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DIVISION 01 - GENERAL REQUIREMENTS

SECTION 01 33 00

SUBMITTAL PROCEDURES

08/18, OMH 02/2021

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SECTION 01 33 00

SUBMITTAL PROCEDURES
08/18, OMH 02/2021

PART 1 GENERAL

1.1 SUMMARY

1.1.1 Submittal Information

The Contractor is responsible for total management of their work including, but not limited to, approval, scheduling, control, certification of all submittals and compliance with all applicable Buy-American and Trade Agreement clauses. The submittal management system provided in these specifications is intended to be a complete system for the Contractor to use to control the quality of materials, equipment and workmanship provided by manufacturers, fabricators, suppliers and subcontractors. Review each submittal for contract compliance. **Compliance with all applicable Buy American and Trade Agreement Clauses is to be included in this review. The Contractor must provide the country of origin on ENG Form 4025 for each item submitted.** The Submittal Register (ENG Form 4288) will be utilized to log and monitor all submittal activities.

The Contracting Officer may request submittals, in addition to those specified, when deemed necessary to adequately describe the work covered in the respective sections. Each submittal is to be complete and in sufficient detail to allow ready determination of compliance with contract requirements.

Units of weights and measures used on all submittals are to be the same as those used in the contract drawings.

1.1.2 Project Type

The Contractor's Quality Control (CQC) System Manager is to check and approve all items before submittal and stamp, sign, and date indicating action taken. Clearly identify proposed deviations from the contract requirements. Include within submittals items such as: Contractor's, manufacturer's, or fabricator's drawings; descriptive literature including (but not limited to) catalog cuts, diagrams, operating charts or curves; test reports; test cylinders; samples; O&M manuals (including parts list); certifications; warranties; and other such required items.

1.1.3 Submission of Submittals

Schedule and provide submittals requiring Government approval, after notice to proceed (NTP). Provide ample lead time to ensure the submittal's processing by the Government and any lead time needed by the manufacturer upon ordering after approval. Dispose of samples not incorporated into the work in accordance with manufacturer's Safety Data Sheets (SDS) and in compliance with existing laws and regulations.

1.2 DEFINITIONS

1.2.1 Submittal Descriptions (SD)

Submittal requirements are specified in the technical sections. Examples and descriptions of submittals identified by the Submittal Description (SD) numbers and titles follow:

SD-01 Preconstruction Submittals

Submittals that are required prior to or at the start of construction (work) or the next major phase of the construction on a multiphase contract.

Preconstruction Submittals include schedules and a tabular list of locations, features, and other pertinent information regarding products, materials, equipment, or components to be used in the work.

The Government reserves the right to handle pre-construction submittals (listed below) as administrative submittals via a Serial Letter, as directed by the Project, Area or Resident Office. When directed by the Project, Area or Resident Office (as directed), submit administrative submittals for acceptance by the Government. Format for the Serial Letter will be as directed by the Project, Area or Resident Office.

Certificates Of Insurance

Surety Bonds

List Of Proposed Subcontractors

List Of Proposed Products

Baseline Network Analysis Schedule (NAS)

Submittal Register

Schedule Of Prices Or Earned Value Report

Accident Prevention Plan

Work Plan

Quality Control (QC) plan

Permits

Environmental Protection Plan

SD-02 Shop Drawings

Drawings, diagrams and schedules specifically prepared to illustrate some portion of the work.

Diagrams and instructions from a manufacturer or fabricator for use in producing the product and as aids to the Contractor for integrating the product or system into the project.

Drawings prepared by or for the Contractor to show how multiple systems and interdisciplinary work will be coordinated.

SD-03 Product Data

Catalog cuts, illustrations, schedules, diagrams, performance charts, instructions and brochures illustrating size, physical appearance and other characteristics of materials, systems or equipment for some portion of the work.

Samples of warranty language when the contract requires extended product warranties.

SD-05 Design Data

Design calculations, mix designs, analyses or other data pertaining to a part of work.

SD-06 Test Reports

Report signed by authorized official of testing laboratory that a material, product or system identical to the material, product or system to be provided has been tested in accord with specified requirements. Unless specified in another section, testing must have been within three years of date of contract award for the project.

Report that includes findings of a test required to be performed on an actual portion of the work or prototype prepared for the project before shipment to job site.

Report that includes finding of a test made at the job site or on sample taken from the job site, on portion of work during or after installation.

Investigation reports

Daily logs and checklists

Final acceptance test and operational test procedure

SD-07 Certificates

Statements printed on the manufacturer's letterhead and signed by responsible officials of manufacturer of product, system or material attesting that the product, system, or material meets specification requirements. Must be dated after award of project contract and clearly name the project.

Document required of Contractor, or of a manufacturer, supplier, installer or Subcontractor through Contractor. The document purpose is to further promote the orderly progression of a portion of the work by documenting procedures, acceptability of methods, or personnel qualifications.

Confined space entry permits

Text of posted operating instructions

SD-08 Manufacturer's Instructions

Preprinted material describing installation of a product, system or material, including special notices and (SDS)concerning impedances, hazards and safety precautions.

SD-09 Manufacturer's Field Reports

Documentation of the testing and verification actions taken by manufacturer's representative at the job site, in the vicinity of the job site, or on a sample taken from the job site, on a portion of the work, during or after installation, to confirm compliance with manufacturer's standards or instructions. The documentation must be signed by an authorized official of a testing laboratory or agency and state the test results; and indicate whether the material, product, or system has passed or failed the test.

Factory test reports.

SD-10 Operation and Maintenance Data

Data provided by the manufacturer, or the system provider, including manufacturer's help and product line documentation, necessary to maintain and install equipment, for operating and maintenance use by facility personnel.

Data required by operating and maintenance personnel for the safe and efficient operation, maintenance and repair of the item.

Data incorporated in an operations and maintenance manual or control system.

SD-11 Closeout Submittals

Documentation to record compliance with technical or administrative requirements or to establish an administrative mechanism.

Submittals required for Guiding Principle Validation (GPV) or Third Party Certification (TPC).

Special requirements necessary to properly close out a construction contract. For example, Record Drawings and as-built drawings. Also, submittal requirements necessary to properly close out a major phase of construction on a multi-phase contract.

1.2.2 Approving Authority

Office or designated person authorized to approve the submittal.

1.2.3 Work

As used in this section, on-site and off-site construction required by contract documents, including labor necessary to produce submittals, construction, materials, products, equipment, and systems incorporated or to be incorporated in such construction. In exception, excludes work to produce SD-01 submittals.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having any designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submit the following in accordance with this section. When directed by the Government, the submittal register may be submitted via Section of 01 45 00.15 10 RESIDENTIAL MANAGMENT SYSTEM CONTRACTOR MODE (RMS-CM) in lieu of the copy attached to this section. SpecsIntact is the software system used by Government to generate the Submittal Register that is loaded into RMS-CM.

SD-01 Preconstruction Submittals

Submittal Register; G, RO

1.3.1 Action Codes

1.3.1.1 Contractor Action Codes

DESIGN BID BUILD SUBMITTALS			
Submittal Classifications shown in UFGS Sections	Submittal Classification	Corresponding SpecsIntact Submittal Register Code which is populated in the SI Submittal Register. Software Limitations: (The software shows one character delineation in the SpecsIntact Submittal Register)	RMS - The following Submittal Classifications are populated in RMS when the SpecsIntact Submittal Data File is pulled into RMS)
G	Submittal requires Government Approval	G	GA
BLANK	Submittal is For Information Only (FIO)	BLANK	FIO

1.3.1.2 Government Reviewer Designations

Following the Submittal Classification designation "G", the following reviewer designations may be included:

RO - Resident Office
AO - Area Office
DO - District Office
HNC - Huntsville Engineering and Support Center

Additional information will be provided at the pre-design and/or pre-construction conference.

Corps of Engineers, Omaha District Office for "DO" reviewer designations, submittals will be coordinated through RMS.

1.4 SUBMITTAL CLASSIFICATION

1.4.1 Government Approved (G)

Government approval is required for extensions of design, critical materials, variations, equipment whose compatibility with the entire system must be checked, and other items as designated by the Government.

Within the terms of the Contract Clause SPECIFICATIONS AND DRAWINGS FOR CONSTRUCTION, submittals are considered to be "shop drawings."

1.4.2 For Information Only

Submittals not requiring Government approval will be for information only. Within the terms of the Contract Clause SPECIFICATIONS AND DRAWINGS FOR CONSTRUCTION, they are not considered to be "shop drawings."

1.4.3 Sustainability Reporting Submittals

Sustainability reporting submittals are as specified in Section 01 33 29 SUSTAINABILITY REQUIREMENTS AND REPORTING.

Schedule submittals for these items throughout the course of construction as provided; do not wait until closeout.

1.5 PREPARATION

1.5.1 Transmittal Form

Use the ENG Form 4025 transmittal form for submitting both Government-approved and information-only submittals. Submit in accordance with the instructions on the reverse side of the form. These forms are included in the RMS CM software that the Contractor is required to use for this contract. Properly complete this form by filling out all the heading blank spaces and identifying each item submitted. If there are multiple Item numbers listed on a particular ENG Form 4025 submittal, combine all submitted items for review into a single Adobe file with bookmarks (for ease of review). Exercise special care to ensure proper listing of the specification paragraph and sheet number of the contract drawings pertinent to the data submitted for each item.

Submittals shall not comingle multiple "Government Reviewer Designations" (see subpart of the same name) on a single ENG Form 4025, nor shall "For Information Only" items (those without a "G" designation on the Submittal Register) be comingled on a common ENG Form 4025 with items containing one of the "Government Reviewer Designations".

1.5.2 Submittal Format

1.5.2.1 General Requirements

When submitting multiple items, clearly identify the pages relevant to the specific items referenced by item number and item name. A cover sheet with the item number and item name immediately before the first page of information pertaining to a given item is acceptable.

On product data cut sheets submitted with multiple variants (models, options, etc.), identify the specific model type(s), option(s), etc., which will be used.

Where multiple parties contribute to the contents of a particular submittal item or logically-group set of items, all items shall be submitted in one cohesive transmittal package for review (that is, portions of items shall not be piecemealed across multiple submittals and/or inappropriately-assigned submittal items). Compilation and aggregation of components necessary for submittals required to an item (group of items identified or necessary for coordinated review) to demonstrate satisfation of the item's/items' contract requirements and the quality control thereof is the responsibility of the contractor. Incomplete submittals will be subject to rejection on the basis of not satisfying all relevant requirements or for submittal of only portions of the requirements.

On re-submittals, the contractor shall include the acknowledgement of and/or response to all comments from the prior submittal, including identification of where changes are made incorporating the review comments. Changes to previously-approved items or subportions of items shall be clearly identified and include a statement regarding the purpose of the change.

Responses or other commentary provided within submittals, requests for information, and similar correspondence shall provide specificity when referencing criteria requirements, past discussions, or past correspondence. Statements such as "per NFPA 70", "per discussion", or "per past RFI"/"per past submittal" are not sufficient; rather, the contractor (or parties subcontracted to assemble documentation and/or correspondence) shall provide the specific criteria section, date of discussion/correspondence, and/or RFI number, submittal number, or other correspondence identifier.

The Contractor Recommendation section of Requests for Information must contain an actionable path forward. RFI Contractor Recommendation sections submitted as blank or containing non-recommendation statements such as "Please advise" are not acceptable.

1.5.2.2 Format of SD-01 Preconstruction Submittals

When the submittal includes a document that is to be used in the project, or is to become part of the project record, other than as a submittal, do not apply the Contractor's approval stamp to the document itself, but to a separate sheet accompanying the document.

Provide data in the unit of measure used in the contract documents.

1.5.2.3 Format for SD-02 Shop Drawings

Provide shop drawings not less than 8 1/2 by 11 inches nor more than 30 by 42 inches, except for full-size patterns or templates. Prepare drawings to accurate size, with scale indicated, unless another form is required. Ensure drawings are suitable for reproduction and of a quality to produce clear, distinct lines and letters, with dark lines on a white background.

a. Include the nameplate data, size, and capacity on drawings. Also include applicable federal, military, industry, and technical society

publication references.

b. Dimension drawings, except diagrams and schematic drawings. Prepare drawings demonstrating interface with other trades to scale. Use the same unit of measure for shop drawings as indicated on the contract drawings. Identify materials and products for work shown.

Submit an electronic copy of drawings in PDF format.

1.5.2.3.1 Drawing Identification

Include on each drawing the drawing title, number, date, and revision numbers and dates.

Number drawings in a logical sequence. Each drawing is to bear the number of the submittal in a uniform location next to the title block. Place the Government contract number in the margin, immediately below the title block, for each drawing.

1.5.2.4 Format of SD-03 Product Data

Present product data submittals for each section. Include a table of contents, listing the page and catalog item numbers for product data.

Indicate, by prominent notation, each product that is being submitted; indicate the specification section number and paragraph number to which it pertains.

1.5.2.4.1 Product Information

Supplement product data with material prepared for the project to satisfy the submittal requirements where product data does not exist. Identify this material as developed specifically for the project, with information and format as required for submission of SD-07 Certificates.

Provide product data in units used in the Contract documents. Where product data are included in preprinted catalogs with another unit, submit the dimensions in contract document units, on a separate sheet.

1.5.2.4.2 Standards

Where equipment or materials are specified to conform to industry or technical-society reference standards of such organizations as the American National Standards Institute (ANSI), ASTM International (ASTM), National Electrical Manufacturer's Association (NEMA), Underwriters Laboratories (UL), or Association of Edison Illuminating Companies (AEIC), submit proof of such compliance. The label or listing by the specified organization will be acceptable evidence of compliance. In lieu of the label or listing, submit a certificate from an independent testing organization, competent to perform testing, and approved by the Contracting Officer. State on the certificate that the item has been tested in accordance with the specified organization's test methods and that the item complies with the specified organization's reference standard.

1.5.2.4.3 Data Submission

Collect required data submittals for each specific material, product, unit of work, or system into a single submittal that is marked for choices,

options, and portions applicable to the submittal. Mark each copy of the product data identically. Partial submittals will not be accepted for expedition of the construction effort.

Submit the manufacturer's instructions before installation.

1.5.2.5 Format of SD-04 Samples

1.5.2.5.1 Sample Characteristics

Furnish samples in the following sizes, unless otherwise specified or unless the manufacturer has prepackaged samples of approximately the same size as specified:

a. Sample of Equipment or Device: Full size.

b. Sample of Materials Less Than 2 by 3 inches: Built up to 8 1/2 by 11 inches.

c. Sample of Materials Exceeding 8 1/2 by 11 inches: Cut down to 8 1/2 by 11 inches and adequate to indicate color, texture, and material variations.

d. Sample of Linear Devices or Materials: 10 inch length or length to be supplied, if less than 10 inches. Examples of linear devices or materials are conduit and handrails.

e. Sample Volume of Nonsolid Materials: Pint. Examples of nonsolid materials are sand and paint.

f. Color Selection Samples: 2 by 4 inches. Where samples are specified for selection of color, finish, pattern, or texture, submit the full set of available choices for the material or product specified. Sizes and quantities of samples are to represent their respective standard unit.

g. Sample Panel: 4 by 4 feet.

h. Sample Installation: 100 square feet.

1.5.2.5.2 Sample Incorporation

Reusable Samples: Incorporate returned samples into work only if so specified or indicated. Incorporated samples are to be in undamaged condition at the time of use.

Recording of Sample Installation: Note and preserve the notation of any area constituting a sample installation, but remove the notation at the final clean-up of the project.

1.5.2.5.3 Comparison Sample

Samples Showing Range of Variation: Where variations in color, finish, pattern, or texture are unavoidable due to nature of the materials, submit sets of samples of not less than three units showing extremes and middle of range. Mark each unit to describe its relation to the range of the variation.

When color, texture, or pattern is specified by naming a particular

manufacturer and style, include one sample of that manufacturer and style, for comparison.

1.5.2.6 Format of SD-05 Design Data

Provide design data and certificates on 8 1/2 by 11 inch page size.

1.5.2.7 Format of SD-06 Test Reports

By prominent notation, indicate each report in the submittal. Indicate the specification number and paragraph number to which each report pertains.

1.5.2.8 Format of SD-07 Certificates

Provide design data and certificates on 8 1/2 by 11 inch page size.

1.5.2.9 Format of SD-08 Manufacturer's Instructions

Present manufacturer's instructions submittals for each section. Include the manufacturer's name, trade name, place of manufacture, and catalog model or number on product data. Also include applicable federal, military, industry, and technical-society publication references. If supplemental information is needed to clarify the manufacturer's data, submit it as specified for SD-07 Certificates.

Submit the manufacturer's instructions before installation.

1.5.2.9.1 Standards

Where equipment or materials are specified to conform to industry or technical-society reference standards of such organizations as the American National Standards Institute (ANSI), ASTM International (ASTM), National Electrical Manufacturer's Association (NEMA), Underwriters Laboratories (UL), or Association of Edison Illuminating Companies (AEIC), submit proof of such compliance. The label or listing by the specified organization will be acceptable evidence of compliance. In lieu of the label or listing, submit a certificate from an independent testing organization, competent to perform testing, and approved by the Contracting Officer. State on the certificate that the item has been tested in accordance with the specified organization's test methods and that the item complies with the specified organization's reference standard.

1.5.2.10 Format of SD-09 Manufacturer's Field Reports

By prominent notation, indicate each report in the submittal. Indicate the specification number and paragraph number to which each report pertains.

1.5.2.11 Format of SD-10 Operation and Maintenance Data (O&M)

Comply with the requirements specified in Section 01 78 23 OPERATION AND MAINTENANCE DATA for O&M Data format.

1.5.2.12 Format of SD-11 Closeout Submittals

When the submittal includes a document that is to be used in the project or is to become part of the project record, other than as a submittal, do

not apply the Contractor's approval stamp to the document itself, but to a separate sheet accompanying the document.

Provide data in the unit of measure used in the contract documents.

1.5.3 Source Drawings for Shop Drawings

1.5.3.1 Source Drawings

The entire set of source drawing files (DWG or DGN) will not be provided to the Contractor. Request the specific Drawing Number for the preparation of shop drawings. Only those drawings requested to prepare shop drawings will be provided. These drawings are provided only after award.

1.5.3.2 Terms and Conditions

Data contained on these electronic files must not be used for any purpose other than as a convenience in the preparation of construction data for the referenced project. Any other use or reuse is at the sole risk of the Contractor and without liability or legal exposure to the Government. The Contractor must make no claim, and waives to the fullest extent permitted by law any claim or cause of action of any nature against the Government, its agents, or its subconsultants that may arise out of or in connection with the use of these electronic files. The Contractor must, to the fullest extent permitted by law, indemnify and hold the Government harmless against all damages, liabilities, or costs, including reasonable attorney's fees and defense costs, arising out of or resulting from the use of these electronic files.

These electronic source drawing files are not construction documents. Differences may exist between the source drawing files and the corresponding construction documents. The Government makes no representation regarding the accuracy or completeness of the electronic source drawing files, nor does it make representation to the compatibility of these files with the Contractor hardware or software. The Contractor is responsible for determining if any conflict exists. In the event that a conflict arises between the signed and sealed construction documents prepared by the Government and the furnished source drawing files, the signed and sealed construction documents govern. Use of these source drawing files does not relieve the Contractor of the duty to fully comply with the contract documents, including and without limitation the need to check, confirm and coordinate the work of all contractors for the project. If the Contractor uses, duplicates or modifies these electronic source drawing files for use in producing construction data related to this contract, remove all previous indication of ownership (seals, logos, signatures, initials and dates).

1.5.4 Electronic File Format

Provide submittals in electronic format, with the exception of material samples required for SD-04 Samples items. Compile the submittal file as a single, complete document, to include the Transmittal Form described within. Name the electronic submittal file specifically according to its contents, and coordinate the file naming convention with the Contracting Officer. Electronic files must be of sufficient quality that all information is legible. Use PDF as the electronic format, unless otherwise specified or directed by the Contracting Officer. All documents must make use of optical character recognition (OCR) routines to

make text searchable and selectable, so that the text can be copied. Index and bookmark files exceeding 30 pages to allow efficient navigation of the file. When required, the electronic file must include a valid electronic signature.

E-mail electronic submittal documents smaller than 10MB to an e-mail address as directed by the Contracting Officer, unless directed otherwise by COR. Provide electronic documents over 10 MB on an optical disc or through an electronic file sharing system, such as secure ftp site or DoD SAFE located at the following website: https://safe.apps.mil/. Use of the Government web application must be initiated by the Government, unless Contractor has a Government CAC card. This Government web application restricts the number of days files are available to download.

1.6 QUANTITY OF SUBMITTALS

Submittals are to be transmitted electronically, unless directed otherwise.

1.6.1 Number of SD-04 Samples

a. Submit two samples, or two sets of samples showing the range of variation, of each required item. One approved sample or set of samples will be retained by the approving authority and one will be returned to the Contractor.

b. Submit one sample panel or provide one sample installation where directed. Include components listed in the technical section or as directed.

c. Submit one sample installation, where directed.

d. Submit one sample of nonsolid materials.

1.7 INFORMATION ONLY SUBMITTALS

Submittals without an action code must be certified by the QC manager and submitted to the Contracting Officer for information-only. Approval of the Contracting Officer is not required on information only submittals. The Contracting Officer will mark "receipt acknowledged" on submittals for information and will return only the transmittal cover sheet to the Contractor. Normally, submittals for information only will not be returned. However, the Government reserves the right to return unsatisfactory submittals and require the Contractor to resubmit any item found not to comply with the contract. This does not relieve the Contractor from the obligation to furnish material conforming to the plans and specifications; will not prevent the Contracting Officer from requiring removal and replacement of nonconforming material incorporated in the work; and does not relieve the Contractor of the requirement to furnish samples for testing by the Government laboratory or for check testing by the Government in those instances where the technical specifications so prescribe.

1.8 PROJECT SUBMITTAL REGISTER

A sample Project Submittal Register showing submittals required by the specifications is attached to this section as "Project Submittal Register."

1.8.1 Submittal Management

Prepare and maintain a submittal register, as the work progresses. Do not change data that is output in columns (c), (d), (e), and (f) as delivered by Government; retain data that is output in columns (a), (g), (h), and (i) as approved. As an attachment, provide a submittal register showing items of equipment and materials for which submittals are required by the specifications. This list may not be all-inclusive and additional submittals may be required. Maintain a submittal register for the project in accordance with Section 01 45 00.15 10 RESIDENT MANAGEMENT SYSTEM CONTRACTOR MODE(RMS CM). The Government will provide the initial submittal register in electronic format with the following fields completed, to the extent that will be required by the Government during subsequent usage.

Column (c): Lists specification section in which submittal is required.

Column (d): Lists each submittal description (SD Number. and type, e.g., SD-02 Shop Drawings) required in each specification section.

Column (e): Lists one principal paragraph in each specification section where a material or product is specified. This listing is only to facilitate locating submitted requirements. Do not consider entries in column (e) as limiting the project requirements.

Thereafter, the Contractor is to track all submittals by maintaining a complete list, including completion of all data columns and all dates on which submittals are received by and returned by the Government.

1.8.2 Preconstruction Use of Submittal Register

Submit the submittal register as an electronic database, using the submittal management program furnished to Contractor, unless directed otherwise by COR. Include the QC plan and the project schedule. Verify that all submittals required for the project are listed and add missing submittals. Coordinate and complete the following fields on the register database submitted with the QC plan and the project schedule:

Column (a) Activity Number: Activity number from the project schedule.

Column (g) Contractor Submit Date: Scheduled date for the approving authority to receive submittals.

Column (h) Contractor Approval Date: Date that Contractor needs approval of submittal.

Column (i) Contractor Material: Date that Contractor needs material delivered to Contractor control.

1.8.3 Contractor Use of Submittal Register

Update the following fields in the Government-furnished submittal register program or equivalent fields in the program used by the Contractor with each submittal throughout the contract.

Column (b) Transmittal Number: List of consecutive, Contractor-assigned numbers.

Column (j) Action Code (k): Date of action used to record Contractor's review when forwarding submittals to QC.

Column (l) Date submittal transmitted.

Column (q) Date approval was received.

1.8.4 Approving Authority Use of Submittal Register

Update the following fields:

Column (b) Transmittal Number: List of consecutive, Contractor-assigned numbers.

Column (l) Date submittal was received.

Column (m) through (p) Dates of review actions.

Column (q) Date of return to Contractor.

1.8.5 Action Codes

See paragraph Action Codes above.

1.8.6 Delivery of Copies

Submit an updated electronic copy of the submittal register to the Contracting Officer with each invoice request, unless a paper copy is requested by the Contracting Officer. Provide an updated Submittal Register monthly regardless of whether an invoice is submitted.

1.9 VARIATIONS

Variations from contract requirements require Contracting Officer approval pursuant to contract Clause FAR 52.236-21 Specifications and Drawings for Construction, and will be considered where advantageous to the Government.

1.9.1 Considering Variations

Discussion of variations with the Contracting Officer before submission will help ensure that functional and quality requirements are met and minimize rejections and resubmittals. For variations that include design changes or some material or product substitutions, the Government may require an evaluation and analysis by a licensed professional engineer hired by the contractor. When contemplating a variation that results in lower cost, consider submission of the variation as a Value Engineering Change Proposal (VECP).

Specifically point out variations from contract requirements in transmittal letters. Failure to point out variations may cause the Government to require rejection and removal of such work at no additional cost to the Government.

1.9.2 Proposing Variations

When proposing variations, deliver a written request to the Contracting

Officer, with documentation of the nature and features of the variation and why the variation is desirable and beneficial to Government. If lower cost is a benefit, also include an estimate of the cost savings. In addition to documentation required for variation, include the submittals required for the item. Clearly mark the proposed variation in all documentation.

Check the column "variation" of ENG Form 4025 for submittals that include variations proposed by the Contractor. Set forth in writing the reason for any variations and note such variations on the submittal. The Government reserves the right to rescind inadvertent approval of submittals containing unnoted variations.

1.9.3 Warranting that Variations are Compatible

When delivering a variation for approval, the Contractor warrants that this contract has been reviewed to establish that the variation, if incorporated, will be compatible with other elements of work.

1.9.4 Review Schedule Extension

In addition to the normal submittal review period, a period of 14 calendar days will be allowed for the Government to consider submittals with variations.

1.10 SCHEDULING

Schedule and submit concurrently product data and shop drawings covering component items forming a system or items that are interrelated. Submit pertinent certifications at the same time. No delay damages or time extensions will be allowed for time lost in late submittals. .

a. Coordinate scheduling, sequencing, preparing, and processing of submittals with performance of work so that work will not be delayed by submittal processing. The Contractor is responsible for additional time required for Government reviews resulting from required resubmittals. The review period for each resubmittal is the same as for the initial submittal.

b. Submittals required by the contract documents are listed on the submittal register. If a submittal is listed in the submittal register but does not pertain to the contract work, the Contractor is to include the submittal in the register and annotate it "N/A" with a brief explanation. Approval by the Contracting Officer does not relieve the Contractor of supplying submittals required by the contract documents but that have been omitted from the register or marked "N/A."

c. Resubmit the submittal register and annotate it monthly with actual submission and approval dates. When all items on the register have been fully approved, no further resubmittal is required.

Contracting Officer review will be completed within 20 calendar days after the date of submission or longer period as identified in the individual specification sections or the relevant "Submittal Coordination and Sequencing Requirements" supbart of this Section, and shall be considered the "normal" review period. However, for submittals delivered to the government on or after the observed day of Veterans Day and on or before the observed day of Martin Luther King, Jr.'s, Birthday (holiday

adjustment period), the review period shall be extended by an additional 50% of the number of normal review period calendar days (the extensions for variances shall aggregate to this value without a holiday adjustment).

The Government review period for each construction submittal does not begin until the submittal is delivered via RMS CM. Contract compliance for all submittals are the Contractor's responsibility. Government acceptance or receipt acknowledged does not remove this responsibility for contract compliance on any construction submittal.

1.11 GOVERNMENT APPROVING AUTHORITY

When the approving authority is the Contracting Officer, the Government will:

a. Note the date on which the submittal was received.

b. Review submittals for approval within the scheduling period specified and only for conformance with project design concepts and compliance with contract documents.

c. Identify returned submittals with one of the actions defined in paragraph REVIEW NOTATIONS and with comments and markings appropriate for the action indicated.

Upon completion of review of submittals requiring Government approval, stamp and date submittals. An electronic copy of the submittal will be retained by the Contracting Officer and an electronic copy of the submittal will be returned to the Contractor. The Government may process submittals in the RMS CM System.

1.11.1 Review Notations

Submittals will be returned to the Contractor with the following notations:

a. Submittals marked "approved" or "accepted" authorize proceeding with the work covered.

b. Submittals marked "approved as noted" or "approved, except as noted, resubmittal not required," authorize proceeding with the work covered provided that the Contractor takes no exception to the corrections.

c. Submittals marked "not approved," "disapproved," or "revise and resubmit" indicate incomplete submittal or noncompliance with the contract requirements or design concept. Resubmit with appropriate changes. Do not proceed with work for this item until the resubmittal is approved.

d. Submittals marked "not reviewed" indicate that the submittal has been previously reviewed and approved, is not required, does not have evidence of being reviewed and approved by Contractor, or is not complete. A submittal marked "not reviewed" will be returned with an explanation of the reason it is not reviewed. Resubmit submittals returned for lack of review by Contractor or for being incomplete, with appropriate action, coordination, or change.

e. Submittals marked "receipt acknowledged" indicate that submittals have been received by the Government. This applies only to "information-only submittals" as previously defined.

1.12 DISAPPROVED SUBMITTALS

Make corrections required by the Contracting Officer. If the Contractor considers any correction or notation on the returned submittals to constitute a change to the contract drawings or specifications, give notice to the Contracting Officer as required under the FAR clause titled CHANGES. The Contractor is responsible for the dimensions and design of connection details and the construction of work. Failure to point out variations may cause the Government to require rejection and removal of such work at the Contractor's expense.

If changes are necessary to submittals, make such revisions and resubmit in accordance with the procedures above. No item of work requiring a submittal change is to be accomplished until the changed submittals are approved.

1.13 APPROVED SUBMITTALS

The Contracting Officer's approval of submittals is not to be construed as a complete check, and indicates only that the general method of construction, materials, detailing, and other information are satisfactory.

Approval or acceptance by the Government for a submittal does not relieve the Contractor of the responsibility for meeting the contract requirements or for any error that may exist, because under the Quality Control (QC) requirements of this contract, the Contractor is responsible for ensuring information contained with in each submittal accurately conforms with the requirements of the contract documents.

After submittals have been approved or accepted by the Contracting Officer, no resubmittal for the purpose of substituting materials or equipment will be considered unless accompanied by an explanation of why a substitution is necessary.

1.14 APPROVED SAMPLES

Approval of a sample is only for the characteristics or use named in such approval and is not be construed to change or modify any contract requirements. Before submitting samples, provide assurance that the materials or equipment will be available in quantities required in the project. No change or substitution will be permitted after a sample has been approved.

Match the approved samples for materials and equipment incorporated in the work. If requested, approved samples, including those that may be damaged in testing, will be returned to the Contractor, at its expense, upon completion of the contract. Unapproved samples will also be returned to the Contractor at its expense, if so requested.

Failure of any materials to pass the specified tests will be sufficient cause for refusal to consider, under this contract, any further samples of the same brand or make as that material. The Government reserves the right to disapprove any material or equipment that has previously proved unsatisfactory in service.

Samples of various materials or equipment delivered on the site or in place may be taken by the Contracting Officer for testing. Samples

failing to meet contract requirements will automatically void previous approvals. Replace such materials or equipment to meet contract requirements.

1.15 Submittal Coordination and Sequencing Requirements

For any set of submittals identified to be submitted simultaneously for coordinated reviews, if submitted separately, the review period shall start upon receipt of the last submittal (or resubmittal) in the package. Note some items are parts of multiple dependencies.

Where multiple items are identified for the same specifications section, the items shall be submitted under one cover / Form 4025.

1.15.1 Underground Work Coordination at Powerplant

The following items shall be submitted together:

03 30 00 Item: Reinforcing Steel

21 13 13 Item: Shop Drawing

21 13 18 Item: Shop Drawing

26 13 13 Item: Switchgear Drawings
26 13 13 Item: Switchgear

26 20 00 Item: Underground Conduit Routing Plan
26 20 00 Item: Medium- to Low-Voltage Transformers

26 24 13 Item: Switchboard Drawings
26 24 13 Item: Switchboard

27 10 00 Item: Underground Conduit Routing Plan

The bend radii of larger electrical, telecommunications, pump control, and switchgear control conduits and ductbanks preclude routing between the top of the footing and bottom of slab-on-grade and/or create excessive penetrations through grade beams. As such, specially reinforced windows are required in the footing to ensure structural integrity for this Seismic Risk Category V building.

Additionally, the fire water entrance will require coordination with the footing reinforcement and require substantial completion of the fire suppression systems to evaluate the footing accommodations required to support the requisite riser assemblies.

The coordinated submittals referenced above shall demonstrate with precision representative of products selected to be installed and approved for installation the locations of conduits penetrating the footing, to include the openings in the major electrical equipment permitting underground conduit entrance/exit, as well as any high density of smaller conduits routing underground from panelboards. Any conduit or group of conduits disrupting a 6-inch diameter of footing or slab-on-grade concrete must be detailed. See Sheet S-501.

Approval without resubmittal needs ("A" or "B" action) of all the aforementioned items must occur prior to placement of permanent underground conduits, footings, slab on grade, and grade beams.

Note some electrical submittal items above have additional approval dependencies.

1.15.2 Roof System

The Contractor shall submit the following submittals (and subsequent resubmittals) together:

07 22 00 Item: Insulation Board Layout
07 22 00 Item: Insulation
07 22 00 Item: Cover Board
07 22 00 Item: Fasteners
07 22 00 Item: Wind Resistance
07 22 00 Item: Flame Spread Rating
07 22 00 Item: Installer Qualifications

07 54 19 Item: Detail Drawings
07 54 19 Item: Roof Plan
07 54 19 Item: PVC Roofing Membrane
07 54 19 Item: Wind Uplift Resistance
07 54 19 Items: Membrane Flashing

07 60 00 Item: Gutters
07 60 00 Item: Downspouts
07 60 00 Item: Expansion Joints
07 60 00 Item: Counterflashing
07 60 00 Item: Reglets
07 60 00 Item: Eave Flashing
07 60 00 Item: Finish Samples
07 60 00 Item: Wind Uplift Requirements

Approval without resubmittal needs ("A" or "B" action) of all the aforementioned items must occur prior to installation of the associated item.

1.15.3 Stairs

The Contractor shall submit the following submittals (and subsequent resubmittals) together:

05 51 00 Item: Fabrication Drawings
05 51 00 Item: Steel Pan Stairs
05 51 00 Item: Steel Stairs
05 51 00 Item: Structural Calculations

05 52 00 Item: Fabrication Drawings
05 52 00 Item: Steel Guardrails and Handrails
05 52 00 Item: Design Calculations For Steel Connections

1.15.4 Seismic Protection

The Contractor shall submit the following submittals (and subsequent resubmittals) together:

13 48 73 Item: Bracing
13 48 73 Item: Vibration Isolators
13 48 73 Item: Design Calculations
13 48 73 Item: ICC ES AC156 Shake Table Test

21 13 13 Items: Seismic Bracing

21 13 18 Items: Seismic Bracing

23 05 48.19 Item: Contractor Designed Bracing
23 05 48.19 Item: Coupling and Bracing
23 05 48.19 Item: Equipment Restraint
23 05 48.19 Item: Contractor Designed Bracing
23 05 48.19 Item: Anchor Bolts

26 05 48 Item: Equipment Requirements
26 05 48 Item: Lighting Fixtures
26 05 48 Item: Supports and Attachments
26 05 48 Item: Equipment Requirements
26 05 48 Item: Lighting Fixtures
26 05 48 Item: Flexible Fittings
26 05 48 Item: Anchors
26 05 48 Item: Isolation and Energy Dissipation Systems
26 05 48 Item: Design Calculations
26 05 48 Item: Design Drawings
26 05 48 Item: Independent Design Review Report

Allow a minimum of 30 calendar days exclusive of mailing for Government reviews and approvals.

1.15.5 Fire Protection

The Contractor shall submit the following submittals (and subsequent resubmittals) together:

21 13 13 Item: Sprinkler System Designer
21 13 13 Item: Sprinkler System Installer
21 13 13 Item: Shop Drawing
21 13 13 Item: Hydraulic Calculations
21 13 13 Item: Pipe
21 13 13 Item: Fittings
21 13 13 Item: Valves
21 13 13 Item: Relief Valves
21 13 13 Item: Sprinklers
21 13 13 Item: Pipe Hangers and Supports
21 13 13 Item: Sprinkler Alarm Switch
21 13 13 Item: Valve Supervisory (Tamper) Switch
21 13 13 Item: Fire Department Connection
21 13 13 Item: Backflow Prevention Assembly
21 13 13 Item: Air Vent
21 13 13 Item: Hose Valve

21 13 18 Item: Sprinkler System Designer
21 13 18 Item: Sprinkler System Installer
21 13 18 Item: Releasing System Designer
21 13 18 Item: Releasing System Technician
21 13 18 Item: Releasing System Installer
21 13 18 Item: Nitrogen Generation System Commissioning Technician
21 13 18 Item: Releasing System Site-Specific Software Acknowledgement
21 13 18 Item: Shop Drawing
21 13 18 Item: Wiring Diagrams
21 13 18 Item: Control System Layout
21 13 18 Item: Battery Power (RSCP)

21 13 18 Item: Voltage Drop Calculations (RSCP)
21 13 18 Item: Pipe
21 13 18 Item: Fittings
21 13 18 Item: Valves
21 13 18 Item: Relief Valves
21 13 18 Item: Sprinklers
21 13 18 Item: Pipe Hangers and Supports
21 13 18 Item: Sprinkler Alarm Switch
21 13 18 Item: Valve Supervisory (Tamper) Switch
21 13 18 Item: Fire Department Connection
21 13 18 Item: Backflow Prevention Assembly
21 13 18 Item: Hose Valve
21 13 18 Item: High/Low-Nitrogen Pressure Supervisory Switch
21 13 18 Item: Pre-Action Valve
21 13 18 Item: Nitrogen Generation System
21 13 18 Item: Releasing Service Fire Alarm Control Panel (RSCP)
21 13 18 Item: Terminal Cabinets
21 13 18 Item: Auxiliary Power Supply Panels
21 13 18 Item: Batteries (RSCP)
21 13 18 Item: Battery Chargers
21 13 18 Item: Heat Detectors
21 13 18 Item: Addressable Interface Devices (RSCP)
21 13 18 Item: Addressable Control Modules (RSCP)
21 13 18 Item: Isolation Modules
21 13 18 Item: Surge Protective Devices
21 13 18 Item: Hydraulic Calculations

21 30 00 Item: Fire Protection Specialist
21 30 00 Item: Installation Drawings
21 30 00 Item: Piping Layout
21 30 00 Item: Pump Room
21 30 00 Item: Catalog Data

25 05 11.03 Item: Network Communication Report
25 05 11.03 Item: Cybersecurity Riser Diagram
25 05 11.03 Item: Control System Cybersecurity Documentation
25 05 11.03 Item: Control System Cybersecurity Testing Procedures

28 31 70 Item: Qualified Fire Protection Engineer (QFPE)
28 31 70 Item: Fire alarm system designer
28 31 70 Item: Supervisor
28 31 70 Item: Technician
28 31 70 Item: Installer
28 31 70 Item: Test Technician
28 31 70 Item: Fire Alarm System Site-Specific Software Acknowledgement
28 31 70 Item: Wiring Diagrams
28 31 70 Item: System Layout
28 31 70 Item: Notification Appliances
28 31 70 Item: Initiating devices
28 31 70 Item: Battery Power (Other than RSCP)
28 31 70 Item: Voltage Drop Calculations (Other than RSCP)
28 31 70 Item: Dedicated Emergency Panel Schedules
28 31 70 Item: Fire Alarm Control Unit (FACU)
28 31 70 Item: Releasing Service Fire Alarm Control Panel (RSCP)
28 31 70 Item: LCD Annunciator
28 31 70 Item: Manual Stations
28 31 70 Item: Smoke Detectors
28 31 70 Item: Duct Smoke Detectors
28 31 70 Item: Addressable Interface Devices

28 31 70 Item: Addressable Control Modules
28 31 70 Item: Isolation Modules
28 31 70 Item: Notification Appliances
28 31 70 Item: Batteries
28 31 70 Item: Battery Chargers
28 31 70 Item: Supplemental Notification Appliance Circuit Panels
28 31 70 Item: Level Sensor
28 31 70 Item: Auxiliary Power Supply Panels
28 31 70 Item: Surge Protective Devices
28 31 70 Item: Alarm Wiring
28 31 70 Item: Back Boxes and Conduit
28 31 70 Item: Ceiling Bridges
28 31 70 Item: Terminal Cabinets
28 31 70 Item: Automatic Fire Alarm Transmitters
28 31 70 Item: Radio Transmitter and Interface Panels
28 31 70 Item: Environmental Enclosures or Guards
28 31 70 Item: Hydrogen Detectors
28 31 70 Item: Carbon Monoxide Detectors
28 31 70 Item: Low Temperature Sensors
28 31 70 Item: Solenoid Disconnect Switches
28 31 70 Item: Pressure Switches
28 31 70 Item: Spare Parts
28 31 70 Item: Equipment List

Additionally, the following submittals shall be submitted no later than the first time the above items are submitted:

25 05 11.03 Item: Device Account Lock Exception Request
25 05 11.03 Item: Multiple Ethernet Connection Device Request
25 05 11.03 Item: Contractor Computer Cybersecurity Compliance Statements
25 05 11.03 Item: Contractor Temporary Network Cybersecurity Compliance Statements
25 05 11.03 Item: Resumes and Certifications
Note 25 05 11.03 Item: "Resumes and Certifications" is required to be submitted within 14 days after notice to proceed.

All submittals other than those identified under Section 25 05 11.03 shall be stamped and sealed by the contractor's QFPE. See Section 28 31 70 regarding QFPE qualifications.

Allow a minimum of 40 calendar days exclusive of mailing for Government reviews and approvals.

1.15.6 Adjustable Speed Drives and Associated Equipment

1.15.6.1 Generator Supply Fans

The Contractor shall submit the following submittals (and subsequent resubmittals) together:

23 30 00 Item: Axial Flow Fans
26 29 23 Item: Adjustable Speed Drives (Generator Supply Fans)

1.15.6.2 Other Equipment Requiring Adjustable Speed Drives

Should the contractor determine equipment other than that identified above requires an adjustable speed drive/variable frequency drive, the Contractor shall submit the following submittals (and subsequent

resubmittals) together.

1.15.7 Interior Lighting

At a minimum, the following shall be submitted for approval together:

26 51 00 Item: Luminaire Drawings
26 51 00 Item: Luminaires
26 51 00 Item: Light Sources
26 51 00 Item: Luminaire Design Data
26 51 00 Item: LED Drivers
26 51 00 Item: LED Luminaire - ANSI/IES LM-79 Test Report
26 51 00 Item: LED Light Source - ANSI/IES LM-80 Test Report
26 51 00 Item: LED Light Source - ANSI/IES TM-21 Test Report

1.15.8 Exterior Lighting

At a minimum, the following shall be submitted for approval together:

26 56 00 Item: Luminaire Drawings
26 56 00 Item: Pole Drawings
26 56 00 Item: Luminaires
26 56 00 Item: Light Sources
26 56 00 Item: LED Drivers
26 56 00 Item: Photosensors
26 56 00 Item: Poles
26 56 00 Item: Brackets
26 56 00 Item: Luminaire Design Data
26 56 00 Item: ANSI/IES LM-79 Test Report
26 56 00 Item: ANSI/IES LM-80 Test Report
26 56 00 Item: ANSI/IES TM-21 Test Report
26 56 00 Item: Exterior Lighting Control System

1.15.9 Intercommunication System

The Contractor shall submit the following submittals (and subsequent resubmittals) together:

25 05 11.04 Item: Network Communication Report
25 05 11.04 Item: Cybersecurity Riser Diagram
25 05 11.04 Item: Control System Cybersecurity Documentation
25 05 11.04 Item: Control System Cybersecurity Testing Procedures

27 51 23 Item: Installation
27 51 23 Item: All-Call Amplifier
27 51 23 Item: Cone-Type Loudspeakers
27 51 23 Item: Horn-Type Loudspeakers
27 51 23 Item: Intercommunication Amplifier
27 51 23 Item: Master Station
27 51 23 Item: Remote Audio-Only Station
27 51 23 Item: Remote Audio Station
27 51 23 Item: Speaker Enclosures

Additionally, the following submittals shall be submitted no later than the first time the above items are submitted:

25 05 11.04 Item: Device Account Lock Exception Request
25 05 11.04 Item: Multiple Ethernet Connection Device Request
25 05 11.04 Item: Contractor Computer Cybersecurity Compliance

Statements
25 05 11.04 Item: Contractor Temporary Network Cybersecurity Compliance Statements
25 05 11.04 Item: Proposed STIG and SRG Applicability Report
25 05 11.04 Item: Resumes and Certifications
Note 25 05 11.04 Item: "Resumes and Certifications" is required to be submitted within 14 days after notice to proceed.

Allow a minimum of 30 calendar days exclusive of mailing for Government reviews and approvals.

1.15.10 HEMP Shield Penetration

Media required to penetrate the Building 433 HEMP shield shall not commence prior to the approval ("A" or "B" Action) of the following submittals:

33 82 00 Item: HEMP Protection Subsystem (Shielding) Specialist
33 82 00 Item: HEMP Measures Shop Drawings

1.15.11 HVAC Controls

The Contractor shall submit the following submittals (and subsequent resubmittals) together:

23 09 00 Item: DDC Contractor Design Drawings

25 05 11.01 Item: Network Communication Report
25 05 11.01 Item: Cybersecurity Riser Diagram
25 05 11.01 Item: Control System Cybersecurity Documentation
25 05 11.01 Item: Control System Cybersecurity Testing Procedures

Additionally, the following submittals shall be submitted no later than the first time the above items are submitted:

25 05 11.01 Item: Device Account Lock Exception Request
25 05 11.01 Item: Multiple Ethernet Connection Device Request
25 05 11.01 Item: Contractor Computer Cybersecurity Compliance Statements
25 05 11.01 Item: Contractor Temporary Network Cybersecurity Compliance Statements
25 05 11.01 Item: Cybersecurity Interconnection Schedule
25 05 11.01 Item: Proposed STIG and SRG Applicability Report
25 05 11.01 Item: Resumes and Certifications
Note 25 05 11.01 Item: "Resumes and Certifications" is required to be submitted within 14 days after notice to proceed.

Allow a minimum of 30 calendar days exclusive of mailing for Government reviews and approvals.

1.15.12 Fuel Distribution System

The Contractor shall submit the following submittals (and subsequent resubmittals) together:

25 05 11.02 Item: Network Communication Report
25 05 11.02 Item: Cybersecurity Riser Diagram
25 05 11.02 Item: Control System Cybersecurity Documentation
25 05 11.02 Item: Control System Cybersecurity Testing Procedures

33 01 50.31 Items: Leak Detection System (other than O&M Data)
33 01 50.31 Items: Electronic Monitoring/Alarm Panel (other than O&M Data)

33 09 52 Item: Shop Drawing
33 09 52 Item: Laptop Computer
33 09 52 Items: Programmable Logical Controller (PLC) Hardware and Software
33 09 52 Item: Control Wiring Data Lists
33 09 52 Item: Human Machine Interface (HMI)
33 09 52 Item: Fiber Converter Panels (FCP) and Components
33 09 52 Items: Pump Control Panels (PCP) and Components
33 09 52 Item: Graphics Display Screen

33 56 10 Item: Tank Gauges

33 57 55 Items: Meters
33 57 55 Items: Packaged Truck Offload System
33 57 55 Item: Pressure Gages
33 57 55 Item: Differential Pressure Gauge
33 57 55 Item: Automatic Pump Controls
33 57 55 Item: Flow Switches
33 57 55 Item: Submersible Pump
33 57 55 Item: Gear Pump
33 57 55 Item: Packaged Truck Offload System
33 57 55 Item: Liquid Level Gauge
33 57 55 Item: Operating Tank Level Switches

Additionally, the following submittals shall be submitted no later than the first time the above items are submitted:

25 05 11.02 Item: Device Account Lock Exception Request
25 05 11.02 Item: Multiple Ethernet Connection Device Request
25 05 11.02 Item: Contractor Computer Cybersecurity Compliance Statements
25 05 11.02 Item: Contractor Temporary Network Cybersecurity Compliance Statements
25 05 11.02 Item: Cybersecurity Interconnection Schedule
25 05 11.02 Item: Proposed STIG and SRG Applicability Report
25 05 11.02 Item: Resumes and Certifications
Note 25 05 11.02 Item: "Resumes and Certifications" is required to be submitted within 14 days after notice to proceed.

Allow a minimum of 40 calendar days exclusive of mailing for Government reviews and approvals.

1.15.13 Overhead Electric Cranes

The Contractor shall submit the following submittals (and subsequent resubmittals) together:

41 22 13.14 Item: Overhead Electric Traveling Crane
41 22 13.14 Item: Complete Schematic Wiring Diagram
41 22 13.14 Item: Hoists
41 22 13.14 Item: End Stops
41 22 13.14 Item: Variable Frequency Drives
41 22 13.14 Item: Motors
41 22 13.14 Item: Runway Conductor System

41 22 13.14 Item: Bridge Conductor System
41 22 13.14 Item: Limit Switches
41 22 13.14 Item: Pendant Pushbutton Station
41 22 13.14 Item: Controls
41 22 13.14 Item: Control Parameter Settings
41 22 13.14 Item: Capacity Overload Protective Device
41 22 13.14 Item: Load and Sizing Calculations

1.15.14 Electrical Equipment Supporting Fire Protection

1.15.14.1 Transformers for Electric Fire Pumps

The transformers associated with the electric fire pump shall not be approved for installed equipment suitability prior to the approval of the Section 21 30 00 Fire Pump sized to satisfy the needs of suppression systems performance based on the hydraulic calculations of Sections 21 13 13 and 21 13 18.

21 13 13 Item: Hydraulic Calculations

21 13 18 Item: Hydraulic Calculations

21 30 00 Item: Installation Drawings
21 30 00 Item: Catalog Data

26 12 19.10 Items: Pad-mounted Transformer Drawings (Fire Pump)

1.15.14.2 Non-Fire Pump Features

Approval of 26 20 00 Item: "Panelboards" for Panels NFL and NL will not be considered without the approval of the following submittal item, which requires a complete design of the fire alarm and suppression systems:

28 31 70 Item: Dedicated Emergency Panel Schedules

Provide the following as required by individual panelboard, transformer, enclosed circuit breaker, and/or automatic transfer switch supporting contractor-furnished items:

26 20 00 Item: Interim CFCI Equipment Electrical Data (Fire Alarm)

1.15.15 Generation, Distribution, and Controls (Medium Voltage plus Switchboards)

The Contractor shall submit the following submittals (and subsequent resubmittals) together with respect to control equipment/devices and interfaces:

25 05 11.05 Item: Network Communication Report
25 05 11.05 Item: Cybersecurity Riser Diagram
25 05 11.05 Item: Control System Cybersecurity Documentation
25 05 11.05 Item: Control System Cybersecurity Testing Procedures

26 05 73 Item: Interim Load Flow Study
26 05 73 Item: Interim Fault Current Analysis
26 05 73 Item: Interim Protective Device Coordination Study
26 05 73 Item: Transformer Inrush Data
[*Am-00002]
26 13 02 Item: Switchgear Drawings

26 13 02 Item: Electronic Overcurrent Control Curves
26 13 02 Item: Solid Dielectric Insulated Pad-mounted Switchgear
26 13 02 Item: Insulated High-Voltage Connectors
26 13 02 Item: Surge Arresters[**Am-00002]

26 13 13 Item: Switchgear Drawings
26 13 13 Item: Switchgear
26 13 13 Item: Generator Controls Sequence of Operations

26 20 00 Item: Metering
26 20 00 Item: Circuit Breakers (Switchboards)
26 20 00 Item: Busway

26 24 13 Item: Switchboard Drawings
26 24 13 Item: Switchboard

26 32 15 Item: Engine-Generator Set and Auxiliary Equipment
26 32 15 Item: Auxiliary Systems
26 32 15 Item: Detailed Drawings
26 32 15 Item: Harmonic Requirements
26 32 15 Item: Engine-Generator Set Efficiencies
26 32 15 Item: Emissions
26 32 15 Item: Filters
26 32 15 Item: Engine-Generator Parameter Schedule
26 32 15 Item: Exchanger
26 32 15 Item: Generator
26 32 15 Item: Vibration-Isolation
26 32 15 Item: Exciter
26 32 15 Item: Performance Criteria
26 32 15 Item: Heat Exchanger
26 32 15 Item: Time-Delay on Alarms
26 32 15 Item: Cooling System
26 32 15 Item: Vibration Isolation
26 32 15 Item: Battery Charger
26 32 15 Item: Capacity Calculations for Engine-Generator Set
26 32 15 Item: Brake Mean Effective Pressure (BMEP) Calculations
26 32 15 Item: Torsional Vibration Stress Analysis Computations
26 32 15 Item: Turbocharger Load Calculations

Additionally, the following submittals shall be submitted no later than the first time the above items are submitted:

25 05 11.05 Item: Device Account Lock Exception Request
25 05 11.05 Item: Multiple Ethernet Connection Device Request
25 05 11.05 Item: Contractor Computer Cybersecurity Compliance Statements
25 05 11.05 Item: Contractor Temporary Network Cybersecurity Compliance Statements
25 05 11.05 Item: Cybersecurity Interconnection Schedule
25 05 11.05 Item: Proposed STIG and SRG Applicability Report
25 05 11.05 Item: Resumes and Certifications
Note 25 05 11.05 Item: "Resumes and Certifications" is required to be submitted within 14 days after notice to proceed.

The Contractor shall not submit nor shall submittals be considered approved for installation on any electrical equipment containing overcurrent protective devices or requiring a short circuit rating or an arc flash rating until the Power System Studies (Section 26 05 73) has been submitted for review by the Contractor and until it has been approved

(transmittal "A" or "B" Action) by the reviewing agent. However, a conservative utility available fault value may be used for an interim study suitable to release equipment, however, true values must be used for establishing equipment available fault current and arc flash labeling. See Section 26 05 73.

Allow a minimum of 40 calendar days exclusive of mailing for Government reviews and approvals.

1.15.16 Electrical Distribution Equipment (Downstream of Switchboards)

The Contractor shall submit the following submittals (and subsequent resubmittals) together:

26 05 73 Item: Interim Load Flow Study
26 05 73 Item: Interim Fault Current Analysis
26 05 73 Item: Interim Protective Device Coordination Study
26 05 73 Item: Transformer Inrush Data

26 20 00 Item: Panelboards
26 20 00 Item: Circuit Breakers (Other than Switchboards)
26 20 00 Item: Switches
26 20 00 Item: Manual Transfer Switch
26 20 00 Item: Low- to Low-Voltage Transformers
26 20 00 Item: Enclosed Circuit Breakers
26 20 00 Item: Adjustable Circuit Breaker Settings Cover
26 20 00 Item: Circuit Breaker Handle Locks and Lock-out Device
26 20 00 Item: Conductor Termination Adapters

26 36 23 Item: Automatic Transfer Switch Drawings
26 36 23 Item: Automatic Transfer Switches
26 36 23 Item: By-Pass/Isolation Switch (BP/IS)

Provide the following as required by individual panelboard, transformer, enclosed circuit breaker, and/or automatic transfer switch supporting contractor-furnished items:

26 20 00 Item: Interim CFCI Equipment Electrical Data
26 20 00 Item: CFCI Equipment Electrical Data

Submittals may be further subdivided for approval of logically-grouped equipment with supporting information such as follows:

1. Generator Station Service Panelboards with 26 20 00 Item "Interim CFCI Equipment Electrical Data (Generator Station Service)"
2. Filter Shelter distribution equpment with 26 20 00 Item "Interim CFCI Equipment Electrical Data (Filter Shelter)"
3. Offload distribution equpment with 26 20 00 Item "Interim CFCI Equipment Electrical Data (Offload)" and congruently the 26 05 73 Items for Interim Studies for the Offload.

The Contractor shall not submit nor shall submittals be considered approved for installation on any electrical equipment containing overcurrent protective devices or requiring a short circuit rating or an arc flash rating until the Power System Studies (Section 26 05 73) has been submitted for review by the Contractor and until it has been approved (transmittal "A" or "B" Action) by the reviewing agent. However, a conservative utility available fault value may be used for an interim study suitable to release equipment, however, true values must be used for

establishing equipment available fault current and arc flash labeling. See Section 26 05 73.

Allow a minimum of 40 calendar days exclusive of mailing for Government reviews and approvals.
[*Am-00002]

1.15.17 Temporary Lighting Coordination

Prior to the de-energization of the impacted circuits, the following must be approved with either "A" or "B" Action:

26 56 00 Item: Perimeter Security Lighting Photometric Plan[**Am-00002]

1.16 Contractor-Furnished Items Requiring Electrical Interface

Any contractor-furnished devices and equipments requiring interface with the electrical distribution system shall be accounted for in the "CFCI Equipment Electrical Data" submittal(s).

When submitting products requiring such interface, provide in the submittal a summary of the characteristics required by the Section 26 20 00 "CFCI Equipment Electrical Data" submittal, and provide in the submittal manufacturer documentation expressing the electrical supply needs.

Specification sections containing contractor-furnished items anticipated to require electrical interface have been identified in the contract documents, with an attempt to consolidate in the EP610 series Equipment Electrical Connection Schedules. However, should additional contractor-furnished items require the support described in this subpart, the contractor shall furnish for such items the information required herein.
[*Am-00002]
The "CFCI Equipment Electrical Data" shall be a perpetually-maintained log tracking items which have been (1) not been submitted, (2) submitted, (3) submitted and approved, and (4) installed (indicating the current status), in addition to the parameters identified in Section 26 20 00, with log recordings occurring as such activities are executed. The contractor shall furnish the up-to-date log within three business days of government request (in addition to "CFCI Equipment Electrical Data" submittal activities identified in the contract specifications).

Submittals for each item included in the "CFCI Equipment Electrical Data" logs/submittals shall include evidence of review for the item electrical characteristics validating conformance to the electrical circuit configuration and characteristics indicated on the contract documents; the evidence shall be a written endorsement by the contractor quality control personnel and/or designated contractor electrical representative (to include the electrical subcontractor at the contractor's discretion) indicating quality control has occurred to ensure coordination of the equipment submitted with the portion of the electrical distribution system to which the equipment will interface.[**Am-00002]

See Section 26 20 00 for additional instructions.

1.17 WITHHOLDING OF PAYMENT

Payment for materials incorporated in the work will not be made if required approvals have not been obtained.

1.18 CERTIFICATION OF SUBMITTAL DATA

Certify the submittal data as follows on Form ENG 4025: "I certify that the above submitted items had been reviewed in detail and are correct and in strict conformance with the contract drawings and specifications except as otherwise stated.

_____NAME OF CONTRACTOR _____ SIGNATURE OF CONTRACTOR

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Not Used

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Not Used

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26 13 01 Attachment 1 - SBIRS PKG C Record Drawings

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[*Am-00002] (New Section Added, Replaces 26 13 01 "PAD-MOUNTED DEAD-FRONT AIR INSULATED SWITCHGEAR")

SECTION 26 13 02

PAD-MOUNTED SOLID DIELECTRIC SWITCHGEAR
11/24

PART 1 GENERAL

Attachments: 26 13 01 Attachment 1 - SBIRS PKG C Record Drawings

1.1 RELATED SECTIONS

Section 33 71 02 UNDERGROUND ELECTRICAL DISTRIBUTION, applies to this section with the additions and modifications specified herin.

1.2 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM A240/A240M	(2023) Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications
ASTM D1535	(2014; R 2018) Standard Practice for Specifying Color by the Munsell System

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE 386	(2016) Separable Insulated Connector Systems for Power Distribution Systems Rated 2.5 kV through 35 kV
IEEE 495	(2007) Guide for Testing Faulted Circuit Indicators
IEEE C2	(2023) National Electrical Safety Code
IEEE C37.60	(2019) High-Voltage Switchgear and Controlgear - Part 111: Automatic Circuit Reclosers for Alternating Current Systems Up to 38 kV
IEEE C37.62	(2020) Standard for Pad-Mounted Dry Vault, Submersible and Overhead Fault Interrupters for Alternating Current Systems Up to and Including 38kV
IEEE C37.74	(2014) Standard Requirements for Subsurface, Vault, and Pad-Mounted Load-Interrupter Switchgear and Fused Load-Interrupter Switchgear for

	Alternating Current Systems Up to 38 kV
IEEE C57.12.28	(2023) Standard for Pad-Mounted Equipment - Enclosure Integrity
IEEE C62.11	(2020) Standard for Metal-Oxide Surge Arresters for Alternating Current Power Circuits (>1kV)

INTERNATIONAL ELECTRICAL TESTING ASSOCIATION (NETA)

NETA ATS	(2021) Standard for Acceptance Testing Specifications for Electrical Power Equipment and Systems

INTERNATIONAL ELECTROTECHNICAL COMMISSION (IEC)

IEC 62271-111	(2019) High Voltage Switchgear And Controlgear - Part 111: Automatic Circuit Reclosers for Alternating Current Systems up to and including 38 kV

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2023; ERTA 7 2023; TIA 23-15) National Electrical Code
NFPA 70B	(2023) Recommended Practice for Electrical Equipment Maintenance

U.S. DEPARTMENT OF DEFENSE (DOD)

DOD 8500.01	(2014; Change 1-2019) Cybersecurity
DOD 8510.01	(2022) Risk Management Framework (RMF) for DoD Systems

UL SOLUTIONS (UL)

UL 467	(2022) UL Standard for Safety Grounding and Bonding Equipment

1.3 RELATED REQUIREMENTS

Section 26 08 00 APPARATUS INSPECTION AND TESTING, applies to this section, with the additions and modifications specified herein. Cybersecurity requirements are specified in Section 25 05 11 CYBERSECURITY FOR FACILITY-RELATED CONTROL SYSTEMS.

1.4 DEFINITIONS

1.4.1 Way

A way is considered a three-phase or single-phase circuit connection to the bus, which may contain combinations of switches and protective devices or may be a solid bus.

1.4.2 Switched Way

A switched way is considered a three-phase circuit entrance to the bus through a switch. For single-phase switches, it is a single-phase entrance to the bus through a switch.

1.5 SUBMITTALS

Include in submittals the information required by the "CFCI Equipment Electrical Data" submittal in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM and as described in Section 01 33 00 Subpart "Contractor-Furnished Items Requiring Electrical Interface". For this Section, any accessories requiring 600V or less station service electrical supply for function of the equipment (controls, actuators, battery chargers, heaters, etc.) shall be included in the CFCI Equipment Electrical Data submittal.

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Switchgear Drawings; G, DO

SD-03 Product Data

Electronic Overcurrent Control Curves; G, DO

Insulated High-Voltage Connectors; G, DO

Surge Arresters; G, DO

Solid Dielectric Insulated Pad-mounted Switchgear; G, DO

Include data on switches and associated accessories with each submittal. Include manufacturer's information for each component, device and accessory provided with the equipment with each submittal.

SD-06 Test Reports

Acceptance Checks and Tests; G, RO

SD-07 Certificates

Paint Coating System; G, RO

Cybersecurity; G, RO

SD-09 Manufacturer's Field Reports

Switchgear Design and Production Tests; G, RO

SD-10 Operation and Maintenance Data

Solid Dielectric Insulated Pad-mounted Switchgear Operation and

Maintenance, Data Package 5; G, RO

Submit in accordance with Section 01 78 23 OPERATION AND MAINTENANCE DATA

1.5.1 Submittal Coordination and Sequencing Requirements

See references to this Specifications Section and/or specific submittal items in Section 01 33 00, as well as requirements herein and as referenced in other parts of this contract, for coordination and sequencing of submittals and the associated work to be performed.

1.6 QUALITY ASSURANCE

1.6.1 Switchgear Drawings

Furnish drawings that include, but are not limited to, the following:

a. Overall dimensions, weights, plan view, and front view

b. Ratings

c. Single-line diagram

d. Nameplate schedule

e. Conduit entry/ exit locations

f. Anchor bolt template and locations

1.6.2 Paint Coating System

Submit IEEE C57.12.28 paint coating system performance requirement tests.

1.6.3 Electronic Overcurrent Control Curves

Provide time-current characteristic curves in PDF and Excel format and in electronic format suitable for import or updating into the EasyPower computer program.

1.7 MAINTENANCE

1.7.1 Solid Dielectric Insulated Pad-mounted Switchgear Operation and Maintenance

Submit Operation and Maintenance Manuals in accordance with Section 01 78 23 OPERATION AND MAINTENANCE DATA.

1.8 CYBERSECURITY

All control systems (including systems separate from an energy management control system) must be planned, designed, acquired, executed and maintained in accordance with DOD 8500.01 and DOD 8510.01, and as required by individual Service Imnplementation Policy.

Submit certification that equipment complies with the above DoD instructions.

PART 2 PRODUCTS

2.1 SOLID DIELECTRIC INSULATED PAD-MOUNTED SWITCHGEAR

IEEE C37.74.

2.1.1 Ratings and Test Requirements

The maximum voltage rating of the switchgear must be 15.5 kV. Provide the corresponding ratings associated with the required switchgear voltage rating as follows:

Rated Maximum Voltage, kV	15.5
Rated Withstand Impulse Voltage, kV BIL	95
Continuous and Load Interrupting Current, A	600
Short-Time Current, kA rms Sym	12.5
Short-Circuit interrupting Current,kA rms Sym	12.5

Provide switch and fault interrupter ways for the required continuous and load interrupting current.

2.1.2 Switchgear Construction

Provide switchgear with the following construction configuration:

a. Switch contacts and cable entrance terminations contained in a dead front, enclosed in a steel compartment. All penetrations, bussing, switches and interrupters shall be potted in a liquid-tight synthetic solid dielectric insulation compound. Unit shall carry a IP 68 rating on the medium voltage equipment.

b. Configured with load interrupting and fault interrupter switched ways as indicated.

c. Accessible terminations suitable for cables entering from below.

d. Switch contact positions for switched ways visible through viewing windows in the switchgear termination compartment.

e. Each switched way with two position switch; Open and Closed. Grounding provided via grounding parking elbow.

f. Manual operating provisions mounted at switch and capable of hookstick operation per IEEE C37.74.

2.1.2.1 Pad/Vault-mounting Provisions

Provide enclosed switchgear on a concrete vault with front and rear access, as indicated, including the following:

a. Fabricate a switchgear enclosure and enclosure base of ASTM A240/A240M type 304 or 304L stainless steel.

b. Enclosure base includes any part of the switchgear enclosure that is within 3 inches of concrete pad.

c. Paint enclosure including base ASTM D1535 Munsell 7GY3.29/1.5 green.

d. Comply with IEEE C57.12.28 for the paint coating system regardless of equipment material.

2.1.3 Load Interrupting Switched Ways

Provide the following for load interrupter switched ways:

a. Three-pole group operated switching.

b. Interrupter switches operated by means of an externally accessible switch-operating handle.

c. Switch-operating handle located at each dead front switch mechanism inside pad-mounted gear enclosure.

d. Pad lockable stainless steel access cover.

e. Labels to indicate switch position.

f. Switch position viewing window.

2.1.3.1 Fault Interrupting Ways

IEEE C37.60, IEC 62271-111, IEEE C37.62. Provide non-fused, non-reclosing, manual reset, vacuum interrupters consisting of vacuum interrupter and a spring or magnetic assisted operating mechanism. Each fault interrupting way must utilize internal mounted current transformers and an electronic overcurrent control to provide three-pole ganged tripping for single-phase and three-phase faults. Provide microprocessor overcurrent relaying with adjustable settings. Provide remote tripping via an external dry contact device for fault interrupting ways. Provide power from the switchgear itself and internal battery.

2.1.4 Low Voltage Test Points

Provide load interrupting switch ways with load side voltage sensors that allow for low voltage checks with relay interface at test point of elbow connectors to confirm energized and in-phase conditions using a standard high-impedance voltmeter.

2.1.5 Dead-Front High-Voltage Bushings

IEEE 386. 15.5 kV, 95 kV BIL. Provide 600 ampere one-piece deadbreak apparatus bushings for each switched way.

a. Parking stands: Provide a parking stand near each dead-front bushing. Provide insulated standoff bushings for parking of energized load-break connectors on each parking stands.

2.2 INSULATED HIGH-VOLTAGE CONNECTORS

IEEE 386. Provide corresponding connector for each switched way. Provide a grounding eye and test point on each connector.

a. 600 Ampere deadbreak connector ratings: Voltage: 15.5 kV, 95 kV BIL. Short time rating: 25,000 rms symmetrical amperes. Provide connectors with 200 ampere bushing interface.

2.3 GROUNDING PROVISIONS

Provide a ground-connection pad in each termination compartment.

2.4 FAULTED CIRCUIT INDICATORS

Install one set of faulted circuit indicators on the test points of each set of separable insulated connectors. Faulted circuit indicators must comply with IEEE 495. Indicators must be self powered; with automatic trip with mechanical flag indication upon overcurrent followed by loss of system voltage. Indicators must be compact, sealed corrosion resistant construction with provision for hotstick installation and operation.

2.5 SURGE ARRESTERS

IEEE C62.11, rated 15, fully shielded, dead-front, metal-oxide-varistor, elbow type with resistance-graded gap, suitable for plugging into inserts. Provide arresters on switched ways as indicated.

]2.6 SOURCE QUALITY CONTROL

2.6.1 Switchgear Design and Production Tests

Furnish reports which include results of design and production tests performed according to IEEE C37.74 and IEEE C37.60, IEEE C37.62. Perform manufacturer production tests on each switchgear assembly to ensure that design performance is maintained in production.

PART 3 EXECUTION

3.1 INSTALLATION

Conform to IEEE C2, NFPA 70, and to the requirements specified herein.

3.2 GROUNDING

NFPA 70 and IEEE C2, except provide grounds and grounding systems with a resistance to solid earth ground not exceeding10 ohms. When work, in addition to that indicated or specified, is directed to obtain the specified ground resistance, the provision of the contract covering "Changes" applies.

3.2.1 Grounding Electrodes

Provide driven ground rods as specified in Section 33 71 02 UNDERGROUND ELECTRICAL DISTRIBUTION.

3.2.2 Switchgear Grounding

Connect No. 4/0 bare copper conductor ground ring, not less than 24 inches below grade, to the upper end of the ground rods by exothermic welds or compression connectors. Provide No. 4/0 bare copper conductors connecting the switchgear grounding provisions to two different ground rods.

3.2.3 Connections

Make joints in grounding conductors and ground ring by exothermic weld or compression connector. Install exothermic welds and compression connectors as specified in Section 33 71 02 UNDERGROUND ELECTRICAL DISTRIBUTION.

3.2.4 Grounding and Bonding Equipment

UL 467, except as indicated or specified otherwise.

3.3 FOUNDATION FOR EQUIPMENT AND ASSEMBLIES

Mount switch on concrete vault, including the following:

a. Show vault size on the drawings.

b. Provide slab size at least 12 inches thick, reinforced with a 6 by 6-W2.9 by W2.9 mesh, placed uniformly 4 inches from the top of the slab.

c. Place slab on a 6 inch thick, well-compacted gravel base.

d. Install top of concrete slab approximately 4 inches above finished grade. Provide edges above grade with 1/2 inch chamfer.

e. Provide slab of adequate size to project at least 8 inches beyond equipment.

f. For installations that use a box pad or vault, train the incoming cables around the box or vault prior to terminating at the switchgear. Stub up conduits, with bushings, 2 inches into cable wells in the concrete pad. Coordinate dimensions of cable wells with switch cable training areas. Provide concrete work as specified in Section 03 30 00 CAST-IN-PLACE CONCRETE.

3.4 FIELD QUALITY CONTROL

3.4.1 Performance of Acceptance Checks and Tests

Perform in accordance with the manufacturer's recommendations, NFPA 70B, NETA ATS and referenced ANSI standards. Submit reports, including acceptance criteria and limits for each test in accordance with NETA ATS "Test Values".

Include the following visual and mechanical inspections and electrical tests, performed in accordance with NETA ATS.

3.4.1.1 Switchgear

a. Visual and Mechanical Inspection

(1) Compare equipment nameplate information with specifications and approved shop drawings.

(2) Inspect physical and mechanical condition.

(3) Check for proper anchorage, alignment, required area clearances, and grounding.

(4) Perform mechanical operator tests in accordance with manufacturer's instructions.

(5) Inspect all indicating devices for proper operation.

b. Electrical Tests

(1) Perform contact-resistance tests.

(2) Trip fault interrupters by operation of overcurrent control.

(3) Perform insulation-resistance tests.

(4) Perform an over-potential test on each switched way pole with the switched way in the open position in accordance with the manufacturer's instructions.

3.4.1.2 Grounding System

a. Visual and Mechanical Inspection

Inspect ground system for compliance with contract plans and specifications.

b. Electrical Tests

(1) Perform ground-impedance measurements utilizing the fall-of-potential method. On systems consisting of interconnected ground rods, perform tests after interconnections are complete. On systems consisting of a single ground rod perform tests before any wire is connected. Take measurements in normally dry weather, not less than 48 hours after rainfall. Use a portable ground resistance tester in accordance with manufacturer's instructions to test each ground or group of grounds. Use an instrument equipped with a meter reading directly in ohms or fractions thereof to indicate the ground value of the ground rod or grounding systems under test.

(2) Submit the measured ground resistance of each ground rod and grounding system, indicating the location of the rod and grounding system. Include the test method and test setup (i.e., pin location) used to determine ground resistance and soil conditions at the time the measurements were made.

3.4.2 Follow-Up Verification

Upon completion of acceptance checks and tests, show by demonstration in service that devices are in good operating condition and properly performing the intended function. Perform each test function not less than three times. As an exception to requirements stated elsewhere in the contract, notify the Contracting Officer five working days in advance of the dates and times for checks and tests.

3.5 FIELD APPLIED PAINTING

Where field painting of enclosures is required to correct damage to the manufacturer's factory applied coatings, provide manufacturer's recommended coatings and apply in accordance with manufacturer's instructions.

-- End of Section --[**Am-00002]

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08/19, CHG 3: 11/21

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SECTION 26 20 00

ELECTRICAL DISTRIBUTION SYSTEM
08/19, CHG 3: 11/21

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI C12.1	(2014; Errata 2016) Electric Meters - Code for Electricity Metering

ASTM INTERNATIONAL (ASTM)

ASTM B1	(2013) Standard Specification for Hard-Drawn Copper Wire
ASTM B8	(2023) Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft
ASTM D709	(2017) Standard Specification for Laminated Thermosetting Materials

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE 81	(2012) Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System
IEEE 100	(2000; Archived) The Authoritative Dictionary of IEEE Standards Terms
IEEE C2	(2023) National Electrical Safety Code
IEEE C57.12.01	(2020) General Requirements for Dry-Type Distribution and Power Transformers Including Those with Solid-Cast and/or Resin-Encapsulated Windings
IEEE C57.12.51	(2019) IEEE Guide for Mechanical Interchangeability of Ventilated Dry-Type Transformers
IEEE C57.12.80	(2010) Standard Terminology for Power and Distribution Transformers
IEEE C57.12.91	(2011) Standard Test Code for Dry-Type Distribution and Power Transformers
IEEE C57.98	(2011) Guide for Transformer Impulse Tests

IEEE C57.124	(1991; R 2002) Recommended Practice for the Detection of Partial Discharge and the Measurement of Apparent Charge in Dry-Type Transformers

INTERNATIONAL ELECTRICAL TESTING ASSOCIATION (NETA)

NETA ATS	(2021) Standard for Acceptance Testing Specifications for Electrical Power Equipment and Systems

NATIONAL ELECTRICAL CONTRACTORS ASSOCIATION (NECA)

NECA NEIS 1	(2015) Standard for Good Workmanship in Electrical Construction

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

ANSI C80.1	(2020) American National Standard for Electrical Rigid Steel Conduit (ERSC)
ANSI C80.3	(2020) American National Standard for Electrical Metallic Tubing (EMT)
ANSI C80.5	(2020) American National Standard for Electrical Rigid Aluminum Conduit
NEMA 250	(2020) Enclosures for Electrical Equipment (1000 Volts Maximum)
NEMA BU 1.1	(2010) General Instructions for Proper Handling, Installation, Operation and Maintenance of Busway Rated 600 V or Less
NEMA FU 1	(2012) Low Voltage Cartridge Fuses
NEMA ICS 1	(2022) Standard for Industrial Control and Systems: General Requirements
NEMA ICS 2	(2000; R 2020) Industrial Control and Systems Controllers, Contactors, and Overload Relays Rated 600 V
NEMA ICS 4	(2015) Application Guideline for Terminal Blocks
NEMA ICS 6	(1993; R 2016) Industrial Control and Systems: Enclosures
NEMA KS 1	(2013) Enclosed and Miscellaneous Distribution Equipment Switches (600 V Maximum)
NEMA MG 1	(2021) Motors and Generators
NEMA MG 10	(2017) Energy Management Guide for Selection and Use of Fixed Frequency Medium AC Squirrel-Cage Polyphase

	Induction Motors
NEMA MG 11	(1977; R 2012) Energy Management Guide for Selection and Use of Single Phase Motors
NEMA RN 1	(2005; R 2013) Polyvinyl-Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit
NEMA ST 20	(2014) Dry-Type Transformers for General Applications
NEMA TC 2	(2020) Standard for Electrical Polyvinyl Chloride (PVC) Conduit
NEMA TC 3	(2021) Polyvinyl Chloride (PVC) Fittings for Use With Rigid PVC Conduit and Tubing
NEMA VE 1	(2017) Metal Cable Tray Systems
NEMA WD 1	(1999; R 2020) Standard for General Color Requirements for Wiring Devices
NEMA WD 6	(2021) Wiring Devices Dimensions Specifications
NEMA Z535.4	(2011; R 2017) Product Safety Signs and Labels
NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)	
NFPA 70	(2023; ERTA 7 2023; TIA 23-15) National Electrical Code
NFPA 70E	(2024) Standard for Electrical Safety in the Workplace
NFPA 780	(2023) Standard for the Installation of Lightning Protection Systems
TELECOMMUNICATIONS INDUSTRY ASSOCIATION (TIA)	
TIA-568.1	(2020e) Commercial Building Telecommunications Infrastructure Standard
TIA-569	(2019e; Add 1 2022) Telecommunications Pathways and Spaces
TIA-607	(2019d) Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises
U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)	
10 CFR 431	Energy Efficiency Program for Certain Commercial and Industrial Equipment
29 CFR 1910.147	The Control of Hazardous Energy (Lock Out/Tag Out)

29 CFR 1910.303	Electrical, General

U.S. DEPARTMENT OF DEFENSE (DOD)

UFC 3-520-01	(2015; with Change 2, 2021) Interior Electrical Systems
UFC 3-540-01	(2014; with Change 2, 2019) Engine-Driven Generator Systems for Prime and Standby Power Applications

UL SOLUTIONS (UL)

UL 1	(2005; Reprint Jan 2022) UL Standard for Safety Flexible Metal Conduit
UL 6	(2022) UL Standard for Safety Electrical Rigid Metal Conduit-Steel
UL 6A	(2008; Reprint Mar 2021) UL Standard for Safety Electrical Rigid Metal Conduit - Aluminum, Red Brass, and Stainless Steel
UL 20	(2018; Reprint Jan 2021) UL Standard for Safety General-Use Snap Switches
UL 44	(2018; Reprint May 2021) UL Standard for Safety Thermoset-Insulated Wires and Cables
UL 50	(2024) UL Standard for Safety Enclosures for Electrical Equipment, Non-Environmental Considerations
UL 67	(2018; Reprint Jul 2020) UL Standard for Safety Panelboards
UL 83	(2017; Reprint Mar 2020) UL Standard for Safety Thermoplastic-Insulated Wires and Cables
UL 248-4	(2010; Reprint Apr 2019) Low-Voltage Fuses - Part 4: Class CC Fuses
UL 248-8	(2011; Reprint Aug 2020) Low-Voltage Fuses - Part 8: Class J Fuses
UL 248-10	(2011; Reprint Aug 2020) Low-Voltage Fuses - Part 10: Class L Fuses
UL 248-12	(2011; Reprint Aug 2020) Low Voltage Fuses - Part 12: Class R Fuses
UL 248-15	(2018) Low-Voltage Fuses - Part 15: Class T Fuses
UL 360	(2013; Reprint Aug 2021) UL Standard for Safety Liquid-Tight Flexible Metal Conduit

UL 467	(2022) UL Standard for Safety Grounding and Bonding Equipment
UL 486A-486B	(2018; Reprint May 2021) UL Standard for Safety Wire Connectors
UL 486C	(2018; Reprint May 2021) UL Standard for Safety Splicing Wire Connectors
UL 489	(2016; Rev 2019) UL Standard for Safety Molded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures
UL 506	(2017; Reprint Jan 2022) UL Standard for Safety Specialty Transformers
UL 508	(2018; Reprint Jul 2021) UL Standard for Safety Industrial Control Equipment
UL 510	(2020; Dec 2022) UL Standard for Safety Polyvinyl Chloride, Polyethylene and Rubber Insulating Tape
UL 514A	(2013; Reprint Jun 2022) UL Standard for Safety Metallic Outlet Boxes
UL 514B	(2012; Reprint May 2020) Conduit, Tubing and Cable Fittings
UL 514C	(2014; Reprint Feb 2020) UL Standard for Safety Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers
UL 651	(2011; Reprint May 2022) UL Standard for Safety Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings
UL 674	(2022) UL Standard for Safety Electric Motors and Generators for Use in Hazardous (Classified) Locations
UL 698A	(2018; Rev 2019) UL Standard for Safety Industrial Control Panels Relating to Hazardous (Classified) Locations
UL 797	(2007; Reprint Mar 2021) UL Standard for Safety Electrical Metallic Tubing -- Steel
UL 854	(2020; Reprint Jan 2022) Standard for Service-Entrance Cables
UL 857	(2009; Reprint Apr 2021) UL Standard for Safety Busways
UL 869A	(2006; Reprint Jun 2020) Reference Standard for Service Equipment
UL 870	(2016; Reprint Mar 2019) UL Standard for Safety Wireways, Auxiliary Gutters, and

	Associated Fittings
UL 877	(1993) Standard for Safety Circuit Breakers and Circuit-Breaker Enclosures for Use in Hazardous (Classified) Locations
UL 886	(1994) Standard for Safety Outlet Boxes and Fittings for Use in Hazardous (Classified) Locations
UL 943	(2016; Reprint Sep 2023) UL Standard for Safety Ground-Fault Circuit-Interrupters
UL 984	(1996; Reprint Sep 2005) Hermetic Refrigerant Motor-Compressors
UL 1008	(2022) UL Standard for Safety Transfer Switch Equipment
UL 1010	(2006) Standard for Safety Receptacle-Plug Combinations for Use in Hazardous (Classified) Locations
UL 1063	(2017; Reprint Jun 2022) UL Standard for Safety Machine-Tool Wires and Cables
UL 1203	(2013; Reprint Apr 2022) UL Standard for Safety Explosion-Proof and Dust-Ignition-Proof Electrical Equipment for Use in Hazardous (Classified) Locations
UL 1242	(2006; Reprint Apr 2022) UL Standard for Safety Electrical Intermediate Metal Conduit -- Steel
UL 1283	(2017; Reprint Feb 2024) UL Standard for Safety Electromagnetic Interference Filters
UL 1449	(2021; Reprint Dec 2022) UL Standard for Safety Surge Protective Devices
UL 1561	(2011; Reprint Jun 2015) Dry-Type General Purpose and Power Transformers
UL 1569	(2018) UL Standard for Safety Metal-Clad Cables
UL 1660	(2019; Reprint Jan 2022) Liquid-Tight Flexible Nonmetallic Conduit
UL 1699	(2017; Reprint Feb 2022) UL Standard for Safety Arc-Fault Circuit-Interrupters
UL 4248-1	(2022) UL Standard for Safety Fuseholders - Part 1: General Requirements
UL 4248-12	(2018; Reprint Feb 2022) UL Standard for Safety Fuseholders - Part 12: Class R

1.2 DEFINITIONS

Unless otherwise specified or indicated, electrical and electronics terms used in these specifications, and on the drawings, are as defined in IEEE 100.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" classification. Submittals not having a "G" classification are for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

Shop drawings shall include detailed connection wiring diagrams and indicate all processors/platforms and connections to other systems such as SCADA, UMCS, Smart Metering or other. Identify the smart meter (utility metering) enclave and SCADA enclave. Provide all documentation necessary for Risk Management Framework. Refer to Section 25 05 11.05 Cybersecurity of Facility-Related Control Systems - Generator/Switchgear.

SD-02 Shop Drawings

Underground Conduit Routing Plan; G, DO

Panelboards; G, DO

This item may (and are encouraged to) be submitted for preliminary review only prior or concurrent to the submittal and approval of the Section 26 05 73 analyses.

Submit this item after or concurrent to Section 26 20 00 Item: CFCI Equipment Electrical Data.

Final CFCI Equipment Electrical Data; G, DO

Submit CFCI Equipment Electrical Data prior to or concurrent with Panelboards, Circuit Breakers (including enclosed), Low- to Low-Voltage Transformer, and Switches (26 20 00); Switchboards (and associated items; 26 24 13); and Section 26 05 73 studies and analyses.

