**ADDENDUM NO. 1**

Date July 22, 2026

City of Austin

Project Name: Hornsby Bend BMP Ammonia Removal Facility and Drainage Improvements

C.I.P. No. 3164.125 and 3164.094  IFB No.: CLMC1165

This Addendum forms a part of the Contract and corrects or modifies original Bid Documents, issued on June 19, 2026. **Acknowledge receipt of this addendum in space provided on bid form.** Failure to do so may subject bidder to disqualification.

A. Project Manual Revisions:

**Replace** the following sections with the attached versions noted Addendum No 1:

Section 00020 Invitation for Bids. Bid Opening date discrepancy has been corrected
Section 05520 Aluminum Handrails
Section 11140 Self-Priming Horizontal Non-Clog Pumps
Section 11270 MBBR Deammonification System
Section 15205 Common Requirements for Process Valves
Section 17100 Process Instrumentation and Controls System
Section 17900 Plant Control Philosophy

B. Drawing Revisions:

**Replace** the following sheets with the attached versions noted Addendum No 1.
Sheet 1 Cover Sheet
Sheet 00-G-006 General Design Criteria
Sheet 01-C-112 Civil ARF Overall Site Plan
Sheet 02-C-101 Civil ARF Yard Piping Plan
Sheet 00-S-002 Structural General Notes II
Sheet 00-S-003 Structural General Notes III
Sheet 04-S-301 Structural ARF Sections I
Sheet 00-I-004 General Symbols and Nomenclature IV
Sheet 00-I-005 General Symbols and Nomenclature V
Sheet 04-I-602 Ammonia Removal Facility EQ Transfer Lift Station – P&ID
Sheet 00-D-001 General Notes and Abbreviations
Sheet 04-D-101 ARF Overall Plan
Sheet 04-D-102 ARF EQ Transfer Lift Station Plan
Sheet 04-D-303 ATR Sections III
Sheet 04-D-304 ARF EQ Transfer Lift Station Sections - IV
Sheet 04-D-305 ARF EQ Transfer Lift Station Sections – V
Sheet 04-D-901 ARF Isometric View I
Sheet 04-D-902 ARF Isometric View II
Sheet 00-E-027 General CP-01 Schematics – I
Sheet 00-E-028 General CP-01 Schematics – II
Sheet 00-E-029 General CP-01 Schematics – III

Sheet 00-E-030 General CP-01 Schematics – IV
Sheet 00-E-031 General CP-01 Schematics – V
Sheet 00-E-032 General CP-02 Schematics – I
Sheet 00-E-033 General CP-02 Schematics – II
Sheet 00-E-034 General CP-02 Schematics – III
Sheet 00-E-035 General CP-02 Schematics – IV
Sheet 00-E-036 General CP-02 Schematics – V
Sheet 00-E-037 General CP-02 Schematics – VI
Sheet 00-E-038 General CP-02 Schematics - VII

This addendum consists of 184 page(s)/ sheet(s).

Jules Parrish

Digitally signed by Jules Parrish
DN: C=US, E=jules.parrish@austintexas.gov, O=City of Austin, OU=Capital Delivery Services, CN=Jules Parrish
Date: 2026.07.23 16:22:18-05'00'

Approved by OWNER

Approved by ENGINEER/ARCHITECT (as applicable per license requirements)

**END**

STATE OF TEXAS
ALDO J. SOTELO
106723
LICENSED
PROFESSIONAL ENGINEER
07/22/2026

## 1. OVERVIEW AND PROJECT INFORMATION

Following is a summary of information for this Project. Bidder is cautioned to refer to other sections of the Project Manual, Drawings and Addenda (Bid Documents) for further details.

The City of Austin, hereafter called OWNER, is requesting Bids for furnishing all labor, materials, equipment, supervision, and incidentals, and for performing all Work required for the following:

| | |
|---|---|
| Project: | Hornsby Bend Biosolids Management Plant Ammonia Removal Facility and Drainage Improvements |
| Located at: | 2210 FM 973, Austin, Texas 78725 |
| CIP ID No.: | 3164.125 and 3164.094 |
| Solicitation No.: | CLMC 1165 |

The Work includes two Capital Improvement Projects (CIP). For CIP ID No 3164.125, the Work consists of a new process ammonia removal facility located within the Hornsby Bend Biosolids Management Plant. This new facility includes a new 60x70-ft concrete equalization basin with 1 vertical shaft mixer, a new transfer lift station with 3 self-priming pumps to pump filtrate from the equalization basin to the reactors, 2 new 60x80-ft concrete reactors with 4 vertical shaft mixers, air diffuser system, foam mitigation system with 10 air lift pumps, carrier media to provide ammonia treatment, a concrete splitter box with 2 V-notch weir gates to split the flow to the reactors, and an effluent channel with weirs, a new effluent lift station with 3 self-priming pumps to pump facility effluent, a new 2,250 SF pre-engineered metal building with concrete slab and HVAC system to house the air blowers and electrical equipment, rehabilitation of an existing lift station with 3 submersible pumps to serve as influent lift station for the new facility, and associated 6-18” DI/SS process and air piping, valves and flow meters, metal walkways and stairs, electrical, and instrumentation and controls. The new facility also includes site improvements including site drainage and grading with concrete channels and flumes, a new 25-ft wide concrete/asphalt/flexbase access road around the facility, yard piping including 600 LF of 6-8” DI force main with a concrete valve vault, 300 LF of 6” PVC drain pipe with manholes, and a 1-2.5” PVC NPW pipe system with yard hydrants, electrical service with transformer, and electrical and control duct banks and junction boxes.

For CIP ID No. 3164.094 (refer to drawings by Walker Partners), the Work consists of site drainage improvements located in areas around the new process ammonia removal facility. Drainage improvements include: a 81,181 CF biofiltration water quality and 2-yr detention pond with structural retaining walls and a splitter box, grading and excavation for 1,661 LF of open trapezoidal channels, 1,233 LF of concrete trickle channel, 325 LF of 6’x2’ RCB storm drain, two (2) area inlets, 49 LF of 18” RCP culvert pipe with safety end treatments, 95 LF of 36” RCP culvert pipe with safety end treatments, 400 LF of 36” RCP storm drain with junction box for overflow outfall, two (2) manholes for overflow outfall pipe, 150 LF of 6" perforated PVC drain pipe for biofiltration bed, 120 LF of 6" PVC and 320 LF of 8" PVC drain pipe for biofiltration pond discharge, 21,407 SF concrete rip rap for armoring slopes steeper than 3:1, 105 LF of concrete flumes, 26,020 SF of HMAC mill and overlay, tree removal, plantings for biofiltration pond, and all necessary appurtenances.

## 2. BID DOCUMENTS

Bid Documents are obtained through the City's Vendor Connection website, log on https://financeonline.austintexas.gov/afo/account_services/solicitation/solicitations.cfm. A complete set of Bid Documents, including all sections of the Project Manual and Drawings, are included in the attachments section of each solicitation.

All addenda and answers to Bidders' questions will also be posted in the attachments section for each solicitation on the City's Vendor Connection website.

## 3. SUBMISSION OF BIDS

Bids must be submitted electronically via Austin Finance Online eResponse. eResponse instructions are located on the Solicitation Details page of this solicitation in Austin Finance Online.

Disclaimer: The result of the bid opening does not become final until all bids are verified, and the bid tab is certified. The pencil bid tab and certified bid tab will be posted in Austin Finance Online at the following link:

https://financeonline.austintexas.gov/afo/account_services/solicitation/solicitations.cfm

**ALL BIDS AND COMPLIANCE PLANS ARE DUE PRIOR TO (Austin time) 2:00 PM ON AUGUST 6, 2026. BIDS WILL BE OPENED AT (Austin time) 3:00 PM ON AUGUST 6, 2026.**

**ALL BIDS AND COMPLIANCE PLANS NOT RECEIVED PRIOR TO THE DATE AND TIME SET FORTH ABOVE WILL NOT BE ACCEPTED FOR CONSIDERATION.** The time of record is the time received in Austin Finance Online.

## 4. VENDOR REGISTRATION AND NON-DISCRIMINATION

To create, edit, or submit an eResponse Bid, you must be logged in to your vendor account as the primary contact. You are eligible to submit an eResponse Bid after creating a user account and providing the business information of your organization. All CONTRACTORS must be registered to do business with OWNER prior to the Contract Award. All Subcontractors must be registered with the OWNER prior to execution of a contract. Prime Contractors are responsible for ensuring that their Subcontractors are registered as vendors with the City of Austin. Registration can be done through the OWNER's on-line Vendor Registration system. Log onto and follow directions:

https://financeonline.austintexas.gov/afo/account_services/account/login.cfm

The City of Austin, in accordance with the provisions of Title VI of the Civil Rights Act of 1964 (78 Stat. 252, 42 U.S.C. §§ 2000d to 2000d-4) and the Regulations, hereby notifies all bidders that it will affirmatively ensure that any contract entered into pursuant to this advertisement, disadvantaged business enterprises will be afforded full and fair opportunity to submit bids in response to this invitation and will not be discriminated against on the grounds of race, color, or national origin in consideration for an award.

## 5. MBE/WBE PROCUREMENT PROGRAM

All City procurements are subject to the City's Minority-Owned and Women-Owned Business Enterprise Procurement Program found at Chapter 2-9-A of the City Code, as amended. The Program provides Minority-Owned and Women-Owned Business Enterprises (MBEs/WBEs) or Disadvantaged Business Enterprises (DBEs) full opportunity to participate in all City contracts. Goals for MBE/WBE or DBE participation are stated for each solicitation. Information on achieving the goals or documenting good faith efforts to achieve the goals are contained in the MBE/WBE Procurement Program Package or DBE Procurement Program Package attached to the solicitation. When goals are established, Bidders are required to complete and return the MBE/WBE or DBE Compliance Plan with their Bid. If a Compliance Plan is not submitted prior to the date and time set forth in the solicitation, the Bid will not be accepted for consideration. (See Section 00820 for MBE/WBE requirements on "no goal" solicitations.)

## 6. BID GUARANTY

All Bids shall be accompanied by an acceptable Bid guaranty in an amount of not less than five percent (5%) of the total Bid, as specified in Section 00100, Instructions to Bidders.

## 7. BONDS AND INSURANCE

Performance and payment bonds when required shall be executed on forms furnished by OWNER. Each bond shall be issued in an amount of one hundred percent (100%) of the Contract Amount by a solvent corporate surety company authorized to do business in the State of Texas, and shall meet any other requirements established by law or by OWNER pursuant to applicable law.

Minimum insurance requirements are specified in Section 00810, Supplemental General Conditions.

## 8. WAGE COMPLIANCE

Minimum wage rates have been established and are specified in Section 00830, Wage Rates and Payroll Reporting.

## 9. CONTRACT TIME

Contract Time is of the essence and all Work shall be substantially completed within **Six Hundred and Sixty (660) Calendar Days** after date specified in the Notice to Proceed, in accordance with the Bid Form, Section 00300.

Final completion shall be achieved within **Sixty (60) Calendar Days** after substantial completion.

Liquidated damages are **one thousand eight-hundred and sixty dollars ($1860.00)** per Calendar Day for failure to substantially complete the work and **seven hundred dollars ($700.00)** per Calendar Day for failure to achieve final completion within **Sixty (60) Calendar Days** after substantial completion, in accordance with the Bid Form, Section 00300.

## 10. OWNER'S RIGHTS

OWNER reserves the right to reject any or all Bids and to waive any minor informality in any Bid or solicitation procedure (a minor informality is one that does not affect the competitiveness of the Bid).

## 11. PRE-BID CONFERENCE

A **non-mandatory** Pre-Bid Conference will be held on **July 7, 2026, 11:00 a.m. (Austin time), via MS Teams (Pre-Bid Meeting)**

Pre-Bid Meeting-CLMC1165-Hornsby Bend Ammonia Removal Facility And Drainage Imp. | Meeting-Join | Microsoft Teams

Attendance **is not** mandatory unless otherwise stated. Bidders must attend any mandatory Pre-Bid Conference and are encouraged to attend any non-mandatory Pre-Bid Conference to ensure their understanding of OWNER's bidding and contracting requirements, particularly MBE/WBE or DBE Procurement Program requirements. If the Pre-Bid Conference is mandatory the Bidder must arrive and sign-in within fifteen (15) minutes of the scheduled start time of the meeting, otherwise the Bidder will not be allowed to submit a Bid for the project.

A **non-mandatory** Site-Visit will be held on **July 8, 2026, 10:00 a.m. (Austin time), 2210 FM 973, Austin, Texas 78725.**

Attendance **is not** mandatory unless otherwise stated. Bidders must attend any mandatory Site-Visit and are encouraged to attend any non-mandatory Site-Visit. If the Site-Visit is mandatory the Bidder must arrive and sign-in within fifteen (15) minutes of the scheduled start time of the Site-Visit, otherwise the Bidder will not be allowed to submit a Bid for the project.

## 12. ANTI-LOBBYING AND PROCUREMENT

On June 14, 2018, the Austin City Council adopted Ordinance No. 20180614-056 replacing Chapter 2.7, Article 6 of the City Code relating to Anti-Lobbying and Procurement. The policy defined in this Code applies to Solicitations for goods and/or services requiring City Council approval under City Charter Article VII, Section 15 (Purchase Procedures). The City requires Offerors submitting Offers on this Solicitation to certify that the Offeror has not in any way directly or indirectly had communication restricted in the ordinance section 2-7-104 during the No-Lobbying Period as defined in the Ordinance. The text of the City Ordinance is posted on the Internet at:

https://assets.austintexas.gov/purchase/downloads/New_ALO_Ordinance_No_20180614-056.pdf

## 13. AUTHORIZED CONTACT PERSONS

The persons listed below may be contacted for information regarding the Invitation for Bid.

PROJECT MANAGER: Jules Parrish, phone 512-974-9385, email Jules.Parrish@austintexas.gov

CAPITAL PROCUREMENT CONTACT: Jeremiah Johnson, phone 512-974-3049, email jeremiah.johnson@austintexas.gov

AUSTIN SMALL AND MINORITY BUSINESS CONTACT: Veronica Hawkins, phone 512-974-9113, email veronica.hawkins@austintexas.gov

**END**

## PART I - GENERAL

### 1.01 SUMMARY

A. This Section includes the fabrication, furnishing, and installation of aluminum handrails, complete in place, at locations shown on PLANS.

### 1.02 (NOT USED)

### 1.03 REFERENCES

The latest version of the publications listed below form a part of this Specification to the extent referenced. The publications are referred to in the text by basic designation only.

**ALUMINUM ASSOCIATION (AA)**

| | |
|---|---|
| ASD-1 | Aluminum Standards and Data |
| DAF-45 | Designation System for Aluminum Finishes |
| SAA-46 | Standards for Anodized Architectural Aluminum |

**AMERICAN SOCIETY OF TESTING AND MATERIALS (ASTM)**

| | |
|---|---|
| A193/A193M | Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High Temperature Service |
| B429 | Standard Specification for Aluminum Alloy Extruded Structural Pipe and Tube |
| F593 | Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs |

**AMERICAN WELDING SOCIETY (AWS)**

| | |
|---|---|
| D1.2 | Structural Welding Code Aluminum |

**OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION (OSHA)**

| | |
|---|---|
| 29 CFR 1910 | OSHA Regulation Safety and Health Standards for General Industry |

**INTERNATIONAL CONFERENCE OF BUILDING OFFICIALS (ICBO)**

| | |
|---|---|
| UBC | Uniform Building Code |

### 1.04 DEFINITIONS

A. PLANS use the terms handrail and guardrail to refer to the railing system defined by this Specification and standard detail drawings.

## 1.05 (NOT USED)

## 1.06 SUBMITTALS

A. Submit the following in accordance with Specification Section 01300 "Submittals".

B. Product data for materials used.

C. Complete shop drawings showing handrail locations, railings, posts, splice locations and expansion joint locations. Also include manufacturer's details for connections, anchorage, splices, expansion joints, gates and other pertinent data.

D. Design calculations showing that the material meets or exceeds the allowable working stress under the applied loading conditions. Test reports may be used to complement the design calculations. Design calculations to be sealed by a Professional Engineer licensed in the State of Texas.

E. Field layout of fabricated sections to ensure proper fit during erection, after fabrication and finishing, and prior to shipment.

F. Certificate of Conformance as required in Paragraph 1.07 - Quality Assurance.

## 1.07 QUALITY ASSURANCE

A. All design computations and detailed drawings are to be prepared by or under the direct supervision of a Professional Engineer licensed in the State of Texas. Provide a certificate signed and sealed by same engineer stating that the computations and drawings are in conformance with specified design criteria.

B. Provide handrail system complying with Uniform Building Code and OSHA Regulations.

## 1.08 DELIVERY, STORAGE AND HANDLING

A. Deliver handrail to jobsite with sufficient protection to ensure arrival in acceptable and undamaged condition.

B. Store handrail on level supports above ground, not in contact with dissimilar metals. Protect to prevent damage and exposure from elements until erected. Replace or repair damaged sections at no additional cost to OWNER.

## 1.09 - 1.11 (NOT USED)

## PART II - PRODUCTS

### 2.01 MANUFACTURER(S)

A. Manufacturer: Products of the following manufacturers, provided they comply with requirements of the Contract Documents, will be among those considered acceptable, or an approved equal.

1. Hollaender Railing Systems (Interna-Rail).
2. Thompson Fabricating Co. (TUFrail).

### 2.02 MATERIALS AND/OR EQUIPMENT

A. General

1. Handrail shall be the product of a company normally engaged in the manufacture of pipe railing.
2. Handrail shall conform to requirements of OSHA 1910.29 and applicable building code. Local building code in Austin, TX is the Uniform Building Code.
3. Handrail and posts to be fabricated from 1½-inch nominal diameter 6063-T6 or 6061-T6 aluminum pipe, Schedule 40 minimum conforming to ASTM B429. Exposed aluminum surface to be 0.7-mil thick clear anodized finish, per Aluminum Association Designation M43C22A41.
4. Handrail to be 42 inches high; stair handrail to be 34 inches high, unless other¬wise noted on PLANS. Centerlines of posts and handrails to be in same plane. Locate intermediate rails as shown on PLANS.
5. Unless shown otherwise in PLANS, post spacing not to exceed 5 feet for horizontal handrail and 4 feet for stair handrail (measured horizontally). The manufacturer must reduce the post spacing and/or add dowels, as required to meet the loading requirements.
6. Provide a 4-inch-high extruded aluminum toe plate that attaches to the posts with clamps that will allow for horizontal expansion and contraction between posts. Toe plate to have not more than 1/4-inch clearance above floor level, and provided on all walkways and stair landings. Provide notch in toe plate at post as required to maintain specified clearance.
7. Handrail system, which consists of three horizontal rail members, posts, connections and anchorages, shall be designed to withstand a 200-pound concentrated load applied at any point and in any direction or a 50 lb./ft. uniform load applied in any direction. Concentrated and uniform loads need not be assumed to act concurrently. The posts and associated floor flange anchorage shall be designed to withstand a 200-pound concentrated load applied at the top rail.
8. Provide expansion joint splices in all rails of handrail and toe board at not greater than 20 feet spacing and at expansion joints in concrete structure. Minimum projection of expansion splice inside adjacent pipe shall be 1½”.

9. Splices and expansion joints in the railing system components shall be located within 8 inches of posts or other railing system supports.
10. Provide 1/4-inch weep holes at low points in all handrails and posts to prevent trapping of moisture.
11. Removable handrail to have vertical pipe supports fastened as shown on PLANS. Unless otherwise indicated, fabricate removable handrail in unit sections not exceeding 10 feet long with at least three vertical supports, including one at each end.
12. Handrails attached to load-bearing walls to be mounted with aluminum or stainless steel brackets. Fasten each bracket with a minimum 3/8-inch diameter Type 316 stainless steel expansion bolt set into the wall and tapped into bracket. Bracket to have a 3-inch projection from wall and be uniformly spaced approximately 4 feet with the end brackets not more than 12 inches from the ends of the handrails.
13. Posts and rails to be continuous throughout their sectional lengths. Curved members to be formed to true radii, free from dye marks or surface abrasions. Furnish handrail in shop fabricated sections, complete with accessories, including gates, hardware, closure caps for rail terminations, base trim, and anchorages.
14. Posts shall not interrupt the continuation of the top rail at any point along the railing, including corners and end terminations (OSHA 1910.29). The top surface of the top railing shall be smooth and shall not be interrupted by a projecting fitting.
15. Aluminum surfaces in contact with concrete, grout or dissimilar metals will be protected with a mylar isolator, bituminous paint or other approved material.
16. Handrail system posts are to be anchored to concrete structures with Type 316 stainless steel bolts. Bolts and floor flange shall be designed to resist a 200-pound load applied horizontally to the top rail. Bolt manufacturer's published shear and pullout values shall be reduced for spacing and edge distance conditions as shown on plans.
17. Safety Chains: Construct safety chains of stainless steel, straight link type, 3/16-inch diameter, with at least twelve links per foot, and with boat type snap hooks on each end. Provide S.S. 3/8-inch bolt with 3/4 -inch eye diameter for attachment of chain, anchored as indicated. Supply a minimum of two chains or as noted on PLANS, 4 inches longer than the anchorage spacing, for each guarded area. Locate safety chain where indicated.

B. Nonwelded Aluminum Handrails

1. Fittings to be extruded or cast aluminum, 6063 Aluminum Alloy with a minimum 0.4-mil thick clear anodized finish per Aluminum Association Designation M43C22A4l.
2. The handrail shall be made of pipes joined together with component fittings. Components that are glued or pop-riveted at the joints will not be acceptable. All components must be mechanically fastened with stainless steel hardware.

3. Fitting shall be an internal double-prong expandable fitting that is activated by a stainless steel or aluminum set screw. The fitting shall be externally connected to the pipe by means of an anodized aluminum tubular rivet nut, and stainless steel socket head cap screw. All fittings, elbows, wall returns, and caps to be flush-type. Exposed fasteners to be set flush or recessed. All fasteners to be Type 316 stainless steel.
4. Unless otherwise noted on PLANS, all handrails to be nonwelded aluminum.

C. Welded Aluminum Handrail

1. Handrail and posts to be joined by welding only if indicated on PLANS. Welding to consist of flush-type weld fittings or coping of pipe ends to conform with adjoining pipe and welding. Welds to be ground smooth and flush.
2. Elbows, capped terminations, and wall returns to be formed by flush fittings. Secure rails terminating against masonry or concrete with flanged fittings and anchor bolts.

## 2.03 FABRICATION

A. Furnish railings in shop-fabricated sections, complete with accessories, including gates, plated hardware, closure caps for rail termination, base trim, and anchorages.

## 2.04 (NOT USED)

## PART III - EXECUTION

## 3.01- 3.02 (NOT USED)

## 3.03 ERECTION/INSTALLATION/APPLICATION AND/OR CONSTRUCTION

A. Handrail to be installed by fabricator in strict compliance with fabricator's instructions. Install handrail plumb and within a tolerance of 1/4-inch maximum deviation either side of the longitudinal centerline. Cuts to be clean and straight, free from burrs and nicks.

B. Posts embedded in concrete to be set in sleeves with quick-setting non-shrink grout.

C. Install removable and permanent handrail units with bolted floor type flanges.

D. Use of shims, washers, wedges, or similar devices are not allowed when plumbing or aligning handrail.

**3.04 - 3.10 (NOT USED)**

**3.05 MEASUREMENT AND PAYMENT**

A. No separate measurement or payment for work performed under this Section. Include cost of same in Contract price bid for work of which this is a component part.

**END OF SECTION**

## PART I - GENERAL

### 1.01 SUMMARY

A. The CONTRACTOR shall provide self-priming horizontal non-clog pumps, with electric motors and appurtenant work, complete and operable, in accordance with the Contract Documents.

B. The Supplier shall examine the Site conditions, intended application, and operation of the pump system and recommend the pump that will best satisfy the indicated requirements.

### 1.02 RELATED REQUIREMENTS

A. Reference Specifications

| | |
|---|---|
| 01300 | Submittals |
| 01650 | Facility Startup/ Commissioning |
| 01730 | Operation and Maintenance Data |
| 09960 | High-Performance Coatings |
| 11000 | Equipment General |
| 11100 | Pumps General |
| 16220 | Motors |
| 17900 | Plant Control Philosophy |

### 1.03 REFERENCES

A. Reference Standards

| **American National Standards Institute (ANSI)** | |
|---|---|
| ANSI B16.1 | Cast Iron Pipe Flanges and Flanged Fittings 125, 250, and 800 lbs |
| **ASTM International (ASTM)** | |
| ASTM A48 | Gray Iron Castings |
| ASTM A108 | Steel bars, Carbon, Cold Finished, Standard Quality |
| ASTM A153 | Zinc Coating (Hot Dip) on Iron and Steel Hardware |
| ASTM A385 | Standard Practice for Providing High-Quality Zinc Coating (hot-Dip) |

**Hydraulic Institute Standards - all**

## 1.04 SUBMITTALS

A. Furnish submittals in accordance with Section 01300 – Submittals.

B. Shop Drawings: Submit complete fabrication, general assembly, foundation requirements, and installation Drawings for all pumps, motors, and accessories to illustrate construction and assembly of components.

C. Product data: Provide manufacturer's literature including general assembly, materials of construction, performance characteristics, coatings, power requirements, wiring diagrams, service connections, and additional information necessary to determine compliance with these Specifications:

D. Pump:

1. Name of manufacturer
2. Type and model
3. Rotative speed
4. Size of suction nozzle
5. Size of discharge nozzle
6. Type of bearings
7. Net weight of pump only
8. Net weight of components and total assembly including motor
9. Complete performance curves showing capacity versus head, NPSH required, pump efficiency and BHP
10. Type and construction of seals.
11. Type of coupling
12. Data on shop painting

E. Motors:

1. Name of manufacturer
2. Type and model

3. Type of bearings and shaft

4. Rated size of motor hp

5. Temperature rating

6. Full load rotative speed

7. Net weight

8. Efficiency at full load and rated pump condition

9. Full load current

10. Locked rotor current

F. Manufacturer's installation instructions: Provide connection requirements and start-up instructions for pumps.

G. Test reports:

1. Submit certified copies of shop test reports for each pump supplier at least 10 days before shipping equipment.

2. Reports shall include:

a. Test log

b. Description of test piping, equipment and setup

c. Test procedure

d. Certified performance curves, plotted against capacity:

1) Head

2) Brake horsepower

3) Efficiency

4) Actual speed

5) Net positive suction head required

H. Operation and Maintenance Manuals:

1. Submit O&M Manuals in accordance with 01730 – Operation and Maintenance Data.

## 1.05 DELIVERY STORAGE AND HANDLING

A. Deliver, store, protect, and handle products to site under provisions of Section 01600 –Materials and Equipment

B. Accept pumps and components on site in factory packing. Inspect for damage. Comply with manufacturer's installation instructions.

## 1.06 WARRANTY

A. The equipment seller shall be solely and fully responsible for warranty and mechanical design adequacy of all the pump components in the scope of supply defined in this section of the specification. This warranty shall become effective for a period of one (1) year from the date of substantial completion.

# PART II - PRODUCTS

## 2.01 PERFORMANCE AND DESIGN REQUIREMENTS

A. General:

1. Stable and free of cavitation and noise throughout the specified operating head range

2. Minimum hydrostatic test pressure: 1.5 times the shutoff head plus suction pressure

3. Design based on running clearance between the impeller and suction cover of at least 0.015 inch

4. Terminology used conforms with that of the Hydraulic Institute Standards

5. Solids Handling Capability

   a. All internal passages, impeller vanes, and recirculation ports shall pass a 3.0” spherical solid. Smaller internal passages that create a maintenance nuisance or interfere with priming and pump performance shall not be permitted. Upon request from the engineer, manufacturer’s certified drawings showing size and location of the recirculation port(s) shall be submitted for approval.

6. Reprime Performance

   a. During unattended operation, the pump shall retain adequate liquid in the casing to ensure automatic repriming while operating at its rated speed in a completely open system.

   b. The pump must reprime 20 vertical feet at the specified speed and impeller diameter. Reprime lift is defined as the static height of the

pump suction above the liquid, while operating with only one-half of the liquid remaining in the pump casing. The pump must reprime and deliver full capacity within five minutes after the pump is energized in the reprime condition.

B. Operating Conditions: The work of this Section shall be suitable for long-term operation under the following conditions:

| | |
|---|---|
| Duty | Continuous |
| Ambient environment | Outdoors |
| Minimum temperature, degrees F | 20 |
| Maximum Temperature, degrees F | 105 |
| Fluid service | Dewatering Filtrate |
| Project site elevation, ft (m.s.l) | 437 |
| Minimum available NPSH, ft absolute | 10.16 |
| Electrical Requirements | Class 1, Div 2 |

C. EQ Transfer Pumps

| | |
|---|---|
| Equipment Number | LSPUMP-01, LSPUMP-02, LSPUMP-03 |
| Quantity | 2 Duty + 1 Standby |
| Location | EQ Transfer Lift Station |
| Pump Operation | VFD |

1. Performance Requirements

| | |
|---|---|
| Minimum flow capacity per pump, gpm | 250 |
| Flow to ATR Influent Splitter Box (Normal Operation) pump head TDH, ft | |
| Maximum EQ Basin WSL Elevation | 12.2 |
| Minimum EQ Basin WSL Elevation | 26.7 |
| Flow to ARF Effluent Channel (Drain Operation) pump head TDH, ft | |

| | |
|---|---|
| Maximum EQ Basin WSL Elevation | 11.3 |
| Minimum EQ Basin WSL Elevation | 31.5 |
| Design/ Maximum flow capacity per pump, gpm | 500 |
| Flow to ATR Influent Splitter Box (Normal Operation) pump head TDH, ft | |
| Maximum EQ Basin WSL Elevation | 29.3 |
| Minimum EQ Basin WSL Elevation | 43.8 |
| Flow to ARF Effluent Channel (Drain Operation) pump head TDH, ft | |
| Maximum EQ Basin WSL Elevation | 34.2 |
| Minimum EQ Basin WSL Elevation | 51.4 |
| Maximum motor size, hp | 10 |
| Pinch valve size, in | 6 |
| Pinch valve open % | 14.3 |

2. Pump Dimensions

| | |
|---|---|
| Suction diameter, in | 6 |
| Discharge diameter, in | 6 |
| Suction flange rating, ANSI, psi | 150 |
| Discharge flange rating, ANSI, psi | 150 |

D. ARF Effluent Pumps

| | |
|---|---|
| Equipment Number | LSPUMP-04, LSPUMP-05, LSPUMP-06 |
| Quantity | 2 Duty + 1 Standby |
| Location | ARF Effluent Lift Station |
| Pump Operation | Constant Speed |

| | |
|---|---|
| Alternative Operation | Mechanical Pully |

1. Performance Requirements

| | |
|---|---|
| Flow capacity per pump, gpm | 500 |
| Design flow pump head per pump, TDH ft | |
| Flow to Pond 1W (Normal Operation) | 62.5 |
| Flow to SSTP (Alternative Operation) | 72.5 |
| Maximum motor size, hp | 20 |

2. Pump Dimensions

| | |
|---|---|
| Suction diameter, in | 6 |
| Discharge diameter, in | 6 |
| Suction flange rating, ANSI, psi | 150 |
| Discharge flange rating, ANSI, psi | 150 |

## 2.02 PUMP REQUIREMENTS

A. General: Construction of self-priming horizontal non-clog pumps shall conform to the following requirements:

| | |
|---|---|
| Casing and frame | Cast iron, ASTM A 48, with removable coverplate for inspection or service |
| Pump base | Cast iron base plate |
| Impeller | Ductile iron ASTM A 395 or A 536, statically and dynamically balanced, open |
| Wear plate | Type 316 stainless steel, replaceable |

| | |
|---|---|
| Cover plate | Cast iron, removable and adjustable |
| Shaft and sleeve | 17-4 Precipitation hardened stainless steel |
| Seal | Cartridge type, flushless double mechanical seal, with silicon carbide rotating and stationary faces |
| Coupling | Flexible heavy duty spacer shaft coupling with guard |
| Bearings | Ball bearings with min L-10 life of 50,000 hours at max load |
| Flap valve | Neoprene with steel reinforcing |
| Gaskets and O-rings | Buna-N |
| Hardware | Type 316 Stainless steel |

B. Drive: Constant speed drive with TEFC heavy duty, horizontal, inverter-duty electric motor suitable for 480-volt, 3-phase, 60-Hz power supply, in accordance with Section 16220 –Motors. The service factor shall be 1.15.

C. Casing:

1. Permits removal of the rotating element without disconnecting the piping

2. Flanged clean out hand holes on discharge and suction nozzles with interior surfaces flush with the casing water passages

3. Parts to have registered fit for alignment

4. Nozzle flanges: ANSI 125 lb diameter and drilling

5. Pipe tapped openings with gage cocks for draining, priming, and venting the casing

D. Impeller:

1. Two-vane, open type

2. One-piece casting completely machined on all exterior surfaces

3. Statically and dynamically balanced per Hydraulic Institute Standards

4. Keyed and locked to the shaft with a self-locking or pinned non-clog type fastener

5. Uniform sections and smooth surfaces free from cracks and porosity on interior water passages

E. Shaft and shaft sleeves:

1. Shaft completely machined
2. Shaft deflection at stuffing box not more than 0.002 inches at any operating head
3. Replaceable sleeve extending from the impeller through the stuffing box
4. Sleeve positively locked against rotation and axial movement
5. Sleeves sealed to prevent leakage between shaft and sleeve
6. Total shaft run out less than 0.002 inches

F. Wearing rings for enclosed impeller pumps:

1. Provide renewable wearing rings in casing
2. Design clearance at least 1 mil/in. of ring diameter
3. Casing ring positively locked in place

G. Bearings:

1. Anti-friction type
2. Oil lubricated
3. Minimum life (AFBMA L-l0) rating: 100,000 hrs
4. Rated for max shaft speed
5. Located in common cavity as mechanical seal

H. Frame assembly:

1. Rigidly support the rotating element with 2 bearings
2. Outboard bearing to carry both radial and axial loads
3. To permit axial adjustment of rotor without dismantling
4. Bearing enclosures to keep out contaminants and retain lubricant and with adequate provisions for adding and flushing lubricant
5. Ample clearance for stuffing box maintenance

I. Balance:

1. Accurately machine all rotating parts
2. Place pump in as near perfect rotational balance as practicable
3. Equipment which vibrates excessively will be rejected
4. The mass of the unit and its distribution shall preclude resonance at any operating speed

J. Limits:

1. Max peak-to-peak vibration displacement at any point on the machine: 2.0 mils
2. Max peak-to-peak vibration displacement of shaft at face to stuffing box: 2.0 mils
3. Ratio of rotative speed to critical speed of unit or components: Less than 0.8 or more than 1.3

K. Mechanical seals:

1. Balanced, flushing type
2. Double floating, self-aligning
3. Oil lubricated

L. Assembly:

1. Mount pump and drive on common base
2. Connect motor to pump with belts and sheaves
3. Provide belt guard
4. Connect pump and drive shaft with flexible coupling
5. Mount motor in vertical position

M. Protective Coating

1. Pumps shall be coated in accordance with Section 09960 – High-Performance Coating.
2. Pump, motor and other non stainless steel components shall have epoxy paint finish.

3. Apply rust preventive compound to all machines, polished an non ferrous surfaces that are not to be painted.

N. Air Release Valves

1. An automatic air release valve shall be furnished for each pump designed to permit the escape of air to the atmosphere during initial priming or unattended repriming cycles. Upon completion of the priming cycle or repriming cycle, the valve shall close to prevent recirculation. Valves shall provide visual indication of valve closure and shall operate solely on discharge pressure. Valves which require connection to the suction line shall not be acceptable.

2. All valve parts exposed to sewage shall be constructed of cast iron, stainless steel, or similar corrosion resistant materials. Diaphragms, if used, shall be of fabric reinforced neoprene or similar inert material.

3. A cleanout port, three inches in diameter, shall be provided for ease of inspection, cleanout, and service.

4. Valves shall be field adjustable for varying discharge heads.

5. Connection of the air release valves to the station piping shall include stainless steel fittings.

O. Pinch Valve

1. Pinch valves shall be furnished at each pump's discharge to increase head. Valves shall be ductile cast iron, fully enclosed, split body. Interior and exterior shall have corrosion resistant fusion bonded epoxy coating. Face-to-face dimensions should be ASME B-16.10 for all sizes and flange drilling shall be ANSI #150.

2. Valve shall achieve bi-directional bubble tight, centerline closure at the maximum work pressure.

3. Tube shall be constructed with polyester or stronger ply cords with non-stretch folds that flex, not stretch during closure. Tube flanges shall also contain an internal stainless steel ring, and have no bolt holes, to allow replacement without removing the valve from the pipeline.

4. Pull Bars shall be constructed of 316 stainless steel and all fasteners shall be 304 stainless steel.

5. Valve shall be operated with a manual handwheel or handwheel with bevel gear.

6. The top pinch bar shall be raised and lowered by a center actuator shaft with polished, non-threaded surface. Lower pinch bar shall be

raised and lower with two pull bars anchored to the actuator base plate extending through the valve body.

7. Permanent factory calibration of the pinching mechanism shall be provided with lock nut system on the pull bar extensions, including tamper indication seal. Valves requiring calibration after tube replacement shall not be permitted.

8. Manufacturer: RF Valves, Inc.

P. Gauge Kit

1. Each pump shall be equipped with a glycerin filled compound gauge to monitor suction pressures, and a glycerin filled pressure gauge to monitor discharge pressures.

## 2.03 PUMP CONTROLS

A. Pumps shall be controlled in accordance with Section 17100 – Process Instrumentation and Control System.

## 2.04 SPARE PARTS

A. Each pump shall be provided with the following spare parts:

1. One complete set of wear rings

2. One bearing set

3. One complete mechanical seal

4. One full gasket kit

5. One shaft sleeve

6. One year supply of all greases and lubricants for each pump

## 2.05 MANUFACTURER

A. Gorman Rupp

B. WEMCO

# PART III - EXECUTION

## 3.01 COORDINATION

A. Pump manufacturer shall be responsible for coordination with variable frequency drive manufacturer and motor manufacturer through CONTRACTOR to ensure compatibility over full range of operation.

## 3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions and on equipment base as indicated on Drawings and in accordance with Specification 11100 – Pumps General.

B. Provide anchor bolts in accordance with manufacturer's instructions.

C. Level, plumb and align unit into position to fit connecting piping.

D. Grout pump base after initial fitting and alignment but before final bolting of connecting piping. Take special care to maintain alignment of components. No strain shall be transmitted to the pump flanges. Test pump connections for piping stresses after final alignment and bolting:

1. Loosen flange bolts

2. If any movement or opening of joints is observed, adjust piping to fit

3. Realign couplings after grouting

4. Do not shim between machined surfaces

## 3.03 FIELD START-UP SERVICES

A. Field services shall be furnished in accordance with Section 11100 – Pumps General.

B. Inspection, Startup, and Field Adjustment: Provide manufacturer's field service representative for a minimum of one day (8 hours) to inspect installation and witness field testing.

C. Instruction of OWNER's Personnel: The training representative of the manufacturer shall be present at the Site two separate days for 4 hours (each trip) to furnish the services required by Section 11100 – Pumps General.

D. Perform clear water test and record performance of each pump in accordance with Hydraulic Institute Standards.

**END OF SECTION**

## PART I - GENERAL

### 1.01 SUMMARY

A. The MANUFACTURER shall furnish the process and control system equipment for a biological wastewater treatment system, as shown on the Contract Drawings and specified herein. The process equipment shall generally include, but is not limited to, AnoxKaldnes K5 media, a medium bubble aeration system, cylindrical screen assemblies, air lift pumps, mixer(s), process control PLC-based panel, instrumentation, seed media, technology licenses, and patent infringement indemnification. A single MANUFACTURER shall supply the Biological Treatment System as defined herein in order to establish system performance responsibility.

B. Mechanical instrumentation and electrical process equipment to be furnished under this section includes, but is not limited to, the following:

1. AnoxKaldnes K5 polyethylene media
2. AnoxKaldnes medium bubble aeration system
3. Two (2) modulating air flow control valves
4. Nine (9) manual airflow isolation valves, per reactor
5. Two (2) cylindrical screen assemblies, per reactor
6. Instrumentation, as identified herein
7. Five (5) air lift pumps and one (1) orifice plate fitting for foam control, per reactor
8. Two (2) top motor mounted hyperbolic mixers, per reactor
9. ATR drain screens as shown on the Contract Drawings
10. Process control panel

### 1.02 RELATED REQUIREMENTS

A. Reference Specifications

| | |
|---|---|
| 01300 | Submittals |
| 01400 | Quality Control Services |
| 01600 | Products, Materials, Equipment and Substitutions |
| 01650 | Facility Startup/ Commissioning |
| 05500 | Metal Fabrications |

| | |
|---|---|
| 11000 | Equipment General |
| 11376 | Positive Displacement Blower |
| 15001 | Piping General |
| 15006 | Hangers and Supports for Process Piping |
| 15023 | Stainless Steel Process Pipe and Tubing |
| 15202 | Butterfly Valves |
| 15205 | Common Requirements for Process Valves |
| 16480 | Variable Frequency Drives |
| 17100 | Process Instrumentation and Control System |
| 17102 | Flow Measuring Systems |
| 17122 | Pressure Gauges |
| 17200 | Instrument and Control Cabinets and Associated Equipment |
| 17310 | Pressure Indicating Transmitter |
| 17320 | Temperature Gauges |
| 17345 | Radar Level Element & Indicating Transmitter |
| 17370 | Mechanically Activated Level Switches |
| 17600 | PLCs & OIUs Equipment |
| 17620 | Fiber Optic & Ethernet Communication Equipment |
| 17900 | Plant Control Philosophy |

## 1.03 REFERENCES

A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

B. Equipment shall be in accordance with the following standards including MANUFACTURER's published recommendations, as applicable:

1. American Society for Testing and Materials (ASTM).

2. American National Standards Institute (ANSI).

3. American Society of Mechanical Engineers (ASME).

4. American Welding Society (AWS).

5. AWS D1.6 - Structural Welding Code: Stainless Steel

6. National Fire Protection Association (NFPA).

7. Federal Specifications (FS).

8. National Electrical Manufacturers Association (NEMA).

9. National Electric Code (NEC).

10. Occupational Safety and Health Administration (OSHA).

11. American Iron and Steel Institute (AISI)

12. American Institute of Steel Construction (AIWC)

13. American Gear Manufacturers Association (AGMA)

14. International Society of Automation (ISA)

## 1.04 DEFINITIONS

A. SCFM: A standard cubic feet per minute is understood to be air at 68°F, 14.7 PSIA and 36% relative humidity flowing at a rate of 1 cubic foot per minute.

B. SOTR: Standard oxygen transfer rate is understood to be the rate of oxygen transferred to tap water (pounds of oxygen per hour) at standard conditions of 68°F, 0.0 mg/l residual dissolved oxygen concentration, and a barometric pressure of 760 mm Hg (dry air).

C. SOTE: Standard oxygen transfer efficiency is understood to be the fraction of oxygen transferred under standard conditions of 68°F, 0.0 mg/l residual dissolved oxygen concentration, and a barometric pressure of 760 mm Hg (dry air).

D. SWD: Side water depth is understood to be the overall dimension from the high point of the basin floor to the water surface.

## 1.05 SYSTEM DESCRIPTION

A. The Moving Bed Biofilm Reactor (MBBR) Deammonification process allows carrier elements (media) to move about freely within a reactor using the medium bubble aeration system in aerobic reactors. Screen assemblies shall be used to retain the media within the reactor(s).

B. A MBBR system shall be installed as part of the new Ammonia Removal Facility (ARF) and shall be designed to oxidize ammonia-nitrogen and reduce the total inorganic nitrogen (TIN) contained in dewatering filtrate.

C. The MANUFACTURER shall provide all anchor bolts for all equipment being provided by the MANUFACTURER. MANUFACTURER shall be responsible for sizing the anchor bolts, which shall be signed off on by a licensed

Professional Engineer. Refer to Structural General Notes on 00-S-002 for additional requirements for anchor bolts. All in-tank anchors shall be 316/316L SS.

D. The OWNER shall provide required laboratory equipment, laboratory facilities and analytical work required for startup, adjustment and performance testing per MANUFACTURER submitted startup and performance testing requirements.

## 1.06 GENERAL CONTRACTOR SCOPE OF WORK

A. The CONTRACTOR shall install all equipment and materials as provided by the MANUFACTURER.

B. The CONTRACTOR shall supply and install all pipe sections, wall penetrations, and pipe supports as required for the MBBR Deammonification equipment and as shown on the Contract Drawings and required to connect to the MANUFACTURER supplied equipment.

C. At interfaces with media retention screen(s) of all types, the CONTRACTOR shall supply, install, and finish all concrete surfaces so that they are smooth, square, and free of gaps greater than or equal to 3/32-inch through which media could escape.

D. The CONTRCTOR shall provide all lubricants and other supplies required for equipment startup and adjustment.

E. The CONTRACTOR shall provide all support beams and/or slabs, platforms, grating, floor plate, handrails, and platforms as shown on Contract Drawings.

F. The CONTRACTOR shall provide all labor, supplies and utilities as required for startup, adjustment and performance testing, with the exception of sampling and analysis labor and equipment provided by OWNER.

G. The CONTRACTOR and MANUFACTURER shall assist the OWNER with process startup activities. The CONTRACTOR shall be responsible for the placement of seeded and unseeded media, temporary pumping and piping systems, and temporary heating as required by the MANUFACTURER. The OWNER will operate the process during startup and performance testing.

H. The CONTRACTOR shall supply and install all panels and variable frequency drives (VFD's) in compliance with Section 16480 – Variable Frequency Drives and as shown on the Contract Drawings, unless otherwise noted.

I. The CONTRACTOR shall install all control panels and instrumentation provided by the MANUFACTURER in compliance with Division 17.

J. The CONTRACTOR shall supply and install all electrical power, control wiring and conduit to the MANUFACTURER supplied equipment, including

wire, cable trays, cable, junction boxes, fittings, disconnects, conduit, etc. in compliance with Division 16.

K. The CONTRACTOR shall coordinate with the MANUFACTURER on all interface points such as piping and electrical tie-ins. Unless otherwise noted in the specifications or on the drawings, equipment to connect interface points shall be the responsibility of the CONTRACTOR.

## 1.07 SUBMITTALS

A. Submittals shall be in accordance with Section 01300 –Submittals and Section 11000 – Equipment General.

B. Shop Drawings: In addition to the shop drawing information required elsewhere, the following items shall be submitted:

1. Installation instructions on all equipment including, but not limited to, aeration equipment, mixers, air lift pumps, instruments, media retention screens, etc.

2. Controls narrative for the purpose of integrating controls with filtrate feed, equalization, and effluent transfer systems.

3. Literature and drawings describing the equipment in sufficient detail including dimensions and materials of construction to indicate full accordance with the Specifications.

4. Calculations confirming that the equipment furnished meets all design criteria and the intent of the Contract Documents including aeration demand calculations, mixing energy calculations, and surface area removal rate calculations. All aeration calculations shall be submitted for the minimum, average, and peak loadings as listed in Section 2.

5. Hydraulic calculations confirming that there is less than 3-inches of headloss through the media retention screens under peak flow conditions (as listed in Section 2).

6. Calculations showing all mixer and impeller design information (stresses, critical speed, deflections, shear, impeller power draw at specified speed, and pumping capacity at specified speed of the impeller).

7. Calculations for mixer gear and bearing life.

8. Structural design calculations for the mixer mounting devices.

9. Anchor calculations for aeration diffuser grid.

10. Calculations and/or literature confirming that all components within the gear reducer will receive adequate lubrication.

11. Data on the characteristics, features, and performance of the equipment.

12. The total weight of the equipment including the weight of the single largest item.

13. Motor drive data.

14. Welding Fabrication Procedure

C. Certifications: Furnish affidavits from the mixer MANUFACTURER stating that the mixers have been properly tested and are ready for full-time operation. Certification of Performance Test and vibration report required.

## 1.08 QUALITY ASSURANCE

A. All equipment furnished under this specification shall be new and unused, unless otherwise noted in this specification (exception is the seeded media).

B. Refer to Section 01400 – Quality Control Services.

C. The CONTRACTOR shall assume responsibility for the satisfactory installation and assisting the OWNER with initial startup of the entire MBBR Deammonification system.

D. The installations shall conform to all applicable codes that are typical and reasonable for the type of installation.

## 1.09 DELIVERY STORAGE AND HANDLING

A. The CONTRACTOR shall be responsible for receipt, protection and storage in accordance with Section 01600 –Materials and Equipment, and the MANUFACTURER's recommendations of all items shipped to the site from the time of delivery until installation is completed and the units and equipment are ready for operation. The equipment shall be suitably covered and protected at all times. Sufficient blocking shall be provided to prevent noticeable sagging of stored materials between supports and to prevent permanent distortion of the equipment. No iron or steel a shall be allowed to come into contact with stainless steel components during handling and storage of the equipment. The CONTRACTOR shall follow the MANUFACTURER's instructions to exercise any stored rotating equipment.

B. The CONTRACTOR shall coordinate phased delivery of the unseeded media with the MANUFACTURER so that the media is not being stored on site upon delivery for more than 72 hours upon arrival.

C. The CONTRACTOR shall coordinate the delivery of the seed media with the MANUFACTURER so that the seed media can be installed within eight (8) hours of arrival onsite immediately into the deammonification reactor that

is being aerated and is receiving centrate at the time of delivery. All equipment shall be tested and all virgin media received before seeded media is shipped. Any shipping delays within the MANUFACTURER'S control that impact the seed media prior to arrival and unloading at the Hornsby Bend Biosolids Management Plant and result in additional costs shall be by the MANUFACTURER up to 10 percent of the Contract Value. Any impacts to the seed media after unloading that result in additional costs shall be by the CONTRACTOR.

## 1.10 WARRANTY

A. The MANUFACTURER shall guarantee the equipment, including media, controls, mixers, appurtenances and instrumentation, for two (2) year after notice of substantial completion for the ARF, with a warranty against all defects in workmanship and materials.

## 1.11 OPERATION AND MAINTENANCE MANUALS

A. Prior to start-up, MANUFACTURER shall furnish complete operations and maintenance manuals in accordance with Section 01730 – Operation and Maintenance Data. The manuals shall be prepared specifically for this installation and shall include all required descriptions, and other information that is required to instruct operation and maintenance personnel unfamiliar with such equipment.

## 1.12 SPARE PARTS

A. The MANUFACTURER shall submit a list of suggested spare parts for the mixers, motors and drives, and a listing of the price for each spare part. Spare parts may then be purchased by the OWNER directly from the MANUFACTURER and outside of the scope of these Contract Documents.

B. Reference specification Sections 17100, 17200, 17310, 17345, 17380, 17600, and 17620 for required instrumentation and control system spare parts.

## 1.13 PATENTS

A. The MANUFACTURER shall indicate if any patents or licenses are involved because of equipment furnished, or process employed. License fees or royalties required in connection with use of the MBBR Deammonification System shall be included in the Contract Price for the life of the equipment. The MANUFACTURER shall assume all costs of patent fees or licenses for equipment or processes, and shall defend and save harmless the CONTRACTOR, OWNER and ENGINEER and their agents from damages, judgments, claims and expenses arising from license fees or claimed infringements or any letters of patent or patent right, or because of royalty or fee for the use of any equipment or process, structural feature or arrangement of any of the component parts of the equipment supplied by MANUFACTUERER when operated and maintained as instructed by MANUFACTURER; and the price stipulated for all such patent

fees, licenses, or other costs pertaining thereto.

## 1.14 PROCESS PERFORMANCE GUARANTEES

A. The ammonia removal performance of the MBBR Deammonification system will be demonstrated via one (1) thirty (30) day performance test during the first twelve (12) months of operation, following stabilization of the process. The performance test will demonstrate that the MANUFACTURER has complied with the effluent quality criteria specified herein.

B. Guaranteed Performance is based upon a process designed in accordance with the influent and effluent wastewater criteria from Section 2.

C. Additionally, the following conditions shall be met by the OWNER:

1. There will be sufficient alkalinity, either present in the wastewater or by means of chemical addition. The OWNER shall be responsible for the cost and labor of any chemical addition required for startup.

2. The wastewater being reasonably biodegradable with no inhibitory concentrations of toxic compounds present.

D. The MBBR deammonification process shall meet the following guaranteed percent removals at average loading conditions, as indicated in Section 2:

| Parameter | Units | Required Performance (30-day average) |
|---|---|---|
| Ammonia ($NH_4$-N) Oxidation (mg/L) | % | ≥ 80 |
| Total Inorganic Nitrogen (TIN) Reduction (mg/L) | % | ≥ 70 |

Notes:

1. The running 7-day average reactor temperature shall not be lower than the minimum process water design temperature (77°F) or greater than 95°F, and any daily average ambient temperature shall not be less than 37.4° F.

2. The 7-day average applied loads shall not exceed the design loadings (calculated based on the maximum month design flow and average concentration) by more than 10 percent. The 30-day average applied loads shall not exceed the design loadings.

3. The 7-day average $NH_4$-N concentration in the filtrate shall not be less than 600 mg/L and the average over the test period shall not be less than 630 mg/L.

## PART II - PRODUCTS

### 2.01 ACCEPTABLE MANUFACTURERS

A. Veolia Water Technologies, Inc.

### 2.02 MBBR DEAMMONIFICATION SYSTEM DESIGN CRITERIA

A. The MBBR Deammonification System design shall be based on the equalized flow and load conditions summarized in the table below. The MANUFACTURER shall provide all equipment and components necessary to achieve future design with this phase of work, except for the media fill. The floating media fill shall be provided for only the Initial Values and Future Values will be met with additional fill installed in the future.

| Parameter | Units | Initial Value | Ultimate Value |
|---|---|---|---|
| Flow, Average | MGD | 0.79 | 1.05 |
| Flow, Maximum Month | MGD | 0.87 | 1.16 |
| Flow, Peak | MGD | 0.92 | 1.23 |
| $NH_4$-N, Average | mg/L | 630 | |
| TSS, Average | mg/L | 500 | |
| COD, Average | mg/L | 530 | |
| Alkalinity (as $CaCO_3$), Average | mg/L | 2,520* | |
| Temperature, Minimum/ Maximum | $^oC$ | 25 / 40 | |
| pH, Average | s.u. | 7.9 | |
| Ammonia Oxidation | % | 90 | |
| Total Inorganic Nitrogen Removal | % | 80 | |

*Required alkalinity is 2,000 mg/L based on the average influent TKN concentration of 630 mg/L and 80 percent ammonia oxidation.

B. Process aeration shall be provided by three (2 duty and 1 standby) new positive displacement blowers provided by the CONTRACTOR. Refer to Section 11376 – Positive Displacement Blowers.

C. The MBBR Deammonification System shall be designed for operation in the Ammonia Treatment Reactors as indicated on the Drawings. Equipment shall be designed for the following:

| Parameter | Units | Initial Value | Future Value |
|---|---|---|---|
| Number of Reactors | - | 2 | 2 |
| Reactor Dimensions (Each) | ft | 80 L x 60 W x 19.5 (SWD) | |
| Total Reactor Volume (All Trains) | $ft^3$ | 187,200 | |
| Type of Biofilm Carriers | - | K5 | |
| Fill of Biofilm Carriers, All Reactors | % | 36.3 | 48.5 |
| Total Bulk Volume of Carriers | $ft^3$ | 68,042 | 91,747 |
| Aeration System Type | - | Medium Bubble | |
| Depth of Diffuser Submergence | ft | 18.5 | |
| Design Residual D.O. Concentration | mg/L | 1.5 | |
| Actual Oxygen Required (AOR), Average Flow | lb-$O_2$/hr | 317 | 421 |
| AOR, Max Month Flow | lb-$O_2$/hr | 349 | 465 |
| Total Standard Oxygen Transfer Efficiency at 19.5 ft SWD | % | 20.4 | |
| Total Air Requirement, Ave Load | SCFM | 3,460 | 4,600 |
| Total Air Requirement, Max Month Load | SCFM | 3,770 | 5,030 |

## 2.03 MBBR EQUIPMENT

A. BIOFILM CARRIERS (MEDIA)

1. The MANUFACTURER shall provide AnoxK™5 (K5) carrier elements.

2. ENGINEER or OWNER may reject media if field inspection during final placement of the media reveals non-conformity in terms of media

shape, size, or stock material integrity.

3. Virgin media shall be contained in bags. The media in each bag shall be of known volumetric quantity such as to facilitate accurate inventory control during final placement of the media. Each bag shall have handles on the topside to assist in moving the bags from the storage location above the basins for final placement of the media.

4. Seed media shall be contained in 275-gallon totes or other suitable waterproof container. Installation of the unseeded and seeded media shall be the responsibility of the CONTRACTOR.

5. The CONTRACTOR shall install the media into the reactors and maintain an accurate inventory of the number of bags installed in each reactor. These records shall be made available to the OWNER, ENGINEER or MANUFACTURER upon request.

6. The MANUFACTURER shall provide 68,042 cubic feet of media for the MBBR system of which at least 5 percent (3,402 cubic feet) of the supplied media shall be "seeded" with anammox bacteria. The seeded media shall be equally divided into the two Ammonia Treatment Reactors.

7. Media material shall be an extruded, white, virgin high-density polyethylene. Recycled materials will not be accepted.

8. The nominal density of the media in bulk is 7.5 lb/ft3. The nominal specific gravity of the media shall be 0.95. Nominal effective surface area for K5 media in bulk for biomass growth is 800 m2/m3. The diameter shall be 25 mm with a height of 3 to 4 mm.

B. AERATION SYSTEM (MEDIUM BUBBLE)

1. General: The CONTRACTOR shall install aeration grids in the basins as shown on the Contract Drawings and specified herein. The MANUFACTURER shall furnish the items listed below:

   a. Drop pipes and in–basin manifolds as indicated in the Contract Drawings

   b. Aeration grids and assemblies

   c. Supports and anchors

   d. All stainless steel components shall undergo passivation/pickling in accordance with the requirements specified in Section 15023 – Stainless Steel Piping and Tubing and Section 05015 – Stainless Steel Fabrications.

2. Drop Pipe: 316/316L stainless steel drop pipes shall be provided for the aeration grid(s) to connect to the air supply piping as shown on

the Contract Drawings. The drop pipe shall be schedule 10 and be connected to the air supply piping. The MANUFACTURER air piping scope of supply ends at the top of the drop legs with a new 316 stainless steel flexible coupling. The in-basin manifolds, piping, and pipe supports shall be provided by the MANUFACTURER. CONTRACTOR shall be responsible for all piping from the top of the drop leg 316SS flex coupling back to the blowers.

a. Aeration Grids:

1) 316/316L stainless steel aeration grid(s) shall be provided for the basins as shown on the Contract Drawings. The aeration grids shall be comprised of an aeration grid manifold of Schedule 10 pipe with 1-1/4-inch diameter laterals of Schedule 5 pipe. The laterals shall be uniformly spaced along the length of the aeration grid manifold. Each lateral will have a series of 4mm (5/32-inch) holes uniformly spaced along the bottom. The lateral pipe shall include a crimped drop pipe at the end, to provide for easy drainage, and to prevent entry of media. Each aeration grid shall be supplied with all necessary couplings and hardware.

2) The CONTRACTOR is responsible for field verifying the existing basin floor elevations and providing the information to the MANUFACTURER prior to the submittal.

3) Straub flexible couplings used to connect aeration grid piping sections. Weld beads will be applied to the aeration grids to prevent the couplings from migrating.

b. Supports:

1) Drop Pipe Supports: MANUFACTURER shall provide all required supports. CONTRACTOR shall install all supports according to MANUFACTURER'S requirements.

2) Aeration Grid and In-Basin Manifold Supports: Aeration grid and in-basin manifold supports to be fabricated from 316/316L stainless steel. Each support shall consist of a minimum 2-inch bearing contact between the pipe and support. The support shall be secured by two (2) 18-8 stainless steel threaded rods with a minimum diameter of 5/8-inch. Each rod will be anchored to the concrete by chemical anchors. The aeration grid and in-basin manifolds shall be secured to the support by a u-bolt to prevent lateral movement. Supports shall be designed to allow for on-site height adjustment. Supports shall have a maximum spacing of 9'-0" and shall be per the MANUFACTURER's shop drawings. All interconnecting hardware required to secure the support to the aeration grid shall be provided by the MANUFACTURER. No field welding shall be required. In-basin manifolds, supports and hardware to be

provided by the MANUFACTURER.

3) Aeration piping, grids, and supports shall all be design to carry the weight of the reactor's media, assuming wet media and maximum media fill.

c. Construction

1) Welding: All welding shall conform to MANUFACTURER Welding Fabrication Procedures and shall be in accordance with Section 05500 – Metal Fabrications. All factory welding shall undergo pickling/passivation to prevent rust and corrosion.

2) Bolting: Unless otherwise specified, bolts, screws, nuts, and washers shall be Type 316 stainless steel. All support nuts shall be double nutted to prevent potential disassembly associated with vibration in the piping.

3) Installation: The installation of the aeration equipment shall be such that upon completion of installation, all diffusers are level to ±1/8-inch of a common horizontal plane.

d. Design

1) The system shall be designed to be submerged within the tank basin without deforming any component and shall be designed to resist the forces from the top entry mixers.

2) All welded parts and assemblies shall be shop fabricated from 316/316L stainless steel with a 2D finish. Unless otherwise specified, all non-welded parts and pieces shall be shop fabricated from type 316/316L stainless steel with a 2D finish.

3) All flanged joints shall have 45 to 55 durometer, Shore A, EPDM gaskets.

4) All aeration grid and in-basin manifold supports shall be designed to compensate for a maximum floor elevation difference of ±3-inches.

5) All supports shall be designed to resist the load of the media and biofilm in the event the tank is drained.

C. CYLINDRICAL SCREEN ASSEMBLIES

1. The CONTRACTOR shall install two (2) cylindrical screens for media retention in each basin as shown on the Contract Drawings and specified herein. The MANUFACTURER shall furnish the cylindrical screens.

2. Cylindrical Screen (Media Retention Sieve): 316/316L stainless steel

cylindrical screens shall be provided for each reactor as shown on the Contract Drawings. The cylindrical screens shall be constructed of a minimum 14-gauge sheet and have a perforation pattern of a 5/8-inch dia. with 13/16-inch centers, on a staggered spacing. Each screen will have a minimum ¼-inch thick plate mounting flange with two sets of anchor holes for wall mounting.

3. Construction

   a. Welding: All welding shall conform to MANUFACTURER Welding Fabrication Procedures and shall be in accordance with Section 05500 – Metal Fabrications.

   b. Bolting: Unless otherwise specified, bolts, screws, nuts, and washers shall be 316 stainless steel and supplied by the MANUFACTURER. Anchor bolts shall be in accordance with Section 05500 – Metal Fabrications.

   c. Installation: Each cylindrical screen shall be direct wall mounted as required by the MANUFACTURER. The installation of the cylindrical screen shall be such that upon completion of installation, all cylindrical screens are level to ±1/8-inch of a common horizontal plane.

4. Design

   a. The system shall be designed to be submerged within the tank basin assuming the maximum allowable media fill without deforming any component.

   b. All welded parts and assemblies shall be shop fabricated from 316L stainless steel with a 2D finish. Unless otherwise specified, all non-welded parts and pieces shall be shop fabricated from type 304 stainless steel with a 2D finish.

   c. There shall be less than 3-inches headloss through the cylindrical screens under peak flow conditions.

D. TOP ENTRY MIXERS

1. General

   a. The CONTRACTOR shall provide the mixer bridges and install the top entry mixer(s) in the reactors as shown on the Contract Drawings and specified herein. The MANUFACTURER shall furnish the mixers as specified herein and in accordance with Section 11210 – Vertical Shaft Mixers.

   b. Mixers shall be of the non-clogging, vertical shaft, hyperboloid-body type.

c. The mixer and its appurtenances shall be specifically designed for continuous duty operation in a submerged application in the MBBR Deammonification reactors filled with the K5 Media. The mixers shall not overload the motors at any point within the operating limits recommended by the mixer manufacturer.

d. The mixer shall be designed with no submerged bearings and with a dry installed motor. The entire weight of the mixers shall be supported by concrete bridges/walkways provided by the CONTRACTOR.

e. Qualifications of Manufacturer: The manufacturers shall be experienced in the design and construction of equipment for this purpose and shall have furnished such equipment and can prove that it has performed successfully for a period of not less than three (3) years.

f. Acceptable Manufacturers:

1) Veolia AnoxKaldnes / Invent Environmental Technologies, Inc

2. Design: The mixers shall be capable of mixing each MBBR reactor as required by the design conditions and performance tests outlined below.

| | |
|---|---|
| No. of mixers | Two (2) per reactor |
| Mixer configuration | Hyperbolic |
| Model | HCM/2500-40-29.5 |
| Liquid being mixed | Mixed liquor With AnoxKaldnes Media |
| Media Type | AnoxK 5 |
| Percent Fill | Up to 50% (at Ultimate condition) |
| Speed | 39.6 RPM |
| <u>Mixing Zone</u> | |
| Depth | 19.5 ft |
| Length | 80 ft |
| Width | 60 ft |
| Motor Horsepower | 29.5 Hp |
| Mixer Diameter | 98.4 inches |
| Pitched Blade Diameter (cyberprop) | 71 inches (1.8 m) |
| Motor Type | Squirrel Cage, Induction type |
| Nominal Motor Speed | Coordinate with Mixer RPM Requirements |

| | |
|---|---|
| Motor Efficiency | NEMA MG1 Premium Efficiency |
| Design | Design B |
| Duty | Continuous |
| Insulation | Class F |
| Voltage | 460V, 3 Ph., 60 Hz |
| Service Factor | 1.15 (The motor service factor shall not be used in sizing the motors) |

a. Each mixer assembly shall consist of a dry installed heavy-duty speed reducer with hollow shaft, variable speed premium efficient electric motor, baseplate, 316-SS shaft, and upper 4-blade propeller and composite lower hyperbolic mixer body.

b. The bottom of the hyperbolic mixing body should not exceed 12” above the basin floor.

c. During operation the mixer should not generate any upward forces on the bridge construction. The mixer should have a steady stationary flow pointed downward parallel to the mixer shaft. The highest speeds and turbulent fluctuations should be produced in the bottom area.

d. The gear drive assembly for each mixer shall consist of parallel-shaft helical gearbox and motor as designed by SEW Eurodrive. The mixer gear drive must be built in accordance with the current AGMA Standards. The AGMA calculated drive HP rating shall be stamped on the drive nameplate. Drive housings shall be of high quality close grained cast iron, or fabricated steel, stress relieved and reinforced, and shall be provided with lifting lugs.

e. Each unit shall be provided with an integral or separate baseplate and shall have a minimum 12” ductile iron pedestal base (provided by the MANUFACTURER) for ease of assembly of the agitator shaft and to facilitate draining of the oil from the gear drive.

f. Gearing must be vertical parallel shaft all helical gears or helical spiral bevel to ensure the highest efficiency coupled with the convenience of mounting and maintenance (worm gearing is not acceptable). Helical gears shall be a minimum AGMA Quality 10 per AGMA standard 390.03. Spiral/bevel sets shall be a minimum AGMA Quality 8, matched and lapped. The gears shall be lubricated from a common oil bath. The full load operating noise levels of the mixer drives shall not exceed 85 dBA at 3 feet from any part of the drive assembly.

g. The mixer gear drive shall be designed with an output shaft system suitable for the loadings imposed by the specific duty. The drive’s

minimum AGMA service factor shall be 1.5 and based upon motor nameplate horsepower. The service factor shall be based on AGMA Standard 6010-F97 for 24 hour per day moderate shock application. Service factors based on uniform load and motor bhp will not be accepted. Agitator gear drive coupled to impeller shaft must be designed, manufactured, and tested by the mixer supplier. Furnishing second party gear drives will not be allowed.

h. All drive bearings shall be of the antifriction type, ball or roller bearings. All bearings within the drive, including output shaft bearings, shall have minimum AFBMA B-10 lives of 50,000 hours when operating at full motor nameplate horsepower at design speed.

i. Each drive must have an effective lubrication of rotating elements without leakage down the output shaft. Output shaft bearings may be grease lubricated. Output shaft bearing seals shall be dry-well type. Lip seals shall not be permitted.

j. The electric motor drivers shall have a 1.15 service factor and TEFC/TENV enclosure with class F insulation and class B temperature rise above 104 °F ambient. The motors shall be squirrel cage induction motors for operation on 3 phase, 60 hertz, 460V with synchronous speed of 1800 RPM or less. Motors shall be variable speed, premium efficiency type and rated for severe duty. Efficiency shall be determined in accordance with IEEE 112, Test Method B. Maturation mixer motors are to be used with AC inverters that shall meet NEMA MG1, part 31 for variable torque, 10:1 turndown operation. The motor shall be connected to the input shaft with a flexible coupling and shall be pilot mounted with a NEMA C face flange. Integral mounted motors without flexible coupling attachments shall not be accepted. IEC or other non-NEMA motor flanges will not be accepted. All motors shall be designed constructed and tested in accordance with applicable IEEE, NEA, and ANSI, standards.

k. The lower mixer shaft shall be connected to the upper, or drive output shaft, by means of a rigid flanged or integral coupling.

l. The agitator shaft shall be of solid 316 stainless steel construction. The shaft shall be designed such that the combined (Mohrs circle) maximum shear stress shall not exceed 9,000 psi under maximum operating loads for stainless steel. It shall be of overhung design for use in complete coverage (liquid levels at least one impeller diameter above the impeller height). The use of underwater steady bearings is not permitted. The mixer shaft shall have a maximum operating speed of 0.75 times the natural frequency of the shaft and impeller assembly without the use of stabilizing ring and lower shaft bearing.

m. Mixer hyperboloid shall be manufactured of FRP and be a

streamlined stress-free body without any mounted or fitted parts. The transport ribs which accelerate the flow shall be integrated in the mixer body. The mixer body shall be coated with a gel coat to provide a polished surface. The hyperboloid mixer shall have laminated stainless steel insert nuts.

n. Spare Parts: MANUFACTURER shall include one set of rubber buffers and one shaft holder for each mixer provided, all lubricating oils required for one full year of operation (prefilled). Spare parts shall be identical to and interchangeable with similar parts installed.

o. Upon installation each unit shall be run to demonstrate its ability to operate without overloading, jamming, or excessive vibration during normal operation.

p. All non-wetted parts will be shipped with MANUFACTURER's standard factory paint, suitable for use as a finish coat in accordance with Section 09960 – High-Performance Coatings. All touch-up and additional coats are to be applied in the field by the CONTRACTOR. Wetted parts, of 304 or 316 stainless steel, will not be painted.

q. The MANUFACTUER shall provide 316 stainless steel anchor bolts, nuts, and washers, and furnish templates necessary for setting the equipment. Placement of the anchor bolts shall be performed by the CONTRACTOR from certified dimension prints supplied by the MANUFACTURER. Anchor bolts shall be in accordance with Section 05500 – Metal Fabrications.

r. The mixers shall be as manufactured by Invent Environmental Technologies, Inc. and shall be sized to provide adequate mixing energy based on a maximum media fill of 50 percent of the deammonification basin volume.

