Washington County
MARYLAND

PURCHASING DEPARTMENT
DIVISION OF BUDGET & FINANCE

**PUR-1485**
**ADDENDUM NO. 2**
**INVITATION TO BID**

**OAK RIDGE PUMP STATION UPGRADE**

**DATE: Wednesday, September 22, 2021** **BIDS DUE: Wednesday, September 29, 2021**
*(Revised Due Date via Addendum No. 1)* **2:00 P.M. (EDT/EST)**

To Bidders:

This Addendum is hereby made a part of the Contract Documents on which all bids will be based and is issued to correct and clarify the original documents.

Please acknowledge receipt of this Addendum at the appropriate space on the Proposal Form. This Addendum consists of three (3) pages and three (3) attachments.

**NOTE: All Bidders must enter the Washington County Administrative Complex through either the front door at the 100 West Washington Street entrance or through the rear entrance (w/blue canopy roof) which is handicap accessible and must use the elevator to access the Purchasing Department to submit their bid and/or to attend the Pre-Bid Conference and/or the Bid Opening. Alternate routes are controlled by a door access system. Washington County Government has announced new security protocols being implemented at the Washington County Administrative Complex at 100 West Washington Street, Hagerstown. The general public will be subject to wand search and will be required to remove any unauthorized items from the building prior to entry. Prohibited items include but are not limited to: Weapons of any type; Firearms, ammunition and explosive devices; Cutting instruments of any type - including knives, scissors, box cutters, work tools, knitting needles, or anything with a cutting edge, etc.; Pepper spray, mace or any other chemical defense sprays; and Illegal substances.**

**ITEM NO. 1:** *Inquiry:* Can you provide further clarification regarding the lighting.
1. In reference to Addendum #1 Item #24. Please confirm that fixture WC will change to WA. Please confirm that fixture WA is to change to WB in spec section
2. In reference to Addendum #1 Item #24. There is no reference to type WC fixture 16500. Please provide specific fixture.

*Response:* Part 1 of Item No. 1 herein: Essentially, the lights in the hazardous areas such as the Wet Well and Grinder Area shall be "WA fixture as shown on the drawings and listed in the attached Section 16500 specification. The WA's are also noted as Class 1, Division 1. The lights in the Meter Pit shall be the

"WB" fixture as showing on the plans and listed in the attachment "A" Section 16500 specification. The lights on the outside of the building shall be the "WC" fixture as shown on the plan sheet and listed in the attachment "A" Section 16500 specification.

*Response:* Part 2 of Item No. 1 herein: Attachment "A" Section 16500 shall replace the previously provided technical specification. Attachment "A" includes the WC description which was omitted from the previous section.

**ITEM NO. 2:** *Inquiry:* Addendum 1, Item No. 24 corrected the references to the light fixtures, but did not answer the original question: There is no fixture WC in the lighting schedule. Can you please get someone to specify what Fixture WC is?

*Response:* Refer to Item No. 1 of this Addendum.

**ITEM NO. 3:** *Inquiry:* I was wondering if you could please send me a list of the bidders for this job so that I can supply them with pricing for these items.

*Response:* See Addendum No. 1, Attachment "B".

**ITEM NO. 4:** *Inquiry:* "Also by changing the WC's to WA's, they'd be putting a high bay on an exterior. I think this Addendum just made everything more confusing when all that was needed was for them to specify the WC fixture."

*Response:* Refer to Item No. 1 of this Addendum.

**ITEM NO. 5:** Refer to attachment's "B" and "C" to this addendum; technical specifications (Section 17100 and 17110). They shall replace the previous specs included in the bidding documents. Attachment's "B" and "C" clarify the 208v vs 480v at the station.

**ITEM NO. 6:** **ADD** the following to Section 17500:

**J. AUTOMATIC TELEPHONE DIALER**

**1. Programmable Controller Outputs**

a. The programmable controller outputs for the pump station alarms will be output from the PLC located in the Pump Station Control Panel.

b. Digital Outputs (24vdc):

| Description | Destination Point |
|---|---|
| (1) Sewage Pump Common Alarm | Alarm Relay in Pump Station Control Panel |

**2. Description of Operation**

a. The pumping station alarms shall be programmed to three common alarm outputs in the PLC. The alarm outputs will be wired to relays in the Pump Station Control Panel. A normally open contact on each relay will be wired to the existing SCADA system for notification of a pump station alarm.

By Authority of:

Rick F. Curry, CPPO
Director of Purchasing

*(**NOTE:** The wording of all "Inquiries" submitted are displayed exactly as received.)*

**SECTION 16500**
**LIGHTING FIXTURES**

## PART 1 - GENERAL

### 1.01 DESCRIPTION

A. Work Included:

1. Furnish all labor and materials to complete lighting fixture installation and associated items indicated, specified herein or both. Fixtures of size and type specified herein shall be supplied, installed and connected for each outlet indicated on the Drawings. Furnish and install lamps in each fixture.

### 1.02 QUALITY ASSURANCE

A. Regulations, Standards and Publications:

1. Fixtures shall be U.L. listed.

2. All fixtures shall meet all Federal, State and local required criteria.

3. All light fixtures shall be mounted in accordance with manufacturer's recommendations.

4. Ballasts shall be Electrical Testing Laboratories, Inc. (E.T.L.) - Certified Ballast Manufacturers Association (C.B.M.) certified.

