

ADDENDUM NO. 2

TO PROSPECTIVE BIDDERS UNDER  
CONSTRUCTION CONTRACT TP-4 EAST FACILITY  
AND CLARIFIERS REHABILITATION PROJECT  
Timpanogos Special Service District Water Reclamation Facility

RECEIPT OF THIS ADDENDUM MUST BE ACKNOWLEDGED IN THE BID FORM

This addendum will be attached to the Agreement and is a Contract Document

**Addendum No. 2 consists of:**

1. **Answers to Bidder's Questions:**

*Q-1. Is a Utah County Building permit required?*

A. Yes, a building permit is required due to worker ingress, and egress use of the clarifier walkways and for the project electrical work. Contractor to perform and comply with the following:

1. An allowance item for the building permit has been added to the Bid Form. Contractor to do all the work to review, obtain and comply with all permit requirements.
2. Submit permit application, contract plans and brief scope of work for review and fee assessment. Third party (pre) review services are available. Contact the Utah County Government Community Development for more information.
3. Provide Utah County Government Community Development with deferred submittals as required for the plan review / approval.
4. Utah County Government Community Development to provide Contractor with an inspection checklist once review is complete.
5. Utah County Government Community Development contact information:

Steve Kitchen – Building Official  
51 South University Ave.  
Suite 117  
Provo, UT 84601  
[stevek@utahcounty.gov](mailto:stevek@utahcounty.gov)  
(810) 851-8342

*Q-2. Would you consider naming Clearstream Environmental for the TSSD bid? They've got 100's of installs and have history with B&C. Could you let me know what the process would be to get them in as an approved equal?*

A. Yes, Clearstream Environmental will be considered and “or Equal”.

*Q-3. Will there be handrail installed on the top of the outer launder wall that would serve as a support point for launder covers?*

A. No handrail is proposed to be installed on the top of the outer launder wall.

*Q-4. Can the launder covers be composed of both 6061-T6 aluminum and 5052-H32 aluminum?*

A. Yes.

*Q-5. We would like you to allow Westech to bid their precision bearing clarifier drive on your project. Westech cannot participate if the Spec doesn't allow us to bid the very drive unit that the customer has at their plant.*

A. Precision bearing clarifier drives are acceptable as an “or Equal”.

*Q-6. We would like to propose an RSG CM40 drive with LED readout stainless panel. This drive meets with all the performance and design criteria called out in the spec.*

A. RSG CM40 drives with LED readout stainless panels are acceptable as an “or Equal”.

*Q-7. Are the manufactures providing sandblasting, priming, or finish coats for the alternative?*

A. Yes, we will allow the walkway and painted carbon steel component manufactures to sandblast, prime, intermediate, stripe coat, and finish coat these materials in their shop and deliver painted components to the field. Contractor to conduct all coating repairs in the field.

*Q-8. If (we) have to sandblast in the field, will it be ok to open blast and paint the clarifiers or will there be environmental restrictions and (would we) have to contain the blast and overspray?*

A. Contractor to comply with all applicable Utah Department of Environmental Quality air quality, air particulate, abatement, measurement, and reporting requirements. Brown & Caldwell recommends that Contractors contact and review their sandblasting and coating plans with the Utah Department of Environmental Quality for verification as to what is allowed. Contractor to prevent all sandblast media, paint, painting waste materials and paint overspray from entering the plant treatment stream. Contractor will be responsible for any damage to surrounding structures and vehicles from spent abrasive or paint overspray.

*Q-9. Would the Owner consider extending the bid date by one week?*

A. Yes, the bid date has been extended one week. The new bid date is Wednesday September 6, 2023. Bids shall be received no later than 2:00 pm on that date.

*Q-10. Note 5 on Drawing E-08-1003 is not called out on the drawing. Does this note apply to this drawing? If so, where?*

A. Note 5 on Drawing E-08-1003 is called out in photo “B/E-08-1001, Clarifier E-3 Conduit Runs”.

*Q-11. Can we get a single line drawing for the electrical scope?*

A. No electrical single line drawings are available.

*Q-12. Can we get P&IDs with changes noted for the scope of work?*

A. No P&IDs are available.

*Q-13. Is there any other details besides Note 1 on E-08-2001 “VMVL-3-N-R3-UNVI” or equal for a lighting specification?*

A. No. For a project with this small of a lighting scope (2 luminaries with photocells), we typically do not create a separate lighting specification.

*Q-14. In Addendum 1 on Page 2 of 3 it states under A. i. “Bids shall be received no later than 2 p.m. on Wednesday, August 29, 2023”. Please confirm if bids are due on Tuesday, August 29<sup>th</sup> or Wednesday, August 30<sup>th</sup>.*

A. The bid date has been changed. The bid date is now Wednesday, September 6, 2023. Bids shall be received no later than 2:00 pm on that date. Attached is the revised Advertisement for Bids.

*Q-15. On Page 5 of Bid Form for Construction Contracts Under 7.01 B & C it states a list of proposed subcontractors and suppliers is due with the bid however in the instruction to bidders for construction contracts page 7 under 12.03 it states “The apparent Successful Bidder, and any other Bidder so requested, shall within five days after Bid opening, submit to Owner a list of the Subcontractors or Suppliers proposed along with their qualifications for the following portion of the Work: Any Subcontractors whose subcontract exceeds 5 percent of the Work.” Please remove the requirement to submit a list of subcontractors and suppliers with the bid.*

A. This is a request for a list of subcontractors and not the full list with qualifications as required by 12.03.

*Q-16. On Page 5 of Bid Form for Construction Contracts Under 7.01 D states that a list of project references is needed with the bid. Please provide if 3 references is sufficient.*

A. Requirement has been removed. See revised attached Bid Form.

*Q-17. On Page 5 of Bid Form for Construction Contracts Under 7.01 H it states Required Bidder Qualification Statement with supporting data shall be submitted with the bid. Please provide form for what is required to submit with our bid.*

A. Requirement has been removed. See revised attached Bid Form.

*Q-18. Specification 33 39 30 under section 2.01.C.1, given the low operating pressures design parameters of the TP-4 system, please confirm if both unidirectional carbon and glass fiber can be used in strengthening applications to offer the Owner the most cost effective FRP design possible.*

- A. This project is specified as a CFRP system. The use of GFRP for dielectric isolation and as a waterproofing layer is acceptable provided that unidirectional carbon fiber is utilized to provide the structural strength. GFRP-only design with no CFRP is not allowed.

*Q-19. Specification 33 39 30 under section 2.01.C.3, given the low operating pressures design parameters of the TP-4 system, please confirm if a minimum laminate thickness of 0.04 inch would be acceptable for an optimized FRP design.*

- A. A minimum laminate thickness of 0.04 inch is acceptable assuming the structural requirements per the specifications are met.

*Q-20. Spec. Section 33 39 30 – CFRP: Please confirm and provide if there are any live loads on the yard piping subject to CFRP repairs.*

- A. Live loads on the yard piping are to be HS-20 loading. In addition, the clarifier loads are to be calculated assuming the clarifiers are full with liquid. Please see attached revised specification 33 39 30.

*Q-21. Spec. Section 33 39 30 – CFRP: Please confirm if there is a water table (elevation?) for CFRP design.*

- A. The ground water depth on average is typically 5 feet below grade site wide, although during the wet season the groundwater level can vary. For the CFRP design calculations, assume the groundwater depth is at grade.

*Q-22. Drawings & spec. refers to both steel and RCP piping, plans show RCP except for small detail of end termination for steel. Please confirm actual pipe material type(s) subject to CFRP repairs and regions for each/transition (if applicable).*

- A. The pipelines subject to CFRP are RCP except at the location where the pipelines transition from RCP to a metallic 90-degree bend at the center of the clarifiers. The vertical spool piece between the metallic 90-degree bend and the floor of the clarifier (connection to the vertical riser column) is also metallic.

*Q-23. Section 1.01- E.4. - The specifications indicate spiral blades, however they also call out a header and orifice design (which would not be spiral rake). Please confirm a spiral rake blade is to be provided.*

- A. Spiral rake blades are to be provided.

*Q-24. Section 1.01 – E.5. – The specifications indicate that the drive cages to be designed to withstand forces and operate clockwise and counter-clockwise. This is outside the industry standard and therefore we are seeing for confirmation with this requirement. Please not that in doing so, It will increase the weight of the cage by at least 50%. Furthermore, running in the opposite direction, the process will collect sludge in the middle of the tank and it would push outward. Mechanically, it won't be protected with the cutoff alarm. To do this it would also be a large cost increase. Please confirm the cage is to be designed to withstand forces and operate in the designed single direction.*

A. Cage is to be designed to withstand forces from the mechanism to operate in both directions as specified.

*Q-25. Section 1.01 – E.7. Feedwell. Please confirm the total SWD is 7' with 6" freeboard.*

A. The feedwells shall be 7'- 0" with no freeboard.

*Q-26. Section 1.01 – E.7. Spiral rake blades. From experience and industry standard, the 20" rake blade at the center is too small. The existing units are 30" and is what we recommend. Please confirm 30" is acceptable.*

A. 30" rake blades are acceptable.

*Q-27. Section 1.01 – F.1. – The listed tip speed for the sludge collector is too slow. Please confirm our recommended tip speed can be provided for optimum performance.*

A. Use the recommended tip speed for your design.

*Q-28. Section 2.03 –A. 2. The specifications indicated the EDI **and** Feedwell shall be fabricated of 316 stainless steel plate. Please confirm that we can provide the industry standard where the feedwell will be FRP panels and frame, not plate.*

A. The Feedwell may be FRP panels and 304 stainless steel frame.

*Q-29. Section 40 05 57.23, 2.05 C talks about Location of Control Station and Remote Control Stations. Will TSSD need a second control station for each of the Rotork Actuators?*

A. No, a second control station for each of the Rotork actuators is not needed. Each of these actuators are to be locally controlled at the gate pedestals. See attached revised Specification Section 40 05 57.23.

*Q-30. Drawing PM-08-3002 shows (3) BFVs (Tags BFV1-11-13-03, BFV1-11-13-02, BFV1-11-13-01). Will these valves be reused or are new BFVs needed?*

A. These are existing valves that are to be reused, and no new BFVs are needed or required.

2. **Directives / Clarifications:**

- a. Specification Section 33 39 30, Section 2.2.C. Loadings. The following items have been added to this section:

**1.e.** Live loading is HS-20 at locations not underneath the clarifiers

**1.f.** The clarifier loading is to be calculated when clarifier tanks are full.

- b. Specification Section 46 43 21.11, Part 1, Section 1.03 A., Submittals, No. 12, e. The listed 250 lbs. Live Load should be listed as a concentrated point load. The requirement is for the lauder covers to be capable of supporting a 250 lb. concentrated point load.

3. **Specifications:**

- a. Delete 00 11 00 – Advertisement in its entirety and replace with updated attached 00 11 00 Advertisement for Bids
- b. Delete 00 41 00 – Bid Form in its entirety and replace with updated attached 00 41 00 00 – Bid Form
- c. Delete 33 39 30 – Fiber Reinforced Polymer Composite Repairs for Pipelines and replace with updated attached 33 39 30 – Fiber Reinforced Polymer Composite Repairs for Pipelines
- d. Delete 40 05 57.23 – Electric Motor Actuators, Lift Gate Pedestals and replace with updated attached 40 05 57.23 Electric Motor Actuators, Lift Gate Pedestals

4. **Attachments:**

Attachment A – Revised Specifications (remove original and replace with the following)

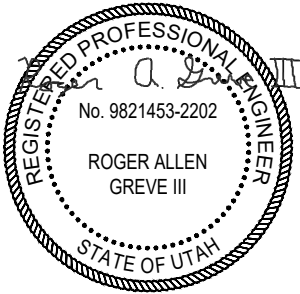
00 11 00 – Advertisement for Bids

00 41 00 – Bid Form

33 39 30 – Fiber Reinforced Polymer Composite Repairs for Pipelines

40 05 57.23 – Electric Motor Actuators, Lift Gate Pedestals

Date: August 25, 2023



END OF SECTION

Addendum No. 2

**ATTACHMENT A**

Addendum No. 2



**TSSD WATER RECLAMATION FACILITY  
6400 N. 5050 W., UTAH COUNTY, UT**

**TP-4 EAST FACILITY UTILITIES AND CLARIFIERS REHABILITATION PROJECT**

**00 11 10**

**ADVERTISEMENT FOR BIDS (ADDENDUM NO. 2)**

Sealed Bids for the construction of the **East Facility Utilities and Clarifiers Rehabilitation Project** will be received **from prequalified Bidders only**, by **Timpanogos Special Service District (TSSD), Water Reclamation Facility**, at the office of the **TSSD Water Reclamation Facility 6400 N., 5050 W. Utah County, UT 84003** until **2:00 p.m.** local time on **September 6, 2023**, at which time the Bids received will be **publicly** opened and read.

