	MECHANICAL SYMBOL L	<u>IST</u>	
CHWS	CHILLED WATER SUPPLY PIPING	ABV	ABOVE FINISHED FLOOR
——— CHWR ——	CHILLED WATER RETURN PIPING	AFF	ABOVE FINISHED FLOOF
CTWS	COOLING TOWER WATER SUPPLY PIPING	CFM	CUBIC FEET PER MINUT
——— CTWR ——	COOLING TOWER WATER RETURN PIPING	COND	CONDENSATE
——— CWR ——	CONDENSOR WATER RETURN PIPING	CT	COOLING TOWER
——— CWS ——	CONDENSOR WATER SUPPLY PIPING	CW	COLD WATER
——————————————————————————————————————	ICE WATER RETURN PIPING	EX	EXISTING
——————————————————————————————————————	ICE WATER SUPPLY PIPING	FD	FLOOR DRAIN
— STM (#150) —	STEAM SUPPLY PIPING	GPM	GALLONS PER MINUTE
— — COND — —	STEAM CONDENSATE RETURN PIPING	HW 	HOT WATER
- — - PC — —	PUMPED CONDENSATE PIPING	RS	ROOF SUMP
	DOMESTIC COLD WATER PIPING		
SW	SOFTENED DOMESTIC WATER PIPING		
D	REDUCER		
	CAP		
\longrightarrow	ISOLATION GATE VALVE		
	FLOW ARROW		
Ø	VALVE IN RISER		
0	ELBOW RISING UP		
C	ELBOW DROPPING DOWN		
	TEE WITH PIPE UP		
	TEE WITH PIPE DOWN		
•	FLOOR DRAIN		

	ELECTRICAL SYMBOL LIST
•	ELECTRICAL DEVICE
⊠h	COMBINATION STARTER
	NON-FUSED DISCONNECT SWITCH
=	DUPLEX RECEPTACLE
4	THREE PHASE MOTOR
VFD	VARIABLE FREQUENCY DRIVE
EX	EXISTING
WP	WEATHERPROOF, NEMA 3R WITH TAYMAC COVER
)	CIRCUIT BREAKER
°/	DISCONNECT SWITCH
	FUSE
FLA	FULL LOAD AMPS
TCL	TOTAL CONNECTED LOAD
HP	HORSEPOWER

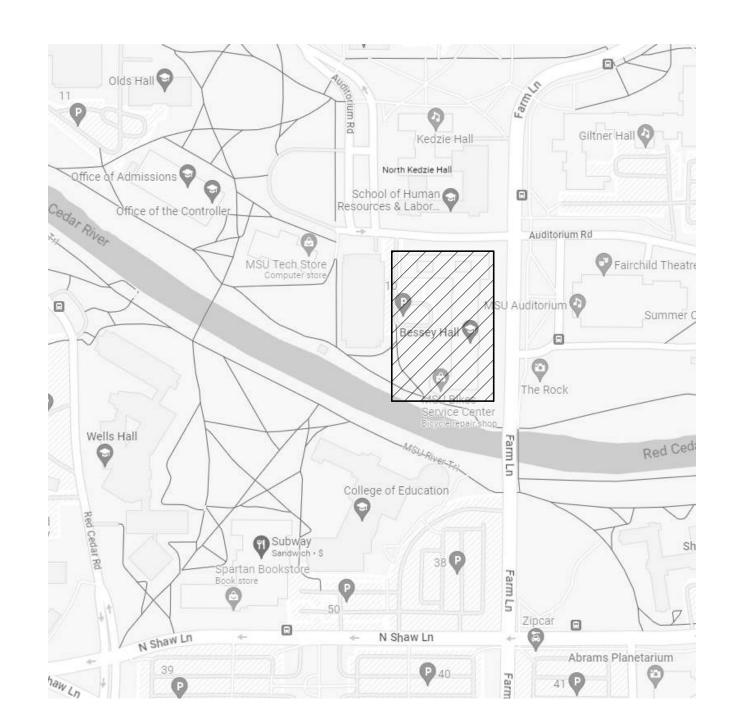
DRAWING INDEX

DRAWING NUMBER	<u>TITLE</u>
TS	TITLE SHEET
M1.01	BASEMENT PLAN - MECHANICAL DEMOLITION
M1.02	ROOF PLAN - MECHANICAL DEMOLITION
M2.01	BASEMENT PLAN - MECHANICAL REVISIONS
M2.02	ROOF PLANS - MECHANICAL REVISIONS
M2.03	MECHANICAL REVISIONS - ALTERNATE
M2.04	OVERALL BASEMENT PLAN - MECHANICAL
M2.05	SITE PLAN
M3.01	3D CHILLER VIEWS
M3.02	SECTIONS
M3.03	3D ISOMETRIC VIEWS
M3.04	3D ISOMETRIC VIEWS
M4.01	CHILLER INSTALLATION PROCEDURE
M5.01	MECHANICAL SCHEDULES
M5.02	MECHANICAL SCHEDULES
M6.01	MECHANICAL DETAILS
M6.02	MECHANICAL DETAILS
M6.03	MECHANICAL DETAILS
M7.01	MECHANICAL CONTROLS
M7.02	MECHANICAL CONTROLS
E1.01	BASEMENT PLAN - ELECTRICAL DEMOLITION
E2.01	BASEMENT PLAN - ELECTRICAL REVISIONS
E2.02	BASEMENT PLAN - ELECTRICAL REVISIONS - ALTERNATE #1
E2.03	ROOF PLAN - ELECTRICAL DEMOLITION AND REVISIONS
E3.01	ELECTRICAL ONE-LINE DIAGRAMS
E3.02	ALTERNATE #1 ELECTRICAL ONE LINE DIAGRAMS
S1.01	STRUCTURAL FRAMING PLAN AND DETAILS

