CenterPoint Energy Telephone Numbers

Real Time Operations Department ("RTO")

RTO System Controller	281-894-0491 (24 hours)
RTO HOTLINE (Emergency)	281-894-1625 (24 hours)

Outage Scheduling:

Submit request to: OutageRequest@centerpointenergy.com

Outage Questions call 713/207-2714 (Primary) or 713-207-2196

Metering Department:

High Voltage Metering	713-945-6689
Metering Engineering	713-207-7507

Transmission Accounts Representatives:

Gary Dwyer	713-207-3621
Rick Ferrell	713-207-3512
Henry French	713-207-2789
Gary Shadwell	713-207-3538

1 Introduction

1.1 Applicability

1.1.1 This procedure applies to entities ("the Customers") who own high voltage transmission and/or generation facilities interconnected to CenterPoint Energy Houston Electric, LLC's ("CNP") 69 kV, 138 kV, or 345 kV transmission system. Customer, as used in this document, includes the Customer's authorized contractors or agents. The Customer shall ensure that the provisions in this document are applied to facilities that may be owned by others and that are interconnected to the Customer's facility at the same voltage at which the Customer's facility is interconnected to CNP's transmission system.

1.2 Purpose

1.2.1 The purpose of this document is to facilitate the coordinated operation, outage coordination, maintenance, design, and modification of the Customer's high voltage transmission or generation facilities with CNP facilities.

1.3 Copies of This Procedure

1.3.1 The Customer shall keep copies of this procedure in applicable Customer substation control houses and plant operating centers. This procedure, including forms, may be reproduced.

1.4 Facility Ownership or Name Change

1.4.1 The Customer shall inform CNP of any change in ownership or name of their interconnected facilities or facilities owned by others that are interconnected to their facilities.

1.5 Procedure Conflicts

1.5.1 Any conflicts between this procedure and the Customer's procedures shall be thoroughly discussed with appropriate CNP representatives and resolved before beginning any work.

1.6 Maintenance Responsibility

1.6.1 The Customer is responsible for the operation and periodic preventive maintenance of all substation facilities owned by the Customer except for equipment designated by CNP to be maintained by CNP. The Customer shall not perform preventive maintenance on equipment maintained by CNP.

1.7 Equipment Changes

1.7.1 The Customer shall provide all equipment, in accordance with CNP specifications, whenever changes in CNP transmission system, including monitoring and protection devices, require changes in the Customer's interconnected facilities to maintain compatibility.

1.7.2 The Customer shall provide sufficient notice to CNP of any proposed changes to their facilities as specified in Section 9. This notification shall include providing necessary details, so that CNP can provide comments based upon a general, functional review. The Customer shall not procure any equipment or materials or begin any work until all CNP comments are incorporated or resolved.

1.8 Generation Installation and Operation

1.8.1 Customers desiring to connect generation that will operate in parallel to CNP's transmission system shall file an application with the Electric Reliability Council of Texas ("ERCOT") requesting interconnection in accordance with ERCOT's Generation Interconnection Procedure.

1.8.2 The Customer's generation facility must be operated in accordance with the ERCOT Protocols and Operating Guides available at:

http://www.ercot.com/mktrules/nprotocols/current

http://www.ercot.com/mktrules/guides/noperating/cur

1.9 Power Factor

1.9.1 The Customer shall provide suitable apparatus to maintain power factor consistent with the requirements of CNP's Tariff for Retail Delivery Service.

1.10 Voltage Fluctuations

1.10.1 The Customer shall provide suitable apparatus to mitigate voltage fluctuations to reasonable limits should the Customer's equipment cause voltage fluctuations that interfere with CNP's transmission system.

1.11 Emergency Response

1.11.1 In an emergency, the Customer shall switch substation equipment, reduce MW output, change reactive output, or perform other measures as directed by ERCOT or CNP's Real Time Operations Department ("RTO"), to help alleviate the emergency.

1.11.2 CNP may interrupt transmission service to and deliveries from the Customer in the event of an emergency.

2 CNP Access to the Customer's Facilities

2.1 Authorized Representative of CNP

2.1.1 An authorized representative of CNP shall have access to the Customer's premises for the purpose of inspecting CNP's wiring and apparatus, repairing, erecting, removing, or replacing CNP owned equipment, reading CNP meters, and for all other purposes related to the interconnection including switching CNP equipment. The Customer shall provide necessary equipment outages to

allow CNP to perform periodic maintenance on equipment that CNP owns or to repair or replace equipment that CNP owns.

3 Communications with CNP

3.1 Real Time Operations Department

3.1.1 RTO operates CNP's transmission system and coordinates the operation of interconnected high voltage facilities. RTO provides routine and emergency switching instructions, issues clearances, and dispatches CNP personnel in response to electrical outages and problems. The Customer shall schedule planned outages with RTO and obtain from RTO switching instructions for any equipment at the Customer's substation that is directly interconnected with CNP's transmission system. Switching in the Customer's facilities that are remote to the Customer's substation directly interconnected with CNP's transmission system does not need to be scheduled. CNP will notify the Customer one or more days in advance if switching is required in the Customer's substation for planned transmission line outages or if the Customer's substation will be placed in a single-ended condition.

3.2 Scheduling Transmission Equipment Outages

3.2.1 CNP's substation equipment outage scheduling and reporting requirements have been developed to support ERCOT requirements for scheduling outages on circuit breakers, bus sections, transmission lines, and transformers that have an operating voltage of 60 kV and higher and to support requirements for scheduling outages of ERCOT Polled-Settlement ("EPS") metering equipment.

3.2.2 The Customer shall contact the RTO Outage Scheduler as shown in Table 1 at the end of this section to coordinate outages in the substation that is directly interconnected with CNP's transmission system. Requests are considered in the order they are received.

3.2.3 Switching Orders, Clearances - The Customer shall follow switching instructions provided by the RTO System Controller prior to initiating any switching to remove equipment from service or return equipment to service in the Customer's facilities. The Customer shall request a clearance from the RTO System Controller when required. A "Switching Order" form and a "Transmission Switching Check List" form are included in this document. The RTO System Controller can be contacted at 281-894-0491.

3.2.4 Unplanned Outages, Emergencies - The Customer shall contact the RTO System Controller as soon as possible whenever any unplanned tripping of any circuit breaker operating at a voltage of 60 kV and higher occurs. An "Unplanned Outage Check List" form is included in this document. In the event of an unplanned generation outage, the Customer or his designated representative shall advise CNP's RTO System Controller as soon as possible. In emergency situations, switching may be performed by a qualified person, which is authorized by the Customer, based upon switching instructions

provided by the RTO System Controller. An "Emergency Switching Check List" form is included in this document. The RTO System Controller can be contacted at 281-894-0491 or at the RTO HOTLINE 281-894-1625.

3.2.5 ERCOT Approvals - The RTO System Scheduler will coordinate a review and notifies the Customer whether the outage can be scheduled for the desired day. Transmission line outages and the energization of new equipment require the approval of ERCOT. The Customer shall notify the RTO System Scheduler as soon as possible if an outage is canceled prior to the outage date. The Customer shall immediately notify the RTO System Controller if an outage is canceled on the day of the outage. CNP endeavors to notify the Customer as soon as possible when it is deemed necessary to cancel an outage.

3.2.6 Customer Substation Evacuations – During emergencies requiring evacuation of the Customer's facility, the Customer shall contact RTO prior to the evacuation and provide information regarding the operational status of their substation and associated support facilities, such as substation station service power, battery and battery charger, and ability for CNP to access the substation. The Customer's substation is an integral part of the interconnected transmission system and disabling them has an impact on the electrical grid.

3.3 Transmission Accounts Division

3.3.1 CNP's Transmission Accounts Division is responsible for coordinating the Customer's service needs within CNP. Transmission Accounts representatives endeavor to inform the Customer of long range planned switching and projects that may affect the Customer's facility.

3.3.2 The Customer shall notify the Transmission Accounts representative as specified in Section 9 when equipment additions or removals are planned or when high voltage equipment 60 kV and higher or associated equipment requires modification or replacement. The Customer shall contact a Transmission Accounts representative to request current CNP specifications and applicable bills of material for substation equipment additions and replacement.

3.3.3 Transmission Accounts representatives may be contacted for any questions concerning the operation of the Customer's substation. The Transmission Accounts representatives are listed on Page 1 of this document.

3.4 Substation and Equipment Identification

3.4.1 CNP assigns a substation name, or a Substation ID of six characters or less, to identify the Customer's substation facility. The Substation ID is also referred to as the six character mnemonic name in which some characters may be blank. CNP mounts signs with the substation name or the Substation ID on a substation control house door and on a substation entrance gate at the Customer's facility.

3.4.2 The Customer's high voltage circuit breakers switches, transformers, and certain low side equipment shall be identified with CNP's assigned numbers. CNP develops a substation basic one-line diagram that includes these assigned numbers. CNP or the Customer shall mark these numbers on the substation equipment. CNP may stencil identification numbers on substation equipment and mount signs, labels, drawings, telephone numbers, and instructions on the Customer's facilities.

3.4.3 The Customer shall use CNP's assigned substation name, or Substation ID, and equipment identification numbers in discussions with the RTO System Controller and the RTO System Scheduler.

3.5 Telephone Lines and Data Communication

3.5.1 The Customer shall maintain a telephone in the substation control house connected to an outside telephone line that is independent from the Customer's telephone system.

3.5.2 The Customer shall maintain data acquisition equipment to provide real-time data to RTO when it has been installed at electric generating facilities.

3.5.3 CNP maintains a communication circuit for real time data if CNP Supervisory Control and Data Acquisition ("SCADA") equipment is installed at the Customer's facility.

3.6 Alarm Response

3.6.1 CNP responds to alarms for communication equipment installed to protect CNP transmission circuits.

3.6.2 The Customer shall report substation alarms to the RTO System Controller and respond to alarms pertaining to their equipment. A "Loss of DC" alarm shall be immediately reported to the RTO System Controller and investigated by the customer.

Outage Scheduling Requirements

Per ERCOT and CNP outage reporting requirements, planned outages on circuit breakers, transmission lines, and autotransformers that are rated 60 kV and higher must be submitted to the ERCOT Outage Coordinator by the CNP RTO Outage Coordinator.

Per ERCOT Protocols, planned outages on ERCOT Polled Settlement ("EPS") meters and the equipment to which they are connected require a 5 day minimum notice. A 10 calendar-day minimum notice is required for any modifications to approved EPS equipment.

Table 1 Planned Outage Scheduling

Equipment Being Requested	Minimum Advance Notice	Contact
69 kV and 138 kV lines, single load transformers, individual breakers and bus outages of no more than one day in duration.	No later than 1200 hours Wednesday two weeks before the Planned Outage is to take place.	Outage Scheduler @ 713-207-2196 or 713-207-2714
All transmission line outages and equipment outages, including busses, of up to four contiguous days duration (daily or continuous outages).	35 Calendar Days	Outage Scheduler @ 713-207-2196 or 713-207-2714
Any transmission line outages and/or equipment outages, including busses, of 5 days or longer duration (daily or continuous)	90 Calendar Days	Outage Scheduler @ 713-207-2196 or 713-207-2714

Amount of time between the request for approval of the proposed Outage and the scheduled start date of the proposed Outage:	ERCOT shall approve or reject no later than:
Three days	1800 hours, two days before the start of the proposed Outage
Between four and eight days	1800 hours, three days before the start of the proposed Outage
Between nine days and 45 days	Four days before the start of the proposed Outage
Between 46 and 90 days	30 days before the start of the proposed Outage
Greater than 90 days	75 days before the start of the proposed Outage

4 Switching, Clearances, Grounding

4.1 Billable Costs

4.1.1 Grounding and switching requested by the Customer to be performed during other than normal working hours is billable to the Customer.

4.1.2 Grounding and switching charges will be waived under the following conditions:

4.1.2.1 The Customer requesting switching or grounding activities by CNP is a transmission voltage service customer that is interconnected to CNP's transmission system through a customer-owned substation; and

4.1.2.2 The requested activities are to allow the Customer to perform maintenance activities or equipment upgrades on its transmission voltage facilities within the Customer's substation; and

4.1.2.3 The switching and grounding field activities are requested to occur on a normal CNP work day, with outages commencing no earlier than 0800, and outages concluding no later than 1600.

4.1.3 Outages extending beyond the timeframes identified in Section 4.1.2.3 on a forced basis may result in billing for associated switching and grounding activities, as determined on a case-by-case basis.

