

15711 INDUCED DRAFT COOLING TOWERS

SPECIFIER:

CSI MasterFormat 2004 number: 23 65 00

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Cooling towers, with certified thermal performance by Cooling Technology Institute (CTI) STD-201 for new or replacement cooling towers 150 tons and above.
2. Replacement cooling towers for 100 tons or less, without CTI certification.

SPECIFIER:

1. *Design shall use a single cooling tower for 200 tons or less, 2 equal sized towers for up to 400 tons, and multiple equal sized cooling towers of at least 200 tons each at installations above 400 tons.*
2. *M-DCPS will use truck mounted cooling towers for temporary duty. Provide strategically placed full sized flanges between cooling tower shut-off valves and condenser water pump suitable for temporary emergency connection of a portable cooling tower at single tower installations.*

B. Related Sections:

1. 02830 - Chain Link Fences and Gates.
2. 09900 - Painting of Unpainted Surfaces.
3. 09901 - Painting of Previously Painted Surfaces.
4. 15240 - Vibration Isolation.
5. 15510 - Piping (HVAC).
6. 15540 - Pumping Equipment (HVAC).
7. 15545 - Water Treatment.
8. 15900 - Controls and Instrumentation.

1.2 SUBMITTALS

- A. Submittals for cooling towers sized below 150 tons will not be accepted, unless it is for the replacement of existing cooling towers.
- B. Submit properly identified manufacturer's literature of the cooling tower, and the following documentation for approval before starting work:

SPECIFIER: The following paragraphs 1, 2, 3, and 4 apply to any size cooling tower.

1. Shop drawings.
2. Piping layout.

3. Submit wind load calculations and connection details for the cooling tower(s), framework, casing, supports and foundation(s), all signed and sealed by a Florida registered engineer, demonstrating compliance with FBC - American Society of Civil Engineers (ASCE) 7.
4. Fan motor data including speed and condenser water temperature controls.
5. Performance Curves:
 - a. Cooling tower performance curves based on approach water temperatures, (leaving water temperature - design wet bulb temperature = approach) vs. range temperatures, (entering water temperature - leaving water temperature = range) at design wet bulb (wb) temperature.
 - 1) Design wb for cooling towers shall be 80 degrees F.
 - 2) Maximum condenser water supply temperature to chiller shall be 86 degrees F.
 - 3) Maximum return water temperature to cooling tower shall be 96 degrees F.
 - 4) Design dry bulb for cooling towers shall be 91 degrees F.
 - b. All curves shall extend through plus and minus 40 percent of the design water flow.
 - c. Submit fan and cooling tower performance change curves using one pitch angle per cooling tower size.

SPECIFIER: The following paragraph d. applies to cooling towers above 150 tons.

- d. Submit cooling tower thermal performance curves with heat transfer characteristics (KaV/L) for counterflow or (KaY/L) for crossflow cooling tower vs. liquid to gas ratio curves (LG) curves. Include design characteristic curve and design point. All curves shall be CTI certified and according to the latest version of CTI Standard 201 testing and standard procedures, using the following minimum parameters:
 - 1) Water temperature ranges from cooling tower, for temperature ranges of 4 degrees F. through 14 degrees F. in 2 degree intervals.
 - 2) Approach water temperatures of 4 degrees F. to 12 degrees F. in 2 degree F. intervals.
 - 3) Wet bulb temperatures of 80 degrees F. to 60 degrees F. in 2 degrees F. intervals.

1.3 QUALITY ASSURANCE

- A. Tower manufacturer shall be a member of the Cooling Technology Institute (CTI).
- B. Cooling tower thermal performance shall be certified, listed, and rated by CTI for towers 150 tons and above.
- C. Comply with the following CTI standards:
 1. STD-111 Gear Speed Reducers.
 2. STD-201 Certification Standard for Commercial Water Cooling Towers.

- D. Cooling tower shall meet fire rating and construction requirements according to Factory Mutual, but listing is not mandatory.
- E. Cooling towers shall comply with NFPA 214 "Standard on Water Cooling Towers".
- F. Installations requiring condensers sized below 150 tons shall be air-cooled. Systems using cooling towers below 150 tons, except for existing cooling tower replacements, are not allowed.
- G. For replacement cooling towers that are less than 100 tons, certification and testing by CTI is not required. Performance curves, ratings and capacities shall be based on CTI 201, and in addition they shall comply with these specification and the following:
 - 1. Fan drives shall be right angle geared or direct drive.
 - 2. Provide adjustable or fixed fan blade pitch angles.
 - 3. The cooling tower manufacturer shall warranty and guarantee tower's thermal performance, rating, capacity, and compliance with other requirements as specified. Warranty shall include all labor and materials necessary to upgrade or replace the cooling tower to comply with specified requirements.
 - 4. A compliance evaluation to specifications and capacity test shall be done on the cooling tower by the Board's Test and Balance consultant at the Board's cost, before acceptance. Test shall use recognized industry guidelines. Cooling tower shall be rejected if test is not successful.