Site dewatering will be required for the east clarifier rehabilitation work. The Owner will drain and clean each clarifier prior to the start of the work. East facility secondary clarifier work is to include the demolition, removal, disposal, and replacement of all the internal carbon steel components at and below the waterline with new components. New skimmers and 4-foot scum beaches, weirs, baffles, and Stamford baffles are to be installed in the three clarifiers. The east clarifier drives are to be removed and replaced. The Contractor is to remove and replace the existing east clarifier walkways. The Contractor is to furnish and install new aluminum and stainless-steel launder covers on the three east clarifiers. Contractor is directed to the Bid Form and Technical Specs for bid alternatives related to materials for the clarifier equipment with one option being stainless and another alternative being carbon coated steel.

The east facility secondary clarifier splitter box work shall consist of the removal, replacement of the existing east clarifier gate operator pedestals and installation of Rotork electric actuators.

East facility electrical work is to consist of the installation of Rotork electric actuators and corresponding electrical service on the new clarifier splitter box gate pedestals. New lighting is to be installed on the top of the east clarifier splitter box. The lighting on the clarifier bridges is to be removed and reinstalled with walkway replacement. The electrical feeds to east clarifiers 1 and 3 are to be replaced. Sidewalks are to be replaced as noted on the plans as part of the electrical refeed work.

East facility pipe lining rehabilitation work is to be conducted on the 30-inch diameter RCP mixed liquor pipes associated with east clarifiers 1 and 2. East facility pipe point repair work is to be conducted on the 16-inch diameter DIP RAS pipe associated with east clarifier 3. Piping is to be investigated prior to work to confirm repair locations, procedure and repaired once the east clarifier center feed pipes have been removed. CCTV inspection video footage of these pipes is provided in the supplementary information.

Bids will be received for a single prime Contract. Bids shall be on a lump sum basis as indicated in the Bid Form.

The Issuing Office for the Bidding Documents is: **Brown and Caldwell, contact Roger Greve, 6975 Union Park Center, Suite 490, Midvale, UT 84047, phone: 410-733-1751 email: rgreve@brwnncald.com.**

Bidding Documents will be provided in electronic portable document format (pdf) to invited Bidders. The Bidding Documents will be provided via email or other large file transfer service. Printed copies will not be provided.

A pre-bid conference will be held **at 2:00 p.m. local time on August 2, 2023 at the Timpanogos Special Service District Water Reclamation Facility, 6400 N., 5050 W. Utah County, Utah 84003. Attendance at the pre-bid conference is mandatory.** Invited Bidders not in attendance will be deemed un-responsive and any submitted Bids will be returned un-opened.

Bid security shall be furnished in accordance with the Instructions to Bidders.

Owner: **TSSD Water Reclamation Facility**

By: **Rich Mickelson**

Date: **August 29, 2023**

+ + END OF ADVERTISEMENT FOR BIDS +

**00 41 00**  
**BID FORM**

Timpanogos Special Service District Water Reclamation Facility  
6400 N., 5050 W. Utah County, UT 84119

**TP-4 EAST FACILITY UTILITIES AND CLARIFIERS REHABILITATION PROJECT**

(BID FORM REPLACED IN ITS ENTIRETY IN ADDENDUM NO. 2)

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**ARTICLE 1 – BID RECIPIENT**

1.01 This Bid is submitted to:

*Timpanogos Special Service District Water Reclamation Facility, 6400 N. 5050 W., Utah County, UT 84003*

1.02 The undersigned Bidder proposes and agrees, if this Bid is accepted, to enter into an Agreement with Owner in the form included in the Bidding Documents to perform all Work as specified or indicated in the Bidding Documents for the prices and within the times indicated in this Bid and in accordance with the other terms and conditions of the Bidding Documents.

**ARTICLE 2 – BIDDER’S ACKNOWLEDGEMENTS**

2.01 Bidder accepts all of the terms and conditions of the Instructions to Bidders, including without limitation those dealing with the disposition of Bid security. This Bid will remain subject to acceptance for 90 days after the Bid opening, or for such longer period of time that Bidder may agree to in writing upon request of Owner.

**ARTICLE 3 – BIDDER’S REPRESENTATIONS**

3.01 In submitting this Bid, Bidder represents that:

A. Bidder has examined and carefully studied the Bidding Documents, and any data and reference items identified in the Bidding Documents, and hereby acknowledges receipt of the following Addenda:

<u>Addendum No.</u>	<u>Addendum, Date</u>
_____	_____
_____	_____
_____	_____
_____	_____

B. Bidder has visited the Site, conducted a thorough, alert visual examination of the Site and adjacent areas, and become familiar with and satisfied itself as to the general, local, and Site conditions that may affect cost, progress, and performance of the Work.

C. Bidder is familiar with and has satisfied itself as to all Laws and Regulations that may affect cost, progress, and performance of the Work.

D. Bidder has carefully studied all: (1) reports of explorations and tests of subsurface conditions at or adjacent to the Site and all drawings of physical conditions relating to existing surface or subsurface structures at the Site that have been identified in the Supplementary Conditions, especially with respect to Technical Data in such reports and drawings, and (2) reports and drawings relating to Hazardous Environmental Conditions, if any, at or adjacent to the Site that have been identified in the Supplementary Conditions, especially with respect to Technical Data in such reports and drawings.

E. Bidder has considered the information known to Bidder itself; information commonly known to contractors doing business in the locality of the Site; information and observations obtained from visits to the Site; the Bidding Documents; and any Site-related reports and drawings identified in the Bidding Documents, with respect to the effect of such information, observations, and documents on (1) the cost, progress, and

performance of the Work; (2) the means, methods, techniques, sequences, and procedures of construction to be employed by Bidder; and (3) Bidder's safety precautions and programs.

- F. Bidder agrees, based on the information and observations referred to in the preceding paragraph, that no further examinations, investigations, explorations, tests, studies, or data are necessary for the determination of this Bid for performance of the Work at the price bid and within the times required, and in accordance with the other terms and conditions of the Bidding Documents.
- G. Bidder is aware of the general nature of work to be performed by Owner and others at the Site that relates to the Work as indicated in the Bidding Documents.
- H. Bidder has given Engineer written notice of all conflicts, errors, ambiguities, or discrepancies that Bidder has discovered in the Bidding Documents, and confirms that the written resolution thereof by Engineer is acceptable to Bidder.
- I. The Bidding Documents are generally sufficient to indicate and convey understanding of all terms and conditions for the performance and furnishing of the Work.
- J. The submission of this Bid constitutes an incontrovertible representation by Bidder that Bidder has complied with every requirement of this Article, and that without exception the Bid and all prices in the Bid are premised upon performing and furnishing the Work required by the Bidding Documents.

#### **ARTICLE 4 – BIDDER'S CERTIFICATION**

4.01 Bidder certifies that:

- A. This Bid is genuine and not made in the interest of or on behalf of any undisclosed individual or entity and is not submitted in conformity with any collusive agreement or rules of any group, association, organization, or corporation;
- B. Bidder has not directly or indirectly induced or solicited any other Bidder to submit a false or sham Bid;
- C. Bidder has not solicited or induced any individual or entity to refrain from bidding; and
- D. Bidder has not engaged in corrupt, fraudulent, collusive, or coercive practices in competing for the Contract. For the purposes of this Paragraph 4.01.D:
  - 1. "corrupt practice" means the offering, giving, receiving, or soliciting of any thing of value likely to influence the action of a public official in the bidding process;
  - 2. "fraudulent practice" means an intentional misrepresentation of facts made (a) to influence the bidding process to the detriment of Owner, (b) to establish bid prices at artificial non-competitive levels, or (c) to deprive Owner of the benefits of free and open competition;
  - 3. "collusive practice" means a scheme or arrangement between two or more Bidders, with or without the knowledge of Owner, a purpose of which is to establish bid prices at artificial, non-competitive levels; and
  - 4. "coercive practice" means harming or threatening to harm, directly or indirectly, persons or their property to influence their participation in the bidding process or affect the execution of the Contract.

**ARTICLE 5 – BASIS OF BID (ADDENDUM NO. 2)**

5.01 Bidder will complete the Work in accordance with the Contract Documents for the following price(s):

<b>East Clarifier Splitter Box:</b>		
<b>Item No.</b>	<b>Description*</b>	<b>Lump Sum Bid Price (numerals)</b>
1	Remove and replace the three existing lift gate pedestals and gear boxes with three new lift gate pedestals and gear boxes and Rotork actuators per specification 43 05 11 and 40 05 57.23. Furnish and install new lighting, light posts, and power supply on the top of the east clarifier splitter box (2 lights total). Install power supply for and to the new lift gate electric actuators and lighting.	
<b>East Clarifiers E-1, E-2, E-3:</b>		
<b>Item No.</b>	<b>Description*</b>	<b>Lump Sum Bid Price (numerals)</b>
2	Furnish and install new clarifier mechanisms and associated equipment per specification 46 43 21.13, and as per the contract drawings. All material 1'-0 above, or below the water line shall be 304 stainless-steel. Pipe to be Schedule 10, 304 stainless-steel, pipe supports to be 316 stainless-steel. Furnish and install painted carbon steel walkways per specification 46 43 21.13. Remove and reinstall existing walkway lighting, light posts, and local lighting controls. Electrical re-feed of East Clarifiers 1 and 3.	
3	Furnish and install aluminum launder covers with 304 stainless steel supports per specification 46 43 23.	

East Facility Pipe Repairs		
Item No.	Description*	Lump Sum Bid Price (numerals)
4	<b>East Clarifiers 1 and 2:</b> 30-inch RCP Mixed Liquor Pipes CFRP lining repairs. <b>East Clarifier 3:</b> 16-inch RAS pipe joint repair.	
Balance of Remaining Work		
5	Balance of remaining work:	
6	Allowance	\$250,000
<u>7</u>	<u>Utah County Building Permit Allowance</u>	<u>\$6,000</u>
<b>Base Bid Total (Items 1 – 7)</b>		

Notes:

1) Allowance items is at Owner's discretion. Allowance items may be fully, partially, or not be fully used. Allowance items to be reviewed and approved by Engineer and Owner.

**ALTERNATES**

5.02 The Basis of Bid and Notice of Award is shown in 5.01. After the bid's have been reviewed and a Notice of Award has been issued, and at Owner's discretion, Owner may elect to add or remove the following items from the Work. Owner may elect to add or deduct some, all or none of the items shown in the schedule below.

Item No.	Description*	Bid Price (Deduct – negative Add – positive)
<b>East Clarifiers E-1, E-2, E-3:</b>		
1	Furnish and install painted carbon steel clarifier components 1'-0 above and below the waterline, in lieu of 304 stainless steel materials, and painted carbon steel walkways per specification 46 43 21.13 and 09 90 00, and weirs, baffles, scum beaches, scum spray system as per the contract drawings. Furnish and install new scum spray piping as polyurethane coating Schedule 40 carbon steel in lieu of stainless-steel materials. Scum system to contain galvanized carbon steel	



	hangers with manually controlled anti-rotation, full cone jet spray nozzle system. Electrical re-feed of East Clarifiers 1 and 3. Remove and reinstall existing walkway lighting, light posts, and local lighting controls.	
2	Remove and dispose of existing conduit rack, relocate existing generator building conduit (1 total), electrical refeed of East Clarifier 2 to be included with electrical refeed of Clarifiers 1 and 3.	

#### ARTICLE 6 - TIME OF COMPLETION

- 6.01 Bidder agrees that the Work will be substantially complete within 365 days from the date the Contract times commence to run and will be completed and ready for final payment in accordance with Paragraph 15.06 of the General Conditions within 425 days from the date the Contract times commence to run.
- 6.02 Bidder accepts the provisions of the Agreement as to liquidated damages.

#### ARTICLE 7 – ATTACHMENTS TO THIS BID (ADDENDUM NO. 2)

- 7.01 The following documents are submitted with and made a condition of this Bid:
- A. Required Bid security;
  - B. List of Proposed Subcontractors;
  - C. List of Proposed Suppliers;
  - ~~D. List of Project References;~~
  - E. Single Entity Unit Team (SEU) submittal information as outlined in specification section 33 39 30 for pipe rehabilitation work;
  - F. Evidence of authority to do business in the state of the Project; or a written covenant to obtain such license within the time for acceptance of Bids;
  - G. Contractor's License No.:                      [or] Evidence of Bidder's ability to obtain a State Contractor's License and a covenant by Bidder to obtain said license within the time for acceptance of Bids;
  - ~~H. Required Bidder Qualification Statement with supporting data;~~
  - I. Within 24 hours of Bid Opening, the Bidder with the lowest Bid shall submit a Schedule of Values for further review by the Owner. The Schedule of Values shall include at a minimum the following Work allocations: Mobilization/demobilization and related General Requirements, Civil Site Work, Structural, Electrical, Process Piping and Related Process Work

**ARTICLE 8 – DEFINED TERMS**

8.01 The terms used in this Bid with initial capital letters have the meanings stated in the Instructions to Bidders, the General Conditions, and the Supplementary Conditions.