4.1.4 Outages with switching or grounding activities requested for more than two consecutive days may be subject to charges for each additional consecutive day, even if the outages occur within the timeframes identified in Section 4.1.2.3, unless early or intermittent outage restoration is required by ERCOT or for CNP system requirements.

4.1.5 Questions regarding charges should be directed to the Transmission Accounts representative.

4.2 Switching

4.2.1 CNP performs necessary switching at the remote end of a CNP transmission line for outages at the Customer's substation that require switching of CNP transmission lines. CNP provides switching instructions for the high voltage devices in the Customer's substation that is directly interconnected with CNP's transmission system. Switching instructions are not provided for remote facilities interconnected to the Customer's substation that is directly interconnected with CNP's transmission system. A "Switching Order" form and a "Transmission Switching Check List" form are included in this document.

4.2.2 The Customer shall follow switching instructions provided by the RTO System Controller prior to initiating any switching to remove equipment from service or return equipment to service in the Customer's facilities. The Customer shall implement specific procedures for the switching of its facilities. These procedures shall include a visual check that all phases have fully opened or

closed. A device bearing a Hold Tag shall not be operated under any circumstances.

4.2.3 The Customer shall provide a Hold Order to RTO for switching at generation facilities for equipment that interconnects with CNP.

4.3 Clearances

4.3.1 A clearance is required for applicable work on high voltage apparatus connected to CNP transmission lines when switching at the remote end of a CNP transmission line is necessary. Clearances are also issued when the Customer and CNP will be working on apparatus within the same isolated area at the Customer's facilities. Each party will be issued an individual clearance.

4.3.2 The Customer shall request a clearance from the RTO System Controller when required. Personnel authorized by CNP will perform either "trip & hold" or "check for trip & hold" on necessary devices before a clearance will be issued.

4.3.3 A clearance cannot be released by anyone other than the person to whom it was issued unless uncontrollable circumstances make that impossible. In this situation, the person's supervisor may, after informing each member of the crew that such action is being taken, contact the RTO System Controller to release the clearance. For field personnel shift changes, the person assuming the leadership of the work will be issued a new clearance and the person to whom the clearance was originally issued will then release the clearance.

4.4 Grounding

4.4.1 CNP issues clearances indicating that high voltage devices have been opened, locked, and tagged to prevent the devices from operating. The Customer shall verify that the apparatus is de-energized before protective grounding is attached or work on high voltage facilities begins.

4.4.2 The Customer shall install protective grounds on all de-energized electrical apparatus before applicable work is performed on it. When more than one party (e.g., the Customer and CNP) will be working on apparatus within the same isolated area at the Customer's facilities, each party shall install their own individual grounds before applicable work is performed.

4.4.3 Work may be performed on the control circuits and mechanisms of a device without grounding the apparatus, if such work can be performed without risk of contact with primary voltages. Grounds may be temporarily removed if required by testing procedures.

4.4.4 Before a grounding device is attached to any conductor, the conductor shall first be tested to confirm that it is de-energized. Grounds shall be placed such that the operation of a switching device cannot remove their protection.

4.4.5 The clamps and conductors of grounding devices shall be designed for the available fault current. Grounding devices must be inspected for broken

strands and loose connections. The surface of the ground clamps shall be clean of corrosion and oxides.

4.4.6 Grounding devices for transmission voltage conductors shall be installed and removed with the use of applicable live line tools. Grounding devices shall be securely connected at the ground end before connection is made to the conductor. Grounds shall be removed by first detaching the connection at the conductor and, then, detaching the connection at the ground end. When grounding to a steel structure, the ground shall not be applied to a flat surface unless an appropriate flat surface clamp is used.

4.4.7 CNP does not ground Customer-owned substation equipment except for work being performed by CNP.

4.5 Switching 345 kV Facilities Equipped with Ferroresonance Protection

4.5.1 Ferroresonance protection is installed whenever a wound potential transformer ("PT") is connected to 345 kV and the possibility of a ferroresonance condition occurring exists. If applicable, the Customer shall implement specific procedures for switching 345 kV equipment that has ferroresonance protection installed. Procedures shall include the following:

- Place the sync handle in position for the last breaker that will be opened.
- Monitor the potential lights on all three phases before and after the last breaker is opened. If one or more of the lights do not dim immediately but gets brighter:
  - immediately close the last breaker opened to reenergize the bus
  - investigate the ferroresonance protection
- If all three lights dim immediately:
  - reset the targets (flags) on the ferroresonance protection relays
- If relay targets did not operate:
  - investigate the ferroresonance protection circuit

4.6 Terminology for Switching Orders

Time - Military time, or 24 hour clock, based on prevailing Central Time.

Check Ring for Close - Verify by visual inspection that all devices in the ring are in the closed position.

Remove / Roll Loads - Remove all loads connected to a power transformer. This may be done by tripping applicable low side breakers or by rolling load to an adjacent transformer and tripping applicable low side breakers.

Trip - Initiate and complete an opening operation on a device.

Close - Initiate and complete a closing operation on a device.

Hold Tag - A tag placed on a device to indicate the equipment shall not be allowed to change operating state. The tag shall indicate the party who placed the tag.

Trip and Hold - Trip device, physically or mechanically (e.g., affix padlock) disable device from closing, and place a Hold Tag on the device.

Check for Trip and Hold - Verify by visual inspection that a device is in the trip position and place a Hold Tag on the device.

Secure Against Operation (SAO) - Physically, mechanically, or electrically disable a device (e.g., a motor operated disconnect switch) to prevent it from operating.

Secondary Potential Fuse (SPF) - Remove and tag fuses on the secondary side of potential devices to prevent the possibility of back energizing isolated equipment.

4.7 Switching Order

SWITCHING

ORDER # _____

SUBSTATION _____

EQUIPMENT _____

OUT	**RESTORE**
DISP _____	DISP. _____
TIME _____	TIME _____
DATE _____	DATE _____
EXEC. BY _____	EXEC. BY _____
TIME _____	TIME _____

CLEARANCE # _____

ISSUED	**RELEASED**
DISP. _____	DISP. _____
TIME _____	TIME _____
DATE _____	DATE _____

ISSUED TO _____

NUMBER OF MEN _____ AND GROUNDS _____

ON _____

_____

INSTRUCTIONS

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SWITCHING PROCEDURES DISCUSSED
WITH ALL MEMBERS OF CREW: Y N

CREW INITIALS _____

4.8 Transmission Switching Check List

4.8.1 The following basic procedures are for the day of the switching after the outage has been scheduled with and authorized by the RTO System Scheduler (713-207-2196). This applies to the Customer's substation that is directly interconnected with CNP's transmission system.

- ☐ Call the RTO System Controller at 281-894-0491 and request a Switching Order
  - ☐ Provide name, company affiliation, and telephone number
  - ☐ Provide Substation ID
  - ☐ Describe reason for request
  - ☐ Fill out Switching Order
    - ☐ Record the Switching Order number
    - ☐ Record start time provided by the RTO System Controller
    - ☐ Record the RTO System Controller's name
    - ☐ Record the instructions to take equipment OUT
    - ☐ Repeat the instructions
- ☐ Execute the Switching Order placing Hold Tags where appropriate
- ☐ Call the RTO System Controller when the instructions have been completed
  - ☐ Report the actual completion time
  - ☐ Record the completion time provided by the RTO System Controller on Switching Order
  - ☐ Request a Clearance if necessary
    - ☐ Provide the number of personnel in the crew
    - ☐ Provide the number of and location of grounds
- ☐ Verify apparatus is de-energized with a hot line indicator
- ☐ Install protective grounds when required
- ☐ Perform work
- ☐ Remove protective grounds if installed
- ☐ Call the RTO System Controller to request to RESTORE equipment
  - ☐ Report whether more than one Hold Tag is on any device
  - ☐ Provide Clearance number if applicable
    - ☐ Provide the number of personnel in the crew clear of the apparatus
    - ☐ Provide the number of grounds removed
  - ☐ Provide the Switching Order number
  - ☐ Fill out Switching Order
    - ☐ Record start time provided by the RTO System Controller
    - ☐ Record the RTO System Controller's name
    - ☐ Discuss performing Switching Order instructions in reverse order
- ☐ Alert all personnel to move to a safe distance from apparatus being energized
- ☐ Execute the Switching Order removing Hold Tags where appropriate
- ☐ Call the RTO System Controller when restoration has been completed
  - ☐ Report the actual completion time
  - ☐ Record the completion time provided by the RTO System Controller on Switching Order

5 Outage Scheduling Check List

5.1 Outage Scheduling Check List

5.1.1 The following instructions are for scheduling transmission equipment outages. This applies to the Customer's substation that is directly interconnected with CNP's transmission system. Please refer to the "Outage Scheduling Requirements" outlined in Section 3 of these procedures.

5.1.2 ☐ Submit the following form to OutageRequest@centerpointenergy.com

5.1.3 ☐ For outage questions, call 713-207-2714 (Primary) or 713-207-2196.

☐ Please provide the following information:

CENTERPOINT ENERGY OUTAGE REQUEST FORM FOR TRANSMISSION CUSTOMERS									
SUBMITTAL DATE:			VERSION #			CUSTOMER NAME		Substation MNEMONIC:	
REQUESTED BY:			Office #			ON SITE CONTACT		Office #	
			Cell Ph#					Cell Ph#	
EQUIPMENT	START DATE	START TIME	END DATE	END TIME	DAILY - D CONT - C	KV	EMERGENCY RESTORE TIME	CNP TO GROUND Line Y/N	REASON FOR OUTAGE/REMARKS
All Outage Requests should be e-mailed to OutageRequest@centerpointenergy.com For Questions call 713-207-2714 (fax# 713-207-2571)									

Please make a courtesy phone call if a revision has changed the original submittal. CNP will contact the "Requestor" if additional data is required.

6 Unplanned Outages

6.1 Unplanned Outages

6.1.1 ERCOT Protocols require that CNP notify ERCOT of all unplanned transmission outages.

6.1.2 The Customer shall contact the RTO System Controller as soon as possible whenever any unplanned tripping of any high voltage (60 kV and higher) circuit breaker occurs. CNP crews will be dispatched when high voltage circuit breakers remain open in the Customer's substation that is directly interconnected with CNP's transmission system. CNP crews will reset relay targets except in emergency situations. An "Unplanned Outage Check List" form is included in this procedure.

6.1.3 CNP crews are not dispatched when high voltage circuit breakers remain open in a remote, non-CNP substation connected to the Customer's substation, but not directly interconnected with the CNP system. In such a case, the Customer shall discuss and evaluate the event with the RTO System Controller. The Customer shall notify the RTO System Controller prior to any switching.

6.1.4 In the event of an unplanned generation outage, the Customer or his designated representative shall advise CNP's RTO System Controller as soon as possible.

6.2 Unplanned Outages of 345 kV Facilities Equipped with Ferroresonance Protection

6.2.1 Ferroresonance protection is installed whenever a wound potential transformer ("PT") is connected to a 345 kV and the possibility of a ferroresonance condition occurring exists. If applicable, the Customer shall implement specific procedures for unplanned tripping of 345 kV equipment that has ferroresonance protection installed. Procedures shall include the following:

- ☐ Visually inspect the potential transformer lights on all three phases
- ☐ If one or more of the lights are bright and not dim
  - ☐ Open all the breaker disconnect switches to isolate the potential transformers
  - ☐ Disconnect/Remove the PTs from service on the phases with the bright lights
- ☐ If one or more of the lights are dark and not dim
  - ☐ Open all the breaker disconnect switches along the affected bus
  - ☐ Disconnect/Remove the PTs from service on the phases with the dark lights
- ☐ If remote monitoring of potential transformer voltages indicated a ferroresonance condition occurred
  - ☐ Open all the breaker disconnect switches to isolate the potential transformers
  - ☐ Disconnect/Remove the PTs from service on the phases that indicated ferroresonance
- ☐ If all three lights are dim
  - ☐ Reset the targets on the ferroresonance protection relays
- ☐ If relay targets do not indicate proper action
  - ☐ Investigate the ferroresonance protection circuit

6.3 Emergency Switching

6.3.1 In emergency situations, switching may be performed prior to a CNP crew arriving at the Customer's substation. A qualified person, authorized by the Customer, may operate breakers and switches based upon switching instructions provided by the RTO System Controller. Prior to switching, all relay trip targets shall be reset after the Customer has recorded them and reported them to the RTO System Controller. All personnel shall move to a safe distance from apparatus being energized prior to switching. An "Emergency Switching Check List" form is included in this procedure.

