Orange & Rockland
a conEdison, inc. company

ORU-ENGR-6B-001

FACILITY INTERCONNECTION REQUIREMENTS

Transmission and Substation Engineering Department
January 31, 2022

Revision History

Revision No.	Author	Revision	Date
0	R. Mangonon	Original	3/31/2020
1	R. Mangonon	First	01/31/2022

TABLE OF CONTENTS

I. INTRODUCTION 5

II. GENERAL REQUIREMENTS 5

III. SUBSTATION CONFIGURATIONS 5-7

Interconnection at an Existing Substation 5

Interconnection at a New Substation 6

IV. TECHNICAL REQUIREMENTS 7-17

A. Circuit Breakers 7

B. Current Transformers 8

C. Potential Transformers 8

D. Disconnect Switches 9

E. Surge Arresters 9

F. Grounding 10

G. AC Service Station 11

H. DC Service Station 13

I. Wiring Methods 14

V. SYSTEM PROTECTION 18-22

A. Generator Protection 18

B. Transmission Protection 19

i. Bus Protection 20

ii. Line Protection 21

iii. Breaker Failure Protection 22

C. Direct Current (DC) Power Systems 22

TABLE OF CONTENTS

VI. SUPERVISORY CONTROL & DATA ACQUISITION (SCADA)..... 23

A. Supervisory Control and Status Monitoring 23

B. Communication with Developer/Requested Party RTU 23

VII. COMMUNICATIONS..... 24

VIII. METERING.....25-26

A. Revenue Metering 25

B. Control Metering 26

IX. ORU/RECO CONTACT 27

I. INTRODUCTION

The purpose of this document is to provide the general, technical, and operational requirements necessary for safe and reliable interconnection of new facilities into the Orange and Rockland Utilities, Inc. / Rockland Electric ORU/RECO ("ORU/RECO") transmission system. This document should be in conjunction with ORU-ENGR-6A ("Facility Connection Informational Kit").

II. GENERAL REQUIREMENTS

Interconnections to the ORU/RECO's transmission system must be consistent with ORU/RECO's substation and transmission design standards and with standard utility practices. Any proposed interconnection must not degrade the reliability, operating flexibility or safety of ORU/RECO's existing transmission system

At a minimum the following codes and standards shall be followed:

NESC C2-2017 – National Electric Safety Code
NFPA – National Fire Protection Association
NFPA 70 National Electric Code (NEC)
OSHA – Occupational Safety and Health Administrations

III. SUBSTATION CONFIGURATIONS (BREAKER ARRANGEMENT)

At the 69 and 138 kV voltage levels, a developer and/or requesting party can interconnect to an existing substation or to a new substation at the location of its choice (for specific breaker arrangements see latest version of ORU-ENGR-6A).

Interconnection at an Existing Substation

The existing substations at the 69 and 138 kV voltage levels are mostly designed with a straight bus, breaker and a half, or ring bus configurations. Connection to an existing substation would depend on the substation configuration and would be designed to comply with ORU/RECO's Transmission Planning Criteria and system operational requirements.

ORU/RECO shall specify the protection system design and provide all settings for protective systems that protect ORU/RECO equipment.

Interconnection at a New Substation

The requesting party may elect to build interconnection facilities on greenfield sites such as new substations and transmission lines. Under this option, the developer will engineer, design, procure, construct and commission greenfield interconnection facilities that will be owned by ORU/RECO. The requesting party shall hire contractors and vendors that adhere to ORU/RECO standards and use standards/specifications with ORU/RECO's oversight and approval.

ORU/RECO shall specify the protection system design and provide all settings for protective systems that protect ORU/RECO's equipment.

The developer and/or requesting party shall coordinate the schedule for its work with ORU/RECO to ensure that its requests for oversight/approval are matched with ORU/RECO's resources.

