

# BID SOLICITATION



**City of Chattanooga**  
**101 East 11th Street, Suite G13**  
**Chattanooga, TN 37402**

## BID OPENING DATE AND TIME:

27-MAR-18 at 2:00 PM

**BID NUMBER: 305051**

## SEALED BIDS

Mail or submit two (2) signed copies of bid form to this office in the enclosed envelope. Retain one copy for your file.

## BUYER:

**PHONE #:** (423) 643-7230

**DELIVERY REQUIRED:**

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City of Chattanooga  
 101 East 11th Street, Suite G13  
 Chattanooga, TN 37402

| Item   | Class-Item | Quantity | Unit | Unit Price | Total |
|--|------------|----------|------|------------|-------|
| Requisition No.: 93249<br>Ordering Dept.: Waste Resources<br>Buyer: Geoffrey Hipp 423-643-7233<br>*****<br>DESCRIPTION: MCC / Switchboard per specifications<br>*****<br>ATTACHMENTS:<br>- Specifications<br>- Iran Divestment Act<br>- Affirmative Action Plan<br>- Standard Terms and Conditions:<br>( <a href="http://www.chattanooga.gov/purchasing/standard-terms-and-conditions">http://www.chattanooga.gov/purchasing/standard-terms-and-conditions</a> )<br>*****<br>*** BIDS MUST BE RECEIVED NO LATER THAN ***<br>***** 2:00 PM ON MARCH 27, 2018 *****<br>*****<br>PRE-BID MEETING 3-12-18, 2:00 PM AT MOCCASIN BEND WASTEWATER TREATMENT PLANT<br>*****<br>PLEASE SUBMIT BIDS IN DUPLICATE INDICATING<br>BID NUMBER (305051) ON OUTSIDE PACKAGING<br>ALL ITEMS MUST BE QUOTED F.O.B. DESTINATION, FREIGHT ALLOWED.<br>*****<br>NOTE: All bids received are subject to the terms and conditions contained herein and as listed in the above referenced website. The undersigned Bidder acknowledges having received, reviewed, and agrees to be bound to these terms and conditions, unless specific written exceptions are otherwise stated. The City of Chattanooga reserves the right to reject any and/or all bids, waive any informalities in the bids received, and to accept any bid which in its opinion may be for the best interest of the city.<br>The City of Chattanooga will be non-discriminatory in the purchase of all goods and services on the basis of race, color, or national origin.<br>*****<br>PLEASE PROVIDE US WITH THE FOLLOWING INFORMATION:<br>Company Name _____<br>Address _____<br>Phone/Toll-Free No. _____<br>Fax No. _____<br>E-Mail Address _____<br>Contact Person's Name _____<br>Estimated Delivery _____<br>Minority-Owned Business ____ Small Business ____ Veteran ____<br>Minority Woman Owned Business ____ Disabled Veteran ____<br>Women-Owned Business ____ |            |          |      |            |       |

**NOTE: ALL BIDS RECEIVED ARE SUBJECT TO THE TERMS AND CONDITIONS**

ALL BIDS MUST BE SIGNED – The undersigned offers the above quoted prices under the conditions contained herein.

The City is Exempt from all Federal and State Tax.  
 Bids will be received at the above mentioned address.

COMPANY: \_\_\_\_\_

TERMS OF PAYMENT: \_\_\_\_\_

SIGNATURE: \_\_\_\_\_

TELEPHONE NUMBER: \_\_\_\_\_

NAME AND TITLE: \_\_\_\_\_

# BID SOLICITATION



**City of Chattanooga**  
**101 East 11th Street, Suite G13**  
**Chattanooga, TN 37402**

## SEALED BIDS

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**VENDOR** RFQ

**BID OPENING DATE AND TIME:**

27-MAR-18 at 2:00 PM

**BID NUMBER: 305051**

**BUYER:**

**PHONE #:** (423) 643-7230

**DELIVERY REQUIRED:**

MAIL TO

City of Chattanooga  
101 East 11th Street, Suite G13  
Chattanooga, TN 37402

| Item | Class-Item                                    | Quantity | Unit | Unit Price | Total |
|------|---|----------|------|------------|-------|
| 1    | MCC & Generator Connection per attached Specs | 1        | Each | _____      | _____ |

NOTE: ALL BIDS RECEIVED ARE SUBJECT TO THE TERMS AND CONDITIONS

The City is Exempt from all Federal and State Tax.  
Bids will be received at the above mentioned address.

TERMS OF PAYMENT: \_\_\_\_\_

TELEPHONE NUMBER: \_\_\_\_\_

ALL BIDS MUST BE SIGNED – The undersigned offers the above quoted prices under the conditions contained herein.

COMPANY: \_\_\_\_\_

SIGNATURE: \_\_\_\_\_

NAME AND TITLE: \_\_\_\_\_

**SPECIFICATIONS FOR  
MCC/ SWITCHBOARD REPLACEMENT  
MOCCASIN BEND WASTEWATER TREATMENT PLANT  
CHATTANOOGA TENNESSEE  
February 2018**

**1.0 GENERAL INFORMATION**

This specification is for the purchase of one (1) motor control center (MCC), 480V, 600 A main lug only , and one (1) switchboard/MCC Cabinet (portable generator connection and main breaker).

The equipment will replace the existing equipment at The Moccasin Bend Wastewater Treatment Plant Dilution Building. This specification describes the type of equipment needed and is for the equipment only. The City's contractor will install the equipment.

**2.0 GENERAL SPECIFICATIONS**

- 2.1 A minimum 1 year warranty is required.
- 2.2 Vendor shall include all shipping costs in bid and stated delivery time after receipt of PO.
- 2.3 Delivery shall be to 455 Moccasin Bend Road, Chattanooga Tenn., 37405.
- 2.4 City shall unload.
- 2.5 All potential vendors are strongly encouraged to attend a pre-bid meeting / walk thru at the Moccasin Bend Wastewater Treatment Plant Operations and Control conference room on Monday, March 12<sup>th</sup>, 2018 at 2:00 pm.
- 2.6 Drawings of the project are attached showing the material and the installation. Bids are requested on the materials only.
- 2.7 The technical specification below for switchboards will cover the generator connection cabinet and for VFD's even though they will be supplied with the MCC.

### **3.0 TECHNICAL SPECIFICATIONS**

#### **3.1 SWITCHBOARDS (SECTION 26 24 13)**

##### **PART 1 GENERAL**

###### **1.01 SECTION INCLUDES**

- A. Low-voltage (600 V and less) switchboards and associated accessories for service and distribution applications.
- B. Overcurrent protective devices for switchboards.
- C. Portable Generator Provisions

###### **1.02 REFERENCE STANDARDS**

- A. FS W-C-375 - Circuit Breakers, Molded Case; Branch Circuit and Service.
- B. IEEE C57.13 - IEEE Standard Requirements for Instrument Transformers.
- C. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).
- D. NEMA PB 2 - Deadfront Distribution Switchboards.
- E. UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures.
- F. UL 869A - Reference Standard for Service Equipment.
- G. UL 891 - Switchboards.

###### **1.03 SUBMITTALS**

- A. Product Data: Provide manufacturer's standard catalog pages and data sheets for switchboards, enclosures, overcurrent protective devices, and other installed components and accessories.
  - 1. Include characteristic trip curves for each type and rating of overcurrent protective device upon request.
- B. Shop Drawings: Indicate dimensions, voltage, bus ampacities, overcurrent protective device arrangement and sizes, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.
  - 1. Include dimensioned plan and elevation views of switchboards and adjacent equipment with all required clearances indicated.
  - 2. Include wiring diagrams showing all factory and field connections.
- C. Source Quality Control Test Reports: Include reports for tests designated in NEMA PB 2 as production (routine) tests.
- D. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
- E. Maintenance Data: Include information on replacement parts and recommended maintenance procedures and intervals.
- F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  - 1. Enclosure Keys: Two of each different key.

#### **1.04 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- B. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

### **PART 2 PRODUCTS**

#### **2.01 MANUFACTURERS**

- A. Switchboards:
  - 1. General Electric Company: [www.geindustrial.com](http://www.geindustrial.com).
  - 2. Schneider Electric; Square D Products: [www.schneider-electric.us](http://www.schneider-electric.us).
  - 3. Siemens Industry, Inc: [www.usa.siemens.com](http://www.usa.siemens.com).
- B. Source Limitations: Furnish switchboards and associated components produced by the same manufacturer as the other electrical distribution equipment used for this project and obtained from a single supplier.

