Addendum No. 2

To: Pre-Quote Meeting Attendees and City of Mobile Bidding Website

From: Cindy Klotz, CIP PM
City of Mobile Architectural Engineering Department

Re: City of Mobile Alabama – Cathodic Protection for Bulkheads
155 and 201 South Water Street
Mobile, Alabama 36602
CT-018b-21

Date: March 24, 2023

This Addendum forms a part of, and modifies, the Project Manual for the above referenced project, dated February 27, 2023. Acknowledge the receipt of this Addendum No. 2 and all subsequent Addenda, if any, in the space provided on the Bid Form. Failure to do so may subject Bidder to disqualification.

General: N/A

Forms and Specifications:

Item 1: Section 01010 Summary of Work, Article 1.1G: Amend as follows:

"G. Material and Equipment: Products, transportation, handling, storage, and protection, products options, substitutions. A "Bill of Materials" and "Vendor Resources" section is provided in the Cathodic Protection technical specifications. These sections are provided for convenience only: contractor to verify all quantities. Labor and Materials may be sourced from any qualified supplier".

Item 2: Section 01010 Summary of Work, Article 1.3C: delete article in its entirety and substitute as follows:

"Work shall be performed in a single phase and includes landside and waterside cathodic protection at the Cruise Terminal and GulfQuest Maritime Museum waterfront. The Work also shall also

include the modification of the Cruise Terminal's electrical system to accommodate the new CP system, and the construction of a galvanized steel equipment platform at the Cruise Terminal.

Item 3: Section 01010 Summary of Work, Article 1.39B: change "…one (1) year warrantee…" to "…five (5) year warrantee". This change shall additionally take place throughout the Project Manual.

Item 4: Delete technical specification sections Cruise Terminal Landside dated September 30, 2022, GulfQuest Landside dated September 30, 2022, Cruise Terminal Waterside dated September 30, 2022, and GulfQuest Waterside dated September 30, 2022, in their entirety.

Item 5: Replace with new technical specification sections Cruise Terminal Landside CP dated March 22, 2023, GulfQuest Landside CP dated March 22, 2023, Cruise Terminal Waterside CP dated March 22, 2023, and GulfQuest Waterside CP dated March 22, 2023.

Drawings: N/A

RFIs: N/A

Attachments:

Technical specification sections

- Cruise Terminal Landside CP dated March 22, 2023
- GulfQuest Landside CP dated March 22, 2023
- Cruise Terminal Waterside CP dated March 22, 2023
- GulfQuest Waterside CP dated March 22, 2023

END OF ADDENDUM NO. 2

TECHNICAL SPECIFICATIONS

IMPRESSED CURRENT LANDSIDE CP SYSTEM SPECIFICATIONS

March 22, 2023
Addendum No. 2

CITY OF MOBILE ALABAMA

MOBILE CRUISE TERMINAL

TABLE OF CONTENTS

SECTION 1- GENERAL

1 SCOPE

1.1 The work consists of furnishing all labor, equipment, and materials, and performing all operations necessary to complete the following:

1.2 Install one (1) cathodic protection Rectifier.

1.3 Install one (1) each "linear" groundbed cathodic protection system to cathodically protect the landside of the seawall bulkhead associated with the Mobile Cruise Line Terminal, in Mobile, Alabama.

1.4 Conduct a native potential survey on the landside of the seawall at the Mobile Cruise Line Terminal.

1.5 Energize, adjust, and checkout the cathodic protection system after installation.

1.6 The linear anode is to be installed to a depth of twenty feet (20') which parallels the seawall. The soil resistivity was measured to be 2449 ohm-cm at the 20-foot depth. A soil boring log of this area shows that from 0' to -20' the soil consists of a loose brown, fine sand. From -20' to -35', soft clays were found.

1.7 The City of Mobile shall be responsible for furnishing and/or installing the AC power to the general area of the rectifier. This is to include the installation of a 480/3/60 three phase disconnect box, rated at 40 amps. This disconnect is to be installed within ten feet (10) of the rectifier's control panel.

1.8 Easements and permits as may be required.

1.9 A storage area for materials will be provided by the Mobile Cruise Line Terminal. It will be located underneath the two elevated platforms where the rectifiers are going to be located; or another onsite location as provided by the Cruise Terminal.

1.10 The drawings included with this specification indicate the general arrangement of the cathodic protection system. If the contractor desires to make changes to the CP system installation as shown on these drawings, then the changes shall be submitted to the owner's engineer for approval. This approval process must be done prior to any work being initiated as it relates to any departures from the CP system drawings of this specification.

1.11 Directional Boring: Contractor is responsible for locating underground utilities and/or structures.

2 CONTRACTOR CREDENTIALS

2.1 This CP system shall be installed, energized, and evaluated by a firm regularly engaged in the field of cathodic protection of marine seawall bulkheads and possess an accepted history in the installation of these kinds of marine installations. At all times during construction, the contractor shall maintain a qualified supervisor to direct the construction activity and interface with the City of Mobile's representative, as required.

2.2 The company that is awarded the contract to install the waterside CP system at Mobile Cruise Terminal must have at least ten (10) years of experience in the design and installation of CP systems on marine seawall bulkheads.

2.3 The supervisor for this job must possess the following two (2) AMPP (NACE) accreditations: 1) Corrosion Specialist-G and 2) Cathodic Protection Specialist or possess the AMPP (NACE) Accreditation of CP4. The firm who is awarded this project will provide all labor, materials, and supervision for the installation of the waterside CP system at Mobile Cruise Terminal. The supervisor must be on job site at all times while all construction/installation work is being performed.

2.4 The supervisor must have five (5) years of experience in installing and servicing CP systems for marine seawall bulkheads. This is to be evidence by the successful completion of five marine seawall bulkhead projects.

2.5 The firm that is awarded this contract must possess an Alabama State Contractors license at the time of bidding this project. They must also obtain and/or be able to meet other requirements in Division 1 Sections.

2.6 Evidence of the company's work experience/history in the field of marine (seawall) CP systems, the Supervisor's AMPP (NACE) accreditations, and his work experience/ history, to include a copy of the firm's Alabama Contractors License must be submitted with the bid for this project, otherwise the bid will not be considered as a valid response to the solicitation.

3 STANDARD PRODUCTS

3.1 Unless otherwise indicated in writing by the owner's engineer, materials under these specifications shall be considered standard products from manufacturers regularly engaged in the production of cathodic protection equipment and materials and of the manufacturer's latest approved standard design.

3.2 Where brand names and/or numbers are specified, it is understood that "or equal" shall apply. The brand names have been used only to describe the standard of quality, performance, and characteristics desired. However, if bidding an "equivalent to the brand specified, it is mandatory that the bidder furnish, at least seven (7) calendar days prior to the bid, detailed literature cutsheets, and/or specifications to be used in evaluation of products.

3.3 See Division 1 Sections 01010 "Summary of Work" Article 1.35 Substitutions and Section 01635 "Substitution Procedures" for more information.

4 MATERIAL SUBMITTALS

4.1 Contractor shall submit to owner for approval, a complete list of material and equipment. The list shall include catalog numbers, cuts, diagrams, drawings, and other descriptive date required by the owner. No consideration will be given to partial lists.

Anode – Linear Distributed Anode System
Positive Header Cables
Surface Cable Routing Junction Box Frame and Cover Rectifier
Negative Structure Header Cables
Electrical Conduit

4.2 See Division 1 Section 01010 Summary of Work and Section 01330 Submittal Procedures for Additional Information.

SECTION 2- PRODUCTS

1 RECTIFIERS

The landside rectifier shall be manufactured by Universal Rectifiers Model No. OSOI-100-200 CBCKRWZ.

- OSOI = Oil Cooled, Non-Hazardous area, Manual link bar control, Silicon stack
- DC rating: 100 Volts – 200 Amps
- C = 230/460 VAC, 3 Phase, 60 Hertz input
- B = Set to run on 460 VAC
- C = AC & DC lightning arrestors
- K = DC Failure Light
- R = 115 VAC convenience outlet on the front panel
- W= Terminal block for remote Monitor, terminals to include DC Volts=/-. Amps =/-, 15 VDC
- Z=Hybrid bridge stack with 3ph 12-volt relay for remote interruption (Apply 12 VDC to interrupt)
- Z = Binding Posts for Interrupt
- Z = One Positive Terminal for #2/0 cable
- Z = Two Negative Terminals for #1/0 cable with a shunt on each of the negative terminals
- Z - One 2” DC knockout and one 1” AC knockout
- Z – 12” Stand for Cabinet
- Type GO case, Hot Dip galvanized, approx. 1600 pounds
- 600 Gallons of transformer oil required

1.1 APPLICABLE STANDARDS

1.1.1 EMA Publication No. MR 20-1958, reaffirmed by NEMA 1971-Semiconductor Rectifiers, Cathodic Protection Units.

1.1.2 NEMA Standard Publication No. 250-1979, including Rev. No. 1 – December 1980, Enclosures for Electrical Equipment (1000 Volts maximum)

1.2 GENERAL

1.2.1 The AC input of the rectifiers shall be 115, 230 or 460 VAC – single or three phase – 60 Cycle.

1.3 ENCLOSURE

1.3.1 The rectifier case shall be NEMA 4X, completely weatherproof for outdoor use. The case shall be constructed of not less than eleven-gauge steel. All fabrication welds shall be clean and smooth. The entire case shall be hot dip galvanized per ASTM-123.

1.3.1.1 The cabinet is to be equipped with an instrument compartment welded to one end of the case prior to galvanizing. This compartment shall house

the circuit breaker, output meters and the output terminals and shall have a hinged door and lockable stainless-steel latch.

1.3.1.2 The lid on the oil chamber shall be hinged on one side and have a minimum of four stainless steel latches to provide a moisture proof seal. The gasket on the lid shall be an oil resistant neoprene sponge.

1.3.2 On rectifiers 500 watts and above, the transformer and stack shall be mounted on separate removable racks in the oil chamber.

1.3.3 The internal horizontal panel on which the voltage adjustment taps, AC input terminals and D.C. terminals are mounted shall be at least four inches below the recommended oil level as marked within the oil chamber.

1.3.4 All connecting wires from oil chamber to the instrument compartment shall be sealed with an oil resistant compound. These wires shall have a ½" gap in the insulation above oil level to prevent siphoning.

1.3.5 A grounding lug to accommodate a #6 wire shall be provide on the outside of the cabinet.

1.4 TRANSFORMER

1.4.1 The transformer shall be specifically designed for use in a cathodic protection rectifier, having separate primary and secondary copper windings. Wire size on both windings is to be based on a minimum of 1,000 circular mils per ampere. The material used in the core of the transformers shall be of such quality that core losses do not exceed 0.62 watts per pound. The amount of core material shall be no less than the amount given by the following formula:

AC = The square root of the watts in the primary divided by 5.58

1.4.2 AC = The minimum area of core in square inches. The core area is figured as the cross-sectional area of that portion of the core which passes through the coil.

1.4.3 The transformer shall be immersed in class F transformer varnish until all taps, insulating materials, outer wrapping and coil windings have been completely saturated. The transformer will then be oven baked until completely dry.

1.4.4 When a three-phase rectifier is specified, it shall be provided with a three-phase transformer with three separate wound legs or three separate transformers.

1.4.5 The secondary shall have a sufficient number of coarse and fine taps to provide a minimum of 18 equal step of adjustment. These taps shall be brought out to link bar arrangement for adjusting the output of the rectifier.

1.4.6 The link bars shall be terminated on at least a 5/16" stud lug that has one end drilled out so that the transformer tap wire can be soldered to the back of the stud.

1.4.7 Quick change plastic knobs with brass inserts shall be used to connect the link bars to the studs.

1.5 RECTIFYING ELEMENTS

1.5.1 The rectifier stack shall consist of high current density selenium cell arranged to give full wave rectification. Ratings shall be within the manufacturer's recommended current rating for continuous operation with a 50 degrees C ambient temperature.

1.5.2 The RMS voltage rating of the rectifier stack shall be sufficient to withstand, without damage, the full output of the transformer secondary when the load is disconnected from the D. C. terminals, i.e.., under open circuit conditions.

1.5.3 When silicon is used as the rectifying element, current rating for continuous operation shall be for 50 degrees C. ambient and the PRV rating of the diodes shall be at least 1200 PIV. The diodes shall be protected against high voltage surges with selenium surge suppressors.

1.5.4 Current and voltage shall be de-rated for higher ambient temperature, where required, and in accordance with the manufacturer's recommendations.

1.6 PROTECTIVE DEVICES

1.6.1 The entire unit is to be protected against overload and short circuit with a fully magnetic circuit breaker of proper rating connected between the A.C. supply and transformer primary.

1.6.2 Circuit breakers shall have two poles for single phase units and three poles for three phase units. In the case of 100 amps or less silicon rectifiers, single pole, fully magnetic circuit breakers shall be inserted in one leg of the A.C. secondary of single-phase units and in at least two of the secondary legs of a three-phase unit.

1.6.2.1 All units above 100 amps shall be bolt in style fuses and shall not rely on pressure type fuse holders.

1.7 DC METERS

1.7.1 One D.C. voltmeter and one D.C. ammeter shall be provided. Each will have an accuracy of 2% full scale. Hoyt # 17/3 meters or approved equal shall have minimum scale lengths of 1 5/8".

1.7.2 The ammeter shall be connected to an external shunt with and accuracy of at least 1%.

1.7.3 The shunt shall be plainly marked to show ampere rating and millivolt drop. This shunt is to be mounted on the front panel of the rectifier so as to be readily accessible for meter accuracy checks.

1.8 DC TERMINALS

1.8.1 Solderless lugs rated for full rectifier output current shall be provided for the positive and negative output terminals of the rectifier and shall be mounted on an insulated panel.

1.8.2 Output terminals shall be clearly identified on the panel as “Positive” and “Negative.”

1.9 WIRING AND CONDUCTORS

1.9.1 All wiring within the rectifier, except the meter circuits, shall be of the high temperature motor lead wire with a minimum of 105 degrees C rating. Wire size shall be based on not less than 500 circular mils per ampere.

1.9.2 All current carrying bolts, terminals and connections made through the panel shall be either soldered to the bolt head or made by use of double nut method, so as not to depend on the compression strength of the panel to maintain a tight connection.

1.9.3 Tap changing studs and output lugs shall be a minimum of 5/16” diameter.

1.10 RECTIFIER DATA

1.10.1 Each rectifier shall be provided with an engraved metal nameplate with the following information.

1. Name of manufacturer
2. AC input voltage
3. AC input amperes
4. AC frequency
5. Phase
6. DC output volts
7. DC output amperes
8. Ambient temperature in degrees C.

1.10.2 In addition to this a waterproof envelope, placed in a suitable holder in the rectifier door, shall contain a complete wiring diagram, operating and maintenance manual and a copy of the test data obtained on the final bench check out of the rectifier.

1.11 INSTRUMENT PANEL

1.11.1 Phenolic grade XXX, non-conductive, moisture resistant, specifically designed for panel board use.

2 AC POWER

2.1 AC Power to be supplied by the City of Mobile. The AC Power supplied will terminate in an AC Disconnect Box within ten feet (10’) of the rectifier. Please refer to Section 1, paragraph 1.7.

3 REMOTE RECTIFIER MONITORING

3.1 The rectifier is to have an American Innovation Satellite Rectifier Remote Monitor Unit Model No. RM4014S with Surge Arrester connected to the rectifier.

4 LINEAR ANODES

4.1 GENERAL DESCRIPTION

4.1.1 The landside anode shall be Ceranode Piggyback Linear Anode in Coke Sock: Model No. PBL-CS-559 ft.-STI-125H-20 ft.-583 ft.-1/0 AWG-KYNAR-CXFH – 559 ft. Active Length, CXFH connection, 20 ft. Lead and 579 ft. Tail plus 4 ft. for 2 ft. loop back, using 1/0 AWG Kynar20/HMWPR65 Cable rated at 400mAsqft for 20 years.

4.1.2 The linear anode assembly shall be pre-assembled at CerAnode and placed on a 48” wooden installation reel.

4.1.3 There will be 20ft lead and 610ft tail + 4ft for 2ft loop back, “Fold in Half”, using 1/0 AWG Kynar20/HMWPE65 Cable

4.1.4 Please refer to the drawing included with this specification for installation details of the installed linear anode assembly.

4.1.5 The anode must be assembled with Loresco SC3 carbon backfill in a natural cotton fiber sock as provided by CerAnode. Substitutions must be pre-approved per Division 1 Sections.

4.2 CURRENT DENSITY AND ANODE LIFE

4.2.1 The linear anode shall be rated at 400 ma per linear foot for an estimated life of 20 years. This application in soil will allow for a discharge rate of 236 amps for 20 years. At a discharge rate of 157 amps, the estimated life for this linear anode is 30 years.

4.2.2 This rating is good down to soil resistivity of 1300 ohm-cm.

4.3 LINEAR ANODE-TO-CABLE CONNECTION

4.3.1 The anode-to-cable connection shall be made at the center of each anode and have an electrical resistance of less than 0.001 ohm.

4.4 LINEAR ANODE QUALITY ASSURANCE

4.4.1 The linear anode assembly as assembled by CerAnode renders a 7-year factory warranty, when the linear anode is installed and operated as per the warranty specifications. This warranty is from CerAnode and not from the contractor

4.5 LINEAR ANODE HEADER CABLE

4.5.1 From the end of the Linear Anode back to the rectifier, 2/0 AWG HMWPE cable with “RED INSULATION” is to be used.

4.6 LINEAR ANODE HEADER CABLE SPLICE

4.6.1 The linear anode is to be spliced to the rectifier’s positive header cable using the Burndy “C” Crimp System. The “C” crimp to be used is Burndy Model No. YC26C26.

4.6.2 The splice kit to be used to encapsulate the splice of the linear anode cable to the rectifier's positive header cable is to be Royston's "Splice Right" splice kit.

5 RECTIFIER-TO-STRUCTURE (NEGATIVE) CABLE

5.1 Two (2) #1/0 AWG HMWPE cables will be welded to the front (water side) of the seawall via a Steel Structure Connection Plate. The location of these two plates is at the 150-foot location and 450-foot location as measured from the southeast corner of the seawall of the Mobile Cruise Line Terminal. These negative cable connection plates will be welded to the seawall about five feet (5') from the seafloor bottom. The plate and weld area to the seawall are to be coated liberally with underwater Alocit 28.15 Underwater Epoxy coating. These two cables will be routed along the face of the seawall on the bottom. When these two cables reach the area where the Surface Cable Routing Box is located, which is near the 350-foot location as measured from the southeast corner of this seawall; they be routed vertically to this Surface Cable Routing Box and then on to their appropriate landside rectifier. These cables along with the other cables installed along the face of the seawall are to be overlaid with Rip Rap Burlap Concrete Bags. All these cables are then routed to the top of the dock at this location via 2" PVC schedule 80 conduits. This makes a total of four negative cables that will be routed back to their respective rectifier for the CP systems associated with the Mobile Cruise Line Terminal seawall. Two (2) negative cables for the two (2) waterside rectifiers, and two (2) negative cables for the one (1) landside rectifier. The two landside negative cables are to be terminated in its appropriate rectifier cabinet.

5.2 CABLE-TO-STRUCTURE CONNECTION

5.2.1 The rectifier's negative cathodic protection cable shall be thermite welded to the structure steel connection plate which measures 6" by 6" by ¼" thick. The steel connection plate is then welded to the seawall with the double pass welding procedure. The entire plate and cable thermite weld area is to be liberally coated with Alocit 28.15 Underwater Epoxy coating.

5.3 THERMITE WELD COATING

5.3.1 Thermite welds shall be protected and coated with Alocit 28.15 Underwater Epoxy coating.

5.4 D.C. ELECTRICAL CONDUIT

5.4.1 D.C. electrical conduit and fittings shall be schedule 80 conduit grade PVC, conforming to all codes and ordinances. All 90 degree and 45-degree ells shall be the "sweep" style elbows.

5.5 SURFACE CABLE ROUTING JUNCTION BOXES

5.5.1 For the Cruise Line Terminal's "Landside" CP system, there will be two (2) of these Surface Cable Routing Junction Boxes. The aircraft rated frame and cover is to be EJ USA, Inc.'s Model 8083 Frame and Cover. They are to be used for the purposes of gaining access to the inside of the Surface Cable Routing Boxes. These boxes are where all of the CP systems cables are located as they are routed

to their appropriate rectifier. The junction box itself is to be constructed using rebar and concrete. The actual concrete construction details for the Surface Cable Routing Junction Boxes to which the EJ Frame and Cover are to be mounted, are shown in the drawing package with this specification.

5.5.2 One (1) of these Surface Cable Routing Junction Boxes is located at the northeast leg of the elevated platform where the rectifiers are installed. Before this box is actually constructed, this location serves as the "TAIL" pit for the directional bore that will be made to connect the linear anode's "HEAD" pit to this "TAIL" pit at the rectifier elevated platform. The linear anode assemblies' rectifier positive header cables will be routed through this junction box on their way to their appropriate rectifier. Please refer to the drawing provided with this specification for more detailed information.

5.5.3 The second Surface Cable Routing Junction Box is located where the two Linear Anode head pits are located in the parking lot of the Maritime Museum. In fact, there are not two "HEAD" pits, but just one large "HEAD" pit at this location and it is located where the two linear anode assemblies come together. One of the linear anode assemblies is for the Cruise Line Terminal and the other linear anode assembly is for the Maritime Museum. The directional bores for these two linear anode assemblies will be made from this same "HEAD" pit location. One will be made to the south and one will be made to the north. Please refer to the drawing package provided with this specification for more details. The directional bore that will allow for the linear anode positive header cables to be routed and connected to their appropriate rectifier, will be made to the southeast from this linear anode "HEAD" pit. Again, please refer to the drawings provided with this specification for more detailed information.

5.5.4 If the need arises, the contractor may make cable splices in the Surface Cable Routing Boxes. These splices are permitted for the purposes of facilitating the arduous task of cable installation. These splices are to use the Burndy Crimping System, using either the Burndy "C" Crimps, or the Burndy "Butt" Crimps. The spliced crimps are then to be sealed with Royston's "Splice Right" splice kits.

5.5.5 Header cable Surface Cable Routing Junction Boxes are to be EJ USA, Inc. Model No. 8083 and be rated for "Airport Traffic".