Connection to ORU/RECO's 138 kV system shall be made using a four (4) breaker ring bus configuration. If more than one transmission line is affected the number of circuit breakers in the ring bus will be adjusted accordingly. Connection to ORU/RECO's 69 kV system shall be made by a three (3) circuit breaker configuration. If two (2) or more lines are affected a ring bus configuration shall be used (see latest version of ORU-ENGR-06A for the diagrams).

Adding a fourth source to a three terminal line or a third source to a two-terminal line limits the effectiveness of the protective relay schemes and reduces system reliability. This type of configuration can limit the amount of power that can he supplied by the weakest source to the line, cause compromises and degradation of line protection, and limit the transmission availability to the developer. ORU/RECO typically does not allow three terminal line configurations for generator interconnects and the line will be broken into two lines. A three-breaker T tap or a ring bus will used if connecting to an ORU/RECO substation is not feasible. New line protection packages will be needed for the new lines created by splitting the existing ORU/RECO line to accommodate the generator.

IV. TECHNICAL REQUIREMENTS

A. Circuit Breakers

1. All circuit breakers installed within the ORU/RECO substation switchyard or switching stations shall adhere to ORU/RECO numbering system. All switches to be operated by ORU/RECO will be locked with locks furnished by ORU/RECO.

2. Circuit Breaker ratings shall comply with the latest editions of IEEE C37.011, ANSI C37.04 and NERC requirements and must be in accordance with ORU/RECO methodologies in determining facility ratings. ORU/RECO prefers a breaker with standard TRV ratings as per IEEE C37.011 without the use of surge grading capacitors (see **Table 1**).

3. Outdoor Dead Tank SF6 Puffer power circuit breaker design with electrical ratings as follows:

Table 1: Circuit Breaker Ratings

Characteristic	**69kV**	**138kV**
Maximum Voltage, kV	72.5	145
Continuous Current, A	2000	2000
Frequency, Hz	60	
Interrupting Current, kA	40	40
Interrupting Time, cycles	3	2
Basic Impulse Level, kV	350	650
Peak Withstand, kA	104	104
Duty Cycle	O-0.3s-CO-15s-CO	

B. Current Transformers

1. Two sets (two per pole, 12 in total) of 2000/5A multi-ratio, 10C800 & 0.3B1.8 dual accuracy class CTs shall be provided.

2. CTs shall have a thermal rating of 2

3. The tap ratios of multi-ratio current transformers shall conform to ANSI Standard C57.13.

4. The design must allow for the addition of dedicated metering grade CTs for interstate line revenue metering. ORU/RECO will request this option on breakers in the specific PO. No more than 10 breakers are expected to need this option.

5. For each current transformer design, the manufacturer shall furnish ORU/RECO with two (2) copies of calculated (or typical) ratio and excitation curves. Ratio curves shall be shown at 50VA burden (at 5 amperes). This information shall be furnished for each tap of multi-ratio current transformers.

6. Nomenclature, location and arrangement of outgoing terminal pads for ORU/RECO use will be provided to the successful vendor. Internal wiring, location of apparatus, etc. is the manufacturer's responsibility.

C. Potential Transformers

1. The potential transformers shall have two (2) split secondary windings rated for 115 V and 67.08 V.

2. At 69 kV the BIL shall be 350 kV and at 138 kV the BIL shall be 650kV.

D. Disconnect Switches

1. The developer and/or requesting party shall install the Disconnect Switches with the following specifications (see ***Table 2***):

Table 2: Disconnect Switch Specifications*

CHARACTERISTICS	69 kV	138 kV
Maximum Voltage (kV)	72.5	145
Continuous Current (A)	2,000	2,000
Frequency (Hz)	60	60
Short Circuit Symmetrical Withstand RMS – 3 sec (kA)	30	63
Peak Withstand (Sec)	3	2
Basic Impulse Level (kV)	350	650

*ORU/RECO uses Southern States Type EV-2 disconnects.

