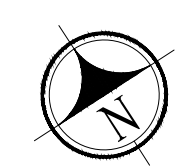


CONSULTANTS:

ROGER LUDLOWE MIDDLE SCHOOL
COOLING TOWER
REPLACEMENT
689 UNQUOWA ROAD
FAIRFIELD, CT 06824

PROJECT NAME:

KEYPLAN

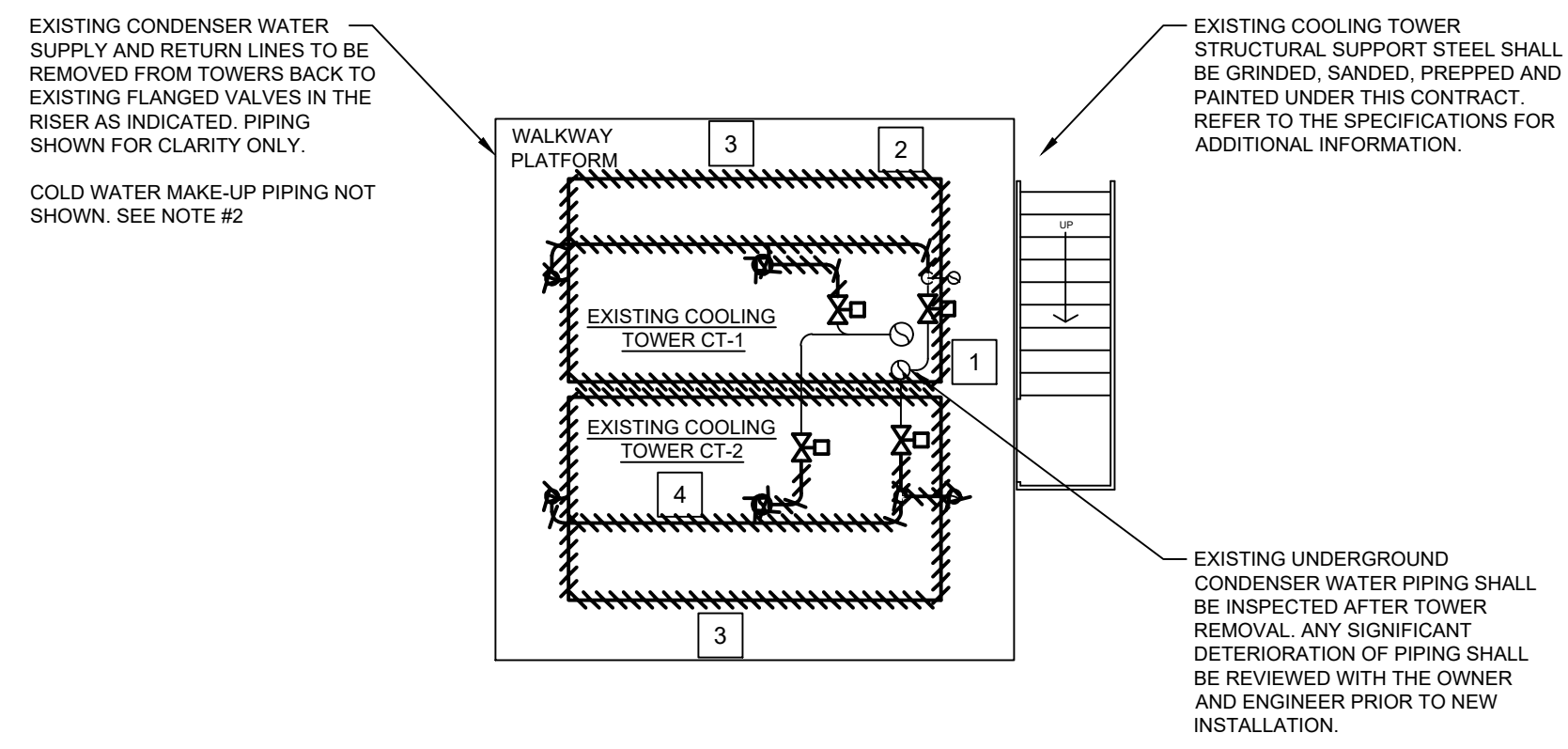


REVISIONS		
REV. NO.	DATE	DESCRIPTION

100% CONSTRUCTION DOCUMENTS

DRAWING TITLE:
MECHANICAL DEMOLITION AND NEW WORK PLANS AND SCHEDULE

DATE: 05/19/20
DRAWN BY: REA
CHECKED BY: WJD
SCALE: AS NOTED
PROJ #: 2018071.00
DRAWING NUMBER:
M101



1 COOLING TOWERS CT-1/CT-2 MECHANICAL DEMOLITION PLAN

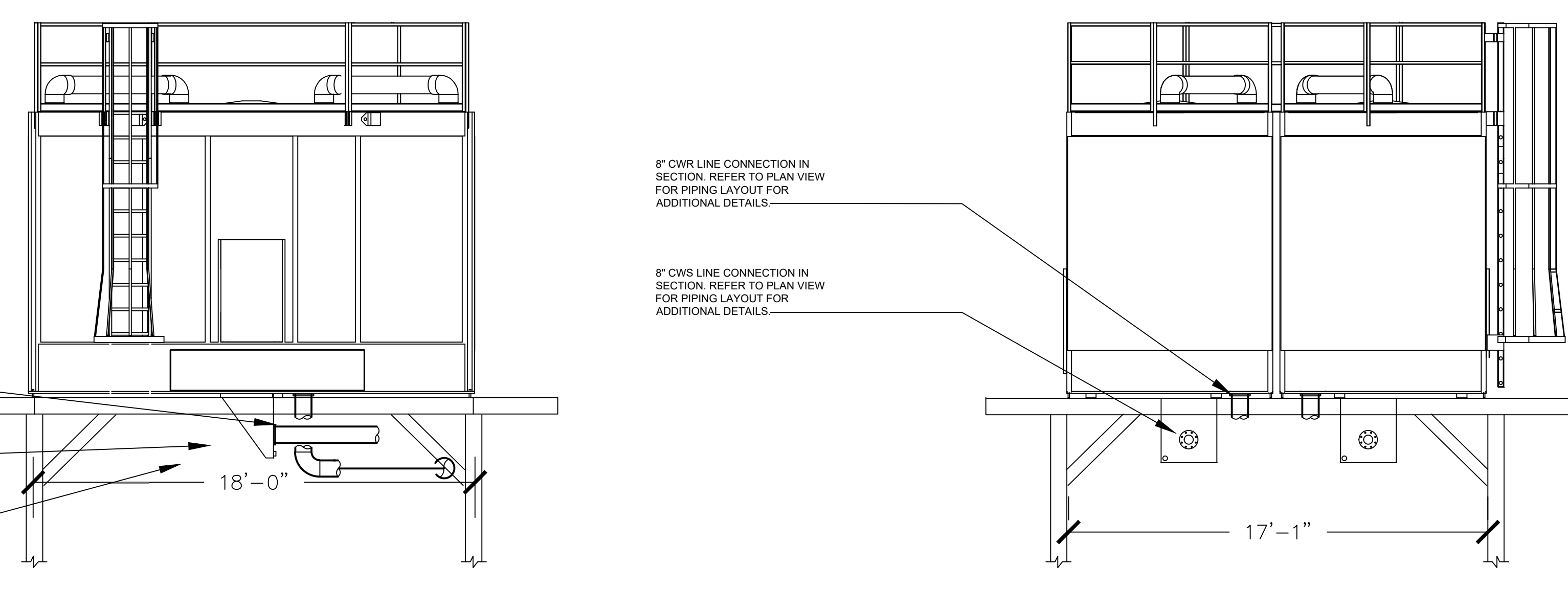
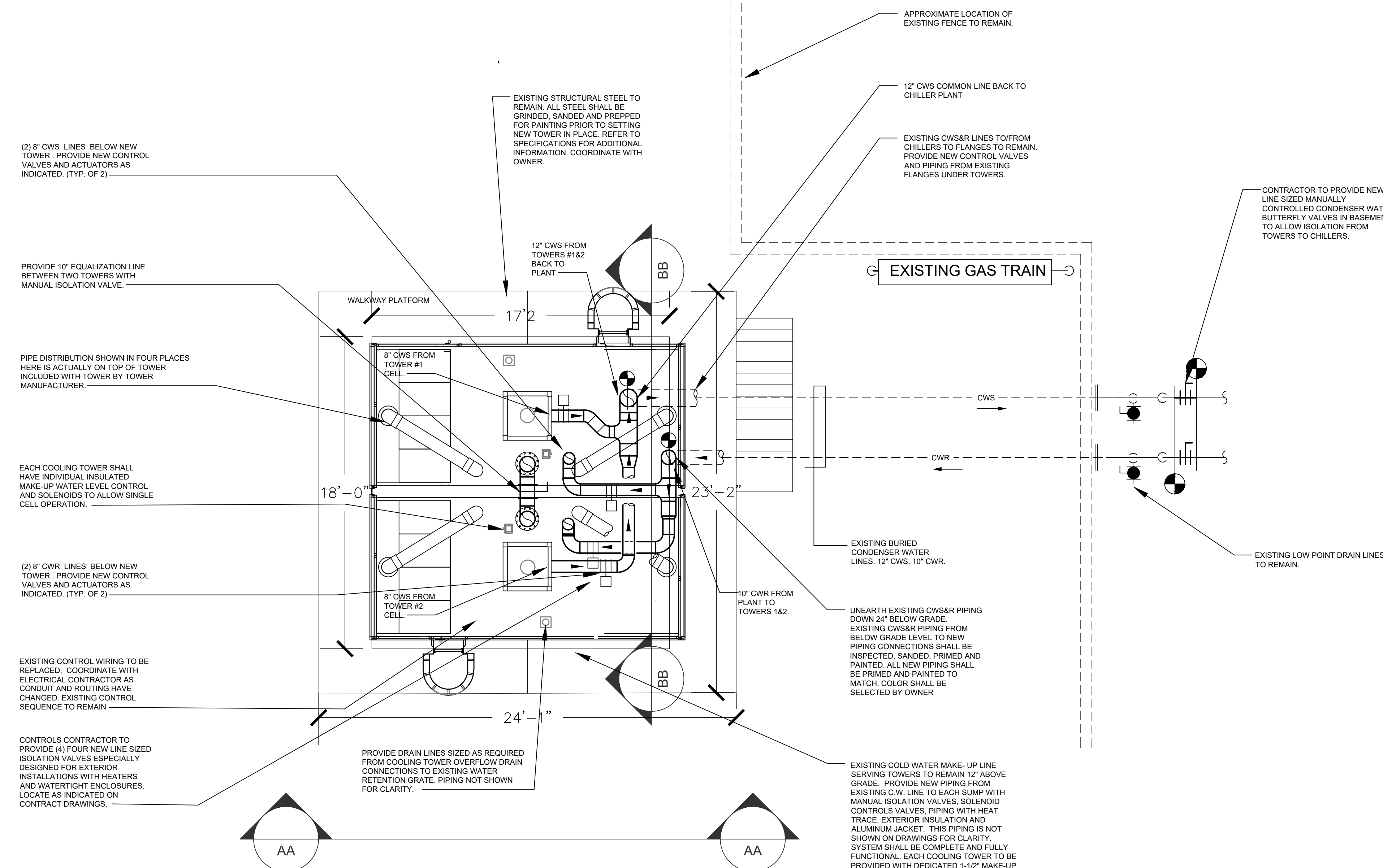
Scale: 1/8"=1'-0"

MECHANICAL DEMOLITION KEY NOTES:

- DISCONNECT BOTH CWS AND CWR PIPING AT EACH TOWER. REMOVE EXISTING CWR PIPING INCLUDING CONTROL VALVES TO EACH TOWER (4 LINES). REMOVE CWS LINES FROM BOTTOM OF TOWERS BACK TO AND INCLUDING EACH CONTROL VALVE. PROVIDE TEMPORARY CAPS TO PROTECT WATER LINES DURING THE REMOVAL. EXISTING COOLING TOWER TO BE REMOVED BY MECHANICAL CONTRACTOR.
- COLD WATER MAKE-UP LINES ARE ELECTRICALLY HEAT TRACED. MECHANICAL CONTRACTOR TO REMOVE COLD WATER MAKE-UP LINES UNDER TOWER BACK TO ISOLATION VALVE RISER AND MAKE SAFE. NEW MAKE-UP LINES TO BE INSTALLED UNDER NEW WORK.
- COORDINATE ELECTRICAL POWER DISCONNECTION AT EQUIPMENT TO BE REMOVED WITH WITH ELECTRICAL CONTRACTOR. REFER TO E101, E201 FOR ADDITIONAL INFORMATION.
- DRAIN LINES FROM TOWERS TO DRAIN TO BE REMOVED.

