Telephone Numbers

Real Time Operations Division (RTO)

RTO HOTLINE	**281-894-1625** (24 hours)
RTO System Controller	281-894-0491 (24 hours)
RTO Outage Schedulers	713-207-2571 (FAX)
Larry Wagner larry.wagner@centerpointenergy.com	713-207-2714
Larry Pilcik larry.pilcik@centerpointenergy.com	713-207-2730
RTO Outage Coordinator: kenneth.aubry@centerpointenergy.com	713-207-1619
RTO System Coordinators:	713-207-2714
Steve McNeill steve.mcneill@centerpointenergy.com	713-207-2497
Michael Hall michael.hall@centerpointenergy.com	713-207-2766

Metering Department

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

Transmission Accounts Representatives

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

1 Introduction

1.1 Applicability

1.1.1 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/protocols/current.html and

http://www.ercot.com/mktrules/guides/operating/index.html

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 Division

3.1.1 CNP's Real Time Operations Division ("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
Outages 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.

Also 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 @ 713-207-2714 or 713-207-2730
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 @ 713-207-2714 or 713-207-2730
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 @ 713-207-2714 or 713-207-2730

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
- ☐ If one or more of the lights do not dim immediately but gets brighter
  - ☐ Immediately close the last breaker opened to reenergize the bus
  - ☐ Investigate the ferroresonance protection
- ☐ If all three lights dim immediately
  - ☐ Reset the targets ("flags") on the ferroresonance protection relays
- ☐ If relay targets did not operate
  - ☐ Investigate the ferroresonance protection circuit

4.6 Terminology for Switching Orders

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

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

Block Transformers - Place automatic control of the load tap changer to the manual position.

Unblock Transformers - Place automatic control of the load tap changer to the automatic 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** TIME _____

DISP _____ DISP. _____

TIME _____ TIME _____

DATE _____ DATE _____

EXEC. BY _____ EXEC. BY _____

TIME _____ TIME _____

CLEARANCE # _____

ISSUED **RELEASED**

DISP. _____ DISP. _____

_____ 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

☐ 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, phone number 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 the 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 2.9.2 of the current ERCOT Operating Guides: www.ercot.com/mktrules/guides/operating/index .

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.

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 necessary information to Transmission Accounts	
Month of January	Sept. 1	June 1	(the prior year)
Month of February	Oct. 1	July 1	(the prior year)
Month of March	Nov. 1	August 1	(the prior year)
Month of April	Dec. 1	September 1	(the prior year)
Month of May	Jan. 1	October 1	(the prior year)
Months of June–July – August (Summer Model)	Feb. 1	November 1	(the prior year)
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 such as SCADA equipment and transmission line protective relaying equipment. 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"
Generator Interconnection Specification

SPECIFICATION

FOR

COGENERATOR CONNECTED
TO THE HL&P
TRANSMISSION SYSTEM

HOUSTON LIGHTING & POWER COMPANY
SYSTEM ENGINEERING DEPARTMENT
P.O. BOX 1700 HOUSTON, TEXAS 77001

REFERENCE DRAWINGS:

REFERENCE SPECIFICATIONS:

HL&P Specification 007-231-14, Latest Revision
HL&P Specification 007-400-02, Dated 2/15/86
HL&P Specification 007-231-70, Dated 4/15/85

NO	DATE	ITEMS REVISED	BY	CH	APP
1	5/14/86	Completely Rewritten	PR	KAB	

HOUSTON LIGHTING & POWER CO.
HOUSTON, TEXAS

WRITTEN	04/22/84	L. G. Pond
CHECKED	08/06/84	J. S. Herrera
APPROVED	08/21/84	J. H. Stout

SHEET 1 OF 17 SHEETS

007 231 78

CONTENTS

1.0 SCOPE

1.1 This specification covers technical requirements for a cogenerator interconnecting to the Houston Lighting and Power Company (HL&P) transmission system.

1.2 Each cogenerator will have its own design parameters that may necessitate some deviation from these requirements. However, all exceptions must be approved by HL&P.

