RIVER PROTECTION PROJECT – WASTE TREATMENT PLANT

ENGINEERING SPECIFICATION

FOR

B34, BOF Switchgear Building

Content applicable to ALARA?	☐ **Yes** ☒ **No**	**Quality Level**
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Revision History

Revision	Reason for Revision	Q Specification Revision Only Margin Reduced?		CM Only
		YES	NO	N/A
0	Issued for Bid	N/A	N/A	N/A
1	Formatting and reference corrections throughout document Incorporation of changes from revised SDD including removal of references to feeders to Annex and Simulator buildings and removal of any reference to future power source/substation. Incorporation of 60% design review comments. Incorporation of explicit SDD design and materials requirements, including expansion of requirements for MVE Switchgear (1.2.1(d)(1)), 125V DC System (1.2.1(d)(4)), added section Building Design (3.3.12), added electrical isolation requirement (3.7.12), Conduit and Wireway Systems (3.7.16), Grounding System (3.7.17), Lightning Protetion System (3.7.19), Control and Instrumentation (3.8), Plumbing (3.11), added section Other/General Requirements (3.12), Lighting (4.1.16), Convenience Receptacles (4.1.17). Cables and Wiring (4.1.18), Cable Tray System (4.1.20) Removal of 13.8kV Switchgear Accessories from Electrical Requirements Section (Section 3.7). The 13.8kV Switchgear Accessories are already included in Section 1.2.1(1)(i)(d)(v). Update Exhibit 6 - Electrical Building Conceptual Layout to reflect change of main double door location from south to north side of building. Incorporated EIE 24590-HLW-EIE-SYSE-24-0034, Rev 0	☐	☐	☒
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		☐	☐	☐

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Appendices

1 Scope

1.1 Specification Purpose

1.1.1 The Office of River Protection (ORP) and its contractors manage 177 underground radioactive waste storage tanks at the Hanford Site in Washington. These 177 tanks contain approximately 55.5 million US gallons of radioactive waste. Bechtel National, Inc. (BNI) has entered into a contract with the US Department of Energy to design, construct, and commission the Hanford Tank Waste Treatment and Immobilization Plant (WTP) to process and vitrify this waste into a stable form that is suitable for permanent storage. The WTP will be constructed in the 200 East Area of the Hanford Site, near Richland, Washington. The main facilities within the WTP complex will be the Pretreatment Facility (PTF), Low-Activity Waste Facility (LAW), High-Level Waste Facility (HLW), Balance of Facilities (BOF), Analytical Laboratory (Lab), and the Effluent Management Facility (EMF).

1.1.2 The WTP facilities require a constant and secure electrical supply to ensure the protection of critical high value DOE assets (i.e., melters, etc.). Non-Interruption of power is therefore a pre-requisite for these operations. The current electrical substation and the associated switchgear were not designed with an ability to perform a phased approach and parallel modifications because the original concept was to provide power to all facilities (PT, HLW, LAW, BOF, Lab) at the same time.

This has led to the unintended consequences of not being able to connect future facilities to the WTP power source without extended outages to Direct Feed Low Activity Waste (DFLAW) operations, and the potential for power limitations to meet future requirements using the existing power source configuration and sizing. Therefore, expansion of the WTP power source to increase flexibility of supply to deliver power to future facilities (DFHLW), which may require a different design approach (i.e., a modular expandable adaptable power supply), is critical to the mission.

CCN 323333, Maximize Flexibility for Future Electrical Power Need at WTP And Hanford (Options Evaluation paper), recommended providing a new Switchgear Building (B87-2, since renamed BOF Switchgear Building, Building 34), and associated transmission and distribution infrastructure to supply the needed power. This option meets the requirements of the HLW-related facilities, avoids disruption to DFLAW operations, reduces project cost and schedule risks, and provides a highly reliable power source with the greatest flexibility / opportunity to adjust as the Hanford HLW treatment mission need develops. This option also provides future flexibility for the DOE and the Hanford mission to support overall cleanup operations[1].

This specification applies to the BOF Switchgear Building, Building 34, which purpose is primarily to provide medium voltage (and limited low voltage) electrical power to the new electric Steam Plant (B39); existing HLW Facility; new BOF buildings such as Asset Protection Building (B36), Wet Chem Building (B38), and Emergency Power Building (B37);; new Vault for DFHLW (future); and future growth loads.

1.2 Equipment Material, and Services Required

This specification covers the minimum technical requirements for the design, fabrication, assembly, coating/painting, testing, inspection, labeling, documentation, and preparation for shipment of BOF Switchgear Building (B34), to the WTP site per the

requirements provided by Buyer. The scope of work shall include, but not be limited to, the following:

1.2.1 A complete manufacturer's standard prefabricated metal or concrete building, shall include the following:

a. Entire freestanding superstructure, including exterior envelope and complete interior work with finishing, self-framing insulated metal roof, siding, wall panels, doors, louvers, accessories, painting, penetrations, and penetration seals associated with the design.

b. Complete floor design supported on piers raised 7 ft. (minimum) above grade including floor penetrations as required for cable and water (pre-action fire suppression system and eye wash) entry from below and floor drains.

c. Designing, furnishing, installation, and testing of lighting (interior, exterior, and emergency egress) system, convenience receptacles, HVAC system, fire detection alarm and suppression system, lightning protection system, and grounding system. The cables for these systems are unscheduled.

d. Procurement, mounting, installation, and testing of equipment listed below, per Exhibits 1 thru 5 of this specification, data sheets and drawings listed in the material requisition (to be confirmed prior to procurement):

1. Two (2) 13.8kV Type 2C arc-resistant switchgear line-ups, each consisting of A and B assemblies (MVE-SWGR-34001/2-A and MVE-SWGR-34001/2B), tied together via cables between tie breakers, with main and tie breakers interlocked to prevent extended paralleling of buses. Momentary paralleling of Switchgear A and B buses shall be permitted to perform bus transfer operations without interruption of power to either the A or B bus. Bus transfer operations shall be blocked if a main or tiebreaker is tripped on a fault.[2]

i. The 13.8-kV switchgear shall be designed for indoor service, with incoming vacuum-break, stored-energy, draw-out type breakers[3]. Each assembly shall be metal-clad, NEMA 1 gasketed, free-standing, floor mounted, flush front vertical sections arranged to form a single structure, complete with common phase bus, grounding bus, circuit breakers, protective relays, metering, infrared windows, remote racking, and auxiliary control devices and accessories. Insulated boots to be provided on bus joints.

1. All circuit breakers shall be electrically operated by a motor-charged stored energy spring mechanism. They shall be three-pole, vacuum type, horizontal draw-out[4], and be capable of being withdrawn on rails for inspection and maintenance.

2. Switchgear circuit breakers to be provided with multi-function protection relays. Remote indication of the breaker position and trip status shall be provided for each switchgear assembly circuit breaker[5],[6].

3. Each circuit breaker shall have local and remote-control capability. A door mounted selector switch shall be provided for Local-Remote mode selection. Provisions shall be made to receive control signal from the plant control system through the communication network for remote control of circuit breakers.

ii. Each line-up shall consist of a normal power bus section and a standby power bus section.

1. The normal and standby power bus sections are to be connected via tie breakers, with breakers interlocked with main switchgear feeder breaker and standby supply feed breaker to prevent extended paralleling of buses.

iii. Each assembly shall be rated at 13.8-kV, 3-phase, 60-Hz and rated to withstand the maximum short circuit current available in the system[7].

iv. A thermostat-controlled space heater shall be provided in each vertical section, with additional space heater(s) provided at each end of the switchgear line-up, to prevent condensation[8].

v. The following MVE switchgear accessories shall be provided:

1. Wheeled lift truck (MVE-MHAN-34001)
2. Breaker test cabinet (MVE-CAB-34001)
3. Portable test kit for calibration and testing of breaker digital solid-state relays.
4. Traveling type circuit breaker lifter rail mounted on top of switchgear section.

vi. Each switchgear compartment shall be provided with a light and switch.

2. Not Used

3. One (1) Uninterruptible Power Supply System (UPE-UPS-34001), which includes the following:

i. Rectifier/Battery Charger

ii. Inverter

iii. Manual Maintenance Bypass Switch

iv. Isolating Bypass Source Transformer (UPE-XFMR-34001) and associated breakers

v. Battery Disconnect Switch (UPE-SW-34001)

vi. Battery Bank (UPE-BATT-34001)

vii. Battery Monitor (UPE-CAB-34001)

viii. Panelboard (UPE-PNL-34001)

ix. Static Transfer Switch

x. Monitoring Instrumentation

xi. Synchronizing Controls

xii. Inter-Connecting Cables

4. One (1) 125V DC system to provide control power to the medium voltage switchgear[9]. System shall consist of batteries, battery chargers, and distribution panel boards[10]. DC power shall be available from DC battery banks being kept

on a continuous float charge by dedicated battery chargers. System shall include the following:

i. Battery Bank (DCE-BATT-34001) (VRLA standard manufacturer design), compete with all necessary cables or straps and lugs for inter-cell and inter-tier connections. The battery size shall be based on a three-hour load profile and include and additional 15% capacity for future loads[11].

ii. Battery Rack

iii. Battery Chargers (DCE-CHGR-34001/2). NEMA Type-1 enclosure with all components serviceable from the front. Under normal plant operating conditions, the DC loads shall be supplied from battery chargers[12]. The battery chargers shall have adequate capacity to recharge batteries in 10 hrs while supplying power to the normal continuous DC system loads[13].

iv. 125V DC Load Distribution Panel (DCE-PNL-34001). NEMA Type-12 enclosure, arranged to form a single structure with common bus bar assembly.

v. Battery Monitoring System Cabinet (DCE-CAB-34001).

vi. Battery Disconnect Switch (DCE-SW-34001)

vii. Associated hardware

viii. Interconnecting Cables

5. One (1) 480V - 208/120V Distribution Transformer (LVE-XFMR-34001) and Distribution Panelboard (LVE-PNL-34001).

6. Two (2) 480V Distribution Panelboards (LVE-PNL-34002A and LVE-PNL-34002B)

e. Cable installation and termination of circuits identified in Section 1.2.1(d) of this specification.

f. Design and installation of raceway system for both Buyer and Seller installed power, control and instrument cables, and communication/data cables in accordance with the requirements of this specification.

g. Portable fire extinguisher(s).

h. Equipment nameplates, warning labels, signage, and tags.

i. Recommended spare parts list.

j. Hydrogen mitigation system.

1. Designing, furnishing, installation, and testing of Hydrogen Mitigation system for UPS Battery, which includes the following: hydrogen mitigation control panel (C1V-PNL-34001), pager system, battery room exhaust fan (C1V-FAN-34001), and horn/strobe tower (C1V-ANN-34001).

k. Design, Procurement, Fabrication, Mounting, installation, and testing for Controller Cabinet, 24590-BOF-JX-PCJ-ENCL-34000 and Remote I/O Cabinet, 24590-BOF-JX-PCJ-ENCL-34001.

l. Furnishing and installation of isolated ground bus in accordance with the requirements of this specification.

m. Designing and installation of raceway system for communications electrical system (CME) in accordance with the requirements of this specification.

n. Furnishing, installation, and testing of fire protection water system (FPW) in accordance with NFPA 13 requirements and this specification. Refer to Appendix A– Preaction Fire Suppression System. Pre-action valve and compressor to be located in under-building heated doghouse.

o. Furnishing, installation, and testing of fire detection and alarm system (FDE) in accordance with the requirements of this specification. Refer to Appendix B– Fire Detection and Alarm System.

p. Instant water heater for eyewash station (as required to maintain "tepid" water condition).

q. Floor drains

r. Supplemental Factory Acceptance Tests (FAT) of equipment specified in Exhibits 1, 3, and 4, in accordance with Section 6.5.11 of this specification.

1.2.2 The work shall include the submission of design calculations, drawings, and other documents to Buyer as required by this specification and the exhibits, in accordance with forms G-321-E and G-321-V of the material requisition.

1.2.3 Materials, equipment and /or documents shall be free from or apparent indications of suspect and/or counterfeit characteristics.

1.2.3.1 Standardized equipment shall be used between plants as much as practical, in order to improve operator familiarity, reduce maintenance training, minimize spare parts inventories, reduce maintenance procedures, and reduce design effort[14].In order to conform with equipment already on WTP site, Seller is directed to procure the UPS system equipment from GUTOR (Schneider Electric), equipment specified in Exhibits 1, 4, and 5 from EATON corporation, battery monitoring system from Eagle Eye Power Solutions, and pager system from RACO (Remote Alarms and Controls).

1.2.4 Seller shall be ultimately responsible for the completeness and quality of all materials, equipment and services provided as identified in this specification, its associated data sheets, and material requisition.

1.3 Work by Others

1.3.1 The following items are excluded from Seller's scope of work:

a. All foundations, including foundation supports with embedded mounting bolts or welded attachments.

b. Mounting/installation of completed building, including anchor bolts and welding attachments.

c. Installation of all underground piping, underground electrical conduits, and the electrical raceways leading to Building 34.

d. Shipping and conveyance

e. Installation at jobsite of stairways, railings, landings, platforms, gutters, downspouts, and fall arrest system.

f. Cable routing and termination connections to external equipment.

g. Conduit / Cable entry penetration sealing and water line entry penetration sealing.

h. Water lines to Building 34

i. Installation of flashing and weatherproof sealing of the assembled building

j. Installation of cables, devices, and outlet device boxes associated with CME, using Seller installed raceway system.

k. Connection from switchgear building lighting protection and grounding system to site ground grid.

l. Supply of stairways, railings, landings, and platforms.

m. Drain line(s) from Building 34 or under-building sanitary tank.

1.4 Safety/Quality Classifications

1.4.1 All manufactured products associated with this specification are Commercial Material (CM).

1.5 Definitions

Assumption: An engineering assumption is a design parameter or input, stated as a supposition, presumption, or judgment which is based on an engineer's experience, empirical data, hypothesis, probable inference, published literature, standard engineering practice, or background data. An assumption is used when exact verifiable data is not available.

Assumptions made using preliminary criteria or preliminary data that require future confirmation are referred to as "assumptions requiring future confirmation" and must be identified as requiring verification.

Buyer: Bechtel National, Inc.

Certificate of Compliance: A certified document that the goods or services provided meet the required standards, codes, or specifications, also known as a certificate of conformance or certificate of conformity.

Seller: The party whom the contract for work herein has been awarded. This is a comprehensive term and includes supplier, sub-supplier, vendor, contractor, Seller.

Submittal: A document provided to the WTP by a Seller for review, status coding, and return to the Seller.

1.6 Abbreviations

AISC	American Institute of Steel Construction
AISI	American Iron and Steel Institute
ANSI	American National Standards Institute
ASCE	American Society of Civil Engineers
ASD	Adjustable Speed Drive

ASHRAE	American Society of Heating, Refrigerating, and Air-Conditioning Engineers
ASME	American Society of Mechanical Engineers
ASTM	American Society of Testing and Materials
AWS	American Welding Society
BNI	Bechtel National Inc.
BOF	Balance of Facilities
CFR	Code of Federal Regulations
CoC	Certificate of Compliance
CM	Commercial Material
CME	Communications Electrical System
C&I	Control & Instrumentation
DOE	Department of Energy
FDE	Fire Detection & Alarm System
FM	Factory Mutual
FPW	Fire Protection Water System
HLW	High-Level Waste facility
HSB	BOF Switchgear Building
HVAC	Heating, Ventilating, and Air Conditioning
IBC	International Building Code
ICS	Industrial Control and Systems
IEEE	Institute of Electrical and Electronics Engineers
IES	Illumination Engineers Society
EMF	Effluent Management Facility
Lab	Analytical Laboratory
LAW	Low-Activity Waste facility
MBMA	Metal Building Manufacturers Association
MR	Material Requisition
NEMA	National Electrical Manufacturers Association
NEC	National Electrical Code
NESC	National Electrical Safety Code
NFPA	National Fire Protection Association
NRTL	Nationally Recognized Testing Laboratory
OSHA	Occupational Safety and Health Administration
PCJ	Process Control System
PDC	Power Distribution Center
PO	Purchase Order
Plf	pounds per linear foot
psf	pounds per square foot

PTF	Pretreatment facility
RPP	WTP River Protection Project – Waste Treatment Plant
TBD	To Be Determined
TBV	To Be Verified
UL	Underwriter's Laboratories
WTP	Hanford Tank Waste Treatment and Immobilization Plant
WPS	Welding Procedure Specification

2 Applicable Documents

2.1 General

2.1.1 Work shall be performed in accordance with the referenced codes, standards, and documents listed in this specification, the exhibits, drawings, data sheets, material requisition, and purchase order. For the purposes of this specification, the word "should" shall be replaced by "shall" wherever it appears in the referenced Codes or Standards.

2.1.2 When specific chapters, sections, parts, or paragraphs are listed for a code, industry standard, or referenced document, only those chapters, sections, parts, or paragraphs of the document shall apply.

2.1.3 For the codes and standards listed in Section 2.2, the specific revision or effective date identified on the document shall be followed. For daughter codes and standards, referenced in the prime codes and standards, the specific revision or date of the daughter code or standard in effect, when the prime code or standard was issued, shall be followed. If a date or revision is not identified for the prime code or standard, the latest issue, including addenda shall apply. The effective dates and revisions listed under Section 2.2 shall apply to subsequent references to the codes and standards within this specification.

2.1.4 In case of conflict between this specification and referenced codes and standards, the more conservative requirement shall apply. Any conflicts between referenced documents shall be identified in writing and submitted to Buyer for resolution. In general, when resolving conflicts, the following order of precedence shall apply:

a. Purchase Order
b. Single Line Drawings
c. Data Sheets
d. This Specification
e. Referenced Codes and Standards
f. Manufacturer's Standards

2.1.5 In the absence of a listed standard, Seller shall utilize industry consensus standards and commonly accepted practices appropriate for equipment designed for use in a standard commercial product.

2.2 Codes and Standards

The applicable codes and standards for BOF Switchgear Building (B34) and electrical equipment are listed below, as provided in the Engineering, Procurement, and Construction (EPC) Code of Record for the High-Level Waste (HLW) Facility and DFHLW Supporting Facilities[15]. If the code or standard year is not specified, then the code or standard year shall be the most recent in effect at the time of procurement.

2.2.1 B34, BOF Switchgear Building

10 CFR 851	Worker Safety and Health Program.
29 CFR 1910	Occupational Safety and Health Standards. Code of Federal Regulations, as amended.
ANSI/AISC 360	Specification for Structural Steel Building
ICEA/NEMA	Power Cable Ampacities
AISI S100	North American Specification for the Design of Cold-Formed Steel Structural Members
ANSI/ASHRAE 15	Safety Standard for Mechanical Refrigeration Systems
ANSI/NEMA Z535.4	American National Standard for Product Safety Signs and Labels
ASCE 7, 2022	Minimum Design Loads and Associated Criteria for Buildings and Other Structures
ASHRAE 52.2	Methods of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particulate Size
ASHRAE 62	Ventilation for Acceptable Indoor Air Quality
ASHRAE 90.1, 2022	Energy Standard for Buildings except Low-Rise Residential Buildings
ASHRAE Handbooks	Fundamentals, Applications, Refrigeration, Systems and Equipment
ASTM A480	Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip
ASTM C665	Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing
ASTM C719	Standard Test Method for Adhesion and Cohesion of Elastomeric Joint Sealants under Cyclic Movement (Hockman Cycle)
ASTM C834	Standard Specification for Latex Sealants
ASTM C920	Standard Specification for Elastomeric Joint Sealants
ASTM E84	Standard Test Method for Surface Burning Characteristics of Building Materials
ASTM E136	Standard Test Method for Behavior of Materials in a Vertical Tube Furnace at 750°C
AWS D1.1/D1.1M	Structural Welding Code – Steel
AWS D1.3/D1.3M	Structural Welding Code – Sheet Steel
FM 5-11	Lightning and Surge Protection for Electrical Systems
FM 5-18	Protection of Electrical Equipment Single Phasing and Related Faults

FM 5-19	Switchgear and Circuit Breakers
FM 5-31	Cables and Bus Bars
IBC, 2021	International Building Code
IFC, 2021	International Fire Code
IEEE/ANSI-C2	National Electric Safety Code (NESC)
IEEE 142	Recommended Practice for Grounding of Industrial and Commercial Power System
IEEE 242	Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems
IEEE 260.1	American National Standard Letter Symbols for Units of Measurement (SI Units, Customary Inch-Pound Units, and Certain Other Units)
IEEE 315	Graphic Symbols for Electrical and Electronics Diagrams
IEEE 399	Recommended Practice for Industrial and Commercial Power Systems Analysis
IEEE 493	Recommended Practice for the Design of Reliable Industrial and Commercial Power Stations
IEEE 519	Recommended Practices and Requirements for Harmonic Control in Electrical Power Systems
IEEE 1100	Recommended Practice for Powering and Grounding for Sensitive Electronic Equipment
IEEE 1187	Recommended Practice for the Installation Design and Installation of Valve-Regulated Lead-Acid Storage Batteries for Stationary Applications
IEEE 1202	Standard for Flame Testing of Cables for Use in Cable Tray in Industrial and Commercial Occupancies
IES	Lighting Handbook Reference & Application
IESNA/ANSI RP-7	Recommended Practice for Lighting Industrial Facilities
MBMA	Metal Building Systems Manual
NEMA 250	Enclosures for Electrical Equipment (1000 Volts Maximum)
NEMA ICS 6	Industrial Control and Systems: Enclosures
NEMA VE 1	Metal Cable Tray Systems
NEMA VE 2	Cable Tray Installation Guidelines
NEMA WC 70	Power Cables Rated 2000V or Less for the Distribution of Electrical Energy
NFPA 10, 2022	Standard for Portable Fire Extinguishers
NFPA 13, 2022	Standard for the Installation of Sprinkler Systems
NFPA 70, 2023	National Electrical Code (NEC)
NFPA 70E, 2015	Standard for Electrical Safety in the Workplace
NFPA 72, 2022	National Fire Alarm and Signaling Code
NFPA 80, 2022	Standard for Fire Doors and Other Fire Windows
NFPA 90A, 2021	Standard for the Installation of Air-Conditioning and Ventilation Systems

NFPA 101, 2021	Life Safety Code
NFPA 780, 2023	Standard for the Installation of Lightning Protection Systems
UL 44	Standard for Safety Thermoset-Insulated Wires and Cables
UL 96	Safety Lightning Protection Components
UL 96A	Safety Installation Requirements for Lightning Protection Systems
UL 467	Standard for Safety Grounding and Bonding Equipment
UL 508A	Standard for Safety Industrial Control Panels
UL 1277	Standard for Safety Electrical Power and Control Tray Cables with Optional Optical-Fiber Members
UL 1581	Safety Reference Standard for Electrical Wires, Cables, and Flexible Cords

2.2.2 13.8kV Switchgear

ANSI C37.55	Metal-Clad Switchgear Assemblies Conformance Test Procedures
IEEE C37.04	Standard Rating Structure for AC High-Voltage Circuit Breakers
IEEE C37.06	Standard for AC High-Voltage Circuit Breakers Rated on a Symmetrical Current Basis – Preferred Ratings and Related Required Capabilities for Voltages over 1000 Volts
IEEE C37.09	Standard Test Procedure for AC High-Voltage Circuit Breakers Rated on a Symmetrical Current Basis
IEEE C37.20.2	Metal-Clad Switchgear
IEEE C37.20.7	Guide for Testing Metal-Enclosed Switchgear Rated up to 38 kV for Internal Arcing Faults
IEEE C37.90	Relays and Relay Systems Associated with Electric Power Apparatus
IEEE C37.100.1	Standard of Common Requirements for High Voltage Power Switchgear Rated Above 1000 Volts
IEEE C57.13	Requirements for Instrument Transformers
NEMA LA –1	Surge Arresters
NEMA SG-4	Alternating-Current High-Voltage Circuit Breakers
NEMA SG-6	Power Switching Equipment
UL 467	Grounding and Bonding Equipment
UL 869A	Safety Reference Standard for Service Equipment

2.2.3 Uninterruptible Power Supply (UPS) Systems

CSA C22.2 No. 66.1/ UL 5085-1	Low Voltage Transformers – Part 1: General Requirements
CSA C22.2 No. 66.2/ UL 5085-2	Low Voltage Transformers – Part 2: General Purpose Transformers

IEC 62040-3	Uninterruptible Power Systems (UPS) – Part 3: Method of Specifying the Performance and Test Requirements
IEEE 485	Recommended Practice for Sizing Lead-Acid Batteries for Stationary Applications
IEEE 1184	Guide for Batteries for Uninterruptible Power Systems
IEEE 1187	Recommended Practice for the Installation Design and Installation of Valve-Regulated Lead-Acid Storage Batteries for Stationary Applications
IEEE 1188	IEEE Recommended Practice for Maintenance, Testing, and Replacement of Valve-Regulated Lead-Acid (VRLA) Batteries for Stationary Applications
IEEE 1189	Guide for Selection of Valve-Regulated Lead-Acid (VRLA) Batteries for Stationary Applications
IEEE 1491	Guide for Selection and Use of Battery Monitoring Equipment in Stationary Applications
NEMA 250	Enclosures for Electrical Equipment (1000 Volts Maximum)
NEMA PE1	Uninterruptible Power Supplies
NEMA PE 5	Utility Type Battery Chargers
UL 94	Standard for Safety Test for Flammability of Plastic Materials for Parts in Devices and Appliances
UL 1778	Standard for Safety - Uninterruptible Power Systems

2.2.4 125 Vdc System

IEEE 485	Recommended Practice for Sizing Lead Acid Batteries for Stationary Applications
IEEE 946	Recommended Practice for the Design of DC Auxiliary Power Systems for Generating Stations
IEEE 1187	Recommended Practice for Installation Design and Installation of Valve – Regulated Lead-Acid (VRLA) Storage Batteries for Stationary Applications
IEEE 1188	Recommended Practice for Maintenance, Testing and Replacement of Valve-Regulated Lead-Acid Storage Batteries for Stationary Applications
IEEE 1189	Guide for Selection of Valve-Regulated Lead-Acid Storage Batteries for Stationary Applications
NEMA 250	Enclosure for Electrical Equipment
NEMA CC 1	Electric Power Connection for Substations
NEMA PB 1	Panelboards
NEMA PE 5	Electromagnetic Interference (EMI)
IBC, 2021	International Building Code
AWS D1.1	Structural Welding Code – Steel

2.2.5 Panelboards and Dry Type Transformers

NEMA PB1	Panelboards

NEMA ST 20	Dry-Type Transformers for General Applications
NEMA 250	Enclosures for Electrical Equipment (1000 Volts Maximum)
UL 50	UL Standard for Safety Enclosures for Electrical Equipment
UL 67	UL Standard for Safety Panelboards
UL 94	Standard for Safety Test for Flammability of Plastic Materials for Parts in Devices and Appliances
UL 1561	UL Standard for Safety Dry-Type General Purpose and Power Transformers – Third Edition

2.3 Project Specifications

24590-WTP-3PS-G000-T0003	Engineering Specification for Packaging, Handling, and Storage Requirements
24590-WTP-3PS-G000-T0014	Engineering Specification for Supplier Design Analysis
24590-WTP-3PS-JQ00-T0004	Engineering Specification for Management of Supplier Software

2.4 Design Documents

2.4.1 Single Line Diagrams

24590-BOF-E1-MVE-34001	Switchgear Building 34 MVE Single Line Diagram
24590-BOF-E1-MVE-34002	Switchgear Building 34 MVE Detailed Single Line Diagram
24590-BOF-E1-MVE-34003	Switchgear Building 34 MVE Detailed Single Line Diagram
24590-BOF-E1-LVE-34001	Switchgear Building 34 LVE Single Line Diagram
24590-BOF-E1-DCE-34001	Switchgear Building 34 125VCD Single Line Diagram
24590-BOF-E1-UPE-34001	Switchgear Building 34 Uninterruptible Power Supply Single Line Diagram

2.4.2 Communications Electrical System Drawings

24590-BOF-EF-CME-(TBD)	Switchgear Building 34 Communication Layout Drawing (to be issued at 90% Design)

2.4.3 Fire Detection and Alarm System

Refer to Appendix B

2.4.4 Communication and Protective Devices Setting Documents

24590-BOF-E1R-MVE-(TBD)	Protective Device Setting Document for Switchgear Building 34 13.8kV Switchgear (to be issued at 90% Design)
24590-BOF-E1R-LVE-(TBD)	Protective Device Setting Document for Switchgear Building 480V Secondary Unit Substation Load Center (to be issued at 90% Design)
24590-BOF-J1-MVE-34001	Switchgear Building 34 Control System Block Diagram 1
24590-BOF-J1-MVE-34002	Switchgear Building 34 Control System Block Diagram 2
24590-BOF-J0X-J12W-(TBD)	Switchgear Building 34 Instrument Index

24590-BOF-J9-MVE-34001	Switchgear Building 34 Controller Cabinet Rack Arrangement
24590-BOF-J9-MVE-34002	Switchgear Building 34 Remote I/O Cabinet Rack Arrangement

2.4.5 Data Sheets

24590-BOF-ECD-LVE-(TBD)	Electrical Data Sheet: Distribution Panelboard, LVE-PNL-34001 (to be issued at 90% Design)
24590-BOF-EKD-LVE-34001	Electrical Data Sheet: 480V Secondary Unit Substation Load Center
24590-BOF-EKD-MVE-34001	Electrical Data Sheet: BOF Prefabricated Electrical Switchgear Building (Building 34)
24590-BOF-ESD-MVE-34001	Electrical Data Sheet: 13.8kV Switchgear MVE-SWGR-34001A
24590-BOF-ESD-MVE-34003	Electrical Data Sheet: 13.8kV Switchgear MVE-SWGR-34002A
24590-BOF-EUD-UPE-34001	Electrical Data Sheet: UPS System
24590-BOF-EDD-DCE-34001	Electrical Data Sheet: 125VDC System
24590-BOF-EAD-UPE-(TBD)	Electrical Data Sheet: UPS Panelboard UPE-PNL-34001 (to be issued at 90% Design)

2.4.6 Other Documents

24590-WTP-3PS-JXXE-T0003	Engineering Specification for Commercial C&I Enclosures, Panels, Cabinets, and Racks
24590-WTP-LIST-ESH-16-0001	Restricted Materials List
24590-WTP-3PS-G000-T0014	Engineering Specification for Supplier Design Analysis.
24590-HLW-3PS-E000-T0001	Engineering Specification for Electrical Bulk Material

3 Design Requirements

This section defines the content and requirements for design analysis reports when required in Commercial Quality Level (CM) material requisitions containing document category 8.0 submittals on the G-321-E form.

3.1 Design Analysis Report Contents

3.1.1 Equipment and components shall be arranged to provide a safe, neat, operational, and functional installation that meets the codes and standards specified herein. The spacing of the equipment in the structure shall comply with NEC, OSHA, or the manufacturer's recommended maintenance space requirements, whichever are greater to facilitate adequate access for maintenance and removal of equipment as required. Exhibit 6, B34, Switchgear Building Conceptual Layout, is a suggested layout.

3.1.2 The equipment listed in Section 1.2.1(d) shall be in accordance with this specification and the following:

a. Exhibit 1, *13.8kV Switchgear*

b. Exhibit 2, *Not Used*

c. Exhibit 3, *Uninterruptible Power Supply (UPS) Systems*

d. Exhibit 4, *125V DC System*

e. Exhibit 5, *Panelboards and Dry Type Transformers*

3.1.3 Seller shall provide general arrangement/outline dimensional drawing for the building. Drawing shall contain external envelope, centerline(s), required clearances/working space boundaries, connections, and tag numbers for equipment. The general arrangement drawing is Seller's responsibility, with Buyer's concurrence.

In addition, Seller shall provide outline drawings for the equipment specified in Exhibits 1 thru 5, Seller shall furnish the following information for equipment outline drawings:

a. For equipment specified in Exhibits 1, 3, and 4:

1. General arrangement and outline dimensions
2. Equipment load data of each line up
3. Equipment's footprint of each line up
4. Equipment's center of gravity of each line up
5. Location of all accessories
6. Minimum clearances front and rear working space areas
7. Indication of incoming feed (top/bottom)

b. For equipment specified in Exhibits 5, Item 1 and 6 from the above list.

c. For the Controller and RIO Cabinets located inside the C&I Room (see Section 3.8.1).

3.1.4 Calculations shall also be provided for panel equipment heat emission/cabinet heat dissipation, for the Controller and RIO Cabinets located inside the C&I Room (see Section 3.8.1).

3.1.5 Calculations and analyses shall be developed and documented to conform with the requirements of 24590-WTP-3PS-G000-T0014, Engineering Specification for Supplier Design Analysis.

3.1.6 Clear minimum interior headroom height shall be provided to avoid interference with ceiling mounted commodities. The building's exterior size shall be as shown on Seller's drawings, or data sheets.

3.1.7 Seller shall provide catalog cut sheets and manufacturer's data for Building 34 HVAC system, Preaction Fire Suppression System, Fire Detection and Alarm System, Controller and RIO Panels and components, and equipment specified in Exhibits 1 thru 5. Seller shall also include cut sheets for components, including, but not limited to, the following:

a. Relays, including model number, functional and connection schemes, time current excitation curves.

b. Circuit breakers.

c. Furnished equipment to interface with Buyer's network.

d. Manufacturer's information for the proposed UPS battery.

e. Battery monitoring system.

f. Load center accessories.

g. Technical operating manuals containing a full description of the word/bit structure for communication interface if available from manufacturer.

3.1.8 Seller shall provide detailed bill of materials with name of manufacturer, catalog number for all components and accessories of Building 34, equipment specified in Section 3.8.1 and Exhibits 1 thru 5.

3.1.9 For equipment specified in Exhibit 1, 13.8kV Switchgear, Seller shall provide protective device instructions including time current characteristic curve, current transformer excitation curves, and ground sensor time current curves.

3.2 Environmental Conditions

3.2.1 Building and equipment shall be suitable for operation at the service conditions as specified on the data sheets included in the material requisition.

3.2.2 Battery room temperature to be maintained between 72° F and 77° F[16].

3.2.3 C1 Control/Computer room temperature to be maintained between 68° F and 75° F with relative humidity between 40% and 55%[17].

3.3 Structural Requirements

3.3.1 Seller shall design the building structure per requirements delineated in this specification, including the codes and standards listed in Section 2.2 and the material requisition.

3.3.2 The building will be a single-story structure, installed outdoors, which shall be suitable for installation on 7 ft. (minimum) above grade pier foundations as indicated on Exhibit 7, Conceptual Concrete Forming Plan.

3.3.3 Seller shall provide foundation requirements drawing showing building anchor points and foundation loads.

In addition, equipment specified in Exhibits 1 thru 5 shall be anchored/attached to the building structure. As a minimum, Seller shall furnish mounting detail drawings with the following:

a. Recommended channel locations

b. Anchorage sizes and location – Anchor bolt location and size; and where available, weld size and lengths for anchorage to floor plate / beams

c. Installation tolerances for foundation

d. Design loads for foundation and anchorage design shall be per ASCE 7-22 and Section 3.5.

3.3.4 The building design shall be of the size, spacing, slope, and spans shown on Seller's drawings which shall be reviewed and accepted by Buyer. Shipping sections shall be designed to accommodate transport to the jobsite.

3.3.5 Provide non-permanent temporary framing and supports (as required) on each shipping section to prevent any deformation/damage during handling and transit. Secure all material that may become loose during shipment.

3.3.6 Equip each building shipping section with removable lifting lugs properly sized and strategically located to support rigging, lifting, and setting of each building shipping section by Buyer.

3.3.7 Seller shall provide fall protection tie-offs, located as shown on Exhibit 6, and designed for 5,000 lb per 29 CFR 1926, Subpart M (OSHA Safety and Health Regulations for Construction).

3.3.8 Seller shall perform a rigging calculation and provide rigging plans and diagrams for each building shipping section.

3.3.9 Seller shall provide seismic calculation for Building 34 and seismic qualification reports for the equipment, including equipment specified in Exhibits 1 thru 5. Seismic qualification reports shall contain analytical reports or test data that demonstrates suitability of material, component, or system in relation to the conditions imposed by the stated seismic criteria. Include seismic qualification test plans, and weight and center of gravity report.

3.3.10 Seller shall perform structural and seismic calculations to support structural drawings.

3.3.11 Deflection Criteria

This section applies to structural steel members[18]. For these criteria, "F" represents the specified minimum yield stress of steel in kips per square inch, and "L" represents the length of the span.

a. The depth of fully stressed floor beams and girders shall not be less than (F/800) times the span. If members of less depth are used, the allowable bending stress shall be decreased in the same ratio as the depth is decreased that from recommended above. Also, the deflections under live and combined dead plus live loads shall not exceed L/360 and L/240 respectively.

   Note: 1. Construction loads need not be included in these deflection criteria.

   Note: 2. These criteria do not apply to platforms, multi-commodity supports and miscellaneous steelwork.

b. The depth of fully stressed roof purlins shall not be less than (F/1000) times the span except in the case of flat roofs.

c. All roofs shall be designed with sufficient slope or camber to endure adequate drainage after the long-term deflection from dead loads or shall be designed to resist ponding load. Ponding load shall include water accumulation from any source, including snow, due to deflection.

d. For steel deck(s), the live load deflection shall not exceed the lesser of L/240 or 1[19].

3.3.12 Building Design

3.3.12.1 Operations and Maintenance Space[20]

Adequate corridors and equipment pull space shall be provided for performing operation and maintenance activities.

3.3.12.2 Equipment Clearances[21]

Adequate clearances around equipment shall be included to accommodate maintenance and operation personnel and any encumbrances such as protective garments, respirators, portable lifting devices, and alignment equipment for pumps, etc.

3.3.12.3 Arrangement[22]

Equipment and structural elements such as columns and beams arranged with respect to one another shall allow for access to equipment by maintenance personnel.

3.3.12.4 Equipment Accessibility 5 Feet[23]

Equipment, instrumentation, and electrical components that are located more than 5 feet from ground level shall have adequate space to allow for access with a ladder, portable manlift, or scaffolding for operation and maintenance.

3.3.12.5 Equipment Accessibility 6 Feet[24]

Equipment, instrumentation, and electrical components that are 6 feet and over from floor level shall be provided with permanent work platform with fixed ladder/stair access to perform operation and maintenance.

3.3.12.6 Equipment Space for Transport[25]

Space shall be provided to allow transport of the equipment to repair shops or to disposal.

3.3.12.7 Equipment Maintenance Pathways[26]

Pathways shall be included for removal of equipment to the maintenance areas.

3.4 Architectural Requirements

3.4.1 Roof system shall comply with building code requirements. Roofing systems shall be constructed using commercial grade materials and consist of compatible components as recommended by the manufacturer[27].

3.4.2 Occupancy type shall be based on the requirements of the IBC, Chapter 3, "Use and Occupancy Classification."[28]

3.4.3 Determination of the “type of construction” shall be based on the requirements defined in the IBC, Chapter 5, "General Building Heights and Areas."[29]

3.4.4 For determination of life safety means of egress requirements, the occupancy classification shall be based on NFPA 101, Chapter 6, "Classification of Occupancy and Hazard of Contents". The facility shall be considered an industrial occupancy and shall also comply with requirements of NFPA 101, Chapter 40, "Industrial Occupancies."[30]

3.4.5 Means of egress provisions, shall be in accordance with NFPA 101, Chapter 7 "Means of Egress”. OSHA Standards, that govern non-egress requirements, shall be in accordance with OSHA 29 CFR 1910, Occupational Safety and Health Standards (Subpart D)[31].

3.4.6 The building shall be designed in accordance with the energy conservation requirements set forth in ASHRAE Standard 90.1, Energy Standard for Buildings except Low-Rise Residential Buildings[32].

3.4.7 Maintenance shall be incorporated into the design using durable, low maintenance materials and systems. Noncombustible and limited combustible materials and assemblies shall be used as required.

3.4.8 Seller shall provide Preliminary Life Safety Code Evaluation (LSCE) and International Building Code Evaluation (IBCE) reports showing design compliance to codes, standards, and project requirements for intermittent occupancy which as a minimum includes:

a. Building occupancy classification

b. Building construction type

c. Area and height calculations

d. Fire resistance requirements

e. Egress requirements

3.4.9 Seller shall provide shop drawings for Building 34 as specified below:

a. Metal building erection shop drawings. Include profiles, sizes, spacing and location of structural members, rough openings, equipment supports and curbs, cambers and loads. Indicate welded connection with assigned lengths using standards AWS symbols.

b. Anchor bolt layout shop drawing(s) with bolt diameters, locations, and column reaction schedule.

c. Metal wall and roof panel shop drawings. Wall and roof system dimensions on plans and elevations, panel layout, general construction details, anchorage, and method of installation. Connection details shall provide a weather tight seal.

d. Layouts and details of accessory roof items such as gutters and downspouts, flashing and trim, etc.

e. Cable tray support shop drawings. Include plans, sections, elevations, details.

f. Layouts and details of accessory building features such as doors and door frames, etc.

g. Locations and type of sealants and sealant accessories.

h. Wireway and conduit drawings for CME system. Include plans, sections, elevations, and details.

i. Conduit drawings for FDE system. Include plans, sections, elevations, and details.

j. Seller shall provide prefabricated metal canopies at each exterior door. Acceptable manufacturers are: 1) Basis of Design: Vestis Systems: 2) American Structures and Design: www.americanstructures.com 3) Architectural Fabrication: https://arch-fab.com/ 4) or approved equal. Each single door shall have a 4'-9" wide canopy. Each pair of doors shall have a 7'-6" wide canopy. Each canopy shall protrude 4'-0" from the face of exterior wall.

3.5 Loadings

3.5.1 Loads are specified here, in Data Sheets, in Specifications, and in referenced codes and standards. In case of conflict, highest value of all shall be used.

3.5.2 Load combinations provided as specified in ASCE 7-22 shall be applied as follows:

a. Where any load reduces effect of other loads, the corresponding coefficient for that load shall be taken as 0.6 for allowable stress design if it can be demonstrated that the load is always present or occurs simultaneously with other loads. Otherwise, the coefficient for that load shall be taken as zero[33].

b. All load combinations shall be checked for zero live load condition[34].

3.5.3 Live Loads

Live loads shall be defined as those loads produced by the use and occupancy of the structure. Environmental loads, such as wind load, snow load, rain load, seismic (earthquake) load, or dead load are not included. Live load can be eliminated for the area of the footprint of large permanently fixed equipment. Live loads shall not be less than the minimum uniform load or concentrated load stipulated in ASCE 7[35]. No credit for the live load reduction factors, as described in ASCE 7 Sections 4.7 and 4.8, or IBC, shall be taken in the design of building including contents[36]. The concentrated loads shown on the building data sheet, 24590-BOF-EKD-MVE-34001, *Electrical Data Sheet for Prefabricated Electrical Switchgear Building (Building 34)* for platforms, walkways, stairs, roof trusses, steel floor framing, stair treads, and floor plates shall be considered in lieu of uniformly distributed loads when they produce greater effects on the structure[37]. Live loads shall be uniformly distributed over the horizontal projection of the specified areas, and shall have the following minimum values, unless otherwise specified in the data sheets:

a. Platforms, Walkways, and Stairs

Platforms, walkways, and stairs around the perimeter of the building are in the Buyer's scope. The walkways will be designed for a uniform load of 250 psf to allow for equipment maintenance and possible utility supports.

b. Roof Loads – Lr

Minimum roof live load shall be 20 psf[38]. Live loads on a roof are those produced during maintenance by workers, equipment, and materials, and during the life of the structure by movable objects[39].

c. Floor Loads

Design shall be based on equipment weight, storage, personnel load or wall weight, or a uniform load of 250 psf[40]. Whichever is greater.

d. Thermal Forces

Thermal forces caused by thermal expansion of equipment under all operating conditions shall be allowed for. When portions of a structure are not free to expand or contract under temperature variations, allowance will be made for stresses resulting from temperature change. When portions of a structure are subject to unequal temperature variations, allowance will be made for stresses resulting from the variation.

e. Dynamic Loads

Dynamic loads shall be considered and applied in accordance with the manufacturer, specifications, criteria, recommendations, and industry standards.

Vibration loads shall be defined as those forces that are caused by vibrating machinery, such as pumps, blowers, fans and compressors, opening/closing of breakers or contactors, etc.

3.5.4 Dead Loads[41]

a. Dead loads shall be defined as the weight of all permanent construction, including walls, floors, ceilings, stairways, all equipment, built-in partitions, structures, fireproofing, insulation, piping, HVAC ductwork, and electrical raceways.

b. Minimum dead load due to piping, raceway, and HVAC ductwork shall be taken as 25 psf. Where there is sufficient maturity of design, a dead load based on actual weight of commodities plus 20% (i.e., HVAC ductwork, raceway, piping) and equipment may be utilized. The basis for the actual weight shall be documented in the calculation.

c. The minimum allowance for the weights of partitions shall be as follows:

- For partition weights 150 lb/ft or less, a partition load of 20 psf shall be used.
- Partition weights greater than 150 lb/ft, the actual linear loads shall be used.

d. The unit weights of materials and construction assemblies for buildings and other structures shall be those given in ASCE 7. Where unit weights are neither established in that standard nor determined by test or analysis, the weights shall be determined from data in manufacturer's drawings or catalogs.

3.5.5 Wind Loads[42]

The building shall be designed for a basic wind velocity and wind load parameters as specified in the building data sheet, 24590-BOF- EKD-MVE-34001, *Electrical Data Sheet for Prefabricated Electrical Switchgear Building (Building 34)*.

3.5.6 Snow Loads[43]

The building shall be designed for snow loads in accordance with the requirements identified in the building data sheet, 24590-BOF-EKD-MVE-34001, *Electrical Data Sheet for Prefabricated Electrical Switchgear Building (Building 34).*

3.5.7 Seismic Loads[44]

The building shall be seismically designed in accordance with the requirements of applicable building codes to survive the maximum design earthquake of the seismic zone specified on the data sheet, 24590-BOF-EKD-MVE-34001, *Electrical Data Sheet for BOF Prefabricated Electrical Switchgear Building (Building 34),* without permanent damage or significant deformation.

3.5.8 Ash Fall Loads[45]

The building shall be designed for the ash fall loads in accordance with the requirements identified in the building data sheet, 24590-BOF-EKD-MVE-34001, *Electrical Data Sheet for BOF Prefabricated Electrical Switchgear Building (Building 34).*

3.6 HVAC Requirements

3.6.1 The HVAC system shall maintain interior design conditions as specified in Section 3.2, for summer and winter temperatures and humidity control, for selectable occupied/unoccupied mode of building manual/automatic operation.

3.6.2 The building shall be heated, ventilated, and cooled using wall mounted, packaged heat pump HVAC system units. The HVAC system, including any thermostats and humidistats, shall be accessible for inspection, maintenance, and component replacement without interruption of HVAC to the building[46.] Seller shall size the HVAC system units with 20% margin, such that one single unit failure on any room will not upset the required temperature of that specific area, i.e. battery room, C&I room or electrical equipment room. Calculations shall take into consideration the ambient site conditions, the dimensions of the structure, the solar heat generated on the structure, and the heat generated by the equipment within the structure. The HVAC system units shall be provided with temperature controllers as required to control the temperature and humidity in the different rooms independently. A water line to the building will be provided for humidity control and for emergency eyewash station. The water line interface location of Buyer and Seller piping is outside the building. Seller shall provide the location of the nozzle outside the building for connection to Buyer piping on their submittals. Location of water line to be inside heated doghouse under building along with fire service water line and preaction system valve.

3.6.3 The outdoor ambient conditions, shown on the building data sheet, 24590-BOF-EKD-MVE-34001, Electrical Data Sheet for Prefabricated Electrical Switchgear Building (Building 34), for maximum and minimum ambient temperature and maximum wind speed, shall be used to determine heating, cooling, ventilating, and air conditioning requirements.

3.6.4 The outdoor ventilation intakes shall be designed to prevent hoarfrost build up .[47]

3.6.5 Each HVAC unit shall be provided with an interlock that disables the HVAC upon a signal from Buyer's fire alarm system.[48]

3.6.6 Each HVAC unit shall be power fed in accordance with Section 3.7.3 of this specification.

3.6.7 Seller shall submit to Buyer a complete HVAC package, including the following drawings:

a. Overall HVAC System single line diagram showing all electrical equipment and components.

b. Dimensional layout drawing showing location of HVAC equipment and electrical control equipment.

c. Schematic/wiring, interconnection diagrams, and cable schedule showing details of all internal connections.

3.6.8 Provide outside air ventilation at a rate of 0.6 cfm/ft^2 in the electrical equipment and C&I rooms. Locate outdoor air intakes to minimize potential for high wind to produce pressure

gradients inside the building, and to minimize the possibility of exhaust fumes from equipment and trucks to enter the building.

3.6.9 Hydrogen Mitigation System for UPS Battery

a. Provide a battery room exhaust fan (C1V-FAN-34001) to maintain concentration of hydrogen gas in the battery room below 1% of the room volume.

b. Continuous ventilation shall be provided at a rate of not less than 1 cubic foot per minute per square foot (cfm/ft ^{2}) of floor area of the room. Make-up air can be supplied directly or transferred from other areas of the building as defined in ASHRAE 62.1, *Ventilation for Acceptable Indoor Quality*. If supplied directly, it must be filtered with MERV 11 filters at a minimum.

c. Provide hydrogen mitigation control panel (C1V-PNL-34001) to monitor battery thermal runaway condition on UPS battery (UPE-CAB-34001), and battery room exhaust fan (C1V-FAN-34001) failure for loss of power or overload. When any of these conditions are present, C1V-PNL-34001 shall activate the following:

- Horn/strobe tower (C1V-ANN-34001) located above battery room door.
- Pager system in C1V-PNL-34001.
- Two sets of contacts shall be wired to a terminal block. One contact will be used for alarm signal to the 24590-BOF-JX-PCJ-ENCL-34001 and the other will be spare for future use by Buyer.

d. Control panel shall be UL labeled by a certified UL 508A, *Standard for Safety Industrial Control Panels*, shop.[50]

e. All non-current carrying metallic parts of electrical equipment shall be bonded together and made electrically continuous.[51]

f. Control panel shall have permanent nameplates and labels to identify all equipment components, devices, cables, and wires.

g. In addition to the instrumentation and controls, C1V-PNL-34001 shall be furnished with pushbuttons for alarm test and horn silence functions.

3.6.10 Seller shall perform a HVAC sizing calculation for the building. Calculation report per manufacturer's standard calculation is acceptable in lieu of calculation, as long as input data and equations used for report generation are provided along with the report for verification of adequacy of the results.

3.6.11 HVAC system units' control panels shall be UL labeled by a certified UL 508A, Standard for Safety Industrial Control Panels, shop.

3.6.12 HVAC system units' control panels shall have permanent nameplates and labels to identify all equipment components, devices, cables, and wires.

3.7 Electrical Requirements

3.7.1 Electrical design and installations including lighting, receptacles, etc., shall comply with NFPA 70 and applicable building codes of the State of Washington.

3.7.2 All electrical equipment and material, including industrial control panels and cabinets that are assemblies of industrial control devices, shall be suitable for installation and use in conformity with the provisions of NFPA 70.

3.7.3 The following equipment and services shall be fed from panels as shown on the following Panel Schedules:

- 24590-BOF-E8-DCE-34001
- 24590-BOF-E8-LVE-34002
- 24590-BOF-E8-LVE-34002A
- 24590-BOF-E8-LVE-34002B
- 24590-BOF-E8-UPE-34001

And as specified below:

a. HVAC units shall be fed from distribution panels LVE-PNL-34002A and LVE-PNL-34002B (split equally) using an independent circuit for each HVAC unit.

b. A single phase, 120 VAC circuit shall be provided to C1V-PNL-34001 from UPE-PNL-34001 for operation of C1V-FAN-34001, and alarm system, including pager system.

c. A single phase, 120 VAC circuit shall be provided to UPE-CAB-34001 from UPE-PNL-34001 for battery monitoring system.

d. A single phase, 120 VAC circuit shall be provided to LVE-CAB-34001 from LVE-PNL-34001 for load center breaker test cabinet.

e. Lighting fixtures shall be fed from LVE-PNL-34001.

f. Convenience receptacles shall be fed from LVE-PNL-34001.

g. Redundant single phase, 120 VAC circuits shall be provided to 24590-BOF-JX-PCJ-ENCL-34000, 24590-BOF-JX-PCJ-ENCL-34001 from UPE-PNL-34001, and LVE-PNL-34001 respectively.

3.7.4 All switches and circuit breakers used as switches shall be located so that the center of the grip of the operating handle of the switch or circuit breaker, when in its highest position, will not be more than 6 ft. 7 in. above the floor or working platform per NFPA 70 Article 404.8(A). If the equipment is mounted on a housekeeping pad the allowable height of the operating handle shall be reduced by the height of the housekeeping pad.

3.7.5 Provide clearance working space and dedicated equipment space per NFPA 70 Articles 110.26 and 110.32 through 110.34, including space sufficient for a 90-degree opening for all electrical equipment doors or hinged panels.

3.7.6 Electrical equipment shall be built where practical in such a manner that energized conductive parts greater than or equal to 50V are isolated against direct or incidental contact (i.e. “finger safe” terminal blocks and components or terminal blocks covered with a removable covering) in all areas where routine maintenance is to be performed.

3.7.7 Seller shall provide electrical shop drawings for the building as specified below:

a. Lighting and receptacle layouts, including wiring.

b. Grounding layout drawing with elevation details.

c. Panel schedules

d. Control panel layout for equipment specified in Section 3.6.9(c)

e. Electrical power requirements for lighting, HVAC, etc.

f. Isolated ground bus detail, including Bill of Materials with information including manufacturer, catalog number, and quantity.

3.7.8 Seller shall provide Single Line, Schematic, and Wiring Diagrams for equipment specified in Exhibits 1, 3, and 4.

3.7.9 Seller shall provide internal and interconnecting wiring diagrams for equipment specified in Section 3.6.9(c) of this specification and Exhibits 1 thru 5.

3.7.10 Seller shall provide Control Schematics and Logic Diagrams for equipment specified in Exhibits 1 and 3.

3.7.11 Means shall be provided for the complete and safe isolation of electrically powered equipment. Isolation points shall be readily accessible, lockable in the de-energized position, and prevent unintentional or inadvertent re-energization[52].

3.7.12 Acceptability of Electrical Equipment[53]

Electrical equipment, including all internal components and material of listed or labeled equipment and assemblies, shall be evidenced by listing or labeling by a nationally recognized testing laboratory (NRTL) as recognized by OSHA. A UL/NRTL recognized component mark is acceptable in lieu of the standard UL labeling. Documentation supporting appropriate NRTL listing or labeling shall be provided to Buyer for review. One of two methods shall be used.

a. Method 1: Listed, Labeled, or Certified[54]

Buyer will approve and accept electrical equipment without additional examination if it is Listed, Labeled, or Certified by a US NRTL, as recognized by OSHA under 29 CFR 1910- Subpart S and is acceptable for the application, environment and other requirements of NEC Article 110. For a listing of and Typical Registered Certification Marks of US NRTL as recognized by OSHA go to the current OSHA listing available on their website.

