Sealed/ Emailed **Base Bid** proposals (single copy) will be received by GH Phipps, on behalf of Jefferson County School District R-1 at the office GH Phipps, 5995 Greenwood Village, CO 80111, until 3:00 P.M., M.S.T., Friday, March 14, 2014.

1. Bidders shall submit their Base Bid on the provided Bid Proposal Form and shall submit only the Lump Sum Base Bid at this time. The Bid Proposal form shall be completely filled out.

Bids will be received from the following Manufacturer’s Representatives:

CFM Company
1440 S Lipan St,
Denver, CO 80223
Contact: Steve Carver

T: 303.761.2291

J.L. Hermon & Associates, Inc
7342 S. Alton Way Ste. H
Centennial, CO 80112
Contact: Bill Bobby

T: 303.771.4045

For the Project: Columbine High School General Renovations

All questions shall be submitted in writing to GH Phipps, Matt Paull <matt.paul@ghphipps.com>

Beginning March 12, 2014, at 12:00 PM, sets of Pre-purchase Documents will be available from the office of GH Phipps, 5995 Greenwood Village, CO 80111 (303.571.5377).

Each bid must be submitted on a form, a specimen copy of which is enclosed in these documents. Loose and/or electronic copies of the Bid Proposal Form will be provided.

All bids must be sealed and marked JEFFERSON COUNTY SCHOOLS, COLUMBINE HIGH SCHOOL COOLING TOWER PRE-PURCHASE. The School District reserves the right to reject any and all bids, to waive all irregularities, and to accept any bid deemed to be in its best interest.

END OF SECTION 00020
BID PROPOSAL FORM

Sealed/ Emailed bids are due by 3:00 PM Friday, March 14, 2014 and shall be submitted directly to:

GH Phipps
5995 Greenwood Village
CO 80111
Attention: Matt Paull <matt.paull@ghphipps.com>

The following bid is hereby submitted by:

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

ACKNOWLEDGMENTS:
The undersigned Bidder acknowledges examination of the following:

a) Contract Documents
   • Drawings dated March 11, 2014
   • specifications dated March 11, 2014

b) Project Site/Existing Conditions

c) Receipt of Addenda Numbers:
   ______, ______, ______.

AGREEMENTS:
The undersigned Bidder agrees to the following:

a) To hold bid open for 45 calendar days from date of Bid Opening.

b) To provide the equipment in compliance with the Contract Documents.

c) The Jefferson County School District No. R-1 reserves the right to reject any or all bids and to waive informalities.

f) The Jefferson County School District No. R-1 reserves the right to award the contract on the basis of either cost or schedule.

Base Bid: $_______________________ (base bid includes shipping and delivery to jobsite)

Shipping and Delivery Commitment: ________ Weeks from confirmed Purchase Order.
Note: Include 4 week allowance for shop drawing submittal and review.

Bid Clarifications: The following are clarifications, or exceptions, to the bid documents, specifications and addenda identified above. If none, state NONE below.

________________________________________________________________________
In submitting a bid in response to this Invitation to Bid, I certify that the bid, and the attached required submittal documentation, meets the technical and performance requirements as outlined in the specification.

Submitted this ___________ day of _______________________________2014

The Bidder

ATTEST: Secretary

(Type/Print name under signature)

______________________________

Address

______________________________

County

______________________________

Phone

By____________________________

Type/Print Name Here

Secretary       Signature

SIGNATURES: If the Proposal is being submitted by a Corporation, the Proposal should be signed by an officer, i.e., President or Vice President. The signature of the officer signing shall be attested to by the Secretary and properly sealed.

If the Proposal is being submitted by an individual or a partnership, the Proposal shall so indicate and be properly signed.
SECTION 23 05 15 - VARIABLE FREQUENCY CONTROLLERS

PART 1 - GENERAL

1.1 SECTION INCLUDES
   A. Variable Frequency Drives (VFDs)

1.2 RELATED DOCUMENTS
   A. Drawings, General and Special Conditions, General Requirements, and other applicable technical specifications apply to work of this section.