1.3 Because this specification is limited to technical requirements for cogenerator interconnection, the cogenerator may be required to enter separate contractual arrangements (including, without limitation, an Interconnection Study Agreement, Interconnection Construction Agreement, Operating Agreement, and Agreement for Purchase of Energy and/or Capacity) with HL&P prior to interconnection. These agreements may detail procedures, guidelines, and requirements for cogenerator interconnection besides the technical specifications provided by this document.

2.0 INTERCONNECTION CRITERIA

2.1 Cogenerator shall provide certain information to HL&P so that HL&P can determine if an Interconnection Study is necessary. This information includes, without limitation, the proposed location of the cogenerator facility, the gross and net generation capability of the new facility, and an approximate date that interconnection is desired.

2.2 If an Interconnection Study is required, it shall be conducted in accordance with an Interconnection Study Agreement between HL&P and the cogenerator. HL&P shall determine the transmission voltage and number of transmission lines required for the cogenerator substation. HL&P shall also estimate the cost and lead time for interconnection. Subsequent interconnection studies may be required if there are changes in projected cogenerator or HL&P transmission system parameters.

2.3 HL&P will plan transmission system improvements or additions to interconnect the cogenerator to the HL&P grid.

2.3.1 HL&P will design the interconnection to be consistent with HL&P and Electric Reliability Council of Texas (ERCOT) reliability guidelines.

2.3.2 For all cogenerators with a combined generation output in excess of 100 MW, HL&P will design the transmission interconnection so that all cogenerator output will be delivered into the system for any two transmission line or substation component outages.

2.3.3 For all cogenerators with an output of less than 100 MW, the minimum acceptable design will be a two transmission line, three breaker ring bus.

2.3.4 HL&P will further design the transmission system for improvements that may be required to avoid overloading any single transmission line above 100% of the line's normal continuous current rating in the event of any other single component outage. In addition, all substation voltages will be no less than 0.95 per unit nor greater than 1.05 per unit for any single contingency.

2.3.5 HL&P is required, as a member of ERCOT, to provide a reliable transmission grid that will not cause cascading outages following the events listed below.

a. Loss of all generating capacity at any generating station.

b. Loss of any two generating units.

c. Outage of any single or double circuit transmission line, generating unit, transformer, or bus.

d. Outage of any circuit or generating unit during scheduled maintenance on any other transmission line or generating unit.

e. Simultaneous outage of overhead transmission lines parallel to each other for a substantial distance having a spacing between circuits of less than the height of the structures.

f. Any fault cleared by normal operation of back-up relays.

g. Loss of any large load or concentrated load area.

HL&P will include in its analysis various load levels as well as the effect of firm contractual interchange transactions.

2.4 If HL&P's interconnection plan requires the cogenerator to connect to the 138kV system, the interconnecting substation will comply with HL&P Specification 007-231-14 entitled "Customer Owned 138kV Substation Design."

2.4.1 The cogenerator shall be required to sign an Operating Agreement prior to interconnecting on the HL&P transmission system. The Operating Agreement will specify procedures for switching, maintenance, and what to do in the event of an abnormal occurrence as well as procedures for bringing generators on or off line.

2.4.2 Ownership, maintenance, operation, and control of equipment shall be detailed after design is finalized and shall be consistent with the Operating Agreement, HL&P Specification 007-400-02, and HL&P Specification 007-231-14.

2.4.3 Cogenerator shall incorporate into his design provisions for having a control room manned by a qualified operator 24 hours a day and for providing hourly readings of megawatt hour production at the generator terminals so that the cogenerator can comply with the terms of the Operating Agreement.

2.5 If HL&P's interconnection plan requires the cogenerator to connect to the 345kV system, the interconnecting substation shall comply with HL&P Specification 007-231-70 entitled "345kV Qualified/Customer Facility".

2.5.1 The cogenerator shall be required to sign an Operating Agreement prior to interconnecting on the HL&P transmission system. The Operating Agreement will specify procedures for switching, maintenance, and what to do in the event of an abnormal occurrence as well as procedures for bringing generators on or off line.

2.5.2 Ownership, maintenance, operation, and control of equipment shall be detailed after design is finalized and shall be consistent with the Operating Agreement, HL&P Specification 007-400-02, and HL&P Specification 007-231-70.