E. Surge Arresters

1. The developer and or requesting party shall install Surge Arresters with the following specifications (see ***Table 3***):

Table 3: Surge Arresters Specification

CHARACTERISTICS	69 kV	138 kV
Maximum Voltage (kV)	72.5	145
MCOV – RMS (kV)	48	98
Duty Cycle (kV)	60	120
Frequency (Hz)	60	60

F. Grounding

1. Soil resistivity tests shall be performed in accordance with the recommendations of IEEE Guide 81 prior to designing the ground grid; design the ground grid with 0.8-ohm resistance maximum, the breaker interrupting of 40kA and 0.3s time.

2. All station ground mesh shall be determined by the grounding study but not less than 19#9 Copperweld and shall be buried a minimum of 24 inches below grade.

3. All underground connections shall be made by the Cadweld process.

4. A minimum of two pigtail connections determined by the grounding study but not less than 4/0 AWG stranded copper (.528" OD), extending three (3) feet above top of finished foundations, shall be provided to ground electrical apparatus and structures.

5. Ground Rods shall be 3/4" diam. X 10' long Copperweld unless otherwise noted on plans.

6. Ground Enhancement Material (GEM) shall be manufactured by ERICO.

7. Ground Rods shall be installed driven or drilled to their full length.

8. Grounding wire shall be 19 #9 Type DSA, 40% conductivity Copperweld for the station grounding grid and fence cable risers (pigtails). Equipment and structure cable risers (pigtails) shall be 4/0 AWG stranded copper wire.

9. Grounding wire shall be installed a minimum of 24" below finished grade. Continuous lengths shall be used as much as possible to avoid buried splices.

10. Grounding connections shall be by Cadweld Process, unless indicated otherwise on the Contract Drawings. All cable connections shall be made using connectors as noted on the drawings Conductors must be thoroughly cleaned before making welds. All Cadweld splices shall be made in accordance with Cadweld instructions.

11. If rock is encountered during the installation of the ground rods, and approved by ORU/RECO, the Vendor shall install ground enhancing material (GEM) in the grounding hole.

12. Cable trenches and all conduits entering cable trenches through the openings in the bottom must be grounded. All GI conduits entering cable trenches shall terminate just inside the trench wall and be capped with a nylon-insulated grounding bushing.

13. A continuous length of 19#9 Copperweld wire shall be installed inside any new cable trench.

14. Each conduit installed in a equipment control cabinet or mechanism housing shall have a #2 CU. pigtail installed on a Nylon Insulated Grounding Bushing and shall be continuous with the station ground grid and connected with a compression fitting.

15. The continuous length of Copperweld wire inside a cable trench (if installed) shall be bonded to the Substation ground grid at both ends.
16. The ground system must be tested by the developer and/or requesting party using the resistance measurement procedures in accordance with IEEE Standard 81 "Recommended Guide for Measuring Ground Resistance and Potential Gradients in the Earth". The results shall be shared with ORU/RECO/RECO prior to energizing the developer and/or requesting party facilities. By ORU/RECO/RECO energizing the developer and/or requesting party facilities, it shall not be construed as ORU/RECO/RECO approval of the adequacy of the developer and/or requesting party facility.

G. AC STATION SERVICE

The Vendor shall calculate the actual service size required and then coordinate with the Company for station service rated for three phase 120/208 volts. Typical Company pad-mount sizes for 13.2/7.620kV -120/208V (95kV BIL) are:

kVA	Primary Bushing Size (Amps)
75	200
150	200
300	200
500	200
750	200
1000	200

Company requests two AC station services, Normal and Backup. If two independent sources are not available, one source shall be taken from a nearby distribution circuit the backup shall be a diesel generator.

Each station service source (two-pad-mount transformers or a pad-mount transformer and diesel generator) shall account for the full load of the station.

Transfer switching scheme shall be provided to interconnect the normal and backup power sources.

Vendor shall arrange the temporary service supply for use during construction thru the Company's New Business Department. See section 8.3 for more details.