**ARTICLE 9 – BID SUBMITTAL**

BIDDER: *[Indicate correct name of bidding entity]*

---

By:

*[Signature]* \_\_\_\_\_

*[Printed name]* \_\_\_\_\_

*(If Bidder is a corporation, a limited liability company, a partnership, or a joint venture, attach evidence of authority to sign.)*

Attest:

*[Signature]* \_\_\_\_\_

*[Printed name]* \_\_\_\_\_

Title: \_\_\_\_\_

Submittal Date: \_\_\_\_\_

Address for giving notices:

---

Telephone Number: \_\_\_\_\_

Fax Number: \_\_\_\_\_

Contact Name and e-mail address: \_\_\_\_\_

Bidder's License No.: \_\_\_\_\_

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## SECTION 33 39 30

### FIBER REINFORCED POLYMER COMPOSITE REPAIRS FOR PIPELINES

#### PART 1 GENERAL INFORMATION

##### 1.01 SUMMARY

- A. The Carbon Fiber-Reinforced Polymer (CFRP) installer shall furnish labor, all materials, tools, equipment, transportation, storage, and supervision required for the design, supply, and installation of internally bonded CFRP, including protective coatings, termination rings, and substrate repair materials, to rehabilitate pipe at locations shown on the Project Drawings.
- B. Substrate preparation and repair as well as clean-up after the completion of Work shall be performed by the CFRP installer.
- C. The CFRP system shall be installed by an applicator certified by the product manufacturer by means of written verification.
- D. The Work related to the installation of CFRP system shall be coordinated with other trades working in the area.

##### 1.02 SINGLE ENTITY UNIT TEAM AND WORK PRODUCT DEFINITIONS

- A. Installer: The installer shall furnish labor, all materials, tools, equipment, transportation, storage, and supervision required for the design, supply, and installation of internally bonded CFRP, including protective coatings, termination rings, and substrate repair materials, to rehabilitate pipe at locations shown on the Project Drawings.
- B. Manufacturer: The manufacturer of CFRP materials and any associated resins, epoxies, or other materials necessary to reflect a completed CFRP system.
- C. Designer: The Engineer of Record that designs the custom CFRP system, including any structural design necessary. The Designer will produce design information in the form of drawings, calculations, reports, etc. for the Project. The Designer shall be a licensed Structural or Civil Engineer in the State of Utah whose license is valid during the Project duration.
- D. Manufacturer's QC Representative (MQCR): Manufacturer's designated person who is present on the job site for the duration of CFRP construction activities. The MQCR shall be responsible for verifying compliance with the Manufacturer's QA/QC program and Project QC requirements as well as documenting QC details throughout the Project.
- E. Single Entity Unit (SEU): The SEU shall provide single unit responsibility for delivering the rehabilitated pipeline inclusive of material and installation, quality control and five (5) year bonded warranty for the Work described in this Specifications. The roles of the SEU may be assumed by Manufacturer, Installer, Designer (if applicable) and/or Joint Venture between the parties in order to complete the work as required in these Specifications inclusive of five (5) year bonded warranty. The SEU shall be fully responsible for all the Work including the design, manufacture, supply, installation, quality control, and

testing, related to the CFRP lining system. The SEU will be the point of contact for the coordination of efforts between the Manufacturer, Designer, Installer, and MQCR.

- F. Working Documents: The Designer signed and sealed calculations and drawings accepted by the OWNER for the Work.

### 1.03 SEU AND QUALIFICATIONS

- A. SEU: The CONTRACTOR shall engage a SEU who manages a team of professionals regularly engaged in the design, manufacture, supply, installation, and testing of CFRP internal lining of pipes for this Project. The team shall consist of a manufacturer of CFRP materials, the Installer, and the Designer. The SEU shall submit qualifications with the Bid as defined in Section 1.6.
- B. CFRP Lining System Material Qualifications: The CONTRACTOR shall provide testing documentation that demonstrates that properties meet or exceed those used for design of CFRP rehabilitation systems. Minimum material properties shall meet the requirements listed in Article 2.1 of this Specification.

### 1.04 NOT USED

### 1.05 REFERENCES

- A. Design and installation of the composite system must comply with pertinent provisions of the following codes and standards. These written Specifications take precedence over incorporated references. The latest revision of the code or standard in effect at the time of execution of the Contract Documents shall be used.
1. American Concrete Institute (ACI):
    - ACI 440.2R: Guide for the Design and Construction of Externally Bonded Fiber-Reinforced Polymers (FRP) System for Strengthening Concrete Structures.
    - ACI 440.3R: Guide Test methods for FRP for Reinforcing or Strengthening Concrete Structures.
    - ACI 503R: Use of Epoxy Compounds with Concrete.
    - ACI 546R: Concrete Repair Guide.
  2. American Society for Testing and Materials (ASTM):
    - ASTM C811: Standard Practice for Surface Preparation of Concrete for Application of Chemical-Resistant Resin Monolithic Surfacing's.
    - ASTM D570: Standard Test Method for Water Absorption of Plastics.
    - ASTM D638: Standard Test Method for Tensile Properties of Plastics.
    - ASTM D695: Standard Test Method for Compressive Properties of Rigid Plastics.
    - ASTM D790: Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.
    - ASTM D792: Standard Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement.
    - ASTM D1141: Standard Practice for the Preparation of Substitute Ocean Water.

- ASTM D2247: Standard Practice for Testing Water Resistance of Coatings in 100 Percent Relative Humidity.
- ASTM D2563: Standard Practice for Classifying Visual Defects in Glass-Reinforced Plastic Laminate Parts.
- ASTM D3039: Standard Test Method for Tensile Properties of Polymer Matrix Composite Materials.
- ASTM D4065: Standard Practice for Plastics: Dynamic Mechanical Properties: Determination and Report of Procedures.
- ASTM D4258: Standard Practice for Surface Cleaning Concrete for Coating.
- ASTM D4473: Standard Test Method for Plastics: Dynamic Mechanical Properties: Cure Behavior.
- ASTM D4541: Standard Test Method for Pull-Off Strength of Coatings using Portable Adhesion Testers.
- ASTM D7290: Standard Practice for Evaluating Material Property Characteristic Values for Polymeric Composites for Civil Engineering Structural Applications.
- ASTM E104: Standard Practice for Maintaining Constant Relative Humidity by Means of Aqueous Solutions.
- ASTM E2092: Standard Test Method for Distortion Temperature in Three-Point Bending by Thermomechanical Analysis.
- ASTM E2160: Standard Test Method for Heat of Reaction of Thermally Reactive Materials by Differential Scanning Calorimetry.
3. American Water Works Association (AWWA):
- AWWA C305: CFRP Renewal and Strengthening of Prestressed Concrete Cylinder Pipe (PCCP).
- AWWA M11: Steel Water Pipe: A Guide for Design and Installation.
- AWWA M45: Fiberglass Pipe Design, Manual of Water Supply Practices.  
Other applicable AWWA Standards.
4. International Code Council (ICC):
- ICC- AC125: Acceptance Criteria for Concrete and Reinforced and Unreinforced Masonry Strengthening Using Fiber-Reinforced Polymer (FRP) Composite Systems.
- ICC- AC178: Acceptance Criteria for Concrete and Reinforced and Unreinforced Masonry Strengthening Using Externally Bonded Fiber-Reinforced Polymer (FRP) Composite Systems.
5. International Concrete Repair Institute (ICRI):
- ICRI 03730: Guide for Surface Preparation for the Repair of Deteriorated Concrete Resulting from Reinforcing Steel Corrosion.
- ICRI 03732: Selecting and Specifying Concrete Surface Preparation for Coatings, Sealers, and Polymer Overlays.
- ICRI 03733: Guide for Selecting and Specifying Materials for Repair of Concrete Surfaces.
6. National Sanitation Foundation (NSF):
- NSF 61A: Drinking Water System Components – Health Effects.
- NSF 61-Annex G: Lead Content Requirement

- 7. Society for Protective Coatings (SSPC):
  - SSPC SP 10: Near-White Blast Cleaning
  - SSPC SP 6: Commercial Blast Cleaning

## 1.06 CONTRACTOR SUBMITTALS

- A. The CONTRACTOR shall submit the following information in accordance with the requirements of the General Requirements.
- B. Submittals Due with Bid. The CONTRACTOR shall submit the following qualifications, design submittal, and SEU documentation with the bid:
  - 1. Installer Qualifications: List a minimum of twenty (20) separate water or waste water pipe rehabilitation projects in the last five (5) years with an internal hydraulic pressure of 10 psi or more, involve internal structural lining of reinforced concrete pipe or steel pipe, and with pipe diameters greater than or equal to 30 inches using the internally applied CFRP wet layup method. Ten (10) reference projects shall have a length greater than 50 lineal feet. Three (3) reference projects shall have internal CFRP wet layup method of a 90-degree bend. Five (5) reference projects shall have been designed for HS-20 traffic loading. Contact information for each project reference, date of installation and a summary of the Work performed for each reference shall be provided.
  - 2. Manufacturer's Material Qualifications: Provide documentation of a minimum of twenty (20) separate pipe rehabilitation projects using the internally applied CFRP wet layup method on pipes with diameters greater than or equal to 30 inches which have been in service for a minimum of five (5) years. Each project reference shall have a length greater than 50 lineal feet. Contact information for each project reference, date of installation and a summary of the Work performed for each reference shall be provided.
  - 3. The Designer Qualifications: Provide documentation that the Designer has been the Engineer of Record for twenty (20) water or wastewater pipe rehabilitation projects with an internal hydraulic pressure of 10 psi or more and HS-20 traffic loading using the internally applied CFRP wet layup method within the past five (5) years. Five (5) reference projects shall have internal CFRP wet layup method of a 90-degree bend. Contact information for each project reference, date of installation and a summary of the Work performed for each reference shall be provided.
  - 4. Draft Structural Calculations and Drawings. Draft Documents shall detail the type, product name, locations, dimensions, number of layers and orientation of CFRP/GFRP materials, weight of fabric, minimum overlap length circumferentially and longitudinally, product name of saturating epoxy, primer epoxy, and the top coat epoxy, and/or coatings installed. The Designer shall also provide a technical discussion and design details regarding proposed electrical isolation between the steel pipe and fittings and the CFRP liner. Draft Drawings shall include lining termination details for each end of the CFRP application, including branch line ends
  - 5. Provide documentation of SEU teaming agreement or joint venture between the Installer, Manufacturer, and Designer. Provide confirmation of the ability to provide a five (5) year bonded warranty as the SEU. List each member of the SEU team, contact information, and acknowledgement that each SEU team member meets the experience requirements of this specification.

- C. Submittals Due After Award of Contract: Technical and QA/QC submittals shall be submitted to the OWNER no later than 30 days after Notice to Proceed.
1. Technical Submittal:
  2. Submit a summary statement of design methodology, specific approach and compliance with Manufacturer's recommendations.
  3. Structural calculations and Drawings (Working Documents) stamped and signed by the Designer. Working Documents shall detail the type, product name, locations, dimensions, number of layers and orientation of CFRP/GFRP materials, weight of fabric, minimum overlap length circumferentially and longitudinally, product name of saturating epoxy, primer epoxy, and the top coat epoxy, and/or coatings installed. The Designer shall also provide a technical discussion and design details regarding proposed electrical isolation between the steel pipe and fittings and the CFRP liner. Working Document Drawings shall include lining termination details for each end of the CFRP application, including branch line ends.
  4. Installation and curing procedures, maintenance instructions, and general recommendations regarding CFRP material to be used.
  5. Access and ventilation plan including confined space certification for all personnel scheduled to conduct confined space entry.
  6. Noise abatement plan for equipment needed to support ventilation, dehumidification, and other equipment required as part of CFRP installation. Comply with Contract Document requirements for acceptable decibel levels within specific distances from occupied dwellings. Include plan and details of proposed barriers to mitigate excessive noise.
  7. Certification of Installer by the Manufacturer of the CFRP system. Documentation from the Manufacturer shall demonstrate that Installer's personnel are trained and certified in the installation of the proposed CFRP system for internal strengthening of pipelines using carbon fiber.
  8. Certification that the Installer's superintendent, the foreman, and the lead technicians scheduled to install the CFRP system for this Project have a minimum of ten (10) projects in the last three (3) years of internal water or wastewater pipe repair projects using CFRP on pressure pipes. A list of projects including CFRP internal lining of large diameter pipes shall be provided for the proposed CFRP installation superintendent, foreman, and lead technicians.
  9. Documentation that the Installer has authority to use the repair methods intended for use for the Project without infringing on U.S. patents, associated with the Work.
  10. Documentation that Designer has designed of a minimum of three (3) water or wastewater pipe rehabilitation projects which have used the internal joint seal termination details in a manner comparable to the proposed rehabilitation system.
  11. Documentation that the Designer has been the Engineer of Record for twenty (20) water or wastewater pipe rehabilitation projects with an internal hydraulic pressure of 10 psi or more and HS-20 traffic loading using the internally applied CFRP wet layup method within the past five (5) years where the proposed CFRP Designer was the Engineer of Record. Contact information for each project reference and a summary of the Work performed for each reference shall be provided.
  12. Manufacturer's certification that the proposed CFRP system can fully cure within 72 hours.
  13. Manufacturer's Product Data Sheet indicating physical, mechanical, and chemical characteristics of all materials used in proposed CFRP systems. Data sheets shall



include properties of composite materials determined by independent laboratory testing following ASTM standards listed herein.