5. The installation must comply with the amended National Electrical Code of the National Fire Protection Association.

B. Qualification:

1. When more than one name of manufacturer of fixture is listed in these specifications, the first manufacturer and number determine the style and quality.

### 1.03 SUBMITTALS

A. Shop Drawings:

1. Submit manufacturer's latest publication of each fixture including ballast information, construction details, light distribution details and/or coefficients.

## PART 2 - PRODUCTS

### 2.01 MATERIALS

A. LED Drivers:

1. LED light driver shall be of high efficiency.

2. LED light driver shall allow operation of all other LEDs in the event of an LED failure.

B. Light Fixture Schedule:

1. CA: Ceiling mounted, 120 volt, high efficiency LED, nominal 8" x 4', totally enclosed gasketed fixture suitable for wet locations. Fixture shall be provided with an electronic driver. Fixture shall produce a minimum of 4,000 initial lumens and have a color temperature of less than or equal to 4,100K. Housing shall be one-piece high impact plastic to provide durability and corrosion resistance. The lens shall be one-piece deep clear polycarbonate, resistant to damage. Fixture shall have plastic latches to apply positive, uniform pressure on the gaskets to seal against dust and moisture. Provide gasketed conduit hubs. Fixture shall be Holophane #EMSL48-4000LM-IMACD-MD-MVOLT-GZ10-40K-80CRI-WLFEND2, Lithonia #FEM4LED-4L-IMACD-WLFEND-PLCL-WLFEND, or Columbia #LXEM-4-40-HL-DCA-E-U-DWH.

2. CB: Ceiling mounted, 120 volt, high efficiency LED, nominal 4' linear, totally enclosed gasketed fixture. Fixture shall be designed for a Class 1, Division 1 hazardous environment where flammable gases or vapors, flammable liquids, combustible dust and/or ignitable fibers may exist. The fixture housing shall be baked-on powder epoxy for added corrosion protection. Fixture shall be AZZ Lighting #XML-07-L-C-4-U-MB, or equal.

3. WA: Wall mounted, 120 volt, high efficiency LED fixture. Fixture shall be designed for a Class 1, Division 1 hazardous environment where flammable gases or vapors, flammable liquids, combustible dust and/or ignitable fibers may exist. The fixture housing shall be baked-on powder epoxy for added corrosion protection. Fixture shall have a prismatic glass globe and stainless steel wire guard. Fixture shall be Holophane #HRLL-8L-AS-GG-WL, or equal.

4. WB: Wall mounted, multi-volt, high efficiency LED fixture. The fixture shall have a color temperature of less than or equal to 4,000. The fixture housing shall be constructed of die-cast copper-free aluminum with epoxy powder finish. Fixture shall have a prismatic glass reflector. Fixture shall be NEMA 4X rated and UL listed as suitable for wet locations. Fixture shall be furnished with a SPAS20K surge suppressor. Fixture shall be Holophane #HPLED-56-700-4K-AS-US-G-L5H, or equal.

5. WC: Wall mounted, 120 volt, LED fixture. The fixture housing shall be constructed of die-cast copper-free aluminum with epoxy powder finish. Fixture shall have a prismatic glass refractor with symmetrical distribution, and shall be UL listed as suitable for wet locations. Fixture shall have stainless hardware. Fixture shall be photoelectric controlled. Fixture shall be Holophane W4GLED-30C-1000-40K-T3M-120-PE-BZSDP, or equal.

**PART 3 - EXECUTION**

**3.01 INSTALLATION**

A. Installation:

1. Contractor shall furnish supports for the light fixtures.

2. The fixture manufacturer's catalog numbers describing the various types of fixtures shall be used as a guide only and do not include all the required accessories or hardware that may be required for a complete installation. The Contractor shall be responsible for furnishing, at no additional cost to the Owner, all required accessories and hardware for a complete installation.

3. All inoperable lamps shall be replaced with new lamps during the course of construction, up to and including the date of final acceptance by the Owner and Engineer.

**END OF SECTION**

**SECTION 17100**
**MOTOR CONTROL CENTER**

## PART 1 - GENERAL

### 1.01 DESCRIPTION

A. Work Included:

1. Furnish and install a motor control center in the Oak Ridge Pump Station as shown on the Drawings. The motor control center shall include required number of vertical sections, main lugs, circuit breakers, combination type motor starters, control transformers, relays, selector switches, push buttons, pilot lights, elapsed time meters, and special controls as shown on the Drawings and specified herein.

B. Special Requirements:

1. The Motor Control Center shall be provided by the Pump Control System Supplier.

### 1.02 QUALITY ASSURANCE

A. Regulations, Standards and Publications:

| | |
|---|---|
| ANSI | American National Standards Institute |
| NEC | National Electrical Code |
| NEMA | National Electrical Manufacturers Association |
| UL | Underwriters' Laboratories, Inc. |

1. All internal conductors are to be of sufficient cross-sectional area copper to carry the rated ampere load and not exceed the maximum heat rise above ambient temperature specified by UL and NEMA.