Seller shall submit a Certificate of Compliance (CoC) document to Buyer for review and approval that lists the USA Electrical Standard(s) that the equipment is evaluated to for its NRTL Listing. Only those standards that are listed on the OSHA website: https://www.osha.gov/nationally-recognized-testing-laboratory-program/list-standards are acceptable. The certification shall confirm that the NRTL label will be as shown on the OSHA website: https://www.osha.gov/nationally-recognized-testing-laboratory-program/current-list-of-nrtls including the additional markings required to indicate acceptability for use in the USA.

b. Method 2: Field Evaluation by a NRTL[55]

Electrical equipment that is part of an overall electrical or mechanical assembly having a NRTL field evaluation, where the report states that the equipment has been

accepted or otherwise deemed safe by the NRTL recognized by OSHA under 29 CFR 1910-Subpart S, using US standards, will be evaluated by Buyer for acceptability. If found acceptable no further examination of the equipment is required. Seller shall submit all field evaluation reports completed by an OSHA recognized NRTL to Buyer for review and approval. These evaluation reports shall show compliance to the applicable USA Electrical Standard(s) recognized by OSHA that are listed on the OSHA website: https://www.osha.gov/nationally-recognized-testing-laboratory-program/list-standards. The NRTL label will be as shown on the OSHA website https://www.osha.gov/nationally-recognized-testing-laboratory-program/current-list-of-nrtls with whatever additional markings that are necessary to indicate acceptability for use in the USA. The list of OSHA Recognized Standards that each NRTL is recognized by OSHA to test to, are found at https://www.osha.gov/nationally-recognized-testing-laboratory-program/current-list-of-nrtls, by individually selecting each NRTL.

3.7.13 Cable and Wiring Design Requirements

a. All wiring and cabling shall be properly supported per NFPA 70 requirements.

b. Seller-provided wiring for building utilities, such as, lighting, receptacles, etc., shall not be routed in cable trays. Seller provided cables and wiring shall be Buyer approved.

c. For scheduled wiring, the wire/cable shall be Seller-provided/Buyer-approved and shall have both ends of the wire tagged with sleeve type wire markers. The cable tag and termination information includes cable scheme number, “From” and “To” equipment number, cable code, and conductor identification as applicable.

d. Not used.

e. The ampacity of all wiring inside the building shall be calculated assuming a maximum ambient temperature of 40°C (104°F)[56].

3.7.14 Cable Tray System Design[57]

a. The design of the building shall include steel strut channels embedded in the ceiling for Buyer use in supporting cable trays, conduits, and other items by threaded rod and strut channel hangers that may be required to be installed at the jobsite. The cable tray supports shall be designed to support the maximum loading of the tray based on the NEMA rating of the tray.

b. Seller shall provide a barrier within the cable tray to separate Buyer’s C&I cables. Barrier locations will be provided at 90% design phase.

c. Each cable tray level shall be bonded to the interior grounding system at a minimum of two places diagonally opposite from each other.

3.7.15 Conduit & Wireway System Design

a. Building design shall include raceways (conduit, wireways, etc.) as needed for Seller provided building utilities (HVAC, lighting, receptacles, etc.). Conduit and wireways shall be installed and supported in accordance with the NEC.

b. Seller shall design the structure to allow for Buyer installed site conduits and conduit supports and identify the maximum weight of conduit and support allowed. Seller shall identify areas on the drawings where Buyer's site installed conduits and supports cannot be installed.

c. Conduits and wireways for scheduled cables shall be labeled with Buyer's numbers (to be provided at 90% Design).

d. Where cables transition from a scheduled raceway or cable tray to a short segment of another type of raceway to enable flexible connections to the equipment (e.g. flexible conduit, exposed cables into hubs or into short conduit stub-ups) those short transitional raceway segments are considered to be unscheduled field routed raceway and are not required to have unique identification numbers[61]. Seller shall provide conduits or wireways for all unscheduled field routed raceways.

e. Power, control, and communication cables not rated for cable tray installation, including Belden 82842, shall be routed using conduit or wireways.

f. Seller shall provide conduit and wireways for CME system as specified in Section 3.10 of this specification.

3.7.16 Grounding System Design

a. Design the exterior ground pads to include four (4) grounding pads (one at each corner of the structure) that will accommodate a copper #4/0 AWG ground wire and show the location on Seller drawings.

b. Electrical equipment such as panelboards, transformers, and switchgear shall be equipped with a ground bus. The equipment grounding conductors of feeders and incoming power cables shall be connected to the ground bus. The ground bus shall also be connected to the building ground system via copper ground conductors[63]. Connections to the grounding system shall be made with a qualified process (specifically, exothermic weld or compression type connectors)[64]. Connection of the building ground system to ground grid system by Buyer.

c. All electrical equipment, building steel, and metallic enclosures containing electrical apparatus shall be grounded[65].All equipment grounding conductors shall be copper. No.6 or smaller conductors shall be insulated and have a green jacket or green jacket with one or more yellow stripes. Conductors larger than No.6 shall either be bare or insulated. An insulated conductor larger than No.6 is permitted, at the time of installation, to be permanently identified as an equipment grounding conductor at each end and at every point where the conductor is accessible. One or more insulated conductors in a multiconductor cable, at the time of installation, shall be permitted to be permanently identified as equipment grounding conductors at each end and at every point where the conductors are accessible The equipment grounding conductors shall be sized accordance with Table 250-122 and identified in accordance with Article 250- 119 of the National Electrical Code, NFPA 70[71].

d. Seller-supplied equipment, including the building structure itself, shall be grounded in accordance with manufacturer or NFPA 70 requirements.

e. The grounding conductors shall be of sufficient size to carry the maximum available ground fault current.[77].

f. The 480Y/277-V and 208Y/120-V systems neutral point shall be solidly grounded to the main building ground bar, which is to be solidly grounded to the ground grid (by Buyer)[78].

g. The grounding system design shall permit appropriate periodic inspection and testing of electrical equipment such as wiring, insulation, connections, and switchboards, to assess the continuity of the systems and the condition of their components[79].

h. Grounding of instrumentation[80]

1. Instrumentation shall be grounded per the manufacturer's requirements.

2. Instrument signal and computer systems shall be provided with low impedance insulated and isolated ground system.

3. The isolated ground system for instrument signal and computer systems shall be connected at a test point for periodic checks.

4. The isolated grounding system for instrument signal and computer systems shall be a radial system with insulated cables, without loops, that connects to the building grounding system at a single point.

5. The isolated grounding system for instrument signal and computer systems grid impedance shall be maintained at less than 5 ohms.

i. All signal cables shall be shielded and their shields connected to ground at the panel end only, unless otherwise specified by the manufacturer[81].

j. The UPE system neutral of the UPS output shall be grounded at a single point, either at the inverter or the respective distribution panelboard[82].

k. The 125-V DC system shall be ungrounded[83]

3.7.17 Lighting System Design

a. Seller shall design the interior, emergency egress, and exterior lighting applying the light loss factors per IES Handbook, and meeting NEC requirements.

b. Seller shall perform a lighting calculation using AGI 32 or Buyer approved software, in accordance with Section 3.1.5, to demonstrate that the lighting design provided by Seller meets Buyer specified lighting levels as shown on building data sheet, 24590-BOF-EKD-MVE-34001, *Electrical Data Sheet for Prefabricated Electrical Switchgear Building (Building 34)*. Calculation reports per manufacturer's standard are acceptable in lieu of calculations, as long as input data and equations used for reports' generation are provided along with the reports for verification of adequacy of the results.

3.7.18 Lightning Protection System Design[84]

a. Seller shall design and install a lightning protection system in accordance with NFPA 780. The lighting protection system to consist of air terminals connected

together and connected by down conductors to a Buyer provided dedicated ground rod, which is connected to Buyer site ground electrode system. Suggested layout is shown in Exhibit 8, *Lightning Protection System Conceptual Layout*.

b. Lighting protection system shall be designed to allow the replacement of necessary components following lightning strikes[85].

c. Lightning protection test points shall be provided between down conductors and ground electrodes to facilitate periodic testing[86].

d. Lighting protection system air terminals shall be located such that they are outside of the arc flash ducting restricted area.

3.8 Control and Instrumentation Requirements

3.8.1 The Buyer selected the Industrial IT platform from ABB, Inc. as the primary control system for the WTP facility. The Seller shall provide the following control panels:

Equipment Tag No.	Description	Mounting
24590-BOF-JX-PCJ-ENCL-34000	Switchgear Building 34 Controller Cabinet, located in the PDC building C&I Room	Floor Free Standing
24590-BOF-JX-PCJ-ENCL-34001	Switchgear Building 34 Remote I/O Cabinet, located in the PDC building C&I Room	Floor Free Standing

3.8.2 The Control Panels design and fabrication, shall be in accordance with document no 24590-WTP-3PS-JXXE-T0003 - Commercial C&I Enclosures, Panels, Cabinets, and Racks.

3.8.3 The Control Panels shall be provided at a minimum with the components required in dwg. no 24590-BOF-J9-MVE-34001 - Switchgear Building 34 Controller Cabinet Rack Arrangement and 24590-BOF-J9-MVE-34002 - Switchgear Building 34 Remote I/O Cabinet Rack Arrangement; The Seller shall provide final panel design, including panel drawings to show the actual panel arrangement / layout, dimensions, all the necessary components, wiring and terminations for the Control Panels.

3.8.4 Seller shall furnish 24590-BOF-JX-PCJ-ENCL-34000 with Ethernet (Modbus TCP) communication module to support monitoring status of load center main breakers, tie breaker, and feeder breakers.

3.8.5 Seller shall furnish 24590-BOF-JX-PCJ-ENCL-34001 with 24 VDC loop power for discrete and analog signals from Battery Chargers (DCE-CHGR-34001 and 34002), Disconnect switch (DCE-SW-34001), Distribution Panel (DCE-PNL-34001), Uninterruptible Power Supply (UPE-UPS-34001), UPE Battery Monitoring System (UPE-CAB-34001), 125 Vdc Battery Monitoring System (DCE-CAB-34001) and Hydrogen Mitigation Control Panel (C1V-PNL-34001).

3.8.6 Seller shall furnish 24590-BOF-JX-PCJ-ENCL-34001 with 24 VDC loop power for all the other discrete signals, including the hardwired signals associated with breaker control (open/close), main breakers / switchgear status, switchgear equipment selection and transfer switches, transformers differential / pressure lockout, LVE substation, etc. See doc. no. 24590-

BOF-J0X-J12T-34001- BOF – Balance of Facilities Switchgear Building 34 Instrument Index for the full lists of signals.

3.8.7 Seller shall also furnish 24590-BOF-JX-PCJ-ENCL-34001 with the necessary terminal blocks and wiring to accommodate all the discrete and analog signals listed in document 24590-BOF-J0X-J12T-34001– BOF – Balance of Facilities Switchgear Building 34 Instrument Index.

3.8.8 Seller shall provide schematic/wiring diagrams depicting cables and terminations between PCJ enclosures, and the electrical equipment and instrumentation specified in Sections 3.8.2 thru 3.8.7.

3.8.9 See drawings 24590-BOF-J1-MVE-34001 and 24590-BOF-J1-MVE-34002 –Switchgear Building 34 Control System Block Diagrams, for the electrical equipment communication to control system.

3.8.10 See eyewash station alarm requirements, Section 3.11.1.

3.8.11 Seller shall provide a desktop / computer-based Operator Workstation with two monitors (24") and a table / desk in the C&I Room.

3.8.12 All transmitters, transducers, and process switches shall be located as close to the point of measurement as can be achieved.[87]

3.8.13 All transmitters shall be located on racks to minimize field construction costs, and to facilitate commissioning and maintenance, exceptions to this rule shall be addressed on a case-by-case basis.[88]

3.8.14 Monitoring instrumentation shall be capable of returning to normal operation following switching transients (for example, without requiring manual recalibration).[89]

3.8.15 All signal cables shall be shielded and their shields connected to ground at the Control Panels end only.[90]

3.8.16 All discrete input signals to Control Panels shall be dry-contact, 24 VDC circuits, and discrete output signals from the control systems are 24 VDC; Seller to provide the necessary interposing relays when greater isolation, voltage, or current capacity is required.[91]

3.8.17 Independent System Commissioning[92]

To the extent practicable, systems shall be designed to be commissioned independently. Prior to integrated testing, appropriate groups of interfaced systems shall be commissioned separately. Buyer acceptance testing of the ICN elements shall be performed prior to commissioning.

3.9 Fire Protection Requirements

3.9.1 Seller shall provide portable, multipurpose (Type A/B/C), dry chemical fire extinguishers in quantity and location(s) required to meet the NFPA 10, Standard for Portable Fire Extinguishers, requirements. All fire protection system equipment (e.g., portable fire extinguishers) shall be UL listed and FM approved.

3.9.2 Seller shall provide pre-action fire protection water system (FPW). Seller shall provide exterior under-building heated doghouse with preaction valve and accessories with connection location for connection from building fire protection water system to Buyer's site fire water supply line. Refer to Appendix A for additional requirements.

3.9.3 Seller shall provide fire detection and alarm system (FDE), to be interfaced with site fire detection system. Refer to Appendix B for additional requirements.

3.10 Communications Electrical System (CME) Requirements

3.10.1 Seller shall design a raceway system for Communications Electrical System (CME) in accordance with 24590-BOF-(TBD), BOF Switchgear Building B34 Communication Layout Drawing, and this specification.

3.10.2 CME raceway system shall consist of metallic wireways located to facilitate installing cables, and conduits from the wireways to the CME outlet device boxes. Pull boxes are also acceptable.

3.10.3 Wireways and conduits shall be sized for installation of twisted pair category 6 cables with the following criteria:

- Any single conduit run extending from the wireways shall not serve more than three outlet device boxes.
- Condit fill for twisted pair Category 6 cable shall not exceed the following table requirements:

Table 2 – Conduit Fill for Twisted Pair Category 6 Cable

Conduit Trade Size (Inches)	3/4"	1"	1.5"	2"	3"
Number of Category 6 Cables	4	7	16	22	50

3.10.4 All conduits shall be ¾ inches minimum, the recommended minimum bend radius for ¾ inch conduits is 6 inches.

3.10.5 Outlet device boxes can be used as a pull point for conduit run with trade size ¾ inch and 1 inch.

3.10.6 No conduit between pull points, pull boxes, or wireways shall exceed 100 feet. No more than two 90-degree bends, a total of 180 degrees of bend, or one bend exceeding 90 degrees between pull points is required.

3.10.7 Pull boxes shall not be used in lieu of a bend. Conduits shall enter pull boxes on opposing ends from each other. All pull boxes utilized as pull-points shall be in-line.

3.10.8 For exterior outlet device boxes, Seller shall provide conduits at the recommended height, and an exterior wall penetration as shown on Table in 24590-BOF-EF-CME-(TBD), BOF Electrical Building B34 Communication Layout Drawing (to be provided at 90% design).

3.10.9 If pull boxes are used, Seller shall size them in accordance with the following table:

Table 3 – Pull Box Sizing

Conduit Trade Size (inches)	**Width (inches)**	**Length (inches)**	**Depth (inches)**	**Width Increase or Additional Conduit**
1	4	16	3	3

1.5	8	27	4	4
2	8	36	4	5
3	12	48	5	6
4	15	60	8	8

3.11 Plumbing Requirements

3.11.1 Seller shall provide a continuous source, single action, tempered water emergency eyewash station per OSHA requirements. Provide water line connection location at building exterior. Provide floor drain. Provide instant electric water heater, as required, to provide tepid water temperature. The eyewash station shall be equipped with a flow switch and relay contact to activate alarm when the eyewash station is in use; the alarm shall report to the Remote I/O cabinet 24590-BOF-JX-PCJ-ENCL-34001 located in the C&I room. Also, the water collection reservoir from the eyewash station shall be equipped with high level alarm to indicate when the reservoir is full; this alarm shall also report to the Remote I/O cabinet located in the C&I room.

3.11.2 Floor drains or sumps shall be provided in areas requiring eyewash/safety shower stations to collect water drainage from eyewash/shower usage and testing[94].

3.11.3 All building floor drains shall be routed to a collection vessel or sump[95].

3.12 Other/General Requirements

3.12.1 ACGIH Sound Limits[96]

Plant spaces shall be designed to allow continuous occupancy under ACGIH limits without PPE. Where this is not practical, the design shall minimize noise exposure levels to allow continuous occupancy with PPE up to the use of double hearing protection (i.e. less than 109 dBA). Equipment within rooms shall be designed to be below 109dBA when equipment is in operation. Rooms with equipment that require PPE for entry shall be considered “high-noise areas” for compliance with ORD Section 12.5, Communications.

3.12.2 Equipment Clearances[97]

Adequate clearances around equipment shall be included to accommodate maintenance and operation personnel and any encumbrances such as protective garments, respirators, portable lifting devices, and alignment equipment for pumps, etc.

3.12.3 Protective Circuits and Instrument Maintenance[98]

Provision shall be made in the building design to perform instrument calibrations, preventive maintenance, and periodic functional testing of protective circuits while the plant is in normal operation.

4 Materials

4.1 Construction

4.1.1 Building structure and components such as building base, floor, roof, ceiling, platforms, walkways, and exterior and interior walls shall be rated to withstand the loading requirements delineated in Section 3.5.

4.1.2 Skid

The base of the building shall be constructed of structural steel beam perimeter framework rigidly braced with structural steel cross-members that form a self-supporting base. The base shall remain within allowable deformations when transporting, rigging, or lifting a module and when installed in final location.

4.1.3 Floor

a. The floor shall be made of smooth steel plate. Floor cutouts and penetration seals shall be provided to accommodate cable, tray, conduit, and duct entrances.

b. The floor area under and around the batteries, as well as the wall area adjacent thereto, shall be provided with an acid-resistant material or shall be painted with an acid-resistant paint in accordance with NESC Section 14.

4.1.4 Roof

a. Roof shall be installed with accessory components including closure strips, sealants, gutters, downspouts, and any other related accessories to provide a complete roofing system meeting the industry standards and practices and shall be sealed for air and water infiltration.

b. Roof panels shall be factory finished standing seam galvanized sheet metal with a high rib profile or the manufacturer's standard product line approved by Buyer.

c. Roof shall be sloped in accordance with the manufacturer's recommendations to achieve positive drainage to gutters, downspouts, and concrete splash blocks with a minimum slope of 1/4" per foot.

d. Downspouts shall extend past floor line to finish grade.

e. Size gutters and downspouts for a maximum rainfall of 1.8" in 6 hours.

f. Access to roof with mechanical equipment shall be by means of ladders or hatches that comply with OSHA standards. Roof mounted walkways, where provided, shall be non-slip and compatible with the roofing system. Fall arrest systems or guardrails shall be provided at facility roofs as required by OSHA directives.

4.1.5 Ceilings

Ceilings shall be made of metal liner panels which are galvanized sheet metal, flush profile panel construction.

4.1.6 Walls

a. The exterior wall system shall consist of a factory finished galvanized sheet metal panel, fiberglass insulation, and interior metal liner panels Additional related system components shall include flexible sealant, clips, coping, facility panel closures, and gaskets.

b. Interior metal liner panels shall be galvanized sheet metal, flush profile.

c. Interior partition walls are non-load-bearing partitions and shall be constructed of either metal studs with 5/8" (minimum) gypsum wallboard attached by screws, or manufacturer's standard metal partition system. Where partition walls are required to be fire rated, they shall be constructed per UL, or other approved, Nationally Recognized Testing Laboratory (NRTL) rated final assemblies, including penetration protection as required.

4.1.7 Stairs, Ladders, and Platforms

Stairs, ladders, and platforms are in the Buyer's scope and shall be coordinated with the Seller.

4.1.8 Wall, Roof, Ceiling, and Floor Insulation

Provide manufacturer's standard insulation system complying with ASTM C665, Type I, ASTM C578 and ASTM C1289 as applicable, passing ASTM E136, and with maximum flame spread and smoke developed indices of 25 and 50, respectively per ASTM E84, Insulation shall meet minimum requirements of ASHRAE Standard 90.1, *Energy Standard for Buildings Except Low- Rise Residential Buildings.*

4.1.9 Penetrations

Where cable tray/conduit/raceway wall penetrations are required, the cutouts shall be completely framed and shall have no sharp edges. Where other types of penetrations are required, the cutout shall be neat and professionally made, and the penetration shall be provided with the appropriate type of penetration seal to prevent the ingress of air, water, ash, or dust to maintain the interior environment of the building. Where a penetration is made through a fire-rated wall, floor, or ceiling, the penetration seal shall maintain the fire rating.

4.1.10 Sealants

a. Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by the sealant manufacturer based on testing and field experience.

b. Use sealant manufacturer's standard test methods to determine whether priming and other specific joint preparation techniques are required to obtain optimum adhesion of joint sealants to joint substrates. Sealant manufacturer's test methods shall be in compliance with ASTM C834, ASTM C920, or ASTM C719 as applicable.

c. Colors of Exposed Joint Sealants shall be selected from manufacturer's standard colors.

4.1.11 Interior Finishes

a. Interior finishes shall provide a durable and easily cleanable surface. Gypsum wallboard partitions and interior surfaces that are not pre-finished shall receive a semi-gloss latex enamel paint with primer and two finish coats.

b. Exposed interior wall and ceiling finish materials and any factory installed material greater than 20 gauge (0.9 mm) shall have an UL-listed, FM-approved, or other NRTL flame spread rating of 25 or less, and a smoke development rating of 50 or less as tested per ASTM E84, *Standard Test Method for Surface Burning Characteristics of Building Materials*.

4.1.12 Color / Finish Schedule

The building shall be painted in accordance with the color provided in the following color schedule. Colors for incidental items, or for items not specifically scheduled below, shall be selected by Seller from paint manufacturer's full range.

Color Schedule:

a. **Floor**: Clear Sealer or matching Benjamin Moore; BM 2143-50, "*Old Prairie*".

b. **Metal Roof**: Matching CENTRIA Architectural Systems Color No. 977 "Moss" or similar approved color[99].

c. **Gutters and Downspouts**: Matching adjacent wall or siding color[100].

d. **Ceilings**: Factory finished with manufacturer's standard "white" color.

e. **Exterior Metal Wall**: Matching CENTRIA Architectural Systems "Limestone" No. 1760 or approved equivalent

f. **Interior Metal Liner Panels:** Factory finished with manufacturer's standard "white" color.

g. **Interior Gypsum Walls**: Matching Benjamin Moore; BM 2143-60, "*Moonlight White*".

h. **HM Doors/Frames:**

i. **Interior**: Matching Benjamin Moore; BM 2139-40, "*Heather Gray*"

j. **Exterior**: Matching Centria #977, "*Moss*".

k. **Stairs (applicable to non-galvanized):**

l. **Stringers**: Matching Inorganic Zinc Primer (Gray) or Benjamin Moore; BM 2139-40, "*Heather Gray*".

m. **Tread Pan and Riser**: Matching Inorganic Zinc Primer (Gray) or Benjamin Moore; BM 2139-40, "*Heather Gray*".

n. **Tread**: Clear Sealer

o. **Handrails/Guardrails**: Matching Inorganic Zinc Primer (Gray) or Benjamin Moore; BM 2139-40, "*Heather Gray*".

4.1.13 Doors and Door Hardware

a. Exterior doors shall be flush face, hollow metal, and insulated. Doors and frames shall be as per manufacturer's standard.

b. Interior doors shall be flush face, commercial, hollow metal doors and frames per manufacturer's standard. Doors shall be provided with all appropriate hardware.

c. Doors and frames for openings, if located in a fire rated barrier, shall bear UL and/or other NRTL labels appropriate for each fire rated wall opening, and shall be fire rated in accordance with the 2022 edition of NFPA 80, *Standard for Fire Doors and Other Opening Protectives.*

d. Provide hardware as required for the door function code and fire label requirements. All hardware for doors shall be manufacturer's standard. Cylinders shall be interchangeable core- type with 6-pin tumblers to accept the project's existing Corbin 59C2-6 re-cored system. Hardware shall be UL approved for fire rated doors. Hardware installation shall comply with manufacturer's standard installation methods. Hardware shall include the following:

- Hinges: 4 1/2 inches by 4 1/2 inches minimum for 3'-0" wide doors or less; 5 inches (high) by 4 1/2 inches minimum for doors over 3'-0" wide, full mortise, heavy weight, anti- friction bearings, and button tip. Hinges used on exterior doors shall have a hinge pin retention feature that allows removal of the hinge pin only when the door is open. Place hinges for all doors to allow doors to swing 180 degrees.
- Lockable entrance hardware shall be manufacturer's standard lever handles. Design shall be based on Corbin Russwin ML2000 mortise locksets with LWM trim design or approved equal.
- Provide exit or panic hardware on exterior doors.
- Weather-stripping and Door Gaskets: A perimeter seal equivalent to PEMKO 303AS shall be provided at the door head and jambs.
- Threshold: Set all thresholds in mastic bed.
- Stops: Provide wall type, convex, one stop per leaf.
- Automatic Closer with built-in hold open device: Provide surface closer, modern type with cover. Closers shall be complete with brackets, arms, mounting devices, fasteners, and other features necessary for the particular application. Provide hold open arm function at non-rated interior doors. Closer cover shall match plated finish of arm. The forces required to fully open any door manually in a means of egress shall not exceed 15 lbf (pounds force) to release the latch, 30 lbf to set the door in motion, and 15 lbf to open the door to the minimum required width.
- Drip shields/water flashing: Provide at exterior door heads.
- Fastening: Provide fasteners of proper type, quality, size, quantity, and finish with hardware. Fasteners exposed to weather shall be stainless steel.
- Hardware shall be finished in conformance to manufacturer's standard as follows:

Table 4 – Hardware Finished Colors

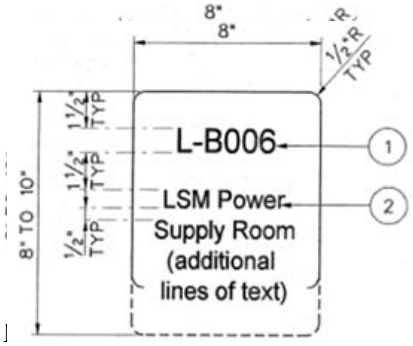
Hardware	Finish	Comments
Hinges	630	Satin Stainless Steel
Locksets and Latchsets	626	Satin Chromium Plated
Closers	652	Satin Chromium Plated
Flush bolts	626	Satin Chromium Plated
Thresholds	612	Satin Bronze
Wall Stops	652	Satin Chromium Plated
Silencers	Gray	

e. Provide a removable transom at the equipment door.

4.1.14 Building Signage

Interior and exterior building signage shall be of the sizes and types indicated. Room and door numbers will be provided to Seller during the document review process. Signs shall be complete with lettering, framing, and attachments. Provide two-color, scratch resistant, non-static, fire retardant, washable melamine surface laminate with a non-glare surface and a tough brown phenolic core. Paint the core a contrasting color after artwork has been carved into the surface. Select finishes and contrasting color combinations from the paint manufacturer's sample colors. For mounting use silicone adhesive and double-sided vinyl tape fabricated from materials that are not corrosive to the sign material, mounting surface or threaded studs. Use sleeves and adhesives or lead expansion-bolt devices for drilled in place anchors.

a. Room sign:

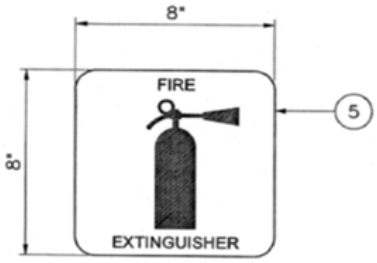


Room Number

Keynote 1: Room Number/Title Text Height: 1 inch minimum Black Letters

Keynote 2: Room Name/General Text Height: ¾" minimum Black Letters

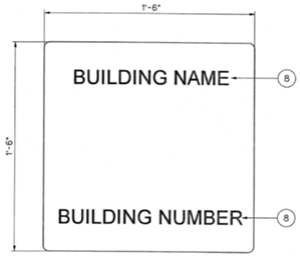
b. Fire Extinguisher Sign:



Fire Extinguisher

Keynote 5: Dimensions/layout are approximate for Universal Graphic signs. Provide manufacturers stock fire extinguisher signage.

c. Exterior Building Sign:



Exterior Building Sign

Keynote 8: Building Name and Building Number Text Height: 1 ¼" minimum Black letters.

d. Provide a Danger sign on the outside of each entrance door to the building. The sign shall be in accordance with ANSI/NEMA Z535.4, and shall have a top red header with an explanation mark inside a white triangle to the left of the word "DANGER" in white. The lower left box shall have the image of an electrical arc enclosed in yellow triangle above the image of a hand inside a not allowed circle. The lower right box will have the following text: "High Voltage. / KEEP OUT / Authorized personnel only." in black letters."

e. Provide a Danger sign on the outside of battery room door. The sign shall be in accordance with IFC-2000, Section 608.6, and shall have a top red header with an explanation mark inside a white triangle to the left of the word "DANGER" in white. The lower box will have the following text: "Battery Room / This room contains lead-acid / battery system, corrosive liquid (electrolyte) and energized electrical circuits / Authorized personnel only" in black letters."

4.1.15 Equipment Nameplates and Safety Labels

a. Equipment and components shall be provided with nameplates. The nameplates shall be machine engraved phenolic, with black lettering on a white background, attached with stainless steel screws. Lettering size shall be manufacturer's standard.

b. Equipment nameplates shall contain the following information:

1. Manufacturer's name
2. Model number
3. Buyer's equipment tag number, as shown on data sheets.
4. System voltage, phases, wires, frequency, and rated fault current as applicable.
5. Equipment Rating

6. Buyer's purchase order number
7. Buyer's purchase order item number
8. Manufacturer's shop order number as applicable.

c. Additional nameplate requirements for equipment in Exhibits 1 through 5, see the following:

1. Exhibit 1, *13.8kV Switchgear*
2. Exhibit 3, *Uninterruptible Power Supply (UPS) Systems*
3. Exhibit 4, *125V DC System*
4. Exhibit 5, *Panelboards and Dry Type Transformers*

d. Buyer will provide to Seller the equipment tag numbers for HVAC Units and motors rated ½ Hp and above for attaching to the equipment.

e. Warning labels shall be prominently displayed on each incoming section access door of any load center equipment that has rear access, and shall be red with engraving white lettering as follows:

"DANGER – HIGH VOLTAGE

f. **ISOLATE AT SOURCE"**

Switches or circuit breakers that are back-fed, where incoming line cables are connected to what is normally considered the load side terminals, a warning sign shall be attached to the switch or breaker cover as follows:

WARNING
THIS IS A REVERSE-FEED CIRCUIT BREAKER, WHERE THELOAD SIDE TERMINALS WILL HAVE VOLTAGE PRESENT WITH THE CIRCUIT BREAKER HANDLE IN THE OFF- POSITION. CHECK FOR VOLTAGE ON BOTH LINE AND LOAD SIDE TERMINALS TO ENSURE NO VOLTAGE IS PRESENT.

g. Where enclosures have more than one power source, provide yellow sign with the following text:

"**CAUTION – MORE THAN ONE POWER SOURCE**"

h. Where enclosures or equipment compartments have multiple sources, Seller shall provide a label with white lettering on a red background. The label shall denote all other services, feeders, or branch circuits suppling the equipment in addition to the following text:

"DANGER - EXTERNAL VOLTAGE SOURCE"

i. Seller shall provide nameplate engraving list for all equipment nameplates.

4.1.16 Lighting

a. Interior Lighting shall be LED[102].

b. Lighting Controls shall be from dedicated breakers in panelboard. Lighting levels for all interior rooms of the building shall be 30 Average Maintained foot-candles[103].

c. Emergency lighting shall be provided using self-contained battery packs ("bug-eye" type lighting fixtures), each rated for 90 minutes. These lights shall be located in areas of personnel traffic to allow egress in the event of an AC lighting system failure. Emergency lighting shall be provided in accordance with NFPA 101 requirements for the means of egress[104].

d. Exit sign lighting shall be provided at each door location per NFPA 101 requirements.

e. Exterior lighting including the platforms, stairs, and general outside area shall be provided with a minimum of one high pressure sodium exterior light at each entry door that is controlled via breaker in panelboard[105] [106]. The light shall be shielded such that no glare light is visible from above.

f. Any Seller proposed fixture type and make will be reviewed and accepted by Buyer for each application.

g. Circuit breakers used for switching lighting loads on a regular basis shall be listed by a Nationally Recognized Testing Laboratory (NRTL) for switching duty[107].

4.1.17 Convenience Receptacles[108]

The building shall be provided with 120 VAC, 20A duplex receptacles conveniently located such that a 50-foot extension cord shall reach any location in the area and shall be equipped with ground fault circuit interrupters as required and located per NFPA 70. A 120 VAC, 20A GFCI outdoor rated duplex receptacle shall be provided on the exterior surface at each entry/exit door.

4.1.18 Cables and Wiring

Seller to provide cable datasheets (refer to 24590-HLW-3PS-E000-T0001, Rev 1 *Engineering Specification for Electrical Bulk Material, Appendix F through J).*

a. Medium Voltage Cable[109] [110]

1. The 15-kV and 5-kV power cable shall be Class B stranded copper conductor with an extruded semi- conducting layer, ethylene-propylene rubber (EPR) insulation, and shielding. The cable insulation shall be rated 133 % and rated for continuous operation at 90 °C (194 °F), 130 °C (266 °F) for emergency overload operation and 250 °C (482 °F) for short circuit conditions, in accordance with applicable Insulated Cable Engineers Association (ICEA)

a) Rated Voltage

i. 15 kV

b) System Voltage

i. 13.8 kV, 3 phase, 3 wire AC. Low Resistance grounding

c) Service

i. Power distribution

d) Requirements

i. 90°C or higher, continuous rating. Conductor Maximum Temperature shall be in accordance with Table 4-1 of NEMA WC 74

e) Fabrication

i. Conductors - Single conductor, stranded copper conductor, class B per ASTM B-8

ii. Insulation - Flame-retardant Ethylene-Propylene Rubber (EPR) or equivalent 133% insulation level rated for (a), (b) and (c)

iii. Shield - Extruded, semi-conducting, thermoset ethylene co-polymer and 25% Lapped Copper Tape.

iv. Outer Jacket - Black, flame-retardant Polyvinyl Chloride Jacket

v. Fire Performance - 70,000 BTU/hr vertical tray flame test per IEEE 1202 or IEEE 383.

b. Low Voltage Power and Control Cable[111] [112]

1. Power, lighting, motor feeder, and control cable shall be single conductor or multi-conductor, stranded copper conductors, rated 600-V, and shall be flame retardant, moisture resistant, thermoset insulation.

a) Seller provided wiring shall be rated 600 V, 75°C or higher, continuous rating, Class B stranded, copper or tinned copper, with flame-retardant, moisture, heat, impact and ozone resistant, cross-linked polyethylene (XLPE), Type XHHW or XHHW-2 insulation. Overall jackets shall be black, flame-retardant Polyvinyl Chloride for multi conductor or black, flame-retardant Polyvinyl Chloride or composite for single conductor. Seller provided cables shall meet the 70,000 BTU/hr vertical tray flame test per IEEE Std. 1202 or IEEE 383.

b) Use a minimum gauge size of AWG #12 for power and lighting circuits.

c) Cables for Modbus communication network interface shall be Belden 82842, two twisted pair #24 AWG with overall shield.

d) Cables for profibus DP communication network interface shall be Belden B3079A single twisted pair #22 AWG with overall shield.

e) Cables for Ethernet / Modbus TCP communication network interface shall be CAT 6A type with overall shield.

f) Cables for discrete signals shall be UL listed as TC, 600 V insulation, UL 1581 listed for 70,000 BTU vertical tray flame test; or IEEE 383 vertical flame test; or IEEE 1202; 100% foil polyester/aluminum individual and overall shields with 22AWG Drain wire. Each circuit shall have a minimum of 6-8 twists/ft.

4.1.19 Conduit System

RGS conduit shall be used both inside and outside of the building. All scheduled conduits shall be labeled with Buyer's conduit numbers (to be provided during detail design review). Unscheduled conduits (such as for lighting applications) shall not be labeled but shall be marked per the manufacturer's standard. Conduits shall be labeled with white adhesive, tie-on

or snap-on markers with black lettering. Markers shall be placed at each end of the conduit, unless one marker is visible from each end.

4.1.20 Cable Tray System[113]

a. Install cable tray system for Buyer's scheduled cables. Conceptual cable tray layout to be provided at 90% design. The cable tray shall be NEMA 20C flanged out, hot dipped galvanized steel ladder tray, with 9 in. rung spacing, rated for heavy duty load/spans with 4-inch loading depth or as specified on building data sheet, 24590-BOF-EKD-MVE-34001, Electrical Data Sheet for Prefabricated Electrical Switchgear Building (Building 34). The cable tray type, model, and manufacturer shall be approved by Buyer. All fittings shall have a minimum bend radius of 24 in., unless otherwise noted.

b. Power, instrumentation and control trays shall be ladder type. Solid bottom with covers may be utilized for instrumentation, (service levels 1 and 2) cables. All tray subject to mechanical damage shall contain covers or other suitable means of protection.

c. Analog and digital communication cable tray shall be located below low-voltage power control cable tray.

d. Cable trays shall be grounded at both ends. Individual tray sections shall be connected together by splice plates for ground continuity. Individual tray sections that are not connected together by splice plates shall have a ground cable installed between the trays for ground continuity.

e. Cable trays shall be labeled with a white stick-on label with black letterings, with one label for every tray node. If trays have a barrier, there shall be a label for each side of the barrier, as if it were two separate trays. The specific label information will be determined later.

4.1.21 Grounding System

a. Provide a complete grounding system, including a copper ground bar (1/4 in. x 2 in.) in each room mounted approximately 3 in. below the ceiling and connected to each piece of equipment by bare copper ground wire. Where it is necessary for a copper ground bar to cross shipping splits, an AWG 4/0 bare copper wire shall be used to connect each piece.

b. A green insulated copper ground cable, size AWG #4/0, shall be provided and connected from the ground bar to the exterior ground pads. The ground pads shall be 4 in. x 4 in. x 1/8 in. copper with a NEMA type 4-hole bolt pattern.

c. Seller shall provide a copper isolated ground bus with the minimum dimensions of 24" x 2" x ¼". The isolated ground shall be located in the C&I room. Exact ground bus location will be determined by Buyer.

4.1.22 Fastening Hardware

All fastening hardware, where applicable, shall be NRTL listed, plated to prevent rusting or shall be made from a noncorrosive metal. Bolted fasteners for cable tray splices, using the splice plates, bolts, nuts and locking devices recommended by the cable tray manufacturer, shall be tool tight, wrench tight or hand tight. Cable termination screws, nuts, and bolts shall

be tool tight, wrench tight or hand tight, unless the equipment manufacturer specifies a torque value.

4.1.23 Equipment Rear Access

For equipment requiring rear access, Seller shall provide sufficient space for personnel access and maintenance to comply with NEC requirements, or alternatively, provide hinged, three-point, latching, and pad lockable exterior building doors for access to cabinet backs.

4.1.24 Lightning Protection System Components

Lightning protection system components shall be in accordance with UL 96, *Lightning Protection Components.*

4.1.25 Fire Detection and Alarm (FDE) System

Refer to Appendix B

4.2 Prohibited Materials

It is prohibited to use any of the materials on 24590-WTP-LIST-ESH-16-0001, *Restricted Materials List,* including but not limited to asbestos, PCB, mercury, or low melting point metals in the manufacture, fabrication, assembly, and finish of the building.

4.3 Software Requirements

4.3.1 Seller shall meet Software requirements for all equipment embedded software, including equipment specified in Exhibits 1, 3, and 4, HVAC system, and pager system, in accordance with the applicable sections of 24590-WTP-3PS-JQ00-T0004, Engineering Specification for Management of Supplier Software, as required for the type of device and software.

4.3.2 Seller shall configure communication devices for equipment specified in Exhibit 1 to be identified in accordance with IO Configuration Document for Switchgear Building 34 (to be provided at 90% design).

4.3.3 Seller shall set protective devices for equipment specified in Exhibit 1 in accordance with 24590-BOF-E1R-LVE-(TBD), Protective Device Setting Document for Switchgear Building 34 13.8kV Switchgear (to be provided at 90% design).

5 Fabrication

5.1 Welding

5.1.1 Welding and weld filler materials shall be in accordance with the requirements of AWS D1.1, Structural Welding Code – Steel, or AWS D1.3, Structural Welding Code – Sheet Steel, and shall be performed by certified welders. Welding procedures and welders shall be qualified in accordance with the applicable welding code. Welding Procedure Specifications WPSs previously qualified to other standards (e.g. ASME IX) may be used based on properly documented evidence and Buyer review and approval.

5.1.2 Welding procedures, procedure qualifications, and welders' qualifications shall be submitted for Buyer's review prior to beginning of fabrication and assembly of the building.

5.1.3 Seller shall provide welding qualification verification reports of welds performed including the identification of the qualified weld(s), and certification that the weld(s) were verified.

5.2 Assembly

5.2.1 Seller of the building is responsible for maintaining quality throughout the fabrication and assembly process by maintaining and following their Quality Management System that documents and controls the assembly process.

5.2.2 Equipment shall be arranged and fabricated to provide convenient building shipping sections.

5.2.3 All materials, parts and accessories of any equipment and/or components specified in Exhibits 1, 3, and 4 that require re-assembly shall be provided by Seller. Seller shall provide re-assembly drawings.

5.2.4 Seller shall provide complete instructions (including torque value information) for all items that need to be re-connected or assembled at the jobsite.

5.2.5 Seller shall provide detailed re-assembly drawings of the building, indicating sufficient information to facilitate assembly of shipping sections, including but not limited to, wiring connection details, and bus bar joints assembled at Seller's facility.

6 Tests and Inspections

6.1 General

6.1.1 Seller shall provide inspection and test plan that contains detail descriptions of the inspections and test to be performed during the receipt, manufacturing, and conformance verification activities for the building and equipment specified in Exhibits 1, 3, and 4. Inspection and test plan shall include identification of Buyer and Seller witness and hold points.

6.2 Personnel Qualifications

6.2.1 All tests and inspections shall be performed by personnel qualified to perform tests and inspections per requirements of this specification and all applicable codes and standards in Section 2 of this specification.

6.3 Visual Weld Examination

6.3.1 All welding shall be visually inspected and examined in accordance with AWS D1.1, *Structural Welding Code – Steel*, to assure that welding quality is being maintained throughout the building fabrication and assembly process. Visual inspection shall be documented within the welding report.

6.4 Electrical and Factory Acceptance Test for Equipment

6.4.1 Equipment specified in Exhibits 1 thru 5, shall be inspected and tested by the original equipment manufacturers in accordance with manufacturer's procedures and the requirements below:

a. Exhibit 1, *13.8kV Switchgear,* Section 6

b. Not Used

c. Exhibit 3, *Uninterruptible Power Supply (UPS) Systems,* Section 6

d. Exhibit 4, *125VDC System,* Section 6

e. Exhibit 5, *Panelboards and Dry Type Transformers,* Section 6

6.4.2 Seller shall provide test procedures for all tests indicated in Section 6.4.1 of this specification.

6.4.3 Seller shall provide certified test reports for all tests indicated in Section 6.4.1 of this specification.

6.5 Factory Acceptance Test for Building 34

6.5.1 Perform inspections and functional tests for building services, such as HVAC system, lighting, receptacles, BMS, and alarming system, etc.

6.5.2 Perform insulation resistance (megger) tests on each load center, switchgear, switchboards, and panelboards bus sections, phase to phase and phase to ground using manufacturer's instructions. If no instructions are provided by manufacturer, perform a one-minute test for 600 V rated equipment at 1000 Vdc with an acceptance criterion of 100 megohms, for 5000 V rated equipment at 2500 Vdc with an acceptance criteria of 1000 megohms, and for 15,000 V rated equipment at 2500 Vdc with and acceptance criteria of 5000 megohms.

6.5.3 Perform continuity tests on any cables and bus bar joints assembled in Seller's facility.

6.5.4 Verify breakers and starters have correct ratings, agree with the single line drawings, and located in the correct compartment.

6.5.5 For all power cables installed by Seller, the following shall be performed:

a. 100 percent point to point continuity check/test.

b. Insulation resistance (megger) tests. When performing the insulation resistance tests on cables with insulation rating less than 2500 V, use 1000 V dc for the test voltage, and 50 megohms as the minimum passing acceptance criteria. When performing the insulation resistance tests on cables with insulation rating over 12000 V, use 5000 - 10000 Vdc for the test voltage, and 50 megohms as the minimum passing acceptance criteria The results shall be recorded on Cable Continuity / Megger Data Sheets (Reference 24590- CON-F00207) or equivalent and the completed form included in the quality verification documentation.

c. Verify all bolted electrical connections within shipping limitations are torqued per manufacturer's specifications. If no torque values are provided by the manufacturer, the connections shall be hand/tool tight.

6.5.6 Prior to shipment, Seller shall perform an overall field evaluation (FE) by a Recognized NRTL, to perform a NEC compliance inspection for B34, Switchgear Building. The FE report shall be submitted to Buyer for review and approval. Buyer representative will perform an independent field evaluation against applicable UL standards, and NEC compliance inspection at Seller's facility.

6.5.7 Seller shall provide factory acceptance test procedure for all tests and inspections indicated in Sections 6.5.1 thru 6.5.5, and 6.5.10 of this specification.

6.5.8 Seller shall provide certified factory acceptance test report for all tests and inspections indicated in Sections 6.5.1 thru 6.5.5, and 6.5.10 of this specification.

6.5.9 Seller shall perform an acoustic noise test for each ASD assembly, measured at 3 feet from the assembly at full frequency and load range of the ASD.

6.5.10 Fire Detection and Alarm System Testing Requirements

a. After installing wiring devices, Seller shall perform tests for ground faults, stray voltage, short circuit faults, loop resistance, circuit integrity per NFPA 72 and compliance with the equipment manufacturer's requirements.

b. Stray Voltage - All installation conductors shall be tested with a volt/ohmmeter to verify that there are no stray (unwanted) voltages between installation conductors or between installation conductors and ground. Unless a different threshold is specified in the system installed equipment manufacturer's specifications, the maximum allowable stray voltage shall not exceed 1 volt ac/dc. (NFPA 72, Table 14.4.3.2, 15(1)).

c. Loop Resistance - With each initiating and indicating circuit installation conductor pair short circuited at the far end, the resistance of each circuit shall be measured and recorded. It shall be verified that the loop resistance does not exceed the installed equipment manufacturer's specified limits. (NFPA 72, Table 14.4.3.2, 15(4)).

6.5.11 Supplemental Factory Acceptance Tests (FAT)

a. Solid state breaker trip units shall be tested to ensure identification is in accordance with Section 4.3.2 of this specification and communicates with Buyer's communication system.

b. Seller shall inspect protective devices to conform to settings defined in Section 4.3.3 of this specification.

c. Seller shall perform Electrical Startup of Uninterruptible Power System in accordance with manufacturer standard operating instructions manual.

6.6 Site Tests

All site tests will be performed by Buyer.

7 Preparation for Shipment

7.1 Cleanliness

7.1.1 The building and equipment specified in Exhibits 1 thru 5, shall be inspected for cleanliness before preparing for shipment. Dirt, oil, residue, metal chips, water, loose parts, or other forms of contamination shall be removed before shipment.

7.1.2 Seller shall submit cleaning procedures and verification reports only for the building.

7.2 Painting

7.2.1 The building shall be provided with a coating system that prevents the formation of corrosion, as follows:

a. The structure shall be treated to remove rust and scale prior to coating. An application of primer and topcoat shall be provided to all interior and exterior surfaces of the structure in accordance with the manufacturer's standard procedures.

b. The floor of each section shall be provided with an application of a suitable primer, followed by an application of gray epoxy, with a nonskid finish, in accordance with the manufacturer's standard procedures.

c. Seller shall paint the building in accordance with Section 4.1.12.

7.2.2 Equipment specified in Exhibits 1 thru 5 shall be painted in accordance with:

a. Clean, prime and finish painting the equipment in accordance with the manufacturer's standard procedures.

b. Enclosures of equipment specified in Exhibits 1 thru 4 shall be painted with ANSI 61 indoor light gray paint unless otherwise specified on the data sheets.

7.2.3 Seller shall provide paint chip(s) samples only for the building.

7.2.4 Seller shall submit coating procedures and verification reports only for the building.

7.3 Shipping Tags

Refer to Purchase Order.

7.4 Packaging

7.4.1 Since the building will be transported in shipping sections, provisions for disconnecting the wiring for shipment and reconnecting it at the jobsite shall be made. Seller shall adequately tag each disconnected cable so the WTP crafts can properly re-connect the wires to the proper termination point. In addition, each disconnected cable shall be secured and protected for shipment. Seller shall provide complete instructions (including torque value information) for all wiring, grounding, cable trays, conduits, hangers, connector plates and equipment that needs to be re-connected at the jobsite. Prior to shipment, the open end/sides of each shipping section shall be protected for shipment against weather and transit conditions.

7.4.2 Seller shall pay particular attention to proper packaging and bracing of the equipment to ensure its safe arrival at the jobsite. Precautions required for handling and storing the equipment shall be clearly indicated on the outside of each shipping split.

7.4.3 Necessary connectors, bolts, nuts, washers, gaskets, shall be furnished, suitably packaged, and marked to facilitate field assembly.

7.5 Shipping Instructions and Storage Requirements

7.5.1 Equipment shall be arranged and fabricated to provide convenient shipping sections. Protection shall be provided to prevent any damage to the structure and its contents that may result during shipment. Each shipping section and all equipment contained therein shall be protected during transit and sealed to prevent the entrance of dirt or moisture during shipping or outdoor storage.

7.5.2 Each shipping section shall be provided with steel section supports, lifting eyes, etc., to maintain alignment of parts during shipping, handling, hoisting, and installation. The location

of lifting points shall be clearly identified on the drawings and on the exterior of each shipping split section of the building.

7.5.3 Each shipping section shall be identified with the name of contents, purchase order number, and purchase order item number, and shall have its weight and center of gravity clearly marked on the drawings and the outside of the packaging.

7.5.4 Cover factory-finished materials in such a way that finishes are protected during fabrication, storage, and shipment.

7.5.5 Store materials off the ground in a dry environment, and in such a way that the deterioration, damage, or loss of essential properties is prevented.

7.5.6 For additional packaging, shipping, handling, and storage requirements, see Specification 24590- WTP-3PS-G000-T0003, Engineering Specification for Packaging, Handling, and Storage Requirements, and the applicable sections of the Material Requisition and Purchase Order.

7.6 Documentation

7.6.1 Installation, Operation, and Maintenance Manuals

The following manuals shall be submitted to Buyer for review and approval:

a. Seller shall provide an Installation, Operation, and Maintenance Manual for the building. This document includes any miscellaneous components / equipment documentation required for the operation of the building (i.e. HVAC Units, lighting, etc.). Include a written description of equipment operation, operation and maintenance instruction information for all Seller provided equipment and components.

b. Seller shall provide an Installation, Operation, and Maintenance Manual for each equipment specified in Exhibits 1 thru 5, which shall include as a minimum, installation instructions, operation instruction information/books, maintenance instruction information/books, written description of equipment operation, long and short-term storage instructions, and any other relevant technical data needed for the proper operation or long-term maintenance of the equipment.

7.6.2 Seller shall provide Transportation and Shipping Documentation for the building (Shipping preparation procedure, and transport and lifting drawings) in accordance with Sections 8.5 and 12.2 of Specification 24590-WTP-3PS-G000-T0003, Engineering Specification for Packaging, Handling, and Storage.

7.6.3 Seller shall provide Site Storage, Handling and Maintenance Requirements Manual for the building and equipment specified in Exhibits 1 thru 5, in accordance with Specification 24590-WTP-3PS- G000-T0003, Engineering Specification for Packaging, Handling, and Storage Requirements, Section 11.1.2.

7.7 Spare Parts List

7.7.1 Seller shall provide recommended spare parts lists for all equipment, including HVAC system, for the preventive maintenance in three distinct classifications of spare parts.

a. Startup/warranty spare parts: Parts that may be required at any time during equipment installation, startup, testing, and unit operation through the warranty period.

b. Operational spare parts: Parts that require replacement at regular intervals to maintain continuous operation of the supplied equipment and/or system.

c. Capital spare parts: Parts or equipment that provide reliable equipment operation throughout the plant life and having a significant lead time for manufacture and delivery.

8 Quality Assurance

8.1 Quality Program

8.1.1 Seller shall establish and implement a quality program that conforms to the requirements specified in this specification, and to the other applicable codes and standards as referenced in this specification and the Material Requisition. Seller quality requirements shall apply to the work necessary for carrying out design, procurement, fabrication, installation, and testing.

9 Configuration Management

Reserved.

10 Documentation and Submittals

10.1 General

10.1.1 Seller shall submit to Buyer the Engineering and Quality Verification documents in the forms, quantities, and timing shown in Form G-321-E, Engineering Document Requirements, and Form G-321-V, Quality Verification Document Requirements, in Part 2 of the MR (References to be verified with procurement during 60% deliverables phase).

10.1.2 Any deviations and/or conflicts considered for incorporation in the work must be submitted to Buyer on completed Supplier Deviation Disposition Request (SDDR) form, which is attached to Part 2 of MR, for Buyer's approval.

10.2 Submittals

10.2.1 Drawings

a. **General Arrangement/Outline Dimension Drawings (G-321-E Category 1.1)**
Seller shall provide drawings in accordance with Sections 3.1.3 and 3.6.7(b) of this specification.

b. **Mounting Detail Drawings for Equipment (G-321-E Category 1.1)**
Seller shall provide drawings in accordance with Section 3.3.3 of this specification.

c. **Foundation Requirements Drawings for Building 34 (G-321-E Category 1.1)**
Seller shall provide drawings in accordance with Section 3.3.3 of this specification.

d. **Grounding Details Drawings (G-321-E Category 1.1)**
Seller shall provide documentation in accordance with Section 4.1.21 of this specification.

e. **Assembly Drawings (G-321-E Category 1.2)**
Seller shall provide drawings in accordance with Sections 5.2.3 and 5.2.5 of this specification.

f. **Shop Detail Drawings (G-321-E Category 1.3)**
Seller shall provide drawings in accordance with Sections 3.4.9 and 3.7.7 of this specification.

g. **Single Line, Schematic, and Wiring Diagrams (G-321-E Category 1.4)**
Seller shall provide drawings in accordance with Section 3.6.7(a), 3.6.7(c), 3.7.8, 3.7.9, and 3.8.5 of this specification.

h. **Control Schematic and Logic Diagrams (G-321-E Category 1.5)**
Seller shall provide drawings in accordance with Section 3.7.10 of this specification.

i. **Transport and Lifting Drawings (G-321-E Category 29.1)**
Seller shall provide documentation in accordance with Section 7.6.2 of this specification.

j. **Piping and Instrumentation Diagram (P&ID)**
Seller shall provide diagram showing the piping and instruments inside the building from the outer wall connection to the eyewash station and the water collection reservoir.

10.2.2 Parts Lists

a. **Recommended Spare Part Lists (G-321-E Category 2.0)**
Seller shall provide recommended spare parts lists in accordance with Section 7.7 of this specification.

b. **Nameplate Engravings List (G-321-E Category 1.3)**
Seller shall provide nameplate engraving lists in accordance with Section 4.1.14(i) of this specification.

c. **Bill of Materials (G-321-E Category 2.0)**
Seller shall provide lists in accordance with Section 3.1.7 of this specification.

d. **Catalog Cut Sheets**
Seller shall provide catalog cut sheets for all equipment in Exhibits 1 through 5 and also HVAC equipment, cable trays, and light fixtures.

10.2.3 Completed Data sheets (G-321-E Category 3.0)

b. Seller shall provide completed data sheets listed in Sections 2.4.5 of this specification.