6.3.2 UNPLANNED OUTAGE CHECK LIST

6.3.3 The following instructions are for whenever an unplanned tripping of a transmission service voltage breaker occurs.

- ☐ Call the RTO System Controller at 281-894-0491
- ☐ Provide the following information to the RTO System Controller
  - ☐ Your name, company affiliation, and telephone number
  - ☐ Substation ID
  - ☐ Nature of the problem
  - ☐ Time of outage
  - ☐ Status of all breakers and switches (i.e., open, closed, tagged)
  - ☐ Cause of the event if known
  - ☐ Fault location and faulted equipment if known
  - ☐ Fires and their proximity to energized equipment
  - ☐ Plant and substation entry constraints (e.g., chemical releases)
- ☐ Record the RTO System Controller's name
- ☐ Investigate and provide the following information to the RTO System Controller
  - ☐ Cause of the event if found during investigation
  - ☐ Fault location and faulted equipment if found during investigation
  - ☐ Number of trip operations for each breaker (i.e., change in breaker veeder reading)
  - ☐ Relay trip targets - Do not reset targets
- ☐ Discuss outage with CNP crews
- ☐ CNP crews record and reset relay trip targets
- ☐ CNP crews record breaker veeder readings
- ☐ Resolve outage and complete any necessary corrective action
  - ☐ Call the RTO System Controller at 281-894-0491 to request to RESTORE equipment
  - ☐ Record the instructions to RESTORE equipment
  - ☐ Repeat the instructions
- ☐ Execute the instructions
- ☐ Call the RTO System Controller when instructions have been completed

BY: _____ DATE: _____

6.4 EMERGENCY SWITCHING CHECK LIST

6.4.1 The following basic procedures are for emergency situations. Contact the RTO System Controller at one of the following telephone numbers.

- ☐ Call the RTO System Controller HOTLINE at 281-894-1625
- ☐ Provide the following information to the RTO System Controller
  - ☐ Your name, company affiliation, and telephone number
  - ☐ Substation ID☐ Nature of the problem
  - ☐ Time of outage
  - ☐ Status of all breakers and switches (i.e., open, closed, tagged)
  - ☐ Cause of the event if known
  - ☐ Fault location and faulted equipment if known
  - ☐ Fires and their proximity to energized equipment
  - ☐ Plant and substation entry constraints (e.g., chemical releases)
  - ☐ Relay trip targets
- ☐ Record the RTO System Controller's name
- ☐ Record the instructions to RESTORE equipment
- ☐ Reset relay trip targets
- ☐ Execute the instructions
- ☐ Call the RTO System Controller at 281-894-0491 when instructions have been completed

BY: _____ DATE: _____.

6.5 Other Emergency Conditions

6.5.1 Customer substations are an integral part of the interconnected transmission system and disabling them has an impact on the electrical grid. In certain emergency situations, the Customer may evacuate or shut down their facility. In such cases, the Customer shall endeavor to keep the portion of their substation that is directly connected to the transmission grid in service, unless specifically directed otherwise by ERCOT or CNP's RTO System Controller.

7 Generation Operation

7.1 Applicability

7.1.1 This section applies only if the Customer operates electric generating facilities and participates in the wholesale transmission market. The Customer shall follow the ERCOT Operating Guides and ERCOT Protocols or other regulatory requirements that apply to their facilities

7.2 Unit Operation

7.2.1 Where CNP owns the interconnecting substation and there is not an in-line breaker to synchronize a generating unit, the Customer has control of CNP's

substation breakers that are functioning as generator breakers. CNP has operational control of the disconnect switches associated with these breakers.

7.2.2 The Customer shall have generation control personnel on duty at the generating unit site at all times that the generating units are on-line.

7.2.3 The Customer or Customer's representative shall notify the RTO System Controller (281-894-0491) immediately before a unit is synchronized and connected to CNP's transmission system.

7.2.4 The Customer shall operate units to support the transmission system voltage by regulating reactive power output up to levels demonstrated in the ERCOT tests as required in the ERCOT Protocols. The Customer shall maintain the ERCOT specified voltage level unless otherwise directed by the RTO System Dispatcher or ERCOT.

7.2.5 The Customer's voltage regulators, speed governors, and power system stabilizers, if required by ERCOT, shall be in service whenever generating units are on-line. The Customer shall immediately notify ERCOT whenever a voltage regulator, speed governor, or power system stabilizer is taken out of service or placed back in service. The Customer shall maintain settings as close as practical to five percent speed regulation.

7.2.6 The Customer shall maintain generating units on-line during system frequency and voltage excursions per ERCOT Operating Guides: www.ercot.com/mktrules/guides/noperating/cur .

8 Protective Relaying and Control

8.1 Settings for Relays Installed for the Protection and Automatic Reclosing of CNP Transmission Lines

8.1.1 CNP calculates and implements all settings for the Customer's relays installed for the protection and automatic reclosing of CNP transmission lines and for the Customer's relays installed to prevent back-energizing CNP's system from generation installed on the low side of the Customer's power transformers. On a case-by-case basis, CNP may issue settings for other relays owned by the Customer. The relay settings implemented by CNP for the Customer's relays will be provided to the Customer upon request.

8.2 Applicable Relay Settings

8.2.1 The Customer shall provide CNP with the settings of the Customer's relays that trip or close the Customer's high voltage (60 kV and higher) circuit breakers. The Customer shall provide to the Transmission Accounts representative any proposed settings changes for such relays for CNP's review.

8.3 Communications Connections to Electronic Devices

8.3.1 An electronic device that can directly or indirectly trip a circuit breaker connected to a CNP transmission circuit is not allowed to be monitored through routable protocol communication (i.e. Ethernet) or dial-up communication. Monitoring of

this electronic device for metering data or event data or any communications processor connected to this electronic device is only allowed through a serial port, such as Modbus, DNP3, or SEL Fast Meter. Control commands are not allowed through the serial port.

9 Equipment Additions, Replacement, Upgrades and Removal

9.1 Equipment Changes

9.1.1 The Customer shall notify the Transmission Accounts representative with sufficient notice to meet the timeline and data reporting requirements in Table 2 below when equipment additions or removals are planned or when high voltage equipment or associated equipment requires modification or replacement. The Customer shall notify the Transmission Accounts representative prior to performing functional testing and allow CNP to witness the testing.

9.1.2 The Customer shall provide equipment and installation, including testing and inspections, per applicable CNP specifications and bill of materials. The Customer shall provide necessary details, such as drawings, specifications, and manufacturer type and catalog number, for CNP's review. All CNP comments must be incorporated or resolved before any equipment or materials are procured or any work is begun.

9.1.3 ERCOT Protocols require that all changes to equipment rated at 60 kV and above be communicated by CNP to ERCOT prior to the in-service date as specified in Table 2 below.

9.1.4 ERCOT only approves energization requests when the transmission element is satisfactorily modeled in the ERCOT Network Operations Model.

9.2 Modification, Repair, and Replacement of Customer Equipment

9.2.1 CNP notifies the Customer of problems in their facilities of which CNP becomes aware. The Customer shall provide any needed equipment modifications, repairs, or replacement within an appropriate time frame. The Customer shall replace equipment that CNP demonstrates is no longer maintainable. On a case-by-case basis, the Customer and CNP shall develop the responsibilities for the modification, repair, and replacement of this equipment.

9.2.2 Industry experience may dictate that certain equipment be modified, repaired, or replaced due to manufacturing defects or unacceptable failure rates and consequences. The Customer shall, within an appropriate time frame, modify, repair, or replace equipment based on manufacturer issued product service advisories or CNP issued advisories.

Customer Substation Equipment Additions, Relocations, Upgrades and/or Removals

When installing, relocating, or upgrading transmission system equipment, Customers must contact their appropriate CNP Transmission Accounts representative with sufficient notice to meet the timelines and data requirements shown below. ERCOT Nodal Protocols Section 3.10.1 requires that all changes to transmission equipment energized at 60 kV and above be communicated by CNP to ERCOT using the Network Operations Model Change Request ("NOMCR") process as summarized below:

Table 2

Target Physical Equipment In-Service Month	Deadline to Submit to RTO	Timeline to Submit initial information to Transmission Accounts Rep	
Month of January	**Sept. 1**	June 1	(prior year)
Month of February	**Oct. 1**	July 1	(prior year)
Month of March	**Nov. 1**	August 1	(prior year)
Month of April	**Dec. 1**	September 1	(prior year)
Month of May	**Jan. 1**	October 1	(prior year)
Month of June	**Feb. 1**	November 1	(prior year)
Month of July	**Mar. 1**	December 1	(prior year)
Month of August	**Apr. 1**	January 1	
Month of September	**May 1**	February 1	
Month of October	**June 1**	March 1	
Month of November	**July 1**	April 1	
Month of December	**Aug. 1**	May 1	

(1) Pursuant to the ERCOT Nodal Protocols, CNP requires the following information to meet the deadlines shown above. The NOMCR data requirements include, but are not limited to:

- Completed project expected in-service date
- Equipment ratings
- Device nomenclature will be provided by CNP
- Engineering drawings showing the final configuration.
- Construction sequence with expected energization dates for each piece of equipment.
- Identification of SCADA data points
- Additional data as may be determined by ERCOT

(2) Known outage requests must be submitted by Real Time Operations with the NOMCR's for each expected energization date.

(3) ERCOT only approves energization requests when the Transmission Element is satisfactorily modeled in the ERCOT Network Operations Model.

10 Equipment Maintenance

10.1 CNP Maintenance

10.1.1 CNP will perform periodic testing of certain of the Customer's equipment if the equipment is installed for the protection of CNP transmission lines. This includes power line carrier tuning and testing of wave traps, tuners, and carrier sets and calibration and testing of relays and fiber optic communication equipment. CNP will perform periodic calibration and testing of SCADA transducers that provide real time data to CNP. CNP may designate additional equipment of the Customer for maintenance by CNP. CNP will label equipment maintained by CNP.

10.1.2 CNP will endeavor to coordinate CNP maintenance with the Customer's maintenance outages.

10.1.3 CNP transmission line outages are required for CNP to perform testing of applicable wave traps of the Customer.

10.1.4 Outages of approximately ten hours duration for certain of the Customer's facilities are required for CNP's periodic maintenance of CNP high voltage metering instrument transformers. Transformer outages are required for metering instrument transformers installed on the high side of transformers. A total separation from CNP's system may be required for certain substation configurations.

10.2 Customer Maintenance

10.2.1 The Customer shall perform periodic inspections and preventive maintenance on all structures and equipment owned by the Customer except for equipment designated by CNP for maintenance by CNP. The Customer shall not perform preventive maintenance on the equipment maintained by CNP. The Customer shall maintain equipment logs and test reports, which shall be provided to CNP upon request.

10.2.2 Depending upon ownership, equipment maintained by the Customer may include the following: line surge arresters, potential and current transformers not owned by CNP, coupling capacitors, coupling capacitor potential devices, switches (including auxiliary contacts and motors if installed), breakers (bushings, mechanism, tanks), transformers (bushings, surge arresters, main tank, load tap changer, alarms), relays not tested by CNP, and DC battery system equipment.

10.2.3 The Customer shall notify the RTO System Scheduler at least ten (10) business days in advance before performing maintenance on potential or current transformers connected to CNP meters.

10.3 Monthly Inspections

10.3.1 The Customer shall perform monthly inspections to include the following as applicable.

- ☐ Visual inspection of outdoor equipment including inside control cabinets
- ☐ Verify oil levels
- ☐ Verify transformer nitrogen blanket pressure

- ☐ Verify transformer fan operation
- ☐ Verify breaker compressor or hydraulic pump operation
- ☐ Drain condensate from breaker mechanism air tanks
- ☐ Verify operation of control house heating and air conditioning

10.4 Quarterly, Semi-annual Testing, and Inspection

10.4.1 CNP recommends Total Combustible Gas ("TCG") testing once every three months on transformers equipped with a nitrogen blanket.

10.4.2 Infrared thermography of high voltage equipment is recommended once every six months.

10.5 DC Battery System

10.5.1 The Customer shall perform periodic DC battery system equipment inspections and maintenance to include the following as applicable.