2.5.3 Cogenerator shall incorporate into his design provisions for having a control room manned by a qualified operator 24 hours a day and for providing hourly readings of megawatt hour production at the generator terminals so that the cogenerator can comply with the terms of the Operating Agreement.

3.0 GENERATING UNIT

3.1 The cogenerator shall submit specific information regarding the electrical characteristics of each generating machine during the initial planning stages of the project.

3.1.1 The required forms are contained in sheets 8 through 17 of this specification. This information is necessary in order to establish an interconnection plan that will be consistent with HL&P loading and stability criteria.

3.1.2 HL&P will furnish typical generator data for planning purposes, if requested.

3.2 The generator excitation system response ratio shall not be less than 0.5 (five-tenths).

3.3 The generator shall have a short circuit ratio of not less than 0.5 (five-tenths).

3.4 In order to regulate a high side voltage consistent with HL&P voltage profile needs, the generator and step up transformer shall maintain an HL&P specified high side bus voltage up to a power factor of 0.89 lagging or the generating unit's leading power factor capability, as appropriate.

3.4.1 HL&P will periodically specify a voltage level that the cogenerator shall monitor and maintain subject to the above criteria. If the specified voltage cannot be met, the cogenerator may be required to contribute to the purchase of other reactive sources specified and installed by HL&P or limit their generation output.

3.5 The maximum allowable deviation factor of the open circuit terminal voltage wave shall not exceed 0.1 (one-tenth).

3.6 The balanced Telephone Influence Factor (TIF) shall not exceed 30 (thirty). The residual TIF shall not exceed 30 (thirty).

3.7 The generator shall be capable of withstanding, without damage, the effects of a continuous current unbalance corresponding to a negative phase sequence current of 10%, providing rated kVA is not exceeded, and the maximum current does not exceed 105% of rated current in any phase.

4.0 GENERATION STEP-UP TRANSFORMER

4.1 The low side voltage rating of the generation step-up transformer shall be rated generator voltage.

4.2 The high side voltage rating of the generation step-up transformer shall be either 138kV or 345kV as appropriate, with three taps above 138kV or 345kV at 2 1/2% increments and one tap 2 1/2% below 138kV or 345kV. Each tap shall be able to handle the full MVA rating of the transformer.

4.3 The impedance shall be 7-8% (7% preferred) on the generator base.

4.4 The generation step-up transformer shall be rated to deliver to the transmission system (as a minimum) the rated MVA output of the generator less any auxiliary load.

4.5 The high side connection of the generation step-up transformer shall be wye grounded.

5.0 PROTECTIVE RELAYING

5.1 Protective relaying for the substation shall be in accordance with HL&P Specification 007-231-14 for 138kV substations and HL&P Specification 007-231-70 for 345kV substations.

5.2 The cogenerator machine characteristics and plant design shall incorporate the under-frequency guidelines and criteria of the Electric Reliability Council of Texas (ERCOT) system. These guidelines state that all generators shall remain on line until all three load shedding blocks have been executed. The blocks are automatically tripped by under-frequency relays at 59.3 Hz, 58.9 Hz, and 58.5 Hz. Therefore, the cogenerator shall not separate from the HL&P system during under-frequency conditions until the frequency has declined to a level below 58.5 Hz. Options acceptable to HL&P include: manual trip at 58.3 Hz, relay trip at 58.4 Hz with a .5 second time delay, or 58.3 Hz with no time delay.

5.3 The loss-of-excitation relaying shall have sufficient time delay to prevent false tripping for stable transient impedance swings.

6.0 SCADA AND TELEMETRY SYSTEM

6.1 Supervisory Control and Data Acquisition (SCADA) system and an analog tone telemetry system shall be in accordance with HL&P Specification 007-400-02 for 138kV or 345kV substations.

7.0 LETTER OF CERTIFICATION

7.1 A letter of certification stating compliance with this specification shall be submitted to HL&P before the substation is energized.