HX-2: HEATING PLATE AND FRAME HEAT EXCHANGER. AS PART OF THE TOWER COOLING REPLACEMENT, QUALIFIED MECHANICAL CONTRACTOR WITH A MINIMUM 5 YEARS EXPERIENCE TO PROVIDE ALPHA LAVAL HEATING HEAT EXCHANGER PLATE PACK REPLACEMENT. HX-2 IS LOCATED IN THE BASEMENT MECHANICAL ROOM. MC TO PROVIDE ISOLATION OF HEAT EXCHANGER USING ASSOCIATED ISOLATION VALVES. DRAINING AND OPENING OF HEAT EXCHANGER. THIS SHALL INCLUDE CLEANING OF BOTH INLINE STRAINERS. PLATES ARE TO BE REMOVED AND REPLACED WITH FACTORY REPLACEMENT PACKS. PLATE REPLACEMENT PACK BUDGET NUMBER IS \$28,000. CONTACT ALPHA-LAVAL FACTORY REPRESENTATIVE, MICHAEL DEFE0@203) 257-5086 FOR ADDITIONAL INFORMATION AND PRICING. QUALIFIED CONTRACTOR TO CLEAN AND PREP EXISTING END FRAME PLATES AND CARRYING BAR PRIOR TO REASSEMBLY. ONCE PLATE PACKS ARE PROPERLY INSTALLED, TORQUE FRAME AS REQUIRED PER THE FACTORY INSTRUCTIONS. PROVIDE PRESSURE LEAK TESTING AS PER MANUFACTURERS INSTRUCTION. ONCE COMPLETED, TEST WATER QUALITY OF BOTH SIDES OF HEAT EXCHANGER. CONTRACTOR TO INSTALL INSULATED HEAT EXCHANGER COVERS PRIOR TO COMPLETION. ANY INSULATION THAT IS DAMAGED NEAR THE HX SHALL BE REPLACED. VERIFY EXISTING TEMPERATURE AND PRESSURE SENSORS ARE ACCURATE. REPLACE IF NECESSARY. PERFORM AND RECORD PERFORMANCE AUDIT ON REBUILT HEAT EXCHANGER WITH SYSTEM RUNNING UNDER DESIGN OPERATIONAL CONDITIONS RECORDING TEMPERATURES AND PRESSURE AT ALL FOUR CONNECTION POINTS.

HX-1: COOLING PLATE AND FRAME: **ADD ALTERNATE-1** AS AN ADD ALTERNATE A QUALIFIED MECHANICAL CONTRACTOR WITH A MINIMUM 5 YEARS EXPERIENCE TO PROVIDE THE OWNER WITH A DETAILED COST FOR LABOR AND MATERIAL TO REPLACE ALPHA-LAVAL HX-1 PLATE PACK. MECHANICAL CONTRACTOR TO PROVIDE THE FOLLOWING. HX-1 ALPHA LAVAL COOLING HEAT EXCHANGER PLATE PACK REPLACEMENT. HX-1 IS LOCATED IN THE BASEMENT MECHANICAL ROOM. MC TO PROVIDE ISOLATION OF HEAT EXCHANGER USING ASSOCIATED ISOLATION VALVES. DRAINING AND OPENING OF HEAT EXCHANGER. THIS SHALL INCLUDE CLEANING OF BOTH INLINE STRAINERS. PLATES ARE TO BE REMOVED AND REPLACED WITH FACTORY REPLACEMENT PACKS. PLATE REPLACEMENT PACK BUDGET NUMBER IS \$53,000. CONTACT ALPHA-LAVAL FACTORY REPRESENTATIVE, MICHAEL DEFE0@203) 257-5086 FOR ADDITIONAL INFORMATION AND PRICING. QUALIFIED CONTRACTOR TO CLEAN AND PREP EXISTING END FRAME PLATES AND CARRYING BAR PRIOR TO REASSEMBLY. ONCE PLATE PACKS ARE PROPERLY INSTALLED, TORQUE FRAME AS REQUIRED PER THE FACTORY INSTRUCTIONS. PROVIDE PRESSURE LEAK TESTING AS PER MANUFACTURERS INSTRUCTION. ONCE COMPLETED, TEST WATER QUALITY OF BOTH SIDES OF HEAT EXCHANGER. CONTRACTOR TO INSTALL INSULATED HEAT EXCHANGER COVERS PRIOR TO COMPLETION. ANY INSULATION THAT IS DAMAGED NEAR THE HX SHALL BE REPLACED. VERIFY EXISTING TEMPERATURE AND PRESSURE SENSORS ARE ACCURATE. REPLACE IF NECESSARY. PERFORM AND RECORD PERFORMANCE AUDIT ON REBUILT HEAT EXCHANGER WITH SYSTEM RUNNING UNDER DESIGN RUNNING CONDITIONS RECORDING TEMPERATURES AND PRESSURE AT ALL FOUR CONNECTION POINTS.



2 COOLING TOWERS CT-1/CT-2 MECHANICAL NEW WORK PLAN

Scale: 1/4"=1'-0"

UNIT NO.	MANUFACTURER	MODEL & SIZE	CAPACITY		EVAPORATOR					ELECTRICAL DATA			NOISE RATING dBA AT 5FT	WEIGHT		REMARKS			
			TONS	CAPACITY	FLUID	E.F.T. °F	L.F.T. °F	FLOW (GPM)	WET BULB °F	EVAP. (GPM)	FANS	AIR FLOW		# FANS H.P.	PH		VOLTS	SHIPPING	OPERATING
			CT-1	MARLEY	NC8403PLN2	300	4,500 MBH	WATER	95 °F	85 °F	900	78 °F	19.0	70"7 BLADES	83,960		(1) 15.0	3	480
CT-2	MARLEY	NC8403PLN2	300	4,500 MBH	WATER	95 °F	85 °F	900	78 °F	19.0	70"7 BLADES	83,960	(1) 15.0	3	480	74	7,100	15,500	NOISE RATING IS AT FAN INLET

REFER TO SPECIFICATIONS FOR MATERIALS AND OPTIONS.
EACH TOWER SHALL BE CAPABLE OF RUNNING INDEPENDENTLY. EACH BASIN SHALL HAVE ELECTRONIC LEVEL SENSOR AND SOLENOID VALVES FOR EACH CELL.
TOWER INSTALLATION TO MATCH EXISTING STEEL AT NO COST TO THE OWNER.

SECTION 23 0000 - HVAC SPECIFICATION

PART 1 - GENERAL

1.1 GENERAL

- A. All work shall be done in strict accordance with all applicable Codes and Regulations of local and State Agencies and utility companies. This Contractor shall bear the cost of all fees, permits, licenses and taxes and any utility company charges in connection with the work. All equipment installed shall be UL listed.
- B. AIA Document A201-2007 "General Conditions of the Contract for Construction" is hereby made part of these Specifications.
- C. Prime Contractor shall be the Mechanical Contractor who shall arrange and be responsible for all work in Contract Documents including any subcontracted work.

1.2 SCOPE

- A. Provide a complete HVAC system and all other equipment as shown on the Drawings and herein specified, including but not limited to:
 1. Removal of existing and installation of new cooling towers. System shall be complete in all respects, tested, accepted and ready to operate.
 2. Provide HX-2 plate pack replacement. Heat exchangers located in basement mechanical room. Provide add alternate numbers for HX-1 plate pack change out.
 3. Refer to drawings and specifications for details.

1.3 SUBMITTALS

- A. Submit manufacturer's drawings of the following to the Engineer for approval:
 1. Submit information on all equipment to be used, cooling towers, piping, insulation, valves and controls etc.
 2. Submit electronic shop drawings of piping shop drawings showing clearances with structural members and major equipment of other trades.
 3. Provide shop drawings of cooling towers.

1.4 GUARANTEE

- A. Materials, equipment and workmanship shall have standard warranty against defects in material and workmanship. Any failure due to defective or improper material, equipment, workmanship or design shall be made good, forthwith, by and at the expense of the Contractor, including any damage done to areas, materials and other systems resulting from this failure. Guarantee period shall extend for one year from the Date of Acceptance.
- B. The Mechanical Contractor shall provide a guarantee covering all material, workmanship, and labor for 1 year following the Date of Acceptance.

1.5 DEFINITION

- A. As used on Contract Documents, the term "to provide" shall mean "to furnish, install and connect completely in the specified or approved manner the item or material described."

1.6 OPERATING AND MAINTENANCE INSTRUCTIONS

- A. Upon completion of the project, the Mechanical Contractor shall fully instruct the Owner in the operation, adjustment and maintenance of all equipment and systems furnished.
- B. The Mechanical Contractor shall provide the Owner with three (3) sets of complete maintenance and operating instructions, and technical data, in booklet form, of all equipment and devices furnished in the Contract.

1.7 CONTRACTOR'S INSPECTION

- A. Contract Drawings are diagrammatic and do NOT show every required fittings, etc. The Mechanical Contractor shall familiarize himself with the existing site conditions, prior to submitting a bid, and shall include all equipment and accessories necessary for complete and operational systems.
- B. The Mechanical Contractor shall examine the Mechanical / Electrical Drawings and specifications to determine the extent of work. The Mechanical Contractor shall visit the site and become familiar with the project and local conditions before submitting a Bid. Drawings are diagrammatic and indicate the general arrangement of systems and work included in the Contract. If so directed by the Engineer, the Mechanical Contractor shall, without extra charge, make reasonable modifications in the layout to prevent conflict with those of other trades and for proper installation of work. The Mechanical Contractor shall coordinate locations of equipment with all trades before starting construction. Any modifications to the equipment layout required for installation shall be performed at no additional cost to the Owner.

1.8 ARRANGEMENT OF WORK

- A. Work shall be coordinated between trades to prevent unnecessary interference. Work shall present a neat coordinated appearance. Install work as necessary to provide maximum possible headroom, adequate clearance and ready access for inspection, operation, safe maintenance and repair, and Code conformance. Where space appears inadequate, consult the Owner before proceeding with installation.

1.9 INSURANCE

- A. Furnish insurance certificates required by the Owner.

1.10 PERMITS, LAWS, ORDINANCES, CODES AND STANDARDS

- A. Obtain and pay for permits, inspections, licenses and certificates required. Work of this Contract shall meet current accepted editions of the State Building Code, State Fire Safety Code and other laws, rules and regulations of local, State and Federal authorities including, but not limited to: National Fire Protection Association #13; National Fire Protection Association #90A; National Fire Protection Association #90B; National Fire Protection Association #99; International Plumbing Code; International Mechanical Code; National Fire Protection Association #70 (National Electrical Code); and local utility company requirements. Pay utility company backcharges. Equipment, materials and components listed UL Product Directories, shall bear UL labels.

1.11 FILTERS AND STRAINERS

- A. Any equipment which operates with filters or strainers shall have filters and strainers installed at all times.

1.12 WORK BY OTHERS

- A. The Mechanical Contractor shall install all motors provided under the HVAC Contract ready for wiring by the Electrical Contractor and shall furnish and deliver to the Electrical Contractor wiring diagrams for all motor starters for installation and wiring. The Mechanical Contractor shall furnish motor starters, relays and all temperature control equipment to the Electrical Contractor for installation and wiring. The General Contractor shall perform all excavation, backfill, chases, openings, cutouts, patching and finish work. Rigging of cooling towers is also inclusive in this Contract.

1.13 FIELD MEASUREMENTS

- A. The Mechanical Contractor shall verify in the field all measurements necessary for the work.
- B. The Mechanical Contractor shall coordinate supply and return condenser water piping at all locations with structure, conduits and piping of other trades.

1.14 WORKMANSHIP

- A. Equipment and materials shall be new, of first quality, selected and arranged to fit properly into spaces indicated. Install equipment and materials in accordance with manufacturer's recommendations.

