City of Statesville
Electric Utilities

3-Phase Padmount Transformer Concrete Foundation Specifications

July 2010

Flat Pad and Pit Pad Application and Construction

This information is intended to provide direction to ensure that the proper dimensions are used for the concrete transformer foundation. The City of Statesville has approved two sizes and two types of concrete pads for padmounted transformers. They are the "Small" and "Large" sizes of the "Pit" Pad and the "Flat" Pad.

A "Pit" Pad is preferred for all 3-phase padmount installations. However, where there are 3 or less secondary conductors per phase, and the conductors are no larger than 400 MCM, a "flat" pad may be considered. The City of Statesville's project coordinator will make the final decision whether it is permissible to use a "flat" pad. If the customer is installing more than ten (10), 600 MCM or smaller conductors per phase, or more than eight (8) conductors per phase that are larger than 600 MCM, additional arrangements will be needed. Please contact the Electric Utilities Department.

Generally, the "Small" Pad is used for transformers rated 300 KVA and below, and the "Large" Pad is used for transformers rated 500 KVA and above. A "Large" pad should be used where the number of customer conduits/conductors exceeds the window opening restrictions of the 'Small" pad, and when load growth and/or a transformer change-out to a larger size is anticipated.

Customer Responsibilities

The customer shall bear all costs for the pad. The customer may choose to construct the transformer pad on site or purchase a prefabricated unit from a manufacturer. In either case, the customer is responsible for assuring the pad is manufactured to the requirements provided in the specification. A poured on-site is preferred over a pre-cast.

Listed below are the instructions for building a transformer pad on site.

1. Customer is to contact The City of Statesville Electric Utility to inspect pad forms and dimensions prior to concrete being poured.
2. Customer shall supply the concrete mix (as shown in the Concrete Mix Specifications, see page 2), welded wire fabric, #4 reinforcing bars, and shall pour the "flat pad" or "pit pad."
3. The dimensions shall be in accordance with the specifications based on the transformer KVA size. The thickness of all walls on the "pit pad" shall be a minimum of 5 ½" thick. The transformer KVA Size is to be specified by The City of Statesville.
4. Refer to the Padmount Building Clearance Standard (see pages 13 to 16) for the minimum allowable distance between transformer pads and buildings, building openings and equipment. There shall be a minimum clearance of 10' from the front of the concrete pad to any walls, machinery, or any obstacles. If there are multiple transformers or secondary bus enclosures involved in the installation, there shall be a minimum clearance of 3 feet between all padmount equipment.

Customer Responsibilities (Continued)

5. A 1" metering conduit from the secondary compartment of the pit pad to the metering location as specified by The City of Statesville. This will usually be the building wall. For any other location, please consult in The City of Statesville. See page 5.
6. Customer shall install the conduit for the primary conductors (as specified) as close to the center of the "primary" area as practical. The "primary" conduit(s) and the customer's "secondary" conduits shall be cut to meet the dimensions as shown. (See page 11).
7. Customer shall inform The City of Statesville of the number, size, and type of secondary conductors that will be installed.
8. The customer must be specific regarding the requested delivery voltage! Special metering and grounding considerations may need to be considered. For 3-wire deliveries, a single grounding conductor from the customer shall be connected to the copper grounding ring in the transformer compartment, and the ground strap must be completely disconnected from the XO bushing.

> **Note:** 4-wire deliveries and 3-wire deliveries **SHALL NOT** be provided from the same transformer.

9. It is the responsibility of the customer to provide excess length when conductors are in parallel. All parallel conductors shall be grouped and marked by the electrician. There must be no more than 1.5 feet difference between the shortest and the longest of any parallel cables on any one phase.

The City of Statesville Responsibilities

1. The City will supply and install the 10' ground rod prior to the installation of the padmount transformer.
2. The City will install lugs on the secondary conductors and will make the connections of the secondary conductors to the low voltage spade terminals. Excess secondary conductor length is the responsibility of the customer as there will be very little space in the secondary compartment of the transformer to accommodate excess cable.

Concrete Mix Specifications

1. Concrete mix used for Transformer pads shall meet the following requirements:

   • Minimum 28 day compressive strength of 3,000 psi

   • Maximum water / cement ratio of 0.50

   • Maximum slump of 4 inches

   • Air-entrainment content between 4 and 8 percent

2. Concrete shall be afforded adequate cure for a minimum of:
   - **five (5) days** if the ambient temperature is over **70º F**, or
   - **seven (7) days** if the ambient average temperature is below **70º F**.
3. Adequate cure can be performed by any of the following methods:
   - Waterproof membranes
   - Sprinkling or Soaking
   - Curing Compounds
4. Pad shall be supported on a sub-base of sand, gravel, or crushed stone. The granular sub-base is to be a minimum of four (4) inches thick and shall be compacted with a vibratory compactor.
5. Dampen the sub-base prior to concrete placement. At the time of placement, the sub-base shall not contain standing water.
6. The top of the concrete pad must be steel troweled and completely smooth to prevent "gaps" between the transformer and the surface of the concrete pad.

Installing Conduit in Pit Pads

Conduit for The City's Primary Cables shall be specified by The City and installed by the customer when pouring the pad. Conduit shall be Schedule 40 and shall adhere to the following specifications:

Conduit Size	Elbow Radius
4"	36"
5"	36"
6"	36"