1.4 WARRANTY

- A. Cooling tower manufacturer:
 - 1. Shall warrant, guarantee, and provide required replacement materials for the complete tower, tower components and accessories, including drive motors and controls for not less than 5 years from the date of Substantial Completion.
 - 2. Shall warrant that during the first year of the warranty period, tower loss of capacity shall not exceed 5 percent.
 - 3. Shall provide all costs, including labor and material, necessary to test and reinstate cooling tower rated efficiency during that period if conditions indicate a loss of capacity or efficiency.
- B. Installation contractor shall provide all labor necessary for all cooling tower warranty work during the 1 year warranty from date of Substantial Completion.
- C. Warranty work shall correct cooling tower defects in labor or materials including but not limited to the items listed below:
 - 1. Excessive corrosion or wear and tear.
 - 2. Exceeding specified drift.
 - 3. Leaking.
 - 4. Splashing, surging, cavitating, or overflowing.
 - 5. Prolonged maintenance shutdowns during normal school hours.

1.5 MAINTENANCE

- A. The installation contractor shall provide the necessary labor and materials to maintain the cooling tower during the 1 year warranty period starting at substantial completion acceptance.
 - 1. The installation contractor shall do needed touch-up painting to prevent rusting or corrosion on the cooling tower, cooling tower support, piping, and piping supports.
 - 2. The installation contractor shall provide complete water treatment service as called for in Section 15545 - Water Treatment.
 - 3. If the project is a replacement of an older cooling tower, the temperature controllers, pressure gauges, and thermometers shall be replaced. .

- B. Maintenance costs shall include necessary costs required to maintain tower and tower components and controls, piping, valving and other items provided by him, at peak reliability, efficiency, and operating condition during said one year period.

- C. The installation contractor shall maintain the cooling tower by performing at a minimum the Inspection and Maintenance Schedule required by the Latest ASHRAE Systems and Equipment Handbook Chapter "Cooling Tower" and as suggested by cooling tower manufacturer.
 - 1. Work shall be performed as required and as follows:
 - a. Whenever daily or weekly schedules are required, they shall be deemed to be required monthly.
 - b. Any necessary corrective work shall be undertaken. Necessary corrective work not in contract shall be reported in writing to M-DCPS.
 - c. Item 2. Check fan, motor, gear reducer, drive shaft and assemblies for unusual noise, vibration, loose mountings, and leaks monthly. Structural members shall be checked yearly and, if needed, shall be repaired before contract expiration.
 - d. Item 8. Change of gearbox oil shall be done after the first month of operation and every 6 months thereafter, unless manufacturer guarantees longer intervals.
 - e. Item 16. Repaint shall be applying ZC compound consisting of 95 percent pure zinc as specified.
 - f. All system's water temperatures shall be taken, checked, and recorded, including chilled and condenser water temperatures and outdoor conditions. Differential pressure across pumps and condensers shall be taken, checked, and recorded.
 - g. At least one fan start and stop shall be observed each month.
 - h. Verify calibration of fan thermostat with chiller's condenser water temperature indicator monthly.
 - i. Clean all condenser water piping strainers after the initial first month of operation and thereafter as needed.
 - j. Remove cooling tower suction strainer and clean after initial first month of operation and thereafter as needed.
 - k. Exercise all system valves periodically by fully opening and closing them. Return balancing valves to their proper position after exercising.
 - l. A watch for excessive drift and tower water conditions shall be kept monthly. Tower water shall be kept clear, without oily film, excessive foaming or scum.
 - m. Clean the cooling tower after the initial first month of operation and thereafter as needed. No high-pressure equipment shall be used in cooling tower cleaning.

