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Refer to last page of document for electronic approvals of latest revision.			



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Design Criteria for Developer Connection to the New York Power Authority Transmission System

1 INTRODUCTION

1.1 Intent

The Design Criteria for Developer Connection to the New York Power Authority Transmission System (DCDC) is a guide for Developers proposing an interconnection with the New York Power Authority (NYPA) transmission system or generation facility. A Developer is defined as any interconnecting entity.

No guideline can anticipate all the specific requirements for a project to be designed and constructed in the future. Requirements change with specific or unique project conditions and as regulatory agencies update rules or regulations, or as NYPA practice changes. The Developer shall consider requirements in the DCDC to be the minimum requirements. Where specific requirements are not indicated within this document, the design shall be based on recognized industry standards and good engineering practice.

As they are well-defined relative to other types of interconnections, the detailed requirements for interconnection of generation projects are the focus of this document. Transmission expansion or end-user load interconnections may be subject to additional or slightly different requirements, as may be set forth by NYPA for the specific application. In addition, Developer shall use project-specific interaction with NYPA including correspondence, and meetings/meeting notes to prepare the project-specific design for submittal to NYPA. The NYPA accepted design will govern.

1.2 **In this document, the word “shall” means that provisions are mandatory. The word “should” indicates provisions that are generally practical. For exceptions to “shall” or “should” provisions, the Developer shall submit specific requests including proposed/recommended resolution and explanation and obtain NYPA acceptance prior to proceeding. “Or equal” or “or equivalent” means “or NYPA accepted equal/equivalent”; “accepted” means “NYPA accepted”; “including” means “including, but not limited to”. “Switchyard” is used to identify the substation or switchyard which Developer shall provide for NYPA ownership that NYPA will operate subsequent to construction and turnover. Objective**

This document provides the Developer; requirements and guidance for connecting to NYPA's generation facilities or transmission systems as required by North American Electric Reliability Corporation (NERC) FAC-001 – Facility Interconnection Requirements. This document includes the design criteria/ minimum requirements for the design and installation of equipment to be connected to the NYPA generation facilities, and the NYPA transmission system at the 115 kV, 230 kV or 345 kV voltage levels. Specific requirements for connection to the 765 kV transmission systems have not been provided as these connections are not considered viable developer interconnection but can be provided on request.

1.3 **General Requirements**

The Developer proposing to interconnect with NYPA's generation facilities or transmission systems shall contact the New York Independent System Operator (NYISO), notify the NYISO of their intention for an interconnection, and follow the NYISO



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Open Access Transmission Tariff (OATT) Interconnection Process. These processes can be found on the NYISO web site at the following link: ["https://www.nyiso.com/viewassets/-/asset_publisher/GXU3ESEMStFM/content/comprehensive-system-planning-process-flow-banner?_com_liferay_asset_publisher_web_portlet_AssetPublisherPortlet_INSTANCE_GXU3ESEMStFM_groupId=20142"](https://www.nyiso.com/viewassets/-/asset_publisher/GXU3ESEMStFM/content/comprehensive-system-planning-process-flow-banner?_com_liferay_asset_publisher_web_portlet_AssetPublisherPortlet_INSTANCE_GXU3ESEMStFM_groupId=20142). The specific process to follow depends on the specific attributes of the proposed projects and its related interconnection.

The Developer shall adhere to NYPA applicable processes and policies in execution of the project, including the design, construction, quality assurance, and documentation processes.

NYPA is divided into four major regions: Western (Niagara (NIA)), Northern (St. Lawrence (STL)), Central (Utica and Blenheim Gilboa (BG)), and Southeast New York (SENY). There may be different requirements from those stated in the DCDC, for a specific region due to unique physical or operational conditions. These specific instances shall be incorporated by Developer during detail design.

The Developer shall coordinate, plan, design, construct, and test interconnection facilities in compliance with criteria set forth by this DCDC document, the Building Code of the State of New York (NYSBC), New York Independent System Operator (NYISO), New York State Reliability Council (NYSRC), Northeast Power Coordinating Council (NPCC), North American Electric Reliability Corporation (NERC), the Federal Energy Regulatory Commission (FERC), NYPA, and other agencies with jurisdiction.

Items or requirements in this DCDC document do not diminish or supersede requirements of Law, Codes, Regulations, Standards, Good Utility Practice, the Interconnect Agreement (IA), Operations Coordination Agreement or Developer's obligations. As Developer encounters conflicts or requires clarification, the Developer shall submit a request for information (RFI) to NYPA for resolution. The Developer shall coordinate requirements and resolve issues.

The Developer shall provide a complete integrated and coordinated design. The design shall consist of coordinated specifications, calculations, drawings, etc. The intent is that when the project is complete the Developer will have provided a facility that meets contractual, regulatory, and NYPA requirements; including the submission of complete Record Drawings and Turn Over Package documentation that NYPA will use to operate and maintain the facility to regulatory requirements, and NYPA standards and practice.

The Developer's generation infrastructure up to and including the generation step-up transformer(s) shall be external to the NYPA switchyard.

The Developer shall provide equipment with adequate provision to perform "Lock-Out-Tag-Out" operations in accordance with OSHA requirements and NYPA's Clearance and protection program, see NYPA's document CCP-1, "Clearance and Protection Procedure for the Northern, Central & Western Regions".

References in this document to items to be submitted, shall be submitted by Developer to NYPA for NYPA's information, review, or acceptance as applicable. NYPA review, comments, acceptance, or approval shall not be construed as confirming, endorsing, or

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providing a warranty as to the design, fitness, safety, durability, or reliability. The Developer shall make such changes as may reasonably be required by NYPA to be in accordance with good utility practice, to ensure that the facility is compatible with the NYPA requirements, for operational control, and to satisfy appropriate safety requirements. NYPA shall not, by reason of such review or failure to review, be responsible for compliance with codes regulations, and/or standards. These responsibilities shall remain the Developer's obligation.

Approval of the connection concept will be evaluated against statutory, contractual, regulatory, and tariff requirements. The connection configuration shall not result in adverse effects on the New York State transmission system, NYPA transmission system, NYPA generation facilities, NYPA customers' equipment, the general public, or adversely impact NYPA's existing contractual rights or obligations.

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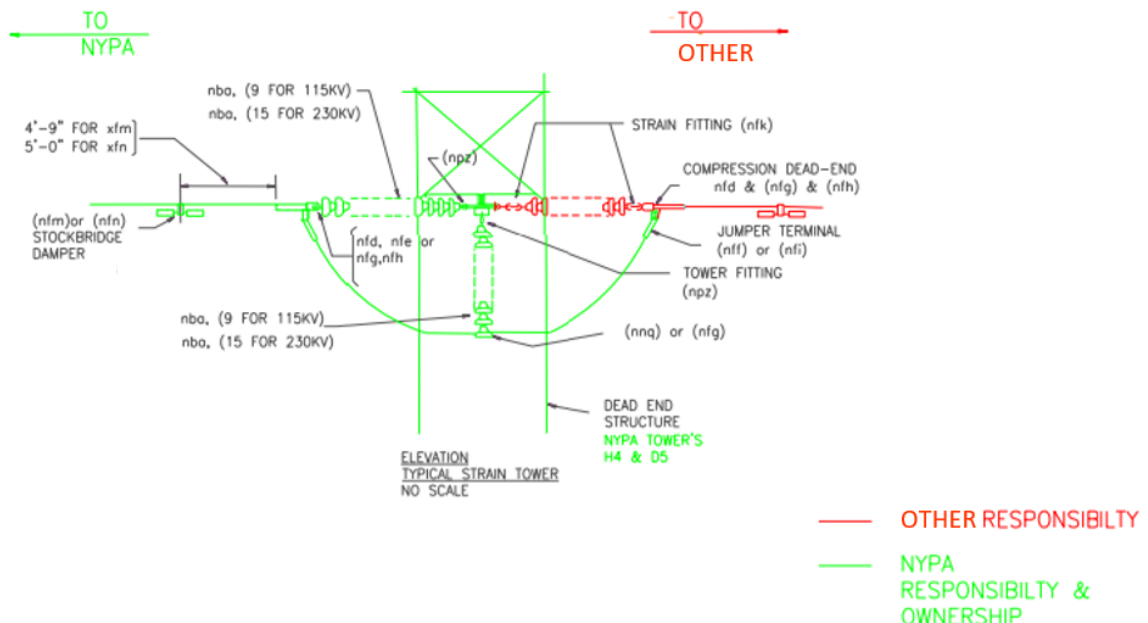
2 SYSTEM REQUIREMENTS

2.1 Impact Studies

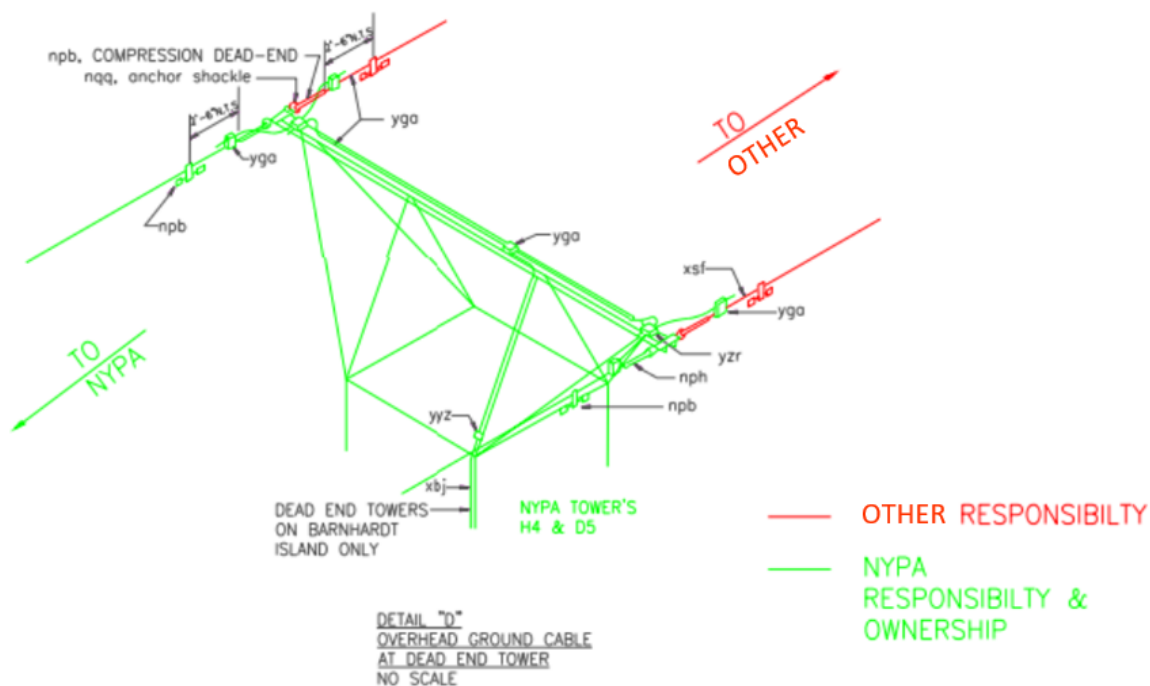
All connections to the NYPA transmission system must follow the NYISO Interconnection Process defined in the NYISO Open Access Transmission Tariff (OATT). This process includes filing an Interconnection Request and performing a Feasibility Study, System (Reliability) Impact Study, and Facilities Study.

2.2 Point of Interconnection and Change of Ownership

The point of interconnection shall be proposed by developer and agreed upon by NYPA during the scoping meeting. The details of interconnection must be developed during facility study. The connection configuration shall be submitted at the scoping meeting. This configuration shall be shown diagrammatically on a one-line diagrams., as well as on physical drawings. All transmission drawings shall clearly identify the POINT OF Change of Ownership (POCO) demarking NYPA's responsibility for O&M. The POCO shall be at a hardware fitting, preferably at a jumper loop. The exact demarcation of ownership change shall be clearly detailed on the drawings as illustrated in the elevation and detail examples below.



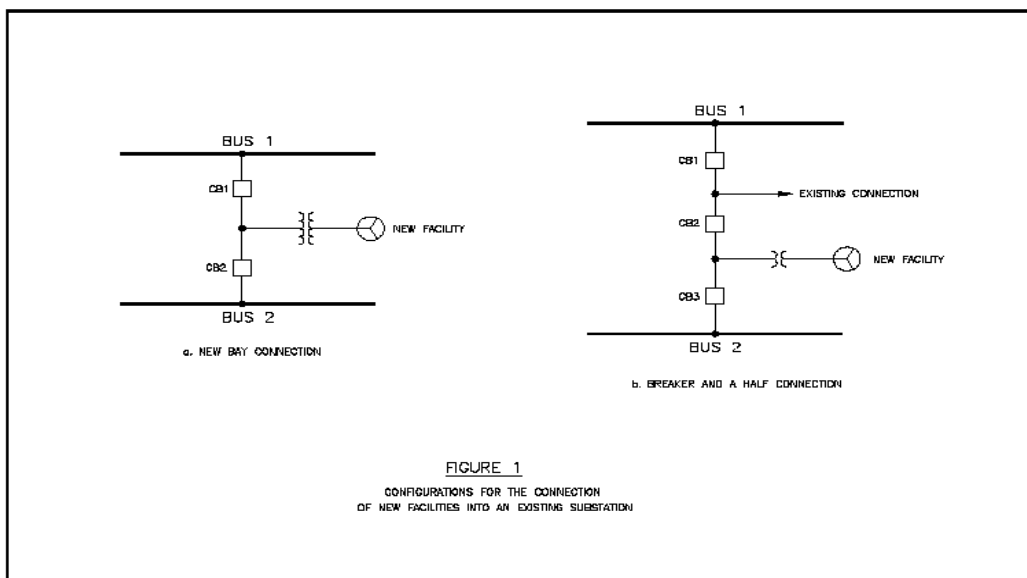
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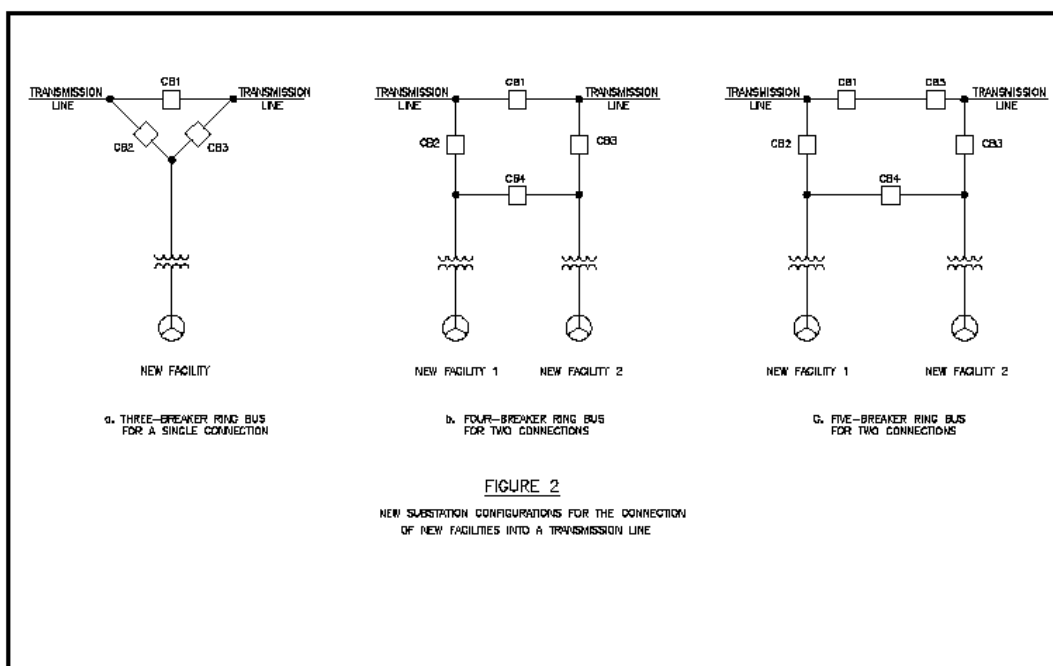
2.3 Connection Configuration

- Connections to a NYPA generation facility, or the NYPA transmission system, into a switchyard, generating facilities or a transmission line, shall be in an acceptable configuration as outlined below: The Switchyard connection shall be terminated into an existing switch position as shown in Figure 1 and Figure 2. Each connection requires two associated circuit breakers to permit operation with one circuit breaker out of service. Thus a new connection might be terminated into a new switchyard bay with two new circuit breakers CB1 and CB2 (Figure 1a - Detail a) or into an expanded existing bay with one additional circuit breaker CB2 or CB3 (Figure 11- Detail b).

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- Connections to a transmission line shall be terminated in a switchyard. The switchyard for a single Developer connection shall be a ring bus configuration. For example with a three-breaker ring bus configuration, two ends of a segmented transmission line will be connected through circuit breaker CB1 and the facility connected through two circuit breakers, CB2, and CB3 (Figure 2– Detail a). In some cases, the addition of a fourth circuit breaker in series with CB1 may be required.



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- For a switchyard with two Developer connections, the circuit breaker configuration maybe a four breaker ring bus (Figure 2), similar to the previous case. In such a configuration the line terminals are connected at the switchyard through CB1 while the facilities are connected to the ring bus by CB2 and CB4 (Facility 1) and by CB3 and CB4 (Facility 2). In a four-breaker ring bus configuration with two connecting facilities, only the failure of CB1 (Figure 2 – Detail b) results in the shutdown of the transmission line and isolation of the connected facilities. Failure of any other circuit breaker in this configuration leads to the opening of two adjacent circuit breakers and keeps one of the facilities connected to a transmission line terminal. The complete isolation of the facilities during CB1 failure in a four-breaker ring bus can be avoided by installing an additional circuit breaker in series with CB1 (Figure 2– Detail c).

The minimum switchyard configuration is a three breaker ring bus in a two-bay configuration. The developer's submitted configuration shall be reviewed by NYPA and affected transmission owners during the NYISO Interconnection Process and IA negotiation.

2.4 Connection Characteristics

Developer generation facilities shall interface with the NYPA system by means of a transformer or a transformer bank. The facilities shall not cause a reduction in the quality of service provided to NYPA customers. Voltage limits for Developer's generation sources connected to NYPA transmission facilities or NYPA generation facilities will be determined by NYISO/NYPA. Inverter based sources shall eliminate the use of momentary cessation to the greatest possible extent.

