Requirements (continued)



- b) Secondary Splice Box – 24" x 36" or smaller: 3 feet on short sides, 2 feet on one long side.



- c) Secondary Splice Box – 3' x 5' or larger: Same as Table 2.



- X = 3' for Round or Square
 X = 3' for 3' x 5'
 X = 5' for 4' 6" x 8' 6"

Figure 3
Example of Subsurface Equipment or Enclosures Installed on Sloped Terrain
 (see Note 4.A on Page 4)

Clearances and Location Requirements for Enclosures, Pads, and Underground Equipment

4. Work Space Requirements (continued)

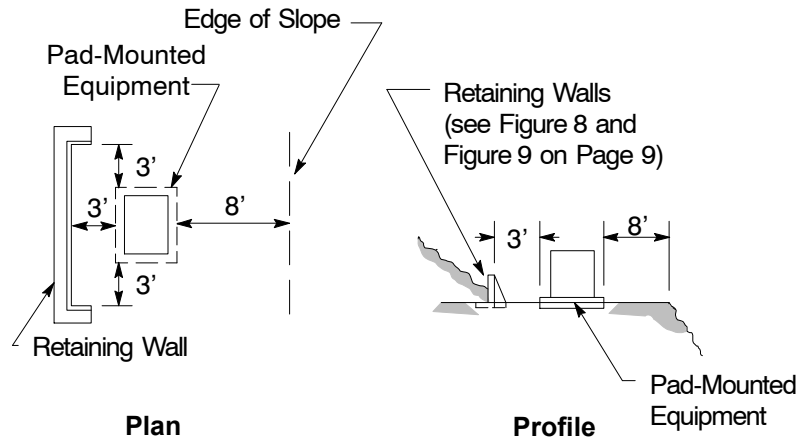


Figure 4
Example of Pad-Mounted Equipment (with front doors only) Installed on Sloped Terrain
(see Note 4.B on Page 4)

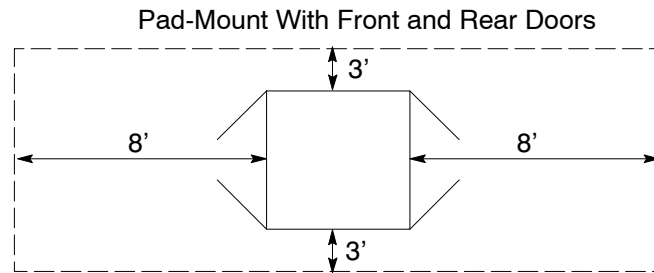


Figure 5
Work Space for Pad-Mounted Equipment
(with front and rear doors including most switches and capacitors)
(see Note 4.B on Page 4)

5. Hazardous Locations

Use the following guide when installing pad-mounted and subsurface equipment in areas where hazardous liquids and gases are dispensed or stored in sealed containers.

- A. Liquified flammable gases: Do not install pad-mounted or subsurface equipment within 20 feet of a gas dispenser without conforming to the regulations concerning installation of electrical equipment in hazardous areas (refer to [Articles E500-1, E500-2, E500-3, E514-1, and E514-2 of Title 24, Part 3, State Building Standards](#)).
Examples: Gas station fuel pump, convenience store propane pump.
- B. Any container which stores flammable liquid or gas: These containers will be considered equivalent to "combustible walls". Therefore, the required clearances are the same as established in Note 2.A.a on Page 2 of this document. Examples: Emergency generator, propane tank at a house.

Clearances and Location Requirements for Enclosures, Pads, and Underground Equipment

6. *Spill Prevention Control and Countermeasure (SPCC) and Oil Containment*

It is the customer's responsibility to comply with spill prevention and containment requirements for oil-filled electrical equipment in accordance with applicable laws, regulations, and ordinances. The Spill Prevention Control and Countermeasure (SPCC) regulations and the [Uniform Fire Code \(UFC\)](#) require the installation of containment structures to prevent spills and leaks of oil from reaching a waterway. SPCC requirements are found in the [Code of Federal Regulations, Title 40, Part 112](#) and apply to facilities having a total quantity of oil exceeding 1,320 gallons. The requirements of [UFC Articles 79](#) and [80](#) may also apply to containers and equipment holding more than 55 gallons of oil. These regulations include information on the type and size of the containment needed. Additional containment requirements may be mandated in local hazardous materials ordinances.

7. *Future Construction*

Consideration should be given not only to conditions existing at the time of installation but also to possible future structures and equipment that could interfere with required clearances or accessibility. On those installations where there is a high probability of a future obstruction, install a clearance requirement sign (Code 373998) on the equipment.

8. *Noise Control*

Transformer noise level increases with the kVA size. Avoid placing transformers alongside bedrooms and other places where noise may be objectionable.

9. *Retaining Walls*

- A. Retaining walls are required when PG&E determines that it is necessary to protect equipment or enclosures against landslides, drainage wash, drifting sands, etc. The applicant is responsible for the installation and maintenance of the retaining walls and any associated safety rail. The retaining wall will be designed to provide a barrier of sufficient strength and suitable construction to provide adequate protection and working space around the enclosure or equipment. Typical examples of retaining wall placement are shown in Figure 3 and Figure 4 on Page 6 of this document.
- B. Pre-approved retaining wall designs and materials are shown on Pages 8 and 9 of this document.
- C. For retaining walls in excess of the dimensions shown on Page 8:
 - a) The wall will be constructed of precast concrete, concrete poured in place, or concrete block.
 - b) A safety rail of corrosion resistant material is required at the top of all retaining walls when wall height exceeds 4 feet (refer to Utility Standard SAFE-1012S for more information).
 - c) The applicant will provide PG&E with a set of design drawings and structural calculations certified by a licensed civil engineer.
- D. Treated redwood or pressure-treated Douglas fir posts (nominal 4" x 4" minimum) and planks (nominal 2 inches or thicker) may be used for short (1 foot or less) retaining walls. Posts should be 24 inches or less in length and extend at least 12 inches below ground and not more than 12 inches above ground (see Page 9).
- E. The working area within the retaining wall shall be level.
 - a) For pad-mounted equipment, it is to be slightly below the pad level (see the appropriate pad document for specific information).
 - b) For subsurface enclosures, it is to be level with the enclosure.
- F. The working area shall be kept weed free and covered with a locally acceptable decorative covering.

Clearances and Location Requirements for Enclosures, Pads, and Underground Equipment

10. Precast Retaining Walls

Note

1. For drainage requirements, see Figure 9 on Page 9.

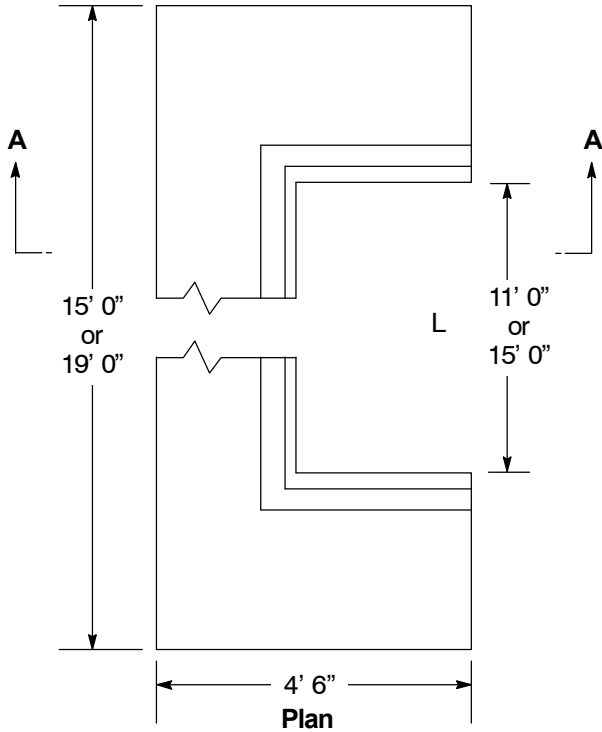


Figure 6
Concrete Poured in Place or
Concrete Block Retaining Wall

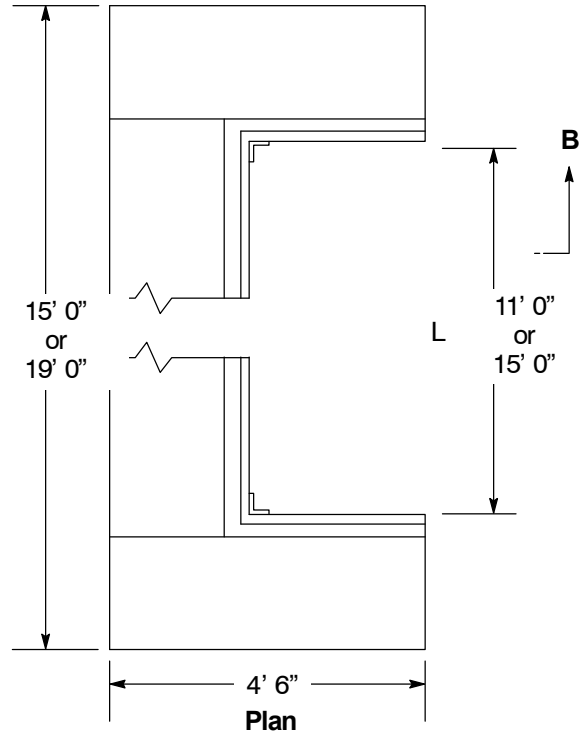
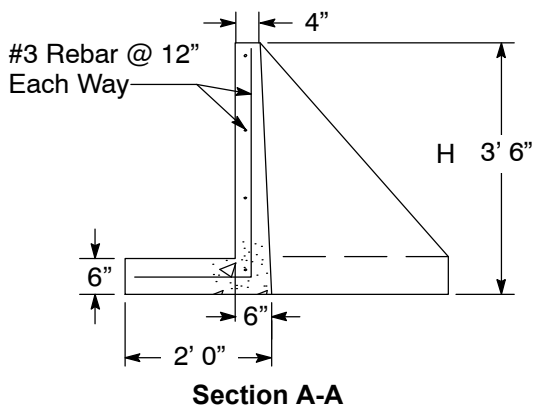
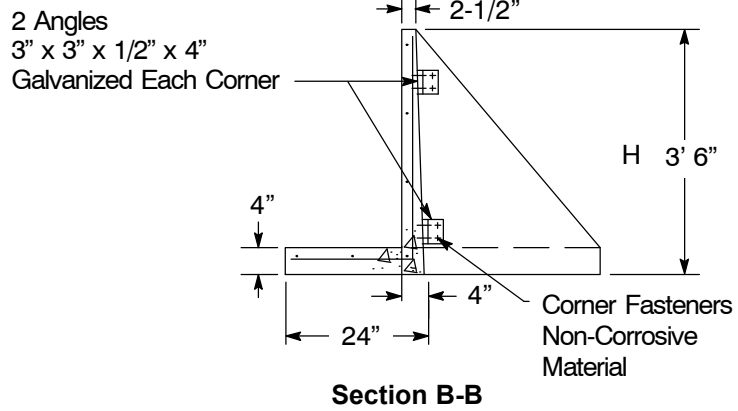


