ATTENDANCE AT PRE-BID CONFERENCE IS MANDATORY

PREPARED BY:
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WATER AND SEWER DEPARTMENT

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7503393 531307

Water and Sewer Department
175 E. 2nd Street
Tulsa, Oklahoma 74103
(918) 596-9845

TECHNICAL SPECIFICATIONS
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## TECHNICAL SPECIFICATIONS

### BID ITEM EQUIPMENT REPLACEMENT SPECIFICATIONS

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<th>General Description</th>
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<td>5.</td>
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<td>Aeration Basin #2 Diffusers - NSWWTP</td>
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</tr>
<tr>
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<td>214.98</td>
<td>Extra Work Allowance</td>
</tr>
<tr>
<td>11.</td>
<td>214.99</td>
<td>Mobilization Bid Item</td>
</tr>
</tbody>
</table>

### ADD ALTERNATES

- **A.** 214.10 Pipe Gallery 1 and 2 Electrical Box Refurbishment - NSWWTP
- **B.** 214.11 Primary Building 1 and 2 Pipe Painting – NSWWTP
- **C.** 214.12 Flatrock FEB Joint Refurbishment – NSWWTP

### ANCILLARY EQUIPMENT AND WORK
200 INTRODUCTION

200.1 Project work shall include all equipment, labor, materials, hardware, cable, terminations, and incidentals necessary to remove existing equipment that is to be replaced, install the new equipment, and place the new equipment in fully operational, functional and warrantable service. All equipment to be supplied shall be brand new current year model and not used, remanufactured, or discontinued items.

200.2 Contractor shall field verify all elevations and dimensions of existing piping, valves, and equipment to be removed or demolished, and for replacement and/or modification. Contractor’s work shall be based on field measurements and shall include field adjustments and additions for the proper installation of equipment. The contractor shall take note of all objects in the vicinity of equipment being installed to ensure that there are no issues with interference. It is the responsibility of the contractor to make modifications necessary to adjacent objects such as pipe supports and similar items to install the new equipment unless such objects are not reasonably visible during the site visit. It is the responsibility of the contractor to review all field conditions and take necessary field measurements prior to ordering equipment. The Authority will make available the information it has pertaining to the existing equipment.

200.3 The Authority’s contact people are:

| Northslope Wastewater Treatment Plants & Facilities | Shawn Glen – Northside WWTP and Lower Bird Creek WWTP Superintendent 5628 N 105th East Avenue Tulsa, OK 74117 918-591-4570 |
| Northside Wastewater Treatment Plant | Andrew Liechti – Sr. Engineer 5628 N 105th East Avenue Tulsa, OK 74117 918-591-4714 |
| Northside Wastewater Treatment Plant | Colin Wilmering – Maintenance Manager 5628 N 105th East Avenue Tulsa, OK 74117 918-591-4578 |
| Water Pollution Control | Matt Vaughan – Section Manager 175 E. 2nd Street, Suite 1400 Tulsa, OK 74103 918-596-9845 |
201 QUALIFICATION REQUIREMENTS

201.1 Only contractors holding a valid pre-qualification certificate from the Tulsa Metropolitan Utility Authority in Classification A (General) or D (Utility Construction), are eligible to bid on this project. No additional qualification information is required to be submitted.

201.2 Only contractors that attend the mandatory pre-bid meeting will be allowed to bid on this project.

202 SUMMARY OF BID ITEMS

The Basis of Award shall be the eleven (11) Bid Items 1 through 11. The lowest responsible bid shall be determined by the Base Bid amount for Bid Items 1 through 11.

<table>
<thead>
<tr>
<th>Bid Item No.</th>
<th>Specification No.</th>
<th>General Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>214.1</td>
<td>All materials, labor, equipment, and supervision required for removal and replacement of the discharge and suction gate valves at the Northside Wastewater Treatment Plant (NWWTP) Apache Lift Station (LS), per these specifications. N105-LFT1-VLV01, -VLV03</td>
</tr>
<tr>
<td>2</td>
<td>214.2</td>
<td>All materials, labor, equipment, and supervision required for removal and replacement of two (2) progressive cavity pumps at the Northside Wastewater Treatment Plant (NWWTP), per these specifications. N070-DAF-TSP01, -TSP02</td>
</tr>
<tr>
<td>3</td>
<td>214.3</td>
<td>All materials, labor, equipment, and supervision required for removal and replacement of two (2) fill gate actuators at the Northside Wastewater Treatment Plant (NWWTP) Flat Rock Creek Flow Equalization Basin (FEB) wet well, per these specifications. N131-FEB1-SGT01, -SGT02</td>
</tr>
<tr>
<td>4</td>
<td>214.4</td>
<td>All materials, labor, equipment, and supervision required for removal and replacement of two (2) submersible diversion pumps at the Northside WWTP Mingo Flow Equalization Basin (FEB) wet well, per these specifications. N133-FEB1-SBM04, -SBM05</td>
</tr>
<tr>
<td>5</td>
<td>214.5</td>
<td>All materials, labor, equipment, and supervision required for removal and replacement of all diffuser assemblies in the Northside Wastewater Treatment Plant (NWWTP) Aeration Basin #2, per these specifications.</td>
</tr>
<tr>
<td>6</td>
<td>214.6</td>
<td>All materials, labor, equipment, and supervision required for improvements (painting) to all of the walls in the basement of the DAF facility at the City of Tulsa Northside Wastewater Treatment Plant (NWWTP), per these specifications.</td>
</tr>
<tr>
<td>7</td>
<td>214.7</td>
<td>All materials, labor, equipment, and supervision required for improvements (painting) to the existing piping in the basement of the DAF facility at the City of Tulsa Northside Wastewater Treatment Plant (NWWTP), per these specifications, which shall include the following.</td>
</tr>
<tr>
<td>8</td>
<td>214.8</td>
<td>All materials, labor, equipment, and supervision required for removal and replacement of three (3) Saturation Valves at the Northside Wastewater Treatment Plant (NWWTP) DAF facility, per these specifications. N070-DAF1-DMV01, -DMV02, -DMV03</td>
</tr>
<tr>
<td>9</td>
<td>214.9</td>
<td>All materials, labor, equipment, and supervision required for removal and replacement of the roof on the West Access Building of Pipe Gallery 1 at the Northside Wastewater Treatment Plant (NWWTP), per these specifications.</td>
</tr>
<tr>
<td>10</td>
<td>214.98</td>
<td>Extra Work Allowance – $35,000.00 Lump Sum Allowance for various mechanical, electrical, plumbing, or unforeseen circumstances work not identified in the bid items.</td>
</tr>
<tr>
<td>11</td>
<td>214.99</td>
<td>Mobilization Bid Item – Not to exceed 5% of Base Bid Items not including the Mobilization Bid Item</td>
</tr>
<tr>
<td>Alt. A</td>
<td>214.10</td>
<td>All materials, labor, equipment, and supervision required for refurbishment of twelve (12) cast-in electrical boxes at the Northside Wastewater Treatment Plant (NWWTP), per these specifications.</td>
</tr>
<tr>
<td>Alt. B</td>
<td>214.11</td>
<td>All materials, labor, equipment, and supervision required for improvements (painting) to the existing piping in both Primary 1 and 2 buildings at the City of Tulsa Northside Wastewater Treatment Plant (NWWTP), per these specifications.</td>
</tr>
<tr>
<td>Alt. C</td>
<td>214.12</td>
<td>All materials, labor, equipment, and supervision required for the refurbishment of the designated concrete joints in the Flat Rock Creek Flow Equalization Basin (FEB) of the City of Tulsa's Northside Wastewater Treatment Plant (NWWTP), per these specifications.</td>
</tr>
</tbody>
</table>
203 GENERAL CONTRACTOR RESPONSIBILITIES

The cost of items in this Section and other Sections of these specifications shall be equitably included in Section 202 Bid items.

203.1 Prior to disposal of any material or equipment that is City of Tulsa property and removed as part of the contract work, Contractor shall contact the Authority and explicitly offer to the Authority first right to claim and retain such materials or equipment as City of Tulsa property. Contractor shall be responsible for the disposal of all such equipment and materials not claimed by the Authority.

203.2 Contractor shall field verify all elevations and dimensions of existing piping, valves, and equipment to be demolished. Contractor work shall be based on field measurements and shall include field adjustments and additions for the proper installation of equipment. The contractor shall take note of all objects in the vicinity of equipment being installed to ensure that there are no issues with interference. It is the responsibility of the contractor to make modifications necessary to adjacent objects such as pipe supports and similar to install the new equipment unless such objects are not reasonably visible during the site visit. It is the responsibility of the contractor to review all field conditions and take necessary field measurements prior to ordering equipment. The Authority will make available the information it has pertaining to the existing equipment.

203.3 Contractor will coordinate, provide, and bear the cost of all items below:
- Equipment, materials, tools.
- Labor, supervision, coordination.
- Procedures for continual operation of the wastewater facilities.
- Flow stoppage, plugging, bypass pumping, sump pumping.
- Rigging, lifting, material handling, illuminating.
- Vacuum truck service and disposal of grit, sludge, sediment.
- Trash service and disposal of debris.
- Methods to prevent debris from going into drains.
- Delivery, unloading, storage, and security of equipment and materials.
- Protection of equipment and materials from damage.
- Protection of water coils and water piping from freeze damage.
- Procedures to prevent damage to underground pipes or utilities.
- Paint, coatings, and other measures to protect new equipment and materials from corrosion.
- Electrical wires, cable, conduit, terminations, and other incidental items.
- Hardware, brackets, clamps, hangers, supports, equipment bases, and other incidental items.
- Modifications or replacement of concrete bases to accommodate the new equipment.
- Modifications to any previously-installed facility equipment and structures.
- Modifications or adaption needed to allow new equipment to properly fit with any previously-installed facility equipment and structures.
- Modifications due to new code requirements.
- Modifications due to new industry standards.
- Modifications due to lack of availability of certain equipment or materials.
- Fees, permits, inspections.

203.4 Before Starting Work for each Bid Item, Contractor will do all of the following:
- Submit Documents for Review to the Engineer as per the Submittal Requirements.
- Verify the Documents for Review have been checked and accepted by the Engineer as per paragraph GC-5 of the General Conditions of Contract.
- Field-verify all necessary dimensions.
- Field-verify the conditions of facility equipment and structures.
- Verify that the capacity, performance, and dimensions of the new equipment will allow for proper operation of the Complete System.
- Verify that clearances between any new equipment and any previously-installed facility equipment and structures are reasonable, safe, and allow for proper operation of the Complete System.
- Coordinate with the Engineer for approval of any modifications to facility equipment and structures.
- Verify the availability of the equipment and materials the Contractor plans to use.

203.5 During and after installation of new equipment, Contractor will do all of the following:
- Install new equipment per manufacturer's instructions
- Verify the new equipment is installed correctly
- Test the newly installed equipment under actual operating conditions

203.6 For purposes of draining of storage or conveyance structures, the contractor will do all of the following
- Coordinate with the Engineer. If conditions permit, the plant operations crew will attempt to drain the structure using installed facility equipment such as valves and built-in pumps. If conditions permit, the plant operations crew will attempt to provide general wash-down. The contractor will provide any needed pump or vacuum service to maintain drained condition.

- Provide any needed pumping or vacuum service if installed facility equipment is not functional or not fully functional.

- Provide any needed pumping or vacuum service to remove and dispose of grit, sediment, sludge, or bulk debris.

204 SUBMITTALS

All submittals shall be accompanied by a transmittal letter and/or cover letter that includes the project name and number, the contract specification number under which the equipment is being supplied, the Equipment ID number of the equipment being referenced, and the submittal revision number as appropriate.

204.1 Contractor shall submit, for each bid item, the manufacturer’s instructions and recommendations for installation, for subsequent testing of the units, and for ensuring they are in proper operation. These instructions shall be part of these specifications and binding on the contractor.

204.2 Contractor shall include, for each bid item, a work plan acceptable to the Engineer describing the duration and sequence of work. Plan shall be approved prior to commencement of work. All work requiring flow stoppage or removing equipment from service must be scheduled at least 48 hours in advance with Plant Superintendent. When flow stoppage is required for equipment installation, contractor shall have all necessary materials at the installation site prior to any flow stoppage, and shall proceed with installation of equipment to minimize downtime.

204.3 Contractor shall, within 15 days of issuance of Work Order, submit three (3) copies of the following items for review and approval - one (1) copy to be returned to Contractor following review, two (2) copies to be retained by Authority:

204.3.1 Product Data and Information: Submit catalog data including rating and descriptive literature of all components and systems for approval by Authority. This shall include items required by 204.

204.3.2 Itemized list with manufacturer’s part numbers, part descriptions and schedule of values (unit prices) for the equipment proposed for each location.
204.3.3 Shop Drawings: Submit the following shop drawings for approval by Authority:

204.3.3.1 Bill of materials including manufacturers’ name and catalog number

204.3.3.2 Outline drawing showing dimensions, arrangement, and Identification of components and nameplate schedule for all units

204.3.3.3 Individual schematic control diagrams for each unit

204.3.4 Manufacturer’s training, reports and certifications requirements:
Manufacturer’s certification that the equipment is suitable and will perform within specification and manufacturer’s design operating parameters for the locations and conditions herein specified. Manufacture’s services shall also include site visits prior to construction, during installation and for start-up, as necessary for a detailed start up report and Manufacture’s certification of proper installation. Submit Manufactures start-up reports and certification of proper installation when they become available and included copies in the final O&Ms. Start-up report should include pertinent start up details, equipment description, project information and complete initial set points and initial operational readings and date. Submit training agenda, handouts, power point/video and Speaker resume for acceptance prior to scheduling training. Provide two separate training days as coordinated with the Plant to accommodate both day and night shifts, to be a minimum of 4 hours minimum per training day (classroom and field training).

204.3.5 Safety Plan: This submittal will be checked for general conformance with Section 207 Safety requirements and applicable OSHA and local regulations. Notwithstanding, it is the Contractors responsibility to ensure that the plan is comprehensive and in full conformance with all applicable OSHA, federal, state and local regulations.

204.3.6 Work Plan (reference Section 204.2): Submit for approval by Authority, the work plan for each bid item clearly showing the work task sequencing plan and time requirements, including downtime durations. This shall include items required by Section 203.

204.3.7 Submit for approval by Authority, plans and specifications for any concrete pad, support, piping, or other construction modifications from original installation.
204.3.8 Warrantee Tracking Log: Shall be maintained by the contractor and shall be provided as a Monthly Meeting handout and project completion end of project submittal.

204.4 Operations and Maintenance Manuals:

204.4.1 Contractor shall furnish to the Engineer two (2) hard copies of an Operation and Maintenance Manual for each piece of equipment and associated control systems furnished and installed.

204.4.2 Contractor shall furnish to the Engineer one (1) soft copy of all O & M manuals. CDs/jump drives shall be formatted in pdf and shall contain all printed material included in the hard copies. A separate pdf folder shall be created for each Equipment numbered piece of equipment, within which all files pertaining to that piece of equipment shall be located.

204.4.3 Prior to the work reaching 80 percent completion, Contractor shall submit to the Engineer for approval two (2) copies of the manual with all specified material. Submittal of the approval copies shall be made with the partial payment request for the specified completion. Within 30 days after the Engineer’s approval of the two-copy submittal, Contractor shall furnish to the Engineer the remaining hard copies of the manual and the soft copy. Contractor shall submit any missing material for the manual prior to requesting certification of substantial completion.

204.4.4 Format and Contents: Each O & M manual shall include the following:

204.4.4.1 One copy of a completed EQUIPMENT NAMEPLATE AND SUMMARY DATA form.

204.4.4.2 One copy of the equipment Start-Up report and Manufacture’s certification of proper installation.

204.4.4.3 One copy of the manufacturer’s operating and maintenance instructions. Operating instructions include equipment start-up, normal operation, shutdown, emergency operation and troubleshooting. Maintenance instructions include equipment installation, calibration and adjustment, preventive and repair maintenance, troubleshooting, parts list and recommended spare parts.
204.4.4 List of electrical relay settings and control and alarm contact settings.

204.4.5 Electrical interconnection wiring diagram for equipment furnished including all control and lighting systems.

204.4.6 Record drawings showing as-built schematic control diagrams for each unit and one-line diagrams.

204.4.7 Cross-references where required between the appropriate sections of the Contractor’s O&M manual and the manufacturers’ manuals.

204.5 Equipment Nameplate Information – Contractor shall, upon startup of each piece of equipment, complete the form, titled **EQUIPMENT NAMEPLATE AND SUMMARY DATA**, found at the end of this section, and shall include the completed form in the front of that equipment’s respective O & M manual. The form shall be included with each O & M manual copy submitted. Equipment ID nameplate requirements are found in specification section 204.3.6 of these specifications.

204.6 Submittals shall be sent to the following address:

Andrew Liechti, P.E.
City of Tulsa Water and Sewer Department
Northside Wastewater Treatment Plant
5628 N. 105th E. Ave., Tulsa, OK 74117
T: 918-591-4714, C: 918-381-4950
E: aliechti@cityoftulsa.org
## EQUIPMENT NAMEPLATE AND SUMMARY DATA

<table>
<thead>
<tr>
<th>Equipment Number:</th>
<th>_________________________________________________________</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description (Include size):</td>
<td>________________________________________________________</td>
</tr>
<tr>
<td>Project #:</td>
<td>__________________________________________________________</td>
</tr>
<tr>
<td>Spec. #:</td>
<td>__________________________________________________________</td>
</tr>
<tr>
<td>Vendor:</td>
<td>__________________________________________________________</td>
</tr>
<tr>
<td>Manufacturer:</td>
<td>__________________________________________________________</td>
</tr>
<tr>
<td>Model #:</td>
<td>__________________________________________________________</td>
</tr>
<tr>
<td>*Item or Drawing #:</td>
<td>__________________________________________________________</td>
</tr>
<tr>
<td>*Serial #:</td>
<td>__________________________________________________________</td>
</tr>
<tr>
<td>Purchase Price:</td>
<td>$ ________________________________</td>
</tr>
<tr>
<td>Date Placed in Service (for 1-yr Warranty):</td>
<td>____________________________________________</td>
</tr>
<tr>
<td>Manufacturer’s Warranty Period and End Date:</td>
<td>_______________________________________</td>
</tr>
</tbody>
</table>

### Parts / Associated Details:

- ____________________________________________________
- ____________________________________________________
- ____________________________________________________

### Maintenance Schedule

- (May be an attached sheet from O&M Manual; do not use “See O&M Manual”)
- Initial: ____________________________________________
- Weekly: ____________________________________________
- Monthly: ____________________________________________
- Semi-Annual: ________________________________________
- Annual: ____________________________________________

### Applicable Motor Information:

- N.A. (Circle if not applicable)
- Vendor: ____________________________________________
- Manufacturer: _________________________________________
- Model #: ____________________________________________
- Item #: ____________________________________________
- Serial #: ____________________________________________
- Frame: ____________________________________________
- Insul. Class: _______________________________________
- Volts/Hz/Amps: ______________________________________
- HP / RPM / SF: ______________________________________
- Manufacturer’s Warranty Period and End Date: ___________

*Item or Drawing # may not be unique. For example, it may be the same for a group of same size valves or gates, each one having this same number that is unique to the group. The Serial # should be listed only when unique to this individual piece of equipment, otherwise it is N.A.
205 MONTHLY PROGRESS REPORTS AND PROGRESS MEETINGS

205.1 The Contractor shall submit monthly written project progress reports detailing the project’s progress to date, problems encountered or anticipated which impact project schedule, and plans for the next two weeks’ work.

205.2 Project progress reports shall be due as agreed upon during pre-work meeting.

205.3 Monthly progress meetings shall be scheduled on a weekday mutually agreeable to the Authority and the Contractor and shall be specified at the pre-work conference. The Contractor shall run the Monthly Meetings for the duration of the project and provide a meeting agenda including work completed, work planned, project, updated project schedule and other pertinent project status information.

205.4 The contractor shall submit a work progress and planned completion schedule for each bid item at the monthly progress meeting. The pre-work conference will constitute the first monthly progress meeting.

205.5 The Contractor shall maintain, update and submit an Equipment Log at each monthly meeting that lists each piece of equipment by Equipment ID number and lists Startup Date, Warranty Start Date and O&M Manual Submittal Date, among other project details. The spread sheet document shall be a shared document and submitted to the City at the end of the project for City’s future use. A sample Equipment log is available upon request.

206 SECURITY

206.1 Each project site where work is to be performed under this Contract is a secured site. The Contractor shall be responsible for security as described in this section.

206.2 Site Access: The Contractor shall respect all existing security measures at each project site, and shall implement the following measures to apply to all work performed under this Contract. Coordination for Plant access and City of Tulsa security pass access will be required.

206.2.1 Work at both Northside and Southside shall be restricted to the hours defined by TMUA GC-19 unless otherwise authorized by the Plant Superintendent.

206.3 Common Requirements:

206.3.1 Identification Badges: An Identification Badge, issued by the City of Tulsa Security Office, is required for the following people:

- The driver of each vehicle that will be entering the facility multiple times or on a regular basis.

- Sub-contractors and foremen that will be supervising other workers.

The Identification Badge also functions as an Access Card to allow access
through the front gate of the facility. Six months is the maximum time that an
Access Card is active.

206.3.2 Contractor will coordinate with the Engineer to request Identification Badges. Application for an Identification Badge will require a background investigation. Each person that is applying for an Identification Badge will need to complete the following two (2) forms:
- City of Tulsa Access Card / Identification Card Request Form
- City of Tulsa Security, Background and Prescreen Investigation Form
A current soft copy of the forms can be obtained from the Engineer.

206.3.3 The Contractor will send the completed forms as required. Approved individuals will coordinate with the City of Tulsa Security Office to complete the process and obtain their Identification Badge.

206.3.4 The Contractor will coordinate with the Engineer to request reactivation of Access Cards. Reactivation may require re-application and additional background investigation.

206.4 Contractor and Authority acknowledge that Contractor shall not solely be responsible for all secured access to the site, that City personnel will have access and will be performing their regular duties pertaining to the operation and maintenance of the site facilities, and that security at the site shall require the cooperation of all persons authorized to access the site for the performance of their work. To the extent the Contractor is responsible for and has control of secured access, Contractor shall restrict site access to only persons essential to the performance or inspection of the work being performed under this Contract.

206.5 Contractor shall provide Engineer twenty-four (24) hours advance notification of any delivery of equipment or materials to the site, and shall make arrangements with Engineer to provide for inspection of such delivery.

