1 Introduction

1.1 Applicability

1.1.1 These procedures apply to entities ("Customers") who own high voltage transmission and/or generation facilities interconnected to CenterPoint Energy's 69kV, 138kV, or 345kV transmission system. Customer, as used in this document, includes Customer's authorized contractors or agents. The Customer is responsible for ensuring 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 CenterPoint Energy's (CNP) transmission system. CNP, as used in this document, refers to CenterPoint Energy.

1.2 Purpose

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

1.3 Procedure Copies

1.3.1 The Customer will keep copies of these procedures in applicable Customer substation control houses and plant operating centers. These procedures, including forms, may be reproduced.

1.4 Ownership or Name Changes

1.4.1 The Customer will 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 these procedures and the Customer's procedures should 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 will not perform preventive maintenance on equipment maintained by CNP.

1.7 Equipment Changes

1.7.1 The Customer is responsible for providing 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 will provide sufficient notice to CNP of any proposed changes to their facilities as specified in Section 9. This notification will include providing necessary details so that CNP can provide comments based upon a general, functional, and compliance review. The Customer will 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:

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

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

1.9 Power Factor

1.9.1 The Customer is responsible for providing 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 is responsible for providing 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 will switch substation equipment, reduce MW output, change reactive output, or perform other measures as directed by ERCOT or CNP's Real Time Operations Division ("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 Customer 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 will 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 CNP's Real Time Operations Department ("RTO") is responsible for operating CNP's transmission system and coordinating 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 will schedule planned outages with RTO and obtain from RTO switching instructions for any equipment at the customer substation that is directly interconnected with CNP's transmission system. Switching in the customers facilities that are remote to the customer's substation that is directly interconnected with CNP's transmission system does not need to be scheduled. CNP will notify customers one or more days in advance if switching is required in a customer substation for planned transmission line outages or if a customer substation will be placed in a single-ended condition.

3.2 Scheduling Transmission Equipment Outages

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

3.2.2 The Customer will 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 will 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 will 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 will contact the RTO System Controller as soon as possible whenever any unplanned tripping of any circuit breaker operating at a voltage of 60kV and higher occurs. A "Forced Outage Check List" form is included in this document. In the event of an unplanned generation outage, the Customer or his designated representative will advise CNP's RTO System Controller as soon as possible. In emergency situations, switching may be performed by a qualified person, 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 notify the Customer whether or not 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 will notify the RTO System Scheduler as soon as possible if an outage is canceled prior to the outage date. The Customer will immediately notify the RTO System Controller if an outage is canceled on the day of the outage. CNP will endeavor 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 a 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 (i.e. substation station service power, battery & battery charger, ability for CenterPoint Energy to access substation, etc). Customer substations are 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 will endeavor to inform Customer's of long range planned switching and projects which may affect the Customer's facility

3.3.2 The Customer will notify the Transmission Accounts representative as specified in Section 9 when equipment additions or removals are planned or when high voltage equipment 60kV and higher or associated equipment requires modification or replacement. The Customer will 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 (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 will mount signs with 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 will be identified with CNP's assigned numbers. CNP will develop a substation basic one-line diagram that includes these assigned numbers. CNP or the Customer will 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 will 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 will maintain a telephone in the substation control house connected to an outside telephone line independent from the Customer's telephone system.

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

3.5.3 CNP will maintain 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 will respond to alarms for communication equipment installed to protect CNP transmission circuits.

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

Transmission Control / Real Time Operations
Outage Scheduling, Metering and Forced Outage Requirements

Per ERCOT and CenterPoint Energy outage reporting requirements, planned outages on circuit breakers, transmission lines and autotransformers rated 60kV and higher must be submitted to the ERCOT Outage Coordinators by the CenterPoint Energy Real Time Operations Outage Coordinator.

Per ERCOT Protocols, planned outages on ERCOT Polled Settlement (EPS) meters and/or 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 Outages

Equipment Being Requested	Minimum Advance Notice	Contact
69kV & 138kV 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 notice	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 notice	Outage Scheduler @ 713-207-2196 or 713-207-2714

Forced Outages

Forced outages due to equipment emergencies will be handled by CenterPoint Energy - Real Time Operations and ERCOT System Operations on a case-by-case basis by the Customer contacting the Real Time Operations Security Desk at 713-207-2203.