☐ Every Month
- ☐ Visually inspect batteries (corroded connections, leaks, cracked cases)
- ☐ Visually inspect chargers
- ☐ Verify and correct water levels
- ☐ Record and verify float voltage
- ☐ Record and verify ground reference voltage

☐ Every Six Months
- ☐ Clean battery surfaces
- ☐ Check charger ventilation
- ☐ Record and verify cell voltages
- ☐ Perform internal cell resistance testing
- ☐ Measure inter-cell connection resistance
- ☐ Record and verify specific gravity reading
- ☐ Verify float and equalize voltage settings
- ☐ Verify proper operation of chargers and alarms
- ☐ Verify proper operation of high voltage shutdown circuits

10.6 Functional Testing

10.6.1 The Customer shall perform functional trip testing of each high voltage circuit breaker by tripping and closing the breaker from the breaker control switch at least once every year. This breaker tripping may be coordinated with the switching required for maintenance outages.

10.6.2 High voltage circuit breakers equipped with dual trip coils that use a common actuating shaft (e.g., Allis Chalmers, Westinghouse) require special functional testing. The Customer shall perform a test on each breaker by applying trip voltage simultaneously to both trip coils. If the breaker does not immediately trip, the voltage must be quickly removed to avoid damaging the coils. After verifying the wiring, the Customer shall appropriately label the control wiring. The Customer's maintenance procedures shall include tagging and properly reconnecting trip coil wiring. The Customer shall perform this test whenever a trip coil is replaced or breaker control wiring is modified.

10.7 Special Inspection and Testing

10.7.1 Industry experience may dictate that certain equipment requires special inspection and testing due to manufacturing defects or unacceptable failure rates and consequences. The Customer shall perform special inspection and testing based on manufacturer issued product service advisories and CNP issued advisories.

11 Plant Design Considerations

11.1 Emergency Systems

11.1.1 Continuous electric service from utility power systems cannot be guaranteed even for facilities that are connected to a large number of transmission lines. The possibility exists that a total power outage or separation from the utility system may occur. It is important to consider this when plant emergency systems are designed.

11.2 Automatic Reclosing

11.2.1 CNP utilizes automatic reclosing of high voltage circuit breakers following unplanned tripping of CNP transmission lines. CNP endeavors to intentionally delay the initial reclose attempt by at least one second. The Customer is responsible for the separation of necessary motors or other equipment within one second of the tripping.

11.3 System Voltage

11.3.1 Electric service from a utility power system cannot be guaranteed against fluctuations. Voltage sag is a common fluctuation that occurs during the time of a fault. The large majority of faults on a utility transmission system are single line-to-ground faults. With automatic reclosing of circuit breakers, several voltage sags can occur within a one-minute period. Most voltage sags from faults on transmission systems have a very short duration of less than ten cycles with high-speed fault clearing. Another common fluctuation is a transient voltage oscillation that occurs each time a capacitor bank is energized. Equipment, such as motor contractors, adjustable speed drives, programmable logic controllers, and high intensity discharge lamps, can be sensitive to these short duration voltage sag and transient voltage oscillation.

11.3.2 It is important to consider voltage sag "ride-through" for equipment applied to critical processes where nuisance tripping can cause a whole process to shut down. Plant power systems and equipment control systems can be designed or modified to ride-through the most common voltage sags and transient voltage oscillations on utility power systems. CNP will provide additional information upon request.

11.4 Electrical Protection Coordination Studies

11.4.1 If the Customer performs plant electrical protection coordination studies, the Customer may contact a Transmission Accounts representative to request the available CNP system fault current and system impedance at the Customer's facility.

11.5 Substation Design Specifications

11.5.1 The Customer can contact a Transmission Accounts representative to request current CNP specifications and applicable bills of material for new substations and substation equipment additions and replacement.

Exhibit "G"
Telemetry Specification

SPECIFICATION

FOR

REMOTE TELEMETRY OF A CUSTOMER OWNED FACILITY

CenterPoint Energy

ELECTRIC ENGINEERING DEPARTMENT

P.O. BOX 1700 HOUSTON, TEXAS 77251

REFERENCE DRAWINGS: Latest Revisions of
CenterPoint Energy, CNP Drawing No.BSC-007-400-01 SH.3.
CenterPoint Energy, CNP Drawing No.BSC-564-500-01 SH.1, 2.

REFERENCE SPECIFICATIONS: Latest Revisions of
CenterPoint Energy, CNP Specification No. 007-231-14, Customer 138kV Substation Design.

REFERENCE DOCUMENTS: Latest Revisions of
CenterPoint Energy Transmission & Substation Outage and Clearance Coordination Procedures.

NO	DATE	REVISION	BY	CH	APP
					MDB
6	3/26/2012	Revised Sec.2, 3, 5, 7, Fig 1,2	CWM	WAC	MDB
5	2/30/2004	Revised for EPS METER Communication	CWM	CWM	MWF

CenterPoint Energy Houston Electric		
WRITTEN	12/30/03	C.W. Mogannam
CHECKED	12/30/03	R.M. Secrest
APROVED	12/30/03	M.W. Furnish
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CONTENTS

1. SCOPE

1.1. This specification defines the requirements for the engineering, installation, calibration, and commissioning of a Supervisory Control and Data Acquisition (SCADA) Remote Terminal Unit (RTU) and Metering Telemetry, as applicable, at a customer owned facility on the CenterPoint Energy (CNP) transmission system.

2. GENERAL

2.1. Installation of a CNP SCADA RTU in customer-owned facilities is typically required for all new transmission substations that have a circuit breaker that sectionalizes a CNP transmission line.

2.2. At tap substations CNP typically uses the high voltage revenue meters for telemetry of real time data.

2.3. All equipment and work covered by this specification shall be designed, constructed, and tested in accordance with the latest revisions or editions of industry requirements in effect at the time of fabrication. Industry requirements include the applicable codes, standards, specifications, regulations, tests, and procedures of all federal, state and local laws, and include (but are not limited to) the following:

2.3.1. American National Standards Institute (ANSI)

2.3.2. IEEE formerly the Institute of Electrical and Electronics Engineers, Inc.

2.3.3. National Electrical Manufacturers Association (NEMA)

2.3.4. Occupational Safety and Health Administration (OSHA)

2.3.5. Federal Communications Commission (FCC)

2.4. In the event of conflicting requirements, the order of precedence shall be this specification, other referenced CNP specifications, and the standards referenced in section 2.2.

2.5. CNP will specify the SCADA RTU and associated SCADA equipment. The SCADA RTU will be in a standalone cabinet to be installed in the Customer substation control building. The customer must provide interface equipment such as transducers, status and alarm contacts, cabling, terminal blocks, and conduit. Communication equipment must also be installed and wired by Customer in the Customer substation control building. Metering Cabinets will be installed in accordance with the CNP Customer 138KV Substation Design Specification.

2.6. Communications between substation devices shall be serial. Routable protocol communication (i.e., Ethernet) or dial-up communication shall not be used for the CNP transmission system protection devices.

2.7. Equipment specified may be substituted with written approval from CNP Substation Projects, System Operations.

2.8. All equipment, engineering and installation shall be furnished by the Customer unless otherwise noted in this specification or separate agreements.

2.9. Generating facilities will provide CNP additional generator data via Modbus or DNP3 communications protocol from the Plant control system or RTU to the CNP RTU located in the substation. Selected substation data from the CNP RTU is available to the plant. See Figure 2 for typical communications diagram.

3. SCADA SYSTEM

3.1. The SCADA RTU is composed of three subsystems: (1) analog, (2) status, and (3) control.

3.2. Analog Subsystem: Analog Data is typically gathered from Intelligent Electronic Devices (IEDs) or transducers. IEDs include Electronic Meters and microprocessor relays. Communication to various IEDs shall be serial, via DNP3 or Modbus protocols. If transducers are used, CNP will determine the transducer electrical requirements. See Table 1 for acceptable transducer models. Meter test switches are required for the transducer current and voltage connections. The Customer shall provide an electrical relaying and metering one-line diagram of the proposed Customer-owned substation for review by CNP.

3.2.1. Customer Substation Analog Telemetry Requirements

3.2.1.1. Kilovolts for each substation bus, AØ

3.2.1.2. Megawatts for each line position, 3Ø

3.2.1.3. Megavars for each line position, 3Ø

3.2.1.4. Megawatts for each substation load, 3Ø

3.2.1.5. Megavars for each substation load, 3Ø

3.2.2. CNP will require the following additional analog data from a Generating facility:

3.2.2.1. Generator terminal voltage for each generator bus, A phase only

3.2.2.2. Megawatts (net preferred) for each generator unit, 3Ø

3.2.2.3. Megavars (net preferred) for each generator unit, 3Ø

3.2.2.4. Frequency for each generator unit

3.2.2.5. Data from the plant electrical load EPS meters (watts, vars, watt-hour from each meter)

3.3. Status Subsystem: The status subsystem of the SCADA RTU shall consist of the following.

3.3.1. Status of selected transmission voltage circuit breakers or other devices directly affecting the CNP electrical system, as determined by CNP RTO. Status shall be derived from either an isolated auxiliary "a" contact in the breaker or monitoring a trip coil of the breaker. Refer to Figure 3 for Breaker Status Connections.

3.3.2. Indication of low voltage and battery charger failure is required for the 130 VDC battery system(s). Typical charger alarms include the following: low voltage, high voltage, loss of AC input, and loss of charger. All these indications shall be combined so that an occurrence of any one of these shall cause a single battery alarm (normally open contact) to the SCADA RTU.

3.3.3. SCADA Close Inhibit (SCI) indication is required of breakers controlled by SCADA whenever a lockout relay can inhibit breaker closure by SCADA. A dry, normally open, contact from that relay shall be supplied for SCI indication. Indication contacts from all lockout relays shall be wired in parallel for a single indication in the SCADA cabinet, see Figure 1.

3.3.4. Indication of Carrier Tester (CAR) or Pilot (PIL) relaying failure.

3.3.5. Indication for the loss of a potential to a line relay (PT1) that could cause a misoperation of the zone relaying under high load conditions. This alarm is typically generated by a contact from the line relay. Indications from separate relays will be combined for a single alarm.

3.3.6. Indication of a failed self check diagnostic of a microprocessor based relay. Designated Relay CPU Fail (RCPU). This alarm is typically generated by a contact from the line relay. Indications from separate relays will be combined for a single alarm.

3.3.7. CNP will require the following additional status signals from the Generating facility:

3.3.7.1. Generator Breaker for each unit

3.3.7.2. Motor operated switches for each unit

3.3.7.3. Generator automatic voltage regulator status (Automatic/Manual).

3.4. Control Subsystem: The control subsystem of the SCADA RTU shall consist of the following:

3.4.1. CNP shall have remote control of all transmission (69kV, 138kV, 345kV) circuit breakers that directly affect the CNP transmission system. Dual remote control (control of a breaker by both the Customer's control system and CNP RTO) is not permitted. Figure 3 illustrates how SCADA control will interface with a typical breaker control scheme.

3.4.2. CNP shall have remote control, automatic carrier removal (ATCR), of each pilot relaying scheme. A control contact from the SCADA RTU shall be installed in each pilot circuit. See Figure 3 for typical carrier control circuit.

4. DESIGN, LAYOUT , AND PHYSICAL CRITERIA

4.1. SCADA Set Designation: The type of SCADA RTU installed by CNP will depend on the number of controlled breakers.

4.1.1. A free-standing cabinet typically 24" wide by 18" deep and 72" tall, with front access. Clearance of 30" in front of the door shall be reserved for maintenance access. Substations with more than four transmission breakers may require a larger cabinet(s). Refer to latest Customer RTU drawing submitted by CNP at the project kick-off.

4.2. Connections to the RTU: The Construction Contractor shall install all interconnections between the SCADA RTU and the substation panels.

4.2.1. The Customer shall provide a 120 VAC, fifteen (15) amp, dedicated AC power circuit, protected by a fifteen (15) amp circuit breaker, to the SCADA RTU Cabinet for lighting and a convenience outlet.

4.2.2. The Customer shall provide a 130 VDC, fifteen (15) amp, dedicated DC power circuit, protected by a fifteen (15) amp circuit breaker, to the SCADA RTU Cabinet for the main RTU power.

4.2.3. All cable shields shall be grounded at a location other than the SCADA RTU Cabinet. Cable shields shall be grounded at one end only.

4.3. Cabling: The Customer shall size and install all conduit or cable troughs in accordance with ANSI/NFPA 70 (National Electrical Code).

4.3.1. Polyethylene Polyvinylchloride (PEPVC) insulated shielded 2/C #16 cable with stranded copper conductors shall be used for terminations for all transducer outputs.

4.3.2. Breaker controls shall use seven conductor (#12) PEPVC insulated cable with stranded copper conductors for terminations.