Figure 7
Precast Concrete Retaining Wall
(see Table 2 on Page 8)



Section A-A



Section B-B

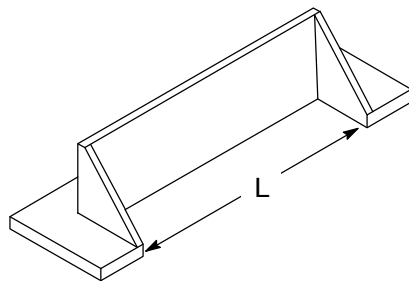


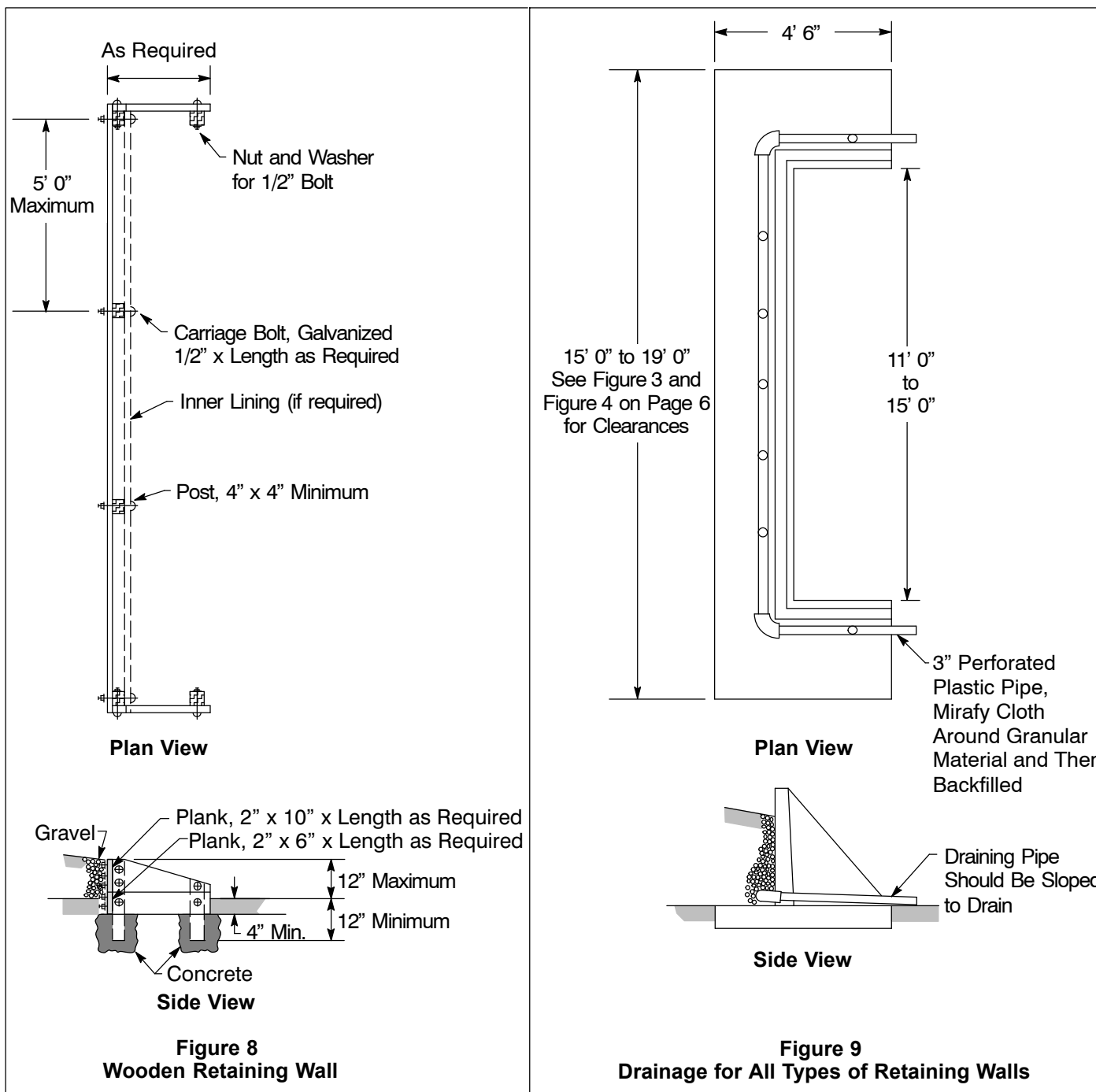
Table 2 Codes for Precast Retaining Walls

Dimension		Code ¹
L	H	
11' 0"	3' 6"	024881
15' 0"		024882

¹ See Document 066211 for approved suppliers.

Clearances and Location Requirements for Enclosures, Pads, and Underground Equipment

11. Wooden Retaining Walls and Drainage Details for All Retaining Walls



Clearances and Location Requirements for Enclosures, Pads, and Underground Equipment

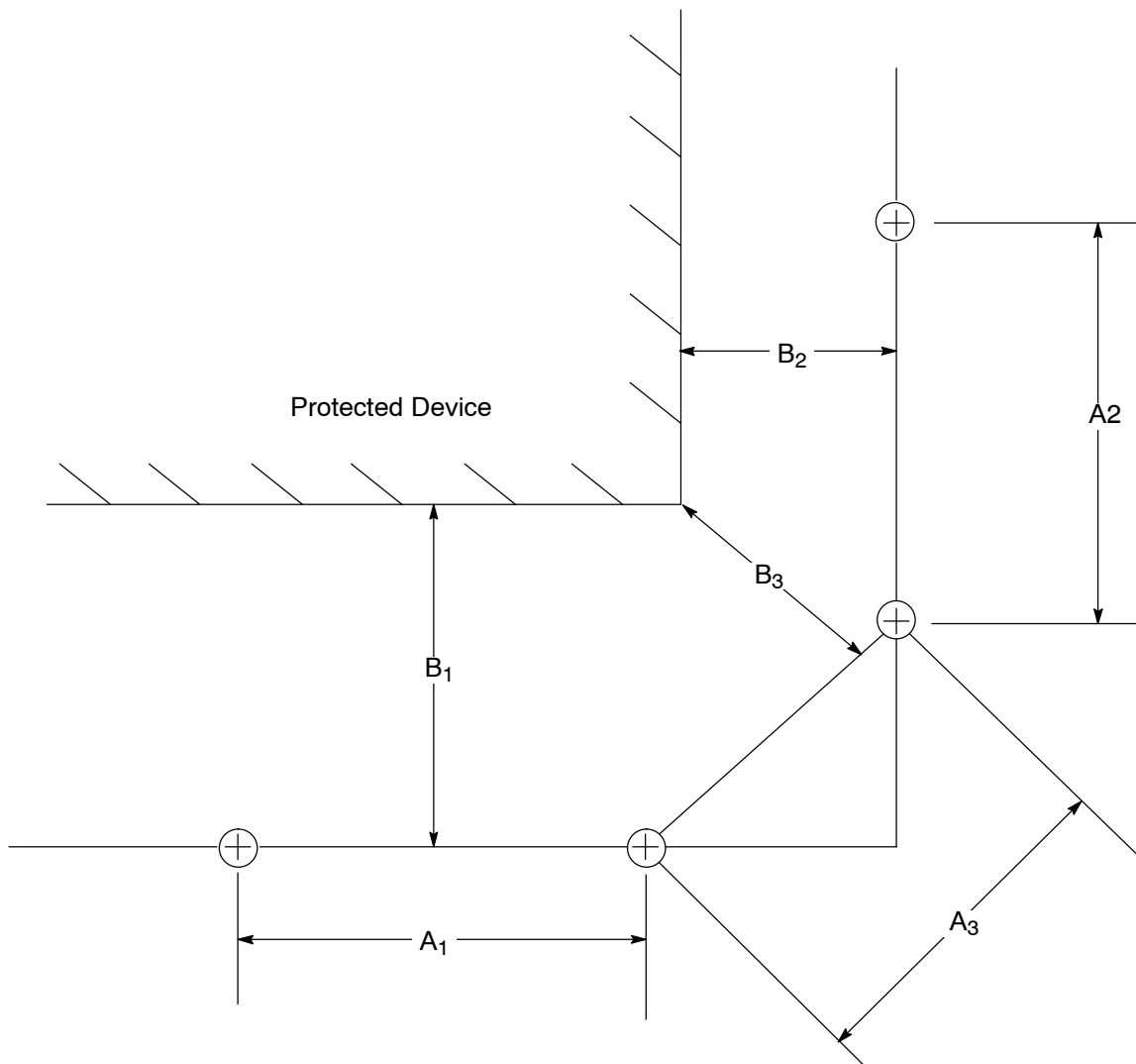
12. **Barrier Posts**

13. Physical protection from vehicular traffic shall be provided in accordance with the level of vehicular exposure. Barrier posts, etc., are intended to provide reasonable warning from accidental vehicular contact, rather than to prevent all possible contact. When PG&E determines it necessary, the applicant will provide acceptable physical protection.
14. In general, pad-mounted equipment having the following setbacks do not require the customer to provide any other physical protection.
 - a) Single-family, duplex, and other low density residential areas: 3-foot minimum from the edge of the thoroughfare pavement due to low vehicular traffic (see *G.O. 128, Rule 23.6* for definition of thoroughfare).
 - b) Commercial, apartment, condominium, and other high density areas: 9 feet from the edge of the thoroughfare pavement due to high vehicular traffic and frequent truck-backing.

The design of the particular layout may, of course, call for an increase or decrease in these dimensions. For example, a 3-foot setback is often adequate for parts of commercial parking lots where traffic flow is constrained and backing perpendicular to the curb is unlikely.
15. The posts shown in this document are the standard means for providing such physical protection. Suitable alternatives to these protective posts may be proposed by the applicant for PG&E's approval.
16. All barrier posts at the same installation site will be the same height.
17. A building wall can be considered as physical protection provided it is located at a point where a post would be normally required.
18. Maintain 36" minimum clearance between barrier posts and the edge of the pad in front of the equipment doors so that they do not interfere with opening the doors.
19. Certain types of pad-mounted equipment have doors in both front and back and require 36" minimum clearance to the pad on both sides.
20. Use removable posts when:
 - a) Posts are installed less than 8 feet in front of the equipment's doors, or
 - b) Where fixed posts would obstruct access for installation or replacement of equipment.
21. Preferred barrier post arrangements for specific equipment are provided in Figure 11 on Page 12 to Figure 23 on Page 24. These may be modified as needed, to meet specific layouts, but must conform to the requirements in Figure 10 on Page 11.
22. Barrier post details are shown in Figure 24 on Page 25 to Figure 30 on Page 27.