Per ERCOT requirements, forced outage on EPS meters with no back-up or check meters must be corrected within 12 hours. Forced outages on EPS meters with back-up or check meters must be corrected within 5 days.

4 Switching, Clearances, Grounding

4.1 Billable Costs

4.1.1 Grounding and switching requested by 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 party requesting switching and/or grounding activities by CenterPoint Energy is a transmission voltage service Customer who is interconnected to CenterPoint Energy'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 CenterPoint Energy 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 and/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/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 will provide all necessary switching at the remote end of a CNP transmission line for outages at a Customer substation which require switching of CNP transmission lines. CNP will provide switching instructions for the high voltage devices in the Customer substation that is directly interconnected with CNP's transmission system. Switching instructions are not provided for remote facilities interconnected to the customer 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 will 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 will implement specific procedures for the switching of its facilities. These procedures will include a visual check that all phases have fully opened or

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

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 will 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 will verify that the apparatus is de-energized before protective grounding is attached or work on high voltage facilities begins.

4.4.2 The Customer is responsible for assuring that protective grounds are installed 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 will 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, that conductor will first be tested to confirm that it is de-energized. Grounds will be placed such that the operation of a switching device cannot remove their protection.

4.4.5 The clamps and conductors of grounding devices will be designed for the available fault current. Grounding devices must be inspected for broken strands and loose connections. The surface of the ground clamps must be clean of corrosion and oxides.

4.4.6 Grounding devices for transmission voltage conductors must be installed and removed with the use of applicable live line tools. Grounding devices must

always be securely connected at the ground end before connection is made to the conductor. Grounds must always 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 must 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 345kV Facilities Equipped with Ferroresonance Protection

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

Procedures will 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.

1. 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
2. If all three lights dim immediately:
   - reset the targets (flags) on the ferroresonance protection relays
3. 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 it shall not be operated. The tag will 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, and/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

_____ _____

_____ _____

_____ _____

_____ _____

_____ _____

_____ _____

_____ _____

_____ _____

_____ _____

_____ _____

_____ _____

_____ _____

_____ _____

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 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 basic procedures 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, Metering and Forced Outage Requirements" outlined in Section 3 of this procedure.

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

5.1.3 □ For Outage Questions call 713/207-2714

□ 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 follow with courtesy phone call or 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 will contact the RTO System Controller as soon as possible whenever any unplanned tripping of any high voltage (60kV and higher) circuit breaker occurs. CNP crews will be dispatched when high voltage circuit breakers remain open in the customer substation that is directly interconnected with CNP's transmission system. CNP crews will reset relay targets except in emergency situations. A "Forced Outage Check List" form is included in this document.

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

6.2 Unplanned Outages of 345kV Facilities Equipped with Ferroresonance Protection

6.2.1 Ferroresonance protection is installed whenever a wound potential transformer (PT) is connected to a 345kV and the possibility of a ferroresonance condition occurring exists. If applicable, the Customer will implement specific procedures for unplanned tripping of 345kV equipment that has ferroresonance protection installed. Procedures will 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 PT(s) 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 PT(s) 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 a Customer's incoming 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 will be reset after the Customer has recorded them and reported them to the RTO System Controller. All personnel will move to a safe distance from apparatus being energized prior to switching. An "Emergency Switching Check List" form is included in this document.

6.3.2 UNPLANNED OUTAGE CHECK LIST

6.3.3 The following basic procedures are for whenever any unplanned tripping of any transmission service voltage breaker occurs.

- ☐ Call the RTO System Controller Hot Line 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)
- ☐ 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 Hot Line 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, Customer's 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 or other responsible personnel.

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 will 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 will have control of CNP's substation breakers that are functioning as generator breakers. CNP will have operational control of the disconnect switches associated with these breakers.

7.2.2 The Customer will 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 will notify the RTO System Controller (281-894-0491) immediately before a unit is synchronized and connected to CNP's transmission system. The Customer will report forced unit outages.

7.2.4 The Customer will 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 will maintain the ERCOT specified voltage level unless otherwise directed by the RTO System Dispatcher or ERCOT. If ERCOT specifies a maximum voltage in addition to the recommended level, the Customer will maintain the maximum voltage only during light system load conditions. If the ERCOT does not specify a voltage level, the Customer will provide reactive support based on instructions provided by ERCOT or the RTO System Dispatcher.