10.2.4 Procedures

a. **Inspection and Test Plan (G-321-E Category 6.1)**
Seller shall provide plan/procedure in accordance with Section 6.1.1 of this specification.

b. **Welding Procedures and Qualifications (G-321-E Category 12.0)**
Seller shall provide procedures in accordance with Section 5.1.2 of this specification.

c. **Cleaning and Coating Procedures (G-321-E Category 15.0)**
Seller shall provide procedures in accordance with Sections 7.1.2 and 7.2.4 of this specification.

d. **Electrical and Factory Acceptance Test Procedures for Equipment (G-321-E Categories 26.2 and 34.0)**
Seller shall provide procedures in accordance with Section 6.4.2 of this specification.

e. **Factory Acceptance Test Procedure for Building 34 (G-321-E Category 34.0)**
Seller shall provide procedure in accordance with Section 6.5.7 of this specification.

f. **Shipping Preparation Procedure (G-321-E Category 29.0)**
Seller shall provide procedure in accordance with Section 7.6.2 of this specification.

g. **Software Test Procedures (G-321-E Category 32.0)**
Seller shall provide procedures in accordance with Section 4.3 of this specification.

h. **Supplemental Factory Acceptance Test Procedure (G-321-E Category 32.0)**
Seller shall provide a procedure for the tests specified in Section 6.5.11 of this specification.

10.2.5 Reports

a. **Seismic Qualification Reports for Equipment (G-321-E Category 7.0)**
Seller shall provide report in accordance with Section 3.3.9 of this specification.

b. **NRTL Field Evaluation Reports (G-321-E Category 36.0)**
Seller shall provide reports in accordance with Section 3.7.13(b) of this specification.

c. **Welding Qualification Verification Reports (G-321-E Category 12.0)**
Seller shall provide reports in accordance with Section 5.1.3 of this specification.

d. **Cleaning and Coating Verification Reports (G-321-E Category 15.0)**
Seller shall provide reports in accordance with Sections 7.1.2 and 7.2.4 of this specification.

e. **Certified Test Reports for Equipment (G-321-E Category 34.0)**
Seller shall provide certified test reports in accordance with Section 6.4.3 of this specification.

f. **Certified Factory Acceptance Test Report for Building 34 (G-321-E Category 34.0)**
Seller shall provide certified test report in accordance with Section 6.5.8 of this specification.

g. **Preliminary Life Safety Code Evaluation Report (G-321-E Category 36.0)**
Seller shall provide reports in accordance with Section 3.4.8 of this specification.

h. **Preliminary International Building Code Evaluation Report (G-321-E Category 36.0)**
Seller shall provide reports in accordance with Section 3.4.8 of this specification.

i. **Field Evaluation Report for Building 34 (G-321-E Category 36.0)**
Seller shall provide report in accordance with Section 6.5.6 of this specification.

j. **Certified Software Test Reports (G-321-E Category 32.0)**
Seller shall provide certified test reports in accordance with Section 4.3 of this specification.

k. **Battery Sizing Calculation Report (G-321-E Category 36.0)**
Seller shall provide a calculation report in accordance with Exhibit 4, 125V DC Systems, Section 3.6.4 of this specification.

l. **Battery Sizing Calculation Report (G-321-E Category 36.0)**
Seller shall provide a calculation report in accordance with Exhibit 3, Uninterruptible Power Supply (UPS) Systems, Section 3.4.1 of this specification.

m. **Battery Hydrogen Generation Calculation Report (G-321-E Category 36.0)**
Seller shall provide a calculation report in accordance with Exhibit 3, Uninterruptible Power Supply (UPS) Systems, Section 3.4.1 of this specification.

n. **Lighting Calculation Reports (G-321-E Category 36.0)**
Seller shall provide calculation reports in accordance with Section 3.7.17 of this specification.

o. **HVAC Calculation Report (G-321-E Category 36.0)**
Seller shall provide a calculation report in accordance with Section 3.6.10 of this specification.

p. **Certified Supplemental Factory Acceptance Test Report (G-321-E Category 32.0)**
Seller shall provide a report for the tests specified in Section 6.5.11 of this specification.

q. **Certified Prototype Test Reports (G-321-E Category 27.0)**
Seller shall provide a report for the tests specified in Exhibit 3, Section 6.2.1 of this specification.

10.2.6 Calculations

c. All Calculations shall be in accordance with Section 3.1.5 of this specification.

a. **Seismic Calculation for Building 34 (G-321-E Category 8.0)**
Seller shall provide calculation in accordance with Section 3.3.9 of this specification.

b. **Structural and Rigging Calculation for Building 34 (G-321-E Category 8.0)**
Seller shall provide calculation in accordance with Section 3.3.8 and 3.3.10 of this specification.

10.2.7 Manuals

a. **Erection/Installation Instructions (G-321-E Category 4.1)**
Seller shall provide manual in accordance with Section 7.6.1 of this specification.

b. **Operation Manuals (G-321-E Category 4.2)**
Seller shall provide manual in accordance with Section 7.6.1 of this specification.

c. **Maintenance Manuals (G-321-E Category 4.3)**
Seller shall provide manual in accordance with Section 7.6.1 of this specification.

d. **Site Storage and Handling Instructions (G-321-E Category 4.4)**
Seller shall provide manual in accordance with Section 7.6.3 of this specification.

e. **Software Documentation (G-321-E Category 32.0)**
Seller shall provide software documentation in accordance with Section 4.3 of this specification.

f. **Load Center Relay/Breaker Setting Instructions (G-321-E Category 4.2)**
Seller shall provide relay/breaker setting instructions in accordance with Section 3.1.9 of this specification.

10.2.8 Certificates of Compliance

a. **Certificate of Compliance for NRTL Items (G-321-E Category 36.0)**
Seller shall provide Certificate of Compliance in accordance with Section 3.7.13(a) of this specification.

10.2.9 Schedules

a. **Schedule and Document Index (G-321-E Category 1.0)**
Seller shall prepare and submit a completed Seller's Index/Schedule –Form 15EX as required by Part 2 of MR for the building and equipment specified in Exhibits 1 thru 5 of this specification, which shall include the planned schedule for submitting the documents required by this specification and the MR Form G-321-E, Document Category 1.0.

b. **Engineering, Fabrication, Inspection, and Testing Schedule (G-321-E Category 5.0)**
Seller shall submit an engineering, fabrication, Inspection and Testing schedule for building, detailing the chronological sequence of events per MR Form G-321-E, Document Category 5.0. The schedule shall include Seller Quality witness/hold points, as applicable. The schedule does not suffice for formal notification of witness/hold points for which a separate notification is still required in accordance with the witness/hold point requirements (i.e., 5-day advance notice).

10.2.10 Other Documents

a. **Paint Chip(s) Samples for Building 34 (G-321-E Category 10.0)**
Seller shall provide paint chip(s) samples in accordance with Section 7.2.3 of this specification.

b. **Catalog Cut Sheets and Manufacturer's Data (G-321-E Category 11.0)**
Seller shall provide documents in accordance with Section 3.1.7 of this specification.

11 Requirement Source References

Refer to Switchgear Building Specification Codes and Standards, Section 2.2 of this specification. Applicable versions of Codes and Standards provided via Code of Record Case-by-Case exemption for BOF Switchgear Building and take precedence over referenced Codes and Standards in referenced documents.

[1] 24590-BOF-3ZD-34-00001_000, *DFHLW Switchgear and Building System Design Description*

[2] 24590-BOF-3ZD-34-00001_000, *DFHLW Switchgear and Building System Design Description*, Section 3.4.3.2 (13.8-kV Switchgear Paralleling A & B Buses)

[3] 24590-BOF-3ZD-34-00001_000, *DFHLW Switchgear and Building System Design Description*, Section 3.4.3.14 (13.8-kV Switchgear Design)

[4] 24590-BOF-3ZD-34-00001_000, *DFHLW Switchgear and Building System Design Description*, Section 3.4.3.14 (13.8-kV Switchgear Design)

[5] 24590-BOF-3ZD-34-00001_000, *DFHLW Switchgear and Building System Design Description*, Section 3.4.3.15 (Switchgear Circuit Breaker Protection Relays)

[6] 24590-BOF-3ZD-34-00001_000, *DFHLW Switchgear and Building System Design Description*, Section 3.4.3.25 (Switchgear and Tie Breaker Status)

[7] 24590-BOF-3ZD-34-00001_000, *DFHLW Switchgear and Building System Design Description*, Section 3.4.3.13 (13.8-kV Switchgear Rating)

[8] 24590-BOF-3ZD-34-00001_000, *DFHLW Switchgear and Building System Design Description*, Section 3.4.3.21 (Electrical Equipment Anti-Condensation Heaters)

[9] 24590-BOF-3ZD-34-00001_000, *DFHLW Switchgear and Building System Design Description*, Section 3.4.3.7 (DC Power to Medium-Voltage Switchgear)

[10] 24590-BOF-3ZD-34-00001_000, *DFHLW Switchgear and Building System Design Description*, Section 3.4.3.6 (125-VDC Electrical Power (DCE) System Design)

[11] 24590-BOF-3ZD-34-00001_000, *DFHLW Switchgear and Building System Design Description*, Section 3.4.3.9 (DC Power Battery Size)

[12] 24590-BOF-3ZD-34-00001_000, *DFHLW Switchgear and Building System Design Description*, Section 3.4.3.10 (DC Loads Under Normal Operating Conditions)

[13] 24590-BOF-3ZD-34-00001_000, *DFHLW Switchgear and Building System Design Description*, Section 3.4.3.11 (DC Battery Chargers Capacity)

[14] 24590-BOF-3ZD-34-00001_000, *DFHLW Switchgear and Building System Design Description*, Section 3.4.1.6 (Plant Standardization)

[15] 24590-WTP-COR-MGT-18-00001_003, *Engineering, Procurement, and Construction (EPC) Code of Record for the High-Level Waste (HLW) Facility and DFHLW Supporting Facilities*

[16]24590-WTP-DB-ENG-18-001_004, *Basis of Design for the HLW and DFHLW Supporting Facilities*, Table 12.1

[17]24590-WTP-DB-ENG-18-001_004, *Basis of Design for the HLW and DFHLW Supporting Facilities*, Table 12.1

[18] 24590-WTP-DC-ST-01-001_020, *Structural Design Criteria, Section 5.6.2 (Structural Steel Members)*

[19] 24590-WTP-DC-ST-01-001_020, *Structural Design Criteria, Section 5.6.4* (*Steel Deck)*

[20] 24590-BOF-3ZD-34-00001_000, *DFHLW Switchgear and Building System Design Description*, Section 3.4.12.1 (Operations and Maintenance Space)

[21] 24590-BOF-3ZD-34-00001_000, *DFHLW Switchgear and Building System Design Description*, Section 3.4.12.2 (Equipment Clearances)

[22] 24590-BOF-3ZD-34-00001_000, *DFHLW Switchgear and Building System Design Description*, Section 3.4.12.3 (Plant Arrangement)

[23] 24590-BOF-3ZD-34-00001_000, *DFHLW Switchgear and Building System Design Description*, Section 3.4.12.4 (Equipment Accessibility 5 Feet)

[24] 24590-BOF-3ZD-34-00001_000, *DFHLW Switchgear and Building System Design Description*, Section 3.4.12.5 (Equipment Accessibility 6 Feet)

[25] 24590-BOF-3ZD-34-00001_000, *DFHLW Switchgear and Building System Design Description*, Section 3.4.12.6 (Equipment Space for Transport)

[26] 24590-BOF-3ZD-34-00001_000, *DFHLW Switchgear and Building System Design Description*, Section 3.4.12.7 (Equipment Maintenance Pathways)

[27] 24590-WTP-DC-AR-01-001_009, *DFLAW Architectural Design Criteria,* Section 4.2 (Roofing Material Requirements)

[28] 24590-WTP-DC-AR-01-001_009, *DFLAW Architectural Design Criteria,* Section 3.2 (Types of Occupancies)

[29] 24590-WTP-DC-AR-01-001_009, *DFLAW Architectural Design Criteria,* Section 3.3 (Types of Construction)

[30] 24590-WTP-DC-AR-01-001_009, *DFLAW Architectural Design Criteria,* Section 3.2.1 (Life Safety Code Occupancy Classifications)

[31] 24590-WTP-DC-AR-01-001_009, *DFLAW Architectural Design Criteria,* Section 3.4 (Means of Egress)

[32] 24590-WTP-DC-AR-01-001_009, *DFLAW Architectural Design Criteria,* Section 3.6 (Energy Conservation)

[33] 24590-WTP-DC-ST-01-001_020, *Structural Design Criteria,* Section 6.4(b) (Load Factors and Load Combinations)

[34] 24590-WTP-DC-ST-01-001_020, *Structural Design Criteria,* Section 6.4(c) (Load Factors and Load Combinations)

[35] 24590-WTP-DC-ST-01-001_020, *Structural Design Criteria,* Section 4.4 (Live Load)

[36] 24590-WTP-DC-ST-01-001_020, *Structural Design Criteria,* Section 4.4.3 (Reduction in Live Loads)

[37] 24590-WTP-DC-ST-01-001_020, *Structural Design Criteria,* Section 4.4.1 (Floor Live Load)

[38] 24590-WTP-DC-ST-01-001_020, *Structural Design Criteria,* Section 4.4.4 (Roof Live Load)

[39] 24590-WTP-DC-ST-01-001_020, *Structural Design Criteria,* Section 4.4 (Live Load)

[40] 24590-WTP-DC-ST-01-001_020, *Structural Design Criteria,* Section 4.4.1 (Floor Live Load)

[41] 24590-WTP-DC-ST-01-001_020, *Structural Design Criteria,* Section 4.3 (Dead Load)

[42] 24590-WTP-DC-ST-01-001_020, Structural Design Criteria, Section 4.7 (Wind Load)

[43] 24590-WTP-DC-ST-01-001_020, *Structural Design Criteria,* Section 4.5 (Snow Load)

[44] 24590-WTP-DC-ST-01-001_020, *Structural Design Criteria,* Section 4.9 (Earthquake (Seismic) Loads)

[45] 24590-WTP-DC-ST-01-001_020, *Structural Design Criteria,* Section 4.6 (Ashfall Load)

[46] 24590-WTP-DB-ENG-18-001, *Basis of Design for the HLW and DFHLW Supporting Facilities,* Section 9.12.2 (Maintenance and Spares)

[47] 24590-WTP-DB-ENG-18-001_004, *Basis of Design for the HLW and DFHLW Supporting Facilities,* Section 12.6 (Hoarfrost Protection)

[48] 24590-WTP-3YD-FSW-00001, *System Description for the Fire Service Water (FSW), Fire Protection Water (FPW), and the Fire Detection and Alarm (FDE) Systems,* Section 4.1.7.8 (Interfaces with FACP)

[50] 24590-WTP-DC-E-06-001_006, *Design Criteria for Approval of Electrical Equipment,* Section 4 (Criteria for Acceptability of Electrical Equipment)

[51]24590-WTP-DC-E-21-001_000, *HLW & PTF Electrical Design Criteria,* Section 15.1. (General Grounding)

[52] 24590-BOF-3ZD-34-00001_000, *DFHLW Switchgear and Building System Design Description*, Section 3.4.3.20 (Safe Isolation for Electrical Equipment)

[53] 24590-WTP-DC-E-06-001_006, *Design Criteria for Approval of Electrical Equipment,* Section 4 (Criteria for Acceptability of Electrical Equipment)

[54] 24590-WTP-DC-E-06-001_006, *Design Criteria for Approval of Electrical Equipment,* Section 6 (Option 1 (Primary): Listed, Labeled, or Certified by a NRTL)

[55] 24590-WTP-DC-E-06-001_006, *Design Criteria for Approval of Electrical Equipment,* Section 7 (Option 2 (Alternate): Field Evaluation by a NRTL)

[56] 24590-WTP-DB-ENG-18-001, *Basis of Design for the HLW and DFHLW Supporting Facilities*, Table 12-1, Note 7 *Ambient temperature for cables*

[57]24590-WTP-DC-E-21-001_000, *HLW & PTF Electrical Design Criteria,* Section 11.5 (Cable Trays)

[61]24590-WTP-DC-E-21-001_000, *HLW & PTF Electrical Design Criteria*, Section 11.1 (Raceway Systems – General Criteria)

[63] 24590-WTP-DC-E-21-001_000, *HLW & PTF Electrical Design Criteria*, Section 15.1 (General Grounding)

[64] 24590-WTP-3ZD-GRE-00001, *System Design Description for the Grounding and Lightning Protection Electrical (GRE) System,* Section 3.5.1.6 (Connection Process)

[65] 24590-WTP-3ZD-GRE-00001_003, *System Design Description for the Grounding and Lightning Protection Electrical (GRE) System*, Section 3.5.1.2 (Grounding of Structures and Equipment)

[71] 24590-WTP-DC-E-21-001_000, *HLW & PTF Electrical Design Criteria*, Section 15.1 (General Grounding)

[77] 24590-WTP-3ZD-GRE-00001, *System Design Description for the Grounding and Lightning Protection Electrical (GRE) System*, Section 3.5.1.3 (Grounding System Sizing)

[78] 24590-BOF-3ZD-34-00001_000, *DFHLW Switchgear and Building System Design Description*, Section 3.4.16.3 (Grounding the 480Y/277-V and 208Y/120-V Systems)

[79] 24590-WTP-3ZD-GRE-00001_003, *System Design Description for the Grounding and Lightning Protection Electrical (GRE) System*, Section 3.4.4.1 (Operability and Maintainability)

[80] 24590-WTP-3ZD-GRE-00001_003, *System Design Description for the Grounding and Lightning Protection Electrical (GRE) System*, Section 3.5.1.2 (Grounding of Instrumentation)

[81] 24590-WTP-3ZD-GRE-00001_003, *System Design Description for the Grounding and Lightning Protection Electrical (GRE) System*, Section 3.5.1.13 (Grounding of Signals Cables)

[82] 24590-WTP-3ZD-GRE-00001_003, *System Design Description for the Grounding and Lightning Protection Electrical (GRE) System*, Section 3.5.1.20 (Grounding of the Uninterruptible Power Supply)

[83] 24590-WTP-3ZD-GRE-00001_003, *System Design Description for the Grounding and Lightning Protection Electrical (GRE) System*, Section 3.5.1.21 (Grounding of the 125-V DC System)

[84] 24590-WTP-DB-ENG-18-001, *Basis of Design for the HLW and DFHLW Supporting Facilities, Section 8.7.2 (Lightning and Surge Protection)*

[85] 24590-BOF-3ZD-34-00001_000, *DFHLW Switchgear and Building System Design Description*, Section 3.4.3.22 (Lightning Protection System Replaceability)

[86] 24590-BOF-3ZD-34-00001_000, *DFHLW Switchgear and Building System Design Description*, Section 3.4.3.22 (Lightning Protection Test Points)

[87] 24590-BOF-3ZD-34-00001_000, *DFHLW Switchgear and Building System Design Description*, Section 3.4.5.3 (Instrument Installation Locations)

[88] 24590-BOF-3ZD-34-00001_000, *DFHLW Switchgear and Building System Design Description*, Section 3.4.5.8 (Transmitters on Racks)

[89] 24590-BOF-3ZD-34-00001_000, *DFHLW Switchgear and Building System Design Description*, Section 3.4.5.9 (Power Distribution Monitoring Instrumentation Effects from Electrical Transients)

[90] 24590-BOF-3ZD-34-00001_000, *DFHLW Switchgear and Building System Design Description*, Section 3.4.5.6 (Signal Cable Shielding)

[91] 24590-BOF-3ZD-34-00001_000, *DFHLW Switchgear and Building System Design Description*, Section 3.4.5.5 (Control Systems Discrete Signals)

[92] 24590-BOF-3ZD-34-00001_000, *DFHLW Switchgear and Building System Design Description*, Section 3.4.1.2 (Independent System Commissioning)

[94] 24590-BOF-3ZD-34-00001_000, *DFHLW Switchgear and Building System Design Description*, Section 3.4.4.1 (Drainage for Eyewash/Safety Shower Stations)

[95] 24590-BOF-3ZD-34-00001_000, *DFHLW Switchgear and Building System Design Description*, Section 3.4.4.2 (Building Floor Drains)

[96] 24590-BOF-3ZD-34-00001_000, *DFHLW Switchgear and Building System Design Description*, Section 3.4.1.7 (ACGIH Sound Limits)

[97] 24590-BOF-3ZD-34-00001_000, *DFHLW Switchgear and Building System Design Description*, Section 3.4.12.2 (Equipment Clearances)

[98] 24590-BOF-3ZD-34-00001_000, *DFHLW Switchgear and Building System Design Description*, Section 3.4.1.9 (Protective Circuits and Instrument Maintenance)

[99] 24590-WTP-DC-AR-01-001_009, *Architectural Design Criteria*, Section 3.1.1 (Architectural Design Philosophy)

[100] 24590-WTP-DC-AR-01-001_009, *Architectural Design Criteria*, Section 3.1.1 (Architectural Design Philosophy)

[102]24590-WTP-DC-E-21-001_000, *HLW & PTF Electrical Design Criteria*, Section 13.4 (Lighting Design)

[103] 24590-WTP-DC-E-21-001_000, *HLW & PTF Electrical Design Criteria*, Section 13.4.6 (Illumination Levels and Control)

[104] 4590-WTP-DC-E-21-001_000, *HLW & PTF Electrical Design Criteria*, Section 13.2.2 (Emergency Lighting)

[105] 24590-WTP-DC-E-21-001_000, *HLW & PTF Electrical Design Criteria*, Section 13.4.2 (Outdoor Area and Security Lighting)

[106] 24590-WTP-DC-E-21-001_000, *HLW & PTF Electrical Design Criteria*, Section 13.4.6 (Illumination Levels and Control)

[107] 24590-BOF-3ZD-34-00001_000, *DFHLW Switchgear and Building System Design Description*, Section 3.4.3.19 (Switching Lighting Circuit Breakers Listing)

[108] 24590-WTP-DC-E-21-001_000, *HLW & PTF Electrical Design Criteria*, Section 13.6 (Convenience Receptacles)

[109] 24590-BOF-3ZD-34-00001_000, *DFHLW Switchgear and Building System Design Description*, Section 3.4.3.17 (Medium-Voltage Cable)

[110] 24590 -HLW-3PS-E000-T0001. *Engineering Specification for Electrical Bulk Material*, Appendix A (Medium Voltage Cable Specification Sheet)

[111] 24590-BOF-3ZD-34-00001_000, *DFHLW Switchgear and Building System Design Description*, Section 3.4.3.18 (Low-Voltage Cable)

[112] 24590 -HLW-3PS-E000-T0001. *Engineering Specification for Electrical Bulk Material*, Appendix B (Low Voltage Power and Control Cable Specification Sheet)

[113]24590-WTP-DC-E-21-001_000, *HLW & PTF* Electrical Design Criteria, Section 11.5 *Cable Trays*

Exhibit 1 13.8 kV Switchgear

24590-WTP-3PS-ESM1-T0001, Rev. 3 and its associated Specification Change Notices (SCNs) were used as applicable to create the following exhibit.

1 Scope

1.1. General

This Exhibit defines the technical requirements for furnishing 13.8 kV Switchgear. If conflicts arise between this Exhibit and the Switchgear Building specification, SELLER shall submit a Supplier Deviation Disposition Request (SDDR) requesting resolution.

1.2. Equipment, Material, and Services Required

1.2.1. This Exhibit covers the design, manufacture, assembly, shop testing, and delivery of industrial type metal-clad 15kV class switchgear for use as the primary 13.8 kV electrical distribution system for the Switchgear Building WTP project. The 13.8 kV power distribution system is a 3-phase, 60 Hz, 3-wire, low resistance grounded system.

1.2.2. See Section 1.2.3 of Specification.

1.2.3. See Section 3.7.2 of Specification.

1.2.4. See Section 3.7.12 of Specification.

1.3. Work by Others - See Section 1.3 of Specification.

1.4. Definitions - See Sections 1.5 and 1.6 of Specification.

1.5. Safety/Quality Classifications - See Section 1.4 of Specification.

2 Applicable Documents – See Section 2 of Specification.

2.1. Codes – See Section 2.2.2 of Specification.

2.2. Industry Standards – See Section 2.2.2 of Specification.

2.3. Reference Documents/Drawings – See Sections 2.3, 2.4.1, and 2.4.5 of Specification.

3 Design Requirements

3.1. General

3.1.1. The 13.8 kV system and its associated switchgear is the primary electrical distribution system for the West Side of WTP. The 13.8kV main incoming power is provided from the local substation A6 via two separate feeders. The 13.8 kV system and its associated switchgear are grouped into two separate plant loads, designated as Load Group A and Load Group B. Each of the off-site power sources normally serves one load group and has the capability of carrying the total plant load (load Group A and load Group B), should one supply fail.

3.2. Performance

3.2.1. The 13.8 kV switchgears shall be designed to provide reliable power distribution for continuous operation of Load Group A and Load Group B loads for the duration of the serviceable design life of the plant which is 40 years.

3.3. Design Conditions

3.3.1. Switchgear, Bus, Relays, and materials shall comply with the applicable standards of IEEE C37.20.2, C37.06 and C37.90.

3.3.2. The switchgear shall be designed to comply with applicable standards of IBC 2021 to survive the maximum design earthquake of the specified seismic zone without permanent damage, significant permanent deformation of parts, which would be destructive to the switchgear. The switchgear shall be designed using applicable design loads (Seismic, Live, Dead, etc.) and loading combinations in accordance with Section 3.5 of this specification.

3.4. Environmental Conditions

3.4.1. See Section 3.2 of Specification.

3.5. Mechanical Requirements

3.5.1. The switchgear assembly shall be metal-clad, NEMA 1 gasketed, free-standing, floor mounted, flush front vertical sections arranged to form a single structure, complete with common phase bus, grounding bus, circuit breakers, protective relays, metering, auxiliary control devices and accessories.

3.5.2. The switchgear structures shall be designed and constructed to withstand the internal pressure created by faults (equal to maximum fault current rating of the largest circuit breaker) within the structure, without danger to the operating personnel.

3.5.3. Provision shall be made for top or bottom cable entrances for medium voltage power cable as specified on the data sheets. All low voltage power and control cables will be top entry. Adequate space shall be provided for Buyer's cable routing and terminations. The cable conductor size will be shown on the Buyer's Single Line Diagrams.

3.5.4. Provisions shall be made for the addition of vertical section(s) at either end of the switchgear assembly line-up. This shall include drilled holes in the bus and removable plates and/or side panel at the vertical end sections. Metal parts, plates, side panels, bolts, and other hardware shall be designed and constructed such that bolt arrangement or patterns shall be interchangeable.

3.5.5. Front and rear door panels shall be hinged with door stops and bolted with captive hardware. All front doors shall be provided with key-lock handle for restricted access and safety.

3.5.6. The switchgear assembly will be attached/anchored to the building structure. Seller shall provide mounting details in accordance with Section 3.3.3 of this Specification.

3.5.7. Bus Bars and Bus Splice Connections

3.5.7.1. Bus bars, bus splices and connections shall be made from hard drawn flat copper and fully insulated. The bus bars shall have the same cross-sectional area throughout the length of the switchgear assembly.

a) The bus bar support and insulation shall be for 15 kV class and flame retardant, track resistant and non-hygroscopic materials.

b) Bus shall be braced to withstand fault current equal to the closing and latch rating of the circuit breakers.

c) Bus joints shall be silver plated, bolted and insulated. Bolted connections, as a minimum shall be flat washer, conical washer, and nut combination.

3.5.7.2. Color coding of the phase bars shall be marked on the insulation at the point of the Buyer's cable connection. Phase bars shall be marked color coded as follows:

a) Phasing configuration: A – B – C: Left to Right, Top to Bottom, Front to Back, when facing the front view of the switchgear assembly.

b) Color Code Configuration: Phase A – Red, Phase B – Yellow, Phase C – Blue, unless noted otherwise.

3.5.7.3. A copper ground bus shall extend the full length of each switchgear bus section and shall have a momentary current rating and a two second short time current rating equal to or greater than the highest current rating of any power circuit breaker in the assembly. At each end of the switchgear lineup, the ground bus shall be provided with a clamp type lug for buyer's 250 kcmil bare copper ground cable.

3.6. Loadings

Not applicable

3.7. Electrical Requirements

3.7.1. Circuit Breakers

3.7.1.1. Circuit breaker sizes and ratings shall be per Single Line Diagrams

3.7.1.2. All circuit breakers shall be electrically operated by a motor-charged stored energy spring mechanism. They shall be three-pole, vacuum type, horizontal draw-out, and be capable of being withdrawn on rails for inspection and maintenance.

3.7.1.3. Each circuit breaker shall have both "test" and "disconnected" draw-out positions in which it may be left with the door closed.

3.7.1.4. Circuit breakers shall be provided with manual trips and the state, manual or closed shall be readily ascertained by visual observation.

3.7.1.5. All circuit breakers of the same size and rating shall be electrically and mechanically interchangeable.

3.7.1.6. The Seller shall provide 125VDC power supply (min / max of 105 V DC to 135 V DC) for each switchgear assembly. Close and Trip circuits for each breaker shall be fused separately. Fuse blocks shall be dead-front, pull-out type. The supplier is responsible for the circuit protection and distribution of the control power supply within the switchgear assembly.

3.7.1.7. Mechanical interlock shall be provided to prevent closing of the breaker between operating and test positions, to trip breakers upon insertion or removal from housing and to discharge stored energy mechanisms upon insertion or removal from their housing. The breaker shall be secured positively in the housing between the operating and test positions. In the test position, the line and load stabs shall be disconnected, ground and control wire connections shall be maintained, and power stab shutters shall be closed.

3.7.1.8. Mechanism Operated Contacts (M.O.C.) and Truck Operated Contacts (T.O.C.) shall be provided. Four or more N.O. and four or more N.C contacts shall be wired to the terminal blocks for Buyer use.

3.7.1.9. All circuit breakers shall have an Operation Counter. The counter shall display the actual number of operations (open position) the circuit breaker has performed.

3.7.1.10. Circuit Breaker Compartments shall include a racking mechanism, circuit breaker operated automatic shutters covering the high voltage bus connections, safety interlocks, and electrical racking motor and accessories for remote racking of the circuit breaker.

3.7.2. Control, Metering, Protection, and Indication

3.7.2.1. Each circuit breaker shall have local and remote-control capability. A door mounted selector switch shall be provided for Local-Remote mode selection.

a) Local control will be by a manually operated, spring return to center pistol grip control switch mounted on the door with trip close position indication.

b) Remote control and monitoring shall be via the plant communication network through a communication interface.

3.7.2.2. Provisions shall be made to receive control signal from the plant control system (PCS) through the communication network for remote control of circuit breakers. In addition to the network communication, provisions for hardwired open and close commands from the PCS shall be provided, including 125VDC/24VDC interposing relays to allow connecting these signals into the breaker open and close control circuits operating at 125VDC.

3.7.2.3. Metering, protection, control, and indication shall be provided as shown on the single line diagrams.

3.7.2.4. Metering and protective devices shall be solid state microprocessor-based multifunction type which operate from a 5A secondary output of a current transformer.

3.7.2.5. Protective relays shall be “flush” mounted and installed on the front of the switchgear.

3.7.2.6. Meters and relays shall be capable of withstanding without damage the secondary currents associated with the switchgear rated fault current flowing in the primary of current transformers.

3.7.2.7. As a minimum the multi-function relays shall have a built-in alphanumeric display capable of displaying the following information with metering accuracy of ±1% of primary current transformer rating or full scale.

a) For Main Circuit Breaker

- Kilowatt (kW)
- Watthour (WH)
- Demand (WD)
- Volt (V)
- Current (A)
- Reactive Power (VAR)
- Power Factor (PF)

b) For Tie Breaker and Feeder Breakers

- Current (A)

3.7.2.8. The relays shall have the following features:

a) Communication network compatible with buyer’s communication network.

b) Continuous self-diagnostic

c) Unit failure alarm contact

d) Programmable lockout/self-reset after trip function

e) Programmable setpoints for device curves selection

f) Programmable inputs, such as current transformer ratio

3.7.2.9. The following contacts and functions shall be wired as inputs and made available to the multi-function relay for status monitoring. For incoming and tie breakers, remote indication shall include (as appropriate), but not limited to, 52a, 52b, 86T, 27L, and 69L switch position. For feeder breakers, the indication shall be limited to 52a, and 69L switch position.

3.7.2.10. Relay Alarm and/or Trip contacts shall not change state when power is lost, or an under-voltage condition occurs. The trip contacts shall only cause a trip upon detection of an over-current fault condition or other protective relay function.

3.7.2.11. Indications

a) The circuit breaker LED indication lamps shall be mounted on each door compartment with the following lens color.

Green – Open, Red – Closed, Amber – Tripped.

b) Contacts for remote indication shall be provided.

3.7.3. Internal Wiring (by Supplier)

3.7.3.1. All internal control wiring shall be flame retardant, 600V, 90 °C, synthetic heat-resistant (SIS) switchboard copper stranded wire, as listed in NFPA 70.

a) Minimum conductor size shall be # 14 AWG. All conductor sizes and type shall be per NFPA 70.

3.7.3.2. All internal wiring shall be bundled and securely held in position. It shall be either looped or routed inside a covered gutter or wireway. The use of tie-raps and the attachment to the side sheets of CT wiring is acceptable. Wiring installation shall be readily accessible to allow future modification.

3.7.3.3. All internal wiring shall be continuous from terminal to terminal without splices. Each wire shall be tagged at both ends with plastic sleeve-type wire markers. Wire tag numbers shall be per Supplier numbering system and shall be included in all applicable Supplier interconnection drawings.

3.7.3.4. All control wiring shall be crimped in self-insulated compression ring tongue type lugs, suitable for the specific type of devices and terminated on terminal blocks. Supplier's wiring shall be terminated on one side (Supplier side) of the terminal blocks only. No more than two wires per terminal point is allowed.

a) Terminal lugs shall be ring-tongue, self-insulated, single crimp, and compression type.

b) Terminal blocks, in general, shall be screw-type and rated 600V.

c) Supplier shall provide 20% spare terminal points.

3.7.3.5. For connections on door mounted components, all affected wire shall be looped, wrapped for protection, and firmly clamped at door and breaker compartment.

a) All wiring passing through metal sheets, barrier or raceway shall be adequately protected and supported to prevent wiring insulation damage and stress.

3.7.4. External Cable (by Buyer)

3.7.4.1. The Supplier shall provide ample space for external cables. All external wires shall be terminated on one side (Buyer side) of the terminal blocks.

3.7.4.2. NEMA two-hole long barrel compression lugs shall be provided for incoming and feeder cables. The lug quantity and size shall accommodate the cable size and conductors as listed on the Buyer's respective single line diagrams.

3.7.5. Instrument Transformers (CT, PT)

3.7.5.1. Current and potential transformers turn ratio, output, class, burden, and accuracy suitable for connected relays, meters and instruments shall be provided by the Supplier, as shown in Single Line Diagrams and Data Sheets. The transformers shall be designed to withstand the basic impulse level (BIL) of the switchgear.

a) The current and voltage transformer shall conform to ANSI C57.13.

3.7.5.2. Current Transformer (CT)

Wiring for the current transformer secondary leads shall be crimped in self-insulated compression ring-type lugs and terminated on shorting screw type terminal blocks remote from the high voltage compartment. Minimum conductor size shall be No.10 AWG.

a) The common or ground lead shall be copper and connected to the ground bus.

b) Shorting terminals shall be provided at the terminal block where external connections are required.

c) Thermal and mechanical rating of the CT shall be coordinated with the circuit breaker.

3.7.5.3. Potential Transformer (PT)

a) Potential transformers shall be draw-out, fused type and have provision for safely disconnecting the fuses and transformer from the energized bus. Cartridge-type fuses shall be furnished for the primary and secondary of the potential transformer.

b) The potential transformers shall be installed in a separate and isolated compartment, a shutter shall be provided when the transformer is withdrawn.

3.7.6. Space Heaters

3.7.6.1. Each vertical section and/or breaker compartment shall be provided with a space heater, thermostat controlled, to prevent condensation. Additional space heater(s) shall be provided at each end of the switchgear assembly.

a) Space heaters shall be rated 240 VAC and shall be sized to provide the required heat output when connected to 120 VAC power supply. Single pole circuit breaker shall be located on corresponding compartment.

b) For each switchgear assembly, Supplier shall provide an ammeter or an indicating light, to indicate the 120 VAC power source to space heaters are available and that the heaters are energized.

3.7.7. Grounding and Surge Arresters

3.7.7.1. All metallic non-current carrying parts of the switchgear assembly shall be bonded together and connected to the switchgear ground bus. Grounding and bonding materials shall be per UL 467.

3.7.7.2. All doors shall be bonded to the main structure by a flexible bare copper strap.

3.7.7.3. Removable parts, (circuit breakers) shall have a suitable means of effective grounding until they are completely withdrawn with all power and control circuitry wiring disconnected.

3.7.7.4. Surge arresters shall be distribution class, volt-limiting type, adequately sized to keep voltage surge below the insulation level of the switchgear assembly. Surge arresters shall comply with NEMA LA-1.

a) Surge arresters shall be installed in cable compartments per Single Line Diagram and connected in each phase. The surge arresters shall be located on each incoming line connection.

3.7.8. Nameplates

3.7.8.1. Nameplates shall be provided to identify each instrument, instrument switch, meter, relay, control switch, indicating light, circuit breaker compartment, potential transformer compartment, auxiliary compartments and to identify all equipment and terminal blocks within the compartments. All nameplates shall be in accordance with Section 4.1.15(a) of this Specification.

3.7.8.2. Nameplates shall be provided to identify the complete switchgear assembly, in accordance with Section 4.1.15(a) of this Specification.

3.7.8.3. "Warning and Hazard" signs and/or labels, shall be industry standard, commercially available as self-adhesive. Location of signs shall be determined by the Supplier with minimum requirements per Section 4.1.15(e) through 4.1.15(h) of this Specification.

a) When potential transformers are connected at the line side of the incoming breaker, a red nameplate shall be located near the transformer and shall be engraved white lettering as follows:

DANGER - HIGH VOLTAGE
TRANSFORMER STILL ENERGIZED
WHEN INCOMING BREAKER OPEN

3.7.9. Miscellaneous

3.7.9.1. Metal screen and filter shall be provided for any openings for protection against rodents, insects, and contaminants. The wire mesh shall not impede ventilation.

3.8. Communication Network Interface

The Buyer has selected the Industrial^{IT} platform from ABB, Inc. as the primary control system for the WTP facility. Control functions and monitoring data will be communicated between the switchgear and the control panel in the PDC Building C&I Room over a communication network.

3.8.1. Communication Interface

The Supplier shall provide an Ethernet / ModBus TCP/IP interface for each breaker, for communication with the control panel in the Switchgear Building 34 C&I room.

3.8.2. Ethernet TCP/IP communication

The supplier shall provide Ethernet network switches (as necessary, managed, model number TBD) for each of the switchgear MVE-SWGR-34001/2A and 34001/2B.

a) The Seller will provide 125 V DC power supply (min. 105 V DC to max. 135 V DC) for each switchgear assembly. The Supplier is responsible for the circuit protection and distribution of the control power supply within the switchgear assembly.

3.9. Accessibility and Maintenance

3.9.1. Switchgear shall be designed and constructed readily accessible for inspection and verification during normal operation and scheduled maintenance. Safety to personnel shall be the priority to meet this requirement.

3.10. Arc Resistant Switchgear

3.10.1. The medium voltage metal enclosed switchgear shall include arc resistant features to duct arc flash from the switchgear enclosure to the building exterior. Refer to Electrical Building Conceptual Layout for proposed locations of arc flash duct routing.

3.11. Infrared (IR) Viewing Windows

3.11.1. When indicated on the Data Sheet(s), an infrared (IR) viewing port with cover, shall be provided.

a) The IR viewing ports shall have the necessary characteristics, i.e., strength, rigidity, and environmental requirements compatible with the furnished metal clad Switchgear. They shall be capable of withstanding impact and load from both sides (inside and outside), and shall not crack, shatter, or dislodge during and after an arc flash incident. They shall also withstand the rigors of normal day-to-day operations.

b) The viewing port shall be located to permit the scanning or thermal inspection of all three phases of the medium voltage power cables field terminations and other electrical components without opening the equipment doors.

c) The Supplier shall indicate in his proposal the manufacturer of the viewing port and whether the arc testing has been performed with the IR viewer ports installed.

4 Materials

4.1. Construction

4.1.1. Construction of all specified switchgear assembly shall be in accordance with this Exhibit.

4.1.2. Construction of all specified switchgear assemblies shall be in accordance with this exhibit and Section 4.1 of Specification

4.2. Prohibited Materials - See Section 4.2 of Specification.

4.3. Special Requirements – Not Applicable

4.4. Storage of Special Materials (e.g., stainless steel) prior to work

4.4.1. The storage and handling of all multifunction microprocessor-based protection devices shall be in accordance with the manufacturer's standard procedures and practices.

5 Fabrication

5.1. Assembly

5.1.1. "Spare" compartments shall be furnished complete, including circuit breaker, metering, relays and indications, communication network interface as shown in Single Line diagram and Data Sheets.

5.1.2. Equipped spaces will be furnished with the hardware, wiring, and miscellaneous equipment (including current transformers, protective and interposing control relays and monitoring devices) with the exception of the circuit breaker. The quantity of equipped spaces and the hardware ratings will be called out on the one-lines. Medium voltage power cable lugs are not required for equipped spaces.

5.1.3. "Spaces" (blank cells) as specified in single line diagrams, shall be convertible to a breaker compartment in the field with no cutting or welding of the sheet metal by using the appropriate Supplier's standard conversion kit.

5.1.4. Painting

Preparation, priming procedure shall be in accordance with the Supplier standard practice. Finish color shall be ANSI 61, Gray. The Supplier shall submit standard finish color or other color samples for Buyer's approval.

a) Finishing shall be over rust-inhibiting primer on phosphatized-treated metal surface.

6 Tests and Inspections

6.1. Personnel Qualifications - See Section 6.2.1 of Specification

6.2. Shop Tests

6.2.1. All required shop tests shall be performed by the Supplier in accordance with ANSI C37.55 and Supplier Standard Test Procedures. The Supplier shall submit a certified copy of all shop test reports, including sub-supplier (if applicable).

6.2.1.1. When Supplier Standard Test procedures are used, the Supplier shall demonstrate that the "procedures" meets or exceeds the requirements of ANSI C37.55. The Supplier Test Procedure shall be part of the Supplier QA Program.

a) If applicable, The Supplier shall submit acceptable procedures for "Routine Test" and "Full or Final Test". The Buyer shall review and approved the procedures.

6.2.2. Tests shall include but shall not be limited to the following:

6.2.2.1. Supplier Design Test

a) This test shall be in accordance with ANSI C37.55 and / or Supplier standard testing procedures.

6.2.2.2. Shop Test or Production Test

a) Alignment test with master cell to verify all interfaces and changeability.

b) Circuit breakers operated over the range of minimum to maximum control voltages.

c) One-minute dielectric test per ANSI C37.55, primary and secondary circuits.

d) Alignment of circuit breakers to verify interfaces on each breaker compartment.

e) Operation of relays and other devices verified by operational sequence test.

f) Vacuum Bottle test and certifications.

g) Final Inspection and quality check prior to shipment.

6.2.3. The Buyer reserves the right to inspect the equipment and witness the tests at the factory prior to any shipment to assure compliance with this Specification.

6.3. Site Tests - See Section 6.6 of Specification

7 Preparation for Shipment

7.1. Shipping Instructions - See Section 7.5.6 of Specification

7.1.1. See Section 7.5 of Specification

7.1.2. See Section 7.3 of Specification

8 Quality Assurance – Not Applicable

9 Configuration Management – Not Applicable

10 Documentation and Submittals – See Section 10 of Specification

Exhibit 2 Deleted

Exhibit 3 Uninterruptible Power Supply Systems

Uninterruptible Power Supply (UPS) Systems

24590-WTP-3PS-EU00-T0002, Rev. 2 and its associated Specification Change Notices (SCNs) were used as applicable to create the following exhibit.

1 Scope

1.1. General

This Exhibit defines the technical requirements for furnishing the Uninterruptible Power Supply (UPS) System. If conflicts arise between this Exhibit and the Switchgear Building specification, SELLER shall submit a Supplier Deviation Disposition Request (SDDR) requesting resolution.

1.2. Equipment, Material, and Services Required

1.2.1. This Exhibit establishes requirements for the design, fabrication, assembly, quality assurance, inspection, testing, and delivery of Uninterruptible Power Supply (UPS) system. The UPS system is supplied from a 480V, 3-phase secondary distribution system and for the single-phase source through 480-208Y/120V transformer. The UPS system shall be completed with all components as indicated under Section 3.1.1.

1.2.2. The Supplier shall furnish all the UPS equipment, including any special tools and equipment required for the installation. Seller shall also provide a Battery Monitoring System (BMS) with a battery cell temperature sensor and specify the cable type.

1.2.3. See Section 1.2.3 of Specification.

1.2.4. See Section 3.7.2 of Specification.

1.2.5. See Section 3.7.12 of Specification.

1.2.6. The UPS system including battery seismic design shall be in accordance with Section 3.5.7 of Specification.

1.3. Work by Others - See Section 1.3 of Specification.

1.4. Definitions - See Sections 1.5 and 1.6 of Specification.

1.5. Safety/Quality Classifications - See Section 1.4 of Specification.

2 Applicable Documents – See Section 2.1.4 of Specification.

2.1. Codes – See Section 2.2.3 of Specification.

2.2. Industry Standards – See Section 2.2.3 of Specification.

2.3. Reference Documents/Drawings – See Sections 2.3, 2.4.1, and 2.4.5 of Specification.

3 Design Requirements

3.1. General

3.1.1. The UPS system shall be configured as an on-line, double conversion, single UPS system, having an alternate source input through a bypass transformer. The complete system shall include an input circuit breaker, a rectifier-charger, a battery with disconnect, an inverter with output circuit breaker, a bypass transformer, a static transfer switch with input circuit breaker for current from the transformer, a maintenance bypass switch and a load-side circuit breaker.

3.1.2. The primary source for the UPS, as well as the bypass source, will be supplied from the building distribution system, 480 V, 3- phase, 60 Hz, solidly grounded neutral. This system is supplied from a 480V panelboard.

3.1.3. The over-all performance requirements of each UPS shall be as indicated in the data sheets referenced in the material requisition or purchase order.

3.1.4. Electrical protection shall be designed by the UPS supplier for all major components to provide discrimination under design inrush and all fault conditions. Both rectifier- charger and inverter shall be protected against reversed battery polarity. Protection shall also be provided against supply system switching transients.

3.1.5. All switches and/or circuit breakers that serve as power disconnects shall have the operating handle accessible with the enclosure door/cover closed. A switch and/or circuit breaker provided within enclosure shall be NRTL listed that includes the enclosure.

3.1.6. See Section 4.1.15(f) of Specification.

3.1.7. See Section 3.7.4 of Specification.

3.1.8. See Section 3.1.5 of Specification.

3.1.9. The UPS enclosures, Battery disconnect switch, UPS battery, and BMS, shall be anchored to the building structure. Seller shall provide mounting details in accordance with Section 3.3.3 of Specification.

3.2. Operating Modes

The following sections describe the various operating modes.

3.2.1. Normal Mode

The UPS load shall be continuously supplied by the static inverter from the rectifier- charger through the normal positions of the static transfer switch and the manual bypass switch. The rectifier-charger shall derive power from the primary (normal) AC source and supply DC power to the inverter while simultaneously charging the battery.

3.2.2. Emergency Mode

Upon loss of the primary (normal) AC source, the UPS load shall continue to be supplied by the inverter, which without interruption, shall obtain its power from the battery.

3.2.3. Recharge Mode

Upon restoration of the primary (normal) AC source, the rectifier-charger shall power the inverter and simultaneously recharge the battery. This shall be an automatic function causing no interruption of power to the load.

3.2.4. Static Bypass Mode

For continuity of power in the event of UPS malfunction, and to clear load faults, the static transfer switch shall automatically transfer the UPS load to the alternate AC source.

3.2.5. Manual Bypass Mode

For continuity of UPS load during maintenance, the manual bypass switch shall allow the load to be switched to the alternate source without interruption of power to the load.

3.2.6. Battery Maintenance Mode

If the battery only is taken out of service for maintenance, the UPS shall continue to operate and meet all specified performance criteria except for the reserve time capacity.

3.3. Rectifier-Charger

3.3.1. The rectifier-charger shall be a constant voltage, current limiting, self-regulating, static semi-conductor type and shall be sized to supply the fully loaded inverter dc input current as well as to recharge the battery. Current limiting shall be incorporated, adjustable from 50% to 100% of the rectifier rated output current, and factory set to 100%. The rectifier-charger shall be capable of operating with input voltage and frequency tolerances as indicated in the data sheets.

3.3.2. Each rectifier-charger shall be provided with an input circuit breaker and also surge suppressors as needed to protect against supply side switching transients.

3.3.3. The rectifier-charger shall be provided with a DC filter, if needed, sized adequately to ensure that the rectifier-charger output will meet the inverter output requirements, without the battery connected.

3.3.4. Boost charging capability shall be provided but will not be used automatically for the VRLA batteries. A suitably adjustable high float charging voltage, with battery temperature compensation, shall be used to prevent overcharging, and to avoid the need for boost charging. The battery temperature probe shall be provided with the charger.

3.3.5. The DC system shall be operated ungrounded and shall have a center point high impedance ground fault monitoring system. High DC voltage alarm (DC out of tolerance) and charger shutdown (rectifier failure) shall be provided.

3.4. Battery

3.4.1. Seller shall perform a battery sizing calculation, including hydrogen generation at all charging modes, except for thermal runaway condition. The battery shall be sized based on battery room minimum temperature as specified in Data Sheet 24590-BOF-EKD-MVE-34001, *Electrical Data Sheet for BOF Prefabricated Switchgear Building 34*, and in accordance with the requirements of this Exhibit. Calculation reports per manufacturer standards are acceptable in lieu of calculations, as long as input data and equations used for reports generation are provided along with the reports for verification of adequacy of the results.

3.4.2. The battery shall be of the sealed Valve Regulated Lead Acid (VRLA) type, using lead alloy plates and absorbed-electrolyte technology for a high short time discharge rate and non-spillability. In normal operation, the battery shall not require any scheduled boost (equalizing) charge. The individual cells shall be of the manufacturer's latest design, of 20-year designed life expectancy, unless otherwise indicated in the data sheets.

3.4.3. Based on the battery reserve time and load profile indicated in the data sheets, the battery manufacturer shall be responsible for cell package selection and stacking and also a battery sizing calculation to verify the adequacy with the specific cell type selected. The battery sizing shall be in accordance with IEEE 1184, as applicable, using Aging Factor of 1.25 in accordance with IEEE 485.

3.4.4. The cell container and cover shall be of a flame-retardant material, with a UL 94 oxygen index of at least 28. A low-pressure relief valve and flame arrester shall be provided for abnormal or

abusive conditions. The container and cover design shall incorporate allowances for plate growth without affecting performance, and for reduced stress on jar- to-cover seals and terminal post-to-cover seals.

3.4.5. To reduce space requirements, the battery shall be configured with multi-cell modules, which are vertically stackable as a seismically qualified structure. The modules shall be designed for adequate natural air circulation. The battery assembly with its structure shall be seismically qualified for this project in accordance with the special seismic requirements stated in the data sheets, and Section 3.5.7 of this specification.

3.4.6. The battery assembly shall be provided with a molded case switch for each string, having short circuit protection only.

3.4.7. If specified on the datasheet, a Battery Monitoring System (BMS) shall be provided in accordance with IEEE 1491, as applicable. See Section 3.14 of this Exhibit for details on the BMS.

3.5. Inverter

3.5.1. The inverter shall be either the ferro-resonant type or the pulse width modulated (PWM) type, according to the manufacturer's product design. The inverter ratings shall be as specified in the data sheets.

3.5.2. The inverter output voltage regulation (steady state) shall be as specified in the data sheets for all values of input voltage within the battery operating range, and for output load variations from no load to full load, at a power factor of 1.0 to 0.75 lagging, unless otherwise specified on the data sheets.

3.5.3. The inverter output voltage transient response (over or under-voltage dynamic regulation) shall be as shown in the data sheets for any of the following disturbances:

- A step load change of 100%
- Switch to bypass or return from bypass

3.5.4. The transient recovery time (return to steady state conditions) for the disturbances listed above shall be as shown in the data sheets.

3.5.5. The voltage unbalance shall be ± 5% and the phase displacement shall be ± 2% for a three-phase output with 100% load unbalance.

3.5.6. The inverter output frequency shall be automatically synchronized and phase-locked to the alternate AC source. If the alternate source frequency is out of range, the inverter shall automatically revert to free running with a regulation within the frequency range of 58.5 to 61.5 Hz.

3.5.7. When the alternate source frequency returns to within the selected range, the Inverter shall automatically re-synchronize at a maximum slew rate (adjustable) of 1Hz/sec, and phase-lock to the alternate source.

3.5.8. The inverter output load ratings shall be based on a load having overall 75%, and having a harmonic content of the following:

Harmonic	Amperes	Harmonic	Amperes
Fundamentals	100%	11th	3%
3rd	70%	13th	1%
5th	42%	15th	0.7%
7th	5%	17th	0.6%
9th	3%	19th	0.5%

3.5.9. The inverter output shall provide harmonic neutralization and filtering to limit the total harmonic distortion (THD) of the UPS output voltage to 5% rms maximum, with 3% rms maximum for any single harmonic, unless otherwise specified on the Data Sheets.

3.5.10. In the event of a load fault, the inverter shall meet the requirements indicated in the data sheets.

3.5.11. The inverter shall be capable of operating without the battery connected and meet all the specified performance requirements.

3.5.12. The inverter shall be supplied with an output protective device.

3.6. Static Transfer Switch

3.6.1. The static transfer switch shall use silicon-controlled rectifiers (SCR) for power switching. The continuous output rating of the static transfer switch shall be compatible with that of the inverter. Follow-up by-pass contactors or breakers shall not be used.

3.6.2. The ratings of the static transfer switch for continuous duty as well as for 1 cycle and 30-cycle withstand shall be as shown in the data sheets.

3.6.3. The static transfer switch shall automatically transfer the load from the inverter to the alternate AC source with no more than ¼ cycle interruption of power to the load under the following conditions:

a) Inverter output voltage more than 5% above or below normal.

b) Load current exceeds overload rating and time (as indicated in the data sheets).

c) Inverter failure.

d) Battery discharge voltage limit reached (if by-pass voltage is available)

3.6.4. The static transfer switch shall be capable of manually being transferred and re-transferred by a control on the front panel.

3.6.5. The static transfer switch shall be blocked from transferring the load to the alternate AC source when the alternate AC source voltage is less than 84 percent.

3.6.6. Front panel indicators shall be provided to indicate that the static switch is supplying the load from the inverter or the alternate AC source.

3.6.7. The static transfer switch shall automatically retransfer the load from the alternate AC source to the inverter with no more than ¼ cycle interruption of power to the load under the following conditions:

a) Inverter output voltage returns to within 5% of nominal.

b) Load current reduces to within UPS rated full load current.

c) Upon loss of the alternate AC source.

3.6.8. If transfer was due to inverter failure, when the inverter system is healthy again a re-transfer shall take place automatically.

3.6.9. Manual retransfer shall be blocked if the inverter is not synchronized with the alternate AC source.

3.6.10. The alternate AC power source connection to the static switch shall be through a protective device located in the UPS cabinet.