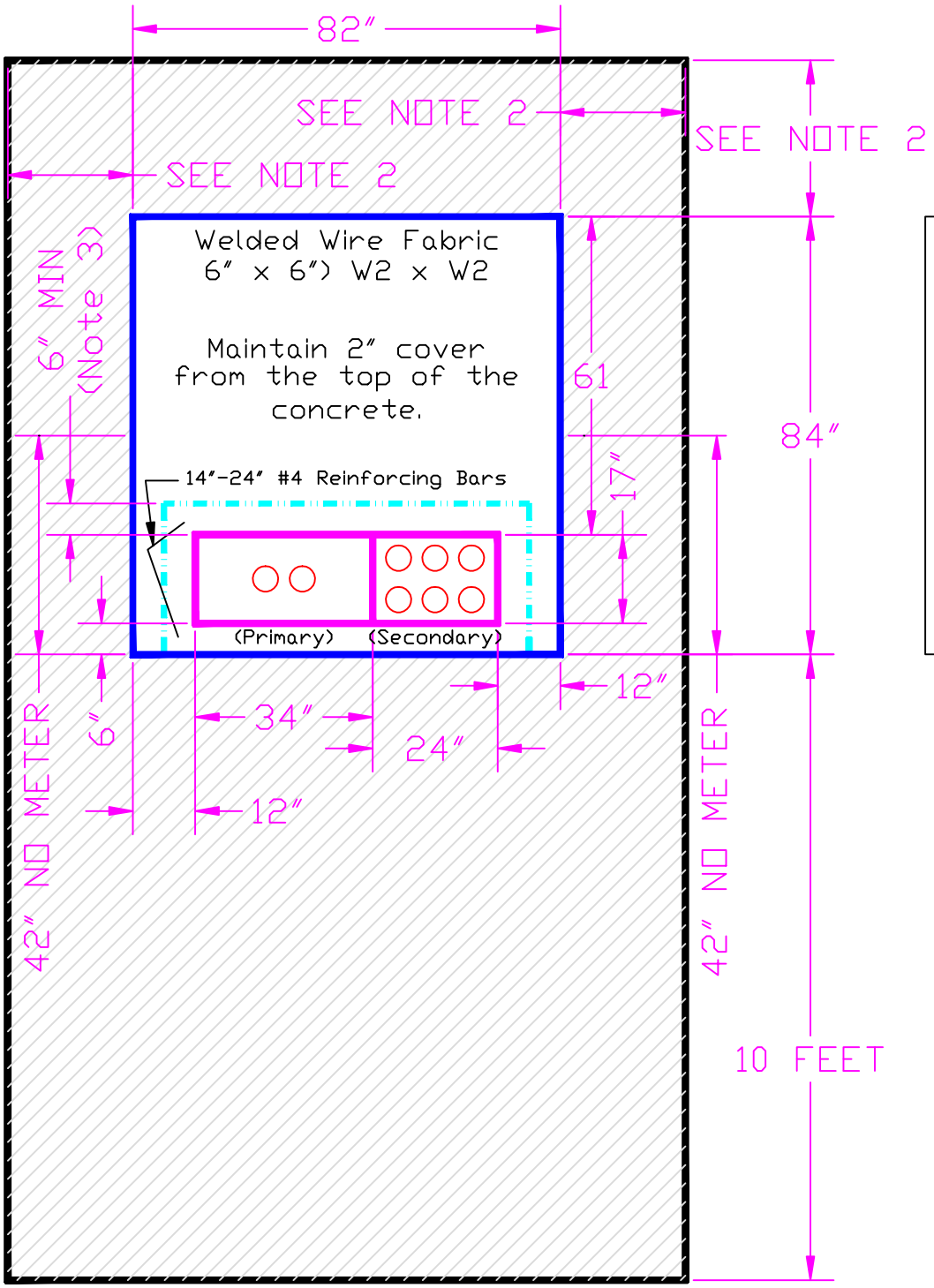
All conduits shall be installed so the belled end is "up" in the transformer compartment to minimum damage to the cables during installation.

Customer's secondary conduits shall not cross or interfere with the primary conduits. (The customer's conduit can exit the secondary side either coming out the front, the right side, or the back.)

The customer's conduits shall not extend outside the designated "secondary" area of the window.

Small Flat Pad and Pit Pad

(This Drawing is Not To Scale)



SMALL
FLAT PAD
&
PIT PAD
DIMENSIONS
82″ WIDE
84″LONG

1- Pad to be a Minimum of 5-1/2″ Thick

2- Shaded area around pad indicates minimum clearance from obstructions

(Refer to the Padmount Building Clearance Standard for minimum distance from sides and back of concrete. 10′ minimum from front of concrete.)