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

7.2.6 The Customer will maintain generating units on-line during system under-frequency conditions to the standards set forth in Section 2.6.2 of the current ERCOT Operating Guides: www.ercot.com/mktrules/guides/noperating/cur .

8 Protective Relay Settings

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

8.1.1 CNP will calculate and implement all settings for customer owned relays installed for the protection and automatic reclosing of CNP transmission lines and for customer owned relays installed to prevent back-energizing CNP's system from

generation installed on the low side of Customer power transformers. On a case-by-case basis, CNP may issue settings for other Customer owned relays. The relay settings implemented by CNP for the Customer's owned relays will be provided to the Customer upon request.

8.2 Applicable Relay Settings

8.2.1 The Customer will provide CNP with the settings of Customer owned relays that trip or close any Customer owned high voltage (60kV and higher) circuit breakers. The Customer will 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 CenterPoint Energy transmission circuit is not allowed to be monitored via 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 via a serial port (Modbus, DNP3 or SEL Fast Meter). Control command(s) are not allowed through the serial port.

9 Equipment Additions, Replacement, Upgrades and Removal

9.1 Notify CNP of Equipment Changes

9.1.1 The Customer must 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.

9.1.2 The Customer will provide equipment and installation per applicable CNP specifications and bill of materials. The Customer will provide necessary details (e.g., 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 shall only approve 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 will notify the Customer of problems in their facilities of which CNP becomes aware. The Customer will provide any needed equipment modifications, repairs, or replacement within an appropriate time frame. The Customer will replace equipment that CNP demonstrates is no longer maintainable. On a case-by-case basis, the Customer and CNP will 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 will, 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 CenterPoint Energy 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) CNP will require the following information to meet the deadlines shown above. The NOMCR data requirements include, but are not limited to (per Nodal Protocol 3.3.2.1):

- 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 shall only approve 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 Customer 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 (Supervisory Control and Data Acquisition) transducers that provide real time data to CNP. CNP may designate additional Customer equipment 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 Customer wave traps.

10.1.4 Outages of approximately ten hours duration for certain Customer facilities are required for CNP's periodic maintenance of any 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 will 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 will not perform preventive maintenance on the equipment maintained by CNP. The Customer will maintain equipment logs and test reports, which will 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 will notify the RTO System Scheduler at least ten (10) working days in advance before performing maintenance on potential or current transformers connected to CNP meters.

10.3 Monthly Inspections

10.3.1 The Customer will 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 will 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 cell impedance testing
  - ☐ Measure connection resistance
  - ☐ Record and verify specific gravity reading on a single pilot cell
  - ☐ 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 and/or CNP will perform functional trip testing following substation additions or modifications. Each high voltage breaker will be tripped and closed from the breaker control switch at least once every year. This breaker tripping, as well as functional trip testing, may be coordinated with the switching required for maintenance outages. The Customer will notify the RTO System Scheduler, by Noon Wednesday of the week prior to the planned maintenance before performing functional testing and allow CNP to witness the testing.

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 will 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 will appropriately label the control wiring. The Customer's maintenance procedures will include tagging and properly reconnecting trip coil wiring. The Customer will 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 will 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. A common fluctuation is a voltage sag 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 Customers typically perform plant electrical protection coordination studies from time to time. 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
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 (100) 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 (lFB) 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