3.7. Bypass Transformer

The bypass transformer shall be of the general purpose, ventilated, dry type, in accordance with CSA C22.2 No. 66.1&2/ UL 5085-1&2, and of output power and K-factor ratings as indicated in the data sheet. The transformer shall have a grounded inter-winding shield. It shall be designed to operate with non-linear loads with a harmonic profile rating as indicated in Section 3.5.8 of this Exhibit. Full capacity taps shall be provided according to the data sheets, for voltage adjustment.

3.8. Manual (Maintenance) Bypass Switch

3.8.1. A manual bypass switch shall be provided to electrically isolate the UPS inverter output and the static switch for maintenance. Its rating shall be compatible with the inverter and the bypass transformer output rating.

3.8.2. The manual bypass switch shall be make-before-break, assuring UPS load power continuity.

3.8.3. The manual bypass switch shall be mounted in the bypass transformer cabinet, which shall be physically separated and electrically isolated from the UPS to provide total isolation for maintenance.

3.8.4. The maintenance bypass switch shall be supplied with a load side circuit breaker.

3.8.5. The neutral conductors from the inverter output and from the bypass transformer output shall be connected to a grounding terminal located upstream of the manual bypass switch. The neutral conductors shall be sized for 200% of the phase conductor current.

3.8.6. A hard-wired bypass feeder shall be provided that is entirely external to the UPS enclosure, and that will supply power during UPS maintenance with all external voltages isolated from the UPS enclosure.

3.9. Not Used

3.10. Instrumentation and Alarms

3.10.1. The UPS system shall have a metering and alarm panel on the front of the unit. The panel shall contain all metering, indications, and alarms necessary to monitor the UPS at this panel.

3.10.2. Metering shall be provided as listed in the data sheet or as shown on single line drawing.

3.10.3. Alarm indications shall be provided, as a minimum, as listed in the data sheet or as shown on single line drawing.

3.10.4. Protective devices shall be furnished as required to ensure that the system is operating within its design limits and to alarm if it is incapable of operating satisfactorily.

3.10.5. Protective devices shall be furnished as required to ensure that the system is operating within its design limits and to alarm if it is incapable of operating satisfactorily.

3.10.6. Protective devices shall be separate from alarm devices where practical. If a common relay is used for both alarm and protective functions, it shall have separate contacts for alarm and protective circuits.

3.10.7. A reset switch shall be provided to reset all alarms.

3.10.8. A common alarm relay, with a volt-free form C contact, shall be provided for fault indication to the control system. If specified on the datasheet, signal from the Battery Monitoring System (BMS) shall be provided to tie to the common alarm relay in UPS cabinet.

3.10.9. Relays shall be de-energized to actuate alarms.

3.10.10. Indicator testing shall be provided without interruption of output power.

3.11. Not Used

3.12. Environmental Conditions

3.12.1. See Section 3.2 of Specification.

3.13. Special Design Requirements for Small UPS Systems – Not Applicable

3.14. Battery Monitoring System (BMS)

3.14.1. The BMS shall be designed for operation from a 120VAC, single-phase, 60 Hz power source and an input voltage variation of +10% to -15%.

3.14.2. The BMS shall provide a complete system for monitoring the condition of the VRLA battery, by measuring and recording the parameters stated in the referenced Buyer's single line diagram and datasheets, which includes as a minimum pilot cell temperature, battery current, and internal ohmic resistance for each cell.

3.14.3. The BMS shall have the capability to store and display battery data and alarm triggers. Two auxiliary form C contacts shall be provided for the remote alarm indication of abnormal measured parameters. The BMS shall provide temperature monitoring and alarm for each cell, battery current indication and alarm, ohmic value readings for each cell to the Integrated Control Network (ICN).

3.14.4. The components of the BMS shall be designed to allow future changes in battery/string organization, without rendering system obsolete.

3.14.5. The interconnection means of the BMS shall be simple to install, maintain and expand in order to allow the repair or replacement of monitored battery/cells.

4 Materials

4.1. Prohibited Materials - See Section 4.2 of specification

4.2. Software Requirements - See Section 4.3 of specification

5 Construction

5.1. General

5.1.1. The UPS equipment assemblies other than the batteries shall be housed in free standing cabinets, that when placed side by side, shall form a compatible line-up, see data sheet for NEMA enclosure

type. A drip shield/pan shall be provided over each enclosure that will direct dripping or spraying water away from entering any openings in the top of the UPS equipment.

5.1.2. All switches and/or circuit breakers that serve as power disconnects shall have the operating handle accessible with the enclosure door/cover closed and be provided with provisions to padlock the device in both the open and closed positions. A switch and/or circuit breaker provided within enclosure shall be NRTL listed that includes the enclosure.

5.1.3. For Switches or circuit breakers that are back-fed, where incoming line cables are connected to what is normally considered the load side terminals, a warning sign shall be attached to the switch or breaker cover as shown in Section 4.1.15(f) of Specification.

5.1.4. All switches and circuit breakers used as switches shall be located so that the center of the grip of the operating handle of the switch or circuit breaker, when in its highest position, will not be more than 6 ft. 7 in. above the floor or working platform. If the equipment is mounted on a housekeeping pad the allowable height of the operating handle shall be reduced by the height of the housekeeping pad.

5.2. Wiring and Termination

5.2.1. Control wiring shall be made from flame retardant, 600 V, type SIS, (or Buyer approved equal) stranded copper wire, and shall be continuous from terminal to terminal without splices and tagged at both ends with plastic sleeve–type wire markers showing wire identification. Factory pre-printed wiring identification on insulation will be acceptable in lieu of sleeve-type markers in lieu of sleeve-type markers.

5.2.2. Minimum conductor size shall be #12AWG for power wiring and #16AWG (or smaller approved by Buyer) for control wiring, except where this is impractical due to terminal limitations of the internal devices.

5.2.3. Control wiring shall be connected to only one side of all field wiring terminal blocks and no more than two wires (excluding flat jumper straps) shall be attached to the same terminal. Spare terminals, numbering approximately 30% of active terminals, shall be included.

5.2.4. All enclosures shall be provided with a copper ground bus, 1/4 in. x 1 in. minimum cross-section.

5.3. Nameplates

5.3.1. Seller shall provide nameplate for each assembly of the UPS system in accordance with Section 4.1.15(a) and 4.1.15(b) of Specification.

6 Tests and Inspections

6.1. Personnel Qualifications - See Section 6.2.1 of Specification.

6.2. Shop Tests

6.2.1. The Seller shall perform design (type) tests as well as routine tests on the complete UPS system. Tests shall be completed using the proposed type batteries to be supplied for the UPS, or with identical type and number of cells. Alternative type of batteries for test purposes shall require approval by the Buyer. Previously performed design tests and synchronization routine tests on similar equipment need not be repeated, but test certificates have to be submitted for Buyer's approval.

6.2.2. The design tests and routine tests in the shop for the complete UPS system shall be in accordance with IEEE Std 944 and shall include all items listed under sec. 7.3 in Table 2 of the IEEE standard, and as described under sec 7.4 of that standard. In addition, the UPS shall be type- tested for the

conducted EMI in the inverter output (see sec 3.5.9 of this Exhibit). Additional testing to manufacturer's standard specification may also be performed.

6.2.3. Seller shall perform additional routine tests on the following functional component units, as indicated below:

a) For the static transfer switch, routine tests for overload and short circuit capability (see Section 3.6.2 of this Exhibit)

b) For the bypass transformer routine tests per CSA C22.2 No. 66.1&2/ UL 5085- 1&2.

c) For the battery, manufacturer's standard tests; this will include a full capacity test for each battery bank.

d) For Seller's purchased items, routine tests need not be repeated if previous test reports are submitted and approved.

6.2.4. Each individual assembly shall receive a 48-hour minimum "burn-in" at full load prior to performing the standard tests.

6.2.5. Seller shall validate hard-wired bypass components on UPS by test.

6.2.6. Reserved.

6.2.7. See Section 6.1.1 of Specification.

6.2.8. See Section 6.4.3 of Specification.

6.3. Site Tests - See Section 6.6 of Specification.

7 Preparation for Shipment

7.1. Cleanliness - See Section 7.1 of Specification.

7.2. Painting - See Section 7.2 of Specification

7.3. Shipping Tags - See Section 7.3 of Specification

7.4. Packaging/ Shipping & Storage Instructions

7.4.1. For packaging, shipping, handling, and storage requirements, see Specification 24590- WTP-3PS-G000-T0003 and other applicable sections of the Material Requisition and Purchase Order.

7.4.2. The UPS system shall be shipped in assembled sections to meet transportation compliance, handling, and installation requirements.

7.4.3. All materials, parts, and accessories of any equipment and/or components that require re-assembly shall be provided by the Seller. Re-assembly instructions shall be provided with shipment. Small loose parts requiring assembly shall be bagged, marked, and tagged.

7.4.4. Seller shall recommend proper storage of the UPS system prior to installation.

8 Quality Assurance - Reserved

9 Configuration Management – Not Applicable

10 Documentation and Submittals – See Section 10 of Specification.

Exhibit 4 125 Vdc System

125 Vdc System

24590-WTP-3PS-ED00-T0003, Rev. 3 was used as applicable to create the following exhibit.

1 Scope

1.1. General

This Exhibit defines the technical requirements for furnishing 125 Vdc System. If conflicts arise between this Exhibit and the Switchgear Building specification, SELLER shall submit a Supplier Deviation Disposition Request (SDDR) requesting resolution.

1.2. Equipment, Material, and Services Required

1.2.1. This specification establishes requirements for the design, fabrication, assembly, quality assurance, inspection/testing, and delivery of factory assembled, 125V DC System. The125V DC system shall consist of Battery, Battery Rack, Battery Chargers, DC Distribution Panel, and associated hardware. The 125V DC system equipment shall be per manufacturer's latest standard design proven in service to meet the requirements and intent of this Specification and the Material Requisition.

1.2.2. See Section 1.2.3 of specification.

1.2.3. See Section 3.7.2 of specification.

1.2.4. See Section 3.7.12 of specification.

1.3. Work by Others - See Section 1.3 of specification

1.4. Definitions - See Section 1.5 and 1.6 of specification

1.5. Safety/Quality Classifications - See Section 1.4 of specification

2 Applicable Documents - See Section 2.1.4 of Specification.

2.1. Codes – See Section 2.2.4 of Specification.

2.2. Industry Standards – See Section 2.2.4 of Specification.

2.3. Reference Documents/Drawings – See Sections 2.3, 2.4.1, and 2.4.5 of Specification.

3 Design Requirements

3.1. General

3.1.1. All components of the battery charger shall be rated for at least boost charging plus full load requirements at continuous operation for the specified life of the system in the specified ambient conditions. See Data Sheets.

3.1.2. Isolators and switches shall be rated for at least 125% of the maximum continuous load rating of the rectifiers and any short-term overload rating. They shall have load-break fault make capability and be fitted with ON/OFF indicators.

3.1.3. Not used.

3.1.4. The Supplier shall confirm that no significant radio frequency interference will be generated by the rectifier system in accordance with NEMA PE 5, Electromagnetic Interference (EMI).

3.1.5. Electrical protection shall be designed by the equipment supplier for all major components to give discrimination under design inrush and all fault conditions. Current limiting on the rectifier shall be incorporated, adjustable from 50% to 110% of rated current (amps) and factory set to 110%.

3.1.6. The rectifier/charger shall be protected against reversed battery polarity.

3.1.7. The Supplier shall submit, as part of his quotation the estimated maximum heat loss in kW from the equipment. The heat loss shall be confirmed after completion of detailed design.

3.1.8. The 125V DC unit assemblies shall be attached/anchored to the building structure. The attachment/anchorage shall be designed for the structure loads including seismic loads as specified in Section 3.5.7 of this specification.

3.2. Performance

3.2.1. The 125V DC system shall be designed to provide a reliable power distribution for continuous operation of the load groups A and B, during the 40 years design life of the plant, and to allow periodic testing, inspection, re-calibration and maintenance while the plant is in normal operation.

3.2.2. The batteries shall have design life expectancy of 20 years.

3.3. Environmental Conditions

3.3.1. See Section 3.2 of Specification.

3.4. Mechanical and Structural Requirements

The Supplier shall provide the design, installation details and assembly instructions of each battery bank, the battery charger, and the DC load distribution panel and other related components as specified on the Data Sheets

3.4.1. Battery Bank

1) The battery shall be VRLA standard manufacturer design. Cell terminal post shall be equipped with lead alloy connectors.

2) The battery shall be shipped complete with all necessary cables or straps and lugs for inter-cell and inter-tier connections. All hardware shall be per manufacturer standard, approved for VRLA batteries.

3) Single or multi-tier steel rack shall be painted with a minimum of two coats of acid-resistant paint. Metallic racks shall be provided with grounding terminals.

3.4.2. Battery Charger

1) The battery charger(s) enclosure shall be NEMA Type-1. All components shall be serviceable from the front. Provisions shall be made for cable entry as specified on the Data Sheets.

3.4.3. 125V DC Load Distribution Panel

1) The DC load distribution panel shall be in NEMA Type12 enclosure, arranged to form a single structure with a common bus bar assembly. Provision shall be made for cable entry as specified on the Data Sheets.

2) The distribution board shall be designed and constructed to facilitate inspection, cleaning, repair and maintenance and to ensure absolute safety during operation, inspection and maintenance.

3) Similar parts and components shall be interchangeable.

4) Any equipped spares shall be arranged such that they can be connected without de-energizing the complete distribution board.

3.5. Not Used

3.6. Electrical Requirements

3.6.1. The 125V DC battery bank, the battery charger(s) and the DC loads shall be connected to the DC bus through circuit breakers.

3.6.2. During normal operation, the load current of the 125V DC system shall be supplied by the main charger. The standby charger shall be used when the main charger is shutdown. The nominal 125V DC bus shall be controlled at the required float and equalizing voltage by control on the front panel of the battery charger.

3.6.3. The load breakers shall be the first line protection to isolate a faulty feeder, and the battery and charger incoming breakers shall be coordinated as their back up protection.

3.6.4. Battery Bank

1) The type, duration and timing of the loads shall be considered by Supplier in sizing the battery bank in accordance with IEEE 485, IEEE 1187 and IEEE 1189 for Valve Regulated Lead-Acid batteries for the load profile submitted.

2) The battery shall be recharged to its normal operating voltage within 10 hours after being discharged to 105V DC.

3) The battery end-of-discharged voltage shall be selected in view of the load profile and acceptable voltage drop for each load group. The end voltage per cell shall be 1.75V DC.

3.6.5. Battery Charger

1) The battery charger shall be sized to provide power to the largest combination of non-continuous loads that would be connected to the bus simultaneously during normal plant operation while equalize charging the battery bank at the highest charging current rate. Reference IEEE Std.946, Section 7.

2) The charger output voltage shall be +/- 1% of the DC float voltage and +/- 1% of the equalizing voltage under any load condition, for +/- 10% input voltage variation, and +/- 5% input frequency variation.

3) The charger shall be sized to recharge and maintain the battery to 95% of its rated capacity within 10 hours (after the battery is fully discharge).

4) The charger output shall be current limited to a maximum of 120% of its rating, under any condition of load demand.

5) The charger shall use all solid-state components and shall be fully automatic, self-regulating, and filtered with a maximum 2 % ripple voltage.

6) The charger shall be inherently self-protected against external over voltage on the incoming AC power supply.

7) The charger shall provide for automatic and manual equalization of the battery. Control of float and equalize adjustments shall be provided via the front instrument panel.

8) One (each) DC voltmeter, AC voltmeter and DC ammeter shall be provided on the battery charger front enclosure.

9) The battery charger shall be provided with an input isolation transformer. The battery charger shall be temperature compensated.

3.6.6. DC Load Distribution Panel – The DC Bus

1) The DC load distribution panel shall be used to distribute the 125V DC power.

2) The 125V DC bus shall be located inside the DC load distribution panel. Circuit breakers shall be used for every feeder as isolating points. The interrupting capacity of the breakers as shown on the data sheets shall be high enough to isolate the fault.

3) Busbars and connections shall be manufactured from hard drawn copper.

4) Busbars shall be of the same cross-sectional area throughout its required length.

5) Busbars shall be marked to indicate Positive and Negative.

6) Busbars and connections shall be sized, braced, and supported to withstand the mechanical forces and thermal effects resulting from the distribution board rated short circuit current as shown on the Data Sheets.

7) Copper ground bar shall be sized according to equipment rating. All non-current carrying metal parts and cable gland plate (if provided) shall be interconnected to the ground bar.

3.7. Control, Alarm, and Indication Requirements

3.7.1. Protective devices shall be furnished to ensure that the system is operating within its design limits and to alarm abnormal operating conditions.

3.7.2. Protective devices shall be separate from alarm devices where practical. If a common relay is used for both alarm and protective functions, separate contacts shall be used.

3.7.3. Alarms shall reset automatically.

3.7.4. A common alarm relay with Form C (NO-NC) contacts shall be provided for a connection to a remote alarm.

3.7.5. Relays shall be de-energized to actuate alarms.

3.7.6. Indicator light testing shall be provided without interruption of output power.

3.8. Accessibility and Maintenance

3.8.1. The125V DC battery bank, main and common chargers and DC load distribution panel including circuit breakers and accessories shall be designed and constructed accessible for inspection and verification during normal operation and regular maintenance. Safety to personnel shall be the priority to meet this requirement.

3.9. Communication Network Interface

Buyer's network interface for 125V DC system shall be as follows:

3.9.1. Relays shall be de-energized to actuate alarms.

3.9.2. The DC Distribution Panel requires a battery breaker open (dry contact) signal, and an analog signal from a volt transducer (4-20ma).

3.9.3. For local alarm requirements, see section 3.7 of this Exhibit and the Data Sheets

4 Prohibited Materials - See Section 4.2 of Specification.

5 Construction

5.1. Assembly

5.1.1. Wiring

1) Control wiring shall be flame retardant, 600V, type SIS stranded copper wire and shall be continuous from terminal without splices and tagged at both ends with plastic sleeve-type wire markers or engineering approved equal, using the origin-destination method.
2) Control and alarm wiring shall be a minimum of #18 AWG.
3) All wiring harnesses shall be securely bundled and shall be protected from rubbing against other parts within the enclosure.
4) Number of wires attached per terminal shall be per manufacturer internal wiring standard.
5) All components shall be wired in accordance with applicable NFPA 70 and UL Standards.

5.1.2. Terminal Lugs

1) Single hole lugs with anti-rotation barriers sized for incoming and outgoing cables shall be provided.
2) Terminal blocks shall be supplied and clearly marked for wiring that will be installed by others, including wiring between sections.
3) Twenty (20 %) percent spare terminal points shall be provided for Buyer's use. Terminal points for Buyer's use shall be easily accessible with no obstacles or interferences with other internal wiring

5.1.3. Nameplates

1) See Section 4.1.15 of Specification.
2) Battery bank nameplates shall be furnished loose, for affixing after rack assembly by Owner.
3) "Warning" and "Hazard" signs and/or labels, shall be provided in accordance with industry standard, commercially available as self-adhesive. The location shall be determined by the Supplier.

5.2. Accessories and Special Tools

5.2.1. A complete set of accessories, including special tools, shall be provided for operating, maintaining, and testing of the equipment. The Supplier shall provide a list of accessories and special tools, separately priced, with his quotation. The accessories shall be housed and individually labeled in a wall mounted lockable cabinet with external label.

5.2.2. Battery tools and accessories shall be included. The extent of supply shall depend upon the battery system, and shall include inter-cell (block) connectors, grease and insulated wrenches as appropriate.

5.3. Welding – See Section 5.1 of Specification.

5.4. Battery Rack

5.4.1. A single or multi-tier steel rack designed to meet the specified seismic zone shall be provided. (See Section 3.4.1.3 of this Exhibit).

6 Tests and Inspections

6.1. Personnel Qualifications – See Section 6.2.1 of Specification.

6.2. Shop Tests

6.2.1. The Supplier shall perform all standard tests in accordance with the reference standards in Section 2.2.4 for the following equipment:

1) Testing for batteries per IEEE 1188 (Lead-Acid).
2) Testing for battery chargers per NEMA PE 5.
3) Testing for load distribution panel per NEMA PB 1 and NEMA 250

6.2.2. The battery charger shall receive a 48-hour minimum burn-in test prior to performing the standard tests.

6.2.3. The Buyer reserves the right to inspect the unit(s) and witness the test at the factory.

6.3. Site Tests

6.3.1. See Section 6.6 of Specification

7 Preparation for Shipment

7.1. Cleanliness – See Section 7.1 of Specification.

7.2. Painting – See Section 7.2 of Specification.

7.3. Shipping Tags – See Section 7.3 of Specification

7.4. Reserved

7.5. Packaging/ Shipping & Storage Instructions

7.5.1. See Section 7.5.6 of Specification

7.5.2. See Section 7.5.1 of Specification.

7.5.3. See Section 7.4.3 of Specification.

7.6. Shipping Instructions

7.6.1. See Section 7.5.6 of Specification.

7.7. Storage Instructions

Seller shall recommend proper storage of the transformers and panelboards.
8 Quality Assurance - Reserved
9 Configuration Management - Not Applicable
10 Documentation and Submittals – See Section 10 of Specification.

Exhibit 5 Panelboards and Dry Type Transformers

Panelboards and Dry Type Transformers

24590-WTP-3PS-ECD0-T0002, Rev. 0 and its associated Specification Change Notice (SCN), 24590-WTP-3PN-ECD0- 00001, were used as applicable to create the following exhibit.

1 Scope

1.1. General

This Exhibit defines the technical requirements for furnishing Panelboards and Dry Type Transformers. If conflicts arise between this Exhibit and the Switchgear Building specification, SELLER shall submit a Supplier Deviation Disposition Request (SDDR) requesting resolution.

1.2. Equipment, Material, and Services Required

1.2.1. This Exhibit establishes requirements for the design, fabrication, assembly, quality assurance, inspection, testing, and delivery of distribution panelboards and dry type transformers. This equipment shall be suitable from a 480V, 3 phase, 60 Hz, secondary distribution system.

1.2.2. See Section 1.2.3 of specification.

1.3. Acceptability of Electrical Equipment - See Section 3.7.12 of specification

1.4. Work by Others - See Section 1.3 of specification

1.5. Definitions - See Section 1.4 and 1.6 of specification

1.6. Safety/Quality Classifications - See Section 1.4 of specification

2 Applicable Documents - See Section 2.1.4 of Specification.

2.1. Codes – See Section 2.2.5 of Specification.

2.2. Industry Standards – See Section 2.2.5 of Specification.

2.3. Reference Documents/Drawings – See Sections 2.3, 2.4.1, and 2.4.5 of Specification.

3 Design Requirements

3.1. General

3.1.1. Each panelboard shall meet the requirements of NEMA PB 1.

3.1.2. All equipment shall be UL listed or NRTL (See Section 1.3 of this Exhibit).

3.1.3. All equipment associated with this Exhibit shall be suitable for indoor service.

3.1.4. All equipment associated with this Exhibit shall be suitable for indoor service.

3.1.5. The neutral terminal shall be connected to the transformer ground terminal with an equipment grounding conductor sized per the NEC.

3.1.6. The panelboards seismic design shall be in accordance with Section 3.5.7 of Specification.

3.2. Performance

Under normal plant operating conditions, the transformers and associated equipment shall be designed and installed to perform their intended function suitable for the duration of the serviceable design life expectancy of the plant. The project design life is 40 years

3.3. Accessibility and Maintenance

3.3.1. Each circuit breaker shall be provided with a pad lockable device for locking the breaker in either the ON of OFF position; reference EATON catalog number CHPL or MCBPL or equivalent.

3.4. Environmental Conditions

3.4.1. See Section 3.2 of Specification.

4 Prohibited Materials - See Section 4.2 of specification.

5 Construction

5.1. General

The dry type transformers and panelboards shall be housed in NEMA 1 enclosures (minimum) for indoor locations, unless specified otherwise in the data sheets or Material Requisition.

5.2. Nameplates

5.2.1. Seller shall provide nameplate for panels and transformers in accordance with Section 4.1.15a and 4.1.15b of Specification. Transformer nameplate shall include K factor.

6 Tests and Inspections

6.1. Personnel Qualifications – See Section 6.2.1 of Specification.

6.2. Shop Tests

6.2.1. Seller shall perform design (type) tests on one representative dry-type transformer and panelboard of each type as well as routine tests on each individual unit. Previously performed design tests on similar equipment need not be repeated, but test certificates shall be submitted for Buyer's approval.

6.2.2. The design tests and routine tests for panelboards shall be in accordance with NEMA PB 1, and for transformers in accordance with NEMA ST-20. Additional testing to manufacturer's standard specification may also be performed.

6.2.3. See Section 6.4.1 of Specification.

6.2.4. See Section 6.4.3 of Specification.

6.3. Site Tests

6.3.1. See Section 6.6 of Specification

7 Preparation for Shipment

7.1. Cleanliness - See Section 7.1 of Specification.

7.2. Painting – See Section 7.2 of Specification.

7.3. Shipping Tags - See Section 7.3 of Specification

7.4. Reserved

7.5. Packaging/ Shipping & Storage Instructions

7.5.1. See Section 7.5.1 of Specification.

7.5.2. The method of preparation for shipment shall protect the equipment, devices and accessories against corrosion, dampness (using silica gel desiccant bags or other means), breakage, or vibration damage during transportation, handling, and storage.

7.5.3. All materials, parts and accessories of any equipment and or components that require re-assembly shall be provided by the Seller. Re-assembly instructions shall be provided with shipment. Small loose parts requiring assembly shall be bagged, marked and tagged per Section 7.3.

7.5.4. See Section 7.5 of Specification.

7.6. Shipping Instructions

See Section 7.5.6 of Specification.

7.7. Storage Instructions

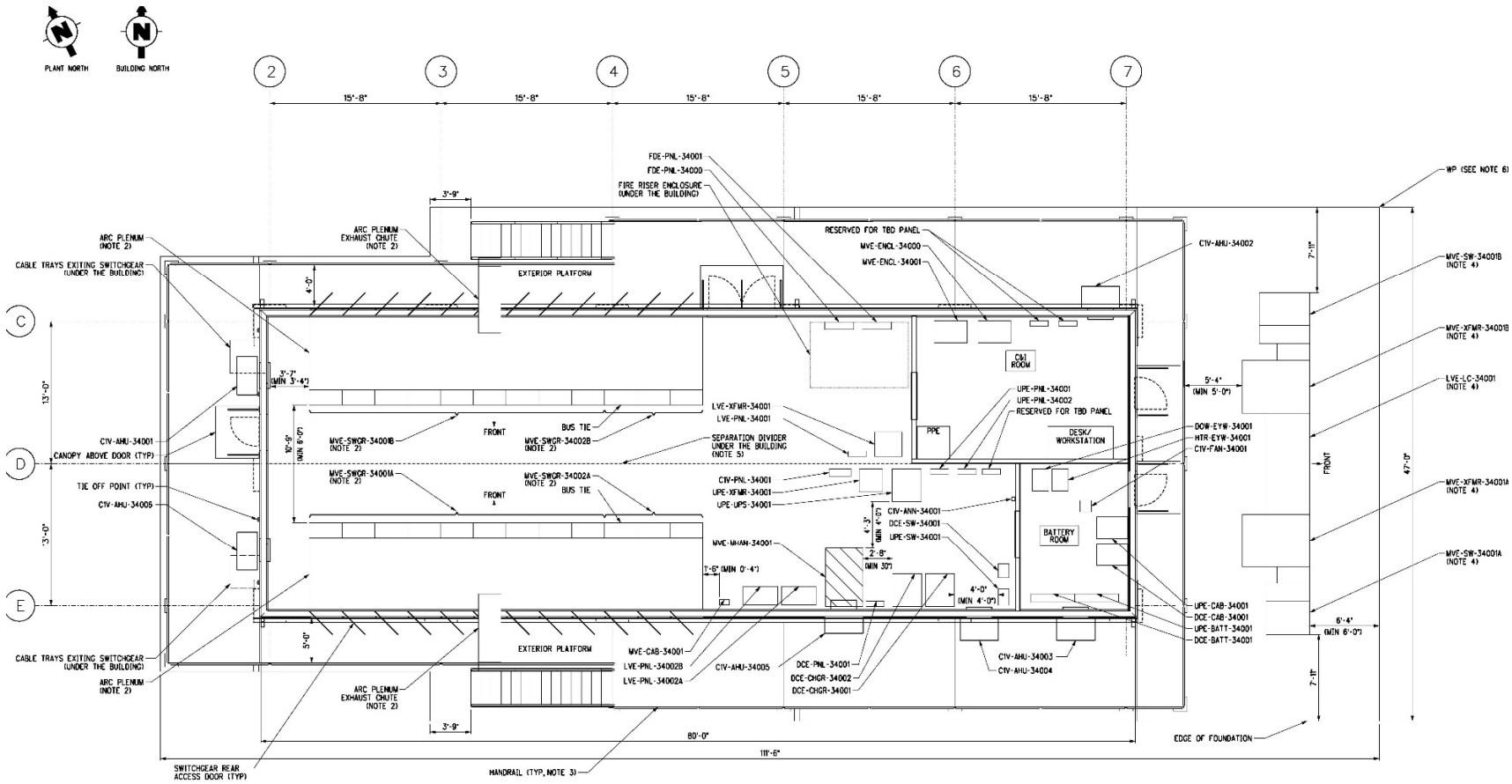
See Section 7.5.5 of Specification.

8 Quality Assurance - Reserved

9 Configuration Management - Not Applicable

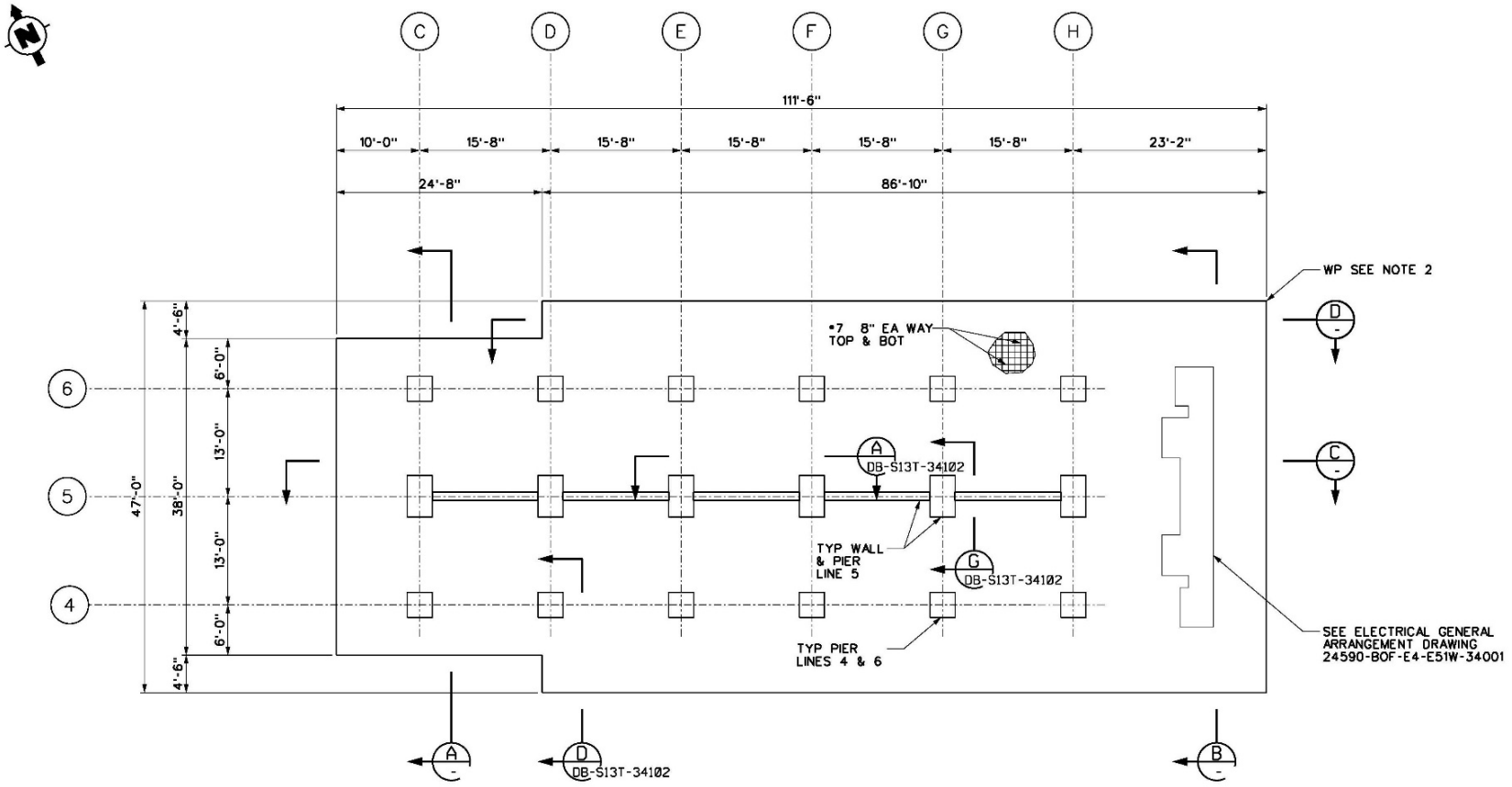
10 Documentation and Submittals – See Section 10 of Specification.

Exhibit 6 Electrical Building Conceptual Layout



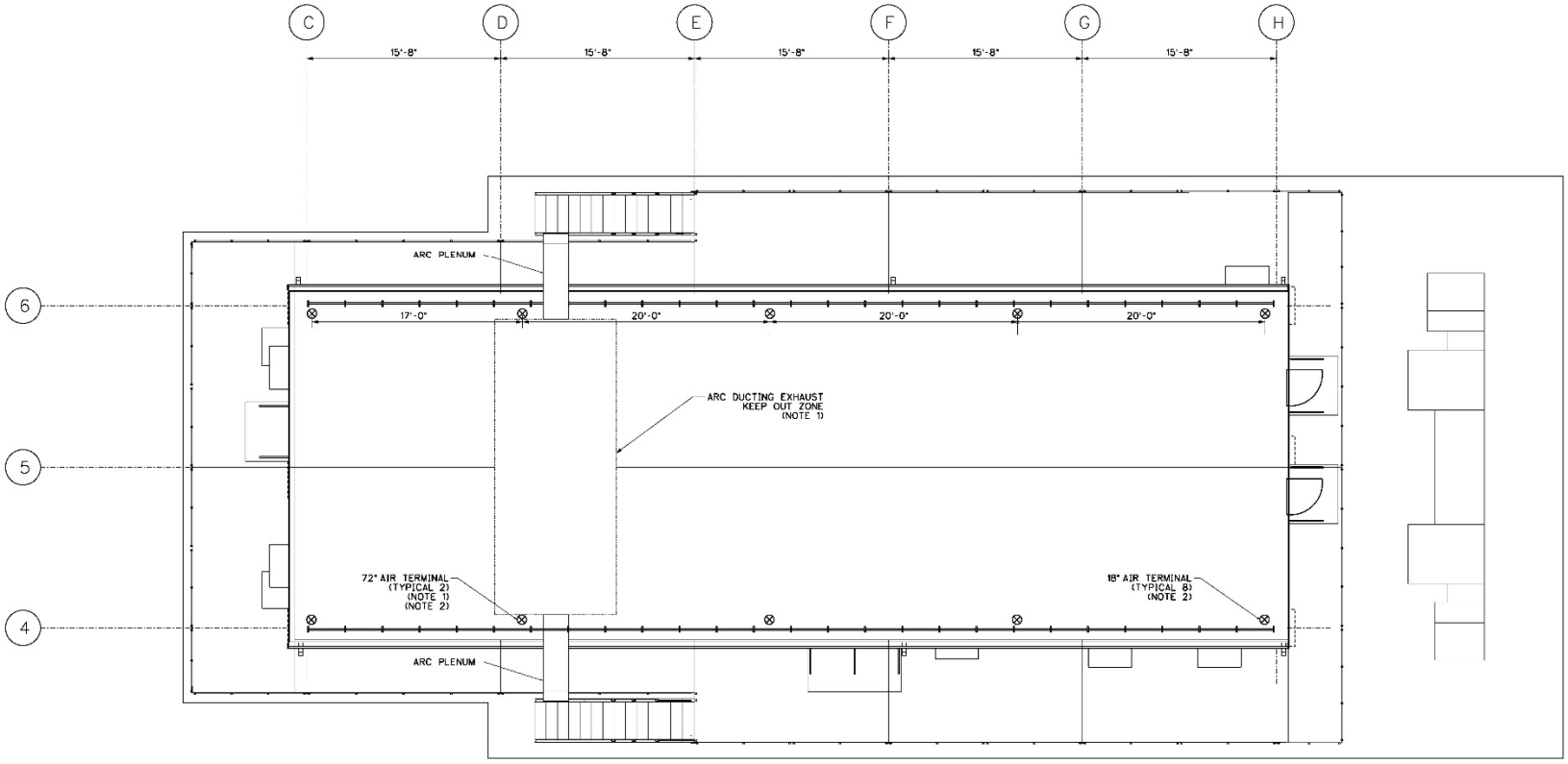
SWITCHGEAR BUILDING PLAN AT EL 8'-0"

Exhibit 7 Conceptual Concrete Forming Plan



CONCRETE FORMING PLAN AT EL Ø'-Ø"

Exhibit 8 Lightning Protection Conceptual Layout



NOTES:

1. AIR TERMINALS NEXT TO ARC DUCTING TO BE PLACED OUTSIDE OF ARC HAZARD ZONE, AND SIZED TO STAND AT LEAST 1'-0" ABOVE FINAL TOP OF DUCT INSTALLATION.
2. ALL AIR TERMINALS SHALL BE INSTALLED WITHIN 24" OF EDGE OF ROOF.

SWITCHGEAR BUILDING ROOF - LIGHTNING PROTECTION PLAN

Appendix A Preaction Fire Suppression System

Contents

A.1 Scope

This appendix describes the preaction fire suppression systems requirements for the BOF Switchgear Building (B34), The preaction fire suppression system shall be in full compliance with National Fire Protection Association (NFPA) 13 – 2022 and Factory Mutual (FM) Data 2-8 (2017). The features described in this appendix are a requirement for this Project and shall be supplied by SELLER.

A.1.1 Equipment, Material, and Services Required

A.1.1.1 SELLER shall design, install, flush, and test the preaction fire suppression system in new condition. The system shall include all required hardware, wiring within panels, programming, and software to accomplish the requirements of this appendix.

A.1.1.2 Design, lay out, fabricate, install, flush, and test a complete preaction fire protection system, including pipe, fittings, sprinkler heads, hangers, supports, earthquake bracing, seismic separation assemblies, deluge valve, control valve assemblies, water motor alarm gongs, alarm pressure switches, supervisory air, and necessary accessories and components to ensure a complete and operable system.

A.1.1.3 Provide seismic bracing, per requirements of the National Fire Protection Association (NFPA) and Factory Mutual Global (FM).

A.1.1.4 The preaction standpipe, valves, instruments, and pneumatic components shall be installed in a “doghouse” provided by SELLER.

A.1.1.5 The doghouse shall be maintained at the same inside temperature as the switchgear building for standpipe environmental weather protection.

A.1.2 Definitions and Acronyms.

Following are definitions of words and phrases shown in this specification.

ASME	American Society of Mechanical Engineers
ASTM	International
AWS	American Welding Society
CAD	Computer Aided Design
DGN	Drawing Design (file)
FM	Factory Mutual Global
IBC	International Building Code
ICC	International Code Council
IFC	International Fire Code
NFPA	National Fire Protection Association
NPS	Nominal Pipe Size
OS&Y	Outside Screw and Yoke
PSI	Pounds per Square Inch
PSIG	Pounds per Square Inch Gauge

QA	Quality Assurance
QC	Quality Control
UL	Underwriters Laboratories, Inc.
VAC	Voltage, Alternating Current
WAC	Washington Administrative Code
WTP	Hanford Tank Waste Treatment and Immobilization Plant
ZOI	Zone of Influence

Assumption: An engineering assumption is a design parameter or input, stated as a supposition, presumption, or judgment, which is based on an engineer's experience, empirical data, hypothesis, probable inference, published literature, standard engineering practice, and (or) background data. An assumption is used when exact verifiable data is not available.

Assumptions made using preliminary criteria or preliminary data that require future confirmation are referred to as "assumptions requiring future confirmation" and must be identified as requiring verification.

Computer Platform: The combination of computer microprocessor and operating system.

CONTRACTOR: Refers to primary contractor, Bechtel National, Inc., for the River Protection Project-Waste Treatment Plant (RPP-WTP).

Software Application: Software applications in the context of this specification are used for performing computational and/or analytical analysis to provide or support the design analysis results and conclusions. These applications include:

- Commercially available analysis software used to perform computations and analysis. Examples are ANSYS, GTStrudl, Pipe-Flo Professional, AutoPIPE, COMPRESS, FLUENT, and ETAP PowerStation.
- Commercially available, general-purpose software used to perform computations and analysis that provide or support the design analysis results and conclusions. Examples are Excel, Mathcad, and Mathematica.
- Software developed by or for the Supplier or sub-supplier used to perform computations and analysis that provide or support the design analysis results and conclusions.
- Files provided by SELLER need to be in 3D file format to allow for interference or clash checking. Acceptable file extensions are .dwg or .dgn.

The following software use and applications are not applicable to this specification:

- Software use and applications that are noncomputational or nonanalytical in nature and do not support the design analysis results and conclusions.
- Software used to select or size standard component offerings given CONTRACTOR-provided parameters.
- Software designed to support the development and operation of end-user applications including, but not limited to, database programs, report generators, desktop publishing, word processing programs, graphics programs, terminal emulators, communications programs, office equipment device drivers, operating system software, and spreadsheet software when the spreadsheet is not performing computations providing or supporting the results and conclusions.

SELLER: Refers to the party ultimately selected to provide the equipment or service described in the subcontract.

A.2 Applicable Documents

A.2.1 Codes and Standards

The following regulatory requirements are applicable to the preaction fire protection systems to the extent specified herein. Work shall be done in accordance with the referenced codes, standards, and documentation identified in this appendix. The SELLER shall apply the latest issue, including addenda, at the time of award as applicable for the following codes and industry standards with exceptions as noted. When specific chapters, sections, parts, or paragraphs are listed following a code, industry standard, or reference document, only those chapters, sections, parts, or paragraphs of the document are applicable and shall be applied.

A.2.1.1 ASTM International (ASTM).

b. ASTM A53 Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinccoated, Welded and Seamless.

c. ASTM A182 Standard Specification for Forged or Rolled Alloy and Stainless-Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High Temperature Service.

d. ASTM A312/A312M Standard Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless-Steel Pipes.

e. ASTM A403/A403M Standard Specification for Wrought Austenitic Stainless Steel Pipe Fittings.

f. ASTM A795/A795M Standard Specification for Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless Steel Pipe for Fire Protection Use.

A.2.1.2 American Society of Mechanical Engineers (ASME)

b. ASME B16.3 Malleable Iron Threaded Fittings: Classes 150 and 300.

c. ASME B16.4 Gray Iron Threaded Fittings: Classes 125 and 250.

d. ASME B16.5 Pipe Flanges and Flanged Fittings: NPS 1/2 Through NPS 24 Metric/Inch Standard.

e. ASME B16.42 Ductile Iron Pipe Flanges and Flanged Fittings: Classes 150 and 300.

A.2.1.3 National Fire Protection Association (NFPA).

b. NFPA 13 (2022) Standard for the Installation of Sprinkler Systems.

c. NFPA 70 (2023) National Electrical Code.

d. NFPA 72 (2022) National Fire Alarm and Signaling Code.

A.2.1.4 American Welding Society (AWS)

b. AWS B2.1/B2.1M Specification for Welding Procedure and Performance Qualification.

A.2.1.5 International Code Council (ICC).

b. IBC (2021) International Building Code (IFC).

c. IFC (2021) International Fire Code (IFC).

A.2.1.6 Factory Mutual (FM) Global

b. FM Approval Guide.

c. FM Data Sheet 2-8 (2017), Earthquake Protection for Water-Based Protection Systems.

A.2.1.7 Washington Administrative Code (WAC).

b. Chapter 212-80 Fire Protection Sprinkler System Contractors.

A.2.1.8 Reference Documents (ASTM).

Reference documents are the latest revision, unless noted otherwise:

b. 24590-WTP-3DP-G030-00044, Standard Component Numbering.

c. 24590-WTP-3PS-G000-T0014, Engineering Specification for Supplier Design Analysis.

d. 24590-WTP-3PS-G000-T0018, Engineering Specification for Flushing and Cleaning Requirements for the Startup of Quality and Commercial Fluid Systems in All Facilities.

e. 24590-WTP-3PS-M000-T0014, Engineering Specification for Labeling of Permanent Plant Components.

f. 24590-WTP-AHJIR-FP-16-00002, Hanger Locations on Fire Protection System Piping.

g. 24590-WTP-AHJIR-FP-16-00003, End of Fire Sprinkler System Branch Line Restraints.

A.3 Design Requirements

A.3.1 Layout Requirements

A.3.1.1 Layout and installation of the preaction sprinkler systems shall be performed per NFPA 13.

A.3.1.2 Preaction fire suppression systems shall be designed for a nominal plant life of 40 years.

A.3.1.3 Pipe layout shall be arranged so that the entire system drains back through the riser or through a gang drain installed on branch lines. Auxiliary drains are not permitted. Removing sprinkler heads or similar parts of the system for drainage purposes is not acceptable. Note: Pendent or flexible head installations are not required to automatically drain.

A.3.1.4 Hydraulically designed sprinkler systems shall be designed for a supply pressure of at least 10%, but not less than 10 psi below the supply curve and shall consider velocity pressures.

A.3.1.5 For hydraulic calculations, the area/density method shall be used as described in NFPA 13 (2022), 19.2.3, but in no case less than 0.17 gpm/ft2 over 3,000 ft2 without CONTRACTOR'S approval. When the area being calculated is not physical 3000 ft2 an area/density of 0.20 gpm/ft2 shall be used.

A.3.1.6 Hydraulic calculations shall include the necessary underground piping, fittings, and valves back to the effective point of the flow test.

A.3.1.7 Hydraulic calculations shall use a "C" factor of 100 for all piping downstream of the preaction valve.

A.3.1.8 Piping, sprinkler heads, and pipe fittings shall not be routed in dedicated electrical space. Dedicated electrical space is considered the space equal to the width and depth of the electrical equipment and the space extending from the floor to a height of 6 ft above the electrical equipment or to the structural ceiling, whichever is lower. Sprinkler protection for the dedicated space, shall comply with dedicated electrical space requirements in NFPA 70 (2023). Piping, sprinkler heads, and pipe fittings can be routed above dedicated electrical space with protection provided to avoid electrical equipment damage from condensation, leaks, or breaks as approved by the CONTRACTOR (WTP Electrical Authority Having Jurisdiction).

A.3.1.9 The preaction system shall be pneumatically supervised with air at a minimum pressure of 7 psi and shall not exceed 10 psig. High- and Low-pressure switches shall be provided for connection to the releasing control panel provided by SELLER.

A.3.1.10 Tankless air compressors that are oil free for use on preaction systems shall be preapproved by the CONTRACTOR. Where tankless air compressors are approved for use, the supervising air pressure cannot exceed 30 psig.

A.3.2 Mechanical Requirements

A.3.2.1 Sprinkler piping, fittings, and devices with a UL listing and FM approval shall be provided, unless a specified product is only covered by one of the agencies. Exceptions shall be made on a case-by-case basis and shall be approved by the CONTRACTOR.

A.3.3 Piping/Fittings

A.3.3.1 Piping shall be Schedule 40 galvanized steel with galvanized fittings. Where permitted by NFPA and FM, piping that normally contains water and is not subject to external corrosion may be black Schedule 40 with fitting materials complying with NFPA and FM.

A.3.3.2 Piping located in a corrosive environment or piping that may contain a corrosive environment shall be Schedule 40 stainless steel with stainless steel fittings.

A.3.4 Air Supply

A.3.4.1 The air supply for this installation shall be obtained from a riser mounted air compressor provided by SELLER. A tank mounted air compressor is acceptable if supplied as part of a prepackaged assembly. Air compressors shall operate on 120 VAC. System shall be capable of restoring air pressure within 30 minutes.

A.3.4.2 If a tank mounted air compressor is used, the air supply shall be regulated by an approved regulating type air maintenance device containing a field adjustable regulator having a range of 5 to 50 psi, a check valve, a strainer, and a rapid fill valve.

A.3.5 Seismic Bracing

A.3.5.1 Earthquake sway bracing, wall and floor collars, and hanger supports shall be installed in accordance with NFPA 13 and/or FM Data Sheet 2-8.

A.3.5.2 Earthquake sway bracing shall be provided based upon FM 2-8 using a "G" factor of 0.5. Calculations, using the zone of influence method, showing the forces on the attachments shall be made to verify that the minimum requirements outlined are not exceeding the allowable strengths of listed equipment or allowable strength of the building structure at the point of attachment. Details of the sway bracing shall be provided on the shop drawings and bracing calculation sheets.

A.3.5.3 SELLER shall submit calculations demonstrating that seismic forces on brace components do not exceed allowable component strengths as published by the manufacturer or contained within NFPA 13 and/or FM Data Sheet 2-8.

A.3.5.4 Piping installed such that it is supported by laying directly on the building structural members or trapeze shall be secured in place (e.g., with U-bolts qualified for the load rating they are taking) to resist vertical movement.

A.3.6 Control Valves

A.3.6.1 Butterfly valves shall be installed wherever possible.

A.3.6.2 Butterfly valves shall be UL listed or FM approved and include an approved integral, prewired position supervisory tamper switch assembly.

A.3.6.3 In cases where a butterfly valve cannot be used or is impractical, a UL listed, or FM approved OS&Y valve shall be used with CONTRACTOR approval. An approved position supervisory switch shall be provided with each UL listed or FM approved OS&Y valve.

A.3.7 Hangers

A.3.7.1 Hanger materials shall be chosen and located to comply with the requirements of NFPA 13 and FM Data Sheet 2-8 (2017).

A.3.7.2 Hangers attaching to steel purlins shall be attached by connecting into the web of the top 1/3 of purlin using side beam brackets.

A.3.7.3 Because of the unique characteristics of some types of fittings, certain manufacturers recommend hanger spacing less than the maximums given in NFPA 13 (2022), Section 17.4.3.2. In such circumstances, the manufacturer’s recommendations should be followed.

A.3.7.4 The end sprinkler on a line shall be restrained against excessive vertical and lateral movement (Reference: NFPA 13 (2022), Section 18.6.3). The end sprinkler line restraint shall:

b. prevent the end of branch line piping from whipping or bouncing out of its hanger.

c. support the end of the branch line from a hanger attachment to the building structure that is capable of sustaining earthquake loads without detachment of the hanger.

d. prevent excessive movement that could cause damage to the end sprinkler by contact with building structural elements, ceiling, or other objects Satisfactory examples of meeting the intent of this requirement include, but are not limited to, installing Tolco Figure 25 “Surge Restrainer”, threading the rod down tight to the pipe as allowed by NFPA, installing the piping tight or close to the structure, or using rods shorter than 6 in. as allowed for branch lines that require bracing.

A.3.8 Sprinkler Heads

A.3.8.1 Sprinkler heads shall be upright type, pendent, standard, or quick response with a minimum nominal K value of 5.6.

A.3.8.2 Ordinary temperature heads shall be installed below suspended ceilings; high temperature heads shall be installed above suspended ceilings.

A.3.8.3 Pendent heads shall be installed on return bends.

A.3.8.4 Quick response sprinklers shall not be used.

A.3.9 Sprinkler Spacing

A.3.9.1 Sprinkler spacing shall be based on the hazard protected, but in no case less than the NFPA 13 requirements required for Ordinary Hazard, Group II occupancy.

A.3.10 Spare Sprinklers

A.3.10.1 Spare sprinkler heads shall be provided in accordance with NFPA 13.

A.3.10.2 A wall mounted metal cabinet adjacent to the riser shall be provided to contain the sprinkler heads along with a wrench for each type of sprinkler head.

A.3.10.3 The cabinet shall have a hinged cover.

A.3.11 Head Guards

A.3.11.1 Head guards shall be placed around sprinkler heads installed within 8 ft of the floor and for any sprinkler head otherwise subject to mechanical damage.

A.3.12 Escutcheons

A.3.12.1 Semi-recessed two-piece escutcheons shall be provided on pendent sprinklers located beneath an intermediate ceiling. Where obstructions are unavoidable, other configurations of two-piece escutcheons may be used with CONTRACTOR approval.

A.3.13 Water Flow Alarm Pressure Switch

A.3.13.1 Water flow alarm pressure-type switch with two sets of single pole double throw contacts shall be provided as part of the preaction valve trim. This switch reports to the fire alarm control

panel that is connected to the site's Integrated Control Network (ICN). This will notify the HLW control room that the sprinkler system has been activated.

A.3.14 High/Low Air Pressure Switch

A.3.14.1 Pressure type supervisory switch that delivers signal at a 3-psi differential shall be provided. This switch reports to the fire alarm control panel that is connected to the site's ICN. This will notify the HLW control room that the sprinkler system has been activated.

A.3.15 Solenoid Valve

A.3.15.1 Deluge valve releasing device shall be an electrical 2-way, normally closed, pilot operated solenoid valve UL listed for its intended use. Solenoid valve shall be manufactured by Skinner Valve, Division of Parker Hannifin Corp., PIN 73218BN4UNLVN0C111C2 or CONTRACTOR approved equal.

A.3.16 Supervision Requirements

A.3.16.1 Valves controlling fire protection water supplies shall be provided with UL listed and FM approved valve tamper switches.

A.3.17 Accessibility and Maintenance

A.3.17.1 The preaction system riser shall be in a doghouse below the switchgear building, identified on subcontract drawings and be unobstructed and readily accessible for maintenance purposes.

A.3.18 Main Drains

A.3.18.1 Drains shall be arranged to allow for full discharge to a safe location without requiring additional hose or piping to be temporarily attached.

A.3.18.2 The preferred drain location is to the outside of the building.

A.3.18.3 Drain valves shall consist of 1/4 turn ball valves.

A.3.19 Fire Department Pumper Connections

A.3.19.1 The sprinkler riser shall be equipped with a fire department pumper connection arranged in accordance with NFPA 13.

A.3.20 Nameplates

A.3.20.1 SELLER shall provide an equipment tag number for all valves, preaction valve operating trim devices, compressors, tanks, pumps, strainers, alarm-initiating devices, and any other equipment in accordance with 24590-WTP-3DP-G03B-00044, Standard Component Numbering. CONTRACTOR will provide nameplate.

A.4 Materials

Only new pipe, fittings, valves, sprinklers, and devices shall be employed in the installation of automatic preaction sprinkler systems following the requirements of NFPA 13.

A.4.1 Prohibited Materials

b. Thin wall and Schedule 10 piping.

c. Welded couplings.

d. Plain end fittings.

e. Used materials.

f. Welded fittings on galvanized piping.

g. Plug type anchors, set by driving anchor bodies into holes and over plugs.

h. Dry sprinkler heads.

A.4.2 Sprinkler Piping

A.4.2.1 Black pipe shall be Schedule 40, conforming to the requirements of ASTM A53.

A.4.2.2 Galvanized steel piping shall be Schedule 40 welded or seamless, conforming to the requirements of ASTM A795.

A.4.2.3 Stainless steel pipe shall be seamless 304L, Schedule 40, conforming to the requirements of ASTM A312.

