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321 N. Furnace Street
Suite 200
Birdsboro, PA 19508

February 9, 2023

ADDENDUM NO. 1

**CITY OF ABERDEEN
CONTRACT 22-07
Long Drive Booster Pump Station
ARRO Project No. 05233.36**

In accordance with the requirements of the “Instructions to Bidders,” this Addendum shall be attached to and become a part of the Contract Documents for the above referenced project.

The Pre-bid Meeting Minutes that includes questions and responses to date, the pre-bid Sign-in Sheet are attached and are considered part of this Addendum.

Concerning the Project Manual

A revised Section 11215, is attached as part of this Addendum.

BIDDERS MUST ACKNOWLEDGE RECEIPT OF THIS ADDENDUM IN THE SPECIFIED PLACE ON THE BID FORM. THE ABSENCE OF THIS ACKNOWLEDGMENT WILL BE CAUSE FOR REJECTION OF THE BID.

City of Aberdeen
Long Drive Booster Pump Station Contract No. 22-07
Tuesday, January 31, 2023 @ 11:00 AM
ARRO Project No. 05233.36

Pre-Bid Meeting Minutes

1. Project generally comprises of providing and installation of a pre-fabricated three (3) pump station, components, yard piping, generator and restoration of the area disturbed by construction.
2. All bids must be received by the City at City Hall until 1:00 P.M., prevailing time, on Thursday, February 23, 2023 at which time they will be opened.
3. Envelopes containing the bid shall be sealed and addressed to Shawn Brogan. The envelope shall be clearly marked **“LONG DRIVE BOOSTER PUMP STATION – BID NO. 22-07”**.
4. Questions on the bid document will be accepted until 4:00 PM prevailing time on Tuesday, February 14, 2023. All questions outside of this meeting must be submitted to the Office of the Engineer at: jimmy.dennis@arroconsulting.com .
5. Each bid must be accompanied by bid security in the form of a bid bond, certified check, letter of credit or bank check for 5% of the bid total.
6. Bidders shall have a minimum of (5) years, (5) projects documented experience in this type work and project must be in excess of \$250,000 in order to be considered project experience.
7. Contract times; Substantial Completion – within 440 calendar days, Final Completion – within 600 calendar days. The amount of the Liquidated Damages is set at \$500.00 a calendar day.
8. The start date of the Contract will be a mutually agreed upon date between the City, Engineer and the selected contractor.
9. The bid form is a lump sum price bid with four (4) contingency items.
10. This project is funded with City of Aberdeen funds therefore Maryland Minimum Wage Rates are NOT required.
11. Payment will not be made for equipment stored on site but not incorporated into the work.

12. A preconstruction, progress, start-up and final walkthrough meetings are required throughout the construction period.
13. The selected contractor will need to submit shop drawings to the Office of the Engineer for their review and approval.
14. Working hours are 7:00 AM to 5:00 PM Monday through Friday. Any request to deviate from this will need to be made in writing to the City through the Office of the Engineer.
15. The selected contractor will need to coordinate work through the Office of the Engineer. Shutdowns of existing service will need to be scheduled a minimum of seven days prior to the scheduled shutdown.
16. The selected contractor will need to create “red-line as-constructed” drawings and submit them to them to the Office of the Engineer for review and approval prior to Final Completion.
17. Contract closeout documents, are required prior to final payment.
18. The selected contractor will need to provide to the Office of the Engineer a video or photographs of the construction area prior to the start of work.
19. The selected contractor will need to provide temporary lavatory facilities for the working crew.
20. The selected contractor will need to provide their own “laydown/storage” area.
21. The selected contractor will need to find a location to dispose of excavated material that cannot be utilized for the trench backfill in the lawn/field areas also trenches are to be backfilled with aggregate in paved or stoned areas.

Questions received through 1/30/23:

1. **Question:** Section 16231 for the diesel generator mentions other generator enclosure accessories such as an exhaust ventilation fan. There is no mention of an exhaust vent fan on the electrical drawings. Please confirm this vent fan can be excluded and is not required?
Response:*2.9.H.1 should be deleted. An exhaust fan is not required on a generator of this size.*
2. **Question:** Section 16231 for the diesel generator mentions other generator enclosure accessories such as a DC lighting system. Is this required inside the generator enclosure?
Response:*2.9.I.2 should be deleted. This is not required.*

3. **Question:** Section 16231 for the diesel generator mentions other generator enclosure accessories such as interior AC lighting system. Are these AC lights required inside the generator enclosure?
Response: *Yes, AC lights are required for maintenance activities.*
4. **Question:** Section 16231 for the diesel generator mentions other generator enclosure accessories such as factory wired GFCI outlets. Are these convenience outlets required inside the generator enclosure?
Response: *Yes, GFCI outlets are required for maintenance activities.*
5. **Question:** Section 16231, Part 4 for the Generator Data item 4.1 lists the motor starting kVA as 663 kVA at a 35% max voltage dip. Please confirm if this is required or if the generator sizing report can be provided for this unit to confirm other generator manufacturers sizing?
Response: *Generator sizing reports may be submitted to confirm the unit is adequate to operate the station.*
6. **Question:** Sheet 10 of 13 shows a new 400A ATS. Is there a written ATS specification section in the project manual?
Response: *The ATS will be part of the package BPS. A revised Section 11215, is attached as part of Addendum No.1*

Comments by the City:

1. If more time is needed to prepare bids, please let the Engineer know ASAP. The City will consider extending the bid due date.
2. The waterline feeding this BPS is currently under construction and will be completed prior to the BPS project is under construction.
3. When the project starts, no time extension will be provided. If additional time is needed for construction, that needs to be discussed during the execution of the Agreement.

Questions presented at the Prebid Meeting:

1. **Question:** Will there be a scheduling issue with the ball fields?
Response: *Scheduling issues are not anticipated; this work is to the rear of the public area. The access drive will need to be accessible as much as possible however.*
2. **Question:** The paving restoration in front of the building is unclear, please define?

Response: For bidding purpose, plan on paving restoration as shown on the plan to the center of the access drive. Paving restoration must slope away from the building keeping the water runoff away from the building.

3. **Question:** The Specifications state the Contractor needs to secure their own “laydown” area, does the city have any area that can be used?
Response: The area behind the Stadium can be utilized however, the access drive needs to remain open for stadium employees to perform their duties.
4. **Question:** Are E&S controls required around the replacement fence?
Response: There was no submittal that included E&S controls for the replacement fence area however, the selected contractor shall utilize “good Judgement practices” while installing the fence to ensure eroding sediment does not occur.
5. **Question:** Is the new electric service by BG&E or the contractor?
Response: Please refer to Sheet No 2 of 13, Site Plan, for the delineation of work between BG&E and the contractor for installing the new electric service. In general, the contractor will be responsible for coordinating with the utility, providing the transformer base, and providing the low voltage conduit and BG&E will be responsible for proving the transformer, low voltage wiring, and metering.
6. **Question:** Is the replacement fence shown?
Response: Yes, part of the security fence to the rear of the building is replacing and existing 4’ high chain link fence shown as bold shown on Plan Sheet 2 of 13.7
7. **Question:** There is a curb detail on the drawings, is there new curbing proposed?
Response: No, there is no new curbing proposed. The detail was provided if needed for repairs/restoration.
8. **Question:** Is equipment being purchased by the city or the contractor?
Response: All equipment is to be supplied by the contractor.
9. **Question:** There is a note on the E&S plan sheets about a tank, is there a tank included in this plan?
Response: No, tank on this project and ARRO was not able to locate this note.

SECTION 11215

PACKAGED BOOSTER PUMP STATION

PART 1 – GENERAL

1.01 SECTION INCLUDES

- A. Factory-built, above-ground water booster pump station (the “Product”), with all the necessary piping, controls, and appurtenances as shown on the plans and as specified herein. Product as specified is as manufactured by Engineered Fluid, Inc., Centralia, Illinois.

1.02 REFERENCES

- A. This section includes reference to the specification sections listed below. The Building Manufacturer must refer to those sections for product and work coordination purposes.
 - 1. Unit Masonry: Section 04200
 - 2. Wood Trusses: Section 06190
 - 3. Shingles: Section 07311
 - 5. Cladding/Siding: Section 07460
 - 6. Flashing and Sheet Metal: Section 07600

1.03 QUALITY ASSURANCE

- A. These specifications and the drawings represent the acceptable standard of quality for equipment, materials, and methods of construction.
- B. The manufacturer of this Product shall be one recognized and established in the design and production of package water booster pump stations. The manufacturer shall maintain regular production facilities at its place of business.
- C. The facilities shall be open for inspection by a representative of the Engineer/Owner/ Contractor at any time during the construction and testing of the equipment covered under these specifications. The pump station manufacturer shall be required to affix an UNDERWRITER'S LABORATORIES (UL) LABEL attesting to the compliance of that assembled equipment under the PACKAGED PUMPING SYSTEMS (QCZJ) UL Listing Category. This label shall be inclusive of the entire station with enclosure so as to demonstrate compliance with the National Electrical Code requirements for working clearances and wiring procedures. Equipment manufactured without this third party certification label or equipment manufactured by an outside source or "brokered equipment" defined as systems not assembled on the premises of the manufacturer by that company's employees WILL NOT be allowed.

- D. The pump station manufacturer shall be registered as an approved Industrialized Building Manufacturer with the Maryland Department of Housing and Community Development. A Proof of Approval, current at the time of the Bid opening, shall be submitted with the Bid. The manufacturer shall comply with the provisions of the Maryland Industrialized Building and Mobile Homes Regulations. The units shall be fabricated in accordance with the Maryland standards effective at the time of construction.

- E. Substitution of Product by other qualified manufacturers may be considered after award of a Contract in accordance with the requirements of Supplementary Conditions Paragraph SC-6.05. Substitute manufacturers shall provide the following:
 - 1. Complete description of the equipment, system, process, or function, including a list of system components and features, drawings, catalog information and cuts, manufacturer's specifications (including materials description).
 - 2. Pump material data, performance curves, horsepower requirements at design, and selected motor horsepower.
 - 3. Functional description of internal instrumentation and control supplied including list of parameters monitored, controlled, or alarmed.
 - 4. Addresses and phone numbers of nearest manufacturer's representatives.
 - 5. A list of minimum five installation references, where similar equipment by the substitute manufacturer has been in service for a minimum of five (5) years.
 - 6. Detailed drawings, plan and sectional views, site, architectural, structural, mechanical, plumbing, electrical, control, instrumentation details, and technical specifications.
 - 7. All differences between these specifications and the proposed substitute equipment shall be clearly stated in writing under the heading of "DIFFERENCES".
 - 8. Warranty requirements for substitute Products shall be the same as those for the Products specified in this section.
 - 9. A Proof of Approval that the substitute manufacturer is registered as an approved Industrialized Building Manufacturer with the Maryland Department of Housing and Community Development.