CODE INFORMATION

APPLICABLE CODES

- 2015 MICHIGAN MECHANICAL CODE
- 2017 NATIONAL ELECTRICAL CODE - 2018 MICHIGAN PLUMBING CODE



PROJECT LOCATION



VICINITY MAP

BESSEY HALL
CHILLER REPLACEMENT

CAPITAL PROJ. NO. MORGAN

CHARLAND CIVIL INT DES MORGAN APPR

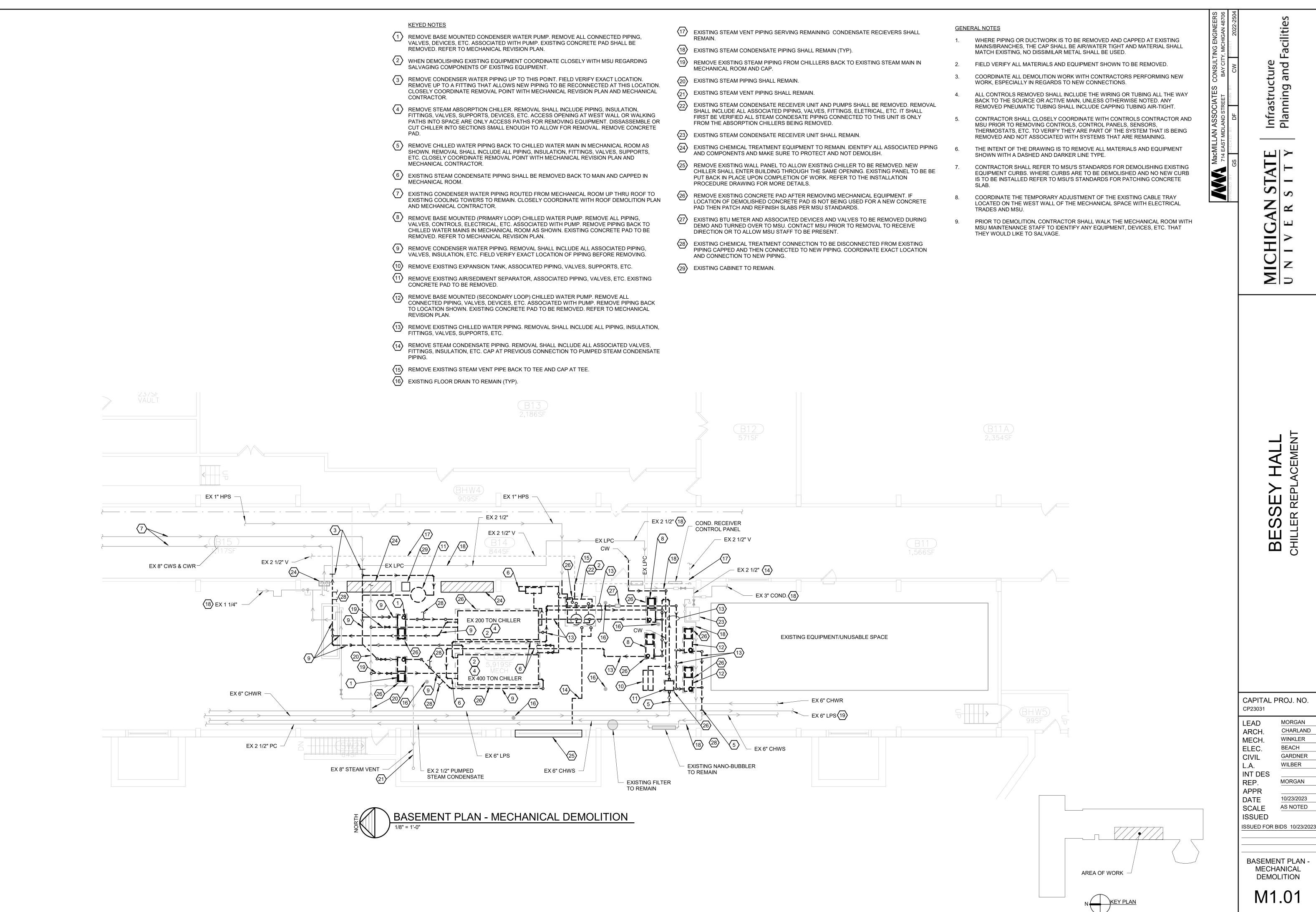
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TITLE SHEET

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of **27**



ne: C:\Users\cwendling\Documents\2022-2504 MECH-Bessey Hall Centra

CHARLAND WINKLER CIVIL INT DES

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ROOF PLAN -MECHANICAL DEMOLITION

3 OF 27

EX 8" CWS — EX 8" CWR -ノ川牛ノーシ EX 8" CWS EX 8" CWS EX 4" DRAIN

PARTIAL ROOF PLAN - MECHANICAL DEMOLITION

1 REMOVE CONDENSER WATER PIPING AS SHOWN. REMOVAL SHALL INCLUDE ALL PIPING, INSULATION, FITTINGS, VALVES, SUPPORTS, ETC. CLOSELY COORDINATE REMOVAL POINT WITH MECHANICAL REVISION PLAN AND MECHANICAL CONTRACTOR. REMOVE CONDENSER WATER PIPING UP TO THIS POINT JUST ABOVE ROOF. FIELD

VERIFY EXACT POINT. REMOVE UP TO A FITTING THAT ALLOWS NEW PIPING TO BE RECONNECTED AT THIS LOCATION. CLOSELY COORDINATE REMOVAL POINT WITH MECHANICAL REVISION PLAN AND MECHANICAL CONTRACTOR.

REMOVE COOLING TOWER. DISASSEMBLE TOWER AS NECESSARY TO REMOVE FROM ROOF. DISCONNECT FROM EXISTING ROOF SUPPORT STEEL. SUPPORT STEEL TO REMAIN AND BE RE-USED FOR NEW COOLING TOWER.

REMOVE DOMESTIC WATER MAKE-UP PIPING AS SHOWN. REMOVAL SHALL INCLUDE ALL PIPING, INSULATION, FITTINGS, VALVES, SUPPORTS, ETC. CLOSELY COORDINATE REMOVAL POINT WITH MECHANICAL REVISION PLAN AND MECHANICAL CONTRACTOR.

REMOVE DOMESTIC WATER MAKE-UP PIPING TO THIS POINT. FIELD VERIFY EXACT POINT. REMOVE UP TO A FITTING THAT ALLOWS NEW PIPING TO BE RECONNECTED AT THIS LOCATION. CLOSELY COORDINATE REMOVAL POINT WITH MECHANICAL REVISION PLAN AND MECHANICAL CONTRACTOR.

REMOVE DRAIN PIPING AS SHOWN. REMOVAL SHALL INCLUDE ALL PIPING, INSULATION, FITTINGS, VALVES, SUPPORTS, ETC. CLOSELY COORDINATE REMOVAL POINT WITH MECHANICAL REVISION PLAN AND MECHANICAL CONTRACTOR.

REMOVE DRAIN PIPING UP TO THIS POINT. FIELD VERIFY EXACT POINT. REMOVE UP TO A FITTING THAT ALLOWS NEW PIPING TO BE RECONNECTED AT THIS LOCATION. CLOSELY COORDINATE REMOVAL POINT WITH MECHANICAL REVISION PLAN AND MECHANICAL

(8) EXISTING ROOF SUMP TO REMAIN.

GENERAL NOTES

KEYED NOTES

WHERE PIPING OR DUCTWORK IS TO BE REMOVED AND CAPPED AT EXISTING MAINS/BRANCHES, THE CAP SHALL BE AIR/WATER TIGHT AND MATERIAL SHALL MATCH EXISTING, NO DISSIMILAR METAL SHALL BE USED.

2. FIELD VERIFY ALL MATERIALS AND EQUIPMENT SHOWN TO BE REMOVED.

COORDINATE ALL DEMOLITION WORK WITH CONTRACTORS PERFORMING NEW WORK, ESPECIALLY IN REGARDS TO NEW CONNECTIONS.

4. ALL CONTROLS REMOVED SHALL INCLUDE THE WIRING OR TUBING ALL THE WAY BACK TO THE SOURCE OR ACTIVE MAIN, UNLESS OTHERWISE NOTED. ANY REMOVED PNEUMATIC TUBING SHALL INCLUDE CAPPING TUBING AIR-TIGHT.

CONTRACTOR SHALL CLOSELY COORDINATE WITH CONTROLS CONTRACTOR AND MSU PRIOR TO REMOVING CONTROLS, CONTROL PANELS, SENSORS, THERMOSTATS, ETC. TO VERIFY THEY ARE PART OF THE SYSTEM THAT IS BEING REMOVED AND NOT ASSOCIATED WITH SYSTEMS THAT ARE REMAINING.

SHOWN WITH A DASHED AND DARKER LINE TYPE.

WHEN DEMOLISHING EXISTING EQUIPMENT AND INSTALLING NEW EQUIPMENT ON ROOF REFER TO MSU STANDARDS FOR ROOF PROTECTION (1" INSULATION UNDER 1/2" PLYWOOD).

