Preparing Activity: NAVFAC Superseding
UFGS-26 05 33 (January 2007)

UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated July 2023
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SECTION TABLE OF CONTENTS

DIVISION 26 - ELECTRICAL

SECTION 26 05 33

DOCKSIDE POWER CONNECTION STATIONS

02/22

PART 1 GENERAL

1.1 REFERENCES
1.2 RELATED REQUIREMENTS
1.3 DEFINITIONS
1.4 SUBMITTALS
1.5 QUALITY ASSURANCE
1.5.1 Drawings
1.5.2 Regulatory Requirements
1.5.3 Standard Products
1.5.3.1 Alternative Qualifications
1.5.3.2 Material and Equipment Manufacturing Date
1.6 WARRANTY
1.7 MAINTENANCE
1.7.1 Operation and Maintenance Data

PART 2 PRODUCTS

2.1 600 V POWER CONNECTION STATION
2.1.1 Enclosure Integrity
2.1.2 600 V Single Pole Connectors
2.1.2.1 Panel Mount Connectors
2.1.2.2 Cable Mount In-Line Connectors
2.1.3 600 V Power Receptacle
2.1.4 Industrial Service Auxiliary Devices
2.1.4.1 Shunt Trip Pushbutton Control
2.1.4.2 Fusing
2.1.4.3 Circuit Breaker
2.1.4.4 Circuit Breaker Operating Mechanism
2.1.5 Metering Accessories
2.1.5.1 Watt-hour Meter
2.1.5.2 Current Transformers
2.1.5.3 Watt-hour Meter/Current Transformer Cabinet
2.1.6 Enclosure Configurations

2.2 15 KV POWER CONNECTION STATION
2.2.1 Enclosure Integrity
2.2.2 15 kV Cable Couplers
2.2.3 Separable Insulated Connectors and Accessories
2.2.3.1 Deadbreak Junctions
2.2.3.2 Insulated High-Voltage Connectors
2.2.4 Flexible Power Cable
2.2.5 Enclosure Configuration
2.3 SHIP SERVICE EMERGENCY TRIP PANEL
2.4 MANUFACTURER'S NAMEPLATE
2.5 FIELD FABRICATED NAMEPLATES
2.6 WARNING SIGNS
2.7 SOURCE QUALITY CONTROL
2.7.1 Paint Coating System
2.7.2 600 V Single Pole Connector Compatibility Tests
2.7.2.1 Impact Test
2.7.2.2 Pull Strain Test
2.7.2.3 Shear Test
2.7.2.4 Torque Test
2.7.2.5 Heat Rise Test
2.7.2.6 Moisture Resistance Test
2.7.2.7 Dielectric Voltage Withstand Test
2.7.2.8 Insulation Resistance Test
2.7.3 600 V Single Pole Connector Torque Test
2.7.4 Power Receptacle and Plug Assembly Tests
2.7.5 15 kV Cable Coupler Design Tests

PART 3 EXECUTION

3.1 INSTALLATION
3.2 POWER CONNECTION STATION GROUNDING
3.3 FIELD APPLIED PAINTING
3.4 FIELD FABRICATED NAMEPLATE MOUNTING
3.5 WARNING SIGN MOUNTING
3.6 FIELD QUALITY CONTROL
3.6.1 Performance of Acceptance Checks and Tests
3.6.1.1 Power Connection Stations and Control Panels
3.6.1.2 Current Transformers
3.6.1.3 Watt-hour Meters
3.6.1.4 Circuit Breakers
3.7 DEMONSTRATION

-- End of Section Table of Contents --

UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated July 2023
****

SECTION 26 05 33

DOCKSIDE POWER CONNECTION STATIONS
02/22

****
NOTE: This guide specification covers 600 V and 15 kV dockside power connection stations for use in 480 V, 4160 V, and 13.8 kV ship service and 480 V industrial service electrical distribution systems meeting the requirements of UFC 4-150-02, "DOCKSIDE UTILITIES FOR SHIP SERVICE". This specification section shall be referenced in Section 26 11 16 SECONDARY UNIT SUBSTATIONS and Section 26 11 13.00 20 PRIMARY UNIT SUBSTATION when the power connection stations are to be included as an auxiliary compartment of the switchgear associated with a secondary or primary unit substation being provided for electrical ship service.

Use the following related guide specification for associated power distribution equipment:

--Section 26 08 00 APPARATUS INSPECTION AND TESTING
--Section 26 12 19.10 THREE-PHASE, LIQUID-FILLED PAD-MOUNTED TRANSFORMERS
--Section 33 71 02 UNDERGROUND ELECTRICAL DISTRIBUTION
--Section 26 11 16 SECONDARY UNIT SUBSTATIONS
--Section 26 11 13.00 20 PRIMARY UNIT SUBSTATION
--Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM

Before preparing plans and specifications for a specific project, consult Unified Facilities Criteria UFC 4-150-02, "DOCKSIDE UTILITIES FOR SHIP SERVICE" demand and service requirements.