4.3.3. Two conductor (#10 or larger) PEPVC insulated cable with stranded copper conductors shall be used for terminations of the AC and DC power circuit.

4.3.4. Status and alarms shall be terminated with two conductor (#16) PEPVC insulated cable with stranded copper conductors.

4.3.5. The Customer shall install the necessary conduit or cable management between the SCADA RTU and the relay panels.

4.4. Every breaker with 130 VDC SCADA control circuits shall have breaker coil surge suppression. A one hundred (I00) ohm, eleven (11) watt resistor (Ohmite style 995-10A) and a zener diode (Motorola type IN3051A) or equivalent shall be used for this suppression. The series combination of the zener diode and the resistor shall be parallel to each breaker trip and breaker close coil. States slider-link terminal blocks shall be installed in the breakers for terminating the resistors and zener diodes. CNP will verify breaker coil surge suppression. See Figure 3.

5. COMMUNICATION LINES

5.1. The Customer shall provide and maintain a full business (IFB) phone line and telephone for voice communications terminating inside the substation control house. This phone shall be direct dial and not go through the Customer's main switchboard or extension. This phone shall have a cord extendable such that the front of the relay panels and SCADA RTU are visible from the phone. This line may also be used by CNP for remote interrogation of meters.

5.2. CNP shall provide additional 1FB communication line(s) from the telephone company for EPS Generation metering, as required, terminating at the Customer's telephone demarcation point.

5.3. CNP shall provide a separate 4 wire data communication line(s) from the telephone company, terminating at the Customer's telephone demarcation point. This communication line will be used for the SCADA RTU to transmit real time data to CNP RTO. The Customer shall supply the name and telephone number of a representative for purposes of co-ordinating the installation of these line(s). See Figure 1 for a typical Customer Substation Communications Block Diagram. For generator substations, CNP will install two SCADA communication lines. The second line shall be for a back up RTU for redundant generator data. See Figure 2 for a typical generator substation Communications Block Diagram.

5.4. For new substations the Customer shall provide and install a communication cable with multiple pairs between the telephone service provider demarcation point and the substation control house. These communication circuits will terminate at the SCADA RTU cabinet and metering cabinet(s). At existing customer substations it may be necessary to install additional cable if there are no existing spares available.

5.5. CNP, at its option, may use SCADA Radio (952/928 MHz FM) for the SCADA communication circuit specified in section 5.3. The requirements of the radio, antenna, and associated equipment will be determined by CNP. The Customer shall provide a location for this equipment less than fifty feet from the SCADA RTU.

5.6. The telephone communication circuit(s) shall be specified to operate in the event of power failure. The communication line shall remain operational in the event a line conditioner or loopback device fails.

6. CALIBRATION AND MAINTENANCE

6.1. After all equipment necessary for remote telemetry has been installed, CNP personnel will calibrate and verify operation of all equipment installed per this specification.

6.2. The RTU and transducers installed per this specification will be maintained by CNP unless otherwise noted in an agreement with the Customer. Maintenance will include accuracy checks, recalibration and replacement/repair of equipment when needed.

6.3. CNP shall furnish locks that will remain in series with Customer locks to permit access to all switchyard gates, substation control house door(s), and disconnect switches.

7. CURRENT TRANSFORMERS AND POTENTIAL TRANSFORMERS

7.1. The current transformers (CTs) and potential transformers (PTs) necessary for transducers and meter circuits itemized in this specification shall be provided according to CNP specification 007-231-14. If a particular application is not covered by this specification, then CNP will designate the necessary PT(s) and CT(s) on the substation one-line diagram that the Customer submits for comment and approval.

7.2. For some substation layouts a potential rollover circuit shall be needed. If a potential rollover circuit is needed, it will be designated by CNP on the one-line diagram that the Customer submits for comment and approval.

8. DRAWING APPROVAL

8.1. The Contractor shall provide electronic and paper copies of all drawings showing equipment connections and structural details of all equipment associated with SCADA installation as follows.

8.1.1. IFA – Issued For Approval and comment to CNP Substation Projects. These can be submitted electronically or with paper copies. CNP will review the drawings and make corrections, comments or changes as required. PDF (Adobe Acrobat V5 or greater) is the preferred format for IFA.

8.1.2. IFC – Issued For Construction to CNP Substation Projects. These shall be 7 sets of 11 x 17 paper copies for CNP Engineering, CNP Substation Construction Coordinators and Substation Performance. Additionally, the Contractor shall supply a CD with a complete set of prints saved in Microstation ver. J(7) and PDF format for additional copies.

8.1.3. As Built – The Contractor shall make any reasonable corrections to the drawings that result from installation and commissioning of the SCADA RTU. These shall be completed within 30 days of the construction completion. CNP Substation Projects shall approve as-built drawings for final issue.

8.1.4. Final Issue – the Contractor shall issue all SCADA prints to the CNP drawing management system in Microstation Version J(7) Format. All drawings (Customer and SCADA) shall be saved on a compact disc (CD) for CNP records. Customer drawing(s) shall be in the PDF format. The CD shall be labelled with the Project name, Contractor name, Contractor project number, CNP contract number and date.

8.1.5. The Customer shall be copied on these drawings as specified by the Customer.

8.2. Drawings required by this specification include:

1. Substation one-line relaying and metering diagrams illustrating the overall telemetry scheme,
2. Substation control house layout(s) and floor plan(s),
3. Conduit and cable lists
4. Conduit Layout or Plan and Profile
5. RTU manufacturers prints and Customer connections
6. AC Schematics for all power and control circuits,
7. AC Relaying Schematics (Electrical Three-Line),
8. Relay panel layouts,
9. Bill of material for items required by this specification,

10. Battery charger alarm relay(s) schematics,
11. AC & DC Distribution Panels,
12. Communication cable and conduit routing through Customer facility,
13. Customer Facility Plot Layout,

Table 1 ACCEPTABLE TRANSDUCERS AND TEST SWITCHES

DESCRIPTION	MANUFACTURER	MODEL NO.	MONITORING POINTS
VOLTAGE TRANSDUCER	AMETEK SCIENTIFIC COLUMBUS	VT110A4	ONE PER SUBSTATION BUS
TEST SWITCH SINGLE PHASE	DURHAM	2-1022F-03	ONE PER EACH TRANSDUCER
WATT/VAR TRANSDUCER SINGLE PHASE	AMETEK SCIENTIFIC COLUMBUS	XLWV5C5	ONE PER EACH LINE OR LOAD
WATT/VAR TRANSDUCER THREE PHASE	AMETEK SCIENTIFIC COLUMBUS	XLWV342K5A4	ONE PER EACH LINE, GENERATOR OR LOAD
TEST SWITCH THREE PHASE	DURHAM	2-1058F-00	ONE PER EACH TRANSDUCER