1.3 RELATED SECTIONS
   A. Division 26 – Electrical; All Sections
   B. Section 230513 - Mechanical/Electrical Requirements for Mechanical Equipment
   C. Section 230514 – Motor Controllers

1.4 REFERENCE STANDARDS
   A. Comply with the requirements of the reference standards noted herein, except where more stringent requirements are listed herein or otherwise required by the Contract Documents.
   B. NFPA 70 - National Electrical Code.
   C. ANSI/NEMA ICS 6 - Enclosures for Industrial Controls and Systems.
   D. NEMA AB 1 – Molded Case Circuit Breakers.
   E. NEMA ICS 2 - Industrial Control Devices, Controllers, and Assemblies.
   G. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).
   H. ANSI/UL Standard 508.
   I. IEEE Standard 519-1992; For Voltage and Total Demand Distortion.
   J. FCC Rules and Regulations, Part 15, Subpart J; For Radiated RFI.
1.5 SUBMITTALS

A. Submit under provisions of Division 1.

B. Shop Drawings: Include front and side views of enclosures with overall dimensions and weights shown; conduit entrance locations and requirements; and nameplate legends.

C. 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.

D. Test Reports: Indicate field test and inspection procedures and test results.

E. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.

F. Manufacturer's Field Reports: Submit under provisions of Division 1.

G. Manufacturer's Field Reports: Indicate Start-Up Inspection findings.

1.6 OPERATION AND MAINTENANCE DATA

A. Submit under provisions of Division 1.

B. Operation Data: Include instructions for starting and operating controllers, and describe operating limits that may result in hazardous or unsafe conditions.

C. Maintenance Data: Include routine preventive maintenance schedule.

1.7 REGULATORY REQUIREMENTS

A. Conform to requirements of NFPA 70.

B. Furnish products listed and classified by Underwriters Laboratories, Inc., and conforming to referenced standards as suitable for purpose specified and indicated.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site under provisions of Division 1.

B. Store, protect, and handle products under provisions of Division 23.

C. Accept controllers on site in original packing. Inspect for damage.

D. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.
E. Handle in accordance with manufacturer's written instructions. Lift only with lugs provided for the purpose. Handle carefully to avoid damage to components, enclosure, and finish.

1.9 FIELD MEASUREMENTS

A. Verify that field measurements are as on Shop Drawings.

1.10 MAINTENANCE SERVICE

A. Furnish service and maintenance of controller for two (2) years from Date of Substantial Completion.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. All VFDs provided for this project shall be of a single manufacturer.

B. Approved Manufacturers:
   1. Asea Brown Boveri (ABB)
   2. Yaskawa
   3. Square D

2.2 GENERAL

A. The VFD shall convert incoming 3-phase 60 Hz AC power to a variable frequency, variable voltage AC output suitable for control of a standard NEMA Design B induction motor over a 10:1 speed range.

B. The VFD shall consist of a 3-phase full-wave converter section to rectify the incoming AC source, a filtered DC bus section, and a sinusoidal PWM output section utilizing IGBT type output transistors, and utilizing sensorless torque vector control logic, as specified below.

C. The VFD shall maintain a near unity power factor regardless of speed or load (0.95 or better for drives larger than 5 HP).

D. Inverter section shall utilize insulated gate bipolar transistors (IGBTs) with a minimum rating of 1200 VDC, and have an adjustable carrier frequency range of 1 to 6 kHz through 100 HP, and 1 to 3 kHz above 100 HP.

E. The VFD and options shall be tested to ANSI/UL Standard 508 and listed by either UL or ETL.

F. The VFD torque characteristic shall match the driven load.

G. Input Power: 480 Volt, 3-phase, 60 Hz.

H. The VFD shall include an integral disconnect to isolate the VFD from input power.
I. Voltage Tolerance: ±10%; Frequency tolerance ±3%.

J. The VFD output shall be rated for continuous duty with full load amp ratings that meet or exceed NEC Table 430-150. The VFD shall have overload capability of 110 percent rated current for 60 seconds. Output voltage range shall not exceed input rated voltage.

K. Ambient Operating Conditions: Temperature, 0-40 degrees C; Relative Humidity, 0-95 percent, non-condensing, 5600 feet elevation, without deration.

L. All printed circuit boards and power subassemblies shall be burned in at elevated temperature (50 degrees C minimum) for forty-eight (48) hours minimum. The completed, assembled VFD shall be functionally tested under motor load before shipment to ensure proper operation. The manufacturer shall provide certification that these tests have been completed.

2.3 BASIC FEATURES

A. Control power transformer with fused primary and 24V or 120V fused secondary.

B. VFD AC line input high-speed semi-conductor type current-limiting fuses rated 200,000 AIC minimum.

C. Operator Controls:
   1. "HAND-OFF-AUTO" Selector Switch. In "AUTO' position, drive starts and stops motor from remote contact closure, and motor speed shall be proportional to a remote speed control signal. In "HAND" position, motor is started and stopped from VFD Keypad/Display Module, and the motor speed shall be as set through the VFD Keypad/Display Module.
   2. Pilot Lights: LED Type. 22.5mm IEC Style, Red "VFD On", White "Control Power On", and Amber "VFD Fault".