THE INTENT OF THE DRAWING IS TO REMOVE ALL MATERIALS AND EQUIPMENT

REFER TO PARTIAL PLAN OVERALL ROOF PLAN - MECHANICAL DEMOLITION

MICHIG

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MORGAN

CHARLAND

WINKLER

GARDNER

BEACH

WILBER

MORGAN

10/23/2023

AS NOTED

BASEMENT PLAN -

MECHANICAL

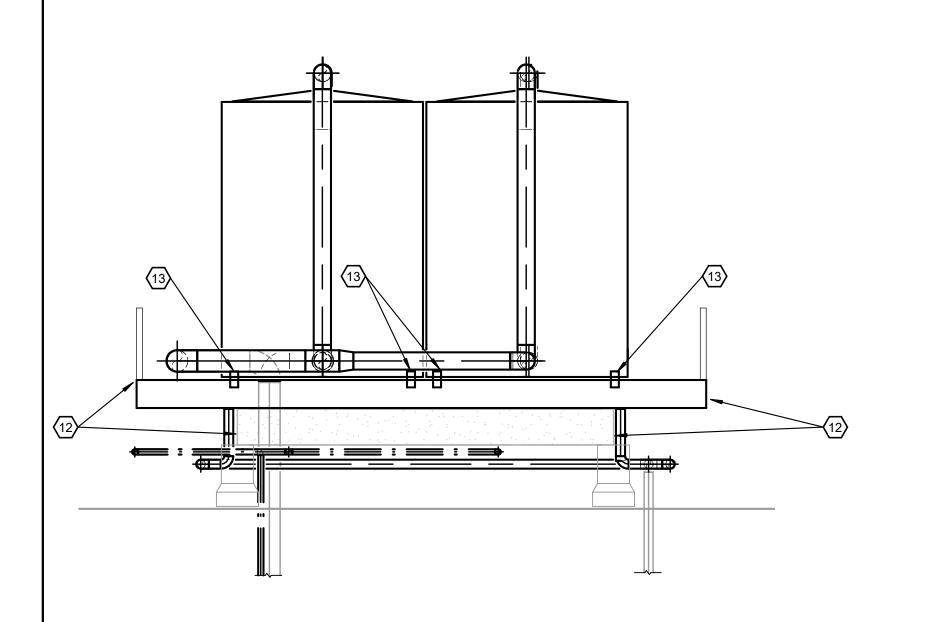
REVISIONS

of **27**

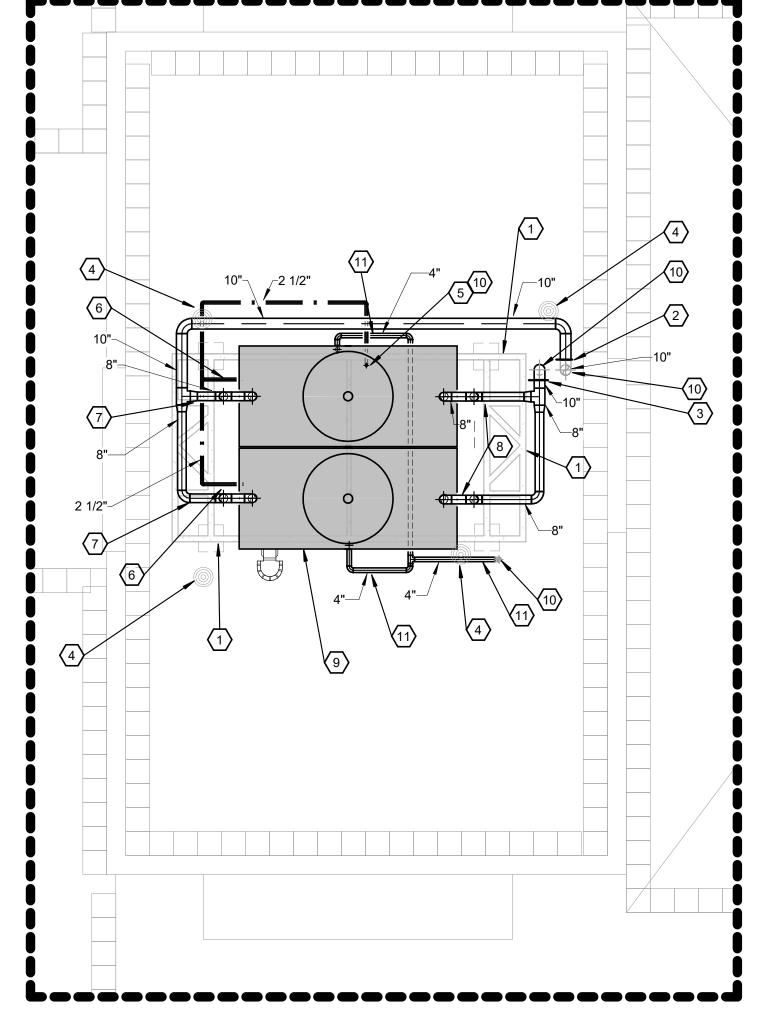
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FITTINGS, PIPING, ETC.

ELEVATION VIEW 1 - COOLING TOWER (LOOKING EAST)



ELEVATION VIEW 2- COOLING TOWER (LOOKING NORTH)





KEYED NOTES

(1) EXISTING COOLING TOWER SUPPORT STEEL TO REMAIN. REFER TO DETAILS ON THIS SHEET.

NEW CONDENSER WATER RETURN PIPING. CONNENCT NEW CONDENSER WATER RETURN PIPING TO EXISTING CONDENSER WATER RETURN PIPING AT ROOF. CLOSELY COORDINATE CONNECTION POINT WITH DEMOLITION PLANS. FIELD VERIFY EXACT CONNECTION LOCATION AT ROOF.

NEW CONDENSER WATER SUPPLY PIPING. CONNECT NEW CONDENSER WATER SUPPLY PIPING TO EXISTING CONDENSER WATER SUPPLY PIPING AT ROOF. CLOSELY COORDINATE CONNECTION POINT WITH DEMOLITION PLANS. FIELD VERIFY EXACT CONNECT LOCATION AT ROOF.

4 EXISTING ROOF SUMP TO REMAIN.

CONNECT NEW 2 1/2" CW MAKE-UP PIPING TO EXISTING 2 1/2" CW MAKE-UP PIPING AT ROOF. FIELD VERIFY EXACT CONNECTION LOCATION AT ROOF.

6 ROUTE NEW 2 1/2" CW PIPING TO NEW COOLING TOWERS ON ROOF. TRANSITION CW PIPING AT COOLING TOWERS AS NECESSARY FOR CONNECTION. FIELD VERIFY EXACT CONNECTION LOCATION.

CONNECT NEW CONDENSER WATER RETURN PIPING TO NEW COOLING TOWER. TRANSITION PIPE SIZE AT COOLING TOWER AS NECESSARY FOR NEW CONNECTION. FIELD VERIFY EXACT CONNECTION LOCATION.

CONNECT NEW CONDENSER WATER SUPPLY PIPING TO NEW COOLING TOWER. TRANSITION PIPE SIZE AT COOLING TOWER AS NECESSARY FOR NEW CONNECTION. FIELD VERIFY EXACT CONNECTION LOCATION.

