The purpose of electric pad-mount transformers, better known as “big green boxes,” is to change high voltage electricity to a lower voltage in your community. This resource is intended as a general overview of pad-mounted transformers; always consult with your power company on responsibilities, access, conflicts, design, maintenance, repair, or safety.

Safety

* Contacting overhead or underground electric lines or equipment and natural gas pipelines can cause serious injury or death. Any part of a crane, scaffold, construction material, antenna, cable, rope, guy wire, or tool that touches an overhead electric line or penetrates an underground cable can become energized. Penetrating an underground natural gas line with a backhoe or other tool can cause a violent explosion.
* Before digging state law requires you to contact California 811 Underground Service Alert (USA) by dialing [811](https://www.california811.org/) at least two working days before excavation. Ensure that you contact USA when planning underground work, before digging begins, to allow adequate time for USA to determine the location of underground gas and electric lines or equipment.
* Arc-flash warning. Power companies may require persons working on, working near, or observing others working on any facility or owned equipment to wear flame-resistant (FR) clothing due to potential arc-flash hazards. Always consult with the owner of the pad-mounted transformer for their safety requirements.
* Maintain working distance from exposed energized conductors and apparatus at all times and keep material and tools from accidental contact.

Inspection

All pad-mounted transformers shall be inspected externally and internally for abnormal conditions. The result of this inspection and any abnormal conditions found shall be documented and corrected.

1. Shrubs or trees within an eight-foot operating space that will interfere with the operation of equipment.
2. Missing or unintelligible high voltage sign or equipment identification numbers.
3. Cabinet damaged or unsecured, missing lock, or unsafe to the public.
4. Need for barrier post for vehicular protection.

**This model form/template must be customized to meet your Agency’s needs.**

Pad-Mounted Transformers

Revision September 2020

1. Fiber barriers in the primary compartment show signs of tracking.
2. Temperature:
3. On units equipped with a thermometer, record and reset the maximum temperature drag hand and proceed per oil temperature column.
4. On units equipped with a temperature sticker, check and proceed per temperature sticker.

**Transformer Temperature**

|  |  |  |
| --- | --- | --- |
|  | **Temperature Sticker** | **Oil Temperature** |
| **1.** | First of 6 indicators colored. | Less than 110 °C - Normal, no action required. |
| **2.** | 2 or 3 indicators colored. | 110 to 120 °C - Overloaded, create an EPCM tag to investigate and correct. |
| **3.** | 4 to 6 indicators colored. | 120 °C or greater - Extreme overload, consider curtailing load and create an EPCM tag to investigate and correct. |

**Temperature Sticker**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | **88** | **93** | **99** | **104** | **11** | **116** | **C°** |
|  |  |  |  |  |  |  |  |
|  | **19** | **20** | **21** | **22** | **23** | **24** | **F°** |

Maintenance

Items identified during inspections shall be prioritized with a response/repair grade. Routine maintenance may be scheduled with other associated work.

Inspectors shall complete all possible repairs of abnormal conditions, which can safely be done by a single individual.

The inspection log shall be used to document any new abnormalities as they are encountered in the field.

Infrared inspections shall be performed in conjunction with the underground inspection process. Personnel performing these inspections should be thoroughly familiar with all

the equipment involved and all safety rules and procedures associated with such equipment.

To facilitate repairs that can be completed during the inspection, the inspector shall be equipped with the proper tools and materials to safely perform corrective maintenance.

The following grades are intended to be a guide.

**Table 1 - (Minor or incidental work)**

|  |  |
| --- | --- |
| **Condition** | **Grade** |
| Visibility strips on barrier post missing | 2 |
| No lock on removable barrier post | 2 |
| No barrier post or inadequate protection | 2 |
| Needs retaining wall | 2 |
| Grade problem | 2 |
| Insufficient working space | 2 |
| Insufficient clearance from third party structure | 2 |
| Vegetation is obstructing covers, door, and/or working space | 2 |
| Deteriorated due to chemical exposure (e.g., waste oil) | 1 to 2 |
| Ground rod, rig bus, and/or connectors have become disconnected or ineffective | 1 |
| Fault indicator missing or not working | 2 |
| Overheating discovered with infrared check | 1 or 2 |
| Ground rod and/or connectors have become disconnected or ineffective | 1 or 2 |
| Internal insulated barriers with obvious localized discoloration, tracking, or arcing | 2 |
| High voltage sign missing | 2 |
| Equipment number missing | 2 |
| Missing decal: Maintain 8-foot clear space in front of doors | 2 |

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

**(**[**Information from Pacific Gas and Electric Green Book**](https://www.pge.com/en_US/large-business/services/building-and-renovation/greenbook-manual-online/greenbook-manual-online.page)**)**

*Go to Appendix C: Electric and Gas Engineering Documents - 051122*

*Note: See references for other power company webpages*

Clearances

Clearances are divided into the following sections:

* Building clearances.
* Substructure clearances.
* Horizontal workspace 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** each of their subsections.