3. Execution

4. Factory Test: The mixer MANUFACTURER shall perform inspections and tests on each unit before shipment. Hyperbolic mixer body diameter, motor rating, and electrical connections shall be checked for compliance with contract requirements. The following tests shall be performed on the SEW gearmotors:

   a. One-second-high potential test

   b. No-load run test including no-load current, no-load speed, phase deviation current and no-load motor power.

   c. Visual inspection of the unit.

d. Tester shall inspect for any abnormal noise.

e. Certified copies of all test procedures and results shall be provided to the ENGINER prior to shipment.

f. Startup and Testing: Prior to the start of the mixer tests, fill the zones to the maximum water elevation with test water (plant effluent).

1) Run the mixer for one hour at maximum design conditions. Demonstrate for each mixer:

2) Is free of overheating of any parts.

3) Is free of all objectionable vibration, in accordance with manufacturer's recommendations.

4) Is free of overloading of any parts.

5) Via the Control Station(s), verify mixer functions.

6) Record amperage draw.

7) Continue operating the mixer for 24 hours without overheating, excessive vibration or overloading.

8) Certified copies of all test procedures and results shall be provided to the Engineer.

E. AIR LIFT PUMPS

1. General: The MANUFACTURER shall supply AnoxKaldnes air lift pump assemblies complete with mounting brackets, Type 316 stainless steel anchor bolts, washers, nuts and lifting chain. The air lift pump assemblies shall be Type 316/316L stainless steel. The CONTRACTOR shall install and connect aeration supply to the air lift pumps as shown on the Contract Drawings.

2. Each air lift pump shall draw water from the MBBR deammonification reactor to be spread on the reactor water surface to reduce surface foam.

3. MANUFACTURER shall design and supply orifice plates, tubing and small diameter valves to feed air to the airlift pumps.

4. CONTRACTOR shall supply aeration piping, expansion joints and valves to air lift pumps as shown on the Contract Drawings. CONTRACTOR shall include Type 316 stainless steel supports as indicated on the Contract Drawings and shall provide expansion couplings as indicated to account for thermal pipe expansion.

5. CONTRACTOR shall secure fasteners for all airlift pump supports with nylon lock nut connections to prevent vibration from disassembling the fasteners.

F. ANCHORS

1. The MANUFACTURER shall size and furnish all anchoring hardware for the supplied equipment – refer to Section 05500 – Metal Fabrications.

2. The CONTRACTOR shall furnish all epoxy and dispensing equipment for chemical anchoring. The epoxy shall be Hilti H-200 adhesive or similar epoxy anchor product.

G. MANUAL AIRFLOW ISOLATION VALVES

1. The MANUFACTURER shall furnish nine (9) manual butterfly valve for each reactor– refer to Section 15202 – Butterfly Valves.

## 2.04 BLOWERS

A. Blowers shall be provided by the CONTRACTOR. Blowers shall be designed to meet the required aeration demand for the MBBR Deammonification System including diffuser grids, airlift pumps, and other components of the system requiring forced air. Refer to Section 11376 – Positive Displacement Blower

## 2.05 INSTRUMENTATION AND CONTROLS

A. The requirements in Division 17 are applicable to this section.

B. Control Strategy: The MANUFACTURER shall submit a complete set of control strategies including all proprietary process control strategies which depict all monitoring and control functions on a loop by loop basis. Refer to Section 17900 – ARF Control Narrative and associated CP Appendix.

C. Refer to Section 17100 for required network coordination and graphics meeting with the owner and system integrator.

D. Vendor Control Panel

1. The MANUFACTURER shall provide a PLC-based control panel to monitor and control the MBBR Deammonification process. The PLC-based control panel shall include the PLC, operator display, control relays, push buttons and selector switches, indicating lights, power supplies, incoming power surge protector, analog isolators, signal conditioners, circuit breakers, and terminal strips as described herein and on the contract drawings.

2. Configuration and programming of the MANUFACTURER'S PLC and the

OIU shall be by the MANUFACTURER.

3. The CONTRACTOR shall furnish and install all required equipment, including signal wiring, piping, terminations, incidental conduits, and necessary mounting and accessory equipment to provide a complete and operational system.

4. The CONTRACTOR will terminate all wiring within instrument cabinets at terminal blocks.

5. The MBBR Deammonification Control Panel shall be located in the new Blower Building and shall be supplied in a NEMA 12 carbon steel enclosure suitable for indoor use. The front panel of the cabinet shall contain operator interface and push buttons, as detailed within this specification. The Schneider Electric Modicon PLC based control panel shall also include an operator interface display mounted on the front of the control panel. The internal portion of the cabinet shall contain all rack mounted PLC equipment, power supply, processor and interface cards. Relays, terminal strips and surge suppressors shall also be contained within the cabinet. Terminal strips for all field wiring shall be furnished within the panel. Refer to the network block diagram for additional equipment supply an d connectivity details.

    a. The MANUFACTURER shall include an uninterruptible power supply capable of operating the MBBR PLC for no less than 10 minutes within the PLC panel.

    b. The MANUFACTURER shall provide a Schneider Modicon M580 controller that is compliant with OWNER standard.

    c. Redundant processors are not required.

    d. The MANUFACTURER shall provide a panel mounted 15” Operator interface unit (OIU), Schneider Electric Harmony GTU HMIDT732, with the latest Vijeo Designer software.

        1) The Manufacturer shall coordinate with the ICS (Instrument and Control System Contractor) the required OIU graphics development requirements. At a minimum, the Manufacturer shall utilize the Owner’s standards for representation of equipment status, alarms, tagging, naming convention, and entry and view fields for consistency in operational interpretation.

        2) Allowance shall be made to attend a network and graphics coordination meeting with the ICS as described in section 17100. Graphics submittal shall be as described in section 17900.

    e. Coordinate with the Owner for required network equipment IP addresses.

6. An alarm horn shall be provided loose with the Control Panel. The CONTRACTOR shall mount this horn adjacent to the Control Panel. The horn shall be manufactured by Federal Signal or an approved equivalent. A horn disconnect switch/circuit breaker shall be provided inside the Control Panel.

7. The MANUFACTURER shall supply a PLC I/O list as a required element of the PLC system design. The format for PLC I/O list is an OWNER standard in order to align with other plant data systems.

8. The MANUFACTURER shall supply functional requirements documentation, program organization diagrams, control logic descriptions, and logic diagrams as necessary to thoroughly document the system program. Final PLC program and OIU control screens shall be separately furnished on a secured USB to the Owner for Owner use. Installed PLC programs and OIU screens shall not be password protected.

9. Remote access to the vendor control panel will be prohibited.

E. Flow Control Valves

1. The MANUFACTURER shall supply two (2) air flow control valves to control airflow to each reactor in accordance with Section 15201 Actuators for Process Valves and Gates and Section 15202 Butterfly Valves.

F. Field Instrumentation

1. Thermal Mass Flow Meter

a. The MANUFACTURER shall supply two (2) thermal mass flow meters to measure airflow to each reactor in accordance with Section 17102 Flow Measuring Systems.

2. Dissolved Oxygen (DO) Probes

a. The MANUFACTURER shall provide two (2) DO probes (one per reactor).

b. The interface unit shall convert the sensed dissolved oxygen concentration to an analog electrical signal.

c. The wetted probe shall sense the dissolved oxygen concentration via a luminescent sensor. The signal from the sensor shall be tied to the interface unit that will convert the sensor signal to a 4 to 20 mA signal that will interface with the PLC. The dissolved oxygen transmitter shall be utilized for monitoring the dissolved oxygen concentration in the tank.

d. The measuring principle shall be based on luminescent material

that is sensitive to oxygen.

e. Sensor replacement shall not require factory service personnel to be present. Calibration shall be accomplished in free air and will not require special chemical baths.

f. The interface transmitter shall be housed in a NEMA 4X/IP66 enclosure with a corrosion-resistant finish.

g. Operation characteristics

1) The dissolved oxygen probe shall be a continuous-reading probe that utilizes luminescent sensor technology.

2) The probe will not require calibration more frequently than once every six months.

3) The measurement range shall be 0.00 to 20.00 mg/L dissolved oxygen.

4) The operation of the analyzers shall not be affected by H2S, pH, K+1, Na+1, Mg+2, Ca+2, NH4+1, Al+3, Pb+2, Cd+2, Zn+2, Cr (total), Fe+2, Fe+3, Mn+2, Cu+2, Ni+2, Co+2, CN-1, NO3-1, SO4-2, S-2, PO4+3, Cl-1, anion active tensides, crude oils, or Cl2.

5) The probe shall provide electrolyte-free operation without the requirements of sample conditioning.

h. The probe shall be furnished with a mounting kit.

i. The analyzer shall be HACH LDO® 2 Probe and sc4500 Controller interface unit.

3. Float Switch

a. MANUFACTURER shall provide two (2) float switches (one per reactor) in accordance with Section 17370 – Mechanically Activated Level Switches.

4. Combination pH/Temperature Probe

a. The MANUFACTURER shall provide two (2) pH/temperature probes (one per reactor).

b. The pH sensor shall be of Differential Electrode Technique design which uses two electrodes to compare the process value to a stable internal reference standard buffer solution. The standard electrode shall have non-flowing and fouling resistant characteristics.

c. The sensor shall have a measuring range for pH of 0.00 to 14.00.

d. The sensor shall be manufactured by Hach, model number DPD1P1.

e. The microprocessor-based transmitter shall accept any Hach Differential Technique Digital or Analog pH or ORP sensor or any conventional combination electrode.

f. The transmitter shall be NEMA 4X rated, 120VAC and shall offer two 4-20mA output signals.

g. The transmitter shall be Hach model sc4500.

5. Ammonia Analyzer

a. The MANUFACTURER shall provide two (2) ammonia analyzers (one for the influent/EQ and one for reactor pair) and three (3) sampling mechanisms (one influent/ EQ and one for each reactor) for analyzing the ammonia in process water

b. The method of measuring ammonium will be by gas selective electrode (GSE) that uses liquid to gas- phase conversion.

1) Sample is mixed with sodium hydroxide that converts ammonium to ammonia which is expelled from the sample.

2) The ammonia gas can pass the gas selective membrane.

3) Ammonia changes the pH of the electrolyte and the electrode then measures the pH value and calculates the ammonium concentration.

c. Performance Requirements

1) Measurement range (depending on model/range selected):

a) 10 to 1000 mg/L

2) Lower detection limit (depending on model/range selected):

a) 10 mg/L

3) Accuracy (depending on model):

a) 3% ±0.05 mg/L, or

b) 3% ±1.0 mg/L, or

c) 4.5% ±10 mg/L

4) Reproducibility (depending on model/range selected):

a) 2% ±0.05 mg/L, or

b) 2% ±1.0 mg/L, or

c) 2% ±10 mg/L

5) Response time: Less than 5 minutes (T90), including sample preparation (in combination with Hach Filterprobe sc)

6) Measurement interval: 5 to 120 minutes, adjustable

7) When connected to a multi-parameter digital controller the overall status of the instrument performance is displayed as a percentage value via a measurement indicator

8) When connected to a multi-parameter digital controller the overall time remaining until maintenance tasks are due is displayed in days

9) Operational Criteria

a) Sample temperature: 39 to 104 °F (4 to 40 °C)

b) Sample pH: 5 to 9 pH

c) Operating temperature: - 4 to 114 °F (-20 to 45 °C)

d) Operating humidity: 95% relative humidity, non-condensing

d. CE conform. Listed to UL and CSA safety standards by TUV.

e. The product shall include a one-year warranty from date of shipment.

f. Manufacturer: Hach , Model NH6000 sc Ammonium Analyzer.

1) Housing: ASA UV-resistant, IP55-rated, lockable

2) Gas sensitive electrode

3) Colorimeter

g. Equipment

1) The analyzer calibrates and cleans itself automatically.

2) The analyzer is equipped with self-diagnostic routines.

3) The required power supply is 115 Vac/50-60Hz connected to a Hach model sc4500 universal controller.

4) Data transmission is made with a data cable with the controller.

5) Outputs include relay, current outputs, and bus interface via the controller

6) Integrated sample pump for the FX620

h. Components

1) Standard Equipment: Analyzer, Manual, Reagents

2) 21.3 x 28.3 x 15.4 inches (540 x 720 x 390 mm)

3) Weight: 68 pounds (31 kg)

i. Accessories

1) Hach FX620 Sampling System

2) Filtrax Sample Filtration Systems and associated

3) Hach sc4500 controller

4) Mounting kits (stand)

## 2.06 REACTOR WALL QUALITY

A. CONTRACTOR shall be responsible for finishing, refinishing, filling, patching, or otherwise creating a smooth surface on the reactor floor and walls. Finish quality shall comply with ACI 301 Subsection 5.3.3.3.c SF-3.0.

# PART III - EXECUTION

## 3.01 GENERAL

## 3.02 PREPARATION

## 3.03 ERECTION, INSTALLATION, AND APPLICATION INSTRUCTIONS

A. General installation requirements shall be in accordance with Sections 11000 – Equipment General.

B. Placement of the anchor bolts shall be determined by the CONTRACTOR from certified dimension prints supplied by the MANUFACTURER.

C. Bolts and nuts for securing guide rail shall be assembled with "never-seize" and shall be secured with stainless steel wire locks or stainless steel castellated nuts and cotter pins.

## 3.04 SYSTEM START-UP, TESTING, AND CERTIFICATION

A. In accordance with Specification Section 01650 – Facility Startup/ Commissioning and MANUFACTURER supplied startup procedures.

B. The PLC-based control system shall be Engineer witnessed factory tested and field tested as detailed in specification Section 17100-3.01, 4.01, and 5.01.

C. MANUFACTURER shall submit system start-up, testing, and certification procedures to the OWNER and ENGINEER a minimum of one twenty (120) days prior to startup for review and approval.

D. The MANUFACTURER shall provide thirty-two (32) days of service in not less than six (6) trips by a fully qualified factory service representative to inspect the installed equipment, assist the CONTRACTOR to start the equipment operation.

E. The OWNER shall conduct weekly conference calls with the MANUFACTURER to review performance data and provide guidance on any process modifications.

F. The MANUFACTURER, in conjunction with the CONTRACTOR shall inspect equipment furnished by the MANUFACTURER and provide certification on the installation. This certification shall be limited to the visual inspection and known quantitative aspects of the MANUFACTURER's equipment.

G. The MANUFACTURER shall provide the services of a factory trained representative to check and verify the PLC program functionality (Dry testing).

H. The MANUFACTURER shall configure, program and test the control system and provide a written control narrative for the system. Instrument manufacturer shall be responsible for providing field services for calibration purposes and assist in integrating the instruments into the PLC. The System Integrator shall be responsible for updating the existing SCADA HMI screens with the new processes.

I. Prior to filling the tank with any filtrate or media, CONTRACTOR shall conduct functional testing of diffuser grids. Grids shall be tested with non-potable water and run over the range of the minimum and maximum air ranges. CONTRACTOR shall slowly ramp up from the minimum flow range to the maximum. Test shall be run at the maximum air flow rate for a minimum of 2 hours. CONTRACTOR shall observe for any areas which are not functioning properly and correct any issues. Should any issues be detected, contractor shall repair the issues and restart the testing for the 2-hour duration. Contractor shall coordinate visual confirmation by ENGINEER/ OWNER and provide documentation to OWNER upon successful completion of diffuser testing.

J. Instruments and other devices that require calibration and checkout will be carried out after the CONTRACTOR has the equipment installed and verified continuity. Instruments and devices shall be configured and

demonstrated to function prior to start-up. A document indicating the set points and calibration shall be furnished by the MANUFACTURER for documentation records.

K. The CONTRACTOR shall furnish all MANUFACTURER-approved consumables, including oil and grease prior to operation of equipment. All consumables after substantial completion will be by the OWNER.

L. Operation, maintenance and installation manuals shall be provided for the supplied equipment – refer to Section 01300 –Submittals and Section 01730 – Operation & Maintenance Data for O&M manual requirements.

## 3.05 TRAINING

A. The MANUFACTURER shall provide on-site training to the OWNER plant personnel.

B. The MANUFACTURER shall supply two (2) training sessions. The first session shall be before start-up and will consist of two (2) days to cover different shifts of OWNER's staff. The second training session shall occur within 6 months of initiating startup and will also consist of two (2) days.

C. The training services shall comprise a qualified representative to instruct and train plant personnel in the proper startup, operation, shutdown, maintenance, repair and troubleshooting of the system. Mechanical equipment suppliers will also provide training on their specific equipment.

D. A training outline shall be submitted to the ENGINEER for approval including the credentials of the training staff.

E. The training shall include the following topics:

1. System walkthrough
2. Theory of the Process
3. System Design
4. Mechanical Components
5. Instrumentation
6. Process Control Functions
7. Optimum Operation
8. Troubleshooting
9. Hands-on use of the Control Interface
10. Question and Answer Session

## 3.06 PERFORMANCE TESTING

A. The MANUFACTURER shall be responsible for providing guidance to the OWNER on the performance test including submitting performance testing procedures for review by the OWNER and ENGINEER a minimum of sixty (60) days prior to the testing start date for approval.

B. CONTRACTOR shall be responsible for dedicating the appropriate number of staff to assist OWNER during the performance testing period. CONTRACTOR shall anticipate no less than four (4) months and no greater than eight (8) months of time for performance testing. Performance testing shall last no less than thirty (30) days and shall commence within fourteen (14) days of MANUFACTURER'S written approval that system stability has been reached.

C. The OWNER shall be responsible for conducting the performance testing per MANUFACTURER's test plan, for collecting all samples, for carrying out all laboratory tests and for keeping detailed records as necessary for determining whether the performance guarantees have been met. The records shall be retained until the performance guarantee has been satisfied or until expiration of the period during which the performance test is to be performed whichever occurs earlier, and such records shall include all daily log sheets, notes, sample inspections, and instrument charts produced in operation of the plant.

D. Upon successful completion of the Performance Test, MANUFACTURER shall execute and submit a performance test report and the Certificate of Performance Test Acceptance to the OWNER. The effective date for acceptance shall be the date the Performance Test was completed.

E. The performance test shall be subject to the following general conditions:

1. All volumes specified shall be measured by tank gauges or calibrated meters acceptable to the MANUFACTURER and corrected to 60 °F .

2. All analyses, data reduction or tests not otherwise specified shall be carried out by procedures approved by the ENGINEER. (The publication, Standard Methods for Examination of Water and Wastewater, most recent edition, shall be the primary procedure source unless a different source is agreed upon by OWNER and the MANUFACTURER.)

3. The CONTRACTOR shall furnish all materials, utilities, services and personnel as required to operate the MBBR reactors during the performance tests.

4. The CONTRACTOR and OWNER will notify the MANUFACTURER in writing thirty (30) days in advance of beginning the performance test.

F. The following are specific responsibilities of the MANUFACTURER and OWNER with respect to the performance test and guarantees:

1. The OWNER shall be obligated to carry out the performance test at such conditions and at such time as the MANUFACTURER may reasonably request (or MANUFACTURER and OWNER mutually agree) for purposes of determining whether guarantees are met. The time within which the performance test is to be carried out may be extended by the length of any period of down time required for correcting any failure or deficient performance.

2. The OWNER shall provide the labor required to obtain samples and measurements and shall pay for all laboratory analyses of the samples.

3. All laboratory analyses shall be performed by the OWNER.

4. If during the performance test it appears that the process guarantees are not being met, the MANUFACTURER shall have the right to have the MBBR reactors operated at such reasonable conditions as it may deem necessary or advisable for the purpose of determining the nature or cause of the failure of the plant to meet such guarantee, provided such operating conditions are in accordance with good engineering practice and OWNER'S operating rules enforced at the plant site. Thereafter, the MANUFACTURER shall have the right to make or have made such adjustments in order to meet such guarantee and the right to make or have made such alterations or modifications to the plant necessary to correct deficiencies in the process design basis as it deems necessary or advisable. Such alterations or modifications shall be subject to review and approval by the OWNER and implemented at no additional expense to the OWNER.

5. The following recordings shall be taken daily during the Performance Testing period using analyzed samples and recording points:

| Sampling and Analyses During Performance Testing | | | | |
|---|---|---|---|---|
| Parameter | Sample Type | Frequency | Influent | Effluent |
| Plant Flow, MGD | Continuous | Daily | X | X |
| TSS, mg/L | Grab or 24 hr Composite | 3/week | X | X |
| COD, mg/L | Grab or 24 hr Composite | 3/ week | X | |
| Soluble COD, mg/L | Grab or 24 hr Composite | 3/week | X | |
| Total Kjeldahl Nitrogen (TKN), mg/L | Grab or 24 hr Composite | 3/week | X | |
| $NH_3$-N, mg/L | Grab or 24 hr Composite | 5/ week | X | X |
| $NO_3$-N, mg/L | Grab or 24 hr Composite | 5/week | X | X |
| $NO_2$-N, mg/L | Grab or 24 hr Composite | 5/week | X | X |
| Total Phosphate (PO4-P), mg/L | Grab or 24 hr Composite | 3/ week | X | X |

| | | | | |
|---|---|---|---|---|
| Alkalinity, mg/L as $CaCO_3$ | Grab or 24 hr Composite | 3/week | X | X |
| Dissolved Oxygen (DO), mg/L | Continuous | Daily | | X |
| pH, SU | Continuous | Daily | X | X |
| Temperature, $^0$C | Continuous | Daily | X | X |

6. The MANUFACTURER and OWNER will jointly review performance of the process system to determine compliance with performance guarantees. Review will include, but not be limited to, a comparison of influent and process design basis with the actual performance results.

7. The OWNER will promptly notify the MANUFACTURER of the failure to meet any process guarantee and specify the respect in which such guarantee has not been met.

8. If the MANUFACTURER disputes any claimed failure, notice of such dispute shall be furnished promptly to OWNER.

9. The MANUFACTURER shall not be responsible for non-fulfillment of guarantees or the cost of alterations or modifications to the plant due to deficiencies in the MBBR reactors beyond MANUFACTURER's control, such as the design by the ENGINEERS, materials or equipment, workmanship (other than that of the MANUFACTURER) or services beyond the control of the MANUFACTURER, including, but not limited to:

    a. Defective materials or mechanical conditions or deficient performance of equipment utilized in parts auxiliary to the technology not supplied by the MANUFACTURER.

    b. Noncompliance with the process design basis for said plant and/or noncompliance with operating instructions, or reasonable revisions of either of these consistent with the Specifications, furnished or approved in writing by the MANUFACTURER to OWNER or defective conditions or performance of any materials, equipment or work supplied by or contracted for by OWNER, other than those provided or supplied by the MANUFACTURER, provided that the MANUFACTURER has given OWNER notice of such noncompliance or defective conditions or performance promptly upon discovery of the same.

    c. Failure of OWNER to furnish adequate utilities such as, but not limited to electricity, air, water, etc., as set forth in the O&M Manual supplied by the MANUFACTURER: an adequate operating staff; or mechanical failure of any of the equipment or component parts thereof due to ordinary wear and tear.

    d. Failure of OWNER to perform any of the responsibilities and

obligations assumed by it in accordance with the provisions hereof.

e. The failure of the OWNER substantially to comply with any or all of the foregoing conditions which impairs the MANUFACTURER'S ability to satisfy its guarantee shall constitute a waiver of the requirement of performance test to which such conditions are applicable and thereupon the MANUFACTURER guarantees relating to such tests shall be deemed to have been met.

G. Performance Standards and Exclusive Remedy

1. In the event that the MBBR system does not achieve the required level of performance during the test period, the MANUFACTURER shall be permitted to conduct up to one (1) additional test to meet the specified process guarantee criteria. Each testing period not to exceed 100 days. For any retesting, the OWNER shall bear the same responsibilities for labor and laboratory testing as indicated herein for the initial performance testing, and the OWNER shall continue to bear the same operational responsibilities as indicated for the initial test.

2. If the biological treatment system fails to achieve the required effluent quality during the performance test period and fails the additional test, the MANUFACTURER shall pay for labor and material associated with identifying the cause of the performance test failure as well as modifications to improve effluent quality, at no additional expense to the OWNER.

3. The total amount of all necessary modifications and retesting expended by the MANUFACTURER to satisfy any of the guarantees shall not exceed 1.0 times the amount paid for the MANUFACTURER's scope.

H. The MANUFACTURER shall provide Performance and Payment Bonds in an amount equal to 100 percent of the MANUFACTURER's contract amount. The Performance and Payment Bonds will be provided after the execution of MANUFACTURER's contract and will be released in writing upon successful completion of the performance test as set forth herein, however the bonds shall not be outstanding for longer than 18 months from the date the contract is executed. MANUFACTURER shall provide a letter from its surety company with its bid confirming the SYSTEM SUPPLIER's ability to provide such bonds. MANUFACTURER's bid will be rejected if it does not include a letter of surety.

## 3.07 MEASUREMENT AND PAYMENT

A. No separate payment for work performed under this Section. Include cost of same in Contract price bid for work of which this is a component part.

**END OF SECTION**

## PART I - GENERAL

### 1.01 SUMMARY

A. Provide valves, actuators, and appurtenances, complete and operable, as indicated in accordance with the Contract Documents.

B. The provisions of this Section shall apply to all valves and valve actuators except where otherwise indicated.

C. Valves and actuators in particular locations may require a combination of units, sensors, limit switches, and controls, as indicated.

D. Support

1. Where a valve is to be supported by means other than the piping to which it is attached, obtain from the valve manufacturer a design for its support and foundation that satisfies the criteria in Section 11000 – Equipment General.

2. Submit the support design, including drawings and calculations sealed by an engineer, with the Shop Drawings.

E. Unit Responsibility

1. The CONTRACTOR shall assign a single manufacturer to be responsible for the supply, coordination of design, assembly, testing, and furnishing of each valve; however, the CONTRACTOR shall be responsible to the OWNER for compliance with the requirements of each valve Section.

F. Single Manufacturer

1. Where 2 or more valves of the same type and size are required, the valves shall be furnished by the same manufacturer.

### 1.02 RELATED REQUIREMENTS

A. Reference Specifications

| | |
|---|---|
| 01300 | Submittals |
| 01730 | Operation and Maintenance Data |
| 05500 | Metal Fabrications |
| 09960 | High-Performance Coatings |
| 11000 | Equipment General |
| 15001 | Piping General |

| | |
|---|---|
| 15005 | Piping Identification |
| 15201 | Actuators for Process Valves and Gates |
| 16220 | Motors |

## 1.03 REFERENCES

A. Reference Standards

| | |
|---|---|
| **American National Standards Institute (ANSI)** | |
| **American Water Works Association (AWWA)** | |
| **ASTM International (ASTM)** | |
| ASTM A 48 | Standard Specification for Gray Iron Castings |
| ASTM A 126 | Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings |
| ASTM A 216 | Standard Specification for Steel Castings, Carbon, Suitable for Fusion Welding, for High-Temperature Service |
| ASTM A 351 | Standard Specification for Castings, Austenitic, for Pressure-Containing Parts |
| ASTM A 395 | Standard Specification for Ferritic Ductile Iron Pressure-Retaining Castings for Use at Elevated Temperatures |
| ASTM A 515 | Standard Specification for Pressure Vessel Plates, Carbon Steel, for Intermediate- and Higher-Temperature Service |
| ASTM A 536 | Standard Specification for Ductile Iron Castings |
| ASTM B 62 | Standard Specification for Composition Bronze or Ounce Metal Castings |
| ASTM B 584 | Standard Specification for Copper Alloy Sand Castings for General Applications |
| **Manufacturers Standardization Society of the Valve and Fittings Industry (MSS)** | |
| MSS SP-25 | Standard Marking Systems for Valves, Fittings, Flanges, and Unions |
| **NSF International (NSF)** | |
| NSF/ANSI 61 | Drinking Water System Components – Health Effects |

## 1.04 SUBMITTALS

A. Furnish submittals in accordance with the requirements of Section 01300 – Submittals.

B. Furnish the following information on Shop Drawings:

1. valve name, size, Cv factor, pressure rating, identification number (if any), and specification section number.

2. complete information on the valve actuator, hydraulic power units (HPU), pneumatic air supply system including size, manufacturer, model number, limit switches, and mounting.

3. cavitation limits for control valves.

4. assembly drawings showing part nomenclature, materials, dimensions, weights, and relationships of valve handles, hand wheels, position indicators, limit switches, integral control systems, needle valves, and control systems.

5. data for electric motor-actuated valves.

6. complete wiring diagrams and control system schematics; and,

7. A valve-labeling schedule, listing the valves to be furnished with stainless steel tags, indicating in each case the valve location and the proposed wording for the label.

C. Furnish a technical manual containing the required information for each valve, as indicated.

D. Furnish a spare parts list, containing the required information for each valve assembly, as indicated.

E. Factory Test Data

1. Where indicated, submit signed, dated, and certified factory test data for each valve requiring certification, before shipping the valve.

2. Furnish a certification of quality and test results for factory-applied coatings.

F. Field Test Data

1. Submit signed, dated, and certified field test data for each valve.

## 1.05 WARRANTY

A. The manufacturer shall warrant that the equipment supplied to be free of defects in material and workmanship for a period of one (1) year from the date of substantial completion.

# PART II - PRODUCTS

## 2.01 PRODUCTS

A. General

1. Provide valves and gates of new and current manufacture.

2. Provide valves 6-inch and larger with actuators with position indicators.

3. Unless otherwise indicated, provide valve actuators in accordance with Section 15201 – Actuators for Process Valves and Gates.

B. Protective Coating

1. Coat the exterior surfaces of valves and the wet interior surfaces of ferrous valves of sizes 2-inch and larger in accordance with the requirements of Section 09960 – High-Performance Coatings.

2. The valve manufacturer shall certify in writing that the required coating has been applied and tested in the manufacturing plant prior to shipment, in accordance with the indicated requirements.

3. Do not coat the machined flange faces of valves except where such flanges are not adjoining a mating flange as shown in the Contract Documents. Apply rust inhibitor coating on machined surfaces of the flange prior to shipment.

C. Valve Labeling

1. Except when such requirement is waived by the Engineer in writing, provide a label on shut-off valves and control valves except for hose bibbs and chlorine cylinder valves.

2. Furnish a label composed of 1/16-inch plastic or stainless steel, a minimum of 2 inches by 4 inches in size, as indicated in Section 15005 – Piping Identification, and permanently attached to the valve or on the wall adjacent to the valve as directed by the Engineer.

D. Valve Testing

1. As a minimum, unless otherwise indicated or recommended by the reference standards, test valves 3 inches in diameter and smaller in accordance with the manufacturer's standard procedure.

2. Factory-test valves 4 inches in diameter and larger as follows:

   a. Hydrostatic Testing

      1) Subject valve bodies to an internal hydrostatic pressure equivalent to twice the water-rated pressure of the valve.

      2) Metallic valves rating pressures shall be based at 100 degrees F.

      3) Plastic valves rating pressures shall be based at 73 degrees F, or at a higher temperature according to material type.

      4) During the hydrostatic test, there shall be no visible leakage through the valve body, end joints, or shaft seals, nor shall parts of the valve be permanently deformed.

      5) Allow test duration of at least 10 minutes, in order to allow visual examination for leakage.

   b. Seat Testing

      1) Test the valves for leaks in the closed position, with the pressure differential across the seat equal to the water rated pressure of the valve.

      2) Provide test duration of at least 10 minutes, in order to allow visual examination for leakage.

      3) The leakage rate shall be the more stringent of the following:

         a) As recommended by the reference standard for that type of valve; or

         b) Leakage past the closed valve not to exceed one fluid ounce per hour per inch diameter for metal seated valves and drop-tight for resilient seated valves.

   c. Performance Testing

      1) Shop-operate the valves from the fully-closed to the fully-open position and reverse under no-flow conditions in order to demonstrate that the valve assembly operates properly.

E. Certification

   1. Prior to shipment of valves with sizes larger than 4-inches in diameter, submit certified, notarized copies of the factory tests, showing compliance with the applicable standards of AWWA, ANSI, or ASTM.

F. Valve Markings

1. Permanently mark valve bodies in accordance with MSS SP-25 - Standard Marking Systems for Valves, Fittings, Flanges, and Unions.

## 2.02 MATERIALS

A. General

1. Provide materials suitable for the intended application.

2. Provide materials in contact with potable water listed as compliant with NSF/ANSI 61.

3. Ensure that materials not indicated are of high-grade standard commercial quality, free from defects and imperfections that might affect the serviceability of the product for the purpose for which it is intended.

4. Unless otherwise indicated, provide valve and actuator bodies conforming to the following requirements:

   a. Cast Iron: Close-grained gray cast iron, conforming to ASTM A 48 - Gray Iron Castings, Class 30, or to ASTM A 126 - Gray Iron Castings for Valves, Flanges, and Pipe Fittings

   b. Ductile Iron: ASTM A 536 - Ductile Iron Castings, or to ASTM A 395 - Ferritic Ductile Iron Pressure-Retaining Castings for Use at Elevated Temperatures

   c. Steel: ASTM A 216 - Steel Castings, Carbon Suitable for Fusion Welding for High-Temperature Service, or to ASTM A 515 - Pressure Vessel Plates, Carbon Steel, for Intermediate- and Higher-Temperature Service

   d. Bronze: ASTM B 62 - Composition Bronze or Ounce Metal Castings, and valve stems not subject to dezincification shall conform to ASTM B 584 - Copper Alloy Sand Castings for General Applications. Bronze materials in contact with potable water service shall be free of lead content meeting the Lead Reduction Act.

   e. Stainless Steel: Stainless steel valve and operator bodies and trim shall conform to ASTM A 351 - Steel Castings, Austenitic, for High-Temperature Service, Grade CF8M, or shall be Type 316 stainless steel

   f. PVC: Polyvinyl chloride materials for valve body, flanges, and cover shall conform to Cell Classification 12454

   g. CPVC: Chlorinated Poly Vinyl Chloride materials for valve body, flanges, and cover shall conform to Cell Classification 23447

h. NSF/ANSI 61: Materials shall be listed for use in contact with potable water.

i. Elastomeric materials used for seat, seals and O-rings shall be compatible with temperature, pressures and fluid or gas service.

1) Elastomeric materials for water with chloramines shall be Teflon or Viton-A.

2) Elastomeric materials for water with dissolved ozone residual shall be Teflon suitable for ozone service.

3) Elastomeric materials for oxygen (LOX or GOX) shall be Teflon specially manufactured and packaged suitable for oxygen service.

## 2.03 VALVE CONSTRUCTION

A. Bodies

1. Provide valve bodies that are cast, molded (in the case of plastic valves), forged, or welded, of the materials indicated, and with smooth interior passages.

2. Provide wall thicknesses uniform and in agreement with the applicable standards for each type of valve, without casting defects, pinholes, and other defects that could weaken the body.

3. Perform welds on welded bodies by certified welders and ground welds smooth.

4. Provide valve ends as indicated and rated for the maximum temperature and pressure to which the valve will be subjected.

B. Valve End Connections

1. Unless otherwise indicated, valves 2-1/2 inches in diameter and smaller may be provided with threaded end connections.

2. Unless otherwise indicated, provide valves 3 inches in diameter and larger with flanged end connections.

3. Flanges, bolts and gaskets shall be as specified in Section 15001 - Piping General.

C. Bonnets

1. Connect valve bonnets to the body by clamping, screwing, or flanging.

2. Provide bonnets of the same material, temperature, and pressure rating as the body.

3. Make provisions for the stem seal with the necessary glands, packing nuts, and yokes.

D. Stems

1. Provide valve stems of the materials indicated, or, if not indicated, of the best commercially-available material for the specific service, with adjustable stem packing, O-rings, chevron V-type packing, or other suitable seal. Bronze materials in contact with potable water shall be NSF 61 approved and free of lead. Elastomeric materials shall be compatible with fluid service.

2. Where dezincification is not a problem, bronze conforming to ASTM B 584 may be used, except that the zinc content shall not exceed 16 percent.

E. Stem Guides

1. Provide stem guides spaced with an L/R ratio not to exceed 200:1. Submit calculations for L/R ratios and guide spacing to the Engineer for review.

2. Stem guides shall have slotted holes and shall be adjustable in two directions.

3. Construct submerged stem guides from Type 316 stainless steel.

F. Internal Parts

1. Provide internal parts and valve trim as indicated for each individual valve.

2. Where not indicated, construct valve trim from Type 316 stainless steel or other material best-suited for the intended service.

G. Nuts and Bolts

1. Unless otherwise indicated, provide nuts and bolts on valve flanges and supports in accordance with the requirements of Section 05500 – Metal Fabrications and Section 15001 – Piping General.

## 2.04 EXTENSION SHAFT STEM

A. Valves mounted in dry areas with gearbox attached to the valve and with remote actuator shall be supplied with an extension shaft stem with universal joint attached to the gear and actuator. All components shall be sized to operate under the maximum service conditions for the valve. Unless otherwise indicated, shaft stem and universal joints shall be made of carbon steel with epoxy coating suitable for the fluid service. Each valve, shaft stem, floor stand and actuator shall be pre-assembled and

"matched marked" in the manufacturer's shop to ensure proper fit when assembled in field.

## 2.05 VALVE ACTUATORS

A. Valve actuators shall be as indicated and as specified in Section 15201 – Actuators for Process Valves and Gates.

## 2.06 VALVE ACCESSORIES

A. Provide valves complete with the accessories required to provide a functional system.

## 2.07 SPARE PARTS

A. Furnish the required spare parts, suitably packaged and labeled with the valve name, location, and identification number.

B. Furnish the name, address, and telephone number of the nearest distributor for the spare parts of each valve.

C. Spare parts are intended for use by the Owner, after expiration of the correction of defects period.

## 2.08 MANUFACTURERS

A. Valve manufacturers shall have a successful record of not less than 5 years in the manufacture of the indicated valves.

# PART III - EXECUTION

## 3.01 VALVE INSTALLATION AND TRIAL OPERATION

A. General

1. Install valves, actuating units, stem extensions, valve boxes, and accessories in accordance with the manufacturer's written instructions and as indicated.

2. Adequately brace gates in order to prevent warpage and bending under the intended use.

3. Firmly support valves in order to avoid undue stresses on the pipe.

B. Access

1. Install valves in a manner to provide easy access for actuation, removal, and maintenance, and to avoid interference between valve actuators and structural members, handrails, and other equipment.

C. Valve Accessories

1. Where combinations of valves, sensors, switches, and controls are indicated, properly assemble, and install such items such that systems are compatible and operating properly.

2. Clearly note the relationship between interrelated items on Shop Drawing submittals.

D. Trial Operation

1. After installation, schedule trial operation witnessed by the Engineer and the Owner.

2. All valves shall be cleaned thoroughly of all foreign materials and final adjustments made. The valves shall then be operated through one complete cycle from a fully closed position to a fully open position and back to a fully closed position to verify that the assembly is functional.

3. For control valves that operate in multiple operating scenarios, the Contractor shall simulate all operational scenarios including the hydraulic power units, pilot control system or pneumatic air supply system to demonstrate compliance to the specifications.

4. A field leakage test meeting the maximum allowable specified requirement shall be conducted.

5. Test certificate shall be signed by the valve manufacturer and the Contractor and shall be submitted to the Engineer.

## 3.02 FIELD QUALITY CONTROL

A. Coordinate inspection of all valves by manufacturer's representative, confirm valve orientation is correct, and instruct Owner on their operation and maintenance.

## 3.03 VALVE SCHEDULE

A. The following Valve Schedule shall apply to all valves 4 inches and larger, and all actuated valves. This Valve Schedule does not include vendor-supplied valves. Contractor shall provide all valves as required by the Contract Drawings. This Valve Schedule does not include all number and types of valves required for the Project.

B. The following Valve Schedule Notes shall apply where indicated:

1. 100% (full) port and glass-lined

2. Handwheel actuator mounted on valve stem extension to operator floor

C. Abbreviations relating to Actuator Type:

1. CW = Chainwheel
2. HW = Handwheel
3. L = Lever

| Valve Tag | Drawing Number | Valve Type | Valve Size, in | Location | Fluid Service | Actuator Type | Actuator Service | Controls | Notes |
|---|---|---|---|---|---|---|---|---|---|
| LSPU1-CV-01 | 03-I-601 | CHECK | 6 | BPLS EFFLUENT LIFT STATION VALVE VAULT | TF | N/A | N/A | N/A | |
| LSPU2-CV-01 | 03-I-601 | CHECK | 6 | BPLS EFFLUENT LIFT STATION VALVE VAULT | TF | N/A | N/A | N/A | |
| LSPU3-CV-01 | 03-I-601 | CHECK | 6 | BPLS EFFLUENT LIFT STATION VALVE VAULT | TF | N/A | N/A | N/A | |
| LSPU1-PV-01 | 03-I-601 | PLUG | 6 | BPLS EFFLUENT LIFT STATION VALVE VAULT | TF | HW | N/A | N/A | (1) |
| LSPU2-PV-01 | 03-I-601 | PLUG | 6 | BPLS EFFLUENT LIFT STATION VALVE VAULT | TF | HW | N/A | N/A | (1) |
| LSPU3-PV-01 | 03-I-601 | PLUG | 6 | BPLS EFFLUENT LIFT STATION VALVE VAULT | TF | HW | N/A | N/A | (1) |
| LSPI1-PV-01 | 03-I-601 | PLUG | 8 | ARF BYPASS VALVE VAULT | TF | HW | N/A | N/A | (1) |
| LSPI1-PV-02 | 03-I-601 | PLUG | 10 | ARF BYPASS VALVE VAULT | TF | HW | N/A | N/A | |
| LSPI1-PV-03 | 03-I-601 | PLUG | 10 | ARF BYPASS VALVE VAULT | TF | HW | N/A | N/A | |
| LSPI3-PV-01 | 03-I-601 | PLUG | 8 | ARF BYPASS VALVE VAULT | ARE | HW | N/A | N/A | |
| LSPI1-PV-04 | 04-I-601 | PLUG | 8 | FLOW METER STATION | TF | HW | N/A | N/A | (1) |
| LSPI1-PV-05 | 04-I-601 | PLUG | 8 | FLOW METER STATION | TF | HW | N/A | N/A | (1) |
| LSPI1-PV-06 | 04-I-601 | PLUG | 8 | FLOW METER STATION | TF | HW | N/A | N/A | (1) |
| LSPI1-PV-07 | 04-I-601 | PLUG | 8 | EQ BASIN | TF | CW | N/A | N/A | (1) |
| LSPI1-PV-08 | 04-I-601 | PLUG | 8 | EQ BASIN BYPASS | TF | CW | N/A | N/A | (1) |
| LSPU1-PV-01 | 04-I-602 | PLUG | 6 | EQ TRANSFER LIFT STATION | TF | HW | N/A | N/A | (1) |
| LSPU2-PV-01 | 04-I-602 | PLUG | 6 | EQ TRANSFER LIFT STATION | TF | HW | N/A | N/A | (1) |
| LSPU3-PV-01 | 04-I-602 | PLUG | 6 | EQ TRANSFER LIFT STATION | TF | HW | N/A | N/A | (1) |
| LSPU1-PV-02 | 04-I-602 | PLUG | 6 | EQ TRANSFER LIFT STATION | TF | CW | N/A | N/A | (1) |
| LSPU2-PV-02 | 04-I-602 | PLUG | 6 | EQ TRANSFER LIFT STATION | TF | CW | N/A | N/A | (1) |
| LSPU3-PV-02 | 04-I-602 | PLUG | 6 | EQ TRANSFER LIFT STATION | TF | CW | N/A | N/A | (1) |
| LSPU1-CV-01 | 04-I-602 | CHECK | 6 | EQ TRANSFER LIFT STATION | TF | N/A | N/A | N/A | |
| LSPU2-CV-01 | 04-I-602 | CHECK | 6 | EQ TRANSFER LIFT STATION | TF | N/A | N/A | N/A | |

| Valve Tag | Drawing Number | Valve Type | Valve Size, in | Location | Fluid Service | Actuator Type | Actuator Service | Controls | Notes |
|---|---|---|---|---|---|---|---|---|---|
| LSPU3-CV-01 | 04-I-602 | CHECK | 6 | EQ TRANSFER LIFT STATION | TF | N/A | N/A | N/A | |
| LSPU1-PIV-01 | 04-I-602 | PINCH | 6 | EQ TRANSFER LIFT STATION | TF | HW | N/A | N/A | |
| LSPU2-PIV-01 | 04-I-602 | PINCH | 6 | EQ TRANSFER LIFT STATION | TF | HW | N/A | N/A | |
| LSPU3-PIV-01 | 04-I-602 | PINCH | 6 | EQ TRANSFER LIFT STATION | TF | HW | N/A | N/A | |
| LSPI2-PV-01 | 04-I-602 | PLUG | 8 | EQ BASIN | TF | CW | N/A | N/A | (1) |
| LSPI2-PV-02 | 04-I-602 | PLUG | 8 | EQ BASIN DRAIN | TF | HW | N/A | N/A | |
| NH3R1-PV-01 | 04-I-604 | PLUG | 6 | ARF EFFLUENT CHANNEL | TF | HW | N/A | N/A | (2) |
| NH3R1-PV-02 | 04-I-604 | PLUG | 6 | ARF EFFLUENT CHANNEL | ARE | HW | N/A | N/A | (2) |
| NH3R2-PV-01 | 04-I-605 | PLUG | 6 | ARF EFFLUENT CHANNEL | TF | HW | N/A | N/A | (2) |
| NH3R2-PV-02 | 04-I-605 | PLUG | 6 | ARF EFFLUENT CHANNEL | ARE | HW | N/A | N/A | (2) |
| LSPU4-PV-01 | 04-I-607 | PLUG | 6 | ARF EFFLUENT LIFT STATION | ARE | HW | N/A | N/A | (2) |
| LSPU4-PV-02 | 04-I-607 | PLUG | 6 | ARF EFFLUENT LIFT STATION | ARE | HW | N/A | N/A | |
| LSPU5-PV-01 | 04-I-607 | PLUG | 6 | ARF EFFLUENT LIFT STATION | ARE | HW | N/A | N/A | |
| LSPU5-PV-02 | 04-I-607 | PLUG | 6 | ARF EFFLUENT LIFT STATION | ARE | HW | N/A | N/A | |
| LSPU6-PV-01 | 04-I-607 | PLUG | 6 | ARF EFFLUENT LIFT STATION | ARE | CW | N/A | N/A | |
| LSPU6-PV-02 | 04-I-607 | PLUG | 6 | ARF EFFLUENT LIFT STATION | ARE | CW | N/A | N/A | |
| LSPU4-CV-01 | 04-I-607 | CHECK | 6 | ARF EFFLUENT LIFT STATION | ARE | N/A | N/A | N/A | |
| LSPU5-CV-01 | 04-I-607 | CHECK | 6 | ARF EFFLUENT LIFT STATION | ARE | N/A | N/A | N/A | |
| LSPU6-CV-01 | 04-I-607 | CHECK | 6 | ARF EFFLUENT LIFT STATION | ARE | N/A | N/A | N/A | |

**END OF SECTION**

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## PART I - GENERAL

### 1.01 SCOPE

A. Provide all labor, materials, and equipment to furnish, configure, program, install, calibrate, test, adjust, and place into operation the facility's additions and modifications to the existing monitoring and control system as specified herein and described in the Specifications and as shown on the Drawings. The Drawings and Specifications show and specify those features required to illustrate and describe functional requirements of the additions and modifications of the monitoring and control system.

B. A single Instrument and Control System Contractor (ICS) shall furnish all services and equipment defined herein and in other Specification sections as listed below under Related Work. The Instrument and Control System Contractor is referred to herein and after (in Division 17 of the Specifications) as the ICS, ICS supplier/firm, or Contractor. The ICS shall have the qualifications as described in the "Quality Assurance" subsection.

C. The ICS shall also:

1. Supply all instrumentation (wired and non-wired), analyzers, that are not specifically listed as vendor supply.

2. Terminate and tag all field wiring associated with the Process instrumentation and control System shown on the DRAWINGS and specified herein and in other Specification sections listed below under Related Work.

3. Tag Instrumentation and control wiring/cable per the requirements and methodology/scheme outlined in specification Section 16205 "Wiring (600 Volts and Below)", "Wire Tagging Methodology".

4. Provide factory assembly, configuration, programming, testing (factory and field) and commissioning of the Balance of Plant PLC based control panel (non-vendor) hardware and software.

5. Update existing Plant HMI screens, trends, alarms, event logs and historian to incorporate all new processes, including vendor provided processes under this contract and in accordance with Austin Water (AW) programming standards. This includes workshops with the AW to review HMI and programing standards.

6. Calibrate, set, and test the Supervisory Control and Data Acquisition (SCADA) system equipment, components, cables, hardware, and software that is being added and/or modified.

7. For all Process instrumentation and control System (PICS) equipment and ancillaries, the ICS shall provide:

   a. Required hardware submittals for all components of the PICS in accordance with Division 1 requirements and these specifications.

b. Equipment and ancillaries.

c. Instructions, details, and recommendations to, and coordination with, all other installation entities for Certificate of Proper Installation. This includes configuration of all instrumentation.

d. Certification of readiness for operation.

e. Start up and Commissioning services

f. Design, develop, and electronically draft loop drawings, control panel designs and site layouts

g. Fabricate panels

h. Perform factory tests on panels

i. Perform bench calibration and verify calibration after installation

j. Oversee and certify installation (inclusive of Vendor packages)

k. Oversee, document, and certify loop testing

l. Oversee, document, and certify system commissioning

m. Conduct the performance test

n. Prepare Owner's manuals

o. Conduct training classes

p. Prepare record drawings

q. Furnish, install, configure and program the switches, and plant PLC's to communicate and operate as outlined in the contract documents and per the Owner's standards.

r. Spare parts list including cost per item provided

s. Field testing/calibration of sensors and instruments, using equipment appropriate to the device, including, but not limiting to:

   1) Test pressure pump for field calibration/testing of pressure transmitters.

   2) Signal generator/multi-function meter for field calibration/testing of resistance temperature detector (RTD) monitoring devices

   3) Temperature/heat generator for field calibration/testing of temperature transmitters.

8. Provide special additional services during installation, including:

   a. Verify that the following are furnished and installed:

      1) Correct type, size, and number of signal wires with their raceways.

      2) Correct electrical power circuits and raceways.

      3) Correct size, type, and number of PICS related pipes, valves, fittings, and tubes.

      4) Correct size, type, materials, and connections of process mechanical piping for in-line primary elements

   b. For equipment not provided by the ICS, but directly connected to the PICS:

      1) Obtain manufacturer's information regarding installation, interface, function, and adjustment for equipment from the Contractor.

      2) Coordinate with Contractor to allow required interface and operation with the PICS.

      3) Verify that installation, interfacing signal terminations, calibration, and adjustments have been completed in accordance with the manufacturer's recommendations.

      4) Test to demonstrate the required interface and its integrated operation with the PICS.

      5) Equipment in this category includes the following:

         a) OWNER's Top-End Computer System (i.e. existing iFix servers and Proficy Historia servers and supporting network)

         b) Project Process/Mechanical Equipment

         c) Project Switchboards/Motor control centers/Power monitoring units

D. Effort is required of the ICS to establish functional and complete communication network links between the proposed equipment of this project and the Owner's existing SCADA equipment in order to achieve proper and complete system operation. This effort shall include, but not be limited to:

   1. Terminating new cabling in the OWNER's existing equipment.

2. Coordination with all responsible parties, i.e., OWNER/ENGINEER, manufacturers, etc., to facilitate proper communication equipment selection, cable termination connector quantities/types, patch panel locations in control panels to address minimum cable bending radius, etc., as required.

3. System startup testing, diagnosing, and resolving communication system issues, etc.

E. Extensive field verification is required for all modifications to existing control panels. The ICS shall field verify spatial dimensions inside the existing control panels for proposed equipment, wiring terminations, loop power supply sizes, loads on existing instrument loops, points of connections to existing equipment, etc. as required to support the proposed modification effort associated with this project. The ICS shall field locate proposed equipment to be installed inside the existing control panel as also shown on the DRAWINGS. The proposed location shall be coordinated with the arrangement of the existing control panel internally and externally mounted components.

F. The OWNER's existing SCADA system is vital to the operation of the OWNER's facility. Therefore, required interruptions to the OWNER's existing SCADA shall be minimized and coordinated with the OWNER. Should an outage to a facility be required, the Contractor shall request such an outage in writing no less than two (2) weeks in advance.

Contractor's written request shall identify the desired date, time, duration, and purpose of the requested day unless he/she obtains a written approval from the owner authorizing the outage. The OWNER reserves the right to modify or reject any request for such an outage. Modification or rejection of the contractor's request by the OWNER shall **NOT** be considered reason for delays in the construction schedule. Unless otherwise noted, the duration of the outage shall be limited to four (4) hours or less. The OWNER reserves the right to limit the duration of the outage to less than 4 hours. Modification of the outage duration by the OWNER shall **NOT** be considered reason for delays in the construction schedule.

G. It is the ICS responsibility to identify any deficiencies in the existing SCADA system equipment and any other equipment **PRIOR** to starting construction or demolition activities. Should the existing equipment, its associated interconnect wiring, power supplies, fuses, etc., as applicable, be damaged or become otherwise unusable during the construction course of this project, the ICS shall determine the problem, correct it, and furnish and install all necessary wiring/hardware/etc., to match existing and make all final connections such that all affected equipment operates as previously operated to the OWNER's satisfaction at No Additional Cost to the OWNER.

H. The ICS shall facilitate the construction sequencing requirements of this project. If applicable, this shall include any and all temporary installation of proposed equipment as shown on the DRAWINGS and all associated wire termination, tagging, testing, etc. required to make the equipment operational and fully functional. Effort shall also be included to relocate the temporarily installed equipment to their permanent location as well as all

associated re-termination, re-tagging, re-testing, etc., to make this equipment operational and fully functional. This shall include coordination with the existing field conditions, proposed motor starters and existing control system to maintain continuous facility operation. Refer to the DRAWINGS for additional requirements.

I. The ICS will be responsible for coordination of any inter-PLC IO messaging requirements with the Vendors (i.e., Vendor-to-Vendor or Vendor-to-Plant) as necessary to accommodate the control programming and system integration requirements detailed in Section 17900 – Plant Control Philosophy. The ICS will also be responsible for display of the Vendor developed screens at the Plant HMI, ensuring a common look, function, accessibility and means of navigation. The Vendor screens will be incompatible with the Plant SCADA HMI and the ICS shall be required to re-create all Vendor screens in accordance with the existing AW graphic standards.

J. Experience Requirement: The Instrument and Control System Contractor (ICS), under contract with the CONTRACTOR, shall be responsible for procuring, assembling, configuring, programming, factory testing and field commissioning the plant PLC-based control system as described in the contract documents. The CONTRACTOR shall be responsible for system installation and operation in accordance with the contract documents and shall provide the services of qualified System Integrator field engineers and installers capable of directing and executing installation, pre-commissioning and startup activities as it relates to the vendor packages, plant PLC control system equipment and other CONTRACTOR free-issued components. The CONTRACTOR, through the use of System Integrator personnel shall also coordinate the work of vendor package integration with the balance of plant control system. In support of this work responsibility, the System Integrator shall be required to demonstrate experience at, and capability of, providing similarly sized and complex control systems for Municipal Water or Wastewater Treatment Plants. Experience and capability requirements shall include as a minimum:

1. Experience in furnishing and installing Control Systems based on the Schneider Electric Modicon M580 processors (PLCs), Viejo/Magelis software, and iFix for similarly sized control systems for Municipal Water or Wastewater Treatment Plants.
2. A permanently employed in-house staff dedicated to the design, engineering, project management, training, programming, and configuration of PLC equipment, fiber optic communications and managed control system networks. The System Integrator shall have the staff size and experience to provide all required services in a timely and expert manner, as dictated by the Project Construction Schedule.
3. Permanent employment of programmers who have a minimum of five years' experience at programming Schneider Modicon processors (PLCs), Vijeo Designer control system software package, GE Proficy iFIX software package, latest version of each software package available.
4. Experience in furnishing, installing and testing industrial Ethernet networks for similarly sized control systems.

5. Successful completion of at least five projects within the last six years of similar size and type.
6. The CONTRACTOR shall submit a resume summary of the Project Manager, Lead Instrumentation / Controls Engineer, and all control system programmers anticipated to take part in the project. The resume shall list the education level, training and experience qualifications of the Project Manager (i.e. the person who will serve as the primary decision maker and interface to the CONTRACTOR), the Lead I&C Engineer (i.e. the person who will serve as the lead technical decision maker), configuration, installation and security) and the control system programmers along with (3) named references (with contact numbers) for projects completed in the last 6 years. In addition, the following qualifications must be met or exceeded:

    a. The Project Manager shall provide evidence of management of similar sized projects and/or projects of similar complexity. A minimum of three projects over the last 6 years must be identified.

    b. The Lead Instrumentation / Controls Engineer shall be an engineer with a minimum 4 year degree (Electrical, Mechanical or Chemical Engineering) from a college accredited by the American Consulting Engineering Council as an Engineering College.

7. Where the specification calls for Manufacturers' representative's services, the CONTRACTOR'S employees will not be accepted as qualified to do the work or be compensated for the services. The CONTRACTOR will only be paid for service of representatives that are in direct employment of the equipment manufacturer

## 1.02 RELATED REQUIREMENTS

A. The Contract Documents are complementary; what is called for by one is as binding as if called for by all.

B. It is the CONTRACTOR's responsibility for scheduling and coordinating the Work of subcontractors, suppliers, and other individuals or entities performing or furnishing any of CONTRACTOR's Work.

C. Division-16: ELECTRICAL SPECIFICATIONS

D. Division-17: INSTRUMENTATION AND CONTROL SPECIFICATIONS

E. All other divisions of the Specifications related to the installation of the process mechanical equipment, etc. that are related to the operation of the instrumentation and control system.

F. Related work as called for on the DRAWINGS, as specified herein or in other Sections of the Specifications.

## 1.03 SUBMITTALS (Vendor and Non-Vendor)

A. General:

1. Do not design, manufacture, or ship any PICS equipment until all related submittals have been reviewed and approved by the ENGINEER. Submit shop drawings and product data in complete functional packages, i.e., submit all shop drawings and product data for a given loop or subsystem together as a functional package. Piecemeal submittals not organized by systems or incomplete submittals for a given loop or subsystem will not be accepted.

2. All system layout drawings, cross sectional view drawings, instrument loop drawings, wiring diagram drawings, Connection detail drawings, physical layout, and detail drawings, etc. shall be developed and red-lined (to reflect the "as-built" conditions) electronically using "AUTOCAD software".

B. Administrative Submittals:

1. Schedule of Values

a. Purpose: Project Schedule of Values to provide a basis for Partial Payment for Work completed.

b. Content: Summary of major milestones and associated Partial Payments for Work provided under PICS Subsystems.

c. Show a specific line item and value for all workstations, computers, laptops, if applicable.

d. Show a specific line item and value for all spare parts and tools, if applicable.

e. Show specific line items and values for all training to be provided as follows, if applicable:

1) SCADA Hardware Training

2) SCADA Software Training

3) Top-End Software Training

4) Ethernet Hardware/Software Training

5) Control Panel(s) Training

6) Instrumentation Training

7) Miscellaneous Training

2. PICS Progress schedule

   a. Purpose: Supplement the overall Project Progress Schedule to:

      1) Coordinate activities between the Contractor and the ICS

      2) Coordinate interactions with the OWNER/ENGINEER for coordination meetings, submittal reviews, etc.

      3) Clarify required work sequences and major milestone prerequisites.

   b. Provide multiple submittals of the project schedule throughout the duration of the Project as required.

3. OWNER Training Plan: Submit description/schedule of OWNER Training to be provided.

4. Spare parts list shall include the following:

   a. Product Description

   b. Manufacturer

   c. Part Number

   d. Serial Number, if applicable

   e. Quantity

   f. Unit Pricing

5. Statements of Qualification: Submit for PICS firm, site representative, start-up and testing team members.

C. Submit shop drawings as specified below:

1. Detailed product data, catalog cut sheets, cabinet exterior and interior front elevations, bill of materials, and spare parts list including pricing

2. Point-to-Point Wiring Diagrams: Prepare Point-to-Point Instrument Loop Wiring Diagrams, ladder diagrams (control schematics), cabinet wiring, and other field wiring diagrams in accordance to the format shown on the DRAWINGS. Drawings shall be neat; and legible, and on 11 inch x 17 inch sized sheets and electronically formatted pages. Drawings to include all relevant information for equipment connected to the PICS, regardless of whether the equipment is provided by the ICS or not, i.e., include motor control centers, OWNER pre-purchased equipment, etc. Contractor shall also submit for approval a complete schedule of all wire tag numbers sorted by area and equipment/instrument/field device.

3. Although typical control schematics/instrument loops are presented on the DRAWINGS for some equipment, the Contractor shall generate specific equipment control schematic drawings/instrument loops (i.e., individual control schematic/instrument loop drawings dedicated for each specific equipment) based upon the typical control schematic/instrument loop drawings, the device identification/tag replacement schedules shown on the DRAWINGS, and the additional requirements described herein. The Contractor generated specific equipment control schematics/instrument loops shall follow the same overall presentation format as the typical equipment control schematics/instrument loops presented on the DRAWINGS. The specific equipment control schematics/instrument loop drawings complete with all specific equipment/device tags (as a minimum, also refer to the additional requirements described herein) shall be generated by the Contractor and included with the project submittals (i.e., prior to equipment purchase) and the "As-Built" drawings. Any Contractor generated control schematic/instrument loop shown as applicable for multiple equipment shall not be accepted.

4. Wire Tags:

   a. Samples Submittal: Contractor shall submit for approval wire tag samples for all types of interconnects and field wiring from the proposed/existing cabinets/panels with associated point-to-point wiring diagrams in a separate submittal prior to submitting the complete wire tag schedule for review.

   b. Wire Tag Table and Wiring Diagrams Submittal: After the sample wire tags are approved, the Contractor shall submit a wire tag table showing all provided wire tags, along with the associated point-to-point wiring diagrams. Refer to Specification hereinafter for additional wire tag table requirements. Refer to Specification 16205 "Wiring (600 Volts and Below)", "Wire Tagging Methodology".

   c. Wire Tag Numbers Complete Schedule Submittal: Contractor shall also submit for approval a complete schedule of all wire tag numbers sorted by area and equipment/ instrument/ field device.

d. Wire Codes / Wire Numbers Cross Reference Table: It is anticipated that all wire numbers cannot be accommodated on the format shown on the DRAWINGS for loop diagrams, ladder diagrams, control schematics, etc. To facilitate the depiction of wire numbers on these types of drawings, the Contractor shall at minimum generate uniquely identified alpha-numeric wire codes and do the following:

1) Include them on the loop diagrams, ladder diagrams, control schematics, etc.

2) List them on cross-reference tables of wire numbers shown on additional drawings, and

3) Group wire codes and drawings by specific process equipment, such as Transfer Pump No. 1, Transfer Pump No. 2, etc. The OWNER shall provide additional requirements for the table headings, table organization, wire code generation, and formatting during the Pre-Submittal Conference specified hereinafter and the Contractor shall incorporate these requirements at no additional cost to the Owner.

D. Testing Related Submittals:

1. Submit factory and field calibration reports as required per the individual instrument specifications.

2. Submit the following for each of type of test (ORT and PAT) required under Division 17 of the Specifications:

a. Preliminary Test Procedures: Outlines of proposed tests, forms, and checklists.

b. Final Test Procedures: Proposed test procedures, forms, and checklists.

c. Test Documentation: Copy of signed off test procedures when tests are completed.

E. Training Related Submittals:

1. Submit the following for each type of training required under Division 17 of the Specifications:

a. Training plan, course to PICS, subjects to be addressed in the training

b. Schedule

c. Training agenda for each course

d. Instructor qualifications

e. Listing of available training courses and outline of course to PICS and agendas

F. Submit Operation and Maintenance manuals in accordance with Section 01730 of the Specifications and as specified below:

1. Include approved shop drawing data in the Operation and Maintenance manuals with the following modifications to the shop drawing exhibits:

   a. Reflect "As-Built" conditions.

   b. Prints of exhibits, wiring diagrams, etc. shall be half size (11-inch by 17-inch).

   c. Submittals shall include hard copies (of the quantity and format required by the Contract Documents) and electronic version in "AUTOCAD"; This applies to all drawings requested in this Section of the Specifications and any other manufacturer's product standard drawings required for submittal.

2. Procedures for operating and shut-down

3. Included approved Testing Related Submittals with final "As-Built" conditions.

4. Safety instructions.

5. Calibration instructions and factory test results of each instrument.

6. Maintenance and repair instructions.

7. Recommended spare parts list with individual pricing.

8. Name, address and phone number of instrumentation control system supplier's local representative.

9. Additionally, comply with the requirements of the Contract Documents.

G. Pre-submittal conference

1. General:

   a. Review the manner in which the contract requirements will be met prior to preparation of submittals. The Contractor, Engineer, OWNER, and ICS shall attend. Schedule, conduct, and arrange the conference within 14 calendar days after receipt of written notice to proceed work is given by the OWNER. The OWNER may elect to cancel the pre-submittal conference if so desired and proceed directly to the submittal process.

b. The ICS shall present the following at the conference:

1) List of equipment and materials required and the brand that shall be used for each item

2) Sample submittals from similar projects including the types of drawings/data/lists specified herein

## 1.04 SPECIAL CONDITIONS

A. All components used in the instrument and control systems shall be new (**NOT** used) and the current model produced by the manufacturer.

B. All equipment of a common type shall be the product of a single manufacturer.

# PART II - QUALITY ASSURANCE

## 2.01 ACCEPTABLE PROCESS INSTRUMENTATION AND CONTROL SYSTEM (PICS)

A. Provide a complete, workable, and installed-in-place Process Instrument and Control System, hereinafter referred to as the PICS, as specified herein. The PICS shall be designed, installed, and started up by the single ICS firm.