1.04 SUBMITTALS

- A. Shop Drawings and Product Data: In compliance with Section 11200 – Basic Equipment Requirements.

- B. Submittals shall contain a minimum of two (2) 24” x 36” drawings, one each covering the booster pump station and the electrical control schematic.
 - 1. The booster pump station drawing shall show at least three different views, and illustrate the National Electrical Code (NEC) clearances per Section 110-26 of the Code.

- C. Submittals booklets shall include complete data sheets covering all individual components that make up the booster pump station, the UL file number under which the manufacturer is listed, and the manufacturer's warranty.

1. Provide a full size photocopy of the manufacturer's combination UL/manufacturer logo Packaged Pumping Systems label.
- D. Electrical drawing submittals shall show the coordinated termination wire numbers from those systems integrated into this enclosure, such as the telemetry equipment provided by the Contractor. This Contractor shall initiate the termination wire numbers.

1.05 PROJECT CONDITIONS

- A. An adjustable spreader-type lifting device, built to lift the building structure without impinging the lifting chains/cables on the building sidewalls and any other required lifting equipment, shall be provided by the Contractor for the purpose of unloading station from trailer by the Contractor.

1.06 MANUFACTURER'S WARRANTY

- A. Manufacturer shall warranty the complete Pump Station for:
 1. A period of one (1) year from the date of Substantial Completion and acceptance of the Work by Owner. The one (1) year period shall be inviolate regardless of any component manufacturer's warranty for equipment and components within the station.
 2. Complete coverage of all equipment, components and systems shall be provided in or with the station by the manufacturer of the station, exclusive of those components supplied by and/or installed by others independent of the manufacturer of record for this station. Contractor shall be responsible for the full cost of labor and materials for replacement and/or repair of faulty or defective components during the warranty period.
- B. The manufacturer's warranty policy does not cover items considered consumables, i.e., light bulbs, pump packing, lubricants, and other maintenance items consumed by usage.
- C. It is the intent of the manufacturer's warranty to provide the Owner with a single source responsible party for all components specified herein. "Second party" or "pass-through" warranties will not be accepted.

PART 2 – PRODUCTS

2.01 PUMP STATION COMPONENTS

- A. Building Enclosure: The equipment enclosure size, as shown on the drawings, is appropriate for National Standard mandated clearances and for proper clearances above, below and around equipment to provide for safe servicing, removal, and reinstallation of that equipment. The drawings show centerline and clearance/maintenance minimum dimensions about major equipment items. Dimensions less than those shown are not acceptable.

1. Building enclosure shall be a factory assembled, modular structure attached to the pump station base structure and requiring no additional assembly at the job site. The building design criteria shall be:
 - a. To withstand 90 mph wind load;
 - b. To support 30 psf live roof load;
 - c. Designed for seismic zone 4.
2. The materials shall be resistant to moisture degradation and infestation and be maintainable.
3. Insulation values for the walls and roof structure shall be a minimum R-21 in the walls and the roof. Insulation within the roof and wall panels shall be foam-in-place polyurethane material applied between the interior and exterior sheathing forming a closed cell bounded by the steel framing. The insulation shall have a minimum density of 2.2 lbs/cu. ft. nominal and shall be applied to the thickness required to provide a minimum R value of 21. The insulation shall have an ASTM E-84 flame spread index of 20 and smoke developed of 450.
4. Building framing materials shall comply with the A.I.S.I. Specification for the Design of Cold-formed Steel Structural Members and to Standards ASTM C-955, ASTM C-1007, ASTM C-645, ASTM C-754 and ICBO 4782P. and 4784P. A framing design incorporating the members covered by the listed specifications and standards shall develop a structure meeting or exceeding the building design criteria listed above. Structural insulated panels or SIPS will not be allowed.
5. The building structure shall be fabricated using steel C-studs as wall framing members and C-joists as roof trusses. The size, placement, and spacing of studs and joists shall be in accordance with the design criteria and material standards. The wall C-studs shall be a minimum 2" x 3 5/8" size of 20 gauge material minimum. The roof C-joists shall be a minimum 2" x 8" size of 16 gauge material minimum.
6. The exterior wall and roof sheathing shall be 1/2-inch thick, exterior, C-C grade plywood.
7. The interior wall and roof/ceiling sheathing shall be 3/4-inch thick, exterior, C-C grade plywood.
 - a. OSB or particle board sheathing is not allowed.
8. All interior wall & ceiling surfaces shall be covered with 0.090" thick FRP (fiberglass reinforced plastic) sheeting of pebble grain, gloss, white finish. The individual wall faces shall be covered with one continuous sheet. The FRP sheets shall be glued to the plywood sheathing requiring no fasteners. Corner moldings of like FRP material shall be installed and finished in a workmanlike manner.
9. Openings in the sidewalls and/or roof shall be as shown and be fully framed out and supported using single or multiple framing members sufficient to support and fasten those devices or equipment items requiring a framed opening, these being access hatches, HVAC equipment, pipe passages, conduit passages, door and window openings, and other special purpose openings as might be shown and required.
10. The attaching of devices or equipment to the building at a framed opening shall be applied according to the device manufacturers mounting instructions.

B. Doors:

1. Heavy Duty Steel Personnel Doors:
 - a. Doors are manufactured of 18-gauge galvanized steel. All doors shall be full flush construction and 1-3/4 inches thick. Doors shall be reinforced, stiffened, insulated, and sound deadened with a solid polystyrene foam board permanently bonded to the inside of each face skin. The lock and hinge edge of each door shall be welded with a center hairline seam the full height of the door. The lock edge shall be reinforced full height by a 14-gauge continuous one-piece channel x extruded templating. The hinge edge shall be reinforced full height by a 14-gauge continuous one-piece channel, formed and tapped for hinges. Top and bottom of the door shall be closed with 16-gauge channels. Doors shall have beveled 1/8-inch (3) in 2-inch (51) lock edge and square hinge edge. Doors shall be thoroughly cleaned and receive an iron phosphate treatment prior to receiving one coat of prime paint. Door closures and rim panics are reinforced with 14-gauge channels.
 - b. Doors shall be fully-mounted in frames produced for pre-hanging of commercial 1-3/4" doors. Frames are formed to 16-gauge commercial quality cold rolled steel conforming to ASTM A366 or A620 and A568. Frames are produced in two welded units, to be mechanically joined during installation. The base side is prepared for all required hardware. Both units, base and trim, are furnished with welded mitered faces. Frame anchoring includes compression anchors and stud screws. Door hinges shall be continuous gear hinges, fabricated of extruded 6063-T6 aluminum alloy/temper with pinless assembly. The doors shall have a lockset, exterior handle, interior panic type exit device, and top mounted-door closer with hold-open device.
 - c. Doors and frames shall be finished with a two-component, aliphatic/acrylic polyurethane coating, white in color, with a high gloss finish. The coating shall be resistant to a wide range of solvents and chemicals under splash and spill conditions. The coating system shall be V.O.C. compliant.
 2. Steel Roll-up Door:
 - a. The station shall be provided with a roll-up type, insulated steel door as shown on the plans. The overall opening of the roll-up door shall be as shown on the plans. The door shall be equipped with a chain wheel operator.
 - b. The door frame shall include aluminum extrusions offset 5" to accommodate the field-applied CMU facade by the Contractor. The door shall be weatherstripped with a weather seal.
 3. All doors shall be factory finished in a color to match that of the dark CMU.
- C. Observation Window: The partition wall shall be supplied with an 18-inch x 18-inch observation window allowing a view to the controls room. The window shall be a stationary, single pane window with wire-reinforced safety glass.
- D. Mounting and Fastening:
1. Building shall be fabricated up from and securely attached to a framework fabricated of 2" x 6" steel tubing welded at each corner to form a base frame serving as a stable base for handling and transporting the building prior to attaching the building to the station base skid. To hold the building framing to the

- 2" x 6" base frame, 5/8" anchor studs will be welded to the base frame. In assembling the building framing to the base frame, a 3 1/4" x 4" x 1/4" thick anchor plate under a flat washer, lock washer, and 5/8" nut shall be used to fasten the building framing to the framing base as shown. The base frame shall be grit blasted to a SP-6 finish and coated with the specified coating material.
2. The building enclosure shall be firmly and securely attached to the steel base structure by lag bolting from inside the station, through evenly spaced 9/32" holes pre-drilled into an angle piece that has been continuously welded to the steel floor. The lag bolts shall screw into the 2" x 6" tubular base frame upon which the building has been built.
 3. The lag bolts shall be plated steel, size 5/16" diameter x 2" long. The number and location of the lag bolts shall be as determined by structural analysis so as to maintain the live load and wind load ratings as specified and to resist shearing and tearing in the process of transporting and placing the finished station.
- E. Exterior Treatment: The exterior finish will be field-applied split-face CMU, as specified in Section 04200 – Unit Masonry; it will be provided by the Contractor. The station manufacturer shall apply a layer of Dow Styrofoam Weathermate housewrap to the exterior of each building. The housewrap shall reduce air infiltration and moisture damage.
- F. Roof System: Roof system components shall be as shown on the Drawings and as specified in Sections 06190, 07311, 07460 and 07600. Roof system is not included in the pump station package; it shall be constructed by Contractor in the field.
- G. Building Substructure:
1. The base/floor system substructure shall be made up of steel plate and standard structural steel shapes of the sizes and weights as shown on the plans for this item. The substructure shall be designed to support the building live and dead loads plus the burden imposed by loading, transporting and unloading of this equipment. All steel plates used in the substructure shall meet or exceed the requirements of ASTM-A36. The structural shapes (channels and angles) shall be of the thickness/weight as shown on the plans for this item and shall meet or exceed the requirements for ASTM A-36. The structural rectangular or square tubing shall be of the wall gauge as shown on the plans for this item and shall meet or exceed the requirements for ASTM A-500 Grade B.
 2. The station shall have floor drains as shown on the drawing.
 3. The station shall have rain gutters as shown on the drawing. Rain gutters shall be provided and installed by the Contractor in the field.
- H. Piping Penetrations: Where suction and discharge piping, or any other pressure piping, passes through the station base/floor system substructure that area of the floor shall be provided with a grout sleeve. The contractor shall be responsible for furnishing and installing grout.
- I. Safety Floor Matting: The walkway areas (that space from the entrance ladder to the control panel and the entire NEC clearance area) shall be covered with a rubber

drainage runner. The runner shall be medium duty, 1/2 inch minimum thickness of open slot design allowing fluids to drain under standing or walking surfaces. The runner shall have a tread design to promote sure footing. The underside of the runner shall have a raise knob design to permit aeration and drainage, and to reduce runner fatigue. The runner shall not be glued to the floor.

