



Customer Substation Guidelines

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Revision History

Revision	Date	Comments
0	April 20, 2006	Initial Development by DL based on existing guideline and several other sources
1	March 28, 2007	Added Section 6.8 for metering phone line.
2	August 16, 2007	Added Section 8.13 for resistor bushings.
3	October 22, 2007	Edited Section 6.4 to make customer's termination structure 10' outside fence.
4	March 23, 2009	Inserted new Section 7.1
5	November 24, 2009	Edited Section 6.4 from 10' to 3' outside fence. Made grounding edits.
6	March 19, 2010	Removed Section 6.8. Use BlueTree Communications.
7	June 04,2010	Changed from 3' to 10' on sections 6.2 and 6.4.
8	April 13, 2012	Changed Sections 3.3, 3.6, 3.8 & 4.1 as suggested by Cory Touard & Brian Peeler
9	January 24, 2013	Changed Section 7.3 as suggested by Travis Gregg for non-conductive Str.
10	January 29, 2013	Revised Section 3.3 about fill material. Revised Section 3.8 about NAVD88.
11	February 25, 2013	Added dwg CUST-POA. Modified Section 6.1
12	June 03, 2014	Added" substation neutral" to section 7.4
13	May, 7, 2015	Changed Section 3.3 by adding 10' graded area outside fence and added slope ratios. Added 6% road grade in Section 3.9.
14	November 18, 2016	Changed various articles in Section 3 for more details on access road, surface level 2 feet



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		above base flood elevation, and clearing 10' beyond fence.
15	May 3, 2017	Added "unless there is a neutral resistor (See Section 8)" to Section 6.3. Also added customer's switchgear "and grounding" to Section 6.3. Updated Customer's Point of Attachment Sketch on last page.
16	January 30, 2018	Removed CEII statement at bottom of Drawing STNDS-CUSTPOA-1 on page 15.
17	June 18, 2018	Corrected several Typo's throughout the document.
18	April 26, 2019	Changed South Carolina Electric & Gas to Dominion Energy South Carolina.
19	April 28, 2019	Added Section 6.8 on phasing.

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Date: April 20, 2006

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1.0 Purpose

The purpose of these guidelines is to set-forth Dominion Energy South Carolina Inc. (DESC) Policy in regard to sites for customer electric substations, access road to substation and routing of Transmission lines on customer property. These guidelines also address substation interfaces with the customer and items the customers need to furnish for the substation. These guidelines are to be followed in negotiations with the customer, in the design, and in providing for the construction, operation and maintenance of such substations.

2.0 References

2.1 Previous Customer Substation Guidelines

2.2 Old Engineering Design Manual

3.0 Substation Site Requirements

3.1 The customer shall furnish, free of charge, an adequate piece of property for the substation, an access road to the substation, and/or other facilities as required. Easements will be required, drawn up in similar fashion to a property plat, showing the location of the substation as well as that portion of the customer property required for the access road and the transmission line(s).

3.2 The size of the station shall be the minimum required to meet electrical clearances while providing safe working space for DESC personnel. The size and location should also take into account any zoning, code, ordinances, environmental, restrictive covenants, etc. The access road will provide necessary access for construction, operation and maintenance. DESC will provide the dimensions of the property required for the substation and access

road. The substation site and access road location will be mutually agreed upon by customer and DESC.

- 3.3** The customer shall perform all clearing and grading required of the site and access road. Any stormwater construction and/or land disturbance permits (to include installation, maintenance, and inspection of controls) will be the responsibility of the customer and shall include the complete period of substation construction. A bearing capacity of 2,000 lbs/sq. ft. (psf) is required. The customer shall be required to furnish certified documentation from a Registered Engineer as to the bearing capacity of the soil. In the event that 2,000 psf is not possible due to poor or wet soil, the customer will be required to furnish pilings for foundations, which support substation equipment. Material used for fill shall be free from clay balls, roots, organic material and stripped material. If needed, import fill material shall be reasonably well graded from coarse to fine and containing sufficient fines for compaction. All sources of import fill material shall be submitted to DESC Corporate Environmental Services for approval. The graded level area shall extend 10 feet outside the proposed substation fence. Outside the graded level area, the maximum slope ratio for cut and fill shall not exceed 1 foot vertical to 3 feet horizontal.
- 3.4** The site must be well drained and should have a slope of approximately 0.5% grade from its centerline to the edge of the site or as directed by DESC. Runoff water from areas around the site should not drain through or under the substation area.
- 3.5** It shall be the customer's responsibility to ensure that the substation area and access road is free of any pipes, cables, ducts, drainage ditches, or structures, either overhead or underground. The substation site shall not be located in close proximity to large quantities of flammable liquids, in a blasting area, or in an area with a high concentration of airborne materials.

