

SWINOMISH

ELECTRICAL SPECIFICATIONS

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SECTION 16010
BASIC ELECTRICAL REQUIREMENTS**PART 1 - GENERAL**

1.01 DEFINITIONS

- A. Where the words "furnish", "provide", "install" appear in this Division, or a manufacturer is indicated with item or product catalog number listed, install and furnish the item complete and operating for the purpose or function intended, unless noted otherwise.
- B. All references to power system voltages are RMS per definition in NEC Article 100.

1.02 SYSTEMS DESCRIPTION

- A. Design Build Requirements: Electrical systems required for this work includes all labor, materials, equipment, and services necessary to complete the electrical work shown on the Performance Drawings, specified herein or required for a complete operable facility and not specifically described in other Sections of these Specifications. Among the items required are:
 - 1. Electrical Demolition to accommodate the construction
 - 2. Service and distribution equipment including CT cabinets, meter sockets, disconnects, shorepower dockheads, panelboards and step-down transformer.
 - 3. Enclosed disconnect switches for equipment as required.
 - 4. Wire, cable and raceway for installation overwater.
 - 5. Marine listed panelboards, and transformers.
 - 6. Dockhead power centers and marine-grade enclosures for installation overwater.
 - 7. Perform all excavation required for work in this section and for Puget Sound Energy infrastructure.
 - 8. Any items not mentioned in these specifications or not indicated on drawings, but necessary for successful and efficient operation of the work shall be held to be implied and shall be furnished and installed as part of the contract at no additional cost to the Owner. No exceptions.

1.03 RELATED WORK SPECIFIED IN OTHER SECTIONS

- A. Drawings and general provisions of the Contract, including General Terms and Conditions and Division 1 Specification Sections, apply to these sections.

1.04 QUALITY ASSURANCE

- A. The electrical contractor shall have a minimum of five (5) years experience in constructing projects of a similar type.
- B. The electrical contractor shall have successfully completed two similar projects, including one within the same county as the subject project.

1.05 SUBMITTALS

- A. Qualifications:
 - 1. Company description and history, location, names of officers and principal staff assigned to project, years in business and name of parent company, if applicable
 - 2. List of two similar completed projects as described under QUALITY ASSURANCE, with contact name and telephone number.
- B. Materials Substitutions:
 - 1. Submit requests for substitutes to the Engineer in compliance with Performance Document requirements ten (10) days prior to bid date. Failure to do so will result in rejection of proposed substitutions.
 - 2. Performance Document requirements apply to all equipment submitted for substitution approval. Any deviation or non-compliance shall be indicated by an attached letter explaining a proposed change. Approval of submitted material does not grant deviation from the Contract requirements. Include in Bid Sum additional expense resulting from the Contractor's decision to use substitute materials including all costs by other affected crafts.
- C. Shop Drawings and Product Data:
 - 1. Schedule so as not to delay construction schedule, and no later than 30 days after award of contract, submit common brochure(s) with index and divider tabs by specification section, containing all required catalog cuts. Third generation materials will not be accepted. (i.e. copies of faxed information). Allow two weeks-plus routing time for review of each submittal and re-submittal. Include physical and electrical characteristics; i.e. dimensions, weight, materials, voltage, phase, etc., of all new equipment except basic wiring materials. Include installation wiring diagrams for each special system.

2. Submit in a three ring binder with hardback covers. Do not fill binder more than 50%. (i.e. 2" binder 1" total insert). Highlight with yellow marker adequate information to show materials being proposed.
 3. Submit all sections complete in one package for review. Partial submittals will not be reviewed and will be returned as Not-Reviewed. All adverse impact to the project due to delay in providing complete submittals shall be born by the contractor.
 4. The contractor agrees to pay for the Engineer's review costs for submittals beyond one re-submittal. Cost shall be levied by deductive change order to the contract.
 5. If deviations, discrepancies or conflicts between Shop Drawings and the Performance Drawings and Specifications are discovered either prior to or after Shop Drawing Submittals are processed by the Engineer; Performance Drawings and Specifications take precedence.
 6. Contractor agrees that Shop Drawing Submittals processed by Engineer are not Change Orders. The purpose of Shop Drawings is to demonstrate to the Engineer that the Contractor understands the design concept.
 7. Contractor demonstrates understanding of design concept by indicating material he intends to furnish and install, and by detailing fabrication and installation methods.
- D. Office Samples: Submit samples as requested by the Engineer.
- E. Project Record Documents:
1. On completion of work, deliver to Engineer one set of accurately marked Drawings. Show all change and variations from Drawings and exact routes of all feeders, service conduits and location of all conduits stubbed out for future continuation with definite dimensions and burial depths. Label each drawing as "Record Drawing" with Electrical Contractors' name and date.
 2. Drawings and lettering, neat, clean and legible.
 3. During progress of work, maintain an accurate record set of the drawings of the installation on project site at all times, locating each circuit precisely by dimension. Work set subject to inspection by Engineer.
- F. Operation and Maintenance Data:
1. Submit the following prior to final acceptance and Contractor's request for final payment for Division 16 work, in conformance with the Project Closeout requirements of the General Provisions:

- a. Record Drawings.
 - b. Maintenance and Operation Manuals.
2. Provide four complete sets of Maintenance and Operation Manuals including, but not limited to, the following:
- a. Shop Drawings and installation, maintenance, operation manuals for all power distribution and control equipment including service and distribution equipment, branch panels, unit substations, emergency generator system, etc.
 - b. Copies of certificates of Code Authority acceptance, and test data and other special guarantees, warranties, etc. specified elsewhere herein and/or indicated on the Drawings.
 - c. Schematic diagrams, installation wiring diagrams and instructions and Maintenance/ Operation Manuals for all communications, special systems, signaling and control systems and equipment.
3. Assemble each set in standard hardback, 3 ring binder(s). Binder fill shall not exceed 50%, i.e. 1" thickness of paper in 2" binder. Use tabular dividers to organize the materials in the same order as this Specification. Mark each divider according to (sub)section number and name.

1.06 DELIVERY, STORAGE AND HANDLING

- A. Acceptance at site:
1. Do not use scratched, marred or deformed materials.
 2. Do not use material or equipment in wet cartons or boxes, stored in or exposed to rain, water, dust, dirt or snow.

1.07 SEQUENCING AND SCHEDULING

- A. Safety: In accordance with generally accepted construction practices, the Contractor is solely and completely responsible for conditions of the job site, including safety of all persons and property during performance of the work. This requirement applies continuously and is not limited to normal working hours.
- B. Install work in a sequence necessary to accommodate Owner's occupancy requirements during the construction period. Coordinate electrical schedule and operations with the Owner.

1.08 WARRANTY

- A. General Warranty: Without additional charge, replace any work or material, which develops defects, except from abuse, within one (1) year from date of substantial completion unless otherwise noted.

1.09 ALTERNATES

- A. Alternates quoted on Bid Forms will be reviewed and accepted or rejected at the Owner's option. Accepted Alternates will be identified in Owner-Contractor Agreement.
- B. Coordinate related work and modify surrounding work as required.

1.10 REFERENCES

- A. ANSI/NFPA 70-National Electrical Code, including amendments for jurisdiction having authority.
- B. International Building Code (IBC).
- C. International Fire Code (IFC).
- D. Washington Administrative Code (WAC)

PART 2 - PRODUCTS

2.01 MANUFACTURERS:

- A. General: Like items from one manufacturer; i.e., receptacles, breakers, panels, etc.

2.02 MATERIALS

- A. Provide electrical materials of the type and quality indicated, or prior approved substitute, new, listed by the Underwriters' Laboratories, bearing their label wherever standards have been established and label service is regularly furnished by them. Indicated brand names and catalog numbers are used to establish standards of performance and quality. The description of materials listed herein governs in the event that catalog numbers do not correspond to the materials described herein.