B. Quality Control:

1. The motor control center shall be new and limited to products regularly produced and recommended for service ratings in accordance with engineering data or other comprehensive literature. In all cases where device, or devices, or part of equipment is herein referred to in singular, reference shall apply to as many items as required to complete installation.

### 1.03 SUBMITTALS

A. Shop Drawings:

1. Submit in accordance with the requirements of Section 17010. Shop drawings shall be complete in all respects and shall indicate all dimensions, installation methods, size, weight, capacity, ratings, integral controls and types of materials, elevations, and sections. Shop drawings shall include manufacturer's literature and complete information on the following:

a. Freestanding Vertical Sections
b. Main Lugs
c. Thermal-Magnetic Type Circuit Breakers
d. Motor Circuit Protector Type Circuit Breakers
e. Automatic Transfer Switch
f. Magnetic Across-the-Line Motor Starters

g. Control Transformers
h. Relays
i. Selector Switches
j. Push Buttons
k. Pilot Lights
l. Elapsed Time Meters
m. Special Controls
n. Engineered Control Diagrams and Connection Diagrams
o. Nameplate Schedules

### 1.04 MANUFACTURER

A. The motor control center shall be Allen-Bradley Bulletin 2100.

## PART 2 - PRODUCTS

### 2.01 MATERIALS

A. Motor Control Center Structure and Configuration:

1. The Motor Control Center shall be NEMA Type 1, gasketed. Wiring shall be NEMA Class 1, Type B. The motor control center shall have main lugs as indicated on the Drawings to feed the horizontal bus. Provide lugs of adequate size to terminate incoming cables. The motor control center shall be furnished with a ground bus, and a neutral bus as indicated on the Drawings.

2. The motor control center shall be rated at 480 volts, 3 phase, 4 wire, 60 Hz and shall be braced to withstand a short circuit current of 65,000 rms symmetrical amperes.

3. Motor starter units shall be combination type with a molded case circuit breaker. Control voltage for units shall be 120 volts.

4. The motor control center shall consist of vertical sections bolted together to form a rigid, freestanding assembly.

5. Vertical sections shall be formed of 13 gauge hot rolled steel with uniform blemish-free surfaces. Top and bottom structural parts shall be 10 gauge. End closing plates shall be 12 gauge, and unit parts and doors shall be 14 gauge. Base channels shall be provided constructed of rugged steel to easily withstand the stress of transit and moving the control center into position. Bolt holes in the base channels shall be provided in all sections for the purpose of bolting the control center to the floor. Steel removable lifting angles shall be provided on the top of the sections for convenience in handling the control center.

6. Each section, to comply with standards of NEMA, shall be approximately 90" high excluding lifting angles and base channels. It shall be approximately 20" deep by 20" to 35" wide, as indicated on the Drawings.

7. End sections shall have end-closing plates, which can be removed for the addition of future sections. The top plate shall be of a removable one-piece construction for added convenience in cutting conduit holes. Removable blank plates flanged on all 4 sides and having captive screws shall cover all unused unit spaces.

B. Main Lugs:

1. Main circuit breaker shall be thermal magnetic molded case type, service entrance rated, individually mounted and identified. Main circuit breaker shall have quick-make, quick-break mechanism and shall visually indicate whether the breaker is closed, open or tripped. The main breaker shall have sufficient interrupting capacity to properly close against and interrupt instantaneously, without damage, the maximum short circuit current available at the breaker. Minimum interrupting capacity shall be 65,000 amperes symmetrical at 480 volts.

C. Horizontal Wireways:

1. Adequate conduit entrance space and wire entry room shall be provided at both the top and bottom of each section. The bottom horizontal wireway shall be 12" and the top horizontal wireway shall be 6" and both shall extend through the length and depth of the control center section with openings between sections. Covers over these wireways shall be equipped with captive type screws to prevent loss of hardware during installation. These wireways shall be isolated from the bus bars.

D. Vertical Wireways:

1. A vertical wire trough located on the right-hand side of each standard section and having a cross-sectional area of not less than 28 sq.in. shall extend from the top horizontal wire trough to the bottom horizontal wire trough for the purpose of routing user's motor and control wires to the control units. The wire trough shall be isolated from the bus bars to guard against accidental contact. A separately hinged door having captive type screws shall cover the vertical wire trough for safe and easy access to wiring without disturbing control units.

2. Wire ties shall be furnished in the vertical wire trough to group and securely hold wires in place for a neat, orderly installation.

3. Where wire access ports between unit spaces and vertical wire trough are open, shutters shall be provided to prevent items, such as a fish tape, from accidentally entering the unit space. Snap-in wire grommets shall be provided in wire access ports for size 2 units and smaller for isolation and added protection of small wires. For larger units, snap-in wire guards shall be provided for added protection of larger wires.

E. Automatic Transfer Switch:

1. Furnish an 600 amp, 480 volt, 3-pole, 4-wire automatic transfer switch in Motor Control Center-P for utility and generator service. The transfer switch shall be suitable for continuous operation and shall consist of a double throw power transfer mechanism and a microprocessor controller.