B. Acceptable ICS firm shall have the following minimum qualifications:

1. ICS Firm: Minimum of 5 years' experience in providing, integrating, installing, testing, and start-up similar systems as those required for this project

2. ICS Firm Site Representative: Minimum of 8 years' experience installing similar systems as those required for this project

3. ICS Firm Start-up and Testing Team Members: Minimum of 3 years' experience in testing systems similar to those required for this project.

4. ICS Firm shall have a minimum building size of 5,000 sq ft.

C. PICS meetings to be scheduled in accordance with the Contract Documents.

## 2.02 SYSTEM COORDINATION AND QUALITY

A. Coordinate installation of instrumentation with mechanical and electrical systems.

B. Coordinate subsystems to provide a complete operational and functional instrumentation system to the satisfaction of the Owner and Engineer.

C. Equipment, instruments, components, and materials for PICS components shall be new (not used) and of the current model.

D. Instrument and Control Components Furnished by Others: Certain items of instrumentation and controls shall be furnished by various equipment manufacturers. Coordinate the purchase orders of the items such that the resulting system will function properly.

## 2.03 DESIGN CRITERIA

A. Design, construct, and install all PICS components in compliance with the applicable provisions of the following standards, codes, and regulations:

1. American National Standards Institute (ANSI) Standards.
2. American Institute of Steel Construction (AISC) Standards.
3. American Society for Testing and Materials (ASTM) Standards.
4. American Waterworks Association (AWWA) Standards.
5. Joint Industrial Council (JIC) Standards.
6. National Electric Code (NEC)
7. National Electrical Manufacturer's Association (NEMA) Standards.
8. Local and State Building Codes.
9. Occupational Safety and Health Administration (OSHA) Regulations.
10. Scientific Apparatus Manufacturer's Association (SAMA) Standards.
11. International Society of Automation (ISA) Standards.
12. National Fire Protection Association (NFPA)
13. Institute of Electrical and Electronics Engineers (IEEE).
14. Underwriters Laboratories (UL) 508A

## 2.04 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Delivery: Enclose cabinets and subassemblies in heavy polyethylene envelopes to protect them from dust and moisture. Place corrosive-inhibitive vapor capsules in shipping containers, and related equipment as recommended by the capsule manufacturer.

B. Storage: All materials and equipment shall be environmentally protected and stored in climate controlled (temperature and humidity, etc.) environment. The Instrument Control Panels and the field control and instrument/monitoring panels shall not be moved from climate-controlled storage room to the project site until the construction of each electrical/control room is completed, and the air-conditioning and heating system of the facility is in an operating condition satisfactory to the OWNER and ENGINEER.

## 2.05 CALIBRATION INSTRUMENTS

A. Each instrument used for calibrating PICS equipment shall bear the seal of a reputable laboratory certifying that instrument has been calibrated within the previous twelve (12) months to a standard endorsed by the National Institute of Standards and Technology (NIST). At OWNER's request, ICS shall submit calibration certification report.

## 2.06 START DATE OF THE PROCESS CONTROL AND SYSTEM AND ASSOCIATED SUBSYSTEM WARRANTY (PICS INCLUDING SUBSYSTEMS)

A. Start Date of the Process instrumentation and control System and associated subsystem Warranty (PICS including Subsystems) shall commence the date in which the Warranty period commences for the overall project per the requirements of the Procurement Documents. The duration of the warranty shall be a minimum of two (2) years.

B. Provide a Warranty Letter stating the Start Date and End Date. This letter shall be included within the O&M Manual

# PART III - SEQUENCING AND SCHEDULING

## 3.01 GENERAL

A. All work provided under this section shall be in accordance with the OWNER/ENGINEER-approved Schedule of Submittal Submissions and Schedule of Values.

B. Specification and Construction Implementation Plan requires phased installation of equipment and systems. Stage all PICS activities (submittals, fabrication, installation, testing, start-up, training, etc.) to support the construction sequencing requirements of the project.

C. Wherever language in this section refers to the PICS, the entire installed PICS, the entire PICS, or similar language, it shall be interpreted to apply to the individual phases of the work; except the requirements for the Performance Acceptance Test (PAT).

D. Key milestone dates associated with PICS activity shall be included in the overall project schedule. Include the following dates as a minimum:

1. FDT start and end date
2. ORT start and end date
3. PAT start and end date
4. Date Configuration System is delivered to the Engineer, if applicable
5. Date Configuration System is expected to be retrieved from the Engineer, if applicable
6. Training dates

## 3.02 NETWORK COORDINATION MEETING

A. Subsequent to the pre-submittal meeting the ICS shall conduct a network coordination meeting with the owner and engineer.

B. The ICS shall chair and develop an agenda for a meeting which shall address the basic criteria to be adhered to in the configuration and connection of the new process controls into the existing plant control system. As a minimum, this meeting shall address the following issues:

1. Ethernet switch configurations
2. IP addresses to be used
3. Integration into the existing plant control system
4. PLC programming standards

## 3.03 GRAPHICS COORDINATION MEETINGS

A. Refer to section 17900 for meeting requirements.

## 3.04 PREREQUISITE ACTIVITIES AND LEAD TIMES:

A. Start the following key Project activities when prerequisite activities and lead times listed below have been completed and satisfied:

1. Shop Drawings submittal prerequisite: Completion of the Pre-submittal conference

2. Test Prerequisite:

   a. All associated process and mechanical equipment, controlled and monitored by the instrumentation and control system, complete in place

   b. Associated test plan submittal approved. For FDT, ORT and PAT, notice of test schedule required 2 weeks prior to the start of test.

3. FDT Prerequisite:

   a. Approved FDT test procedures

   b. Approved FDT test forms

   c. 14 calendar days advance written notice to given to OWNER & Engineer of impending FDT.

4. ORT Prerequisite:

   a. FDT successfully completed.

   b. Approved ORT test procedures

   c. Approved ORT test forms

   d. 14 calendar days advance written notice to given to OWNER & Engineer of impending ORT.

5. PAT Prerequisite:

   a. Application software completed and configuration system shipped to the project site.

   b. ORT successfully completed.

   c. Approved PAT test procedures

   d. 14 calendar days advance written notice to given to OWNER & Engineer of impending PAT.

6. O&M submittal prerequisite: PAT successfully completed.

B. Configuration System Delivery: If applicable, deliver the entire Configuration System to the programmer's office no sooner than 10 days after pre-submittal conference and no later than 6-months prior to starting

ORT.

## PART IV - PRODUCTS

### 4.01 GENERAL

A. Refer to requirements of PICS Subsystem provided in Division-17 Specifications.

### 4.02 SOURCE QUALITY CONTROL

A. General:

1. Test all PICS elements, both hardware (instruments, components, devices, PLCs, etc.) and specific software, to demonstrate that PICS satisfies all requirements.

2. Factory Demonstration Test "FDT"

   a. Develop and provide forms as required to document FDT. All forms generated shall have provisions for signature by PICS representative and OWNER/Engineer.

   b. Component Inspections and Tests:

      1) Check for proper installation on a component-by-component basis.

      2) Check for proper wiring on a point-to-point basis.

      3) Energize equipment to check for functionality.

   c. Functional testing of the control system including but not limited to
      1) I/O point checkouts

      2) HMI screen layouts

      3) Control System Testing per the Control Philosophy

   d. The OWNER/Engineer reserves the rights for the FDT to be a Witnessed or Unwitnessed Factory Test.

3. On-Site Tests Described Under PART 5 - EXECUTION:

   a. Operational Readiness Tests "ORT".

   b. Performance Acceptance Tests "PAT".

4. Test Format: Cause and effect

a. Person conducting test initiates an input (cause)

b. Specific test requirement is satisfied if the correct result (effect) occurs

5. Procedures, Forms, and Checklists:

a. Conduct all tests in accordance with, and documented on, Engineer/Owner accepted procedures, forms, and checklists.

b. Describe each test item to be performed.

c. Have space after each test item description for sign off by appropriate party after satisfactory completion.

6. Required Test Documentation: Test procedures, forms, and checklists. All signed by Engineer and Contractor and reviewed by Owner.

7. Conducting Tests:

a. All special testing materials and equipment.

b. Wherever possible, perform tests using actual process variables, equipment, and data.

c. If it is not practical to test with real process variables, equipment, and data, provide suitable means of simulation.

d. Define simulation techniques in test procedures.

e. For PICS Subsystems for which OWNER provides applications software, provide sufficient temporary software configuring to allow for ORT testing of these subsystems prior to installation of the OWNER's applications software.

8. Engineer will actively participate in the tests. Owner will participate in tests when available.

9. Owner/Engineer reserves the right to test or retest all system functions.

10. Owner's/Engineer's decision will be final regarding acceptability and completeness of all testing.

B. Maintenance of Configuration System:

1. Provide for maintenance of the Configuration System at the programmer's office. Repair or replace failed equipment within two days of notice by OWNER/Engineer/Programmer.

C. Provide field support during testing of installed applications software

## PART V - EXECUTION

### 5.01 EXAMINATION

A. Equipment furnished by Supplier or any other subcontractor and installed by the ICS/Contractor, requires Supplier to observe and advise on installation to extent required to certify that equipment has been properly installed and will perform as required.

B. For equipment not provided by the ICS, but that directly interfaces with the PICS, verify the following conditions:

1. Proper installation.
2. Calibration and adjustment of all instrumentation and control devices.
3. Correct control action.
4. Switch settings.
5. Opening and closing speeds and travel stops.
6. Input and output signals.

### 5.02 INSTALLATION

A. Material and Equipment Installation:

1. Follow manufacturer's installation instructions, unless otherwise indicated or directed by the OWNER/ENGINEER
2. Retain a copy of the manufacturer's instructions at the project site, available for review at all times.

B. Wiring:

1. All wiring connected to PICS components and assemblies shall be in accordance with the requirements of Division 16 and 17 of the Specifications.

### 5.03 FIELD QUALITY CONTROL

A. General: All requirements listed in Subsection Source Quality Control, above, also apply to this Subsection, Field Quality Control.

B. Onsite Supervision:

1. The ICS Project Site Representative shall supervise and coordinate all onsite PICS activities.

2. The ICS Project Site Representative shall be On-Site during total period required to complete all On-Site PICS activities.

C. Startup and Testing Team:

1. Thoroughly check installation, termination, and adjustment for all PICS Subsystems and their components.

2. Complete On-Site tests.

3. Provide and conduct startup services

4. Complete On-Site training.

D. Sequence of Work: Provide individual ORTs and PATs for individual process equipment where required to support the staged construction and startup of the facility. Coordinate the construction sequencing requirements with the OWNER.

E. Specialty Equipment: For certain components or systems provided under this Section but not manufactured by the ICS, provide services of qualified manufacturer's representative during installation, start-up, testing (both ORT and PAT) and OWNER's training. For example: RTD calibrator, vibration shaker table (which may be furnished/operated by vibration sensor manufacturer representative), pressure calibrator, etc, shall be provided as required.

F. Initial On-Site System Demonstration Tests:

1. Programmable Logic Controllers (PLCs):

a. Test all loop-specific functions and demonstrate all I/O Points.

b. Test all non-loop-specific functions including, but not limited to, the following:

1) Failure Mode and Backup Procedures: Power failure, auto restart, retentive outputs

G. Operational Readiness Test (ORT):

1. Prior to start of the Performance Acceptance Test "PAT", the ICS firm shall inspect, and test the PICS equipment and systems, document the resulting tests performed, implement all corrective actions necessary, perform all associated re-testing, and document that the PICS is installed and ready for operation. Subsequent to the ICS documentation that the PICS is installed and ready for operation, perform jointly with the OWNER/ENGINEER an ORT on the associated PICS equipment to demonstrate that it is fully operable as required by the Contract

Documents.

2. For PICS subsystems where the PLC program is provided by the OWNER/Engineer, provide a temporary program to allow testing of these subsystems.

3. Loop/Component Inspections and Tests:

   a. Check PICS for proper installation, calibration, and adjustment on a loop-by-loop, and component-by-component basis.

   b. Develop and provide forms as required to document ORT. All forms generated shall have provisions for signature by PICS representative.

   c. Develop and provide test form hereinafter called the "Loop Status Report" to organize, track inspection, adjustment, and calibration of each loop. Loop Status Report shall include the following as a minimum:

      1) Project name

      2) Loop number

      3) Tag number for each component

      4) Checkoff/signoffs for each component:

         a) Tag/identification

         b) Installation

         c) Wiring termination

         d) Tubing termination

         e) Calibration/adjustment

      5) Checkoffs/signoffs for each loop:

         a) Panel interface termination

         b) PLC I/O interface terminations

      6) PLC I/O Signals are Operational: Received/sent, processed, adjusted

      7) Total loop operational

      8) Space for comments.

   d. Develop and provide test form hereinafter called the "Component Calibration Sheet" to organize, track inspection, adjustment, and

calibration of each component (except hand switches, pilot lights, gauges, and similar items) and each PLCs I/O Module. The Component Calibration Sheet shall include the following as a minimum:

1) Project Name

2) Loop Number

3) Component tag number or I/O module number

4) Manufacturer name

5) Model number/serial number

6) Summary of functional requirements. For example:

   a) Indicators

   b) Transmitters/converters, input and output ranges

   c) Computing elements' functions

   d) Controllers, action (direct/reverse) and control modes (P&ID)

   e) Switching elements, unit range, differential (fixed/adjustable), reset (auto/manual)

   f) PLC I/O modules: input or output

7) Calibrations, for example, but not limited to:

   a) Analog devices: Actual inputs and output at 0, 25, 50, 75, and 100 percent of span, rising and falling

   b) Discrete Devices: Actual trip points and rest points

   c) Controllers: Mode settings (P&ID)

   d) PLC I/O Modules: Actual inputs or outputs of 0, 25, 50, 75, and 100 percent of span, rising and falling.

8) Space for comments

e. Maintain loop status reports, valve adjustment sheets, and component calibration sheets at the project site and always make them available to the OWNER/ENGINEER.

f. These inspections and tests, inclusive of the above-described forms, will be spot checked by the OWNER/ENGINEER.

g. The ICS shall implement all corrective measures needed and perform

retest on any modified sub-system/component.

h. The Contractor shall claim and validate a thorough ORT was performed successfully and all resulting corrective action measures taken were performed successfully and re-tested successfully. Upon successful completion of the ORT, the Contractor shall submit letter notification to the OWNER/ENGINEER stating that the ORT has been successfully completed. The letter notification shall further state that the ICS is ready to begin the Performance Acceptance Test. Submit all forms upon completion of ORT as required by the OWNER/ENGINEER.

H. Performance Acceptance Tests "PAT":

1. Once the ORT has been successfully completed, perform jointly with the Engineer & OWNER a PAT on the associated PICS to demonstrate that it is operating as required by the Contract Documents. The PAT will employ the OWNER/Engineer/Programmer's PLC application software developed for the project.

2. The cumulative total quantity of calendar days shall be consumed in association and in synch with the overall construction sequence for the project. Any Holidays that occur during the PAT shall result in a corresponding number of days being added to the duration of the PAT. The PAT encompasses the startup and testing period of the instrumentation and control system for the associated process and mechanical equipment that are controlled and monitored by the instrumentation and control system. The PAT shall be conducted using application software developed by the OWNER/Engineer/Programmer. The ICS shall test functions installed in the hard-wired system and the entire associated instrumentation and control system including validating the operation and monitoring and control functions of all instruments, all control devices, all instrument and control components, control functions, alarm functions, monitoring functions, calibration ranges, control/alarm setpoint operations, etc.

3. Demonstrate each required function on a paragraph-by-paragraph, loop-by-loop, and site-by-site basis based upon the operating description used by the OWNER/Engineer for PLC application software development.

4. Non-loop specific tests shall be the same as previously required except that the entire installed PICS shall be tested using actual process variables and all functions demonstrated.

5. Perform local and manual tests for each loop before proceeding to remote and automatic modes

6. Where possible, verify test results using visual confirmation of process equipment and actual process variable. Unless otherwise directed, exercise and observe devices supplied by Others, as needed to verify correct signals to and from such devices and to confirm overall system

functionality. Test verification by means of disconnecting wires or measuring signal levels is acceptable only where direct operation of plant equipment is not possible and is approved by the Engineer.

7. Make updated versions of documentation required for PAT available to the OWNER at the project site, both before and during tests.

8. Develop and provide PAT test forms that include the following, at minimum:

   a. Project name

   b. Lists the requirements of the loop

   c. Briefly describes the test

   d. Cites the expected results and the actual results

   e. Provides space for checkoff by witnesses.

9. Make one copy of all O&M manuals available to the OWNER/Engineer at the site both before and during testing.

I. The ICS shall implement all corrective measures needed and perform re-test on any modified system.

## 5.04 MEASUREMENT AND PAYMENT

A. No separate measurement or payment for work performed under this Section. All costs are included in the Base Bid.

**END OF SECTION**

## BFPLS-CP01-RIO-01

| | |
|---|---|
| AI | 1 |
| AO | 0 |
| DI | 23 |
| DO | 3 |
| DSAI | 0 |
| DSAO | 0 |
| DSDI | 0 |
| DSDO | 0 |

| IO Tag | I/O Type | Signal Type | Description | PID Drawing No. | Processor Cabinet No. | RACK / BASE | SLOT | I/O POINT | CARD/MODULE TERMINALS | FIELD I/O ADDR * | BIT NO * | EGU LOW | EGU HIGH | EGU | SCALED IN PLC? | RAW LOW | RAW HIGH | SIGNAL TYPE | TERMINAL BLOCK | TERMINAL NO'S | LOOP DIAG | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DEWATER-WW1-LSH-01 | DI | 24VDC | BFP Effluent Lift Station Wet Well High Level Alarm | 03-I-601 | BFPLS-CP-01 | | | | | | | | | | | | | | | | | |
| DEWATER-WW1-LSLL-01 | DI | 24VDC | BFP Effluent Lift Station Wet Well Low Low Level Alarm | 03-I-601 | BFPLS-CP-01 | | | | | | | | | | | | | | | | | |
| DEWATER-WW1-LSHH-01 | DI | 24VDC | BFP Effluent Lift Station Wet Well High High Level Alarm | 03-I-601 | BFPLS-CP-01 | | | | | | | | | | | | | | | | | |
| DEWATER-WW1-LSH-02 | DI | 24VDC | BFP Effluent Lift Station Wet Well High Level Alarm | 03-I-601 | BFPLS-CP-01 | | | | | | | | | | | | | | | | | |
| DEWATER-WW1-LSH-03 | DI | 24VDC | BFP Effluent Lift Station Wet Well High Level Alarm | 03-I-601 | BFPLS-CP-01 | | | | | | | | | | | | | | | | | |
| DEWATER-WW1-LIT-01 | AI | 4-20 mA | BFP Effluent Lift Station Wet Well Level Indication | 03-I-601 | BFPLS-CP-01 | | | | | | | | | | | | | | | | | |
| DEWATER-LSPU1-HS-01 | DO | 24VDC | BFP Effluent Pump No 1 Start/Stop Command | 03-I-601 | BFPLS-CP-01 | | | | | | | | | | | | | | | | | |
| DEWATER-LSPU1-YL-01A | DI | 24VDC | BFP Effluent Pump No 1 In Remote Status | 03-I-601 | BFPLS-CP-01 | | | | | | | | | | | | | | | | | |
| DEWATER-LSPU1-YL-01B | DI | 24VDC | BFP Effluent Pump No 1 Running Status | 03-I-601 | BFPLS-CP-01 | | | | | | | | | | | | | | | | | |
| DEWATER-LSPU1-YA-01A | DI | 24VDC | BFP Effluent Pump No 1 Fault Alarm | 03-I-601 | BFPLS-CP-01 | | | | | | | | | | | | | | | | | |
| DEWATER-LSPU1-YA-01B | DI | 24VDC | BFP Effluent Pump No 1 E-Stop Initiated Alarm | 03-I-601 | BFPLS-CP-01 | | | | | | | | | | | | | | | | | |
| DEWATER-LSPU1-MSH-01 | DI | 24VDC | BFP Effluent Pump No 1 Motor Moisture Alarm | 03-I-601 | BFPLS-CP-01 | | | | | | | | | | | | | | | | | |
| DEWATER-LSPU1-TS-01 | DI | 24VDC | BFP Effluent Pump No 1 Motor Temperature Alarm | 03-I-601 | BFPLS-CP-01 | | | | | | | | | | | | | | | | | |
| DEWATER-LSPU2-HS-01 | DO | 24VDC | BFP Effluent Pump No 2 Start/Stop Command | 03-I-601 | BFPLS-CP-01 | | | | | | | | | | | | | | | | | |
| DEWATER-LSPU2-YL-01A | DI | 24VDC | BFP Effluent Pump No 2 In Remote Status | 03-I-601 | BFPLS-CP-01 | | | | | | | | | | | | | | | | | |
| DEWATER-LSPU2-YL-01B | DI | 24VDC | BFP Effluent Pump No 2 Running Status | 03-I-601 | BFPLS-CP-01 | | | | | | | | | | | | | | | | | |
| DEWATER-LSPU2-YA-01A | DI | 24VDC | BFP Effluent Pump No 2 Fault Alarm | 03-I-601 | BFPLS-CP-01 | | | | | | | | | | | | | | | | | |
| DEWATER-LSPU2-YA-01B | DI | 24VDC | BFP Effluent Pump No 2 E-Stop Initiated Alarm | 03-I-601 | BFPLS-CP-01 | | | | | | | | | | | | | | | | | |
| DEWATER-LSPU2-MSH-01 | DI | 24VDC | BFP Effluent Pump No 2 Motor Moisture Alarm | 03-I-601 | BFPLS-CP-01 | | | | | | | | | | | | | | | | | |
| DEWATER-LSPU2-TS-01 | DI | 24VDC | BFP Effluent Pump No 2 Motor Temperature Alarm | 03-I-601 | BFPLS-CP-01 | | | | | | | | | | | | | | | | | |
| DEWATER-LSPU3-HS-01 | DO | 24VDC | BFP Effluent Pump No 3 Start/Stop Command | 03-I-601 | BFPLS-CP-01 | | | | | | | | | | | | | | | | | |
| DEWATER-LSPU3-YL-01A | DI | 24VDC | BFP Effluent Pump No 3 In Remote Status | 03-I-601 | BFPLS-CP-01 | | | | | | | | | | | | | | | | | |
| DEWATER-LSPU3-YL-01B | DI | 24VDC | BFP Effluent Pump No 3 Running Status | 03-I-601 | BFPLS-CP-01 | | | | | | | | | | | | | | | | | |
| DEWATER-LSPU3-YA-01A | DI | 24VDC | BFP Effluent Pump No 3 Fault Alarm | 03-I-601 | BFPLS-CP-01 | | | | | | | | | | | | | | | | | |
| DEWATER-LSPU3-YA-01B | DI | 24VDC | BFP Effluent Pump No 3 E-Stop Initiated Alarm | 03-I-601 | BFPLS-CP-01 | | | | | | | | | | | | | | | | | |
| DEWATER-LSPU3-MSH-01 | DI | 24VDC | BFP Effluent Pump No 3 Motor Moisture Alarm | 03-I-601 | BFPLS-CP-01 | | | | | | | | | | | | | | | | | |
| DEWATER-LSPU3-TS-01 | DI | 24VDC | BFP Effluent Pump No 3 Motor Temperature Alarm | 03-I-601 | BFPLS-CP-01 | | | | | | | | | | | | | | | | | |

## ARF-CP01-PLC-01

| | |
|---|---|
| AI | 9 |
| AO | 3 |
| DI | 27 |
| DO | 4 |
| DSAI | 0 |
| DSAO | 0 |
| DSDI | 0 |
| DSDO | 0 |

| IO Tag | I/O Type | Signal Type | Description | PID Drawing No. | Processor Cabinet No. | RACK / BASE | SLOT | I/O POINT | CARD/MODULE TERMINALS | FIELD I/O ADDR * | BIT NO * | EGU LOW | EGU HIGH | EGU | SCALED IN PLC? | RAW LOW | RAW HIGH | SIGNAL TYPE | TERMINAL BLOCK | TERMINAL NO'S | LOOP DIAG | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ARF-YL-CP-01 | DI | 24VDC | ARF-CP-01 UPS ON Status | 04-I-601 | ARF-CP-01 | | | | | | | | | | | | | | | | | |
| ARF-XA-CP-01 | DI | 24VDC | ARF-CP-01 UPS Battery Low Voltage Status | 04-I-601 | ARF-CP-01 | | | | | | | | | | | | | | | | | |
| ARF-YA-CP-01 | DI | 24VDC | ARF-CP-01 UPS Fail Alarm | 04-I-601 | ARF-CP-01 | | | | | | | | | | | | | | | | | |
| ARF-FEB1-FIT-01 | AI | 4-20 mA | ARF Bypass Valve Vault Discharge Flow Indication | 04-I-601 | ARF-CP-01 | | | | | | | | | | | | | | | | | |
| ARF-FEB1-LSL-01 | DI | 24VDC | ARF Equalization Basin Low Level Alarm | 04-I-601 | ARF-CP-01 | | | | | | | | | | | | | | | | | |
| ARF-MIX3-HS-01 | DO | 24VDC | ARF Equalization Basin Mixer Start/Stop Command | 04-I-601 | ARF-CP-01 | | | | | | | | | | | | | | | | | |
| ARF-MIX3-YL-01A | DI | 24VDC | ARF Equalization Basin Mixer In Remote Status | 04-I-601 | ARF-CP-01 | | | | | | | | | | | | | | | | | |
| ARF-MIX3-YL-01B | DI | 24VDC | ARF Equalization Basin Mixer Running Status | 04-I-601 | ARF-CP-01 | | | | | | | | | | | | | | | | | |
| ARF-MIX3-YA-01A | DI | 24VDC | ARF Equalization Basin Mixer Fault Alarm | 04-I-601 | ARF-CP-01 | | | | | | | | | | | | | | | | | |
| ARF-MIX3-YA-01B | DI | 24VDC | ARF Equalization Basin Mixer E-Stop Initiated Alarm | 04-I-601 | ARF-CP-01 | | | | | | | | | | | | | | | | | |
| ARF-MIX3-TS-01 | DI | 24VDC | ARF Equalization Basin Mixer Motor Temperature Alarm | 04-I-601 | ARF-CP-01 | | | | | | | | | | | | | | | | | |
| ARF-TS-001 | DI | 24VDC | Electrical Room HVAC Ambient Temperature Alarm | 04-I-601 | ARF-CP-01 | | | | | | | | | | | | | | | | | |
| ARF-YA-001 | DI | 24VDC | Electrical Room HVAC AHU-01 Fault Alarm | 04-I-601 | ARF-CP-01 | | | | | | | | | | | | | | | | | |
| ARF-PDSH-001 | DI | 24VDC | Electrical Room HVAC AHU-01 Dirty Filter Differential Pressure Alarm High | 04-I-601 | ARF-CP-01 | | | | | | | | | | | | | | | | | |
| ARF-YA-002 | DI | 24VDC | Electrical Room HVAC AHU-02 Fault Alarm | 04-I-601 | ARF-CP-01 | | | | | | | | | | | | | | | | | |
| ARF-PDSH-002 | DI | 24VDC | Electrical Room HVAC AHU-02 Dirty Filter Differential Pressure Alarm High | 04-I-601 | ARF-CP-01 | | | | | | | | | | | | | | | | | |
| ARF-PDSH-003 | DI | 24VDC | Electrical Room HVAC CFU-01 Dirty Filter Differential Pressure Alarm High | 04-I-601 | ARF-CP-01 | | | | | | | | | | | | | | | | | |
| ARF-FEB1-LIT-01 | AI | 4-20 mA | ARF Equalization Basin Level Indication | 04-I-601 | ARF-CP-01 | | | | | | | | | | | | | | | | | |
| ARF-FEB1-AIT-01 | AI | 4-20 mA | ARF Equalization Basin NH3 Indication | 04-I-601 | ARF-CP-01 | | | | | | | | | | | | | | | | | |
| ARF-LSPU1-HS-01 | DO | 24VDC | ARF EQ Transfer Pump No 1 Start/Stop Command | 04-I-602 | ARF-CP-01 | | | | | | | | | | | | | | | | | |
| ARF-LSPU1-YL-01A | DI | 24VDC | ARF EQ Transfer Pump No 1 In Remote Status | 04-I-602 | ARF-CP-01 | | | | | | | | | | | | | | | | | |
| ARF-LSPU1-SK-01 | AO | 4-20 mA | ARF EQ Transfer Pump No 1 Speed Control | 04-I-602 | ARF-CP-01 | | | | | | | | | | | | | | | | | |
| ARF-LSPU1-SI-01 | AI | 4-20 mA | ARF EQ Transfer Pump No 1 Speed Indication | 04-I-602 | ARF-CP-01 | | | | | | | | | | | | | | | | | |
| ARF-LSPU1-YL-01B | DI | 24VDC | ARF EQ Transfer Pump No 1 Running Status | 04-I-602 | ARF-CP-01 | | | | | | | | | | | | | | | | | |
| ARF-LSPU1-YA-01A | DI | 24VDC | ARF EQ Transfer Pump No 1 Fault Alarm | 04-I-602 | ARF-CP-01 | | | | | | | | | | | | | | | | | |
| ARF-LSPU1-YA-01B | DI | 24VDC | ARF EQ Transfer Pump No 1 E-Stop Initiated Alarm | 04-I-602 | ARF-CP-01 | | | | | | | | | | | | | | | | | |
| ARF-LSPU1-II-01 | AI | 4-20 mA | ARF EQ Transfer Pump No 1 Current Indication | 04-I-602 | ARF-CP-01 | | | | | | | | | | | | | | | | | |
| ARF-LSPU1-TAH-01 | DI | 24VDC | ARF EQ Transfer Pump No 1 Motor Temperature Alarm | 04-I-602 | ARF-CP-01 | | | | | | | | | | | | | | | | | |
| ARF-LSPU2-HS-01 | DO | 24VDC | ARF EQ Transfer Pump No 2 Start/Stop Command | 04-I-602 | ARF-CP-01 | | | | | | | | | | | | | | | | | |
| ARF-LSPU2-YL-01A | DI | 24VDC | ARF EQ Transfer Pump No 2 In Remote Status | 04-I-602 | ARF-CP-01 | | | | | | | | | | | | | | | | | |
| ARF-LSPU2-SK-01 | AO | 4-20 mA | ARF EQ Transfer Pump No 2 Speed Control | 04-I-602 | ARF-CP-01 | | | | | | | | | | | | | | | | | |
| ARF-LSPU2-SI-01 | AI | 4-20 mA | ARF EQ Transfer Pump No 2 Speed Indication | 04-I-602 | ARF-CP-01 | | | | | | | | | | | | | | | | | |
| ARF-LSPU2-YL-01B | DI | 24VDC | ARF EQ Transfer Pump No 2 Running Status | 04-I-602 | ARF-CP-01 | | | | | | | | | | | | | | | | | |
| ARF-LSPU2-YA-01A | DI | 24VDC | ARF EQ Transfer Pump No 2 Fault Alarm | 04-I-602 | ARF-CP-01 | | | | | | | | | | | | | | | | | |
| ARF-LSPU2-YA-01B | DI | 24VDC | ARF EQ Transfer Pump No 2 E-Stop Initiated Alarm | 04-I-602 | ARF-CP-01 | | | | | | | | | | | | | | | | | |
| ARF-LSPU2-II-01 | AI | 4-20 mA | ARF EQ Transfer Pump No 2 Current Indication | 04-I-602 | ARF-CP-01 | | | | | | | | | | | | | | | | | |
| ARF-LSPU2-TAH-01 | DI | 24VDC | ARF EQ Transfer Pump No 2 Motor Temperature Alarm | 04-I-602 | ARF-CP-01 | | | | | | | | | | | | | | | | | |
| ARF-LSPU3-HS-01 | DO | 24VDC | ARF EQ Transfer Pump No 3 Start/Stop Command | 04-I-603 | ARF-CP-01 | | | | | | | | | | | | | | | | | |
| ARF-LSPU3-YL-01A | DI | 24VDC | ARF EQ Transfer Pump No 3 In Remote Status | 04-I-603 | ARF-CP-01 | | | | | | | | | | | | | | | | | |
| ARF-LSPU3-SK-01 | AO | 4-20 mA | ARF EQ Transfer Pump No 3 Speed Control | 04-I-603 | ARF-CP-01 | | | | | | | | | | | | | | | | | |
| ARF-LSPU3-SI-01 | AI | 4-20 mA | ARF EQ Transfer Pump No 3 Speed Indication | 04-I-603 | ARF-CP-01 | | | | | | | | | | | | | | | | | |
| ARF-LSPU3-YL-01B | DI | 24VDC | ARF EQ Transfer Pump No 3 Running Status | 04-I-603 | ARF-CP-01 | | | | | | | | | | | | | | | | | |
| ARF-LSPU3-YA-01A | DI | 24VDC | ARF EQ Transfer Pump No 3 Fault Alarm | 04-I-603 | ARF-CP-01 | | | | | | | | | | | | | | | | | |
| ARF-LSPU3-YA-01B | DI | 24VDC | ARF EQ Transfer Pump No 3 E-Stop Initiated Alarm | 04-I-603 | ARF-CP-01 | | | | | | | | | | | | | | | | | |
| ARF-LSPU3-II-01 | AI | 4-20 mA | ARF EQ Transfer Pump No 3 Current Indication | 04-I-603 | ARF-CP-01 | | | | | | | | | | | | | | | | | |
| ARF-LSPU3-TAH-01 | DI | 24VDC | ARF EQ Transfer Pump No 3 Motor Temperature Alarm | 04-I-603 | ARF-CP-01 | | | | | | | | | | | | | | | | | |

## ARF-CP02-PLC-01

| | |
|---|---|
| AI | 32 |
| AO | 11 |
| DI | 81 |
| DO | 10 |
| DSAI | 0 |
| DSAO | 0 |
| DSDI | 0 |
| DSDO | 0 |

| IO Tag | I/O Type | Signal Type | Description | PID Drawing No. | Processor Cabinet No. | RACK / BASE | SLOT | I/O POINT | CARD/MODULE TERMINALS | FIELD I/O ADDR * | BIT NO * | EGU LOW | EGU HIGH | EGU | SCALED IN PLC? | RAW LOW | RAW HIGH | SIGNAL TYPE | TERMINAL BLOCK | TERMINAL NO'S | LOOP DIAG | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ARF-YL-CP-02 | DI | 24VDC | ARF-CP-02 UPS ON Status | 04-I-601 | ARF-CP-02 | | | | | | | | | | | | | | | | | |
| ARF-XA-CP-02 | DI | 24VDC | ARF-CP-02 UPS Battery Low Voltage Status | 04-I-601 | ARF-CP-02 | | | | | | | | | | | | | | | | | |
| ARF-YA-CP-02 | DI | 24VDC | ARF-CP-02 UPS Fail Alarm | 04-I-601 | ARF-CP-02 | | | | | | | | | | | | | | | | | |
| ARF-NH3R1-ZK-01 | AO | 4-20 mA | ATR 1 Aeration Distribution Valve Position Command | 04-I-604 | ARF-CP-02 | | | | | | | | | | | | | | | | | |
| ARF-NH3R1-YL-01 | DI | 24VDC | ATR 1 Aeration Distribution Valve Ready Status | 04-I-604 | ARF-CP-02 | | | | | | | | | | | | | | | | | |
| ARF-NH3R1-ZLO-01 | DI | 24VDC | ATR 1 Aeration Distribution Valve Opened Status | 04-I-604 | ARF-CP-02 | | | | | | | | | | | | | | | | | |
| ARF-NH3R1-ZLC-01 | DI | 24VDC | ATR 1 Aeration Distribution Valve Closed Status | 04-I-604 | ARF-CP-02 | | | | | | | | | | | | | | | | | |
| ARF-NH3R1-NAHH-01 | DI | 24VDC | ATR 1 Aeration Distribution Valve Torque Alarm | 04-I-604 | ARF-CP-02 | | | | | | | | | | | | | | | | | |
| ARF-NH3R1-ZI-01 | AI | 4-20 mA | ATR 1 Aeration Distribution Valve Position Indication | 04-I-604 | ARF-CP-02 | | | | | | | | | | | | | | | | | |
| ARF-NH3R1-FIT-01 | AI | 4-20 mA | ATR 1 Aeration Distribution Flow Indication | 04-I-604 | ARF-CP-02 | | | | | | | | | | | | | | | | | |
| ARF-MIX1A-HS-01 | DO | 24VDC | ATR 1 Mixer No 1 Start/Stop Command | 04-I-604 | ARF-CP-02 | | | | | | | | | | | | | | | | | |
| ARF-MIX1A-YL-01A | DI | 24VDC | ATR 1 Mixer No 1 In Remote Status | 04-I-604 | ARF-CP-02 | | | | | | | | | | | | | | | | | |
| ARF-MIX1A-SK-01 | AO | 4-20 mA | ATR 1 Mixer No 1 Speed Control | 04-I-604 | ARF-CP-02 | | | | | | | | | | | | | | | | | |
| ARF-MIX1A-SI-01 | AI | 4-20 mA | ATR 1 Mixer No 1 Speed Indication | 04-I-604 | ARF-CP-02 | | | | | | | | | | | | | | | | | |
| ARF-MIX1A-YL-01B | DI | 24VDC | ATR 1 Mixer No 1 Running Status | 04-I-604 | ARF-CP-02 | | | | | | | | | | | | | | | | | |
| ARF-MIX1A-YA-01A | DI | 24VDC | ATR 1 Mixer No 1 Fault Alarm | 04-I-604 | ARF-CP-02 | | | | | | | | | | | | | | | | | |
| ARF-MIX1A-YA-01B | DI | 24VDC | ATR 1 Mixer No 1 E-Stop Initiated Alarm | 04-I-604 | ARF-CP-02 | | | | | | | | | | | | | | | | | |
| ARF-MIX1A-II-01 | AI | 4-20 mA | ATR 1 Mixer No 1 Current Indication | 04-I-604 | ARF-CP-02 | | | | | | | | | | | | | | | | | |
| ARF-MIX1A-TAH-01 | DI | 24VDC | ATR 1 Mixer No 1 Motor Temperature Alarm | 04-I-604 | ARF-CP-02 | | | | | | | | | | | | | | | | | |
| ARF-MIX1B-HS-01 | DO | 24VDC | ATR 1 Mixer No 2 Start/Stop Command | 04-I-604 | ARF-CP-02 | | | | | | | | | | | | | | | | | |
| ARF-MIX1B-YL-01A | DI | 24VDC | ATR 1 Mixer No 2 In Remote Status | 04-I-604 | ARF-CP-02 | | | | | | | | | | | | | | | | | |
| ARF-MIX1B-SK-01 | AO | 4-20 mA | ATR 1 Mixer No 2 Speed Control | 04-I-604 | ARF-CP-02 | | | | | | | | | | | | | | | | | |
| ARF-MIX1B-SI-01 | AI | 4-20 mA | ATR 1 Mixer No 2 Speed Indication | 04-I-604 | ARF-CP-02 | | | | | | | | | | | | | | | | | |
| ARF-MIX1B-YL-01B | DI | 24VDC | ATR 1 Mixer No 2 Running Status | 04-I-604 | ARF-CP-02 | | | | | | | | | | | | | | | | | |
| ARF-MIX1B-YA-01A | DI | 24VDC | ATR 1 Mixer No 2 Fault Alarm | 04-I-604 | ARF-CP-02 | | | | | | | | | | | | | | | | | |
| ARF-MIX1B-YA-01B | DI | 24VDC | ATR 1 Mixer No 2 E-Stop Initiated Alarm | 04-I-604 | ARF-CP-02 | | | | | | | | | | | | | | | | | |
| ARF-MIX1B-II-01 | AI | 4-20 mA | ATR 1 Mixer No 1 Current Indication | 04-I-604 | ARF-CP-02 | | | | | | | | | | | | | | | | | |
| ARF-MIX1B-TAH-01 | DI | 24VDC | ATR 1 Mixer No 2 Motor Temperature Alarm | 04-I-604 | ARF-CP-02 | | | | | | | | | | | | | | | | | |
| ARF-NH3R1-LSH-01 | DI | 24VDC | ATR 1 Instrument Chamber High Level Alarm | 04-I-604 | ARF-CP-02 | | | | | | | | | | | | | | | | | |
| ARF-NH3R1-LSL-01 | DI | 24VDC | ATR 1 Instrument Chamber Low Level Alarm | 04-I-604 | ARF-CP-02 | | | | | | | | | | | | | | | | | |
| ARF-NH3R1-LIT-01 | AI | 4-20 mA | ATR 1 Instrument Chamber Level Indication | 04-I-604 | ARF-CP-02 | | | | | | | | | | | | | | | | | |
| ARF-NH3R1-AIT-01 | AI | 4-20 mA | ATR 1 Instrument Chamber Ph/Temp Indication | 04-I-604 | ARF-CP-02 | | | | | | | | | | | | | | | | | |
| ARF-NH3R1-AIT-02 | AI | 4-20 mA | ATR 1 Instrument Chamber DO Indication | 04-I-604 | ARF-CP-02 | | | | | | | | | | | | | | | | | |
| ARF-CHANN1-LSH-01 | DI | 24VDC | ATR 1 ARF Effluent Chamber High Level Alarm | 04-I-604 | ARF-CP-02 | | | | | | | | | | | | | | | | | |
| ARF-CHANN1-LSL-01 | DI | 24VDC | ATR 1 ARF Effluent Chamber Low Level Alarm | 04-I-604 | ARF-CP-02 | | | | | | | | | | | | | | | | | |
| ARF-CHANN1-LIT-01 | AI | 4-20 mA | ATR 1 ARF Effluent Chamber Level Indication | 04-I-604 | ARF-CP-02 | | | | | | | | | | | | | | | | | |
| ARF-NH3R2-ZK-01 | AO | 4-20 mA | ATR 2 Aeration Distribution Valve Position Command | 04-I-605 | ARF-CP-02 | | | | | | | | | | | | | | | | | |
| ARF-NH3R2-YL-01 | DI | 24VDC | ATR 2 Aeration Distribution Valve Ready Status | 04-I-605 | ARF-CP-02 | | | | | | | | | | | | | | | | | |
| ARF-NH3R2-ZLO-01 | DI | 24VDC | ATR 2 Aeration Distribution Valve Opened Status | 04-I-605 | ARF-CP-02 | | | | | | | | | | | | | | | | | |
| ARF-NH3R2-ZLC-01 | DI | 24VDC | ATR 2 Aeration Distribution Valve Closed Status | 04-I-605 | ARF-CP-02 | | | | | | | | | | | | | | | | | |
| ARF-NH3R2-NAHH-01 | DI | 24VDC | ATR 2 Aeration Distribution Valve Torque Alarm | 04-I-605 | ARF-CP-02 | | | | | | | | | | | | | | | | | |
| ARF-NH3R2-ZI-01 | AI | 4-20 mA | ATR 2 Aeration Distribution Valve Position Indication | 04-I-605 | ARF-CP-02 | | | | | | | | | | | | | | | | | |
| ARF-NH3R2-FIT-01 | AI | 4-20 mA | ATR 2 Aeration Distribution Flow Indication | 04-I-605 | ARF-CP-02 | | | | | | | | | | | | | | | | | |
| ARF-MIX2A-HS-01 | DO | 24VDC | ATR 2 Mixer No 1 Start/Stop Command | 04-I-605 | ARF-CP-02 | | | | | | | | | | | | | | | | | |
| ARF-MIX2A-YL-01A | DI | 24VDC | ATR 2 Mixer No 1 In Remote Status | 04-I-605 | ARF-CP-02 | | | | | | | | | | | | | | | | | |
| ARF-MIX2A-SK-01 | AO | 4-20 mA | ATR 2 Mixer No 1 Speed Control | 04-I-605 | ARF-CP-02 | | | | | | | | | | | | | | | | | |
| ARF-MIX2A-SI-01 | AI | 4-20 mA | ATR 2 Mixer No 1 Speed Indication | 04-I-605 | ARF-CP-02 | | | | | | | | | | | | | | | | | |
| ARF-MIX2A-YL-01B | DI | 24VDC | ATR 2 Mixer No 1 Running Status | 04-I-605 | ARF-CP-02 | | | | | | | | | | | | | | | | | |
| ARF-MIX2A-YA-01A | DI | 24VDC | ATR 2 Mixer No 1 Fault Alarm | 04-I-605 | ARF-CP-02 | | | | | | | | | | | | | | | | | |
| ARF-MIX2A-YA-01B | DI | 24VDC | ATR 2 Mixer No 1 E-Stop Initiated Alarm | 04-I-605 | ARF-CP-02 | | | | | | | | | | | | | | | | | |
| ARF-MIX2A-II-01 | AI | 4-20 mA | ATR 2 Mixer No 1 Current Indication | 04-I-605 | ARF-CP-02 | | | | | | | | | | | | | | | | | |
| ARF-MIX2A-TAH-01 | DI | 24VDC | ATR 2 Mixer No 1 Motor Temperature Alarm | 04-I-605 | ARF-CP-02 | | | | | | | | | | | | | | | | | |
| ARF-MIX2B-HS-01 | DO | 24VDC | ATR 2 Mixer No 2 Start/Stop Command | 04-I-605 | ARF-CP-02 | | | | | | | | | | | | | | | | | |
| ARF-MIX2B-YL-01A | DI | 24VDC | ATR 2 Mixer No 2 In Remote Status | 04-I-605 | ARF-CP-02 | | | | | | | | | | | | | | | | | |
| ARF-MIX2B-SK-01 | AO | 4-20 mA | ATR 2 Mixer No 2 Speed Control | 04-I-605 | ARF-CP-02 | | | | | | | | | | | | | | | | | |
| ARF-MIX2B-SI-01 | AI | 4-20 mA | ATR 2 Mixer No 2 Speed Indication | 04-I-605 | ARF-CP-02 | | | | | | | | | | | | | | | | | |
| ARF-MIX2B-YL-01B | DI | 24VDC | ATR 2 Mixer No 2 Running Status | 04-I-605 | ARF-CP-02 | | | | | | | | | | | | | | | | | |
| ARF-MIX2B-YA-01A | DI | 24VDC | ATR 2 Mixer No 2 Fault Alarm | 04-I-605 | ARF-CP-02 | | | | | | | | | | | | | | | | | |
| ARF-MIX2B-YA-01B | DI | 24VDC | ATR 2 Mixer No 2 E-Stop Initiated Alarm | 04-I-605 | ARF-CP-02 | | | | | | | | | | | | | | | | | |
| ARF-MIX2B-II-01 | AI | 4-20 mA | ATR 2 Mixer No 2 Current Indication | 04-I-605 | ARF-CP-02 | | | | | | | | | | | | | | | | | |
| ARF-MIX2B-TAH-01 | DI | 24VDC | ATR 2 Mixer No 2 Motor Temperature Alarm | 04-I-605 | ARF-CP-02 | | | | | | | | | | | | | | | | | |
| ARF-NH3R2-LSH-01 | DI | 24VDC | ATR 2 Instrument Chamber High Level Alarm | 04-I-605 | ARF-CP-02 | | | | | | | | | | | | | | | | | |
| ARF-NH3R2-LSL-01 | DI | 24VDC | ATR 2 Instrument Chamber Low Level Alarm | 04-I-605 | ARF-CP-02 | | | | | | | | | | | | | | | | | |
| ARF-NH3R2-LIT-01 | AI | 4-20 mA | ATR 2 Instrument Chamber Level Indication | 04-I-605 | ARF-CP-02 | | | | | | | | | | | | | | | | | |
| ARF-NH3R2-AIT-01 | AI | 4-20 mA | ATR 2 Instrument Chamber Ph/Temp Indication | 04-I-605 | ARF-CP-02 | | | | | | | | | | | | | | | | | |
| ARF-NH3R2-AIT-02 | AI | 4-20 mA | ATR 2 Instrument Chamber DO Indication | 04-I-605 | ARF-CP-02 | | | | | | | | | | | | | | | | | |
| ARF-NH3R1-AIT-03 | AI | 4-20 mA | ATR 1 NH3 Indication | 04-I-606 | ARF-CP-02 | | | | | | | | | | | | | | | | | |
| ARF-JBX1-LIT-01 | AI | 4-20 mA | ATR 1 Influent Splitter Box Level Indication | 04-I-606 | ARF-CP-02 | | | | | | | | | | | | | | | | | |
| ARF-JBX1-ZK-01 | AO | 4-20 mA | ATR 1 Influent Splitter Box Gate Position Command | 04-I-606 | ARF-CP-02 | | | | | | | | | | | | | | | | | |
| ARF-JBX1-YL-01 | DI | 24VDC | ATR 1 Influent Splitter Box Gate Ready Status | 04-I-606 | ARF-CP-02 | | | | | | | | | | | | | | | | | |
| ARF-JBX1-ZLO-01 | DI | 24VDC | ATR 1 Influent Splitter Box Gate Opened Status | 04-I-606 | ARF-CP-02 | | | | | | | | | | | | | | | | | |
| ARF-JBX1-ZLC-01 | DI | 24VDC | ATR 1 Influent Splitter Box Gate Closed Status | 04-I-606 | ARF-CP-02 | | | | | | | | | | | | | | | | | |
| ARF-JBX1-NAHH-01 | DI | 24VDC | ATR 1 Influent Splitter Box Gate Torque Alarm | 04-I-606 | ARF-CP-02 | | | | | | | | | | | | | | | | | |
| ARF-JBX1-ZI-01 | AI | 4-20 mA | ATR 1 Influent Splitter Box Gate Position Indication | 04-I-606 | ARF-CP-02 | | | | | | | | | | | | | | | | | |
| ARF-JBX1-ZK-02 | AO | 4-20 mA | ATR 2 Influent Splitter Box Gate Position Command | 04-I-606 | ARF-CP-02 | | | | | | | | | | | | | | | | | |
| ARF-JBX1-YL-02 | DI | 24VDC | ATR 2 Influent Splitter Box Gate Ready Status | 04-I-606 | ARF-CP-02 | | | | | | | | | | | | | | | | | |
| ARF-JBX1-ZLO-02 | DI | 24VDC | ATR 2 Influent Splitter Box Gate Opened Status | 04-I-606 | ARF-CP-02 | | | | | | | | | | | | | | | | | |
| ARF-JBX1-ZLC-02 | DI | 24VDC | ATR 2 Influent Splitter Box Gate Closed Status | 04-I-606 | ARF-CP-02 | | | | | | | | | | | | | | | | | |
| ARF-JBX1-NAHH-02 | DI | 24VDC | ATR 2 Influent Splitter Box Gate Torque Alarm | 04-I-606 | ARF-CP-02 | | | | | | | | | | | | | | | | | |
| ARF-JBX1-ZI-02 | AI | 4-20 mA | ATR 2 Influent Splitter Box Gate Position Indication | 04-I-606 | ARF-CP-02 | | | | | | | | | | | | | | | | | |
| ARF-JBX1-LIT-02 | AI | 4-20 mA | ATR 2 NH3 Indication | 04-I-606 | ARF-CP-02 | | | | | | | | | | | | | | | | | |
| ARF-NH3R2-AIT-03 | AI | 4-20 mA | ATR 2 Influent Splitter Box Level Indication | 04-I-606 | ARF-CP-02 | | | | | | | | | | | | | | | | | |
| ARF-LSPU4-HS-01 | DO | 24VDC | ARF Effluent Pump No 1 Start/Stop Command | 04-I-607 | ARF-CP-02 | | | | | | | | | | | | | | | | | |
| ARF-LSPU4-YL-01A | DI | 24VDC | ARF Effluent Pump No 1 In Remote Status | 04-I-607 | ARF-CP-02 | | | | | | | | | | | | | | | | | |
| ARF-LSPU4-YL-01B | DI | 24VDC | ARF Effluent Pump No 1 Running Status | 04-I-607 | ARF-CP-02 | | | | | | | | | | | | | | | | | |
| ARF-LSPU4-YA-01A | DI | 24VDC | ARF Effluent Pump No 1 Fault Alarm | 04-I-607 | ARF-CP-02 | | | | | | | | | | | | | | | | | |
| ARF-LSPU4-YA-01B | DI | 24VDC | ARF Effluent Pump No 1 E-Stop Initiated Alarm | 04-I-607 | ARF-CP-02 | | | | | | | | | | | | | | | | | |
| ARF-LSPU4-TS-01 | DI | 24VDC | ARF Effluent Pump No 1 Motor Temperature Alarm | 04-I-607 | ARF-CP-02 | | | | | | | | | | | | | | | | | |
| ARF-LSPU5-HS-01 | DO | 24VDC | ARF Effluent Pump No 2 Start/Stop Command | 04-I-607 | ARF-CP-02 | | | | | | | | | | | | | | | | | |
| ARF-LSPU5-YL-01A | DI | 24VDC | ARF Effluent Pump No 2 In Remote Status | 04-I-607 | ARF-CP-02 | | | | | | | | | | | | | | | | | |
| ARF-LSPU5-YL-01B | DI | 24VDC | ARF Effluent Pump No 2 Running Status | 04-I-607 | ARF-CP-02 | | | | | | | | | | | | | | | | | |
| ARF-LSPU5-YA-01A | DI | 24VDC | ARF Effluent Pump No 2 Fault Alarm | 04-I-607 | ARF-CP-02 | | | | | | | | | | | | | | | | | |
| ARF-LSPU5-YA-01B | DI | 24VDC | ARF Effluent Pump No 2 E-Stop Initiated Alarm | 04-I-607 | ARF-CP-02 | | | | | | | | | | | | | | | | | |
| ARF-LSPU5-TS-01 | DI | 24VDC | ARF Effluent Pump No 2 Motor Temperature Alarm | 04-I-607 | ARF-CP-02 | | | | | | | | | | | | | | | | | |
| ARF-LSPU6-HS-01 | DO | 24VDC | ARF Effluent Pump No 3 Start/Stop Command | 04-I-607 | ARF-CP-02 | | | | | | | | | | | | | | | | | |
| ARF-LSPU6-YL-01A | DI | 24VDC | ARF Effluent Pump No 3 In Remote Status | 04-I-607 | ARF-CP-02 | | | | | | | | | | | | | | | | | |
| ARF-LSPU6-YL-01B | DI | 24VDC | ARF Effluent Pump No 3 Running Status | 04-I-607 | ARF-CP-02 | | | | | | | | | | | | | | | | | |
| ARF-LSPU6-YA-01A | DI | 24VDC | ARF Effluent Pump No 3 Fault Alarm | 04-I-607 | ARF-CP-02 | | | | | | | | | | | | | | | | | |
| ARF-LSPU6-YA-01B | DI | 24VDC | ARF Effluent Pump No 3 E-Stop Initiated Alarm | 04-I-607 | ARF-CP-02 | | | | | | | | | | | | | | | | | |
| ARF-LSPU6-TS-01 | DI | 24VDC | ARF Effluent Pump No 3 Motor Temperature Alarm | 04-I-607 | ARF-CP-02 | | | | | | | | | | | | | | | | | |
| ARF-BLWR1-HS-01 | DO | 24VDC | ARF Air Blower No 1 Start/Stop Command | 05-I-601 | ARF-CP-02 | | | | | | | | | | | | | | | | | |
| ARF-BLWR1-YL-01A | DI | 24VDC | ARF Air Blower No 1 In Remote Status | 05-I-601 | ARF-CP-02 | | | | | | | | | | | | | | | | | |
| ARF-BLWR1-SK-01 | AO | 4-20 mA | ARF Air Blower No 1 Speed Control | 05-I-601 | ARF-CP-02 | | | | | | | | | | | | | | | | | |

## ARF-CP02-PLC-01

| | |
|---|---|
| AI | 32 |
| AO | 11 |
| DI | 81 |
| DO | 10 |
| DSAI | 0 |
| DSAO | 0 |
| DSDI | 0 |
| DSDO | 0 |

| IO Tag | I/O Type | Signal Type | Description | PID Drawing No. | Processor Cabinet No. | RACK / BASE | SLOT | I/O POINT | CARD/MODULE TERMINALS | FIELD I/O ADDR * | BIT NO * | EGU LOW | EGU HIGH | EGU | SCALED IN PLC? | RAW LOW | RAW HIGH | SIGNAL TYPE | TERMINAL BLOCK | TERMINAL NO'S | LOOP DIAG | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ARF-BLWR1-SI-01 | AI | 4-20 mA | ARF Air Blower No 1 Speed Indication | 05-I-601 | ARF-CP-02 | | | | | | | | | | | | | | | | | |
| ARF-BLWR1-YL-01B | DI | 24VDC | ARF Air Blower No 1 Running Status | 05-I-601 | ARF-CP-02 | | | | | | | | | | | | | | | | | |
| ARF-BLWR1-YA-01A | DI | 24VDC | ARF Air Blower No 1 Fault Alarm | 05-I-601 | ARF-CP-02 | | | | | | | | | | | | | | | | | |
| ARF-BLWR1-YA-01B | DI | 24VDC | ARF Air Blower No 1 E-Stop Initiated Alarm | 05-I-601 | ARF-CP-02 | | | | | | | | | | | | | | | | | |
| ARF-BLWR1-II-01 | AI | 4-20 mA | ARF Air Blower No 1 Current Indication | 05-I-601 | ARF-CP-02 | | | | | | | | | | | | | | | | | |
| ARF-BLWR1-TAH-01A | DI | 24VDC | ARF Air Blower No 1 Motor Temperature Alarm | 05-I-601 | ARF-CP-02 | | | | | | | | | | | | | | | | | |
| ARF-BLWR1-PAL-01 | DI | 24VDC | ARF Air Blower No 1 Suction Low Pressure Alarm | 05-I-601 | ARF-CP-02 | | | | | | | | | | | | | | | | | |
| ARF-BLWR1-PAH-01 | DI | 24VDC | ARF Air Blower No 1 Discharge High Pressure Alarm | 05-I-601 | ARF-CP-02 | | | | | | | | | | | | | | | | | |
| ARF-BLWR1-TAH-01B | DI | 24VDC | ARF Air Blower No 1 Discharge High Temperature Alarm | 05-I-601 | ARF-CP-02 | | | | | | | | | | | | | | | | | |
| ARF-BLWR2-HS-01 | DO | 24VDC | ARF Air Blower No 2 Start/Stop Command | 05-I-601 | ARF-CP-02 | | | | | | | | | | | | | | | | | |
| ARF-BLWR2-YL-01A | DI | 24VDC | ARF Air Blower No 2 In Remote Status | 05-I-601 | ARF-CP-02 | | | | | | | | | | | | | | | | | |
| ARF-BLWR2-SK-01 | AO | 4-20 mA | ARF Air Blower No 2 Speed Control | 05-I-601 | ARF-CP-02 | | | | | | | | | | | | | | | | | |
| ARF-BLWR2-SI-01 | AI | 4-20 mA | ARF Air Blower No 2 Speed Indication | 05-I-601 | ARF-CP-02 | | | | | | | | | | | | | | | | | |
| ARF-BLWR2-YL-01B | DI | 24VDC | ARF Air Blower No 2 Running Status | 05-I-601 | ARF-CP-02 | | | | | | | | | | | | | | | | | |
| ARF-BLWR2-YA-01A | DI | 24VDC | ARF Air Blower No 2 Fault Alarm | 05-I-601 | ARF-CP-02 | | | | | | | | | | | | | | | | | |
| ARF-BLWR2-YA-01B | DI | 24VDC | ARF Air Blower No 2 E-Stop Initiated Alarm | 05-I-601 | ARF-CP-02 | | | | | | | | | | | | | | | | | |
| ARF-BLWR2-II-01 | AI | 4-20 mA | ARF Air Blower No 2 Current Indication | 05-I-601 | ARF-CP-02 | | | | | | | | | | | | | | | | | |
| ARF-BLWR2-TAH-01A | DI | 24VDC | ARF Air Blower No 2 Motor Temperature Alarm | 05-I-601 | ARF-CP-02 | | | | | | | | | | | | | | | | | |
| ARF-BLWR2-PAL-01 | DI | 24VDC | ARF Air Blower No 2 Suction Low Pressure Alarm | 05-I-601 | ARF-CP-02 | | | | | | | | | | | | | | | | | |
| ARF-BLWR2-PAH-01 | DI | 24VDC | ARF Air Blower No 2 Discharge High Pressure Alarm | 05-I-601 | ARF-CP-02 | | | | | | | | | | | | | | | | | |
| ARF-BLWR2-TAH-01B | DI | 24VDC | ARF Air Blower No 2 Discharge High Temperature Alarm | 05-I-601 | ARF-CP-02 | | | | | | | | | | | | | | | | | |
| ARF-BLWR3-HS-01 | DO | 24VDC | ARF Air Blower No 3 Start/Stop Command | 05-I-601 | ARF-CP-02 | | | | | | | | | | | | | | | | | |
| ARF-BLWR3-YL-01A | DI | 24VDC | ARF Air Blower No 3 In Remote Status | 05-I-601 | ARF-CP-02 | | | | | | | | | | | | | | | | | |
| ARF-BLWR3-SK-01 | AO | 4-20 mA | ARF Air Blower No 3 Speed Control | 05-I-601 | ARF-CP-02 | | | | | | | | | | | | | | | | | |
| ARF-BLWR3-SI-01 | AI | 4-20 mA | ARF Air Blower No 3 Speed Indication | 05-I-601 | ARF-CP-02 | | | | | | | | | | | | | | | | | |
| ARF-BLWR3-YL-01B | DI | 24VDC | ARF Air Blower No 3 Running Status | 05-I-601 | ARF-CP-02 | | | | | | | | | | | | | | | | | |
| ARF-BLWR3-YA-01A | DI | 24VDC | ARF Air Blower No 3 Fault Alarm | 05-I-601 | ARF-CP-02 | | | | | | | | | | | | | | | | | |
| ARF-BLWR3-YA-01B | DI | 24VDC | ARF Air Blower No 3 E-Stop Initiated Alarm | 05-I-601 | ARF-CP-02 | | | | | | | | | | | | | | | | | |
| ARF-BLWR3-II-01 | AI | 4-20 mA | ARF Air Blower No 3 Current Indication | 05-I-601 | ARF-CP-02 | | | | | | | | | | | | | | | | | |
| ARF-BLWR3-TAH-01A | DI | 24VDC | ARF Air Blower No 3 Motor Temperature Alarm | 05-I-601 | ARF-CP-02 | | | | | | | | | | | | | | | | | |
| ARF-BLWR3-PAL-01 | DI | 24VDC | ARF Air Blower No 3 Suction Low Pressure Alarm | 05-I-601 | ARF-CP-02 | | | | | | | | | | | | | | | | | |
| ARF-BLWR3-PAH-01 | DI | 24VDC | ARF Air Blower No 3 Discharge High Pressure Alarm | 05-I-601 | ARF-CP-02 | | | | | | | | | | | | | | | | | |
| ARF-BLWR3-TAH-01B | DI | 24VDC | ARF Air Blower No 3 Discharge High Temperature Alarm | 05-I-601 | ARF-CP-02 | | | | | | | | | | | | | | | | | |
| ARF-AIP1-PIT-01 | AI | 4-20 mA | ARF Air Blower Discharge Common Header Pressure Indication | 05-I-601 | ARF-CP-02 | | | | | | | | | | | | | | | | | |

## PART I - GENERAL

### 1.01 DOCUMENT CONVENTIONS AND PURPOSE

A. The following terms, used throughout this document, shall be as defined below:

1. "Will", "shall" or "must" indicates a mandatory requirement or course of action.

2. "Should" indicates a recommended requirement or course of action

3. "May" or "can" indicates a possible course of action.

B. This document outlines the basic control philosophy for the Facility and describes the site process control requirements to be read in conjunction with the various mechanical equipment specification sections and referenced against the project Process and Instrumentation Drawings (P&IDs), electrical control schematics, specs and plans.

C. Any deviation from the requirements of this document must be approved in writing by the Engineer of record or authorized representative.

### 1.02 THE REQUIREMENT

A. **General:** The CONTRACTOR, through the use of a qualified and directly contracted System Integrator (ICS), shall be responsible for configuring and programming PLC and HMI hardware for implementation of the control philosophies described in this section, the functions detailed on the Contract drawings, and the points listed in the I/O schedule. The requirements of Specification Section 17100– Process Control and Instrumentation Systems (PICS) apply to this section. Vendor package suppliers, also under contract with CONTRACTOR, shall be subject to the same responsibilities and requirements (as further detailed in section 2.1).

B. PLC controller programs shall be capable of functioning normally in the absence of an HMI station without any special modifications. Process logic, including monitoring, control and alarming functions shall be programmed at the PLC controller level only. Vendor PLC-based control packages shall be subject to the same requirements.

C. Reference to Plant PLC in the individual control philosophies is synonymous with the ammonia removal PLC, ARF-CP1-PLC-01.

D. Abbreviations used in this section:

| | |
|---|---|
| A/M | Auto/Manual |
| AAH | Analyzer Alarm High |
| AAHH | Analyzer Alarm High-High |
| AAL | Analyzer Alarm Low |

| | |
|---|---|
| AALL | Analyzer Alarm Low-Low |
| ACK | Acknowledge |
| ATC | Automatic Transfer Controller |
| AWT | Advanced Water Treatment |
| CIP | Clean-In-Place |
| DCS | Distributed Control System |
| DLR | Device Level Ring |
| DOL | Direct On-Line (Starter) |
| FAL | Flow Alarm Low |
| FAH | Flow Alarm High |
| GUI | Graphic User Interface |
| HMI | Human Machine Interface |
| HOA | Hand-Off-Auto |
| HOR | Hand-Off-Remote |
| I/O | Input / Output |
| L/R | Local/Remote |
| LAH | Level Alarm High |
| LAHH | Level Alarm High-High |
| LAL | Level Alarm Low |
| LALL | Level Alarm Low-Low |
| LCP | Local Control Panel |
| LCS | Local Control Station |
| LO | Locked Out |
| LOA | Local-Off-Auto |
| LOR | Local-Off-Remote |
| MCC | Motor Control Center |
| MPRM | Motor Protection Relay Module |
| NAS | Network Attached Storage |
| NPW | Non Potable Water |
| NTP | Network Time Protocol |
| OCA | Open-Close-Auto |
| OI | Operator Interface |
| OSC | Open-Stop-Close |
| PAH | Pressure Alarm High |
| PAHH | Pressure Alarm High-High |
| PAL | Pressure Alarm Low |
| PALL | Pressure Alarm Low-Low |
| PD | Positive Displacement |
| PID | Proportional + Integral + Derivative |
| PLC | Programmable Logic Controller |
| RAS | Return Activated Sludge |
| RIO | Remote Input / Output |
| RVSS | Reduced Voltage Soft Starter |
| SCADA | Supervisory Control and Data Acquisition |
| SOP | Standard Operating Procedure |
| S/S | Start/Stop |
| TAH | Temperature Alarm High |
| TAHH | Temperature Alarm High-High |
| TBC | To Be Confirmed (By the Engineer prior to or at the FAT) |
| TBD | To Be Determined (By the Engineer or Vendor during field commissioning) |

| | |
|---|---|
| UPS | Uninterruptible Power Supply |
| UW | Utility Water |
| VCP | Vendor Control Panel (Supplied by Equipment or Package Vendor) |
| VFD | Variable Frequency Drive |
| VSD | Variable Speed Drive (Integral to Metering Pumps) |

E. The CONTRACTOR (and Vendor package suppliers) shall reference mechanical drawings and specification sections and electrical equipment location plans, specifications and control schematics as noted on the P&ID drawings for additional control clarifications.

## PART II - PRODUCTS

### 2.01 THE CONTROL SYSTEM ARCHITECTURE

A. Required PLC controller and communication cabinets (as shown on the Network Block Diagrams) shall be furnished (configured, programmed and fully tested) by the ICS (under direct contract with the CONTRACTOR). PLC controller programming shall be as described herein. The PLC controllers shall be used to automatically monitor and control equipment provided under this contract. The PLC HMI hardware shown on the Network Block Diagrams shall be used to facilitate a GUI for the Facility system monitoring, operator setpoint entry, and operator interface to the Facility PLC control functions (inclusive of vendor package controls as defined herein).

B. Required package vendor PLC panels shall be factory-assembled, configured and programmed by the package vendor as described herein and elsewhere in the contract documents – all as confirmed by the Engineer in the certified vendor submittals. The vendor package PLCs (as specified in section 17600) shall be used to automatically monitor and control equipment provided in the associated vendor package. The vendor package HMI hardware specified in Section 17600 and shown on the Network Block Diagrams (where applicable) shall be used to facilitate a GUI for package system monitoring, operator setpoint entry, and operator interface to the package PLC control functions.

   Note: For networked vendor packages, the Vendor shall be subject to specific programming requirements to ensure that a parallel HMI interface to the Vendor PLC - Plant master HMI and the Vendor OI - can be properly managed without input handling conflict at the Vendor PLC.