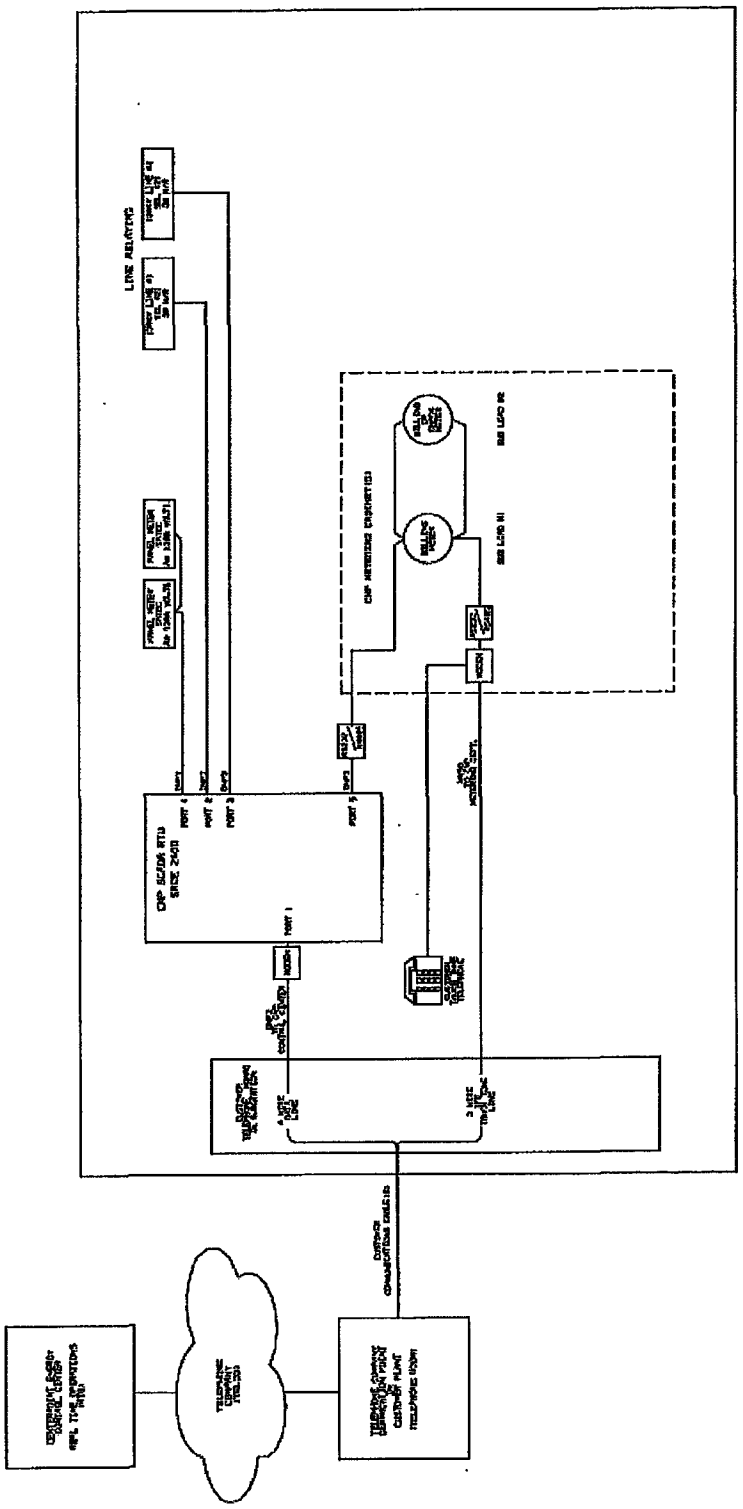
X, Y = AUXILIARY COILS OF RC RELAY

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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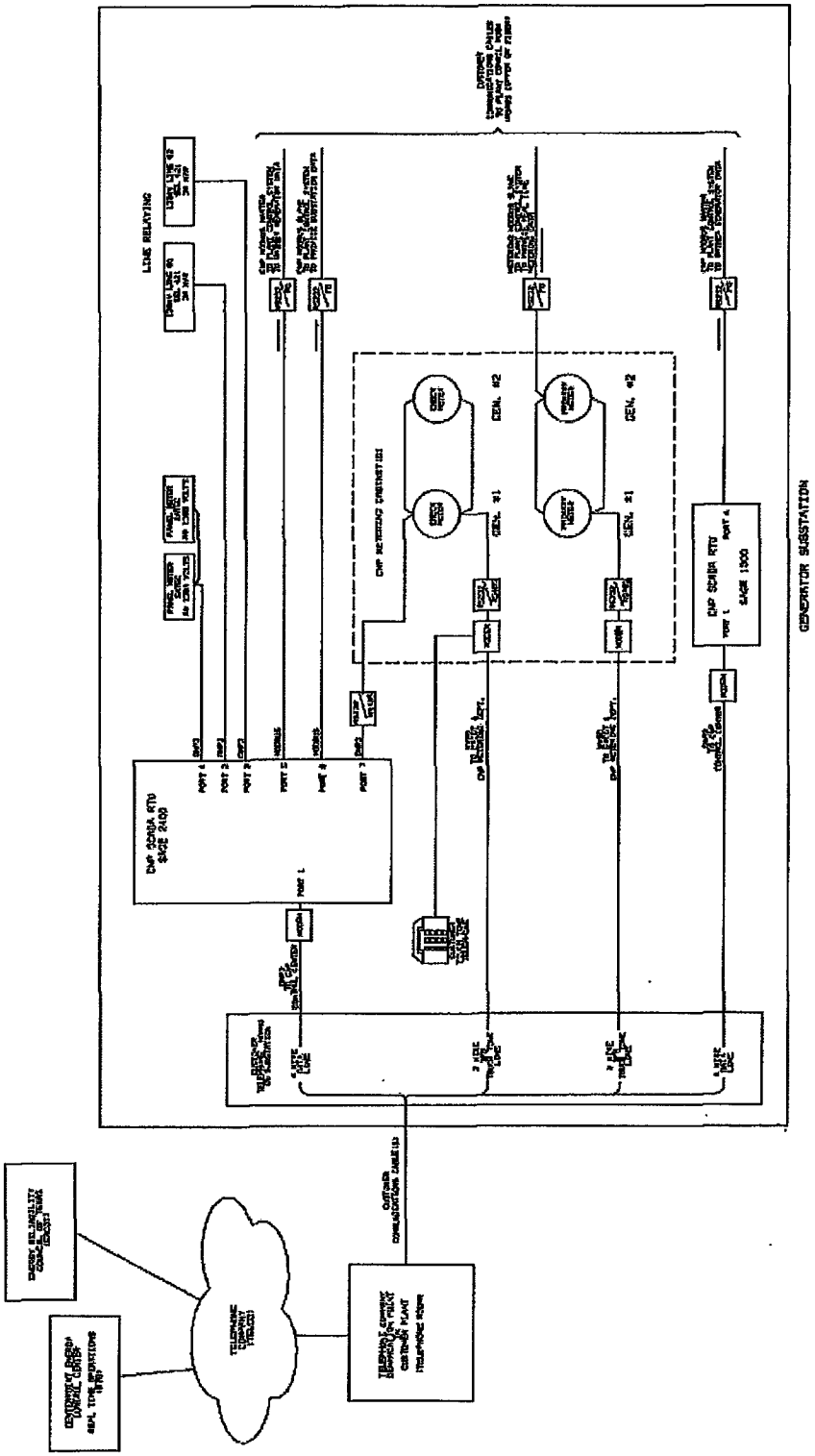