The Vendor shall design the three phase 208/120 VAC systems in the control module considering the following constraints:

The AC station service shall be metered at the service entry point to the substation or the control house in accordance with Company standards using the Company provided Milbank Meter Mounting Device or approved equal, 200A, 208VAC, catalog number U1854-XL-QG-BLG-LI.

Panels shall be Cutler-Hammer Type PRL1A AC panels or approved equal. Each panel shall be fed thru a Cutler-Hammer Type DH; Model Number DH324NGK, fused, general duty type safety switch or approved equal.

A/C Panel(s) design shall consider the station load requirements and

separation to provide sufficient number of breakers with a minimum of 20% spare. Two (2) Cutler-Hammer Type PRL1A A.C. panels or approved equal, 225A copper bus with main lug connections, 42 branch circuits with 1-100A/3P, 1-35A/3P, 2-20A/2P, 2-30A/1P and 12-20A/1P breakers. Panel shall be as per O&R standard C-57-058. Two (2) Cutler-Hammer Type PRL1A A.C. panels, 225A copper bus with main lug connections; top entry; 42 branches or approved equivalent with 1-100A/3P; 1-60A/3P; 1- 50A/3P; 2-20A/2P, 2-30A/2P and 10-20A/1P; 8-30A/1P and 7- 15A/1P breakers.

H. DC Station Service

The Control module will be equipped with an Exide 125 volt DC Battery system utilizing (20) 3CA-5 battery units with a single depth 2 tier rack and battery charger type MCRF; 120 VAC input. The battery charger shall be one (1) MCRF130-12E microprocessor-controlled battery charger/eliminator to operate from a 120/240 volt single phase AC source with 12 ampere DC capacity and filtered to less than 30 mV ripple manufactured by Exide. The charger is capable of supporting the loads (to its current limit) with the battery disconnected. The unit is complete with AC and DC circuit breakers; temperature compensation with a 20-foot cord; 0-255 hour auto equalize timer and lamp; 1% Digital LED meter to Vdc, Adc, timer hours and alarm settings; in a NEMA 1 cabinet finished in ANSI 61 gray paint. Alarms include AC failure, DC failure, Hi volts DC, Lo volts DC, Positive Ground Fault, Negative Ground Fault, and summary alarm contact for remote annunciation. A disconnect switch to separate the batteries and an exhaust fan shall also be provided.

The switchgear should consists of two (2) Cutler-Hammer Type PRL2A D.C. panels or approved equivalent, 2 pole; 125 VDC; top entry; 225A copper bus with main lug connections, 36 branch or approved equivalent with 15-30A/2P, 15-20A/2P, and 2-15A/2P breakers with one (1) Exhaust Fan for Ventilation of Control House. (In addition to battery system fan.)

DC systems must be monitored to detect abnormal voltage levels, both high and low, DC grounds and loss of AC to the battery chargers. Capacitor trip and AC to DC converters are unacceptable.

One (1) 5ft. x 3ft. desk for use with station computer (furnished by O&R). Computer desk will have ability to route cables to panels and RTU for connection to relays and RTU.

Stick file wall attachment hardware for company drawing storage.

Two (2) fire extinguishers shall be provided at opposite corners in the control module.

A copper ground bus bar shall be provided above the floor along the perimeter of the module. This may be secured to the wall.

I. Wiring Methods

1. The cables shall be installed in accordance with manufacturer's recommendations on minimum pulling temperatures, minimum sidewall pressure, and maximum pulling tension. All cable ends shall be sealed from contamination during the pulling operation, and during storage on cable reels.

2. Unless otherwise noted, all cable furnished under this specification shall be manufactured and tested in accordance with the current applicable specification of the Insulated Cable Engineer's Association (ICEA) and the American Society of Testing and Materials (ASTM). In case of differences, the ICEA requirements shall govern.