- 1) All cleaning after the initial first month of operation shall be done at the same time, and shall include the cold water basin, the water distribution system, drift eliminators, and the inlet louvers.
 - 2) Water treatment service shall be coordinated with the initial first month cleaning.
 - 3) Inspect cooling tower after cleaning and monthly.
 - 4) Repair leaks with 3M, Type 5200 Marine caulking.
- n. Maintain a log of all maintenance and work performed in and around cooling tower. Log shall include the recording of specified required parameters. Maintain a duplicate log in chiller room at site. Site log shall be current with main log.
- D. The installation contractor shall provide as part of his maintenance work one year of water treatment service as required under Section 15545 - Water Treatment. If the cooling tower is a replacement project, the Board shall determine the water treatment service provider.
1. Submit by fax, the required monthly water treatment service reports and required quarterly coupon reports to the M-DCPS Water Treatment Department, 305-995-7959.
 2. The installation contractor shall evaluate the cooling tower and water treatment service after 11 months of operation and report any deficiencies in writing to M-DCPS Water Treatment Department before the end of the initial 1 year period.
 3. The installation contractor shall warrant and pay for all incidental costs associated with lack of proper cooling tower maintenance or water treatment during his responsible term including, but not limited to, cleaning, repair, or replacement of the following components:
 - a. Replacement of affected tower components or the complete cooling tower.
 - b. Condenser water piping system, including valving and appurtenances.
 - c. Condenser water pumps and impellers.
 - d. Chiller's condenser tubes.
- E. The general corrosion rate in carbon steel condensing system components shall be maintained at a rate of less than 0.2 mils/year without pitting and for copper and copper alloys shall be maintained at a rate of less than 0.5 mils/year without pitting.
- F. Inspection of the Chillers Water Cooled Condensers (Shell and Tubes):
1. The installation contractor at a date and time directed by M-DCPS but not later than 11 months after substantial completion, shall open and afterwards close, both actions at no additional cost to M-DCPS, at least one head of each water cooled condenser (shell& tubes) for a sufficient amount of time to allow for M-DCPS to evaluate the condition of the chiller's interior barrel and tubes.
 2. The chiller's head opening shall be accomplished when directed by M-DCPS, either during a teacher workday if available, or on a weekend and will remain open for a sufficient amount of time for a proper evaluation. M-DCPS shall examine and evaluate the condenser's interior and determine its status, including if there is excessive corrosion, a need for cleaning and/or repairs. All directed additional work shall be performed after-hours, shall minimize the chiller's downtime and if necessary shall require multiple head openings and closings to provide for uninterrupted school

HVAC operations, shall be fully at the contractor's expense and shall be subsequently examined and approved by M-DCPS before being finally closed.

3. The installation contractor shall remind M-DCPS's Water Treatment Department in writing (Tel. 305-995-7979, Fax 305-995-7959) of the need to open the chiller's heads two weeks prior to the 11th month, if not previously accomplished, and shall not interpret or construe either M-DCPS's or the contractor's failure to communicate on a timely basis as a waiver not to perform the required work when subsequently directed.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Cooling Tower Manufacturers:

1. Evapco Cooling Towers, Westminster, MD.
2. Marley Cooling Tower Co., Mission, KS.
3. Baltimore Air Coil, Baltimore, MD.
4. American Cooling Tower.
5. The Cooling Tower Company.
6. Mesan USA.

2.2 MATERIALS

A. Cooling tower construction including, but not limited to the following appurtenances, materials, and items shall be heavy gage 304 stainless steel:

1. Cold water basin.
2. Hot water distribution basin, if used.
3. Fan mounting deck.
4. Cooling tower strainer.
5. Air inlet louvers.
6. Fan disconnect enclosure.
7. Lubrication lines.
8. Sumps.
9. Structural framing.
10. Exterior casing, water separation casing materials, and any other non-structural materials.
11. Fan cylinder or stack.
12. Fan guard wire mesh.
13. Stainless steel screws used for panels, fan mounting deck, and other components.
14. Stainless steel through-bolts to assemble the cooling tower. Overall length of through-bolts shall not exceed 1/4 inch. in length beyond the outward face of the securing nut.

2.3 COMPONENTS

A. Cooling Tower Framework, Casing, Supports and Foundation:

1. Of sufficient gage, size, and strength to enable the finished cooling tower to withstand wind pressure velocities as determined by FBC and ASCE 7.

SPECIFIER: In the contract documents, the A/E shall state:

1. *The cooling tower's exposure and shape and importance factors to be used for the selected cooling tower.*
2. *The cooling tower manufacturer shall provide and use the shape factor of the actual submitted cooling tower in their calculations.*

- a. Submit wind load calculations and load diagrams, signed and sealed by a Florida registered engineer for approval.
- b. Incorporate exposure, shape, and importance factors.