Clearances and Location Requirements for Enclosures, Pads, and Underground Equipment

12. Barrier Posts (continued)



A = Distance Between Posts in Inches
 B = Shortest Distance Between the Protected Device and the Line Between Barrier Posts

Figure 10
 Generic Barrier Post Placement

Requirements

1. "A" must be less than or equal to 42 inches.
2. "B" must be greater than or equal to 12 inches on non-operable sides.
3. "B" must be greater than or equal to 36 inches on operable sides.
4. B_n must be greater than or equal to (A_n/2)+3.

Table 3 Common A and B Pairs

"A" (inches)	"B" (inches)
18	12
24	15
30	18
42	24
42	36

Clearances and Location Requirements for Enclosures, Pads, and Underground Equipment

13. Preferred Barrier Post Arrangement for Transformers

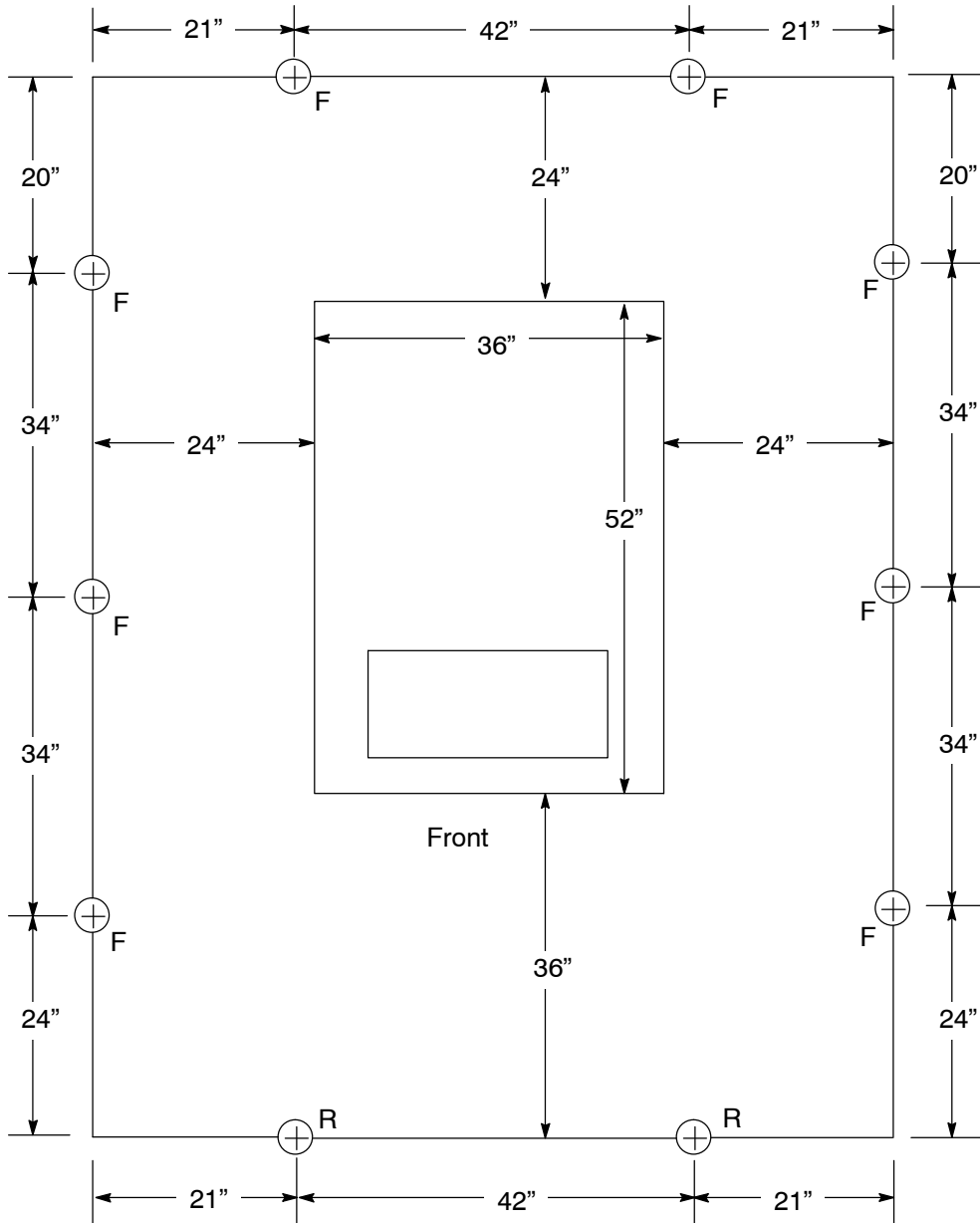


Figure 11
Style DF-LB Box Pad
36" x 52"
(Document 064309)

F = Fixed
R = Removable

Clearances and Location Requirements for Enclosures, Pads, and Underground Equipment

13. Preferred Barrier Post Arrangement for Transformers (continued)

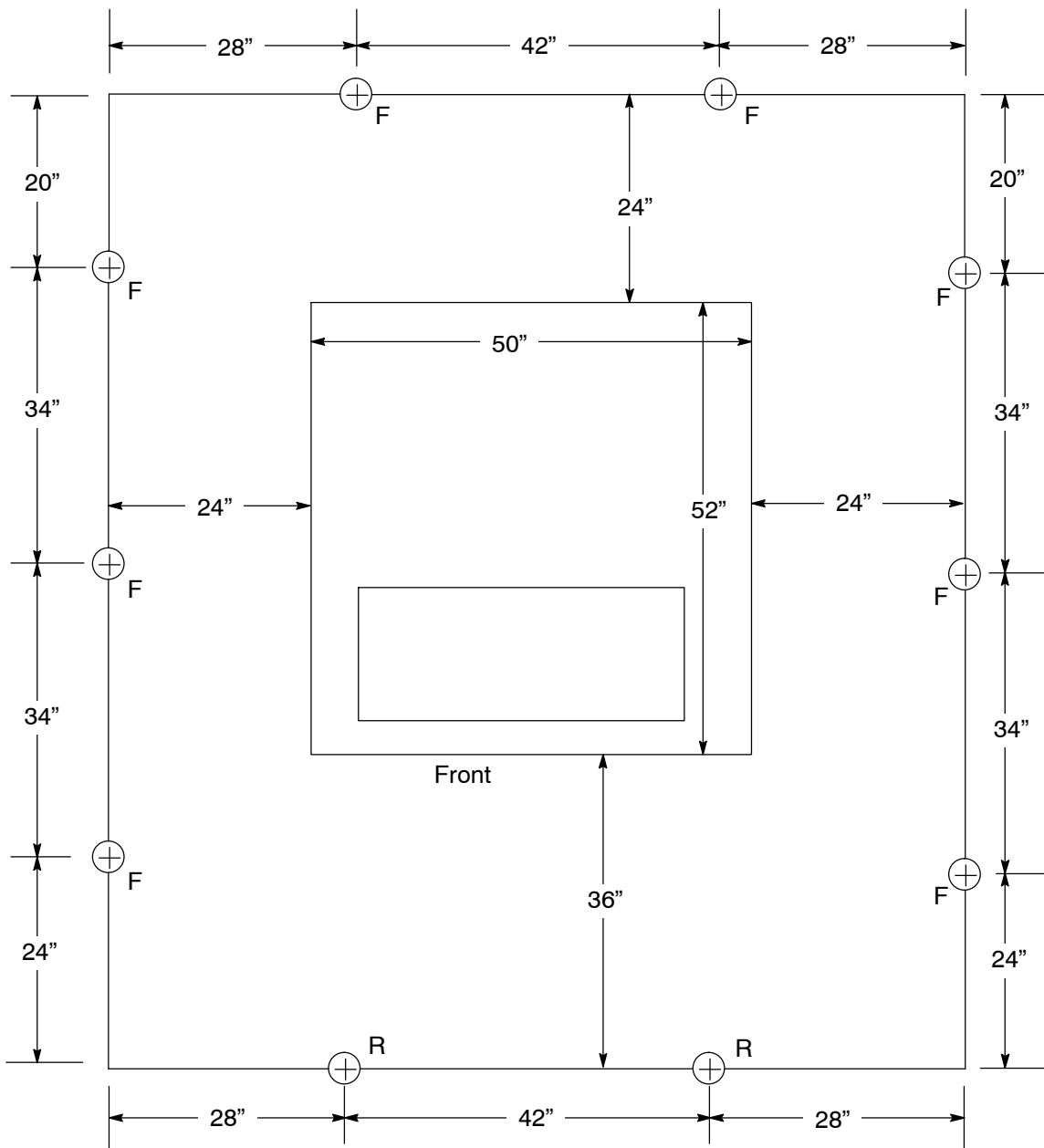


Figure 12
 Style DF-LB Box Pad
 50" x 52"
 (Document 064309)

F = Fixed
 R = Removable

Clearances and Location Requirements for
Enclosures, Pads, and Underground Equipment