SECTION 3- EXECUTION AND INSTALLATION

1 LANDSIDE CATHODIC PROTECTION SYSTEM

1.1 The linear landside anode consists of one pre-assembled linear anode with an approximate active length of 590-feet long which uses the 400 mA MMO wire anode material.

1.2 The linear anode system is to be directional bored to an installed depth of twenty feet (20'). The directional bore will be done from the head pit located in the parking lot of the Maritime Museum. The bore is from the head pit to the south. Refer to Drawing included with this specification for specific details.

1.3 The linear anode landside positive header cable is to be 2/0 AWG HMWPE with RED insulation and is routed back to its rectifier via Surface Cable Routing Junction Boxes. The boxes are to be manufactured by EJ USA, Inc. They are "airport rated" and are Model No. 8083 Junction Box Frame and Cover.

1.4 A second directional bore will be made from this head pit down to a new tail pit that is located next to the northeast leg of the rectifier elevated platform. The general direction of this bore is to the southeast. The bore will result in two each 2/0 HMWPE "RED INSULATED" cables being pulled back to the linear anode head pit. One cable is spliced to the Mobile Cruise Terminal's linear anode assembly, and the other cable will be spliced to the Mobile Maritime Museum's linear anode assembly.

2 EXCAVATION, TRENCHING, AND BACKFILLING

2.1 Provide shoring and/or sheeting where excavation or field conditions do not allow adequate slope for banks.

2.2 Trenching excavation for cable installation in conduit shall be made as narrow as practical, but width should allow proper compaction. Trenches shall not be widened by scraping or loosening materials from the side. Every effort shall be made to keep the sides of the trenches firm and undisturbed until backfilling has been completed and consolidated.

2.3 Depth of Trench. Trenches shall be excavated to a depth that will allow the cable conduit to be laid at a minimum depth of twenty-four inches (24").

2.4 Backfilling shall be accomplished in such a manner that no damage is done to the conduit and/or the cable insulation.

2.5 Compaction of backfill shall be to 95% per ASTM D1557 (modified proctor). In soft, weak, or wet soils, tamp backfill to consolidate and densify the material.

2.6 Reconditioning of Surfaces: Surfaces disturbed during the excavation for conduit runs shall be of the same kind as what was removed during excavations.

3 RECTIFIER UNITS

3.1 Actual rectifier DC output voltage required shall be determined by actual anode(s) to seawall bulkhead resistance. This resistance value is to be measured by using a temporary DC power source and powering up the installed linear anode system. Then and only then can the rectifier's voltage capability be ascertained. Hence, the rectifier shall not be ordered until CP circuit resistance has been measured.

3.2 The rectifier specified in the Bill of Materials was based on data collected from the field (soil resistivity). It is felt that the calculated circuit resistance of this rectifier will be very close to what will be actually purchased after the actual circuit resistance is determined. Unless there is a significant difference between the calculated circuit resistance and the actual circuit resistance, then a price change will not be allowed for the rectifier. A" significant difference" is defined as a circuit resistance difference of more than 10%. If a price change is requested on this item, then the contractor shall submit a copy of the original quoted cost from the manufacturer and a copy of the quote for the rectifier based on the actual circuit resistance of the CP system. The amount of the price change allowed

will be limited to the rectifier's cost difference with a 15% profit margin applied to the cost difference (Cost Difference X 1.15 = Allowed Price Change).

3.3 The rectifier and related equipment shall comply with local and national electric codes. The AC power disconnect for the rectifier units shall be furnished and connected by the Contractor. The connection from the AC Power disconnect to the rectifier shall be provided by the contractor.

4 ENERGIZING AND TESTING

4.1 AMPP (NACE) Criteria The achievement of cathodic protection is to be based on acceptable AMPP (NACE) criteria. The AMPP (NACE) criterion that is to be used for the seawall bulkhead is SP0169-2013 and it states under section 6.2.1.2: *"A minimum of 100 mv of cathodic polarization. Either the formation or decay of polarization must be measured to satisfy this criterion.* There is an alternative criterion stated under section 6.2.1.3 which states: "A structure-to-electrolyte potential of -850 mv or more negative as measured with respect to a saturated copper/copper sulfate (CSE) reference electrode. This potential may be either a direct measurement of the polarized potential or a current-applied potential. Interpretation of a current-applied measurement requires consideration of the significance of voltage drops in the earth and metallic parts."

4.2 Since this project involves seawater, a silver-silver chloride (AGCL) reference cell will be used. The threshold potential of -850 mV using a CSE reference cell is equal to the potential of -800 mV when an AGCL reference cell is used.

4.3 To properly consider voltage drops in the CP system, a complete set of native potential readings are to be taken and recorded. After the system, has been energized and adjusted an "instant on/off" survey is to be conducted on the structure.

4.4 Upon completion of the installation of the landside CP system, the system shall be energized, tested and adjusted for proper operation. When the seawall bulkhead has been under cathodic protection for at least 30 days, an "instant on/off" survey is to be conducted. "Instant off" structure potentials from minus -800 mV to minus -1150 mV as measured with a silver-silver chloride reference electrode, shall be considered acceptable.

4.5 After the initial survey, it highly recommended that an annual survey be conducted every year to insure effective cathodic protection is being maintained.

4.6 Report: Upon completion of the post installation survey, a written report shall be submitted that will include the following:

Rectifier data sheets to include the final setting and DC output.
Operation and maintenance instructions
Potential data - *native*
Potential data – *polarized*

5 VENDOR RESOURCES

5.1 Stainless Steel Brackets

5.1.1 Gulf States Hangers and Supports: 7100 Bellingrath Road, Theodore, AL 36582 (251-653-6228)

5.2 Linear Anode

5.2.1 CerAnode Technologies International: Greg Smith; 4011 Riverside Dr., Dayton Ohio 45405 (937-278-6547

5.3 Underwater Diving

5.3.1 Commercial Diving Services: Doug Christopher; 4376 Dawes Lane East; Mobile, AL 36619 (251-665-0017)

5.4 Universal Rectifiers

5.4.1 Universal Rectifiers: Mike Hill; P.O. Box 1640, Rosenberg, TX 77471 (281-342-8471)

5.5 EJ USA, Inc.

5.5.1 EJ USA Inc.: 800-626-4653

6 OTHER PROVISIONS

6.1 DISCLAIMER

6.1.1 It is the contractor's responsibility to verify quantities, part numbers, and viability of all materials specified in this specification.

6.1.2 It is the responsibility of the contractor to achieve cathodic protection as specified.

6.2 PHYSICAL CHANGES

6.2.1 The contractor may at his discretion move the linear anode and related cable runs to locations that are different from the locations shown on the installation drawings. These locations changes can be associated with underground and/or unknown obstacles that are encountered during installation. These changes are to be noted and communicated to the City's engineer on the project, as well as being shown on the contractor's "as-built" drawings.

6.3 PRICE CHANGES

6.3.1 The successful contractor for this project must hold his bided price firm for 90 days from the bid date for this offering. Price changes will be allowed if and only if there is a significant price increase for an item from a manufacturer that occurs either during and/or after 90 days has elapsed from the bid date and the contract awarded date. A "significant price" increase is one that amounts to more than a 10% increase in an item's **cost** from a manufacturer. Integral to the approval for a price increase must be evidenced by the original manufacture's quoted price document to the contractor; and the manufacturer's revised, dated document to the contractor, which shows the increased price to the contractor. The amount of the price change allowed will limited to the item's cost difference with a 15% profit margin applied to the cost difference (Cost Difference X 1.15 = Allowed Price Change).

7 WARRANTY

7.1 LIMITED WARRANTY: This limited Warranty covers the installation and the equipment associated with the Cathodic Protection System (the "Product") supplied by the contractor ("installer") for this project.

7.2 LIMITED FIVE YEAR LABOR AND MATERIAL WARRANTY: Subject to the limitations set forth below, Installer warrants to the purchaser ("Buyer") that the Product will be free from defects or failure caused by improper installation for a period of five (5) years from the Date of Installation ("the Warranty Period"). The Date of Installation shall be the date listed on the Certificate of Substantial Completion.

7.3 EXCEPTIONS TO WARRANTY: The limited warranty does not cover defects, damage to Product or Product failure caused by any of the following:

7.3.1 System settings and current discharge in excess of design expectations.

7.3.2 Abuse, abnormal use, or accident.

7.3.3 Use for a purpose or in a manner for which the Product was not intended; or

7.3.4 Hidden defects in the structure where the Product is installed.

7.4 See also Contract for Construction and Section 01010 Section "Summary of Work".

8 BILL OF MATERIALS

LANDSIDE CATHODIC PROTECTION CP SYSTEM

BILL OF MATERIALS

MATERIALS

QTY.	DESCRIPTION
1 Each	**RECTIFIER -** Universal 100 Volt – 200 Amp - Model Code 0S0I-100-200-CBCKRWZ
1 **Each**	**LINEAR DISTRIBUTED ANODE SYSTEM:** CerAnode Piggyback Linear Anode in Coke Sock: Model No. PBL-CS-590FT-STI-125H-20FT-614FT-1/0 AWG-KYNAR-CXFH - 590Ft Active Length, CXFH connection, 20Ft Lead and 610Ft Tail plus 4Ft for 2Ft loop back, using 1/0 AWG Kynar20/HMWPR65 Cable, rated at 400mAsqft for 20 years
400-Feet	**POSITIVE LINEAR ANODE HEADER CABLE:** CerAnode Positive Header Cable Assembly No. CABLE-168: Two each 2/0 HMWPE Positive Header Cable Assembly – 400 feet long each with "RED INSULATION" inside of a protective sleeve. This header cable assembly with two 2/0 cables – 400' long, will be on its own wooden reel. This item is shown in both the Cruise Terminal's and the Maritime Museum's Bill of Materials. Only one of these should be supplied with this project, as both seawall CP systems will utilize this single item.

1 Each	**SPLICE KIT:** Royston "Splice Right" Splice Kit
1 Each	**CABLE CRIMPS:** Burndy 2/0 to 1/0 "C" Crimp Model No. YC26C26
972-Feet	**STRUCTURE NEGATIVE HEADER CABLE:** Two each #1/0 AWG HMWPE cables for this CP System. These two cables are the rectifier's negative structure header cables.
2 Each	**SURFACE CABLE ROUTING JUNCTION BOXES:** EJ Airport Rated Model 8083 Junction Box Frame and Cover
60-Feet	**PVC Conduit:** Schedule 80, 2" PVC Conduit – Electrical Grade. It should be noted that a conduit allowance for this CP System has been already allocated under the Bill of Materials listed for the Mobile Cruise Terminal's Bill of Materials - Waterside.
1-Lot	**Underwater Epoxy Coating:** Alocit 28.15 Underwater Epoxy Coating System
1-Lot	**MISC ITEMS:** Rigid Conduit, straps, mounting hardware, conduit fittings, splice crimps, and all incidental items required for the proper installation of the cathodic protection system.

TECHNICAL SPECIFICATIONS

IMPRESSED CURRENT
WATERSIDE
CP SYSTEM

March 22, 2023
Addendum No. 2

CITY OF MOBILE ALABAMA

MOBILE CRUISE TERMINAL

TABLE OF CONTENTS

SECTION 1- GENERAL

1 SEAWALL DESCRIPTION

1.1 The Mobile Cruise Terminal Seawall does not have a Cathodic Protection (CP) system on its seawall. This specification outlines the proposed impressed current CP system for this seawall. The seawall is approximately 600 linear feet in length and is constructed with AZ-26 Z-plate.

1.2 The seawall structure is "L" shaped with 600 feet in the main seawall that runs North and South and a short leg on the south corner of the seawall that runs West from that corner approximately 35 feet. Please refer to the Drawing Set included with this specification for more detail.

1.3 The seawall Z-plate is 60 feet in length. The water depth is approximately 28 to 30 feet.

1.4 The Mobile River flows by the seawall water and empties into Mobile Bay. The water is considered to be brackish water. The water resistivity at High Tide is 1486 ohm-cm; and at Low tide, it is 1333 ohm-cm. All design calculations were made using the High Tide resistivity of 1486 ohm-cm.

2 CP SYSTEM MAJOR COMPONENTS

2.1 The new impressed current CP system will utilize 44 Anotec High Silicon Iron Anodes – Model No. 4884LZ. Their installation locations will be specified later in this specification.

2.2 There will be two (2) Alco Rectifiers – Model No. OSOI 70-170 CBCKRWZ which will power the Anotec Anodes. Each rectifier will drive twenty-two (22) anodes making a total of forty-four (44) anodes for the protection of the Mobile Cruise Line Terminal seawall. The rectifiers will be powered with 460/3/60 AC power.

2.3 The Anotec Anodes will have varying lengths of AWG #6 copper stranded PVDF/HMWPE cable attached to them. The length of the cable will be dependent on the distance from the junction box to which they are to be terminated. These anode cable leads will be terminated in an Anode Shunt Junction Box. There are two (2) Anode Shunt Junction Boxes for this CP system, with each shunt box being able to accommodate twenty-two (22) anodes each.

2.4 There will be one (1) positive AWG #2/0 copper stranded HMWPE cable with RED insulation from each Anode Shunt Junction Box to its appropriate rectifier. This 2/0 cable is to be rated at 195 amps.

2.5 The minimum life expectancy design constraint of 15 years will apply to all CP components in this CP system.

2.6 There will be one (1) positive AWG #2/0 copper stranded HMWPE cable with RED insulation from each Anode Shunt Junction Box to its appropriate rectifier. This 2/0 cable is to be rated at 195 amps.

2.7 All CP component locations are shown in the drawing section of this specification.

3 SCOPE

3.1 The work consists of furnishing all labor, equipment, and materials, including performing all operations necessary to complete the following:

3.1.1 Install two (2) new cathodic protection rectifiers on the elevated platform located at the northeast corner of the Cruise Line Terminal's Building. Please refer to the drawing section of this specification for more details. The new rectifier is an Alco Model No. OSOI 70-170 CBCKRWZ.

3.1.1.1 Install 300 gallons of Tulstar Transformer Oil Type II OT-3216 into each rectifier.

3.1.2 Contractor will supply a 460/3/60 - 20 amp Disconnect Box within 10 feet of the installed rectifier.

3.1.2.1 The successful contractor for this project will connect the 460/3/60 AC power supply from the provided disconnect to the rectifier.

3.1.3 Install forty-four (44) new Anotec Model No. 4884LZ High Silicon Iron Anodes along the face of the seawall. They are to be space evenly along the face of the Seawall Bulkhead on fifteen-foot (15') intervals and at an approximate distance of twenty-five feet (25') from the face of the seawall. They are to be water jetted into the seafloor at these locations to a depth of ten-feet (10') as measured from the bottom of the anode to the top of the seafloor bottom.

3.1.4 The rectifier for this system will have one (1) AWG #2/0 copper stranded HMWPE positive header cable with RED insulation. The rectifier is outfitted with one (1) positive lug to which the one (1) positive header cable will be connected. The other end of the positive header cables will be routed to its appropriate Anode Shunt Junction Box.

3.1.5 There will be one (1) AWG #2/0 copper stranded HMWPE negative (seawall) header cable for this rectifier. The rectifier is outfitted with one (1) negative terminal lug to which this cable will be terminated. The other end of this cable will be attached to the seawall. Please see the drawing relating to this in the drawing section of this specification. The negative cable will be thermite welded or pin brazed to a steel plate measuring 6" x 6" x ¼" thick. After the cable has been thermite welded to the steel plate, it is to be liberally coated with Alocit 28.15 Underwater Epoxy. The steel plate is then welded to the seawall with a double pass weld method. The newly welded steel plate and the new welds are to be recoated with Alocit 28.15 Underwater Epoxy.

3.1.6 The routing of the rectifier positive and negative header cables will involve cutting the concrete deck of the dock and exposing the dirt beneath the concrete. Once the dirt has been exposed, dirt is to be excavated to a depth of 24", which

forms a cable trench. All cables are to installed in 2" electrical grade PVC conduit. Once all cable and conduit has been assembled in the trench, the trench is to be backfilled to a depth of 12" from the top of the concrete deck. "CAUTION CP CABLE BURIED BELOW" tape is to be installed at this depth. The trench is then backfilled to the bottom of the existing concrete deck and properly compacted to 95% compaction per ASTM D 1557 (modified proctor) so that they are no voids or sinking. The cut in the concrete deck is then to be filled with new 3000 psi or better concrete.

3.1.7 Install the two (2) Anode Shunt Junction Boxes in the locations shown on the drawing for this Seawall's CP system. Please note that the Anode Shunt Junction Boxes are to have barricade protection against vehicle damage. Please refer to the drawings covering this issue in the Drawing Section of this specification. The seawall for the Mobile Cruise Line Terminal is approximately 600 feet in length. This equates two rectifier zones that measure about 300 feet in length. The midpoint of these two zones respectively is at the 150-foot position and the 450-foot position. The Anode Shunt Junction Boxes are to be mounted to galvanized 4" I-beam with a 12-inch by 12-inch by ½-inch base plate. These pedestals are to be provided by the successful contractor for this project. These pedestals will be anchored to the concrete deck of the dock at these two locations. Please refer to the drawing for more details. All cables entering and leaving the Anode Shunt Junction Boxes are to be routed in electrical grade PVC conduit. There are to be NO underwater splices for either anode lead wire cables, negative header cables, and/or positive header cables.

3.1.8 Install two (2) test station test leads in each of the new two (2) new Anode Shunt Junction Boxes. The two AWG #10 copper stranded HMWPE Test Leads are to be labeled in the Junction Box as being "Structure Test Leads".

3.2 The seawall is to be made electrically continuous by welding each z-plate joint along the entire length of the seawall. This is to be done approximately three-feet (3)' just below the water's surface. First, the weld area is to be water blasted to remove all foreign materials from the weld area. Next, a double pass four-inch (4") weld is to be welded to each z-plate joint. After welding, then the entire weld area is to be coated with Alocit 28.15 Underwater Epoxy.

3.3 Conduct a native potential survey on the waterside of the Mobile Cruise Terminal's Seawall Bulkhead.

3.4 Energize, adjust, and checkout the cathodic protection system after installation, to ensure that cathodic protection is being achieved on the waterside of the Mobile Cruise Terminal Seawall Bulkhead.

3.5 Measure the current being discharged from each of the new impressed current anodes.

3.6 Conduct an On/Off (Instant-Off) Electrolyte to structure potential survey of the Mobile Cruise Terminal Seawall Bulkhead. A written report is to be issued depicting all data collected to include both native potential and polarized potential survey data.

4 CONTRACTOR CREDENTIALS

4.1 This CP system shall be installed, energized, and evaluated by a firm regularly engaged in the field of cathodic protection of marine seawall bulkheads and possess an accepted history in the installation of these kinds of marine installations. At all times during construction, the contractor shall maintain a qualified supervisor to direct the construction activity and interface with the City of Mobile's representative, as required.

4.2 The company that is awarded the contract to install the waterside CP system at Mobile Cruise Terminal must have at least ten (10) years of experience in the design and installation of CP systems on marine seawall bulkheads.

4.3 The supervisor for this job must possess the following two (2) AMPP (NACE) accreditations: 1) Corrosion Specialist-G and 2) Cathodic Protection Specialist, or possess the AMPP (NACE) Accreditation of CP4. The firm who is awarded this project will provide all labor, materials, and supervision for the installation of the waterside CP system at Mobile Cruise Terminal. The supervisor must be on job site at all times while all construction/installation work is being performed.

4.4 The supervisor must have five (5) years of experience in installing and servicing CP systems for marine seawall bulkheads. This is to be evidence by the successful completion of five marine seawall bulkhead projects.

4.5 The firm that is awarded this contract must possess an Alabama State Contractors license at the time of bidding this project. They must also obtain, or have, other qualifications as required by Division 1 Sections.

4.6 Evidence of the company's work experience/history in the field of marine (seawall) CP systems, the Supervisor's AMPP (NACE) accreditations, and his work experience/ history, to include a copy of the firm's Alabama Contractors License must be submitted with the bid for this project, otherwise the bid will not be considered as a valid response to the solicitation.

5 AC POWER

5.1 The City of Mobile will provide the 460/3/60 20-Amp AC Power Disconnect. The contractor for this project is responsible for connecting the new rectifier to the provided disconnect.

5.2 Easements and permits may be required and are the responsibility of the contractor.

6 STANDARD PRODUCTS

6.1 Unless otherwise indicated in writing by the owner's engineer, materials under these specifications shall be considered standard products from manufacturers regularly engaged in the production of cathodic protection equipment and materials and of the manufacturer's latest approved standard design.

6.2 Where brand names and/or numbers are specified, it is understood that "or equal" shall apply. The brand names have been used only to describe the standard of quality, performance, and characteristics desired. However, if bidding an "equivalent to the brand specified, it is mandatory that bidder furnish at least seven (7) calendar days prior to bid, detailed literature and/or specifications to can be used in evaluation of substituted products. Substitutions of named materials will not be considered after the bid. See Division 1 Sections 01010 Summary of Work, Article 1.35 "Substitutions" and Section 01635 "Substitution Procedures" for more information.

7 MATERIAL SUBMITTALS

7.1 Contractor shall submit to owner for approval, a complete list of materials and equipment required by this specification. The list shall include catalog numbers, cut sheets, diagrams, drawings, and other descriptive data required by the owner. No consideration will be given to partial lists

7.1.1 Rectifiers

7.1.2 Rectifier Oil

7.1.3 Rectifier Positive and Negative Header Cable

7.1.4 Impressed Current Anodes

7.1.5 Anode Lead Wire Cable

7.1.6 Anode Shunt Junction Boxes

7.1.7 Test Lead Cable

7.1.8 Underwater Coating System

See Section 01010 "Summary of Work" and Section 01330 "Submittal Procedures" for additional information.

7.2 A list of all subcontractors assigned to the project shall also be provided within three (3) calendar days after identification of Apparent Low Bidder. (See Invitation to Bid Article 3.), along with the description of the work they will perform, to include with full addresses, telephone numbers, and contact persons.