206.6 Any observation by the Contractor of activity at or associated with the project site that Contractor observes and considers to be unusual or suspicious in nature, or that poses a threat to the integrity or welfare of the project site or associated facilities, shall be duly noted at the time of the observation. Any such observation shall be immediately reported to the Engineer.

206.7 No statement pertaining to security in these Specifications shall constitute a contract between Contractor and Authority for the performance of security services.
207   SAFETY

207.1 Contractor shall be responsible for performing all work under this contract in a safe
manner and in compliance with all applicable local, state, and federal safety and health
regulations. All of the following requirements shall apply:

207.2 Contractor shall submit a site safety plan prior to start of work. Contractor's attention is
directed to safety regulations applicable to the work under this contract, which include
but are not limited to the following:

207.2.1 OSHA Standards 29CFR1910.147, the control of hazardous energy
(Lockout/Tagout)

207.2.2 Fire Prevention and Protection: The Contractor shall take all necessary
measures to prevent fire, and shall provide satisfactory firefighting means at
the location of work.

207.2.3 Condition of Equipment and Materials: All equipment, tools, and appliances,
and materials used in connection with the project shall be handled and
operated only when they are in safe operating condition and in accordance
with a standard safety procedure.

207.2.4 Confined Space Entry: Contractor shall determine if any work areas in this
contract are considered permit spaces for entry, as defined in OSHA
regulations, and shall perform all work so determined in accordance with all
applicable state and federal labor, safety, and health regulations.

207.2.5 Combustible - Explosive Atmospheres: Contractor shall determine if any work
areas in this contract are considered combustible and explosive spaces for
entry, as defined in OSHA regulations, and shall perform all work and employ
equipment in accordance with all applicable state and federal labor, safety,
and health regulations.

208   PROTECTION OF PROPERTY

208.1 The protection of City, State and Government equipment, fences, gates, signs, and
other City property is of prime importance, and if damaged, destroyed or removed, they
shall be repaired, replaced, or paid for by the Contractor. Disturbance to this property
must first be approved by the agency which controls it.

208.2 No valve or other control on any utility main or building service line shall be operated
for any purpose by the Contractor.

208.3 At places where the Contractor's operations are adjacent to, or crossing, the plane of
railway, telegraph, telephone, electric, and gas lines, or water lines, sanitary sewers,
and storm sewers, damage to which might result in expense, loss or inconvenience,
work shall not be commenced until all arrangements necessary for the protection
thereof have been made. Contractor shall notify the Notification Center of Oklahoma One-Call System, Inc., of any excavation or demolition prior to the commencement of such work. Notification shall be made no sooner than then (10) days nor later than forty-eight (48) hours prior to start of work, excluding Saturdays, Sundays, and legal holidays.

208.4 The Authority has attempted to locate all storm sewers, culverts, buried telephone or electrical conduits, sanitary sewers, water mains, and gas mains that might interfere with the construction of this project. The Contractor shall cooperate with the owners of any underground or overhead utility lines in their removal and rearrangement operations in order that these operations may progress in a reasonable manner and duplication or rearrangement work may be reduced to a minimum, and that services rendered by those parties will not be unnecessarily interrupted.

208.5 It shall be the responsibility of the contractor to follow all rules and regulations set forth by the Oklahoma Department of Environmental Quality with regard to storm water runoff associated with construction activities involving the disturbance of land. The contractor shall review the regulations and determine if a DEQ storm water discharge permit is required. If a permit is required, it is the responsibility of the contractor to apply for and obtain the permit prior to disturbance of soil. If a permit is not required, the contractor shall still take all necessary action to comply with DEQ rules.

208.6 In the event the contractor in any way fails to comply with the requirement of protecting, repairing, and restoring of any utility or utility service, the Engineer may, upon forty-eight (48) hours’ notice, proceed to protect, repair, rebuild or otherwise restore such utility or utility service as may be deemed necessary, and the cost thereof will be deducted from any money due or which may become due the contractor pursuant to the terms of his contract.

209 PROTECTION OF MATERIALS

209.1 All materials and equipment delivered to the work site shall be adequately housed and protected against damage or deterioration as required by the equipment manufacturer. The Contractor shall keep his storage yard(s) in good order, arrange his materials neatly, and protect them from damage.

210 REFERENCES TO OTHER SPECIFICATIONS

210.1 Where a referenced American Society for Testing Materials (ASTM), National Electric Code (NEC), National Electrical Manufacturers Association (NEMA), American National Standards Institute (ANSI), Institute of Electrical and Electronics Engineers (IEEE), or
other agency designated specification is specified for a material, component, or device, that designated specification shall be the current revision, either tentative or adopted. If a referenced specification is in disagreement with these specifications, the Tulsa Metropolitan Utility Authority specifications shall govern.

211 CLEAN-UP

211.1 Immediately upon completion of the work at each site in the contract, the Contractor shall remove all excess materials, equipment, tools, and debris, and restore the site to a condition and in a manner satisfactory to the Engineer.

212 PLACING WORK IN SERVICE

212.1 If desired by the Authority, portions of the work may be returned to service when completed, and the Contractor shall give prior access to the work for this purpose, but such use and operation shall not constitute an acceptance of the work. Any such return to service shall comply with Section GC-38 of the General Conditions of these Contract Documents and Specifications.

212.2 Warranty: All equipment and work shall have a one (1) year factory warranty from date of acceptance, which shall include all materials and labor.

213 PAYMENT

213.1 Contractor will refer to Paragraph GC-29 of the General Conditions of Contract regarding partial payments. The Engineer will withhold the following percentage of the dollar amount for each Bid Item:
- 20% for Documents for Record, Start-up Service (if required), and Training Service (if required).
- 5% for Final Acceptance of the Work including Equipment Identification Tags.
- 5% retainage as required by Paragraph GC-29 of the General Conditions of Contract.

END OF SECTION
214.1 All materials, labor, equipment, and supervision required for removal and replacement of the discharge and suction gate valves at the Northside Wastewater Treatment Plant (NWWTP) Apache Lift Station (LS), per these specifications.

214.1.1 The project located at the City of Tulsa’s Northside Wastewater Treatment Plant’s Apache LS, consists of removing and replacing the existing 24” discharge and 30” suction valves for Pump 1 with the proposed 24” discharge and 20” suction valves. Alternatively, a new 30” suction valve can be installed. The project includes the correct and complete installation of new valves and any additional piping modifications necessary for the installation, as specified herein. All work shall be performed in conformance with the manufacturer’s instructions and recommendations for installation, subsequent testing of the new units, and ensuring they are in proper operation.

214.1.2 Existing valves to be replaced, their location and the proposed valve installation locations are shown on the accompanying WPC20-3 drawing sheet designated as 214.1A.

214.1.3 Contractor shall be knowledgeable about and shall field verify all elevations and dimensions of existing piping and equipment that in any way bears on the removal of the existing equipment and installation of the proposed equipment. Work shall be based on field measurements. The Authority will make available the information it has pertaining to the existing equipment.

214.1.4 Project work shall include all materials, equipment, labor, and supervision, necessary to complete the project as specified herein, including but not limited to any and all crane work, rigging, delivery and complete installation of components to fully operational and warrantable condition.

214.1.5 Contractor shall submit work plan acceptable to the Engineer describing the duration and sequence of work. Plan shall be approved prior to commencement of work. All work requiring flow stoppage or equipment removed from service must be scheduled at least seven days in advance with Plant Superintendent. Contractor shall have the valves, and other materials as necessary at the installation site prior to any flow stoppage. It is the contractor’s responsibility to prepare the system being worked on for disassembly. This includes coordinating with plant operations the closing of upstream/downstream valves and pumping down any reservoirs necessary. It is the responsibility of the contractor to bypass any flow during the
construction. The Plant Superintendent will instruct the contractor on where to direct bypassed flow.

214.1.5.1 Contractor shall be responsible for providing temporary piping or any modifications needed to use existing piping for temporary bypass pumping or flow stoppage.

214.1.5.2 For the Suction Valve work, the wet well will need to be pumped down and flow stoppage to the entire wet well will be necessary. Flow stoppage can only be achieved for 6 hours at a time, so coordination will be critical.

214.1.5.3 All unneeded equipment and debris from any work shall become the responsibility of the contractor and shall be removed from the site and disposed of properly.

214.1.6 The proposed valves shall be high performance isolation knife gate valves. The valves shall be specifically designed to handle waste solids at heavy consistencies. Proposed 24" and 20" Valves shall be model VM (alternative 30" valve shall be model W0) knife gate valves manufactured by Wey Valve, Inc. or approved equal by Delta Valve that meets the following requirements:

214.1.6.1. **General Rating:** Valve shall be of full lug or full flange flat face-to-face design. Valve will have threaded flange bolt holes to permit independent upstream or downstream pipe flange removal without affecting the shutoff or body shell pressure rating of the valve. Flange drilling shall be per MSS-SP81 Standard. 20" valve to have maximum 4.50" face to face dimension that meets standard of AWWA C-520.

214.1.6.2 **Pressure Rating:**

214.1.6.2.1: Body shell pressure rating shall be 150 psig CWP.

214.1.6.2.2: Standard Shut off pressure rating shall be 150 psi.

214.1.6.2.3: The valve body shall be tested at 1.5 times the rated pressure and the valve gate at 1.1 times the rated pressure while in the fully shut position with zero cc/min leakage permitted past the seat or to valve exterior.

214.1.6.3 **Materials:**
214.1.6.3.1: Valve body material shall be Ductile Iron

214.1.6.3.2: Valve gate shall be type 316 stainless steel with a hard chrome finish.

214.1.6.3.3: Resilient seals shall be Buna-N.

214.1.6.3.4: Packing shall be a mixture of Teflon and grease to permit ease of packing, but with a sufficient fluidity to transmit equal sealing pressure across the full length of the packing chamber. Flax, braided rope and / or asbestos are not to be used. The packing itself shall not serve as the sealing component.

214.1.6.3.5: The actuator support structure of the valve shall be four (4) solid posts of carbon steel. The valve yoke shall be of sufficient strength to withstand five times the maximum operating torque or thrust required for the valve to operate.

214.1.6.3.6: The valve drive stem shall be of chrome steel.

214.1.6.3.6: The valve stem drive nut shall be of 45,000 psi bronze.

214.1.6.3.6: The valve yoke bearings shall be of 45,000 psi bronze.

214.1.6.3.6: All mechanical fasteners on the valve body shall be type 316 stainless steel.

214.1.6.4 Design:

214.1.6.4.1: The valve shall be furnished with a resilient seat which seals around the edge, not the face of the gate and shall be replaceable and mechanically retained. The body seal groove is machined with sufficient tolerances to prevent body seat creeping (dimpling and/or spaced blind holes in body seat area are not allowed).

214.1.6.4.2: The valve shall have a secondary metal seat to provide gate support and withstand the full rated pressure in either direction.

214.1.6.4.3: The seat shall provide ZERO cc/min leakage at the full rated pressure differential in either direction. Shutoff rating exceeds any ANSI class VI specification that allows for leakage.

214.1.6.4.4: The dual top gate seals shall be fully enclosed and shall be re-packable with the valve in service under fully
rated pressure and without the removal of packing gland or follower. This seal shall be capable of resealing by means of injection of packing material into the seal chamber through external ports located at a minimum of four locations to insure even pressure and packing material distribution. The top seals shall be protected by glass filled phenolic scraper blades. The scraper blades shall be pressed into the gate by means of mechanically retained rubber backing cord.

214.1.6.4.5: 4.5 Both faces and both edges of the gate shall have a surface finish of 43 micro-inch to ensure ease of operation and seal performance.

214.1.6.4.6: The leading edge of the gate shall be straight or shall not inscribe more than a 60 degree included angle.

214.1.6.4.7: The gate shall be guided for the full length of the stroke and supported to withstand full rated shutoff pressure in either direction for the full length of valve stroke. The interior of the valve port shall be contoured to insure self-cleaning, non-jamming cycling in media consistencies up to 15%. The resilient seat in the bottom port area of the valve shall be flush with the port area and shall not form a cavity in which debris can collect. Valve design cannot allow discharge of process media onto the ground or into any reservoir or bonnet. The design shall not rely on flush ports to clear the gate guides, seat or bonnet area of the valve.

214.1.6.5 **Valve Operators:** Valves identified in the drawings as manually operated shall be chain wheel operated with a beveled gear. Chains shall be minimum of 3 feet from the operating floor.

Provide Loose: 2” drive nut assembly attached to hand wheel

Manual Operators: Sizing of bevel gear operators and/or chain wheel operator combination as required by manufacturer’s valve torque/thrust requirements for specific size of valves on scope.

a. Bevel Gear Operator: Manufacturer: Dynatorque BG-4 (20” and 24”)
b. Chain wheel Operator: Manufacturer: Babbit Steam Specialties
- Epoxy coated chain wheel and stainless chain

214.1.6.6 **Coatings:** All non stainless steel metal surfaces shall be chip resistant primed and epoxy powder coated.

214.1.7 **INSTALLATION:** The valves shall be installed in strict conformance with the manufacturer’s recommendations, which are to be submitted with the shop drawings. All fasteners shall be 316 stainless steel and a nickel based anti-seize shall be applied to threaded fasteners during assembly. Contractor shall provide the piping necessary for any modifications to connect the proposed valves into the existing hard piping systems.

214.1.14 **TAGGING:** Contractor shall supply equipment tags to be mounted on the valves. Tags shall show the City of Tulsa’s Equipment ID number for each valve (as listed below). The tags shall be visible without the need to “hunt” for the tags and shall be viewable and readable from eye level. Tags shall be made to conform to Section 215.1.4 of these specifications.

Equipment ID Tag Numbers:

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<th>Tag Number</th>
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<tr>
<td>Discharge Valve</td>
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</tr>
<tr>
<td>Suction Valve</td>
<td>N105-LFT1-VLV01</td>
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</tbody>
</table>

214.1.15 **TESTING.** After completion of the installation, the equipment shall be tested by the Contractor under actual operating conditions. An Authorized Owner’s Representative shall witness the testing.

END OF SECTION
214.2 All materials, labor, equipment, and supervision required for removal and replacement of two (2) progressive cavity pumps at the Northside Wastewater Treatment Plant (NWWTP), per these specifications.

214.2.1 The project located at the City of Tulsa’s Northside Wastewater Treatment Plant’s DAF facility, consists of removing and replacing the existing progressive cavity pump assembly components in the basement of the DAF facility with the proposed. The project includes the correct and complete installation of new pumps, discharge connections and valves, piping modifications, and piping supports as specified herein. The installation includes connection of new pumps to existing controls and disconnects with new cable. It also includes removal and replacement of seal water piping. All work shall be performed in conformance with the manufacturer’s instructions and recommendations for installation, subsequent testing of the new units, and ensuring they are in proper operation, including proper function with the NWWTP’s SCADA system.

214.2.2 Existing pump assemblies to be replaced, locations and the proposed pump assemblies installation locations are shown on the accompanying WPC20-3 drawing sheets designated as 214.2A and 214.2B.

214.2.3 Contractor shall be knowledgeable about and shall field verify all elevations and dimensions of existing piping and equipment that in any way bears on the removal of the existing equipment and installation of the proposed equipment. Work shall be based on field measurements. The Authority will make available the information it has pertaining to the existing equipment.

214.2.4 Project work shall include all materials, equipment, labor, and supervision, necessary to complete the project as specified herein, including but not limited to any and all crane work, rigging, delivery and complete installation of components to fully operational and warrantable condition.

214.2.5 Contractor shall submit work plan acceptable to the Engineer describing the duration and sequence of work. Plan shall be approved prior to commencement of work. All work requiring flow stoppage or equipment removed from service must be scheduled 48 hours in advance with Plant Superintendent. Contractor shall have the pumps, controls, and other materials as necessary at the installation site prior to any flow stoppage. It is the contractor’s responsibility to prepare the system being worked on for disassembly. This includes coordinating with plant operations the closing of
upstream/downstream valves and pumping down any reservoirs necessary. It is the responsibility of the contractor to bypass any flow during the construction. The Plant Superintendent will instruct the contractor on where to direct bypassed flow.

214.2.5.1 Contractor shall be responsible for providing temporary discharge piping or any modifications needed to reuse existing discharge piping for temporary bypass pumping.

214.2.5.2 All unneeded equipment and debris from any work shall become the responsibility of the contractor and shall be removed from the site and disposed of properly.

214.2.6 The proposed DAF Thickened Sludge pumps shall be progressive cavity pumping units. The progressive cavity pumps shall be specifically designed to pump waste solids at heavy consistencies without plugging or dewatering of the solids. Pumps shall be a model NEMO NM063SY01L07V.2 progressive cavity pumping units manufactured by NETZSH, Inc. or model BN 70-6LS/ A1-C1-L8-F0-GA progressive cavity pumping units manufactured by SEEPEX that meets the following requirements:

214.2.6.1. **Conditions of Operation:** Each pump shall be capable of providing the following hydraulic conditions:

<table>
<thead>
<tr>
<th>Design Conditions</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Flow:</td>
<td>175 GPM</td>
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<tr>
<td>Differential Pressure:</td>
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<td>Suction Pressure:</td>
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<td>Discharge Pressure:</td>
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<td>Maximum Pump Speed:</td>
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<tr>
<td>Service Voltage:</td>
<td>3ph, 60HZ, 230/460V</td>
</tr>
<tr>
<td>Minimum Motor Size:</td>
<td>10.0 HP</td>
</tr>
</tbody>
</table>

214.2.6.2 **Housing:**

214.2.6.2.1 The pump casing shall be designed for the type of service specified and shall be of sufficient strength, weight,
and metal thickness to ensure long life, accurate alignment, and reliable operation. The suction casing shall be constructed of close-grained cast iron and have three clean out ports, two 180 degrees apart accessing the drive joint. The third shall allow access to the rotor joint. Stamped or formed metal is not acceptable.

214.2.6.2.2: The casing shall have multiple connections for vents, drains, and gauges. Connections to allow for rotation of housing as needed.

214.2.6.2.3: The suction and discharge connections shall be ANSI/B16.1 flanges sized for the pump specified. The discharge flange shall have a vent/gauge connection that can be rotated in 90 increments. The discharge support feet shall be separate from the discharge flange.

214.2.6.2.4: The pump shall be supplied with adequate NPT connections for stuffing box drainage, pump drainage, flushing, and gauge connections.

214.2.6.2.5: The drain port shall be at the lowest point in the housing to ensure it completely drains regardless of the orientation of the housing.

214.2.6.2.6: Provide 2 square hand-hole side plates on each side of the pump, 180° apart, large enough to permit easy inspection of the drive shaft joint and mechanical seal and servicing of pump.

214.2.6.2.7: There shall be a top inspection cover integral to the design to allow for inspection of rotor joint and clean out of the suction body. The body shall maintain and contain remaining pump components and structural integrity of the pump.
214.2.6.2.8: Pump suction housing shall have a minimum of two support feet to support potential pipe stress and ensure proper reassembly during maintenance.

214.2.6.3 **Stator:**

214.2.6.3.1: The pump’s stator shall be formed from Buna-n rubber inside a two piece metal shell.

214.2.6.3.2: The stator rubber shall be made and blended specifically designed for PC pumps.

214.2.6.3.3: Stator shall be designed to allow a minimum nominal pump pressure capability of 90 PSI.

214.2.6.3.4: The removal of the rotor and stator (together as one assembly) shall not require any disconnection of the suction or discharge piping. Pump shall be full service in place. Deviations or special adaptors are not allowed.

214.2.6.4 **Rotor:**

214.2.6.4.1: The rotor shall be precision machined from tool steel with a chromium content of 11-13.5% hardened to a Rockwell C hardness of C57-60 and then covered with heavy layers of hard chrome plating.

214.2.6.4.2: The removal of the rotor shall not require any disconnection of the suction or discharge piping. Pump shall be full service in place. Deviations or special adaptors are not allowed.

214.2.6.4.3: Rotor rotation shall be counter clockwise, to the left if looking from the drive end.

214.2.6.4.4: The rotor shall be longer than the stator when assembled to ensure maximum usage and complete sealing line of stator from both ends. Rotors shorter or that do not
extend out the end of the stator when assembled are not acceptable.

214.2.6.4.5: The removal of the rotor shall not require any disconnection of the suction or discharge piping. Deviations or special adaptors are not allowed.

214.2.6.4.6: Removal of the stator shall include the rotor joint for complete inspection.

214.2.6.4.7: Access to rotor disconnection area shall have a minimum of 2" of accessibility from all angles to allow for easy servicing.

214.2.6.5 Universal Joint:
214.2.6.5.1: The rotor shall be connected to the drive shaft by means of a connecting rod with high strength, shock resistant universal joints. The universal joints shall be a sealed Pin type, lubricated by oil. Gear joints are not acceptable.

214.2.6.5.2: The sealed pin type universal joints shall be factory lubricated with oil and completely sealed from the abrasive fluid being pumps.

214.2.6.5.2: The pin shall be contained by means of 316SS sleeve, sealed by o-rings and be held in place by a circle clip.

214.2.6.6 Drive Train:
214.2.6.6.1: The rotor shall be driven by means of a heavy duty sealed drive train. The rotor shall be joined to the drive shaft by means of a connecting rod with sealed pin type universal joints at each end.

214.2.6.6.2: The connecting rod shall be two-piece design to allow for the rotor and stator to be removed from the suction housing. Disassembly of a joint is not acceptable.
214.2.6.6.3: The connecting rod shall be joined and driven by harden pins. Using screws or bolts to transfer rotational thrust is not acceptable.

214.2.6.6.4: The sealed pin type universal joints shall be factory lubricated with oil and completely sealed from the abrasive fluid being pumps, utilizing a metal cover over the pin and flexible rubber seal on the connecting rod end.

214.2.6.6.5: The joint seal shall not employ sacrificial parts such as clamp bands and shall not require special tools to assemble.

214.2.6.6.6: To optimize seal and pin joint life, the connecting rod shall be of sufficient length to maintain its operating angle within 1 degree. Flexishafts, cardin joints, gear joints, and unsealed pin joints are not acceptable.

214.2.6.7 Shaft Seal:

214.2.6.7.1: The pumps shall be fitted with a double cartridge seal with Tungsten Carbide Seal stationary face and Carbon rotating faces with 316SS metal parts. Seals shall be Eagle Burgmann Cartex Dual Seals or approved equal. Seal plans already in place with water pressure limited to 15psi above the suction pressure.

214.2.6.7.2: The mechanical seal shall be inside mounted, in the pedestal area and allow for the drive shaft to be removed with or without removing the cartridge seal.