Adhere to UFC 1-300-02 Unified Facilities Guide Specifications (UFGS) Format Standard when editing this guide specification or preparing new project specification sections. Edit this guide specification for project specific requirements by adding, deleting, or revising text. For bracketed items, choose applicable item(s) or insert appropriate information.

Remove information and requirements not required in respective project, whether or not brackets are present.

Comments, suggestions and recommended changes for this guide specification are welcome and should be submitted as a Criteria Change Request (CCR).

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NOTE: This section contains the following ACAD files (Graphics) which are available in metric (SI) and U.S. Customary (IP) system dimensions. Use files to develop project specific drawings. Files may be modified as necessary.

File Name	TITLE
26 05 33-Layout 1 (SI	600 V Ship Service Power Connection Station
26 05 33-Layout 1 (IP)	600 V Ship Service Power Connection Station
26 05 33-Layout 2 (SI)	600 V Industrial Service Power Connection Station
26 05 33-Layout 2 (IP)	600 V Industrial Service Power Connection Station
26 05 33-Layout 3 (SI)	15 kV Power Connection Station
26 05 33-Layout 3 (IP)	15 kV Power Connection Station

NOTE: Do not include this index in project specification.

NOTE: To download UFGS Forms, Graphics, and Tables, go to: http://www.wbdg.org/ffc/dod/unified-facilities-guide-specifications-ufgs/forms-graphics-tables

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NOTE: This section contains links to the following Shore Power Cable and Connector requirement documents in PDF form. Use these files to develop procurement specifications for components required in OPNAVINST 11310.2B, Operation and Maintenance Policy for Shore-to Ship Power and UFC 4-150-02, "Dockside Utilities for Ship Service". Do not include this index in project specifications.

File (Package) Name	TITLE
26 05 33 Pkg 1	Enhanced Low Voltage Portable Power Cables, 600V
26 05 33 Pkg 2	Enhanced Plus Low Voltage Portable Power Cables, 600V
26 05 33 Pkg 3	Medium Voltage Portable Power Cables, 350 KCMIL, 8KV
26 05 33 Pkg 4	Medium Voltage Portable Power Cables, 500 KCMIL, 8KV
26 05 33 Pkg 5	Medium Voltage Portable Power Cables, 350 KCMIL, 15KV
26 05 33 Pkg 6	Medium Voltage Portable Power Cables, 500 KCMIL, 15KV
26 05 33 Pkg 7	Single Pole Inline Connectors, 600V
26 05 33 Pkg 8	Cable Couplers, 15KV

NOTE: To download UFGS Forms, Graphics, and Tables, go to: http://www.wbdg.org/ffc/dod/unified-facilities-guide-specifications-ufgs/forms-graphics-tables

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NOTE: The following information should be indicated on the project drawings or specified in the project specifications.

1. Site Plan showing location, space available, and desired arrangement of power connection station.

2. Single-line diagram showing number and configuration of power connection stations; type, number, and size of conductors for each circuit; metering; and power cable terminations.

3. Floor plan, and elevation and section views of power connection stations as necessary indicating the number and configuration of receptacles, auxiliary devices, and metering accessories.

4. Control diagrams showing operation of circuit breakers, emergency trip pushbuttons, shunt trip

pushbuttons, electric interlock switches, and control cabling between power connection stations, emergency trip panels, and associated unit substation switchgear.
****

PART 1 GENERAL

1.1 REFERENCES

****
NOTE: This paragraph is used to list the publications cited in the text of the guide specification. The publications are referred to in the text by basic designation only and listed in this paragraph by organization, designation, date, and title.

Use the Reference Wizard's Check Reference feature when you add a Reference Identifier (RID) outside of the Section's Reference Article to automatically place the reference in the Reference Article. Also use the Reference Wizard's Check Reference feature to update the issue dates.

References not used in the text will automatically be deleted from this section of the project specification when you choose to reconcile references in the publish print process.
****

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 A167	(2011) Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
ASTM B33	(2010; R 2020) Standard Specification for Tinned Soft or Annealed Copper Wire for Electrical Purposes
ASTM D709	(2017) Standard Specification for Laminated Thermosetting Materials
ASTM D1535	(2014; R 2018) Standard Practice for Specifying Color by the Munsell System
ASTM D2240	(2015; E 2017) Standard Test Method for Rubber Property - Durometer Hardness

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE 100	(2000; Archived) The Authoritative Dictionary of IEEE Standards Terms
IEEE 386	(2016) Separable Insulated Connector Systems for Power Distribution Systems Rated 2.5 kV through 35 kV
IEEE C2	(2023) National Electrical Safety Code
IEEE C57.12.28	(2014) Standard for Pad-Mounted Equipment - Enclosure Integrity
IEEE C57.13	(2016) Standard Requirements for Instrument Transformers