Interconnections with Inverter based source(s) shall be in compliance with IEEE P2800.

All transmission spans into the substation shall be from a dead-end structure outside the substation. Relaying equipment shall provide automatic separation of the facility from the NYPA system. Each connection shall be provided with switching and control devices capable of interrupting system short circuit currents at the connection location. The facility shall be equipped with a visual separation from the NYPA system.

A SCADA Remote Terminal Unit (RTU) shall be provided for remote operational control of the station. The RTU shall adhere to NYPS standards NYPA Control Systems. The RTU will provide System Operations personnel control and status monitoring of the circuit breakers, disconnects, station service MODs, protective relaying etc. The RTU shall also have the capability of transmitting analog quantities and revenue metering data. Unless other arrangements are made, the RTU will also serve to provide NYISO control values and flags to the interconnecting generation facilities and will pass Interconnecting Facility status and real time data through to the NYISO via the NYPA Control System. Note that any other requirements for separate NYISO telecommunications are the sole responsibility of the developer.

In addition, a separate data concentrator will be required to collect maintenance data, such as from real time transformer monitoring data for transmission to the NYPA Integrated System Operations Center (ISOC). Other system monitoring requirements may be required as specific to the station equipment.

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Reactive compensating devices shall not be installed without the approval of NYPA / NYISO.

A generating plant shall be able to:

1. Operate continuously within voltage variations of +/-10% for 115 kV system and -10% /+5% for 230 kV and 345 kV systems.
2. Withstand system voltage disturbances in accordance with the time periods and associated voltage levels summarized in Figure 3 (FERC Order 661).
3. Operate within +/-0.95 power factor at the point of connection to the system.
4. Comply with IEEE 519 "Recommended Practices Requirements for Harmonic Control in Electrical Power Systems".

2.5 System Operations

Operating guidelines shall be defined in the Operations Coordination Agreement.

NYISO, in coordination with NYPA, reserves the right to open switching devices without prior notice to Developer for any of the following reasons:

- System emergency or system conditions leading to a possible system emergency.
- Inspection of the connecting facilities or protective equipment reveals a hazardous condition.
- The connecting generating equipment or power transaction interferes with NYPA customers or with operations of the NYISO system.
- Failure to maintain the connecting facilities in accordance with the IA.

Connection equipment between the facility generators and the point of interconnection with the NYPA system shall be inspected and approved for service by NYPA prior to energization.

The Developer is responsible for generator synchronization to the transmission system. The limits established by NYISO for frequency and voltage shall be observed when connecting or disconnecting the generators or station loads from the system.

The Developer shall not be permitted to energize or de-energize NYPA circuits. Energization of the Developer's facility shall be coordinated with NYPA operations. The Developer shall schedule facility outages with NYPA. The Developer's facility shall have controls that are compatible with the controls of the NYPA control area. If Developer's generators remain connected to a de-energized line, Developer's controls shall automatically open the breakers connecting to NYPA's system so that the NYPA switchyard breaker(s) can be reclosed, and the circuit reconnected to the supply bus.

Emergency generator(s) connected to the Developer's system shall not operate in parallel with the NYPA system. The Developer's facilities shall not create an energized feedback condition when the NYPA system is de-energized. The electric systems with

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emergency generators connected must be provided with a 'break before make' transfer switch or other approved method to prevent emergency generator operation in parallel to the NYPA system.

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3 SYSTEM DESIGN CHARACTERISTICS

3.1 Electrical System Service Conditions

Main system parameters, meteorological conditions and clearances at the switchyards are summarized in Tables 3.1.1 - 3.1.3.

3.1.1 Electrical System Parameters

Nominal Voltage, kV	115	230	345
Maximum Operating Voltage, U _{max} , kV	126	242	362
BIL, kV (Clean Insulators)	550	900	1050
BIL, kV (Contaminated Insulators)	550	1050	1300

Transmission system continuous current and short circuit current ratings are site-specific. These ratings will be specified by NYPA.

3.1.2 Meteorological Conditions

Ambient Temperature Range	-40°C to +40°C
Average Ambient Temperature	30°C
Max Bus Temperature Rise	50°C
Altitude	<1000 m
Max Gust Velocity	90 mph
Max Sustained Wind Velocity	15 mph
Wind Velocity	2 fps
Keraunic Level	per Keraunic Chart

3.1.3 Minimum Switchyard Clearance Distances

The clearance distances for switchyards are presented as a function of outdoor insulation BIL., see Section 3.1.1 and 3.3 B.

BIL, kV	550	900	1050	1300
Metal-to-Metal for Rigid Conductors	4'-5"	7'-5"	8'-9"	9'-11"
Center Line-to-Center Line for Rigid Buses	7'-0"	11'-0"	13'-0"	15'-0"
Rigid Conductor-to-Grounded Parts	3'-6"	5'-11"	6'-11"	8'-8"
Bare Overhead Conductor-to-Ground	12'-0"	15'-0"	16'-0"	18'-0"
Bare Overhead-to-Roadway	30'	34'	34'	37'
Rigid Bus-to-Roadway	22'	24'	24'	26'

3.2 Lightning and Switching Overvoltage Protection

Lightning protection shall be accomplished by lightning masts and shields installed within the territory of the switchyard. The probability of protection shall be 99%. The lightning masts and

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shields shall be directly connected to the switchyard ground via a minimum 4/0 soft drawn annealed copper conductor.

All equipment installed in the switchyard shall be protected from lightning and switching overvoltage by surge arresters whose rating is determined by insulation coordination studies.

3.3 Insulation Coordination

- A. Early in design development Developer shall submit insulation coordination studies including site-specific BIL recommendation. Consider stresses due to lightning, switching surges, and other transient phenomena which may cause overvoltage.
- B. For systems operating at 230kV and above, two BIL levels are available for each voltage. In each case, the lower BIL level is acceptable for clean environment sites, while the higher BIL level shall be provided at locations where there is a significant potential for insulation contamination.

3.4 Relaying Protection

- A. The Developer shall submit Relaying and Metering single line drawings including transformers, capacitor banks, reactors, arrestors, etc. with ratings and full applied primary and secondary ratio information, and connections to the NYPA system. NYPA shall provide Developer select "go-by drawings" to facilitate standardization of the design to NYPA standards. "Go-Bys" include single- and three-line diagrams, typical AC and DC elementary diagrams and various wiring diagrams for relay panels, termination panels, control panels and similar drawings. The drawings shall include major components with specifications and ratings, protective relaying, and instrument transformers with their full and applied tap ratio information used for each protection zone element. Discrete and multi-function protective relays shall be depicted with each activated function and associated input sources and output trip device designations. All wiring diagrams shall be point-to-point type.
- B. The protective relaying system shall be designed to coordinate with other segments of the transmission system based on the analysis of system faults and transient stability of the system for various system conditions to attain the required speed of interruption.
- C. The relay protection system shall be engineered, designed and presented in accordance with NYPA design standards. Special protection systems or remedial schemes are not to be used. Detailed specifications for the interconnection relay protection shall be provided in the project-specific Protections Application Document (PAD). The Developer will be expected to prepare the PAD, after consultation with NYPA, and submitting the completed PAD to NYPA for review and acceptance. The protection systems illustrated on the functional relaying diagram shall include all elements of:
 - Transmission line protection
 - Transformer and reactor protection
 - Bus protection

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- Breaker failure protection
- Independent primary and secondary systems from diverse manufacturers for each of the above
- Generator protection
- Station service transformer protection
- Synchronizing and synch check relaying
- Distribution line protection
- Miscellaneous service protection
- Reclosing
- Stub-bus Protection
- Circuit Breaker Low Gas Pressure Protection

The diagrams shall include:

- Point of Interconnection to NYPA system
- Switchyard equipment and ratings
- Relay manufacturers
- Relay models with ANSI device numbers
- Relaying schemes
- Zones of protection
- Associated instrument transformer ratios and accuracy class
- Auxiliary relays and relay communication equipment

If the facility is to be connected to an NYPA facility considered part of the Bulk Power System (BPS), the interconnecting facility's protection system shall comply with Northeast Power Coordinating Council (NPCC) Bulk Power System Protection Criteria and NERC Reliability Standards. For inverter-based resources, the protection system design must adhere to NERC Reliability Standard PRC-024

The Developer shall design and document the protection systems for all equipment. The protective relay and design for the line, bus, transformer, breaker, and other switchyard equipment for the interconnecting facility shall be submitted for review by NYPA Protection & Control Engineering (PCE) group.

Each transformer connected to the NYPA system shall have a delta winding configuration on the high-voltage (NYPA connected) side of the transformer.

All protective relay systems shall be fully numerical, microprocessor-based relays with GPS clock time-stamped fault data recovery via sequence of events, waveform capture, and relay watchdog functions.

When the interconnection is to the BPS, or if the interconnection is to a critical NYPA circuit, each HV circuit breaker shall be provided with two completely separate breaker failure relaying systems.

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Depending on the classification of the particular line system configuration and/or conditions, special protection or additional redundant systems may be required.

Instrument transformers used for protective relaying shall be of C800 accuracy class. HV circuit breakers shall have dual independent trip coils.

The relay cabinet and the panel layouts shall be submitted. Specification for relay panel design will be provided by NYPA in the standard EDS-PCE110 "Electrical Design Standard for Indoor Protective Relay Panel/Cabinets and Terminal Cabinets". The Developer shall provide space and layout for future addition of relay control panel cabinets in each of the primary room (minimum 4 cabinets) and secondary room (minimum 6 cabinets).

The DC power supply for the protective relaying and communication system shall be 125 VDC battery sources in accordance with the DC station service section of this document. Fully redundant battery systems and chargers shall be provided for BPS interconnections and interconnections to systems designated critical by NYPA. Relaying and annunciation for the 'loss of DC' to protection and breaker control circuits shall be provided locally and remotely.

Automatic re-closing requirements shall be determined by NYPA based on the location of the interconnecting facility.

O. Interlocks and/or synch check equipment shall be provided to allow the remote operation of the switchyard breakers .

Standalone Sequence of Event Recorder equipment and Digital Fault Recorder equipment or equivalent functionality shall be provided per NYPA specifications. Communications shall be provided for remote access to event and fault records. The Developer shall provide engineering drawings documenting the design, installation, and functional testing (yellow line).

An HMI (Human-Machine Interface) computer including software shall be provided for local status indication, metering, and alarm annunciation/acknowledgment. The HMI shall be capable of providing a status indication, metering, and alarms typically via an interface with the SCADA RTU. The HMI shall be powered from a non-interruptible power source.

All HV circuit breakers and motorized disconnect switches shall be provided with local and remote control and status indication. Manual disconnects shall be provided with local and remote position indication.

Relay equipment status, trouble and failure alarms shall be wired to the SCADA RTU for remote monitoring.

Local control and panel devices (switches, lights, synch scope, etc.) shall be provided.

Phase angle transducers shall be provided to measure the phase angle across HV circuit breakers. They shall be connected to the SCADA RTU for monitoring.

Breaker control and relay protection circuits shall be configured with relay and breaker control functions segregated and separately fused. This usually relates to the protection relays that would in some designs be powered by the breaker control fuses in schemes including synch check or reclosing. The Developer shall coordinate this design aspect with NYPA.

3.5 Short Circuit Current

NYPA shall provide the site-specific available short circuit current design criteria along with the system X/R ratio. The Developer shall submit short circuit studies with variations

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and contingencies of fault currents for proper coordination and settings of the protective relay system and for the selection of switching equipment.

3.6 Protective Relay Settings

The Developer shall submit relay setting calculations, justifications, and applied settings for the switchyard and Developer's switchyard protective relaying. The Developer shall submit preliminary relay setting calculations including the basis used for the calculations and the applied settings. The Developer shall submit final commissioned in-service relay setting files in a complete report including the basis for calculations. These submissions shall be in an editable Word (doc(x) file) format. The Developer shall apply settings for the transmission line and feeder protective relaying up to and including the adjacent terminals and from POI to the Developer's switchyard or generator step-up transformers.

3.7 Metering

The Developer shall confirm in writing that new or modified transmission or generating facilities are within Balancing Authority (NYISO) Area's metered boundaries. Revenue metering shall be at the point of interconnection, e.g. the high-voltage side of the step-up transformer, and shall include the following:

- A. **Instrument Transformers:** The specific type, number, connection, and ratios of the instrument transformers will be checked and determined by NYPA PC/Metering groups based on the expected output and load and the connection to the NYPA system.
- B. **Intelligent Electronic Devices (IEDs):** The IEDs for revenue metering MWH, MW, and MVAR and other electrical indications shall be configured and tested by NYPA and mounted in a separate metering cabinet. These devices will be connected to the RTU/RTAC via RS232, RS485 or Ethernet connection. Ethernet and landline or cellular communications shall be provided by Developer for redundant communications paths to the IEDs as described in the NYPA standard SCADA RTU/RTAC substation requirement.
- C. **Metering Cabinet:** The metering cabinet(s) shall be a free-standing or wall mount lockable, sealable cabinet located near the SCADA RTU/RTAC cabinet. AC and DC station power shall be supplied to the metering cabinet(s).
- D. **Instrument Transformer Secondary Wiring:** PT and CT secondary wiring shall be routed underground in a dedicated PT conduit and a dedicated CT conduit ("home runs") from the instrument transformers to the meter cabinet. These CT and PT secondary wiring conduits shall not run in the yard common wiring trenches, shall be segregated from all other power cables, and shall be routed at a distance to eliminate the influence from other voltage and current-carrying cables. The Developer shall provide a lockable/sealable CT/PT junction box at the base of the CT/PT structure for shorting and fusing. Only a multi-conductor control cable may be utilized with a minimum 600V AC insulation level. Minimum # 10 AWG stranded copper cable shall be used for the CTs wiring and minimum #12 AWG stranded copper shall be used for the PTs wiring. Additional control cable requirements, such as shielding and twisted pairs, may be specified.

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3.8 Communication Systems and Equipment

- A. Communication systems shall be provided to integrate seamlessly into the existing and planned NYPA communication systems. The systems shall provide for inter-connectivity with the switchyard and the NYPA SCADA, Sensor Monitoring, Revenue Metering, Security, voice and business system. The system shall utilize mediums specified by NYPA. The system shall provide continuous communication from the facility to the designated NYPA termination location. Where direct connection to NYPA communications infrastructure is to be provided, NYPA will specify the channel equipment to be provided by the developer. This may include additional channel equipment to be installed by NYPA at the remote location

The systems shall have the capability to transmit and receive various types of signaling including metering, relay protection, security, CCTV, voice, life safety, alarms, and SCADA equipment.

The Developer shall provide the switchyard audio public address system including indoors serving the NYPA Control Building and outdoors in the switchyard. The Developer shall provide local and remote paging from any NYPA location.

- B. NYPA will provide the Developer with communication systems high-level specifications including interconnectivity with existing and planned NYPA systems. The Developer shall design and provide communications systems.
- C. Circuits designated by NYPA as critical shall be supported by two separate communication mediums/pathways. Any diverse transmission medium or other broadband based facilities supplied by common or value added carrier shall be configured dedicated point to point. Virtual circuits shall not be allowed for protective relay or SCADA circuits.
- D. System security requirements using encryption or other means shall be specified by NYPA.
- E. Certain communications applications, e.g. SCADA, Protective Relaying, shall be provided pathways with enough capacity to meet the minimum requirements for effective, uninterrupted communication. Additional bandwidth shall be supplied for the other applications, plus spare capacity.
- F. The communication system design shall include:

The communication system and related equipment shall be provided with redundant power supplies and related equipment.

If a standalone building supporting microwave equipment is provided, it shall be provided with a dedicated UPS system, redundant HVAC sources, standalone battery bank, and space for future addition of equipment.

NYPA will specify communication requirements and will apply for FCC license, FAA filings, etc. NYPA shall be the named licensee for Communications licenses and permits.

The public address system shall have a minimum impact on surrounding areas and conform to Federal, State, and local ordinances and regulations. Submit supporting calculations.

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Lightning protection with Master Label per NFPA 780 shall be provided for communication equipment. Bonding and grounding shall conform to the latest edition of the Motorola R56 manual, "Motorola Standards and Guidelines for Communications Sites", and NFPA.

All telephone or T1 facilities including broadband entering a switchyard shall be via buried non-conductive fiber optic cable.

The Developer shall supply a plain old telephone (POTS) circuit and phone handsets. In addition, a minimum of six telephone circuits shall be integrated into the NYPA region phone system:

- Ring down line to control center (multiple extension locations)
- Gate phone (plus provide a key or card key access at truck and automobile window heights)
- Primary room (multiple extension locations)
- Secondary room (multiple extension locations)
- Public address
- Breaker cabinet circuit (bridged, jack located in each HV Circuit Breaker cabinet)

Handsets for POTS and NYPA circuits shall be provided at multiple locations (in addition to that of the corresponding designation); submit layout. The Developer shall provide telephone handsets with audible ring and visual flashing light indication.

The Developer shall install local area network (LAN) jacks at primary, secondary, control room desks, and other locations; submit layout.

Communication equipment shall be installed per industry standards and NYPA practice.

NYPA OPGW splicing and optical transport network equipment is responsibility of the developer. The equipment shall be specified for each project based on project location and approved by NYPA network team.

Communication facilities shall be designed assuming they are Critical Assets. The installation shall comply with NERC-CIP, see below section.