LIST OF ABBREVIATIONS AND SYMBOLS USED IN FIGURES

aN4, aN14 = TYPICAL WIRE NAMES IN CNP CARRIER RELAYING SCHEMES

ATCR = AUTOMATIC CARRIER REMOVAL

C = CLOSE

CS = CONTROL SWITCH

CVE = SYNCRO-VERIFIER RELAY

ICR = INDICATION CONTROL RELAY

N 11, N21 = TYPICAL WIRE NAMES IN CNP RECLOSE REMOVAL SCHEMES

NO = NORMALLY OPEN

OC = BREAKER CLOSE COTL

RC = AUTOMATIC RECLOSING RELAY

RR = RECLOSE REMOVAL LATCHING RELAY

T = TRIP

TC = BREAKER TRIP COIL

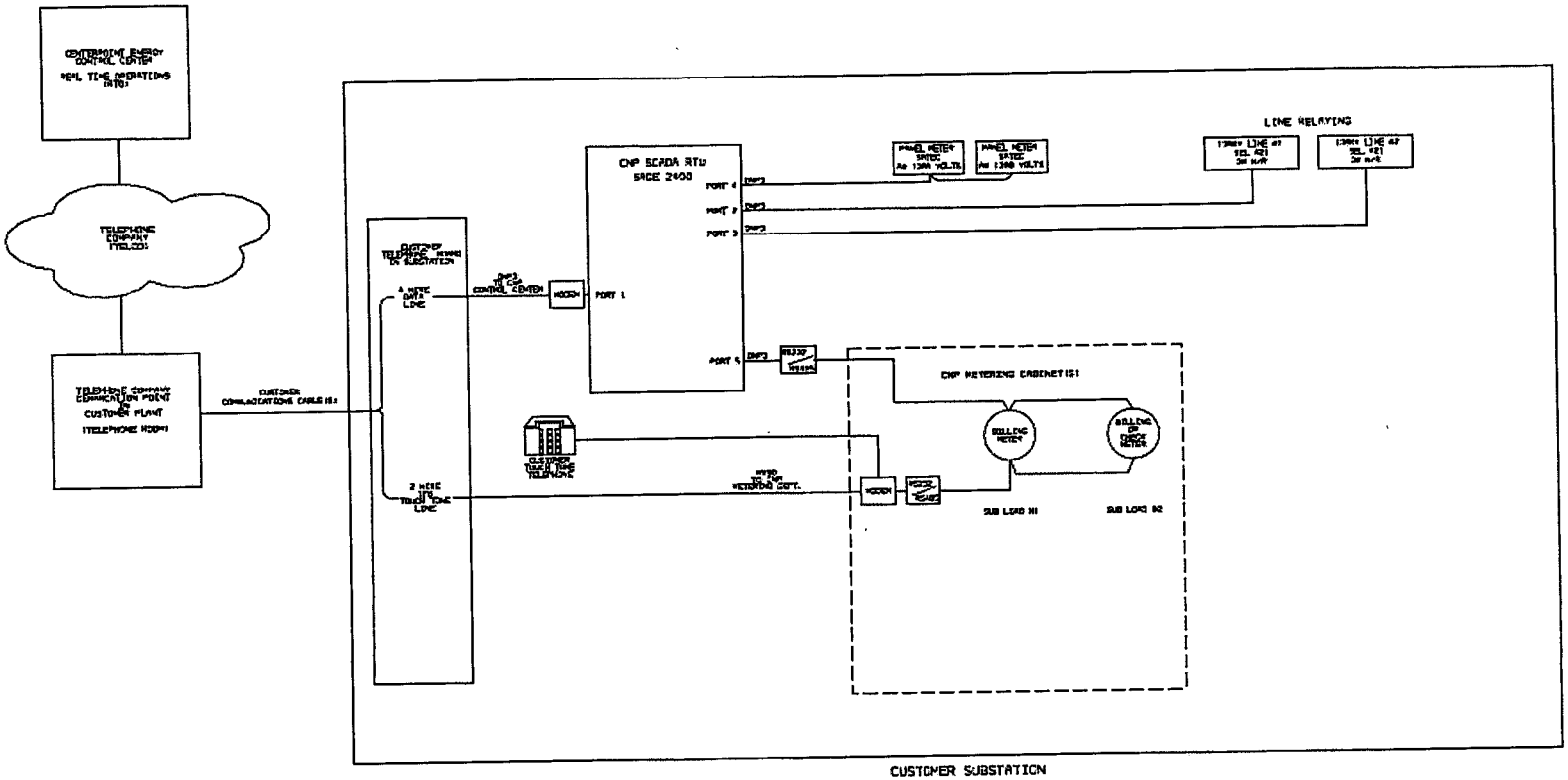
X, Y = AUXILIARY COILS OF RC RELAY

SSS = SLIDER-LINK TERMINAL

R = RESISTOR

DDD = ZENER DIODE

AMS = AUTOMATIC / MANUAL THROWOVER SWITCH



CNP Drawing: BSC-564-500-01 sh.1

Customer Substation Communications Block Diagram

Figure 1

	CenterPoint Energy Houston Electric	
WRITTEN	12/30/03	C.W. Mogannam
CHECKED	12/30/03	R.M. Secrest
APROVED	12/30/03	M.W. Furnish
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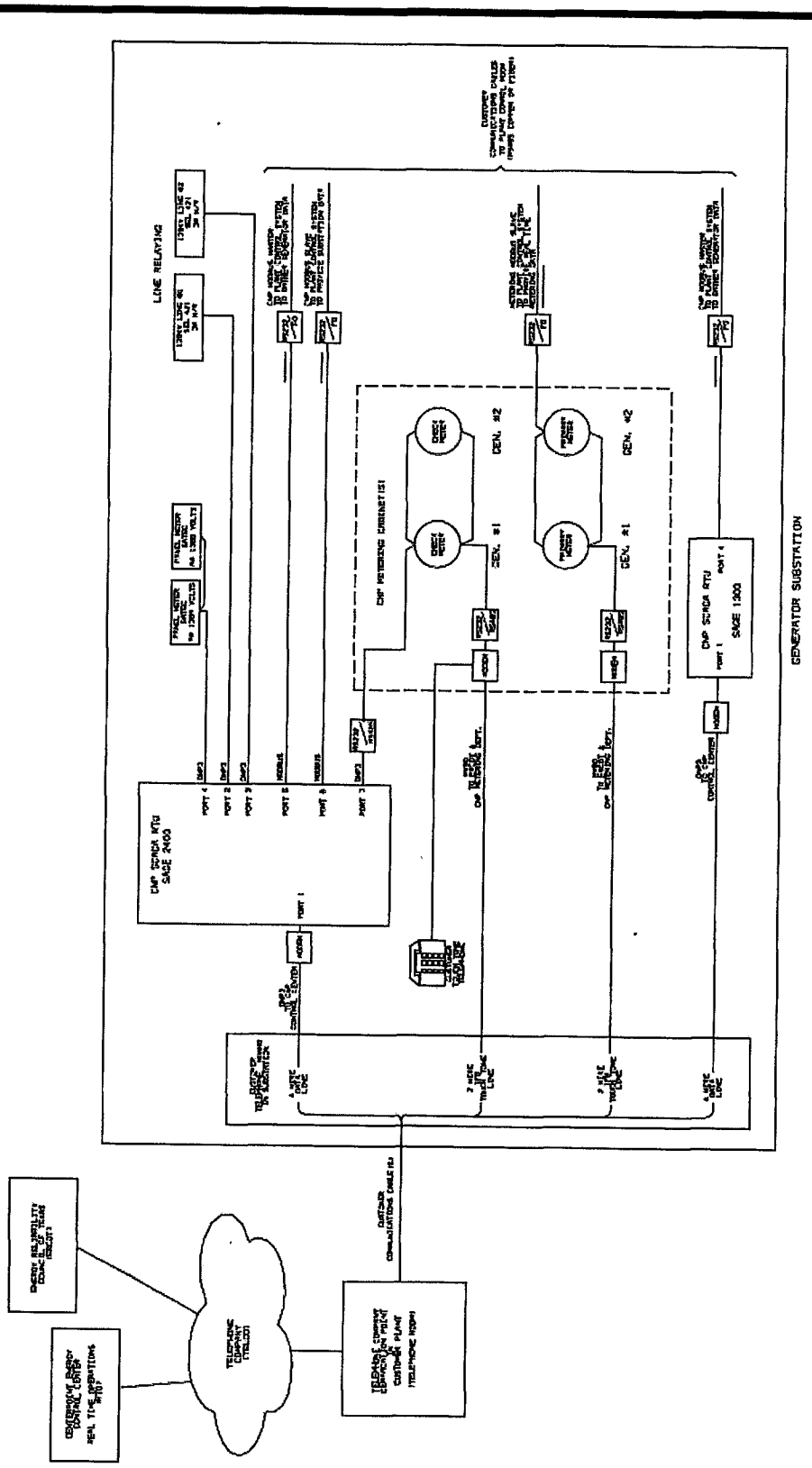
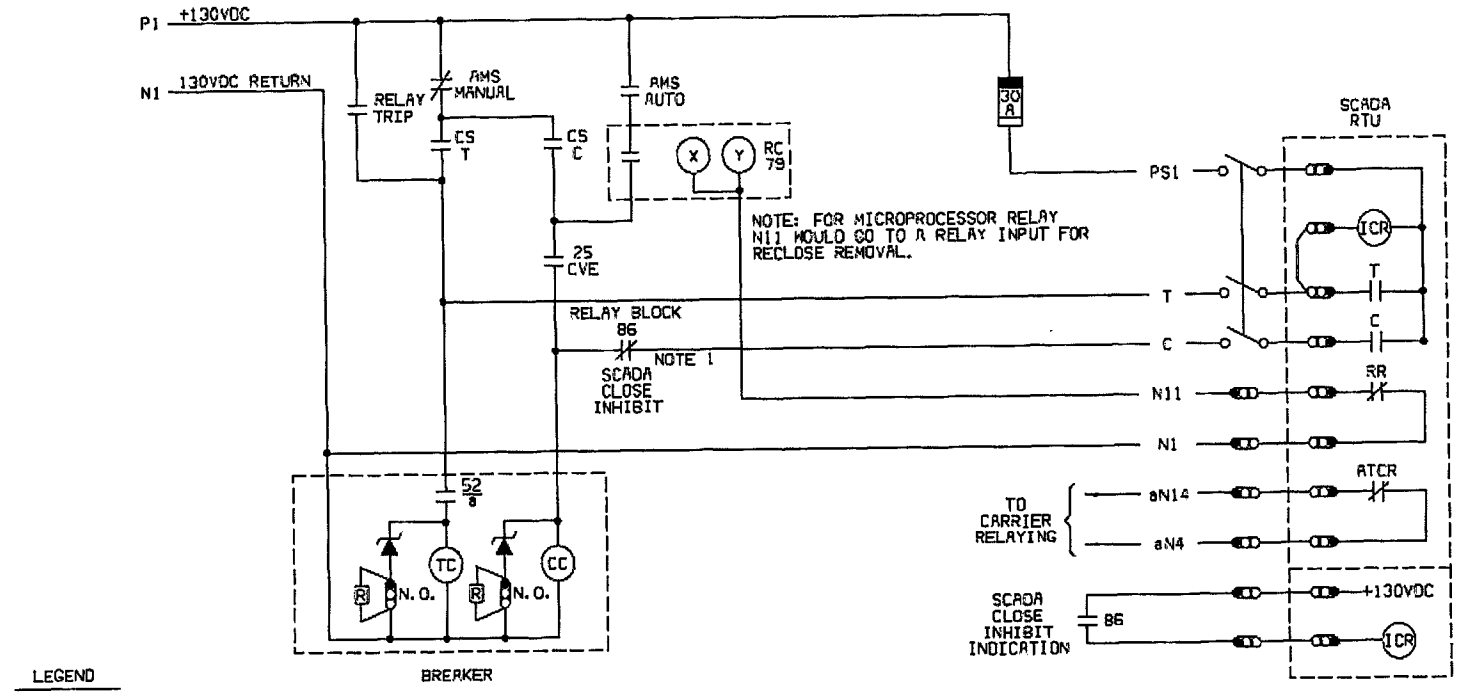


CNP Drawing: BSC-564-500-01 sh.2
Generator Substation Communications Block
Diagram Figure 2

CenterPoint Energy Houston Electric			
WRITTEN	12/30/03	C.W. Mogannam	
CHECKED	12/30/03	R.M. Secrest	
APROVED	12/30/03	M.W. Furnish	
	Page 11 of 12		
	SPC	007	400	02



LEGEND

RR = RECLOSE REMOVAL LATCHING RELAY INSIDE SCADA
ATCR = AUTOMATIC CARRIER REMOVAL
ICR = INDICATION CONTROL RELAY MONITORS STATUS OF A SWITCH
SCI = SCADA CLOSE INHIBIT
– DISCONNECTING TERMINAL BLOCK. DARK END IS TOP. LINK OPENS DOWN
– FUSE

NOTE: 1.) RELAY BLOCK CONTACT SHOWN COULD REPRESENT SEVERAL CONTACTS IN SERIES

SUBSTATION BASIC

FIGURE 3 TYPICAL
TRANSMISSION BKR SCADA CONTROL

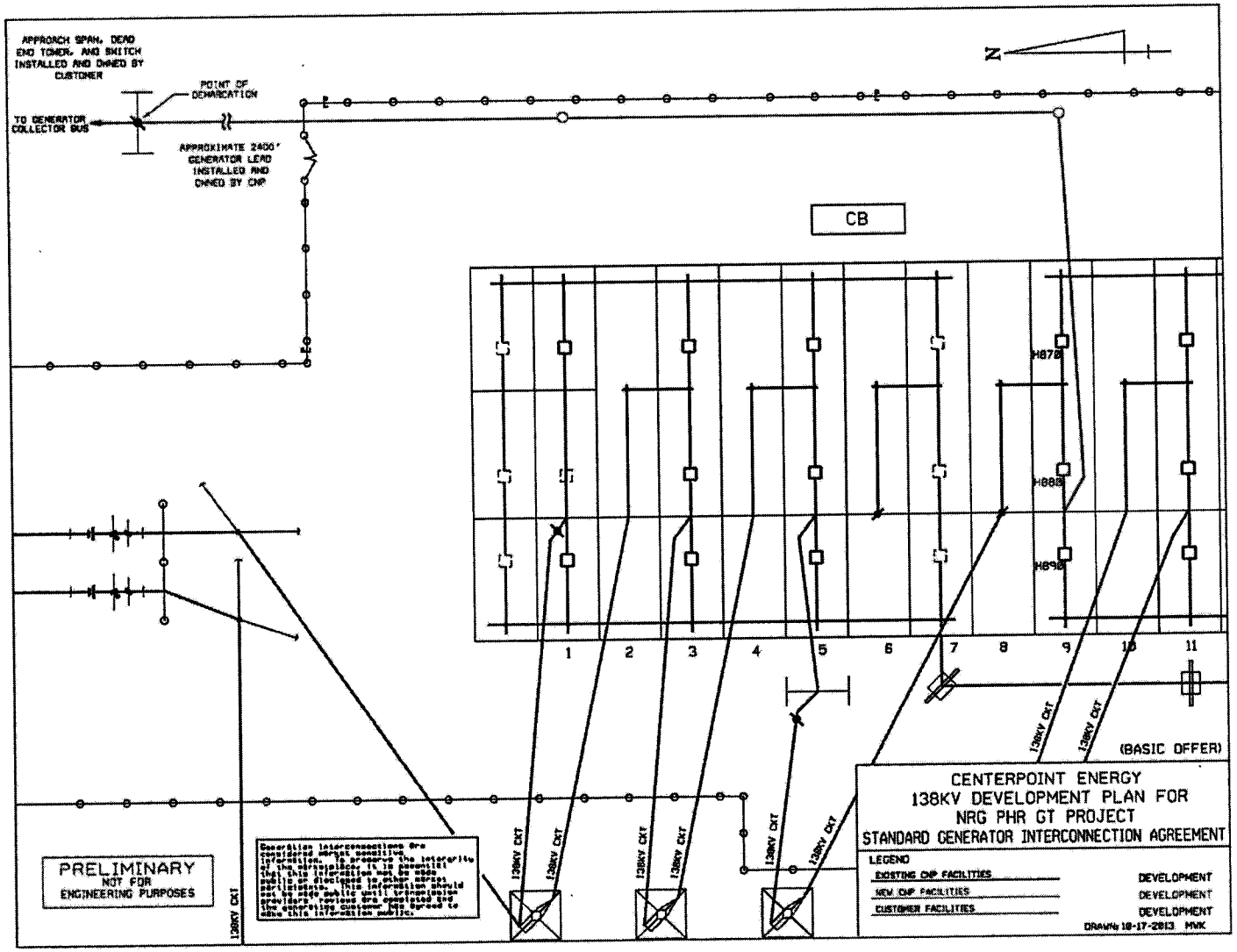
CNP Drawing: BSC-007-400-02 SH.3

Transmission breaker SCADA Control

Figure 3

		CenterPoint Energy Houston Electric
	WRITTEN	12/30/03 C.W. Mogannam
	CHECKED	12/30/03 R.M. Secrest
	APROVED	12/30/03 M.W. Furnish
SPC 007 400 02	Page 12 of 12	

Exhibit "H"
Attached Drawings


APPROACH SPAN, DEAD END TOWER, AND SWITCH INSTALLED AND OWNED BY CUSTOMER
POINT OF DEMARCATION
TO GENERATOR COLLECTOR BUS
APPROXIMATE 2400' GENERATOR LEAD INSTALLED AND OWNED BY CNP
CB
N
1
2
3
4
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6
7
8
9
10
11
138KV CKT
(BASIC OFFER)
PRELIMINARY
NOT FOR
ENGINEERING PURPOSES
CENTERPOINT ENERGY
138KV DEVELOPMENT PLAN FOR
NRG PHR GT PROJECT
STANDARD GENERATOR INTERCONNECTION AGREEMENT
LEGEND
EXISTING CNP FACILITIES
NEW CNP FACILITIES
CUSTOMER FACILITIES
DEVELOPMENT
DEVELOPMENT
DEVELOPMENT
DRAWN 10-17-2013 MWK