1.15 COORDINATION WITH OWNER

- A. All work shall be scheduled with the Owner. Interruptions in the Owner's access to the site shall be subject to Owner limitations of date and duration.

1.16 OPERATION OF SERVICES AND UTILITIES

- A. Shutdown of existing services and utilities shall, without exception, be coordinated with the proper utility and with the Owner as to date, time of day, and duration before any service is interrupted. Notify the Owner of estimated duration of shutdown period at least ten days in advance of proposed shutdown.

1.17 PROTECTION

- A. Close open ends of work with temporary covers or plugs during construction to prevent entry of obstructing material or damaging water. Protect existing property, equipment and finishes from damage. Repair, to original condition, existing property that has been damaged during execution of the work.

1.18 CLEANING

- A. Work site must be kept clean. Rubbish, debris and leftover or excess materials shall be removed daily.

1.19 LUBRICATION

- A. No equipment shall be operated for temporary service or testing without proper lubrication. Items requiring lubrication shall be left freshly and fully lubricated at time of substantial completion. Furnish Owner with one (1) complete new set of any special lubrication devices required for servicing, e.g., grease guns, fittings and adapters.

1.20 PAINTING

- A. All new condenser water supply and return piping shall be painted with primer to match structural steel frame. Existing tower structural steel shall be cleaned with industry standard preparation SSPC-SP-3. All loose paint removed and prepried to receive new primer coats over the entire structural steel platform. Repaint steel with two coats of primer. Color to match to be selected by owner.

1.21 CUTTING AND PATCHING

- A. Areas destroyed by new construction or demolition shall be patched and repaired to match existing conditions. Patch painting of other surfaces shall be to nearest cut-off point.

1.22 WATERPROOFING

- A. Provide necessary sleeves, caulking and flashing required to make openings waterproof.

1.23 FIREPROOFING

- A. At closing of each working day, provide temporary firestopping in every opening cut between floors and through fire-rated partitions. Permanent firestops shall be provided around sleeves and at other permanent openings through fire-rated partitions and floors, as required. Materials used for fire stopping shall be Class A "Noncombustible" with firestopping capabilities equal to that of adjacent construction.

1.24 BASES AND SUPPORTS

- A. Provide necessary supports, pads, bases and piers required. Equipment shall be securely attached to building structure in acceptable manner. Attachments shall be of strong and durable nature, as determined by the Owner.

1.25 ACCESS

- A. Provide adequately sized access doors, for access to concealed equipment and components requiring servicing or inspection. Doors shall have fire ratings equal to construction in which they are located.

1.26 TESTS

- A. Perform tests required by the Owner, legal authorities and agencies. Each piece of equipment, including motors and controls, shall be operated continuously for minimum one-hour test. Correct all defects appearing during tests, and repeat tests until no defects are disclosed. Final tests shall be made in the Owner's presence.

1.27 INSTRUCTION TRAINING

- A. Competent technicians shall provide instruction to Owner's personnel. Instructions shall include, but are NOT limited to, following:
 1. Familiarization with HVAC Control System, hardware and operation procedures.
 2. Familiarization with Management System Hardware.
 3. Use of management system.
 4. Modifications of software packages.
 5. Trouble-shooting and service procedures.

PART 2 - PRODUCTS

2.1 MATERIALS AND METHODS

A. Piping:

1. Condenser water supply and return piping 2-1/2 inches and larger shall be Schedule 40 black steel with welded or flanged fittings. Piping two (2") inches and smaller shall be Schedule 40 black steel with Class 125 cast iron screwed fittings.
2. Cooling coil condensate drain piping shall be Type "M" copper with wrought copper pressure fittings and 95/5 solder. Use 45 degree lateral type fittings and long sweep elbows. No tees or short radius elbows will be allowed.
3. Cold water make-up piping shall be Type "M" copper with wrought copper pressure fittings and 95/5 solder.
4. Water system piping shall be run level. Take-offs shall be made from the bottom of the main or at 45 degrees from the bottom of the main. Provide drain valves at all low points; manual air vents at all high points. Use eccentric reducers on horizontal lines, flush to top of the pipe.
5. Provide unions and shut-off valves at all equipment, coils, etc.
6. All piping shall be supported in a manner to prevent vibration or sagging. In no case shall the hanger spacing exceed the distances listed in the current accepted edition of the International Mechanical Code.

B. Valves:

1. Globe: Nicco #T-235, Stockham #B-22.
2. Check (2" and smaller): Nicco #T-433-Y, Hammond #HB94.
3. Check (2-1/2" and larger): Nicco #F91 8, Hammond #R1124.
4. Ball Valves: Apollo #70-100, Jamesbury #A11TT.
5. Butterfly: Stockham #LD-711, Keystone #AR-2.
6. Balancing: Armstrong CBV or Bell & Gossett "Circuit Setter".
7. Hose Bibb Drain: Nicco #74, Central Brass #545.

C. Insulation Systems:

1. Piping systems shall be insulated in accordance with the following schedule (all conforming to ASHRAE Standard 90.1):
 - a. Cold Water Piping:
 - 1) 3/4" through 2" pipe: 1-1/2" fiberglass
 - 2) 2-1/2" through 6" pipe: 2" fiberglass
 - b. All indoor fiberglass piping insulation shall have all service jacket and zeston covers on all fittings, valves, etc.
 - c. Piping exposed:
 - 1) All sizes: 3" thick expanded cellular glass or 1-1/2" thick urethane foam pipe insulation. Provide watertight aluminum jacket with fitting and valve covers.
 - 2) All make-up water piping shall be heat traced prior to insulation. Heat trace by Div. 26. Insulation Div. 23.
 - f. Piping insulation shall run continuous through all pipe hangers. Protect insulation with 1/2" long sheet metal insulation protection saddles. Under saddles of piping 1-1/2" or larger, substitute rigid/calcium silicate insulation inserts for the specified insulation and of the same thickness as the specified insulation.
 - g. Maintain the integrity of all piping vapor barriers. Should condensation develop on any pipe, fitting, etc., the Mechanical Contractor shall correct the vapor barrier break and replace any insulation damaged by moisture.

2.2 AUTOMATIC TEMPERATURE CONTROLS

- A. Cooling tower unit shall be controlled by the building automation controls system. Original sequences and point configuration to remain. Automated Logic to provide engineering and support and as required to meet original sequences. Verify existing sensors, wiring and programming is complete in all aspects for a fully operational system. Any new temperature wells, if required shall be coordinated and provided by the mechanical contractor. Refer to electrical drawings as required, new control wiring to be provided in new conduit.
- B. Cooling tower controls shall interface with existing Automated Logic DDC system currently in the building. Existing Automated Logic cooling tower interface DAX100 module from previous cooling tower shall be re-installed in new cooling towers CT-1&2. Extend all control wiring as required for a complete installation. Provide new control wiring to towers as required. Refer to Electrical plan E101 and the specifications for wiring route as new conduit runs are being provided.
- C. Automated Logic shall provide shop drawings prior to installation.
- D. Controls contractor to provide automated cooling tower control valves suitable for exterior installation. Valves shall be weather tight and provided with interior heaters, and proper power wiring enclosures.

PART 3 - COOLING TOWER

3.1 COOLING TOWER WARRANTY

- A. Stainless steel cooling tower comes with a factory 5-year warranty from date of shipment, Mechanical Contractor to provide 1-year labor warranty.

3.2 SUMMARY

- A. The Mechanical Contractor shall furnish and install cooling towers as shown and as scheduled on the contract documents. The unit(s) shall be installed in accordance with this specification and perform at the conditions specified, scheduled or as shown on the contract drawings.

3.3 MANUFACTURERS

A. General

- 1. Manufacturer of cooling tower products shall have had a minimum of five years successful experience in the manufacture and service support of the cooling towers specified herein. Manufacturers with less than five years experience in the production of cooling towers units of the sizes and types specified shall not be acceptable.

B. Approved Manufacturers

- 1. Marley. #NC8403PLN2: If Mechanical Contractor decides to submit on a different cooling tower unit manufacturer, the Mechanical Contractor will be responsible for any additional costs, including additional steel support, structural analysis and any other material related to the installation of the cooling towers. Equal substitutions shall Evapco or BAC meeting specifications herein.

3.4 GENERAL UNIT DESCRIPTION

A. Base:

1. Provide an induced draft, crossflow type, factory assembled, film fill, industrial duty, stainless steel cooling tower situated as shown on the plans. The limiting overall dimensions of the tower shall be 18.17 ft wide, 17.087 ft long, and 11.94 ft high. Total operating power of all fans shall not exceed 30 BHP, consisting of 2 @ 15 Hp motor(s). Tower shall be similar and equal in all respects to Marley #NC8403PLN2.

2. The cooling towers shall be designed for quiet operation, and shall produce an overall level of sound not higher than 74 dB(A) measured at 5'-0" ft from the location: Air Inlet Face. Sound levels shall be independently verified by a CT-licensed sound test agency to ensure validity and reliability of the manufacturers published values.

B. Thermal Performance:

1. The cooling tower shall be capable of cooling 1800 gpm of water from 95 °F to 85 °F at a design entering air wet-bulb temperature of 78 °F and its thermal rating shall be Certified by the Cooling Technology Institute.
2. The cooling tower shall be capable of a minimum 79.752 gpm/Hp efficiency per ASHRAE Standard 90.1.

C. Performance Warranty:

1. CTI Certification not withstanding, the cooling tower manufacturer shall guarantee that the cooling tower supplied will provide the specified performance conditions when the cooling tower is installed according to plan.

D. Design Loading:

1. The cooling tower structure, anchorage and all its components shall be designed by a licensed professional engineer, employed by the manufacturer, per the International Building Code to withstand a wind load of 30 psf, as well as a 3g seismic load and shall be designed in accordance with OSHA guidelines.
2. The cooling tower shall be structurally capable of being supported at the four outer corners of the tower cell. Alternatively, the cooling tower manufacturer shall provide supporting steel to adapt tower to be supported at four outer corners.

E. Construction:

1. Except where otherwise specified, all components of the cooling tower shall be fabricated of stainless steel. The cooling 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. The circulating water shall contain no oil, grease, fatty acids or organic solvents.
2. The cooling tower shall be listed in the current FM Approval Guide (approvalguide.com) and conform to the FM Approval Standard for Cooling Towers, Class Number 4930 that is approved for use without sprinkler systems. The cooling tower shall have successfully passed full scale fire testing, static and cyclic wind pressure testing, large missile impact testing (for Zone HW), and structural design evaluation as administered by FM-Approvals. The cooling tower shall be capable of 170-140 psf for Zone H as defined by FM Global. A copy of the FM Approval Certificate of Compliance, dated November 2013 or later shall be available upon request.

F. Mechanical Equipment:

1. Fan(s) shall be propeller-type, incorporating aluminum alloy blades attached to galvanized hubs with U-bolts. Blades shall be individually adjustable. Maximum fan tip speed shall be 13,000 ft/min. Fan(s) shall be driven through a right angle, industrial duty, oil lubricated, geared speed reducer that requires no oil changes for the first five (5) years of operation. All gearbox bearings shall be rated at an L10A service life of 100,000 hours or greater and the gear sets shall have AGMA Quality Class of 9 or greater. The gearbox shall include any modifications to enable operation down to 10% of full speed.
2. An external oil level dipstick shall be located adjacent to the motor at the fan deck surface and shall be accessible from a portable maintenance ladder.
3. Fan motor(s) shall be 15 Hp maximum, NEMA Premium Efficiency, TEFC, 1.15 service factor, inverter duty, variable torque, and specially insulated for cooling tower duty (Class F). Speed and electrical characteristics shall be 1800 rpm, single-winding, 3-phase, 60 Hz, 480 volts. Motor shall operate in the shaft-horizontal position for geardrive towers and shaft-down position for belt drive towers. Nameplate horsepower shall not be exceeded at design operation. Motors shall be furnished with shaft grounding rings.
4. The motor to gearbox close coupling shall be a tire-type, single piece, flexible element design to accommodate frequent speed changes that are inherent with VFD applications.
5. The complete mechanical equipment assembly for each cell shall be supported by two horizontal steel beams that resist misalignment between the motor and the gear reducer/belt drive system. The mechanical equipment assembly shall be warranted against any failure caused by defects in materials and workmanship for no less than five (5) years following the date of cooling tower shipment. This warranty shall cover the fan, speed reducer, drive shaft and couplings, and the mechanical equipment support. The electric motor shall carry a manufacturer's warranty of at least one year.
6. A factory installed terminal box shall be furnished and mounted to the outside of the cooling tower where applicable. The fan motor and optional components—including the vibration switch and water level probes—shall be factory wired to terminal points inside the terminal box. Optional tower components which ship loose, including the oil level switch and immersion heaters shall be field wired in the terminal box. Enclosure shall be NEMA 3R or NEMA 4X with hinged and lockable door meeting UL and CSA standards. Terminal box shall include lockable stainless steel snap-latch door fasteners, terminal blocks marked with wire numbers, sub-panel and a wiring diagram. Complete assembly shall be built to UL 508A standards. Conduit entry and exit points shall be the bottom of the enclosure preventing water collection in the enclosure.
7. A vibration limit switch in a NEMA 4X housing shall be installed on the mechanical equipment support and wired to the shutdown circuit of the fan motor starter or VFD. The purpose of this switch will be to interrupt control power voltage to a safety circuit in the event of excessive vibration causing the starter or VFD equipment to de-energize the motor. It shall be adjustable for sensitivity, and include a means to reset the switch.