D. Keypad/Display Module:
   1. A multi-line alpha-numeric backlit display capable of displaying at minimum motor speed (Hz), motor current (A), motor voltage (V), elapsed time meter (Hrs.), inverter load (%) and all drive programming parameters.
   2. Keypad to enable starting and stopping, and manual speed adjustment when the selector switch is in "HAND" position.

E. Programmable Relay Outputs (three minimum) capable of indicating the following:
   1. VFD in Run Mode
   2. VFD at Zero Speed
   3. VFD Fault

F. Terminals for field-installed external safeties.

G. Field-selectable Auto Restart on power source failure.

H. Adjustable voltage boost for starting high torque loads.

I. Drive shall be capable of starting into a spinning motor by matching frequency and phase angle to the motor back EMF.
J. Critical Speed Avoidance: Drive shall allow the User to avoid operation at resonant speeds. Selected speeds shall be stepped over. Four (4) critical speeds shall be capable of being avoided, with an adjustable bandwidth for each critical speed.

K. Signal Follower: In Auto Speed mode, motor speed shall be proportional to an external speed control signal. Verify with Control Contractor whether the control signal is 4-20 ma or 0-10 vdc. Provide control signal consistent throughout the facility. Loss of reference signal shall cause drive to go to programmable preset speed.

2.4 MOTOR PROTECTION
A. For all installations where the conductors from the VFD to the motor exceed 100 feet in length, provide a minimum 3 percent reactance motor protecting dv/dt filter at the VFD output terminals.

2.5 ADJUSTMENTS
A. Acceleration Time: 2 to 20 Second minimum range.
B. Deceleration Time: 2 to 20 Second minimum range.
C. Volts/Hz Ratio: Programmable.
D. Voltage Boost: Programmable.
E. Critical Speed Lockout: Four (4) critical speeds with adjustable bandwidth.
F. Current Limit: 30 to 110 percent sine wave current rating.
G. Carrier Frequency Range: 1 to 6 kHz through 100 HP and 1 to 3 kHz above 100 HP.
H. Output Frequency Range: 0 to 80 Hz minimum range.
I. All drive parameters shall be stored in non-volatile memory (EEPROM).

2.6 PROTECTIVE FEATURES
A. VFD shall have built-in protection for power source transients, over-voltage, under-voltage, and phase loss. VFD shall not require an input isolation transformer for transient protection.
B. DC bus over-voltage protection.
C. Instantaneous shutdown when load current exceeds 150 percent.
D. Adjustable electronic Class 20 inverse time characteristic over-current overload protection for the motor.
E. The VFD shall be capable of withstanding randomly applied short circuit current applied across the output terminals without damage.
F. Protection of VFD for any external disconnects between the drive and the motor. Provide control terminals for connection of disconnect switch auxiliary contacts, which will immediately stop the drive when opened.

G. DC bus discharge circuit for protection of service personnel, with "BUS CHARGED" indicator.

H. Troubleshooting Diagnostic Features:
   1. Indicator lights on inverter power module to indicate correct operation (or failure) of individual power switching devices.
   2. Indicator lights to show drive fault/ready states, and reason for fault shutdown, including: Instantaneous overload, motor overload, output or DC bus over-voltage, or source over-voltage, under-voltage, or phase loss. The VFD shall store in memory at minimum the previous five (5) alarms.

2.7 FABRICATION

A. Wiring Terminations: Match conductor materials and sizes indicated.

B. Enclosure:
   1. For Dry, Indoor Applications: NEMA 250, Type I
   2. For Wet, Indoor, Temperature Controlled Applications, NEMA 250, Type 4, with ventilation provisions, or closed loop heat exchanger, as required for adequate VFD cooling. Any powered enclosure ventilation or heat exchanger shall be configured to operate from a single point of electrical connection, common with the VFD.
   3. For Outdoor Applications: NEMA 250, Type 4, with NEMA 250, Type 3R rain shield. In addition, provide panel heaters, and/or panel closed loop heat exchanger or panel air conditioner as required to maintain the temperature within the VFD enclosure, within the allowable operating temperature range of the VFD. Any panel heaters and/or air conditioners shall be configured to operate from a single point of electrical connection, common with the VFD.