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- 3.6** The substation site shall not contain any hazardous materials nor shall it have a history of environmental contamination, including petroleum products, that could increase the risk or hazard to human health, property, or the environment, either on the surface or below surface. The site shall not have historically been a solid waste landfill. Any materials known to exist below grade other than naturally occurring soils shall be made known to DESC, as soon as a site is identified. If the customer cannot demonstrate to DESC that the site is clean, then DESC may, at its option, install wells and/or borings to test water quality or soil characteristics. The customer shall reimburse DESC for the costs to install wells and/or borings to test water quality or soil characteristics. In the event that hazardous materials or contamination are discovered, the customer shall provide another site or have the contaminated site cleaned at his expense. DESC may conduct a review of documentation regarding the historical use of the selected site in order to determine if baseline or background sampling is required. The customer shall reimburse any environmental sampling and related laboratory analysis to DESC. DESC may, at its option, accept the site if all hazardous materials are made known or a suitable baseline is established and the amount of any contamination is less than acceptable levels as determined by DESC.
- 3.7** The customer shall be responsible for determining if the substation site falls in a designated wetland area or contains an archaeological site. If the substation site should fall in one of these categories, the customer shall provide another site, or obtain the necessary permits required for site preparation.
- 3.8** The site shall not be located in a floodway or floodplain. Minimum surface elevation shall be 2 feet above Base Flood Elevations based on the current FEMA Flood Maps.
- 3.9** The customer shall provide an access road into the substation. The road shall be capable of supporting heavy truck equipment. Maximum slope of the

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road shall not exceed 8 percent, or 6 percent for large 230kV transformers. The access road shall not contain sharp bends, which would restrict access by large equipment. The location of the access road will be mutually agreed upon by customer and DESC.

3.10 The customer will furnish to DESC, as soon as possible, a copy of the site layout, wetlands delineation, sediment and erosion control drawings, and other associated drawings indicating the exact location of the substation. Adequate reference points, such as property corners and property lines shall be shown locating the substation.

3.11 DESC will furnish gravel inside the substation. DESC will also furnish gravel outside the substation for a distance of 5 feet from the fence. DESC will furnish a security fence around the substation.

3.12 DESC will provide the dimensions of the substation fence. The customer shall leave a ten-foot border outside the perimeter of the fence before any side slope begins. The ten-foot area outside the fence shall be cleared and kept clear of vines and small growth. Natural vegetation and undergrowth will not be cleared from the remaining border.

3.13 The customer will be responsible for the disposal of any excess soil removed from the substation during clearing and grading or subsequent digging for foundations and other structures.

4.0 Transmission Line R/W Requirements

4.1 Unencumbered R/W and access shall be provided for the transmission line/s entering the station. Transmission Engineering shall determine the area required. Once the transmission line has been installed, filling shall not raise the area under the line. Minimum ground clearances must be maintained. DESC must approve any use of the transmission R/W, such as parking, prior

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to use. Construction cranes or other tall equipment shall be restricted from operating within 20 feet of the transmission line/s.

- 4.2** The customer shall be responsible for determining if the transmission route over their property contains designated wetlands or an archaeological site. If the transmission access falls in one of these categories, the customer shall provide another site, or obtain the necessary permits required for site preparation. If an archaeological site does exist and DESC must traverse this area to complete work, customer will be responsible for cost incurred by Company to meet customer's demand that Company uses that particular R/W. Customer shall provide a drawing with wetlands delineation for any R/W containing wetlands.

5.0 Easements

- 5.1** DESC will furnish to the customer a drawing indicating the location and width of all necessary rights-of-way. The customer shall have this information added to their site layout and furnish one copy of the layout to DESC for their reference and coordination in the construction of the substation and lines.
- 5.2** Transmission Engineering and Substation Engineering will have the necessary drawings prepared and forwarded to the Right-Of-Way Department for them to obtain appropriate easements.

6.0 Substation Customer Interfaces

- 6.1** The point of service connection for the customer is a NEMA drilled two hole (for 600 amp service) or four hole (for 1200 amp service and above) switch pad. The switch pad may be made of copper or aluminum material. The switch pad is located inside the DESC substation. Its exact location will be

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shown on an DESC General Plan and Elevations drawing which will be given to the customer when the construction drawings are issued. No strain can be placed on the point of connection. Customer to furnish necessary connectors and conductors to make attachment to the point of connection. See Attached Sketch CUST-POA for further details.