SECTION 2- PRODUCTS

1 RECTIFIER

1.1 The waterside rectifiers shall be manufactured by Universal Rectifiers Model No. OSOI 70-170 CBCKRWZ

- OSOI = Oil Cooled, Standard Rectifier, Non-Hazardous location, Manual link bar control, Silicon Stack
- 70 Volt
- 170 Amp
- C = 230/460 VAC, 3 Phase, 60 Hertz input
- B = Set to run on 460 VAC
- C = AC & DC lightning arrestors

- K = DC Failure Light
- R = 115 VAC convenience outlet on the front panel
- W = Terminal Block for Remote Monitor, terminals to include DC Volts +/-, Amps +/-, 115 VAC
- Z = Hybrid bridge stack with 3Ph 12 Volt relay for remote interruption (Apply 12VDC to interrupt)
- Z = Binding Posts for Interrupt
- Z = ONE (1) positive terminal and ONE (1) Negative terminal for #2/0 cable
- Z = TWO 2" DC Knockouts, One 1" AC knockout
- Z = 12" stand for cabinet
- Type EO case, Hot dip galvanized, Approx. 1200 pounds
- 300 Gallons of Rectifier Transformer Oil

1.2 APPLICABLE STANDARDS

1.2.1 NEMA Publication No. MR 20-1958, reaffirmed by NEMA 1971-Semiconductor Rectifiers, Cathodic Protection Units.

1.2.2 NEMA Standard Publication No. 250-1979, including Rev. No. 1 – December 1980, Enclosures for Electrical Equipment (1000 Volts maximum)

1.3 GENERAL

1.3.1 The AC input of the rectifier shall be 460 VAC – three phase – 60 Cycle.

1.4 ENCLOSURE

1.4.1 The rectifier case shall be NEMA 4X, completely weatherproof for outdoor use. The case shall be constructed of not less than eleven-gauge steel. All fabrication welds shall be clean and smooth. The entire case shall be hot dip galvanized per ASTM-123.T

1.4.2 The cabinet is to be equipped with an instrument compartment welded to one end of the case prior to galvanizing. This compartment shall house the circuit breaker, output meters and the output terminals and shall have a hinged door and lockable stainless-steel latch.

1.4.3 The lid on the oil chamber shall be hinged on one side and have a minimum of four stainless steel latches to provide a moisture proof seal. The gasket on the lid shall be an oil resistant neoprene sponge.

1.4.4 On rectifiers five- Hundred (500) watts and above, the transformer and stack shall be mounted on separate removable racks in the oil chamber.

1.4.5 The internal horizontal panel on which the voltage adjustment taps, AC input terminals and D.C. terminals are mounted shall be at least four inches below the recommended oil level as marked within the oil chamber.

1.4.6 All connecting wires from oil chamber to the instrument compartment shall be sealed with an oil resistant compound. These wires shall have a ½” gap in the insulation above oil level to prevent siphoning.

1.5 TRANSFORMER

1.5.1 The transformer shall be specifically designed for use in a cathodic protection rectifier, having separate primary and secondary copper windings. Wire size on both windings is to be based on a minimum of 1,000 circular mils per ampere. The material used in the core of the transformers shall be of such quality that core losses do not exceed 0.62 watts per pound. The amount of core material shall be no less than the amount given by the following formula:

1.5.2 AC = The square root of the watts in the primary divided by 5.58

1.5.3 AC = The minimum area of core in square inches. The core area is figured as the cross-sectional area of that portion of the core which passes through the coil.

1.5.4 The transformer shall be immersed in class F transformer varnish until all taps, insulating materials, outer wrapping and coil windings have been completely saturated. The transformer will then be oven baked until completely dry.

1.5.5 When a three-phase rectifier is specified, it shall be provided with a three-phase transformer with three separate wound legs or three separate transformers.

1.5.6 The secondary shall have a sufficient number of coarse and fine taps to provide a minimum of 18 equal step of adjustment. These taps shall be brought out to link bar arrangement for adjusting the output of the rectifier.

1.5.7 The link bars shall be terminated on at least a 5/16” stud lug that has one end drilled out so that the transformer tap wire can be soldered to the back of the stud.

1.5.8 Quick change plastic knobs with brass inserts shall be used to connect the link bars to the studs.

1.6 RECTIFYING ELEMENTS

1.6.1 The rectifier stack shall consist of high current density selenium cell arranged to give full wave rectification. Ratings shall be within the manufacturer’s recommended current rating for continuous operation with a 50 degrees C ambient temperature.

1.6.2 The RMS voltage rating of the rectifier stack shall be sufficient to withstand, without damage, the full output of the transformer secondary when the load is disconnected from the D. C. terminals, i.e., under open circuit conditions.

1.6.3 When silicon is used as the rectifying element, current rating for continuous operation shall be for 50 degrees C. ambient and the PRV rating of the diodes shall be at least 1200 PIV. The diodes shall be protected against high voltage surges with selenium surge suppressors.

1.6.4 Current and voltage shall be de-rated for higher ambient temperature, where required, and in accordance with the manufacturer’s recommendations.

1.7 PROTECTIVE DEVICES

1.7.1 The entire unit is to be protected against overload and short circuit with a fully magnetic circuit breaker of proper rating connected between the A.C. supply and transformer primary.

1.7.2 Circuit breakers shall have two poles for single phase units and three poles for three phase units. In the case of 100 amps or less silicon rectifiers, single pole, fully magnetic circuit breakers shall be inserted in one leg of the A.C. secondary of single-phase units and in at least two of the secondary legs of a three-phase unit.

1.7.2.1 All units above 100 amps shall be bolt in style fuses and shall not rely on pressure type fuse holders.

1.8 DC METERS

1.8.1 One D.C. voltmeter and one D.C. ammeter shall be provided. Each will have an accuracy of 2% full scale. Hoyt # 17/3 meters or approved equal shall have minimum scale lengths of 1 5/8".

1.8.2 The ammeter shall be connected to an external shunt with and accuracy of at least 1%.

1.8.3 The shunt shall be plainly marked to show ampere rating and millivolt drop. This shunt is to be mounted on the front panel of the rectifier so as to be readily accessible for meter accuracy checks.

1.9 DC TERMINALS

1.9.1 Solderless lugs rated for full rectifier output current shall be provided for the positive and negative output terminals of the rectifier and shall be mounted on an insulated panel.

1.9.2 Output terminals shall be clearly identified on the panel as "Positive" and "Negative".

1.10 WIRING AND CONDUCTORS

1.10.1 All wiring within the rectifier, except the meter circuits, shall be of the high temperature motor lead wire with a minimum of 105 degrees C rating. Wire size shall be based on not less than 500 circular mils per ampere.

1.10.2 All current carrying bolts, terminals and connections made through the panel shall be either soldered to the bolt head or made by use of double nut method, so as not to depend on the compression strength of the panel to maintain a tight connection.

1.10.3 Tap changing studs and output lugs shall be a minimum of 5/16" diameter.

1.11 RECTIFIER DATA

1.11.1 Each rectifier shall be provided with an engraved metal nameplate with the following information.

1. Name of manufacturer
2. AC input voltage
3. AC input amperes
4. AC frequency
5. Phase
6. DC output volts
7. DC output amperes
8. Ambient temperature in degrees C.

1.11.2 In addition to this a waterproof envelope, placed in a suitable holder in the rectifier door, shall contain a complete wiring diagram, operating and maintenance manual and a copy of the test data obtained on the final bench check out of the rectifier.

1.12 INSTRUMENT PANEL

1.12.1 Phenolic grade XXX, non-conductive, moisture resistant, specifically designed for panel board use.

2 AC POWER

2.1 An AC Power Disconnect rated at 460/3/60 - 20 amps will be furnished by the Contractor. It is to positioned within ten-feet (10') of the rectifier's installed location. It shall be the responsibility of the contractor to connect the AC power from the disconnect to the new rectifier's control circuitry.

3 REMOTE RECTIFIER MONITORING

3.1 The rectifier is to have an American Innovation Satellite Rectifier Remote Monitor Unit Model No. RM4014S with Surge Arrester connected to the rectifier.

4 RECTIFIER OIL

4.1 The Rectifier Oil shall be Tulstar Transformer Oil Type II OT-3216 into the rectifier.

5 RECTIFIER POSITIVE AND NEGATIVE HEADER CABLE

5.1 The rectifier's single Positive Header Cable is to be AWG #2/0 copper stranded HMWPE header cable with RED insulation. The rectifier's single Negative Header Cable is to be AWG #2/0 copper stranded HMWPE header cable.

5.2 Rectifier positive and negative header cables shall be an AWG #2/0 copper stranded HMWPE Cathodic Protection Cable, manufacturer by Kalas MFG. This cable conforms to ASTM specifications B-8 and B-3, latest edition. It also conforms to ASTM D-1248, Type 1, Class C Category 5 Grade E-5 and J-3: and IPECA S61-402, Part 6 paragraph 6.11, 4a. The cable shall be identified by the surface ink printed with "Conductor Size, Kalas MFG, Co., HMWPE CATHODIC PROTECTION CABLE". The positive header cable is to come with RED insulation.

6 IMPRESSED CURRENT ANODES

6.1 The anodes shall be Anotec Model No. 4884-LZ High Silicon Iron Anodes, which have a tubular geometry with the dimensions of 3.2 inches in diameter and 84 inches long. The anodes weigh without cable 123 pounds.

6.2 Anodes shall be chilled cast high silicon iron anodes. The lead wired is to be an AWG #6 copper stranded PVDF/HMWPE insulated CP cable. The lead wire is to be assembled to the anode via an approved Anotec distributor using the Anotec Hydraulic Anchor Seating Machine.

6.3 The connection resistance should no greater than 0.001 ohms between the anode and its lead wire cable.

6.4 Anode Current Density and Life

6.4.1 The anode shall be rated at 6.6 to 8.8 amps for an estimated life of 15 years in seawater.

7 ANODE LEAD WIRE CABLE

7.1 Electrical Data – The cable shall have a DC current rating of 70 amps at 600C, with a copper cross section of AWG #6 copper stranded.

7.2 Insulation Data – The insulation shall have of two (2) insulation layers and be PVDF/HMWPE chlorine resistant insulated cable.

7.3 The inner layer shall be PVDF fluoropolymer with a thickness of 20 mils.

7.4 The outer layer shall be high molecular weight polyethylene with a thickness of 65 mils.

7.5 The cable length for each waterside anode will vary based on its installation location to its respective Anode Shunt Junction Box. Refer to the provided drawing for approximate “anode cable lengths” within each rectifier zone.

7.6 Anode lead wire cable shall be an AWG #6 copper stranded PVDF/HMWPE Cathodic Protection Cable, manufacturer by Kalas MFG. This cable conforms to ASTM specifications B-8 and B-3, latest edition. It also conforms to ASTM D-1248, Type 1, Class C Category 5 Grade E-5 and J-3: and IPECA S61-402, Part 6 paragraph 6.11, 4a. The cable shall be identified by the surface ink printed with “Conductor Size, Kalas MFG, Co., HMWPE CATHODIC PROTECTION CABLE”.

8 ANODE SHUNT JUNCTION BOX

8.1 This Anode Shunt Junction Box measures 18” X 16” X 8”.

8.2 It has twenty-two (22) circuits with Type SW Shunts rated at 50mV=5 Amps and KA-4C lugs for AWG #6 Cable. Above the Shunt will be engraved “1 mV = .1 Amp”.

8.3 It is to have one rectifier positive common Header Lug No. KPA-28 for AWG #2/0 Cable.

8.4 There shall be two isolated terminals for AWG #10 cable with the engraving “STRUCTURE TEST LEADS” above the two lugs.

8.5 All nuts and bolts will be stainless steel.

8.6 The Busbar and terminal lugs will be nickel-plated copper.

9 TEST LEAD CABLE

9.1 Test lead cables are to be AWG #10 copper stranded HMWPE Cable and are terminated in the Anode Shunt Junction Box for each rectifier zone.

9.2 The connection of the two structure test leads to the seawall is to be achieved by thermite welding or pin brazing two AWG #10 copper stranded HMWPE test wire leads to a 6" by 6" by ¼" thick steel plate. Next the steel plate is to be double pass welded to the Mobile Cruise Terminal's seawall bulkhead. The location of where the test lead steel plate is to be welded to the seawall is to be in the general area where each Junction Box is located. The welded steel plate, including the thermite weld areas are then to be coated with Alocit 28.15 Underwater Epoxy Coating. This coating system is an approved underwater coating system for this project. The test leads themselves are to be routed in electrical grade PVC Conduit from the seawall to its Anode Shunt Junction Box. The conduit is to be anchored to the steel Z-plate seawall bulkhead and to the seawall's concrete cap using SS316, two-hole heavy duty conduit clamps. The conduit for the test leads is to extend into the water a minimum of six feet (6'). Distances between conduit clamps cannot exceed three feet (3').

10 QUIKRETE BURLAP RIP-RAP BAGS

10.1 Quikrete Rip Rap Burlap Concrete Bags are to overlaid continuously over the anode cables as they are run to the face of the seawall and then down the face of the seawall back to their appropriate Anode Shunt Junction Box. The part number for these 60-pound bags is1129-61.

10.2 The purpose of these Rip Rap Bags is two-fold. First, they are installed to keep the anode cables fixed on the bottom of the seafloor. Second, they are there to serve as protection against mechanical damage from objects that may fall from above and impact the cables resulting in damage to the cables and their insulation.

11 SHIP BONDING STATION "A"

11.1 The Ship Bonding Station is to be installed at a location near the 450-foot location as measured from South to North at the Mobile Cruise Line Terminal's seawall. The Ship Bonding Station is a 16" x 14" X 6" fiberglass box with one (1) Type SW Shunt rated at 50mV-200A. It includes two (2) KA-28 lugs for 4/0 cable, The left lug will be engraved with "SHIP HULL" and the right lug will be engraved with "SEAWALL".

11.2 It will be mounted to a 4" galvanized I-beam similar to the Anode Shunt Junction Boxes. It will be also protected with four steel barricade posts filled with concrete. Please see the attached drawing for more details. The Ship Bonding Station will have a 4/0 grounding cable terminated in the Ship Bonding Station. The other end of this cable will be thermite welded to a 4" X 4" X 1/2" thick steel plate which has been double passed welded to the seawall at this same location. The weld location is to be about three feet below the surface of the water directly to the z-plate seawall. The entire weld plate is to be liberally coated with Alocit 28.15 Underwater Epoxy coating after being welded to the

seawall. The 4/0 cable is routed to the surface and then to the Ship Bonding Station in PVC electrical grade conduit. Inside the Ship Bonding Station will be a 200 Amp Shunt and an additional 4/0 lug. This additional 4/0 lug is being provided for any ship that is moored at the dock to make the ship's hull electrically continuous with the seawall. Since the seawall will be under cathodic protection, it is most important that all steps be taken to insure the avoidance of interference corrosion on the ship's hull. It is to be understood that it is the ship's responsibility to provide their own ship's hull connection cable. The additional 4/0 lug is provided for this connection. Once connected the shunt in the Ship Bonding Station can be used to measure any DC current being shared between the seawall and the ship's hull, along with the direction of current flow.

SECTION 3- EXECUTION AND INSTALLATION

1 RECTIFIER

1.1 The installation of the rectifier and related equipment shall comply with local, state, and national electric codes.

1.2 For the Mobile Cruise Line Terminal's waterside CP system, there is to be two (2) rectifiers installed on the elevated platform located on the northeast corner of the Mobile Cruise Line Terminal Building.

1.3 Actual rectifier DC output voltage required shall be determined by actual anode(s) to seawall bulkhead resistance. This resistance value is to be measured by using a temporary DC power source and powering up the installed linear anode system. Then and only then can the rectifier's voltage capability be ascertained. Hence, the rectifier shall not be ordered until CP circuit resistance has been measured.

1.4 The rectifier specified in the Bill of Materials was based on data collected from the field (water resistivity). It is felt that the calculated circuit resistance of this rectifier will be very close to what will be actually purchased after the actual circuit resistance is determined. Unless there is a significant difference between the calculated circuit resistance and the actual circuit resistance, then a price change will not be allowed for the rectifier. A "significant difference" is defined as a circuit resistance difference of more than 10%. If a price change is requested on this item, then the contractor shall submit a copy of the original quoted cost from the manufacturer and a copy of the quote for the rectifier based on the actual circuit resistance of the CP system. The amount of the price change allowed will be limited to the rectifier's cost difference with a 15% profit margin applied to the cost difference (Cost Difference X 1.15 = Allowed Price Change).

1.5 The installation of the positive and negative cables for this rectifier will require cutting concrete curbs, concrete decks and/or sidewalks.

1.6 The contractor will be responsible for replacing all concrete that he disturbs.

1.7 Rectifier negative structure cables are to be thermite welded to a 6" X 6" X ¼" steel plate. This steel plate will then be welded to the waterside of the Mobile Cruise Terminal

Seawall Bulkhead using the double pass welding technique. This steel plate assembly is then to be completely and liberally coated with Alocit 28.15 Underwater Epoxy.

1.8 Rectifier positive anode header cables are to make their transition in the same general location as where each rectifier's negative cables are attached to the seawall. They are to be encased in PVC Electrical Grade Conduit as it is routed from above the water level to below water level. Gulf States Hanger Model No. SS316 Fig. 115 Two- Hole Cable Clamps and/or Special SS316 Fig. 88A Standoff Clamps with 4 conduit mounting places are to be used to anchor the conduit to both the seawall's concrete cap and/or the z-plate of the seawall itself. The distance between conduit clamps cannot exceed three feet (3'). Please refer to drawings provided with this specification for more detail.

1.9 There are to be no underwater splices in rectifier positive or negative header cables.

2 ANODE SHUNT JUNCTION BOX – CABLE

2.1 The Anotec Anode's AWG #6 lead wire cables are to be terminated in the Anode Shunt Junction Boxes. There are to be no splices in these anode cables.

2.2 When the anode cables are brought from underwater to the atmosphere, they are to be routed in 2" Schedule 80 Electrical Grade PVC Conduit. The conduit is to be held in place with Gulf States Hanger and Supports' Fig. No. 115 2" SS316 Two-Hole Conduit Clamps in the area of the seawall bulkhead's concrete cap. The maximum spacing between these clamps is not to exceed three-feet (3') and there must be minimum of two (2) of these clamps installed in the concrete cap area. Below the concrete seawall bulkhead's concrete cap, where the seawall bulkhead's steel z-plate is located, Gulf States Hangers and Supports Fig No. 88A-Special SS316 Offset Conduit Clamps are to be welded to the face of the steel z-plate seawall bulkhead to further support the conduit runs. Please refer to the drawing set provided with this specification as it relates to these "Offset Conduit Clamps. All four (4) of the 2" PVC Conduits that run from the bottom of the Anode Shunt Junction Box are to extend a distance of 6-feet (6') from the seafloor bottom so that these clamps line up with the face of the seawall bulkhead's concrete cap. Since each seawall bulkhead is different, the contractor will be responsible for determining the "offset" distance from the z-plate and the vertical conduit runs so that they all line up with the face of the seawall bulkhead's concrete cap and then into their Anode Shunt Junction Box mounted on and above this area on top of the Terminal's concrete deck. The maximum distance between these "Offset Clamps" cannot exceed three-feet (3') on these conduit runs below the seawall bulkhead's concrete cap.

2.3 The anode lead wire cables are to run directly along the face of the seawall on the seafloor bottom, and then up the face of the seawall to its appropriate Anode Shunt Junction Box. These anode cable runs, to include the "rectifier's positive" cable run, will be overlayed continuously with "Ballast Quikrete Rip-Rap Bags" on the seafloor bottom.

2.4 The installation of cables and related equipment shall comply with all local, state, and national electric codes.

3 ANODE INSTALLATION

3.1 The Anotec Anodes are water jetted into the seafloor bottom as previously described in Paragraph 3-1-3.

3.2 Anode cables are to be routed directly to the face of the seawall. They are then routed along the face of the seawall to the general area of their appropriate Anode Shunt Junction Box. The anode cables are then routed up to their Anode Shunt Junction Box inside of PVC electrical grade conduit.

3.3 Anode cables when laid on the seafloor bottom are to be overlaid continuously with Quikrete Burlap Rip Rap Bags.

3.4 The water depth along face of the Mobile Cruise Terminal Bulkhead Seawall varies. For installation purposes, the contractor can safely use the depth of thirty-feet (30') for their calculations.

3.5 The contractor may at his discretion move anodes and related cable runs to locations that are different from the locations shown on the installation drawings. These locations changes can be associated with underground, underwater, and/or unknown obstacles that are encountered during installation. These changes are to be noted and communicated to the customer's engineer on the project, as well as being shown on the contractor's "as-built" drawings.

4 ANODE SHUNT JUNCTION BOX INSTALLATION

4.1 The Anode Shunt Junction Box is to be installed in the middle of its rectifier zone. As mentioned earlier these Junction Boxes are to mounted to a galvanized 4" I-beam pedestal. All mounting hardware and concrete anchors used in the mounting of the junction box shall be SS316.

4.2 The Anode Shunt Junction Boxes will be mounted on the Cruise Terminal's concrete deck approximately fifteen-feet (15') from the eastern edge of the dock. They are to be located so that they do not interfere ship mooring ropes.

4.3 Each Anode Shunt Junction Box is to be protected by four each six-inch (6") diameter concrete filled Bollard posts. Please refer to the attached drawing included in the drawing package for this specification. This drawing will show the locations where the contractor is to install them.

4.4 There will be four (4) each 2" PVC conduit penetrations into each of the junction boxes. Twenty-two (22) AWG #6 anode lead wires, two (2) AWG #10 test lead wires and one (1) AWG #2/0 rectifier positive cable will enter the junction box via these three penetrations.

4.5 All conduit penetrations into the Anode Shunt Junction Box shall be waterproof penetrations. This means that all PVC Terminal Adapter Fittings are to be PVC glued

into the Shunt Box in addition to a SS fender washer and locknut being installed on the Terminal Adapter fitting inside the junction box.

4.6 After the Anode Shunt Junction Box installation is finalized and the anode cables have been terminated in their proper lug on the busbar, to include the termination of the rectifier's positive cable and test lead cables, expanding foam is to be sprayed inside the ID of each conduit penetration for the purpose of blocking water migration into the junction box through the conduit.

5 SURFACE CABLE ROUTING JUNCTION BOXES

5.1 For the Cruise Terminal's "waterside" CP system, there will be nine (9) of these Surface Cable Routing Junction Boxes. The aircraft rated frame and cover is to be EJ USA, Inc.'s Model 8083 Frame and Cover. They are to be used for access the inside of the Surface Cable Routing Boxes, which are constructed using rebar and concrete. The actual concrete construction details for the Surface Cable Routing Junction Boxes to which the EJ Frame and Cover are to be mounted, are show in the drawing package with this specification.