3. Cables shall not contain PVC or paper fillers.

4. Any communication or control cables installed in air handling plenums shall be UL 910 plenum rated.

5. Control and power wiring shall be SIS copper conductor with solid, continuous sheath, moisture/oil/flame resistant, 90 deg. C, cross-linked polyethylene (XLPE)

insulation, rated 600 volts, and meet the IEEE 383 Vertical Tray Flame Test criteria. Only stranded wire of adequate ampacity shall be used.

6. If wire other than specified is to be used, the vendor shall submit all its specifications for the Company's review.

7. Multi- conductor cables, 600V class, used for control applications shall follow UL and ICEA standards. The required number of insulated conductors shall be arranged in a NEMA standard color sequence, in a round configuration, covered with a taped or extruded flame-retardant barrier, and with a CPE thermoset or CSPE jacket overall. Tripping circuits shall be wired with shielded multi-conductor cables having a longitudinally applied 5 mil copper tape between a suitable bedding material and the overall cable jacket.

8. Shielded cable for tripping circuits and shielded twisted pairs for control and metering circuits shall be used.

9. Cable shields shall be installed in accordance with the recommendations of IEEE Guide C37.122.1 Section 4.3.2.

10. Cables shall carry the manufacturer's identification, number of conductors, conductor material, and size printed on the outer jacket for the entire length of the cable.

11. The Vendor shall Megger® cables. Any defective cable installed is the responsibility of the Vendor and shall be removed and replaced by the Vendor. The Vendor is responsible for off-site disposal of empty nonreturnable cable reels.

12. Wiring shall be neatly arranged and clamped securely to panels to prevent movement or breakage. Except as otherwise provided in standard vendor supplied packages, a bundle shall have a maximum of 12 wires in order to facilitate tracing wires.

13. Conductors shall not travel over sheet metal edges or through punched holes without proper mechanical protection. The intent of this is to avoid chafing, cutting, or other abrasion damage to the conductor insulation.

14. Wiring clamps and supports at hinge transition points shall be properly sized to

prevent chafing of insulation when the cubicle door is opened and closed. Metal clamps must have insulating inserts between the clamps and wiring. Nonmetallic clamps are preferred.

15. All control wiring shall be #12 AWG except for CT circuits which shall all be #10 AWG. See table below.

16. All heater connections shall be made with heat resistant wires. The manufacturer shall specify the wire in the bid proposal.

17. Single conductor wires shall be used on all power circuits. The paralleling of several equivalent smaller wires in place of a single wire is not acceptable.

18. Twenty (20 %) percent spare terminal points are required. A minimum space of 3 inches shall be provided adjacent to the terminal block for making external connections.

19. A permanent marking strip, identified in accordance with the Vendor's wiring diagrams, shall be furnished on each terminal block.

20. No terminal blocks are to be mounted on a swing panel.

21. In the event of multiple rows of adjacent terminal blocks, a minimum 6-inch space between rows shall be provided. The lowest terminal block shall be a minimum of 10 inches from the cabinet bottom.

22. In the rare instances when sliding-link terminal blocks must be mounted horizontally, they should be mounted so that the links fall closed when unscrewed. Not more than two wires shall be landed on any one terminal.

23. The terminal blocks shall be States Company Catalog No. ZWM 250 sliding link type terminal blocks.

24. All cables and wires shall be continuous between terminations. Splicing of any wiring is not permitted.

25. Non-PVC insulated, tin plated copper ring-tongue terminal lugs shall be used for all terminations.

26. All wires shall be labeled at each end using white tubular plastic wire markers securely gripping the wire. Adhesive markers are not acceptable. All identification markings shall coincide with the schematic and wiring diagrams. The imprints shall be in black color, legible and non-fading.

27. Cable ampacities shall be based on 40 deg. C ambient temperature for indoor installation, 35 deg. C for outdoor and 30 deg. C for below grade installations. The following cables are standard cable sizes used in Company-designed substations:

Wire Size	Conductors	Applications
#10	5 Conductor	CT Leads, PT Leads, Control & Indication
#10	7 Conductor	Potential Leads between PT's & Junction Box
#10	12 Conductor & 10 Conductor	Control & Indication
#8	2 Conductor	AC & DC Power
#16	2 Conductor & Multi-pair	Metering & RTU Inputs
#10	3 Conductor	Floodlighting
#12	1 conductor	Switchboard wiring between panels

28. A maximum of two conductors only shall be terminated at any one terminal point. No solder terminal connections shall be used.