INTERNATIONAL ELECTRICAL TESTING ASSOCIATION (NETA)

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

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

ANSI C12.7	(2022) Requirements for Watthour Meter Sockets
NEMA WC 58/ICEA S-75-381	(2008) Portable and Power Feeder Cables for Use in Mines and Similar Applications

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2023) National Electrical Code

U.S. DEPARTMENT OF DEFENSE (DOD)

MIL-C-24368/1	(2021; Rev C) Connector Assemblies; Plug, Power Transfer, Shore to Ship and Ship to Ship, 500 Volts, 500 Amperes, 60 Hertz, Symbol Number 1160
MIL-C-24368/2	(2021; Rev B) Connector Assemblies; Receptacle, and Receptacle-Cabled, Power Transfer, Shore to Ship and Ship to Ship, 500 Volts, 500 Amperes, 60 Hertz, Symbol Number 1161
MIL-DTL-24643/3	(2009; Rev E) Cable, Electrical, -20 Degrees C to +90 Degrees, 600 Volts, Types LSSHOF, LSDHOF, LSTHOF, and LSFHOF

UNDERWRITERS LABORATORIES (UL)

UL 50	(2015) UL Standard for Safety Enclosures for Electrical Equipment, Non-Environmental Considerations

UL 94	(2023; Reprint May 2023) UL Standard for Safety Tests for Flammability of Plastic Materials for Parts in Devices and Appliances
UL 489	(2016; Rev 2019) UL Standard for Safety Molded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures

1.2 RELATED REQUIREMENTS

Section 26 08 00 APPARATUS INSPECTION AND TESTING applies to this section, with the additions and modifications specified herein.

1.3 DEFINITIONS

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

1.4 SUBMITTALS

****

NOTE: Review Submittal Description (SD) definitions in Section 01 33 00 SUBMITTAL PROCEDURES and edit the following list, and corresponding submittal items in the text, to reflect only the submittals required for the project. The Guide Specification technical editors have classified those items that require Government approval, due to their complexity or criticality, with a "G." Generally, other submittal items can be reviewed by the Contractor's Quality Control System. Only add a "G" to an item if the submittal is sufficiently important or complex in context of the project.

For Army projects, fill in the empty brackets following the "G" classification, with a code of up to three characters to indicate the approving authority. Codes for Army projects using the Resident Management System (RMS) are: "AE" for Architect-Engineer; "DO" for District Office (Engineering Division or other organization in the District Office); "AO" for Area Office; "RO" for Resident Office; and "PO" for Project Office. Codes following the "G" typically are not used for Navy, Air Force, and NASA projects.

The "S" classification indicates submittals required as proof of compliance for sustainability Guiding Principles Validation or Third Party Certification and as described in Section 01 33 00 SUBMITTAL PROCEDURES.

Choose the first bracketed item for Navy, Air Force, and NASA projects, or choose the second bracketed item for Army projects.

****

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.][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

****
NOTE: Revise or amplify these paragraphs where necessary to cover project requirements.
****

600 V Power Connection Station; G[, [_____]]

15 kV Power Connection Station; G[, [_____]]

Ship Service Emergency Trip Panel; G[, [_____]]

Include wiring diagrams and installation details of equipment indicating layout and arrangement, control panels, accessories, and other items that must be shown to ensure a coordinated installation. Wiring diagrams shall identify circuit terminals and indicate the internal wiring for each item of equipment and the interconnection between each item of equipment. Drawings shall indicate adequate clearance for operation, maintenance, and replacement of operating equipment devices. Submittals shall include the nameplate data, size, and capacity. Submittals shall also include applicable federal, military, industry, and technical society publication references.

SD-03 Product Data

600 V Single Pole Connectors; G[, [_____]]

Industrial Service Auxiliary Devices; G[, [_____]]

Metering Accessories; G[, [_____]]

15 kV Cable Couplers; G[, [_____]]

Deadbreak Junctions; G[, [_____]]

High-Voltage Connectors; G[, [_____]]

Flexible Power Cable; G[, [_____]]

SD-06 Test Reports

Paint Coating System; G[, [_____]]

600 V Single Pole Connector Compatibility Tests; G[, [_____]]

600 V Single Pole Connector Torque Test; G[, [_____]]

Power Receptacle and Plug Assembly Tests; G[, [_____]]

15 kV Cable Coupler Design Tests; G[, [_____]]

Acceptance Checks and Tests; G[, [_____]]

SD-10 Operation and Maintenance Data

600 V Power Connection Station, data package 5; G[, [_____]]

15 kV Power Connection Station, data package 5; G[, [_____]]