#### **2.02 SWITCHBOARDS**

- A. Provide switchboards consisting of all required components, control power transformers, instrumentation and control wiring, accessories, etc. as necessary for a complete operating system.
- B. Provide products listed, classified, and labeled as suitable for the purpose intended.
- C. Description: Dead-front switchboard assemblies complying with NEMA PB 2, and listed and labeled as complying with UL 891; ratings, configurations and features as indicated on the drawings.
- D. Service Entrance Switchboards:
  - 1. Listed and labeled as suitable for use as service equipment according to UL 869A.
  - 2. For solidly-grounded wye systems, provide factory-installed main bonding jumper between neutral and ground busses, and removable neutral disconnecting link for testing purposes.
- E. Service Conditions:
  - 1. Provide switchboards and associated components suitable for operation under the following service conditions without derating:
    - a. Altitude: Less than 6,600 feet (2,000 m).
    - b. Ambient Temperature:
      - 1) Switchboards Containing Molded Case or Insulated Case Circuit Breakers: Between 23 degrees F (-5 degrees C) and 104 degrees F (40 degrees C).
- F. Short Circuit Current Rating:
  - 1. Provide switchboards with listed short circuit current rating not less than the available fault current at the installed location as indicated on the drawings.
- G. Main Devices: Configure for top or bottom incoming feed as indicated or as required for the installation. Provide separate pull section and/or top-mounted pullbox as indicated or as required to facilitate installation of incoming feed.
- H. Bussing: Sized in accordance with UL 891 temperature rise requirements.
  - 1. Through bus (horizontal cross bus) to be fully rated through full length of switchboard (non-tapered). Tapered bus is not permitted.
  - 2. Provide solidly bonded equipment ground bus through full length of switchboard, with a suitable lug for each feeder and branch circuit equipment grounding conductor.
  - 3. Phase and Neutral Bus Material: Tin Plated Copper.
  - 4. Ground Bus Material: Tin Plated Copper.
- I. Conductor Terminations: Suitable for use with the conductors to be installed.
  - 1. Line Conductor Terminations:

- a. Main and Neutral Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
    - b. Main and Neutral Lug Type: Mechanical.
  - 2. Load Conductor Terminations:
    - a. Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
    - b. Lug Type:
- J. Generator Connections:
  - 1. Provide with option to utilize CAM-LOK Receptacles or Mechanical Lugs for portable connection of Generator.
  - 2. Shall be sized for full rating of switchboard.
- K. Kirk Key Interlock
  - 1. Generator Breaker and Main Circuit Breaker shall be provided with a kirk key interlock system.
- L. Enclosures:
  - 1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
    - a. Outdoor Locations: Type 3R.
  - 2. Finish: Manufacturer's standard unless otherwise indicated.
  - 3. Outdoor Enclosures:
    - a. Color: Manufacturer's standard.
    - b. Access Doors: Lockable, with all locks keyed alike.
- M. Arc Flash Energy-Reducing Maintenance Switching: Where indicated, provide a local accessory switch with status indicator light that permits selection of a maintenance mode with alternate electronic trip unit settings for reduced fault clearing time.
- N. Owner Metering:
  - 1. Provide microprocessor-based digital electrical metering system including all instrument transformers, wiring, and connections necessary for measurements specified.
  - 2. Measured Parameters:
    - a. Voltage (Volts AC): Line-to-line, line-to-neutral for each phase.
    - b. Current (Amps): For each phase and neutral.
    - c. Frequency (Hz).
    - d. Real power (kW): For each phase, 3-phase total.
    - e. Reactive power (kVAR): For each phase, 3-phase total.
    - f. Apparent power (kVA): For each phase, 3-phase total.
    - g. Power factor.
    - h. Real energy (kWh).
    - i. Reactive energy (kVARh).
    - j. Apparent energy (kVAh).
    - k. Current demand.
    - l. Power demand: Real, reactive, and apparent.
  - 3. Meter Accuracy: Plus/minus 1.0 percent.
  - 4. Features:
    - a. Communications Capability: Compatible with system indicated. Provide all accessories necessary for proper interface.
    - b. KYZ pulse output.
    - c. Adjustable demand interval.
    - d. Remote monitoring capability via PC.
- O. Instrument Transformers:
  - 1. Comply with IEEE C57.13.
  - 2. Select suitable ratio, burden, and accuracy as required for connected devices.
  - 3. Current Transformers: Connect secondaries to shorting terminal blocks.
  - 4. Potential Transformers: Include primary and secondary fuses with disconnecting means.

## 2.03 OVERCURRENT PROTECTIVE DEVICES

### A. Circuit Breakers:

1. Interrupting Capacity:
  - a. Provide circuit breakers with interrupting capacity as required to provide the short circuit current rating indicated, but not less than specified minimum requirements.
  - b. Fully Rated Systems: Provide circuit breakers with interrupting capacity not less than the short circuit current rating indicated.
2. Molded Case Circuit Breakers:
  - a. Description: Quick-make, quick-break, over center toggle, trip-free, trip-indicating circuit breakers; listed and labeled as complying with UL 489, and complying with FS W-C-375 where applicable; ratings, configurations, and features as indicated on the drawings.
    - 1) Provide electronic trip circuit breakers.
  - b. Thermal Magnetic Circuit Breakers: For each pole, furnish thermal inverse time tripping element for overload protection and magnetic instantaneous tripping element for short circuit protection.
  - c. Electronic Trip Circuit Breakers: Furnish solid state, microprocessor-based, true rms sensing trip units.
    - 1) Provide the following field-adjustable trip response settings:
      - (a) Long time pickup, adjustable by replacing interchangeable trip unit or by setting dial.
      - (b) Long time delay.
      - (c) Short time pickup and delay.
      - (d) Instantaneous pickup.
      - (e) Ground fault pickup and delay where ground fault protection is indicated.
  - d. Provide the following circuit breaker types where indicated:
    - 1) 100 Percent Rated Circuit Breakers: Listed for application within the switchboard where installed at 100 percent of the continuous current rating.
  - e. Provide the following features and accessories where indicated or where required to complete installation:
    - 1) Pad-Lock Provision: For locking circuit breaker handle in OFF position.
    - 2) Auxiliary Switch: SPDT switch suitable for connection to system indicated for indicating when circuit breaker has tripped or been turned off.
    - 3) Undervoltage Release: For tripping circuit breaker upon predetermined drop in coil voltage with field-adjustable time delay to prevent nuisance tripping.
    - 4) Alarm Switch: SPDT switch suitable for connection to system indicated for indicating when circuit breaker has tripped.

## 2.04 SOURCE QUALITY CONTROL

- ### A. Factory test switchboards according to NEMA PB 2, including the following production (routine) tests on each switchboard assembly or component:
1. Dielectric tests.
  2. Mechanical operation tests.
  3. Grounding of instrument transformer cases test.
  4. Electrical operation and control wiring tests, including polarity and sequence tests.
  5. Ground-fault sensing equipment test.

## **3.2 MOTOR-CONTROL CENTERS (SECTION 26 24 19)**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Low-voltage (600 V and less) standard (non-arc-resistant) NEMA motor control centers.
- B. Motor control center units:
  - 1. Feeder units.
  - 2. Combination magnetic motor starter units.
  - 3. Variable Frequency Drives
- C. Overcurrent protective devices for motor control centers and associated units, including overload relays.
- D. Motor control accessories:
  - 1. Auxiliary contacts.
  - 2. Pilot devices.
  - 3. Control and timing relays.
  - 4. Control power transformers.
  - 5. Control terminal blocks.

#### **1.02 REFERENCE STANDARDS**

- A. FS W-C-375 - Circuit Breakers, Molded Case; Branch Circuit and Service.
- B. IEEE C57.13 - IEEE Standard Requirements for Instrument Transformers.
- C. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).
- D. NEMA ICS 2 - Industrial Control and Systems Controllers, Contactors and Overload Relays Rated 600 Volts.
- E. NEMA ICS 5 - Industrial Control and Systems: Control Circuit and Pilot Devices.
- F. NEMA ICS 6 - Industrial Control and Systems: Enclosures.
- G. NEMA ICS 18 - Motor Control Centers.
- H. NFPA 70 - National Electrical Code.
- I. UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures.
- J. UL 845 - Motor Control Centers.

#### **1.03 SUBMITTALS**

- A. Product Data: Provide manufacturer's standard catalog pages and data sheets for motor control centers, enclosures, units, overcurrent protective devices, and other installed components and accessories.
  - 1. Include characteristic trip curves for each type and rating of overcurrent protective device upon request.
- B. Shop Drawings: Indicate dimensions, voltage, bus ampacities, unit arrangement and sizes, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.



1. Include dimensioned plan and elevation views of motor control centers and adjacent equipment with all required clearances indicated.
2. Include wiring diagrams showing all factory and field connections.
- C. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
- D. Maintenance Data: Include information on replacement parts and recommended maintenance procedures and intervals.
- E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  1. Enclosure Keys: Two of each different key.
  2. Electronic Trip Circuit Breakers: Provide one portable test set.
  3. Indicating Lights: Two of each different type.