2.03 ACCESSORIES

- A. Special Features and Incidentals:
 - 1. Include special features, finishes, description or requirements indicated in the Performance Documents for particular items or equipment, but not included by or in the item's listed catalog number.
 - 2. Provide and install as part of the Contract work all incidentals, brackets, supports, framing, backing, signal transformers, relays, etc., not specifically mentioned herein or noted on the Performance Drawings, but

required to complete the system or systems, in a safe and satisfactory working condition, as part of the Contract Work.

2.04 FABRICATION

- A. Shop/Factory Finishing: Modify manufacturer's products at the factory to comply with special requirements where noted. Contractor's responsibility to verify compliance.

PART 3 - EXECUTION

3.01 VERIFICATION

- A. Verification of Conditions:
 - 1. Bidder is expected to visit site of proposed construction, unless prevented by project conditions. Verify and inspect the existing site to determine the conditions that affect this work.
 - 2. Include all costs in the bid price for the work and/or material required to comply with the Performance Documents, based on the actual existing conditions and the information indicated on the Performance Documents.
 - 3. Failure to visit the site and verify conditions affecting work of this Division does not relieve Contractor from the necessity of doing any and all work that is necessary to make all electrical installations and systems complete.
 - 4. Prepare Construction drawings showing proposed rearrangement of work to meet project conditions, including changes to Work specified in other sections. Obtain permission of Engineer before proceeding.
- B. Performance Documents:
 - 1. Performance Drawings are diagrammatic only with symbols representing electrical equipment, and wiring.
 - 2. Electrical symbols indicating wiring and equipment, shown on the Performance Drawings or specified in Division 16, are included in Division 16 work unless specifically noted otherwise.
 - 3. Provide Construction Drawings indicate general directions and routes of feeders and service conductor systems. Determine exact route and installation of electrical wiring and equipment with conditions of construction and acceptance of Engineer.

4. Deviations from Performance Drawings required to make the electrical installation conform to the facility's construction design are part of the Contract work. Obtain Engineer's approval prior to executing any deviations from Performance Drawings.
5. Data given herein and shown on Performance Drawings is as exact as could be secured but its absolute accuracy is not guaranteed.

C. Clarification:

1. Prior to submitting a bid, bring to the attention of the Engineer any ambiguous, conflicting or unclear instructions. The Engineer in Addendum form will clarify such items.
2. In the event that time does not permit clarification prior to bid opening, the Performance Drawings govern in matters of quantity, the Specification in matters of quality. In event of conflict on the Performance Drawings or in the Specifications, the greater quantity and the higher quality apply.
3. Should the Performance Documents indicate a condition conflicting with the Governing Codes and Regulations, refrain from installing that portion of the work until clarified by the Engineer. Remove and correctly install, as part of the Contract work, any work installed in violation of the Governing Codes.

3.02 INSTALLATION

A. Project Conditions:

1. Coordinate location and installation requirements of, panelboards, transformers, and other devices with other elements of sitework, including fixed piers and floats. Coordinate quantities and locations of raceway chases, handholes and pedestals on fixed piers.

B. Codes and Permits:

1. Comply with the latest Rules and Regulations of the Codes of the State and local Authorities Having Jurisdiction (AHJ). Contractor responsible for apprising himself of the pertinent Codes prior to commencing work.
2. Furnish all materials and labor required for compliance with these Rules and Regulations. Items in excess of Code requirements take precedence.
3. Obtain and pay for all required permits, plan check charges and certificates. Deliver Certificates of Acceptance from the Code-Enforcing Authorities to Engineer.
4. Conform to local utility company regulations.

5. All electrical equipment shall be installed in a neat and workmanlike manner.

3.03 FIELD QUALITY CONTROL

A. Tests:

1. Conduct tests of equipment and systems as required by NFPA and local codes to demonstrate compliance with requirements specified in Division 16.
2. Provide journeyman electrician with tools, meters, instruments and other test equipment required. Remove and replace trims, covers, fixtures, etc., and test materials, systems, methods and workmanship in the presence of the Engineer for final review at completion of the work.

B. Inspection:

1. Do not close in or cover work prior to review by the Engineer.
2. Contractor responsible for cost of uncovering and making repairs where work has been closed in or covered prior to review by Engineer. This includes trenches and underground conduits.

3.04 CLEANING

A. Tools and Materials:

1. Keep tools and materials in an orderly manner throughout the construction period.
2. Upon completion of the work, remove all supplies, materials, tools, etc., furnished by the Electrical Division.

B. Dirt, Debris and Dust:

1. Remove dirt and debris of whatever nature caused by the execution of the work from job site at frequent periods appropriate to the progress of the work, or as directed by the Engineer.
2. Leave the entire electrical system installed under this Contract in clean, dust-free and proper working order.

3.05 TRENCHING AND BACKFILLING

- #### A.
- Conduit installed for utility systems (power) shall be installed in accordance with utility standards, including trenching, bedding and backfilling.

- B. Provide trenching, backfilling, restoration of paving, sidewalk, plants, etc., for electrical systems conduits, cables and ducts.
- C. Conduit under traffic areas shall be installed in accordance with one of the following requirements:
 - 1. For utility systems, in accordance with utility standards.
 - 2. Schedule 40 PVC, minimum 36-inches below finished grade.
 - 3. Schedule 80 PVC, minimum 12-inches below finished grade.
 - 4. Schedule 40 PVC with concrete or CDF backfill, minimum 12-inches below finished grade.
- D. For non-metallic conduit, a minimum 3" cover of sand or clean earth fill shall be placed all around the conduit on leveled trench bottom. Lay all steel conduit on a smooth level trench bottom, so that contact is made for its entire length. Water shall be removed from trench while electrical conduit is being laid.
- E. Place backfill in layers not exceeding 8" deep and compact to 95% of maximum density at optimum moisture to preclude settlement. Where higher compaction is called for on the drawings or other sections of the specification, they shall prevail.
 - 1. Under paved areas, sidewalk, and interior slabs use bank sand or pea gravel.
 - 2. Exterior use excavated material, if suitable to obtain compaction with final 8" soil, without rocks.
- F. Following backfilling, grade all trenches to the level of surrounding soil.
- G. Saw cut all concrete and paving prior to trenching. Replace concrete and paving to match existing.
- H. Replace all plants, grass, etc. damaged with like materials.
- I. Properly dispose of unused spoils, including soil, concrete and asphalt in approved manner.

3.06 INSTRUCTION PERIODS

- A. After substantial completion of the work and less than 20 days after the O & M manuals have been delivered to the Engineer and after all tests and final inspection of the work by the Authority(s) having Jurisdiction; the Contractor shall demonstrate the electrical systems and instruct the Owner's designated operating and maintenance personnel in the operation and maintenance of the various electrical systems. The Contractor shall arrange scheduled instruction

periods with the Engineer. The Contractor's representatives shall be superintendents or foremen knowledgeable in each system and suppliers representatives when so specified.

B. Scheduled instruction periods shall be:

1. Power Distribution System 1 HRS
2. Dockside Centers and other float-mounted equipment 1 HRS

3.07 FINAL ACCEPTANCE REQUEST

A. The Contractor shall submit to the Engineer a Job Completion Form (form attached in this section) properly filled out prior to the time substantial completion of the electrical work is requested. At this time also submit copies of final inspection certificates and receipts for loose materials turned over to the Engineer.

JOB COMPLETION FORM

PROJECT NAME: _____

PROJECT LOCATION: _____

DATE: _____

- A. Electrical Inspectors Final Acceptance
Copy of certificate attached.

Name	Agency	Date
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- B. The following systems have been demonstrated to Engineer.