2. The transfer switch shall be arranged to close a contact for remote starting of the diesel generator, after a time delay of 0-6 seconds, after power failure or drop in any phase voltage to 70 percent of line voltage. During the delay period, the load circuits shall not be disconnected from the normal service lines.

3. When the generator is delivering not less than 95 percent of rated voltage and frequency, the load circuits shall be transferred. Retransfer to normal service shall be automatic when full line voltage and phase are restored after a time delay of 0 to 5 minutes, set for 3 minutes. Provisions shall also be made for manual transfer to the generator. After transfer to normal source, the generator shall continue to run for 5 minutes (adjustable 0 to 25 minutes) unloaded, shall shut down and shall be ready to start upon the next failure of the normal source or for manual start-up. If the generator should fail while carrying the load, retransfer to the

normal source after a short delay shall be made upon restoration of the normal power. The pick-up and drop-out settings of the phase voltage-sensing relays shall be completely adjustable in the field from 70 percent to 100 percent pick-up and drop-out.

4. The transfer switch shall be double-throw switch operated by a single coil mechanism momentarily and electrically. Operating current for transfer shall be obtained from the source to which the load is to be transferred. Failure of any coil or disarrangement of any parts shall not permit a neutral position. The switch shall be positively locked mechanically on either source without the use of hooks, latches, semi-permanent magnets, or contacts. All contacts and coils shall be readily accessible for replacement from the front of the panel without major disassembly of associated parts.

5. The transfer switch shall be equipped with a test button, and auxiliary contacts as required to show that the switch is in the normal or emergency position. Provide pilot lights on the enclosure door to indicate the switch position.

6. Auxiliary contacts shall be provided for remote indication of the transfer switch position. The contacts shall be wired to a terminal block in the transfer switch enclosure.

7. The transfer switch shall have a load test switch to simulate normal power failure.

8. The transfer switch shall be furnished with an inphase monitor.

9. Provide a 7-day solid-state exercise clock to set the day, time and duration of the generator exercise period. Furnish a selector switch to enable the generator to be exercised with or without load.

10. Minimum withstand and closing ratings shall be in accordance with UL 1008.

11. The automatic transfer switch shall be the same as the generator manufacturer.

12. The automatic transfer switch shall be furnished with all software, programs and cables necessary for maintenance and adjustment of the transfer switch.

F. Vertical Sections:

1. Each vertical section shall be divided into compartments, each containing a combination starter or other control assembly as indicated on the Drawings. Power shall be provided to these compartments from the main bus by bus bars extending the full height of the unit. Sections shall also be provided with horizontal spaces at the top and at the bottom, which shall line up with adjacent section to form horizontal wiring raceways along the entire length of the control center.

G. Compartments:

1. Compartments shall be built in interchangeable combinations of modular heights. A full vertical section shall contain six equal NEMA size l modular compartments exclusive of top and bottom wiring spaces. Starter compartments shall not be less than 12" high. Only l/2 and integral multiples of the basic module will be allowed. Compartments for NEMA size 4 and smaller starters shall be draw out type.

2. Guide rails shall be provided in the structure for supporting and aligning a unit during its removal or replacement. Draw out units shall have pressure type, line disconnecting stabs of high strength alloy and shall be held in place by means of quick acting, captive machine screw fasteners arranged so the units can be removed or remounted readily without access to the

rear of the structure. Each compartment whether draw out or stationary, shall be enclosed and effectively baffled to isolate any fault which may occur and shall be covered by an individual door fixed to the structure with a continuous full length piano hinge or two (three for doors over 36" high) semi-concealed, heavy-duty, pin type hinges. Doors shall be secured with captive, quick acting fasteners and shall be arranged to completely cover all live parts whether the draw out unit is present or not.

H. Bus Bars:

1. Main horizontal bus bars rated as indicated on Drawings but not less than 1,200 amperes shall be provided at the top or center of the control center and extend its entire length, except when cut and supplied with splice bars to divide the control center for ease in handling or when section is indicated on Drawings to be furnished without bus.

2. Horizontal bus bars of copper shall be mounted edge-to-edge to provide greater mechanical strength.

3. Vertical copper bus bars shall be rated not less than 300 amperes for adequate current carrying capacity in a variety of plug-in applications.

4. Horizontal and vertical bus bars shall be electrolytically tin plated copper. Connections between horizontal and vertical busses shall be joined by bolts, conical spring washers for constant pressure joints and self-clinching nuts to allow joint maintenance from the front.

5. High strength glass reinforced alkyd insulators shall be used as bus supports and as unit plug-in insulators. Bus and plug-in insulators shall be red to indicate the proximity of energized bus parts.

6. The temperature rise, above ambient temperature outside the enclosure, of bus bars and connections shall not exceed 50°C and that of connections to insulated cable shall not exceed 45°C when operated continuously at rated current. Bus work, wiring and equipment shall be rated to withstand short circuits of 65,000 rms symmetrical amperes at 480 volts or as noted on the Drawings.