#### **1.04 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- B. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

### **PART 2 PRODUCTS**

#### **2.01 MANUFACTURERS**

- A. Motor Control Centers:
  1. General Electric Company; : [www.geindustrial.com](http://www.geindustrial.com).
  2. Schneider Electric; Square D Products; : [www.schneider-electric.us](http://www.schneider-electric.us).
  3. Siemens Industry, Inc; : [www.usa.siemens.com](http://www.usa.siemens.com).
- B. Source Limitations: Furnish motor control centers, switchboards and associated components, including starters and VFD's, produced by a single manufacturer and obtained from a single supplier.

#### **2.02 MOTOR CONTROL CENTERS**

- A. Provide motor control centers consisting of all required components, control power transformers, instrumentation and control wiring, accessories, etc. as necessary for a complete operating system.
- B. Provide products listed, classified, and labeled as suitable for the purpose intended.
- C. Description: Dead-front standard (non-arc-resistant) type motor control center assemblies complying with NEMA ICS 18, and listed and labeled as complying with UL 845; ratings, configurations and features as indicated on the drawings.
- D. Configuration:
  1. Arrangement: Front-mounted units only (no rear-mounted units or back-to-back configuration).
  2. NEMA Classification and Wiring Type: NEMA ICS 18, Class I, Type C.
    - a. Master Terminal Blocks located at bottom of MCC.
  3. MCC is going back in place of an MCC being removed. Existing conduit entries at bottom of sections will be utilized and will require coordination in the field.
- E. Service Conditions:
  1. Provide motor control centers and associated components suitable for operation under the following service conditions without derating:
    - a. Altitude:
      - 1) Class 1 Km Equipment (devices utilizing power semiconductors, e.g. variable frequency controllers): Less than 3,300 feet (1,000 m).
    - b. Ambient Temperature: Between 32 degrees F (0 degrees C) and 104 degrees F (40 degrees C).

2. Provide motor control centers and associated components suitable for operation at indicated ratings under the service conditions at the installed location.
- F. Short Circuit Current Rating:
1. Provide motor control centers and associated units with listed short circuit current rating not less than the available fault current at the installed location as indicated on the drawings.
- G. Main Devices: Configure for top or bottom incoming feed as indicated or as required for the installation. Provide top-mounted pullbox as indicated or as required to facilitate installation of incoming feed.
- H. Bussing:
1. Horizontal Main Bus: Size for a maximum temperature rise of 117 degrees F (65 degrees C) over an ambient temperature of 104 degrees F (40 degrees C), in compliance with NEMA ICS 18 and UL 845 requirements.
  2. Vertical Bus: Minimum size of 300 A, in compliance with NEMA ICS 18 requirements.
  3. Provide fully rated neutral lug pad in incoming section where neutral is indicated, with a suitable lug for each feeder and branch circuit requiring a neutral connection.
  4. Provide solidly bonded equipment ground bus through full length of motor control center, with a suitable lug for each feeder and branch circuit equipment grounding conductor.
  5. Phase and Neutral Bus Material: Tin Plated Copper.
  6. Ground Bus Material: Tin Plated Copper.
- I. Conductor Terminations: Suitable for use with the conductors to be installed.
1. Line Conductor Terminations:
    - a. Main and Neutral Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
    - b. Main and Neutral Lug Type: Mechanical.
- J. Enclosures:
1. Comply with NEMA ICS 6.
  2. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
    - a. Indoor Clean, Dry Locations: Type 12.
    - b. Outdoor Locations: Type 3R.
  3. Finish: Manufacturer's standard unless otherwise indicated.
  4. Enclosure Space Heaters:
    - a. Provide in each motor control center section installed outdoors and in unconditioned indoor spaces.
    - b. Size according to manufacturer's recommendations for worst case ambient temperature to prevent condensation and/or maintain required service conditions.
    - c. Heater Control: Thermostat.
    - d. Heater Power Source: Provide connection to transformer factory-installed in motor control center.
  5. Outdoor Enclosures:
    - a. Color: Manufacturer's standard.
    - b. Access Doors: Lockable, with all locks keyed alike.
- K. Future Provisions:
1. Prepare designated spaces for future installation of devices including bussing, connectors, mounting hardware and all other required provisions.
  2. Arrange and equip horizontal bus and ground bus to accommodate future installation of additional motor control sections.
- L. Arc Flash Energy-Reducing Maintenance Switching: Where indicated, provide a local accessory switch with status indicator light that permits selection of a maintenance mode with alternate electronic trip unit settings for reduced fault clearing time.

- M. Retractable stabs: All units shall be constructed so that each unit can be inserted and withdrawn from the vertical bus while the unit door is closed.
- N. Closed door stab and shutter position indication
  - 1. External visual indication of the position of the stabs within the unit shall be provided.
  - 2. Green indicating that the stabs are mechanically withdrawn and not engaged into the vertical bus.
- O. Red indicating that the stabs are mechanically inserted into the vertical bus and voltage is likely to be present at the stabs.
- P. Mechanical Safety Interlocks:
  - 1. Safety interlocks that prevent the unit from being inserted into or removed from the structure when the stab is in the extended or engaged position.
  - 2. Safety interlocks that prevent the unit from being racked in or out of the structure with the disconnect in the "on" position.
- Q. Owner Metering:
  - 1. Provide microprocessor-based digital electrical metering system including all instrument transformers, wiring, and connections necessary for measurements specified.
  - 2. Measured Parameters:
    - a. Voltage (Volts AC): Line-to-line, line-to-neutral for each phase.
    - b. Current (Amps): For each phase and neutral.
    - c. Frequency (Hz).
    - d. Real power (kW): For each phase, 3-phase total.
    - e. Reactive power (kVAR): For each phase, 3-phase total.
    - f. Apparent power (kVA): For each phase, 3-phase total.
    - g. Power factor.
    - h. Real energy (kWh).
    - i. Reactive energy (kVARh).
    - j. Apparent energy (kVAh).
    - k. Current demand.
    - l. Power demand: Real, reactive, and apparent.
  - 3. Meter Accuracy: Plus/minus 0.5 percent.
  - 4. Features:
    - a. Communications Capability: Compatible with system indicated. Provide all accessories necessary for proper interface.
    - b. KYZ pulse output.
    - c. Adjustable demand interval.
    - d. Remote monitoring capability via PC.
- R. Instrument Transformers:
  - 1. Comply with IEEE C57.13.
  - 2. Select suitable ratio, burden, and accuracy as required for connected devices.
  - 3. Current Transformers: Connect secondaries to shorting terminal blocks.
  - 4. Potential Transformers: Include primary and secondary fuses with disconnecting means.

## **2.03 MOTOR CONTROL CENTER UNITS**

- A. Feeder Units: Circuit breaker type.
- B. Combination Magnetic Motor Starter Units:
  - 1. Description: NEMA ICS 2, Class A combination motor controllers with magnetic contactor(s), externally operable disconnect and overload relay(s).
  - 2. Configuration: Full-voltage non-reversing type unless otherwise indicated.
  - 3. Use of non-standard starter sizes smaller than specified standard NEMA sizes is not permitted.
  - 4. Disconnects: Circuit breaker type.
    - a. Circuit Breakers: Motor circuit protectors (magnetic-only) unless otherwise indicated or required.

- b. Provide externally operable handle with means for locking in the OFF position. Provide safety interlock to prevent opening the cover with the disconnect in the ON position with capability of overriding interlock for testing purposes.
    - c. Provide auxiliary interlock for disconnection of external control power sources where applicable.
  - 5. Overload Relays: Solid-state type unless otherwise indicated.
  - 6. Pilot Devices Required:
    - a. Furnish local pilot devices for each unit as specified below unless otherwise indicated on drawings.
    - b. Single-Speed, Non-Reversing Starters:
      - 1) Pushbuttons: START-STOP.
      - 2) Selector Switches: HAND/OFF/AUTO.
      - 3) Indicating Lights: Red ON, Green OFF.
- C. Variable-Frequency AC Drive Units: Comply with Section 26 29 23.
- D. Distribution Equipment Units: Where incorporation of low-voltage distribution equipment within motor control center units is indicated, provide suitable components complying with applicable specified requirements.