J. Chain Hoist & Trolley & Lift Device:

1. The hoist shall be rated for 2,000 lbs. with 12' of lift. The frame, gear and handwheel covers will be constructed of cold pressed steel. The chain shall be manganese alloy steel, case hardened with anti-rust treatment. The hook shall be alloy steel, heat treated, equipped with safety latch. The trolley shall be push type with wide flange wheels constructed of cast steel and ball bearings. Trolley must be capable of direct coupling with a minimum 1-ton rating. The trolley beam shall be a "W4x13" flange steel beam conforming to ASTM-A36 standards.

K. Corrosion Protection:

1. All interior and exterior surfaces of the exposed steel structure, transmission piping, and fittings shall be gritblasted equal to commercial blast cleaning (SSPC SP6). Following fabrication all exposed surfaces of the station, interior and exterior, shall be coated according to the following requirements.
 - a. All weldments will be pretreated by hand to provide additional corrosion protection using the same product as the base coat. Following the pretreatment full coating application shall take place.
 - b. The base coating shall take place immediately after surface preparation. The protective coating shall consist of a two-component, high solids, high build, fast drying epoxy system for protection and finishing of steel and having excellent corrosion resistant properties. The epoxy system shall be self-priming and require no intermediate coatings.
 - c. Following the base coating application, a full finish coating application shall take place. The protective coating shall consist of a two-component, high solids, high build, fast drying epoxy system for protection and finishing of steel and having excellent corrosion resistant properties. The epoxy system shall be self-priming and require no intermediate coatings. The base and finish coats shall provide a total dry mil thickness of 8.0 mils. The finish shall be "flint gray" in color.
 - d. Following assembly and just prior to shipping, there shall take place a thorough cleaning of the floor of the station followed by a rolled on coating of the two part epoxy coating to cover over any scuffing or scaring that might have occurred during assembly.
 - e. The exposed surfaces of the structural steel base shall have a non-skid coating of a two-component, 100% high performance aromatic polyurea spray elastomer system with zero VOC (Volatile Organic Compounds), 100% solid. The coating shall offer outstanding performance and superior elastomeric protection for various substrates. The coating shall be designed as a user-friendly product for moisture insensitive applications because of its pure polyurea chemistry, and offer exceptional adhesion properties for properly prepared substrates. The high-performance formulation shall

produce an excellent skin formation for chemical resistance and moisture protection. The coating shall be dark gray in color. Both the Iso “A” Side and Resin “B” Side shall be preconditioned between 70-90°F before application.

- f. Iso “A” and Polyol “B” components must be pumped by low-pressure transfer pumps to a suitable high-pressure proportional pumping system.

Temperature Settings:
 Iso “A” Block Heater: 140-160°F
 Resin “B” Block Heater: 140-160°F
 Hoses (Iso and Polyol) 140-150°F
 Equipment Hydraulic Pressure: 2,000-2,500PSI

CHEMICAL TECHNICAL DATA:

Mix Ratio by Volume: Gel Time: 1A:1B 6-9 Sec
 Tack Free Time: 9-12 Sec
 Viscosity (cps) @ 77°F
 “A” Iso Side: 1,000±100
 “B” Resin Side: 370±50
 Material Density (lbs/gal) @ 77°F “A” “A” Iso Side: 9.5 lbs/gal
 “B” Resin Side: 8.4 lbs/gal.

BASIC PHYSICAL PROPERTIES:

All tests are performed by OCM Test Laboratories.

- ISO 17025 Certified
- American Association for Laboratory Accreditation (A2LA)

Test Name	Test Methods	Value
Hardness Shore D	ASTM D2240	60±1
Coefficient of Friction	ASTM D1894	
Static		0.305
Kinetic		0.127
Dielectric Const.	ASTM D150	3.6
Dissipation Factor	ASTM D150	0.031
Volume Resistance	ASTM D257	2.3x10 ¹⁴ ohm cm
Elongation	ASTM D412	162%
Flexural Strength ASTM D790		2,630 PSI
Flexural Modulus	ASTM D790	0.056 MSI
Fungus Test	MIL-STD 810F	Pass
Pull-off Test–Adhesion	ASTM C297	
To Metal – No Primer		1,800 PSI
To Metal – XPM Primer		1,910 PSI
To Metal – LXSF515 Primer		1,870 PSI
Taber Abrasion	ASTM D4060	0.06980
(gm Loss/1000 cycles)		
Tear Strength	ASTM D624	783 ppi
Tensile Strength	ASTM D412	3,432 PSI
Water Vapor Trans.	ASTM E96	0.499 Grains/Hr Sq.Ft.

The chemical resistance testing for the coating shall be per ASTM D543 for immersion in fluids methods. Additional product certifications shall include USFDA Coatings for Incidental Food Contact Applications Certified by Keller and Heckman LLP and MIL-STD-810F.

L. Booster Pumps:

1. Pumps shall be of the vertical, close-coupled, in-line, back pull-out, centrifugal type. Pumps shall be Model CR 95-3-2 A-G-A-E-HQQE, as manufactured by Grundfos.
2. Pump station shall be capable of delivering the fluid medium at the following capacities and heads when operating at 0 feet minimum suction pressure.
 - a. Operating Conditions: The pump driver shall be a standard, NEMA-JM frame, induction motor, inverter duty rated, open drip-proof construction, of the vertical extended shaft, normal thrust type, and shall be 40 hp, 3,329 rpm nominal and suitable for 3 phase, 60 cycle, 480-volt electrical service.
 - 1) Pump #1, #2, and #3: Each pump shall be able to operate on VFDs at the specified design point at the required minimum efficiency without overloading the motor.
 - a) 480 GPM @ 225 Ft. TDH: efficiency: 71%

M. Elastomer Pipe Connector:

1. The inlet side of each booster pump shall include an elastomer connector to help isolate vibration and noise in the piping system. The elastomer connector shall be of single sphere design, constructed of neoprene and nylon with bias-ply tire reinforcing cord to provide a 225-psi working pressure rating to a minimum of 120°F. The elastomer connector shall pass through the plate steel flanges designed to grip the connector so the connector seals without gaskets when the flange bolts are drawn up.
2. A control joint limiting pipe connector movement shall be supplied with each pipe connector.

N. Piping:

1. Piping shall be steel and conform to material specification ASTM A-53(CW) for nominal pipe size four (4) inch and smaller and ASTM A-53(ERW) Grade B for nominal pipe size five (5) inches and larger. Steel butt-welding fittings shall conform to material specification ASTM A-234 Grade WPB and to the dimensions and tolerances of ANSI Standards B16.9 and B16.28 respectively.
2. Pipe Coating:
 - a. The internal surfaces of piping to be fusion bonded coated shall be grit blasted to an SP-10 finish with the finish profile required by the coating material manufacturer. The internal, wetted surfaces of the steel transmission piping shall have applied to it a Fusion Bonded Epoxy Coating on the interior pipe surface. The coating shall be applied and meet the testing requirements of Table 1 and Table 2 with the exception of Table 2 section 7 per AWWA C-213. The powder coating product shall be National Sanitation Foundation (NSF) Standard 61 certified material. Prior to shipment of the station, the station manufacturer shall provide in writing to

the Engineer certification that the fusion bonded epoxy coating has been applied to all internal surfaces of the steel piping using the proper method. Said certification shall show under the station manufacturer's letterhead:

- 1) Date of application;
 - 2) Material manufacturer and product designation including a product data sheet for the coating;
 - 3) Applier of the fusion bonded coating, name, address and phone number;
 - 4) Notarized signature of an officer of the station manufacturing company stating the fusion bonded epoxy coating was applied to AWWA Standard C213-91 or the latest revision.
- b. Forged steel flanges shall conform to material specification ASTM A-105 Class 60 and/or ASTM A-181 for carbon steel forgings and to the dimensions and tolerances of ANSI Standards B16.5 as amended in 1992 for Class 150 and Class 300 flanges.
- c. The piping sizes shall be as shown on the drawing.
- 1) Size 10 inch and below - Schedule 40
 - 2) Size 12 inch thru 20 inch - Standard weight (.375" wall)
 - 3) Size 24 inch and above - Standard weight (.500" wall)
- d. All pipe welds shall be performed by certified welders employed by the pump station manufacturer. As part of the equipment submittals, the pump station manufacturer shall provide copies of the welding certificates of the employees who are to perform the pipe welds.
- e. All piping surfaces shall be prepared by gritblasting, or other abrasive blasting, prior to any welding. Piping of 5" diameter and smaller may be cut by saw. Piping of 6" diameter and larger shall be bevel cut, and Oxyfuel or Plasma-arc cutting techniques shall be used to assure and facilitate bevel pipe cuts. No saw cuts or other form of abrasive cut-offs are allowed on 6" and larger diameter pipe.
- f. In all cases, short circuit transfer, spray transfer, or pulse-arc transfer modes of the gas metal arc welding process shall be applied semi-automatically. When utilizing the short circuit mode, shielding gas consisting of 50% carbon dioxide and 50% argon gas shall be used. When utilizing the spray or pulse-arc transfer modes, a shielding gas consisting of 5% carbon dioxide and 95% argon shall be used. In all cases, welding wire with a minimum tensile strength of 70,000 psi shall be employed. All flange welds and butt welds of equal size pipe shall be a single continuous nonstop weld around the complete circumference of the pipe. Whenever possible, vertical up weld passes will be applied to all pipe welds. No vertical down weld passes will be allowed. Completed welding assemblies shall create no internal obstruction, restriction or create any unintended sources of water deflection.
- g. Piping of six (6) inch diameter and larger shall require a minimum of two (2) weld passes to complete each weld. The first pass, or root pass, shall be applied at the bottom of the bevel cut using the short circuit transfer welding mode, and the second pass, or cap pass, shall be applied over the root pass using the spray or pulse arc transfer welding modes to insure that at a

minimum the total weld thickness shall be equal to thinnest of the two pieces being welded together.

O. Pipe Supports:

1. Provide pipe supports by minimum sizing for:
 - a. 8" and smaller piping shall be 2" x 3" x 3/16" wall rectangular tubing;
 - b. 10" and larger piping shall be 3" x 4" x 1/4" wall rectangular tubing;
 - c. 6" and larger piping shall be provided with "kick" bracing projecting fully from the underside of the pipe to the floor at an angle of no less than 15 degrees from vertical out at a right angle to the run of the pipe being supported. These "kick" braces shall be in addition to the vertical pipe supports called out above.
2. Pipe supports shall be fully welded at both end points to the pipe and steel floor where required.
3. Pipe stands made of pipe welded only at the floor and upholding a bracket with or without a threaded jack bolt or a U-bolt are not acceptable.