13. Preferred Barrier Post Arrangement for Transformers (continued)

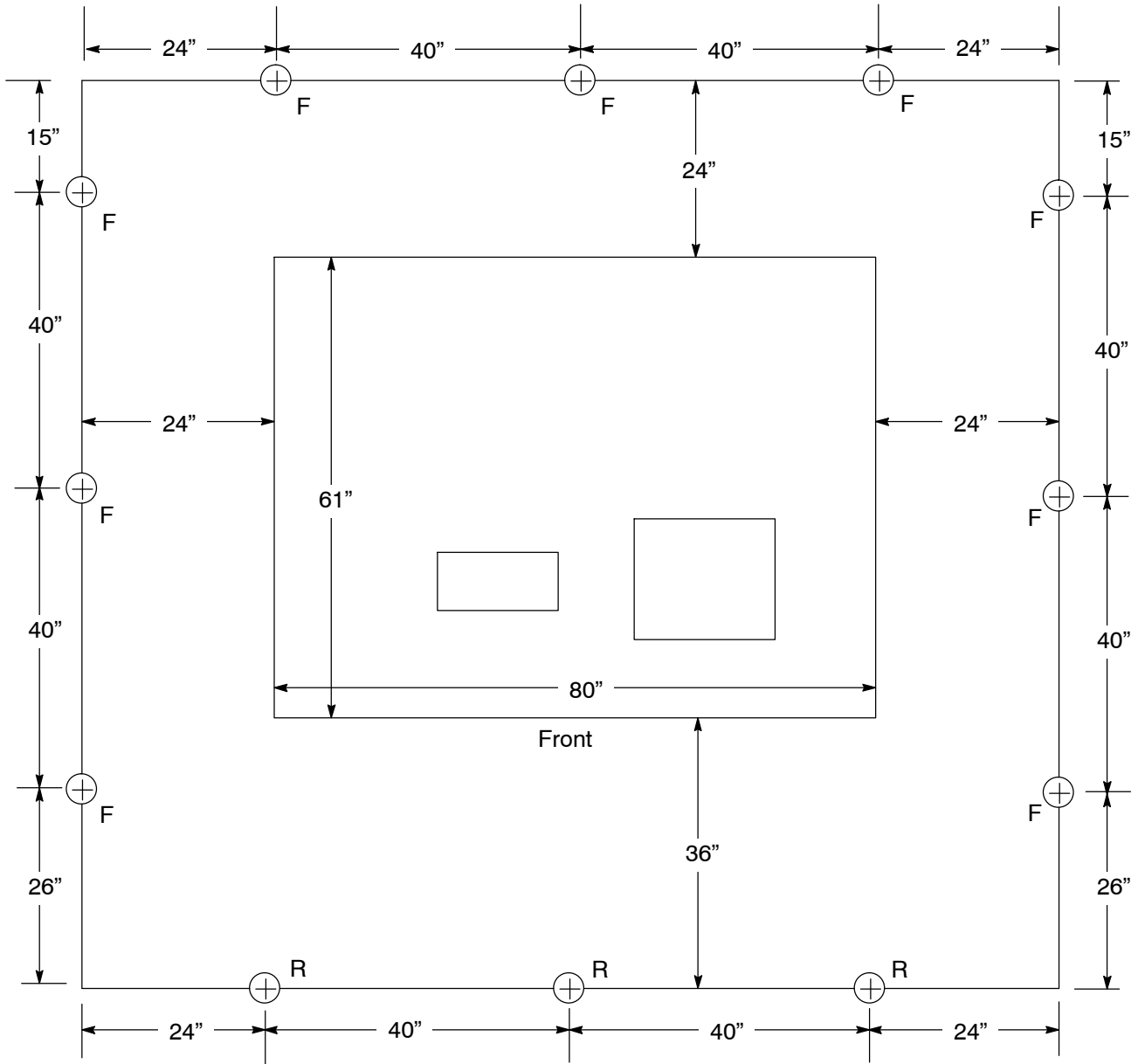
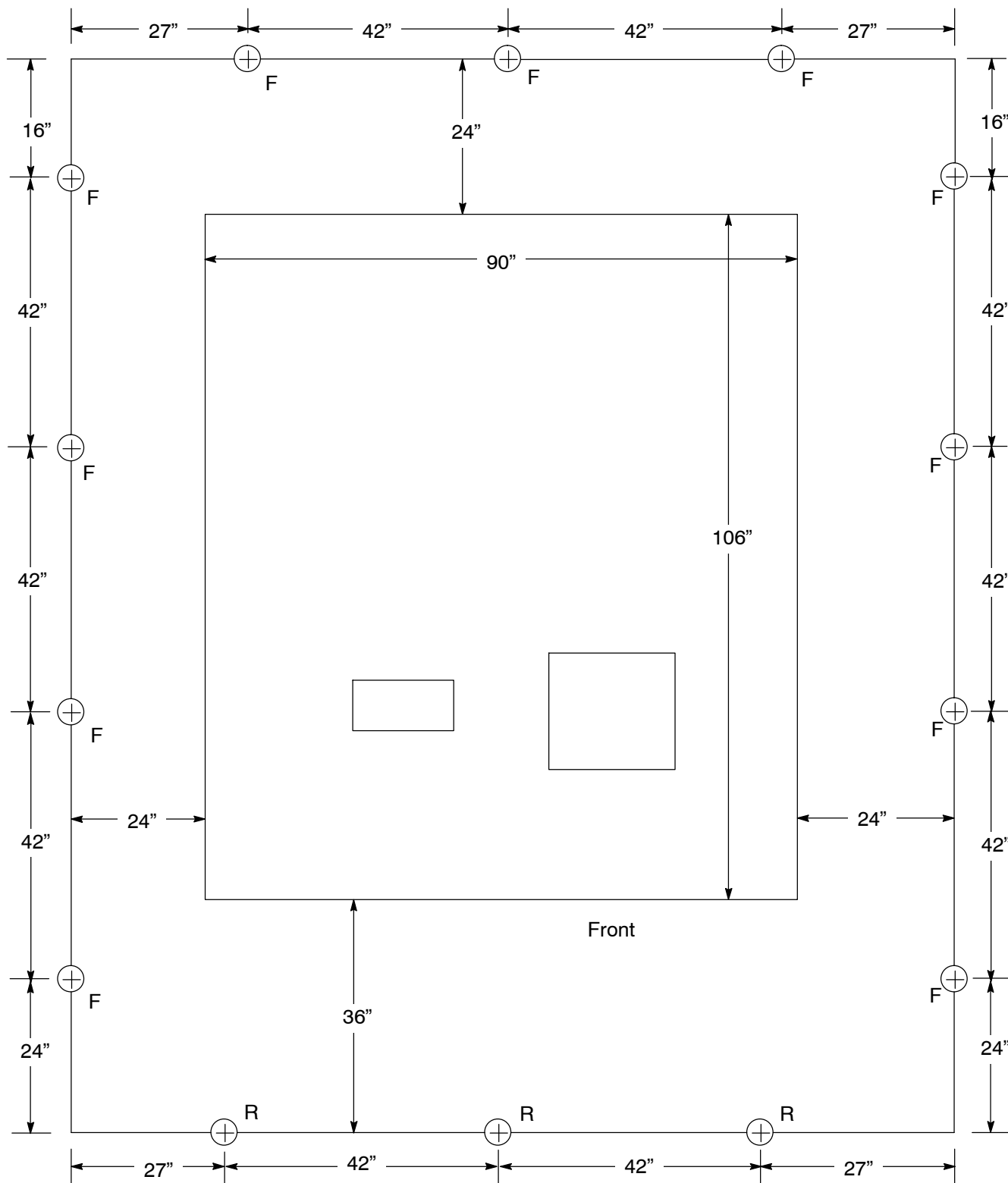


Figure 13
Style IIE-LB Pad
80" x 61"
(Document 045292)

F = Fixed
R = Removable

Clearances and Location Requirements for Enclosures, Pads, and Underground Equipment

13. Preferred Barrier Post Arrangement for Transformers (continued)



F = Fixed
R = Removable

Figure 14
Style IIE-LB Pad
90" x 106"
(Document 045292)

Clearances and Location Requirements for Enclosures, Pads, and Underground Equipment

14. Barrier Posts for Capacitors

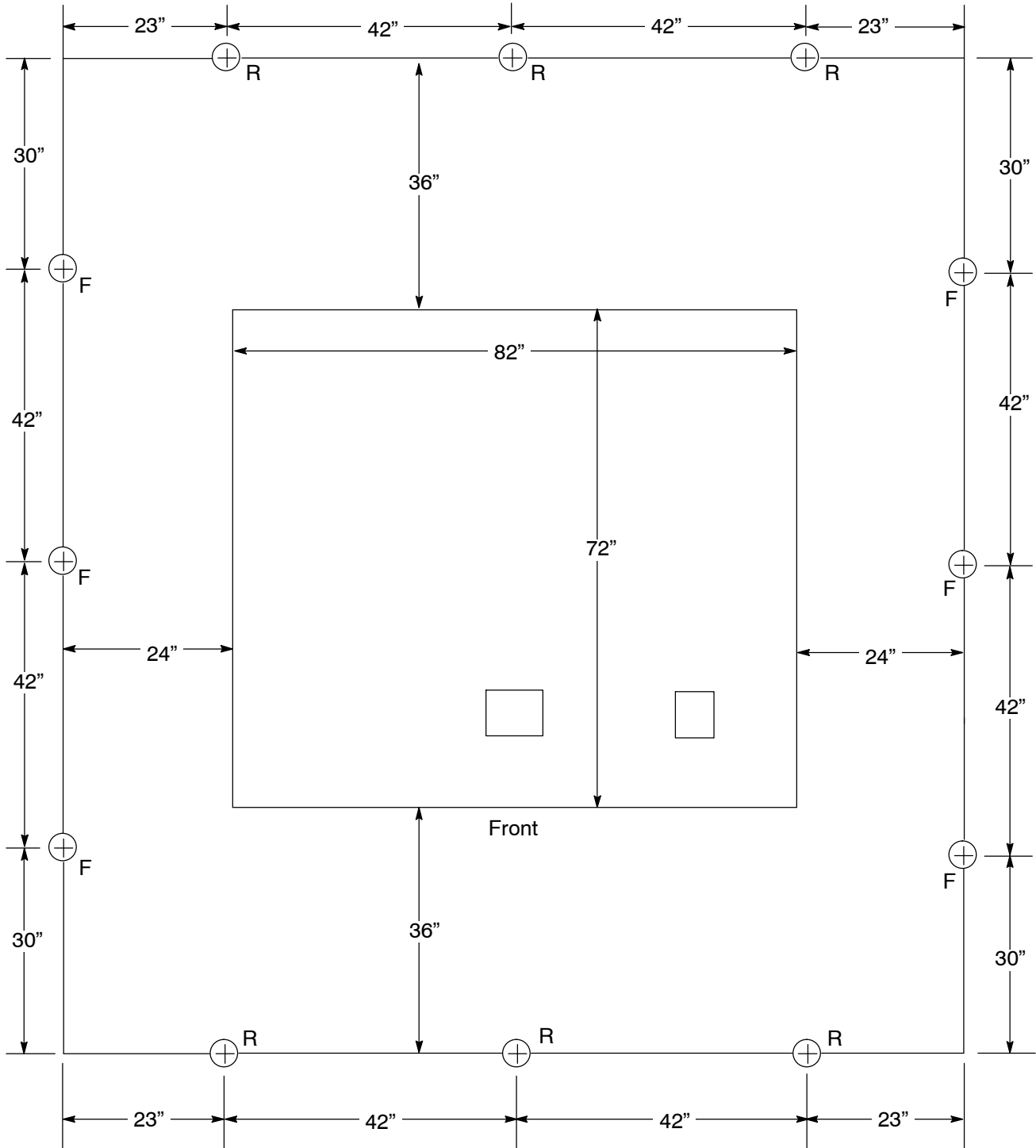


Figure 15
Pad-Mount Capacitor
82" x 72"
(Document 066197)

F = Fixed
R = Removable

Clearances and Location Requirements for Enclosures, Pads, and Underground Equipment