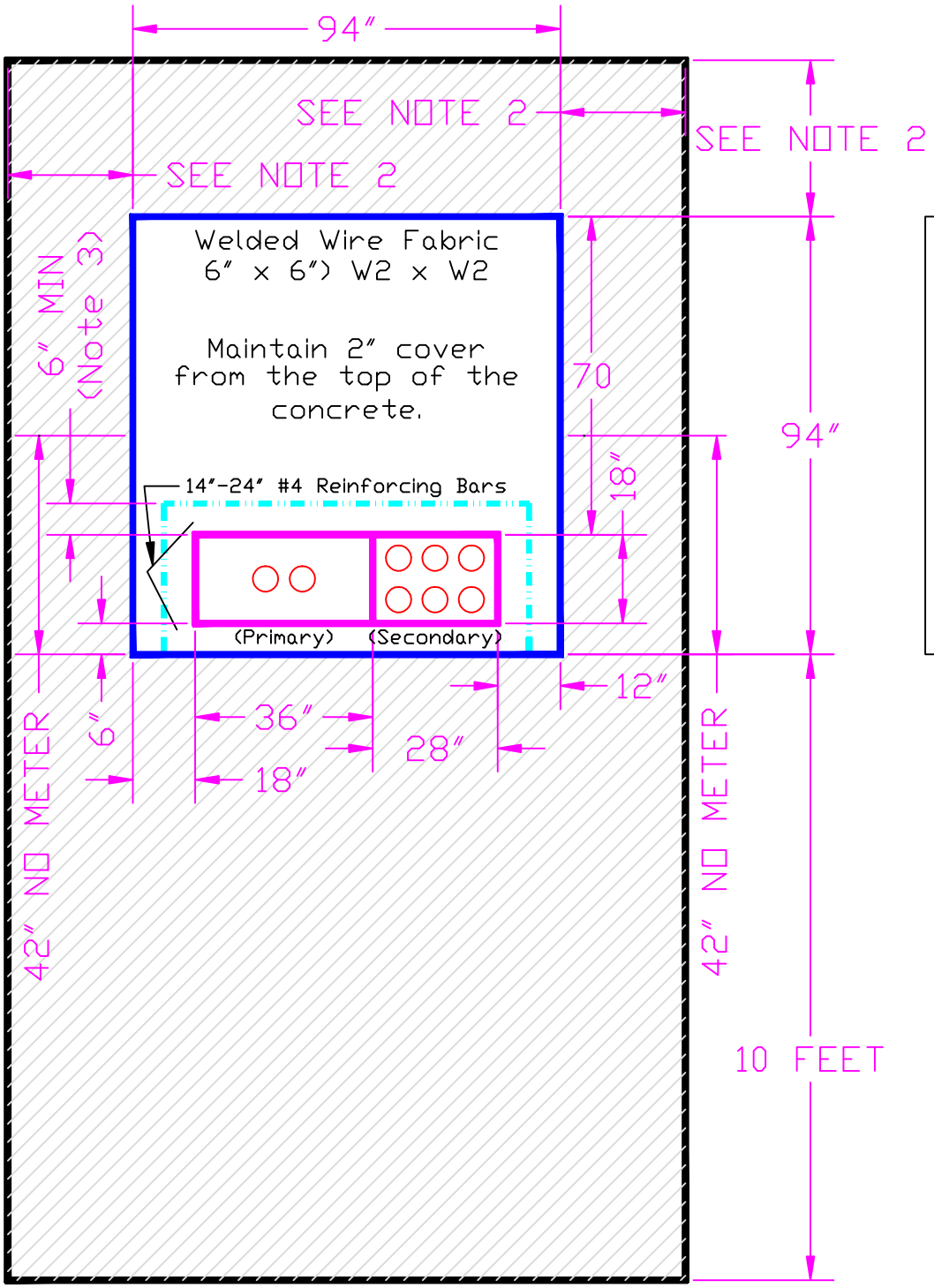
3- Pit Pad Only

4- Cover bottom of pit with 6″ of gravel.

5- Do not place 1″ meter conduit within 42″ of front corner nor anywhere on the front side.

Large Flat Pad and Pit Pad

(This Drawing is Not To Scale)



LARGE
FLAT PAD
&
PIT PAD
DIMENSIONS
94″ WIDE
94″LONG

1- Pad to be a Minimum of 5-1/2″ Thick

2- Shaded area around pad indicates minimum clearance from obstructions

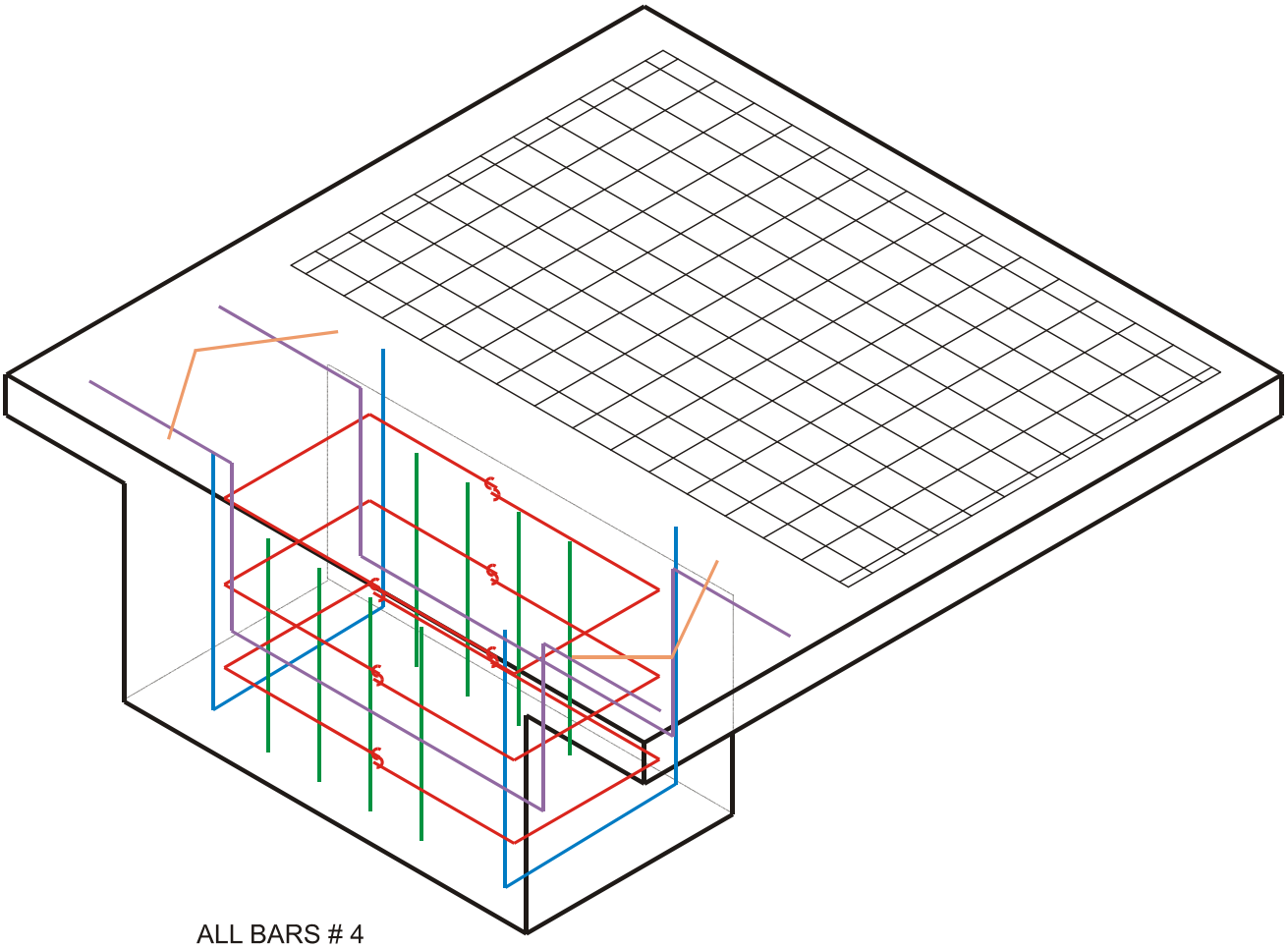
(Refer to the Padmount Building Clearance Standard for minimum distance from sides and back of concrete. 10′ minimum from front of concrete.)

3- Pit Pad Only

4- Cover bottom of pit with 6″ of gravel.