P. Service Connections on Internal Piping: All plumbed devices within the station eventually requiring service, such as meters, control valves, pumps, and like equipment, shall be easily removed from the piping by the presence of appropriately placed and sufficient quantity of adaptors and couplings as shown on the drawings; no less than the quantity of couplings and adaptors shown shall be allowed.

Q. Restraining Points: The main inlet and outlet piping to the station shall each be provided with two (2) or four (4) restraining points as welded on "eyes" or similar device welded to the framing to facilitate the attachment of joint restraint tie rods or other device to be used in retarding any pipe movement at the connections.

R. Compression Couplings:

1. The booster station piping shall include a compression type, flexible coupling to prevent binding and facilitate removal of associated equipment where shown on the plans for this item. In lieu of a compression coupling, a Uni-Flange or a flanged coupling adapter (FCA) may be used.
2. All compression couplings, Uni-Flanges, flanged coupling adapters (FCA), and flexible connectors/expansion joints shall include a minimum of two (2) control joint rods with appropriate restraining points.

S. Combination Pressure Gauges (on suction and discharge pipe of each pump): Combination pressure gauges shall have a built-in pressure snubber and 4-1/2 inch minimum diameter faces and be turret style, black phenolic case with clear glass face. The movement shall be rotary, of 400 Series stainless steel with teflon coated pinion gear and segment. The gauge shall be bottom connected & accept a 1/4" NPT female thread. Combination pressure gauge range and scale graduations shall be in psi and feet of water as follows:

1. Main Inlet Pressure: 0 to 100 psi, 10 psi figure intervals, with graduating marks every 1 psi (0-230 ft.).

2. Pump Suction Pressures (Pump #1 and Pump #2): 0 to 100 psi, 10 psi figure intervals, with graduating marks every 1 psi (0-230 ft.).
3. Main Outlet Pressures (Pump #1 and Pump #2): 0 to 200 psi, 20 psi figure intervals, with graduating marks every 2 psi (0-460 ft.).
4. Pump Discharge Pressures (Pump #1 and Pump #2): 0 to 200 psi, 20 psi figure intervals, with graduating marks every 2 psi (0-460 ft.).
5. All gauges shall be panel mounted off the pipeline and be flexible connected to their respective sensing point. The gauge trim tubing shall be complete with both isolating and vent valves and the tubing shall be so arranged as to easily vent air and facilitate gauge removal.
6. Gauges shall be Ashcroft Duragauge Plus Model 1279XLL.

T. Sample Sink, Piping and Valves:

1. Provide a sample sink where shown on the drawings. The sink shall be a single bowl, compression molded material composed of mineral-filled thermoplastic polymers with fiber reinforcement, finished to a smooth surface. The sink shall be manufactured in accordance with ANSI Z124.3. The sink shall have a nominal 0.25 inch thickness, and dimensions of 25" wide by 22" deep and 9" sink well. Provide a gooseneck style laboratory faucet. Faucet shall be metal construction with lever type handle and 1/2" MNPT threaded connection; faucet shall be Zurn Z825B1, or equal. Sample sink shall be Swanstone Model KSSB-2522.
2. Provide a single, right angle outlet, smooth nose, brass sample tap shall be affixed to the manual vent ball valve for the low suction lockout and suction pressure gauge assembly.
 - a. Ball Valves: Two-piece forged brass body, blowout-proof stem, TFE packing with adjustable stem packing gland. Valves shall meet or exceed ASTM B124 and shall be NPT threaded complete with lever operator. Maximum working pressure shall be 600 psi. Valves shall be Hammond Model 8901.
 - b. Pressure Reducing Valve: Designed to reduce incoming water pressure to an adjustable downstream pressure. Valve body shall be bronze construction with thermoplastic seat and integral stainless steel strainer; connections shall be threaded. Maximum working pressure 400 psi. Adjustable spring range shall be 25 psi - 75psi. Valve shall be Watts Model N55B – M1.
3. Piping:
 - a. Type L Copper with SOLDER joints, aboveground.
 - b. Type K Copper, with FLARED joints, underground.

U. Hose Bibb with Backflow Preventer: There shall be provided a standard hose bib with backflow preventer and air gap on the suction piping. The hose bib connection shall be through a pressure regulator if the header pressure would exceed 60 psi.

V. Valves:

1. Gate (Isolating) Valves:
 - a. Valves shall meet or exceed AWWA Standard C-500.
 - b. Valves shall be cast iron body, bronze mounted, resilient seat, NRS (non-rising stem).

- c. Valves shall be flanged pattern with flange and drilling complying to ANSI B16.1, class 125. Each valve shall be complete with hand wheel operator and shall be constructed so as to open left (counter-clockwise). Maximum working pressure shall be 200 psi.
 - d. Valves shall be M&H Valve Model 4067-02.
2. Non-Slam Check Valve:
- a. Each pump discharge pipe run shall include a wafer-type, non-slam check valve. The body of the check valve shall be cast iron. The plug and seat shall be bronze and conform to ASTM Designation B-584. The seat shall contain a Buna-N seal to provide zero leakage. The seal design shall provide for both a metal to metal low and high pressure without over-loading or damaging the Buna-N seal. The guide bushings shall be bronze copper alloy and conform to ASTM Designation B-584. The valve spring and seat retainers shall be stainless steel and conform to ASTM Designation A-313. The valve plug shall be guided at both ends by a center shaft integral with the valve plug. Alignment of the center shaft shall be provided by guide bushings.
 - b. Non-slam check valves shall be Val-Matic Series 1400-BN.
3. Relief Valve:
- a. Valve shall be pilot controlled, hydraulically operated, diaphragm type automatic control valve. The main valve shall be furnished with a resilient, replaceable seat. The control pilot shall be a direct-acting, adjustable, spring loaded, normally closed pilot designed to close the main valve whenever the sensed pressure is below the pilot spring setting. The relief valve shall function to limit the discharge header pressure to the value set into the control pilot. The valve shall be sized as shown on the plan and be globe pattern, flanged to meet ANSI Class 125 and have a maximum pressure rating of 250 psi.
 - b. Valve shall be CLA-VAL Model 50G-01BKC-DS150.
4. Air Release Valve:
- a. Provide an air release valve at the discharge pipe as shown on the Drawings. The air release valve shall be capable of automatically releasing accumulated air from a fluid system while that system is in operation and under pressure. The body and cover shall be of cast iron. To assure droptight shut-off, a viton orifice button shall be used to seal the valve discharge orifice when the valve is in a closed position. The leverage mechanism, float, and all other internal trim shall be of stainless steel. The air release valve shall have a maximum working pressure of 175 psi.
 - b. Air Release Valve shall be Val-Matic, Model 15A.3, or Equal.

W. Factory Pressure Testing:

- 1. When the station plumbing is completed, and prior to shipping, the pressure piping within the station (including valves, pumps, control valves, and fittings), connections as make up the entire system shall be hydrostatically tested at a pressure of 150 psi or a pressure equal to the lowest test pressure rating of the equipment within the tested system, whichever is lesser pressure. The test pressure shall be applied for a minimum of 20 minutes, during which time all

joints, connections and seams shall be checked for leaking. Any deficiencies found shall be repaired and the system shall be retested.

2. Test results shall be transmitted in writing to the Engineer prior to shipment of the station and shall note test pressure, time at full pressure and be signed by the Quality Control Manager or test technician.

2.02 ELECTRICAL COMPONENTS

A. Electrical Apparatus Components:

1. Design, Assembly, and Test: The electrical apparatus and control panel design, assembly, and installation, and the integration of component parts will be the responsibility of the manufacturer of record for this booster pumping equipment. That manufacturer shall maintain at its regular place of business a complete electrical design, assembly and test facility to assure continuity of electrical design with equipment application. Control panels designed, assembled or tested at other than the regular production facilities or by other than the regular production employees of the manufacturer of record for this booster pumping equipment will not be approved.
2. Conformance To Basic Electrical Standards: The manufacturer of electrical control panels and their mounting and installation shall be done in strict accordance with the requirements of UL Standard 508 and the National Electrical Code (NEC) latest revision so as to afford a measure of security as to the ability of the eventual owner to safely operate the equipment. No exceptions to the requirements of these codes and standards will be allowed; failure to meet these requirements will be cause to remove the equipment and correct the violation.
3. U.L. Listing: All service entrance, power distribution, control, and starting equipment panels shall be constructed and installed in strict accordance with Underwriter's Laboratories (UL) Standard 508 "Industrial Control Equipment." The UL label shall also include an SE "Service Entrance" rating stating that the main distribution panel is suitable for use as service entrance equipment. The panels shall be shop inspected by UL, or constructed in a UL recognized facility. All panels shall bear a serialized UL label indicating acceptance under Standard 508 and under Enclosed Industrial Control Panel or Service Equipment Panel. In addition, a photocopy of the UL labels for this specific project shall be transmitted to both the project engineer and the contractor for installation within their permanent project files, prior to shipment of the equipment covered under these specifications.
4. E.T.L. Listing: All control panels shall be E.T.L. Listed by Interek Testing Services (ITS) under Category 4 - Industrial Control Equipment. Each completed panel shall bear an E.T.L. listing label. The listing label shall include the station manufacturer's name, address and telephone number. The station manufacturer shall have quarterly inspections performed by ITS at the manufacturer's facilities to ensure that the products being listed comply with the report and procedural guide for that product.
5. Equipment Grounding:

- a. Each electrical equipment item in the station shall be properly grounded per Section 250 of the National Electrical Code. Items to be grounded include, but are not limited to, pump motor frames, control panel, transformer, convenience receptacles, dedicated receptacle for heater, air conditioner, dehumidifier, lights, light switch, exhaust fans, and pressure switches.
 - b. All ground wires from installed equipment shall be in conduit and shall lead back to the control panel to a copper ground buss specific for grounding purposes and so labeled. The ground buss shall be complete with a lug large enough to accept the installing electrician's bare copper earth ground wire. The bus shall serve as a bond between the earth ground and the equipment ground wires.
6. Panel Mounting Hardware: Metal framing channel shall be used exclusively for mounting of all electrical panels and electrical components except for those specifically designated otherwise.
7. Electrical Service: The electrical service provided for this station will be 480-volt, 3-phase, 60-cycle, 4-wire.
- B. Pump Station Service and Distribution:**
- 1. Circuit Breakers: Individually enclosed molded case circuit breakers of trip rating and frame size as indicated on Drawings and of the following construction:
 - a. Circuit Breaker: Molded case type with overcenter, trip free, toggle type operating mechanism, quick-make, quick-break action and positive handle indication. Two-and three-pole breakers of common trip type. Operating handles assume center position when tripped.
 - 1) Circuit breaker shall have a permanent trip unit containing individual thermal and magnetic trip elements in each pole.
 - 2) Circuit breaker so constructed to accommodate supply connections at either end.
 - 3) Circuit breaker calibrated for operation in an ambient temperature of 40° C.
 - 4) Circuit breakers UL Listed and shall meet NEMA Standard No. AB1-1975.
 - 5) Standalone circuit breakers rated for 240-volts shall have short-circuit ratings of no less than 10,000 AIC; circuit breakers rated for 480-volts shall have short-circuit ratings of no less than 22,000 AIC.
 - a) One (1) Transformer Breaker, three-phase, Secondary Side, 50 amps (feed to metering vault panelboard).
 - b. NEMA 1 Enclosure Indoor Use: Fabricated from sheet steel with knockouts and of construction in accordance with UL 98 and so Listed.
 - 1) Finish of gray color baked enamel, electro-deposited (or similar) on cleaned phosphatized steel.
 - 2) Enclosure equipped with provisions for padlocking in OFF Position.
 - 3) Trip indication visible through enclosure by circuit breaker handle.
 - 4) Enclosure equipped with provisions for field installable, insulated, groundable neutral.