14. Manufacturer's Material Safety Data Sheets for all materials.
15. Manufacturer's application instructions.
16. Manufacturer's written acknowledgement that materials and process used meets Occupational Safety and Health Administration (OSHA), Environmental Protection Agency (EPA) and local ordinances for health and safety. Also include a statement that confirms all materials proposed for use on this Project are Volatile Organic Compound (VOC) compliant and safe for use in confined spaces.
17. An accepted/valid International Code Council (ICC) Evaluation Service Report (ESR) for the proposed pipeline rehabilitation system. Products that do not have an ESR number shall provide all the durability tests defined in ICC AC 125 to validate the proposed system durability. No polyester or vinyl ester will be accepted as alternates to an epoxy matrix.
18. Manufacturer's Full-scale Testing Validation Report that documents pressure testing on 30-inch- diameter or greater sections of pipeline under pressures of at least 10 psi.
19. Quality Control Submittal:
  20. Quality Control report describing the inspection of completed installation. Include the following, as a minimum:
    21. All requirements defined in Section 1.9.
    22. Name of personnel responsible for quality control.
    23. Testing program for surface preparation evaluation procedure.
    24. Material testing documentation of CFRP and GFRP.
    25. Method for ensuring that the adhesion of FRP system will conform to specified and indicated requirements.
    26. Methods for repairing defective linings.
    27. Contingency plan to meet specified requirements in the event of an interruption to the CFRP placement.
      - 1) Pipeline internal environmental monitoring including the type of measurement equipment and data loggers to be used to continuously monitor and record the air temperature, surface temperature, and relative humidity within the pipeline at several representative areas during rehabilitation. In addition, a hygrometer and thermometer shall be used to take periodic relative humidity and temperature readings, respectively, as a quality control measure. Hygrometer testing shall be performed and recorded on an hourly basis during rehabilitation activities, and when requested by the ENGINEER. The monitoring plan shall include a dewpoint temperature chart and define limits of acceptable environmental temperatures and relative humidity within the pipe.
      - 2) Details on the Installer and ENGINEER training program to be provided by the Manufacturer.

D. Post CFRP Installation Submittal:

1. Submit a completed QA/QC report describing the inspection of the installation in which documents all inspection steps described in Section 1.9 of this Specification.
2. Provide a post construction survey of the completed Work.

3. Provide a warranty for the completed FRP installation work as outlined in Section 1.10 of this Specification.
4. As-Built Drawings indicating all FRP liner details and end terminations installed.

### **1.07 STORAGE AND SAFE HANDLING OF MATERIALS**

- A. Storage and safe handling of materials shall meet the following requirements and/or Manufacturer's recommendations, whichever is more stringent.
- B. Storage:
  1. Epoxy and resin compounds shall be stored in their unopened containers in temperature range of between 40 degrees F and 100 degrees F. An optimum storage temperature is between 65 degrees F and 85 degrees F.
  2. Epoxy and resin materials have a limited shelf life. In order to preserve their properties and reactivity, these materials shall be stored in their unopened containers for periods of two (2) years or less. Materials that have exceeded their shelf life, and materials that have been stored improperly, as specified by Manufacturer, must be disposed of in accordance with the disposal instructions given in Section 3.8 of this Specification.
  3. Fabrics typically have a ten-year shelf life, which must be verified by the Manufacturer, and must be kept away from dust, moisture, chemicals, direct sunlight, physical damage, and fire.
- C. Safe Handling:
  1. CONTRACTOR shall ensure that all materials are handled with care to avoid any physical damage and also to avoid potential safety hazards. Those who are involved with handling and application of the epoxy compounds must thoroughly be informed of the safety hazards and potential dangers of the particular chemical they are handling. This includes access to and familiarity with the Safety Data Sheets (SDS). The SDS must be consistently placed in a familiar location and at all times be accessible to the work crew.
  2. CONTRACTOR is responsible for providing SDS to all personnel and inform them of the potential safety hazards and other important characteristics of epoxies and resins. Furthermore, the CONTRACTOR is responsible for making sure that all stages of the Project are executed in accordance with the federal, state, and local environmental laws and regulations in addition to the OSHA requirements and laws to protect the safety of all workers.
  3. CONTRACTOR shall ensure safe ventilation is provided when working with epoxy and resin compounds. Safety goggles or glasses are necessary when working with epoxies. Coveralls and chemical resistant gloves must be worn by all personnel in the work area. The gloves must have been tested for resistance to resins, epoxies, and solvents.
  4. CONTRACTOR shall avoid unnecessary and prolonged handling of fabrics.

### **1.08 CFRP MANUFACTURERS**

- A. The CFRP Manufacturer shall meet all criteria listed in this Specification. The following firms meet the criteria for CFRP Manufacturer as required by this Specification:
- B. CFRP Manufacturers:

- a. Fyfe Company, 15341 Vantage Parkway east, Houston, TX 77073
2. Structural Technologies, LLC, 10150 Old Columbia Road, Columbia, MD 21046

## 1.09 QUALITY ASSURANCE AND QUALITY CONTROL

- A. Introduction: The SEU shall be responsible for the quality control of all materials and processes in the Project and providing access to the repair areas to allow for quality assurance inspections. The Installer shall be responsible for the quality assurance aspects of the installation. The Manufacturer shall provide a project specific QA/QC training session for all Installer personnel as well as all ENGINEER's personnel involved in the QA/QC process. The QA/QC program must be reviewed and accepted by the ENGINEER. A QA/QC plan shall be submitted for review and acceptance by the ENGINEER. The QA/QC plan shall include specific procedures for personnel safety, tracking and inspection of all CFRP components prior to installation, inspection of all prepared surfaces prior to CFRP application, inspection of the Work in progress to ensure conformity to Specifications, test samples, inspection of all completed Work, repair of any defective work and clean up. The QA/QC program documentation (inspection forms, test reports, laboratory results, etc.) generated will be provided to the ENGINEER on a weekly basis.
- B. Field Quality Control: All phases of Work performed shall be inspected by the SEU prior to presenting the Work to the ENGINEER for acceptance.
- C. Materials Inspection: The packaging list and all delivered materials must be inspected for conformity to the Working Documents by the Installer prior to presenting this information to the ENGINEER for acceptance. Any material, that does not meet the requirements of the Working Documents shall be rejected and replaced with the correct material.
- D. Daily Inspection: Daily inspection by the SEU shall be performed to record: 1) date and time of repair; 2) ambient and steel/CML surface temperatures; 3) general weather conditions; 4) surface dryness per ACI 503.4; 5) surface profile and surface preparation using Society for Protective Coatings (SSPC) requirements; 6) qualitative description of surface cleanliness; 7) type of auxiliary heat source, if any; 8) fiber and epoxy batch numbers and their locations in the structure; 9) qualitative appearance of all mixed resins; 10) saturation of the fabric and documentation of weight tests; 11) observations of the progress of curing of the resins; 12) conformance with installation procedures and accepted Project Drawings; 13) adhesion test results of bond strength, failure mode, and location; 14) location and size of any delaminations or air voids; 15) photos; and 16) the general progress of the Work. CFRP properties from tests of field samples or witness panels shall be obtained following construction to allow for proper curing, shipping to laboratory, and laboratory testing constraints. All documentation is to be transmitted to the ENGINEER on a weekly basis.
- E. Fiber Orientation Inspection: Fiber orientation will be visually examined and documented by the Installer for conformity to the Working Documents. Non-conforming areas will be removed and repaired by the Installer at no additional cost to the OWNER.
- F. Debonding Inspection and Repair: Following the first 24 hours after installation, visual inspection will be conducted by the SEU to determine locations of any swellings, bubbles, air voids, or delaminations. All suspect defective locations will be documented and presented to the ENGINEER. If an air pocket is suspected, an acoustic tap test will be

carried out with a hard object to identify delaminated areas by sound, with at least one (1) strike per square foot of area. Defects smaller than 2 square inches will require no corrective actions as long as the total delaminated area is less than five (5) percent of the total laminate area, there are no more than ten (10) such delaminations per 10 square feet, and they are not located around the boundaries of the fabric or laminate. Moderate delaminations less than 25 square inches will be repaired by using low pressure epoxy injection as long as the defect is local and does not extend through the complete thickness of the laminate in case of multiple CFRP/GFRP systems. If any delamination growth is suspected between the CFRP/GFRP plies, the area around the defects to an extent of at least 1 inch on all sides shall be carefully removed, the area cleaned and patched with the same number of plies extending at least 6 inches on all sides. This repair scheme must also be conducted for defects larger than 25 square inches. Repair procedures for conditions not specifically addressed in this Specification shall be reviewed and accepted by the ENGINEER. Any required repairs shall be by the Installer at no additional cost to the OWNER.

G. Adhesion Inspection:

1. Prior to repair of pipe sections, at least three (3) pull-off tests per mock up area and at least one (1) mock up area per 100 lineal feet of pipeline, or per localized repair region, whichever is greater, must be performed on mockup areas on adjacent non-repair pipes in accordance with ASTM D4541, to verify adhesion strength of the bond between CFRP and substrate. Test locations and sampling frequency shall be as those identified on the Working Documents. The verification provided by the testing on the mockup areas serves as verification of the quality of construction. All pull-off tests are to be performed by the Installer and witnessed by the ENGINEER.
2. Failure mode shall be at least a minimum of 700 psi must be achieved as the tensile stress between the CFRP and the steel pipe in order to pass the adhesion test, or at least a minimum of 300 psi must be achieved as the tensile stress between the CFRP and the concrete pipe in order to pass the adhesion test. Failed tests will result in the work area being rejected and the CFRP must be removed and replaced by the Installer's at no additional cost to the OWNER. The test area must be patched with thickened epoxy.

H. Testing:

1. Field testing of the CFRP system is required each day of application. The Installer is responsible for all field testing, costs expected to the Bid.
2. Two (2) sample sets minimum shall be made per installation shift. The sample sets shall measure minimum dimensions of 12 inches x 12 inches, made of each composite layer. Each sample shall be coded and dated and shall be accompanied with the site environmental data such as the pipeline. The samples shall be cured following the Manufacturer's recommendations before they are sent to the lab for testing. Either two (2) panels or 20 percent of all panels fabricated during a project, whichever is greater, shall be tested.
3. The Installer shall test the tensile properties of the samples at a test laboratory with previous documented experience testing civil grade CFRP composites in accordance with ASTM D3039. A reference list of at least five (5) different projects completed by the test laboratory which involved ASTM D3039 testing of civil grade CFRP shall be submitted prior to acceptance of the test laboratory. The test laboratory shall be accredited by one (1) of the following accreditation agencies:
  - a. International Accreditation Service (IAS)

- b. American Association for Laboratory Accreditation (A2LA)
- 4. The test laboratory will perform a minimum of five (5) tensile tests per panel in accordance with ASTM D3039 with the following modification: the nominal thickness of the CFRP samples reported on the material's product data sheet rather than the actual thickness of the CFRP samples will be used for calculating material properties. The lot number for the fabric and the resin used for preparing the sample must be recorded by the lab along with the tensile strength, modulus, specimen dimensions, and percent elongation.
- 5. The tested tensile properties must meet or exceed the design tensile strength and tensile modulus as defined in the product submittal. If one (1) sample average results do not achieve the design properties, additional coupons from the same day of application shall be tested. If the second panel fails to meet the required tensile properties, the application of CFRP system for that day shall be rejected, and the ENGINEER shall be contacted for review and acceptance of remedial measures proposed.