A.4.3 Piping Fittings

A.4.3.1 Reduction in pipe size shall be made with one-piece reducing fittings. Multiple bushings shall not be allowed for reductions. Regular fittings shall be:

b. flanged per ASME B16.5.

c. grooved.

d. threaded malleable iron per ASME B16.3 for piping less than or equal to 2 in. NPS.

e. threaded ductile iron per ASME B16.42 for piping less than or equal to 2 in. NPS.

A.4.3.2 Cast iron fittings ¾ in. NPS or less shall be permitted in factory trim on sprinkler risers.

A.4.3.3 Stainless steel fittings shall be per ASTM A403/A403M, A182, Grade 304L, or dual certified.

A.4.4 Pipe Couplings

A.4.4.1 Couplings shall be:

b. flanged per ASME B16.5.

c. grooved.

d. threaded malleable iron per ASME B16.3 for piping less than or equal to 2 in. NPS.

e. threaded ductile iron per ASME B16.42 for piping less than or equal to 2 in. NPS.

A.4.4.2 Cast iron couplings ¾ in. NPS or less shall be permitted in factory trim on sprinkler risers.

A.4.4.3 Flexible grooved couplings in pipelines shall be Victaulic® styles 75 or 77, Gruvlok® style 7000 or 7001, or CONTRACTOR approved equal.

A.4.4.4 Rigid grooved couplings in pipelines shall be Victaulic® style 07, Gruvlok® styles 7400 or 7401, or CONTRACTOR approved equal.

A.4.4.5 Grooved reducing couplings in pipelines shall be Victaulic® style 750 or CONTRACTOR approved equal.

A.4.4.6 The installation of the couplings shall be in accordance with the manufacturer's recommendations including the requirements for bolt torque values.

A.4.5 Mechanical Tees

A.4.5.1 Bolted branch outlets shall be Victaulic® style 920 or Gruvlok® style 7045 (U-bolt not acceptable), or CONTRACTOR approved equal, for pipe sizes 2 in. and larger. Bolted branch outlets on pipes less than 2 in. shall be Gruvlok® style 7044 branch outlet or CONTRACTOR approved equal.

A.4.5.2 Coupons shall be attached for verification.

A.4.6 Signs

A.4.6.1 Control valves, drain valves, and test valves shall have permanently marked weatherproof metal or rigid plastic identification signs per NFPA 13.

A.4.6.2 Lettering shall be red letters on white background or white letters on red background.

A.4.6.3 Letters shall be a minimum of 1 in. high, or CONTRACTOR approved equal.

A.4.6.4 Identification sign shall be secured with corrosion-resistant wire, chain, or other approved means.

A.4.6.5 Control valve sign shall identify the portion of the building served.

A.4.6.6 Manual activation stations shall have a sign stating Manual Fire Sprinkler Activation.

A.4.7 Hydraulic Data Placards

A.4.7.1 Hydraulic data placards shall be metallic and permanently embossed with the information required by NFPA 13.

A.4.7.2 The use of markers or tape will not be allowed.

A.4.7.3 SELLER shall supply, fill in the required information, and install the placards on or adjacent to the system riser.

A.4.8 System Preaction Valve

A.4.8.1 The system preaction valve shall be complete with trim and associated equipment.

A.4.8.2 Valve shall be Reliable® model BX, Reliable® model A, or CONTRACTOR approved equal.

A.4.8.3 Preaction valve and piping shall be sized accordingly to support attached hydraulically designed sprinkler system.

A.4.8.4 The valve shall be trimmed to allow for electrical release using the detection system.

A.4.9 Package Preaction System

A.4.9.1 Package preaction system shall be UL listed and FM approved and have the following: a complete, self-contained preaction system within a cabinet, consisting of a valve with trim to allow for operation as a single or double interlock system; control valve with supervisory tamper switch assembly; air supply using air compressor; and associated necessary components to ensure proper operational functions as required. The valve shall be trimmed to allow for release using an electric detection system.

A.4.9.2 The system shall be sized accordingly to support attached hydraulically designed sprinkler system. Package system shall be Reliable® PrePak Preaction System or CONTRACTOR approved equal.

A.4.10 Pipe Stands

A.4.10.1 Pipe stands shall be adjustable and have a pipe saddle. Pipe stands shall be TOLCO™ Fig. 319 with Fig. 317 saddle or CONTRACTOR approved equal.

A.4.11 Straps

A.4.11.1 Beam clamp retaining straps shall be UL listed and FM approved, TOLCO™ Fig. 69, 69R galvanized steel, or CONTRACTOR approved equal.

A.4.11.2 Flush mount pipe straps shall be TOLCO™ Fig. 20S, carbon steel, or CONTRACTOR approved equal.

A.4.12 Hangers

A.4.12.1 Threaded side beam brackets shall be TOLCO™ Fig. 58 or CONTRACTOR approved equal with bolt and hex nut fastener.

A.4.12.2 C-type beam clamps with retaining strap shall be TOLCO™ Fig. 65, 66, 68S, 68W, or CONTRACTOR approved equal.

A.4.12.3 Ring hangers shall be TOLCO™ Fig. 2, 200 or CONTRACTOR approved equal.

A.4.12.4 Surge restrainers shall be TOLCO™ Fig. 25 or CONTRACTOR approved equal.

A.4.13 Concrete Anchors

A.4.13.1 Concrete anchors shall be Hilti® models HDI, Kwik Bolt® 3, ITW-Ramset Trubolt® Wedge Anchor, or CONTRACTOR approved equal.

A.4.13.2 Concrete inserts shall be Cooper B-Line® Fig. B2505 Spot Insert or a stainless-steel CONTRACTOR approved equal.

A.4.13.3 Post-installed concrete anchor locations shall be approved by CONTRACTOR prior to installation.

A.4.14 OS&Y Valve Supervision

A.4.14.1 The switch shall be waterproof and have two sets of single-pole, double-throw, and Form C snap action contacts.

A.4.14.2 Electrical supervision shall be provided on the valves using a Potter model OSYSU2 switch, or CONTRACTOR approved equal.

A.4.15 Water Flow Pressure Alarm Switch

A.4.15.1 Pressure type water flow alarm switch with built in recycling pneumatic delay and two sets of single pole, double throw contacts shall be provided as part of the valve trim.

A.4.15.2 Potter PS10-2 Pressure Type Switch, or CONTRACTOR approved equal, shall be used.

A.4.16 Supervisory Air Pressure Alarm Switch

A.4.16.1 Potter PS15-2 Pressure Type Switch, or CONTRACTOR approved equal, shall be used.

A.4.17 Sprinkler Heads

A.4.17.1 Heads shall be listed and approved for use in the occupancies installed.

A.4.17.2 Standard sprinkler shall be Reliable® Model G, or CONTRACTOR approved equal.

A.4.17.3 Stainless steel heads shall be Central Model A-2, Viking® Model N-2, or CONTRACTOR approved equal.

A.4.18 Sprinkler Guards

A.4.18.1 Sprinkler guards shall be of the type which can be installed after the sprinkler head is installed.

A.4.18.2 Sprinkler head and guard manufacturer shall be the same.

A.4.18.3 Guards shall be Reliable® Model C series or CONTRACTOR approved equal.

A.4.19 Control Valves

A.4.19.1 Butterfly valves shall be UL listed or FM approved, either Nibco® GD-4765-0 or Nibco® WD-3510-8 with approved position supervisory switches, or CONTRACTOR approved equal.

A.4.19.2 OS&Y valves shall be UL listed or FM approved, resilient wedge, and pre-grooved stem for supervisory switch. OS&Y valves shall be Kennedy KS-RW, Mueller Co. 2360-6, or CONTRACTOR approved equal.

A.4.20 Check Valves

A.4.20.1 Check valves shall be UL listed or FM approved and equipped with a removable faceplate for easy inspection and maintenance. Valve shall be Viking® Swing Check Model G-1 or CONTRACTOR approved equal.

A.4.21 Fire Department Pumper Connections

A.4.21.1 Fire department connections shall be 2.5 in. female swivel with National Standard fire hose threads.

A.4.21.2 The fire department connections shall be Potter Roemer or CONTRACTOR approved equal.

A.4.21.3 The number of outlet connections shall be per NFPA 13. Breakable caps shall be included and be Potter Roemer Model 5950 or CONTRACTOR approved equal.

A.4.21.4 An identification plate shall be provided.

A.4.22 Flexible Commercial Sprinkler Connections

A.4.22.1 Flexible hose assemblies and end fittings shall be 100% Type 304 stainless steel composition.

A.4.22.2 Straight hose assembly shall be UL listed and FM approved; 2 ft length, 3 ft length, 4 ft length, 5 ft length, or 6 ft length; 1/2 in. outlet; 175 psi maximum rated pressure; fully welded nonmechanical fittings; braided; and factory leak-tested with minimum 1 in. true-bore internal corrugated hose diameter.

A.4.23 Cathodic Protection

A.4.23.1 Electrical isolation flange gasket kits shall be provided for broad service conditions.

A.4.23.2 The kits shall be manufactured from field proven materials having a minimum dielectric strength of 500 Volts/mil.

A.4.23.3 The kits shall be standard type with full face, type E gasket, one-piece insulating sleeve and associated gasket, and provided with detailed installation instructions.

A.4.24 Seismic Joints

A.4.24.1 Seismic joints shall be located at seismic separation points and be Metraflex®, FireLoop®, or CONTRACTOR approved equal.

A.5 Installation/Special Requirements

A.5.1 Cleanliness

A.5.1.1 SELLER shall remove dirt, oil, grease, loose mill scale, weld spatter, and other foreign matter from interior and exterior surfaces prior to installation.

A.5.2 Certification

A.5.2.1 SELLER shall be certified in the state of Washington in accordance with WAC 212-80, Fire Protection Sprinkler System Contractors.

A.5.3 Shop Welding

A.5.3.1 Shop welding shall be by a qualified welder using a weld procedure prepared in accordance with AWS B2.1. Welders or welding machine operators shall, upon completion of each weld, stamp an imprint of their identification into the side of the pipe adjacent to the weld.

A.5.3.2 There shall be no onsite welding by SELLER.

A.6 Tests and Inspections

A.6.1 Cleaning

A.6.1.1 Upon completion of installation, and prior to the final inspection, the system shall be cleaned and drained at least two (2) times to remove any contaminants. (Reference: 24590-WTP-3PS-G000-T0018, Engineering Specification for Flushing and Cleaning Requirements for the Startup of Quality and Commercial Fluid Systems in All Facilities)

A.6.2 Testing

A.6.2.1 General

b. Notify all respective parties in writing at least two (2) weeks in advance of any testing.

A.6.2.2 Hydrostatic

b. Integrity test shall be conducted after installation is complete. The initial test shall consist of hydrostatically testing all fire protection piping at not less than 225 psi pressure for two (2) hours with no visible leakage.

c. Leaks shall be repaired, and the system shall be retested.

d. A final hydrostatic test shall be performed with the same requirements when the entire fire protection system is complete.

A.6.2.3 Pneumatic

b. An air pressure leakage test at not less than 40 psi shall be conducted for 24 hours.

c. Any leakage that results in a loss of pressure more than 1.5 psi for the 24 hours shall be corrected.

d. Leaks shall be repaired, and the system shall be retested.

A.6.2.4 Operational

b. Where using an air compressor directly feeding the preaction system riser, verify the air compressor starts and stops at the correct air pressures for the preaction valve selected.

c. Pressures must not exceed the maximum pressure or go below the minimum pressure as recommended by the preaction valve manufacturer.

A.6.2.5 Release Solenoid Circuit.

b. Operation of solenoid shall be verified.

A.6.2.6 Contractor Interface

b. SELLER shall notify CONTRACTOR when hydrostatic pipe testing will occur, so CONTRACTOR may witness hydrostatic pipe testing.

c. SELLER shall notify CONTRACTOR when pneumatic pipe testing will occur, so CONTRACTOR may witness pneumatic pipe testing.

d. Surveillance will be performed by the CONTRACTOR to verify compliance of the work to the drawings and specifications.

A.6.3 Final Inspection

A.6.3.1 SELLER shall make a complete and final inspection of the installation, checking out alarms, valves, piping, seismic bracing, hangers, etc. and conduct a final main drain test on the system.

A.7 Quality Assurance

A.7.1 Compliance

A.7.1.1 Work shall be done in a skillful and workmanlike manner. SELLER shall do construction work associated with the installation of equipment. No modifications or rearrangements, not shown on the drawings, shall be made without prior approval from CONTRACTOR's Fire Protection Engineer. One set of approved fire protection design drawings shall be maintained during construction.

A.7.1.2 The following conditions apply as preapproved field changes, allowing the use of a SELLER Field Change Notice:

b. Change does not impact calculations but may impact other design documents.

c. Added fittings and/or grooved couplings including, but not limited to, inline tees for drains and vents without changing line size.

d. Change in attachment method is acceptable if the new attachment method is already approved.

A.7.2 Construction

A.7.2.1 SELLER quality control (QC) personnel shall make weekly inspections of the system during installation. SELLER shall document and repair, replace, or remove any condition that negatively impacts the system.

A.8 Documentation and Submittals

Shop drawings and associated supporting documentation for the preaction system installation, catalog data, hydrostatic test procedure, flushing procedure, and Sprinkler Contractors Material and Test Certificate shall be submitted.

A.8.1 Submittals

A.8.1.1 Each submittal shall be submitted for review and approved by CONTRACTOR's Fire Protection Engineer prior to beginning of installation. A complete submittal package will consist of the G-321-E form, layout drawings, hydraulic calculations, seismic calculations, and seismic zone of influence (ZOI) drawings and cut sheets. Initial submittals shall be a complete package for review, or a partial package as directed by CONTRACTOR.

A.8.1.2 SELLER shall submit the following material documents.

b. Materials and Equipment Manufacturer's Data Sheets: SELLER shall provide manufacturer's data sheets for each different item of materials and equipment specified.

c. A list of parts recommended by the manufacturer for operational support for one (1) year, for replacement after one (1) year, and for replacement after three (3) years of service.

d. Operating instructions shall outline step-by-step procedures for startup, operation, and shutdown for supplied devices and equipment.

e. The instructions shall include the manufacturer's name, model number, service manual, parts list, and brief description of equipment and operating features.

f. Maintenance instructions shall list routine maintenance procedures, breakdowns, and repairs, and troubleshooting guide.

g. The manufacturer's instructions for each panel, instrument, device, and component shall be clearly marked or highlighted to indicate the specific model or class number.

h. SELLER, when required to provide schematic/wiring diagrams, indicating buyer point of connection and any connections provided by SELLER.

A.8.2 Cut Sheets

A.8.2.1 Cut sheets shall be submitted for any system components that have not been approved on a prior submittal.

A.8.3 Drawings

A.8.3.1 SELLER shall submit layout drawings for approval prior to construction. Drawings shall be completed on size E (44 in. × 34 in.) computer aided design (CAD) generated drawings. All lettering size shall be a minimum of 1/8 (.125) in. on the main body of the drawing. Drawings shall be done using MicroStation Version J, or a similar program, which generates drawing design (DGN) files which are compatible with MicroStation Version J and do not require any changes or reconfiguration to produce legible drawings. Files provided by SELLER need to be in 3D file. Acceptable file extensions are .dwg or .dgn.

A.8.3.2 As-built drawings shall be submitted in both the CAD generated drawing format above and in an electronic CAD DGN format compatible with MicroStation Version J. All hard copies submitted shall be sealed in accordance with WAC 212-80, Fire Protection Sprinkler System Contractors.

A.8.4 Procedures

A.8.4.1 SELLER shall submit a hydrostatic, pneumatic test procedure and a detailed, job specific flushing procedure. The flushing procedure shall outline where the flushing water will be obtained and how it will be disposed of in a safe manner. It shall also outline how the flow will be monitored to ensure adequate flow and how long the flow must be maintained to adequately flush the piping. This procedure shall be submitted to CONTRACTOR for review prior to any connections to existing plant piping.

A.8.4.2 SELLER shall submit an inspection procedure detailing the organized process used to ensure proper performance of the fire suppression system. This procedure shall be submitted for review prior to acceptance of the system by CONTRACTOR.

A.8.5 Inspection and Test Reports

A.8.5.1 SELLER shall submit an acceptance test plan document for the preaction system.

A.8.5.2 A final inspection form shall be submitted for the preaction sprinkler system installed. See section A.9.4 Fire Protection Installation Final Inspection Form to be submitted.

A.8.5.3 Acceptance test documents shall be reviewed and found to be acceptable by the CONTRACTOR prior to placing the system in service.

A.8.6 Calculations

A.8.6.1 A copy of the calculations used to establish the sizing and configuration of the sway bracing shall be provided for review prior to installation. Calculation format shall follow NFPA 13 (2022 edition) or CONTRACTOR approved equivalent format.

A.8.6.2 Hydraulic calculations to establish the sizing and configuration of the sprinkler piping, prepared in accordance with NFPA 13, including the electronic copies of the input data compatible with the latest issue of HASS 7.5 or later and the software, shall be submitted for approval.

A.8.6.3 Calculations shall be sealed in accordance with WAC 212-80, Fire Protection Sprinkler System Contractors.

A.8.6.4 Each seismic brace type (brace detail) shall have a corresponding calculation for analyzing seismic bracing. The bounding ZOI for each seismic brace type is to be shown on the pipe support location drawing, and the location drawing shall be referenced on the seismic brace calculation sheet. As a minimum, the seismic brace calculation shall also include:

- Seismic brace assembly detail.
- Calculated weight for brace using bounding ZOI.
- Brace leg information including the slenderness ratio calculated.
- Seismic brace components listing.
- Fastener information including guidance in FM Data Sheet 2-8, Section 2.2.1.3.6 for expansion anchors.
- Allowable fastener shear and tension
- Net vertical uplift force (Vt), as applicable

A.8.6.5 All calculations/analyses shall comply with 24590-WTP-3PS-G000-T0014, *Engineering Specification for Supplier Design Analysis*.

A.8.7 QC Inspections

A.8.7.1 SELLER QC personnel shall submit weekly inspections of the system during installation.

A.8.8 Documentation

A.8.8.1 Manuals

b. SELLER shall supply a set of operation and maintenance manuals to CONTRACTOR.

A.8.8.2 Certificates

b. SELLER's Material and Test Certificate for the preaction system (see section A.9.3) shall be completed and accepted, for the preaction system, prior to final acceptance of the installation. All copies of the SELLER's Material and Test Certificate submitted shall be sealed in accordance with WAC 212-80, Fire Protection Sprinkler System Contractors.

A.8.8.3 Method of Attachment Certification

b. A letter, from the SELLER's Structural Engineer, approving the method, location, and forces used in the attachment of earthquake sway bracing shall be submitted.

A.8.9 Design Analysis Report Contents

The design analysis shall be documented in a sufficiently detailed manner that an independent reviewer who is technically competent in the subject can review and understand the analysis and verify the adequacy of the results without recourse to the originator.

Design analysis report requirements checklist is provided in section A.9.2. This checklist is provided to the SELLER as a convenience to allow the SELLER to understand how the CONTRACTOR will be evaluating submitted analysis reports to ensure the requirements contained in this appendix were met.

The following information shall be included in the design analysis report.

A.8.9.1 Participants

Printed name, title, and signature with date of the individuals who originated, checked, and approved the analysis shall be documented. Names of organizations or subcontracted companies are not adequate. When required by this specification or the applicable purchase order, certification of the design analysis report by a registered professional engineer shall be stamped, signed, and dated on the cover page.

A.8.9.2 Software/Computer Platform

Software used to perform the analysis shall be listed. This includes the software name and version as well as the name and version of any add-on modules (e.g., plug-ins and extension packs). Provide the computer platform including microprocessor type and model (e.g., Intel Core i74770) and operating system (e.g., Microsoft Windows 10) when using software applications that provide or support the design analysis results and conclusions.

A.8.9.3 Purpose

A concise statement of the purpose of the analysis shall be provided. If the analysis is intended to verify that acceptance criteria are met, the acceptance criteria and their source shall be provided.

A.8.9.4 Inputs

Inputs including a description, value, unit, and their sources shall be listed. SELLER's use of input data that is different than provided by the CONTRACTOR is acceptable provided it is more conservative and that a justification with an acceptable method of comparison is provided. Inputs typically include:

- Data from applicable codes and standards.
- CONTRACTOR supplied design criteria and inputs.
- SELLER and/or third party generated data.
- Design conditions and physical data of components.

A.8.9.5 Applicable Codes and Standards

The title and version of any codes and standards used in or to support the analysis shall be listed. Use of a code or standard edition/year that is different than specified in section A.2.1 is

not permitted without prior documented approval from the CONTRACTOR/Subcontract Administrator.

A.8.9.6 Assumptions

Assumptions used in performing the analysis and the technical basis for their use shall be listed.

The technical basis shall provide a sufficiently detailed rational of why the assumption is acceptable for this analysis. Identify any technical references, standards, or published technical journals used to support the technical basis. Assumptions using preliminary data that are shown to be sufficiently bounded do not require future confirmation. Assumptions requiring future confirmation shall be clearly identified. If an analysis contains such assumptions, the document shall be marked on the first page or cover page, "CONTAINS ASSUMPTIONS REQUIRING FUTURE CONFIRMATION". Assumptions requiring future confirmation include, but are not limited to:

- Results from another SELLER's preliminary analysis or information from SELLER's preliminary drawings used in this analysis.
- Preliminary data planned to be superseded by information provided by other SELLER generated or sub-supplier documents.

A.8.9.7 Methodology

Description of how the component(s) will be analyzed shall be provided; this includes where applicable, load applications, boundary conditions, and methods of evaluation. In addition:

- Source or derivation of all major equations that are not in common usage shall be identified.
- Sufficient margin and conservatism shall be included to account for uncertainties and manufacturing tolerances. Margin and conservatism included in the analysis are identified as such.

A.8.9.8 Analysis

Documentation of calculations, manipulation of equations, or other steps necessary to process inputs and assumptions through the methodology into results shall be provided. Computations or analysis performed using a spreadsheet (e.g., Excel) shall be presented such that it can be independently reviewed and recreated. This includes displaying and printing cell formulae, macros, scripts, or strings of multiple functions. When the same formula is applied to a series of values (such as in a table), only one representative formula is necessary to be shown in the printout attached to the design analysis report.

A.8.9.9 Results and Conclusions

A concise statement addressing calculation results and recommendations that shows how the objectives were satisfied by the analysis shall be provided.

A.8.9.10 References

References shall include drawings, codes, standards, and technical publications used. Identification information such as proper title, document number, revision number, copyright date, section, and page number(s) shall be provided, so that references can be easily found. Unpublished data sources (e.g., SELLER generated documents, product catalogs, cut sheets, and internet sources) shall be attached to the design analysis report where permitted by copyright. Data sources provided as a submittal to the CONTRACTOR do not need to be attached.

A.8.10 Design Analysis Report Checking and Validation

A.8.10.1 The design analysis shall be originated (or prepared) and independently checked by individuals who are technically qualified in the subject of the analysis.

A.8.10.2 The checker shall verify the appropriateness of all aspects of the design analysis report (such as design inputs, use of software, software inputs and outputs, assumptions, methodology, application of margin and conservatism, results, references, and conclusions).

A.8.10.3 The checker shall confirm mathematical accuracy of the results by performing a numerical check using the original formula or verifying the calculation using an alternate method, such as an alternate calculation.

A.8.10.4 Alternate calculations used for checking shall be attached to the original calculation. Alternate calculations do not need to be checked.

A.8.11 Design Analysis Report Documentation and Submittals

A.8.11.1 Design analysis reports required to be completed are specified within the purchase order and shall be submitted in accordance with G-321-E form document category number 8.0 requirements.

A.8.11.2 Native format electronic files, if required to support the analysis report, shall be submitted with the analysis report.

A.8.11.3 The Software Application Use Questionnaire shall be completed and submitted to the CONTRACTOR during the bid phase and any time after award when the Supplier or sub-supplier intends to use a software application for performing computational and/or analytical analysis that provides or supports the design analysis results and conclusions.

A.9 Forms

A.9.1 Design Analysis Software Application Use Questionnaire for CM Supplier

Design Analysis Software Application Use Questionnaire for CM Supplier	
Supplier:	PO/Subcontract #:

1. List the name and version of each software application to be used in the design analysis (see Section A.1.2, Definitions) by the SELLER or any sub-suppliers. Identify any custom software applications or commercial software that has been modified by/for the Supplier or any sub-suppliers. If no software applications are to be used in the design analysis, then state "None used".

If no software applications are listed in #1 above, the Supplier or sub-supplier will not be using a software application in performance of the design analysis and the remaining questions do not need to be answered.

2. Will the SELLER or sub-suppliers be relying on **any** results produced by software applications used in the design analysis to be correct/accurate without checking the results as described in Section A.8.10? In other words, the SELLER or sub-suppliers will be relying on the software application to produce correct results without performing a mathematical check, alternate calculation, or qualification test to verify the results from the software application. ☐ Yes ☐ No

   If the response to #1 above lists any commercially available analysis software or software developed by or for the Supplier or sub-supplier (see Section A.1.2, Definitions) **and** "No" is indicated above, identify the method that will be used to verify the results are correct/accurate (e.g.; mathematical check, alternate calculation or qualification test).

   Method:

If the answer to question #2 above is "No", the remaining questions do not need to be answered.

3. Is analysis going to be performed by a sub-supplier? If yes, who are sub-suppliers and what is their scope? ☐ Yes ☐ No

   List Sub-Supplier(s) name and Sub-Supplier's Scope:

4. How many years of experience does the Supplier or sub-supplier have using each of the software applications listed in Question #1 above?

5. Does the Supplier or sub-suppliers review software error notices or reports for the software applications being used in the design analysis? ☐ Yes ☐ No

   How are the software supplier's error notifications obtained, tracked, and dispositioned by the Supplier or sub-suppliers?

   Submit any Supplier or sub-supplier procedures or instructions related to this activity.

6. What validation/acceptance testing is performed by the Supplier or sub-suppliers to ensure the software application provides correct results on the computing platform used and for the range of use in the design analysis? This activity is sometimes referred to as software verification and validation (V&V).

   Note: Identify the validation/acceptance testing for each of the software applications listed in question #1 above.

Submit any Supplier or sub-supplier procedures or instructions related to this activity.
7. How is software tested/checked for acceptable performance on the computer platform (see definition in Section A.1.2), or when significant hardware or operating system changes are made to previously tested computer platforms? This activity is referred to as in-use verification. Submit any Supplier or sub-supplier procedures or instructions related to this activity.
8. How are Supplier or sub-supplier users trained in the use of the software and any software revisions? Submit any Supplier or sub-supplier procedures or instructions related to this activity.

A.9.2 Design Analysis Report Checklist

Design Analysis Report Requirements Checklist	Yes	No	N/A
1. Are the printed name, title, signature, and date documented for the originator, checker, and approver provided in the design analysis report?			
2. Is the originator a different person than the checker?			
3. Were any software applications (see Section A.1.2, Definitions in the specification) used in to perform the analysis? **If so**, does the analysis report contain **all** the following information: a. the computer program name and version, b. the name and version of any add-on modules (e.g., plug-ins, extension packs) used, c. the computer platform including microprocessor type and model (e.g., Intel Core i7-4770), and d. operating system (e.g., Microsoft Windows 10)			
4. Does the design analysis report clearly identify the purpose of the analysis (why the analysis is being performed)?			
5. If codes and/or standards are used in the analysis, are the versions of the codes, standards, or references listed and are they consistent with the requirements?			
6. Are inputs listed and are the sources of input data identified such that independent verification of their applicability may be established?			
7. If SELLER used input data that is different than provided by the CONTRACTOR, is it more conservative and is a justification with an acceptable method of comparison provided?			
8. Are assumptions identifiable and is a technically defensible basis for their use provided?			

Design Analysis Report Requirements Checklist	Yes	No	N/A
9. Does the design analysis report contain any assumptions requiring future confirmation? **If so**, does the cover page of the design analysis report contain the following statement: "CONTAINS ASSUMPTIONS REQUIRING FUTURE CONFIRMATION"?			
10. Does the design analysis report contain a detailed description of how the component(s) will be analyzed?			
11. Does the design analysis report identify the source or derivation of all major equations that are not in common usage?			
12. Are the manipulations of equations or other steps necessary to process inputs and assumptions through the methodology into results documented?			
13. Are the outputs documented such that critical values are extracted and presented to provide assurance of the correctness of the results? Do the outputs show that they bound the problem?			
14. If commercially available, general purpose software was used to perform computations and analysis that provide or support the design analysis results and conclusions (see Section A.1.2, Definitions in the specification), does the design analysis report contain sufficient documentation to enable checking? **This includes**, displaying and printing cell formulae, macros, scripts, or strings of multiple functions.			
15. Is there sufficient margin and conservatism included to account for uncertainties and manufacturing tolerances?			
16. Do the results and conclusions provide concise statements of how each of the objectives identified in the design analysis report were satisfied by the analysis?			
17. Are published sources and references identified by document title, revision or edition, copyright date, section, page number, etc. as applicable, such that data can be readily located?			
18. Are unpublished data sources and references attached to the design analysis report where permitted by copyright?			
19. If appropriate, were native format electronic files for input, output, and option selections submitted to WTP? Were these electronic files referenced within the body of the design analysis report/design analysis report, together with a description of the files and how they are used to support the analysis?			
20. If an alternate calculation was performed by the checker, is it attached to the design analysis report and is the method used in the alternate calculation appropriate?			
21. Does the design analysis report contain sufficient detail such that a person technically qualified in the subject can review and understand the analysis and verify adequacy of the results without recourse to the originator?			

A.9.3 SELLER's Material and Test Certificate for Above-Ground Piping

PROCEDURE
Upon completion of work, inspection and tests shall be made by SELLER's representative and witnessed by a CONTRACTOR's representative. All defects shall be corrected, and system left in service before SELLER's personnel finally leave the job.

A certificate shall be filled out and signed by both representatives. Copies shall be prepared for approving authorities, CONTRACTOR, and SELLER. It is understood the CONTRACTOR's representative's signature in no way prejudices any claim against SELLER for faulty material, poor workmanship, or failure to comply with approving authority's requirements or local ordinances.

Property Name		**Date**
Property Address		
PLANS	Accepted by approving authorities (names)	
	Address	
	Installation conforms to accepted plans. Equipment used is approved. If no, explain deviation	☐ YES ☐ NO ☐ YES ☐ NO
INSTRUCTIONS	Has person in charge of fire equipment been instructed as to location of control valves and care and maintenance of this new equipment? If no, explain	☐ YES ☐ NO
	Have copies of the following been left on the premises: 1. System Components Instructions 2. Care and Maintenance Instructions 3. NFPA 25	☐ YES ☐ NO ☐ YES ☐ NO ☐ YES ☐ NO
LOCATION OF SYSTEM	Supplies Buildings	

SPRINKLERS	Make	Model	Year of Manufacture	Orifice Size	Quantity	Temperature Rating

PIPE AND FITTINGS	Type of Pipe Type of Fittings

ALARM VALVE OR FLOW INDICATOR	Alarm Device			Maximum Time to Operate Through Test Connection	
	Type	Make	Model	Minutes	Seconds

DRY PIPE OPERATING TEST	Dry Valve			Q.O.D. *		
	Make	Model	Serial No.	Make	Model	Serial No.

	Time to Trip Thru Test Connection*		Water Pressure	Air Pressure	Trip Point Air Pressure	Time Water Reached Test Outlet*		Alarm Operated Properly	
	Min	Sec	psi	psi	psi	Min	Sec	Yes	No
Without Q.O.D. *									
With Q.O.D. *									

If no, explain.

DELUGE & PREACTION VALVES		
	Operation ☐ Pneumatic ☐ Electric ☐ Hydraulic	
	Piping Supervised ☐ YES ☐ NO	Detecting media supervised ☐ YES ☐ NO
	Does valve operate from the manual trip and/or remote control stations ☐ YES ☐ NO	

*Measured from time inspector's test connection is opened. * Quick Operating Device

DELUGE & PREACTION) VALVES (continued	Is there an accessible facility in each circuit for testing ☐ YES ☐ NO				If no, explain			
	Make	Model	Does Each Circuit Operate Supervision Loss Alarm		Does Each Circuit Operate Valve Release		Maximum Time to Operate Release	
			Yes	No	Yes	No	Min	Sec
PRESSURE REDUCING VALVE TEST	Location & Floor	Make & Model	Setting	Static Pressure		Residual Pressure (Flowing)		Flow Rate
				Inlet (PSI)	Outlet (PSI)	Inlet (PSI)	Outlet (PSI)	Flow (GPM)
TEST DESCRIPTION	Hydrostatic: Hydrostatic test shall be made at not less than 225 psi (15.3 bars) for two hours or 50 psi (3.4 bars) above static pressure in excess of 150 psi (10.2 bars) for two hours. Differential dry-pipe valve clappers shall be left open during test to prevent damage. All aboveground piping leakage shall be stopped.							
	Pneumatic: Establish 40 psi (2.7 bars) air pressure and measure drop that shall not exceed 1-1/2 psi (0.1 bars) in 24 hours. Test pressure tanks at normal water level and air pressure and measure air pressure drop that shall not exceed 1-½ psi (0.1 bars) in 24 hours.							
TESTS	All piping hydrostatically tested at ___ psi for ___ hrs. Dry piping pneumatically tested ☐ YES ☐ NO Equipment operates properly ☐ YES ☐ NO				If no, state reason			
	Do you certify as the Sprinkler CONTRACTOR that additives and corrosive chemicals, sodium silicate or derivatives of sodium silicate, brine, or other corrosive chemicals were not used for testing systems or stopping leaks? ☐ YES ☐ NO							
	Drain Test	Reading of gage located near water supply test connection: ___ psi			Residual pressure with valve in test connection open wide ___ psi.			
	Underground mains and lead in connections to system risers flushed before connection made to sprinkler piping. Verified by copy of the U Form No. 85B ☐ YES ☐ NO ☐ Other Explain Flushed by installer of underground sprinkler piping ☐ YES ☐ NO							
	If powder driven fasteners are used in concrete, has representative sample testing been satisfactorily completed ☐ YES ☐ NO						If no, explain	
BLANK TESTING GASKETS	Number Used		Locations				Number Removed	
WELDING	Welding piping ☐ YES ☐ NO							
	If yes...							
	Do you certify as the sprinkler contractor that welding procedures comply with the requirements of at least AWS B2.1? ☐ YES ☐ NO							
	Do you certify that the welding was performed by welders qualified in compliance with the requirements of at least AWS B2.1? ☐ YES ☐ NO							
	Do you certify that the welding was carried out in compliance with a documented quality control procedure to ensure that all discs are retrieved, that openings in piping are smooth, that slag and other welding residue are removed, and that the internal diameters of piping are not penetrated? ☐ YES ☐ NO							
CUTOUTS (DISCS)	Do you certify that you have a control feature that all cutouts (discs) are retrieved?							
HYDRAULIC DATA NAMEPLATE	Name Plate Provided ☐ YES ☐ NO				If no, explain			
REMARKS	Date left in service with all control valves open:							
SIGNATURES	Name of Sprinkler SELLER							
	Tests Witnessed By							
	For CONTRACTOR (Signed)		Title		Date			
	For Sprinkler SELLER (Signed)		Title		Date			

A.9.4 SELLER's Fire Protection Installation Final Inspection Form

WTP FIRE PROTECTION INSTALLATION
FINAL INSPECTION FORM

Sprinkler SELLER name and address	_____ _____ _____
Facility Inspected Building/System No./ Control Valve No.	_____ _____ _____
Inspection by: Name Address Phone	_____ _____ _____ _____ _____ PE or CET No: _____

I have personally inspected the automatic sprinkler system referenced above and found it to be installed in accordance with the approved working drawings and associated review comments. The attached As-Built drawings and hydraulic calculations reflect the installation as it presently exists.

The following is the results of the main drain test conducted during my inspection:

Static Pressure: _____ Psig
Residual Pressure: _____ Psig

I certify that areas of the building covered by the above referenced system have been protected in accordance with NFPA, the project specifications, and signs and placards have been installed.

_____ Date:
(Signed by SELLER'S PE or CET)

Comments or Exceptions:

Appendix B Fire Detection and Alarm System

Contents

B.1 Scope

This appendix describes an integrated Notifier fire detection and alarm system, for the BOF Switchgear Building (B34), using intelligent addressable devices in full compliance with National Fire Protection Association (NFPA) 72 – 2022, Factory Mutual (FM) Data Sheet 5-40 – Sept. 2007, and FM Data Sheet 5-48 – Oct. 2021. The features described in this appendix are a requirement for this Project and shall be furnished by SELLER.

B.1.1 Equipment, Material, and Services Required

B.1.1.1 CONTRACTOR shall design, install, and test the fire detection and alarm system(s) in new condition. The system shall include all required hardware, wiring within panels, programming, and software to accomplish the requirements of this appendix.

B.1.1.2 All equipment furnished shall be new and product of a single manufacturer (Notifier), engaged in the manufacturing and sale of intelligent fire alarm devices for over five years. Each device supplied by a manufacturer different than that of the designated fire alarm equipment shall be listed as compatible with the furnished system.

B.1.1.3 It will be the responsibility of SELLER to design and approve the installation of the fire alarm devices in conjunction with the local AHJ.

B.1.1.4 It will be the responsibility of the SELLER to perform initial programming and acceptance testing of the SELLER designed components in both a standalone configuration and integrated configuration as required by NFPA 72 and this appendix.

B.1.1.5 The system shall include, but not be limited to the following elements:

a. Fire alarm control units, including all required modules, attachments, and interconnecting cables.
b. Integrated facility Monitoring
c. Emergency Voice Evacuation System
d. Circuit interface panels including all modules.
e. Power supplies, batteries, and battery chargers.
f. Equipment enclosures.
g. Intelligent devices such as manual pull stations, smoke detectors, alarm monitoring modules, monitor modules, relay modules, and supervised control modules.
h. Printers and video display terminals.
i. Audible (speakers) occupant notification devices.
j. Visual strobe occupant notification devices.
k. Historical archiving.
l. The latest revision of all software and firmware to provide a complete functioning system in both a networked and standalone configuration.
m. Wiring type and color scheme.

n. Fiber optic interface modules for high-speed networking.

o. List of spare parts used in the fire alarm control.

B.1.2 Acronyms

Following are acronyms shown in this specification:

AHJ	Authority Having Jurisdiction
ATP	Acceptance Test Procedure
CFM	Cubic Feet per Minute
COTS	Commercial-off-the-shelf
DAA	Digital Audio Amplifier
DVC-EM	Digital Voice Control – Extended Memory
FACP	Fire Alarm Control Panel
FM	Factory Mutual Global
FPM	Feet per Minute
HFD	Hanford Fire Department
ICN	Integrated Control Network
IDC	Initiating Device Circuit
LCD	Liquid Crystal Display
MFA	Manual Fire Alarm
NAC	Notification Appliance Circuit
NEC	National Electrical Code
NFPA	National Fire Protection Association
RFAR	Radio Fire Alarm Reporting
SLC	Signal Line Circuit
SPKR	Speaker
UL	Underwriters Laboratories, Inc.

B.1.3 Qualifications of the Fire Alarm SELLER

B.1.3.1 Before commencing work, SELLER shall submit data showing that the fire alarm equipment to be installed represents the design as specified.

B.1.3.2 SELLER shall have in his employ, a NICET Level IV, Certified Senior Engineering Technician(s), assigned to oversee this contract during the entire contract period.

B.1.3.3 SELLER shall provide the services of NICET Level III, Certified Engineering factory-trained technician(s), experienced in the installation and operation of the type of system proposed as a minimum for field activities.

B.2 Applicable Documents

B.2.1 Codes and Standards

The publications listed below form a part of the Fire Detection and Alarm System requirements. The publications are referenced in the text by the basic designation only. The indicated version of each publication shall be used.

a. Factory Mutual (FM) - FM Fire Protection Approval Guide

b. Factory Mutual Data Sheet 5-40, Fire Alarm Systems, Sept. 2007 edition.

c. Factory Mutual Data Sheet 5-48, Automatic Fire Detection, Oct. 2021 edition.

d. International Building Code (IBC), 2021 edition

e. International Fire Code (IFC), 2021 edition

f. NFPA 70 National Electrical Code, 2023 edition.

g. NFPA 72 National Fire Alarm and Signaling Code, 2022 edition.

h. NFPA 90A, Standard for the Installation of Air-Conditioning and Ventilating Systems, 2021 edition.

i. NFPA 101 Life Safety Code, 2021 edition.

j. NFPA 170 Standard for Fire Safety and Emergency Symbols, 2021 edition.

k. Underwriters Laboratories (UL) - Fire Protection Equipment Directory

B.3 Design Requirements

B.3.1 Basic Function

B.3.1.1 The system shall support addressable smoke detection, manual stations, monitor modules, relay modules, control modules, digital voice control, remote annunciation, digital audio amplifiers, power supplies, batteries, etc.

B.3.1.2 The fire alarm control panel shall be UL listed as a test instrument for the measurement of the sensitivity of connected intelligent photoelectric smoke detectors to comply with the testing requirements of NFPA 72. The control panel shall be capable of displaying sensitivity readings.

B.3.1.3 The system shall be electrically supervised, with alarm & supervisory initiation devices installed on Signaling Line Circuits (SLC) designed as Class B as a minimum. Devices connected to the signaling circuit shall be individually identifiable at the control panel for alarm or supervisory indication and unique identification.

B.3.1.4 Area Detectors and intelligent Duck Smoke Detectors shall be interrogated for sensitivity settings from the control panel as described in NFPA 72 and logged into the panels event history file. Sensitivity settings of individual detectors shall be automatically or manually adjusted from the control panel.

B.3.1.5 Any system connected photoelectric smoke detector shall be capable of self-adjustment to compensate for the accumulation of contaminants that would change the detector sensitivity in either a more or less sensitive direction.

B.3.1.6 The system shall annunciate a trouble condition when any smoke detector approaches 80% of its alarm threshold due to gradual contamination, signaling the need for service and eliminating unwanted alarms.

B.3.1.7 The trouble report shall annunciate the specific location of the smoke detector requiring service. All smoke detectors installed in the system shall include this feature.

B.3.1.8 The visual notification appliance circuits shall be connected in the fire alarm control panel enclosure or in the auxiliary power supply enclosures. The circuits used for audible (speaker) signals shall be connected inside the fire alarm control panel enclosure or audio amplifier enclosure. The circuits shall be installed as Class B as a minimum.

B.3.1.9 All fire alarm circuits shall be installed as power limited circuits per article 760 of the National Electrical Code.

B.3.1.10 Power limitation shall be provided using on board self-restoring solid-state thermal devices. Units using fuses for this purpose and requiring board replacement or exchange are not considered equal.

B.3.1.11 Fire alarm circuits (SLC, NAC, SPKR, IDC) and power supply loading shall not exceed 80% of their rated capacity.

B.3.1.12 The system shall be designed to provide spare capacity of the components such that the existing system does not exceed 80% of its maximum capacity for devices.

B.3.1.13 The system shall be compatible with the existing Notifier panels, equipment, and associated NOTI-FIRE-NET™ High-Speed network. All panels when networked shall report to a common integrated monitoring system, ONYXWorks workstation, that can be installed anywhere on the network.

B.3.1.14 Locate the Fire Alarm Control Panel at the entrance to the building in accordance with BOD Section 13.3.3.5

B.3.2 Fire Alarm System Zoning

B.3.2.1 Each addressable device or zone on the system shall be displayed at the local fire alarm control panel by a contactor approved unique alphanumeric label identifying its location.

B.3.3 Fire Alarm Reporting System Operation

B.3.3.1 The fire alarm control panel shall have the capability to operate in two distinct configurations: standalone and networked. All panels shall ultimately operate in the networked configuration. However, they will initially operate as a standalone system.

B.3.3.2 The fire alarm system shall be capable of performing a dual role as a mass notification system capable of emergency live voice announcements to a single building, group of buildings, or all areas when networked.

B.3.3.3 Activation of any fire alarm initiating device in the standalone configuration shall cause the following local actions and indications:

a. Display a message describing the device originating the alarm condition at the fire alarm control panel LCD alphanumeric display in the building. Remote LCD annunciators shall display the alarm condition.

b. Sound the audible circuits and activate visual signals. Audible signals, other than the NFPA 13 required waterflow alarm, shall be silenceable from the fire alarm control panel by an alarm silence switch. The audible alarm signals shall resound for a subsequent alarm condition, reported by a different device.

c. Activate the HFD radio transmitting signaling system (RFAR).

B.3.3.4 Activation of any supervisory circuit shall cause the following actions and indications:

a. Display the origin of the supervisory condition report at the Fire Alarm Control Panel and at the remote annunciator alphanumeric LCD display.

b. Activate supervisory audible and visual signals as required per NFPA 72.

c. Audible supervisory signals shall be silenceable from the fire alarm control panel by an acknowledge switch. The supervisory indication shall be transferred to a visual indicator on the control panel and the supervisory signals shall resound for a subsequent supervisory condition, reported by a different device.

B.3.3.5 Receipt of a trouble report (primary power loss, open or grounded initiating or signaling circuit wiring, open, grounded, or shorted indication system wiring, device communication failure, battery disconnect, or similar trouble condition) at the fire alarm control panel shall cause the following actions and indications:

a. Display at the fire alarm control panel LCD display the origin of the trouble condition.

b. Activate the signaling system transmitter to the Hanford Fire Department (HFD).

B.3.4 Integrated Building Monitoring

B.3.4.1 The building monitoring shall be provided using the latest UL listed operating system available, current Windows, based ONYXWorks workstation with connections for high speed fiber optics Noti-Fire-Net™ connection, touch screen monitors, and UPS power supplies.

B.3.5 Pre-Action Sprinkler System Releasing Panels

B.3.5.1 One panel shall be provided for the pre-action system.

B.3.5.2 Releasing panels shall be NFS-320 fire alarm panels.

B.3.5.3 Releasing panels shall be networked, using the Noti-Fire-Net™, with the building fire alarm system.

B.3.5.4 Activation, suppression system monitoring, and releasing shall be from devices connected directly to the releasing panel.

B.3.5.5 Fire alarm notification appliances shall be provided in the protected area and controlled by the building fire alarm control panel.

B.3.5.6 The releasing panel for the Switchgear Building shall be located in the doghouse.

B.3.6 Key Locking of Panels

B.3.6.1 Fire alarm panel equipment shall be housed in key locked control cabinets. Two keys shall be furnished for each lock.

B.3.7 Device and Wire Labels

B.3.7.1 All devices, cables, and wires shall be labeled per SELLER's design drawings and the requirements below.

B.3.7.2 Labels inside of an enclosure.

a. Devices within enclosures are assigned an alphanumeric identifier representative of the device model number. (i.e., AMG, LCM)

b. One of the following wiring identification methods shall be used:

- Destination wiring method. For example, near the terminal where the wire leaves the device, the wire shall be labeled identifying its destination device and terminal. Similarly, at the opposite end, the wire will have a different label identifying the origination device and terminal. Short jumpers between terminals on the same device do not require labels.
- Wire identification method. For example, near the terminal where the wire leaves the device, the wire shall be labeled with a 3-digit sequential number. (e.g., 100). The opposite end of the wire shall have the same 3-digit number. Short jumpers between terminals on the same device only need a single identification.

B.3.7.3 Labeling between enclosures or field devices.

a. Field devices are assigned an alphanumeric identifier depending on the type of system involved. For addressable fire alarm systems, the device is given an alphanumeric identifier corresponding to the device address assigned within the software of the microprocessor.

b. When wiring from one enclosure to another enclosure or field device, one of the following wiring identification methods shall be used:

- When wiring from one enclosure to another enclosure or field device, the wire shall be numbered, and the wire label shall be maintained at both ends of the wire. The label and number should be sequential and shall be unique from any other label used in the installation.
- Destination wiring method. For example, near the terminal where the wire leaves the device, the wire shall be labeled identifying its destination device. Similarly,

at the opposite end the wire will have a different label identifying the origination device. Short jumpers between terminals on the same device do not require labels.

- Devices with multiple terminals: When the terminals for the wires entering the device are different than the terminals used for the wires leaving the device, an extension shall be added to the wire label identifying where the wire is to be connected.

B.3.8 Fire Alarm Reporting

B.3.8.1 Radio Transceiver

a. The site fire alarm system transmits signals to the Hanford Fire Department using a Monaco BT-X communicator. The fire alarm SELLER is responsible for providing all engineering necessary to connect this municipal box system to the switchgear building fire alarm system. The equipment for the installation will be obtained from the Hanford Fire Department. Final connection and antenna alignment of the system will be made by others.

B.4 Materials

B.4.1 Fire Alarm Control Panel

B.4.1.1 The fire alarm control panels shall consist of Notifier units with connecting cables, modules, circuitry, and other basic parts required to function as specified.

B.4.1.2 FACP shall support remote system displays, annunciators, and printers. All fire detection, alarm, and indicating devices supported by the panel shall function as a self-standing system in the fail-safe mode.

B.4.1.3 Class “B” system digital communication capabilities are required for the control panel to communicate with remote circuit interface panels, annunciators, and displays. All communications shall be conducted in a digital format.

B.4.1.4 Commercial-off-the-shelf (COTS) controls: Procured packaged systems considered as COTS are acceptable for integration into the ICN systems. For this determination, COTS controls are control hardware/software which do not require customization or design engineering for use. The SELLER shall supply the interface to the ICN using ICN supported communication hardware as follows:

Package Description		Interface	Media
Status Only-No control via ICN	Significant data exchange	OPC over Ethernet	Fiber Optic

B.4.1.5 FACP’s shall be programmed to transmit status output via RS-232, RS-485 connection or the Noti-Fire-Net™. The connection will be made by others.

Package Description	Interface	Media

RS-232 RS-485	Status output over serial data exchange	Via RS-232 Via RS-485	Copper

B.4.1.6 FACP Shall provide a dry contact for a General / Common Fire Alarm hardwired digital signal to the Switchgear Building B34 Control Panels located in the C&I Room

B.4.2 Fire Alarm System Power Supplies

B.4.2.1 Primary Power Supply

a. Primary power for the FACP and battery chargers shall each be obtained from the Contractor supplied 120 VAC source. Circuit breakers shall be marked red, fitted with a listed breaker locking device, and used only for fire alarm. Each circuit used for fire alarm purposes shall be permanently labeled “Fire Alarm”.

B.4.2.2 Secondary Power Supply

a. Provide rechargeable, sealed-type storage batteries and a battery charger.
   - The secondary power supply for emergency voice/alarm communications service shall be capable of operating the system under quiescent load for a minimum of 24 hours and then shall be capable of operating the system during a fire or other emergency condition for a period of 15 minutes at maximum connected load.
   - The secondary power supply for preaction or deluge system releasing service shall be capable of operating the system under quiescent load for a minimum of 90 hours and then shall be capable of operating the system under release power and alarm operations for a period of 10 minutes.
   - The required load used to size batteries shall be determined by adding a safety factor of 20% to the calculated load.

b. Provide battery-charging circuitry for each standby battery bank in the low voltage power supply or as a separate circuit. The charger shall be automatic in design, adjusting the charge rate to the condition of the batteries, and capable of restoring all batteries from full discharge to full charge in forty-eight (48) hours.

c. Battery chargers/power supplies shall be addressable and supervised, where possible.

B.4.3 Audio

B.4.3.1 Voice Notification: Provide emergency voice/alarm communications with multichannel capability, using Notifier DVC-EM command capable of controlling up to 32 digital audio amplifiers.

B.4.3.2 Audio Amplifiers: All amplifiers shall be digital Notifier DAA2-Series, having a 25VRMS output.

B.4.4 Smoke Detectors, Intelligent Photoelectric

B.4.4.1 Furnish and install intelligent photoelectric smoke detectors as required, with features and characteristics as follows:

B.4.4.2 The detector shall be self-compensating for ambient temperature and humidity. The detector shall be addressed and tested prior to installation. The detector readout shall yield a discrete value for status tracking and logging for determining maintenance and cleaning requirements.

B.4.4.3 The control panel shall provide sensitivity readout from the detector without removal from the pluggable base.

B.4.4.4 The detector shall display a rapidly flashing or solid LED when in the Alarm State. The LED shall flash at a slow rate when the detector is in the normal non-alarm condition. The conditions shall occur whenever the system is operating from normal or standby power.

B.4.4.5 Sensitivity assignments shall be set electronically. The detectors shall be assigned a sensitivity level based on environment, time of day or any programmable function as required by the system user, and shall respond at that level whether in the “online” or “default” mode.

B.4.4.6 Detectors shall be supplied with the feature enabling the detector to maintain a constant programmed sensitivity within the environment installed, regardless of contaminant accumulation. This feature shall compensate by increasing or decreasing the alarm threshold, dependent on the ambient detector chamber value, eliminating failure to detect at the desired level and unwanted alarms at lower levels.

B.4.4.7 The detectors furnished shall be listed for use in environments as covered by Factory Mutual, UL-268 (UROX) and shall be installed according to the requirements of NFPA 72. Where applicable, detectors shall be listed for in duct use in air velocities between 0 and 4000 FPM in addition to open area coverage. Manufacturer temperature conditions shall also be followed.

B.4.4.8 Smoke detectors shall alarm at their programmed sensitivity settings and shall not revert to a common default setting when their operating system segment is in the default mode. Detectors installed shall be FSP-851 series, addressable photoelectric detector, with B210LP series base using flash scan communications technology or Contractor approved equal.

B.4.5 Duct Smoke Detectors (if required)

B.4.5.1 Intelligent UL listed photoelectric duct smoke detectors shall be installed in the supply ducts of re-circulating air handling systems that have a minimum supply air capacity of 2000 CFM. If the return air has a capacity in excess of 15,000 CFM, a smoke detector shall be installed in the return and supply air ducts.

B.4.5.2 The duct smoke detectors shall be installed in accordance with the manufacturer’s installation instructions and NFPA 90A, and NFPA 72.

B.4.5.3 SELLER shall test and certify the duct smoke detectors per manufacturer’s requirements.

B.4.5.4 SELLER supplied duct detectors shall be Notifier InnovairFlex DNR intelligent photoelectric Duct Smoke Detector with optional remote key lock test station and optional relay module with Flash Scan communications protocol or approved equal.

B.4.6 Manual Fire Alarm Station (MFA), Intelligent

B.4.6.1 Provide MFA with double action feature, intelligent manual stations with key lock/reset. Notifier NOT-NBG12LX or approved equal.

B.4.6.2 Station shall be equipped with terminal strip and pressure style screw terminals for the connection of field wiring.

B.4.6.3 The manual stations shall be addressable and identifiable by the fire alarm control panel using flash scan communications technology.

B.4.6.4 The MFA shall use a key to reset the station after an alarm or test.

B.4.7 Monitor Module

B.4.7.1 Provide for integration of compatible two wire and shorting style contact devices into the signal line circuit with the following capabilities:

a. Communication interaction with the analog signaling circuit having the capability of reporting alarm or trouble conditions from the devices monitored.

b. Compatible with ionization, photoelectric, and all listed contact type devices including 4-wire devices.

c. Module shall be equipped with terminal strip and pressure style screw terminals for the connection of the device and systems communications field wiring. The module shall also have an on-board alarm LED furnished with the cover plate. Mini monitor modules maybe used as an exception without requiring screw terminals where required and with the concurrence of the fire protection AHJ.

d. The module shall be addressable and identifiable by the master fire alarm control panel.

e. Modules shall be installed using industry standard 4” square electrical outlet boxes; flush, surface, and/or weatherproof as required.

f. Monitor modules shall use flash scan communications technology.

B.4.8 Control and Relay Module

B.4.8.1 Furnish and install, for the control of electrical devices where required, intelligent analog signaling circuit interface module. Modules shall be supplied to meet the project requirements as follows:

a. Unit with form C software programmable control contacts for the management of specified electrical loads as required by this attachment.

b. The module shall be suitable for two wire two-way communications on the intelligent analog signaling line circuit using flash scan communications technology.