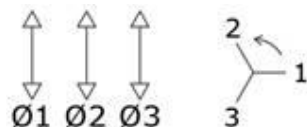
- 6.2** Customer's equipment, other than the overhead conductor to the point of connection, shall be located ten (10) feet outside the substation fence and easement. Any variation is an exception which must be approved by DESC Engineering.
- 6.3** The main power transformer is generally connected in grounded wye. An overhead 3' foot pigtail neutral conductor will be provided to the customer, unless there is a neutral resistor (See Section 8). The customer must extend and terminate this conductor at the customer's switchgear and grounding, even if the customer has no loads connected from phase to neutral. This will provide a path for neutral current to flow back to the transformer in the case of a line-to-ground short circuit on the customer's system. The current flow through this neutral conductor path minimizes the possibility of the existence of dangerous step potential voltages.
- 6.4** When the primary conductor to the customer's facilities is to be underground cable, the cable termination structure is to be furnished by the customer and located ten (10) feet outside the substation fence, with connection to the substation point of connection being made by means of overhead conductor as described in section 6.1.
- 6.5** The customer shall ensure that access to all substation gates is kept clear, and that no material is dumped or stored against the fence. The customer shall take whatever steps are necessary to prevent damage to the fence caused by vehicles, personnel, materials, or corrosive chemicals. In the event that damage to the fence does occur, the DESC Substation Construction & Maintenance Department shall be notified immediately. In such cases, the

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customer should ensure that: (1) the security of the substation is not jeopardized as a result of the damaged fence, and (2) unauthorized persons do not enter the substation.

- 6.6** The customer shall be responsible for providing and maintaining any substation screen required by local ordinances. Any screening placed on DESC easements must be coordinated with the DESC Engineering Department.
- 6.7** In the case that control wiring, metering pulse wiring, or CT secondary leads must be run between the DESC substation and the customer's facilities, a weatherproof enclosure ("Customer Interface Box") will be mounted outside the substation fence. Alternately, the interface wiring may be connected to a special interface panel located in the DESC Relay House. In this case conduit from the relay house to the fence line will be provided by DESC. Conduit from the substation fence line to the customer facilities will be the responsibility of the customer. The point of connection for all such leads will be on sliding link type terminal blocks located in the Customer Interface Box or on the interface panel located in the relay house. Whenever such interconnections are required between the DESC substation and the customer's facilities, the customer's ground system must be connected to the substation ground system to prevent transferred voltage potentials as described in the Grounding section below. Reference Section 7.1 for grounding requirements.
- 6.8** DESC's phasing designations 1, 2, & 3 do not correspond to industry standard phasing designations A, B, & C respectively. If customer requires industry standard ABC clockwise rotation then the following connections should be made: DESC 123 = Customer CBA. DESC uses a counter-clockwise "1-3-2" phase rotation as indicated below.



7.0 Grounding

7.1 Dominion Energy South Carolina, Inc. (DESC) must consider the safety of its employees and anyone else that may be working near or in contact with its facilities. An adequately designed substation grounding grid is an important safety component of the electric system as it protects individuals from the potentially hazardous touch and step voltages that may occur during an electrical fault. When a customer connects to a DESC ground grid through any metallic interconnection including fencing, conduits, etc., the customer's facility and its equipment may be subjected to potentially unsafe voltages transferred through those connections. It is also possible that these potentially unsafe voltages could occur on metallic buildings, fences, equipment, etc. in close proximity to DESC's fence even if the grounding systems are not connected.

7.1.1 DESC does not evaluate the customer's ground grid, the adequacy of which directly impacts the potential for unsafe step and touch voltages on customer's equipment, buildings, or their electrical systems. This must be evaluated by the customer. Industrial customers should have a ground grid evaluation performed by an engineering firm experienced in grounding evaluations to ensure any touch, step, or transfer of voltage potentials are mitigated appropriately. The customer should ensure the grounding contractor is knowledgeable with respect to power system grounding evaluations associated with utility systems as well as industrial facilities.

7.1.2 DESC and its grounding contractors utilize the Safe Engineering Services CDEGS grounding evaluation computer modeling software. In an attempt to assist the customer with their study, where available, DESC will provide access to the grounding

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resistivity measurements, grid and fault data, and any existing documentation and module input for the grounding program for use by the customer's grounding contractor. DESC will provide, upon request, contact information for engineering firm/firms that have performed grounding studies for DESC. Any information released by DESC regarding its electrical system must be treated as confidential information as required by the Federal Energy Regulatory Commission and the U.S. Department of Homeland Security. As such, the grounding contractor and customer will be required to sign DESC's standard non-disclosure agreement prior to release of such information.