#### **1.10 WARRANTY**

- A. The SEU shall warranty the CFRP system against defects in the workmanship and material for a period of five (5) years. Warranty period shall commence after final acceptance of the Project by the OWNER. The Warranty documentation shall be issued by the SEU and submitted by the CONTRACTOR prior to final acceptance of the Project by the OWNER.
- B. The SEU shall provide a five-year bonded warranty for the CFRP system, which is bonded by an "A rated surety" licensed to provide surety bonds in the state of Utah. Documentation of ability to provide a bonded warranty shall be provided with bid. The warranty shall include, but not be limited to, covering workmanship and/or material defects such as bubbles, delamination, fabric tears spanning more than five (5) percent of the estimated surface area of the pipe, interfacial peel-off of CFRP layers and top coat, and debonding from concrete substrate. The warranty shall cover materials and labor for repair of material and/or workmanship defects during the warranty period.
- C. The ENGINEER will schedule a condition field walk of completed CFRP work areas after repaired pipes are placed back in service within the warranty period. The Installer and Manufacturer shall have a representative present for the condition field walk. The cost of the warranty condition field walk preparation and attendance shall be included in the Bid. The ENGINEER will give a minimum of 30 days' notice regarding the field walk date. The SEU shall be prepared to participate in the condition field walk and mobilize resources and materials to address any areas requiring warranty-related remediation during the same scheduled pipeline shutdown.
- D. If, in the opinion of the OWNER, defective Work is detected during the warranty period which creates a dangerous condition or requires immediate correction or modification to prevent further loss to the OWNER or to prevent interruption of the OWNER operations, the OWNER will attempt to give the notice required by the General Conditions. If the CONTRACTOR cannot be contacted or does not comply with the OWNER's request for correction within a reasonable time as determined by the OWNER, the OWNER may, notwithstanding the provisions of this section, proceed to make such correction or provide such modification. The costs of such correction or modification shall be charged against the CONTRACTOR. Such action by the OWNER will not relieve the CONTRACTOR of

the warranties required by this section or elsewhere in the Contract Documents. In the event of failure to comply with the above-mentioned conditions within one (1) week after being notified in writing, the OWNER is hereby authorized to proceed to have the defects remedied at the expense of the CONTRACTOR who hereby agrees to pay the cost and charges thereof immediately on demand. The CONTRACTOR's warranty shall continue as to any corrected deficiency until the remainder of the original five-year warranty period.

## **PART 2 PRODUCTS**

### **2.01 CFRP LINING SYSTEM**

- A. The CFRP system shall consist of a combination of epoxy resin matrix reinforced with carbon and glass fibers.
- B. Use materials for the CFRP system from a single manufacturer and ensure the consistency of compatible products for primer, surface rendering, saturation resin, carbon fiber, intermediate thickened epoxy coats, and final top intended and tested for use in wastewater immersion environments.
- C. Products shall be certified by the product manufacturer to have the following properties:
  - 1. Carbon Fiber and Glass Fiber Fabrics: Only unidirectional carbon fiber shall be used for strengthening applications. Bidirectional glass fiber fabrics are permitted for use on non-structural applications.
  - 2. Saturation resin shall be a two-component epoxy and shall have: 1) a maximum water absorption of two (2) percent when tested in accordance with ASTM D570 (24 hours); 2) a minimum compressive yield strength of 10,000 psi when tested in accordance with ASTM D695 (75 degrees F, 7-day cure); 3) a minimum tensile modulus of 400,000 psi; 4) a minimum tensile strength of 6,000 psi with an elongation of greater than two (2) percent when tested in accordance with ASTM D638 (14-day cure); 5) a minimum flexural strength of 7,500 psi and a minimum flexural modulus of 350 ksi when tested in accordance with ASTM D790 (14-day cure); and 6) a minimum shore D hardness of 70 at a minimum of 85 percent cure when tested in accordance with ASTM D2240.
  - 3. Epoxy/carbon fiber composite shall have: 1) a minimum tensile modulus of elasticity of 9,000 ksi; 2) a minimum laminate thickness of 0.07 inch; 3) a maximum laminate thickness of 0.10 inch 4) a minimum tensile strength of 100 ksi; 5) a minimum flexural modulus of 8,000 ksi; 6) a minimum flexural strength of 14,000 psi; and 6) a minimum strain at CFRP rupture of 0.7 percent when tested in accordance with ASTM D3039.
  - 4. Epoxy/glass fiber composite shall have: 1) a minimum tensile modulus of elasticity of 2,000 ksi; 2) a minimum laminate thickness of 0.01 inch; 3) a maximum laminate thickness of 0.10 inch; 4) a minimum tensile strength of 30 ksi; 5) a minimum flexural modulus of 4,000 ksi; and 6) a minimum strain at GFRP rupture of 1.0 percent when tested in accordance with ASTM D3039.
- D. A thickened epoxy system, which consists of the saturating epoxy and silica fume mixed at the site according to the Manufacturer's recommended procedure, shall be used to provide a smooth surface for the application of the CFRP laminate. Silica fume used shall consist of Cab-O-Sil TS 720, Aerosil R202, or equal.

- E. The CFRP system shall be top coated with a protective epoxy coating intended and tested for use in wastewater immersion environments, approved by Manufacturer and compatible with the CFRP system. All products installed inside the pipeline shall be VOC compliant. Polyester or vinyl ester will not be accepted as an alternate to an epoxy structural CFRP system matrix component.
- F. Termination of CFRP:
  - 1. A termination detail involving termination of the CFRP lining system into the joint region, flange, or structure, as well as implementation of specialized joint rings shall be provided to ensure durable water tightness and prevent water from getting behind the CFRP liner.
  - 2. To prevent galvanic corrosion, a layer of epoxy saturated glass fiber reinforced polymer composite (GFRP) shall be applied in direct contact with the steel substrate prior to implementation of the CFRP laminate.
  - 3. The Installer shall provide and install appropriately sized double or single band Type 316L stainless steel expansion rings, as called out in Specification Section 3.7 Joint Termination of CFRP System, with 1/4 in elastomeric rubber strips at the terminations between the CFRP liner and the host piping system.

## 2.02 DESIGN REQUIREMENTS (ADDENDUM NO. 2)

- A. The CFRP lining system, consisting of CFRP and GFRP layers, shall include full 360-degree coverage of the entire length of each designated repair area. No localized CFRP/GFRP patches shall be permitted.
- B. Design repair for areas shown on the design drawings using fully-structural, standalone CFRP liners without reliance on the host pipes.
- C. Loadings:
  - 1. The CFRP system shall be designed to resist loads from internal pressures, and all other loads specified herein. The design shall be based on the maximum of the forces resulting from different load combinations as required by the Load and Resistance Factor Design (LRFD) approach of AWWA Standard C305.
    - a. Internal Working Pressure of 11 psi.
    - b. Temperature Differential (with respect to installation temperature) of plus or minus 40 degrees F.
    - c. A vacuum pressure of 1 psi maximum.
    - d. Hydraulic thrust force due to tees, reducers, and branches.
    - e. Live loading is HS-20 at locations not underneath the clarifiers.
    - f. The clarifier loading is to be calculated when clarifier tanks are full.
- D. Additional Design Requirements:
  - 1. The CFRP design shall be performed according to the LRFD procedure specified in AWWA Standard C305, including but not limited to all applicable loads, load combinations, material adjustment factors, resistance factors, and watertightness requirements. Other manuals and standards referenced by AWWA C305 shall be used only to the extent directed within AWWA C305.
  - 2. The CFRP liner system shall satisfy the material qualification requirements of AWWA C305.

3. The CFRP system shall be designed to provide strength, durability, reliability and watertightness for each of the following potential limit states, as applicable, subjected to the combined factored loads, considering the distress state of the host pipe:
  - a. Rupture of CFRP laminate in the circumferential direction due to internal pressure.
  - b. Rupture of CFRP laminate in the circumferential direction due to bending of empty pipe.
  - c. Rupture of CFRP laminate in the circumferential direction due to combined pressure and bending due to gravity loads.
  - d. Buckling of the CFRP laminate in the circumferential direction due to external loads and pressures and internal negative pressure.
  - e. Rupture of the CFRP laminate in the longitudinal direction due to pressure induced thrust, Poisson's effect of internal pressure, and temperature change.
  - f. Shear bond failure of CFRP at all CFRP terminations (e.g., pipe ends, branches, etc.).
  - g. Buckling of the CFRP laminate in the longitudinal direction due to temperature change.
  - h. Rupture of the CFRP laminate in the longitudinal direction due to longitudinal bending under pipe and water weights between pipe supports and wall penetrations, including consideration of local stresses at such supports.
4. The CFRP liner shall be able to bridge over locally degraded areas of the host pipe as demonstrated by both design calculations and laboratory testing of watertightness per AWWA C305.
5. The CFRP liner shall have a minimum bond strength of 700 psi on steel substrate as required by AWWA C305, and minimum bond strength of 300 psi on concrete substrate as required by ASTM D4541, to be verified by pull-off testing performed in mockup areas prepared inside the pipeline at the beginning on construction. The selected repair material shall be resistant to the environmental conditions expected after repairs. Designer shall review data on the environmental condition in the pipelines and the condition of repair substrates (e.g., steel, mortar lining, etc.), and the literature on the performance of available FRP materials (fibers and resins) used for lining sewers with the hand lay-up method, and recommend a material that has sufficient chemical resistance to the expected environment in this application and has good long term bond properties to concrete.
6. The CFRP system shall include intermediate joint detailing at each pipe joint which allows the pipeline to maintain the level of flexibility present in the original pipeline. At a minimum, this intermediate joint detailing shall include an additional layer of CFRP, a minimum 3 feet in length, centered over each joint for the full circumference of the pipe. Prior to installation of this additional CFRP layer at the intermediate joints, the SEU shall provide a bond breaker material centered over the joint consisting of one (1) of the following: 100 percent acrylic elastomeric coating, paraffin wax, or equal. See Drawings for a conceptual representation of this joint detail.
7. The CFRP liner system shall include additional local layers and details as needed in the vicinity of special features such as tees, outlets, and branches.

#### E. CFRP Liner Design:



1. Determine the number of layers of carbon fiber-reinforced composite material and the layout of the layers, circumferentially and longitudinally, required to resist the specified loadings in all applicable design limit states with adequate strength/demand ratios per AWWA C305.
2. The design shall be based on properties of the CFRP repair system determined in accordance with the testing required in Section 2.2E.3 of this Specification based on AWWA C305.
3. The design mechanical properties of the single-ply CFRP laminate shall be the characteristic values of strength and modulus defined as the 5th-percentile of a two-parameter Weibull distribution with 80 percent confidence based on ASTM D7290 using results of tests performed in accordance with the Test Method ASTM D3039 test procedure. For multi-ply applications, the characteristic values of strength and modulus in circumferential and longitudinal directions shall be adjusted statistically based on statistical distribution of test results of single-ply strength and modulus.
4. Documentation shall be provided in the calculations to determine the minimum development length between the CFRP lining system and the steel substrate to ensure water tightness at all CFRP terminations based on the calculated longitudinal stresses and shear bond strength of the CFRP lining system on steel substrate prepared to the specified surface profile.

## **PART 3 EXECUTION**

### **3.01 INSPECTION**

- A. CFRP system shall be inspected during all phases of construction by the ENGINEER subsequent to training provided by the Manufacturer. The ENGINEER shall examine substrates, areas, and conditions under which structural epoxy-resin fabric composite systems will be applied for compliance with requirements. The CONTRACTOR shall coordinate with the ENGINEER to allow access to the work area under the CONTRACTOR'S confined space permit. The ENGINEER will direct the SEU to correct any unsatisfactory conditions prior to continuing the CFRP installation process.
- B. The Installer shall examine existing conditions to identify potential obstructions and constraints, verify dimensions, geometry and manhole locations and map all voids and cracks in the host pipe wall.
- C. The CONTRACTOR shall utilize video inspection to document the condition of pipe prior to any repair, after preparation of the surface and before the liner is installed, after completion of liner installation. A copy of each video shall be made available to the ENGINEER for reviewing within 24 hours after the recording of the video. Any defects or changed conditions revealed on the video should be brought to the ENGINEER's attention in writing along with video images showing the defect.

### **3.02 ENVIRONMENTAL CONDITIONS**

- A. Maintain the temperature within acceptable curing range provided by epoxy manufacturer. In cold conditions, auxiliary heat sources may be used to raise the ambient temperature to level recommended by the Manufacturer.
- B. The humidity shall be maintained to meet the recommendation of the Manufacturer. Humidity levels must be low enough to allow for epoxy to cure and reach design

strengths. Portable barriers and blowers shall be erected at the repair location to dehumidify the concrete substrate's surface in the pipe.