TURBINE - GENERATOR DATA

STATION AND UNIT #_____ YEAR INSTALLED _____

MANUFACTURER _____ P.O. #_____

TURBINE NO. _____ TYPE: STEAM REHEAT _____ NON REHEAT _____

COMBUSTION TURBINE _____

RATED TURBINE KW

OIL _____ COAL _____

GAS _____ NUCLEAR _____

RATED PSIG _____ SPEED _____

RATED GENERATOR KV _____

RATED GENERATOR MVA _____

RATED POWER FACTOR _____

NET MW CAPABILITY (TURBINE) _____ @ 40°F _____ @ 100°F (Rated Output & Power Factor Less Auxiliaries)

SHORT CIRCUIT RATIO _____

FULL-LOAD FIELD AMPERES @ RATED P.F. _____

FIELD RESISTANCE (OHMS) _____

TEMP COEFFICIENT _____

UNIT WR^2 ($Lbs\text{-}Ft^2$) _____ (Combined Turbine-Generator)

H CONSTANT _____ (Combined Turbine-Generator)

VOLTAGE REGULATOR TYPE _____

EXCITER

TYPE _____

KW RATING _____

TURBINE - GENERATOR DATA

VOLTAGE RESPONSE RATIO _____

% SPEED REGULATION _____

SATURATION CURVE NO. _____ (Supply 1 Copy)

VEE CURVE NO. _____ (Supply 1 Copy)

CAPABILITY CURVE NO. _____ (Supply 1 Copy)

EXPECTED TURBINE KW OUTPUT VS. AMBIENT AIR TEMPERATURE CURVE NO. _____ (Supply 1 Copy)

GENERATOR CONSTANTS FOR TRANSIENT STABILITY STUDIES
STATION AND UNIT _____

REACTANCES:. percent, based on rated MVA, KV

SYNCHRONOUS (Xd) _____

SYNCHRONOUS (Xq) _____

TRANSIENT (X'di), (at rated current) (unsat) _____

TRANSIENT (X'dv), (at rated voltage) (sat) _____

TRANSIENT (X'qi) _____

TRANSIENT (X'qv) _____

SUB-TRANSIENT (X"di) _____

SUB-TRANSIENT (X"dv) _____

SUB-TRANSIENT (X"qi) _____

SUB-TRANSIENT (X"qv) _____

NEGATIVE-PHASE-SEQUENCE (X2), (at rated voltage) _____

ZERO-PHASE-SEQUENCE (Xo), (at rated voltage) _____

LEAKAGE REACTANCE (X), (at rated voltage) _____

POTIER REACTANCE (Xp) _____

ARMATURE RESISTANCE, OHMS PER PHASE _____

TIME CONSTANTS: Seconds

Open Circuit (T'do) _____

Open Circuit (T'qo) _____

Open Circuit (T"do) _____

Open Circuit (T"qo) _____

GENERATOR CONSTANTS FOR TRANSIENT STABILITY STUDIES

STATION AND UNIT _____

SATURATION FACTORS:

S1.0 (@ Rated Terminal Volts) _____

S1.2 (@ 120% of Rated Terminal Volts) _____

GENERATION STEP-UP TRANSFORMER DATA

STATION AND UNIT #_____

YEAR INSTALLED _____

MANUFACTURER _____ P.O.# _____

RATED KVA	H WINDING	X WINDING	Y WINDING
55°C Rise	_____	_____	_____
65°C Rise	_____	_____	_____

TYPE _____

PHASE _____ CYCLES _____

H WINDING VOLTAGES AND BIL _____
(INCLUDE ALL TAPS)

X WINDING VOLTAGES AND BIL _____

Y WINDING VOLTAGES AND BIL _____

% EXCITING CURRENT AT 100% RATED VOLTAGE _____

IMPEDANCE _____ % ON _____ MVA BASE

WINDING RESISTANCE

H _____

X _____

Y _____

CURRENT TRANSFORMERS

H Winding _____

X Winding _____

Y Winding _____

Neutral _____

REVISION NO.	1					

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GENERATION STEP-UP TRANSFORMER DATA

PRESENT TAP SETTING:

H Winding _____

X Winding _____

Y Winding _____

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DATA SPEED GOVERNOR

Provide the data constants required for your speed governor and steam turbine systems based on the above generalized block diagram. If your machine cannot be represented by the above block diagram, include a block diagram and the necessary data constants.