1.	Power System _____	Engineer.	Date
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- C. Record Drawings Attached
Transmitted previously to _____

Date

- D. O & M Manuals Attached
Transmitted previously to _____

Date

- F. The work is complete in accordance with contract documents and authorized changes except _____

_____ and the Port/Engineer's representative is requested to meet with

Supervisor of Electrical Work	at _____	on _____	Date
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Contractors Rep. Signature	Date
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END OF SECTION

**SECTION 16060
GROUNDING AND BONDING****PART 1 - GENERAL**

1.01 SUMMARY

- A. Section includes:
 - 1. Rod electrodes.
 - 2. Wire.
 - 3. Mechanical connectors.
 - 4. Exothermic connections.

1.02 REFERENCES

- A. IEEE 142 (Institute of Electrical and Electronics Engineers) - Recommended Practice for Grounding of Industrial and Commercial Power Systems.
- B. NECA (National Electrical Contractors Association) - Standard of Installation.
- C. NFPA 70 (National Fire Protection Association) - National Electrical Code.

1.03 SYSTEM DESCRIPTION

- A. Grounding systems may use the following elements as grounding electrodes:
 - 1. Rod electrode.

1.04 PERFORMANCE REQUIREMENTS

- A. Grounding System Resistance: 25 ohms maximum.

1.05 SUBMITTALS

- A. Section 16010 - Submittals.
- B. Product Data: Submit data on grounding electrodes and connections.
- C. Project Record Documents: Record actual locations of components and grounding electrodes.

1.06 QUALITY ASSURANCE

- A. Provide grounding materials conforming to requirements of NEC, IEEE 142, and UL labeled.

- B. Perform work in accordance with local authority having jurisdiction.

1.07 COORDINATION

- A. Section 16010 – Sequencing and Scheduling.

PART 2 - PRODUCTS

2.01 ROD ELECTRODES

- A. Manufacturers:

1. Apache Grounding/Erico Inc.
2. Copperweld, Inc.
3. Erico, Inc.
4. O-Z Gedney Co.
5. Thomas & Betts.

- B. Furnish materials in accordance with local authority having jurisdiction.

- C. Product Description:

1. Material: Copper-clad steel.
2. Diameter: 3/4 inch minimum.
3. Length: 10 feet minimum.

- D. Connector: Connector for exothermic welded connection or U-bolt clamp.

2.02 WIRE

- A. Material: Stranded copper.

- B. Foundation Electrodes: 4 AWG.

- C. Grounding Electrode Conductor: Copper conductor insulated.

- D. Bonding Conductor: Copper conductor insulated.

2.03 CONNECTIONS

- A. Manufacturers:

1. Apache Grounding/Erico Inc.

2. Cadweld, Erico, Inc.
 3. Copperweld, Inc.
 4. ILSCO Corporation.
 5. O-Z Gedney Co.
 6. Thomas & Betts, Electrical.
- B. Furnish materials in accordance with local authority having jurisdiction.
- C. Product Description, Exothermic Connectors: Exothermic materials, accessories, and tools for preparing and making permanent field connections between grounding system components.
- D. Product Description, Mechanical Connectors: Bronze connectors, suitable for grounding and bonding applications, in configurations required for particular installation.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Section 16010 - Verification.
- B. Verify final backfill and compaction has been completed before driving rod electrodes.

3.02 PREPARATION

- A. Clean surfaces to bare metal at connection points.

3.03 EXISTING WORK

- A. Modify existing grounding system to maintain continuity to accommodate renovations.
- B. Extend existing grounding system using materials and methods compatible with existing electrical installations and as specified.

3.04 INSTALLATION

- A. Install in accordance with local Authority Having Jurisdiction and IEEE 142.
- B. Install rod electrodes. Install additional rod electrodes to achieve specified resistance to ground where required.

- C. Permanently ground entire light and power system in accordance with NEC and Authority Having Jurisdiction, including service equipment, distribution panels, lighting panelboards, switch and starter enclosures, grounding type receptacles, and other exposed non-current carrying metal parts of electrical equipment.
 - D. Ground electrical equipment on floating elements in accordance with NEC and Authority Having Jurisdiction. Provide proper grounding conductors in flexible feeder cables as required.
- 3.05 FIELD QUALITY CONTROL
- A. Section 16010 – Field Quality Control.
 - B. Perform ground resistance testing in accordance with IEEE 142.
 - C. Perform continuity testing in accordance with IEEE 142.

END OF SECTION

SECTION 16070

ELECTRICAL SUPPORTS**PART 1 GENERAL**

1.01 SUMMARY

- A. Section Includes:
 - 1. Equipment Support.

1.02 REFERENCES

- A. NFPA 70 (National Fire Protection Association) - National Electrical Code.
- B. NECA (National Electrical Contractors Association) - Standard of Installation.

1.03 SUBMITTALS

- A. Section 16010 - Submittals.
- B. Shop Drawings: Provide elevation drawing of fabricated support structures with dimensions and identification of elements.

PART 2 - PRODUCTS

2.01 FORMED STEEL CHANNEL

- A. Manufacturers:
 - 1. Allied Tube & Conduit Corp.
 - 2. B-Line Systems
 - 3. Midland Ross Corporation, Electrical Products Division.
 - 4. Unistrut Corp.
- B. Product Description: Galvanized 12-gage thick steel with holes 1-1/2 inches on center.

PART 3 - EXECUTION

3.01 INSTALLATION - EQUIPMENT SUPPORTS

- A. Provide support structures for panelboards, disconnect switches, or other equipment as required.

- B. Construct main support elements of galvanized steel members, stainless steel, or marine grade aluminum, unless shown otherwise. Construct secondary support elements of galvanized steel, galvanized formed steel channel or stainless steel, unless shown otherwise.
- C. Touch-up painted all welded joints or damaged spots on steel elements with zinc-rich paint.

END OF SECTION

SECTION 16075

ELECTRICAL IDENTIFICATION**PART 1 GENERAL**

1.01 SUMMARY

- A. Section includes:
 - 1. Nameplates.
 - 2. Labels.
 - 3. Wire markers.
 - 4. Conduit markers.
 - 5. Underground Warning Tape.

1.02 SUBMITTALS

- A. Section 16010 - Submittals.
- B. Product Data:
 - 1. Submit manufacturer's catalog literature for each product required.
- C. Project Record Documents: Record actual locations of tagged devices; include tag numbers.

1.03 DELIVERY, STORAGE, AND HANDLING

- A. Section 16010 – Delivery, Storage and Handling.
- B. Accept identification products on site in original containers. Inspect for damage.
- C. Accept materials on site in original factory packaging, labeled with manufacturer's identification, including product density and thickness.
- D. Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping.

1.04 ENVIRONMENTAL REQUIREMENTS

- A. Install labels or nameplates only when ambient temperature and humidity conditions for adhesive are within range recommended by manufacturer.

PART 2 - PRODUCTS

2.01 NAMEPLATES

- A. Product Description: Laminated three-layer plastic with engraved white letters on black background color.
- B. Letter Size:
 - 1. 1/8 high letters for identifying individual equipment and loads.
 - 2. 1/4 high letters for identifying grouped equipment and loads.
- C. Minimum nameplate thickness: 1/8 inch.

2.02 LABELS

- A. Labels: Embossed adhesive tape, with 3/16 white letters on black background.

2.03 WIRE MARKERS

- A. Description: Cloth tape, split sleeve, or tubing type wire markers.
- B. Legend:
 - 1. Power and Lighting Circuits: Branch circuit or feeder number.

2.04 UNDERGROUND WARNING TAPE

- A. Description: 6-inch wide plastic tape, colored red with suitable warning legend describing buried electrical lines.
- B. Description (Primary Conduit): 6-inch wide metallic plastic tape, colored red with suitable warning legend describing buried electrical lines.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Degrease and clean surfaces to receive adhesive for identification materials.

3.02 EXISTING WORK

- A. Install identification on existing equipment to remain in accordance with this section as indicated on drawings.

3.03 INSTALLATION

- A. Install identifying devices after completion of painting.