214.2.6.8 Pump Drive Shaft:

214.2.6.8.1: The drive shaft shall be of the solid drive shaft design in order to avoid clogging and/or trapping of solids, which could either interrupt the movement of the connecting rod or disturb the seal of the rear joint. Maximum shaft deflection under normal operating conditions shall not exceed
0.002". Hollow or telescoping designed drive shafts are not acceptable.

214.2.6.8.2: The drive shaft shall be solid mounted in two ball or tapered roller bearings. The Anti-Friction Bearing Manufacturer's Association minimum B-10 life expectancy of the bearings shall be in excess of 100,000 hours at the maximum operating conditions of this Specification.

214.2.6.8.3: The universal joint head shall be removable from the drive shaft to allow access to the stuffing box or mechanical seal without disturbing the drive end of the pump.

214.2.6.9 **Coupling:**

214.2.6.9.1: The belt driven pump, sheaves and belt shall be protected by an OSHA coupling guard.

214.2.6.9.2: The pump shall be in the piggyback orientation and driven by a 1:1 gear reducer and direct coupled with a C-face motor to the gearbox.

214.2.6.9.3: The gearbox and motor frame shall be capable of allowing adjustment and tightening of the belt.

214.2.6.10 **Pump Performance:** The suction body of the pump shall be oversized at the entrance of the rotor and stator pumping elements to allow the free flow of high solids materials. The rotor joint head shall be set back from the stator and the leading edge of the stator shall be chamfered so not to restrict the flow into the pumping elements. If the pump does not incorporate the aforementioned features, the use of a rag deflector shall be required.

214.2.6.11 **Gear Motor Features:** The motor to be manufactured by Nord or approved equal and to meet the following specifications.
Power: 10 HP  
Voltage: 230-460/3/360  
Service Factor: 1.15  
Speed: 1765 rpm  
Duty: S1, Continuous  
Insulation: Class F  
Enclosure: TEFC-IP55  
Other: 5:1, Constant Torq, Inverter Duty, IE3 Premium Efficient, NEMA Rated with Thermostat  
Output Speed: 77/383 rpm  
Ratio: 4.61  
Input Speed: 1765 rpm  
Service Factor: 1.4  
Output Torque: 1646 lb-in  
Output Shaft: Solid Keyed

Autovent

214.2.6.13 **Pump Accessories:**

**214.2.6.13.1:** Dry Run Protection - The pump shall have a PT100 thermistor probe model STP2 or STP3 as manufactured by NETZSCH Pumps North America mounted in the stator and Omron thermal controller mounted in the control panel to allow for the ability to shut down the pump on dry run conditions.

**214.2.6.3.2:** Pressure Protection - The pump system shall have an adjustable pressure cut-off sensor that shuts down the pump if the pressure rises above the set point.

214.2.7 Seal Water System: Remove and replace seal water system piping as shown on accompanying WPC20-3 drawing sheets designated as 214.2A and 214.2B.

214.2.8 Disconnects: All work is to be in compliance with National Electric Code, NFPA 70. All work is to be in compliance with OSHA Standards. Disconnect switches must be installed in accordance with OSHA Standard 1910.147 and designed to accept a lockout device. Disconnect switch will be stainless
steel construction meeting NEMA 4X standards.

214.2.9 The proposed pumps and motors shall be installed to work with existing control systems, including the NSWWTP’s SCADA system.

214.2.10 The contractor shall dispose of all parts of the existing pump systems deemed unnecessary to the plant. The Plant Superintendent shall specify which parts of the existing pump are to be salvaged.

214.2.11 Contractor shall use caution to avoid damage to existing power and data cables. Existing power and data cables running from MCC and PLC to control boxes shall not be replaced unless damaged. Contractor shall be responsible for any damage to existing electrical equipment or power cables.

214.2.12 Contractor shall change out and provide the piping necessary to connect the proposed pumps into the existing hard piping systems.

214.2.13 **PIPING MODIFICATION:**

Existing thickened sludge line piping may be reused. However, contractor shall furnish and install new pipes, hangers and all appurtenances necessary to complete the installation. Couplings shall be re-aligned after grouting. Final coupling misalignment shall be within one-half of the coupling manufacturer’s allowable tolerance.

Existing Plant Effluent Water shall be removed and replaced with like-kind. The new piping shall be painted per manufacturer’s recommendation and the following requirements:

- Piping shall be primed with Tnemec Series 27 F.C. Typoxy, or approved equal to a nominal dry film thickness (DFT) of 4.0 mils.
- Piping shall be painted with a second (top) coat of Tnemec Series 27 F.C. Typoxy, or approved equal to a nominal dry film thickness (DFT) of 4.0 mils.
- Top Coat shall be Purple (Pantone 522) per the Oklahoma Department of Environmental Quality (DEQ) Title 252, Chapter 656, Section 252:656-27-4. In addition, piping shall have orange bands that are six (6) inches wide and spaced along the pipe at five (5) foot intervals.
- The following language: “CAUTION: RECLAIMED WATER-DO NOT DRINK.” shall be provided on the pipe near the equipment.
served, adjacent to valves, at each branch or tee, and at least every 50 feet in straight runs of pipe and be per Department of Environmental Quality (DEQ) Title 252, Chapter 656, Section 252:656-27-4. Additionally, the capital letters, “PEW”, shall be centered at intervals evenly spaced between the “CAUTION: RECLAIMED WATER-DO NOT DRINK” language along straight runs and as possible at branches or tees. Lettering shall be painted or stenciled on piping.

214.2.14 PIPING SUPPORT ADDITIONS: Existing thickened sludge line piping shall have two additional pipe supports installed in the locations shown on drawing sheet WPC20-3 214.2B. Pipe supports shall match existing pipe supports.

214.2.15 TAGGING: Contractor shall supply equipment tags to be mounted on the equipment. Tags shall show the City of Tulsa’s Equipment ID number for each pump (as listed below). The tags shall be visible without the need to “hunt” for the tags and shall be viewable and readable from eye level. Tags shall be made to conform to Section 215.1.4 of these specifications.

Equipment ID Tag Numbers:

Thickened Sludge Pump #1 N070-DAF-TSP01
Thickened Sludge Pump #2 N070-DAF-TSP02

214.2.16 TESTING. The pumps shall be installed in strict conformance with the manufacturer’s recommendations, which are to be submitted with the shop drawings. After completion of the installation, the equipment shall be tested by the Contractor under actual operating conditions. An Authorized Manufacturer’s Representative shall do onsite verification of pumps at Start-Up.

END OF SECTION
214.3 All materials, labor, equipment, and supervision required for removal and replacement of two (2) fill gate actuators at the Northside Wastewater Treatment Plant (NWWTP) Flat Rock Creek Flow Equalization Basin (FEB) wet well, per these specifications.

214.3.1 The project located at the City of Tulsa’s Northside Wastewater Treatment Plant’s Flat Rock Creek FEB, consists of removing and replacing the existing fill gate actuators of the Flat Rock Creek FEB with the proposed. The project includes the correct and complete installation of new actuators, as specified herein. This includes connection of new actuators to existing gate stems and ensuring proper function. All work shall be performed in conformance with the manufacturer’s instructions and recommendations for installation, subsequent testing of the new units, and ensuring they are in proper operation, including proper function with the NWWTP’s SCADA system.

214.3.2 Existing gate actuators to be replaced, their locations are shown on the accompanying WPC20-3 drawing sheets designated as 214.3A thru 214.3B.

214.3.3 Contractor shall be knowledgeable about and shall field verify all elevations and dimensions of existing equipment that in any way bears on the removal of the existing equipment and installation of the proposed equipment. Work shall be based on field measurements. The Authority will make available the information it has pertaining to the existing equipment.

214.3.4 Project work shall include all materials, equipment, labor, and supervision, necessary to complete the project as specified herein, including but not limited to any and all crane work, rigging, delivery and complete installation of components to fully operational and warrantable condition.

214.3.5 Contractor shall submit work plan acceptable to the Engineer describing the duration and sequence of work. Plan shall be approved prior to commencement of work. All work requiring flow stoppage or equipment removed from service must be scheduled 48 hours in advance with Plant Superintendent. Contractor shall have the actuators and other materials as necessary at the installation site prior to any work on removal of existing equipment. It is the contractor’s responsibility to prepare the system being worked on for disassembly. This includes coordinating with plant operations the closing of upstream/downstream valves and pumping down any reservoirs necessary. It is the responsibility of the contractor to bypass any flow into the wet well during the construction. The Plant Superintendent will instruct the contractor on where to direct bypassed flow.
214.3.5.1 Contractor shall be responsible for providing temporary discharge piping or any modifications needed to reuse existing discharge piping for temporary bypass pumping.

214.3.5.2 All unneeded equipment and debris from any work shall become the responsibility of the contractor and shall be removed from the site and disposed of properly.

214.3.6 The proposed gate actuators shall be three-phase electronic, non-intrusive type gate actuators designed for adaptation to existing operable 48” sluice gates using wiring as recommended by the manufacturer. Actuators shall comply with AWWA C540/542 and be Flowserve/Limitorque System MX units or Auma that meet the following requirements:

214.3.6.1 **Motor:**

The motor shall be three-phase/60-cycle 460V with Class F insulation and a thermistor embedded within the motor windings to prevent damage due to overload. The motor shall be easily removed through the use of a plug-in connector and shaft coupling.

214.3.6.2 **Power Transmission:**

The power transmission shall be completely bearing-supported and consist of a hardened alloy steel worm and bronze alloy worm gear, oil-bath lubricated using a synthetic oil designed specifically for extreme pressure gear transmission service.

214.3.6.3 **Sensors:**

214.3.6.3.1 Valve position shall be sensed by a 15-bit, optical, absolute position encoder. Open and closed positions shall be stored in permanent, nonvolatile memory. The encoder shall measure valve position at all times, including both motor and handwheel operation, with or without three-phase power present, and without the use of a battery.

214.3.6.4.2 An electronic torque sensor shall be included. The torque limit may be adjusted from 40-100% of rating in 1% increments. The motor shall be deenergized if the torque limit is exceeded. A boost function shall be included to
prevent torque trip during initial valve unseating and during extreme arctic temperatures (-50°C), and a “Jammed Valve” protection feature, with automatic retry sequence, shall be incorporated to deenergize the motor if no movement occurs.

214.3.6.4 **Electronics:**

214.3.6.4.1: The control module shall include power and logic circuit boards, control transformer, and protection fuses, all mounted to a steel plate and attached in the control compartment with captive screws. The module shall be easily removed through the use of plug-in connectors. The module shall also include a reversing contactor, local control switches, 32-character LCD, and LED indicators. All internal wiring shall be flame-resistant, rated 105°C, and UL listed.

214.3.6.4.2: The LCD module shall use solid-state Hall-effect devices for local communication and configuration. The use of reed switches for this purpose on the LCD module is prohibited.

214.3.6.4.3: The reversing contactor shall be mechanically interlocked to prevent simultaneous energizing of the open and close coils. The control module shall also include an auto reversal delay to inhibit high current surges caused by rapid motor reversals. The control transformer shall include vacuum-impregnated coils and dual primary fuses. A phase correction circuit shall be included to correct motor rotation faults caused by incorrect site wiring. The phase correction circuit shall also detect the loss of a phase and disable operation to prevent motor damage.

214.3.6.4.4: Remote control may be configured as 2, 3, or 4 wires for open-stop-close control. Terminals must also be provided for ESD (Emergency Shutdown) and Inhibit Movement commands. The ESD signal shall override any existing signal (except LOCAL, STOP, and INHIBIT) and send the valve to its configured emergency position. The ESD may be configured to override LOCAL, STOP, and/or INHIBIT. Remote control functions may be powered by external 24 VDC, 125 VAC, or the actuator’s internal supply.
of 110 VAC or 24 VDC. The internal supplies shall be protected against overcurrent and short circuit faults.

214.3.6.4.5: Terminals shall be included to connect the electronic controls package, including display, to a back-up 24 VDC power source.

214.3.6.4.6: A dedicated circuit to prevent undesired valve operation in the event of an internal circuit fault or erratic command signal shall be included. An open or short-circuit in the internal circuit board logic shall not energize the motor contactor, nor shall a single fused control relay contact fail to deenergize the motor contactor. The command inputs shall be optically coupled and require a pulse width of at least 250 ms to 350 ms to turn on or off. In the event of an internal circuit fault, an alarm shall be signaled by tripping the Monitor Relay and through LCD indication.

214.3.6.4.7: A pad lockable LOCAL-STOP-REMOTE switch and an OPEN-CLOSE switch shall be included for local valve actuator control. The control switches shall not penetrate the controls cover and shall be designed to electrically isolate the actuator’s internal components from the external environment. The OPEN-CLOSE switch may be configured for maintained or push-to-run (inching) control.

214.3.6.4.8: Four latched contacts rated 250VAC/30VDC, 5 amps shall be provided for remote indication of valve position, configured as 1-N/O and 1-N/C for both the open and closed positions. The contacts may be configured to represent any other actuator status; mid-travel position, switched to local, over torque, motor overtemperature, manual operation, switched to remote, switched to stop, valve moving, close torque switch, open torque switch, hardware failure, ESD active, inhibit active, or valve jammed.

214.3.6.4.9: A monitor relay shall be included and shall trip when the actuator is not available for remote operation. Both N/O and N/C contacts shall be included, rated 250 VAC/30 VDC, 5 amps. The yellow LED shall blink when the monitor relay is active.
214.3.6.4.10: A 32-character, Liquid Crystal Display (LCD) shall be included to display valve position as a percent of open, 0-100%, and current actuator status. “STATUS OK” shall be displayed for an operable actuator. If the actuator is not operable, the appropriate alarm shall be displayed. The alarm shall be continuously displayed until the actuator is operable. Red, green, and yellow LEDs shall be included for open, close, stopped, and moving indication.

214.3.6.4.11: Diagnostic facilities shall be included to accumulate and report the performance of the motor, encoder, contactor, cycle time, handwheel operations, actuator ID, firmware revision, and output turns. In addition, a torque profile of the reference baseline valve stroke and the last valve stroke shall be included. All diagnostic information shall be displayed on the LCD.

214.3.6.5 Calibration: All calibration shall be possible without removing any covers and without the use of any special tools. All calibration shall be performed by answering the “YES” and “NO” questions displayed on the LCD. “YES” is signaled by using the OPEN switch and “NO” by using the CLOSE switch, as indicated adjacent to the switches. A configurable password option shall be available to prevent unauthorized changes.

214.3.6.6 Site Connections: All customer connections shall be located in a terminal chamber that is separately sealed from all other actuator components. Site wiring shall not expose actuator components to the environment. The internal sealing within the terminal chamber is suitable for NEMA 4, 6, and IP68. The chamber shall include screw-type terminals, three power and 50 control, for site connections. Three conduit entries, available as: (2) - 1.25” NPT (M32) and (1)-1.5” NPT (M40) shall be located in the terminal chamber.
214.3.6.7  **Physical Attributes:**

**214.3.6.7.1:** The actuator shall be coated with a polymer powder coat. The coating system shall be suitable for an ASTM B117 salt spray test of 1500 hours. External fasteners shall be high-strength carbon steel, zinc plated, chromate-hexavalent coated, and then top coated with a high-strength, high-endurance polymer. The fasteners shall be suitable for an ASTM B117 salt spray test of 500 hours.

**214.3.6.7.2:** A handwheel and declutch lever shall be provided for manual operation. The handwheel shall not rotate during electric operation nor can a seized motor prevent manual operation. Changing from motor to manual operation is accomplished by engaging the declutch lever. Energizing the motor shall return the actuator to motor operation. The declutch lever is pad lockable in the motor position.

**214.3.6.8.3:** The actuator shall include a removable bushing to mate with the valve shaft.

214.3.6.8  **Design and Quality Control:**

**214.3.6.8.1:** Every actuator shall be factory tested to verify: rated output torque, output speed, handwheel operation, local control, control power supply, valve jammed function, all customer inputs and outputs, motor current, motor thermistor, LCD and LED operation, direction of rotation, microprocessor checks, and position-sensor checks. A report confirming successful completion of testing shall be included with the actuator.

**214.3.6.8.2:** All actuator designs shall have been tested to demonstrate electromagnetic compatibility with the following:

- Machinery; EN 60204 EMC
- EMC; EN 50081-1 & 2
- Applicable Emissions Standards; EN 50011:1998
- Conducted emissions; EN 55011:1998 & FCC Part 15, subpart J
• Applicable Immunity Standards; IEC EN 61000-6-1:2001
• ESD; IEC 61000-4-1:1995
• Radiated RF Immunity; IEC 61000-4-3:1995
• Fast Transients and Bursts; IEC 61000-4-4:1995
• Voltage Surges; IEC 61000-4-5:1995
• Conducted RF Immunity; IEC 61000-4-6:1996
• Magnetic Field Immunity; IEC 61000-4-8:1993
• Voltage Dips and Interrupts; IEC 61000-4-11:1994
• Vibration and seismic capability shall be in accordance with MILSTD-167, IEEE-344-1975, and IEC68-2-6.
• The actuator shall be tagged with CE mark per compliance with directives 89/336/EEC and 98/37/EEC.

214.3.6.8.3: Actuators shall be designed for open/stop/close service with local control stations and the existing NSWWTP Scada System.

214.3.7 Proposed gate actuators shall be installed and connected to the existing power supply that is 480v, 60Hz, 3 phase. The proposed actuators shall be installed to work with existing control systems, including the NSWWTP’s SCADA system.

214.3.8 All actuators, material and equipment to be salvaged shall be removed carefully to prevent damage, and then delivered to an area designated by the Plant Superintendent on site. The contractor shall dispose of all parts of the existing actuator deemed unnecessary to the plant. The Plant Superintendent shall specify which parts of the existing pump are to be salvaged.

214.3.9 Contractor shall use caution to avoid damage to existing power and data cables. Existing power and data cables running from MCC and PLC to control boxes shall not be replaced unless damaged. Contractor shall be responsible for any damage to existing electrical equipment or power cables.

214.3.10 TAGGING: Contractor shall supply equipment tags to be mounted on the Hand/Off Auto controls directly above the wet well. Tags shall show the City of Tulsa’s Equipment ID number for each pump (as listed below) as well as a designation as to which pump in the wet well corresponds to which Equipment ID number. The tags shall be visible without the need to “hunt” for the tags and shall be viewable and readable from eye level. Tags shall
be made to conform to Section 215.1.4 of these specifications.

Equipment ID Tag Numbers:

Gate Actuator #1    N131-FEB1-SGT01
Gate Actuator #2    N131-FEB1-SGT02

**214.3.11 TESTING.** The actuators shall be installed in strict conformance with the manufacturer’s recommendations, which are to be submitted with the shop drawings. After completion of the installation, the equipment shall be tested by the Contractor under actual operating conditions. An Authorized Manufacturer’s Representative shall do onsite verification of actuators at Start-Up.

END OF SECTION
214.4 All materials, labor, equipment, and supervision required for removal and replacement of two (2) submersible diversion pumps at the Northside Wastewater Treatment Plant (NWWTP) Mingo Flow Equalization Basin (FEB) wet well, per these specifications.

214.4.1 The project located at the City of Tulsa’s Northside Wastewater Treatment Plant’s Mingo FEB, consists of removing and replacing the existing submersible diversion pump assembly components in the wet well of the Mingo FEB with the proposed. The project includes the correct and complete installation of new pumps, discharge connections and valves, and rails, as specified herein. It also includes connection of new pumps to existing controls and disconnects with new cable. All work shall be performed in conformance with the manufacturer’s instructions and recommendations for installation, subsequent testing of the new units, and ensuring they are in proper operation, including proper function with the NWWTP’s SCADA system.

214.4.2 Existing pump assembly to be replaced, its location and the proposed pump assembly installation location are shown on the accompanying WPC20-3 drawing sheets designated as 214.4A thru 214.4C.

214.4.3 Contractor shall be knowledgeable about and shall field verify all elevations and dimensions of existing piping and equipment that in any way bears on the removal of the existing equipment and installation of the proposed equipment. Work shall be based on field measurements. The Authority will make available the information it has pertaining to the existing equipment.

214.4.4 Project work shall include all materials, equipment, labor, and supervision, necessary to complete the project as specified herein, including but not limited to any and all crane work, rigging, delivery and complete installation of components to fully operational and warrantable condition.

214.4.5 Contractor shall submit work plan acceptable to the Engineer describing the duration and sequence of work. Plan shall be approved prior to commencement of work. All work requiring flow stoppage or equipment removed from service must be scheduled 48 hours in advance with Plant Superintendent. Contractor shall have the pumps, controls, and other materials as necessary at the installation site prior to any flow stoppage. It is the contractor’s responsibility to prepare the system being worked on for disassembly. This includes coordinating with plant operations the closing of upstream/downstream valves and pumping down any reservoirs.
necessary. It is the responsibility of the contractor to bypass any flow into the wet well during the construction. The Plant Superintendent will instruct the contractor on where to direct bypassed flow.

214.4.5.1 Contractor shall be responsible for providing temporary discharge piping or any modifications needed to reuse existing discharge piping for temporary bypass pumping.

214.4.5.2 Contractor shall clean out wet well, as needed, to facilitate work, including dewatering.

214.4.5.3 All unneeded equipment and debris from any work shall become the responsibility of the contractor and shall be removed from the site and disposed of properly.

214.4.6 The proposed diversion pumps shall be angleflow submersible pumping units. The submersible pumps shall be specifically designed to pump waste solids at heavy consistencies without plugging or dewatering of the solids. Pumps shall be a model 12” D5731MV angleflow submersible pumping units manufactured by Fairbanks Morse that meets the following requirements:

214.4.6.1. **Conditions of Operation:** Each pump shall be capable of providing the following hydraulic conditions:

<table>
<thead>
<tr>
<th>Design Conditions</th>
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<tr>
<td>Flow:</td>
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<tr>
<td>4,500 GPM</td>
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<tr>
<td>Head:</td>
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<tr>
<td>Minimum Pump Efficiency:</td>
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<td>Maximum Pump Speed:</td>
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<td>880 RPM</td>
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<tr>
<td>Maximum Nameplate Motor HP:</td>
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<td>40</td>
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<tr>
<td>Maximum Shutoff Head:</td>
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</table>

214.4.6.2 **Impeller:**

**214.4.6.2.1:** The Impeller shall be one piece, single suction, enclosed 3-vane, radial flow design with well-rounded leading vane edges and thick hydrofoil shape which prevents the accumulation of solids and stringy material through the impeller. It is to be dynamically balanced and secured to the shaft by means of a key and fastener.
214.4.6.2.2: Wiper vanes are not allowed. The impeller waterways and clearance between the impeller periphery and volute cutwater shall be capable of passing a 4.5” sphere.