V. SYSTEM PROTECTION

The developer and/or requesting party shall meet the ORU/ RECO protection relaying system requirements that are necessary for a safe and reliable parallel operation of both the customer's equipment and the ORU/ RECO transmission system. The protective relaying systems shall meet or exceed all applicable NERC, NPCC, RF, NYSO, PJM and ANSI/IEEE Standards. The protective relaying design shall be utility grade and provide proper coordination of speed and sensitivity necessary to maintain the stability, security and reliability of ORU/RECO system.

The developer and/or requesting party shall perform relay coordination, short circuit, stability and other studies and analyses as deemed necessary by the ORU/RECO for the interconnection of the requesting party's facility with the ORU / RECO system. The Company shall have the right to review such studies and analyses and require changes to design parameters if necessary, to keep within equipment capabilities.

The protection system (Protective Relays, Voltage & Current sensing equipment, DC Battery & Control circuits) configuration selected by the interconnecting customer shall be approved by ORU/RECO. The protection system shall also be compatible with existing protection system used on ORU/RECO transmission system.

The specific relay requirements for any interconnection to the ORU/RECO system can vary over a wide range. Based on the requesting party's specific project data on generation capacity and location, ORU/RECO will review relay requirements necessary to interface with the ORU/ RECO's existing protection and provide guidance to the requesting party as required.

A. Generator Protection

Generation resources (Synchronous or Inverter-based) connected to the ORU/RECO transmission system are responsible for providing means of protecting their facilities from electrical disturbances and other system conditions as determined by the system impact study.

Generator Protection system shall meet the requirements for stable operation during temporary system conditions such as voltage, frequency and power excursions to

avoid the creation of the cascading grid events.

Isolation of all faults on the requesting party's premises and the interconnection to the ORU/RECO system. The customers protective equipment shall isolate faults while maintaining coordination (where possible) between relaying systems of the requesting party and ORU/ RECO.

Automatic opening of the requesting party's generator of intertie circuit breaker upon loss of the ORU/RECO's supply feeder (either for work or system fault). The requesting party's circuit breaker shall be prevented from closing into de-energized ORU/RECO equipment.

The intertie circuit breaker shall be automatically locked out and prevented from being closed into a de-energized ORU/RECO system or partially de-energized system (loss of one phase).

With the increasing number of customer owned generation in the ORU/RECO system, ORU/RECO has developed increasing concern with system stability. The customer shall carefully investigate the stability limits, both steady-state and transient of the interconnecting generating station.

B. Transmission Protection

All elements (Buses, Lines, Transformer, and breakers) of the interconnection tie at transmission system voltage shall be protected by dual protective relaying systems, each of which is independently capable of detecting and isolating all faults thereon, without undue disturbance to the ORU/RECO system.

Use of two identical protection systems is not recommended due to the risk of simultaneous failure of both systems because of design deficiencies and equipment problems.

The protection system design shall avoid the use of components common to the two systems. Complete separation (both electrical and physical) as described in NPCC Document D-4 for system protection criteria, may be required between the two lines of protection.

All protective relays and lockout must be equipped with test switches to facilitate

testing and maintenance. The type of test switches used shall be approved by ORU/RECO.

Each protective relay shall be fed from a dedicated DC circuit. A lockout relay shall have an independent DC circuit when energized by more than one protective relay. The type of lockout relay used shall be approved by ORU/RECO.

The first and second system of protection relays shall be supplied from separate current transformers and separate windings of voltage transformers or coupling capacitor potential devices.