G. Fill, Louvers and Drift Eliminators:

1. Fill shall be film type, thermofomed of PVC, with louvers and eliminators formed as part of each fill sheet. Fill shall be suspended from hot dip galvanized structural tubing supported from the tower structure, and shall be elevated above the floor of the cold-water basin to facilitate cleaning. Air inlet faces of the tower shall be free of water splash out.
2. Drift eliminators shall be PVC, triple-pass, and shall limit drift losses to 0.005% or less of the design water flow rate.

H. Hot Water Distribution System:

1. Two open stainless steel basins (one above each bank of fill) shall receive hot water piped to each cell of the tower. These basin components shall be installed and sealed at the factory and assembled with bolted connections. Tap screws shall not be allowed due to their potential to develop leaks. The basins shall be equipped with removable, stainless steel covers capable of withstanding the loads described in paragraph 4.1. The water distribution system shall be accessible and maintainable during tower fan and water operation.
2. Each cell of the cooling tower shall include a single hot-water inlet connection located as shown on the plans. An internal system of PVC piping shall deliver water equally to the distribution basins without the need for balancing valves. This internal piping system shall require no scheduled maintenance, and shall be located such that it does not interfere with normal maintenance access. The internal piping shall extend to the exterior surface of the cooling tower.
3. The water distribution system shall be accessible and maintainable while cooling tower is operating.

I. Casing, Fan Deck and Fan Guard:

1. The casing and fan deck shall be stainless steel, and shall be capable of withstanding the loads described in paragraph 4.1. The top of the fan opening shall be equipped with a conical, non-sagging, removable fan guard, fabricated of welded 5/16" and 7 gauge rods. Fan cylinders 5'-0" in height and over shall not be required to have a fan guard.

J. Access:

1. A large stainless steel, rectangular access door shall be located on both cased faces for entry into the cold-water basin. Doors shall provide convenient access to the fan plenum area to facilitate inspection and allow maintenance to the fan drive system. The access doors shall be at least 30" wide by 48" high.
2. The air inlet faces of the tower shall be covered by 1" mesh hot dipped galvanized steel wire screens. Screens shall be secured to removable galvanized L-edge frames. Screens shall be designed to permit full access to the cold-water basin by removal of one panel on each air inlet.
3. A large stainless steel, rectangular access door shall be located on both cased faces for entry into the cold-water basin. Doors shall provide convenient access to the fan plenum area to facilitate inspection and allow maintenance to the fan drive system. The access doors shall be at least 30" wide by 48" high.
4. The top of the cooling tower shall be equipped with a guardrail complete with knee rail and toe board, designed according to OSHA guidelines and factory welded into subassemblies for ease of field installation. The guardrail assembly shall be hot dipped galvanized after welding and capable of withstanding a 200 pound concentrated live load in any direction. Posts shall be spaced on centers of 9'-0" or less. A 1 1/2" wide aluminum ladder with 2" t-beam side rails and 1.25" diameter rungs shall be permanently attached to the endwall casing of the tower, rising from the base of the tower to the top of the guardrail.
5. Provide one ladder extension for connection to the foot of the ladder attached to the cooling tower casing. This extension shall be long enough to rise from the roof (grade) level to the base of the cooling tower. The installing contractor shall be

responsible for cutting the ladder to length; attaching it to the foot of the cooling tower ladder; and anchoring it at its base.

6. A heavy gauge aluminum safety cage, welded into subassemblies for ease of field installation, shall surround the ladder, extending from a point approximately 7'-0" above the foot of the ladder to the top of the guardrail. Maximum weight of welded subassemblies shall not exceed 20 lb for ease of installation.
7. A steel, self-closing gate shall be provided at the guardrail level of the ladder.
8. The existing access platform at the base of the tower extending from the stairs around the entire tower shall remain.
9. Provide a factory-installed walkway extending from one cased-face access door to the other cased face. A steel framework shall support the walkway and the top of the walkway shall be at or above the cold-water basin overflow level. The walkway and framework to be equivalent material as the tower basin and have a minimum width of 36".

K. Cold Water Collection Basin:

1. The collection basin shall be welded stainless steel construction. The basin shall include the number and type of suction connections required to accommodate the outflow piping system shown on the plans. Suction connections shall be equipped with stainless steel debris screens. An overflow and drain connection shall be provided in each cell of the cooling tower. The basin floor shall slope toward the drain to allow complete flush out of debris and silt that may accumulate. Cooling towers of more than one cell shall include a method for flow and equalization between cells. The basin shall be accessible and maintainable while water is circulating. All steel items that project into the basin shall also be made of stainless steel.
2. Provide a water level control system including a NEMA 4X control panel, water level probes and probe stiling chamber in each cell. The control system shall monitor the water level in the cold-water basin to determine level events used for cold-water make-up, high and low alarms or pump shut down. The control panel shall use electromechanical relays providing power for the make-up solenoid and electrical contacts for alarm and pump shutdown control circuits. Probes shall be contained in a vertical stiling chamber to stabilize the water in the cold-water basin. Probes shall have replaceable stainless steel tips and level height shall be field adjustable.
3. A hole and bolt circle shall be provided in the depressed section of the basin for equalizer piping between cells. A full-face, 25" thick, 50 durometer gasket shall be provided at each equalizer location. Equalization line shall be a minimum of 8" with line sized butterfly shut off.

PART 4 - EXECUTION

4.1 FIRE STOPS

- A. All penetrations through fire rated walls, ceilings or floors in which pipes pass shall be sealed with a UL approved fire-stop fitting classified for an hourly rating equal to the rating of the wall, ceiling or floor.

4.2 REMOVAL, RELOCATION AND/OR ABANDONMENT

- A. Certain items of existing equipment and piping may be indicated for removal, relocation or abandonment. Items noted for removal shall be disconnected and turned over to the Owner or disposed of by the Mechanical Contractor if the Owner so requests. Items noted for relocation are intended for reuse in another location as designated on the contract drawings. It shall be the responsibility of the Mechanical Contractor to remove the material from its present location, store the material in a safe place and reinstall the material in its new location. Questions regarding the suitability of the material or equipment shall be brought to the attention of the Engineer in writing. Abandonment shall be defined as abandoning in place any item so designated and shall include proper piping or ductwork termination within any occupied or open area. All abandoned pipes and ducts shall be disconnected and capped at their mains. All abandoned pipes shall be capped.

4.3 PIPE PRESSURE TESTING

- A. Piping systems shall be pressure tested as indicated below for each system. All piping shall be tested before it is covered, concealed or made otherwise inaccessible.
- B. Leaks found during pressure tests shall be corrected by remaking the joint, tightening or other suitable method. The Mechanical Contractor shall not add any "stop-leak" type compounds to the piping system.
- C. Any system requiring leak repair shall be retested in the same manner as the original test.
- D. The Mechanical Contractor shall furnish all booster pumps, compressors, hoses and equipment required to perform all pressure tests.

4.4 CLEANING OF CONDENSER WATER LOOP:

- A. All piping systems shall be thoroughly cleaned before placing in operation to rid the system of dirt, piping compound, mill scale, oil and any and all other material foreign to the system. Circulate and flush cooling towers and new piping prior to opening building isolation valves in Basement. All pumps and hoses to be provided by contractor to provide circulating and flushing requirements. Chemically treat final fill at completion.

4.5 BALANCING AIR SYSTEMS

- A. This contract is for all labor, materials and equipment required for the condenser water systems.
- B. Condenser water systems to be balanced including existing condenser water pumps and heat exchanger. The Balancing Contractor shall secure a set of as-built plans prior to commencing work.
- C. The Balancing Contractor shall attend a coordination meeting with the Mechanical and ATCS Contractors to coordinate balanced flows to each operating cooling tower.
- D. Upon completion of all tests and balancing operations, the Mechanical Contractor shall submit five (5) copies of the certified Balancing Report to the General Contractor. This report shall include all data for each of the air and water systems.
- E. Balancing of systems shall be followed up after building is occupied; any rebalancing shall be done as required to meet occupant's requirements without extra charge.

4.6 START UP AND ADJUSTMENT

- A. Startup of equipment shall be performed according to manufacturer's recommendations. Startup and adjustment shall include services required to check out, test and balance devices to ensure proper sequencing of operation, prior to instruction of the Owner's maintenance personnel.
- B. Prior to startup, equipment shall be checked for physical damage, loose connections, loose parts, leaks and other defects and defects shall be corrected.
- C. Furnish startup/adjustment services by manufacturer for following equipment. Manufacturer shall be responsible for supervising and inspecting equipment installation and for equipment start up and adjustment.
 1. Cooling towers, water level indicator, cold water make-up.
 2. Heat trace of make-up water lines coordinated with Div. 26.
 3. Controls for isolation valves and fan speed control.
 4. Heat exchanger rebuild and start-ups shall be performed according to manufacturers recommendations.

END OF SECTION

VANZELM
ENGINEERS

VANZELM HEYWOOD & SHADFORD, INC.
118 TALCOTT NOTCH FARMINGTON, CT 06032
TEL: (860) 284-3044 FAX: (860) 284-3008

CONSULTANTS:

PROJECT NAME:
**ROGER LUDLOWE MIDDLE SCHOOL
COOLING TOWER
REPLACEMENT
689 UNQUOWA ROAD
FAIRFIELD, CT 06824**

KEYPLAN



REVISIONS		
REV. NO.	DATE	DESCRIPTION

**100% CONSTRUCTION
DOCUMENTS**

DRAWING TITLE:

**MECHANICAL
SPECIFICATIONS**

DRAWING NUMBER:	
DATE:	05/19/20
DRAWN BY:	REA
CHECKED BY:	WJD
SCALE:	NO SCALE
PROJ. NO.:	2018071.00

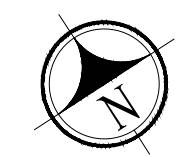
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CONSULTANTS:

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COOLING TOWER
REPLACEMENT
689 UNQUOWA ROAD
FAIRFIELD, CT 06824**

PROJECT NAME:

KEY PLAN



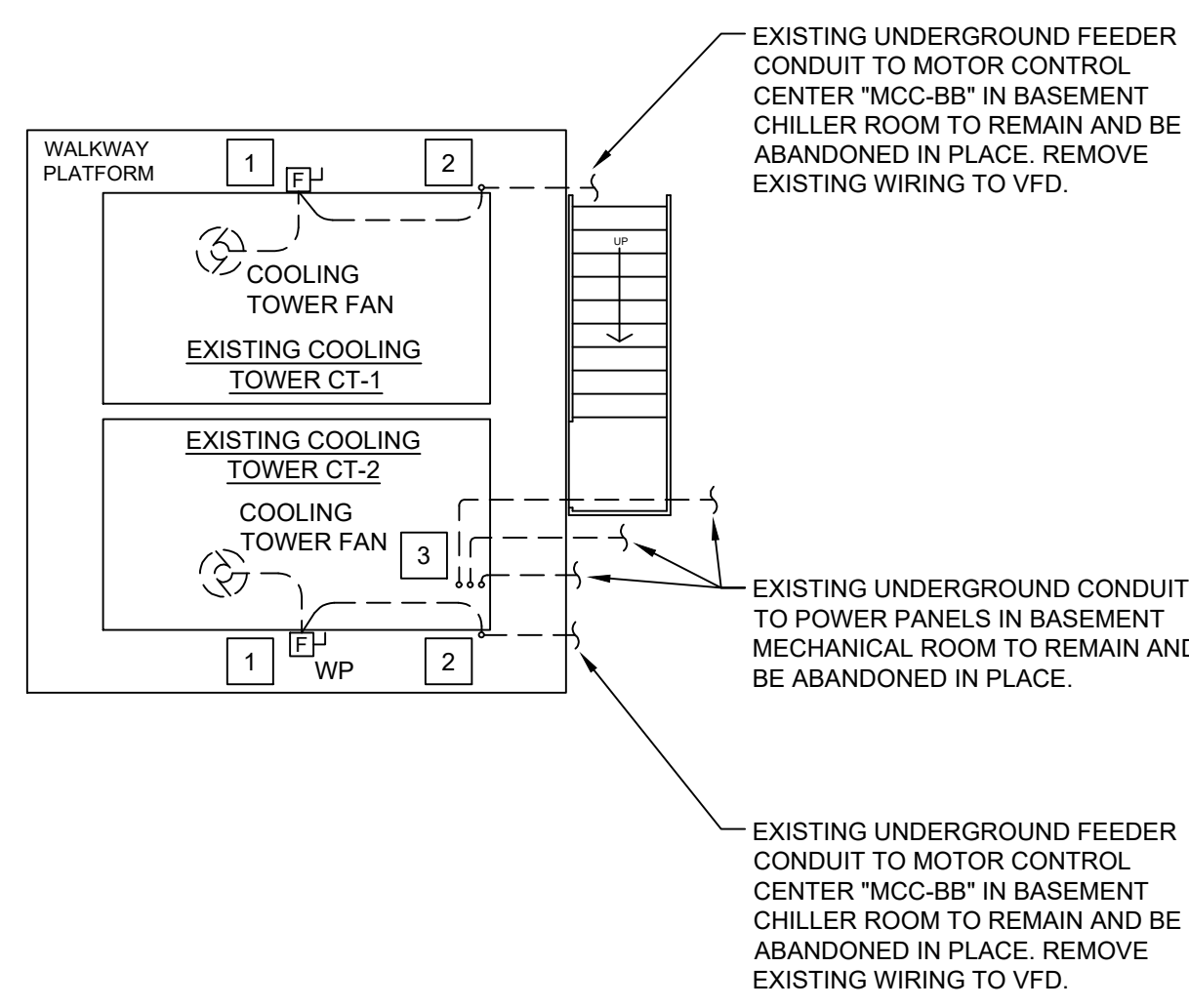
REVISIONS		
REV. NO.	DATE	DESCRIPTION

100% CONSTRUCTION DOCUMENTS

DRAWING TITLE:
ELECTRICAL DEMOLITION AND NEW WORK PLANS, DETAILS, SCHEDULE

DRAWING NUMBER:
E101

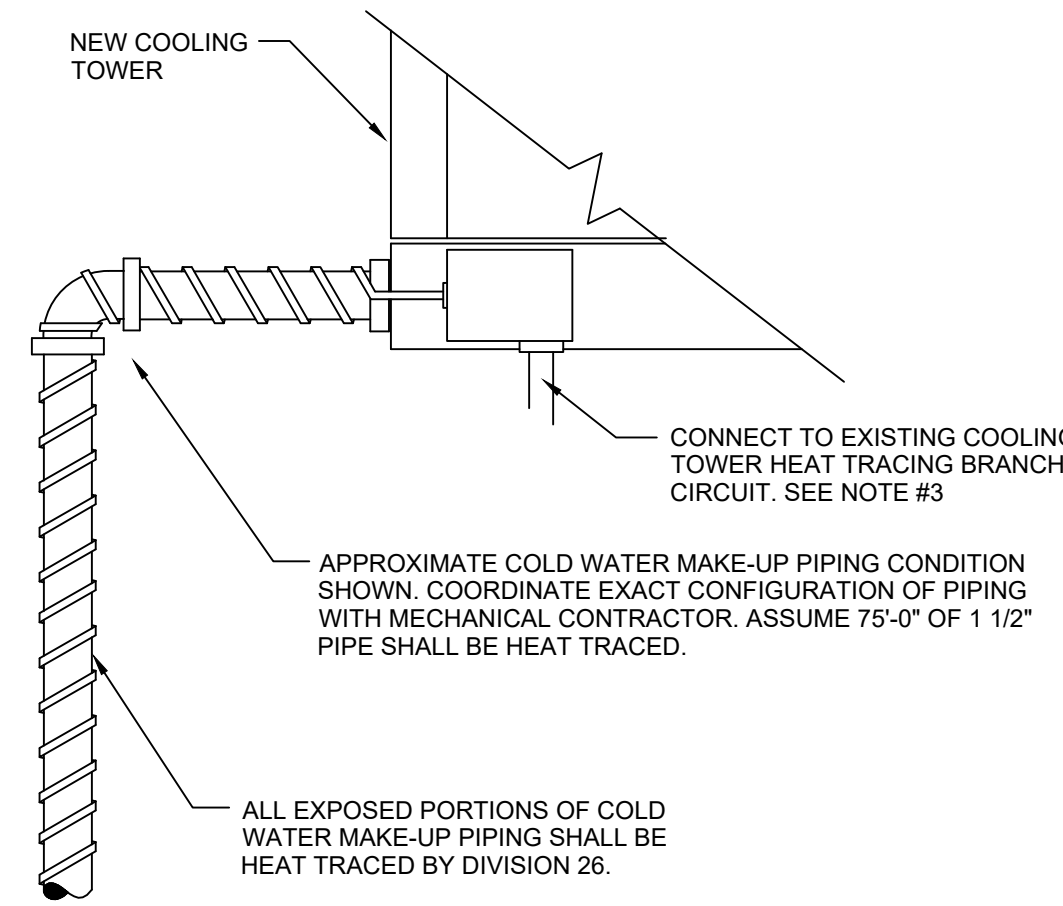
DATE: 05/19/20
DRAWN BY: RLG
CHECKED BY: WJD
SCALE: AS NOTED
PROJ #: 2018071.00



**COOLING TOWERS CT-1/CT-2
ELECTRICAL DEMOLITION PLAN**
SCALE: NONE

ELECTRICAL DEMOLITION KEY NOTES:

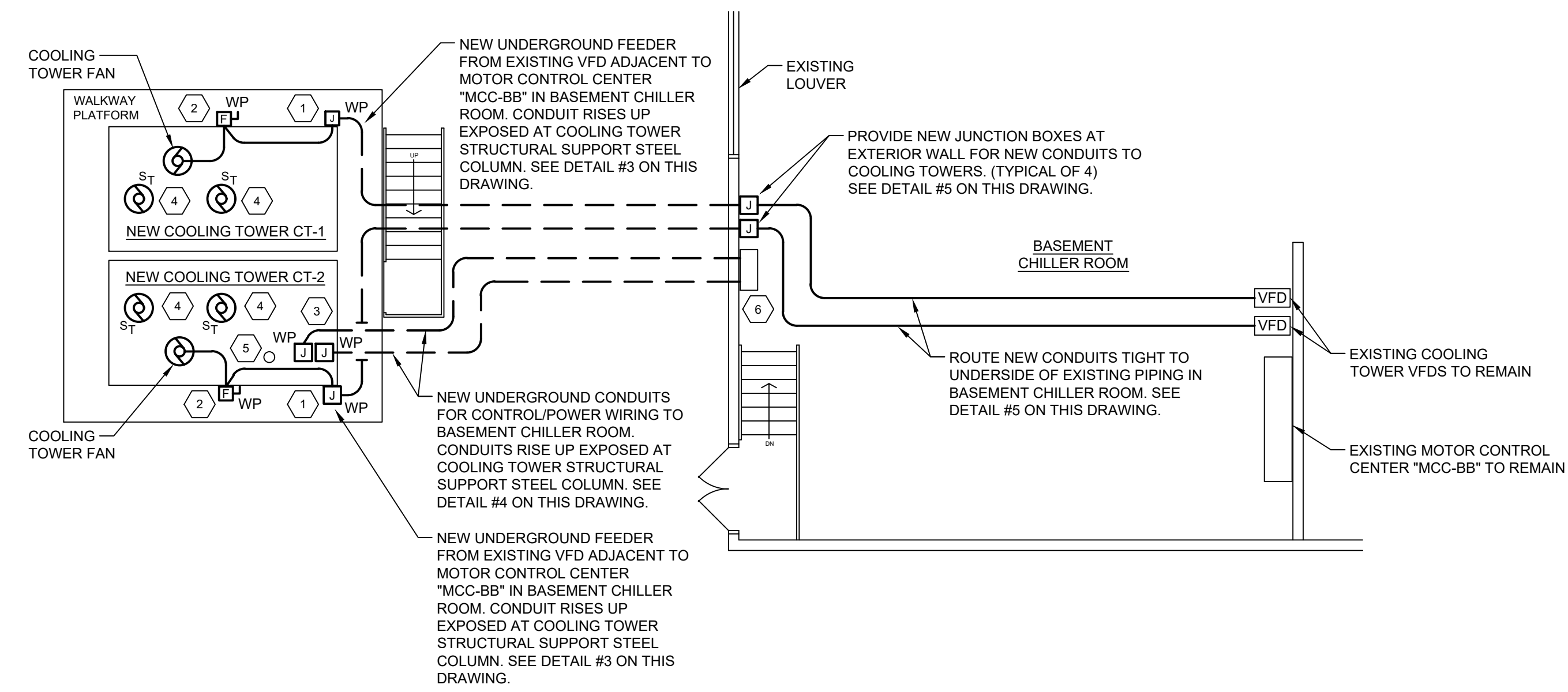
- DISCONNECT AND MAKE SAFE FOR REMOVAL THE POWER FEEDER TO EXISTING COOLING TOWER. EXISTING COOLING TOWER TO BE REMOVED BY MECHANICAL CONTRACTOR.
- DISCONNECT AND REMOVE EXISTING CONDUIT STUB-UP FROM UNDERGROUND FOR POWER FEEDER TO COOLING TOWER. SEE NEW WORK PLAN AND DETAIL #3 ON THIS DRAWING.
- DISCONNECT AND REMOVE EXISTING CONDUIT STUB-UPS FROM UNDERGROUND FOR CONTROL/POWER CIRCUITS TO BOTH COOLING TOWERS. EXISTING BRANCH CIRCUIT WIRING IN BASEMENT MECHANICAL ROOM TO REMAIN IN PLACE. SEE NEW WORK PLAN AND DETAIL #4 ON THIS DRAWING.



HEAT TRACE DETAIL FOR COOLING TOWER MAKE-UP WATER PIPING
SCALE: NONE

DETAIL NOTES:

- PROVIDE SELF-REGULATING HEAT TRACE CABLE RATED AT 8.0 WATTS PER LINEAR FOOT AT 120VOLTS. WRAP PIPING AT A RATE OF 1.5 FEET OF CABLE PER LINEAR FOOT OF PIPE. PROVIDE COMPLETE INSTALLATION IN ACCORDANCE WITH SPECIFICATIONS INCLUDING POWER CONNECTIONS, SPLICES, END SEALS, LABELS, ALUMINUM TAPE, ETC. INSTALL HEAT TRACE CABLE PER MANUFACTURERS REQUIREMENTS. PIPING MUST BE INSULATED AFTER INSTALLATION OF HEAT TRACE CABLE BY MECHANICAL OR PLUMBING CONTRACTOR.
- REFER TO ELECTRICAL SPECIFICATION SECTION #2.8 FOR ADDITIONAL INFORMATION.
- REPLACE EXISTING CIRCUIT BREAKER SERVING COOLING TOWER HEAT TRACING CABLE WITH A 20A/1P 30mA GROUND FAULT CIRCUIT BREAKER AT SOURCE PANEL.