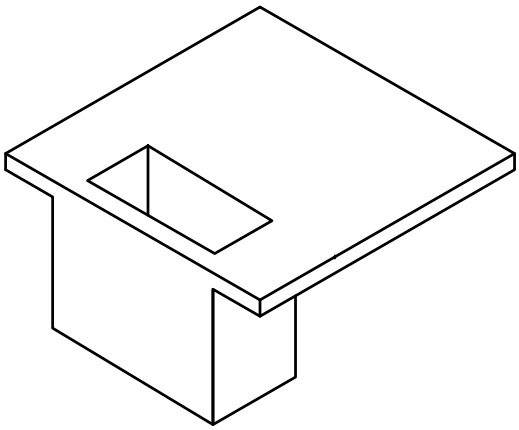
5- Do not place 1″ meter conduit within 42″ of front corner nor anywhere on the front side.

CONCRETE PIT PAD - COMPLETE CONSTRUCTION



ALL BARS # 4
GRADE 60 DEFORMED

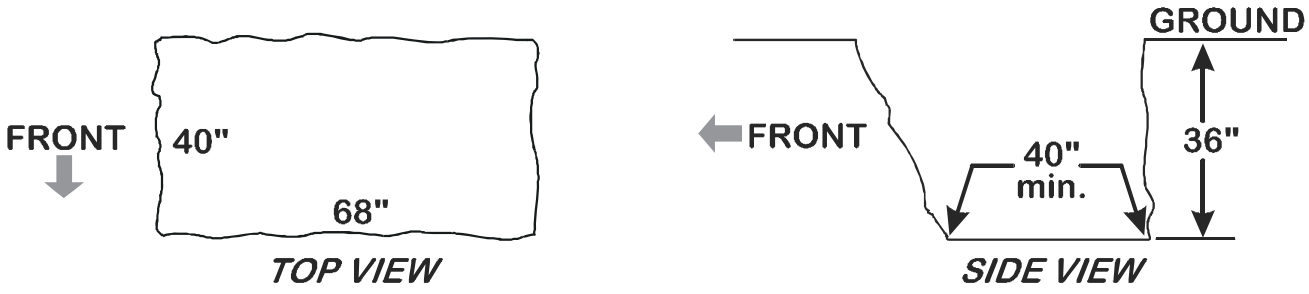
SHAPE DETAIL	SYMBOL	MARK
		4R1
		4R2
		4R3
		4R4
		4R5



Instructions for Building 3-Phase Padmounted Transformer "Pit Pads"

Step 1 Dig a rectangular shaped hole approximately 40" x 68" and 36" deep. (The 68" side should be to the front.)

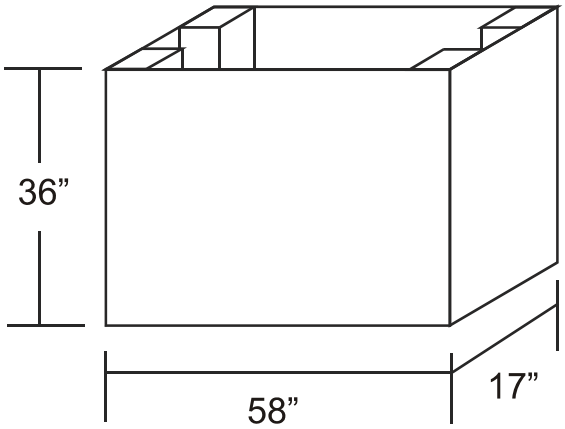
> **Note:** The hole indicates the front of the transformer. The pad should be located so that a minimum of 10' of clearance can be maintained in front of the transformer and a minimum of 3' of clearance on all other sides.



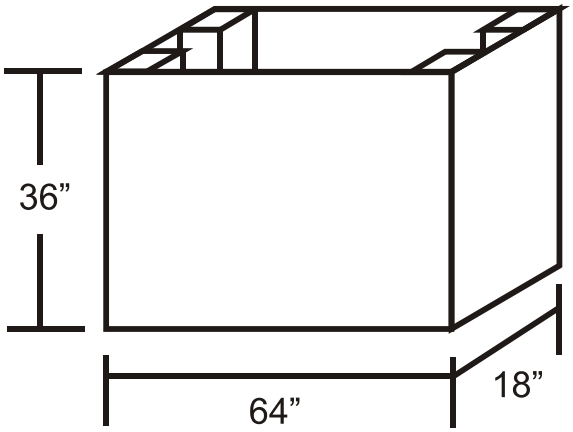
Dig The Hole

Step 2 Build a rectangular shaped box, open at the top and bottom, from 2x4's and plywood. The plywood sides of the box should be 36" tall.

Window Opening for the
Small 82” x 84” “Pit” Pad



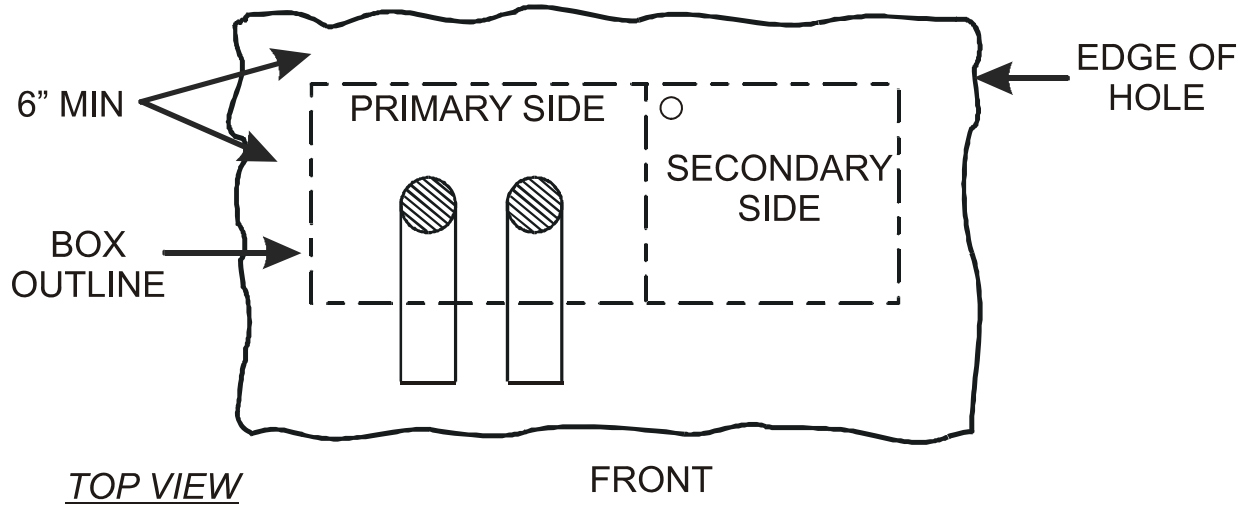
Window Opening for the
Large 94” x 94” “Pit” Pad