Ship Service Emergency Trip Panel; G[, [_____]]

1.5 QUALITY ASSURANCE

1.5.1 Drawings

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

a. One-line diagram including breakers, fuses, current transformers, and meters.

b. Outline drawings including front elevation, section views, footprint, and overall dimensions.

c. Markings and NEMA nameplate data, including fuse information (manufacturer's name, catalog number, and ratings).

d. Circuit breaker type, interrupting rating, and trip devices, including available settings.

e. Three-line diagrams and elementary diagrams and wiring diagrams with terminals identified, and indicating prewired interconnections between items of equipment and the interconnection between the items.

f. Manufacturer's instruction manuals and published time-current curves (on full size logarithmic paper) of the main secondary breaker and largest secondary feeder device. These shall be used by the designer of record to provide breaker settings that will insure protection and coordination are achieved.

1.5.2 Regulatory Requirements

In each of the publications referred to herein, consider the advisory provisions to be mandatory, as though the word, "shall" 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 shall be in accordance with the mandatory and advisory provisions of NFPA 70 unless more stringent requirements are specified or indicated.

1.5.3 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 shall have been in satisfactory commercial or industrial use for 2 years prior to bid opening. The 2-year period shall include applications of equipment and materials under similar circumstances and of similar size. The product shall have been on sale on the commercial market through advertisements,

manufacturers' catalogs, or brochures during the 2-year period. Where two or more items of the same class of equipment are required, these items shall be products of a single manufacturer and the component parts of the item shall be the products of the same manufacturer.

1.5.3.1 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.

1.5.3.2 Material and Equipment Manufacturing Date

Products manufactured more than 3 years prior to date of delivery to site shall not be used, unless specified otherwise.

1.6 WARRANTY

The equipment items shall be supported 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.

1.7 MAINTENANCE

1.7.1 Operation and Maintenance Data

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

PART 2 PRODUCTS

2.1 600 V POWER CONNECTION STATION

Ship service and industrial service power connection station assemblies shall include enclosure, power receptacles, auxiliary devices, metering accessories, and related wiring. Each power connection station shall have the number of circuits indicated and each circuit shall provide three-phase, three-wire service.

2.1.1 Enclosure Integrity

****
NOTE: Where exposed to physical damage from vehicular traffic, provide suitable guards.
****

Enclosure shall be UL 50 listed, type 3R, fabricated entirely of ASTM A167 type 304 or 304L stainless steel. All interior and exterior covers and doors shall be minimum 12 gauge stainless steel sheets. Unit shall have fixed top and open bottom. Side covers shall be bolt-on and removable. Rear covers shall be hinged. Optional doors shall have full height continuous hinge and door stop to allow door to be secured open at 90 degrees. Ventilating or similar openings in equipment shall be designed so that foreign objects inserted through these openings are deflected from energized parts. Paint enclosure ASTM D1535 light gray No. 61. Paint coating system shall comply with IEEE C57.12.28.[Provide removable mullions between the doors.]

2.1.2 600 V Single Pole Connectors

Insulated connectors shall be rated for 600 volts, 690 amperes, 60 hertz, single pole, continuous duty operation. Connectors shall be compatible with Leviton and Duraline cam-type positive latching ball nose connectors. Insulation and protective caps shall be ethylene propylene thermoplastic rubber (EPTR) colored black phase A, white phase B, and red phase C, conforming to the following:

a. Constant Service Temperature Range: minus 60 degrees C to 135 degrees C minus 81 degrees F to 275 degrees F

b. Flammability: UL 94 HB Rated

c. Electrical: UL Relative Thermal Index (RTI): 100 degrees C 212 degrees F minimum

d. Durometer Hardness: ASTM D2240, 55 - 65A

2.1.2.1 Panel Mount Connectors

****

NOTE: (1) Provide auxiliary switches with receptacles to be used for supplying industrial service and where required by the activity utility department with receptacles used for supplying ship service. (2) When electric interlock switches are required, indicate circuiting to effect opening of breakers and disabling of closing of breakers via the interlock switches when a connector plug is removed from the associated receptacle.

****

Provide 15 degree angled, panel mount female connectors (receptacles) with threaded stud terminations. Each receptacle shall be provided with a protective cap attached via wirelon.[Panel Mount Connectors (receptacles) indicated to have electric interlock switches shall have a thru-center plunger that engages a single-pole double-throw, water-tight aluminum housed "roller lever actuated" switch upon insertion of a connector plug. UL listed switch shall be electrically rated for 100,000 cycles at 10 amps, 125/250 VAC, and mechanically rated for 20,000,000 cycles.]