C. The CONTRACTOR shall be responsible for field assembly, installation, pre-commissioning, final commissioning and startup of the control network components as detailed in the Contract Specifications.

D. System Overview:

   1. The control system architecture, as shown on the network overview drawings, will be largely based on the Schneider Electric Modicon line of PLC processors. The Ethernet network will utilize single mode fiber optic

cabling as the primary communication medium. The balance of plant controllers will be used to govern coordinated operation of the Vendor package systems as well as provide control and monitoring of other non-Vendor supporting systems.

2. Major vendor control packages with single controllers will be entirely based on the Schneider Electric line of Modicon controllers with dedicated Harmony OIU (as developed by the package Vendor). The major vendor control panels will be field located on or in close proximity to the associated equipment skid, directly connected to the plant control network via industrial managed Ethernet switch.

3. All controller cabinets (CP01 and CP02) are intended to be normally (common) supplied with a non-key locked 3-point latching handles (pad-lock ready). By default, the status points listed below will be monitored for all panels and access to the controller IP webpage (as applicable) provided.

    a. Intrusion Detection

    b. High Temperature

    c. Failure of Primary Power Supply

    d. Failure of Secondary Power Supply

    e. Primary Controller Failure (inclusive of power supply)

    f. Secondary Controller Failure (inclusive of power supply) – where applicable

4. Normal operation of plant equipment will require the presence of an online plant and/or Vendor package controller. However, E-room equipment local controls will be provided to support maintenance activities or, in some cases (as identified in the detailed control philosophy sections) override emergency operation. Specifically, starters will include local controls at the starter; access to drive local control functions will be available but password protected; drive / starter local safety interlocks will be provided (as shown on the P&IDs and electrical control schematics) to support direct interface of hardwired mechanical protection signals.

5. To the fullest extent practical, variable speed drives will be interfaced to the CP01 PLC and Vendor CP02 PLC controllers using hardwired cabling (for control and monitoring). Status monitoring of UPS units (unless specifically noted otherwise), smart power monitors, motor protection relay modules and select process analyzers will be based on Modbus TCP protocol (using industrial stranded copper Cat6A cabling). Traditional hardwired copper connections will be used for monitoring of discrete field signals and control of on/off valves, starters and other equipment requiring a discrete control interface. Similarly, traditional shielded

conductor pairs will be used for monitoring of analogue field signals and control of modulating valves and other equipment requiring an analogue control / remote setpoint interface. Analogue signals of 4-20mA will be proportionally scaled to the measured or control value. Discrete signals will be 24VDC unless specifically noted otherwise. Instruments certified to be HART compatible shall be preferentially supplied.

6. Most plant equipment will include a field-mounted local control station (LCS).The LCS is intended to provide an Operator accessible emergency stop control point in close proximity to the associated equipment. The LCS push-pull E-stop button command signal will be directly fail-safe hardwired to the associated starter or drive (refer to project electrical control schematics).

## 2.02 PLC/HMI CONTROL FUNCTIONS

A. **General:** PLC/HMI requirements are as listed in the sub-sections below and are generally applicable to Vendor developed PLC/OI control packages except where specifically noted as "Not Applicable to Vendor Packages".

B. **Standards:** The ICS shall refer to the Austin Water Control System Programming Standards, attached as Appendix A. Where conflicts exist between the specification and AW standards, the AW requirements shall govern.

C. **Development Overview and Access:** The PLC HMI shall display the status or value of all PLC controller input and output points described in this section, detailed in the I/O schedule and shown on the P&ID drawings. In addition, the PLC HMI shall serve as a parallel interface point for all networked vendor package controllers, displaying the status or value of all shared I/O points as well as providing access to vendor package control points and setpoint entries. Unless specifically directed otherwise by the ENGINEER in writing, controller and OI / HMI control screen development requirements shall be subject to the requirements detailed herein and the following specification sections:

1. Section 17600 – PLCs and OIUs Equipment

2. Austin Water (AW) Control System Programming Standards

Access to the PLC HMI (and vendor control package OIs) will be password restricted to authorized personnel only with increasing authority required to effect system changes. In general, PLC HMI base access groups will be defined as follows:

1. Maintenance Group – view access to specific equipment usage / performance summary screens (with pre-defined historical and real-time trend pop-ups), alarm screens and Viewpoint Navigation screen. No other view, write or control access rights. Alarm acknowledgement will also be restricted.

2. Operations Group – typically granted equipment and process control rights but limited access to process control configuration / tuning parameters. Specific operator adjustable values shall be as defined in the detailed control descriptions.

3. Supervisory Group – typically granted administrative level rights within the control system software environment but only limited (if any) access to the operating system. Supervisors shall have access to all operator adjustable values as well as process control configuration / tuning parameters and alarm configuration. Specific supervisor tunable values shall be as defined in the detailed control descriptions.

4. Administrator / Developer – full application and operating system level administrative access rights.

D. **Controller Setpoint Handling:**

Operator entered setpoints shall be constrained to match PLC programmed setpoint ranges. If a value lower than the setpoint range is entered, the PLC program defaults to the lowest possible range value. If a value higher than the setpoint range is entered, the PLC program defaults to the highest possible range value. The PLC shall prohibit entry of setpoint values beyond the operational range of a system or process. In general, confirmed PLC setpoint entries become the default program values. All system setpoints are to be made adjustable at the HMI by authorized users as detailed in the individual control philosophy sections.

Should a PLC reboot occur, through purpose or uncontrolled event, the PLC program shall be automatically restored with last setpoint entries. No operator intervention shall be necessary to bring a freshly rebooted controller online and operational.

E. **Controller Run Output handling:** In general, a PLC issued motor run command signal shall be propagated as a maintained contact. However, the PLC run command output signal must be disabled under the following conditions:

a. Equipment stop issued (by the PLC, operator or Local Auto logic).

b. Equipment fail detected.

c. Equipment placed in local control at the equipment, outside of PLC control.

d. Power-loss (black-out) condition detected.

If separate START and STOP (or Open and Close) outputs have been allowed for, once initiated, the PLC shall maintain the selected output for no less than 3 seconds to allow the local logic sufficient time to latch in the PLC issued command signal.

F. **Significant Digit Usage:** All HMI display values will be configured to show a minimum of 1 significant digit except in the following cases where 2 significant digits are required:

1. Flow readings (where the primary reading is scaled to 3 digits or less)

G. **Control Mode Definitions** – as a function of defining system control logic, it is necessary to define the manner and extent of control available at the major control access layers. Typical access layer control definitions are provided here as reference.

1. Local Control Mode (Field Selected): This mode of control refers to the first line of operator initiated control functions available at the equipment and/or drive/starter and by definition PLC independent. This mode of operation, although available in most cases, will be generally restricted to maintenance activities except where specifically noted otherwise.

2. Local Safety Interlocks: This level of control is not selectable and is always active. It specifically refers to protection hardwired logic integral to the equipment or equipment package that is directly interlocked with the equipment controls and which automatically executes regardless of the current method of operation.

3. Controller Programmed Safety Interlocks: This level of control is not selectable and is always active unless parameter bypass selection is required to be HMI accessible and then invoked by a Supervisor. It specifically refers to protection logic programmed at the PLC with an output that is directly hardwire interlocked with the equipment controls and which automatically executes regardless of the current method of operation. Note: The output will be wired fail-safe such that in the event of controller failure, the equipment will be forced to stop.

4. Local Auto Control Mode (HMI or Field Selected – subject to package configuration): This mode of control refers to independent operational logic integral to the equipment or equipment package that is responsible for the proper operation of the equipment. The operational logic may execute based on remote command triggers (e.g. start/stop, open/close, etc.) or field inputs (e.g. flow, pressure, level, temperature, etc.). Local auto mode may be bypassed through selection of local control mode (if available).

5. Remote Manual Control Mode (HMI Selected): This mode of control refers to operator initiated control functions available via the control system operator interface, HMI or LCP but executed via the PLC control logic (i.e., all PLC process interlocks and safety functions remain engaged).

6. Remote Auto Control Mode (HMI Selected): This mode of control refers to PLC initiated control functions which are automatically executed and managed by the PLC logic, operator independent.

7. Other control modes applicable to a specific process or system shall be as defined in Part 3.

H. **Historical Data Collection and Display:** The existing plant Historian shall be used to historically collect, trend and record, in the historical database, all analog input and output data represented on the Contract Drawings and I/O Schedule. In addition the HMI shall:

1. Log (daily and lifetime) runtimes to the historical database for all monitored equipment.

2. Log the number of starts to the historical database for all monitored equipment.

3. Calculate and log daily (and other Part 3 required) flow totals for all measured flows.

Note: daily flow totals will be summed and recorded over a 24-hr period from 12am to 12am with allowance for daylight savings time (DST) annual time shift.

I. **Trending Format – General:** As a minimum, trends shall display the process variable, the transmitter tag, a clear description and the units for both axes. For variables which are controlled by the PLC, both the setpoint and the controlled process variable shall be displayed on the same trend. Where multiple variables are displayed, separate and distinct colors shall be used for each variable along with a color key with clear descriptions defining each variable. The ICS shall be responsible for providing PLC programming to support the above log points. All logic required to develop the above I/O for historical collection at the HMI shall be provided by the System Integrator.

J. **Alarm Terminology:** The following alarm terms will be used throughout this document.

1. Permissive: PLC tracked Input, status, interlock and/or process variable value required to allow start of a piece of equipment or a process to proceed. Although lack of permissive will inhibit start, loss of permissive will not necessarily generate a fault once the equipment or process is operational.

2. Warning or System Alert (displayed as per Owner graphics standards): PLC generated low priority alarm intended to alert Operators to process or equipment operation drift outside of norm. Typically the gap between "warning" and "alarm" is sufficient to allow Operator response to avoid an alarm/trip condition.

Note 1: System alerts are also utilized at specific field equipment locations to alert area personnel to imminent start of rotating equipment. System alerts (typically in the form of beacons and/or horns) are only used in areas of potentially unsecured (i.e. exposed

and/or approachable) rotating equipment which may start unexpectedly.

3. Alarm or Trip (displayed as per Owner graphics standards) PLC generated high priority alarm or interlock intended to alert Operations to PLC execution of equipment or process protective measures OR imminent fault condition requiring operator intervention / action.

K. **Alarm History:** The project's alarm history (inclusive of system warnings, alarms and advisories) shall be made accessible at the HMI to all authorized users. The Alarm History shall be established as read-only from the moment of system field initialization. An alarm configuration screen at the HMI shall allow a Admin to enable or disable any HMI warning or alarm notification without the need to access the control system software back office tools. Other related requirements:

1. Warnings / Alarms related to HMI displayed field equipment and facilities shall be displayed on the related system control screen as well as recorded in the historical alarm summary.

2. Warnings / Alarms may be assigned to one of four (maximum) sub-groups. The alarm sub-groups shall be as defined at the conclusion of the project Graphics Meetings.

L. **Fault Detection / Handling:**

1. Unresponsive Equipment: In addition to monitoring fail contacts for controlled equipment, if at any point a device fails to start, stop, open or close as commanded by the PLC, a "Fail to Respond" condition shall be generated by the PLC and displayed at the HMI. PLC generated "Fail to Respond" fault, as well as any other logically generated fail condition identified in the detailed control philosophy sections, shall be resettable at the HMI unless specifically noted otherwise. The HMI reset function shall be in the form of a screen button made visible to the Operator at the interlock or control faceplate when a PLC generated fault condition is detected for the associated equipment. "Fail to Respond" specifics shall be as follows:

   a. When a drive or starter is being called to run, default "Fail to Respond" fault delay shall be 10sec. If a drive or starter is called to start and run status is not received before expiration of the fault timer (Supervisor adjustable), the controller shall generate a "Fail-to-Respond" alarm and lock-out the equipment.

      1) In general, the "Fail to Respond" time delay timers (for stop commands in particular) will take into account the drive configured spin-down timer.

   b. When a drive or starter is in operation, if the run status is lost for longer than 3secs (Supervisor adjustable), the controller shall generate a "Fail-to-Respond" alarm and lock-out the equipment.

c. In both cases, only an HMI reset will be required to allow the equipment to be restarted.

2. Analogue Inputs: The PLC shall generate an instrument or signal fault (Out of Range or PV_Bad) alarm if the analog input from a given field instrument or device is detected to be equal to or less than 3.8mA or equal to or greater than 20.5mA for longer than 10 seconds. The alarm time delay assigned to each signal shall be a Supervisor adjustable value.

   Note: When an instrument is detected to be in fault, system control response to the signal and all associated alarms (e.g. LAHH, LALL, etc.) shall be suspended. Other system response specifics shall be as defined in the Part 3 control detailed control descriptions.

3. Discrete Instrument Warning / Alarm Contacts: The PLC shall process a discrete warning / alarm contact if the contact is detected to be active for longer than a preset (supervisor adjustable) time delay. The default settings shall be 2 seconds unless specifically noted otherwise in the Part 3 detailed control descriptions.

   Note: discrete signals arriving via drive, starter, actuator, LCP or other device which have already confirmed authenticity of the alarm shall be immediately processed by the PLC without time delay unless specifically noted otherwise in the Part 3 detailed control descriptions

M. **Event Logging:** An event log, separate from the alarm history, shall be made accessible at the HMI (read-only from the moment of system field initialization) to all authorized users. The event log shall date/time stamp and record any discrete change in status of the equipment monitored by the PLC (e.g., Auto/Manual, Local/Remote, Run/Off, Open/Close, Forward-Off-Reverse, Intrusion, Start Sequence Change, Alarm Enable/Disable, etc.). Important notes:

1. HMI adjustable setpoint values shall be historically collected and trended against the associated process variable or performance parameter.

2. Events may be assigned to one of four (maximum) sub-groups. The event sub-groups shall be as defined at the conclusion of the project Graphics Meetings.

N. **Loop tuning parameters:** The PLC HMI interface shall be configured to allow supervisory level users to access all loop tuning parameters from the HMI for any control loop. Changing loop tuning parameters shall not require reconfiguring, reprogramming, or reloading of the PLC program. All changes to any loop tuning parameters shall be logged to the historical database and trended as described under paragraph 2.3.L – Event Logging.

O. **Equipment READY Logic:** The term "READY" (used throughout this document) shall be interpreted as "being available for PLC control". The

following conditions, as applicable, must be satisfied to achieve "READY" status:

1. Field equipment is Available (powered) AND is currently in Remote and/or Auto mode at the starter/drive/actuator (as applicable) i.e. not in Local Control Mode.

2. No fail (interlock) conditions pending (including field E-Stop).

3. No run inhibit (permissive) conditions exist.

    a. Equipment start via the PLC cannot be achieved without the associated equipment satisfying the above "READY" definition. With initiation via the PLC and run status confirmation, the equipment shall be noted to be in REM AUTO RUN or REM MAN RUN mode depending upon HMI operating mode selection.

        1) Note: if the equipment has been started at the starter/drive control interface, the equipment shall be noted to be in LOCAL RUN mode with PLC confirmation of run status

4. Unless specifically stated otherwise in the detailed control descriptions, it will not be necessary to display a "Not Ready" status if the above conditions are not satisfied. However, fail conditions, run inhibit conditions, local control status and run status shall be clearly displayed.

P. **Local Control Station (LCS) Handling Reference:** Where shown on the contract drawings, a local control station shall be provided at the field equipment. Each station shall include one push-pull E-Stop button fail-safe hardwired directly to the starter or drive and which may be engaged with effect regardless of the current operating mode of the equipment or communication means (hardware or fieldbus). Once pressed, the equipment will be immediately disabled at the starter / drive local control level and an alarm generated at the HMI. Release of the LCS E-stop button and reset of the alarm condition at the drive and the HMI will cancel the emergency stop.

Q. **Process Control Deviation:** Throughout the various plant processes, the PLC will be required to control and manipulate equipment designed to maintain a preset flow, level, temperature, pressure or other water quality parameter. In general, should the control system fail to maintain the identified process parameter within the operator or system specified deadband for longer than a preset time period (Supervisor adjustable default shall be as nominated within the specific control section and/or the project alarm table), a process warning shall be generated by the PLC and displayed at the HMI. In specific instances (as defined in the Part 3 detailed control descriptions), should the condition persist beyond a second preset time delay, a critical process alarm shall be generated. Additional system response shall be as defined in the specific control section.

R. **VFD Control Coordination:** In general, VFD operating parameters critical to proper drive operation will be established at the drive. The PLC control program will be developed to support this arrangement.

1. Where a start delay timer has been set at the pump VFD, the PLC shall be programmed to account for pump start delay in the re-start logic (and fail-to-respond logic) following issue of pump stop command or unexpected pump stop. Where possible the start delay timer shall be displayed at the HMI.

2. It should be anticipated that the VFD of any given pump may include a custom configuration that does not necessarily support operation over the entire speed range. The PLC speed control signal (as generated by logic controller or operator entered setpoint) shall be ranged 0 to 100% of maximum and output proportionally from 4-20 mA. The VFD will manage the received signal over its actual configured operating range.

3. For all VFDs, the ramp rate (starting and stopping) shall be as set at the VFD. The PLC PID controller (as applicable) will be tuned to take into account the final VFD ramp rate.

S. **Auto Rotation Logic:** Where referenced in the detailed controls section, the start sequence for a system of pumps or other equipment may be automatically established by the PLC or manually established by an authorized Operator.

1. PLC Auto Sequencing: In auto sequencing mode, the equipment start sequence will be automatically rotated by the PLC based on runtime values. Pump runtimes will be continuously compared. Should two or more runtime meters register runtime hours within a +/- 1hr deadband (Supervisor adjustable), the runtimes will be considered equal and the auto start sequence will default to the numerical order of the equipment in question (i.e. Pump No.1 will be selected to precede Pump No.2 under this runtime comparison scenario). When pump runtimes exceed the deadband limit, the start sequence will be automatically updated. However, pump operation will not normally be impacted by a start sequence change (in Auto or Manual sequencing mode): pump start/stop re-order will be applied as a normal function of pump Cascade start/stop operation unless specifically noted otherwise in the Part 3 detailed control descriptions. Auto PLC rotation may also be suspended by an authorized Operator via the HMI and the pump start sequence manually selected by the operator by means of an HMI pump start selection matrix.

   a. Override Auto Sequencing Runtime Comparator: An override sequencing runtime comparator will be provided and made adjustable by authorized Operator (default = 72hrs). Under auto sequencing mode, should the pump(s) remain in continuous operation for a period greater than the preset runtime comparator, the controller logic will auto cycle the pumps to match the current pending start sequence. For forced rotation, the new pump will

always be started and confirmed running prior to shutdown of the current in-operation pump (unless specifically noted otherwise in the Part 3 detailed control descriptions).

2. Operator Manual Sequencing: An authorized operator may manually establish the start sequence for a system of equipment by means of a matrix selection chart at the associated system HMI control screen. For manual start sequence entry, the operator will be required to enter a start position next to each equipment number. The selection interface will be programmed with a means of directing the PLC to accept or cancel the entered start sequence. Once the Operator has completed the start sequence, the PLC must be directed to accept the sequence in order for the entries to be written to the appropriate active PLC registers. Directing the PLC to cancel will clear all proposed entries. Submitted start sequences containing duplicate and/or invalid entries will be automatically rejected and not written to the active PLC registers (thereby retaining the original start sequence). Until the start sequence modifications are accepted, the PLC will ignore all unaccepted start sequence modifications and continue to operate equipment based on the current start sequence.

T. **Bumpless Remote Auto to Remote Manual Transition:** Changing the HMI control status of PLC controlled equipment from Remote Auto to Remote Manual shall be a bumpless operation. Therefore a VFD operating in Auto mode at 78% of maximum speed shall maintain that speed and remain in operation when switched from Auto to Manual control at the HMI. A similar adjustment to a modulating valve actuator should display identical behavior.

U. **Flow Signal Dampening:** Various flow meters are used to measure the rate of flow of water, air and chemicals throughout the facility. The PLC shall be programmed to dampen the incoming analog signal. This shall be accomplished by calculating a running average of the flow signal over 5-second periods (nominal setpoint) using a data sample rate of 0.5 seconds. The means for a supervisor to enable/disable this function and adjust the sampling period (fixed options of 5-sec, 10-sec and 15-sec) at the HMI shall be provided. Refer to individual Appendix sections for specific application.

V. **Out of Service:** The control system shall have the capability to assign an "Out-of Service" tag to equipment monitored by the control system. During extended periods of maintenance and/or repair, an operator may make such an assignment so as to suppress associated alarms and inhibit HMI control functions.

Note: normal "lockout / tag-out / check-out" procedures will need to be followed with the field equipment and associated electrical feeds.

W. **Control System Historian:** The ICS shall coordinate integration of project signals into the existing Proficy Historian, project alarms into the existing alarm management tools, and project events into the existing event log with the Owner. Data integration into existing Report generation tools is excluded. Creation of custom fixed trends is excluded.

X. **Control Philosophy Refinement:** It shall be understood that some refinement and/or minor modification of the control philosophy will be necessary over the course of the project as part of the control system configuration and programming work. Forums for informal discussions and clarifications have been provided in these documents. They include the Pre-submittal Conference, Graphics Development Workshops, Factory Testing, Field Development Phase and Startup. **Note:** All timer, level, position, analysis, pressure, temperature and flow rate values noted within the control philosophy sections are provided for reference only and are subject to refinement based on system testing and final construction.

1. Where the control philosophy sections reference control screens to be developed, final control screen development will be subject to the requirements of the Owner and the production agreements reached during the project Graphics Development workshops.

## 2.03 GRAPHICS GENERATION

A. It is the responsibility of the ICS to configure the OIU and to develop, design, engineer, configure and test all of the HMI graphic displays required for this project. All of this work shall take into account the specific needs and requirements of the OWNER. In order to facilitate this work the CONTRACTOR shall conduct the following meetings with the Engineer and OWNER's groups:

B. Graphics Meeting No. 1

1. The CONTRACTOR shall chair and develop an agenda for a meeting which shall address the basic criteria to be adhered to in the configuration and development of the HMI graphic displays. At this meeting, which shall be attended by the System Integrator, the Vendor, the OWNER and ENGINEER, the ICS shall present the OWNER's HMI standards and requirements for messaging, tagging, conveyance of screen updates and overall look of the Vendor OIT screens. As a minimum, this meeting shall address the following issues:

a. All facility conventions for identifying tag names and descriptors (this will include process areas, piping, mechanical equipment, tanks, valves, inline equipment, instruments, workstations/servers, control components and network components)

b. Designation of groups within each plant or station area along with tag names and descriptors.

c. The assignment of individual control loops and inputs to specific groups.

d. Organization of the systems universal display hierarchy.

e. Paging schemes to be used to enable the movement from one

display to another.

f. An itemization of the type of display to be used at each level in the graphic hierarchy (e.g., pre-formatted displays, templates, custom graphics, etc.)

g. Color convention to be employed on all graphics for the annotation of various status information, differentiation between alarms on the basis of alarm priority, background colors, static field colorization and dynamic field colorization.

h. The utilization of blinking and conditional text.

i. Definition of graphic symbolism to be used on the project. This listing shall include but not be limited to symbols to be used for process instrumentation, process equipment, piping, vessels and valves. All symbolism must be specific as opposed to generic in that shapes must define both function and type (e.g., specific symbols for each valve design, each pump design, each type of flow meter, etc.). If the CONTRACTOR's library of shapes does not adequately describe plant or pipeline conditions, the CONTRACTOR shall develop additional shapes to meet the plants or pipelines requirements.

j. Definition of all display select commands that enable the operator to move within the display hierarchy.

k. The utilization of cursor movement commands which enable the operator to move within a display.

l. Definition of control input commands which enable the operator to interact with faceplates control stations and custom graphic displays to implement control outputs/functions.

m. Definition of data input commands which enable the operator to enter numeric values into the PLC system.

n. Definition of the utilization of "poke" points or fields which are dynamically sensitive to operator inputs to facilitate operator entry directly into graphic displays.

o. A review of graphic generation procedures.

p. Historian data collection parameters.

q. Electronic O&M production and accessibility at the existing SCADA servers.

r. User groups and process monitoring/control accessibility

s. Overall system navigation and access philosophy and organization of screen monitoring and control data to support.

t. Vendor package control mode coordination – to manage control authority transition from a Vendor package OIT to the Plant HMI and vice versa.

u. Alarm handling, event logging and approach to managing historical alarm and event log access

v. Web-enabled devices web page integration.

2. Subsequent to the adjournment of graphics meeting No. 1 the CONTRACTOR shall collect from ICS prepare and formalize a document titled "GRAPHICS CRITERIA" which shall contain detailed meeting minutes and a definition of all graphic guidelines to be adhered to. This report shall be supplemented by a first draft OIT control screen package which illustrates the incorporation and application of each graphic criteria. The report shall be submitted to the ENGINEER for review / approval within 30 calendar days of the meeting's adjournment. ENGINEER comments will be returned to the CONTRACTOR for action and response review during Graphics Workshop No.2. A formal submittal shall be submitted prior to the second Graphics Workshop.

C. Graphics Meeting No. 2

1. After the finalization of the vendor graphics criteria, the CONTRACTOR shall develop a second draft HMI control screen package as required to support all vendor OITs being furnished under this project, taking into account the ENGINEER's first draft review comments. At this meeting the CONTRACTOR shall submit 5 color hard copies of the complete package and present a navigable version of the OIT control screen package using the project OIT software. During the workshop, the CONTRACTOR will:

a. Review the recorded requirements of Graphics Coordination Workshop No.1 and show how each has been addressed

b. Review the ENGINEER's and System Integrator's first draft submittal review comments and show or explain how each has been (or will be) addressed.

c. Review the OIT control screen package for overall content completeness

d. Demonstrate approach to input command handling, setpoint management and secure access control.

e. Demonstrate navigability, functionality and overall quality of delivery.

f. Collect and record all actionable comments received.

2. Subsequent to the adjournment of Graphics Coordination meeting No. 2 the CONTRACTOR shall prepare a formalized re-submittal (if necessary) of the OIT control screen package for ENGINEER review/approval along with the detailed meeting minutes. Meeting minutes shall be submitted within 5 working days of meeting adjournment and will include an expected time frame for CONTRACTOR delivery of the HMI control screen package re-submittal.

   a. The CONTRACTOR shall allow 1 day for each meeting.

3. The following HMI graphic displays shall be developed for this project (as minimum):

   a. All plant or station processes.

   b. All group alarm displays.

   c. All control loop tuning displays.

   d. All analog faceplate displays.

   e. All key macro icon displays.

   f. All database archiving control displays.

   g. All customer displays for operator set point entry and recipe displays.

   h. All historical trending displays.

   i. Control system network configuration and diagnostic displays.

   j. Redundant communication diagnostic and control displays.

   k. Redundant master node diagnostic and control displays.

   l. All local node diagnostics (include PLC's, Operator Interfacing Units and Instruments).

   m. All group event displays

D. Software License and Registration:

1. All software provided shall be installed and used within the terms of the software manufacturer’s license agreement. All software purchased by the

CONTRACTOR shall be registered to the CONTRACTOR during the construction phase of this project. During that time, the CONTRACTOR shall be responsible for providing and incorporating minor software package updates issued by the software manufacturer. For example, if version 3.1 of a program is purchased, and versions 3.2 and 3.3 were released prior to project completion, the CONTRACTOR shall be responsible for incorporating these later versions into the final project. The CONTRACTOR would not be responsible for incorporating major software revisions such as the release of a version 4.0 or 4.1.

2. Prior to substantial completion of this project, the CONTRACTOR shall re-register all provided software packages to the OWNER and provide the ENGINEER and the OWNER with written confirmation of having done so.

3. HMI Software shall be GE iFIX

## PART III - EXECUTION

### 3.01 DETAILED CONTROL PHILOSOPHY SECTIONS

A. The listed detailed control philosophy sections shall be developed in accordance with Parts 1 and 2 of this specification. The sections are provided as appendices to this specification with the indicated CP-XX reference.

**END OF SECTION**

## Appendix CP-01: BFP EFFLUENT LIFT STATION

REFERENCE DOCUMENTS:

| Document Number | Document Title | Date |
|---|---|---|
| 03-I-601 | P&ID – BFP Effluent Lift Station | |
| | Motor Control Schematic | |
| | | |

LIST OF EQUIPMENT AND INSTRUMENTATION:

| Equipment Field Tag | Equipment Description |
|---|---|
| LSPUMP-01 | BFP Effluent Pump No 1 |
| LSPU1-TS-01 | BFP Effluent Pump No 1 Motor Winding High Temp Switch |
| LSPU1-MSH-01 | BFP Effluent Pump No 1 Pump Leak |
| LSPU1-PI-01 | BFP Effluent Pump No 1 Discharge Pressure Gauge |
| | |
| LSPUM-02 | BFP Effluent Pump No 2 |
| LSPU2-TS-01 | BFP Effluent Pump No 2 Motor Winding High Temp Switch |
| LSPU2-MSH-01 | BFP Effluent Pump No 2 Pump Leak |
| LSPU2-PI-01 | BFP Effluent Pump No 2 Discharge Pressure Gauge |
| | |
| LSPUMP-03 | BFP Effluent Pump No 3 |
| LSPU3-TS-01 | BFP Effluent Pump No 3 Motor Winding High Temp Switch |
| LSPU3-MSH-01 | BFP Effluent Pump No 3 Pump Leak |
| LSPU3-PI-01 | BFP Effluent Pump No  Discharge Pressure Gauge |
| | |
| WW1-LSH-01 | BFP Wet Well High Level Switch 1 |
| WW1-LSH-02 | BFP Wet Well High Level Switch 2 |
| WW1-LSH-03 | BFP Wet Well High Level Switch 3 |
| WW1-LSHH-01 | BFP Wet Well High High Level Switch |
| WW1-LSLL-01 | BFP Wet Well Low Low Level Switch |
| WW1-LIT-01 | BFP Wet Well Level Transmitter |
| | |
| LSPI1-PV-01 | BFP Discharge plug valve to ARF EQ Basin – normally open |
| LSPI1-PV-02 | Discharge plug valve to Pond 1/SSTP – normally closed |
| LSPI1-PV-03 | Discharge plug valve to Pond 1/SSTP – normally closed |
| LSPI3-PV-01 | ARF Effluent Lift Station Discharge plug valve to Pond 1/SSTP – normally open |
| | |
| | Existing BFP Effluent Lift Station Flow meter |
| | |
| | |
| | |
| | |
| | |

LIST OF ALARMS

| TAG | Description | Priority | Alarm Delay |
|---|---|---|---|
| LSPU1-YA-01A-A | BFP Effluent Pump 1 Fail To Run | | |
| LSPU1-YA-01A-B | BFP Effluent Pump 1 Fail To Stop | | |
| LSPU1-TAH-01 | BFP Effluent Pump 1 High Temp | | |
| LSPU1-MAH-01 | BFP Effluent Pump 1 Leak | | |
| LSPU1-YA-01A | BFP Effluent Pump 1 Fail | | |
| LSPU1-YA-01B | BFP Effluen  Pump 1 Estop | | |
| | | | |
| LSPU2-YA-01A-A | BFP Effluent Pump 2 Fail To Run | | |
| LSPU2-YA-01A-B | BFP Effluent Pump 2 Fail To Stop | | |
| LSPU2-TAH-01 | BFP Effluent Pump 2 High Temp | | |
| LSPU2-MAH-01 | BFP Effluent Pump 2 Leak | | |
| LSPU2-YA-01A | BFP Effluent Pump 2 Fail | | |
| LSPU2-YA-01B | BFP Effluent Pump 2 Estop | | |
| | | | |
| LSPU3-YA-01A-A | BFP Effluen  Pump 3 Fail To Run | | |
| LSPU3-YA-01A-B | BFP Effluen  Pump 3 Fail To Stop | | |
| LSPU3-TAH-01 | BFP Effluent Pump 3 High Temp | | |
| LSPU3-MAH-01 | BFP Effluent Pump 3 Leak | | |
| LSPU3-YA-01A | BFP Effluent Pump 3 Fail | | |
| LSPU3-YA-01B | BFP Effluent Pump 3 Estop | | |
| | | | |
| WW1-LALL-01 | BFP Wet Well Low Low Level | | |
| WW1-LAH-01 | BFP Wet Well High Level | | |
| WW1-LAH-02 | BFP Wet Well High Level | | |
| WW1-LAH-03 | BFP Wet Well High Level | | |
| WW1-LAHH-01 | BFP Wet Well High High Level | | |
| | | | |
| | | | |

Priority: 1- Plant Shutdown, 2-Process Shutdown, 3-Alarm, 4 Operator Alert
Note: All Alarms are Latching unless otherwise noted.

LIST OF SETPOINTS:

| Description | Setpoint | Delay |
|---|---|---|
| Level Setpoint Pump No 1 Start | | |
| Level Setpoint Pump No 2 Start | | |
| Level Setpoint Pump No 3 Start | | |
| | | |
| Low Low Level Cutoff | | |
| High High Level | | |

EQUIPMENT DESCRIPTION: The BFP Effluent Lift Station consists of the following major components listed below:

- BFP Effluent Pumps 1-3
  - Constant Speed Pumps

- Emergency Stop Pushbutton
- Level Transmitter
- Low Level Switch (Low level cutoff)
- High Level Switch
- Valve Vault – To divert flow to the ARF EQ Basin

OPERATIONAL OVERVIEW:

The three BFP effluent pumps are submersible pumps within a wet well that pump filtrate and wash water from the Belt Filter Press building to the ARF EQ basin or bypass it directly to the ATRs or Pond 1 West

LOCAL CONTROL MODE:

Local Control Mode for the BFP Effluent Pumps is available at the MCC located in the electrical room. By selecting HAND at the HOA switch, a pump will start and run continuously until the HOA switch is rotated to the OFF position. Remote control from the PLC is disabled. Hardwired interlocks are still active.

LOCAL SAFETY INTERLOCKS:

The BFP Effluent Pumps shall be immediately called to stop, and an alarm generated if any of the conditions listed below are detected. A physical reset will be required before the pump will be available to operate.

- Motor Overload
- Motor Windings High Temp
- Pump Leak
- E-Stop
- Wetwell Low Low Level

CONTROLLER PROGRAMMED INTERLOCKS:

A BFP Effluent Pump E-stop output shall be triggered, run inhibited and an HMI equipment alarm generated if any of the conditions listed below are detected by SCADA:

- Wet Well Low Level from Transmitter

LOCAL AUTOMATIC CONTROL MODE:

In the event of loss of communication with the plant control system and/or level transmitter failure, the BFP Effluent Pumps will operate based on float level control. Each pump has a dedicated level switch mounted in the wet well at different levels. Refer to electrical control schematics for additional details.

REMOTE MANUAL CONTROL MODE (Plant PLC):

The Plant PLC, CP01 shall manage / coordinate operation of the BFP Effluent Lift Station. Status, alarm and control I/O represented on the referenced P&IDs and as mentioned in this CP shall be accommodated at

the Plant HMI. Integrator developed control screens shall include as a minimum the following suite of operator interface screens:

- Login Screen / Main Menu
- Graphic representation of System Overview
- Text-based System Overview including equipment current draw and daily / total runtimes (total runtime reset shall be a supervisory level function), start counts, and well level trends
- Alarm History Screen
- Current Alarm Screen
- Event Log Screen
- Preset Trends Access Screen/Menu
- Help/eO&M (which is to include detailed instruction on how to use the HMI, what information is contained on each major control screen and an outline of the related vendor control narratives)
- Graphic representation of the BFP Effluent Lift Station with access to override manual controls, selection controls and setpoint / timer adjustments. Graphic should include schematic representation of all conveyance system.
- Graphic representation of each pump
- Control/Configuration Palette for the pumps (supervisory level access only)
- Refer to section 17900 for general requirements including:
  - Remote/Manual pump duty rotation (duty/standby)
  - Out-of-Service selection

The BFP Effluent pump station shall provide the following as a minimum:

- Per Pump, on same screen:
  - Status (Run, Hand/Remote, and all Fail Conditions)
  - Manual S/S controls (only accessible if pump station placed in Remote Control Mode)
  - Runtime (daily and lifetime)
  - Start Count (daily, monthly, lifetime)
  - Duty assignment
- Wet well level reading
- Wet well level instrument fault detected
- Wet well LAL (Low Level Cutoff)
- Pump Station A/M status
- BFP Effluent Total Flow
  - Flow rate, Daily Total and net flow meter total display
- Alarms Display
- Process deviation alarm setpoint - display and entry (default = +/-5%)

With the starter exhibiting a Ready status (no faults) at the HMI and the pump station HMI common control station A/M switch in Manual (i.e. Remote Manual Control Mode) the associated pump may be manually controlled by an authorized operator at the HMI using the S/S controls previously

described provided the safety interlock alarms conditions are not detected.

Note: Valid wet well level signal need not be available for Remote Manual start of the pumps.

The PLC logic will process all pump start/stop commands under the supported remote operating modes. Each pump will be set to Remote at the local OI.

The pump remote start will be subject to the following permissives:

- Wet well low-low level (operator adjustable) conditions are not detected.
- The selected pump is ready to operate

A pump shall be called to stop, run inhibited, and a PLANT HMI equipment alarm generated if any of the conditions listed below are detected by the PLC:

- Emergency Stop

REMOTE AUTO CONTROL MODE (Plant PLC):

With the pump station HMI common control station in REMOTE mode, all pump starters exhibiting a Ready status at the HMI will be made available to the PLC REMOTE control logic. (Note: no additional Operator confirmation will be necessary to initiate the pump station.)

Pump station REMOTE start will be subject to the following permissives:

- Valid flow target demand available
- Low level alarm condition not detected
- Level start / stop and timer setpoints populated
- Start sequence populated
- At least one pump is Ready to operate
- Pump station Remote operating mode selected

The control station shall also include a separate Supervisor level control screen to support the following control and monitoring functions:

- Pump Station A/M control selection (a single common A/M control selection shall be used to dictate the control status of all Pumps)
- Pump start sequence select A/M (Pumps shall maintain previous command if transitioning between Auto/Manual.)
- Pump start sequence manual select
  - Note: Pump Remote/Manual rotation logic shall be subject to the requirements of section 17900.

- Tabular representation of:
  - First pump start setpoint with delay timer (entry and display). Default level entry, 10 second delay.
  - Second pump start setpoint with delay timer (entry and display). Default level entry, 10 second delay.
  - Third pump start shall be operator initiated
  - LAL pump station stop setpoint with delay timer (entry and display) Default entries % level TBD, 3 second delay.
  - Wetwell LAHH delay timer (default = 2 seconds)
  - Wetwell LALL override shutdown delay timer (default = 2 seconds)

| **Pump Station Level Control Logic** | | |
|---|---|---|
| **Pump Station Demand Flow** | **Demand Falling** | **Demand Rising** |
| • Longer than 10 seconds<br>• Pump Station in REMOTE Mode<br>• Level is greater than Xft | | Start lead pump |
| • Longer than 10 seconds<br>• 1st pump called to run in REMOTE<br>• 1st cannot meet Level (TBD delay)<br>• Level equal to or greater than 2nd pump start setpoint (TBD) | | Start 2nd pump |
| • Longer than 10 seconds<br>• 2nd pump called to run in REMOTE<br>• Level equal to less than XXft | 2nd Pump Stop | |
| • Longer than 3 seconds<br>• Wet well level equal to or less than pump station stop setpoint (TBD) | Stop all pumps. | |
| • LALL float switch trip detected | Stop and inhibit start for all pumps until LALL condition clears. | |

## Appendix CP-02: EQ BASIN AND EQ TRANSFER PUMPS

REFERENCE DOCUMENTS:

| Document Number | Document Title | Date |
|---|---|---|
| 04-I-601 | P&ID – ARF EQ Basin | |
| 04-I-602 | P&ID – ARF EQ Transfer Pumps | |
| | Motor Control Schematic | |
| | | |

LIST OF EQUIPMENT AND INSTRUMENTATION:

| Equipment Field Tag | Equipment Description |
|---|---|
| | |
| MIXER-03 | EQ Basin Mixer |
| MIX3-TS-01 | EQ Basin Mixer Motor Winding High Temp Switch |
| MIX3-HS-01 | EQ Basin Mixer Emergency Stop |
| | |
| FEB1-LSL-01 | EQ Basin Wet Well Low Level Switch |
| FEB1-LIT-01 | EQ Basin Wet Well Level Transmitter |
| FEB1-AIT-01 | EQ Basin Wet Well Ammonia Analyzer |
| | |
| LSPUMP-01 | EQ Transfer Pump No 1 |
| LSPU1-TS-01 | EQ Transfer Pump No 1 Motor Winding High Temp Switch |
| LSPU1-FCS-01 | EQ Transfer Pump No 1 Local Control Station |
| | |
| | |
| LSPUMP-02 | EQ Transfer Pump No 2 |
| LSPU2-TS-01 | EQ Transfer Pump No 2 Motor Winding High Temp Switch |
| LSPU2-FCS-01 | EQ Transfer Pump No 2 Local Control Station |
| | |
| | |
| LSPUMP-03 | EQ Transfer Pump No 3 |
| LSPU3-TS-01 | EQ Transfer Pump No 3 Motor Winding High Temp Switch |
| LSPU3-FCS-01 | EQ Transfer Pump No 3 Local Control Station |
| | |
| | |
| LSPI1-PV-01 | BFP Discharge plug valve to ARF EQ Basin – normally open |
| LSPI1-PV-02 | Discharge plug valve to Pond 1/SSTP – normally closed |
| LSPI1-PV-03 | Discharge plug valve to Pond 1/SSTP – normally closed |
| LSPI3-PV-01 | ARF Effluent Lift Station Discharge plug valve to Pond 1/SSTP – normally open |
| | |
| FEB1-FIT-01 | EQ Transfer Lift Station Flow meter |
| | |
| | |

LIST OF ALARMS

| TAG | Description | Priority | Alarm Delay |
|---|---|---|---|
| LSPU1-YA-01A-A | EQ Transfer Pump 1 Fail To Run | | |
| LSPU1-YA-01A-B | EQ Transfer Pump 1 Fail To Stop | | |
| LSPU1-TAH-01 | EQ Transfer Pump 1 High Temp | | |
| LSPU1-YA-01A | EQ Transfer Pump 1 VFD Fail | | |
| LSPU1-YA-01B | EQ Transfer Pump 1 Estop | | |
| | | | |
| LSPU2-YA-01A-A | EQ Transfer Pump 2 Fail To Run | | |
| LSPU2-YA-01A-B | EQ Transfer Pump 2 Fail To Stop | | |
| LSPU2-TAH-01 | EQ Transfer Pump 2 High Temp | | |
| LSPU2-YA-01A | EQ Transfer Pump 2 VFD Fail | | |
| LSPU2-YA-01B | EQ Transfer Pump 2 Estop | | |
| | | | |
| LSPU3-YA-01A-A | EQ Transfer Pump 3 Fail To Run | | |
| LSPU3-YA-01A-B | EQ Transfer Pump 3 Fail To Stop | | |
| LSPU3-TAH-01 | EQ Transfer Pump 3 High Temp | | |
| LSPU3-YA-01A | EQ Transfer Pump 3 VFD Fail | | |
| LSPU3-YA-01B | EQ Transfer Pump 3 Estop | | |
| | | | |
| MIX3-YA-01A-A | EQ Mixer Fail To Run | | |
| MIX3-YA-01A-B | EQ Mixer Fail To Stop | | |
| MIX3-TAH-01 | EQ Mixer High Temp | | |
| MIX3-YA-01A | EQ Mixer Fail | | |
| MIX3-YA-01B | EQ Mixer Estop | | |
| | | | |
| FEB1-LAL-01 | EQ Basin Low Level | | |
| | | | |
| | | | |

Priority: 1- Plant Shutdown, 2-Process Shutdown, 3-Alarm, 4 Operator Alert
Note: All Alarms are Latching unless otherwise noted.

LIST OF SETPOINTS:

| Description | Setpoint | Delay |
|---|---|---|
| Level Setpoint Pump No 1 Start | | |
| Level Setpoint Pump No 2 Start | | |
| Level Setpoint Pump No 3 Start | | |
| | | |
| Low Level Cutoff - Mixer | | |
| Low Low Level Cutoff - Pump | | |
| High High Level | | |

EQUIPMENT DESCRIPTION: The EQ Basin and Transfer Pump Station consists of the following major components listed below:

- Equalization Basin Mixer – Constant Speed
- Equalization Transfer Pumps 1-3, Variable Speed
    - Local Control Station
- EQ Basin Level Transmitter
- Low Level Switch (Low level cutoff)

OPERATIONAL OVERVIEW:

The three EQ Transfer pumps deliver process fluid from the Belt Filter presses from the Equalization Basin to the ATR Influent Splitter Box or to the ARF Effluent Channel to drain the EQ Basin.

The process fluid can also bypass the EQ basin and transfer pumps via manual valve, EQ1-PV-02, and be directly fed to the ATR Influent Splitter Box. Normal operation will be with this valve normally closed.

LOCAL CONTROL MODE:

Local Control Mode for the EQ Basin Mixer is available at the MCC located in the electrical room. By selecting HAND at the HOA switch, a pump will start and run continuously until the HOA switch is rotated to the OFF position. Remote control from the PLC is disabled. Hardwired interlocks are still active.

Local control mode will be available at the EQ Transfer equipment VFD. By entering the VFD OI security password and placing the drive in local, the Operator will have access to drive Start/Stop and speed controls. The pump shall run continuously at the set speed once started until called to Stop by the Operator or upon fault detection. The local control mode of operation is not a supported operating mode and should be used for drive or equipment maintenance purposes only.

LOCAL SAFETY INTERLOCKS:

The EQ Mixer shall be immediately called to stop, and an alarm generated if any of the conditions listed below are detected. A physical reset will be required before the pump will be available to operate.

- Motor Overload
- Motor Windings High Temp
- E-Stop

The EQ Transfer Pumps shall be immediately called to stop, and an alarm generated if any of the conditions listed below are detected. A physical reset will be required before the pump will be available to operate.

- VFD Fault
- Motor Windings High Temp
- E-Stop

CONTROLLER PROGRAMMED

INTERLOCKS:

A EQ Mixer and Transfer pump E-stop output shall be triggered, run inhibited and an HMI equipment alarm generated if any of the conditions listed below are detected by SCADA:

- Wet Well Low Level from Transmitter

LOCAL REMOTE CONTROL MODE:

Not applicable.

REMOTE MANUAL CONTROL MODE (Plant PLC):

The Plant PLC shall manage / coordinate operation of the EQ Transfer pump Station. Status, alarm and control I/O represented on the referenced P&IDs and as mentioned in this CP shall be accommodated at the Plant HMI. Integrator developed control screens shall include as a minimum the following suite of operator interface screens:

- Login Screen / Main Menu
- Graphic representation of System Overview
- Text-based System Overview including equipment current draw and daily / total runtimes (total runtime reset shall be a supervisory level function), start counts, and well level trends
- Alarm History Screen
- Current Alarm Screen
- Event Log Screen
- Preset Trends Access Screen/Menu
- Help/eO&M (which is to include detailed instruction on how to use the HMI, what information is contained on each major control screen and an outline of the related vendor control narratives)
- Graphic representation of the EQ Transfer Lift Station with access to override manual controls, selection controls and setpoint / timer adjustments. Graphic should include schematic representation of all conveyance system.
- Graphic representation of each pump
- Control/Configuration Palette for the pumps (supervisory level access only)
- Refer to section 17900 for general requirements including:
  - Remote/Manual pump duty rotation (duty/standby)
  - Out-of-Service selection

The overview pump station shall provide the following as a minimum:

- Per Pump, on same screen:
  - Status (Run, Hand/Remote, Speed SP, Speed, and all Fail Conditions)
  - Manual S/S controls (only accessible if pump station placed in Remote Control Mode)
  - Runtime (daily and lifetime)

    - Start Count (daily, monthly, lifetime)
    - Duty assignment
- Wet well level reading
- Wet well level instrument fault detected
- Wet well LAL (Low Level Cutoff)
- Pump Station A/M status
- Alarms Display
- Process deviation alarm setpoint - display and entry (default = +/-5%)

With the starter exhibiting a Ready status (no faults) at the HMI and the mixer station HMI common control station A/M switch in Manual (i.e. Remote Manual Control Mode) the associated mixer may be manually controlled by an authorized operator at the HMI using the S/S controls previously described provided the safety interlock alarms conditions are not detected.

Note: Valid wet well level signal need not be available for Remote Manual start of the pumps.

The PLC logic will process all pump start/stop commands under the supported remote operating modes. Each pump will be set to Remote at the local OI.

The pump remote start will be subject to the following permissives:

- Wet well low-low level (operator adjustable) conditions are not detected.

A transfer pump shall be called to stop, run inhibited, and a PLANT HMI equipment alarm generated if any of the conditions listed below are detected by the PLC:

- Emergency Stop

With the VFD exhibiting a Ready status (no faults) at the HMI and the pump station HMI common control station A/M switch in Manual (i.e. Remote Manual Control Mode) the associated pumps may be manually controlled by an authorized operator at the HMI using the S/S controls previously described provided the safety interlock alarms conditions are not detected.

Note: Valid wet well level signal need not be available for Remote Manual start of the pumps.

The PLC logic will process all pump start/stop commands under the supported remote operating modes. Each pump will be set to Remote at the local OI.

The pump remote start will be subject to the following permissives:

- Wet well low-low level (operator adjustable) conditions are not detected.
- The selected pump is ready to operate

A pump shall be called to stop, run inhibited, and a PLANT HMI equipment alarm generated if any of the conditions listed below are detected by the PLC:
Emergency Stop

REMOTE AUTO CONTROL MODE (Plant PLC):

With the pump station HMI common control station in REMOTE mode, all pump VFDs exhibiting a Ready status at the HMI will be made available to the PLC REMOTE control logic. (Note: no additional Operator confirmation will be necessary to initiate the pump station.)

Pump station REMOTE start will be subject to the following permissives:

- Valid level target available
- Low level alarm condition not detected
- Level start / stop and timer setpoints populated
- Start sequence populated
- At least one pump is Ready to operate
- Pump station Remote operating mode selected

Mixer Remote start will be subject to the following permissives

- Low level alarm condition not detected

The control station shall also include a separate Supervisor level control screen to support the following control and monitoring functions:

- Pump Station A/M control selection (a single common A/M control selection shall be used to dictate the control status of all Pumps)
- Pump start sequence select A/M (Pumps shall maintain previous command if transitioning between Auto/Manual.)
- Pump start sequence manual select
  - Note: Pump Remote/Manual rotation logic shall be subject to the requirements of section 17900.
- Tabular representation of:
  - First pump start setpoint with delay timer (entry and display). Default level entry, 10 second delay.
  - Second pump start setpoint with delay timer (entry and display). Default level entry, 10 second delay.
  - Third pump start shall be operator initiated
  - LAL pump station stop setpoint with delay timer (entry and display) Default entries % level TBD, 3 second delay.

- Wetwell LAHH delay timer (default = 2 seconds)
- Wetwell LALL override shutdown delay timer (default = 2 seconds)

| Pump Station Level Control Logic | | |
|---|---|---|
| **Pump Station Demand Flow** | **Demand Falling** | **Demand Rising** |
| • Longer than 10 seconds<br>• Pump Station in REMOTE Mode<br>• Level is greater than Xft | | Start lead pump |
| • Longer than 10 seconds<br>• 1st pump called to run in REMOTE<br>• 1st cannot meet Level (TBD delay)<br>• Level equal to or greater than 2nd pump start setpoint (TBD) | | Start 2nd pump |
| • Longer than 10 seconds<br>• 2nd pump called to run in REMOTE<br>• Level equal to less than XXft | 2nd Pump Stop | |
| • Longer than 3 seconds<br>• Wet well level equal to or less than pump station stop setpoint (TBD) | Stop all pumps. | |
| • LALL float switch trip detected | Stop and inhibit start for all pumps until LALL condition clears. | |

## Appendix CP-03: AMMONIA TREATMENT REACTOR AND AERATION BLOWERS

REFERENCE DOCUMENTS:

| Document Number | Document Title | Date |
|---|---|---|
| 04-I-604 | P&ID – Ammonia Removal Facility Reactor No 1 | |
| 04-I-605 | P&ID – Ammonia Removal Facility Reactor No 2 | |
| 04-I-606 | P&ID – Ammonia Removal Facility Reactors | |
| 05-I-601 | ARF Blowers | |

LIST OF EQUIPMENT AND INSTRUMENTATION:

| Equipment Field Tag | Equipment Description |
|---|---|
| | |
| JBX1-LIT-01 | ATR Influent Splitter Box Level Transmitter |
| JBX1-LIT-02 | ATR Influent Splitter Box Level Transmitter |
| JBX1-MOG-01 | ATR Reactor No 1 Weir Gate |
| JBX1-MOG-02 | ATR Reactor No 2 Weir Gate |
| | |
| MIXER-01A | ATR No 1 Mixer No 1 |
| MIX1A-TS-01 | ATR No 1 Mixer No 1 Motor Winding High Temp Switch |
| MIX1A-FCS-01 | ATR No 1 Mixer Emergency Stop |
| | |
| MIXER-01B | ATR No 1 Mixer No 2 |
| MIX1B-TS-01 | ATR No 1 Mixer No 2 Motor Winding High Temp Switch |
| MIX1B-FCS-01 | ATR No 1 Mixer No 2Emergency Stop |
| | |
| NH3R1-LIT-01 | ATR No 1 Wet Well Level Transmitter |
| | |
| NH3R1-AIT-01 | ATR No 1 pH/Temp Analyzer |
| NH3R1-AIT-02 | ATR No 1 Dissolved Oxygen Analyzer |
| NH3R1-AIT-03 | ATR No 1 Ammonia Analyzer |
| | |
| CHAN1-LSL-01 | ATR No 1 Instrument Chamber Low Level Switch |
| CHAN1-LSH-01 | ATR No 1 Instrument Chamber High Level Switch |
| CHAN1-LIT-01 | ATR No 1 Instrument Chamber Level Transmitter |
| | |
| | |
| MIXER-02A | ATR No 2 Mixer No 1 |
| MIX2A-TS-01 | ATR No 2 Mixer No 1 Motor Winding High Temp Switch |
| MIX2A-FCS-01 | ATR No 2 Mixer Emergency Stop |
| | |
| MIXER-02B | ATR No 2 Mixer No 2 |
| MIX2B-TS-01 | ATR No 2 Mixer No 2 Motor Winding High Temp Switch |
| MIX2B-FCS-01 | ATR No 2 Mixer No 2Emergency Stop |
| | |
| NH3R2-LIT-01 | ATR No 1 Wet Well Level Transmitter |
| | |
| NH3R2-AIT-01 | ATR No 1 pH/Temp Analyzer |
| NH3R2-AIT-02 | ATR No 1 Dissolved Oxygen Analyzer |

| | |
|---|---|
| | |
| | |
| BLOWER1 | Air Blower No 1 |
| BLWR1-PI-01 | Air Blower No 1 suction pressure gauge |
| BLWR1-PSL-01 | Air Blower No 1 suction low pressure switch |
| BLWR1-TS-01 | Air Blower No 1 motor winding high temp switch |
| BLWR1-TS-02 | Air Blower No 1 discharge high temp switch |
| BLWR1-TI-01 | Air Blower No 1 discharge temperature gauge |
| BLWR1-PI-02 | Air Blower No 1 discharge pressure gauge |
| BLWR1-PSH-01 | Air Blower No 1 discharge high pressure switch |
| BLWR1-FCS-01 | Air Blower No 1 field control station |
| | |
| BLOWER2 | Air Blower No 2 |
| BLWR2-PI-01 | Air Blower No 2 suction pressure gauge |
| BLWR2-PSL-01 | Air Blower No 2 suction low pressure switch |
| BLWR2-TS-01 | Air Blower No 2 motor winding high temp switch |
| BLWR2-TS-02 | Air Blower No 2 discharge high temp switch |
| BLWR2-TI-01 | Air Blower No 2 discharge temperature gauge |
| BLWR2-PI-02 | Air Blower No 2 discharge pressure gauge |
| BLWR2-PSH-01 | Air Blower No 2 discharge high pressure switch |
| BLWR2-FCS-01 | Air Blower No 2 field control station |
| | |
| BLOWER3 | Air Blower No 3 |
| BLWR3-PI-01 | Air Blower No 3 suction pressure gauge |
| BLWR3-PSL-01 | Air Blower No 3 suction low pressure switch |
| BLWR3-TS-01 | Air Blower No 3 motor winding high temp switch |
| BLWR3-TS-02 | Air Blower No 3 discharge high temp switch |
| BLWR3-TI-01 | Air Blower No 3 discharge temperature gauge |
| BLWR3-PI-02 | Air Blower No 3 discharge pressure gauge |
| BLWR3-PSH-01 | Air Blower No 3 discharge high pressure switch |
| BLWR3-FCS-01 | Air Blower No 3 field control station |
| | |
| NH3R1-MOV-01 | Blower discharge flow control valve for reactor No 1 |
| NH3R1-FIT-01 | Blower discharge flow meter for reactor No 1 |
| | |
| NH3R2-MOV-01 | Blower discharge flow control valve for reactor No 2 |
| NH3R2-FIT-01 | Blower discharge flow meter for reactor No 2 |
| | |
| AIP1-PIT-01 | Blowers common header discharge pressure |
| | |
| | |
| | |
| | |
| | |
| | |

LIST OF ALARMS

| TAG | Description | Priority | Alarm Delay |
|---|---|---|---|
| MIX1A-YA-01A-A | ATR NO 1 MIXER NO 1 FAIL TO START | | |

| | | | |
|---|---|---|---|
| MIX1A-YA-01A-B | ATR NO 1 MIXER NO 1 FAIL TO STOP | | |
| MIX1A-TAH-01 | ATR NO 1 MIXER NO 1 MOTOR TEMPERATURE HIGH | | |
| MIX1A-YA-01A | ATR NO 1 MIXER NO 1 FAIL | | |
| MIX1A-YA-01B | ATR NO 1 MIXER NO 1 E STOP | | |
| | | | |
| MIX1B-YA-01A-A | ATR NO 1 MIXER NO 2 FAIL TO START | | |
| MIX1B-YA-01A-B | ATR NO 1 MIXER NO 2 FAIL TO STOP | | |
| MIX1B-TAH-01 | ATR NO 1 MIXER NO 2 MOTOR TEMPERATURE HIGH | | |
| MIX1B-YA-01A | ATR NO 1 MIXER NO 2 FAIL | | |
| MIX1B-YA-01B | ATR NO 1 MIXER NO 2 E STOP | | |
| | | | |
| JBX1-MOG-NAHH-01 | ATR NO 1 INFLUENT SPLITTER BOX MOTORIZED GATE TORQUE HIGH HIGH | | |
| NH3R1-MOV-NAHH-01 | ATR NO 1 AERATION MOTORIZED VALVE TORQUE HIGH HIGH | | |
| | | | |
| MIX2A-YA-01A-A | ATR NO 2 MIXER NO 1 FAIL TO START | | |
| MIX2A-YA-01A-B | ATR NO 2 MIXER NO 1 FAIL TO STOP | | |
| MIX2A-TAH-01 | ATR NO 2 MIXER NO 1 MOTOR TEMPERATURE HIGH | | |
| MIX2A-YA-01A | ATR NO 2 MIXER NO 1 FAIL | | |
| MIX2A-YA-01B | ATR NO 2 MIXER NO 1 E STOP | | |
| | | | |
| MIX2B-YA-01A-A | ATR NO 2 MIXER NO 2 FAIL TO START | | |
| MIX2B-YA-01A-B | ATR NO 2 MIXER NO 2 FAIL TO STOP | | |
| MIX2B-TAH-01 | ATR NO 2 MIXER NO 2 MOTOR TEMPERATURE HIGH | | |
| MIX2B-YA-01A | ATR NO 2 MIXER NO 2 FAIL | | |
| MIX2B-YA-01B | ATR NO 2 MIXER NO 2 E STOP | | |
| | | | |
| JBX1-MOG-NAHH-02 | ATR NO 2 INFLUENT SPLITTER BOX MOTORIZED GATE TORQUE HIGH HIGH | | |
| NH3R2-MOV-NAHH-01 | ATR NO 2 AERATION MOTORIZED VALVE TORQUE HIGH HIGH | | |
| | | | |
| BLWR1-YA-01A-A | AIR BLOWER NO 1 FAIL TO START | | |
| BLWR1-YA-01A-B | AIR BLOWER NO 1 FAIL TO STOP | | |
| BLWR1-TAH-01A | AIR BLOWER NO 1 MOTOR TEMPERATURE HIGH | | |
| BLWR1-PAL-01 | AIR BLOWER NO 1 SUCTION PRESSURE LOW | | |
| BLWR1-PAH-01 | AIR BLOWER NO 1 DISCHARGE PRESSURE HIGH | | |
| BLWR1-TAH-01B | AIR BLOWER NO 1 DISCHARGE TEMPERATURE HIGH | | |
| BLWR1-YA-01A | AIR BLOWER NO 1 FAIL | | |
| BLWR1-YA-01B | AIR BLOWER NO 1 E STOP | | |
| | | | |

| | | | |
|---|---|---|---|
| BLWR2-YA-01A-A | AIR BLOWER NO 2 FAIL TO START | | |
| BLWR2-YA-01A-B | AIR BLOWER NO 2 FAIL TO STOP | | |
| BLWR2-TAH-01A | AIR BLOWER NO 2 MOTOR TEMPERATURE HIGH | | |
| BLWR2-PAL-01 | AIR BLOWER NO 2 SUCTION PRESSURE LOW | | |
| BLWR2-PAH-01 | AIR BLOWER NO 2 DISCHARGE PRESSURE HIGH | | |
| BLWR2-TAH-01B | AIR BLOWER NO 2 DISCHARGE TEMPERATURE HIGH | | |
| BLWR2-YA-01A | AIR BLOWER NO 2 FAIL | | |
| BLWR2-YA-01B | AIR BLOWER NO 2 E STOP | | |
| | | | |
| BLWR3-YA-01A-A | AIR BLOWER NO 3 FAIL TO START | | |
| BLWR3-YA-01A-B | AIR BLOWER NO 3 FAIL TO STOP | | |
| BLWR3-TAH-01A | AIR BLOWER NO 3 MOTOR TEMPERATURE HIGH | | |
| BLWR3-PAL-01 | AIR BLOWER NO 3 SUCTION PRESSURE LOW | | |
| BLWR3-PAH-01 | AIR BLOWER NO 3 DISCHARGE PRESSURE HIGH | | |
| BLWR3-TAH-01B | AIR BLOWER NO 3 DISCHARGE TEMPERATURE HIGH | | |
| BLWR3-YA-01A | AIR BLOWER NO 3 FAIL | | |
| BLWR3-YA-01B | AIR BLOWER NO 3 E STOP | | |
| | | | |
| | | | |
| | | | |
| | | | |

Priority: 1- Plant Shutdown, 2-Process Shutdown, 3-Alarm, 4 Operator Alert
Note: All Alarms are Latching unless otherwise noted.

LIST OF SETPOINTS:

| Description | Setpoint | Delay |
|---|---|---|
| | | |
| | | |
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**Ammonia Treatment Reactor**

EQUIPMENT DESCRIPTION:

The Ammonia Treatment Reactors consists of the following major components listed below per train, total of 2 trains:

- Two Variable Speed Mixers
  - Local Control Station
- Influent Weir Gate

- Influent Level Transmitter
- Ammonia Analyzer
- Instrument chamber instrumentation
  - Level Transmitter
  - High- and Low-Level Switches
  - DO, pH/temp analyzers

OPERATIONAL OVERVIEW:

Belt Filter Press process fluid is transferred into the ATR splitter box where flow is split between the two reactors.

The flow for each reactor is managed by a weir gate and associated level transmitter.

LOCAL CONTROL MODE:

Local control mode will be available at the Mixer VFD. By entering the VFD OI security password and placing the drive in local, the Operator will have access to drive Start/Stop and speed controls. The pump shall run continuously at the set speed once started until called to Stop by the Operator or upon fault detection. The local control mode of operation is not a supported operating mode and should be used for drive or equipment maintenance purposes only.

With the gate actuator LOR switch in Local, the gate weir may be manually positioned at the actuator by means of the Open-Stop-Close selector switch and position selector. Selecting Open will drive the valve open. Selecting Close will drive the valve closed. Selecting Close while the valve is opening will stop the valve opening movement and then drive the valve closed (and vice versa). Selecting Stop will hold the valve at the current position. Local operation of the actuator is intended to be reserved for field testing activities only.

LOCAL SAFETY INTERLOCKS:

The ATR Mixer shall be immediately called to stop, and an alarm generated if any of the conditions listed below are detected. A physical reset will be required before the pump will be available to operate.

- VFD Fault
- Motor Windings High Temp
- E-Stop

A gate actuator shall be called to stop and a local alarm generated (and subsequently reported to the PLC) if any of the conditions listed below are detected. A physical reset will be required at the actuator (per the manufacturer's reset procedure) before the valve actuator will be available to operate.

- Motor Overload
- High Torque

With loss of control signal, the gate actuator will be configured to fail closed. With loss of line power, the actuator will be automatically

switched to battery power thereby allowing the actuator to process a remote command signal.

CONTROLLER PROGRAMMED INTERLOCKS:

A Mixer E-stop output shall be triggered, run inhibited and an HMI equipment alarm generated if any of the conditions listed below are detected by SCADA:

- Reactor Low Level from Transmitter

LOCAL REMOTE CONTROL MODE:

Not applicable.

REMOTE MANUAL CONTROL MODE (Plant PLC):

The Plant PLC shall manage / coordinate operation of the Ammonia Treatment Reactor. Status, alarm and control I/O represented on the referenced P&IDs and as mentioned in this CP shall be accommodated at the Plant HMI. Integrator developed control screens shall include as a minimum the following suite of operator interface screens:

- Login Screen / Main Menu
- Graphic representation of System Overview
- Text-based System Overview including equipment current draw and daily / total runtimes (total runtime reset shall be a supervisory level function), start counts, and well level trends
- Alarm History Screen
- Current Alarm Screen
- Event Log Screen
- Preset Trends Access Screen/Menu
- Help/eO&M (which is to include detailed instruction on how to use the HMI, what information is contained on each major control screen and an outline of the related vendor control narratives)
- Graphic representation of the reactors with access to override manual controls, selection controls and setpoint / timer adjustments. Graphic should include schematic representation of all conveyance system.
- Graphic representation of each mixer/reactor
- Control/Configuration Palette for the mixers and blowers (supervisory level access only)
- Refer to section 17900 for general requirements including:
  - Remote/Manual pump duty rotation (duty/standby)
  - Out-of-Service selection

The overview pump station shall provide the following as a minimum:

- Per Mixer, on same screen:

- Status (Run, Hand/Remote, Speed SP, Speed, and all Fail Conditions)
- Manual S/S controls (only accessible if pump station placed in Remote Control Mode)
- Runtime (daily and lifetime)
- Start Count (daily, monthly, lifetime)
- Duty assignment

- Reactor level reading
- Reactor level instrument fault detected
- Reactor LAL (Low Level Cutoff)
- Reactor A/M status
- Alarms Display
- Process deviation alarm setpoint - display and entry (default = +/-5%)

With the VFD exhibiting a Ready status (no faults) at the HMI and the pump station HMI common control station A/M switch in Manual (i.e. Remote Manual Control Mode) the associated pumps may be manually controlled by an authorized operator at the HMI using the S/S controls previously described provided the safety interlock alarms conditions are not detected.

Note: Valid level signal need not be available for Remote Manual start of the pumps.

The PLC logic will process all pump start/stop commands under the supported remote operating modes. Each pump will be set to Remote at the local OI.

The mixer remote start will be subject to the following permissives:

- Reactor low-low level (operator adjustable) conditions are not detected.

A mixer shall be called to stop, run inhibited, and a PLANT HMI equipment alarm generated if any of the conditions listed below are detected by the PLC:
Emergency Stop

REMOTE AUTO CONTROL MODE (Plant PLC):

With the reactor HMI common control station in REMOTE mode, all pump VFDs exhibiting a Ready status at the HMI will be made available to the PLC REMOTE control logic. (Note: no additional Operator confirmation will be necessary to initiate the pump station.)