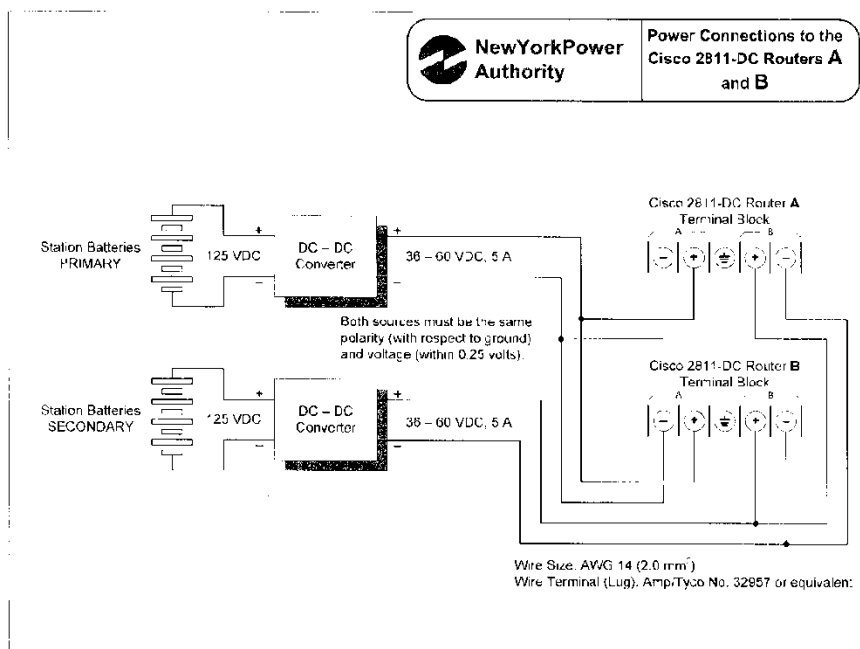
3.9 SCADA and RTU

- A. The Developer shall provide a SCADA RTU (Supervisory Control and Data Acquisition Remote Terminal Unit) per NYPA specification in the switchyard Control Building. NYPA will specify the network routers, switches, and/or firewalls as appropriate for installation by the Developer. The Developer shall contract with the RTU manufacturer or a system integrator to configure the RTU and integrate the RTU into the substation control system as per SCADA RTU/RTAC Substation Requirements standard.
- B. The Developer shall notify NYPA and coordinate so NYPA personnel may observe SCADA/RTU system integrator's work. Depending on the extent of

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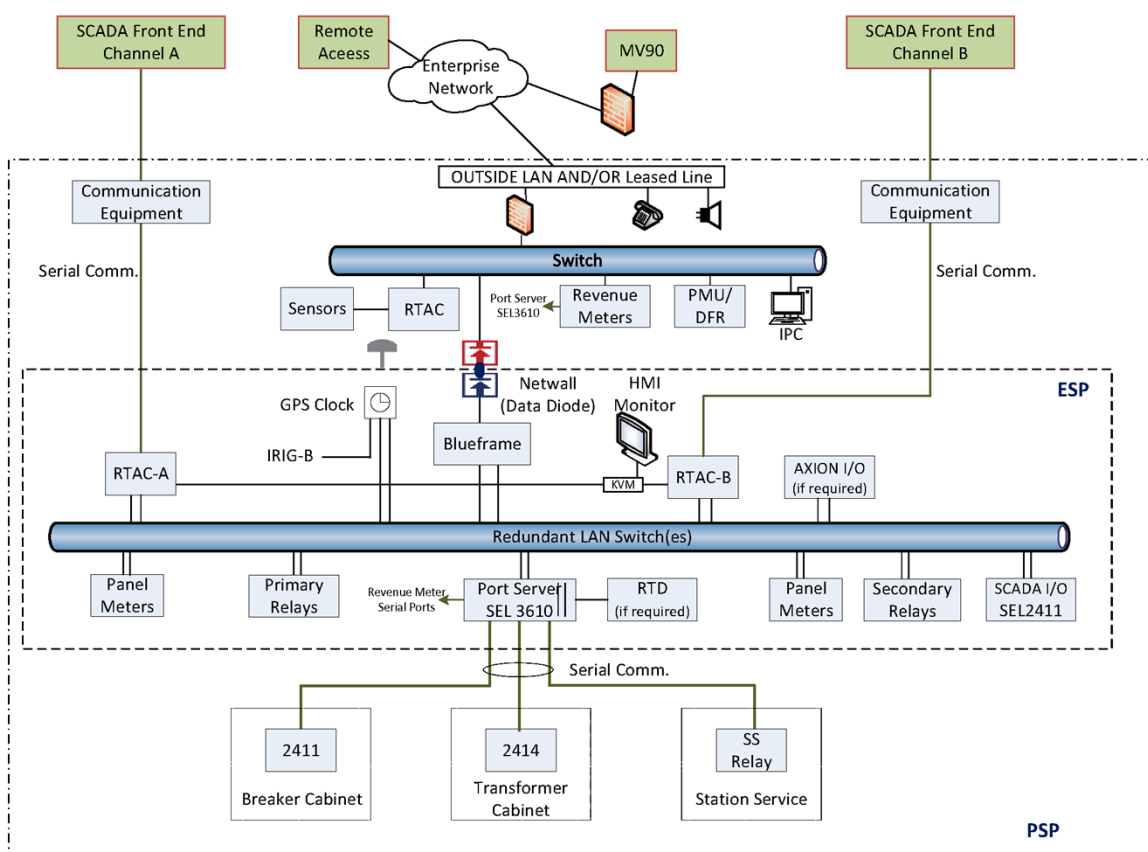
the work (e.g. for a completely new station) NYPA may require an integrated factory test of the SCADA and associated networking, IEDs and controls.

- C. The minimum SCADA RTU communication channel is a dedicated, non-virtual, digital point-to-point circuit from the facility to NYPA's existing control center.
- D. The Developer shall install the network routers, switches, and firewalls in a separate free-standing, lockable cabinet provided with tamper switches wired to the RTU and/or substation security equipment. Equipment (routers, switches, etc.) for SCADA communications shall be powered by station batteries via redundant power supplies, see figure below. Equipment servicing diverse communications pathways shall be powered by separate station batteries.



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Each Router/Switch shall communicate using a standard digital termination facility. In the configuration typical, two (2) digital facilities shall be supplied by the Developer as agreed by NYPA. The intent is to provide true diversity for the switchyard communication system. Typically the first digital facility shall be supplied via a microwave system. The diverse digital facility will be the point-to-point common carrier supplied pathway. The two digital facilities may not share the same physical or electrical paths. A typical configuration is shown below.



Hardwired equipment status inputs shall utilize dry contacts only. Hardwired analog inputs shall utilize ungrounded current (+/- 1mA inputs (nominal) or 4-20mA transducer inputs). The RTU shall also be capable to poll intelligent electronic devices (IEDs) using DNP 3 and MODBUS RTU protocols via serial or Ethernet connections. Connections between the RTU and protective relaying shall be as per the SCADA RTU/RTAC Substation Requirements Standard for Substation SCADA but shall also include hardwired inputs. Serial connections that extend outside the Control Building shall connect to the RTU via Fiber/RS232 converters. Ethernet connections shall utilize switchyard qualified Ethernet switches installed no more than 20 feet from the RTU. IEC 61850 is the protocol standard for greenfield digital substations.

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The RTU shall be enclosed in a free-standing lockable cabinet provided with tamper switches wired to an RTU input and or the station Security System, be installed in the Control Building, typically with front and rear access. Cabinets will provide for top and bottom cable entry compatible with the Control Building design. At a minimum, a POTS line handset and a NYPA extension handset shall be installed a maximum of 12' from the RTU.

The Developer shall provide the HMI computer and software per NYPA specification.

If the cyber facility is categorized by NYPA as part of the BPS, the RTU and communication cabinet shall be protected both physically and electronically to NERC CIP requirements, including:

1. Adherence to the NYPA Standard for Control System Cyber Security Requirements, see NYPA document, "General Cyber Security Requirements Exhibit".
2. Card Key access control with logging of access to the equipment.
3. Video monitoring/Storage/Offsite Communication.
4. Separate secure room (preferred) or "six" wall enclosure, such as a security cage, if the physical area around the device cannot be secured from general access.
5. TCP/IP access should be limited, monitored, and controlled via firewalls, Intrusion Detection.
6. Remote access is prohibited.

3.10 Grounding

- A. A complete system of substation grounding shall be provided. The design shall provide a safe, effective, and reliable grounding system and shall take into account the value of ground resistance, grid resistance, the level of step and touch potential, and the magnitude of fault currents flowing to ground. The Developer shall provide a complete grounding system study substantiating the basis of design and include soil test data, design data, and calculations. Scope of study shall include the new construction as well as the impact of new work on the existing grounding facilities.
- B. The ground study shall be completed in accordance with the latest approved IEEE Std. 80 Guide for Safety in AC Substation Grounding. Additional standards include but are not limited to a. ANSI / IEEE Std. 80 - 2013 – IEEE Guide for Safety in AC Substation Grounding
 - b. IEEE Std. 81 - 2012 – IEEE Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System
 - c. IEEE Std 81.2 - IEEE Guide for Measurement of Impedance and Safety Characteristics of Large, Extended or Interconnected Grounding Systems.
 - d. IEEE Std. 142 - 2007 – IEEE Recommended Practice for Grounding of Industrial and Commercial Power Systems
 - e. IEEE Std. 367 – 2012 – IEEE Recommended Practice for Determining the Electric Power Station Ground Potential Rise and Induced Voltage from a Power Fault

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- f. IEEE Std. 525 - 2016 – IEEE Guide for the Design and Installation of Cable Systems in Substations
- g. IEEE Std 575 - IEEE Guide for the Application of Sheath-Bonding Methods for Single Conductor Cables and the Calculation of Induced Voltages and Currents in Cable Sheaths.
- h. IEC 60479-1 – Effects of Current Passing Through the Human Body – Part I
- i. IEC 60479-2 – Effects of Current Passing Through the Human Body – Part II
- j. IEEE Std 837 - IEEE Standard for Qualifying Permanent Connections Used in Substation Grounding
- C. The Developer shall meet the following requirements for the grounding system testing and study:
 - a. The required measurements of site conditions shall include:
 - i. Soil Resistivity- A minimum of ten (10) soil resistivity tests shall be conducted. The average test value shall be used in calculations to determine the optimum configuration of the grounding grid and the depth and quantity of ground rods
 - ii. Ground System Impedance
 - iii. Point-to-Point Ground Impedance across the grounding grid and for all major equipment grounding points at the site, including facility fence
 - iv. Ground Potential Rise - Oscillographic Measurements
 - v. Any Field Observations
 - b. System network grounding model creation in WinIGS software or another NYPA-approved equivalent for:
 - i. Ground impedance comparison (measured vs. calculated)
 - ii. Ground resistance comparison (measured vs. calculated)
 - iii. Short circuit current comparison (calculated vs. NYPA provided)
 - c. Ground system safety evaluation and safety assessment:
 - i. Prove ground system meets all requirements of IEEE Std. 80
 - ii. Calculate touch and step voltages under worst fault conditions
 - iii. Recommendations for ground system improvements including ground conductor size selection, top layer material, grounding system upgrades, and bill of materials.
 - d. Lightning shielding assessment
 - i. Prove system is effectively shielded from lightning in accordance with NFPA 780. System design shall be in accordance with UL 96A Master Label requirements.
 - ii. Perform evaluation of current lightning protection system including determining the likelihood of direct lightning hits to equipment (transformers, breakers, switchgear, etc.), buswork, building, etc.
 - iii. Recommendations for enhancements to the lightning shielding
- D. The grounding system design shall include recommendations for improvements from the study.

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- E. The grounding system resistance prior to connection to the out of switchyard grounding system shall be less than 2 ohms. The Developer shall obtain the maximum short circuit current design criteria from NYPA.
 - F. The switchyard grounding system shall be comprised of ground rods and ground grid. The grounding system shall be designed to provide safety for personnel, protect equipment, and property. The system shall be designed with sufficient fault current flow to the ground for reliable operation of relaying protection.
 - G. The perimeter of the ground grid shall be extended minimum 3' outside the fence of the switchyard. For outward swinging gates, the ground grid shall be extended to encompass the total gate swing plus 3'.
 - H. The switchyard fence and gates shall be grounded. Every other steel post of the switchyard fence shall be grounded. The barbed wires shall be connected to ground at every other post using screw connectors and minimum 2/0 AWG stranded soft drawn annealed copper wire to the ground connection at the base of each grounded post.
 - I. The grounding system shall encompass the switchyard yard, switchyard fence, and Control Building.
 - J. The ground grid shall be buried minimum 2' below grade, with a parallel and perpendicular pattern of grid conductors.
 - K. A minimum of two test stations shall be constructed and covered with hand-holes on the top of the rods for maintenance access.
 - L. The grounding system in the Control Building shall include a separate approach, which shall be bonded together with the yard grounding system to form one complex grounding system. The special grounding for the Control Building shall be a high-frequency grounding system. The metallic enclosures and panels shall be connected to a reference ground to minimize high-frequency noise. Equipment connection details shall be indicated on drawing submissions.
 - M. Submit grounding design drawings including a minimum of three separate layout drawings: for switchyard, fence grounding, and the Control Building. Provide equipment grounding details and grounding details.
 - N. All structures and equipment shall be grounded to a common ground grid. Minimum #4/0 AWG bare stranded soft drawn annealed copper shall be used for the ground grid as well as for connections to equipment and structures. Exothermic connections shall be used for below-grade connections. Above grade connections to equipment and structures shall be bolted or crimped.
 - O. Transformers, cooling tanks, circuit breaker tanks, and support structures shall be grounded at two points at diametrically opposed corners. Other equipment shall be grounded at a minimum of one point. HV disconnect and ground switch operating handle location(s) shall be provided with an at-grade grounding mat. The grounding mats shall be connected to the grounding grid

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at two locations. Platforms for access due to the height of the cabinets (e.g., HV circuit breaker cabinets) shall be grounded at two opposed locations.

- P. All cable shields, except instrumentation cable shields, including those of the station service transformer feeders, shall be solidly grounded at both ends unless otherwise specified by NYPA. Instrumentation cable shields shall be grounded at the cabinet end; multi-stop wire paths should be grounded at end closest to the control building. Provide equipment grounding conductors. Metallic conduits, whether embedded or exposed, shall be electrically continuous and bonded at both ends. Flexible conduits shall be installed with bonding bushings and external bonding jumpers.
 - Q. All outdoor equipment cabinets and junction boxes shall have a ground connection to the ground grid.
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4 DOCUMENTS

Engineering Documents including drawings, specifications, calculations, studies, reports, etc. shall be signed and sealed by the Engineer of Record (EOR), a licensed Professional Engineer (PE) registered in New York State (NYS), in accordance with NYS Education Department guidelines.

Design drawings, specifications, and Contractor submittals including catalog cuts, manufacturers' documentation, shop drawings, etc. shall be submitted. Submittals shall include calculations, assumptions, and supporting documentation. Submit studies and calculations including time-overcurrent protection, protection coordination, insulation coordination, AC and DC fuse coordination, and ground grid. Prior to submittal Developer submittals shall be stamped to indicate approval by the EOR.

Calculation submittals shall be formatted to include: Summary of Results, Purpose, Basis, Assumptions, References, and Detailed Calculations. Each page of the calculation shall be initialed by the preparer, reviewer and EOR.

The Developer shall provide the design, drawings, calculations, and specifications complete and coordinated in detail. The Developer shall provide complete detailed design packages in accordance with Good Utility Practice that will be used for Construction, Operations, Maintenance, and Clearances under NYPA's CPP-1 program. Design / Build quality drawings and specifications are not sufficient. The design packages shall include drawings, specifications, and calculations that unambiguously detail the design. The intent is that the construction contractors may construct the design with a minimum of field interpretation and that the As-Built and record documents faithfully and unambiguously document the installation and testing, including down to the detailed point to point wiring level.

The design drawings and specifications shall be submitted in logical packages for each design phase including Schematic, For Design, For Permit, For Construction. The Developer shall submit As Built Drawings and Record Drawings. The Developer's project schedule shall allow sufficient time intervals for NYPA review/ acceptance, and for re-issue of drawings and specifications required thereby. The Developer shall document the SCADA, sensor monitoring and cyber security systems as per the NYPA Substation SCADA Requirements Standard for communications diagrams, point lists and SCADA designations on elementary diagrams.

The Developer shall submit, administer, and enforce a rigorous Design Quality Assurance / Quality Control (D-QA/QC) Program and proactively quality assure the design packages prior to submittal including "Yellow Lining" prior to drawing package submittal. Design submittal Yellow Lining includes the physical checking, marking, initialing, and dating of the drawings as part of the design check and coordination D-QA/QC process.

The Developer shall also provide Construction Yellow Lining as part of the Record Drawing Process, see below.

The Developer shall provide extensive labeling of items including panels, panel schedules, equipment, conduits, cables, terminations, etc. Labels shall coordinate exactly to the drawings in order to comply with NYPA's CPP-1 and to ensure the safety of personnel. The Developer shall coordinate labels with NYPA including equipment, yard equipment, and structures. The Developer shall coordinate with NYPA the cable and termination labeling. The Developer shall

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coordinate with NYPA to incorporate any non-industry standard labels (e.g. DC label colors for 125V DC terminations). See also Section 5.20.

The Developer shall maintain an organized Request for Information (RFI) process and database for RFIs.

The Developer shall provide databases including Drawing Index/database, Specification Index / database, Calculation Index/database, Equipment Index/database, Bill of Material (BOM) / database, and Vendor Drawing Index/database. The Drawing Index database shall track drawings, drawing revisions, submittal dates/transmittal numbers, comments/responses / transmittals, etc.; similar for the Specification database. Each equipment item shall be assigned a unique equipment number. The BOM shall have unique designations for each material item that will be coordinated onto the drawings – each drawing BOM will not start with item number 1, rather items shall coordinate to the BOM database number. BOM item numbering shall not be fully consecutive. Rather BOM items should be grouped in logical system groups and sequences, with gaps in the numbering to allow BOM items to be added in the latter stages of design and construction.

Databases shall be MS Access or approved format. Databases shall be kept up to date contemporaneously with submittal transmittal.

The Developer shall coordinate with NYPA to establish the Drawing Index and drawing numbers and to detail the drawing and drafting requirements for the interconnection design. The Developer shall coordinate requirements to NYPA standard Appendix F: Computer-Aided Drawing Requirements for New York Power Authority. The Developer shall supply NYPA standard ANSI “E” size drawings.

The Developer shall submit and administer a detailed Change Control Program that ensures that changes made by the EOR are documented on the design documents and submitted to NYPA for review, and that field changes have been approved in advance of installation by the EOR and submitted to NYPA for review. Developer Change Control Program shall conform to the NYPA Configuration Management policy and procedure.

The Developer shall provide all electronic project file including all database files, and AutoCAD drawings files in AutoCAD and PLS CADD, to NYPA at the conclusion of the Project..

4.1 Drawings

Developer drawings shall detail the Work. Changes to the content of a drawing shall result in the incrementing of the revision from A to B, B to C, etc. Addition and deletion changes shall be described in the revision block or by notes on the Drawing and by back circling (clouding) and revision triangles on a freezable revision layer. Revisions shall be dated and initialed. After submission to, and approval by NYPA, Record Drawings shall be issued Revision 0 (zero).