NEW COOLING TOWER SHALL BE INSTALLED ON EXISTING FRAMEWORK. INSTALL NEW COOLING TOWER ON EXISTING FRAME AS NECESSARY FOR SUPPORT OF NEW COOLING TOWER. FIELD VERIFY EXACT LOCATION OF FRAME AND NEW COOLING TOWER. REFER TO DETAILS ON THIS SHEET.

EXISTING PIPE PENETRATION CURB SHALL BE REMOVED, REPAIRED RE-INSTALLED AND RE-SEALED.

ROUTE NEW BASIN DRAIN PIPING BELOW TOWER AND CONNECT TO EXISTING DRAIN PIPING JUST ABOVE ROOF.

NEW STEEL TO BE INSTALLED ON EXISTING STEEL STRUCTURE TO SUPPORT NEW COOLING TOWER. CONTRACTORS AND COOLING TOWER MANUFACTURER SHALL FIELD VERIFY ALL DIMENSIONS OF EXISTING STEEL AND FURNISH AND INSTALL THE ADDITIONAL STEEL REQUIRED TO MAKE THE MANUFACTURER-REQUIRED CONNECTIONS WORK. REFER TO STRUCTURAL DRAWINGS FOR MORE DETAIL.

FURNISH AND INSTALL NEW ANCHOR BOLTS TO CONNECT NEW COOLING TOWER TO NEW SUPPORT STEEL. MECHANICAL CONTRACTOR SHALL COORDINATE EXACT BOLT REQUIREMENTS WITH COOLING TOWER MANUFACTURER. REFER TO STRUCTURAL DRAWINGS FOR MORE DETAIL.

FURNISH AND INSTALL NEW SECTIONS OF GRATING TO EXTEND AREA OF EXISTING ACCESS PLATFORM FLOOR. FIELD VERIFY DIMENSION OF NEW SECTIONS REQUIRED. REFER TO STRUCTURAL DRAWINGS FOR MORE DETAIL.

GENERAL NOTES

ALL PIPNG SHALL BE INSTALLED PER STATE/LOCAL CODES.

COORDINATE ROUTING/LOCATION OF PIPING WITH ALL OTHER TRADES. DETERMINE LOCATION OF ALL PIPING, DUCTWORK, CONDUIT, CABLE TRAY, ETC. PRIOR TO INSTALLING PIPING IN FINAL LOCAION.

NO PIPING SHALL BE LOCATED DIRECTLY ABOVE ELECTRICAL PANELS OR DEVICES. NO PIPING SHALL BE ALLOWED WITHIN 3'-0" OF PANELS, UNLESS PIPING IS HIGHER THAN 7'-0" ABOVE FLOOR. VERIFY ALL PIPE ROUTING WITH ELECTRICAL TRADES.

WHEN DEMOLISHING EXISTING EQUIPMENT AND INSTALLING NEW EQUIPMENT ON ROOF REFER TO MSU'S STANDARDS FOR ROOF PROTECTION (1" INSULATION UNDER 1/2" PLYWOOD)

REVISIONS TO EXISTING STEEL STRUCTURE SHOWN ARE ASSOCIATED WITH THE BASIS OF DESIGN COOLING TOWER. MECHANICAL CONTRACTOR SHALL INCLUDE COSTS ASSOCIATED WITH ANY ADDITIONAL STEEL REVISIONS OR ADDITIONS NECESSARY TO MAKE ANOTHER

SUPPORT NEW PIPING FROM EXISTING STEEL STRUCTURE WHERE NEW PIPING IS UNDER OR ALONGSIDE THE STEEL STRUCTURE. WHERE PIPING IS LOCATED OUTSIDE THE BOUNDARY OF THE EXISTING STEEL STRUCTURE, UTILIZE NON-PENETRATING PIPE SUPPORTS, WITH A

BESSEY CHILLER REPL CHILL

CAPITAL PROJ. NO. CP23031

MORGAN LEAD CHARLAND ARCH. WINKLER MECH. BEACH GARDNER CIVIL WILBER INT DES

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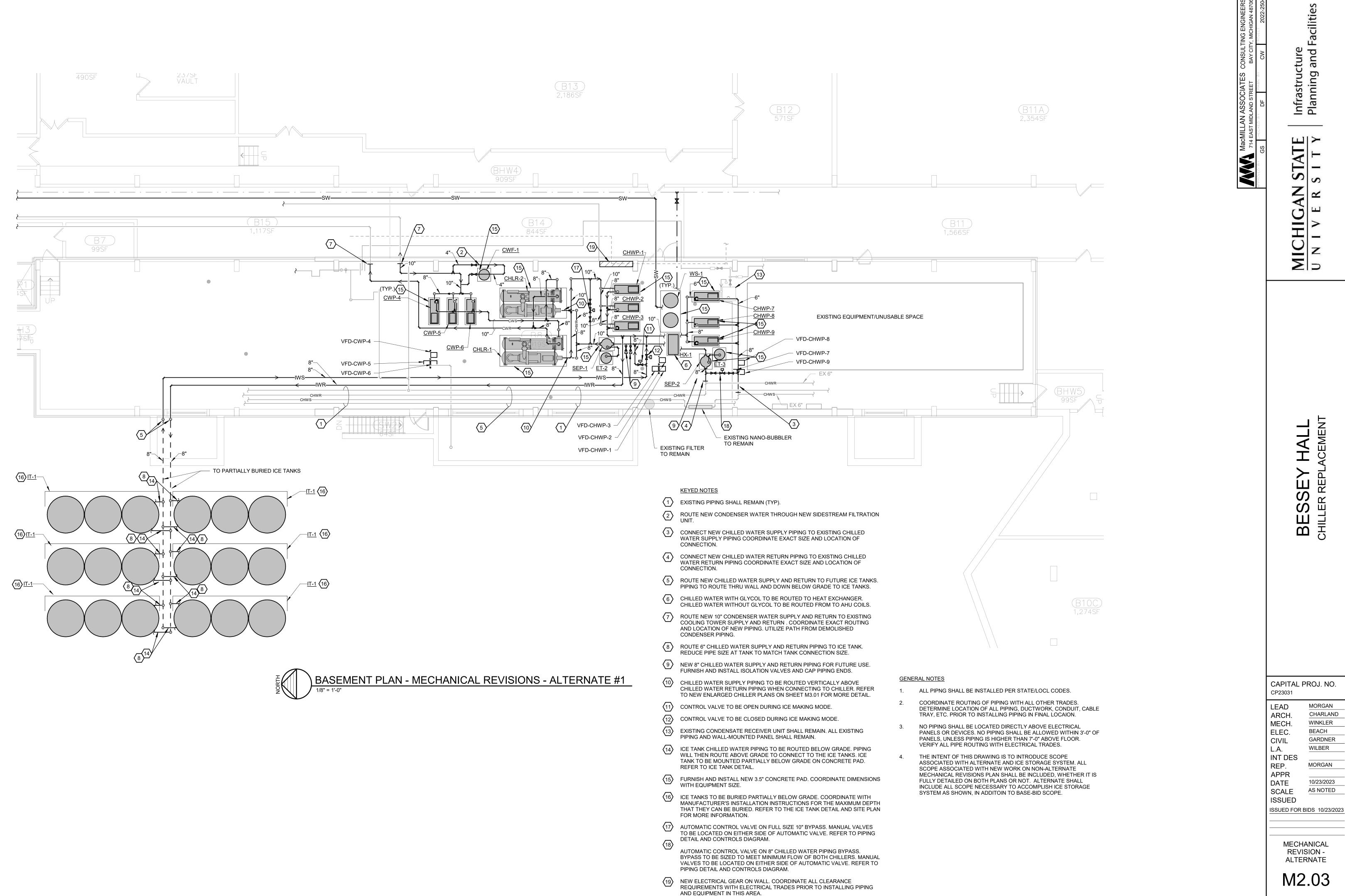
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MECHANICAL REVISIONS