Interim CFCI Equipment Electrical Data; G, DO
Interim CFCI Equipment Electrical Data (Fire Alarm); G, DO
Interim CFCI Equipment Electrical Data (Generator Station Service); G, DO
Interim CFCI Equipment Electrical Data (Filter Shelter); G, DO
Interim CFCI Equipment Electrical Data (Offload); G, DO

Busway; G, DO

Cable Trays; G, DO

Wireways; G, DO

Switchgear; G, DO

Marking Strips Drawings; G, DO

SD-03 Product Data

Receptacles; G, DO

Circuit Breakers (Switchboards); G, DO

Circuit Breakers (Other then Switchboards); G, DO

Switches; G, DO

Manual Transfer Switch; G, DO

Low- to Low-Voltage Transformers; G, DO

Submit Low- to Low-Voltage Transformers prior to or concurrent with Panelboards, Circuit Breakers (including enclosed), and Switches (26 20 00); Switchboards (and associated items; 26 24 13); and Section 26 05 73 studies and analyses.

Medium- to Low-Voltage Transformers; G, DO

Enclosed Circuit Breakers; G, DO

Motor Controllers; G, DO

Manual Motor Starters; G, DO

Metering; G, DO

Secondary Bonding Busbar; G, DO

Surge Protective Devices; G, DO

Cable Trays; G, DO

Adjustable Circuit Breaker Settings Cover; G, DO

Circuit Breaker Handle Locks and Lock-out Device; G, DO

Sealoffs; G, DO

Conductor Termination Adapters; G, DO

SD-05 Design Data

Cable Tray Design; G, DO

SD-06 Test Reports

600-volt Wiring Test; G, RO

Grounding System Test; G, RO

Low- to Low-Voltage Transformer Tests; G, RO

Medium- to Low-Voltage Transformer Tests; G, RO

Ground-fault Receptacle Test; G, RO

Arc-fault Receptacle Test; G, RO

SD-07 Certificates

Fuses; G, RO

SD-09 Manufacturer's Field Reports

Low- to Low-Voltage Transformer Factory Tests

Medium- to Low-Voltage Transformer Factory Tests

SD-10 Operation and Maintenance Data

Electrical Systems, Data Package 5; G, RO

Metering, Data Package 5; G, RO

1.3.1 Submittal Coordination and Sequencing Requirements

See references to this Specifications Section and/or specific submittal items in Section 01 33 00, as well as requirements herein and as referenced in other parts of this contract, for coordination and sequencing of submittals and the associated work to be performed.

1.4 QUALITY ASSURANCE

1.4.1 Regulatory Requirements

In each of the publications referred to herein, consider the advisory provisions to be mandatory, as though the word, "must" had been substituted for "should" wherever it appears. Interpret references in these publications to the "authority having jurisdiction," or words of similar meaning, to mean the Contracting Officer. Provide equipment, materials, installation, and workmanship in accordance with NFPA 70 unless more stringent requirements are specified or indicated. NECA NEIS 1 shall be considered the minimum standard for workmanship.

1.4.2 Standard Products

Provide materials and equipment that are products of manufacturers regularly engaged in the production of such products which are of equal material, design and workmanship and:

a. Have been in satisfactory commercial or industrial use for 2 years prior to bid opening including applications of equipment and materials under similar circumstances and of similar size.

b. Have been on sale on the commercial market through advertisements, manufacturers' catalogs, or brochures during the 2-year period.

c. Where two or more items of the same class of equipment are required, provide products of a single manufacturer; however, the component parts of the item need not be the products of the same manufacturer unless stated in this section.

1.4.2.1 Alternative Qualifications

Products having less than a 2-year field service record will be acceptable if a certified record of satisfactory field operation for not less than 6000 hours, exclusive of the manufacturers' factory or laboratory tests, is furnished.

1.4.2.2 Material and Equipment Manufacturing Date

Products manufactured more than 3 years prior to date of delivery to site are not acceptable.

1.5 MAINTENANCE

1.5.1 Electrical Systems

Submit operation and maintenance data in accordance with Section 01 78 23, OPERATION AND MAINTENANCE DATA and as specified herein. Submit operation and maintenance manuals for electrical systems that provide basic data relating to the design, operation, and maintenance of the electrical distribution system for the building. Include the following:

a. Single line diagram of the "as-built" building electrical system.

b. Schematic diagram of electrical control system (other than HVAC, covered elsewhere).

c. Manufacturers' operating and maintenance manuals on active electrical equipment.

1.6 WARRANTY

Provide equipment items supported by service organizations that are reasonably convenient to the equipment installation in order to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.

1.7 SEISMIC REQUIREMENTS

Provide seismic details conforming to Section 13 48 73 SEISMIC CONTROL FOR MISCELLANEOUS EQUIPMENT and to Section 26 05 48 SEISMIC PROTECTION FOR ELECTRICAL EQUIPMENT.

1.8 Underground Conduit Routing Plan

Provide a plan expressing conduits routing underground both within the footprint of the building and those entering and/or exiting the building footprint (including those captured be Section 33 82 00). See coordinated submittal requirements regarding this submittal item with respect to impacted submittal content by other trades, most notably alterations and accommodations of footing reinforcement for conduit and ductbank with vertical routing through the footings.

PART 2 PRODUCTS

2.1 MATERIALS AND EQUIPMENT

As a minimum, meet requirements of UL, where UL standards are established for those items, and requirements of NFPA 70 for all materials, equipment,

and devices.

2.2 CONDUIT AND FITTINGS

Conform to the following:

2.2.1 Rigid Metallic Conduit

2.2.1.1 Rigid, Threaded Zinc-Coated Steel Conduit

ANSI C80.1, UL 6.

2.2.1.2 Rigid Aluminum Conduit

ANSI C80.5, UL 6A.

2.2.2 Rigid Nonmetallic Conduit

PVC Type EPC-40, and EPC-80 in accordance with NEMA TC 2,UL 651.

2.2.3 Intermediate Metal Conduit (IMC)

UL 1242, zinc-coated steel only.

2.2.4 Electrical, Zinc-Coated Steel Metallic Tubing (EMT)

UL 797, ANSI C80.3.

2.2.5 Plastic-Coated Rigid Steel and IMC Conduit

NEMA RN 1, Type 40(40 mils thick).

Due to low soil resistivity measured at the site (leading to a "severe" corrosion potential), all non-concrete encased underground metallic conduits shall be plastic-coated.

2.2.6 Flexible Metal Conduit

UL 1, limited to 6 feet.

2.2.6.1 Liquid-Tight Flexible Metal Conduit, Steel

UL 360, limited to 6 feet.

2.2.7 Fittings for Metal Conduit, EMT, and Flexible Metal Conduit

UL 514B. Ferrous fittings: cadmium- or zinc-coated in accordance with UL 514B.

2.2.7.1 Fittings for Rigid Metal Conduit and IMC

Threaded-type. Split couplings unacceptable.

2.2.7.2 Fittings for EMT

Steel compression type.

2.2.8 Fittings for Rigid Nonmetallic Conduit

NEMA TC 3 for PVC, and UL 514B.

2.2.9 Liquid-Tight Flexible Nonmetallic Conduit

UL 1660.

2.3 BUSWAY

NEMA BU 1.1, UL 857. Provide the following:

a. Buses: copper.

b. Busways: rated 480 volts, 1200 continuous current amperes, three-phase, four-wire, and include integral or internal 50-percent ground bus.

c. Short circuit rating: 42,000 root mean square (rms) symmetrical amperes minimum.

d. Busway systems: suitable for use indoors.

e. Enclosures: metallic.

f. Hardware: plated or otherwise protected to resist corrosion.

g. Joints: one-bolt type with through-bolts, which can be checked for tightness without de-energizing system.

h. Maximum hot spot temperature rise at any point in busway at continuous rated load: do not exceed 55 degrees C above maximum ambient temperature of 40 degrees C in any position.

i. Internal barriers to prevent movement of superheated gases.

j. Coordinate proper voltage phasing of entire bus duct system, for example where busway interfaces with transformers, switchgear, switchboards, motor control centers, and other system components.

2.3.1 Feeder Busways

Provide ventilated, except that vertical busways within 6 feet of floors must be unventilated, low-impedance busway. Provide bus bars fully covered with insulating material, except at stabs. Provide an entirely polarized busway system.

2.4 CABLE TRAYS

NEMA VE 1. Provide the following:

Submit cable tray design, including dimensional layout, load and seismic calculations, and fill calculations. Dimensional layout includes cable spacings, cable tray splices, and supports. Fill calculations include an index of cables for each section and identification of the lb/ft, cross sectional area, and insulation voltage class for each cable. At the contractor's discretion, cable tray may be installed rooms with the term "Switchgear" (four rooms) for ease of installation and maintenance complying with NFPA 70.

a. Cable trays: form a wireway system, with a nominal 4 inch depth.

b. Cable trays: constructed of aluminum.

c. Cable trays: include splice and end plates, dropouts, and miscellaneous hardware.

d. Edges, fittings, and hardware: finished free from burrs and sharp edges.

e. Fittings: ensure not less than load-carrying ability of straight tray sections and have manufacturer's minimum standard radius.

f. Radius of bends: 12 inches but in no case shall be less than required to maintain manufacturers minimum cable bending radii.

2.4.1 Basket-Type Cable Trays

Provide sized to meet cabling capacity requirements with maximum wire mesh spacing of 2 by 4 inch. Cable tray to accommodate initial fill ratio of 25% and to not exceed 50% fill ratio.

2.4.2 Ladder-Type Cable Trays - For use in all Communication Rooms

Provide size as indicated with maximum rung spacing of 9 inches. Tray must be installed with the proper mounting hardware to securely fasten the tray to the walls and the top of the Floor-Mounted Racks. Tray shall be equipped with the proper grounding lugs to assure proper grounding and bonding of the tray. Provide side walls extending above the ladder rungs for the nominal height indicated on plans (Basis of Design: Legrand PW Ladder Cable Tray).

2.5 OPEN TELECOMMUNICATIONS CABLE SUPPORT

Open telecommunications cable support shall not be used.

2.6 OUTLET BOXES AND COVERS

UL 514A, cadmium- or zinc-coated, if ferrous metal. UL 514C, if nonmetallic.

2.6.1 Outlet Boxes for Telecommunications System

Provide the following:

a. Standard type 4 11/16 inches square by 2 1/8 inches deep.

b. Outlet boxes for single-connector, wall-mounted telecommunications phone outlets may be single-gang 4 by 2 1/8 by 2 1/8 inches deep.

c. Depth of boxes: large enough to allow manufacturers' recommended conductor bend radii.

2.7 CABINETS, JUNCTION BOXES, AND PULL BOXES

UL 50; volume greater than 100 cubic inches, NEMA Type 1 enclosure; sheet steel, hot-dip, zinc-coated. Where exposed to wet, damp, or corrosive environments, NEMA Type .

Reference E-### series sheets for environmental condition requirements (including hazardous locations) and provide appropriate cabinet, junction box, pull box, and terminal box enclosures, hubs, and connections for the conditions indicated.

2.8 WIRES AND CABLES

Provide wires and cables in accordance applicable requirements of NFPA 70 and UL for type of insulation, jacket, and conductor specified or indicated. Do not use wires and cables manufactured more than 12 months prior to date of delivery to site.

2.8.1 Conductors

Provide the following:

a. Conductor sizes and capacities shown are based on copper, unless indicated otherwise.

b. Conductors No. 8 AWG and larger diameter: stranded.

c. Conductors No. 10 AWG and smaller diameter: solid.

d. Conductors for remote control, alarm, and signal circuits, classes 1, 2, and 3: stranded unless specifically indicated otherwise.

e. All conductors: copper.

2.8.1.1 Minimum Conductor Sizes

Provide minimum conductor size in accordance with the following:

a. Branch circuits: No. 12 AWG.
The branch circuit sizes listed on the plans are minimum values. However, should a larger conductor size (with a larger diameter) be installed, the contractor is responsible for re-sizing raceways to account for the NFPA 70 fill ratio requirements.

b. Class 1 remote-control and signal circuits: No. 14 AWG.

c. Class 2 low-energy, remote-control and signal circuits: No. 16 AWG.

d. Class 3 low-energy, remote-control, alarm and signal circuits: No. 22 AWG.

e. Digital low voltage lighting control (DLVLC) system at 24 Volts or less: Category 5 UTP or better cables in accordance with DLVLC system manufacturer requirements. See Sheet TN500 for jacket color.

2.8.2 Color Coding

Provide color coding for service, feeder, branch, control, and signaling circuit conductors. Feeders shall be identified in accordance with NFPA 70 Article 215.12.

2.8.2.1 Ground and Neutral Conductors

Provide color coding of ground and neutral conductors as follows:

a. Grounding conductors: Green.

b. Neutral conductors: White.

c. Exception, where neutrals of more than one system are installed in same raceway or box, other neutrals color coding: white with a different colored (not green) stripe for each.

2.8.2.2 Ungrounded Conductors

Provide color coding of ungrounded conductors in different voltage systems as follows:

a. 208/120 volt, three-phase

(1) Phase A - black

(2) Phase B - red

(3) Phase C - blue

b. 480/277 volt, three-phase

(1) Phase A - brown

(2) Phase B - orange

(3) Phase C - yellow

c. 120/240 volt, single phase: Black and red

d. On three-phase, four-wire delta system, high leg: orange, as required by NFPA 70.

2.8.3 Insulation

Unless specified or indicated otherwise or required by NFPA 70, provide power and lighting wires rated for 600-volts, Type THWN/THHN conforming to UL 83 or Type XHHW conforming to UL 44, except that grounding wire may be type TW conforming to UL 83; remote-control and signal circuits: Type TW or TF, conforming to UL 83. Where equipment or devices require 90-degree Centigrade (C) conductors, provide only conductors with 90-degree C insulation or better.

For service entrance conductors, provide insulated conductors rated 600 volts and conforming to the requirements of NFPA 70, including listing requirements. Wires and cables manufactured more than 24 months prior to date of delivery to the site are not acceptable. Service entrance conductors must conform to UL 854, type USE.

Insulation values listed on the plans are minimum values (see "PANEL SCHEDULE KEY" entry for "MCIT" for final insulation value instructions). However, should a higher insulation value with a larger diameter be installed, the contractor is responsible for re-sizing raceways to account for the NFPA 70 fill ratio requirements.

2.8.4 Bonding Conductors

ASTM B1, solid bare copper wire for sizes No. 8 AWG and smaller diameter; ASTM B8, Class B, stranded bare copper wire for sizes No. 6 AWG and larger diameter.

2.8.4.1 Telecommunications Bonding Backbone (TBB)

Provide a copper conductor TBB in accordance with TIA-607 with No. 6 AWG minimum size, and sized at 2 kcmil per linear foot of conductor length up to a maximum size of 750 kcmil. Provide insulated TBB with insulation as specified in the paragraph INSULATION and meeting the fire ratings of its pathway.

2.8.4.2 Bonding Conductor for Telecommunications

Provide a copper conductor Bonding Conductor for Telecommunications between the telecommunications main grounding busbar (PBB) and the electrical service ground in accordance with TIA-607. Size the bonding conductor for telecommunications the same as the TBB. Reference EG600 for minimum grounding bonding conductor sizes.

2.8.5 Service Entrance Cables

Service Entrance (SE) and Underground Service Entrance (USE) Cables, UL 854.

2.8.6 Wire and Cable for 28 VDC Circuits

Insulated copper conductors.

2.8.7 Metal-Clad Cable

UL 1569; NFPA 70, Type MC cable.

2.8.8 Cable Tray Cable or Power Limited Tray Cable

UL listed; type TC or PLTC.

2.9 SPLICES AND TERMINATION COMPONENTS

UL 486A-486B for wire connectors and UL 510 for insulating tapes. Connectors for No. 10 AWG and smaller diameter wires: insulated, pressure-type in accordance with UL 486A-486B or UL 486C (twist-on splicing connector). Must provide a uniform compression over the entire conductor contact surface. Provide solderless terminal lugs on stranded conductors.

2.10 DEVICE PLATES

Provide the following:

a. UL listed, one-piece device plates for outlets to suit the devices installed.

b. For metal outlet boxes, plates on unfinished walls: zinc-coated sheet steel or cast metal having round or beveled edges.

c. For nonmetallic boxes and fittings, other suitable plates may be provided.

d. Plates on finished walls: stainless steel,nylon or lexan, minimum 0.03 inch wall thickness and same color as receptacle or toggle switch with which they are mounted.

f. Screws: machine-type with countersunk heads in color to match finish of plate.

g. Sectional type device plates are not be permitted.

h. Plates installed in wet locations: gasketed and UL listed for "wet locations."

2.11 SWITCHES

2.11.1 Toggle Switches

NEMA WD 1, UL 20, single pole, double pole, three-way, and four-way, totally enclosed with bodies of thermoplastic or thermoset plastic and mounting strap with grounding screw. Include the following:

a. Handles: light gray thermoplastic.

b. Wiring terminals: screw-type, side-wired.

c. Contacts: silver-cadmium and contact arm - one-piece copper alloy.

d. Switches: rated quiet-type ac only, 120/277 volts, with current rating and number of poles indicated. Provide two-pole switch where indicated for 480V lighting circuits. See Equipment Electrical Connection Schedule for toggle switches which are required to be motor-rated (with thermal overloads) and/or a rating of 30A rather than 20A.

Switch sizes identified on plans are minimum sizes, and the contractor is responsible for increasing sizes to account for increased current drawn based on requirements of contractor-furnished equipment and/or for termination compatibility with conductor sizes increased due to voltage drop mitigation requirements and/or conductor ampacity corrections/adjustments for the ambient temperature or number of current-carrying conductors. (Additionally, see Subparts "Conductor Termination Adapters" and "CFCI Equipment Electrical Data")

2.11.2 Switch with Red Pilot Handle

NEMA WD 1. Provide the following:

a. Pilot lights that are integrally constructed as a part of the switch's handle.

b. Pilot light color: red and illuminate whenever the switch is closed or "on".

c. Pilot lighted switch: rated 20 amps and 120 volts as indicated.

d. The circuit's neutral conductor to each switch with a pilot light.

2.11.3 Disconnect Switches

NEMA KS 1. Provide heavy duty-type switches where indicated, where switches are rated higher than 240 volts, and for double-throw switches. Utilize Class R fuseholders and fuses for fused switches, unless indicated otherwise. Provide horsepower rated for switches serving as the motor-disconnect means. Provide switches in NEMA,. Provide switches in enclosure rated per NEMA ICS 6 and as indicated on the plans.

2.11.4 Manual Transfer Switch

Provide UL 1008 double-throw, manual/non-automatic transfer switches of configuration, NEMA ICS 6 enclosure rating, and minimum size indicated on EP600 series sheets. Provide service-entrance rated equipment where indicated.

Where indicated, manual/non-automatic transfer switches shall be equipped with a normally open relay output which closes upon transfer to the alternate power source.
[*Am-00002]
For manual transfer switches identified on one-line as requiring consideration, provide heating elements provided as determined by manufacturer specifications and component limitations. Perform calculations to confirm consistent heating of enclosure. Power from internal distribution. [**Am-00002]

2.11.5 Switches Associated with Fire Alarm or Similar Equipment

Switches associated with fire alarm devices/equipment or similar equipment shall be red. Reference the panel schedules for circuits identified with notes as being "FIRE PROTECTION/LIFE SAFETY EQUIPMENT".

2.12 FUSES

NEMA FU 1. Provide complete set of fuses for each fusible switch. Coordinate time-current characteristics curves of fuses serving motors or connected in series with circuit breakers or other circuit protective devices for proper operation. Submit coordination data for approval. Provide fuses with a voltage rating not less than circuit voltage.

2.12.1 Fuseholders

Provide in accordance with UL 4248-1.

2.12.2 Cartridge Fuses, Current Limiting Type (Class R)

UL 248-12, Class RK-1. Provide only Class R associated fuseholders in accordance with UL 4248-12.

2.12.3 Cartridge Fuses, High-Interrupting Capacity, Current Limiting Type (Classes J, L, and CC)

UL 248-8, UL 248-10, UL 248-4, Class J for zero to 600 amperes, Class L for 601 to 6,000 amperes, and Class CC for zero to 30 amperes.

2.12.4 Cartridge Fuses, Current Limiting Type (Class T)

UL 248-15, Class T for zero to 1,200 amperes, 300 volts; and zero to 800 amperes, 600 volts.

2.13 RECEPTACLES

Provide the following:

a. UL 498, general purpose specification grade, grounding-type. Residential grade receptacles are not acceptable.

b. Ratings and configurations: as indicated.

c. Bodies: light gray as per NEMA WD 1.

d. Face and body: thermoplastic supported on a metal mounting strap.

e. Dimensional requirements: per NEMA WD 6.

f. Screw-type, side-wired wiring terminals or of the solderless pressure type having suitable conductor-release arrangement.

g. Grounding pole connected to mounting strap.

h. The receptacle: containing triple-wipe power contacts and double or triple-wipe ground contacts.

i. Controlled receptacles: as required per ASHRAE 90.1. Provide marking for controlled receptacle per NFPA 70.

2.13.1 Weatherproof Receptacles

Provide receptacles, UL listed for use in "wet locations" with integral GFCI protection. Include cast metal box with gasketed, hinged, lockable and weatherproof while-in-use, die-cast metal/aluminum cover plate.

2.13.2 Ground-Fault Circuit Interrupter Receptacles

UL 943, duplex type for mounting in standard outlet box. Provide device capable of detecting current leak when the current to ground is 6 milliamperes or higher, and tripping per requirements of UL 943 for Class A ground-fault circuit interrupter devices. Provide screw-type, side-wired wiring terminals or pre-wired (pigtail) leads.

2.13.3 Plugs

Provide heavy-duty, rubber-covered three-, four-, or five-wire cord of required size, install plugs thereon, and attach to equipment. Provide UL listed plugs with receptacles, complete with grounding blades. Where equipment is not available, turn over plugs and cord assemblies to the Government.

2.13.4 Tamper-Resistant Receptacles

Provide duplex receptacle with mechanical sliding shutters that prevent the insertion of small objects into its contact slots.

2.13.5 Arc-Fault Circuit Interrupter Receptacles

UL 1699, duplex type for mounting in standard outlet box. Provide device capable of detecting series arcing current when the current to ground is 5 amperes or higher, and tripping per requirements of UL 1699.

2.13.6 Hazardous-Rated Receptacles

Provide UL-listed receptacles rated for Class I Division II locations as appropriate based on hazardous plans on E-### series sheets and as depicted on plans.

2.14 PANELBOARDS

Provide panelboards in accordance with the following:

a. UL 67 and UL 50 having a minimum short-circuit current rating as indicated on the drawings or as established by the studies required by Section 26 05 73, POWER SYSTEMS STUDIES, whichever is greater.

b. Panelboards for use as service disconnecting means: additionally conform to UL 869A.

c. Panelboards: circuit breaker-equipped.

d. Designed such that individual breakers can be removed without disturbing adjacent units or without loosening or removing supplemental insulation supplied as means of obtaining clearances as required by UL.

e. "Specific breaker placement" is required in panelboards to match the breaker placement indicated in the panelboard schedule on the design drawings. Include in submittal a narrative explanation in situations where "Specific breaker placement" is not possible due to equipment/device limitation(s). A variance request for relocation is required and is subject to government review and approval.

f. Use of "Subfeed Breakers" is not acceptable.

g. Main breaker: "separately" mounted "above" or "below" branch breakers.

h. Where "space only" is indicated, make provisions for future installation of breakers.

i. Directories: indicate load served by each circuit in panelboard. Use the load names in the panel schedules as a basis, however, omit commentary items in "< >" (such as "< BID OPTION >") of a given circuit. Directories shall represent the final installed condition of the panelboard circuits (such as spares and spaces in place of anticipated or contingency circuits); some circuits indicated on plans are contingent upon base or bid option award or upon the equipment selected by the contractor. For equipment connections requiring receptacles and a receptacle is not shown as the basis of design connection, add "RECEPTACLE" to the load name similar to equipment connected by receptacle already shown; likewise, where a receptacle is indicated but the equipment installed requires a different connection, remove "RECEPTACLE" from the load name in the directory.

j. Directories: indicate source of service to panelboard (e.g., Panel PA served from Panel MDP in Room ###).

l. Type directories and mount in holder behind transparent protective covering.

m. Panelboards: listed and labeled for their intended use.

n. Panelboard nameplates: provided in accordance with paragraph FIELD FABRICATED NAMEPLATES.

o. Submit panelboard elevation drawings indicating at minimum the following:

(1) Circuit breaker and space layout.
(2) Circuit breaker rating, poles, and model information.
(3) Name of load assigned to each circuit (may be omitted in situations where all circuit breakers are identical (such as all 20A circuit breakers on a lighting panel) or the individual differences are obvious (a few are lockable or GFCI).
(4) Branch circuit frame size mismatch/limitations (if applicable).
(5) Enclosure dimensions.
(6) Enclosure ratings (NEMA ICS 6, bus, SCCR, etc.).
(7) Enclosure properties (bus material, mounting, SE label, series rated, system voltage, number of sections).
(8) Components list and options included.
(9) Dimension from floor to center of highest operating handle for NFPA 70 compliance (6 ft 7 in).
(10) The mounting height to bottom to demonstrate elevation above hazardous areas (where applicable), and allow for the proper installation of conduits entering the bottom of equipment and the associated sealoff (where applicable).

p. Submit bill of materials for each panelboard to include quantities and catalog number of each component.

Reference Section 28 31 70 Subpart "Primary Power" for coordination of devices and equipment to be supplied from the "Dedicated Emergency Panel Schedule". Final approval for distribution equipment covered by this Section for elements pertaining to the fire alarm and related systems will not be considered until the Section 28 31 70 "Dedicated Emergency Panel Schedule" is approved, which requires a substantially-developed fire alarm/etc. systems design; Coordinate across trades for timely delivery of this information.

2.14.1 Enclosure

Provide panelboard enclosure in accordance with the following:

a. UL 50.

b. Cabinets mounted outdoors or flush-mounted: hot-dipped galvanized after fabrication .

c. Cabinets: painted in accordance with paragraph PAINTING.

d. Outdoor cabinets: NEMA 4x with conduit hubs welded to the cabinet. [*Am-00002] For enclosures identified on one-line as requiring consideration, provide heating elements as determined by manufacturer specifications and component limitations. Perform calculations to confirm consistent heating of enclosure. Power from internal distribution or from panel circuit breaker. If powering from circuit breaker, ensure all other electrical requirements and panel related design limitations are still met.[**Am-00002]

e. Front edges of cabinets: form-flanged or fitted with structural shapes welded or riveted to the sheet steel, for supporting the panelboard front.

f. All cabinets: fabricated such that no part of any surface on the finished cabinet deviates from a true plane by more than 1/8 inch.

g. Holes: provided in the back of indoor surface-mounted cabinets, with outside spacers and inside stiffeners, for mounting the cabinets with a 1/2 inch clear space between the back of the cabinet and the wall surface.

h. Flush doors: mounted on hinges that expose only the hinge roll to view when the door is closed.

i. Each door: fitted with a combined catch and lock latch and provided with a hinged trim assembly.

j. Keys: two provided with each lock, with all locks keyed alike.

k. Finished-head cap screws: provided for mounting the panelboard fronts on the cabinets.

2.14.2 Panelboard Buses

Support bus bars on bases independent of circuit breakers. Design main buses and back pans so that breakers may be changed without machining, drilling, or tapping. Provide isolated neutral bus in each panel for connection of circuit neutral conductors. Provide separate ground bus identified as equipment grounding bus per UL 67 for connecting grounding conductors; bond to steel cabinet. In addition to equipment grounding bus, provide second "isolated" ground bus, where indicated.

2.14.2.1 Panelboard Neutrals for Non-Linear Loads

Panel schedules shown on the plans with 200% neutral shall be considered panelboards supporting non-linear loads. Provide in accordance with the following:

a. UL listed, with panelboard type specifically UL heat rise tested for use on non-linear loads.

b. Panelboard: heat rise tested in accordance with UL 67, except with the neutral assembly installed and carrying 200 percent of the phase bus current during testing.

c. Verification of the testing procedure: provided upon request.

d. Two neutral assemblies paralleled together with cable is not acceptable.

e. Nameplates for panelboard rated for use on non-linear loads: marked "SUITABLE FOR NON-LINEAR LOADS" and in accordance with paragraph FIELD FABRICATED NAMEPLATES.

f. Provide a neutral label with instructions for wiring the neutral of panelboards rated for use on non-linear loads.

2.14.3 Circuit Breakers

To ease grouping of submittals in coordination and sequencing, furnish information as "Circuit Breakers (Switchboards)" and "Circuit Breakers (Other then Switchboards)"

UL 489, having a minimum short-circuit current rating equal to the short-circuit current rating of the panelboard in which the circuit breaker will be mounted. Breaker terminals: UL listed as suitable for type of conductor provided. Where indicated on the drawings, provide circuit breakers with shunt trip devices. Series rated circuit breakers and plug-in circuit breakers are unacceptable.

UL 489 solid-state circuit breakers shall be used where indicated on the plans and in Section 26 05 73 POWER SYSTEM STUDIES. Thermal-magnetic type shall be used in all locations not indicated to be solid-state type.

The circuit breaker ratings indicated on the panel schedules are estimates based on basis of design equipment or standard ratings. Both solid-state and thermal magnetic-type circuit breaker ratings and/or settings are subject to change based on the manufacturer recommendations for equipment to be provided in this contract, including transformer inrush values and values for equipment listed on the "Equipment Electrical Connection Schedule". Contractor shall coordinate the protection device ratings with the equipment approved to be installed, is responsible for providing the appropriate ratings/settings, and shall indicate deviations from the design ratings in the submittal process.

Reference Section 28 31 70 Section "Primary Power" for coordination of devices and equipment to be supplied from the "Dedicated Emergency Panel Schedule". Final approval for distribution equipment covered by this Section for elements pertaining to the fire alarm and related systems will not be considered until the Section 28 31 70 "Dedicated Emergency Panel Schedule" is approved, which requires a substantially-developed fire alarm/mass notification/releasing service/containment/etc. systems design; Coordinate across trades for timely delivery of this information.

Specific specialty type circuit breakers found on the plans and schedules including but not limited to GFCI, AFCI, shunt trip, devices with red handles, and those lockable in the ON and/or OFF position (or appurtenances used for the satisfaction of said requirements) shall be included in the Circuit Breakers submittal.

Circuit breaker types shall be based on the protective coordination study to selectively coordinate to the degree indicated in Section 26 05 73 POWER SYSTEM STUDIES. Circuit breaker types shall be adjusted in accordance with the recommendations resulting from the studies performed. However, adjustments shall not be performed which compromise the criteria- or manufacturer-required protection of equipment (such as NFPA 70 Section 450.3 primary and secondary protection limits for transformers or manufacturer-recommended MOCP values, respectively). Examples of such adjustments are changing from one model line of a given manufacturer to another for specific troublesome protective devices preventing an acceptable level of coordinated protection selectivity (such as from Siemens HGB or BQD to Siemens FXD6, from Siemens BQD for Siemens NGB, from Siemens BL for Siemens BLH). Circuit breakers shall not be considered accepted until protective coordination study is accepted with "A" or "B" Action.

2.14.3.1 Multipole Breakers

Provide common trip-type with single operating handle. Design breaker such that overload in one pole automatically causes all poles to open. Maintain phase sequence throughout each panel so that any three adjacent breaker poles are connected to Phases A, B, and C, respectively.

2.14.3.2 Circuit Breaker With Ground-Fault Circuit Interrupter

UL 943 and NFPA 70. Provide with auto-monitoring (self-test) and lockout features, "push-to-test" button, visible indication of tripped condition, and ability to detect and trip when current imbalance is 6 milliamperes or higher per requirements of UL 943 for Class A ground-fault circuit interrupter devices.

2.14.3.3 Arc-Fault Circuit Interrupters

UL 489, UL 1699 and NFPA 70. Molded case circuit breakers: rated as indicated. Two pole arc-fault circuit-interrupters: rated 120/240 volts. The provision of (two) one pole circuit breakers for shared neutral circuits in lieu of (one) two pole circuit breaker is unacceptable. Provide with "push-to-test" button.

2.14.3.4 Solid-State Trip Elements

Solid-state circuit breakers shall be provided at the locations indicated on the EP600 panel schedules. All electronics shall be self-contained and require no external relaying, power supply, or accessories. Printed circuit cards shall be treated to resist moisture absorption, fungus growth, and signal leakage. All electronics shall be housed in an enclosure which provides protection against arcs, magnetic interference, dust, and other contaminants. Solid-state sensing shall measure true RMS current with error less than one percent on systems with distortions through the 13th harmonic. Peak or average actuating devices are not acceptable. Current sensors shall be toroidal construction, encased in a plastic housing filled with epoxy to protect against damage and moisture and shall be integrally mounted on the breaker. Where indicated on the drawings, circuit breaker frames shall be rated for 100 percent continuous duty. Circuit breakers shall have tripping features as shown on the drawings and as described below:

a. Long-time current pick-up, adjustable from 50 percent to 100 percent of continuous current rating.

b. Adjustable long-time delay.

c. Short-time current pick-up, adjustable from 1.5 to 9 times long-time current setting.

d. Adjustable short-time delay.

e. Short-time I square times t switch.

f. Instantaneous current pick-up, adjustable from 1.5 to 9 times long-time current setting.

g. (At locations indicated on the plans) Ground-fault pick-up, adjustable from 20 percent to 60 percent of sensor rating, but in no case greater than 1200 amperes. Sensing of ground-fault current at the main

bonding jumper or ground strap shall not be permitted.

h. (At locations indicated on the plans) Adjustable ground-fault delay.

i. (At locations indicated on the plans) Ground-fault I square times t switch.

j. Overload, Short-circuit, Ground-fault (as applicable) trip indicators shall be provided.

k. Provide circuit breakers with high-instantaneous trip properties where needed to satisfy selective coordination requirements. See Section 26 05 73 POWER SYSTEM STUDIES.

2.14.3.4.1 Circuits Protected by Solid-State (Adjustable) Trip Elements

Circuits protected by solid-state (adjustable) trip elements are shown sized for the value identified on the panel schedules, one-line diagrams, and other elements where circuit sizing is indicated on the plans and account for ampacity correction and adjustment factors. Except where indicated otherwise, all adjustable trip circuit breakers shall be provided with a restricting means described in NFPA 70 Section 240.6(C), and that means shall be a removable and sealable cover (240.6(C)(1)); the others means described in NFPA 70 Section 240.6(C) are not acceptable.

Should the solid-state (adjustable) circuit breaker not be restricted by a means described in NFPA 70 Section 240.6(C) and the trip element is capable of a rating greater than the value identified in the diagram and schedules described above, the contractor is responsible for changing the conductor and raceway size(s) at no additional cost to the government to satisfy NFPA 70 Section 240.6(B), and shall account for all correction and adjustment factors stated in NFPA 70 and UFC 3-520-01 and to maintain compliance with the voltage drop requirements of ASHRAE 90.1 and UFC 3-501-01 for the proportional load increase relative to the original circuit breaker rating indicated on the plans. The contractor shall submit such changes for government approval as Adjustable-Trip Circuit Breaker Circuit Corrections. This shall include circuits whose protection is on the load end of the conductors (such as transformer secondary conductors). Bonding jumpers and equipment grounding conductors shall likewise be adjusted.

Where restricted by a means described in NFPA 70 Section 240.6(C) and the trip element is capable of a rating greater than the value identified in the diagram and schedules described above, provide a label for the circuit breaker indicating the conductors are sized to an adjusted trip rating below the maximum capable by the trip element and state the rating to which the conductors are sized.

Electronic circuit breakers may be used in other applications at the contractor's discretion (i.e., utilizing a larger frame with a smaller plug trip rating in order to land larger conductors on the terminals).

2.14.3.4.2 Adjustable Circuit Breaker Settings Cover

All adjustable circuit breakers shall be provided with a removable sealable cover over the adjusting means in accordance with NFPA 70. Covers shall be sized appropriately for each circuit breaker to enclose all adjustable breaker trip settings without interfering with normal breaker operability. Cover shall be of transparent plastic which allows for

unobstructed visibility of breaker settings while restricting physical access to the adjusting means. Cover shall be sealable by means of screws, bolts, or other approved locking means.

2.14.3.5 Maintenance Switch

Where a solid-state circuit breaker is rated for or can be adjusted to 800 amperes or higher, the device shall be provided with an auxiliary two-position arc energy-reducing maintenance switching with local status indicator. Positions shall be labeled "NORMAL OPERATION" and "MAINTENANCE". "NORMAL OPERATION" shall provide the protection settings identified by and approved in the protective coordination study. "MAINTENANCE" shall change the instantaneous and short-time current pick-up settings to the lowest values permitted by the device.

2.14.3.6 Circuit Breaker Handle Locks and Lock-out Device

All circuit breakers supplying fire alarm circuits, or as otherwise indicated in the drawings, shall be provided with handle locks capable of securing the circuit breaker in the On or Off position. Handle locks intended as lock-on devices for circuit breakers feeding fire alarm circuits shall be non-padlock, screw type devices. Lock-out devices intended to secure circuit breakers in the Off position shall be padlockable. Handle locks and lock-out devices shall be sized appropriately for each circuit breaker they are intended to be secured to.

2.14.3.7 Enclosed Circuit Breakers

UL 489. Individual molded case circuit breakers with voltage and continuous current ratings, number of poles, overload trip setting, and short circuit current interrupting rating as indicated. Enclosure type as indicated. Provide solid neutral unless otherwise noted.

Similar to the Circuit Breakers submittal, specific specialty type enclosed circuit breakers found on the plans and schedules (or appurtenances used for the satisfaction of said requirements) shall be included in the Enclosed Circuit Breakers submittal.
[*Am-00002]
Heating elements provided as determined by manufacturer specifications and component limitations. Perform calculations to confirm consistent heating of enclosure. Power from internal distribution. [**Am-00002]

2.15 MOTOR SHORT-CIRCUIT PROTECTOR (MSCP)

Motor short-circuit protectors, also called motor circuit protectors (MCPs): UL 508 and UL 489, and provided as shown. Provide MSCPs that consist of an adjustable instantaneous trip circuit breaker used only in conjunction with a combination motor controller which provides coordinated motor branch-circuit overload and short-circuit protection. Rate MSCPs in accordance with the requirements of NFPA 70.

2.16 TRANSFORMERS

2.16.1 Low- to Low-Voltage Transformers

Provide transformers in accordance with the following:

a. NEMA ST 20, general purpose, dry-type, self-cooled, ventilated, except sealed where indicated to be NEMA 4.

b. Provide transformers in NEMA enclosure rating as indicated on the transformer schedule.

c. Taps for transformers 15 kVA and larger: Two 2.5 percent taps Full Capacity Above Nominal (FCAN) and four 2.5 percent taps Full Capacity Below Nominal (FCBN) .

d. Transformer insulation system:

(1) 220 degrees C insulation system for transformers 15 kVA and greater, with temperature rise not exceeding 115 degrees C under full-rated load in maximum ambient of 40 degrees C.

(2) 180 degrees C insulation for transformers rated 10 kVA and less, with temperature rise not exceeding 80 degrees C under full-rated load in maximum ambient of 40 degrees C.

e. Transformer of 150 degrees C temperature rise is not acceptable.

f. Transformer of 115 degrees C temperature rise: capable of carrying continuously 115 percent of nameplate kVA without exceeding insulation rating.

g. Transformer of 80 degrees C temperature rise: capable of carrying continuously 130 percent of nameplate kVA without exceeding insulation rating.

h. Manufacturer transformer inrush data shall be available and provided for use under Section 26 05 73 COORDINATED POWER SYSTEM PROTECTION WITH ARC FLASH HAZARD STUDY.

i. See Sheet EP600 regarding requirements completely enclosed transformers in accordance with NFPA 70 Section 450.21(B) Exception #2 for specific transformer(s).

2.16.1.1 Specified Transformer Efficiency

Transformers, indicated and specified with: 480V primary, 80 degrees C or 115 degrees C temperature rise, kVA ratings of 37.5 to 100 for single phase or 30 to 500 for three phase, energy efficient type. The transformer is not acceptable if the calculated transformer efficiency is less than the efficiency indicated in 10 CFR 431, Subpart K.

2.16.1.2 Transformers With Non-Linear Loads

Provide transformers for non-linear loads in accordance with the following:

a. Transformer insulation: UL recognized 220 degrees C system. Neither the primary nor the secondary temperature is allowed to exceed 220 degrees C at any point in the coils while carrying their full rating of non-sinusoidal load.

b. Transformers are to be UL listed and labeled for K-Factor rating as indicated in accordance with UL 1561.

c. Transformers evaluated by the UL K-Factor evaluation: listed for not greater than 115 degrees C average temperature rise only.

d. Transformers with K-Factor ratings with temperature rise of 150 degrees C rise are not acceptable.

e. K-Factor rated transformers impedance: allowed range of 3 percent to 5 percent, with a minimum reactance of 2 percent to prevent excessive neutral current when supplying loads with large amounts of third harmonic.

2.16.2 Medium- to Low-Voltage Transformers

IEEE C57.12.01, and IEEE C57.12.51 for dry-type transformers rated 501 kVA and larger. Transformer base must be fabricated of type 304 or 304L stainless steel. Transformer base must include any part of the transformer that is within 3 inches of concrete pad. Windings must be copper.

Provide a vacuum pressure impregnated (VPI) type transformer with an insulation system rated 220 degrees C, and with an 80 degree C average winding temperature rise above a 40 degrees C maximum ambient.

2.16.2.1 Transformer Ratings

Transformer must be rated 95 kV BIL Primary and 10 kV BIL Secondary, with KVA as indicated.

a. Transformer voltage ratings: As indicated.

b. Provide four 2.5 percent full capacity taps, two above and two below rated primary voltage. Locate tap adjustments on the face of the high voltage coil. Adjustments must be accessible by removing the front panel and must be made when the transformer is de-energized.

c. Audible sound levels must comply with the following:

kVA	DECIBELS (MAX)
750	64

d. Diagrammatic stainless steel or laser-etched anodized aluminum nameplate.

e. Transformer must include ground pads, lifting lugs and provisions for jacking under base. See S-### series sheets for pad details. The transformer base construction must be suitable for using rollers or skidding in any direction. The transformer must have an insulated low-voltage neutral bushing with lugs for ground cable, and with removable ground strap.

f. Dry type transformer must have the following accessories.

g. Winding temperature indicator

2.17 MOTORS

Provide motors in accordance with the following:

a. NEMA MG 1 except provide fire pump motors as specified in Section 21 30 00 FIRE PUMPS.

b. Hermetic-type sealed motor compressors: Also comply with UL 984.

c. Provide the size in terms of HP, or kVA, or full-load current, or a combination of these characteristics, and other characteristics, of each motor as indicated or specified.

d. Determine specific motor characteristics to ensure provision of correctly sized starters and overload heaters.

e. Rate motors for operation on 208-volt, 3-phase circuits with a terminal voltage rating of 200 volts, and those for operation on 480-volt, 3-phase circuits with a terminal voltage rating of 460 volts.

f. Use motors designed to operate at full capacity with voltage variation of plus or minus 10 percent of motor voltage rating.

g. Unless otherwise indicated, use continuous duty type motors if rated 1 HP and above.

h. Where fuse protection is specifically recommended by the equipment manufacturer, provide fused switches in lieu of non-fused switches indicated.

i. Use Inverter-Rated motors designed to operate with adjustable speed drive (ASD).

[*Am-00002]

j. Coordinate with the motor supplier to determine and provide accordingly the requisite thermal protection, and coordinate across trades for the location of the thermal protection, which may be a combination device encompassing the motor thermal protection, the motor disconnecting means, and/or the motor control device.[**Am-00002]

2.17.1 High Efficiency Single-Phase Motors

Single-phase fractional-horsepower alternating-current motors: high efficiency types are not acceptable. In exception, for special purpose motors and motor-driven equipment with a minimum seasonal or overall efficiency rating, such as a SEER rating, provide equipment with motor to meet the overall system rating indicated.

2.17.2 Premium Efficiency Polyphase and Single-Phase Motors

Select polyphase and continuous-duty single phase motors based on high efficiency characteristics relative to typical characteristics and applications as listed in NEMA MG 10 and NEMA MG 11. In addition, continuous rated, polyphase squirrel-cage medium induction motors must meet the requirements for premium efficiency electric motors in accordance with NEMA MG 1, including the NEMA full load efficiency ratings. In exception, for motor-driven equipment with a minimum seasonal or overall efficiency rating, such as a SEER rating, provide equipment with motor to meet the overall system rating indicated.

2.17.3 Motor Sizes

Provide size for duty to be performed, not exceeding the full-load nameplate current rating when driven equipment is operated at specified capacity under most severe conditions likely to be encountered. When motor size provided differs from size indicated or specified, make adjustments to wiring, disconnect devices, and branch circuit protection

to accommodate equipment actually provided. Provide controllers for motors rated 1-hp and above with electronic phase-voltage monitors designed to protect motors from phase-loss, undervoltage, and overvoltage. Provide protection for motors from immediate restart by a time adjustable restart relay.

2.17.4 Wiring and Conduit

Provide internal wiring for components of packaged equipment as an integral part of the equipment. Provide power wiring and conduit for field-installed equipment using adjustable speed drive (ASD) manufacturer required wiring type and length, (where applicable)and motor control equipment forming part of motor control centers or switchgear assemblies, the conduit and wiring connecting such centers, assemblies, or other power sources to equipment as specified herein. Power wiring and conduit: conform to the requirements specified herein. Control wiring: provided under, and conform to, the requirements of the section specifying the associated equipment.

2.18 MOTOR CONTROLLERS

Provide motor controllers in accordance with the following:

a. UL 508, NEMA ICS 1, and NEMA ICS 2, except fire pump controllers as specified in Section 21 30 00 FIRE PUMPS.

b. Provide controllers with thermal overload protection in each phase, and one spare normally open auxiliary contact, and one spare normally closed auxiliary contact.

c. Provide controllers for motors rated 1-hp and above with electronic phase-voltage monitors designed to protect motors from phase-loss, undervoltage, and overvoltage.

d. Provide protection for motors from immediate restart by a time adjustable restart relay.

e. When used with pressure, float, or similar automatic-type or maintained-contact switch, provide a hand/off/automatic selector switch with the controller.

f. Connections to selector switch: wired such that only normal automatic regulatory control devices are bypassed when switch is in "hand" position.

g. Safety control devices, such as low and high pressure cutouts, high temperature cutouts, and motor overload protective devices: connected in motor control circuit in "hand" and "automatic" positions.

h. Control circuit connections to hand/off/automatic selector switch or to more than one automatic regulatory control device: made in accordance with indicated or manufacturer's approved wiring diagram.

i. Provide selector switch with the means for locking in any position.

j. Provide a disconnecting means, capable of being locked in the open position, for the motor that is located in sight from the motor location and the driven machinery location. As an alternative, provide a motor controller disconnect, capable of being locked in the

open position, to serve as the disconnecting means for the motor if it is in sight from the motor location and the driven machinery location.

k. Overload protective devices: provide adequate protection to motor windings; be thermal inverse-time-limit type; and include manual reset-type pushbutton on outside of motor controller case.

l. Cover of combination motor controller and manual switch or circuit breaker: interlocked with operating handle of switch or circuit breaker so that cover cannot be opened unless handle of switch or circuit breaker is in "off" position.

m. Minimum short circuit withstand rating of combination motor controller: shall be the rating of the supply panelboard/switchboard.

n. Provide controllers in hazardous locations with classifications as indicated on the E-### series sheets.

Controller sizes identified on plans are minimum sizes, and the contractor is responsible for increasing sizes to account for increased current drawn based on requirements of contractor-furnished equipment and/or for termination compatibility with conductor sizes increased due to voltage drop mitigation requirements and/or conductor ampacity corrections/adjustments for the ambient temperature or number of current-carrying conductors. (Additionally, see Subparts "Conductor Termination Adapters" and "CFCI Equipment Electrical Data")

2.18.1 Control Wiring

Provide control wiring in accordance with the following:

a. All control wire: stranded tinned copper switchboard wire with 600-volt flame-retardant insulation Type SIS meeting UL 44, or Type MTW meeting UL 1063, and passing the VW-1 flame tests included in those standards.

b. Hinge wire: Class K stranding.

c. Current transformer secondary leads: not smaller than No. 10 AWG.

d. Control wire minimum size: No. 14 AWG.

e. Power wiring for 480-volt circuits and below: the same type as control wiring with No. 12 AWG minimum size.

f. Provide wiring and terminal arrangement on the terminal blocks to permit the individual conductors of each external cable to be terminated on adjacent terminal points.

2.18.2 Control Circuit Terminal Blocks

Provide control circuit terminal blocks in accordance with the following:

a. NEMA ICS 4.

b. Control circuit terminal blocks for control wiring: molded or fabricated type with barriers, rated not less than 600 volts.

c. Provide terminals with removable binding, fillister or washer head

screw type, or of the stud type with contact and locking nuts.

d. Terminals: not less than No. 10 in size with sufficient length and space for connecting at least two indented terminals for 10 AWG conductors to each terminal.

e. Terminal arrangement: subject to the approval of the Contracting Officer with not less than four spare terminals or 10 percent, whichever is greater, provided on each block or group of blocks.

f. Modular, pull apart, terminal blocks are acceptable provided they are of the channel or rail-mounted type.

g. Submit data showing that any proposed alternate will accommodate the specified number of wires, are of adequate current-carrying capacity, and are constructed to assure positive contact between current-carrying parts.

2.18.2.1 Types of Terminal Blocks

a. Short-Circuiting Type: Short-circuiting type terminal blocks: furnished for all current transformer secondary leads with provision for shorting together all leads from each current transformer without first opening any circuit. Terminal blocks: comply with the requirements of paragraph CONTROL CIRCUIT TERMINAL BLOCKS above.

b. Load Type: Load terminal blocks rated not less than 600 volts and of adequate capacity: provided for the conductors for NEMA Size 3 and smaller motor controllers and for other power circuits, except those for feeder tap units. Provide terminals of either the stud type with contact nuts and locking nuts or of the removable screw type, having length and space for at least two indented terminals of the size required on the conductors to be terminated. For conductors rated more than 50 amperes, provide screws with hexagonal heads. Conducting parts between connected terminals must have adequate contact surface and cross-section to operate without overheating. Provide each connected terminal with the circuit designation or wire number placed on or near the terminal in permanent contrasting color.

2.18.3 Control Circuits

Control circuits: maximum voltage of 120 volts derived from control transformer in same enclosure. Transformers: conform to UL 506, as applicable. Transformers, other than transformers in bridge circuits: provide primaries wound for voltage available and secondaries wound for correct control circuit voltage. Size transformers so that 80 percent of rated capacity equals connected load. Provide disconnect switch on primary side. Provide one fused secondary lead with the other lead grounded.

2.18.4 Enclosures for Motor Controllers

NEMA ICS 6.

2.18.5 Multiple-Speed Motor Controllers and Reversible Motor Controllers

Across-the-line-type, electrically and mechanically interlocked. Multiple-speed controllers: include compelling relays and multiple-button, station-type with pilot lights for each speed.

2.18.6 Pushbutton Stations

Provide with "start/stop" momentary contacts having one normally open and one normally closed set of contacts, and red lights to indicate when motor is running. Stations: heavy duty, oil-tight design.

2.18.7 Pilot and Indicating Lights

Provide LED cluster lamps.

2.19 MANUAL MOTOR STARTERS (MOTOR RATED SWITCHES)

SingleDoubleThree pole designed for flush mounting with overload protection and pilot lights.

2.19.1 Pilot Lights

Provide yoke-mounted, seven element LED cluster light module. Color: in accordance with NEMA ICS 2.

2.20 LOCKOUT REQUIREMENTS

Provide circuit breakers, disconnecting means, and other devices that are electrical energy-isolating capable of being locked out for machines and other equipment to prevent unexpected startup or release of stored energy in accordance with 29 CFR 1910.147, NFPA 70E and 29 CFR 1910.303. Comply with requirements of Division 23, "Mechanical" for mechanical isolation of machines and other equipment.

2.21 TELECOMMUNICATIONS SYSTEM

Provide system of telecommunications wire-supporting structures (pathway), including: outlet boxes, conduits with pull wires and other accessories for telecommunications outlets and pathway in accordance with TIA-569 and as specified herein. Additional telecommunications requirements are specified in Section 27 10 00 BUILDING TELECOMMUNICATIONS CABLING SYSTEM.

2.21.1 Backboards

Provide void-free, fire rated interior grade plywood, 3/4 inch thick, 4 by 8 feet. Do not cover the fire stamp on the backboard. Coordinate backboard requirements with telecommunications backboard requirements as specified in Section 27 10 00 BUILDING TELECOMMUNICATIONS CABLING.

2.22 GROUNDING AND BONDING EQUIPMENT

2.22.1 Ground Rods

UL 467. Ground rods: cone pointed copper-clad steel, with minimum diameter of 3/4 inch and minimum length 10 feet. Sectional type rods may be used for rods 20 feet or longer.

2.22.2 Ground Bus

Copper ground bus: provided in the electrical rooms as indicated on the plans.

2.22.3 Secondary Bonding Busbar

Provide corrosion-resistant grounding busbar suitable for indoor installation in accordance with TIA-607. Busbars: plated for reduced contact resistance. If not plated, clean the busbar prior to fastening the conductors to the busbar and apply an anti-oxidant to the contact area to control corrosion and reduce contact resistance. Provide a Primary bonding busbar (TGB) in the telecommunications entrance facility. The Primary bonding busbar (TGB) sized in accordance with the immediate application requirements and with consideration of future growth. Provide Primary bonding busbars with the following:

a. Predrilled copper busbar provided with holes for use with standard sized lugs,

b. Minimum dimensions of 0.25 in thick by 4 in wide for the TGB with length as indicated;

c. Listed by a nationally recognized testing laboratory.

2.23 HAZARDOUS LOCATIONS

Electrical materials, equipment, and devices for installation in hazardous locations, as defined by NFPA 70: specifically approved by Underwriters' Laboratories, Inc., or Factory Mutual for particular "Class," "Division," and "Group" of hazardous locations involved. Boundaries and classifications of hazardous locations: as indicated. Equipment in hazardous locations: comply with UL 1203 for electrical equipment, UL 877 for circuit breakers, UL 886 for outlet boxes and fittings, UL 1010 for receptacles, UL 698A for industrial controls, and UL 674 for motors.

2.24 MANUFACTURER'S NAMEPLATE

Provide on each item of equipment a nameplate bearing the manufacturer's name, address, model number, and serial number securely affixed in a conspicuous place; the nameplate of the distributing agent will not be acceptable.

2.25 FIELD FABRICATED NAMEPLATES

Provide field fabricated nameplates in accordance with the following:

a. ASTM D709.

b. Provide laminated plastic nameplates for each equipment enclosure, relay, switch, and device; as specified or as indicated on the drawings.

c. Each nameplate inscription: identify the function and, when applicable, the position.

d. Nameplates: melamine plastic, 0.125 inch thick, white with black center core.

e. Provide red laminated plastic label with white center core where indicated.

f. Surface: matte finish. Corners: square. Accurately align lettering and engrave into the core.

g. Minimum size of nameplates: one by 2.5 inches.

h. Lettering size and style: a minimum of 0.25 inch high normal block style.

2.26 WARNING SIGNS

Provide warning signs for flash protection in accordance with NFPA 70E and NEMA Z535.4 for switchboards, panelboards, industrial control panels, and motor control centers that are in other than dwelling occupancies and are likely to require examination, adjustment, servicing, or maintenance while energized. Provide field installed signs to warn qualified persons of potential electric arc flash hazards when warning signs are not provided by the manufacturer. Provide marking that is clearly visible to qualified persons before examination, adjustment, servicing, or maintenance of the equipment.

2.27 FIRESTOPPING MATERIALS

Provide firestopping around electrical penetrations in accordance with Section 07 84 00 FIRESTOPPING.

2.28 WIREWAYS

UL 870. Material: steel galvanized 16 gauge for heights and depths up to 6 by 6 inches, and 14 gauge for heights and depths up to 12 by 12 inches. Provide in length required for the application with screw - cover NEMAappropriate for application (match ratings of area equipment) enclosure per NEMA ICS 6.

2.29 METERING

Reference Section 26 24 13, SWITCHBOARDS. Metering requirements from Section 26 24 13, SWITCHBOARDS shall also apply to service-entrance panelboard(s). ANSI C12.1.

2.30 SURGE PROTECTIVE DEVICES

Provide parallel type surge protective devices (SPD) which comply with UL 1449 at the service entrance, panelboards, and switchboards where indicated on the EP600 series one-line diagram and panel schedules, and as indicated elsewhere in the contract drawings and specifications; this shall include both distribution equipment surge protective devices (where required at panelboards, distribution panels, switchboards, switchgear, etc.) and branch circuit surge protective devices. Provide surge protectors in an enclosure matching the NEMA ICS 6 rating identified for the protected equipment (See EP620 series panel schedules). SPD must have the same short-circuit current rating as the protected equipment and must not be installed at a point of system where the available fault current is in excess of that rating. Use Type 1 or Type 2 SPD and connect on the load side of a dedicated circuit breaker unless otherwise indicated; use of a fuse in lieu of circuit breaker is not acceptable. Do not install SPD inside a panel enclosure. The maximum lead length permitted is 3'. Submit performance and characteristic curves. Provide Form C dry contacts for remote monitoring, and indicate to the reporting system when the unit has malfunctioned and/or requires replacement (SPDs shall be provided with local visual indicators for the same diagnostics; UFC 3-520-01 Sections 3-4.1.1 and 3-4.1.2). SPD submittals shall include the manufacturer's

recommended overcurrent protective device rating for the device(s) to be installed, and the circuit breaker ratings and conductor sizes shall be adjusted accordingly at no additional cost to the government.

Provide the following modes of protection:

FOR SINGLE PHASE AND THREE PHASE WYE CONNECTED SYSTEMS-
Phase to phase (L-L)
Each phase to neutral (L-N)
Neutral to ground (N-G)
Phase to ground (L-G)

FOR DELTA CONNECTIONS-
Phase to phase (L-L)
Phase to ground (L-G)

SPDs at the service entrance: provide with a minimum surge current rating of 80,000 amperes for L-L mode minimum and 40,000 amperes for other modes (L-N, L-G, and N-G) and downstream SPDs rated 40,000 amperes for L-L mode minimum and 20,000 amperes for other modes (L-N, L-G, and N-G).

Provide SPDs per NFPA 780 for the lightning protection system.

Maximum L-N, and N-G Voltage Protection Rating:

600V for 120V, single phase system
1,000V for 120/240V, single phase system
600V for 120/240V, three phase system
600V for 208Y/120V, three phase system
1,200V for 480Y/277V, three phase system

Maximum L-G Protection Rating:
700V for 120V, single phase system
1,000V for 120/240V, single phase system
700V for 120/240V, three phase system
700V for 208Y/120V, three phase system
1,200V for 480Y/277V, three phase system

Maximum L-L Voltage Protection Rating:

1,200V for 120/240V, three phase system
1,200V for 208Y/120V, three phase system
1,800V for 480Y/277V, three phase system

The minimum MCOV (Maximum Continuous Operating Voltage) rating for L-N and L-G modes of operation: 120 percent of nominal voltage for 240 volts and below; 115 percent of nominal voltage above 240 volts to 480 volts.

Provide EMI/RFI filtering per UL 1283 for each mode with the capability to attenuate high frequency noise. Minimum attenuation: 20db.

2.31 FACTORY APPLIED FINISH

Provide factory-applied finish on electrical equipment in accordance with the following:

a. NEMA 250 corrosion-resistance test and the additional requirements as specified herein.

b. Interior and exterior steel surfaces of equipment enclosures: thoroughly cleaned followed by a rust-inhibitive phosphatizing or equivalent treatment prior to painting.

c. Exterior surfaces: free from holes, seams, dents, weld marks, loose scale or other imperfections.

d. Interior surfaces: receive not less than one coat of corrosion-resisting paint in accordance with the manufacturer's standard practice.

e. Exterior surfaces: primed, filled where necessary, and given not less than two coats baked enamel with semigloss finish.

f. Equipment located indoors: ANSI Light Gray, and equipment located outdoors: ANSI Light Gray.

g. Provide manufacturer's coatings for touch-up work and as specified in paragraph FIELD APPLIED PAINTING.

2.32 SOURCE QUALITY CONTROL

2.32.1 Transformer Factory Tests

2.32.1.1 Low- to Low-Voltage Transformer Factory Tests

Include routine NEMA ST 20 transformer test results on each transformer and also provide the results of NEMA "design" and "prototype" tests that were made on transformers electrically and mechanically equal to those specified.

2.32.1.2 Medium- to Low-Voltage Transformer Factory Tests

2.32.1.2.1 Design Tests

In accordance with IEEE C57.12.01 and IEEE C57.12.91. Additionally, IEEE C57.12.80 Section 5.1.2 states that "design tests are made only on representative apparatus of basically the same design." Submit design test reports in the same submittal package as the product data, shop drawings, and certificates of transformer losses for each of the specified transformers. Design tests must have been performed prior to the award of this contract.

Provide required submittals with index and tabs.

a. Tests must be certified and signed by a registered professional engineer. Engineers stamp and signature must appear on at least the first page of the factory test reports.

b. Temperature rise: "Basically the same design" for the temperature rise test means a transformer with the same coil construction (such as wire wound primary and sheet wound secondary), the same kVA, the same cooling type, the same temperature rise rating, the same insulating class and the same insulating medium as the transformer specified.

Provide temperature rise readings, formulas, calculations of average temperature rise, and description of test method.

c. Lightning impulse: Basically the same design" for the lightning

impulse dielectric test means a transformer with the same BIL and the same coil construction.

(1) IEEE C57.12.91 and IEEE C57.98. Provide design lightning impulse tests consisting of a reduced full-wave, two-chopped waves, and one full wave test for each phase of the primary and secondary windings of the same transformer.

(2) State test voltage levels.

d. Partial Discharge Test per IEEE C57.124. Provide transformer ratings, description and diagram of test method used, test readings and final results.

Routine and Other Tests

In accordance with IEEE C57.12.01 and IEEE C57.12.91. Routine and other tests must be performed by the manufacturer on each of the actual transformers prepared for this project to ensure that the design performance is maintained in production. Submit test reports, by serial number and receive approval before delivery of equipment to the project site. Required tests and testing sequence must be as follows:

e. Resistance measurements

f. Phase relation

g. Ratio

h. Insulation power-factor by manufacturer's recommended test method

i. No-load losses (NLL) and excitation current

j. Load losses (LL) and impedance voltage

k. Lightning impulse: Perform the complete design type impulse tests on the transformer primary winding only.

(1) IEEE C57.12.91 and IEEE C57.98

(2) State test voltage levels

(3) Provide photographs of oscilloscope display waveforms or plots of digitized waveforms with test reports.

l. Low frequency dielectric

m. Applied voltage

n. Induced voltage

2.33 Conductor Termination Adapters

Pin adapters, reducers, lug kit adapters, pigtail adapters, and similar devices may be used for reduction from conductor size(s) larger than size(s) acceptable by terminals on equipment satisfying all other contract requirements.

Devices must be listed and compatible with the material with which

interface occurs (i.e., copper conductors, aluminum busbars, etc.). Devices must not result in modification of equipment in or on which they are installed which results in compromise of the listing of the equipment nor of the manufacturer(s) warranty.

Products must be UL 486A-486B listed.

Crimp, compression, or mechanical/torque type adapters are permitted.

Adapters provided for insulated conductors (other than grounding electrode conductors, bonding jumpers, and equipment bonding conductors) shall be provided with an insulating cover. Adapters provided for bare conductors (and for grounding electrode conductors, bonding jumpers, and equipment bonding conductors) may omit an insulating cover.

Adapters must not be used to reduce conductor sizes below the maximum size permitted by the equipment, circuit breaker, etc., terminations in question requiring the adapters. Conductors must not be reduced in size smaller than required by ambient temperature and current-carrying conductor ampacity corrections and adjustments; utilize increased conductor insulation temperature rating as necessary.

2.34 Documentation of Terminations

All submittals for distribution equipment and disconnecting means on which conductors terminate (to include transformers, panelboards, switchboards, switchgear, variable frequency drives, enclosed circuit breakers, starters, disconnect switches, and similar) shall include conductor termination information to validate the suitability of equipment provided against the conductors required to satisfy voltage drop and ampacity adjustment/correction requirements.

2.35 Electrical System Accounting for Contractor-Furnished/Contractor-Installed (CFCI) Equipment and Devices:

While the Federal Acquisition Regulation (FAR) and Defense Federal Acquisition Regulation Supplement (DFARS) requirements prohibit the use of branch name (or equal) references in solicitations without a Justification and Approval for sole source procurement, equipment connection electrical properties (voltage, phase, amps, protection) included on the “Equipment Electrical Connection Schedule” are based on products available at the time of design and have been incorporated into the electrical distribution system included in the contract documents. The contractor must select equipment matching the electrical properties to the extent a deviation is not required for the sizes and configurations of the supply circuits and distribution equipment. Should any deviations be required, such changes (including but not limited to conductor quantities, conductor sizes, protection size, protection poles, disconnect size, disconnect type, disconnect poles, supply equipment (panelboard, switchboard, switchgear, transformer) rating, and reperformance of power studies) shall be at no additional cost to the government, and any submittals approved which are impacted by such deviations must be re-submitted for approval incorporating the changes required to account for the deviations from the design conditions.

Equipment phase balancing of the load must be maintained to no greater than 5% imbalance while observing destination and routing grouping of circuits on the panelboards represented on the contact document panel schedules; exceptions to the 5% imbalance will be limited to lightly

loaded or low circuit quantity panelboards (namely where already demonstrated in the contract documents to not satisfy this requirement) and instances where not practical from a circuit organization perspective (for example, see circuit organization on the panelboard(s) dedicated to telecommunication circuits) but maintaining an aggregated phase balance at upstream busses. Adjustments must maintain the spare space requirements, spare capacity requirements, conductor ampacity requirements, and voltage drop limits identified in UFCs 3-501-01 and 3-520-01, and shall re-account for fault contributions in the final establishment of withstand and interrupt ratings (and in turn, arc flash calculations and labeling).

This subpart is applicable to all electrical installation in the contract and not limited to the products listed in this individual specification section.

2.35.1 CFCI Equipment Electrical Data

Submit in tabular form all contractor-furnished/contractor-installed equipment requiring power connections shall be submitted at the same time as the supply equipment submittals and shall include the following:

(1) Equipment identifier on electrical plans
(2) Equipment type
(3) Approved Submittal Number (eg, 23 81 00.00 20-# for unitary air conditioning equipment)
(4) Manufacturer
(5) Model and Catalog Number
(6) Voltage
(7) Phase(s)
(8) Full-Load Amps (FLA)
(9) Minimum Circuit Ampacity (MCA)
(10) Manufacturer-Recommended Overcurrent Protection Device (MOCP)
(11) Minimum Disconnect Size

Inclusion of unapproved equipment will result in rejection of the CFCI and supply equipment submittals.

Identify in CFCI Equipment Electrical Data equipment with voltage, phase, FLA, MCA, and MOCP characteristics differing from the contract documents.

For CFCI equipment with multiple load components from a single building feed (for example: bridge cranes), provide the above data for the entire assembly with respect to the circuit supplied by the building (in addition to the protective elements for the individual components for the respective equipment's schematic diagram submittals).

Include equipment operating on 24V or similar characteristics utilizing step-down transformers local to the equipment but connected to the building distribution system. Items whose power is supplied from a control panel where the voltage is reduced below the aforementioned threshold need not be included, but the control panel interfacing with the electrical distribution system shall be included.

Include Surge Protective Devices (even though they have no load) in CFCI Equipment Electrical Data to track the MOCP and corresponding conductor requirements should they differ from the values assumed in the contract documents.
[*Am-00002]
Include all fire alarm circuits requiring power from the building

electrical distribution system. This activity requires a substantially-developed fire alarm/etc. systems design; Coordinate across trades for timely delivery of this information.[**Am-00002]

Include Adjustable Speed/Variable Frequency Drives in CFCI Equipment Electrical Data to track circuit characteristics which may require adjustment in accordance with NFPA 70 Article 430 Part X.

Devices and equipment requiring building electrical distribution interface must adhere to the electrical configurations (phase/poles, voltage, etc.) identified by instance on the electrical plans and schedules.

Electrical System Contractor Variances for equipment shall be furnished at the time the Product Data is submitted and shall be comprehensive of all equipment seeking variance. Purchase and/or installation of equipment requiring an electrical variance prior to variance approval shall be at the risk to the contractor. Request for variance shall not assume approval of such variance. The electrical system connections have been coordinated with the basis of design equipment shown on the architectural, interior design, fire protection, plumbing, mechanical, and/or electrical drawings. Should the equipment submitted for approval vary from the design equipment electrical needs and require a different connection than shown on the electrical plans, the contractor shall submit for approval revised schedules, plans, and diagrams indicating the changes to the electrical system due to the equipment variance based on the manufacturer-recommended minimum circuit ampacity (MCA) and maximum overcurrent protection (MOCP). The DOR reserves the right to increase conductor sizes above the manufacturer-required MCA due to ASHRAE 90.1 voltage drop and NFPA 70 derating/correction factors.

Circuit breakers shall be coordinated with deviation required by variances from the characteristics used in design as described in other specification sections and EP sheets. Where deviations are necessary, government approval is required. Deviations will be evaluated on the basis of load balancing by phase, maintaining spacial proximity, and system and equipment assignment; change in the votage will not be acceptable except in rare circumstances. Request for variance shall indicate the originating and final locations of all transplanted circuit breakers and the associated load names. Finally, circuit breakers for equipment requiring submission for approval are subject to change based on the manufacturer's MOCP of the submitted equipment, and the manufacturer's MOCP value shall be the value used for the protection device rating incorporated into related electrical protection device/equipment submittals and the installed condition. Incorporation of the final circuit breaker sizes into the distribution equipment is the responsibility of the contractor and are subject to approval through the submittal process. Circuit breaker sizes in the design documents shall not be assumed to be final for equipment provided in this contract and do not override the manufacturer's recommendations.

All equipment and devices must be properly rated for installation in the available fault current environment which exists at the location the equipment is installed. The contractor shall provide supplemental equipment features or fault current reduction measures where furnished equipment has a SCCR value less than the vault current available at the installed location where needed to satisfy this requirement.

Equipment and devices supporting CFCI equipment may be submitted for basic contract compliance review, but not for approval for installed equipment

suitability without the associated data described herein.

2.35.2 Interim CFCI Equipment Electrical Data

The information required by the "CFCI Equipment Electrical Data" submittal may be furnished on an interim basis for inclusion of the partial set of the final data to support approval of related electrical distribution equipment (such as the data associated with a specific panelboard or set of panelboards). The data provided must be complete for the items included, to include identification of the submittal approving the equipment without a re-submittal required (that is, the submittal has received an "A" or "B" Action).

This item in the submittal registry is representative of any number of submittals the contractor wishes to produce for the purpose described in the preceding paragraph, and additional submittal registry entries may be created with unique names to facilitate the review and approval needs throughout the project life cycle prior to the approval of the comprehensive set of CFCI Equipment Electrical Data.

The following may be used for parts of the distribution system to facilitate equipment approval:

Interim CFCI Equipment Electrical Data (Fire Alarm)
For all equipment supplied by Section 28 31 70 Item: "Dedicated Emergency Panel Schedules".

Interim CFCI Equipment Electrical Data (Generator Station Service)
For all equipment supplied by panels GA1, GA2, GB1, and GB2 for generator loads requiring building power.

Interim CFCI Equipment Electrical Data (Filter Shelter)
For all equipment supplied by distribution equipment at the Filter Shelter (See EP604S, EP614S, EP632S, EP633S, and EP634S).

Interim CFCI Equipment Electrical Data (Offload)
For all equipment supplied by distribution equipment at the pumped offload (outside the Restricted Area fence; see EP603, EP613, EP631).

2.36 COORDINATED POWER SYSTEM PROTECTION

Prepare analyses as specified in Section 26 05 73 POWER SYSTEM STUDIES.

PART 3 EXECUTION

3.1 INSTALLATION

Electrical installations, including weatherproof and hazardous locations and ducts, plenums and other air-handling spaces: conform to requirements of NFPA 70 and IEEE C2 and to requirements specified herein.

3.1.1 Underground Service

Underground service conductors and associated conduit: continuous from service entrance equipment to outdoor power system connection.

Encase the underground portion of the conduit in a concrete envelope and bury as specified for underground duct with concrete encasement.

3.1.2 Hazardous Locations

Perform work in hazardous locations, as defined by NFPA 70, in strict accordance with NFPA 70 for particular "Class," "Division," and "Group" of hazardous locations involved. Provide conduit and cable seals where required by NFPA 70. Provide conduit with tapered threads. Reference E-### series sheets for extent of hazardous area. Conductor and conduit sizes indicated on plans shall be considered minimum sizes.

3.1.2.1 Sealoffs

All conduits have been sized based on maximum 40 percent fill ratios and shall be considered minimum sizes. Provide sealoffs specifically identified and rated for 40 percent fill in accordance with the permission stated in NFPA 70 Section 501.15(C)(6). Sealoffs shall be inspectable and accessible.

3.1.3 Service Entrance Identification

Service entrance disconnect devices, switches, and enclosures: labeled and identified as such.

3.1.3.1 Labels

Wherever work results in service entrance disconnect devices in more than one enclosure, as permitted by NFPA 70, label each enclosure, new and existing, as one of several enclosures containing service entrance disconnect devices. Label, at minimum: indicate number of service disconnect devices housed by enclosure and indicate total number of enclosures that contain service disconnect devices. Provide laminated plastic labels conforming to paragraph FIELD FABRICATED NAMEPLATES. Use lettering of at least 0.25 inch in height, and engrave on black-on-white matte finish. Service entrance disconnect devices in more than one enclosure: provided only as permitted by NFPA 70.

3.1.4 Wiring Methods

Provide insulated conductors installed in rigid steel conduit, IMC, rigid nonmetallic conduit, or EMT, except where specifically indicated or specified otherwise or required by NFPA 70 to be installed otherwise. Grounding conductor: separate from electrical system neutral conductor. Provide insulated green equipment grounding conductor for circuit(s) installed in conduit and raceways. Shared neutral, or multi-wire branch circuits, are not permitted with arc-fault circuit interrupters. Minimum conduit size: 1/2 inch in diameter for low voltage lighting and power circuits. Vertical distribution in multiple story buildings: made with metal conduit in fire-rated shafts, with metal conduit extending through shafts for minimum distance of 6 inches. Firestop conduit which penetrates fire-rated walls, fire-rated partitions, or fire-rated floors in accordance with Section 07 84 00 FIRESTOPPING.

3.1.4.1 Prohibition on Shared Raceways for Circuits Supplied from Generator

Per UFC 3-540-01 Section 2-5.1, wiring from the generator to the loads served shall be kept entirely independent of all other general wiring unless otherwise permitted in NFPA 70 Article 700.

3.1.4.2 Pull Wire

Install pull wires in empty conduits. Pull wire: plastic having minimum 200-pound force tensile strength. Leave minimum 36 inches of slack at each end of pull wire.

3.1.4.3 Metal-Clad Cable

Install in accordance with NFPA 70, Type MC cable.

3.1.5 Adjustments for Unique Conductor Termination Applications

Note the equipment frame ratings on plans are identified in the schedule key to be minimum ratings, and larger frames (either for equipment or individual circuit breakers) will be required to terminate the conductors significantly increased in size for voltage drop (especially conductors associated with PHA and PHB) in accordance with the acceptable wire size and set ranges established by the manufacturer(s).

For feeders (other than panelboard-mounted circuit breakers for single-motor feeder applications) and service conductors, conductors must terminate without splicing directly on terminations provided by the equipment manufacturers or using a product described in Subpart "Conductor Termination Adapters." This shall also apply to terminations at disconnect switches, starters, combination starter/disconnects, and enclosed circuit breakers. Splices for the purpose of wire size reduction to land conductors on equipemnt terminations or adapters described are not acceptable.

For branch circuits and panelboard-mounted circuit breakers for single-motor feeder applications where adapters will not fit on devices at the point of termination, the total length of conductor to be reduced below the size adjusted to mitigate voltage drop must not exceed 10 feet or 10 percent of the circuit length, whichever is less. Provide the sizing information on the equipment directory (and O&M manual, where applicable) indicating differing conductor sizes along the circuit.

For conductors represented on the power studies where splices occur to reduce conductor sizes to land on terminations, model this size change accordingly in the power studies.

In applications where 200% neutral bus is indicated, if the equipment supplier needs to provide larger phase lugs and the new 100% bus would satisfy the original 200% bus, the new equipment does not need a 200% neutral as long as the conductors can suitably terminate on the new 100% bus lugs. In other words, provide a neutral bus with termination which will accommodate the conductors. For example, if the plans indicate a 100A mains with 200% neutral but requires conductors (for example: 3-3/0, 350kcmil N) exceeding the 100A mains buses' terminations (thus requiring a 225A or 400A frame), if the neutral conductor can land without reduction on thet 100% neutral bus of a size at least 200% the size of the original bus, the 100% neutral bus is acceptable on the larger equipment frame size.

3.1.6 Conduit Installation

Unless indicated otherwise, conceal conduit under floor slabs and within finished walls, ceilings, and floors. Exposed conduit is permissible in the generator bays, utility rooms, and unfinished spaces. Keep conduit minimum 6 inches away from parallel runs of flues and steam or hot water

pipes. Install conduit parallel with or at right angles to ceilings, walls, and structural members where located above accessible ceilings and where conduit will be visible after completion of project. Run conduits under floor slab as if exposed; do not install conduits routed horizontally on top of the floor.

Exterior building-mounted devices and equipment shall be wired from within the building and shall conform to the interior wiring standards described in this section to the greatest extent possible. No exterior building-mounted equipment and device circuits shall be surface mounted.

Conduits and associated support elements shall be coordinated with all other trades prior to installation. Installation resulting in interferences shall be resolved at no additional cost to the government. For example, conduits shall not be installed below door openings, including overhead coiling doors.

For entities shown at the roof level or mounted to the building exterior, even though the supporting infrastructure (such as junction boxes and conduits) may be shown on outside the building, the raceways shall be interior to the building except where necessary to exit the building to supply the end devices unless otherwise noted.

See E-### series sheets regarding areas subject to physical damage.

3.1.6.1 Restrictions Applicable to Aluminum Conduit

a. Do not install underground or encase in concrete or masonry.

b. Do not use brass or bronze fittings.

3.1.6.2 Restrictions Applicable to EMT

a. Do not install underground.

b. Do not encase in concrete, mortar, grout, or other cementitious materials.

c. Do not use in areas subject to physical damage including but not limited to equipment rooms where moving or replacing equipment could physically damage the EMT.

d. Do not use in hazardous areas.

e. Do not use outdoors or in areas requiring wet ratings (see E-### series sheets).

f. Do not use in fire pump rooms.

g. Do not use when the enclosed conductors must be shielded from the effects of High-altitude Electromagnetic Pulse (HEMP).

3.1.6.3 Restrictions Applicable to Nonmetallic Conduit

a. PVC Schedule 40.

(1) Do not use where subject to physical damage, including but not limited to, mechanical equipment rooms, electrical equipment rooms, fire pump rooms, generator rooms, and where restrictions

are applying to both PVC Schedule 40 and PVC Schedule 80.

(2) Do not use above grade, except where allowed in this section for rising through floor slab or indicated otherwise.

b. PVC Schedule 40 and Schedule 80.

(1) Do not use where subject to physical damage.

(2) Do not use in hazardous (classified) areas.

(3) Do not use in penetrating fire-rated walls or partitions, or fire-rated floors.

-

3.1.6.4 Restrictions Applicable to Flexible Conduit

Use only as specified in paragraph FLEXIBLE CONNECTIONS.

3.1.6.5 Service Entrance Conduit, Underground

PVC, Type-EPC 40, galvanized rigid steel or steel IMC. Underground portion shall be encased in minimum of 3 inches of concrete and shall be installed minimum 18 inches below slab or grade.

3.1.6.6 Underground Conduit

Plastic-coated rigid steel; plastic-coated steel IMC; PVC, Type EPC-40. Convert nonmetallic conduit, other than PVC Schedule 40 or 80, to plastic-coated rigid, or IMC, steel conduit before rising through floor slab. Plastic coating: extend minimum 6 inches above floor.

3.1.6.7 Conduit for Circuits Rated Greater Than 600 Volts

Rigid metal conduit or IMC only.

3.1.6.8 Conduit Installed Under Floor Slabs

Conduit run under floor slab: located a minimum of 12 inches below the vapor barrier. Seal around conduits at penetrations thru vapor barrier. Use NECA NEIS 1 Table 2a (Minimum Raceway Spacing) to determine under floor slab conduit spacing unless greater spacing is required elsewhere in this section.

To the greatest extent practical, route power distrubution system feeders underground and avoid routing through underground areas identified as Class I Division 1 (see E-### sheet series for these areas).

3.1.6.9 Conduit Through Floor Slabs

Where conduits rise through floor slabs, do not allow curved portion of bends to be visible above finished slab. Where conduit rises through slab-on grade, seal all electrical penetrations to address radon mitigation and prevent infiltration of air, insects, and vermin.

3.1.6.10 Conduit Installed in Concrete Floor Slabs

Rigid steel; steel IMC; fiberglass, or PVC, Type EPC-40.Locate so as not to adversely affect structural strength of slabs. Install conduit within middle one-third of concrete slab. Do not stack conduits more than two

diameters high with minimum vertical separation of one inches. Space conduits horizontally not closer than three diameters, except at cabinet locations. Curved portions of bends must not be visible above finish slab. Increase slab thickness as necessary to provide minimum one inch cover over conduit. Where embedded conduits cross building expansion joints, provide suitable watertight expansion/deflection fittings and bonding jumpers. Expansion/deflection fittings must allow horizontal and vertical movement of raceway. Conduit larger than one inch trade size: installed parallel with or at right angles to main reinforcement; when at right angles to reinforcement, install conduit close to one of supports of slab. Where nonmetallic conduit is used, convert raceway to plastic coated rigid steel or plastic coated steel IMC before rising above floor, unless specifically indicated.

3.1.6.11 Stub-Ups

Provide conduits stubbed up through concrete floor for connection to free-standing equipment with adjustable top or coupling threaded inside for plugs, set flush with finished floor. Extend conductors to equipment in rigid steel conduit, except that flexible metal conduit may be used 6 inches above floor. Where no equipment connections are made, install screwdriver-operated threaded flush plugs in conduit end.

3.1.6.12 Conduit Support

Support conduit by pipe straps, wall brackets, threaded rod conduit hangers, or ceiling trapeze. Plastic cable ties are not acceptable. Fasten by wood screws to wood; by toggle bolts on hollow masonry units; by concrete inserts or expansion bolts on concrete or brick; and by machine screws, welded threaded studs, or spring-tension clamps on steel work. Threaded C-clamps may be used on rigid steel conduit only. Do not weld conduits or pipe straps to steel structures. Do not exceed one-fourth proof test load for load applied to fasteners. Provide vibration resistant and shock-resistant fasteners attached to concrete ceiling. Do not cut main reinforcing bars for any holes cut to depth of more than 1 1/2 inches in reinforced concrete beams or to depth of more than 3/4 inch in concrete joints. Fill unused holes. In partitions of light steel construction, use sheet metal screws. In suspended-ceiling construction, run conduit above ceiling. Do not support conduit by ceiling support system. Conduit and box systems: supported independently of both (a) tie wires supporting ceiling grid system, and (b) ceiling grid system into which ceiling panels are placed. Do not share supporting means between electrical raceways and mechanical piping or ducts. Coordinate installation with above-ceiling mechanical systems to assure maximum accessibility to all systems. Spring-steel fasteners may be used for lighting branch circuit conduit supports in suspended ceilings in dry locations. Support exposed risers in wire shafts of multistory buildings by U-clamp hangers at each floor level and at 10 foot maximum intervals. Where conduit crosses building expansion joints, provide suitable watertight expansion fitting that maintains conduit electrical continuity by bonding jumpers or other means. For conduits greater than 2 1/2 inches inside diameter, provide supports to resist forces of 0.5 times the equipment weight in any direction and 1.5 times the equipment weight in the downward direction.

3.1.6.13 Directional Changes in Conduit Runs

Make changes in direction of runs with symmetrical bends or cast-metal fittings. Make field-made bends and offsets with hickey or

conduit-bending machine. Do not install crushed or deformed conduits. Avoid trapped conduits. Prevent plaster, dirt, or trash from lodging in conduits, boxes, fittings, and equipment during construction. Free clogged conduits of obstructions.

3.1.6.14 Locknuts and Bushings

Fasten conduits to sheet metal boxes and cabinets with two locknuts where required by NFPA 70, where insulated bushings are used, and where bushings cannot be brought into firm contact with the box; otherwise, use at least minimum single locknut and bushing. Provide locknuts with sharp edges for digging into wall of metal enclosures. Install bushings on ends of conduits, and provide insulating type where required by NFPA 70.

3.1.6.15 Flexible Connections

Provide flexible steel conduit between 3 and 6 feet in length for recessed and semirecessed lighting fixtures; for equipment subject to vibration, noise transmission, or movement; and for motors; and for equipment explicitly indicated on the drawings. Install flexible conduit to allow 20 percent slack. Minimum flexible steel conduit size: 1/2 inch diameter. Provide liquid tight flexible nonmetallic conduit in wet and damp locations (see E-### series sheets) and in fire pump rooms for equipment subject to vibration, noise transmission, movement or motors. Provide separate ground conductor across flexible connections. Plastic cable ties are not acceptable as a support method.