Building Clearances

1. Clearances from building surfaces, Pad-mounted equipment shall have the following clearances (based on *G.O. 128, Rule 34.3 [D]*): <https://www.cpuc.ca.gov/gos/OriginalGO128/index.htm>

Go to Section 111-Equipment:

* 1. Three-foot minimum from combustible building surfaces to the edge of the pad.
  2. Two-foot minimum from non-combustible building surfaces to the edge of the pad. Non-combustible materials include brick, clay, concrete, steel, stone, and stucco.

1. Doorway clearance.

Pad-mounted equipment shall not be placed where it impedes the flow of traffic through a doorway. In general, four feet of doorway clearance is sufficient (based on the Uniform Building Code). <https://www.dir.ca.gov/title8/3235.html>

1. Vertical clearance from overhangs.

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 17.1 and 34.2). <https://www.cpuc.ca.gov/gos/OriginalGO128/index.htm>

* 1. 20-foot minimum for 1P pad-mounted or subsurface equipment.
  2. 30-foot minimum for 3P pad-mounted or subsurface equipment.
  3. When required for installations such as in dry vaults 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.

Substructure Clearances

1. Pad-Mounted Equipment:

The area one foot around and six feet below the pad or pedestal shall be kept free of foreign substructures.

1. Subsurface Equipment or Enclosures:

The area one foot around and three feet below the enclosure shall be kept free of foreign substructures.



**Table 1 Table 1 Vertical Clearance Requirements**

|  |  |
| --- | --- |
| Vertical Clearance | Equipment |
| 20’ | 1∅ Pad-Mounted |
| 30’ | 3∅ Pad-Mounted |



**Building and Doorway Clearances**

**Horizontal Work Space Requirements**

1. 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 workspace (based on G.O. 128, Rule 34.2). <https://www.cpuc.ca.gov/gos/OriginalGO128/index.htm>
2. Subsurface enclosures and equipment.
3. 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 2 Workspace Clearances**

|  |  |
| --- | --- |
| Primary Enclosures | Required Clearances |
| Round or Square | 3’ From Outside Edges |
| 3’ x 5’ (interior dimensions) | 3’ From Outside Edges |
| 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 |

In some instances, the specific equipment may allow clearance to be reduced if needed due to field conditions, i.e., the side on which a J-Box is mounted may have the three-foot clearance reduced to two feet as the operations all takes place on the other side.

1. Pad-Mounted Equipment:
2. An eight-foot minimum in front of all equipment doors to provide room to operate with hot sticks and to replace the equipment.
3. Three-foot minimum from non-operable sides.

*Exceptions:*

(1) Landscaping obstructions (decorative walls, planters, rocks, etc.) that are up to about one foot wide and two feet tall may be placed next to the pad on non-operable sides.

(2) May be reduced to two feet on **one** of the two sides **or** on the back.

1. Secondary Enclosures − Minimum Workspace Required:
   1. Pedestal: three feet in front, two feet to the side, and one foot to the back.



1. Secondary Splice Box − 24” x 36” or smaller: three feet on short sides, two feet on one long side.



Workspace Clearances

****

**Example of Pad-Mounted Equipment (with front doors only) Installed on Sloped Terrain**



**Workspace for Pad-Mounted Equipment**

**(With front and rear doors including most switches)**

Hazardous Locations

1. 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.
   1. Liquefied flammable gases**:** Do not install pad-mounted or subsurface equipment within 20 feet of a gas dispenser without conforming to the regulations concerning the installation of electrical equipment in hazardous areas.
   2. Examples: Gas station fuel pump, convenience store propane pump. 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 this document. Examples: Emergency generator, propane tank at a house.

Spill Prevention Control and Countermeasure (SPCC) and Oil Containment

1. It is the customer’s responsibility to comply with spill prevention and containment requirements for oil-filled electrical equipment following 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, and 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.

Retaining Walls

1. Retaining walls are required when determined 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.

Barrier Post

1. Physical protection from vehicular traffic shall be provided by 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.
2. In general, pad-mounted equipment having the following setbacks does not require the customer to provide any other physical protection.
3. 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 the definition of thoroughfare). <https://www.cpuc.ca.gov/gos/OriginalGO128/index.htm>
4. 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.
5. All barrier posts at the same installation site will be the same height.
6. A building wall can be considered as physical protection provided it is located at a point where a post would be normally required.
7. 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.
8. Use removable posts when:
   1. Posts are installed less than 8 feet in front of the equipment’s doors, or
   2. Where fixed posts would obstruct access for installation or replacement of equipment.



A = Distance between posts in Inches

B = Shortest Distance between the Protected Device and the line between Barrier Posts Requirements

**Generic Barrier Post Placement**

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.

**Common A and B Pairs**



Placement of Posts and Details



**Steel Barrier Post**

****

**Footing for Fixed Steel Post Detail Footing for Removable Steel Post Detail**

References

* Southern California Edison, Electric Service Requirements Manual [webpage](https://www.sce.com/regulatory/distribution-manuals/electrical-service-requirements).
* San Diego Gas & Electric, Electric Service Standards [webpage](https://www.sdge.com/builder-services/electric-service-standards-guide-manual).
* Liberty Utilities, California [webpage](https://libertyutilities.com/).