C. Finish: Manufacturer's standard enamel.

2.8 SOURCE QUALITY CONTROL

A. Inspect and production-test each product specified in this section.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that surface is suitable for controller installation.

B. Do not install controller until building environment can be maintained within the service conditions required by the manufacturer.
3.2 PREPARATION
   
   A. For floor-mounted VFDs, provide 4” concrete housekeeping pad.

3.3 INSTALLATION
   
   A. Install controller where indicated, indoors, in accordance with manufacturer's written instructions and NEMA ICS 3.1. Provide lockout wiring to prevent operation of VFD when disconnect is off.

   B. Tighten accessible connections and mechanical fasteners after placing controller.

   C. Install fuses in fusible switches.

   D. Provide engraved plastic nameplates under the provisions of Division 26.

   E. Provide neatly typed label inside each motor controller door identifying motor served, nameplate horsepower, full load amperes, code letter, service factor, and voltage/phase rating.

3.4 FIELD QUALITY CONTROL
   
   A. Inspect completed installation for physical damage, proper alignment, anchorage, and grounding.

3.5 START-UP SERVICE
   
   A. Provide minimum two (2) hours of start-up service for each VFD. Service shall be performed by factory-trained service technicians.

   B. Technician shall verify correct installation, start-up the drive, adjust all required operating parameters, and verify proper operation in all operating modes.

   C. Owner Training: Provide minimum eight (8) hours training in operation and trouble-shooting procedures for the installed drives.

3.6 ADJUSTING
   
   A. Make final adjustments to installed drive to assure proper operation of fan system. Obtain performance requirements from installer of driven loads.

3.7 CLEANING
   
   A. Touch up scratched or marred surfaces to match original finish.
3.8 DEMONSTRATION

A. Provide systems demonstration under provisions of Division 26.

B. Demonstrate operation of controllers in automatic and manual modes.

END OF SECTION 23 05 15
SECTION 23 65 00 - COOLING TOWERS, PRE-PURCHASE

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Extent of Factory-Fabricated Cooling Tower Work required by this section is indicated on drawings and schedules and by requirements of this section.

B. Types of Factory-Fabricated Cooling Towers specified in this section include the following:
   1. Factory-Fabricated Cooling Towers:
      a. Induced-Draft, Propeller Fan, Crossflow

C. Refer to other Division 23 sections for condenser water piping; condenser water treatment; vibration control; remote cooling tower sump; temperature controls; not work of this section.

D. Refer to Division 26 sections for the following work; not work of this section.
   1. Power supply wiring from power source to power connection on cooling tower. Include starters, disconnects, and required electrical devices, except where specified as furnished, or factory-installed, by manufacturer.
   2. Interlock wiring between cooling towers; and between cooling towers and field-installed control devices.
      a. Interlock wiring specified as factory-installed is work of this section.

E. Provide the following electrical work as work of this section, complying with requirements of Division 26 sections:
   1. Control wiring between field-installed controls, indicating devices, and cooling tower control panels.
      a. Control wiring specified as work of Division 26 for Automatic Temperature Controls is work of that section.

1.2 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of factory-fabricated cooling towers, of types and sizes required, whose products have been in satisfactory use in similar service for not less than five (5) years.

B. Provide manufacturer's certification of tower cooling capacity, based on factory-performance tests, and provide performance curve plotting Leaving-Water Temperature (LWT) against Wet-Bulb Temperature (WBT).

C. Certify tower wind resistance to withstand pressure indicated, in any direction.

D. Certify earthquake resistance against loading as indicated.

E. Codes and Standards:
1. UL and NEMA Compliance: Provide electric motors and electrical components required as part of factory-fabricated cooling towers, which have been listed and labeled by UL and comply with NEMA Standards.

2. NEC Compliance: Install cooling towers in accordance with NFPA 70 "National Electrical Code".

3. Provide Towers with materials of non-combustible composition such that Code Requirement for Fire Sprinklers in Tower is avoided.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data, including rated capacities, pressure drop, fan performance data, weights (shipping, installed, and operating), installation and start-up instructions, and rating curves with selected points clearly indicated.

B. Shop Drawings: Submit assembly-type shop drawings indicating dimensions, weight loadings, required clearances, and methods of assembly of all components.