3.1.6.16 Telecommunications and Signal System Pathway

Install telecommunications pathway in accordance with TIA-569.

Cable trays, conduits, and associated support elements shall be coordinated with all other trades prior to installation. Installation resulting in interferences shall be resolved at no additional cost to the government. For example, cable trays and conduits shall not be installed below door openings, including overhead coiling doors.

a. Horizontal Pathway: Telecommunications pathways from the work area to the telecommunications room: installed and cabling length requirements in accordance with TIA-568.1. Size conduits, wireways, and cable trays in accordance with TIA-569 and as indicated.

b. Backbone Pathway: Telecommunication pathways from the telecommunications entrance facility to telecommunications rooms, and, telecommunications equipment rooms (backbone cabling): installed in accordance with TIA-569. Size conduits, wireways, and cable trays for telecommunications risers in accordance with TIA-569 and as indicated.

3.1.6.17 Areas Subject to Severe Physical Damage

See sheet E-120 and E-100S.

3.1.7 Busway Installation

Comply at minimum with NFPA 70. Install busways parallel with or at right angles to ceilings, walls, and structural members. Support busways at 5 foot maximum intervals, and brace to prevent lateral movement. Provide fixed type hinges on risers; spring-type are unacceptable. Provide flanges where busway makes penetrations through walls and floors, and seal

to maintain smoke and fire ratings. Provide waterproof curb where busway riser passes through floor. Seal gaps with fire-rated foam and caulk. Provide expansion joints, but only where bus duct crosses building expansion joints. Provide supports to resist forces of 0.5 times the equipment weight in any direction and 1.5 times the equipment weight in the downward direction.

3.1.8 Cable Tray Installation

Install and ground in accordance with NFPA 70. In addition, install and ground telecommunications cable tray in accordance with TIA-569 and TIA-607. Install cable trays parallel with or at right angles to ceilings, walls, and structural members. Cable tray and tray supports must not partially nor completely obstruct access to the room. Support in accordance with manufacturer recommendations but at not more than 6 foot intervals. Coat contact surfaces of aluminum connections with an antioxidant compound prior to assembly. Adjacent cable tray sections: bonded together by connector plates of an identical type as the cable tray sections. For grounding of cable tray system provide No. 2 AWG bare copper wire throughout cable tray system, and bond to each section, except use No. 1/0 aluminum wire if cable tray is aluminum. Terminate cable trays 10 inches from both sides of smoke and fire partitions. Install conductors run through smoke and fire partitions in 4 inch rigid steel conduits with grounding bushings, extending 12 inches beyond each side of partitions. Seal conduit on both ends to maintain smoke and fire ratings of partitions. Firestop penetrations in accordance with Section 07 84 00, FIRESTOPPING. Provide supports to resist forces of 0.5 times the equipment weight in any direction and 1.5 times the equipment weight in the downward direction.

3.1.9 Boxes, Outlets, and Supports

Provide boxes in wiring and raceway systems wherever required for pulling of wires, making connections, and mounting of devices or fixtures. Boxes for metallic raceways: cast-metal, hub-type when located in wet locations, when surface mounted on outside of exterior surfaces, when surface mounted on interior walls exposed up to the greater height of 7 feet above floors and walkways or the height of "areas subject to physical damage", or when installed in hazardous areas, and when specifically indicated. Boxes in other locations: sheet steel, except that aluminum boxes may be used with aluminum conduit, and nonmetallic boxes may be used with nonmetallic conduit system. Provide each box with volume required by NFPA 70 for number of conductors enclosed in box. Boxes for mounting lighting fixtures: minimum 4 inches square, or octagonal, except that smaller boxes may be installed as required by fixture configurations, as approved. Boxes for use in masonry-block or tile walls: square-cornered, tile-type, or standard boxes having square-cornered, tile-type covers. Provide gaskets for cast-metal boxes installed in wet locations and boxes installed flush with outside of exterior surfaces. Provide separate boxes for flush or recessed fixtures when required by fixture terminal operating temperature. Provide access panels in gypsum ceilings to reach junction boxes; coordinate with other trades such that opening provides unimpeded access to device to be maintained (i.e., opening is not directly below ductwork or cable tray).Support boxes and pendants for surface-mounted fixtures on suspended ceilings independently of ceiling supports. Fasten boxes and supports with wood screws on wood, with bolts and expansion shields on concrete or brick, with toggle bolts on hollow masonry units, and with machine screws or welded studs on steel. In open overhead spaces, cast boxes threaded to raceways need not be separately supported

except where used for fixture support; support sheet metal boxes directly from building structure or by bar hangers. Where bar hangers are used, attach bar to raceways on opposite sides of box, and support raceway with approved-type fastener maximum 24 inches from box. When penetrating reinforced concrete members, avoid cutting reinforcing steel.

3.1.9.1 Boxes

Boxes for use with raceway systems: minimum 1 1/2 inches deep, except where shallower boxes required by structural conditions are approved. Boxes for other than lighting fixture outlets: minimum 4 inches square, except that 4 by 2 inch boxes may be used where only one raceway enters outlet. Telecommunications outlets: a minimum of 4 11/16 inches square by 2 1/8 inches deep, except for wall-mounted telephones (see Section 27 10 00 BUILDING TELECOMMUNICATIONS CABLING SYSTEMS). Mount outlet boxes flush in finished walls in finished spaces.

3.1.9.2 Pull Boxes

Construct of at least minimum size required by NFPA 70 of code-gauge aluminum or galvanized sheet steel, except where cast-metal boxes are required in locations specified herein. Provide boxes with screw-fastened covers. Where several feeders pass through common pull box, tag feeders to indicate clearly electrical characteristics, circuit numbers, and panel designations.

3.1.9.3 Extension Rings

Extension rings are not permitted for new construction.

3.1.10 Mounting Heights

Mount panelboards, enclosed circuit breakers, motor controller and disconnecting switches so height of center of grip of the operating handle of the switch or circuit breaker at its highest position is maximum 79 inches above floor or working platform or as allowed in Section 404.8 per NFPA 70. Mount lighting switches, receptacles, telecommunications outlets, and other devices as indicated on mounting height detail sheet.

3.1.11 Conductor Identification

Provide conductor identification within each enclosure where tap, splice, or termination is made. For conductors No. 6 AWG and smaller diameter, provide color coding by factory-applied, color-impregnated insulation. For conductors No. 4 AWG and larger diameter, provide color coding by plastic-coated, self-sticking markers; colored nylon cable ties and plates; or heat shrink-type sleeves. Identify control circuit terminations in accordance with Division 23 Specification Sections. Provide telecommunications system conductor identification as specified in Section 27 10 00 BUILDING TELECOMMUNICATIONS CABLING SYSTEMS.

3.1.11.1 Marking Strips

Provide marking strips for identification of power distribution, control, data, and communications cables in accordance with the following:

a. Provide white or other light-colored plastic marking strips, fastened by screws to each terminal block, for wire designations.

b. Use permanent ink for the wire numbers

c. Provide reversible marking strips to permit marking both sides, or provide two marking strips with each block.

d. Size marking strips to accommodate the two sets of wire numbers.

e. Assign a device designation in accordance with NEMA ICS 1 to each device to which a connection is made. Mark each device terminal to which a connection is made with a distinct terminal marking corresponding to the wire designation used on the Contractor's schematic and connection diagrams.

f. The wire (terminal point) designations used on the Contractor's wiring diagrams and printed on terminal block marking strips may be according to the Contractor's standard practice; however, provide additional wire and cable designations for identification of remote (external) circuits for the Government's wire designations.

g. Prints of the marking strips drawings submitted for approval will be so marked and returned to the Contractor for addition of the designations to the terminal strips and tracings, along with any rearrangement of points required.

3.1.12 Splices

Make splices in accessible locations. Make splices in conductors No. 10 AWG and smaller diameter with insulated, pressure-type connector. Make splices in conductors No. 8 AWG and larger diameter with solderless connector, and cover with insulation material equivalent to conductor insulation.

3.1.12.1 Splices of Aluminum Conductors

Make with solderless circumferential compression-type, aluminum-bodied connectors UL listed for AL/CU. Remove surface oxides from aluminum conductors by wire brushing and immediately apply oxide-inhibiting joint compound and insert in connector. After joint is made, wipe away excess joint compound, and insulate splice.

3.1.13 Covers and Device Plates

Install with edges in continuous contact with finished wall surfaces without use of mats or similar devices. Plaster fillings are not permitted. Install plates with alignment tolerance of 1/16 inch. Use of sectional-type device plates are not permitted. Provide gasket for plates installed in wet locations.

3.1.14 Electrical Penetrations

Seal openings around electrical penetrations through fire resistance-rated walls, partitions, floors, or ceilings in accordance with Section 07 84 00 FIRESTOPPING.

3.1.15 Grounding and Bonding

Provide in accordance with NFPA 70 and NFPA 780. Ground exposed, non-current-carrying metallic parts of electrical equipment, access flooring support system, metallic raceway systems, grounding conductor in

metallic and nonmetallic raceways, telecommunications system grounds, underground storage tanks and pipelines (see Section 33 56 10 FACTORY-FABRICATED FUEL STORAGE TANKS), and neutral conductor of wiring systems. Make ground connection at main service equipment, and extend grounding conductor to point of entrance of metallic water service. Make connection to water pipe by suitable ground clamp or lug connection to plugged tee. If flanged pipes are encountered, make connection with lug bolted to street side of flanged connection. Supplement metallic water service grounding system with additional made electrode in compliance with NFPA 70. Make ground connection to driven ground rods on exterior of building. Bond additional driven rods together with a minimum of 4 AWG soft bare copper wire buried to a depth of at least 12 inches. Interconnect all grounding media in or on the structure to provide a common ground potential. This includes lightning protection, electrical service, telecommunications system grounds, as well as underground metallic piping systems. Make interconnection to the gas line on the customer's side of the meter. Reference EG600 for minimum conductor sizing requirements. Use main size lightning conductors for interconnecting these grounding systems to the lightning protection system. In addition to the requirements specified herein, provide telecommunications grounding in accordance with TIA-607. Where ground fault protection is employed, ensure that connection of ground and neutral does not interfere with correct operation of fault protection.

3.1.15.1 Ground Rods

Provide ground rods and measure the resistance to ground using the fall-of-potential method described in IEEE 81. Do not exceed 25 ohms under normally dry conditions for the maximum resistance of a driven ground. If this resistance cannot be obtained with a single rod, additional rods, spaced on center. Spacing for additional rods must be a minimum of 10 feet. If the resultant resistance exceeds 25 ohms measured not less than 48 hours after rainfall, notify the Contracting Officer who will decide on the number of ground rods to add.

3.1.15.2 Grounding Connections

Make grounding connections which are buried or otherwise normally inaccessible, excepting specifically those connections for which access for periodic testing is required, by exothermic weld or high compression connector.

a. Make exothermic welds strictly in accordance with the weld manufacturer's written recommendations. Welds which are "puffed up" or which show convex surfaces indicating improper cleaning are not acceptable. Mechanical connectors are not required at exothermic welds.

b. Make high compression connections using a hydraulic or electric compression tool to provide the correct circumferential pressure. Provide tools and dies as recommended by the manufacturer. Use an embossing die code or other standard method to provide visible indication that a connector has been adequately compressed on the ground wire.

3.1.15.3 Ground Bus

Provide a copper ground bus in the electrical equipment rooms as indicated. Noncurrent-carrying metal parts of transformer neutrals and

other electrical equipment: effectively grounded by bonding to the ground bus. Bond the ground bus to both the entrance ground, and to a ground rod or rods as specified above having the upper ends terminating approximately 4 inches above the floor. Make connections and splices of the brazed, welded, bolted, or pressure-connector type, except use pressure connectors or bolted connections for connections to removable equipment.

3.1.15.4 Resistance

Maximum resistance-to-ground of grounding system: do not exceed 5 ohms under dry conditions. Where resistance obtained exceeds 5 ohms, contact Contracting Officer for further instructions.

3.1.15.5 Telecommunications System

Provide telecommunications grounding in accordance with the following:

a. Telecommunications Grounding Busbars: Provide a Primary bonding busbar (TGB) in the telecommunications entrance facility. Install the TGB as close to the electrical service entrance grounding connection as practicable. .

   1. Connectors: Mechanical type, cast silicon bronze, solderless compression type wire terminals, and long-barrel, two-bolt connection to ground bus bar.

   2. Ground Bus Bar: Copper, minimum 1/4 inch thick by 4 inches wide with 9/32-inch holes spaced 1-1/8 inches apart.

   3. Stand-Off Insulators: Comply with UL 891 for use in switchboards, 600 V. Lexan or PVC, impulse tested at 5000 V.

b. Telecommunications Bonding Conductors: Provide main telecommunications service equipment ground consisting of separate bonding conductor for telecommunications, between the TGB and readily accessible grounding connection of the electrical service. Grounding and bonding conductors should not be placed in ferrous metallic conduit. If it is necessary to place grounding and bonding conductors in ferrous metallic conduit that exceeds 3 feet in length, bond the conductors to each end of the conduit using a grounding bushing or a No. 6 AWG conductor, minimum.

c. Telecommunications Grounding Connections: Telecommunications grounding connections to the TGB: utilize listed compression two-hole lugs, exothermic welding, suitable and equivalent one hole non-twisting lugs, or other irreversible compression type connections. Bond all metallic pathways, cabinets, and racks for telecommunications cabling and interconnecting hardware located within the same room or space as the TGB to the TGB. In a metal frame (structural steel) building, where the steel framework is readily accessible within the room; bond each TGB to the vertical steel metal frame using a minimum No. 6 AWG conductor. Where the metal frame is external to the room and readily accessible, bond the metal frame to the TGB with a minimum No. 6 AWG conductor. When practicable because of shorter distances and, where horizontal steel members are permanently electrically bonded to vertical column members, the TGB may be bonded to these horizontal members in lieu of the vertical column members. All connectors used for bonding to the metal frame of a building must be listed for the intended purpose.

d. Comply with TIA-607.

3.1.16 Equipment Connections

Provide power wiring for the connection of motors and control equipment under this section of the specification. Except as otherwise specifically noted or specified, automatic control wiring, control devices, and protective devices within the control circuitry are not included in this section of the specifications and are provided under the section specifying the associated equipment.

3.1.17 Government-Furnished Equipment

Contractor rough-in for Government-furnished equipment make connections to Government-furnished equipment to make equipment operate as intended, including providing miscellaneous items such as plugs, receptacles, wire, cable, conduit, flexible conduit, and outlet boxes or fittings; except the contractor shall make final connections to Government-furnished systems furniture.

3.1.18 Surge Protective Devices

Connect the surge protective devices in parallel to the power source, keeping the conductors as short and straight as practically possible. Maximum allowed lead length is 3 feet avoiding 90 degree bends. Do not locate surge protective devices inside a panelboard or switchboard enclosure.

3.2 FIELD FABRICATED NAMEPLATE MOUNTING

Provide number, location, and letter designation of nameplates as indicated. Fasten nameplates to the device with a minimum of two sheet-metal screws or two rivets.

3.3 WARNING SIGN MOUNTING

Provide the number of signs required to be readable from each accessible side. Space the signs in accordance with NFPA 70E.

3.3.1 Remote Disconnecting Means Placards

For equipment with remote and/or lockable disconnecting means, provide a placard indicating the location of the disconnecting means.

3.4 FIELD APPLIED PAINTING

Paint electrical equipment as required to match finish of adjacent surfaces or to meet the indicated or specified safety criteria. Painting: as specified in Section 09 90 00 PAINTS AND COATINGS.Where field painting of enclosures for panelboards, load centers or the like is specified to match adjacent surfaces, to correct damage to the manufacturer's factory applied coatings, or to meet the indicated or specified safety criteria, provide manufacturer's recommended coatings and apply in accordance to manufacturer's instructions.

3.5 FIELD QUALITY CONTROL

Furnish test equipment and personnel and submit written copies of test

results. Give Contracting Officer 5 working days notice prior to each test. Where applicable, test electrical equipment in accordance with NETA ATS.

3.5.1 Devices Subject to Manual Operation

Operate each device subject to manual operation at least five times, demonstrating satisfactory operation each time.

3.5.2 600-Volt Wiring Test

Test wiring rated 600 volt and less to verify that no short circuits or accidental grounds exist. Perform insulation resistance tests on wiring No. 6 AWG and larger diameter using instrument which applies voltage of 1,000 volts DC for 600 volt rated wiring and 500 volts DC for 300 volt rated wiring per NETA ATS to provide direct reading of resistance. All existing wiring to be reused must also be tested.

3.5.3 Transformer Tests

3.5.3.1 Low- to Low-Voltage Transformer Tests

Perform the standard, not optional, tests in accordance with the Inspection and Test Procedures for transformers, dry type, air-cooled, 600 volt and below; as specified in NETA ATS. Measure primary and secondary voltages for proper tap settings. Tests need not be performed by a recognized independent testing firm or independent electrical consulting firm.

3.5.3.2 Medium- to Low-Voltage Transformer Tests

a. Visual and Mechanical Inspection

(1) Compare equipment nameplate information with specifications and approved shop drawings.

(2) Inspect physical and mechanical condition.

(3) Inspect all bolted electrical connections for high resistance using low-resistance ohmmeter, verifying tightness of accessible bolted electrical connections by calibrated torque-wrench method, or performing thermographic survey.

(4) Perform specific inspections and mechanical tests as recommended by manufacturer.

(5) Verify that resilient mounts are free and shipping brackets have been removed.

(6) Verify that winding core, frame, and enclosure groundings are correct.

(7) Verify that as-left tap connections are as specified.

b. Electrical Tests

(1) Perform insulation-resistance tests.

(2) Perform power-factor tests or dissipation-factor tests in

accordance with the test equipment manufacturer's instructions.

(3) Perform resistance measurements through all bolted connections with low-resistance ohmmeter, if applicable.

(4) Perform turns-ratio tests.

(5) Perform an applied-voltage test on high and low voltage windings-to-ground. See IEEE C57.12.91. The ac dielectric-withstand-voltage test result must not exceed 75 percent of factory test voltage for one-minute duration. The dc dielectric-withstand-voltage test result must not exceed 100 percent of the ac rms test voltage specified in IEEE C57.12.91 for a one-minute duration. If no evidence of distress or insulation failure is observed by the end of the total time of voltage application during the dielectric-withstand-voltage test, the test specimen is considered to have passed the test.

(6) Verify correct secondary voltage phase-to-phase and phase-to-neutral after energization and prior to loading.

3.5.4 Ground-Fault Receptacle Test

Test ground-fault receptacles with a "load" (such as a plug in light) to verify that the "line" and "load" leads are not reversed. Press the TEST button and then the RESET button to verify by LED status that the device is a self-test model as specified in UL 943.

3.5.5 Arc-Fault Receptacle Test

Test arc-fault receptacles with a "load" (such as a plug in light) to verify that the "line" and "load" leads are not reversed. Press the TEST button and then the RESET button to verify by LED status that the device is a self-test model as specified in UL 1699.

3.5.6 Grounding System Test

Test grounding system to ensure continuity, and that resistance to ground is not excessive. Test each ground rod for resistance to ground before making connections to rod; tie grounding system together and test for resistance to ground. Make resistance measurements in dry weather, not earlier than 48 hours after rainfall. Submit written results of each test to Contracting Officer, and indicate location of rods as well as resistance and soil conditions at time measurements were made.

3.5.7 Phase Rotation Test

Perform phase rotation test to ensure proper rotation of service power prior to operation of new or reinstalled equipment using a phase rotation meter. Follow the meter manual directions performing the test.

-- End of Section --

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SECTION 26 36 23

AUTOMATIC TRANSFER SWITCHES AND BY-PASS/ISOLATION SWITCH
05/20, CHG 1: 08/21

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM B117	(2019) Standard Practice for Operating Salt Spray (Fog) Apparatus
ASTM D709	(2017) Standard Specification for Laminated Thermosetting Materials

INTERNATIONAL ELECTRICAL TESTING ASSOCIATION (NETA)

NETA ATS	(2021) Standard for Acceptance Testing Specifications for Electrical Power Equipment and Systems

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA 250	(2020) Enclosures for Electrical Equipment (1000 Volts Maximum)
NEMA ICS 2	(2000; R 2020) Industrial Control and Systems Controllers, Contactors, and Overload Relays Rated 600 V
NEMA ICS 4	(2015) Application Guideline for Terminal Blocks
NEMA ICS 6	(1993; R 2016) Industrial Control and Systems: Enclosures

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2023; ERTA 7 2023; TIA 23-15) National Electrical Code
NFPA 110	(2022) Standard for Emergency and Standby Power Systems

UL SOLUTIONS (UL)

UL 508	(2018; Reprint Jul 2021) UL Standard for Safety Industrial Control Equipment
UL 1008	(2022) UL Standard for Safety Transfer Switch Equipment

UL 1066	(2022) UL Standard for Safety Low-Voltage AC and DC Power Circuit Breakers Used in Enclosures

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Automatic Transfer Switch Drawings; G, DO

SD-03 Product Data

Automatic Transfer Switches; G, DO

By-Pass/Isolation Switch (BP/IS); G, DO

SD-06 Test Reports

Acceptance Checks and Tests; G, RO

Functional Acceptance Tests; G, RO

Factory Testing; G, RO

Factory Test Reports; G, RO

SD-07 Certificates

Proof of Listing; G, RO

SD-10 Operation and Maintenance Data

Operation and Maintenance Manual, Submit in accordance with Section 01 78 23 OPERATION AND MAINTENANCE DATA, Data Package 5; G, RO

1.2.1 Submittal Coordination and Sequencing Requirements

See references to this Specifications Section and/or specific submittal items in Section 01 33 00, as well as requirements herein and as referenced in other parts of this contract, for coordination and sequencing of submittals and the associated work to be performed.

1.3 OPERATION AND MAINTENANCE MANUAL

Assemble and bind manuals in durable, hard-covered, water resistant binders. Assemble and index the manuals per the following table of contents:

a. Manufacturer's O&M per "SD-10 Operation and Maintenance Data".

b. Catalog data required by "SD-03 Product Data"

c. Drawings required by "SD-02 Shop Drawings".

1.3.1 Additions to Operation and Maintenance Manuals

In addition to requirements of SD-10 Data Package 5, include the followings on the actual equipment provided:

a. An outline drawing, front, top, and side views.

b. Prices for spare parts and supply list.

c. Date of Purchase.

d. Corrective maintenance procedures.

e. Operating manual outlining step-by-step procedures for system startup, operation, and shutdown.

f. Include simplified wiring and control diagrams in the manual for system as installed.

g. Provide typical contact voltage drop readings under specified conditions for use during periodic maintenance. Provide instructions for determination of contact integrity.

1.3.2 Spare Parts

Furnish the following the following minimum spare parts and any other spare parts required in one-year operation, of the same material and workmanship, meeting the same requirements, and interchangeable with the corresponding original parts.

a. Fuses: Two of each type and rating.

1.4 QUALITY ASSURANCE

1.4.1 Proof of Listing

Submit proof of listing by UL 1008.

1.4.2 Automatic Transfer Switch Drawings

Include the following as a minimum:

a. An outline drawing, including front, top, and side views.

b. Provide a nameplate of corrosion-resistant material with not less than 1/8 inch tall characters showing manufacturer's name and equipment ratings. Mount nameplate to front of enclosure and meet the nameplate requirements of NEMA ICS 2.

c. Provide detail drawings that include manufacturer's name and catalog number, electrical ratings, total system transfer statement, reduced normal supply voltage at which transfer to the alternate supply is initiated, transfer delay times, short-circuit current rating, wiring diagram, description of interconnections, testing instructions, acceptable conductor type for terminals, tightening torque for each wire connector, and other required UL 1008 markings.

d. Submit interface equipment connection diagram showing conduit and wiring between ATS and related equipment. Provide diagrams showing interlocking provisions and cautionary notes, if any.

e. Drawings are to indicate adequate clearance for operation, maintenance, and replacement of operating equipment devices. [*Am-00002]

f. Document temperature limitations of both extremes for all components. For automatic transfer switches identified on one-line as requiring consideration, provide heating elements as determined by manufacturer specifications and component limitations. Perform calculations to confirm consistent heating of enclosure. Power from internal distribution. [**Am-00002]

1.4.3 Regulatory Requirements

In each of the publications referred to herein, consider the advisory provisions to be mandatory, as though the word "must" had been substituted for "should" wherever it appears. Interpret references in these publications to the "authority having jurisdiction," or words of similar meaning, to mean the Contracting Officer. Equipment, materials, installation, and workmanship must be in accordance with the mandatory and advisory provisions of NFPA 70 unless more stringent requirements are specified or indicated

1.4.4 Standard Product

Provide materials and equipment that are products of manufacturers regularly engaged in the production of such products which are of equal material, design and workmanship, and:

a. Have been in satisfactory commercial or industrial use for 2 years prior to bid opening including applications of equipment and materials under similar circumstances and of similar size.

b. Have been on sale on the commercial market through advertisements, manufacturers' catalogs, or brochures during the 2-year period.

c. Where two or more items of the same class of equipment are required, provide products of a single manufacturer; however, the component parts of the item need not be the products of the same manufacturer unless stated in this section.

1.4.4.1 Alternative Qualifications

Products having less than a 2-year field service record are acceptable if the manufacturer has been regularly engaged in the design and production of automatic transfer switches and if a certified record of satisfactory field operation for not less than 6000 hours, exclusive of the manufacturers' factory or laboratory tests, is furnished.

1.4.4.2 Material and Equipment Manufacturing Date

Products manufactured more than 1 years prior to date of delivery to site are not acceptable.

1.5 DELIVERY AND STORAGE

Protect equipment placed in storage from humidity and temperature variations, moisture, water intrusion, dirt, dust, or other contaminants. In harsh environments where temperatures exceed non-operational parameters established within this specification, provide an environmentally controlled equipment storage facility to ensure temperature parameters are within equipment specification. Provide documentation of same to the Government when storage is implemented.

1.6 ENVIRONMENTAL CONDITIONS

Provide an ATS that is suitable for prolonged performance under following service conditions:

a. Operating altitude: Sea level to 3,300 ft. (Systems applied at higher altitudes are to be derated in accordance with the manufacturer's instructions).

b. Operating ambient temperature range: 40 to 104 degrees F.

c. Operating relative humidity: 0 to 90 percent, without condensation.

1.7 SEISMIC REQUIREMENTS

Provide seismic details conforming to Section 26 05 48, SEISMIC PROTECTION FOR ELECTRICAL EQUIPMENT.

PART 2 PRODUCTS

2.1 AUTOMATIC TRANSFER SWITCHES

Each automatic transfer switch must be rated and marked for total system transfer and have the current and voltage ratings as indicated. Provide a switch operating mechanism that is electrically operated, have quick-make, quick-break, load break contacts, and be mechanically held in both positions. Switches utilizing circuit breakers are not acceptable. Provide an ATS that is UL listed. ATS must be manufactured and tested in accordance with applicable requirements of NEMA ICS 2, UL 1008 and UL 1066. ATS must conform to NFPA 110. Provide the ATS with the following characteristics:

a. Voltage: 480 volts ac.

b. Amperage: As Indicated on EP601. Provide an ATS with a continuous load current rating of the switch rating.

c. Number of Phases: Three.

d. Number of Wires: Four.

e. Frequency: 60 Hz.

f. Poles: Four switched. One of the poles is the neutral.

g. ATS Withstand Current Rating: ATS must be rated to close on and withstand the available RMS symmetrical short circuit current at the ATS terminals. The ATS must be listed in accordance with UL 1008 for 18 cycle close and withstand ratings.

h. Nonwelding Contacts: Provide contacts that are nonwelding at the available fault current rating. Contacts must be suitable for repetitive power transfer switching. Switches rated 800 amps and above must have segmented, blow-on construction for high withstand and close-on capability and be protected by separate arcing contacts.

i. Phase and Neutral Contacts: Provide contacts with silver alloy composition. Provide neutral contacts with the same continuous current rating as main or phase contacts.

j. Configuration. Provide an ATS for use in emergency systems described in NFPA 70. Provide an ATS that is listed for emergency use.

k. ATS Configuration. Provide an open transition ATS.

2.1.1 Undervoltage Sensing - Normal/Preferred Source

Undervoltage Sensing - Normal Source. Provide undervoltage sensing for each phase in the normal/preferred source. Sense low phase-to-ground voltage on each phase. Provide sensing circuit with adjustable dropout, 75-98 percent of nominal value and adjustable pickup, 85-100 percent of nominal value. Factory set dropout value to 90percent. Factory set pickup value to 90percent.

2.1.2 Voltage/Frequency Lockout Relay - Alternate/Emergency Source

Voltage/Frequency Lockout Relay. Three-phase sensing must be provided on the normal and emergency source. Prevent premature transfer to alternate/emergency source. Provide pickup voltage that is adjustable from 85-100 percent of nominal. Factory set for pickup at 90 percent. Provide pickup frequency that is adjustable from 90-97 percent of nominal. Factor set frequency pickup for 95 percent.

2.1.3 Adjustable Time Delay - Transfer to Alternate/Emergency Power Source

Adjustable Time Delay - Transfer to Alternate Power Source. Transfer to alternate power source time delay for transfer switches as indicated, adjustable 0-5 minutes. Factory set to 10 seconds. ATS is to monitor the frequency and voltage of alternate power source and transfer when frequency and voltage are stabilized.

2.1.4 Adjustable Time Delay- Re-transfer to Normal/Preferred Source

Adjustable Time Delay- Transfer to Source. Re-transfer to normal source time delay, adjustable 0-30 minutes. Factory set at 10 minutes. Time delay is automatically defeated upon loss or sustained undervoltage of alternate power source, provided that normal source has been restored.

2.1.5 Engine-Generator Exerciser

Exerciser. Solid-state, programmable-time switch exerciser to allow automatic starting of the generator set, subsequent load transfer, retransfer of load and shuts down engine after a preset cool-down period. Initiates exercise cycle at preset intervals adjustable from on a daily, weekly, bi-weekly or monthly basis.. Running periods are adjustable from 10-30 minutes. Factory settings are for 7-day exercise cycle, 20 minute running period and 5-minute cool-down period. Exerciser features include the following:

a. Exerciser Transfer Selector Switch: Permits selection of exercise with and without load transfer or dual independent exercisers that allow for unloaded and loaded schedule testing.

b. Push-button programming control with digital display of settings.

c. Integral battery operation of time switch when normal control power is not available.

2.1.6 Unassigned Auxiliary Contacts

Provide two normally open and two normally closed, single-pole, double-throw auxiliary contacts for each switch position rated at 10 amperes at 480 volts.

2.1.7 Front Panel Devices

Provide devices mounted on cabinet front consisting of:

a. Mode selector switch with the following positions and associated functions. Selector switch can be part of the microprocessor controller consisting of an LCD screen with a graphical interface or as a stand-alone test switch.

(1) TEST - Simulates loss of normal/preferred source system operation.

(2) NORMAL - Transfers system to normal/preferred source bypassing re-transfer time delay.

b. Switch position indicating lights or graphical LCD display. Indicate source to which load is connected.

c. Source-Available Monitor. Provide source-available indicating lights or graphical LCD display monitor that is labeled to show when one or both sources of power are available. If indicating lights are used, then the preference is to have Green be normal/preferred power and Red be for alternate/emergency power; however, other color schemes are allowed if clearly marked.

d. Lamp test button.

2.1.8 In-Phase Monitor

Provide an in-phase monitor that consists of a factory-wired, internal relay that controls transfer so it occurs only when the two sources are synchronized in phase. Relay compares phase relationship and frequency difference between normal and emergency sources and initiates transfer when both sources are within 5 electrical degrees, and only if transfer can be completed within 60 electrical degrees. Transfer is initiated only if both sources are within 2 Hz of nominal frequency and 70 percent or more of nominal voltage Manufacturer is to provide information regarding what conditions a transfer cannot be accomplished.

2.2 BY-PASS/ISOLATION SWITCH (BP/IS)

Include non-load-break by-pass/isolation switches for the indicated automatic transfer switches. Designs which disconnect or interrupt the load when bypassing are not acceptable. Include the following features

for each combined by-pass/isolation switch and automatic transfer switch:

a. Bypass/isolation switch (BP/IS) and associated ATS are to be made by the same manufacturer and must be completely interconnected and tested at factory and at project site as specified.

b. ATS is to be manufactured, listed and tested in accordance with paragraph AUTOMATIC TRANSFER SWITCH. BP/IS switch current, voltage, closing, and short-circuit withstand closing ratings are to be equal or exceed comparable ratings specified for ATS and have the same phase arrangement and number of poles.

c. Provide externally operated and arranged selector switch or handle so designed and constructed not to stop in an intermediate or neutral position during operation and that one person can safely bypass the ATS. Accomplish isolation of the ATS externally by one person. Bypass and isolation handles must be permanently affixed and operable without opening the enclosure door. Provide interlocks that ensure ATS is disconnected from source and load during isolation. Interlocks prevent ATS operation, except for testing and maintenance, while isolated. BP/IS operation is to be accomplished without disconnecting switch load terminal conductors. Equipment which require separate tools, keys, or other devices to operate the bypass/isolation mechanism which may not be present during an emergency is not acceptable.

d. Provide drawout transfer switch that provides physical separation from bypass switch and live parts and accessibility for testing and maintenance operation.

e. Provide contacts that have the same contact temperature that do not exceed those of the ATS contacts when carrying rated load. Provide contacts as specified for associated ATS, including provisions for inspection of contacts without disassembly of BP/IS or removal of entire contact enclosure. Provide manufacturer instructions for determining contact integrity in order To facilitate maintenance.

f. The ATS controls remain functional with the ATS isolated or in bypass mode to permit monitoring of the normal power source and automatic starting of the generator in the event of a loss of the normal power source. In the isolated mode, the bypass section is capable of functioning as a manual transfer to transfer the load to either power source for maintenane purposes or when automatic control has failed. Equipment that requires automatic controls to be functional to operate the bypass switch is not acceptable.. The ATS can be completely removed from the enclosure, if required for maintenance or repair, while the bypass section continues to power the load.

h. Construct Bypass/isolation switch for convenient removal of parts from front of switch enclosure without removal of other parts or disconnection of external power conductors.

i. Achieve load by-pass to the source with no load interruption. Bypass/isolation equipment that breaks the load is not accpetalbe.

k. Provide a means to ensure the switch is transferred to the alternate or emergency power source when normal power source becomes unavailable.

2.2.1 Markings

Mark isolation handle positions with engraved plates or other approved means to indicate position or operating condition of associated ATS, as follows:

a. Provide an indication that shows that BP/IS section is providing power to the load.

b. Provide indication of ATS isolation/test position.

c. Provide suitable control labels and instruction signs describing operating instructions.

d. Indicating lamps or LCD screen for indicating that shows the source availability, bypass switch position, transfer switch position, and isolation handle position. If indicating lights are used, provide a lamp test button that turns the indicating lights on, but does not cause any function to take place.

2.2.2 Interconnection

Interconnect BP/IS and associated ATS with suitably sized copper bus bars silver-plated at each connection point, and braced to withstand magnetic and thermal forces created at withstand current rating specified for associated ATS.

2.3 ENCLOSURE

Provide an enclosure that meets the following:

a. Provide ATS and accessories in a wall-mounted, ventilated NEMA 250, Type 1, smooth sheet metal enclosure constructed in accordance with applicable requirements of NEMA ICS 6, UL 508, UL 1066, and UL 1008. Provide door with suitable hinges, locking handle latch, and gasketed jamb. Provide at least No. 14 metal gauge.

b. Factory wiring within enclosure and field wiring terminating within enclosure must comply with NFPA 70. Provide wire that is permanently tagged or marked near terminal at each end with wire number shown on approved detail drawing, when wiring is not color coded. Conform terminal block to NEMA ICS 4. Arrange terminals for entrance of external conductors from top and bottom of enclosure as shown. Main switch terminals, including neutral terminal if used, must be pressure type suitable for termination of external copper conductors shown.

2.3.1 Construction

Construct enclosure for ease of removal and replacement of ATS components and control devices from front without disconnection of external power conductors or removal or disassembly of major components.

2.3.2 Cleaning and Painting

Protect both the inside and outside surfaces of an enclosure, including means for fastening against corrosion by enameling, galvanizing, plating, powder coating, or other equivalent means. Protection is not required for metal parts that are inherently resistant to corrosion, bearings, sliding surfaces of hinges, or other parts where such protection is impractical.

Provide manufacturer's standard finish material, process, and color that is free from runs, sags, peeling, or other defects. An enclosure marked Type 1, 3R, 4 or 12 is acceptable if there is no visible rust at the conclusion of a salt spray (fog) test using the test method in ASTM B117, employing a 5 percent by weight, salt solution for 24 hours. Type 4X enclosures are acceptable following performance of the above test with an exposure time of 200 hours.

2.3.3 Field Fabricated Nameplates

Nameplate is to comply with ASTM D709. Provide laminated plastic nameplates for each equipment enclosure as specified or as indicated on the drawings. Provide an inscription on each nameplate that identifies the name of the equipment, sources of power, calculated short circuit with date and the location e.g. 'SWB-1 Electrical Room 103'. Provide nameplates that are made of melamine plastic, 0.125 inch thick, white with black center core. Provide the nameplate with a surface that is matte finished and that has square corners.. Accurately align lettering and engrave into the core. Provide nameplates that are at least 1.0 by 2.5 inches with a minimum lettering size of 0.25 inch high normal block style.

2.4 FACTORY TESTING

Submit a description of proposed field test procedures, including proposed date and steps describing each test, its duration and expected results, not less than 2 weeks prior to test date. Submit certified factory and field test reports, within 14 days following completion of tests. Provide reports that are certified and dated and that demonstrate that tests were successfully completed prior to shipment of equipment.

2.4.1 Prototype Factory Testing

A prototype of specified ATS is to be factory tested in accordance with UL 1008. In addition, perform factory tests on each ATS as follows:

a. Insulation resistance test to ensure integrity and continuity of entire system

b. Main switch contact resistance test.

c. Visual inspection to verify that each ATS is as specified.

d. Mechanical test to verify that ATS sections are free of mechanical hindrances.

e. Electrical tests to verify complete system electrical operation and to set up time delays and voltage sensing settings.

2.4.2 Factory Test Reports

Provide three certified copies of factory test reports from the manufacturer.

PART 3 EXECUTION

3.1 INSTALLATION

Installation must conform to the requirements of NFPA 70 and manufacturer's recommendation.

3.2 PREREQUISITES FOR FUNCTIONAL ACCEPTANCE TESTING

Completion of the following requirements is mandatory prior to scheduling functional acceptance tests for the automatic transfer switch.

3.2.1 Performance of Acceptance Checks and tests

Complete as specified in paragraph entitled "Acceptance Checks and Tests". The Acceptance Checks and Tests are to be accomplished by the Testing organization as described in Section 26 08 00 APPARATUS INSPECTION AND TESTING.

3.2.2 Manufacturers O&M Information

The manufacturers O&M information required by the paragraph entitled "SD-10 Operation and Maintenance Data", is to be submitted to and approved by the Contracting Officer.

3.2.3 Test Equipment

Ensure all test equipment and instruments is on hand prior to scheduling field tests, or subject to Contracting Officer's approval, evidence must be provided to show that arrangements have been made to have the necessary equipment and instruments on site prior to field testing.

3.3 FIELD QUALITY CONTROL

Give Contracting Officer 15 days notice of dates and times scheduled for tests which require the presence of the Contracting Officer. The Contracting Officer will coordinate with the using activity and schedule a time that will eliminate or minimize interruptions and interference with the activity operations. The contractor is responsible for costs associated with conducting tests outside of normal working hours and with incorporating special arrangements and procedures, including temporary power conditions. The contractor provides labor, equipment, apparatus, including test load, and consumables required for the specified tests. Calibration of all measuring devices and indicating devices must be certified. Provide the services of a qualified factory-trained manufacturer's representative to assist the contractor in installation and start-up of the equipment specified under this section. The manufacturer's representative is to provide technical direction and assistance to the contractor in general assembly of the equipment, connections and adjustments, and testing of the assembly components contained herein. Perform the following field tests in accordance with the manufacturer's recommendations and include the following visual and mechanical inspections and electrical tests, performed in accordance with NETA ATS.

3.3.1 Automatic Transfer Switch Acceptance Checks and Tests

a. Visual and Mechanical Inspection

(1) Compare equipment nameplate data with specifications and approved shop drawings.

(2) Inspect physical and mechanical condition.

(3) Confirm correct application of manufacturer's recommended

lubricants.

(4) Verify that manual transfer warnings are attached and visible.

(5) Verify tightness of all control connections.

(6) Verify tightness of accessible bolted connections by calibrated torque-wrench method. Thermographic survey is not required.

(7) Perform manual transfer operation.

(8) Verify positive mechanical interlocking between normal and alternate sources.

b. Electrical Tests

(1) Measure contact-resistance. Correct values that exceed 500 microhms and values for 1 pole deviating by more than 50 percent from other poles.

(2) Perform insulation-resistance on each pole, phase-to-phase and phase-to-ground with switch closed, and across each open pole for one minute. Perform tests in both source positions.

(3) Verify settings and operations of control devices.

(4) Calibrate and set all relays and timers.

3.3.2 Functional Acceptance Tests

Functional Acceptance Tests must be coordinated with Section 26 32 15 ENGINE-GENERATOR SET STATIONARY 15-2500 KW, WITH AUXILIARIES.Functional Acceptance Test must be coordinated with Section 21 30 00 FIRE PUMPS. Include simulating power failure and demonstrating the following operations for each automatic transfer switch. Demonstrate in service that the automatic transfer switches are in good operating condition, and function not less than five times.

a. Perform automatic transfer tests:

(1) Simulate loss of normal/preferred power.

(2) Return to normal/preferred power.

(3) Simulate loss of emergency/alternate power.

(4) Simulate all forms of single-phase conditions.

b. Verify correct operation and timing of the following functions:

(1) Normal source voltage-sensing relays.

(2) Engine start sequence.

(3) Time delay upon transfer.

(4) Alternate source voltage-sensing relays.

(5) Automatic transfer operation.

(6) Interlocks and limit switch function.

(7) Time delay and retransfer upon normal power restoration.

(8) By-pass/isolation functional modes and related automatic transfer switch operations.

3.3.3 Infrared Scanning

After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each switch. Remove all access panels so joints and connections are accessible to portable scanner.

a. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each switch 11 months after acceptance.

b. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.

c. Record of Infrared Scanning: Prepare a certified report that identifies switches checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.4 TRAINING

Provide 4 hours of training to maintenance personnel on the proper operation, maintenance and adjustment of the automatic transfer switch. Coordinate this training with that of the generator equipment.

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SECTION 26 51 00

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SECTION 26 51 00

INTERIOR LIGHTING
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PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS (ASHRAE)

ASHRAE 189.1	(2014) Standard for the Design of High-Performance Green Buildings Except Low-Rise Residential Buildings
ASHRAE 90.1 - IP	(2019) Energy Standard for Buildings Except Low-Rise Residential Buildings

ASTM INTERNATIONAL (ASTM)

ASTM A580/A580M	(2023) Standard Specification for Stainless Steel Wire
ASTM A641/A641M	(2019) Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire
ASTM A653/A653M	(2023) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM A1008/A1008M	(2021a) Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable
ASTM B164	(2003; R 2014) Standard Specification for Nickel-Copper Alloy Rod, Bar, and Wire
ASTM B633	(2023) Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel
ASTM D4674 REV A	(2002; R 2010) Standard Practice for Accelerated Testing for Color Stability of Plastics Exposed to Indoor Office Environments

EUROPEAN UNION (EU)

Directive 2011/65/EU	(2011) Restriction of the Use of Certain

	Hazardous Substances in Electrical and Electronic Equipment

ILLUMINATING ENGINEERING SOCIETY (IES)

ANSI/IES LM-79	(2019) Approved Method: Electrical and Photometric Measurements of Solid State Lighting Products
ANSI/IES LM-80	(2020) Approved Method: Measuring Luminous Flux and Color Maintenance of LED Packages, Arrays and Modules
ANSI/IES LS-1	(2020) Lighting Science: Nomenclature and Definitions for Illuminating Engineering
ANSI/IES TM-15	(2020) Technical Memorandum: Luminaire Classification System for Outdoor Luminaires
ANSI/IES TM-21	(2021) Technical Memorandum: Projecting Long-TermLuminous, Photon, and Radiant Flux Maintenance of LED Light Sources
IES Lighting Library	IES Lighting Library

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE 100	(2000; Archived) The Authoritative Dictionary of IEEE Standards Terms
IEEE C2	(2023) National Electrical Safety Code
IEEE C62.41	(1991; R 1995) Recommended Practice on Surge Voltages in Low-Voltage AC Power Circuits

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA 77	(2017) Temporal Light Artifacts: Test Methods and Guidance for Acceptance Criteria
NEMA 250	(2020) Enclosures for Electrical Equipment (1000 Volts Maximum)
NEMA ANSLG C78.377	(2017) Electric Lamps— Specifications for the Chromaticity of Solid State Lighting Products
NEMA C82.77-10	(2020) Harmonic Emission Limits - Related Power Quality Requirements
NEMA ICS 2	(2000; R 2020) Industrial Control and Systems Controllers, Contactors, and Overload Relays Rated 600 V
NEMA SSL 1	(2016) Electronic Drivers for LED Devices, Arrays, or Systems

NEMA SSL 3	(2011) High-Power White LED Binning for General Illumination
NEMA SSL 7A	(2015) Phase-Cut Dimming for Solid State Lighting: Basic Compatibility
NEMA WD 1	(1999; R 2020) Standard for General Color Requirements for Wiring Devices
NEMA WD 7	(2011; R 2016; R 2021) Occupancy Motion Sensors Standard

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2023; ERTA 7 2023; TIA 23-15) National Electrical Code
NFPA 101	(2024) Life Safety Code
NFPA 110	(2022) Standard for Emergency and Standby Power Systems

U.S. DEPARTMENT OF DEFENSE (DOD)

[*Am-2]

UFC 3-530-01	(2023); Change 1 2023 Interior and Exterior Lighting Systems [**Am-2]

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

47 CFR 15	Radio Frequency Devices

UL SOLUTIONS (UL)

UL 20	(2018; Reprint Jan 2021) UL Standard for Safety General-Use Snap Switches
UL 94	(2023; Reprint May 2023) UL Standard for Safety Tests for Flammability of Plastic Materials for Parts in Devices and Appliances
UL 508	(2018; Reprint Jul 2021) UL Standard for Safety Industrial Control Equipment
UL 844	(2012; Reprint Oct 2021) UL Standard for Safety Luminaires for Use in Hazardous (Classified) Locations
UL 916	(2015; Reprint Oct 2021) UL Standard for Safety Energy Management Equipment
UL 924	(2016; Reprint Dec 2022) UL Standard for Safety Emergency Lighting and Power Equipment
UL 1472	(2015) UL Standard for Safety Solid-State Dimming Controls

UL 1598	(2021; Reprint Jan 2024) UL Standard for Safety Luminaires
UL 2043	(2013) Fire Test for Heat and Visible Smoke Release for Discrete Products and Their Accessories Installed in Air-Handling Spaces
UL 8750	(2015; Reprint Sep 2021) UL Standard for Safety Light Emitting Diode (LED) Equipment for Use in Lighting Products

1.2 RELATED REQUIREMENTS

Materials not considered to be luminaires, luminaire accessories, or lighting equipment are specified in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM. Luminaires and accessories that are mounted in exterior environments and not attached to the exterior of the building are specified in Section 26 56 00 EXTERIOR LIGHTING. Commissioning requirements are specified in Section 01 91 00.15 BUILDING COMMISSIONING.

1.3 DEFINITIONS

a. Unless otherwise specified or indicated, electrical and electronics terms used in these specifications and on the drawings, must be as defined in IEEE 100 and ANSI/IES LS-1.

b. For LED luminaire light sources, "Useful Life" is the operating hours before reaching 70 percent of the initial rated lumen output (L70) with no catastrophic failures under normal operating conditions. This is also known as 70 percent "Rated Lumen Maintenance Life" as defined in ANSI/IES LM-80.

c. For LED luminaires, "Luminaire Efficacy" (LE) is the appropriate measure of energy efficiency, measured in lumens/watt. This is gathered from LM-79 data for the luminaire, in which absolute photometry is used to measure the lumen output of the luminaire as one entity, not the source separately and then the source and housing together.

d. Total harmonic distortion (THD) is the root mean square (RMS) of all the harmonic components divided by the total fundamental current.

1.4 SUBMITTALS

Government approval is required for submittals with a "G" classification. Submittals not having a "G" classification are for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Luminaire Drawings; G, DO

Sequence of Operation for Lighting Control System; G, DO

SD-03 Product Data

Luminaires; G, DO

Light Sources; G, DO

LED Drivers; G, DO

Luminaire Warranty; G, RO

Luminaire Design Data; G, DO

Lighting Controls Warranty; G, RO

Local Area Controller; G, DO

Lighting Contactor; G, DO

Switches; G, DO

Wall Box Dimmers; G, DO

Occupancy/Vacancy Sensors; G, DO

Photosensors; G, DO

Power Packs; G, DO

Power Hook Luminaire Hangers; G, DO

Exit Signs; G, DO

LED Emergency Lighting Transfer Switch; G, DO

Central Emergency Lighting System; G, DO

Include in submittals the information required by the "CFCI Equipment Electrical Data" submittal in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM and as described in Section 01 33 00 Subpart "Contractor-Furnished Items Requiring Electrical Interface".

SD-06 Test Reports

ANSI/IES LM-79 Test Report; G, DO

ANSI/IES LM-80 Test Report; G, DO

ANSI/IES TM-21 Test Report; G, DO

Photosensor Verification Test; G, RO

SD-07 Certificates

LED Driver and Control System Interface Compatibility Certificate; G, RO

SD-10 Operation and Maintenance Data

End-User Training Plan; G, RO

1.4.1 Submittal Coordination and Sequencing Requirements

See references to this Specifications Section and/or specific submittal items in Section 01 33 00, as well as requirements herein and as referenced in other parts of this contract, for coordination and sequencing of submittals and the associated work to be performed.

1.5 QUALITY ASSURANCE

Data, drawings, and reports must employ the terminology, classifications and methods prescribed by the IES Lighting Library as applicable, for the lighting system specified.

1.5.1 Luminaire Drawings

Include dimensions, accessories installation details, and construction details. Photometric data, including CRI, CCT, LED driver type, zonal lumen data, candlepower distribution data, and other data as identified by UFC 3-530-01 Paragraph 3-2 Lighting Calculations, must accompany shop drawings.

LLFs shall be as identified in Luminaire Schedules in column "FIO LLF".

LED Luminaires shall use a light loss factor (LLF) of 0.700 regardless of life beyond the required L70 value described in this specification section.

Include light loss factors by fixture type on the Luminaire Drawings.

Calculation points shall be located on grids with point spacing to be no greater than 1/3 the luminaire mounting height.

1.5.2 Luminaire Design Data

a. Provide safety certification and file number for the luminaire family that must be listed, labeled, or identified in accordance with the NFPA 70. Applicable testing bodies are determined by the US Occupational Safety Health Administration (OSHA) as Nationally Recognized Testing Laboratories (NRTL) and include: CSA (Canadian Standards Association), ETL (Edison Testing Laboratory), and UL (Underwriters Laboratories).

b. Provide long-term lumen maintenance projections for each LED luminaire in accordance with ANSI/IES TM-21. Data used for projections must be obtained from testing in accordance with ANSI/IES LM-80.

1.5.3 ANSI/IES LM-79 Test Report

Submit test report on manufacturer's standard production model of specified luminaire. Testing must be performed at the same operating drive current as specified luminaire. Include all applicable and required data in IES format as outlined under "14.0 Test Report" in ANSI/IES LM-79.

1.5.4 ANSI/IES LM-80 Test Report

Submit report on manufacturer's standard production LED light source (package, array, or module) of specified luminaire. Testing must be performed at the same operating drive current as specified luminaire. Include all applicable and required data as outlined under "8.0 Test Report" in ANSI/IES LM-80.

1.5.5 ANSI/IES TM-21 Test Report

Submit test report on manufacturer's standard production LED light source (package, array, or module) of specified luminaire. Testing must be performed at the same operating drive current as specified luminaire. Include all applicable and required data, as well as required interpolation information as outlined under "7.0 Report" in ANSI/IES TM-21.

1.5.6 LED Driver and Control System Interface Compatibility Certificate

Submit certification from the luminaire, driver, or control system manufacturer that ensures compatibility and operability between devices.

1.5.7 Test Laboratories

Test laboratories for the ANSI/IES LM-79 and ANSI/IES LM-80 test reports must be one of the following:

a. National Voluntary Laboratory Accreditation Program (NVLAP) accredited for solid-state lighting testing as part of the Energy-Efficient Lighting Products laboratory accreditation program for both LM-79 and LM-80 testing.

b. One of the qualified labs listed on the Department of Energy - LED Lighting Facts Approved Testing Laboratories List for LM-79 testing.

c. One of the EPA-Recognized Laboratories listed for LM-80 testing.

1.5.8 Regulatory Requirements

Equipment, materials, installation, and workmanship must be in accordance with the mandatory and advisory provisions of NFPA 70, unless more stringent requirements are specified or indicated. Provide luminaires and assembled components that are approved by and bear the label of UL for the applicable location and conditions unless otherwise specified.

1.5.9 Standard Products

Provide materials and equipment that are products of manufacturers regularly engaged in the production of such products which are of equal material, design, and workmanship. Products must have been in satisfactory commercial or industrial use for six months prior to bid opening. The six-month period must include applications of equipment and materials under similar circumstances and of similar size. The product must have been on sale on the commercial market through advertisements, manufacturers' catalogs, or brochures during the six-month period. Where two or more items of the same class of equipment are required, these items must be products of a single manufacturer; however, the component parts of the item need not be the products of the same manufacturer unless stated in this section.

1.5.9.1 Alternative Qualifications

Products having less than a six-month field service record will be acceptable if a certified record of satisfactory field operation for not less than 6000 hours, exclusive of the manufacturers' factory or laboratory tests, is furnished.

1.5.9.2 Material and Equipment Manufacturing Date

Do not use products manufactured more than six months prior to date of delivery to site, unless specified otherwise.

1.6 WARRANTY

Support all equipment items by service organizations which are reasonably convenient to the equipment installation in order to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.

1.6.1 Luminaire Warranty

Provide and transfer to the government the original LED luminaire manufacturers standard commercial warranty for each different luminaire manufacturer used in the project.

a. Provide a written five year minimum replacement warranty for material, luminaire finish, and workmanship. Provide written warranty document that contains all warranty processing information needed, including customer service point of contact, whether or not a return authorization number is required, return shipping information, and closest return location to the luminaire location.

   (1) Finish warranty must include failure and substantial deterioration such as blistering, cracking, peeling, chalking, or fading.

   (2) Material warranty must include:

      (a) All LED drivers and integral control equipment.

      (b) Replacement when more than 15 percent of LED sources in any lightbar or subassembly(s) are defective, non-starting, or operating below 70 percent of specified lumen output.

b. Warranty period must begin in accordance with the manufacturer's standard warranty starting date.

c. Provide replacements that are promptly shipped, without charge, to the using Government facility point of contact and that are identical to or an improvement upon the original equipment. All replacements must include testing of new components and assembly.

1.6.2 Lighting Controls Warranty

Provide and transfer to the government the original lighting controls manufacturers standard commercial warranty for each different lighting controls manufacturer used in the project. Warranty coverage must begin from date of final system commissioning or three months from date of delivery, whichever is the earliest. Warranty service must be performed by a factory-trained engineer or technician.

a. Unless otherwise noted, provide a written five year minimum warranty on the complete system for all systems with factory commissioning. Provide warranty that covers 100 percent of the cost of any replacement parts and services required over the five years which are directly attributable to the product failure. Failures include, but are not limited to, the following:

(1) Software: Failure of input/output to execute switching or dimming commands.

(2) Damage of electronic components due to transient voltage surges.

(3) Failure of control devices, including but not limited to occupancy sensors, photosensors, and manual wall station control devices.

b. Provide a written five year minimum warranty on all input devices against defect in workmanship or materials provided by device manufacturer.

c. Provide a written five year minimum warranty on all control components attached to luminaires against defect in workmanship or materials.

1.7 COORDINATION

Coordinate layout and installation of lighting fixtures and suspension system with other construction that penetrates ceilings or is supported by them, including HVAC equipment, cranes, fire alarm and suppression system, public address speakers, fire wall ratings, and partition assemblies.

PART 2 PRODUCTS

2.1 PRODUCT COORDINATION

2.2 LUMINAIRES

UL 1598, NEMA C82.77-10. Provide luminaires as indicated in the luminaire schedule on EL600 and NL plates on EL601 or details on project plans, complete with light source, wattage, and lumen output indicated. All luminaires of the same type must be provided by the same manufacturer. Luminaires must be specifically designed for use with the driver and light source provided.

Luminaires shall satisfy the provisions of the Buy American Act

2.2.1 Luminaires

UL 8750, ANSI/IES LM-79, ANSI/IES LM-80. For all luminaires, provide:

a. Complete system with LED drivers and light sources.

b. Housings constructed of non-corrosive materials. All new aluminum housings must be anodized or powder-coated. All new steel housings must be treated to be corrosion resistant.

c. ANSI/IES TM-21, ANSI/IES LM-80. Minimum L70 lumen maintenance value of 50,000 hours unless otherwise indicated in the luminaire schedule on EL600. Luminaire drive current value must be identical to that provided by test data for luminaire in question. "Projected" or "Reported" values per ANSI/IES TM-21 shall be used. "Calculated" values in excess of the ANSI/IES TM-21 "6x" testing time shall not be used. Laboratory testing shall be completed by a National Voluntary Laboratory Accreditation Program laboratory.

d. Minimum flux in lumens and maximum power in wattage as specified in the luminaire schedule. Theoretical models of initial lamp lumens per

watt are not acceptable.

e. UL listed for dry or damp location typical of interior installations. Any luminaire mounted on the exterior of the building must be UL listed for wet location typical of exterior installations.

f. LED driver and light source package, array, or module are accessible for service or replacement without removal or destruction of luminaire.

g. Lenses constructed of heat tempered borosilicate glass, UV-resistant acrylic, or silicone. Provide polycarbonate vandal-resistant lenses as indicated. Sandblasting, etching and polishing must be performed as indicated in the luminaire description.

h. ANSI/IES TM-15 Provide exterior building-mounted luminaires that do not exceed the BUG ratings as listed in the luminaire schedule. If BUG ratings are not listed in the luminaire schedule, provide luminaires that do not exceed B4-U0-G2.

i. LED fixtures with screw base light sources are not permitted.

2.2.2 Luminaires for Hazardous Locations

In addition to requirements stated herein, provide LED luminaires for hazardous locations which conform to UL 844 or which have Factory Mutual certification for the class and division indicated.

2.3 LIGHT SOURCES

NEMA ANSLG C78.377, NEMA SSL 3. Provide type, delivered lumen output, and wattage as indicated in the luminaire schedule on project plans.

2.3.1 LED Light Sources

Provide LED light sources that meet the following requirements:

a. NEMA ANSLG C78.377. Emit white light and have a nominal CCT as included on the luminaire schedule on EL600.

b. Minimum Color Rendering Index (CRI) of 80 for interior applications and 70 for exterior applications, except as noted on the luminaire schedules.

c. Directive 2011/65/EU. Restriction of Hazardous Substances (RoHS) compliant.

d. Light source color consistency by utilizing a binning tolerance within a 3-step McAdam ellipse.

2.4 LED DRIVERS

NEMA SSL 1, UL 8750. Provide LED drivers that are electronic, UL Class 1 or Class 2, constant-current type and that comply with the following requirements:

a. The combined driver and LED light source system does not exceed the minimum luminaire efficacy values as listed in the luminaire schedule provided.

b. Operates at a voltage of 120-277 volts at 50/60 hertz, with input voltage fluctuations of plus/minus 10 percent unless otherwise indicated in EL600 luminaire schedule.

c. Power Factor (PF) greater than or equal to 0.90 at full input power and across specified dimming range.

d. Maximum Total Harmonic Distortion (THD) less than 20 percent at full input power and across specified dimming range.

e. Operates for at least 50,000 hours at maximum case temperature and 90 percent non-condensing relative humidity.

f. Withstands Category A surges of 2 kV without impairment of performance. Provide surge protection that is integral to the driver.

g. Integral thermal protection that reduces the output power to protect the driver and light source from damage if the case temperature approaches or exceeds the driver's maximum operating temperature.

h. 47 CFR 15. Complies with the requirements of the Federal Communications Commission (FCC) rules and regulations, Non-Consumer (Class A) for EMI/RFI (conducted and radiated).

i. Class A sound rating.

j. Directive 2011/65/EU. Restriction of Hazardous Substances (RoHS) compliant.

k. Provide dimming capability as indicated in the luminaire schedule or as control matrices dictate.

2.5 LIGHTING CONTROLS

UFC 3-530-01, ASHRAE 90.1 - IP, and ASHRAE 189.1. Provide lighting control system as indicated. Lighting control equipment shall include, if indicated: control modules, power packs, dimming ballasts, occupancy sensors, photocells, and light level sensors.

Wireless control devices and systems are prohibited such that even wireless components used in programming are not permissable to remain functional after installation.

2.5.1 System

Provide lighting control system that operates the lighting system as described in the lighting control strategies in the project plans. Submit Sequence of Operation for Lighting Control System describing the operation of the proposed lighting control system and devices. Sequence of Operation must provide the strategies identified in the lighting control strategies.

2.5.1.1 Localized Control Systems

Provide room or area-wide lighting control system capable of manual control, time-based control, and receiving input from photosensors and occupancy/vacancy sensors.

2.5.1.1.1 Local Area Controller

Provide controller designed for single area or room with the following requirements:

a. Operates at a voltage of 120-277 volts at 50/60 hertz.

b. Provide zones according to plans and lighting control matrices.

c. Provide inputs for occupancy/vacancy sensors, photosensors, and low-voltage wall switches.

d. Capable of 0-10V dimming as required by control matrices.

e. Provide override 'ON' function with input from Fire Alarm Control Panel for all emergency lighting. Controller must not turn off power to emergency batteries or exit signs.

2.5.2 Lighting Contactor

NEMA ICS 2. Provide an electrically-held lighting contactor housed in a enclosure conforming to NEMA ICS 6 for the environmental condition indicated on the plans. Provide contactor with quantity of single or double pole contacts as indicated on the drawings, rated 600 volts, 30 amps. Provide coil operating voltage matching the supply circuit voltage shown on the drawings.

Provide a Hand-Off-Auto switch on the exterior front face each contactor enclosure. Connect as indicated on control drawings.

2.5.3 Devices

2.5.3.1 Switches

Provide line-voltage toggle switches as specified in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM. When used for non-digital loads, devices must be rated at 20 Amps inductive load, and be compatible with the lighting control systems.

2.5.3.2 Wall Box Dimmers

UL 1472, UL 20, IEEE C62.41, NEMA 77, NEMA SSL 7A. Dimmers must provide flicker-free, continuously variable light output throughout the dimming range of at minimum 10 percent to 100 percent. Devices must be capable of operating at their full rated capacity regardless of being single or ganged-mounted, and be compatible with three-way and four-way switching scenarios.

Provide wall-box dimmers that meet the following requirements:

a. Device operates as part of a lighting control system or an independent control device as depicted on the plans.

b. Device operates with the use of a vertical slider, paddle, rotary, button, or toggle with adjacent vertical slider.

c. Finish of device matches switches and outlets in the same area.

d. Back box in wall has sufficient depth to accommodate body of switch

and wiring.

e. Dimmer is capable of controlling 0-10 volt LED drivers. Dimmers and the drivers they control must be provided from the same manufacturer or tested and certified as compatible for use together.

f. Radio frequency interference suppression is integral to device.

2.5.3.3 Occupancy/Vacancy Sensors

IEEE C62.41, NEMA WD 1, UL 94, UL 916, UL 508, ASTM D4674 REV A, NEMA WD 7. Provide occupancy/vacancy sensors with coverage patterns as indicated on project plans. Provide no less quantity of sensors as shown on plans, but add additional sensors when required to fulfill coverage requirement for the specific model of sensor provided. Provide vacancy sensor operation that requires manual control to activate luminaires and turns luminaires off after a set time of inactivity. Provide ceiling or wall-mounted occupancy/vacancy sensors that meet the following requirements:

a. Operating voltage of 12-24 or 120-277 volts.

b. Time delay of 30 seconds to 30 minutes with at least four intermediate time delay settings.

c. Sensors are as depicted on the plans.

e. Shielded or controlled by internal logic to adjust sensitivity to avoid false triggering due to ambient temperature, air temperature variations or HVAC air movement.

f. Sensor is equipped to automatically energize the connected load upon loss of normal power when located in a means of egress.

g. Occupancy and vacancy operation is field-adjustable and programmable with push-button or dip switch on the sensor device.

h. No leakage current to load when in the off mode.

i. Utilize zero-crossing circuitry to prevent damage from high inrush current and to promote long life operation.

2.5.3.3.1 Dual Technology Sensors

Provide dual technology sensors that meet the requirements for PIR sensors and ultrasonic sensors indicated above. If either the PIR or ultrasonic sensing registers occupancy, the luminaires must remain on.

2.5.3.3.2 Integrated Sensors

Provide integrated occupancy/vacancy sensors that mount directly to the luminaires as indicated in project plans.

2.5.3.3.3 Power Packs

UL 2043. Provide power packs to provide power to lighting control sensors as required in accordance with the manufacturer's specifications. Provide power packs that meet the following requirements:

a. Operate at an input voltage of 120-277 VAC, with an output voltage

12-24 VDC at 225 mA.

b. Constructed of plenum-rated, high-impact thermoplastic enclosure.

c. Utilizes zero-crossing circuitry to prevent damage from inrush current.

d. Maximum load rating of 16 amps for electronic lighting loads.

e. Directive 2011/65/EU. Restriction of Hazardous Substances (RoHS) compliant.

2.5.3.4 Photosensors

Provide photosensors that meet the following requirements:

a. Detect changes in ambient lighting level and enable dimming as required by sequence of operation by operating in a closed-loop system.

b. Contain a detection cone, where the base of the cone may be circular or an elongated shape, and where the smallest angle between the edge and the axis of the cone is between 20 and 50 degrees. The cone axis may be tilted to the vertical when installed to give the sensor preferred directionality.

c. Sensors are mounted as depicted on the plans with sensitivity, filtering, range and viewing angle to meet requirements of sequence of operation, scope of work and construction documents. Location and mounting to be per manufacturer's instructions.

d. Time delay that is adjustable from 1 to 30 seconds ON delay, and 1 to 30 minutes OFF delay to prevent cycling, with deadband adjustment of 25 percent to 100 percent above lower setpoint.

e. Output dimming signal is linear to light level with less than 1 percent variation. Cadmium sulfide photo-resistors are not acceptable.

f. Sensor is not combined in the same housing or location with occupancy or vacancy sensors if the proper location for one function compromises the successful operation of the other function, or in any way reduces the system's ability to meet the design intent.

g. Photocell shall be designed to fail to the ON position.

2.6 EXIT AND EMERGENCY LIGHTING EQUIPMENT

2.6.1 Exit Signs

UL 924, NFPA 101. Provide wattage as indicated in the luminaire schedule on project plans. Wire exit signs and emergency lighting units ahead of the local switch, to the normal lighting circuit located in the same room or area. Provide LED Exit Signs that meet the following criteria:

a. Housing constructed of UV-stable, thermo-plastic.

b. UL listed for damp location, unless otherwise noted on the plans.

c. Configured for mounting according the depiction on the plans.

d. 6 inch high, 3/4 inch stroke red lettering on face of sign with chevrons on either side of lettering to indicate direction.

e. Single or double face as indicated in project plans and luminaire schedule.

2.6.1.1 Exit Signs with Battery Backup

Equip with automatic power failure device, test switch, and pilot light, and fully automatic high/low trickle charger in a self-contained power pack. Battery must be sealed, maintenance free nickel-cadmium type, and must operate unattended for a period of not less than five years. Emergency run time must be a minimum of 1-1/2 hours. LEDs must have a minimum rated life of 10 years. In lieu of battery, can use a nonradioactive photoluminescent plate.

2.6.2 LED Emergency Lighting Transfer Switch

UL 924, NFPA 101. Provide ELTS as depicted on the plans. ELTS to come with automatic power failure detection, test switch, and LED indicator (or combination switch/indicator). ELTS must be rated appropriate for environmental conditions as noted on E-series sheets and be warranted for a minimum of five years.

2.6.3 Self-Diagnostic Circuitry for LED Drivers

UL 924, NFPA 101. Provide emergency lighting unit with fully-automatic, integral self-testing/diagnostic electronic circuitry. Circuitry must provide for a one minute diagnostic test every 28 days, and a 30 minute diagnostic test every six months, minimum. Any malfunction of the unit must be indicated by LED(s) visible from the exterior of the luminaire. A manual test switch must also be provided to perform a diagnostic test at any given time.

2.6.4 Central Emergency Lighting System (CLI)

UL 924, NFPA 101, NFPA 110 level 1, NFPA 70. Provide a central power system providing emergency power at volts as depicted on plans, 60 hertz, for a minimum period of 90 minutes. Design the system to handle surges during loss and recovery of the voltage, and to deliver its full rated output to the designated lamp load. Provide batteries for power.

2.6.4.1 Operation

Provide system such that when the lighting system loses normal supply voltage, it automatically disengages itself from the normal input line, and switches to a self-contained inverter with built-in protection when the output is shorted or overloaded. Ensure that, when normal line voltage resumes, the emergency system automatically switches back to normal operation. Size the transfer switch for this function to handle 125 percent of full load. Provide the battery system with self-contained inverters with overload protection.

2.6.4.2 Charger

Provide a completely automatic battery charger that maintains the batteries in a fully charged condition and recharges the batteries to full capacity within 24 hours after full discharge in accordance with UL 924.

2.6.4.3 Batteries

Provide sealed lead-acid or nickel-cadmium batteries, maintenance-free for a period of not less than 10 years under normal operating conditions.

2.6.4.4 Accessories

Provide visual indicators to indicate normal power, inverter power, and battery-charger operation. Provide a low-voltage test switch to simulate power failure by interrupting the input line, voltage meter, electrolyte level detector to automatically disable the charging circuit in the event of a fault, and low-voltage cutoff to prevent extreme battery power dissipation.

2.6.4.5 Enclosure

Provide a free-standing cabinet with floor stand and constructed of 2.7 millimeter 12 -gage sheet steel with baked-on enamel finish and a locking latch.

2.7 LUMINAIRE MOUNTING ACCESSORIES

2.7.1 Suspended Luminaires

Coordinate with requirements of Section 26 05 48 SEISMIC PROTECTION FOR ELECTRICAL EQUIPMENT. The stricter requirements shall apply.

a. Provide hangers capable of supporting twice the combined weight of luminaires supported by hangers.

b. Hangers must allow luminaires to swing within an angle of 45 degrees. Brace pendents 4 feet or longer to limit swinging.

c. Single-unit suspended luminaires must have cable hangers. Multiple-unit or continuous row luminaires with a separate power supply cord must have a tubing or stem for wiring at one point and a tubing or rod suspension provided for each unit length of chassis, including one at each end.

d. Provide all linear pendent and surface mounted luminaires with two supports per four-foot section or three per eight-foot section unless otherwise recommended by manufacturer.

2.7.2 Recess and Surface Mounted Luminaires

Provide access to light source and LED driver from bottom of luminaire. Provide trim and lenses for the exposed surface of flush-mounted luminaires as indicated on project drawings and specifications. Luminaires recessed in ceilings which have a fire resistive rating of one hour or more must be enclosed in a box which has a fire resistive rating equal to that of the ceiling. For surface mounted luminaires with brackets, provide flanged metal stem attached to outlet box, with threaded end suitable for supporting the luminaire rigidly in design position. Flanged part of luminaire stud must be of broad base type, secured to outlet box at not fewer than three points.

2.7.3 Luminaire Support Hardware

2.7.3.1 Wire

ASTM A641/A641M. Galvanized, soft tempered steel, minimum 0.11 inches in diameter, or galvanized, braided steel, minimum 0.08 inches in diameter.

2.7.3.2 Wire for Humid Spaces

ASTM A580/A580M. Composition 302 or 304, annealed stainless steel, minimum 0.11 inches in diameter.

ASTM B164. UNS NO4400, annealed nickel-copper alloy, minimum 0.11 inches in diameter.

2.7.3.3 Threaded Rods

Threaded steel rods, 3/16 inch diameter, zinc or cadmium coated.

2.7.3.4 Straps

Galvanized steel, one by 3/16 inch, conforming to ASTM A653/A653M, with a light commercial zinc coating or ASTM A1008/A1008M with an electrodeposited zinc coating conforming to ASTM B633, Type RS.

2.7.4 Power Hook Luminaire Hangers

UL 1598. Where applicable, provide an assembly consisting of through-wired power hook housing, interlocking plug and receptacle, power cord, and luminaire support loop. Power hook housing must be cast aluminum having two 3/4 inch threaded hubs. Support hook must have safety screw. Luminaire support loop must be cast aluminum with provisions for accepting 3/4 inch threaded stems. Power cord must include 16 inches of 3 conductor No. 16 Type SO cord. Assembly must be rated 120 volts or 277 volts, 15 amperes.

2.8 EQUIPMENT IDENTIFICATION

2.8.1 Manufacturer's Nameplate

Each item of equipment must have a nameplate bearing the manufacturer's name, address, model number, and serial number securely affixed in a conspicuous place; the nameplate of the distributing agent will not be acceptable.

2.8.2 Labels

UL 1598. All luminaires must be clearly marked for operation of specific light sources and LED drivers. The labels must be easy to read when standing next to the equipment, and durable to match the life of the equipment to which they are attached. Note the following light source characteristics in the format "Use Only _____":

a. Correlated Color Temperature (CCT) and Color Rendering Index (CRI) for all luminaires.

b. Driver and dimming protocol.

All markings related to light source type must be clear and located to be

readily visible to service personnel, but unseen from normal viewing angles when light sources are in place. LED drivers must have clear markings indicating dimming type and indicate proper terminals for the various outputs.

2.9 FACTORY APPLIED FINISH

NEMA 250. Provide all luminaires and lighting equipment with factory-applied painting system that as a minimum, meets requirements of corrosion-resistance testing.

PART 3 EXECUTION

3.1 INSTALLATION

IEEE C2, NFPA 70.

3.1.1 Light Sources

When light sources are not provided as an integral part of the luminaire, deliver light sources of the type, wattage, lumen output, color temperature (CCT), color rendering index (CRI), and voltage rating indicated to the project site and install just prior to project completion, if not already installed in the luminaires from the factory.

3.1.2 Luminaires

Set luminaires plumb, square, and level with ceiling and walls, in alignment with adjacent luminaires and secure in accordance with manufacturers' directions and approved drawings. Provide accessories as required for ceiling construction type indicated on Finish Schedule. Luminaire catalog numbers do not necessarily denote specific mounting accessories for type of ceiling in which a luminaire may be installed. Provide wires, straps, or rods for luminaire support in this section. Install luminaires with vent holes free of air blocking obstacles.

3.1.2.1 Suspended Luminaires

Measure mounting heights from the bottom of the luminaire for ceiling-mounted luminaires and to center of luminaire for wall-mounted luminaires. Obtain architect approval of the exact mounting height on the job before commencing installation and, where applicable, after coordinating with the type, style, and pattern of the ceiling being installed. Support suspended luminaires from structural framework of ceiling or from inserts cast into slab.

a. Provide suspended luminaires with 45 degree swivel hangers so that they hang plumb and level.

b. Locate so that there are no obstructions within the 45 degree range in all directions.

c. The stem, canopy and luminaire must be capable of 45 degree swing.

d. Rigid pendent stem, aircraft cable, rods, or chains 4 feet or longer excluding luminaire must be braced to prevent swaying using three cables at 120 degree separation.

e. Suspended luminaires in continuous rows must have internal wireway

systems for end to end wiring and must be properly aligned to provide a straight and continuous row without bends, gaps, light leaks or filler pieces.

f. Utilize aligning splines on extruded aluminum luminaires to assure minimal hairline joints.

g. Support steel luminaires to prevent "oil-canning" effects.

h. Match supporting pendents with supported luminaire. Aircraft cable must be stainless steel.

i. Match finish of canopies to match the ceiling, and provide low profile canopies unless otherwise shown.

j. Maximum distance between suspension points must be 10 feet or as recommended by the manufacturer, whichever is less.

3.1.2.2 Recessed and Semi-Recessed Luminaires

a. Support recessed and semi-recessed luminaires independently from the building structure by a minimum of two wires, straps or rods per luminaire and located near opposite corners of the luminaire. Secure horizontal movement with clips provided by manufacturer. Ceiling grid clips are not allowed as an alternative to independently supported luminaires.

b. Support round luminaires or luminaires smaller in size than the ceiling grid independently from the building structure by a minimum of four wires, straps or rods per luminaire, spaced approximately equidistant around.

c. Do not support luminaires by acoustical tile ceiling panels.

d. Where luminaires of sizes less than the ceiling grid are indicated to be centered in the acoustical panel, support each independently and provide at least two 3/4 inch metal channels spanning, and secured to, the ceiling tees for centering and aligning the luminaire.

e. Luminaires installed in suspended ceilings must also comply with the requirements of Section 09 51 00 ACOUSTICAL CEILINGS.

f. Adjust aperture rings on all applicable ceiling recessed luminaires to accommodate various ceiling material thickness. Coordinate cut-out size in ceiling to ensure aperture covers cut-out entirely. Install aperture rings such that the bottom of the ring is flush with finished ceiling or not more than 1/16 inch above. Do not install luminaires such that the aperture ring extends below the finished ceiling surface.

3.1.2.3 Field Applied Painting

Paint lighting equipment as required to match finish of adjacent surfaces or to meet the indicated or specified safety criteria. Provide painting as specified in Section 09 90 00 PAINTS AND COATINGS.

3.1.3 LED Drivers

Provide LED drivers integral to luminaire as constructed by the manufacturer.

3.1.4 Exit Signs

NFPA 101. Wire exit signs and emergency lighting units ahead of the local switch, to the normal lighting circuit located in the same room or area.

3.1.5 Lighting Controls

3.1.5.1 Scene Wallstations

Submit labeling templates for all scene wallstations, ganged faceplates and other manual control cover plates. Label each scene control button with approved scene description.

3.1.5.2 Occupancy/Vacancy Sensors

a. Provide quantity of sensor units indicated as a minimum. Provide additional units to give full coverage over controlled area. Full coverage must provide hand and arm motion detection for office and administration type areas and walking motion for industrial areas, warehouses, storage rooms and hallways.

b. Locate ceiling-mounted sensors no closer than 6 feet from the nearest HVAC supply or return diffuser.

c. Locate the sensor(s) as indicated and in accordance with the manufacturer's recommendations.

3.1.5.3 Photosensors

Locate and aim sensor as indicated and in accordance with the manufacturer's recommendations. Adjust sensor set-point in accordance with the manufacturer's recommendations and for the indicated light level of the area of coverage, measured at the work plane.

3.2 FIELD QUALITY CONTROL

3.2.1 Tests

3.2.1.1 Lighting Control Verification Tests

Verify lighting control system and devices operate according to approved sequence of operations. Verification tests are to be completed after commissioning.

a. Verify occupancy/vacancy sensors operate as described in sequence of operations. Provide testing of sensor coverage, sensitivity, and time-out settings in all spaces where sensors are placed. This is to be completed only after all furnishings have been installed.

b. Verify photosensors operate as described in sequence of operations. Provide testing of sensor coverage, aiming, and calibration in all spaces where sensors are placed. This is to be completed only after all furnishings have been installed. Submit photosensor verification test.

c. Verify wall box dimmers and scene wallstations operate as described in sequence of operations.

3.2.1.2 Emergency Lighting Test

Interrupt power supply to demonstrate proper operation of emergency lighting. If adjustments are made to the lighting system, re-test system to show compliance with standards.

3.3 CLOSEOUT ACTIVITIES

3.3.1 Commissioning

NFPA 101. Commission all components of the lighting system and lighting control system in accordance with Section 01 91 00.15 BUILDING COMMISSIONING. Factory Trained Field Service Technician is responsible for calibration and programming sequences for input devices and systems in accordance with the requirements described in the sequence of operation.

3.3.2 Training

3.3.2.1 End-User Training

Submit an End-User Training Plan at least 30 calendar days prior to training session that describes training procedures for end-users on the lighting control system. Provide users with a list of control devices located within user-occupied spaces, such as photosensors and occupancy and vacancy sensors, including information on the proper operation and schedule for each device. Provide demonstration for each type of interface. Provide users with the building schedule as currently commissioned, including conditional programming based on astronomic time clock functionality. Provide users with the correct contact information for maintenance personnel who will be available to address any lighting control issues.

-- End of Section --

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SECTION 26 56 00

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08/21

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SECTION 26 56 00

EXTERIOR LIGHTING
08/21

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

AASHTO LTS	(2013; Errata 2013) Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals

ASTM INTERNATIONAL (ASTM)

ASTM A153/A153M	(2023) Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM B117	(2019) Standard Practice for Operating Salt Spray (Fog) Apparatus

EUROPEAN UNION (EU)

Directive 2011/65/EU	(2011) Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment

ILLUMINATING ENGINEERING SOCIETY (IES)

ANSI/IES LM-79	(2019) Approved Method: Electrical and Photometric Measurements of Solid State Lighting Products
ANSI/IES LM-80	(2020) Approved Method: Measuring Luminous Flux and Color Maintenance of LED Packages, Arrays and Modules
ANSI/IES LS-1	(2020) Lighting Science: Nomenclature and Definitions for Illuminating Engineering
ANSI/IES RP-8	(2018; Addenda 1 2020; Errata 1-2 2021) Recommended Practice for Design and Maintenance of Roadway and Parking Facility Lighting
ANSI/IES TM-15	(2020) Technical Memorandum: Luminaire Classification System for Outdoor Luminaires

ANSI/IES TM-21	(2021) Technical Memorandum: Projecting Long-TermLuminous, Photon, and Radiant Flux Maintenance of LED Light Sources
IES Lighting Library	IES Lighting Library

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE 100	(2000; Archived) The Authoritative Dictionary of IEEE Standards Terms
IEEE C62.41.2	(2002) Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and Less) AC Power Circuits

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

ANSI C136.3	(2020) Roadway and Area Lighting Equipment - Luminaire Attachments
ANSI C136.13	(2020) Roadway and Area Lighting Equipment - Metal Brackets for Wood Poles
ANSI C136.21	(2014) American National Standard for Roadway and Area Lighting Equipment - Vertical Tenons Used with Post-Top-Mounted Luminaires
NEMA 250	(2020) Enclosures for Electrical Equipment (1000 Volts Maximum)
NEMA ANSLG C78.377	(2017) Electric Lamps— Specifications for the Chromaticity of Solid State Lighting Products
NEMA C82.77-10	(2020) Harmonic Emission Limits - Related Power Quality Requirements
NEMA C136.31	(2018) Roadway and Area Lighting Equipment - Luminaire Vibration
NEMA SSL 1	(2016) Electronic Drivers for LED Devices, Arrays, or Systems
NEMA SSL 3	(2011) High-Power White LED Binning for General Illumination

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2023; ERTA 7 2023; TIA 23-15) National Electrical Code

UL SOLUTIONS (UL)

UL 773	(2016; Reprint Jul 2020) UL Standard for Safety Plug-In, Locking Type Photocontrols for Use with Area Lighting

UL 773A	(2016; Reprint Jun 2020) UL Standard for Safety Nonindustrial Photoelectric Switches for Lighting Control
UL 1310	(2018; Reprint Jun 2022) UL Standard for Safety Class 2 Power Units
UL 1598	(2021; Reprint Jan 2024) UL Standard for Safety Luminaires
UL 8750	(2015; Reprint Sep 2021) UL Standard for Safety Light Emitting Diode (LED) Equipment for Use in Lighting Products

1.2 RELATED REQUIREMENTS

Materials not considered to be luminaires, luminaire accessories, or lighting equipment are specified in Section(s) 33 71 02 UNDERGROUND ELECTRICAL DISTRIBUTION . Luminaires and accessories installed in interior of buildings or attached to the exterior of a building are specified in Section 26 51 00 INTERIOR LIGHTING. Commissioning requirements are specified in Section 01 91 00.15 BUILDING COMMISSIONING

1.3 DEFINITIONS

a. Unless otherwise specified or indicated, electrical and electronics terms used in these specifications and on the drawings must be as defined in IEEE 100 and ANSI/IES LS-1.

b. For LED luminaire light sources, "Useful Life" is the operating hours before reaching 70 percent of the initial rated lumen output (L70) with no catastrophic failures under normal operating conditions. This is also known as 70 percent "Rated Lumen Maintenance Life" as defined in ANSI/IES LM-80.

c. For LED luminaires, "Luminaire Efficacy" (LE) is the appropriate measure of energy efficiency, measured in lumens/watt. This is gathered from LM-79 data for the luminaire, in which absolute photometry is used to measure the lumen output of the luminaire as one entity, not the source separately and then the source and housing together.

d. Total Harmonic Distortion (THD) is the Root Mean Square (RMS) of all the harmonic components divided by the total fundamental current.