5.2 Two (2) of these boxes are located close to the eastern edge of the Cruise Terminal's deck directly in front of the two(2) Anode Shunt Junction Boxes for this CP system. Please refer to the drawing provided with this specification for more detailed information.

5.3 There are three (3) Surface Cable Routing Junction Boxes located on the eastern edge of the Cruise Terminal's deck directly across from the elevated platforms where the rectifiers are installed. This is the surface junction box where all the rectifier cables for the waterside CP systems will be make their transition from the water to their appropriate rectifier on the elevated platform. There are three (3) more located at the elevated platforms. This for both the Cruise Terminal and the Maritime Museum CP systems. This makes a total of six (6) boxes for these cable transitions. Please refer to the drawing provided with this specification for more detailed information.

5.4 The ninth Surface Cable Routing Box is located directly across from the Ship Bonding Station "A" on the eastern edge of the of the Cruise Terminal's deck. Please refer to the drawing provided with this specification for more detailed information.

5.5 If the need arises, the contractor may make cable splices in the Surface Cable Routing Boxes. These splices are permitted for the purposes of facilitating the arduous task of cable installation. These splices are to use the Burndy Crimping System, using either the Burndy "C" Crimps, or the Burndy "Butt" Crimps. The spliced crimps are then to be sealed with Royston's "Splice Right" splice kits.

SECTION 4- ENERGIZING AND TESTING

1 TESTING

1.1 AMPP (NACE) Criteria: The achievement of cathodic protection is to be based on acceptable AMPP (NACE) criteria. The AMPP (NACE) criterion that is to be used for

the seawall bulkhead is SP0169-2013 and it states under section 6.2.1.2: “A minimum of 100 mv of cathodic polarization. Either the formation or decay of polarization must be measured to satisfy this criterion. There is an alternative criterion stated under section 6.2.1.3 which states: “A structure-to-electrolyte potential of -850 mv or more negative as measured with respect to a saturated copper/copper sulfate (CSE) reference electrode. This potential may be either a direct measurement of the polarized potential or a current-applied potential. Interpretation of a current-applied measurement requires consideration of the significance of voltage drops in the earth and metallic parts.”

1.1.1 Since this project involves seawater, a silver-silver chloride (AGCL) reference cell will be used. The threshold potential of -850 mV using a CSE reference cell is equal to the potential of -800 mV when an AGCL reference cell is used.

1.2 To properly consider voltage drops in the CP system, a complete set of native potential readings are to be taken and recorded. After the system has been energized and adjusted, a polarized (“instant on/off”) survey is to be conducted on the structure.

1.3 Upon completion of the installation of the waterside CP system, the system shall be energized, tested, and adjusted for proper operation. When the seawall bulkhead has been under cathodic protection for at least 30 days, a polarized (“instant on/off”) survey is to be conducted. “Instant off” structure potentials from minus -800 mV to minus -1150 mV as measured with a silver-silver chloride reference electrode, shall be considered acceptable.

1.4 Report

1.4.1 Upon completion of the post installation survey, a written report shall be submitted that will include the following:

1.4.1.1 Rectifier data sheets to include the final setting and DC output.

1.4.1.2 Operation and maintenance instructions

1.4.1.3 Potential data – native

1.4.1.4 Potential data – On and Instant-Off

1.4.1.5 Individual anode current

SECTION 5- OTHER PROVISIONS

1 DISCLAIMER

1.1 It is the contractor’s responsibility to verify quantities, part numbers, and viability of all materials specified in this specification, as there may be errors and omissions.

1.2 It is the responsibility of the Contractor to achieve cathodic protection as specified.

2 PRICE CHANGES

2.1 The successful contractor for this project must hold his bided price firm for 90 days from the bid date for this offering. Price changes will be allowed if and only if there is a significant price increase for an item from a manufacturer that occurs either during and/or after 90 days has elapsed from the bid date and the contract awarded date. A "significant price" increase is one that amounts to more than a 10% increase in an item's **cost** from a manufacturer. Integral to the approval for a price increase must be evidenced by the original manufacture's quoted price document to the contractor; and the manufacturer's revised, dated document to the contractor, which shows the increased price to the contractor. The amount of the price change allowed will limited to the item's cost difference with a 15% profit margin applied to the cost difference (Cost Difference X 1.15 = Allowed Price Change).

SECTION 6- VENDOR RESOURCES

1 Stainless Steel Brackets

1.1 Gulf States Hangers and Supports: 7100 Bellingrath Road, Theodore, AL 36582 (251-653-6228)

2 Underwater Diving

2.1 Commercial Diving Services: Doug Christopher; 4376 Dawes Lane East; Mobile, AL 36619 (251-665-0017)

3 Universal Rectifiers

3.1 Universal Rectifiers: P.O. Box 1640, Rosenberg, TX 77471 (281-342-8471)

4 EJ USA, Inc.

4.1 EJ USA Inc.: 800-626-4653

SECTION 7- WARRANTY

1 LIMITED WARRANTY: This limited Warranty covers the installation and the equipment associated with the Cathodic Protection System (the "Product") supplied by the contractor ("installer") for this project.

2 LIMITED FIVE YEAR MATERIALS & LABOR WARRANTY: Subject to the limitations set forth below, Installer warrants to the purchaser ("Buyer") that the Product will be free from defects or failure caused by improper installation for a period of five (5) year from the Date of Installation ("the Warranty Period"). The Date of Installation shall be the date listed on the Certificate of Substantial Completion.

3 EXCEPTIONS TO WARRANTY: The limited warranty does not cover defects, damage to Product or Product failure caused by any of the following:

3.1 System settings and current discharge in excess of design expectations.

3.2 Abuse, abnormal use, or accident.

3.3 Use for a purpose or in a manner for which the Product was not intended

4 See also Contract for Construction and Section 01010 Section Summary of Work.

SECTION 8- DIVING SUBCONTRACTOR

1 The Diving Subcontractor on this project shall possess the following:

1.1 State Licensed Board for General Contractors certified member and a licensed "General Contractor in the State of Alabama in the field of H/RR-S: Marine Construction

1.2 Member in good standing with the Association of Diving Contractors International in the field of "Commercial Diving and Marine Services"

1.3 Approved by Alocit-USA as a "Certifier Underwater Coating Applicator". When applied by an Alocit Certified Applicator, the coating has a warranty for 10 years.

1.4 Installation of underwater cathodic protection systems as evidenced by a minimum of at least five installations in the past ten years.

SECTION 9- BILL OF MATERIALS

CATHODIC PROTECTION SYSTEM
BILL OF MATERIALS

MATERIALS QTY.	**DESCRIPTION**
2 Each	**CATHODIC PROTECTION RECTIFIERS:** Universal Rectifier Model No. OSOI-70-170-CBCKRWZ
300-Gal	**RECTIFIER OIL:** Tulstar Transformer Oil Type II OT-3216
768-Feet	**POSITVIE HEADER CABLE:** AWG #2/0 copper stranded HMWPE Cathodic Protection Cable
888-Feet	**NEGATIVE HEADER CABLE:** AWG #2/0 copper stranded HMWPE Cathodic Protection Cable
44 Each	**IMPRESSED CURRENT ANODES:** Anotec Model No. 4884LZ with varying lengths of AWG #6 copper stranded PVDF/HMWPE Cathodic Protection Cable
8640-Feet	**ANODE CABLE:** AWG #6 copper stranded PVDF/HMWPE Cathodic Protection Cable
2 Each	**ANODE SHUNT JUNCTION BOXES:** Universal Rectifiers Quote No. 31584, 18" x 16" x 8", 21 each Type SW Shunts rated 50mV-5 Amp. 21 each KA-4C Lugs (6 AWG Cable), 1 each KPA-25 Lug and two (2) #12 AWG test terminals, Bus Bars and terminal lugs are to be nickel plated copper, and all nuts and bolts

	are to be made of stainless steel.
2 Each	**JUNCTION BOX PEDSTALS:** See drawing
2184-Feet	**CONDUIT:** Schedule 80, 2" PVC Conduit – Electrical Grade
1-Lot	**CONDUIT CABLE CLAMPS:** Gulf States Hangers and Supports 2" Fig. No. 115 SS 316 Two Hole Conduit Clamps
1-Lot	**SS OFFSET CONDUIT CLAMPS:** Gulf States Hanger and Supports 2" SS316 Fig. No. 88A-Special Offset Conduit Clamps. These special clamps will support four (4) conduit runs simultaneously. The "offset" dimension to be determined by contractor prior to ordering.
1-Lot	**SS CONCRETE WEDGE ANCHORS:** Fasteners Plus Conquest 3/8" x 3" SS316 (SKU: CWA38-300SS6)
8 Each	**PVC WATERPROOF SPLICE BOX PENETRATION FITTINGS:** Graybar Model No. TA-2 Terminal Adapter (Part No. 88285283)
1032 Each	**QUIKCRETE RIP RAP BAGS:** Quikrete Model No. 1129-61, 60-pound 3-1 Burlap Rip Rap Bags, which measure 16" W X 23" L X 3.75 H
200-Feet	**TEST LEAD CABLE:** No. 10 HMWPE Test Lead Cable
1 Lot	**MISC ITEMS:** PVC conduit, SS316 conduit mounting hardware, SS316 concrete anchors, conduit fittings not listed, thermite welds, underwater coatings, and all incidental items required for the proper installation of the cathodic protection system as described in this specification.
1 Each	**Ship Bonding Station, Universal Rectifier:** Fiberglass Box 16" X 14" X 6" with one SW Shunt rated 50mV-200A with KA-28 Lugs for 4/0 cable, one lug is engraved with "Ship's Hull" on the left side and "Seawall" on the right side. The box's door is engraved with "Ship Bonding Station".
40-Feet	**PVC Conduit:** Schedule 80, 3" PVC Conduit – Electrical Grade
4 Each	**CONDUIT CABLE CLAMPS:** Gulf States Hangers and Supports 3" Fig. No. 115 SS 316 Two Hole Conduit Clamps
50-Feet	**Bonding Cable:** 4/0 AWG HMWPE Bonding Cable
9 Each	**Surface Cable Routing Boxes:** EJ USA, Inc. aircraft rated Model No. 8083 Frame and Cover
1 Lot	**Underwater Epoxy Coating:** Alocit 28.15 Underwater Epoxy Coating System

TECHNICAL SPECIFICATIONS

IMPRESSED CURRENT LANDSIDE CP SYSTEM SPECIFICATIONS

March 22, 2023
Addendum No. 2

CITY OF MOBILE ALABAMA

MOBILE MARITIME MUSEUM

TABLE OF CONTENTS

SECTION 1- GENERAL

1 SCOPE

1.1 The work consists of furnishing all labor, equipment and materials, and performing all operations necessary to complete the following:

1.2 Install one (1) cathodic protection rectifier.

1.3 Install one (1) each "linear" groundbed cathodic protection system to cathodically protect the landside of the seawall bulkhead associated with the Mobile Maritime Museum, in Mobile, Alabama.

1.4 Conduct a native potential survey on the landside of the seawall at the Mobile Maritime Museum.

1.5 Energize, adjust, and checkout the cathodic protection system after installation.

1.6 The linear anode is to be installed to a depth of twenty-feet (20') which parallels the seawall. The soil resistivity was measured to be 2449 ohm-cm at the 20-foot depth. A soil boring log of this area shows that from 0' to -20' the soil consists of a loose brown, fine sand. From -20' to -35', soft clays were found.

1.7 The City of Mobile shall be responsible for furnishing and/or installing the AC power to the general area of the rectifier. This is to include the installation of a 480/3/60 three phase disconnect box, rated at 40 amps. This disconnect is to be installed within ten-feet (10) of the rectifier's control panel.

1.8 Easements and permits as may be required.

1.9 A storage area for materials will be provided by the Mobile Cruise Terminal. It will be located underneath the two elevated platforms where the rectifiers are going to be located or another onsite location assigned by the Cruise Terminal.

1.10 The drawings included with this specification indicate the general arrangement of the cathodic protection system. If the contractor desires to make changes to the CP system installation as shown on these drawings, then the changes shall be submitted to the owner's engineer for approval. This approval process must be done prior to any work being initiated as it relates to any departures from the CP system drawings of this specification.

1.11 Directional Boring: Contractor is responsible for locating underground utilities and obstructions.

2 CONTRACTOR CREDENTIALS

2.1 This CP system shall be installed, energized, and evaluated by a firm regularly engaged in the field of cathodic protection of marine seawall bulkheads and possess an accepted history in the installation of these kinds of marine installations. At all times during construction, the contractor shall maintain a qualified supervisor to direct the construction activity and interface with the City of Mobile's representative, as required.

2.2 The company that is awarded the contract to install the waterside CP system at Mobile Cruise Terminal must have at least ten (10) years of experience in the design and installation of CP systems on marine seawall bulkheads.

2.3 The supervisor for this job must possess the following two (2) AMPP (NACE) accreditations: 1) Corrosion Specialist-G and 2) Cathodic Protection Specialist, or possess the AMPP (NACE) Accreditation of CP4. The firm who is awarded this project will provide all labor, materials, and supervision for the installation of the waterside CP system at Mobile Cruise Terminal. The supervisor must be on job site at all times while all construction/installation work is being performed.

2.4 The supervisor must have five (5) years of experience in installing and servicing CP systems for marine seawall bulkheads. This is to be evidence by the successful completion of five marine seawall bulkhead projects.

2.5 The firm that is awarded this contract must possess an Alabama State Contractors license at the time of bidding this project. They must also obtain and/or be able to meet other requirements in Division 1 Sections.

2.6 Evidence of the company's work experience/history in the field of marine (seawall) CP systems, the Supervisor's AMPP (NACE) accreditations, and his work experience/ history, to include a copy of the firm's Alabama Contractors License must be submitted with the bid for this project, otherwise the bid will not be considered as a valid response to the solicitation.

3 STANDARD PRODUCTS

3.1 Unless otherwise indicated in writing by the owner's engineer, materials under these specifications shall be considered standard products from manufacturers regularly engaged in the production of cathodic protection equipment and materials and of the manufacturer's latest approved standard design.

3.2 Where brand names and/or numbers are specified, it is understood that "or equal" shall apply. The brand names have been used only to describe the standard of quality, performance, and characteristics desired. However, if bidding an "equivalent to the brand specified, it is mandatory that bidder furnish at least seven (7) calendar days prior to bid, detailed literature and/or specifications to can be used in evaluation of substituted products. Substitutions of named materials will not be considered after the bid. See Division 1 Sections 01010 Summary of Work, Article 1.35 "Substitutions" and Section 01635 "Substitution Procedures" for more information.

4 MATERIAL SUBMITTALS

4.1 Contractor shall submit to owner for approval, a complete list of materials and equipment required by this specification. The list shall include catalog numbers, cut sheets, diagrams, drawings, and other descriptive data required by the owner. No consideration will be given to partial lists

4.1.1 Anode – Linear Distributed Anode System

4.1.2 Positive Header Cables

4.1.3 Surface Cable Routing Junction Box Frame and Cover Rectifier Negative Structure Header Cables

4.1.4 Electrical Conduit

4.2 See Section 01010 “Summary of Work” and Section 01330 “Submitted Procedures” for additional information.

SECTION 2- PRODUCTS

1 RECTIFIERS

1.1 The landside rectifier shall be manufactured by Universal Rectifiers Model No. OSOI-100-200 CBCKRWZ.

- OSOI = Oil Cooled, Non-Hazardous area, Manual link bar control, Silicon stack
- DC rating: 100 Volts – 200 Amps
- C = 230/460 VAC, 3 Phase, 60 Hertz input
- B = Set to run on 460 VAC
- C = AC & DC lightning arrestors
- K = DC Failure Light
- R = 115 VAC convenience outlet on the front panel
- W= Terminal block for remote Monitor, terminals to include DC Volts=/-. Amps =/-, 15 VDC
- Z=Hybrid bridge stack with 3ph 12-volt relay for remote interruption (Apply 12 VDC to interrupt)
- Z = Binding Posts for Interrupt
- Z = One Positive Terminal for #2/0 cable
- Z = Two Negative Terminals for #1/0 cable with a shunt on each of the negative terminals
- Z - One 2” DC knockout and one 1” AC knockout
- Z – 12” Stand for Cabinet
- Type GO case, Hot Dip galvanized, approx. 1600 pounds
- 600 Gallons of transformer oil required

1.2 APPLICABLE STANDARDS

1.2.1 EMA Publication No. MR 20-1958, reaffirmed by NEMA 1971-Semiconductor Rectifiers, Cathodic Protection Units.

1.2.2 NEMA Standard Publication No. 250-1979, including Rev. No. 1 – December 1980, Enclosures for Electrical Equipment (1000 Volts maximum)

1.3 GENERAL

1.3.1 The AC input of the rectifiers shall be 115, 230 or 460 VAC – single or three phase – 60 Cycle.

1.4 ENCLOSURE

1.4.1 The rectifier case shall be NEMA 4X, completely weatherproof for outdoor use. The case shall be constructed of not less than eleven-gauge steel. All fabrication welds shall be clean and smooth. The entire case shall be hot dip galvanized per ASTM-123.

1.4.2 The cabinet is to be equipped with an instrument compartment welded to one end of the case prior to galvanizing. This compartment shall house the circuit breaker,

output meters and the output terminals and shall have a hinged door and lockable stainless-steel latch.

1.4.3 The lid on the oil chamber shall be hinged on one side and have a minimum of four stainless steel latches to provide a moisture proof seal. The gasket on the lid shall be an oil resistant neoprene sponge.

1.4.4 On rectifiers 500 watts and above, the transformer and stack shall be mounted on separate removable racks in the oil chamber.

1.4.5 The internal horizontal panel on which the voltage adjustment taps, AC input terminals and D.C. terminals are mounted shall be at least four inches below the recommended oil level as marked within the oil chamber.

1.4.6 All connecting wires from oil chamber to the instrument compartment shall be sealed with an oil resistant compound. These wires shall have a ½" gap in the insulation above oil level to prevent siphoning.

1.4.7 A grounding lug to accommodate a #6 wire shall be provide on the outside of the cabinet.

1.5 TRANSFORMER

1.5.1 The transformer shall be specifically designed for use in a cathodic protection rectifier, having separate primary and secondary copper windings. Wire size on both windings is to be based on a minimum of 1,000 circular mils per ampere. The material used in the core of the transformers shall be of such quality that core losses do not exceed 0.62 watts per pound. The amount of core material shall be no less than the amount given by the following formula:

AC = The square root of the watts in the primary divided by 5.58

1.5.2 AC = The minimum area of core in square inches. The core area is figured as the cross-sectional area of that portion of the core which passes through the coil.

1.5.3 The transformer shall be immersed in class F transformer varnish until all taps, insulating materials, outer wrapping and coil windings have been completely saturated. The transformer will then be oven baked until completely dry.

1.5.4 When a three-phase rectifier is specified, it shall be provided with a three-phase transformer with three separate wound legs or three separate transformers.

1.5.5 The secondary shall have a sufficient number of coarse and fine taps to provide a minimum of 18 equal step of adjustment. These taps shall be brought out to link bar arrangement for adjusting the output of the rectifier.

1.5.6 The link bars shall be terminated on at least a 5/16" stud lug that has one end drilled out so that the transformer tap wire can be soldered to the back of the stud.

1.5.7 Quick change plastic knobs with brass inserts shall be used to connect the link bars to the studs.

1.6 RECTIFYING ELEMENTS

1.6.1 The rectifier stack shall consist of high current density selenium cell arranged to give full wave rectification. Ratings shall be within the manufacturer's recommended current rating for continuous operation with a 50 degrees C ambient temperature.

1.6.2 The RMS voltage rating of the rectifier stack shall be sufficient to withstand, without damage, the full output of the transformer secondary when the load is disconnected from the D. C. terminals, i.e.., under open circuit conditions.

1.6.3 When silicon is used as the rectifying element, current rating for continuous operation shall be for 50 degrees C. ambient and the PRV rating of the diodes shall be at least 1200 PIV. The diodes shall be protected against high voltage surges with selenium surge suppressors.

1.6.4 Current and voltage shall be de-rated for higher ambient temperature, where required, and in accordance with the manufacturer's recommendations.

1.7 PROTECTIVE DEVICES

1.7.1 The entire unit is to be protected against overload and short circuit with a fully magnetic circuit breaker of proper rating connected between the A.C. supply and transformer primary.

1.7.2 Circuit breakers shall have two poles for single phase units and three poles for three phase units. In the case of 100 amps or less silicon rectifiers, single pole, fully magnetic circuit breakers shall be inserted in one leg of the A.C. secondary of single-phase units and in at least two of the secondary legs of a three-phase unit.

1.7.2.1 All units above 100 amps shall be bolt in style fuses and shall not rely on pressure type fuse holders.

1.8 DC METERS

1.8.1 One D.C. voltmeter and one D.C. ammeter shall be provided. Each will have an accuracy of 2% full scale. Hoyt # 17/3 meters or approved equal shall have minimum scale lengths of 1 5/8".

1.8.2 The ammeter shall be connected to an external shunt with and accuracy of at least 1%.

1.8.3 The shunt shall be plainly marked to show ampere rating and millivolt drop. This shunt is to be mounted on the front panel of the rectifier so as to be readily accessible for meter accuracy checks.

1.9 DC TERMINALS

1.9.1 Solderless lugs rated for full rectifier output current shall be provided for the positive and negative output terminals of the rectifier and shall be mounted on an insulated panel.

1.9.2 Output terminals shall be clearly identified on the panel as "Positive" and "Negative".

1.10 WIRING AND CONDUCTORS

1.10.1 All wiring within the rectifier, except the meter circuits, shall be of the high temperature motor lead wire with a minimum of 105 degrees C rating. Wire size shall be based on not less than 500 circular mils per ampere.

1.10.2 All current carrying bolts, terminals and connections made through the panel shall be either soldered to the bolt head or made by use of double nut method, so as not to depend on the compression strength of the panel to maintain a tight connection.

1.10.3 Tap changing studs and output lugs shall be a minimum of 5/16" diameter.

1.11 RECTIFIER DATA

1.11.1 Each rectifier shall be provided with an engraved metal nameplate with the following information.

1. Name of manufacturer
2. AC input voltage
3. AC input amperes
4. AC frequency
5. Phase
6. DC output volts
7. DC output amperes
8. Ambient temperature in degrees C.

1.11.2 In addition to this a waterproof envelope, placed in a suitable holder in the rectifier door, shall contain a complete wiring diagram, operating and maintenance manual and a copy of the test data obtained on the final bench check out of the rectifier.