7.2 DESC will install a ground system, usually a grid of copper conductors buried beneath and adjacent to the fenced enclosure of sufficient size, capacity and conductance to adequately dissipate expected fault currents. It will be designed to maintain step and touch potentials at safe levels in the substation area under fault conditions.

7.3 The substation fence will be bonded to the ground grid. A portion of the grid will be buried 3 feet outside the fence as part of the step and touch potential protection. Conventional, customer steel structures are not permitted within 10' of the substation fence. When a structure is needed within this 10' requirement, DESC recommends non-conductive materials. This will mitigate touch potential issues between a customer structure and the DESC fence. The customer shall notify DESC Substation Engineering Department with any exceptions to this requirement. The ground grid design includes gate areas which is 13 feet outside the fence assuming each gate leaf is 10 feet long.

7.4 To avoid possibly high potential differences, connection between the substation and customer ground system is required whenever a substation

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neutral, conduit, control, metering, CT or other leads are run between the substation and the customer's facilities.

7.5 When required or if the customer desires to connect to DESC's substation ground system, DESC will provide two copper ground leads three feet outside the fence for the customer to make his connections.

7.6 Customer fences, structures, or other metallic objects located near the substation shall be coordinated with DESC. The customer should be aware that any interconnection of the customer ground system to the DESC substation ground system requires special analysis, by the customer, to evaluate the impact of the grounding interconnection. For example, fences, structures, or other metallic objects located near the customer ground system should be evaluated to ensure safe step and touch voltage potentials.

8.0 Transformer Neutral Resistor (if required by customer)

Standard service for any three phase, 4-wire, wye voltages provides that the transformer neutral be solidly grounded on the low-voltage side. The following conditions apply if the customer requires impedance-grounding to limit the maximum line-to-ground fault current. Resistance grounding is the most common method of impedance grounding. It is accomplished by connecting the transformer neutral to ground through one resistor. The additional equipment and responsible parties required for resistance grounding are shown below.

8.1 The neutral grounding resistor to be furnished and supplied by the customer. The current rating, resistor value, and time rating of the resistor to be determined by the customer based on their requirements. The voltage and BIL ratings to be no smaller than the service voltage. The resistor frame, or housing, to be made of galvanized steel or aluminum so no rusting or maintenance will be required on the resistor.

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- 8.2** An Instrument Current Transformer mounted on or in the resistor frame to be furnished and supplied by the customer. The voltage and BIL ratings to be no smaller than the service voltage. The primary current rating of the CT shall be between 50% and 100% of the current rating of the neutral resistor. For example, for a neutral resistor rated 400 amps, the CT ratio needs to have a 200/5 to 400/5 ratio.
- 8.3** A support structure to be supplied and furnished by the customer.
- 8.3.1** The resistor support insulators on top of the structure to be station post and the voltage and BIL ratings to be no smaller than the service voltage.
 - 8.3.2** The structure to be designed to provide isolation from the foundation level of 10' - 0" to all energized parts for 25,000 volts and below.
 - 8.3.3** The structure and resistor to be Seismic Zone 3 rated.
 - 8.3.4** The structure to be hot dipped galvanized steel.
 - 8.3.5** The structure to have two holes per leg for grounding. One hole located at the top and at the bottom of each leg. Holes to be 9/16" diameter.
 - 8.3.6** If structure exceeds a foot print of 6' x 7' wide, notify proper DESC's representative.
- 8.4** The resistor, structure, and instrument CT will be mounted in DESC's substation next to the neutral bushing of the main power transformer.
- 8.5** The secondary of the instrument CT, located in the resistor, will go to a neutral overcurrent relay provided by DESC. The neutral overcurrent relay will be installed on the DESC transformer relay protection panel to provide backup protection against uncleared ground faults on the customer's system.
- 8.6** Materials to construct the foundation for the structure will be provided by DESC.

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- 8.7** Miscellaneous conduit and wiring for the instrument CT's secondary current will be provided by DESC.
- 8.8** The wire to connect the resistor to the power transformer neutral bushing will be provided by DESC.
- 8.9** Labor to install all of the above items to be done by DESC.
- 8.10** Items 8.1, 8.2, and 8.3 will be purchased and furnished by the customer and delivered to DESC construction personnel at the substation site for installation.
- 8.11** In order to ensure the reliability of the DESC's transformer protection relay system, no customer device can be connected in the secondary circuit of the neutral instrument CT. If the customer wishes to monitor transformer neutral current for his own relaying, a second instrument current transformer must be furnished by the customer, mounted on the support structure (item 8.3), and its primary winding connected in series with the other instrument CT (item 8.2). The point of connection for the secondary that leads from this instrument CT will be in a Customer Interface Box.
- 8.12** The customer will provide DESC with copies of all manufacturers' drawings relative to Items 8.1, 8.2, and 8.3 early in the project so that foundations for the structure can be designed. These items will be indicated on the DESC construction drawings.
- 8.13** The resistor shall have an entrance bushing mounted on top, and an exit bushing mounted underneath the resistor. The entrance bushing voltage and BIL ratings to be no smaller than the service voltage.