Pump station REMOTE start will be subject to the following permissives:

- Valid level target available

- Low level alarm condition not detected
- Level start / stop and timer setpoints populated

Mixer Remote start will be subject to the following permissives
- Low level alarm condition not detected

## ARF AERATION BLOWERS

EQUIPMENT DESCRIPTION:

The ARF Blower System shall consist of the major components listed below:

- Vendor skid equipment:
  - Three VFD positive displacement blowers arranged on a common discharge header and designed to operate in a 2 plus 1 arrangement to support the operation of the air lift pumps and ammonia treatment reactors no 1 and 2.
  - Each Blower Enclosure includes the following instrumentation
    - Suction and Discharge pressure gauges
    - Suction and Discharge pressure switches
    - Motor temperature high switch
    - Discharge high temperature switch
    - Discharge temperature gauge
    - Suction and discharge silencers
- Vendor equipment shipped loose:
  - Common discharge header pressure transmitter
  - Reactor 1 Discharge thermal mass flow meter
  - Reactor 1 Discharge flow control valve
  - Reactor 2 Discharge thermal mass flow meter
  - Reactor 2 Discharge flow control valve

- Contractor furnished equipment:
  - Lockable manual butterfly valve (located on section 1 process air header)
  - Air diffuser branches with manual isolation butterfly valve
  - Common Discharge Header Temperature Gauge

Each blower will be furnished as a pre-assembled skid for Contractor installation and will include an intake low suction pressure switch, inlet and outlet silencer, discharge safety valve, discharge high temperature and discharge high pressure switch as shown on the referenced P&IDs. All switches shall be supplied as dual-setpoint type. The common header discharge pressure transmitter will be used for monitoring only. Discharge diffusers installed within each chamber's collection sump will be equipped with manual isolation valves only.

Variable speed motors will be driven by Contractor furnished VFDs housed in the electrical room. The VFDs will be configured by the VFD Supplier to communicate with the Plant PLC (for

monitoring and control) using hardwired signals as shown on the referenced Network Block Diagram and detailed in section 17900.

OPERATIONAL OVERVIEW:

With detection of ARF system online, process flows are gravity fed are pumped to the ARF splitter box where the process is split between two trains and then aerated to support DO levels 0-Xmg/L.

The basin is aerated by the blowers to maintain a fixed dissolved oxygen level. Specifically, air flow to the basin is controlled by the blower's VFD which works to maintain an operator established dissolved oxygen level within the tank based on a PID developed flow rate. The flow rate to the tank is measured by a thermal mass air flow meter and the readings are propagated to the Plant PLC controller as control feedback - all as detailed in the sections below.

LOCAL CONTROL MODE:

Local control mode will be available at the blower VFD. By entering the VFD OI security password and placing the drive in local, the Operator will have access to drive Start/Stop and speed controls. The blower shall run continuously once started until called to Stop by the Operator or upon fault detection. The local control mode of operation is not a supported operating mode and should be used for drive or blower maintenance purposes only.

LOCAL SAFETY INTERLOCKS:

An blower shall be immediately called to stop and an alarm generated if any of the conditions listed below are detected. A physical reset will be required at the drive before the blower will be available to operate. Refer to section 17900-2.2-O for LCS E-stop control.

- Drive Fault
- Motor Overload or High Current
- Motor Winding High Temperature
- Low Intake Pressure
- High Discharge Pressure
- High Discharge Temperature
- Blower Surge (low current)

CONTROLLER PROGRAMMED SAFETY INTERLOCKS:

Not applicable.

LOCAL AUTO CONTROL MODE:

Not applicable.

REMOTE MANUAL CONTROL MODE

(Plant PLC): The Plant PLC shall monitor equipment status and alarms as shown on the referenced P&ID drawings. An overview control station shall be developed for the Process Blower System at the HMI. The overview station shall provide the following as a minimum:

- Per Blower:
  - Status (Auto/Manual, Run, Ready, Speed Feedback, Current Draw, E-stop and all Fail Conditions)
  - Duty selection
- Blower system common discharge pressure and alarm (PAH and PAHH)
- Common discharge Instantaneous process air flow
- Tank DO reading and alarms (AAH, AAL and AALL)
- Plant Status (Run / Off, Auto / Manual) and Operating Mode

The overview station shall include separate pop-up Supervisor-level control palettes to support Blower System Control functions:

- Blower start sequence Auto/Manual
  - **Note:** Blower Auto/Manual rotation logic shall be subject to the requirements of section 17900-2.2.
- Manual start sequence select (with display of current start sequence)
- Auto Mode Select:
  - Fixed Flow Control Mode
    - Flow setpoint range - display and entry
    - Flow setpoint – display and entry (default = TBD)
    - Start/stop transition timers and PID limits - display and entry (see control logic table for default values)
  - DO Trim Control Mode
    - DO setpoint range - display and entry
    - DO Setpoint – display and entry (default = TBD)
    - Start/stop transition timers and PID limits - display and entry (see control logic table for default values)
- Flow deadband - display and entry (default = TBD)
- DO deadband - display and entry (default = TBD)
- Process deviation alarm setpoint - display and entry (default = +/-5%)
- Tank setpoints:
  - Blower override shutdown level setpoint (default = TBC) and time delay (2sec) - display and entry
  - Blower start level setpoint (default = TBC) and time delay (10sec) - display and entry

Based on a standard drive control faceplate, the overview station shall include a separate pop-up Operator-level control palette for each blower to support the following monitoring and control functions:

- Status (Run, Ready, Speed Feedback, Current Draw, E-stop and all Fail Conditions)
- Remote Auto/Manual mode select (independent of Plant Auto/Manual operating status)
- Start / Stop control and Speed Setpoint - only available in Remote Manual mode with blower Ready status confirmation
    - With Operator start, a blower shall run continuously at the Operator set speed until called to stop or a fault condition is encountered.
    - Should the Tank level fall below the preset blower shutdown level for longer than the preset time delay, the blower will be immediately called to stop and start inhibited. With tank level recovery above the blower start level setpoint for longer than the preset time delay, the blower PLC lockout will be auto reset thereby allowing a Ready status to be restored and re-start permitted.
- Runtime (daily and lifetime)
- Link to Blower System common PID controller (refer to CP-XX)

REMOTE AUTO CONTROL MODE

With a blower's READY status confirmed, the Plant PLC shall operate the available blowers in Duty/Standby fashion to meet system DO setpoint. With the start of the duty blower, the blower speed will ramp up based on a demand cascade control signal (refer to control mode descriptions below) to maintain a discharge flow rate as directly referenced from the monitored current draw (Plant PLC):

- <u>DO Control Loop:</u> DO sensor shall be installed in the aeration basin. An authorized Operator shall enter a DO setpoint at the SCADA HMI. The setpoint shall be used in a PID control loop (with preset deadband) to generate a flow setpoint based on the Operator selected active DO signal. In addition, a flow demand signal, based on the PID loop result, shall be used in the PLC's demand calculation logic to determine the required blower system discharge flow setpoint.
    - DO Setpoint Range: 0 – 2mg/l

The blower control system shall issue an alarm if unable to maintain ±5% of the flow setpoint for greater than 60 seconds.

With detection of Operator initiated Plant Auto Start, all blowers exhibiting a Ready status shall be made available to the Blower auto start sequence. The Plant PLC PID controller (refer to CS-XX for implementation requirements) shall operate the blowers adjust the common speed output based on the Operator selected control mode, control setpoints and timers. Prior to Blower System Auto Start an authorized Operator will be required to establish the following control parameters:

- At least one blower skid has been selected for duty and exhibits a Ready status. Blower duty selection options are as follows:
    - Duty – lead start position
    - Standby – available to start in the event the duty blower becomes unavailable and a blower is being called to start
    - Offline – not available to start

- Blower System Remote Auto Control mode has been selected:
    - DO Control Mode
        - **Note 1:** Drive ramp rate, min speed and max speed shall be as set at the VFD. The PID controls shall take into account the drive settings per section 17900-2.2.

With duty blower start, the Plant PLC will ramp the blower speed as necessary to achieve the flow setpoint.

The Plant PLC control logic will employ a Supervisor adjustable operating deadband of +/-5% of maximum. PLC ramp of the PID output will be suspended if the PV is within the preset operating deadband. PV deviation outside of the deadband limits for longer than 2 seconds will release the PID deadband suspension.

As system demand decreases (through Operator adjustment of setpoint or achievement of desired water quality), the Plant PLC shall adjust the blower speed as necessary to maintain the PV within the setpoint deadband.

If a blower fails, fails to start or stop, or becomes otherwise unavailable (i.e. Not Ready) the condition shall be alarm registered at the Plant HMI and the next blower in sequence shall be immediately called to start or stop (thereby bypassing the preset timers). This shall not impact the selected start sequence.

**Note 1:** All PV setpoints, PID threshold setpoints and timers shall be adjustable at the Plant HMI Supervisory level.

## Appendix CP-04: ARF EFFLUENT PUMP STATION

REFERENCE DOCUMENTS:

| Document Number | Document Title | Date |
|---|---|---|
| 04-I-607 | P&ID – ARF Effluent Pump Station | |
| | Motor Control Schematic | |
| | | |

LIST OF EQUIPMENT AND INSTRUMENTATION:

| Equipment Field Tag | Equipment Description |
|---|---|
| LSPUMP-04 | ARF Effluent Pump No 1 |
| LSPU4-TS-01 | ARF Effluent Pump No 1 Motor Winding High Temp Switch |
| LSPU4-HS-01 | ARF Effluent Pump No 1 Emergency Stop |
| LSPU4-PI-01 | ARF Effluent Pump No 1 Suction Pressure Gauge |
| LSPU4-PI-02 | ARF Effluent Pump No 1 Discharge Pressure Gauge |
| | |
| LSPUMP-05 | ARF Effluent Pump No 2 |
| LSPU5-TS-01 | ARF Effluent Pump No 2 Motor Winding High Temp Switch |
| LSPU5-HS-01 | ARF Effluent Pump No 2 Emergency Stop |
| LSPU5-PI-01 | ARF Effluent Pump No 2 Suction Pressure Gauge |
| LSPU5-PI-01 | ARF Effluent Pump No 2 Discharge Pressure Gauge |
| | |
| LSPUMP-06 | ARF Effluent Pump No 3 |
| LSPU6-TS-01 | ARF Effluent Pump No 3 Motor Winding High Temp Switch |
| LSPU6-HS-01 | ARF Effluent Pump No 3 Emergency Stop |
| LSPU6-PI-01 | ARF Effluent Pump No 3 Suction Pressure Gauge |
| LSPU6-PI-01 | ARF Effluent Pump No 3 Discharge Pressure Gauge |
| | |
| CHAN1-LSL-01 | ATR No 1 Instrument Chamber Low Level Switch |
| CHAN1-LSH-01 | ATR No 1 Instrument Chamber High Level Switch |
| CHAN1-LIT-01 | ATR No 1 Instrument Chamber Level Transmitter |

LIST OF ALARMS

| TAG | Description | Priority | Alarm Delay |
|---|---|---|---|
| LSPU4-YA-01A-A | ARF Effluent Pump 1 Fail To Run | | |
| LSPU4-YA-01A-B | ARF Effluent Pump 1 Fail To Stop | | |
| LSPU4-TAH-01 | ARF Effluent Pump 1 High Temp | | |
| LSPU4-YA-01A | ARF Effluent Pump 1 Fail | | |
| LSPU4-YA-01B | ARF Effluent Pump 1 Estop | | |
| | | | |
| LSPU5-YA-01A-A | ARF Effluent Pump 2 Fail To Run | | |
| LSPU5-YA-01A-B | ARF Effluent Pump 2 Fail To Stop | | |
| LSPU5-TAH-01 | ARF Effluent Pump 2 High Temp | | |
| LSPU5-YA-01A | ARF Effluent Pump 2 Fail | | |
| LSPU5-YA-01B | ARF Effluent Pump 2 Estop | | |
| | | | |

| | | | |
|---|---|---|---|
| LSPU6-YA-01A-A | ARF Effluent Pump 3 Fail To Run | | |
| LSPU6-YA-01A-B | ARF Effluent Pump 3 Fail To Stop | | |
| LSPU6-TAH-01 | ARF Effluent Pump 3 High Temp | | |
| LSPU6-YA-01A | ARF Effluent Pump 3 Fail | | |
| LSPU6-YA-01B | ARF Effluent Pump 3 Estop | | |
| | | | |
| CHAN1-LAL-01 | ATR No 1 Instrument Chamber Low Level | | |
| CHAN1-LAH-01 | ATR No 1 Instrument Chamber High Level | | |
| | | | |

Priority: 1- Plant Shutdown, 2-Process Shutdown, 3-Alarm, 4 Operator Alert
Note: All Alarms are Latching unless otherwise noted.

LIST OF SETPOINTS:

| Description | Setpoint | Delay |
|---|---|---|
| Level Setpoint Pump No 1 Start | | |
| Level Setpoint Pump No 2 Start | | |
| Level Setpoint Pump No 3 Start | | |
| | | |
| Low Low Level Cutoff | | |
| High High Level | | |

EQUIPMENT DESCRIPTION:

The ARF Effluent Pump Station consists of the following major components listed below:

- ARF Effluent Pumps 1-3
  - Constant Speed Pumps
  - Emergency Stop Pushbutton
- ARF Effluent Channel Level Transmitter
- ARF Effluent Channe Low Level Switch (Low level cutoff)
- ARF Effluent Channe High Level Switch

OPERATIONAL OVERVIEW:

The three ARF effluent pumps transfers the treated process fluid from the ARF system to the bypass valve vault connected to Pond 1W and SSTP.

LOCAL CONTROL MODE:

Local Control Mode for the ARF Effluent Pumps is available at the MCC located in the electrical room. By selecting HAND at the HOA switch, a pump will start and run continuously until the HOA switch is rotated to the OFF position. Remote control from the PLC is disabled. Hardwired interlocks are still active.

LOCAL SAFETY INTERLOCKS:

The ARF Effluent Pumps shall be immediately called to stop, and an alarm generated if any of the conditions listed below are detected. A physical reset will be required before the pump will be available to operate.

- Motor Overload

- Motor Windings High Temp
- E-Stop

CONTROLLER PROGRAMMED INTERLOCKS:

An ARF Effluent Pump E-stop output shall be triggered, run inhibited and an HMI equipment alarm generated if any of the conditions listed below are detected by SCADA:

- Wet Well Low Level from Transmitter

LOCAL REMOTE CONTROL MODE:

Not applicable.

REMOTE MANUAL CONTROL MODE (Plant PLC):

The Plant PLC shall manage / coordinate operation of the ARF Effluent Pump Station. Status, alarm and control I/O represented on the referenced P&IDs and as mentioned in this CP shall be accommodated at the Plant HMI. Integrator developed control screens shall include as a minimum the following suite of operator interface screens:

- Login Screen / Main Menu
- Graphic representation of System Overview
- Text-based System Overview including equipment current draw and daily / total runtimes (total runtime reset shall be a supervisory level function), start counts, and well level trends
- Alarm History Screen
- Current Alarm Screen
- Event Log Screen
- Preset Trends Access Screen/Menu
- Help/eO&M (which is to include detailed instruction on how to use the HMI, what information is contained on each major control screen and an outline of the related vendor control narratives)
- Graphic representation of the ARF Effluent Pump Station with access to override manual controls, selection controls and setpoint / timer adjustments. Graphic should include schematic representation of all conveyance system.
- Graphic representation of each pump
- Control/Configuration Palette for the pumps (supervisory level access only)
- Refer to section 17900 for general requirements including:
  - Remote/Manual pump duty rotation (duty/standby)
  - Out-of-Service selection

The ARF effluent pump station overview shall provide the following as a minimum:

- Per Pump, on same screen:
  - Status (Run, Hand/Remote, and all Fail Conditions)
  - Manual S/S controls (only accessible if pump station placed in Remote Control Mode)
  - Runtime (daily and lifetime)
  - Start Count (daily, monthly, lifetime)
  - Duty assignment
- Effluent Channel level reading
- Effluent Channel level instrument fault detected
- Effluent Channel LAL (Low Level Cutoff)
- Pump Station A/M status
- Alarms Display
- Process deviation alarm setpoint - display and entry (default = +/-5%)

With the starter exhibiting a Ready status (no faults) at the HMI and the pump station HMI common control station A/M switch in Manual (i.e. Remote Manual Control Mode) the associated pump may be manually controlled by an authorized operator at the HMI using the S/S controls previously described provided the safety interlock alarms conditions are not detected.

Note: Valid Effluent Channel level signal need not be available for Remote Manual start of the pumps.

The PLC logic will process all pump start/stop commands under the supported remote operating modes. Each pump will be set to Remote at the local OI.

The pump remote start will be subject to the following permissives:

- Wet well low-low level (operator adjustable) conditions are not detected.
- The selected pump is ready to operate

A pump shall be called to stop, run inhibited, and a PLANT HMI equipment alarm generated if any of the conditions listed below are detected by the PLC:

- Emergency Stop

REMOTE AUTO CONTROL MODE (Plant PLC):

With the pump station HMI common control station in REMOTE mode, all pump starters exhibiting a Ready status at the HMI will be made available to the PLC REMOTE control logic. (Note: no additional Operator confirmation will be necessary to initiate the pump station.)

Pump station REMOTE start will be subject to the following permissives:

- Valid level target demand available
- Low level alarm condition not detected
- Level start / stop and timer setpoints populated
- Start sequence populated
- At least one pump is Ready to operate
- Pump station Remote operating mode selected

The control station shall also include a separate Supervisor level control screen to support the following control and monitoring functions:

- Pump Station A/M control selection (a single common A/M control selection shall be used to dictate the control status of all Pumps)
- Pump start sequence select A/M (Pumps shall maintain previous command if transitioning between Auto/Manual.)
- Pump start sequence manual select
  - Note: Pump Remote/Manual rotation logic shall be subject to the requirements of section 17900.
- Tabular representation of:
  - First pump start setpoint with delay timer (entry and display). Default level entry, 10 second delay.
  - Second pump start setpoint with delay timer (entry and display). Default level entry, 10 second delay.
  - Third pump start shall be operator initiated
  - LAL pump station stop setpoint with delay timer (entry and display) Default entries % level TBD, 3 second delay.
  - Effluent Channel LAHH delay timer (default = 2 seconds)
  - Effluent Channel LALL override shutdown delay timer (default = 2 seconds)

| **Pump Station Level Control Logic** | | |
|---|---|---|
| **Pump Station Demand Level** | **Demand Falling** | **Demand Rising** |
| • Longer than 10 seconds<br>• Pump Station in REMOTE Mode<br>• Level is greater than Xft | | Start lead pump |
| • Longer than 10 seconds<br>• 1st pump called to run in REMOTE<br>• 1st cannot meet Level (TBD delay)<br>• Level equal to or greater than 2nd pump start setpoint (TBD) | | Start 2nd pump |

| | | |
|---|---|---|
| • Longer than 10 seconds<br>• 2nd pump called to run in REMOTE<br>• Level equal to less than XXft | 2nd Pump Stop | |
| • Longer than 3 seconds<br>• Wet well level equal to or less than pump station stop setpoint (TBD) | Stop all pumps. | |
| • LALL float switch trip detected | Stop and inhibit start for all pumps until LALL condition clears. | |

APPROVED Date 07/10/2026

| AUSTIN FIRE DEPARTMENT | |
|---|---|
| FIRE DESIGN CODES | 2021 INTERNATIONAL FIRE CODE (IFC) WITH CITY OF AUSTIN LOCAL AMENDMENTS TO IFC |
| FIRE FLOW DEMAND @ 20 PSI (GPM) | 1,500 GPM |
| OCCUPANCY CLASSIFICATION | F-1 |
| CONSTRUCTION CLASSIFICATION | IIB |
| BUILDING FIRE AREA (S.F.) | 2,200 S.F. |
| AUTOMATIC FIRE SPRINKLER SYSTEM TYPE (IF APPLICABLE) | N/A |
| REDUCED FIRE FLOW DEMAND @ 20 PSI FOR HAVING A SPRINKLER SYSTEM (GPM) (IF APPLICABLE) | N/A |
| AFD FIRE HYDRANT FLOW TEST | TEST CONDUCTED 5/19/2025 @ 14:58<br>RESIDUAL HYDRANT #2149259<br>STATIC: 120 PSI – RESIDUAL: 78 PSI<br>FLOW HYDRANT #2149251<br>FLOW RATE: 1520 GPM |
| AFD FIRE HYDRANT FLOW TEST LOCATION | 2210 S. FM 973, AUSTIN, TX 78725<br>FH #2149259 (RESIDUAL)<br>FH #2149251 (FLOW) |
| CITY OF AUSTIN PIPELINE ORDINANCE APPLIES TO PROJECT | NO |
| HIGH-RISE | NO |
| INTERNATIONAL WILDLAND-URBAN INTERFACE CODE | 2015 WILDLAND-URBAN INTERFACE CODE (IWUIC) WITH CITY OF AUSTIN LOCAL AMENDMENTS APPLY. |
| ALTERNATIVE METHOD OF COMPLIANCE AMOC (IF APPLICABLE) | N/A |

# CITY OF AUSTIN, TEXAS
# AUSTIN WATER

# HORNSBY BEND BMP PROCESS AMMONIA REMOVAL FACILITY AND DRAINAGE IMPROVEMENTS

CIP ID: 3164.094 & 3164.125

AUSTIN WATER PROJECT NO.: S-2026-0025

JUNE 2026

Travis County Fire Marshal's Office
REVIEWED FOR COMPLIANCE
APPROVED TO PROCEED
Nothing in this review is intended to authorize any aspect of work that is not in compliance with adopted codes and laws.
9:00 am - July 15, 2026
Greg Anderson
PLAN REVIEWER

REVIEWED
July 01, 2026
RB McMillan
Austin Water
Roger McMillan

AUSTIN WATER EXPIRATION DATE
July 01, 2029

GENERAL COVER NOTES:

1. THE LOCATION OF EXISTING UNDERGROUND UTILITIES ARE SHOWN IN AN APPROXIMATE WAY ONLY. THE CONTRACTOR SHALL DETERMINE THE EXACT LOCATION OF ALL EXISTING UTILITIES BEFORE COMMENCING WORK. THEY AGREE TO BE FULLY RESPONSIBLE FOR ANY AND ALL DAMAGES WHICH MIGHT BE OCCASIONED BY THEIR FAILURE TO EXACTLY LOCATE AND PRESERVE ANY AND ALL UNDERGROUND UTILITIES.
2. CONTRACTOR SHALL NOTIFY THE CITY OF AUSTIN PUBLIC WORKS DEPARTMENT 24-HOURS PRIOR TO STARTING CONSTRUCTION OR CLEARING OPERATIONS.
3. CONTRACTOR SHALL CALL "ONE CALL" AT 1-800-344-8377 FOR UTILITY LOCATIONS AT LEAST 48-HOURS PRIOR TO ANY WORK IN CITY EASEMENTS OR STREET RIGHTS-OF-WAY.
4. THIS PROJECT IS LOCATED WITHIN THE COLORADO RIVER WATERSHED. THE COLORADO RIVER WATERSHED IS CLASSIFIED AS SUBURBAN (OUTSIDE OF CITY LIMITS). THE PROJECT SHALL BE DEVELOPED, CONSTRUCTED, AND MAINTAINED IN ACCORDANCE WITH CHAPTER 25 OF THE CODE OF THE CITY OF AUSTIN.
5. NO PORTION OF THIS SITE IS LOCATED WITHIN PARKLAND OR LAND USED FOR PARK PURPOSES.
6. THIS PROJECT IS NOT WITHIN THE EDWARDS AQUIFER RECHARGE ZONE AS DEFINED BY THE CITY OF AUSTIN. THIS PROJECT IS NOT WITHIN THE EDWARDS AQUIFER RECHARGE ZONE AS REGULATED BY THE TEXAS COMMISSION ON ENVIRONMENTAL QUALITY (TCEQ).
7. THERE ARE NO CRITICAL ENVIRONMENTAL FEATURES WITHIN 150 FEET OF ANY PORTION OF THIS PROJECT. A FIELD INVESTIGATION WAS PERFORMED AS PART OF THIS PROJECT ON OCTOBER 15, 2025.
8. NO PORTION OF THIS PROJECT'S LIMITS OF CONSTRUCTION IS LOCATED WITHIN THE 100-YEAR FLOODPLAIN, BUT A PORTION OF THE TRACT IN WHICH THE LIMITS OF CONSTRUCTION EXIST IS LOCATED WITHIN THE 100-YEAR FLOODPLAIN AS DEFINED BY THE CITY OF AUSTIN AND BY THE FEDERAL EMERGENCY MANAGEMENT AGENCY (FEMA) FLOODPLAIN INSURANCE RATE MAP(S) NO. 48453C0610L, DATED 1/22/2020. THE ENTIRE LIMITS OF CONSTRUCTION AND THE ENTIRE TRACT IN WHICH THE LIMITS OF CONSTRUCTION EXIST IS LOCATED IN THE 500-YEAR FLOODPLAIN AS DEFINED BY THE CITY OF AUSTIN AND BY THE FEDERAL EMERGENCY MANAGEMENT AGENCY (FEMA) FLOODPLAIN INSURANCE RATE MAP(S) NO. 48453C0610L, DATED 1/22/2020.
9. ADDITIONAL TRENCH E/S CONTROL: TRIANGULAR SEDIMENT FILTER DIKE WILL BE INSTALLED ACROSS FULL WIDTH OF TRAFFIC CLOSURE AND DOWNSTREAM OF CONSTRUCTION. REMOVING AND RESETTING FILTER DIKE IS CONSIDERED SUBSIDIARY TO BARRICADES AND TRAFFIC HANDLING.
10. APPROVAL OF THESE PLANS BY THE CITY OF AUSTIN INDICATES COMPLIANCE WITH APPLICABLE CITY REGULATIONS ONLY. APPROVAL BY OTHER GOVERNMENTAL ENTITIES MAY BE REQUIRED PRIOR TO THE START OF CONSTRUCTION. THE APPLICANT IS RESPONSIBLE FOR DETERMINING WHAT ADDITIONAL APPROVALS MAY BE NECESSARY.
11. IF AT ANY TIME DURING CONSTRUCTION OF THIS PROJECT AN UNDERGROUND STORAGE TANK (UST) IS FOUND, CONSTRUCTION IN THAT AREA MUST STOP UNTIL A CITY OF AUSTIN UST CONSTRUCTION PERMIT IS APPLIED FOR AND APPROVED. ANY UST REMOVAL WORK MUST BE CONDUCTED BY A UST CONTRACTOR THAT IS REGISTERED WITHIN THE TEXAS COMMISSION ON ENVIRONMENTAL QUALITY (TCEQ). CONTACT ELIZABETH SIMMONS AT ELIZABETH.SIMMONS@AUSTINTEXAS.GOV IF YOU HAVE ANY QUESTIONS (COA TITLE 6).
12. RELEASE OF THIS APPLICATION DOES NOT CONSTITUTE A VERIFICATION OF ALL DATA, INFORMATION, AND CALCULATIONS SUPPLIED BY THE APPLICANT. THE ENGINEER OF RECORD IS SOLELY RESPONSIBLE FOR THE COMPLETENESS, ACCURACY, AND ADEQUACY OF HIS/ HER SUBMITTAL, WHETHER OR NOT THE APPLICATION IS REVIEWED FOR CODE COMPLIANCE BY CITY ENGINEERS.
13. THIS PROJECT SHALL COMPLY WITH 2015 IWUIC AS ADOPTED BY CITY OF AUSTIN.
14. ALL IMPROVEMENTS SHALL BE MADE IN ACCORDANCE WITH THE RELEASED SITE PLAN. ANY ADDITIONAL IMPROVEMENTS WILL REQUIRE SITE PLAN AMENDMENT AND APPROVAL OF THE DEVELOPMENT SERVICES DEPARTMENT.
15. ADDITIONAL ELECTRIC EASEMENTS MAY BE REQUIRED AT A LATER DATE.
16. WATER AND WASTEWATER SERVICE WILL BE PROVIDED BY THE CITY OF AUSTIN.
17. THE 2-YEAR DETENTION AND WATER QUALITY POND SHALL BE MAINTAINED BY THE HORNSBY BEND PROPERTY OF CITY OF AUSTIN.
18. FOR DRIVEWAY CONSTRUCTION: THE OWNER IS RESPONSIBLE FOR ALL COSTS FOR RELOCATION OF, OR DAMAGE TO UTILITIES.
19. FOR CONSTRUCTION WITHIN THE RIGHT-OF-WAY, A ROW EXCAVATION PERMIT IS REQUIRED.

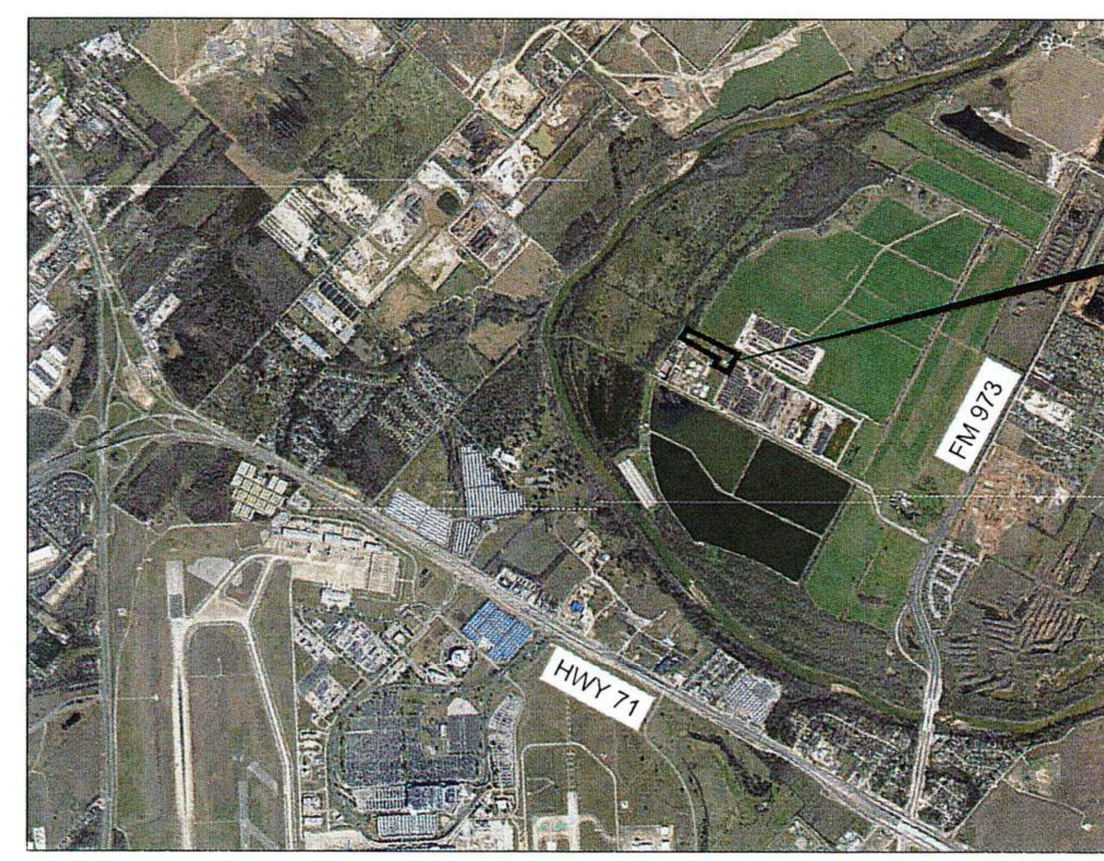
AUSTIN FIRE DEPARTMENT NOTES:

1. THE AUSTIN FIRE DEPARTMENT REQUIRES FINAL ASPHALT OR CONCRETE PAVEMENT ON REQUIRED ACCESS ROADS PRIOR TO THE START OF COMBUSTIBLE CONSTRUCTION. ANY OTHER METHOD OF PROVIDING "ALL-WEATHER DRIVING CAPABILITIES" SHALL BE REQUIRED TO BE DOCUMENTED AND APPROVED AS AN ALTERNATIVE METHOD OF CONSTRUCTION IN ACCORDANCE WITH APPLICABLE RULES FOR TEMPORARY ROADS OUTLINED IN THE CITY OF AUSTIN FIRE PROTECTION CRITERIA MANUAL.
2. FIRE HYDRANTS SHALL BE INSTALLED WITH THE CENTER OF THE FOUR (4) INCH OPENING (STEAMER) LOCATED AT LEAST 18 INCHES ABOVE FINISHED GARDE. THE STEAMER OPENING OF FIRE HYDRANTS SHALL FACE THE APPROVED FIRE ACCESS DRIVEWAY OR PUBLIC STREET AND SET BACK FROM THE CURB LINE(S) AN APPROVED DISTANCE, TYPICALLY THREE (3) TO SIX (6) FEET. THE AREA WITHIN THREE (3) FEET IN ALL DIRECTIONS FROM ANY FIRE HYDRANT SHALL BE FREE OF OBSTRUCTIONS.
3. TIMING OF INSTALLATIONS: WHEN FIRE PROTECTION FACILITIES ARE INSTALLED BY THE CONTRACTOR, SUCH FACILITIES SHALL INCLUDE SURFACE ACCESS ROADS, EMERGENCY ACCESS ROADS OR DRIVES SHALL BE INSTALLED AND MADE SERVICEABLE PRIOR TO AND DURING THE TIME OF CONSTRUCTION. WHEN THE FIRE DEPARTMENT APPROVES AN ALTERNATIVE METHOD OF PROTECTION, THIS REQUIREMENT MAY BE MODIFIED AS DOCUMENTED IN THE APPROVAL OF THE ALTERNATE METHOD.
4. ALL EMERGENCY ACCESS ROADWAYS AND FIRE LANES, INCLUDING PERVIOUS/ DECORATIVE PAVING, SHALL BE ENGINEERED AND INSTALLED AS REQUIRED TO SUPPORT THE AXLE LOADS OF EMERGENCY VEHICLES. A LOAD CAPACITY SUFFICIENT TO MEET THE REQUIREMENTS FOR HS-20 LOADING (16KIPS/ WHEEL) AND A TOTAL VEHICLE LIVE LOAD OF 80,000 POUNDS IS CONSIDERED COMPLIANT WITH THIS REQUIREMENT.
5. FIRE LANES DESIGNATED ON SITE PLANS SHALL BE REGISTERED WITH THE CITY OF AUSTIN FIRE DEPARTMENT AND INSPECTED FOR FINAL APPROVAL.
6. THE MINIMUM VERTICAL CLEARANCE REQUIRED FOR EMERGENCY VEHICLES ACCESS ROADS OR DRIVES IS 14 FEET FOR THE FULL WIDTH OF THE ROADWAY OR DRIVEWAY.

AUSTIN ENERGY NOTES:

1. AUSTIN ENERGY HAS THE RIGHT TO PRUNE AND/OR REMOVE TREES, SHRUBBERY AND OTHER OBSTRUCTIONS TO THE EXTENT NECESSARY TO KEEP THE EASEMENTS CLEAR. AUSTIN ENERGY WILL PERFORM ALL TREE WORK IN COMPLIANCE WITH CHAPTER 25-8, SUBCHAPTER B OF THE CITY OF AUSTIN LAND DEVELOPMENT CODE.
2. THE OWNER/ DEVELOPER OF THIS SUBDIVISION/ LOT SHALL PROVIDE AUSTIN ENERGY WITH ANY EASEMENT AND/OR ACCESS REQUIRED, IN ADDITION TO THOSE INDICATED, FOR THE INSTALLATION AND ONGOING MAINTENANCE OF OVERHEAD AND UNDERGROUND ELECTRIC FACILITIES. THESE EASEMENTS AND/OR ACCESS ARE REQUIRED TO PROVIDE ELECTRIC SERVICE TO THE BUILDING AND WILL NOT BE LOCATED SO AS TO CAUSE THE SITE TO BE OUT OF COMPLIANCE WITH CHAPTER 25-8 OF THE CITY OF AUSTIN LAND DEVELOPMENT CODE.
3. THE OWNER SHALL BE RESPONSIBLE FOR THE INSTALLATION OF TEMPORARY EROSION CONTROL, REVEGETATION AND TREE PROTECTION. IN ADDITION, THE OWNER SHALL BE RESPONSIBLE FOR ANY INITIAL TREE PRUNING AND TREE REMOVAL THAT IS WITHIN TEN FEET OF THE CENTER LINE OF THE PROPOSED OVERHEAD ELECTRICAL FACILITIES DESIGNED TO PROVIDE ELECTRIC SERVICE TO THIS PROJECT. THE OWNER SHALL INCLUDE AUSTIN ENERGY'S WORK WITHIN THE LIMITS OF CONSTRUCTION FOR THIS PROJECT.
4. THE OWNER OF THE PROPERTY IS RESPONSIBLE FOR MAINTAINING CLEARANCES REQUIRED BY THE NATIONAL ELECTRIC SAFETY CODE (NESC), OCCUPATIONAL SAFETY AND HEATH ADMINISTRATION (OSHA) REGULATIONS, CITY OF AUSTIN RULES AND REGULATIONS AND TEXAS STATE LAWS PERTAINING TO CLEARANCES WHEN WORKING IN CLOSE PROXIMITY TO OVERHEAD POWER LINES AND EQUIPMENT. AUSTIN ENERGY WILL NOT RENDER ELECTRIC SERVICE UNLESS REQUIRED CLEARANCES ARE MAINTAINED. ALL COSTS INCURRED BECAUSE OF FAILURE TO COMPLY WITH THE REQUIRED CLEARANCES WILL BE CHARGED TO THE OWNER.
5. ANY RELOCATION OF ELECTRIC FACILITIES SHALL BE AT LANDOWNER'S/ DEVELOPER'S EXPENSE.

| CITY OF AUSTIN REVISIONS/ CORRECTIONS TABLE | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| CORRECTION OR REVISION NUMBER | DESCRIPTION | REVISE (R), REPLACEMENT (RR), ADD (A), VOID (V), DRAWING #S | TOTAL # DRAWINGS IN PLAN SET | NET CHANGE IMP. COVER (SQ FT) | TOTAL SITE IMP. COVER (SQ FT %) | CITY OF AUSTIN SIGNATURE | TRAVIS COUNTY REVIEWED BY | DATE |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |




VICINITY MAP
NTS

PROJECT SITE
2210 S. FM 973
AUSTIN, TEXAS 78725

LEGAL DESCRIPTION(S)
CITY OF AUSTIN ABS 15 SUR 17 HORNSBY R ACR 50.0 (TCAD ID #292210)
CITY OF AUSTIN ABS 15 SUR 17 HORNSBY R ACR 84.67 (TCAD ID #292207)
CITY OF AUSTIN ABS 15 SUR 17 HORNSBY R ACR 269.0 (TCAD ID #292208)
LOCATED IN THE CITY OF AUSTIN 2-MILE ETJ, IN TRAVIS COUNTY, TEXAS, ACCORDING TO THE MAP OR PLAT THERE OF RECORDED IN OFFICIAL PUBLIC RECORDS, TRAVIS COUNTY, TEXAS

SITE DATA FOR TRAVIS COUNTY

TOTAL AREA OF TRACT BEING DEVELOPED = 84.16 ACRES
AREA OF PROPOSED GROUND DISTURBANCE FOR PROJECT = 7.70 ACRES

AREA OF EXISTING IMPERVIOUS COVER = 24.447 ACRES
AREA OF NEW IMPERVIOUS COVER = 0.7 ACRES

TOTAL AREA OF IMPERVIOUS COVER ON TRACT ONCE DEVELOPMENT COMPLETED = 25.147 ACRES

MAYOR
KIRK WATSON

CITY COUNCIL
DISTRICT 1 - NATASHA HARPER-MADISON
DISTRICT 2 - VANESSA FUENTES
DISTRICT 3 - JOSE VELASQUEZ
DISTRICT 4 - JOSE "CHITO" VELA
DISTRICT 5 - RYAN ALTER
DISTRICT 6 - KRISTA LAINE
DISTRICT 7 - MIKE SIEGEL
DISTRICT 8 - PAIGE ELLIS
DISTRICT 9 - ZOHAIB "ZO" QADRI
DISTRICT 10 - MARC DUCHEN

CITY MANAGER
T.C. BROADNAX

AUSTIN WATER DIRECTOR
SHAY RALLS ROALSON

Stantec
Walker Partners
CAS CONSULTING
carollo
Baer Engineering and Environmental Consulting, Inc.
Jose I. Guerra, Inc. Consulting Engineers Civil • Structural • Mechanical • Electrical
NEGRETE & KOLAR ARCHITECTS, LLP
JRSA CONSULTING ELECTRICAL ENGINEERS

PROJECT INFORMATION

STREET ADDRESS:
2210 SOUTH FM 973
AUSTIN, TEXAS 78725

RELATED CASES:
SP-2024-0153C
SP-2024-0257D

OWNER:
CITY OF AUSTIN
AUSTIN WATER

CONTACT:
JOHN MITCHELL, PE
HORNSBY BEND FACILITY ENGINEER
2210 SOUTH FM 973
AUSTIN, TEXAS 78725
(512) 972-1951

JULES PARRISH
CAPITAL DELIVERY PROJECT MANAGER
6800 BURLESON ROAD, BLDG 312, SUITE 200
AUSTIN, TEXAS 78744
(512) 972-9385

SUBMITTAL PREPARED BY:
FOR CIP ID 3164.125
STANTEC CONSULTING SERVICES, INC.
TBPE# F-6324 TBPLS# 10194230
1905 ALDRICH STREET, SUITE 300
AUSTIN, TEXAS 78723
(512) 328-0011

FOR CIP ID 3164.094
WALKER PARTNERS, LLC
TBPE# 8053 TBPLS# 10032500
6504 BRIDGE POINT PKWY, SUITE 200
AUSTIN, TEXAS 78730
(512) 382-0021

ENGINEER OF RECORD:

STATE OF TEXAS — ALDO J. SOTELO — 106323 — LICENSED PROFESSIONAL ENGINEER

06/19/2026
ALDO SOTELO, P.E. — DATE
PROJECT MANAGER
STANTEC CONSULTING SERVICES, INC.
DESIGN OF CIP ID 3164.125

STATE OF TEXAS — S. JARED NIERMANN — 122045 — LICENSED PROFESSIONAL ENGINEER

06/19/2026
S. JARED NIERMANN, P.E. — DATE
PROJECT MANAGER
WALKER PARTNERS, LLC
DESIGN OF CIP ID 3164.094

REVIEWED BY:
6-18-26
JOHN MITCHELL, P.E. — DATE
AUSTIN WATER PROJECT SPONSOR

APPROVAL FOR CITY OF AUSTIN PERMIT:

7/10/2026
DEVELOPMENT SERVICES DEPARTMENT — DATE

FO/OM 7/1/2026
AUSTIN WATER PIPELINE ENGINEERING — DATE

07/09/2026
AUSTIN FIRE DEPARTMENT — DATE

~~INDUSTRIAL WASTE~~ — DATE

APPROVAL FOR TRAVIS COUNTY PERMIT:

TRAVIS COUNTY TNR HAS COMPLETED THE REVIEW OF **CITY OF AUSTIN - AUSTIN WATER - HORNSBY BEND BMP PROCESS AMMONIA REMOVAL FACILITY AND DRAINAGE IMPROVEMENTS**, TRAVIS COUNTY DEVELOPMENT PERMIT NUMBER **25-52801** ON **6/24/2026.** ANY QUESTIONS MAY BE DIRECTED TO JACQUELYN THOMAS, P.E. AT JACQUE.THOMAS@TRAVISCOUNTYTX.GOV AND (512) 854-7580.

TRAVIS COUNTY TRANSPORTATION AND NATURAL RESOURCE DEPARTMENT — DATE

2025-1417
TRAVIS COUNTY FIRE MARSHALL SITE PLAN PERMIT — DATE

ENGINEER'S STATEMENT

1. ALL RESPONSIBILITY FOR THE ADEQUACY OF THESE PLANS REMAINS WITH THE ENGINEER WHO PREPARED THEM. IN ACCEPTING THESE PLANS, THE CITY/ COUNTY MUST RELY UPON THE ADEQUACY OF THE WORK OF THE DESIGN ENGINEER.

SITE APPROVAL

CASE NUMBER SP-2025-0282D APPLICATION DATE 11/26/2025
APPROVED ON 7/10/2026 ☒ ADMINISTRATIVELY ☐ BY COMMISSION
UNDER SECTION ☒ 112 ☐ 142 OF CHAPTER 25-5 OF THE CITY OF AUSTIN CODE
EXPIRATION DATE (LDC 25-5-81) 7/10/2029 CASE MANAGER Kara Weinstein

DEVELOPMENT SERVICES DEPARTMENT

RELEASED FOR GENERAL COMPLIANCE 7/10/2026 ZONING ETJ

SHEET 1 OF 229

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## GENERAL DESIGN CRITERIA

| INFLUENT BFP FILTRATE FEED | UNIT | INITIAL | ULTIMATE |
|---|---|---|---|
| FLOW, ANNUAL AVERAGE | MGD | 0.79 | 1.05 |
| FLOW, MAXIMUM MONTH, (TREATMENT CAPACITY) | MGD | 0.87 | 1.16 |
| FLOW, PEAK WEEK (HYDRAULIC CAPACITY) | MGD | 0.92 | 1.23 |
| NH3-N, DESIGN | mg/L | 630 | |
| TSS, DESIGN | mg/L | 500 | |
| CHEMICAL OXYGEN DEMAND (COD), DESIGN | mg/L | 530 | |
| ALKALINITY AS CALCIUM CARBONATE (CaCO3), DESIGN | mg/L | 2,520 | |
| TOTAL KJELDAHL NITROGEN (TKN), DESIGN | mg/L | 650 | |
| TOTAL PHOSPHORUS | mg/L | 110 | |
| TEMPERATURE, MINIMUM | C | 25 | |
| TEMPERATURE, MAXIMUM | C | 40 | |
| PH | S.U | 7.9 | |
| **EFFLUENT CONCENTRATIONS AND PERFORMANCE** | | | |
| EFFLUENT COD | mg/L | 520 | |
| EFFLUENT TSS | mg/L | 580 | |
| NH3-N OXIDATION | % | 90 | |
| EFFLUENT NH3-N | mg/L | 63 | |
| TOTAL INORGANIC NITROGEN REDUCTION | % | 80 | |
| EFFLUENT TOTAL INORGANIC NITROGEN (TIN) | mg/L | 126 | |

| BFP EFFLUENT LIFT STATION DESIGN CRITERIA | | | |
|---|---|---|---|
| **PUMPS** | | | |
| TYPE | - | SUBMERSIBLE | |
| QUANTITY | - | 3 (2 DUTY + 1 STANDBY) | |
| CONTROL | | CONSTANT SPEED | |
| DESIGN CAPACITY, EACH | GPM | 450 | |
| DESIGN TDH | | | |
| FLOW TO EQ BASIN (NORMAL OPERATION) | FT | 38.5 | |
| FLOW TO ATR INFLUENT SPLITTER BOX (ALTERNATIVE OPERATION - EQ BYPASS) | FT | 40.7 | |
| FLOW TO POND 1W (ALTERNATIVE OPERATION - ARF BYPASS) | FT | 44.7 | |
| FLOW TO SSTP (ALTERNATIVE OPERATION) | FT | 53.2 | |
| POWER | HP | 7.5 | |

| EQUALIZATION (EQ) BASIN DESIGN CRITERIA | | | |
|---|---|---|---|
| **EQ BASIN** | | | |
| EQUALIZATION VOLUME | MG | 0.61 | 0.61 |
| EQUALIZATION TIME, AVERAGE FLOW | HOURS | 18.6 | 14 |
| EQUALIZATION TIME, MAX MONTH FLOW | HOURS | 16.9 | 12.7 |
| QUANTITY | - | 1 | |
| LENGTH, EA | FT | 70 | |
| WIDTH, EA | FT | 60 | |
| MINIMUM SIDEWATER DEPTH | FT | 5 | |
| MAXIMUM SIDEWATER DEPTH | FT | 19.5 | |
| **MIXER** | | | |
| TYPE | - | TOP MOUNTED VERTICAL SHAFT | |
| QUANTITY | - | 1 | |
| MOTOR SIZE | HP | 10 | |
| CONTROL | | SINGLE SPEED | |
| **EQ TRANSFER LIFT STATION PUMPS** | | | |
| TYPE | - | SELF-PRIMING CENTRIFUGAL | |
| QUANTITY | - | 3 (2 DUTY + 1 STANDBY) | |
| CONTROL | | VFD | |
| DESIGN CAPACITY, EACH (100% CAPACITY/ NO VFD TURNDOWN) | GPM | 500 | |
| FLOW TO ATR INFLUENT SPLITTER BOX (NORMAL OPERATION) PUMP HEAD, TDH | | | |
| MAXIMUM EQ BASIN WSL ELEVATION | FT | 29.3 | |
| MINIMUM EQ BASIN WSL ELEVATION | FT | 43.8 | |
| FLOW TO ARF EFFLUENT CHANNEL (DRAIN OPERATION) PUMP HEAD, TDH | | | |
| MAXIMUM EQ BASIN WSL ELEVATION | FT | 34.2 | |
| MINIMUM EQ BASIN WSL ELEVATION | FT | 51.4 | |
| DESIGN CAPACITY, EACH (50% CAPACITY/ MAX VFD TURNDOWN) | GPM | 250 | |
| FLOW TO ATR INFLUENT SPLITTER BOX (NORMAL OPERATION) PUMP HEAD, TDH | | | |
| MAXIMUM EQ BASIN WSL ELEVATION | FT | 12.2 | |
| MINIMUM EQ BASIN WSL ELEVATION | FT | 26.7 | |
| FLOW TO ARF EFFLUENT CHANNEL (DRAIN OPERATION) PUMP HEAD, TDH | | | |
| MAXIMUM EQ BASIN WSL ELEVATION | FT | 11.3 | |
| MINIMUM EQ BASIN WSL ELEVATION | FT | 31.5 | |
| POWER | HP | 10 | |

| AMMONIA TREATMENT REACTOR (ATR) DESIGN CRITERIA | UNIT | INITIAL | ULTIMATE |
|---|---|---|---|
| **REACTORS** | | | |
| QUANTITY | - | 2 | |
| LENGTH, EA | FT | 80 | |
| WIDTH, EA | FT | 60 | |
| SIDEWATER DEPTH | FT | 19.5 | |
| VOLUME PER REACTOR | CU.FT | 93,600 | |
| TOTAL VOLUME | CU.FT | 187,200 | |
| HYDRAULIC RESIDENCE TIME, DESIGN | HOURS | 39 | 29 |
| **MEDIA** | | | |
| TYPE | - | ANOX K5 | |
| MEDIA FILL | % | 36.3 | 48.5 |
| MEDIA VOLUME, TOTAL | CU.FT | 68,042 | 90,747 |
| **MIXERS** | | | |
| TYPE | - | TOP MOUNTED VERTICAL SHAFT | |
| QUANTITY, PER REACTOR | - | 2 | |
| MOTOR SIZE | HP | 29.5 | |
| CONTROL | - | VFD | |
| **AERATION DIFFUSERS** | | | |
| AIR HEADER QUANTITY, TOTAL | | 2 | |
| TYPE | | MEDIUM BUBBLE AERATION GRID, SS NOZZLE | |
| AIR GRID QUANTITY, PER REACTOR | | 8 | |
| NUMBER OF DIFFUSERS, PER REACTOR | | 232 | |
| **BLOWERS** | | | |
| TYPE | - | ROTARY LOBE - POSITIVE DISPLACEMENT | |
| NUMBER | - | 3 (2 DUTY + 1 STANDBY) | |
| CONTROL | - | VFD | |
| DESIGN CAPACITY, EACH | SCFM | 2,840 | |
| DISCHARGE PRESSURE | PSIG | 9.5 | |
| MOTOR SIZE | HP | 200 | |
| **FOAM SUPPRESSION** | | | |
| TYPE | - | AIR LIFT PUMPS | |
| PUMP QUANTITY, PER REACTOR | - | 5 | |
| AIR DEMAND, PER REACTOR | SCFM | 100 | |

| ARF EFFLUENT LIFT STATION | | |
|---|---|---|
| **PUMPS** | | |
| TYPE | - | SELF-PRIMING CENTRIFUGAL |
| QUANTITY | - | 3 (2 DUTY + 1 STANDBY) |
| CONTROL | | CONSTANT SPEED |
| DESIGN CAPACITY, EACH | GPM | 500 |
| DESIGN TDH | | |
| FLOW TO POND 1W (NORMAL OPERATION) | FT | 62.5 |
| FLOW TO SSTP (ALTERNATIVE OPERATION) | FT | 72.5 |

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| 1 | ADDENDUM 1 | BR | AJS | 2026.07.22 |
| | | By | Appd | YYYY.MM.DD |

| Issued | | | | |
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| | | By | Appd | YYYY.MM.DD |

Permit/Seal

STATE OF TEXAS
ALDO J. SOTELO
106703
PROFESSIONAL ENGINEER
07/22/2026

Client/Project
CITY OF AUSTIN
HORNSBY BEND BMP
PROCESS AMMONIA
REMOVAL FACILITY
AUSTIN, TX

Project No.: 177311636
File Name: 00-G-006_1

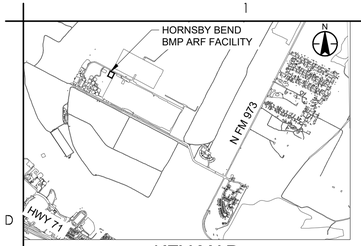
Scale: NONE

| BR | NS/BR | AJS/CC | 2026.07.22 |
|---|---|---|---|
| Dwn. | Dsgn. | Chkd. | YYYY.MM.DD |

Title
GENERAL
DESIGN CRITERIA

Revision: Sheet: 6 of 229
Drawing No.
**00-G-006**

ORIGINAL SHEET - ANSI D




KEY MAP
SCALE: 1"=200'

| SURVEY CONTROL POINTS | | | | |
|---|---|---|---|---|
| NO. | NORTHING | EASTING | ELEV | DESCRIPTION |
| 1 | 10055970.94 | 3144529.40 | 438.41 | MAG NAIL SET TOP CURB |
| 2 | 10055806.53 | 3144845.29 | 438.24 | MAG NAIL SET TOP CURB |
| 3 | 10048780.24 | 3149110.35 | 452.45 | BRASS DISC FND (P-17 3001) |
| 4 | 10056149.44 | 3144184.85 | 438.39 | MAG NAIL SET TOP CURB |
| 30 | 10054800.32 | 3129063.99 | 498.67 | BRASS DISC FND (26 DN 7715) |
| 31 | 10056163.90 | 3136190.69 | 441.81 | BRASS DISC FND (20300810) |

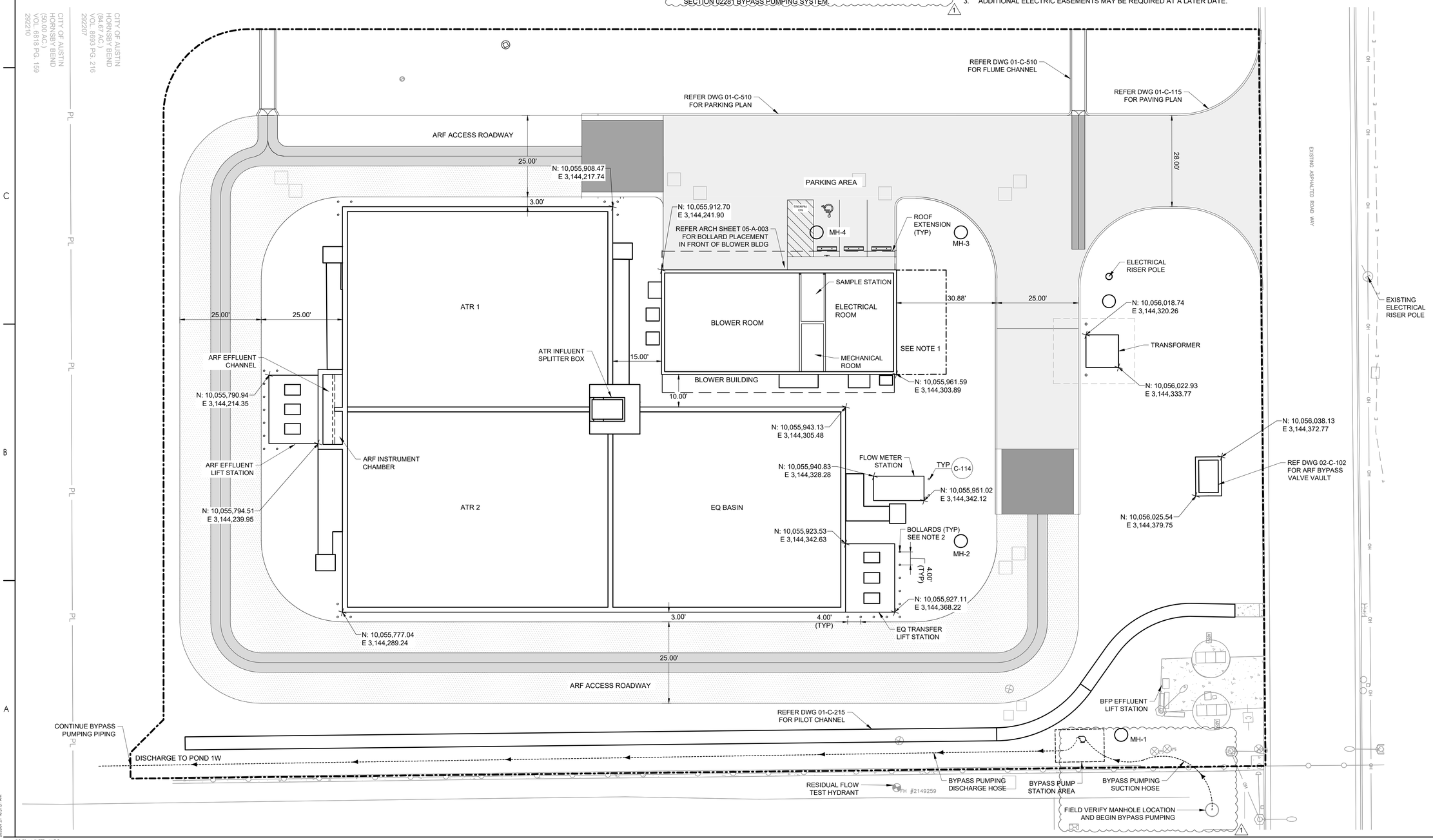
NOTES:
1. SPACE RESERVED FOR POTENTIAL FUTURE CHEMICAL STORAGE AND FEED SYSTEM FOR ALKALINITY ADDITION (NOT A PART OF SCOPE OF THIS PROJECT).
2. INSTALL BOLLARDS AT LOCATIONS AND SPACING SHOWN. PLACE 18" FROM CENTER OF BOLLARD TO FACE OF WALL OR EDGE OF CONCRETE SLAB.
3. COORDINATE WITH HORNSBY BEND STAFF ON LOCATION OF BYPASS PUMPING DISCHARGE IN PONDS AND ROUTE OF BYPASS PUMPING PIPING TO PONDS.
4. REFER TO SHEET 01-C-115 FOR PAVING PLAN AND SHEETS 01-C-510, 01-C-511 FOR PAVING DETAIL.
5. REFER SHEET 01-C-101 FOR OVERALL LOC
6. WORK ON THE EXISTING BFP LIFT STATION SHALL BE SCHEDULED, SEQUENCED, AND PERFORMED IN A MANNER THAT MINIMIZES THE TOTAL LIFT STATION SHUTDOWN DURATION. THE CONTRACTOR SHALL CONSIDER REQUIREMENTS FOR ALL SCOPES OF WORK INVOLVED INCLUDING DEMOLITION, STRUCTURAL, MECHANICAL, ELECTRICAL, AND CONTROLS. CONTRACTOR SHALL ALSO CONSIDER EXISTING CONDITION AND CONSTRAINTS. THE CONTRACTOR SHALL BE RESPONSIBLE FOR PROVIDING A COMPLETE AND FUNCTIONAL BYPASS PUMPING SYSTEM FOR THE DURATION OF THE BFP LIFT STATION SHUTDOWN IN ORDER TO MAINTAIN NORMAL OPERATION OF THE DEWATERING FACILITY. REFERENCE SPECIFICATION SECTION 02281 BYPASS PUMPING SYSTEM.

1

| IMPERVIOUS COVER SUMMARY TABLE | | | | | |
|---|---|---|---|---|---|
| | IMPERVIOUS COVER (SF) | | | | |
| | EXISTING | PROPOSED | TOTAL | %* | HEIGHT |
| BLOWER BUILDING | 0 | 2,314 | 2,314 | 0.06 | 16'-0" |
| PAVEMENT AND OTHER IMPERVIOUS | 778 | 28,311 | 29,089 | 0.79 | NA |

* % OF TOTAL TRACT AREA OF 84.16 ACRES (3,666,009.6 SF)

SITE PLAN RELEASE NOTES:
1. ALL IMPROVEMENTS SHALL BE MADE IN ACCORDANCE WITH THE RELEASED SITE PLAN. ANY ADDITIONAL IMPROVEMENTS WILL REQUIRE SITE PLAN AMENDMENT AND APPROVAL OF THE DEVELOPMENT SERVICES DEPARTMENT.
2. APPROVAL OF THIS SITE PLAN DOES NOT INCLUDE BUILDING AND FIRE CODE APPROVAL NOR BUILDING PERMIT APPROVAL.
3. ADDITIONAL ELECTRIC EASEMENTS MAY BE REQUIRED AT A LATER DATE.

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| Revision | By | Appd | YYYY.MM.DD |
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| AD25SDU04.1 | BR | SPK | 2026.07.22 |

Permit/Seal

STATE OF TEXAS
SEAN P. KIRBY
130085
LICENSED
PROFESSIONAL ENGINEER
07/22/2026

Client/Project
CITY OF AUSTIN

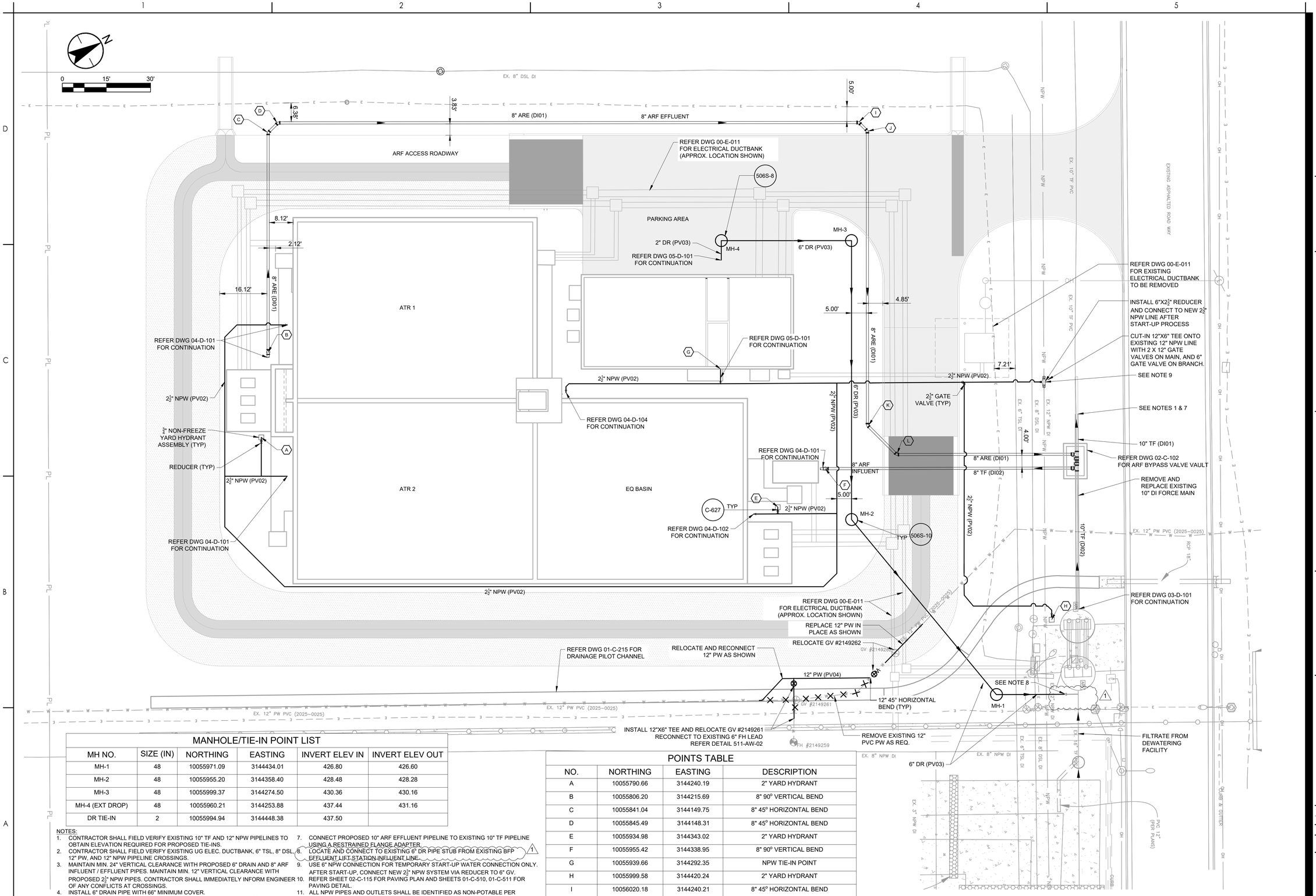
HORNSBY BEND BMP
PROCESS AMMONIA
REMOVAL FACILITY
AUSTIN, TX

Project No.: 177311636
File Name: 01-C-112
Scale: 1" = 15'

| BR | BR/AJS | SPK | 2026.07.22 |
|---|---|---|---|
| Dwn. | Dsgn. | Chkd. | YYYY.MM.DD |

Title
CIVIL
ARF OVERALL SITE PLAN

Revision: Sheet: 62 of 229
Drawing No.
01-C-112




## MANHOLE/TIE-IN POINT LIST

| MH NO. | SIZE (IN) | NORTHING | EASTING | INVERT ELEV IN | INVERT ELEV OUT |
|---|---|---|---|---|---|
| MH-1 | 48 | 10055971.09 | 3144434.01 | 426.80 | 426.60 |
| MH-2 | 48 | 10055955.20 | 3144358.40 | 428.48 | 428.28 |
| MH-3 | 48 | 10055999.37 | 3144274.50 | 430.36 | 430.16 |
| MH-4 (EXT DROP) | 48 | 10055960.21 | 3144253.88 | 437.44 | 431.16 |
| DR TIE-IN | 2 | 10055994.94 | 3144448.38 | 437.50 | |

NOTES:
1. CONTRACTOR SHALL FIELD VERIFY EXISTING 10" TF AND 12" NPW PIPELINES TO OBTAIN ELEVATION REQUIRED FOR PROPOSED TIE-INS.
2. CONTRACTOR SHALL FIELD VERIFY EXISTING UG ELEC. DUCTBANK, 6" TSL, 8" DSL, 12" PW, AND 12" NPW PIPELINE CROSSINGS.
3. MAINTAIN MIN. 24" VERTICAL CLEARANCE WITH PROPOSED 6" DRAIN AND 8" ARF INFLUENT / EFFLUENT PIPES. MAINTAIN MIN. 12" VERTICAL CLEARANCE WITH PROPOSED 2½" NPW PIPES. CONTRACTOR SHALL IMMEDIATELY INFORM ENGINEER OF ANY CONFLICTS AT CROSSINGS.
4. INSTALL 6" DRAIN PIPE WITH 66" MINIMUM COVER.
5. INSTALL 8" ARF INFLUENT / EFFLUENT PIPE WITH 48" MINIMUM COVER.
6. INSTALL 2½" NPW PIPES WITH 30" MINIMUM COVER.
7. CONNECT PROPOSED 10" ARF EFFLUENT PIPELINE TO EXISTING 10" TF PIPELINE USING A RESTRAINED FLANGE ADAPTER.
8. LOCATE AND CONNECT TO EXISTING 6" DR PIPE STUB FROM EXISTING BFP EFFLUENT LIFT STATION INFLUENT LINE. 1
9. USE 6" NPW CONNECTION FOR TEMPORARY START-UP WATER CONNECTION ONLY. AFTER START-UP, CONNECT NEW 2½" NPW SYSTEM VIA REDUCER TO 6" GV.
10. REFER SHEET 02-C-115 FOR PAVING PLAN AND SHEETS 01-C-510, 01-C-511 FOR PAVING DETAIL.
11. ALL NPW PIPES AND OUTLETS SHALL BE IDENTIFIED AS NON-POTABLE PER CHAPTER 15-1-13 OF THE CROSS CONNECTION REGULATION ORDINANCE.