1.4 SUBMITTALS

Government approval is required for submittals with a "G" classification. Submittals not having a "G" classification are for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Luminaire Drawings; G, DO

Pole Drawings; G, DO

SD-03 Product Data

Luminaires; G, DO

Light Sources; G, DO

LED Drivers; G, DO

Luminaire Warranty; G, RO

Lighting Controls Warranty; G, RO

Pole Warranty; G, RO

Photosensors; G, DO

Poles; G, DO

Brackets; G, DO

SD-05 Design Data

Luminaire Design Data; G, DO

[*Am-00002]

Perimeter Security Lighting Photometric Plan; G, RO[**Am-00002]

SD-06 Test Reports

ANSI/IES LM-79 Test Report; G, DO

ANSI/IES LM-80 Test Report; G, DO

ANSI/IES TM-21 Test Report; G, DO

SD-08 Manufacturer's Instructions

Poles; G, RO

SD-10 Operation and Maintenance Data

Exterior Lighting Control System; G, DO

Maintenance Staff Training Plan; G, RO

End-User Training Plan; G, RO

1.4.1 Submittal Coordination and Sequencing Requirements

See references to this Specifications Section and/or specific submittal items in Section 01 33 00, as well as requirements herein and as referenced in other parts of this contract, for coordination and sequencing of submittals and the associated work to be performed.

1.5 QUALITY ASSURANCE

Data, drawings, and reports must employ the terminology, classifications and methods prescribed by the IES Lighting Library as applicable, for the lighting system specified.

1.5.1 Drawing Requirements

1.5.1.1 Luminaire Drawings

Include dimensions, accessories, and installation and construction details. Photometric data, including CRI, CCT, TM-15-11 BUG rating, LED driver type, aiming diagram, zonal lumen data, and candlepower distribution data per LM-79 must accompany shop drawings.

1.5.1.2 Pole Drawings

Include dimensions, wind load determined in accordance with AASHTO LTS, pole deflection, pole class, and other applicable information.

1.5.2 Luminaire Design Data

a. Provide distribution data according to IES classification type as defined in IES Lighting Library and ANSI/IES RP-8.

b. B.U.G. rating for the installed position as defined by ANSI/IES TM-15 and shielding as defined by ANSI/IES RP-8.

c. Provide safety certification and file number for the luminaire family. Include listing, labeling and identification in accordance with NFPA 70 (NEC). Applicable testing bodies are determined by the US Occupational Safety Health Administration (OSHA) as Nationally Recognized Testing Laboratories (NRTL) and include: CSA (Canadian Standards Association), ETL (Edison Testing Laboratory), and UL (Underwriters Laboratories).

d. Provide long term lumen maintenance projections for each LED luminaire in accordance with ANSI/IES TM-21. Data used for projections must be obtained from testing in accordance with ANSI/IES LM-80.

e. Provide wind loading calculations for luminaires mounted on poles. Weight and effective projected area (EPA) of luminaires and mounting brackets must not exceed maximum rating of pole as installed in particular wind zone area.

1.5.3 ANSI/IES LM-79 Test Report

Submit test report on manufacturer's standard production model of specified luminaire. Testing must be performed at the same operating drive current as specified luminaire. Include all applicable and required data as outlined under "14.0 Test Report" in ANSI/IES LM-79.

1.5.4 ANSI/IES LM-80 Test Report

Submit report on manufacturer's standard production LED light source (package, array, or module) of specified luminaire. Testing must be performed at the same operating drive current as specified luminaire. Include all applicable and required data as outlined under "8.0 Test Report" in ANSI/IES LM-80.

1.5.5 ANSI/IES TM-21 Test Report

Submit test report on manufacturer's standard production LED light source (package, array or module) of specified luminaire. Testing must be performed at the same operating drive current as specified luminaire.

Include all applicable and required data, as well as required interpolation information as outlined under "7.0 Report" in ANSI/IES TM-21.

[*Am-00002]1.5.6 Perimeter Security Lighting Photometric Plan

For location(s) identified on plans where security lighting will be impacted during the construction process and necessitate a temporary security lighting installation. Provide photometric plan that meets requirements of AFI 31-101 in conjunction with guidance provided by base. [**Am-00002]

1.5.7 Test Laboratories

Test laboratories for the ANSI/IES LM-79 and ANSI/IES LM-80 test reports must be one of the following:

a. National Voluntary Laboratory Accreditation Program (NVLAP) accredited for solid-state lighting testing as part of the Energy-Efficient Lighting Products laboratory accreditation program.

b. One of the qualified labs listed on the Department of Energy - Energy Efficiency & Renewable Energy, Solid-State Lighting web site.

c. One of the EPA-Recognized Laboratories listed at for LM-80 testing.

1.5.8 Regulatory Requirements

Equipment, materials, installation, and workmanship must be in accordance with the mandatory provisions of NFPA 70 unless more stringent requirements are specified or indicated. Provide luminaires and assembled components that are approved by and bear the label of UL for the applicable location and conditions unless otherwise specified.

1.5.9 Standard Products

Provide materials and equipment that are products of manufacturers regularly engaged in the production of such products which are of equal material, design and workmanship. Products must have been in satisfactory commercial or industrial use for six months prior to bid opening. The six-month period must include applications of equipment and materials under similar circumstances and of similar size. The product must have been on sale on the commercial market through advertisements, manufacturers' catalogs, or brochures during the six-month period. Where two or more items of the same class of equipment are required, these items must be products of a single manufacturer; however, the component parts of the item need not be the products of the same manufacturer unless stated in this section.

1.5.9.1 Alternative Qualifications

Products having less than a six-month field service record will be acceptable if a certified record of satisfactory field operation for not less than 6000 hours, exclusive of the manufacturers' factory or laboratory tests, is furnished.

1.5.9.2 Material and Equipment Manufacturing Date

Do not use products manufactured more than six months prior to date of delivery to site, unless specified otherwise.

1.6 WARRANTY

Support all equipment items by service organizations which are reasonably convenient to the equipment installation in order to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.

1.6.1 Luminaire Warranty

Provide and transfer to the government the original LED luminaire manufacturers standard commercial warranty for each different luminaire manufacturer used in the project.

a. Provide a written five year minimum replacement warranty for material, luminaire finish, and workmanship. Provide written warranty document that contains all warranty processing information needed, including customer service point of contact, whether or not a return authorization number is required, return shipping information, and closest return location to the luminaire location.

   (1) Finish warranty must include failure and substantial deterioration such as blistering, cracking, peeling, chalking, or fading.

   (2) Material warranty must include:

      (a) All LED drivers and integral control equipment.

      (b) Replacement when more than 15 percent of LED sources in any lightbar or subassembly(s) are defective, non-starting, or operating below 70 percent of specified lumen output.

b. Warranty period must begin in accordance with the manufacturer's standard warranty starting date.

c. Provide replacements that are promptly shipped, without charge, to the using Government facility point of contact and that are identical to or an improvement upon the original equipment. All replacements must include testing of new components and installation.

1.6.2 Lighting Controls Warranty

Provide and transfer to the government the original lighting controls manufacturers standard commercial warranty for each different lighting controls manufacturer used in the project. Warranty coverage must begin from date of final system commissioning or three months from date of delivery, whichever is the earliest. Warranty service must be performed by a factory-trained engineer or technician.

a. Unless otherwise noted, provide a written five year minimum warranty on the complete system for all systems with factory commissioning. Provide warranty that covers 100 percent of the cost of any replacement parts and services required over the five years which are directly attributable to the product failure. Failures include, but are not limited to, the following:

   (1) Software: Failure of input/output to execute switching or dimming commands.

(2) Damage of electronic components due to transient voltage surges.

(3) Failure of control devices, including but not limited to photosensors and motion sensors.

b. Provide a written five year minimum warranty on all input devices against defect in workmanship or materials provided by device manufacturer.

c. Provide a written five year minimum warranty on all control components attached to luminaires against defect in workmanship or materials.

1.6.3 Pole Warranty

Provide and transfer to the government the original pole manufacturers standard commercial warranty for each different pole manufacturer used in the project. Warranty coverage must begin from date of final system commissioning or three months from date of delivery, whichever is the earliest. Provide a written three year minimum replacement warranty for material, luminaire finish, and workmanship. Warranty service must be performed by a factory-trained engineer or technician.

1.7 OPERATION AND MAINTENANCE MANUALS

1.7.1 Lighting System

Provide operation and maintenance manuals for the lighting system in accordance with Section 01 78 23 OPERATION AND MAINTENANCE DATA that provide basic data relating to the design, operation, and maintenance of the lighting system. Include the following:

a. Manufacturers' operating and maintenance manuals.

b. Luminaire shop drawings for modified and custom luminaires.

c. Luminaire Manufacturers' standard commercial warranty information as specified in paragraph LUMINAIRE WARRANTY.

1.7.2 Exterior Lighting Control System

Provide operation and maintenance manuals for the exterior lighting control system in accordance with Section 01 78 23 OPERATION AND MAINTENANCE DATA that provide basic data relating to the design, operation, and maintenance of the exterior lighting control system. Include the following:

a. Control System One-Line Diagram

b. Product data for all devices, including installation and programming instructions.

c. Training materials, such as videos or in-depth manuals, that cover basic operation of the lighting control system and instructions on modifying the control system. Training materials must include calibration, adjustment, troubleshooting, maintenance, repair, and replacement.

PART 2 PRODUCTS

2.1 PRODUCT COORDINATION

2.2 LUMINAIRES

UL 1598, NEMA C82.77-10. Provide luminaires as indicated in the luminaire schedule and XL plates or details on project plans, complete with light source, wattage, and lumen output indicated. All luminaires of the same type must be provided by the same manufacturer. Luminaires must be specifically designed for use with the LED driver and light source provided.

2.2.1 Luminaires

UL 8750, ANSI/IES LM-79, ANSI/IES LM-80. For all luminaires, provide:

a. Complete system with LED drivers and light sources.

b. Housing constructed of non-corrosive materials. All new aluminum housings must be anodized or powder-coated. All new steel housings must be treated to be corrosion resistant.

c. ANSI/IES TM-21, ANSI/IES LM-80. Minimum L70 lumen maintenance value of 50,000 hours unless otherwise indicated in the luminaire schedule on ES111. Luminaire drive current value must be identical to that provided by test data for luminaire in question. "Projected" or "Reported" values per ANSI/IES TM-21 shall be used. "Calculated" values in excess of the ANSI/IES TM-21 "6x" testing time shall not be used. Laboratory testing shall be completed by a National Voluntary Laboratory Accreditation Program laboratory.

d. Minimum flux in lumens and maximum power in wattage as specified in the luminaire schedule. Theoretical models of initial lamp lumens per watt are not acceptable.

e. Product rated for operation within an ambient temperature range of minus 22 degrees F to 104 degrees F.

f. UL listed for wet locations.

g. IES Lighting Library. Light distribution and NEMA field angle classifications as indicated in luminaire schedule on project plans.

h. Housing finish that is baked-on enamel, anodized, or baked-on powder coat paint. Finish must be capable of surviving ASTM B117 salt fog environment testing for 2500 hours minimum without blistering or peeling.

i. LED driver and light source package, array, or module are accessible for service or replacement without removal or destruction of luminaire.

j. ANSI/IES TM-15 Provide exterior building-mounted luminaires that do not exceed the BUG ratings as listed in the luminaire schedule. If BUG ratings are not listed in the luminaire schedule, provide luminaires that do not exceed B4-U0-G2.

k. Fully assembled and electrically tested prior to shipment from factory.

l. Finish color is as indicated in the luminaire schedule or detail on the project plans.

m. Lenses constructed of clear tempered glass or UV-resistant acrylic.

n. All factory electrical connections are made using crimp, locking, or latching style connectors. Twist-style wire nuts are not acceptable.

o. NEMA C136.31. Comply with 3G vibration testing.

2.3 LIGHT SOURCES

NEMA ANSLG C78.377, NEMA SSL 3. Provide type, lumen rating, and wattage as indicated in luminaire schedule on project plans.

2.3.1 LED Light Sources

Provide LED light sources that meet the following requirements:

a. NEMA ANSLG C78.377. Emit white light and have a nominal Correlated Color Temperature (CCT) as depicted on luminaire schedule on EL111D.

b. Minimum Color Rendering Index (CRI) as depicted on luminaire schedule on EL111D.

c. Directive 2011/65/EU. Restriction of Hazardous Substances (RoHS) compliant.

d. Light source color consistency by utilizing a binning tolerance within a 4-step McAdam ellipse.

2.4 LED DRIVERS

NEMA SSL 1, UL 1310. Provide LED Drivers that are electronic, UL Class 1 or Class 2, constant-current type and meet the following requirements:

a. The combined LED driver and LED light source system is greater than or equal to the minimum luminaire efficacy values as listed in the luminaire schedule provided.

b. Operate at a voltage of 120-277 volts at 50/60 hertz, with input voltage fluctuations of plus or minus 10 percent.

c. Power Factor (PF) greater than or equal to 0.90 at full input power and across specified dimming range.

d. Maximum Total Harmonic Distortion (THD) less than or equal to 20 percent at full input power and across specified dimming range.

e. Operates for at least 50,000 hours at maximum case temperature and 90 percent non-condensing relative humidity.

f. Meets the "Elevated" (10kV/10kA) requirements per IEEE C62.41.2 -2002. Manufacturer must indicate whether failure of the electrical immunity system can possibly result in disconnect of power to luminaire. Provide surge protection that is integral to the LED driver.

g. Contains integral thermal protection that reduces the output power to

protect the driver and light source from damage if the case temperature approaches or exceeds the driver's maximum operating temperature.

h. Complies with the requirements of the Federal Communications Commission (FCC) rules and regulations, Title 47 CFR part 15, Non-Consumer (Class A) for EMI/RFI (conducted and radiated).

i. Class A sound rating for all drivers mounted under a covered structure, such as a canopy, or where otherwise appropriate.

j. Directive 2011/65/EU. Restriction of Hazardous Substances (RoHS) compliant.

k. UL listed for wet locations typical of exterior installations.

l. Dimmable, and compatible with a standard dimming control circuit of 0 - 10V.

m. Rated to operate between ambient temperatures of minus 22 degrees F and 104 degrees F.

2.5 LIGHTING CONTROLS

2.5.1 System

Provide exterior lighting control system that operates the exterior lighting system as described in the exterior lighting control strategies in the project plans.

Wireless control devices and systems are prohibited such that even wireless components used in programming are not permissable to remain functional after installation.

2.5.2 Devices

2.5.2.1 Photosensors

UL 773, UL 773A. Provide Photosensors that meet the following requirements:

a. Hermetically sealed, cadmium sulfide or silicon diode light sensor type 277 volts, 50/60 Hz with single-pole, single-throw contacts.

b. Turns ON at 1 to 3 footcandles and turns OFF at 3 to 15 footcandles.

c. Designed to fail to the ON position.

d. Housing is constructed of die cast aluminum, rated to operate within a temperature range of minus 40 to 158 degrees F.

e. Time delay that prevents accidental switching from transient light sources.

g. Designed for 20-year service to match life expectancy of long-life LED fixtures and exceed 15,000 operations at full load. Provide photosensors with zero-cross technology to withstand severe in-rush current and extend relay life.

j. Provide photosensors with metal oxide varistor (MOV) type surge protection.

2.6 POLES

AASHTO LTS. Provide round tapered poles designed for wind loading of 100 miles per hour while supporting luminaires and all other appurtenances indicated. The effective projected areas (EPA) of luminaires and appurtenances used in calculations must be specific for the actual products provided on each pole. Provide poles that are embedded-base type designed for use with underground supply conductors. Poles must have oval-shaped hand hole having a minimum clear opening of 3 by 5 inches. Secure hand hole covers by stainless steel captive screws. Provide metal poles with an internal grounding connection accessible from the hand hole near the bottom of each pole. Install a means of wire disconnection accessible from the hand hole. Do not install square poles. Provide poles from a Manufacturer with a standard provision for protecting the finish during shipment and installation. Do not install scratched, stained, chipped, or dented poles.

2.6.1 Brackets and Supports

ANSI C136.3, ANSI C136.13, and ANSI C136.21. Provide pole brackets that are not less than 1 1/4 inch galvanized steel pipe secured to pole. Slip-fitter or pipe-threaded brackets may be used, but brackets must be coordinated to luminaires provided, and brackets for use with one type of luminaire must be identical. Brackets for pole-mounted street lights must correctly position luminaire no lower than mounting height indicated. Mount brackets not less than 24 feet above street. Provide special mountings or brackets as indicated and of metal which will not promote galvanic reaction with luminaire head.

2.6.2 Pole Foundations

Provide anchor bolts consisting of a steel rod with a minimum yield strength of 50,000 psi; the top 12 inches of the rod must be galvanized in accordance with ASTM A153/A153M. Concrete must be as specified in Section 03 30 00 CAST-IN-PLACE CONCRETE and Section 33 71 02 UNDERGROUND ELECTRICAL DISTRIBUTION.

2.7 EQUIPMENT IDENTIFICATION

2.7.1 Manufacturer's Nameplate

Each item of equipment must have a nameplate bearing the manufacturer's name, address, model number, and serial number securely affixed in a conspicuous place; the nameplate of the distributing agent will not be acceptable.

2.7.2 Labels

UL 1598. Luminaires must be clearly marked for operation of specific light sources and drivers according to proper light source type. Note the following luminaire characteristics in the format "Use Only _____":

a. Correlated color temperature (CCT) and color rendering index (CRI) for all luminaires.

b. Driver and dimming protocol.

Markings related to light source type must be clear and located to be readily visible to service personnel, but unseen from normal viewing angles when light sources are in place. LED drivers must have clear markings indicating dimming type and indicate proper terminals for the various outputs.

2.8 FACTORY APPLIED FINISH

NEMA 250. Provide all luminaires and lighting equipment with factory-applied painting system that as a minimum meets requirements of corrosion-resistance testing.

PART 3 EXECUTION

3.1 INSTALLATION

3.1.1 Luminaires

Install all luminaires in accordance with the luminaire manufacturer's written instructions. Install all luminaires at locations and heights as indicated on the project plans. Level all luminaires in accordance to manufacturer's written instructions. Aim all luminaires in accordance with aiming diagram.

3.1.2 LED Drivers

Provide LED drivers integral to luminaire as constructed by the manufacturer.

3.1.3 Field-Applied Painting

Provide field applied painting for luminaires. Paint lighting equipment as required to match finish of adjacent surfaces or to meet the indicated or specified safety criteria. Provide painting as specified in Section 09 90 00 PAINTS AND COATINGS.

3.1.4 Pole Setting

Set pole to depth as indicated.

3.1.5 Lighting Controls

Additional lighting control installation requirements.

3.1.5.1 Photosensors

Aim photosensor according to manufacturer's recommendations.

3.1.5.2 Motion Sensors

Locate sensors in accordance with the manufacturer's recommendation. Locate sensors to achieve coverage of areas as indicated on project plans. Coverage patterns must be derated as recommended by manufacturer based on mounting height of sensor and any obstructions such as trees. Do not use gross rated coverage in manufacturer's product literature.

3.1.6 Grounding

Ground noncurrent-carrying parts of equipment including metal poles, luminaires, mounting arms, brackets, and metallic enclosures as specified in Section 33 71 02 UNDERGROUND ELECTRICAL DISTRIBUTION. Where copper grounding conductor is connected to a metal other than copper, provide specially treated or lined connectors suitable for this purpose.

3.2 FIELD QUALITY CONTROL

3.2.1 Tests

Upon completion of installation, verify that equipment is properly installed, connected, and adjusted. Perform initial operational test, consisting of the entire system energized for 72 consecutive hours without any failures of any kind occurring in the system. All circuits must test clear of faults, grounds, and open circuits.

3.2.1.1 Lighting Control Verification Test

Verify lighting control system and devices operate according to approved sequence of operations. Verification tests are to be completed after commissioning.

3.3 CLOSEOUT ACTIVITIES

3.3.1 Training

Provide on-site training to the Owner's personnel in the operation and maintenance of lighting and lighting control system. Provide training that includes calibration, adjustment, troubleshooting, maintenance, repair, and replacement.

3.3.1.1 Maintenance Staff Training

Submit a Maintenance Staff Training Plan at least 30 calendar days prior to training session that describes training procedures for Owner's personnel in the operation and maintenance of lighting and lighting control system. Provide on-site training which demonstrate full system functionality, assigning schedules, calibration adjustments for light levels and sensor sensitivity, integration procedures for connecting to third-party devices, and manual override including information on appropriate use. Provide protocols for troubleshooting, maintenance, repair, and replacement, and literature on available system updates and process for implementing updates.

3.3.1.2 End-User Training

Submit a End-User Training Plan at least 30 calendar days prior to training session that describes training procedures for end-users on the lighting control system. Provide demonstration for each type of user interface. Provide users with the curfew schedule as currently commissioned, including conditional programming based on astronomic time clock functionality. Provide users with the correct contact information for maintenance personnel who will be available to address any lighting control issues.

-- End of Section --

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SECTION 33 08 55

FUEL DISTRIBUTION SYSTEM START-UP (NON-HYDRANT)
08/19

PART 1 GENERAL

1.1 SUMMARY/APPLICABILITY

This specification defines the requirements and procedures for startup and performance testing of all equipment, components, control systems, devices, and associated appurtenances which are used for the receipt, storage, transfer and issue of petroleum fuel products for non-hydrant fuel facility systems. It covers requirements for safety, Government scheduling and coordination, device testing, existing and new system cleanliness, system flushing, demonstration of indicated and specified system performance, and final acceptance and reporting. The types of fuel systems covered include:

a. tank truck, rail car, pipeline and marine off-loading and loading systems

b. fuel transfer pumphouses and systems

c. installation pipelines and interterminal pipelines

d. military service station facilities handling gasoline, diesel, and jet fuel that:

(1) refuel (provide motive fuel for) commercial type government vehicles.

(2) refuel (provide motive fuel for) military tactical vehicles.

(3) load fuel into the storage tanks of tactical refueler tank trucks.

It does not cover private vehicle fueling stations such as exchange service stations, nor aircraft direct refueling hydrant systems.

1.2 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN PETROLEUM INSTITUTE (API)

API RP 1595	(2012; R 2019; 2nd Ed) Design, Construction, Operation, Maintenance, and Inspection of Aviation Pre-Airfield Storage Terminals

U.S. ARMY CORPS OF ENGINEERS (USACE)

ER 1110-1-8167	(2016) Engineering and Desig -- Petroleum, Oil, and Lubricants Mandatory Center Of Expertise

1.3 ADMINISTRATIVE REQUIREMENTS

1.3.1 Plans

The Contractor must submit detailed written plans (prepared by the System Supplier) for implementation of the System Start-Up Plan, the Fuel Provisioning Plan, and the Performance Testing Plan. The plans must specify a detailed plan incorporating in a sequential manner all work specified in PART 3 EXECUTION of this specification section. Plan elements must include:

a. Personnel. List of Contractor's personnel by trade, list of key personnel, list of safety equipment, list of miscellaneous equipment such as two-way radios, and personnel transportation vehicles.

b. Fluid Used for Hydrotesting, and Flushing. Identify what fluid will be used for each operation in each system section.

c. Fuel. See the Fuel Provisioning Plan.

d. Storage-Into. Identify where the contents of the piping will be pushed into including the capacity required, how the storage vessel will be prepared for receiving the piping content, how it will be emptied and how it will be cleaned after the contents are removed.

e. Storage-From. Identify where the fluid that will be drained or pushed into the piping will come from including the capacity required, the number, size and type of the storage vessel, how the storage vessel is filled, how it will be emptied, and how it will be cleaned after the contents are removed.

f. Piping. Notwithstanding the requirements described elsewhere, every pipe section and individual component in the system covered by this specification section must be filled, vented, hydrostatically tested, flushed, cleaned, and tested for fuel quality. It must also be able to be isolated and drained if found that it needs repair. The Plans must detail how this is to be done.

g. Equipment Tests. Detailed procedures and schedules for each system component to perform all system tests under each operating scenario in accordance with paragraph EQUIPMENT TESTS.

h. Performance Testing. Detailed procedures and schedules for each system component to perform all system tests under each operating scenario in accordance with paragraph PERFORMANCE TESTING.

i. Hydrotesting Plans. See the Work Plan in Section 33 52 40 FUEL SYSTEMS PIPING (NON-HYDRANT).

j. Schedule. Schedules must be generated with listing dates and durations of all system start-up activities as well as regular coordination and safety meetings and dates of key events for Government participation.

k. Contingency plans. Information on spill and fire contingencies, along with the required Government Fire and Safety Office involvement and approvals.

l. Coordination with Installation. Description of how Contractor and System Supplier must implement system start-up in coordination with ongoing operations at the Installation. Plan must incorporate all phasing and work restriction requirements of the Contract documents.

1.3.2 Copies of API Publication

Provide four copies of API RP 1595 to the Contracting Officer.

1.3.3 Fuel Testing Laboratory Qualifications

Contractor must submit the qualifications of the DoD Fuel Testing Laboratory which will be used to test the fuel samples.

1.3.4 System Start-up Plan

Submit a detailed written plan prepared by the Contractor and System Supplier for implementation of System Start-Up. Submit the plan 60 (CONUS) days prior to System Start-Up. The Contractor and System Supplier are responsible for implementing System Start-Up in coordination with ongoing operations.

1.3.5 Performance Testing Plan

Submit a detailed written plan prepared by the Contractor for implementation of Performance Testing. Submit the plan 60 (CONUS) days prior to System Start-Up. The Contractor and the System Supplier are responsible for implementing the Performance Testing Plan in coordination with ongoing operations.

1.3.6 Fuel Provisioning Plan

Submit a detailed written Fuel Provisioning Plan prepared by the Contractor. The Fuel Provisioning Plan must include a timeline for the required receipt date(s), grade of fuel, and quantity of fuel on each receipt date required to execute the Start-up and the Performance Testing plans.

1.3.7 Certification (Ready for Start-Up and Performance Testing)

As a prerequisite to fuel system start-up, the Contractor must submit a certificate that certifies all work provided on the fuel system, except for touch-up field painting, has been inspected and approved by the specified approving authorities. Further, the Contractor must certify on this certificate that all specified checks and inspections have been successfully completed prior to start-up. Submit the plan 30 (CONUS) notice prior to commencement of fuel system start-up. The Contractor must submit the Certificate of Completion to the Contracting Officer at least 7 calendar days prior to commencement of system start-up and performance testing. The Contracting Officer must then be responsible for scheduling the Government representatives and appropriate military command authority for participation in the inspection, performance testing, and final approval activities. Any contractual deficiencies observed must be corrected by the Contractor without cost to the Government.

1.4 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for

Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Copies of API RP 1595; G, DO

System Start-Up Plan; G, DO

Performance Testing Plan; G, DO

Fuel Provisioning Plan; G, RO

SD-06 Test Reports

Final Reports; G, DO

Equipment Tests; G, DO

Piping Flushing Checklist; G, DO

SD-07 Certificates

Fuel Testing Laboratory Qualifications; G, RO

Certification (Ready for Start-Up and Performance Testing); G, DO

Contractor Start-Up Qualifications; G, RO

Certificate of Calibration; G, RO

Disposal Of Waste Materials

SD-11 Closeout Submittals

Certification of Entire System

1.5 CLOSEOUT SUBMITTALS

1.5.1 Final Reports

Contractor must prepare a final report that documents the execution of the approved start-up and performance testing plan. All items of work specified in the Start-up and Performance Testing plans must be carried out and reported in this report unless otherwise approved by the Contracting Officer. Include as a part of this report:

a. Verification letters of approved fuel storage tank hydrostatic tests and the approved piping hydrostatic tests, as generated under other specification sections.

b. Final settings of the valves and switches.

c. A copy of the flow and pressure output graphs and excel data and charts on CDR media with an explanation of what the graph indicates and what the system is doing.

d. A schematic flow diagram drawing of the resultant system showing major valves with the "normal" position of each manual valve noted,

equipment, and the type, location, and setpoints of each safety relief valve and thermal relief valve.

e. A certified pipeline inventory - a detailed list with sizes, lengths, quantity, and volumes must be provided for the systems in this project. Such systems include, but are not limited to: marine receipt, pipeline receipt, truck off-loading receipt, pumphouse, pump pad, truck loading, marine loading, transfer pipeline, product recovery, and other miscellaneous piping systems. Fuel system volume must be calculated using as constructed pipe lengths, internal diameters, fittings, and components. Totals must be provided for all items containing fuel with the exception of tanks which is covered by other specifications.

1.6 QUALITY ASSURANCE

1.6.1 Contractor Start-Up Qualifications

Submit the following data for approval:

a. Certification stating that the Contractor has provided start-up services (including start-up, existing system cleanliness confirmation, and performance testing experience) for five similar systems in the last five years.

b. Project names, locations, system description, and items provided at these installations. Include user point-of-contact and current telephone numbers.

1.6.2 Certification of Entire System

Prior to the acceptance of the newly constructed system by the Government, all installed mechanical and electrical system components must be inspected and approved by the Contracting Officer. Provide the Contracting Officer 60 days notice in order to schedule the Installation and Service Headquarters and/or their designated appointee for participation in the inspection, Performance Testing, and approval. Any deficiencies observed must be corrected by the Contractor without cost to the Government.

1.6.3 Service Headquarters Definition

SME is defined as Service Headquarters Subject Matter Experts: Air Force - The Air Force Fuels Facilities Subject Matter Expert (AFCEC/COS); Army - Headquarters, U.S. Army Corps of Engineers; POL-MCX Facilities Proponent (CECW-EC) through the Army Petroleum Center (APC); Navy/Marine Corps - NAVFAC POL Facility Subject Matter Expert (NAVFAC EXWC, CI11). ER 1110-1-8167 Engineering and Design Petroleum, Oil, and Lubricants Mandatory Center of Expertise must be followed.

The Service Control Point (SCP) is defined as follows: Army - Army Petroleum Center; Air Force - Air Force Petroleum Office; Navy/Marine Corps - Naval Supply Systems Command - Energy.

1.7 SYSTEM SUPPLIER INVOLVEMENT

The System Supplier is defined in Specification 33 57 55 FUEL SYSTEMS COMPONENTS (NON-HYDRANT). The Contractor and the System Supplier must work together to prepare the Start-Up Plan, Equipment Testing Plan,

Performance Testing Plan, and the Final Reports. They must both be present during all activities described in this section. The System Supplier must be responsible to the Contractor for scheduling all Contractor, sub-Contractor, and manufacturer's service personnel during activities described in this specification section.

1.8 DISPOSAL OF WASTE MATERIALS

The Contractor must be responsible for properly disposing of any sludge, debris, filtration elements, and waste fuel resulting from piping and tank flushing activities as specified in Section 33 57 55. Comply with all applicable Installation, local (city and county), State, and Federal Regulations for hazardous waste disposal.

PART 2 PRODUCTS

2.1 GOVERNMENT-FURNISHED MATERIAL AND EQUIPMENT

The Government will furnish the following materials, equipment and services during the performance of the work under this section.

2.1.1 Fuel

Some fuel loss should be expected. Fuel that is lost during flushing , equipment testing, and performance testing is viewed as a Start-up and Performance Testing expense and should be budgeted for in Contractor estimates. As Basis of Bid, the Contractor must allow for 200 gallons of fuel losses in the bid.

The Contractor is responsible for the disposal of any waste product.

The Contractor must establish a Department of Defense Activity Address Code and must reimburse the US Government for any US Government fuel lost resulting from poor workmanship or contamination.

The Government will provide fuel given that the requirements are submitted with sufficient lead time to allow the US Government to secure the grade and volume required and make the necessary transportation requirements. The Contractor must provide a copy of the Start-up, Fuel Provisioning, and Performance Testing plans a minimum of 60 days in advance of System Start-up.

FLUSHING, EQUIPMENT TESTS and PERFORMANCE TESTING: The flushing, and testing phases will be identified separately in the start-up and Performance Testing plans. Fuel used for flushing, and testing will become contaminated, the fuel must be isolated and is considered off-specification until the quality can be verified. Fuel volumes required for flushing and testing should be minimized to limit costs, so estimates should be made accordingly. The Contractor will be responsible for disposing of any waste product.

Upon satisfactory completion of the flushing operations, the Government will supply the additional quantities of fuel required to complete the other work under this section. This larger volume of fuel will not be delivered to the system until the Contractor has satisfactorily completed all work and, in particular, the removal of preservatives and foreign matter from those portions coming in contact with the fuel valves, pumps, filter-separators and other such system components.

2.2 CONTRACTOR-FURNISHED MATERIAL AND EQUIPMENT

2.2.1 Contractor-furnished

Provide material, equipment and labor not specified to be Government-furnished and required for proper System Start-Up of the system. Equipment being provided must be calibrated and the certificate of calibration be submitted to the Contracting Officer prior to use. Equipment must include but not be limited to the following:

a. Temporary strainers.

b. Pipe spools.

c. Flow meters.

d. Pressure gauges.

e. Electronic sensors and recorders for pressure are included in the Pump Control Panel (PCP). This equipment must be used to monitor and record the system during the "Equipment Tests" and "Performance Testing" portions of this Specification Section. Recorded data must be used by the Contractor and equipment factory representatives to achieve final control valve and equipment adjustments. Recorded data must include:

(1) Fueling pumps discharge pressures.

(2) Storage Tank levels.

(3) Product Recovery Tank levels.

(4) Fueling pumps suction pressures.

(10) Back Pressure Control Valve downstream pressures.

(11) Bypass Pressure Control Valve upstream pressures.

(12) Bypass Pressure Control Valve downstream pressures.

f. The Contractor must have on hand sufficient filter elements and coalescer cartridges to adequately clean the system. During the cleaning operation, provide a flow versus pressure drop graph for each filter-separator, as provided in Attachment 1 - Equipment Tests. Change coalescers and cartridges upon reaching a differential pressure of 15 psi or when pressure drop is less than previous graph or fails to increase properly. Isolate each filter-separator, one at a time and use one fueling pump to obtain rated flow rate 300 gpm . A minimum of one complete set of coalescer elements and separator cartridges for each filter-separator must be turned over to the Government after new coalescer elements and separator cartridges are installed in each filter-separator vessel after completion of Performance Testing.

n. The Contractor must be responsible for providing the electrical power from a source identified by the Government to the testing locations.

o. Temporary filtration/strainers.

[*Am-00002]
p. Diesel Exhaust Fluid (DEF)[**Am-00002]

2.2.2 Design Conditions

Use temporary flushing lines and equipment that are equal in strength, stability, and materials to the associated permanent components. However, spools may be carbon steel. Additional design conditions must be as specified in Section 33 57 55 FUEL SYSTEMS COMPONENTS (NON-HYDRANT).

2.2.3 Electric Power

Electric power required for the performance of the work under this section must be furnished by the Contractor.

PART 3 EXECUTION

3.1 SEQUENCE OF EVENTS

The following events take place in the Start-Up and Performance Testing of a system and their definitions:

a. System Start-Up Phase: The System Start-Up phase encompasses all of the events described below up to the Performance Tests Phase.

b. Preliminary Requirements: Confirms completion of the system before fuel is received.

c. Preparations for Flushing: Activities that take place before initial receipt of fuel.

d. Pneumatic Testing: Test for leaks in a piping system using air under pressure as the test medium. For requirements see Section 33 52 40 FUEL SYSTEMS PIPING (NON-HYDRANT).

e. Hydrostatic Testing - Water: Use of water to test for leaks in a piping system using liquid under pressure as the test medium. For requirements see Section 33 52 40 FUEL SYSTEMS PIPING (NON-HYDRANT).

f. Hydrostatic testing - Fuel: Use of fuel to test for leaks in a piping system using liquid under pressure as the test medium. For requirements see Section 33 52 40 FUEL SYSTEMS PIPING (NON-HYDRANT).

g. Soak Testing: Perform "Soak Testing" of the piping system using fuel, as per Section 33 52 40 FUEL SYSTEMS PIPING (NON-HYDRANT)

h. Flushing: In this context, refers to removing gross contamination (free water and solids) from a fuel system using fuel.

i. Cleaning (filter vessels and strainers): Filter vessels and strainers that are designed to be opened for cleaning must be opened and cleaned.

j. Control Valve Adjustment: Control valve adjustment so that equipment can be safely tested and adjusted.

k. Equipment Tests: Tests performed by the Contractor and the System Supplier to confirm that individual components of the fuel system are correctly installed and are operational.

1. Performance Tests Phase: Government witnessed demonstration of the proper operation of the individual pieces of equipment and the system or systems as a whole.

3.2 PRELIMINARY REQUIREMENTS

All activities listed in paragraph PART 3 EXECUTION must be performed sequentially in the order they are presented. Prior to any on-site system start-up activities, the Contractor must ensure that all requirements of the paragraph SAFETY are satisfied. Project must be substantially complete, except for touch-up field painting, and Contractor's work area must be free of debris, trash and obstacles. Perform the following activities prior to receipt of fuel:

3.2.1 Safety

Prior to any on-site system start-up activities, the following safety procedures must be accomplished in all fueling areas to be started up and performance tested under this specification section: testing/operation of emergency showers and eyewash stations, placement of Contractor-provided portable eyewash units within 100 feet or 10 seconds from the fueling point, verification of proper grounding throughout system, coordination with Government Fire and Safety Office and Fuels personnel, placement of Contractor-provided spill pads, placement of Contractor-provided fire extinguishers capable of extinguishing a fuel fire. Ensure that all radios/devices at all Class I, Division 1 areas are intrinsically safe.

3.2.2 Electrical Preparations

Prior to energizing the electrical system components, verify that short-circuit links have been removed from current transformer and that secondary circuits have been connected. Confirm that all tests required for fire detection and suppression systems have been performed and accepted. Verify all electrical transmitter connections and ensure proper calibration. Verify all electrical system components meet the classification and division as required by the design. Verify correct rotation of all motors prior to testing. Verify paddle type flow switches by physically actuating vanes and checking outputs. Conduit explosion-proof sealoffs must be poured after initial electrical checks but before fuel receipt.

3.2.3 Emergency Fuel Shutoff (EFSO) System Testing

Prior to initial fuel receipt, verify that each switch will trip the circuit breaker of the fuel pumps.

3.2.4 Piping System

Ensure that all piping weld integrity, leak detection systems, and coating inspections have been performed per the applicable specifications. Provide statement that required testing has been completed in the Final Reports. Evacuate all accumulated water from piping low point drains, valve cavities, and equipment drains. Verify all bolted connections are tightness tested to required torque using a calibrated torque wrench. Verify that all pressure gauges are properly calibrated, located and installed. Ensure that piping's cathodic protection system is tested, calibrated and operational. Ensure that pipe marking and identification are provided as specified. Ensure that piping system thermal relief provisions are installed as designed. Verify the correct installation of

piping expansion loops and supports.

3.3 PREPARATIONS FOR FLUSHING

Upon completion of the system to the satisfaction of the Contracting Officer and the Service Headquarters and/or their designated appointee, make the following preparations for flushing the system.

3.3.1 Protection of System Components

The following items must be removed from the system prior to start of flushing operations and, where applicable, replaced with spools of pipe, diameter equal to the item removed.

a. Control valves. This also includes control valve tubing exterior to the valve such as that which runs from tank level control valves up to tank float pilots.

b. Sensors which are exposed to the fluid such as pressure gauges and thermometers.

c. Coalescer and separator elements in filter-separators.

d. Meters.

After flushing, the above items must be reinstalled in the system and the spool sections turned over to the Contracting Officer.

3.3.2 Strainers

Ensure strainers are clean before flushing. Temporary 60 mesh strainers with minimum 300 percent open area must be provided in the suction line ahead of each fueling pump to remain permanently in the system. Any damaged permanent or temporary strainers must be replaced by the Contractor at no additional cost to the Government.

3.3.3 Water Draw-off

Remove any accumulated water from piping, equipment, and storage tanks' sumps and bottoms. Drain water and return fuel via filtration to storage tank. Repeat process until all water is removed. Dispose of petroleum contaminated water in accordance with Installation, local, State, and Federal regulations.

3.4 INITIAL FUEL RECEIPT INTO STORAGE TANK

3.4.1 General

Utilize one storage tank for initial fuel receipt to isolate contaminated fuel. Initial receipt of fuel must be done by gravity if possible. The Contractor must station personnel throughout piping system at high point vents to bleed air. All flanges and system components will be periodically inspected for leaks during filling procedures.

3.4.2 Storage Tanks

Receipt flow rate into an empty storage tank must not exceed 3 feet per second (FPS), as measured in the main receipt piping, until outlet of tank fill tube is submerged.

3.4.3 Components

Ensure that filter-separators and other vessels are filled slowly by closing outlet valves and venting through air eliminators. Fill filter vessels using slow-fill line to maintain a packed condition in vessels throughout initial fill of piping system. Differential pressure across strainers must be continuously monitored. Any time a strainer differential pressure reaches 20 psig, it must be cleaned.

3.4.4 Fuel Quality

Fuel used during initial receipt must be considered contaminated and must be positively isolated, with blind flanges or closed, padlocked manual valves, from any active transfer, or tank truck loading operations. Fuel isolation must continue until all flushing is completed. A method of checking fuel quality that is acceptable to the Contracting Officer must be provided at the beginning and end of any new piping section.

3.4.5 Fuel Receipt

3.4.5.1 Fuel Receipt by Commercial Truck

Start-up personnel must meet with Government personnel in charge of existing fuel storage to discuss fuel transfer procedures. Topics must include: methods of communication to start/stop pumps; flow rate and head characteristics of transfer pumps; methods of restricting initial receipt flow rate; methods of straining and filtering initial receipt fuel; accommodating multiple pump starts resulting from required strainer and filter cleaning operations; required quantity of fuel to be transferred. Coordinate with Government personnel to schedule quantity of trucks required. Contractor's personnel must be positioned at each offloading position, at the pumphouse and at the receipt tank, all in radio contact. Contractor must provide a written summary of truck receipt procedures to the Contracting Officer. If truck unloading system is newly constructed, perform initial receipt, flushing, and testing prior to performance testing.

3.4.5.2 Fuel Receipt from Piping System

Start-up personnel must meet with Government personnel in charge of existing fuel storage to discuss fuel transfer procedures. Topics must include: methods of communication to start/stop remote pumps; flow rate and head characteristics of pumps; methods of restricting initial receipt flow rate; methods of straining and filtering initial receipt fuel; accommodating multiple pump starts resulting from required strainer and filter cleaning operations; required quantity of fuel to be used. Contractor must provide a written summary of piping fill procedures to the Contracting Officer.

3.4.6 Initial Low Point Flush

Perform an initial low point flush operation by flushing each low point drain through a portable basket strainer for 10 seconds at a system pressure of 30 psig. Repeat flush until basket strainer collects no additional debris.

3.4.7 Storage Tank Tightness Tests

Perform tightness testing and manufacturer's tests of the storage tanks per Specification Section 33 56 10 FACTORY-FABRICATED FUEL STORAGE TANKS.

3.4.8 Piping Hydrostatic Tests

Hydrostatically test the piping system with fuel as required by Section 33 52 40 FUEL SYSTEMS PIPING (NON-HYDRANT).

3.4.9 Piping Soak Tests

Upon completion of hydrostatic testing with fuel, perform "Soak Testing" of the piping systems per API RP 1595. Duration of the test must be a minimum of 4 days and maximum of 7 days.

3.5 INITIAL FUEL RECEIPT DIRECTLY INTO PIPING SYSTEM

3.5.1 General

Initial receipt of fuel must be done by gravity if possible. The Contractor must station personnel throughout piping system at high point vents to bleed air. All flanges and system components will be periodically inspected for leaks during filling procedures.

3.5.2 Components

Ensure that filter-separators and other vessels are filled slowly by closing outlet valves and venting through air eliminators. Downstream valves must be throttled to maintain a packed condition in vessels throughout initial fill of piping system. Differential pressure across strainers must be continuously monitored. Any time a strainer DP reaches 20 psig, it must be cleaned.

3.5.3 Fuel Receipt

3.5.3.1 Fuel Receipt from Existing Piping System

Start-up personnel must meet with Government personnel in charge of existing fuel system to discuss fuel transfer procedures. Topics must include: methods of communication to start/stop remote pumps; flow rate and head characteristics of pumps; methods of restricting initial receipt flow rate; methods of straining and filtering initial receipt fuel; accommodating multiple pump starts resulting from required strainer and filter cleaning operations; required quantity of fuel to be used. Contractor must provide a written summary of piping fill procedures to the Contracting Officer.

3.5.4 Initial Low Point Flush

Perform an initial low point flush operation by flushing each low point drain through a portable basket strainer for 10 seconds at a minimum system pressure of 30 psig. Repeat flush until basket strainer collects no additional debris.

3.5.5 Piping Hydrostatic Tests

Hydrostatically test the piping system with fuel as required by Section 33 52 40 FUEL SYSTEMS PIPING (NON-HYDRANT).

3.5.6 Piping Soak Tests

Upon completion of hydrostatic testing with fuel, perform "Soak Testing" of the piping systems per API RP 1595. Duration of the test must be a minimum of 4 days and maximum of 7 days.

3.6 FLUSHING

Flushing procedures remove gross particulate and water contaminants. All piping including but not limited to receipt piping,issue piping, product recovery lines, truck off-loading lines, thermal relief piping, high point vents, low point drains, control valve tubing on the control valves, must be flushed with fuel.

In the event flushing identifies the presence of clay or soil like material in the system, Contractor must immediately notify Contracting Officer for direction.

3.6.1 Flushing Requirements

Begin flushing of fuel system piping at low flow rates using one pump in multiple pump systems at 50 percent of rated flow. Slowly increase flushing flow rate until a plus or minus 12 FPS fuel velocity is achieved. Flush for one piping volume. For gravity, suction, or other non-pumped piping segments, minimum flushing volume must be four times the pipe volume. Sampling must be performed by the Contractor and testing must be done by an independent fuels testing laboratory approved by the Contracting Officer. Fuel must be free of gross contamination and visible free water to the satisfaction of the Contracting Officer.

In the event flushing identifies the presence of clay or soil like material in the system, Contractor must immediately notify Contracting Officer for direction.

3.6.2 Fueling System Piping

During flushing procedure periodically bleed air through high point vent and drain water through low point drains.

3.6.2.1 General Fuel Lines

The flushing of all of the system piping segments must be accomplished by pumping fuel through the fueling system piping and back into the same tank the fuel was withdrawn from. Air must be bled from system high points. The procedure must be continued until the fuel being delivered into the tanks is acceptable to the Contracting Officer. After the piping system segments have been flushed to the satisfaction of the Contracting Officer (and periodically during the flushing operation), the Contractor must flush all high point vents and low point drains for a minimum of 10 seconds at a pressure of 30 psig. Flush all plug valves of debris using the drain port at the bottom of the valve. Cone strainers must be kept clean in order to insure maximum flow rate. All accumulated material from the strainers must be reviewed and identified, including source if possible. Upon completion of the first flushing operations, the cone strainers must be cleaned, reinstalled, and remain in the system. In addition, baskets from all strainers must be removed and cleaned.

3.6.2.2 Truck Offloading System Piping

Flushing of the truck offloading system and piping must occur during the receipt operations. Samples of the incoming fuel must be taken at the point of connection with the OTR tank truck. Sample the fuel into and out of each offloading station.

3.6.2.3 Pump Pad Piping

Remove system components as specified in paragraph PROTECTION OF SYSTEM COMPONENTS. Perform the following flushing operations by withdrawing fuel from one tank and returning it to another tank. Circulate a sufficient amount of fuel for each operation. Bleed air from high points.

a. Position manual valves to circulate fuel through one pump, filter-separator combination.

3.6.3 Piping Flushing Checklist

The Contractor must generate a comprehensive matrix of all new and existing piping sections in the system. Matrix must serve as an Owner's piping inventory and a checklist for all Contractor-provided flushing operations. Column entries must include pipe section name, location, diameter, approximate length, flushing fuel velocity and volume achieved and acceptable results of sampling.

3.7 CONTROL VALVE ADJUSTMENT

Check all control valve settings and field adjust from the factory settings at System Start-Up as necessary to provide a smooth operation, devoid of pressure surges, spikes, and hunting. Check the filter separator control valves and adjust as follows:

3.7.1 Control Valves on Issue Filter-Separator Downstream Side

a. Position valves so that one fueling pump can pump through only one filter-separator. Close the valve at the entrance of the apron loop, and open the bypass valve, allowing discharge into the circulating line.

b. Start the pump and adjust the filter-separator control valve for the rated flow capacity of the filter-separator at nominal rated flow.

c. Repeat above for each remaining filter-separator.

3.8 EQUIPMENT TESTS

After completion of flushing,, Contractor must complete and submit the Equipment Tests (see Attachment 1 - Equipment Tests). Equipment Tests must be submitted prior to Performance Testing

3.8.1 Control System and Control Valves

Field adjustment of automatic control valves and automatic pump controls while in operation must be made only by the valve manufacturer's authorized field test engineer. . Both the mechanical and electrical components must be adjusted concurrently. Record required data necessary to prepare Equipment Tests Report.

3.8.2 Tank Level Alarms

Position valves to transfer fuel between tanks.

Start fueling pump and pump sufficient fuel out of the first tank to allow the low-low level alarm (LLLA) to stop the fueling pump. Repeat procedure for each fueling pump and each tank until the low-low level alarm stops the fueling pumps due to low liquid level in tank.

Repeat testing for high-high level alarm other alarms checking each one in turn. Repeat procedure for each fueling pump and each tank until the high-high level alarm closes the valve due to high liquid level in tank.

3.8.3 Fueling Pump Operation

Demonstrate operation of all pump control start/stop station to start and stop the fueling pumps in the presence of the Contracting Officer. Repeat the operating sequence with each of the pumps being selected as lead pump if the pumps are controlled by a Pump Control Panel or an automatic control system with a variable lead pump. For this test, measure the flow rates. Witness and record flow rates and test results.

3.8.4 Emergency Shutdown

With one fueling pump circulating fuel through the system, test each "Emergency Stop" pushbutton station to verify that the pump stops . Repeat above procedure for each fueling pump and "Emergency Stop" pushbutton station. Conduct tests for both the automatic and manual modes. With all the fueling pumps circulating fuel through the system, push an "Emergency Stop" pushbutton station.

3.9 PERFORMANCE TESTS

Performance testing must occur after the Contractor has performed the Equipment Tests. Performance testing must demonstrate to the satisfaction of the Contracting Officer and Service Headquarters and/or their designated appointee these portions of the fueling system are working as specified. Performance testing must consist of repeating the Equipment Tests (indicated in previous paragraphs) and operating the fueling system during actual operations in the presence of Government Witnesses. The maximum rated capacity of the system must be demonstrated. The Contractor must notify the Contracting Officer 30 calendar days in advance of the test to permit arrangement for the use of Government-furnished items. During the time period of performance testing, no construction activities will be allowed on the project site. The project site must be considered an operational (fuel) zone (verses a construction zone) during this performance testing period. Personnel, dressed for fuel's operation, will be present to witness testing and participate in Contractor provided training.

3.9.1 Final Performance Test

A final performance test must consist of demonstrating the operation of the system for the purpose for which it is intended:

a. off-loading over the road tank trucks
b. transferring fuel through the piping system

3.9.2 Satisfactory Performance

In the event a portion of the system or any piece of equipment fails to meet the test, make the necessary repairs or adjustments and repeat the Performance Test until satisfactory performance is obtained. The determination of satisfactory performance must be made by the Contracting Officer and the Service Headquarters and/or their designated appointee.

3.9.3 Performance Testing Plan

Contractor must edit the example Performance Testing plan and submit for approval. An example Performance Testing plan can be found at the end of this Section as Attachment 2 - Performance Testing Plan. Submit plan a minimum of 60 days prior to performance testing.

3.9.4 Equipment Tests

Contractor must provide 10 hard copies and electronic copies of the completed Equipment Tests to the Service Headquarters and/or their designated appointee at the start of Performance Testing for validation during Performance Testing.

3.9.5 Final Acceptance

Fill the system with fuel and operate leak-free prior for acceptance. Anything wet with fuel is considered to be leaking.

3.9.5.1 Tank High Liquid Level Shut-Off Valve Test and Adjustments

During the final filling of tanks, check the tank automatic high liquid level shut-off valve for proper functioning at least three times by lowering the fuel level and refilling again. Adjust valve to achieve a safe fill level.

3.9.5.2 Tank Level Indicator Adjustments

Also, during the final filling of tanks, adjust and calibrate the tank level indicators including the final setting of the high high level (HHLA) and high level (HLA) alarms. Since the HHLA is at a point higher than the High Liquid Level Shut-Off Valve float set point, an artificial method of simulating HHL must be used.

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SECTION 33 09 52

FUEL PUMP CONTROL AND ANNUNCIATION SYSTEM (NON-HYDRANT)
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PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C37.90	(2005; R 2011) Standard for Relays and Relay Systems Associated With Electric Power Apparatus
IEEE C62.41	(1991; R 1995) Recommended Practice on Surge Voltages in Low-Voltage AC Power Circuits

INTERNATIONAL SOCIETY OF AUTOMATION (ISA)

ISA 18.1	(1979; R2004) Annunciator Sequences and Specifications

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA 250	(2020) Enclosures for Electrical Equipment (1000 Volts Maximum)
NEMA IA 2	(2005) Programmable Controllers - Parts 1 thru 8
NEMA ICS 1	(2022) Standard for Industrial Control and Systems: General Requirements
NEMA ICS 2	(2000; R 2020) Industrial Control and Systems Controllers, Contactors, and Overload Relays Rated 600 V
NEMA ICS 4	(2015) Application Guideline for Terminal Blocks
NEMA ICS 6	(1993; R 2016) Industrial Control and Systems: Enclosures

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2023; ERTA 7 2023; TIA 23-15) National Electrical Code

U.S. FEDERAL COMMUNICATIONS COMMISSION (FCC)

FCC Part 15	Radio Frequency Devices (47 CFR 15)

UL SOLUTIONS (UL)

UL 508	(2018; Reprint Jul 2021) UL Standard for Safety Industrial Control Equipment
UL 1012	(2010; Reprint Apr 2016; Rev Mar 2021) UL Standard for Safety Power Units Other than Class 2
UL 1449	(2021; Reprint Dec 2022) UL Standard for Safety Surge Protective Devices

1.2 ADMINISTRATIVE REQUIREMENTS

a. Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM applies to this section, with the additions and modifications specified herein.

b. Programmable Logic Controllers (PLCs) receive information from motor operated valved, position indicated ball valves, automatic tank gauging/independent level alarm probes and sensors, and other devices to control the fueling system.

c. The control system must be furnished by a single supplier. See Section 33 57 55 FUEL SYSTEM COMPONENTS (NON-HYDRANT) for other required components of the control system. The control system supplier must be responsible for providing a fully functional control system, in accordance with the drawings and specifications, including the field devices. Installation must be in accordance with NFPA 70.

d. Submit six copies of Operation and Maintenance Manuals, within 7 calendar days following the completion of factory tests. Installation, Operation, and Maintenance manuals for all system components supplied must be furnished following the completion of shop tests and must include:

(1) Pump Control Panels and Fiber Converter Panels including interior and exterior system components layout. Complete guide outlining step-by-step procedures for system startup and operation.

(2) All documents previously submitted and approved with all comments and field changes annotated. Complete description of the sequence of operation including that described in PART 3 and any subsystems not controlled by the PLC (e.g. alarm annunciator safety/circuit).

(3) Complete listing of all programming of the PLCs, and laptop computer.

(4) Complete relay ladder logic diagrams, PLC input/output diagrams and control power distribution diagrams for the complete control system.

(5) Complete troubleshooting guide, which lists possible operational problems and corrective action to be taken, including all as-built conditions.

e. Submit documents demonstrating the accuracy and completeness of the list of material and components, that items proposed comply fully with contract requirements, and are otherwise suitable for the application

indicated. Documents must consist of all data or drawings published by the manufacturer of individual items listed including manufacturer's descriptive and technical literature, performance data, catalog cuts, and installation instructions. Submit additional material if the listed items are not adequate to identify intent or conformance to technical requirements. Provide typed and electronic copies of these lists for approval. Any delays associated with resubmittals of incomplete or ambiguous initial submittals will be the Contractor's responsibility.

f. Documents must be bound in a suitable binder adequately marked or identified on the spine and front cover. A table of contents page must be included and marked with pertinent contract information and contents of the manual. Tabs must be provided to separate different types of documents, such as catalog ordering information, drawings, instructions, and spare parts data. Index sheets must be provided for each section of the manual when warranted by the quantity of documents included under separate tabs or dividers.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Shop Drawing; G, DO

SD-03 Product Data

Tools and Spare Parts

Laptop Computer; G, DO

Programmable Logical Controller (PLC) Hardware and Software; G, DO

Control Wiring Data Lists; G, DO

Human Machine Interface (HMI) Touchscreen; G, DO

Fiber Converter Panels (FCP) and Components; G, DO

Pump Control Panels (PCP) and Components; G, DO

Graphics Display Screen; G, DO

SD-06 Test Reports

Certified Pump Control Panels (PCP) Shop Test Reports; G, DO

Record of Test

SD-07 Certificates

Experience and Qualifications; G, DO

Testing Plan; G, DO

Training Plan for Instructing Personnel; G, DO

SD-10 Operation and Maintenance Data

Operation and Maintenance Manuals; G, DO

1.3.1 Submittal Coordination and Sequencing Requirements

See references to this Specifications Section and/or specific submittal items in Section 01 33 00, as well as requirements herein and as referenced in other parts of this contract, for coordination and sequencing of submittals and the associated work to be performed.

1.4 TOOLS AND SPARE PARTS

Provide the following:

a. Any special tools necessary for operation and maintenance of the system components providing supplier name, current cost, catalog order number, and a recommended list of spare parts to be stocked.

b. One spare set of fuses of each type and size.

c. Recommended manufacturer list of spare parts, including part number, current unit price, and source of supply.

d. One spare power supply module.

e. One spare I/O module for discrete devices.

f. Two PLC RAM back-up batteries.

1.5 EXPERIENCE AND QUALIFICATIONS

Submit the following data for approval:

a. Certification stating that the manufacturer has manufactured, installed, and successfully completed at least five PLC-based systems for automatic cycling of pumps based upon varying dispensing demands ranging from 0 to 2400 GPM utilizing multiple pumps.

b. Certification that the control systems have successfully operated over the last 2-years and are currently in service.

c. Project names, locations, and system description of these installations. Include user point-of-contact and current telephone numbers.

1.6 WARRANTY

The Pump Control and Annunciation System including devices, hardware and software must be warranted for a period of one year from the date of acceptance of the system by the Government. This warranty service must include parts and labor service for system components supplied under this specification. Upon notification by the Government of system or component failure, respond at the site with necessary parts within 48-hours of notification.

PART 2 PRODUCTS

2.1 MATERIALS AND SYSTEM COMPONENTS

2.1.1 Pump Control Panels (PCP) and Components

NEMA ICS 1, NEMA ICS 6, NEMA 250, and UL 508. The PCP enclosure must be a freestanding NEMA Type 12, smooth, gasketed enclosure constructed of 12 gauge steel. All seams must be continuously welded and there must be no drilled holes or knockout prior to delivery to the job site. The pump control panel dimensions must be a maximum of 90-inches high, maximum 36-incheswide, and a maximum of 24-inches deep and must have removable lifting eyes. The interior surfaces of the panel must be properly cleaned, primed, and spray painted with white high-gloss enamel. Exterior surfaces must have standard factory finish. Access for the PCP must be front only and must consist of hinged doors having 3-point latching mechanisms. The doors must open approximately 120 degrees. Rack mounting angles, swing-out panels and other component mounting hardware must be installed such that servicing of one component must not require removal or disconnection of other components. No clearance will be required between the back of the panel and the room walls. Terminal facilities must be arranged for entrance of external conductors from the top or bottom of the enclosure.

2.1.2 Fiber Converter Panels (FCP) and Components

NEMA ICS 1, NEMA ICS 6, NEMA 250, and UL 508. The FCP enclosure must be a rack mounted NEMA Type 4X, [*Am-00002] heated and insulated for cold weather, [**Am-00002] stainless steel 316L, smooth, gasketed enclosure constructed of 14 gauge steel. All seams must be continuously welded and there must be no drilled holes or knockout prior to delivery to the job site. [*Am-00002] <text deleted> [**Am-00002] Exterior surfaces must have standard factory brushed finish. Access for the FCP must be front only and must consist of hinged doors having 3-point latching mechanisms. The doors must open approximately 120 degrees. Rack mounting angles, swing-out panels and other component mounting hardware must be installed such that servicing of one component must not require removal or disconnection of other components. Terminal facilities must be arranged for entrance of external conductors from the top or bottom of the enclosure. [*Am-00002] FCP enclosure heater must be thermostatically controlled and fan driven. Heater must be powered from FCP power distribution. Heating calculations must be performed to provide consistent heating of the enclosure. [**Am-00002]

2.1.3 Ventilation System

Provide one supply fans, single phase, 115 volt. Each fan must supply a minimum of 100 CFM. The supply and exhaust grill must contain a filter that is easily removed from the exterior of the enclosure. Also provide two thermostats with an adjustable set point range of 70 degrees F to 140 degrees F. Locate the thermostats near the top in the interior of the PCP.

2.1.4 Ground Bar

The control panel must have a tin-plated copper equipment ground bar. The bar must have a minimum of twenty grounding screws.

2.1.5 Human Machine Interface (HMI) Touchscreen Terminals

Provide HMI touchscreens in locations as provided on the drawings.

Touchscreen terminal must be industrial grade. The touchscreen terminal must be a minimum of 15-inches SGA TFT LED LCD. Provide the latest Intel Atom process operating at aminimum of 1.91 GHz quad core processor with a minimum of 4 GB DDR3L SDRAM and 64G SSD. Touchscreen terminal operating temperature should range from -4 degrees F to 140 degrees F. The cooling system must be fanless. The touchscreen terminal must be a minimum of 36 million touches at a single point. The touchscreen terminal type must be 5 wire analog resistive. Input and Output connections must include one RS-232, one RS-232/422/485, one USB 3.0, three USB 2.0 and any other connection type to make a complete operational system.

2.1.6 Standard Indicator Lights

NEMA ICS 1, NEMA ICS 2, and UL 508. Lights must be heavy duty, NEMA 13, 1-inch mounting hole, round indicating lights operating at 120 volts ac/dc or 24 volts ac/dc. Long life bulbs must be used. Indicator lights must have a legend plate with words as shown on drawings. Lens color as indicated on the drawings. Lights must be "push to test (lamp)" type. LED type lamps of comparable size and color may be substituted for standard indicator lights.

2.1.7 Selector Switches

NEMA ICS 1, NEMA ICS 2, and UL 508. Non-illuminated lever operated selector switches must be heavy duty, NEMA 13, round, and utilize a 7/8-inches mounting hole. They must have the number of positions as indicated on the drawings. Switches must be rated 600 volt, 10 amperes continuous. Legend plates must be provided with each switch with words as indicated on the drawings.

2.1.8 Pushbuttons

NEMA ICS 1, NEMA ICS 2, and UL 508. Non-illuminated pushbuttons must be heavy duty, NEMA 13, round, utilize a 7/8-inch mounting hole, and have the number and type of contacts as indicated on the drawings or elsewhere in the specifications. The emergency stop switch must be a red mushroom head, 1.5inch diameter, momentary contact type. Pushbuttons must be rated 600 volt, 10 amperes continuous. Legend plates must be provided with each switch with words as indicated on the drawings.

2.1.9 Relays

IEEE C37.90, NEMA ICS 2, UL 508.

2.1.10 Nameplates

Nameplates must be made of laminated plastic with black outer layers and a white core. Edges must be chamfered. Nameplates must be fastened with black-finished round-head drive screws or approved nonadhesive metal fasteners.

2.1.11 Transient Voltage Surge Suppression Devices

IEEE C62.41 for Category "B" transients, UL 1449.

2.1.12 Terminal Blocks

NEMA ICS 4. Terminal blocks for conductors exiting the PCP must be two-way type with double terminals, one for internal wiring connections and the

other for external wiring connections. Terminal blocks must be made of bakelite or other suitable insulating material with full deep barriers between each pair of terminals. A terminal identification strip must form part of the terminal block and each terminal must be identified by a number in accordance with the numbering scheme on the approved wiring diagrams.

2.1.13 Circuit Breakers

UL 508. Individual, appropriately sized, terminal block mounted, circuit breakers must be provided for all 120 volt PCP mounted system components and for the 120 volt terminal boards shown on the drawings.

2.1.14 Uninterruptible Power Supplies

UL 1012. Input voltage must be 120 volts (nominal), 1 phase, 60 Hertz. Output voltage regulation must be plus/minus 5.0 percent for the following conditions:

a. 20 to 100 percent load on output.

b. Input voltage variation of minus 15 to 10 percent.

c. Constant load power factor between 80 and 100 percent.

Response time must be 1.5 cycles or less. Battery capacity must be such as to provide an orderly shut down of operating programs or as a minimum 10 minutes.

2.1.15 Miscellaneous Power Supplies

UL 1012. Certain field devices may require power other than 120 VAC (i.e. 24 VDC). The power supplies must be convection cooled, have fully isolated independent outputs, have constant voltage, have short circuit and overvoltage protection, and have automatic current limiting.

2.1.16 Alarm Horns

UL 508. The alarm horns must consist of vibrating horns and resonating horns as shown on the drawings. One vibrating horn is to be mounted on each Fiber Converter Panel, and two vibrating and two resonating horns must be mounted outside of Building 451 as shown on the drawings. The exterior horns must each produce 100 db at 10 feet and must be provided in a weather proof housing. The PCP and FCP horns must produce 70 db at 10 feet.

2.1.17 Laptop Computer

2.1.17.1 Hardware

The following are the minimum hardware requirements for the laptop computer:

a. Latest Core i9 CPU operating at 5.4 GHz or faster

b. 16 GB RAM

c. 1 TB hard drive SSD

e. 16-inch 1920 x 1200 LED - Backlit Display

f. Keyboard

g. Pointing device (e.g. mouse, track ball)

h. 120VAC and Battery power supply

i All cables and connectors for interfacing with PLCs

j. One HDMI Port

k. Three USB 3.2 communications ports

l. Provide a carrying case for the Laptop Computer

2.1.17.2 Software

The following is the minimum software to be loaded on the laptop. The software must be the most current versions and compatible with each other to make a complete and usable system. All software needs to be fully site licensed (provide with software key) and come with all devices to allow a full restore or reload of software in the event of a hard drive crash.

a. Operating system (e.g. the latest commercially available MS Operating system)

b. Software for programming the PLCs

2.2 PROGRAMMABLE LOGICAL CONTROLLER (PLC) HARDWARE AND SOFTWARE

2.2.1 General

a. NEMA IA 2. PLC must be able to receive discrete and analog inputs and through its programming it must control discrete and analog output functions, perform data handling operations and communicate with external devices and remote I/O racks. PLC must be a modular, field expandable design allowing the system to be tailored to the process control application. The capability must exist to allow for expansion to the system by the addition of hardware and user software. At a minimum the PLC must include mounting backplanes, power supply modules, CPU module, communication modules, and I/O modules.

b. Design and test PLC provided for use in the high electrical noise environment of an industrial plant. PLC module must comply with the FCC Part 15 Part A for radio noise emissions. The programmable controller processor must be able to withstand conducted susceptibility tests as outlined in NEMA ICS 2, IEEE C37.90.

c. PLC must function properly at temperatures between 32 and 122 degrees F, at 5 to 95 percent relative humidity non-condensing and have storage temperatures between minus 40 and 140 degrees F at 5 to 95 percent relative humidity non-condensing.

d. PLC must have manufacturer's standard system status indicators (e.g. power supply status, system fault, run mode status, back-up battery status).

2.2.2 Central Processing Unit Module

The CPU must be a modular self-contained unit that will provide time of day, scanning, application (ladder rung logic) program execution, storage of the application program, storage of numerical values related to the application process and logic, I/O bus traffic control, peripheral and external device communications and self-diagnostics.

2.2.3 Power Supply Module

a. The power supply module must be plugged into the backplane not separately mounted. The power supply must be wired to utilize 120 VAC, 60 Hz power, the system must function properly within the range of minus 10 to plus 15 percent of nominal voltage. The power supply must provide an output to the backplane at a wattage and voltage necessary to support the attached modules. A single main power supply module must have the capability of supplying power to the CPU module and local communication and I/O modules. Auxiliary power supplies must provide power to remote racks.

b. Each power supply must have an integral on/off disconnect switch to the module. If the manufacturers standard power supply does not have an on/off disconnect switch a miniature toggle type switch must be installed near the PLC and clearly labeled as to its function.

c. The power supply must monitor the incoming AC line voltage for proper levels and have provisions for both over current and over voltage protection. If the voltage level is detected as being out of range the system must have adequate time to complete a safe and orderly shutdown.

2.2.4 Program Storage/Memory Requirements

a. The PLC must have the manufacturers standard nonvolatile executive memory for the operating system. The PLC must also have EEPROM (Electrically Erasable Programmable Read Only Memory) for storage of the user program and battery backup RAM for application memory. The EEPROM must be loaded by use of the laptop computer.

b. Submit a calculation of the required amount of EEPROM and RAM (random access memory) needed for this application plus an extra 50 percent.

c. The number of times a normally open (N.O.) or normally closed (N.C.) contact of an internal output can be programmed must be limited only by the memory capacity to store these instructions.

2.2.5 Input/Output (I/O) Modules

a. Provide all required I/O modules (analog input, analog output, discrete input, discrete output, and isolated discrete output) to manipulate the types of inputs and outputs as shown on the drawings and to comply with the sequence of operations. Also provide a minimum of 20 percent (round up for calculation) spare input and output points of each type provided, but not less than 2 of each type.

b. I/O modules must be a self-contained unit housed within an enclosure to facilitate easy replacement. All user wiring to I/O modules must be through a heavy-duty terminal strip. Pressure-type screw terminals must be used to provide fast, secure wire connections. The terminal

block must be removable so it is possible to replace any input or output module without disturbing field wiring.

c. During normal operation, a malfunction in any remote input/output channel must affect the operation of only that channel and not the operation of the CPU or any other channel.

d. Isolation must be used between all internal logic and external power circuits. This isolation must meet the minimum specification of 1500 VRMS. Provide optically isolated I/O components which are compatible with field devices.

e. Each I/O module must contain visual indicators to display ON/OFF status of individual input or output points.

f. Discrete output modules must be provided with self-contained fuses for overload and short circuit protection of the module.

g. All input/output modules must be color coded and titled with a distinctive label.

2.2.6 Interfacing

The PLC must have communication ports and communication modules using the manufacturers standard communication architecture for connections of the FCPs, other PCP, and Laptop Computer.

2.2.7 Program Requirements

a. The programming format must be ladder diagram type as defined by NEMA IA 2.

b. There must be a means to indicate contact or output status of the contact or output on the LCD screen (of the laptop computer). Each element's status must be shown independently, regardless of circuit configuration.

c. The program must be full featured in its editing capabilities (e.g. change a contact from normally open to normally closed, add instructions, change addresses).

2.2.8 Diagnostics

The CPU must continuously perform self-diagnostic routines that will provide information on the configuration and status of the CPU, memory, communications and I/O. The diagnostic routines must be regularly performed during normal system operation. A portion of the scan time of the controller should be dedicated to perform these housekeeping functions. In addition, a more extensive diagnostic routine should be performed at power up and during normal system shutdown. The CPU must log I/O and system faults in fault tables, which must be accessible for display. When a fault affects I/O or communication modules the CPU must shut down only the hardware affected and continue operation by utilizing healthy system components. All faults must be annunciated on the alarm annunciator.

PART 3 EXECUTION

3.1 PUMP CONTROL PANELS (PCP) AND COMPONENTS

3.1.1 General

a. Where two or more system components performing the same function are required, they must be exact duplicates produced by the same manufacturer. All display instruments of each type must represent the same outward appearance, having the same physical size and shape, and the same size and style of numbers, characters, pointers, and lamp lenses.

b. The PCP must include all required resident software programs and hardware to provide the specified sequence of operation. All software optical discs, including programming manuals, must be turned over to the Government at the completion of start-up so modification can be done in the field with no outside assistance.

c. It is intended that process controlling devices except field devices, and motor controllers be attached to or mounted within each PCP enclosure and all interconnecting wiring installed prior to shipment to the job site. This is to allow shop testing of the system and to decrease field labor requirements.

d. The PCP must be shipped fully assembled in one piece after the completion of the shop tests and all defects corrected.

3.1.2 Wiring

Wiring methods and practices must be in conformance with NEMA ICS 1, NEMA ICS 2, NEMA ICS 4, and NEMA ICS 6 recommendations as applicable. All wiring to instruments and control devices must be made with stranded wire, and wiring must be permanently labeled with conductor/wire numbers within one-inch of termination points. Labels must be tubular heat-shrinkable wire markers that remain legible after exposure to industrial fluids and abrasion. Position markers so that wire numbers can be read without disturbing or disconnecting wiring. Use of individual character-markers placed side-by-side is not acceptable. Numbers must match approved shop drawings. All wiring must be neatly laced from point of entry into enclosures to termination points with nylon lacing cord or plastic lacing ties. Lacing within wiring channels is not required. Where the PCP contains intrinsically safe wiring, barriers or other devices, the panel must be arranged so that all intrinsically safe wiring is separated from non-intrinsically safe wiring by approved methods. Wiring channels containing intrinsically safe wiring must be blue and be labeled as "Intrinsically Safe Wiring Only" on the cover. All conduit penetrations into the PCP containing intrinsically safe wiring must be separated from non-intrinsically safe conduit penetrations by a minimum of 2-inches. Provide typed Control Wiring Data Lists within each terminal cabinet and the PCP. The data lists must include: conductor identification number, wire gauge, wire insulation type, "FROM" terminal identification, "TO" terminal identification, and remarks. The preliminary lists generated by the Contractor will be submitted for approval to the Contracting Officer and will be updated to As-Built conditions by the Contractor. The As-Built data lists must be placed in a document holder within each enclosure.

3.1.3 Certified Pump Control Panels (PCP) Shop Test Reports

The manufacturer must shop test each PCP and laptop computer. The procedure must include simulation of field components and must provide for fully testing each pump control functions, fiber converter functions, and (HMIs) as a unit before delivery to the project site. The test must, reveal system defects, including, but not limited to, functional deficiencies, operating program deficiencies, algorithm errors, timing problems, wiring errors, loose connections, short circuits, failed components and misapplication of components. The test must be performed prior to shipment to the site and problems detected must be corrected. The final testing and correction sequence must be repeated until no problems are revealed and then two additional successful tests must be performed. Submit certified test report within 15-days after completion of the test. The report must include a statement that the Pump Control Panel performs as specified. Notify the Contracting Officer and the Service Headquarters 30-days prior to the final shop testing date. The Contracting Officer may require a Government witness at the final test before the PCP is shipped to the site.

3.1.4 Ventilation System

Thermostat T-1, must control fan F-1 and thermostat T-2 must control fan F-2. T-1 and T-2 must be set at 80 degrees F to maintain interior air temperature to 20 degrees F above ambient. Thermostat T-2 , set at 100 degrees F, must provide a non-critical PCP HIGH TEMPERATURE alarm to the alarm annunciator.

3.1.5 Grounding

The PCP ground bar must be connected to the building counterpoise via a #10 AWG conductor. Within the enclosure all I/O racks, processor racks, and power supplies must be grounded to meet the manufacturer's specifications.

3.1.6 Indicator Lights, Switches, and Pushbuttons

Indicator lights, switches, and pushbuttons must be mounted as shown on the drawings and must be arranged to allow easy vision and operation of each device. Each device must have a nameplate or legend plate as indicated on the drawings. Nameplate wordings must be as indicated on the drawings.

3.1.7 Surge Protective Devices

Surge protective devices (SPD) must be installed in the PCP to minimize effects of nearby lightning strikes, switching on and off of motors and other inductive loads. SPD must be provided for each control circuit ladder. Each ladder may contain any combination of the following devices: PLCs, power supplies (e.g., 24 volt), fans, relays, lights, switches. SPD must also be provided for PLC I/O originating outside of the building.

3.1.8 Terminal Blocks

As a minimum, any FCP or PCP device that connects to a field device (devices not located in the FCP or PCP) must be connected to a terminal block. A connection diagram similar to the drawings must be provided to the field Contractor for field connections to the FCP or PCP.

3.1.9 Circuit Breakers

As a minimum, any 120 volt FCP or PCP device i.e. (fans, lights, power receptacles, converter panels, 24 VDC power supplies, PLC CPUs, PLC I/O racks) must be provided with an individual circuit breaker. Additionally 120 volt terminal boards connecting to field devices (devices not located in the FCP or PCP) must be protected by a 120 volt circuit breaker.

3.1.10 Uninterruptible Power supplies

The PCP must contain two uninterruptible power supplies (UPS) (each connected to a dedicated circuit). As shown on the drawings one UPS must supply the PLC System , and the second UPS must supply the miscellaneous device power. The UPSs output capacity must be sufficient to drive all the system components connected plus 25 percent. The UPSs must be mounted on shelves near the bottom of the PCP but not rest on the floor of the PCP.

3.1.11 Power Supplies

Provide and install all 120 VAC and 24 VDC power supply. Interconnecting wiring between UPSs and PLC power supplies must be completely installed prior to shipment to the job site.

3.1.12 Alarm Annunciator and Horns

Signals must be initiated by PCP outputs as required. The control system must energize alarm horns, both an integral panel mounted vibrating horn and remote horns, and flash the appropriate HMI indicator. The minimum number of windows (on Human Machine Interface (HMI) Touch Screen) must correspond to the number of alarm points, plus 15 percent spare. The drawings indicate HMI annunciator screen layout and the alarms to be annunciated.

3.1.12.1 Non-critical Alarms

Non-critical alarm windows must be white with black lettering and must sound the panel mounted vibrating horns and the exterior mounted vibrating horns.

3.1.12.2 Critical Alarms

Critical alarm windows must be red with white lettering and must sound the panel mounted vibrating horns and the exterior mounted resonating horns. Critical alarms must also cancel all automatic pump starts in the PLC.

3.1.12.3 Alarm Sequence

Alarm sequence for each alarm must be as follows (ISA 18.1 sequence 'A').

a. For a normal condition, visual indicator and horns will be off.

b. For an alarm condition, visual indicator will flash, and horns will sound (this condition will be locked in).

c. Upon acknowledgment of the alarm condition, visual indicator will be steady on and the horns will be off.

d. If, after acknowledgment of an alarm condition, another alarm condition is established, the new alarm will cause the appropriate

window to flash and the horn to sound.

e. When condition returns to normal after acknowledgment, the visual indicator and the horn will be off.

3.1.13 Human Machine Interface (HMI) Touch Screen

The Human Machine Interface (HMI) Touch Screen must be flush mounted in a wall mounted panel. The Human Machine Interface (HMI) Touch Screen must download system parameters from the PLCs for display. The Human Machine Interface (HMI) Touch Screen must also upload new set point values that the operator has changed using the Human Machine Interface (HMI) Touch Screen, after a password has been entered.

3.1.13.1 Screen Number 1

This must be a general opening screen. As a minimum it must display the name and location of the installation (e.g. Buckley Space Force Base, CO), name of the project (e.g., Power Independence, Mission Control Station) and screen navigation information.

3.1.13.2 Screen Number 2

Screen number two must list the systems parameters monitored by the PCP and their current value. The values must be continuously updated, a 2 second delay maximum between updates will be acceptable.

Parameter	Value
Bulk Receipt Tank	BT-001/BT-002/BT-003/BT-004
Bulk Issue Tank	BT-001/BT-002/BT-003/BT-004
Operating Receipt Tank	OT-N/OT-S
Operating Issue Tank	OT-N/OT-S
OP-1	On/Off xxxxx.xx HOURS
IP-F1	On/Off xxxxx.xx HOURS
IP-F2	On/Off xxxxx.xx HOURS
IP-F3	On/Off xxxxx.xx HOURS
IP-F4	On/Off xxxxx.xx HOURS
IP-O1	On/Off xxxxx.xx HOURS
IP-O2	On/Off xxxxx.xx HOURS
IP-O3	On/Off xxxxx.xx HOURS

IP-O4	On/Off xxxxx.xx HOURS
R10	Open/Closed
R11	Open/Closed
R12	Open/Closed
R13	Open/Closed
R14	Open/Closed
R15	Open/Closed
R16	Open/Closed
R17	Open/Closed
R18	Open/Closed
R19	Open/Closed
R20	Open/Closed
R21	Open/Closed
R27	Open/Closed
R28	Open/Closed
R29	Open/Closed
R30	Open/Closed
R31	Open/Closed
R32	Open/Closed
R33	Open/Closed
R34	Open/Closed
R35	Open/Closed
I01	Open/Closed
I02	Open/Closed
I03	Open/Closed
I04	Open/Closed
I05	Open/Closed
I06	Open/Closed

I07	Open/Closed
I08	Open/Closed
I09	Open/Closed
I10	Open/Closed
I11	Open/Closed
I12	Open/Closed
I13	Open/Closed
I14	Open/Closed
I15	Open/Closed
I16	Open/Closed
I17	Open/Closed
I18	Open/Closed
I19	Open/Closed
I20 (MOV)	Open/Closed
I21 (MOV)	Open/Closed
I22 (MOV)	Open/Closed
I23 (MOV)	Open/Closed
I24	Open/Closed
I25	Open/Closed
I26	Open/Closed
I27	Open/Closed
BV1	Open/Closed
BV2	Open/Closed
BV3	Open/Closed
BV4	Open/Closed
BV5 (MOV)	Open/Closed
BV6 (MOV)	Open/Closed
BV7	Open/Closed

BV8	Open/Closed
BV9 (MOV)	Open/Closed
BV10 (MOV)	Open/Closed
BV11	Open/Closed
BV12	Open/Closed
BV13 (MOV)	Open/Closed
BV14 (MOV)	Open/Closed
BV15	Open/Closed
BV17 (MOV)	Open/Closed
BV18 (MOV)	Open/Closed
BV19	Open/Closed
BV20	Open/Closed
Only one of the words separated by a slash (/) must be displayed. The xxxxx.x HOURS is the fuel pumps elapsed run time and the value must not be lost when the lead PLC is switched. The pump and valve status words must be color coded to match the colors used on the graphic display screen. Manual ball valves and Motor Operated Valves (MOV)s must have different symbols.	

3.1.13.3 Screen Number 3

The following table must be displayed graphically. The table lists the set points that can be adjusted using the operator interface. A password must be entered before the "current value" can be adjusted. The value entered can only be a number within the "set point range". The "default value" is the value held in the program that is loaded into EEPROM memory (This screen may require more than one display screen).

SET POINT DESCRIPTION	SET POINT RANGE	DEFAULT VALUE	CURRENT VALUE
Bulk Tank No. 1 High-High Level	xx'-xx" to xx'-xx"	xx'-xx"	xx'-xx"
Bulk Tank No. 1 High Level	xx'-xx" to xx'-xx"	xx'-xx"	xx'-xx"
Bulk Tank No. 1 Pump Stop Level	xx'-xx" to xx'-xx"	xx'-xx"	xx'-xx"
Bulk Tank No. 1 Pump Start Level	xx'-xx" to xx'-xx"	xx'-xx"	xx'-xx"
Bulk Tank No. 1 Low Level	xx'-xx" to xx'-xx"	xx'-xx"	xx'-xx"
Bulk Tank No. 1 Low-Low Level	xx'-xx" to xx'-xx"	xx'-xx"	xx'-xx"
Bulk Tank No. 2 High-High Level	xx'-xx" to xx'-xx"	xx'-xx"	xx'-xx"
Bulk Tank No. 2 High Level	xx'-xx" to xx'-xx"	xx'-xx"	xx'-xx"
Bulk Tank No. 2 Pump Stop Level	xx'-xx" to xx'-xx"	xx'-xx"	xx'-xx"
Bulk Tank No. 2 Pump Start Level	xx'-xx" to xx'-xx"	xx'-xx"	xx'-xx"
Bulk Tank No. 2 Low Level	xx'-xx" to xx'-xx"	xx'-xx"	xx'-xx"
Bulk Tank No. 2 Low-Low Level	xx'-xx" to xx'-xx"	xx'-xx"	xx'-xx"
Bulk Tank No. 3 High-High Level	xx'-xx" to xx'-xx"	xx'-xx"	xx'-xx"
Bulk Tank No. 3 High Level	xx'-xx" to xx'-xx"	xx'-xx"	xx'-xx"
Bulk Tank No. 3 Pump Stop Level	xx'-xx" to xx'-xx"	xx'-xx"	xx'-xx"
Bulk Tank No. 3 Pump Start Level	xx'-xx" to xx'-xx"	xx'-xx"	xx'-xx"
Bulk Tank No. 3 Low Level	xx'-xx" to xx'-xx"	xx'-xx"	xx'-xx"
Bulk Tank No. 3 Low-Low Level	xx'-xx" to xx'-xx"	xx'-xx"	xx'-xx"
Bulk Tank No. 4 High-High Level	xx'-xx" to xx'-xx"	xx'-xx"	xx'-xx"
Bulk Tank No. 4 High Level	xx'-xx" to xx'-xx"	xx'-xx"	xx'-xx"
Bulk Tank No. 4 Pump Stop Level	xx'-xx" to xx'-xx"	xx'-xx"	xx'-xx"
Bulk Tank No. 4 Pump Start Level	xx'-xx" to xx'-xx"	xx'-xx"	xx'-xx"
Bulk Tank No. 4 Low Level	xx'-xx" to xx'-xx"	xx'-xx"	xx'-xx"
Bulk Tank No. 4 Low-Low Level	xx'-xx" to xx'-xx"	xx'-xx"	xx'-xx"
Operating Tank No. 1 High-High Level	xx'-xx" to xx'-xx"	xx'-xx"	xx'-xx"
Operating Tank No. 1 High Level	xx'-xx" to xx'-xx"	xx'-xx"	xx'-xx"

SET POINT DESCRIPTION	SET POINT RANGE	DEFAULT VALUE	CURRENT VALUE
Operating Tank No. 1 Pump Start Level	xx'-xx" to xx'-xx"	xx'-xx"	xx'-xx"
Operating Tank No. 1 Pump Stop Level	xx'-xx" to xx'-xx"	xx'-xx"	xx'-xx"
Operating Tank No. 1 Low Level	xx'-xx" to xx'-xx"	xx'-xx"	xx'-xx"
Operating Tank No. 1 Low-Low Level	xx'-xx" to xx'-xx"	xx'-xx"	xx'-xx"
Operating Tank No. 2 High-High Level	xx'-xx" to xx'-xx"	xx'-xx"	xx'-xx"
Operating Tank No. 2 High Level	xx'-xx" to xx'-xx"	xx'-xx"	xx'-xx"
Operating Tank No. 2 Pump Start Level	xx'-xx" to xx'-xx"	xx'-xx"	xx'-xx"
Operating Tank No. 2 Pump Stop Level	xx'-xx" to xx'-xx"	xx'-xx"	xx'-xx"
Operating Tank No. 2 Low Level	xx'-xx" to xx'-xx"	xx'-xx"	xx'-xx"
Operating Tank No. 2 Low-Low Level	xx'-xx" to xx'-xx"	xx'-xx"	xx'-xx"
Day Tank No. 1 High-High Level	xx'-xx" to xx'-xx"	xx'-xx"	xx'-xx"
Day Tank No. 1 High Level	xx'-xx" to xx'-xx"	xx'-xx"	xx'-xx"
Day Tank No. 1 Low Level	xx'-xx" to xx'-xx"	xx'-xx"	xx'-xx"
Day Tank No. 1 Low-Low Level	xx'-xx" to xx'-xx"	xx'-xx"	xx'-xx"
Day Tank No. 2 High-High Level	xx'-xx" to xx'-xx"	xx'-xx"	xx'-xx"
Day Tank No. 2 High Level	xx'-xx" to xx'-xx"	xx'-xx"	xx'-xx"
Day Tank No. 2 Low Level	xx'-xx" to xx'-xx"	xx'-xx"	xx'-xx"
Day Tank No. 2 Low-Low Level	xx'-xx" to xx'-xx"	xx'-xx"	xx'-xx"
Day Tank No. 3 High-High Level	xx'-xx" to xx'-xx"	xx'-xx"	xx'-xx"
Day Tank No. 3 High Level	xx'-xx" to xx'-xx"	xx'-xx"	xx'-xx"
Day Tank No. 3 Low Level	xx'-xx" to xx'-xx"	xx'-xx"	xx'-xx"
Day Tank No. 3 Low-Low Level	xx'-xx" to xx'-xx"	xx'-xx"	xx'-xx"
Day Tank No. 4 High-High Level	xx'-xx" to xx'-xx"	xx'-xx"	xx'-xx"
Day Tank No. 4 High Level	xx'-xx" to xx'-xx"	xx'-xx"	xx'-xx"
Day Tank No. 4 Low Level	xx'-xx" to xx'-xx"	xx'-xx"	xx'-xx"

SET POINT DESCRIPTION	SET POINT RANGE	DEFAULT VALUE	CURRENT VALUE
Day Tank No. 4 Low-Low Level	xx'-xx" to xx'-xx"	xx'-xx"	xx'-xx"

3.1.13.4 Screen Number 4

This screen must be a duplicate of the Graphic Display Drawing showing a schematic of the process flow. This screen must be referred to as the graphical display. Many operating parameters must be displayed here as required in later paragraphs of this specification.