- c. NEMA 3R Enclosure Outdoor Use: Fabricated from sheet steel enclosure with threaded hubs sized for conduit indicated on Drawings and UL Listed construction.
 - 1) Enclosure equipped with provisions for up to three padlocks in OFF position.
 - 2) Enclosure shall have an external operating handle with trip indication by assuming a position between ON and OFF position.
 - 3) Enclosure equipped with provisions for field installable, insulated, grounded neutral.
- 2. Main & Branch Circuit Panelboard: Provide dead-front safety type panelboard equipped with automatic thermal-magnetic circuit breakers. Electrical characteristics of each panel shall be as scheduled on the Drawings. Panelboard construction and components shall conform to NEMA Standards and to NEC 384, and bear the UL Label.
 - a. Cabinets: Back boxes of code gauge galvanized steel, or equivalent rust-resistant steel per UL Standard 50 with wiring gutters sized per UL Standard 67. Fronts and doors of full finished (rust primer and baked enamel) code gauge steel, with concealed hinges and stainless steel door pull and cylinder type tumbler lock (panelboard locks all keyed alike); and circuit directory frame and card under clear plastic cover on door interior.
 - b. Flat Style Bus Structure: Copper bus bars of rectangular cross-section and main lugs and bus structure rated as indicated on the Drawings; with such ratings established by heat rise tests per UL Standard 67 for Heat Rise. Provide safety barriers to barrier main lugs or breaker on five sides; also provide barriers at bus structure ends opposite the main lugs or breaker. Breaker connections to the bus of distributed-phase or phase-sequence type. Bus bars factory-mounted to bases and not dependent on breakers for support. Screws and bolts used for making connections to bus factory equipped with lock washers; riveted connections not acceptable. **OR;**
 - c. Stacked Bus Structure: Bus structure shall conform to requirements specified previously and arranged in stacked configuration with breaker arrangement of the distributed phase sequence.
 - d. Breakers: Automatic, with quick-make and quick-break action on manual operation, trip free, with inverse time characteristics secured through the use of a bi-metallic tripping element supplemented by a magnetic trip. Automatic tripping (tripping on overload or short-circuit currents) clearly indicated by the operating handle assuming a neutral position midway between the Manual ON and OFF positions. Breakers having slow-make, slow-break manual mechanism not acceptable. Breakers of size and type as indicated on the Drawings.
 - e. Tests: Integrated equipment rating tests on each panelboard with breakers mounted shall be factory conducted per proposed UL standard pertaining to listings of molded case circuit breakers for high-interrupting capacity ratings, and submitted to the Engineer. Testing of panelboard circuit breakers for short-circuit rating only with the breaker individually mounted

is not acceptable. Also testing of bus structure by applying a fixed fault to the bus structure alone is not acceptable.

- 1) Refer to this section of specifications for the required short-circuit ratings of the series-rated panelboards and breakers.
 - f. Acceptable Manufacturers:
 - 1) Eaton Cutler-Hammer.
 - 2) Siemens.
 - 3) Square D Company.
 - 4) Or Equal.
 - g. Panelboard Types:
 - 1) 208 & 240 volt – Similar to Square D Type NQ.
 - 2) 480/277 volts – Similar to Square D Type NF.
 - 3) 480 volts – Similar to Square D Type I-Line.
3. Automatic Transfer Switch: Provide service entrance rated automatic transfer switch equipped with automatic, programmable, engine-generator exerciser and the following features:
- a. Controller operates through a period of loss of control power.
 - b. Undervoltage Sensing for Each Phase of Normal Source: Sense low phase-to-ground voltage on each phase. Pickup voltage shall be adjustable from 85 to 100 percent of nominal, and dropout voltage shall be adjustable from 75 to 98 percent of pickup value. Factory set for pickup at 90 percent and dropout at 85 percent.
 - c. Voltage/Frequency Lockout Relay: Prevent premature transfer to generator. Pickup voltage shall be adjustable from 85 to 100 percent of nominal. Factory set for pickup at 90 percent. Pickup frequency shall be adjustable from 90 to 100 percent of nominal. Factory set for pickup at 95 percent.
 - d. Time Delay for Retransfer to Normal Source: Adjustable from zero to 30 minutes, and factory set for 10 minutes. Override shall automatically defeat delay on loss of voltage or sustained undervoltage of emergency source, provided normal supply has been restored.
 - e. Test Switch: Simulate normal-source failure.
 - f. Switch-Position Pilot Lights: Indicate source to which load is connected.
 - g. Source-Available Indicating Lights: Supervise sources via transfer-switch normal- and emergency-source sensing circuits.
 - 1) Normal Power Supervision: Green light with nameplate engraved "Normal Source Available."
 - 2) Emergency Power Supervision: Red light with nameplate engraved "Emergency Source Available."
 - h. Unassigned Auxiliary Contacts: Two normally open, single-pole, double-throw contacts for each switch position, rated 10 A at 240-V ac.
 - i. Transfer Override Switch: Overrides automatic retransfer control so transfer switch will remain connected to emergency power source regardless of condition of normal source. Pilot light indicates override status.

- j. Digital Communication Interface: Matched to capability of remote annunciator or annunciator and control panel.
 - k. Switch Characteristics: Designed for continuous-duty repetitive transfer of full-rated current between active power sources.
 - l. Acceptable Manufacturers:
 - 1) ASCO
 - 2) Cummins Power Generation
 - 3) Eaton
 - 4) Or Equal.
- C. The 480-volt distribution panel shall be complete with the following branch circuit breakers:
- 1. One (1) 3-pole, 200-amp main breaker;
 - 2. Three (3) 3-pole, 70-amp pump motor breakers;
 - 3. One (1) 3-pole, 15-amp phase monitor breaker;
 - 4. One (1) 2-pole, 70-amp primary single-phase transformer breaker (building power);
 - 5. One (1) 3-pole, 30-amp primary three-phase transformer breaker (metering vault power);
 - 6. With space for one (1) 3-pole, 70-amp spare breaker.
- D. Pump Station Control Panel: All control panel hardware including programable logic controller , I/O card, circuit breakers, time delay relays and control relays shall be incorporated into one (1) NEMA 4/12 control panel provided by the vendor.
- E. The 120-volt distribution panel shall be complete with the following branch circuit breakers:
- Provide thermal-magnetic trip circuit breakers as follows:
- 1. One (1) Transformer Breaker, single-phase, Secondary Side, 125 amps;
 - 2. Twenty (20) Auxiliary Circuit Breakers, as follows:
 - a. #1 Controls
 - b. #2 Lights
 - c. #3 HVAC Unit
 - d. #4 HVAC Unit
 - e. #5 Dehumidifier
 - f. #6 Convenience Outlet
 - g. #7 Convenience Outlet
 - h. #8 Convenience Outlet
 - i. #9 Generator Block Heater
 - j. #10 Generator Accessories
 - k. #11 Telemetry
 - l. #12 – #20 Spare
- F. Phase Monitor: A phase monitor shall be supplied to protect three-phase equipment against phase loss, undervoltage and phase reversal conditions. When a fault is sensed,

the monitor output relay opens within two seconds or less to turn the equipment off and/or cause an audio or visual alarm. Both Delta and Wye systems may be monitored. The monitor shall have an automatic reset and shall also include an adjustable voltage delay. The monitor shall have an indicator LED (glows when all conditions are normal and shall monitor phase sequence: ABC operate (will not operate CBA). The phase monitor shall be UL approved and CSA certified.

G. Surge Protection Device (SPD):

1. Main Service Protection: Provide the TVSS protection on each phase in accordance with Article 280 of the National Electrical Code. The TVSS unit shall meet ANSI/IEEE C62.41 Location C, B & A; UL 1449 3rd edition; UL 1283 Tracking Filter; NEMA LS1 Compliances, 2.2-9 and 3-9; component level fusing, NEMA 4 enclosure; fused disconnect switch; 30-year unlimited free replacement warranty.
 - a. Maximum Rated Surge Current: 240kA per phase; 120kA per mode.
 - b. Acceptable Manufacturer:
 - 1) Total Protection Solutions; Model SurgeTrack TK-ST240-3Y480-L.
 - 2) Or Equal.

H. Power Transformers:

1. Balanced 120/208 three-phase power for the auxiliary circuits within the booster station shall be obtained by use of a 30 KVA dry, step down transformer. The transformer shall be wall-mounting type, in a NEMA 3R non-ventilated weatherproof enclosure. Transformer shall operate with noise levels equal to or less than ANSI and NEMA standards. Transformer insulation shall be Class 180c. The unit shall be "UL" approved for indoor/outdoor application.

I. Pressure Transmitter Assemblies:

1. Pressure transmitters shall be supplied to measure pump station suction and discharge pressure. The transmitters shall sense gauge pressure and transmit a 4-20 mA dc signal. The instruments shall measure pressure of a predetermined span. Range is to be fixed at 0-362 PSI. The accuracy shall be $\leq \pm 1.0\%$ of span.
2. Each transmitter shall provide an analog output and include a standard LCD with pushbuttons to provide Intelligent transmitter configuration directly from the on-board pushbuttons. The one-line digital indicator shall display the measurement in any selected units.
3. All process-wetted parts of each instrument shall be Type 316L stainless steel. The transmitter shall be protected by a gasketed, weatherproof IP65 and IP67 enclosure.
4. The transmitter shall have 1/4 inch NPT female threaded tapping ports.
5. Gauge Pressure Transmitter manufacturer:
 - a. Allen-Bradley Series 836P

J. Telemetry Control:

1. Interface Panel: Booster station manufacturer shall provide the following as an adjunct to the supplied telemetry equipment.
 - a. 1" telemetry entrance conduit complete to telemetry panel.