- B. Nameplate Installation:
1. Install nameplate parallel to equipment lines.
 2. Install nameplate with corrosive-resistant mechanical fasteners or adhesive.
 3. Secure nameplate to equipment front using screws, rivets, or adhesive.
 4. Install nameplates for the following:
 - a. Panelboards.
 - b. Transformers.
 - c. Service Disconnects.
- C. Wire Marker Installation:
1. Install wire marker for each conductor at panelboard gutters, and each load connection.
- D. Underground Warning Tape Installation:
1. Install underground warning tape along length of each underground conduit, raceway, or cable 6 to 8 inches below finished grade, directly above buried conduit.

END OF SECTION

**SECTION 16095
MINOR ELECTRICAL DEMOLITION****PART 1 - GENERAL**

1.01 SUMMARY

A. Section Includes:

1. Removal of existing electrical equipment, wiring, and conduit in areas to be remodeled; removal of designated construction; dismantling, cutting and alterations for completion of the Work.
2. Disposal of materials.
3. Storage of removed materials.
4. Identification of utilities.
5. Salvaged items.
6. Relocate existing equipment to accommodate construction.

1.02 SUBMITTALS

- A. Section 16010 - Submittals.
- B. Shop Drawings: Indicate demolition, location and construction of temporary work. Describe demolition removal procedures and phasing schedule.

1.03 SCHEDULING

- A. Coordinate all demolition with Engineer, Puget Sound Energy and the Owner before commencing work.
- B. Schedule work to coincide with phasing and new construction.
 1. Perform noisy, malodorous or dusty work during hours as directed by the Owner and/or Engineer.

1.04 COORDINATION

- A. Section 16010 – Scheduling and Sequencing.
- B. Conduct demolition to minimize interference with adjacent or in-use areas.
- C. Coordinate and sequence demolition so as not to cause shutdown of operation of surrounding areas.

- D. Shut-down Periods:
 - 1. Arrange timing of shut-down periods of in-service panels at least 48 hours in advance with the Owner. Do not shut down any utility without prior written approval.
 - 2. Keep shut-down period to minimum or use intermittent period as directed by the Owner.
 - 3. Maintain life-safety systems in full operation in adjacent or in-use areas.
- E. Identify salvage items in cooperation with the Owner.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Section 16010 - Verification.
- B. Verify that wiring and equipment indicated to be demolished serves only abandoned facilities, powercenters, and branch circuit.
- C. Verify termination points for demolished services.

3.02 PREPARATION

- A. Erect, and maintain temporary safeguards, including warning signs and lights, barricades or similar measures, for protection of the public, the Owner, Contractor's employees, and existing improvements to remain.
- B. Provide temporary egress signage and emergency lighting where required.

3.03 DEMOLITION

- A. Demolition Drawings are based on casual field observation and/or existing record documents. Report discrepancies to Engineer before disturbing existing installation or proceeding with work.
- B. Remove all exposed abandoned conduits, supports, and electrical devices.
- C. Remove conduit, wire, boxes, and fastening devices to avoid any interference with new installation.

- D. Reconnect equipment being disturbed by renovation work and required for continued service.
 - E. Disconnect or shut off service to areas where electrical work is to be removed. Remove equipment and related conduit and wiring that are not part of final project.
 - F. Clean and repair existing equipment to remain.
- 3.04 SALVAGE ITEMS
- A. Remove and protect items indicated on Performance Drawings to be salvaged and turn over to the owner.
 - B. Items of salvageable value may be removed as work progresses. Transport salvaged items from site as they are removed. Dispose of salvage in approved manner.
- 3.05 REUSABLE ELECTRICAL EQUIPMENT
- A. Disconnect, remove, or relocate existing electrical material and equipment interfering with new installation.
 - B. Reconnect existing lighting fixture to maintain the existing Lighting System.
- 3.06 DISPOSAL
- A. Properly dispose of all spoils materials to be removed from site.
 - B. Properly dispose of concrete and pavement in accordance with local rules and regulations.
 - C. Properly dispose of soils in accordance with local rules and regulations
- 3.07 CLEANING
- A. Section 16010 - Cleaning.
 - B. Remove demolished materials as work progresses. Legally dispose.
 - C. Keep workplace neat.

END OF SECTION

1) SECTION 16120
WIRES AND CABLES

PART 1 - GENERAL

1.01 SUMMARY

- A. Section includes building wire and cable, portable power cable and wiring connectors and connections.

1.02 REFERENCES

- A. NECA (National Electrical Contractors Association) - Standard of Installation.

1.03 SYSTEM DESCRIPTION

- A. Product Requirements: Provide products as follows:
1. Solid conductor for feeders and branch circuits 10 AWG and smaller.
 2. Conductor not smaller than 12 AWG for power and lighting circuits.
 3. 10 AWG conductors for 20 ampere, 120-volt branch circuits longer than 75 feet.
 4. Type G portable power cable for underwater applications or installations where physical movement is encountered.
- B. Wiring Methods: Provide the following wiring methods:
1. Use only building wire, Type XHHW-2 insulation, in raceway unless otherwise shown on drawings.
 2. Use Type G portable power cable with integral ground wire for underwater applications and connections from fixed-to-floating or floating-to-floating applications.

1.04 DESIGN REQUIREMENTS

- A. Conductor shall be copper only.

1.05 SUBMITTALS

- A. Section 16010 - Submittals.
- B. Product Data: Submit for wire.

- C. Project Record Documents: Record actual locations of components and circuits.

1.06 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

1.07 COORDINATION

- A. Section 16010 – Sequencing and Scheduling.
- B. Where wire and cable destination is indicated and routing is not shown, determine routing and lengths required.
- C. Wire and cable routing indicated is approximate unless dimensioned.

PART 2 - PRODUCTS

2.01 BUILDING WIRE

- A. Manufacturers:
 - 1. Southwire
 - 2. General Cable Co.
 - 3. Substitutions: Section 16010 - Submittals.
- B. Product Description: Single conductor insulated wire.
- C. Conductor: Copper.
- D. Insulation Rating: 600 volts, 90 degrees C.
- E. Insulation: NFPA 70; Type XHHW-2 insulation for feeders and branch circuits.

2.02 PORTABLE POWER CABLE (TYPE G)

- A. Manufacturers:
 - 1. Southwire
 - 2. General Cable.
 - 3. Substitutions: Section 16010 - Submittals.
- B. Product Description: Flexible power cable, multi-conductor with integral grounding conductors. UL listed and labeled Type G. Suitable for continuous immersion in water.

- C. Conductor: Copper.
- D. Insulation Rating: 2000 volts, 90 degrees C.
- E. Insulation: Ethylene propylene rubber insulation, chlorinated polyethylene jacket.

2.03 WIRING CONNECTORS

- A. Solderless Pressure Connectors or Compression Connectors.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Section 16010 – Verification.
- B. Verify that site and marine work likely to damage wire and cable has been completed.
- C. Verify that raceway and junction box installation are complete and supported.

3.02 PREPARATION

- A. Completely and thoroughly swab raceway before installing wire.

3.03 EXISTING WORK

- A. Provide access to existing wiring connections remaining active and requiring access. Modify existing installation as needed.
- B. Extend existing circuits using materials and methods as specified.
- C. Clean and repair existing wire and cable remaining.

3.04 INSTALLATION

- A. Route wire and cable to meet Project design guidelines and conditions.
- B. Install wire and cable in accordance with NECA "Standard of Installation."
- C. Neatly train and lace wiring inside boxes, equipment, and panelboards.
- D. Identify wire and cable under provisions of Section 16075. Identify each conductor with its circuit number or other designation indicated.
- E. Special Techniques--Building Wire in Raceway:
 - 1. Pull conductors into raceway at same time.

2. Install building wire 4 AWG and larger with pulling equipment.

F. Special Techniques - Wiring Connections:

1. Clean conductor surfaces before installing lugs and connectors.
2. Make splices, taps, and terminations to carry full ampacity of conductors with no perceptible temperature rise.
3. Tape uninsulated conductors and connectors with electrical tape to 150 percent of insulation rating of conductor.
4. Install solderless pressure connectors with insulating covers for copper conductor splices and taps, 8 AWG and smaller.
5. Install insulated spring wire connectors with plastic caps for copper conductor splices and taps, 10 AWG and smaller.
6. Install solid conductor for feeders and branch circuits 10 AWG and smaller.