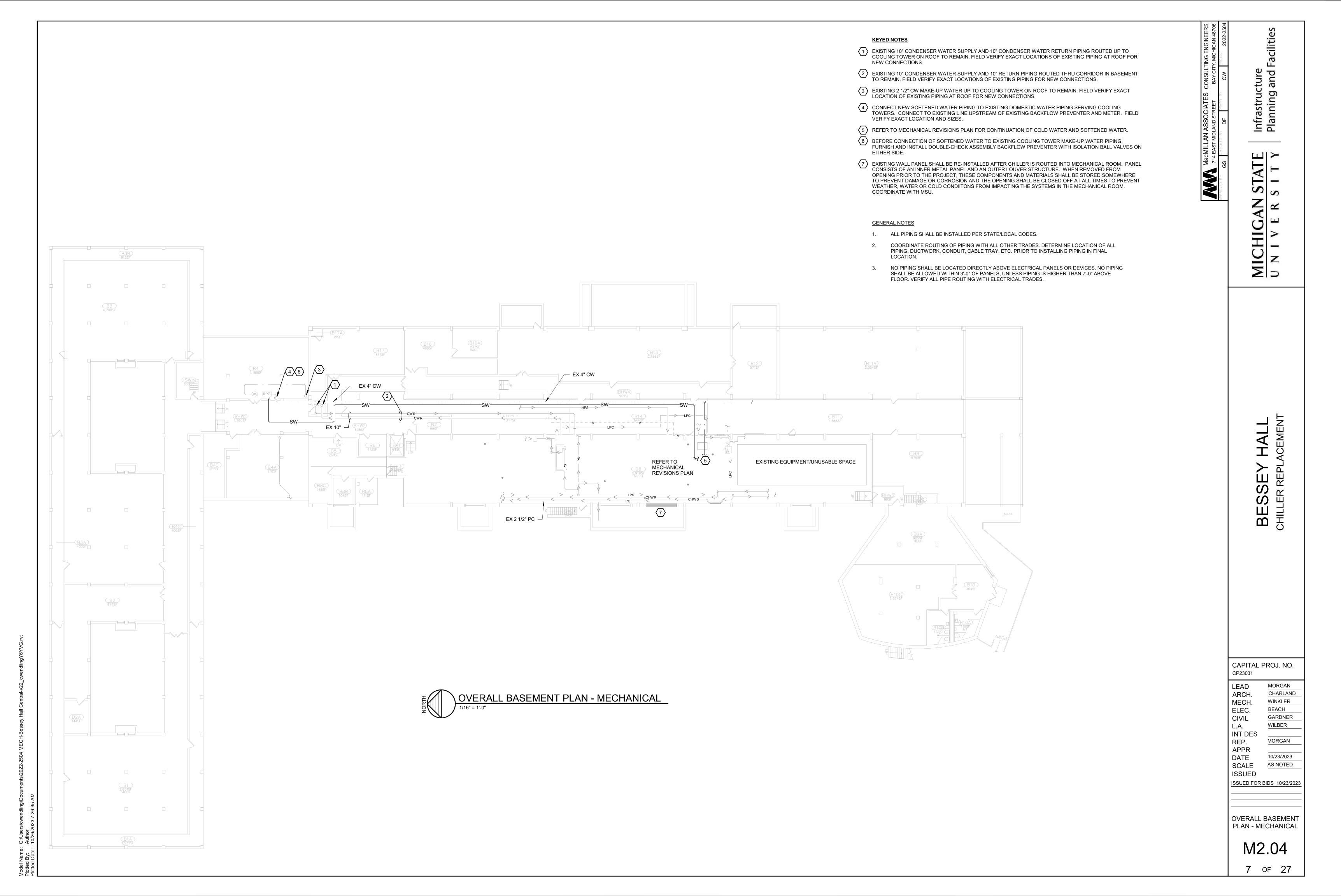
ROOF PLAN -

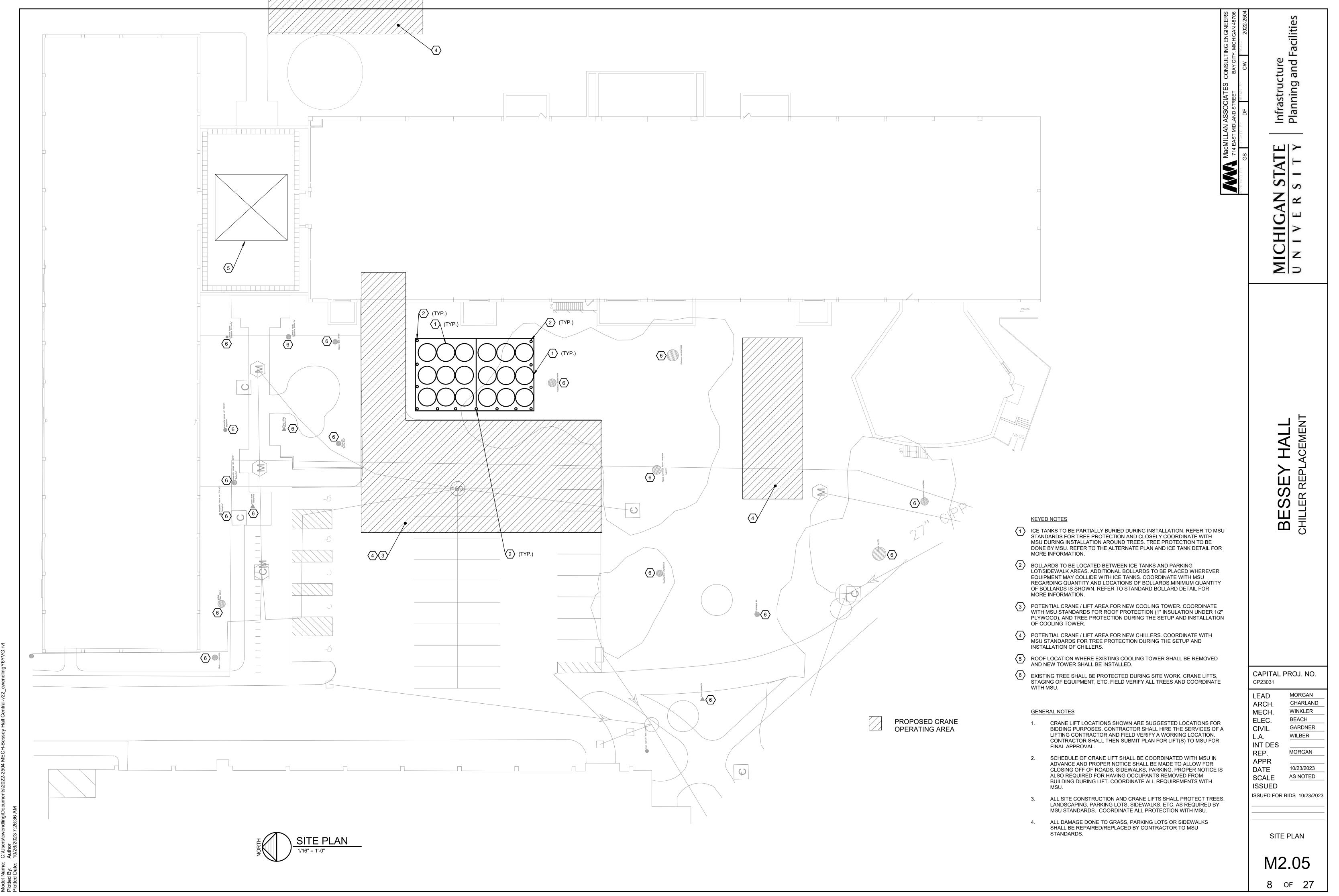
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COOLING TOWER MANUFACTURER WORK. CONCRETE ROOF PAD INSTALLED UNDERNEATH SUPPORT. REFER TO PARTIAL PLAN OVERALL ROOF PLAN - MECHANICAL REVISIONS