SPEED GOVERNOR CONSTANTS		STEAM TURBINE CONSTANTS	
K		T_4	
T_1		T_5	
T_2		T_6	
T_3		T_7	
U_0		K_1	
U_C		K_2	
P_{MAX}		K_3	
P_{MIN}		K_4	

Note: If your governor has the fast valving feature, provide the necessary data.

K_5 _____

K_6 _____

K_7 _____

K_8 _____

EXCITER DATA

IEEE EXCITER TYPE*

DATA CONSTANTS	1	2	3	4	8
K_A					
K_C					
K_E					
K_F					
K_I					
K_P					
K_R					
K_V					
S_{MAX}					
$S_{0.75MAX}$					
T_A					
T_B					
T_C					
T_E					
T_{F1}					

EXCITER DATA

DATA CONSTANTS	IEEE EXCITER TYPE* 1	2	3	4	8
T_{F2}					
T_R					
T_{RH}					
V_{BMAX}					
V_{EMAX}					
V_{EMIN}					
V_{CMAX}					
V_{RMAX}					
V_{RMIN}					

*Fill in column of applicable data constants for the IEEE Exciter type corresponding to your machine.

Exhibit "H"
Telemetry Specification

SPECIFICATION

FOR

REMOTE TELEMETRY OF A CUSTOMER FACILITY

CenterPoint Energy

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

REFERENCE DRAWINGS: Latest Revisions of
CenterPoint Energy, CNP Drawing No.BSC-007-400-02 SH.1 & 2

REFERENCE SPECIFICATIONS: Latest Revisions of
CenterPoint Energy, CNP Specification No. 007-400-01, SCADA RTU
CenterPoint Energy, HL&P Specification No. 007-267-01, Transducer

REFERENCE DOCUMENTS: Latest Revisions of
CenterPoint Energy, Engineering Bulletin No. 19, CNP NAMING CONVENTION
CenterPoint Energy, SCADA ALARMS

CenterPoint Energy HOUSTON, TEXAS		
WRITTEN	12/30/03	C.W. Mogannam
CHECKED	12/30/03	R.M.Secrest
APPROVED	12/30/03	M.W. Furnish
	SHEET 1 OF 10 SHEETS	
	007	400 02

NO	DATE	ITEMS REVISED	BY	CH	APP
5	2/30/04	REVISED FOR EPS METERING COMM	CWM	CWM	MWF

CONTENTS

1. SCOPE

1.1. This specification defines the requirements for the engineering, installation, calibration, and maintenance of remote telemetry at customer owned facilities connected to the CenterPoint Energy (CNP) transmission system.

2. GENERAL

2.1. Remote telemetry in Customer-owned facilities is required for (1) All new Independent Power Producers on the transmission system (2) all new transmission substations, (3) existing transmission substations which are undertaking significant rearrangement or expansion of their existing electrical facilities, or (4) existing transmission substations which CNP or ERCOT considers critical to system reliability.

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

2.2.1. American National Standards Institute (ANSI)

2.2.2. National Electrical Manufacturers Association (NEMA)

2.2.3. Occupational Safety and Health Administration (OSHA)

2.2.4. Federal Communications Commission (FCC)

2.3. In the event of conflicting requirements, the order of precedence shall be the applicable federal, state, and local laws and regulations, this specification, and other referenced CNP specifications.

2.4. CNP will specify the Supervisory Control And Data Acquisition (SCADA) Remote Terminal Unit (RTU). The Customer must provide interface equipment consisting of items such as transducers, status and alarm contacts, cabling, terminal blocks, conduit, and communication equipment. All equipment shall be furnished and installed by the Customer unless otherwise noted in this specification or agreed to by separate agreements.