All protective relays shall be provided with digital (contact status) inputs from breakers within its protection zone and the associated lockout relays. Status contact inputs from breakers, when necessary, may include both a form “a” and form “b” contact from the equipment depending upon the input capabilities of the relay.

The spare inputs/outputs for each digital relay shall be wired to FT switches and terminal block based on the availability and Company Protection engineer requirements.

The critical failure contact of all protective relays shall energize a station alarm input.

All protection system devices, with time synchronization capability, shall be connected to a GPS satellite time source, using IRIG-B protocol. The satellite-synchronized clock device shall be approved by ORU/RECO.

i. Bus Protection:

The relay protection of each bus section associated with the transmission interconnection shall be comprised of redundant systems of Bus Differential relays. The type of bus differential relay used shall be approved by ORU/RECO.

The Bus Differential Relays shall each trip a separate lockout relay, which will trip, block the closing and initiated breaker failure logic of all breakers required to isolate the bus section.

ii. Line Protection:

The type of protection for underground and overhead transmission feeders vary widely and will be defined by the characteristics of the specific interconnection circuit.

Each interconnection tie line protection shall be comprised of redundant protective systems; each capable of independently protecting for faults on the entirety of the line. The line protection system shall also be configured to provide backup protection for adjacent lines and buses protection systems if they fail to operate.

Generally, communication assisted protective schemes (e.g. Line Current Differential, DCB, DCUB, POTT, etc...), in conjunction with some form of backup protection (e.g. stepped distance and ground inverse time overcurrent elements) shall be required.

Direct transfer tripping utilizing dedicated communication channel is required for backup protection and islanding schemes.

Protection upgrades to existing remote terminals will be determined by ORU/RECO.

- **Inter Relay and Direct Transfer Trip Communication:**

  The communication facilities shall have a degree of reliability no less than that of the other protection system's components. Where communication channels are required in each of the two protection systems, the channels shall be separated physically and designed to minimize the risk of both channels being disabled simultaneously by a single event. The use of fiber optic is recommended to obviate the problems associated with electromagnetic induction.

  ORU /RECO requires that a communication channel be installed, at requesting party's expense, as part of the relay protection scheme. This channel may be a leased telephone circuit, power line carrier, pilot wire circuit, microwave, or other means to be determined by ORU / RECO.

Wave traps are required wherever power line carrier is being used to transmit a high frequency carrier current signal over the power conductors. The signal frequency must be selected not to interfere with existing communication circuits.

iii. Breaker failure protection

Each breaker associated with the transmission interconnection shall have redundant breaker failure protection system. The breaker failure protection may be implemented via dedicated relays or within the bus or line protection relays depending on the interconnecting location and voltage level. If dedicated breaker failure relays are required, the type of relay used shall be approved by ORU.

The breaker failure protection systems will each trip a dedicated breaker failure lockout relay; which will trip and block the closing of all breakers associated with the isolation of the failed breaker.

In a configuration where a remote terminal breaker needs to be isolated by a local breaker failure protection, direct transfer trip scheme will be required. Two separated lines of transfer tripping shall be required for remote tripping between Company and customer terminals.

Transfer tripping can be incorporated into the protective relay system or be separate.

The specific type of transfer trip scheme to be used for the interconnection shall be coordinated with the ORU/ RECO's existing protection at the location of the interconnection.

C. Direct Current (DC) Power Systems

DC supplies associated with the interconnection system's protection and power circuit breaker(s) close and Trip coils must have a high degree of reliability. The DC system design shall be in accordance with the NPCC "Bulk Power System Protection Criteria." (See similar specification under **Technical Requirements Section H** above).

VI. SUPERVISORY CONTROL AND DATA ACQUISITION (SCADA)

A. Supervisory Control and Status Monitoring.

ORU/RECO shall have supervisory control of all breakers, circuit switchers; motor operating disconnects, transformers LTC, and electrically reset lockout relays. Each supervisory controlled device shall have a status monitoring feedback to ORU/RECO control center. All lockout relays shall have status monitoring to report to ORU/RECO control center.