[2.1.2.2 Cable Mount In-Line Connectors

Male and female cable mount in-line connectors (plugs) shall be designed for terminating on 500 kcmil cables with a crimp-type connection. The connectors shall lock together so that they can not twist or turn loose unless a push button release mechanism is engaged. The insulated sleeve shall be mechanically secured to the connector contacts to give a minimum of 3100N 700 pounds shear force.[Provide a mating male cable mount in-line connector (plug) for each panel mount connector to be turned over to the contracting officer.][Provide [_____] male and [_____] female cable mount in-line connectors[terminated as indicated][to be turned over to the contracting officer].]

][2.1.3 600 V Power Receptacle

****
NOTE: Select the following paragraph only for repair projects where the existing MIL-C-24368/2 power receptacles are being replaced in the existing enclosure.
****

Rated for 500 volts, 500 amperes, 60 hertz, three-pole, continuous duty operation. Power receptacle assembly shall conform to MIL-C-24368/2. Provide receptacle assembly with factory potted cable pigtails. Cable pigtails shall be a minimum of 1220 mm 4 feet in length and 3-1/c Type LSSHOF-500 cables conforming to MIL-DTL-24643/3. Provide each receptacle with provisions for interlocking the receptacle with its respective feeder circuit breaker so that breaker will trip automatically if an attempt is made to remove the plug from the receptacle and when the receptacle cover is opened.

][2.1.4 Industrial Service Auxiliary Devices

****
NOTE: Provide circuit breaker overcurrent protection of each service circuit. When the over current protection for the industrial service circuits is located within the associated industrial power connection station, include the paragraphs for "Fusing," "Circuit Breakers," and "Circuit Breaker Operating Mechanism." When the overcurrent protection is located in a remote panelboard, include the paragraph for "Shunt Trip Pushbutton Control" and indicate conduit and wiring from the industrial power connection station shunt trip pushbutton control to the circuit breaker shunt trip. Also indicate circuiting to effect opening of breakers via the shunt trip pushbutton control (in conjunction with the interlock switches).
****

Provide the following auxiliary devices for each industrial service power connection station circuit.

[2.1.4.1 Shunt Trip Pushbutton Control

****
NOTE: Indicate desired location (side cover or rear flange) of pushbutton control on drawings.
****

Provide NEMA Q600 rated, 30 millimeter 12 inches, heavy duty industrial type, normally-open, momentary, red pushbutton behind a spring return cover, each circuited to shunt trip one circuit breaker.

][2.1.4.2 Fusing

****
NOTE: Include "fusing" when metering is provided.
****

Provide a fuse block mounted in the enclosure containing one fuse per phase to protect the voltage input to the[watt hour meter][and][circuit breaker shunt trip].

][2.1.4.3 Circuit Breaker

****
NOTE: Provide 200 kA, non-fused, current limiting circuit breakers when the service transformer is rated 1000 kVA and greater. When the overcurrent protection is located in a remote panelboard, indicate the required circuit breaker ratings on the "Panelboard Schedule."
****

UL 489. 100 percent rated,[non-fused, current limiting,] molded case circuit breaker, 480 VAC, 400 amperes, 3-pole, [200][_____] kaic short circuit current interrupting rating, with a 480 V shunt trip.

]2.1.4.4 Circuit Breaker Operating Mechanism

Provide flexible cable mechanism with flange mounted disconnect handle for each circuit breaker as indicated.

][2.1.5 Metering Accessories

****
NOTE: When metering is required by the activity and the industrial power connection stations are to be directly connected to the industrial power transformer secondary, the industrial power connection stations shall include the following metering accessories. Where a panelboard is to be provided for industrial loads, provide a separate watt-hour meter/current transformer cabinet.
****

Provide watt-hour meter and current transformers for each industrial service power connection station circuit.

2.1.5.1 Watt-hour Meter

Provide a socket-mounted, electronic programmable outdoor watt-hour meter mounted on door of cabinet. Meter shall either be programmed at the factory or shall be programmed in the field. When field programming is performed, turn field programming device over to the Contracting Officer at completion of project. Meter shall be coordinated to system requirements and conform to ANSI C12.1.

a. Design: Provide watt-hour meter for use on a three-phase, 3-wire, 480 volt system with 3 current transformers. Include necessary KYZ pulse initiation hardware for Energy Monitoring and Control System (EMCS).

b. Class: 20; Form: 45S, accuracy: plus or minus 1.0 percent; Finish: Class II

c. Cover: Polycarbonate and lockable to prevent tampering and unauthorized removal.

d. Kilowatt-hour Register: Five digit electronic programmable type

e. Demand Register:

(1) Provide solid state.

(2) Meter reading multiplier: Indicate multiplier on the meter face.

(3) Demand interval length: Shall be programmed for 15 minutes with rolling demand up to six subintervals per interval.

f. Socket: ANSI C12.7. Provide NEMA Type 3R, box-mounted socket, ringless, having manual circuit-closing bypass and having jaws compatible with requirements of the meter. Cover unused hub openings with blank hub plates. Provide manufacturers standard enclosure color unless otherwise indicated.