Window Box

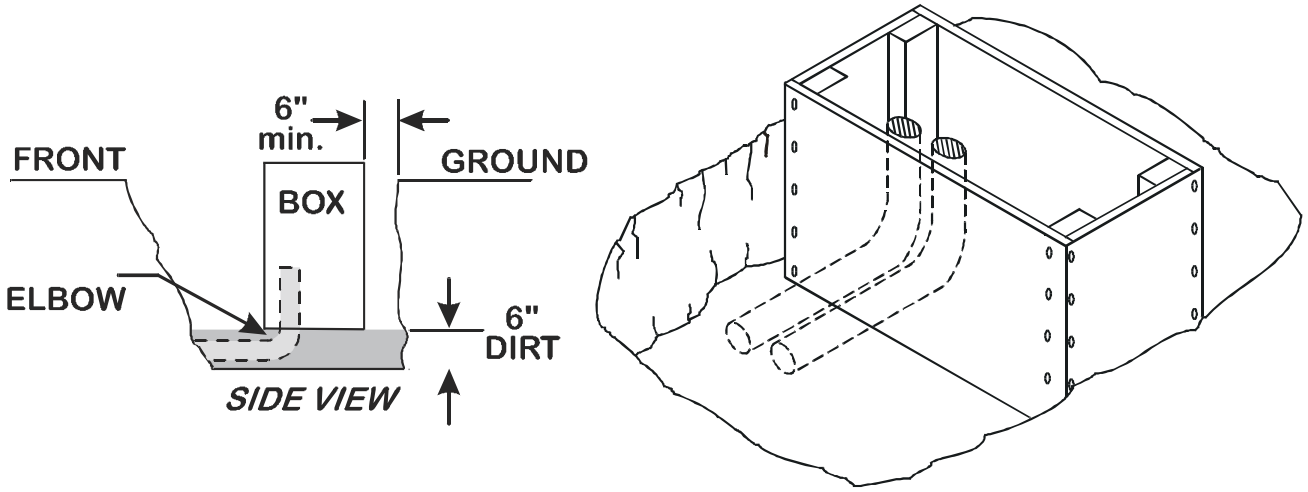
Step 3 Set the box in the hole and position it so that a minimum of 6" of space exists between the sides and back of box and the edge of the hole. (The space between box and front edge of hole will probably be 10" to 12".) Trace a line around the bottom outside edge of box in dirt and then remove the box. Install two (2) conduit elbows in bottom of hole for the primary conductors as specified by The City (belled end up) entering from the front of hole and placed so they will come up within outline of box. TAPE BOTH ENDS OF CONDUITS COMPLETELY CLOSED.

Note: The customer’s secondary conduits should be installed at this time. If the customer is providing the service conductors to the transformer, they may elect to enter the secondary side of the box from the front, back or right side. If The City is providing the service conductors, all conduits must enter from the front of the box. The 1" metering conduit should also be installed at this time. Make sure it is in the designated “secondary” area.



Window Box Placement

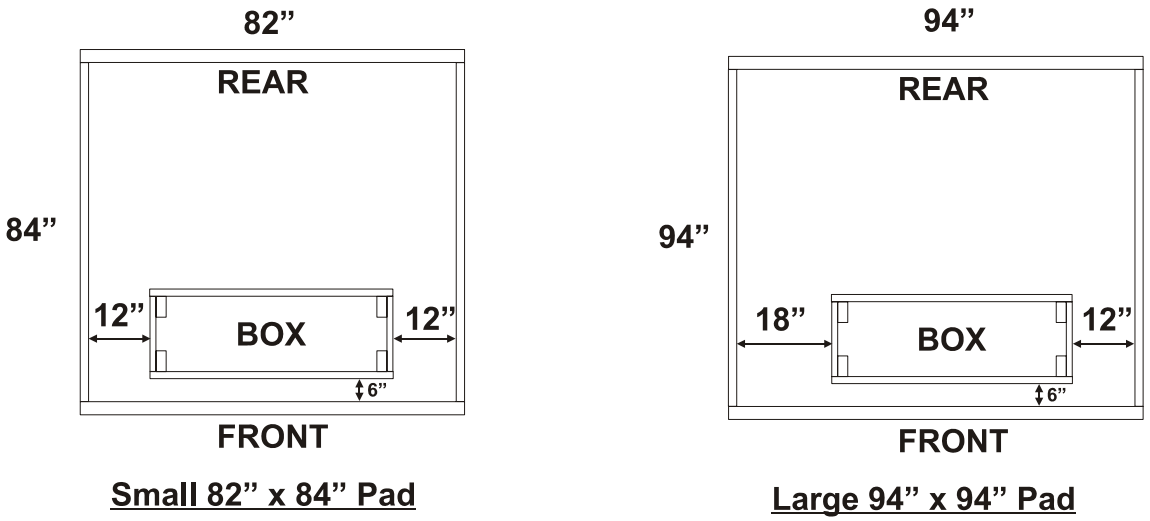
Step 4 Fill approximately 6" of dirt in the hole to support elbows. Place the box back in the hole over conduits, positioning box again so a minimum of 6" of space exists between the back and sides of the hole and box. The box should stick out from the top of the hole approximately 6" (or the width of a standard 2x6 board). Make sure conduits enter correctly in primary and secondary side of box.



Primary Conduit Installation

Step 5 Form the top part of the pad using 2x6 boards using the dimensions as indicated below.

> **Note:** It may be easier to "level" box with the sides if you lay two 2x4 boards on the top of the side boards so that they cross over top of box as shown in Figure 6. Tack these boards onto top of box to ensure sides are the same height as the box.