B. Thermal Fill:

1. Consisting of self-extinguishing, cross-fluted sheets of inert cellular film PVC.
2. Preassembled fill sections using nails, staples, glue, or other type of permanent fasteners are not allowed.
3. Fill sheets shall be formed using multiple films each having at least a 13 mill thickness.

C. Casing: Sealed watertight.

D. Corners: With waterproof finishes.

E. Drift Eliminators:

1. PVC honeycomb. Fire resistive and self-extinguishing per ASTM E84
2. Tower drift shall not exceed 0.005 percent of water being circulated.

F. Two Pass Louvers or Two Air Direction Changes:

1. To eliminate splash-out and return water to cold water basin, reduce the potential for algae growth, and reduce debris entry.
2. Louver shall be easily removable in counterflow cooling towers and may be fixed in crossflow towers.
3. Supports shall not exceed 2 feet on centers for all cooling towers.

G. Hinged Access Personnel Door:

1. Provide access door into each fill and basin cell area.
2. Door minimum size shall be 36 inches wide by 30 inches high or reasonable equivalent area.
3. Provide OSHA compliant ladder access and handrailed landing area to outside access door.

H. Cell Partitions:

1. Full height and full width partition between cells, watertight, extending from cold water basin up to fan deck level.
2. Equip partition with weir gate or equalizing pipe connections for independent cell operation and 100% isolation between each cell.
3. Provide a personnel door for access between cells.

I. Water Distribution System:

1. Interior rotating spray bars or rotating nozzles are not allowed. There shall be a single point condenser water supply and single point condenser water return connection to the cooling tower. Cooling tower field installed piping is not acceptable.

a. Counterflow Cooling Tower:

- 1) Nozzles shall be one piece, corrosion resistant, nonmoving, large orifice 3/8" x 1" size minimum, efficient at various flow rates and shall have anti-sludge rings.
- 2) The PVC spray header and branches shall be accessible and removable for cleaning purposes.

b. Crossflow Cooling Tower:

- 1) Distribution basins shall have watertight partitions.
 - a) Each section shall have a shut-off valve.
 - b) Water from each pipe or valve shall discharge into a splash box designed to prevent splashout and water surge in basin.
 - c) Openings or nozzles shall be non-clogging.
- 2) Hot water distribution basins accessible with removable covers. Extend FMD over basins if necessary.

J. Fan:

1. Each fan shall operate within an eased inlet fan cylinder.
2. Equip each cell with a heavy duty, induced draft propeller fan having either solid section cast aluminum, extruded aluminum, or FRP blades with stainless steel or carbon fiber shaft with compatible hub.
3. Fan cylinders less than 6 feet high shall be provided with a mesh fan guard having removable sections for access to mechanical equipment.
4. Fans shall be factory statically balanced and match marked for field re-assembly.
5. Blade pitch angles shall be adjustable for sizes 150 tons and above.
6. Fan motor shall be totally enclosed, either fan-cooled or air over, and be placed in an accessible area of the tower and shall be provided with manufacturer's recommended vibration isolation.
7. Fan Motor shall be an electric TEFC or TEAO motor, Class B, premium efficiency, with a service factor of 1.15, insulated for cooling tower use. Horsepower shall not be exceeded at design operation.
8. Fan motor speed control:
 - a. Provide variable frequency drive (VFD) package capable of motor speeds from 25 to 100 percent. Provide VFD with inverter type, reactors, and clamp modules to prevent motor damage. Motors shall be inverter duty rated.
 - b. Fan cycles shall be limited to 6 on-off cycles per hour.
 - c. Motor control sequencing from high to low speed shall include a minimum delay time of 30 seconds or more as indicated by motor wiring instructions.

- d. Microprocessor based temperature control system shall adjust fan speed to maintain a constant condenser water supply temperature.
9. Locate motor out of the moisture laden discharge air stream of the cooling tower, whenever that option is available for submitted cooling towers.
10. Cooling towers shall have fan and shaft bearings, supported by heavy duty self-aligning bearings with a minimum L-10 life of 40,000 hours, and 280,000 hour average life. Bearing shall be isolated from the airstream inside a heavy steel enclosure.
11. Fan starter shall be located inside chiller room area. Provide indicating lights for fan speeds.
12. Fan stainless steel disconnect shall be provided on fan mounting deck within 6 feet of cooling tower fan motor.

