

# FlowMark Specification for Cooling Towers

## SECTION 23 25 00 – HVAC Water Treatment

### COOLING TOWER WATER TREATMENT SYSTEM

#### PART 1 GENERAL

##### 1.1 DESCRIPTION

- A. This section specifies cleaning and treatment of circulating HVAC water systems, including the following:
  - 1. Tower Cooling Water - Closed Loop Systems Fluid Coolers
  - 2. Condenser Water – Open Cooling Water Loop Systems
  - 3. Tower Cooling Water – Evaporative Condensers
  - 4. Evaporative Fluid Coolers – Direct and/or Indirect

##### 1.2 RELATED WORK

- A. Test requirements and instructions on use of equipment/system: Section 01 00 00, GENERAL REQUIREMENTS
- B. General mechanical requirements and items, which are common to more than one section of Division 23: Section 23 05 11, COMMON WORK RESULTS FOR HVAC AND STEAM GENERATION
- C. Piping and valves: Section 23 21 13, HYDRONIC PIPING and Section 23 22 13, STEAM AND CONDENSATE HEATING PIPING

##### 1.3 QUALITY ASSURANCE

- A. Refer to paragraph, QUALITY ASSURANCE in Section 23 05 11, COMMON WORK RESULTS FOR HVAC AND STEAM GENERATION.
- B. Technical Services: Provide the services of an experienced water treatment specialist, or technical representative, approved by the Water Treatment System Manufacturer to direct flushing, cleaning, pre-treatment, training, debugging, and acceptance testing operations. The water treatment specialist shall direct and perform chemical limit control during construction period and monitor systems for a period of 12 months after completion and acceptance by owner, including not less

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than 12 service calls and written status reports. During this period they shall perform monthly tests of the cooling tower for Heterotrophic Bacteria and submit reports stating Colony Forming Units per milliliter to the owner/operator and the Water Treatment System Manufacturer.

- C. Field Quality Control and Laboratory Reports: During the one year service period, the water treatment specialist shall provide not less than 12 reports based on on-site periodic visits, as stated in paragraph 1.3.B, sample taking and testing. They shall review with facility personnel the state of water treatment control for the previous period. In addition to field tests, the water treatment specialist shall provide water chemistry test reports. These monitoring reports shall assess water treatment instrumentation accuracy, scale formation, fouling and corrosion control, and shall contain instructions for the correction of any out-of-control condition.
- D. Log Forms: Provide water treatment test log form in electronic format that can be reproduced by owner for use by plant personal making regular system water tests.

## 1.4 SUBMITTALS

- A. Submit in accordance with Section 01 33 00, SUBMITTAL PROCEDURES.
- B. Manufacturer's Literature and Data including:
  - 1. Electronic Chemical-Free treatment for open loop systems, including installation and operating instructions
  - 2. Conductivity Controller and Blowdown Valve, including installation and operating instructions
  - 3. Optional Coupon Rack and other Accessories as required by the contract documents
- C. Water analysis verification: Water analysis to include at a minimum the analysis of the following compositions of the Make-up water source:
  - 1. pH
  - 2. Specific Conductivity ( $\mu\text{S}/\text{cm}$ )
  - 3. Calcium Hardness (as ppm  $\text{CaCO}_3$ )
  - 4. Total Hardness (as ppm  $\text{CaCO}_3$ )
  - 5. Total Alkalinity or m-Alkalinity (as ppm  $\text{CaCO}_3$ )
  - 6. Chloride (as Cl)
  - 7. Iron (as Fe)

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8. Phosphate (as PO<sub>4</sub>)
  9. Silica (as SiO<sub>2</sub>)
  10. Sulfate (as SO<sub>4</sub>)
- D. Supply Maintenance and operating instructions in accordance with Section 01 00 00, GENERAL REQUIREMENTS suitable for inclusion into a standard 3-ring binder.

## PART 2 - PRODUCTS

### 2.1 GENERAL

- A. The Contractor shall furnish and install an Electronic Chemical-free Water Treatment System as shown and detailed on the contract documents. All components of the system provided will be manufactured and supplied by a single company and be certified to be functionally compatible, such as the **Mark II – Mark IV System** manufactured by **FlowMark Water Treatment** Daytona Beach, Florida or an approved substitution.

### 2.2 ELECTRONIC WATER TREATMENT SYSTEM

- A. Provide a complete Electronic Water Treatment System Equal to the **FlowMark System** manufactured by **FlowMark Water Treatment** Daytona Beach, Florida or an approved substitution.
1. The use of other chemical free technologies including but not limited to ultrasound, cavitation, magnets, copper/zinc alloys, copper/silver electrodes, electrostatic systems and such like are not acceptable
- B. System Description
1. The system shall consist of control Panel and Vinyl Covered Treatment Pads Wired in Series to be wrapped around the outside of the water system piping.
  2. The Vinyl Covered Treatment Pads Placement shall be as shown and detailed on the contract documents.
    - a. Normal full flow installation shall be in the main cooling tower recirculation line after the pump(s).
    - b. Alternate by-pass flow installation shall be on the discharge side of the Tower Basin Filtration System.