## **2.04 OVERCURRENT PROTECTIVE DEVICES**

- A. Overload Relays:
  - 1. Provide overload relays and, where applicable, associated current elements/heaters, selected according to actual installed motor nameplate data, in accordance with manufacturer's recommendations and NFPA 70; include consideration for motor service factor and ambient temperature correction, where applicable.
  - 2. Inverse-Time Trip Class Rating: Class 20 unless otherwise indicated or required.
  - 3. Trip-free operation.
  - 4. Visible trip indication.
  - 5. Resettable.
    - a. Employ manual reset unless otherwise indicated.
    - b. Do not employ automatic reset with two-wire control.
  - 6. Solid-State Overload Relays:
    - a. Selectable inverse-time trip class rating; available ratings of Class 10, 20, and 30, minimum.
    - b. Adjustable full load current.
    - c. Phase loss protection.
    - d. Phase imbalance protection.
    - e. Ambient temperature insensitive.
    - f. Thermal memory.
    - g. Trip test function.
    - h. Provide isolated alarm contact.
- B. Circuit Breakers:
  - 1. Interrupting Capacity (not applicable to motor circuit protectors):
    - a. Provide circuit breakers with interrupting capacity as required to provide the short circuit current rating indicated, but not less than specified minimum requirements.
    - b. Fully Rated Systems: Provide circuit breakers with interrupting capacity not less than the short circuit current rating indicated.
  - 2. Motor Circuit Protectors:
    - a. Description: Instantaneous-trip circuit breakers furnished with magnetic instantaneous tripping elements for short circuit protection, but not with thermal inverse time tripping elements for overload protection; UL 489 recognized only for use as part of a listed combination motor controller with overload protection; ratings, configurations, and features as indicated on the drawings.
    - b. Provide field-adjustable magnetic instantaneous trip setting.
  - 3. Molded Case Circuit Breakers:

- a. Description: Quick-make, quick-break, over center toggle, trip-free, trip-indicating circuit breakers; listed and labeled as complying with UL 489, and complying with FS W-C-375 where applicable; ratings, configurations, and features as indicated on the drawings.
  - 1) Provide thermal magnetic circuit breakers for circuit breaker frame sizes less than 225 amperes.
- b. Minimum Interrupting Capacity:
  - 1) 10,000 rms symmetrical amperes at 240 VAC or 208 VAC.
  - 2) 14,000 rms symmetrical amperes at 480 VAC.
- c. Thermal Magnetic Circuit Breakers: For each pole, furnish thermal inverse time tripping element for overload protection and magnetic instantaneous tripping element for short circuit protection.
- d. Provide the following features and accessories where indicated or where required to complete installation:
  - 1) Pad-Lock Provision: For locking circuit breaker handle in OFF position.

## **2.05 MOTOR CONTROL ACCESSORIES**

- A. Auxiliary Contacts:
  - 1. Comply with NEMA ICS 5.
  - 2. Provide number and type of contacts indicated or required to perform necessary functions, including holding (seal-in) circuit and interlocking.
- B. Pilot Devices:
  - 1. Comply with NEMA ICS 5; heavy-duty type.
  - 2. Nominal Size: 30 mm.
  - 3. Pushbuttons: Unless otherwise indicated, provide momentary, non-illuminated type with flush button operator; normally open or normally closed as indicated or as required.
  - 4. Selector Switches: Unless otherwise indicated, provide maintained, non-illuminated type with knob operator; number of switch positions as indicated or as required.
  - 5. Indicating Lights: Push-to-test type unless otherwise indicated.
  - 6. Provide LED lamp source for indicating lights and illuminated devices.
- C. Control and Timing Relays:
  - 1. Comply with NEMA ICS 5.
  - 2. Provide number and type of relays indicated or required to perform necessary functions.
- D. Control Power Transformers:
  - 1. Size to accommodate burden of contactor coil(s) and all connected auxiliary devices.
  - 2. Include primary and secondary fuses.
- E. Control Terminal Blocks: Include 25 percent spare terminals.

### **3.3 VARIABLE-FREQUENCY MOTOR CONTROLLERS (SECTION 26 29 23)**

#### **PART 1 GENERAL**

##### **1.01 SECTION INCLUDES**

- A. Variable frequency controllers.

##### **1.02 REFERENCE STANDARDS**

- A. NEMA ICS 7.1 - Safety Standards for Construction and Guide for Selection, Installation, and Operation of Adjustable-Speed Drive Systems.
- B. NEMA ICS 7 - Industrial Control and Systems: Adjustable-Speed Drives.
- C. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems.
- D. NFPA 70 - National Electrical Code.

##### **1.03 SUBMITTALS**

- A. Product Data: Provide catalog sheets showing voltage, controller size, ratings and size of switching and overcurrent protective devices, short circuit ratings, dimensions, and enclosure details.
- B. Shop Drawings: Indicate front and side views of enclosures with overall dimensions and weights shown; conduit entrance locations and requirements; and nameplate legends.
- C. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
- D. Manufacturer's Field Reports: Indicate start-up inspection findings.
- E. Operation Data: NEMA ICS 7.1. Include instructions for starting and operating controllers, and describe operating limits that may result in hazardous or unsafe conditions.
- F. Maintenance Data: NEMA ICS 7.1. Include routine preventive maintenance schedule.
- G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  - 1. Extra Air Filters: Two of each type.

##### **1.04 QUALITY ASSURANCE**

- A. Conform to requirements of NFPA 70.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience and with service facilities within 100 miles (160 km) of Project.
- C. Products: Listed, classified, and labeled as suitable for the purpose intended.
- D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

##### **1.05 WARRANTY**

- A. The manufacturer warrants the materials and workmanship of the drive to be free from defect for a period of thirty-six (36) months from date of shipment.

## **PART 2 PRODUCTS**

### **2.01 MANUFACTURERS**

- A. Manufacturer of VFDs shall be same as the MCC Manufacturer. .

### **2.02 DESCRIPTION**

- A. Variable Frequency Controllers: Enclosed controllers suitable for operating the indicated loads, in conformance with requirements of NEMA ICS 7. Select unspecified features and options in accordance with NEMA ICS 3.1.
  - 1. Employ microprocessor-based inverter logic isolated from power circuits.
  - 2. Employ pulse-width-modulated inverter system.
  - 3. Design for ability to operate controller with motor disconnected from output.
- B. Finish: Manufacturer's standard enamel.
- C. Integrated with MCC.

### **2.03 OPERATING REQUIREMENTS**

- A. Rated Input Voltage: 480 volts, three phase, 60 Hertz.
- B. Displacement Power Factor: Between 1.0 and 0.95, lagging, over entire range of operating speed and load.
- C. Operating Ambient: 0 degrees C to 40 degrees C.
- D. Minimum Efficiency at Full Load: 97 percent.
- E. Volts Per Hertz Adjustment: Plus or minus 10 percent.
- F. Current Limit Adjustment: 60 to 110 percent of rated.
- G. Acceleration Rate Adjustment: 0.5 to 30 seconds.
- H. Deceleration Rate Adjustment: 1 to 30 seconds.
- I. Input Signal: 4 to 20 mA DC.
- J. Constant Torque (Heavy Duty 150% overload capability)

### **2.04 COMPONENTS**

- A. Display: Provide integral digital display to indicate output voltage, output frequency, and output current.
- B. Status Indicators: Separate indicators for overcurrent, overvoltage, ground fault, overtemperature, input power ON and voltage indicator for each phase.
- C. Furnish HAND-OFF-AUTOMATIC selector switch and manual speed control.
- D. Include undervoltage release.
- E. DC Choke and 5% Input Line Reactor
- F. Control Power Source: Integral control transformer.
- G. Door Interlocks: Furnish mechanical means to prevent opening of equipment with power connected, or to disconnect power if door is opened; include means for defeating interlock by qualified persons.
- H. Safety Interlocks: Furnish terminals for remote contact to inhibit starting under both manual and automatic mode. Shall be selectable in field for enabling/disabling.
- I. Control Interlocks: Furnish terminals for remote contact to allow starting in automatic mode.
- J. Disconnecting Means: Include integral circuit breaker on the line side of each controller.
- K. Wiring Terminations: Match conductor materials and sizes indicated.
- L. The VFD shall employ the following power components:
  - 1. Diode or fully gated bridge on the input.
  - 2. Switching logic power supply operating from the DC bus.