**COOLING TOWERS CT-1/CT-2
ELECTRICAL NEW WORK PLAN**
SCALE: NONE

ELECTRICAL NEW WORK KEY NOTES:

- PROVIDE NEW COOLING TOWER POWER FEEDER FROM EXISTING VFD ADJACENT TO MOTOR CONTROL CENTER "MCC-BB". PROVIDE A WEATHER PROOF JUNCTION BOX AND EXTEND NEW CONDUIT AND CONDUCTORS TO NEW COOLING TOWER DISCONNECT SWITCH. SEE DETAIL #3 ON THIS DRAWING.
- PROVIDE NEW 60AMP, 3P, 480V WEATHER PROOF DISCONNECT SWITCH AND MOUNT ON NEW COOLING TOWER UNIT. MAKE FINAL CONNECTIONS FROM DISCONNECT SWITCH TO COOLING TOWER PER MANUFACTURERS WIRING DIAGRAMS.
- PROVIDE NEW COOLING TOWER CONTROL/POWER CONDUIT/CONDUCTORS FROM EXISTING JUNCTION BOX IN BASEMENT CHILLER ROOM. PROVIDE WEATHER PROOF JUNCTION BOXES AND EXTEND SAME SIZE CONDUITS AND CONDUCTORS TO NEW COOLING TOWER CONTROL EQUIPMENT. SEE DETAIL #4 ON THIS DRAWING.
- THERE ARE TWO MOTOR OPERATED VALVES PER COOLING TOWER UNIT. PROVIDE POWER AND CONTROL WIRING FOR EACH VALVE PER DIRECTION FROM MECHANICAL CONTRACTOR.
- PROVIDE ELECTRIC HEAT TRACING AT NEW COOLING TOWER COLD WATER MAKE-UP LINE. SEE DETAIL #6 ON THIS DRAWING.
- EXISTING POWER/CONTROL WIRING TERMINATES AT EXISTING WALL MOUNTED JUNCTION BOX. INTERCEPT WIRING AND EXTEND TO SIMILAR NEW EQUIPMENT AT NEW COOLING TOWERS, I.E. CONTROL VALVES AND ELECTRIC HEAT TRACING.

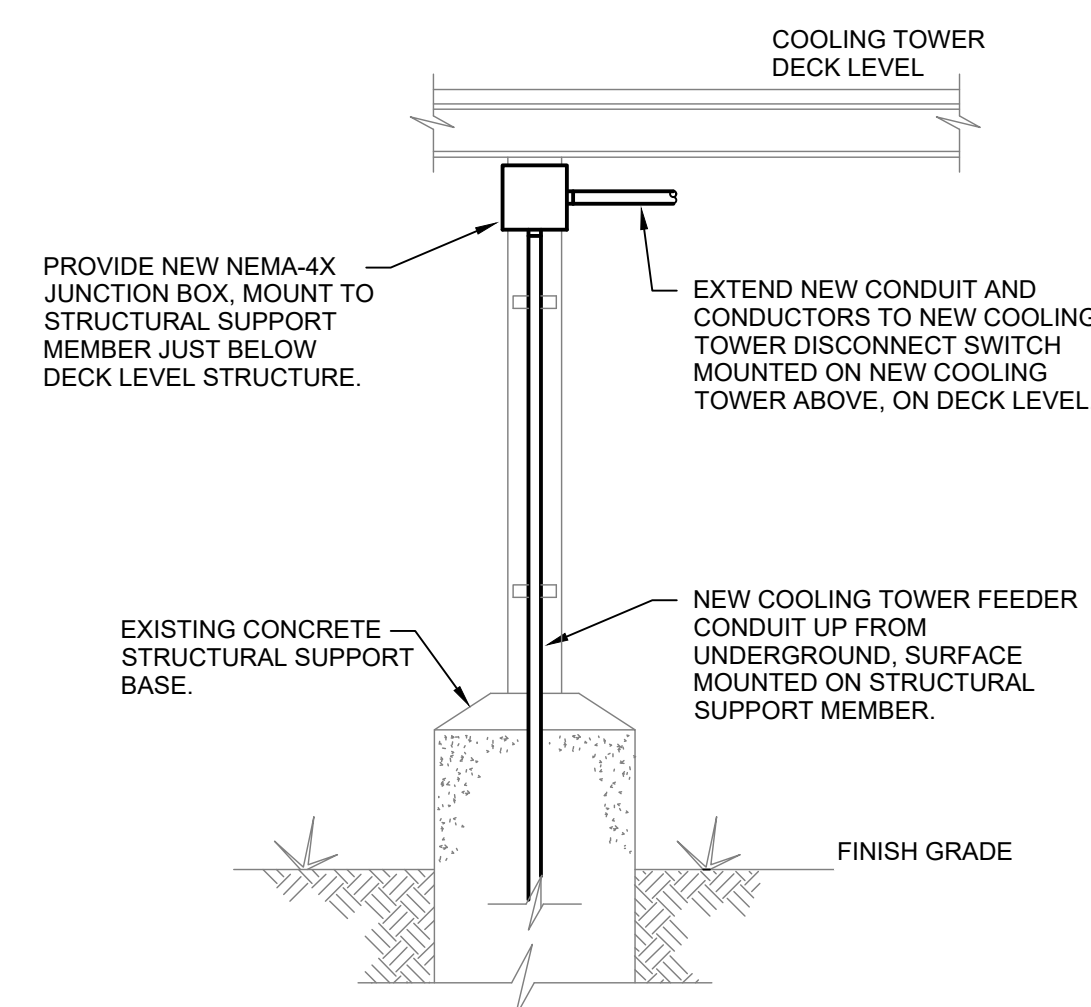
MOTOR CIRCUIT SCHEDULE												
EQUIPMENT	LOCATION	CIRCUIT / SOURCE PANEL	O.C.P. DEVICE	FEEDER	LOCAL DISC. SWITCH	MOTOR STARTER TYPE	SIZE	LOCATION	LOAD KW	LOAD HP	REMARKS	
CT-1	BLDG. EXTERIOR	NOTE #7	NOTE #7	3#10, 1#10G, 1 1/2" C	60A/35A, 3P-WP	NOTE #7	-	AT UNIT	15.0	3	480	NOTE #7
CT-2	BLDG. EXTERIOR	NOTE #7	NOTE #7	3#10, 1#10G, 1 1/2" C	60A/35A, 3P-WP	NOTE #7	-	AT UNIT	15.0	3	480	NOTE #7

MOTOR CIRCUIT SCHEDULE REFERENCED NOTES:

- REFER TO FLOOR PLANS FOR ADDITIONAL SOURCE PANEL INFORMATION.
- DISCONNECT SWITCH TO HAVE MICRO SWITCH FOR SIGNALING VFD SHUTDOWN PRIOR TO OPENING OF MOTOR FEEDER BLADES.
- VFD FURNISHED AND INSTALLED BY DIVISION 23. POWER WIRING FROM SOURCE TO VFD BY DIVISION 26. POWER WIRING BETWEEN VFD AND MOTORS BY DIVISION 26. CONTROL WIRING BY DIVISION 23.
- VFD FURNISHED BY DIVISION 23 AND INSTALLED BY DIVISION 26. POWER WIRING FROM SOURCE TO VFD BY DIVISION 26. POWER WIRING BETWEEN VFD AND MOTORS BY DIVISION 26. CONTROL WIRING BY DIVISION 23.
- STARTER/CONTROLLER IS PRE-WIRED TO MOTORS AND FURNISHED BY DIVISION 23.
- LOCAL DISCONNECT SWITCH FURNISHED BY DIVISION 23 AS AN INTEGRAL COMPONENT OF THE EQUIPMENT.
- CONNECT NEW COOLING TOWER UNIT TO EXISTING VFD CONTROLLER ADJACENT TO MOTOR CONTROL CENTER "MCC-BB". (COOLING TOWER VFDs ARE FED FROM EXISTING MOTOR CONTROL CENTER "MCC-BA")

MOTOR CIRCUIT SCHEDULE GENERAL NOTES:

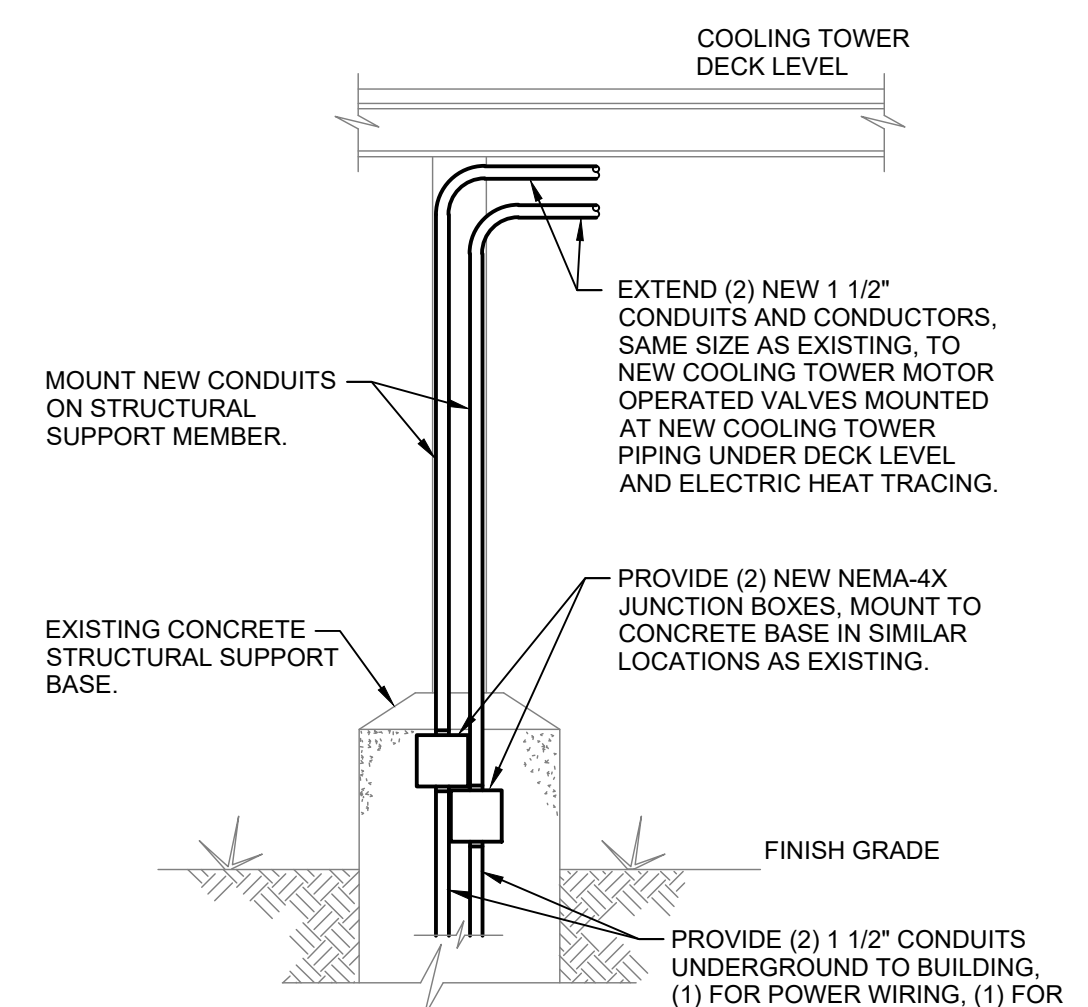
- REFER TO SPECIFICATIONS FOR STANDARD FEATURES.
- ABBREVIATIONS:
VFD - VARIABLE FREQUENCY DRIVE
FVNR - FULL VOLTAGE, NON-REVERSING
RVNR - REDUCED VOLTAGE, NON-REVERSING
FHMIS - FRACTIONAL HORSEPOWER MOTOR STARTER
W/EQ - WITH EQUIPMENT (FURNISHED BY MECHANICAL CONTRACTOR)
MAN - MANUAL STARTER (TOGGLE SWITCH WITH THERMAL OVERLOADS)
- O.C.P. DEVICES AND LOCAL DISC. SWITCHES ARE THREE POLE UNLESS OTHERWISE NOTED.
- LOCAL DISCONNECT SWITCH SIZE INDICATES SWITCH FRAME FOLLOWED BY FUSE SIZE (I.E. 30A/20A REPRESENTS 30A FRAME SWITCH WITH 20A FUSES).
- PROVIDE WEATHERPROOF FUSED DISCONNECT SWITCHES WHERE LOCATED OUTSIDE OR IN WET LOCATIONS.
- STARTERS, DISCONNECT SWITCHES, CIRCUIT BREAKERS, BRANCH CIRCUIT WIRING, ETC. INDICATED IN THE MOTOR CIRCUIT SCHEDULE SHALL BE FURNISHED AND INSTALLED BY DIVISION 26 UNLESS OTHERWISE NOTED.
- THE "O.C.P. DEVICE" SHALL BE A CIRCUIT BREAKER UNLESS OTHERWISE NOTED.