C. Wiring Diagrams: Submit manufacturer's electrical requirements for power supply wiring to cooling towers. Submit manufacturer's ladder-type wiring diagrams for interlock and control wiring. Clearly differentiate between portions of wiring that are factory-installed and portions to be field-installed.

D. Record Drawings: At project closeout, submit record drawings of installed systems products in accordance with requirements of Division 1.

E. Maintenance Data: Submit maintenance data and parts list for each cooling tower, control, and accessory; including "trouble-shooting" maintenance guide. Include this data, product data, shop drawings, and wiring diagrams, in maintenance manual; in accordance with requirements of Division 1.

F. Certifications: Submit required certifications and written tests results for required testing.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Handle cooling towers and components carefully to prevent damage, breaking, denting and scoring. Do not install damaged cooling towers or components; replace with new.

B. Store cooling towers and components in clean place. Protect from dirt, fumes, construction debris, and physical damage.

C. Comply with manufacturer's rigging and installation instructions for unloading cooling towers, and moving them to final location.
PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturer: Subject to compliance with requirements, provide products by one of the following:
   1. Factory-Fabricated Cooling Towers:
      a. Baltimore Aircoil Co., Inc.
      b. Marley (The) Cooling Tower Co.

2.2 FACTORY-FABRICATED COOLING TOWERS

A. Induced-Draft, Propeller Fan, Crossflow:
   1. General: Fabricate cooling towers using manufacturer's standard design, materials, and construction in accordance with published product information, except as otherwise indicated.
   2. Design structural system for the following live-loading in addition to tower dead-loads and operating-loads:
      a. Wind Loading: 30 psf on exposed vertical surfaces.
   3. Fabricate structural system including assembly of hot water collecting basin and steel casings as follows:
      a. Bolt connections with fasteners having equal or better corrosion-resistance than materials fastened; seal joints to make watertight enclosure.
      b. Provide rigging supports on structure for final rigging.
   4. Casings: Fabricated and installed by manufacturer to make tower watertight.
      a. Provide hot-dipped galvanized steel.
   5. Cold water basins: Designed and installed to support water and to ensure water tightness:
      a. Cold water basins shall be welded 301L stainless steel.
      b. Provide oversized bottom outlet drain and overflow drain. Floor shall be sloped for complete drainage.
      c. Provide stainless steel debris screens.
      d. Provide internal walk-way supported over the basin.
   6. Wetted-Surface Fill with Integral Drift Eliminators fabricated into wave-formed configurations installed by manufacturer to assure break-up of water into droplets.
      a. Provide vertical sheets of polyvinyl chloride plastic having flame spread rating of five (5) per ASTM E 84.
   7. Louvers: Designed and installed by manufacturer, and of sufficient thickness and rigidity to prevent visible sagging:
      a. Provide fiberglass reinforced plastic (FRP).
   8. Water Distribution System: gravity-flow type with metering orifices; installed by manufacturer to ensure even distribution of water over wetted-surface-fill.
   9. Single inlet return water connection and internal distribution piping with balancing valve on each of two (2) branches to the distribution basins. Balancing valve shall have stainless steel stem and locking handle.
   10. Basin Covers: Removable, stainless steel covers with handles, installed by manufacturer to prevent debris from entering basin and to inhibit algae growth by eliminating sunlight.
   11. Inlet Screens: Mounted in removable frames by manufacturer:
      a. Provide galvanized steel mesh; 1-inch mesh pattern using 1/32-inch galvanized wire.
12. Handrails: Provide galvanized steel pipe rails of required height above tower. Include knee and toe rails of required diameter and heights.

13. Ladders: Provide galvanized steel or aluminum ladder, to top of cooling tower working surface.
   a. Provide safety cage.

   a. Provide cast-aluminum propeller-fan of adjustable-pitch type.
      1) Provide gear-drive including speed reducer to allow operation down to 10% of full speed.
      2) Provide fan guard.

15. Fan Bearings: Provide self-aligning ball bearings, L10A service life of 100,000 hours; include external extended grease lines, and fittings.


17. Motor Speed: Provide motor rated at 1,800 rpm (induction duty rated).

18. Vibration Cutout Switch: Provide switch to de-energize fan motors if excessive vibration occurs due to fan imbalance.

19. Provide variable speed drive for each fan motor control; Refer to Section 230514. Provide NEMA 3R enclosure for outdoor use.

20. Except where otherwise specified, all components of the cooling tower shall be fabricated of steel, protected against corrosion by G-235 galvanizing. The tower shall be capable of withstanding water having a pH of 6.5 to 8.0; a chloride content (NaCl) up to 300 ppm; a sulfate content (SO4) up to 250 ppm; a calcium content (CaCO3) up to 500 ppm; and silica (SiO2) up to 150 ppm.