3. MOV protection - phase to phase and phase to ground with jumpers to remove the phase to ground unit when applicable.
  4. Gold plated plug-in connections on printed circuit boards.
  5. Microprocessor-based inverter logic isolated from power circuits.
  6. Inverter section with no commutation capacitors.
- M. The VFD shall have a standard built-in 7th IGBT for use as a dynamic braking chopper. This IGBT shall be able to provide at least 100% braking torque on a continuous basis with a properly sized externally-mounted brake resistor.
- N. The VFD shall have two EMC options to comply to IEC 61800-3 specification, each with an optional EMC earthing/grounding plate:
1. Embedded EMC filter - shall achieve 10 m for C2 and 20 m for C3.
  2. External EMC filter - shall achieve 30 m for C1 and 100 m for C2 and C3.
- O. The VFD shall have a standard USB port that connects to a PC for upgrading firmware or uploading/downloading parameter configurations.
- P. With its RS-485 port, the VFD shall provide an interface for up to 2 independent peripherals to be connected at one time at 19.2K Bps. Connection and identification of peripheral interface DSI addresses shall require no user adjustments.
- Q. A slot for an optional encoder card shall be available to perform simple positioning control. Closed loop with encoder feedback shall be available to replace slip compensation with trim for improved speed range and regulation.
- R. The VFD shall have embedded control I/O.
- S. The VFD's printed circuit board shall be conformal coated, certified to IEC60721-3-2 with 3C2 (Chemical & Gases at the minimum).
- T. The VFD's control module shall have an integral Human Interface Module (HIM).
1. LCD display with scrolling text, used to display drive operating conditions, fault/alarm indications and programming information and capable of showing multiple languages via selectable mode.
  2. Status LED for drive condition.
  3. Status LEDs for communications status, including embedded DSI status, adapter health and communications network status.
  4. Keys for navigation, start, stop and reverse.
  5. Potentiometer used to control speed of the drive.

## 2.05 COMMUNICATIONS

- A. The variable frequency drive (VFD) shall be capable of communications through standard protocols, and Modbus and Profibus shall be the preferred networks.
1. Through its USB port, the VFD shall be capable of direct connection to a PC.
  2. Through its integral RS-485 port, the VFD shall be able to use Modbus RTU:
    - a. For programming from a PC.
    - b. In a multi-drop network configuration.
  3. Through its integral Ethernet port, the EtherNet/IP network is supported.
- B. The VFD shall be able to communicate with at least 2 networks at the same time.
- C. The VFD shall have available adapter cards, including:
1. Dual port EtherNet/IP - to support Device Level Ring topology.
  2. PROFIBUS DP.
  3. Modbus.
- D. VFD communications adapters shall have individually selectable fault actions in the case of a communications loss or if the controller is idle (in program mode or faulted):
1. Faulting the VFD.
  2. Stopping the VFD.
  3. Zeroing data written to the VFD.



4. Holding the VFD in its last state.
5. Using a user-selectable fault configuration.

## **2.06 CONTROL FEATURES**

- A. The variable frequency drive (VFD) shall be programmable for the following motor control modes:
  1. Volts per Hertz.
  2. Sensorless vector control.
  3. Closed loop velocity vector control.
  4. Sensorless vector control with Economizer.
  5. Permanent magnet motor control
- B. The VFD shall be capable of open loop and closed loop speed regulation applications.
- C. Programmable features shall include:
  1. Flying start
  2. V/F ratio
  3. Bus regulator
  4. Process PID
  5. Fiber-application-specific features
  6. Common DC bus
  7. 1/2 DC bus operation
  8. Regulation with encoder feedback or analog input
  9. Multi-drive connectivity (with communication option card)
  10. StepLogic Function (relay and timers)
  11. 16 preset speeds
- D. The VFD shall include energy cost reduction potential through energy monitoring features and Economizer and permanent magnet motor control modes.

## **2.07 CONTROL I/O**

- A. The variable frequency drive (VFD) shall have 2 analog inputs (1 unipolar and 1 bipolar), independently isolated from the rest of the drive I/O.
- B. The VFD shall have 7 digital inputs (24 VDC, 6 programmable) to provide application versatility.
- C. The VFD shall have 1 analog output that is scalable, 10-bit, suitable for metering or as a speed reference for another drive.
- D. The VFD shall have 2 digital outputs and 2 relay outputs (1 form A and 1 form B) to be used to indicate various drive, motor or logic conditions.

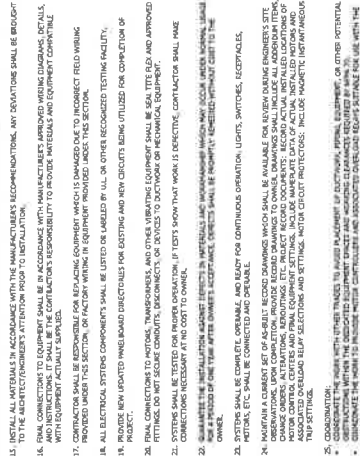
## **2.08 SOURCE QUALITY CONTROL**

- A. Shop inspect and perform standard productions tests for each controller.

## ELECTRICAL SPECIFICATIONS

- [illegible]

### TYPICAL DEVICE MOUNTING HEIGHTS



## ELECTRICAL SHEET INDEX

### ELECTRICAL LEGEND

1. ALL WIRING SHALL BE PERFORMED IN ACCORDANCE WITH ALL STATE, LOCAL AND NATIONAL CODES AND STANDARDS INCLUDING THE NATIONAL ELECTRICAL CODE, NEC, AND CODES, HRA, INCLUDING CODES AND STANDARDS REGARDING WIRING. REPAIRS OR MODIFICATIONS TO EXISTING WIRING SHALL BE PERFORMED IN ACCORDANCE WITH THE NATIONAL ELECTRICAL CODE, NEC, AND CODES, HRA, INCLUDING CODES AND STANDARDS REGARDING WIRING.
2. ALL ELECTRICAL WORK SHALL BE PERFORMED IN ACCORDANCE WITH THE NATIONAL ELECTRICAL CODE, NEC, AND CODES, HRA, INCLUDING CODES AND STANDARDS REGARDING WIRING.
3. ALL ELECTRICAL WORK SHALL BE PERFORMED IN ACCORDANCE WITH THE NATIONAL ELECTRICAL CODE, NEC, AND CODES, HRA, INCLUDING CODES AND STANDARDS REGARDING WIRING.
4. ALL ELECTRICAL WORK SHALL BE PERFORMED IN ACCORDANCE WITH THE NATIONAL ELECTRICAL CODE, NEC, AND CODES, HRA, INCLUDING CODES AND STANDARDS REGARDING WIRING.
5. ALL ELECTRICAL WORK SHALL BE PERFORMED IN ACCORDANCE WITH THE NATIONAL ELECTRICAL CODE, NEC, AND CODES, HRA, INCLUDING CODES AND STANDARDS REGARDING WIRING.
6. ALL ELECTRICAL WORK SHALL BE PERFORMED IN ACCORDANCE WITH THE NATIONAL ELECTRICAL CODE, NEC, AND CODES, HRA, INCLUDING CODES AND STANDARDS REGARDING WIRING.
7. ALL ELECTRICAL WORK SHALL BE PERFORMED IN ACCORDANCE WITH THE NATIONAL ELECTRICAL CODE, NEC, AND CODES, HRA, INCLUDING CODES AND STANDARDS REGARDING WIRING.
8. ALL ELECTRICAL WORK SHALL BE PERFORMED IN ACCORDANCE WITH THE NATIONAL ELECTRICAL CODE, NEC, AND CODES, HRA, INCLUDING CODES AND STANDARDS REGARDING WIRING.
9. ALL ELECTRICAL WORK SHALL BE PERFORMED IN ACCORDANCE WITH THE NATIONAL ELECTRICAL CODE, NEC, AND CODES, HRA, INCLUDING CODES AND STANDARDS REGARDING WIRING.
10. ALL ELECTRICAL WORK SHALL BE PERFORMED IN ACCORDANCE WITH THE NATIONAL ELECTRICAL CODE, NEC, AND CODES, HRA, INCLUDING CODES AND STANDARDS REGARDING WIRING.
11. ALL ELECTRICAL WORK SHALL BE PERFORMED IN ACCORDANCE WITH THE NATIONAL ELECTRICAL CODE, NEC, AND CODES, HRA, INCLUDING CODES AND STANDARDS REGARDING WIRING.
12. ALL ELECTRICAL WORK SHALL BE PERFORMED IN ACCORDANCE WITH THE NATIONAL ELECTRICAL CODE, NEC, AND CODES, HRA, INCLUDING CODES AND STANDARDS REGARDING WIRING.

|   |                                   |
|---|-----------------------------------|
| <input type="checkbox"/> WALL OUTLET  | POWER                             |
|  | DUAL HEAD EMERGENCY LIGHTING UNIT |

TYPICAL DEVICE MOUNTING HEIGHTS

RECEPTACLES ☐ 250 WATT ☐ SWITCHES

[illegible]