2.1.5.2 Current Transformers

IEEE C57.13. Provide butyl-molded window type current transformers with 600 volt insulation, 10 kV BIL. Provide three current transformers with characteristics listed in the following table.

CT Ratio	RF	Meter Accuracy Class
400/5	4.0	0.3 thru B-0.2

[2.1.5.3 Watt-hour Meter/Current Transformer Cabinet

Cabinet shall be NEMA 3R fabricated of 12 gauge stainless steel and shall have hinged front door with vault handle. Paint enclosure ASTM D1535 light gray No. 61. Paint coating system shall comply with IEEE C57.12.28.

]]2.1.6 Enclosure Configurations

****

NOTE: Ship Service Power Stations shall consist of multiple sections, with each section having a maximum of four vertically arranged receptacle circuits. Provide pad lockable doors to restrict access to unused energized receptacles where ship service circuits are connected in parallel to multiple stations. See Layout 1 for typical enclosure design.

****

a. Enclosures for ship service stations shall be configured as indicated. All three receptacles of the same circuit shall be mounted on a common plate. Each plate shall have handles on both ends and shall be bolted to the front cover so that it can be removed from the front without disconnecting the incoming circuit power cables. Each section shall include a full width ground bus.[Each section shall have a hinged pad lockable door.] Provide nameplates to identify each phase designation and each circuit number as indicated.

****

NOTE: Industrial Power Stations shall consist of

multiple sections, with each section having a maximum of two vertically arranged receptacle circuits. Include information concerning circuit breakers, current transformers, fusing, shunt trip pushbuttons, and watt-hours meters when auxiliary devices and metering accessories are specified. Indicate desired side for mounting external ground bus and shunt trip. See Layout 2 for typical enclosure design.

****

b. Enclosures for industrial service stations shall be configured as indicated. All three receptacles of the same circuit shall be mounted on a common plate. Each plate shall have handles on both ends and shall be bolted to the front cover so that it can be removed from the front without disconnecting the power cable. Include a full width internal ground bus and a ground bus with four NEMA spaced lug mounting holes on the exterior as indicated.[Mount the[circuit breakers,][and][current transformers] on inside of enclosure.][The handle for the circuit breaker operating mechanism shall be located on the rear flange.][Mount watt-hour meters on rear hinged covers.][Mount shunt trip pushbuttons on side cover as indicated.]

2.2 15 KV POWER CONNECTION STATION

15 kV power connection station assemblies shall include enclosure, 15 kV power receptacles, dead-front high-voltage deadbreak junctions, and insulated high-voltage connectors. Each power connection station shall have the number of circuits indicated and each circuit shall provide three-phase, three-wire service.

2.2.1 Enclosure Integrity

****

NOTE: Where exposed to physical damage from vehicular traffic, provide suitable guards.

****

IEEE C57.12.28 fabricated entirely of ASTM A167 type 304 or 304L stainless steel. All interior and exterior covers and doors shall be minimum 12 gauge stainless steel sheets. Unit shall have fixed top and open bottom with padlockable two-door front and removable center post. Side and rear covers shall be bolt-on. Doors shall be 915mm 36 inch wide with full height continuous hinge and door stops to allow doors to be secured open at 90 degrees. Paint enclosure ASTM D1535 light gray No. 61. Paint coating system shall comply with IEEE C57.12.28.[Provide removable mullions between the doors.]

2.2.2 15 kV Cable Couplers

****

NOTE: (1) High voltage cable couplers are used predominately in the mining and tunneling industries. There currently is no industry standard for these products and therefore, couplers from different manufactures may not be compatible. Once the use of a particular model coupler has been established at an activity, it may be necessary to request proprietary procurement of future couplers

to ensure compatibility. (2) When couplers are requested by station to have a mechanical interlock feature, coordinate keys with existing or new interlock scheme. (3) The interlock design when required for new installations shall be as follows: The circuit breakers associated with the receptacles of a respective power connection station shall be electrically locked open via a common electric reset multi-contact auxiliary relay that is controlled by a key-operated selector switch. Placing the selector switch in the key-release position shall electrically lock open the circuit breakers. This same key will then be used for unlocking/locking the associated couplers. Inserting the key into the selector switch will allow return to the "close" position, unlocking the circuit breakers.