G. Fixed Pier (Over-Water) Installation

1. All conductors for marine-side installation to be copper.
2. Use type XHHW-2 copper wire in raceway for all fixed point-to-point applications inside floats or inside raceway on ramps. All wiring to be installed in suitable raceway.
3. All conductor entering junction boxes shall be in raceway.
4. Use type G multi-conductor cable with integral ground wire for connection of power feeders between floating elements (floats) and from floating elements (floats) to landside. Terminate multi-conductor cable at each end inside junction boxes or handholes intended for transitioning multi-conductor cable to single-conductor wire or with suitable connectors on lugs inside electrical equipment.
5. Provide cable strain relief devices for Type G cable at all places where cable hangs unsupported. Strain relief to be mesh grip configuration of stainless steel, Kellems type and sized for the maximum yield stress.
6. Install Type G cable cut to a suitable length to allow for maximum float movement, including tidal and storm action without imposing undue stress on cable. Cable shall be arranged to lay on seabed between seawall and float and routed in a direct manner. Cables between floating elements shall be arranged to hang in water as required. All installation to be made with cable strain relief devices.

3.05 WIRE COLOR

A. General

1. For wire sizes 10 AWG and smaller, install wire colors in accordance with the following:
 - a. Black and red for single phase circuits at 120/240 volts.
 - b. Orange, brown, and yellow for circuits at 277/480 volts single or three phase.
 2. For wire sizes 8 AWG and larger, identify wire with colored tape at terminals, splices and boxes. Colors are as follows:
 - a. Black and red for single phase circuits at 120/240 volts.
 - b. Orange, brown, and yellow for circuits at 277/480 volts single or three phase.
- B. Neutral Conductors: White. When two or more neutrals are located in one conduit, individually identify each with proper circuit number.
- C. Branch Circuit Conductors: Install three or four wire home runs with each phase uniquely color-coded.
- D. Feeder Circuit Conductors: Uniquely color code each phase.
- E. Ground Conductors:
1. For 6 AWG and smaller: Green.
 2. For 4 AWG and larger: Identify with green tape at both ends and visible points including junction boxes.
- F. Control Conductors and Cables: Individually color-coded as required.

3.06 FIELD QUALITY CONTROL

- A. Section 16010 – Field Quality Control.

END OF SECTION

**SECTION 16130
RACEWAY AND BOXES****PART 1 - GENERAL**

1.01 SUMMARY

- A. Section includes conduit, outlet boxes, pull and junction boxes, and vaults.

1.02 REFERENCES

- A. ANSI C80.1 - Rigid Steel Conduit, Zinc Coated.
- B. ANSI C80.3 - Electrical Metallic Tubing, Zinc Coated.
- C. NECA (National Electrical Contractor's Association) - "Standard of Installation"
- D. NEMA FB 1 (National Electrical Manufacturers Association) - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit and Cable Assemblies.
- E. NEMA OS 1 (National Electrical Manufacturers Association) - Sheet-steel Outlet Boxes, Device Boxes, Covers, and Box Supports.
- F. NEMA OS 2 (National Electrical Manufacturers Association) - Nonmetallic Outlet Boxes, Device Boxes, Covers and Box Supports.
- G. NEMA TC 2 (National Electrical Manufacturers Association) - Electrical Plastic Tubing (EPT) and Conduit (EPC-40 and EPC-80).
- H. NEMA TC 3 (National Electrical Manufacturers Association) - PVC Fittings for Use with Rigid PVC Conduit and Tubing.
- I. NEMA 250 (National Electrical Manufacturers Association) - Enclosures for Electrical Equipment (1000 Volts Maximum).

1.03 SYSTEM DESCRIPTION

- A. Provide all raceway and boxes to complete the wiring system. Raceway and boxes located at other locations required for splices, taps, wire pulling, equipment connections, and compliance with regulatory requirements.
- B. Underground: Provide thin-wall nonmetallic conduit, unless otherwise shown on plans. Provide cast metal boxes or nonmetallic handhole. Provide rigid steel conduit for all bends and stub-ups. Provide cast metal or nonmetallic boxes or pre-cast concrete vaults.
- C. Above Grade: Provide rigid steel conduit. Provide cast metal or nonmetallic outlet, pull, and junction boxes.

- D. Overwater or in Floating Elements: Provide thinwall non-metallic conduit. Provide hot molded glass fiber reinforced polyester boxes, NEMA 6 or 6P.

1.04 DESIGN REQUIREMENTS

- A. Minimum Raceway Size: 3/4 inch unless otherwise specified.

1.05 SUBMITTALS

- A. Section 16010 - Submittals.
- B. Product Data: Submit for the following:
 - 1. Metal conduit.
 - 2. Liquidtight flexible metal conduit.
 - 3. Nonmetallic conduit.
 - 4. Raceway fittings.
 - 5. Conduit bodies.
 - 6. Outlet boxes.
 - 7. Pull and junction boxes.
 - 8. Handholes.
- C. Manufacturer's Installation Instructions: Submit application conditions and limitations of use stipulated by Product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, and installation of Product.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Section 16010 – Delivery, Storage and Handling.
- B. Protect conduit from corrosion and entrance of debris by storing above grade. Provide appropriate covering.
- C. Protect PVC conduit from sunlight.

1.07 COORDINATION

- A. Section 16010 – Sequencing and Scheduling.
- B. Coordinate installation of outlet boxes for equipment connected under Section 16150.

PART 2 - PRODUCTS

2.01 METAL CONDUIT

- A. Manufacturers:
 - 1. Allied Tube and Conduit
 - 2. Western Tube and Conduit
 - 3. Wheatland Tube Company
 - 4. Substitutions: Section 16010 - Submittals.
- B. Rigid Steel Conduit: ANSI C80.1.
- C. Fittings and Conduit Bodies: NEMA FB 1; aluminum or steel fittings.

2.02 LIQUIDTIGHT FLEXIBLE METAL CONDUIT

- A. Manufacturers:
 - 1. Anaconda
 - 2. Eastern Wire and Conduit
 - 3. Electriflex
 - 4. Substitutions: Section 16010 - Submittals.
- B. Product Description: Interlocked steel construction with PVC jacket.
- C. Fittings: NEMA FB 1.

2.03 NONMETALLIC CONDUIT

- A. Manufacturers:
 - 1. Carlon
 - 2. Ipex
 - 3. PW Pipe
 - 4. Substitutions: Section 16010 - Submittals.
- B. Product Description: NEMA TC 2; Schedule 40 PVC. Schedule 80 where indicated on drawings.

- C. Fittings and Conduit Bodies: NEMA TC 3.

2.04 OUTLET BOXES

- A. Manufacturers:

1. Allied Molded Products
2. Appleton
3. Arc-Co
4. Carlon
5. Crouse-Hinds
6. Raco
7. Substitutions: Section 16010 - Submittals.

- B. Nonmetallic Outlet Boxes: NEMA OS 2.

- C. Cast Boxes: NEMA FB 1, Type FD, cast aluminum or feralloy. Furnish gasketed cover by box manufacturer. Furnish threaded hubs.

2.05 PULL AND JUNCTION BOXES

- A. Manufacturers:

1. Hoffman
2. Quazite
3. Skyline
4. Stahlin
5. Utility Vault Co.
6. Substitutions: Section 16010 - Submittals.

- B. Fiberglass Handholes: Die-molded, glass-fiber hand holes:

1. Cable Entrance: Pre-cut 6 inch x 6 inch cable entrance at center bottom of each side.
2. Cover: Glass-fiber, weatherproof cover with nonskid finish.