## POINTS TABLE

| NO. | NORTHING | EASTING | DESCRIPTION |
|---|---|---|---|
| A | 10055790.66 | 3144240.19 | 2" YARD HYDRANT |
| B | 10055806.20 | 3144215.69 | 8" 90° VERTICAL BEND |
| C | 10055841.04 | 3144149.75 | 8" 45° HORIZONTAL BEND |
| D | 10055845.49 | 3144148.31 | 8" 45° HORIZONTAL BEND |
| E | 10055934.98 | 3144343.02 | 2" YARD HYDRANT |
| F | 10055955.42 | 3144338.95 | 8" 90° VERTICAL BEND |
| G | 10055939.66 | 3144292.35 | NPW TIE-IN POINT |
| H | 10055999.58 | 3144420.24 | 2" YARD HYDRANT |
| I | 10056020.18 | 3144240.21 | 8" 45° HORIZONTAL BEND |
| J | 10056021.46 | 3144243.93 | 8" 45° HORIZONTAL BEND |
| K | 10055974.65 | 3144332.81 | 8" 45° HORIZONTAL BEND |
| L | 10055978.84 | 3144346.10 | 8" 45° HORIZONTAL BEND |

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| ADDENDUM 1 | BR | SPK | 2026.07.22 |

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|---|---|---|---|

Permit/Seal

STATE OF TEXAS
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PROFESSIONAL ENGINEER
07/22/2026

Client/Project
CITY OF AUSTIN
HORNSBY BEND BMP PROCESS AMMONIA REMOVAL FACILITY
AUSTIN, TX

Project No.: 177311636
File Name: 02-C-101
Scale: 1" = 15'

| BR | BR/AJS | SPK | 2026.07.22 |
|---|---|---|---|
| Dwn. | Dsgn. | Chkd. | YYYY.MM.DD |

Title
CIVIL
ARF YARD PIPING PLAN

Revision: Sheet: 63 of 229
Drawing No.
02-C-101

ORIGINAL SHEET - ANSI D

## CONCRETE REPAIR

1. THE MANUFACTURER OF THE SPECIFIED PRODUCT SHALL BE ISO 9001/9002 CERTIFIED AND HAVE IN EXISTENCE A RECOGNIZED ONGOING QUALITY ASSURANCE PROGRAM INDEPENDENTLY AUDITED ON A REGULAR BASIS.
2. CONTRACTOR SHALL BE QUALIFIED IN THE FIELD OF CONCRETE REPAIR AND PROTECTION WITH A SUCCESSFUL TRACK RECORD OF 5 YEARS OR MORE. CONTRACTOR SHALL MAINTAIN QUALIFIED PERSONNEL WHO HAVE RECEIVED PRODUCT TRAINING BY A MANUFACTURER'S REPRESENTATIVE.
3. INSTALL MATERIALS IN ACCORDANCE WITH ALL SAFETY AND WEATHER CONDITIONS REQUIRED BY THE MANUFACTURER, OR AS MODIFIED BY APPLICABLE RULES AND REGULATIONS OF LOCAL, STATE AND FEDERAL AUTHORITIES HAVING JURISDICTION. CONSULT MATERIAL SAFETY DATA SHEETS FOR COMPLETE HANDLING RECOMMENDATIONS.
4. ALL MATERIALS MUST BE DELIVERED IN ORIGINAL, UNOPENED CONTAINERS WITH THE MANUFACTURER'S NAME, LABELS, PRODUCT IDENTIFICATION, AND BATCH NUMBERS. DAMAGED MATERIAL MUST BE REMOVED FROM THE SITE IMMEDIATELY.
5. STORE ALL MATERIALS OFF THE GROUND AND PROTECT FROM RAIN, FREEZING OR EXCESSIVE HEAT UNTIL READY FOR USE.
6. CONDITION THE SPECIFIED PRODUCT AS RECOMMENDED BY THE MANUFACTURER.
7. ENVIRONMENTAL CONDITIONS: DO NOT APPLY MATERIAL IF IT IS RAINING OR SNOWING OR IF SUCH CONDITIONS APPEAR TO BE IMMINENT. MINIMUM APPLICATION TEMPERATURE 40ºF (5ºC) AND RISING.
8. PRECAUTIONS SHOULD BE TAKEN TO AVOID DAMAGE TO ANY SURFACE NEAR THE WORK ZONE DUE TO MIXING AND HANDLING OF THE SPECIFIED PRODUCT.
9. SUBMIT TWO COPIES OF MANUFACTURER'S LITERATURE, TO INCLUDE: PRODUCT DATA SHEETS, AND APPROPRIATE MATERIAL SAFETY DATA SHEETS (MSDS).
10. PROVIDE A WRITTEN WARRANTY FROM THE MANUFACTURER AGAINST DEFECTS OF MATERIALS FOR A PERIOD OF ONE (1) YEAR, BEGINNING WITH DATE OF SUBSTANTIAL COMPLETION OF THE PROJECT.
11. GENERAL SURFACE PREPARATION SHALL INCLUDE THE FOLLOWING:
    - A. AREAS TO BE REPAIRED MUST BE CLEAN, SOUND, AND FREE OF CONTAMINANTS. ALL LOOSE AND DETERIORATED CONCRETE SHALL BE REMOVED BY MECHANICAL MEANS. MECHANICALLY PREPARE THE CONCRETE SUBSTRATE TO OBTAIN AN EXPOSED AGGREGATE SURFACE WITH A MINIMUM SURFACE PROFILE OF +/- 1/8 IN. (CSP 7-8 PER ICRI GUIDELINES). SATURATE SURFACE WITH CLEAN WATER. SUBSTRATE SHOULD BE SATURATED SURFACE DRY (SSD) WITH NO STANDING WATER DURING APPLICATION. AREA TO BE PATCHED SHALL NOT BE LESS THAN 3/4 IN. IN DEPTH.
    - B. WHERE REINFORCING STEEL WITH ACTIVE CORROSION IS ENCOUNTERED, SANDBLAST THE STEEL TO A WHITE METAL FINISH TO REMOVE ALL CONTAMINANTS AND RUST. WHERE CORROSION HAS OCCURRED DUE TO THE PRESENCE OF CHLORIDES, THE STEEL SHALL BE HIGH PRESSURE WASHED AFTER MECHANICAL CLEANING. PRIME STEEL WITH 2 COATS OF SIKA ARMATEC 110 EPOCEM AS DIRECTED BY MANUFACTURER. (SEE SPEC COMPONENT SC-201-0699)
    - C. CONSULT PRODUCT SPECIFICATION FOR PRODUCT-SPECIFIC REQUIREMENTS OF SURFACE PREPARATION.
12. PRIOR TO REPAIR, CONTRACTOR SHALL RECEIVE TRAINING FROM PRODUCT MANUFACTURER.
13. WHERE REMOVAL OF ANCHORED ITEMS IN CONCRETE IS REQUIRED:
    - A. AFTER REMOVING ITEMS AS DIRECTED, CUT AND REMOVE ANCHORS DOWN 3/4" BELOW SURFACE OF CONCRETE. SANDBLAST ANCHORS AND EXPOSED REBAR TO A WHITE METAL FINISH TO REMOVE ALL CONTAMINANTS AND RUST. WHERE CORROSION HAS OCCURRED DUE TO THE PRESENCE OF CHLORIDES, THE STEEL SHALL BE HIGH PRESSURE WASHED AFTER MECHANICAL CLEANING. PRIME STEEL WITH 2 COATS OF SIKA ARMATEC 110 EPOCEM AS DIRECTED BY MANUFACTURER. FILL IN DAMAGED AREA OF CONCRETE WITH APPROVED EPOXY GROUT, MATCH EXISTING SURFACE FINISH.
14. WHERE EPOXY RESIN ADHESIVE FOR PRESSURE INJECTION OF CRACKS AND SEALING OF CRACKS AND PORTING DEVICES IS SPECIFIED:
    - A. THE COMPONENTS AND MIXING RATIOS SHALL BE IN STRICT COMPLIANCE WITH THE MANUFACTURER SPECIFICATIONS. THE MATERIALS SHALL NOT CONTAIN ASBESTOS.
    - B. PORTING DEVICES AS REQUIRED FOR EITHER MANUAL OR AUTOMATED APPLICATION SHALL BE SUPPLIED FROM MANUFACTURER OF THE PRESSURE INJECTION EQUIPMENT. LOCATE THE PORTING DEVICES AS REQUIRED BY THE EQUIPMENT MANUFACTURER.
    - C. ON STRUCTURES OPEN ON BOTH SIDES, PROVIDE PORTING DEVICES ON OPPOSITE SIDES AT STAGGERED ELEVATIONS.
    - D. APPLY THE EPOXY RESIN ADHESIVE FOR SEALING IN SUCH A MANNER THAT MINIMIZE DEFACING AND DISCOLORATION OF THE SUBSTRATE.
    - E. IF PENETRATION OF ANY CRACKS IS IMPOSSIBLE, CONSULT THE ENGINEER BEFORE DISCONTINUING THE INJECTION PROCEDURE. IF MODIFICATION OF THE PROPOSED PROCEDURE IS REQUIRED TO FILL THE CRACKS, SUBMIT MODIFICATION IN WRITING TO THE ENGINEER FOR ACCEPTANCE PRIOR TO PROCEEDING.
    - F. AFTER THE EPOXY RESIN ADHESIVE FOR GROUTING HAS CURED, THE EPOXY RESIN ADHESIVE FOR SEALING CRACKS AND PORTING DEVICES SHALL BE REMOVED AS REQUIRED BY THE ENGINEER. CLEAN THE SUBSTRATE IN A MANNER TO PRODUCE A FINISH APPEARANCE ACCEPTABLE TO THE ENGINEER AND OWNER.

## VAPOR BARRIER NOTES

1. A VAPOR BARRIER SHALL BE PLACED UNDER THE CONCRETE SLAB FOR THE BLOWER BUILDING. THE VAPOR BARRIER SHALL CONSIST OF A POLYETHYLENE OR POLYOLEFIN RESIN GEOMEMBRANE THAT MEETS THE FOLLOWING REQUIREMENTS:
    - A. MEET OR EXCEED THE CLASS A REQUIREMENTS OF ASTM E1745
    - B. WATER VAPOR TRANSMISSION RATE (WVTR) OF 0.006 GRAINS (0.012 PERMS) OR LESS PER SQUARE FOOT IN ACCORDANCE WITH ASTM E96
    - C. MINIMUM PUNCTURE RESISTANCE OF 2445 GRAMS IN ACCORDANCE WITH ASTM D1709
    - D. MINIMUM TENSILE STRENGTH OF 76.6 PLF/INCH IN ACCORDANCE WITH ASTM D882
    - E. MINIMUM THICKNESS OF 15 MILS
2. ACCEPTABLE PRODUCT IS STEGO WRAP CLASS A VAPOR BARRIER BY STEGO INDUSTRIES LLC, SAN JUAN CAPISTRANO, CALIFORNIA, OR APPROVED EQUAL.
3. VAPOR BARRIER SHALL BE INSTALLED IN STRICT ACCORDANCE WITH THE MANUFACTURER'S INSTRUCTIONS AND RECOMMENDATIONS. SPECIAL ATTENTION SHALL BE PAID TO THE VAPOR BARRIER INSTALLATION AT PIPE AND CONDUIT PENETRATIONS.
4. LAP JOINTS IN VAPOR BARRIER A MINIMUM OF 6 INCHES AND SEAL CONTINUOUSLY WITH A PRESSURE SENSITIVE, HIGH-DENSITY POLYETHYLENE TAPE MANUFACTURED SPECIFICALLY FOR THE USE OF SEALING VAPOR BARRIER LAPS. THE TAPE SHALL MEET THE FOLLOWING REQUIREMENTS:
    - A. WATER VAPOR TRANSMISSION RATE (WVTR) OF 0.3 PERMS OR LESS PER SQUARE FOOT IN ACCORDANCE WITH ASTM E96
    - B. MINIMUM TAPE WIDTH OF 4 INCHES
5. THE VAPOR BARRIER SHALL BE CONTINUOUS UNDER THE MAT SLAB. THE VAPOR BARRIER SHALL BE INSTALLED SMOOTH AND LEVEL. BUNCHING WILL NOT BE PERMITTED AND SHALL BE CORRECTED PRIOR TO CONCRETE PLACEMENT.

## VAPOR BARRIER NOTES (CONT)

6. CAREFULLY INSPECT VAPOR BARRIER FOR DAMAGE, TEARS OR PENETRATIONS PRIOR TO CONCRETE PLACEMENT. ALL DAMAGED AREAS SHALL BE REPAIRED BY CUTTING PATCHES OF VAPOR BARRIER, OVERLAPPING DAMAGED AREA 6 INCHES AND TAPING ALL EDGES.

## CONSTRUCTION JOINT (CJ) NOTES

1. LOCATE JOINTS NOT SHOWN ON DRAWINGS AS TO LEAST IMPAIR THE STRENGTH OF THE STRUCTURE. SUBMIT PROPOSED JOINT LAYOUTS FOR REVIEW BY THE ENGINEER.
2. IN GENERAL, LOCATE JOINTS NEAR THE MIDDLE OF THE SPAN FOR SLABS, BEAMS AND GIRDERS UNLESS A BEAM INTERSECTS A GIRDER AT THIS POINT. IN THIS CASE, OFFSET THE JOINT A DISTANCE EQUAL TO TWICE THE WIDTH OF THE BEAM AND INSTALL HORIZONTAL KEYWAYS NEAR THE TOP AND BOTTOM OF THE JOINT.
3. LOCATE HORIZONTAL JOINTS IN WALLS AND COLUMNS AT THE UNDERSIDE OF FLOOR SLABS, BEAMS AND GIRDERS, AND AT THE TOP OF FOOTINGS AND FLOOR SLABS. PLACE BEAMS AND GIRDERS AT THE SAME TIME AS THE FLOOR SLABS.
4. LOCATE JOINTS PERPENDICULAR TO THE MAIN REINFORCING STEEL. CONTINUE REINFORCING STEEL ACROSS JOINT AS DETAILED.

## SPECIAL CONSTRUCTION JOINT REQUIREMENTS

1. IN ADDITION TO THE REQUIREMENTS STATED ABOVE, THE FOLLOWING REQUIREMENTS SHALL APPLY.
2. BASIN MAT SLABS: IN ENVIRONMENTAL STRUCTURES: CONSTRUCTION JOINTS SHALL BE SPACED AT A MAXIMUM OF 35 FT OR APPROVED BY ENGINEER OF RECORD.
3. WALLS IN ENVIRONMENTAL STRUCTURES: CONSTRUCTION JOINTS SHALL BE SPACED AT A MAXIMUM OF 35 FT ON CENTER AND NO FARTHER THAN 15 FT FROM ANY WALL INTERSECTION.
4. CONTRACTOR MUST SUBMIT MONOLITH DRAWINGS, INDICATING LOCATION OF ALL PROPOSED CONCRETE JOINTS, FOR REVIEW AND APPROVAL BY ENGINEER PRIOR TO THE START OF ANY CONCRETE. REFER TO SPECS FOR ADDITIONAL INFORMATION TO BE INCLUDED.
5. CONSTRUCTION JOINTS IN ALL ENVIRONMENTAL STRUCTURES SHALL BE PROVIDED WITH CONTINUOUS RIBBED WATERSTOP AS DETAILED.
6. BUILDING SLABS ON GRADE: CONSTRUCTION JOINTS SHALL BE SPACED SO THAT NO MORE THAN 4000 SQ FT OF SLAB AREA IS PLACED IN A SINGLE POUR.
7. BUILDING SUSPENDED SLABS AND BEAMS: CONSTRUCTION JOINTS SHALL BE SPACED AT A MAXIMUM 80 FT ON CENTER IN ANY DIRECTION AND SO THAT NO MORE THAN 4000 SQ. FT OF SLAB AREA IS PLACED IN A SINGLE POUR.

## STRUCTURAL STEEL NOTES

1. STRUCTURAL STEEL SHALL CONFORM TO AISC "SPECIFICATION FOR STRUCTURAL STEEL BUILDINGS", ANSI/AISC 360-22.
2. ALL W, S, M HOT-ROLLED STRUCTURAL SHAPES SHALL CONFORM TO ASTM A992/A992M-22. ALL OTHER STRUCTURAL STEEL SHALL CONFORM TO THE ASTM A36/A36M-19 UNLESS OTHERWISE SHOWN OR NOTED.
3. ALL HSS STRUCTURAL STEEL SHALL CONFORM TO ASTM A500/A500M-21A, GRADE C. ALL STRUCTURAL STEEL PIPE (NON-HSS) SHALL CONFORM TO ASTM A53/A53M-22, GRADE B.
4. ALL STAINLESS-STEEL SHAPES SHALL CONFORM TO ASTM A276/A276M-17, AND/OR A479/A479M-21, TYPE 316L, UNLESS OTHERWISE SHOWN OR NOTED. ALL STAINLESS-STEEL PLATE, SHEET, OR STRIP SHALL CONFORM TO ASTM A666-15 OR A240/A240M-22B.
5. ALL STRUCTURAL STEEL SHALL BE DESIGNED, FABRICATED AND ERECTED IN ACCORDANCE WITH THE LATEST SPECIFICATIONS OF THE AMERICAN INSTITUTE OF STEEL CONSTRUCTION AND THE STEEL JOIST INSTITUTE.
6. ALL BOLTS AND BOLTED CONNECTIONS SHALL CONFORM TO THE REQUIREMENTS OF THE "STANDARD SPECIFICATION FOR HIGH STRENGTH STRUCTURAL BOLTS AND ASSEMBLIES, STEEL AND ALLOY STEEL, HEAT TREATED, INCH DIMENSIONS 120 KSI AND 150 KSI MINIMUM TENSILE STRENGTH, AND METRIC DIMENSIONS 830 MPA AND 1040 MPA MINIMUM TENSILE STRENGTH" ASTM F3125/F3125M-22, WHICH HAS REPLACED ASTM A325/325M, A490/A490M, F1852, AND F2280. APPROVED BY THE RESEARCH COUNCIL ON STRUCTURAL CONNECTIONS. CONNECTIONS SHALL BE BEARING TYPE UNLESS NOTED OTHERWISE IN DRAWINGS. ALL STRUCTURAL BOLTS SHALL CONFORM TO GRADE A325, TYPE 1 UNLESS OTHERWISE SHOWN OR NOTED. FURNISH HARDENED WASHERS AT ALL BOLTED CONNECTIONS, INCLUDING ANCHOR BOLTS.
7. ALL STAINLESS-STEEL BOLTS AND EXPANSION ANCHORS SHALL CONFORM TO ASTM F593-22, TYPE 316 AND ALL NUTS SHALL CONFORM TO ASTM F594-22, TYPE 316.
8. GALVANIZING –
    - A. GALVANIZING OF STEEL MEMBERS SHALL CONFORM TO ASTM A123/A123M-17. ALL STEEL FRAMING THAT COMES IN CONTACT WITH PRESSURE TREATED WOOD SHALL BE COATED TO A G90 THICKNESS AND ALL BOLTS, HEADED STUDS AND CONNECTORS SHALL BE COATED TO A G185 THICKNESS.
    - B. ALL EXPOSED STEEL SHALL BE GALVANIZED. REFER TO ARCH FOR ADDITIONAL PAINT AND FINISH REQUIREMENTS.
    - C. ALL MINOR DAMAGE TO GALVANIZED STEEL, DUE TO WELDING AND OTHERS, SHALL BE PROMPTLY REPAIRED USING ZRC COLD GALVANIZING COMPOUND OR APPROVED EQUAL.
9. REFER TO ARCHITECTURAL, MECHANICAL, HVAC AND ELECTRICAL PLANS FOR VERIFICATION OF ALL BOLTS, BLOCKING ANCHORS, ETC, FOR THE ANCHORAGE OF THEIR RESPECTIVE ITEMS.
10. ALL BEAMS AND COLUMNS SHALL BE FULL LENGTH WITHOUT SPLICES UNLESS OTHERWISE INDICATED ON PLANS.
11. ALL STRUCTURAL STEEL DETAILS AND CONNECTIONS SHALL CONFORM TO THE STANDARDS OF THE AISC.
12. CONTRACTORS SHALL PROVIDE THE DESIGN FOR ALL STEEL CONNECTIONS NOT COMPLETELY DEFINED ON THE DRAWINGS. CONTRACTOR SHALL RETAIN A PROFESSIONAL ENGINEER LICENSED IN THE STATE OF TEXAS TO DESIGN SUCH CONNECTIONS. CONNECTION DESIGNS SHALL BE SUBMITTED TO THE ENGINEER FOR REVIEW. REFER TO DRAWINGS FOR ADDITIONAL INFORMATION.
13. ALL STEEL BEAMS SHALL BE ERECTED WITH THEIR NATURAL CAMBER UP.
14. ALL SHOP AND FIELD WELDS SHALL BE MADE BY WELDERS WHO HAVE BEEN QUALIFIED AND CERTIFIED TO MAKE THE REQUIRED WELDS WITHIN THE PREVIOUS SIX MONTHS IN ACCORDANCE WITH THE LATEST AMERICAN WELDING SOCIETY SPECIFICATIONS AWS D1.1. ELECTRODES FOR FIELD AND SHOP WELDS SHALL BE E70XX, UNLESS NOTED OTHERWISE. FOR ELECTRODES USED ON AISI 316L TO AISI 316L USE AWS E-316L.
15. FULL AND PARTIAL PENETRATION WELDS PERFORMED IN THE FIELD SHALL BE ULTRASONICALLY TESTED.
16. ERECTION CONNECTORS SHALL BE PROVIDED IN ORDER TO PROPERLY ALIGN MEMBERS AND BE TRUE AND PLUMB WHEN WELDS ARE MADE.
17. SHOP DRAWINGS SHALL BE PREPARED FOR ALL STRUCTURAL STEEL AND SUBMITTED FOR REVIEW BY ENGINEER. ENGINEERING DRAWINGS SHALL NOT BE REPRODUCED AND USED AS SHOP DRAWINGS.

## STEEL STRUCTURAL NOTES (CONT)

18. THE STEEL FABRICATOR IS RESPONSIBLE FOR COORDINATION WITH THE MANUFACTURER OF STEEL JOISTS AND JOIST GIRDERS.
19. TEMPORARY SUPPORTS, SUCH AS TEMPORARY GUYS, BRACES, FALSEWORK, CRIBBING OR OTHER ELEMENTS REQUIRED FOR THE ERECTION OPERATION WILL BE DETERMINED, FURNISHED, AND INSTALLED BY THE ERECTOR. THESE TEMPORARY SUPPORTS SHALL BE CAPABLE OF SECURING THE STEEL FRAMING, OR ANY PARTLY ASSEMBLED STEEL FRAMING, AGAINST LOADS COMPARABLE IN INTENSITY TO THOSE FOR WHICH THE STRUCTURE WAS DESIGNED, RESULTING FROM WIND, SEISMIC FORCES AND ERECTION OPERATIONS.
20. THE LIFTING AND ERECTION OF PRE-ASSEMBLED ELEMENTS SUCH AS TRUSSES OR PREFABRICATED FRAMING ARE CONSIDERED SPECIAL ERECTION CONDITIONS. THE SELECTION OF LIFT POINTS AND ERECTION TECHNIQUES ARE THE RESPONSIBILITY OF THE CONTRACTOR. LOCATE AND PROVIDE SUFFICIENT LIFT POINTS TO PREVENT OVERSTRESS AND/OR DISTORTION OF ANY COMPONENTS WITHIN THE ASSEMBLY. PROVIDE TEMPORARY STRONG-BACKS, STIFFENERS AND/OR LIFTING DEVICES AS REQUIRED.
21. THE CONTRACTOR SHALL COMPLY WITH OSHA REQUIREMENTS FOR STEEL ERECTION.
    - A. WHERE PERIMETER SAFETY CABLES ARE REQUIRED:
        - a. CABLES MAY BE ATTACHED TO PERIMETER TUBE AND PIPE COLUMNS WITH STEEL DEVICES (PLATES, CLIPS, ETC.) WELDED TO THE COLUMNS.
        - b. AT WIDE FLANGE COLUMNS, HOLES, UP TO 1" DIAMETER, MAY BE DRILLED IN THE WEB OR FLANGE AT 42" TO 45" ABOVE THE FINISHED FLOOR AND AT THE MIDPOINT BETWEEN THE FINISHED FLOOR AND THE TOP CABLE, TO PERMIT INSTALLATION OF THE PERIMETER CABLE SYSTEM.
        - c. THE DESIGN OF ATTACHMENTS, THE PERIMETER CABLE SYSTEM AND ANCHORAGE TO THE STRUCTURE IS THE RESPONSIBILITY OF THE CONTRACTOR.
    - B. PRIOR TO ERECTION OF STEEL, THE CONTRACTOR SHALL PROVIDE TO THE STEEL ERECTOR, ON THE BASIS OF APPROPRIATE ASTM STANDARD TEST METHODS OF FIELD CURED SAMPLES, VERIFICATION THAT THE FOUNDATIONS, PIERS, WALLS, AND MASONRY HAVE ACHIEVED SUFFICIENT STRENGTH PER OSHA REQUIREMENTS.
22. PROVIDE ELECTRICALLY INERT BARRIER BETWEEN DISSIMILAR METALS TO AVOID CONTACT CORROSION.
23. ALL RAILING AND THEIR CONNECTIONS SHALL BE ALUMINUM. WHERE DISSIMILAR METALS CONNECT REFER TO #22 ABOVE.

## MONOLITHIC DRAWINGS

1. CONTRACTOR MUST SUBMIT MONOLITHIC DRAWINGS FOR ALL CONCRETE WORK, IN 2D OR ISOMETRIC VIEW. EACH DRAWING SHALL CLEARLY IDENTIFY, LOCATE AND DIMENSION THE FOLLOWING:
    - A. CONTROL, CONSTRUCTION, CONTRACTION AND EXPANSION JOINTS, AS DERIVED FROM THE DIRECTIONS IN CONSTRUCTION JOINT NOTES. ALL JOINTS ADDED, DELETED OR MOVED FROM THE DESIGN DRAWINGS SHALL BE CLEARLY IDENTIFIED.
    - B. ALL REBAR LAYOUTS ASSOCIATED WITH JOINT LOCATIONS.
    - C. EMBED ITEMS
    - D. ALL CONCRETE PENETRATIONS
    - E. WATERSTOPS
    - F. KEY ELEVATIONS
    - G. ELECTRICAL CONDUIT
    - H. ALL OTHER ITEMS LOCATED IN OR PASSING THROUGH THE CONCRETE

## METAL STAIRS

1. METAL STAIRS ARE A PRE-ENGINEERED SYSTEM THAT SHALL BE DESIGNED AND ENGINEERED BY THE SUPPLIER PER IBC 2024 SECTION 1011 AND CHAPTER 16. METAL STAIRS ARE DEFERRED SUBMITTAL AND TO BE HANDLED PER IBC 2024 107.3.4.1. THE METAL STAIR SYSTEM INCLUDES ALL COMPONENTS OF THE STAIRS (TREADS, STRINGERS, LANDINGS (INTERMEDIATE AND AT FLOOR LEVEL), RAILINGS, ETC), AND ALL SUPPORT/CONNECTION DEVICES (HANGERS, POSTS AND COLUMNS TO CARRY LANDING BEAMS OR HORIZONTAL FRAMING, CLIPS, ANCHORAGES, ETC).
2. REFER TO ARCHITECTURAL DRAWINGS FOR MATERIALS, CONFIGURATIONS, DIMENSIONS, DESIGNS, EXTENT AND FINISHES. COORDINATE FIT OF STAIR SYSTEM WITH THE ROUGH OPENINGS SHOWN ON THE STRUCTURAL DOCUMENTS.
3. THE STRUCTURAL DESIGN SHALL BE PERFORMED BY AN ENGINEER THAT IS LEGALLY QUALIFIED (LICENSED OR REGISTERED) TO PRACTICE IN THE JURISDICTION WHERE THIS PROJECT IS LOCATED, AND WHO IS EXPERIENCED IN THE DESIGN OF METAL STAIRS AND HANDRAIL SYSTEMS. SUBMITTALS WHICH DO NOT BEAR THE SEAL AND SIGNATURE OF THE SPECIALTY ENGINEER WILL BE RETURNED REJECTED.
4. THE STRUCTURAL DESIGN SHALL BE IN CONFORMANCE WITH THE LOCAL BUILDING CODE AS NOTED IN THE GENERAL NOTES FOR THIS PROJECT, WITH THE AISC SPECIFICATION FOR STRUCTURAL STEEL BUILDINGS, AND WITH THE AISC CODE OF STANDARD PRACTICE.
5. THE STAIR SYSTEM SHALL BE DESIGNED TO MEET THE FOLLOWING MINIMUM PERFORMANCE CRITERIA (REFER TO SPECIFICATIONS FOR ADDITIONAL, SPECIAL OR MORE RESTRICTIVE CRITERIA):
    - A. UNIFORM LIVE LOAD: ------------------------ 100 PSF
    - B. CONCENTRATED LIVE LOAD: ------------- 300 LBS (OVER 4 SQ. IN.)
    - C. MAX. LIVE LOAD DEFLECTION: ------------ L/480.
    - D. MAX. TOTAL LOAD DEFLECTION: ---------- L/360.
6. POST INSTALLED ANCHORAGES TO MASONRY WALLS SHALL BE LIMITED TO THE USE OF ADHESIVE ANCHORING SYSTEMS INSTALLED IN FULLY GROUTED CELLS. EXPANSION AND SCREW ANCHORS WILL BE ALLOWED IN CONCRETE ONLY. SEE POST-INSTALLED REBARS AND ANCHOR NOTES. ANCHORS SHALL BE CLOSELY COORDINATED WITH THE PLACEMENT OF REINFORCING STEEL. TO THE GREATEST EXTENT POSSIBLE, ANCHORAGES SHALL BE LIMITED TO SHEAR CONDITIONS ONLY. ANCHORAGES IN TENSION SHALL BE AVOIDED.
7. ALL RAILING AND THEIR CONNECTIONS SHALL BE ALUMINUM. WHERE DISSIMILAR METALS CONNECT REFER TO #22 IN STRUCTURAL STEEL NOTES ON THIS PAGE.

## METAL STAIRS (CONT)

8. ENGINEER'S REVIEW OF STAIR SHOP DRAWINGS WILL BE LIMITED TO THE INTERFACE BETWEEN STAIR SYSTEM AND BUILDING STRUCTURE. THIS REVIEW WILL CHECK THE COMPATIBILITY OF LOADS AND POSITIONS OF LOADS IMPARTED ONTO THE BUILDING STRUCTURE, AND COMPATIBILITY OF THE CONNECTIONS WITH THE BUILDING STRUCTURE. THE STRUCTURAL ENGINEER RESPONSIBLE FOR THE DESIGN OF THE STAIR SYSTEM WILL RETAIN ALL RIGHTS AND RESPONSIBILITIES FOR THE DESIGN OF THE STAIRS AND THE CONNECTIONS TO THE BUILDING STRUCTURE. SHOP DRAWINGS SHALL CLEARLY IDENTIFY THE FOLLOWING:
    - A. PROJECT IDENTITY AND LOCATION
    - B. SUPPLIER/FABRICATOR IDENTITY AND ADDRESS
    - C. ENGINEERS IDENTITY AND ADDRESS
    - D. CONFORMANCE WITH THE APPLICABLE BUILDING CODES.
    - E. DESIGN LOADING CRITERIA.
    - F. DESIGN DEFLECTION CRITERIA.
    - G. CONNECTIONS TO THE STRUCTURE (CLEARLY IDENTIFIED AND DETAILED).
    - H. CONCENTRATED LIVE LOAD USED IN DESIGN
    - I. MAX. LIVE LOAD DEFLECTION IN INCHES AND COMPARED TO L/480
    - J. MAX. TOTAL LOAD DEFLECTION IN INCHES AND COMPARED TO L/360
    - K. SHOP DRAWINGS SHALL BEAR THE SEAL AND SIGNATURE OF THE ENGINEER RESPONSIBLE FOR THE DESIGN OF THE STAIR SYSTEM. SUBMITTALS WHICH DO NOT BEAR THE SEAL AND SIGNATURE OF THE SPECIALTY ENGINEER WILL BE RETURNED REJECTED.

## PRE-ENGINEERED METAL BUILDING NOTES

1. SEE PRE-ENGINEERED METAL BUILDING MANUFACTURER'S DRAWINGS FOR ROOF METAL DECK, PURLINS, AND FRAMING.
2. THE GENERAL CONTRACTOR SHALL PROVIDE AND SET ANCHOR BOLTS AND EMBED PLATES PER PRE-ENGINEERED METAL BUILDING MANUFACTURER'S DRAWINGS.
3. THE CONTRACTOR SHALL COMPARE STRUCTURAL DRAWINGS WITH PRE-ENGINEERED METAL BUILDING MANUFACTURER'S DRAWINGS AND REPORT ANY DISCREPANCY TO THE ENGINEER PRIOR TO FABRICATION OR INSTALLATION OF STRUCTURAL MEMBERS.
4. PRE-ENGINEERED METAL BUILDING SHOP DRAWINGS (PLANS, DETAILS, CALCULATIONS) SHALL BEAR THE SEAL OF A REGISTERED PROFESSIONAL ENGINEER IN THE STATE OF THE PROJECT.
5. PRE-ENGINEERED METAL BUILDING SYSTEMS SHALL BE DESIGNED AS PINNED CONNECTIONS AT THE BASE OF ALL COLUMNS AND POSTS.
6. PRE-ENGINEERED METAL BUILDING DESIGN LOADS SHALL BE AS FOLLOWS:
    - A. WIND: SEE GENERAL NOTES
      LATERAL DEFLECTION LIMIT H/240
    - B. GRAVITY: ROOF LIVE LOAD: SEE DESIGN CRITERIA
      ROOF DEAD LOAD: STRUCTURE WEIGHT + 15 PSF
      DEFLECTION LIMITS: LL = L/360
      TOTAL = L/240
7. PRE-ENGINEERED METAL BUILDING MANUFACTURER IS RESPONSIBLE FOR THE DESIGN OF ALL CONCRETE ANCHORAGE AT THE BUILDING FOUNADTION INTERFACE.

## SUBGRADE PREPARATION

1. ALL SUBGRADE SHALL BE PREPARED IN STRICT CONFORMANCE TO THE GEOTECHNICAL ENGINEER'S RECOMMENDATIONS. THE FOLLOWING PARAGRAPHS ARE EXCERPTS FROM THE GEOTECHNICAL REPORT. REFER TO THE GEOTECHNICAL REPORT, SUPPLEMENTARY LETTERS AND SPECIFICATIONS FOR ADDITIONAL INFORMATION.
2. "PROVIDE A LEVELING COURSE OR WORK SURFACE (FOR THE ATP AND EQ BASINS AND VALVE VAULTS), A GRAVEL PAD CONSISTING OF ONE-INCH DIAMETER UNIFORMLY GRADED CRUSHED ROCK OR WASHED GRAVEL WITH A MINIMUM THICKNESS OF 12 INCHES MAY BE PLACED ON THE EXPOSED LEAN CLAY UNDER THE SLAB. THE GRAVEL SHOULD BE A ONE-INCH DIAMETER UNIFORMLY GRADED CRUSHED ROCK OR WASHED GRAVEL. A VAPOR BARRIER SHOULD BE PLACED OVER THE GRAVEL BLANKET AND BELOW THE BASIN [...]. [SUBGRADE WALL] TRENCHES SHALL BE BACKFILLED WITH A WELL GRADED, LOW PI (3 TO 18) MATERIAL MEETING THE GEOTECHNICAL SELECT FILL SPECIFICATIONS OR CITY OF AUSTIN ITEM 210 FLEXIBLE BASE MATERIAL.[...] IT IS IMPORTANT THAT BACKFILL AGAINST THE BASIN WALLS BE COMPACTED IN SHALLOW 8-INCH LIFTS AND TESTING BY THE TESTING LABORATORY TO ASSURE DIFFERENTAIL SETTLEMENT IS WITHIN AN ACCEPTABLE TOLERANCE WITH A MINIMUM WIDTH OF 36 INCHES TO WITHIN 24 INCHES OF THE FINISHED GRADE. THE FINAL 24 INCHES SHOULD BE BACKFILLED WITH A CLAY TOPSOIL. THE BACKFILL SHOULD BE COMPACTED IN 8-INCH LIFTS TO A MINIMUM OF 95% OF THE OPTIMUM DRY DENSITY IN ACCORDANCE WITH TXDOT TEST METHOD TEX-113-E. MOISTURE CONTENT SHOULD BE WITHIN 3% OF OPTIMUM. THE BUILDING PAD SHOULD BE PREPARED BY REMOVING ALL FILL MATERIAL AND ALL BROWN, LIGHT BROWN, AND REDDISH-BROWN LEAN CLAY AND ANY ORGANICS TO THE REQUIRED BASIN AND VAULT DEPTHS."
    - A. STRUCTURAL DETAILS SHOW A 4" THICK SEAL SLAB IN LIEU OF THE ABOVE RECOMMENDED 12" GRAVEL PAD CONSISTING OF ONE-INCH DIAMETER UNIFORMLY GRADED CRUSHED ROCK OR WASHED GRAVEL. USE OF THE 4" THICK SEAL SLAB IS THE STRUCTURAL INTENT AND A 12" THICK GRAVEL PAD SHALL NOT BE PROVIDED. (1)
1. "THE AT-GRADE BUILDINGS AND PADS SHOULD BE PREPARED BY REMOVING THE ADDITIONAL BROWN SANDY LEAN CLAY AND ALL ORGANIC SOILS OUTSIDE OF THE BASIN EXCAVATION TO MEET THE REQUIREMENTS PRESENTED BELOW FOR EACH BUILDING/PAD. THERE SHOULD BE A MINIMUM OF 48 INCHES OF SELECT FILL/FLEXIBLE BASE BELOW THE BLOWER/ELECTRICAL BUILDING PADS. THERE SHOULD BE A MINIMUM OF 6 FEET OF SELECT FILL/FLEXIBLE BASE BELOW THE TRANSFER PUMP STATION AND EFFLUENT PUMP STATION PADS. THERE SHOULD BE A MINIMUM OF 36 INCHES OF SELECT FILL/FLEXIBLE BASE BELOW THE TRANSFORMER PAD, FLOW METER PAD, AND THE VARIOUS SMALL MISCELLANEOUS PADS FOR STAIR LANDINGS AND HVAC COMPRESSORS. [...] THE EXPOSED SUBGRADE AND ALL FILL SHOULD BE COMPACTED IN 8-INCH LIFTS TO A MINIMUM OF 95% OF THE MAXIMUM DRY DENSITY IN ACCORDANCE WITH TXDOT TEST METHOD TEX-113-E. SOIL MOISTRUE SHOULD BE WITHIN 3% OF OPTIMUM. THE SELECT FILL/FLEXIBLE BASE PAD SHOULD EXTEND A MINIMUM OF 3 FEET BEYOND THE EDGE OF THE PROPOSED BUILDINGS/PADS."
4. "SLOPE GROUNDS AWAY FROM FOUNDATIONS TO PROVIDE RAPID DRAINAGE."
5. WHERE EXISTING CONDITIONS AT THE LOCATIONS OF NEW EQUIPMENT PADS AND THE NEW BLOWER BUILDING FOUNDATION REQUIRE: FILL TO ACHIEVE FINAL GRADE LEVEL, PROVIDE ONLY COMPACTED SELECT FILL. DO NOT USE EXISTING SITE SOILS. WHERE REQUIRED SELECT FILL DEPTH CANNOT BE OBTAINED DUE TO EXISTING GRADE, CONTRACTOR SHALL CUT AND REMOVE EXISTING SOILS TO FOLLOW THESE REQUIREMENTS.
6. SOIL PREPARATIONS SHALL EXTEND A MINIMUM OF 5'-0" BEYOND THE EDGES OF THE BLOWER BUILDING AND THE EQUIPMENT PADS.



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Permit/Seal

STATE OF TEXAS · KENNETH W. HANKS · 97528 · LICENSED · PROFESSIONAL ENGINEER
6/19/2026

Client/Project
CITY OF AUSTIN

HORNSBY BEND BMP
PROCESS AMMONIA
REMOVAL FACILITY

AUSTIN, TX

Project No.:177311636
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Title
STRUCTURAL GENERAL NOTES II

Revision: 1 Sheet: 77 of 229

Drawing No.
**00-S-002**

POST-INSTALLED REBAR AND ANCHORS

THE BELOW PRODUCTS ARE THE DESIGN BASIS FOR THIS PROJECT. PRODUCT DIAMETER AND EMBEDMENT SHALL BE SHOWN IN THE DETAILS. INSTALL PRODUCTS IN ACCORDANCE WITH MANUFACTURER'S PRINTED INSTALLATION INSTRUCTIONS (MPII). CONTRACTOR SHALL CONTACT MANUFACTURER'S REPRESENTATIVE FOR PRODUCT INSTALLATION TRAINING AND SHALL SUBMIT LETTER TO THE ENGINEER-OF-RECORD (EOR) INDICATING TRAINING HAS TAKEN PLACE. REFER TO THE PROJECT BUILDING CODE AND/OR EVALUATION REPORT FOR SPECIAL INSPECTIONS AND PROOF LOAD REQUIREMENTS. SUBSTITUTION REQUESTS FOR PRODUCTS OTHER THAN THOSE LISTED BELOW MAY BE SUBMITTED BY THE CONTRACTOR TO THE EOR FOR REVIEW. SUBSTITUTIONS WILL ONLY BE CONSIDERED FOR PRODUCTS HAVING A RESEARCH REPORT RECOGNIZING THE PRODUCT FOR THE APPROPRIATE APPLICATION UNDER THE PROJECT BUILDING CODE. SUBSTITUTION REQUESTS SHALL INCLUDE CALCULATIONS THAT DEMONSTRATE THE SUBSTITUTED PRODUCT IS CAPABLE OF ACHIEVING THE EQUIVALENT PERFORMANCE VALUES OF THE DESIGN BASIS PRODUCT.
UNLESS OTHERWISE NOTED ON THE PLANS, ANCHORS SHALL BE:

1. FOR ANCHORING INTO CONCRETE:
   A. MECHANICAL ANCHORS SHALL HAVE BEEN TESTED IN ACCORDANCE WITH ACI 355.2-19 AND ICC-ES AC193 FOR CRACKED CONCRETE. PRE-APPROVED PRODUCTS INCLUDE:
      1. SIMPSON STRONG-TIE "STRONG-BOLT 2" (ICC-ES ESR-3037)
      2. SIMPSON STRONG-TIE "TITEN-HD" (ICC-ES ESR-2713)
      3. SIMPSON STRONG-TIE "STAINLESS STEEL TITEN HD" (IAPMO-UES ER-493)
      4. HILTI "KWIK BOLT KB-TZ2" (ICC-ES ESR-4266)
      5. HILTI "KH-EZ" (ICC-ES ESR-3027)
      6. DEWALT SCREW BOLT + (ICC-ES ESR-3889)
      7. DEWALT POWER-STUD + SD2 (ICC-ES ESR-2502)
   B. ADHESIVE FOR REBAR AND THREADED ROD ANCHORS SHALL HAVE BEEN TESTED IN ACCORDANCE WITH ACI 355.4-19 AND ICC-ES AC308 FOR CRACKED CONCRETE APPLICATIONS. DESIGN ADHESIVE BOND STRENGTH HAS BEEN BASED ON ACI 355.4-19 TEMPERATURE RANGE A WITH INSTALLATIONS INTO DRY HOLES DRILLED USING CARBIDE DRILL BIT INTO CRACKED CONCRETE THAT HAS CURED FOR AT LEAST 21 DAYS. ADHESIVE ANCHORS REQUIRING CERTIFIED INSTALLATIONS SHALL BE INSTALLED BY A CERTIFIED ADHESIVE ANCHOR INSTALLER PER ACI 318-19 26.7.2.e. INSTALLATIONS REQUIRING CERTIFIED INSTALLERS SHALL BE INSPECTED PER ACI 318-19 26.13.1.6 PRE-APPROVED PRODUCTS INCLUDE:
      1. SIMPSON STRONG-TIE "AT-3G" (ICC-ES ESR-5026)
      2. SIMPSON STRONG-TIE "SET-3G" (ICC-ES ESR-4057)
      3. HILTI "HIT-HY 200-R V3" W/ HOLLOW DRILL BIT (SAFESET) SYSTEM w/ HILTI HIT-Z ROD (ICC-ES ESR-4868)
      4. HILTI "HIT-HY 200-R V3" W/ HOLLOW DRILL BIT (SAFESET) SYSTEM (ICC-ES ESR-4868)
      5. HILTI "HIT-RE 500 V3" w/ HOLLOW DRILL BIT (SAFESET) SYSTEM (ICC-ES ESR-3814)
      6. HILTI "KWIK-X DUAL ACTION ANCHOR" (ICC-ES ESR-5065)
      7. DEWALT PURE 220+ EPOXY SYSTEM (ICC-ES ESR-5144)
      8. DEWALT PURE 220+ EPOXY SYSTEM (ICC-ES ESR-5144) W/ DEWALT HOLLOW DUST X SYSTEM
      9. DEWALT AC200+ ACRYLIC ADHESIVE SYSTEM (ICC-ES ESR-4027)
      10. DEWALT AC200+ ACRYLIC ADHESIVE SYSTEM (ICC-ES ESR-4027) W/ DEWALT HOLLOW DUST X SYSTEM

2. FOR ANCHORING INTO MASONRY:
   A. SOLID-GROUTED CONCRETE MASONRY
      1. MECHANICAL ANCHORS SHALL HAVE BEEN TESTED IN ACCORDANCE WITH ICC-ES AC01 OR ICC-ES AC106. PRE-APPROVED PRODUCTS INCLUDE:
         1. SIMPSON STRONG-TIE "TITEN-HD" (ICC-ES ESR-1056)
         2. SIMPSON STRONG-TIE "STRONG-BOLT 2" (IAPMO-UES ER-240)
         3. HILTI "KWIK BOLT KB-TZ2" (ICC-ES ESR-4561)
         4. HILTI "KWIK BOLT KH-EZ (ICC-ES ESR-3056)
         5. DEWALT POWER-STUD + SD1 (ICC-ES ESR-2966)
         6. DEWALT SCREW-BOLT+ (ICC-ES ESR-4042)
      2. ADHESIVE FOR REBAR AND THREADED ROD ANCHORS SHALL HAVE BEEN TESTED IN ACCORDANCE WITH ICC-ES AC58. PRE-APPROVED PRODUCTS INCLUDE:
         1. SIMPSON STRONG-TIE "SET-3G" (ICC-ES ESR-4844)
         2. HILTI HIT-HY 270 MASONRY ADHESIVE ANCHORING SYSTEM (ICC-ES ESR 4143)
         3. HILTI "HIT-HY 200-R V3" (ICC-ES ESR 4878)
         4. DEWALT AC100+GOLD (ICC-ES ESR-3200)
   B. HOLLOW CONCRETE MASONRY
      1. MECHANICAL ANCHORS SHALL HAVE BEEN TESTED IN ACCORDANCE WITH ICC-ES AC106. PRE-APPROVED PRODUCTS INCLUDE:
         1. SIMPSON STRONG-TIE "TITEN-HD" (ICC-ES ESR-1056)
      2. ADHESIVE FOR REBAR AND THREADED ROD ANCHORS SHALL HAVE BEEN TESTED IN ACCORDANCE WITH ICC-ES AC58. THE APPROPRIATE SCREEN TUBE SHALL BE USED AS RECOMMENDED BY THE ADHESIVE MANUFACTURER. PRE-APPROVED PRODUCTS INCLUDE:
         1. SIMPSON STRONG-TIE "SET-3G" (ICC-ES ESR-4844)
         2. HILTI HIT-HY 270 MASONRY ADHESIVE ANCHORING SYSTEM (ICC-ES ESR 4143) WITH HILTI HIT-SC SCREEN TUBE
         3. DEWALT AC100+GOLD (ICC-ES ESR-3200)

3. REBAR DOWELING INTO FIRE-RATED CONCRETE ASSEMBLY:
   A. EXCEPT WHERE INDICATED ON THE DRAWINGS, POST-INSTALLED REINFORCING BAR IN CONSTRUCTION SHALL CONSIST OF THE FOLLOWING ADHESIVE ANCHOR TYPES:
      1. HILTI "HIT-RE 500 V3 w/ HILTI HOLLOW DRILL BIT (SAFESET) SYSTEM" (ICC-ES ESR-3814)
      2. HILTI "HIT-FP 700 R" w/ HILTI HOLLOW DRILL BIT (SAFESET) SYSTEM

1

CONTROLLED LOW STRENGTH MATERIAL (CLSM)

1. UNLESS SPECIFICALLY APPROVED OTHERWISE, CONTROLLED LOW STRENGTH MATERIAL (CLSM, ALSO KNOWN AS FLOWABLE FILL) SHALL BE DESIGNATED AS A PERMANENT MATERIAL. DESIGN COMPRESSIVE STRENGTH FOR THIS PERMANENT TYPE OF CLSM SHALL CONFORM TO COA SPECIFICATION ITEM NO. 402S - *NORMAL SET CONTROLLED LOW STRENGTH MATERIAL*. CHEMCIAL ADMIXTURES MAY ALSO BE USED IN CLSM TO MODIFY PERFORMANCE PROPERTIES OF STRENGTH, FLOW, SET, AND PERMIABILITY.

METAL HANDRAILS

1. METAL HANDRAILS ARE A PRE-ENGINEERED SYSTEM TAHT SHALL BE DESIGNED AND ENGINEERED BY THE SUPPLIER PER OSHA 1910.29 REQURIEMENTS. METAL HANDRAILS ARE A DEFERRED SUBMITTAL ITEM AND ARE TO BE HANDLED PER IBC 2024 107.3.4.1. THE METAL HANDRAIL SYSTEM INCLUDES ALL COMPONENTS OF THE RAILS AND ALL SUPPORT/CONNECTION DEVICES.

## ABBREVIATIONS

| | | | | | |
|---|---|---|---|---|---|
| AB | ANCHOR BOLT | FDN | FOUNDATION | RD | ROOF DRAIN |
| ADDL | ADDITIONAL | FIN | FINISH | REINF | REINFORCEMENT, REINFORCING |
| ADH | ADHESIVE | FLG | FLANGE | REQD | REQUIRED |
| AFF | ABOVE FINISH FLOOR | FLR | FLOOR | RT | RADIOGRAPHIC TESTING |
| AL | ALUMINUM | FO | FACE OF | RTN | RETURN |
| ALT | ALTERNATE | FRMG | FRAMING | SBD | SCHEDULED BEAM DEPTH |
| ANC | ANCHOR | FRP | FIBER REINFORCED POLYMER | SCHED | SCHEDULE / SCHEDULED |
| APVD | APPROVED | FS | FAR SIDE FT FOOT / FEET | SECT | SECTION |
| ARCH | ARCHITECT, ARCHITECTURAL | FTG | FOOTING | SHT | SHEET |
| BC | BOTTOM CHORD | GA | GAUGE, GAGE | SIB | STRUCTURAL ISOLATION BREAK |
| BLDG | BUILDING | GALV | GALVANIZED | SIM | SIMILAR |
| BM | BEAM | GB | GRADE BEAM | SJD | SCHEDULED JOIST DEPTH |
| BOC | BOTTOM OF CONCRETE | GRD | GRADE | SLV | SHORT LEG VERTICAL |
| BOS | BOTTOM OF STEEL | GRT | GROUT | SOG | SLAB ON GRADE |
| BOT | BOTTOM | GRTG | GRATING H HIGH | SPA | SPACING |
| BRG | BEARING | HCA | HEADED CONCRETE ANCHOR | SPCS | SPACES |
| BTWN | BETWEEN | HD | HOT DIPPED | SPECS | SPECIFICATIONS |
| CC | CENTER TO CENTER | HORIZ | HORIZONTAL | SQ | SQUARE |
| CFM | COLD FORMED METAL | HSB | HIGH STRENGTH BOLT | SS | STAINLESS STEEL |
| CHKD | CHECKERED / CHECKED | IF | INSIDE FACE | SSH | SHORT SLOTTED HOLE |
| CIP | CAST IN PLACE | IN | INCH(ES) | STD | STANDARD |
| CJ | CONSTRUCTION JOINT | JT | JOINT | STIFF | STIFFENER |
| CL | CENTERLINE | L | LOW LONG LONGITUDINAL | STIR | STIRRUP |
| CLR | CLEARANCE / CLEAR | LLH | LONG LEG HORIZONTAL | STL | STEEL |
| CMU | CONCRETE MASONRY UNIT | LLV | LONG LEG VERTICAL | SW | STUD WELD |
| COL(S) | COLUMN(S) | LSH | LONG SLOTTED HOLE | SYM | SYMMETRICAL |
| CONC | CONCRETE | MAINT | MAINTENANCE | T&B | TOP & BOTTOM |
| CONN | CONNECTION | MAX | MAXIMUM | T/ | TOP OF |
| CONT | CONTINUOUS | MB | MACHINE BOLT | T/PL | TOP OF PLATE |
| CTR | CENTER | MEP | MECHANICAL, ELECTRICAL, & PLUMBING | T/SL | TOP OF SLAB |
| CTRD | CENTERED | MECH | MECHANICAL | TC | TOP CHORD |
| DBA | DEFORMED BAR ANCHOR | MFR | MANUFACTURER | TD | TRUSS DIAGONAL |
| DEMO | DEMOLITION | MIN | MINIMUM | TEMP | TEMPORARY/TEMPERATURE |
| DIA, Ø | DIAMETER | MTL | METAL | THK | THICK |
| DIM | DIMENSION | NOM | NOMINAL | TO | TOP OF |
| DIST | DISTANCE | NDT | NON-DESTRUCTIVE TESTING | TOC | TOP OF CONCRETE |
| DN | DOWN | NS | NEAR SIDE | TOF | TOP OF FOOTING |
| DP | DEEP | NTS | NOT TO SCALE | TOG | TOP OF GRATING |
| DS | DRILLED SHAFT | OC | ON CENTER | TOS | TOP OF SLAB / STEEL |
| DWG | DRAWING EA EACH | OD | OUTSIDE DIAMETER | TOW | TOP OF WALL |
| ECS | EPOXY COATED STEEL | OF | OUTSIDE FACE | TRANS | TRANSVERSE |
| EE | EACH END | O/O | OUT TO OUT | TV | TRUSS VERTICAL |
| EF | EACH FACE | OPNG | OPENING | TYP | TYPICAL |
| EJ | EXPANSION JOINT | OPP | OPPOSITE | UNO | UNLESS NOTED OTHERWISE |
| EL, ELEV | ELEVATION / ELEVATOR | OSH | OVERSIZED HOLE PC PRECAST | UT | ULTRASONIC TESTING |
| EOR | ENGINEER OF RECORD | PEMB | PRE-ENGINEERED METAL BUILDING | VERT | VERTICAL |
| EQ | EQUAL | PGL | PROFILE GRADE LINE | VIF | VERIFY IN FIELD |
| EQUIP | EQUIPMENT | PJF | PREMOLDED JOINT FILLER | W | WIDE |
| EQUIV | EQUIVALENT | PL, P | PLATE | W/,W/ | WITH |
| ES | EACH SIDE | PLF | POUNDS PER LINEAR FOOT | WP | WORK POINT |
| EW | EACH WAY | PSF | POUNDS PER SQUARE FOOT | WS | WATERSTOP |
| EXP | EXPANSION | PROJ | PROJECTION | WWF | WELDED WIRE FABRIC |
| EXIST | EXISTING | P/S | PUMP STATION | | |
| FD | FLOOR DRAIN | PVC | POLYVINYL CHLORIDE | | |

STATEMENT OF SPECIAL INSPECTION PER IBC 2024, CHAPTER 17

PER 2024 INTERNATIONAL BUILDING CODE, THE FOLLOWING IS A LIST OF THE REQUIRED SPECIAL INSPECTIONS APPLICABLE FOR THIS PROJECT:

| IBC SECTION | TYPE OF SPECIAL INSPECTIONS AND EXTENT | APPLICABLE | NON APPLICABLE | NON STRUCTURAL | INSPECTION FREQUENCY | |
|---|---|---|---|---|---|---|
| | | | | | CONTINUOUS | PERIODIC |
| 1705.2 | STEEL CONSTRUCTION | X | | | X | X |
| 1705.2.2 | STRUCTURAL STAINLESS STEEL | X | | | X | X |
| 1705.2.3 | COLD-FORMED STEEL DECK | | X | | | |
| 1705.2.4 | OPEN-WEB STEEL JOISTS AND JOIST GIRDERS | | X | | | |
| 1705.2.5 | COLD-FORMED STEEL TRUSSES SPANNING 60 FEET OR GREATER | | X | | | |
| 1705.2.6 | METAL BUILDING SYSTEMS | X | | | | X |
| 1705.3 | CONCRETE CONSTRUCTION | X | | | X | X |
| 1705.3.1 | REINFORCING STEEL WELDING INSPECTION | | X | | | |
| 1705.4 | MASONRY CONSTRUCTION | | X | | | |
| 1705.5 | WOOD CONSTRUCTION | | X | | | |
| 1705.6 | SOILS | X | | | X | X |
| 1705.7 | DRIVEN DEEP FOUNDATIONS | | X | | | |
| 1705.8 | CAST-IN-PLACE DEEP FOUNDATIONS (PIERS) | | X | | | |
| 1705.9 | HELICAL PILE FOUNDATIONS | | X | | | |
| 1705.10 | STRUCTURAL INTEGRITY OF DEEP FOUNDATION ELEMENTS | | X | | | |
| 1705.11 | FABRICATED ITEMS | X | | | | X |
| 1705.12 | SPECIAL INSPECTION FOR WIND RESISTANCE | | X | | | |
| 1705.13 | SPECIAL INSPECTION FOR SEISMIC RESISTANCE | | X | | | |
| 1705.14 | TESTING FOR SEISMIC RESISTANCE | | X | | | |
| 1705.15 | SPRAYED FIRE-RESISTIVE MATERIALS | | | X | | |
| 1705.16 | INTUMESCENT FIRE-RESISTANT COATINGS | | | X | | |
| 1705.17 | EXTERIOR INSULATION AND FINISH SYSTEMS/WATER-RESISTIVE BARRIER COATING | | | X | | |
| 1705.18 | FIRE-RESISTANCE PENETRATIONS AND JOINTS | | | X | | |
| 1705.19 | SPECIAL INSPECTION FOR SMOKE CONTROL | | | X | | |
| 1705.2 | SEALING OF MASS TIMBER | | | X | | |
| 1706 | DESIGN STRENGTH OF MATERIALS | | X | | | |
| 1707 | ALTERNATIVE TEST PROCEDURES | | X | | | |
| 1708 | IN-SITU LOAD TESTS | | X | | | |
| 1709 | PRECONSTRUCTION LOAD TESTS | | X | | | |

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TBPELS FIRM F-3

| Revision | By | Appd | YYYY.MM.DD |
|---|---|---|---|
| 1 ADDENDUM 1 | EF | YC | 2026.07.20 |

| Issued | By | Appd | YYYY.MM.DD |
|---|---|---|---|
| | | | |

Permit/Seal

STATE OF TEXAS
KENNETH W. HANKS
97528
LICENSED
PROFESSIONAL ENGINEER
6/19/2026

Client/Project
CITY OF AUSTIN

HORNSBY BEND BMP PROCESS AMMONIA REMOVAL FACILITY
AUSTIN, TX

Project No.:177311636
File Name: 1163604s
Scale:

| Author | Designer | Checker | YYYY.MM.DD |
|---|---|---|---|
| FM | EF | KH | 2026.07.20 |

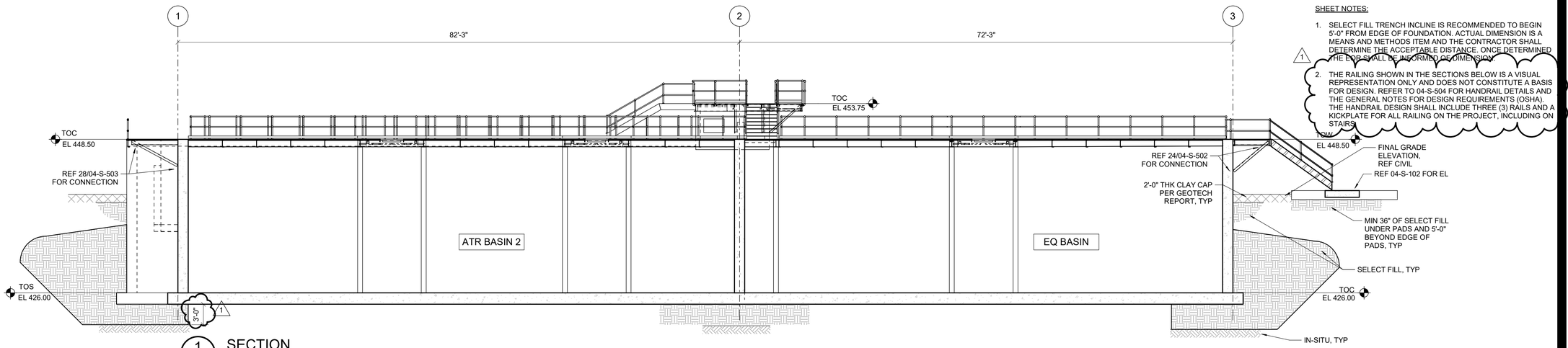
Title
STRUCTURAL GENERAL NOTES III

Revision: 1 Sheet: 78 of 229
Drawing No.
**00-S-003**

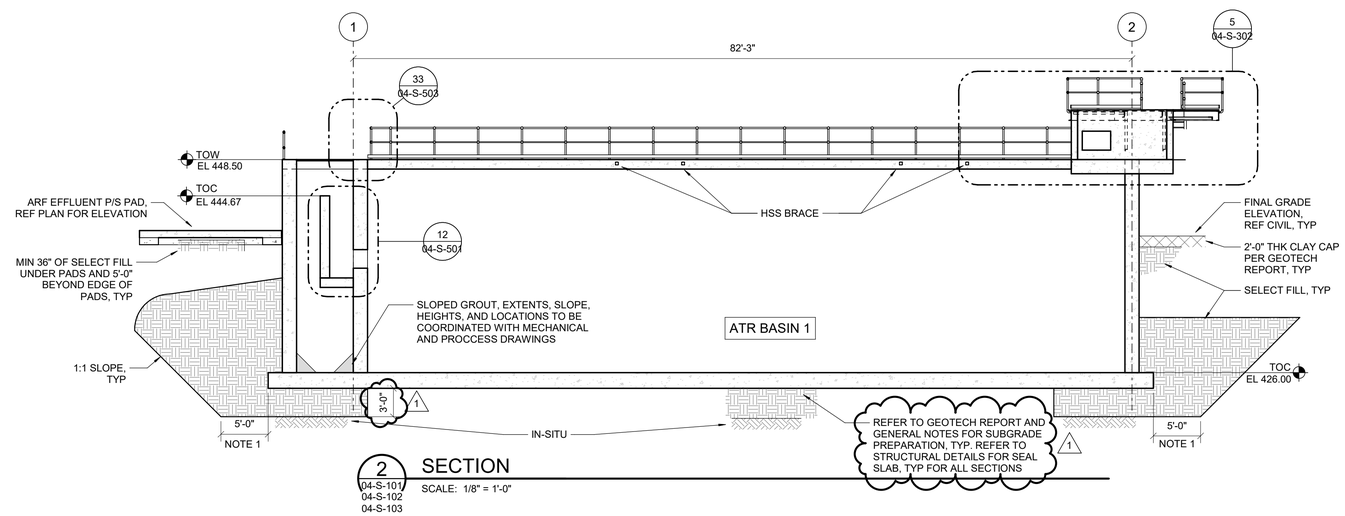
7/20/2026 9:14:53 AM
ORIGINAL SHEET - ANSI D

SHEET NOTES:

1. SELECT FILL TRENCH INCLINE IS RECOMMENDED TO BEGIN 5'-0" FROM EDGE OF FOUNDATION. ACTUAL DIMENSION IS A MEANS AND METHODS ITEM AND THE CONTRACTOR SHALL DETERMINE THE ACCEPTABLE DISTANCE. ONCE DETERMINED THE EOR SHALL BE INFORMED OF DIMENSION.
2. THE RAILING SHOWN IN THE SECTIONS BELOW IS A VISUAL REPRESENTATION ONLY AND DOES NOT CONSTITUTE A BASIS FOR DESIGN. REFER TO 04-S-504 FOR HANDRAIL DETAILS AND THE GENERAL NOTES FOR DESIGN REQUIREMENTS (OSHA). THE HANDRAIL DESIGN SHALL INCLUDE THREE (3) RAILS AND A KICKPLATE FOR ALL RAILING ON THE PROJECT, INCLUDING ON STAIRS.