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- 1) To provide proper water treatment in by-pass systems, the Mark II – Mark IV System and Tower Filtration Package will be sized for a minimum of 25 percent of total tower recirculation rate.

### C. Control Panel:

1. Wall mounted Nema 4X Water-Resistant, Corrosion Resistant, Lockable, Enclosure.
2. An internally mounted Circuit Breaker will be used to provide safety system shutoff for servicing. Replaceable fuses are not acceptable.
3. Maximum power required for Electronic Water Treatment System is 80 watts.
4. Power Factor must be greater than 0.70.
5. System must be able to operate continuously with or without water flow.. Electrical interlock with water circulation pump is not required.
6. Unit will be equipped with an automatic switching universal power supply for 100 to 240 VAC input at 47 to 63 Hz.
7. Alarm Relay with S.P.D.T Dry form C contact (for building management system or remote monitor) shall be provided.
  - a. Contacts are rated for a minimum of 5 amps at 30 VDC or 10 amps at 250 VAC.
  - b. Relay is to be energized when Electronic Treatment System is performing properly.
8. Alarm Relay will verify the following System operating status conditions
  - a. Primary Power Status: e.g. Loss of utility power, tripped circuit breaker, or unit unplugged.
  - b. Secondary Power Status: e.g. Severed or removed Vinyl Covered Treatment Pads Wired in Series signal cable connection, or failure of one or more coils
  - c. Control Panel Circuit Board Operation Status: e.g. Board overheating, electronic failure.
9. The weatherproof Signal Cable must be field replaceable to allow for repair or modification. Standard length is 10 feet, with optional lengths available.
10. Signal Cable insulation shall be rated for outdoor use with UV stable insulation.
11. Signal Cable Connectors shall be rated water resistant for outdoor use.
12. High intensity LED Indicators indicating power and signal shall be easily visible 12 feet away

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in full sunlight. The use of incandescent bulbs for indicators is not allowed.

13. NEMA-4 construction for the Control Panel is required. Powered fan ventilation with inlet air filter is not allowed.
14. Electronic signals shall be generated by use of Class D pulse width modulation circuitry.
15. Signal Character and strength shall be field adjustable by qualified technician.

## D. Vinyl Covered Treatment Pads Wired in Series

1. Vinyl Covered Treatment Pads Wired in Series will wrap around the existing condenser and or chilled water piping to provide electronic water treatment.
2. A permanently attached 18 inch signal cable weatherproof/waterproof connector is provided to mate with field replaceable Signal Cable from the Control Panel.
3. The Vinyl Covered Treatment Pads Wired in Series is provided with a minimum of four electrically independent signal coils (DC Signals).
4. A PVC Pipe Cover Wrap will be provided to cover Vinyl Treatment pads once installed on pipe.

## E. Conductivity Controller

1. Electronic Water Treatment System Manufacturer shall furnish a Conductivity Controller to provide proper automatic conductivity based blowdown control for the cooling tower.
2. Conductivity controller shall have the following features:
  - a. NEMA 4x enclosure.
  - b. Maintenance free Toroidal conductivity sensor. Standard contact type probes will not be acceptable.
  - c. Large graphical display with easy to read font.
  - d. Simple four button user interface.
  - e. Flow Switch input.
  - f. 4-20 mA isolated analog output.
  - g. Dry contact alarm output
3. Flow sensor to prevent off-cycle blowdown operation
4. Sample Valve is provided for convenient withdrawing of water samples

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5. Conductivity Controller, Sensor, Sample Valve and Flow Switch will mounted on panel suitable for wall or rack mounting.
  6. Isolation valves will be provided to allow for cleaning probe and flow switch without turning system water flow.
- F. Blowdown or Bleed Valve:
1. Provide motorized spring return ball valve with 120 volt, single phase power input.
    - a. Furnish with appropriate cover, if required, to maintain a minimum rating of NEMA 3R if installed outdoors.
    - b. Install bypass line with block valve around blowdown valve for servicing and emergency manual blowdown operation.
    - c. Do not install strainer(s) in blowdown line.
    - d. Install throttling valve ahead of the blowdown valve to make adjustments in blowdown volume rate if required.
    - e. Bleed Valve size to be determined by fifteen minute per hour blowdown rate calculated at maximum tower load for three cycles of concentration
- G. Optional Corrosion Test Coupon Assembly:
1. If required by the contract documents, provide a two-station or four-station corrosion coupon rack constructed of PVC, complete with piping, valves, and mild steel and copper coupons. Locate copper coupon downstream from mild steel coupon in the test coupon assembly. Include isolation and ball valves and a flow control valve to limit velocity to less than 5 feet per second. Entire assembly shall be mounted on a panel suitable for wall or rack mounting.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Verify field conditions and suitability for installation according to manufacturer's published installation data.