- b. NEMA 1 telemetry interface panel.
 - c. Separate 120-volt single phase power circuit in conduit to the telemetry interface panel.
 - d. Telemetry control circuits made up and in conduit from main control panel to telemetry interface panel terminal strip.
 - e. Metal framing channel to mount telemetry equipment.
- K. Telephone Backboard: Booster station manufacturer shall provide the following as an adjunct to the supplied telephone equipment.
- 1. 2" entrance conduit complete to telephone backboard.
 - 2. Size 24" x 24" plywood backboard with RJ-11 jack.
 - 3. Metal framing channel to mount backboard and telephone equipment.
- L. Adjustable Frequency AC Controllers:
- 1. This specification is to cover a complete Variable Frequency Drive (VFD aka: VFD, AFD, ASD, Inverter, AC Drive, et al) designed for use with a standard AC induction motor in water and wastewater applications. The VFD must provide a V/Hz or sensor-less vector mode of operation.
 - 2. The VFD package as specified herein shall be UL61800-5-1 listed and CSA C.22.2 No. 274-17 listed as a complete assembly. The VFD shall be furnished in an UL Type 1 (NEMA 1) listed enclosure rated as specified for operation at ambient temperatures between -15°C and 40°C at an altitude not exceeding 3300 feet, with relative humidity less than 95% and no condensation allowed.
 - 3. The VFD tolerated voltage window shall allow the VFD to operate from a line of +30% nominal, and -35% nominal voltage as a minimum. The VFD efficiency shall be 96.5% or better at full speed and load. The VFD shall have a DC bus voltage controller to automatically maintain the DC bus levels in high or low line conditions for the purpose of maintaining full motor voltage at all times. The short term normal duty overload current capacity shall be 110% of rated current for one (1) minute out of ten (10) minutes
 - 4. All VFDs shall have the same customer interface, including digital display, and keypad, regardless of horsepower rating. The keypad shall be removable, capable of remote mounting and allow for uploading and downloading of parameter settings as an aid for start-up of multiple VFDs. Control connections shall remain consistent for all power ratings
 - 5. The control panel shall include Hand-Off-Auto selections and manual speed control. The drive shall incorporate "bump-less transfer" of speed reference when switching between "Auto" and "Hand" modes. There shall be a possibility to reset the VFD from the control panel. The control panel shall include a backlit LCD. The display shall be in complete words, in a language selectable by the user, for programming and fault diagnostics (alphanumeric fault codes are not acceptable). The control panel shall have a real-time clock with battery backup for adding time stamps to events, faults, warnings and also timer functions utilizing real-time clock. There shall be an editable home-view in the control panel to allow different customer specific configurations.
 - 6. A dedicated "Help" button shall be available on the control panel. The Help button shall provide context sensitive assistance for programming and

troubleshooting. The control panel shall provide interactive assistants (wizards) to help to commission and use the drive.

7. The control panel shall provide a clear, interactive, context sensitive menu based user interface to make it easy to adjust the settings of the drive. The control panel shall provide an easy to use I/O menu, where the user can see the status and function of all the analog and digital inputs and outputs. The control panel shall have a menu, which contains diagnostic data about the drive operation collected in one single location. The data shall include data about active faults, warnings and events. In addition the data shall contain a summary of VFD active control sources.
8. The user shall be able to take a screen capture snapshot of the display with the control panel and be able to download the screen capture for user's computer for further purposes. The user shall be able to connect a PC tool with a USB cable to the control panel to be able to set up and control the VFD. It shall be possible to connect the USB cable without using any tools.
9. The VFD shall have 2 quick ramps that allow for quick acceleration and/or deceleration of the pump motor.
10. The VFD shall offer a pump cleaning feature to reduce build-up of debris on the pump impeller. This feature can be activated by: Every start or Stop, when drive is in a underload / overload condition, timed interval or digital input. The cleaning cycle status shall be visible in the panel screen when cleaning is active. The VFD shall operate normally after the cleaning cycle is completed.
11. The VFD shall offer torque boost for applications where increased torque is needed for initial starting of the pump motor.
12. The VFD shall have intelligent pump control (IPC) with multi-pump functionality and an intelligent master/follower configuration for controlling up to 8 parallel pumps equipped with VFDs without additional modules. VFD shall have a parameter synchronization feature to program the PID, IPC and AI parameters in all parallel VFDs. The Functionality to start and stop the pumps based on capacity, operating time or efficiency of the pump to ensure each pump is operated regularly. The IPC shall be capable of level control, flow control, pressure control and pump alternation.
13. The VFD shall have soft pipe filling functionality, can be used to fill an empty pipe, by having programmable pipe fill time.
14. The VFD shall have a programmable Sleep functionality for PID control in pumping systems to stop the pump during low demand. "Sleep Boost" shall be available to reduce short cycling of the pump. The boost function will boost the pressure or water level before the pump shuts down to sleep.
15. The VFD shall provide a RTU kind programming capability as standard. It shall be possible to use different kinds of arithmetic, logical, selection, comparison and operation function blocks to monitor and control the VFD, functions, inputs, outputs and variables. There shall be a possibility to run different kinds of function block programs in different states and to set the criteria, when to change the state.
16. Real-time clock and calendar shall be available as standard for giving true time and date information to fault event history. The real-time clock should have a

minimum of 10 years power-off back-up without optional components. Back-up battery shall be replaceable without opening the VFD enclosure. Real time clock shall be possible to use with timed functions, which shall allow controlling the VFD and its functions based on time of the day, day of the week, seasons of the year, holiday periods and holiday dates and special working periods and working days.

17. Timed functions should be possible to use for starting and stopping the drive, for selecting the speed reference, for selecting the PID loop controller's set-point, for controlling the relay outputs, for selection the control location, for giving the run permissive or interlock signal to the VFD, etc. There shall be also a boost function, which allows starting the VFD and/or its functions regardless, time of the day, day of the week, seasons or holidays.
18. The VFD shall be capable of controlling an induction motor, permanent magnet motor and synchronous reluctance motors as standard. Have a maximum allowed motor cable length 1000 feet (300 meters). The VFD shall commission an induction motor, permanent magnet motor and synchronous reluctance motor with the motor nameplate values only, without the need to get the motor values from other sources.
19. Scalar and vector control modes shall be supported and there shall be independent control chains and parameters for both of the motor control modes.
20. The overload rating of the VFD shall be 110% of its rated normal duty current for 1 minute every 10 minutes and with a minimum of 130% for 2 seconds every 1 minute. Overload ability shall be available at all times - not only at start.
21. The VFD shall be capable of sensing the loss of load (broken belt / broken coupling / dry pump) and signal the loss of load condition. The drive shall be possible to be programmed to signal this condition via a control panel warning, relay output and/or over the serial communications.
22. Relay outputs shall include programmable for on/off time delays that will allow for drive acceleration or deceleration to and from zero speed, without signaling a false underload condition.
23. It shall be possible to disconnect a motor running full speed by opening an optional contactor between motor and VFD without causing any damage to the VFD.
24. The VFD shall include a standard embedded functional safety feature Safe Torque Off, (STO), to make the motor mechanically safe.
25. The VFD shall include an energy optimization circuit (flux optimization) that will automatically reduce applied motor voltage to the motor to reduce energy consumption by up to 10% and lower audible motor noise.
26. The VFD shall be capable of starting into a spinning load (forward or reverse) up to full speed and accelerate or decelerate to a set-point (flying start) without tripping or component damage.
27. The VFD shall restart after a power loss without the need to resend the start command. This feature shall be there regardless of the control source, control panel, I/O or fieldbus.
28. Flux braking shall be available, where the VFD controls the motor to dissipate the extra rotary energy as heat whenever braking is required. It shall be possible to

use this flux braking feature to decelerate the motor from one speed to another – not only for stopping the motor.

29. Power-Loss-Ride-Through shall be programmable. If the incoming supply voltage is cut off, the VFD continues to operate using the kinetic energy of the rotating motor. The drive continues to be operational as long as the motor rotates and generates energy.
30. The VFD shall include a switching frequency control function. This adjusts the switching or carrier frequency, based on actual VFD temperature and allows the highest carrier frequency without de-rating the VFD or operating at high carrier frequency only at low speeds (temperature fold-back). It shall be possible to set a minimum and a reference switching frequency.
The VFD shall include a noise smoothing function, which distributes the acoustic motor noise over a range of frequencies instead of a single tonal frequency resulting in lower peak noise intensity.
31. The VFD shall have three (3) programmable critical frequency or critical speed lockout ranges to prevent the VFD from operating the load continuously on an undesirable speed range (skip frequencies)
32. All I/O terminals shall be color coded to simplify wiring and troubleshooting, and shall have a special mode for testing I/O and the drive configuration without being connected to equipment. All I/O shall be accessible (monitor and control) for fieldbus protocols (pass-through I/O). It shall be possible to monitor status of the I/O from VFDs control panel.
33. The VFD shall have at least two (2) programmable analog inputs. Both inputs shall accept current (0 to 20 mA or 4 to 20mA) or voltage (0 to 10 VDC) signals. The signal type selection, voltage or current, shall be made via VFD user interface. DIP-switches or jumpers are not allowed for input type programming. Analog Input shall have an inaccuracy of $\leq 1\%$ of full scale in both current and voltage modes.
34. The analog inputs shall be programmable to be used as: speed reference, frequency reference, pressure monitor, PID loop controller's set-point reference or signal feedback, or other defined inputs.
35. If the analog input reference (4 to 20 mA or 2 to 10 VDC) is lost, the VFD shall give the user the option of: (1) stopping and displaying a fault; (2) running at a programmable preset speed and displaying an alarm; (3) hold the VFD speed based on the last good reference received and displaying an alarm. The drive shall be programmable to signal this condition via a control panel warning, relay output and/or over the serial communication bus.
36. The VFD shall have at least two (2) programmable analog outputs (0 to 20 mA or 4 to 20 mA) out of which one shall be software configurable to be either voltage (0 to 10 VDC) or current output. Analog Output shall have an inaccuracy of $\leq 1\%$ of full scale in both current and voltage modes. The analog outputs shall be programmable to give an output signal proportional to frequency, motor speed, output voltage, output current, motor torque, motor power, DC bus voltage, active reference or other defined data.