☒ RECESSED DOUBLE DUPLEX

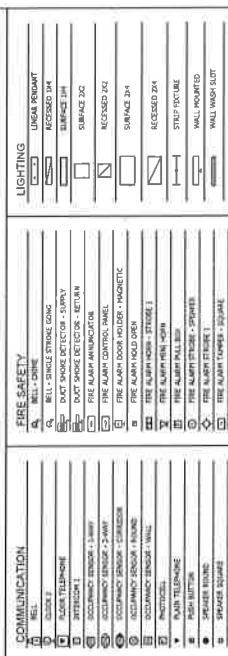
☐ STAFFER - SAFECOMM

☐ THUNDERBOLT

**SECURITY**

## ABBREVIATIONS

4561  
4562  
4563  
4564



MOCCASIN BEND WASTEWATER TREATMENT PLANT  
DILUTION MCC REPLACEMENT  
CHATTANOOGA, TN

[illegible]

MOCCASIN BEND WASTEWATER TREATMENT PLANT  
DILUTION MCC REPLACEMENT  
CHATTANOOGA, TN

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|------|---------------|-----|
|      |               |     |
|      |               |     |
|      |               |     |
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|      |               |     |
| DATE | NOTES/REMARKS | SEA |
|      | REVISED       |     |



PROJECT NO.: 010-18  
DATE: 02-20-2018  
CHECKED BY: ADW  
DRAWN BY: ADW  
TITLE:  
ELECTRICAL  
FLOORPLANS AND  
ELEVATIONS

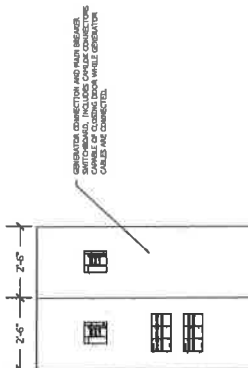
SHEET NO. F2

## ELECTRICAL SHEET NOTES - UN-REFERENCED

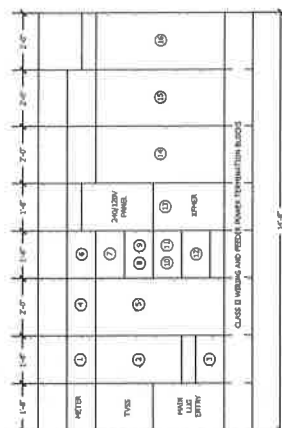
- CONTRACTOR SHALL DOCUMENT LOCATIONS OF ALL CONDUITS/CAILES EXITING EXISTING MCC FOR COORDINATION WITH NEW EQUIPMENT. DIMENSIONS AND LAYOUT OF MCC/SWITCHBOARDS ARE FOR INTENT AND IT IS UNDERSTOOD THAT THIS MAY VARY BETWEEN MANUFACTURERS. ACTUAL EQUIPMENT DIMENSIONS MUST MEET THE ORIGINAL CONSTRAINTS OF THE SPACE.

## ELECTRICAL SHEET NOTES - REFERENCED

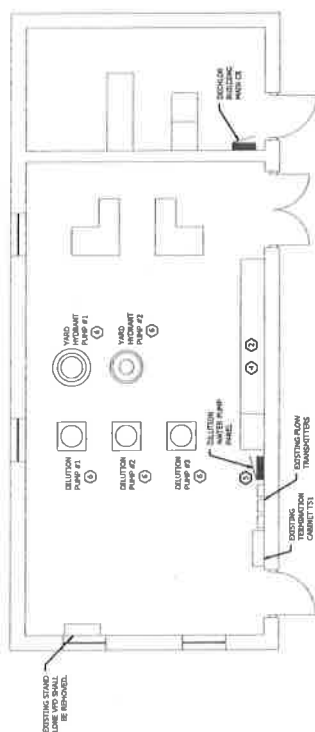
- [illegible]



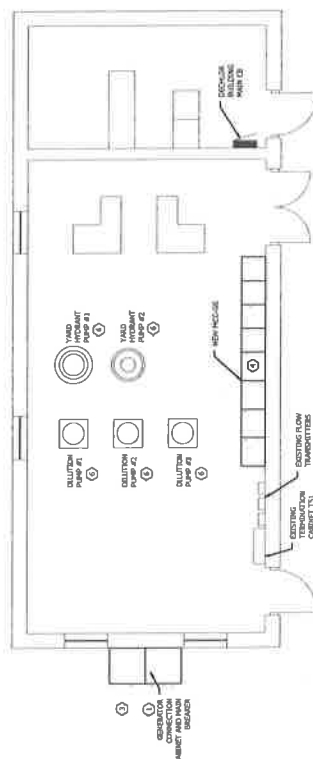
1 MAIN AND GENERATOR CONNECTION CABINET ELEVATION



NEW HIGH-GG ELEVATION



1 EXISTING / DEMO PLAN - ELECTRICAL  
BY: [signature] DATE: 10/15/10



NEW PLAN - ELECTRICAL

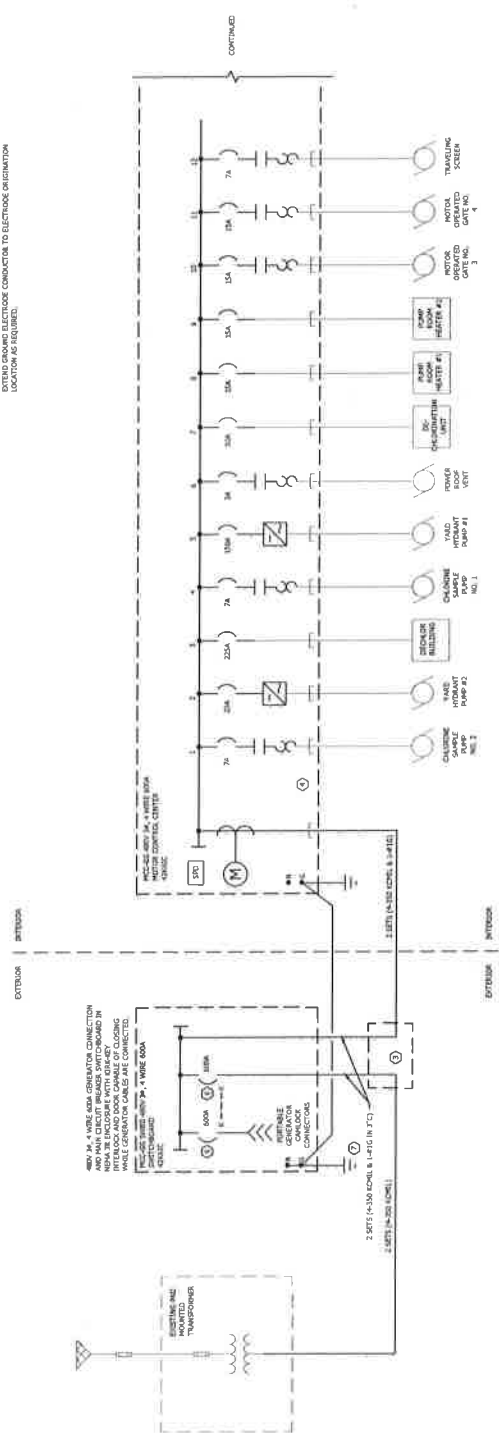
ELECTRICAL SHEET NOTES - UN-REFERENCED

- 1. NEW EXISTING MAIN CIRCUIT BREAKER AND PORTABLE GENERATOR
- 2. COORDINATE ANY REQUIRED OUTAGE TIMES WITH OWNER AND DEVELOP A PLAN FOR SHIP ONCE
- 3. NEW MAIN CIRCUIT BREAKER IN SAME LOCATION AS EXISTING. ALL FEEDS ENTERING TOP AND BOTTOM SHALL BE KEPT IN TACT TURNING DOWN FOR RELEASE
- 4. INTERRUPT EXISTING FEED FROM TRANSFORMER TO MCC AND REMOVE EQUIPMENT FOR INSTALLATION OF NEW CABLES. CONTRACTOR WILL BE RESPONSIBLE FOR THE SAFETY OF EXISTING UNDERGROUND CONDUITS PRIOR TO REMOVAL
- 5. ALL EXISTING INSTRUMENTATION AND CONTROLS WIRING IS TO REMAIN IN PLACE. NEW WIRING SHALL BE REQUIRED TO TRANSMIT ALL SIGNALS TO THE MCC. ALL WIRING TO EXISTING EQUIPMENT SHALL BE RE-TERMINATED IN NEW MCC. ALL WIRING TO EXISTING EQUIPMENT SHALL BE RE-TERMINATED IN NEW MCC. ALL WIRING TO EXISTING EQUIPMENT SHALL BE RE-TERMINATED IN NEW MCC.
- 6. NEW EXISTING MAIN CIRCUIT BREAKER AND PORTABLE GENERATOR SHALL BE KEPT IN TACT TURNING DOWN FOR RELEASE
- 7. UTILIZE EXISTING GROUND ELECTRODE SYSTEM FOR BONDING NEW WIRING. NEW WIRING SHALL BE BONDING TO EXISTING GROUND ELECTRODE SYSTEM. NEW WIRING SHALL BE BONDING TO EXISTING GROUND ELECTRODE SYSTEM. NEW WIRING SHALL BE BONDING TO EXISTING GROUND ELECTRODE SYSTEM.