of **27**





BESSEY
CHILLER REPL

CAPITAL PROJ. NO. CP23031

LEAD MORGAN ARCH. MECH. CHARLAND WINKLER GARDNER CIVIL INT DES

REP. MORGAN APPR 10/23/2023

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3D CHILLER VIEWS

M3.01

- CONNECT CHILLED WATER SUPPLY AND RETURN TO NEW CHILLER. REDUCE/INCREASE PIPE SIZE WHEN NECESSARY TO CONNECT TO CHILLER.

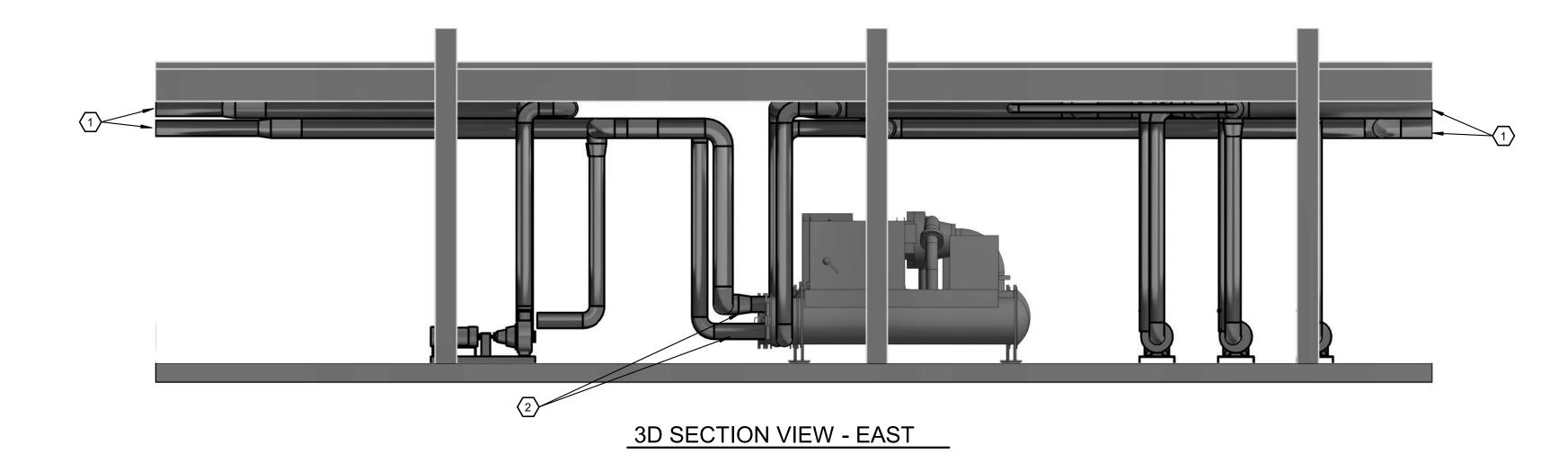
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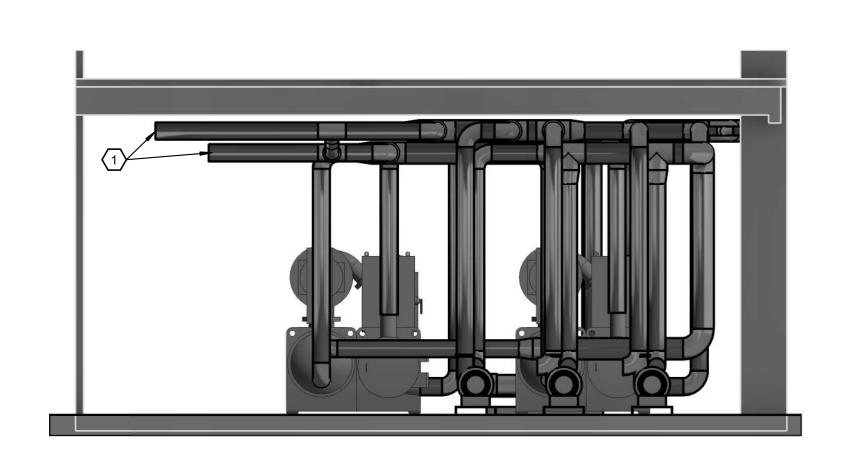
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SECTIONS

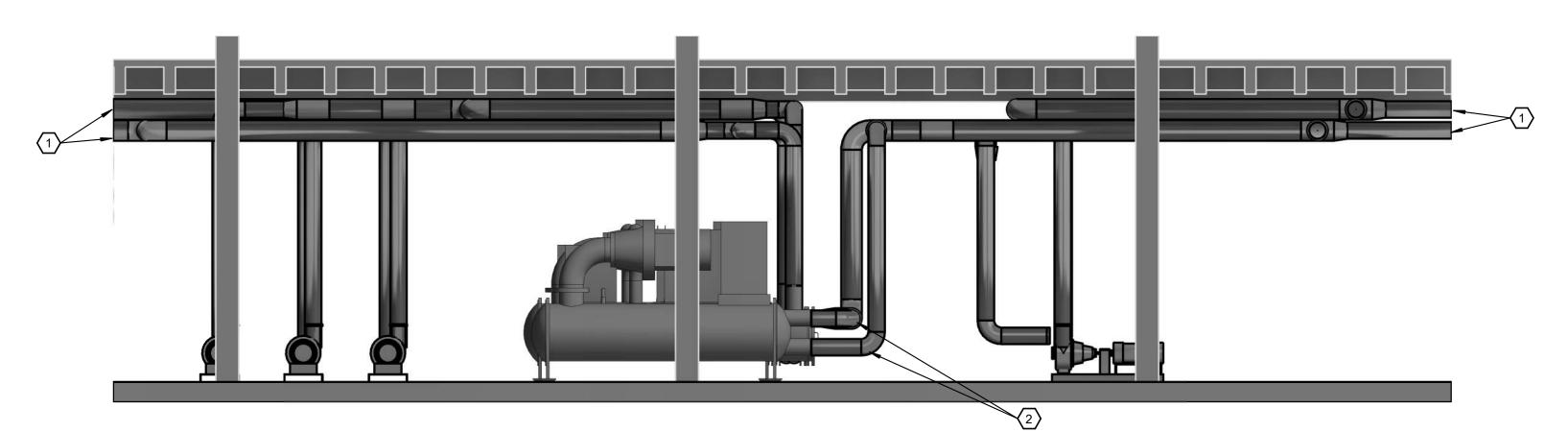
M3.02 10 of 27

3D - SECTION VIEW - NORTH





3D - SECTION VIEW - SOUTH



3D - SECTION VIEW - WEST

- REFER TO THE MECHANICAL REVISIONS FLOOR PLAN FOR MORE INFORMATION AND CONTINUATION OF PIPING.