37. The VFD shall have at least six (6) programmable digital inputs (24 VAC and 12 to 24 VDC, PNP or 5 pcs NPN) to connect to external devices, as follows:
 - a. All inputs can be configurable for PTC sensors.
 - b. There shall be a programmable run permissive circuit.
 - c. Up to four (4) programmable free text interlock inputs shall be available.
 - d. The VFD shall have at least one digital input which can be configured to receive a pulse signal up to 16 kHz.
38. The VFD shall have at least three (3) programmable digital Form-C relay (changeover) outputs. The relays shall include programmable on and off delay times and adjustable hysteresis.
39. The VFD shall have an EIA-485 (RS-485) port for serial communications as standard. The VFD shall be equipped with built-in fieldbus communication of type Modbus RTU. EtherNet/IP, Modbus/TCP, DeviceNet, PROFIBUS-DP, PROFINET protocols shall be available as plug-in and inbuilt options.
40. The VFD shall have an integral 5% impedance line reactors to reduce the harmonics to the power line and to add protection from AC line transients. The 5% impedance may be from dual (positive and negative DC buss) reactors, or 5% AC line reactors. VFDs with only one DC reactor shall add AC line reactors.
41. All VFDs through 50 HP shall be protected from input and output power mis-wiring. The VFD shall sense this condition and display an alarm on the keypad.
42. THE VARIABLE FREQUENCY DRIVE UNITS SHALL BE ABB MODEL ACQ580.

M. Pump Disconnects:

1. The station manufacturer shall provide a pump disconnect for each pumping unit as shown on the plans. The pump disconnects shall be 600 volt, 3 pole, non-fused disconnect switches with pistol handles and NEMA 1 enclosures.
2. Pump disconnect switches shall be as manufactured by ABB Control, Inc. or equal.

N. Miscellaneous Devices:

1. Hand-Off-Auto switches shall be oiltight, maintained, and be located on the main control panel door for each furnished and future pump.
2. Pilot lights shall be oiltight, transformer type as follows:
 - a. Red – Low Suction Pressure.
 - b. Green – Pump #1 Running.
 - c. Green – Pump #2 Running.
 - d. Green – Pump #3 Running (Future Pump).
3. Nameplates shall be furnished on all panel front mounted switches and lights.
4. The control panel door shall be complete on the interior with a stick-on transparency containing an "as-built" reproduction of the electrical control panel schematic. The wiring diagram shall be a corrected "as-built" copy & contain individual wire numbers, circuit breaker numbers, switch designation & control function explanations.

- O. Alarms: Building manufacturer to provide.
1. The unauthorized entry alarm shall be a 120-volt AC circuit driven by a door mounted limit switch. The limit switch shall be the adjustable arm, roller contactor type, which makes an internal SPST micro switch. The switch will be so mounted as to activate anytime the entry door is opened. The unauthorized entry alarm circuit shall be complete with a time delay relay, 0-180 seconds minimum and manual alarm lock out key switch. The alarm circuitry will be set up to activate every time the entry door is opened after a time delay period has lapsed. The engagement of the key switch will lock out the alarm.
 2. A motor starter auxiliary contact shall indicate pump status.
 3. Provided a 120-volt AC relay which will generate a power fail alarm.
 4. The low suction pressure alarm shall be generated by the low suction pressure switch described elsewhere.
 5. The fire/smoke alarm shall be generated by a 120-volt AC relay controlled by a fire/smoke detector in the station.
 6. Station flooding alarm shall be generated by the water leak detection switch, which will be normally open, described elsewhere.
 7. The following readouts and alarms shall be displayed at the local OIT:

<u>DESCRIPTION</u>	<u>FUNCTION</u>
High Flow	Display Alarm
Valve Position	Display (Percent Open)
High Discharge Pressure	Display Alarm
High High Discharge Pressure	Display Alarm
Low Suction Pressure	Display Alarm
Low Low Suction Pressure	Display Alarm
High Intake Pressure	Display Alarm
Low Intake Pressure	Display Alarm
Hickory Ridge Low Pressure	Display Alarm
Hickory Ridge Comm. Fail	Display Alarm
Pump No. 1 Run Status	Display
Pump No. 2 Run Status	Display
Pump No. 3 Run Status	Display
Pump No. 1 Out of Auto	Display
Pump No. 2 Out of Auto	Display
Pump No. 3 Out of Auto	Display
Pump No. 1 Fail	Display Alarm
Pump No. 2 Fail	Display Alarm
Pump No. 3 Fail	Display Alarm
VFD No. 1 Failure	Display Alarm
VFD No. 2 Failure	Display Alarm
VFD No. 3 Failure	Display Alarm
Generator Low Fuel	Display Alarm
Generator General Failure	Display Alarm
Generator Fuel Tank Leak	Display Alarm
Generator Run Status	Display

<u>DESCRIPTION</u>	<u>FUNCTION</u>
Generator Run Hours	Display
Transfer Switch in Normal	Display
Transfer Switch on Generator	Display
Phase/Power Fail	Display Alarm
Station Smoke	Display Alarm
Wireless Communications Fail	Display Alarm
Station Security Breach	Display Alarm

P. Remote Terminal Unit:

1. Provide one (1) complete Remote Terminal Unit (RTU) 200 Series control system as described herein. The system shall be completely factory integrated and tested. The RTU system shall be as manufactured by Data Flow Systems, Inc.
2. Basis For Design:
 - a. This equipment specification and related documents represent a design based on the Data Flow System, Inc TAC II SCADA system, interface, input/output and other peripheral devices shall be compatible with Data flow System equipment. No other equipment is acceptable unless the "Prebid Submittal" requirements of this specification are strictly adhered to and the Engineer provides written notification of alternate system approval in writing prior to the bid date.
3. Complete System Responsibility:
 - a. The Pump Station Supplier shall be the System Integrator and will have complete responsibility for the Station RTU Control System and Related Control Functions, and for all communications leaving or entering the station. Specifically, this shall include identifying all electrical, mechanical and plumbing schematics and wiring inter-connect diagrams, providing instrument installation details, preparing input/output listings, writing software, performing software and hardware integration, installation in the station at the factory, debugging, calibrating and tuning the various components and subsystems and providing training and warranty services (elsewhere in this contract).
4. UL Listing Requirement:
 - a. The system integrator shall produce panels that fully comply with Underwriters Laboratory Standard for Industrial Control Panels # 508A.
 - b. All panels shall be UL 508A listed. The UL 508A "sticker" shall be clearly displayed in the appropriate location within the panel. The UL 508A listing shall be in the name of the equipment manufacturer. Third party substitutions of UL 508A listed equipment shall be strictly prohibited.
5. System Integrator Facility & Staff:
 - a. The pump station manufacturer shall have full time Control System Engineers who are dedicated to the development of RTU programs, SCADA software, Instrumentation configuration and control logic development. The system integrator shall have been in the business of providing telemetry, control and SCADA systems to the water production and water distribution market for no less than 10 years.

6. Enclosure:
 - a. Enclosures shall be NEMA 4X for indoor and outdoor locations. Enclosure shall be fabricated from high-grade stainless steel with a painted exterior in the manufacturer's standard color. Units shall include a single gasket front door. Hinges, locking hasp and door clamping hardware shall be included.
7. Incoming Power Requirements & UPS:
 - a. Controls shall operate from a source of 120 volts, 1 phase, 60 Hz. The panel shall be accompanied with an uninterruptible power supply (UPS). The UPS shall condition the power as well as provide 500 VA of power during outages. A 6-amp control power circuit breaker shall be employed as both a method of equipment protection and as a means of power disconnection. The circuit breaker shall be a single pole, thermal, magnetic type with a 10,000-Amp interrupt rating. The circuit breaker shall be UL listed.
8. Power Supply Module:
 - a. All DC power supplies required for operation shall be provided. Units shall provide sufficient voltage regulation and ripple control to assure powered components can operate within their required tolerances.
9. Wiring Requirements:
 - a. All wiring shall be in complete conformance with the National Electrical Code, state, local and NEMA electrical standards. All incoming and outgoing wires shall be connected to numbered terminal blocks and all wiring neatly tied and fastened to chassis as required.
10. Network data line surge suppressors:
 - a. Provide transient surge suppressors for all leased telephone line, and Ethernet connections that are included as a part of this system. Unit shall have connection capabilities for RJ45, 100 BASE-T, 10 BASE-T, Token Ring, and RS-422 connections. The unit shall have a nominal clamping voltage of 7.5 volts and a Peak Pulse Current rating of 750 amperes. Unit shall be as manufactured by Tripp Lite, Inc., Model DNET-1.
11. Control Panel - Design, Assembly & Test:
 - a. The RTU panel design, assembly, the integration of component parts and startup will be the responsibility of the manufacturer of record for this booster pumping equipment. That manufacturer shall maintain at its regular place of business a complete RTU design, assembly and test facility to assure continuity of control design with equipment application.
 - b. RTU panels designed, assembled or tested at other than the regular production facilities or by other than the regular production employees of the manufacturer of record for this booster pumping equipment will not be approved.
12. Programmable Logic Controller (PLC) Module:
 - a. Provide microprocessor-based Programmable Logic Control (PLC) Module as detailed in this specification and on the applicable plan sheets. The PLC Module shall be capable of use in a stand-alone configuration and also be capable of being networked into a larger system. It shall be specifically suitable for use in a telemetry system as an intelligent remote telemetry unit. The RTU shall be programmable in standard ladder logic.

- b. The RTU shall be of modular design with a common plug-in "rack" in which the PLC Module and I/O cards are placed. The racks shall be available in 2, 4, 10 or 15 input/output modules. The system shall be capable to add racks in order to add I/O cards.
- c. The PLC Module shall be programmable in standard ladder logic and are designed as plug-in function module. The CPU shall have a minimum of 16M of RAM memory and also include a non-volatile Memory that shall store the program and setpoints.
- d. The RTU PLC module shall have the capability to have "On-Line" programming modifications made.
- e. The RTU PLC module shall have integral to it at least two (2) communication ports, one (1) of which shall be capable of 10 BASE-T, RS-232, Modbus devices, and TCP/IP. The unit shall have a voltage of 12-14VDC and a supply current of 579mA. The communications operations shall include the capability of report by exception polling. Unit shall be as manufactured by Data Flow System, Inc. Model: NIM001
- f. The RTU PLC module and I/O cards shall all be U.L. listed.
- g. I/O cards shall be interchangeable in any slot in the rack. The quantity and type of I/O cards required for this project are detailed in this specification and plans. It shall be the responsibility of the telemetry system manufacturer to insure that at least 20% spare of each type of I/O is provided. The following describes the requirements for each type of I/O card:
 - 1) Digital Monitor Module (Input) :
 - a) Digital Monitor Module is designed to monitor 1 to 12 digital inputs. Each input is optically isolated with transient suppression for protection from voltage spikes. The DMM can directly monitor AC or DC voltages from 10 to 30V. By using a 22/47/100K ohm resistor in series, an input can monitor from 31 to 300VAC/DC. The cards shall have easily visible LED indicators showing the status of each input channel. (LED ON = INPUT PRESENT).
 - 2) Digital Control Module (Output):
 - a) Digital Control Module shall be available in 4 or 8 independent 60 to 280V AC devices. The control relays are available as solid state or mechanical relay contacts. The DCM can also accept either 4 or 8 digital inputs of 12 to 30V AC or DC. Voltages greater than 30V and up to 300V can be accommodated using an inline series resistor. All inputs have surge protection and opto-isolators to increase protection. The cards shall have an LED indication for each channel showing the relay is closed.
 - 3) Analog Monitor Module (Input):
 - a) Analog Monitor Module input card used to monitor from 1 to 4 analog inputs. The inputs are optically isolated: each input can be configured from 0-10mA or 0-5V. This module can also monitor 4 optically isolated digital inputs.