15. Barrier Posts for J-Boxes

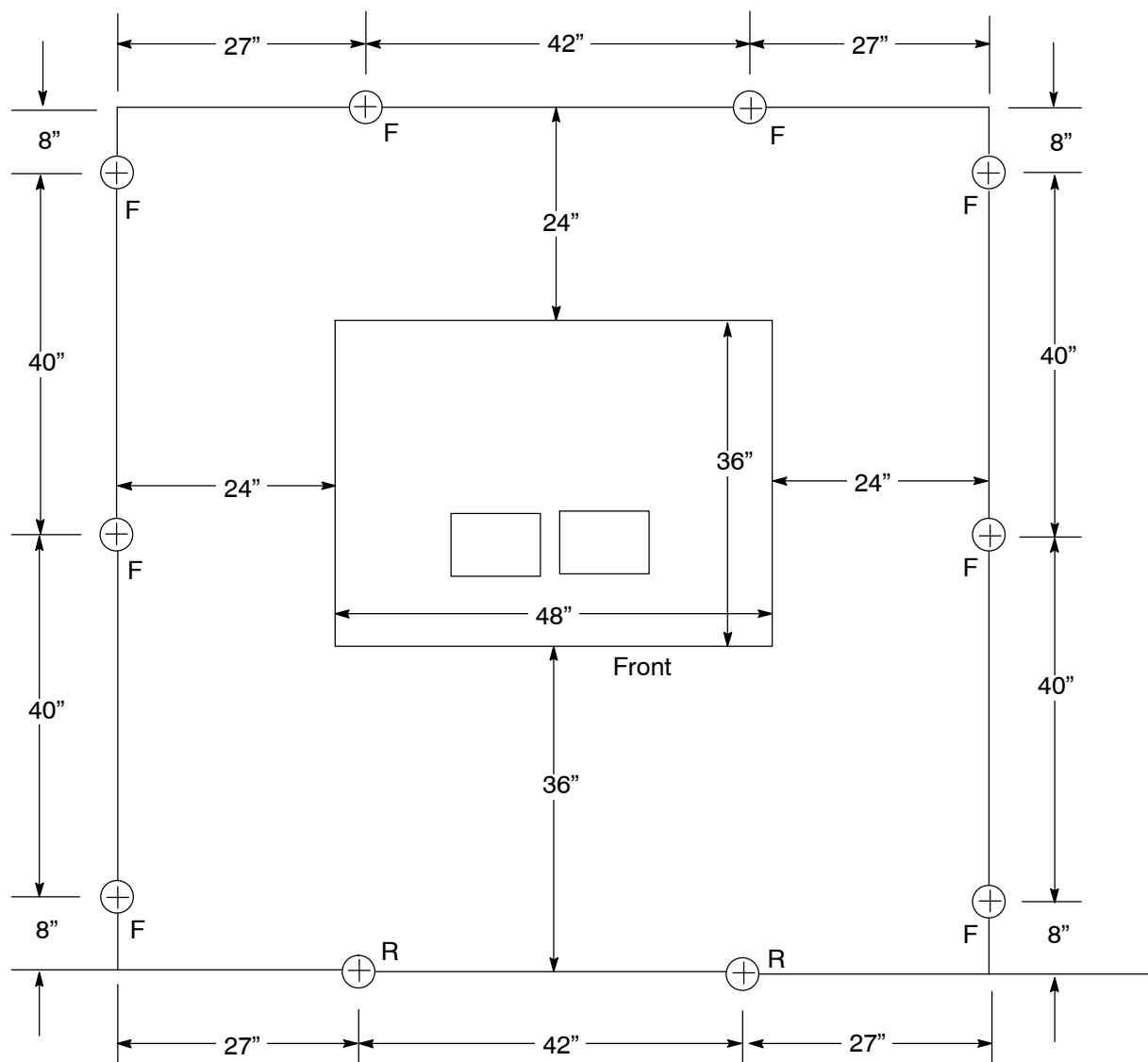


Figure 16
1-Wire, Pad-Mounted Junction
48" x 36"
(Document 066212)

F = Fixed
R = Removable

Clearances and Location Requirements for
Enclosures, Pads, and Underground Equipment

15. Barrier Posts for J-Boxes (continued)

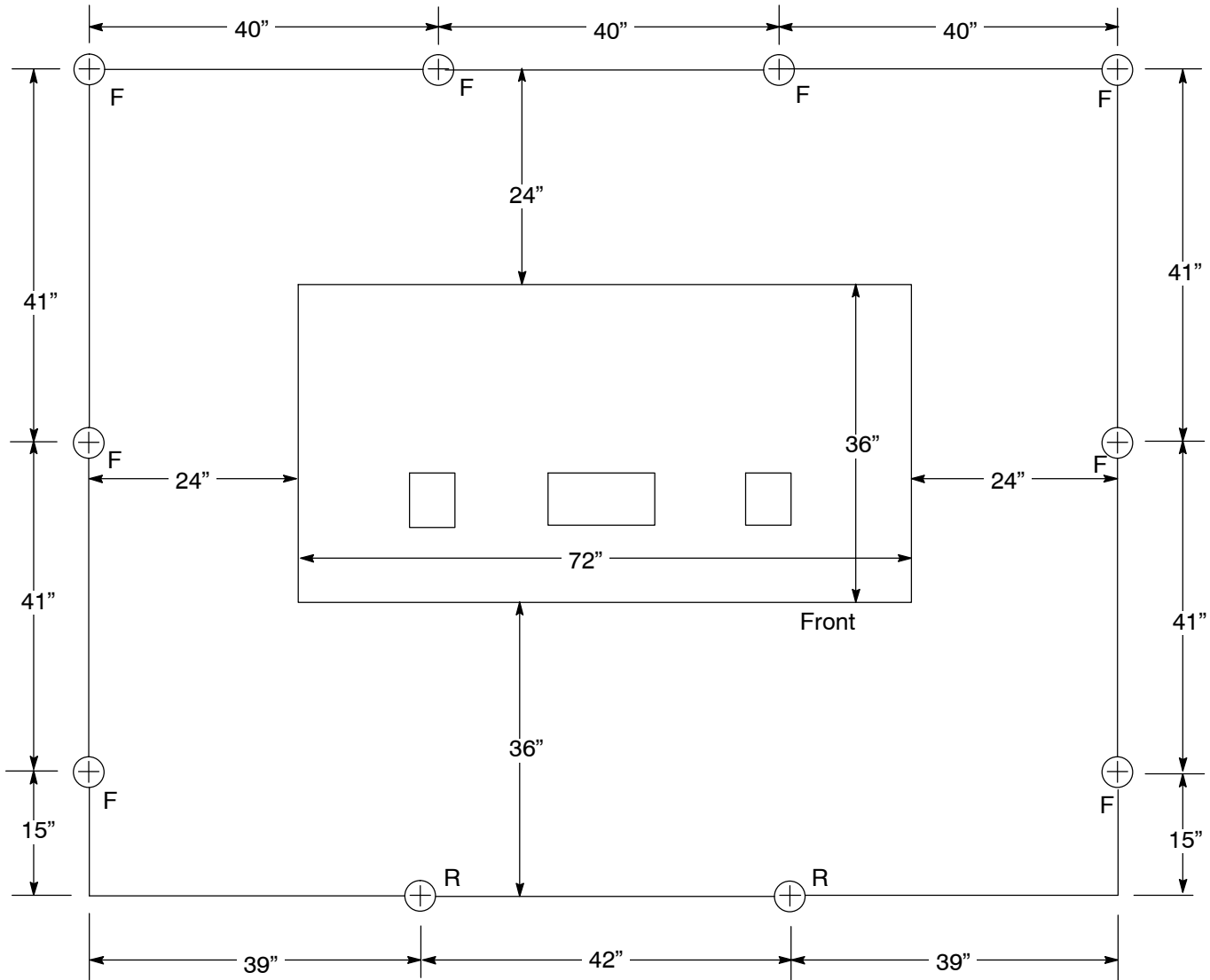


Figure 17
2- or 3-Wire Pad-Mounted Junction
72" x 36"
(Document 066212)

F = Fixed
R = Removable

Clearances and Location Requirements for Enclosures, Pads, and Underground Equipment

16. Barrier Posts for PMH Switch

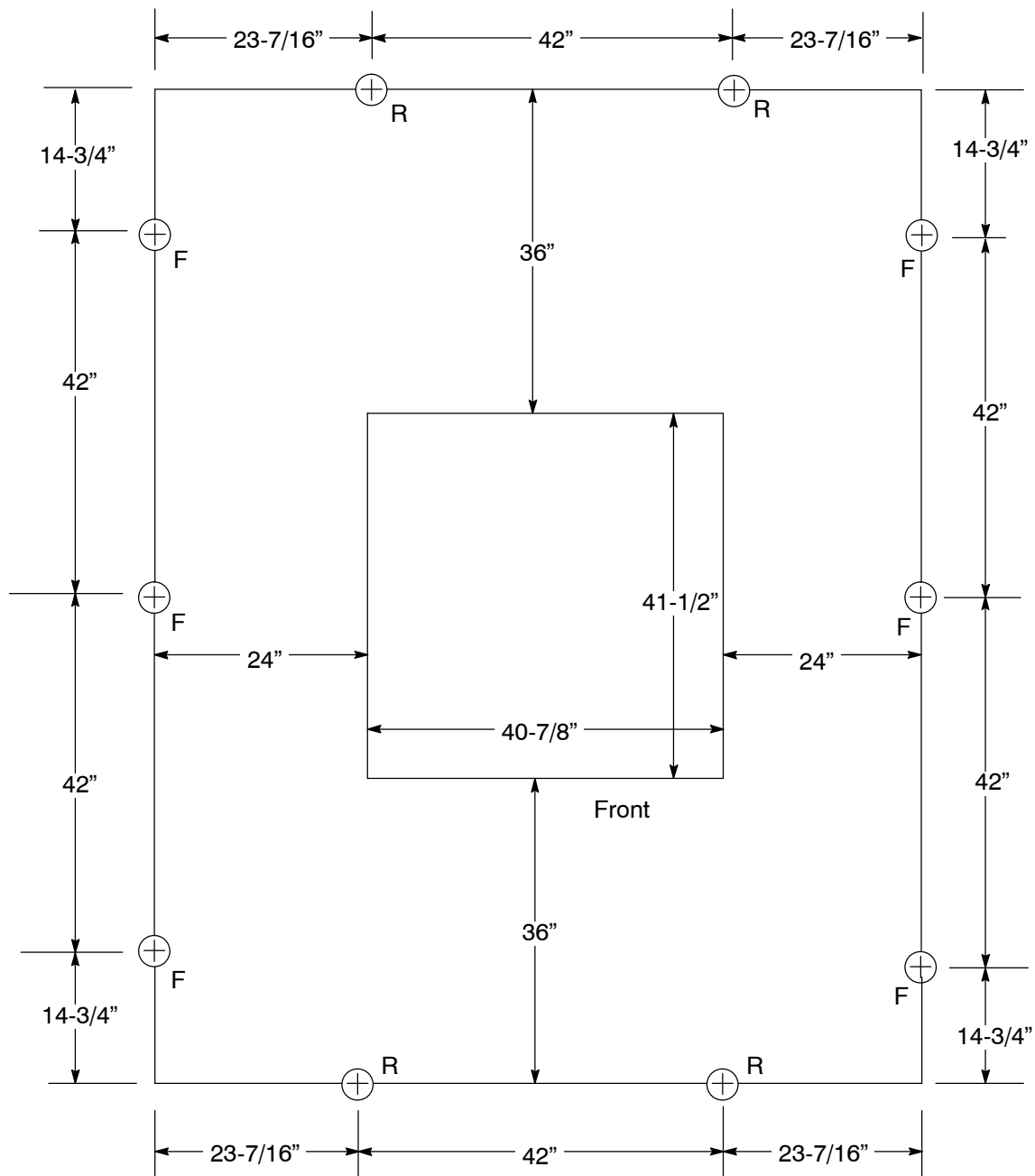


Figure 18
 PMH Switchgear
 40-7/8" x 41-1/2"
 (Document 053318)