CNP Drawing: BSC-564-500-01 sh.2
Generator Substation Communications Block
Diagram Figure 2

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
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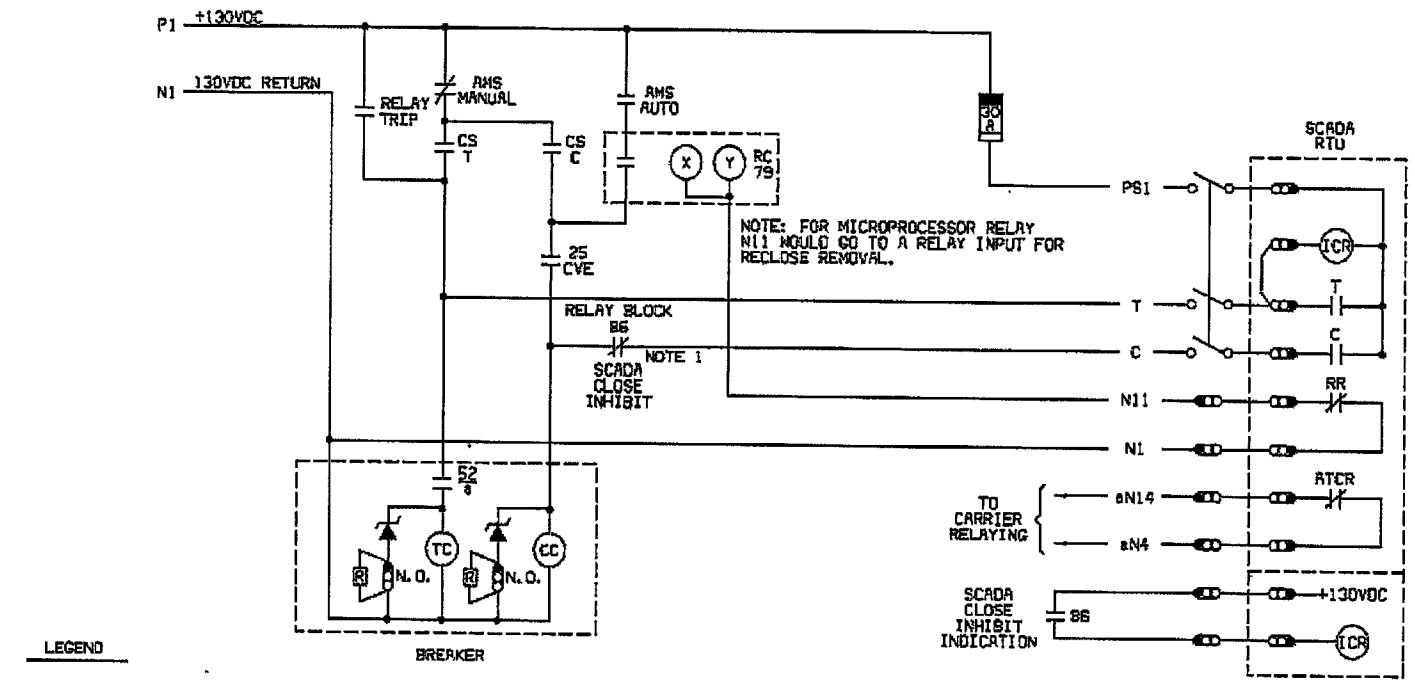