1 SECTION
04-S-102
04-S-103
SCALE: 1/8" = 1'-0"

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04-S-101
04-S-102
04-S-103
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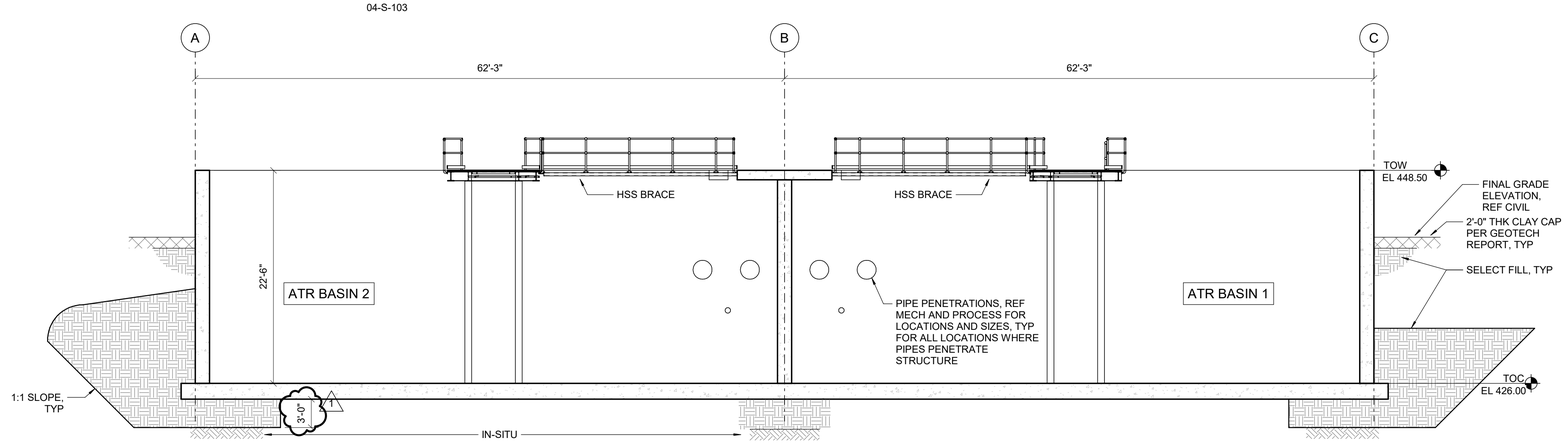


3 SECTION
04-S-101
04-S-102
04-S-103
SCALE: 1/8" = 1'-0"


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| 1 ADDENDUM 1 | EF | YC | 2026.07.20 |

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|---|---|---|---|

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STATE OF TEXAS
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07/19/2026

Client/Project
CITY OF AUSTIN
HORNSBY BEND BMP
PROCESS AMMONIA
REMOVAL FACILITY
AUSTIN, TX

Project No.:177311636
File Name: 11636046

Scale: 1/8" = 1'-0"

| FM | EF | KH | 2026.07.20 |
|---|---|---|---|
| Author | Designer | Checker | YYYY.MM.DD |

Title
STRUCTURAL ARF
SECTIONS I

Revision: 1 Sheet: 83 of 229

Drawing No.
04-S-301

7/20/2026 9:47:39 AM

ORIGINAL SHEET - ANSI D

## PROCESS ABBREVIATIONS

| | |
|---|---|
| AIR | AIR |
| ARF EFFLUENT | ARE |
| DRAIN | DR |
| NON-POTABLE WATER | NPW |
| THICKENING FILTRATE | TF |

## FACILITY ABBREVIATIONS

| | |
|---|---|
| AMMONIA REMOVAL FACILITY | ARF |
| BELT FILTER PRESS EFFLUENT LIFT STATION | DEWATER |

## EQUIPMENT ABBREVIATIONS

| | |
|---|---|
| AIR RELEASE VALVE | ARV |
| AMMONIA TREATMENT REACTOR | NH3R |
| BELT FILTER PRESS | BFP |
| BLOWER | BLWR |
| FLOW EQUALIZATION BASIN | FEB |
| FILTER (GENERAL) | F |
| MECHANICAL EQUIPMENT (GENERAL) | ME |
| MIXER | MIX |
| MOTOR OPERATED VALVE | MOV |
| MOTOR OPERATED GATE | MOG |
| PNEUMATIC OPERATED VALVE | POV |
| LIFT STATION PUMP | LSPU |
| SLIDE GATE | SG |
| SOLENOID OPERATOR VALVE | SOV |
| TANK | TK |
| VAULT | VLT |
| WET WELL | WW |

## AREA NUMBERING

| | |
|---|---|
| AREA 00 | GENERAL |
| AREA 01 | SITE CIVIL |
| AREA 02 | YARD PIPING PLAN |
| AREA 03 | BFP EFFLUENT LIFT STATION |
| AREA 04 | AMMONIA REMOVAL FACILITY |
| AREA 05 | BLOWER BUILDING |

## VALVE ABBREVIATIONS

| | |
|---|---|
| GATE VALVE | GV |
| BALL VALVE | BV |
| BUTTERFLY VALVE | BFV |
| CHECK VALVE | CV |
| DIAPHRAGM VALVE | DV |
| GLOBE VALVE | GLV |
| NEEDLE VALVE | NV |
| PLUG VALVE | PV |
| PINCH VALVE | PIV |
| SPECIALITY VALVES | VX |

1

## CONTROL EQUIPMENT ABBREVIATIONS

| | |
|---|---|
| CONTROL PANEL | CP |
| FIELD CONTROL STATION | FCS |
| LIGHTNING SURGE ARRESTOR | LSA |
| MOTOR CONTROL CENTER | MCC |
| MAIN CONTROL PANEL | MCP |
| MULTIMODE FIBER | MMF |
| MOTOR STARTER | START |
| NOT APPLICABLE | N/A |
| NORMALLY CLOSED | NC |
| NORMALLY OPEN | NO |
| OPERATOR INTERFACE | OI |
| OPERATOR INTERFACE TERMINAL | OIT |
| PROGRAMMABLE LOGIC CONTROLLER | PLC |
| SINGLE MODE FIBER | SMF |
| UNINTERRUPTABLE POWER SUPPLY | UPS |
| VARIABLE FREQUENCY DRIVE | VFD |

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| 1 ADDENDUM NO. 1 | BH | NS | 2026.07.22 |

Revision

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07.17.2026

Client/Project
CITY OF AUSTIN

HORNSBY BEND BMP
PROCESS AMMONIA
REMOVAL FACILITY

AUSTIN, TX

Project No.: 177311636

File Name: 00-I-004

Scale: NO SCALE

| EB | BH | AA | 2026.06.19 |
|---|---|---|---|
| Dwn. | Dsgn. | Chkd. | YYYY.MM.DD |

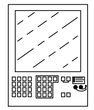
Title
GENERAL
SYMBOLS AND
NOMENCLATURE - IV

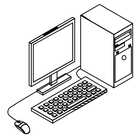
Revision: Sheet: 116 of 229

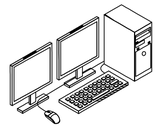
Drawing No.
**00-I-004**

ORIGINAL SHEET - ANSI D

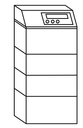
# NETWORK AND CONTROL COMPONENTS SYMBOL LIBRARY


PANEL MOUNTED
OPERATOR INTERFACE

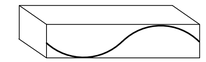

DESKTOP / CONSOLE WORKSTATION


DUAL SCREEN WORKSTATION

LAPTOP

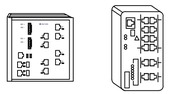

TOWER UPS

PANEL UPS


RACK MOUNT UPS

PRINTER

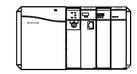
POWER MONITOR / MPRM


DIN-RAIL MOUNTED
MODULAR INDUSTRIAL
ETHERNET SWITCH

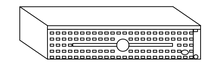
FIBER
TRANSCEIVER

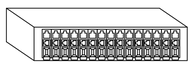
1
SCHNEIDER REMOTE I/O CHASSIS

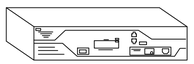
SCHNEIDER M580 PLC

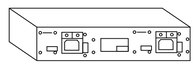

AB CONTROLLOGIX® PLC

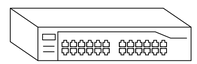
SIEMENS PLC

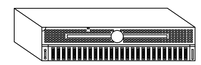

RACK MOUNT SERVER

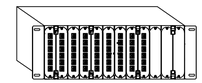

RACK MOUNT 15 PORT
MEDIA CONVERTER CHASSIS

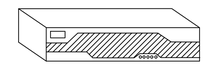

RACK MOUNT ROUTER

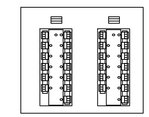

RACK MOUNT ETHERNET SWITCH
REDUNDANT POWER SUPPLY


RACK MOUNT
24 PORT ETHERNET SWITCH

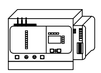

RACK MOUNT
NETWORK ACCESSIBLE STORAGE

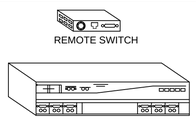

RACK MOUNT
FIBER OPTIC PATCH PANEL


RACK MOUNT
FIREWALL APPLIANCE

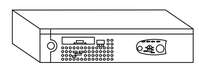

FOUNDATION FIELDBUS
MEGABLOCKS

VARIABLE
FREQUENCY DRIVE


STARTER

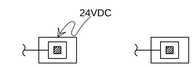


RACK MOUNT
KVM SWITCH


RACK MOUNT
DIGITAL VIDEO RECORDER (DVR)

LEASED LINE
MODEM

RACK MOUNTED INDUSTRIAL
HARDENED SWITCH



ACTIVE
TERMINATOR

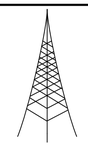
PASSIVE
TERMINATOR

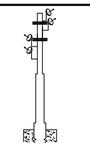
GAS DETECTOR
NETWORK SYMBOL

YAGI ANTENNA

OMNI ANTENNA

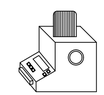
SATELLITE ANTENNA

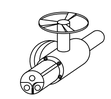

LATTICE TOWER


MONO-POLE TOWER

POLE OR WALL-
MOUNT CAMERA

CEILING-MOUNT
CAMERA


METERING PUMP
NETWORK SYMBOL


CONTROL VALVE ACTUATOR
NETWORK SYMBOL

IP PHONE

REV 010119

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ORIGINAL SHEET - ANSI D

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Revision

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07.17.2026

Client/Project
CITY OF AUSTIN

HORNSBY BEND BMP
PROCESS AMMONIA
REMOVAL FACILITY

AUSTIN, TX

Project No.: 177311636

File Name: 00-I-005

Scale: NO SCALE

| EB | BH | AA | 2026.06.19 |
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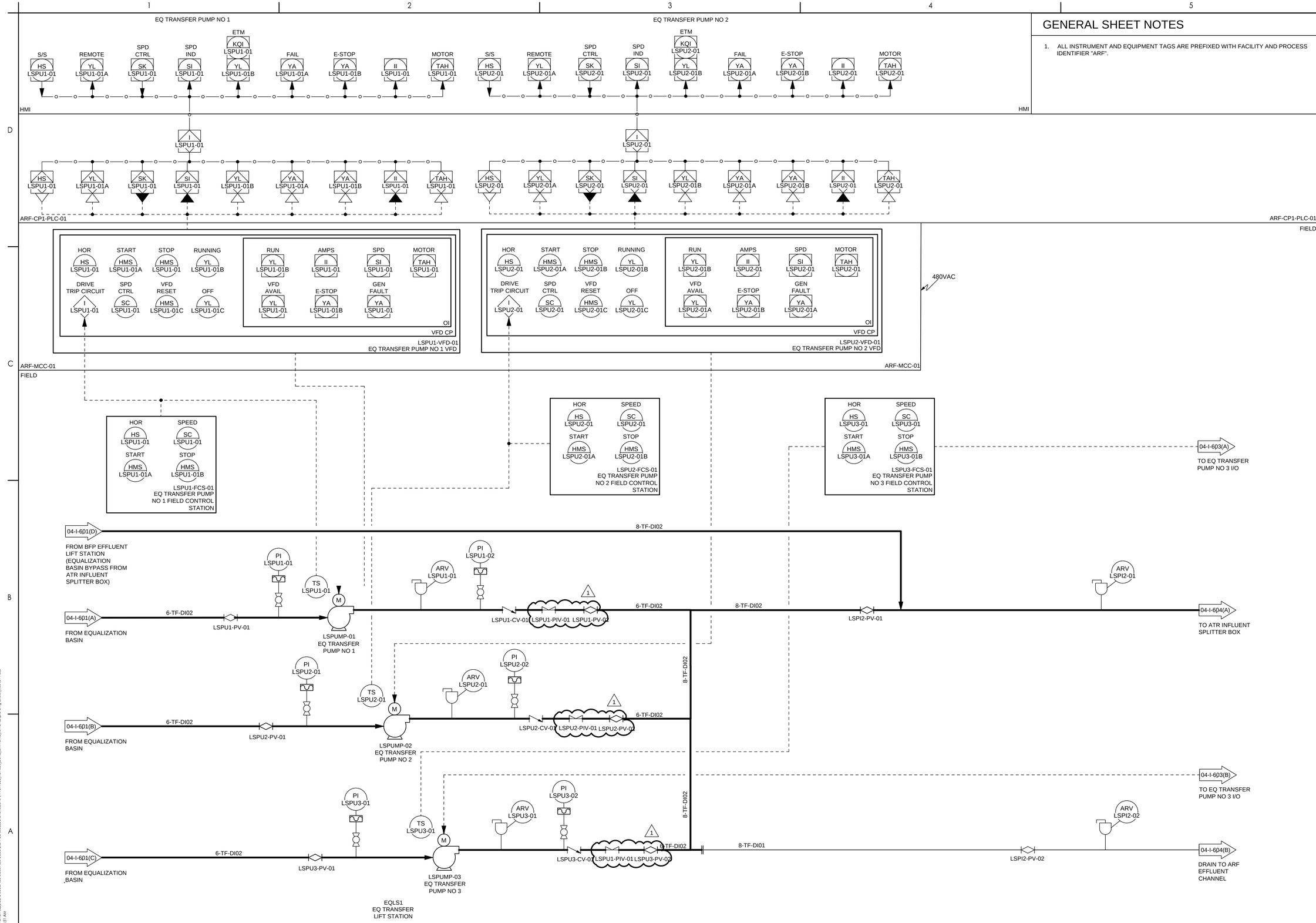
| Dwn. | Dsgn. | Chkd. | YYYY.MM.DD |

Title
GENERAL
SYMBOLS AND
NOMENCLATURE - V

Revision:

Sheet: 117 of 229

Drawing No.
**00-I-005**




## GENERAL SHEET NOTES

1. ALL INSTRUMENT AND EQUIPMENT TAGS ARE PREFIXED WITH FACILITY AND PROCESS IDENTIFIER "ARF".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STATE OF TEXAS
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07.17.2026

Client/Project
CITY OF AUSTIN
HORNSBY BEND BMP
PROCESS AMMONIA
REMOVAL FACILITY
AUSTIN, TX

Project No.: 177311636
File Name: 044-602

Scale: NO SCALE

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| Dwn. | Dsgn. | Chkd. | YYYY.MM.DD |

Title
AMMONIA REMOVAL FACILITY
EQ TRANSFER LIFT
STATION - P&ID

Revision: Sheet: 133 of 229

Drawing No.
**04-I-602**

ORIGINAL SHEET - ANSI D

# GENERAL NOTES

## GENERAL

1. THE DESIGN SHOWS EQUIPMENT, PIPING, DIMENSIONS, AND PLANS BASED ON REPRESENTATIVE EQUIPMENT SELECTED BY THE ENGINEER.
2. THE CONTRACTOR MAY SUBMIT PROPOSED DESIGN AMENDMENTS TO THE ENGINEER FOR REVIEW. INCLUDE PLANS, SECTIONS, DETAILS, AND SCHEMATICS OF EQUIPMENT AND APPURTENANCES REQUIRED.
3. BACKGROUND DRAWINGS AND DIMENSIONS SHOWN IN THE DESIGN ARE FOR REFERENCE ONLY. CLARIFY DISCREPANCIES WITH THE ENGINEER PRIOR TO FABRICATION OR CONSTRUCTION.
4. EQUIPMENT FOUNDATION AND PAD DIMENSIONS ARE APPROXIMATE. COORDINATE EQUIPMENT PAD DIMENSIONS WITH THE MANUFACTURER AND STRUCTURAL DETAILS TO SUIT INSTALLATION REQUIREMENTS.
5. CONFIRM PROPOSED DEVIATIONS FROM STANDARD DETAILS WITH ENGINEER

## STRUCTURAL ANCHORS

1. ANCHOR DETAILS APPLY TO MIN 3000 PSI CAST-IN-PLACE CONCRETE ONLY. CHECK WITH ENGINEER FOR MASONRY OR PRE-CAST CONCRETE.
2. SCAN TO LOCATE REINFORCING STEEL IN CONCRETE AND CONFIRM SUITABILITY OF PROPOSED POST-INSTALL ANCHOR LOCATIONS WITH ENGINEER PRIOR TO INSTALLATION
3. USE ONLY UNDERCUT ANCHORS FOR OVERHEAD INSTALLATION AND WHEN PLACED IN CONSTANT TENSION (EPOXY AND EXPANSION ANCHORS NOT PERMITTED).
4. SUBMIT PROPOSED ANCHORS FOR ENGINEER'S REVIEW

## PIPING

1. PROVIDE INTERCONNECTING PIPING, FITTINGS, WALL PIPES, AND PIPE SUPPORTS (INCLUDING THOSE REQUIRED FOR INSTRUMENTS, DRAINS, AND OTHER APPURTENANCES) AS REQUIRED FOR A COMPLETE PROCESS MECHANICAL PIPING SYSTEM.
2. CONNECT PIPE DRAIN OUTLETS AND EQUIPMENT DRAINS TO THE NEAREST FLOOR DRAIN, FLOOR SINK, HUB DRAIN, OR TRENCH DRAIN WITH CONTINUOUS DOWNWARD SLOPE.
3. ROUTE PIPE TO AVOID TRIP, HEAD, AND LIMB HAZARDS.
4. PASSIVATE STAINLESS STEEL AFTER WELDING.
5. USE SUPPORTS TO MINIMIZE STRAIN AT PIPE-TO-EQUIPMENT CONNECTIONS.
6. ELBOWS 2-1/2" AND LARGER SHALL BE STANDARD LONG RADIUS ELBOWS, UNLESS OTHERWISE NOTED. WHERE REQUIRED IN TIGHT AREAS FOR FIT-UP, USE SHORT RADIUS OR REDUCING ELBOWS.
7. SMALL DIAMETER PROCESS PIPING MAY NOT BE SHOWN IN ITS ENTIRETY. REFER TO P&IDS TO UNDERSTAND THE SCOPE ASSOCIATED WITH EACH PIPING SYSTEM.
8. MAINTAIN MINIMUM HEADROOM CLEARANCE HEIGHT OF 7'-6".
9. PROCESS MECHANICAL PIPING SYSTEMS AND EQUIPMENT SHALL BE INSTALLED IN SUCH A WAY TO BE EASILY DISMANTLED AND REMOVED WITHOUT DISTURBING THE REMAINING AND ADJACENT EQUIPMENT, PIPING, AND SUPPORTS.
10. UNLESS OTHERWISE SHOWN, HORIZONTAL REDUCERS INSTALLED IN PIPING SYSTEMS SHALL BE ECCENTRIC (BOTTOM FLAT). HORIZONTAL REDUCERS CONNECTED TO PUMP SUCTIONS SHALL BE ECCENTRIC (TOP FLAT).
11. SLEEVE COUPLINGS, FLANGED COUPLING ADAPTERS, AND FLEXIBLE COUPLINGS SUBJECT TO A POSITIVE INTERNAL FLUID PRESSURE SHALL BE PROVIDED WITH RESTRAINT SYSTEMS.
12. EXPOSED PIPING SUBJECT TO FREEZING SHALL BE INSULATED AND HEAT TRACED (IF HEAT TRACE IS SPECIFIED). SEE THE SPECIFICATION SECTION 15001 - 'PIPING, GENERAL AND SECTION 15145 - 'PROCESS PIPING AND EQUIPMENT INSULATION' FOR HEAT TRACE AND INSULATION REQUIREMENTS.

## PIPE SUPPORTS

1. SEE PIPE SUPPORTS SPECIFICATION SECTION 15006 - FOR SPACING, AND OTHER REQUIREMENTS.
2. PIPE SUPPORT MATERIALS

| EXPOSURE | SUPPORT LOCATION | HDG | 304 SS | 316 SS | OTHER |
|---|---|---|---|---|---|
| AIR, OCCASIONAL WATER | OUTDOOR OR INDOOR, NON-SUBMERGED, NON-COASTAL | X | X | | |
| WATER | FULLY OR PARTIALLY SUBMERGED, OR WITHIN 24" OF LIQUID SURFACE | | | X | |

OCCASIONAL CONTACT INCLUDES PRECIPITATION AND WATER CLEANING
HDG - HOT DIPPED GALVANIZED STEEL
OTHER - SEE DRAWINGS, SPECIFICATION FOR DIRECTION

3. RE-COAT EXPOSED SURFACES OF DRILLED OR CUT FRP OR PVC-COATED SUPPORTS PER MANUFACTURER'S REQUIREMENTS
4. USE EXTRA-WIDE PIPE SADDLES OR METALLIC SHIELDS WITH LOOSE FIT AROUND THE CIRCUMFERENCE OF PVC AND FRP PIPE.
5. USE 2" WIDE BY 1/8" THICK ELASTOMERIC STRIP AROUND FULL CIRCUMFERENCE OF COPPER PIPE AND TUBE.
6. USE PLASTIC CAPS ON EXPOSED SUPPORT ENDS WITHIN 0'-0" AND 8'-0" OF WALKING SURFACES.
7. PROVIDE PIPE SUPPORTS REQUIRED FOR A COMPLETE PIPING SYSTEM. PIPE SUPPORTS SHALL BE PROVIDED WHERE REQUIRED BY THE SPECIFICATION SECTION 15006 HANGERS AND SUPPORTS FOR PROCESS PIPING AND/OR AS SHOWN IN DRAWINGS.

## VALVES AND GATES

1. MOUNT VALVE AND GATE OPERATORS TO ALLOW COMPLETE OPENING/CLOSING WITHOUT INTERFERENCE FROM ADJACENT EQUIPMENT.
2. SUBMIT VALVE OPERATOR ORIENTATION FOR ENGINEER'S REVIEW.
3. FOLLOW MANUFACTURER'S REQUIREMENT FOR PLACEMENT OF VALVE SEAT (UPSTREAM OR DOWNSTREAM) AND VALVE STEM ORIENTATION

## MECHANICAL ABBREVIATIONS

| | |
|---|---|
| ADJ | ADJUSTABLE |
| ARE | AMMONIA REMOVAL FACILITY EFFLUENT |
| ARF | AMMONIA REMOVAL FACILITY |
| ATR | AMMONIA TREATMENT REACTOR |
| ARV | AIR RELEASE VALVE |
| BFP | BELT FILTER PRESS |
| BFV | BUTTERFLY VALVE |
| CL | CENTERLINE |
| CV | CHECK VALVE |
| DI | DUCTILE IRON |
| DR | DRAIN |
| DO | DISSOLVED OXYGEN |
| EL | ELEVATION |
| EQ | EQUALIZATION |
| FLG | FLANGE |
| H | HEIGHT |
| IA | INSTRUMENT AIR |
| L | LENGTH |
| MAX | MAXIMUM |
| MIN | MINIMUM |
| 1 NPW | NON-POTABLE WATER |
| PIV | PINCH VALVE |
| PV | PLUG VALVE |
| PVC | POLY VINYL CHLORIDE |
| SCH | SCHEDULE |
| SS | STAINLESS STEEL |
| TYP | TYPICAL |
| TF | THICKENED FILTRATE |
| UNO | UNLESS NOTED OTHERWISE |
| W | WEST/WIDTH |
| W/ | WITH |
| W/O | WITHOUT |
| WS | WATER SURFACE |

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STATE OF TEXAS
ALDO J. SOTELO
106123
PROFESSIONAL ENGINEER
07/22/2026

Client/Project
CITY OF AUSTIN
HORNSBY BEND BMP
PROCESS AMMONIA
REMOVAL FACILITY
AUSTIN, TX

Project No.: 177311636
File Name: 00-D-001
Scale: NONE

| PK | NS/AJS | CC/JAL | 2026.07.22 |
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Title
GENERAL NOTES AND ABBREVIATIONS

Revision: 1 Sheet: 140 of 229
Drawing No.
00-D-001

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ORIGINAL SHEET - ANSI D

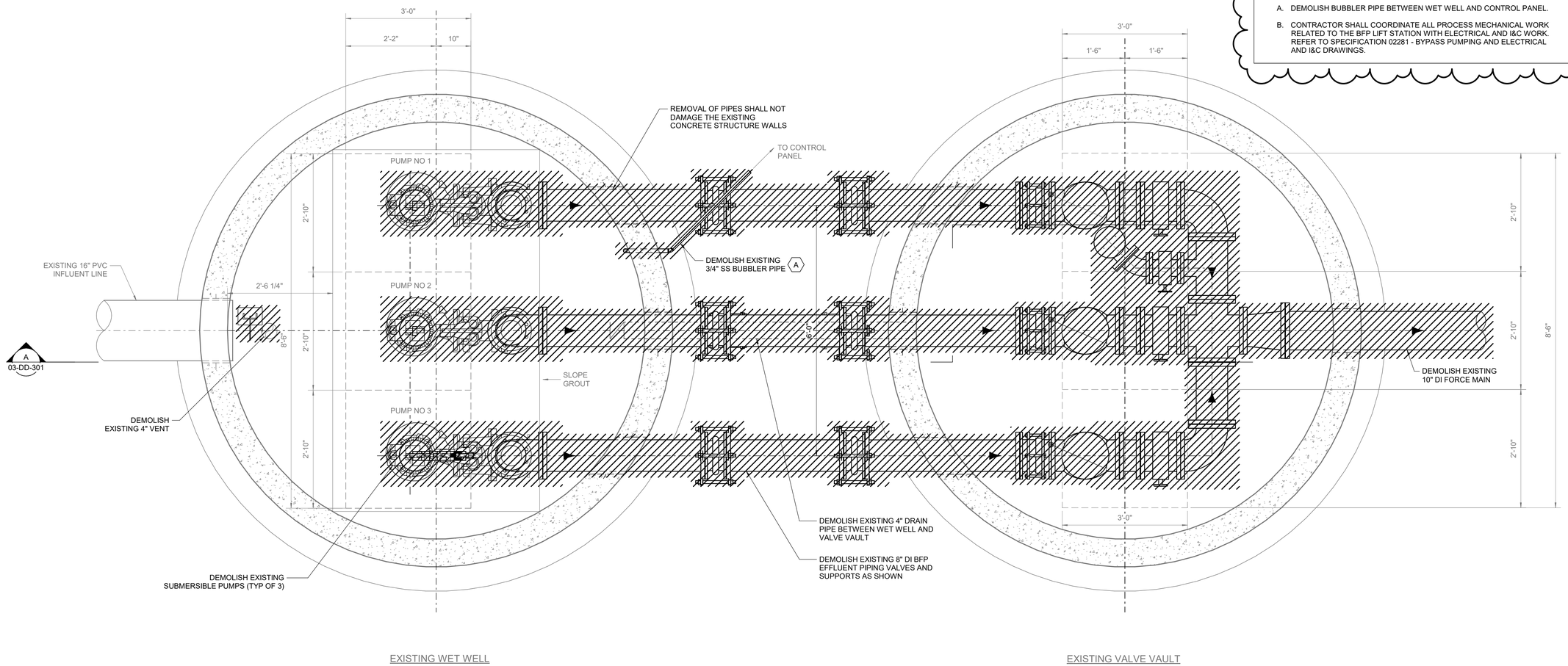
## GENERAL SHEET NOTES

1. WORK ON THE EXISTING BFP LIFT STATION SHALL BE SCHEDULED, SEQUENCED, AND PERFORMED IN A MANNER THAT MINIMIZES THE TOTAL LIFT STATION SHUTDOWN DURATION. THE CONTRACTOR SHALL CONSIDER REQUIREMENTS FOR ALL SCOPES OF WORK INVOLVED INCLUDING DEMOLITION, STRUCTURAL, MECHANICAL, ELECTRICAL, AND CONTROLS. CONTRACTOR SHALL ALSO CONSIDER EXISTING CONDITION AND CONSTRAINTS. THE CONTRACTOR SHALL BE RESPONSIBLE FOR PROVIDING A COMPLETE AND FUNCTIONAL BYPASS PUMPING SYSTEM FOR THE DURATION OF THE BFP LIFT STATION SHUTDOWN IN ORDER TO MAINTAIN NORMAL OPERATION OF THE DEWATERING FACILITY. REFERENCE SPECIFICATION SECTION 02281 BYPASS PUMPING SYSTEM
2. THE CONTRACTOR SHALL BE RESPONSIBLE FOR CLEANING AND INSPECTING THE INTERIOR OF THE BFP LIFT STATION WET WELL AND VALVE VAULT PRIOR TO STARTING THE WORK. REFER TO SPECIFICATION SECTION 03920 CONCRETE SURFACE REPAIR TO DETERMINE THE APPROPRIATE CONCRETE SURFACE REPAIR METHOD. REFER TO SPECIFICATION SECTION 09960 HIGH PERFORMANCE COATINGS TO DETERMINE THE APPROPRIATE CONCRETE SURFACE COATING SYSTEM

## SHEET KEYNOTES

A. DEMOLISH BUBBLER PIPE BETWEEN WET WELL AND CONTROL PANEL.

B. CONTRACTOR SHALL COORDINATE ALL PROCESS MECHANICAL WORK RELATED TO THE BFP LIFT STATION WITH ELECTRICAL AND I&C WORK. REFER TO SPECIFICATION 02281 - BYPASS PUMPING AND ELECTRICAL AND I&C DRAWINGS.




## PLAN

SCALE: 3/4" = 1'-0"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STATE OF TEXAS
ALDO J. SOTELO
106123
PROFESSIONAL ENGINEER
07/22/2026

Client/Project
CITY OF AUSTIN

HORNSBY BEND BMP
PROCESS AMMONIA
REMOVAL FACILITY
AUSTIN, TX

Project No.:177311636
File Name: N/A
Scale: 3/4" = 1'-0"

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Title
BFP EFFLUENT LIFT STATION
DEMOLITION PLAN

Revision: 1 Sheet: 144 of 229
Drawing No.
**03-DD-101**

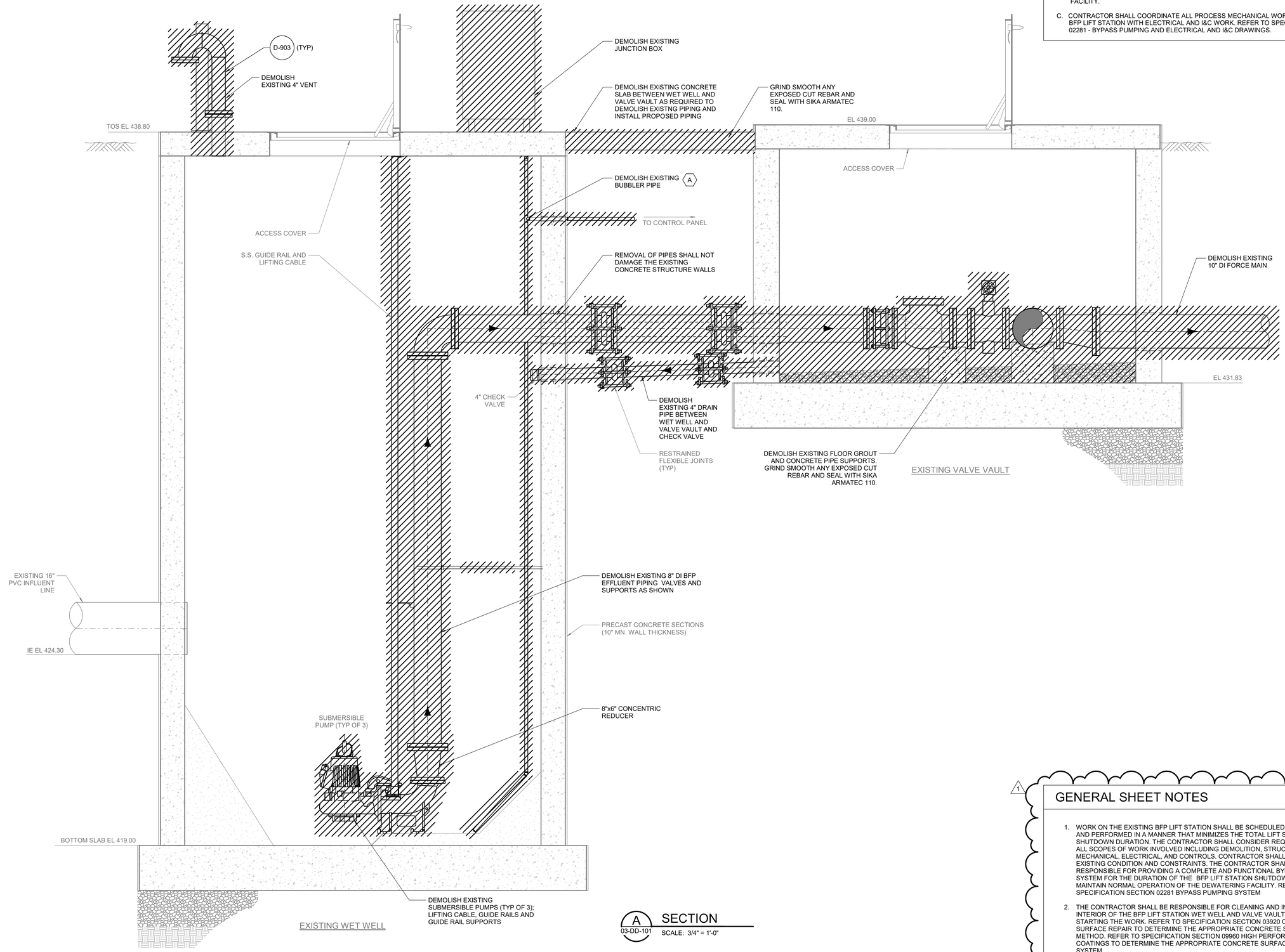
ORIGINAL SHEET - ANSI D

## SHEET KEYNOTES

A. DEMOLISH BUBBLER PIPE BETWEEN WET WELL AND CONTROL PANEL.

B. CONTRACTOR SHALL DISPOSE ALL DEMO MATERIALS PROPERLY AT THE APPROPRIATE FACILITY.

C. CONTRACTOR SHALL COORDINATE ALL PROCESS MECHANICAL WORK RELATED TO THE BFP LIFT STATION WITH ELECTRICAL AND I&C WORK. REFER TO SPECIFICATION 02281 - BYPASS PUMPING AND ELECTRICAL AND I&C DRAWINGS.




A 03-DD-101 SECTION
SCALE: 3/4" = 1'-0"

## GENERAL SHEET NOTES

1. WORK ON THE EXISTING BFP LIFT STATION SHALL BE SCHEDULED, SEQUENCED, AND PERFORMED IN A MANNER THAT MINIMIZES THE TOTAL LIFT STATION SHUTDOWN DURATION. THE CONTRACTOR SHALL CONSIDER REQUIREMENTS FOR ALL SCOPES OF WORK INVOLVED INCLUDING DEMOLITION, STRUCTURAL, MECHANICAL, ELECTRICAL, AND CONTROLS. CONTRACTOR SHALL ALSO CONSIDER EXISTING CONDITION AND CONSTRAINTS. THE CONTRACTOR SHALL BE RESPONSIBLE FOR PROVIDING A COMPLETE AND FUNCTIONAL BYPASS PUMPING SYSTEM FOR THE DURATION OF THE BFP LIFT STATION SHUTDOWN IN ORDER TO MAINTAIN NORMAL OPERATION OF THE DEWATERING FACILITY. REFERENCE SPECIFICATION SECTION 02281 BYPASS PUMPING SYSTEM

2. THE CONTRACTOR SHALL BE RESPONSIBLE FOR CLEANING AND INSPECTING THE INTERIOR OF THE BFP LIFT STATION WET WELL AND VALVE VAULT PRIOR TO STARTING THE WORK. REFER TO SPECIFICATION SECTION 03920 CONCRETE SURFACE REPAIR TO DETERMINE THE APPROPRIATE CONCRETE SURFACE REPAIR METHOD. REFER TO SPECIFICATION SECTION 09960 HIGH PERFORMANCE COATINGS TO DETERMINE THE APPROPRIATE CONCRETE SURFACE COATING SYSTEM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STATE OF TEXAS
ALDO J. SOTELO
106163
PROFESSIONAL ENGINEER
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Client/Project
CITY OF AUSTIN
HORNSBY BEND BMP PROCESS AMMONIA REMOVAL FACILITY
AUSTIN, TX

Project No.:177311636
File Name: N/A
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Title
BFP EFFLUENT LIFT STATION DEMOLITION SECTION

Revision: 1 Sheet: 145 of 229
Drawing No.
03-DD-301

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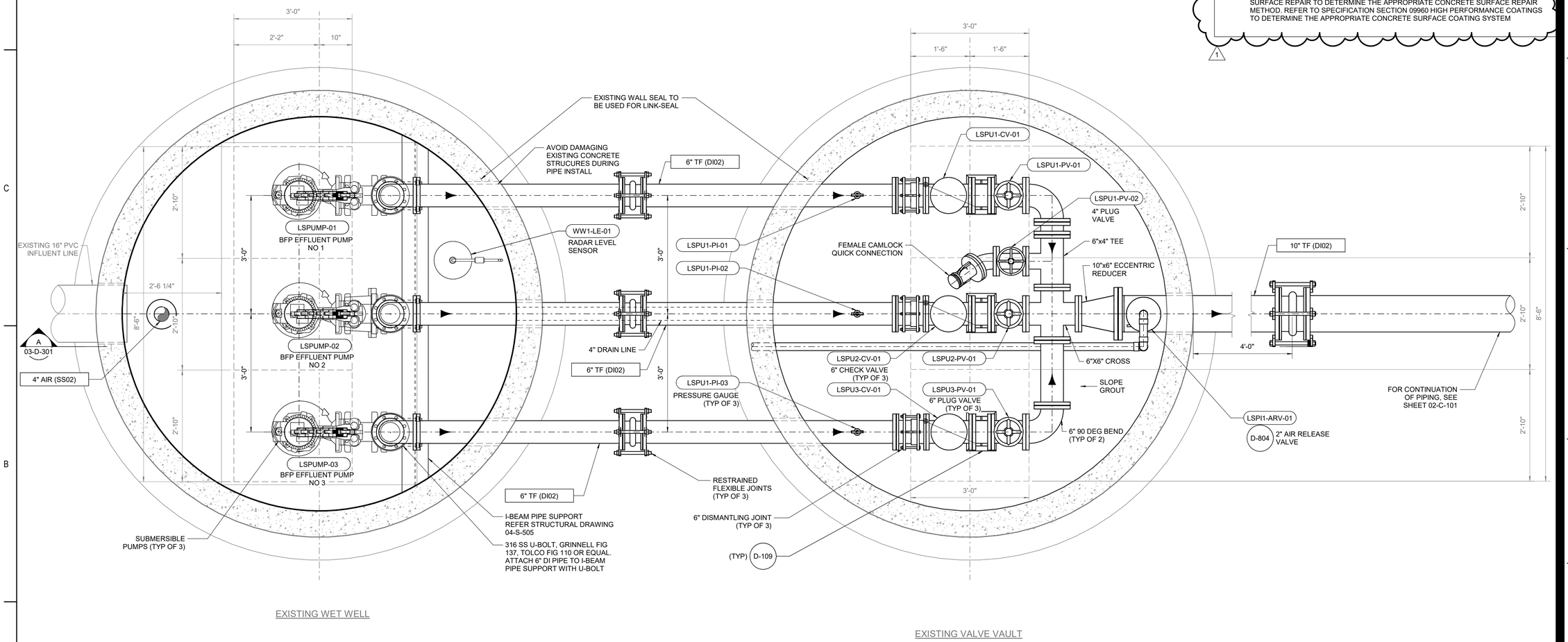
ORIGINAL SHEET - ANSI D

## GENERAL SHEET NOTES

1. CONTRACTOR TO REUSE EXISTING PIPE PENETRATIONS FOR PROPOSED DISCHARGE AND DRAIN PIPES
2. ALL INSTRUMENT AND EQUIPMENT TAGS ARE PREFIXED WITH AREA IDENTIFIER "DEWATER"
3. TAGS FOR INSTRUMENTATION AND ANCILLARY EQUIPMENT ARE PROVIDED ON THE P&IDs
4. WORK ON THE EXISTING BFP LIFT STATION SHALL BE SCHEDULED, SEQUENCED, AND PERFORMED IN A MANNER THAT MINIMIZES THE TOTAL LIFT STATION SHUTDOWN DURATION. THE CONTRACTOR SHALL CONSIDER REQUIREMENTS FOR ALL SCOPES OF WORK INVOLVED INCLUDING DEMOLITION, STRUCTURAL, MECHANICAL, ELECTRICAL, AND CONTROLS. CONTRACTOR SHALL ALSO CONSIDER EXISTING CONDITION AND CONSTRAINTS. THE CONTRACTOR SHALL BE RESPONSIBLE FOR PROVIDING A COMPLETE AND FUNCTIONAL BYPASS PUMPING SYSTEM FOR THE DURATION OF THE BFP LIFT STATION SHUTDOWN IN ORDER TO MAINTAIN NORMAL OPERATION OF THE DEWATERING FACILITY. REFERENCE SPECIFICATION SECTION 02281 BYPASS PUMPING SYSTEM
5. THE CONTRACTOR SHALL BE RESPONSIBLE FOR CLEANING AND INSPECTING THE INTERIOR OF THE BFP LIFT STATION WET WELL AND VALVE VAULT PRIOR TO STARTING THE WORK. REFER TO SPECIFICATION SECTION 03920 CONCRETE SURFACE REPAIR TO DETERMINE THE APPROPRIATE CONCRETE SURFACE REPAIR METHOD. REFER TO SPECIFICATION SECTION 09960 HIGH PERFORMANCE COATINGS TO DETERMINE THE APPROPRIATE CONCRETE SURFACE COATING SYSTEM




## PLAN

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ALDO J. SOTELO
106323
PROFESSIONAL ENGINEER
07/22/2026

Client/Project
CITY OF AUSTIN
HORNSBY BEND BMP PROCESS AMMONIA REMOVAL FACILITY
AUSTIN, TX

Project No.:177311636
File Name: N/A
Scale: 3/4" = 1'-0"

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Title
BFP EFFLUENT LIFT STATION
PLAN

Revision: 1 Sheet: 146 of 229
Drawing No.
**03-D-101**

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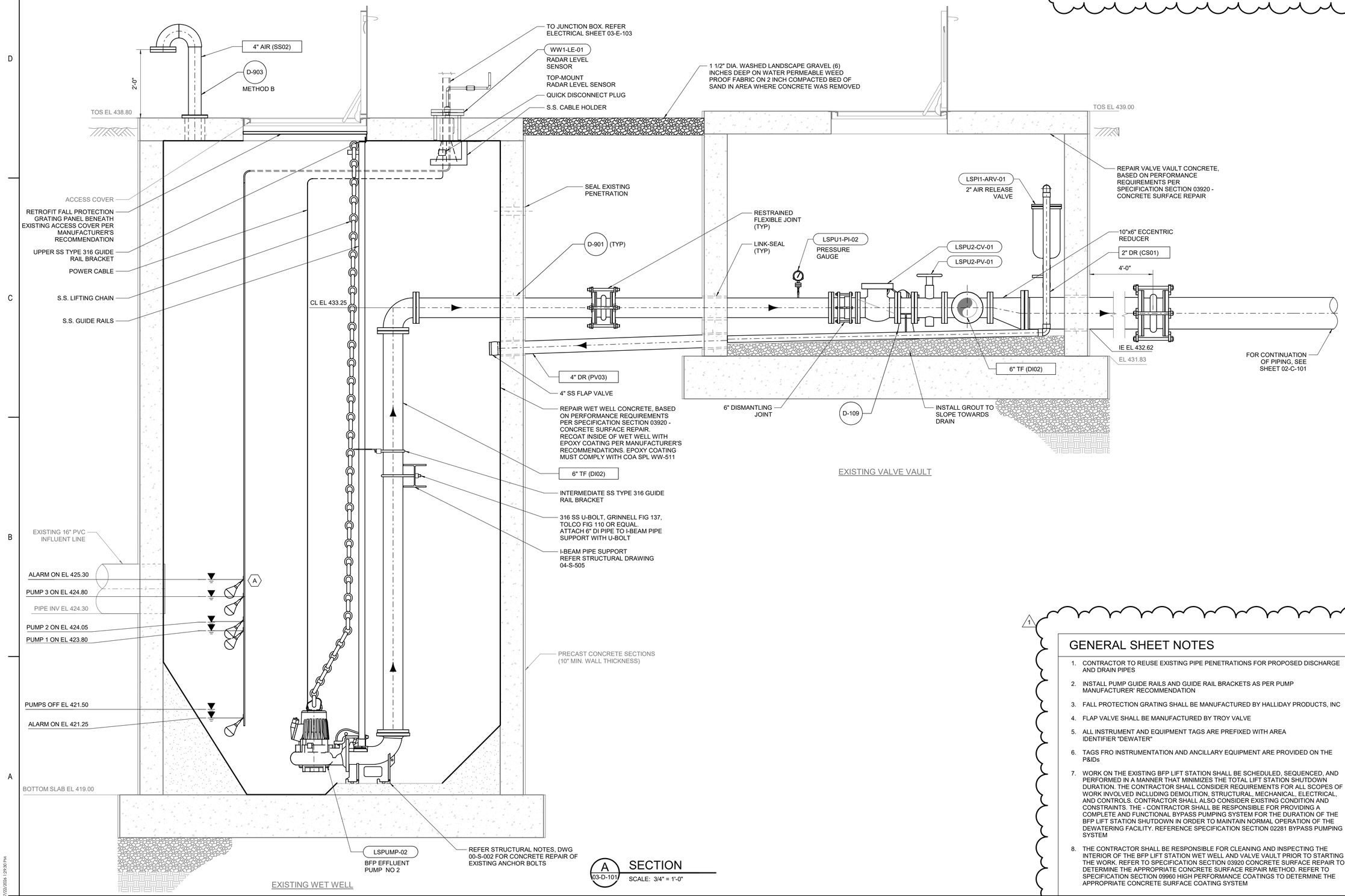


A 03-D-101 SECTION
SCALE: 3/4" = 1'-0"

## SHEET KEYNOTE

1

A. FLOATS ARE SHOWN REPRESENTATIVELY AND SHALL BE LOCATED AS TO PREVENT INTERFERENCE FROM THE INCOMING FLOW. CONTRACTOR TO CONFIRM LOCATION OF HOOK FOR THE PROPOSED LEVEL FLOATS WITH CITY AND ENGINEER DURING CONSTRUCTION

## GENERAL SHEET NOTES

1

1. CONTRACTOR TO REUSE EXISTING PIPE PENETRATIONS FOR PROPOSED DISCHARGE AND DRAIN PIPES
2. INSTALL PUMP GUIDE RAILS AND GUIDE RAIL BRACKETS AS PER PUMP MANUFACTURER' RECOMMENDATION
3. FALL PROTECTION GRATING SHALL BE MANUFACTURED BY HALLIDAY PRODUCTS, INC
4. FLAP VALVE SHALL BE MANUFACTURED BY TROY VALVE
5. ALL INSTRUMENT AND EQUIPMENT TAGS ARE PREFIXED WITH AREA IDENTIFIER "DEWATER"
6. TAGS FRO INSTRUMENTATION AND ANCILLARY EQUIPMENT ARE PROVIDED ON THE P&IDs
7. WORK ON THE EXISTING BFP LIFT STATION SHALL BE SCHEDULED, SEQUENCED, AND PERFORMED IN A MANNER THAT MINIMIZES THE TOTAL LIFT STATION SHUTDOWN DURATION. THE CONTRACTOR SHALL CONSIDER REQUIREMENTS FOR ALL SCOPES OF WORK INVOLVED INCLUDING DEMOLITION, STRUCTURAL, MECHANICAL, ELECTRICAL, AND CONTROLS. CONTRACTOR SHALL ALSO CONSIDER EXISTING CONDITION AND CONSTRAINTS. THE - CONTRACTOR SHALL BE RESPONSIBLE FOR PROVIDING A COMPLETE AND FUNCTIONAL BYPASS PUMPING SYSTEM FOR THE DURATION OF THE BFP LIFT STATION SHUTDOWN IN ORDER TO MAINTAIN NORMAL OPERATION OF THE DEWATERING FACILITY. REFERENCE SPECIFICATION SECTION 02281 BYPASS PUMPING SYSTEM
8. THE CONTRACTOR SHALL BE RESPONSIBLE FOR CLEANING AND INSPECTING THE INTERIOR OF THE BFP LIFT STATION WET WELL AND VALVE VAULT PRIOR TO STARTING THE WORK. REFER TO SPECIFICATION SECTION 03920 CONCRETE SURFACE REPAIR TO DETERMINE THE APPROPRIATE CONCRETE SURFACE REPAIR METHOD. REFER TO SPECIFICATION SECTION 09960 HIGH PERFORMANCE COATINGS TO DETERMINE THE APPROPRIATE CONCRETE SURFACE COATING SYSTEM

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ALDO J. SOTELO
106323
PROFESSIONAL ENGINEER
07/22/2026

Client/Project
CITY OF AUSTIN
HORNSBY BEND BMP PROCESS AMMONIA REMOVAL FACILITY
AUSTIN, TX

Project No.:177311636
File Name: N/A
Scale: 3/4" = 1'-0"

| PK | AJS | CC/JAL | 2026.07.22 |
|---|---|---|---|
| Dwn. | Dsgn. | Chkd. | YYYY.MM.DD |

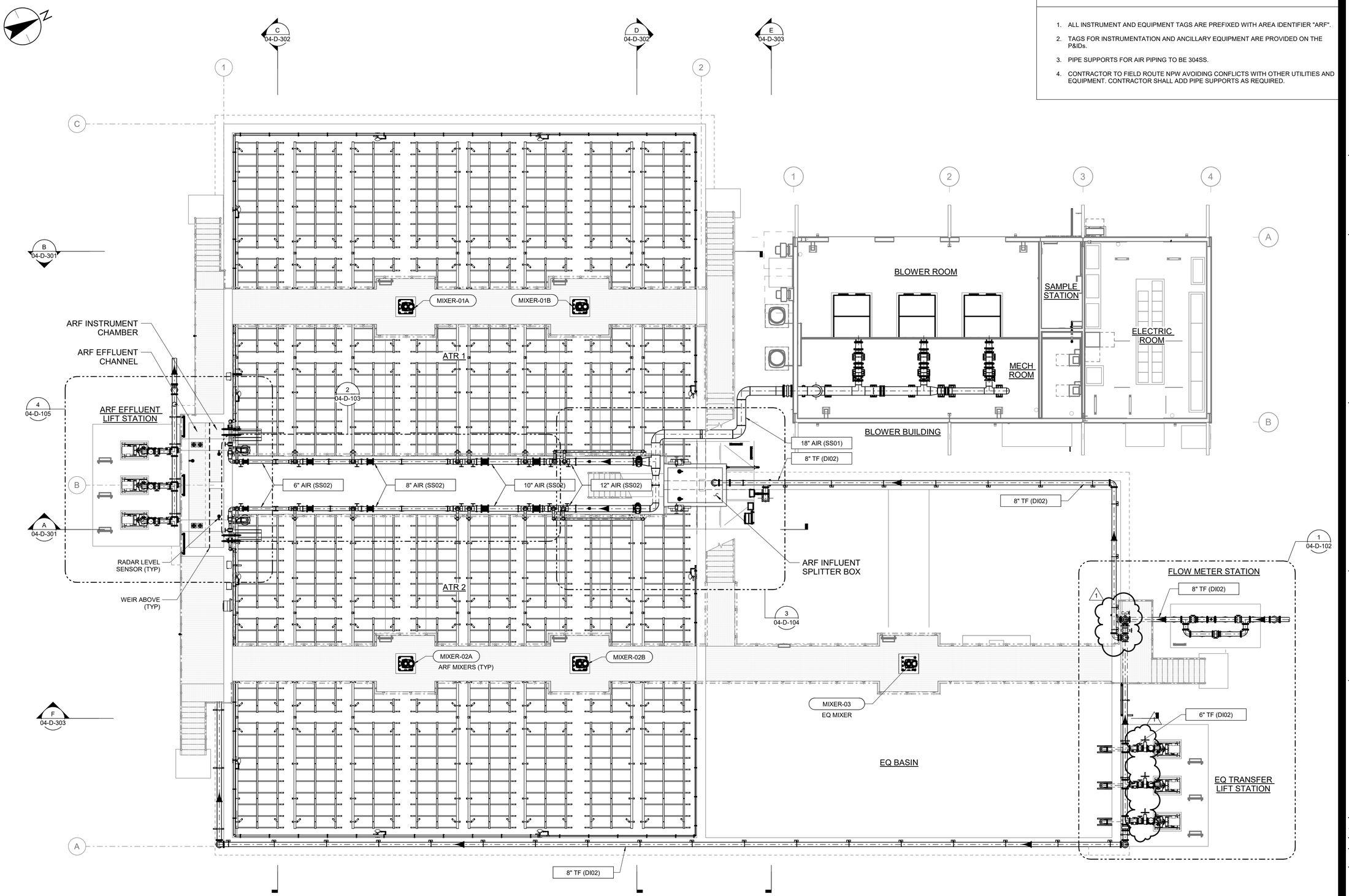
Title
BFP EFFLUENT LIFT STATION SECTION

Revision: 1 Sheet: 147 of 229
Drawing No.
03-D-301

ORIGINAL SHEET - ANSI D
7/22/2026 1:29:50 PM

## GENERAL SHEET NOTES

1. ALL INSTRUMENT AND EQUIPMENT TAGS ARE PREFIXED WITH AREA IDENTIFIER "ARF".
2. TAGS FOR INSTRUMENTATION AND ANCILLARY EQUIPMENT ARE PROVIDED ON THE P&IDs.
3. PIPE SUPPORTS FOR AIR PIPING TO BE 304SS.
4. CONTRACTOR TO FIELD ROUTE NPW AVOIDING CONFLICTS WITH OTHER UTILITIES AND EQUIPMENT. CONTRACTOR SHALL ADD PIPE SUPPORTS AS REQUIRED.




## OVERALL PLAN

SCALE: 1/8" = 1'-0"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07/22/2026

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CITY OF AUSTIN
HORNSBY BEND BMP PROCESS AMMONIA REMOVAL FACILITY
AUSTIN, TX

Project No.:177311636
File Name: N/A
Scale: 1/8" = 1'-0"

| PK/BR | AJS | CC/JAL | 2026.07.22 |
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| Dwn. | Dsgn. | Chkd. | YYYY.MM.DD |

Title
ARF OVERALL PLAN

Revision: 1 Sheet: 148 of 229
Drawing No.
**04-D-101**

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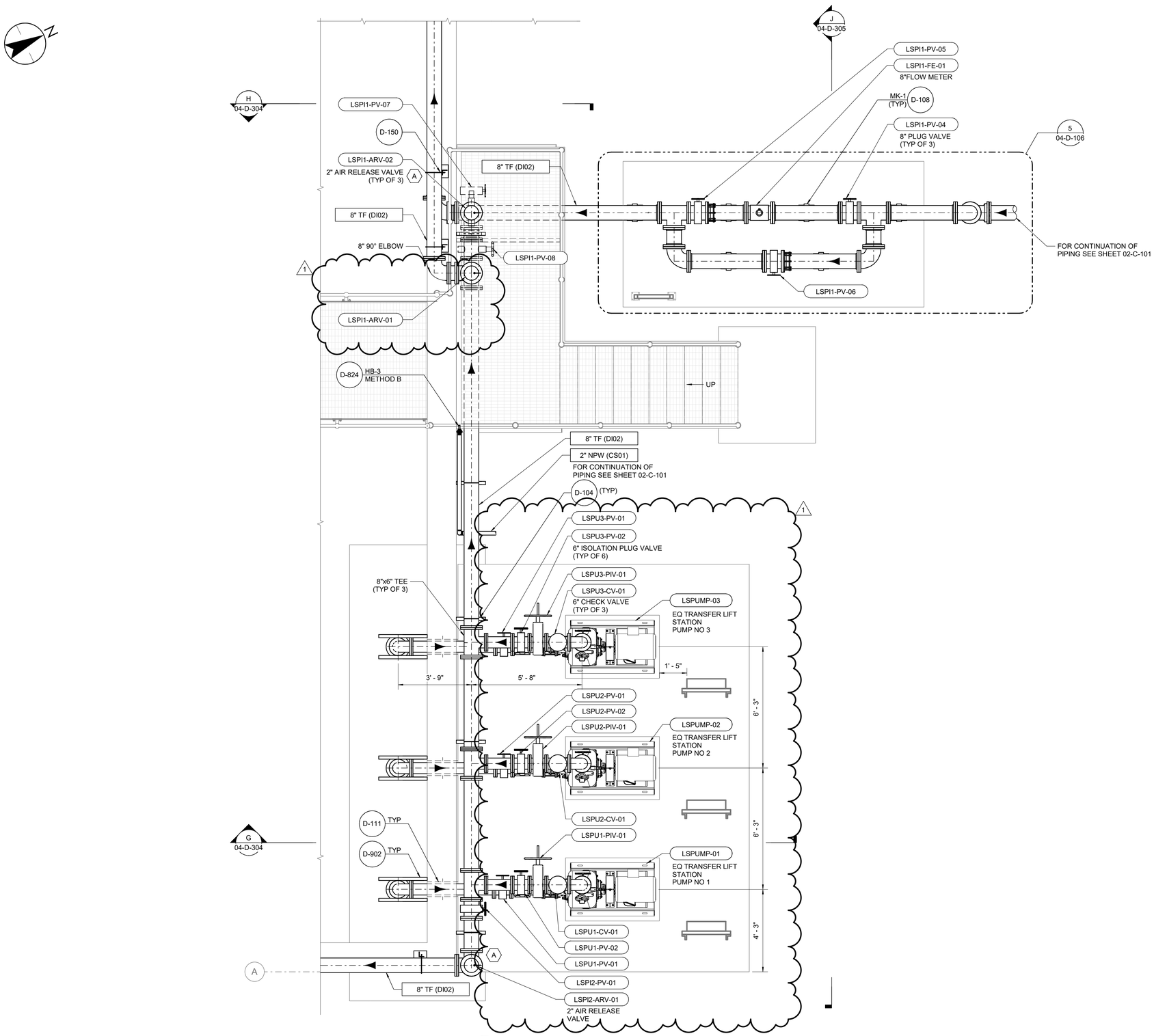
ORIGINAL SHEET - ANSI D




1 04-D-101 EQ TRANSFER LIFT STATION PLAN

SCALE: 3/8" = 1'-0"

## GENERAL SHEET NOTES

1. ALL BURIED PIPE FITTINGS AND BENDS TO BE RESTRAINED.
2. ALL INSTRUMENT AND EQUIPMENT TAGS ARE PREFIXED WITH AREA IDENTIFIER "ARF".
3. TAGS FOR INSTRUMENTATION AND ANCILLARY EQUIPMENT ARE PROVIDED ON THE P&IDs.
4. PIPE SUPPORTS FOR AIR PIPING TO BE 304SS.
5. HEAT TRACE AND INSULATE NPW PIPE ABOVE GRADE.

## SHEET KEYNOTE

A. ROUTE DRAIN LINE FROM ARV BACK TO EQ BASIN.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REMOVAL FACILITY
AUSTIN, TX

Project No.:177311636

File Name: N/A

Scale: 3/8" = 1'-0"

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Title
ARF EQ TRANSFER LIFT
STATION PLAN

Revision: 1 Sheet: 149 of 229

Drawing No.
**04-D-102**

7/21/2026 6:56:30 PM

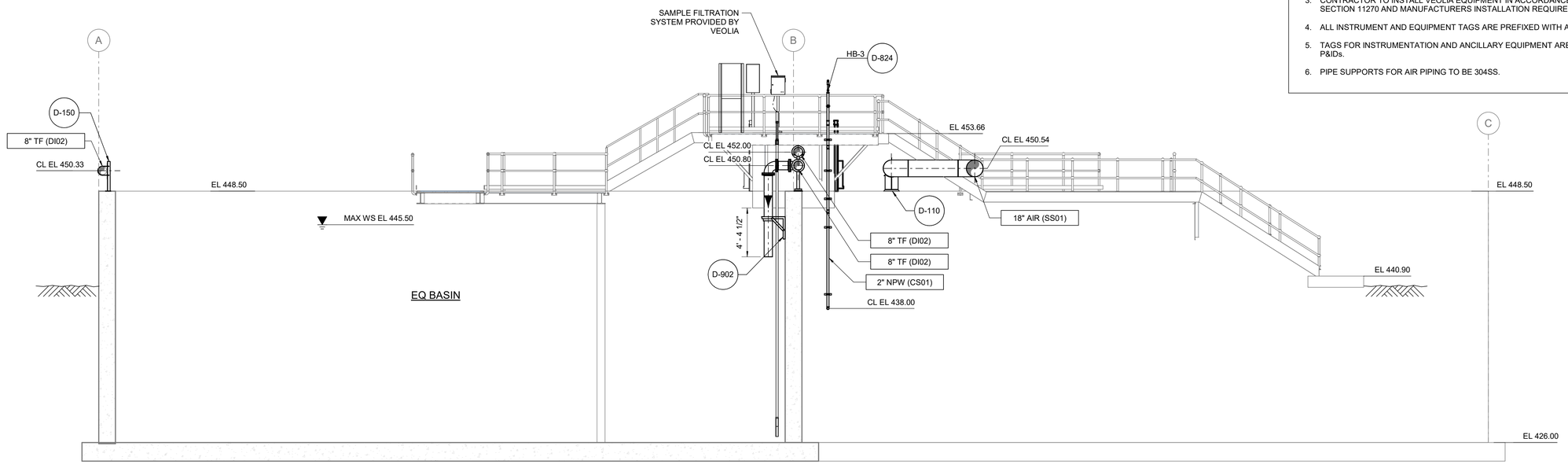
ORIGINAL SHEET - ANSI D

## SHEET KEYNOTE

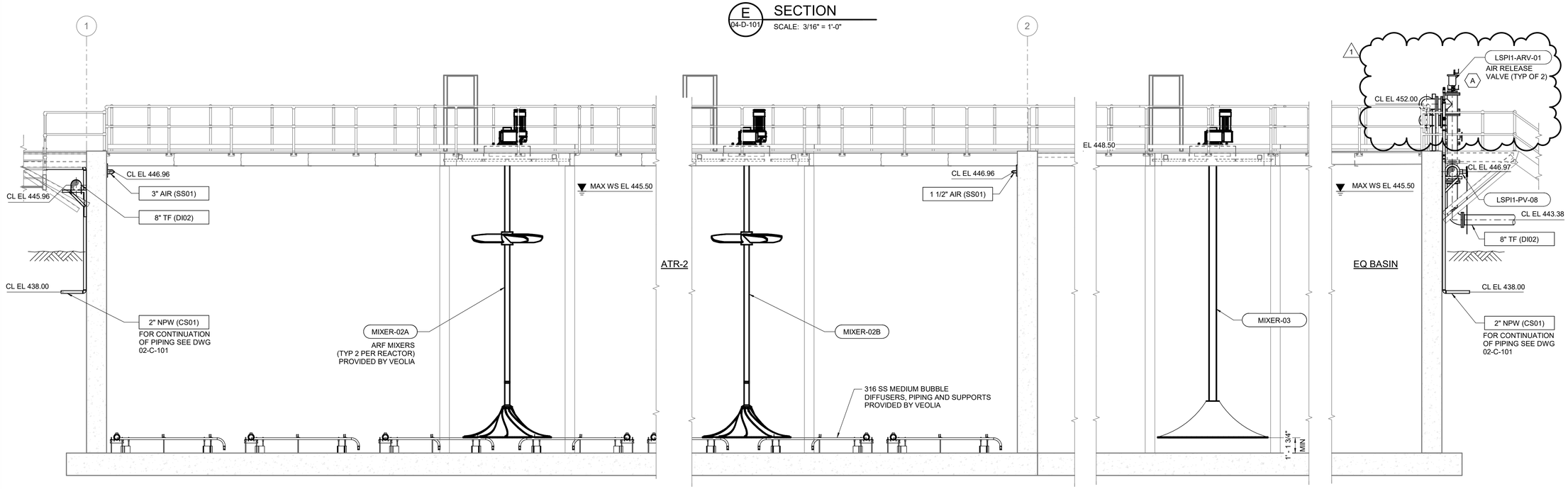
A. ROUTE DRAIN LINE FROM ARV BACK TO EQ BASIN.

## GENERAL SHEET NOTE

1. ALL PROCESS AERATION PIPING ON THE WALKWAY SHALL BE INSULATED. SEE SPECIFICATION 15023 FOR REQUIREMENTS.
2. HEAT TRACE AND INSULATE NPW PIPE ABOVE GRADE.
3. CONTRACTOR TO INSTALL VEOLIA EQUIPMENT IN ACCORDANCE WITH SPECIFICATION SECTION 11270 AND MANUFACTURERS INSTALLATION REQUIREMENTS.
4. ALL INSTRUMENT AND EQUIPMENT TAGS ARE PREFIXED WITH AREA IDENTIFIER "ARF".
5. TAGS FOR INSTRUMENTATION AND ANCILLARY EQUIPMENT ARE PROVIDED ON THE P&IDs.
6. PIPE SUPPORTS FOR AIR PIPING TO BE 304SS.




E 04-D-101 SECTION
SCALE: 3/16" = 1'-0"




F 04-D-101 SECTION
SCALE: 1/4" = 1'-0"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AUSTIN, TX

Project No.:177311636
File Name: N/A

Scale: As indicated

| PK/BR | AJS | CC/JAL | 2026.07.22 |
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| Dwn. | Dsgn. | Chkd. | YYYY.MM.DD |

Title
ATR SECTIONS III

Revision: 1 Sheet: 156 of 229
Drawing No.
**04-D-303**

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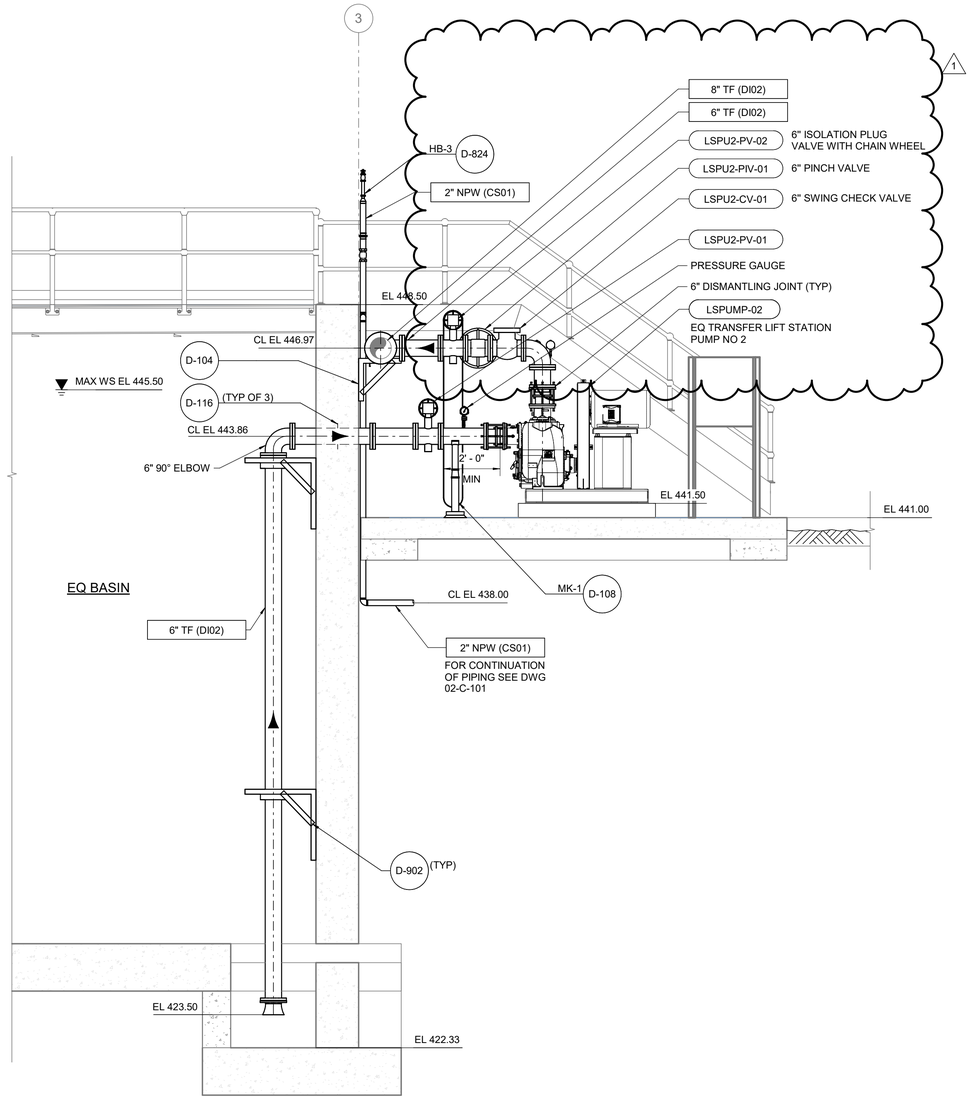
ORIGINAL SHEET - ANSI D

## SHEET KEYNOTE

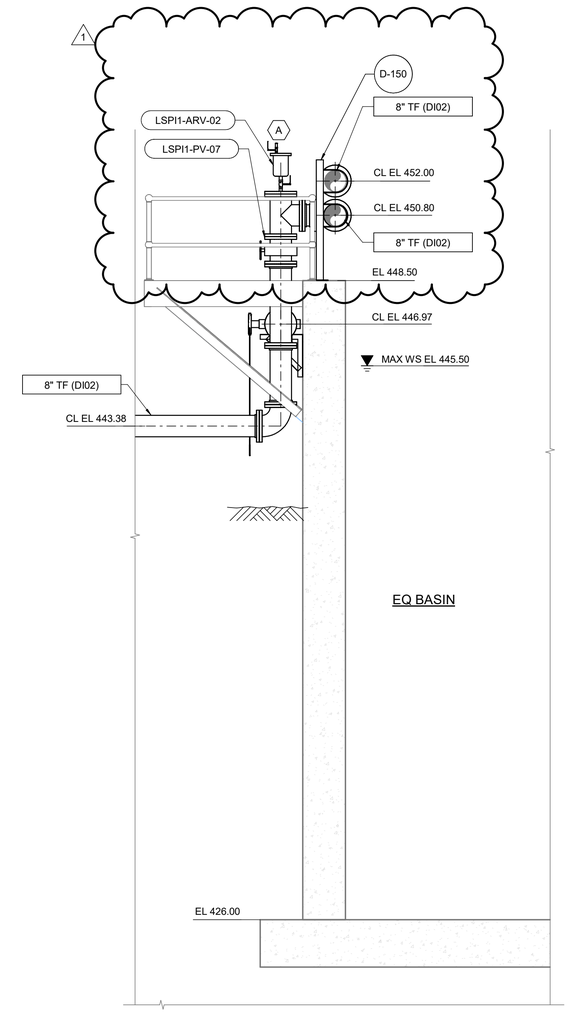
A. ROUTE DRAIN LINE FROM ARV BACK TO EQ BASIN.

## GENERAL SHEET NOTE

1. HEAT TRACE AND INSULATE NPW PIPE ABOVE GRADE.
2. ROUTE DRAIN LINE FOR ALL THE PUMP DISCHARGE ARVS TO DRAIN MH-2.
3. ALL INSTRUMENT AND EQUIPMENT TAGS ARE PREFIXED WITH AREA IDENTIFIER "ARF".
4. TAGS FOR INSTRUMENTATION AND ANCILLARY EQUIPMENT ARE PROVIDED ON THE P&IDs.
5. PIPE SUPPORTS FOR AIR PIPING TO BE 304SS.