The developer shall follow Appendix F and follow the naming, labeling and numbering convention of NYPA’s, specific to individual site.

Each drawing category shall include a symbol legend. Plan, elevation, equipment, and associated detail drawings shall be scaled. Drawings shall accurately depict the Work.

Design Criteria for Developer Connection to the New York Power Authority Transmission System

4.1.1 Schematic Drawings

“S” drawings shall be complete including equipment specification information, equipment IDs, and ratings. Include one-line diagrams for power system, metering, and relaying diagrams, the low voltage AC and DC systems, grounding; system, phasing, and logic diagrams; relay setting sheets, protective functions, and communications. Panel schedules shall identify the loads associated with each breaker. Panel breaker loads, maximum continuous loads per phase, etc. shall be included in the calculations.

4.1.2 4.1.2 Elementary Drawings

“E” drawings shall depict instrument, component, and terminal block point to point connections with cable, terminal, and conductor identifications depicted. Reference origin and destination device and reference drawings shall be identified. Show detail including internal device diagrams; synchronizing; DC systems; breaker, breaker failure, MOD control; watt-hour metering; sequential event, and digital fault recorders; transformer, bus, line, breaker failure, backup relaying, disconnect switches; AC elementary; annunciator; drainage and dewatering; air conditioning; lighting; control, and miscellaneous.

4.1.3 Wiring Drawings

“W” drawings shall depict all point-to-point wiring connections, terminal blocks, relay panel wiring, cabinet wiring, etc. Cable, conductor, and terminal identification/labels shall be depicted. Detail including relaying, metering, synchronizing, sequential event recorder, digital fault recorder, microwave system, security, HV circuit breakers, switches, MODs, station service, fire protection, control building power distribution, ATSS, communication, lighting control, and miscellaneous circuits.

4.1.4 Conduit Drawings

“C” drawings shall identify and locate all installed conduit. Subsurface locations shall be depicted with dimensional accuracy. Stub-ups shall be dimensionally located relative to served equipment or structure. Conduit size, material, and labeled ID's shall be included, along with continuation drawing reference. Cable tray routing and contents shall be detailed. Conduit and cable schedule, and cable tray schedule shall identify conductor IDs, type, number, size, and equipment served.

4.1.5 Arrangement Drawings

“A” drawings shall completely depict structures and equipment installations to scale in the plan, elevation, and/or sectional views sufficient to convey full spatial information. Dimensional information shall be sufficient to allow ready interpretation of available space, working, and clear spaces.

4.1.6 Lighting Drawings

“L” drawings shall locate and identify lighting including identifications of fixtures, electrical and control circuits, and conduit. Lighting distribution with lumen levels at surface, working platform levels and equipment shall be depicted.

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4.1.7 Miscellaneous Drawings

“M” drawings are required, not included in other types. Consult NYPA for items to be included.

4.1.8 Numerical Drawings

“N” drawings include switchyard topography, grading, plan, foundations, switchyard steel, building architectural, steel, and concrete, heating and ventilation, plumbing, and fire alarm drawings.

4.1.9 Transmission Drawings

“T” drawings shall depict attachment facility transmission level conductors, equipment, structure, and grounding. Drawings include location plan, clearing ROW, ROW map, plan, and profile, wood structures, steel towers, miscellaneous details, counterpoise and grounding, site access, stringing tables, obstacle lighting, phasing, and line data.

4.1.10 Cable and Conduit Schedules

The Cable and Conduit schedules shall be complete and fully coordinated with the Block Diagram and other drawings. Depict data including cable ID's, endpoints, wire sizes, conduit, and/or cable tray ID's.

4.2 Specifications

Purchase and construction specifications shall be in CSI or approved format, detailed and complete. Components of the Work shall be sufficiently specified as to minimize the installation contractor decision process.

Examples (as well as NYPA requirements):

- Low voltage fusible and circuit breaker overcurrent protective devices shall be identified with specificity, including voltage, ampere, interrupting capacity ratings, protective, and dimensional class. Fuse holders shall include rejection feature for class R, J, L, etc. Low voltage renewable fuses or one-time fuses utilizing zinc link fusible elements shall not be permitted.
- 120 V outlets mounted on outdoor surfaces shall be in weatherproof box equipped with clear covers, individually protected by GFI receptacles rated 20 A.
- Electrical conductors shall be specified type, stranded copper, gauge or kCMIL, insulation, and jacketing. Thermoplastic insulation or PVC insulation or jacket is not acceptable in the switchyard or Control Building.
- Fire extinguishers shall have effective rating categories and capacities specified.

4.3 Record Drawings

Record Drawings shall faithfully reflect the As-Built installation.

As the construction proceeds, the Developer shall maintain detailed As-Built Drawings (Construction Yellow Lines) of each drawing. The Developer shall maintain Construction Yellow Lines including contemporaneously keeping up to date As-Built Drawings that

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yellow line /confirm that the design matches the As-Built condition with date and initialing showing a progression of completed components; and/or showing changes using **RED**, **GREEN**, and **BLUE** notations with the date and initial. Any adjustments to design documents caused by engineering or field changes shall be incorporated into the As-Built yellow lines (including attaching the ECN or FCN and yellow lining) and subsequently incorporated into the Record Drawings. The As-Built components and materials shall be the components and materials installed. The Developer shall submit the As-Built Drawings (yellow lines), including BOM, Cable, and Conduit schedules, etc. prior to the energization of the switchyard by NYPA.

Record Drawings shall be CAD drafted using the As-Built Drawing information. Record Drawings and specifications shall be signed and sealed by the EOR.

The Developer shall require the EOR /EOR representative to continuously monitor construction or make periodic, sufficient site verification inspections to assure the installation reflects the design and enable EOR to issue Certificate(s) of Completion.

A Developer surveyor shall survey the As-Built locations of items including grading, access roads, structures, manholes, equipment, buildings; underground structures, underground conduit route and elevations, drainage routes and inverts for the purpose of accurately depicting the information on the Record Drawings. Microwave towers shall be surveyed including foundation elevation and tower location.

Arrangement drawings shall reflect to scale, structure, actual equipment installed, locations, and spatial relationships, both in plan and elevation views.

Elementary and wiring diagrams shall be verified to ensure they reflect installed conditions including cable and wire termination labels, and terminal IDs.

The Developer shall remove or finalize interim notes prior to submittal of Record Drawings.

Developer Record Drawings shall meet the following criteria:

TYPE I – Drawings originated and drafted by Developer

- Work shall be **BLACK** color
- Clouding, revision triangles, and notes (**BLUE**) shall be removed
- Drawing Revision Block shall indicate Rev 0, “Record Drawing”, be initialed, and dated. Record Drawings shall be signed and sealed with PE stamp by the EOR.
- Transmittal of Record Drawings to NYPA:
 - A. Electronic copies provided in DWG file format. DWG files shall have an indication in the seal box that the drawing has been sealed, coordinate with NYPA. Drawing file is named the drawing number without revision number added.
 - B. “Wet” signed and sealed full-size copy and PDF thereof.

TYPE II – NYPA SK1 drawings supplied to Developer by NYPA

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- Work shall be shown: additions in **RED** or in **BLACK** and back circled; deletions **GREEN**, or in **BLACK** and back circled.
- Revision triangles and notes (**BLUE**) shall be removed
- Drawing Revision Block shall indicate Rev xa, “Record Drawing”, be initialed, and dated. X in xa references the revision number that was provided to Developer by NYPA; a in xa references the next alphabetic character in the series incremented one from the last alphabetic character used by Developer. Record Drawings shall be signed and sealed with PE Stamp by the EOR.
- Transmittal of Record Drawings to NYPA:
 - A. Electronic copies provided in DWG file format. DWG files shall have an indication in the seal box that the drawing has been sealed, coordinate with NYPA. Drawing file is named the drawing number without revision number added.
 - B. “Wet” signed and sealed full-size copy and PDF thereof.

TYPE III – Drawings that have been produced by NYPA For Construction and provided to Developer for use on the project

- Work shall be shown: additions in **RED** or in **BLACK** and back circled; deletions **GREEN**, or in **BLACK** and back circled.
- Revision triangles and notes (**BLUE**) shall be removed
- Drawing Revision Block shall increment the alpha character indicating “Record Drawing”, initialed, and dated.
- Record Drawings shall be signed and sealed with PE Stamp by the EOR.
- Transmittal of Record Drawings to NYPA:
 - A. Electronic copies provided in DWG file format. DWG files shall have an indication in the seal box that the drawing has been sealed, coordinate with NYPA. Drawing file is named the drawing number without revision number added.
 - B. “Wet” signed and sealed full-size copy and PDF thereof.

4.4 Turn Over Packages

Turn over packages (TOPs) include Permit / Construction TOPs (CTOPs) and Equipment TOPs (ETOPs) shall be in accordance with NYPA Procedure O-AMM-20-016.

The Developer shall transmit the construction turn over and construction QA/QC documentation in the CTOPs; equipment information for NYPA Operations and Maintenance in the ETOPs. The TOPs shall contain all pertinent information. Developer shall provide CTOPs and ETOPs as hard copy, pdf files, and in MS Access database(s) or other approved format. The ETOPs shall be coordinated to the Equipment List and BOM. The database shall allow drawings and documents associated with any particular equipment or BOM item to be easily accessed, retrieved, and printed.

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The following lists are indicative of contents. The Developer shall submit content early during the project design phase.

CTOP:

- All permits, variances, licenses, access roads, rights of way, structures, and allowed usage, all in a form acceptable to NYPA.
 - NYPA will require free and clear title to all real estate interests transferred to it. Developer to provide independent title reports evidencing same, brought forward to the date of transfer.
 - Evidence that the real property is free of environmental contamination or conditions, regulatory actions or encumbrances including copies of completed environmental reports, studies, correspondence and regulatory agency acceptance documenting all environmental conditions have been addressed.
 - All Deeds, easements and other real estate transfer documents shall utilize NYPA's standard language for such documents.
 - All Surveys for lands transferred to NYPA shall utilize NYPA's standard format.
- Certificates of Inspections including Electrical, Structural, Fabricator, Fire Alarm, Board of Underwriters.
- Testing Certifications, Soil Compaction, Concrete testing, etc. (compilation of reports)
- Certificates of Special Inspections
- EOR Certificates of Completion
- Certificate of Occupancy from Authority Having Jurisdiction
- Field Testing documentation
- QA/QC checklists (compilation of reports, CIMP checklists, etc.)
- As-Built Construction Drawing List
- Field Change Request (FCN)/ Field Change Notice (FCN)/ Design Change Notice (DCN) list
- QA/QC Nonconformance List / Documentation of resolutions

ETOP:

- Equipment Specification
- Equipment Purchase Order documentation
- Factory Test documentation, Field Installed (Baseline) Test data.
- Pictures of Equipment Nameplate showing Model and Serial Numbers and picture of Equipment Label
- Vendor product documents including drawings, specifications, operation and maintenance manuals, Safety Data Sheets, recommended spare parts lists,

Design Criteria for Developer Connection to the New York Power Authority Transmission System

Representative and Factory contact information. Vendor Drawings shall be EOR approved and annotated to indicate supplied equipment configuration: e.g. strike through components not supplied; highlight with arrows/ stamps for included components.

- List of Developer provided spare parts, PO, PO numbers, Part numbers, supplier, and costs.
- Programming manuals and documentation of as-supplied programming e.g. relay settings data.

Warranties, maintenance, and/or service agreements, expiration dates, contact information. Developer will provide NYPA with copies of any OEM, supplier, contractor or subcontractor warranties with transfer of assets. NYPA will be named as the recipient and beneficiary of such warranties as a pass-through warranty to which NYPA is entitled and the ultimate beneficiary of

Design Criteria for Developer Connection to the New York Power Authority Transmission System

5 EQUIPMENT AND MATERIALS

Developer shall submit equipment and materials.

5.1 Power Circuit Breakers

- A. HV circuit breakers shall be dead-tank, SF6 type.
- B. The continuous and short-circuit current rating of the circuit breakers shall be determined by NYPA for each specific project.
- C. Circuit breakers shall be equipped with two trip coils, double break type.
- D. The circuit breakers shall be supplied with a minimum of 18 normally open and 18 normally closed auxiliary contacts.
- E. The circuit breaker selector switch shall have a minimum of 10 decks, each with 4 contacts.
- F. Circuit breaker control cabinets shall be equipped with local/remote switch telephone extension jack and a 60A 480V convenience outlet to accommodate breaker maintenance.
- G. Power Circuit Breakers shall comply with NYPA ES-103-01, "Outdoor Oil-less Power Circuit Breakers".

5.2 Disconnect Switches

Motorized Group Operated Line Disconnect Switches and Manual Gang Operated Circuit Breaker Disconnect Switches

- A. All line or feeder disconnects shall be motorized and breaker disconnect shall be manual disconnects, all bus disconnects in breaker & half configuration shall be motorized. All disconnects to be motorized for 345 & 765kV systems.
 - a. Motorized switches shall have manual backup operator.
- A. Motorized and manual line and breaker disconnect switches shall be designed to operate in all weather conditions, including icing conditions.
- B. Line disconnect switches shall be provided with manually operated grounding switches.
- C. The site-specific continuous and momentary current ratings of disconnect and grounding switches will be specified by NYPA.
- D. Motorized and manual disconnect switches shall be provided with external limit switches with a minimum of 6 normally open and 6 normally closed auxiliary contacts. The LSs shall be used for indication and/or relaying purposes.
- E. Line disconnect switches and grounding switches shall have "open" and "closed" position indication located on the operating mechanism.
- F. Disconnect Switches shall comply with NYPA ES-103-02, Disconnect/Ground Switches".

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5.3 Potential Transformers

- A. Potential transformers shall be provided for relaying and/or metering.
- B. Both capacitances coupled and magnetically coupled units are acceptable. However, for revenue metering only magnetically coupled potential transformers shall be used.
- C. If capacitance coupled transformers are used for an application that requires periodic CCVT recalibration, then these instrument transformers shall be used only if a set of magnetically coupled transformers is installed at the switchyard and can be used for in-service comparison.
- D. The Developer shall submit an accuracy class and burden of each potential transformer.
- E. The PT/CCVT shall comply with NYPA specification, ES118-00, "Instrument Transformers".

5.4 Current Transformers

- A. Current transformers shall be bushing type, window type or free-standing installed for relaying and/or metering.
- B. The accuracy class and burden of the current transformers shall be as follows:
 - 1. Relaying Accuracy Class shall be in compliance with $V_k \geq C$ 800V at the maximum tap.
 - 2. Metering accuracy class CT shall typically be 0.15 B 1.8. Extended range accuracy Class CT performance may be required.
- C. All type of CTs shall comply with NYPA specification, ES-118-00, "Instrument Transformers".

5.5 Surge Arresters

- A. Surge arresters shall be station class, metal oxide, gapless, polymer type. The Surge arrester ratings shall be determined by the Insulation Coordination Studies.
- B. Surge arrestors shall comply with NYPA specification NYPA SR-101, "Surge Arrestors".

5.6 Power Transformers

- A. The step-up transformer shall be supplied by the Developer and installed outside the perimeter of the NYPA switchyard.
- B. The step-up transformer shall meet the following criteria:

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1. The high voltage winding shall be delta connected, unless otherwise instructed by NYPA;
2. The high voltage rating shall match the NYPA system voltage;
3. No-Load tap changer is usually acceptable. There may be specific instances where load tap changer shall be required. The Developer shall coordinate with NYPA early in the design.
4. The Developer shall submit the transformer MVA rating and impedance p.u. value.

If the installation is on the property to be owned by NYPA the power transformer shall meet the following criteria:

1. Transformer shall be mineral oil-filled. The mineral oil shall be certified PCB free. An oil containment system meeting regulatory requirements for oil filled equipment shall be provided. The fluid containment system shall be designed to provide for management of rain, ice, and snow accumulation and proper operation of the containment system. Drainage piping from such containment shall be to "daylight" and shall not be perforated piping.
2. Noise generated by the transformer and accessory fans, shall be 2 dba less than: NEMA/IEEE limits, local laws and regulatory requirements..
3. In special case, if the transformer is required with low noise level the transformer manufacturer shall clarify if transformer will be provided with or without sound enclosure to meet the required sound limits.
4. Power Transformers shall comply with NYPA specification ES-102-01, "Standard Specification Power Transformer Class II". Section 1.12, A-E shall not apply.

5.7 Control Building

- A. Developer shall provide a switchyard Control Building. The Control Building shall be a single story, steel frame, metal siding building with reinforced concrete foundation. The building layout shall neatly accommodate equipment and accessories, allow access throughout for maintenance and replacement of equipment, and shall contain layout and allocated space for future equipment associated with expansion of the switchyard.
- B. The Control Building shall be manufactured in accordance with the requirements of New York Department of State (NYDOS), Factory Manufactured Buildings (Modular) and shall bear an NYDOS Insignia.
- C. The installation of the Control Building shall be performed in accordance with NYPA Construction Permit Process, see NYPA document O-TC-20-001, "Code Compliance Program: NYPA Permitting Procedure", and meet the requirements of the New York Uniform Fire Prevention and Building Code in effect at time of submittal of final Signed & Sealed design package. In the event of a conflict between NYPA requirements and the Uniform Code, the more conservative shall prevail.