214.4.6.3 Volute and Sliding Bracket:
214.4.6.3.1: The volute is to be cast of extra thick walls made of close-grained cast iron conforming to ASTM A48, Class 30. It is to be one-piece, constant velocity equalizing pressure with smooth fluid passages large enough to pass any size solid that can pass through the impeller. The volute shall have an integral tapered suction inlet area to direct flow to the impeller eye and have a centerline flanged discharge. Volute discharge shall be minimum 16” diameter as measured on the inside diameter of the discharge flange opening.

214.4.6.3.2: The sliding bracket assembly shall be a part of the pumping unit constructed so that when lowered to the discharge base/elbow, the knifing action of the vertical metal-to-metal seal provides a self-cleaning, non-clogging, non-sparking UL Listed explosion-proof assembly.

214.4.6.4 Guide Rail/Bracket: Two (2) stainless steel rails shall be provided to guide each pump when being raised or lowered in the sump and mount on the discharge base/elbow. Single rail or cable guide systems are not acceptable. The rails shall align the pump with the discharge elbow as it is lowered into place. A stainless steel upper guide rail bracket shall be furnished to support and align the rails at the top of the sump. For rail lengths greater than 20 feet, a stainless steel intermediate rail guide bracket shall be included.

214.4.6.5 Wear Rings: A. Radial type removable wear rings are to be provided on both the impeller and suction head. They shall provide a seal between the impeller and fronthead for reduction of recirculation. The impeller wear ring shall be approximately 50 Brinell softer than the fronthead wear ring.

214.4.6.6 Discharge Base: The installation shall include a rigid discharge base elbow to support the total weight of the pumping unit. The base is to be bolted directly to the floor.
with the 90 degree elbow having a 125# ANSI flange discharge vertically.

### 214.4.6.7 Submersible Electric Motor/Pump:

#### 214.4.6.7.1: Each submersible solids-handling pump shall be driven by a completely sealed, electric submersible squirrel cage induction motor, 1.15 service factor, 460 volts, 3 phase, 60 Hertz power. The motor nameplate horsepower rating shall not be exceeded by the brake horsepower requirements at any head and capacity condition on the operating curve.

#### 214.4.6.7.2: The submersible motor shall be UL Listed for Class I, Division 1, Group C and D explosion-proof hazardous locations as defined by the National Electric Code. All electrical parts shall be housed in an air-filled, cast iron, water-tight enclosure which is sealed by the use of O-rings and shall have rabbet joints with an extra large overlap.

#### 214.4.6.7.3: The stator-winding and lead shall be insulated with moisture-resistant Class F insulation for continuous duty in 40 Degree C rise liquids. The motor shall be designed for continuous duty capable of minimum of ten (10) starts per hour. The motor shall not draw more than the nominal listed motor HP at rated voltage on point on the operating curve. Automatic reset, normally closed thermal overloads shall be imbedded in the motor winding to provide overheating protection. Motor winding thermostats shall be connected to an electrical controller per local and state codes, and the National Electric Code.

#### 214.4.6.7.4: Motor shaft shall be 316 stainless steel. Carbon steel shafts or shaft sleeves are not acceptable. The rotor is to be dynamically balanced to meet NEMA vibration limits; all hardware to be stainless steel. Cable leads are to allow the connection of a cable to the motor, to be accomplished in the field without soldering cable. All leads are to be sealed and designed to prevent cable-wicking to conduit box located on top of the motor. The sealing system shall consist of a rubber grommet followed by epoxy that is high in adhesive qualities and has a low coefficient of expansion. Each cable wire is to have a small section of insulation removed to
establish a window area of bare wire and each wire is to be untwisted and surrounded by epoxy potting material. A cable strain relief mechanism shall be an integral part of the sealing system. Cable sealing system shall be capable of withstanding an external pressure test of 1200 PSI as well as a cable assembly pull test as required of Underwriters Laboratories. Singular grommet or other similar sealing systems are not acceptable. Motor shall be supplied with 30 feet of multi-conductor type “SOW-A” or “W” power cable and control cable. Cable sizing shall conform to NEC specifications and be UL listed.

214.4.6.7.5: Power and control leads shall be terminated on a sealed terminal board. The terminal board and its bronze lugs shall be O-ring sealed.

214.4.6.7.6: Each pump shall be provided with two separate tandem-mounted mechanical seals to prevent the pumped liquid from entering the rotor/stator cavity area to ensure reliability of operation. The upper and lower seals are mounted to rotate in the same direction. The mechanical seals must be commercially available and manufactured by a major seal manufacturer such as John Crane or equal.

214.4.6.7.7: The upper seal is to be completely immersed in an oil bath and seals the oil chamber and the motor housing. The lower seal mating surfaces are to be immersed in the oil bath sealing the pump volute and the oil chamber. Each seal shall be held in contact by its own spring system and require neither maintenance nor adjustment, but shall be easily inspected and replaceable. The lower seal spring shall be protected from trash in the pumped fluid by a spring cover, which extends over the entire length of the compressed seal spring. Pressure generated by the pump assists in sealing the mating surfaces of the lower seal.

214.4.6.7.8: Seal materials for the upper and lower seals shall be stainless steel and Buna-N components. The upper seal shall have the carbon rotating face rotating against a Ni-Resist stationary face. The lower seal shall have a silicon carbide rotating face against a tungsten carbide stationary
face. Reference Section 214.4.6.8 for more on mechanical seal requirements.

214.4.6.7.9: Two moisture detection probes shall be installed so that they will detect moisture in either the seal or stator cavity measuring resistivity between the probes. They shall be wired internally to the control cable connection at the top of the motor. Float type devices located in the rotor/stator area or single probe-to-ground moisture detectors measuring continuity are not acceptable. O-ring sealed inspection plugs shall be provided in the mechanical seal oil chamber for ease in inspection, draining, and filling of oil.

214.4.6.7.10: The pump shall rotate on a minimum of two bearings permanently lubricated but capable of being re-greased, suitable for a minimum L10 bearing life of 40,000 hours. All mating surfaces shall be machined and fitted and sealed with O-rings. Fittings shall be accomplished by metal-to-metal contact between each machine surface, resulting in controlled compression with O-rings, without requirement of a specific torque limit. No secondary sealing compound shall be used.

214.4.6.7.11: A heavy-duty stainless steel lifting bail shall be included and be of adequate strength to lift the entire pump and motor assembly.

214.4.6.7.12: A Stainless Steel Nameplate shall be attached to each pump giving the manufacturer's model and serial number, rated capacity, head, speed and all pertinent data.

214.4.6.8 Mechanical Seals:

214.4.6.8.1: The mechanical seal and support system shall be designed to ensure fluid film stability, to minimize the effect of erosion of the component parts, and to ensure that process dilution is minimized.

214.4.6.8.2: The mechanical seal face materials shall be Tungsten Carbide vs. Tungsten Carbide

214.4.6.8.3: All mechanical seal metallic seal components shall be constructed of stainless steel.

214.4.6.8.4: Elastomers shall be constructed of Aflas. Elastomers are not to fret the shaft sleeve OD.
214.4.6.8.5: Mechanical seals shall be equivalent of ANSI standard dual cartridge seals, AESSEAL CDSA, or equal. The inboard seal faces shall operate on a clean barrier water fluid, pressurized to a minimum of 15 PSI greater than the maximum process pressure in the pump seal chamber. The inboard seal face shall be pressure balanced to the barrier fluid with approximately a 30 / 70 (process / barrier) pressure balance. The seal face drive mechanism should be metal against metal for durability. The seal environment shall be protected by a close clearance between the back plate and the rotating shaft on the process side of the seal. The optimal diametrical clearance shall be 0.125”, and this closed frame plate configuration shall be designed for the purpose of reducing the velocity of the process slurry in the seal housing.

214.4.6.8.6: Each mechanical seal shall be individually serialized with a unique reference number, and that detail to be permanently electrochemically etched on the seal gland.

214.4.6.8.7: Each mechanical seal to be statically air tested to API 682 pressure test parameters.

214.4.6.8.8: Vendor shall supply: Mechanical Seal GA certified drawing and Seal Support System certified drawing. Installation instructions shall be included with each seal in shipping box. Installation instructions for system installation shall be provided separately prior to construction phase and detail mounting position relative to pump seal.

214.4.7 Proposed pumping units shall be installed and connected to the existing power supply that is 480v, 60Hz, 3 phase through receptacles on the existing control panel using a switch-rated disconnect plug and receptacle. The switch-rated disconnect plug and receptacle shall be UL 1682 listed and shall be model DSN60 manufactured by Meltric, or approved equal. New power cables shall be six (6) feet longer than what is required by the manufacturer, coiled and hung with a stainless steel hanger. The proposed pumps and motors shall be installed to work with existing control systems, including the NSWWTP’s SCADA system.

214.4.8 Where possible, existing fasteners may be used to install the new pump and rails. New fasteners shall be used as necessary to complete the
All fasteners shall be 316 stainless steel and a nickel based anti-seize shall be applied to threaded fasteners during assembly.

214.4.9 All pump, material and equipment to be salvaged shall be removed carefully to prevent damage, and then delivered to an area designated by the Plant Superintendent on site. The contractor shall dispose of all parts of the existing pump deemed unnecessary to the plant. The Plant Superintendent shall specify which parts of the existing pump are to be salvaged.

214.4.10 Contractor shall use caution to avoid damage to existing power and data cables. Existing power and data cables running from MCC and PLC to control boxes shall not be replaced unless damaged. Contractor shall be responsible for any damage to existing electrical equipment or power cables. Power and data cables between control boxes and pumps shall be new.

214.4.11 Contractor shall change out and provide the piping necessary to connect the proposed pumps into the existing hard piping systems, including new base elbow and eccentric reducer.

214.4.12 Contractor shall provide and attach a lifting chain to the top of each pump. The length of the chain shall extend from the pump’s location in the bottom of the wet well to six (6) feet above the top of the wet well cover grate. The chain shall be Grade 30 Proof Coil Size 3/16 inch, 316 SS, for corrosion resistance.

214.4.13 PIPING MODIFICATION: Existing piping may be reused. However, contractor shall furnish and install new pipes, hangers and all appurtenances necessary to complete the installation. Couplings shall be re-aligned after grouting. Final coupling misalignment shall be within one-half of the coupling manufacturer’s allowable tolerance.

214.4.14 TAGGING: Contractor shall supply equipment tags to be mounted on the Hand/Off Auto controls directly above the wet well. Tags shall show the City of Tulsa’s Equipment ID number for each pump (as listed below) as well as a designation as to which pump in the wet well corresponds to which Equipment ID number. The tags shall be visible without the need to “hunt” for the tags and shall be viewable and readable from eye level. Tags shall be made to conform to Section 215.1.4 of these specifications.
Equipment ID Tag Numbers:

- Diversion pump #4 N133-FEB1-SBM04
- Diversion pump #5 N133-FEB1-SBM05

214.4.15 TESTING. The pumps shall be installed in strict conformance with the manufacturer’s recommendations, which are to be submitted with the shop drawings. After completion of the installation, the equipment shall be tested by the Contractor under actual operating conditions. An Authorized Manufacturer’s Representative shall do onsite verification of pumps at Start-Up.

END OF SECTION
214.5 All materials, labor, equipment, and supervision required for removal and replacement of all diffuser assemblies in the Northside Wastewater Treatment Plant (NWWTP) Aeration Basin #2, per these specifications.

214.5.1 The project located at the City of Tulsa’s Northside Wastewater Treatment Plant’s Aeration Basin #2, consists of removing and replacing all existing diffuser assembly components in Aeration Basin #2 with the proposed. The project includes the correct and complete installation of new diffuser assemblies, as specified herein. All work shall be performed in conformance with the manufacturer’s instructions and recommendations for installation, including, but not limited to, use of lubricant and tools recommended. Furthermore, subsequent testing of the new units, ensuring they are in proper operation shall be completed.

214.5.2 Existing diffuser assemblies to be replaced location and the proposed diffuser assembly installation location are shown on the accompanying WPC20-3 drawing sheets designated as 214.5A thru 214.5J.

214.5.3 Contractor shall be knowledgeable about and shall field verify all elevations and dimensions of existing equipment that in any way bears on the removal of the existing diffuser assemblies and installation of the proposed diffuser assemblies. Work shall be based on field measurements and counts. The City will provide the information it has pertaining to the existing equipment.

214.5.4 Project work shall include all materials, equipment, labor, and supervision, necessary to complete the project as specified herein, including but not limited to any and all crane work, rigging, delivery and complete installation of components to fully operational and warrantable condition.

214.5.5 Contractor shall submit work plan acceptable to the Engineer describing the duration and sequence of work. Plan shall be approved prior to commencement of work. All work requiring flow stoppage or basin removed from service must be scheduled four (4) weeks in advance with Plant Superintendent. Contractor shall have materials as necessary at the installation site prior to any flow stoppage. It is the contractor’s responsibility to prepare the system being worked on for disassembly. This includes coordinating with plant operations the closing of upstream/downstream valves and pumping down any reservoirs necessary. It is the responsibility of the contractor to bypass any flow during construction. The Plant Superintendent will instruct the contractor on where to direct bypassed flow.
214.5.5.1 All unneeded equipment and debris from any work shall become the responsibility of the contractor and shall be removed from the site and disposed of properly.

214.5.6 The proposed diffuser assemblies shall be 9” membrane disc diffuser elements to be installed in the existing diffuser holders. Membrane disc diffuser to match the existing diffuser holder and base plate in order to allow proper fit of the membrane to ensure performance, secure connection and adequate seal on o-ring. Retainer rings shall be replaced as part of the diffuser assemblies. Diffuser Assemblies shall be model Silver Series II 9” Membrane Disc Diffusers manufactured by Sanitaire, or approved equal, that meets the following requirements:

a. Incorporate an integral check valve into the membrane diffuser.

b. Design and test diffusers for a dynamic wet pressure (DWP) of 12 inches ± 20% water column @ 1.0 SCFM/diffuser and 2 inches submergence.

c. Visual Uniformity – Observe diffusers for uniform air distribution across the active surface of the diffuser at 1.0 SCFM/diffuser and 2 inches submergence. Active surface is defined as the perforated horizontal projected area of the diffuser.

d. Quality Control – Test diffuser using primary sampling criteria outlined in Military Standard 105E.

e. Manufacture circular membrane diffuser discs with integral O-ring of EPDM synthetic rubber compound with precision die formed slits. Thermoplastic materials (i.e. plasticized PVC or polyurethane) are not acceptable.

f. Add carbon black to the material for resistance to ultraviolet light.

g. Design diffuser as one-piece injection molded part with a minimum thickness of 0.080 inches for 9 inch diameter unit.

h. Limit the maximum tensile strength of the diffuser to 10 psi when operating at 2.4 SCFM/sq. ft. of material. Furnish proportionately thicker material for larger diameter disc diffusers to limit the maximum tensile stress and to resist stretching.
i. Produce diffusers free of tears, voids, bubbles, creases or other structural defects.

j. Furnish diffuser material to meet the following:

<table>
<thead>
<tr>
<th>Item</th>
<th>Value/Units</th>
<th>ASTM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Base Polymer</td>
<td>EPDM</td>
<td>D573</td>
</tr>
<tr>
<td>UV Resistance</td>
<td>Carbon Black</td>
<td></td>
</tr>
<tr>
<td>Specific Gravity</td>
<td>1.25 or less</td>
<td></td>
</tr>
<tr>
<td>Durometer – Minimum</td>
<td>58% ± 5%</td>
<td>D2240</td>
</tr>
<tr>
<td>Modulus of Elasticity</td>
<td>500 psi</td>
<td>D412</td>
</tr>
<tr>
<td>Ozone Resistance (72 hrs: 40°C pphm)</td>
<td>No cracks  @ 2X magnification</td>
<td>D1171</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Test A</td>
</tr>
<tr>
<td>Tensile Strength</td>
<td>1200 psi</td>
<td>D412</td>
</tr>
<tr>
<td>Elongation - %</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Retained 70 hrs @ 100°C</td>
<td>75% Max</td>
<td>D573</td>
</tr>
<tr>
<td>- minimum at break</td>
<td>350%</td>
<td>D412</td>
</tr>
</tbody>
</table>

214.5.7 INSTALLATION: Diffuser Assemblies and Retainer Rings shall be installed per manufacturers instructions including the following noted steps and concerns.

1. Before installation on a given row of diffusers, Contractor is to remove the diffusers to be replaced and flush out existing piping.

2. **It is extremely important not to over-torque the retainer rings during installation.**

3. Contractor is to report any assemblies that are missing plates, so that City personnel can purchase for replacement.

4. Contractor to report any existing diffuser holders or piping that has existing damage, so that City personnel can purchase for replacement. Contractor will be responsible for any existing holders or piping that is damaged during install.

214.5.8 TESTING: The diffuser assemblies shall be installed in strict conformance with the manufacturer’s recommendations, which are to be submitted with the shop drawings. After completion of the installation, the diffuser assemblies shall be tested by the Contractor under actual operating conditions. An Authorized Manufacturer’s Representative shall do onsite verification of diffusers at Start-Up and provide a report on transfer efficiency.

END OF SECTION
214.6 All materials, labor, equipment, and supervision required for improvements (painting) to all of the walls in the basement of the DAF facility at the City of Tulsa Northside Wastewater Treatment Plant, per these specifications, which shall include the following.

1. Complete surface preparation and Coating of all of the walls in the DAF facility basement per attached Drawing WPC 20-3 214.6A per the following.

214.6.1 Surface Preparation: Existing walls shall be cleaned as required by coating manufacturer and as follows.
   A. Remove all loose paint.
   B. All surfaces must be clean, dry and free of oil, grease and other contaminants before commencing coating.

214.6.2 Spot Priming: All locations where existing paint is removed during surface preparation must be spot primed as required by coating manufacturer and as follows.
   A. Apply Waterborne Cementitious Acrylic at a rate of 60-80 square feet per gallon.
   B. Waterborne Cementitious Acrylic shall be as recommended by first and second coat manufacturer.
   C. Waterborne Cementitious Acrylic shall be allowed time to cure per manufacturer's recommendation before any first coat or second coat is applied.
   D. Waterborne Cementitious Acrylic shall be Tnemec Series 130 Envirofill, or approved equal.

214.6.3 First Coat: Existing walls shall be painted with a first coat as directed by manufacturer and as follows.
   A. Apply Waterborne Acrylic Epoxy to a nominal dry film thickness (DFT) of 4.0-6.0 mils.
   B. Waterborne Acrylic Epoxy shall be compatible with the Waterborne Cementitious Acrylic primer as recommended by the primer manufacturer.
   C. Waterborne Acrylic Epoxy shall not be applied to Cementitious Acrylic primer until the primer is cured per manufacturer's recommendation.
   D. Waterborne Acrylic Epoxy shall be allowed time to cure per manufacturer's recommendation before a second coat or any other work is performed.
   E. Waterborne Acrylic Epoxy shall be Tnemec Series 114 H.B. Tneme-Tufcoat, or approved equal.

214.6.4 Second Coat: Existing walls shall be painted with a second coat as directed by manufacturer and as follows.
A. Apply second coat of Waterborne Acrylic Epoxy to a nominal dry film thickness (DFT) of 4.0-6.0 mils.

B. Waterborne Acrylic Epoxy shall be compatible with the Waterborne Cementitious Acrylic primer and first coat as recommended by the manufacturer.

C. The second coat of Waterborne Acrylic Epoxy shall not be applied until the first coat is cured per manufacturer’s recommendation.

D. The second coat of Waterborne Acrylic Epoxy shall be allowed time to cure per manufacturer’s recommendation before any further work is performed.

E. Waterborne Acrylic Epoxy shall be Tnemec Series 114 H.B. Tneme-Tufcoat, or approved equal.

214.6.5 Quality Assurance

A. Quality assurance procedures and practices shall be utilized to monitor all phases of surface preparation, application and inspection throughout the duration of the project. Procedures or practices not specifically defined herein may be utilized provided they meet recognized and accepted professional standards and are approved by the Engineer.

B. No coating or paint shall be applied: When the surrounding air temperature or the temperature of the surface to be coated or painted is below the minimum surface temperature for the products specified herein; or when the surrounding air temperature is wet or damp (5° F. or less) above the dew point; or when the air temperature is expected to drop below specified minimum temperature within six hours after application of coating. Dew point shall be measured by use of an instrument such as a Sling Psychrometer in conjunction with U. S. Department of Commerce Weather Bureau Psychrometric Tables. If above conditions are prevalent, coating or painting shall be delayed or postponed until conditions are favorable. The day’s coating or painting shall be completed in time to permit the film sufficient drying time prior to damage by atmospheric conditions. When necessary for proper application, a temporary enclosure shall be erected and kept heated until the coating has fully cured.

C. Thickness of coatings and paint shall be checked with a non-destructive thickness gauge. The integrity of coated interior surfaces shall be tested with an approved inspection device.
E. The Contractor shall furnish, until final acceptance of coating and paint, inspection devices in good working condition for detection of dry film thickness of coating and paint.

Dry film thickness gauges shall be made available for the Engineer's use at all times until final acceptance of application. All inspection and testing shall be witnessed by the Engineer. All inspection and testing shall be recorded and a copy turned in to the Engineer at the weekly progress meetings. The original shall be kept onsite for review.

F. Warranty inspection shall be conducted during the eleventh month following completion of all coating and painting work. All defective work shall be repaired in accordance with this specification and to the satisfaction of the Engineer/Owner.

G. The coating manufacturer shall observe the surface preparation, mixing and application of the coating systems and submit a written report of what has been observed and any additional recommendations.

H. The Contractor's coating and painting equipment shall be designed for application of material specified and shall be maintained in first class working condition. Compressors shall have suitable traps and filters to remove water and oils from the air. The Contractor's equipment shall be subject to approval of the Engineer.

214.6.6 PROTECTION OF PROPERTY

A. The protection of City, State and Government equipment, fences, gates, signs, and other City property is of prime importance, and if the same be damaged, destroyed or removed, they shall be repaired, replaced, or paid for by the Contractor. Disturbance to this property must first be approved by the agency that controls it.

214.6.7 PROTECTION OF MATERIALS

A. All materials and equipment delivered to the site of the work shall be adequately housed and protected against damage or deterioration according to standard accepted procedures. The Contractor shall keep his storage yards in good order, arrange his materials neatly, and protect them from damage.
B. All coatings and paints shall be stored in enclosed structures to protect them from weather and excessive heat or cold. Flammable coatings or paint must be stored to conform to City, County, State and Federal safety codes for flammable coating or paint materials. At all times coatings and paints shall be protected from freezing.