7. A copper ground lug shall be provided in each incoming line vertical section capable of accepting a #8 to 250 MCM cable. A horizontal and vertical copper ground bus shall be provided in each section of the motor control center. Horizontal ground bus shall run continuously throughout the control center except where splits are necessary for ease of shipment and handling; in which case, splice bars shall be provided. Ground bus shall be tin plated copper and have a cross-sectional area of equal to 28% of the main horizontal bus cross-sectional area. Horizontal ground bus shall be located at the bottom of the motor control center.

I. Bus Barriers:

1. Insulated horizontal and vertical bus barriers shall be furnished to reduce the hazard of accidental contact. These barriers shall have a red color to indicate proximity to energized busses. Vertical bus barriers shall have interlocking front and back pieces to give added protection on all sides and shall segregate the phases from each other. Small, separate openings in the vertical bus barriers shall permit unit plug-in contacts to pass through and engage the vertical bus bars.

2. Bottom bus covers shall be provided below the vertical bus to protect the ends of this bus from contact with fish tapes or other items entering the bottom of the enclosure. Unused plug-in openings shall have plastic snap-in closing plates.

J. Unit Plug-In:

1. Unit plug-in contacts shall be provided for size l through size 5 motor starters and for branch circuit breakers.

2. The plug-in connection shall be 2-point connection for each phase designed to tighten during heavy current surge. The plug-in fingers shall be tin plated to yield a low resistance connection and shall be backed by spring steel clips to provide high-pressure connection points. Contact fingers shall be mounted in their support so these fingers become floating and self-aligning to allow solid seating onto the vertical bus bars.

K. Unit Doors:

1. Each unit shall have a door securely mounted with hinges, which allow the door to swing open a minimum of 112 degrees. Unit doors shall be fastened to the stationary structure so they can be closed to cover the unit space when the units have been temporarily removed. Unit doors shall be held closed with captive type screws, which engage self-aligning cage nuts. These screws shall provide at least 2 threads of engagement to help hold unit doors closed under fault conditions. Removable door panels held captive type screws shall be provided on starter unit doors for mounting push buttons, selector switches or pilot lights. Blank door panels capable of accepting future push button devices shall be furnished when push button devices are not originally specified for starter units. Starter units shall have an external low profile overload reset button.

2. Pilot devices and instruments, including push buttons, reset buttons, and indicating lights, shall be flush mounted in the compartment doors. Equipment shall not be mounted on the rear of draw out units. All equipment within the unit shall be arranged to provide ample electrical clearances and easy access for maintenance. Draw out combination starter unit of a given type and size shall be made interchangeable. Only those items, which are common to all starters, shall be mounted in the unit.

3. Where a spare unit is indicated on the Drawings, it shall be a complete combination starter of the type and size shown.

L. Unit Support Pan:

1. Each plug-in unit shall be supported and guided by a tilt and lift-out removable pan so unit rearrangement is easily accomplished. For easy unit installation and rearrangement, transfer of this unit support pan from one location to another shall be accomplished without the use of tools after the unit and door have been removed.

M. Unit Saddles:

1. Each plug-in unit shall have a sheet steel saddle designed to physically isolate the unit from the bus compartment and adjacent units. Saddles shall be equipped with captive, self-aligning mounting screws, which hold the unit securely in place during shipment and maintain the unit and structure at the same potential. Handholds shall be provided on each plug-in unit to facilitate unit removal.

N. Disconnect Operator:

1. A flange mounted operator handle shall be supplied for each switch or breaker. To prevent false circuit indication, this mechanism shall be engaged with the switch or breaker at all times regardless of unit door position. The operator handle shall have a conventional up-down

motion with the down position as "OFF." It shall be possible to lock this handle in the "OFF" position with up to three 3/8" diameter shackle padlocks. The operator handle shall be color coded to display red in the "ON" position and black in the "OFF" position.

2. The operator handle shall be interlocked with the unit door so the disconnect cannot be switched to the "ON" position unless the unit door is closed. It shall be possible to defeat this interlock by a deliberate act of an electrician should he desire to observe the operation of the operator handle assembly. This interlock shall also prevent opening the unit door, unless the disconnect is in the "OFF" position. A defeater for this action shall also be provided in the event an electrician must gain access to the unit without interrupting the service.

O. Starter Units:

1. Starter units shall be completely draw out Type B, sizes as indicated on the Drawings, so units may be withdrawn without disconnecting any wiring. Units over three space units high may be bolt-in type. A positive guidance system shall be provided to assure proper alignment of wedge-shaped power stabs in dead-front openings in vertical power bus. The screw racking mechanism shall serve as a mechanical advantage to the operator during unit insertion or removal. Stab-in power terminals shall be of a type that will increase contact pressure on short circuits.

2. All starter units shall be rated to withstand short circuits of 65,000 rms symmetrical amperes at 480 volts or as noted on the Drawings.

P. Thermal Magnetic Type Circuit Breakers:

1. Thermal magnetic circuit breakers shall have quick-make, quick-break mechanisms and shall visually indicate whether the breaker is closed, open or tripped.

2. All breakers shall have sufficient interrupting capacity to properly close against and interrupt instantaneously, without damage, the maximum short circuit current available at the breaker. Minimum interrupting capacity of breakers shall be 65,000 amps rms symmetrical at 480 volts.