21. Vibration Control: Provide as the following types of vibration isolators, with number and size of isolators selected by manufacturer.
   a. Isolator Type 1: Pad, rubber or glass fiber.

22. Controls:
   a. Provide a complete UL listed Variable Speed Drive system. VFD panel construction shall include a main disconnect with short circuit and thermal overload protection with external operating handle, lockable in the off position for lock-out tag-out safety procedures. A service switch directly ahead of the VFD shall be provided for voltage isolation during VFD maintenance. The VFD system shall receive a speed reference signal from the building management system monitoring the tower cold-water temperature. The VFD shall have an internal PI regulator to modulate fan speed maintaining set point temperature. The drive’s panel shall display the set-point temperature and cold-water temperature on two separate lines. Operator controls shall be mounted on the front of the enclosure and shall consist of Start and Stop control, Auto/Manual selections, and manual speed control. To prevent heating problems in the cooling tower fan motor, the VFD system shall de-energize the motor once 25% motor speed is reached and cooling is no longer required. The cooling tower manufacturer shall supply VFD start-up assistance and vibration testing throughout the speed range to identify and lockout any natural frequency vibration levels which may exceed CTI guidelines.
   b. Provide a make-up water float valve.
   c. Provide a system of electric immersion heaters and controls for each cell of the tower to prevent freezing of water in the collection basin during periods of shutdown. The system shall consist of one or more stainless steel electric immersion heaters installed in threaded couplings provided in the side of the basin. A NEMA 4X control panel and associated temperature probe shall include circuitry to monitor cold water temperature and low water level, providing ON OFF thermostatic like control. The temperature probe shall be located in the cold-
water basin. The system shall be capable of maintaining 40°F water temperature at an ambient air temperature of minus 20 °F. The panel shall include an off switch.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: The installation of cooling towers will be covered in the specifications issued with the final construction documents

3.2 ADJUSTING AND CLEANING

A. Start-Up: Comply with manufacturer's instructions for filling and start-up of operation, but not less than the following:
1. Verify lubrication of rotating parts; lubricate as needed.
2. Verify fan rotation direction.
3. Verify that motor amperage is in accordance with manufacturer's data.
4. Balance condenser water flow to each tower, and to each inlet for multiple inlet towers.
5. Adjust water level control for proper operating level.
6. Adjust bleed valve for indicated percentage of circulated water volume.
7. Balance equalizer lines between multiple towers (if any).
8. Adjust temperature controls and verify operation.

B. Operation Test: Test each cooling tower to show that it will operate in accordance with indicated requirements.

3.3 CLOSEOUT PROCEDURES

A. Provide services of manufacturer's technical representative for one (1) 8-hour day to instruct Owner's personnel in operation and maintenance of factory-fabricated cooling towers.
1. Schedule training with Owner, provide at least seven (7) day notice to Contractor and Engineer of training date.

END OF SECTION 23 65 00
## COOLING TOWER PRE-PURCHASE SCHEDULE

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(1) PROVIDE WITH UNIT MOUNTED VARIABLE FREQUENCY DRIVE WITH NEMA 3 (OUTDOOR) MOISTURE ATMOSPHERE ENCLOSURE. (FIELD WIRING AND ENCLOSURE)

(2) PROVIDE WITH VARIATION CUT-OFF SWITCH

(3) PROVIDE WITH EXTERNAL LUBRICATION LINES / ZERKS.

(4) PROVIDE DEEPERED SEAM OUTPUT SUMP CONNECTION.

(5) PROVIDE STAINLESS STEEL SHROUD.

(6) 5 YEAR EQUIPMENT WARRANTY.

(7) PROVIDE WITH BOTTOM OUTLET SUMP WITH ANTI-VORTEX INLET; INTERIOR DISTRIBUTION CHAMBER PIPING AND CONNECTION TO FILL HEADER; 10" FLANGED EXTERIOR PIPE CONNECTION.

(8) PROVIDE MAKE-UP WATER ELECTRONIC LEVEL CONTROLLER AND VALVE, LOW WATER CUT-OFF, FIELD WIRE AND PROVIDE CONTACTOR, TRANSFORMER, CIRCUIT BREAKER, DISCONNECT SWITCH.

(9) PROVIDE SUMP HEATER CONTROL.