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- C. The following Control Building spaces shall be provided as a minimum:
- Heated vestibule, approximately 6'x8'
 - Break room, minimum 14'x14'
 - Control room/work room, minimum 14'x14'
 - Primary and Secondary Relay Rooms (each separated by 2 hr. fire rated barrier or enclosure)
 - Primary and Secondary Battery Rooms (each separated by 2 hr. fire rated enclosure)
 - The equipment layout shall provide proper working clearances and clear space.
- D. The Control Building will house the primary and secondary protection system relay panels located in separate primary and secondary relay rooms, communication and carrier cabinets, monitoring equipment, SCADA cabinets, and fault and event recorder cabinets. The batteries, battery chargers, low voltage switchgear, and AC and DC distribution panels will be located within the building. (NOTE: Physical and electrical separation between primary and secondary relay systems shall be per NPCC Directory 4.) The control equipment and the power equipment shall be divided into two separate areas of the Control Building for electrical safety purposes.
- E. Cables entering the building from the switchyard shall be routed below the Control Building floors in trenches / cable trays and/or via overhead cable trays. If below floor, the relay, terminal, RTU, etc. cabinets shall be fastened to structural steel frames at the top of the trenches to provide wire routes from below.
- F. All conduits penetrating the exterior walls of the building shall be plugged with duct seal to preclude condensation associated with convection within the conduit.
- G. Overhead interior cable trays shall be routed above the equipment. Overhead cable trays shall not be routed in the vicinity of high voltage equipment (transformers, circuit breakers, disconnect switches, cap banks, etc.) such that failure of the equipment could cause collateral damage to the cables or cable tray.
- H. Building and structure design parameters including importance factors, component importance factors; dead, live, wind and snow loads; seismic, and site class shall be in accordance with the NYSBC, IEEE, and standards and codes.
- I. The Control Building shall be provided with fire detection, alarm, manual fire extinguishers and where appropriate dedicated clean agent fire suppression systems. All spaces of the control building shall be provided with the fire detectors. The fire alarm system shall be capable of local and remote indication with local acknowledgement. The fire detection and HVAC systems shall be appropriately interlocked.
- J. Fire detectors shall be early warning smoke detectors of the photoelectric or ionization type. The alarm system shall provide local audible/visible annunciation

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in and exterior to the Control Building. The local fire alarm panel shall be connected to the RTU to provide remote alarm. Circuits shall be electrically supervised. The smoke detection system shall be installed in enclosed areas/buildings which house cabling, breakers, control cabinetry, switchgear, transformers, or other electrical equipment of low, high, or control voltages. Installation shall conform to latest edition of ANSI/NFPA.

- K. The fire alarm panel shall be provided with battery back-up with a minimum capacity of 24 hours per NFPA.
- L. Floor and wall openings in the Control Building shall be sealed with a UL listed penetration detail to maintain the fire rating of the floor or wall. Conduit penetrations shall be sealed at ceiling, floor, and wall. There shall be no roof penetrations.
- M. The HVAC system for the control building shall be designed to provide heating, cooling, and ventilation air. Ambient design conditions shall be as specified in the NYSBC. Outside design temperature and conditions shall be per ASHRAE for the location of the switchyard. HVAC equipment shall be sized for 150% of the design load. HVAC equipment shall have multiple units in a lead-lag control arrangement. Space heaters shall be provided to back up the HVAC system(s).
- N. Battery rooms shall be provided: primary and secondary. The HVAC system and gas detection system for each battery room shall be designed in accordance with IEEE and NYSBC to provide ventilation air. This airflow shall be factored into the heating and cooling load calculations. The system shall be designed to provide even air temperature around the batteries and prevent hot or cold spot within the battery room. The ventilation system shall be designed to minimize the amount of air used for ventilation. Provide ventilation fan with spark resistant construction and explosion-proof motor. Doors to any battery room/area shall be equipped with safety signs, prohibiting smoking, sparks, or the use of open flames per ANSI. Battery room fire suppression shall be provided by portable non-conductive dry chemical fire extinguishers minimum Classification 4-A: 60-B: C.
- O. HVAC equipment shall be electric, self-contained, pre-assembled, pre-wired, and thermostatically controlled. Design and placement of HVAC system on the exterior of the building shall account for access and snow accumulation.
- P. A Control Building security system shall be integrated with the switchyard security system described in Section 7. HVAC, security, gas detection, and fire system operation, trouble and failure alarms shall be monitored via the RTU. High and low-temperature alarms in each of the Primary and Secondary Relay and Battery Rooms, hydrogen alarm, eye wash or emergency shower activation and other alarms (e.g. sump high level) shall be wired to the RTU.
- Q. Eye wash stations and emergency showers shall be provided in accordance with IEEE for eye wash and ANSI for eye wash and emergency showers. Submit locations, at least one in each battery room. Each station shall have a collection reservoir for used fluid and dry contacts for alarm connected to the RTU. The eye wash station shall be self-contained (Fend-All 2000 or approved equal) or permanently plumbed from the potable water source. Self-contained units shall be gravity operated, complete with a catch tank. For a permanently plumbed unit, provide floor drain and a source of tepid water. The source of tepid water shall

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be designed for a 15-minute supply period. Mixing valves and anti-scald devices shall be provided.

- R. If the Control Building is finished with a flat roof, the roof shall be provided with membrane construction. Provide 30-year warranty. Caulked joints in a prefabricated building roof slab configuration are not acceptable.
- S. Control Building exterior doors shall be furnished with Best Access Systems construction key cores for the insertion of permanent key cores by NYPA Security. Or equal is not acceptable.
- T. The Developer shall provide automated external defibrillators (AEDs), wall-mounted First Aid kits, Key Boxes, and furniture. The Developer shall supply the Powerheart G5 AED or its latest, FDA Approved, replacement model by Zoll and an industrial, wall mounted, first aid station in compliance with the latest ANSI Z308.1 standard.
- U. Adequate space shall be provided within the Control Building, including the electrical panels/cubicles and power supply for the future installation of a level II EV charging station.
- V. In the substation layout, just outside the Control Building, a 15' by 15' space shall be reserved for the installation of a bathroom facility. The ground under this location shall be kept clear and shall not be used to route any piping or conduit.
 - a. Provide a single handicapped design bathroom with shower in heated and ventilated, insulated, metal building on a concrete slab with a floor drain.
 - b. Provide potable hot and cold water. Potable water shall be provided, including connection to municipal water source and/or well. Hot water shall be provided by a tank-less water heater. If well, test water for determination of disinfection, chlorination or other treatment system options.
 - c. Provide sewer connection to an on-site sewage treatment system or local POTW (Publicly Owned Treatment Works).
 - d. The building temperature and water flow shall be monitored and wired to RTU.
- W. In the substation layout, just outside the Control Building, a 35' by 35' space shall be reserved for the installation of an emergency generator and fuel supply. The ground under this location shall be kept clear and shall not be used to route any piping of conduit. See section 5.16, "Emergency Power".

5.8 GIS Equipment Building

- A. Where applicable, the Developer shall provide a GIS Equipment Building.
- B. In lieu of providing a separate Control Building, the GIS Equipment Building shall incorporate all the attributes and requirements of the Control Building in Section 5.7 Control Building in addition to the attributes and requirements of this section.
- C. The building layout shall neatly accommodate equipment and accessories, allow access throughout for maintenance, testing and replacement of

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equipment, and shall contain allocated space for the storage of service and testing equipment. High-pot testing capabilities shall be incorporated into the building design and the required testing accessories (test bushing, bus extension, etc.) shall be included with the project's deliverables.

- D. The GIS Equipment Building's exterior shall be similar in architectural appearance as other structures in the vicinity of the installation.
- E. The GIS Equipment Building floor slab shall be flat, and level as required for the proper installation of the GIS equipment.
- F. The GIS Equipment Building shall include an overhead bridge crane for GIS equipment service and replacement.
- G. The GIS Equipment Building exterior shall have roll-up door that is appropriately sized for the access, removal and replacement of the GIS equipment and GIS service equipment.
- H. The GIS Equipment Building shall incorporate a SF6 Gas monitoring and detection system. This system shall be wired to the RTU and alarm locally and remotely on detection of SF6.
- I. All GIS equipment shall include equipment sensors to monitor the gas pressure for detection of SF6 leaks. These sensors shall be wired to the RTU.

5.9 Power Cables

- A. Cables shall be suitable for underground and above ground use in wet and dry service conditions.
- B. The feeder ratings to the station service transformers shall be determined based on recognized standards and Good Engineering Practice for 133% insulation level. Cables shall be rated 600V for AC power circuits 600V and below and for 125V DC and below.
- C. Medium voltage (>5KV) cables shall be: Class B, 90°C, concentric-lay-stranded copper conductor, ethylene-propylene rubber (EPR) insulation, helically applied copper tape, low smoke, zero halogens thermo-setting jacket. Conductor and insulation shields shall consist of an extruded layer of a semi-conducting thermosetting compound compatible with the insulation. The copper tape shall be capable of carrying the line-to-ground fault for the time needed by the circuit protective device to clear the fault without exceeding 200°C. Medium Voltage Power Cable shall comply with NYPA specification ES-105-00, "5KV – 35KV Power Cable".
- D. 600V rated cables shall be Class B, 90°C, concentric-lay-stranded copper conductor, flame-resistant ethylene-propylene rubber or cross-linked polyethylene insulation, low smoke, zero halogens thermo-setting jacket. Thermoplastic or PVC insulation is not acceptable. Low Voltage Power Cable shall comply with NYPA specification ES-106-00, "Low Voltage (1000V) Power & Control Cable".

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5.10 Control and Instrumentation Cables

- A. All multiple conductor cables for AC and DC service shall be rated minimum 600V AC and shall be as specified in Section 5.8 D above.
- B. In addition to A., Control and instrumentation cables installed in HV (115kV and above) switchyard shall be shielded with 5 mil helically wrapped tinned copper tape, no less than 25% overlap, with #16 or #18 drain wire.
- C. Terminations shall be nylon insulated (no PVC) compression, ring type, UL listed.
- D. Instrumentation Cable shall comply with NYPA specification ES-106-01, "Instrumentation and Control Cable".

5.11 Cable Trenches, Conduits, and Trays

- A. Underground raceways should be the primary means to run power and control cables to yard equipment. The raceway system should be comprised of direct buried conduits from equipment to a cable trench system containing cable trays leading to the Control Building.
- B. Acceptable construction for the cable trench systems shall be either:
 - 1. Cast-in-place concrete construction
 - 2. Precast concrete trench

Trenches shall be provided with installed access ladder rungs.

- C. Cable trenches shall be arranged such that the routing follows the basic coordinates of the switchyard. Provision for storm water drainage, e.g. French drains, shall be provided. Segregation barriers shall be provided where it is necessary to run cables of different signal levels in the same tray or trench. HS-25 rated trench covers shall be provided. Minimum trench inside clear dimensions shall be 4' height x 4' wide. Same minimum dimensions if cable trenches are provided under the floor in the Control Building.

If cable trenches are provided under the floor in the Control Building, they shall be dry bottom. Slope to sump and provide sump pump(s) and above grade discharge piping. Sump level and pump operation shall be monitored and wired to the RTU.

- D. Functional separation criteria for conduit runs are that power, control, primary relaying and secondary relaying cable classes shall be routed in dedicated conduits until they reach the pertinent cable trays, as described below. Power cables above 600V shall be run entirely in direct-buried conduit outside the cable trenches.
- E. Aluminum ladder type cable trays shall be installed in the trench for cable placement. The cable segregation criteria in a tray shall be as follows:
 - 1. Station Service conductors;
 - 2. All other 600 V power cables (operating at 480/277V, 120/208 V, 120-240 V);

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3. 120 VAC control, PT, and CT wiring;
4. 125 VDC (or less) power and control (less than 20 amperes);
5. Instrumentation, low voltage (24VDC or less) discrete inputs, analog signals (4-20mA); Communications, telephone, fiber, Ethernet, etc.;

All cables associated with fire detection, alarm, and suppression systems shall occupy a dedicated raceway.

In addition, cables shall be separated as required by NPCC, NEC, IEEE, and codes and standards.

- F. Cable trays shall have bonding jumpers to maintain continuity of the ground path.
- G. Underground conduits in the switchyard shall be buried at least 24" below finished grade. Conduits shall be PVC with rigid steel stub-ups, or rigid galvanized steel.
- H. Conduit exposed in the switchyard shall be rigid galvanized steel. Indoor and outdoor conduits shall be labeled per the Conduit Schedule, see section 5.20.4. Watertight conduit fittings shall be used at outdoor junction boxes and terminal cabinets.
- I. Where liquid-tight flexible conduit is used, provide bonding bushings and external bonding jumpers.
- J. Pull boxes or manholes shall be spaced so that allowed cable pulling tension and sidewall pressure are not exceeded. Conduit elbows, pull-box dimensions, and manhole openings shall be such that the minimum cable bending radius is not violated. The following parameters shall be determined based on pertinent standards and manufacturer's recommendations:
 1. Allowable pulling tension
 2. Allowable sidewall pressure
 3. Minimum bending radius
- K. Cables shall be continuous runs. Pull boxes, cable trays, trenches, LB's, etc. shall not be used for locating splices, even if listed for such service. Submit specific proposed exceptions. Conduit runs shall be sloped to provide drainage into hand holes or cable trenches.
- L. Provide spare conduits with pull cords:
 1. At each HV Circuit Breaker – one 2" to each of primary, secondary trench
 2. One 1-1/2" from gate phone location to Control Building telephone board.
 3. As appropriate

5.12 Lighting

- A. Interior lighting shall be LED and controlled by occupancy sensors. Exterior wall pack and switchyard lighting shall be timer/photocell controlled with manual override, LED or pulse start metal halide, suitable for ambient

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conditions with re-strike quartz lamp. Lighting shall be high efficiency with low harmonic distortion.

B. Design drawings and calculations shall be submitted showing illumination levels for each area, calculation methods (not on drawing itself), design and installation details, and bill of materials.

C. Lighting shall fulfill the following functions:

1. Outdoor general lighting
2. Indoor general lighting
3. Local lighting
4. Emergency lighting
5. Security

D. The switchyard shall be illuminated by general lighting and security lighting. The Control Building shall be illuminated by general, emergency, and local lighting.

E. The levels of illumination shall be:

For outdoor general lighting10 fc ground level

Illumination level at ground level about 3' outside the switchyard fence shall be less than 0.5 fc (coordinate with surveillance camera equipment)

For indoor general lighting.....30 fc ground level

For local lighting of switchboards, metering, and control

panels in the Control Building.....50 fc front panel @ 4'

Emergency light (ground level)15% of general lighting

Security lighting at the fenceSee Section 7

F. UL 924 compliant exit and directional signage shall be provided with battery back-up (UL listed, minimum 90-minute capacity), or powered from the UPS panel - in accordance with NYSBC.

G. UL 914 compliant emergency lighting shall be provided in Control Building illuminated spaces. Emergency lighting shall be provided at the primary and secondary relay cabinet faces. The emergency lighting fixtures shall be UL listed with battery back-up for a minimum 90-minute capacity or powered from the UPS panel - in accordance with NYSBC. Emergency lighting shall also be provided on the exterior of the building at each of the personnel exits.

H. Lighting shall be calculated in accordance with accepted standards, namely: general lighting, by "zonal cavity" method; local lighting, by "point-by-point" method; switchyard lighting, by "graphical method."

I. Lighting fixtures and lamp types are:

- Control BuildingLED, warm white
- SwitchyardLED or Metal Halide with re-strike quartz lamp



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- Battery room.....LED, Vapor-proof or explosion proof

5.13 AC Station Service Power

- A. The Developer shall design a complete Station Service power system for the facility and equipment. The entire AC station service system shall be considered essential. The AC station service power shall be metered with revenue metering grade CTs, PTs, and meters.
- B. The AC station service shall be configured for reliability.
 - a. Reliable supplies shall be configured in a “cascade” using two breaks before making automatic transfer switches (ATSS) equipped with maintenance bypass. ATS signals shall be connected to the RTU for trouble, alarms and switch positions to be monitored via SCADA with supervision remote from site.
 - b. Primary power shall be Developer supplied power derived from Developer’s HV bus via a transformer (or from a transformer in the switchyard).
 - c. The first backup shall be provided from local utility source.
 - d. Where required by applicable regulations, a second backup from a Developer supplied emergency diesel fueled generator. This configuration assumes the Developer’s substation is adjacent to the NYPA switchyard.
- C. The voltage shall match the local utility service voltage. Sources shall be 480V, 3-phase, 4-wire, grounded; 120/208V, 3-phase, 4-wire, grounded; or 120/240 V, 1-phase, 3-wire, grounded. If 480V power is not provided by the service source, the Developer shall provide a step-up transformer to provide a source of power for switchyard equipment maintenance (gas cart or oil processing trailer).
- D. AC distribution panel boards shall be the main breaker equipped, configured with Critical and Non-Critical circuits in separate panels (Red Dot and Green Dot per NYPA CPP-1). Coordinate with NYPA.
- E. The station service kVA sizing shall be calculated based on the calculated maximum AC load, including equipment maintenance loads, with 4 12kw EV charging stations plus 2 future, plus a 25% margin for future expansion. Each source, transformer or emergency generator, shall be rated to supply the entire AC station service load plus a margin.
- F. A UL 924 battery backup UPS system and panel board shall be provided for AC loads sensitive to switching transients including fire alarm system, HMI, security system, site computers (provide labeled outlet receptacles at various locations), SER and DFR computers, emergency lighting (if included in design), and loads that do not tolerate break before make transfer (e.g., radios, other computer equipment). The Developer shall provide 8 hours, plus 40% load margin in the UPS system backup load supply capability. The UPS shall comply with NYPA specification SR-106, “Uninterruptible Power Systems”. If desired, the Developer design may power the UPS from the

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primary/secondary 125V battery set(s), appropriate load to be included in that sizing calculation.

- G. As part of the design, the developer shall provide Load Study, Short Circuit Study, Protective Device Coordination Study, Arc Flash Incident Energy Analysis, and Electrical Safety Review for station service system.
- a. Short circuit Study and Arc Flash Incident Energy Analysis shall be performed via electrical system modeling. Arc flash calculation methodology shall be per IEEE-1584, IEEE-1584.1 and NFPA 70E latest version requirements. For more detailed requirements refer to NYPA's specification 26-05-73.10, "Short-Circuit Study/Protective Device Coordination Study/Arc Flash Analysis/Arc Flash Mitigation".
 - i. Mitigation of incident energy levels above 8 cal/cm² shall be provided where practicable. The 30% submissions shall include these studies and include design adjustments to meet this goal.
 - ii. Where incident energy levels exceed 8 cal/cm², provide:
 - 1. Remote operation and remote racking provisions
 - 2. IR windows for external IR scanning during operation
 - 3. Absence of voltage test stations, safely externally usable without opening equipment covers.
 - iii. Modeling is required to be performed using SKM PowerTools software (latest commercial version - no alternate). SKM models electronic files with associated library files as well as PDF copy reports are a deliverable for NYPA interim reviews and final as-built record.
 - b. Protective devices shall be set per the final coordination study.
 - c. Arc Flash warning labels per NYPA standard format, shall be provided for electrical equipment per the NYPA Electrical Safety Procedure document.
- H. Engineer of record shall provide Electrical Safety Review which includes a detailed review of project and equipment design for compliance with OSHA, NESC, NFPA and NYPA Electrical Safety Procedure.
- a. This review shall consider the operation and maintenance to ensure the design and provided equipment meets with the referenced standards.
 - i. Include all steps necessary to put equipment into an electrically safe condition to operate, or to perform work. Provide written step by step procedure: to operate, or to put in electrically safe condition to maintain.
 - 1. Provide additional disconnecting switch points for medium and low voltage to allow for isolation of equipment from sources

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without the need to take outages on transmission/sub-transmission/distribution level components.