214.6.8 REFERENCES TO APPLICATION SPECIFICATIONS

A. Thinning shall be permitted only as recommended by the manufacturer and approved by the Engineer.

B. Each application of coating or paint shall be applied evenly, free of brush marks, sags, runs, with no evidence of poor workmanship. Care shall be exercised to avoid lapping on glass or hardware. Coatings and paints shall be sharply cut to lines. Finished surfaces shall be free from defects or blemishes.

C. Protective coverings or drop cloths shall be used to protect floors, fixtures and equipment. Care shall be exercised to prevent coatings or paints from being spattered onto surfaces that are not to be coated or painted. The Contractor shall be responsible for correcting and repairing any damage resulting from its or its subcontractor’s operations. Surfaces from which materials cannot be removed satisfactorily shall be recoated or repainted as required to produce a finish satisfactory to the Engineer.

D. When two coats of coating or paint are specified, where possible, the first coat shall contain sufficient approved color additives to act as an indicator of coverage or the two coats must be of contrasting color.

E. Film thickness per coat specified in Section 214 or per the manufacturer’s specifications is the minimum required. If roller application is deemed necessary, the Contractor shall apply additional coats to achieve the specified thickness.

F. All material shall be applied as specified.

214.6.9 CLEAN-UP

A. Immediately upon completion of the work at the site location in the contract, the Contractor shall remove all excess materials, equipment, tools, and debris.
Coating or paint spots, oil or stains upon adjacent surfaces shall be removed and the jobsite cleaned. All damage to surfaces resulting from the work of this section shall be cleaned, repaired, or refinished to the satisfaction of the Engineer at no cost to the Owner. Paint chips and all debris are to be collected and disposed of in accordance with all City, County, State and Federal regulations.

END OF SECTION
214.7 All materials, labor, equipment, and supervision required for improvements (painting) to the existing piping in the basement of the DAF facility at the City of Tulsa Northside Wastewater Treatment Plant, per these specifications, which shall include the following.

1. Complete surface preparation and Coating of the Plant Effluent Water (PEW), Dewatering, Thickener Effluent, WAS, Air and Drain Systems per attached Drawings WPC 20-3 214.7A thru B, including piping, supports, valves, operators, couplings and miscellaneous.

214.7.1 Surface Preparation: Existing piping shall be cleaned as required by coating manufacturer and as follows.
A. All piping, valves, supports, operators, couplings and miscellaneous of each system shall be High Pressure Powerwashed clean and allowed to dry followed by SSPC SP-2 &SP3 handtool and powertool cleaning of rusted or corroded areas.
B. All surfaces must be clean, dry and free of oil, grease and other contaminants before commencing coating.

214.7.2 Surface Priming: Existing piping shall be primed as required by coating manufacturer and as follows.
A. All piping, valves, supports, operators, couplings and miscellaneous of each system shall have an epoxy primer applied to a nominal dry film thickness (DFT) of 4.0 mils.
B. Epoxy primer shall be as recommended by final top coat manufacturer.
C. Epoxy primer shall be allowed time to cure per manufacturer’s recommendation before any second coat or topcoat is applied.
D. Epoxy primer shall be Tnemec Series 27 F.C. Typoxy, or approved equal.

214.7.3 Topcoat: Existing piping shall be painted with a second (top) coat as directed by manufacturer and as follows.
A. All piping, valves, supports, operators, couplings and miscellaneous of each system shall have an epoxy topcoat applied to a nominal dry film thickness (DFT) of 4.0 mils.
B. Epoxy topcoat shall be compatible with the Epoxy primer as recommended by topcoat and primer manufacturer.
C. Epoxy topcoat shall not be applied to epoxy primer until epoxy primer is cured per manufacturer’s recommendation.
D. Epoxy topcoat shall be allowed time to cure per manufacturer’s recommendation before any further work, such as directional arrows, lettering, stripes, etc. is performed.
E. Epoxy topcoat shall be Tnemec Series 27 F.C. Typoxy, or approved equal.

214.7.4 Colors and Markings: Existing piping shall be identified with lettering or tags designating the service of each piping system, shall be marked with flow directional arrows, and shall be color coded as found on Drawings WPC 19-3 214.7 A thru C, and as follows.

A. PEW System: All PEW System piping, valves, supports, operators, couplings and miscellaneous shall be color coded and marked as follows.

1. Color Coding: Topcoat shall be Purple (Pantone 522) per the Oklahoma Department of Environmental Quality (DEQ) Title 252, Chapter 656, Section 252:656-27-4. In addition, piping shall have orange bands that are six (6) inches wide and spaced along the pipe at five (5) foot intervals.

2. Lettering: The following language: “CAUTION: RECLAIMED WATER-DO NOT DRINK.” shall be provided on the pipe near the equipment served, adjacent to valves, at each branch or tee, and at least every 50 feet in straight runs of pipe and be per Department of Environmental Quality (DEQ) Title 252, Chapter 656, Section 252:656-27-4. Additionally, the capital letters, “PEW”, shall be centered at intervals evenly spaced between the “CAUTION: RECLAIMED WATER-DO NOT DRINK” language along straight runs and as possible at branches or tees. Lettering shall be painted or stenciled on piping. Lettering shall be white. Reference Table 1 for lettering size requirements.

3. Flow Arrows: PEW System piping shall not have flow arrows.

B. WAS System: All WAS System piping, valves, supports, operators, couplings and miscellaneous shall be color coded and marked as follows.

1. Color Coding: Topcoat shall be Tnemec Peach Tea (34BR) or equivalent color.

2. Lettering: Lettering shall be provided on the pipe near the equipment served, adjacent to valves, at each branch or tee, and at least every 50 feet in straight runs of pipe. Lettering shall be as on existing piping and as directed by Engineer. Lettering shall be painted or stenciled on piping. Lettering shall be white. Reference Table 1 for lettering size requirements.

3. Flow Arrows: Flow arrows shall be in the direction of flow and shall be located six inches from the lettering on the flow direction side (i.e. flow arrows shall point away from lettering). Flow arrows shall be white.
C. Dewatering and Thickener Effluent Systems: All Dewatering and Thickener Effluent System piping, valves, supports, operators, couplings and miscellaneous shall be color coded and marked as follows.

1. Color Coding: Topcoat shall be Tnemec Beige (44 BR) or equivalent color.

2. Lettering: Lettering shall be provided as directed by Engineer. Lettering shall be as on existing piping and as directed by Engineer. Lettering shall be painted or stenciled on piping. Lettering shall be black. Reference Table 1 for lettering size requirements.

3. Flow Arrows: Flow arrows shall be in the direction of flow and shall be located six inches from the lettering on the flow direction side (i.e. flow arrows shall point away from lettering). Flow arrows shall be black.

D. Air Systems: All Air System piping, valves, supports, operators, couplings and miscellaneous shall be color coded and marked as follows.

1. Color Coding: Topcoat shall be Spearmint Green/Safety (09SF) or equivalent color.

2. Lettering: Lettering shall be provided as directed by Engineer. Lettering shall be as on existing piping and as directed by Engineer. Lettering shall be painted or stenciled on piping. Lettering shall be black. Reference Table 1 for lettering size requirements.

3. Flow Arrows: Flow arrows shall be in the direction of flow and shall be located six inches from the lettering on the flow direction side (i.e. flow arrows shall point away from lettering). Flow arrows shall be black.

E. Drain Systems: All Drain System piping, valves, supports, operators, couplings and miscellaneous shall be color coded and marked as follows.

1. Color Coding: Topcoat shall be No. 2 Pencil (47GR) or equivalent color.

2. Lettering: Lettering shall be provided as directed by Engineer. Lettering shall be as on existing piping and as directed by Engineer. Lettering shall be painted or stenciled on piping. Lettering shall be white. Reference Table 1 for lettering size requirements.

3. Flow Arrows: Flow arrows shall be in the direction of flow and shall be located six inches from the lettering on the flow direction side (i.e. flow arrows shall point away from lettering). Flow arrows shall be white.
Table 1: Lettering Dimensions

<table>
<thead>
<tr>
<th>Outside Pipe Diameter</th>
<th>Minimum Height of Letters</th>
</tr>
</thead>
<tbody>
<tr>
<td>5/8 inch and smaller</td>
<td>Metal Tags – 1/4 inch</td>
</tr>
<tr>
<td>3/4 to 1-1/4 inches</td>
<td>1/2 inch</td>
</tr>
<tr>
<td>1-1/2 to 2 inches</td>
<td>3/4 inch</td>
</tr>
<tr>
<td>2-1/2 to 6 inches</td>
<td>1-1/4 inches</td>
</tr>
<tr>
<td>8 to 10 inches</td>
<td>2-1/2 inches</td>
</tr>
<tr>
<td>Over 10 inches</td>
<td>3-1/2 inches</td>
</tr>
</tbody>
</table>

214.7.5 Quality Assurance

A. Quality assurance procedures and practices shall be utilized to monitor all phases of surface preparation, application and inspection throughout the duration of the project. Procedures or practices not specifically defined herein may be utilized provided they meet recognized and accepted professional standards and are approved by the Engineer.

B. Surface preparation will be based upon comparison with “Pictorial Surface Preparation Standards for Painting Steel Surfaces” SSPC-Vis-1 and ASTM Designation D2200; “Standard Methods of Evaluating Degree of Rusting on Painted Steel Surfaces: SSPC-Vis-1 and ASTM Designation D610; Visual Standard for Surfaces of New Steel Airblast Cleaned and Sand Abrasive.”

C. No coating or paint shall be applied: When the surrounding air temperature or the temperature of the surface to be coated or painted is below the minimum surface temperature for the products specified herein; or when the surrounding air temperature is wet or damp (5° F. or less) above the dew point; or when the air temperature is expected to drop below specified minimum temperature within six hours after application of coating. Dew point shall be measured by use of an instrument such as a Sling Psychrometer in conjunction with U. S. Department of Commerce Weather Bureau Psychrometric Tables. If above conditions are prevalent, coating or painting shall be delayed or postponed until conditions are favorable. The day’s coating or painting shall be completed in time to permit the film sufficient drying time prior to damage by atmospheric conditions. When
necessary for proper application, a temporary enclosure shall be erected and kept heated until the coating has fully cured.

Application of the first coat shall follow immediately after surface preparation and cleaning and before rust bloom occurs. Any cleaned areas not receiving first coat within this period shall be re-cleaned prior to application of first coat.

D. Thickness of coatings and paint over steel substrates shall be checked with a non-destructive, magnetic-type thickness gauge. Use an instrument such as a Tooke Gauge if a destructive tester is deemed necessary. The integrity of coated interior surfaces shall be tested with an approved inspection device. Non-destructive holiday detectors shall not exceed 67.5 volts nor shall destructive holiday detectors exceed the voltage recommended by the manufacturer of the coating system.

For thicknesses between 10 and 20 mils (250 microns and 500 microns) a non-sudsing type wetting agent, such as Kodak Photo-Flo, shall be added to the water prior to wetting the detector sponge. All pinholes shall be marked, repaired in accordance with the manufacturer's printed recommendations and retested. No pinholes or other irregularities will be permitted in the final coating.

E. The Contractor shall furnish, until final acceptance of coating and paint, inspection devices in good working condition for detection of holidays and measurement of dry film thickness of coating and paint. The Contractor shall also furnish U.S. Department of Commerce, National Bureau of Standards certified thickness gauges and certified instrumentation to test accuracy of holiday detectors.

Dry film thickness gauges and holiday detectors shall be made available for the Engineer's use at all times until final acceptance of application. All inspection and testing shall be witnessed by the Engineer. All inspection and testing, including daily weather conditions, shall be recorded and a copy turned in to the Engineer at the weekly progress meetings. The original shall be kept onsite for review.

F. Warranty inspection shall be conducted during the eleventh month following completion of all coating and painting work. All defective work shall be repaired in accordance with this specification and to the satisfaction of the Engineer/Owner.
G. The coating manufacturer shall observe the surface preparation, mixing and application of the coating systems and submit a written report of what has been observed and any additional recommendations.

H. The Contractor’s coating and painting equipment shall be designed for application of material specified and shall be maintained in first class working condition. Compressors shall have suitable traps and filters to remove water and oils from the air. The Contractor’s equipment shall be subject to approval of the Engineer.

214.7.6 PROTECTION OF PROPERTY

A. The protection of City, State and Government equipment, fences, gates, signs, and other City property is of prime importance, and if the same be damaged, destroyed or removed, they shall be repaired, replaced, or paid for by the Contractor. Disturbance to this property must first be approved by the agency that controls it.

B. No valve or other control on any utility main or building service line shall be operated for any purpose by the Contractor. Before painting any valve, the Contractor shall have the Engineer mark valves that shall not be painted to avoid having those valves “painted shut”.

C. At places where the Contractor’s operations are adjacent to, or crossing, the plane of railway, telegraph, telephone, electric, and gas lines, or water lines, sanitary sewers, and storm sewers, damage to which might result in expense, loss or inconvenience, work shall not be commenced until all arrangements necessary for the protection thereof have been made.

D. In the event the contractor in any way fails to comply with the requirement of protecting, repairing, and restoring of any utility or utility service, the Engineer may, upon forty-eight (48) hours notice, proceed to protect, repair, rebuild or otherwise restore such utility or utility service as may be deemed necessary, and the cost thereof will be deducted from any money due or which may become due the contractor pursuant to the terms of his contract.

214.7.7 PROTECTION OF MATERIALS

A. All materials and equipment delivered to the site of the work shall be adequately housed and protected against damage or deterioration according to standard
accepted procedures. The Contractor shall keep his storage yards in good order, arrange his materials neatly, and protect them from damage.

B. All coatings and paints shall be stored in enclosed structures to protect them from weather and excessive heat or cold. Flammable coatings or paint must be stored to conform to City, County, State and Federal safety codes for flammable coating or paint materials. At all times coatings and paints shall be protected from freezing.

214.7.8 REFERENCES TO APPLICATION SPECIFICATIONS

A. Coating and paint application shall conform to the requirements of the Steel Structures Painting Council Paint Application Specifications SSPC-SPA1, latest revision, for “Shop, Field and Maintenance Painting”, the American Water Works Association and the manufacturer of the coating and paint materials.

B. Thinning shall be permitted only as recommended by the manufacturer and approved by the Engineer.

C. Each application of coating or paint shall be applied evenly, free of brush marks, sags, runs, with no evidence of poor workmanship. Care shall be exercised to avoid lapping on glass or hardware. Coatings and paints shall be sharply cut to lines. Finished surfaces shall be free from defects or blemishes.

D. Protective coverings or drop cloths shall be used to protect floors, fixtures and equipment. Care shall be exercised to prevent coatings or paints from being spattered onto surfaces that are not to be coated or painted. The Contractor shall be responsible for correcting and repairing any damage resulting from its or its subcontractor’s operations. Surfaces from which materials cannot be removed satisfactorily shall be recoated or repainted as required to produce a finish satisfactory to the Engineer.

E. When two coats of coating or paint are specified, where possible, the first coat shall contain sufficient approved color additives to act as an indicator of coverage or the two coats must be of contrasting color.
F. Film thickness per coat specified in Section 214 or per the manufacturer’s specifications is the minimum required. If roller application is deemed necessary, the Contractor shall apply additional coats to achieve the specified thickness.

G. All material shall be applied as specified.

H. All welds and irregular surfaces shall receive a brush coat of the specific product prior to application of the first complete coat (stripe coat).

214.7.9 CLEAN-UP

A. Immediately upon completion of the work at the site location in the contract, the Contractor shall remove all excess materials, equipment, tools, and debris. Coating or paint spots, oil or stains upon adjacent surfaces shall be removed and the jobsite cleaned. All damage to surfaces resulting from the work of this section shall be cleaned, repaired, or refinished to the satisfaction of the Engineer at no cost to the Owner. Paint chips and all debris are to be collected and disposed of in accordance with all City, County, State and Federal regulations.

END OF SECTION
214.8 All materials, labor, equipment, and supervision required for removal and replacement of three (3) Saturation Valves at the Northside Wastewater Treatment Plant (NWWTP) DAF facility, per these specifications.

214.8.1 The project located at the City of Tulsa’s Northside Wastewater Treatment Plant’s DAF facility, consists of removing and replacing the existing saturation valves with the proposed. The project includes the correct and complete installation of new valves, as specified herein. The work also includes coordination with Clearstream to provide one 8-hour day of field service by their representative for on-site testing, calibration, adjustment and training over the complete saturation and DAF system after all three valves are installed.

214.8.2 Existing saturation valves to be replaced locations are shown on the accompanying WPC20-3 drawing sheet designated as 214.8A.

214.8.3 Contractor shall be knowledgeable about and shall field verify all elevations and dimensions of existing equipment that in any way bears on the removal of the existing equipment and installation of the proposed equipment. Work shall be based on field measurements. The Authority will make available the information it has pertaining to the existing equipment.

214.8.4 Project work shall include all materials, equipment, labor, and supervision, necessary to complete the project as specified herein, including but not limited to any and all crane work, rigging, delivery and complete installation of components to fully operational and warrantable condition.

214.8.5 Contractor shall submit work plan acceptable to the Engineer describing the duration and sequence of work. Plan shall be approved prior to commencement of work. All work requiring flow stoppage or equipment removed from service must be scheduled 48 hours in advance with Plant Superintendent. Contractor shall have the valves and other materials as necessary at the installation site prior to any work on removal of existing equipment. It is the contractor’s responsibility to prepare the system being worked on for disassembly. This includes coordinating with plant operations the closing of upstream/downstream valves and pumping down any reservoirs necessary.

214.8.5.1 All unneeded equipment and debris from any work shall become the responsibility of the contractor and shall be removed from the site and disposed of properly.
214.8.6 The proposed valves shall be weir style diaphragm type valves designed for use with wastewater and installed as recommended by the manufacturer. Valves shall be Dia-Flow valves model number IT252431P343226 manufactured by ITT, Inc. or approved equal that meet the following requirements:

214.8.6.1 **Body:** Cast Iron, Unlined, ANSI 125/150 RF Flanged Connections.

214.8.6.2 **Diaphragm:**
- Material: Buna-N (FDA)
- Temperature Rating: -10 to 180 degrees F

214.8.6.3 **Bonnet:** Actuated/Ductile Iron

214.8.6.4 **Actuator:** Air Motor: #25 Reverse Acting/101 Spring – Air to open, spring to close

214.8.6.5 **Mechanical Accessories:** Adjustable Travel Stop.

214.8.6.6 **Weir valve Cv Rating:** maximum 160

214.8.7 Proposed valves shall be installed and connected to the existing piping, including air supply. The proposed valves shall be installed to work with existing saturation system and shall be shown to function properly within the system.

214.8.8 All valves, material and equipment to be salvaged shall be removed carefully to prevent damage, and then delivered to an area designated by the Plant Superintendent on site. The contractor shall dispose of all parts of the existing valves deemed unnecessary to the plant. The Plant Superintendent shall specify which parts of the existing pump are to be salvaged.

214.8.9 **TAGGING:** Contractor shall supply equipment tags to be mounted on the valve body. Tags shall show the City of Tulsa’s Equipment ID number for each pump (as listed below). The tags shall be visible without the need to “hunt” for the tags and shall be viewable and readable from a ladder. Tags shall be made to conform to Section 215.1.4 of these specifications.
Equipment ID Tag Numbers:

Saturation Valve #1  N070-DAF1-DMV01
Saturation Valve #2  N070-DAF1-DMV02
Saturation Valve #3  N070-DAF1-DMV03

214.8.11 TESTING. The actuators shall be installed in strict conformance with the manufacturer’s recommendations, which are to be submitted with the shop drawings. After completion of the installation, the equipment shall be tested by the manufacturer’s representative under actual operating conditions. An Authorized Manufacturer’s Representative shall do onsite verification of valves at Start-Up. This can be completed during the 8-hour day of field service discussed in Section 214.8.1.

END OF SECTION
214.9 All materials, labor, equipment, and supervision required for removal and replacement of the roof on the West Access Building of Pipe Gallery 1 at the Northside Wastewater Treatment Plant, per these specifications.

214.9.1 The project, located at the West Access Building of Pipe Gallery 1 at the City of Tulsa’s Northside Wastewater Treatment Plant, consists of removing and replacing the existing roof with the proposed roof. The scope of work includes the following.

A. Demolition and removal of the existing roofing systems, including but not limited to the roof membrane, insulation, flashing, trim, roof penetration flashing, fasteners, soffit or other component of the roofing system for a complete replacement to new materials and warranty.

B. Protection of existing roof decking, surface mounted equipment, skylights, vents and any other roof mounted items.

C. If necessary, adjustment of roof drains, or vent pipe elevations to meet roofing manufacturer warranty requirements.

D. Contractor to dispose of any removed roofing materials and clean-up site daily.

E. Refer to Specification Section 215 for additional painting and preparation requirements.

F. Contractor work cannot impede daily function of the NSWWTP facility. Roads shall not be blocked by equipment.

214.9.2 More information regarding the scope of work is shown on the accompanying WPC20-3 drawing sheets designated as 214.9A thru 214.9B.

214.9.3 Contractor shall be knowledgeable about and shall field verify all elevations and dimensions of existing roofing and equipment that in any way bears on the removal of the existing roofing and installation of the proposed roofing. Work shall be based on field measurements. The Authority will make available the information it has pertaining to the existing equipment.

214.9.4 Project work shall include all materials, equipment, labor, and supervision, necessary to complete the project as specified herein, including but not limited to any and all crane work, rigging, delivery and complete installation.
of components to fully operational and warrantable condition.

214.9.5 Contractor shall submit work plan acceptable to the Engineer describing the duration and sequence of work. Plan shall be approved prior to commencement of work. Contractor shall coordinate this work with other work in order to minimize time equipment is out of service.

214.9.6 The Contractor shall install equipment and materials in a workmanlike manner utilizing craftsmen skilled in the particular trade. Installation practices shall conform to Manufacturer’s recommendations.

214.9.7 Manufacture Product Warranty: Contractor shall coordinate, complete Manufacture form requirements and provide the City all final warranty documentation. Payment for completed in place work shall be 90% of bid item cost and remaining 10% of bid item payment shall represent acceptable completed warranty paperwork transmitted to the City, c/o Plant Superintendent.