F = Fixed
 R = Removable

Clearances and Location Requirements for
Enclosures, Pads, and Underground Equipment

16. Barrier Posts for PMH Switch (continued)

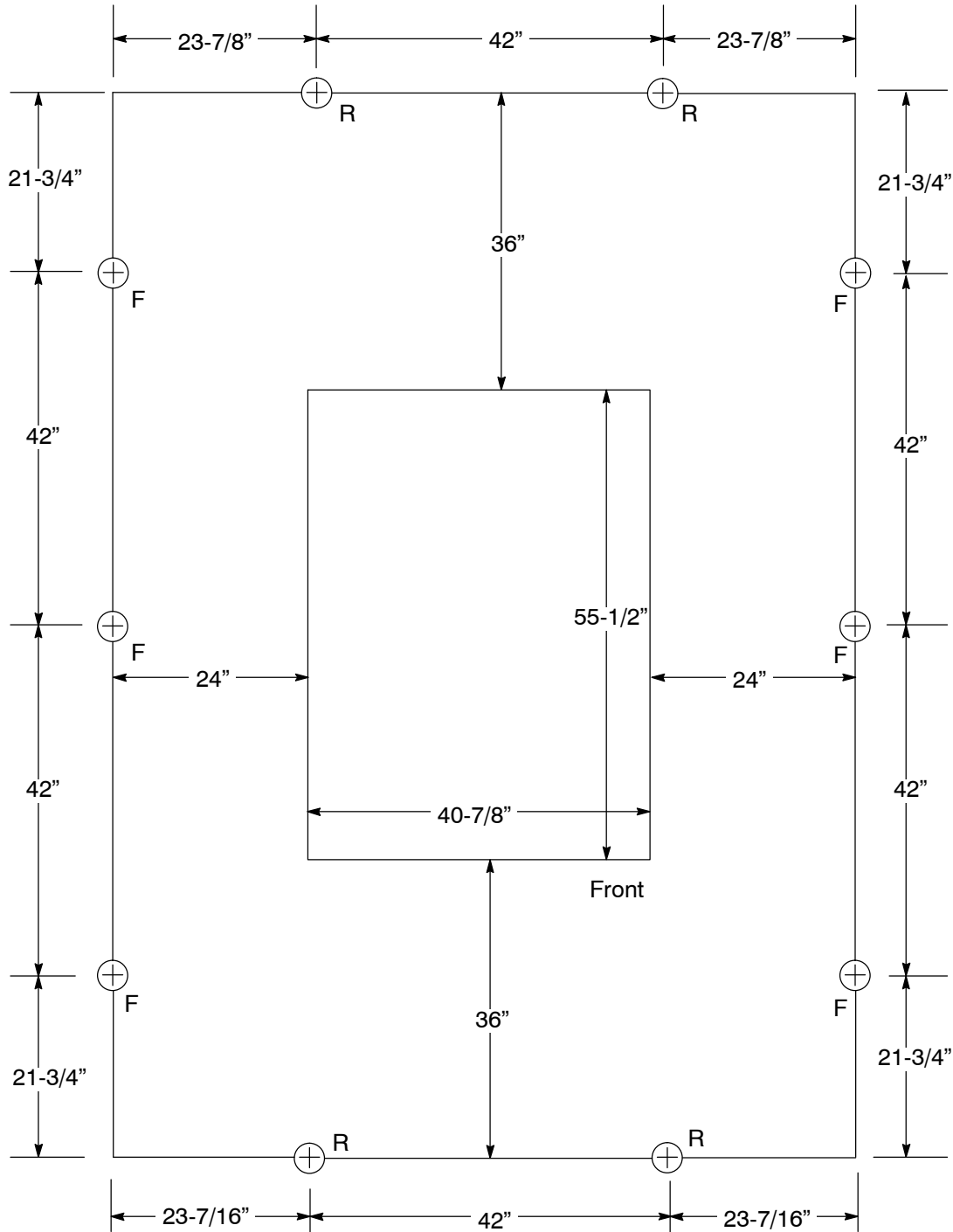


Figure 19
PMH Switchgear
40-7/8" x 55-1/2"
(Document 053318)

F = Fixed
R = Removable

Clearances and Location Requirements for Enclosures, Pads, and Underground Equipment

16. Barrier Posts for PMH Switch (continued)

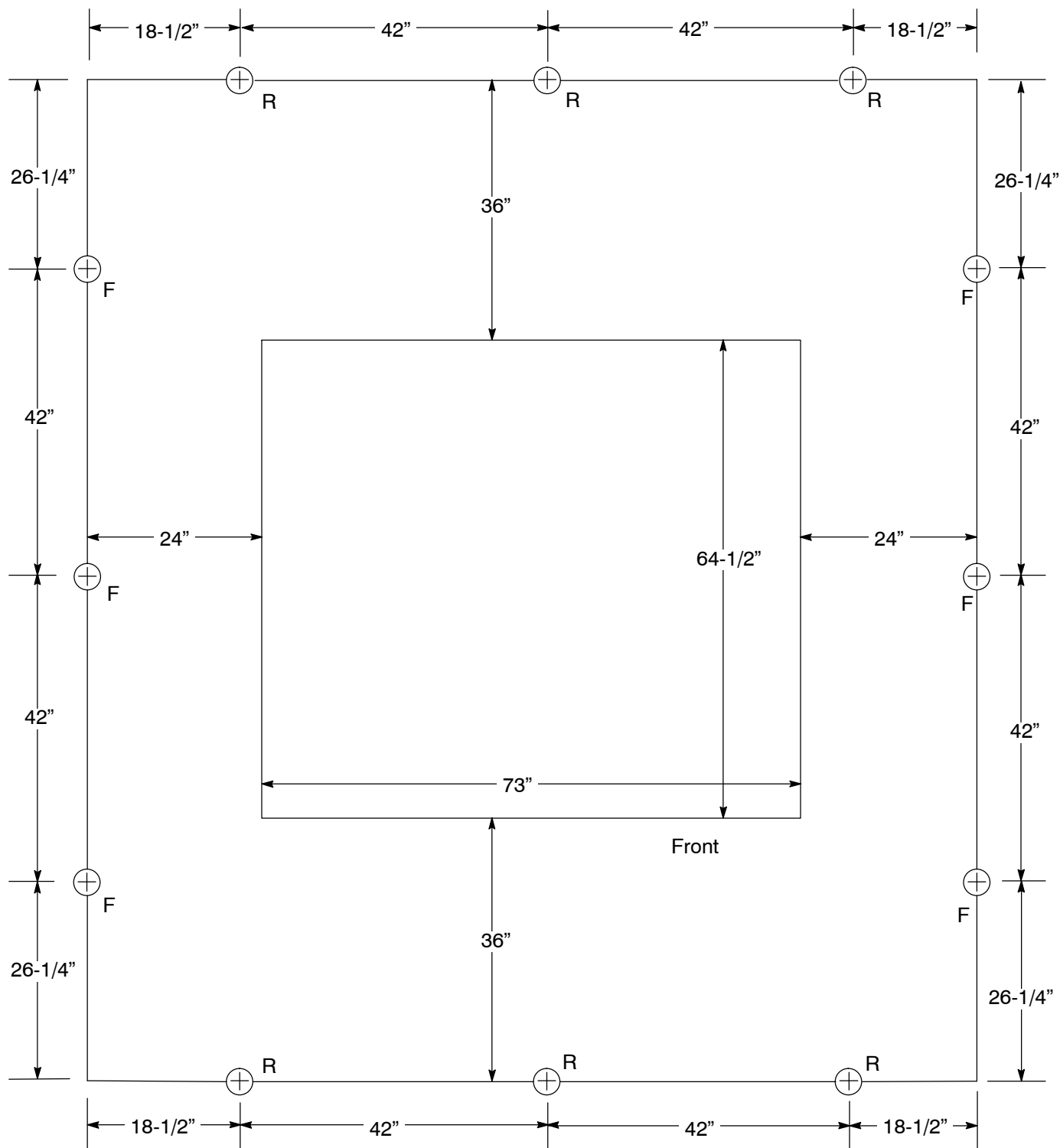


Figure 20
PMH Switchgear Pad
73" x 64-1/2"
(Document 053318)

F = Fixed
R = Removable

Clearances and Location Requirements for
Enclosures, Pads, and Underground Equipment