- 4) Analog Control Module (Output):
 - a) Analog Control Module used to control from 1 to 4 analog outputs. Each output provides 0-20 mA with 12-bit accuracy.
 - h. The RTU, including all module cards and accessories as detailed in this specification, shall be as manufactured by Data Flow Systems, Inc as supplied by Northern Data Systems, Inc (NDS) 1250 Scenic Highway, Unit 1701-323, Lawrenceville, Georgia 30045.
 - i. Wiring between Telemetry Cabinet and the Northern Data Systems RTU unit shall be hardwire via CAT5e networking cable.
13. Touch Screen Operator Interface:
 - a. The RTU control system shall include a front panel mounted touch screen display for operator interface. The display shall have a 5.7" screen with 640 x 480 pixel resolution using 18 colors. Unit shall have 512MB of flash memory. Unit shall have a battery backed real time clock.
 - b. The touch screen operator interface shall be PanelView Plus 7 as manufactured by Allen-Bradley Co., Milwaukee, WI 53204.
 - c. All required communication modules; cables and accessories shall be provided for a complete and operational system.
 14. Remote Diagnostics System:
 - a. This system shall be equipped with a remote diagnostics modem. This system shall use a standard 2 or 4 wire telephone line capable of DTMF dialing and automatic network speed recognition (100/10). This system shall be integrated with the RTU and shall consist of an Ethernet data modem, telephone line, transient voltage surge suppressor, and all required configuration changes. This system shall allow engineering and service personnel the ability to monitor station performance, download RTU programs to new RTU processors and modify existing RTU programs from the manufacturer's place of business.
 - b. The communication equipment shall be manufactured by Moxa. Model series 8, EDS-508A or approved equal.
 15. Programming Software:
 - a. All RTU equipment supplied on this project shall be programmable in standard ladder logic. The ladder logic development and configuration software shall be the same for all RTU listed in this specification. Equipment requiring separate program development and configuration software for each product is not acceptable.
 - b. The software program shall be Windows based and be Microsoft certified for use with Windows NT, Windows 95, Windows 98 and future versions.
 - c. The software shall be able to develop the ladder logic programs, provide equipment configurations, diagnostics for both equipment and software, upload programs, download programs, and edit programs "on-line" where applicable.
 - d. The software shall be as manufactured by Data Flow Systems, Inc., HT4 SCADA Software Program.

16. Pump Monitored Conditions:
- a. Suction Pressure Alarms/Cutouts:
 - 1) If the signal from the pump station suction-side pressure transmitter, P₃, (downstream of the flow control valve) indicates suction pressures lower than a low-pressure setpoint (adjustable), the Controller shall send a signal to the VFDs, slowing down the pumps until the minimum upstream pressure is met. If the pressure signal reaches a low-low pressure setpoint (adjustable), then the Controller shall send a signal to shut off the drive/pump until suitable operating pressures are restored (i.e. setpoint is exceeded for a set time).
 - b. Discharge Pressure Alarms/Cutouts:
 - 1) If the signal from the pump station discharge pressure transmitter, P₄, indicates downstream pressures in excess of a high-pressure setpoint (adjustable), the Pump Controller shall send a signal to the VFDs, slowing down the pumps until the downstream pressure limit is met. If a high-high pressure set point (adjustable) is reached from P₄, the VFDs will shut down and require manual resetting from the RTU/PLC).
 - c. Pump Failure:
 - 1) The site operation shall have logic that shall activate alarm indicators and outputs when a pump is called to operate, is in the automatic mode of operation, and fails to provide a positive motor engaged indication or if an input from the called pump's motor starter overload indicates a thermal overload trip.
 - d. Automatic Transfer Of Pump Call Upon Failure:
 - 1) The site operation shall have logic that shall transfer the pump call of a failed pump to the next available pump. This shall override the alternation logic.

Q. Conduit and Wiring:

- 1. The service entrance conduits shall be rigid steel conduit, individually sized to accept the inbound service conductors and telemetry/telephone/radio cables, and shall be installed from the main power or control panel through the equipment enclosure floor and terminate exterior to the equipment enclosure. The service entrance exterior conduit connection points shall be capped or plugged for shipment.
- 2. All wiring within the equipment enclosure and outside of the control panel or panels shall be run in conduit except for the watertight flexible conduit and fittings properly used to connect pump drivers, fan motors, solenoid valves, limit switches, etc., where flexible connections are best utilized. Only the dehumidifier where furnished by the original manufacturer with a UL approved rubber cord and plug, may be plugged into a receptacle.

R. Equipment Enclosure Conduit: Rigid, heavy wall, Schedule 40 PVC with solvent weld moisture-proof connections, in minimum size 3/4" or larger, sized to handle the type, number and size of equipment conductors to be carried - in compliance with Article

347 of the National Electrical Code and NEMA TC-2, Federal WC-1094A and UL-651 Underwriters Laboratory Specifications.

- S. Conduit stubbed through the floor shall be galvanized rigid steel with a minimum of 6” AFF.
- T. Flexible Connections: Where flexible conduit connections are necessary, the conduit used shall be liquid-tight, flexible, totally nonmetallic, corrosion resistant, nonconductive, U.L. listed conduit sized to handle the type, number and size of equipment conductors to be carried - in compliance with Article 351 of the National Electrical Code.
- U. Motor Circuit Conductors: Sized for load. All branch circuit conductors supplying a single motor of one (1) horsepower or more shall have an ampacity of not less than 125 percent of the motor full load current rating, dual rated type THHN/THWN, as set forth in Article 310 and 430-B of the National Electrical Code, Schedule 310-13 for flame retardant, heat resistant thermoplastic, copper conductors in a nylon or equivalent outer covering.
- V. Control And Accessory Wiring: Sized for load, type MTW/AWM (Machine tool wire/appliance wiring material) as set forth in Article 310 and 670 of the National Electrical Code, Schedule 310-13 and NFPA Standard 79 for flame retardant, moisture, heat and oil resistant thermoplastic, copper conductors in compliance with NTMA and as listed by Underwriters Laboratories (AWM), except where accessories are furnished with a manufacturer supplied UL approved rubber cord and plug.
- W. Receptacles: Four (4) duplex, ground fault circuit interrupter type receptacles shall be 20-amp, 120-volts furnished in FS boxes and covers and located about the periphery of the equipment enclosure, with one (1) receptacle adjacent to the main control panel. One (1) weather-protected, duplex, receptacle will be furnished and mounted on the station exterior wall in the vicinity of the generator set.
- X. Lighting:
 - 1. Interior: There shall be one or more forty-eight (48) inch minimum length LED light fixtures installed within the equipment enclosure, as shown on the plan for this item. The fixture shall be 120/277VAC, 6000 lumens minimum with a medium distribution lens, 4K color temp, and be UL Listed for a wet environment. The light switch shall be of the night glow type and be located conveniently adjacent to the door. Open fixtures will not be accepted.
 - 2. Exterior: An exterior light shall be provided as located on the drawing. The light shall be 20 watt LED, 5K color, and 1532 lumens. Housing shall be one piece, injection molded, bronze polycarbonate. A button type photo control shall be provided
- Y. Water Detection:
 - 1. Water Leak Detection: Conductance actuated single-level service, 120 VAC operation to low voltage on the probes, 316 SS probes, normally open contact

which closes on contact with water, SPDT 10-amp output contacts, NEMA 4 enclosure, protected probes mounted 1/8" above the floor.

- a. Acceptable Manufacturers:
 - 1) B/W Controls.
 - 2) Warrick Controls.
 - 3) Or Equal.

2.03 MISCELLANEOUS

- A. Heating/Cooling/Exhaust Unit: Unit shall be one piece, wall mounted, factory assembled, precharged, prewired, tested and ready to operate. The unit shall have a limited warranty of five years on parts and five years on the compressor. The unit shall be approved and listed by Underwriters' Laboratories, Inc., and Canadian Underwriters' Laboratories (CUL). Unit performance shall be certified in accordance with Air Conditioning and Refrigeration Institute Standard 210/240-89 for Unitary Air-Source air conditioners or latest standard.
 1. Two (2) each exterior wall mounted, hard-wired as shown;
 2. Enclosed weatherproof casing constructed of 20-gauge galvanized steel, finished with baked-on polyester enamel paint;
 3. One (1) washable filter;
 4. Remote adjustable thermostat;
 5. Cooling capacity in tons: 1;
 6. Cooling Capacity: 11,100 BTUH at 230 volts, single phase;
 7. Amps: 30;
 8. Twin indoor blowers, SCFM maximum/minimum: 325/300 at 0.2" static pressure;
 9. Electrical supplemental heater: 5 kW;
 10. HVAC Units will be provided with 5" offsets to accommodate the field-applied brick facade by others.
- B. Dehumidifier:
 1. One (1) each, installed as shown.
 2. Capacity 30 pints per 24 hours.
 3. Compressor rated 115 volts, 60 Hz, 3.4 operating amps.
 4. 126 CFM fan, 2 fan speeds.
 5. Humidity range 35 to 90% RH, ambient temperature range of 42 to 105 F, Type R22 refrigerant.
 6. Washable filter.
 7. Condensate piped direct to sump.
 8. UL listed rubber cord.
 9. EPA compliant.
- C. Fire Extinguishers: Two (2) fire extinguishers shall be provided and wall mounted, as shown on the Drawings. The units shall be portable, Kidde Dry Chemical Pro5TMP, 5 lbs. capacity, with a 3-A: 40-B:C UL rating or equal.

PART 3 – EXECUTION

3.01 START-UP SERVICES

- A. Start-up service technician shall be a regular employee of booster station manufacturer.
- B. As part of the submittals covering this equipment, list the manufacturer's employee names and telephone numbers with extension for those individuals who are directly responsible for this project. Also list each start-up service technician and telephone number.
- C. Verify that one (1) or more of the service technicians listed above will perform the required start-up service on the equipment covered in the submittals.
- D. Three (3) full days, excluding travel time, at job site for start-up and training.
- E. Start-up service to include bound O&M manuals as required by Section 01700 – Project Closeout.
- F. Start-up service report attested to by start-up technician and representative of owner or engineer.
- G. Service report distributed to:
 - 1. Manufacturer's File
 - 2. Engineer's File
 - 3. Contractor's File
 - 4. Owner's File

END OF SECTION