COOLING TOWER FEEDER CONDUIT MODIFICATIONS AT STRUCTURAL COLUMN
SCALE: NONE

DETAIL NOTES:

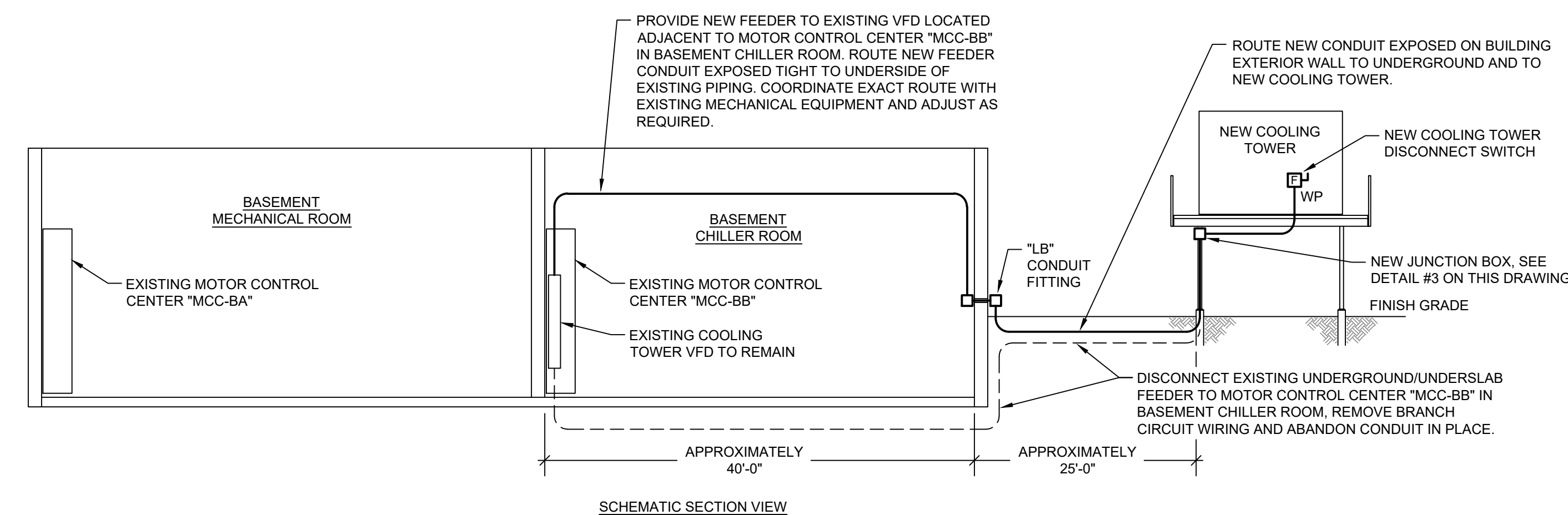
- DETAIL IS TYPICAL FOR TWO COOLING TOWER MAIN POWER FEEDERS, CT-1 AND CT-2. SEE DETAIL #2 FOR ADDITIONAL INFORMATION.



COOLING TOWER CONTROL/POWER CONDUIT MODIFICATIONS AT STRUCTURAL COLUMN
SCALE: NONE

DETAIL NOTES:

- SEE DETAIL #2 FOR LOCATION AND ADDITIONAL INFORMATION.



COOLING TOWER FEEDER CONDUIT MODIFICATIONS SCHEMATIC DIAGRAM
SCALE: NONE

DETAIL NOTES:

- DETAIL IS TYPICAL FOR TWO COOLING TOWER MAIN POWER FEEDERS, CT-1 AND CT-2. REFER TO FLOOR PLANS FOR LOCATIONS.
- DETAIL IS TYPICAL FOR TWO ADDITIONAL 1 1/2" CONDUIT RUNS FOR POWER AND CONTROL WIRING. (THESE RUNS NOT SHOWN FOR CLARITY) SEE DETAIL #4 ON THIS DRAWING FOR ADDITIONAL INFORMATION.
- COORDINATE NEW CONDUIT PENETRATIONS AT EXTERIOR WALL WITH EXISTING FIELD CONDITIONS AND OWNER.

ELECTRICAL SPECIFICATION

PART 1 - GENERAL

1.1 GENERAL

- A. All work shall be done in strict accordance with all applicable Codes and Regulations of local and State Agencies. The Electrical Contractor shall bear the cost of all fees, permits, licenses and taxes in connection with the work. All equipment installed shall be UL listed.
B. Prime Contractor shall be the Mechanical Contractor who shall arrange and be responsible for all work in Contract Documents including any subcontracted work.

1.2 SCOPE

A. Demolition:

- 1. The Electrical Contractor shall reference mechanical and electrical plans and remove or relocate existing electrical materials as shown. Removal of wiring that is no longer in service shall be complete back to source. Existing conduit may be reused when in suitable condition. Wiring for branch circuits shall not be reused unless otherwise noted. Circuits that remain shall be left in operating condition.
2. Existing electrical materials shall NOT be reused unless so indicated on the Drawings. All materials removed under this Division and not scheduled for reuse or requested by the Owner, shall be disposed of off site.

B. New Work:

- 1. Provide complete electrical, power and special systems as indicated on the Contract Drawings.
2. Provide all electrical work necessary to power Owner-supplied equipment. Provide all power wiring, core drills, etc., necessary for a complete installation.
3. Systems shall be complete in all respects, tested, approved and ready for operation.

C. Work by Others:

- 1. Other Trade Contractors and Owner's equipment vendors shall install all motors for equipment provided under their trade work contracts; motors shall be ready for wiring by the Electrical Contractor.
2. Other Trade Contractors and Owner's equipment vendors shall furnish and deliver to the Electrical Contractor wiring diagrams for all electrically operated equipment. Other Trade Contractors shall furnish relays and control equipment to the Electrical Contractor who shall install and wire these devices. The Electrical Contractor shall provide motor starters and disconnect switches unless noted otherwise.
3. The Mechanical Contractor shall provide chases, openings, cutting, patching, painting and finish work.
4. The Mechanical Contractor shall install all access doors where required; doors needed for access to electrical systems shall be furnished by the Electrical Contractor.

1.3 SHOP DRAWING SUBMITTALS

- A. Submit shop drawings on equipment and materials, in sextuplet (6 copies), to the Engineer for approval. The Drawings shall include ratings, performance information, operating data and wiring diagrams. The Electrical Contractor shall assume full responsibility for work performed or equipment supplied that is not in agreement with approved shop drawings.

B. The following list of electrical items must be submitted by the Electrical Contractor for approval:

- 1. Conduit/conduit fittings/conductors
2. Disconnect switches
3. Circuit breakers

1.4 RECORD DRAWINGS

- A. Neatly and accurately record all changes to Contract Documents on record set of drawings furnished by the General Contractor. These record "as-built" drawings shall include locations of specific items as listed in the various Specification DIVISIONS. Upon project completion, these record drawings shall be turned over to the Engineer.

1.5 DEFINITION

- A. As used on Contract Drawings, the term "to provide" shall mean "to furnish, install and connect completely in the specified or approved manner the item or material described."

1.6 GUARANTEE

- A. Materials, equipment and workmanship shall have standard warranty against defects in material and workmanship. Failures due to defective or improper material, equipment, workmanship or design shall be made good, forthwith, by and at the expense of the Electrical Contractor, including damage done to areas, materials and other systems resulting from such failures. Guarantee period shall extend for one year from the Date of Acceptance.

1.7 INSPECTION

- A. Contract Drawings are diagrammatic and do NOT show every required fitting, etc. The Electrical Contractor shall familiarize himself with existing site conditions prior to submitting a bid, and shall include all equipment and accessories necessary for complete and operational systems.

1.8 INSURANCE

- A. Furnish insurance certificates required by the Owner.

1.9 PERMITS, LAWS, ORDINANCES, CODES AND STANDARDS

- A. Obtain and pay for permits, inspections, licenses and certificates required. Work of this Contract shall meet current accepted editions of the State Building Code, State Fire Safety Code and other laws, rules and regulations of local, State and Federal authorities including, but not limited to: National Fire Protection Association #13, National Fire Protection Association #90A, National Fire Protection Association #90B, National Fire Protection Association #99, International Plumbing Code, International Mechanical Code, National Fire Protection Association #70 (National Electrical Code). Equipment, materials and components listed in UL Product Directories, shall bear UL labels.

1.10 ARRANGEMENT OF WORK

- A. Work shall be coordinated between trades to prevent interference. Work shall present a neat coordinated appearance. Install work as necessary to provide maximum possible headroom, adequate clearance and ready access for inspection, operation, safe maintenance and repair and Code conformance. Where space appears inadequate, consult the Engineer before proceeding with installation.

1.11 WORKMANSHIP

- A. Equipment and materials shall be new, of first quality, selected and arranged to fit properly into spaces indicated. Install equipment and materials in accordance with manufacturer's recommendations.

1.12 COORDINATION WITH OWNER

- A. Work shall be scheduled with the Owner. Interruptions in Owner's access to the site shall be subject to Owner limitations of date and duration.

1.13 OPERATION OF SERVICES AND UTILITIES

- A. Shutdown of existing services shall, without exception, be coordinated with the Owner as to date, time of day, and duration before any service is interrupted. Notify the Owner of estimated duration of shutdown period at least ten days in advance of proposed shutdown.

1.14 PROTECTION

- A. Close open ends of work with temporary covers or plugs during construction to prevent entry of foreign material. Protect existing property, equipment and finishes from damage. Repair, to original condition, existing property that has been damaged during execution of the work.

1.15 CLEANING

- A. Work site must be kept clean. Rubbish, debris and leftover or excess materials shall be removed daily.

1.16 LUBRICATION

- A. No equipment shall be operated for temporary service or testing without proper lubrication. Items requiring lubrication shall be left freshly and fully lubricated at time of substantial completion. Furnish Owner with one complete new set of any special lubrication devices required for servicing, e.g., grease guns, fillings and adapters.

1.17 PAINTING

- A. Equipment and materials shall have standard manufacturer's finish except where otherwise noted.

1.18 CUTTING AND PATCHING

- A. Cutting and patching to be performed by Mechanical Contractor. Painting of finished surfaces after patching shall match adjacent finishes.

1.19 WATERPROOFING

- A. Provide necessary sleeves, caulking and flashing required to make openings waterproof.

1.20 FIREPROOFING

- A. At closing of each working day, opening cut between floors and through fire-rated partitions shall be provided with UL approved, Class A "Noncombustible", firestopping with ratings equal to that of adjacent construction.

1.21 BASES AND SUPPORTS

- A. The Mechanical Contractor shall provide necessary supports, pads, bases and piers for equipment. Equipment shall be securely attached to building structure in acceptable manner. Attachments shall be of strong and durable nature, as determined by the Owner.

1.22 ACCESS

- A. Provide adequately sized access doors, for access to concealed equipment and components requiring servicing or inspection. Doors shall have fire ratings equal to construction in which they are located.

1.23 TESTS

- A. Perform tests required by the Owner, legal authorities and agencies. Each piece of equipment, including motors and controls, shall be operated continuously for minimum one-hour test. Correct all defects appearing during tests, and repeat tests until no defects are disclosed. Final tests shall be made in the Owner's presence.

1.24 SYSTEMS OPERATION AND MAINTENANCE

- A. Upon completion of the work and at a time designated by the Engineer, the Electrical Contractor shall furnish instruction manuals including data, warranties, etc., and shall instruct the Owner or his representative as to the arrangement, location and operation of all equipment and systems furnished and installed under the Electrical Contract.