3.1.13.5 Screen Number 5

This screen must be the Alarm Annunciator and it must be superimposed over the current active screen on the Human Machine Interface (HMI) Touch Screen when an alarm is activated.

3.1.13.6 Screen Number 5

This screen must be a screen designed solely for assisting the testing team during initial start up to watch all of the significant parameters of the systems operation simultaneously on one screen. This screen must include the system parameters i.e. (pump selection, tank selection, valve position, etc.) from screen 2, the set points from screen 3, and timers for all of the actions that will take place following a delay function.

3.1.13.7 Screen Number 7

This screen must be an alarm history screen. This screen must be referred to as the Alarm History Display. This screen must be capable of storing and displaying all alarms that have occurred in the system for at least a period of 30-days.

3.1.13.8 Screen Number 8

This screen must be a screen designed to show EFSO system status. This screen must show the status of all 13 EFSO pushbuttons. Refer to EFSO system control diagram.3.1.14 Laptop Computer

The Laptop computer must be used to create, edit, and load the ladder logic program into the PLCs and the operator interface graphics control program into the Human Machine Interface (HMI) Touch Screen. The Laptop must also be used to monitor the PLCs memory and ladder logic program. The computer must be stored in a lockable cabinet located within the Pump Control Panel.

3.2 PROGRAMMABLE LOGICAL CONTROLLER (PLC) HARDWARE AND SOFTWARE

3.2.1 General

The basic operation of the PLC system is (Reference "Control System Block Diagram" on the drawings):

a. The CPU and its associated I/O rack (I/O-1) sends system outputs to appropriate devices and receive input signals from field devices (PITs-1, DPTs-1, DPTs-3, flow switches, valve limit switches).

3.2.2 Programs

a. Provide two copies of all working programs (i.e. PLC logic, HMI Touchscreen Terminal) on read only optical discs as well as a printed program listing.

b. Provide rung comments (documentation) in the ladder logic program. Each device, on the ladder, must be identified as to the type of device, i.e. limit switch XX, flow indicator XX, motor starter XX. Rung comments must be provided for input and output rungs. The programmer must also provide a comment describing the function of each rung or group of rungs that accomplish a specific function.

3.3 GRAPHICS DISPLAY SCREEN

3.3.1 General

The graphic display screen shall be capable of being displayed on the Human Machine Interface (HMI) Touch Screen.

3.3.2 Display Presentation

The Graphic Display shall depict the process fuel flow schematically as indicated on the drawings. Red, green, and amber symbols shall be integrated with the process schematic to provide current equipment status graphically. The symbols shall be located immediately adjacent to related equipment symbol.

3.3.3 Process Schematic

The process schematic graphic representation shall utilize conventional symbols when possible. Symbols and flow lines shall be sized and spaced so as to provide a clear representation of the system process. The Graphic Display shall be suitable for supervised field modification when future items are added. Minor changes may be incorporated to allow proper line width and spacing. Component arrangement, piping routing, and location of valves shall match the flow diagram. The Graphic Display layout shall be approved by the Government.

3.4 INSTALLATION

Installation must conform to the manufacturer's drawings, written recommendations and directions.

3.4.1 Shop Drawing

The shop drawing must be clear and readable and preferably drawn using a computer aided drafting package. At the conclusion of the project the

diagram drawings must be redrafted to include all as-built conditions. These updated drawings must be included in the O&M Manuals and appropriate section of the drawings placed in a data pocket located in each of the enclosures. The shop drawing at a minimum must show:

a. Overall dimensions, front, side and interior elevation views of the PCP showing size, location and labeling of each device.

b. Overall dimensions, front elevation of the GDP showing graphical layout and size, location and labeling of each device.

c. Power ladder diagram indicating power connections between SDP, power conditioners, PLCs, power supplies and field and panel devices. Any terminal block connection numbers used must be indicated.

d. Control ladder diagram indicating control connections between field and devices and PLC I/O modules. Terminal block connection numbers and PLC terminal numbers must be indicated.

e. Communication connections between PLCs and I/O racks. Communication channel numbers must be indicated.

f. Bill of materials.

g. Written control sequence covering all inputs, outputs, and control scheme.

3.4.2 System Start-Up and Testing

a. At PCP start-up and testing provide personnel, onsite, to provide technical assistance, program fine tuning, and to start-up and test the system. Start-up and testing must be coordinated with the overall fueling system start-up test specified in Section 33 08 55 FUEL DISTRIBUTION SYSTEM START-UP (NON-HYDRANT). Prior to this test, all connections must have been made between the PCP, Human Machine Interface (HMI) Touch Screen, and all field devices. In addition, wiring must have been checked for continuity and short circuits. Adjust set point values, timing values, and program logic as required to provide a functional hydrant fuel control system. Once the system has been fine tuned and passed the system test, the new system default values, must be loaded into the PLC EEPROM and Human Machine Interface (HMI) Touch Screen adjusted to indicate the new values.

b. A step-by-step Testing Plan of the PCP must be submitted. The test must be designed to show that every device (lights, switches, display screens, alarms) on the PCP and HMI Touchscreen TerminalHuman Machine Interface (HMI) Touch Screen is in working order and that the PLC program controls the system per specifications. The test must be performed in conjunction with Section 33 08 55 FUEL DISTRIBUTION SYSTEM START-UP (NON-HYDRANT). The plan must include a place for the Contractor and government representative to initial each step of the plan after satisfactory completion and acceptance of each step. The complete initialed Record of Test must be certified by the Contractor and then submitted.

3.4.3 Training Plan for Instructing Personnel

a. Upon completion of the system start-up a competent technician regularly employed by the PCP manufacturer must hold a training class

for the instruction of Government personnel in the operation and maintenance of the system. Provide both classroom type theory instruction and hands-on instruction using operating system components provided. The period of instruction must be a minimum of three 8-hour working days. The training must be designed to accommodate 8 operators, 4 maintenance personnel, and 2 programmers. The Contracting Officer must receive written notice a minimum of 14-days prior to the date of the scheduled classes.

b. Furnish a written lesson plan and training schedule for Government approval at least 60-days prior to instructing operating, maintenance and programming personnel. Concurrently submit above to the Service Headquarters or officially designated alternate for their input into the review process. Approval of lesson plan will be based on both Government and Service Headquarters' concurrence. This plan must be tailored to suit the requirements of the Government. The training must be divided into three separate classes. Each class must be tailored to a specific group of personnel. The groups are: 1) Operators, those that will use the control system on a day-to-day basis; 2) Maintenance personnel, those that will perform routine and non-routine maintenance and trouble shooting of the control system; 3) Programmers, those that will make changes to and trouble shoot the PLC and Human Machine Interface (HMI) Touch Screen programs. The training program must provide:

(1) a detailed overview of the control system including the complete step-by-step procedures for start-up, operation and shut-down of the control system.

(2) a general overview of programmable logic controllers.

(3) the maintenance of system components installed.

(4) the programming of the PLC and Human Machine Interface (HMI) Touch Screen.

(5) troubleshooting of the system.

c. Complete approved Operation and Maintenance manuals for this specification and 26 20 00 INTERIOR DISTRIBUTION SYSTEM must be used for instructing operating personnel. Training must include both classroom and hands-on field instruction. The class must be recorded in DVD format.

d. Provide training courses in DVD format covering system overview, operation, maintenance, trouble shooting, and programming. These DVDs must be produced onsite by the Contractor using the supplied Pump Control Panel as the teaching aid, or commercially produced DVDs by the PLC manufacturer or third party who specializes in training on PLC systems. Along with the DVDs, provide workbooks, which follow along with the DVDs.

3.5 PLC CONTROL SYSTEM SEQUENCE OF OPERATION

The following describes general functions of the fueling system components.

3.5.1 Abbreviations

a. SYS: components of System including UPS, power supply, CPU, I/O, and

system input and outputs.

b. CPU: SYS PLC CPU.

c. I/O: SYS PLC input/output modules.

d. PCP: Pump Control Panel.

e. HMI: Human Machine Interface.

f. UPS: Uninterruptible Power Supply.

3.5.2 Bulk Tanks

3.5.2.1 Level Control

Each bulk tank has an Automatic Tank Gauging (ATG) system. The ATG system provides fuel level, volume, temperature and water contents. From the ATG, level control can be generated based on predetermined fuel levels. The ATG must be used to generate low-low, low, high and high-high levels to the PLC system.

3.5.2.1.1 Low-Low Level

When the low-low level is activated, the associated tank's graphic display low-low level symbol must change to red in color. If the selected tank's level drops below the low-low level, the alarm annunciator's low-low level alarm sequence activates, issue pump and MOVs associated with the tank must be disabled. If all tanks are at low-low level, no issue pumps or MOVs in automatic mode must be enabled.

3.5.2.1.2 Low Level

When the low level is activated, the associated tank's graphic display low level symbol must change to red in color and the alarm annunciator's non-critical low level alarm sequence activates.

3.5.2.1.3 High Level

When the high level float is activated the associated tank's graphic display high level light must light up and the alarm annunciator's non-critical high level alarm sequence activates.

3.5.2.1.4 High-High Level

When the high-high level float is activated the associated tank's graphic display high-high level light must light up, the alarm annunciator's critical high-high level alarm sequence activates, the pump control panel must de-energize the solenoid on the tank's high level shutoff valve to force it closed.

3.5.3 Operating Tanks

3.5.3.1 Level Control (ATG)

Each operating tank has an Automatic Tank Gauging (ATG) system and an Independent Level Alarm (ILA) system. The ATG system provides fuel level, volume, temperature and water contents. From the ATG, level control can be generated based on predetermined fuel levels. The ATG must be used to

generate low-low, low, high and high-high levels to the PLC system. The ILA system is used for pump control.

3.5.3.1.1 Low-Low Level

When the low-low level float is activated the associated tank's graphic display low-low level symbol must change to red in color. If the selected tank's level drops below the low-low sensor the alarm annunciator's low-low level alarm sequence activates, issue pump(s) running in automatic mode must be disabled.

3.5.3.1.2 Low Level

When the low level float is activated the associated tank's graphic display low level light must light up and the alarm annunciator's non-critical low level alarm sequence activates.

3.5.3.1.3 High Level

When the high level float is activated the associated tank's graphic display high level light must light up and the alarm annunciator's non-critical high level alarm sequence activates.

3.5.3.1.4 High-High Level

When the high-high level float is activated the associated tank's graphic display high-high level light must light up, the alarm annunciator's critical high-high level alarm sequence activates.

3.5.3.2 Level Control (ILA)

Each operating tank has electronic level switches to monitor low-low, low, high, and high-high fuel levels.

3.5.3.2.1 Low-Low Level

When the low-low level elevation is attained the associated tank's GDP low-low level light must light up. If the selected tank's level drops below the low-low sensor the alarm annunciator's low-low level alarm sequence activates, issue pumps running in automatic mode must be disabled. If all tanks are at low-low level, no issue pumps in automatic mode must be enabled.

3.5.3.2.2 Low Level

When the low level elevation is attained the associated tank's GDP low level light must light up and the alarm annunciator's non-critical low level alarm sequence activates. The low level switch shall start the selected bulk tank issue pump.

3.5.3.2.3 High Level

When the high level elevation is attained the associated tank's GDP high level light must light up and the alarm annunciator's non-critical high level alarm sequence activates. The high level switch shall shut off the selected bulk tank issue pump.

3.5.3.2.4 High-High Level

When the high-high level elevation is attained, the associated tank's GDP high-high level light must light up and the alarm annunciator's critical high-high level alarm sequence activates. The High-high level switch closes the associated operating tank MOV.

3.5.4 Day Tanks

3.5.4.1 Level Control (ATG)

Each day tank has four level float switches to measure low-low, low, high and high-high levels.

3.5.4.1.1 Low-Low Level

When the low-low level float is activated the associated tank's graphic display low-low level symbol must change to red in color. If the selected tank's level drops below the low-low sensor the alarm annunciator's low-low level alarm sequence activates, issue pump(s) running in automatic mode must be disabled.

3.5.4.1.2 Low Level

When the low level float is activated the associated tank's graphic display low level light must light up and the alarm annunciator's non-critical low level alarm sequence activates.

3.5.4.1.3 High Level

When the high level float is activated the associated tank's graphic display high level light must light up and the alarm annunciator's non-critical high level alarm sequence activates.

3.5.4.1.4 High-High Level

When the high-high level float is activated the associated tank's graphic display high-high level light must light up, the alarm annunciator's critical high-high level alarm sequence activates.

3.5.4.2 Level Control (ILA)

Each day tank has electrinic level switches to monitor low-low, low, high, and high-high fuel levels.

3.5.4.2.1 Low-Low Level

When the low-low level elevation is attained the associated tank's GDP low-low level light must light up. If the selected tank's level drops below the low-low sensor the alarm annunciator's low-low level alarm sequence activates, the associated generator shall not start.

3.5.4.2.2 Low Level

When the low level elevation is attained the associated tank's GDP low level light must light up and the alarm annunciator's non-critical low level alarm sequence activates. The selected operating tank lead pump shall start.

3.5.4.2.3 High Level

When the high level elevation is attained the associated tank's GDP high level light must light up and the alarm annunciator's non-critical high level alarm sequence activates. The operating tank lead pump shall stop.

3.5.4.2.4 High-High Level

When the high-high level elevation is attained, the associated tank's GDP high-high level light must light up and the alarm annunciator's critical high-high level alarm sequence activates.

3.5.5 Fueling Pumps (FP)

The lead pump selection must select the pump starting sequence. Each pump's motor controller has a status relay to indicate the on/off status of the pump. When status relay is open the associated pump's graphic display off light must activate and screen number 2 must indicate on. When the status relay is closed the associated pump's graphic display on light must activate and screen number 2 must indicate off. The status relay state must also be used to start and stop the pumps elapsed run time timer and must be displayed on screen number 2.

3.5.6 Flow Switch, Fueling Pump

On the discharge side of each pump is a flow switch to indicate positive flow (fail safe feature). If the PLC has given a signal to start a pump and the flow switch has not closed before the set point timer expires or if the flow switch opens after the pump has been running then the pump must be in a failure state and it must be disabled (taken out of the starting sequence), the non-critical alarm sequence must also be activated, and the next pump in the start sequence started. After the PLC has stopped all of the pumps, any failed pump must be added back into the start sequence.

3.5.7 Safety Circuit

3.5.7.1 Emergency Stop Status

The emergency stop circuit status relay (ER1) N.O. contact must be connected as indicated on the Terminal Block Connection drawing. When the circuit is activated the critical alarm sequence is activated and any calls to start fueling pumps must be canceled and no additional pump start signals must be sent until the circuit has been reset. The fueling pumps will actually be stopped by an emergency stop circuit status relay (ER1) N.O. contact in the fuel pump motor control circuit.

3.5.7.2 Circuit Power Status

When the safety circuit power status relay is closed the PCP emergency circuit power on light must light up.

3.5.8 Pump Control Panel

3.5.8.1 CPU Faults

The PCP mounted CPU on light is connected to SYS. The associated CPU light must light when no system faults are detected. When a fault is detected by the CPU the faulted CPU's on light must be turned off and the alarm

annunciator's non-critical alarm sequence must be activated.

3.5.8.2 Mode Select

The HMI touch screen shows what mode of fueling is active: issue, or off. The screen number 2 status must indicate the active mode.

A selection on the The HMI touch screen selects what mode of fueling is active: issue, transfer or off. The screen number 2 status must indicate the active mode.

A selection on the The HMI touch screen selects what mode of fueling is active: issue, transfer, tightness Test or off. The screen number 2 status must indicate the active mode.

3.5.8.3 Lead Pump Select (Operating Tanks)

A selection on the The HMI touch screen selects which pump must be the lead pump. The selection must fix the starting sequence for all pumps. If the lead pump fails to start or fails during operation, that pump will be disabled and the lag pump in the sequence started. The screen number 2 status display must indicate the lead pump.

3.5.8.4 PCP Temperature Alarm

The alarm thermostat when activated must activate the alarm annunciator's non-critical alarm sequence.

3.6 OPERATING PROGRAM REQUIREMENTS

The control system's logic program must be stored on a EEPROM chip. Default values of operator adjustable parameters must be permanently stored on the chip with the capability of resetting the values in RAM to the values within the range specified below. The default values can be changed through the use of the personal computer (after the correct password has been entered). After loss of power and battery failure the adjustable settings must revert back to the default values located on the chip. The default values shown here must be reset to the values determined during the system start up and test.

3.7 AUTOMATIC MODE - TRANSFER CONDITION

a. The issue bulk tank pump shall start when the operating tank ILA low level switch is closed. The issue bulk tank pump shall stop when the operating tank ILA high level switch is closed. If the issue bulk tank ATG low-low level alarm is activated, the bulk tank issue pump shall not start.

b. The operating tank lead issue pump shall start when a day tank ILA low level switch is closed. The operating tank lead pump shall stop when the day tank ILA high level switch is closed. MOVs BV06, BV10, BV14, and BV18 on the primary issue fuel line shall be commanded open. MOVs BV05, BV09, BV13, and BV17 on the secondary issue fuel line shall be commanded closed. If the day tank ATG low-low level alarm is activated the associated generator shall not start.

c. Any failure of an operational tank lead pump shall automatically start the operational tank lag pump. MOVs BV05, BV09, BV13, and BV17 on the secondary issue fuel line shall be commanded open. MOVs BV06, BV10,

BV14, and BV18 on the primary issue fuel line shall be commanded closed.

d. Any MOV position error such as an MOV on the primary issue fuel line fails to open, the operating tank lead pump shall automatically stop and the operating tank lag pump shall automatically start. Starting of the operating tank lag pump commands MOVs BV05, BV09, BV13, and BV17 on the secondary issue fuel line to open. MOVs BV06, BV10, BV14, and BV18 on the primary issue fuel line shall be commanded closed isolating the failure on the primary fuel line.

3.8 OFF MODE

a. Automatic starting of fueling pumps must be disabled. All other functions (graphic display, HMI touchscreen terminal, EFSO system) must be active to allow manual control of the fueling pumps using the Hand-Off-Auto or Hand-Auto switch.

b. The second, fueling pumps maybe started or stopped manually as needed by the operator.

3.9 MANUAL OPERATION OF FUELING PUMPS

a. If the PLC system is still active see paragraph OFF MODE.

b. If the PLC system has no power or the CPUs have faulted (CPU light on PCP off) the pumping system will be in a completely manual mode. Other valves may need to be opened or closed manually by the operators for the system to work properly.

-- End of Section --

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BUCO00102MS506.PDF	MS506	BT-004 DETAILS
BUCO00102MS507.PDF	MS507	OT-001 DETAILS
BUCO00102MS508.PDF	MS508	OT-002 DETAILS
BUCO00102MS509.PDF	MS509	DT-001 DETAILS
BUCO00102MS510.PDF	MS510	DT-002 DETAILS
BUCO00102MS511.PDF	MS511	DT-003 DETAILS
BUCO00102MS512.PDF	MS512	DT-004 DETAILS
BUCO00102MS513.PDF	MS513	LUBE OIL TANK DETAILS
BUCO00102MS514.PDF	MS514	FILTER SHELTER PROFILE VIEWS - SHEET 1 OF 2
BUCO00102MS515.PDF	MS515	FILTER SHELTER PROFILE VIEWS - SHEET 2 OF 2
BUCO00102MS516.PDF	MS516	ISOLATION VALVE VAULT AND LOW POINT DRAIN DETAIL
BUCO00102MS517.PDF	MS517	GENERATOR BUILDING - TRENCH DETAILS - SHEET 1 OF 2
BUCO00102MS518.PDF	MS518	GENERATOR BUILDING - TRENCH DETAILS - SHEET 2 OF 2

ELECTRICAL SITE

FILE NAME	SHEET ID NO.	DESCRIPTION
BUCO00102ES001.PDF	ES001	ELECTRICAL NOTES AND SUPPLEMENTAL LEGEND
BUCO00102ES100.PDF	ES100	ELECTRICAL SITE PLAN OVERVIEW
BUCO00102ES111.PDF	ES111	SITE LIGHTING OFFLOAD
BUCO00102ES112.PDF	ES112	SITE LIGHTING OFFLOAD
BUCO00102ES401.PDF	ES401	ELECTRICAL SITE PLAN - ENLARGED
BUCO00102ES402.PDF	ES402	ELECTRICAL SITE PLAN - ENLARGED
BUCO00102ES403.PDF	ES403	ELECTRICAL SITE PLAN - ENLARGED
BUCO00102ES404.PDF	ES404	ELECTRICAL SITE PLAN - ENLARGED PHASE 1
BUCO00102ES405.PDF	ES405	ELECTRICAL SITE PLAN - ENLARGED PHASE 2
BUCO00102ES406.PDF	ES406	ELECTRICAL SITE PLAN - ENLARGED PHASE 3
BUCO00102ES407.PDF	ES407	ELECTRICAL SITE PLAN - ENLARGED PHASE 4
BUCO00102ES500.PDF	ES500	ELECTRICAL SITE DETAILS
BUCO00102ES501.PDF	ES501	ELECTRICAL SITE DETAILS
BUCO00102ES502.PDF	ES502	ELECTRICAL SITE DETAILS
BUCO00102ES503.PDF	ES503	ELECTRICAL SITE DETAILS
BUCO00102ES504.PDF	ES504	ELECTRICAL SITE DETAILS
BUCO00102ES505.PDF	ES505	ELECTRICAL SITE DETAILS
BUCO00102ES901.PDF	ES901	ELECTRICAL SITE FIO
BUCO00102ET100.PDF	ET100	TEMPORARY ELECTRICAL FEED PLAN

TELECOMMUNICATIONS SITE

FILE NAME	SHEET ID NO.	DESCRIPTION
BUCO00102TS001.PDF	TS001	TELECOMMUNICATIONS NOTES AND SUPPLEMENTAL LEGEND
BUCO00102TS101.PDF	TS101	TELECOMMUNICATIONS SITE PLAN - AREA 1
BUCO00102TS102.PDF	TS102	TELECOMMUNICATIONS SITE PLAN - AREA 2
BUCO00102TS103.PDF	TS103	TELECOMMUNICATIONS SITE PLAN - AREA 3
BUCO00102TS401.PDF	TS401	TELECOMMUNICATIONS SITE PLAN - ENLARGED
BUCO00102TS501.PDF	TS501	TELECOMMUNICATIONS SITE DETAILS
BUCO00102TS502.PDF	TS502	TELECOMMUNICATIONS SITE DETAILS
BUCO00102TS503.PDF	TS503	TELECOMMUNICATIONS SITE DETAILS
BUCO00102TS504.PDF	TS504	TELECOMMUNICATIONS SITE DETAILS HEMP
BUCO00102TS901.PDF	TS901	TELECOMMUNICATIONS FIO
BUCO00102TS902.PDF	TS902	TELECOMMUNICATIONS FIO
BUCO00102TS903.PDF	TS903	TELECOMMUNICATIONS FIO

ELECTRICAL FUELS SITE

FILE NAME	SHEET ID NO.	DESCRIPTION
BUCO00102EF001.PDF	EF001	SUPPLEMENTAL FUELS ELECTRICAL LEGEND
BUCO00102EF101.PDF	EF101	ELECTRICAL FUELING SYSTEM SITE PLAN
BUCO00102EF401.PDF	EF401	TRUCK OFFLOAD ENLARGED SITE PLAN
BUCO00102EF402.PDF	EF402	BULK STORAGE ENLARGED SITE PLAN
BUCO00102EF403.PDF	EF403	GENERATOR BUILDING ENLARGED SITE PLAN
BUCO00102EF501.PDF	EF501	HAZARDOUS AREA DETAILS
BUCO00102EF502.PDF	EF502	OFFLOAD ELCTRICAL DETAILS
BUCO00102EF503.PDF	EF503	OFFLOAD PUMP CONTROL PANEL AND FIBER CONVERTER PANEL DETAILS
BUCO00102EF504.PDF	EF504	OFFLOAD PUMP CONTROL DIAGRAM
BUCO00102EF505.PDF	EF505	FILTER SHELTER ELECTRICAL EQUIPMENT RISER ELEVATION
BUCO00102EF506.PDF	EF506	TANK CONTROL DIAGRAMS AND MOTOR STARTER/DISCONNECT ELEVATION
BUCO00102EF507.PDF	EF507	FILTER SHELTER FIBER CONVERTER PANEL I/O DIAGRAMS SHEET 1 OF 3
BUCO00102EF508.PDF	EF508	FILTER SHELTER FIBER CONVERTER PANEL I/O DIAGRAMS SHEET 2 OF 3
BUCO00102EF509.PDF	EF509	FILTER SHELTER FIBER CONVERTER PANEL DIAGRAMS SHEET 3 OF 3
BUCO00102EF510.PDF	EF510	OPERATING TANK PUMP CONTROL DIAGRAM
BUCO00102EF511.PDF	EF511	OPERATING TANK EQUIPMENT RISER AND EFSO ELEVATIONS AND EFSO CIRCUIT DIAGRAM
BUCO00102EF512.PDF	EF512	PUMP CONTROL PANEL ELEVATION
BUCO00102EF513.PDF	EF513	PUMP CONTROL PANEL POWER DISTRIBUTION DIAGRAM
BUCO00102EF514.PDF	EF514	CONTROL SYSTEM DIAGRAM
BUCO00102EF515.PDF	EF515	TERMINAL BLOCK CONNECTIONS (FOR FIELD DEVICES) SHEET 1 OF 3
BUCO00102EF516.PDF	EF516	TERMINAL BLOCK CONNECTIONS (FOR FIELD DEVICES) SHEET 2 OF 3
BUCO00102EF517.PDF	EF517	TERMINAL BLOCK CONNECTIONS (FOR FIELD DEVICES) SHEET 3 OF 3
BUCO00102EF518.PDF	EF518	TERMINAL BLOCK DIAGRAMS SHEET 1 OF 3
BUCO00102EF519.PDF	EF519	TERMINAL BLOCK DIAGRAMS SHEET 2 OF 3
BUCO00102EF520.PDF	EF520	TERMINAL BLOCK DIAGRAMS SHEET 3 OF 3
BUCO00102EF521.PDF	EF521	CONTROL SYSTEM I/O SHEET 1 OF 4
BUCO00102EF522.PDF	EF522	CONTROL SYSTEM I/O SHEET 2 OF4
BUCO00102EF523.PDF	EF523	CONTROL SYSTEM I/O SHEET 3 OF 4
BUCO00102EF524.PDF	EF524	CONTROL SYSTEM I/O SHEET 4 OF 4
BUCO00102EF525.PDF	EF525	ATG/ILA SYSTEM OUTPUT DIAGRAM
BUCO00102EF526.PDF	EF526	OFFLOAD AND BULK TANK POWER AND CONTROL PLAN
BUCO00102EF527.PDF	EF527	OPERATING AND DAY TANK POWER AND CONTROL PLAN
BUCO00102EF528.PDF	EF528	ATG/ILA SYSTEM INPUT DIAGRAM
BUCO00102EF529.PDF	EF529	EFSO SYSTEM CONTROL DIAGRAM
BUCO00102EF530.PDF	EF530	OFFLOAD EFSO SYSTEM CONTROL DIAGRAM
BUCO00102EF531.PDF	EF531	MOTOR OPERATED VALVE DIAGRAM

STRUCTURAL

FILE NAME	SHEET ID NO.	DESCRIPTION
BUCO00102S-001.PDF	S-001	STRUCTURAL NOTES
BUCO00102S-002.PDF	S-002	SCHEDULE OF SPECIAL INSPECTIONS
BUCO00102S-003.PDF	S-003	SCHEDULE AND STATEMENT OF SPECIAL INSPECTIONS
BUCO00102S-004.PDF	S-004	SNOW LOADS
BUCO00102S-005.PDF	S-005	COMPONENT AND CLADDING WIND LOADS
BUCO00102S-100.PDF	S-100	FOUNDATION PLAN
BUCO00102S-101.PDF	S-101	SLAB-ON-GRADE AND EQUIPMENT PAD PLAN
BUCO00102S-102.PDF	S-102	CONCRETE WALL PLAN
BUCO00102S-103.PDF	S-103	PRECAST WALL PLAN
BUCO00102S-104.PDF	S-104	MEZZANINE AND LOW ROOF FRAMING PLAN
BUCO00102S-105.PDF	S-105	CRANE FRAMING PLAN
BUCO00102S-106.PDF	S-106	ROOF FRAMING PLAN
BUCO00102S-107.PDF	S-107	ROOF DECK REINFORCEMENT PLAN
BUCO00102S-108.PDF	S-108	MEZZANINE AND LOW ROOF DECK REINFORCEMENT PLAN
BUCO00102S-109.PDF	S-109	TRENCH PLAN

STRUCTURAL (CONTINUED)

FILE NAME	SHEET ID NO.	DESCRIPTION
BUCO00102S-200.PDF	S-200	STEEL ELEVATIONS
BUCO00102S-201.PDF	S-201	STEEL ELEVATIONS
BUCO00102S-400.PDF	S-400	EXHAUST SCR BOX SUPPORT FRAMING
BUCO00102S-401.PDF	S-401	EXTERIOR EXHAUST SUPPORT FRAMING
BUCO00102S-402.PDF	S-402	SUPPLY FAN SUPPORT FRAMING
BUCO00102S-403.PDF	S-403	STAIR PLAN AND DETAILS
BUCO00102S-500.PDF	S-500	TYPICAL CONCRETE DETAILS
BUCO00102S-501.PDF	S-501	TYPICAL CONCRETE DETAILS
BUCO00102S-502.PDF	S-502	ROOF DETAILS
BUCO00102S-503.PDF	S-503	ROOF DETAILS
BUCO00102S-504.PDF	S-504	STEEL DETAILS
BUCO00102S-505.PDF	S-505	STEEL DETAILS
BUCO00102S-506.PDF	S-506	STEEL DETAILS
BUCO00102S-507.PDF	S-507	STEEL DETAILS
BUCO00102S-508.PDF	S-508	CRANE SUPPORT DETAILS
BUCO00102S-509.PDF	S-509	MEZZANINE DETAILS
BUCO00102S-510.PDF	S-510	MEZZANINE DETAILS
BUCO00102S-511.PDF	S-511	LOW ROOF DETAILS
BUCO00102S-512.PDF	S-512	BASE PLATE DETAILS
BUCO00102S-513.PDF	S-513	BASE PLATE DETAILS
BUCO00102S-514.PDF	S-514	FOUNDATION DETAILS
BUCO00102S-515.PDF	S-515	FOUNDATION DETAILS
BUCO00102S-516.PDF	S-516	FOUNDATION DETAILS
BUCO00102S-517.PDF	S-517	GRADE BEAM INTERSECTION REINFORCEMENT
BUCO00102S-518.PDF	S-518	GRADE BEAM INTERSECTION REINFORCEMENT
BUCO00102S-519.PDF	S-519	TRENCH AND GRATING DETAILS
BUCO00102S-600.PDF	S-600	COMPOSITE DECK SCHEDULE
BUCO00102S-900.PDF	S-900	3D VIEWS

ARCHITECTURAL

FILE NAME	SHEET ID NO.	DESCRIPTION
BUCO00102A-101.PDF	A-101	FIRST FLOOR PLAN
BUCO00102A-102.PDF	A-102	MEZZANINE FLOOR PLAN
BUCO00102A-103.PDF	A-103	ROOF PLAN
BUCO00102A-104.PDF	A-104	FIRST FLOOR REFLECTED CEILING PLAN
BUCO00102A-105.PDF	A-105	MEZZANINE REFLECTED CEILING PLAN
BUCO00102A-106.PDF	A-106	AIR BARRIER PLAN & SECTIONS
BUCO00102A-201.PDF	A-201	NORTH AND SOUTH ELEVATIONS
BUCO00102A-202.PDF	A-202	EAST AND WEST ELEVATIONS
BUCO00102A-301.PDF	A-301	BUILDING SECTIONS
BUCO00102A-310.PDF	A-310	WALL SECTIONS
BUCO00102A-311.PDF	A-311	WALL SECTIONS
BUCO00102A-400.PDF	A-400	ENLARGED PLANS
BUCO00102A-401.PDF	A-401	STAIR & LADDER DETAILS
BUCO00102A-410.PDF	A-410	PARTITION TYPES
BUCO00102A-440.PDF	A-440	INTERIOR ELEVATIONS
BUCO00102A-510.PDF	A-510	ROOF DETAILS
BUCO00102A-511.PDF	A-511	ROOF DETAILS
BUCO00102A-512.PDF	A-512	SECTION DETAILS
BUCO00102A-530.PDF	A-530	WALL DETAILS
BUCO00102A-600.PDF	A-600	ROOM FINISH SCHEDULE
BUCO00102A-601.PDF	A-601	DOOR SCHEDULES
BUCO00102A-602.PDF	A-602	DOOR DETAILS
BUCO00102A-603.PDF	A-603	DOOR DETAILS
BUCO00102A-604.PDF	A-604	WINDOW AND LOUVER TYPES
BUCO00102A-605.PDF	A-605	WINDOW AND LOUVER DETAILS
BUCO00102A-700.PDF	A-700	COMPOSITE PRECAST CONCRETE PANEL PLAN
BUCO00102A-701.PDF	A-701	PRECAST PANEL ELEVATIONS
BUCO00102A-702.PDF	A-702	PRECAST PANEL ELEVATIONS

INTERIORS

FILE NAME	SHEET ID NO.	DESCRIPTION
BUCO00102IG101.PDF	IG101	SIGNAGE TYPICALS

FIRE PROTECTION

FILE NAME	SHEET ID NO.	DESCRIPTION
BUCO00102FA001.PDF	FA001	FIRE ALARM GENERAL NOTES AND SUPPLEMENTAL LEGEND
BUCO00102FA101.PDF	FA101	FIRE ALARM INITIATION AND CONTROL PLAN
BUCO00102FA102.PDF	FA102	FIRE ALARM INITIATION AND CONTROL PLAN MEZZANINE
BUCO00102FA201.PDF	FA201	FIRE ALARM NOTIFICATION PLAN
BUCO00102FA202.PDF	FA202	FIRE ALARM NOTIFICATION PLAN MEZZANINE
BUCO00102FA401.PDF	FA401	ENLARGED FIRE ROOM PLAN
BUCO00102FA501.PDF	FA501	FIRE ALARM DETAILS
BUCO00102FA600.PDF	FA600	FIRE ALARM RISER DIAGRAM
BUCO00102FA601.PDF	FA601	FIRE ALARM MATRIX
BUCO00102FA602.PDF	FA602	RSCP FIRE ALARM MATRIX
BUCO00102F-101.PDF	F-101	COMPOSITE LIFE SAFETY AND BUILDING CODE PLAN
BUCO00102F-102.PDF	F-102	COMPOSITE MEZZANINIE LIFE SAFETY AND BUILDING CODE PLAN
BUCO00102F-103.PDF	F-103	CODE PLAN NARRATIVE
BUCO00102FX101.PDF	FX101	COMPOSITE FIRE SUPPRESSION PLAN
BUCO00102FX102.PDF	FX102	COMPOSITE MEZZANINE FIRE SUPPRESSION PLAN

INDEX LEGEND

1. SHEET INDENTIFICATION NUMBERS:

M - 2 0 1

- DISCIPLINE DESIGNATOR w/ Level 2 Designator *(see A/E/C CADD STANDARD RELEASE 6.0 for Level 2 Designator)*
- SHEET TYPE DESIGNATOR
- SHEET SEQUENCE NUMBER

2. DISCIPLINE DESIGNATORS:

G	GENERAL
H	HAZARDOUS MATERIALS
V	SURVERY / MAPPING
B	GEOTECHNICAL
C	CIVIL
L	LANDSCAPE
S	STRUCTURAL
A	ARCHITECTURAL
I	INTERIORS
Q	EQUIPMENT
F	FIRE PROTECTION
P	PLUMBING
D	PROCESS
M	MECHANICAL
E	ELECTRICAL
T	TELECOMMUNICATIONS
R	RESOURCE

3. SHEET TYPE DESIGNATORS:

0	GENERAL
1	PLANS
2	ELEVATIONS
3	SECTIONS
4	LARGE-SCALE VIEWS
5	DETAILS
6	SCHEDULES & DIAGRAMS
7	USER DEFINED
8	USER DEFINED
9	3D REPRESENTATIONS

US Army Corps of Engineers ®

MARK	DESCRIPTION	DATE
1	AM #0002 - GENERAL REVISIONS	09/19/2025

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ISSUE DATE: 05/01/2025
SOLICITATION NO.: W9126F25RA043
CONTRACT NO.:

DESIGNED BY: J. KAITANY
DRAWN BY: J. KAITANY
CHECKED BY: C. COPE
SUBMITTED BY: B. GORUP
SIZE: ANSI D
FILE NAME: BUCO00102_DM_AI.rvt
Date: 9/19/2025 7:48:52 AM
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US ARMY CORPS OF ENGINEERS
OMAHA DISTRICT
1616 CAPITOL AVE.
OMAHA, NE 68102

BUCKLEY SFB, COLORADO
POWER INDEPENDENCE: MISSION CONTROL STATION

INDEX

SHEET ID
G-002

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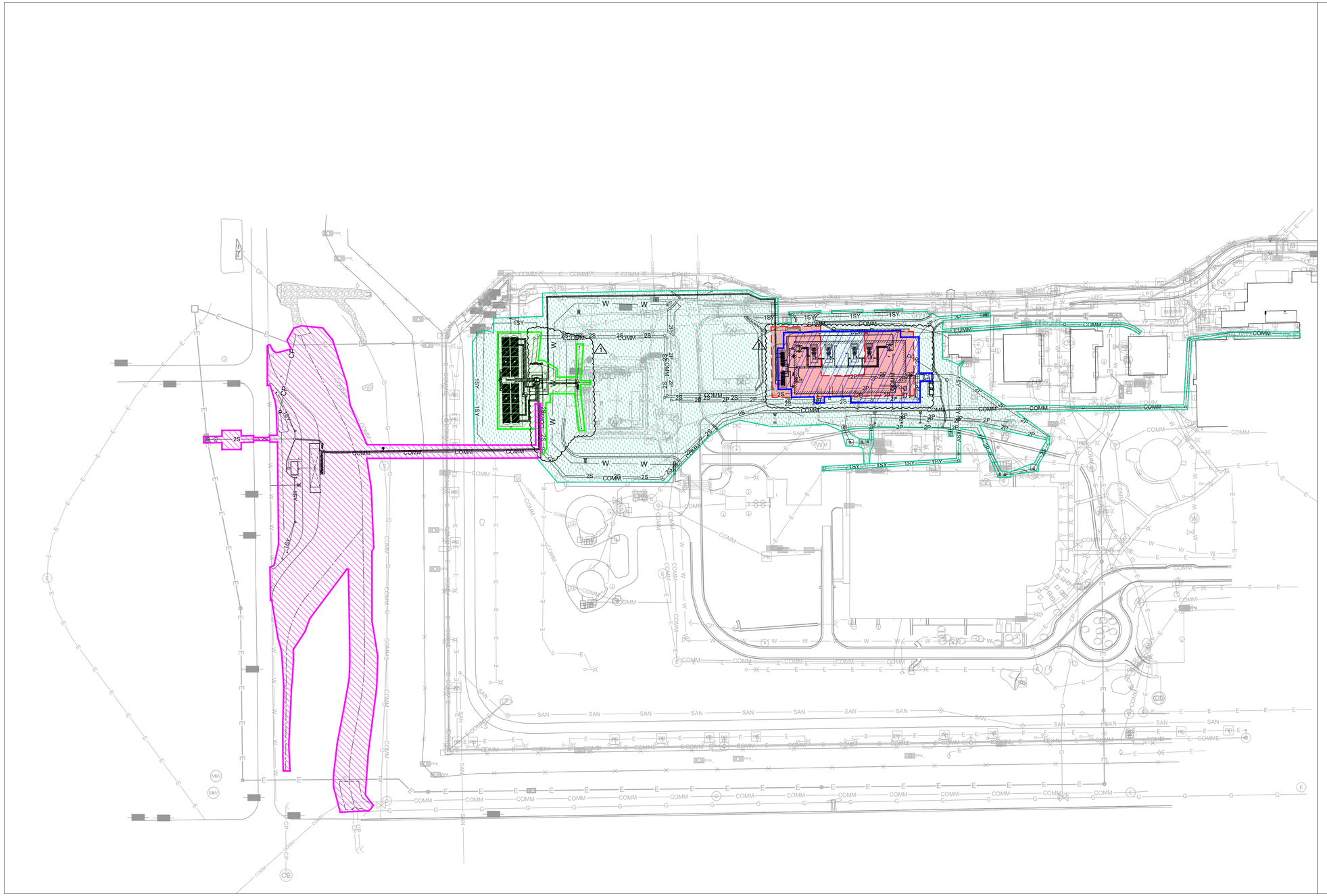

NOTES
1. SEE SPECS FOR CLIN SCHEDULE.
2. THE CURB & GUTTER REMOVAL AND REPLACEMENT SHOWN ON CS107 IS TO BE INCLUDED IN CLIN 0004.
3. CLIN 0006, 0007 AND 0008 NOT SHOWN.
4. ALL WORK SHOWN ON G-006 IS TO BE INCLUDED IN CLIN 0004.

TRUE NORTH

0 80' 160'

A1 CLIN OVERVIEW PLAN

US Army Corps of Engineers®

MARK	DESCRIPTION	DATE
1	AM. #0002 - GENERAL REVISIONS	09/19/2025

DESIGNED BY: N. BURNS
DRAWN BY: N. BURNS
CHECKED BY: T. OWENS
SUBMITTED BY: T. OWENS
SIZE: ANSI D
ISSUE DATE: 05/01/2025
SOLICITATION NO.: W9128F25RA043
CONTRACT NO.:
FILE NUMBER:
FILENAME: BUCO00102CS100-104.dwg

U.S. ARMY CORPS OF ENGINEERS
OMAHA DISTRICT
1616 CAPITOL AVE
OMAHA, NE 68102

BUCKLEY SFB, COLORADO
POWER INDEPENDENCE, MISSION CONTROL STATION

CLIN OVERVIEW PLAN

SHEET ID
G-007

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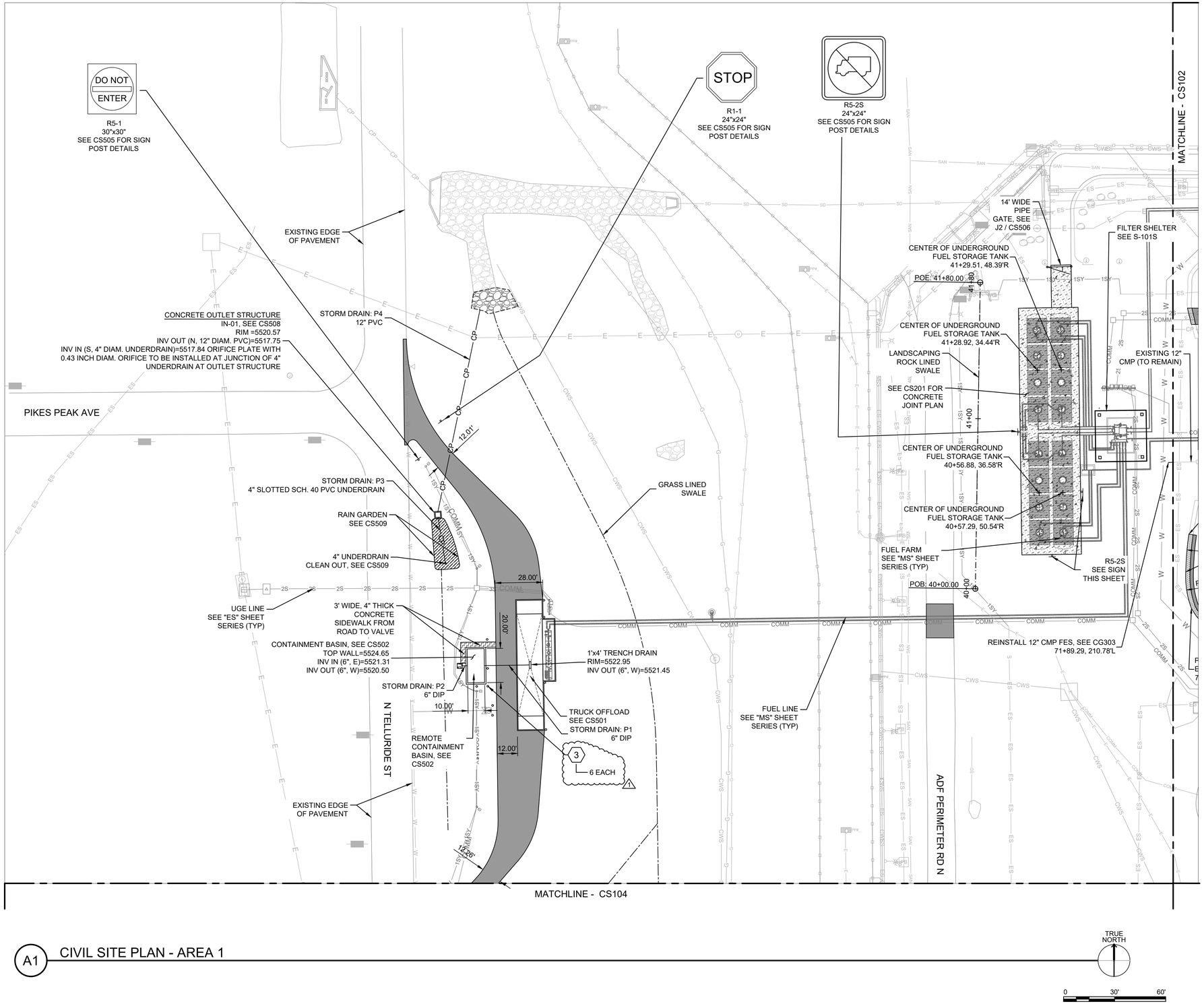


A1 CIVIL SITE PLAN - AREA 1

GENERAL NOTES

1. SEE CG301-303 FOR ROAD, CHANNEL & AND STORM DRAIN PROFILES.
2. SEE CG201 FOR CHANNEL TYPICAL SECTIONS.
3. SEE CG101-104 FOR GRADING INFORMATION AND ADDITIONAL HORIZONTAL DESIGN INFORMATION.
4. SEE CE101-104 FOR SEEDING AND ADDITIONAL SURFACING INFORMATION.
5. THE PAVEMENT REMOVALS AND REPLACEMENT AND SURFACE DISTURBANCES WITHIN THE RESTRICTED AREA ARE PRIMARILY ASSOCIATED WITH TRENCHING FOR UTILITY CONSTRUCTION AND SHALL BE UPDATED AS NECESSARY.

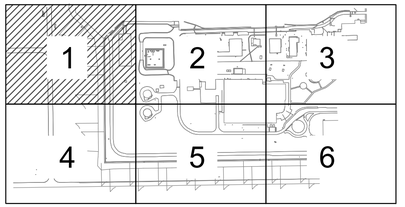
KEY NOTES

1. CARRY CURB AND GUTTER, SEE C1 / CS506
2. VALLEY GUTTER, SEE L14 / CS506
3. BOLLARD, SEE STRUCTURAL PLANS
4. GRAVITY OFFLOAD CONCRETE EDGE, SEE N8 / CS506
5. U-CHANNEL, SEE J14 / CS506
6. CONCRETE CROSSPAN, SEE C7 / CS506
7. SPILL CURB AND GUTTER, SEE C1 / CS506

LEGEND

- FULL-DEPTH ASPHALT SEE L8 / CS506
- REBAR REINFORCED CONCRETE PAVEMENT, SEE N14 / CS506
- WWM REINFORCED CONCRETE PAVEMENT, SEE G14 / CS506
- CONCRETE EQUIPMENT PAD, SEE STRUCTURAL PLANS
- GRAVITY OFFLOAD CONCRETE EDGE, SEE N8 / CS506
- RIPRAP
- CONCRETE SIDEWALK
- RAINGARDEN INFILTRATION MEDIA SEE CS509

KEY PLAN



TRUE NORTH
SCALE:1" = 400'

US Army Corps of Engineers®

MARK	DESCRIPTION	DATE
1	AM. #0002 - GENERAL REVISIONS	09/19/2025

DESIGNED BY: N. BURNS
DRAWN BY: N. BURNS
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SIZE: ANSI D
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SOLICITATION NO.: W9128F25RA043
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FILENAME: BUCO00102CS100-104.dwg

U.S. ARMY CORPS OF ENGINEERS
OMAHA DISTRICT
1616 CAPITOL AVE
OMAHA, NE 68102

BUCKLEY SFB, COLORADO
POWER INDEPENDENCE, MISSION CONTROL STATION

CIVIL SITE PLAN - AREA 1

SHEET ID
CS101

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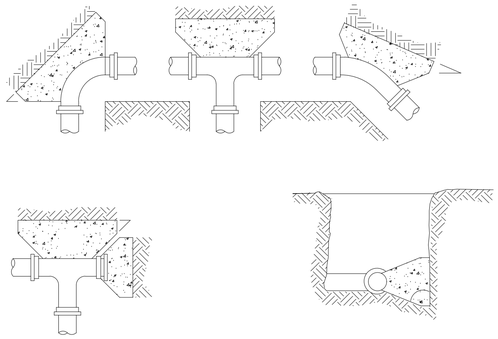


NOTES:

1. PLACE 4 ML. POLYETHYLENE BETWEEN CONCRETE AND FITTING (CONCRETE SHALL NOT INTERFERE WITH JOINT.)
2. MINIMUM CONCRETE THICKNESS SHALL BE 12 INCHES.
3. THE HORIZONTAL DIMENSION (b) OF THE BEARING AREA SHALL BE BETWEEN 1.0 AND 2.0 TIMES THE VERTICAL DIMENSION (h). (h <= b <= 2h)
4. THE VERTICAL DIMENSION (h) OF THE BEARING AREA SHALL BE EQUAL TO ONE-HALF THE TOTAL DEPTH (H) TO THE BOTTOM OF THE THRUST BLOCK BUT NOT LESS THAN THE OUTSIDE DIAMETER (DO) OF THE FITTING (DO < h <= H/2).
5. THRUST BLOCK ORIENTATION SHALL BE SUCH THAT THE CENTER OF THE FITTING CORRESPONDS WITH THE CENTER OF THE THRUST BLOCK.
6. THE MINIMUM ALLOWABLE ANGLE (EITHER VERTICAL OR HORIZONTAL) SHALL BE 45 DEGREES.

TABLE 3: BEARING AREA OF BLOCK IN SQ. FT. (b X h)					
FITTING SIZES	TEE AND END	90° BEND	45° BEND	22 1/2° BEND	11 1/4° BEND
6"	5.9	8.4	4.5	2.3	1.2
8"	10.6	14.9	8.1	4.1	2.1
10"	16.5	23.3	12.6	6.4	3.2
12"	23.7	33.6	18.2	9.3	4.7

K2 THRUST BLOCKING
SCALE: NTS

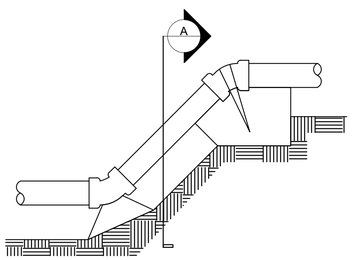
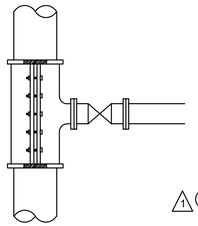


TABLE 1: MINIMUM CONCRETE ANCHOR BLOCK VOLUMES FOR UPPER VERTICAL BENDS (CU.FT.)				
FITTING SIZES	90° BEND	45° BEND	22 1/2° BEND	11 1/4° BEND
6"	98.9	69.9	37.9	4.1
8"	175.8	124.3	67.3	5.5
10"	274.7	194.3	105.1	6.8
12"	395.6	279.8	151.4	8.2

NOTES:

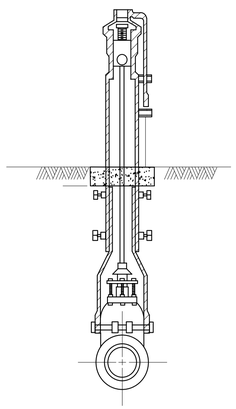
1. PLACE 4 ML. POLYETHYLENE BETWEEN CONCRETE AND FITTING (CONCRETE SHALL NOT INTERFERE WITH JOINT.)
2. MINIMUM CONCRETE THICKNESS SHALL BE 12 INCHES.

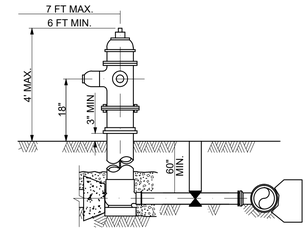


NOTES:

1. PLACE 1/16 " POLYETHYENE BETWEEN CONCRETE AND FITTING (CONCRETE SHALL NOT INTERFERE WITH JOINT.)
2. MINIMUM CONCRETE THICKNESS SHALL BE 12 IN.
3. THE HORIZONTAL DIMENSION OF THE BEARING AREA SHALL BE BETWEEN 0.8 AND 1.25 TIMES THE VERTICAL DIMENTION.
4. THRUST BLOCK ORENTATION SHALL BE SUCH THAT THE CENTER OF THE FITTING CORRESPONDS WITH THE CENTER OF THE THRUST BLOCK.
5. THE MINIMUM ALLOWABLE ANGLE (EITHER VERTICAL OR HORIZONTAL) SHALL BE 45^
6. ALL HYDRANTS ARE TO BE SET WITH PUMPER CONNECTION PERPENDICULAR TO STREET.
7. SEE SECTION 26 42 13 FOR CATHODIC PROTECTION REQUIREMENTS. (1)
8. PROVIDE DIELECTRIC ISOLATION BETWEEN EXISTING AND NEW FERROUS METAL PIPE INSTALL AN INSULATING JOINT TEST STATION.
9. WATER LINE COVER SHALL BE 60" ABOVE TOP OF PIPE.

L12 RIGID CONNECTION FOR 2" PIPE AND LARGER
SCALE: NTS





NOTES: INSTALL HYDRANT SO THAT THE 1-4½" PUMPER CONNECTION IS DIRECTED TOWARD THE HARDSTAND, PERPENDICULAR TO THE CONCRETE PAVEMENT EDGE.

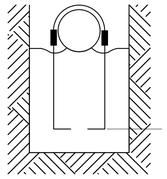
G16 FIRE HYDRANT DETAIL
SCALE: NTS

F12 POST INDICATOR VALVE
SCALE: NTS

TABLE 2: ANCHOR ROD SCHEDULE FOR CONCRETE ANCHOR BLOCKS		
FITTING SIZES	RODS (# AND SIZE)	MIN. EMBEDMENT DEPTH
4"	1 - 3/8"	6"
6"	1 - 3/8"	6"
8"	2 - 1/2"	6"
10"	2 - 1/2"	6"
12"	2 - 5/8"	7"
14"	2 - 3/4"	8"
16"	2 - 3/4"	8"

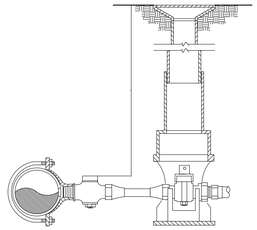
NOTES:

1. PROVIDE TYPE 304 STAINLESS ANCHOR RODS, TURNBUCKLES, U-BOLTS, AND ASSOCIATED HARDWARE

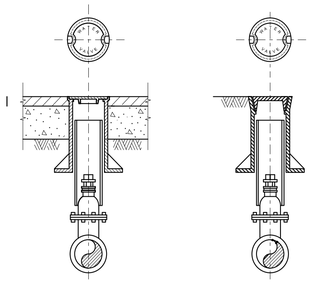


SECTION A

A2 VERTICAL PIPE BEND DETAIL
SCALE: NTS



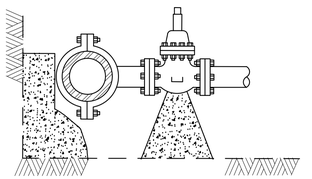
A6 WATER MAIN CONNNECTION DETAIL
SCALE: NTS



PAVEMENT OPEN AREAS

NOTE: NO SCREW TYPE MAY BE USED

A12 VALVE BOX DETAILS
SCALE: NTS



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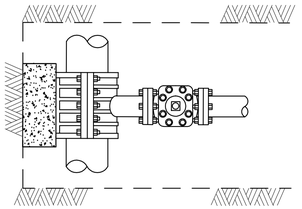

PLAN

A16 TAPPING SLEEVE
SCALE: NTS

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DESIGNED BY: K.BERGER
DRAWN BY: K.BERGER
CHECKED BY: Q. LEE
SUBMITTED BY: T. OWENS
SIZE: ANSI D
ISSUE DATE: 05/01/2025
SOLICITATION NO.: W9126F25RA043
CONTRACT NO.:
FILE NUMBER:
FILENAME: BUCO00102CU301.dwg

U.S. ARMY CORPS OF ENGINEERS
OMAHA DISTRICT
1616 CAPITOL AVE
OMAHA, NE 68102

BUCKLEY SFB, COLORADO
POWER INDEPENDENCE: MISSION CONTROL STATION

WATER UTILITY DETAILS

SHEET ID
CU501

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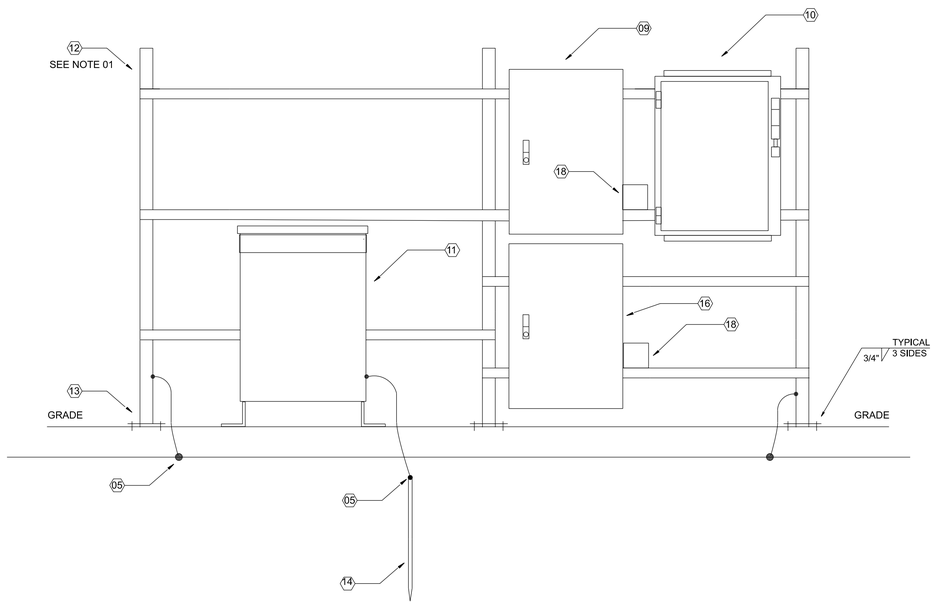
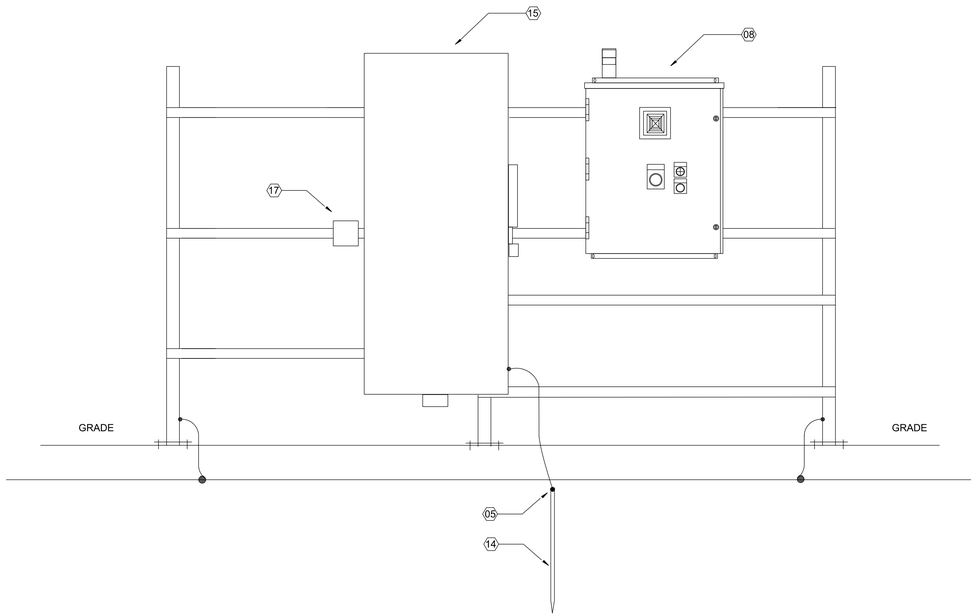


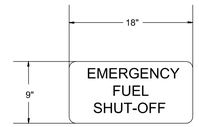
H3 OFFLOAD EQUIPMENT RISER ELEVATION (FRONT)

N.T.S.



B1 OFFLOAD EQUIPMENT RISER ELEVATION (REAR)

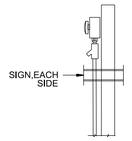
N.T.S.



2" RED LETTERS, WHITE FIELD

N12 EFSO SIGNAGE DETAIL

N.T.S.



K12 EFSO STATION DETAIL

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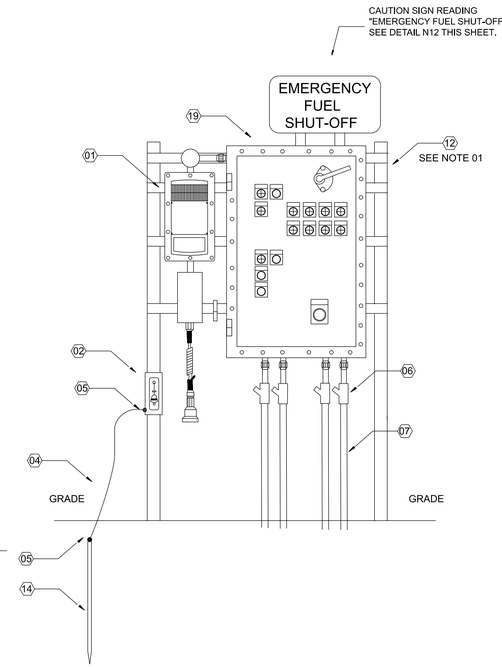

B11 OFFLOAD CONTROL EQUIPMENT RISER DETAIL

N.T.S.

GENERAL SHEET NOTES

01 - CONTRACTOR TO SIZE RISER SUPPORT MEMBERS TO CARRY EQUIPMENT USED
02 - ALL EQUIPMENT RISERS SHALL HAVE (2) PATHS TO GROUND.
03 - EFSO STATION JUMBO MUSHROOM OPERATOR IS 1-NC MOMENTARY CONTACT, WITH "EMERGENCY STOP" LEGEND
04 - ALL CONDUITS ABOVE GRADE AND ALL ELBOWS BELOW GRADE SHALL BE GALVANIZED RIGID STEEL
05 - EQUIPMENT LAYOUT ON EQUIPMENT RISER IS CONCEPTUAL
06 - EQUIPMENT ENCLOSURES SHALL BE WEATHERPROOF (NEMA 4X MIN) INSULATED, AND HEATED. HEATER SHALL BE THERMOSATICALLY CONTROLLED, AND FAN DRIVEN. SEE UFGS 33 09 52 FOR DETAILS
07 - EQUIPMENT SHALL BE HEATED OR COOLED IN ACCORDANCE WITH MANUFACTURES SPECIFICATIONS
08 - EQUIPMENT RISER GROUNDING SHALL BE IN ACCORDANCE WITH NFPA 780
09 - SEE EP600 SHEET SERIES FOR EQUIPMENT DETAILS
10 - SEE SHEETS EF401 AND EG502 FOR DETAILS

SHEET KEY NOTES

01 - GROUND PROVING UNIT
02 - MANUAL GROUND REEL, 30' LENGTH
03 - EXOTHERMIC WELD
04 - #1/0 COPPER GROUND CONDUCTOR
05 - EXOTHERMIC WELD
06 - CONDUIT SEALOFF FITTING (TYP.)
07 - 1" CONDUIT (TYP.)
08 - OFFLOAD FIBER CONVERTER PANEL
09 - OLB PANEL
10 - LIGHTING CONTRACTOR PANEL
11 - TRANSFORMER
12 - C4X7.5 CHANNEL, PRIME AND FINISH PAINT
13 - 4-1/2" CONCRETE ANCHORS AND 1/2"X5"X10" BASEPLATE W/ 1" (MIN.) NON-SHRINK GROUT, (TYP.) PRIME AND FINISH PAINT BASEPLATE
14 - 10'X3/4" COPPER CLAD STEEL GROUNDING ROD, COUNTERPOISE, OR GROUND RING AS APPLICABLE
15 - MANUAL TRANSFER SWITCH (MTS)
16 - OHB PANEL, NEMA (3R)
17 - WEATHERPROOF GFCI DUPLEX RECEPTACLE
18 - SURGE PROTECTION DEVICE (SPD)
19 - OFFLOAD CONTROL PANEL

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DRAWN BY: C. RAISON	SOLICITATION NO.: W9128F25RA043
CHECKED BY: B. BAKER	CONTRACT NO.:
APPROVED BY: S. LINDGREN	FILE NUMBER:
SIZE: ANSI D	FILENAME: BUCC000102-EF501-601.dwg

U.S. ARMY CORPS OF ENGINEERS
OMAHA DISTRICT
1616 CAPITOL AVE
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OFFLOAD ELECTRICAL DETAILS

SHEET ID

EF502

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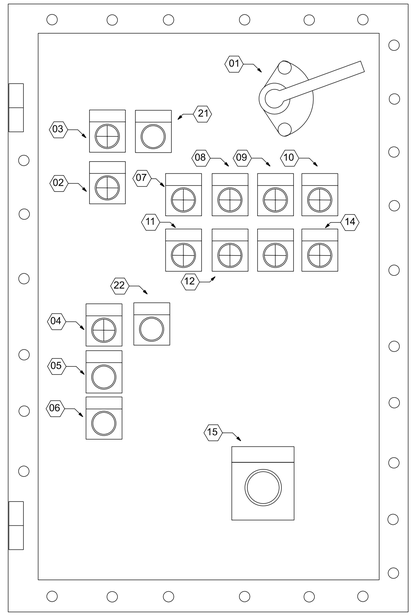
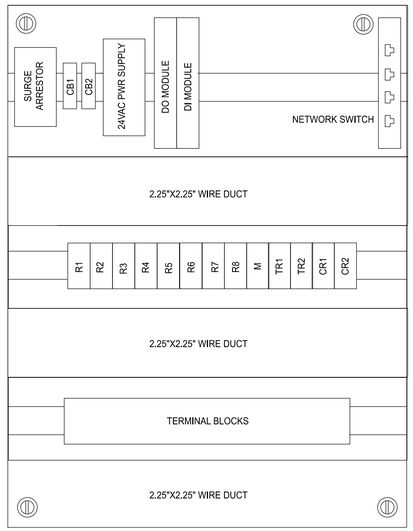


J1 OFFLOAD PUMP CONTROL PANEL ELEVATION
N.T.S.



J5 FIBER CONVERTER PANEL LAYOUT
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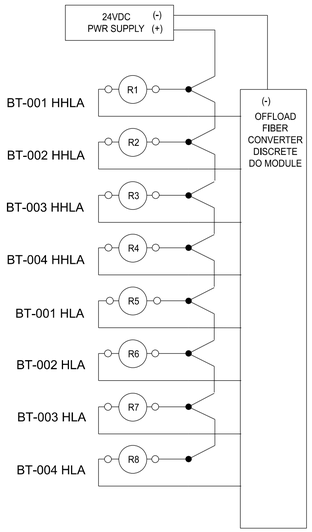

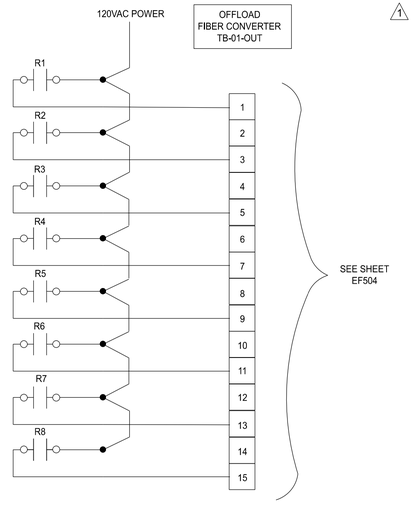

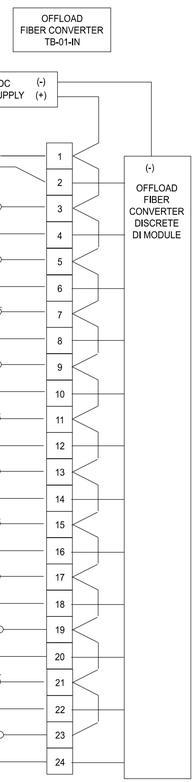

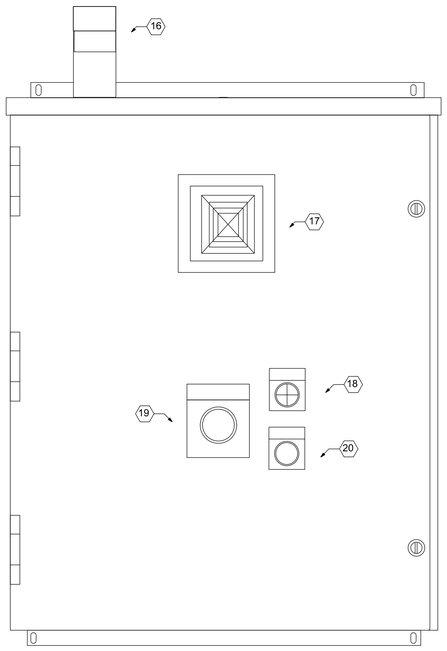

A1 FIBER CONVERTER PANEL ELEVATION
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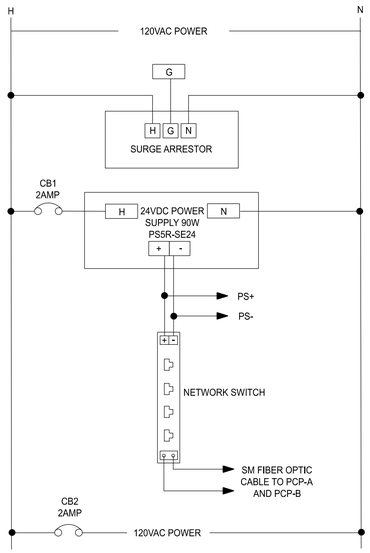

B5 FIBER CONVERTER POWER DISTRIBUTION DIAGRAM
N.T.S.

GENERAL SHEET NOTES

01 - DISCONNECT/STARTER ARE INCORPORATED IN THE PANEL.
02 - OFFLOAD CONTROL PANEL EQUIPMENT/COMPONENT LAYOUT IS CONCEPTUAL
03 - FIBER CONVERTER PANEL EQUIPMENT/COMPONENT LAYOUT IS CONCEPTUAL
04 - FIBER CONVERTER PANEL DIMENSIONS ARE CONCEPTUAL. CONTRACTOR SHALL SIZE THE PANEL TO ACCOMMODATE SYSTEM EQUIPMENT AND COMPONENTS
05 - OFFLOAD CONTROL PANEL DIMENSIONS ARE CONCEPTUAL. CONTRACTOR SHALL SIZE THE PANEL TO ACCOMMODATE SYSTEM EQUIPMENT AND COMPONENTS
06 - OFFLOAD CONTROL PANEL IS LOCATED ON AN EQUIPMENT RISER MOUNTED ON THE OFFLOAD SKID. FOR DETAILS SEE SHEET EF502, B11
07 - FIBER CONVERTER PANEL IS MOUNTED ON THE OFFLOAD EQUIPMENT RISER
08 - ALL PANELS/ENCLOSURES SHALL BE WEATHERPROOF (NEMA 4X MIN) INSULATED, AND HEATED. HEATER SHALL BE THERMOSTATICALLY CONTROLLED AND FAN DRIVEN. SEE UFGS 33-09-52 FOR DETAILS
09 - THE OFFLOAD SYSTEM IS CONSIDERED SACRIFICIAL. REDUNDANT I/O CIRCUITS ARE NOT REQUIRED
10 - EQUIPMENT SHALL BE HEATED OR COOLED PER MANUFACTURER'S RECOMMENDATIONS

SHEET KEY NOTES

01 - DISCONNECT SWITCH
02 - NAME PLATE "EMERGENCY CIRCUIT POWER ON" INDICATOR, WHITE INDICATOR LIGHT
03 - NAME PLATE "AE HIGH FLOW", RED INDICATOR LIGHT
04 - NAME PLATE "OP-1 STATUS", GREEN INDICATOR LIGHT
05 - NAME PLATE "OP-1 CALL", MOMENTARY PUSHBUTTON SWITCH
06 - NAME PLATE "OP-1 CANCEL", MOMENTARY PUSHBUTTON SWITCH
07 - NAME PLATE "BT-001 HHLA", RED INDICATOR LIGHT
08 - NAME PLATE "BT-002 HHLA", RED INDICATOR LIGHT
09 - NAME PLATE "BT-003 HHLA", RED INDICATOR LIGHT
10 - NAME PLATE "BT-004 HHLA", RED INDICATOR LIGHT
11 - NAME PLATE "BT-001 HLA", AMBER INDICATOR LIGHT
12 - NAME PLATE "BT-002 HLA", AMBER INDICATOR LIGHT
13 - NAME PLATE "BT-003 HLA", AMBER INDICATOR LIGHT
14 - NAME PLATE "BT-004 HLA", AMBER INDICATOR LIGHT
15 - NAME PLATE "EMERGENCY STOP","EFSO-1, 3" MUSHROOM MOMENTARY CONTACT PUSHBUTTON SWITCH
16 - EFSO STROBE
17 - VIBRATING HORN (70dB AT 10')
18 - NAME PLATE "EFSO ACTIVATED", RED INDICATOR LIGHT
19 - NAME PLATE "EMERGENCY STOP","EFSO-2, 3" MUSHROOM MOMENTARY CONTACT PUSHBUTTON SWITCH
20 - NAME PLATE "ACKNOWLEDGE" MOMENTARY PUSHBUTTON SWITCH
21 - NAME PLATE "TEST", MOMENTARY PUSHBUTTON SWITCH (AE HIGH FLOW)
22 - NAME PLATE "TEST", MOMENTARY PUSHBUTTON SWITCH (OP-1 STATUS)

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DESIGNED BY:	C. RAISON
DRAWN BY:	C. RAISON
CHECKED BY:	R. WAGNER
SUBMITTED BY:	S. LINDGREN
SIZE:	ANSI D
ISSUE DATE:	05/01/2025
SOLICITATION NO.:	W9128F25RA043
CONTRACT NO.:	
FILE NUMBER:	
FILENAME:	BUCO00102-EF501-601.dwg

U.S. ARMY CORPS OF ENGINEERS
OMAHA DISTRICT
1616 CAPITOL AVE
OMAHA, NE 68102

BUCKLEY SFB, COLORADO
POWER INDEPENDENCE: MISSION CONTROL STATION

OFFLOAD PUMP CONTROL PANEL AND FIBER CONVERTER PANEL DETAILS

SHEET ID
EF503

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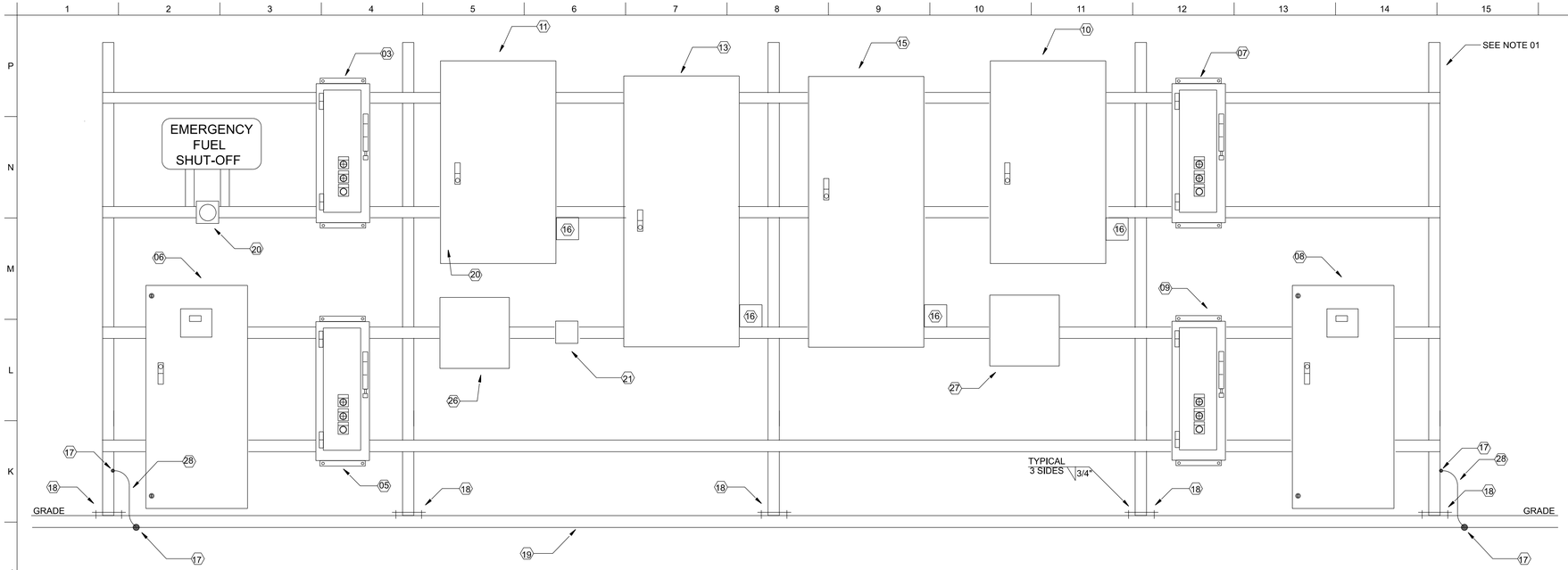
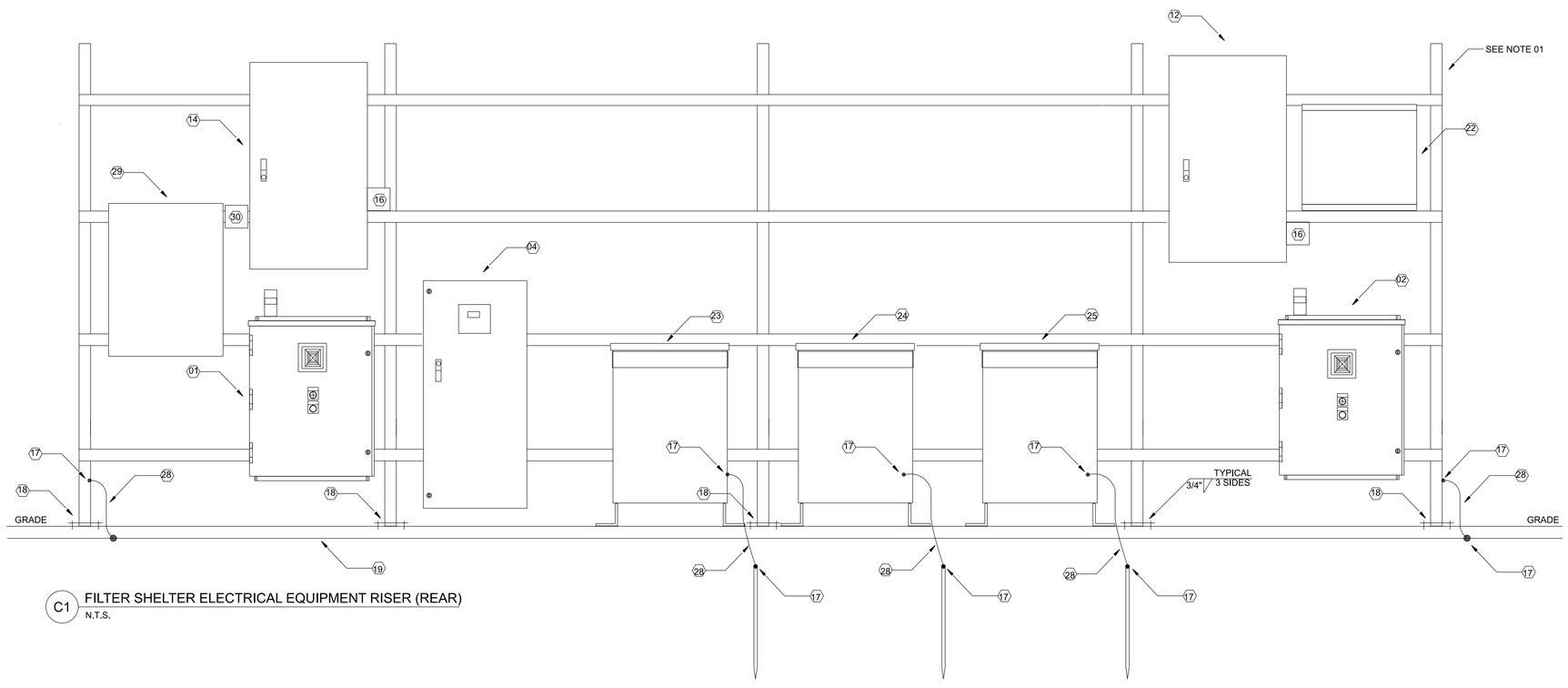


K1 FILTER SHELTER ELECTRICAL EQUIPMENT RISER (FRONT)
N.T.S.



C1 FILTER SHELTER ELECTRICAL EQUIPMENT RISER (REAR)
N.T.S.