B.4.9 Occupant Notification Devices

B.4.9.1 Furnish and install, as required, speaker/visual signals with the following characteristics and capacities:

a. Speakers Characteristics:
   - Minimum sound output rating of 75 dBA at 10 feet with a full (2-watt) power tap and a maximum not exceeding 120 dBA.
   - Speakers shall be field adjustable with dual voltage and adjustable tap settings.
   - Speakers shall be void of lettering.

b. Visual Notification Appliance Characteristics:
   - Light intensity of 15, 15/75, 30, 75 or 110 candela complying with the NFPA 72.
   - Xenon strobe with a minimum repetition rate of 1 HZ, not exceeding 3 HZ and a maximum duty cycle of 40% with pulse duration of 0.2 seconds.
   - Unfiltered or clear filtered white light.

c. The occupant notification devices shall be available in audible only, visual only, and a combination to satisfy all required project applications.

d. All visual notification appliances within one area shall be synchronized.

e. Notification appliance circuits shall be configured so that, at alarm level, the voltage drop at the end of the circuit does not exceed 80% of the manufacturer's specified limit. In addition, notification appliance circuit loading shall not exceed 80% of its rated capacity.

f. Audible notification appliances intended for operation shall meet the requirements of NFPA 72 at the minimum hearing distance from the audible appliance. Audible information shall be verified to be distinguishable and understandable.

g. To ensure that the audible public mode signals are clearly heard, they shall have a sound level of at least 15 dBA above the average ambient sound level or 5 dBA above the maximum sound level having duration of at least 60 seconds, whichever is greater, measured 5 ft. above the floor.

h. All strobes shall be labeled “ALERT” after effective date of this specification.

B.4.10 Fire Alarm Circuit Surge Protection

a. SLC Loop: EDCO SLCP Series (SLCP-30 Vdc clamping)

b. IDC Circuit: EDCO SLCP Series (SLCP-30 Vdc clamping)

c. NAC Circuits: EDCO PHC Series (PHC-043 Vdc clamping)

d. Audio Speaker Circuits: EDCO PHCSP Series (PHC-SP70)

e. EIA-485 circuits: EDCO PC642C Series (PC642C-008LC Vdc clamping)

f. 24 Vdc: EDCO PHC Series (PHC-043 Vdc clamping)

B.5 Execution

B.5.1 Design Drawings

B.5.1.1 SELLER shall provide a general layout of the complete system including equipment arrangement. It shall be the responsibility of SELLER to verify dimensions and assure compatibility with all other systems interfacing with the fire alarm system. SELLER shall:

a. Identify on the drawings number of conductors, conductor sizes, and types of conductors. Provide cable and device with a unique identification. For alarm initiation devices the system identifier shall be the system address for that device. Signals shall be sequentially numbered as the address of the controlling module.

b. Indicate, on the point-to-point wiring diagrams, interconnecting wiring within the panel between modules and connecting wiring to the field device terminals.

c. Provide mounting details of FACP and other boxes to building structure, showing fastener type, sizes, material, and embedded depth where applicable.

B.5.2 Grounding and Bonding

B.5.2.1 Grounding and bonding shall be per the requirements of the equipment manufacturer in compliance with National Electric Code (NEC) requirements.

B.5.2.2 Grounding and bonding of shielded cables shall use approved materials and methods specified by the equipment manufacturer in compliance NEC requirements.

B.5.3 Boxes, Enclosures and Wiring Devices

B.5.3.1 SELLER purchased devices for the fire detection and alarms systems shall be installed by CONTRACTOR in accordance with the manufacturer's and SELLER installation instructions and drawings.

B.5.3.2 After installing wiring devices, CONTRACTOR will perform tests for ground faults, stray voltage, short circuit faults, loop resistance, circuit integrity per NFPA 72 and compliance with the equipment manufacturer's requirements.

B.5.4 Fire Alarm Wire and Cable

B.5.4.1 Fire alarm wire and cable shall be as follows or CONTACTOR approved equivalent. Wiring types and styles shall comply with the NFPA 70 and NFPA 72.

B.5.4.2 Signaling Line Circuit (SLC): #16 AWG minimum, #14 maximum, twisted pair, NEC type FPLR, 300 Volt, 75°C.

B.5.4.3 Initiating Device Circuit (IDC): #16 AWG minimum, NEC type FPLR, 300 Volt, 75°C or #16 AWG minimum solid copper, NEC type THHN/TWHN, 600 Volt, 90°C.

B.5.4.4 Power Supply Circuits (24Vdc): #14 AWG minimum, NEC type FPLR, 300 Volt, 75°C.

B.5.4.5 Strobe Circuits (NAC): #14 AWG minimum, twisted pair, NEC type FPLR, 300 Volt, 75°C.

B.5.4.6 Speaker Circuits: #14 AWG minimum, twisted shielded pair, NEC type FPLR, 300 Volt, 75°C

B.5.5 Surge Protection

B.5.5.1 Surge protection shall be provided in accordance with the fire alarm panel manufacturer requirements and NFPA 70 as follows:

B.5.5.2 Equipment Connected to Alternating Current Circuits: Maximum let through voltage of 350 V(ac), line-to-neutral, and 350 V(ac), line-to-line; do not use fuses.

B.5.5.3 Provide surge protection at each point where Initiating Device, Notification Appliance, Signal Line, and Communications circuits exit or enter a building; rated to protect applicable equipment.

B.5.6 Splices and Cable Terminations

B.5.6.1 SELLER shall ensure proper attachment and tightening of cable connectors to terminal blocks.

B.5.6.2 Splices will not be allowed in any area except on terminal strips in locations approved by CONTRACTOR with the exception of connecting to a mini-monitor module, pigtails from tamper switches, and at T-tap locations. T-tapping shall only occur at device locations.

B.5.6.3 SELLER shall ensure that assembly and testing of special cables, connectors, and plugs is performed per manufacturer's direction or applicable engineering instruction.

B.5.6.4 SELLER shall ensure the color coding of the conductors and cable, and installation of cable marker, as applicable.

B.5.7 Programming

B.5.7.1 In addition to the minimum requirements of NFPA 72 the fire alarm panels shall be programmed in two phases to achieve the following results:

a. Initial Phase Stand Alone Configuration:

- Programming shall be submitted for review prior to downloading to the fire alarm panel.
- Panel shall individually identify each initiating device with a type and location description, such as "MFA #2 NW Corner Building Exit" or "Smoke detector SW area building 34." Intention is to provide sufficient information to emergency response personnel to rapidly evaluate the alarm and respond to the area.
- Fire alarms associated with area smoke detection, fire detection, waterflow, or special hazard system activation shall evacuate the building.
- Duct smoke detectors shall send a supervisory signal upon activation.
- Panel shall activate strobes and fire alarm audio upon operation of any area smoke detection, waterflow, or manual pull station. Audio shall be silenceable, and strobes shall be capable of being turned off until a new initiating event is received or the fire alarm is cleared and the panel reset.
- Panel shall report all alarm, trouble, and supervisory messages to the remote annunciator where installed.
- Building evacuation for fire alarms shall be accomplished by using a recorded voice message preceded and followed by a three-pulse temporal pattern. This sequence shall repeat continuously until silenced.

b. Networked Configuration

- Programming shall be submitted for review prior to downloading to the fire alarm panel.

- Panel shall individually identify each initiating device with a type and location description such as “MFA #2 NW Corner Building Exit” or “Smoke detector SW area building 34.” Intention is to provide sufficient information to emergency response personnel to rapidly evaluate the alarm and respond to the area.
- Fire alarms associated with area smoke detection, fire detection, waterflow, manual pull stations, or special hazard system activation shall evacuate the building.
- Duct smoke detectors shall send a supervisory signal upon activation.
- Panel shall activate strobes and fire alarm audio upon operation of any area smoke detection, waterflow, or manual pull station. Audio shall be silenceable; however, strobes shall continue to function until the fire alarm is cleared and the panel reset.
- Panel shall report all alarm, trouble and supervisory messages to the remote annunciator where installed.
- The emergency notification portion of the fire alarm system shall be programmed to provide a priority to the various messages it will have to deliver. Priorities shall be ranked from 1 to 10 with 1 being the highest and 10 the lowest. Higher priority messages shall override lower priority messages.
- Building evacuation for fire alarms shall be accomplished by using a recorded voice message preceded and followed by a three-pulse temporal pattern. This sequence shall repeat continuously until silenced. (Rank 4)
- Building evacuation for reasons other than fire shall be accomplished by using a recorded tone supplied by the CONTRACTOR. Activation of this tone shall be accomplished using cooperative control by event. (Rank 2)
- Take cover announcements shall be accomplished by using a recorded tone supplied by the CONTRACTOR. Activation of this tone shall be accomplished using cooperative control by event. (Rank 3)
- Emergency live voice announcements shall be the highest priority. (Rank 1)
- The announcement system shall be programmed to allow non-emergency announcements (Rank 9)
- The announcement system shall be programmed to allow music or other audio to be played from the speakers, but this shall be lowest ranked audio signal. (Rank 10)

B.6 Tests and Inspections

B.6.1 Acceptance Test Procedure (ATP)

B.6.1.1 The entire system shall be tested in accordance with a written ATP to demonstrate and certify proper system operation. The ATP shall be prepared by SELLER and submitted for approval six (6) weeks or more prior to the performance of the ATP. As a minimum, the ATP shall provide a detailed, step-by-step method of testing the following to demonstrate that the system functions as intended by the design:

a. The ATP shall verify and document the readout on the control panel and any remote annunciators correctly identifies each device and circuit being tested. The message associated with each device shall be noted in the test procedure.

b. The ATP shall verify and document the tap setting of the speakers in the final installed condition.

c. The ATP shall verify all relays, installed to provide outputs for other systems to monitor, and control modules function as intended even if the output from these devices is not currently used or in service.

d. The ATP shall verify the ONYXWorks station correctly displays and identifies each device and trouble or supervisory messages.

e. The ATP shall allow for any special test requests from the AHJ's monitoring the testing.

f. The ATP shall provide for final signatures from the following organizations:

- WTP Fire Protection Engineering
- WTP Fire Marshall

B.6.2 Testing of Metallic Conductors by installing Contractor

B.6.2.1 Stray Voltage - All installation conductors shall be tested with a volt/ohmmeter to verify that there are no stray (unwanted) voltages between installation conductors or between installation conductors and ground. Unless a different threshold is specified in the system installed equipment manufacturer's specifications, the maximum allowable stray voltage shall not exceed 1 volt ac/dc. (NFPA 72, 2022 edition, Table 14.4.3.2, 15(1))

B.6.2.2 Loop Resistance -With each initiating and indicating circuit installation conductor pair short circuited at the far end, the resistance of each circuit shall be measured and recorded. It shall be verified that the loop resistance does not exceed the limits specified in the manufacturer's published instructions for the installed equipment. (NFPA 72, 2022 edition, Table 14.4.3.2, 15(4))

B.6.2.3 Short-Circuit Faults – Test all installation conductors, other than those intentionally connected together, for conductor-to-conductor isolation per the manufacturer's published instructions for the installed equipment. Also test these same circuits conductor-to-ground. (NFPA 72, 2022 edition, Table 14.4.3.2, 15(3))

B.6.2.4 Ground Faults – Test all installation conductors, other than those intentionally and permanently grounded, for isolation from ground per the installed equipment manufacturer's published instructions. (NFPA 72, 2022 edition, Table 14.4.3.2, 15(2))

B.6.3 Testing of Nonmetallic Conductors by installing Contractor

B.6.3.1 Optical fiber cables – Test the transmission characteristics of optical fibers by the use of an optical power meter or by an optical time domain reflectometer used to measure the relative power loss of the line. Test result data must meet or exceed ANSI/TIA 568.3, Optical Fiber Cabling and Components Standard, related to fiber-optic lines and connection / splice losses and the control unit manufacturer's publisher specification. (NFPA 72, 2022 edition, Table 14.4.3.2, 16(1))

B.7 Quality Assurance

B.7.1 QA Requirements specific to item(s) or service

B.7.1.1 SELLER and their sub-tiers (if applicable) shall have a quality management system that controls the design, manufacturing, testing, inspection, and certification of their products.

B.7.1.2 CONTRACTOR reserves the right to audit the SELLER and their sub-tier's (if applicable) quality management system. The audit is to verify compliance with all requirements of this appendix, terms and condition of the purchase order.

B.8 Documentation and Submittals

B.8.1 Submittals

B.8.1.1 Equipment Information:

a. Manufacturer Cut Sheets including model number, and technical information.
b. Installation Manuals
c. Programming Manuals
d. Operation Manuals
e. Recommended testing and maintenance schedule for all equipment, including a recommended spare parts list.
f. Copy of site-specific software unique to each panel:
   - Hard copy print out and in PDF format.
   - Native electronic file on CD or DVD

B.8.1.2 Installation Information

a. Drawings are to be "E" size; CAD based in MicroStation, version J or V8XM. Drawings shall be submitted in hard copy and electronically as PDF files and native CAD files for the following:
   - Layout drawing showing floor plan location of all devices and control equipment.
   - Riser diagram.
   - Panel connection and circuit diagrams showing interconnection of all modules, detectors, speakers, panels, and wiring counts.
   - Panel mounting details showing how to secure the panel to the walls and install conduits to the panel.
   - Logic Matrix – Sequence of operations in an input/output matrix.
b. Calculations
   - Battery sizing calculations.
   - Voltage drop calculations.

B.8.1.3 As-Builts

a. Upon completion of the installation, record As-Built drawings shall be submitted on each system before final acceptance of the work. SELLER shall furnish to CONTRACTOR a set of record layout drawings including system riser and panel diagrams for each system. The record drawing master shall be on paper media, uniformly drawn to scale, "E" (44" x 34") size for legibility, and reproduction and on CD-ROM in MicroStation version J or V8XM native files and in PDF format.

b. Calculations

- Battery sizing for each panel
- Voltage drop for each NAC circuit

B.8.1.4 Test Procedures:

a. Control Panel/Releasing Panel: Detailed test procedures shall be provided for each fire alarm system panel installation outlining devices to be tested, how to conduct the test, acceptance criteria, unique description as shown on control panel, etc.

b. Integrated Fire Alarm System: Detailed test procedures shall be provided for the ONYXworks station, Noti-Fire-Net™ functionality, and multiple facility live and prerecorded announcements. Devices to be tested, how to conduct the test, acceptance criteria, unique description and details to be shown on works station screen, testing of cooperative control by event logic, testing of the mass notification functions, etc. shall be identified along with actions to be taken by plant operations.

B.8.1.5 Test and Reports

a. Contractor shall perform testing identified in section B.6.2 and B.6.3 prior to panel startup and programming.

- Test reports shall be made available to the SELLER for inclusion with the applicable SELLER test reports in section B.8.1.5.b of this appendix.

b. SELLER shall perform all of the electrical and mechanical tests required by NFPA 72 and the equipment manufacturer. All test reports shall be submitted as part of the ATP required by this appendix. Testing involving device wiring shall be conducted prior to panel programming and start-up.

- Individual System Test Report – Completed and signed test report for the individual system.
- Integrated System Test report – Completed and signed test report for the integrated system to the extent it exists at the time of the test.
- A system record of completion as outlined in NFPA 72, 2022 shall be provided for the fire alarm system installed.

This document has been digitally signed using the Electrosign process.

Document for Signature

Document Number: 24590-BOF-3PS-EKL0-T0001 **Rev:** 001

	Participants	Signature	Completed	Status	Result	Comments
Final Approver	**7/22/2024 6:34 PM**					
	hfeghali		7/22/2024 6:45 PM	Completed	Approve	

River Protection Project Waste Treatment Plant	**Electrical Data Sheet:** **208/120 V Auxiliary Power Distribution Panel Data Sheet** **LVE-PNL-34001**	**DOCUMENT NO:** **24590-BOF-EAD-LVE-34001** **REVISION NO:** **0** **Page 1 of 2**

Visible Equipment Tag Nos.: LVE-PNL-34001

Equipment: BOF Building 34, 208/120 V Auxiliary Power Distribution Panel

Service: 208/120 V LOAD GROUP A

Referenced Specification: 24590-BOF-3PS-EKL0-T0001, Exhibit 5

Line No.	DESCRIPTION	BUYER SPECIFIED	SELLER FURNISHED	UNITS
1.	**SAFETY AND QUALITY CLASSIFICATION**	CM (Non-Safety)		-
2.	**SEISMIC CATEGORY**	SC-IV		-
3.	**SITE CONDITIONS**			
	Altitude	684		FT
	Indoor Ambient Temperature, Maximum	95		° F
	Indoor Ambient Temperature, Minimum	50		° F
	Relative Humidity (Min/Max)	0-100		%
4.	**GENERAL REQUIREMENTS**			
	Enclosure	NEMA 1		-
	Voltage	208/120		VAC
	Frequency	60		HZ
	Phase/No. of Wires	3 Ph, 4 wire		-
	Interrupting Rating	10		KAIC
	Main Breaker	225		Amps
	Branch Breakers	34 ckts, 1 pole, 20A 4 ckts, 1 pole, 30A 4 ckts, 1 pole, 35A		-
	Circuit Breaker with Pad Lockable Device	Yes		-
	Mounting	Surface		-
	Feeder Entry	Top/Bottom		-
	Gutter	Top, Side, Bottom, Extra Space		-
	Main Bus	225, Copper		Amps
	Neutral Bus	225, Copper		Amps
	Ground Bus	Copper		-
	“Finger Safe” Barriers	Yes		
5.	**PAINTING**			
	Type	ANSI 61, Gray		-
6.	**SHOP INSPECTION AND TEST**			
	Manufacturer’s Standard	Yes		-
	Test per Specification	Yes		-
	Is test to be witnessed (Yes/No)	No		-
	Certified Test Reports	Yes		-

Rev No.	Date	Description	By	Checked	Approved
0	See Stamp	Issued for Procurement	J. Mamula	R. Cain	M. Pirvulescu

Originator
By: Jeron Mamula - jmamula
Org Name: Amentum
Placed: Nov 07, 2024

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By: Richard Cain - rcain
Org Name: Amentum
Placed: Nov 07, 2024

Approved
By: Maria Pirvulescu - mpirvule
Org Name: Amentum
Placed: Nov 18, 2024

River Protection Project Waste Treatment Plant	**Electrical Data Sheet:** **208/120 V Auxiliary Power Distribution Panel Data Sheet** **LVE-PNL-34001**	**DOCUMENT NO:** **24590-BOF-EAD-LVE-34001** **REVISION NO:** **0** **Page 2 of 2**

Visible Equipment Tag Nos.: LVE-PNL-34001

Equipment: BOF Building 34, 208/120 V Auxiliary Power Distribution Panel

Service: 208/120 V LOAD GROUP A

Referenced Specification: 24590-BOF-3PS-EKL0-T0001, Exhibit 5

References

Ref. No	Title	Document No.	Rev. No
1	Engineering Specification for B34, BOF Switchgear Building	24590-BOF-3PS-EKL0-T0001	1
2	DFHLW Switchgear and Building System Design Description (For Bechtel Use Only)	24590-BOF-3ZD-34-00001	1
3	Basis of Design for the High-Level Waste (HLW) Facility and DFHLW Supporting Facilities (For Bechtel Use Only)	24590-WTP-DB-ENG-18-001	4
4	High-Level Waste (HLW) Facility and Direct-Feed High-Level Waste (DFHLW) Support Facilities Electrical Design Criteria (For Bechtel Use Only)	24590-WTP-DC-E-21-001	1
5	Switchgear Building Electrical 208/120V Panel Schedule LVE-PNL-34001	24590-BOF-E8-LVE-34002	A
6	Switchgear Building 34 LVE Unit Substation Single Line Diagram	24590-BOF-E1-LVE-34001	1

Notes:

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Document for Signature

Document Number: 24590-BOF-EAD-LVE-34001 **Rev:** 0

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Final Approver	**11/15/2024 10:59 AM**					
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River Protection Project Waste Treatment Plant	**Electrical Data Sheet:** **208/120 V Auxiliary Power Distribution Panel Data Sheet** **LVE-PNL-34002A**	**DOCUMENT NO:** **24590-BOF-EAD-LVE-34002** **REVISION NO:** **0** **Page 1 of 2**

Visible Equipment Tag Nos.: LVE-PNL-34002A

Equipment: BOF Building 34, 208/120 V Auxiliary Power Distribution Panel

Service: 208/120 V LOAD GROUP A

Referenced Specification: 24590-BOF-3PS-EKL0-T0001, Exhibit 5

Line No.	DESCRIPTION	BUYER SPECIFIED	SELLER FURNISHED	UNITS
1.	**SAFETY AND QUALITY CLASSIFICATION**	CM (Non-Safety)		-
2.	**SEISMIC CATEGORY**	SC-IV		-
3.	**SITE CONDITIONS**			
	Altitude	684		FT
	Indoor Ambient Temperature, Maximum	95		° F
	Indoor Ambient Temperature, Minimum	50		° F
	Relative Humidity (Min/Max)	0-100		%
4.	**GENERAL REQUIREMENTS**			
	Enclosure	NEMA 1		-
	Voltage	480		VAC
	Frequency	60		HZ
	Phase/No. of Wires	3 Ph, 3 wire		-
	Interrupting Rating	42		KAIC
	Main Breaker	400		Amps
	Branch Breakers	3 ckts, 3 pole, 15A 1 ckts, 3 pole, 35A 1 ckts, 3 pole, 80A 1 ckts, 3 pole, 125A 1 ckts, 3 pole, 150A 1 ckts, 3 pole, 225A		-
	Circuit Breaker with Pad Lockable Device	Yes		-
	Mounting	Surface		-
	Feeder Entry	Top/Bottom		-
	Gutter	Top, Side, Bottom, Extra Space		-
	Main Bus	400, Copper		Amps
	Neutral Bus	NA		Amps
	Ground Bus	Copper		-
	“Finger Safe” Barriers	Yes		
5.	**PAINTING**			
	Type	ANSI 61, Gray		-

Rev No.	Date	Description	By	Checked	Approved
0	See Stamp	Issued for Procurement	J. Mamula	R. Cain	M. Pirvulescu

Originator
By: Jeron Mamula - jmamula
Org Name: Amentum
Placed: Nov 07, 2024

Checked
By: Richard Cain - rcain
Org Name: Amentum
Placed: Nov 07, 2024

Approved
By: Maria Pirvulescu - mpirvule
Org Name: Amentum
Placed: Nov 18, 2024

River Protection Project Waste Treatment Plant	**Electrical Data Sheet:** **208/120 V Auxiliary Power Distribution Panel Data Sheet** **LVE-PNL-34002A**	**DOCUMENT NO:** **24590-BOF-EAD-LVE-34002** **REVISION NO:** **0** **Page 2 of 2**

Visible Equipment Tag Nos.: LVE-PNL-34002A

Equipment: BOF Building 34, 208/120 V Auxiliary Power Distribution Panel

Service: 208/120 V LOAD GROUP A

Referenced Specification: 24590-BOF-3PS-EKL0-T0001, Exhibit 5

Line No.	DESCRIPTION	BUYER SPECIFIED	SELLER FURNISHED	UNITS
6.	**SHOP INSPECTION AND TEST**			
	Manufacturer's Standard	Yes		-
	Test per Specification	Yes		-
	Is test to be witnessed (Yes/No)	No		-
	Certified Test Reports	Yes		-

References

Ref. No	Title	Document No.	Rev. No
1	Engineering Specification for B34, BOF Switchgear Building	24590-BOF-3PS-EKL0-T0001	1
2	DFHLW Switchgear and Building System Design Description (For Bechtel Use Only)	24590-BOF-3ZD-34-00001	1
3	Basis of Design for the High-Level Waste (HLW) Facility and DFHLW Supporting Facilities (For Bechtel Use Only)	24590-WTP-DB-ENG-18-001	4
4	High-Level Waste (HLW) Facility and Direct-Feed High-Level Waste (DFHLW) Support Facilities Electrical Design Criteria (For Bechtel Use Only)	24590-WTP-DC-E-21-001	1
5	Switchgear Building Electrical 208/120V Panel Schedule LVE-PNL-34002A	24590-BOF-E8-LVE-34003	B
6	Switchgear Building 34 LVE Unit Substation Single Line Diagram	24590-BOF-E1-LVE-34001	1

Notes:

This document has been digitally signed using the Electrosign process.

Document for Signature

Document Number: 24590-BOF-EAD-LVE-34002 **Rev:** 0

	Participants	Signature	Completed	Status	Result	Comments
Final Approver	**11/15/2024 11:01 AM**					
	Pirvulescu, Maria		11/18/2024 5:08 PM	Completed	Approve	

River Protection Project Waste Treatment Plant	**Electrical Data Sheet:** **208/120 V Auxiliary Power Distribution Panel Data Sheet** **LVE-PNL-34002B**	**DOCUMENT NO:** **24590-BOF-EAD-LVE-34003** **REVISION NO:** **0** **Page 1 of 2**

Visible Equipment Tag Nos.: LVE-PNL-34002B

Equipment: BOF Building 34, 208/120 V Auxiliary Power Distribution Panel

Service: 208/120 V LOAD GROUP B

Referenced Specification: 24590-BOF-3PS-EKL0-T0001, Exhibit 5

Line No.	DESCRIPTION	BUYER SPECIFIED	SELLER FURNISHED	UNITS
1.	**SAFETY AND QUALITY CLASSIFICATION**	CM (Non-Safety)		-
2.	**SEISMIC CATEGORY**	SC-IV		-
3.	**SITE CONDITIONS**			
	Altitude	684		FT
	Indoor Ambient Temperature, Maximum	95		° F
	Indoor Ambient Temperature, Minimum	50		° F
	Relative Humidity (Min/Max)	0-100		%
4.	**GENERAL REQUIREMENTS**			
	Enclosure	NEMA 1		-
	Voltage	480		VAC
	Frequency	60		HZ
	Phase/No. of Wires	3 Ph, 3 wire		-
	Interrupting Rating	42		KAIC
	Main Breaker	400		Amps
	Branch Breakers	3 ckts, 3 pole, 15A 1 ckts, 3 pole, 35A 1 ckts, 3 pole, 80A 1 ckts, 3 pole, 150A 1 ckts, 3 pole, 225A		-
	Circuit Breaker with Pad Lockable Device	Yes		-
	Mounting	Surface		-
	Feeder Entry	Top/Bottom		-
	Gutter	Top, Side, Bottom, Extra Space		-
	Main Bus	400, Copper		Amps
	Neutral Bus	NA		Amps
	Ground Bus	Copper		-
	“Finger Safe” Barriers	Yes		
5.	**PAINTING**			
	Type	ANSI 61, Gray		-

Rev No.	Date	Description	By	Checked	Approved
0	See Stamp	Issued for Procurement	J. Mamula	R. Cain	M. Pirvulescu

Originator
By: Jeron Mamula - jmamula
Org Name: Amentum
Placed: Nov 07, 2024

Checked
By: Richard Cain - rcain
Org Name: Amentum
Placed: Nov 07, 2024

Approved
By: Maria Pirvulescu - mpirvule
Org Name: Amentum
Placed: Nov 18, 2024

River Protection Project Waste Treatment Plant	**Electrical Data Sheet:** **208/120 V Auxiliary Power Distribution Panel Data Sheet** **LVE-PNL-34002B**	**DOCUMENT NO:** **24590-BOF-EAD-LVE-34003** **REVISION NO:** **0** **Page 2 of 2**

Visible Equipment Tag Nos.: LVE-PNL-34002B

Equipment: BOF Building 34, 208/120 V Auxiliary Power Distribution Panel

Service: 208/120 V LOAD GROUP B

Referenced Specification: 24590-BOF-3PS-EKL0-T0001, Exhibit 5

Line No.	DESCRIPTION	BUYER SPECIFIED	SELLER FURNISHED	UNITS
6.	**SHOP INSPECTION AND TEST**			
	Manufacturer's Standard	Yes		-
	Test per Specification	Yes		-
	Is test to be witnessed (Yes/No)	No		-
	Certified Test Reports	Yes		-

References

Ref. No	Title	Document No.	Rev. No
1	Engineering Specification for B34, BOF Switchgear Building	24590-BOF-3PS-EKL0-T0001	1
2	DFHLW Switchgear and Building System Design Description (For Bechtel Use Only)	24590-BOF-3ZD-34-00001	1
3	Basis of Design for the High-Level Waste (HLW) Facility and DFHLW Supporting Facilities (For Bechtel Use Only)	24590-WTP-DB-ENG-18-001	4
4	High-Level Waste (HLW) Facility and Direct-Feed High-Level Waste (DFHLW) Support Facilities Electrical Design Criteria (For Bechtel Use Only)	24590-WTP-DC-E-21-001	1
5	Switchgear Building Electrical 208/120V Panel Schedule LVE-PNL-34002B	24590-BOF-E8-LVE-34004	B
6	Switchgear Building 34 LVE Unit Substation Single Line Diagram	24590-BOF-E1-LVE-34001	1

Notes:

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Document for Signature

Document Number: 24590-BOF-EAD-LVE-34003 **Rev:** 0

	Participants	Signature	Completed	Status	Result	Comments
Final Approver	**11/15/2024 11:03 AM**					
	Pirvulescu, Maria		11/18/2024 5:10 PM	Completed	Approve	

River Protection Project Waste Treatment Plant	**Electrical Data Sheet:** **208/120 V UPS Panelboard Data Sheet** **UPE-PNL-34002**	**DOCUMENT NO:** **24590-BOF-EAD-UPE-34001** **REVISION NO:** **0** Page 1 of 2

Visible Equipment Tag Nos.: UPE-PNL-34002

Equipment: BOF Building 34, 208/120 V UPS Panelboard

Service: 208/120V UPS LOADS

Referenced Specification: 24590-BOF-3PS-EKL0-T0001, Exhibit 3

Line No.	DESCRIPTION	BUYER SPECIFIED	SELLER FURNISHED	UNITS
1.	**SAFETY AND QUALITY CLASSIFICATION**	CM (Non-Safety)		-
2.	**SEISMIC CATEGORY**	SC-IV		-
3.	**SITE CONDITIONS**			
	Altitude	684		FT
	Indoor Ambient Temperature, Maximum	95		° F
	Indoor Ambient Temperature, Minimum	50		° F
	Relative Humidity (Min/Max)	0-100		%
4.	**GENERAL REQUIREMENTS**			
	Enclosure	NEMA 1		-
	Voltage	208/120		VAC
	Frequency	60		HZ
	Phase/No. of Wires	3 Ph, 4 wire		-
	Interrupting Rating	10		KAIC
	Main Lugs	125, Copper		Amps
	Branch Breakers	5 ckts, 1 pole, 15A 37 ckts, 1 pole, 20A		-
	Circuit Breaker with Pad Lockable Device	Yes		-
	Mounting	Surface		-
	Feeder Entry	Top		-
	Gutter	Top, Side, Bottom, Extra Space		-
	Main Bus	125, Copper		Amps
	Neutral Bus	125, Copper		Amps
	Ground Bus	Copper		-
	“Finger Safe” Barriers	Yes		
5.	**PAINTING**			
	Manufacturer Standard/ANSI 61	ANSI 61, Gray		-
6.	**SHOP INSPECTION AND TEST**			
	Manufacturer’s Standard	Yes		-
	Test per Specification	Yes		-
	Is test to be witnessed (Yes/No)	No		-
	Certified Test Reports	Yes		-

Rev No.	Date	Description	By	Checked	Approved
0	See Stamp	Issued for Procurement	J. Mamula	R. Cain	M. Pirvulescu

Originator
By: Jeron Mamula - jmamula
Org Name: Amentum
Placed: Nov 07, 2024

Checked
By: Richard Cain - rcain
Org Name: Amentum
Placed: Nov 07, 2024

Approved
By: Maria Pirvulescu - mpirvule
Org Name: Amentum
Placed: Nov 18, 2024

River Protection Project Waste Treatment Plant	**Electrical Data Sheet:** **208/120 V UPS Panelboard Data Sheet** **UPE-PNL-34002**	**DOCUMENT NO:** **24590-BOF-EAD-UPE-34001** **REVISION NO:** **0** **Page 2 of 2**

Visible Equipment Tag Nos.: UPE-PNL-34002

Equipment: BOF Building 34, 208/120 V UPS Panelboard

Service: 208/120V UPS LOADS

Referenced Specification: 24590-BOF-3PS-EKL0-T0001, Exhibit 3

References

Ref. No	Title	Document No.	Rev. No
1	B34, BOF Switchgear Building	24590-BOF-3PS-EKL0-T0001	1
2	DFHLW Switchgear Building System Design Description (For Bechtel Use Only)	24590-BOF-3ZD-34-00001	1
3	Basis of Design for the High-Level Waste (HLW) Facility and DFHLW Supporting Facilities (For Bechtel Use Only)	24590-WTP-DB-ENG-18-001	4
4	High-Level Waste (HLW) Facility and Direct-Feed High-Level Waste (DFHLW) Support Facilities Electrical Design Criteria (For Bechtel Use Only)	24590-WTP-DC-E-21-001	1
5	Switchgear Building 34 Electrical 208/120V Panel Schedule UPE-PNL-39002	24590-BOF-E8-UPE-34001	B
6	Switchgear Building 34 Uninterruptible Power Supply (UPS) Single Line Diagram	24590-BOF-E1-UPE-34001	1

Notes:

This document has been digitally signed using the Electrosign process.

Document for Signature

Document Number: 24590-BOF-EAD-UPE-34001 **Rev:** 0

	Participants	Signature	Completed	Status	Result	Comments
Final Approver	**11/15/2024 11:05 AM**					
	Pirvulescu, Maria		11/18/2024 5:01 PM	Completed	Approve	

River Protection Project Waste Treatment Plant	**Electrical Data Sheet:** **125V DC System**	**DOCUMENT NO:** **24590-BOF-EDD-DCE-34001** **REVISION NO:** **1** **Page** 1 **of** 3

Equipment Tag No: DCE-BATT-34001, DCE-CHGR-34001, DCE-CHGR-34002

Equipment: **125V DC System**

Service: **BOF Switchgear Bldg. (#34)**

Specification: **24590-BOF-3PS-EKL0-T0001 (Exhibit 4)**

Reference Dwg.: **24590-BOF-E1-DCE-34001**

LINE NO.	DESCRIPTION	BUYER REQUESTED	SELLER FURNISHED	UNITS
1	**SAFETY CLASSIFICATION/QUALITY LEVEL** (Ref. 2)	CM		-
	SEISMIC CATEGORY (Ref. 2)	SC-IV		
2	**SERVICE CONDITION** (Ref. 1)			
	Altitude	684		ft
	Seismic Zone (ASCE 7-22)	C		
	Indoor Ambient Service Temperature, Normal/Abnormal High	95/104		°F
	Indoor Ambient Service Temperature, Low	50		°F
	Humidity (Indoor)	10-95		%
	Battery Room Minimum Temperature	72		°F
	Battery Room Maximum Temperature	77		°F
3	**DC SYSTEM DATA**			
	Nominal DC Voltage	125		V DC
	Permissible Float Voltage @ 77° F	136.2		V DC
	Permissible Equalizing Voltage @ 77° F	136.2		V DC
4	**BATTERY** (Ref. 3)			
	Battery Type	VRLA, 20 yrs. Design life		-
	Make/Model	Per Mfg.		-
	No. of Battery Strings in Parallel (each 100%)	(1) string		-
	No. of Cells per String	60		-
	String Nominal Voltage	125		V DC
	Capacity (at 8-hr rate, See attached Load Profile/Duty Cycle Diagram, Fig 1)	180		A-H
	Operating Time (at 100% load profile, no input voltage)	180		Min.
	Volts per cell	2		V DC
	End of Discharge Voltage per Cell	1.75		V / Cell
	Overall Dimensions	Per Mfg.		Inches
	Battery Rack Size	Per Mfg.		Inches
	Life Expectancy	20		Years
	Bottom I-Beam Support	N/A		
	Total Weight	Per Mfg.		lbs.

Rev. No.	Date	Description	By	Checked	Approved
0	03/27/24	For Bid	J. Mamula	M. Pirvulescu	H. Feghali
1	See Stamps	Re-Issue for Bid due to Revised SDD (Removal of Future Power Source)	J. Mamula	M. Pirvulescu	H. Feghali

Originator
By: Jeron Mamula - jmamula
Org Name: Amentum
Placed: Jul 11, 2024

Checked
By: Maria Pirvulescu - mpirvule
Org Name: Amentum
Placed: Jul 11, 2024

Approved
By: Habib Feghali - hfeghali
Org Name: Amentum Project Engineer
Placed: Jul 16, 2024

Equipment Tag No: DCE-BATT-34001, DCE-CHGR-34001, DCE-CHGR-34002	
Equipment:	**125V DC System**
Service:	**BOF Switchgear Bldg. (#34)**
Specification:	**24590-BOF-3PS-EKL0-T0001 (Exhibit 4)**
Reference Dwg.:	**24590-BOF-E1-DCE-34001**

LINE NO.	DESCRIPTION	BUYER	SUPPLIER FURNISHED	UNITS
5	**BATTERY RACKS**			
	Type:			
	Material	Steel		
	Finish / Paint	ANSI 61		
	Single or Multi-tier	By Mfr.		
6	**BATTERY CHARGER** (Ref. 3)			
	Tag No. : DCE-CHGR-34001	1 ea.		-
	DCE-CHGR-34002	1 ea.		-
	Input Voltage	480		V AC
	Input Phase	3		Phase
	Available Short Circuit Current for 480V System	14		kAIC
	Output Amps	50		Amps
	Output Voltage	130		V DC
	Sound Level (To be verified by the Manufacturer)	Per Mfg.		
	Common Trouble Alarm	Yes		-
	A. C. Breaker Tripped Alarm	Yes		-
	D. C. Breaker Tripped Alarm	Yes		-
	Ground Detected Alarm	Yes		-
	Low Voltage DC Alarm	Yes		-
	Over Voltage DC Alarm	Yes		-
	Automatic Float	Yes		-
	Automatic Equalizer	Yes		-
	Re-charge Time	10		Hrs.
	Filtered Output (w/battery-eliminator filter)	Yes		-
	ON Local Indicating Lights	Red		-
	Ammeter (DC) / Voltmeters (DC & AC)	Yes		-
	Fans	Not Required		-
	Enclosure	NEMA 1		-
	Cable Entry	Top & Side		-
7	**BUYER COMMUNICATION INTERFACE**	-		
	(See Exhibit 4, Section 3.9, of the Specification)	Yes		-

Equipment Tag No: DCE-BATT-34001, DCE-CHGR-34001, DCE-CHGR-34002	
Equipment:	**125V DC System**
Service:	**BOF Switchgear Bldg. (#34)**
Specification:	**24590-BOF-3PS-EKL0-T0001 (Exhibit 4)**
Reference Dwg.:	**24590-BOF-E1-DCE-34001**

Ref. No	Title	Document No	Rev. No
1	Electrical Data Sheet: BOF Prefabricated Electrical Switchgear Building (Building 34)	24590-BOF-EKD-MVE-34001	1
2	DFHLW Switchgear and Building System Design Description (For Bechtel Use Only)	24590-BOF-3ZD-34-00001	1
3	Calculation - Sizing of Non-Safety DCE Unit in Building 34	24590-BOF-E1C-DCE-34001	C
4	Engineering Specification for B34, BOF Switchgear Building (Exhibit 4)	24590-BOF-3PS-EKL0-T0001	1

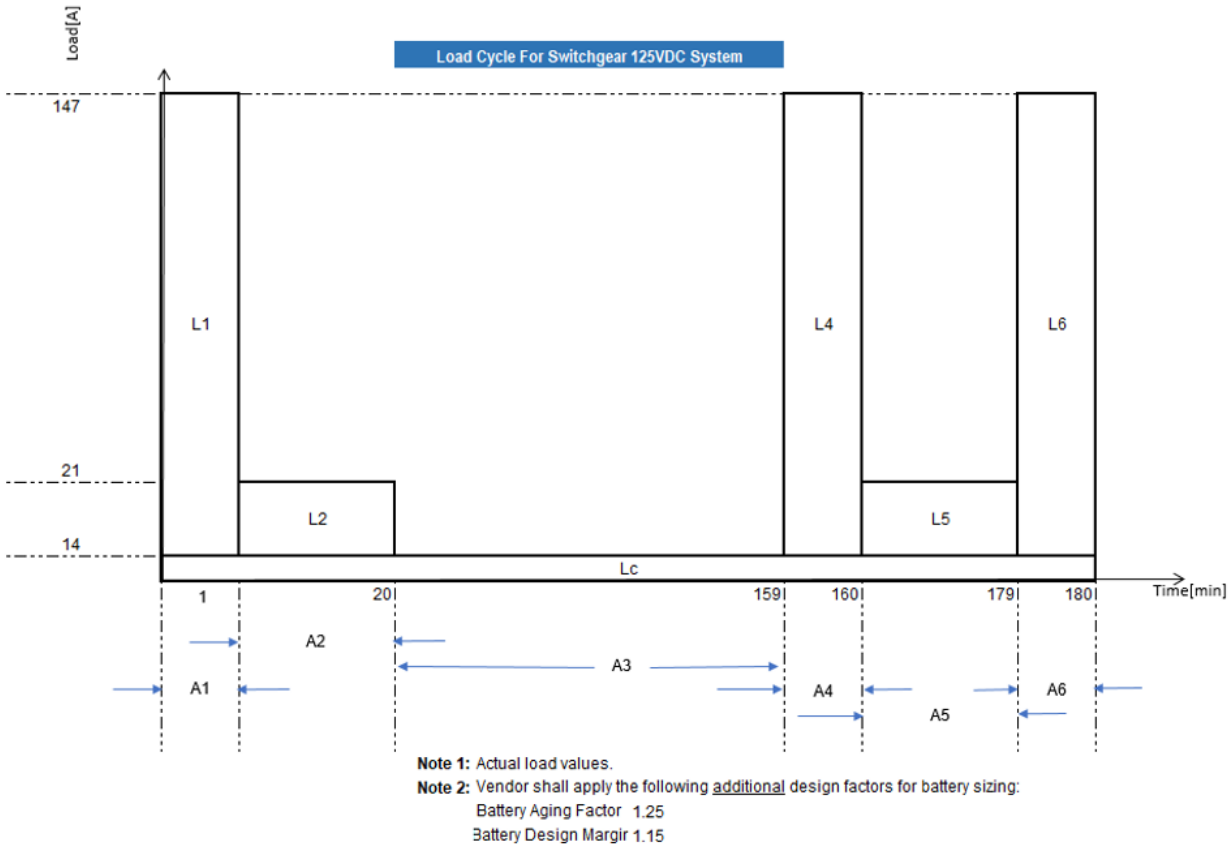

Figure 1 – Duty Cycle Diagram

This document has been digitally signed using the Electrosign process.

Document for Signature

Document Number: 24590-BOF-EDD-DCE-34001 **Rev:** 001

	Participants	Signature	Completed	Status	Result	Comments
Final Approver	**7/16/2024 9:56 AM**					
	hfeghali		7/16/2024 10:01 AM	Completed	Approve	

River Protection Project Waste Treatment Plant	**Electrical Data Sheet:** **BOF PREFABRICATED ELECTRICAL SWITCHGEAR BUILDING (BUILDING 34)**	**DOCUMENT NO:** **24590-BOF-EKD-MVE-34001** **REVISION NO:** **1** **Page** 1 **of** 5

Exterior Building Sign: BOF ELECTRICAL SWITCHGEAR BUILDING, BUILDING 34

Referenced Specification: 24590-BOF-3PS-EKL0-T0001

Reference Single Line Diagrams: 24590-BOF-E1-MVE-34001, 24590-BOF-E1-MVE-34002, 24590-BOF-E1-MVE-34003, 24590-BOF-E1-MVE-34004, 24590-BOF-E1-MVE-34005, 24590-BOF-E1-LVE-34001

Line No.	DESCRIPTION	BUYER SPECIFIED	SELLER FURNISHED	UNITS
1.	**SAFETY CLASSIFICATION / QUALITY LEVEL** (Ref. 2)	CM		-
2.	**SEISMIC CATEGORY** (Ref. 2)	SC-IV		-
3.	**SERVICE CONDITIONS** (Ref. 3)			
	Altitude / Elevation	684		ft.
	Seismic Zone (ASCE 7-22)	C		-
	Outdoor Ambient Air Temperatures			
	Minimum	-25		° F
	Maximum	115		° F
	Maximum Rate of Increase per 20 minutes	26		° F
	Maximum Rate of Decrease per hour	24		° F
	Relative Humidity Range	0 – 100		%
	Design Lifecycle – Minimum	40		Yrs.
	Hazardous Area (Yes/No)	No		-
4.	**CODES & STANDARDS**			
	Compliance to Codes & Standards per Section 2.2.1 of 24590-BOF-3PS-EKL0-34001	Yes		-
	Compliance to WTP Project Specifications per Section 2.3 of 24590-BOF-3PS-EKL0-34001	Yes		-
	Compliance to Manufacturer's Standards	Yes		-
5.	**STRUCTURAL DESIGN**			
	Design Building Exterior Size L × W	Ref. Note 1		ft.
	Design Maximum Building Height for Road Transport	By Supplier		ft.
	Design Maximum Shipping Weight	By Supplier		lb
	Live Loads	-		-
	Roof Trusses & Steel Floor Framing at any single panel point of truss lower chord or anywhere on the beam	2000		lb.

Rev. No.	Date	Description	Originator	Checked	Approved
0	03/26/2024	Issued for Bid	J. Mamula	M. Pirvulescu	H. Feghali
1	See Stamps	Re-Issued for Bid. Includes added referenced Single Line Diagrams	J. Mamula	M. Pirvulescu	H. Feghali

Originator
By: Jeron Mamula - jmamula
Org Name: Amentum
Placed: Jul 11, 2024

Checked
By: Maria Pirvulescu - mpirvule
Org Name: Amentum
Placed: Jul 11, 2024

Approved
By: Habib Feghali - hfeghali
Org Name: Amentum Project Engineer
Placed: Jul 16, 2024

Note 1 - Basis of Design building size is 80ft x 30ft. Any increase in building size shall be approved by the buyer.

Exterior Building Sign: BOF ELECTRICAL SWITCHGEAR BUILDING, BUILDING 34

Referenced Specification: 24590-BOF-3PS-EKL0-T0001

Reference Single Line Diagrams: 24590-BOF-E1-MVE-34001, 24590-BOF-E1-MVE-34002, 24590-BOF-E1-MVE-34003, 24590-BOF-E1-MVE-34004, 24590-BOF-E1-MVE-34005, 24590-BOF-E1-LVE-34001

Line No.	DESCRIPTION	BUYER SPECIFIED	SELLER FURNISHED	UNITS
5.	**STRUCTURAL DESIGN (Cont.)**			
	Floor Plate applied over an area of 1.0 sq in.	200		lb.
	Cable Trays & Supports - uniform	50		psf
	Roof Loads – Minimum	20		psf
	Floor Loads – Greater of Equipment Weight or Uniform Load	250		psf
	Fall Protection Tie-Offs	5000		lb
	Thermal Forces	By Supplier		lb_f
	Dynamic & Vibration Loads	By Supplier		lb_f
	Dead Loads	By Supplier		lb_f
	Wind Load 3 sec. gust @ 33 feet above ground	110		mph
	Ground Snow Load	25		psf
	Seismic Load Parameters			
	Short Period Design 5% Damped Spectral Response Parameter, S_{DS}	0.37		g
	1-sec Design 5% Damped Spectral Response Parameter, S_{D1}	0.18		g
	Ash Fall Load	3.7		psf
	Lifting Lugs Required for Each Shipping Split	Yes		-
	Structural Calculations Required with PE Stamp	Yes		-
6.	**Floor**			
	Minimum Floor Thickness	By Supplier		in.
	Non Slip Surface	Yes		-
	Floor Surface	Smooth Steel Plate		-
	Floor Penetrations with Seals	Yes		-
	Acid-Resistant Coating in Battery Room	Yes		-
	Minimum R-Value Insulation – Floor	Per ASHRAE Std 90.1		$ft^2h°F/Btu$
7.	**CEILING, WALLS AND ROOF**			
	Ceiling, Exterior Walls, & Roof Material	By Supplier		-
	Ceiling, Exterior Walls & Roof Gauge, Minimum	18		ga.
	Weather Protected Roof & Walls	Yes		-
	Interior Headroom Space	By Supplier		in.
	Roof Slope	By Supplier		-
	Sealant Type for Roof & Walls	By Supplier		-
	Minimum service life of sealant	40		yrs.
	Access to Roof by Ladders/Hatches (Yes/No)	No/No		-
	Interior Doors	2		-
	Exterior Double Door with Removable Transom	Yes		-
	Three Single Exterior Doors	Yes		-
	Insect & Rodent Screens for Ventilation Air Inlets & Exhausts	Yes		-
	Minimum R-Value Insulation – Ceiling	Per ASHRAE Std 90.1		$ft^2h°F/Btu$
	Minimum R-Value Insulation – Walls	Per ASHRAE Std 90.1		$ft^2h°F/Btu$
	Minimum R-Value Insulation – Roof	Per ASHRAE Std 90.1		$ft^2h°F/Btu$

Exterior Building Sign: BOF ELECTRICAL SWITCHGEAR BUILDING, BUILDING 34

Referenced Specification: 24590-BOF-3PS-EKL0-T0001

Reference Single Line Diagrams: 24590-BOF-E1-MVE-34001, 24590-BOF-E1-MVE-34002, 24590-BOF-E1-MVE-34003, 24590-BOF-E1-MVE-34004, 24590-BOF-E1-MVE-34005, 24590-BOF-E1-LVE-34001

Line No.	DESCRIPTION	BUYER SPECIFIED	SELLER FURNISHED	UNITS
8.	**HVAC**			
	Heat Pump System Type - Multiple Wall Mounted Units	Wall Mounted		-
	HVAC Sizing to Include Solar Heating, Equipment Heat, Switchgear Building Size, Site Location & Ambient Site Conditions	Yes		-
	Interlock to Disable HVAC upon Signal from Fire Alarm System	Yes		-
	HVAC Enclosure Type	NEMA 3R		
8.1	**External Environmental Design Temperatures for HVAC Sizing** (Ref. 3)			
	Winter (dry bulb 99.6%)	5		° F
	Summer (dry bulb 1%)	101		° F
	Summer (wet bulb 1%)	67		° F
	Mean daily average	30		° F
	Humidity Range	0 – 100		%
8.2	**Indoor Electrical Equipment Design Room Temperatures** (Ref. 3)			
	Normal / Abnormal Maximum	95 /104		° F
	Normal Minimum	50		° F
	Humidity Range	10 – 95		%
8.3	**Indoor Battery Room Design Temperatures (**Ref. 3)			
	Maximum	77		° F
	Minimum	72		° F
8.4	**Indoor C&I Room Design Temperatures** (Ref. 3)			
	Maximum	75		° F
	Minimum	68		° F
	Humidity Range	40 – 55		%
9.	**PAINTING**			
	Roof paint color & number	Moss #977		-
	Paint manufacturer & number	Valspar # 435B631		-
	Wall color & number	Limestone #1760		-
	Paint manufacturer & number	Valspar # 433B529		-
	Anti-corrosion guarantee	No		Yrs.
	Interior metal liner panels	White		-
10.	**GROUNDING SYSTEM**			
	Wire Size	4/0		AWG
	Wire Material	Copper		-
	Quantity	4		-
	Location	Each Corner		-
10.	**GROUNDING SYSTEM (Cont.)**			

Exterior Building Sign: BOF ELECTRICAL SWITCHGEAR BUILDING, BUILDING 34

Referenced Specification: 24590-BOF-3PS-EKL0-T0001

Reference Single Line Diagrams: 24590-BOF-E1-MVE-34001, 24590-BOF-E1-MVE-34002, 24590-BOF-E1-MVE-34003, 24590-BOF-E1-MVE-34004, 24590-BOF-E1-MVE-34005, 24590-BOF-E1-LVE-34001

Line No.	DESCRIPTION	BUYER SPECIFIED	SELLER FURNISHED	UNITS
	2 Ground Pads 4" x 4" x 1/8" copper w/NEMA 4-hole bolt pattern	Yes		-
	Lugs – NEMA, 4-hole, Long Barrel	Yes		-
	Copper Ground Bus Bar	¼ x 2		in.
	Insulated Stand-Off Mounted Copper Ground Bus Bar in C&I Room	¼ x 2		in.
11.	**ELECTRICAL POWER SYSTEM**			
	Nominal Voltage for 3-phase Medium Voltage Distribution	13.8		kV
	Nominal Voltage for 3-phase Low Voltage Distribution	480		V
	Nominal Voltage for 1-phase Low Voltage Distribution	120		V
	Nominal Voltage for Lighting Luminaires	120		V
	Minimum Conductor Size for Lighting Circuits	12		AWG
	Minimum Conductor Size for Power Circuits	12		AWG
	Power, Instrument & Control Cable Tray Type	Metallic, Ladder		-
	Cable Tray Manufacturer	By Supplier		-
	Cable Tray Type & Size	Galvanized Steel Ladder / 24" wide		-
	Cable Tray NEMA VE-1 Rating	20C		-
	Hot Dipped Galvanized Steel w/9" rungs in 24" & 36" widths	Per Spec		-
	Cable & Tray Design Loading	50		lbs./lft.
	LV Power & Control Cable Rating	90		°C
	Vertical Tray Flame Test for Tray Cables	IEEE 1202		-
	RGS Conduit Use	Exterior and Interior		-
	RGS Conduit Use	Indoor Lighting		-
12.	**LIGHTING**			
	Illumination Level for Electrical, C&I and Battery Rooms @ 30" above floor	30		ft.-candles
	Illumination Level for C&I Room @ 30" above floor	50		ft.-candles
	Egress Lighting Illumination Level @ floor level	1		ft.-candles
	Exterior Illumination Level at Building Doors @ floor level	5		ft.-candles
	Exterior Illumination Level at Loading/Unloading Platform @ floor level	20		ft.-candles
	Fluorescent Fixture - maximum total current harmonic distortion	10		%
	Self-Contained Battery Packs – Battery Back-up Time	90		Min.
	Battery Room Lighting Fixtures	By Supplier		-
	AGI 32 Lighting Calculations Required	Yes		-
13.	**HYDROGEN MITIGATION SYSTEM FOR BATTERY ROOM**			
13.1	**Battery Room Exhaust Fan (Tag No. C1V-FAN-34001)**			
	Ventilation Fan Exhaust Flow	By Supplier		CFM
13.2	**Hydrogen Mitigation Control Panel (Tag No. C1V-PNL-34001)**			

Exterior Building Sign: BOF ELECTRICAL SWITCHGEAR BUILDING, BUILDING 34

Referenced Specification: 24590-BOF-3PS-EKL0-T0001

Reference Single Line Diagrams: 24590-BOF-E1-MVE-34001, 24590-BOF-E1-MVE-34002, 24590-BOF-E1-MVE-34003, 24590-BOF-E1-MVE-34004, 24590-BOF-E1-MVE-34005, 24590-BOF-E1-LVE-34001