ELECTRICAL SHEET NOTES - REFERENCED

- 1. NEW EXISTING MAIN CIRCUIT BREAKER AND PORTABLE GENERATOR
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NOTE: THE WIRING OF THE FOLLOWING EQUIPMENT SHALL BE THE RESPONSIBILITY OF THE USER.  
• MCC CASE  
• MCC CASE  
• MCC CASE



| MOTOR CONTROL CENTER |   | MOTOR DATA   |  |
|----------------------|---|--|--|
| NO.                  | NAME  | HP   | AMPS   |
| 1                    | 1000 HP MOTOR   | 1000   | 450  |
| 2                    | 500 HP MOTOR  | 500  | 225  |
| 3                    | 250 HP MOTOR  | 250  | 112  |
| 4                    | 125 HP MOTOR  | 125  | 56   |
| 5                    | 62.5 HP MOTOR   | 62.5   | 28   |
| 6                    | 31.25 HP MOTOR  | 31.25  | 14   |
| 7                    | 15.625 HP MOTOR   | 15.625   | 7  |
| 8                    | 7.8125 HP MOTOR   | 7.8125   | 3.5  |
| 9                    | 3.90625 HP MOTOR  | 3.90625  | 1.75   |
| 10                   | 1.953125 HP MOTOR   | 1.953125   | 0.875  |
| 11                   | 0.9765625 HP MOTOR  | 0.9765625  | 0.4375   |
| 12                   | 0.48828125 HP MOTOR   | 0.48828125   | 0.21875  |
| 13                   | 0.244140625 HP MOTOR  | 0.244140625  | 0.109375   |
| 14                   | 0.1220703125 HP MOTOR   | 0.1220703125   | 0.0546875  |
| 15                   | 0.06103515625 HP MOTOR  | 0.06103515625  | 0.02734375   |
| 16                   | 0.030517578125 HP MOTOR   | 0.030517578125   | 0.013671875  |
| 17                   | 0.0152587890625 HP MOTOR  | 0.0152587890625  | 0.0068359375   |
| 18                   | 0.00762939453125 HP MOTOR   | 0.00762939453125   | 0.00341796875  |
| 19                   | 0.003814697265625 HP MOTOR  | 0.003814697265625  | 0.001708984375   |
| 20                   | 0.0019073486328125 HP MOTOR   | 0.0019073486328125   | 0.0008544921875  |
| 21                   | 0.00095367431640625 HP MOTOR  | 0.00095367431640625  | 0.00042724609375   |
| 22                   | 0.000476837158203125 HP MOTOR   | 0.000476837158203125   | 0.000213623046875  |
| 23                   | 0.0002384185791015625 HP MOTOR  | 0.0002384185791015625  | 0.0001068115234375   |
| 24                   | 0.00011920928955078125 HP MOTOR   | 0.00011920928955078125   | 0.00005340576171875  |
| 25                   | 0.000059604644775390625 HP MOTOR  | 0.000059604644775390625  | 0.000026702880859375   |
| 26                   | 0.0000298023223876953125 HP MOTOR   | 0.0000298023223876953125   | 0.0000133514404296875  |
| 27                   | 0.00001490116119384765625 HP MOTOR  | 0.00001490116119384765625  | 0.00000667572021484375   |
| 28                   | 0.000007450580596923828125 HP MOTOR   | 0.000007450580596923828125   | 0.000003337860107421875  |
| 29                   | 0.0000037252902984619140625 HP MOTOR  | 0.0000037252902984619140625  | 0.0000016689300537109375   |
| 30                   | 0.00000186264514923095703125 HP MOTOR   | 0.00000186264514923095703125   | 0.00000083446502685546875  |
| 31                   | 0.000000931322574615478515625 HP MOTOR  | 0.000000931322574615478515625  | 0.000000417232513427734375   |
| 32                   | 0.0000004656612873077392578125 HP MOTOR   | 0.0000004656612873077392578125   | 0.0000002086162567138671875  |
| 33                   | 0.00000023283064365386962890625 HP MOTOR  | 0.00000023283064365386962890625  | 0.00000010430812835693359375   |
| 34                   | 0.000000116415321826934814453125 HP MOTOR   | 0.000000116415321826934814453125   | 0.000000052154064178466796875  |
| 35                   | 0.0000000582076609134674072265625 HP MOTOR  | 0.0000000582076609134674072265625  | 0.0000000260770320892333984375   |
| 36                   | 0.00000002910383045673370361328125 HP MOTOR                                       | 0.00000002910383045673370361328125                                       | 0.00000001303851604461669921875  |
| 37                   | 0.000000014551915228366851806640625 HP MOTOR                                      | 0.000000014551915228366851806640625                                      | 0.000000006519258022308349609375                                       |
| 38                   | 0.0000000072759576141834259033203125 HP MOTOR                                     | 0.0000000072759576141834259033203125                                     | 0.0000000032596290111541748046875                                      |
| 39                   | 0.00000000363797880709171295166015625 HP MOTOR                                    | 0.00000000363797880709171295166015625                                    | 0.00000000162981450557708740234375                                     |
| 40                   | 0.000000001818989403545856475830078125 HP MOTOR                                   | 0.000000001818989403545856475830078125                                   | 0.000000000814907252788543701171875                                    |
| 41                   | 0.0000000009094947017729282379150390625 HP MOTOR                                  | 0.0000000009094947017729282379150390625                                  | 0.0000000004074536263942718505859375                                   |
| 42                   | 0.00000000045474735088646191895751953125 HP MOTOR                                 | 0.00000000045474735088646191895751953125                                 | 0.00000000020372681319713592529296875                                  |
| 43                   | 0.000000000227373675443230959478759765625 HP MOTOR                                | 0.000000000227373675443230959478759765625                                | 0.000000000101863406598567962646484375                                 |
| 44                   | 0.0000000001136868377216154797393798828125 HP MOTOR                               | 0.0000000001136868377216154797393798828125                               | 0.0000000000509317032992839813232421875                                |
| 45                   | 0.00000000005684341886080773986968994140625 HP MOTOR                              | 0.00000000005684341886080773986968994140625                              | 0.00000000002546585164964199066162109375                               |
| 46                   | 0.000000000028421709430403869934844970703125 HP MOTOR                             | 0.000000000028421709430403869934844970703125                             | 0.000000000012732925824820995330810546875                              |
| 47                   | 0.0000000000142108547152019349674224853515625 HP MOTOR                            | 0.0000000000142108547152019349674224853515625                            | 0.0000000000063664629124104976654052734375                             |
| 48                   | 0.00000000000710542735760096748371124267578125 HP MOTOR                           | 0.00000000000710542735760096748371124267578125                           | 0.00000000000318323145620524883270263671875                            |
| 49                   | 0.000000000003552713678800483741855621337890625 HP MOTOR                          | 0.000000000003552713678800483741855621337890625                          | 0.000000000001591615728102624416351318359375                           |
| 50                   | 0.0000000000017763568394002418709278106689453125 HP MOTOR                         | 0.0000000000017763568394002418709278106689453125                         | 0.0000000000007958078640513122081756591796875                          |
| 51                   | 0.00000000000088817841970012093546390533447265625 HP MOTOR                        | 0.00000000000088817841970012093546390533447265625                        | 0.00000000000039790393202565610408782958984375                         |
| 52                   | 0.000000000000444089209850060467731952667236328125 HP MOTOR                       | 0.000000000000444089209850060467731952667236328125                       | 0.000000000000198951966012828052043914794921875                        |
| 53                   | 0.0000000000002220446049250302338659763336181640625 HP MOTOR                      | 0.0000000000002220446049250302338659763336181640625                      | 0.0000000000000994759830064140260219573974609375                       |
| 54                   | 0.00000000000011102230246251511693298816680908203125 HP MOTOR                     | 0.00000000000011102230246251511693298816680908203125                     | 0.00000000000004973799150320701301097869873046875                      |
| 55                   | 0.000000000000055511151231257558466494083404541015625 HP MOTOR                    | 0.000000000000055511151231257558466494083404541015625                    | 0.0000000000000248689957516035065054893493671875                       |
| 56                   | 0.0000000000000277555756156287792332470417022705078125 HP MOTOR                   | 0.0000000000000277555756156287792332470417022705078125                   | 0.00000000000001243449787580175325274467468359375                      |
| 57                   | 0.00000000000001387778780781438961662352085113535265625 HP MOTOR                  | 0.00000000000001387778780781438961662352085113535265625                  | 0.000000000000006217248937900876626372337341796875                     |
| 58                   | 0.0000000000000069388939039071948083117604255676278125 HP MOTOR                   | 0.0000000000000069388939039071948083117604255676278125                   | 0.0000000000000031086244689504383131861686708984375                    |
| 59                   | 0.00000000000000346944695195359740415588021278381390625 HP MOTOR                  | 0.00000000000000346944695195359740415588021278381390625                  | 0.00000000000000155431223447521915659308433544921875                   |
| 60                   | 0.0000000000000017347234759767987020779401063919053125 HP MOTOR                   | 0.0000000000000017347234759767987020779401063919053125                   | 0.000000000000000777156117237609578296542167724609375                  |
| 61                   | 0.00000000000000086736173798839935103897005319595265625 HP MOTOR                  | 0.00000000000000086736173798839935103897005319595265625                  | 0.0000000000000003885780586188047891482710838623046875                 |
| 62                   | 0.000000000000000433680868994199675519485026597976328125 HP MOTOR                 | 0.000000000000000433680868994199675519485026597976328125                 | 0.00000000000000019428902930940239457413554193115234375                |
| 63                   | 0.0000000000000002168404344970998377597425132989881640625 HP MOTOR                | 0.0000000000000002168404344970998377597425132989881640625                | 0.000000000000000097144514654701197287067770965576171875               |
| 64                   | 0.00000000000000010842021724854991887987125664949408203125 HP MOTOR               | 0.00000000000000010842021724854991887987125664949408203125               | 0.00000000000000004857225732735059864353388548278809375                |
| 65                   | 0.000000000000000054210108624274959439935628324747041015625 HP MOTOR              | 0.000000000000000054210108624274959439935628324747041015625              | 0.0000000000000000242861286636752993217669427413944046875              |
| 66                   | 0.0000000000000000271050543121374797199678141623735205078125 HP MOTOR             | 0.0000000000000000271050543121374797199678141623735205078125             | 0.00000000000000001214306433183764966088347137069722234375             |
| 67                   | 0.00000000000000001355252715606873985998390708118686275390625 HP MOTOR            | 0.00000000000000001355252715606873985998390708118686275390625            | 0.000000000000000006071532165918824830441735685348611171875            |
| 68                   | 0.00000000000000000677626357803436992999195354059343137500000 HP MOTOR            | 0.00000000000000000677626357803436992999195354059343137500000            | 0.0000000000000000030357660829594124152208678426743055859375           |
| 69                   | 0.00000000000000000338813178901718496499597677029671568750000 HP MOTOR            | 0.00000000000000000338813178901718496499597677029671568750000            | 0.00000000000000000151788304147970620761103392133717277796875          |
| 70                   | 0.000000000000000001694065894508592482497988385148357843750000 HP MOTOR           | 0.000000000000000001694065894508592482497988385148357843750000           | 0.000000000000000000758941520739853103805516960668886388984375         |
| 71                   | 0.0000000000000000008470329472542962412489944425741789218750000 HP MOTOR          | 0.0000000000000000008470329472542962412489944425741789218750000          | 0.0000000000000000003794707603699265519027584803344431944921875        |
| 72                   | 0.00000000000000000042351647362714812062497222128708946093750000 HP MOTOR         | 0.00000000000000000042351647362714812062497222128708946093750000         | 0.00000000000000000018973538018496327595137924016722159724609375       |
| 73                   | 0.000000000000000000211758236813574060312496110643544730468750000 HP MOTOR        | 0.000000000000000000211758236813574060312496110643544730468750000        | 0.000000000000000000094867690092481637975689620083610798623046875      |
| 74                   | 0.0000000000000000001058791184067870301562480553217723652343750000 HP MOTOR       | 0.0000000000000000001058791184067870301562480553217723652343750000       | 0.00000000000000000004743384504624081898784481004180539931171875       |
| 75                   | 0.00000000000000000005293955920339351507812402766088618261718750000 HP MOTOR      | 0.00000000000000000005293955920339351507812402766088618261718750000      | 0.000000000000000000023716922523120409493922405020902699655859375      |
| 76                   | 0.000000000000000000026469779601696757539062013830443091308593750000 HP MOTOR     | 0.000000000000000000026469779601696757539062013830443091308593750000     | 0.0000000000000000000118584612615602047469612025104513498279296875     |
| 77                   | 0.0000000000000000000132348898008483787695310069152215456542968750000 HP MOTOR    | 0.0000000000000000000132348898008483787695310069152215456542968750000    | 0.00000000000000000000592923063078010237348060125522567491396484375    |
| 78                   | 0.00000000000000000000661744490042418938476550345761077282714843750000 HP MOTOR   | 0.00000000000000000000661744490042418938476550345761077282714843750000   | 0.000000000000000000002964615315390051186740300627612837456982246875   |
| 79                   | 0.0000000000000000000033087224502120946923827517288053864135724218750000 HP MOTOR | 0.0000000000000000000033087224502120946923827517288053864135724218750000 | 0.0000000000000000000014823076576950255933701503138064187284911234375  |
| 80                   | 0.0000000000000000000016543612251060473461913758644026932067861093750000 HP MOTOR | 0.0000000000000000000016543612251060473461913758644026932067861093750000 | 0.00000000000000000000074115382884751279668507515690320936424556171875 |
| 81                   | 0.0000000000000000000008271806125530236730956879322013466033930468750000 HP MOTOR | 0.0000000000000000000008271806125530236730956879322013466033930468750000 | 0.0000000000000000000003705769144237563983425375784516046821227809375  |
| 82                   | 0.00000000  |  |  |