214.9.8 Roofing PVC or TPO membrane roof system shall be manufactured by Carlisle Syntec Systems with mechanically fastened roofing system and new built up insulation, or approved equal. All other accessories required for proper operation that meet the following specification:

- Roof area(s): Pump station roofs, see plan sheets.
- Insulation Carlisle HP-H Polyiso grade 3 or equal.
- Walk pads/Step treads Walk pads or step treads shall be provided to and from side of building to equipment. Walk pads or step treads shall be laid out around all equipment for maintenance and any roof item requiring regular or periodic maintenance.
- Color of membrane Standard color, white
- Electrical improvements: None.
- Skylight(s): None.
- Roof Mounted Mechanical: Install new flashing and sealant per roofing manufacturer’s requirements. Any laps shall be 6” min and caulked with NP or equal.
- Plumbing Vents: Install new vent pipe boot and sealant per manufacturer’s requirements.

- Hardware/fastener all shall be 316 Stainless unless specifically specified otherwise. All fasteners exposed shall be caulked.

- Fascia & drip edge Like colored anodized heavy aluminum flashing. Any laps shall be 6” min and caulked with NP-1 or equal.

- Exposed Parapet Wall Bronze colored anodized heavy aluminum flashing. Any laps shall be 6” min and caulked with NP-1 or equal.

- Adhesives, primers, bonding Per Roofing System Membrane Manufacture requirements for this project application.

- Warantee Roofing System warranty to be a minimum of 20 years.

214.9.9 **TAGGING:** No tagging is required.

END OF SECTION
214.10 All materials, labor, equipment, and supervision required for refurbishment of twelve (12) cast-in electrical boxes at the Northside Wastewater Treatment Plant (NWWTP), per these specifications.

214.10.1 The project located at the City of Tulsa’s Northside Wastewater Treatment Plant, consists of refurbishing lids (located on floor of walkways located between Aeration Basin 1&2 and Aeration Basin 3&4) of electrical boxes to bring up to original watertightness. The project also includes modifying the bottom of the electrical boxes (located on the ceiling of Pipe Gallery 1 and 2) to allow for access from the Pipe Galleries.

214.10.2 Existing electrical boxes to be refurbished, their location and the proposed refurbishment are shown on the accompanying WPC20-3 drawing sheets designated as 214.10A thru 214.10B.

214.10.3 Contractor shall be knowledgeable about and shall field verify all elevations and dimensions of existing equipment that in any way bears on the refurbishment of the existing equipment. Work shall be based on field measurements. The Authority will make available the information it has pertaining to the existing equipment.

214.10.4 Project work shall include all materials, equipment, labor, and supervision, necessary to complete the project as specified herein, including but not limited to any and all crane work, rigging, delivery and complete installation of components to fully operational and warrantable condition.

214.10.5 Contractor shall submit work plan acceptable to the Engineer describing the duration and sequence of work. Plan shall be approved prior to commencement of work.

214.10.5.1 All unneeded equipment and debris from any work shall become the responsibility of the contractor and shall be removed from the site and disposed of properly.

214.10.6 Existing lid bolts shall be replaced with 1/2” AISI 316 stainless steel bolts. Holes and tapped holes in electrical box lids and electrical boxes shall be sized accordingly. Bolts shall be countersunk in lid as to not add any trip hazards.

214.10.7 Gasket shall be full face 1/16” thick Silicone Rubber.

214.10.8 Sheet metal pans shall be fabricated to slide over existing electrical boxes and shall be constructed of minimum 16 gage sheet steel with no leak points.
at 90-degree bends, such that most moisture drains through drain holes as shown on the drawings.

214.10.9 Screw fasteners shall be minimum #10 self-drilling screws and shall be spaced a maximum of 12” o.c.

214.10.10 PVC drain pipe shall be 1/2” inside diameter Schedule 40 and shall be connected to the sheet metal pan with a manner that is water tight, such that moisture drains through the inside of the pipe.

214.10.11 TESTING. After completion of the installation, the equipment shall be tested by the Contractor under simulated heavy rain operating conditions. Engineer shall be present for testing.

END OF SECTION
214.11 All materials, labor, equipment, and supervision required for improvements (painting) to the existing piping in both Primary 1 and 2 buildings at the City of Tulsa Northside Wastewater Treatment Plant, per these specifications, which shall include the following.

1. Complete surface preparation and Coating of the Plant Effluent Water (PEW), Dewatering, Primary Sludge, and Scum Systems per attached Drawings WPC 20-3 214.11 A thru B, including piping, supports, valves, operators, couplings and miscellaneous.

214.11.1 Surface Preparation: Existing piping shall be cleaned as required by coating manufacturer and as follows.
   A. All piping, valves, supports, operators, couplings and miscellaneous of each system shall be High Pressure Powerwashed clean and allowed to dry followed by SSPC SP-2 & SP3 handtool and powertool cleaning of rusted or corroded areas.
   B. All surfaces must be clean, dry and free of oil, grease and other contaminants before commencing coating.

214.11.2 Surface Priming: Existing piping shall be primed as required by coating manufacturer and as follows.
   A. All piping, valves, supports, operators, couplings and miscellaneous of each system shall have an epoxy primer applied to a nominal dry film thickness (DFT) of 4.0 mils.
   B. Epoxy primer shall be as recommended by final top coat manufacturer.
   C. Epoxy primer shall be allowed time to cure per manufacturer’s recommendation before any second coat or topcoat is applied.
   D. Epoxy primer shall be Tnemec Series 27 F.C. Typoxy, or approved equal.

214.11.3 Topcoat: Existing piping shall be painted with a second (top) coat as directed by manufacturer and as follows.
   A. All piping, valves, supports, operators, couplings and miscellaneous of each system shall have an epoxy topcoat applied to a nominal dry film thickness (DFT) of 4.0 mils.
   B. Epoxy topcoat shall be compatible with the Epoxy primer as recommended by topcoat and primer manufacturer.
   C. Epoxy topcoat shall not be applied to epoxy primer until epoxy primer is cured per manufacturer’s recommendation.
   D. Epoxy topcoat shall be allowed time to cure per manufacturer’s recommendation before any further work, such as directional arrows, lettering, stripes, etc. is performed.
E. Epoxy topcoat shall be Tnemec Series 27 F.C. Typoxy, or approved equal.

214.11.4 Colors and Markings: Existing piping shall be identified with lettering or tags designating the service of each piping system, shall be marked with flow directional arrows, and shall be color coded as found on Drawings WPC 19-3 214.11 A thru C, and as follows.

A. PEW System: All PEW System piping, valves, supports, operators, couplings and miscellaneous shall be color coded and marked as follows.

1. Color Coding: Topcoat shall be Purple (Pantone 522) per the Oklahoma Department of Environmental Quality (DEQ) Title 252, Chapter 656, Section 252:656-27-4. In addition, piping shall have orange bands that are six (6) inches wide and spaced along the pipe at five (5) foot intervals.

2. Lettering: The following language: “CAUTION: RECLAIMED WATER-DO NOT DRINK.” shall be provided on the pipe near the equipment served, adjacent to valves, at each branch or tee, and at least every 50 feet in straight runs of pipe and be per Department of Environmental Quality (DEQ) Title 252, Chapter 656, Section 252:656-27-4. Additionally, the capital letters, “PEW”, shall be centered at intervals evenly spaced between the “CAUTION: RECLAIMED WATER-DO NOT DRINK” language along straight runs and as possible at branches or tees. Lettering shall be painted or stenciled on piping. Lettering shall be white. Reference Table 1 for lettering size requirements.

3. Flow Arrows: PEW System piping shall not have flow arrows.

B. Scum System: All Scum System piping, valves, supports, operators, couplings and miscellaneous shall be color coded and marked as follows.

1. Color Coding: Topcoat shall be Tnemec Peach Tea (34BR) or equivalent color.

2. Lettering: Lettering shall be provided on the pipe near the equipment served, adjacent to valves, at each branch or tee, and at least every 50 feet in straight runs of pipe. Lettering shall “SCUM” as directed by Engineer. Lettering shall be painted or stenciled on piping. Lettering shall be white. Reference Table 1 for lettering size requirements.

3. Flow Arrows: Flow arrows shall be in the direction of flow and shall be located six inches from the lettering on the flow direction side (i.e. flow arrows shall point away from lettering). Flow arrows shall be white.
C. Dewatering and Primary Sludge Systems: All Dewatering and Primary Sludge System piping, valves, supports, operators, couplings and miscellaneous shall be color coded and marked as follows.

1. Color Coding: Topcoat shall be Tnemec Beige (44 BR) or equivalent color.

2. Lettering: Lettering shall be provided as directed by Engineer. Lettering shall “DEWATERING” or “PRIMARY SLUDGE” as directed by Engineer. Lettering shall be painted or stenciled on piping. Lettering shall be black. Reference Table 1 for lettering size requirements.

3. Flow Arrows: Flow arrows shall be in the direction of flow and shall be located six inches from the lettering on the flow direction side (i.e. flow arrows shall point away from lettering). Flow arrows shall be black.

<table>
<thead>
<tr>
<th>Outside Pipe Diameter</th>
<th>Minimum Height of Letters</th>
</tr>
</thead>
<tbody>
<tr>
<td>5/8 inch and smaller</td>
<td>Metal Tags – 1/4 inch</td>
</tr>
<tr>
<td>3/4 to 1-1/4 inches</td>
<td>1/2 inch</td>
</tr>
<tr>
<td>1-1/2 to 2 inches</td>
<td>3/4 inch</td>
</tr>
<tr>
<td>2-1/2 to 6 inches</td>
<td>1-1/4 inches</td>
</tr>
<tr>
<td>8 to 10 inches</td>
<td>2-1/2 inches</td>
</tr>
<tr>
<td>Over 10 inches</td>
<td>3-1/2 inches</td>
</tr>
</tbody>
</table>

214.11.5 Quality Assurance

A. Quality assurance procedures and practices shall be utilized to monitor all phases of surface preparation, application and inspection throughout the duration of the project. Procedures or practices not specifically defined herein may be utilized provided they meet recognized and accepted professional standards and are approved by the Engineer.

B. Surface preparation will be based upon comparison with “Pictorial Surface Preparation Standards for Painting Steel Surfaces” SSPC-Vis-1 and ASTM Designation D2200; “Standard Methods of Evaluating Degree of Rusting on Painted Steel Surfaces: SSPC-Vis-1 and ASTM Designation D610; Visual Standard for Surfaces of New Steel Airblast Cleaned and Sand Abrasive.”
C. No coating or paint shall be applied: When the surrounding air temperature or the temperature of the surface to be coated or painted is below the minimum surface temperature for the products specified herein; or when the surrounding air temperature is wet or damp (5° F. or less) above the dew point; or when the air temperature is expected to drop below specified minimum temperature within six hours after application of coating. Dew point shall be measured by use of an instrument such as a Sling Psychrometer in conjunction with U. S. Department of Commerce Weather Bureau Psychrometric Tables. If above conditions are prevalent, coating or painting shall be delayed or postponed until conditions are favorable. The day's coating or painting shall be completed in time to permit the film sufficient drying time prior to damage by atmospheric conditions. When necessary for proper application, a temporary enclosure shall be erected and kept heated until the coating has fully cured.

Application of the first coat shall follow immediately after surface preparation and cleaning and before rust bloom occurs. Any cleaned areas not receiving first coat within this period shall be re-cleaned prior to application of first coat.

D. Thickness of coatings and paint over steel substrates shall be checked with a non-destructive, magnetic-type thickness gauge. Use an instrument such as a Tooke Gauge if a destructive tester is deemed necessary. The integrity of coated interior surfaces shall be tested with an approved inspection device. Non-destructive holiday detectors shall not exceed 67.5 volts nor shall destructive holiday detectors exceed the voltage recommended by the manufacturer of the coating system.

For thicknesses between 10 and 20 mils (250 microns and 500 microns) a non-sudsing type wetting agent, such as Kodak Photo-Flo, shall be added to the water prior to wetting the detector sponge. All pinholes shall be marked, repaired in accordance with the manufacturer's printed recommendations and retested. No pinholes or other irregularities will be permitted in the final coating.

E. The Contractor shall furnish, until final acceptance of coating and paint, inspection devices in good working condition for detection of holidays and measurement of dry film thickness of coating and paint. The Contractor shall also furnish U.S. Department of Commerce, National Bureau of Standards certified thickness gauges and certified instrumentation to test accuracy of holiday detectors.
Dry film thickness gauges and holiday detectors shall be made available for the Engineer's use at all times until final acceptance of application. All inspection and testing shall be witnessed by the Engineer. All inspection and testing, including daily weather conditions, shall be recorded and a copy turned in to the Engineer at the weekly progress meetings. The original shall be kept onsite for review.

F. Warranty inspection shall be conducted during the eleventh month following completion of all coating and painting work. All defective work shall be repaired in accordance with this specification and to the satisfaction of the Engineer/Owner.

G. The coating manufacturer shall observe the surface preparation, mixing and application of the coating systems and submit a written report of what has been observed and any additional recommendations.

H. The Contractor's coating and painting equipment shall be designed for application of material specified and shall be maintained in first class working condition. Compressors shall have suitable traps and filters to remove water and oils from the air. The Contractor's equipment shall be subject to approval of the Engineer.

214.11.6 PROTECTION OF PROPERTY

A. The protection of City, State and Government equipment, fences, gates, signs, and other City property is of prime importance, and if the same be damaged, destroyed or removed, they shall be repaired, replaced, or paid for by the Contractor. Disturbance to this property must first be approved by the agency that controls it.

B. No valve or other control on any utility main or building service line shall be operated for any purpose by the Contractor. Before painting any valve, the Contractor shall have the Engineer mark valves that shall not be painted to avoid having those valves "painted shut".

C. At places where the Contractor's operations are adjacent to, or crossing, the plane of railway, telegraph, telephone, electric, and gas lines, or water lines, sanitary sewers, and storm sewers, damage to which might result in expense, loss or inconvenience, work shall not be commenced until all arrangements necessary for the protection thereof have been made.
D. In the event the contractor in any way fails to comply with the requirement of protecting, repairing, and restoring of any utility or utility service, the Engineer may, upon forty-eight (48) hours notice, proceed to protect, repair, rebuild or otherwise restore such utility or utility service as may be deemed necessary, and the cost thereof will be deducted from any money due or which may become due the contractor pursuant to the terms of his contract.

214.11.7 PROTECTION OF MATERIALS

A. All materials and equipment delivered to the site of the work shall be adequately housed and protected against damage or deterioration according to standard accepted procedures. The Contractor shall keep his storage yards in good order, arrange his materials neatly, and protect them from damage.

B. All coatings and paints shall be stored in enclosed structures to protect them from weather and excessive heat or cold. Flammable coatings or paint must be stored to conform to City, County, State and Federal safety codes for flammable coating or paint materials. At all times coatings and paints shall be protected from freezing.

214.11.8 REFERENCES TO APPLICATION SPECIFICATIONS

A. Coating and paint application shall conform to the requirements of the Steel Structures Painting Council Paint Application Specifications SSPC-SPA1, latest revision, for “Shop, Field and Maintenance Painting”, the American Water Works Association and the manufacturer of the coating and paint materials.

B. Thinning shall be permitted only as recommended by the manufacturer and approved by the Engineer.

C. Each application of coating or paint shall be applied evenly, free of brush marks, sags, runs, with no evidence of poor workmanship. Care shall be exercised to avoid lapping on glass or hardware. Coatings and paints shall be sharply cut to lines. Finished surfaces shall be free from defects or blemishes.

D. Protective coverings or drop cloths shall be used to protect floors, fixtures and equipment. Care shall be exercised to prevent coatings or paints from being spattered onto surfaces that are not to be coated or painted. The Contractor shall
be responsible for correcting and repairing any damage resulting from its or its subcontractor’s operations. Surfaces from which materials cannot be removed satisfactorily shall be recoated or repainted as required to produce a finish satisfactory to the Engineer.

E. When two coats of coating or paint are specified, where possible, the first coat shall contain sufficient approved color additives to act as an indicator of coverage or the two coats must be of contrasting color.

F. Film thickness per coat specified in Section 214 or per the manufacturer’s specifications is the minimum required. If roller application is deemed necessary, the Contractor shall apply additional coats to achieve the specified thickness.

G. All material shall be applied as specified.

H. All welds and irregular surfaces shall receive a brush coat of the specific product prior to application of the first complete coat (stripe coat).

214.11.9 CLEAN-UP

A. Immediately upon completion of the work at the site location in the contract, the Contractor shall remove all excess materials, equipment, tools, and debris. Coating or paint spots, oil or stains upon adjacent surfaces shall be removed and the jobsite cleaned. All damage to surfaces resulting from the work of this section shall be cleaned, repaired, or refinished to the satisfaction of the Engineer at no cost to the Owner. Paint chips and all debris are to be collected and disposed of in accordance with all City, County, State and Federal regulations.

END OF SECTION
214.12 All materials, labor, equipment, and supervision required for the refurbishment of the designated concrete joints in the Flat Rock Creek Flow Equalization Basin (FEB) of the City of Tulsa’s Northside Wastewater Treatment Plant, per these specifications.

214.12.1 **EVAZOTE Expansion Joints:** Contractor shall perform refurbishment of the expansion joints as designated on Drawing WPC 20-3 214.12A and as described below:

214.12.1.1 The expansion joint refurbishment shall include widening by sawcutting the concrete as required to achieve a new expansion joint width corresponding most closely with the information shown in Table 1. Sawcut depth shall be minimum two inches (2"), and maximum three inches (3").

<table>
<thead>
<tr>
<th>Ambient Air/Ground Temperature at Time of Sawcutting (Degrees F.)</th>
<th>Total Width of Expansion Joint Opening After Sawcut (inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td>40</td>
<td>1.5</td>
</tr>
<tr>
<td>60</td>
<td>1.3</td>
</tr>
<tr>
<td>80</td>
<td>1.1</td>
</tr>
</tbody>
</table>

214.12.2.7 Following sawcutting to the prescribed width, the expansion joint openings shall be properly prepared to receive the new expansion joint material. Pressure wash and remove all foreign material from the expansion joint opening, so that the joint space and concrete surfaces are clean, and free of all foreign matter including sawcutting dust and residue, oil, grease, wax, soil, vegetation, all other loose debris. Final cleaning shall be with oil-free compressed air.

**Product:**

A. The expansion joint material shall be a preformed, impermeable, flexible, EVAZOTE joint material meeting the following requirements:

- Low density, closed cell, cross linked, ethylene vinyl acetate polyethylene copolymer foam;
- Grooves 1/8” x 1/8” x ¼” spacing on the vertical side surfaces of the bond line;
- Section dimensions: 1.56"W x 2.00"D;
- Adhered to the substrate with two-component, 100% solids modified epoxy adhesive;
- Installed recessed 1/8" below the surface of the substrate (slab); 
- Shall not protrude or deflect from its original state more than +/- ¼" during compression and tension cycles; 
- Working range of 60% compression and 30% tension; 
- Ultra-violet, weather, and wear resistant; 
- Chemical resistant to gasoline, salts, and other hazards; 
- Able to withstand internal temperatures of -70°C to 70°C;

**Quality Assurance:**
- Manufacturer shall provide documentation of a minimum of five years’ experience manufacturing for installation this type of joint system. 
- Installer shall have a minimum of five years’ experience in the installation of the joint material. 
- The joint material shall be installed in accordance with the manufacturer’s installation procedures with the bonding material as specified by the manufacturer’s installation procedures. 
- Installation shall be in one continuous operation for a continuous joint length. Splicing shall be kept at a minimum; any splicing shall be performed using heat welding method as recommended by the manufacturer. 
- It is important to clean all excess epoxy from the edges of the joint opening and from the top of the seal as soon as it is pushed into the desired depth. **DO NOT allow the epoxy to cure before cleaning and removing.**

**Delivery Storage and Handling:**
- Store material in a heated area with temperatures not less than 50°F and not to exceed 90°F.

**Warranty:**
- All material shall be warranted against defects in workmanship for a period of five (5) years.

END OF SECTION
214.98 Extra Work Allowance – $35,000.00 Lump Sum Allowance for various mechanical, electrical, plumbing, or unforeseen circumstances work not identified in the bid items.

214.98.1 The allowance shall be used for cost of materials, labor, installation, and overhead and profit for additional MEP/Unforeseen Circumstances work that is not identified in the base bid items.

214.98.2 The allowance shall be used only at the discretion of the City of Tulsa. Any allowance balance remaining at the completion of the contract will be credited back to the City of Tulsa on the final Application for Payment submitted by the contractor.

214.98.3 The contractor shall provide to the City of Tulsa representative a written request for the use of any of the allowance with a schedule of values and all associated backup information.

214.98.4 The contractor shall proceed with Extra Work included in the allowance only after receiving a written order from the City of Tulsa representative authorizing such work. Proceeding with work expected to be covered in the allowance without a written order from the City of Tulsa representative will be at the contractor’s risk. Contractor may not be paid for unapproved work/materials at the discretion of the City of Tulsa representative.

214.98.5 Any additional costs for bonds and insurance shall not be included in any Extra Work allowance because this cost is already included in the contract.

END OF SECTION
214.99 Mobilization Bid Item – A mobilization bid item is included to help cover initial costs of bonds, insurance, permits, submittal preparation and other incidental costs.

214.99.1 Payment shall be made for a Mobilization Bid Item which is intended to cover the costs of bonds, insurance, permits, submittal preparation and other incidental costs. Payment of the Mobilization Bid Item maybe be requested in full on the first payment application. The Mobilization Bid Item shall not exceed five percent (5%) of the sum of all Base Bid Items excluding the Mobilization Bid Item. Add Alternate Items are not part of the Base Bid Items.

END OF SECTION
ANCILLARY EQUIPMENT AND WORK

215 Ancillary Equipment:

215.1 Gauges: Each pump shall be provided with a combination pressure/vacuum gauge in the suction piping and a pressure gauge in the discharge piping. Gauges shall conform to ANSI/ASME B40.1 and shall be indicating dial type, with C-type phosphor bronze Bourdon tube and stainless steel rotary geared movement, or direct drive type with stainless steel helical-wound capillary tube pressure sensing element. The gauge shall have a phenolic open front turret case, and adjustable pointer, a stainless steel or phenolic ring, and an acrylic or shatterproof glass window. The dial shall be 4 ½ inches in diameter, with white background and black markings. Pointer travel shall span not less than 200 degrees or more than 270 degrees. All gauges shall be Accuracy Grade A or better. Pressure gauges shall read in pounds per square inch. Compound gauges shall read in inches of mercury vacuum and pounds per square inch. The range of each gauge shall be per pump manufacturer's recommendation.