GENERAL SHEET NOTES

01 - CONTRACTOR TO SIZE RISER SUPPORT MEMBERS TO CARRY EQUIPMENT USED
02 - ALL EQUIPMENT RISERS SHALL HAVE (2) PATHS TO GROUND
03 - EFSO STATION JUMBO MUSHROOM OPERATOR IS 1-NC MOMENTARY CONTACT, WITH "EMERGENCY STOP" LEGEND
04 - ALL CONDUITS ABOVE GRADE AND ALL ELBOWS BELOW GRADE SHALL BE GALVANIZED RIGID STEEL
05 - EQUIPMENT LAYOUT ON EQUIPMENT RISER IS CONCEPTUAL
06 - ALL PANELS/ENCLOSURES SHALL BE WEATHERPROOF (NEMA 4X MIN) INSULATED, AND HEATED. HEATER SHALL BE THERMOSTATICALLY CONTROLLED AND FAN DRIVEN. SEE UFGS 33 09 52 FOR DETAILS
07 - ELECTRONIC EQUIPMENT SHALL BE HEATED OR COOLED IN ACCORDANCE WITH MANUFACTURES SPECIFICATIONS
08 - EQUIPMENT RISER GROUNDING SHALL BE IN ACCORDANCE WITH NFPA 780
09 - COORDINATE LOCATIONS OF SPDs WITH PANEL SCHEDULE LOCATIONS AS FOUND ON EP600 SHEET SERIES
10 - THE EMERGENCY EYEWASH UNIT IS SELF CONTAINED AND SELF-MONITORS TEMPERATURE TO PREVENT FREEZING. INSTALL PER MANUFACTURER'S SPECIFICATIONS
11 - SEE SHEETS EG603S AND EG502 FOR DETAILS

SHEET KEY NOTES

01 - FILTER SHELTER FIBER CONVERTER PANEL-A
02 - FILTER SHELTER FIBER CONVERTER PANEL-B
03 - IP-F1 CONTROL PANEL
04 - ATS P
05 - IP-F2 CONTROL PANEL
06 - ATS IP-F2
07 - IP-F3 CONTROL PANEL
08 - ATS IP-F3
09 - IP-F4 CONTROL PANEL
10 - PANEL PLA
11 - PANEL PLB
12 - PANEL PH
13 - PANEL PHB
14 - PANEL PL
15 - PANEL PHA
16 - PANEL SPD (TYP.)
17 - EXOTHERMIC WELD (TYP.)
18 - 4-1/2" CONCRETE ANCHORS AND 1/2"x5"x10" BASEPLATE W/ 1" (MIN.) NON-SHRINK GROUT. (TYPICAL) PRIME AND FINISH PAINT BASEPLATE (TYP.)
19 - COUNTERPOISE OR GROUND RING (TYP.)
20 - EFSO-2 PUSHBUTTON
21 - WEATHERPROOF GFCI DUPLEX RECEPTACLE
22 - HEAT TRACE CONTROL
23 - TRANSFORMER PT
24 - TRANSFORMER PTB
25 - TRANSFORMER PTA
26 - ECB IP-F2
27 - ECB IP-F3
28 - GROUNDING CONDUCTOR (TYP.)
29 - EMERGENCY EYEWASH UNIT
30 - WEATHERPROOF GFCI DUPLEX RECEPTACLE (DEDICATED TO EMERGENCY EYEWASH UNIT)

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1	AM #0002 - GENERAL REVISIONS	09/19/2025

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ISSUE DATE: 05/01/2025
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DESIGNED BY: C. RAISON
DRAWN BY: C. RAISON
CHECKED BY: P. WAGNER
SUBMITTED BY: S. LINDGREN
SIZE: ANSI D

U.S. ARMY CORPS OF ENGINEERS
OMAHA DISTRICT
1616 CAPITOL AVE
OMAHA, NE 68102

BUCKLEY SFB, COLORADO
POWER INDEPENDENCE, MISSION CONTROL STATION

FILTER SHELTER ELECTRICAL EQUIPMENT
RISER ELEVATION

SHEET ID
EF505

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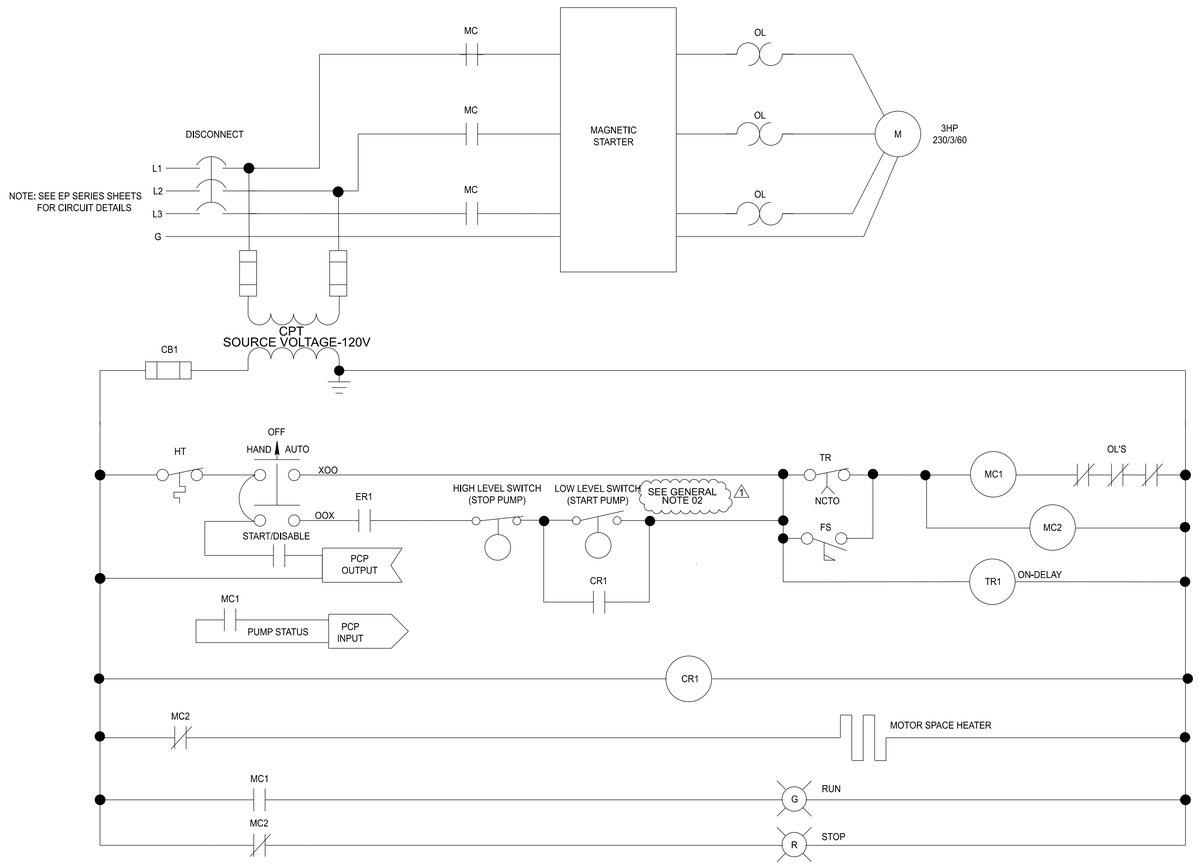
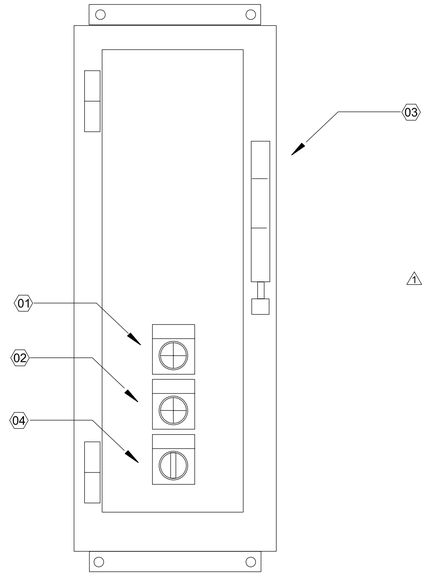


G1 TANK PUMP CONTROL DIAGRAM
N.T.S.



F13 MOTOR STARTER/DISCONNECT ELEVATION
N.T.S.

INTENT OF OPERATION

01 - OPERATING/DAY TANK HIGH LEVEL SWITCHES (STOP) AND LOW LEVEL SWITCHES (START) CONTROL THE OPERATION OF THE BULK AND OPERATING TANK PUMPS
02 - EFSO ACTIVATION SHALL SHUT DOWN ALL PUMPS
03 - HIGH LEVEL (ALARM) SHALL ILLUMINATE HLA INDICATORS AND SOUND THE VIBRATING HORNS
04 - HIGH-HIGH LEVEL (ALARM) SHALL ILLUMINATE HHLA INDICATORS ON THE OFFLOAD CONTROL PANEL, SOUND THE VIBRATING HORNS, AND SHUT DOWN ALL PUMPS
05 - PUMP CONTROL CIRCUITRY IS TO BE INCORPORATED INTO MOTOR STARTER/ DISCONNECT

SHEET KEY NOTES

01 - PUMP STATUS INDICATOR (RUN)
02 - PUNP STATUS INDICATOR (STOP)
03 - ELECTRICAL DISCONNECT
04 - HAND-OFF-AUTO ROTARY (HOA) SWITCH

SHEET GENERAL NOTES

01 - MOTOR STARTER/DISCONNECT SHALL BE WEATHERPROOF (NEMA 4X MIN) INSULATED, AND HEATED. HEATER SHALL BE THERMOSTATICALLY CONTROLLED AND FAN DRIVEN. SEE UFGS 33 09 52 FOR DETAILS
02 - TANK LEVEL CONTROL CIRCUIT (HIGH AND LOW LEVEL SWITCHES AND CR1) ARE NOT REQUIRED FOR BULK TANKS.

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DESIGNED BY:	ISSUE DATE:
C. RAISON	05/01/2025
DRAWN BY:	SOLICITATION NO.:
C. RAISON	W9128F25RA043
CHECKED BY:	CONTRACT NO.:
R. WAGNER	
SUBMITTED BY:	FILE NUMBER:
S. LINDGREN	
SIZE:	FILENAME:
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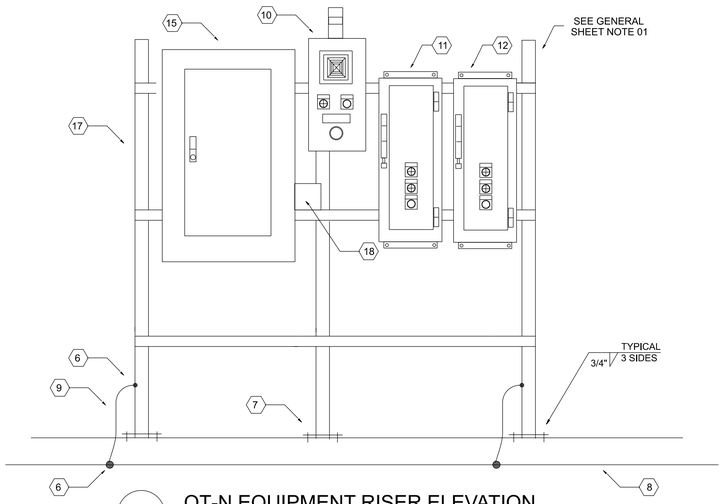
OMAHA, NE 68102

BUCKLEY SFB, COLORADO
POWER INDEPENDENCE, MISSION CONTROL STATION

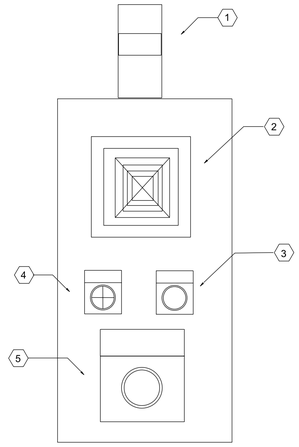
TANK CONTROL DIAGRAMS AND MOTOR STARTER/DISCONNECT ELEVATION

SHEET ID
EF506

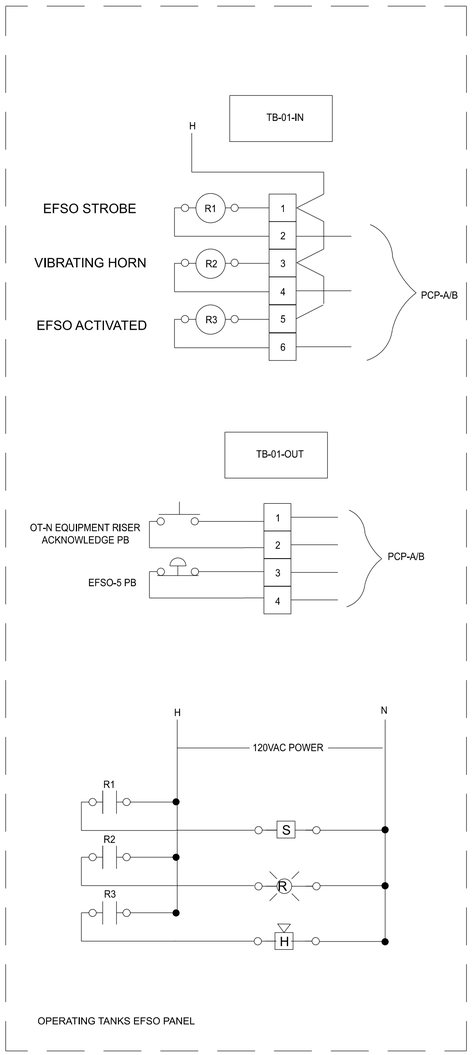
ADVERTISEMENT



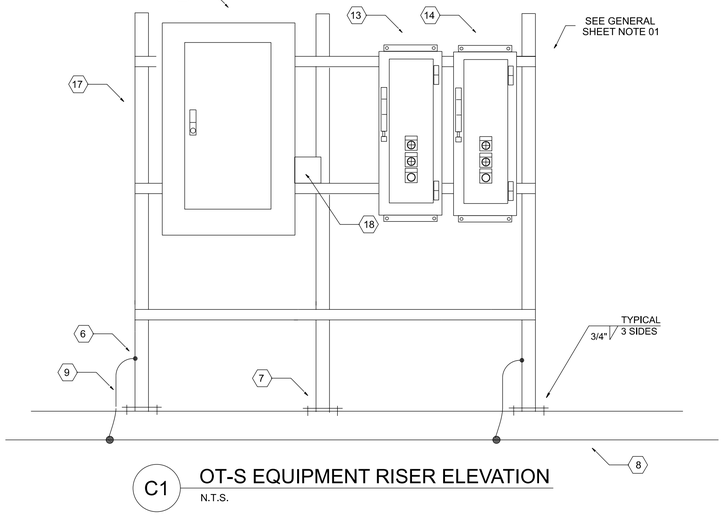
K1 OT-N EQUIPMENT RISER ELEVATION
N.T.S.



F8 OPERATING TANKS EFSO PANEL ELEVATION
N.T.S.



F11 EFSO CIRCUIT DIAGRAM
N.T.S.



C1 OT-S EQUIPMENT RISER ELEVATION
N.T.S.

GENERAL SHEET NOTES

01 - CONTRACTOR TO SIZE RISER SUPPORT MEMBERS TO CARRY EQUIPMENT USED
02 - ALL EQUIPMENT RISERS SHALL HAVE (2) PATHS TO GROUND.
03 - EFSO STATION JUMBO MUSHROOM OPERATOR IS 1-NC MOMENTARY CONTACT, WITH "EMERGENCY STOP" LEGEND
04 - ALL CONDUITS ABOVE GRADE AND ALL ELBOWS BELOW GRADE SHALL BE GALVANIZED RIGID STEEL
05 - EQUIPMENT LAYOUT ON EQUIPMENT RISER IS CONCEPTUAL
06 - EQUIPMENT ENCLOSURES SHALL BE WEATHERPROOF (NEMA 4X MIN) INSULATED, AND HEATED. HEATER SHALL BE THERMOSTATICALLY CONTROLLED AND FAN DRIVEN. SEE UFGS 33 09 52 FOR DETAILS
07 - ELECTRONIC EQUIPMENT SHALL BE HEATED OR COOLED IN ACCORDANCE WITH MANUFACTURES SPECIFICATIONS
08 - EQUIPMENT RISER GROUNDING SHALL BE IN ACCORDANCE WITH NFPA 780
09 - SEE SHEETS EG001 AND EG502 FOR DETAILS

SHEET KEY NOTES

01 - EFSO STROBE
02 - VIBRATING HORN
03 - ACKNOWLEDGE PUSHBUTTON
04 - EFSO STATUS INDICATOR
05 - EFSO-4 PUSHBUTTON
06 - EXOTHERMIC WELD (TYP.)
07 - 4-1/2" CONCRETE ANCHORS AND 1/2"X5"X10" BASEPLATE W/ 1" (MIN.) NON-SHIRNK GROUT (TYP.) PRIME AND FINISH PAINT BASEPLATE (TYP.)
08 - COUNTERPOISE OR GROUND RING (TYP.) SEE EG SERIES SHEETS
09 - GROUNDING CONDUCTOR (TYP.)
10 - EFSO PANEL
11 - IP-O1 MOTOR STARTER/DISCONNECT
12 - IP-O2 MOTOR STARTER/DISCONNECT
13 - IP-O3 MOTOR STARTER/DISCONNECT
14 - IP-O4 MOTOR STARTER/DISCONNECT
15 - PANEL QHA3
16 - PANEL QHB3
17 - C 4"X7.5" CHANNEL (TYP.), PRIME AND FINISH PAINT
18 - PANEL SPD (TYP.)

US Army Corps of Engineers®

MARK	DESCRIPTION	DATE
1	AM #0002 - GENERAL REVISIONS	09/19/2025

P:\09Q4_PROJECTS\BUCO00102\PLAN SETS\03_SHEETS\03_SITE\BUCO00102-EF501-601.DWG
12:38:03 PM 11/30/2023
G6EDJXPFW
AEC_NCS_4_MONO.CTB

DESIGNED BY:	C.RAISON
DRAWN BY:	C.RAISON
CHECKED BY:	P. WAGNER
SUBMITTED BY:	S. LINDGREN
SIZE:	ANSI D
ISSUE DATE:	05/01/2025
SOLICITATION NO.:	W9128F25RA043
CONTRACT NO.:	
FILE NUMBER:	
FILENAME:	BUCO00102-EF501-601.dwg

U.S. ARMY CORPS OF ENGINEERS
OMAHA DISTRICT
1616 CAPITOL AVE
OMAHA, NE 68102

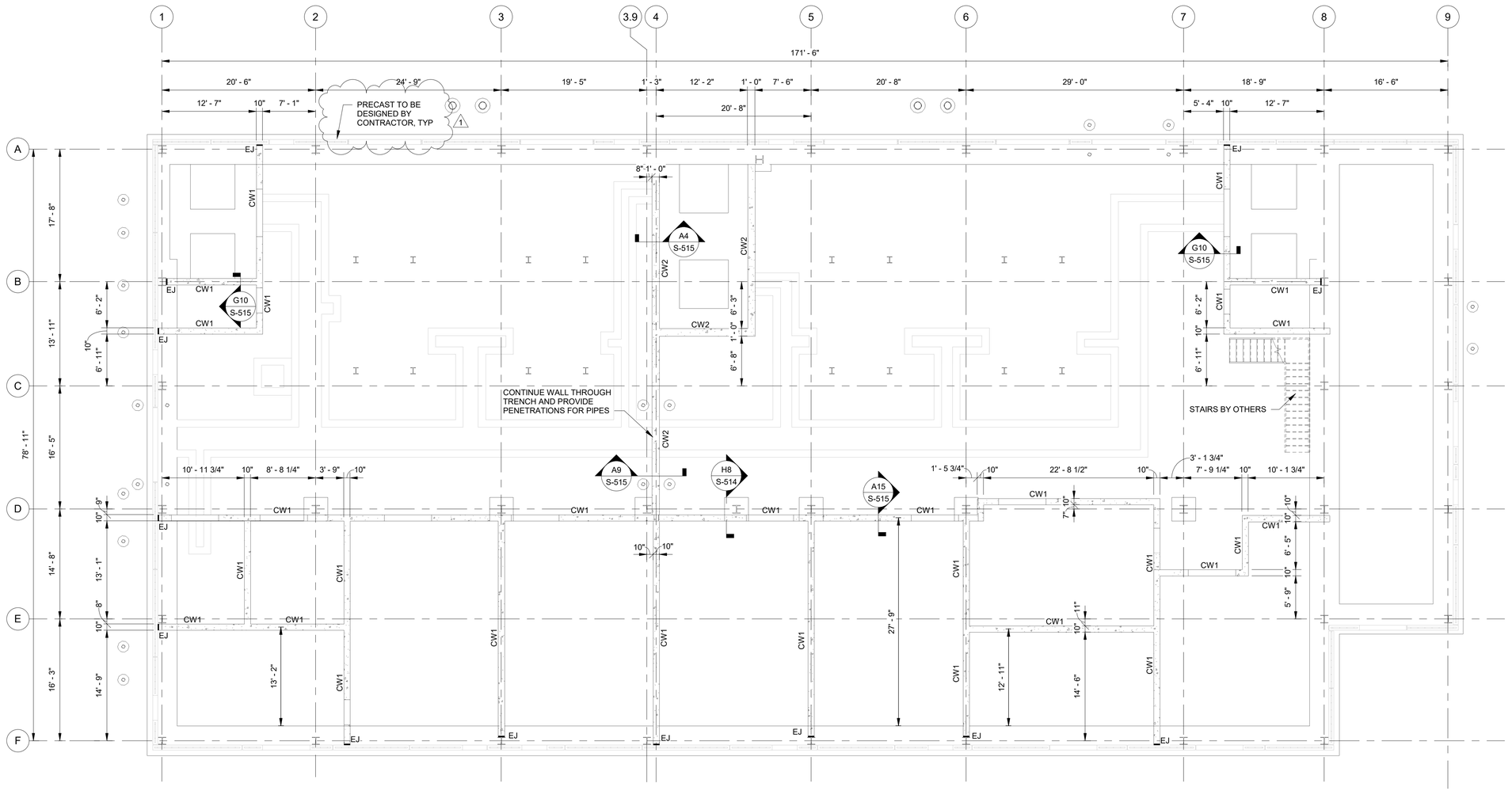
BUCKLEY SFB, COLORADO
POWER INDEPENDENCE, MISSION CONTROL STATION

OPERATING TANK EQUIPMENT RISER AND
EFSO ELEVATIONS AND EFSO CIRCUIT DIAGRAM

SHEET ID
EF511

ADVERTISEMENT

CONCRETE WALL ("CW") SCHEDULE					
MARK	THICKNESS	TOP ELEVATION	BASE ELEVATION	VERTICAL REINFORCEMENT	HORIZONTAL REINFORCEMENT
CW1	10"	12' - 7"	-3' - 8"	#5 @ 8" O.C.E.F.	#4 @ 18" O.C.E.F.
CW2	12"	0' - 0"	-3' - 8"	#5 @ 8" O.C.E.F.	#4 @ 12" O.C.E.F.



CONCRETE WALL NOTES:
1. ALL EXPANSION JOINTS SHALL BE 2".

PLAN NORTH

A4 CONCRETE WALL PLAN
1/8" = 1'-0"

0 4' 8' 16'

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MARK	DESCRIPTION	DATE
1	AM #0002 - GENERAL REVISIONS	09/19/2025

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Plot Date: 9/18/2025 6:55:21 AM

DESIGNED BY: E. HENIN
DRAWN BY: J. OSBORN
CHECKED BY: M. BECK
SUBMITTED BY: S. DENNING
SIZE: ANSI D
ISSUE DATE: 05/01/2025
SOLICITATION NO.: W9128F25RA043
CONTRACT NO.:
FILE NAME: BUCO00102_DM_S.rvt

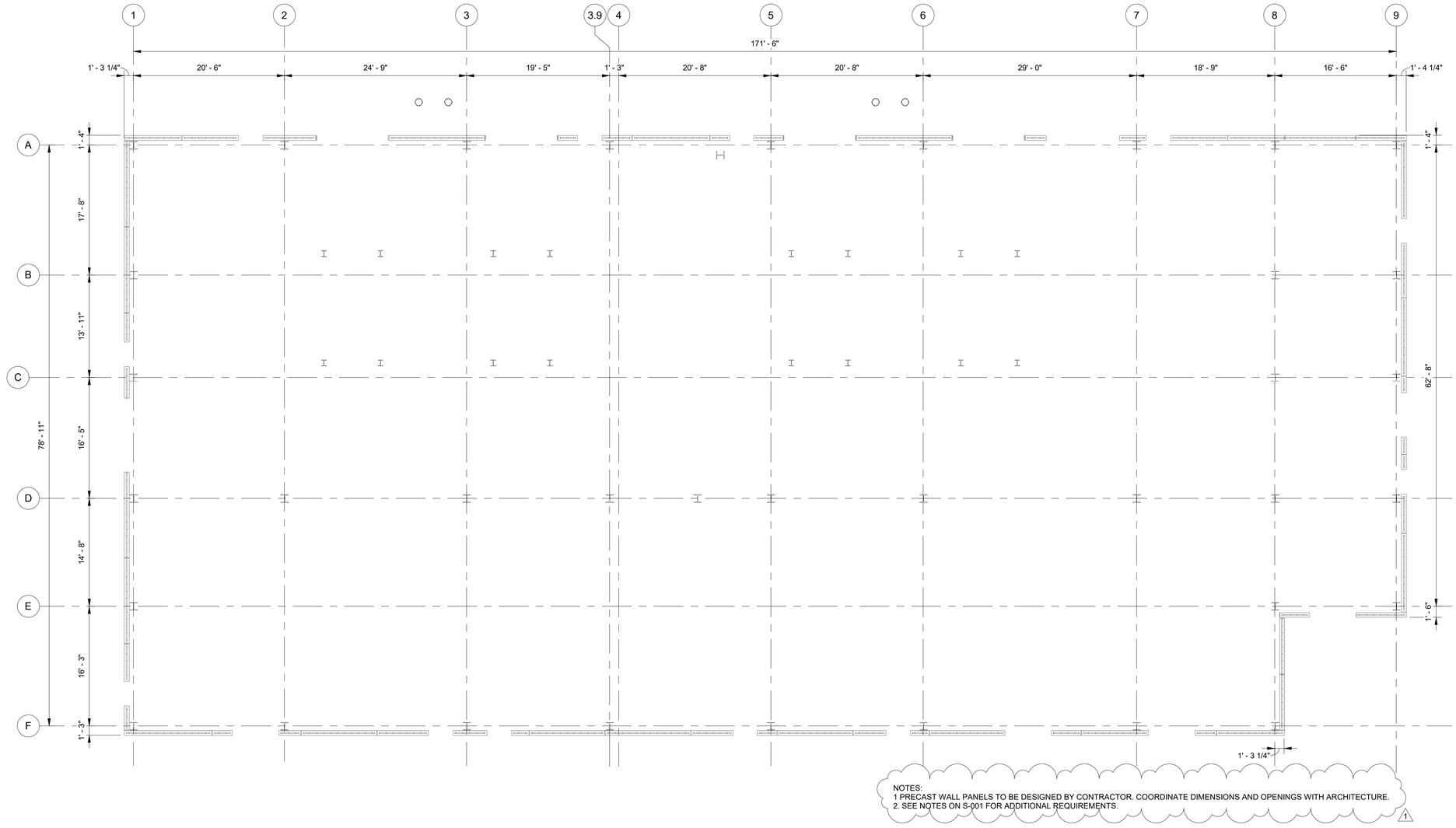
US ARMY CORPS OF ENGINEERS
OMAHA DISTRICT
1616 CAPITOL AVE.
OMAHA, NE 68102

BUCKLEY SFB, COLORADO
POWER INDEPENDENCE, MISSION CONTROL STATION

CONCRETE WALL PLAN

SHEET ID
S-102

ADVERTISEMENT



NOTES:
1 PRECAST WALL PANELS TO BE DESIGNED BY CONTRACTOR. COORDINATE DIMENSIONS AND OPENINGS WITH ARCHITECTURE.
2. SEE NOTES ON S-001 FOR ADDITIONAL REQUIREMENTS.

1

PLAN NORTH

A4 PRECAST WALL PLAN
1/8" = 1'-0"

0 4' 8' 16'

US Army Corps of Engineers ®

MARK	DESCRIPTION	DATE
1	AM #0002 - GENERAL REVISIONS	09/19/2025

File Path: C:\Users\OSBOJUE\Documents\Buckley - US Army Corps of Engineers\Documents\BUCO00102_DM_S_OSBOJUE.rvt

ISSUE DATE: 05/01/2025
SOLICITATION NO.: W9128F25RA043
CONTRACT NO.:

DESIGNED BY: E. HENIN
DRAWN BY: J. OSBORN
CHECKED BY: W. BOECK
SUBMITTED BY: S. DENNING
SIZE: ANSI D
FILE NAME: BUCO00102_DM_S.rvt

Plot Date: 9/18/2025 6:55:28 AM

US ARMY CORPS OF ENGINEERS
OMAHA DISTRICT
1616 CAPITOL AVE
OMAHA, NE 68102

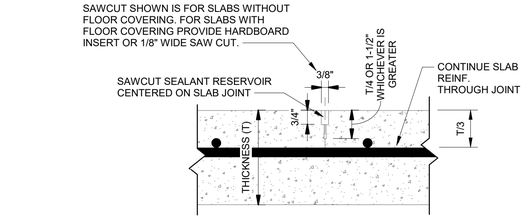
BUCKLEY SFB, COLORADO
POWER INDEPENDENCE: MISSION CONTROL STATION

PRECAST WALL PLAN

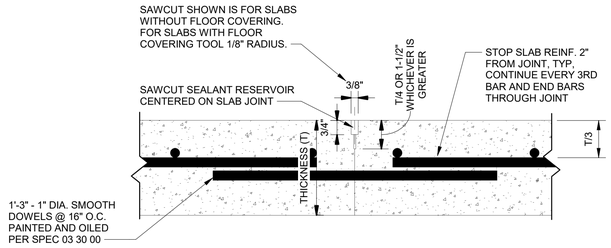
SHEET ID

S-103

ADVERTISEMENT



M1 SLAB-ON-GRADE CONTRACTION JOINT
NTS



J1 SLAB-ON-GRADE CONSTRUCTION JOINT
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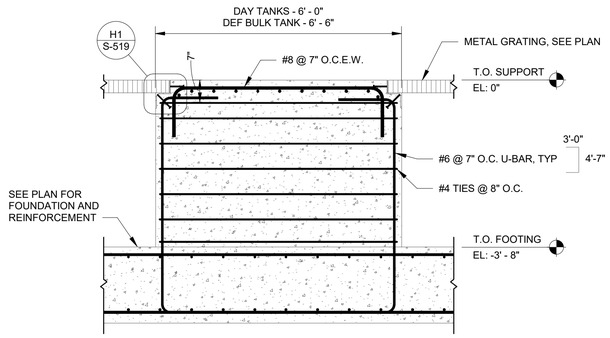
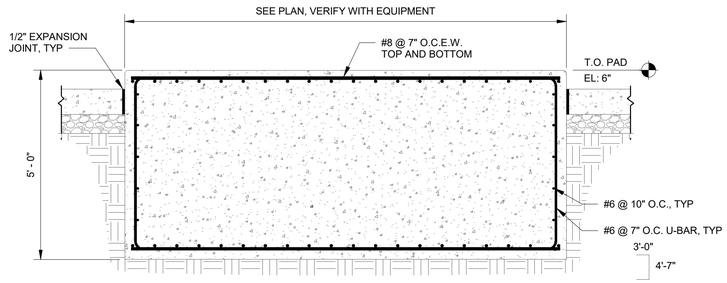


E1 DAY TANK AND DEF BULK TANK PADS
1/2" = 1'-0"

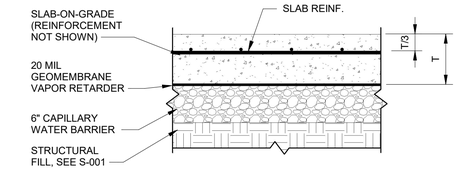
0 1' 2' 4'



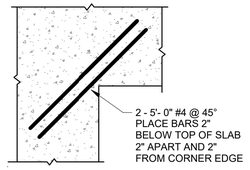
GENERATOR PAD NOTES:
1. DIMENSIONS OF GENERATOR MAT FOUNDATION TO BE VERIFIED BY THE CONTRACTOR WHEN EQUIPMENT IS SELECTED AND APPROVED. MINIMUM EDGE DISTANCE MUST BE 1'-0" FOR GENERATOR ANCHOR BOLTS AND 9" MINIMUM FOR ALL OTHER ANCHOR BOLTS UNLESS OTHERWISE NOTED.
2. GENERATOR AND ASSOCIATED EQUIPMENT ANCHORAGE TO BE PROVIDED BY CONTRACTOR AS A DELEGATED DESIGN BASED ON FINAL APPROVED EQUIPMENT DRAWINGS. REFER TO EQUIPMENT SPECIFICATION FOR ADDITIONAL INFORMATION.

A1 GENERATOR PAD
1/2" = 1'-0"

0 1' 2' 4'

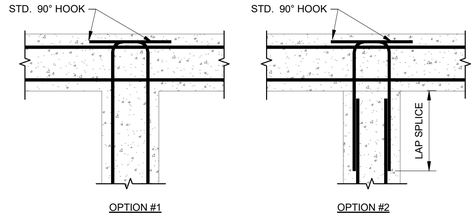


M8 SLAB-ON-GRADE BASE
NTS



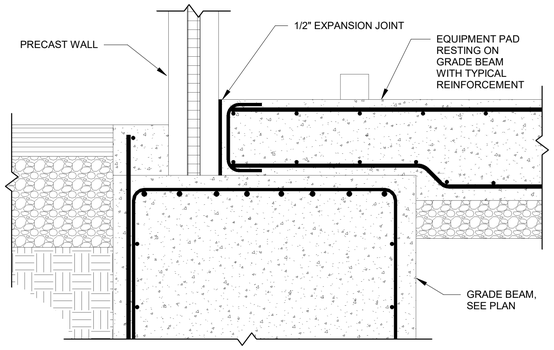
NOTE: REINFORCEMENT SHOWN IS IN ADDITION TO TYPICAL SLAB REINFORCEMENT. BEND BARS AS NEEDED TO PROVIDE FULL LENGTH.

K8 RE-ENTRANT CORNER
NTS

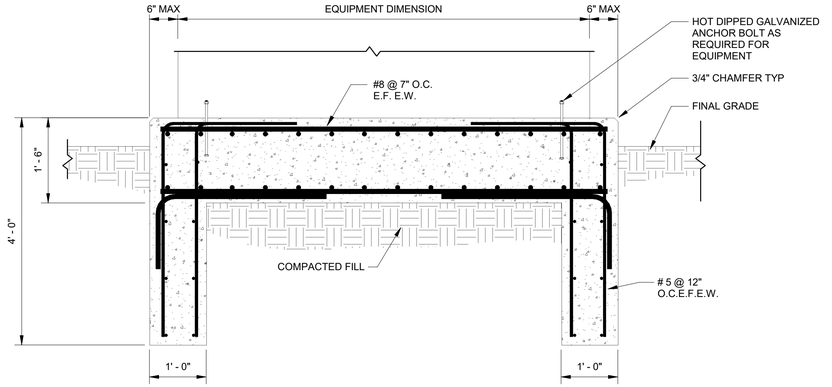


NOTES:
1. VERTICAL REINFORCEMENT NOT SHOWN.
2. UNLESS NOTED OTHERWISE THE CONTRACTOR HAS THE OPTION OF REINFORCING CORNERS AND INTERSECTIONS WITH THE ASSOCIATED OPTION #1 OR OPTION #2.
3. ALL SURFACES AT CONSTRUCTION JOINTS SHALL BE INTENETIONALLY ROUGHENED TO A DEPTH OF 1/4".

E8 TYPICAL WALL REINF. DETAILS
NTS

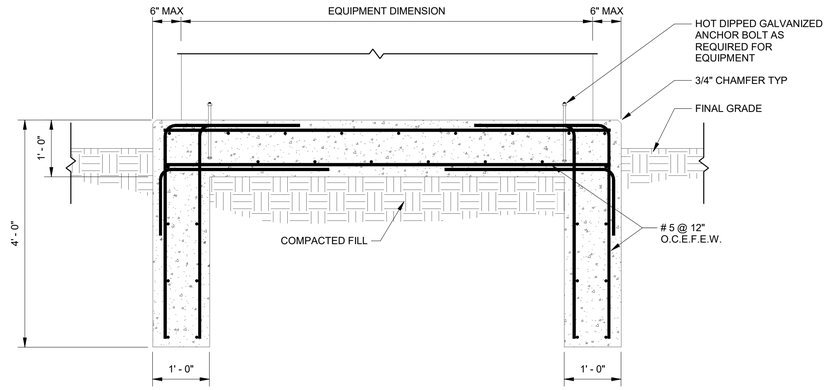


A8 TYP EQUIPMENT PAD AT GRADE BEAM
NTS



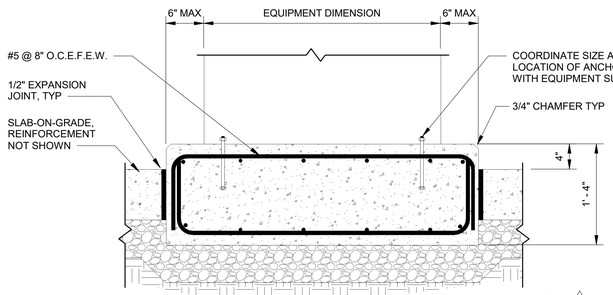
NOTES:
1. SEE MECHANICAL, ELECTRICAL, AND CIVIL SHEETS FOR LOCATION OF THE EXTERIOR LOAD BANK PAD.
2. THE PLAN DIMENSIONS OF EQUIPMENT BASES AND THEIR ANCHOR BOLT LOCATIONS, SIZES, EMBEDMENT, AND PROJECTIONS SHALL SUIT THE REQUIREMENTS OF THE APPROVED EQUIPMENT FURNISHED.
3. ALL SURFACES AT CONSTRUCTION JOINTS SHALL BE INTENETIONALLY ROUGHENED TO A DEPTH OF 1/4".

K13 EXTERIOR LOAD BANK EQUIPMENT PAD
NTS



NOTES:
1. SEE MECHANICAL, ELECTRICAL, AND CIVIL SHEETS FOR LOCATION OF EQUIPMENT PADS.
2. THE PLAN DIMENSIONS OF EQUIPMENT BASES AND THEIR ANCHOR BOLT LOCATIONS, SIZES, EMBEDMENT, AND PROJECTIONS SHALL SUIT THE REQUIREMENTS OF THE APPROVED EQUIPMENT FURNISHED.
3. ALL SURFACES AT CONSTRUCTION JOINTS SHALL BE INTENETIONALLY ROUGHENED TO A DEPTH OF 1/4".

E14 TYP EXTERIOR EQUIPMENT PAD
NTS



NOTES:
1. SEE MECHANICAL, ELECTRICAL, CIVIL, TELECOMMUNICATIONS, AND FIRE PROTECTION SHEETS FOR LOCATION OF EQUIPMENT.
2. THE PLAN DIMENSIONS OF EQUIPMENT BASES AND THEIR ANCHOR BOLT LOCATIONS, SIZES, EMBEDMENT, AND PROJECTIONS SHALL SUIT THE REQUIREMENTS OF THE APPROVED EQUIPMENT FURNISHED.
3. THIS DETAIL SHALL NOT BE USED FOR THE GENERATOR PADS.
4. NOTCH EQUIPMENT PAD AT GRADE BEAM INTERFERENCES AS NECESSARY.

A14 TYPICAL INTERIOR EQUIPMENT PAD
NTS

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1	AM #0002 - GENERAL REVISIONS	09/19/2025

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ISSUE DATE: 05/01/2025
SOLICITATION NO.: W9126P25RA043
CONTRACT NO.:

DESIGNED BY: E. HENIN
DRAWN BY: J. OSBORN
CHECKED BY: W. FOX
SUBMITTED BY: S. DENNING
SIZE: ANSI D
FILE NAME: BUCO00102_DM_S.rvt

Plot Date: 9/18/2025 6:55:35 AM

US ARMY CORPS OF ENGINEERS
OMAHA DISTRICT
1616 CAPITOL AVE.
OMAHA, NE 68102

BUCKLEY SFB, COLORADO
POWER INDEPENDENCE, MISSION CONTROL STATION

TYPICAL CONCRETE DETAILS

SHEET ID
S-500

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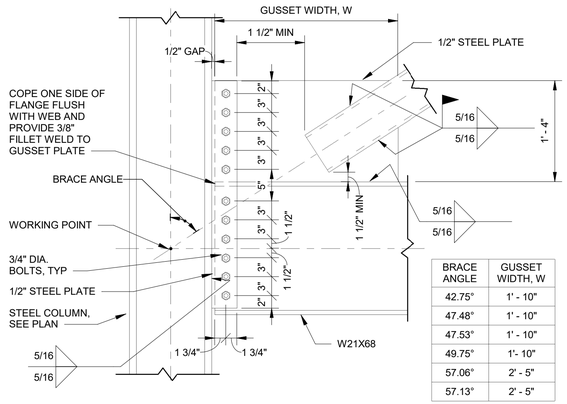
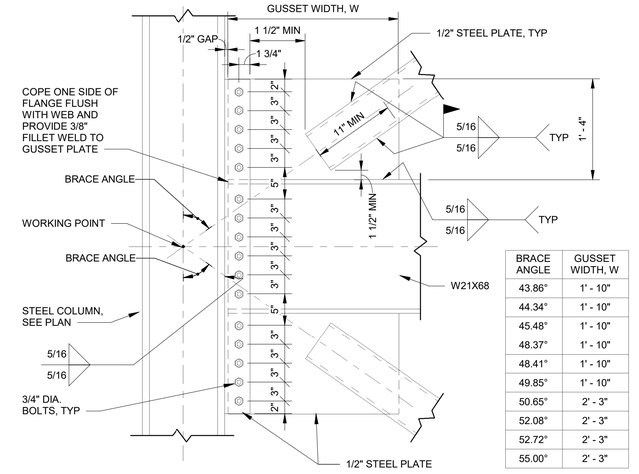


BRACE ANGLE	GUSSET WIDTH, W
42.75°	1' - 10"
47.48°	1' - 10"
47.53°	1' - 10"
49.75°	1'- 10"
57.06°	2' - 5"
57.13°	2' - 5"

G8 W21X68 TO FLANGE W/ UPWARD BRACE

1" = 1'-0"

0 0.5' 1' 2'

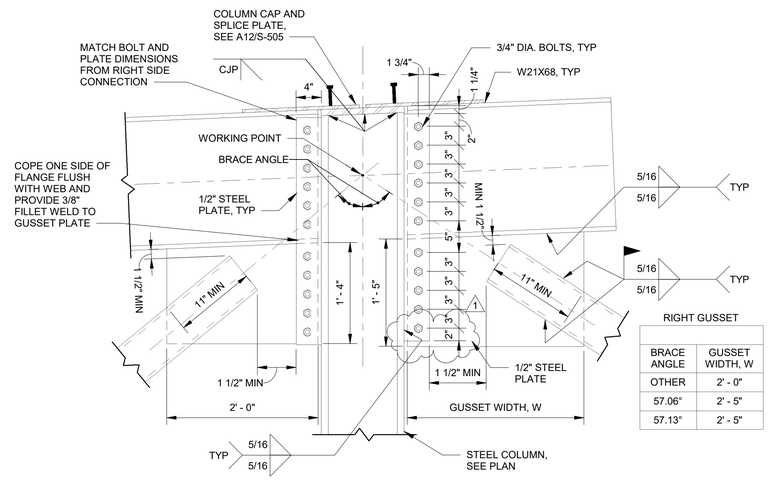


BRACE ANGLE	GUSSET WIDTH, W
43.86°	1' - 10"
44.34°	1' - 10"
45.48°	1' - 10"
48.37°	1' - 10"
48.41°	1' - 10"
49.85°	1' - 10"
50.65°	2' - 3"
52.08°	2' - 3"
52.72°	2' - 3"
55.00°	2' - 3"

G15 W21X68 TO FLANGE W/ DOUBLE BRACE

1" = 1'-0"

0 0.5' 1' 2'



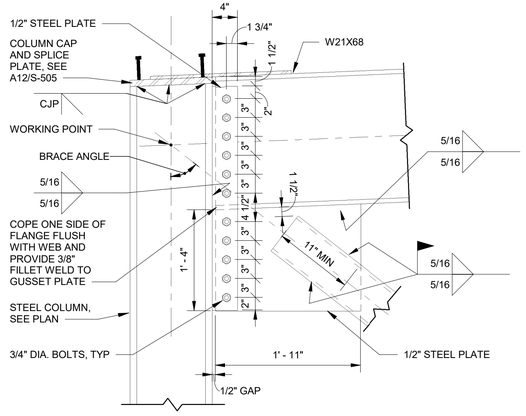
RIGHT GUSSET

BRACE ANGLE	GUSSET WIDTH, W
OTHER	2' - 0"
57.06°	2' - 5"
57.13°	2' - 5"

A1 SLOPED W21X68 TO FLANGE W/ BRACE - DETAIL 2

1" = 1'-0"

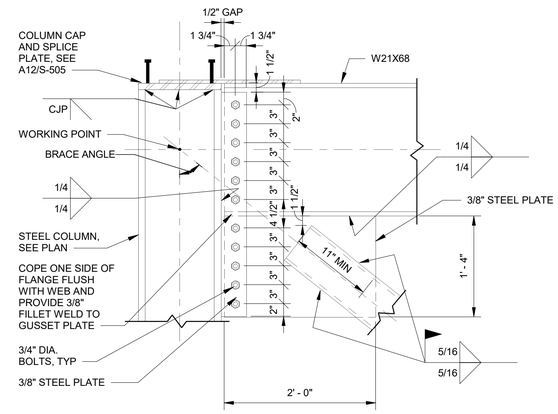
0 0.5' 1' 2'



A8 SLOPED W21X68 TO FLANGE W/ BRACE - DETAIL 1

1" = 1'-0"

0 0.5' 1' 2'



A15 W21X68 TO FLANGE W/ BRACE - LOW ROOF

1" = 1'-0"

0 0.5' 1' 2'

MARK	DESCRIPTION	DATE
1	AM #0002 - GENERAL REVISIONS	09/19/2025

File Path: C:\Users\MSCDUEDO\Desktop\BUCO00102_DM_S_04CDUED.rvt

Plot Date: 9/18/2025 8:55:42 AM

US Army Corps of Engineers ®

DESIGNED BY: E. HENIN
DRAWN BY: J. OSBORN
CHECKED BY: W. BOCK
SUBMITTED BY: S. DENNING
SIZE: ANSI D
ISSUE DATE: 05/01/2025
SOLICITATION NO.: W9128F25RA043
CONTRACT NO.:
FILE NAME: BUCO00102_DM_S.rvt

US ARMY CORPS OF ENGINEERS
OMAHA DISTRICT
1616 CAPITOL AVE
OMAHA, NE 68102

BUCKLEY SFB, COLORADO
POWER INDEPENDENCE, MISSION CONTROL STATION

STEEL DETAILS

SHEET ID

S-507

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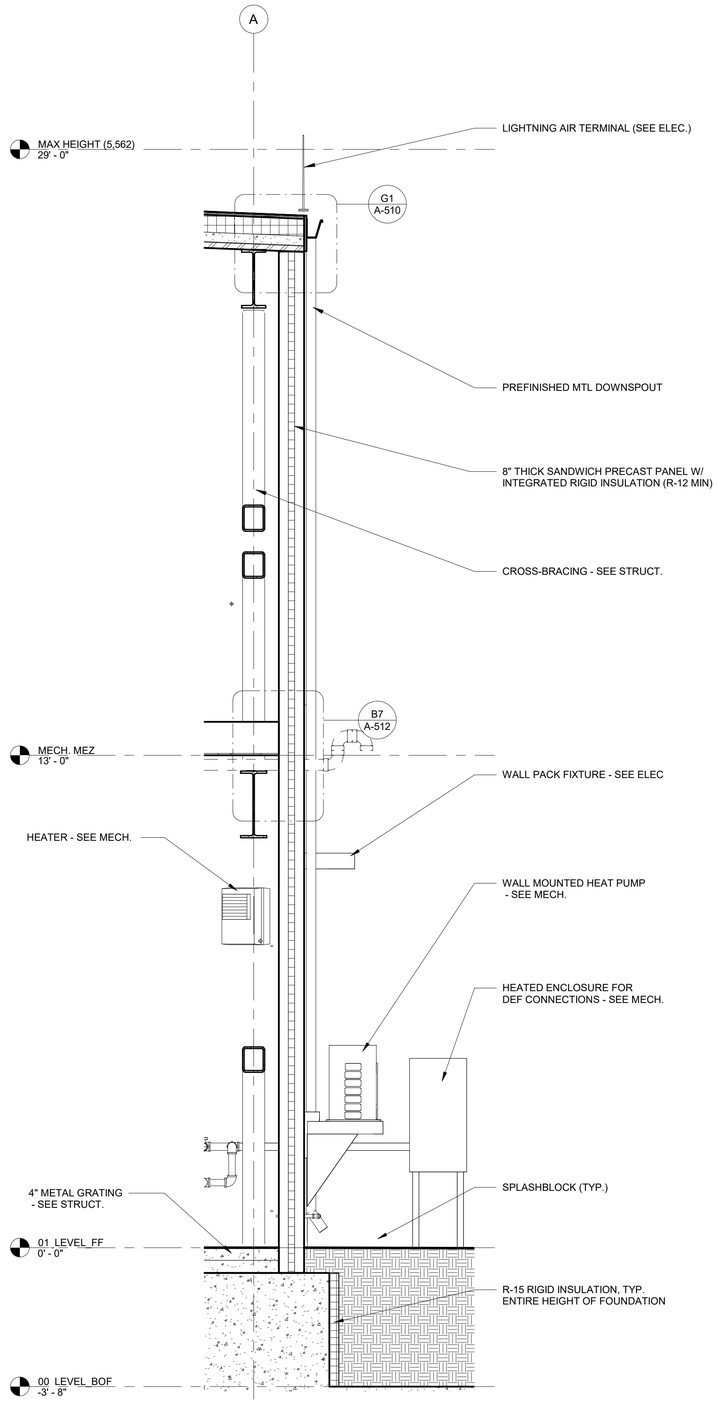
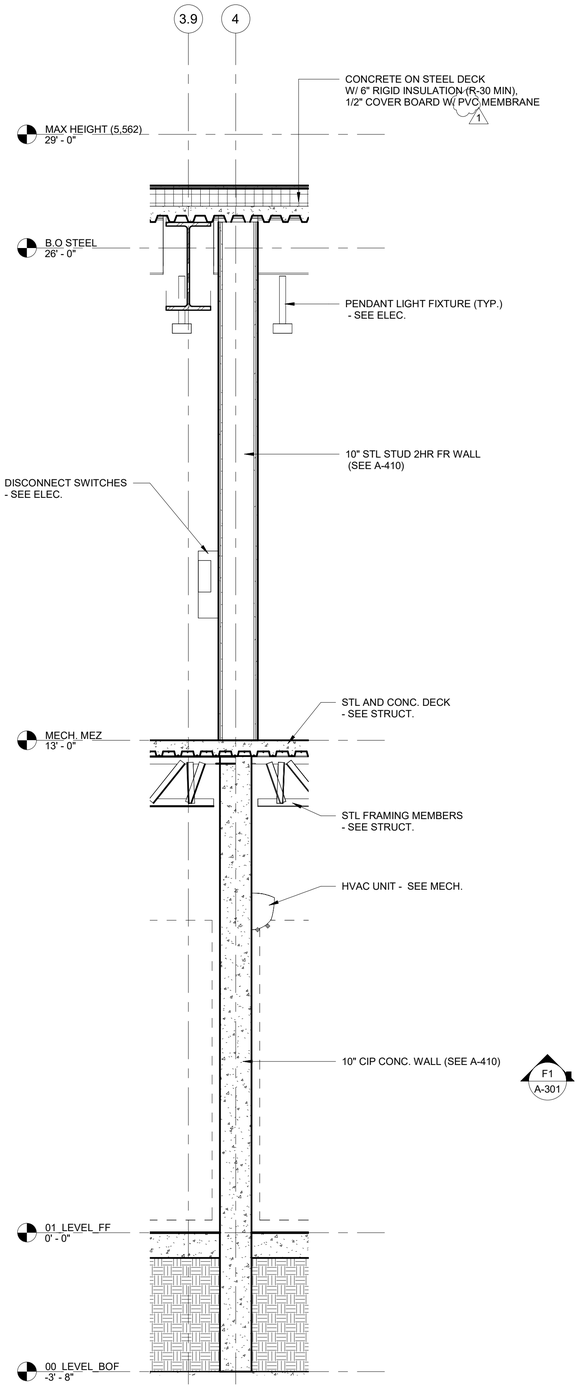


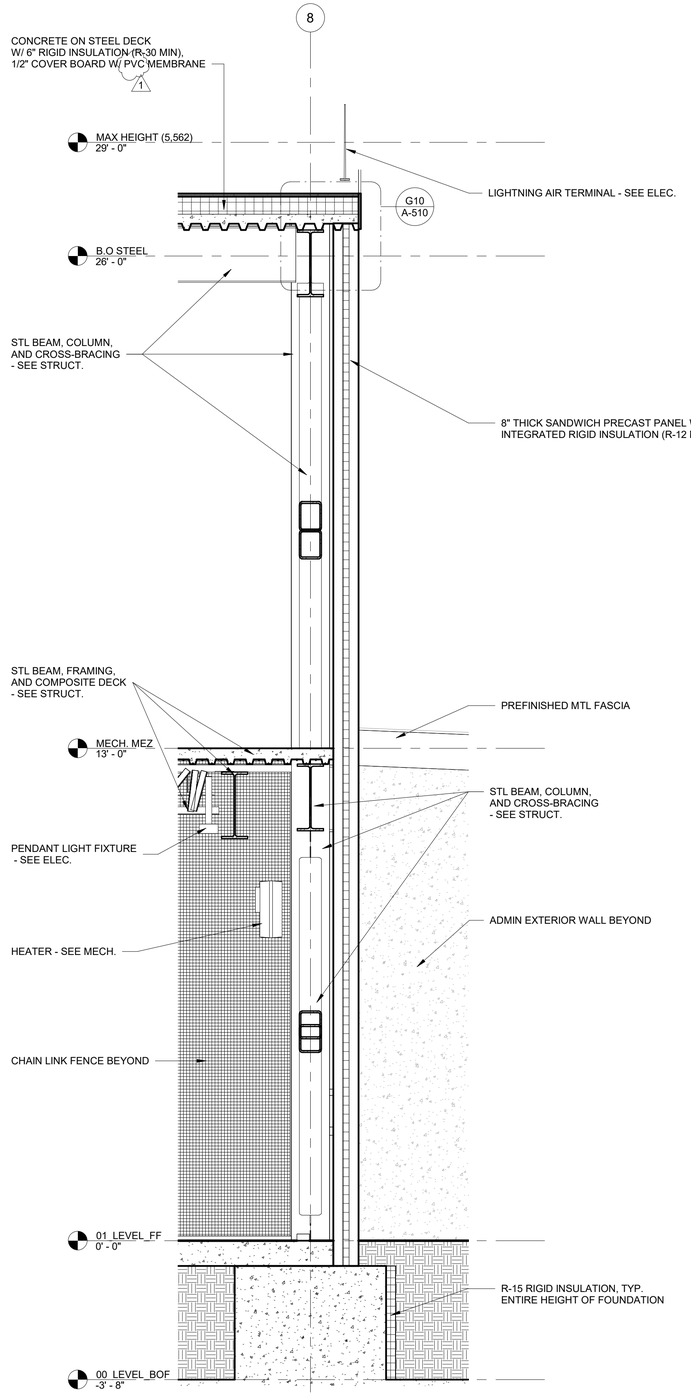
A1 WALL SECTION - PRECAST AT LOUVER

1/2" = 1'-0"



A8 WALL SECTION @ FIRE SEPARATION

1/2" = 1'-0"



A14 WALL SECTION - HIGHBAY

1/2" = 1'-0"

US Army Corps of Engineers ®

MARK	AM #0002 - GENERAL REVISIONS DESCRIPTION	DATE
1		09/19/2025

File Path: C:\Users\jjbeckjet\Documents\BUCC000102_DM_A1_jjbeckjet.rvt

ISSUE DATE: 05/01/2025
SOLICITATION NO.: W9128F25RA043
CONTRACT NO.:

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DRAWN BY: J. KAITANY
CHECKED BY: E. GOLL
SUBMITTED BY: B. GORUP
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US ARMY CORPS OF ENGINEERS
OMAHA DISTRICT
1616 CAPITOL AVE
OMAHA, NE 68102

BUCKLEY SFB, COLORADO
POWER INDEPENDENCE, MISSION CONTROL STATION
BUC000102
WALL SECTIONS

SHEET ID
A-310

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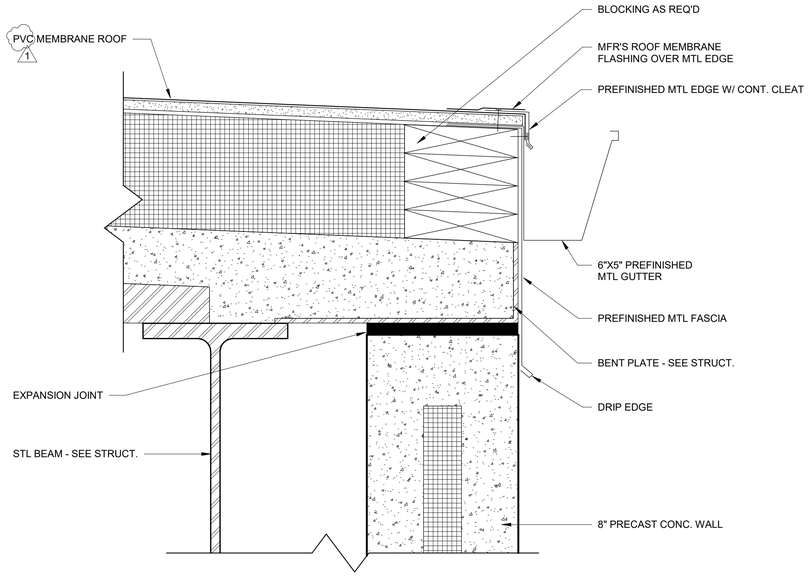
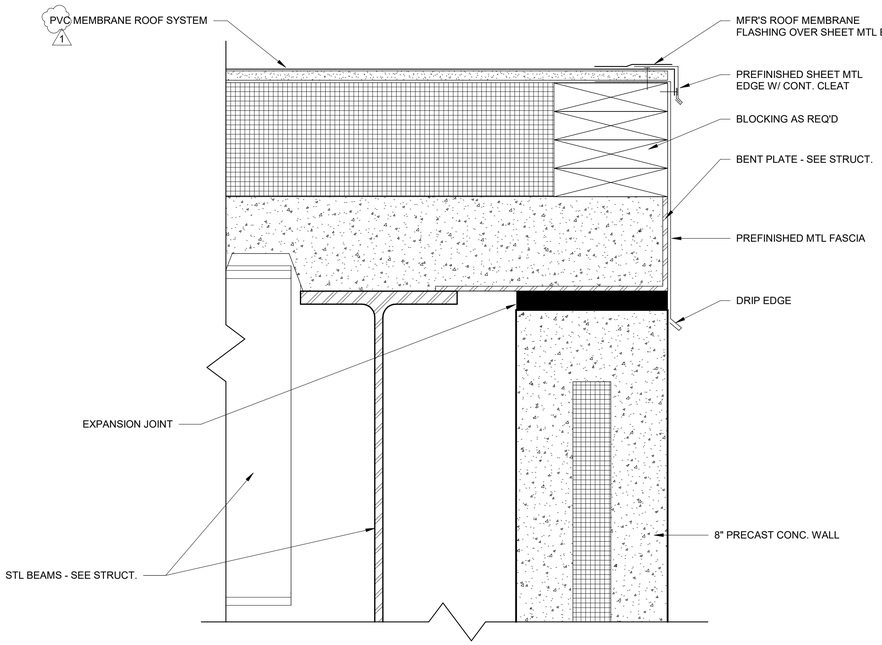


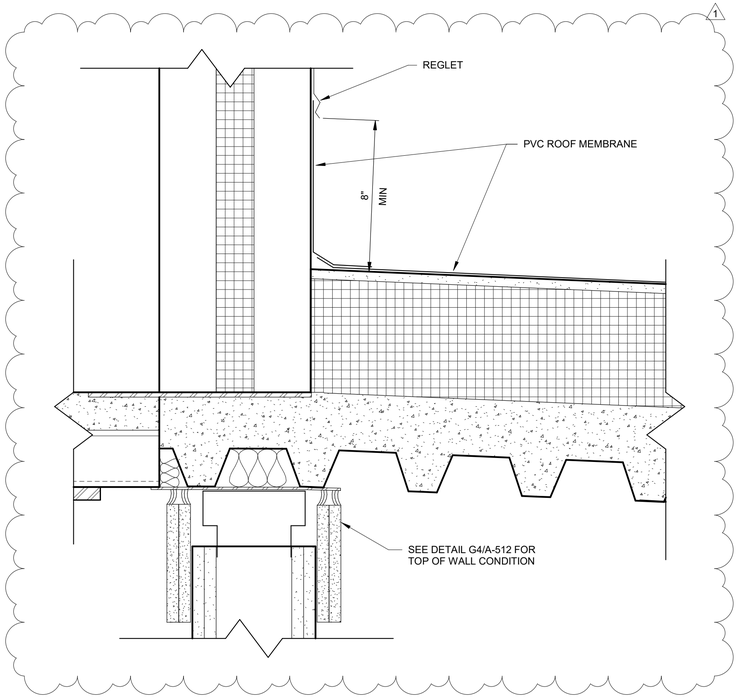
G1 ROOF EAVE DETAIL

3" = 1'-0"



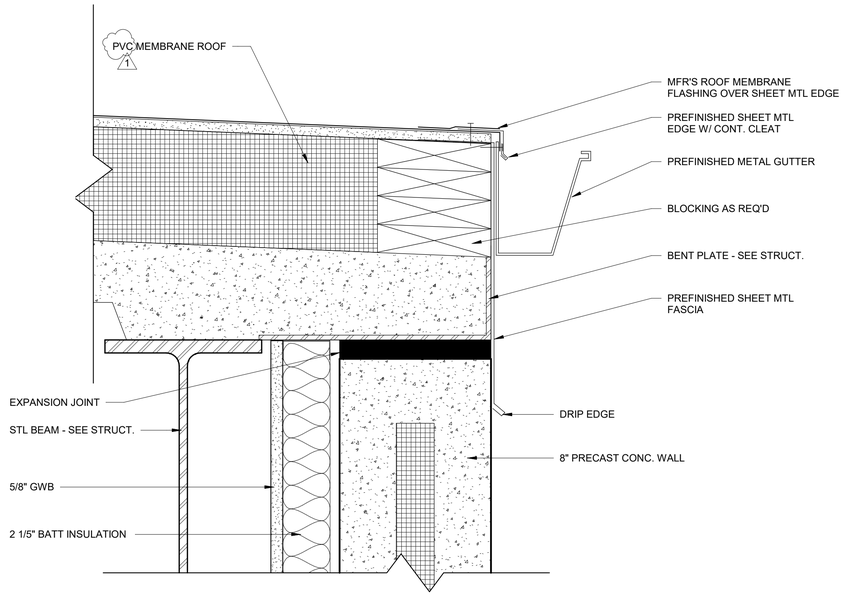
G10 ROOF RAKE EDGE DETAIL

3" = 1'-0"



A1 ADMIN ROOF CONNECTION DETAIL

3" = 1'-0"



A10 ADMIN EAVE DETAIL

3" = 1'-0"

0 0.125' 0.25' 0.5' 0.75'

US Army Corps of Engineers ®

MARK	DESCRIPTION	DATE
1	AM #0002 - GENERAL REVISIONS	09/19/2025

File Path: C:\Users\jdeakyne\Documents\BUCO00102_DM_A1_jdeakyne.rvt

Plot Date: 9/18/2025 2:11:11 PM

DESIGNED BY: K. JARVIS
DRAWN BY: J. KAITANY
CHECKED BY: B. GORUP
SUBMITTED BY: B. GORUP
SIZE: ANSI D
ISSUE DATE: 05/01/2025
SOLICITATION NO.: W9128F25RA043
CONTRACT NO.:
FILE NAME: BUCO00102_DM_A1.rvt

US ARMY CORPS OF ENGINEERS
OMAHA DISTRICT
1616 CAPITOL AVE.
OMAHA, NE 68102

BUCKLEY SFB, COLORADO
POWER INDEPENDENCE, MISSION CONTROL STATION
BUCO00102
ROOF DETAILS

SHEET ID

A-510

ADVERTISEMENT

DOOR SCHEDULE

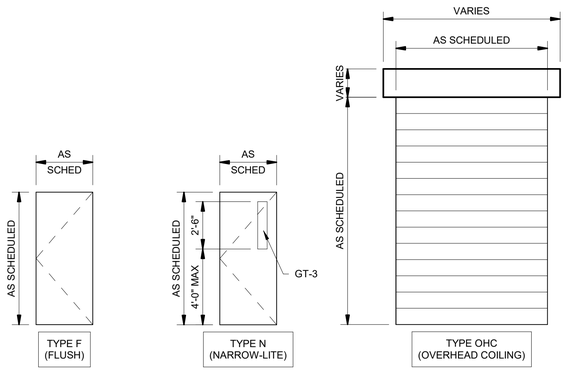
		DOOR						FRAME						
		SIZE								DETAILS				
DOOR NO.	TYPE	WIDTH	HEIGHT	THICKNESS	FINISH	MATERIAL	FIRE RATING	TYPE	MATERIAL	HEAD	JAMB	SILL	HARDWARE	COMMENTS:
100A	N	3' - 0"	7' - 0"	0' - 1 3/4"	PAINT	STL	-	A	HM				HW-1	
100B	F	3' - 0"	7' - 0"	0' - 1 3/4"	PAINT	STL	90 MIN	A	HM				HW-4	INTERIOR DOOR, INSULATED
101	F	3' - 0"	7' - 0"	0' - 1 3/4"	PAINT	STL	-	A	HM				HW-6	
101A	F	3' - 0"	7' - 0"	0' - 1 3/4"	PAINT	STL	-	A	HM				HW-1	
102	F	3' - 0"	7' - 0"	0' - 1 3/4"	PAINT	STL	-	A	HM				HW-7	
103	F	3' - 0"	7' - 0"	0' - 1 3/4"	PAINT	STL	-	A	HM				HW-5	180 DEGREE SWING
104	F	3' - 0"	7' - 0"	0' - 1 3/4"	PAINT	STL	-	A	HM				HW-5	
105A	F	3' - 0"	7' - 0"	0' - 1 3/4"	PAINT	STL	-	A	HM				HW-6	
105B	F	6' - 0"	7' - 0"	0' - 1 3/4"	PAINT	STL	-	A	HM				HW-2	
106A	OHC	10' - 0"	14' - 0"	0' - 3"	PAINT	STL	90 MIN	MFR	STL					ELECTRIC OPERATION, UNINSULATED
106B	F	3' - 0"	7' - 0"	0' - 1 3/4"	PAINT	STL	90 MIN	A	HM				HW-4	
106C	F	3' - 0"	7' - 0"	0' - 1 3/4"	PAINT	STL	-	A	HM				HW-1	
106D	OHC	10' - 0"	12' - 0"	0' - 3"	PAINT	STL		MFR	HM	E1/A-602	A1/A-602	C9/A-602 /1		ELECTRIC OPERATION, INSULATED
106E	F	3' - 0"	7' - 0"	0' - 1 3/4"	PAINT	STL	-	A	HM				HW-1	
108A	F	6' - 0"	7' - 0"	0' - 1 3/4"	PAINT	STL	90 MIN	A	HM				HW-3	
108B	F	6' - 0"	7' - 0"	0' - 1 3/4"	PAINT	STL	-	A	HM				HW-2	
110	F	3' - 0"	7' - 0"	0' - 1 3/4"	PAINT	STL	-	A	HM				HW-4	
111	F	6' - 0"	7' - 0"	0' - 1 3/4"	PAINT	STL	120 MIN	A	HM				HW-5	
112A	F	6' - 0"	7' - 0"	0' - 1 3/4"	PAINT	STL	45 MIN	A	HM				HW-3	
112B	F	3' - 0"	7' - 0"	0' - 1 3/4"	PAINT	STL	45 MIN	A	HM				HW-2	
113	F	6' - 0"	7' - 0"	0' - 1 3/4"	PAINT	STL	-	A	HM				HW-2	
114A	F	6' - 0"	7' - 0"	0' - 1 3/4"	PAINT	STL	45 MIN	A	HM				HW-3	
114B	F	3' - 0"	7' - 0"	0' - 1 3/4"	PAINT	STL	-	A	HM				HW-1	
115A	F	6' - 0"	7' - 0"	0' - 1 3/4"	PAINT	STL	45 MIN	A	HM				HW-3	
115B	F	3' - 0"	7' - 0"	0' - 1 3/4"	PAINT	STL	-	A	HM				HW-1	
116A	F	3' - 0"	7' - 0"	0' - 1 3/4"	PAINT	STL	-	A	HM				HW-4	
116B	OHC	8' - 0"	10' - 0"	0' - 3"	PAINT	STL		MFR	HM					MANUAL OPERATION, UNINSULATED
117A	OHC	10' - 0"	12' - 0"	0' - 3"	PAINT	STL		MFR	STL	E1/A-602	A1/A-602	C9/A-602 /1		ELECTRIC OPERATION, INSULATED
117B	F	3' - 0"	7' - 0"	0' - 1 3/4"	PAINT	STL	-	A	HM				HW-1	
117C	F	3' - 0"	7' - 0"	0' - 1 3/4"	PAINT	STL	-	A	HM				HW-1	
117D	F	3' - 0"	7' - 0"	0' - 1 3/4"	PAINT	STL	-	A	HM				HW-1	
118A	F	6' - 0"	7' - 0"	0' - 1 3/4"	PAINT	STL	45 MIN	A	HM				HW-3	
118B	F	3' - 0"	7' - 0"	0' - 1 3/4"	PAINT	STL	-	A	HM				HW-1	
119A	F	6' - 0"	7' - 0"	0' - 1 3/4"	PAINT	STL	45 MIN	A	HM				HW-3	
119B	F	3' - 0"	7' - 0"	0' - 1 3/4"	PAINT	STL	-	A	HM				HW-1	
120A	F /1	6' - 0"	7' - 0"	0' - 1 3/4"	PAINT	STL	-	A	HM				HW-2	
120B	F	3' - 0"	7' - 0"	0' - 1 3/4"	PAINT	STL	-	A	HM				HW-1	
120C	F	3' - 0"	7' - 0"	0' - 1 3/4"	PAINT	STL	45 MIN	A	HM				HW-4	
121	F	6' - 0"	7' - 0"	0' - 1 3/4"	PAINT	STL	45 MIN	A	HM				HW-3	
122	F	6' - 0"	7' - 0"	0' - 1 3/4"	PAINT	STL	45 MIN	A	HM				HW-3	
123	F	3' - 0"	7' - 0"	0' - 1 3/4"	PAINT	STL	-	A	HM				HW-4	
124	F	6' - 0"	7' - 0"	0' - 1 3/4"	PAINT	STL	120 MIN	A	HM				HW-3	
201	F	3' - 0"	7' - 0"	0' - 1 3/4"	PAINT	STL	90 MIN	A	HM				HW-4	

GENERAL NOTES (APPLIES TO ALL DOORS):

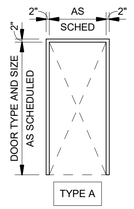
1. ALL EXTERIOR HM DOORS SHALL BE INSULATED. INSULATE EXTERIOR HM FRAMES WITH SPRAY POLYURETHANE FOAM.
2. SEE SPECIFICATION 08 71 00 "DOOR HARDWARE" FOR HARDWARE SCHEDULE.
3. AT DOUBLE DOORS WHERE INACTIVE LEAF IS IDENTIFIED, THE LEFT DOOR PANEL IN THE DIRECTION OF EGRESS OR THE RIGHT DOOR PANEL IN THE DIRECTION OF ENTRY SHALL BE TREATED AS THE ACTIVE LEAF.
4. EXTERIOR DOORS ARE COMPONENT OF THE BUILDING AIR BARRIER ASSEMBLY. EXTERIOR DOOR ASSEMBLIES SHALL CONFORM TO AIR INFILTRATION REQUIREMENTS SPECIFIED.

GLASS TYPES:

GT-3 1/2" CLEAR LAMINATED PANE



DOOR TYPES



FRAME TYPES

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MARK	DESCRIPTION	DATE
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US ARMY CORPS OF ENGINEERS
OMAHA DISTRICT
1616 CAPITOL AVE
OMAHA, NE 68102

BUCKLEY SFB, COLORADO
POWER INDEPENDENCE, MISSION CONTROL STATION
BUCO00102
DOOR SCHEDULES

SHEET ID
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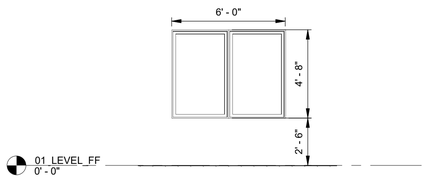
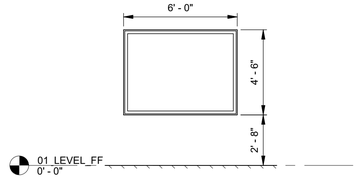
WINDOW SCHEDULE

MARK	R.O. WIDTH	R.O. HEIGHT	FRAME FINISH	FRAME MATERIAL	GLAZING TYPE	GLAZING THICKNESS	DETAILS HEAD	DETAILS JAMB	DETAILS SILL	HEAD HEIGHT	REMARKS (SEE NOTES BELOW)
W1	3' - 0"	4' - 8"	PAINT	STEEL	GT-1	1"	F15/A-605	F8/A-605	F1/A-605	7' - 2"	
W2	6' - 0"	4' - 6"	PAINT	STEEL	GT-2	1"	F15/A-605	A8/A-605	F1/A-605	7' - 2"	

1



L1 TYPE W1 ELEVATION
1/4" = 1'-0"



L6 TYPE W2 ELEVATION
1/4" = 1'-0"

GLASS TYPES:

GT-1 1" INSULATED, LOW-E, TINTED, BLAST RESISTANT (LAMINATED) GLAZING UNIT (EXTERIOR 1/4" TINTED, TEMPERED, LOW-E PANE + 1/2" ARGON-FILLED AIRSPACE + 1/4" INTERIOR CLEAR LAMINATED PANE)

GT-2 CLEAR GLASS, 90 MINUTES FIRE-RATED

GENERAL WINDOW SCHED. NOTES:

1. ALL DIMENSIONS FOR WINDOWS SHALL BE FIELD VERIFIED PRIOR TO ORDERING WINDOWS.
2. GLAZING TYPE THICKNESSES ARE NOMINAL. PROVIDE GLAZING UNIT THICKNESS APPROPRIATE FOR THE DESIGN LOADS AND CONDITIONS.
3. SEE SPECIFICATION 08 81 00 GLAZING FOR FINISH AND GLAZING TINT REQUIREMENTS.
4. EXTERIOR WINDOWS ARE COMPONENT OF THE BUILDING AIR BARRIER ASSEMBLY. EXTERIOR WINDOW ASSEMBLIES SHALL CONFORM TO AIR INFILTRATION REQUIREMENTS SPECIFIED.
5. PROVIDE FIRE RATED WINDOW ASSEMBLIES AT FIRE RATED AND SMOKE RATED WALLS.

1

WINDOW TYPES

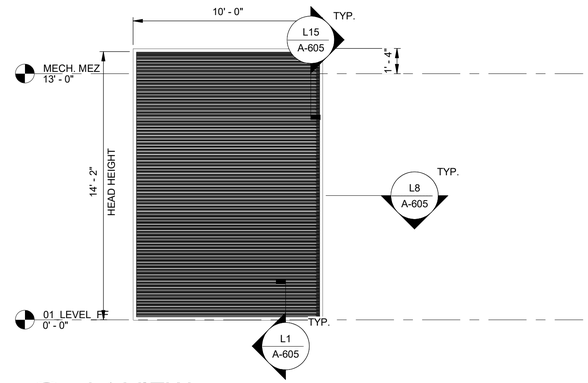
0 2' 4' 8'

LOUVER SCHEDULE

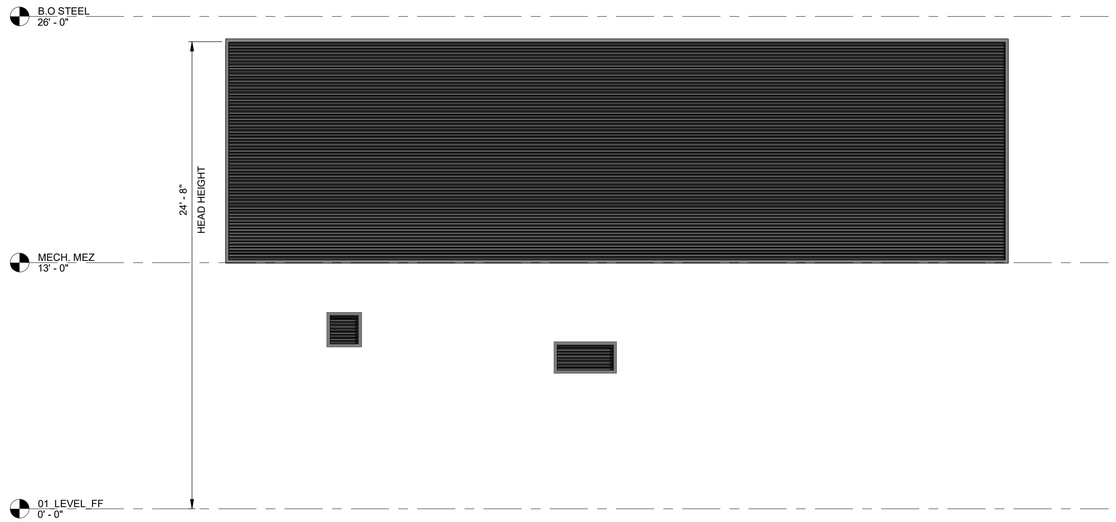
COUNT	MARK	R.O. WIDTH	R.O. HEIGHT	FRAME FINISH	FRAME MATERIAL	DETAILS HEAD	DETAILS JAMB	DETAILS SILL	REMARKS (SEE NOTES)
4	L1	9' - 8"	14' - 0"	PAINT	ALUM.	L15/A-605	L8/A-605	L1/A-605	
2	L2	41' - 0"	11' - 6"	PAINT	ALUM.	L15/A-605	L8/A-605	L1/A-605	
4	L3	1' - 0"	1' - 0"	PAINT	ALUM.	L15/A-605	L8/A-605	L1/A-605	
3	L4	1' - 6"	1' - 6"			L15/A-605	L8/A-605	L1/A-605	
2	L5	3' - 0"	1' - 4"						

GENERAL LOUVER SCHED. NOTES:

1. BLANK OUT AND INSULATE ANY AREA OF LOUVER NOT BACKED BY A DUCT/DAMPER. SEE MECHANICAL DRAWINGS AND SPECIFICATIONS.
2. PROVIDE BIRD SCREENS BEHIND ALL LOUVERS.
3. ALL LOUVERS TO BE STORM PROOF AND TO HAVE A MINIMUM FREE AREA OF 50%, REFER TO MECH SPEC FOR REQUIRED FREE AREA.

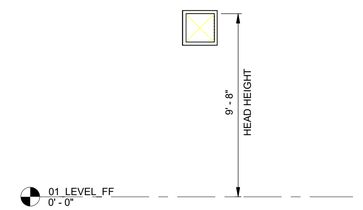


B1 L1 VIEW
1/4" = 1'-0"



B7 L2 VIEW
1/4" = 1'-0"

B17 L3 VIEW
1/4" = 1'-0"



F17 L4 VIEW
1/4" = 1'-0"

LOUVER TYPES

0 2' 4' 8'

US Army Corps of Engineers ®

MARK	DESCRIPTION	DATE
1	AM #0002 - GENERAL REVISIONS	09/19/2025

File Path: C:\Users\jjdeangelo\Documents\BUCO00102_DM_A1_jjdeangelo.rvt

Plot Date: 9/17/2025 2:27:45 PM

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US ARMY CORPS OF ENGINEERS
OMAHA DISTRICT
1616 CAPITOL AVE
OMAHA, NE 68102

BUCKLEY SFB, COLORADO
POWER INDEPENDENCE, MISSION CONTROL STATION
BUCO00102
WINDOW AND LOUVER TYPES

SHEET ID
A-604

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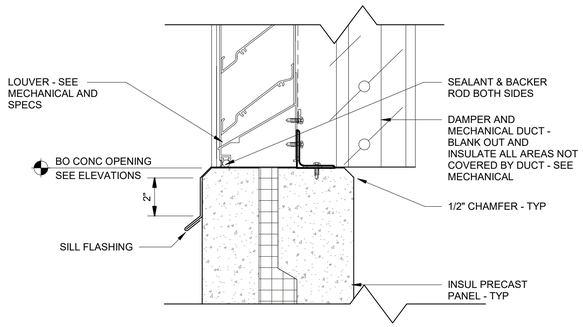
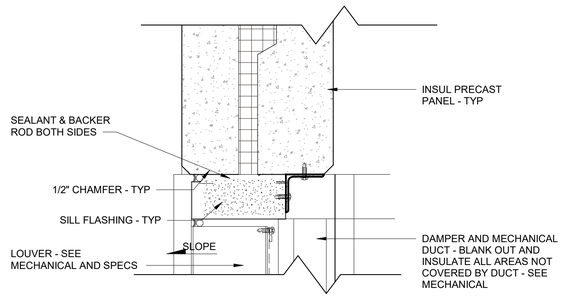


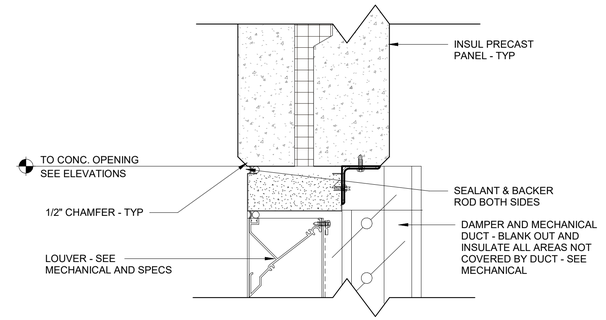
L1 LOUVER SILL @ EXTERIOR WALL

3" = 1'-0"



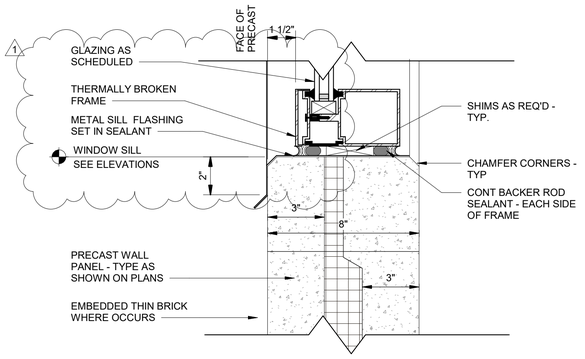
L8 LOUVER JAMB @ EXTERIOR WALL

3" = 1'-0"



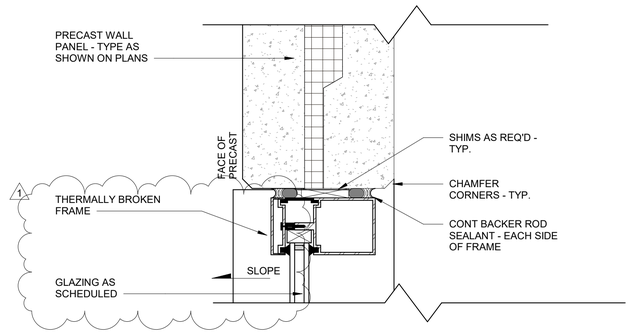
L15 LOUVER HEAD @ EXTERIOR WALL

3" = 1'-0"



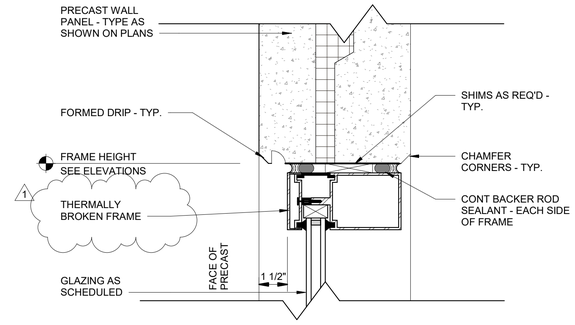
F1 WINDOW SILL DETAIL @ EXT PRECAST

3" = 1'-0"



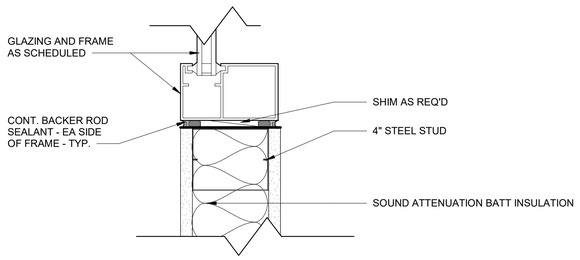
F8 WINDOW JAMB DETAIL @ EXT PRECAST

3" = 1'-0"



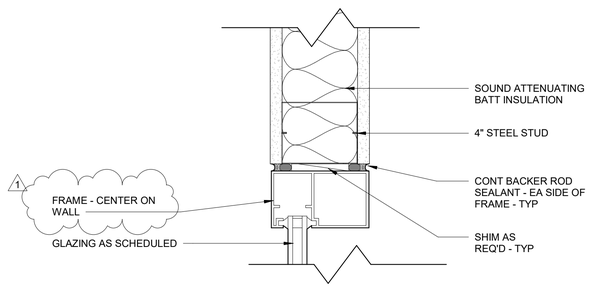
F15 WINDOW HEAD DETAIL @ EXT PRECAST

3" = 1'-0"



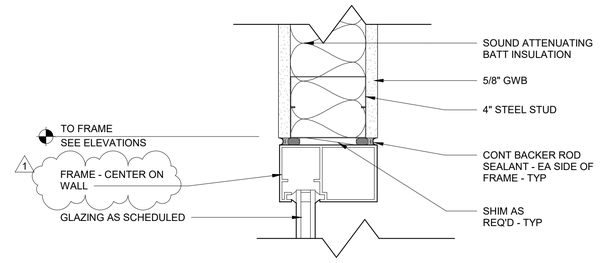
A1 WINDOW SILL DETAIL @ INT WALL

3" = 1'-0"



A8 WINDOW JAMB DETAIL @ INT WALL

3" = 1'-0"



A15 WINDOW HEAD DETAIL @ INT WALL

3" = 1'-0"

US Army Corps of Engineers ®

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SUBMITTED BY:	B. GORUP
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US ARMY CORPS OF ENGINEERS
OMAHA DISTRICT
1616 CAPITOL AVE.
OMAHA, NE 68102

BUCKLEY SFB, COLORADO
POWER INDEPENDENCE: MISSION CONTROL STATION
BUCO00102

WINDOW AND LOUVER DETAILS

SHEET ID

A-605

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NOTES:
1. SPACES MARKED WITH A TILDE (~) ARE EQUIVALENT TO A "N/A" OR NULL VALUED.
2. SPACES MARKED WITH AN ASTERISK (*) WILL BE DEFINED DURING PROGRAMMING OR FIELD INSTALLATION.
3. SEE FIRE ALARM MATRIX FOR ADDITIONAL DDC INTERFACE POINTS.