LEGEND

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

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

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

Transmission breaker SCADA Control

Figure 3

Exhibit "H"
Specification for Customer 138 kV Substation Design

The following specification is intended to apply to the Customer's substation design in all respects except for the designated voltage level. The following specification should be read as '69 kV' whenever '138 kV' is found.

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.

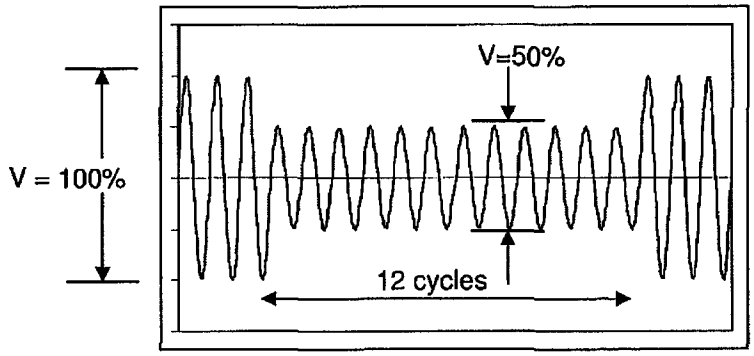
3. CENTERPOINT ENERGY SYSTEM CHARACTERISTICS

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

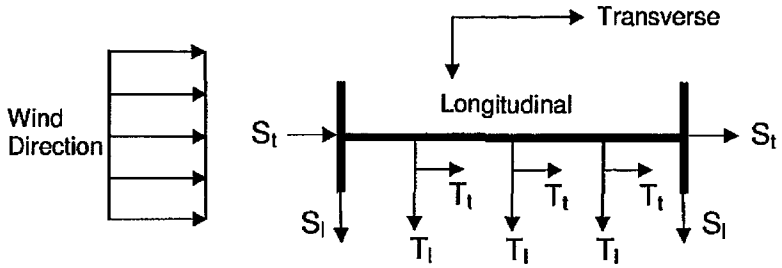
5.1. The customer shall provide a complete structural and foundation design package for the dead-end structures (supporting the CenterPoint Energy transmission lines connected to the customer's 138 kV substation) and the instrument transformer stands in accordance with Article 15.0. The design package 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.

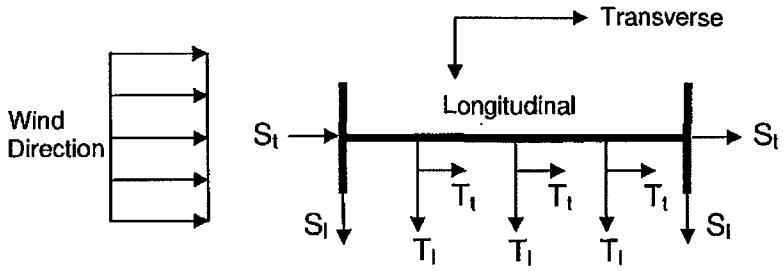


Wind and Ice loads are specified in Section 25 of ANSI/IEEE C2

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.