- C. Water leakage is known to exist through cracks or joints, stop water flow prior to installation. Coordinate with the ENGINEER for accepted leak repair method. Chemical grout injection or other leak repair method shall be performed by the CONTACTOR at no additional cost to the OWNER. CONTRACTOR shall direct ENGINEER's attention to any leaks observed during or just after the pre-construction survey.
- D. CONTRACTOR shall provide proper dust control and ventilation to meet OSHA requirements.
- E. For internal pipeline repairs, the work area is a confined space that will require an entry permit in accordance with Occupational Safety and Health Administration (OSHA) regulations. The CONTRACTOR shall comply with General Conditions and General Requirements for safety and permit compliance.

### 3.03 ACCESS

- A. Access to the pipelines will require that the CONTACTOR isolate the pipeline at the splitter box structure. The pipelines will require dewatering and debris removal prior to initial inspection, to be performed by the CONTACTOR at no additional cost to the OWNER. The pipelines are known to have I/I leaks at cracks, joints, and other locations that will have to be addressed by the CONTACTOR at no additional cost to the OWNER.

### 3.04 PREPARATION

- A. Installer shall ensure that the preparation and soundness of the substrate is complete and fully cured prior to installing the CFRP composite. Installer shall ensure a complete bond between the fiber-reinforced composite system and the substrate is constructed.
  - 1. Removal of Cement Mortar Lining and/or Epoxy Lining: All cement mortar lining and/or epoxy lining shall be removed prior to installation of CFRP. Determination of where CML and epoxy linings are currently installed will be determined by the Installer after access to the pipeline has been established.
    - a. Repair of Steel Surface: All CFRP systems must be bonded to clean, sound, dust free, and dry substrate as verified by ENGINEER. The Manufacturer shall have a dedicated MQCR who is present on the job site for the duration of CFRP construction activities for the Project. The MQCR shall be responsible for verifying compliance with the QA/QC program and Project QC requirements as well as documenting QC details throughout the Project. The steel surface may require repair by welding on steel patches in areas that are too thin to install CFRP or completely corroded through the steel wall. In addition, welding on a steel flange per the Drawings may require steel patching to ensure proper structural integrity of the flange. Steel patching is to be compensated based on a square foot basis per bid table unit costs.
  - 2. Surface Preparation: The steel pipeline shall be abrasively blasted (dry methods only) to SSPC SP10 Near White Metal Blast or SSPC SP 6 - Commercial Blast Cleaning. All termination zones must be a SSPC-10, minimum. The RCP pipeline shall be abrasively blasted (dry methods only) to ICRI CSP3 surface roughness profile.
    - a. All surfaces to receive the CFRP rehabilitation system must be completely cleaned of any dust, grease, oil, curing compounds, wax, stains, paint, surface

lubricants, foreign particles, weathered layers, or any other bond inhibiting materials. The surface shall be dry to the touch and have no standing water in the pipe before installation of CFRP.

- b. Inflow and infiltration (I/I) into the pipelines or structures at cracks, joints, or other locations is known to exist and shall be repaired to stop all I/I prior to application of CFRP lining system and no additional cost to the OWNER.

### **3.05 MIXING OF EPOXY RESINS AND ADHESIVES**

- A. Epoxy resins (including primers) shall be mixed according to the Manufacturer's installation instructions.
- B. Installer shall thoroughly mix two-part resin and epoxy compounds for proper development of the adhesives properties.
- C. No organic solvents or thinners are allowed to be used to thin the epoxies.
- D. Installer shall not mix more resin than can be used during the pot-life of the specific resin system.
- E. Any mixed resin that begins to generate heat or increased viscosity, shall not be used and must be disposed of properly according to the instructions. Mix only small quantities in containers with large surface area to volume ratio to allow heat dissipation and prevent potential fire hazards.

### **3.06 APPLICATION OF CFRP SYSTEM**

- A. The application of the CFRP system, including topcoat, shall be performed in accordance with the Manufacturer's instructions.
- B. The epoxy coating shall be installed on surfaces that have been prepared by Section 3.4. of this Specification. After the surface is properly prepared and dry, a high-solids epoxy primer shall be applied. The cleaned and prepared surfaces must be protected against recontamination until the CFRP system is applied.
- C. The wet-layup method shall be the only accepted method for CFRP installation. The Installer shall utilize a fabric saturator and rolling mechanism such that the epoxy saturated fabric is transported to the point of application through the manhole, which is then applied to the surface of the pipe in a wet lay-up process. No dry-layup application of carbon fiber fabric shall be permitted.
- D. The saturation machine shall be calibrated to ensure accurate fiber resin ratio. The Installer shall confirm complete impregnation of CFRP in epoxy to ensure it is completely wet out through the thickness of the fabric through measuring the gap between the rollers on the mechanical saturator and performing a weight test at the beginning of each shift where CFRP installation takes place, as requested by the ENGINEER, and following any substantial break of one (1) hour or more in CFRP installation where no CFRP material saturation is taking place. A weight test consists of weighing an approximately 1 foot x 1 foot piece of fabric before and after impregnation in the impregnation machine, and ensuring that the fabric-to-resin weight ratio is within the range recommended by the Manufacturer. The Installer shall adjust the impregnation machine as necessary and as specified by the Designer.

- E. Saturated fabric shall be pressed into the surface to achieve thorough contact. Entrapped air between layers shall be released or rolled without wrinkling of the fibers.
- F. A thickened epoxy system, which consists of the saturating epoxy and silica fume mixed at the site according to the Manufacturer's recommended procedure, shall be used to provide a smooth surface for the application of the CFRP laminate. The thickened epoxy shall be used to fill in surface voids and even out the concrete substrate. It is permissible to use a thin coat of thickened epoxy between lamina to enhance adhesion.
- G. The plies and the fibers in the fabric shall be oriented in the directions that are shown on the Working Documents. Misalignments greater than 1 inch per foot or more than 5 degrees will be rejected. Any fabric kinks, folds, waviness, or misalignments shall be reported to the ENGINEER immediately.
- H. The fibers must be fully continuous or lapped in their primary direction. Whenever there is an interruption in the primary direction of the fibers, a lap joint must be designed and fibers need to be overlapped. Designer shall include a detail for such instances as part of the design and be shown on the Working Documents. In no case shall such overlap be less than 6 inches. Additionally, the lap joints on multiple plies and adjacent strips, and termination points must be staggered. No lap joint is necessary for unidirectional fabrics or laminates in a direction perpendicular to the direction of the primary fibers, unless specified in the Working Documents.
- I. When multiple plies are installed, the sequence and stacking shall follow the special instructions in the Working Documents. Each ply shall be installed before the onset of complete gelation of the previous layer. Multiple plies may be applied after the previous ply is cured, provided that the surface is roughened by sanding and is cleaned from dust and residue.
- J. Following the application of all CFRP/GFRP layers, a final epoxy coating in accordance with the Manufacturer's recommendation shall be applied over the composite material to seal the surface.
- K. The final top coat shall be cured to a minimum level of 85 percent confirmed by time-temperature cure data provided by the Manufacturer prior to putting the pipe back in service.

### **3.07 JOINT TERMINATION OF CFRP SYSTEM**

- A. A termination detail involving termination of the CFRP lining system utilizing specialized joint rings shall be provided on the Working Documents to ensure durable water tightness and prevent water from getting behind the CFRP liner. See Drawings for Internal Joint Seals requirements.
- B. The Installer shall provide and install appropriately sized single or double band 316L stainless steel expansion rings with 1/4 inch elastomeric rubber strips at the terminations between the CFRP liner and the host piping system. The stainless steel expansion rings shall be installed in joints at each end of the CFRP rehabilitation at least 24 hours after CFRP installation. The jacking pressure for the expansion ring shall be selected to achieve a minimum of 100 psi interface pressure in accordance with Manufacturer's recommended procedures and installed per the requirements shown on the Drawings.

### **3.08 CLEAN-UP AND DISPOSAL**

- A. Any material that has exceeded its shelf life, is damaged, or has not been stored according to the specified instructions, is in excess or not used when opened must be disposed of in accordance to the SDS and all other Federal, State, and local laws.
- B. CONTRACTOR must thoroughly be familiar with the environmental laws and regulations governing the disposal of chemicals, and is responsible for the complete clean-up of the Project site, removal of the excess and unused materials (waste), empty containers, and other aesthetically unpleasing materials.

SECTION 40 05 57.23  
ELECTRIC MOTOR ACTUATORS, LIFT GATE PEDESTALS

**PART 1 GENERAL**

**1.01 SUMMARY**

- A. This Section includes requirements for electric motor actuators to produce rotary and linear motion to activate gates in open-close, throttling, and modulating services and for lift gate pedestals.

**1.02 REFERENCES**

- A. This section contains references to the following documents. They are a part of this section as specified and modified. Where a referenced document contains references to other standards, those documents are included as references under this section as if referenced directly. In the event of conflict between the requirements of this section and those of the listed documents, the requirements of this section prevail.
- B. Unless otherwise specified, references to documents mean the documents in effect at the time of Advertisement for Bids or Invitation to Bid (or on the effective date of the Agreement if there were no Bids). If referenced documents have been discontinued by the issuing organization, references to those documents mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the following listing, references to those documents mean the specific document version associated with that date, regardless of whether the document has been superseded by a version with a later date, discontinued or replaced.

Reference	Title
ANSI/AWWA C542-16	Electric Motor Actuators for Valves and Slide Gates.
ANSI/NEMA 250	Enclosures for Electrical Equipment (1,000 Volts Maximum).
ANSI/NEMA MG1	Motor and Generators.
ANSI/NFPA 70	National Electrical Code.
UL 429	Electrically Operated Valves.
UL 1002	Electrically Operated Valves for Use in Hazardous (Classified) Locations.
NEMA ICS-2	Industrial Control Devices, Controllers and Assemblies

**1.03 DEFINITIONS:**

- A. Use ANSI/AWWA C542-16, Electric Motor Actuators for Valves and Slide Gates definitions, unless otherwise noted.

- B. For purposes of this Section, the word “valve” refers to both valves and gates.
- C. Electric motor actuators are defined using the following code system which appears in the actuator specification (ACTUSPEC) sheets:

Actuator Type (ACTUSPEC)	Service	Definition
EMTT	Throttling (Modulating)	Electric motor multi-turn
EQTT	Throttling (Modulating)	Electric motor quarter-turn
EMTI	Isolating (Open-Close)	Electric motor multi-turn
EQTI	Isolating (Open-Close)	Electric motor quarter-turn

- D. Service:
  1. Modulating: Operation characterized by the continuous positioning of a gate between between fully open and closed, in response to a continuous control signal.
  2. Open-Close or Isolation: To move gate to fully open or fully closed position in one continuous operation. Alternative terms used are ON-OFF and isolating.
  3. Throttling: Operation characterized by the deliberate and/or the infrequent movement of a to an intermediate position, between fully open and fully closed, and maintaining that position for periods of time.

#### 1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
  1. Data: Ensure the gate data is provided to the actuator manufacturer. Transmit the required torque or thrust, shaft diameter, thread characteristics (including right or left-hand), keyway dimensions, seating requirements (torque or position) for open and close.
  2. Conditions: Identify most adverse conditions to be encountered at any time when actuation is necessary.
    - a. For multi-turn, the following additional data is required for actuator sizing:
      - 1) Maximum torque and thrust running load over the full cycle.
      - 2) Desired speed of actuation or stroking time.
      - 3) The stall torque or maximum thrust output of the actuator not to exceed the torque or thrust capability as determined by the lift gate manufacturer.
    - b. For quarter-turn, the following additional data is required for actuator sizing:
      - 1) The required actuator torque over the full cycle of operation.
      - 2) Desired speed of actuation or stroking time.

#### 1.05 SUBMITTALS

- A. Procedures: Submittal shall be provided in accordance with Section 01 33 00 and the following:
  - B. Action Submittals.
    1. A copy of this Section, addendum updates included, with each paragraph check-marked to indicate compliance or marked to indicate requested deviations from Section requirements.