Small 82” x 84” Pad

Large 94” x 94” Pad

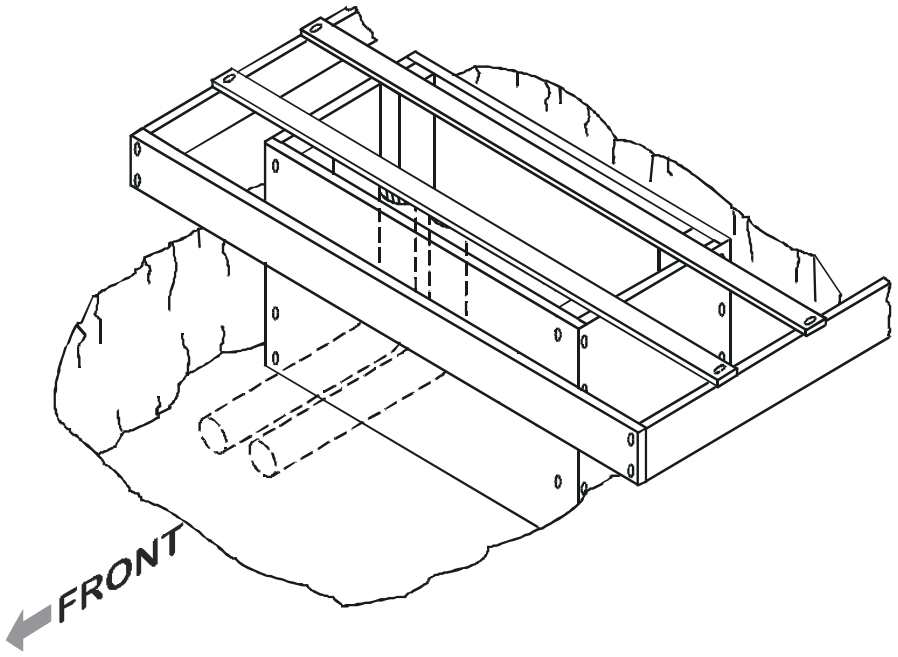
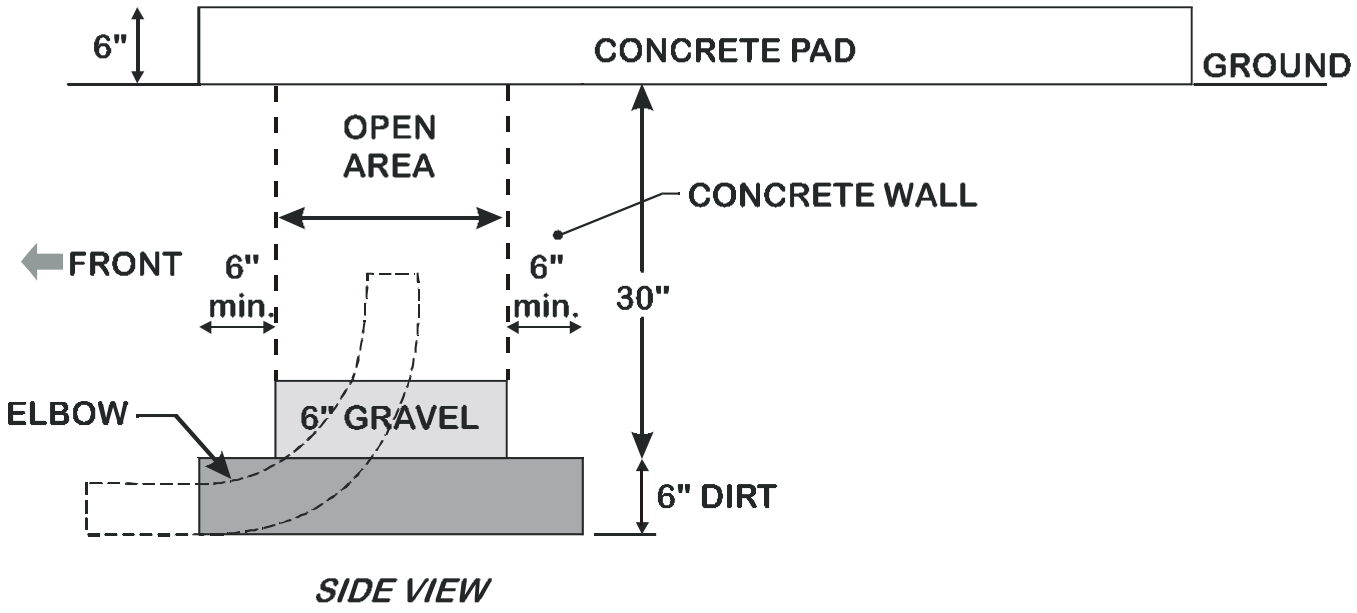
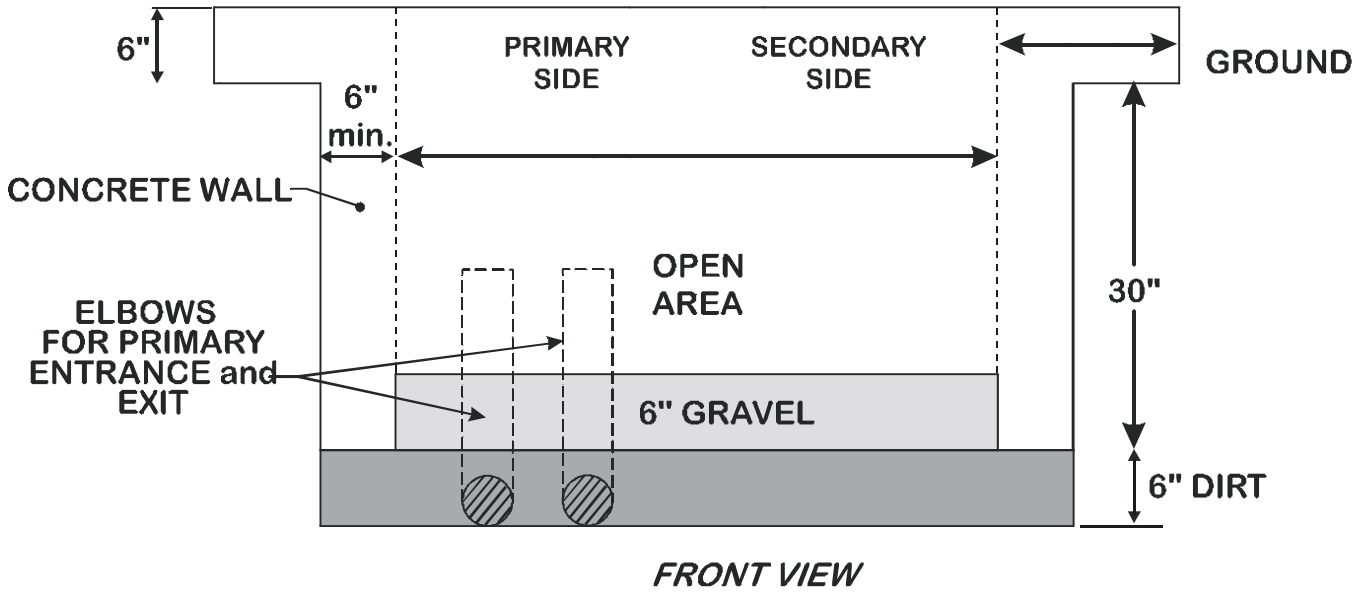