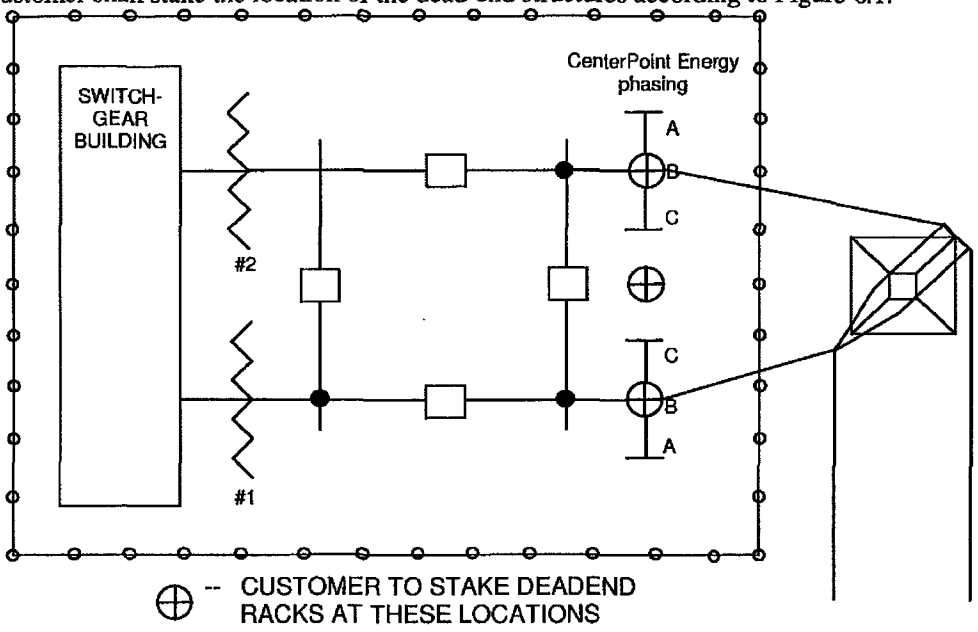
5.6. INSTRUMENT TRANSFORMER STANDS

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

6.2. The customer shall stake the location of the dead-end structures according to Figure 6.1.



Staking Requirements for Typical Customer Substation

Figure 6.1

6.3. An all weather access roadbed shall be provided to the substation capable of supporting heavy construction vehicles. The areas in substations that need to support heavy vehicular traffic should conform to AASHTO H20 loading.

6.4. Access for CenterPoint Energy to attach line conductors to the dead-end structures shall be provided by either:

6.4.1. A 25 ft wide, level, and unobstructed access outside the substation site from a main road to the CenterPoint Energy right-of-way and in front of the dead-end structures with fencing a maximum of 20 ft from the attachment point of the dead-ends and a 13 ft (minimum) wide gate for access into the substation.

6.4.2. A 25 ft wide access inside the substation from the substation access gate (20 ft wide minimum) to the front of the dead-ends with fencing a minimum of 25 ft from the attachment point.

6.5. Access and space shall be provided for installation and future replacement of high voltage equipment including metering instrument transformers.

7. HIGH VOLTAGE EQUIPMENT

7.1. POWER TRANSFORMERS

7.1.1. Power transformers shall conform to IEEE C57.12.00. In addition, sudden pressure and low oil level should be connected for alarming and tripping.

7.1.2. Power transformers shall have a minimum of two 600:5 A multi-ratio current transformers (CT's) per 138 kV bushing. Each CT shall have IEEE C57.13 accuracy C400 or better. Where

applications require additional CT's and/or different ratios, CenterPoint Energy shall provide ratios to support equipment purchase schedule. The secondary resistance of power transformer bushing CT's shall not exceed 0.0025 Ω per turn. CT secondary rated continuous current shall be 10 A minimum. Rating Factor (R.F.) shall equal 2.0.

7.1.3. High side surge arresters shall be provided in accordance with Sub-Article 7.4.

7.1.4. The customer shall determine the need for, and if applicable, settings for a tap changer for de-energized operation and/or on-load tap changer. CenterPoint Energy recommends automatic on-load tap changer.

7.2. CIRCUIT BREAKERS

7.2.1. Circuit breakers shall be of the three-pole, outdoor type, 138 kV nominal, in accordance with ANSI C37.06 and IEEE C37.60, C37.04 and C37.40.

7.2.2. Continuous current rating of 138 kV circuit breakers shall be 4,000 A, with a three phase symmetrical short circuit interrupting capability of 63 kA rms symmetrical. For substations with four or more 138 kV transmission lines, circuit breakers may be required to have a higher continuous rating. The rated interrupting time of the circuit breakers shall be three cycles or less. In some applications, the installation of TRV shaping capacitors may be required in order to achieve the circuit breaker interrupting capability of 63 kA rms symmetrical for line faults. CenterPoint Energy shall determine the placement of TRV shaping capacitors, when required.