	FUNCTION	NAME	DESCRIPTION	SETTINGS (WITH UNITS)	RANGE (WITH UNITS)	IO TYPE	INSTANCE NUMBER	DEVICE ID	FRONT END		OVRD REQ'D	ALARM CONDITION	ALARM PRIORITY	
									DISP REQ'D	TREND REQ'D				
	SYSTEM CONTROL	SYS.ENA	GEN 1-2 COMPARTMENT ENABLE DISABLE	~	ENABLE/DISABLE	COMM-BI	*	*	X	~	~	~	~	MODBUS
		GEN-1-SS	GEN 1 START STOP	~	START/STOP	COMM-BI	*	*	X	X	~	~	~	MODBUS
		GEN-1-STOP	GEN 1 STOP	~	STOP	COMM-BO	*	*	X	~	X	X	CRIT	MODBUS
		RELD-1-C	GEN 1 RELIEF AIR DAMPER POSITION	~	0-100%	AO	*	*	X	~	X	~	~	
		RELD-1-STS	GEN 1 RELIEF AIR DAMPER STATUS	~	0-100%	AI	*	*	X	~	~	~	~	
		GEN-1-RADD-C	GEN 1 RADIATOR AIR DAMPER POSITION	~	0-100%	AO	*	*	X	~	X	~	~	
		GEN-1-RADD-STS	GEN 1 RADIATOR AIR DAMPER STATUS	~	0-100%	AI	*	*	X	~	~	~	CRIT	
		GEN-2-SS	GEN 2 START STOP	~	START/STOP	COMM-BI	*	*	X	X	~	~	~	MODBUS
		GEN-2-STOP	GEN 2 STOP	~	STOP	COMM-BO	*	*	X	~	X	~	CRIT	MODBUS
		RELD-2-C	GEN 2 RELIEF AIR DAMPER POSITION	~	0-100%	AO	*	*	X	~	X	~	~	
		RELD-2-STS	GEN 2 RELIEF AIR DAMPER STATUS	~	0-100%	AI	*	*	X	~	~	~	~	
		GEN-2-RADD-C	GEN 2 RADIATOR AIR DAMPER POSITION	~	0-100%	AO	*	*	X	~	X	~	~	
		GEN-2-RADD-STS	GEN 2 RADIATOR AIR DAMPER STATUS	~	0-100%	AI	*	*	X	~	~	~	CRIT	
		OA-T	OUTDOOR AIR TEMPERATURE	~	-40 - 150F	AI	*	*	X	X	~	~	~	
		SA-T	SUPPLY AIR TEMPERATURE	~	-40 - 150F	AI	*	*	X	X	~	~	~	
		SA-T-SP	SUPPLY AIR TEMPERATURE SET POINT	40F	-40 - 150F	~	*	*	X	X	X	~	~	
	FAN A CONTROL	SF-A-SS	FAN A START STOP	~	START/STOP	BO	*	*	X	~	~	~	~	
		SF-A-STS	FAN A STATUS	~	0-100%	AI	*	*	X	~	~	X	CRIT	
		SF-A-SP	FAN A SPEED	~	0-100%	AO	*	*	X	X	X	~	~	
	OA DAMPER A CONTROL	OAD-A-C	OA DAMPER A POSITION	~	0-100%	AO	*	*	X	X	X	~	~	
		OAD-A-STS	OA DAMPER A STATUS	~	0-100%	AI	*	*	X	~	~	X	CRIT	
	RTN DAMPER A CONTROL	RAD-A-C	RETURN DAMPER A POSITION	~	0-100%	AO	*	*	X	X	X	~	~	
		RAD-A-STS	RETURN DAMPER A STATUS	~	0-100%	AI	*	*	X	~	~	X	CRIT	
	FAN B CONTROL	SF-B-SS	FAN B START STOP	~	START/STOP	BO	*	*	X	~	~	~	~	
		SF-B-STS	FAN B STATUS	~	0-100%	AI	*	*	X	~	~	X	CRIT	
		SF-B-SP	FAN B SPEED	~	0-100%	AO	*	*	X	X	X	~	~	
	OA DAMPER B CONTROL	OAD-B-C	OA DAMPER B POSITION	~	0-100%	AO	*	*	X	X	X	~	~	
		OAD-B-STS	OA DAMPER B STATUS	~	0-100%	AI	*	*	X	~	~	X		
	RTN DAMPER B CONTROL	RAD-B-C	RETURN DAMPER B POSITION	~	0-100%	AO	*	*	X	X	X	~	~	
		RAD-B-STS	RETURN DAMPER B STATUS	~	0-100%	AI	*	*	X	~	~	X	CRIT	
	FAN C CONTROL	SF-C-SS	FAN C START STOP	~	START/STOP	BO	*	*	X	~	~	~	~	
		SF-C-STS	FAN C STATUS	~	0-100%	AI	*	*	X	~	~	X	CRIT	
		SF-C-SP	FAN C SPEED	~	0-100%	AO	*	*	X	X	X	~	~	
	OA DAMPER C CONTROL	SF-A-SS	OA DAMPER C POSITION	~	0-100%	AO	*	*	X	X	X	~	~	
		SF-A-SS	OA DAMPER C STATUS	~	0-100%	AI	*	*	X	~	~	X		
	RTN DAMPER C CONTROL	RAD-C-C	RETURN DAMPER C POSITION	~	0-100%	AO	*	*	X	X	X	~	~	
		RAD-C-STS	RETURN DAMPER C STATUS	~	0-100%	AI	*	*	X	~	~	X	CRIT	
	FAN D CONTROL	SF-D-SS	FAN D START STOP	~	START/STOP	BO	*	*	X	~	~	~	~	
		SF-D-STS	FAN D STATUS	~	0-100%	AI	*	*	X	~	~	X	CRIT	
		SF-D-SP	FAN D SPEED	~	0-100%	AO	*	*	X	X	X	~	~	
	OA DAMPER D CONTROL	OAD-D-C	OA DAMPER D POSITION	~	0-100%	AO	*	*	X	X	X	~	~	
		OAD-D-STS	OA DAMPER D STATUS	~	0-100%	AI	*	*	X	~	~	X	CRIT	
	RTN DAMPER D CONTROL	OAD-D-C	RETURN DAMPER D POSITION	~	0-100%	AO	*	*	X	X	X	~	~	
		OAD-D-STS	RETURN DAMPER D STATUS	~	0-100%	AI	*	*	X	~	~	X	CRIT	
	SPLIT SYSTEM HEAT PUMP	T-01	SPACE TEMPERATURE	~	0 - 120F	AI	*	*	X	X	~	~	~	
		STATUS	UNIT STATUS	~	0-100%	BI	*	*	X	~	~	X	~	
		ALARM	UNIT ALARM	~	0-100%	BI	*	*	X	~	~	~	~	
	PREACTION LOW PRESSURE	F-LP	PREACTION FIRE SUPPRESSION	~	0-100%	BI	*	*	X	~	~	X	CRIT	
1	ELEC. SURGE PROTECTION	MISC.	SURGE PROTECTIVE DEVICE MALFUNCTION	~	0-100%	DI	*	*	X	X	~	X	~	
		MISC.	REPLACE SURGE PROTECTIVE DEVICE	~	0-100%	DI	*	*	X	X	~	X	~	

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MARK	DESCRIPTION	DATE
1	AM #0002 - GENERAL REVISIONS	09/19/2025

File Path: C:\Users\GSEDIXSL\3Documents\Local Revit Models\BUCO00102_DM_ME_GSEDIXSL9.rvt

ISSUE DATE: 05/01/2025
SOLICITATION NO.: W9128F25RA043
CONTRACT NO.:

DESIGNED BY: C. FOSMER
DRAWN BY: C. FOSMER
CHECKED BY: C. FOSMER
SUBMITTED BY: C. FOSMER
SIZE: ANSI D
FILE NAME: BUCO00102_DM_ME.rvt
9/18/2025 12:31:04 PM
Plot Date: 9/18/2025 12:31:04 PM

US ARMY CORPS OF ENGINEERS
OMAHA DISTRICT
1616 CAPITOL AVE
OMAHA, NE 68102

BUCKLEY SFB, COLORADO
POWER INDEPENDENCE, MISSION CONTROL STATION

HVAC CONTROLS

SHEET ID
MH702

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DIESEL EXHAUST FLUID (DEF) GENERAL NOTES

ALL TANKS MUST BE EQUIPPED WITH DROP TUBES EXTENDING TO WITHIN 6 INCHES OF THE TANK BOTTOM TO ENSURE PROPER FILLING, REDUCE SPLASHING, AND MAINTAIN DEF PURITY.

ALL ATGs SHALL REPORT DATA TO READINESS ROOM 100A AND BUILDING B451. ENSURE PROPER CONNECTIVITY AND CONFIGURATION TO FACILITATE ACCURATE AND TIMELY DATA TRANSMISSION TO THESE LOCATIONS.

ALL PUMPS WILL BE AUTOMATICALLY CONTROLLED THROUGH LEVEL SENSORS TO ENSURE EFFICIENT OPERATION. MANUAL CONTROL OVERRIDE CAN BE PERFORMED FROM READINESS ROOM 100A. ADDITIONALLY, PUMP DATA WILL BE REPORTED TO BOTH READINESS ROOM 100A AND BUILDING B451 FOR MONITORING AND RECORD-KEEPING PURPOSES.

DIESEL EXHAUST FLUID (DEF) KEYNOTES

30 3" UREA TANK VENT. TERMINATE WITH GOOSENECK FITTING MINIMUM 18" ABOVE ROOF WITH BIRDSCREEN.

31 DEF FILL CONNECTION WITH CAMLOCK.

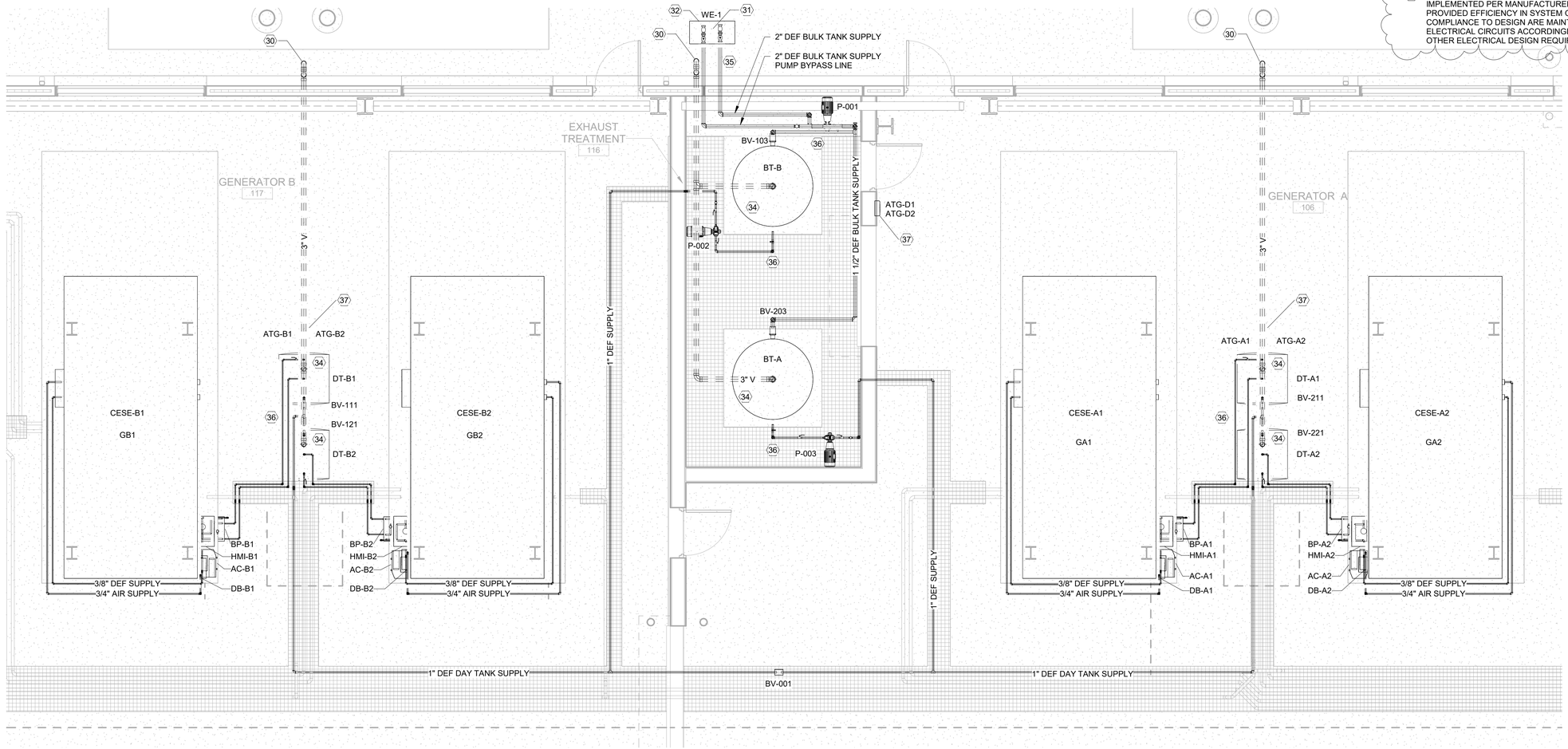
32 CUSTOM MULTI-TANK REMOTE FILL WEATHERPROOF HEATED NEMA FILL POINT ENCLOSURE TO BE INSTALLED AROUND DEF FILL CONNECTION AND SHALL BE MADE ACCESSIBLE TO DEF FILL.

34 PROVIDE AND LEVEL SENSOR, QUALITY SENSOR, AND TEMPERATURE SENSOR. ENSURE ALL SENSORS ARE CONNECTED TO AND COMMUNICATE WITH THE AUTOMATIC TANK GAUGE DEVICE FOR MONITORING AND CONTROL.

35 PROVIDE DOUBLE-WALLED PIPE SYSTEM USED FOR DEF TRANSFER BETWEEN REMOTE FILL BOX AND BUILDING ENTRY POINT.

1 36 INSTALL SMALL BORE PIPE SUPPORTS PER DEF MANUFACTURER'S SPECIFICATIONS

37 ADJACENT ATG PANEL CONSOLIDATION MAY BE IMPLEMENTED PER MANUFACTURER'S REQUIREMENTS PROVIDED EFFICIENCY IN SYSTEM OPERATION AND COMPLIANCE TO DESIGN ARE MAINTAINED. COMBINE ELECTRICAL CIRCUITS ACCORDINGLY AND FOLLOW ALL OTHER ELECTRICAL DESIGN REQUIREMENTS.



C1 DEF PLAN - ENLARGED TRANSFER SYSTEM

1/4" = 1'-0"

US Army Corps of Engineers ®

MARK	DESCRIPTION	DATE
1	AM#0002 - GENERAL REVISIONS	09/19/2025

File Path: C:\Users\jbedard\OneDrive - US Army Corps of Engineers\Documents\BUCC000102_DM_PF_aaiken.b.nichols.rvt

Plot Date: 9/18/2025 1:51:30 PM

DESIGNED BY: A. NICHOLS
DRAWN BY: A. NICHOLS
CHECKED BY: D. COFFELT
SUBMITTED BY: C. FOSMER
SIZE: ANSI D
ISSUE DATE: 05/01/2025
SOLICITATION NO.: W9128F25RA043
CONTRACT NO.:
FILE NAME: BUCC000102_DM_PF.rvt

US ARMY CORPS OF ENGINEERS
OMAHA DISTRICT
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OMAHA, NE 68102

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POWER INDEPENDENCE, MISSION CONTROL STATION

DEF ENLARGED PLAN

SHEET ID

MP401

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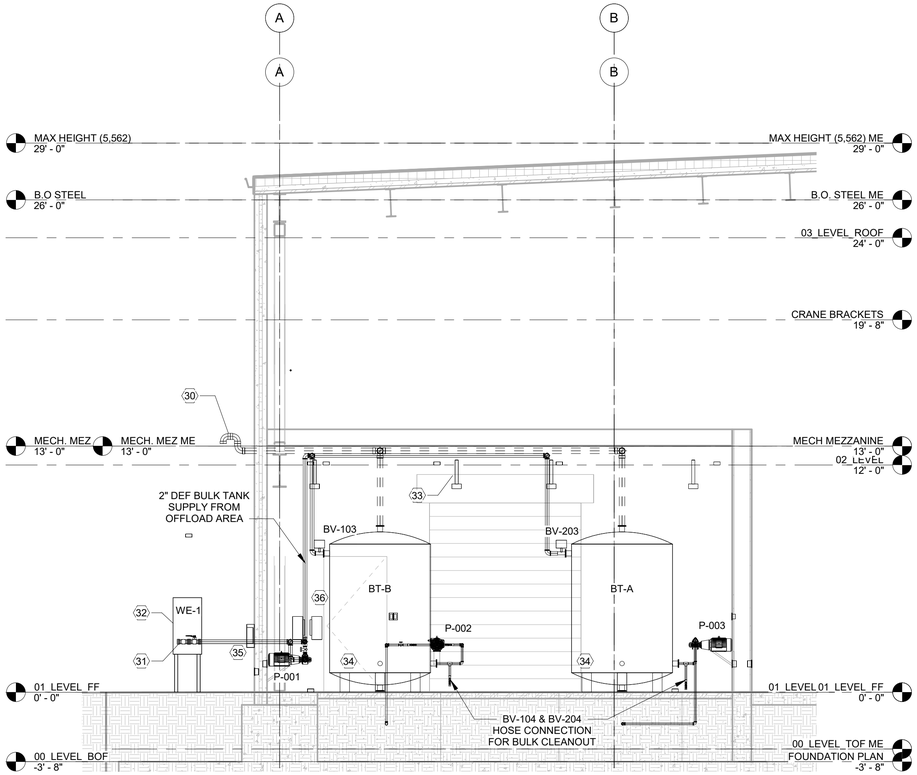
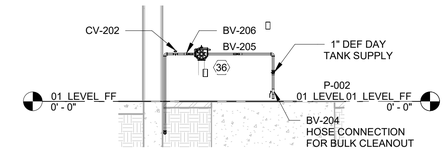


D1 DEF BULK TANK SECTION VIEW

1/4" = 1'-0"



J11 DEF PUMP SECTION VIEW

1/4" = 1'-0"

D11 DEF DAY TANK SECTION VIEW

1/4" = 1'-0"

DIESEL EXHAUST FLUID (DEF) GENERAL NOTES

ALL TANKS MUST BE EQUIPPED WITH DROP TUBES EXTENDING TO WITHIN 6 INCHES OF THE TANK BOTTOM TO ENSURE PROPER FILLING, REDUCE SPLASHING, AND MAINTAIN DEF PURITY.

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ALL PUMPS WILL BE AUTOMATICALLY CONTROLLED THROUGH LEVEL SENSORS TO ENSURE EFFICIENT OPERATION. MANUAL CONTROL OVERRIDE CAN BE PERFORMED FROM READINESS ROOM 100A. ADDITIONALLY, PUMP DATA WILL BE REPORTED TO BOTH READINESS ROOM 100A AND BUILDING B451 FOR MONITORING AND RECORD-KEEPING PURPOSES.

DIESEL EXHAUST FLUID (DEF) KEYNOTES

30 3" UREA TANK VTR. TERMINATE WITH GOOSENECK FITTING MINIMUM 18" ABOVE ROOF WITH BIRDSCREEN.

31 DEF FILL CONNECTION WITH CAMLOCK.

32 CUSTOM MULTI-TANK REMOTE FILL WEATHERPROOF HEATED NEMA FILL POINT ENCLOSURE TO BE INSTALLED AROUND DEF FILL CONNECTION AND SHALL BE MADE ACCESSIBLE TO DEF FILL.

33 DEF 2" FILL (SLOPE @ 1/8" PER FOOT DOWN TO TANKS).

34 PROVIDE AND LEVEL SENSOR, QUALITY SENSOR, AND TEMPERATURE SENSOR. ENSURE ALL SENSORS ARE CONNECTED TO AND COMMUNICATE WITH THE AUTOMATIC TANK GAUGE DEVICE FOR MONITORING AND CONTROL.

35 PROVIDE DOUBLE-WALLED PIPE SYSTEM USED FOR DEF TRANSFER BETWEEN REMOTE FILL BOX AND BUILDING ENTRY POINT.

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1	AM#0002 - GENERAL REVISIONS.	09/19/2025

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ISSUE DATE: 05/01/2025
SOLICITATION NO.: W9128F25RA043
CONTRACT NO.:

DESIGNED BY: A. NICHOLS
DRAWN BY: A. NICHOLS
CHECKED BY: D. SCHEFFLE
SUBMITTED BY: C. FOSMER
SIZE: ANSI D
FILE NAME: BUCC000102_DM_PF.rvt

Plot Date: 9/18/2025 1:51:50 PM

US ARMY CORPS OF ENGINEERS
OMAHA DISTRICT
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OMAHA, NE 68102

BUCKLEY SFB, COLORADO
POWER INDEPENDENCE, MISSION CONTROL STATION

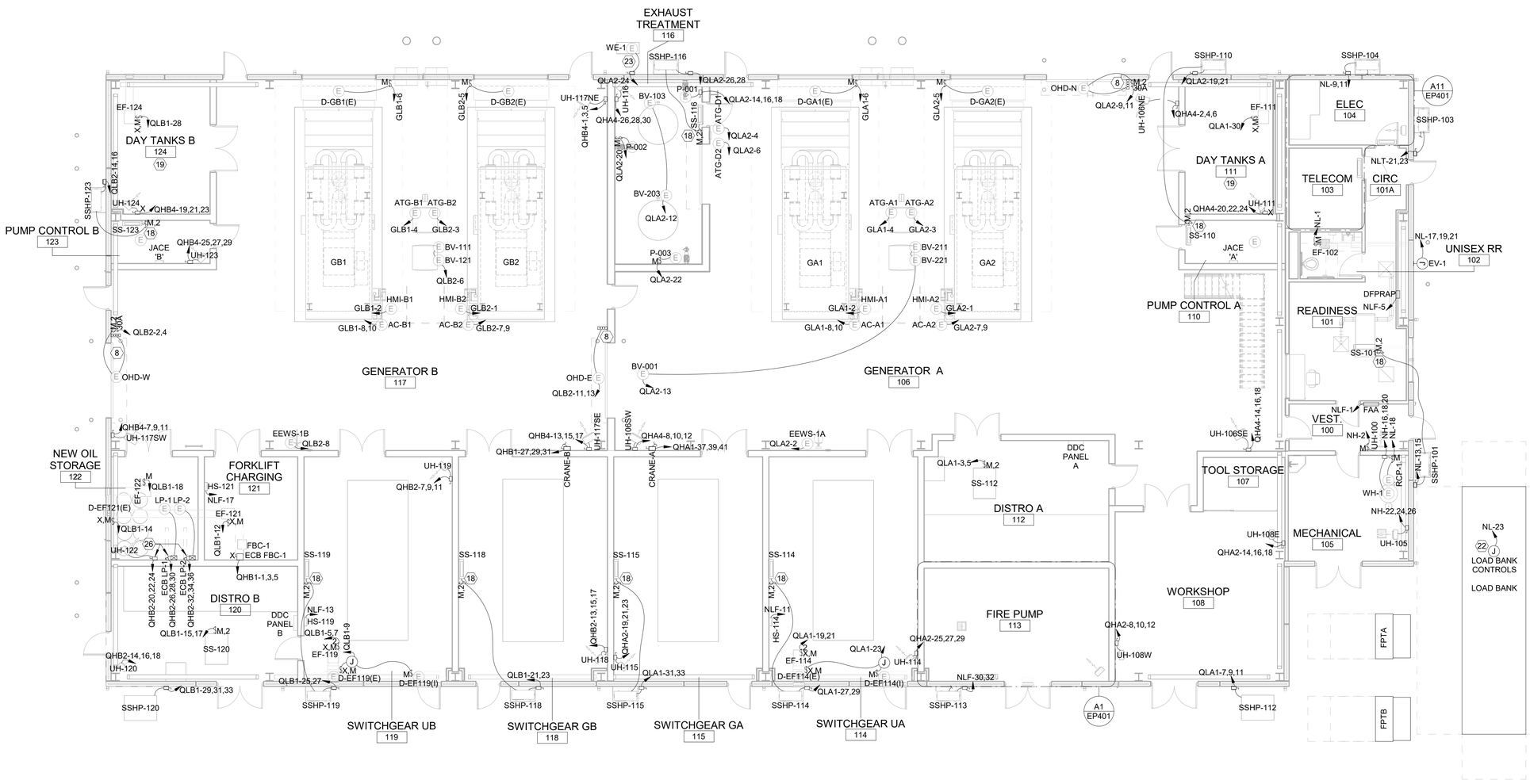
DEF SECTION VIEWS

SHEET ID

MP402

ADVERTISEMENT

1 SWITCHES CHANGED FROM GENERAL USE TO MOTOR-RATED ON THIS SHEET:
D-EF114(E) D-EF114(I) D-EF119(E) D-EF119(I) D-EF121(E)
D-GA1(E) D-GA2(E) D-GB1(E) D-GB2(E)
EF-102 EF-111 EF-121 EF-122 EF-124
OHD-N OHD-W
SS-101 SS-110 SS-114 SS-115
SS-116 SS-118 SS-119 SS-123



A1 EQUIPMENT POWER PLAN
1/8" = 1'-0"

KEY PLAN
B451
PLAN NORTH
0 4' 8' 16'

FOR SUPPLEMENTAL LEGEND, GENERAL NOTES, AND KEYNOTES, SEE SHEET EP001.

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MARK	DESCRIPTION	DATE
1	AM #0002 - GENERAL REVISIONS	09/19/2025

File Path: C:\Users\GEEXIS\3Documents\Local Revit Models\BUCO00102_DM_ME_GEEXIS13.rvt

ISSUE DATE: 05/01/2025
SOLICITATION NO.: W9128F25RA043
CONTRACT NO.:
DESIGNED BY: E.MCNAMARA
DRAWN BY: E.MCNAMARA
CHECKED BY: C.HOLMES
SUBMITTED BY: S.LINDGREN
SIZE: ANSI D
FILE NAME: BUCO00102_DM_ME.rvt
Plot Date: 9/17/2025 1:56:44 PM

US ARMY CORPS OF ENGINEERS
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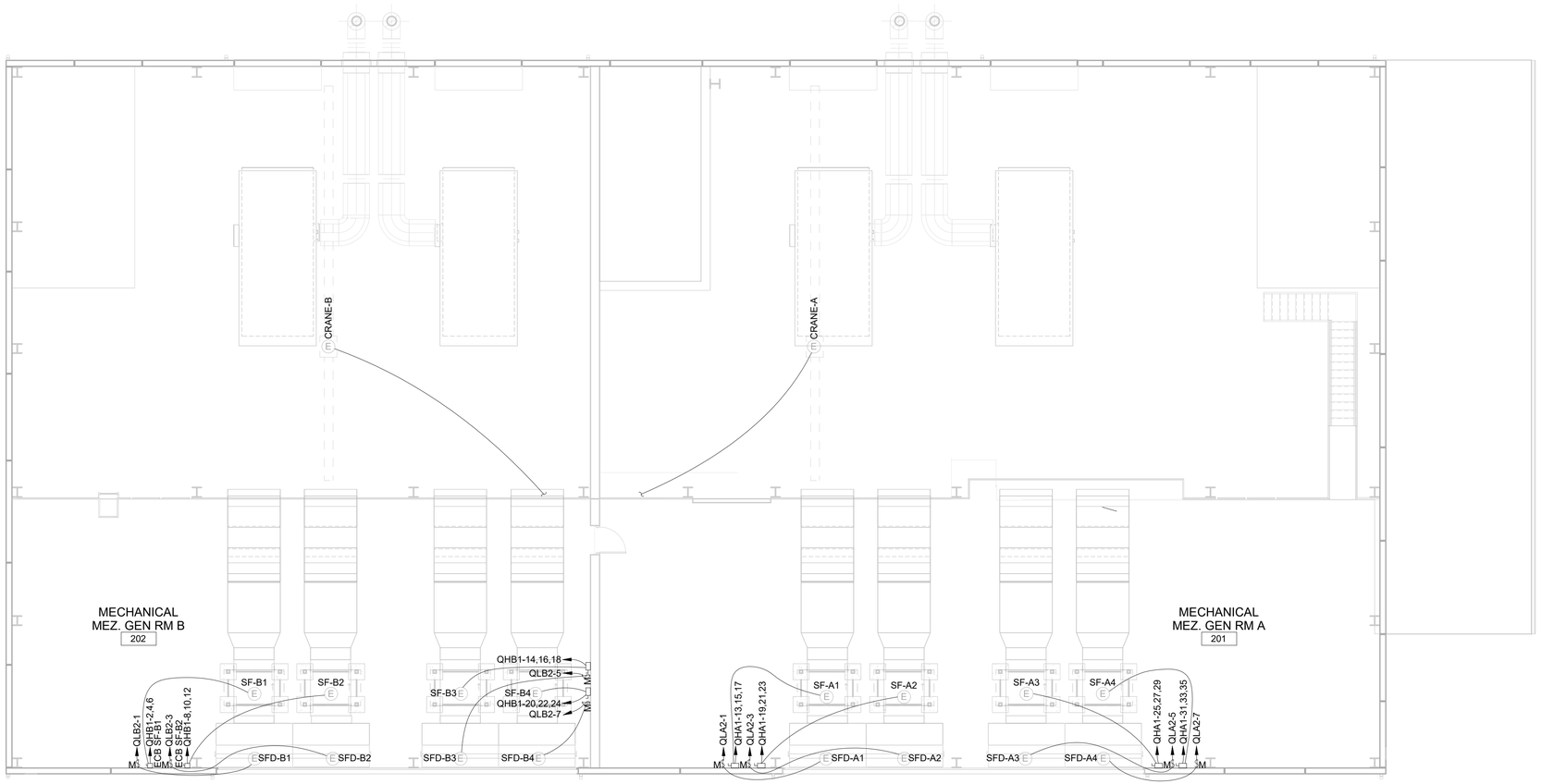
EQUIPMENT POWER PLAN

SHEET ID
EP103

ADVERTISEMENT

1 SWITCHES CHANGED FROM GENERAL USE TO MOTOR-RATED ON THIS SHEET:
SFD-A1 SFD-A2 SFD-A3 SFD-A4
SFD-B1 SFD-B2 SFD-B3 SFD-B4



EQUIPMENT POWER PLAN MEZZANINE

A1 1/8" = 1'-0"

KEY PLAN

FOR SUPPLEMENTAL LEGEND, GENERAL NOTES, AND KEYNOTES, SEE SHEET EP001.

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MARK	DESCRIPTION	DATE
1	AM #0002 - GENERAL REVISIONS	09/19/2025

File Path: C:\Users\GBEIXS\3D\Documents\Local Revit Models\BUCC001102_DM_ME_GBEIXS3.rvt

ISSUE DATE: 05/01/2025
SOLICITATION NO.: W9128F25RA043
CONTRACT NO.:

DESIGNED BY: E.MCNAMARA
DRAWN BY: E.MCNAMARA
CHECKED BY: A.ADAMS
SUBMITTED BY: S.LINDGREN
SIZE: ANSI D
FILE NAME: BUCC00102_DM_ME.rvt

Plot Date: 9/17/2025 1:56:53 PM

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1616 CAPITOL AVE
OMAHA, NE 68102

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EQUIPMENT POWER PLAN MEZZANINE

SHEET ID

EP104

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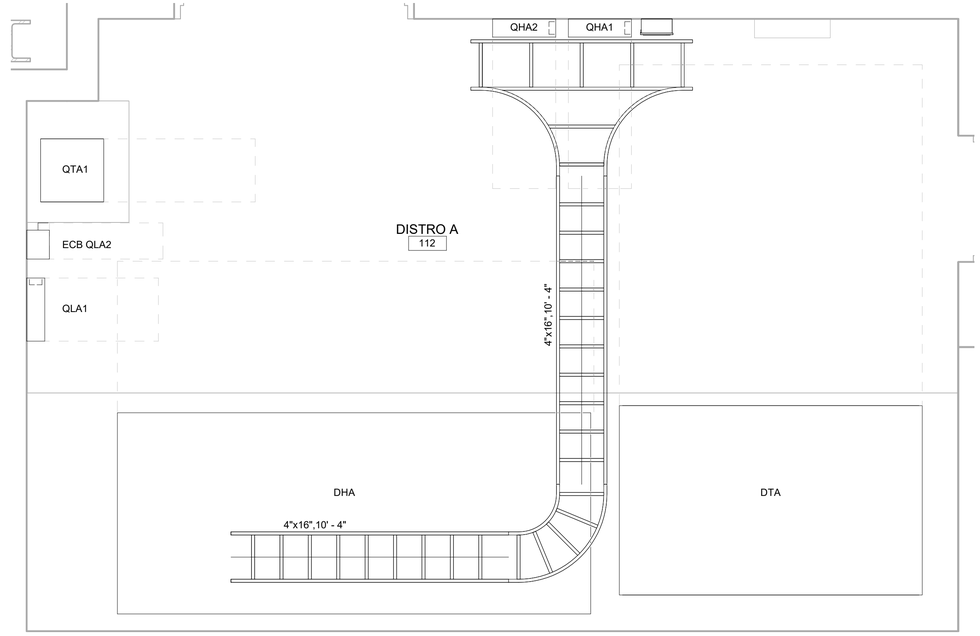
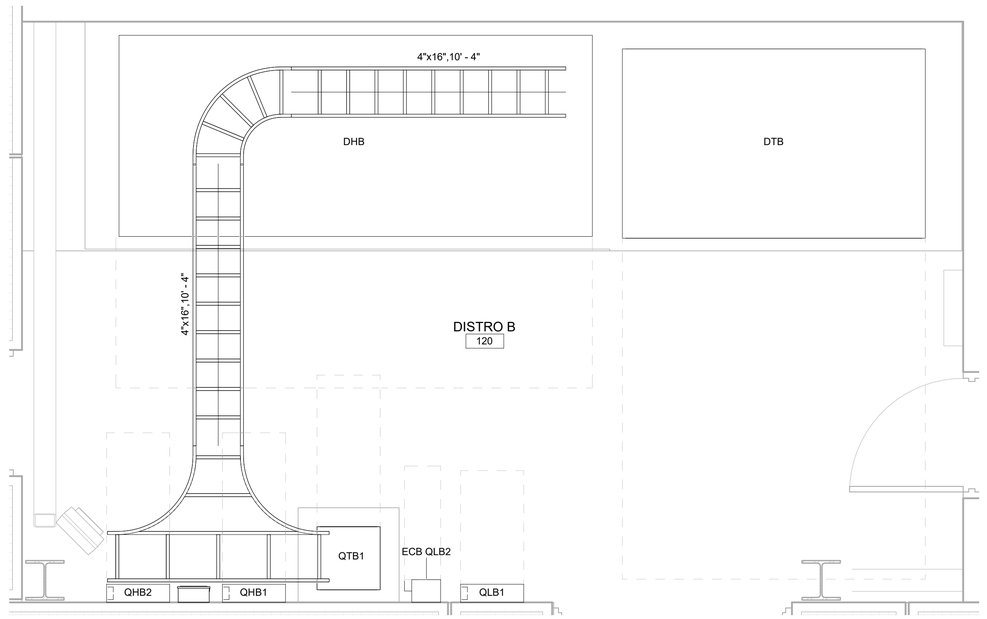


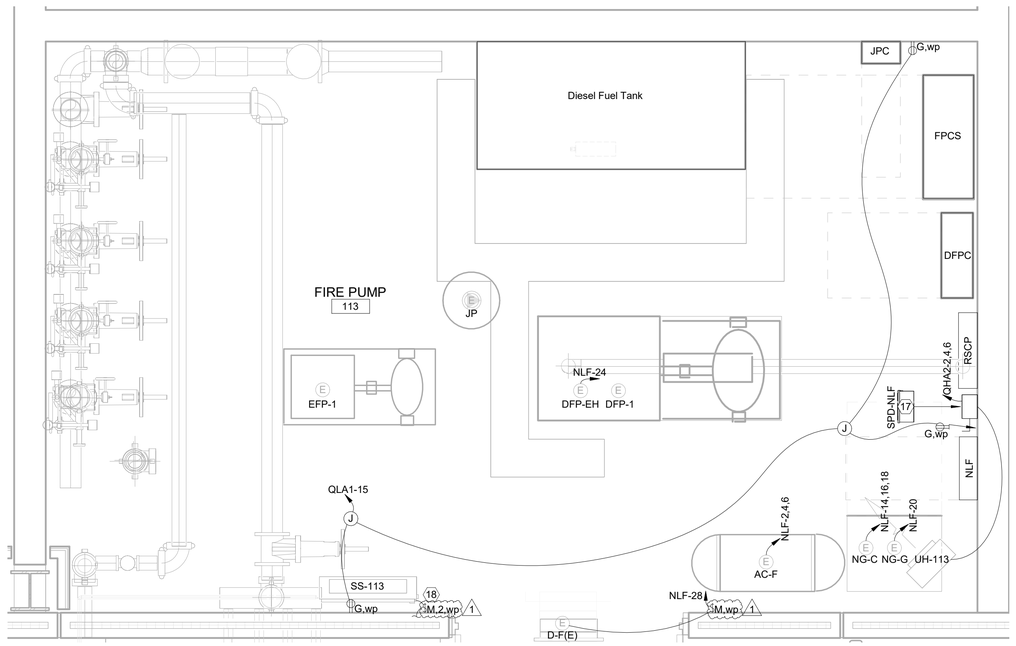
H1 ENLARGED GENERAL AND EQUIPMENT POWER PLAN

1/2" = 1'-0"



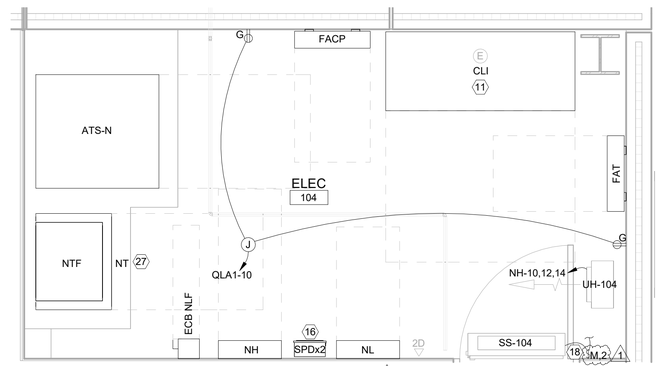
J11 ENLARGED GENERAL AND EQUIPMENT POWER PLAN

1/2" = 1'-0"



A1 ENLARGED GENERAL AND EQUIPMENT POWER PLAN

1/2" = 1'-0"



A11 ENLARGED GENERAL AND EQUIPMENT POWER PLAN

1/2" = 1'-0"

PLAN NORTH

0 1' 2' 4'

FOR SUPPLEMENTAL LEGEND, GENERAL NOTES, AND KEYNOTES, SEE SHEET EP001.

US Army Corps of Engineers ®

MARK	DESCRIPTION	DATE
1	AM #0002 - GENERAL REVISIONS	09/19/2025

File Path: C:\Users\DSEEMXS\3Documents\Local Revit Models\BUCC001102_DM_ME_DSEEMXS3.rvt

ISSUE DATE: 05/01/2025
SOLICITATION NO.: W9128F25RA043
CONTRACT NO.:

DESIGNED BY: E.MCNAMARA
DRAWN BY: E.MCNAMARA
CHECKED BY: A.AMOS
SUBMITTED BY: S.LINDGREN
SIZE: ANSI D
FILE NAME: BUCC001102_DM_ME.rvt
Plot Date: 9/17/2025 1:57:05 PM

US ARMY CORPS OF ENGINEERS
OMAHA DISTRICT
1616 CAPITOL AVE
OMAHA, NE 68102

BUCKLEY SFB, COLORADO
POWER INDEPENDENCE, MISSION CONTROL STATION

ENLARGED GENERAL AND EQUIPMENT POWER PLAN

SHEET ID

EP401

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GENERAL NOTES - EP600-EP609 SHEETS

1	FAULT CURRENT WITHSTAND AND INTERRUPTING CAPACITIES ARE MINIMUM. IF STANDARD RATINGS ARE GREATER, PROVIDE STANDARD RATING.
2	PROVIDE FULL LENGTH 100%-RATED NEUTRAL BAR AND A GROUNDING BAR IN EACH SECTION OF THE SWITCHBOARDS AND PANELBOARDS, UNLESS NEUTRAL IS INDICATED TO BE GREATER THAN THIS VALUE. PROVIDE MAIN BONDING JUMPER IN ACCORDANCE WITH NFPA 70 ARTICLE 250.
3	CONTRACTOR TO COORDINATE GENERATORS PARALLELING GEAR, MAIN SWITCHGEAR AND ATS CONTROLS CONNECTIONS AND REQUIREMENTS WITH EQUIPMENT VENDOR. IT IS THE RESPONSIBILITY OF THE PROVIDER OF ALL EQUIPMENT PROVIDED FOR THE INSTALLED CONDITION TO RESULT IN A FULL AND COMPLETE PARALLELING SYSTEM.
4	NOT ALL CIRCUITS ARE SHOWN ON ONE-LINE DIAGRAM. SEE PANEL SCHEDULES, MECHANICAL EQUIPMENT ELECTRICAL CONNECTION SCHEDULE, AND LIGHTING AND POWER PLANS FOR ADDITIONAL INFORMATION. ONE-LINE DIAGRAM IS INTENDED TO DEPICT CONNECTIONS BETWEEN MAJOR DISTRIBUTION COMPONENTS, AND TO PROVIDE INFORMATION WHERE NOT INDICATED ELSEWHERE.
5	PROVIDE CABLE REDUCING ADAPTERS AS NECESSARY TO ACCOMMODATE CONDUCTORS INCREASED IN SIZE TO MITIGATE VOLTAGE DROP. CONTRACTOR TO PROVIDE ADAPTER KIT TO DOWNSIZE THE CONDUCTORS PRIOR TO ENTERING THE PANEL AND CONNECTING THE LUGS OR CONTRACTOR CAN CHOOSE TO USE A BIGGER PANEL FRAME.
6	SEE POWER PLANS (EP100 AND EP400 SERIES), DRY-TYPE TRANSFORMER SCHEDULE (EP600), MECHANICAL EQUIPMENT ELECTRICAL CONNECTION SCHEDULE (EP610-EP619), AND PANEL SCHEDULES (EP620-EP659) FOR EQUIPMENT NEMA ENCLOSURE RATINGS NOT LISTED ON ONE-LINE DIAGRAM.
7	NOT ALL INFORMATION SHOWN ON THIS DIAGRAM (SPARE CIRCUIT BREAKERS, LOCKABLE BREAKERS, GFCI BREAKERS, MCB TRIP RATINGS, ETC.). REFERENCE PANEL SCHEDULES FOR ADDITIONAL INFORMATION.
8	CONDUIT SEALOFFS NOT IDENTIFIED ON THIS DIAGRAM. PROVIDE CONDUIT SEALOFFS WHERE REQUIRED IN HAZARDOUS AREAS BY NFPA 70. COORDINATE WITH SHEET E-101.
9	FAULT CURRENTS LISTED ASSUME 9,000A AVAILABLE FAULT CURRENT AT THE POINT OF CONNECTION TO ST-MH-3 AND ST-MH-5. CONTRACTOR TO COORDINATE AVAILABLE FAULT CURRENT WITH BASE UTILITY PROVIDER FOR USE WITH 26 05 73 POWER SYSTEM STUDIES. CONTRACTOR SHALL ADJUST EQUIPMENT SHORT CIRCUIT RATINGS ACCORDING TO STUDY RESULTS, BUT SHALL NOT BE LESS THAN THE MINIMUM VALUES STATED IN THE PLANS AND SPECIFICATIONS.
10	REFERENCE SHEET EP620 FOR CIRCUIT NOTES, HEADING DEFINITIONS, INSTRUCTIONS AND ADDITIONAL NOTES.
11	UPON 10 MONTHS POST-COMPLETION OF PROJECT, ELECTRICAL CONTRACTOR MUST PERFORM INFRARED TESTING OF ALL CONNECTIONS OF EQUIPMENT SHOWN. ELECTRICAL CONTRACTOR SHALL RE-TORQUE ANY LOOSE CONNECTIONS FOUND.
12	PROVIDE A MINIMUM 25% SPARE CONDUIT QUANTITY WITH MEDIUM VOLTAGE LINES THAT EXTEND OUTSIDE OF THE BUILDING FOOTPRINT AND POWER LINES OF ANY VOLTAGE WHICH TRAVERSE UNDERGROUND TO THE FILTER SHELTER.

(#) KEYNOTES - EP600 SHEETS

1	EXISTING 4.160KV TRANSFORMER TO BE REPLACED WITH THIS TRANSFORMER. SEE ES AND UD SERIES SHEETS FOR MORE DETAILS. SEE EP600 FOR TRANSFORMER DETAILS.
2	EXISTING SWITCH AND CONNECTIONS TO BE REMOVED DURING PHASING AND RECONNECTING OF POWER TO B442. SEE ES AND UD SERIES SHEETS FOR MORE DETAILS.
3	POWER METER. SEE POINTS ON SHEET MH702.
4	PROTECTIVE RELAY. SEE SPECIFICATION 26 13 13 FOR FURTHER DETAILS.
5	COMBINATION OF NEW CONDUIT AND EXISTING PATHWAYS. SEE ES AND UD SERIES SHEETS FOR MORE DETAILS.
6	INSTALL FEEDERS IN ACCORDANCE WITH NFPA 70 §695.6(A) FROM SWITCHGEAR THROUGH TO EFP-1.
7	REMOTE OPERABLE MOTORIZED BREAKER. SEE SPECIFICATIONS FOR DETAILS.
8	THE COMBINATION FIRE PUMP CONTROLLER/TRANSFER SWITCH SIZE IDENTIFIED ON THE CONTRACT DRAWINGS IS BASED ON PRELIMMINARY CALCULATIONS. SIZE THE COMBINATION FIRE PUMP CONTROLLER/TRANSFER SWITCH TO MATCH THE FIRE PUMP SIZE YIELDED BY THE PERFORMANCE REQUIREMENTS OF THIS CONTRACT'S PLANS AND SPECIFICATIONS. PROVIDE FIRE PUMP SYSTEM IDENTIFICATION PER NFPA 70 ARTICLE 695.
9	LOAD BANK AND LOAD BANK CONDUCTORS AND PATHWAY PROVIDED AS PART OF "LOAD BANK" CLIN. CONCRETE HOUSEKEEPING PAD TO BE PART OF CLIN "ALL OTHER SITE WORK." CAP STUB-UPS IF LOAD BANK EQUIPMENT OPTION IS NOT AWARDED WITH A MECHANICAL PLUG.
10	MTS TO BE PROVIDED WITH RELAY OUTPUT TO PUMP CONTROL PANEL. SEE SPECIFICATIONS AND EF SERIES SHEETS FOR DETAILS.
11	TWO 4" CONDUIT SHALL BE INSTALLED UNDERGROUND TO THE EXTERIOR OF THE BUILDING. CONDUIT SHALL BE INSTALLED WITH PULLWIRE. REFER TO ELECTRICAL SITE SHEETS FOR ADDITIONAL INFORMATION.
12	PROVIDE RED LOCK-ON TYPE CIRCUIT BREAKER.
13	PROVIDE A LABEL WITH THE FOLLOWING INSCRIPTION: "FIRE PROTECTION/LIFE SAFETY EQUIPMENT". CONSTRUCT AND FASTEN THE LABEL IDENTICAL TO THE EQUIPMENT NAMEPLATE, EXCEPT THE LABEL MUST BE RED LAMINATED PLASTIC WITH WHITE CENTER CORE.
14 1	MANHOLE PROVIDED BY CONCURRENT CONSTRUCTION PROJECT "ERCIP ENERGY RESILIENCE: CONSTRUCT REDUNDANT SURVEILLANCE REDUNDANT ELECTRICAL SUPPLY " (SOLICITATION NO. W9128F24R0066). CONTRACTOR TO COORDINATE DE-ENERGIZATION OF PRIMARY FEEDERS TO PROCEED WITH DISCONNECTION OF LOOP WITHIN MANHOLE, INSTALLATION OF ELECTRICAL SWITCH ON MANHOLE, AND TERMINATION OF THE EXISTING FEEDERS AND THE NEW FEEDERS INTO THE SWITCH COMPARTMENTS IDENTIFIED ON THE ONE-LINE DIAGRAM, TEST, AND RE-ENERGIZE. ENERGIZAEMENT OF THE POWERPLANT SHALL NOT OCCUR UNTIL THE XCEL BUILDER CALL LINE AGREEMENT (CLIN "Entire work complete for Xcel Energy capacity increase and other associated fees." (THIS CONTRACT)) IS EXECUTED TO INCREASE THE CAPACITY FROM THE EXISTING STATE TO THAT SUFFICIENT TO SUPPORT B442 AND THE POWERPLANT STATION SERVICE.
E	SEE ENCLOSED CIRCUIT BREAKER SCHEDULE ON SHEET EP600 FOR PROPERTIES.
MG	BOND GROUND CONDUCTORS TO MANHOLE GROUND LOOP/ELECTRODE SYSTEM. PROVIDE GROUND ROD IN MANHOLE. SEE MANHOLE DETAIL(S).
OH	FEEDER SHALL BE ROUTED OVERHEAD IN CABLE TRAY.
P	SEE PANEL/SWITCHBOARD SCHEDULE FOR PROPERTIES.
T	SEE TRANSFORMER SCHEDULES ON SHEET EP600 FOR PROPERTIES.
UG	FEEDER SHALL BE ROUTED UNDERGROUND. COORDINATE CONDUIT INSTALLATION WITH STRUCTURAL FOUNDATION CONSTRUCTION TO ENSURE HORIZONTAL PORTIONS OF CONDUIT ARE INSTALLED BELOW FOOTING DEPTHS PRIOR TO POURING.
ZH	CONSIDERATIONS FOR COLD TEMPERATURES MAY BE REQUIRED. COORDINATE WITH SUPPLING MANUFACTURER ABOUT EQUIPMENT CAPABILITIES AND ASSESS IF HEATED ENCLOSURES OR OTHER REMEDIES ARE REQUIRED. SEE SCHEDULE "14 WS / AFCCC / EWD LOCAL MEAN COINCIDENT (AVERAGE) DRY-BULB TEMPERATURES (1989-2018 BUCKLEY AFB, CO) " ON SHEET E-101 FOR EXTREME TEMPERATURES.

ENCLOSED CIRCUIT BREAKER SCHEDULE

TAG	LOCATION	SUPPLY FROM	VOLTS	EQUIPMENT PROPERTIES								DOWNSTREAM CIRCUIT PROPERTIES					REMARKS
				ENCLOSURE	FAULT DUTY (MIN.)	EQPT FRAME	CB RATING	CKT NOTES	METER	CB SVC	SSCB	ATZ	NLL	CCC	MCIT	CIRCUIT	
ECB QLA2	DISTRO A 112	112 XFMR QTA2	208 V	NEMA 1	10kA	250 A	250 A	--	No	Std	Yes	3	No	3	75	4-350KCMIL, #2 G, 3"C	--
ECB QLB2	DISTRO B 120	120 XFMR QTB2	208 V	NEMA 1	10kA	250 A	250 A	--	No	Std	Yes	3	No	3	75	4-350KCMIL, #2 G, 3"C	--
ECB FBC-1	FORKLIFT CHARGING 121	QHB1	480 V	NEMA 7	22kA	60 A	60 A	--	No	Std	Yes	2	Yes	3	--	--	ENCLOSED CIRCUIT BREAKER SERVES AS PROVISION FOR FUTURE GOVERNMENT-FURNISHED CHARGING EQUIPMENT.
ECB LP-1	NEW OIL STORAGE 122	QHB2	480 V	NEMA 1	22kA	60 A	15 A	B	No	Std	No	3	No	3	75	3-#12, #12 G, 3/4"C	--
ECB LP-2	NEW OIL STORAGE 122	QHB2	480 V	NEMA 1	22kA	60 A	15 A	B	No	Std	No	3	No	3	75	3-#12, #12 G, 3/4"C	--
ECB SF-B1	MECHANICAL MEZ. GEN RM B 202	QHB1	480 V	NEMA 1	22kA	100 A	90 A	B	No	Std	No	3	Yes	3	75	3-#6, #8 G, 1"C	--
ECB SF-B2	MECHANICAL MEZ. GEN RM B 202	QHB1	480 V	NEMA 1	22kA	100 A	90 A	B	No	Std	No	3	Yes	3	75	3-#6, #8 G, 1"C	--
ECB IP-F2	FILTER SHELTER	FILTER SHELTER ATS-PB	480 V	NEMA 3R	14kA	60 A	20 A	B,L	No	Std	Yes	2	No	3	75	3-#12, #12 G, 3/4"C	--
ECB IP-F3	FILTER SHELTER	FILTER SHELTER ATS-PA	480 V	NEMA 3R	14kA	60 A	20 A	B,L	No	Std	Yes	2	No	3	75	3-#12, #12 G, 3/4"C	--
ECB NLF	ELEC 104	104 XFMR NTF	208 V	NEMA 1	10kA	150 A	150 A	E,V	No	Std	Yes	3	Yes	5	75	3-250KCMIL, 2-250KCMIL N, #2 G, 3"C	--

ENCLOSED CIRCUIT BREAKER NOTES
1. WHERE NEUTRAL CONDUCTOR IS PROVIDED, THE NEUTRAL SHALL BE SWITCHED.

TRANSFORMER SCHEDULE GENERAL NOTES

1	CONTRACTOR MUST SIZE THE TRANSFORMER OVERCURRENT PROTECTION (INCLUDING DEVICE FRAME) PER SPECIFICATION 26 05 73 RECOMMENDATIONS AT NO ADDITIONAL COST TO THE GOVERNMENT.
2	BOND TRANSFORMER TO GROUNDING GRID WITH MINIMUM-SIZED GROUNDING ELECTRODE SHOWN IN SCHEDULE.
3	WHERE FEEDERS HAVE BEEN INCREASED IN SIZE TO ACCOUNT FOR VOLTAGE DROP AND/OR AMPACITY CORRECTION FACTORS TO THE DEGREE THAT THE FEEDERS ARE LARGER THAN THE EQUIPMENT TERMINALS, PROVIDE APPROPRIATELY-SIZED CABLE REDUCING ADAPTERS.
4	TRANSFORMER SCHEDULE DOES NOT INCLUDE DRIVE ISOLATION TRANSFORMERS.
5	ENCLOSURE RATINGS LISTED ARE MINIMUM RATINGS WITH RESPECT TO DUST AND LIQUID INGRESS.

MEDIUM- TO LOW-VOLTAGE OIL-FILLED TRANSFORMER SCHEDULE

TAG	SIZE (kVA)	LOCATION	PRIMARY						SECONDARY									MOUNTING LOCATION	ENCLOSURE RATING (MINIMUM)	REMARKS
			SYSTEM	AMPS	CIRCUIT	MCIT	CCC	ATZ	CKT NOTES	SYSTEM	AMPS	CIRCUIT	MCIT	CCC	NLL	ATZ	CKT NOTES	MIN. GND ELECTRODE			
FPTA	45	EXTERIOR	13200V	2 A	3-#2, #6 G, 4"C (15kV AL 133% INSULATION) (1) 4" SPARE CONDUIT	MV-105	3	2	F,P	480Y/277V	54 A	4-#4, 1-1/2"C (1) 1-1/2" SPARE CONDUIT	75	3	No	2	P	#4	GROUND/CONCRETE PAD	NEMA 3R	SEE SECTION 26 12 19.10 SUBMITTAL PHASING AND COORDINATION REQUIREMENT AS IT RELATES TO TRANSFORMER AND SUPPORTING INFRASTRUCTURE SIZING. PROVIDE A LABEL WITH THE FOLLOWING INSCRIPTION: "FIRE PROTECTION/LIFE SAFETY EQUIPMENT". CONSTRUCT AND FASTEN THE LABEL IDENTICAL TO THE EQUIPMENT NAMEPLATE, EXCEPT THE LABEL MUST BE RED LAMINATED PLASTIC WITH WHITE CENTER CORE.
FPTB	45	EXTERIOR	13200V	2 A	3-#2, #6 G, 4"C (15kV AL 133% INSULATION) (1) 4" SPARE CONDUIT	MV-105	3	2	F,P	480Y/277V	54 A	4-#4, 1-1/2"C (1) 1-1/2" SPARE CONDUIT	75	3	No	2	P	#4	GROUND/CONCRETE PAD	NEMA 3R	SEE SECTION 26 12 19.10 SUBMITTAL PHASING AND COORDINATION REQUIREMENT AS IT RELATES TO TRANSFORMER AND SUPPORTING INFRASTRUCTURE SIZING. PROVIDE A LABEL WITH THE FOLLOWING INSCRIPTION: "FIRE PROTECTION/LIFE SAFETY EQUIPMENT". CONSTRUCT AND FASTEN THE LABEL IDENTICAL TO THE EQUIPMENT NAMEPLATE, EXCEPT THE LABEL MUST BE RED LAMINATED PLASTIC WITH WHITE CENTER CORE.
OTM	30	OFFLOAD	13200V	1 A	3-#2, #6 G, 4"C (15kV AL 133% INSULATION) (1) 4" SPARE CONDUIT	MV-105	3	2	P	480Y/277V	36 A	4-1/0, 1-1/2"C (1) 1-1/2" SPARE CONDUIT	75	3	No	2	P	#6	GROUND/CONCRETE PAD	NEMA 3R	PROVIDE POWER METER AT TRANSFORMER.
T442A(TECH)	1500	B442 EXTERIOR	13200V	66 A	3-4/0, #1 G, 4"C (15kV AL 133% INSULATION) (1) 4" SPARE CONDUIT	MV-105	3	2	P	480Y/277V	1803 A	RECONNECT EXISTING FEEDERS: SEE 26 13 13 ATTACHMENT AND FIELD VERIFY	--	--	--	2	P	3/0	GROUND/CONCRETE PAD	NEMA 3R	--
T442B(TECH)	1500	B442 EXTERIOR	13200V	66 A	3-4/0, #1 G, 4"C (15kV AL 133% INSULATION) (1) 4" SPARE CONDUIT	MV-105	3	2	P	480Y/277V	1803 A	RECONNECT EXISTING FEEDERS: SEE 26 13 13 ATTACHMENT AND FIELD VERIFY	--	--	--	2	P	3/0	GROUND/CONCRETE PAD	NEMA 3R	--
T442C(MECH)	1000	B442 EXTERIOR	13200V	44 A	3-4/0, #1 G, 4"C (15kV AL 133% INSULATION) (1) 4" SPARE CONDUIT	MV-105	3	2	P	480Y/277V	1202 A	RECONNECT EXISTING FEEDERS: SEE 26 13 13 ATTACHMENT AND FIELD VERIFY	--	--	--	2	P	3/0	GROUND/CONCRETE PAD	NEMA 3R	--
T442D(MECH)	1000	B442 EXTERIOR	13200V	44 A	3-4/0, #1 G, 4"C (15kV AL 133% INSULATION) (1) 4" SPARE CONDUIT	MV-105	3	2	P	480Y/277V	1202 A	RECONNECT EXISTING FEEDERS: SEE 26 13 13 ATTACHMENT AND FIELD VERIFY	--	--	--	2	P	3/0	GROUND/CONCRETE PAD	NEMA 3R	--

MEDIUM- TO LOW-VOLTAGE DRY-TYPE TRANSFORMER SCHEDULE

TAG	SIZE (kVA)	LOCATION	PRIMARY						SECONDARY									MOUNTING LOCATION	ENCLOSURE RATING (MINIMUM)	REMARKS
			SYSTEM	AMPS	CIRCUIT	MCIT	CCC	ATZ	CKT NOTES	SYSTEM	AMPS	CIRCUIT	MCIT	CCC	NLL	ATZ	CKT NOTES	MIN. GND ELECTRODE			
DTA	750	DISTRO A 112	13200V	33 A	3-4/0, #1 G, 4"C (15kV AL 133% INSULATION)	MV-105	3	0	--	480Y/277V	902 A	1200A BUSWAY (REFER TO 26 20 00; 4P+G)	90	4	Yes	0	--	4/0	FLOOR/CONCRETE PAD	NEMA 1	--
DTB	750	DISTRO B 120	13200V	33 A	3-4/0, #1 G, 4"C (15kV AL 133% INSULATION)	MV-105	3	0	--	480Y/277V	902 A	1200A BUSWAY (REFER TO 26 20 00; 4P+G)	90	4	Yes	0	--	4/0	FLOOR/CONCRETE PAD	NEMA 1	--

LOW- TO LOW-VOLTAGE DRY-TYPE TRANSFORMER SCHEDULE

TAG	SIZE (kVA)	LOCATION	SUPPLY FROM	PRIMARY		SECONDARY										MOUNTING LOCATION	ENCLOSURE RATING (MINIMUM)	HARMONIC TREATMENT	REMARKS
				SYSTEM	AMPS	SYSTEM	AMPS	CIRCUIT	MCIT	CCC	NLL	ATZ	CKT NOTES	MIN. GND ELECTRODE	SYS. BOND. JUMPER				
NT	45	ELEC 104	NH	480V	54 A	208Y/120V	125 A	3-3/0, 500KCMIL N, #4 SSBJ, 3"C	75	4	Yes	0	--	#4	#4	FLOOR/CONCRETE PAD	NEMA 1	K-13	--
NTF	45	ELEC 104	NH	480V	54 A	208Y/120V	125 A	3-250KCMIL, 2-250KCMIL N, #2 SSBJ, 3"C	75	5	Yes	0	V	#2	#2	WALL/ELEVATED	NEMA 1	K-4	PROVIDE A LABEL WITH THE FOLLOWING INSCRIPTION: "FIRE PROTECTION/LIFE SAFETY EQUIPMENT". CONSTRUCT AND FASTEN THE LABEL IDENTICAL TO THE EQUIPMENT NAMEPLATE, EXCEPT THE LABEL MUST BE RED LAMINATED PLASTIC WITH WHITE CENTER CORE.
OTL	15	OFFLOAD	OH	480V	18 A	208Y/120V	42 A	4-#4, #8 SSBJ, 1"C	75	3	No	2	P	#6	#6	GROUND/CONCRETE PAD	NEMA 3R	K-1	--
PT	15	FILTER SHELTER	PH	480V	18 A	208Y/120V	42 A	4-#6, #8 SSBJ, 1-1/4"C	75	3	No	2	--	#6	#6	GROUND/CONCRETE PAD	NEMA 3R	K-1	--
PTA	15	FILTER SHELTER	PHA	480V	18 A	208Y/120V	42 A	4-#6, #8 SSBJ, 1-1/4"C	75	3	No	2	--	#6	#6	GROUND/CONCRETE PAD	NEMA 3R	K-1	--
PTB	15	FILTER SHELTER	PHB	480V	18 A	208Y/120V	42 A	4-#6, #8 SSBJ, 1-1/4"C	75	3	No	2	--	#6	#6	GROUND/CONCRETE PAD	NEMA 3R	K-1	--
QTA1	45	DISTRO A 112	QHA1	480V	54 A	208Y/120V	125 A	4-1/0, #6 SSBJ, 2"C	75	3	No	0	--	#6	#6	WALL/ELEVATED	NEMA 1	K-1	--
QTA2	75	DISTRO A 112	QHA2	480V	90 A	208Y/120V	208 A	4-250KCMIL, #2 SSBJ, 3"C	75	3	No	0	--	#2	#2	FLOOR/CONCRETE PAD	NEMA 1	K-1	--
QTB1	45	DISTRO B 120	QHB1	480V	54 A	208Y/120V	125 A	4-1/0, #6 SSBJ, 2"C	75	3	No	0	--	#6	#6	WALL/ELEVATED	NEMA 1	K-1	--
QTB2	75	DISTRO B 120	QHB2	480V	90 A	208Y/120V	208 A	4-250KCMIL, #2 SSBJ, 3"C	75	3	No	0	--	#2	#2	FLOOR/CONCRETE PAD	NEMA 1	K-1	--

FOR GENERAL NOTES, AND KEYNOTES, SEE SHEET EP600. SEE EP501 FOR GENERATOR CONTROLS DIAGRAM.

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MARK	DESCRIPTION	DATE
1	AM #0002 - GENERAL REVISIONS	09/19/2025

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US ARMY CORPS OF ENGINEERS
OMAHA DISTRICT
1616 CAPITOL AVE.
OMAHA, NE 68102

ISSUE DATE: 05/01/2025
SOLICITATION NO.: W9128F25RA043
CONTRACT NO.:

DESIGNED BY: E.MCNAMARA
DRAWN BY: E.MCNAMARA
CHECKED BY: B.ADKINS
SUBMITTED BY: S.JACOBSEN
SIZE: ANSI D
FILE NAME: BUCO00102_DM_ME.rvt

Plot Date: 9/18/2025 2:37:23 PM

BUCKLEY SFB, COLORADO
POWER INDEPENDENCE, MISSION CONTROL STATION

ELECTRICAL ONE-LINE DIAGRAM NOTES AND SCHEDULES

SHEET ID
EP600

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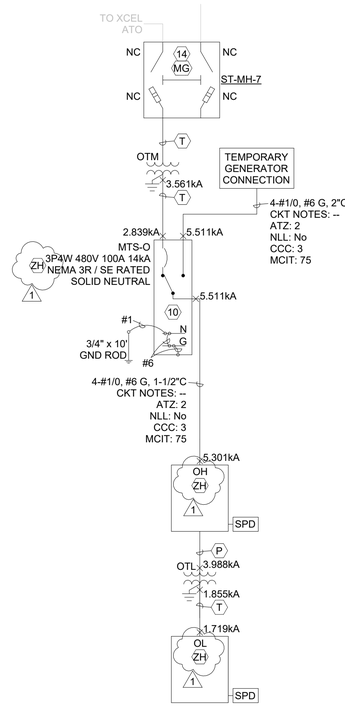

F15 ONE-LINE DIAGRAM: OFFLOAD

SCALE: NTS

FOR TRANSFORMER SCHEDULES, GENERAL NOTES, AND KEYNOTES, SEE SHEET EP600.

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MARK	DESCRIPTION	DATE
1	AM #0002 - GENERAL REVISIONS	09/19/2025

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Plot Date: 9/18/2025 2:37:31 PM

ISSUE DATE: 05/01/2025
SOLICITATION NO.: W9128F25RA043
CONTRACT NO.:

DESIGNED BY: E.MCNAMARA
DRAWN BY: E.MCNAMARA
CHECKED BY: B.ADKINS
SUBMITTED BY: J.MORTEN
SIZE: ANSI D
FILE NAME: BUCO00102_DM_ME.rvt

US ARMY CORPS OF ENGINEERS
OMAHA DISTRICT
1616 CAPITOL AVE.
OMAHA, NE 68102

BUCKLEY SFB, COLORADO
POWER INDEPENDENCE, MISSION CONTROL STATION

ONE-LINE DIAGRAM OFFLOAD

SHEET ID

EP603

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EQUIPMENT ELECTRICAL CONNECTION SCHEDULES KEY

EQUIPMENT ELECTRICAL CONNECTION SCHEDULE - < CONTRACTOR-FURNISHED, CONTRACTOR-INSTALLED: CONTRACTOR-PROVIDED EQUIPMENT, CONTRACTOR IS RESPONSIBLE FOR PROVIDING ELECTRICAL SUPPORT REQUIRED BY THE EQUIPMENT WITH FEATURES IDENTIFIED IN SCHEDULE >
< GOVERNMENT-FURNISHED, GOVERNMENT-INSTALLED: EQUIPMENT PROVIDED BY OTHERS, CONTRACTOR IS RESPONSIBLE FOR THE SUPPORT INDICATED IN SCHEDULE >

E.Q. I.D. TAG	DESCRIPTION	LOCATION	VOLTS	PH	HP	FLA	MCA	PKG UNIT	NEMA ENCL.	DISCONNECT TYPE	DISCONNECT SIZE	DISCONNECT FUSE	STARTER TYPE	STARTER SIZE	PNL-CKT	COORDINATING DOCUMENTS SPECIFICATION(S)	COORDINATING DOCUMENTS SHEET(S)	REMARKS

- EQUIPMENT (OR SUBPART OF EQUIPMENT) SERVED
- EQUIPMENT IDENTIFICATION TAG ("MARK") SHOWN ON PLANS.
- EQUIPMENT LOCATION
- CIRCUIT NOMINAL SUPPLY VOLTAGE
- CIRCUIT PHASE QUANTITY
- EQUIPMENT HORSEPOWER SIZE (AS APPLICABLE)
- EQUIPMENT ESTIMATED FULL-LOAD AMPACITY
- EQUIPMENT ESTIMATED MINIMUM CIRCUIT AMPACITY
- PACKAGED UNIT. "YES" INDICATES EQUIPMENT IS ASSUMED TO CONTAIN AN INTEGRAL STARTER. SHOULD EQUIPMENT BE PROVIDED WITHOUT AN INTEGRAL STARTER, A SEPARATE STARTER (COMBINATION STARTER/DISCONNECT) SHALL BE PROVIDED AND SIZED APPROPRIATELY FOR EQUIPMENT AT NO ADDITIONAL COST TO THE GOVERNMENT.
- NEMA ICS 6 ENCLOSURE RATING (IP RATING IF "IP##" IS SHOWN) FOR DISCONNECTING MEANS, STARTER, VFD, ETC. RACEWAYS AND THE EQUIPMENT ITSELF TO BE RATED FOR THE ENVIRONMENT IN WHICH SAID FEATURES ARE INSTALLED. FOR CIRCUIT BREAKERS AND ENCLOSED CIRCUIT BREAKERS ("--" IN THIS FIELD), SEE THE RESPECTIVE SCHEDULE IDENTIFYING THE ENCLOSURE RATING. FOR RECEPTACLE DISCONNECTING MEANS, SEE PLANS AND APPLIED NOTES FOR RECEPTACLE AND RECEPTACLE PROTECTION AND ENCLOSURE REQUIREMENTS.
- EQUIPMENT-SPECIFIC NOTATIONS. WHERE "NOTE ..." IS INDICATED, SEE SHEET EP610 "EQUIPMENT CONNECTIONS - SCHEDULE NOTES (REMARKS)".
- "COORDINATING DOCUMENTS" ARE LISTED TO INDICATE WHERE MOST REQUIREMENTS FOR A GIVEN PIECE OF EQUIPMENT ARE FOUND FOR GENERAL ORIENTATION PURPOSES. THESE REFERENCES ARE NOT NECESSARILY ALL-INCLUSIVE (FOR EXAMPLE, GENERAL AND KEYED NOTES APPLICABLE TO SPECIFIC CONDITIONS OR APPLICATIONS MAY BE FOUND ELSEWHERE IN THE DOCUMENTS). CONTRACTOR IS RESPONSIBLE FOR MEETING ALL CONTRACT REQUIREMENTS, WHICH ARE NOT NECESSARILY ENCOMPASSED IN THIS SCHEDULE OR ITS REFERENCES.
- ASSIGNED PANELBOARD, DISTRIBUTION PANEL, SWITCHBOARD, OR OTHER EQUIPMENT SUPPLY CIRCUIT SOURCE AND THE POLE ASSIGNMENT(S) ON THE CIRCUIT SOURCE EQUIPMENT.
- EXTERNAL STARTER TYPE AND SIZE RATING BASED ON THE BASIS OF DESIGN EQUIPMENT. SIZE TO BE ADJUSTED FOR ACTUAL EQUIPMENT REQUIREMENTS.
- WHERE "F" IS INDICATED IN THE "DISCONNECT - FUSE" COLUMN, PROVIDE FUSE SIZED PER MANUFACTURER RECOMMENDATIONS.
- RATING FOR IMMEDIATELY-UPSTREAM DISCONNECTING MEANS. WHERE OMITTED, RATING IS COVERED ELSEWHERE.
- INTENDED DISCONNECTING MEANS. DISCONNECT TYPES AS FOLLOWS:
  - SPST SINGLE POLE, SINGLE THROW NEMA KS 1 DISCONNECT.
  - DPST DOUBLE POLE, SINGLE THROW NEMA KS 1 DISCONNECT.
  - DPDT DOUBLE POLE, DOUBLE THROW NEMA KS 1 DISCONNECT.
  - 1 $M MOTOR-RATED SWITCH WITH THERMAL OVERLOAD OR A MOTOR CIRCUIT PROTECTOR. (ADDITIONALLY SEE GENERAL NOTE 8.)
  - $M(2P) SAME AS "$M" ENTRY EXCEPT IN A DOUBLE POLE, SINGLE THROW CONFIGURATION. (ADDITIONALLY SEE GENERAL NOTES 7 AND 8.)
  - $ GENERAL USE SWITCH HAVING AN AMPERE RATING NOT LESS THAN TWICE THE FULL-LOAD RATING OF THE MOTOR (NFPA 70 §430.109(C)(1)).
  - $(2P) SAME AS "$" ENTRY EXCEPT IN A DOUBLE POLE, SINGLE THROW CONFIGURATION. (ADDITIONALLY SEE GENERAL NOTE 7.)
  - CB CIRCUIT BREAKER DISCONNECTING MEANS ONLY. PROVIDE LOCKABLE CIRCUIT BREAKER WHEN LOCATED REMOTELY DUE TO SAFETY ISSUES.
  - ECB ENCLOSED CIRCUIT BREAKER DISCONNECTING MEANS ONLY. PROVIDE LOCKABLE CIRCUIT BREAKER.
  - REC RECEPTACLE / CORD-AND-PLUG CONFIGURATION.
  - DFPC DIESEL FIRE PUMP CONTROLLER
  - JPCP JOCKEY PUMP CONTROL PANEL.
  - FPC FIRE PUMP CONTROLLER
  - FPCS FIRE PUMP CONTROLLER / TRANSFER SWITCH
  - CLF CURRENT-LIMITING FUSE IN DISCONNECT LOCKABLE IN THE CLOSED POSITION.

EQUIPMENT CONNECTIONS - SCHEDULE NOTES (REMARKS)

	(APPLICABLE TO EP610 SERIES SHEETS)
1	THE ELECTRICAL SUPPLY TO THE DISCONNECT SHALL BE UNCHANGED UNLESS A LARGER SUPPLY IS REQUIRED BY THE MANUFACTURER. THE DISCONNECT FUSE RATING AND DOWNSTREAM ELECTRICAL SUPPORT FOR THE CRANE SHALL BE SIZED IN ACCORDANCE NFPA 70-2017 ARTICLE 610 FOR CONTINUOUS DUTY. CONDUCTORS SHALL TAKE INTO ACCOUNT THE AMBIENT TEMPERATURE AND OTHER CODE-REQUIRED AMPACITY CORRECTION FACTORS ASSIGNED TO THE SPACE IN WHICH THE CIRCUIT IS ROUTED. ADDITIONALLY, THE DOWNSTREAM CIRCUIT AND SUBSEQUENT RUNWAY ELECTRIFICATION SYSTEM SHALL HAVE A VOLTAGE DROP OF NO GREATER THAN 2 PERCENT TO THE CRANE-MOUNTED PANEL WHEN LOCATED AT THE COMBINED FARTHEST END OF THE RUNWAY AND BRIDGE.
2	SEE EF500 SERIES SHEETS FOR FUEL ELECTRICAL EQUIPMENT RACK FOR CONTROLLER/DISCONNECT.
3	PROVIDE LOCKABLE DISCONNECTING MEANS.
4	PROVIDE VFD(s) INTEGRAL TO EQUIPMENT.
5	DAMPER/LOUVER TO FAIL OPEN.
6	BASIS OF DESIGN INDOOR UNIT IS SHOWN WITH A 2-POLE SWITCH AND POWERED BY OUTDOOR UNIT. PROVIDE INDOOR UNIT WITH SWITCH ONLY AS REQUIRED BY MANUFACTURER'S INSTRUCTIONS. IF PERMITTED OR REQUIRED BY THE SPLIT SYSTEM MANUFACTURER, PROVIDE SWITCH AT THE OUTDOOR UNIT ONLY, AND AT THE INDOOR UNIT LOCATION, PROVIDE A PLACARD INDICATING THE LOCATION OF THE SWITCH CONTROLLING POWER TO BOTH UNITS. IF SWITCH IS NOT PROVIDED AT INDOOR UNIT, PROVIDE PLACARD AT INDOOR UNIT INDICATING LOCATION OF THE DISCONNECTING MEANS.
7	PROVIDE CIRCUIT WITH DEDICATED SPD IN ENCLOSURE SEPARATE FROM PANEL AND PRIOR TO EXITING BUILDING.
8	BASIS OF DESIGN PROVIDES ONE POINT OF POWER FOR MULTIPLE DAMPERS AS PART OF THE SAME ASSEMBLY.
9	PROVIDE LABEL WITH LOCATION OF THE DISCONNECTING MEANS PER NFPA 70 §430.102(A) EXCEPTION 3.
10	PROVIDE DISCONNECT WITH FUSE PER EQUIPMENT MANUFACTURER INSTRUCTIONS.
11	EQUIPMENT SHALL BE SUPPORTED SUCH THAT ALL ELECTRICAL COMPONENTS ARE OUTSIDE THE HAZARDOUS CONDITION IDENTIFIED ON E-100 SERIES SHEETS.
12	PROVIDE INTEGRAL DISCONNECT TOGGLE SWITCH AT DEVICE.
13	FAULT CURRENT AT THIS LOCATION IS ANTICIPATED TO EXCEED THE WITHSTAND VALUE OF A STANDARD DISCONNECT SWITCH (10,000A). WHERE A FUSIBLE DISCONNECT IS INDICATED, PROVIDE CLASS RK5 (FLSR OR FLNR, AS APPLICABLE) FUSES.
14	PANEL CONTAINING CIRCUIT BREAKER FOR EQUIPMENT IS LOCATED WITHIN SIGHT OF THE EQUIPMENT AND IS INTENDED TO BE USED AS THE DISCONNECTING MEANS.
15	DISCONNECTING MEANS IS A LOCKABLE CIRCUIT BREAKER IN ACCORDANCE WITH NFPA 70 §422.31.
16	DISCONNECTING MEANS IS A LOCKABLE CIRCUIT BREAKER IN ACCORDANCE WITH NFPA 70 §427.55(A).
17	DISCONNECTING MEANS IS A LOCKABLE CIRCUIT BREAKER IN ACCORDANCE WITH NFPA 70 §430.102(B)(2) EXCEPTION 1 DUE TO THE IMPRACTICALITY OF PROVIDING LOCAL DISCONNECTING MEANS AT THE SUBMERSIBLE PUMP.
18	DISCONNECTING MEANS IS A LOCKABLE CIRCUIT BREAKER IN ACCORDANCE WITH NFPA 70 §430.102(B)(2) EXCEPTION 2 AS AN INDUSTRIAL INSTALLATION WITH MEASURES IN PLACE SUCH THAT ONLY QUALIFIED PERSONS SERVICE THE EQUIPMENT.
19	BATTERY SHALL BE PROVIDED WITH A DISCONNECT LOCKABLE IN THE 'ON' POSITION ON THE DOWNSTREAM SIDE OF THE BATTERY PER NFPA 70 §480.7(A).

EQUIPMENT CONNECTIONS - GENERAL SCHEDULE NOTES

	(APPLICABLE TO EP610 SERIES SHEETS)
1	WHERE EQUIPMENT IS PROVIDED WITH A DISCONNECTING MEANS INTEGRAL TO EQUIPMENT, THE SEPARATE DISCONNECTING MEANS MAY BE OMITTED WHERE PERMITTED BY NFPA 70 FOR THE SPECIFIC APPLICATION, EXCEPT WHERE LOCKING-TYPE DISCONNECTS ARE SPECIFIED (INCLUDING DISCONNECT SWITCHES AND CIRCUIT BREAKERS).
2	COORDINATE FINAL ELECTRICAL CONNECTIONS, CONDUCTORS, RACEWAYS, CIRCUIT BREAKER FRAME AND TRIP RATINGS, FUSE RATINGS, STARTER SIZES AND TYPES, DISCONNECTING DEVICES AND SIZES, AND VFD SIZES (AS APPLICABLE) WITH ACTUAL EQUIPMENT PROVIDED (INCLUDING ADJUSTMENT FOR UFC 3-501-01 MAXIMUM PERMISSIBLE BRANCH CIRCUIT VOLTAGE DROP). THIS SCHEDULE HAS BEEN COORDINATED FOR EQUIPMENT LISTED IN THE PLANS AND SPECIFICATIONS INCLUDED IN THIS CONTRACT USING THE AVAILABLE PRODUCT LITERATURE AT THE TIME OF DESIGN. THE CONTRACTOR IS RESPONSIBLE FOR ADJUSTING ELECTRICAL CONNECTIONS, CONDUCTORS, RACEWAY, CIRCUIT BREAKER FRAME AND TRIP, AND DISCONNECTING DEVICES AND SIZES FOR FINAL EQUIPMENT APPROVED AND INSTALLED, INCLUDING ADJUSTMENTS FOR MORE ACCURATE/REFINED MANUFACTURER ELECTRICAL PROPERTIES. THE MAXIMUM OVERCURRENT PROTECTIVE DEVICE RATING, MAXIMUM FUSE RATING, OR SIMILAR LANGUAGE USED TO DENOTE A PROTECTION VALUE SHALL BE CONSIDERED THE MANUFACTURER RECOMMENDED RATING AND USED TO MAKE THE ADJUSTMENTS IDENTIFIED HEREIN. CIRCUIT BREAKER AND SUPPLY CIRCUIT CONDUCTOR INFORMATION FOR EQUIPMENT IS LOCATED ON THE PANEL SCHEDULES. CONDUCTORS AND CONDUIT ARE SIZED AS A SINGLE CIRCUIT AND ACCOUNTING FOR VOLTAGE DROP, ANTICIPATED MAXIMUM AMBIENT TEMPTERATURE, AND NUMBER OF CURRENT CARRYING CONDUCTORS. CONTRACTOR IS RESPONSIBLE FOR DERATING SHOULD MULTIPLE CIRCUITS BE ROUTED IN THE SAME CONDUIT OR IF ROUTING PATH TRAVELS INTO AN AREA ANTICIPATED TO EXCEED THE VALUES INDICATED IN THE PANEL SCHEDULE ENTRY ASSOCIATED WITH THIS EQUIPMENT.
3	ENCLOSURE (THIS SCHEDULE AND E-100 SHEET SERIES) AND FAULT DUTY RATINGS (EP600 SERIES ONE-LINE AND PANEL SCHEDULES, IN CONJUNCTION WITH SECTION 26 05 73) LISTED ARE MINIMUM RATINGS. WHERE A CONFLICT EXISTS BETWEEN THIS SCHEDULE AND THE E-100 SHEET SERIES, THE ENCLOSURE RATING RESULTING IN A HIGHER EQUIVALENT IP VALUE OR NEMA RATING SHALL BE USED. FAULT CURRENT RATINGS SHALL BE ADJUSTED IN ACCORDANCE WITH THE SECTION 26 05 73 COORDINATION STUDY. ADDITIONALLY, NON-FUSIBLE LOCAL DISCONNECTNG MEANS ARE INDICATED WHERE ANTICIPATED FAULT CURRENT IS LESS THAN 10,000A. PROVIDE FUSIBLE DISCONNECT WITH CLASS RK5 (FLSR OR FLNR, AS APPLICABLE) OR PROPERLY RATED ENCLOSED CIRCUIT BREAKER WHERE POWER STUDY REVEALS AVAILABLE FAULT CURRENT OF 10,000A OR GREATER, OR AS REQUIRED BY THE EQUIPMENT MANUFACTURER.
4	LOAD INFORMATION LISTED IN THIS SCHEDULE IS FOR COORDINATION PURPOSES WITH THE DESIGN OF OTHER DISCIPLINES. WHERE CONFLICTS EXIST BETWEEN THIS SCHEDULE AND OTHER REQUIREMENTS, NOTIFY THE COR IMMEDIATELY.
5	WHERE THE CIRCUIT BREAKER IS USED AS THE DISCONNECTING MEANS, THE PANEL NAME, CIRCUIT NUMBER, AND ROOM CONTAINING THE PANEL SHALL BE INCLUDED ON A LABEL ON OR AT THE EQUIPMENT, ALONG WITH THE EQUIPMENT IDENTIFIER.
6	RECEPTACLE CONNECTIONS SHOWN WHERE DESIGN RESEARCH INDICATED PRODUCT AVAILABILITY SUPPORTED SUCH CONNECTION AND DISCONNECTING MEANS. WHERE CONTRACTOR SELECTS EQUIPMENT REQUIRING (OR PERMITTING AND ELECTING TO PROVIDE) HARDWIRED CONNECTION, REMOVE "RECEPTACLE: " FROM PANEL SCHEDULE/DIRECTORY IF RECEPTACLE IS NOT INSTALLED AND PROVIDE THE APPROPRIATE DISCONNECTING MEANS COMPLYING WITH NFPA 70.
7	FOUR-WAY SWITCHES ARE DOUBLE-POLE, DOUBLE-THROW AND MAY NOT BE USED FOR DOUBLE-POLE, SINGLE-THROW APPLICATIONS.
1 8	DUE TO THE DESIGN-PHASE UNKNOWNS REGARDING THE EXISTENCE OF THERMAL OVERLOAD DEVICES FOR A GIVEN MOTOR, THE PLANS SHOW MOTOR-RATED SWITCHES WITH THERMAL OVERLOAD DEVICES. THERMAL OVERLOADS ON THE SWITCH MAY BE OMITTED AND A GENERAL-USE SWITCH COMPLYING WITH NFPA 70 §430.109(C) MAY BE PROVIDED IF THERMAL OVERLOAD DEVICES ASSOCIATED WITH THE MOTOR IN QUESTION ARE PROVIDED ELSEWHERE IN THE CIRCUIT IN ACCORDANCE WITH NFPA 70 §430.32.