1.12 INSTRUMENT PANEL

1.12.1 Phenolic grade XXX, non-conductive, moisture resistant, specifically designed for panel board use.

2 AC POWER

2.1 AC Power to be supplied by the City of Mobile. The AC Power supplied will terminate in an AC Disconnect Box within ten feet (10') of the rectifier. Please refer to Section 1, paragraph 1.7.

3 REMOTE RECTIFIER MONITORING

3.1 The rectifier is to have an American Innovation Satellite Rectifier Remote Monitor Unit Model No. RM4014S with Surge Arrester connected to the rectifier.

4 LINEAR ANODES

4.1 GENERAL DESCRIPTION

4.1.1 The landside anode shall be CerAnode PiggyBack MMO Linear Anode Model No. PBL-CS-559FT-STI-125H-20FT-583FT-1/0AWG-KYNAR-CXFH-559ft.. Active Length, CXFH connection, 20ft. Lead and 579ft. Tail plus 4ft. for 2 ft. loop back, using 1/0 AWG Kynar20/HMWPR65 Cable rated at 400mAsqft for 20 years.

4.1.2 The linear anode assembly shall be pre-assembled at Ceranode and placed on a 48" wooden installation reel.

4.1.3 There will be 20ft lead and 610ft tail + 4ft for 2ft loop back, “Fold in Half”, using 1/0 AWG Kynar20/HMWPE65 Cable

4.1.4 Please refer to the drawing included with this specification for installation details of the installed linear anode assembly.

4.1.5 The anode must be assembled with Loresco SC3 carbon backfill in a natural cotton fiber sock as provided by Ceranode. There can be no substitutions on this specification.

4.2 CURRENT DENSITY AND ANODE LIFE

4.2.1 The linear anode shall be rated at 400 ma per linear foot for an estimated life of 20 years in soil. This application in soil will allow for a discharge rate of 236 amps for 20 years. At a discharge rate of 157 amps, the estimated life for this linear anode is 30 years.

4.2.2 This rating is good down to soil resistivity of 1300 ohm-cm.

4.3 LINEAR ANODE-TO-CABLE CONNECTION

4.3.1 The anode-to-cable connection shall be made at the center of each anode and have an electrical resistance of less than 0.001 ohm.

4.4 LINEAR ANODE QUALITY ASSURANCE

4.4.1 The linear anode assembly as assembled by CerAnode renders a 7-year factory warranty, when the linear anode is installed and operated as per the warranty specifications. This warranty is from Ceranode and not from the contractor.

4.5 LINEAR ANODE HEADER CABLE

4.5.1 From the end of the Linear Anode back to the rectifier, 2/0 AWG HMWPE cable with “RED INSULATION” is to be used.

4.6 LINEAR ANODE HEADER CABLE SPLICE

4.6.1 The linear anode is to be spliced to the rectifier’s positive header cable using the Burndy “C” Crimp System. The “C” crimp to be used is Burndy Model No. YC26C26.

4.6.2 The splice kit to be used to encapsulate the splice of the linear anode cable to the rectifier’s positive header cable is to be Royston’s “Splice Right” splice kit.

5 RECTIFIER-TO-STRUCTURE (NEGATIVE) CABLE

5.1 Two (2) #1/0 AWG HMWPE cables will be welded to the front (water side) of the seawall via a Steel Structure Connection Plate. The location of these two plates is at the 750-foot location and 1050-foot location as measured from the southeast corner of the seawall of the Mobile Cruise Line Terminal. These negative cable connection plates will be welded to the seawall about five feet from the seafloor bottom. The plate and weld area to the seawall are to be coated liberally with underwater Alocit 26.15 Underwater Epoxy coating. These two cables will be routed along the face of the seawall on the bottom. When these two cables reach the area where the Surface Cable Routing Box is located, which is near the 350-foot location as measured from the southeast corner of this seawall; they be routed vertically to

this Surface Cable Routing Box and then on to their appropriate landside rectifier. These cables along with the other cables installed along the face of the seawall are to be overlaid with Rip Rap Burlap Concrete Bags. All these cables are then routed to the top of the dock at this location via 2" PVC schedule 80 conduits. This makes a total of four negative cables that will be routed back to their respective rectifier for the CP systems associated with the Mobile Maritime Museum's seawall. Two (2) negative cables for the two (2) waterside rectifiers, and two (2) negative cables for the one (1) landside rectifier. The two landside negative cables are to be terminated in its appropriate rectifier cabinet.

5.2 CABLE-TO-STRUCTURE CONNECTION

5.2.1 The rectifier's negative cathodic protection cable shall be thermite welded to the structure steel connection plate which measures 6" by 6" by ¼" thick. The steel connection plate is then welded to the seawall with the double pass welding procedure. The entire plate and cable thermite weld area is to be liberally coated with Alocit 28.15 Underwater Epoxy coating.

5.3 THERMITE WELD COATING

5.3.1 Thermite welds shall be protected and coated with Alocit 28.15 Underwater Epoxy coating.

5.4 D.C. ELECTRICAL CONDUIT

5.4.1 D.C. electrical conduit and fittings shall be schedule 80 conduit grade PVC, conforming to all codes and ordinances. All 90 degree and 45-degree ells shall be the "sweep" style elbows.

5.5 SURFACE CABLE ROUTING JUNCTION BOXES

5.5.1 For the Maritime Museum's "Landside" CP system, there will not be any additional Surface Cable Routing Junction Boxes. The junction boxes needed and used by this specification have already been covered in other specifications for this project.

SECTION 3- EXECUTION AND INSTALLATION

1 LANDSIDE CATHODIC PROTECTION SYSTEM

1.1 The linear landside anode consists of one pre-assembled linear anode with an approximate active length of 590-feet long which uses the 400 mA MMO wire anode material.

1.2 The linear anode system is to be directional bored to an installed depth of twenty-feet (20'). The directional bore will be done from the head pit located in the parking lot of the Maritime Museum. The bore is from the head pit to the north. Refer to Drawing included with this specification for specific details.

1.3 The linear anode landside positive header cable is to be 2/0 AWG HMWPE with RED insulation and is routed back to its rectifier via Surface Cable Routing Junction Boxes. The boxes are to be manufactured by EJ USA, Inc. They are "airport rated" and are Model No. 8083 Junction Box Frame and Cover.

1.4 A second directional bore will be made from this head pit down to a new tail pit that is located next to the northeast leg of the rectifier elevated platform. The general direction of

this bore is to the southeast. The bore will result in two each 2/0 HMWPE "RED INSULATED" cables being pulled back to the linear anode head pit. One cable is spliced to the Mobile Cruise Terminal's linear anode assembly, and the other cable will be spliced to the Mobile Maritime Museum's linear anode assembly.

2 EXCAVATION, TRENCHING, AND BACKFILLING

2.1 Provide shoring and/or sheeting where excavation or field conditions do not allow adequate slope for banks.

2.2 Trenching excavation for cable installation in conduit shall be made as narrow as practical, but width should allow proper compaction. Trenches shall not be widened by scraping or loosening materials from the side. Every effort shall be made to keep the sides of the trenches firm and undisturbed until backfilling has been completed and consolidated.

2.3 Depth of Trench. Trenches shall be excavated to a depth that will allow the cable conduit to be laid at a minimum depth of twenty-four inches (24").

2.4 Backfilling shall be accomplished in such a manner that no damage is done to the conduit and/or the cable insulation.

2.5 Compaction of backfill shall be to 95% per ASTM D1557 (modified proctor). In soft, weak or wet soils, tamp backfill to consolidate and densify the material.

2.6 Reconditioning of Surfaces: Surfaces disturbed during the excavation for conduit runs shall be of the same kind as what was removed during excavations.

3 RECTIFIER UNITS

3.1 Actual rectifier DC output voltage required shall be determined by actual anode(s) to seawall bulkhead resistance. This resistance value is to be measured by using a temporary DC power source and powering up the installed linear anode system. Then and only then can the rectifier's voltage capability be ascertained. Hence, the rectifier shall not be ordered until CP circuit resistance has been measured.

3.2 The rectifier specified in the Bill of Materials was based on data collected from the field (soil resistivity). It is felt that the calculated circuit resistance of this rectifier will be very close to what will be actually purchased after the actual circuit resistance is determined. Unless there is a significant difference between the calculated circuit resistance and the actual circuit resistance, then a price change will not be allowed for the rectifier. A "significant difference" is defined as a circuit resistance difference of more than 20%. If a price change is requested on this item, then the contractor shall submit a copy of the original quoted cost from the manufacturer and a copy of the quote for the rectifier based on the actual circuit resistance of the CP system. The amount of the price change allowed will be limited to the rectifier's cost difference with a 15% profit margin applied to the cost difference (Cost Difference X 1.15 = Allowed Price Change).

3.3 The rectifier and related equipment shall comply with local and national electric codes. The AC power disconnect for the rectifier units shall be furnished and connected by owner. The connection from the AC Power disconnect to the rectifier shall be provided by the contractor.

4 ENERGIZING AND TESTING

4.1 AMPP (NACE) Criteria The achievement of cathodic protection is to be based on acceptable AMPP (NACE) criteria. The AMPP (NACE) criterion that is to be used for the seawall bulkhead is SP0169-2013 and it states under section 6.2.1.2: *"A minimum of 100 mv of cathodic polarization. Either the formation or decay of polarization must be measured to satisfy this criterion.* There is an alternative criterion stated under section 6.2.1.3 which states: *"A structure-to-electrolyte potential of -850 mv or more negative as measured with respect to a saturated copper/copper sulfate (CSE) reference electrode. This potential may be either a direct measurement of the polarized potential or a current-applied potential. Interpretation of a current-applied measurement requires consideration of the significance of voltage drops in the earth and metallic parts."*

4.2 Since this project involves seawater, a silver-silver chloride (AGCL) reference cell will be used. The threshold potential of -850 mV using a CSE reference cell is equal to the potential of -800 mV when an AGCL reference cell is used.

4.3 To properly consider voltage drops in the CP system, a complete set of native potential readings are to be taken and recorded. After the system, has been energized and adjusted an "instant on/off" survey is to be conducted on the structure.

4.4 Upon completion of the installation of the landside CP system, the system shall be energized, tested and adjusted for proper operation. When the seawall bulkhead has been under cathodic protection for at least 30 days, an "instant on/off" survey is to be conducted. "Instant off" structure potentials from minus -800 mV to minus -1150 mV as measured with a silver-silver chloride reference electrode, shall be considered acceptable.

4.5 After the initial survey, it highly recommended that an annual survey be conducted every year to insure effective cathodic protection is being maintained.

4.6 Report: Upon completion of the post installation survey, a written report shall be submitted that will include the following:

Rectifier data sheets to include the final setting and DC output.
Operation and maintenance instructions
Potential data - *native*
Potential data – *polarized*

5 VENDOR RESOURCES

5.1 Stainless Steel Brackets

5.1.1 Gulf States Hangers and Supports: 7100 Bellingrath Road, Theodore, AL 36582 (251-653-6228)

5.2 Linear Anode

5.2.1 Ceranode Technologies International: Greg Smith; 4011 Riverside Dr., Dayton Ohio 45405 (937-278-6547

5.3 Underwater Diving

5.3.1 Commercial Diving Services: Doug Christopher; 4376 Dawes Lane East; Mobile, AL 36619 (251-665-0017)

5.4 Universal Rectifiers

5.4.1 Universal Rectifiers: Mike Hill; P.O. Box 1640, Rosenberg, TX 77471 (281-342-8471)

6 OTHER PROVISIONS

6.1 DISCLAIMER

6.1.1 It is the contractor's responsibility to verify quantities, part numbers, and viability of all materials specified in this specification.

6.1.2 It is the responsibility of the contractor to achieve cathodic protection as specified.

6.2 PHYSICAL CHANGES

6.2.1 The contractor may at his discretion move the linear anode and related cable runs to locations that are different from the locations shown on the installation drawings. These locations changes can be associated with underground and/or unknown obstacles that are encountered during installation. These changes are to be noted and communicated to the City's engineer on the project, as well as being shown on the contractor's "as-built" drawings.

6.3 PRICE CHANGES

6.3.1 The successful contractor for this project must hold his bided price firm for 90 days from the bid date for this offering. Price changes will be allowed if and only if there is a significant price increase for an item from a manufacturer that occurs either during and/or after 90 days has elapsed from the bid date and the contract awarded date. A "significant price" increase is one that amounts to more than a 10% increase in an item's **cost** from a manufacturer. Integral to the approval for a price increase must be evidenced by the original manufacture's quoted price document to the contractor; and the manufacturer's revised, dated document to the contractor, which shows the increased price to the contractor. The amount of the price change allowed will limited to the item's cost difference with a 15% profit margin applied to the cost difference (Cost Difference X 1.15 = Allowed Price Change).

7 WARRANTY

7.1 LIMITED WARRANTY: This limited Warranty covers the installation and the equipment associated with the Cathodic Protection System (the "Product") supplied by the contractor ("installer") for this project.

7.2 LIMITED FIVE YEAR MATERIALS & LABOR WARRANTY: Subject to the limitations set forth below, Installer warrants to the purchaser ("Buyer") that the Product will be free from defects or failure caused by improper installation for a period of five (5) year from the Date of Installation ("the Warranty Period"). The Date of Installation shall be the date listed on the Certificate of Substantial Completion

7.3 EXCEPTIONS TO WARRANTY: The limited warranty does not cover defects, damage to Product or Product failure caused by any of the following:

7.3.1 System settings and current discharge in excess of design expectations.

7.3.2 Abuse, abnormal use, or accident.

7.3.3 Use for a purpose or in a manner for which the Product was not intended

7.3.4 See also Contract for Construction and Section 01010 Section Summary of Work

8 BILL OF MATERIALS

LANDSIDE CATHODIC PROTECTION CP SYSTEM

BILL OF MATERIALS

MATERIALS

QTY.	DESCRIPTION
1 Each	**RECTIFIER -** Universal 100 Volt – 200 Amp - Model Code 0S0I-100-200-CBCKRWZ
1 Each	**LINEAR DISTRIBUTED ANODE SYSTEM:** Ceranode Piggyback Linear Anode in Coke Sock: Model No. PBL-CS-590FT-STI-125H-20FT-614FT-1/0 AWG-KYNAR-CXFH - 590Ft Active Length, CXFH connection, 20Ft Lead and 610Ft Tail plus 4Ft for 2Ft loop back, using 1/0 AWG Kynar20/HMWPR65 Cable, rated at 400mAsqft for 20 years
400-Feet	**POSITIVE LINEAR ANODE HEADER CABLE:** Ceranode Positive Header Cable Assembly No. CABLE-168: Two each 2/0 HMWPE Positive Header Cable Assembly – 400 feet long each with "RED INSULATION" inside of a protective sleeve. This header cable assembly with two 2/0 cables – 400' long, will be on its own wooden reel. This item is shown in both the Cruise Terminal's and the Maritime Museum's Bill of Materials. Only one of these should be supplied with this project, as both seawall CP systems will utilize this single item.
1 Each	**SPLICE KIT:** Royston "Splice Right" Splice Kit
1 Each	**CABLE CRIMPS:** Burndy 2/0 "C" Crimp Model No. YC26C26
2100-Feet	**STRUCTURE NEGATIVE HEADER CABLE:** Two each #1/0 AWG HMWPE cables for this CP System. These two cables are the rectifier's negative structure header cables.
60-Feet	**PVC Conduit:** Schedule 80, 2" PVC Conduit – Electrical Grade. It should be noted that a conduit allowance for this CP System has been already allocated under the Bill of Materials listed for the Mobile Cruise Terminal's Bill of Materials – Waterside.
1-Lot	**Underwater Epoxy Coating:** Alocit 28.15 Underwater Epoxy Coating System

1-Lot	**MISC ITEMS:** Rigid Conduit, straps, mounting hardware, conduit fittings, splice crimps, and all incidental items required for the proper installation of the cathodic protection system.

TECHNICAL SPECIFICATIONS

IMPRESSED CURRENT
WATERSIDE
CP SYSTEM

March 22, 2023
Addendum No. 2

CITY OF MOBILE ALABAMA

MOBILE MARITIME MUSEUM

TABLE OF CONTENTS

SECTION 1- GENERAL

1 SEAWALL DESCRIPTION

1.1 The Mobile Maritime Museum seawall does not have a Cathodic Protection (CP) system on its seawall. This specification outlines the proposed impressed current CP system for this seawall. The seawall is approximately 600 linear feet in length and is constructed with AZ-26 Z-plate.

1.2 The seawall Z-plate is 60 feet in length. The water depth is approximately 28 to 30 feet.

1.3 The Mobile River flows by the seawall water and empties into Mobile Bay. The water is considered to be brackish water. The water resistivity at High Tide is 1486 ohm-cm; and at Low tide, it is 1333 ohm-cm. All design calculations were made using the High Tide resistivity of 1486 ohm-cm.

2 CP SYSTEM MAJOR COMPONENTS

2.1 The new impressed current CP system will utilize forty-four (44) Anotec High Silicon Iron Anodes – Model No. 4884LZ. Their installation locations will be specified later in this specification.

2.2 There will be two (2) Alco Rectifiers – Model No. OSOI 70-170 CBCKRWZ which will power the Anotec Anodes. Each rectifier will drive twenty-two (22) anodes making a total of forty-four (44) anodes for the protection of the Mobile Maritime Museum seawall. The rectifiers will be powered with 460/3/60 AC power.

2.3 The Anotec Anodes will have varying lengths of AWG #6 copper stranded PVDF/HMWPE cable attached to them. The length of the cable will be dependent on the distance from the junction box to which they are to be terminated. These anode cable leads will be terminated in an Anode Shunt Junction Box. There are two (2) Anode Shunt Junction Boxes for this CP system, with each shunt box being able to accommodate twenty-two (22) anodes each.

2.4 There will be one (1) positive AWG #2/0 copper stranded HMWPE cable with RED insulation from each Anode Shunt Junction Box to its appropriate rectifier. This 2/0 cable is to be rated at 195 amps.

2.5 The minimum life expectancy design constraint of 15 years will apply to all CP components in this CP system.

2.6 There will be one (1) positive AWG #2/0 copper stranded HMWPE cable with RED insulation from each Anode Shunt Junction Box to its appropriate rectifier. This 2/0 cable is to be rated at 195 amps.

2.7 All CP component locations are shown in the drawing section of this specification.

3 SCOPE

3.1 The work consists of furnishing all labor, equipment, and materials, including performing all operations necessary to complete the following:

3.1.1 Install two (2) new cathodic protection rectifiers on the elevated platform located at the northeast corner of the Cruise Line Terminal's Building. Please refer to the

drawing section of this specification for more details. The new rectifier is an Alco Model No. OSOI 70-170 CBCKRWZ.

3.1.1.1 Install 300 gallons of Tulstar Transformer Oil Type II OT-3216 into each rectifier.

3.1.2 Contractor will supply a 460/3/60 - 20 amp Disconnect Box within 10 feet of the installed rectifier.

3.1.2.1 The successful contractor for this project will connect the 460/3/60 AC power supply from the provided disconnect to the rectifier.

3.1.3 Install forty-four (44) new Anotec Model No. 4884LZ High Silicon Iron Anodes along the face of the seawall. They are to be space evenly along the face of the Seawall Bulkhead on fifteen-foot (15') intervals and at an approximate distance of twenty-five feet (25') from the face of the seawall. They are to be water jetted into the seafloor at these locations to a depth of ten-feet (10') as measured from the bottom of the anode to the top of the seafloor bottom.

3.1.4 The rectifier for this system will have one (1) AWG #2/0 copper stranded HMWPE positive header cable with RED insulation. The rectifier is outfitted with one (1) positive lug to which the one (1) positive header cable with RED insulation will be connected. The other end of the positive header cables with RED insulation will be routed to its appropriate Anode Shunt Junction Box.

3.1.5 There will be one (1) AWG #2/0 copper stranded HMWPE negative (seawall) header cable for this rectifier. The rectifier is outfitted with one (1) negative terminal lug to which this cable will be terminated. The other end of this cable will be attached to the seawall. Please see the drawing relating to this in the drawing section of this specification. The negative cable will be thermite welded or pin brazed to a steel plate measuring 6" x 6" x ¼" thick. After the cable has been thermite welded to the steel plate, it is to be liberally coated with Alocit 28.15 Underwater Epoxy. The steel plate is then welded to the seawall with a double pass weld method. The newly welded steel plate and the new welds are to be recoated with Alocit 28.15 Underwater Epoxy.

3.1.6 The routing of the rectifier positive and negative header cables will involve cutting the concrete deck of the dock and exposing the dirt beneath the concrete. Once the dirt has been exposed, dirt is to be excavated to a depth of 24", which forms a cable trench. All cables are to installed in 2" electrical grade PVC conduit. Once all cable and conduit has been assembled in the trench, the trench is to be backfilled to a depth of 12" from the top of the concrete deck. "CAUTION CP CABLE BURIED BELOW" tape is to be installed at this depth. The trench is then backfilled to the bottom of the existing concrete deck and properly compacted to 95% compaction per ASTM D 1557 (modified proctor) so that they are no voids or sinking. The cut in the concrete deck is then to be filled with new 3000 psi or better concrete

3.1.7 Install the two (2) Anode Shunt Junction Boxes in the locations shown on the drawing for this Seawall's CP system. Please note that the Anode Shunt Junction Boxes are to have barricade protection against vehicle damage. Please refer to the drawings covering this issue in the Drawing Section of this specification. The

seawall for the Mobile Maritime Museum is approximately 600 feet in length. This equates two rectifier zones that measure about 300 feet in length. The midpoint of these two zones respectively is at the 150-foot position and the 450-foot position. The Anode Shunt Junction Boxes are to be mounted to galvanized 4" I-beam with a 12-inch by 12-inch by ½-inch base plate. These pedestals are to be provided by the successful contractor for this project. Please refer to the drawings covering this issue in the Drawing Section of this specification. All cables entering and leaving the Anode Shunt Junction Boxes are to be routed in electrical grade PVC conduit. There are to be NO underwater splices for either anode lead wire cables, negative header cables, and/or positive header cables.

3.1.8 Install two (2) test station test leads in each of the new two (2) new Anode Shunt Junction Boxes. The two AWG #10 copper stranded HMWPE Test Leads are to be labeled in the Junction Box as being "Structure Test Leads".