7.2.3. Each 138 kV circuit breaker shall be equipped with two 4,000:5 A multi-ratio CT's per 138 kV bushing. Each CT shall have an accuracy of C800 on the 3,000:5 A tap in accordance with IEEE C57.13. The secondary resistance of circuit breaker bushing CT's shall not exceed 0.0025 Ω per turn. CT secondary rated continuous current shall be 10 A minimum. Rating Factor (R.F.) shall equal 2.0.

7.2.4. Two trip coils shall be provided with independent 125 VDC control circuits. If both trip coils operate a single armature, both coils shall be designed or marked in such a way as to prevent their being connected in a manner that would result in the breaker not tripping in the event that both coils are energized simultaneously.

7.2.5. Trip and close DC currents shall not exceed 15 A per coil and shall not be less than 4 A per coil.

7.2.6. Trip circuits shall not be fused inside the circuit breaker control cabinet.

7.2.7. Surge suppression shall be provided on each trip and close coil. Reference CenterPoint Energy Specification, 007-400-02.

7.2.8. The circuit breaker operating mechanism shall be both mechanically and electrically trip-free in any position. For oil circuit breakers, a latch check switch shall be provided.

7.2.9. Circuit breakers with air closing mechanisms shall have stored energy for 5 close-open operations. Circuit breakers with spring closing mechanisms shall have the spring charging motor circuit connected to a 125 VDC battery source utilizing a DC supply cable dedicated for this purpose. Voltage rollover from AC to DC shall not be installed for the spring charging motor circuit for circuit breakers.

7.2.10. Gas circuit breakers shall have low gas pressure alarm and close inhibit contacts.

7.2.11. Circuit breaker internal time delay circuitry for reclosing shall not be utilized. External time delayed automatic reclosing, when utilized, shall be wired/connected directly to the circuit breaker close circuit. External time delay for reclosing circuit is to be provided by other relays.

7.2.12. CenterPoint Energy recommends that the control circuitry of circuit breakers be equipped for operation response monitoring.

7.3. AIR BREAK SWITCHES

7.3.1. Transmission line disconnect switches and all disconnect switches in the substation "loop" shall be of the outdoor, three pole, gang operated type rated 138 kV nominal, 4,000 A continuous, 164 kA peak withstand minimum, unless otherwise specified by CenterPoint Energy. For substations with four or more 138 kV transmission lines, contact CenterPoint Energy for the required rating of switches. The switch air gap BIL shall coordinate with the BIL rating of the switch insulators.

7.3.2. Transmission line disconnect switches are required for "full loop" substations or "loop tap" substations converted to "full loop".

7.3.3. "Loop tap" substations must be configured and designed with equipment to permit switching for the scheduled outage of either transmission line section without interrupting service to the customer's load. An interrupting device attached to a disconnect switch in a "loop tap" substation for transmission line load breaking, loop switching or line dropping is not acceptable.

7.3.4. Two auxiliary "a" contacts shall be provided on the disconnect switch between transformers in a three circuit breaker, two transformer substation and the disconnect switch between lines in a two circuit breaker substation.

7.4. SURGE ARRESTERS

7.4.1. All surge arresters shall be metal oxide varsistor type 108 kV class minimum, with a maximum continuous over voltage (MCOV) rating of 88 kV minimum. The minimum required energy absorption capability is 7 kilojoules/ kV of MCOV rating. The minimum required pressure relief capability is 63 kA rms symmetrical.

7.4.2. To allow for grading / leakage current monitoring, CenterPoint Energy recommends that surge arresters be mounted on plates using insulated spacers and associated hardware. The insulated ground conductor from the bottom flange of the arrester must be isolated from any other ground until it passes the point where a tong ammeter reading can be taken. The independent, insulated ground leads should be adequately marked to indicate A, B, and C phases.

7.5. COUPLING CAPACITORS AND LINE TUNERS

7.5.1. CenterPoint Energy shall specify vendor and vendor style number for the coupling capacitor devices and line tuners.

7.6. LINE TRAPS

7.6.1. CenterPoint Energy shall specify vendor and vendor style number for line trap devices.