US Army Corps of Engineers ®

MARK	DESCRIPTION	DATE
1	AM #0002 - GENERAL REVISIONS	09/19/2025

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ISSUE DATE: 05/01/2025
SOLICITATION NO.: W9126P25RA043
CONTRACT NO.:

DESIGNED BY: E.MCNAMARA
DRAWN BY: E.MCNAMARA
CHECKED BY: E.MCNAMARA
SUBMITTED BY: S.LINDGREN
SIZE: ANSI D
FILE NAME: BUCO00102_DM_ME.rvt
Plot Date: 9/17/2025 1:57:15 PM

US ARMY CORPS OF ENGINEERS
OMAHA DISTRICT
1616 CAPITOL AVE
OMAHA, NE 68102

BUCKLEY SFB, COLORADO
POWER INDEPENDENCE, MISSION CONTROL STATION

EQUIPMENT ELECTRICAL CONNECTION NOTES

SHEET ID

EP610

ADVERTISEMENT

EQUIPMENT ELECTRICAL CONNECTION SCHEDULE

E.Q. I.D. TAG	DESCRIPTION	LOCATION	VOLTS	PH	HP	FLA	MCA	PKG UNIT	NEMA ENCL.	DISCONNECT TYPE	DISCONNECT SIZE	DISCONNECT FUSE	STARTER TYPE	STARTER SIZE	PNL-CKT	COORDINATING DOCUMENTS SPECIFICATION(S)	COORDINATING DOCUMENTS SHEET(S)	REMARKS
AC-A1	AIR COMPRESSOR	106 GEN RM A	208 V	1	--	9.5 A	11.9 A	Yes	--	CB	--	--	--	--	GLA1-8,10	26 32 15	MP607	SEE NOTE 18.
AC-A2	AIR COMPRESSOR	106 GEN RM A	208 V	1	--	9.5 A	11.9 A	Yes	--	CB	--	--	--	--	GLA2-7,9	26 32 15	MP607	SEE NOTE 18.
AC-B1	AIR COMPRESSOR	117 GEN RM B	208 V	1	--	9.5 A	11.9 A	Yes	--	CB	--	--	--	--	GLB1-8,10	26 32 15	MP607	SEE NOTE 18.
AC-B2	AIR COMPRESSOR	117 GEN RM B	208 V	1	--	9.5 A	11.9 A	Yes	--	CB	--	--	--	--	GLB2-7,9	26 32 15	MP607	SEE NOTE 18.
AC-F	AIR COMPRESSOR	113 FIRE PUMP	208 V	3	10	32.2 A	40.3 A	Yes	--	CB	--	--	--	--	NLF-2,4,6	21 13 18	FX101	SEE NOTE 14.
ATG-A1	AUTOMATIC TANK GAUGE PANEL	106 GEN RM A	120 V	1	--	2.0 A	2.5 A	Yes	--	CB	--	--	--	--	GLA1-4	33 56 10	MP607	--
ATG-A2	AUTOMATIC TANK GAUGE PANEL	106 GEN RM A	120 V	1	--	2.0 A	2.5 A	Yes	--	CB	--	--	--	--	GLA2-3	33 56 10	MP607	--
ATG-B1	AUTOMATIC TANK GAUGE PANEL	117 GEN RM B	120 V	1	--	2.0 A	2.5 A	Yes	--	CB	--	--	--	--	GLB1-4	33 56 10	MP607	--
ATG-B2	AUTOMATIC TANK GAUGE PANEL	117 GEN RM B	120 V	1	--	2.0 A	2.5 A	Yes	--	CB	--	--	--	--	GLB2-3	33 56 10	MP607	--
ATG-D1	AUTOMATIC TANK GAUGE PANEL	106 GEN RM A	120 V	1	--	2.0 A	2.5 A	Yes	--	CB	--	--	--	--	QLA2-4	33 56 10	MP607	--
ATG-D2	AUTOMATIC TANK GAUGE PANEL	106 GEN RM A	120 V	1	--	2.0 A	2.5 A	Yes	--	CB	--	--	--	--	QLA2-6	33 56 10	MP607	--
ATG-FA	AUTOMATIC TANK GAUGE PANEL	110 PUMP CTRL A	120 V	1	--	2.0 A	2.5 A	Yes	--	CB	--	--	--	--	QLA1-26	33 56 10	EF528	--
ATG-FB	AUTOMATIC TANK GAUGE PANEL	123 PUMP CTRL B	120 V	1	--	2.0 A	2.5 A	Yes	--	CB	--	--	--	--	QLB1-22	33 56 10	EF528	--
BC-A	SWITCHGEAR BATTERY CHARGER	114 SWITCHGEAR UA	120 V	1	--	23.0 A	28.8 A	Yes	--	CB	--	--	--	--	QLA1-17	26 13 13	--	SEE NOTE 19.
BC-B	SWITCHGEAR BATTERY CHARGER	119 SWITCHGEAR UB	120 V	1	--	23.0 A	28.8 A	Yes	--	CB	--	--	--	--	QLB1-11	26 13 13	--	SEE NOTE 19.
BV05	BALL VALVE	124 DAY TANKS B	480 V	3	1	2.1 A	2.6 A	Yes	--	CB	--	--	--	--	QHB4-2,4,6	33 52 40	--	SEE NOTE 9.
BV06	BALL VALVE	124 DAY TANKS B	480 V	3	1	2.1 A	2.6 A	Yes	--	CB	--	--	--	--	QHB4-8,10,12	33 52 40	--	SEE NOTE 9.
BV09	BALL VALVE	124 DAY TANKS B	480 V	3	1	2.1 A	2.6 A	Yes	--	CB	--	--	--	--	QHB4-14,16,18	33 52 40	--	SEE NOTE 9.
BV10	BALL VALVE	124 DAY TANKS B	480 V	3	1	2.1 A	2.6 A	Yes	--	CB	--	--	--	--	QHB4-20,22,24	33 52 40	--	SEE NOTE 9.
BV13	BALL VALVE	111 DAY TANKS A	480 V	3	1	2.1 A	2.6 A	Yes	--	CB	--	--	--	--	QHA4-1,3,5	33 52 40	--	SEE NOTE 9.
BV14	BALL VALVE	111 DAY TANKS A	480 V	3	1	2.1 A	2.6 A	Yes	--	CB	--	--	--	--	QHA4-7,9,11	33 52 40	--	SEE NOTE 9.
BV17	BALL VALVE	111 DAY TANKS A	480 V	3	1	2.1 A	2.6 A	Yes	--	CB	--	--	--	--	QHA4-13,15,17	33 52 40	--	SEE NOTE 9.
BV18	BALL VALVE	111 DAY TANKS A	480 V	3	1	2.1 A	2.6 A	Yes	--	CB	--	--	--	--	QHA4-19,21,23	33 52 40	--	SEE NOTE 9.
BV-001	ACTUATED BALL VALVE	106 GEN RM A	120 V	1	--	0.3 A	0.3 A	Yes	--	CB	--	--	--	--	QLA2-13	33 52 10	MP607	SEE NOTE 14.
BV-103	ACTUATED BALL VALVE	116 EXHAUST TREATMENT	120 V	1	--	0.3 A	0.3 A	Yes	--	CB	--	--	--	--	QLA2-12	33 52 10	MP607	SEE NOTE 15.
BV-111	ACTUATED BALL VALVE	117 GEN RM B	120 V	1	--	0.3 A	0.3 A	Yes	--	CB	--	--	--	--	QLB2-6	33 52 10	MP607	SEE NOTE 14.
BV-121	ACTUATED BALL VALVE	117 GEN RM B	120 V	1	--	0.3 A	0.3 A	Yes	--	CB	--	--	--	--	QLB2-6	33 52 10	MP607	SEE NOTE 14.
BV-203	ACTUATED BALL VALVE	116 EXHAUST TREATMENT	120 V	1	--	0.3 A	0.3 A	Yes	--	CB	--	--	--	--	QLA2-12	33 52 10	MP607	SEE NOTE 15.
BV-211	ACTUATED BALL VALVE	106 GEN RM A	120 V	1	--	0.3 A	0.3 A	Yes	--	CB	--	--	--	--	QLA2-13	33 52 10	MP607	SEE NOTE 14.
BV-221	ACTUATED BALL VALVE	106 GEN RM A	120 V	1	--	0.3 A	0.3 A	Yes	--	CB	--	--	--	--	QLA2-13	33 52 10	MP607	SEE NOTE 14.
CLI	CENTRAL LIGHTING INVERTER	104 ELEC	480 V	3	--	27.0 A	33.8 A	Yes	--	CB	--	--	--	--	NH-4,6,8	26 51 00	--	SEE NOTE 14. CENTRAL LIGHTING INVERTER TO PROVIDE SUFFICIENT POWER TO SUPPLY ALL EMERGENCY LUMINAIRES SERVING BUILDING.
CRANE-A	10T CRANE	106 GEN RM A	480 V	3	20	30.0 A	37.5 A	Yes	4	SPST	60A	--	--	--	QHA1-37,39,41	41 22 13.14	--	SEE NOTES 1, 3.
CRANE-B	10T CRANE	117 GEN RM B	480 V	3	20	30.0 A	37.5 A	Yes	4	SPST	60A	--	--	--	QHB1-27,29,31	41 22 13.14	--	SEE NOTES 1, 3.
D-EF114(E)	LOUVER MOTOR-OPERATED EXHAUST DAMPER	114 SWITCHGEAR UA	120 V	1	--	1.0 A	1.3 A	Yes	7	1 $M	--	--	--	--	QLA1-23	23 09 13	--	SEE NOTE 5.
D-EF114(I)	LOUVER MOTOR-OPERATED INTAKE DAMPER	114 SWITCHGEAR UA	120 V	1	--	1.0 A	1.3 A	Yes	1	$M	--	--	--	--	QLA1-23	23 09 13	--	SEE NOTE 5.
D-EF119(E)	LOUVER MOTOR-OPERATED EXHAUST DAMPER	119 SWITCHGEAR UB	120 V	1	--	1.0 A	1.3 A	Yes	7	$M	--	--	--	--	QLB1-9	23 09 13	--	SEE NOTE 5.
D-EF119(I)	LOUVER MOTOR-OPERATED INTAKE DAMPER	119 SWITCHGEAR UB	120 V	1	--	1.0 A	1.3 A	Yes	1	$M	--	--	--	--	QLB1-9	23 09 13	--	SEE NOTE 5.
D-EF121(E)	LOUVER MOTOR-OPERATED EXHAUST DAMPER	122 NEW OIL STORAGE	120 V	1	--	1.0 A	1.3 A	Yes	7	$M	--	--	--	--	QLB1-14	23 09 13	--	SEE NOTE 5.
D-F(E)	LOUVER MOTOR-OPERATED EXHAUST DAMPER	113 FIRE PUMP	120 V	1	--	1.0 A	1.3 A	Yes	3R	$M	--	--	--	--	NLF-28	23 09 13	--	SEE NOTE 5.
D-GA1(E)	DAMPERS FOR GENERATOR EXHAUST (APPROX. 4)	106 GEN RM A	120 V	1	--	3.0 A	3.8 A	Yes	1	$M	--	--	--	--	GLA1-6	23 09 13	--	SEE NOTE 8.
D-GA2(E)	DAMPERS FOR GENERATOR EXHAUST (APPROX. 4)	106 GEN RM A	120 V	1	--	3.0 A	3.8 A	Yes	1	$M	--	--	--	--	GLA2-5	23 09 13	--	SEE NOTE 8.
D-GB1(E)	DAMPERS FOR GENERATOR EXHAUST (APPROX. 4)	117 GEN RM B	120 V	1	--	3.0 A	3.8 A	Yes	1	$M	--	--	--	--	GLB1-6	23 09 13	--	SEE NOTE 8.
D-GB2(E)	DAMPERS FOR GENERATOR EXHAUST (APPROX. 4)	117 GEN RM B	120 V	1	--	3.0 A	3.8 A	Yes	1	$M	--	--	--	--	GLB2-5	23 09 13	--	SEE NOTE 8.
DDC PANEL A	DIRECT DIGITAL CONTROL PANEL	105 MECHANICAL	120 V	1	--	3.0 A	3.8 A	Yes	--	CB	--	--	--	--	QLA1-13	23 09 00	--	--
DDC PANEL B	DIRECT DIGITAL CONTROL PANEL	105 MECHANICAL	120 V	1	--	3.0 A	3.8 A	Yes	--	CB	--	--	--	--	QLB1-19	23 09 00	--	--
DFP-1	DIESEL FIRE PUMP	113 FIRE PUMP	120 V	1	25	0.0 A	0.0 A	Yes	4	DFPC	--	--	--	--	NLF-26	21 30 00	FX101	--
DFP-EH	DIESEL FIRE PUMP ENGINE HEATER	113 FIRE PUMP	120 V	1	--	8.3 A	10.4 A	Yes	--	CB	--	--	--	--	NLF-24	21 30 00	--	SEE NOTE 14.
EEWS-1A	EMERGENCY EYE WASH STATION	106 GEN RM A	120 V	1	--	5.5 A	6.9 A	Yes	--	CB	--	--	--	--	QLA2-2	22 00 00	P-601	SEE NOTE 14.
EEWS-1B	EMERGENCY EYE WASH STATION	117 GEN RM B	120 V	1	--	5.5 A	6.9 A	Yes	--	CB	--	--	--	--	QLB2-8	22 00 00	P-601	SEE NOTE 14.
EF-102	EXHAUST FAN	102 UNISEX RR	120 V	1	--	0.3 A	0.3 A	Yes	1	1 $M	--	--	--	--	NL-1	23 30 00	MH601	--
EF-111	EXHAUST FAN (SPARK RESISTANT)	111 DAY TANKS A	120 V	1	--	1.5 A	1.9 A	Yes	7	$M	--	--	--	--	QLA1-30	23 30 00	MH601	--
EF-114	EXHAUST FAN (SPARK RESISTANT)	114 SWITCHGEAR UA	208 V	1	1/2	5.4 A	6.8 A	Yes	7	$M(2P)	--	--	--	--	QLA1-19,21	23 30 00	MH601	--
EF-119	EXHAUST FAN (SPARK RESISTANT)	119 SWITCHGEAR UB	208 V	1	1/2	5.4 A	6.8 A	Yes	7	$M(2P)	--	--	--	--	QLB1-5,7	23 30 00	MH601	--
EF-121	EXHAUST FAN (SPARK RESISTANT)	121 FORKLIFT CHARGING	120 V	1	1/40	0.2 A	0.2 A	Yes	7	1 $M	--	--	--	--	QLB1-12	23 30 00	MH601	--
EF-122	EXHAUST FAN	122 NEW OIL STORAGE	120 V	1	1/40	0.2 A	0.2 A	Yes	1	$M	--	--	--	--	QLB1-18	23 30 00	MH601	--

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MARK	DESCRIPTION	DATE
1	AM #0002 - GENERAL REVISIONS	09/19/2025

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ISSUE DATE: 05/01/2025
SOLICITATION NO.: W9128F25RA043
CONTRACT NO.:

DESIGNED BY: E.MCNAMARA
DRAWN BY: E.MCNAMARA
CHECKED BY: B.HOWES
SUBMITTED BY: S.LINDGREN
SIZE: ANSI D
FILE NAME: BUCO00102_DM_ME.rvt

Plot Date: 9/17/2025 2:24:30 PM

US ARMY CORPS OF ENGINEERS
OMAHA DISTRICT
1616 CAPITOL AVE
OMAHA, NE 68102

BUCKLEY SFB, COLORADO
POWER INDEPENDENCE, MISSION CONTROL STATION

EQUIPMENT ELECTRICAL CONNECTION

SHEET ID

EP611

ADVERTISEMENT

EQUIPMENT ELECTRICAL CONNECTION SCHEDULE

E.Q. I.D. TAG	DESCRIPTION	LOCATION	VOLTS	PH	HP	FLA	MCA	PKG UNIT	NEMA ENCL.	DISCONNECT TYPE	DISCONNECT SIZE	DISCONNECT FUSE	STARTER TYPE	STARTER SIZE	PNL-CKT	COORDINATING DOCUMENTS SPECIFICATION(S)	COORDINATING DOCUMENTS SHEET(S)	REMARKS
EF-124	EXHAUST FAN (SPARK RESISTANT)	124 DAY TANKS B	120 V	1	--	1.5 A	1.9 A	Yes	7	1 $M	--	--	--	--	QLB1-28	23 30 00	MH601	--
EFP-1	ELECTRIC FIRE PUMP	113 FIRE PUMP	480 V	3	25	34.0 A	42.5 A	Yes	4	FPCS	--	--	--	--	FPCS-1	21 30 00	FX101	--
EV-1	WALL-MOUNTED ELECTRICAL VEHICLE SUPPLY EQUIPMENT	EXTERIOR EAST	208 V	3	--	20.1 A	25.1 A	Yes	--	CB	--	--	--	--	NL-17,19,21	11 11 37	--	--
FBC-1	FORKLIFT BATTERY CHARGER	121 FORKLIFT CHARGING	480 V	3	--	20.5 A	27.1 A	Yes	--	ECB	--	--	--	--	QHB1-1,3,5	--	--	SEE NOTE 13. THIS ENTRY IS FOR INFRASTRUCTURE (BREAKER, CONDUCTORS, RACEWAY, SEALOFFS, DISCONNECT) FROM SUPPLY PANEL THROUGH AND INCLUDING DISCONNECT LOCAL TO PROPOSED EQUIPMENT LOCATION ONLY. FORKLIFT CHARGING EQUIPMENT FOR THIS ENTRY IS NOT IN SCOPE.
HMI-A1	SCR CONTROLLER: HMI-A1, BP-A1, DB-A1	106 GEN RM A	120 V	1	--	5.0 A	6.3 A	Yes	--	CB	--	--	--	--	GLA1-2	26 32 15	MP607	SEE NOTE 18.
HMI-A2	SCR CONTROLLER: HMI-A2, BP-A2, DB-A2	106 GEN RM A	120 V	1	--	5.0 A	6.3 A	Yes	--	CB	--	--	--	--	GLA2-1	26 32 15	MP607	SEE NOTE 18.
HMI-B1	SCR CONTROLLER: HMI-B1, BP-B1, DB-B1	117 GEN RM B	120 V	1	--	5.0 A	6.3 A	Yes	--	CB	--	--	--	--	GLB1-2	26 32 15	MP607	SEE NOTE 18.
HMI-B2	SCR CONTROLLER: HMI-B2, BP-B2, DB-B2	117 GEN RM B	120 V	1	--	5.0 A	6.3 A	Yes	--	CB	--	--	--	--	GLB2-1	26 32 15	MP607	SEE NOTE 18.
HS-114	HYDROGEN SENSOR PANEL	114 SWITCHGEAR UA	120 V	1	--	4.2 A	5.2 A	Yes	--	CB	--	--	--	--	NLF-11	28 31 70	--	--
HS-119	HYDROGEN SENSOR PANEL	119 SWITCHGEAR UB	120 V	1	--	4.2 A	5.2 A	Yes	--	CB	--	--	--	--	NLF-13	28 31 70	--	--
HS-121	HYDROGEN SENSOR PANEL	121 FORKLIFT CHARGING	120 V	1	--	4.2 A	5.2 A	Yes	--	CB	--	--	--	--	NLF-17	28 31 70	--	--
I20	BALL VALVE	EXTERIOR WEST OPERATING TANKS (NORTH)	480 V	3	1	4.6 A	5.8 A	Yes	--	CB	--	--	--	--	QHA3-1,3,5	33 57 55	--	SEE NOTE 14.
I21	BALL VALVE	EXTERIOR WEST OPERATING TANKS (NORTH)	480 V	3	1	4.6 A	5.8 A	Yes	--	CB	--	--	--	--	QHA3-2,4,6	33 57 55	--	SEE NOTE 14.
I22	BALL VALVE	EXTERIOR WEST OPERATING TANKS (SOUTH)	480 V	3	1	4.6 A	5.8 A	Yes	--	CB	--	--	--	--	QHB3-1,3,5	33 57 55	--	SEE NOTE 14.
I23	BALL VALVE	EXTERIOR WEST OPERATING TANKS (SOUTH)	480 V	3	1	4.6 A	5.8 A	Yes	--	CB	--	--	--	--	QHB3-2,4,6	33 57 55	--	SEE NOTE 14.
ILAP-A	INDEPENDENT LEVEL ALARM PANEL	123 PUMP CTRL B	120 V	1	--	2.0 A	2.5 A	Yes	--	CB	--	--	--	--	QLA1-28	33 56 10	EF528	--
ILAP-B	INDEPENDENT LEVEL ALARM PANEL	123 PUMP CTRL B	120 V	1	--	2.0 A	2.5 A	Yes	--	CB	--	--	--	--	QLB1-26	33 56 10	EF528	--
IP-O1	VERTICAL TURBINE ISSUE PUMP	EXTERIOR WEST OPERATING TANKS (NORTH)	208 V	1	3/4	7.6 A	9.5 A	No	3R	SPST	30A	--	FVNR	00	QLA2-30,32	33 57 55	M-601	SEE NOTE 2.
IP-O2	VERTICAL TURBINE ISSUE PUMP	EXTERIOR WEST OPERATING TANKS (NORTH)	208 V	1	3/4	7.6 A	9.5 A	No	3R	SPST	30A	--	FVNR	00	QLA2-34,36	33 57 55	M-601	SEE NOTE 2.
IP-O3	VERTICAL TURBINE ISSUE PUMP	EXTERIOR WEST OPERATING TANKS (SOUTH)	208 V	1	3/4	7.6 A	9.5 A	No	3R	SPST	30A	--	FVNR	00	QLB2-18,20	33 57 55	M-601	SEE NOTE 2.
IP-O4	VERTICAL TURBINE ISSUE PUMP	EXTERIOR WEST OPERATING TANKS (SOUTH)	208 V	1	3/4	7.6 A	9.5 A	No	3R	SPST	30A	--	FVNR	00	QLB2-22,24	33 57 55	M-601	SEE NOTE 2.
JACE 'A'	JAVA APPLICATION CONTROL ENGINE	110 PUMP CTRL A	120 V	1	--	3.0 A	3.8 A	Yes	--	CB	--	--	--	--	QLA1-22	23 09 23.02 25 10 10	--	--
JACE 'B'	JAVA APPLICATION CONTROL ENGINE	123 PUMP CTRL B	120 V	1	--	3.0 A	3.8 A	Yes	--	CB	--	--	--	--	QLB1-20	23 09 23.02 25 10 10	--	--
JP	JOCKEY PUMP	113 FIRE PUMP	208 V	3	1/2	2.4 A	3.0 A	Yes	4	JPC	--	--	--	--	NLF-8,10,12	21 30 00	FX101	--
LP-1	NEW OIL PUMP	122 NEW OIL STORAGE	480 V	3	1	2.1 A	2.6 A	No	--	ECB	--	--	FVNR	00	QHB2-26,28,30	33 57 55	--	SEE NOTE 13.
LP-2	NEW OIL PUMP	122 NEW OIL STORAGE	480 V	3	1	2.1 A	2.6 A	No	--	ECB	--	--	FVNR	00	QHB2-32,34,36	33 57 55	--	SEE NOTE 13.
NG-C	NITROGEN GENERATOR: COMPRESSOR CIRCUIT	113 FIRE PUMP	208 V	3	--	9.0 A	11.3 A	Yes	--	CB	--	--	--	--	NLF-14,16,18	21 13 18	FX101	SEE NOTE 14.
NG-G	NITROGEN GENERATOR: GENERATOR CIRCUIT	113 FIRE PUMP	120 V	1	--	2.0 A	2.5 A	Yes	--	CB	--	--	--	--	NLF-20	21 13 18	FX101	SEE NOTE 14.
OHD-E	OVERHEAD DOOR	117 GEN RM B	208 V	1	3/4	7.6 A	9.5 A	Yes	--	CB	--	--	--	--	QLB2-11,13	08 33 23	--	SEE NOTE 14.
OHD-N	OVERHEAD DOOR	106 GEN RM A	208 V	1	3/4	7.6 A	9.5 A	Yes	1	1 $M(2P)	30A	--	--	--	QLA2-9,11	08 33 23	--	--
OHD-W	OVERHEAD DOOR	117 GEN RM B	208 V	1	3/4	7.6 A	9.5 A	Yes	1	$M(2P)	30A	--	--	--	QLB2-2,4	08 33 23	--	--
P-001	DEF PUMP	116 EXHAUST TREATMENT	208 V	3	--	12.5 A	15.6 A	Yes	1	SPST	30A	--	--	--	QLA2-14,16,18	33 52 10	MP607	--
P-002	DEF PUMP	116 EXHAUST TREATMENT	120 V	1	1/2	12.0 A	15.0 A	Yes	1	$M	--	--	--	--	QLA2-20	33 52 10	MP607	--
P-003	DEF PUMP	116 EXHAUST TREATMENT	120 V	1	1/2	12.0 A	15.0 A	Yes	1	$M	--	--	--	--	QLA2-22	33 52 10	MP607	--
PCPA	FUEL PUMP CONTROL PANEL	110 PUMP CTRL A	120 V	1	--	25.0 A	31.3 A	Yes	--	CB	--	--	--	--	QLA2-17	33 09 52	EF512	--
PCPB	FUEL PUMP CONTROL PANEL	123 PUMP CTRL B	120 V	1	--	25.0 A	31.3 A	Yes	--	CB	--	--	--	--	QLB2-12	33 09 52	EF512	--
RCP-1	RECIRCULATING PUMP	105 MECHANICAL	120 V	1	--	0.8 A	1.1 A	Yes	1	$M	--	--	--	--	NL-18	22 00 00	P-601	--
SF-A1	GENERATOR SUPPLY FAN	201 MECHANICAL MEZ. GEN RM A	480 V	3	30	40.0 A	50.0 A	Yes	1	SPST	100A	--	VFD	--	QHA1-13,15,17	23 30 00	MH601	--
SF-A2	GENERATOR SUPPLY FAN	201 MECHANICAL MEZ. GEN RM A	480 V	3	30	40.0 A	50.0 A	Yes	1	SPST	100A	--	VFD	--	QHA1-19,21,23	23 30 00	MH601	--
SF-A3	GENERATOR SUPPLY FAN	201 MECHANICAL MEZ. GEN RM A	480 V	3	30	40.0 A	50.0 A	Yes	1	SPST	100A	--	VFD	--	QHA1-25,27,29	23 30 00	MH601	--
SF-A4	GENERATOR SUPPLY FAN	201 MECHANICAL MEZ. GEN RM A	480 V	3	30	40.0 A	50.0 A	Yes	1	SPST	100A	--	VFD	--	QHA1-31,33,35	23 30 00	MH601	--
SF-B1	GENERATOR SUPPLY FAN	202 MECHANICAL MEZ. GEN RM B	480 V	3	30	40.0 A	50.0 A	Yes	1	SPST	100A	--	VFD	--	QHB1-2,4,6	23 30 00	MH601	SEE NOTE 13.
SF-B2	GENERATOR SUPPLY FAN	202 MECHANICAL MEZ. GEN RM B	480 V	3	30	40.0 A	50.0 A	Yes	1	SPST	100A	--	VFD	--	QHB1-8,10,12	23 30 00	MH601	SEE NOTE 13.
SF-B3	GENERATOR SUPPLY FAN	202 MECHANICAL MEZ. GEN RM B	480 V	3	30	40.0 A	50.0 A	Yes	1	SPST	100A	--	VFD	--	QHB1-14,16,18	23 30 00	MH601	--
SF-B4	GENERATOR SUPPLY FAN	202 MECHANICAL MEZ. GEN RM B	480 V	3	30	40.0 A	50.0 A	Yes	1	SPST	100A	--	VFD	--	QHB1-20,22,24	23 30 00	MH601	--
SFD-A1	DAMPERS FOR GENERATOR SUPPLY FAN (APPROX. 4)	202 MECHANICAL MEZ. GEN RM B	120 V	1	--	4.0 A	5.0 A	Yes	1	1 $M	--	--	--	--	QLA2-1	23 09 13	--	--
SFD-A2	DAMPERS FOR GENERATOR SUPPLY FAN (APPROX. 4)	202 MECHANICAL MEZ. GEN RM B	120 V	1	--	4.0 A	5.0 A	Yes	1	$M	--	--	--	--	QLA2-3	23 09 13	--	--
SFD-A3	DAMPERS FOR GENERATOR SUPPLY FAN (APPROX. 4)	202 MECHANICAL MEZ. GEN RM B	120 V	1	--	4.0 A	5.0 A	Yes	1	$M	--	--	--	--	QLA2-5	23 09 13	--	--
SFD-A4	DAMPERS FOR GENERATOR SUPPLY FAN (APPROX. 4)	202 MECHANICAL MEZ. GEN RM B	120 V	1	--	4.0 A	5.0 A	Yes	1	$M	--	--	--	--	QLA2-7	23 09 13	--	--
SFD-B1	DAMPERS FOR GENERATOR SUPPLY FAN (APPROX. 4)	202 MECHANICAL MEZ. GEN RM B	120 V	1	--	4.0 A	5.0 A	Yes	1	$M	--	--	--	--	QLB2-1	23 09 13	--	--
SFD-B2	DAMPERS FOR GENERATOR SUPPLY FAN (APPROX. 4)	202 MECHANICAL MEZ. GEN RM B	120 V	1	--	4.0 A	5.0 A	Yes	1	$M	--	--	--	--	QLB2-3	23 09 13	--	--
SFD-B3	DAMPERS FOR GENERATOR SUPPLY FAN (APPROX. 4)	202 MECHANICAL MEZ. GEN RM B	120 V	1	--	4.0 A	5.0 A	Yes	1	$M	--	--	--	--	QLB2-5	23 09 13	--	--
SFD-B4	DAMPERS FOR GENERATOR SUPPLY FAN (APPROX. 4)	202 MECHANICAL MEZ. GEN RM B	120 V	1	--	4.0 A	5.0 A	Yes	1	$M	--	--	--	--	QLB2-7	23 09 13	--	--
SS-101	SPLIT-SYSTEM INDOOR UNIT	100A READINESS	208 V	1	--	0.7 A	1.0 A	Yes	1	$M(2P)	--	--	--	--	NL-13,15	23 81 00	MH601	NOTE 6.
SS-103	SPLIT-SYSTEM INDOOR UNIT	103 TELE/FA	208 V	1	--	0.7 A	1.0 A	Yes	1	$M(2P)	--	--	--	--	NLT-21,23	23 81 00	MH601	NOTE 6.
SS-104	SPLIT-SYSTEM INDOOR UNIT	104 ELEC	208 V	1	--	0.7 A	1.0 A	Yes	1	$M(2P)	--	--	--	--	NL-9,11	23 81 00	MH601	NOTE 6.
SS-110	SPLIT-SYSTEM INDOOR UNIT	110 PUMP CTRL A	208 V	1	--	0.7 A	1.0 A	Yes	1	$M(2P)	--	--	--	--	QLA2-19,21	23 81 00	MH601	NOTE 6.
SS-112	SPLIT-SYSTEM INDOOR UNIT	112 DISTRO A	208 V	1	--	6.0 A	7.5 A	Yes	1	$M(2P)	--	--	--	--	QLA1-3,5	23 81 00	MH601	--
SS-113	SPLIT-SYSTEM INDOOR UNIT	113 FIRE PUMP	208 V	1	--	0.7 A	1.0 A	Yes	3R 1	$M(2P)	--	--	--	--	NLF-30,32	23 81 00	MH601	NOTE 6.
SS-114	SPLIT-SYSTEM INDOOR UNIT	114 SWITCHGEAR UA	208 V	1	--	0.3 A	1.0 A	Yes	1	$M(2P)	--	--	--	--	QLA1-27,29	23 81 00	MH601	NOTE 6.
SS-115	SPLIT-SYSTEM INDOOR UNIT	115 SWITCHGEAR GA	208 V	1	--	0.3 A	1.0 A	Yes	1	$M(2P)	--	--	--	--	QLA1-31,33	23 81 00	MH601	NOTE 6.
SS-116	SPLIT-SYSTEM INDOOR UNIT	116 EXHAUST TREATMENT	208 V	1	--	0.7 A	1.0 A	Yes	1	$M(2P)	--	--	--	--	QLA2-26,28	23 81 00	MH601	NOTE 6.
SS-118	SPLIT-SYSTEM INDOOR UNIT	118 SWITCHGEAR GB	208 V	1	--	0.3 A	1.0 A	Yes	1	$M(2P)	--	--	--	--	QLB1-21,23	23 81 00	MH601	NOTE 6.
SS-119	SPLIT-SYSTEM INDOOR UNIT	119 SWITCHGEAR UB	208 V	1	--	0.3 A	1.0 A	Yes	1	$M(2P)	--	--	--	--	QLB1-25,27	23 81 00	MH601	NOTE 6.
SS-120	SPLIT-SYSTEM INDOOR UNIT	120 DISTRO B	208 V	1	--	6.0 A	7.5 A	Yes	1	$M(2P)	--	--	--	--	QLB1-15,17	23 81 00	MH601	--
SS-123	SPLIT-SYSTEM INDOOR UNIT	124 PUMP CTRL B	208 V	1	--	0.7 A	1.0 A	Yes	1 1	$M(2P)	--	--	--	--	QLB2-14,16	23 81 00	MH601	NOTE 6.
SSHP-101	SPLIT-SYSTEM OUTDOOR UNIT	EXTERIOR EAST	208 V	1	--	7.9 A	9.9 A	Yes	3R	SPST	30A	--	--	--	NL-13,15	23 81 00	MH601	--
SSHP-103	SPLIT-SYSTEM OUTDOOR UNIT	EXTERIOR NORTH	208 V	1	--	11.0 A	13.8 A	Yes	3R	SPST	30A	--	--	--	NLT-21,23	23 81 00	MH601	--
SSHP-104	SPLIT-SYSTEM OUTDOOR UNIT	EXTERIOR NORTH	208 V	1	--	11.0 A	13.8 A	Yes	3R	SPST	30A	--	--	--	NL-9,11	23 81 00	MH601	--
SSHP-110	SPLIT-SYSTEM OUTDOOR UNIT	EXTERIOR NORTH	208 V	1	--	11.0 A	13.8 A	Yes	3R	SPST	30A	--	--	--	QLA2-19,21	23 81 00	MH601	--
SSHP-112	SPLIT-SYSTEM OUTDOOR UNIT	EXTERIOR SOUTH	208 V	3	--	23.1 A	28.9 A	Yes	3R	SPST	30A	--	--	--	QLA1-7,9,11	23 81 00	MH601	--
SSHP-113	SPLIT-SYSTEM OUTDOOR UNIT	EXTERIOR SOUTH	208 V	1	--	11.0 A	13.8 A	Yes	3R	SPST	30A	--	--	--	NLF-30,32	23 81 00	MH601	--
SSHP-114	SPLIT-SYSTEM OUTDOOR UNIT	EXTERIOR SOUTH	208 V	1	--	11.0 A	13.8 A	Yes	3R	SPST	30A	--	--	--	QLA1-27,29	23 81 00	MH601	--
SSHP-115	SPLIT-SYSTEM OUTDOOR UNIT	EXTERIOR SOUTH	208 V	1	--	11.0 A	13.8 A	Yes	3R	SPST	30A	--	--	--	QLA1-31,33	23 81 00	MH601	--
SSHP-116	SPLIT-SYSTEM OUTDOOR UNIT	EXTERIOR NORTH	208 V	1	--	11.0 A	13.8 A	Yes	3R	SPST	30A	--	--	--	QLA2-26,28	23 81 00	MH601	--
SSHP-118	SPLIT-SYSTEM OUTDOOR UNIT	EXTERIOR SOUTH	208 V	1	--	11.0 A	13.8 A	Yes	3R	SPST	30A	--	--	--	QLB1-21,23	23 81 00	MH601	--
SSHP-119	SPLIT-SYSTEM OUTDOOR UNIT	EXTERIOR SOUTH	208 V	1	--	11.0 A	13.8 A	Yes	3R	SPST	30A	--	--	--	QLB1-25,27	23 81 00	MH601	--
SSHP-120	SPLIT-SYSTEM OUTDOOR UNIT	EXTERIOR SOUTH	208 V	3	--	23.1 A	28.9 A	Yes	3R	SPST	30A	--	--	--	QLB1-29,31,33	23 81 00	MH601	--
SSHP-123	SPLIT-SYSTEM OUTDOOR UNIT	EXTERIOR NORTH	208 V	1	--	11.0 A	13.8 A	Yes	3R	SPST	30A	--	--	--	QLB2-14,16	23 81 00	MH601	--
UH-100	UNIT HEATER	100 VEST.	277 V	1	--	7.2 A	9.0 A	Yes	1	$M	--	--	--	--	NH-2	23 82 46.00 40	MH601	--
UH-104	UNIT HEATER	104 ELEC	480 V	3	--	4.0 A	5.0 A	Yes	1	SPST	30A	--	--	--	NH-10,12,14	23 82 46.00 40	MH601	--
UH-105	UNIT HEATER	105 MECHANICAL	480 V	3	--	4.0 A	5.0 A	Yes	1	SPST	30A	--	--	--	NH-22,24,26	23 82 46.00 40	MH601	--
UH-106NE	UNIT HEATER	106 GEN RM A	480 V	3	--	12.1 A	15.1 A	Yes	1	SPST	30A	--	--	--	QHA4-2,4,6	23 82 46.00 40	MH601	--
UH-106SE	UNIT HEATER	106 GEN RM A	480 V	3	--	12.1 A	15.1 A	Yes	1	SPST	30A	--	--	--	QHA4-14,16,18	23 82 46.00 40	MH601	--
UH-106SW	UNIT HEATER	106 GEN RM A	480 V	3	--	12.1 A	15.1 A	Yes	1	SPST	30A	--	--	--	QHA4-8,10,12	23 82 46.00 40	MH601	--
UH-108E	UNIT HEATER	108 WORKSHOP	480 V	3	--	4.0 A	5.0 A	Yes	1	SPST	30A	--	--	--	QHA2-14,16,18	23 82 46.00 40	MH601	--
UH-108W	UNIT HEATER	108 WORKSHOP	480 V	3	--	4.0 A	5.0 A	Yes	1	SPST	30A	--	--	--	QHA2-8,10,12	23 82 46.00 40	MH601	--
UH-111	UNIT HEATER	111 DAY TANKS A	480 V	3	--	4.3 A	5.4 A	Yes	7	SPST	30A	--	--	--	QHA4-20,22,24	23 82 46.00 40	MH601	--
UH-113	UNIT HEATER	113 FIRE PUMP	480 V	3	--	4.0 A	5.0 A	Yes	3R	SPST	30A	--	--	--	QHA2-2,4,6	23 82 46.00 40	MH601	--
UH-114	UNIT HEATER	114 SWITCHGEAR UA	480 V	3	--	4.0 A	5.0 A	Yes	1	SPST	30A	--	--	--	QHA2-25,27,29	23 82 46.00 40	MH601	--
UH-115	UNIT HEATER	115 SWITCHGEAR GA	480 V	3	--	4.0 A	5.0 A	Yes	1	SPST	30A	--	--	--	QHA2-19,21,23	23 82 46.00 40	MH601	--
UH-116	UNIT HEATER	116 EXHAUST TREATMENT	480 V	3	--	4.0 A	5.0 A	Yes	1	SPST	30A	--	--	--	QHA4-26,28,30	23 82 46.00 40	MH601	--
UH-117NE	UNIT HEATER	117 GEN RM B	480 V	3	--	12.1 A	15.1 A	Yes	1	SPST	30A	--	--	--	QHB4-1,3,5	23 82 46.00 40	MH601	--
UH-117SE	UNIT HEATER	117 GEN RM B	480 V	3	--	12.1 A	15.1 A	Yes	1	SPST	30A	--	--	--	QHB4-13,15,17	23 82 46.00 40	MH601	--
UH-117SW	UNIT HEATER	117 GEN RM B	480 V	3	--	12.1 A	15.1 A	Yes	1	SPST	30A	--	--	--	QHB4-7,9,11	23 82 46.00 40	MH601	--
UH-118	UNIT HEATER	118 SWITCHGEAR GB	480 V	3	--	4.0 A	5.0 A	Yes	1	SPST	30A	--	--	--	QHB2-13,15,17	23 82 46.00 40	MH601	--
UH-119	UNIT HEATER	119 SWITCHGEAR UB	480 V	3	--	4.0 A	5.0 A	Yes	1	SPST	30A	--	--	--	QHB2-7,9,11	23 82 46.00 40	MH601	--
UH-120	UNIT HEATER	120 DISTRO B	480 V	3	--	4.0 A	5.0 A	Yes	--	CB	--	--	--	--	QHB2-14,16,18	23 82 46.00 40	MH601	SEE NOTE 14.
UH-122	UNIT HEATER	122 NEW OIL STORAGE	480 V	3	--	4.0 A	5.0 A	Yes	1	SPST	30A	--	--	--	QHB2-20,22,24	23 82 46.00 40	MH601	--
UH-123	UNIT HEATER	124 PUMP CTRL B	480 V	3	--	4.0 A	5.0 A	Yes	1	SPST	30A	--	--	--	QHB4-25,27,29	23 82 46.00 40	MH601	--
UH-124	UNIT HEATER	124 DAY TANKS B	480 V	3	--	4.3 A	5.4 A	Yes	7	SPST	30A	--	--	--	QHB4-19,21,23	23 82 46.00 40	MH601	--
WE-1	HEATED WATERPROOF EXCLOSURE	EXTERIOR NORTH	120 V	1	--	10.0 A	12.5 A	Yes	1	SPST	30A	--	--	--	QLA2-24	--	MP607	PROVIDE WEATHER-RESISTANT GFCI DOUBLE DUPLEX RECEPTACLE IN ENCLOSURE.
WH-1	STORAGE WATER HEATER	105 MECHANICAL	480 V	3	--	15.0 A	18.8 A	Yes	1	SPST	30A	--	--	--	NH-16,18,20	22 00 00	P-601	--

US Army Corps of Engineers ®

MARK	DESCRIPTION	DATE
1	AM #0002 - GENERAL REVISIONS	09/19/2025

File Path: C:\Users\SEEKINS.RD\Documents\Local Revit Models\BUCO00102_DM_ME_SEEKINS.rvt

Plot Date: 9/17/2025 2:26:57 PM

DESIGNED BY: E.MCNAMARA
DRAWN BY: E.MCNAMARA
CHECKED BY: E.MCNAMARA
SUBMITTED BY: S.LINDGREN
SIZE: ANSI D
ISSUE DATE: 05/01/2025
SOLICITATION NO.: W9128F25RA043
CONTRACT NO.:
FILE NAME: BUCO00102_DM_ME.rvt

US ARMY CORPS OF ENGINEERS
OMAHA DISTRICT
1616 CAPITOL AVE.
OMAHA, NE 68102

BUCKLEY SFB, COLORADO
POWER INDEPENDENCE, MISSION CONTROL STATION

EQUIPMENT ELECTRICAL CONNECTION

SHEET ID

EP612

ADVERTISEMENT

Branch Panel: QHA3

Location: EXTERIOR WEST
Supply From: QHA2
Mounting: Surface
Sections: 1

Enclosure: NEMA 3R
Fault Duty (Minimum): 14kA
Minimum Front Clearance: 4' - 0"
Main Meter: No

Volts: 480/277 Wye
Phases: 3
Wires: 4
Neutral Bus: 100%

Mains Type: MCB
Frame Rating: 100 A
MCB Ampacity Rating: 60 A

MCB Service Rating: Std
MCB Solid State: Yes
MCB Other Features: None

CIRCUIT	MCIT	CCC	NLL	ATZ	SSCB	CB SVC	METER	NOTES	NO	LOAD NAME	LT	CB	P	PHASE A		PHASE B		PHASE C		P	CB	LT	LOAD NAME	NO	NOTES	METER	CB SVC	SSCB	ATZ	NLL	CCC	MCIT	CIRCUIT
3-#12, #12 G, 3/4"C	75	3	No	2	No	Std	No	B	1	I20 OPERATING TANK BALL VALVE	LM...	15 A	3	552 VA	552 VA					3	15 A	M...	I21 OPERATING TANK BALL VALVE	2	B	No	Std	No	2	No	3	75	3-#12, #12 G, 3/4"C
--	--	--	--	--	--	--	--	--	3	--	--	--	--			552 VA	552 VA			--	--	--	--	4	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	5	--	--	--	--					552 VA	552 VA	--	--	--	--	6	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	7	SPARE	--	20 A	3	0 VA	0 VA					3	20 A	--	SPARE	8	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	9	--	--	--	--			0 VA	0 VA			--	--	--	--	10	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	11	--	--	--	--					0 VA	0 VA	--	--	--	--	12	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	13	SPACE ONLY	--	--	1	--	--					1	--	--	SPACE ONLY	14	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	15	SPACE ONLY	--	--	1			--	--			1	--	--	SPACE ONLY	16	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	17	SPACE ONLY	--	--	1					--	--	1	--	--	SPACE ONLY	18	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	19	SPACE ONLY	--	--	1	--	--					1	--	--	SPACE ONLY	20	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	21	SPACE ONLY	--	--	1			--	--			1	--	--	SPACE ONLY	22	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	23	SPACE ONLY	--	--	1					--	--	1	--	--	SPACE ONLY	24	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	25	SPACE ONLY	--	--	1	--	5 VA					3	30 A	O...	PANEL QHA3 SPD	26	K	No	Std	No	2	No	3	75	4-#10, #10 G, 3/4"C
--	--	--	--	--	--	--	--	--	27	SPACE ONLY	--	--	1			--	5 VA			--	--	--	--	28	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	29	SPACE ONLY	--	--	1					--	5 VA	--	--	--	--	30	--	--	--	--	--	--	--	--	--
												Total Load:		1109 VA		1109 VA		1109 VA															
												Total Amps:		4 A		4 A		4 A															
												Phase Imbalance:		0.00%		0.00%		0.00%															

Load Classification		Connected Load	Demand Factor	Estimated Demand
LM	Largest Motor	1656 VA	125.00%	2070 VA
M	Motor	1656 VA	80.00%	1325 VA
O	Other	15 VA	80.00%	12 VA

Panel Totals

Total Connected Load: 3327 VA
Total Estimated Demand: 3407 VA
Total Connected Current: 4 A
Total Estimated Demand Current: 4 A

Notes: SEE ONE-LINE FOR CONSIDERATIONS FOR COLD TEMPERATURES.

1

Branch Panel: QHB3

Location: EXTERIOR WEST
Supply From: QHB2
Mounting: Surface
Sections: 1

Enclosure: NEMA 3R
Fault Duty (Minimum): 18kA
Minimum Front Clearance: 4' - 0"
Main Meter: No

Volts: 480/277 Wye
Phases: 3
Wires: 4
Neutral Bus: 100%

Mains Type: MCB
Frame Rating: 100 A
MCB Ampacity Rating: 60 A

MCB Service Rating: Std
MCB Solid State: Yes
MCB Other Features: None

CIRCUIT	MCIT	CCC	NLL	ATZ	SSCB	CB SVC	METER	NOTES	NO	LOAD NAME	LT	CB	P	PHASE A		PHASE B		PHASE C		P	CB	LT	LOAD NAME	NO	NOTES	METER	CB SVC	SSCB	ATZ	NLL	CCC	MCIT	CIRCUIT
3-#12, #12 G, 3/4"C	75	3	No	2	No	Std	No	B	1	I22 OPERATING TANK BALL VALVE	LM...	15 A	3	552 VA	552 VA					3	15 A	M...	I23 OPERATING TANK BALL VALVE	2	B	No	Std	No	2	No	3	75	3-#12, #12 G, 3/4"C
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--	--	--	--	--	--	--	--	--	27	SPACE ONLY	--	--	1			--	5 VA			--	--	--	--	28	--	--	--	--	--	--	--	--	--
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												Total Load:		1109 VA		1109 VA		1109 VA															
												Total Amps:		4 A		4 A		4 A															
												Phase Imbalance:		0.00%		0.00%		0.00%															

Load Classification		Connected Load	Demand Factor	Estimated Demand
LM	Largest Motor	1656 VA	125.00%	2070 VA
M	Motor	1656 VA	80.00%	1325 VA
O	Other	15 VA	80.00%	12 VA

Panel Totals

Total Connected Load: 3327 VA
Total Estimated Demand: 3407 VA
Total Connected Current: 4 A
Total Estimated Demand Current: 4 A

Notes: SEE ONE-LINE FOR CONSIDERATIONS FOR COLD TEMPERATURES.

1

US Army Corps of Engineers ®

MARK	DESCRIPTION	DATE
1	AM #0002 - GENERAL REVISIONS	09/19/2025

File Path: C:\Users\gfieldsteen\Documents\BUCO00102_DM_ME_gfieldsteen.rvt

ISSUE DATE:	05/01/2025
SOLICITATION NO.:	W9128F25RA043
CONTRACT NO.:	
DESIGNED BY:	E.MCNAMARA
DRAWN BY:	E.MCNAMARA
CHECKED BY:	B.ADKINS
SUBMITTED BY:	
AUTHORIZED BY:	
SIZE:	ANSI D
FILE NAME:	BUCO00102_DM_ME.rvt

Date: 9/18/2025 2:37:36 PM

Plot Date: 9/18/2025 2:37:36 PM

US ARMY CORPS OF ENGINEERS
OMAHA DISTRICT
1616 CAPITOL AVE.
OMAHA, NE 68102

BUCKLEY SFB, COLORADO
POWER INDEPENDENCE, MISSION CONTROL STATION

PANEL SCHEDULES

SHEET ID

EP623

ADVERTISEMENT

Branch Panel: OH

Location: OFFLOAD
Supply From: OFFLOAD MTS-O
Mounting: Surface
Sections: 1

Enclosure: NEMA 3R
Fault Duty (Minimum): 14kA
Minimum Front Clearance: 4' - 0"
Main Meter: No

Volts: 480/277 Wye
Phases: 3
Wires: 4
Neutral Bus: 100%

Mains Type: MCB
Frame Rating: 100 A
MCB Ampacity Rating: 45 A

MCB Service Rating: Std
MCB Solid State: No
MCB Other Features: None

CIRCUIT	MCIT	CCC	NLL	ATZ	SSCB	CB SVC	METER	NOTES	NO	LOAD NAME	LT	CB	P	PHASE A		PHASE B		PHASE C		P	CB	LT	LOAD NAME	NO	NOTES	METER	CB SVC	SSCB	ATZ	NLL	CCC	MCIT	CIRCUIT
3-#12, #12 G, 3/4"C	75	3	No	2	No	Std	No	B	1	OP-001 IN-LINE VERTICAL PUMP	LM...	20 A	3	2493 VA	297 VA					3	30 A	Sp...	TRANSFORMER OTL (PANEL OL)	2	--	No	Std	No	2	No	3	75	3-#10, #10 G, 1"C
--	--	--	--	--	--	--	--	--	3	--	--	--	--			2493 VA	447 VA			--	--	--	--	4	--	--	--	--	--	--	--	--	--
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2-#12, #12 G, 3/4"C	75	2	Yes	2	No	Std	No	--	7	ROAD / AREA LIGHTING	L...	20 A	1	400 VA	--					1	--	--	SPACE ONLY	8	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	9	SPACE ONLY	--	--	1			--	--			1	--	--	SPACE ONLY	10	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	11	SPACE ONLY	--	--	1					--	--	1	--	--	SPACE ONLY	12	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	13	SPACE ONLY	--	--	1	--	5 VA					3	30 A	O...	PANEL OH SPD	14	K	No	Std	No	2	No	3	75	4-#10, #10 G, 3/4"C
--	--	--	--	--	--	--	--	--	15	SPACE ONLY	--	--	1			--	5 VA			--	--	--	--	16	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	17	SPACE ONLY	--	--	1					--	5 VA	--	--	--	--	18	--	--	--	--	--	--	--	--	--
											Total Load:			3195 VA		2945 VA		2765 VA														
											Total Amps:			12 A		11 A		10 A														
											Phase Imbalance:			7.64%		-0.79%		-6.85%														

Load Classification		Connected Load	Demand Factor	Estimated Demand	Panel Totals
L	Lighting	400 VA	100.00%	400 VA	
LM	Largest Motor	7479 VA	125.00%	9349 VA	**Total Connected Load:** 8906 VA
O	Other	60 VA	80.00%	48 VA	**Total Estimated Demand:** 10764 VA
R	Receptacle	180 VA	100.00%	180 VA	**Total Connected Current:** 11 A
T	Transformer Losses	787 VA	100.00%	787 VA	**Total Estimated Demand Current:** 13 A

Notes: SEE ONE-LINE FOR CONSIDERATIONS FOR COLD TEMPERATURES.

1

Branch Panel: OL

Location: OFFLOAD
Supply From: OFFLOAD XFMR OTL
Mounting: Surface
Sections: 1

Enclosure: NEMA 3R
Fault Duty (Minimum): 10kA
Minimum Front Clearance: 3' - 0"
Main Meter: No

Volts: 120/208 Wye
Phases: 3
Wires: 4
Neutral Bus: 100%

Mains Type: MCB
Frame Rating: 100 A
MCB Ampacity Rating: 60 A

MCB Service Rating: Std
MCB Solid State: No
MCB Other Features: None

CIRCUIT	MCIT	CCC	NLL	ATZ	SSCB	CB SVC	METER	NOTES	NO	LOAD NAME	LT	CB	P	PHASE A		PHASE B		PHASE C		P	CB	LT	LOAD NAME	NO	NOTES	METER	CB SVC	SSCB	ATZ	NLL	CCC	MCIT	CIRCUIT
2-#12, #12 G, 3/4"C	75	2	Yes	2	No	Std	No	B	1	GROUND VERIFICATION UNIT	O...	15 A	1	30 VA	--					1	--	--	SPACE ONLY	2	--	--	--	--	--	--	--	--	--
2-#12, #12 G, 3/4"C	75	2	No	2	No	Std	No	--	3	RACK RECEPTACLE	R...	20 A	1			180 VA	--			1	--	--	SPACE ONLY	4	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	5	SPARE	--	20 A	1					0 VA	--	1	--	--	SPACE ONLY	6	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	7	SPARE	--	20 A	1	0 VA	--					1	--	--	SPACE ONLY	8	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	9	SPACE ONLY	--	--	1			--	--			1	--	--	SPACE ONLY	10	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	11	SPACE ONLY	--	--	1					--	--	1	--	--	SPACE ONLY	12	--	--	--	--	--	--	--	--	--
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--	--	--	--	--	--	--	--	--	15	SPACE ONLY	--	--	1			--	5 VA			--	--	--	--	16	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	17	SPACE ONLY	--	--	1					--	5 VA	--	--	--	--	18	--	--	--	--	--	--	--	--	--
											Total Load:			35 VA		185 VA		5 VA														
											Total Amps:			0 A		2 A		0 A														
											Phase Imbalance:			-53.33%		146.67%		-93.33%														

Load Classification		Connected Load	Demand Factor	Estimated Demand	Panel Totals
O	Other	45 VA	80.00%	36 VA	
R	Receptacle	180 VA	100.00%	180 VA	**Total Connected Load:** 225 VA
					Total Estimated Demand: 216 VA
					Total Connected Current: 1 A
					Total Estimated Demand Current: 1 A

Notes: SEE ONE-LINE FOR CONSIDERATIONS FOR COLD TEMPERATURES.

1

FOR KEY, GENERAL NOTES, AND KEYNOTES, SEE SHEET EP620.

US Army Corps of Engineers ®

MARK	DESCRIPTION	DATE
1	AM #0002 - GENERAL REVISIONS	09/19/2025

File Path: C:\Users\gfieldsem\Documents\BUCO00102_DM_ME_gfieldsem.rvt

ISSUE DATE: 05/01/2025
SOLICITATION NO.: W9128F25RA043
CONTRACT NO.:

DESIGNED BY: E.MCNAMARA
DRAWN BY: E.MCNAMARA
CHECKED BY: B.ADKINS
SUBMITTED BY:
J.HEDRICK
SIZE: ANSI D
FILE NAME: BUCO00102_DM_ME.rvt

Date: 9/18/2025 2:37:45 PM
Plot Date:

US ARMY CORPS OF ENGINEERS
OMAHA DISTRICT
1616 CAPITOL AVE.
OMAHA, NE 68102

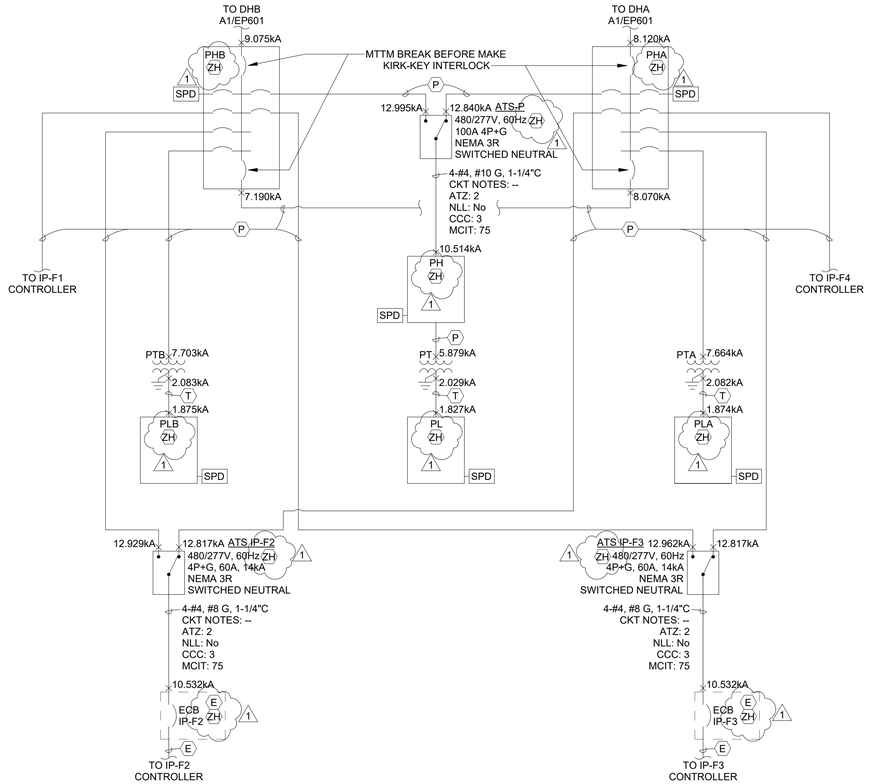
BUCKLEY SFB, COLORADO
POWER INDEPENDENCE: MISSION CONTROL STATION

PANEL SCHEDULES OFFLOAD

SHEET ID

EP631

ADVERTISEMENT



D12 ONE-LINE DIAGRAM: FILTER SHELTER

SCALE: NTS

FOR TRANSFORMER SCHEDULES, GENERAL NOTES, AND KEYNOTES, SEE SHEET EP600.

US Army Corps of Engineers ®

MARK	DESCRIPTION	DATE
1	AM #0002 - GENERAL REVISIONS	09/19/2025

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Plot Date: 9/18/2025 2:37:35 PM

ISSUE DATE: 05/01/2025
SOLICITATION NO.: W9128F25RA043
CONTRACT NO.:
FILE NAME: BUCO00102_DM_ME.rvt

DESIGNED BY: E.MCNAMARA
DRAWN BY: E.MCNAMARA
CHECKED BY: B.ADKINS
SUBMITTED BY: J.MOORE
SIZE: ANSI D

US ARMY CORPS OF ENGINEERS
OMAHA DISTRICT
1616 CAPITOL AVE.
OMAHA, NE 68102

BUCKLEY SFB, COLORADO
POWER INDEPENDENCE, MISSION CONTROL STATION

ONE-LINE DIAGRAM FILTER SHELTER

SHEET ID

EP604S

ADVERTISEMENT

Branch Panel: PHA

Location: FILTER SHELTER
Supply From: 112 SWITCHBOARD DHA
Mounting: Surface
Sections: 1

Enclosure: NEMA 3R
Fault Duty (Minimum): 14kA
Minimum Front Clearance: 4' - 0"
Main Meter: No

Volts: 480/277 Wye
Phases: 3
Wires: 4
Neutral Bus: 100%

Mains Type: MCB
Frame Rating: 100 A
MCB Ampacity Rating: 100 A

MCB Service Rating: Std
MCB Solid State: Yes
MCB Other Features: See Notes "KI" and "SN"

CIRCUIT	MCIT	CCC	NLL	ATZ	SSCB	CB SVC	METER	NOTES	NO	LOAD NAME	LT	CB	P	PHASE A		PHASE B		PHASE C		P	CB	LT	LOAD NAME	NO	NOTES	METER	CB SVC	SSCB	ATZ	NLL	CCC	MCIT	CIRCUIT
4-#4, #8 G, 1-1/4"C	75	3	No	2	No	Std	No	--	1	TRANSFER SWITCH ATS-P (PANEL PH)	Sp...	60 A	3	5272 VA	5 VA					3	30 A	O...	PANEL PHA SPD	2	K	No	Std	No	2	No	3	75	4-#10, #10 G, 3/4"C
--	--	--	--	--	--	--	--	--	3	--	--	--	--			760 VA	5 VA			--	--	--	--	4	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	5	--	--	--	--					1272 VA	5 VA	--	--	--	--	6	--	--	--	--	--	--	--	--	--
4-#4, #8 G, 1-1/4"C	75	3	No	2	Yes	Std	No	--	7	TRANSFER SWITCH ATS IP-F2 (ECB IP-F2)	M...	60 A	3	2382 VA	2382 VA					3	20 A	LM...	IP-F4 VERTICAL TURBINE/CONTROLLER	8	B,L	No	Std	No	2	No	3	75	3-#12, #12 G, 3/4"C
--	--	--	--	--	--	--	--	--	9	--	--	--	--			2382 VA	2382 VA			--	--	--	--	10	--	--	--	--	--	--	--	--	--
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--	--	--	--	--	--	--	--	--	13	SPARE	--	20 A	3	0 VA	2382 VA					3	60 A	M...	TRANSFER SWITCH ATS IP-F3 (ECB IP-F3)	14	--	No	Std	Yes	2	No	3	75	4-#4, #8 G, 1-1/4"C
--	--	--	--	--	--	--	--	--	15	--	--	--	--			0 VA	2382 VA			--	--	--	--	16	--	--	--	--	--	--	--	--	--
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--	--	--	--	--	--	--	--	--	19	SPARE	--	20 A	3	0 VA	267 VA					3	30 A	Sp...	TRANSFORMER PTA (PANEL PLA)	20	--	No	Std	Yes	2	No	3	75	3-#10, #10 G, 3/4"C
--	--	--	--	--	--	--	--	--	21	--	--	--	--			0 VA	1267 VA			--	--	--	--	22	--	--	--	--	--	--	--	--	--
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--	--	--	--	--	--	--	--	--	27	--	--	--	--			0 VA	--			1	--	--	SPACE ONLY	28	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	29	--	--	--	--					0 VA	--	1	--	--	SPACE ONLY	30	--	--	--	--	--	--	--	--	--
4-#1, #8 G, 2"C	75	3	No	2	Yes	Std	No	KI,SFN,V		TIE TO PANEL PHB	P...	100 A	3	4546 VA	--							--	SUBFEED POSITION FOR TIE TO PANEL PHB			--	--	--	--	--	--	--	--
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--	--	--	--	--	--	--	--	--		--	--	--	--					4546 VA	--	--	--	--	--			--	--	--	--	--	--	--	--
											Total Load:			17237 VA		13718 VA		13741 VA														
											Total Amps:			62 A		50 A		50 A														
											Phase Imbalance:			15.69%		-7.92%		-7.77%														

Load Classification		Connected Load	Demand Factor	Estimated Demand
C	Continuous	1504 VA	100.00%	1504 VA
L	Lighting	316 VA	100.00%	316 VA
LM	Largest Motor	7147 VA	125.00%	8933 VA
M	Motor	19293 VA	80.00%	15435 VA
O	Other	60 VA	80.00%	48 VA
P	Power	14638 VA	100.00%	14638 VA
R	Receptacle	180 VA	100.00%	180 VA
T	Transformer Losses	1574 VA	100.00%	1574 VA

Panel Totals

Total Connected Load: 44696 VA
Total Estimated Demand: 42612 VA
Total Connected Current: 54 A
Total Estimated Demand Current: 51 A

Notes: SEE ONE-LINE FOR CONSIDERATIONS FOR COLD TEMPERATURES.

1

Branch Panel: PHB

Location: FILTER SHELTER
Supply From: 120 SWITCHBOARD DHB
Mounting: Surface
Sections: 1

Enclosure: NEMA 3R
Fault Duty (Minimum): 14kA
Minimum Front Clearance: 4' - 0"
Main Meter: No

Volts: 480/277 Wye
Phases: 3
Wires: 4
Neutral Bus: 100%

Mains Type: MCB
Frame Rating: 100 A
MCB Ampacity Rating: 100 A

MCB Service Rating: Std
MCB Solid State: Yes
MCB Other Features: See Note "KI" and "SN"

CIRCUIT	MCIT	CCC	NLL	ATZ	SSCB	CB SVC	METER	NOTES	NO	LOAD NAME	LT	CB	P	PHASE A		PHASE B		PHASE C		P	CB	LT	LOAD NAME	NO	NOTES	METER	CB SVC	SSCB	ATZ	NLL	CCC	MCIT	CIRCUIT
4-#10, #10 G, 3/4"C	75	3	No	2	No	Std	No	K	1	PANEL PHB SPD	O...	30 A	3	5 VA	5272 VA					3	60 A	Sp...	TRANSFER SWITCH ATS-P (PANEL PH)	2	--	No	Std	No	2	No	3	75	4-#4, #8 G, 1-1/4"C
--	--	--	--	--	--	--	--	--	3	--	--	--	--			5 VA	760 VA			--	--	--	--	4	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	5	--	--	--	--					5 VA	1272 VA	--	--	--	--	6	--	--	--	--	--	--	--	--	--
3-#12, #12 G, 3/4"C	75	3	No	2	No	Std	No	B,L	7	IP-F1 VERTICAL TURBINE/CONTROLLER	LM...	20 A	3	2382 VA	2382 VA					3	60 A	M...	TRANSFER SWITCH ATS IP-F3 (ECB IP-F3)	8	--	No	Std	Yes	2	No	3	75	4-#4, #8 G, 1-1/4"C
--	--	--	--	--	--	--	--	--	9	--	--	--	--			2382 VA	2382 VA			--	--	--	--	10	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	11	--	--	--	--					2382 VA	2382 VA	--	--	--	--	12	--	--	--	--	--	--	--	--	--
4-#4, #8 G, 1-1/4"C	75	3	No	2	Yes	Std	No	--	13	TRANSFER SWITCH ATS IP-F2 (ECB IP-F2)	M...	60 A	3	2382 VA	0 VA					3	20 A	--	SPARE	14	--	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	15	--	--	--	--			2382 VA	0 VA			--	--	--	--	16	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	17	--	--	--	--					2382 VA	0 VA	--	--	--	--	18	--	--	--	--	--	--	--	--	--
3-#10, #10 G, 3/4"C	75	3	No	2	Yes	Std	No	-	19	TRANSFORMER PTB (PANEL PLB)	Sp...	30 A	3	267 VA	0 VA					3	20 A	-	SPARE	20	--	-	-	-	-	-	-	-	-	-
--	--	--	--	--	--	--	--	--	21	--	--	--	--			771 VA	0 VA			--	--	--	--	22	--	--	--	--	--	--	--	--	--
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--	--	--	--	--	--	--	--	--	25	SPACE ONLY	--	--	1	--	0 VA					3	20 A	--	SPARE	26	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	27	SPACE ONLY	--	--	1			--	0 VA			--	--	--	--	28	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	29	SPACE ONLY	--	--	1					--	0 VA	--	--	--	--	30	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--		SUBFEED POSITION FOR TIE TO PANEL PHB	--	--		--	4546 VA					3	100 A	P...	TIE TO PANEL PHA		KI,SN	No	Std	Yes	2	No	3	--	See Panel Schedule PHA for Tie Conductors
--	--	--	--	--	--	--	--	--		--	--	--	--			--	4546 VA			--	--	--	--			--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--		--	--	--						--	4546 VA	--	--	--	--			--	--	--	--	--	--	--	--
											Total Load:			17237 VA		13222 VA		14237 VA														
											Total Amps:			63 A		48 A		52 A														
											Phase Imbalance:			15.69%		-11.25%		-4.44%														

Load Classification		Connected Load	Demand Factor	Estimated Demand
C	Continuous	1504 VA	100.00%	1504 VA
L	Lighting	316 VA	100.00%	316 VA
LM	Largest Motor	7147 VA	125.00%	8933 VA
M	Motor	19293 VA	80.00%	15435 VA
O	Other	60 VA	80.00%	48 VA
P	Power	14638 VA	100.00%	14638 VA
R	Receptacle	180 VA	100.00%	180 VA
T	Transformer Losses	1574 VA	100.00%	1574 VA

Panel Totals

Total Connected Load: 44696 VA
Total Estimated Demand: 42612 VA
Total Connected Current: 54 A
Total Estimated Demand Current: 51 A

Notes: SEE ONE-LINE FOR CONSIDERATIONS FOR COLD TEMPERATURES.

1

SEE SHEET EP620 FOR NOTES, KEY, AND LEGEND.

US Army Corps of Engineers ®

MARK	DESCRIPTION	DATE
1	AM #0002 - GENERAL REVISIONS	09/19/2025

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US ARMY CORPS OF ENGINEERS
OMAHA DISTRICT
1616 CAPITOL AVE.
OMAHA, NE 68102

DESIGNED BY: E.MCNAMARA
DRAWN BY: E.MCNAMARA
CHECKED BY: B.ADKINS
SUBMITTED BY: J.HEDRICK
SIZE: ANSI D
FILE NAME: BUCO00102_DM_ME.rvt

ISSUE DATE: 05/01/2025
SOLICITATION NO.: W9128F25RA043
CONTRACT NO.:

Date: 9/18/2025 2:37:51 PM
Plot Date: 9/18/2025 2:37:51 PM

BUCKLEY SFB, COLORADO
POWER INDEPENDENCE: MISSION CONTROL STATION

PANEL SCHEDULES FILTER SHELTER

SHEET ID

EP632S

ADVERTISEMENT

Branch Panel: PH

Location: FILTER SHELTER
Supply From: FILTER SHELTER ATS-P
Mounting: Surface
Sections: 1

Enclosure: NEMA 3R
Fault Duty (Minimum): 14kA
Minimum Front Clearance: 4' - 0"
Main Meter: No

Volts: 480/277 Wye
Phases: 3
Wires: 4
Neutral Bus: 100%

Mains Type: MCB
Frame Rating: 100 A
MCB Ampacity Rating: 60 A

MCB Service Rating: Std
MCB Solid State: Yes
MCB Other Features: None

CIRCUIT	MCIT	CCC	NLL	ATZ	SSCB	CB SVC	METER	NOTES	NO	LOAD NAME	LT	CB	P	PHASE A		PHASE B		PHASE C		P	CB	LT	LOAD NAME	NO	NOTES	METER	CB SVC	SSCB	ATZ	NLL	CCC	MCIT	CIRCUIT
3-#10, #10 G, 3/4"C	75	3	No	2	Yes	Std	No	--	1	TRANSFORMER PT (PANEL PL)	Sp...	30 A	3	267 VA	--					1	--	--	SPACE ONLY	2	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	3	--	--	--	--			447 VA	--			1	--	--	SPACE ONLY	4	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	5	--	--	--	--					1267 VA	--	1	--	--	SPACE ONLY	6	--	--	--	--	--	--	--	--	--
2-#10, #10 G, 3/4"C	75	2	No	2	No	Std	No	B,L	7	HT-HEAT TRACE	M...	25 A	1	5000 VA	--					1	--	--	SPACE ONLY	8	--	--	--	--	--	--	--	--	--
2-#12, #12 G, 3/4"C	75	2	Yes	2	No	Std	No	--	9	CANOPY LIGHTING	L...	20 A	1			316 VA	--			1	--	--	SPACE ONLY	10	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	11	SPACE ONLY	--	--	1					--	--	1	--	--	SPACE ONLY	12	--	--	--	--	--	--	--	--	--
4-#10, #10 G, 3/4"C	75	3	No	2	No	Std	No	K	13	PANEL PH SPD	O...	30 A	3	5 VA	--					1	--	--	SPACE ONLY	14	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	15	--	--	--	--			5 VA	--			1	--	--	SPACE ONLY	16	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	17	--	--	--	--					5 VA	--	1	--	--	SPACE ONLY	18	--	--	--	--	--	--	--	--	--
											Total Load:			5272 VA		760 VA		1272 VA														
											Total Amps:			19 A		3 A		5 A														
											Phase Imbalance:			116.55%		-68.80%		-47.74%														

Load Classification		Connected Load	Demand Factor	Estimated Demand	Panel Totals
C	Continuous	1000 VA	100.00%	1000 VA	
L	Lighting	316 VA	100.00%	316 VA	**Total Connected Load:** 7298 VA
M	Motor	5000 VA	80.00%	4000 VA	**Total Estimated Demand:** 6293 VA
O	Other	30 VA	80.00%	24 VA	**Total Connected Current:** 9 A
R	Receptacle	180 VA	100.00%	180 VA	**Total Estimated Demand Current:** 8 A
T	Transformer Losses	787 VA	100.00%	787 VA	

Notes: SEE ONE-LINE FOR CONSIDERATIONS FOR COLD TEMPERATURES.

1

Branch Panel: PL

Location: FILTER SHELTER
Supply From: FILTER SHELTER XFMR PT
Mounting: Surface
Sections: 1

Enclosure: NEMA 3R
Fault Duty (Minimum): 10kA
Minimum Front Clearance: 3' - 0"
Main Meter: No

Volts: 120/208 Wye
Phases: 3
Wires: 4
Neutral Bus: 100%

Mains Type: MCB
Frame Rating: 100 A
MCB Ampacity Rating: 50 A

MCB Service Rating: Std
MCB Solid State: Yes
MCB Other Features: None

CIRCUIT	MCIT	CCC	NLL	ATZ	SSCB	CB SVC	METER	NOTES	NO	LOAD NAME	LT	CB	P	PHASE A		PHASE B		PHASE C		P	CB	LT	LOAD NAME	NO	NOTES	METER	CB SVC	SSCB	ATZ	NLL	CCC	MCIT	CIRCUIT
--	--	--	--	--	--	--	--	--	1	SPARE	--	20 A	1	0 VA	--					1	--	--	SPACE ONLY	2	--	--	--	--	--	--	--	--	--
2-#12, #12 G, 3/4"C	75	2	No	2	No	Std	No	--	3	RACK RECEPTACLE	R...	20 A	1			180 VA	--			1	--	--	SPACE ONLY	4	--	--	--	--	--	--	--	--	--
2-#12, #12 G, 3/4"C	75	2	No	2	No	Std	No	B,VM	5	EW-C ELECTRIC WATER BLANKET	C...	20 A	1					1000 VA	--	1	--	--	SPACE ONLY	6	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	7	SPARE	--	20 A	1	0 VA	--					1	--	--	SPACE ONLY	8	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	9	SPARE	--	20 A	1			0 VA	--			1	--	--	SPACE ONLY	10	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	11	SPACE ONLY	--	--	1					--	--	1	--	--	SPACE ONLY	12	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	13	SPACE ONLY	--	--	1	--	5 VA					3	30 A	O...	PANEL PL SPD	14	K	No	Std	No	2	No	3	75	4-#10, #10 G, 3/4"C
--	--	--	--	--	--	--	--	--	15	SPACE ONLY	--	--	1			--	5 VA			--	--	--	--	16	--	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	17	SPACE ONLY	--	--	1					--	5 VA	--	--	--	--	18	--	--	--	--	--	--	--	--	--
											Total Load:			5 VA		185 VA		1005 VA														
											Total Amps:			0 A		2 A		9 A														
											Phase Imbalance:			-98.74%		-53.56%		152.30%														

Load Classification		Connected Load	Demand Factor	Estimated Demand	Panel Totals
C	Continuous	1000 VA	100.00%	1000 VA	
O	Other	15 VA	80.00%	12 VA	**Total Connected Load:** 1195 VA
R	Receptacle	180 VA	100.00%	180 VA	**Total Estimated Demand:** 1192 VA
					Total Connected Current: 3 A
					Total Estimated Demand Current: 3 A

Notes: SEE ONE-LINE FOR CONSIDERATIONS FOR COLD TEMPERATURES.

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MARK	DESCRIPTION	DATE
1	AM #0002 - GENERAL REVISIONS	09/19/2025

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Plot Date: 9/18/2025 2:37:58 PM

ISSUE DATE: 05/01/2025
SOLICITATION NO.: W9128F25RA043
CONTRACT NO.:

DESIGNED BY: E.MCNAMARA
DRAWN BY: E.MCNAMARA
CHECKED BY: B.ADKINS
SUBMITTED BY: J.HEDRICK
SIZE: ANSI D
FILE NAME: BUCC00102_DM_ME.rvt

US ARMY CORPS OF ENGINEERS
OMAHA DISTRICT
1616 CAPITOL AVE.
OMAHA, NE 68102

BUCKLEY SFB, COLORADO
POWER INDEPENDENCE: MISSION CONTROL STATION

PANEL SCHEDULES FILTER SHELTER

SHEET ID

EP633S

ADVERTISEMENT

Branch Panel: PLA

Location: FILTER SHELTER
Supply From: FILTER SHELTER XFMR PTA
Mounting: Surface
Sections: 1

Enclosure: NEMA 3R
Fault Duty (Minimum): 10kA
Minimum Front Clearance: 4' - 0"
Main Meter: No

Volts: 120/208 Wye
Phases: 3
Wires: 4
Neutral Bus: 100%

Mains Type: MCB
Frame Rating: 100 A
MCB Ampacity Rating: 50 A

MCB Service Rating: Std
MCB Solid State: Yes
MCB Other Features: None

CIRCUIT	MCIT	CCC	NLL	ATZ	SSCB	CB SVC	METER	NOTES	NO	LOAD NAME	LT	CB	P	PHASE A		PHASE B		PHASE C		P	CB	LT	LOAD NAME	NO	NOTES	METER	CB SVC	SSCB	ATZ	NLL	CCC	MCIT	CIRCUIT
--	--	--	--	--	--	--	--	--	1	SPARE	--	20 A	1	0 VA	--					1	--	--	SPACE ONLY	2	--	--	--	--	--	--	--	--	--
2-#12, #12 G, 3/4"C	75	2	Yes	2	No	Std	No	--	3	FIBER CONVERTER A	P...	20 A	1			1000 VA	--			1	--	--	SPACE ONLY	4	--	--	--	--	--	--	--	--	--
2-#12, #12 G, 3/4"C	75	2	No	2	No	Std	No	B	5	SHA SUMP HEATER A	C...	15 A	1					504 VA	--	1	--	--	SPACE ONLY	6	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	7	SPARE	--	20 A	1	0 VA	--					1	--	--	SPACE ONLY	8	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	9	SPACE ONLY	--	--	1			--	--			1	--	--	SPACE ONLY	10	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	11	SPACE ONLY	--	--	1					--	--	1	--	--	SPACE ONLY	12	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	13	SPACE ONLY	--	--	1	--	5 VA					3	30 A	O...	PANEL PLA SPD	14	K	No	Std	No	2	No	3	75	4-#10, #10 G, 3/4"C
--	--	--	--	--	--	--	--	--	15	SPARE	--	20 A	1			0 VA	5 VA			--	--	--	--	16	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	17	SPARE	--	20 A	1					0 VA	5 VA	--	--	--	--	18	--	--	--	--	--	--	--	--	--
											Total Load:			5 VA		1005 VA		509 VA														
											Total Amps:			0 A		9 A		5 A														
											Phase Imbalance:			-99.01%		98.49%		0.53%														

Load Classification		Connected Load	Demand Factor	Estimated Demand	Panel Totals
C	Continuous	504 VA	100.00%	504 VA	
O	Other	15 VA	80.00%	12 VA	**Total Connected Load:** 1519 VA
P	Power	1000 VA	100.00%	1000 VA	**Total Estimated Demand:** 1516 VA
					Total Connected Current: 4 A
					Total Estimated Demand Current: 4 A

Notes: SEE ONE-LINE FOR CONSIDERATIONS FOR COLD TEMPERATURES.

1

Branch Panel: PLB

Location: FILTER SHELTER
Supply From: FILTER SHELTER XFMR PTB
Mounting: Surface
Sections: 1

Enclosure: NEMA 3R
Fault Duty (Minimum): 10kA
Minimum Front Clearance: 4' - 0"
Main Meter: No

Volts: 120/208 Wye
Phases: 3
Wires: 4
Neutral Bus: 100%

Mains Type: MCB
Frame Rating: 100 A
MCB Ampacity Rating: 50 A

MCB Service Rating: Std
MCB Solid State: Yes
MCB Other Features: None

CIRCUIT	MCIT	CCC	NLL	ATZ	SSCB	CB SVC	METER	NOTES	NO	LOAD NAME	LT	CB	P	PHASE A		PHASE B		PHASE C		P	CB	LT	LOAD NAME	NO	NOTES	METER	CB SVC	SSCB	ATZ	NLL	CCC	MCIT	CIRCUIT
--	--	--	--	--	--	--	--	--	1	SPARE	--	20 A	1	0 VA	--					1	--	--	SPACE ONLY	2	--	--	--	--	--	--	--	--	--
2-#12, #12 G, 3/4"C	75	2	No	2	No	Std	No	B	3	SHB SUMP HEATER B	C...	15 A	1			504 VA	--			1	--	--	SPACE ONLY	4	--	--	--	--	--	--	--	--	--
2-#12, #12 G, 3/4"C	75	2	Yes	2	No	Std	No	--	5	FIBER CONVERTER B	P...	20 A	1					1000 VA	--	1	--	--	SPACE ONLY	6	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	7	SPARE	--	20 A	1	0 VA	--					1	--	--	SPACE ONLY	8	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	9	SPACE ONLY	--	--	1			--	--			1	--	--	SPACE ONLY	10	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	11	SPACE ONLY	--	--	1					--	--	1	--	--	SPACE ONLY	12	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	13	SPACE ONLY	--	--	1	--	5 VA					3	30 A	O...	PANEL PLB SPD	14	K	No	Std	No	2	No	3	75	4-#10, #10 G, 3/4"C
--	--	--	--	--	--	--	--	--	15	SPARE	--	20 A	1			0 VA	5 VA			--	--	--	--	16	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	17	SPARE	--	20 A	1					0 VA	5 VA	--	--	--	--	18	--	--	--	--	--	--	--	--	--
											Total Load:			5 VA		509 VA		1005 VA														
											Total Amps:			0 A		5 A		9 A														
											Phase Imbalance:			-99.01%		0.53%		98.49%														

Load Classification		Connected Load	Demand Factor	Estimated Demand	Panel Totals
C	Continuous	504 VA	100.00%	504 VA	
O	Other	15 VA	80.00%	12 VA	**Total Connected Load:** 1519 VA
P	Power	1000 VA	100.00%	1000 VA	**Total Estimated Demand:** 1516 VA
					Total Connected Current: 4 A
					Total Estimated Demand Current: 4 A

Notes: SEE ONE-LINE FOR CONSIDERATIONS FOR COLD TEMPERATURES.

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US Army Corps of Engineers ®

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Plot Date: 9/18/2025 2:38:04 PM

US ARMY CORPS OF ENGINEERS
OMAHA DISTRICT
1616 CAPITOL AVE.
OMAHA, NE 68102

BUCKLEY SFB, COLORADO
POWER INDEPENDENCE: MISSION CONTROL STATION

PANEL SCHEDULES FILTER SHELTER

SHEET ID

EP634S

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