- ii. Where the equipment voltage requires temporary protective grounds (TPG) to establish electrically safe condition, provide:
 - 1. Calculation of TPG requirements, ratings, equipment sizes (OSHA, IEEE-1048, IEEE-1246, ASTM F885 and ASTM F2249).
 - 2. Provision of all equipment for grounding attachment studs, TPG cables, clamps, etc. for a complete system.
 - 3. TPGs shall be single conductor where possible. Multiple conductors shall be evaluated as required by standards and manufacturer requirements for application.
- b. This review shall be conducted prior to each stage of submission as the design advances – the design shall be adjusted prior to submission to incorporate findings of the review.

5.14 DC Station Service Power

- A. The Developer shall design a complete Station Battery power system for the facility and equipment. Redundant battery banks and chargers shall be provided.
 - a. The DC station service arrangement shall consist of two complete systems, each consisting of a nominal 125V battery, battery charger, and distribution panel.
 - b. The two systems shall normally operate isolated, one dedicated to primary relaying and the other to secondary relaying; plus other station service loads.
 - c. The systems shall be ungrounded, floating. Protection shall be appropriate for a floating system including ground detection alarm. Batteries for Station Service and Microwave communication shall be vented (flooded) lead-acid type.
 - d. Battery chargers, Battery condition monitoring systems, transfer switches trouble, alarms and switch positions shall be monitored via SCADA with supervision remote from site
- B. As part of the design, the developer shall provide Load Study, Short Circuit Study, Protective Device Coordination Study, Arc Flash Incident Energy Analysis, and Electrical Safety Review for station service system.
 - a. Short circuit Study and Arc Flash Incident Energy Analysis shall be performed for battery systems over 100 volts via electrical system modeling. Arc flash calculation methodology shall be per IEEE-1584, IEEE-1584.1 and NFPA 70E latest version requirements. For more detailed requirements refer to NYPA's specification 26-05-73.10, "Short-Circuit Study/Protective Device Coordination Study/Arc Flash Analysis/Arc Flash Mitigation"

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- b. Mitigation of incident energy levels above 8 cal/cm² shall be provided where practicable. The 30% submissions shall include these studies and include design adjustments to meet this goal.
 - c. Where incident energy levels exceed 8 cal/cm², provide:
 - i. Remote operation provisions
 - ii. IR windows for external IR scanning during operation
 - iii. Absence of voltage test stations, safely externally usable without opening equipment covers.
 - d. Modeling is required to be performed using SKM PowerTools software (latest commercial version - no alternate). SKM models electronic files with associated library files as well as PDF copy reports are a deliverable for NYPA interim reviews and final as-built record.
 - e. Protective devices shall be set per the final coordination study.
 - f. Arc Flash warning labels per NYPA standard format, shall be provided for electrical equipment per the NYPA Electrical Safety Procedure document.
- C. Each battery shall be sized to provide the entire calculated switchyard DC power load plus 10% for future expansion. In addition, the AH capacity shall take into account the battery aging and temperature correction and shall be based on 8-hour discharge rate providing 8 hours of backup. Station Service Batteries shall comply with NYPA specification ES-107, "Station Batteries".
- D. A DC system switching arrangement shall be provided such that a battery may be taken out of service for maintenance or testing while the other is in service, providing for the entire station load in accordance with NPCC.
- E. Each battery bank shall be installed a dedicated battery room within the Control Building.
- F. Sizing shall be calculated according to IEEE recommended practices. The sizing of the switchyard batteries shall include the following loads:
- i. Momentary loads due to the simultaneous operation of a group power circuit breakers (for example, bus differential protection) and inrush currents such as those from a motor
 - ii. Continuous loads such as panel lights, holding coils, carrier equipment transmitters, and receivers, microwave, protective relaying, and SCADA for 8 hours minimum
 - iii. Connected DC emergency and exit lighting
- G. For battery sizing purposes, the duration of continuous loads and emergency lighting shall be taken as 8 hours.
- H. The battery chargers shall be of the electronic type. The DC output capacity of each charger shall be such that it is capable of recharging the battery at the highest system

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voltage in 16 hours while serving the connected continuous loads. Battery chargers shall comply with NYPA specification SR-107, "Battery Chargers".

- I. Ventilation and safety equipment shall be provided for the battery rooms.

5.15 Emergency Power

- A. The Developer shall supply diesel fueled emergency generator with an appropriately sized load bank, where required by applicable regulations. This generator shall be sized to supply the AC station service distribution panels load plus margin at continuous operation rating. Generator operation, Fire Suppression System, etc. trouble and failure alarms shall be monitored via the RTU.
- B. The generator shall be a packed unit with a weather-proof enclosure for exterior installation. Critical exhaust silencer and a sound attenuating enclosure shall be provided.
- C. Developer shall perform an ambient noise study to demonstrate compliance with New York State Public Service Law – Article VII.
- D. The starting battery system including a charger capable of supplying generator auxiliary load and charging the battery shall be provided.
- E. The Developer shall provide for periodic testing of the emergency generator. Periodic testing shall be able to be performed by onsite personnel, programmable automatic timer, or by NYPA via supervisory control signals from the RTU. The Developer shall provide controls for automatic testing and an integrated stepped load bank sized for generator rated load. The system shall include local and remote emergency stop controls.
- F. An integral onboard double walled diesel fuel tank shall be provided. The total fuel shall be sized for at least 3 days of continuous operation at the generator rated load. If an additional fuel oil storage tank is required for the fuel supply, the storage tank shall be a double walled, above ground, UL-2085 fire rated tank. The fuel oil storage tank shall be installed on a dedicated foundation. The tank(s) and fuel transfer lines shall be in accordance with all applicable regulations, monitored for leakage both locally and remotely, and wired to the RTU.
- G. The Developer shall provide proper access and accessories to fill and inspect the fuel storage tank.
- H. The Developer shall provide a heating system to ensure reliable fuel supply and engine operation during extreme weather conditions.
- I. The generator and fuel oil storage tanks shall be located outside the Control Building on a separate foundation provided minimum 10 feet from the control building exterior wall with minimum 4' maintenance clearance on all sides around the generator enclosure. Provide a dry agent Fire Suppression System for the EDG. Provide proper access for complete inspection, maintenance, and repair of the EDG system.

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- J. Where a generator is not required by the applicable regulations, adequate space at the optimum location, exterior to the Control Building shall be provided in the layout of the substation for future installation. See Section 5.7, "Control Building".

5.16 Bus and Bus Support

- A. The aerial bus shall be rigid, high strength ANSI Schedule 80, Alloy 6063-T6 or equivalent.
- B. Strain bus extensions may be installed to relieve stresses on potheads and equipment terminals. The strain bus shall be All Aluminum Conductor (AAC) or All Aluminum Alloy Conductor (AAAC) and shall be of compatible size.
- C. Bus size shall be determined considering the continuous current rating of the project and other parameters including short circuit current, ambient temperature and maximum temperature rise, in accordance with IEEE standards. The minimum bus size shall be 4".
- D. The Developer shall calculate the number of supports based on factors such as fiber stress, deflection, cantilever strength, wind-induced vibrations, etc. in accordance with IEEE standards.
- E. Provisions shall be made for thermal expansion of bus. For each length of the rigid bus the Developer shall show the type of fitting at each bus support (fixed-bus or slip-fit) and the location and type of bus couplers.
- F. All horizontal bus runs shall have damping cables placed inside. Do not drill weep holes.
- G. The length of a continuous bus shall be limited to 100'.
- H. The Developer shall submit bus calculations.

5.17 Insulators

- A. Insulators shall be of high strength porcelain or toughened glass. Extra high strength insulators shall be used if site specific conditions warrant their use. Coordinate with NYPA.
- B. Insulators shall be in unit stacks in accordance with NEMA. Stacks of different cantilever strength shall be identified.
- C. Station post insulators shall have a minimum of two stacks. All stacks shall be of the same cantilever strength.
- D. Post-type insulators shall not be used with strain bus, except as stand-off insulators, and only with prior approval from NYPA.
- E. Strain type insulators shall be used to terminate the incoming overhead lines.
- F. Suspension type insulators shall be used where necessary with strain bus for under-hung installation.
- G. Polymer insulators shall not be used for transmission line connections, or bus supports, unless specifically approved by NYPA in writing.

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- H. All toughened-glass suspension type insulators shall comply with NYPA specification, O-TRA-STD-302, "Toughened-Glass Suspension Type Insulators".

5.18 Corona Control

- A. The design and construction of the switchyard shall take into consideration means to minimize the audible noise induced by frequency and corona. Corona-free hardware shall be used. Sharp corners on the bus conductors shall be avoided and bolts shall be kept short.
- B. All 345 kV switchyard hardware shall be rated for the EHV application.
- C. The switchyard bus in a 345 kV switchyard shall be fitted with grounding studs for corona control.

5.19 Surge Counters

Surge counters shall be provided on surge arresters.

5.20 Acoustics

The Developer shall design to ensure that the noise generated by equipment including transformers, corona, and generators meets local and national standards.

5.21 Electrical Identification

The Developer shall install identification on items including structures, equipment, cable trays, conduit, cable and wire. Identification shall be in strict coordination with the drawings. The Developer shall coordinate requirements with NYPA. Electrical equipment, relays, conduits, cables, and conductor terminations shall be labeled and identified as to function and designation. Sample labels of each type shall be submitted.

5.21.1 Equipment Labels

- 5.21.2 Equipment and device nameplates shall be engraved laminated phenol resin, black background with white lettering. Equipment shall be labeled with equipment number and identification. Items including relays, instruments, and control switches shall be labeled to show device designation and function Cable Identification

Each single or multi- conductor cable shall be labeled at both ends. Cables shall be tagged within the termination enclosures using approved cable tags with lettering minimum 3/16" tall. Cable tags shall be located near the end of the jacket, at a safe distance from terminations, attached using plastic wire tie, and not be concealed. In addition to cable tags, termination labeling is required, see below.

5.21.3 Conductor Identification – Termination Labels

Conductor terminations, regardless of use, shall be identified. Each termination shall have a sleeve identifying the terminal point of the conductor. Conductor identification sleeve material shall be approved. Lettering for conductor marker sleeves shall be 1/8" tall.

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5.21.4 Conduit Identification

The Developer shall label each end of conduits with stamped 19-gage brass tags affixed by stainless steel wire ties. Tags shall be 1.50" diameter with 3/16" diameter top hole. The Conduit number shall be stamped with 3/16" tall letters.

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6 CIVIL, STRUCTURAL, AND MECHANICAL

Site selection and development is critical to the design of the switchyard. The Developer shall consult and coordinate with NYPA concerning site selection. The Developer selected site shall be suitable for the intended purpose. Plot, layout, and availability of real estate (future purchase) shall take into account that available plot area for future expansion (additional bay of HV circuit breakers) is required. The switchyard shall not be “boxed in”. Sites requiring extensive cut and fill should be avoided.

6.1 Soil Conditions

- A. The Developer shall perform geotechnical investigations to characterize the site soil bearing capacity, resistivity, water table, bedrock depth, etc. The Developer shall submit comprehensive geotechnical investigations reports. The report(s) will be the basis of site and soil classification for seismic, structural, and other design aspects. The Geotechnical Report recommendations shall be incorporated into the project structural drawings and specifications.

6.2 Limits of Construction

- A. The limits of construction, roadway centerline, right-of-way, easements, and tree protection zones shall be located and flagged prior to site grading and drainage operations.

6.3 Erosion Control

- A. The Developer shall design and provide erosion control. If construction limits are modified, the installation of erosion control measures and tree protection fencing shall be re-established.
- B. Provide NYS approved barriers to trap sediment in runoff prior to runoff entering adjacent buffer areas.
- C. Side slopes adjacent to the roadway and the switchyard will be riprap armored or will be re-vegetated to protect side slopes. Riprap stone will be hard durable rock, angular in shape, and conforming to the USACE, “Hydraulic Design of Flood Control Channels,” EM 1110-2-1601.

6.4 Drainage

- A. Site drainage will be facilitated by grading the switchyard and access road or via discharge to an approved storm-water drainage system. Disturbed buffer areas will be re-vegetated with a seed mix conforming to NYSDOT Standards.

6.5 Site Surfacing

- A. Materials, application of aggregate surfacing, and the sampling and testing of aggregates shall comply with NYSDOT Standards. Aggregates shall be supplied from approved NYSDOT sources. The Access road, on-site parking, and switchyard roads shall be paved. Perimeter and exterior roads shall be a minimum of 30'. Interior roads shall be a minimum of 12'. The topcoat layer of asphalt paving shall be applied subsequent to the final utilization of heavy construction equipment on site.

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- B. Immediately prior to surfacing, the sub-grade shall be at minus 3% / plus 2% of the optimum moisture content and shall be compacted to 95% of the maximum dry density. Soft, organic, and other unacceptable material shall be removed from the sub-grade. The aggregate surface course shall be uniformly graded crushed stone. The aggregate shall be placed in uniform lifts not exceeding 8 inches pre-compacted depth (6 inches in compacted depth).
- C. Field testing and sampling shall be provided by an independent testing laboratory retained by the Developer. The following tests shall be conducted for aggregate surfacing:
- Gradation tests prior to the delivery of materials on site for each aggregate source. Sieve analysis shall be made for each sample according to ASTM C136
 - Two tests for laboratory density prior to delivery of material onsite for each aggregate source. Tests shall be performed according to ASTM D1557
 - In-place field density tests at average intervals of one test per 500 cu. yards. In-place density shall be measured per ASTM D2922.

6.6 Switchyard Structure Design

- A. Structural steel fabrication, erection, and connection design shall conform to the AISC "Specification for the Design, Fabrication, and Erection of Structural Steel", and the provisions included in this section. The steel shall be fabricated and shipped as hot-dip galvanized according to the latest version of the Standard Specification of Zinc Coating on Structural Steel. Steel members shall be cut from full-length stock. Unauthorized splices shall be rejected.
- B. Structural steel shall conform to the following:
- Wide flange shapes:ASTM A992
 - Plates and other shapes:ASTM A36
 - Square and rectangular tubing:ASTM A500, Grade B
 - Round pipes and tubing:ASTM A53, Grade A
 - Anchor rods:ASTM F1554, Grade 36
 - Headed studs:ASTM A108
 - Structural bolts and nuts:ASTM A325, A307, A394
 - Hot-dip galvanizing of structural steel:ASTM A123
 - Hot-dip galvanizing of bolts and nuts:ASTM A153
- C. Structural design criteria shall be provided on the drawings.
- D. Field connections shall be bolted using ASTM A325 high-strength bolts unless noted otherwise. Welding shall conform to AWS D1.1. Welding electrodes

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shall comply with AWS. Concrete shall be set level. If leveling nuts are used, anchor bolts shall be designed for biaxial bending.

E. Deflection calculations shall be based on service load conditions, not ultimate loads. The following deflection limits shall apply:

- Horizontal deflection of vertical members shall be limited to 1/100 of the vertical span.
- Vertical deflection of horizontal members shall be limited to 1/200 of the span.
- Horizontal deflection of horizontal members shall be limited to 1/200 of the span.

F. The following deflection loading conditions shall be used to calculate deflections for structure racking purposes:

- NESC heavy loading;
- No wind, 60°F.

G. Loadings shall meet or exceed the following:

The loadings used in the design of structures shall not be less than those specified in the NESC for “heavy loading”. Structures, supports, etc. shall also be designed to withstand the following load:

5. Condition I (0°F) – NESC

Structures:6.4 PSF Wind

Bus & Conductors:4.0 PSF Wind and 0.5” Ice

Condition II (60°F) – NESC

Structures:Wind per NESC Rule 250C

Bus & Conductors:Wind per NESC Rule 250C and No Ice

Condition III (0°F)

Structures:No Wind

Bus & Conductors:No Wind with 1.5” Ice

The following overload factors shall apply to structures and equipment:

6. Condition I (NESC load factors for Rule 250B loads and Grade B construction)

7. Condition II

Transverse Wind Load:1.25

Transverse & Longitudinal

Wire Pull:1.25

Vertical Loads:.....1.25

8. Condition III



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All Structures & Equipment:1.25

Bus & Conductors:1.25

Transverse loading shape factors shall be as per NESC Section 252B. Switchyard structures shall also be designed to withstand forces caused by short-circuit current.