3. Provide auxiliary contacts on the circuit breakers where indicated on the Drawings.

Q. Motor Circuit Protector Type Circuit Breakers:

1. Motor circuit protector type circuit breakers shall be used for all branch circuit breakers for motor circuits. Breakers shall be instantaneous trip, magnetic only type. Each breaker shall be furnished with a single magnetic trip adjustment, which simultaneously sets the magnetic trip level of all poles. Adjustment shall be continuous throughout the trip range. Minimum interrupting capacity of breakers shall be 65,000 amps rms symmetrical at 480 volts.

2. Provide auxiliary contacts on the circuit breakers where indicated on the Drawings.

R. AC Magnetic Starters - Line Voltage Type:

1. Motor starters shall be across-the-line magnetic type, rated in accordance with NEMA standards, sizes and horsepower ratings. Starter sizes shall be as indicated on the Drawings.

2. Across-the-line magnetic starters shall be equipped with double-break, silver alloy contacts. All contacts shall be replaceable without removing power wiring or removing starter from panel.

3. Coils shall be of molded construction and shall operate on 120 volts AC. All coils shall be replaceable from the front without removing the starter from the panel.

4. Overload relays shall be solid state electronic type. Thermal units shall be one-piece construction and interchangeable. The starter shall be inoperative if the thermal unit is removed.

S. Control Transformers:

1. Provide a control transformer for each motor starter control circuit as indicated on the Drawings. Control transformers for individual control circuits shall be 480 volts to 120 volts and shall be protected according to code. Size shall be as required plus 50VA spare capacity. Primary fuses shall be Class "CC".

T. Relays:

1. Relays shall be heavy-duty general-purpose type with 10 amp contacts. Relays shall have terminals, which plug-in to a socket, mounted to the inside of the MCC bucket. Contact configuration shall be 3PDT.

2. Relay coils shall operate on 120 volts AC, unless indicated otherwise on the Drawings. Relays shall have an indicator light to indicate the relay coil is energized.

U. Selector Switches:

1. Selector switches shall be non-illuminated. Switches shall be 30.5 mm, heavy-duty, oil tight. Switches shall have double-break silver contacts. All switches shall be maintained contact type unless otherwise indicated on Drawings.

2. Provide auxiliary contact blocks as indicated on the Drawings, or in the Description of Operation.

V. Push Buttons:

1. Push buttons shall be non-illuminated. They shall be 30.5 mm, heavy-duty, oil tight. Contacts rated for 10 amps minimum. Push buttons shall be momentary contact type unless noted otherwise on the Drawings.

W. Pilot Lights:

1. Pilot lights shall be LED, push to test, transformer type. They shall be 30.5 mm, heavy-duty, oil tight. Voltage rating shall be 120 volts. Color caps shall be green for "run", and red for "alarm".

X. Elapsed Time Meters:

1. Elapsed time meters shall be time totalizer, non-resettable. They shall have a synchronous motor, which shall drive a set of digit readout wheels to indicate the total time the unit is energized. Readout shall be five-digit including 1/10 digit. Range shall be 0 to 9999.9 hours. Voltage rating shall be 120 volts. Elapsed time meters shall be ENM Company Series T50.

Y. Legend Plates:

1. Provide an engraved legend plate for each pilot device. Engraving shall be as indicated on the Drawings.

Z. Identification:

1. A control center identification number nameplate describing section catalog numbers and characteristics shall be fastened on the vertical wire trough door of every section. Each control center unit shall have its own identification number nameplate giving unit catalog number fastened to the unit saddle near the upper left-hand corner. These nameplates shall also have suitable references to factory records for efficient communication with supplier.

2. Each control center unit shall also have an engraved Bakelite nameplate fastened to the outside of each unit door. Nameplates shall be black with white engraving.

AA. Wiring:

1. The motor control center shall be wired in accordance with NEMA class and type previously specified and shall be furnished to be interconnected with a programmable controller system.

2. All 120 VAC control wiring shall be red. All 24vdc control wiring, and wiring for 24vdc PLC inputs shall be blue. All wiring in each MCC cubicle shall be labeled.

3. Quick separating, pull apart terminals shall be mounted on lift-out brackets in the units. All terminals shall be labeled.

BB. Finish:

1. All painted parts shall undergo a phosphatizing pre-painting treatment for rust resistance and good paint bond. All painting shall be with enamel, which shall be baked for a durable, hard finish. Unit saddles shall be painted white for easy interior visibility. Removable push button plates, flange mounted operator handles and trim plates, and top horizontal wire trough cover plates shall be painted a contrasting charcoal gray. Other painted parts shall be painted ANSI-49 medium light gray.

2. All unpainted parts shall be plated for resistance to corrosion.

## 2.02 SPARE PARTS

A. Provide the following spare parts for the motor control centers:

1. Two (2) Relays for each type utilized
2. Six (6) Fuses for each size and type utilized
3. Six (6) pilot light bulbs with special tool to remove bulb

B. Spare parts shall be packaged individually in boxes that are clearly labeled with part name and manufacturer's part/stock number.

# PART 3 - EXECUTION

## 3.01 FIELD SERVICES

A. Start-up and Testing:

1. Test the operation of each motor starter and all MCC controls.
2. All start-up and testing shall be performed in the presence of the Owner and the Engineer.