Chapter No. 817 (HB0261/SB0377). "Iran Divestment Act" enacted.

Vendor Disclosure and Acknowledgement

By submission of this bid, each bidder and each person signing on behalf of any bidder certifies, and in the case of a joint bid each party thereto certifies as to its own organization, under penalty of perjury, that to the best of its knowledge and belief that each bidder is not on the list created pursuant to § 12-12-106.

(SIGNED) \_\_\_\_\_

(PRINTED NAME) \_\_\_\_\_

(BUSINESS NAME) \_\_\_\_\_

(DATE) \_\_\_\_\_

For further information, please see website:

[https://www.tn.gov/assets/entities/generalservices/cpo/attachments/List\\_of\\_persons\\_pursuant\\_to\\_Tenn.\\_Code\\_Ann.\\_12-12-106,\\_Iran\\_Divestment\\_Act-July.pdf](https://www.tn.gov/assets/entities/generalservices/cpo/attachments/List_of_persons_pursuant_to_Tenn._Code_Ann._12-12-106,_Iran_Divestment_Act-July.pdf)

## **Affirmative Action Plan**

The City of Chattanooga is an equal opportunity employer and during the performance of this Contract, the Contractor agrees to abide by the equal opportunity goals of the City of Chattanooga as follows:

1. The Contractor will not discriminate against any employee or applicant for employment because of race, color, religion, sex, national origin, or handicap. The Contractor will take affirmative action to ensure that applicants are employed, and that employees are treated during employment without regard to their race, color, religion, sex, national origin, or handicap. Such action shall include, but not be limited to, the following: employment, upgrading, demotion or transfer, recruitment or recruitment advertising, layoff or termination, rates of pay or other forms of compensation, and selection for training including apprenticeship. The Contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices setting forth the provisions of this nondiscrimination clause.
2. The Contractor will, in all solicitations or advertisements for employees placed by or on behalf of the Contractor, state that all qualified applicants will receive consideration for employment without regard to race, color, religion, sex, national origin, or handicap.
3. The Contractor will send to each labor union or representative of workers with which he/she has a collective bargaining agreement or other contract or understanding, a notice advising said labor union or workers' representatives of the Contractor's commitments under this section, and shall post copies of the notice in conspicuous places available to employees and applicants for employment.
4. During the term of all construction contracts or subcontracts in excess of \$10,000 to be performed for the City of Chattanooga, the following non-discriminatory hiring practices shall be employed to provide employment opportunities for minorities and women:
  - a. All help wanted ads placed in newspapers or other publications shall contain the phrase "Equal Employment Opportunity Employer".
  - b. Seek and maintain contracts with minority groups and human relations organizations as available.
  - c. Encourage present employees to refer qualified minority group and female applicants for employment opportunities.
  - d. Use only recruitment sources which state in writing that they practice equal opportunity. Advise all recruitment sources that qualified minority group members and women will be sought for consideration for all positions when vacancies occur.

5. Minority statistics are subject to audit by City of Chattanooga staff or other governmental agency.
6. The Contractor agrees to notify the City of Chattanooga of any claim or investigation by State or Federal agencies as to discrimination.

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(Signature of Contractor)

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(Title and Name of Company)

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(Date)