****

Provide high voltage cable couplers rated for 15,000 volts, 500 amperes, 60 hertz, three-phase, continuous duty operation, and configured with three insulated phase contacts, one ground contact, and one isolated ground check contact. Couplers shall be aluminum with epoxy powder coating and include hypalon gaskets and seals, all stainless steel hardware and[three-bolt quick flip][or][90 degree turn] connection feature. Receptacles shall be equipment mount type with provisions for terminating [_____] mm [_____] inch diameter [350][_____] kcmil cables and include Live End Covers.[Provide one cable mount type plug with weatherproof cover and provisions for terminating [_____] mm [_____] inch diameter [350][_____] kcmil cables for each receptacle. Turn plugs over to the contracting officer.] Coupler pairs shall[have provisions for padlocking][have a mechanical interlock that allows key release only after the coupler pair is locked].

a. Voltage ratings: Withstand voltages shall comply with IEEE 386 voltage ratings and characteristics of connectors rated 14.4 kV rms phase-to-phase.

b. Current ratings: Short-time current ratings shall comply with IEEE 386 current ratings and characteristics of 600 A connectors.

2.2.3 Separable Insulated Connectors and Accessories

IEEE 386. 15 kV, 95 kV BIL.

2.2.3.1 Deadbreak Junctions

Provide 600 A deadbreak junctions with two interfaces. Brackets shall be stainless steel.

2.2.3.2 Insulated High-Voltage Connectors

Provide 600 Ampere deadbreak connectors.

2.2.4 Flexible Power Cable

ASTM B33, NEMA WC 58/ICEA S-75-381. Flexible power cable Type SH, 15 kV single conductor.

2.2.5 Enclosure Configuration

****
NOTE: See Layout 3 for typical enclosure design.
****

Enclosures shall be configured as indicated. Include a full width ground bus. A power cable terminated with a 600-ampere deadbreak connector shall connect each phase of each receptacle to one of the 600-ampere one-piece deadbreak apparatus bushings of a deadbreak junction. The remaining apparatus bushing for each deadbreak junction shall be used for connection of the incoming circuit power cables terminated with 600-ampere deadbreak connectors. Provide nameplates to identify each phase designation and each circuit number.

[2.3 SHIP SERVICE EMERGENCY TRIP PANEL

****
NOTE: Provide an emergency trip pushbutton circuited to trip all (480 V, 5 kV, and 15 kV) circuit breakers that provide ship service to a respective berth. Locate the emergency trip box where it can be readily accessed by ships force.
****

Provide a stainless steel NEMA 3R cabinet sized as necessary with a color red pushbutton cover mounted behind the front door. Pushbutton shall be rated for 10 amperes continuous at 600 volts, heavy duty, watertight, momentary contact, marked "SHIP SERVICE EMERGENCY TRIP".

]2.4 MANUFACTURER'S NAMEPLATE

Each item of equipment shall 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.

2.5 FIELD FABRICATED NAMEPLATES

ASTM D709. Provide laminated plastic nameplates for each equipment enclosure, relay, switch, and device; as specified or as indicated on the drawings. Each nameplate inscription shall identify the function and, when applicable, the position. Nameplates shall be melamine plastic, 3 mm 0.125 inch thick, white with [black][_____] center core. Surface shall be matte finish. Corners shall be square. Accurately align lettering and engrave into the core. Minimum size of nameplates shall be 25 by 65 mm one by 2.5 inches. Lettering shall be a minimum of 6.35 mm 0.25 inch high normal block style.

2.6 WARNING SIGNS

Provide warning signs for the enclosures of electrical equipment having a nominal rating exceeding 600 volts.

a. When the enclosure integrity of such equipment is specified to be in accordance with IEEE C57.12.28, provide self-adhesive warning signs on the outside of the high voltage compartment door(s). Sign shall be a decal and shall have nominal dimensions of 178 by 255 mm 7 by 10 inches with the legend "DANGER HIGH VOLTAGE" printed in two lines of nominal

50 mm 2 inch high letters. The word "DANGER" shall be in white letters on a red background and the words "HIGH VOLTAGE" shall be in black letters on a white background.

2.7 SOURCE QUALITY CONTROL

2.7.1 Paint Coating System

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

2.7.2 600 V Single Pole Connector Compatibility Tests

Conduct the following tests in the sequence noted on a male in-line connector mated with a Leviton or Duraline female in-line connector and a female in-line connector mated with a Leviton or Duraline male in-line connector with each connector terminated on a bare 500 kcmil copper conductor. After completion of the tests, inspect assemblies. There shall be no evidence of damage to the connectors. Assemblies shall be satisfactory for immediate return to service at full ratings without maintenance or repair.[Contracting Officer or his designated representative will witness the tests.][A factory-certified report of the specified tests previously performed on identical units of each rating will be acceptable.]

2.7.2.1 Impact Test

Drop each mated connector set in a horizontal position from a height of 36-inches onto a concrete floor 50 times.

2.7.2.2 Pull Strain Test

Apply a 500-lb straight pull on each mated connector set for a duration of 5-minutes.