KEYED NOTES

CONNECT CHILLED WATER SUPPLY AND RETURN TO NEW CHILLER. REDUCE/INCREASE PIPE SIZE WHEN NECESSARY TO CONNECT TO CHILLER.

3D - ISOMETRIC VIEW 2

KEYED NOTES

3D ISOMETRIC VIEWS

ISSUED FOR BIDS 10/23/2023

M3.03 11 OF 27

BESSEY
CHILLER REPL

CAPITAL PROJ. NO. CP23031

ARCH. MECH. ELEC.

CIVIL L.A.

APPR

DATE SCALE ISSUED

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MORGAN

MORGAN

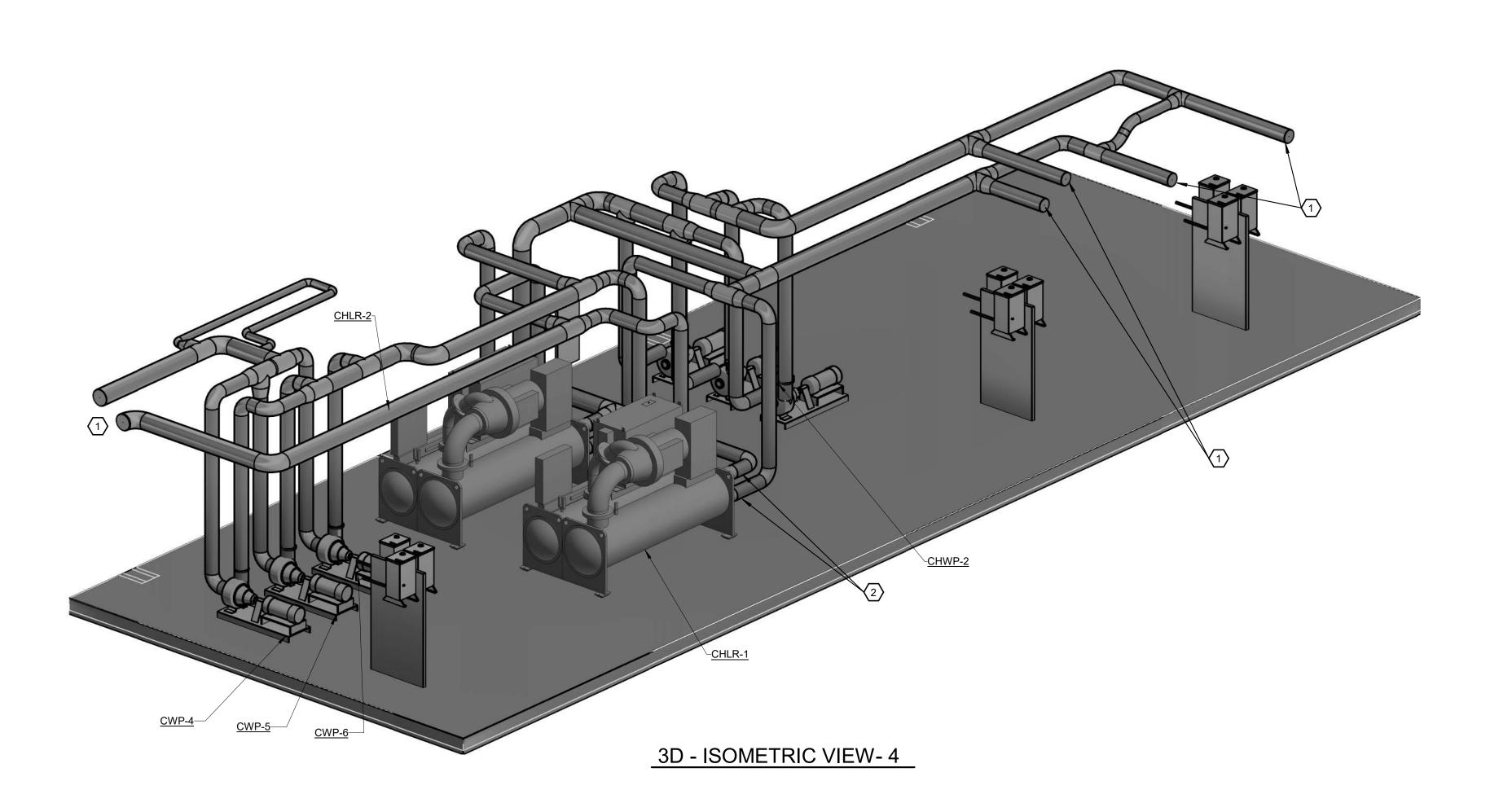
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CHARLAND WINKLER

KEYED NOTES

REFER TO THE MECHANICAL REVISIONS FLOOR PLAN FOR MORE INFORMATION AND CONTINUATION OF PIPING.

CONNECT CHILLED WATER SUPPLY AND RETURN TO NEW CHILLER. REDUCE/INCREASE PIPE SIZE WHEN NECESSARY TO CONNECT TO CHILLER.



BESSEY
CHILLER REPL

CAPITAL PROJ. NO. CP23031

MORGAN CHARLAND WINKLER CIVIL L.A. INT DES

MORGAN APPR DATE SCALE ISSUED 10/23/2023 AS NOTED

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3D ISOMETRIC VIEWS

M3.04

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CHILLER INSTALLATION PROCEDURE

M4.0113 OF 27



PLAN VIEW - CHILLER ON GRADE 3/16" = 1'-0"

INSTALL NOTES:

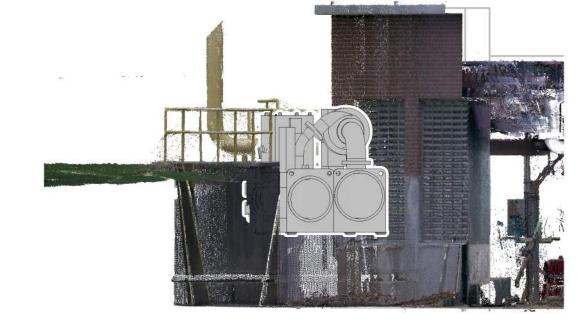
TOP VIEW OF CHILLER LOCATED ON GRADE OUTSIDE OF AREA WAY.



PLAN VIEW - CHILLER OUTSIDE (IN AREAWAY) 3/16" = 1'-0"

INSTALL NOTES:

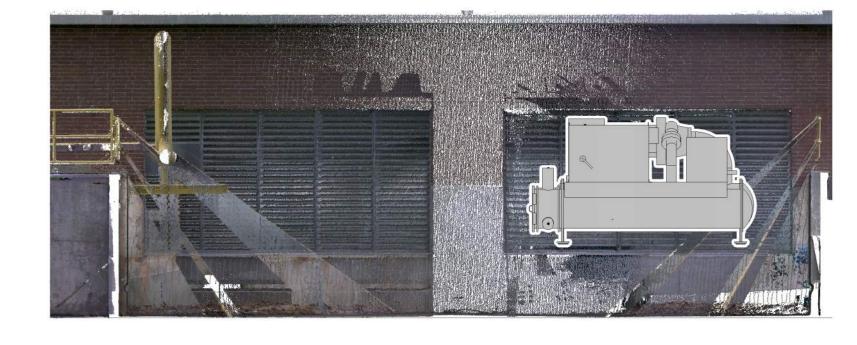
CHILLER TO BE MOVED FROM GRADE OUTSIDE OF AREA WAY TO TOP OF SLAB INSIDE OF AREA WAY.
HIGHLIGHTED PANEL TO BE REMOVED TO MAKE WAY FOR THE OLD CHILLERS TO BE REMOVED AND FOR THE NEW CHILLERS TO BE ROUTED INTO MECHANICAL ROOM.