B. Training:

1. Provide two (2) hours of training on the motor control center. Training shall include theory of operation, maintenance and troubleshooting procedures.

**END OF SECTION**

**SECTION 17110**
**VARIABLE FREQUENCY DRIVES**

## PART 1 - GENERAL

### 1.01 DESCRIPTION

A. Work Included:

1. Furnish and install the following variable frequency AC drives as shown on the Drawings and specified herein:

   a. Three (3) Sewage Pump VFDs

2. The variable frequency drives shall be free-standing drives, as shown on the Drawings.

B. Special Requirements:

1. The variable frequency drives shall be furnished by the Process Control System Supplier, who shall be responsible for coordinating the drive start/stop and speed controls.

### 1.02 QUALITY ASSURANCE

A. Regulations, Standards and Publications:

| | |
|---|---|
| ANSI | American National Standards Institute |
| NEC | National Electrical Code |
| NEMA | National Electrical Manufacturers Association |
| UL | Underwriters Laboratories, Inc. |

B. Quality Control:

1. All variable frequency drives shall be new and limited to products regularly produced and recommended for service ratings in accordance with engineering data or other comprehensive literature. In all cases where device, or devices, or part of equipment is herein referred to in singular, reference shall apply to as many items as required to complete installation.

2. The drives shall be built to applicable NEMA standards and be suitable for use as a component to meet NEC requirements. Drives shall be listed by Underwriters Laboratories (UL).

3. All incoming material shall be inspected and/or tested for conformance to quality assurance specifications. All chips (CMOS, TTL, LINEAR, etc.) shall be functionally tested.

4. All subassemblies shall be inspected and/or tested for conformance to vendor's engineering and quality assurance specifications.

5. All drives shall be burned-in at the factory, cycling load to simulate no load/full load and exercise drive power components.

### 1.03 SUBMITTALS

A. Shop Drawings:

1. Submit in accordance with the requirements of Section 17010. Shop drawings shall be complete in all respects and shall indicate all dimensions, installation methods, size, weight,

capacity, ratings, integral controls, elevations, and sections. Shop drawings shall include manufacturer's literature and complete information on the following:

a. Variable Frequency Drives
b. Drive Enclosure
c. Drive Disconnect Switch
d. Line Reactors
e. Control Transformers
f. Selector Switches
g. Pilot Lights
h. Elapsed Time Meters
i. Relays
j. Panel Layout Drawings
k. Wiring Diagrams

2. The VFD wiring diagrams shall be customized for this project. Standard drawings will not be accepted.

**1.04 MANUFACTURER**

A. The Variable Frequency Drives shall be Allen-Bradley Power Flex 753.

**1.05 WARRANTY**

A. Provide a two (2) year warranty on each variable frequency drive. The warranty shall include parts and labor, and shall start on the date that the drive is started up by an authorized field service representative from the VFD manufacturer.

**PART 2 - PRODUCTS**

**2.01 VARIABLE FREQUENCY DRIVES**

A. General:

1. The variable frequency drives shall convert a fixed frequency, three phase input power to an adjustable AC frequency and voltage source for controlling the speed of a standard, NEMA Design B, AC induction motor.

2. The drives shall be fully digital, microprocessor controlled and shall incorporate a diode bridge rectifier and a transistorized inverter section. IGBT type power transistor modules shall be utilized in the inverter section to invert a fixed DC bus voltage to a symmetrical three-phase pulse-width modulated (PWM) output voltage.

3. The drives shall accept incoming 480 VAC, 60 Hz line power, and shall not be affected by voltage fluctuations of ± 10% or frequency fluctuations of ± 2%. The drive shall include phase-to-phase and phase-to-ground protection, and transient voltage surge protection.

4. Each variable frequency drive shall be designed to operate a 480 volt, 3 phase, AC induction motor in an ambient temperature of 32 to 104°F. The drive output amp rating shall exceed the motor nameplate FLA rating. Refer to the Drawings for the motor hp and the specifications for the motor RPM.

B. Drive Enclosure:

1. The variable frequency drives shall be free-standing enclosures as shown on the Drawings. Provide ventilation fans and louvers as required to dissipate the heat generated by the drive. The ventilation fan should only run when the VFD runs.

C. Drive Operating Characteristics:

1. The drive operation shall be fully digital with microprocessor control of frequency, voltage and current. All drive set-up operations and adjustment shall be digital and stored in a non-volatile memory (EEPROM).

2. To control the rate of change of output frequency for a step change in input reference, the drive shall have two independently adjustable acceleration and deceleration rates.

3. The drive shall have a foldback current limiting circuit. During acceleration, the circuit shall automatically reduce the acceleration rate to a slower rate should the load inertia cause excessive currents.

4. The drive shall have a selectable deceleration voltage limiting circuit. The circuit shall extend the set deceleration ramp should the bus voltage approach high limits due to regeneration.

5. The drive output frequency shall be adjustable from 0-60 Hz.

6. The drive shall have a fully programmable volts per hertz ratio.

7. The drive shall maintain set frequency to within 0.6 Hz during power line fluctuations.

8. The drive speed reference signal shall be a 4-20mA analog signal output from the PLC, or a signal received from the VFD keypad module.