2. A copy of the contract document control diagrams and process and instrumentation diagrams relating to the submitted equipment, with addendum updates that apply to the equipment in this Section, marked to show specific changes necessary for the equipment proposed in the submittal. If no changes are required, mark the drawing or drawings with "no changes required".
  3. Manufacturer's catalog information and other data confirming conformance to design and material requirements.
  4. Lift Gate Pedestal Data Sheet: An information data sheet for each lift gate pedestal showing required mounting and gear box information. Provide pedestal identification (tag) number clearly for each application on the data sheet.
  5. Actuator Data Sheet: An information data sheet for each actuator showing required mounting, operating torque for driven equipment, torque capacity of actuator, actuator speed, associated lift gate torque ratings, motor data (power, hp; full load amps, locked rotor amps, rpm, duty rating). Provide actuator identification (tag) number clearly for each application on the actuator data sheet.
  6. List of components being provided for each actuator.
  7. Shop drawings:
    - a. Actuator assembly.
    - b. Dimensions.
    - c. Electrical wiring diagrams.
- C. Informational Submittals:
1. Application manuals for configuring and set up of actuator for control, monitoring and alarming.
  2. Application software and software manuals for programming communication network bus when specified. Include electronic data sheet or generic station description files for network configuration.
  3. Recommended storage practice. In addition, place this information on the outside of the actuator or shipping container as delivered to the site.
- D. Closeout Submittals:
1. Operation and Maintenance Data: Submit manufacturer's standard operating and maintenance instructions as specified in Section 01 78 23.
  2. Training Certification Section 43 05 11-Form B.
  3. Maintenance Material:
    - a. Spare Part Inventory Listing.
    - b. Spare Parts.
    - c. Special Tools.
    - d. Lubrication guide.
    - e. Certified drawings.
  4. Actuator Configuration Settings: The final settings used for configuration of the actuator to meet field operation requirements. Include both the electronic files and a hard copy printout in pdf format.

## 1.06 QUALITY ASSURANCE

### A. Identification of Listed Products:



1. Provide equipment and materials listed for the purpose for which they are to be used, by an independent testing laboratory. Three such organizations are Underwriters Laboratories (UL), Canadian Standards Association (CSA), and Electrical Testing Laboratories (ETL). Provide independent testing laboratory acceptable to the inspection authority having jurisdiction.

#### **1.07 DELIVERY, STORAGE AND HANDLING**

- A. Procedures: In accordance with Section 01 66 00.

#### **1.08 WARRANTY**

- A. Manufacturer to warrant all actuators furnished under this Section against defects in materials and workmanship for a period of two years, unless otherwise specified.

### **PART 2 PRODUCTS**

#### **2.01 MANUFACTURERS**

- A. Candidate manufacturers are specified on the actuator specification (ACTUSPEC) sheets. The manufacturer's standard models or products may require modification to conform to the specified requirements.

#### **2.02 PERFORMANCE**

- A. Size actuators to produce an operating torque equal to twice the maximum required lift gate operating torque under the specified flow and pressure conditions. Specific requirements for each type of actuator are specified on the actuator specification (ACTUSPEC) sheets located at the end of this Section.
- B. Seat gate or stopping method based on lift gate manufacturer's recommendation:
  1. Torque
  2. Position/Limit
- C. Ambient Temperature Range: -20 to +140 degree Fahrenheit (up to 100% relative humidity).
- D. Rotation:
  1. Quarter-Turn: 90 degrees, with +/- 5 degree adjustable mechanical travel stops. Stops designed to withstand maximum actuator torque.
  2. Multi-Turn: Position setting range of 2.5 to 8,000 turns with a minimum angular resolution of 7.5 degrees at the output.

#### **2.03 CONFIGURATION, COMPONENTS AND FEATURES**

- A. General: Unless otherwise specified, provide electric motor actuators in accordance with the actuator specification (ACTUSPEC) sheets and the following requirements.
- B. Motor:
  1. General:
    1. Specifically designed for lift gate actuator service.

2. Totally-enclosed, non-ventilated construction.
3. Internal heater for anti-condensation protection.
4. Compliance to ANSI/NEMA MG1.
2. Duty Rating based on Actuator Service:
  1. Modulating: 50% (30 minutes) or 100% (continuous) duty motor rated for minimum of 900 starts per hour.
  2. Open-Close: 25% (15 minutes) or 50% (30 minutes) duty motor rated for minimum of 60 starts per hour.
  3. Throttling: 25% (15 minutes) or 50% (30 minutes) duty motor rated for minimum of 60 starts per hour.
3. Motor Starter: Provide actuator with a full voltage reversing starter rated for the motor's locked rotor and full load currents for 10,000 cycles with mechanical and electrical interlocks and overload protection in each phase pole.
4. Three Phase:
  1. Reversible, Squirrel Cage Motor.
    - 1) 460 volt, 3 phase, 60 hertz power with +/- 10 percent voltage fluctuation.
    - 2) Four-pole 1800 RPM or provide pole-speed as required for the application.
    - 3) NEMA Class F insulation.
    - 4) Thermistor or thermostat for thermal protection embedded in the motor windings.
    - 5) Automatic motor thermal reset once motor has cooled sufficiently after overload.
    - 6) Three conduit openings, minimum.
  2. Control Transformer:
    - 1) Epoxy encapsulated and impregnated with short-circuit and overload protection.
    - 2) Rated, at a minimum, to handle 80 percent of the connected load with 120 VAC secondary or other secondary voltage of 24 VDC as required.
    - 3) Adequately rated to provide power for the following functions:
      - a. Energizing of the contactor coils.
      - b. Internally sourced power for remote controls.
      - c. Internal electrical circuits.
      - d. Heater.
- C. Enclosure: Provide NEMA 250 electrical enclosures rated for the application and location specified:
  1. Non-hazardous, indoor and outdoor locations.
    1. Type 4, Weatherproof.
    2. Type 4X, Corrosive.
    3. Type 6, Submersible.
  2. Hazardous locations, indoor and outdoor locations.
    1. Type 4/7, Class I, Divisions 1 and 2, Groups C & D certification.
  3. All external fasteners stainless steel.

- D. Disconnect Switch: Provide a lockable, heavy-duty, NEMA 4X, non-fused, UL listed disconnect switch for mounting near actuator. Where actuated lift gate is out-of-reach, locate the disconnect switch on an adjacent wall at an accessible level.
  - 1. Where depicted on the drawings provide auxiliary contact. The contact to close when disconnect switch is in close position. The contact to open when disconnect switch is in open position.
- E. Gearing:
  - 1. Totally enclosed in an oil or grease filled gearcase suitable for operation at any angle.
  - 2. All drive gearing and components must be of metal construction and machine cut.
  - 3. For rising stem lift gate (multi-turn), provide hollow output shaft accepting a rising stem and incorporating thrust bearings of the ball or roller type at the base of the actuator. Permit the opening of the gearcase for inspection, and disassembly without releasing the stem thrust or taking the lift gate out of service.
  - 4. For quarter-turn, self-locking drive gearing to prevent the lift gate back-driving the actuator. Multi-turn actuator combined with part-turn gearbox for 90-degree rotation can be used for high torque applications or for large nominal diameter quarter-turn lift gates being used for isolating, throttling or modulating service.
  - 5. Design all gearing to withstand a 100 percent overload.
- F. Torque Switches: Provide electric motor actuators with a double-torque switch set to disengage motor power at 40 to 100 percent of actuator rated torque and less than 75 percent of the shaft's design torque. Operate the torque switch in both the opening and closing directions and operate during the complete cycle without the use of auxiliary relays, linkages, latches, or other devices.
  - 1. Provide each side of the torque switch with set point adjustment. Mount a calibration tag near each switch for correlating the settings with output torque activation.
- G. Position Switches: Provide electrical or electro-mechanical confirmation of lift gate position. Position limit switches to indicate various positions between the fully opened and fully closed. Provide limit switches for visual local position indication of the lift gate and for external position monitoring through solid-state relay or electro-mechanical relays. Provide at least two relays with dry contacts for external position monitoring.
- H. Hammer Blow Device: Provide electric motor actuators with a built-in lost-motion device that allows sufficient travel of the motor, prior to engaging the stem nut, for the motor to reach full speed. This action to impart a "hammer blow" to start the lift gate in motion in either direction. Share the load equally by two lugs cast integrally on the drive sleeve.
- I. Handwheel: Provide electric motor actuators with a handwheel for manual operation. Do not rotate the handwheel during motor operation. Do not prevent handwheel operation when motor is locked. Accomplish motor or manual selection by a positive declutching knob or lever which disengages the motor and motor gearing mechanically but not electrically. Prohibit manual and motor simultaneous operation. Do not require more than 80 pounds of rim effort at maximum torque for hand operation.
- J. Electrical actuator setting tool: Bluetooth setting tool to be provided with all of the electrical actuators.

## 2.04 SPARE PARTS

- A. Electrical actuators:
  - 1. 1 spare motor
  - 2. 1 spare seal kit

## 2.05 CONTROL PANEL (ADDENDUM NO. 2)

- A. Provide an integral operator control unit to serve as a control station for each actuator unless otherwise specified.
- B. Control station to include pilot devices:
  - 1. LOCAL (or HAND), OFF, REMOTE (or AUTO), STOP, OPEN, and CLOSE controls through selector switches and/or pushbuttons.
    - 1. In LOCAL, use the control station's OPEN and CLOSE devices to position the lift gate to full open or full close. Configure for inching "maintained or sealed in" action in either travel direction.
    - 2. In REMOTE:
      - 1) Open-Close (Isolating) Service:
        - a) Contacts Closure: Use momentary operation of external OPEN or CLOSE contacts to open and close the lift gate.
      - 2) Modulating or Throttling Service:
        - a) Analog: Use external 4-20 mA input DC isolated signal to position the lift gate with maximum impedance of 250 ohms. On loss of 4-20 mA input DC provide adjustable configuration to fail to the "open", "closed", "% open" or "last" position. Unless otherwise specified initially set to fail to the "last" and reconfigure during system start-up if required for operations to go to a percent open position on loss of the external 4-20 mA.
      - 3) Prevent the controls station's local OPEN and CLOSE devices from operating the lift gate.
    - 3. In STOP, prevent travel in either open or close direction in both LOCAL and REMOTE.
  - 2. Indication:
    - 1. OPEN and CLOSE Status Lights
    - 2. Position for Modulating/Throttling Service: In addition to the above status lights, provide digital readout display for the lift gate position in 1 percent increments from 0 to 100 percent.
- C. Location of Control Station:
  - 1. Local: NEMA 4X/7 Control station factory mounted directly to the electric motor actuator.
  - ~~2. Remote: NEMA 4X/7 Control station mounted separate from the electric motor actuator when specified. Provide one of the following options:
    - ~~1. Add another control station if the factory mounted control station can not be detached from the electric motor actuator. If two control stations are provided then both control stations must have identical operations.~~~~

~~2. Remote mount the entire actuator control package compartment including control power transformers, motor contactors and positioners.~~

D. External Monitoring:

1. Status and Alarms: Provide single pole double throw (SPDT) or single pole single throw (SPST) dry contacts rated at 0.5 amps for 24V DC, and 3 amps for 120 V AC. Provide contacts as normally open or normally closed:
  1. Open Status: Representing lift gate in full open position.
  2. Close Status: Representing lift gate in full close position.
  3. Remote or Auto Status: LOR or HOA in Remote or Auto, representing actuator operation from external source enabled.
  4. Local or Hand Status: LOR or HOA in Local or Hand, representing actuator operation from the control station enabled.
  5. Alarm Status: Representing lift gate or actuator trouble.
2. Position:
  1. Modulating or Throttling Service: In addition to the above external status and alarms, provide a 4-20 mA DC isolated output signal to indicate lift gate position at a minimum impedance of 500 ohms.

## 2.06 NAMEPLATES

- A. Control Station: Provide nameplates for each control station.
  1. Functional Nameplate: Engrave a white phenolic plate with black lettering with lift gate functional description and lift gate equipment number as specified or shown. Permanently fasten functional nameplate to control station. Nameplate wording may be changed without additional cost or time, if changes are made prior to commencement of engraving.
  2. Marking Nameplate: Engrave or stamped stainless steel. Permanently fasten nameplate to the control station. Provide the information on nameplate as required by NFPA 70 (NEC) for industrial control panel markings.
- B. Motor: Engrave or stamped stainless steel. Permanently fasten nameplate to the motor frame and ensure visibly positioned for inspection. Provide the information on nameplate as required by NFPA 70 (NEC).
- C. Actuator: Engrave or stamped stainless steel. Provide the following information on nameplate: manufacturer, model number, serial number, ambient temperature minimum/maximum, rated torque, and opening time.
- D. Lift Gate Pedestals: Engrave or stamped stainless steel. Provide the following information on nameplate: gate manufacturer, model number, serial number. Contractor to coordinate with Owner and Engineer regarding existing lift gate pedestal nameplate information.

## 2.07 ASSEMBLY/FABRICATION

- A. Factory-mount electric motor actuators on the lift gate pedesals as a unit. Provide each lift gate body or actuator with the word "OPEN" cast thereon, an arrow indicating the direction to open, and flow direction arrows.