16. Barrier Posts for PMH Switch (continued)

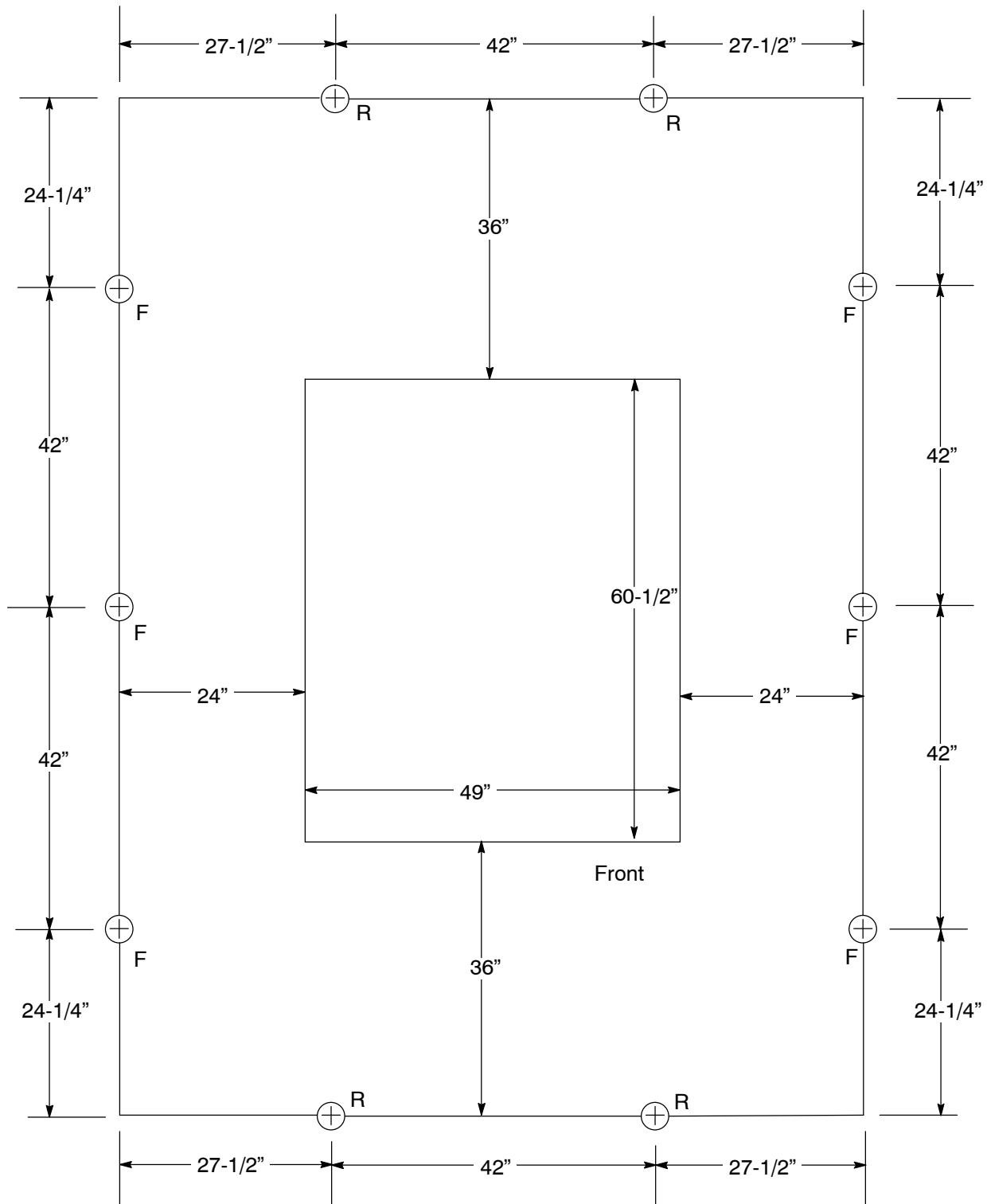
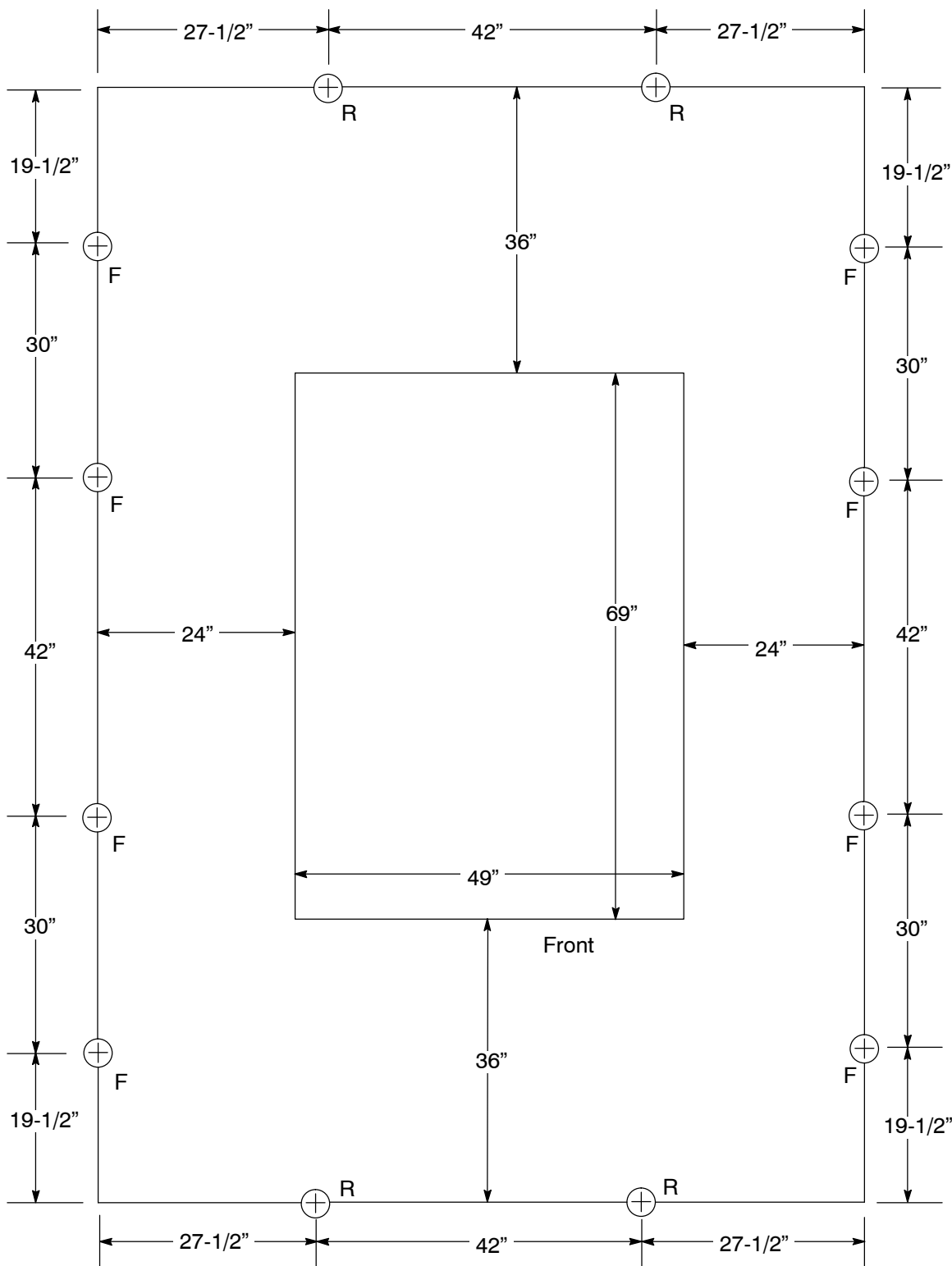


Figure 21
PMH Switchgear Pad
49" x 60-1/2"
(Document 053318)

F = Fixed
R = Removable

Clearances and Location Requirements for Enclosures, Pads, and Underground Equipment

16. Barrier Posts for PMH Switch (continued)



F = Fixed
R = Removable

Figure 22
PMH Switchgear Pad
49" x 69"
(Document 053318)

Clearances and Location Requirements for
Enclosures, Pads, and Underground Equipment

16. Barrier Posts for PMH Switch (continued)

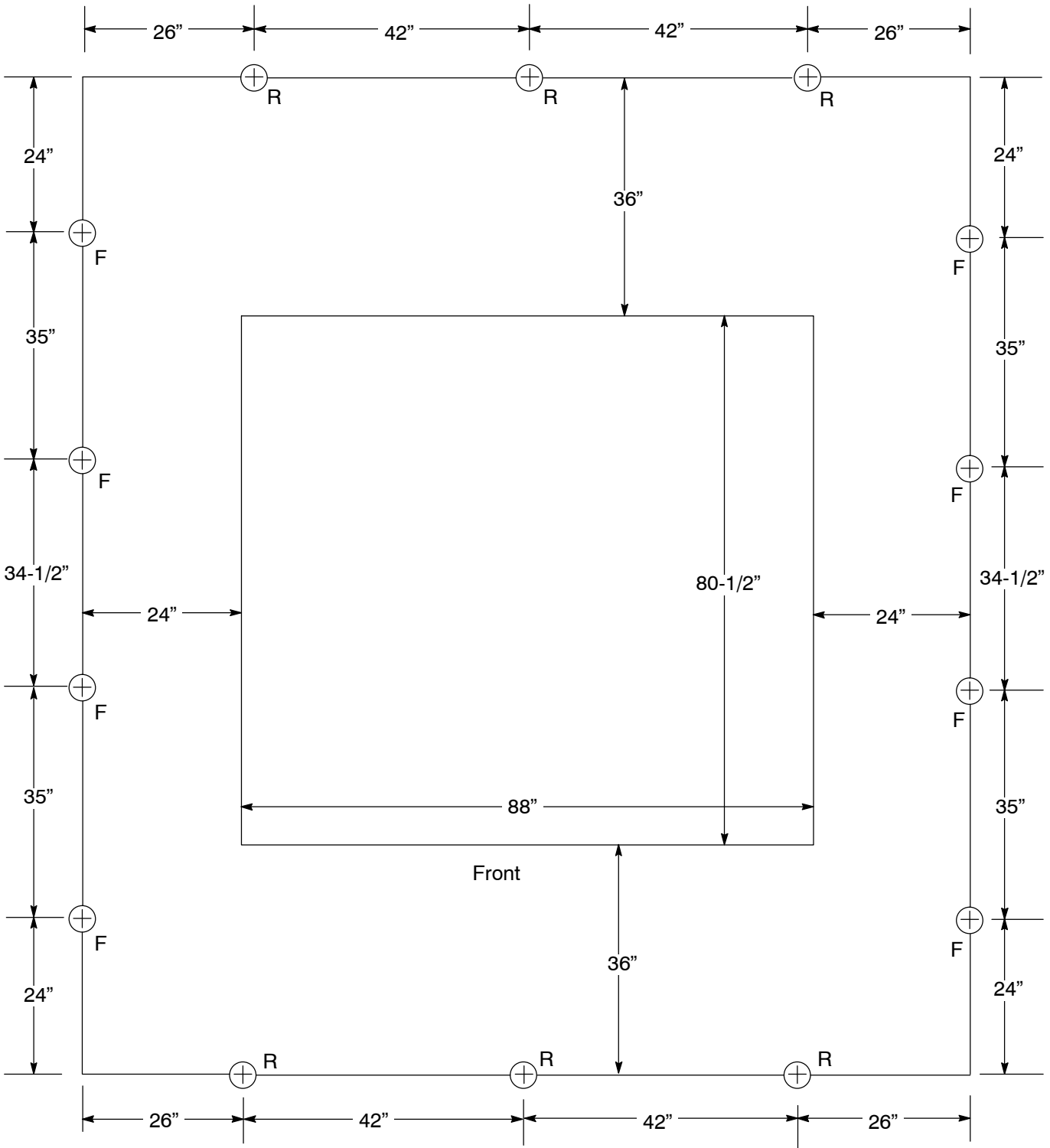


Figure 23
PMH Switchgear Pad
88" x 80-1/2"
(Document 053318)

Clearances and Location Requirements for Enclosures, Pads, and Underground Equipment