Line No.	DESCRIPTION	BUYER SPECIFIED	SELLER FURNISHED	UNITS
	Enclosure Type	NEMA 1, Gasketed		-
	Enclosure Mounting	Wall Mount		-
	Alarming System Interfaces			
	Horn/Strobe Tower (Tag No. C1V-ANN-27001)	Yes		-
	Pager System	Yes		-
	Auxiliary Contacts for Buyer's use	1 NO / 1 NC		-
13.3	**Horn/Strobe Tower (Tag No. C1V-ANN-34001)**			
	Strobe Light Color	Red		
14.	**FIRE PROTECTION**			
	Fire Extinguisher Type	A/B/C		-
	Minimum Number and Location of Fire Extinguishers per NPFA 10	1 At Each Exterior Door		-
	Pre-action Sprinkler System Requirement (Ref. 1)			
15.	**PROHIBITED MATERIALS**			
	Asbestos, PCB, mercury, low melting point metals	Materials Not to Be Used		-
16.	**SHOP INSPECTION AND TESTS**			
	Mfr.'s Standard	Yes		-
	Tests per Section 6.5 of Specification (Ref. 1)	Yes		-
	Is test to be witnessed (Yes/No)	Yes		-
	Certified Test Reports	Yes		-
	Certified Visual Weld Examination Reports	Yes		-

List of References

Item	Title	Document No.	Rev. No
1	Engineering Specification for B34, BOF Switchgear Building	24590-BOF-3PS-EKL0-T0001	1
2	DFHLW Switchgear and Building System Design Description (For Bechtel Use Only)	24590-BOF-3ZD-34-00001	1
3	Basis of Design for the High-Level Waste (HLW) Facility and DFHLW Supporting Facilities	24590-WTP-DB-ENG-18-001	4
4	Electrical Design Criteria	24590-WTP-DC-E-21-001	1

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Document for Signature

Document Number: 24590-BOF-EKD-MVE-34001 **Rev:** 001

	Participants	Signature	Completed	Status	Result	Comments
Final Approver	**7/16/2024 9:58 AM**					
	hfeghali		7/16/2024 10:04 AM	Completed	Approve	

River Protection Project Waste Treatment Plant	**Electrical Data Sheet:** **13.8 kV SWITCHGEAR**	**DOCUMENT NO:** **24590-BOF-ESD-MVE-34001** **REVISION NO:** **1** **Page** 1 **of** 5

Tag No.:	**MVE-SWGR-34001A, MVE-SWGR-34002A**
Equipment:	**BOF Building 34, 13.8 kV SWITCHGEAR ASSEMBLY**
Service:	**LOAD GROUP A**
Specification:	**24590-BOF-3PS-EKL0-T0001**
Reference Single Line Diagrams: 24590-BOF-E1-MVE-34001, 24590-BOF-E1-MVE-34002, 24590-BOF-E1-MVE-34004	

Line No.	DESCRIPTION	BUYER SPECIFIED	SUPPLIER FURNISHED	UNITS
	SAFETY CLASSIFICATION/QUALITY LEVEL (Ref. 2)	NON-SAFETY/CM		-
	SEISMIC CATEGORY (Ref. 2)	SC-IV		-
1.	**SERVICE CONDITIONS** (Ref. 1)			
	Altitude	684		FT
	Seismic Zone (ASCE 7-22)	C		-
	Indoor Electrical Equipment Room Temperature, Normal/Abnormal Maximum	95/104		° F
	Indoor Electrical Equipment Room Temperature, Minimum	50		° F
	Indoor Electrical Equipment Room, Humidity	10 - 95		%
2.	**INCOMING SUPPLY / FEEDER**			
	Voltage	13.8		kV
	Frequency	60		Hz
	Phase	3		Phase
	System Ground	Low Resistance		-
	Cable Entry			
	a) Incoming Power Feeder Cables	Bottom		-
	b) Low Power / Control / Instrumentation Cables	Top		-
	c) Outgoing Load Power Feeder Cables	Bottom		-
	Power Supply			
	a) Breaker Control	125		VDC
	b) Auxiliary	120		VAC
	Cable Size/Bus	See SLD		-
3.	**SWITCHGEAR ENCLOSURE**			
	Type	Indoor, Arc Resistant Type 2C		-
	NEMA Type	NEMA 1 gasketed		-
	Panel			
	Rear Access	Hinged, accessible from outside of the switchgear building		-
	Front Access (Breaker Compartment Door)	Hinged		-
	a) Door Handle/Key lock	1		each
	Finish / Paint	ANSI 61, Light Gray		-

Rev. No	Date	Description	By	Checked	Approved
0	03/27/2024	Issued for Bid	J. Mamula	M. Pirvulescu	H. Feghali
1	See Stamp	Re-Issued for Bid (updated references due to removal of second main breaker/future power source) Incorporation of EIE Document Number 24590-HLW-EIE-SYSE-24-0034	J. Mamula	M. Pirvulescu	H. Feghali

Originator
By: Jeron Mamula - jmamula
Org Name: Amentum
Placed: Jul 11, 2024

Checked
By: Maria Pirvulescu - mpirvule
Org Name: Amentum
Placed: Jul 11, 2024

Approved
By: Habib Feghali - hfeghali
Org Name: Amentum Project Engineer
Placed: Jul 16, 2024

Tag No.:	**MVE-SWGR-34001A, MVE-SWGR-34002A**
Equipment:	**BOF Building 34, 13.8 kV SWITCHGEAR ASSEMBLY**
Service:	**LOAD GROUP A**
Specification:	**24590-BOF-3PS-EKL0-T0001**
Reference Single Line Diagrams: 24590-BOF-E1-MVE-34001, 24590-BOF-E1-MVE-34002, 24590-BOF-E1-MVE-34004	

Line No.	DESCRIPTION	BUYER SPECIFIED	SUPPLIER FURNISHED	UNITS

Line No.	DESCRIPTION	BUYER SPECIFIED	SUPPLIER FURNISHED	UNITS
4.	**MAIN BUS (MVE-SWGR-34001A Section)** (Ref. 4)			
	Nominal Voltage	13.8		kV
	Continuous Current Rating	3000		Amps
	Material	Copper, fully insulated		-
	Joint / Splice Plating	Silver		-
	Bus Insulation	per Mfr		-
	Bus Supports	per Mfr		-
	Bus Bracing			
	a) Type	per Mfr		-
	Cable Size/Bus to MVE-SWGR-34002A Section (via tie breaker)	See SLD		-
5.	**MAIN BUS (MVE-SWGR-34002A Section)** (Ref. 4)			
	Nominal Voltage	13.8		kV
	Continuous Current Rating	1200		Amps
	Material	Copper, fully insulated		-
	Joint / Splice Plating	Silver		-
	Bus Insulation	per Mfr		-
	Bus Supports	per Mfr		-
	Bus Bracing			
	a) Type	per Mfr		-
	Cable Size/Bus to MVE-SWGR-34001A Section (via tie breaker)	See SLD		-
6.	**BUS RELAYING/METERING** (Ref. 5, Ref. 6)			
	Lock out Relay (86B)	Yes		Mfr/Type
	Differential Relay (87B)	Yes		Mfr/Type
	Voltmeter (Analog)	Yes		Mfr/Type
	Voltmeter Switch	Yes		-
7.	**POWER CIRCUIT BREAKER General Characteristic**			
	Manufacturer Type	By vendor		Mfr/Type
	Interrupting Medium	Vacuum		-
	Rated Maximum Voltage	15		kV
	Rated Continuous Current	3000/1200		Amps
	Rated Short-Circuit Current	40/31.5		kA, rms
	Rated Interrupting Time	50		Mx
	Rated Closing and Latching Current	104/82		kA, peak
	Impulse Withstand Voltage Insulation Level	95		kV
	Rated Interrupting Time	3		Cycle
	Rated Permissible Tripping Delay	2		Sec

Tag No.:	**MVE-SWGR-34001A, MVE-SWGR-34002A**
Equipment:	**BOF Building 34, 13.8 kV SWITCHGEAR ASSEMBLY**
Service:	**LOAD GROUP A**
Specification:	**24590-BOF-3PS-EKL0-T0001**
Reference Single Line Diagrams: 24590-BOF-E1-MVE-34001, 24590-BOF-E1-MVE-34002, 24590-BOF-E1-MVE-34004	

Line No.	DESCRIPTION	BUYER SPECIFIED	SUPPLIER FURNISHED	UNITS
8.	**POTENTIAL TRANSFORMER (PT)**	By vendor		Mfr/Type
	PT Ratio	14400 / 120		VAC
	Accuracy	0.3-B-2.0		-
	Basic Impulse Level (BIL), Full Wave	95		kV
	Burden	per Mfr		VA
9.	**CURRENT TRANSFORMER (CT)** (Ref. 5, Ref 6)	By vendor		Mfr/Type
	CT Ratio	see Dwg.		Per Mfr
	Phase CT Relaying Accuracy Class	By vendor		-
	Insulation	per Mfr		-
	Basic Impulse Level (BIL), Full Wave	95		kV
10.	**ZERO SEQUENCE CURRENT TRANSFORMER (CT)**	By vendor		Mfr/Type
	CT Ratio	50:5		Per Mfr
	Zero Sequence CT Relaying Accuracy Class	By vendor		-
	Basic Impulse Level (BIL), Full Wave	95		kV
11.	**MAIN CIRCUIT BREAKER (MVE-SWGR-34001A)** (Ref. 5)			
	Type	Draw-out		-
	Rated Continuous Current	3000		Amps
	Local/Remote Switch	Yes		-
	LED Indicating Lights (Close / Open / Trip)	Yes		-
	Circuit Breaker Control Switch	Yes		-
	Multi –Function Protective Meter / Relaying	Drawout		-
	a) Kilowatt Meter (MW)	Yes		Mfr/Type
	b) Watthour Meter (MWH)	Yes		Mfr/Type
	c) Watt Demand Meter (MWD)	Yes		Mfr/Type
	d) Voltmeter (V)	Yes		Mfr/Type
	e) Ammeter (A)	Yes		Mfr/Type
	f) Volt-Amp Reactive Meter (MVAR)	Yes		Mfr/Type
	g) Power Factor Meter (PF)	Yes		Mfr/Type
	h) AC time Overcurrent Relay (51)	Yes		Mfr/Type
	i) AC time Overcurrent Relay, Ground (51G)	Yes		Mfr/Type
	j) Bus side undervoltage (27B)	Yes		Mfr/Type
	k) Synch Check Relay (25)	Yes		Mfr/Type
12.	**TIE - CIRCUIT BREAKERS WITH MVE-SWGR-34002A** (Ref. 5)			
	Type	Draw-out		-
	Continuous Current Rating	1200		Amps
	Local/Remote Switch	Yes		-
	LED Indicating Light (Close / Open / Trip)	Yes		-
	Circuit Breaker Control Switch	Yes		-

Tag No.:	**MVE-SWGR-34001A, MVE-SWGR-34002A**
Equipment:	**BOF Building 34, 13.8 kV SWITCHGEAR ASSEMBLY**
Service:	**LOAD GROUP A**
Specification:	**24590-BOF-3PS-EKL0-T0001**
Reference Single Line Diagrams: 24590-BOF-E1-MVE-34001, 24590-BOF-E1-MVE-34002, 24590-BOF-E1-MVE-34004	

Line No.	DESCRIPTION	BUYER SPECIFIED	SUPPLIER FURNISHED	UNITS
	Multi-Function Protective Relay / Meter	Drawout		-
	a) Time Overcurrent (51)	Yes		Mfr/Type
	b) Time Overcurrent, Ground (51G)	Yes		Mfr/Type
	c) Synch Check Relay (25)	Yes		Mfr/Type
	d) Directional Power Relay (32)	Yes		Mfr/Type
	e) Ammeter	Yes		
13.	**TIE - CIRCUIT BREAKERS WITH MVE-SWGR-34001B** (Ref. 5)			
	Type	Draw-out		-
	Continuous Current Rating	3000		Amps
	Local/Remote Switch	Yes		-
	LED Indicating Light (Close / Open / Trip)	Yes		-
	Circuit Breaker Control Switch	Yes		-
	Multi-Function Protective relay / Meter	Draw-out		-
	b) Time Overcurrent Relay (51)	Yes		-
	c) Time Overcurrent Relay, Ground (51G)	Yes		-
	d) Sync Check Relay (25)	Yes		-
	e) Ammeter	Yes		-
14.	**FEEDER CIRCUIT BREAKERS** (Ref. 5, Ref 6)			
	Type	Draw-out		-
	Continuous Current Rating	1200		Amps
	Local/Remote Switch	Yes		-
	LED Indicating Light (Close / Open / Trip)	Yes		-
	Circuit Breaker Control Switch	Yes		-
	Multi-Function Protective relay / Meter	Drawout		-
	a) Instantaneous Overcurrent relay (50)	Yes		
	b) Time Overcurrent Relay (51)	Yes		
	c) Time Overcurrent Relay, Ground (51G)	Yes		
	d) Ammeter	Yes		
15.	**SWITCHGEAR SPACE HEATERS**			
	Space Heater Required (Yes/No)	Yes		-
	Rated Voltage	240		VAC
	Operating Voltage	120		VAC
	Required wattage	By Vendor		W
	Power Supply (Internal CPT/External)	External		-
16.	**GROUND CABLE LUG**			
	Size	250		kcmil
	Quantity	2		each
17.	**BUYER COMMUNICATION INTERFACE**			

Tag No.:	**MVE-SWGR-34001A, MVE-SWGR-34002A**
Equipment:	**BOF Building 34, 13.8 kV SWITCHGEAR ASSEMBLY**
Service:	**LOAD GROUP A**
Specification:	**24590-BOF-3PS-EKL0-T0001**
Reference Single Line Diagrams: 24590-BOF-E1-MVE-34001, 24590-BOF-E1-MVE-34002, 24590-BOF-E1-MVE-34004	

Line No.	DESCRIPTION	BUYER SPECIFIED	SUPPLIER FURNISHED	UNITS
	Profibus DP or Modbus Communication Interface	Modbus TCP/IP		-
	Fiber Optic Connection (yes / no)	No		Mfr/Type
	Ethernet Switch(es)	Yes, Output CAT6 to the C&I room		
18.	**SHOP INSPECTION AND TEST**			
	Mfr's Standard	Yes		-
18.	**SHOP INSPECTION AND TEST (Cont.)**			
	Test per Specification	Yes		-
	Is test to be witnessed – Specify Yes/No	Yes		-
	Certified Test Reports	Yes		-
19.	**SURGE ARRESTER**			
	Class	Distribution		-
	Rated voltage	15		kV
20.	**OTHER COMPONENTS AND AUXILIARIES**			
	Remote Racking Device	Integrated electrical-racking system with HMI in the adjacent room		
	Infrared Viewing Ports (For Arc Resistant Switchgear)	Yes		
21.	**Accessories**			
	(1) Maintenance Tool for manually charging the breaker closing spring and manually opening the shutter			
	(1) Levering Crank for moving the breaker between test and connected positions.			
	(1) Test Jumper for electrically operating the breaker while out of its compartment			
	(1) Ramp - for rolling the breaker mounted on lower compartment directly onto the floor			
	(1) Test Cabinet – for testing electrically operated breakers outside housing			
	(1) Test Switch – for testing electrically operated CT's & PT'S			

References

Ref. No.	Title	Document No.	Rev. No
1	Electrical Data Sheet: BOF Prefabricated Electrical Switchgear Building (Building 34)	24590-BOF-EKD-MVE-34001	1
2	DFHLW Switchgear and Building System Design Description (For Bechtel Use Only)	24590-BOF-3ZD-34-00001	1
3	Engineering Specification for B34, BOF Switchgear Building (Exhibit 1)	24590-BOF-3PS-EKL0-T0001	1
4	Switchgear Building 34 Main Single Line Diagram	24590-BOF-E1-MVE-34001	1
5	Switchgear Building 34 MVE-SWGR-34001ASingle Line Diagram	24590-BOF-E1-MVE-34002	1
6	Switchgear Building 34 MVE-SWGR-34002A Single Line Diagram	24590-BOF-E1-MVE-34004	0

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Document for Signature

Document Number: 24590-BOF-ESD-MVE-34001 **Rev:** 001

	Participants	Signature	Completed	Status	Result	Comments
Final Approver	**7/16/2024 9:58 AM**					
	hfeghali		7/16/2024 10:06 AM	Completed	Approve	

River Protection Project Waste Treatment Plant	**Electrical Data Sheet:** **13.8 kV SWITCHGEAR**	**DOCUMENT NO:** **24590-BOF-ESD-MVE-34003** **REVISION NO:** **1** **Page** 1 **of** 5

Tag No.:	**MVE-SWGR-34001B, MVE-SWGR-34002B**
Equipment:	**BOF Building 34, 13.8 kV SWITCHGEAR ASSEMBLY**
Service:	**LOAD GROUP B**
Specification:	**24590-BOF-3PS-EKL0-T0001**
Reference Single Line Diagrams: 24590-BOF-E1-MVE-34001, 24590-BOF-E1-MVE-34003, 24590-BOF-E1-MVE-34003	

Line No.	DESCRIPTION	BUYER SPECIFIED	SUPPLIER FURNISHED	UNITS
	SAFETY CLASSIFICATION/QUALITY LEVEL (Ref. 2)	NON-SAFETY/CM		-
	SEISMIC CATEGORY (Ref. 2)	SC-IV		-
1.	**SERVICE CONDITIONS** (Ref. 1)			
	Altitude	684		FT
	Seismic Zone (ASCE 7-22)	C		-
	Indoor Electrical Equipment Room Temperature, Normal/Abnormal Maximum	95/104		° F
	Indoor Electrical Equipment Room Temperature, Minimum	50		° F
	Indoor Electrical Equipment Room, Humidity	10 - 95		%
2.	**INCOMING SUPPLY / FEEDER**			
	Voltage	13.8		kV
	Frequency	60		Hz
	Phase	3		Phase
	System Ground	Low Resistance		-
	Cable Entry			
	a) Incoming Power Feeder Cables	Bottom		-
	b) Low Power / Control / Instrumentation Cables	Top		-
	c) Outgoing Load Power Feeder Cables	Bottom		-
	Power Supply			
	a) Breaker Control	125		VDC
	b) Auxiliary	120		VAC
	Cable Size	See SLD		-
3.	**SWITCHGEAR ENCLOSURE**			
	Type	Indoor, Arc Resistant Type 2C		-
	NEMA Type	NEMA 1 gasketed		-
	Panel			
	Rear Access	Hinged, accessible from outside of the switchgear building		-
	Front Access (Breaker Compartment Door)	Hinged		-
	a) Door Handle/Key lock	1		each
	Finish / Paint	ANSI 61, Light Gray		-

Rev. No	Date	Description	By	Checked	Approved
0	03/27/2024	Issued for Bid	J. Mamula	M. Pirvulescu	H. Feghali
1	See Stamp	Re-Issued for Bid (due to removal of second main breaker/future power source)	J. Mamula	M. Pirvulescu	H. Feghali

Originator
By: Jeron Mamula - jmamula
Org Name: Amentum
Placed: Jul 11, 2024

Checked
By: Maria Pirvulescu - mpirvule
Org Name: Amentum
Placed: Jul 11, 2024

Approved
By: Habib Feghali - hfeghali
Org Name: Amentum Project Engineer
Placed: Jul 16, 2024

Tag No.:	**MVE-SWGR-34001B, MVE-SWGR-34002B**
Equipment:	**BOF Building 34, 13.8 kV SWITCHGEAR ASSEMBLY**
Service:	**LOAD GROUP B**
Specification:	**24590-BOF-3PS-EKL0-T0001**
Reference Single Line Diagrams: 24590-BOF-E1-MVE-34001, 24590-BOF-E1-MVE-34003, 24590-BOF-E1-MVE-34003	

Line No.	DESCRIPTION	BUYER SPECIFIED	SUPPLIER FURNISHED	UNITS
4.	**MAIN BUS (MVE-SWGR-34001B Section)** (Ref. 4)			
	Nominal Voltage	13.8		kV
	Continuous Current Rating	3000		Amps
	Material	Copper, fully insulated		-
	Joint / Splice Plating	Silver		-
	Bus Insulation	per Mfr		-
	Bus Supports	per Mfr		-
	Bus Bracing			
	a) Type	per Mfr		-
	Cable Size/Bus to MVE-SWGR-34002B Section (via tie breaker)	See SLD		-
5.	**MAIN BUS (MVE-SWGR-34002B Section)** (Ref. 4)			
	Nominal Voltage	13.8		kV
	Continuous Current Rating	1200		Amps
	Material	Copper, fully insulated		-
	Joint / Splice Plating	Silver		-
	Bus Insulation	per Mfr		-
	Bus Supports	per Mfr		-
	Bus Bracing			
	a) Type	per Mfr		-
	Cable Size/Bus to MVE-SWGR-34001B Section (via tie breaker)	See SLD		-
6.	**BUS RELAYING/METERING** (Ref. 5, Ref. 6)			
	Lock out Relay (86B)	Yes		Mfr/Type
	Differential Relay (87B)	Yes		Mfr/Type
	Voltmeter (Analog)	Yes		Mfr/Type
	Voltmeter Switch	Yes		-
7.	**POWER CIRCUIT BREAKER General Characteristic**			
	Manufacturer Type	By vendor		Mfr/Type
	Interrupting Medium	Vacuum		-
	Rated Maximum Voltage	15		kV
	Rated Continuous Current	3000/1200		Amps
	Rated Short-Circuit Current	40/31.5		kA, rms
	Rated Interrupting Time	50		Mx
	Rated Closing and Latching Current	104/82		kA, peak
	Impulse Withstand Voltage Insulation Level	95		kV
	Rated Interrupting Time	3		Cycle
	Rated Permissible Tripping Delay	2		Sec
8.	**POTENTIAL TRANSFORMER (PT)**	By vendor		Mfr/Type
	PT Ratio	14400 / 120		VAC
	Accuracy	0.3-B-2.0		-

Tag No.:	**MVE-SWGR-34001B, MVE-SWGR-34002B**
Equipment:	**BOF Building 34, 13.8 kV SWITCHGEAR ASSEMBLY**
Service:	**LOAD GROUP B**
Specification:	**24590-BOF-3PS-EKL0-T0001**
Reference Single Line Diagrams: 24590-BOF-E1-MVE-34001, 24590-BOF-E1-MVE-34003, 24590-BOF-E1-MVE-34003	

Line No.	DESCRIPTION	BUYER SPECIFIED	SUPPLIER FURNISHED	UNITS
	Basic Impulse Level (BIL), Full Wave	95		kV
	Burden	per Mfr		VA
9.	**CURRENT TRANSFORMER (CT)** (Ref. 5, Ref. 6)	By vendor		Mfr/Type
	CT Ratio	see Dwg.		Per Mfr
	Phase CT Relaying Accuracy Class	By vendor		-
	Insulation	per Mfr		-
	Basic Impulse Level (BIL), Full Wave	95		kV
10.	**ZERO SEQUENCE CURRENT TRANSFORMER (CT)**	By vendor		Mfr/Type
	CT Ratio	50:5		Per Mfr
	Zero Sequence CT Relaying Accuracy Class	By vendor		-
	Basic Impulse Level (BIL), Full Wave	95		kV
11.	**MAIN CIRCUIT BREAKER (MVE-SWGR-34001B)** (Ref. 5)			
	Type	Draw-out		-
	Rated Continuous Current	3000		Amps
	Local/Remote Switch	Yes		-
	LED Indicating Lights (Close / Open / Trip)	Yes		-
	Circuit Breaker Control Switch	Yes		-
	Multi –Function Protective Meter / Relaying	Drawout		-
	a) Kilowatt Meter (MW)	Yes		Mfr/Type
	b) Watthour Meter (MWH)	Yes		Mfr/Type
	c) Watt Demand Meter (MWD)	Yes		Mfr/Type
	d) Voltmeter (V)	Yes		Mfr/Type
	e) Ammeter (A)	Yes		Mfr/Type
	f) Volt-Amp Reactive Meter (MVAR)	Yes		Mfr/Type
	g) Power Factor Meter (PF)	Yes		Mfr/Type
	h) AC time Overcurrent Relay (51)	Yes		Mfr/Type
	i) AC time Overcurrent Relay, Ground (51G)	Yes		Mfr/Type
	j) Bus side undervoltage (27B)	Yes		Mfr/Type
	k) Synch Check Relay (25)	Yes		Mfr/Type
12.	**TIE - CIRCUIT BREAKERS WITH MVE-SWGR-34002B** (Ref. 5)			
	Type	Draw-out		-
	Continuous Current Rating	1200		Amps
	Local/Remote Switch	Yes		-
	LED Indicating Light (Close / Open / Trip)	Yes		-
	Circuit Breaker Control Switch	Yes		-
	Multi-Function Protective Relay / Meter	Drawout		-
	a) Time Overcurrent (51)	Yes		Mfr/Type
	b) Time Overcurrent, Ground (51G)	Yes		Mfr/Type
	c) Synch Check Relay (25)	Yes		Mfr/Type

Tag No.:	**MVE-SWGR-34001B, MVE-SWGR-34002B**
Equipment:	**BOF Building 34, 13.8 kV SWITCHGEAR ASSEMBLY**
Service:	**LOAD GROUP B**
Specification:	**24590-BOF-3PS-EKL0-T0001**
Reference Single Line Diagrams: 24590-BOF-E1-MVE-34001, 24590-BOF-E1-MVE-34003, 24590-BOF-E1-MVE-34003	

Line No.	DESCRIPTION	BUYER SPECIFIED	SUPPLIER FURNISHED	UNITS
	d) Directional Power Relay (32)	Yes		Mfr/Type
	e) Ammeter	Yes		
13.	**TIE – MAINTENANCE CIRCUIT BREAKER WITH MVE-SWGR-34001A** (Ref. 5)			
	Type	Draw-out		-
	Continuous Current Rating	3000		Amps
	Local/Remote Switch	Yes		-
	LED Indicating Light (Close / Open)	Yes		-
	Circuit Breaker Control Switch	Yes		-
14.	**FEEDER CIRCUIT BREAKERS** (Ref. 5, Ref. 6)			
	Type	Draw-out		-
	Continuous Current Rating	1200		Amps
	Local/Remote Switch	Yes		-
	LED Indicating Light (Close / Open / Trip)	Yes		-
	Circuit Breaker Control Switch	Yes		-
	Multi-Function Protective relay / Meter	Draw-out		-
	a) Instantaneous Overcurrent relay (50)	Yes		-
	b) Time Overcurrent Relay (51)	Yes		-
	c) Time Overcurrent Relay, Ground (51G)	Yes		-
	d) Ammeter	Yes		-
15.	**SWITCHGEAR SPACE HEATERS**			
	Space Heater Required (Yes/No)	Yes		-
	Rated Voltage	240		VAC
	Operating Voltage	120		VAC
	Required wattage	By Vendor		W
	Power Supply (Internal CPT/External)	External		-
16.	**GROUND CABLE LUG**			
	Size	250		kcmil
	Quantity	2		each
17.	**BUYER COMMUNICATION INTERFACE**			
	Profibus DP or Modbus Communication Interface	Modbus TCP/IP		-
	Fiber Optic Connection (yes / no)	No		Mfr/Type
	Ethernet Switch(es)	Yes, Output CAT6 to the C&I room		
18.	**SHOP INSPECTION AND TEST**			
	Mfr's Standard	Yes		-
	Test per Specification	Yes		-

Tag No.:	**MVE-SWGR-34001B, MVE-SWGR-34002B**
Equipment:	**BOF Building 34, 13.8 kV SWITCHGEAR ASSEMBLY**
Service:	**LOAD GROUP B**
Specification:	**24590-BOF-3PS-EKL0-T0001**
Reference Single Line Diagrams: 24590-BOF-E1-MVE-34001, 24590-BOF-E1-MVE-34003, 24590-BOF-E1-MVE-34003	

Line No.	DESCRIPTION	BUYER SPECIFIED	SUPPLIER FURNISHED	UNITS
	Is test to be witnessed – Specify Yes/No	Yes		-
	Certified Test Reports	Yes		-
19.	**SURGE ARRESTER**			
	Class	Distribution		-
	Rated voltage	15		kV
20.	**OTHER COMPONENTS AND AUXILIARIES**			
	Remote Racking Device	Integrated electrical-racking system with HMI in the adjacent room		
	Infrared Viewing Ports (For Arc Resistant Switchgear)	Yes		
21.	**Accessories**			
	(1) Maintenance Tool for manually charging the breaker closing spring and manually opening the shutter			
	(1) Levering Crank for moving the breaker between test and connected positions.			
	(1) Test Jumper for electrically operating the breaker while out of its compartment			
	(1) Ramp - for rolling the breaker mounted on lower compartment directly onto the floor			
	(1) Test Cabinet – for testing electrically operated breakers outside housing			
	(1) Test Switch – for testing electrically operated CT's & PT'S			

References

Ref. No.	Title	Document No.	Rev. No
1	Electrical Data Sheet: BOF Prefabricated Electrical Switchgear Building (Building 34)	24590-BOF-EKD-MVE-34001	1
2	DFHLW Switchgear and Building System Design Description (For Bechtel Use Only)	24590-BOF-3ZD-34-00001	1
3	Engineering Specification for B34, BOF Switchgear Building (Exhibit 1)	24590-BOF-3PS-EKL0-T0001	1
4	Switchgear Building 34 Main Single Line Diagram	24590-BOF-E1-MVE-34001	1
5	Switchgear Building 34 MVE-SWGR-34001B Single Line Diagram	24590-BOF-E1-MVE-34003	1
6	Switchgear Building 34 MVE-SWGR-34002B Single Line Diagram	24590-BOF-E1-MVE-34005	0

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	hfeghali		7/16/2024 10:08 AM	Completed	Approve	

River Protection Project Waste Treatment Plant	**Electrical Data Sheet:** **480V-208/120V Dry-Type Transformer**	**DOCUMENT NO:** **24590-BOF-ETD-LVE-34001** **REVISION NO:** **0** **Page 1 of 2**

Visible Equipment Tag Nos.: LVE-XFMR-34001

Equipment: BOF Building 34, Dry-Type Transformer Data Sheet

Service: 208/120V Auxiliary Power Distribution Panel

Referenced Specification: 24590-BOF-3PS-EKL0-T0001, Exhibit 5

Line No.	DESCRIPTION	BUYER SPECIFIED	SELLER FURNISHED	UNITS
1.	**SAFETY AND QUALITY CLASSIFICATION**	CM (Non-Safety)		-
2.	**SEISMIC CATEGORY**	SC-IV		-
3.	**SITE CONDITIONS**			
	Altitude	684		FT
	Indoor Ambient Temperature, Maximum	95		° F
	Indoor Ambient Temperature, Minimum	50		° F
	Relative Humidity (Min/Max)	0-100		%
4.	**ENCLOSURE**			
	Type	Indoor		-
	Enclosure	NEMA 1		-
5.	**SYSTEM PARAMETERS**			
	Primary Rating: Voltage / Phase /Wire /Frequency	480 V / 3 Ph / 3 W / 60 Hz		-
	Primary Winding Connection	Delta		-
	Secondary Rating: Voltage / Phase /Wire /Frequency	208Y/120V /3 Ph / 4 W/ 60 Hz		-
	Secondary Winding Connection	Wye - solidly grounded		-
	Windings	Copper		-
6.	**RATING**			
	Output Power	75		kVA
	Temperature Rise	150		°C
	Insulation System Class	220		°C
	Ambient Temperature	40		°C
	Hot Spot Temperature (Maximum Above Winding Rise)	30		°C
	Winding Termination	75		°C
	Impedance	Per Manufacturer		-
	K-factor	Per Manufacturer		-
	Cooling Method	AA		-
	Transformer Efficiency / Heat Loss			
	@ No load	By Mfr.		% / kW
	@ 50 % load	By Mfr.		% / kW
	@ 75 % load	By Mfr.		% / kW
	@ 100 % load	By Mfr.		% / kW

Rev No.	Date	Description	By	Checked	Approved
0	See Stamp	Issued for Procurement	J. Mamula	R. Cain	M. Pirvulescu

Originator
By: Jeron Mamula - jmamula
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Placed: Nov 18, 2024

River Protection Project Waste Treatment Plant	**ELECTRICAL DATA SHEET** **UPS System (CM)**	**DOCUMENT NO:** **24590-BOF-EUD-UPE-34001** **REVISION NO:** **0** **Page** 1 **of** 5

Tag Nos.: UPE-UPS-34001; UPE-XFMR-34001; UPE-BATT-34001; UPE-CAB-34001; UPE-SW-34001

Equipment: Uninterruptible Power Supply (UPS) System

Standards & Certifications: IEEE, NEMA, UL

Referenced Drawing: 24590-BOF-E1-UPE-34001

Specification: 24590-BOF-3PS-EKL0-T0001 (Exhibit 3)

Line No.	DESCRIPTION	BUYER SPECIFIED	SUPPLIER FURNISHED	UNITS
1.	**SAFETY AND QUALITY CLASSIFICATION** (Ref. 2)	CM		-
2.	**SEISMIC CATEGORY** (Ref. 2)	SC-IV		-
3.	**SERVICE CONDITIONS** (Ref. 1)			
	Altitude	684		FT
	Seismic Zone (ASCE 7-22)	C		-
	Indoor Electrical Equipment Room Temperature, Normal/Abnormal Maximum	95/104		° F
	Indoor Electrical Equipment Room Temperature, Minimum	50		° F
	Indoor Electrical Equipment Room, Humidity	10 - 95		%
	Battery Room Minimum Temperature	72		° F
	Battery Room Maximum Temperature	77		° F
4.	**OVERALL UPS SYSTEM** (Ref. 4)			
4.1	Input:			
	- Voltage / Phase /Wire /Frequency	480 V / 3 Ph / 3 W / 60 Hz		-
	- Voltage Tolerance	+10 %, -15 %		-
	- Frequency Tolerance	± 5 %		-
	- Available Short Circuit Current	< 14		kA
4.2	Output:			
	- Voltage / Phase /Wire /Frequency	208Y/120 V / 3 Ph / 4 W/ 60 Hz		-
	- Continuous Rating, kVA / pf	15 kVA / 0.8 lag		-
	- Load type	Misc. rectifier loads, 1 ph		-
4.3	Bypass Input:			
	- Voltage / Phase /Wire /Frequency	480 V / 3 Ph / 3 W / 60 Hz		-
	- Voltage Tolerance	+10 %, -15 %		-
	- Frequency Tolerance, Minimum	± 5 %		-
	- Available Short Circuit Current	< 14		kA
4.4	Calculated UPS Load with 30% Margin	10,465		VA

Rev No.	Date	Description	By	Checked	Approved
0	See Stamp	Issued for Bid	J. Mamula	M. Pirvulescu	H. Feghali

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Placed: Mar 27, 2024

Tag Nos.: UPE-UPS-34001; UPE-XFMR-34001; UPE-BATT-34001; UPE-CAB-34001; UPE-SW-34001

Equipment: Uninterruptible Power Supply (UPS) System

Standards & Certifications: IEEE, NEMA, UL

Referenced Drawing: 24590-BOF-E1-UPE-34001

Specification: 24590-BOF-3PS-EKL0-T0001 (Exhibit 3)

Line No.	DESCRIPTION	BUYER SPECIFIED	SUPPLIER FURNISHED	UNITS
4.	**OVERALL UPS SYSTEM (Continued)**			
4.5	Efficiency, AC to AC			
	- with PWM inverter, minimum	75 %		-
4.6	UPS Cooling - (Natural or Redundant Fans)	By Supplier		-
4.7	Battery Reserve Time	30		minutes
	- Load Profile	100 % for full period		% kW
5.	**UPS ENCLOSURE (TAG NO. UPE-UPS-34001)**			
5.1	**Rectifier-Charger**			
	Input Transformer (Yes / No)	By Supplier (if reqd.)		-
	Float Voltage Range	By Supplier		-
	Boost Charge Range (Non-auto, maintenance use only)	By Supplier		-
	Input Current Rating	By Supplier		-
	Input p.f. at rated load	By Supplier		-
	Battery Temperature Probe for float voltage compensation (Yes / No)	Yes		-
	Battery Recharge Time when supplying full load	10		hours
	Maximum Reflected Input Harmonic Current	By Supplier		-
	Input Power Factor (minimum)	0.9 lag		-
	Input Filter Required, maximum 5 % THD (Yes / No)	Yes		-
5.2	**DC Link**			
	Nominal DC Voltage	By Supplier		V DC
	Allowable Maximum Float Voltage	By Supplier		V DC
	Allowable Minimum Float Voltage	By Supplier		V DC
	Allowable Boost Charge Voltage (non-auto, maintenance use only)	By Supplier		V DC

Tag Nos.: UPE-UPS-34001; UPE-XFMR-34001; UPE-BATT-34001; UPE-CAB-34001; UPE-SW-34001

Equipment: Uninterruptible Power Supply (UPS) System

Standards & Certifications: IEEE, NEMA, UL

Referenced Drawing: 24590-BOF-E1-UPE-34001

Specification: 24590-BOF-3PS-EKL0-T0001 (Exhibit 3)

Line No.	DESCRIPTION	BUYER SPECIFIED	SUPPLIER FURNISHED	UNITS
5.3	**Inverter**			
5.3.1	Type: Ferro-Resonant or PWM	By Supplier		-
5.3.2	Output Frequency Regulation	± 0.5 %		-
5.3.3	Harmonic Content in Output Voltage			
	- THD, maximum	8 %		-
	- Any single harmonic, maximum	3 %		-
5.3.4	Static Regulation, 0 - 100 % Full Load	± 2 %		-
5.3.5	Dynamic Regulation:			
	100 % step load change			
	- 1 st cycle	less than 30 %		-
	- 2 nd cycle	less than 20 %		-
	Switch to Bypass			
	- 1 st cycle	less than 30 %		-
	- 2 nd cycle	less than 20 %		-
5.3.6	Transient Recovery Time (max.)	4		cycles
5.3.7	Slew Rate, adjustable range	Set at 1		Hz/ sec
5.3.8	Overload Rating at Nominal Voltage			
	- 1 minute	150 %		-
	- 10 minute	125 %		-
5.3.9	Short Circuit Contribution:			
	- Current, % of Rated Current	By Supplier		%
	-Duration	By Supplier		cycles
3.3.10	Output circuit breaker (Yes / No)	Yes		-
5.4	**Static Transfer Switch**			
	Continuous Rating, % of Inverter Rated Current	125 %		-
	1 cycle Rating, % of Inverter Rated Current/ Amps	1,000 % / 1,200 A		-
	30 cycle Rating, % of Inverter Rated Current	By Supplier		-
	Power SCR, Continuous Rating	By Supplier		-
	Inverter Under-voltage Transfer Limit Adjustable Range	By Supplier		-
	Manual Transfer / Retransfer Control Switch (Yes / No)	Yes		-
5.5	**ALARMS & INDICATIONS PANEL**			
5.5.1	Mimic Diagram (Yes / No)	Yes		-
5.5.2	Metering			
	- Charger Input AC Volts (Yes / No)	Yes		-
	- Charger Input AC Amps (Yes / No)	Yes		-
	- Charger Output DC Volts (Yes / No)	Yes		-
	- Charger Output DC Amps (Yes / No)	Yes		-

Tag Nos.: UPE-UPS-34001; UPE-XFMR-34001; UPE-BATT-34001; UPE-CAB-34001; UPE-SW-34001

Equipment: Uninterruptible Power Supply (UPS) System

Standards & Certifications: IEEE, NEMA, UL

Referenced Drawing: 24590-BOF-E1-UPE-34001

Specification: 24590-BOF-3PS-EKL0-T0001 (Exhibit 3)

Line No.	DESCRIPTION	BUYER SPECIFIED	SUPPLIER FURNISHED	UNITS
5.5	**ALARMS & INDICATIONS PANEL (Continued)**			
	- Bypass Input Volts (Yes / No)	Yes		-
	- Bypass Input Amps (Yes / No)	Yes		-
	- Inverter Output AC Volts (Yes / No)	Yes		-
	- Inverter Output AC Amps (Yes / No)	Yes		-
	- Inverter Output Frequency (Yes / No)	Yes		-
5.5.3	Alarms & Indications:			
	- AC Source Failure (Yes / No)	Yes		-
	- Battery on Load (Yes / No)	Yes		-
	- Bypass on Load (Yes / No)	Yes		-
	- DC Ground Fault (Yes / No)	Yes		-
	- Bypass Source Not Available (Yes / No)	Yes		-
	- DC Voltage Low (Yes / No)	Yes		-
	- Fan Failure (If applicable, Yes / No)	Yes		-
	- Battery Disconnected (Yes / No)	Yes		-
	- Common Alarm with volt free Form C Contact (Yes / No)	Yes		-
6.	**BATTERY (TAG No. UPE-BATT-34001)**			
	Battery Type	VRLA		-
	Make/ model	By Supplier		-
	No. of Cells per string	By Supplier		-
	End of Discharge Voltage per Cell	By Supplier		V/ cell
	1 min. Discharge Rate @ End of Discharge Volt (Required)	By Supplier		kW/ cell
	30 min. Discharge Rate @ End of Discharge Volt (Required)	By Supplier		kW/ cell
	No. of Battery Strings in parallel (each 100%)	(1) string only		-
	Over-all Dimensions W X D X H	By Supplier		inches
	Total Weight	By Supplier		lbs.
7.	**BYPASS TRANSFORMER ENCLOSURE (TAG No. UPE-XFRM-34001)**			
7.1	**Bypass Transformer**			
	Primary Rating: Voltage / Phase /Wire /Frequency	480 V / 3 Ph / 3 W / 60 Hz		-
	Primary winding connection	Delta		-
	Secondary Rating: Voltage / Phase /Wire /Frequency	208Y/120V /3 Ph / 4 W/ 60 Hz		-
	Secondary winding connection	Y-solidly grounded		-
	Output Power Rating	15		kVA
	Temperature Rise	115		°C
	Insulation System Class	220		°C
	Impedance (max)	2.5 %		-
	2 - 2½ % taps FCAN, FCBN (Yes / No)	Yes		-

Tag Nos.: UPE-UPS-34001; UPE-XFMR-34001; UPE-BATT-34001; UPE-CAB-34001; UPE-SW-34001

Equipment: Uninterruptible Power Supply (UPS) System

Standards & Certifications: IEEE, NEMA, UL

Referenced Drawing: 24590-BOF-E1-UPE-34001

Specification: 24590-BOF-3PS-EKL0-T0001 (Exhibit 3)

Line No.	DESCRIPTION	BUYER SPECIFIED	SUPPLIER FURNISHED	UNITS
7.2	**Manual (Maintenance) Bypass Switch**			
	Voltage Rating	600		V
	Continuous Current Rating	150		A
	Type: Double -throw Switch/ Breakers	By Supplier		-
7.3	**Load Circuit Breaker**			
	Voltage Rating	600		V
	Continuous Current Rating, (Adjustable Electronic Trip, LSG)	150		A
	No. of Poles	3		-
8.	**Heat Dissipated for Equipment**			
	UPS Enclosure	By Supplier		kW
	Bypass Transformer Enclosure	By Supplier		kW
	Auto-Manual Bypass Switch Enclosure	By Supplier		kW
	Battery	By Supplier		kW
9.	**SHOP INSPECTION AND TESTS**			
	Mfr's Standard	Yes		-
	Test per Specification	Yes		-
	Certified Test Reports	Yes		-
10.	**CABLE ENTRY ARRANGEMENT**			
	(Top/ Bottom/ Side)	Top		-

References

Ref. No.	Title	Document No.	Rev. No
1	Electrical Data Sheet: BOF Prefabricated Electrical Switchgear Building (Building 34)	24590-BOF-EKD-MVE-34001	0
2	DFHLW Switchgear and Building System Design Description (For Bechtel Use Only)	24590-BOF-3ZD-34-00001	0
3	Engineering Specification for B34, BOF Switchgear Building (Exhibit 3)	24590-BOF-3PS-EKL0-T0001	0
4	Switchgear Building 34 Uninterruptible Power Supply (UPS) Single Line Diagram	24590-BOF-E1-UPE-34001	0
5	Calculation: Sizing of Non-Safety UPS Unit in Building 34	24590-BOF-E1C-UPE-34001	A

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	Participants	Signature	Completed	Status	Result	Comments
Signers	**3/27/2024 8:24 AM**					
	Mamula, Jeron		3/27/2024 8:24 AM	Completed	Approve	
	Pirvulescu, Maria		3/27/2024 11:17 AM	Completed	Approve	
Final Approver	**3/27/2024 11:17 AM**					
	hfeghali		3/27/2024 11:28 AM	Completed	Approve	

Visible Equipment Tag Nos.: LVE-XFMR-34001

Equipment: BOF Building 34, Dry-Type Transformer Data Sheet

Service: 208/120V Auxiliary Power Distribution Panel

Referenced Specification: 24590-BOF-3PS-EKL0-T0001, Exhibit 5

Line No.	DESCRIPTION	BUYER SPECIFIED	SELLER FURNISHED	UNITS
7.	**PAINTING**			
	Type	ANSI 61, Gray		-
8.	**DIMENSIONS**			
	L x W x H	Per Manufacturer		-
9.	**SHOP INSPECTION AND TEST**			
	Manufacturer's Standard	Yes		-
	Test per Specification	Yes		-
	Is test to be witnessed (Yes/No)	No		-
	Certified Test Reports	Yes		-

References

Ref. No	Title	Document No.	Rev. No
1	Engineering Specification for B34, BOF Switchgear Building	24590-BOF-3PS-EKL0-T0001	1
2	DFHLW Switchgear and Building System Design Description (For Bechtel Use Only)	24590-BOF-3ZD-34-00001	1
3	Basis of Design for the High-Level Waste (HLW) Facility and DFHLW Supporting Facilities (For Bechtel Use Only)	24590-WTP-DB-ENG-18-001	4
4	High-Level Waste (HLW) Facility and Direct-Feed High-Level Waste (DFHLW) Support Facilities Electrical Design Criteria (For Bechtel Use Only)	24590-WTP-DC-E-21-001	1
5	Switchgear Building 34 LVE Unit Substation Single Line Diagram	24590-BOF-E1-LVE-34001	1

Notes:

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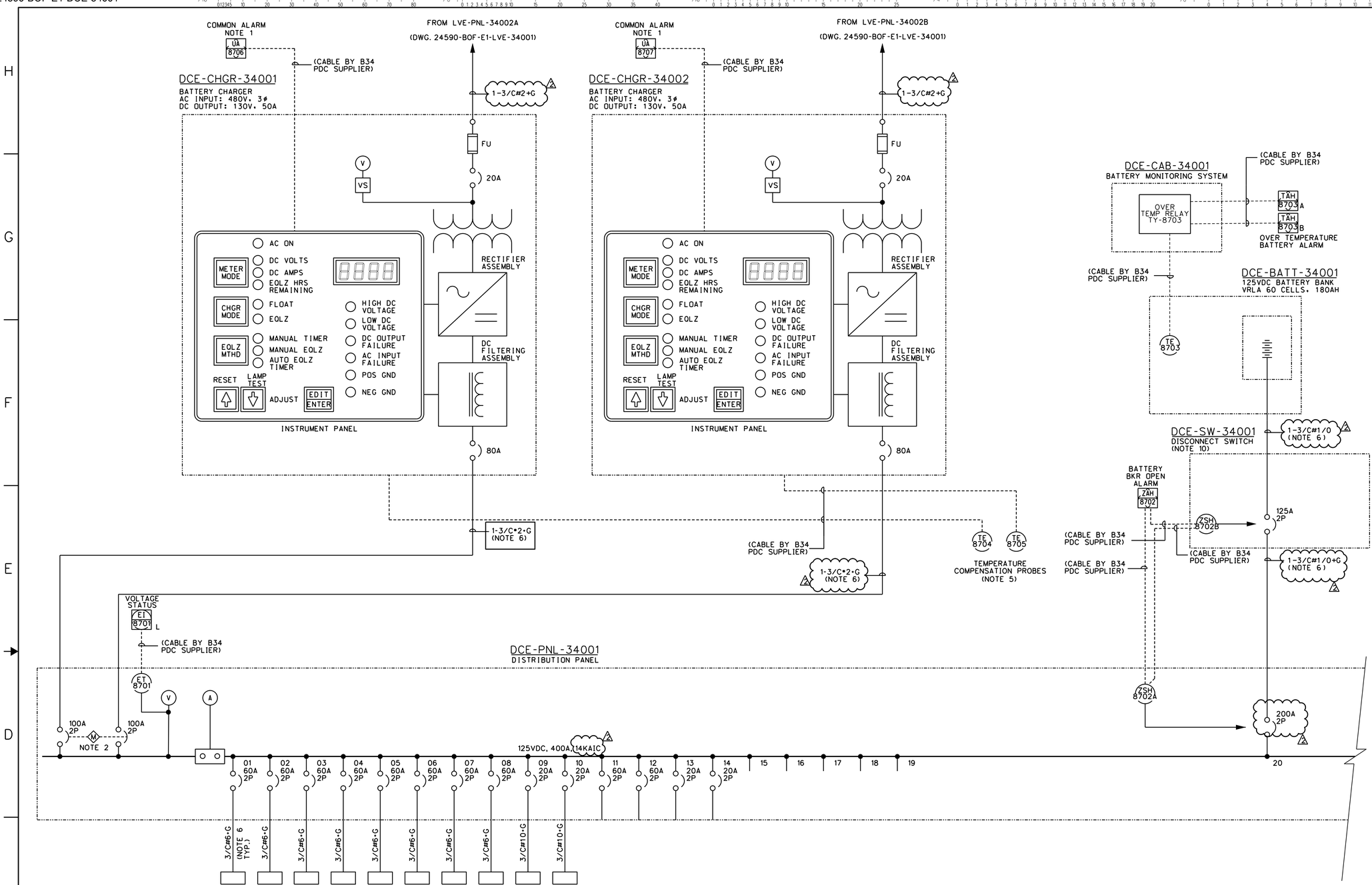
Final Approver	**11/15/2024 11:18 AM**					
	Pirvulescu, Maria		11/18/2024 4:58 PM	Completed	Approve	



NOTES

1. THE MICROPROCESSOR BASED CHARGER HAS LOCAL INDICATORS AND REMOTE COMMON ALARM FOR THE FOLLOWING FUNCTIONS:
   - 52 AC BREAKER TRIPPED
   - 72 DC BREAKER TRIPPED
   - 64 POSITIVE OR NEGATIVE GROUND FAULT DETECTION
   - 27DC DC UNDERVOLTAGE
   - 59DC DC OVERVOLTAGE
2. BREAKERS ARE MECHANICALLY INTERLOCKED SUCH THAT ONLY ONE BREAKER CAN BE CLOSED AT A TIME.
3. FOR CABLE IDENTIFICATION NUMBERING STRUCTURE, SEE 24590-WTP-3DI-E10W-00001.
4. FOR SIMPLICITY, ONLY THE SUFFIX CHARACTERS OF THE CABLE NUMBERING STRUCTURE ARE SHOWN.
5. BATTERY TEMPERATURE PROBES FOR FLOAT VOLTAGE COMPENSATION ARE CONNECTED TO THE CHARGERS.
6. ONLY TWO CONDUCTORS OF THE 3-CONDUCTOR CABLE ARE REQUIRED. THIRD CONDUCTOR AND GROUND ARE NOT USED.
7. DELETED
8. DCE-TE-8703 REPRESENTS INDIVIDUAL TEMPERATURE SENSORS MOUNTED ON EACH BATTERY STACKS WHICH ARE WIRED IN SERIES AND CONNECTED TO THE BATTERY MONITORING SYSTEM (DCE-TY-8703).
9. ALL CABLES ARE SUPPLIED AND INSTALLED BY BNI, UNLESS NOTED OTHERWISE.
10. DISCONNECT SWITCH DCE-SW-34001 IS INSTALLED TO COMPLY WITH NEC SECTION 240-21(b)(2).