- C. In-Ground Cast Metal Box: NEMA 250, Type 6, recessed cover box for flush mounting:
 - 1. Material: Galvanized cast iron.
 - 2. Cover: Smooth Nonskid cover with neoprene gasket and stainless steel cover screws.
 - 3. Cover Legend: "ELECTRIC".
- 2.06 PULL AND JUNCTION BOXES – OVERWATER INSTALLATIONS
- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Vynckier
 - 2. Or equal
 - B. Submersible type, UL listed.
 - C. Boxes for areas subject to temporary or prolonged submersion: hot molded glass fiber reinforced polyester, with M4 threaded inserts.
 - D. Polyester enclosures can withstand continuous temperatures up to 70°C.
 - E. Rated insulation voltage: 1000V.
 - F. NEMA rated types 6 and 6P.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Section 16010 – Sequencing and Scheduling, Verification.
- B. Verify handhole locations and routing and termination locations of raceway prior to construction. Locate underground utilities before excavation.
- C.

3.02 EXISTING WORK

- A. Disconnect and remove abandoned devices and equipment.
- B. Maintain access to existing installations remaining active and requiring access. Modify installation as needed.

- C. Extend existing raceway and box installations using materials and methods as specified.

3.03 INSTALLATION

- A. Install raceway and boxes in accordance with NECA "Standard of Installation."
- B. Ground and bond raceway and boxes in accordance with Section 16060.
- C. Fasten raceway and box supports to structure in accordance with Section 16070.
- D. Identify raceway and boxes in accordance with Section 16075.

3.04 INSTALLATION - RACEWAY

- A. Raceway routing is shown in approximate locations unless dimensioned. Route to complete wiring system.
- B. Coordinate installation of all raceway and vaults with underground civil/structural elements. Verify and maintain clearances to buried tiebacks in all places.
- C. Maintain clearance between raceway and piping for maintenance purposes. Maintain clearances in underground raceway as required by serving utility.
- D. Cut conduit square using saw or pipe cutter; de-burr cut ends.
- E. Bring conduit to shoulder of fittings; fasten securely.
- F. Join nonmetallic conduit using cement as recommended by manufacturer. Wipe nonmetallic conduit dry and clean before joining. Apply full even coat of cement to entire area inserted in fitting. Allow joint to cure for minimum 20 minutes.
- G. Install conduit hubs or sealing locknuts to fasten conduit to cast boxes.
- H. Install no more than equivalent of three 90-degree bends between boxes. Install conduit bodies to make sharp changes in direction, as around beams. Use hydraulic one-shot bender to fabricate or factory elbows for bends in metal conduit larger than 2-inch size.
- I. Avoid moisture traps. Install underground raceway to drain to vaults where possible. Conform to serving utility requirements as required.
- J. Install suitable pull string or cord in each empty raceway except sleeves and nipples. Conform to serving utility requirements as required.
- K. Install suitable caps to protect installed conduit against entrance of dirt and moisture. Coordinate installation of bell-ends on raceway entering vaults with serving utility as required.

3.05 INSTALLATION – BOXES

- A. Pull and Junction Box Installation:
1. Provide as required to facilitate installation of the Work or as required by NFPA 70.
 2. Locate so that covers are accessible at all times.
 3. Support boxes independently of raceway.

3.06 INSTALLATION - OVER-WATER (FLOATS)

- A. All installation on or in floating elements (ramps, headwalks and docks or floats) to be NEMA 4X minimum. Installations on fixed piers over water to be NEMA 3R or 4X minimum. Raceway and boxes shall be of materials described herein.
- B. Conduit, fittings, hubs, elbows, device boxes to be of Rigid Nonmetallic Conduit (RNC) material (e.g. – PVC) on all fixed or floating installations over water. Flexible conduit to be Liquidtight Flexible Nonmetallic Conduit (LFNC).
- C. Furnish and install nonmetallic (PVC) Schedule 40 conduit in ductways pre-cast inside floats. Conduit shall be continuous cemented segments from one cast-in-place handhole to the next. Conduits shall be furnished with end bells to facilitate conductor pulling at point of termination in cast-in-place handholes. Provide separate conduits for power, telephone/data, cable television and fire alarm. Arrange power conduits in ducts separate from low voltage/signal system conduits. Secure conduits by short length of stainless steel unistrut and straps at each end inside handhole. No ferrous metal fittings or hardware shall be used inside in-float handholes.
- D. Exposed pull and junction boxes on floating elements (floats) shall be non-metallic, NEMA 6 or 6P. Provide properly treated 4 x 8-inch wood or galvanized steel support structure as required to support box.
- E. Pull and junction boxes at seawall for termination of flexible cable shall be non-metallic NEMA 6 or 6P.
- F. Provide stainless cable-grip device to properly support type-G cable at terminations where cable is not supported in raceway.
- G. Attach no raceway to exterior of float without prior approval of engineer.
- H. Install electrical support materials to access ramps only as authorized and recommended by ramp manufacturer. Do not penetrate or weld to ramp structure without express consent of ramp manufacturer. All electrical installation on ramps to be made parallel or at right angles to ramp structure. Attaching hardware to be hot dipped galvanized or 316 stainless steel or as required to avoid corrosion due to proximity of dissimilar metals.

3.07 PROTECTION

- A. Provide final protection to maintain coatings and finishes without damage at time of substantial completion.
 - 1. Repair damage to galvanized finishes with zinc-rich paint as recommended by manufacturer.
 - 2. Repair damage to PVC or paint finishes with matching touch-up coating as recommended by manufacturer.

3.08 CLEANING

- A. Section 16010 - Cleaning
- B. Clean interior of boxes to remove dust, debris, and other material.
- C. Clean exposed surfaces and restore finish.

END OF SECTION

**SECTION 16145
DOCKSIDE POWER CENTERS****PART 1 – GENERAL****1.01 SUMMARY**

- A. This Section includes requirements for 120/240 Volt & 208 Volt 3 phase Dockside Power Centers. Provide Dockside Power Centers as detailed on the drawings and specified herein.
- B. Related Documents: The provisions and intent of the Contract, the General and Supplementary Conditions, and Division 1 “General Requirements” Specifications Sections, apply to the Work as if specified in this Section.
- C. Related Sections:
 - 1. Division 16, Section 16060 “Grounding and Bonding.”
 - 2. Division 16, Section 16075 “Electrical Identification.”
 - 3. Division 16, Section 16130 “Raceway and Boxes.”
- D. Coordination:
 - 1. Coordinate the location of units, size and routing of conduit, size and location of splice boxes and proper anchorage of unit to custom stands with the existing project conditions and proposed design requirements.

1.02 REFERENCES

- A. NEMA WD 1
- B. NFPA 70 (National Fire Protection Association) – National Electrical Code.
- C. U.L. (Underwriters Laboratories).

1.03 QUALITY ASSURANCE

- A. Manufacture: Company specializing in the manufacture of products specified in this section with minimum 20 years successful in-service performance.
- B. Provide dockside power centers bearing a U.L. label, which shall cover the entire assembly, with all internal components factory assembled in a U.L. qualified shop.
- C. Listing and Labeling: Provide electrical components, devices, and accessories that are Listed and Labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to the Authority Having Jurisdiction, and marked for intended use for the location and environment in which they are installed.
- D. Comply with NEMA WD 1.

- E. Comply with NFPA 70, as adopted and administered by the Authority Having Jurisdiction.

1.04 SUBMITTALS

- A. Comply with Division 1, "Pre-Construction Submittals".
- B. Product Data: For each product specified.
- C. Manufacturer's Installation Instructions, including storage, handling, protection, examination, preparation, and installation of product.
- D. Shop Drawings: Include layout drawings showing components and wiring for nonstandard enclosures, and cabinets.
- E. Identification: Labeling for receptacles and circuit breakers as identified below.
- F. Maintenance Data: For materials and products to include in maintenance manuals specified in Division 1.