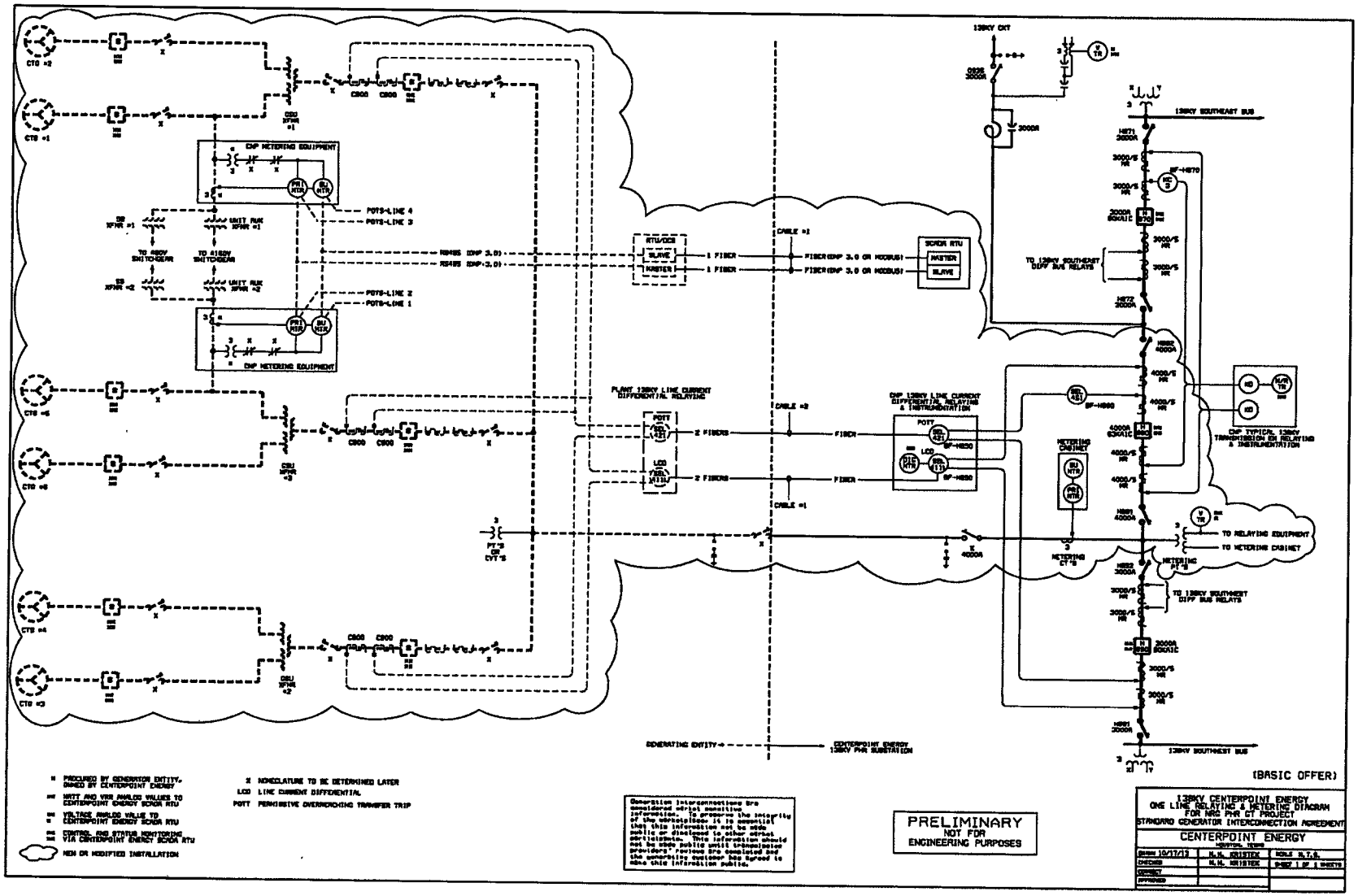

CTG #2
CTG #1
CTG #5
CTG #6
CTG #4
CTG #3
CNP METERING EQUIPMENT
POTS-LINE 4
POTS-LINE 3
POTS-LINE 2
POTS-LINE 1
TO 480V SWITCHGEAR
TO 4160V SWITCHGEAR
RS485 (DNP 3.0)
RTU/DCE
SLAVE
MASTER
1 FIBER
SCADA RTU
FIBER(DNP 3.0 OR MODBUS)
CABLE #1
CABLE #2
PLANT 138KV LINE CURRENT DIFFERENTIAL RELAYING
CNP 138KV LINE CURRENT DIFFERENTIAL RELAYING & INSTRUMENTATION
2 FIBERS
FIBER
POTT
LCD
METERING CT'S
METERING CABINET
TO RELAYING EQUIPMENT
TO METERING CABINET
138KV EXIT
138KV SOUTHEAST BUS
138KV SOUTHWEST BUS
TO 138KV SOUTHEAST DIFF BUS RELAYS
TO 138KV SOUTHWEST DIFF BUS RELAYS
CNP TYPICAL 138KV TRANSMISSION ER RELAYING & INSTRUMENTATION
GENERATING ENTITY
CENTERPOINT ENERGY 138KV PHR SUBSTATION
PROCURED BY GENERATOR ENTITY, OWNED BY CENTERPOINT ENERGY
MW/T AND VAR ANALOG VALUES TO CENTERPOINT ENERGY SCADA RTU
VOLTAGE ANALOG VALUE TO CENTERPOINT ENERGY SCADA RTU
CONTROL AND STATUS MONITORING VIA CENTERPOINT ENERGY SCADA RTU
NEW OR MODIFIED INSTALLATION
X NOMENCLATURE TO BE DETERMINED LATER
LCD LINE CURRENT DIFFERENTIAL
POTT PERMISSIVE OVERREACHING TRANSFER TRIP
Generation interconnections are considered market sensitive information. To preserve the integrity of the marketplace it is essential that this information not be made public or discussed in other market activities. This information should not be made public until transmission providers' reviews are completed and the competitive customer has agreed to make this information public.
PRELIMINARY
NOT FOR
ENGINEERING PURPOSES
(BASIC OFFER)
138KV CENTERPOINT ENERGY
ONE LINE RELAYING & METERING DIAGRAM
FOR NRG PHR GT PROJECT
STANDARD GENERATOR INTERCONNECTION AGREEMENT
CENTERPOINT ENERGY
DRAWN 10/17/13
M.M. KRISTEK
NONE N.T.S.
CHECKED
M.M. KRISTEK
SHEET 1 OF 1 SHEETS
APPROVED

Exhibit "I"
Specification for Customer 138 kV Substation Design

5-8-2006 Addendum to

Spec. No. 007-231-14 Rev. 14 7-22-2005

SPECIFICATION FOR
CUSTOMER 138 kV SUBSTATION DESIGN

CENTERPOINT ENERGY
SUBSTATION OPERATION DEPARTMENT
P.O. BOX 1700 HOUSTON, TEXAS 77251

Date	Original Version	Revision	Comments
5-8-06	a. Table of Contents (TOC) b. REFERENCE DRAWINGS not included in this document	a. Added missing TOC items 4 & 8 b. Added drawings to end of this document	a. Updated Table of Contents b. Reference drawings included

SPECIFICATION
FOR
CUSTOMER
138 kV SUBSTATION
DESIGN

CENTERPOINT ENERGY
SUBSTATION OPERATIONS DEPARTMENT
P.O. BOX 1700 HOUSTON, TEXAS 77251

REFERENCE DRAWINGS: Latest revision of
CenterPoint Energy 004-241-01, Customer-Owned Substation Line Termination Standard
CenterPoint Energy 171-190-06, 138 kV Standard, Instrument Transformer Standard
CenterPoint Energy 581-500-01, 138 kV Potential Transformer Schematic and Wiring Diagram

REFERENCE DOCUMENT: Latest revision of
Operation of a Customer Owned Substation on CenterPoint Energy's Transmission System

REFERENCE SPECIFICATIONS: Latest revision of
CenterPoint Energy 007-231-78, Specification for Cogenerator Connected to CenterPoint Energy Trans. System
CenterPoint Energy 007-400-02, Specification for Remote Telemetry of a Customer-Owned Facility

REFERENCE STANDARDS: Latest revision of

AASHTO
ACI 318
AISC, "Manual of Steel Construction"
ASCE 10
ANSI C12.1
ANSI C37.32
ANSI C37.06
IEEE C37.04
IEEE C37.40
IEEE C37.60
IEEE C57.12.00
IEEE C57.13
IEEE C2 (NESC)
IEEE Std. 80
IEEE Std. 519
IEEE Std. 837
IEEE Std. 1119
IEEE Std. 998
IEEE Std. 142
NEMA CC 1

CENTERPOINT ENERGY HOUSTON, TEXAS				
WRITTEN	4/9/74	E. C. Reid		
CHECKED	4/10/74	L. G. Pond		
APPROVED	7/17/74	C. S. Kayser		
	SHEET	1	OF	26
SPECIFICATION NO.	007	231	14	

NO	DATE	ITEMS REVISED	BY	CH	APP
14	7-22-2005	Change to 4000A and other updates	Var	Var	DRS

TABLE OF CONTENTS

1. SCOPE

1.1. This specification covers design criteria for 138 kV customer-owned substations connected to the CenterPoint Energy Houston Electric, LLC (CenterPoint Energy) transmission system.

2. GENERAL

2.1. Any customer that is approved by CenterPoint Energy to receive service from the CenterPoint Energy 138 kV transmission system is required to provide a substation capable of accepting that service from CenterPoint Energy. The customer's substation becomes an integral part of the CenterPoint Energy transmission system network and therefore has a significant impact on overall system reliability. Consequently, the customer is obligated not only to meet present CenterPoint Energy specifications, but also to modify the substation in the future as the CenterPoint Energy transmission system continues to evolve. When deemed necessary by CenterPoint Energy, changes may be needed to conform to industry standards, transmission system characteristics, and CenterPoint Energy practices or to take advantage of technological advances which will maintain the present reliability of the substation.

2.2. All equipment shall be in accordance with designated standards of this specification, the American National Standards Institute (ANSI), the Institute of Electrical and Electronic Engineers (IEEE), the American Society of Civil Engineers (ASCE), the American Institute of Steel Construction (AISC), National Electrical Manufacturing Association, (NEMA) and the American Concrete Institute (ACI). In the event of conflicting requirements, the order of precedence shall be this specification, ANSI, IEEE, ASCE, AISC, NEMA and ACI Standards. All electrical clearances shall comply with the latest version of the National Electric Safety Code (NESC).

2.3. This specification is not intended to be totally comprehensive. To ensure the efficient coordination between CenterPoint Energy and the customer during the design and construction of the customer's substation, CenterPoint Energy requires that engineering documents be submitted to CenterPoint Energy for review before certain equipment is ordered or construction begins. All items requiring CenterPoint Energy review are listed in Article 15.0 of this specification and shall be submitted in writing to the designated Project Coordinator, or designated representative.

2.4. Any deviations from this specification or CenterPoint Energy reviewed project drawings shall require written acceptance by the responsible CenterPoint Energy Project Coordinator.

2.5. All labor and equipment shall be furnished by the customer unless otherwise noted in this specification.

2.6. Unless otherwise stated in this specification:

2.6.1. CenterPoint Energy will provide only functional reviews of complete and final drawings and schematics,

2.6.2. CenterPoint Energy will not verify or correct customer's point-to-point wiring, and

2.6.3. CenterPoint Energy will require specific tests which are to be conducted by the customer to verify the proper operation and coordination of the substation's protection and control equipment.

2.7. CenterPoint Energy reserves the right to refuse to energize any service which fails to meet this specification.

2.8. The customer will coordinate the operation of their high voltage facilities with CenterPoint Energy's Real Time Operations Division per CenterPoint Energy's "Transmission & Substation Outage and Clearance Coordination Procedures" document.

2.9. It is the customer's responsibility to comply with the applicable laws, ordinances, codes, rules, and regulations established by the appropriate government entities.

2.10. Because the customer's substation becomes an integral part of the CenterPoint Energy transmission system network CenterPoint Energy requires access to the substation 7 days-a-week, 24 hours-a-day, 365 days-a-year. Access to the substation by CenterPoint Energy personnel should be considered when determining the location and plant operating procedures.