REFERENCE DRAWINGS

24590-WTP-E0-E13T-00001	ELECTRICAL SYMBOLS AND LEGEND
24590-BOF-E1-LVE-34001	SWITCHGEAR BUILDING 34 LVE UNIT SUBSTATION SINGLE LINE DIAGRAM
24590-BOF-E1-MVE-34002	SWITCHGEAR BUILDING 34 13.8KV SWITCHGEAR MVE-SWGE-34001A SINGLE LINE DIAGARM
24590-BOF-E1-MVE-34003	SWITCHGEAR BUILDING 34 13.8KV SWITCHGEAR MVE-SWGE-34001B SINGLE LINE DIAGARM
24590-BOF-E1-MVE-34004	SWITCHGEAR BUILDING 34 13.8KV SWITCHGEAR MVE-SWGE-34002A SINGLE LINE DIAGARM
24590-BOF-E1-MVE-34005	SWITCHGEAR BUILDING 34 13.8KV SWITCHGEAR MVE-SWGE-34002B SINGLE LINE DIAGARM

HOLDS

REVISION NOTES

2. UPDATED CABLES SIZE AND BREAKER SIZE Δ2

REV	DESCRIPTION	ORG	CHKD	RVWD	APVD	DATE
2	ISSUED FOR 90% DESIGN	BB	RC	N/A	JM	SEE STAMP
1	RE-ISSUED FOR 60% DESIGN	BB	RC	N/A	MP	07/10/24
0	ISSSUED FOR 60% DESIGN	BB	RC	N/A	MP	03/26/24

Originator | Checked | Approved

REVISION HISTORY

CM QUALITY DESIGNATOR

ISSUED BY RPP-WTP PDC ISSUE STAMP

PROJECT No.	24590
SITE	HANFORD
AREA	200E
BUILDING No.	34

	BY	DATE
ORIGINATOR	BUI, BINH	03/26/24
CHECKER	CAIN, RICHARD	03/26/24
APPROVER	PIRVULESCU, MARIA	03/26/24
REVIEWER	N/A	

CONTENT APPLICABLE TO ALARA? [ ] YES [X] NO
ADR NO. REV:

BECHTEL

RIVER PROTECTION PROJECT
WASTE TREATMENT PLANT
450 HILLS ST.
RICHLAND, WA 99354

CONTRACT No: DE-AC27-01RV14136

SWITCHGEAR BUILDING 34 DC POWER 125 VDC SYSTEM SINGLE LINE DIAGRAM

SCALE: NTS

24590-BOF-E1-DCE-34001

REV 2

LEGEND

- BUS
- CABLE
- LOCATION
- BREAKER INTERLOCK POWER FLOW

FORM E_SDN.DGN 02/2009

"E" SIZE - 44x34
COMPUTER GENERATED - MANUAL DESIGN CHANGES NOT PERMITTED

PLOTTED BY: $USERNAME$ $FILE$

$DATE$ $TIME$

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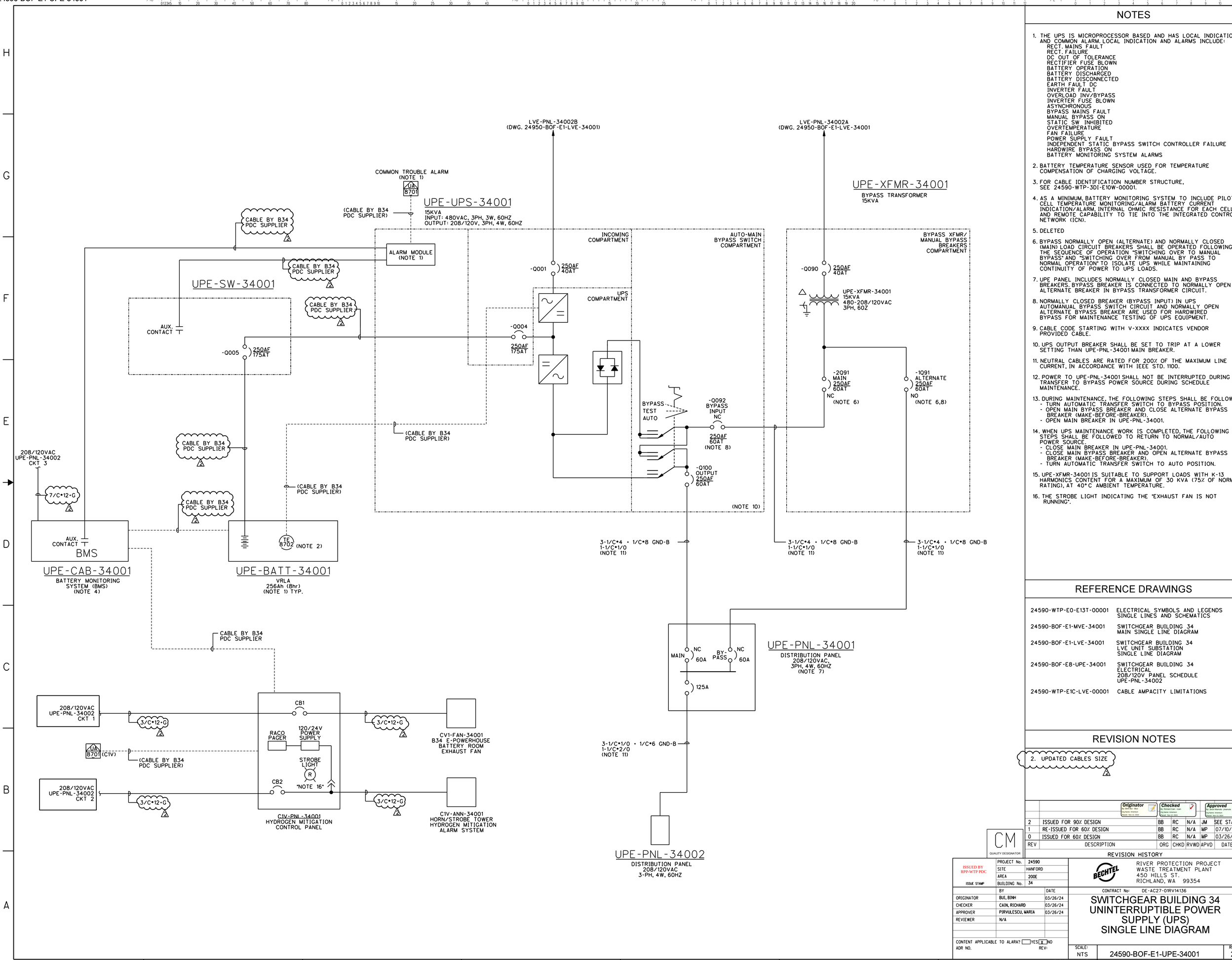
Document for Signature

Document Number: 24590-BOF-E1-DCE-34001 **Rev:** 002

	Participants	Signature	Completed	Status	Result	Comments
Final Approver	**11/13/2024 3:10 PM**					
	Mamula, Jeron		11/13/2024 3:55 PM	Completed	Approve	



NOTES

1. THE UPS IS MICROPROCESSOR BASED AND HAS LOCAL INDICATION AND COMMON ALARM. LOCAL INDICATION AND ALARMS INCLUDE:
   RECT. MAINS FAULT
   RECT. FAILURE
   DC OUT OF TOLERANCE
   RECTIFIER FUSE BLOWN
   BATTERY OPERATION
   BATTERY DISCHARGED
   BATTERY DISCONNECTED
   EARTH FAULT DC
   INVERTER FAULT
   OVERLOAD INV/BYPASS
   INVERTER FUSE BLOWN
   ASYNCHRONOUS
   BYPASS MAINS FAULT
   MANUAL BYPASS ON
   STATIC SW INHIBITED
   OVERTEMPERATURE
   FAN FAILURE
   POWER SUPPLY FAULT
   INDEPENDENT STATIC BYPASS SWITCH CONTROLLER FAILURE
   HARDWIRE BYPASS ON
   BATTERY MONITORING SYSTEM ALARMS
2. BATTERY TEMPERATURE SENSOR USED FOR TEMPERATURE COMPENSATION OF CHARGING VOLTAGE.
3. FOR CABLE IDENTIFICATION NUMBER STRUCTURE, SEE 24590-WTP-3DI-E10W-00001.
4. AS A MINIMUM, BATTERY MONITORING SYSTEM TO INCLUDE PILOT CELL TEMPERATURE MONITORING/ALARM BATTERY CURRENT INDICATION/ALARM, INTERNAL OHMIC RESISTANCE FOR EACH CELL, AND REMOTE CAPABILITY TO TIE INTO THE INTEGRATED CONTROL NETWORK (ICN).
5. DELETED
6. BYPASS NORMALLY OPEN (ALTERNATE) AND NORMALLY CLOSED (MAIN) LOAD CIRCUIT BREAKERS SHALL BE OPERATED FOLLOWING THE SEQUENCE OF OPERATION "SWITCHING OVER TO MANUAL BYPASS" AND "SWITCHING OVER FROM MANUAL BY PASS TO NORMAL OPERATION" TO ISOLATE UPS WHILE MAINTAINING CONTINUITY OF POWER TO UPS LOADS.
7. UPE PANEL INCLUDES NORMALLY CLOSED MAIN AND BYPASS BREAKERS. BYPASS BREAKER IS CONNECTED TO NORMALLY OPEN ALTERNATE BREAKER IN BYPASS TRANSFORMER CIRCUIT.
8. NORMALLY CLOSED BREAKER (BYPASS INPUT) IN UPS AUTOMANUAL BYPASS SWITCH CIRCUIT AND NORMALLY OPEN ALTERNATE BYPASS BREAKER ARE USED FOR HARDWIRED BYPASS FOR MAINTENANCE TESTING OF UPS EQUIPMENT.
9. CABLE CODE STARTING WITH V-XXXX INDICATES VENDOR PROVIDED CABLE.
10. UPS OUTPUT BREAKER SHALL BE SET TO TRIP AT A LOWER SETTING THAN UPE-PNL-34001 MAIN BREAKER.
11. NEUTRAL CABLES ARE RATED FOR 200% OF THE MAXIMUM LINE CURRENT, IN ACCORDANCE WITH IEEE STD. 1100.
12. POWER TO UPE-PNL-34001 SHALL NOT BE INTERRUPTED DURING TRANSFER TO BYPASS POWER SOURCE DURING SCHEDULE MAINTENANCE.
13. DURING MAINTENANCE, THE FOLLOWING STEPS SHALL BE FOLLOWED
    - TURN AUTOMATIC TRANSFER SWITCH TO BYPASS POSITION.
    - OPEN MAIN BYPASS BREAKER AND CLOSE ALTERNATE BYPASS BREAKER (MAKE-BEFORE-BREAKER).
    - OPEN MAIN BREAKER IN UPE-PNL-34001.
14. WHEN UPS MAINTENANCE WORK IS COMPLETED, THE FOLLOWING STEPS SHALL BE FOLLOWED TO RETURN TO NORMAL/AUTO POWER SOURCE.
    - CLOSE MAIN BREAKER IN UPE-PNL-34001.
    - CLOSE MAIN BYPASS BREAKER AND OPEN ALTERNATE BYPASS BREAKER (MAKE-BEFORE-BREAKER).
    - TURN AUTOMATIC TRANSFER SWITCH TO AUTO POSITION.
15. UPE-XFMR-34001 IS SUITABLE TO SUPPORT LOADS WITH K-13 HARMONICS CONTENT FOR A MAXIMUM OF 30 KVA (75% OF NORMAL RATING), AT 40°C AMBIENT TEMPERATURE.
16. THE STROBE LIGHT INDICATING THE "EXHAUST FAN IS NOT RUNNING".

REFERENCE DRAWINGS

24590-WTP-E0-E13T-00001	ELECTRICAL SYMBOLS AND LEGENDS SINGLE LINES AND SCHEMATICS
24590-BOF-E1-MVE-34001	SWITCHGEAR BUILDING 34 MAIN SINGLE LINE DIAGRAM
24590-BOF-E1-LVE-34001	SWITCHGEAR BUILDING 34 LVE UNIT SUBSTATION SINGLE LINE DIAGRAM
24590-BOF-E8-UPE-34001	SWITCHGEAR BUILDING 34 ELECTRICAL 208/120V PANEL SCHEDULE UPE-PNL-34002
24590-WTP-E1C-LVE-00001	CABLE AMPACITY LIMITATIONS

REVISION NOTES

2. UPDATED CABLES SIZE

REV	DESCRIPTION	ORG	CHKD	RVWD	APVD	DATE
2	ISSUED FOR 90% DESIGN	BB	RC	N/A	JM	SEE STAMP
1	RE-ISSUED FOR 60% DESIGN	BB	RC	N/A	MP	07/10/24
0	ISSUED FOR 60% DESIGN	BB	RC	N/A	MP	03/26/24

Originator | Checked | Approved

CM
QUALITY DESIGNATOR

REVISION HISTORY

ISSUED BY RPP-WTP PDC
ISSUE STAMP

PROJECT No.	24590
SITE	HANFORD
AREA	200E
BUILDING No.	34

	BY	DATE
ORIGINATOR	BUI, BINH	03/26/24
CHECKER	CAIN, RICHARD	03/26/24
APPROVER	PIRVULESCU, MARIA	03/26/24
REVIEWER	N/A	

CONTENT APPLICABLE TO ALARA? [ ] YES [X] NO
ADR NO. REV:

BECHTEL
RIVER PROTECTION PROJECT
WASTE TREATMENT PLANT
450 HILLS ST.
RICHLAND, WA 99354

CONTRACT No: DE-AC27-01RV14136

SWITCHGEAR BUILDING 34 UNINTERRUPTIBLE POWER SUPPLY (UPS) SINGLE LINE DIAGRAM

SCALE: NTS

24590-BOF-E1-UPE-34001

REV 2

"E" SIZE - 44x34
COMPUTER GENERATED - MANUAL DESIGN CHANGES NOT PERMITTED

FORM E_SDN.DGN 02/2009

PLOTTED BY: $USERNAME$ $FILE$ $DATE$ $TIME$

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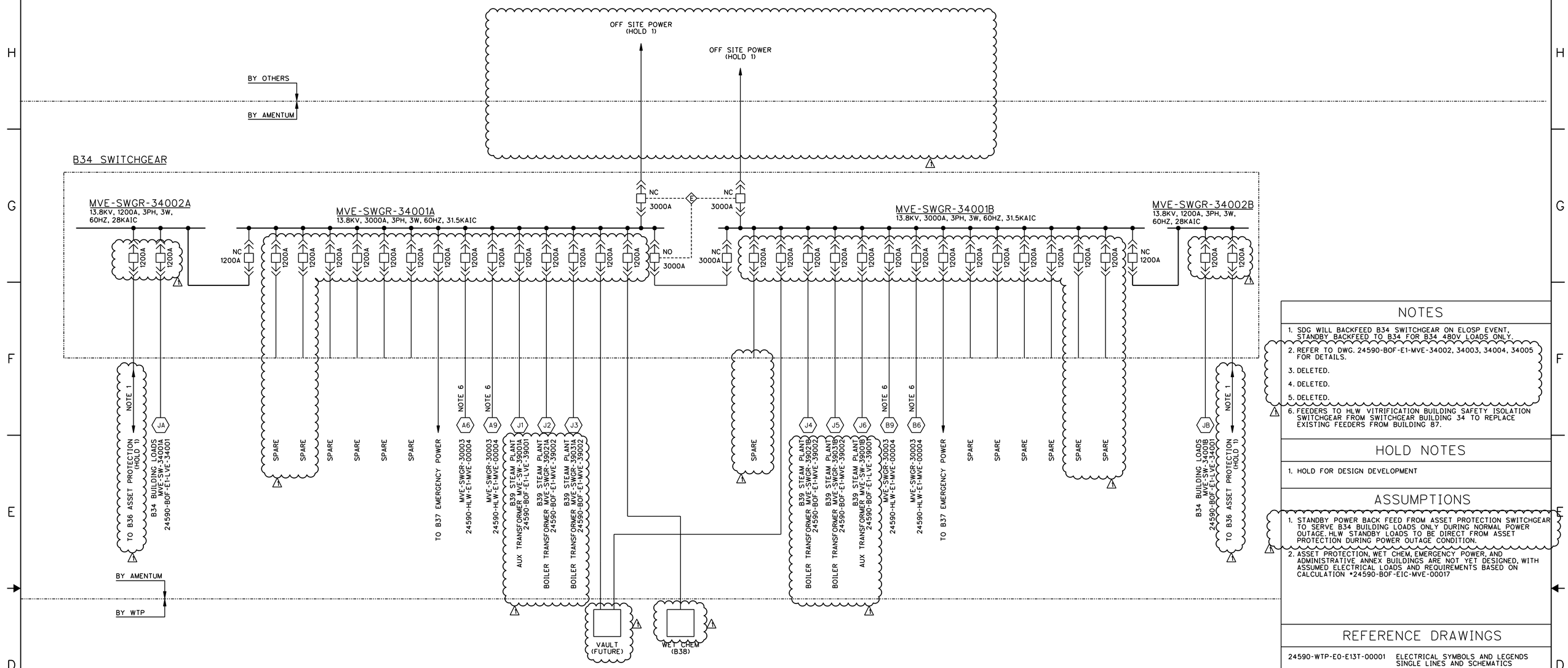
Document for Signature

Document Number: 24590-BOF-E1-UPE-34001 **Rev:** 002

	Participants	Signature	Completed	Status	Result	Comments
Final Approver	**11/13/2024 3:15 PM**					
	Mamula, Jeron		11/13/2024 4:06 PM	Completed	Approve	



NOTES

1. SDC WILL BACKFEED B34 SWITCHGEAR ON ELOSP EVENT. STANDBY BACKFEED TO B34 FOR B34 480V LOADS ONLY.
2. REFER TO DWG. 24590-BOF-E1-MVE-34002, 34003, 34004, 34005 FOR DETAILS.
3. DELETED.
4. DELETED.
5. DELETED.
6. FEEDERS TO HLW VITRIFICATION BUILDING SAFETY ISOLATION SWITCHGEAR FROM SWITCHGEAR BUILDING 34 TO REPLACE EXISTING FEEDERS FROM BUILDING 87.

HOLD NOTES

1. HOLD FOR DESIGN DEVELOPMENT

ASSUMPTIONS

1. STANDBY POWER BACK FEED FROM ASSET PROTECTION SWITCHGEAR TO SERVE B34 BUILDING LOADS ONLY DURING NORMAL POWER OUTAGE. HLW STANDBY LOADS TO BE DIRECT FROM ASSET PROTECTION DURING POWER OUTAGE CONDITION.
2. ASSET PROTECTION, WET CHEM, EMERGENCY POWER, AND ADMINISTRATIVE ANNEX BUILDINGS ARE NOT YET DESIGNED, WITH ASSUMED ELECTRICAL LOADS AND REQUIREMENTS BASED ON CALCULATION *24590-BOF-EIC-MVE-00017

REFERENCE DRAWINGS

24590-WTP-E0-E13T-00001	ELECTRICAL SYMBOLS AND LEGENDS SINGLE LINES AND SCHEMATICS
24590-BOF-E1-MVE-00001	OVERALL FACILITIES MAIN SINGLE LINE DIAGRAM
24590-BOF-E1-MVE-39001	STEAM PLANT BUILDING 39 MAIN SINGLE LINE DIAGRAM
24590-BOF-E1-MVE-34002	SWITCHGEAR BUILDING 34 13.8KV SWITCHGEAR MVE-SWGR-34001A SINGLE LINE DIAGRAM
24590-BOF-E1-MVE-34003	SWITCHGEAR BUILDING 34 13.8KV SWITCHGEAR MVE-SWGR-34001B SINGLE LINE DIAGRAM
24590-BOF-E1-MVE-34004	SWITCHGEAR BUILDING 34 13.8KV SWITCHGEAR MVE-SWGR-34002A SINGLE LINE DIAGRAM
24590-BOF-E1-MVE-34005	SWITCHGEAR BUILDING 34 13.8KV SWITCHGEAR MVE-SWGR-34002B SINGLE LINE DIAGRAM
24590-BOF-E1-LVE-34001	SWITCHGEAR BUILDING 34 LVE UNIT SUBSTATION SINGLE LINE DIAGRAM

REVISION NOTES

1. INCORPORATED EIE 2459-HLW-EIE-SYSE-24-0034

LEGEND

- CABLE
- BUS
- LOCATION
- BREAKER INTERLOCK POWER FLOW
- BIDIRECTIONAL
- UNIDIRECTIONAL

REV	DESCRIPTION	ORG	CHKD	RVWD	APVD	DATE
1	RE-ISSUED FOR 60% DESIGN	BB	RC	N/A	MP	SEE STAMP
0	ISSUED FOR 60% DESIGN	BB	RC	N/A	MP	03/26/24

Originator — Checked — Approved

CM
QUALITY DESIGNATOR

REVISION HISTORY

ISSUED BY RPP-WTP PDC

ISSUE STAMP

PROJECT No.	24590
SITE	HANFORD
AREA	200E
BUILDING No.	34

	BY	DATE
ORIGINATOR	BUI, BINH	03/26/24
CHECKER	CAIN, RICHARD	03/26/24
APPROVER	PIRVULESCU, MARIA	03/26/24
REVIEWER	N/A	

CONTENT APPLICABLE TO ALARA? ☐ YES ☒ NO
ADR NO. REV:

BECHTEL

RIVER PROTECTION PROJECT
WASTE TREATMENT PLANT
450 HILLS ST.
RICHLAND, WA 99354

CONTRACT No: DE-AC27-01RV14136

SWITCHGEAR BUILDING 34 MAIN SINGLE LINE DIAGRAM

SCALE: N.T.S

24590-BOF-E1-MVE-34001

REV 1

"E" SIZE - 44x34
COMPUTER GENERATED - MANUAL DESIGN CHANGES NOT PERMITTED

FORM E_SDN.DGN 02/2009

PLOTTED BY: $USERNAME$ $FILE$ $DATE$ $TIME$

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Document for Signature

Document Number: 24590-BOF-E1-MVE-34001 **Rev:** 001

	Participants	Signature	Completed	Status	Result	Comments
Signers	**7/10/2024 12:57 PM**					
	bbui		7/10/2024 12:58 PM	Completed	Approve	
	Cain, Richard		7/10/2024 3:19 PM	Completed	Approve	
Final Approver	**7/10/2024 3:19 PM**					
	Pirvulescu, Maria		7/10/2024 6:23 PM	Completed	Approve	

34001A-J1 TIE CIRCUIT BREAKER	34001A-K1 SPACE	34001A-H1 SPARE	34001A-G1 SPARE	34001A-F1 MVE-SWGR 30003	34001A-E1 MVE-SW 39001A	34001A-D1 MVE-SWGR 39031A	34001A-C1 WET CHEM	34001A-B1 MAIN CIRCUIT BREAKER	34001A-A1 TIE CIRCUIT BREAKER
34001A TRANSITION SECTION	34001A-K2 SPACE	34001A-H2 SPARE	34001A-G2 SPARE	34001A-F2 B37 EMERG. POWER	34001A-E2 MVE-SWGR 30003	34001A-D2 MVE-SWGR 39021A	34001A-C2 VAULT	34001A-B2 LINE VT	34001A-A2 BUS VT

FRONT VIEW
SWITCHGEAR MVE-SWGR-34001A

13.8 KV 4.16 KV 480V (FROM 4.16 KV) 480V (FROM 13.8 KV)

SYSTEM PHASOR

NOTES

1. MEDIUM VOLTAGE (MV) METAL-CLAD SWITCHGEAR ASSEMBLY WITH DRAWOUT VACUUM BREAKERS.
2. THE NORMAL CIRCUIT BREAKER CONFIGURATION IS WITH BOTH INCOMING (OFF SITE POWER) BREAKERS CLOSED, BUS 'A' TIE BREAKER (MVE-SWGR-34001A-A1) OPEN AND BUS 'B' TIE BREAKER (MVE-SWGR-34001B-A1) MAINTENANCE CLOSED. A 3-POSITION SWITCH IS PROVIDED ON THE BKRS MVE-SWGR-34001A-A1 & MVE-SWGR-34001B-A1 FOR SELECTION OF
(1) MAIN INCOMING BREAKER A (M1).
(2) MAIN INCOMING BREAKER B (M2).
(3) TIE BREAKER (BUS A) TIE (M3)

   THE CONTROL LOGIC IS SUCH THAT IF ALL THREE BREAKERS ARE IN 'CLOSED' POSITION, THE BREAKER SELECTED BY THE SELECTOR SWITCH WILL BE TRIPPED WITHOUT TIME DELAY AS A BACKUP MEASURE, IF THIS SELECTED BREAKER DOES NOT TRIP WITHIN A CERTAIN (SELECTED) TIME, THE LAST BREAKER CLOSED IN THE SEQUENCE WILL TRIP.
3. AN AUTO/MANUAL TRANSFER SELECTOR SWITCH (43) IS LOCATED ON BKRS MVE-SWGR-34002A-B2 & MVE-SWGR-34002B-B2. UNDER NORMAL OPERATING CONDITIONS WHEN BOTH TRANSFER SWITCHES ARE IN AUTO MODE, BKR MVE-SWGR-34001B-J1 IS INTERLOCKED WITH BKR MVE-SWGR-34002B-B2 AND MVE-SWGR-34001A-J1 IS INTERLOCKED WITH BKR MVE-SWGR-34002A-B2. SIMULTANEOUS LOSS OF VOLTAGES ON MVE-SWGR-34002A & 2B WILL INITIATE AN AUTO BUS TRANSFER BY:
   1) OPENING BKRS MVE-SWGR-34001A-J1 & MVE-SWGR-34001B-J1.
   2) CLOSING BKRS MVE-SWGR-34002A-B2 & MVE-SWGR-34002B-B2.
4. DELETED
5. ZERO SEQUENCE CTS ARE SPARE AND SHORTED IN PLACE.
6. OVERCURRENT TRIPS (51/51G) WILL LOCKOUT BKR FROM RE-CLOSE. MANUAL RESET IS REQUIRED. ALL OTHER TRIPS DO NOT REQUIRE MANUAL RESET.
7. JY COMPUTES TOTAL INCOMING POWER (MVA) TO MVE-SWGR-34001A/1B MAIN BREAKERS USING MW AND MVAR VALUES FROM EACH OF THE SWITCHGEAR MAIN BREAKER PROTECTION RELAYS (MVE-U1-8110/8140).
8. IN CASE OF FIRE ALARM, ALL BREAKERS WILL BE TRIPPED WITHOUT TIME DELAY.
9. ON LOSS OF OFF-SITE POWER, MVE-SWGR-34001A-J1 & 1B-J1 TIE BREAKERS TRIP ON UNDERVOLTAGE. LOSS OF OFF-SITE POWER IS DETECTED IN THE ICN WHEN ALL IN COMING BREAKERS ARE OPEN.
10. DELETED
11. FEEDERS TO HLW VITRIFICATION BUILDING SAFETY ISOLATION SWITCHGEAR FROM SWITCHGEAR BUILDING 34 TO REPLACE EXISTING FEEDERS FROM BUILDING 87.
12. EACH CUBICLE TO BE PROVIDED WITH RELAY TEST SWITCHES ON THE FRONT OF THE ENCLOSURE SUCH THAT THE RELAY FUNCTIONS MAY BE TESTED WITHOUT OPENING THE ENCLOSURE DOOR.

REFERENCE DRAWINGS

24590-WTP-EO-E13T-00001	ELECTRICAL SYMBOLS AND LEGEND SINGLE LINES & SCHEMATICS
24590-BOF-E1-MVE-34001	SWITCHGEAR BUILDING 34 MAIN SINGLE LINE DIAGRAM
24590-BOF-E1-MVE-34003	SWITCHGEAR BUILDING 34 13.8KV SWITCHGEAR MVE-SWGR-34001B SINGLE LINE DIAGRAM
24590-BOF-E1-LVE-34001	SWITCHGEAR BUILDING 34 LVE UNIT SUBSTATION SINGLE LINE DIAGRAM
24590-BOF-E1-MVE-34004	SWITCHGEAR BUILDING 34 13.8KV SWITCHGEAR MVE-SWGR-34002A SINGLE LINE DIAGRAM

HOLD NOTES

1. HOLD FOR DESIGN DEVELOPMENT.

REVISION NOTES

2. UPDATED THE NOTE 2, NOTE 3, CTS RATIO AND ADDED NOTE 12

REV	DESCRIPTION	ORG	CHKD	RVWD	APVD	DATE
2	ISSUED FOR 90% DESGN	BB	RC	N/A	JM	SEE STAMP
1	RE-ISSUED FOR 60% DESIGN	BB	RC	N/A	MP	07/10/24
0	ISSUED FOR 60% DESIGN	BB	RC	N/A	MP	03/26/24

Originator Checked Approved

CM QUALITY DESIGNATOR

REVISION HISTORY

ISSUED BY RPP-WTP PDC

ISSUE STAMP

PROJECT No.	24590
SITE	HANFORD
AREA	200E
BUILDING No.	34

	BY	DATE
ORIGINATOR	BUI, BINH	03/26/24
CHECKER	CAIN, RICHARD	03/26/24
APPROVER	PIRVULESCU, MARIA	03/26/24
REVIEWER	N/A	

CONTENT APPLICABLE TO ALARA? [ ] YES [X] NO
ADR NO. REV:

BECHTEL
RIVER PROTECTION PROJECT
WASTE TREATMENT PLANT
450 HILLS ST.
RICHLAND, WA 99354

CONTRACT No: DE-AC27-01RV14136

SWITCHGEAR BUILDING 13.8KV SWITCHGEAR MVE-SWGR-34001A SINGLE LINE DIAGRAM

SCALE: NTS

24590-BOF-E1-MVE-34002

REV 2

"E" SIZE - 44x34
COMPUTER GENERATED - MANUAL DESIGN CHANGES NOT PERMITTED

FORM E_SDN.DGN 02/2009

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Document for Signature

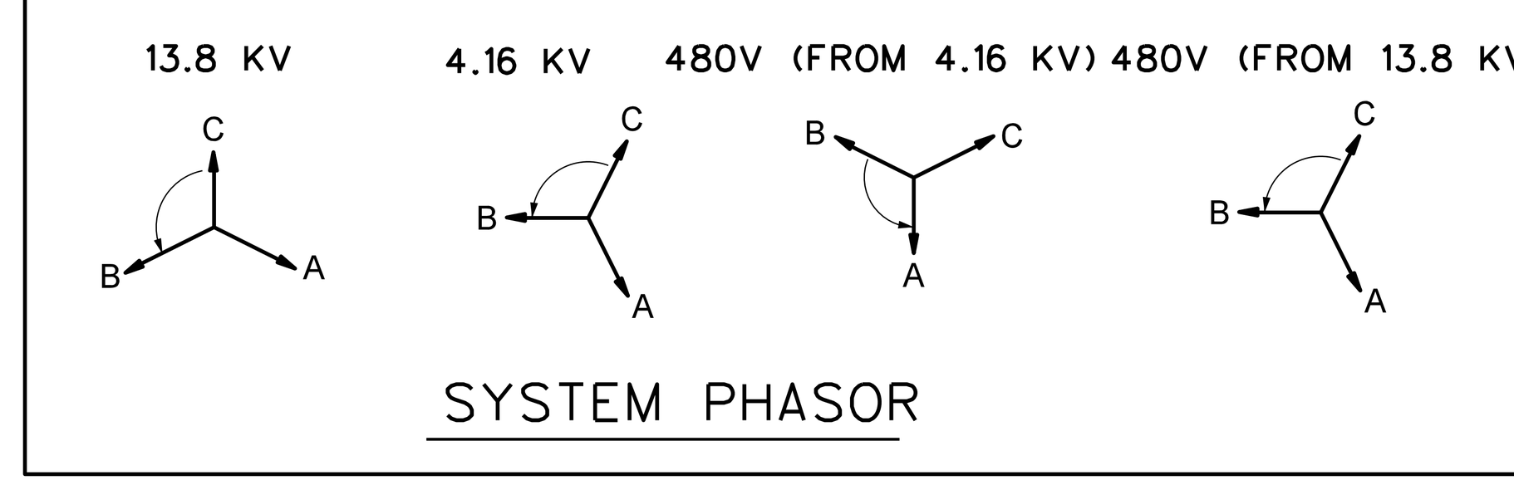
Document Number: 24590-BOF-E1-MVE-34002 **Rev:** 002

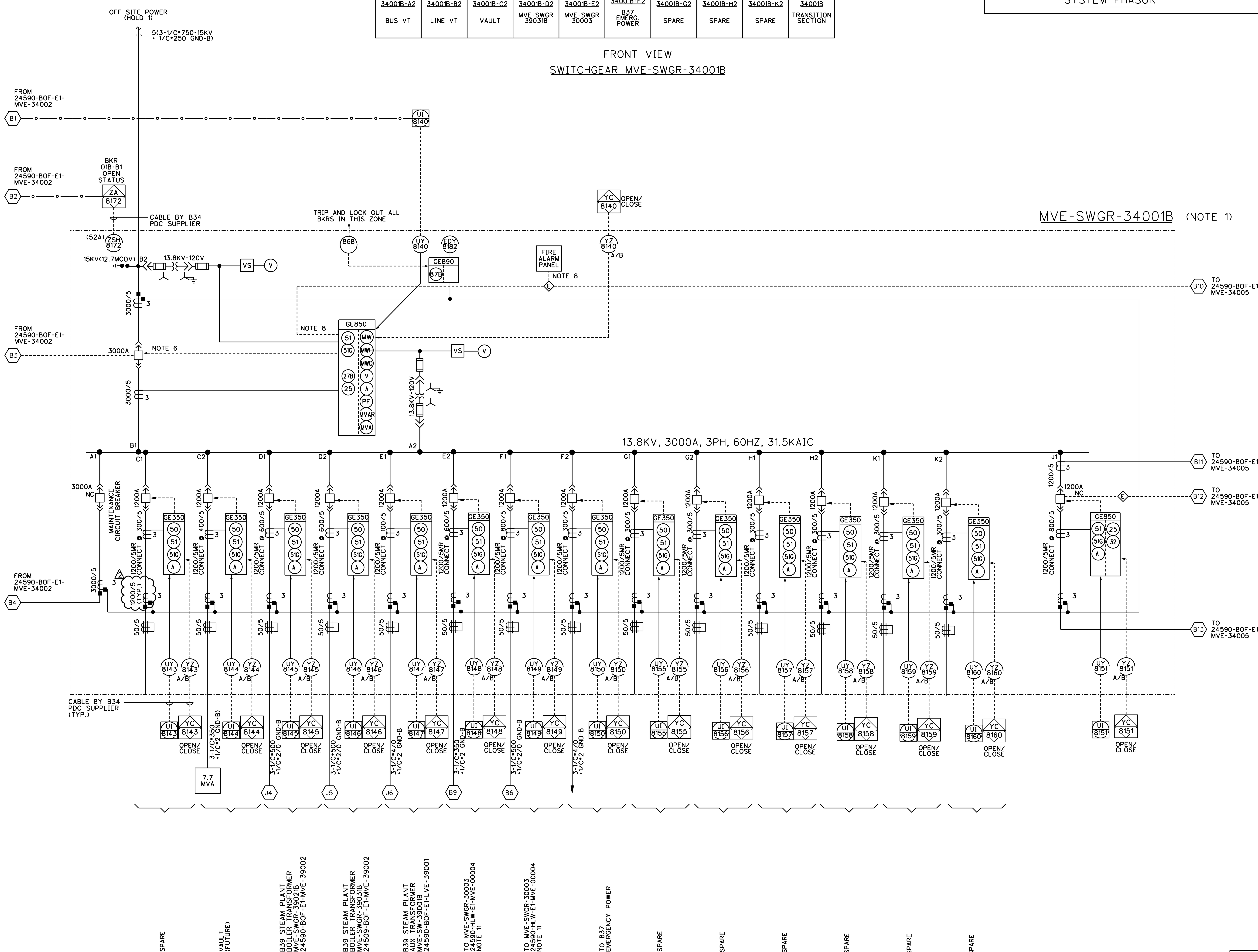
	Participants	Signature	Completed	Status	Result	Comments
Final Approver	**11/13/2024 3:11 PM**					
	Mamula, Jeron		11/13/2024 3:57 PM	Completed	Approve	

34001B-A1	34001B-B1	34001B-C1	34001B-D1	34001B-E1	34001B-F1	34001B-G1	34001B-H1	34001B-K1	34001B-J1
TIE CIRCUIT BREAKER	MAIN CIRCUIT BREAKER	SPARE	MVE-SWGR 39021B	MVE-SW 39001B	MVE-SWGR 30003	SPARE	SPARE	SPARE	TIE CIRCUIT BREAKER
34001B-A2	34001B-B2	34001B-C2	34001B-D2	34001B-E2	34001B-F2	34001B-G2	34001B-H2	34001B-K2	34001B
BUS VT	LINE VT	VAULT	MVE-SWGR 39031B	MVE-SWGR 30003	B37 EMERG. POWER	SPARE	SPARE	SPARE	TRANSITION SECTION

FRONT VIEW

SWITCHGEAR MVE-SWGR-34001B





NOTES

1. MEDIUM VOLTAGE (MV) METAL-CLAD SWITCHGEAR ASSEMBLY WITH DRAWOUT VACUUM BREAKERS.
2. THE NORMAL CIRCUIT BREAKER CONFIGURATION IS WITH BOTH INCOMING (OFF SITE POWER) BREAKERS CLOSED, BUS 'A' TIE BREAKER (MVE-SWGR-34001A-A1) OPEN AND BUS 'B' TIE BREAKER (MVE-SWGR-34001B-A1) MAINTENANCE CLOSED. A 3-POSITION SWITCH IS PROVIDED ON THE BKRS MVE-SWGR-34001A-A1 & MVE-SWGR-34001B-A1 FOR SELECTION OF:
   (1) MAIN INCOMING BREAKER A (M1).
   (2) MAIN INCOMING BREAKER B (M2).
   (3) TIE BREAKER (BUS A) TIE (M3).

   THE CONTROL LOGIC IS SUCH THAT IF ALL THREE BREAKERS ARE IN "CLOSED" POSITION, THE BREAKER SELECTED BY THE SELECTOR SWITCH WILL BE TRIPPED WITHOUT TIME DELAY. AS A BACKUP MEASURE, IF THIS SELECTED BREAKER DOES NOT TRIP WITHIN A CERTAIN (SELECTED) TIME, THE LAST BREAKER CLOSED IN THE SEQUENCE WILL TRIP.
3. AN AUTO/MANUAL TRANSFER SELECTOR SWITCHER (43) IS LOCATED ON BKR MVE-SWGR-34002A-B2 & MVE-SWGR-34002B-B2. UNDER NORMAL OPERATING CONDITIONS WHEN BOTH TRANSFER SWITCHES ARE IN AUTO MODE, BKR MVE-SWGR-34001B-J1 IS INTERLOCKED WITH BKR MVE-SWGR-34002B-B2 AND MVE-SWGR-34001A-J1 IS INTERLOCKED WITH BKR MVE-SWGR-34002A-B2. SIMULTANEOUS LOSS OF VOLTAGES ON MVE-SWGR-34002A & 2B WILL INITIATE AN AUTO BUS TRANSFER BY:
   1) OPENING BKRS MVE-SWGR-34001A-J1 & MVE-SWGR-34001B-J1,
   2) CLOSING BKRS MVE-SWGR-34002A-B2 & MVE-SWGR-34002B-B2,
4. DELETED
5. ZERO SEQUENCE CTS ARE SPARE AND SHORTED IN PLACE.
6. OVERCURRENT TRIPS (51/51G) WILL LOCKOUT BKR FROM RE-CLOSE. MANUAL RESET IS REQUIRED. ALL OTHER TRIPS DO NOT REQUIRE MANUAL RESET.
7. JY COMPUTES TOTAL INCOMING POWER (MVA) TO MVE-SWGR-34001A/1B MAIN BREAKERS USING MW AND MVAR VALUES FROM EACH OF THE SWITCHGEAR MAIN BREAKER PROTECTION RELAYS (MVE-UI-8110/8140).
8. IN CASE OF FIRE ALARM, ALL BREAKERS WILL BE TRIPPED WITHOUT TIME DELAY.
9. ON LOSS OF OFF-SITE POWER, MVE-SWGR-34001A-J1 & 1B-J1 TIE BREAKERS TRIP ON UNDERVOLTAGE. LOSS OF OFF-SITE POWER IS DETECTED IN THE ICN WHEN ALL IN COMING BREAKERS ARE OPEN.
10. DELETED
11. FEEDERS TO HLW VITRIFICATION BUILDING SAFETY ISOLATION SWITCHGEAR FROM SWITCHGEAR BUILDING 34 TO REPLACE EXISTING FEEDERS FROM BUILDING 87.
12. EACH CUBICLE TO BE PROVIDED WITH RELAY TEST SWITCHES ON THE FRONT OF THE ENCLOSURE SUCH THAT THE RELAY FUNCTIONS MAY BE TESTED WITHOUT OPENING THE ENCLOSURE DOOR.

REFERENCE DRAWINGS

24590-WTP-E0-E13T-00001	ELECTRICAL SYMBOLS AND LEGEND SINGLE LINES & SCHEMATICS
24590-BOF-E1-MVE-34001	SWITCHGEAR BUILDING 34 MAIN SINGLE LINE DIAGRAM
24590-BOF-E1-MVE-34002	SWITCHGEAR BUILDING 34 13.8KV SWITCHGEAR MVE-SWGR-34001A SINGLE LINE DIAGRAM
24590-BOF-E1-MVE-34005	SWITCHGEAR BUILDING 34 13.8KV SWITCHGEAR MVE-SWGR-34002B SINGLE LINE DIAGRAM
24590-BOF-E1-LVE-34001	SWITCHGEAR BUILDING 34 LVE UNIT SUBSTATION SINGLE LINE DIAGARM

HOLD NOTES

1. HOLD FOR DESIGN DEVELOPMENT.

REVISION NOTES

1. UPDATED THE NOTE 2, NOTE 3, CTS RATIO AND ADDED NOTE 12.

Originator By: Binh Bui - bbui Org Name: Amentum Placed: Nov 12, 2024
Checked By: Richard Cain - rcain Org Name: Amentum Placed: Nov 12, 2024
Approved By: Jeron Mamula - jmamula Org Name: Amentum Placed: Nov 13, 2024

REV	DESCRIPTION	ORG	CHKD	RVWD	APVD	DATE
2	ISSUED FOR 90% DESIGN	BB	RC	N/A	JM	SEE STAMP
1	RE-ISSUED FOR 60% DESIGN	BB	RC	N/A	MP	07/10/24
0	ISSUED FOR 60% DESIGN	BB	RC	N/A	MP	03/26/24

REVISION HISTORY

CM QUALITY DESIGNATOR

ISSUED BY RPP-WTP PDC
ISSUE STAMP

PROJECT No.	24590
SITE	HANFORD
AREA	200E
BUILDING No.	34

	BY	DATE
ORIGINATOR	BUI, BINH	03/26/24
CHECKER	CAIN, RICHARD	03/26/24
APPROVER	PIRVULESCU, MARIA	03/26/24
REVIEWER	N/A	

CONTENT APPLICABLE TO ALARA? [ ] YES [X] NO
ADR NO. REV:

BECHTEL
RIVER PROTECTION PROJECT
WASTE TREATMENT PLANT
450 HILLS ST.
RICHLAND, WA 99354

CONTRACT No: DE-AC27-01RV14136

SWITCHGEAR BUILDING 34 13.8KV SWITCHGEAR MVE-SWGR-34001B SINGLE LINE DIAGRAM

SCALE: N.T.S
24590-BOF-E1-MVE-34003
REV 2

'E' SIZE - 44x34
COMPUTER GENERATED - MANUAL DESIGN CHANGES NOT PERMITTED

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Document for Signature

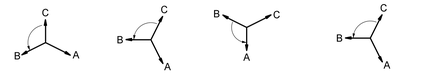
Document Number: 24590-BOF-E1-MVE-34003 **Rev:** 002

	Participants	Signature	Completed	Status	Result	Comments
Final Approver	**11/13/2024 3:13 PM**					
	Mamula, Jeron		11/13/2024 4:01 PM	Completed	Approve	

34002A-B1 UNIT SUB. MVE-SW 34001A	34002A-A1 BUS VT
34002A-B2 ASSET PROTECTION	34002A-A2 LINE VT

FRONT VIEW
SWITCHGEAR MVE-SWGR-34002A

13.8 KV 4.16 KV 480V (FROM 4.16 KV) 480V (FROM 13.8 KV)

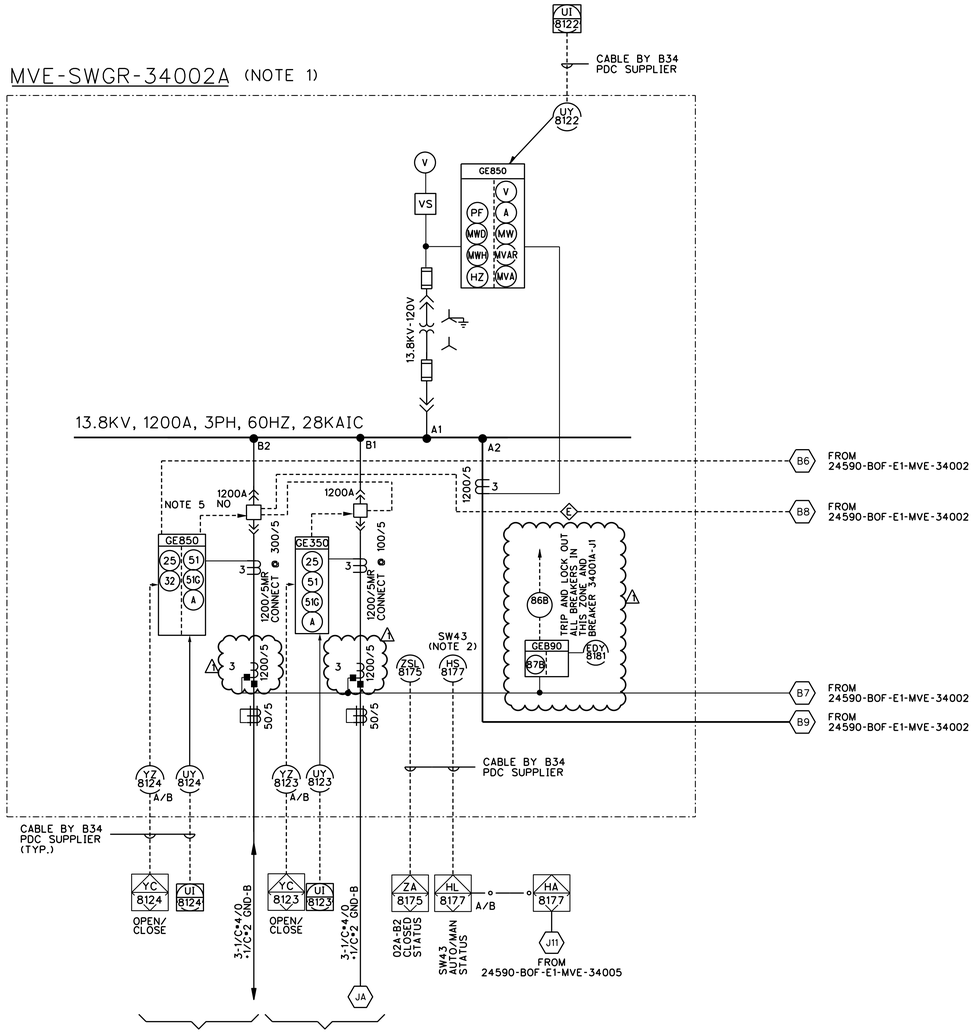


SYSTEM PHASOR

NOTES

1. MEDIUM VOLTAGE (MV) METAL-CLAD SWITCHGEAR ASSEMBLY WITH DRAWOUT VACUUM BREAKERS.
2. AN AUTO/MANUAL TRANSFER SELECTOR SWITCHER (43) IS LOCATED ON BKR MVE-SWGR-34002A-B2 & MVE-SWGR-34002B-B2. UNDER NORMAL OPERATING CONDITIONS WHEN BOTH TRANSFER SWITCHES ARE IN AUTO MODE, BKR MVE-SWGR-34001B-J1 IS INTERLOCKED WITH BKR MVE-SWGR-34002B-B2 AND MVE-SWGR-34001A-J1 IS INTERLOCKED WITH BKR MVE-SWGR-34002A-B2. SIMULTANEOUS LOSS OF VOLTAGES ON MVE-SWGR-34002A & 2B WILL INITIATE AN AUTO BUS TRANSFER BY:
   1) OPENING BKRS MVE-SWGR-34001A-J1 & MVE-SWGR-34001B-J1,
   2) CLOSING BKRS MVE-SWGR-34002A-B2 & MVE-SWGR-34002B-B2.
3. ZERO SEQUENCE CTS ARE SPARE AND SHORTED IN PLACE.
4. OVERCURRENT TRIPS (51/51G) WILL LOCKOUT BKR FROM RE-CLOSE. MANUAL RESET IS REQUIRED. ALL OTHER TRIPS DO NOT REQUIRE MANUAL RESET.
5. IN CASE OF FIRE ALARM, ALL BREAKERS WILL BE TRIPPED WITHOUT TIME DELAY.
6. ON LOSS OF OFF-SITE POWER, MVE-SWGR-34001A-J1 & 1B-J1 TIE BREAKERS TRIP ON UNDERVOLTAGE. LOSS OF OFF-SITE POWER IS DETECTED IN THE ICN WHEN ALL IN COMING BREAKERS ARE OPEN.
7. EACH CUBICLE TO BE PROVIDED WITH RELAY TEST SWITCHES ON THE FRONT OF THE ENCLOSURE SUCH THAT THE RELAY FUNCTIONS MAY BE TESTED WITHOUT OPENING THE ENCLOSURE DOOR.

MVE-SWGR-34002A (NOTE 1)



REFERENCE DRAWINGS

24590-WTP-EO-E13T-00001	ELECTRICAL SYMBOLS AND LEGEND SINGLE LINES & SCHEMATICS
24590-BOF-E1-MVE-34001	SWITCHGEAR BUILDING 34 MAIN SINGLE LINE DIAGRAM
24590-BOF-E1-MVE-34002	SWITCHGEAR BUILDING 34 13.8KV SWITCHGEAR MVE-SWGR-34001A SINGLE LINE DIAGRAM
24590-BOF-E1-MVE-34005	SWITCHGEAR BUILDING 34 13.8KV SWITCHGEAR MVE-SWGR-34002B SINGLE LINE DIAGARM
24590-BOF-E1-LVE-34001	SWITCHGEAR BUILDING 34 LVE UNIT SUBSTATION SINGLE LINE DIAGARM

HOLD NOTES

1. HOLD FOR DESIGN DEVELOPMENT.

REVISION NOTES

1. UPDATED NOTE 2, CTS RATIO, ADDED NOTE 7 AND ADDED RELAY GE890.

REV	DESCRIPTION	ORG	CHKD	RVWD	APVD	DATE
1	ISSUED FOR 90% DESGN	BB	RC	N/A	JM	SEE STAMP
0	ISSUED FOR 60% DESIGN	BB	RC	N/A	MP	07/10/24

Originator | Checked | Approved

REVISION HISTORY

CM QUALITY DESIGNATOR

ISSUED BY RPP-WTP PDC
ISSUE STAMP

PROJECT No.	24590	
SITE	HANFORD	
AREA	200E	
BUILDING No.	34	

	BY	DATE
ORIGINATOR	BUI, BINH	07/10/24
CHECKER	CAIN, RICHARD	07/10/24
APPROVER	PIRVULESCU, MARIA	07/10/24
REVIEWER		

CONTENT APPLICABLE TO ALARA? [ ] YES [X] NO
ADR NO. REV:

BECHTEL
RIVER PROTECTION PROJECT
WASTE TREATMENT PLANT
450 HILLS ST.
RICHLAND, WA 99354

CONTRACT No: DE-AC27-01RV14136

SWITCHGEAR BUILDING 34 13.8KV SWITCHGEAR MVE-SWGR-34002A SINGLE LINE DIAGRAM

SCALE: NTS
24590-BOF-E1-MVE-34004
REV 1

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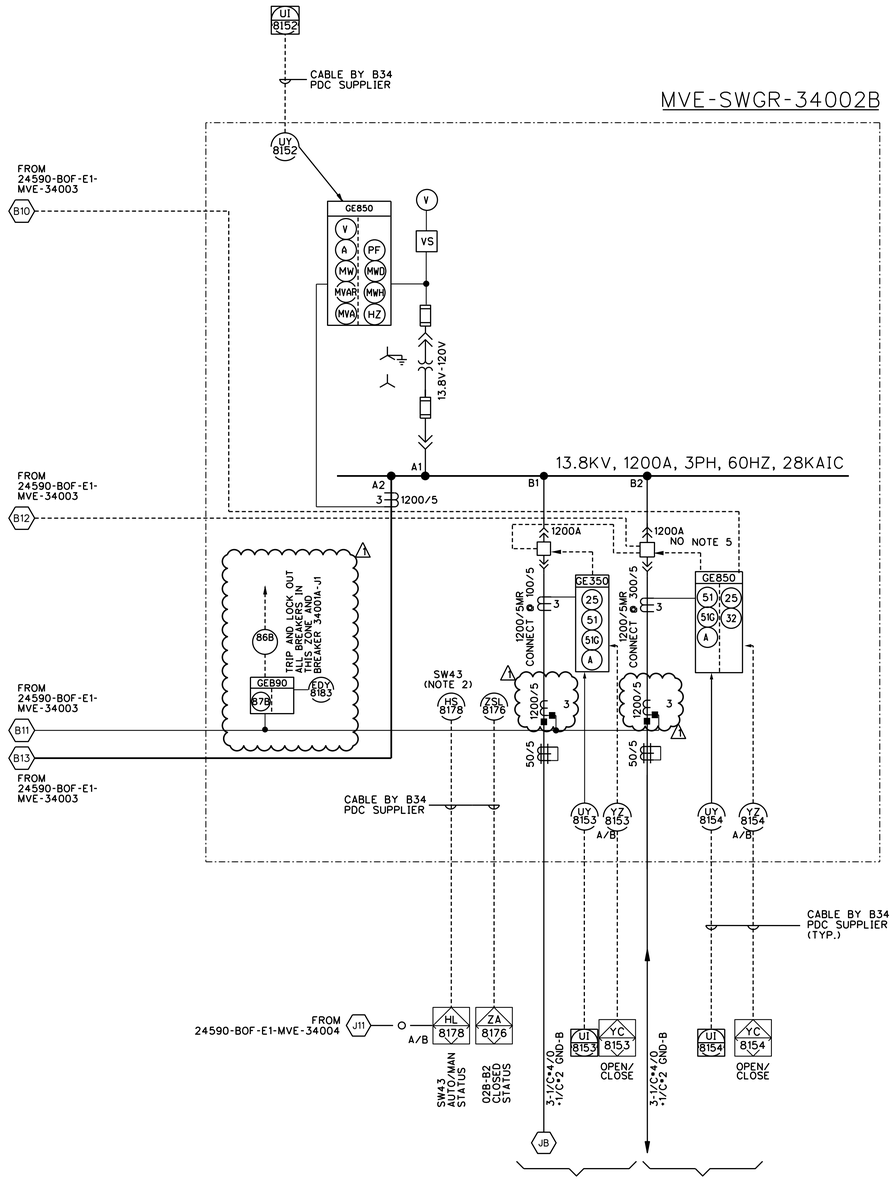
Document Number: 24590-BOF-E1-MVE-34004 **Rev:** 001

	Participants	Signature	Completed	Status	Result	Comments
Final Approver	**11/13/2024 3:14 PM**					
	Mamula, Jeron		11/13/2024 4:03 PM	Completed	Approve	

34002B-A1 BUS VT	34002B-B1 UNIT SUB. MVE-SW 34001A
34002B-A2 LINE VT	34002B-B2 ASSET PROTECTION

FRONT VIEW
SWITCHGEAR MVE-SWGR-34002B



13.8 KV

4.16 KV

480V (FROM 4.16 KV)

480V (FROM 13.8 KV)

NOTES

1. MEDIUM VOLTAGE (MV) METAL-CLAD SWITCHGEAR ASSEMBLY WITH DRAWOUT VACUUM BREAKERS.
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   2) CLOSING BKRS MVE-SWGR-34002A-B2 & MVE-SWGR-34002B-B2. 1
3. ZERO SEQUENCE CTS ARE SPARE AND SHORTED IN PLACE.
4. OVERCURRENT TRIPS (51/51G) WILL LOCKOUT BKR FROM RE-CLOSE. MANUAL RESET IS REQUIRED. ALL OTHER TRIPS DO NOT REQUIRE MANUAL RESET.
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7. EACH CUBICLE TO BE PROVIDED WITH RELAY TEST SWITCHES ON THE FRONT OF THE ENCLOSURE SUCH THAT THE RELAY FUNCTIONS MAY BE TESTED WITHOUT OPENING THE ENCLOSURE DOOR.

REFERENCE DRAWINGS

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24590-BOF-E1-MVE-34001	SWITCHGEAR BUILDING 34 MAIN SINGLE LINE DIAGRAM
24590-BOF-E1-MVE-34003	SWITCHGEAR BUILDING 34 13.8KV SWITCHGEAR MVE-SWGR-34001B SINGLE LINE DIAGRAM
24590-BOF-E1-MVE-34004	SWITCHGEAR BUILDING 34 13.8KV SWITCHGEAR MVE-SWGR-34002A SINGLE LINE DIAGARM
24590-BOF-E1-LVE-34001	SWITCHGEAR BUILDING 34 LVE UNIT SUBSTATION SINGLE LINE DIAGARM

HOLD NOTES

1. HOLD FOR DESIGN DEVELOPMENT.

REVISION NOTES

1. UPDATED NOTE 2, CTS RATIO, ADDED NOTE 7 AND ADDED RELAY GEB90. 1

REV	DESCRIPTION	ORG	CHKD	RVWD	APVD	DATE
1	ISSUED FOR 90% DESGN	BB	RC	N/A	JM	SEE STAMP
0	ISSUED FOR 60% DESIGN	BB	RC	N/A	MP	07/10/24

Originator — Checked — Approved

CM
QUALITY DESIGNATOR

REVISION HISTORY

ISSUED BY RPP-WTP PDC
ISSUE STAMP

PROJECT No.	24590
SITE	HANFORD
AREA	200E
BUILDING No.	34

	BY	DATE
ORIGINATOR	BUI, BINH	07/10/24
CHECKER	CAIN, RICHARD	07/10/24
APPROVER	PIRVULESCU, MARIA	07/10/24
REVIEWER	N/A	

CONTENT APPLICABLE TO ALARA? [ ] YES [X] NO
ADR NO. REV:

BECHTEL
RIVER PROTECTION PROJECT
WASTE TREATMENT PLANT
450 HILLS ST.
RICHLAND, WA 99354

CONTRACT No: DE-AC27-01RV14136

SWITCHGEAR BUILDING 34
13.8KV SWITCHGEAR
MVE-SWGR-34002B
SINGLE LINE DIAGRAM

SCALE: NTS
24590-BOF-E1-MVE-34005
REV 1

'E' SIZE - 44x34
COMPUTER GENERATED - MANUAL DESIGN CHANGES NOT PERMITTED

FORM E_SDN.DGN 02/2009

PLOTTED BY: $USERNAME$ $FILE$ $DATE$ $TIME$

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Document Number: 24590-BOF-E1-MVE-34005 **Rev:** 001

	Participants	Signature	Completed	Status	Result	Comments
Final Approver	**11/13/2024 3:14 PM**					
	Mamula, Jeron		11/14/2024 9:16 AM	Completed	Approve	