17. Placement of Metal Barrier Posts and Details

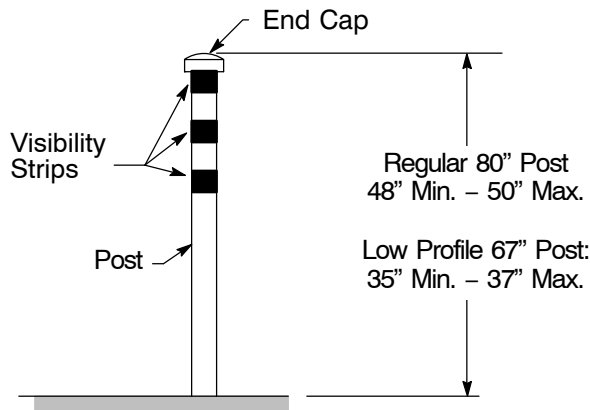
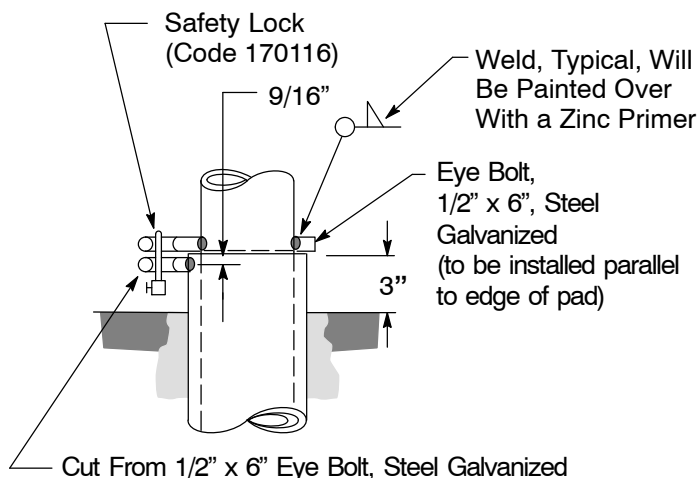


Figure 24
Steel Barrier Post
(see Table 4)



Detail A
(see Figure 26)

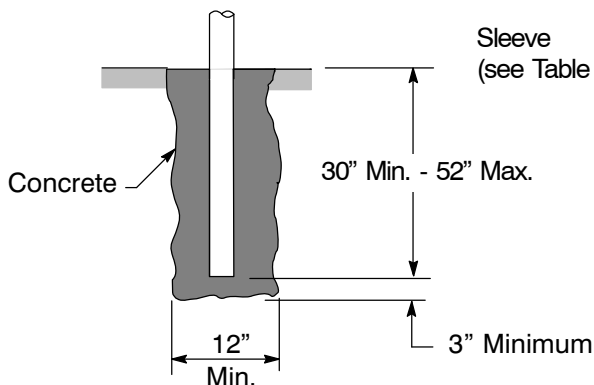


Figure 25
Footing for Fixed Steel Post Detail
(see Table 4)

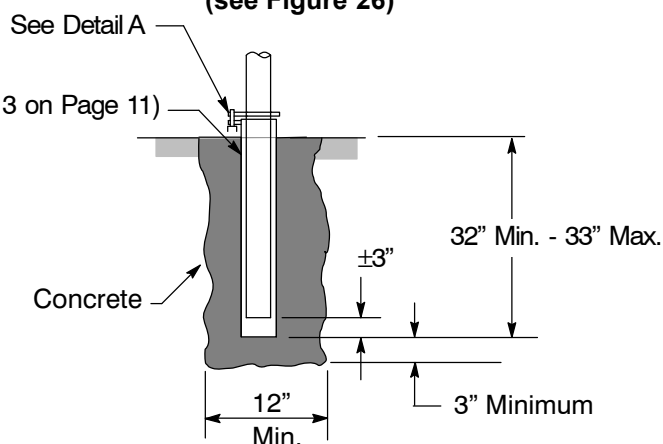


Figure 26
Footing for Removable Steel Post Detail
(see Table 4)

Table 4 Description and Codes for Steel Barrier Posts ¹

Description	Length (inches)	Code	Doc
Galvanized Fixed Post, 4", Steel Pipe, Standard, Schedule 40	80	155107	-
	67 ²	155108	-
Removable Post, 4", Galvanized Steel Pipe, Standard, Schedule 40 With 5" Galvanized Steel Pipe Sleeve, 36" Long, Standard, Schedule 40	80	155105	-
	67 ²	155106	-
Replacement 4" Removable Barrier Post Galvanized Steel Pipe With Cap Less Sleeve and Eye Bolt	67	150265	-
	80	150266	-
End Cap, 4", Galvanized Malleable Iron, May Be Screwed	-	021882	-
Strip, Visibility Reflective Yellow Adhesive Sheet, 2" X 12", Pacific Utilities #PEM212F, Almetek #DL-RY2X12-A	-	013163	022168
Safety Lock	-	170116	-

¹ Posts fabricated from 20-foot lengths of galvanized steel pipe, Code 011794.

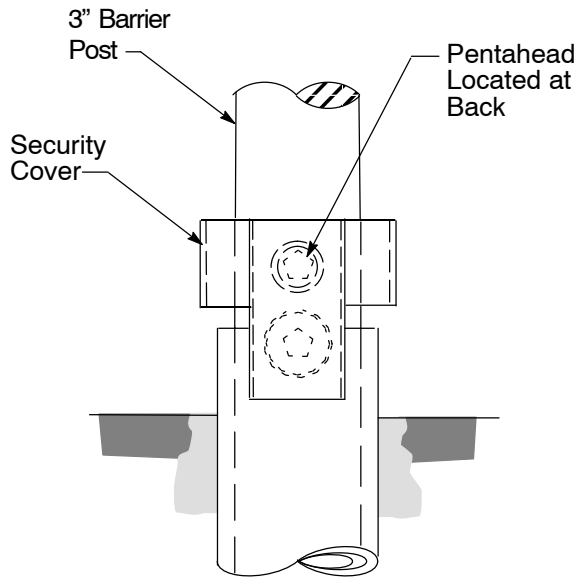
² 67" post length is for single-phase transformer.

Clearances and Location Requirements for
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17. Placement of Metal Barrier Posts and Details (continued)



Figure 27
Security Cover for Removable Post Lock
Material Code 150271



Detail B
See Figure 27

Installation of Security Cover:

1. Remove Top Cap.
2. Slide Collar Down Over the Eyebolts Locked Together.
3. Drill Hole for Bolt.
4. Insert and Engage Pentahead Bolt.

Clearances and Location Requirements for Enclosures, Pads, and Underground Equipment

18. Residential and Light Commercial Non-Metallic Barrier Post

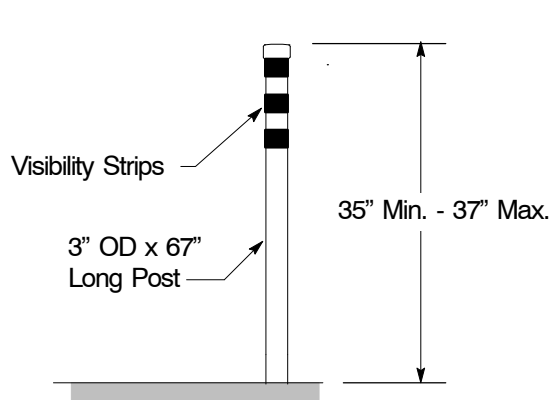
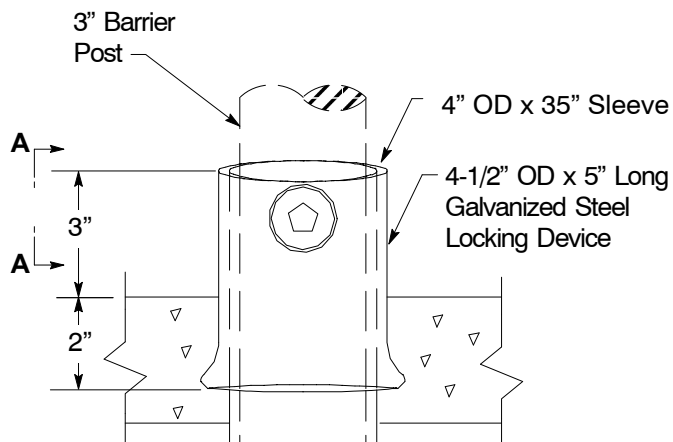
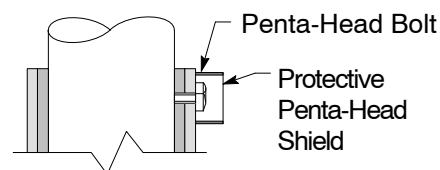


Figure 28
Non-Metallic Barrier Post
(see Table 5)



Detail C
See Figure 30



Section A-A

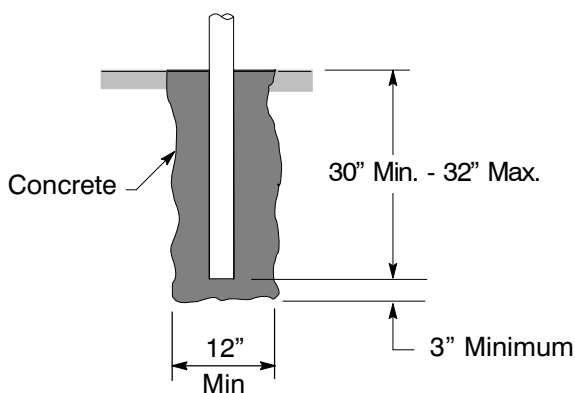


Figure 29
Footing for Fixed Non-Metallic Post

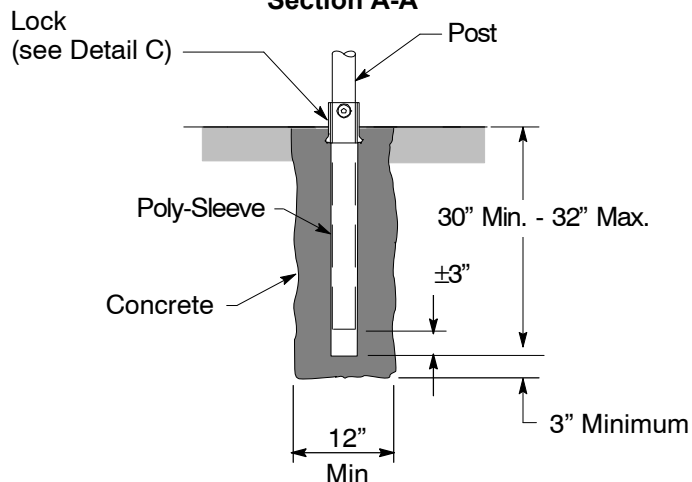


Figure 30
Footing for Removable Non-Metallic Post Kit
(see Table 5)

Table 5 Description and Codes for Non-Metallic Barrier Posts

Description	Allwire	Code
Fixed Post: 3" OD x 67" Long, 1-3/4" Fiberglass Core With 5/8" Polyethylene Cover	FGP674	150553
Removable Post Kit: 4" OD x 35" Long Polyethylene Sleeve, 4-1/2" OD x 5" Long Galvanized Steel Locking Device and 1/2" x 1-1/4" Penta-Head Bolt	RPK001	150554
Security Cover for Removable Post Lock	-	150271

**Clearances and Location Requirements for
Enclosures, Pads, and Underground Equipment**

Revision Notes

Revision 21 has the following changes:

1. Revised Table 1 on Page 4.