Figure 6

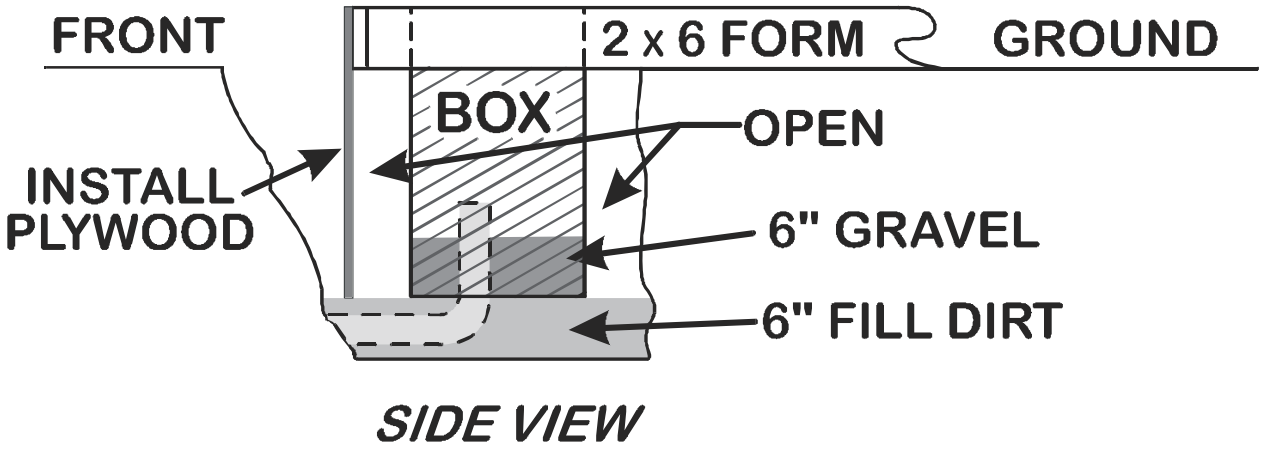
Note: CUT OFF ALL ELBOWS 6” ABOVE GRAVEL.



Depth Dimensions – Front View



Depth Dimensions – Front View



Plywood Installation

Step 6 Install a piece of plywood inside the hole long enough to reach from one side of the hole to the other and wide enough to reach from the top of the front 2x6 form to the bottom of the hole. (These dimensions should be approximately 68" x 36".) Tack the plywood to the front of the 2x6 and let the bottom of the board rest on the ground. Plywood must be thick enough so it won't give at bottom of hole when the concrete is poured.

Step 7 Fill in the area between plywood and the front of the hole with dirt. Be careful that plywood doesn't "push in" at bottom. Fill box with 6" of gravel.

Step 8 Install reinforcing bars around box in "pit area" and welded wire fabric in "pad area" to reinforce entire pit pad. (See pages 7 & 8 for more complete details.)

Step 9 Pour concrete "around" the box and "within" the 2x6 forms. (See page 3 for concrete mix specifications.)

Step 10 Allow concrete to set up, then remove 2x6 forms and box.

THE CITY OF STATESVILLE

PADMOUNT TRANFORMER BUILDING CLEARANCE STANDARD

These guidelines specify minimum distances to buildings, building openings and equipment to provide fire risk protection and adequate working space.

Table 1 below lists the minimum clearances to buildings and building openings. Refer to sections A, B, and C below concerning placement around doors, windows, and air vents (intakes and exhausts). Section D lists allowable distances to specific equipment.

Table 1- Clearances from Buildings and Building Openings

Type of Construction	Clearance extending out from building*	Side clearance	Height clearance
Combustible	12 ft		
Non-Combustible	6 ft		
Doors	20 ft	10 ft	
Windows	10 ft	5 ft	10 ft
Air Vents	20 ft	10 ft	25 ft

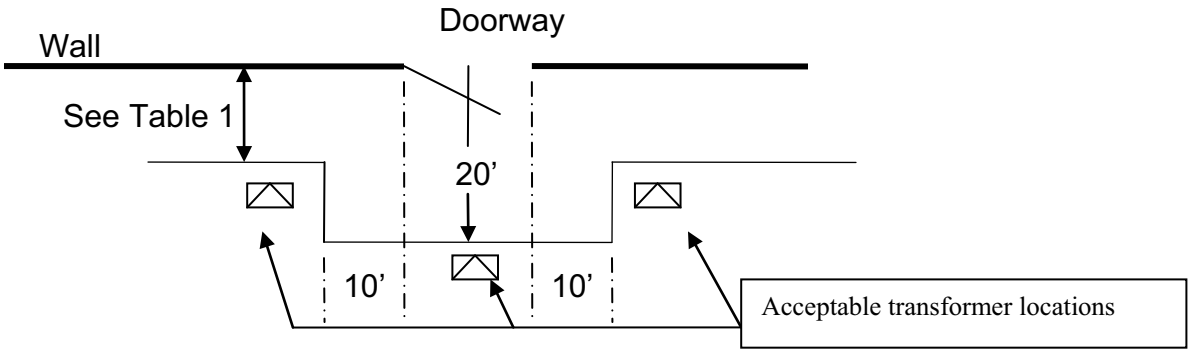
*habitable and non-habitable buildings

Notes:

1. Distances are from the pad or transformer whichever is closer to the building or opening.
2. If the building has an overhang, the distance is measured from the outside edge of the overhang.
3. Outside walkways or stairs attached to the building shall be considered as part of the building. Minimum clearance must also be maintained from walkways used for exit to a place of safety.
4. Avoid placing transformers in front of doors and windows and beneath windows and vents whenever possible.
5. Final grade at the location of the transformer shall provide for mineral oil to drain from the building. Otherwise an oil containment means is required.
6. Distances less than those specified in Table 1 but not less than the working space required in Section E may be allowed if approved by the appropriate code enforcement authority. This may require alternate means of fire protection per NEC Section 450.27 and NESC Section 152(A) (2) including fire batteries, fire rated walls, sprinkler systems, oil containment means, or other approved measures. Use of alternate means of fire protection must be approved by the local code enforcement authority.
7. It shall be the customer's responsibility to conform to all local building codes, insurance regulations, or ordinances affecting the transformer location.
8. Combustible/Non-Combustible construction type shall be that which is defined by respective state building codes.

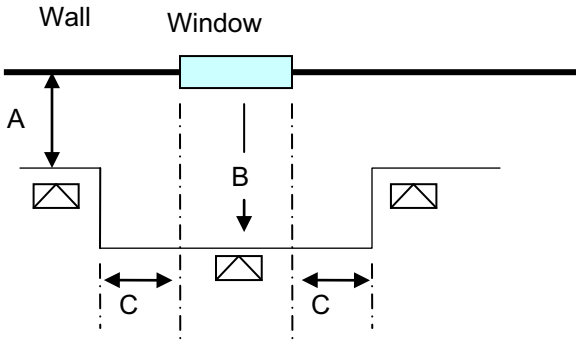
A. Doors, Fire Escapes, or Fire Exits

Padmounted transformers shall not be located within a zone extending outward 20 feet and 10 feet to the side from any doorway, fire escape, or fire exit. See diagram below.



B. Window or Opening other than an Air Vent

Where the vertical clearance to a window is less than 10 ft, the mineral oil-filled transformer shall not be located within a zone extending 10 feet outward from the building and 5 feet to the side of the window. See Table 2 below. Where the vertical clearance is 10 ft or greater, the transformer shall not be located within the distance outward from the building wall as determined by building construction type.



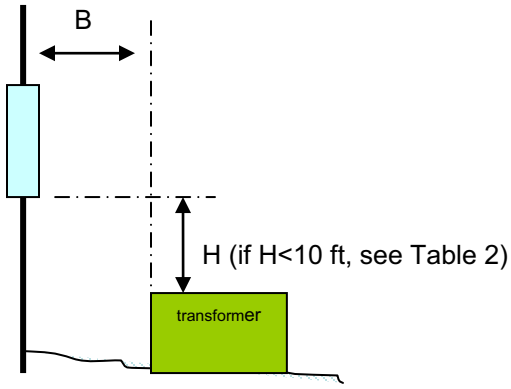
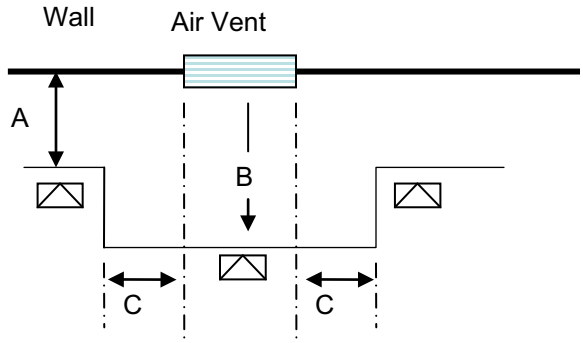


Table 2 (H<10ft)

Type of Construction	A	B	C
Combustible	12 ft	12 ft	----
Non-combustible	6 ft	10 ft	5 ft

C. Air Vent

Where the vertical clearance to an air vent is less than 25 ft, the mineral oil-filled transformer shall not be located within a zone extending 20 feet outward from the building and 10 feet to the side of the vent. See Table 3 below. Where the vertical clearance is 25 ft or greater, the transformer shall not be located within the distance outward from the building wall as determined by building construction type.



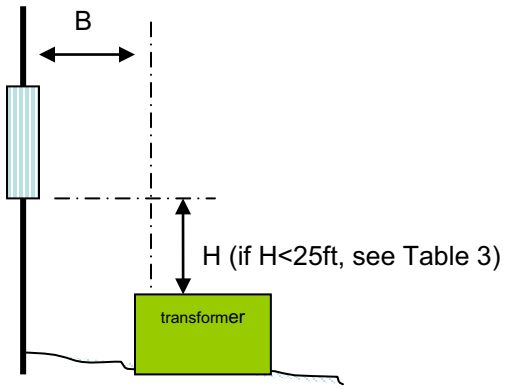


Table 3 (H<25ft)

Type of Construction	A	B	C
Combustible	12 ft	20 ft	10 ft
Non-combustible	6 ft	20 ft	10 ft

D. Allowable Distances from Equipment

Table 4 – Clearance to Equipment*

Type of Equipment	Minimum Distance
Containers of flammable liquids or gas. (Oxygen, LP, Gasoline, etc)	20 ft
Generators, customer owned transformers, etc.	6 ft
Fire hydrants, sprinkler valves, standpipes, etc.	6 ft
Natural gas meters	3 ft

* This is not an all-inclusive list.

E. Working Space

A minimum clear working space of 3 ft must be maintained from each side of the transformer and a minimum of 10 ft from the front. Where a meter is mounted on a transformer, a clear space around the meter at least 3 ft wide, 4 ft deep, and 8 ft high must be provided and always be available for reading, inspecting, testing, and maintenance operations. Clear space for safe access to and egress from the working space must be maintained.