G 04-D-102 SECTION
SCALE: 3/8" = 1'-0"




H 04-D-102 SECTION
SCALE: 3/8" = 1'-0"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Project No.:177311636
File Name: N/A
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Title
ARF EQ TRANSFER LIFT STATION SECTIONS IV

Revision: 1 Sheet: 157 of 229
Drawing No.
**04-D-304**

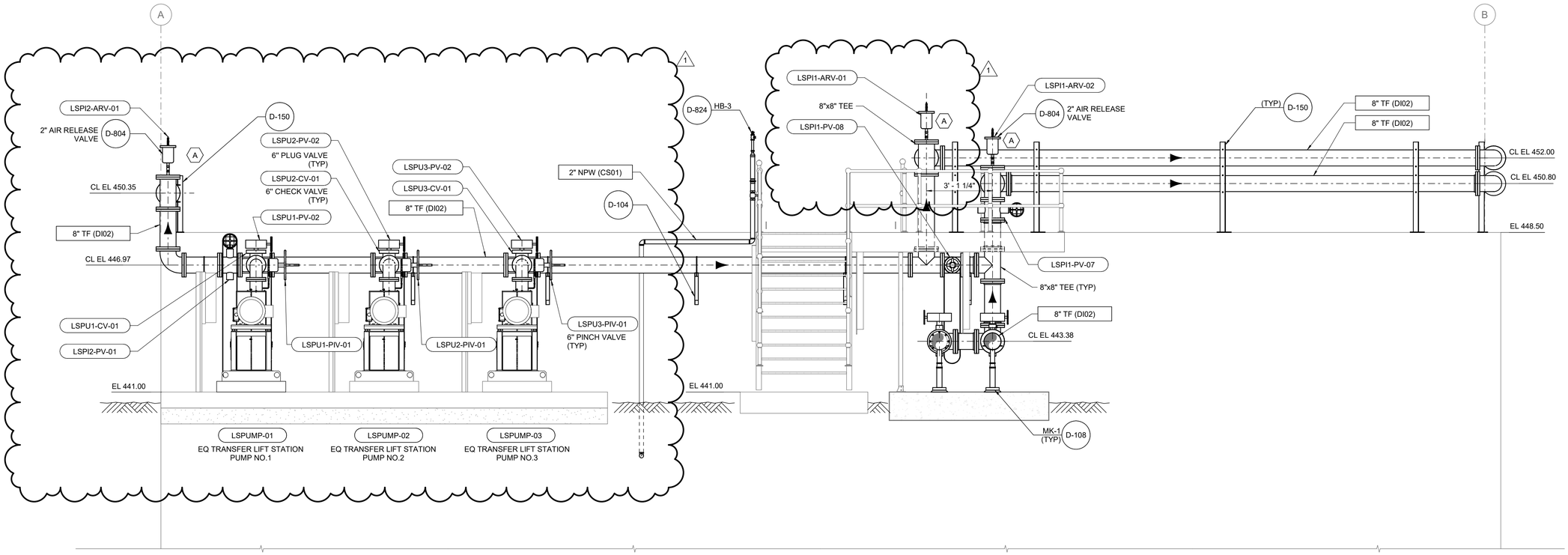
7/21/2026 6:34:38 PM
ORIGINAL SHEET - ANSI D

## GENERAL SHEET NOTE

1. HEAT TRACE AND INSULATE NPW PIPE ABOVE GRADE.
2. ALL INSTRUMENT AND EQUIPMENT TAGS ARE PREFIXED WITH AREA IDENTIFIER "ARF".
3. TAGS FOR INSTRUMENTATION AND ANCILLARY EQUIPMENT ARE PROVIDED ON THE P&IDs.
4. PIPE SUPPORTS FOR AIR PIPING TO BE 304SS.

## SHEET KEYNOTE

A. ROUTE DRAIN LINE FROM ARV BACK TO EQ BASIN.




J 04-D-102 SECTION

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File Name: N/A

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Title
ARF EQ TRANSFER LIFT STATION SECTIONS V

Revision: 1 Sheet: 158 of 229

Drawing No.
**04-D-305**

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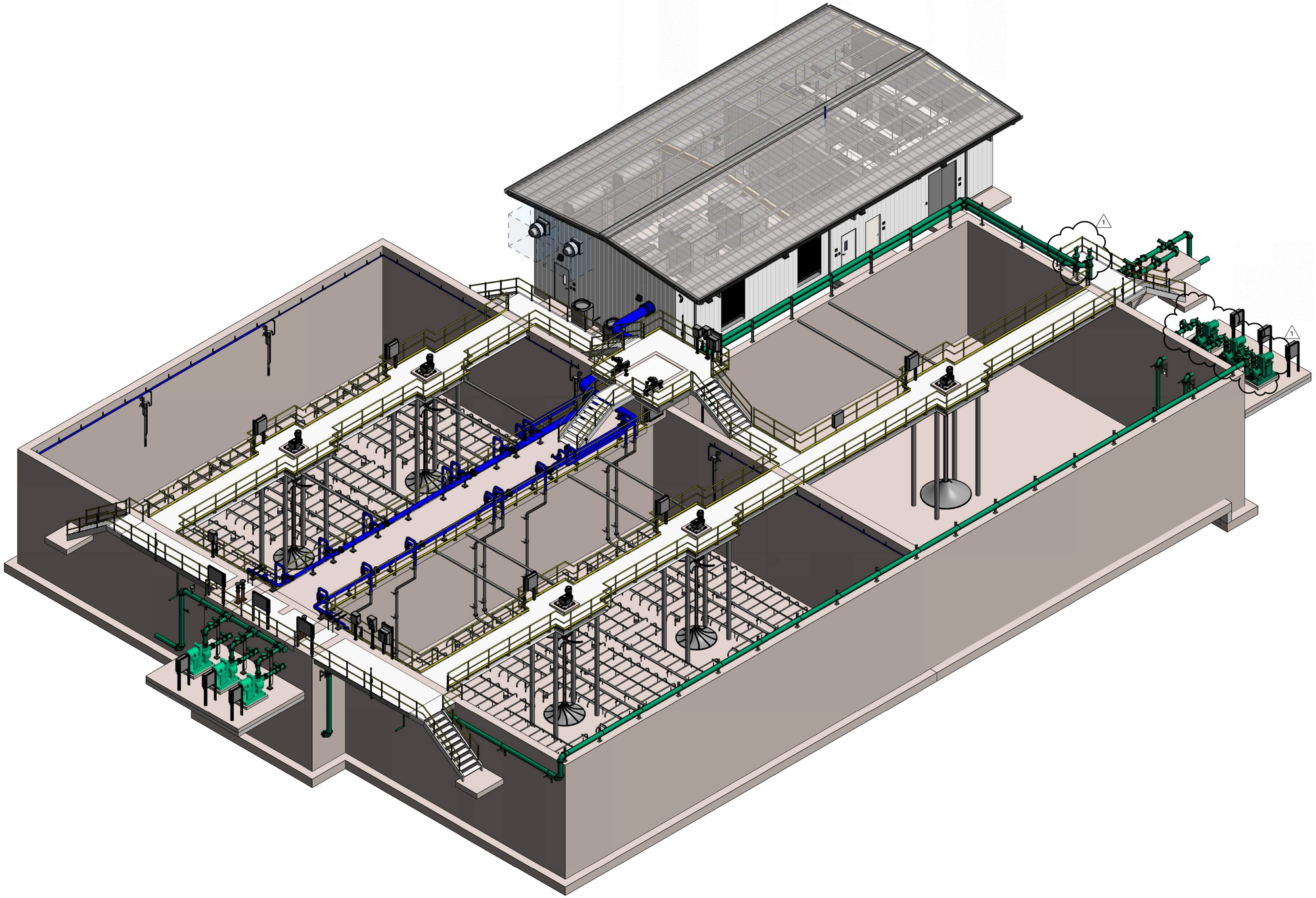
ORIGINAL SHEET - ANSI D



## ISOMETRIC VIEW

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Title
ARF ISOMETRIC VIEW - I

Revision: 1 Sheet: 162 of 229

Drawing No.
**04-D-901**

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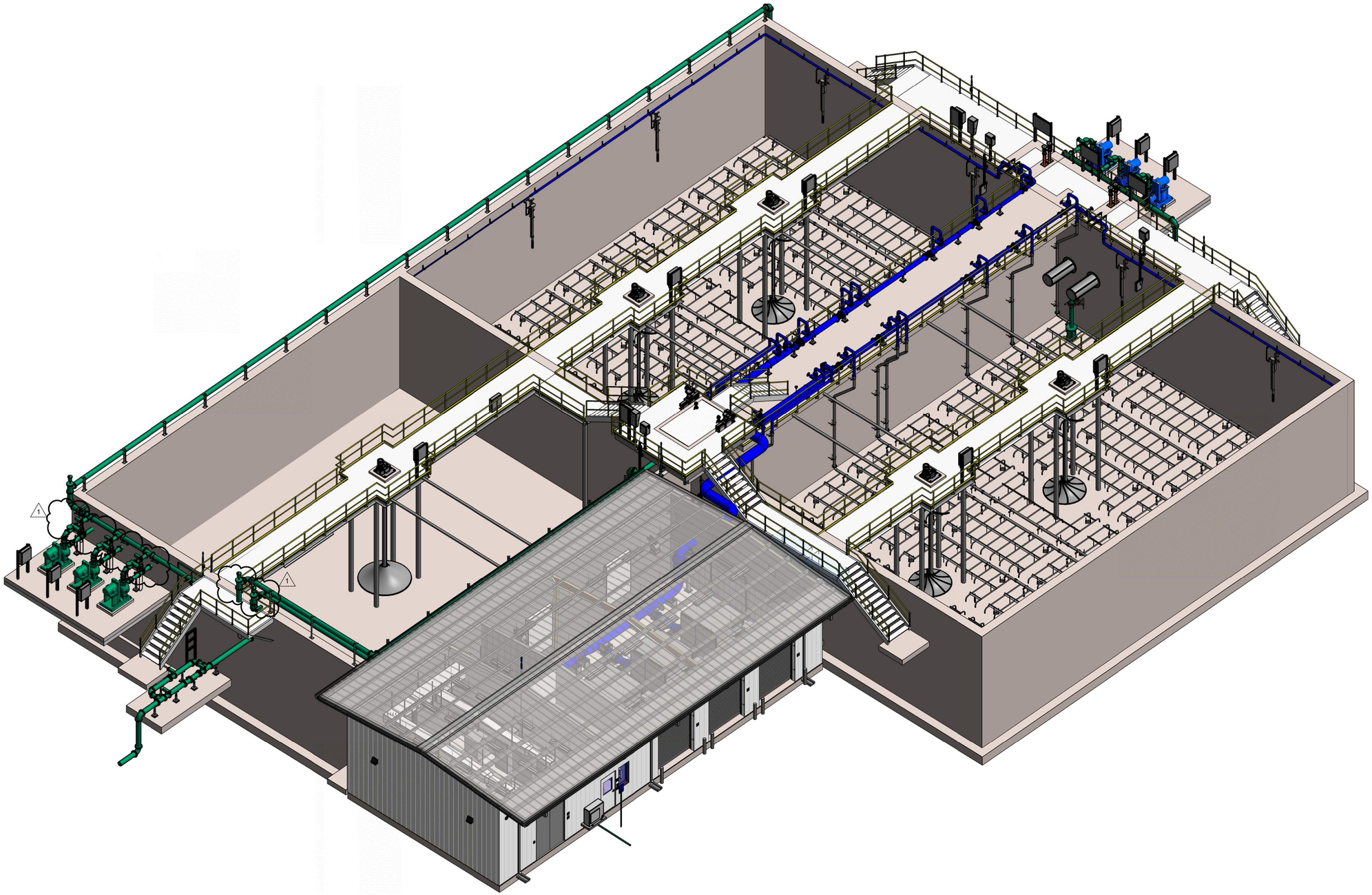
ORIGINAL SHEET - ANSI D




## ISOMETRIC VIEW

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File Name: N/A

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Title
ARF ISOMETRIC VIEW - II

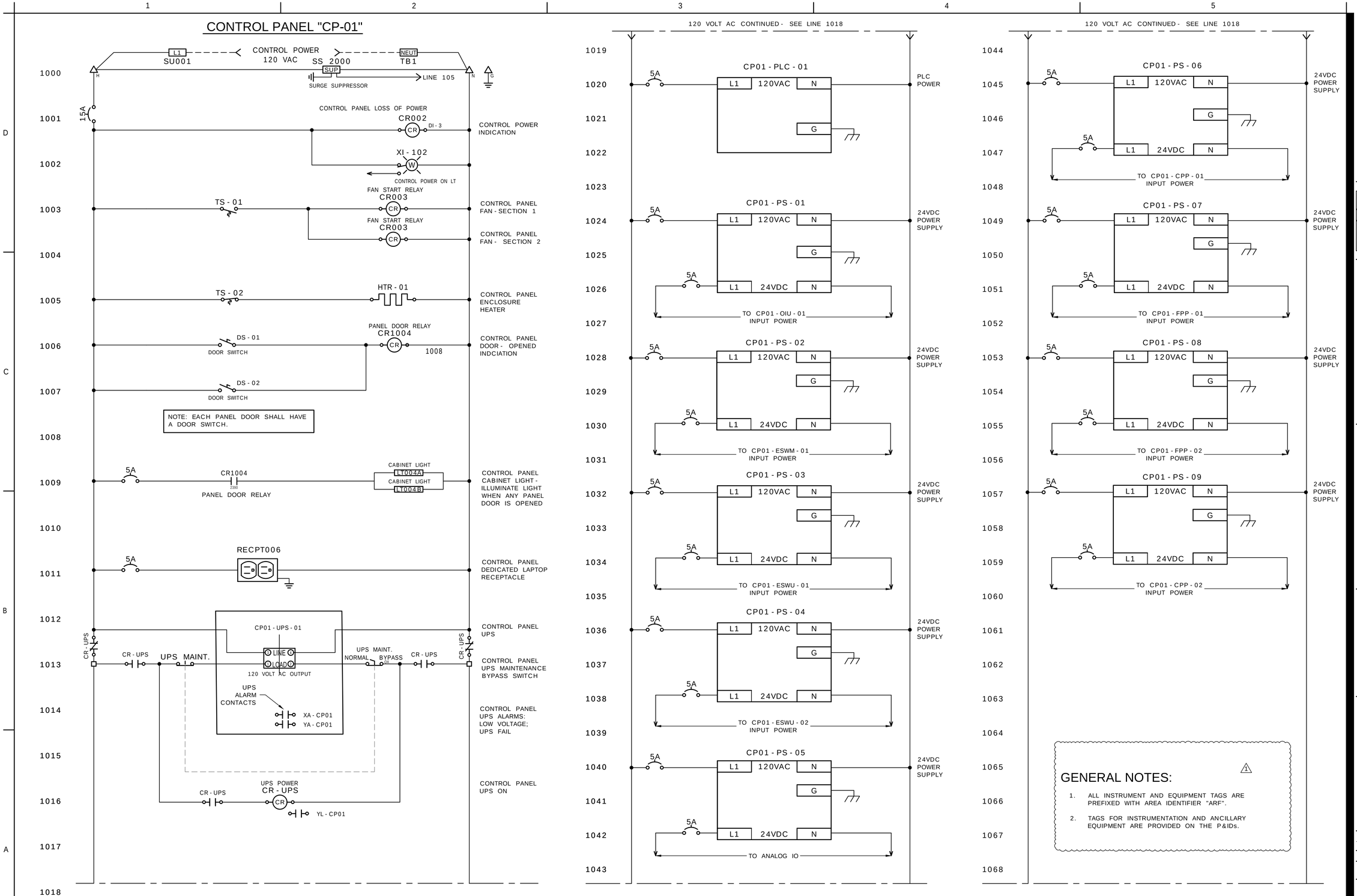
Revision: 1 Sheet: 163 of 229

Drawing No.
**04-D-902**

7/21/2026 6:37:29 PM

ORIGINAL SHEET - ANSI D

# CONTROL PANEL "CP-01"




## GENERAL NOTES:

1. ALL INSTRUMENT AND EQUIPMENT TAGS ARE PREFIXED WITH AREA IDENTIFIER "ARF".
2. TAGS FOR INSTRUMENTATION AND ANCILLARY EQUIPMENT ARE PROVIDED ON THE P&IDs.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Revision

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108870
LICENSED
PROFESSIONAL ENGINEER

Client/Project
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HORNSBY BEND BMP
PROCESS AMMONIA
REMOVAL FACILITY
AUSTIN, TX

Project No.: 177311636

File Name: CP-01

Scale: AS NOTED

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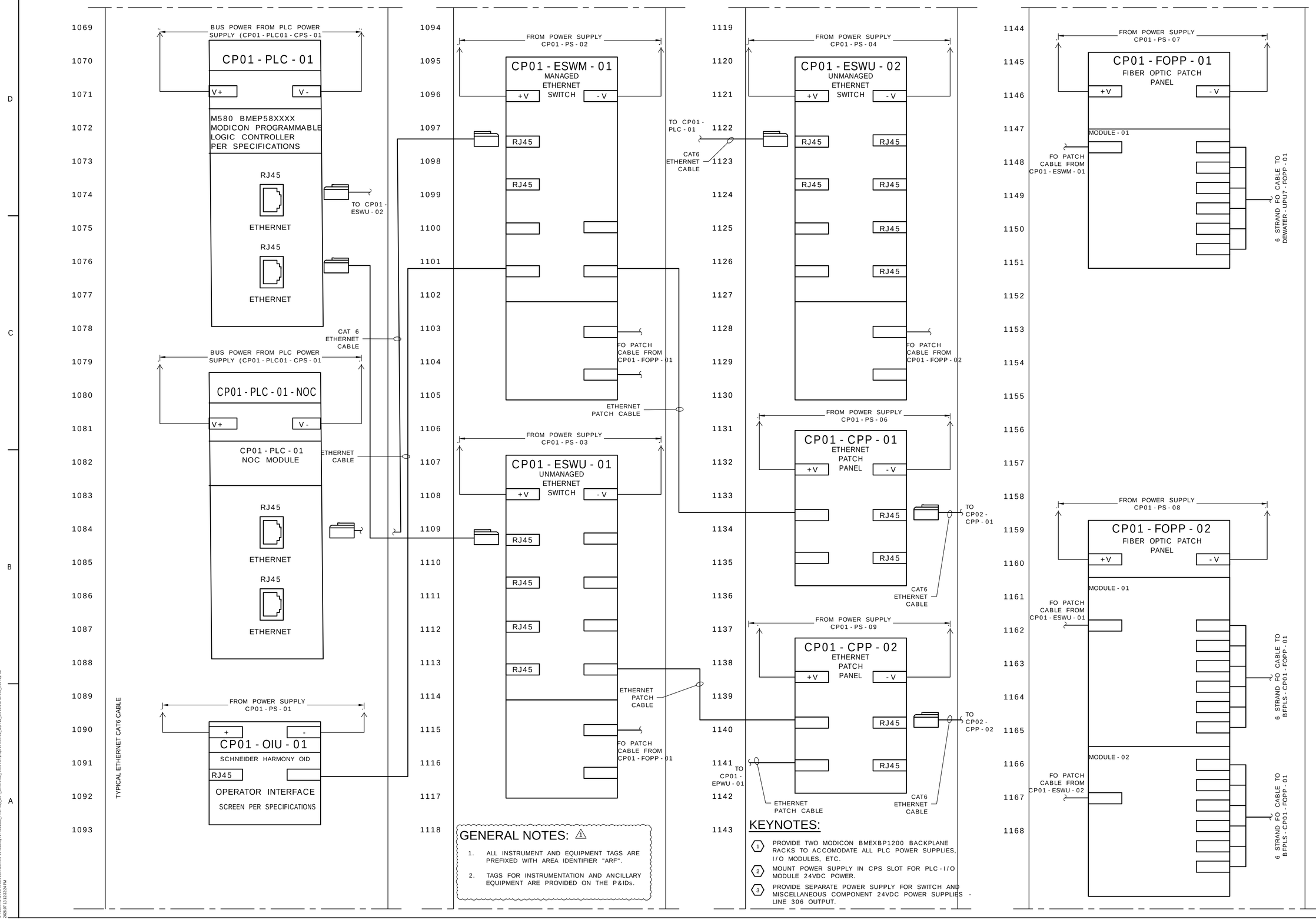
Title
GENERAL
CP-01 SCHEMATICS - I

Revision:

Sheet: 199 of 229

Drawing No.
00-E-027

ORIGINAL SHEET - ANSI D




## GENERAL NOTES: (1)

1. ALL INSTRUMENT AND EQUIPMENT TAGS ARE PREFIXED WITH AREA IDENTIFIER "ARF".
2. TAGS FOR INSTRUMENTATION AND ANCILLARY EQUIPMENT ARE PROVIDED ON THE P&IDs.

## KEYNOTES:

1. PROVIDE TWO MODICON BMEXBP1200 BACKPLANE RACKS TO ACCOMODATE ALL PLC POWER SUPPLIES, I/O MODULES, ETC.
2. MOUNT POWER SUPPLY IN CPS SLOT FOR PLC - I/O MODULE 24VDC POWER.
3. PROVIDE SEPARATE POWER SUPPLY FOR SWITCH AND MISCELLANEOUS COMPONENT 24VDC POWER SUPPLIES - LINE 306 OUTPUT.

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Project No.: 177311636
File Name: CP-01

Scale:AS NOTED

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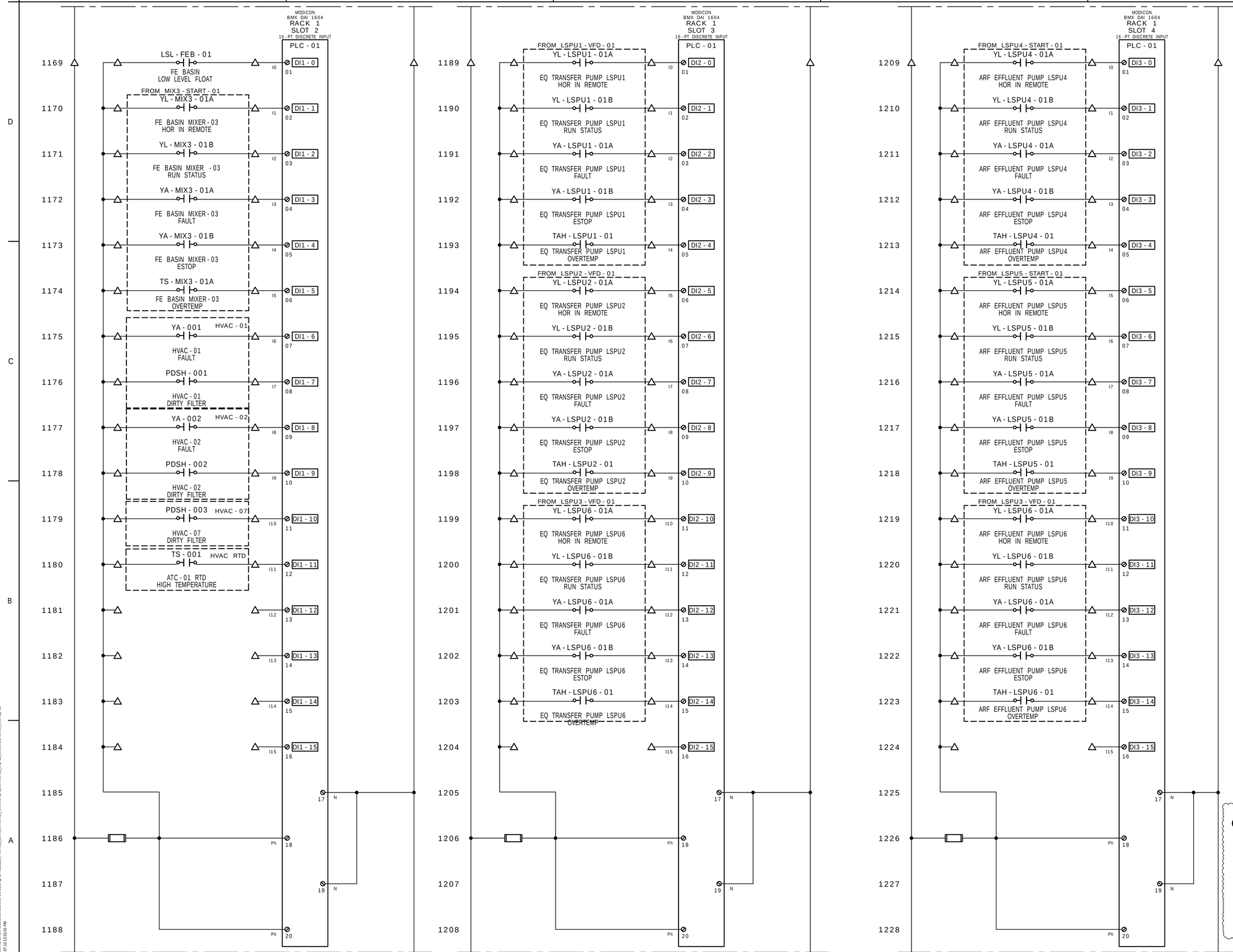
|---|---|---|---|
| Dwn. | Dsgn. | Chkd. | YYYY.MM.DD |

Title
GENERAL
CP-01 SCHEMATICS - II

Revision:
Sheet:200 of 229
Drawing No.
00-E-028

ORIGINAL SHEET - ANSI D




## GENERAL NOTES:

1. ALL INSTRUMENT AND EQUIPMENT TAGS ARE PREFIXED WITH AREA IDENTIFIER "ARF".
2. TAGS FOR INSTRUMENTATION AND ANCILLARY EQUIPMENT ARE PROVIDED ON THE P&IDs.

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Client/Project
CITY OF AUSTIN
HORNSBY BEND BMP PROCESS AMMONIA REMOVAL FACILITY
AUSTIN, TX

Project No.: 177311636
File Name: CP-01

Scale: AS NOTED

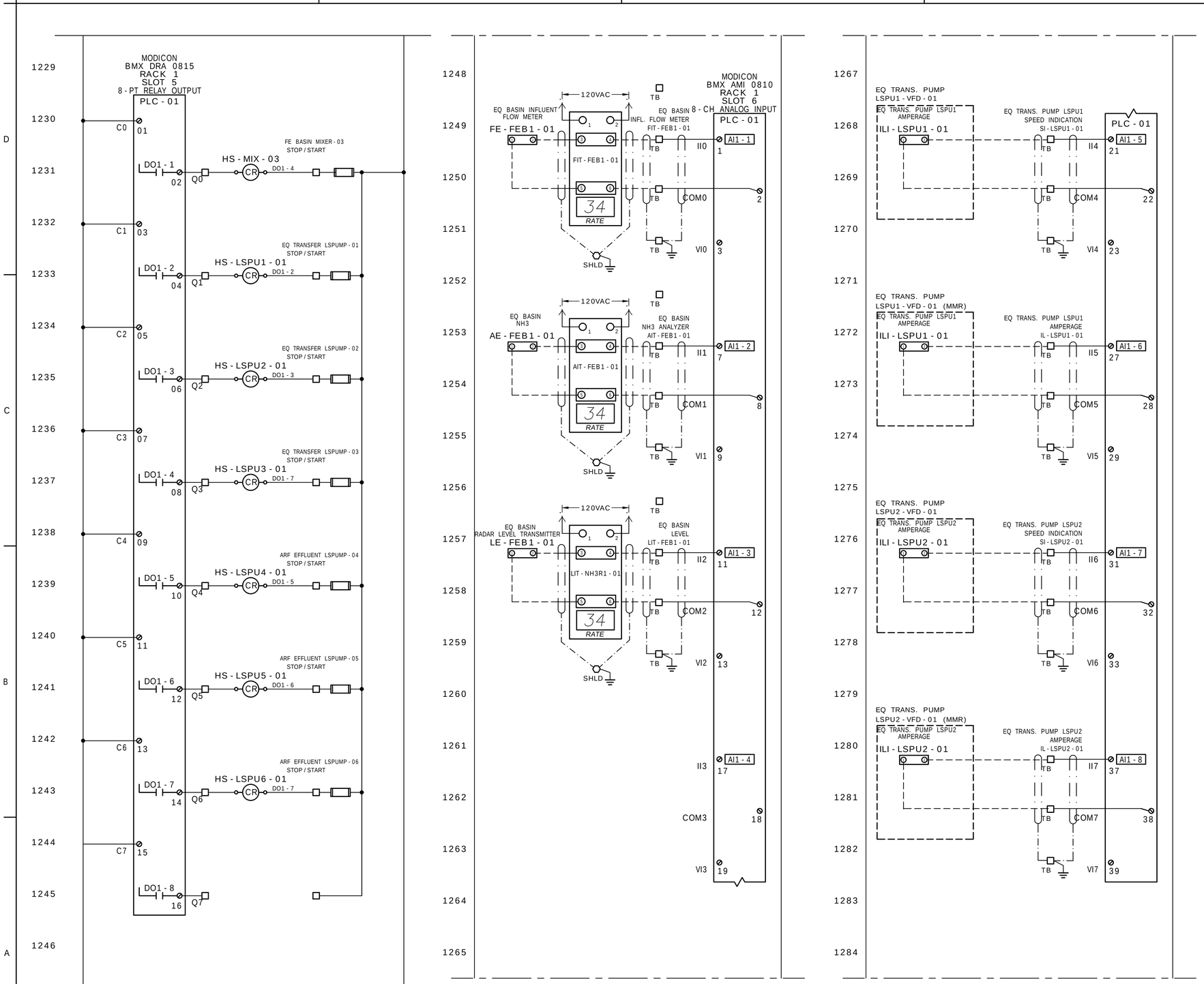
| JRSA | ESZ | ESZ | 2026.06.19 |
|---|---|---|---|
| Dwn. | Dsgn. | Chkd. | YYYY.MM.DD |

Title
GENERAL
CP-01 SCHEMATICS - III

Revision:
Sheet: 201 of 229

Drawing No.
00-E-029

ORIGINAL SHEET - ANSI D

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1. ALL INSTRUMENT AND EQUIPMENT TAGS ARE PREFIXED WITH AREA IDENTIFIER "ARF".
2. TAGS FOR INSTRUMENTATION AND ANCILLARY EQUIPMENT ARE PROVIDED ON THE P&IDs.

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CITY OF AUSTIN
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PROCESS AMMONIA
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AUSTIN, TX

Project No.: 177311636
File Name: CP-01

Scale: AS NOTED

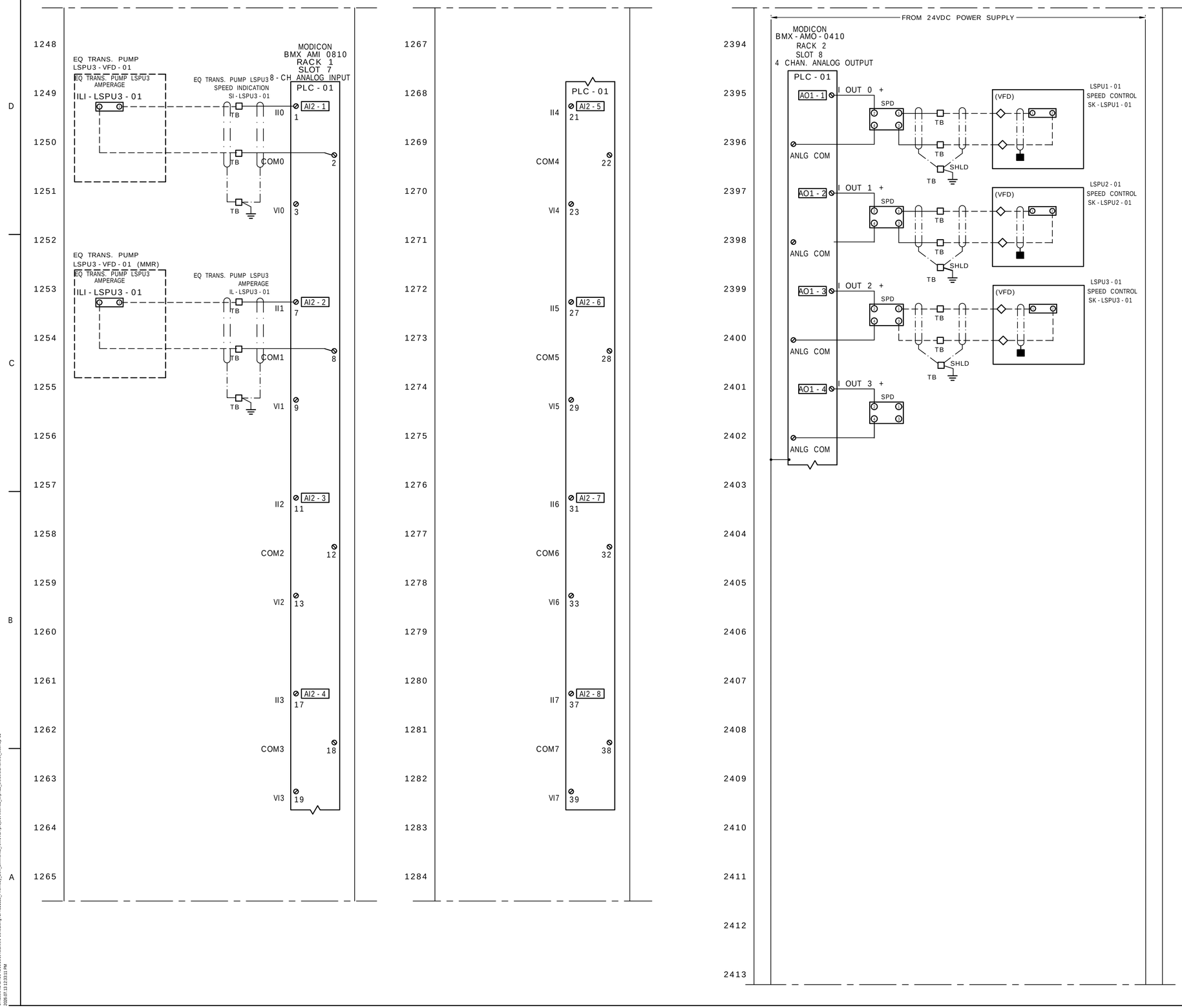
| JRSA | ESZ | ESZ | 2026.06.19 |
|---|---|---|---|
| Dwn. | Dsgn. | Chkd. | YYYY.MM.DD |

Title
GENERAL
CP-01 SCHEMATICS - IV

Revision: Sheet: 202 of 229

Drawing No.
00-E-030

ORIGINAL SHEET - ANSI D




## GENERAL NOTES:

1. ALL INSTRUMENT AND EQUIPMENT TAGS ARE PREFIXED WITH AREA IDENTIFIER "ARF".
2. TAGS FOR INSTRUMENTATION AND ANCILLARY EQUIPMENT ARE PROVIDED ON THE P&IDs.

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PROCESS AMMONIA
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AUSTIN, TX

Project No.: 177311636
File Name: CP-01
Scale: AS NOTED

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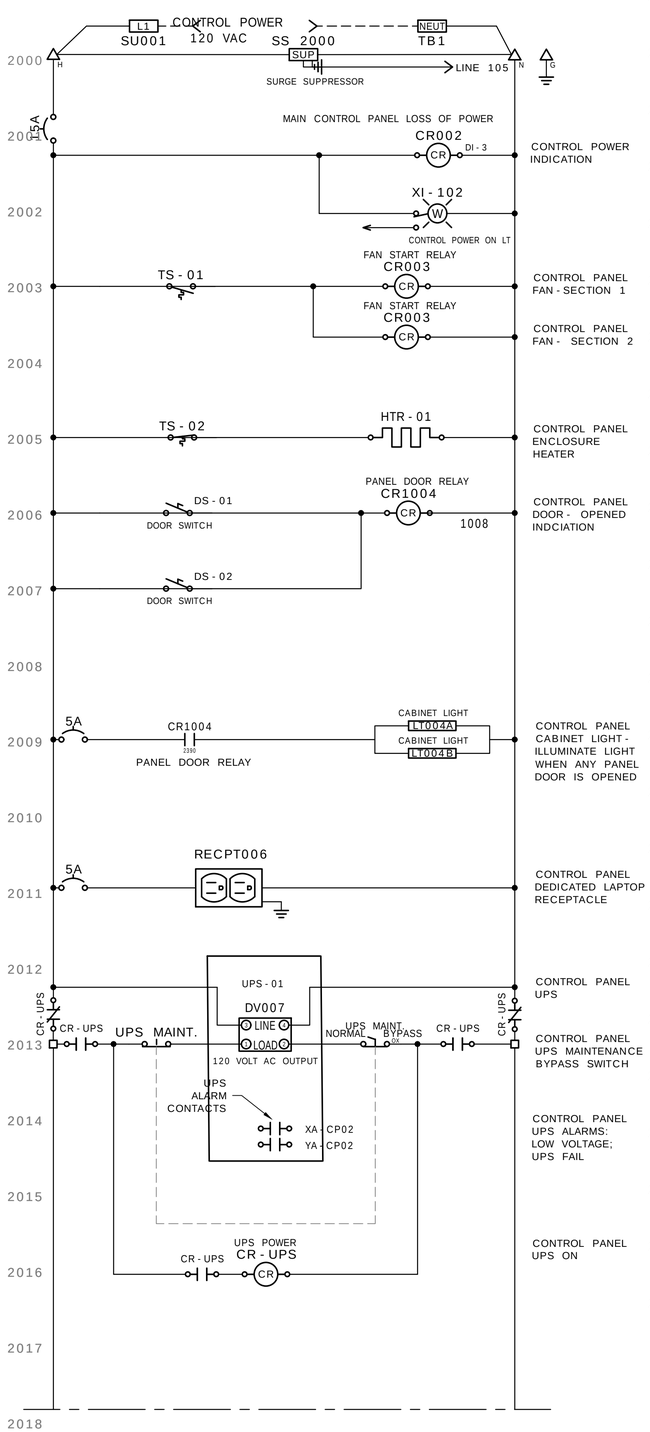
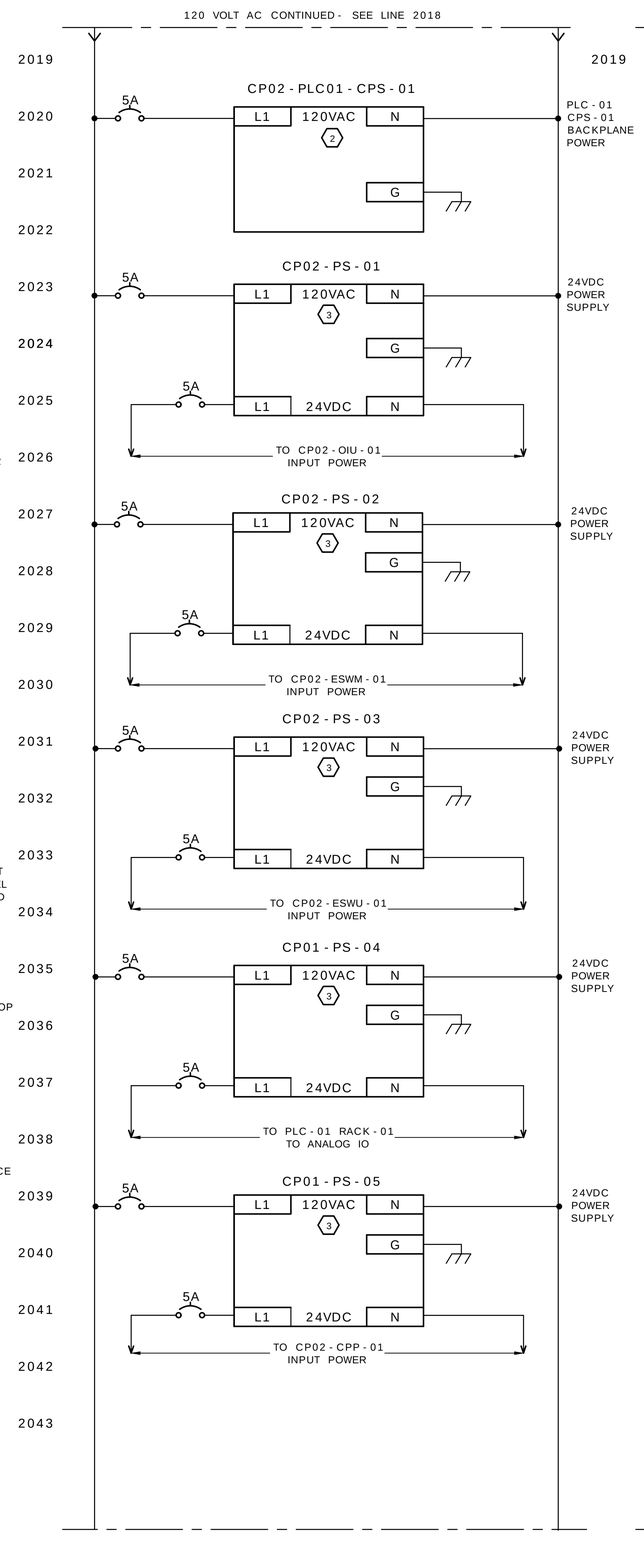
Title
GENERAL
CP-01 SCHEMATICS - V

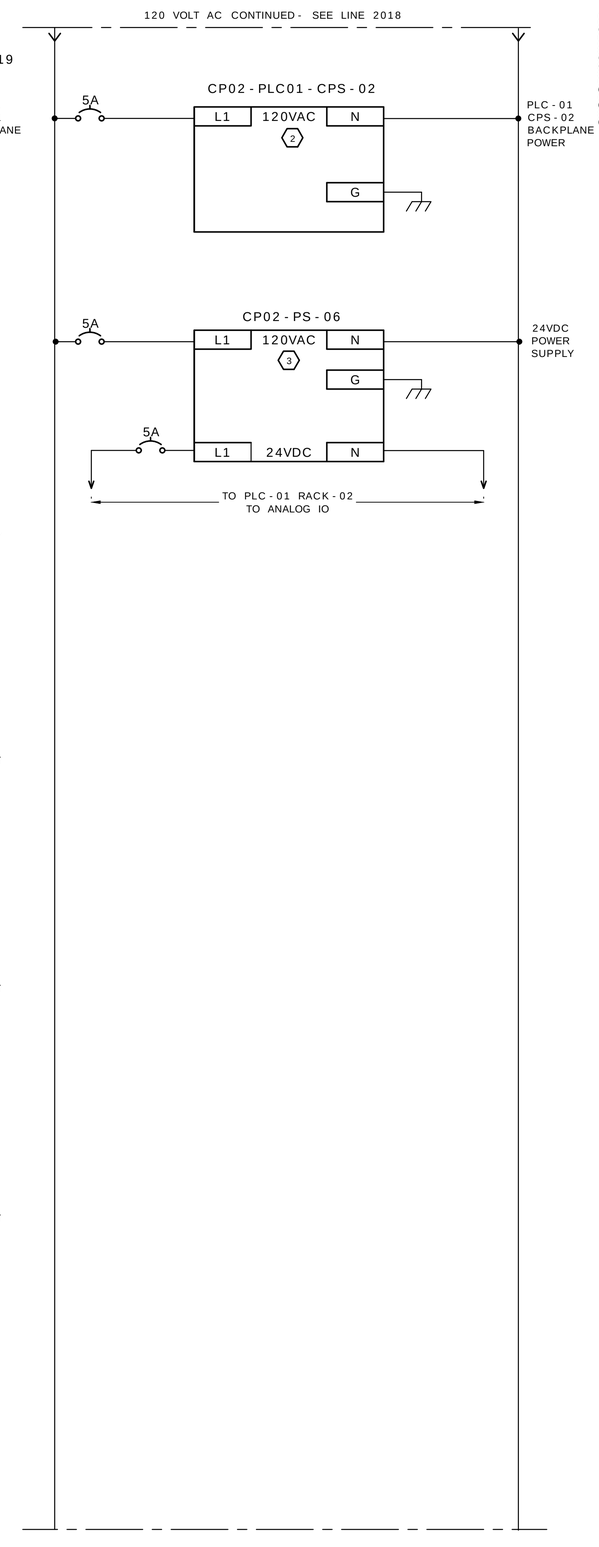
Revision:
Sheet: 203 of 229
Drawing No.
00-E-031

ORIGINAL SHEET - ANSI D

# PLC1 - MAIN CONTROL PANEL "CONTROLPANEL-02"

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## KEYNOTES:

1. PROVIDE TWO MODICON BMEXBP1200 BACKPLANE RACKS TO ACCOMODATE ALL PLC POWER SUPPLIES, I/O MODULES, ETC. PROVIDE END SPACE (SLOT 12) FOR EXPANSION MODULE).
2. MOUNT POWER SUPPLY IN CPS SLOT FOR PLC - I/O MODULE 24VDC POWER.
3. PROVIDE SEPARATE POWER SUPPLY FOR SWITCH AND MISCELLANEOUS COMPONENT 24VDC POWER SUPPLIES.


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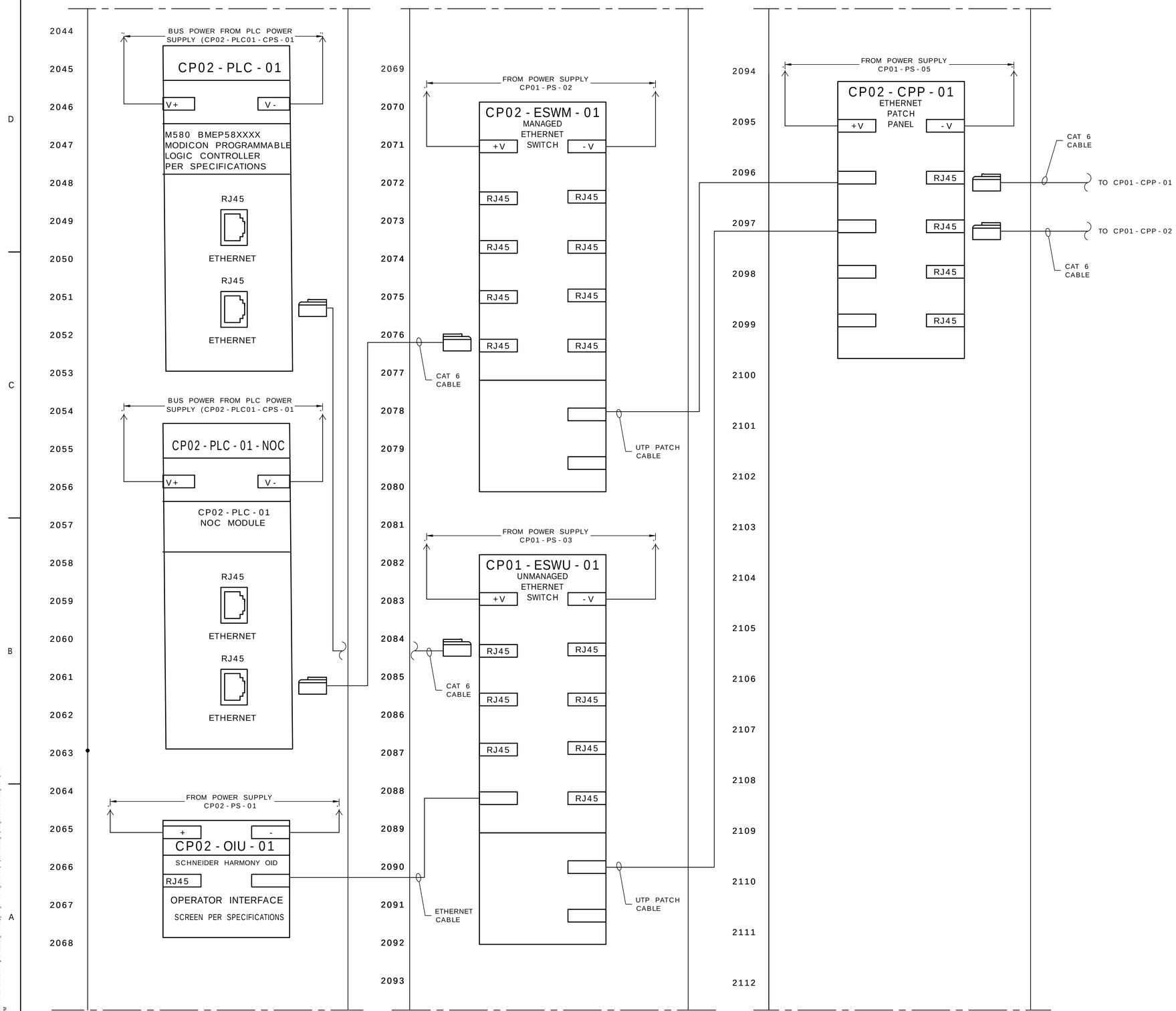
Title
GENERAL
CP-02 SCHEMATICS - I

Revision:
Sheet: 204 of 229

Drawing No.
00-E-032

ORIGINAL SHEET - ANSI D

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Project No.: 177311636
File Name: CP-02
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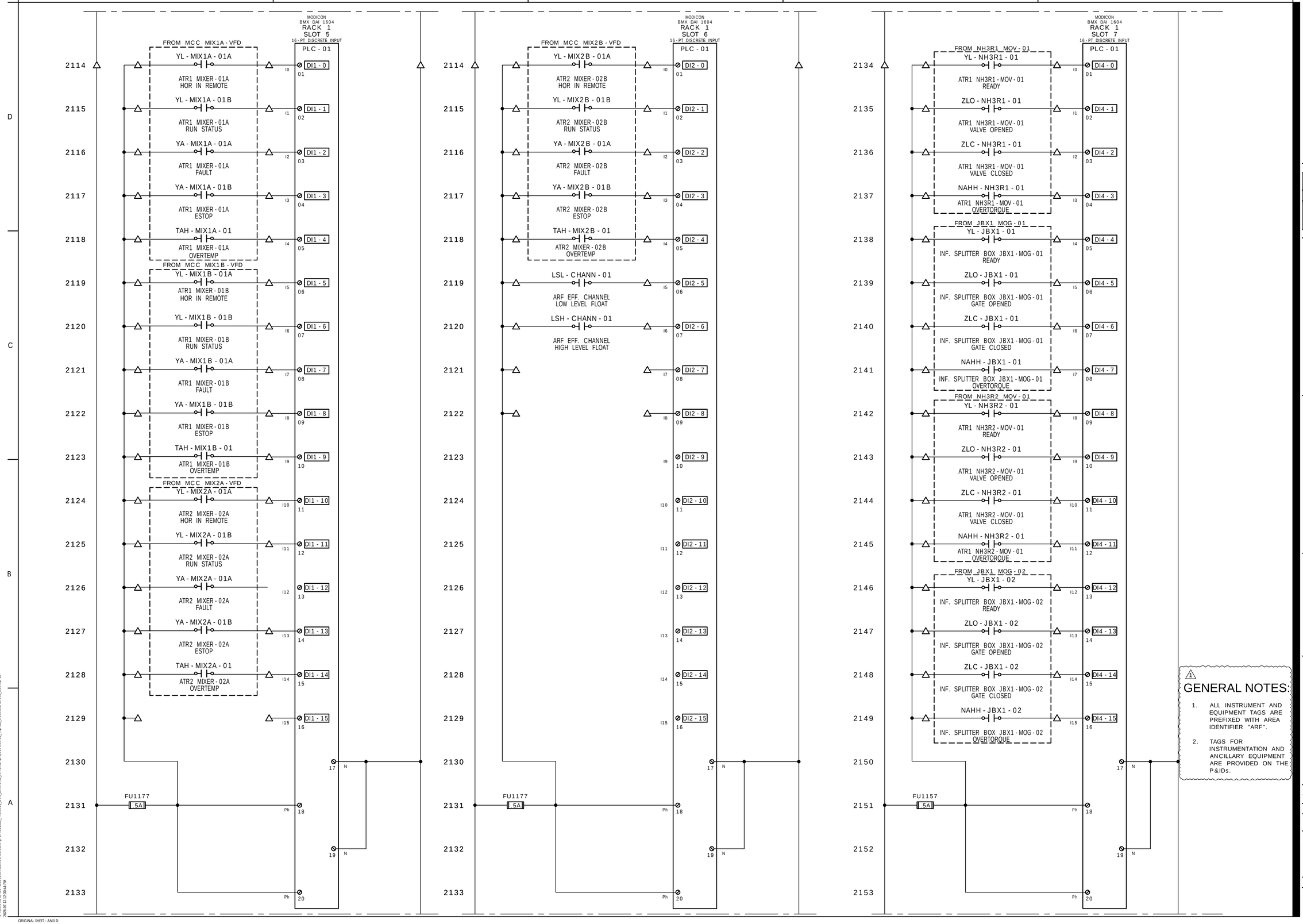
Title
GENERAL
CP-02 SCHEMATICS - II

Revision:
Sheet: 205 of 229
Drawing No.
00-E-033

ORIGINAL SHEET - ANSI D

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Project No.: 177311636

File Name: CP-02

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Title
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Revision: Sheet: 206 of 229

Drawing No.
00-E-034

ORIGINAL SHEET - ANSI D

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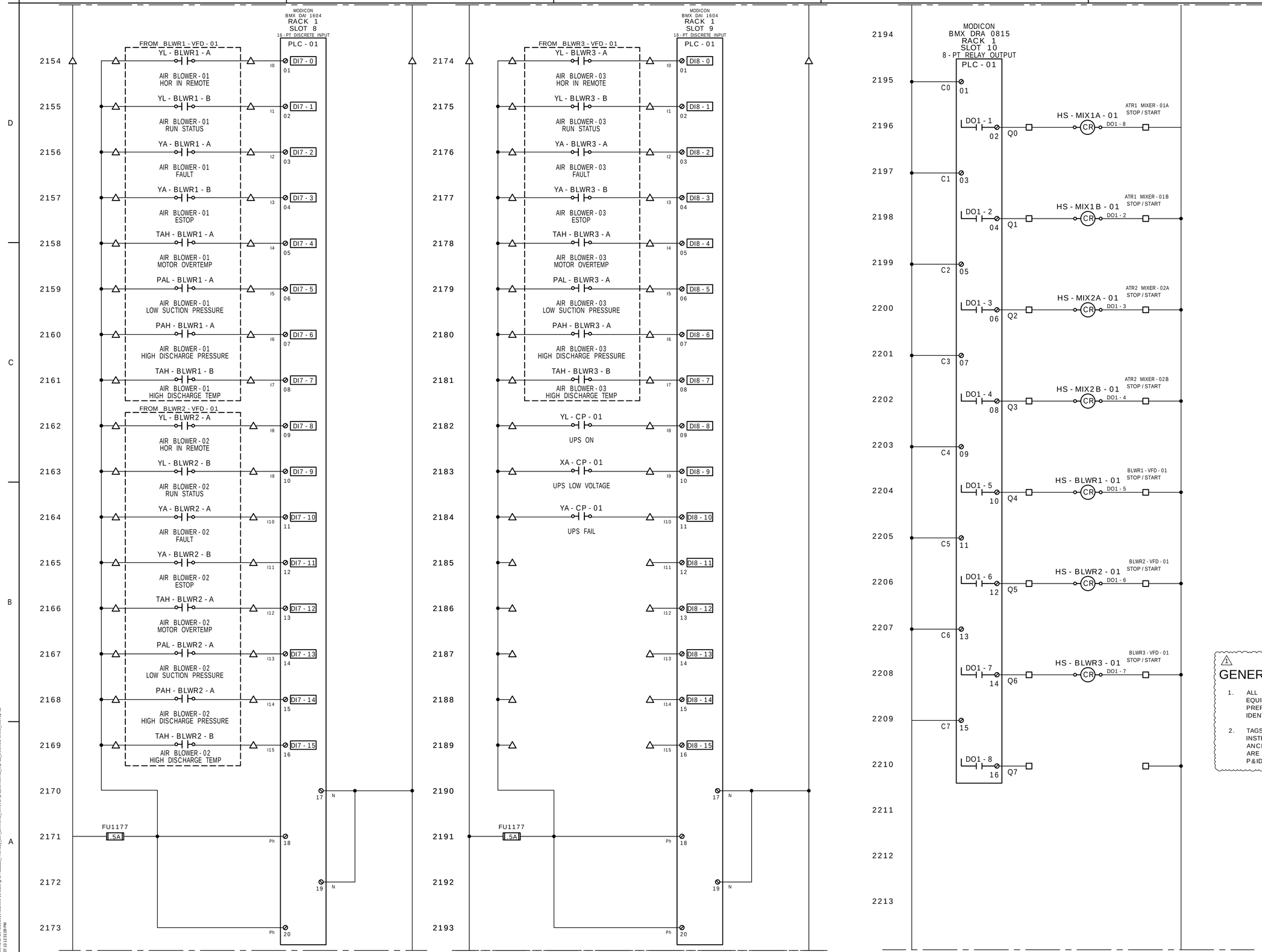
2026.07.13 12:20:44 PM

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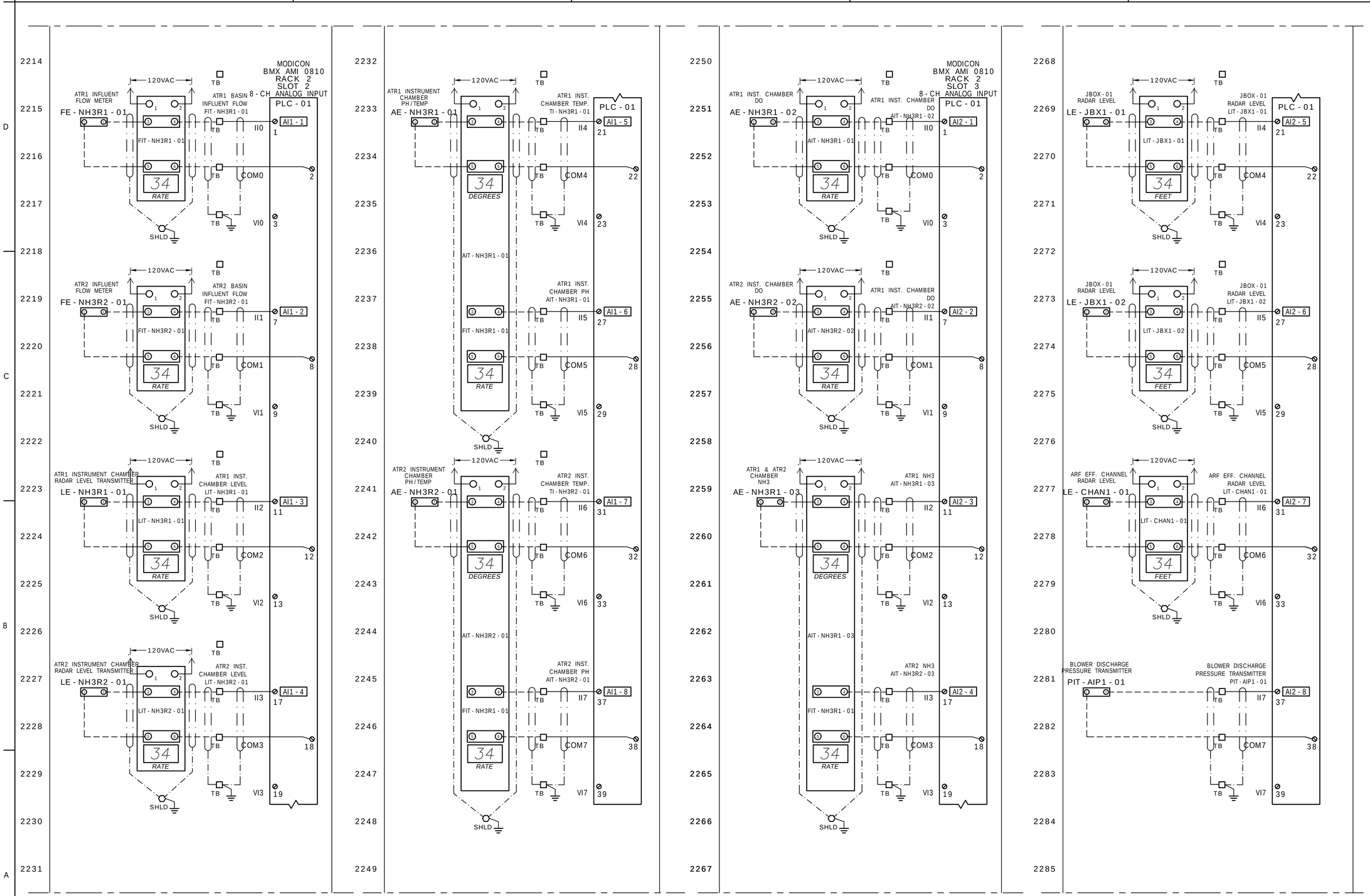
Title
GENERAL
CP-02 SCHEMATICS - IV

Revision: Sheet: 207 of 229

Drawing No.
00-E-035

ORIGINAL SHEET - ANSI D

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Title
GENERAL
CP-02 SCHEMATICS - V

Revision:
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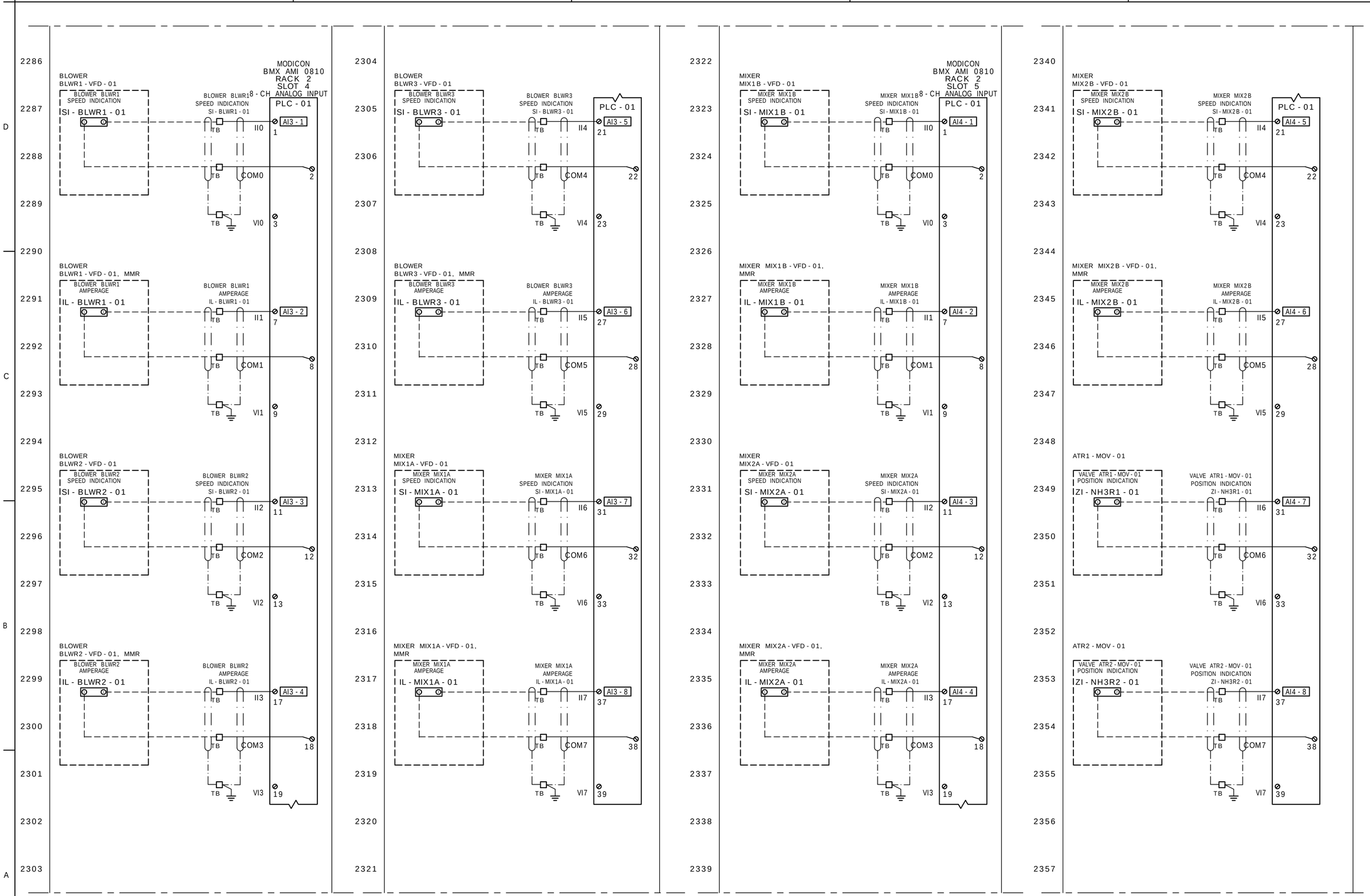
Drawing No.
00-E-036

ORIGINAL SHEET - ANSI D

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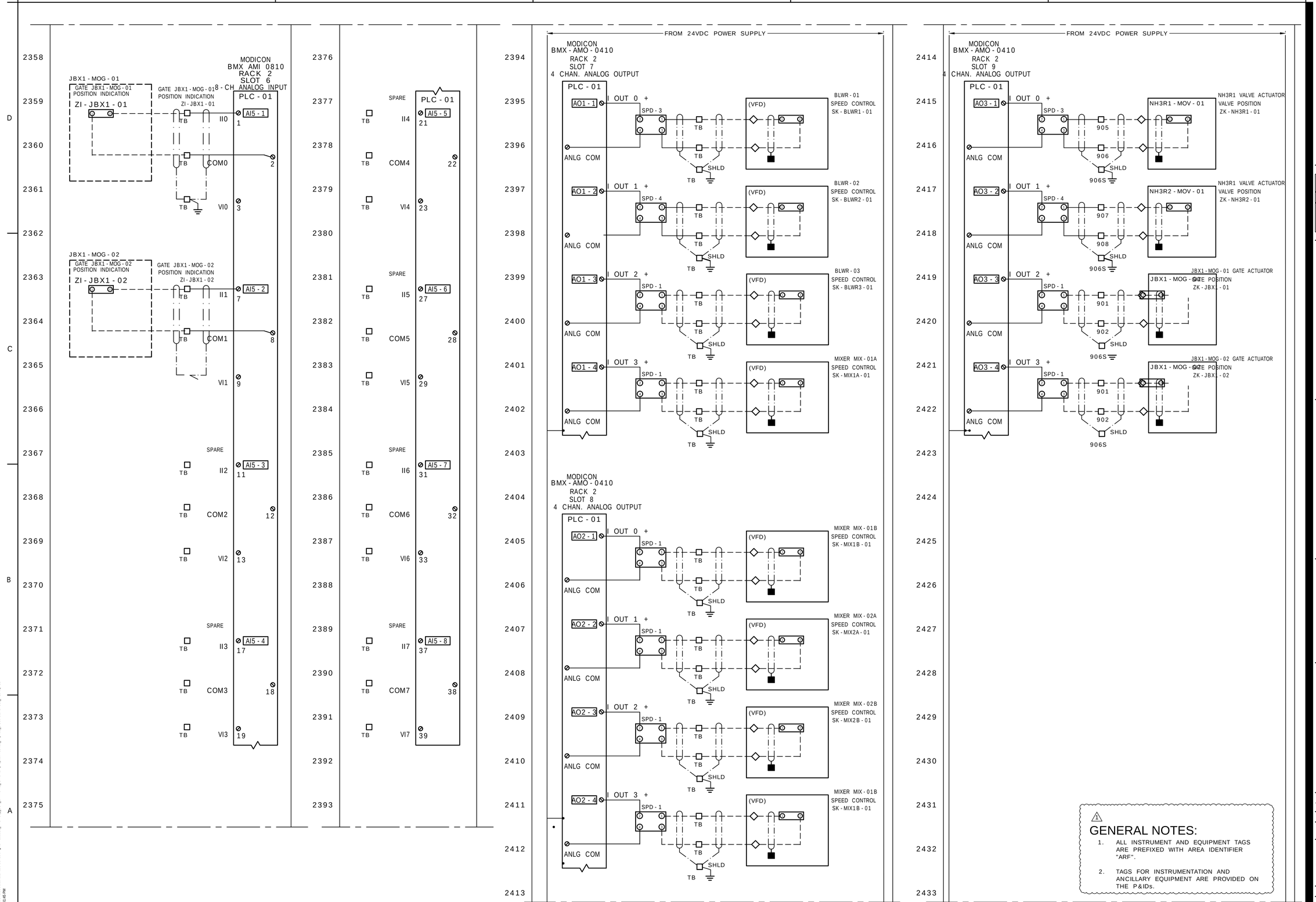
Title
GENERAL
CP-02 SCHEMATICS - VI

Revision:

Sheet: 209 of 229

Drawing No.
00-E-037

ORIGINAL SHEET - ANSI D

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