2.7.2.3 Shear Test

Apply a 100-lb perpendicular pull on each mated connector set for a duration of 5-minutes.

2.7.2.4 Torque Test

Apply a 100 ft-lb torque on each mated connector set for a duration of 5-minutes.

2.7.2.5 Heat Rise Test

Apply 400 amperes through each mated connector set for duration of 30-minutes. Record temperature rise at surface of each mated connector set via infrared scanning equipment. Temperature rise shall be less than 45 degree C.

2.7.2.6 Moisture Resistance Test

Subject the mated connectors to a water spray maintained at 5-psi, with a collection rate of 18-in/hr, at a distance of 5-feet, for one hour. Verify that no water penetrated the connection.

2.7.2.7 Dielectric Voltage Withstand Test

Wrap the mated connectors in conductive foil and apply a test potential of 2200 VAC between the conductor and the foil for a period of 5-minutes. Dielectric breakdown shall constitute a failed test.

2.7.2.8 Insulation Resistance Test

Wrap the mated connectors in conductive foil and using a Megger insulation resistance tester with an open circuit output of 500 VDC, measure the insulation resistance between the conductor and foil. Resistance measurement shall be greater than 100 Megohms.

2.7.3 600 V Single Pole Connector Torque Test

Conduct a torque test on three male and three female cable mount in-line connectors as follows: With the metal connector part rigidly secured, apply a rotating (twisting) force of 700 lbs on the insulating sleeve. The insulating sleeve shall not break free and spin around the connector metal part.[Contracting Officer or his designated representative will witness the tests.][A factory-certified report of the specified tests previously performed on identical units of each rating will be acceptable.]

[2.7.4 Power Receptacle and Plug Assembly Tests

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NOTE: Select the following paragraph only when providing MIL-C-24368/2 receptacles.
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Conduct design, production, and quality assurance tests, as required by MIL-C-24368/1 and MIL-C-24368/2, at the manufacturer's plant during fabrication and assembly of power receptacle and plug assemblies. After completion of tests, inspect assemblies. There shall be no evidence of damage to the receptacle or plug assembly. Assemblies shall be satisfactory for immediate return to service at full ratings without maintenance or repair.[Contracting Officer or his designated representative will witness the tests.][A factory-certified report of the specified tests previously performed on identical units of each rating will be acceptable.]

]2.7.5 15 kV Cable Coupler Design Tests

Furnish reports which include results of AC withstand voltage, DC withstand voltage, impulse withstand voltage, short time current, and current cycling design tests performed in accordance with IEEE 386.

PART 3 EXECUTION

3.1 INSTALLATION

Electrical installations shall conform to IEEE C2, NFPA 70, and to the requirements specified herein.

3.2 POWER CONNECTION STATION GROUNDING

Ground in accordance with NFPA 70. Maximum resistance from assembly to ground shall be 3 ohms.

3.3 FIELD APPLIED PAINTING

Paint electrical equipment as required to match finish of adjacent surfaces or to meet the indicated or specified safety criteria. Painting shall be as specified in Section 09 90 00 PAINTS AND COATINGS.

3.4 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.

3.5 WARNING SIGN MOUNTING

Provide the number of signs required to be readable from each accessible side, but space the signs a maximum of 9 meters 30 feet apart.

3.6 FIELD QUALITY CONTROL

3.6.1 Performance of Acceptance Checks and Tests

Perform in accordance with the manufacturer's recommendations and include the following visual and mechanical inspections and electrical tests, performed in accordance with NETA ATS.

3.6.1.1 Power Connection Stations and Control Panels

a. Visual and mechanical inspection performed in accordance with inspection and test procedures for Switchgear and Switchboard Assemblies.

b. System function tests.

[3.6.1.2 Current Transformers

a. Visual and mechanical inspection in accordance with inspection and test procedures for Instrument Transformers.

b. Electrical tests in accordance with inspection and test procedures for Instrument Transformers.

][3.6.1.3 Watt-hour Meters

a. Visual and mechanical inspection in accordance with inspection and test procedures for Metering Devices.

b. Electrical tests in accordance with inspection and test procedures for Metering Devices.

][3.6.1.4 Circuit Breakers

a. Visual and mechanical inspection in accordance with inspection and test procedures for Circuit Breakers, Air, Insulated-Case/Molded-Case.

b. Perform Electrical tests in accordance with inspection and test procedures for Circuit Breakers, Air, Insulated-Case/Molded-Case.

]3.7 DEMONSTRATION

Upon completion of the work and at a time approved by the Contracting Officer, the Contractor shall provide instructions by a qualified instructor to the Government personnel in the proper operation and maintenance of the equipment. [_____] Government personnel shall receive training comparable to the equipment manufacturer's factory training. The duration of instruction shall be for not less than one 8 hour working day for instruction of operating and maintenance personnel.

-- End of Section --