3.2 The seawall is to be made electrically continuous by welding each z-plate joint along the entire length of the seawall. This is to be done approximately three-feet (3)' just below the water's surface. First, the weld area is to be water blasted to remove all foreign materials from the weld area. Next, a double pass four-inch (4") weld is to be welded to each z-plate joint. After welding, then the entire weld area is to be coated with Alocit 28.15 Underwater Epoxy.

3.3 Conduct a native potential survey on the waterside of the Mobile Maritime Museum's Seawall Bulkhead.

3.4 Energize, adjust, and checkout the cathodic protection system after installation, to ensure that cathodic protection is being achieved on the waterside of the Mobile Maritime Museum Seawall Bulkhead.

3.5 Measure the current being discharged from each of the new impressed current anodes.

3.6 Conduct an On/Off (Instant-Off) Electrolyte to structure potential survey of the Mobile Maritime Museum Seawall Bulkhead. A written report is to be issued depicting all data collected to include both native potential and polarized potential survey data.

4 CONTRACTOR CREDENTIALS

4.1 This CP system shall be installed, energized, and evaluated by a firm regularly engaged in the field of cathodic protection of marine seawall bulkheads and possess an accepted history in the installation of these kinds of marine installations. At all times during construction, the contractor shall maintain a qualified supervisor to direct the construction activity and interface with the City of Mobile's representative, as required.

4.2 The company that is awarded the contract to install the waterside CP system at Mobile Cruise Terminal must have at least ten (10) years of experience in the design and installation of CP systems on marine seawall bulkheads.

4.3 The supervisor for this job must possess the following two (2) AMPP (NACE) accreditations: 1) Corrosion Specialist-G and 2) Cathodic Protection Specialist, or possess the AMPP (NACE) Accreditation of CP4. The firm who is awarded this project will provide all labor, materials, and supervision for the installation of the waterside CP system at Mobile Cruise

Terminal. The supervisor must be on job site at all times while all construction/installation work is being performed.

4.4 The supervisor must have five (5) years of experience in installing and servicing CP systems for marine seawall bulkheads. This is to be evidence by the successful completion of five marine seawall bulkhead projects.

4.5 The firm that is awarded this contract must possess an Alabama State Contractors license at the time of bidding this project. They must also obtain, or have, other qualifications as required by Division 1 Sections.

4.6 Evidence of the company's work experience/history in the field of marine (seawall) CP systems, the Supervisor's AMPP (NACE) accreditations, and his work experience/ history, to include a copy of the firm's Alabama Contractors License must be submitted with the bid for this project, otherwise the bid will not be considered as a valid response to the solicitation.

5 AC POWER

5.1 The Contractor will provide the 460/3/60 20-Amp AC Power Disconnect. The contractor for this project is responsible for connecting the new rectifier to the provided disconnect.

5.2 Easements and permits may be required and are the responsibility of the contractor.

6 STANDARD PRODUCTS

6.1 Unless otherwise indicated in writing by the owner's engineer, materials under these specifications shall be considered standard products from manufacturers regularly engaged in the production of cathodic protection equipment and materials and of the manufacturer's latest approved standard design.

6.2 Where brand names and/or numbers are specified, it is understood that "or equal" shall apply. The brand names have been used only to describe the standard of quality, performance, and characteristics desired. However, if bidding an "equivalent to the brand specified, it is mandatory that bidder furnish at least seven (7) calendar days prior to the bid, detailed literature and/or specifications to can be used in evaluation of substituted products. Substitutions of named materials will not be considered after the Bid. See Division 1 Section 01010 Summary of Work Article 1.35 "Substitutions" and Section 01635 "Substitution Procedures" for more information.

7 MATERIAL SUBMITTALS

7.1 Contractor shall submit to owner for approval, a complete list of materials and equipment required by this specification. The list shall include catalog numbers, cut sheets, diagrams, drawings, and other descriptive data required by the owner. No consideration will be given to partial lists.

- 7.1.1 Rectifiers
- 7.1.2 Rectifier Oil
- 7.1.3 Rectifier Positive and Negative Header Cable
- 7.1.4 Impressed Current Anodes
- 7.1.5 Anode Lead Wire Cable

7.1.6 Anode Shunt Junction Boxes

7.1.7 Test Lead Cable

7.1.8 Underwater Coating System

7.2 A list of all subcontractors assigned to the project shall also be provided within three (3) calendar days after identification of Apparent Low Bidder (see Invitation to Bid Article 6.3) along with the description of the work they will perform, to include with full addresses, telephone numbers, and contact persons.

SECTION 2- PRODUCTS

1 RECTIFIER

1.1 The waterside rectifiers shall be manufactured by Universal Rectifiers Model No. OSOI 70-170 CBCKRWZ

- OSOI = Oil Cooled, Standard Rectifier, Non-Hazardous location, Manual link bar control, Silicon Stack
- 70 Volt
- 170 Amp
- C = 230/460 VAC, 3 Phase, 60 Hertz input
- B = Set to run on 460 VAC
- C = AC & DC lightning arrestors
- K = DC Failure Light
- R = 115 VAC convenience outlet on the front panel
- W = Terminal Block for Remote Monitor, terminals to include DC Volts +/-, Amps +/-, 115 VAC
- Z = Hybrid bridge stack with 3Ph 12 Volt relay for remote interruption (Apply 12VDC to interrupt)
- Z = Binding Posts for Interrupt
- Z = ONE (1) positive terminal for 2/0 cable and ONE (1) Negative terminal for #2/0 cable
- Z = TWO 2" DC Knockouts, One 1" AC knockout
- Z = 12" stand for cabinet
- Type EO case, Hot dip galvanized, Approx. 1200 pounds
- 300 Gallons of Rectifier Transformer Oil

1.2 GENERAL

1.2.1 The AC input of the rectifier shall be 460 VAC – three phase – 60 Cycle.

1.3 ENCLOSURE

1.3.1 The rectifier case shall be NEMA 4X, completely weatherproof for outdoor use. The case shall be constructed of not less than eleven-gauge steel. All fabrication welds shall be clean and smooth. The entire case shall be hot dip galvanized per ASTM-123.T

1.3.2 The cabinet is to be equipped with an instrument compartment welded to one end of the case prior to galvanizing. This compartment shall house the circuit breaker, output meters and the output terminals and shall have a hinged door and lockable stainless-steel latch.

1.3.3 The lid on the oil chamber shall be hinged on one side and have a minimum of four stainless steel latches to provide a moisture proof seal. The gasket on the lid shall be an oil resistant neoprene sponge.

1.3.4 On rectifiers five- Hundred (500) watts and above, the transformer and stack shall be mounted on separate removable racks in the oil chamber.

1.3.5 The internal horizontal panel on which the voltage adjustment taps, AC input terminals and D.C. terminals are mounted shall be at least four inches below the recommended oil level as marked within the oil chamber.

1.3.6 All connecting wires from oil chamber to the instrument compartment shall be sealed with an oil resistant compound. These wires shall have a ½" gap in the insulation above oil level to prevent siphoning.

1.4 TRANSFORMER

1.4.1 The transformer shall be specifically designed for use in a cathodic protection rectifier, having separate primary and secondary copper windings. Wire size on both windings is to be based on a minimum of 1,000 circular mils per ampere. The material used in the core of the transformers shall be of such quality that core losses do not exceed 0.62 watts per pound. The amount of core material shall be no less than the amount given by the following formula:

AC = The square root of the watts in the primary divided by 5.58

1.4.2 AC = The minimum area of core in square inches. The core area is figured as the cross-sectional area of that portion of the core which passes through the coil.

1.4.3 The transformer shall be immersed in class F transformer varnish until all taps, insulating materials, outer wrapping and coil windings have been completely saturated. The transformer will then be oven baked until completely dry.

1.4.4 When a three-phase rectifier is specified, it shall be provided with a three-phase transformer with three separate wound legs or three separate transformers.

1.4.5 The secondary shall have a sufficient number of coarse and fine taps to provide a minimum of 18 equal step of adjustment. These taps shall be brought out to link bar arrangement for adjusting the output of the rectifier.

1.4.6 The link bars shall be terminated on at least a 5/16" stud lug that has one end drilled out so that the transformer tap wire can be soldered to the back of the stud.

1.4.7 Quick change plastic knobs with brass inserts shall be used to connect the link bars to the studs.

1.5 RECTIFYING ELEMENTS

1.5.1 The rectifier stack shall consist of high current density selenium cell arranged to give full wave rectification. Ratings shall be within the manufacturer's recommended current rating for continuous operation with a 50 degrees C ambient temperature.

1.5.2 The RMS voltage rating of the rectifier stack shall be sufficient to withstand, without damage, the full output of the transformer secondary when the load is disconnected from the D. C. terminals, i.e., under open circuit conditions.

1.5.3 When silicon is used as the rectifying element, current rating for continuous operation shall be for 50 degrees C. ambient and the PRV rating of the diodes shall be at least 1200 PIV. The diodes shall be protected against high voltage surges with selenium surge suppressors.

1.5.4 Current and voltage shall be de-rated for higher ambient temperature, where required, and in accordance with the manufacturer's recommendations.

1.6 PROTECTIVE DEVICES

1.6.1 The entire unit is to be protected against overload and short circuit with a fully magnetic circuit breaker of proper rating connected between the A.C. supply and transformer primary.

1.6.2 Circuit breakers shall have two poles for single phase units and three poles for three phase units. In the case of 100 amps or less silicon rectifiers, single pole, fully magnetic circuit breakers shall be inserted in one leg of the A.C. secondary of single-phase units and in at least two of the secondary legs of a three-phase unit.

1.6.3 All units above 100 amps shall be bolt in style fuses and shall not rely on pressure type fuse holders.

1.7 DC METERS

1.7.1 One D.C. voltmeter and one D.C. ammeter shall be provided. Each will have an accuracy of 2% full scale. Hoyt # 17/3 meters or approved equal shall have minimum scale lengths of 1 5/8".

1.7.2 The ammeter shall be connected to an external shunt with and accuracy of at least 1%.

1.7.3 The shunt shall be plainly marked to show ampere rating and millivolt drop. This shunt is to be mounted on the front panel of the rectifier so as to be readily accessible for meter accuracy checks.

1.8 DC TERMINALS

1.8.1 Solderless lugs rated for full rectifier output current shall be provided for the positive and negative output terminals of the rectifier and shall be mounted on an insulated panel.

1.8.2 Output terminals shall be clearly identified on the panel as “Positive” and “Negative”.

1.9 WIRING AND CONDUCTORS

1.9.1 All wiring within the rectifier, except the meter circuits, shall be of the high temperature motor lead wire with a minimum of 105 degrees C rating. Wire size shall be based on not less than 500 circular mils per ampere.

1.9.2 All current carrying bolts, terminals and connections made through the panel shall be either soldered to the bolt head or made by use of double nut method, so as not to depend on the compression strength of the panel to maintain a tight connection.

1.9.3 Tap changing studs and output lugs shall be a minimum of 5/16” diameter.

1.10 RECTIFIER DATA

1.10.1 Each rectifier shall be provided with an engraved metal nameplate with the following information.

1. Name of manufacturer
2. AC input voltage
3. AC input amperes
4. AC frequency
5. Phase
6. DC output volts
7. DC output amperes
8. Ambient temperature in degrees C.

1.10.2 In addition to this a waterproof envelope, placed in a suitable holder in the rectifier door, shall contain a complete wiring diagram, operating and maintenance manual and a copy of the test data obtained on the final bench check out of the rectifier.

1.11 INSTRUMENT PANEL

1.11.1 Phenolic grade XXX, non-conductive, moisture resistant, specifically designed for panel board use.

2 AC POWER

2.1 An AC Power Disconnect rated at 460/3/60 - 20 amps will be furnished by the Contractor. It is to positioned within ten-feet (10’) of the rectifier’s installed location. It shall be the responsibility of the contractor to connect the AC power from the disconnect to the new rectifier’s control.

3 REMOTE RECTIFIER MONITORING

3.1 The rectifier, if required by the owner, is to have an American Innovation Satellite Rectifier Remote Monitor Unit Model No. RM4014S with Surge Arrester connected to the rectifier.

4 RECTIFIER OIL

4.1 The Rectifier Oil shall be Tulstar Transformer Oil Type II OT-3216 into the rectifier.

5 RECTIFIER POSITIVE AND NEGATIVE HEADER CABLE

5.1 The rectifier’s single Positive Header Cables is to be AWG #2/0 copper stranded HMWPE header cable with RED insulation. The rectifier’s Negative Header Cable is to be AWG #2/0 copper stranded HMWPE header cable.

5.2 Rectifier positive and negative header cables shall be an AWG #2/0. They are to be copper stranded HMWPE Cathodic Protection Cable, manufacturer by Kalas MFG. This cable conforms to ASTM specifications B-8 and B-3, latest edition. It also conforms to ASTM D-1248, Type 1, Class C Category 5 Grade E-5 and J-3: and IPECA S61-402, Part 6 paragraph 6.11, 4a. The cable shall be identified by the surface ink printed with "Conductor Size, Kalas MFG, Co., HMWPE CATHODIC PROTECTION CABLE". The positive header cable is to be supplied with RED insulation.

6 IMPRESSED CURRENT ANODES

6.1 The anodes shall be Anotec Model No. 4884-LZ High Silicon Iron Anodes, which have a tubular geometry with the dimensions of 3.2 inches in diameter and 84 inches long. The anodes weigh without cable 123 pounds.

6.2 Anodes shall be chilled cast high silicon iron anodes. The lead wired is to be an AWG #6 copper stranded PVDF/HMWPE insulated CP cable. The lead wire is to be assembled to the anode via an approved Anotec distributor using the Anotec Hydraulic Anchor Seating Machine.

6.3 The connection resistance should no greater than 0.001 ohms between the anode and its lead wire cable.

6.4 Anode Current Density and Life

6.4.1 The anode shall be rated at 6.6 to 8.8 amps for an estimated life of 15 years in seawater.

7 ANODE LEAD WIRE CABLE

7.1 Electrical Data – The cable shall have a DC current rating of 70 amps at 600C, with a copper cross section of AWG #6 copper stranded.

7.2 Insulation Data – The insulation shall have of two (2) insulation layers and be PVDF/HMWPE chlorine resistant insulated cable.

7.3 The inner layer shall be PVDF fluoropolymer with a thickness of 20 mils.

7.4 The outer layer shall be high molecular weight polyethylene with a thickness of 65 mils.

7.5 The cable length for each waterside anode will vary based on its installation location to its respective Anode Shunt Junction Box. Refer to the provided drawing for approximate "anode cable lengths" within each rectifier zone.

7.6 Anode lead wire cable shall be an AWG #6 copper stranded PVDF/HMWPE Cathodic Protection Cable, manufacturer by Kalas MFG. This cable conforms to ASTM specifications B-8 and B-3, latest edition. It also conforms to ASTM D-1248, Type 1, Class C Category 5 Grade E-5 and J-3: and IPECA S61-402, Part 6 paragraph 6.11, 4a. The cable shall be identified by the surface ink printed with "Conductor Size, Kalas MFG, Co., HMWPE CATHODIC PROTECTION CABLE".

8 ANODE SHUNT JUNCTION BOX

8.1 This Anode Shunt Junction Box measures 18" X 16" X 8".

8.2 It has twenty-two (22) circuits with Type SW Shunts rated at 50mV=5 Amps and KA-4C lugs for AWG #6 Cable. Above the Shunt will be engraved "1 mV = .1 Amp".

8.3 It is to have one rectifier positive common Header Lug No. KPA-28 for AWG #2/0 Cable.

8.4 There shall be two isolated terminals for AWG #10 cable with the engraving "STRUCTURE TEST LEADS" above the two lugs.

8.5 All nuts and bolts will be stainless steel.

8.6 The Busbar and terminal lugs will be nickel-plated copper.

9 TEST LEAD CABLE

9.1 Test lead cables are to be AWG #10 copper stranded HMWPE Cable and are terminated in the Anode Shunt Junction Box for each rectifier zone.

9.2 The connection of the two structure test leads to the seawall is to be achieved by thermite welding or pin brazing two AWG #10 copper stranded HMWPE test wire leads to a 6" by 6" by ¼" thick steel plate. Next the steel plate is to be double pass welded to the Mobile Maritime Museum's seawall bulkhead. The location of where the test lead steel plate is to be welded to the seawall is to be in the general area where each Junction Box is located. The welded steel plate, including the thermite weld areas are then to be coated with Alocit 28.15 Underwater Epoxy. This coating system is an approved underwater coating system for this project. The test leads themselves are to be routed in electrical grade PVC Conduit from the seawall to its Anode Shunt Junction Box. The conduit is to be anchored to the steel Z-plate seawall bulkhead and to the seawall's concrete cap using SS316, two-hole heavy duty conduit clamps. The conduit for the test leads is to extend into the water a minimum of six feet (6'). Distances between conduit clamps cannot exceed three feet (3').

10 QUIKRETE BURLAP RIP-RAP BAGS

10.1 Quikrete Rip Rap Burlap Concrete Bags are to overlaid continuously over the anode cables as they are run to the face of the seawall and then down the face of the seawall back to their appropriate Anode Shunt Junction Box. The part number for these 60-pound bags is1129-61.

10.2 The purpose of these Rip Rap Bags is two-fold. First, they are installed to keep the anode cables fixed on the bottom of the seafloor. Second, they are there to serve as protection against mechanical damage from objects that may fall from above and impact the cables resulting in damage to the cables and their insulation.

11 SHIP BONDING STATION - B

11.1 The Ship Bonding Station is to be installed at a location near the 450-foot location as measured from South to North at the Mobile Maritime Museum's seawall. The Ship Bonding Station is a 16" x 14" X 6" fiberglass box with one (1) Type SW Shunt rated at 50mV-200A. It includes two (2) KA-28 lugs for 4/0 cable, The left lug will be engraved with "SHIP HULL" and the right lug will be engraved with "SEAWALL".

11.2 It will be mounted to a 4" galvanized I-beam similar to the Anode Shunt Junction Boxes. It will be also protected with four steel barricade posts filled with concrete. Please see the attached drawing for more details. The Ship Bonding Station will have a 4/0 grounding cable terminated in the Ship Bonding Station. The other end of this cable will be thermite welded to a 4" X 4" X 1/2" thick steel plate which has been double passed welded to the seawall at this same location. The weld location is to be about three feet below the surface

of the water directly to the z-plate seawall. The entire weld plate is to be liberally coated with Alocit 28.15 Underwater Epoxy coating after being welded to the seawall. The 4/0 cable is routed to the surface and then to the Ship Bonding Station in PVC electrical grade conduit. Inside the Ship Bonding Station will be a 200 Amp Shunt and an additional 4/0 lug. This additional 4/0 lug is being provided for any ship that is moored at the dock to make the ship's hull electrically continuous with the seawall. Since the seawall will be under cathodic protection, it is most important that all steps be taken to insure the avoidance of interference corrosion on the ship's hull. It is to be understood that it is the ship's responsibility to provide their own ship's hull connection cable. The additional 4/0 lug is provided for this connection. Once connected the shunt in the Ship Bonding Station can be used to measure any DC current being shared between the seawall and the ship's hull, along with the direction of current flow.

SECTION 3- EXECUTION AND INSTALLATION

1 RECTIFIER

1.1 The installation of the rectifier and related equipment shall comply with local, state, and national electric codes.

1.2 For the Mobile Maritime Museum ’s waterside CP system, there is to be two (2) rectifiers installed on the elevated platform located on the northeast corner of the Mobile Cruise Line Terminal Building.

1.3 Actual rectifier DC output voltage required shall be determined by actual anode(s) to seawall bulkhead resistance. This resistance value is to be measured by using a temporary DC power source and powering up the installed linear anode system. Then and only then can the rectifier’s voltage capability be ascertained. Hence, the rectifier shall not be ordered until CP circuit resistance has been measured.

1.4 The rectifier specified in the Bill of Materials was based on data collected from the field (water resistivity). It is felt that the calculated circuit resistance of this rectifier will be very close to what will be actually purchased after the actual circuit resistance is determined. Unless there is a significant difference between the calculated circuit resistance and the actual circuit resistance, then a price change will not be allowed for the rectifier. A ”significant difference” is defined as a circuit resistance difference of more than 10%. If a price change is requested on this item, then the contractor shall submit a copy of the original quoted cost from the manufacturer and a copy of the quote for the rectifier based on the actual circuit resistance of the CP system. The amount of the price change allowed will be limited to the rectifier’s cost difference with a 15% profit margin applied to the cost difference (Cost Difference X 1.15 = Allowed Price Change).

1.5 The installation of the positive and negative cables for this rectifier will require cutting concrete curbs, concrete decks and/or sidewalks.

1.6 The contractor will be responsible for replacing all concrete that he disturbs.

1.7 Rectifier negative structure cables are to be thermite welded to a 6” X 6” X ¼” steel plate. This steel plate will then be welded to the waterside of the Mobile Maritime Museum Seawall

Bulkhead using the double pass welding technique. This steel plate assembly is then to be completely and liberally coated with Alocit 28.15 Underwater Epoxy.

1.8 Rectifier positive anode header cables are to make their transition in the same general location as where each rectifier's negative cables are attached to the seawall. They are to be encased in PVC Electrical Grade Conduit as it is routed from above the water level to below water level. Gulf States Hanger Model No. SS316 Fig. 115 Two- Hole Cable Clamps and/or Special SS316 Fig. 88A Standoff Clamps with 4 conduit mounting places are to be used to anchor the conduit to both the seawall's concrete cap and/or the z-plate of the seawall itself. The distance between two-hole conduit clamps cannot exceed three feet (3'). Please refer to drawings provided with this specification for more detail.

1.9 There are to be no underwater splices in rectifier positive or negative header cables.

2 ANODE SHUNT JUNCTION BOX – CABLE

2.1 The Anotec Anode's AWG #6 lead wire cables are to be terminated in the Anode Shunt Junction Boxes. There are to be no splices in these anode cables.