9. The drive shall be capable of maintaining 100% of rated output current continuously, and shall be capable of delivering 110% of rated output current for up to one minute.

10. The drive shall be capable of restoring motor operation after a 0.5 second line loss without shutting down on a fault.

11. The drive input circuitry shall not generate line notches or large voltage transients on the incoming line.

12. The drive shall present a displacement power factor of 0.95 or better to the AC line at any speed or load.

13. The drive efficiency at rated load and frequency shall be 96% or better.

D. Drive Controls:

1. Each variable frequency drive shall be furnished with start/stop controls and speed controls as indicated on the Drawings and in the Description of Operation.

E. VFD Keypad Module:

1. A keypad module shall be mounted on the VFD enclosure door for digital set-up of the drive, drive parameter review and drive fault annunciation. The module shall have an LCD display and a digital speed pot for local control of the drive speed.

F. Drive Protection and Diagnostics:

1. Each variable frequency drive shall incorporate internal diagnostic and fault sensing circuits as an integral part of the drive. The following drive protection functions shall be monitored:

a. Momentary Overload Protection - Adjustable from 20 to 110% of Drive Rating
b. Motor Overload Protection
c. Undervoltage Sensing
d. Overvoltage Sensing
e. Phase Protection
f. Drive Overtemperature
g. Ground Fault Detection

2. Each of the above fault conditions shall be annunciated on the VFD keypad, and shall shut down the drive.

**2.02 DRIVE CONTROL COMPONENTS**

A. Line Reactors:

1. Provide line reactors where indicated on the Drawings to eliminate nuisance overvoltage tripping and to reduce harmonic distortion. The line reactors shall be iron core, 5% impedence, Class H insulation, 115ºC rise, copper wound. The line reactors shall be sized for the motor horsepower and shall be manufactured by TCI.

B. Control Transformers:

1. Provide a control power transformer for each drive control circuit. Control transformers shall be 480 volts to 120 volts and shall be protected with primary and secondary fuses.

C. Selector Switches:

1. Selector switches shall be non-illuminated. Switches shall be 30.5 mm, heavy-duty, oil tight. Switches shall have double-break silver contacts. All switches shall be maintained contact type unless otherwise indicated on the Drawings. Provide auxiliary contact blocks as indicated on the Drawings or in the Description of Operation. Provide a legend plate for each switch with white engraving as indicated on the Drawings. Selector switches shall be Allen-Bradley Bulletin 800T, NEMA Type 4/13, or equal by Square D.

D. Pilot Lights:

1. Pilot lights shall be 30.5mm, heavy-duty, push to test, transformer type with LED lamps. Voltage rating shall be 120 volts. Color cap shall be green for "run" and red for “VFD fault". Provide a legend plate for each pilot light with white engraving as indicated on the Drawings. Pilot lights shall be Allen-Bradley Bulletin 800T, NEMA Type 4/13, or equal by Square D.

E. Relays:

1. Relays shall be heavy-duty general-purpose type with 10 amp contacts. Relays shall have terminals, which plug-in to a socket, mounted to the inside of the drive enclosure. Contact configuration shall be 3PDT. Relay coils shall operate on 120 volts AC, unless indicated otherwise on the Drawings. Relays shall have an indicator light to indicate the relay coil is energized.

F. Elapsed Time Meters:

1. Elapsed time meters shall be time totalizer, non-resettable. They shall have a synchronous motor, which shall drive a set of digit readout wheels to indicate the total time the unit is energized. Readout shall be five-digit including 1/10 digit. Range shall be 0 to 9999.9 hours. Voltage rating shall be 120 volts. Elapsed time meters shall be ENM Company Series T50, or equal.

G. Control Wiring:

1. All 120 VAC control wiring shall be red. All 24vdc control wiring, and wiring for 24vdc PLC inputs, shall be blue. All wiring in the VFD shall be labeled.

H. Control Terminal Block:

1. Provide a control terminal block in the VFD enclosure, to terminate all control wiring from the field. All terminals shall be labeled.

**2.03 SPARE PARTS**

A. Provide the following spare parts for the variable frequency drives furnished:

1. One (1) VFD for each size furnished
2. One (1) ventilation fan for each size furnished
3. Four (4) sets of fan filters for each type utilized
4. Six (6) Fuses for each size and type utilized

B. Spare parts shall be packaged individually in boxes that are clearly labeled with part name and manufacturer's part number.

**PART 3 - EXECUTION**

**3.01 FIELD SERVICES**

A. Start-up and Testing:

1. Provide the services of a manufacturer's representative to start-up, adjust and test each variable frequency drive. Demonstrate start/stop control, fault diagnostics and variation of motor speeds in response to both the manual and automatic variable speed controls.

2. All start-up and testing shall be performed in the presence of the Owner and the Engineer.

B. Training:

1. Provide two (2) hours of on-site training for the Owner on the variable frequency drives. Training shall be specific for the VFDs provided and shall include theory of operation, maintenance and troubleshooting procedures. All training shall be performed by a qualified training specialist from the VFD manufacturer.

**END OF SECTION**