Ground Snow Load and Ice Load values:

NYPA Site Name	Location	Snow Load (psf)
Albany 'ALB'	Albany	40
Blenheim-Gilboa 'B-G'	Gilboa	50
Clark Energy Center 'CEC'	Marcy	60
Richard M. Flynn "FLYNN"	Holtsville	30
St. Lawrence 'STL'	Massena	60
Niagara 'NIA' & 'LPGP'	Lewiston	50
Eugene W. Zeltmann "ZEL/500MW"	Queens	25
Harlem River & Hellgate 'SCPP'	Bronx	25
Kent & Gowanus 'SCPP'	Brooklyn	25
Vernon 'SCPP'	Queens	25
Pouch 'SCPP'	Staten Island	25
White Plains Office 'WPO'	White Plains	30

NYPA Site Name	Location	Ice Thickness (in)	Wind Speed (mph)
Albany 'ALB'	Albany	1	40
Blenheim-Gilboa 'B-G'	Gilboa	1	40
Clark Energy Center 'CEC'	Marcy	1.5	40
Richard M. Flynn "FLYNN"	Holtsville	1	50
St. Lawrence 'STL'	Massena	1.5	50
Niagara 'NIA' & 'LPGP'	Lewiston	1	40
Eugene W. Zeltmann "ZEL/500MW"	Queens	1	50
Harlem River & Hellgate 'SCPP'	Bronx	1	50
Kent & Gowanus 'SCPP'	Brooklyn	1	50

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Vernon 'SCPP'	Queens	1	50
Pouch 'SCPP'	Staten Island	1	50

6.7 Foundation Design

- A. Foundation design shall usually be based on spread footings bearing on sandy, gravely native soils, bedrock, or compacted structural fill placed over native soils.
- B. The bottoms of exterior footings shall be placed at or below local frost depth (Geotechnical Soils Report or National Weather Service, NOAA Figure 1), but in no case less than 5 ft. Soft, organic, and other unacceptable material shall be removed from the sub-grade. If bedrock is encountered at the site, or there exists other relevant geological soil condition affecting structural stability, then the recommendations of the Geotechnical Soil Report shall be followed for foundation design and foundation bedding. The Depth of footings shall be determined from the exterior grade elevation adjacent to the foundation.
- C. Any excavation on existing substation shall include underground utility survey (GPR) and hand/vacuum excavation.
- D. Steel reinforcing bars shall be in accordance with ASTM Specification A615 – Grade 60 and shall be detailed, fabricated, and placed in accordance with ACI 315. Welding of reinforcing bars shall not be permitted. Welded wire fabric shall conform to ASTM A185-Grade 40. The concrete design shall conform to ACI 318 “Building Code Requirements for Structural Concrete.” Concrete shall have a minimum compressive strength of 4,000 psi at 28 days (ASTM Specification C94). For drilled caissons, concrete shall have a minimum compressive strength of 3,500 psi at seven days and 5,000 psi at 28 days (ASTM Specification C94). Slump shall not exceed 4 inches; entrained air shall be 5-7%. Concrete shall be cured for a minimum of six days after placement.
- E. Minimum concrete protective covering for reinforcement shall be as follows:
 - i. Surfaces cast against and permanently in contact with earth: 3 inches.
 - ii. Formed surfaces in contact with earth or exposed to weather: 2 inches.
 - iii. Surfaces not in contact with earth or exposed to weather: 1½ inches.
 - iv. Portland cement shall conform to ASTM C150 Type I or II. Aggregates shall conform to ASTM C33.
 - v. The slab finish is very critical for certain structures. The transformer pads need to be level, true, and very smooth. These are to be finished to ACI 301 Class A tolerance.

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6.8 Seismic Design

A. The switchyard and Control Building shall meet the NYSBC seismic design and installation requirements. Structures, equipment, equipment, piping, and ductwork shall be designed and constructed to resist the effects of earthquake motions in accordance with NYSBC, Chapter 16 “Structural Design”, Chapter 17 “Structural Tests and Special Inspections”.

B. The following are minimum seismic design performance requirements:

Seismic Importance Factor: $I_E = 1.0$ for Risk Categories I & II

$I_E = 1.25$ for Risk Category III

$I_E = 1.5$ for Risk Category IV

Site Class: As determined per site specific geotechnical report. Where the soil properties are not known in sufficient detail to determine the site class, use site class D.

Earthquake Ground Motion: Minimum earthquake ground motion shall be based on geographical location and local governing building code requirements; however, ground motion coefficients shall not be less than as shown in Table 2.8.1 for each NYPA site location.

Minimum earthquake ground motion.

NYPA Site Name	Location	S_s *	S_1 **
Albany ‘ALB’	Albany	0.198	0.06
Blenheim-Gilboa ‘B-G’	Gilboa	0.191	0.057
Clark Energy Center ‘CEC’	Marcy	0.185	0.059
Richard M. Flynn “FLYNN”	Holtsville	0.19	0.05
St. Lawrence ‘STL’	Massena	0.456	0.101
Niagara ‘NIA’ & ‘LPGP’	Lewiston	0.157	0.044
Eugene W. Zeltmann “ZEL/500MW”	Queens	0.29	0.06
Harlem & Hellgate ‘SCPP’	Bronx	0.292	0.06
Kent & Gowanus ‘SCPP’	Brooklyn	0.287	0.06
Vernon ‘SCPP’	Queens	0.289	0.06

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Pouch 'SCPP'	Staten Island	0.281	0.059
White Plains Office 'WPO'	White Plains	0.291	0.061

Maximum Considered Earthquake (MCE) of 0.2 sec Spectral Response acceleration 5% damping site class B.

** Same as above except 1.0 sec Spectral Response

- C. The Developer shall submit the manufacturer's complete design calculations for electrical equipment, related mechanical components, and support system.

6.9 HV Circuit Breaker Platforms

- A. The Developer shall provide platforms at each HV Circuit Breaker cabinet for access and maintenance. Platforms shall be steel construction with Grip Strut or equal safety grating, concrete pad, stairs, removable handrails, and appropriate footers.

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7 ENVIRONMENTAL AND FLOOD HAZARDS

The switchyard shall be designed and constructed in accordance with Federal, New York State, and local regulatory requirements, including NYSBC, and NYS Fire Code affecting design, construction, and operation and maintenance of the facility.

The substation or switchyard property and access roads shall be free of contamination and meet the appropriate NYSDEC criteria for land use. The property shall not be the subject of any NYSDEC or USEPA regulatory cleanup or Brownfield program, open spill, or other required action due to environmental conditions, and be free of any encumbrances, deed restrictions or engineering controls

Phase I and II Environmental Site Assessments in accordance with latest ASTM 2247 and ASTM E1527 published standards shall be performed by the Developer prior to final site selection. Where the Authority is not selecting the site, the Authority shall have the right of refusal and will perform its own due diligence, including the performance of its own Phase I and II Environmental Site Assessments, as appropriate, prior to purchasing property for a substation. Environmental design criteria include that the site is environmentally "clean", free of environmental contamination or conditions, regulatory encumbrances and does not have open spills, or agency actions pending etc.. The Developer shall submit all associated documentation including copies of completed environmental reports, studies, correspondence and regulatory agency acceptance documenting all environmental conditions have been addressed.

The Developer shall submit to Agency and NYPA a SPDES General Storm Water Permit for storm water discharges from construction activities that disturb one or more acres of land and discharge to surface water or municipal storm sewer. The Developer shall submit an electronic Notice of Intent (eNOI) form and a Storm Water Pollution Prevention Plan (SWP3) prior to the commencement of construction. The eNOI and SWP3 shall be prepared in accordance with the latest General Permit for Storm Water Discharge from Construction Activity in effect issued by the New York State Department of Environmental Conservation (NYSDEC).

The Developer shall perform environmental conditions assessment and studies required to develop the property (including soil, groundwater, water, wetlands, cultural resources, and rare, threatened and endangered species), and to determine environmental impacts from Interconnection Project Development as required by the State Environmental Quality Review Act (SEQRA). The Authority will have the right of refusal and will perform its own due diligence including Phase I and II Environmental Site Assessments in accordance with latest ASTM 2247 and ASTM E1527 published standards, as appropriate, prior to accepting the property and operation of the substation

The Developer shall ensure that environmental considerations are identified and addressed in the design process. SF6 gas emissions to the environment shall be minimized. Alternatives to the use of petroleum or hazardous substances in equipment and siting and design mitigation measures to prevent release and potential impacts to environmental media shall be considered and provided in the Developer design submittals.

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- The Developer shall identify and submit Environment, Health & Safety (EH&S) operational documents and plans, and all turnover documents. This is inclusive of permits, final Notice of Termination and long-term O&M for permanent stormwater controls, SDSs and technical data sheets for equipment and articles (e.g., di-electric oil, batteries, SF6, fuel), and asset onboarding information.
- The Developer shall arrange for disposal of excavated soil and other waste materials utilizing approved disposal rules and procedures including requirements of NYPA's Division 1 specifications.
- Surfacing material such as crushed stone shall be well graded and washed with no fine materials which would cause dust. Crushed stone shall be granite type, shaped flat, to provide low hazard walking surfaces.
- The Developer shall provide freeze protection of control, relaying, and instrumentation components installed outdoors.
- The Developer's substation and NYPA switchyard shall be designed to contain potential oil spills in accordance with the SPCC rule of section 40 CFR 112, Part 613 of 6NYCRR, NFPA 30, and ANSI/IEEE 980-1984(R2001) Guide for Containment and Control of Oil Spills in Substations.
- The secondary containment shall be designed to contain the full volume of the oil, plus any water which may enter the area, including water from precipitation from a 25-year, 24-hour storm event.
- Any discharge from the oil containment area shall either be captured and held for disposal or shall be treated for discharge to SPDES limits. The use of perforated pipes or percolation pits for flows from oil containment is prohibited.
- N. The Developer shall provide a flood study/siting survey of location. All substation critical equipment that could be affected by flood waters and all building floor slabs shall be at or above the level for the higher of FEMA 100-year BFE plus three feet, DFE or the 500-year BFE. All substation critical equipment that could be affected by flood waters shall be above the level for the FEMA 100-year storm plus three feet. Vertical datum reference shall be clearly defined on any drawings with elevation information

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8 SECURITY

- A. The substation site (control buildings and switchyard) shall be planned as an unmanned facility and provided with complete security systems networked back to a NYPA designated manned facility for 24/7 monitoring. The security system components shall include security fence, security fence detection system, card access control at all entries, PTZ thermal cameras, fixed door cameras on all card access doors, video analytics, video storage, video management system, UPS back up power, centralized access reporting to a NYPA's designated manned location, access control verification. All network hardware shall be included to support latest NERC CIP standards.
- B. The substation shall be totally enclosed by an 8' tall #9 AWG galvanized steel chain link fence with pipe rail at top and bottom and one-foot topping of three strands of barbed wire. The fence, gates, and barbed wires shall be connected to the grounding system (See Section 3.10, "Grounding", for more details). A motorized sliding vehicle gate and a manual man gate shall be provided to facilitate personnel and vehicle traffic access to the switchyard. The vehicle gate shall have card access site entry with free exit out by vehicle, and an entry side intercom system back to designated manned facility. Sliding gate installation shall comply with ASTM F2200 and F1184. No gap between gate and fence post shall exceed 2". All gates shall be operable from both sides and provide for emergency egress from the yard. The yard shall be graded so that the bottom fence gap is maximum 1". The bottom gap at the motorized gate and man gate shall be maximum 4" and a minimum of 2". The fence and man gate shall be constructed to accommodate the fence-mounted intrusion detection system. The Developer shall provide the switchyard security system, including alarm system, thermal PTZ (Pan Tilt Zoom) cameras, video management system with 60 day storage, and appropriate lighting.
- C. The thermal PTZ cameras shall be installed to capture the switchyard perimeter areas and the interiors. Perimeter lighting for night time recording shall be even and low, approximately 1/5th of the surrounding area lighting.
- D. The PTZ cameras shall be controlled by the intrusion system and remotely from the manned location.
- E. All security system component power including CCTV cameras, video management and storage, monitors, intrusion detection and alarm devices and panels, shall be battery-backed up for 12 hours. All access points to the switchyard and buildings, and doors to the relay rooms and battery rooms shall have key-card access.
- F. Additional site-specific security requirements may be applicable. The Developer shall coordinate with NYPA.
- G. The security systems shall include:
 - a. Fence detection systems, fencing slide gate for vehicles, man gate equipment, additional vehicle swing gates(as required).

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- b. Entrance card access on the slide fence gate with free exit loop detector. PSA entrance card access on all switchyard building doors to manage access control.
- c. Best lock and key system with card access entry control for the new switchyard building PSA doors with fail-closed door hardware.
- d. Thermal/Daytime pan tilt cameras with analytics detection system with preset positions to provide pre-alarms (digital zoom thermal camera capability, quantity required based on size/layout of switchyard). Cameras shall be tied into a video management system locally and at the manned monitoring site.
- e. Fixed IP megapixel cameras with video analytics detection system shall be provided for all card access doors. These shall be tied into a video management system locally and viewable at the manned monitoring site.
- f. Every designated PSP door shall be equipped with card access door entry, card access door exit and fixed IP megapixel cameras.
- g. Provide extruded mesh on exterior switchyard control building windows/doors
- h. Provide window detectors
- i. Provide motorized gate operators to be controlled by new card access with a fixed camera for video analytics.
- j. Provide local security monitoring rack/console including CCTV viewing with fence detection map, card access monitoring, UPS, server equipment, POE network switches and T1 communication tie via network interface to NYPA's LAN/OPS Network system for monitoring back to the manned monitoring site
- k. All entrance card readers shall be JCI Pegasus 2000 system equipment.
- H. All equipment and systems shown in the attached security appendices shall be conformed to the site layout and provided. The equipment model numbers/specifications/requirements indicated in the appendices are specific standards for NYPA security systems standardization – no substitutions are allowed.
- I.

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9 FIRE PROTECTION, EQUIPMENT, AND PERSONNEL SAFETY

- A. Switchyard fire protection shall be designed in accordance with IEEE 979-1994 (R2004) Guide for Substation Fire Protection. The Developer shall provide fire protection components including:
- Control and power cables used in the Control Building shall be constructed of a material that does not readily propagate fire and shall be qualified by the flame test parameters specified in the latest edition of IEEE Std. 383.
 - Arrangement of control panels and electrical equipment shall be designed to meet the flame-retardant specifications as prescribed by the latest edition of ANSI/IEEE Standard 420.
 - The Control Building shall have at least two exits located at opposite ends of the building. The arrangement of control panels and electrical equipment inside the Control Building shall be designed to allow personnel to exit the building from either side. The doors shall be adequately marked with illuminated exit signs and the doors shall open in the direction of egress. Doors shall be equipped with panic hardware that will override any exterior lock on the doors.
 - Emergency lighting shall be installed in the Control Building. Emergency lighting shall also be installed on the exterior walls or the building at personnel exits to illuminate the area to allow persons to move away from the building. Emergency lighting and egress arrangement shall conform to the latest editions of ANSI/NFPA standards, NYS Fire Code, and NYSBC Chapter 11- Means of Egress.
 - Surge arresters shall be located as close as possible to the equipment they are protecting yet minimize the possibility of damaging nearby equipment due to an exploding arrester. Surge arresters installed inside the Control Building shall be enclosed or located a safe distance away from passageways and combustibles to minimize the possibility of an equipment fire initiated from surges. Arresters shall be rigidly supported and properly grounded. Arrester arrangement shall conform to the guidance in the latest editions of IEEE. Arrester discharge vent direction shall be indicated on the drawings.
 - All floor and wall openings in the Control Building shall be sealed to maintain the fire rating of the floor or wall, as directed by NYSBC Chapter 7, "Fire Resistance Rated Construction". Conduits shall be sealed at ceiling, floor, and wall penetrations to prevent the propagation of flame, smoke, and other gases/vapors from one area to another. Floor and wall openings shall be sealed in accord with a UL listed penetration detail to maintain the fire rating of the floor or wall.
 - Portable fire extinguishers shall be located in the switchyard and in the Control Building including adjacent to normal entrance/exit doors. Only portable fire extinguishers having a nonconductive extinguishing agent, such as dry chemical agent, or clean agent types shall be used on fires involving energized electrical equipment. Carbon dioxide fire extinguishers equipped with metal horns shall not be allowed. Carbon Dioxide type fire extinguishers shall not be used for battery room locations. Only portable dry chemical extinguishers shall be provided for the switchyard. The type, size, distribution, and installation of portable fire extinguishers shall be per the latest edition of ANSI/NFPA 10.

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- All extinguishing agents shall be non-conductive.
- Specific fire safety measures for the Control Building are described in Section 5.7, “Control Building”.
- SF6 is a nonflammable gas that may generate by-products as a direct or indirect result of a fire. Protection against SF6 concentrations inside any enclosure housing equipment shall be considered in building/enclosure ventilation design. Precautions regarding the harmful effects of SF6 gas and SF6 gas by-products can be found in IEEE Std. C37.122.
- Battery Energy Storage Projects (BESP) shall have clean agent suppression system and an automatic water-based fire suppression system with an adequate water supply, per the latest addition of the NYSBC and NFPA standards. A containment is required for the fire suppression water discharge. Deviations from this require NYPA engineering approval.
- B. Except as stated above for BESP the Developer should consider alternate methods of fire protection other than a water-based fire suppression system:
 - Physical separation of equipment
- Fire barriers
- Minimize the spread of flammable oil by containment
- Filling containments around oil filled equipment with stone to help prevent, control or extinguish an oil fire.
- Fire Suppression Systems:
 - Portable Fire Extinguishers
 - Dry Chemical Systems
 - Clean Agent Systems

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the New York Power Authority Transmission
System**10 REGULATIONS, STANDARDS, AND CODES**

Developers design and construction Work shall comply with regulations, standards, and codes including those listed below. The most recent edition of the listed documents in effect at the time of the construction shall apply. Where construction is subject to the requirements of the NYS Building Code, then the edition of the standard referenced in the NYS Building Code shall be used. Any proposed variances to the NYS Building Code shall be submitted for review by NYPA Code Compliance. Any conflict between the standards or codes or regulations and the DCDC shall be submitted with an explanation and proposed resolution to NYPA. In general, the more stringent requirement shall apply. Where an organization is listed include, without limitation, all codes, guides, and standards of that organization.

The design and construction of control building wiring shall meet the National Electrical Code (NEC; NFPA 70), NFPA 70E, NYSBC, and local Authority Having Jurisdiction (AHJ) requirements including lighting, receptacles, fire alarm detection, and protection, security, and HVAC.