1.05 COORDINATION

- A. Coordinate with existing conditions. , size and routing of conduit and proper anchorage of unit to float. Maintain required NEC and access clearances. Provide mounting height of unit above float deck to conform to NEC.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Sea Technology, Ltd.
P.O. Box 489
Gloucester, Virginia 23061-0489

Local Representative: Darrell McNabb

2001 Management Associates, Inc
1012 Boylston Ave.
Seattle, Wa 98104
206-953-6767 Work
206-332-6062 Fax

2.02 MATERIAL REQUIREMENTS

- A. Dockside Power Centers shall be as manufactured by Sea Technology, Ltd., consisting of the following components:
1. Completely unitized and factory pre-wired fiberglass-enclosed dockside power center suitable for pedestal mounting on fixed or floating marine docks.
 2. Fiberglass enclosure. The fiberglass enclosure shall be UL listed to UL Standard 508, suitable for outdoor use in corrosive atmospheres and be ultra-violet resistant. The enclosures shall be GRAY in color. The fiberglass material shall be self-extinguishing halogen free and meet the requirements of the UL 746C. Enclosures shall be hot compression, injection molded from a fiberglass reinforced polyester mixture containing not less than 25% fiberglass by weight. The mixture shall also contain aluminum hydroxide to extend the life of fiberglass subjected to ultraviolet exposure. Cold molded fiberglass such as by hand lay-up or spray-up process shall not be used. The enclosure body shall not be comprised of any glued parts. Door sealing shall be by extruded continuous neoprene gaskets seated in a molded channel and not glued to a flat surface. The door shall be permanently hinged to the enclosure at the bottom, arranged to swing open through a 90-degree arc with a stop to limit further motion. The door shall latch at the top with two lockable stainless-steel hasps attached with tamper-proof hardware and two screw fasteners at the top corners of the enclosure. External metal parts shall be stainless steel, grade 304 minimum. Internal metal parts shall be corrosion resistant and meet the requirements of the ASTM 117-64 salt spray test. Internal wiring shall be neatly trained and bundled and arranged to permit the 90-degree door swing. The enclosure shall carry an outdoor life rating shall of 25 years. The enclosure shall be finished with a special paint coating and carry a 10-year manufacturer's warranty against ultraviolet surface blemishing.
 3. For power centers that serve two boats, all receptacles, circuit breakers and counter shall be grouped on that side of the enclosure corresponding to the boat slip served.
 4. Flip up spring-loaded cover and cover bases for all circuit breakers and receptacles shall be provided. Covers bases for receptacles shall be strain-relief type. Breaker covers shall be through-bolted to enclosure with tamper proof hardware. Provisions for sealing or pad locking the breaker cover shut shall be provided. Breaker cover lock down post shall be through-bolted to enclosure with tamper proof hardware. Two 1/8 inch thick, adhesive backed closed cell neoprene gaskets shaped as to provide raintight seal for cover and cover base. Cover and base to be General Electric designated "LEXAN" Catalog No. 500 R, rated 94-5V and suitable for ultra-violet exposure. Main body of cover shall measure

- 3-1/4 inch in diameter, with material thickness to be 0.050 inches. All covers and cover bases shall be grey in color.
5. An individual thermal-magnetic circuit breaker shall be provided for each receptacle in the enclosure. The circuit breaker shall be sized for the receptacle rating. Circuit breakers shall be located on the same side of the enclosure as the receptacle they feed. All circuit breakers shall be provided with covers as above and shall comply with NFPA 303. Circuit breakers shall be manufactured by a major electrical equipment manufacturer (Square D with VISI trip indicator or equal).
 6. Power receptacles shall be provided in the power centers as scheduled on the drawings. All receptacles to be female unless noted otherwise on drawings and suitable for use in marine environments. All receptacles shall be provided with strain-relief covers and shall comply with NFPA 303. Receptacles shall be as scheduled and be correct for standard marina ship-to-shore applications. Receptacles shall be manufactured by a major electrical equipment manufacturer.
 7. Integrated LED light. Lens to be GE plastic, Lexan LS2, overall .08 inch thick, 5-3/4 inch by 2-1/3 inch, with neoprene gasket. Lens shall be designed to illuminate the dock surface and the surrounding area
 8. Incoming power cable termination block (buss block) capable of accommodating two sets of feeders to permit loop feed connection. Block shall be capable of accepting feeders sized per drawings.
 9. Identification: Each circuit breaker cover and receptacle cover shall be uniquely labeled A, B, C, or D, with the letter on the receptacle cover matching the letter on the associated circuit breaker cover. Letters shall be affixed to the cover. In addition to letter designations, a label shall indicate the amperage and voltage at each receptacle (for example: A – 50 Amp, 240 Volt). Labels shall be molded into the cover. Submit label design (including dimensional information) for review and approval.
 10. All mounting and bolting hardware shall be stainless steel grade 304 minimum.
 11. All assembled dockside power centers shall be UL listed for marine use and be warranted for 5 years against defects in component quality and workmanship. All defective components shall be replaced at no cost to the Owner.
 12. Each dockside power center shall be completely pre-wired at the factory.

2.03 NAMEPLATES

- A. Provide overall nameplate for each power center, indicating the slip number served and the source panelboard/circuit number.

PART 3 – EXECUTION**3.01 INSTALLATION**

- A. Mounting: Secure solidly to support pedestals per manufacturer's recommendations and as shown on the drawings.
- B. Install devices and assemblies plumb and secure.

3.02 IDENTIFICATION

- A. Identify panelboard from which power center is served and comply with Division 16, Section 16075 "Electrical Identification."

3.03 CONNECTIONS

- A. Connect incoming ground wire to the ground bus inside the power center.
- B. Verify all wiring device grounding terminals are connected to ground bus.
- C. Provide dielectric grease to torque down the connections and apply urethane seal.

3.04 FIELD QUALITY CONTROL

- A. Test wiring devices for proper polarity and ground continuity. Operate each device.
- B. Test meter operation.
- C. Replace damaged or defective components.

3.05 CLEANING

- A. Internally clean power center, devices, device outlet boxes, and enclosures. Replace stained or improperly painted wall plates or devices.

END OF SECTION

**SECTION 16150
WIRING CONNECTIONS****PART 1 - GENERAL**

1.01 SUMMARY

- A. Section includes electrical connections to equipment.
- B. Related Sections:
 - 1. Section 16123 - Building Wire and Cable.
 - 2. Section 16130 - Raceway and Boxes.

1.02 SUBMITTALS

- A. Section 16010 - Submittals.
- B. Product Data: Submit wiring device manufacturer's catalog information showing dimensions, configurations, and construction.
- C. Manufacturer's installation instructions.
- D. Project Record Documents: Record actual locations, sizes, and configurations of equipment connections.

1.03 COORDINATION

- A. Section 16010 – Sequencing and Scheduling.
- B. Obtain and review shop drawings, product data, manufacturer's wiring diagrams, and manufacturer's instructions for equipment furnished under other sections.
- C. Determine connection locations and requirements.
- D. Sequence rough-in of electrical connections to coordinate with installation of equipment.
- E. Sequence electrical connections to coordinate with start-up of equipment.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Section 16010 – Sequencing and Scheduling.
- B. Verify equipment is ready for electrical connection, for wiring, and to be energized.

3.02 INSTALLATION

- A. Make electrical connections.
- B. Provide equipment grounding connection to equipment.
- C. Make conduit connections to equipment using liquidtight flexible conduit with watertight connectors.
- D. Install suitable strain-relief clamps and fittings for cord connections at outlet boxes and equipment connection boxes. Galvanized or stainless steel.
- E. Install disconnect switches (enclosed circuit breakers) to complete equipment wiring requirements.
- F. Install terminal block jumpers to complete equipment wiring requirements.
- G. Install interconnecting conduit and wiring between devices and equipment to complete equipment wiring requirements.