K. Fan Drive.

1. Capacity/Drive:
 - a. Right angle gear drive or direct drive.
2. Right angle gear drive shall have stainless steel drive shaft connected to the electric motor by means of a stainless steel coupling requiring no lubrication.
 - a. Couplings shall be provided with vibration isolation as recommended by cooling tower manufacturer.
 - b. Gear shall require oil changes only every 6 months or 2500 hours.
 - c. Use of synthetic oil and oil changes only once every 5 years are accepted if manufacturer guarantees gear and box with such oil change intervals.
3. Gear speed reducer shall comply with CTI Standard STD-111.
 - a. Equip with spiral bevel with a minimum service factor of 1.6 for load imposed.
 - b. Motor and gear reducer shall rest on a continuous welded SS support assembly.
4. Driveshaft shall be made of stainless steel.
 - a. Provide driveshaft guard(s) that comply with OSHA requirements.
 - b. Composite, fiberglass, carbon, rubber, or plastic drive shafts are not allowed.

L. Lubrication Lines:

1. Extend fan drive lubrication lines to a convenient point outside cylinder, terminating with standard grease fittings.
2. Provide stainless steel gear drive lubrication lines and extend to a convenient point outside fan cylinder. Terminate with a drain plug and dipstick.

M. Cold Water Basin:

1. Sides shall be at least 12 inches high and sealed watertight, even between adjacent cells.

N. Sumps:

1. Deep depressed, for non-vortexing, non-cavitating, non-splashing, non-surging inlet conditions.
2. Provide mesh debris screen and side outlet flanged or Victaulic connection either factory or field installed.

O. Overflow, Bleed-off, and Drain:

1. Cooling towers may be equipped with a pipe overflow set 2 inches below flood rim level of tower.
2. Provide a suitably sized, piped, and trapped bleed-off balancing valve connected to the sanitary sewer.
3. Attach valve to piping between the condenser water return shut-off valve and the cooling tower itself.
4. Provide a suitably sized and piped drain valve piped to the sanitary system. Minimum drain size shall be 4 inch for all cooling towers.

P. Water Makeup:

1. Float operated, factory installed, bronze makeup water valve and separate field installed quick-fill valve for each cell.
2. Valve outlets shall discharge at least 6 inches above tower overflow level.
3. Quick-fill valve shall be at least 2 inch size for towers 100 tons and above.
4. New cooling towers shall be provided with the following items in their domestic water make-up lines:
 - a. A reduced pressure backflow preventer having a 1-1/2" minimum size, and includes proper supports and manufacturer provided valves.
 - b. A sub-water meter used to deduct the sewer charge portion from the cost of the domestic water used by the cooling tower.
 - c. The reduced pressure backflow preventer and the sub-water meter shall be located near the cooling tower, be WASD approved and each shall be sized for a pressure drop of not more than 10 psig and 2% of the condenser water flow.
5. Any existing cooling tower being replaced under scope of this project shall be provided with all items noted in this document unless they already exist, and are in good working order.

Q. Side Discharge Option:

1. Cooling tower complying with all requirements and materials as specified.
2. Provide 304 stainless steel vertical discharge hood with turning vanes and screen, either factory or field assembled shall be furnished and installed.

R. Tower Down-Switches:

1. Vibration sensing cutoff switches shall be adjustable for sensitivity and equipped with a manual reset switch:
 - a. Metrix Instrument Co., Model S173-14
 - b. Marley Model M-1.

- c. PMC-Beata.
- d. Other A/E accepted equivalent.

S. Tower Performance Data:

- 1. Not less than 110 percent of the sum of the chiller's net capacity plus a minimum of 3,000 BTU/ton for compressor mechanical load.

T. Electrical Boxes:

- 1. All electrical boxes in and around the cooling tower subject to the same atmosphere shall be NEMA 4X rated. Fan disconnect box shall be stainless steel.
- 2. Boxes, except specified fan disconnect box, shall be painted as specified or shall be constructed of an accepted corrosion resistant material.

U. Dissimilar Metals:

- 1. Provide proper isolation between dissimilar metals, including between cooling tower, platforms, piping, ladders, handrails, base, or any other component, to prevent galvanic corrosion.

V. Fan Mounting Deck (FMD):

- 1. FMD shall be structurally capable of withstanding an imposed operational and maintenance load of 50 psf or 200 pound concentrated live load without sagging or oil canning.
- 2. FMD shall be removable for access to water distribution system.
- 3. Extended over hot water basin if necessary.