2.2 When the anode cables are brought from underwater to the atmosphere, they are to be routed in 2" Schedule 80 Electrical Grade PVC Conduit. The conduit is to be held in place with Gulf States Hanger and Supports' Fig. No. 115 2" SS316 Two-Hole Conduit Clamps in the area of the seawall bulkhead's concrete cap. The maximum spacing between these clamps is not to exceed three-feet (3') and there must be minimum of two (2) of these clamps installed in the concrete cap area. Below the concrete seawall bulkhead's concrete cap, where the seawall bulkhead's steel z-plate is located, Gulf States Hangers and Supports Fig No. 88A-Special SS316 Offset Conduit Clamps are to be welded to the face of the steel z-plate seawall bulkhead to further support the conduit runs. Please refer to the drawing set provided with this specification as it relates to these "Offset Conduit Clamps. All four (4) of the 2" PVC Conduits that run from the bottom of the Anode Shunt Junction Box are to extend a distance of 6-feet (6') from the seafloor bottom so that these clamps line up with the face of the seawall bulkhead's concrete cap. Since each seawall bulkhead is different, the contractor will be responsible for determining the "offset" distance from the z-plate and the vertical conduit runs so that they all line up with the face of the seawall bulkhead's concrete cap and then into their Anode Shunt Junction Box mounted on and above this area on top of the Terminal's concrete deck. The maximum distance between these "Offset Clamps" cannot exceed three-feet (3') on these conduit runs below the seawall bulkhead's concrete cap.

2.3 The anode lead wire cables are to run directly along the face of the seawall on the seafloor bottom, and then up the face of the seawall to its appropriate Anode Shunt Junction Box. These anode cable runs, to include the "rectifier's positive" cable run, will be overlayed continuously with "Ballast Quikrete Rip-Rap Bags" on the seafloor bottom.

2.4 The installation of cables and related equipment shall comply with all local, state, and national electric codes.

3 ANODE INSTALLATION

3.1 The Anotec Anodes are water jetted into the seafloor bottom as previously described in Paragraph 3-1-3.

3.2 Anode cables are to be routed directly to the face of the seawall. They are then routed along the face of the seawall to the general area of their appropriate Anode Shunt Junction Box. The anode cables are then routed up to their Anode Shunt Junction Box inside of PVC electrical grade conduit.

3.3 Anode cables when laid on the seafloor bottom are to be overlaid continuously with Quikrete Burlap Rip Rap Bags.

3.4 The water depth along face of the Mobile Maritime Museum Bulkhead Seawall varies. For installation purposes, the contractor can safely use the depth of thirty-feet (30') for their calculations.

3.5 The contractor may at his discretion move anodes and related cable runs to locations that are different from the locations shown on the installation drawings. These locations changes can be associated with underground, underwater, and/or unknown obstacles that are encountered during installation. These changes are to be noted and communicated to the customer's engineer on the project, as well as being shown on the contractor's "as-built" drawings.

4 ANODE SHUNT JUNCTION BOX INSTALLATION

4.1 The Anode Shunt Junction Box is to be installed in the middle of its rectifier zone. As mentioned earlier these Junction Boxes are to mounted to a galvanized 4" I-beam pedestal. All mounting hardware and concrete anchors used in the mounting of the junction box shall be SS316.

4.2 The Anode Shunt Junction Boxes will be mounted on the Maritime Museum's concrete deck approximately fifteen-feet (15') from the eastern edge of the dock. They are to be located so that they do not interfere ship mooring ropes.

4.3 Each Anode Shunt Junction Box is to be protected by four each six-inch (6") diameter concrete filled Bollard posts. Please refer to the attached drawing included in the drawing package for this specification. This drawing will show the locations where the contractor is to install them.

4.4 There will be four (4) each 2" PVC conduit penetrations into each of the junction boxes. Twenty-two (22) AWG #6 anode lead wires, two (2) AWG #10 test lead wires and one (1) AWG #2/0 rectifier positive cable will enter the junction box via these three penetrations.

4.5 All conduit penetrations into the Anode Shunt Junction Box shall be waterproof penetrations. This means that all PVC Terminal Adapter Fittings are to be PVC glued into the Shunt Box in addition to a SS fender washer and locknut being installed on the Terminal Adapter fitting inside the junction box.

4.6 After the Anode Shunt Junction Box installation is finalized and the anode cables have been terminated in their proper lug on the busbar, to include the termination of the rectifier's positive cable and test lead cables, expanding foam is to be sprayed inside the ID of each conduit penetration for the purpose of blocking water migration into the junction box through the conduit.

5 SURFACE CABLE ROUTING JUNCTION BOXES

5.1 For the Maritime Museum's "waterside" CP system, there will be three (3) of these Surface Cable Routing Junction Boxes. The aircraft rated frame and cover is to be EJ USA, Inc.'s

Model 8083 Frame and Cover. They are to be used for access the inside of the Surface Cable Routing Boxes, which are constructed using rebar and concrete. The actual concrete construction details for the Surface Cable Routing Junction Boxes to which the EJ Frame and Cover are to be mounted, are show in the drawing package with this specification

5.2 Two (2) of these boxes are located close to the eastern edge of the Maritime Museum's deck directly in front of the two(2) Anode Shunt Junction Boxes for this CP system. Please refer to the drawing provided with this specification for more detail information.

5.3 The third Surface Cable Routing Box is located directly across from the Ship Bonding Station on the eastern edge of the of the Maritime Museum's deck. Please refer to the drawing provided with this specification for more detail information.

5.4 If the need arises, the contractor may make cable splices in the Surface Cable Routing Boxes. These splices are permitted for the purposes of facilitating the arduous task of cable installation. These splices are to use the Burndy Crimping System, using either the Burndy "C" Crimps, or the Burndy "Butt" Crimps. The spliced crimps are then to be sealed with Royston's "Splice Right" splice kits.

SECTION 4- ENERGIZING AND TESTING

1 TESTING

1.1 AMPP (NACE) Criteria: The achievement of cathodic protection is to be based on acceptable AMPP (NACE) criteria. The AMPP (NACE) criterion that is to be used for the seawall bulkhead is SP0169-2013 and it states under section 6.2.1.2: "A minimum of 100 mv of cathodic polarization. Either the formation or decay of polarization must be measured to satisfy this criterion. There is an alternative criterion stated under section 6.2.1.3 which states: "A structure-to-electrolyte potential of -850 mv or more negative as measured with respect to a saturated copper/copper sulfate (CSE) reference electrode. This potential may be either a direct measurement of the polarized potential or a current-applied potential. Interpretation of a current-applied measurement requires consideration of the significance of voltage drops in the earth and metallic parts."

1.1.1 Since this project involves seawater, a silver-silver chloride (AGCL) reference cell will be used. The threshold potential of -850 mV using a CSE reference cell is equal to the potential of -800 mV when an AGCL reference cell is used.

1.2 To properly consider voltage drops in the CP system, a complete set of native potential readings are to be taken and recorded. After the system has been energized and adjusted, a polarized ("instant on/off") survey is to be conducted on the structure.

1.3 Upon completion of the installation of the waterside CP system, the system shall be energized, tested, and adjusted for proper operation. When the seawall bulkhead has been under cathodic protection for at least 30 days, a polarized ("instant on/off") survey is to be conducted. "Instant off" structure potentials from minus -800 mV to minus -1150 mV as measured with a silver-silver chloride reference electrode, shall be considered acceptable.

1.4 Report

1.4.1 Upon completion of the post installation survey, a written report shall be submitted that will include the following:

1.4.1.1 Rectifier data sheets to include the final setting and DC output.
1.4.1.2 Operation and maintenance instructions
1.4.1.3 Potential data - native
1.4.1.4 Potential data – On and Instant-Off
1.4.1.5 Individual anode current

SECTION 5- OTHER PROVISIONS

1 DISCLAIMER

1.1 It is the contractor's responsibility to verify ***quantities,*** part numbers, and viability of all materials specified in this specification, as there may be errors and omissions.

1.2 It is the responsibility of the contractor to achieve cathodic protection on the waterside of the Maritime Museum seawall.

2 PRICE CHANGES

2.1 The successful contractor for this project must hold his bided price firm for 90 days from the bid date for this offering. Price changes will be allowed if and only if there is a significant price increase for an item from a manufacturer that occurs either during and/or after 90 days has elapsed from the bid date and the contract awarded date. A "significant price" increase is one that amounts to more than a 10% increase in an item's **cost** from a manufacturer. Integral to the approval for a price increase must be evidenced by the original manufacture's quoted price document to the contractor; and the manufacturer's revised, dated document to the contractor, which shows the increased price to the contractor. The amount of the price change allowed will limited to the item's cost difference with a 15% profit margin applied to the cost difference (Cost Difference X 1.15 = Allowed Price Change).

SECTION 6- VENDOR RESOURCES

1 Stainless Steel Brackets

1.1 Gulf States Hangers and Supports: 7100 Bellingrath Road, Theodore, AL 36582 (251-653-6228)

2 Underwater Diving

2.1 Commercial Diving Services: Doug Christopher; 4376 Dawes Lane East; Mobile, AL 36619 (251-665-0017)

3 Universal Rectifiers

3.1 Universal Rectifiers: P.O. Box 1640, Rosenberg, TX 77471 (281-342-8471)

4 EJ USA Inc.

4.1 EJ USA, Inc. : 800-626-4653

SECTION 7- WARRANTY

1 LIMITED WARRANTY: This limited Warranty covers the installation and the equipment associated with the Cathodic Protection System (the "Product") supplied by the contractor ("installer") for this project.

2 LIMITED FIVE YEAR MATERIALS & LABOR WARRANTY: Subject to the limitations set forth below, Installer warrants to the purchaser ("Buyer") that the Product will be free from defects or failure caused by improper installation for a period of five (5) year from the Date of Installation ("the Warranty Period"). The Date of Installation shall be the date listed on the Certificate of Substantial Completion.

3 EXCEPTIONS TO WARRANTY: The limited warranty does not cover defects, damage to Product or Product failure caused by any of the following:

3.1 System settings and current discharge in excess of design expectations.

3.2 Abuse, abnormal use, or accident.

3.3 Use for a purpose or in a manner for which the Product was not intended

4 See also Contract for Construction and Section 01010 Section Summary of Work.

SECTION 8- DIVING SUBCONTRACTOR

1.1 The Diving Subcontractor on this project shall possess the following:

1.1.1 State Licensed Board for General Contractors certified member and a licensed "General Contractor in the State of Alabama in the field of H/RR-S: Marine Construction

1.1.2 Member in good standing with the Association of Diving Contractors International in the field of "Commercial Diving and Marine Services"

1.1.3 Approved by Alocit-USA as a "Certifier Underwater Coating Applicator". When applied by an Alocit Certified Applicator, the coating has a warranty for 10 years.

1.1.4 Installation of underwater cathodic protection systems as evidenced by a minimum of at least five installations in the past ten years.

SECTION 9- BILL OF MATERIALS

CATHODIC PROTECTION SYSTEM
BILL OF MATERIALS

MATERIALS

QTY.	DESCRIPTION
2 Each	**CATHODIC PROTECTION RECTIFIERS:** Universal Rectifier Model No. OSOI-70-170-CBCKRWZ
300-Gal	**RECTIFIER OIL:** Tulstar Transformer Oil Type II OT-3216
1776-Feet	**POSITVIE HEADER CABLE:** AWG #2/0 copper stranded HMWPE Cathodic Protection Cable with RED insulation
1920-Feet	**NEGATIVE HEADER CABLE:** AWG #2/0 copper stranded HMWPE Cathodic Protection Cable

44 Each	**IMPRESSED CURRENT ANODES:** Anotec Model No. 4884LZ with varying lengths of AWG #6 copper stranded PVDF/HMWPE Cathodic Protection Cable
8640-Feet	**ANODE CABLE:** AWG #6 copper stranded PVDF/HMWPE Cathodic Protection Cable
2 Each	**ANODE SHUNT JUNCTION BOXES:** Universal Rectifiers Quote No. 31584, 18" x 16" x 8", 22 each Type SW Shunts rated 50mV-5 Amp. 22 each KA-4C Lugs (6 AWG Cable), 1 each KPA-25 Lug and two (2) #12 AWG test terminals, Bus Bars and terminal lugs are to be nickel plated copper, and all nuts and bolts are to be made of stainless steel.
2 Each	**JUNCTION BOX PEDSTALS:** See drawing
2184-Feet	**CONDUIT:** Schedule 80, 2" PVC Conduit – Electrical Grade
1-Lot	**CONDUIT CABLE CLAMPS:** Gulf States Hangers and Supports 2" Fig. No. 115 SS 316 Two Hole Conduit Clamps
1-Lot	**SS OFFSET CONDUIT CLAMPS:** Gulf States Hanger and Supports 2" SS316 Fig. No. 88A-Special Offset Conduit Clamps. These special clamps will support four (4) conduit runs simultaneously. The "offset" dimension to be determined by contractor prior to ordering.
1-Lot	**SS CONCRETE WEDGE ANCHORS:** Fasteners Plus Conquest 3/8" x 3" SS316 (SKU: CWA38-300SS6)
8 Each	**PVC WATERPROOF SPLICE BOX PENETRATION FITTINGS:** Graybar Model No. TA-2 Terminal Adapter (Part No. 88285283)
1188 Each	**QUIKCRETE RIP RAP BAGS:** Quikrete Model No. 1129-61, 60-pound 3-1 Burlap Rip Rap Bags, which measure 16" W X 23" L X 3.75 H
200-Feet	**TEST LEAD CABLE:** No. 10 HMWPE Test Lead Cable
1 Lot	**MISC ITEMS:** PVC conduit, SS316 conduit mounting hardware, SS316 concrete anchors, conduit fittings not listed, thermite welds, underwater coatings, and all incidental items required for the proper installation of the cathodic protection system as described in this specification.
1 Each	**Ship Bonding Station, Universal Rectifier:** Fiberglass Box 16" X 14" X 6" with one SW Shunt rated 50mV-200A with KA-28 Lugs for 4/0 cable, one lug is engraved with "Ship's Hull" on the left side and "Seawall" on the right side. The box's door is engraved with "Ship Bonding Station".
40-Feet	**PVC Conduit:** Schedule 80, 3" PVC Conduit – Electrical Grade
4 Each	**CONDUIT CABLE CLAMPS:** Gulf States Hangers and Supports 3" Fig. No. 115 SS 316 Two Hole Conduit Clamps
50 Feet	**Bonding Cable:** 4/0 AWG HMWPE Bonding Cable
3 Each	**Surface Cable Routing Boxes:** EJ USA, Inc. aircraft rated Model No. 8083 Frame and Cover
1 Lot	**Underwater Epoxy Coating:** Alocit 28.15 Underwater Epoxy Coating System

TECHNICAL SPECIFICATIONS

IMPRESSED CURRENT LANDSIDE CP SYSTEM SPECIFICATIONS

March 22, 2023
Addendum No. 2

CITY OF MOBILE ALABAMA

MOBILE CRUISE TERMINAL

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SECTION 1- GENERAL

1 SCOPE

1.1 The work consists of furnishing all labor, equipment, and materials, and performing all operations necessary to complete the following:

1.2 Install one (1) cathodic protection Rectifier.

1.3 Install one (1) each "linear" groundbed cathodic protection system to cathodically protect the landside of the seawall bulkhead associated with the Mobile Cruise Line Terminal, in Mobile, Alabama.

1.4 Conduct a native potential survey on the landside of the seawall at the Mobile Cruise Line Terminal.

1.5 Energize, adjust, and checkout the cathodic protection system after installation.

1.6 The linear anode is to be installed to a depth of twenty feet (20') which parallels the seawall. The soil resistivity was measured to be 2449 ohm-cm at the 20-foot depth. A soil boring log of this area shows that from 0' to -20' the soil consists of a loose brown, fine sand. From -20' to -35', soft clays were found.

1.7 The City of Mobile shall be responsible for furnishing and/or installing the AC power to the general area of the rectifier. This is to include the installation of a 480/3/60 three phase disconnect box, rated at 40 amps. This disconnect is to be installed within ten feet (10) of the rectifier's control panel.

1.8 Easements and permits as may be required.

1.9 A storage area for materials will be provided by the Mobile Cruise Line Terminal. It will be located underneath the two elevated platforms where the rectifiers are going to be located; or another onsite location as provided by the Cruise Terminal.

1.10 The drawings included with this specification indicate the general arrangement of the cathodic protection system. If the contractor desires to make changes to the CP system installation as shown on these drawings, then the changes shall be submitted to the owner's engineer for approval. This approval process must be done prior to any work being initiated as it relates to any departures from the CP system drawings of this specification.

1.11 Directional Boring: Contractor is responsible for locating underground utilities and/or structures.

2 CONTRACTOR CREDENTIALS

2.1 This CP system shall be installed, energized, and evaluated by a firm regularly engaged in the field of cathodic protection of marine seawall bulkheads and possess an accepted history in the installation of these kinds of marine installations. At all times during construction, the contractor shall maintain a qualified supervisor to direct the construction activity and interface with the City of Mobile's representative, as required.

2.2 The company that is awarded the contract to install the waterside CP system at Mobile Cruise Terminal must have at least ten (10) years of experience in the design and installation of CP systems on marine seawall bulkheads.

2.3 The supervisor for this job must possess the following two (2) AMPP (NACE) accreditations: 1) Corrosion Specialist-G and 2) Cathodic Protection Specialist or possess the AMPP (NACE) Accreditation of CP4. The firm who is awarded this project will provide all labor, materials, and supervision for the installation of the waterside CP system at Mobile Cruise Terminal. The supervisor must be on job site at all times while all construction/installation work is being performed.

2.4 The supervisor must have five (5) years of experience in installing and servicing CP systems for marine seawall bulkheads. This is to be evidence by the successful completion of five marine seawall bulkhead projects.

2.5 The firm that is awarded this contract must possess an Alabama State Contractors license at the time of bidding this project. They must also obtain and/or be able to meet other requirements in Division 1 Sections.

2.6 Evidence of the company's work experience/history in the field of marine (seawall) CP systems, the Supervisor's AMPP (NACE) accreditations, and his work experience/ history, to include a copy of the firm's Alabama Contractors License must be submitted with the bid for this project, otherwise the bid will not be considered as a valid response to the solicitation.

3 STANDARD PRODUCTS

3.1 Unless otherwise indicated in writing by the owner's engineer, materials under these specifications shall be considered standard products from manufacturers regularly engaged in the production of cathodic protection equipment and materials and of the manufacturer's latest approved standard design.

3.2 Where brand names and/or numbers are specified, it is understood that "or equal" shall apply. The brand names have been used only to describe the standard of quality, performance, and characteristics desired. However, if bidding an "equivalent to the brand specified, it is mandatory that the bidder furnish, at least seven (7) calendar days prior to the bid, detailed literature cutsheets, and/or specifications to be used in evaluation of products.

3.3 See Division 1 Sections 01010 "Summary of Work" Article 1.35 Substitutions and Section 01635 "Substitution Procedures" for more information.

4 MATERIAL SUBMITTALS

4.1 Contractor shall submit to owner for approval, a complete list of material and equipment. The list shall include catalog numbers, cuts, diagrams, drawings, and other descriptive date required by the owner. No consideration will be given to partial lists.

Anode – Linear Distributed Anode System
Positive Header Cables
Surface Cable Routing Junction Box Frame and Cover Rectifier
Negative Structure Header Cables
Electrical Conduit

4.2 See Division 1 Section 01010 Summary of Work and Section 01330 Submittal Procedures for Additional Information.

SECTION 2- PRODUCTS

1 RECTIFIERS

The landside rectifier shall be manufactured by Universal Rectifiers Model No. OSOI-100-200 CBCKRWZ.

- OSOI = Oil Cooled, Non-Hazardous area, Manual link bar control, Silicon stack
- DC rating: 100 Volts – 200 Amps
- C = 230/460 VAC, 3 Phase, 60 Hertz input
- B = Set to run on 460 VAC
- C = AC & DC lightning arrestors
- K = DC Failure Light
- R = 115 VAC convenience outlet on the front panel
- W= Terminal block for remote Monitor, terminals to include DC Volts=/-. Amps =/-, 15 VDC
- Z=Hybrid bridge stack with 3ph 12-volt relay for remote interruption (Apply 12 VDC to interrupt)
- Z = Binding Posts for Interrupt
- Z = One Positive Terminal for #2/0 cable
- Z = Two Negative Terminals for #1/0 cable with a shunt on each of the negative terminals
- Z - One 2” DC knockout and one 1” AC knockout
- Z – 12” Stand for Cabinet
- Type GO case, Hot Dip galvanized, approx. 1600 pounds
- 600 Gallons of transformer oil required

1.1 APPLICABLE STANDARDS

1.1.1 EMA Publication No. MR 20-1958, reaffirmed by NEMA 1971-Semiconductor Rectifiers, Cathodic Protection Units.

1.1.2 NEMA Standard Publication No. 250-1979, including Rev. No. 1 – December 1980, Enclosures for Electrical Equipment (1000 Volts maximum)

1.2 GENERAL

1.2.1 The AC input of the rectifiers shall be 115, 230 or 460 VAC – single or three phase – 60 Cycle.

1.3 ENCLOSURE

1.3.1 The rectifier case shall be NEMA 4X, completely weatherproof for outdoor use. The case shall be constructed of not less than eleven-gauge steel. All fabrication welds shall be clean and smooth. The entire case shall be hot dip galvanized per ASTM-123.

1.3.1.1 The cabinet is to be equipped with an instrument compartment welded to one end of the case prior to galvanizing. This compartment shall house

the circuit breaker, output meters and the output terminals and shall have a hinged door and lockable stainless-steel latch.

1.3.1.2 The lid on the oil chamber shall be hinged on one side and have a minimum of four stainless steel latches to provide a moisture proof seal. The gasket on the lid shall be an oil resistant neoprene sponge.

1.3.2 On rectifiers 500 watts and above, the transformer and stack shall be mounted on separate removable racks in the oil chamber.

1.3.3 The internal horizontal panel on which the voltage adjustment taps, AC input terminals and D.C. terminals are mounted shall be at least four inches below the recommended oil level as marked within the oil chamber.

1.3.4 All connecting wires from oil chamber to the instrument compartment shall be sealed with an oil resistant compound. These wires shall have a ½" gap in the insulation above oil level to prevent siphoning.

1.3.5 A grounding lug to accommodate a #6 wire shall be provide on the outside of the cabinet.

1.4 TRANSFORMER

1.4.1 The transformer shall be specifically designed for use in a cathodic protection rectifier, having separate primary and secondary copper windings. Wire size on both windings is to be based on a minimum of 1,000 circular mils per ampere. The material used in the core of the transformers shall be of such quality that core losses do not exceed 0.62 watts per pound. The amount of core material shall be no less than the amount given by the following formula:

AC = The square root of the watts in the primary divided by 5.58

1.4.2 AC = The minimum area of core in square inches. The core area is figured as the cross-sectional area of that portion of the core which passes through the coil.