215.1.2 Mechanical Seals and Seal Water:

215.1.2.1 All pumps shall be equipped with mechanical seals recommended by the pump manufacturer for the specific application of each pump. Contractor shall be responsible for supplying and installing a new seal water system/station with each new pump that requires seal water. The seal water station shall include an electric solenoid valve, an electric pressure switch and a pressure gauge downstream of the pump seal and a pressure gauge upstream of seal. Seal water supply for each pumping unit shall be provided with a Y-type water strainer in series with a Pressure Regulating valve (PRV) upstream of seal. The strainer/PRV combination shall have a by-pass seal water line controlled by a globe valve. See Attached seal water sketch SW1 for seal water station configuration. Seal water volume and pressure shall be as recommended by the pump manufacturer.

215.1.2.2 The new seal water station may contain components that were not originally part of an existing seal water system that
is to be demolished. It is the responsibility of the contractor to supply and install all necessary electrical components including wiring, conduit, connectors, contactors, etc... for a complete installation of the new seal water system. It may also be necessary to integrate the new seal water system components into the existing equipment control system. The contractor shall be responsible for all labor and materials required to integrate new components into the existing control system. The new seal water station electrical and control installation shall conform to the attached sketch SWE1. All electrical work on the seal water station shall conform to the General Electrical Requirements herein.

215.1.2.3 Seal water piping and accessories shall not be of a rigid PVC material. All seal water lines shall be of a flexible plastic material such as PEX with positive mechanical support for all valves and inline equipment, or it shall be of a non-corrosive metal material such as stainless steel. Seal water piping and fixtures shall be submitted according to the submittal section herein.

215.1.2.4 Some existing pumps do not have mechanical seals. Contractor shall determine from field investigations the location of seal water for those pumps. It is the responsibility of the contractor to supply and install all seal water piping, electrical work and materials, and control work and materials required to add a seal water station where one was not used for existing equipment. Locations are to be approved by the engineer.

215.1.2.5 If a new pump is installed that does not require seal water and there are existing seal water lines at the pump location, it is the responsibility of the contractor to remove existing water lines. Lines shall be removed as far up stream as possible to a point that will not interfere with water supply to other equipment. No existing lines shall be abandoned in place.
215.1.3 Valves:

215.1.3.1 All valve parts and surfaces shall be of corrosion resistant materials or have a factory applied epoxy coating sufficient to prevent corrosion in a wastewater environment. See painting/coating section for coating thickness requirements.

215.1.3.2 Plug Valves and Check Valves: Plug valves and check valves shall be of the same size, style and construction as the units being replaced. It is the responsibility of the contractor to review the existing valves and provide correct similar units. Acceptable manufacturers are Pratt, DeZurik, Clow, Val-Matic, or an approved equal.

215.1.3.3 Butterfly Valves: Butterfly valves shall be of the same size, style, and construction as the units being replaced. It is the responsibility of the contractor to review the existing valves and provide correct similar units. Acceptable manufacturers are DeZurik, Clow, Val-Matic, or an approved equal.

215.1.3.4 Gate Valves: Gate valves shall be of the same size, style and construction as the units being replaced. It is the responsibility of the contractor to review the existing valves and provide correct similar units. Acceptable manufacturers are Wey, DeZurik, or approved equal.

215.1.3.5 Plug and butterfly valves supplied with hand wheel operators that are installed more than 6'-0" above floor level shall be supplied with chain wheels and chains to allow for valve operation from the floor.

215.1.3.6 Valves and operators shall be selected by the contractor such that when installed in close proximity to one another the operators will be a sufficient distance apart to allow for uninhibited use by personnel.

215.1.4 Equipment Tagging: New equipment shall be tagged, according to the requirements listed below, with a permanent and visible tag showing the new equipment number using the City of Tulsa Equipment ID numbering system. All tags should be visible to anyone without the need to remove covers or otherwise “hunt” for the tag. See individual equipment sections for Equipment IDs for each item. Tags shall conform to the following specifications.
215.1.4.1 Requirements:

- All new equipment.
- Each new or existing ancillary device associated with the new equipment including:
  - Motor Start/Stop Switches and Electrical Disconnect Switches will have one tag identifying the equipment that it controls or provides power to.
  - Split-system HVAC equipment will have one tag on the air handling unit and another identical tag on the separate condensing unit.
  - Thermostats and Control Dampers will have one tag identifying the associated HVAC equipment.
  - For complex HVAC systems with multiple Thermostats, Control Dampers, or Water Valves; each will have two (2) tags. One tag will list the Thermostat, Control Damper, or Water Valve number and the other tag will list the associated HVAC equipment number.

215.1.4.2 Before attaching tags, Contractor will submit a table of Identification Tags to the Engineer for review. The table will list all the tags the Contractor will provide for all Bid Items and will show the following information: tag shape (rectangular or round); tag text; tag location.

215.1.4.3 Equipment tag numbering shall meet the following requirements:

**PRODUCTS**

**Equipment ID Plates**

All equipment tagged on the drawings, except for buried submerged equipment shall be provided with an Equipment ID Plate bearing the equipment tag number identified on the drawings. Equipment ID Plates shall be rectangular 3.5”x .75” and 1/16” thick laminated Blue/White, laminated impact acrylic such as Rowmark UltraMattes 322-512, or equivalent. Lettering shall be 1 line of text, centered, and white capitalized block letters .25” high and engraved to a depth of 0.08mm.

Equipment ID Plates must follow the Equipment IDing scheme.

Equipment ID Plates shall be attached with permanent adhesive.
**VALVE AND GATE EQUIPMENT ID PLATES**

**Equipment ID Plates**

All valves and gates, except buried or submerged valves, that have been assigned an Equipment ID on the Drawings or in the valve or gate schedule, shall be provided with a permanent number plate. Equipment ID Plates shall be round 1.5” and 1/16” thick laminated blue phenolic plastic engraving stock that is U/V stable. Lettering shall be in 3 sections, centered, and white capitalized block letters 3/16” high and engraved to a depth of 0.08mm.

Equipment ID Plates must follow the Equipment ID Scheme.

Equipment ID Plates shall be attached with permanent ties.

215.1.5 **Equipment Coatings:** All equipment shall be supplied with a factory applied coating sufficient to withstand a wastewater environment. Factory applied coating shall be in accordance with the painting/coating section.

215.1.6 **Equipment Installation:** All anchor bolt connections shall include the use of a washer, lock washer, and nut (without nylon or similar insert).

215.1.6.1 Installation of all equipment and related items shall be performed as directed in the manufacturer's installation instructions.
215.1.6.2 No cutting, drilling or welding of new equipment or part thereof as delivered from the manufacturer for the purpose of adapting or modifying said unit to facilitate its installation will be permitted without written prior approval by the authority.

215.1.6.3 The Contractor shall be responsible for any and all concrete modifications that may be required to install the new equipment. This shall include modifications or replacement of equipment pads and supports. All modifications shall be designed and constructed to conform to the recommendations of *ACI 302.1R-04 Guide for Concrete Floor and Slab Construction* and *ACI 301-10 Standard Specifications for Structural Concrete*. All concrete modifications and repairs shall be coated per the painting/coating section herein.

215.1.7 Equipment Start Up and performance:

215.1.7.1 All new equipment installed by the contractor must be started up and be in operational service for 48 hours with no performance issues prior to demolishing and installing like, adjacent equipment in the same system. If the new equipment exhibits any performance issues, the contractor shall repair the equipment/installation as required and begin a new 48 hour observation period.

END OF SECTION
215.2 GENERAL ELECTRICAL REQUIREMENTS:

215.2.1 Electric Code Compliance: All electrical work shall be performed in compliance with current electrical code.

215.2.2 Electrical Disconnects: All equipment installed or worked on with an electrical portion in the scope of work shall have a new local disconnect switch installed. All local disconnect switches shall be of stainless steel construction meeting NEMA 4X standards (reference Section 215.7.12.2). In the event a Class 1, Division 1 rating is required for explosion proof service, the disconnect shall meet all required ratings for Class 1, Division 1 service. Control panels that incorporate an integral disconnect will not be required to have an external disconnect.

215.2.3 Electric Motors: All electric motors shall be premium efficiency, suitable for operating the intended equipment per the equipment manufacturer’s recommendations.

215.2.4 Electrical Wiring & Related Items: Contractor shall use caution to avoid damage to existing power cables. These cables shall be reused in new equipment installation provided their reuse meets current code requirements. Contractor shall be responsible for any damage to existing electrical equipment or power cables. The contractor shall be responsible for removing the existing control system and replacing it with the new control system. No unused remnants of the existing control system shall be abandoned in place.

215.2.5 Identification: Conduits in manholes, handholes, building entrance pull boxes, junction boxes and equipment shall be provided with identification tags. Identification tags shall be 19 gage stainless steel with ½ inch stamped letters and numbers as indicated on the drawings. Identification tags shall be attached to conduits with nylon tie wraps and shall be positioned to be readily visible.

215.2.6 Rigid Steel Conduit: Rigid steel conduit shall be heavy wall, hot-dip galvanized, shall conform to ANSI C80.1, and shall be manufactured in accordance with UL 6.

215.2.7 Liquidtight Flexible Metal Conduit: Liquidtight Flexible Metal Conduit shall be hot-dip galvanized steel, shall be covered with a moisture proof polyvinyl chloride jacket, and shall be UL labeled.

215.2.8 Rigid Nonmetallic (PVC) Conduit: PVC conduit shall be heavy wall, Schedule 40, UL labeled for aboveground and underground uses, and shall conform to NEMA TC-2 and UL651.
215.2.9  **PVC-Coated Rigid Steel Conduit:**

215.2.9.1 The conduit shall be rigid steel. Before the PVC coating is applied, the hot-dip galvanized surfaces shall be coated with a primer to obtain a bond between the steel substrate and the coating. The PVC coating shall be bonded to the primed outer surface of the conduit. The bond on conduit and fittings shall be stronger than the tensile strength of the PVC coating. The thickness of the PVC coating shall be at least 40 mils.

215.2.9.2 A chemically cured two-part urethane coating, at a nominal 2 mil thickness, shall be applied to the interior of all conduit and fittings. The coating shall be sufficiently flexible to permit field bending the conduit without cracking or flaking of the coating.

215.2.9.3 Every female conduit opening shall have a PVC sleeve extending one conduit diameter or 2 inches, whichever is less, beyond the opening. The inside diameter of the sleeve shall be the same as the outside diameter of the conduit before coating. The wall thickness of the sleeve shall be at least 40 mils.

215.2.9.4 All fittings, condulets, mounting hardware, and accessories shall be PVC-coated. All hollow conduit fittings shall be coated with the interior urethane coating described above. The screw heads on condulets shall be encapsulated by the manufacturer with a corrosion-resistant material.

215.2.9.5 PVC coated rigid steel conduit shall be ETL Verified as PVC-001 and shall be manufactured by OCAL, Perma-Cote or Robroy.

215.2.10  **Aluminum Rigid Conduit System:**

215.2.10.1 The conduit shall be rigid aluminum, T-1 temper as part of electrical of an all-aluminum conduit system with couplings, bends and fittings as required. Any fasteners and other hardware shall be 316 stainless steel as required and applicable.

215.2.10.2 The conduit system shall be UL 6A and ANSI C80 5 rated for application.

215.2.10.3 Provide “seal-off” corrosion protection at all end panels, devide outlets and equipment as recommended by the conduit manufacturer.
215.2.10.4 Acceptable manufacturers are Wheatland Tube, Republic Conduit, and American Conduit by Sapa, or approved equal.

215.2.11 Conductors: All conductors in power, control and instrumentation circuits shall be identified and color coded as described herein.

215.2.11.1 Conductor Identification Number. Except for lighting and receptacle circuits, each individual conductor in power, control and instrumentation circuits shall be provided with wire identification markers at the point of termination.

215.2.11.2 The wire numbers shall be of the heat-shrinkable tube type, with custom typed identification numbers.

215.2.11.3 The wire numbers shall be as indicated on the equipment manufacturer’s drawings.

215.2.11.4 The wire markers shall be positioned to be readily visible for inspection.

215.2.12 Conductor Color Coding: Power conductors shall be color coded as indicated below. For conductors 6 AWG and smaller, the color coding shall be insulation finish color. For sizes larger than 6 AWG, the color coding may be by marking tape. The equipment grounding conductor shall be green or green with one or more yellow stripes if the conductor is insulated.

215.2.12.1 The following color coding system shall be used for Power conductors:

- 120/240V, single-phase – black, red and white
- 120/208V, three-phase – black, red, blue and white
- 120/240V, three-phase – black, orange, blue and white
- 277/480V, three-phase – brown, orange, yellow and gray

215.2.12.1.5 Where 120/240 and 120/208 volt system share the same conduit or enclosure, the neutral for either the 120/240 volt system or the 208 volt system shall be white with a permanent identifiable violet stripe.

215.2.11.2 Control and instrumentation circuit conductors shall be color coded as indicated below:
215.2.11.2.1 Multiconductor Control Cable: 600 Volt
Multiconductor 14 AWG Control Cable


215.2.11.2.3 CONDUCTOR: 14 AWG, 7 OR 19 strands, concentric-lay, uncoated copper. Maximum operating temperature 90°C dry, 75°C wet.

215.2.11.2.4 INSULATION: Polyvinyl chloride, not less than 15 mils average thickness; 13 mils minimum thickness, UL 83 Type THHN and THWN.

215.2.11.2.5 SHIELD: None.

215.2.11.2.6 JACKET: Conductor: Nylon, 4 mils minimum thickness, UL 83.

215.2.11.2.7 Cable assembly: Black, flame-retardant polyvinyl, UL 1277, applied over tape-wrapped cable core.

215.2.11.2.8 COLOR IDENTIFICATION: ICEA S-58-679, Method 1, Table 2 or ICEA S-58-679, Method 3, Table 2. White or green conductors shall not be provided. A durable marking shall be provided on the surface of the cable at intervals not exceeding 24 inches. Marking shall include manufacturer’s name, Type THWN or THHN, conductor size, number of conductors, and voltage class.

215.2.13 Signal Control Cable:


215.2.13.2 CONDUCTOR: 16 AWG, 7-strand, concentric-lay, uncoated copper. Maximum operating temperature 90°C dry, 75°C wet.

215.2.13.3 INSULATION: Polyvinyl Chloride, not less than 15 mils average thickness: 13 mils minimum thickness, UL 62, Type TFN.

215.2.13.4 LAY: Twisted pair with 1-1/2 inch to 2-1/2 inch lay.

215.2.13.5 SHIELD: Cable assembly, combination aluminum-polyester tape and 7-strand, 20 AWG minimum size, tinned copper drain wire, shield applied to achieve 100 percent cover over insulation conductors.
215.2.13.6 JACKET: Conductor. Nylon, 4 mils minimum thickness, UL 62.

215.2.13.7 Cable assembly: Black, flame-retardant polyvinyl chloride, UL 1277, applied over tape-wrapped cable core.

215.2.13.8 CONDUCTOR IDENTIFICATION: One conductor black, one conductor white.

215.2.14 Single Conductors: 600 Volt, Single Conductor Power Cable


215.2.14.4 SHIELD: None


215.2.15 Sump Pump Control Panels: Unless otherwise noted, Contractor shall provide each unit with the following system components to conform to the following specifications:

215.2.15.1 Input Disconnect: Furnish an input circuit breaker with an interrupting rating of 65,000 rms symmetrical amperes.

215.2.15.2 Control Devices: Include door mounted control and monitoring devices for each sump pump as follows:

A. “Manual-OFF-Auto” control selection
B. Maintained Emergency shutdown button – Palm press and red in color
C. Elapsed time meter; shall be non-resettable, rollover at 9999 hours showing resolution of 0.1 hours
D. Indicator lamps for Power On, Run, Phase Loss, Overload, Auto status conditions.

215.2.15.3 NEMA contactors size 1 or larger rated to handle the connected load.

215.2.15.4 Coil Voltage: 120-volts, 60-hertz.

END OF SECTION
215.3 EQUIPMENT PAINTING/COATING

215.3.1 Surface Preparation and Shop Prime Painting: All equipment and disturbed surfaces shall be cleaned and shop primed per equipment manufacturer’s recommendation as part of the work. Equipment nameplates and similar information tags shall be masked off for removal after finish coat applications.

All surface preparation for applying a specified coating system shall be done in accordance with the appropriate “Application Bulletin” from the manufacturer for the specific product specified. Equipment vendors/manufactures shall be consulted concerning the required final coating system to insure that it will be compatible with the primer coat applied at the factory, in the event that the shop applied primer coat is not removed prior to the coating installation.

215.3.2 Final Coat: Unless otherwise specified, all new equipment shall be shop or field painted with a final coat, provided all shop painted finish surfaces shall receive matching field touch-up painting as final treatment, all with a finish coat per the equipment manufacturer’s recommendation. All disturbed surfaces shall be field painted after equipment installation with a finish coat per the equipment manufacturer’s recommendation.

215.3.2.1 Disturbed surfaces will be defined as including piping between suction and discharge valves on pump assembly replacements and pipe to either side of valves on individual valve replacements. All other disturbed surfaces will be defined as existing materials adjacent to new equipment.

215.3.3 Coating Systems:

215.3.3.1 The Coating System for painting structural steel, piping, valves, etc. not exposed to sunlight shall be Sherwin-Williams Coating System Identification A-1, Alkyd 2-coat system. This system has a primer “KemKromik, Univ. Primer” and a finish coat “Industrial Urethane, Alkyd Enamel” or an approved equal. Contractor shall submit supplier information for approval prior to painting.

215.3.3.2 The Coating System for painting structural steel, piping, valves, etc. non-immersed, mildly corrosive, wet environments and not exposed to sunlight shall be Sherwin-Williams Coating System Identification E-1, Polymide Epoxy system. This system has a primer “Macropoxy 646” and a finish coat “Macropoxy 646” or an approved equal. Contractor shall submit supplier information for approval prior to painting.
215.3.3 The Coating System for painting metal surface for exterior weathering exposure in a corrosive environment shall be Sherwin-Williams Coating System Identification EU-2, Urethane Finish, Corrosive Areas 3-coat system. This system has a primer “Corothane Galvapac”, second coat “Macropoxy 646” and a finish coat “Hi-solids Polyurethane” or an approved equal. Contractor shall submit supplier information for approval prior to painting.

215.3.4 Coating System for painting metal surface for full or partial immersion service shall be Sherwin-Williams Coating System Identification E-3, Amine Epoxy Glass Flake Reinforcement. This is a two-coat system using Sher-Glass Epoxy FF. The first coat shall have a red oxide color with a dry film thickness of 10-15 mils. The second coat shall have a haze gray color. Total dry film thickness shall be 20-25 mils.

215.3.5 Paint Color Schedule (All colors and codes are Sherwin Williams. A crossover for Tnemec and Carboline is available on request.):

a. Potable Water Flyway SW6794
b. Plant Effluent Water (PEW) Blueblood SW6966 w/ Orange bands
c. Chilled Water French Roast SW6069 w/ Heartthrob SW6866 bands
d. Heating Water Supply Gray Screen SW7071 w/ White bands
e. Heating Water Return Gray Screen SW7071 w/ Black bands
f. Compressed Air Supreme Green W6442
g. Instrument Air Supreme Green SW6442
h. Blower Air Supreme Green SW6442
i. Natural Gas Heartthrob SW6866
j. Sludge Return Bagel SW6114
k. Sludge Waste Sensational Sand SW6094
l. Digested Sludge French Roast SW6069
m. Sludge Sample Web Gray SW7075 w/ Hearththrob SW6866 bands
n. Drain/Sump Web Gray SW7075
o. Raw Sewage Software SW7074
215.3.3.5.1 If the equipment or piping being painted does not fall under any of these categories, the contractor shall make the best color match to the materials being replaced and adjacent like materials.

215.3.3.6 After painting, any labeling or tags covered by the paint shall be re-applied or uncovered such that all labels are readable. In the event of new piping or equipment replacing piping or equipment with labeling, the new equipment shall be labeled to match the existing.

215.3.3.7 Equipment supplied from the manufacturer with an epoxy coating or manufactured from a corrosion resistant material (stainless steel, etc…) shall not be painted/coated after installation.

215.3.3.8 Factory applied epoxy coating systems shall be in the following thicknesses unless noted otherwise:

a. Primer Coat 3.0 to 5.0 mils
b. Finish Coat 4.0 to 6.0 mils

215.4 COATING SYSTEMS FOR INTERIOR AND EXTERIOR SURFACES:

215.4.1 System 1: Pre-Painted Existing Metals:

- Type of Structure: All exterior non-submerged process steel located above an imaginary plane 9" above high water level and miscellaneous exterior ferrous metal, pumps, motors, piping, fittings & valves, catwalks, bridges, window frames, etc.
- Surface Preparation: All surfaces shall be dry, clean and free of all contaminants. Remove all loosely adhering paint by hand or power tool cleaning per SSPC-SP2 or SP3. Apply a test patch to ensure compatibility. Remove and replace all loose, deteriorated, cracking or otherwise unsound window glazing.
- Painting system:
  - First Coat: One coat of C. Spot Prime all bare steel or areas with tight rust. Apply at 4.0-6.0 Mils DFT.
  - Second Coat: One coat of C. Apply one coat to all areas of substrate. Apply at 4.0-6.0 Mils DFT
  - Finish Coat: One coat of D. Apply to all areas of substrate. Apply at 3.0-4.0 mils DFT.
  - Total dry film thickness shall be 11.0 mils minimum.
215.4.2 **System 2: Ferrous Metal**

- **Type of Structure:** All exterior non-submerged process steel located below an imaginary plane 9” above high water level, gates, troughs, weirs, pipes, fittings, baffles, aerators, air diffusers, underside of digester covers, pumps, flights, skimming arms, and MCC buildings.
- **Surface Preparation:** Remove all foreign contaminants to meet SSPC-SP 1 Standard. Abrasive blast to meet SSPC-SP10 Near White Metal Blast Clean Standard. Blast profiles 1.5-2.0 mils.
- **Painting System:**
  - First Coat: One coat A applied at 2.5-3.5 dry mils
  - Second Coat: One coat B, applied at 4.0-6.0 dry mils.
  - Third Coat: One coat D, applied at 2.0-3.0 dry mils.
  - Total dry film thickness shall be 8.5 mils minimum.

215.4.3 **System 3: Pre-Painted Overhead Doors and Entry Doors**

- **Type of Structure:** Roll up overhead doors
- **Surface Preparation:** Clean per SSPC-SP 1. Remove all loose coatings, dirt, dust, and chalk by hand or power tool cleaning per SSPC-SP2 or SP3. Feather sand all edges of repaired areas. Slick areas will be lightly abraded.
- **Painting System:**
  - Prime Coat: One coat C, applied at 2.0-3.0 mils DFT.
  - Second Coat: One coat D, applied at 2.0-3.0 mils DFT.
  - Total dry film thickness shall be 4.0-6.0 mils minimum.