Any activity by developer or its contractors on land owned or controlled by NYPA (including Right of Way) requires a work permit and is subject to NYPA permitting requirements. If Developer or its contractors are carrying out activities on NYPA owned or controlled property, all such parties shall provide indemnification and insurance, in form and amount acceptable to NYPA. As appropriate, NYPA Code Compliance shall issue Building Permits for Work on NYPA owned or controlled property (including Right of Way). The Developer shall follow NYPA procedures relating thereto. In addition, where there is construction on land that is not owned or controlled by NYPA, then developer shall notify NYPA at the onset of the project. NYPA Code Compliance will discuss with the local AHJ relinquishing AHJ responsibilities to NYPA Code Compliance. If so, the Construction Permit Process for the switchyard will be turned over to NYPA and the Developer shall implement NYPA Code Compliance department requirements. Otherwise, the Developer shall work with the local AHJ and their Construction Permit Process throughout the Project. **Codes and Standards:**

Aluminum Association

American Association of State Highway and Transportation Office

American Concrete Institute (ACI)

American Institute of Steel Construction Specification and Standards (AISC)

American National Standards Institute (ANSI)

American Society of Civil Engineers (ASCE)

American Society of Heating, Refrigerating, and Air-conditioning Engineers (ASHRAE)

American Society for Testing and Materials (ASTM)

American Welding Society Structural Welding Code (AWS)

Association of Edison Illuminating Companies (AEIC)

Concrete Reinforcing Steel Institute (CRSI)

Construction and Materials (NYSDOT Standards)

Illuminating Engineering Society Handbook

Design Criteria for Developer Connection to the New York Power Authority Transmission System

Institute of Electrical and Electronic Engineers (IEEE)
Insulated Cable Engineers Association (ICEA)
National Bureau of Standards (NBS)
National Electrical Code (NEC)
National Electrical Manufacturers Association (NEMA)
National Electrical Safety Code (NESC)
National Earthquake Hazards Reduction Program (NEHRP)
National Fire Protection Association (NFPA)
New York Code of Rules and Regulations (NYCRR)
New York State Building Code, including referenced standards.
New York State Department of Transportation
New York State Energy Conservation Construction Code
New York State Fire Code
New York State Fuel Gas Code
New York State Independent System Operator (NYISO)
New York State Mechanical Code
New York State Plumbing Code
New York State Reliability Council (NYSRC)
North American Electric Reliability Corporation (NERC)
Northeast Power Coordinating Council (NPCC)
Occupational Safety and Health Administration Standards (OSHA)
Sheet Metal and Air Conditioning Contractors National Association (SMACNA)
Underwriters Laboratory (UL)
United States Code of Federal Regulations (CFR)
U.S. Army Corps of Engineers (USACE)
USDA Rural Utilities Service Bulletins



Design Criteria for Developer Connection to the New York Power Authority Transmission System

11 APPENDIX A: STL – FDR PROJECT DRAWING INDEX

Prefix

100-3-Adirondack Substation
100-4-Saranac Substation
100-5-Cumberland Head
100-6-Plattsburgh Substation
100-8-Reynolds Substation
100-10-General Motors
100-13-Municipal & Coop.
100-14-Horton Sub. (MED)
100-D-Duley Substation
100-RY-Ryan Substation
110-VD-Hawkins Point Visitor Center
128-MTC-Marcy Training Center
174-MC-Marcy Substation
6487-MC-Marcy Substation
174-MS-Massena Substation
6489-MS-Massena Substation
176-W-Willis Substation
PA-5-RMPD, LSD, ID, MI & S.P.

PA-5-NUMERICAL INDEX

PA-5-1000 Architectural
PA-5-2000 Concrete
PA-5-3000 Structural
PA-5-4000 (See SEWCALM)
PA-5-5000 Mechanical
PA-5-6000 Iroquois Dam, Mass. Intake, Etc.
PA-5-7000 Mass. Intake, State Park, Etc.

TRANSMISSION LINE DWG. INDEX

100-MA1-Moses-Adir. MA-1 & 2
100-MA3-Moses-Adir. Third Ckt.
100-MW1-Moses-Willis-Platts. 1 WP1
100-PV20-Platts.-Vermont
100-PAF1-Platts.-Air Base
100-PSI-Platts.-Saranac
100-MR1-Moses Reynolds
100-RGM1-Reynolds-Gen. Motors 13.8KV
100-MRG-Moses-Reys.-GM



Design Criteria for Developer Connection to the New York Power Authority Transmission System

100-L33-P-Canadian Tie L34P
176-MWP-Moses-Willis-Platts.
174-MMS-Moses-Massena
174-MSUI-Massena Marcy 765KV
174-MSU7040-Massena-Chateaugay 765KV

The Electrical Drawings are arranged in a uniform numbering sequence. The alphabetical numbering scheme describes the type of drawing.

S.....Schematic
E.....Elementary
W.....Wiring
C.....Conduit
A.....Arrangement
L.....Lighting
M.....Miscellaneous
N.....Numerical
T.....Transmission

SCHEMATIC DRAWING INDEX

1S.....Index
2S.....Legend (see 3E also)
3S.....Relay Setting Sheets
4S.....Logic Diagram
5S.....Power System One Line
6S.....System Diagram
9S.....Metering & Relaying One Line
11S.....Grounding One Line
13S.....Protective Functions
15S.....D.C. Systems
17S.....13.8KV One Line
18S.....480V – One Line
25S.....Phasing
27S.....Communications (see 54E)
30S.....Computers
33S.....Monitors

ELEMENTARY DRAWING INDEX

1E.....Index
2E.....Internal Device Diagrams
3E.....Legend
5E.....Synchronizing



Design Criteria for Developer Connection to the New York Power Authority Transmission System

6E.....	D.C. Systems
7E.....	Generator and Sync. Cond. Control
8E.....	Synchronous Condensers
9E.....	Generator Instrumentation
10E.....	Generator Excitation
11E.....	Intake and Draft Tube
12E.....	Relaying Generator
13E.....	Transformer Relaying
14E.....	Bus Relaying
15E.....	Line Relaying Under Frequency Load Shedding
16E.....	Breaker Failure and Backup Relaying
17E.....	Breaker Control
18E.....	Motor Operated Disconnect Control
19E.....	Station Service Switchgear (13.8KV)
20E.....	Disconnect Switches
21E.....	Breaker Failure – Synchronous Condenser
22E.....	A.C. Elementary
24E.....	Annunciator
26E.....	CO2 Systems and Fire Protection
28E.....	Transformer Control
29E.....	Reactor Bks. & Over-voltage
30E.....	Oscillograph
31E.....	Watthour Metering
33E.....	Drainage and Unwatering
34E.....	Heating & Ventilating, Fire Dampers and Fans
35E.....	Lighting
36E.....	Miscellaneous
40E.....	Station Service Switchgear (480V)
48E.....	Load Frequency Control
50E.....	Supervisory Control
52E.....	Telemetry – Recorders, Transducers, RTD'S
53E.....	Sequential Event Recorders
54E.....	Communications
60E.....	Centrimax
70E.....	Cranes
80E.....	Monitoring System

WIRING DRAWING INDEX

1W.....	Index
6W.....	Main Control Board



Design Criteria for Developer Connection to the New York Power Authority Transmission System

7W.....SERS Term. Cabs.
8W.....“R” Term. Cabinets
9W.....“L” Term. Cabinets
10W.....“C” Term. Cabinets
12W.....Station Service & Recorder Board
13W.....Data Acquisition Cabinets
14W.....“S” Term. Cabinets
16W.....“LR” Line Relaying Cabinets
18W.....“PDA” Potential Device Adjust
19W.....Pilot Wire Terminal Cabinets
20W.....“CC” Carrier Current Cabinets
21W.....CCT Carrier Current terminal Cabinets
22W.....Console – Control Room
23W.....Supervisory Console (Computer)
24W.....Generator Control Wiring
25W.....Generator Diff. Cabinets
26W.....Unit Boards
27W.....Synchronous Condenser
28W.....D.C. Station Batteries
29W.....Switchgear 13.8KV
30W.....Station Service Sw. Gr. (480V)
31W.....MCC – Motor Control Center
32W.....“M” Panels
36W.....Reactor Banks
38W.....Main Transformer Banks
40W.....Switchyard Wiring
41W.....Revenue Metering Panels
42W.....Communications System
44W.....Drum Gates
48W.....Drainage & Unwatering
50W.....Heating & Ventilating
60W.....Fire Protection
61W.....CO2 Wiring
65W.....Miscellaneous
66W.....Test Bench – Test Lab.
67W.....Test Lab. Control Panel
70W.....Gantry Cranes
80W.....Generator Condition Monitors



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CONDUIT & GROUNDING INDEX

1C.....	Index
2C.....	Office Bay or Control House
3C.....	Elevation 246.0 or Switchyard
4C.....	Elevation 210.0
5C.....	Ice Sluices
6C.....	Elevation 194.5' Units
7C.....	Elevation 174.0' Units
8C.....	Elevation 159.0' Units
9C.....	Conduit Details
10C.....	Conduit & Cable Schedule Index
11C.....	Conduit & Cable Schedule
12C.....	Tray & Cable Schedule

ARRANGEMENT INDEX

1A.....	Index
2A.....	Control House Arrangement
3A.....	Miscellaneous Arrangement
5A.....	Generator Main Leads (Isolated Phase Bus)
7A.....	Main Transformer Arrangement
8A.....	High Voltage Leads – Power Tunnel – Pipe Type Cable
10A.....	Cable Trays
12A.....	Crane Conductor System
22A.....	Control areas

LIGHTING DRAWING INDEX

1L	Lighting Index
2L	Fixture Type Drawing or Control House & Tunnels
3L	Lighting One Lines or Swyd. Miscellaneous Details
4L	Lighting Plans
5L	Lighting Panel Schedules
6L	Lighting Panel Details
7L	Lighting Wiring Diagrams
8L	Lighting Miscellaneous Details

ALL ELECTRICAL EQUIPMENT OUTSIDE OF POWERHOUSE

1M	Index
4M	Switchyard Arrangement
6M	Switchyard Plans & Sections
8M	Switchyard Conduit & Grounding
10M	Switchyard Lighting



Design Criteria for Developer Connection to the New York Power Authority Transmission System

12MService Building
13MSwitchyard Relay Building
14MFan Houses
16MMaintenance Building
18MMaintenance Storage Building
19MMaintenance Storage Building No. 2
20MBoiler House & Water Tank
21MOffice Annex
22MGuard House
24MWarehouse Building
26MSynchronous Condenser
30MTower Take Off – Tower Line A-B-C-D
32M13.8KV Distribution System
34MSub – Distribution – Parkway Ltg. & Obstruction Ltg.
40MColes Creek
50MLong Sault Dam
60MConstruction Power
61MCedar Rapids Transmission Line Relocation
70MVisitor Center
80MEel Ladder

NUMERICAL INDEX

1N.....Index
4N.....Substation Topography
6N.....Grading Plan
8N.....Foundations
9N.....Foundation Repair
10N.....Swyd. Steel
12N.....Bldg. Arch. – Steel – Conc.
16N.....Heating & Vent.
18N.....Plumbing
19N.....Fire Alarm

TRANSMISSION INDEX

1TIndex
3TLocation Plan
4TClearing ROW
5TROW Map
7TPlan & Profile
8TWood Str.
9TSteel Towers



Design Criteria for Developer Connection to the New York Power Authority Transmission System

10TMisc. Details
11TCounterpoise & Gndg.
13TAccess
14TStringing Tables
15TObst. Ltg.
17TPhasing
19TLine Data

APPENDIX B: Referenced NYPA Documents

<u>Document Number</u>	<u>Document Title</u>	<u>Section Referenced</u>
CPP-1	Clearance and Protection Procedure for the Northern, Central & Western Regions	1.3
DWG-DC01-TP	ELECTRICAL - DC ELEMENTARY DIAGRAM - \$TP# MVA, TRANSFORMER NO. \$TX# - PRIMARY RELAYING – SHEET 1	3.4 A
DWG-DC01-TBP	ELECTRICAL - DC ELEMENTARY DIAGRAM - \$TP# MVA, TRANSFORMER NO. \$TX# - PRIMARY RELAYING – SHEET 2	3.4 A
DWG-DC01-TS	ELECTRICAL - DC ELEMENTARY DIAGRAM - \$TP# MVA, TRANSFORMER NO. \$TX# - SECONDARY RELAYING	3.4 A
DWG-DC01-BP	ELECTRICAL - DC ELEMENTARY DIAGRAM - BUS NO. \$B# - PRIMARY DIFFERENTIAL RELAYING	3.4 A
DWG-DC01-BS	ELECTRICAL - DC ELEMENTARY DIAGRAM - BUS NO. \$B# - SECONDARY DIFFERENTIAL RELAYING	3.4 A
DWG-DC01-BFP-BR	ELECTRICAL - DC ELEMENTARY DIAGRAM - PCB \$BR#XX - PRIMARY BREAKER FAILURE	3.4 A
DWG-DC01-BFS-BR	ELECTRICAL - DC ELEMENTARY DIAGRAM - PCB \$BR#XX - SECONDARY BREAKER FAILURE	3.4 A
DWG-DC01-BFP-TIEBR	ELECTRICAL - DC ELEMENTARY DIAGRAM - PCB \$BR#YY - PRIMARY BREAKER FAILURE	3.4 A
DWG-DC01-BFS-TIEBR	ELECTRICAL - DC ELEMENTARY DIAGRAM - PCB \$BR#YY - SECONDARY BREAKER FAILURE	3.4 A
DWG-PNL-FRONT-LEFT-RIGHT-TP	ELECTRICAL - OUTLINE - \$TX# PRIMARY RELAY PANEL - PANEL \$P# - FRONT, LEFT & RIGHT VIEWS	3.4 A
DWG-PNL-FRONT-LEFT-	ELECTRICAL - OUTLINE - \$TX# SECONDARY RELAY PANEL - PANEL \$P# -FRONT, LEFT & RIGHT VIEWS	3.4 A



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RIGHT-TS		
DWG-PNL-FRONT-LEFT-RIGHT-BP	ELECTRICAL - OUTLINE - BUS \$B# PRIMARY PANEL - PANEL \$P# - FRONT, LEFT & RIGHT VIEWS	3.4 A
DWG-PNL-FRONT-LEFT-RIGHT-BS	ELECTRICAL - OUTLINE - BUS \$B# SECONDARY PANEL - PANEL \$P# - FRONT, LEFT & RIGHT VIEWS	3.4 A
DWG-PNL-FRONT-LEFT-RIGHT-BFP	ELECTRICAL - OUTLINE - BF PRIMARY RELAY PANEL - PANEL \$P# - FRONT, LEFT & RIGHT VIEWS	3.4 A
DWG-PNL-FRONT-LEFT-RIGHT-BFS	ELECTRICAL - OUTLINE - BF SECONDARY RELAY PANEL - PANEL \$P# - FRONT, LEFT & RIGHT VIEWS	3.4 A
DWG-WD-REAR-TP	ELECTRICAL - WIRING DIAGRAM - \$TX# PRIMARY RELAY PANEL - PANEL \$P# - REAR VIEW	3.4 A
DWG-WD-LEFT-RIGHT-SIDE-TP	ELECTRICAL - WIRING DIAGRAM - \$TX# PRIMARY RELAY PANEL - PANEL \$P# - LEFT & RIGHT SIDE PANELS	3.4 A
DWG-WD-REAR-TS	ELECTRICAL - WIRING DIAGRAM - \$TX# SECONDARY RELAY PANEL - PANEL \$P# - REAR VIEW	3.4 A
DWG-WD-LEFT-RIGHT-SIDE-TS	ELECTRICAL - WIRING DIAGRAM - \$TX# SECONDARY RELAY PANEL - PANEL \$P# - LEFT & RIGHT SIDE PANELS	3.4 A
DWG-WD-REAR-BP	ELECTRICAL - WIRING DIAGRAM - PRIMARY DIFF. RELAYING - BUS \$B# - PANEL \$P# - REAR VIEW	3.4 A
DWG-WD-LEFT-RIGHT-SIDE-BP	ELECTRICAL - WIRING DIAGRAM - PRIMARY DIFF. RELAYING - BUS \$B# - PANEL \$P# - LEFT & RIGHT SIDE PANELS	3.4 A
DWG-WD-REAR-BS	ELECTRICAL - WIRING DIAGRAM - SECONDARY DIFF. RELAYING - BUS \$B# - PANEL \$P# - REAR VIEW	3.4 A
DWG-WD-LEFT-RIGHT-SIDE-BS	ELECTRICAL - WIRING DIAGRAM - SECONDARY DIFF. RELAYING - BUS \$B# - PANEL \$P# - LEFT & RIGHT SIDE PANELS	3.4 A
DWG-WD-REAR-BFP	ELECTRICAL - WIRING DIAGRAM - PRI. BKR. FAILURE RELAYING - PANEL \$P# - REAR VIEW	3.4 A
DWG-WD-LEFT-RIGHT-SIDE-BFP	ELECTRICAL - WIRING DIAGRAM - PRI. BKR. FAILURE RELAYING - PANEL \$P# - LEFT & RIGHT SIDE PANELS	3.4 A
DWG-WD-REAR-BFS	ELECTRICAL - WIRING DIAGRAM - SEC. BKR. FAILURE RELAYING - PANEL \$P# - REAR VIEW	3.4 A
DWG-WD-LEFT-RIGHT-SIDE-BFS	ELECTRICAL - WIRING DIAGRAM - SEC. BKR. FAILURE RELAYING - PANEL \$P# - LEFT & RIGHT SIDE PANELS	3.4 A

Design Criteria for Developer Connection to the New York Power Authority Transmission System

EDS-PCE110	Electrical Design Standard for Indoor Protective Relay Panel/Cabinets and Terminal Cabinets	3.4-L
---NA---	General Cyber Security Requirements Exhibit	3.9 I 1
Appendix F	Computer Aided Design Requirements for New York Power Authority Drawings	4.0
O-CM-00-000	Configuration Management Policy	4.0 4.0
O-CM-00-001	Configuration Management Procedures	4.0
O-AMM-20-016	Project Turnover Procedure	4.4
ES-103-01	Standard Specification for Outdoor Oil-less Power Circuit Breakers	5.1 G
ES-103-02	Standard Specification for Disconnect/Ground Switches	5.2 G
ES118-00	Standard Specification for Instrument Transformers	5.3 D & 5.4 C
SR-101	Standard Requirement for Surge Arrestors	5.5 B
ES-102-01	Standard Specification for Standard Specification Power Transformer Class II	5.6 C 4.
ES-105-00	Standard Specification for 5KV – 35KV Power Cable	5.8 C
ES-106-00	Standard Specification for <u>Low Voltage (1000V) Power & Control Cable</u>	5.8 D
ES-106-01	Standard Specification for Instrumentation and Control Cable	5.9 D
SR-106	Standard Requirement for Uninterruptible Power Systems	5.12 F
26-05-73.10	Short-Circuit Study/Protective Device Coordination Study/Arc Flash Analysis/Arc Flash Mitigation	5.12 G a & 5.13 B a
ES-107	Standard Specification for Station Batteries	5.13 C
SR-107	Standard Requirement for Battery Chargers	5.13 H
OTRA-STD-302	Standard Specification for Toughened Glass Suspension Type Insulators	5.17



Design Criteria for Developer Connection to the New York Power Authority Transmission System

E-Signature Approval History

Role	Name	Approved Date
Additional Approver	Spagnolo, Salvatore	8/15/2022
Content Owner	Kumar, Rajesh	8/15/2022