1.4.3 The transformer shall be immersed in class F transformer varnish until all taps, insulating materials, outer wrapping and coil windings have been completely saturated. The transformer will then be oven baked until completely dry.

1.4.4 When a three-phase rectifier is specified, it shall be provided with a three-phase transformer with three separate wound legs or three separate transformers.

1.4.5 The secondary shall have a sufficient number of coarse and fine taps to provide a minimum of 18 equal step of adjustment. These taps shall be brought out to link bar arrangement for adjusting the output of the rectifier.

1.4.6 The link bars shall be terminated on at least a 5/16" stud lug that has one end drilled out so that the transformer tap wire can be soldered to the back of the stud.

1.4.7 Quick change plastic knobs with brass inserts shall be used to connect the link bars to the studs.

1.5 RECTIFYING ELEMENTS

1.5.1 The rectifier stack shall consist of high current density selenium cell arranged to give full wave rectification. Ratings shall be within the manufacturer's recommended current rating for continuous operation with a 50 degrees C ambient temperature.

1.5.2 The RMS voltage rating of the rectifier stack shall be sufficient to withstand, without damage, the full output of the transformer secondary when the load is disconnected from the D. C. terminals, i.e.., under open circuit conditions.

1.5.3 When silicon is used as the rectifying element, current rating for continuous operation shall be for 50 degrees C. ambient and the PRV rating of the diodes shall be at least 1200 PIV. The diodes shall be protected against high voltage surges with selenium surge suppressors.

1.5.4 Current and voltage shall be de-rated for higher ambient temperature, where required, and in accordance with the manufacturer's recommendations.

1.6 PROTECTIVE DEVICES

1.6.1 The entire unit is to be protected against overload and short circuit with a fully magnetic circuit breaker of proper rating connected between the A.C. supply and transformer primary.

1.6.2 Circuit breakers shall have two poles for single phase units and three poles for three phase units. In the case of 100 amps or less silicon rectifiers, single pole, fully magnetic circuit breakers shall be inserted in one leg of the A.C. secondary of single-phase units and in at least two of the secondary legs of a three-phase unit.

1.6.2.1 All units above 100 amps shall be bolt in style fuses and shall not rely on pressure type fuse holders.

1.7 DC METERS

1.7.1 One D.C. voltmeter and one D.C. ammeter shall be provided. Each will have an accuracy of 2% full scale. Hoyt # 17/3 meters or approved equal shall have minimum scale lengths of 1 5/8".

1.7.2 The ammeter shall be connected to an external shunt with and accuracy of at least 1%.

1.7.3 The shunt shall be plainly marked to show ampere rating and millivolt drop. This shunt is to be mounted on the front panel of the rectifier so as to be readily accessible for meter accuracy checks.

1.8 DC TERMINALS

1.8.1 Solderless lugs rated for full rectifier output current shall be provided for the positive and negative output terminals of the rectifier and shall be mounted on an insulated panel.

1.8.2 Output terminals shall be clearly identified on the panel as “Positive” and “Negative.”

1.9 WIRING AND CONDUCTORS

1.9.1 All wiring within the rectifier, except the meter circuits, shall be of the high temperature motor lead wire with a minimum of 105 degrees C rating. Wire size shall be based on not less than 500 circular mils per ampere.

1.9.2 All current carrying bolts, terminals and connections made through the panel shall be either soldered to the bolt head or made by use of double nut method, so as not to depend on the compression strength of the panel to maintain a tight connection.

1.9.3 Tap changing studs and output lugs shall be a minimum of 5/16” diameter.

1.10 RECTIFIER DATA

1.10.1 Each rectifier shall be provided with an engraved metal nameplate with the following information.

1. Name of manufacturer
2. AC input voltage
3. AC input amperes
4. AC frequency
5. Phase
6. DC output volts
7. DC output amperes
8. Ambient temperature in degrees C.

1.10.2 In addition to this a waterproof envelope, placed in a suitable holder in the rectifier door, shall contain a complete wiring diagram, operating and maintenance manual and a copy of the test data obtained on the final bench check out of the rectifier.

1.11 INSTRUMENT PANEL

1.11.1 Phenolic grade XXX, non-conductive, moisture resistant, specifically designed for panel board use.

2 AC POWER

2.1 AC Power to be supplied by the City of Mobile. The AC Power supplied will terminate in an AC Disconnect Box within ten feet (10’) of the rectifier. Please refer to Section 1, paragraph 1.7.

3 REMOTE RECTIFIER MONITORING

3.1 The rectifier is to have an American Innovation Satellite Rectifier Remote Monitor Unit Model No. RM4014S with Surge Arrester connected to the rectifier.

4 LINEAR ANODES

4.1 GENERAL DESCRIPTION

4.1.1 The landside anode shall be Ceranode Piggyback Linear Anode in Coke Sock: Model No. PBL-CS-559 ft.-STI-125H-20 ft.-583 ft.-1/0 AWG-KYNAR-CXFH – 559 ft. Active Length, CXFH connection, 20 ft. Lead and 579 ft. Tail plus 4 ft. for 2 ft. loop back, using 1/0 AWG Kynar20/HMWPR65 Cable rated at 400mAsqft for 20 years.

4.1.2 The linear anode assembly shall be pre-assembled at CerAnode and placed on a 48” wooden installation reel.

4.1.3 There will be 20ft lead and 610ft tail + 4ft for 2ft loop back, “Fold in Half”, using 1/0 AWG Kynar20/HMWPE65 Cable

4.1.4 Please refer to the drawing included with this specification for installation details of the installed linear anode assembly.

4.1.5 The anode must be assembled with Loresco SC3 carbon backfill in a natural cotton fiber sock as provided by CerAnode. Substitutions must be pre-approved per Division 1 Sections.

4.2 CURRENT DENSITY AND ANODE LIFE

4.2.1 The linear anode shall be rated at 400 ma per linear foot for an estimated life of 20 years. This application in soil will allow for a discharge rate of 236 amps for 20 years. At a discharge rate of 157 amps, the estimated life for this linear anode is 30 years.

4.2.2 This rating is good down to soil resistivity of 1300 ohm-cm.

4.3 LINEAR ANODE-TO-CABLE CONNECTION

4.3.1 The anode-to-cable connection shall be made at the center of each anode and have an electrical resistance of less than 0.001 ohm.

4.4 LINEAR ANODE QUALITY ASSURANCE

4.4.1 The linear anode assembly as assembled by CerAnode renders a 7-year factory warranty, when the linear anode is installed and operated as per the warranty specifications. This warranty is from CerAnode and not from the contractor

4.5 LINEAR ANODE HEADER CABLE

4.5.1 From the end of the Linear Anode back to the rectifier, 2/0 AWG HMWPE cable with “RED INSULATION” is to be used.

4.6 LINEAR ANODE HEADER CABLE SPLICE

4.6.1 The linear anode is to be spliced to the rectifier’s positive header cable using the Burndy “C” Crimp System. The “C” crimp to be used is Burndy Model No. YC26C26.

4.6.2 The splice kit to be used to encapsulate the splice of the linear anode cable to the rectifier's positive header cable is to be Royston's "Splice Right" splice kit.

5 RECTIFIER-TO-STRUCTURE (NEGATIVE) CABLE

5.1 Two (2) #1/0 AWG HMWPE cables will be welded to the front (water side) of the seawall via a Steel Structure Connection Plate. The location of these two plates is at the 150-foot location and 450-foot location as measured from the southeast corner of the seawall of the Mobile Cruise Line Terminal. These negative cable connection plates will be welded to the seawall about five feet (5') from the seafloor bottom. The plate and weld area to the seawall are to be coated liberally with underwater Alocit 28.15 Underwater Epoxy coating. These two cables will be routed along the face of the seawall on the bottom. When these two cables reach the area where the Surface Cable Routing Box is located, which is near the 350-foot location as measured from the southeast corner of this seawall; they be routed vertically to this Surface Cable Routing Box and then on to their appropriate landside rectifier. These cables along with the other cables installed along the face of the seawall are to be overlaid with Rip Rap Burlap Concrete Bags. All these cables are then routed to the top of the dock at this location via 2" PVC schedule 80 conduits. This makes a total of four negative cables that will be routed back to their respective rectifier for the CP systems associated with the Mobile Cruise Line Terminal seawall. Two (2) negative cables for the two (2) waterside rectifiers, and two (2) negative cables for the one (1) landside rectifier. The two landside negative cables are to be terminated in its appropriate rectifier cabinet.

5.2 CABLE-TO-STRUCTURE CONNECTION

5.2.1 The rectifier's negative cathodic protection cable shall be thermite welded to the structure steel connection plate which measures 6" by 6" by ¼" thick. The steel connection plate is then welded to the seawall with the double pass welding procedure. The entire plate and cable thermite weld area is to be liberally coated with Alocit 28.15 Underwater Epoxy coating.

5.3 THERMITE WELD COATING

5.3.1 Thermite welds shall be protected and coated with Alocit 28.15 Underwater Epoxy coating.

5.4 D.C. ELECTRICAL CONDUIT

5.4.1 D.C. electrical conduit and fittings shall be schedule 80 conduit grade PVC, conforming to all codes and ordinances. All 90 degree and 45-degree ells shall be the "sweep" style elbows.

5.5 SURFACE CABLE ROUTING JUNCTION BOXES

5.5.1 For the Cruise Line Terminal's "Landside" CP system, there will be two (2) of these Surface Cable Routing Junction Boxes. The aircraft rated frame and cover is to be EJ USA, Inc.'s Model 8083 Frame and Cover. They are to be used for the purposes of gaining access to the inside of the Surface Cable Routing Boxes. These boxes are where all of the CP systems cables are located as they are routed

to their appropriate rectifier. The junction box itself is to be constructed using rebar and concrete. The actual concrete construction details for the Surface Cable Routing Junction Boxes to which the EJ Frame and Cover are to be mounted, are shown in the drawing package with this specification.

5.5.2 One (1) of these Surface Cable Routing Junction Boxes is located at the northeast leg of the elevated platform where the rectifiers are installed. Before this box is actually constructed, this location serves as the "TAIL" pit for the directional bore that will be made to connect the linear anode's "HEAD" pit to this "TAIL" pit at the rectifier elevated platform. The linear anode assemblies' rectifier positive header cables will be routed through this junction box on their way to their appropriate rectifier. Please refer to the drawing provided with this specification for more detailed information.

5.5.3 The second Surface Cable Routing Junction Box is located where the two Linear Anode head pits are located in the parking lot of the Maritime Museum. In fact, there are not two "HEAD" pits, but just one large "HEAD" pit at this location and it is located where the two linear anode assemblies come together. One of the linear anode assemblies is for the Cruise Line Terminal and the other linear anode assembly is for the Maritime Museum. The directional bores for these two linear anode assemblies will be made from this same "HEAD" pit location. One will be made to the south and one will be made to the north. Please refer to the drawing package provided with this specification for more details. The directional bore that will allow for the linear anode positive header cables to be routed and connected to their appropriate rectifier, will be made to the southeast from this linear anode "HEAD" pit. Again, please refer to the drawings provided with this specification for more detailed information.

5.5.4 If the need arises, the contractor may make cable splices in the Surface Cable Routing Boxes. These splices are permitted for the purposes of facilitating the arduous task of cable installation. These splices are to use the Burndy Crimping System, using either the Burndy "C" Crimps, or the Burndy "Butt" Crimps. The spliced crimps are then to be sealed with Royston's "Splice Right" splice kits.

5.5.5 Header cable Surface Cable Routing Junction Boxes are to be EJ USA, Inc. Model No. 8083 and be rated for "Airport Traffic".

SECTION 3- EXECUTION AND INSTALLATION

1 LANDSIDE CATHODIC PROTECTION SYSTEM

1.1 The linear landside anode consists of one pre-assembled linear anode with an approximate active length of 590-feet long which uses the 400 mA MMO wire anode material.

1.2 The linear anode system is to be directional bored to an installed depth of twenty feet (20'). The directional bore will be done from the head pit located in the parking lot of the Maritime Museum. The bore is from the head pit to the south. Refer to Drawing included with this specification for specific details.

1.3 The linear anode landside positive header cable is to be 2/0 AWG HMWPE with RED insulation and is routed back to its rectifier via Surface Cable Routing Junction Boxes. The boxes are to be manufactured by EJ USA, Inc. They are "airport rated" and are Model No. 8083 Junction Box Frame and Cover.

1.4 A second directional bore will be made from this head pit down to a new tail pit that is located next to the northeast leg of the rectifier elevated platform. The general direction of this bore is to the southeast. The bore will result in two each 2/0 HMWPE "RED INSULATED" cables being pulled back to the linear anode head pit. One cable is spliced to the Mobile Cruise Terminal's linear anode assembly, and the other cable will be spliced to the Mobile Maritime Museum's linear anode assembly.

2 EXCAVATION, TRENCHING, AND BACKFILLING

2.1 Provide shoring and/or sheeting where excavation or field conditions do not allow adequate slope for banks.

2.2 Trenching excavation for cable installation in conduit shall be made as narrow as practical, but width should allow proper compaction. Trenches shall not be widened by scraping or loosening materials from the side. Every effort shall be made to keep the sides of the trenches firm and undisturbed until backfilling has been completed and consolidated.

2.3 Depth of Trench. Trenches shall be excavated to a depth that will allow the cable conduit to be laid at a minimum depth of twenty-four inches (24").

2.4 Backfilling shall be accomplished in such a manner that no damage is done to the conduit and/or the cable insulation.

2.5 Compaction of backfill shall be to 95% per ASTM D1557 (modified proctor). In soft, weak, or wet soils, tamp backfill to consolidate and densify the material.

2.6 Reconditioning of Surfaces: Surfaces disturbed during the excavation for conduit runs shall be of the same kind as what was removed during excavations.

3 RECTIFIER UNITS

3.1 Actual rectifier DC output voltage required shall be determined by actual anode(s) to seawall bulkhead resistance. This resistance value is to be measured by using a temporary DC power source and powering up the installed linear anode system. Then and only then can the rectifier's voltage capability be ascertained. Hence, the rectifier shall not be ordered until CP circuit resistance has been measured.

3.2 The rectifier specified in the Bill of Materials was based on data collected from the field (soil resistivity). It is felt that the calculated circuit resistance of this rectifier will be very close to what will be actually purchased after the actual circuit resistance is determined. Unless there is a significant difference between the calculated circuit resistance and the actual circuit resistance, then a price change will not be allowed for the rectifier. A" significant difference" is defined as a circuit resistance difference of more than 10%. If a price change is requested on this item, then the contractor shall submit a copy of the original quoted cost from the manufacturer and a copy of the quote for the rectifier based on the actual circuit resistance of the CP system. The amount of the price change allowed

will be limited to the rectifier's cost difference with a 15% profit margin applied to the cost difference (Cost Difference X 1.15 = Allowed Price Change).

3.3 The rectifier and related equipment shall comply with local and national electric codes. The AC power disconnect for the rectifier units shall be furnished and connected by the Contractor. The connection from the AC Power disconnect to the rectifier shall be provided by the contractor.

4 ENERGIZING AND TESTING

4.1 AMPP (NACE) Criteria The achievement of cathodic protection is to be based on acceptable AMPP (NACE) criteria. The AMPP (NACE) criterion that is to be used for the seawall bulkhead is SP0169-2013 and it states under section 6.2.1.2: *"A minimum of 100 mv of cathodic polarization. Either the formation or decay of polarization must be measured to satisfy this criterion.* There is an alternative criterion stated under section 6.2.1.3 which states: "A structure-to-electrolyte potential of -850 mv or more negative as measured with respect to a saturated copper/copper sulfate (CSE) reference electrode. This potential may be either a direct measurement of the polarized potential or a current-applied potential. Interpretation of a current-applied measurement requires consideration of the significance of voltage drops in the earth and metallic parts."

4.2 Since this project involves seawater, a silver-silver chloride (AGCL) reference cell will be used. The threshold potential of -850 mV using a CSE reference cell is equal to the potential of -800 mV when an AGCL reference cell is used.

4.3 To properly consider voltage drops in the CP system, a complete set of native potential readings are to be taken and recorded. After the system, has been energized and adjusted an "instant on/off" survey is to be conducted on the structure.

4.4 Upon completion of the installation of the landside CP system, the system shall be energized, tested and adjusted for proper operation. When the seawall bulkhead has been under cathodic protection for at least 30 days, an "instant on/off" survey is to be conducted. "Instant off" structure potentials from minus -800 mV to minus -1150 mV as measured with a silver-silver chloride reference electrode, shall be considered acceptable.

4.5 After the initial survey, it highly recommended that an annual survey be conducted every year to insure effective cathodic protection is being maintained.

4.6 Report: Upon completion of the post installation survey, a written report shall be submitted that will include the following:

Rectifier data sheets to include the final setting and DC output.
Operation and maintenance instructions
Potential data - *native*
Potential data – *polarized*

5 VENDOR RESOURCES

5.1 Stainless Steel Brackets

5.1.1 Gulf States Hangers and Supports: 7100 Bellingrath Road, Theodore, AL 36582 (251-653-6228)

5.2 Linear Anode

5.2.1 CerAnode Technologies International: Greg Smith; 4011 Riverside Dr., Dayton Ohio 45405 (937-278-6547

5.3 Underwater Diving

5.3.1 Commercial Diving Services: Doug Christopher; 4376 Dawes Lane East; Mobile, AL 36619 (251-665-0017)

5.4 Universal Rectifiers

5.4.1 Universal Rectifiers: Mike Hill; P.O. Box 1640, Rosenberg, TX 77471 (281-342-8471)

5.5 EJ USA, Inc.

5.5.1 EJ USA Inc.: 800-626-4653

6 OTHER PROVISIONS

6.1 DISCLAIMER

6.1.1 It is the contractor's responsibility to verify quantities, part numbers, and viability of all materials specified in this specification.

6.1.2 It is the responsibility of the contractor to achieve cathodic protection as specified.

6.2 PHYSICAL CHANGES

6.2.1 The contractor may at his discretion move the linear anode and related cable runs to locations that are different from the locations shown on the installation drawings. These locations changes can be associated with underground and/or unknown obstacles that are encountered during installation. These changes are to be noted and communicated to the City's engineer on the project, as well as being shown on the contractor's "as-built" drawings.

6.3 PRICE CHANGES

6.3.1 The successful contractor for this project must hold his bided price firm for 90 days from the bid date for this offering. Price changes will be allowed if and only if there is a significant price increase for an item from a manufacturer that occurs either during and/or after 90 days has elapsed from the bid date and the contract awarded date. A "significant price" increase is one that amounts to more than a 10% increase in an item's **cost** from a manufacturer. Integral to the approval for a price increase must be evidenced by the original manufacture's quoted price document to the contractor; and the manufacturer's revised, dated document to the contractor, which shows the increased price to the contractor. The amount of the price change allowed will limited to the item's cost difference with a 15% profit margin applied to the cost difference (Cost Difference X 1.15 = Allowed Price Change).

7 WARRANTY

7.1 LIMITED WARRANTY: This limited Warranty covers the installation and the equipment associated with the Cathodic Protection System (the "Product") supplied by the contractor ("installer") for this project.

7.2 LIMITED FIVE YEAR LABOR AND MATERIAL WARRANTY: Subject to the limitations set forth below, Installer warrants to the purchaser ("Buyer") that the Product will be free from defects or failure caused by improper installation for a period of five (5) years from the Date of Installation ("the Warranty Period"). The Date of Installation shall be the date listed on the Certificate of Substantial Completion.

7.3 EXCEPTIONS TO WARRANTY: The limited warranty does not cover defects, damage to Product or Product failure caused by any of the following:

7.3.1 System settings and current discharge in excess of design expectations.

7.3.2 Abuse, abnormal use, or accident.

7.3.3 Use for a purpose or in a manner for which the Product was not intended; or

7.3.4 Hidden defects in the structure where the Product is installed.

7.4 See also Contract for Construction and Section 01010 Section "Summary of Work".

8 BILL OF MATERIALS

LANDSIDE CATHODIC PROTECTION CP SYSTEM

BILL OF MATERIALS

MATERIALS

QTY.	DESCRIPTION
1 Each	**RECTIFIER -** Universal 100 Volt – 200 Amp - Model Code 0S0I-100-200-CBCKRWZ
1 **Each**	**LINEAR DISTRIBUTED ANODE SYSTEM:** CerAnode Piggyback Linear Anode in Coke Sock: Model No. PBL-CS-590FT-STI-125H-20FT-614FT-1/0 AWG-KYNAR-CXFH - 590Ft Active Length, CXFH connection, 20Ft Lead and 610Ft Tail plus 4Ft for 2Ft loop back, using 1/0 AWG Kynar20/HMWPR65 Cable, rated at 400mAsqft for 20 years
400-Feet	**POSITIVE LINEAR ANODE HEADER CABLE:** CerAnode Positive Header Cable Assembly No. CABLE-168: Two each 2/0 HMWPE Positive Header Cable Assembly – 400 feet long each with "RED INSULATION" inside of a protective sleeve. This header cable assembly with two 2/0 cables – 400' long, will be on its own wooden reel. This item is shown in both the Cruise Terminal's and the Maritime Museum's Bill of Materials. Only one of these should be supplied with this project, as both seawall CP systems will utilize this single item.

1 Each	**SPLICE KIT:** Royston "Splice Right" Splice Kit
1 Each	**CABLE CRIMPS:** Burndy 2/0 to 1/0 "C" Crimp Model No. YC26C26
972-Feet	**STRUCTURE NEGATIVE HEADER CABLE:** Two each #1/0 AWG HMWPE cables for this CP System. These two cables are the rectifier's negative structure header cables.
2 Each	**SURFACE CABLE ROUTING JUNCTION BOXES:** EJ Airport Rated Model 8083 Junction Box Frame and Cover
60-Feet	**PVC Conduit:** Schedule 80, 2" PVC Conduit – Electrical Grade. It should be noted that a conduit allowance for this CP System has been already allocated under the Bill of Materials listed for the Mobile Cruise Terminal's Bill of Materials - Waterside.
1-Lot	**Underwater Epoxy Coating:** Alocit 28.15 Underwater Epoxy Coating System
1-Lot	**MISC ITEMS:** Rigid Conduit, straps, mounting hardware, conduit fittings, splice crimps, and all incidental items required for the proper installation of the cathodic protection system.