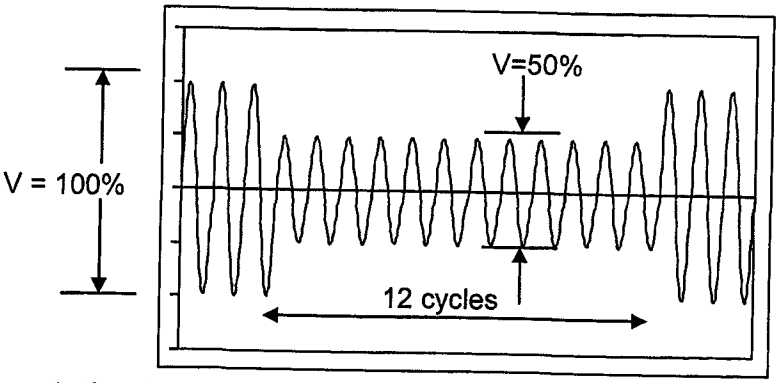
3. CENTERPOINT ENERGY SYSTEM CHARACTERISTICS

3.1. CenterPoint Energy's phase rotation is designated C-B-A counterclockwise and the customer shall phase his equipment accordingly. Connection of the customer's H_1-H_2-H_3 power transformer leads to CenterPoint Energy's C-B-A, B-A-C or A-C-B, respectively, is recommended.

3.2. The steady-state nominal system voltage is 138 kV +/- 5%, wye effectively grounded. Transient conditions exceeding this range may be encountered. See Sub-articles 3.4, 4.6 and 7.1.4 for additional relevant information.

3.3. Frequency, which ERCOT is responsible for maintaining, is nominally 60 Hz. Refer to ERCOT (www.ercot.com) Operating Guides and Protocols for information regarding frequency regulation.

3.4. The customer's equipment "voltage dip ride through" design criteria, that CenterPoint Energy suggests the customer utilize when designing and selecting plant equipment is illustrated in figure 3.1.



"V" represents the phase-to-neutral voltage at the customer's "load side" of a delta-wye transformer for a phase-to-ground fault at the "high side" of the transformer.

Figure 3.1

3.5. Multiple shot, staggered, relay supervised, automatic reclosing is utilized on the CenterPoint Energy transmission system. The first automatic reclosing attempt on CenterPoint Energy transmission line will occur a minimum of one second after the fault has cleared. The number of automatic reclosing attempts varies, but the total duration of the automatic reclosing sequence is typically one minute. The customer shall accordingly coordinate operation and protection of electric motors, computers and other plant equipment.

4. ELECTRICAL DESIGN CRITERIA

4.1. The minimum acceptable electrical design characteristics are listed below:

Bus, Switch and Insulator Impulse Level	650 kV BIL in a non-contaminated area 750 kV BIL or 650 kV BIL with extra creep in a contaminated area

Note: CenterPoint Energy shall make determination of contaminated or non-contaminated area.

Transformer Winding Impulse Level	550 kV BIL
Bus and Switch Insulator Leakage Distance	132 in. creep (equivalent to 750 kV BIL or extra creep 650 kV BIL)
Apparatus Bushing Leakage Distance (circuit breakers, bushings, transformer bushings, etc.)	92 in. creep (equivalent to 650 kV BIL)
Phase to Ground Clearance	52 in. (Metal to Metal)
Phase to Phase Bus Spacing (including vertical spacing at crossover point of high and low bus)	63 in. (Metal to Metal)
Phase to Phase Bushing Spacing (138 kV)	84 in. (Center Line to Center Line)
Phase to Phase Horizontal Spacing at Incoming Line Dead End Structure	144 in. (Center Line to Center Line, regardless of the line angle)

4.2. "Full loop" (ring bus or breaker-and-a-half) or "loop tap" are standard substation configurations allowed by CenterPoint Energy.

4.3. For "full loop" substations, "loop tap" substations or substations arranged for future "loop" service, the continuous current rating of all equipment in the substation "loop" and incoming transmission line positions (transmission line disconnect switches, line traps, etc.) shall be 4,000 A minimum, unless otherwise specified by CenterPoint Energy. For substations with four or more 138 kV transmission lines, the continuous current rating of equipment in the substation may be required to be greater than 4,000 A. The 138 kV substation shall be designed for a short circuit current of 63 kA rms symmetrical, with X/R ratio of 15.

4.4. A key interlock system is not permitted on 138 kV equipment.

4.5. The customer's connected load and equipment shall be designed and operated to adhere to the recommended harmonic limits of IEEE Std. 519.

4.6. The CenterPoint Energy flicker limit criteria for 138 kV customers is as follows:

4.6.1. The operation of customer's equipment (starting of motors, furnaces, etc.) shall not produce a voltage dip greater than 2.0% at the customer's high side bus with one transmission line segment directly associated with the electrical supply to the customer substation out-of-service.

4.6.2. If the starting of the customer's equipment produces a voltage dip greater than 1.5% at the customer's high side bus with all transmission line segments in-service, the customer shall contact CenterPoint Energy for further evaluation.

4.7. The substation ground mat shall be designed for a short circuit current of 63 kA rms symmetrical with X/R ratio of 15 and duration of 0.25 seconds and comply with IEEE Std. 80 and IEEE C2 (NESC). Ground mat connections shall comply with IEEE Std. 837.

4.8. The substation direct lightning stroke shielding design shall comply with IEEE Std. 998.

5. STRUCTURAL AND MECHANICAL DESIGN CRITERIA

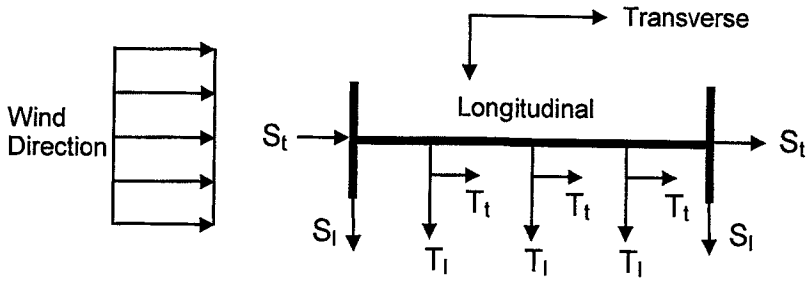
5.1. The customer shall provide a complete structural and foundation design package for the dead-end structures (supporting the CenterPoint Energy transmission lines connected to the customer's 138 kV substation) and the instrument transformer stands in accordance with Article 15.0. The design package shall be signed and sealed by a registered professional engineer and shall include design references/codes, computer analysis, member design, connection design, foundation design, structural and foundation drawings, and all other information that documents the design of the structure(s).

5.2. Design shall be based upon loadings realistically combined to cause the most unfavorable effect upon the structure or component. Refer also to Sub-Article 5.4 and 5.5.5.

5.3. Structures shall meet the Strength Requirements of IEEE C2 (NESC), Section 26, for grade B construction.

5.4. The minimum acceptable structural design loading criteria shall be the more severe of the following two cases:

5.4.1. Case 1 - Combined Ice and Wind Loading: Reference specification IEEE C2 (NESC); minimum allowable strength factors per Section 26, Table 261-1A or Table 261-1B; loading requirements per Section 25, Rule 250.B and Table 250-1; and loading components to be applied to the structure shall be according to Fig.5.1.

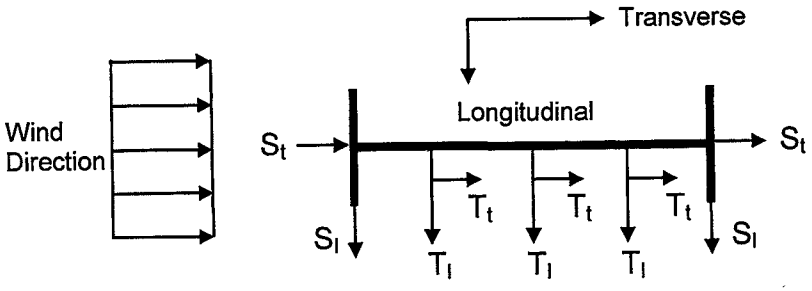


Wind and Ice loads are specified in Section 25 of ANSI/IEEE C2

Static Wire	Conductor Wire
Sl = 6.00 kips/wire longitudinally	Tl = 10.0 kips/phase longitudinally
St= 3.00 kips/wire transversely	Tt = 5.00 kips/phase transversely
Sv = 0.50 kips/wire vertically	Tv = 1.50 kips/phase vertically

CASE 1 - Combined Ice and Wind Loading – Overhead View.
Static wire and conductor wire loading component (Overload capacity factors not included.)
Figure 5.1

5.4.2. Case 2 - Extreme Wind Loading: Reference specification; IEEE C2 (NESC) Section 25, Rule 250.C; minimum allowable strength factors per IEEE C2 (NESC), Section 26, Rule 260.C; and magnitude and direction of static wire and conductor wire loading components to be applied to the structure shall be according to Fig.5.2.



For Case 2 the following shall apply:
Basic Wind speed determined from wind map in, Exposure category C, Importance factor 1.0, Design wind pressure equation and coefficients per IEEE C2 (NESC) Rule 250.C in latest version.

Static Wire	Conductor Wire
Sl = 6.00 kips/wire longitudinally	Tl = 15.0 kips/phase longitudinally
St= 3.00 kips/wire transversely	Tt = 7.50 kips/phase transversely
Sv = 0.50 kips/wire vertically	Tv = 1.50 kips/phase vertically

CASE 2 - Extreme Wind Loading – Overhead View.
Static wire and conductor wire loading component: (Overload capacity factors not included.)
Refer to Sub-Article 8.1.2.4.1
Figure 5.2

5.5. DEAD-END STRUCTURES

5.5.1. In the absence of specifically defined criteria by CenterPoint Energy, the following design criteria shall be used as default design values for dead-end structures.

5.5.1.1. The conductor height at attachment shall be 35 feet above the finished substation grade.

5.5.2. Customer shall design all attachment points to ensure that sufficient electrical clearance is maintained to the customer's structure ground and equipment. CenterPoint Energy will extend the load carrying conductor to the first item of customer's equipment or bus and will furnish, own and maintain all necessary fittings for terminating the line conductors including the tower fittings, suspension insulators, dead-end clamps and line conductor terminal fittings with NEMA standard four-hole flat pads (0.5625 in. diameter holes, 1.75 in. centers) for attachment to the first item of equipment or bus in the customer's substation. CenterPoint Energy will also furnish stirrup clamps or other similar devices (such as a bar on the NEMA pad for ACSS conductors) on the line conductors as required for connection of surge arresters and potential transformers.

5.5.3. Customers shall provide pull-off plates (0.625 in. minimum thickness) for terminating the line conductors and which have a 0.8125 in. diameter chamfered hole at the center of a 1.50 in. radius rounding of the end of the plate. In addition, the customer shall provide pull-off plates (0.375 in. minimum thickness) for terminating the static wires and which have a 0.8125 in. diameter chamfered hole on a 1.50 in. radius rounding of the end of the plate. All pull-off plates must satisfy Equation 4.6-1 and 4.6-2 in ASCE 10. Details for division of ownership shall be in accordance with CenterPoint Energy Drawing 004-241-01.

5.5.4. The height of the dead-end structure's conductor attachment shall be in accordance with the National Electric Safety Code (IEEE C2) or 35 ft whichever is greater, unless otherwise specified by CenterPoint Energy. The static wire height at attachment shall be at a sufficient elevation and position to provide a shield angle to the outside conductors of 30° and 45° between two adjacent static wires (see IEEE Std.142).

5.5.5. The installation of fiber optic cable may be required for transmission protective relaying and/or control purposes. The fiber optic cable installations will normally be installed underground. However, should an overhead installation be required, additional loadings will be imposed on the customer's dead end structure. Additional design information concerning the fiber optic cable will be supplied by CenterPoint Energy when fiber optic cable is to be used. Typically the connection for the fiber optic cable is at least 8 ft from the nearest conductor.

5.6. INSTRUMENT TRANSFORMER STANDS

When high side metering is utilized, the customer shall provide stands for mounting CenterPoint Energy furnished instrument transformers and design and build foundations to support the stands. The design shall be in accordance with Sub-Articles 5.1 - 5.4 of this specification. The necessary design parameters are indicated on CenterPoint Energy Drawing 171-190-06.

6. SITE CRITERIA

6.1. Site preparation and plot plan drawings shall be submitted to CenterPoint Energy for comment. Facilities that must be shown on this drawing include dimensions of the substation site, access roadways, space between the substation and access roadways, walks, culverts and ditches. Refer to Article 15.0