PART 2 - PRODUCTS

2.1 WIRE CABLE AND RACEWAYS

- A. Rigid galvanized steel conduit (RGS) shall be used for all exterior wiring and where subject to dampness, except as noted below or as specifically noted on the Drawings. Connectors and couplings shall be galvanized steel threaded type listed for RMC use.
B. Electrical Metallic Tubing (EMT) shall be used for feeders run above ground in dry areas. Connectors and couplings shall be galvanized steel, either compression type or heavy-duty set screw-type, listed for EMT use. Indent or crimp-type connectors are NOT allowed.
C. EMT or RGS shall be used for all circuit homeruns.
D. Minimum sizes shall be as follows:
1. Conduit and EMT: 3/4" unless otherwise noted.
2. Flexible Metal Conduit: 1/2"
3. Wireway: 4" x 4"
E. Liquid-tight Flexible Metallic Conduit (LFMC) shall be used for connections to vibrating equipment. Connectors and couplings for LFMC shall be zinc plated malleable iron or steel, with engagement window locknut and sealing ring; liquid, oil, and rain-tight; suitable for wet locations, listed for LFMC use: acceptable equivalent to O-Z/Gedney "Type 4C".

- F. Conductors shall be new copper with 600 Volt code gauge insulation conforming to NEC requirements. Wire #10 and smaller shall be solid conductor with THWN/THHN insulation, Size #8 and larger shall be stranded conductors with THWN/THHN insulation. Size #3 and larger shall be stranded conductors with XHHW insulation. Minimum size wire for light and power circuits shall be #12 AWG. The Electrical Contractor shall include an individual code sized green insulated ground conductor for all circuits; the use of the conduit system or cable covering as the sole means of grounding will not be permitted.
G. Common neutrals shall not be used for receptacle circuits, unless otherwise noted on plans. When used, common neutral conductor ampere rating shall be double the phase conductor rating.
H. All conduits and wiring shall be run concealed inside walls where possible. Exposed conduits where allowed shall be run neatly in lines parallel or perpendicular to building walls.

- I. All splices for #10 or smaller shall be made with "Scotchlok" spring connectors or equal. Splices for #8 or larger shall be made with UL approved compression connectors.
J. Provide nylon pull lines for all empty conduits.

2.2 GROUNDING AND BONDING

- A. Equipment Grounds
1. Grounding shall be installed and tested in accordance with NFPA 70 (NEC) and to satisfaction of local Electrical Inspector and Engineer.
2. Provide green THHN insulated copper equipment grounding conductor between the ground bus of the source distribution panel or switchboard and each load being served. Conductor shall be sized according to NEC Table 250.122. Provide separate grounding conductor for each branch circuit, unless otherwise indicated on Contract Drawings.
3. Maintain electrical continuity of raceways.

B. Ground Fault Protection

- 1. If excessive ground current flows, main breakers and/or circuit breakers with ground fault sensing shall trip to protect against arcing ground faults.

C. Materials

- 1. Above-grade and exposed connections shall be Burndy or acceptable equivalent.
2. Wire shall be stranded bare copper or insulated copper, as indicated on Contract Drawings.
3. Bus shall be copper bar, as indicated on Contract Drawings.
4. Bushings and Pressure Lugs shall be by T&B, O.Z./Gedney or acceptable equivalent.
5. Pipe clamps shall be by O.Z./Gedney or acceptable equivalent.

2.3 SAFETY SWITCHES

- A. Safety switches shall be fused, 600 VAC, heavy-duty type in NEMA enclosures suitable for the environment in which they shall be installed. Switches shall be Square D, General Electric or Cutler-Hammer equivalent to the following Square D types:
1. Fused disconnect 2- and 3-pole: "Type H"
2. Fused, raintight (WP) disconnect switches in NEMA 3R enclosures: "Type H-R".

2.4 FUSES

- A. Fuses for circuit protection shall be UL listed, non-renewable, low peak, dual-element, time delay fuses. Bussman Type FRN-RK (250 Volt) or FRS-RK (460 Volt) UL Class RK5 or approved equal.

2.5 MOTOR STARTERS

- A. Provide starters for all motors unless supplied by mechanical contractor or noted otherwise. Starters shall be Allen-Bradley or equal by Square D, General Electric or Cutler-Hammer, as follows:
1. Manual for 120 Volt or 208 volt, 1-phase: Allen Bradley Bulletin 600.
2. Magnetic across-the-line: Allen Bradley Bulletin 509.
3. Combination starter disconnects: Allen Bradley Bulletin 512.

B. Manual starters shall have NEMA 1 enclosure.

C. Magnetic starters shall have the following features:

- 1. NEMA 1 enclosure
2. Two N.O. and two N.C. auxiliary contacts
3. HOA switch
4. Neon run pilot light
5. Three overload heaters
6. Control power transformer.

2.6 OUTLET AND JUNCTION BOXES

- A. Junction boxes shall be sized in accordance with Code requirements.
B. Junction and outlet boxes where exposed to the weather and wet locations shall be threaded hub type and provided with watertight screw-on covers and gaskets.

2.7 CIRCUIT BREAKERS

- A. All new circuit breakers shall match existing in style, manufacturer and interrupting rating for panel in which they are being installed, unless noted otherwise.

2.8 ELECTRICAL HEAT TRACING FOR PIPING

- A. Self-regulating heater shall consist of two 16 AWG tinned copper bus wires embedded in parallel, in self-regulating polymer core; with radiation cross linked modified polyolefin dielectric jacket, outer braid of tinned copper and outer jacket of polyolefin dielectric. Heater shall be Raychem "XL-Trace" or equal by Thermom or Brik-Heat.
B. Provide Raychem "XL-Trace" #8XL1-CR: 8 watts per linear foot at 50' F operating at 120Volts, single phase.

- C. Each run of heat trace cable shall have Raychem "RAYCLIC-PC" power connection; Raychem "RAYCLIC-T" Tee; Raychem "RAYCLIC-S" Splice; Raychem "RAYCLIC-E" End seal kit; Raychem "ETL" "ELECTRIC TRACED" pipe labels; Raychem "GT-65" glass cloth adhesive tape for metal piping; Raychem "AT-180" aluminum tape for plastic piping.

- D. System shall be controlled by an ambient sensing thermostat; Raychem #AMC-1A. Sensing shall be set at 40' F. Sensor shall be located on outside of pipe insulation.

- E. Heating cable branch circuit shall be protected by a 30mA ground fault sensing circuit breaker for equipment and personnel protection. Ground fault sensing receptacles shall NOT be used.

- F. Maximum circuit length of heater cable on a 30Amp circuit breaker with a start-up temperature of 40'F shall be: 190 feet.

- G. Exact lengths of heater cable required shall be coordinated between Electrical Contractor and Mechanical Contractor.

- H. Install heat tracing cable and accessories and test finished installation per manufacturer's installation requirements.

- I. Apply "ELECTRICALLY TRACED" labels to outside of thermal pipe insulation no more than 5'-0" apart.

PART 3 - EXECUTION

3.1 GENERAL WIRING TESTS

- A. At the time of final inspection and test, all wiring and connections throughout the renovation areas must be completed, devices and equipment properly operating and power circuit and control wiring clearly identified with approved tags ready for acceptance. Each system shall test free from short circuit and grounds.

- B. Insulation resistance for low voltage cables and wiring shall be performed at 1000 Volt D.C. for one (1) minute. When insulation resistance must be determined, switchboards, panelboards, fuse holders, switches and overcurrent devices shall be in place, and the insulation resistance when tested at 1000 Volts D.C. shall be no less than 100,000 ohms for #14 and #12 wire and 250,000 ohms for #10 wire and larger.

3.2 GROUNDING SYSTEM TESTS

- A. Test and inspect the main grounding electrode system in accordance with Section 7.13 of the NETA Handbook for Electrical Testing Procedures. Perform a resistance to ground test and insure that resistance is no greater than 5 (five) ohms. Investigate and supplement grounding system where resistance exceeds recommended values and re-test as required.

3.3 OPERATIONAL TESTS

- A. Each piece of electrical equipment, including lighting fixtures, motors and controls shall be operated continuously for minimum test period of one hour.
B. Demonstrate by operating equipment that circuits and devices are in good operating condition. Each item of control equipment shall be operated minimum of five times. Demonstration shall be performed after wiring tests.

3.4 MECHANICAL SYSTEM ADJUSTMENT AND TESTING

- A. Be present during adjustment period and final testing of mechanical systems. Take readings necessary to ensure that electrical systems are operating properly. Tests for mechanical work are detailed under DIVISION 23, MECHANICAL WORK.
B. Take ampere readings with true RMS reading ammeter at each electrical component, such as motor and heating coil, to determine proper operation.

- C. Record readings and submit them in triplicate to the Engineer for review.

3.5 LABELING

- A. Label all new disconnects, starters, motors, in a manner acceptable to the Owner.
B. Provide updated panel schedules in all panelboards affected by this scope of work.
C. All manufacturer's nameplates shall be kept clean and free of paint.

END OF ELECTRICAL SPECIFICATION

Table with 2 columns: SYMBOL and DESCRIPTION. Lists abbreviations for electrical components like AMPERE, ABOVE FINISHED FLOOR, ABOVE FINISHED GRADE, CONDUIT, CIRCUIT BREAKER, CIRCUIT, COOLING TOWER, EXISTING TO REMAIN, ELECTRIC METALLIC TUBING, EXISTING POWER TO REMAIN (WITHIN SPECIFIED AREA), FUSED, FULL LOAD AMPS, FLEXIBLE METALLIC CONDUIT, GROUND, GROUND FAULT INTERRUPTER, LIQUID-TIGHT FLEXIBLE METALLIC CONDUIT, MINIMUM CIRCUIT AMPACITY, MOTOR CONTROL CENTER, NEW LOCATION OF EXISTING RELOCATED, NEW TO REPLACE EXISTING, POLE (SPACE IN PANELBOARD), POLYVINYL CHLORIDE CONDUIT, REMOVE EXISTING, RELOCATE EXISTING, RIGID METALLIC CONDUIT, REMOVE AND REPLACE ON NEW SURFACE, TYPICAL, VOLTS AC, WIRE OR WATTS, WEATHERPROOF.

Table with 2 columns: SYMBOL and DESCRIPTION. Lists power device symbols like ELECTRICAL PANEL 480 / 277 VOLT, ELECTRICAL PANEL 208 / 120 VOLT, MANUAL STARTER WITH THERMAL OVERLOAD PROTECTION, FUSED DISCONNECT SWITCH, ELECTRIC MOTOR, VARIABLE FREQUENCY DRIVE, JUNCTION BOX.

Table with 1 column: LEGEND NOTE. Text: THESE LEGENDS AND ABBREVIATIONS DEFINE ITEMS INDICATED ON DRAWINGS. NOT ALL SYMBOLS OR ABBREVIATIONS DEFINED ARE NECESSARILY USED ON THIS PROJECT.

Table with 1 column: GENERAL ELECTRICAL NOTES. Contains 10 numbered items regarding wire and raceway sizes, electrical conduits, outlet plate gasket seals, individual and general purpose branch circuits, and raceway and wiring indicated on drawings.

Table with 1 column: GENERAL ELECTRICAL DEMOLITION NOTES. Contains 10 numbered items regarding removal of existing electrical equipment, disconnecting and removing existing wiring, existing electrical items to be removed, and continuity of wiring.

Table with 1 column: GENERAL SITE ELECTRICAL NOTES. Contains 13 numbered items regarding excavation, trenching, concrete pads, contractor verification, coordination with owner, location of existing underground utilities, existing conductors, area excavation, existing utilities, maintain minimum depth, power conduits, temporary services, PVC conduit, and power conduits.



VANZELM HEYWOOD & SHADFORD, INC. 18 FALGOUT NOTCH FAIRMINGTON, CT 06032 TEL: (860) 284-3944 FAX: (860) 284-3908

CONSULTANTS:

PROJECT NAME: ROGER LUDLOWE MIDDLE SCHOOL COOLING TOWER REPLACEMENT 689 UNQUOWA ROAD FAIRFIELD, CT 06824

KEYPLAN



Table with 3 columns: REV. NO., DATE, DESCRIPTION. Header row and empty rows below.

100% CONSTRUCTION DOCUMENTS

DRAWING TITLE: ELECTRICAL SYMBOLS, GENERAL NOTES AND SPECIFICATIONS

DATE: 05/19/20 DRAWING NUMBER: E201 DRAWN BY: RLG CHECKED BY: WJD SCALE: NONE PROJ #: 2018071.00