



REQUIREMENTS FOR ALLOWING INSTALLATION OF SUBSURFACE 072149 TRANSFORMERS

Asset Type: Electric Distribution

Function: Design and Construction

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Rev. #07: This document replaces Document 072149, Rev. #06. For a description of the changes, see Page 3.

Purpose and Scope

This document provides special requirements for allowing the installation of a subsurface transformer. Refer to Engineering Standard [Document 076255](#), Underground Transformer Selection, for determination of the preferred transformer locations.

General Information

Requirements for Allowing Installation of Subsurface Transformer:

Pad-mount installations are the preferred standard for underground equipment at PG&E. Where PG&E has suitable equivalent standard subsurface transformers and the applicant pays the special facilities charges, subsurface transformers may be installed in lieu of pad-mount, however:

1. Subsurface transformers may not be installed:
 - A. Where heavy erosion occurs which may fill the enclosure with soil and cannot be integrated by retaining walls.
 - B. Where heavy snowfall occurs (generally above 3,000 foot elevation).
 - C. In areas not graded to prevent surface water from readily flowing into enclosure.
 - D. In areas where design ground water level is within 3 feet below grade.
 - E. In a drainage, a swale, or percolated area, etc.
 - F. Where local estimators or distribution planning personnel deem the location likely to flood.
2. The subsurface enclosure must be designed in accordance with the requirements of [Document 062000](#), and [Engineering Material Specification 53](#) as modified by the provisions herein.
 - A. Low Design Groundwater Level is the condition where the design groundwater level is at or below the excavation depth of the enclosure as noted in [Document 062000](#) (examples: 6' 6" below grade for the incidental 4' x 6' 6" transformer enclosure and 9' below grade for the incidental 4' 6" x 8' 6" UCD transformer enclosure).
 - B. High Design Groundwater Level is the condition where the design groundwater level is above the excavation depth of the enclosure as noted in [Document 062000](#).
3. All requests to use subsurface transformers require soil chloride testing, and determination of design ground water level to determine the suitability of soil conditions if not already disallowed for the reasons in 1.
 - A. Soil chloride testing and design groundwater level determination is the responsibility of the applicant. PG&E does not reimburse the applicant for the cost.
4. Soil chloride testing may be omitted if the applicant elects to provide exterior waterproofing of the subsurface enclosure, or where waterproofing (see Note 8 on Page 2) of the exterior surface is otherwise required such as in high design groundwater table.
 - A. Soil chloride testing must be performed under the supervision of a state licensed professional corrosion or geotechnical engineer.
 - B. Soil chloride tests shall be taken in the vicinity of the proposed subsurface transformer in a location chosen to be adequately representative of all soil strata that could impact the structure of the enclosure or the equipment

in the enclosure, as determined and stated on the report submitted by the state licensed professional engineer in responsible charge.

C. The soil must be tested for chloride by one of the following applicable standards:

Chloride content per ASTM D4327, ASTM D512, CTM 422, or AASHTO T-291

If Chloride content is greater than 5,000 parts per million (ppm), enclosure requires waterproofing.

5. Groundwater level determination shall be performed by a state licensed professional geotechnical engineer and shall be based on site-specific borings and other information as deemed suitable by the state licensed geotechnical engineer in responsible charge.
6. Enclosures in low design groundwater level areas and where chloride content is greater than 5,000 ppm require waterproofing. If chloride content is less than 5,000 ppm, install the enclosure per [Document 062000](#).
7. Enclosures in high design groundwater level areas require waterproofing.
8. Waterproofing includes the following:
 - A. Sealing of all conduits (terminators) entering the enclosure.
 - B. Application of waterproofing membrane on all exterior surfaces including the bottom of the bottom slab. Waterproofing may be applied by the supplier or it may be applied in the field. Where extensions are added in the field, seal the joint with the required sealant prior to installation of the extension, then apply the waterproofing over the joint. Note: ground rods shall be installed before backfilling and while temporary control of groundwater is in place. Seal ground rod holes with wet-use epoxy.
 - C. Application of protection boards on all exterior surfaces including the bottom of the bottom slab to prevent membrane damage during backfill operations.
 - D. Sealing of joints between enclosure sections or extensions.
 - E. Sealing of ground rod holes.
 - F. Do no break out the four knockouts located on the bottom slab of the enclosure.

Materials used for Waterproofing the Enclosure

1. Waterproofing Membrane: Tremco's TREMproof 250 GC fluid applied elastomeric waterproofing Membrane, minimum 215 mils wet thickness; Carlisle's CCW Miradri 860/861 self-adhering sheet membrane, with manufacturer' recommended adhesive primer; or approved equal
2. Protection Board: Tremco's HDPE-40 protection sheet; Carlisle's CCW 200V Protection Fabric, or approved equal.
3. Rayflute Duct Sealing System (RDSS) conduit seal. Refer to [Document 062288](#).

Requirements for Allowing Installation of Subsurface Transformers

References	Location	Document
Single-Phase, Subsurface, Round Transformers	UG-1: Transformers	035313
Underground Commercial Distribution, Three-Phase, Subsurface Transformer	UG-1: Transformers	039830
Live-Front, Low-Profile, Single-Phase, Pad-Mounted Transformers	UG-1: Transformers	042761
Radial, Three-Phase, Pad-Mounted Transformers	UG-1: Transformers	043816
Loop-Style, Three-Phase, Pad Mounted Transformers	UG-1: Transformers	045290
Duplex-Type, Three-Phase, Subsurface Transformer	UG-1: Transformers	051776
Horizontal, Single-Phase, Subsurface Transformers	UG-1: Transformers	060578
Primary Electric Underground Equipment Enclosures	UG-1: Enclosures	062000
Application of Underground Distribution Transformers	UG-1: Transformers/Greenbook	062111
Underground Conduits	UG-1: Conduits	062288
Single-Phase, Dead-Front, and Duplex, Pad-Mounted Transformer	UG-1: Transformers	064307
Pad-Mount Transformers, Style IIG and IIH	UG-1: Transformers	072146
Underground Transformer Selection	Greenbook	076255
Design Requirements for Primary Electric Distribution Concrete Enclosures	TIL	EMS 53

Revision Notes

Revision 07 has the following changes:

1. Corrected Note 2 on Page 2 to 40 mil protection sheet.