END OF SECTION

SECTION 16462
MARINE DISTRIBUTION TRANSFORMERS, AND
PANELBOARDS

PART 1 – GENERAL

1.01 SUMMARY

- A. Section includes:
 - 1. Marine Dry-Type Transformers
 - 2. Marine Panelboards
- B. Related Sections:
 - 1. Section 16010 – Basic Electrical Requirements
 - 2. Section 16060 – Grounding and Bonding
 - 3. Section 16070 – Electrical Supports
 - 4. Section 16075 - Electrical Identification

1.02 REFERENCES

- A. NEMA AB 1 (National Electrical Manufacturers Association) – Molded Case Circuit Breakers
- B. NEMA PB 1 (National Electrical Manufacturers Association) - Panelboards
- C. NEMA ST 1 (National Electrical Manufacturers Association) - Specialty Transformers
- D. NEMA ST 20 (National Electrical Manufacturers Association) - Dry-Type Transformers for General Applications.
- E. NETA ATS (International Electrical Testing Association) - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.
- F. NFPA 70 (National Fire Protection Association) – National Electrical Code.
- G. UL 50 - (Underwriters Laboratory) – Enclosures for Electrical Equipment
- H. UL 67 - (Underwriters Laboratory) - Panelboards

- I. UL 1561 - (Underwriters Laboratory) - Dry Type General Purpose and Power Transformers.
- 1.03 QUALITY ASSURANCE
- A. Manufacturer: Company specializing in manufacturing products specified in this section for the intended application with minimum three years successful in-service performance.
 - B. Listing and Labeling: Provide components, devices, and accessories that are Listed and Labeled as defined in NFPA 70, Article 100 and marked for intended use for the location and environment in which they are installed.
 - C. Comply with NEMA PB 1.
 - D. Comply with NFPA 70, as adopted and administered by the Authority Having Jurisdiction.
- 1.04 SUBMITTALS
- A. Section 16010 - Submittals.
 - B. Product Data: Submit outline and support point dimensions of enclosures and accessories, unit weight, voltage, kVA, and impedance ratings and characteristics, tap configurations, insulation system type, rated temperature rise, compliance with seismic rating and labeling requirements. Show lifting attachment points for transformers and unit substations. Submit description of enclosure and application data for installation of unit on floating marine elements.
 - C. Submit bus configuration, one-line-diagram, current and voltage ratings and short-circuit current rating for panelboards.
 - D. Test Reports: Indicate loss data, efficiency at 25, 50, 75 and 100 percent rated load, and sound level.
 - 1. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 - E. Operations and Maintenance Data: Comply with Division 1, Section "Operations and Maintenance Data"
- 1.05 DELIVERY, STORAGE, AND HANDLING
- A. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

- B. Handle in accordance with manufacturer's written instructions. Lift only with lugs provided for the purpose. Handle carefully to avoid damage to transformer/substation internal components, enclosure, and finish.

1.06 COORDINATION

- A. Section 16010 – Sequencing and Scheduling.
- B. Coordinate layout and installation of transformers/substations with other construction including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access and ventilation.
- C. Coordinate with other trades for size and location of support and anchorage bases for actual equipment supplied.
- D. Coordinate equipment supports with other trades.

1.07 EXTRA MATERIALS

- A. Spare Circuit Breakers: Five spare circuit breakers of sizes most used in unit substation panelboards.
- B. Keys: Four spares of panelboard/cabinet lock key.

PART 2 – PRODUCTS

2.01 MARINE TWO-WINDING DRY-TYPE TRANSFORMERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. AMP
 - 2. IEM
- B. Label: UL label required.
- C. Construction:
 - 1. Description: Copper, two-winding, dry-type, 1-phase or 3-phase using 1 coil per phase in primary and secondary, size as indicated. Winding shall be double-dipped in a salt-resistant insulating medium.
 - 2. Compliance: Comply with NEMA ST 20 and UL 1561.
 - 3. Insulation Class:

- a. 15 kVA and smaller - 185°C class.
 - b. Larger than 15 kVA - 220°C class.
4. Insulation Temperature Rise:
 - a. 150°C rise above 40°C ambient.
 5. Basic Impulse Level:
 - a. 3-300 kVA - 10kV
 - b. Over 300 kVA - 30kV
 6. Taps: 2-2 1/2% FCAN, 2-2 1/2% FCBN
 7. Enclosure: Outdoor, ventilated, NEMA 3R. For transformers installed overwater, enclosure shall be stainless steel. Finish shall be polyurethane powder coated, color white over primer coat. Provide lifting eyes.
 8. Case temperature: 35°C rise above ambient at warmest point at full load.
 9. Sound Level Standards: Sound level standards as defined in NEMA and ANSI.
 10. Nameplate: Include transformer rating and transformer connection data.
 11. Cooling fans are not allowed for transformers.
 12. Three-Phase Transformers
 - a. Primary Winding: 480 Volts 3 phase
 - b. Secondary Winding: 120/208 Volts 3 phase 4 wire
 - c. Or as otherwise scheduled on the drawings.

2.02 MARINE PANELBOARDS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. AMP
 2. IEM
- B. Description: Distribution panelboard in enclosure intended for installation on fixed or floating piers in saltwater marine environment.
- C. Rating: As scheduled on Performance drawings.
- D. Label: UL label required.

- E. Panelboard Construction:
1. Outdoor, ventilated, raintight, NEMA 3R. Enclosure shall be marine grade aluminum alloy #5052, tamper resistant. Hot-dipped galvanized steel frame. Enclosure finish shall be polyurethane powder coated, color white over primer coat.
 2. All copper bus including neutral and ground bus.
 3. Thermal-magnetic, molded-case circuit breakers with inverse-element for overloads and magnetic trip for faults. Standard frame and trip sizes. Circuit breakers of major manufacturer (Square D or equal). Bolt-on type.
 4. Entirely dead-front construction.
 5. Directory Card: Transparent protective cover, mounted inside metal frame, inside panel door.
 6. All external hardware stainless steel. All doors lockable to key master per Owners specification.
 7. Provide panel heater to keep panel dry.
- 2.03 SOURCE QUALITY CONTROL
- A. Production test each unit according to NEMA ST 20.

PART 3 – EXECUTION

3.01 EXAMINATION

- A. Examine surfaces to receive transformers for compliance with installation tolerances, ventilation requirements and other conditions affecting performance.
1. Proceed with installation only after unsatisfactory conditions have been corrected.
- B. Verify mounting supports are properly sized and located, including support bracing in overhead or dock structure.

3.02 INSTALLATION

- A. Section 16010 – Installation.
- B. Set transformer plumb and level.

- C. Anchor transformers to mounting surface. Insure suitable anchorage mechanism is provided in mounting surface.
- D. Provide grounding and bonding for separately derived system in accordance with Section 16060 - Grounding, Article 250 of the National Electrical Code, and the authority having jurisdiction.

3.03 IDENTIFICATION

- A. Provide labels for enclosures and components as specified in Section 16075 - Electrical Identification.
- B. Indicate transformer equipment designation, kVA rating, and primary and secondary voltage ratings.
- C. Panelboard Nameplates: Label each panelboard with engraved laminated-plastic nameplate with panel designation, power source and source location.
- D. Provide framed, typed panelboard circuit directory with accurate descriptions of the connected load. Hand-written directories are **not** acceptable. Complete directory only after all modifications have been made to correct load imbalance.
 - 1. Number circuit breakers with odd numbers on the left and even numbers on the right when facing the panel. Number consecutively; with multiple-pole breakers assigned multiple numbers.
 - 2. Identify branch circuits by slip numbers.
- E. Provide warning and caution signs where indicated or required by the Authority Having Jurisdiction.

3.04 FIELD QUALITY CONTROL

- A. Section 16010 – Field Quality Control.
- B. Perform inspections and tests listed in NETA ATS, Section 7.2.1.
- C. Measure primary and secondary voltages and make appropriate tap adjustments.
- D. Operate all circuit breakers to verify proper function.

END OF SECTION