PLAN "SAFETY" INTO EVERY JOB

REV. 2 4/25/2019 REM UPDATED TO MATCH NEW CUST SUB STD.

DATE

APP.

DATE

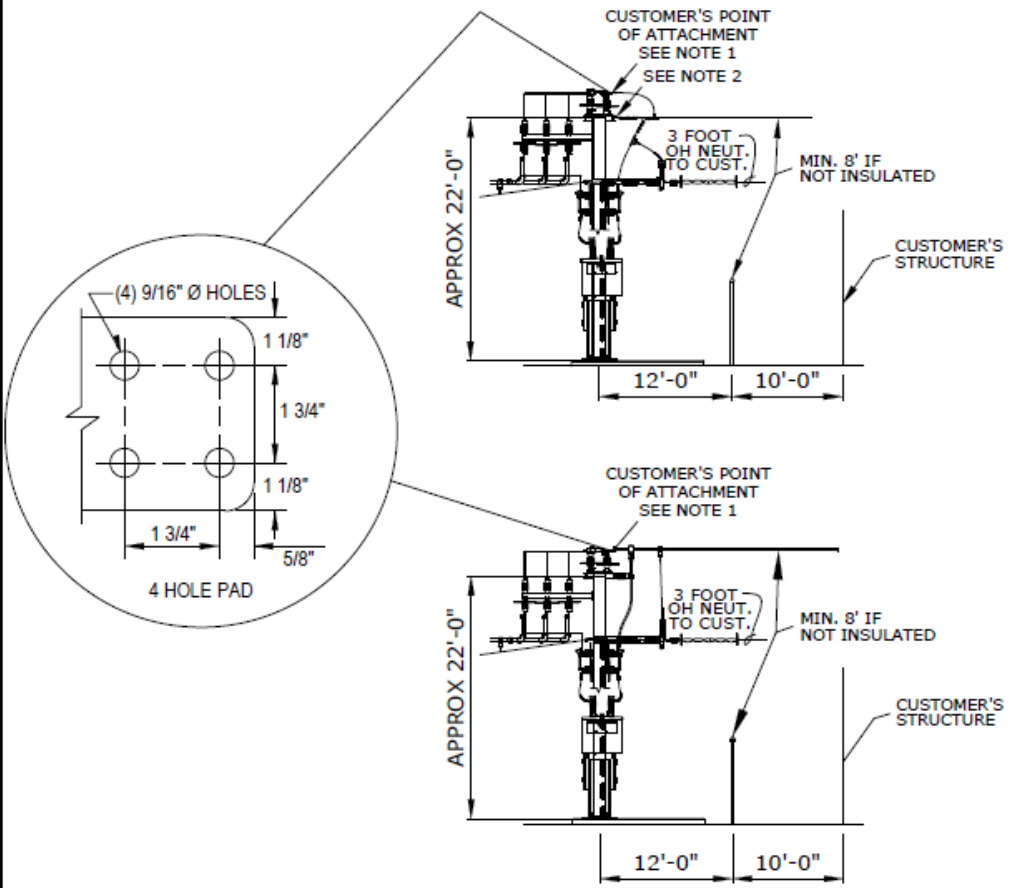
APP.

DATE

CAD DRAWING - DO NOT REVISE MANUALLY

**STNDS-CUSTPOA-1
CUSTOMER'S POINT OF ATTACHMENT**

BY REM
DATE 5/3/2017
REV. 2 SHEET 1 OF 1



NOTE 1:

Customer's point of service connection is a NEMA drilled two hole or four hole copper or aluminum pad on switch. The switch pad has a horizontal limit of 90 lbs. and a vertical limit of 30 lbs. If Switch Pad is Aluminum, a bare copper connector pad cannot be used. No more than 1000 lbs. can be placed on structure. Customer shall furnish bus and connectors to make the point of connection.

NOTE 2:

No more than 1000 lbs. can be placed on structure. Customer shall furnish bus and connectors to make the point of connection. Three $\frac{3}{4}$ " holes are provided on a 3'-6" phase spacing.

**SUBSTATION CONSTRUCTION STANDARDS
DOMINION ENERGY SOUTH CAROLINA, INC.**



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