W. Guardrails, Knee Rails, and Toe Stops:

- 1. Comply with OSHA and NFPA 101 requirements.
- 2. Provide around entire perimeter of the fan deck, minimum 42 inches high, whether cooling tower is to be serviced from interior or exterior.
- 3. Materials for guardrail, knee rails, and toe stops, shall be 304 stainless steel, or hot dipped zinc enriched steel according to G-235 mill hot dipped steel construction.
- 4. Supports to cooling tower shall be properly isolated from dissimilar metal contact to prevent galvanic corrosion.

SPECIFIER: Delete ladder for existing cooling towers being replaced that are less than 75 tons.

X. Ladders:

- 1. Provide OSHA compliant maintenance ladder to access doors and fan mounting deck.
- 2. Extend maintenance ladder handrails at least 3 feet above fan mounting deck, and provide initial step within 12 inches of grade.
- 3. Provide safety-cage when required by OSHA.
- 4. Ladder and its safety cage shall be hot dipped zinc enriched steel according to G-235 mill hot, or stainless steel 304.

5. Ladder supports to cooling tower shall be stainless steel, and shall be properly isolated to prevent galvanic corrosion.

SPECIFIER: Delete work platform if side mounted equipment is not installed.

Y. Work Platform:

1. Provide OSHA compliant work platform for accessibility to cooling tower side mounted equipment requiring periodic maintenance.
2. Portions of work platform extending beyond cooling tower perimeter shall be 304 stainless steel or hot dipped zinc enriched steel according to G-235 mill hot dipped steel or aluminum construction.
3. Provide guardrails, knee rails and toe stops around work platform according to these specifications.
4. Supports to cooling tower shall be properly isolated stainless steel.

Z. Field Supports:

1. Cooling tower's base structural supports shall be hot dipped zinc enriched steel according to G-235 mill hot dipped steel construction.
2. Treat exposed steel areas including bolts, with ZRC compound consisting of 95 percent pure zinc.
3. Pre-drill field supports and cooling tower to accept stainless steel through bolts, washers and nuts.
4. Welding of cooling tower to supports is not allowed.
5. Provide minimum base support clearances for roof or other maintenance work as required by Florida Building Code, Construction.

AA. Painting:

1. Condenser water piping, domestic water piping, valving, piping supports, electrical conduits and boxes in and around the cooling tower and subject to its same atmosphere, not stainless steel, aluminum, PVC, or hot dipped galvanized after fabrication, shall be painted with one coat of a high performance rust inhibitive primer such as aluminum epoxy mastic and 2 coats of high performance chemical resistive coating.
2. Paint exposed PVC with 1 primer coat and 2 coats of latex.
3. See Sections 9900 and 9901 for further requirements.
4. Paint containing lead is not allowed.
5. Dry film thickness of paint shall be at least 10 mils.

BB. Fencing:

1. At Ground Floor, Grade Placed Cooling Towers:
 - a. A surrounding 8 foot high hot dipped galvanized fencing, equipped with a lockable 3 foot wide access gate.
 - b. Fencing shall provide a minimum 10 foot clear space between tower or tower accessories and fence.

2. Under Tower Support Perimeter:
 - a. Hot dipped galvanized fencing, with lockable 3 foot wide access gate, to prevent storage under tower.
 3. Fencing shall comply with Section 02830 - Chain Link Fences and Gates.
- CC. At ground floor grade placed cooling towers, clear area within fencing and under tower area, of grass, weeds, brush, and combustible materials, and provide a 3 inch base of pearock over a 15 mil plastic liner.
- DD. Provide accessibility for connecting hoses from a trucked portable cooling tower to full sized flanged connections in the condenser water supply and return piping of the cooling tower. Locate connections between the cooling tower shutoff valves and the chiller.
- EE. Install ground floor, grade placed cooling towers according to NFPA 241 and at least 31 feet from any building or structure or 40 feet from potential fire hazards listed in NFPA 214 paragraphs 2-1(a) and (b) and at least 100 feet from any parking area.
- FF. Site Placement:
1. Single flow crossflow cooling towers shall have air inlet oriented southeast, towards the prevailing summer breeze.
 2. Double flow crossflow cooling towers shall have shortest blank wall oriented southeast, towards the prevailing summer breeze.
 3. Counterflow cooling towers shall have shortest dimension oriented southeast, towards the prevailing summer breeze.
 4. If cooling towers cannot be sited as described above, orient described walls towards best available summer winds at location.
 5. Fan discharge shall be at least 30 feet from any fresh air intake, including generator room.

PART 3 EXECUTION

3.1 ERECTION

- A. Provide services of manufacturer's authorized field erection crew to assemble, rig, or erect tower.

END OF SECTION