### **3.2 INSTALLATION**

- A. Installation shall meet or exceed all applicable federal, state and local requirements, referenced standards and conform to codes and ordinances of authorities having jurisdiction.

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- B. Install equipment level and plumb.
- C. Install equipment per recommendations in the manufacturer's published installation data.
- D. Cleaning of piping systems using the Electronic Treatment System (Mark II- IV)
  - 1. Immediately after hydrostatic testing of piping, systems shall be cleaned, drained, and flushed with clean water. Any chemical cleaners used in this process shall be thoroughly flushed from the piping system.
  - 2. Under no circumstance will water be allowed to sit stagnant or circulate without water treatment after initial cleaning and testing.
  - 3. Proper system layup procedures must be followed anytime the water system is not running.
    - a. An appropriate vapor type corrosion inhibitor as determined by the factory trained and certified water treatment specialist shall be first circulated in the system for a period of time as required by the treatment manufacturer and dictated by the size of the system treated.
    - b. The system shall be drained of all water.
    - c. Immediately prior to putting the Electronic Treatment System (Mark II- IV) into operation, the system shall be re-filled with clean water.
  - 4. Consult with Water Treatment System Manufacturer or the local Representative for additional details.
- E. CONNECTIONS
  - 1. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
  - 2. Install piping adjacent to equipment to allow service and maintenance.
  - 3. Size and install the control loop piping to conductivity, optional sensors and/or corrosion coupon racks in the size PVC to match fittings provided. Install field provided full port ball valves for isolation of sensors and racks for routine maintenance. Control loop sensors shall not be installed directly in the piping mains.
  - 4. Control loop shall be piped from the pressure side of the recirculating pump to the suction side of the pump, so that the control loop senses the highest pressure of the fluid system. In

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the case of Fluid Coolers or Evaporative Condensers, the control loop shall be taken from the pump discharge and the water shall be returned to the sump.

5. Bleed line should not be attached to the control loop. Install the bleed line downstream of the centrifugal separator or on the pressure side of the recirculating pump, preferably from the side or top of the pipe to prevent plugging of the valve due to accumulated solids, dirt, and debris.
6. Confirm applicable electrical requirements in Division 26 Sections for connecting electrical equipment.
  - a. Provide proper electrical ground to the equipment.
  - b. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

### 3.3 TESTING

- A. Engage a factory-authorized service representative to perform startup service for the Cooling Tower Water Treatment System.
  1. Inspect field-assembled components and equipment installation, including piping and electrical connections. Report results in writing.
  2. Inspect piping and equipment to determine that systems and equipment have been cleaned, flushed, and filled with water, and are fully operational.
  3. Place HVAC water-treatment system into operation and calibrate controls during the preliminary phase of HVAC systems' startup procedures.
  4. Set up Cooling Tower blowdown system according to the Manufacturer's recommendations based upon the site water analysis as specified in PART 1.4 C – Submittal Data of this Section.
  5. The Filed Service Technician shall provide an Initial Start-up Service Report to the operator/owner and the Manufacturer.
- B. No water system using an Electronic Treatment System (Mark II- IV) shall be put into operation without the (Mark II- IV) being energized and the blowdown system and mechanical filtration



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systems fully operational. Failure to comply may result in damage to connected heat exchange equipment from scaling and corrosion, or fouling from biological growth.

## 3.4 ADJUSTING

1. One year of Cooling Water Treatment Service by a Factory Authorized and Trained Service Technician or Authorized Water Treater shall be provided with the cost of the Cooling Tower Water Treatment System.
2. At approximately every 30 days from Initial Start-up Service, the Service Technician shall monitor the performance of the system and make system adjustments as necessary.
3. A written Service Report shall be provided to the Owner/Operator and to the Manufacturer.
4. The monitoring by the Service Technician will include the following:
  - a. Confirm all water treatment system equipment is functioning properly.
  - b. Inspect for any evidence of scale formation.
  - c. Inspect for any evidence of high bacteria levels or biofilm formation.
  - d. Confirm source of makeup water.
  - e. Perform required makeup water analysis
    - 1) Conductivity
    - 2) pH
    - 3) Chloride
  - f. Perform required basin water analysis
    - 1) Conductivity
    - 2) pH
    - 3) Chloride
    - 4) Bacteria analysis by Dipslide or by ASTM D6530 (Kool Kount Assay)
  - g. Calibrate and adjust conductivity controller and other sensors as required

## 3.5 TRAINING

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain Cooling Tower Water Treatment Systems and equipment.
- B. Train Owner's maintenance personnel on procedures and schedules for starting and stopping,

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troubleshooting, servicing, and maintaining equipment and schedules.

1. Schedule at least four (4) hours of training with Owner.
  2. Provide at least seven days' advance notice.
- C. Review data in maintenance manuals, especially data on recommended parts inventory and supply sources and on availability of parts and service.

**END OF SECTION**