215.4.4 **System 4: Pre-Painted Dryvit**

- **Surface Preparation:** High-pressure wash with water. Must be clean, dry and free of oil, grease, and other contaminants. Fill any holes or cracks.
- **Coating System:**
  - Finish Coat: Two coats G, applied at 120-140 sqft/gal.

215.4.5 **System 5: Pre-Painted Ferrous Metal**

- **Type of Structure:** Interior, non-submerged hand railing
- **Surface Preparation:** Clean per SSPC-SP 1. Remove all loose coatings, dirt, dust, chalk by hand or power tool cleaning per SSPC-SP2 or SP3.
- **Painting System:**
  - Prime Coat: One coat E, applied at 4.0-6.0 mils DFT.
  - Second Coat: One coat B, applied at 4.0-6.0 mils DFT.
215.4.6 **System 6: Split Face Block**
- **Type of Structure:** Used for exterior split face block.
- **Surface Preparation:** The surface must be sound, dry and free of cracks, dirt, oils, efflorescence, paint, curing compounds and all other contaminants, which may affect the penetration.
- **Painting System:**
  - Coat: Two coats I, applied at 50-75 sq ft/gallon

215.4.7 **System 7: Pre-painted Immersed Ferrous Metals**
- **Type of Structure:** Immersed ductile or iron pipe, valves, motors, etc.
- **Surface Preparation:** Remove all foreign contaminants to meet SSPC-SP 1 Standard. Abrasive blast to meet SSPC-SP10 Near White Metal Blast Clean Standard.
- **Painting System:**
  - Prime Coat: One coat B, applied at 2.0-4.0 mils DFT
  - Second Coat: One coat B, applied at 2.0-4.0 mils DFT

215.4.8 **System 8: Pre-painted Smooth Concrete and Concrete Block**
- **Type of Structure:** Previously painted smooth concrete and concrete block
- **Surface Preparation:** Remove any loose adhering coatings. Surface must be clean and dry.
- **Painting System:**
  - Prime Coat: One coat F, applied at 200-250 sqft/gallon.
  - Second Coat: One coat H, applied at 120-140 sqft/gal
  - Second Coat: One coat H, applied at 120-140 sqft/gal

The paint and paint products listed below are as manufactured by Sherwin-Williams (SW), Carboline and Tnemec Co., Inc., and are intended to establish standards of quality. No request for substitution will be considered which decreases the film thickness designated and/or the number of coats to be applied, or which offers a change from the generic type of coating specified. Any request for substitution shall contain the full name of each product, descriptive literature, directions for use, generic type, non-volatile content by volume, certified test reports showing results to equal the performance criteria of the products specified herein, and at least 5 treatment plants where each of the coatings has been used on new construction and has rendered satisfactory service. Paint thickness shall be based on dry film thickness.
A. SW GalvaPak Zinc Primer B65 or Tnemec Series 91-H20 Hydro Zinc or Carboline Carboguard 859

B. SW Macropoxy 646 Epoxy or Tnemec Series N69 HB Epoxoline II or Carboline Carboguard 893 S.G.

C. SW Macropoxy 646 Epoxy or Tnemec Series 27WB Typoxy or Carboline Carboguard 890

D. SW Hi-Solids Polyurethane or Tnemec Series 1074-1075 Endura-Shield II or Carboline Carbothane 134 HG

E. SW Macropoxy 646 Epoxy or Tnemec Series 135 Chembuild or Carboline Carboguard 890

F. SW Macropoxy 920 Pre-Prime or Tnemec Series 151 Elasto-Grip FC or Carboline Sanitile 120

G. Tnemec Series 156 Enviro-Crete or Sherwin-Williams Loxon XP Smooth A24 Series or Approved equivalent

H. SW Epo-Plex Multi-Mil B71V110 or Tnemec Series 113 H.B. Tneme-Tufcoat

I. Tnemec Series 633 Prime-A-Pell H2O or Sherwin-Williams H&C HB150 Waterproofer or Approved equivalent

215.5. QUALITY ASSURANCE:

215.5.1 Quality assurance procedures and practices shall be utilized to monitor all phases of surface preparation, application and inspection throughout the duration of the project. Procedures or practices not specifically defined herein may be utilized provided they meet recognized and accepted professional standards and are approved by the Engineer.

215.5.2 Surface preparation will be based upon comparison with “Pictorial Surface Preparation Standards for Painting Steel Surfaces” SSPC-Vis-1 and ASTM Designation D2200; “Standard Methods of Evaluating Degree of Rusting on Painted Steel Surfaces: SSPC-Vis-1 and ASTM Designation D610; Visual Standard for Surfaces of New Steel Airblast Cleaned and Sand Abrasive.”
215.5.3 No coating or paint shall be applied: When the surrounding air temperature or the temperature of the surface to be coated or painted is below the minimum surface temperature for the products specified herein; or when the surrounding air temperature is wet or damp (5° F. or less) above the dew point; or when the air temperature is expected to drop below specified minimum temperature within six hours after application of coating. Dew point shall be measured by use of an instrument such as a Sling Psychrometer in conjunction with U. S. Department of Commerce Weather Bureau Psychrometric Tables. If above conditions are prevalent, coating or painting shall be delayed or postponed until conditions are favorable. The day's coating or painting shall be completed in time to permit the film sufficient drying time prior to damage by atmospheric conditions. When necessary for proper application, a temporary enclosure shall be erected and kept heated until the coating has fully cured.

Application of the first coat shall follow immediately after surface preparation and cleaning and before rust bloom occurs. Any cleaned areas not receiving first coat within this period shall be re-cleaned prior to application of first coat.

215.5.4 Thickness of coatings and paint over steel substrates shall be checked with a non-destructive, magnetic-type thickness gauge. Use an instrument such as a Tooke Gauge if a destructive tester is deemed necessary. The integrity of coated interior surfaces shall be tested with an approved inspection device. Non-destructive holiday detectors shall not exceed 67.5 volts nor shall destructive holiday detectors exceed the voltage recommended by the manufacturer of the coating system.

For thicknesses between 10 and 20 mils (250 microns and 500 microns) a non-sudsing type wetting agent, such as Kodak Photo-Flo, shall be added to the water prior to wetting the detector sponge. All pinholes shall be marked, repaired in accordance with the manufacturer's printed recommendations and retested. No pinholes or other irregularities will be permitted in the final coating.

215.5.5 The Contractor shall furnish, until final acceptance of coating and paint, inspection devices in good working condition for detection of holidays and measurement of dry film thickness of coating and paint. The Contractor shall also furnish U.S. Department of Commerce, National Bureau of Standards certified thickness gauges and certified instrumentation to test accuracy of holiday detectors.

Dry film thickness gauges and holiday detectors shall be made available for the Engineer's use at all times until final acceptance of application. All inspection and testing shall be witnessed by the Engineer. All inspection and testing,
including daily weather conditions, shall be recorded and a copy turned in to the
Engineer at the weekly progress meetings. The original shall be kept onsite for
review.

215.5.6 Warranty inspection shall be conducted during the eleventh month following
completion of all coating and painting work. All defective work shall be repaired
in accordance with this specification and to the satisfaction of the
Engineer/Owner.

215.5.7 The coating manufacturer shall observe the surface preparation, mixing and
application of the coating systems and submit a written report of what has been
observed and any additional recommendations.

215.5.8 The Contractor's coating and painting equipment shall be designed for
application of material specified and shall be maintained in first class working
condition. Compressors shall have suitable traps and filters to remove water and
oils from the air. The Contractor's equipment shall be subject to approval of the
Engineer.

215.6 CONCRETE COATING:

215.6.1 Materials: Concrete coating shall be Sikagard 62, Raven 405, Sauereisen
SewerGard No. 210, Sherwin-Williams Duraplate 6100, B62-475 Series, or an
approved equal to protect concrete and concrete repairs from H2S and other
corrosive elements found in wastewater process facilities. Epoxy coating to be
applied according manufacturer's installation instructions and shall extend
beyond repair areas by a minimum of 6". All concrete coating products shall be
handled and stored in the manner set forth in the manufacturer's installation
instructions.

215.6.2 Surface Preparation: Concrete surfaces to receive coating shall be inspected
prior to surface preparation to determine the condition of the surfaces specified to
receive the coating product(s) and the appropriate method or combination of
methods to be used for surface preparation to meet the requirements of the
coating system(s) to be applied per manufacturer's instructions.

215.6.2.1 Oils, grease, incompatible existing coatings, waxes, form release,
curing compounds, efflorescence, sealers, salts, or other
contaminants which may affect the performance and adhesion of the
coating to the substrate shall be removed per ASTM D-4258.

215.6.2.2 Concrete fins, protrusions, burrs, sharp edges and concrete spatter
shall be corrected by grinding or scraping.
215.6.2.3 Unless otherwise submitted and approved by the Engineer, surfaces to receive coating shall be abrasive blasted per ASTM D-4259 to remove laitance and weak concrete to expose subsurface voids, open honeycomb and air pockets. After blasting, surfaces shall be cleaned of all loose blast grit, dust and other debris by sweeping, vacuuming, air blasting and washing as necessary.

215.6.2.4 Surface preparation method(s) used shall be performed in a manner that provides a uniform, sound clean neutralized surface suitable for the specified coating product(s).

215.6.2.5 Infiltration shall be stopped by using a material which is compatible with the repair products and is suitable for top coating with the coating product(s).

215.6.3 Application of coating products: Application procedures shall conform to the recommendations of the coating product(s) manufacturer, including environmental controls, product handling, mixing, application equipment and methods.

215.6.3.1 Prepared surfaces shall be primed by application of the waterborne epoxy primer described herein at an application rate of 200 square feet per gallon (8 mils wet film thickness). The primer shall be allowed to dry to a tack free state. The solvent-free epoxy topcoat described herein shall then be spray applied to a minimum wet film thickness of 80-100 mils.

215.6.3.2 No more than 12 hours shall be permitted to pass between each application of the waterborne epoxy, the solvent-free epoxy primer and the epoxy topcoat. Subsequent top coating or additional coats of the coating product(s) shall occur within the product’s recoat window as adjusted for temperature extremes. Additional surface preparation procedures will be required if this recoat window is exceeded.

215.6.3.3 Coating product(s) shall interface with adjoining construction materials throughout the structure to effectively seal and protect concrete substrates from infiltration and attack by corrosive elements. Procedures and materials necessary to effect this interface shall be as recommended by the coating product(s) manufacturer.

END OF SECTION
215.7 PROTECTION OF EQUIPMENT IN CORROSIVE AREAS

215.7.1 The contractor will take the actions described in the following sections to protect the new equipment and materials in designated Corrosive Areas. Corrosive Areas are described as: areas where sewage is conveyed, stored, or treated; areas that are exposed to the liquid, solid, or gaseous by-products of the sewage treatment process; areas that are subject to spills, overflows, flooding, and subsequent wash-down.

These areas are characterized by the following contributors to corrosion:

- The continuous presence of hydrogen sulfide (H2S); greater than 1 ppm.
- The continuous presence of moisture; more than normal humidity.
- Fugitive emissions of digester gas which contains between 900 and 1100 ppm of hydrogen sulfide (H2S).
- Products of combustion from the burning of digester gas which contains between 1 and 2 ppm of sulfur oxides (SOX).
- Chlorinated plant effluent which contains about 1 to 2 ppm of total chlorine residual.

Corrosive Areas also include areas where the following chemicals are used or stored:

- Sodium Hydroxide (NaOH) commonly known as caustic soda or lye.
- Potassium Permanganate (KMnO4).
- Sodium Hypochlorite (NaClO) commonly known as liquid bleach or chlorine bleach.
- Sodium Bisulfite (NaHSO3).

215.7.2 Metals to Avoid or Protect in Corrosive Areas: The following metals are susceptible to corrosion in Corrosive Areas. The Contractor will avoid these metals for any exposed components or provide other means of painting or coating these metals:

- Copper, silver, lead
- Copper alloys such as brass, bronze, and cupronickel
- Chrome-plated or nickel-plated brass
- Galvanized steel
- Alloys that contain significant amounts of copper such as Monel and COR-TEN
- Aluminum alloys that contain more than 1% copper such as 2000 series wrought aluminum, 200 series cast aluminum, and 319 cast aluminum.
- Solder containing lead, tin, or silver.
215.7.3 **Recommended Metals for Use in Corrosive Areas:** The following metals hold up well in Corrosive Areas and do not need to be painted or coated:

- 300 series stainless steel. These metals might be referred to by any of the following designations:
  - 18-8 or equivalent alloys containing about 18% chromium and 8% nickel
  - Type 304 or CF8 or A2 stainless.
  - Type 316 or CF3M or A4 stainless.
- Aluminum alloys that contain less than 1% copper such as most extruded aluminum (which are generally 1000 series, 6000 series, or 7000 series) and most other cast aluminum.
- Nickel Alloys
- Electroplated steel with a plating of either aluminum or nickel.

215.7.4 **Dissimilar Metal Corrosion in Corrosive Areas:** For this contract, dissimilar metal connections are defined as the connection of any group listed in the table below connected with any other group. Dissimilar Metal Corrosion can be expected if the dissimilar metal connections are left exposed in Corrosive Areas.

<table>
<thead>
<tr>
<th>Copper Group</th>
<th>Copper or any copper alloys such as brass or bronze.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Iron Group</td>
<td>Iron or any iron alloys such as black steel, carbon steel, galvanized steel or stainless steel.</td>
</tr>
<tr>
<td>Aluminum Group</td>
<td>Aluminum or any aluminum alloys.</td>
</tr>
</tbody>
</table>

The Contractor will use any of the following acceptable methods to avoid dissimilar metal corrosion in Corrosive Areas:

- Connect metals from same group together.
- Provide an electrically insulating material between dissimilar metals. Suitable materials include: electrical tape; proper gasket materials; PTFE thread seal tape may be used for threaded connections.
- Provide Field-applied Paint between the connected metals or over the entire connection area.

215.7.5 **Protection of All Metal in Corrosive Areas:** Contractor will provide painting or coating on all exposed metal components of the new equipment and materials in Corrosive Areas. See paragraph 215.7.3 regarding metals that do not need to be painted or coated. See paragraph 215.7.8 regarding metal parts that are not appropriate to paint.
215.7.6 Factory-applied Paint or Coating for Equipment in Corrosive Areas: Contractor will ensure that the paint or coating on new equipment in Corrosive Areas is resistant to hydrogen sulfide and suitable for use in a wastewater facility. One primer coat by itself is not acceptable. Contractor will bear the cost of any upgraded paint or coating system to meet this requirement. Acceptable factory-applied paint systems include the following:

- Two coats of epoxy paint.
- One primer coat inorganic zinc primer and one top coat epoxy paint.
- Any other paint or coating system approved by the manufacturer as resistant to hydrogen sulfide and suitable for use in a wastewater facility.

Contractor will provide touch-up repair of any factory-applied paint that is damaged during the installation process. Contractor will use epoxy paint (such as Tnemec N69, Sherwin-Williams 646, or equivalent) for any needed touch-up painting.

215.7.7 Field-applied Paint in Corrosive Areas:

- Contractor will provide field-applied paint to all new metal in Corrosive Areas except those identified above in paragraph 215.7.3 or those that are not appropriate to paint (see paragraph 215.7.8). Contractor will coordinate with the Engineer for approval any other metals that do not need to be painted or coated.
- Contractor will apply two (2) full coats of epoxy paint such as Tnemec N69, Sherwin-Williams 646, or equivalent.
- Contractor will match the new paint color to be the same color as the existing equipment and materials.
- Contractor will follow the paint manufacturer’s instructions for surface preparation, but as a minimum will remove all oil, grease, dirt, loose rust, loosely adhering paint, and other foreign matter by hand or power tool cleaning per SSPC-SP2 or SP3. Strongly adhering paint or asphalt coatings do not need to be removed.
- Contractor will follow the paint manufacturer’s instructions for paint application and dry film thickness.
- Contractor will overlap paint slightly onto any exposed adjacent metal that is part of the current facility equipment so that the interface between new metal and old metal is protected by paint.
215.7.8 Field-applied Corrosion Inhibitor in Corrosive Areas: Contractor will provide a light coat of white lithium grease or other corrosion inhibitor on any exposed metal parts in Corrosive Areas that are not appropriate to paint. These include sliding metal parts or metal connections that are intended to be removable. Acceptable products include any of the following:
- White Lithium Grease (from any company)
- WD-40 Long Term Corrosion Inhibitor
- CRC Heavy Duty Corrosion Inhibitor
- Corrosion X
- Fluid Film

215.7.9 Gasket Materials in Corrosive Areas: The Contractor will provide following gasket materials in Corrosive Areas:
- EPDM (Ethylene Propylene Diene Monomer) commonly known as Vistalon.
- Other gasket material approved by the manufacturer as resistant to hydrogen sulfide.

The following gasket materials are susceptible to deterioration from hydrogen sulfide (H2S) and should not be used in in Corrosive Areas:
- Nitrile Butadiene Rubber (NBR) commonly known as Nitrile Rubber or Buna-N.
- Isobutylene Isoprene Rubber (IIR) commonly known Butyl Rubber.
- Natural Rubber.
- Chloroprene Rubber (CR) commonly known as Neoprene.
- Polysiloxane (Q) commonly known as Silicon.
- Fluorocarbon (FKM) commonly known as Viton.

215.7.10 Fasteners and Mounting Hardware in Corrosive Areas: Fasteners are defined as nuts, bolts, washers, screws, and anchors. All fasteners in Corrosive Areas are to be 300 series stainless steel. These metals might be referred to by any of the following designations:
- 18-8 or equivalent alloys containing about 18% chromium and 8% nickel
- Type 304 or CF8 or A2 stainless
- Type 316 or CF3M or A4 stainless

Mounting Hardware is defined as channels, struts, supports, framing, and hangers. Acceptable materials for mounting hardware in Corrosive Areas include:
- 300 Series Stainless Steel (such as 304 or 316)
- 6000 Series Aluminum (such as 6061 or 6063)
 Contractor is to follow the manufacturer’s instructions regarding loading of fasteners and mounting hardware. Contractor will coordinate with the Engineer for approval to reuse any existing fasteners or mounting hardware. Any reused fasteners or mounting hardware that is not stainless steel or aluminum is to be painted in accordance with paragraph 215.7.7.

215.7.11 Protection of HVAC Equipment in Corrosive Areas: The contractor will take the actions described below to protect the new HVAC equipment in designated Corrosive Areas.

215.7.11.1 Contractor will provide complete protective coatings on the following parts of the HVAC system:

- All heat exchanger coils (including water coils, evaporator coils, and condensing coils).
- All copper refrigerant piping between the evaporating coil and the condensing coil.
- All soldered connections of copper refrigerant piping.
- All other copper or brass components.

The protective coating must be approved by the coating manufacture as resistant to hydrogen sulfide and suitable for use in a wastewater facility.

215.7.11.2 All heat exchanger coils (including water coils, evaporator coils, and condensing coils) will have a factory-applied protective coil coating that is applied by the coil manufacturer or by a coating manufacturer’s certified applicator. Acceptable factory-applied protective coil coatings include:

- York ElectroFin E-Coat
- Carrier E-Coat
- Trane CompleteCoat
- Heresite P-413C Baked Phenolic Coating
- Bronz-Glow Husky Coil Coat
- other equivalent product.

215.7.11.3 Contractor will provide touch-up repair of any protective coil coating that is damaged during the installation process. Contractor will use a product that is intended for touch-up repair of damaged coil coatings (such as Bronz-Glow Husky Green Fin Coil Protector or equivalent).

215.7.11.4 All other copper piping, soldered connections, and copper or brass components of the HVAC system will have a complete protective coating. The protective coating will be applied directly on the copper piping, soldered
connections, and copper or brass components and will therefore be under any pipe insulation. Acceptable protective coatings include the following:

- Factory-coated copper tube such as:
  - Mueller Industries Streamline Plastic Coated Copper Tube.
  - Kamco Polyethylene Coated Copper Tube
  - or other equivalent product.
- Field-applied chemically-resistant heat shrinkable sleeves such as:
  - U.S. Plastic Corp. VinylGuard Heat Shrink Tubing or equivalent.
- Field-applied protective coatings such as:
  - Bronz-Glow “Component Coat” or equivalent.
- Field-applied tape coatings such as:
  - Polyken #930 Tape Coating for Joints and Fittings.
  - Tytan International 513 Pipe Wrap Tape.
  - or other equivalent product.

215.7.12 Protection of Electrical Equipment in Corrosive Areas: The contractor will take the actions described below to protect new electrical equipment in designated Corrosive Areas.

215.7.12.1 In Corrosive Areas, Contractor will provide a Complete Electrical System that is protected to a “Watertight” level as defined by the National Electrical Manufacturers Association (NEMA). The Complete Electrical System consists of the new electrical equipment combined with any previously-installed facility equipment.

Acceptable conduit for use in Corrosive Areas:
Contractor will use the following types of conduit in Corrosive Areas:

- Rigid Metal Conduit (RMC) made from Aluminum - should be mounted horizontally or from underneath termination boxes to allow liquids to run away from the fittings
- Liquidtight Flexible Metal Conduit (LFMC) - Fittings for LFMC should not be mounted on the top of boxes as this may allow liquids to flow through loose fittings into electrical boxes.

215.7.12.2 In Corrosives Areas, Contractor will ensure that new NEMA 4X enclosures comply with the following:

- are installed properly in order to retain their rating.
- are mounted by means external to the enclosure cavity.
have new conduit fitting for watertight connection at the conduit entrance.

gasket material is to be EPDM or other material approved by the manufacturer as resistant to hydrogen sulfide.

215.7.12.3 Conduit Types Not Allowed In Corrosive Areas:

- Electrical Metallic Tubing (EMT)
- Intermediate Metal Conduit (IMC)
- Flexible Metal Conduit (FMC)
- Flexible Metallic Tubing (FMT)

215.7.12.4 In Corrosives Areas, Contractor will apply corrosion inhibitor compound to electrical connections, including connections that are within enclosures and connections between copper, aluminum, and ferrous metals. Contractor will apply corrosion inhibitor compound to conduit joints and conduit hubs. Contractor will wipe off excess compound from insulation.

Acceptable corrosion inhibitor compounds include the following:

- Ideal Industries, Noalox Anti-Oxidant Compound
- Penn-Union, CUAL-GEL Oxide Inhibitor Compound
- Thomas&Betts, Conductor Termination Compound
- or other equivalent product.

END OF SECTION