## 2.08 GATE PEDESTALS

- A. Gate pedestals are to be compatible with all existing clarifier lift gate components (including but not limited to gate lift screws)
- B. New gear box to be supplied with gate pedestals that is compatible with all lift gate components and new electric actuators
- C. Contractor and electric actuator equipment supplier to coordinate with lift gate manufacture / supplier to obtain the correct gate pedestal replacement.
- D. Gate pedestals to be ductile iron and coated as per 09 90 00.
- E. New gate pedestals are to be drilled to match Actuator mounting base.
- F. New gate pedestals to be supplied by the electrical actuator supplier.
- G. New gate pedestals to be installed by the General Contractor.
- H. Electrical actuators are to be supplied with PVC stem covers and Rotork Adapters for rising stem gates.

## PART 3 EXECUTION

### 3.01 PREPARATION

- A. Prior to ordering and installation of the electric motor actuators and gate pedestal assemblies, field measure and check all equipment locations, pipe alignments, and structural installations. Ensure that sufficient space and accessibility is available for electric motor actuators.
- B. Contractor and electrical actuator supplier to include site visit(s) to confirm lift gate stem measurements prior to ordering (of electrical actuators).
- C. Electrical actuator drive bushing to be machined to match existing gate stem.
- D. Design, submit, furnish, and install all hardware required to connect the new motorized actuator to the existing gates such that the motorized actuator can move the gate through its complete range of motion. Coordinate directly with the original gate supplier to obtain any required information.

### 3.02 INSTALLATION

- A. Equipment Mounting.
  - 1. Locate actuator with unobstructed access for operation and maintenance.
    - a. Do not obstruct walkways.
    - b. Do not attach to handrails, process piping, or mechanical equipment.
    - c. Do not locate where shock or vibration impairs its operation.
  - 2. Locate remote control station with unobstructed access for operation and maintenance between 48 inches and 60 inches above the floor or a permanent work platform, and within site of the actuator.

3. Mount actuators to have their manual operating accessory, where possible, located between 48 inches and 60 inches above the floor or a permanent work platform.
  4. Mount actuators on new gate pedestals
  5. Gate pedestals
    - a. Gate pedestals are to be compatible with all existing gate components (including but not limited to gate lift screws)
    - b. New gear box to be supplied with gate pedestals that is compatible with all existing gate components and new electric actuators
    - c. Contractor and actuator equipment supplier to coordinate with lift gate manufacture / supplier to obtain correct gate pedestal replacement
    - d. Gate pedestals to be installed where existing pedestals have been removed. Refer to 05 05 20 for anchor bolts and 43 05 13 for mounting.
    - e. Gate pedestals shall be mounted on an equipment pad per detail M7006, PM-08-0002.
- B. Nameplates:
1. Locate nameplates on electrical actuators in a clearly visible location. If necessary, reposition and reattach with stainless steel screws or wire.
  2. Locate nameplates on the lift gate pedestals in the same position as on the existing lift gate pedestals.
- C. Electrical Interconnection: Complu with Division 26 for power wiring, control wiring and signal wiring.

### 3.03 FIELD QUALITY CONTROL

- A. Provide a factory-trained manufacturer's representative at the site for the following activities.
1. Inspect actuator's electrical power, control, signal, communication and grounding wiring for proper termination.
  2. Configure actuator and include:
    - a. Actuator Settings: Limit switch, torque position, travel speed, emergency shutdown function, loss of position signal function, and relay functions.

### 3.04 SYSTEM START UP

- A. General Requirements:
1. Perform testing in accordance with Section 01 45 20, and this Section. Apply no required test without prior notice to the Construction Manager to witness any test. At least 14 days before the commencement of any testing activity, provide a detailed step-by-step test procedure, complete with forms for the recording of test results. Provide all equipment necessary to perform the required tests.
  2. Test each electric motor actuator for each mode of operation including but not limited to both local and remote- open, close, stop, emergency shutdown, position control, and network operation, as well as, the travel rates, limit switches, jam and torque settings, and loss of control signals.
  3. Ensure electric motor actuator control can be re-initiated locally and remotely after power loss recovery without faulting.

4. Provide a factory-trained manufacturer's representative at the site to conduct startup of electrical actuators.
5. Provide a factory-trained manufacturer's representative at the site to re-adjust actuator setting under normal operating conditions with the specified design process fluid.

### 3.05 TRAINING

- A. Provide operation and maintenance training for the equipment provided under this Section for the Owner's personnel in accordance with Section 01 79 00 and taught by a factory-trained manufacturer's representative. Certify training on Form 43 05 11-B specified in Section 01 99 90.
- B. Include in training sessions preventive maintenance requirements, overhaul and troubleshooting instructions, normal operating practices, actuator parameter configuration set-up, changing actuator parameter settings.

## PART 4 APPENDIX – ACTUSPECS

### 4.01 ACTUATOR SPECIFICATION SHEETS (ACTUSPEC)

- A. General requirements for actuators specified in this Section are listed on ACTUSPEC sheets herein.

**Table A**

ACTUSPEC Symbol	Actuator Description	Actuator Service Power
EMTI	Electric Multi-Turn Actuator for Isolating (Open-Close) Service	480 V AC, 3 phase
EMTM	Electric Multi-Turn Actuator for Modulating Service	480 V AC, 3 phase
EMTT	Electric Multi-Turn Actuator for Throttling Service	480 V AC, 3 phase
EQTI	Electric Quarter-Turn Actuator for Isolating (Open-Close) Service	480 V AC, 3 phase
EQTM	Electric Quarter-Turn Actuator for Modulating Service	480 V AC, 3 phase
EQTT	Electric Quarter-Turn Actuator for Throttling Service	480 V AC, 3 phase
EQTI	Electric Quarter-Turn Actuator for Isolating (Open-Close) Service	120 V AC, 1 phase
EQTI	Electric Quarter-Turn Actuator for Isolating (Open-Close) Service, Spring Return CW or CCW	120 V AC, 1 phase

### 4.02 ACTUATOR IDENTIFICATION: EMTI (480V)

- A. Actuator Description: Electric Multi-Turn Actuator for Isolating (Open-Close) Service.
- B. Manufacturers:
  1. Rotork, IQ3 Range IQ.
- C. Features:
  1. Actuator Power Supply: 480 V AC, 3-phase, 60 Hz.



2. Controller: Unfused disconnect type combination starter in compliance with NEMA ICS.
3. Controls:
  1. Power Source: Internal or external 120 volts AC or 24 volts DC.
  2. Remote Control Type: Contact Closure
  3. Emergency Shutdown: A minimum of one independent signal when applied to the actuator overrides any existing command signal and sends lift gate in a preselected shut down position.
  4. Location of Control Station: Local unless otherwise specified

#### **4.03 ACTUATOR IDENTIFICATION: EMTM (480V)**

- A. Actuator Description: Electric Multi-Turn Actuator for Modulating Service.
- B. Manufacturers:
  1. Rotork, IQ3 Range IQM.
- C. Features:
  1. Actuator Power Supply: 480 V AC, 3-phase, 60 Hz.
  2. Controller: Solid-state electronic, servo-amplifier comparator and an electro-mechanical reversing starter.
  3. Controls:
    1. Power Source: Internal or external 120 volts AC or 24 volts DC.
    2. Emergency Shutdown: A minimum of one independent signal when applied to the actuator overrides any existing command signal and sends lift gate in a preselected shut down position.
    3. Location of Control Station: Local unless otherwise specified

#### **4.04 ACTUATOR IDENTIFICATION: EMTT (480V)**

- A. Actuator Description: Electric Multi-Turn Actuator for Throttling Service.
- B. Manufacturers:
  1. Rotork, IQ3 Range IQM.
- C. Features:
  1. Actuator Power Supply: 480 V AC, 3-phase, 60 Hz.
  2. Controller: Solid-state electronic, servo-amplifier comparator and an electro-mechanical reversing starter.
  3. Controls:
    1. Power Source: Internal or external 120 volts AC or 24 volts DC.
    2. Emergency Shutdown: A minimum of one independent signal when applied to the actuator overrides any existing command signal and sends lift gate in a preselected shut down position.
    3. Location of Control Station: Local unless otherwise specified

#### **4.05 ACTUATOR IDENTIFICATION: EQTI (480V)**

- A. Actuator Description: Electric Quarter-Turn Actuator or Multi-Turn Actuator with 90-Degree Gearbox for Isolation Service.
- B. Manufacturers:
  - 1. Rotork, IQT or IQ Pro Series.
- C. Features:
  - 1. Power Supply: 480 V AC, 3-phase, 60 Hz.
  - 2. Controller: An unfused disconnect type combination starter in compliance with NEMA ICS.
  - 3. Controls:
    - 1. Power Source: Internal or external 120 volts AC or 24 volts DC.
    - 2. Emergency Shutdown: A minimum of one independent signal when applied to the actuator overrides any existing command signal and sends lift gate in a preselected shut down position.
    - 3. Location of Control Station: Local unless otherwised specified
  - 4. Gear Train: 90-degree gear box.

#### **4.06 ACTUATOR IDENTIFICATION: EQTM (480V)**

- A. Actuator Description: Electric Quarter-Turn Actuator or Multi-Turn Actuator with 90-Degree Gearbox for Modulating Service.
- B. Manufacturers:
  - 1. Rotork, IQ Pro Series.
- C. Features:
  - 1. Power Supply: 480 V AC, 3-phase, 60 Hz.
  - 2. Controller: Solid-state electronic, servo-amplifier comparator and an electro-mechanical reversing starter.
  - 3. Controls:
    - 1. Power Source: Internal or external 120 volts AC or 24 volts DC.
    - 2. Emergency Shutdown: A minimum of one independent signal when applied to the actuator overrides any existing command signal and sends lift gate in a preselected shut down position.
    - 3. Location of Control Station: Local unless otherwised specified
  - 4. Gear Train: 90-degree gear box.

#### **4.07 ACTUATOR IDENTIFICATION: EQTT (480V)**

- A. Actuator Description: Electric Quarter-Turn Actuator or Multi-Turn Actuator with 90-Degree Gearbox for Throttling Service.
- B. Manufacturers:
  - 1. Rotork, IQ Pro Series.

- C. Features:
1. Power Supply: 480 V AC, 3-phase, 60 Hz.
  2. Controller: Solid-state electronic, servo-amplifier comparator and an electro-mechanical reversing starter.
  3. Controls:
    1. Power Source: Internal or external 120 volts AC or 24 volts DC.
    2. Emergency Shutdown: A minimum of one independent signal when applied to the actuator overrides any existing command signal and sends lift gate in a preselected shut down position.
    3. Location of Control Station: Local unless otherwise specified
  4. Gear Train: 90-degree gear box.

#### **4.08 ACTUATOR IDENTIFICATION: EQTI (120V)**

- A. Actuator Description: Electric Quarter-Turn Actuator for Isolation (Open/Close) Service.
- B. Manufacturers:
1. Flowserve Worchester, Series 75.
  2. GE Remote Control Series (RCS), Model MAR.
  3. Emerson Bettis TorqPlus, Series EM.
  4. Approved equal.
- C. Features:
1. Power Supply: 120 V AC, 1-phase, 60 Hz.
  2. Applications:
    1. Stall Torque: 150 to 900 lb-in.
    2. Current at Rated Stall Torque: Less than 2 amps for 25% duty.
  3. Controls:
    1. Voltage: 120 V AC.
    2. Voltage Source: External fed.
    3. Remote Control Type: Contact Closures.
    4. Location of Control Station: Remote and specified in Section 40 76 00.
    5. Manual Override: Required.
  4. Indication- Open/Close Position: Required.
  5. Gear Train: Direct attach to actuator with no intermediate gearings or linkage.
    1. Lubrication: Permanently lubricated.

#### **4.09 ACTUATOR IDENTIFICATION: EQTI (120V-O OR C)**

- A. Actuator Description: Electric Quarter-Turn Actuator for Isolation Service, Spring Return CW or CCW.
- B. Manufacturers:
1. GE Remote Control Series (RCS), Model SURE.
  2. Emerson Bettis TorqPlus, Series EM.

3. Approved equal.
- C. Features:
1. Power Supply: 120 V AC, 1-phase, 60 Hz.
  2. Fail Position: Open or Close (OC) as specified in Section 40 06 20.13.
  3. Applications:
    1. Stall Torque: 300 to 1200 lb-in.
    2. Current at Rated Stall Torque: Less than 1.5 amps for 50 % duty or better.
  4. Controls:
    1. Voltage: 120 V AC.
    2. Voltage Source: External fed.
    3. Remote Control Type: Contact Closures.
    4. Location of Control Station: Remote and not specified in this Section.
    5. Manual Override: Required.
  5. Indication- Open/Close Position: Required.
  6. Gear Train: Direct attach to actuator with no intermediate gearings or linkage.
  7. Lubrication: Permanently lubricated.

**END OF SECTION**

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