B. Communication with Requested Party RTU.

In order to exchange data, ORU/RECO RTU and developer and/or requesting party RTU shall have client-server and server-client communication channels. The communication shall utilize DNP 3.0 protocol.

C. Control Metering.

Each transmission line and each transformer shall have digital metering device to measure RMS voltage and current for each phase, total Watt, and total VAR. Each interconnection point with a Requested Party shall measure energy Watt-hour and VAR-hour.

VII. COMMUNICATIONS

The developer and/or requesting party shall provide communication facilities sufficient to meet ORU/RECO fiber, telephone, radio, system protection, remote meter reading and Energy Management System/ Supervisory Control and Data Acquisition (EMS/SCADA).

The developer and/or requesting party shall also provide the communication channels and channel hardware following ORU/RECO specifications on type, speed and characteristics of the communication channel equipment. This is to ensure that compatibility with ORU/RECO's existing communications, supervisory control, relaying and telemetering equipment is maintained. The specific type of communication equipment to be furnished by the requesting party will be reviewed and approved by ORU/RECO. The requesting party shall also reimburse ORU/RECO for any costs of additional communication facilities provided by ORU/RECO.

VIII. METERING

A. Revenue Metering

The requesting party desiring to sell power to ORU/RECO, subject to ORU/RECO's approval , shall install, own and maintain all facilities necessary to accommodate ORU/RECO metering. All meters shall be provided by ORU/RECO at the requesting party's expense. Meters shall be capable of bi- directional registration so that deliveries to and from the requesting party's equipment can be separately recorded and treated as separate transactions under the applicable rate or price schedule.

The metering requirements vary with the amount of power delivered to ORU/RECO system. All facilities with a total output greater than 1000 KW shall have equipment to:

1. Measure and record the following:
   - 28.1 Energy in KHW (delivered to and purchased from the developer and/or requesting party;
   - 28.2 Reactive in KVAR;
   - 28.3 Volt squared hours;
   - 28.4 Power failure, and;
   - 28.5 Time of delivery

29. Measure and register by a solid state or digital recorder, quantities as specified above. Provide ORU/RECO with the ability to remote access equipment via dial-up telephone or Wi-Fi connections.

Current transformers to be used for revenue metering circuits must meet the accuracy standards, as specified by the American National Standards Institute (ANSI) C57.13, for an accuracy class of 0.3 percent on all burdens. Current transformers shall have a thermal rating factor of 2.0.

Voltage transformers to be used for revenue metering circuits must meet the accuracy standards, as specified under ANSI C57.13, of 0.3 percent accuracy with "W" through "Z" burden for 25 kV and above.

B. Control Metering

1. ORU/ RECO requires that all facilities connected to the transmission system shall have equipment continuously telemeter the following data to ORU/RECO Energy Control Center (ECC) provided at the expense of the requesting party:
    1.1. Instantaneous generated net rea] power in MW;
    1.2. Instantaneous generated reactive power in KVAR
    1.3. Transmission line voltage in KV;
    1.4. State of all interconnection circuit breakers and other switching devices; and,
    1.5. Frequency (Hz).

2. Additional telemetry requirements may be imposed upon facilities to satisfy the requirements of the NYISO or PJM.

3. Telemetering of generation and transmission data is required to enable the system dispatchers to monitor the power system continually. During major disturbances or transmission line outages, this information becomes a critical requirement in the rapid restoration of service. This data will be provided through the installation of a Remote Terminal Unit (RTU) in the requesting party's facility. The RTU shall be per ORU/RECO specification. The cost of the procurement, installation, calibration, and commissioning of this equipment shall be the expense of the requesting party.

IX. ORU / RECO CONTACT

For questions and inquiries regarding these facility connection requirements, please contact the following:

Chief Engineer
Transmission & Substation Engineering Department
Orange and Rockland Utilities, Inc. / Rockland Electric ORU/RECO
390 West Route 59
Spring Valley, NY 10977