2.5. Equipment specified may be substituted with written approval from the CNP Substation Systems Engineering Division.

2.6. All SCADA equipment shall be readily accessible to CNP personnel.

3. SCADA SYSTEM

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

3.2. Analog Subsystem: The analog subsystem consists of various customer-supplied transducers which send a ±1.5 mA signal to the SCADA RTU or an Intelligent Electronic Device (IED) such as a Electronic meter that can communicate various data via DNP3 or Modbus. CNP will determine the transducer electrical requirements. The Customer shall provide an electrical relay and metering one-line diagram of the existing or proposed Customer-owned substation.

3.2.1. Single phase (AØ) watt monitoring and single phase (AØ) var monitoring are required for each power flow into or out of the substation busses. These include (1) CNP transmission line power flows and (2) loads or auxiliaries connected to the substation busses. See table 1 for acceptable transducer models.

3.2.2. Single phase(AØ) bus voltage monitoring is required for each substation transmission bus equipped with a Potential Transformer (PT). See Table 1 for an acceptable voltage transducer models.

3.2.3. IPP Customers shall provide Net Watt and Var monitoring of all generators. A phase, B phase, C phase, and three phase values shall be supplied to the SCADA RTU. All other power flows can will be three phase values.

3.2.4. Substation Systems Engineering will determine the voltage monitoring requirements for single tap Customer-owned substations.

3.2.5. Meter test switches are required for each transducer's current and voltage connection. Single phase test switches are specified in Table 1.

TABLE 1

ACCEPTABLE ANALOG TRANSDUCERS AND TEST SWITCHES

Company	Model No.	Quantity	Description
Scientific Columbus	XL342K5A4 and XLV342K5A4	One per IPP power flow	Three phase Watt Transducer
Scientific Columbus	XL5C5A4 and XLV5C5A4	One per power flow	Single phase Watt and Var Transducer
Scientific Columbus	VT110A4	One per substation bus	Voltage Transducer
Durham	1060	One per each transducer	Three Phase Test Switch
Durham	1022	One per each transducer	Single Phase Test Switch

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

3.3.1. Status of transmission voltage breakers or other devices directly affecting the CNP electrical system as determined by CNP shall be required. Status shall be derived from either an isolated auxiliary "a" contact in the breaker or monitoring primary trip coil of the breaker. Refer to Fig.1 for Breaker Status Connections.

3.3.2. Indication of low voltage and battery charger failure is required for the 130 VDC battery system(s). For new installations, a charger that has low voltage, high voltage, loss of AC input, and loss of charger output indications shall be provided. A single alarm shall be generated by connecting in parallel the normally open contacts for these indications. For existing installations a charging system monitor (F Squared Industries, Model CSM2-130, EVA) shall be installed by the customer to provide the Alarm.

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.

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

3.4.1. All 69KV, 138KV, or 345KV circuit breakers that directly affect the CNP transmission system as determined by CNP require remote control by CNP. Should CNP require the control of any additional breakers, these items will be indicated by CNP on an Electrical One-Line diagram.

3.4.2. Dual remote control (control of a breaker by both the Customer's and CNP's control center) is not permitted.

3.4.3. Circuit breaker control shall be through the control subsystem of the SCADA RTU. Figure 1 illustrates how SCADA control will interface with a typical breaker control scheme.

3.4.4. Carrier control shall be installed for all CNP lines that are equipped with carrier relaying. A contact from the SCADA RTU shall be installed in the carrier squelch circuit. See figure 2 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 breakers controlled.

4.1.1. A free-standing cabinet will require a maximum area of dimensions 36" wide by 36" deep and 90" tall. Each cabinet may have front and rear access. Clearance of 40" in front of both doors shall be reserved for maintenance access. Substations with more than ten breaker control points will require two cabinets.

4.1.2. A Wall mounted cabinet will require a maximum area of dimensions 36" wide by 36" deep and 90" tall. Each cabinet will have front access. Clearance of 40" in front of the door(s) shall be reserved for maintenance access. Substations with more than ten breaker control points will require two cabinets.

4.2. Connections by the Customer: The Customer shall install all interconnections between the SCADA RTU and the substation control house.

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.

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

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. The color code shall conform to Figure 1.

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 trough 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 (l00) ohm, eleven (11) watt resistor (Ohmite style 995-10A) and a zener diode (Motorola type IN3051A) 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. Durham 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 1.