SECTION VIEW - CHILLER IN AREAWAY

INSTALL NOTES:

SECTION VIEW OF NEW CHILLER IN AREA WAY.



SECTION VIEW - CHILLER ON GRADE

3/16" = 1'-0"

SECTION VIEW OF CHILLER LOCATED ON GRADE OUTSIDE OF AREA WAY.

INSTALL NOTES:

SIDEVIEW - CHILLER IN AREAWAY

INSTALL NOTES: SIDE VIEW OF NEW CHILLER LOCATED IN AREA WAY.



SECTION VIEW - CHILLER GOING THRU WALL OPENING 3/16" = 1'-0"

INSTALL NOTES: NEW CHILLER TO BE ROUTED THROUGH THE REMOVED PANEL IN PREVIOUS STEP.



PLAN VIEW - CHILLER IN MECH ROOM

3/16" = 1'-0"

INSTALL NOTES: CHILLER LOCATED ON FLOOR OF BASEMENT.



SECTION VIEW - CHILLER IN MECHANICAL ROOM

INSTALL NOTES:

3/16" = 1'-0"

SECTION VIEW OF NEW CHILLER LOCATED ON ON FLOOR OF BASEMENT.

NOTES:

- . CHILLER SHALL BE PROVIDED WITH SINGLE POINT ELECTRICAL CONNECTION AT VFD. VFD SHALL BE FACTORY MOUNTED AND WIRED AND SHALL INCLUDE DISCONNECT SWITCH.
- 2. VARIABLE SPEED DRIVE STARTER.
- 3. 75 dBA MAXIMUM SOUND PRESSURE LEVEL AT ALL LOADS.
- THE CHILLER SHALL BE CONTROLLED BY A STAND-ALONE MICROPROCESSOR BASED CONTROL CENTER. THE CHILLER CONTROL CENTER SHALL PROVIDE CONTROL OF CHILLER OPERATION AND MONITORING OF CHILLER SENSORS, ACTUATORS, RELAYS AND SWITCHES.
- 5. CONTROLS CONTRACTOR SHALL BE RESPONSIBLE FOR ANY GATEWAY REQUIRED TO ALLOW BUILDING MANAGEMENT SYSTEM TO COMMUNICATE AND VIEW CHILLER CONTROL INFORMATION.
- 6. MANUFACTURER SHALL INCLUDE (4) 1 INCH THICK NEOPRENE VIBRATION ISOLATION MOUNTING PADS, FOR FIELD MOUNTING.
- 7. COMPRESSOR MOTOR SHALL BE A HERMETIC, OIL-FREE, PERMANENT MAGNETIC TYPE WITH ACTIVE MAGNETIC BEARINGS AND DIRECTLY COUPLED WITH COMPRESSOR.
- 8. EVAPORATOR AND CONDENSER WATER BOXES SHALL BE REMOVABLE TO PERMIT TUBE CLEANING AND REPLACEMENT. WATER BOX SHALL BE PROVIDED WITH HINGES ON EACH END.
- ;9. DRIVELINE COMPONENTS SHALL BE INDIVIDUALLY FIELD SERVICEABLE BY THE ORIGINAL EQUIPMENT MANUFACTURER. IF NOT, THE MANUFACTURER SHALL PROVIDE ONE REPLACEMENT DRIVELINE PER CHILLER.
- 10. CHILLERS ARE TO BE SHIPPED BROKEN DOWN INTO THREE MAJOR PIECES: EVAPORATOR SHELL, CONDENSER SHELL AND DRIVELINE TO FACILITATE RIGGING INTO THE MECHANICAL ROOM.
- THE MANUFACTURER IS RESPONSIBLE FOR PROVIDING FACTORY CERTIFIED TECHNICIANS TO SUPERVISE THE RIGGING OF THE CHILLER COMPONENTS INTO PLACE AND MAKE ALL FINAL CONNECTIONS MECHANICALLY, ELECTRICALLY AND CONTROL WISE.
- 12. THE SERVICES OF A FACTORY TRAINED, FIELD SERVICE REPRESENTATIVE WILL BE PROVIDED TO SUPERVISE THE FINAL LEAK TESTING, CHARGING AND THE INITIAL STARTUP AND CONDUCT CONCURRENT OPERATOR INSTRUCTION.
- 18 MONTH (STARTING ON DAY OF SHIPMENT) FACTORY WARRANTY COVERING ALL PARTS, LABOR AND REFRIGERANT. WARRANTY FOR COMPRESSOR/MOTOR DRIVELINE SHALL SHALL BE AN ADDITIONAL 48 MONTHS (66 MONTHS TOTAL).
- 14. REFER TO SPECIFICATIONS FOR ADDITIONAL INFORMATION AND REQUIREMENTS.

	CROSS-FLOW COOLING TOWER SCHEDULE																						
					FANS				Р	ERFORMANC	E				PIPING CON	NECTIONS		EL	ECTRICAL			WEIGHT	
MARK	LOCATION	NOMINAL TONS	NUMBER OF CELLS	QTY	HP (EACH)	BHP (EACH)	TOTAL FLOW (GPM)	EACH CELL FLOW (GPM)	WATER INLET TEMP	WATER INLET TEMP	WPD (PSI)	AMBIENT AIR TEMP (WB)	BASIN VOLUME (GAL)	INLET/ OUTLET	OVERFLOW	MAKEUP WATER	BASIN DRAIN	VOLTAGE	PHASE	HZ	MANUFACTURER MODEL NUMBER	OPERATING (LBS)	
CT-1	ROOF	800	2	2	40	35.5	1,900	1,210	95°F	85°F	2	78°F	229	10"	4"	2"	1-1/2"	480	3	60	MARLEY NC8403TLN2	33,970	20'-4" X 18'-2" X 15'-1"H

NOTES:

- 1. GALVANIZED STEEL CASING AND STRUCTURE.
- 2. STAINLESS STEEL COLLECTION BASIN AND DISTRIBUTION BASIN.
- 3. 15 MIL PVC FILM FILL WITH INTEGRAL LOUVERS AND DRIFT ELIMINATORS.
- 4. PROVIDE WITH WATER-LEVEL CONTROL USING A STANDARD FLOAT.5. HDG STEEL FAN GUARD.
- 6. ACCESS DOOR ON EACH SIDEWALL. STAINLESS STEEL PLENUM WALKWAY INSIDE EACH CELL. EXTERNAL LUBE LINE WITH DIPSTICK. LADDER WITH CAGE.
- 7. FAN MOTOR SHALL BE CONTROLLED USING A VFD. FURNISH WITH RTD TEMPERATURE SENSOR FOR VFD OPERATION.
- 8. PROVIDE INSTALLATION SUPPORT AND START-UP SUPPORT BY FACTORY-TRAINED AND AUTHORIZED PERSONNEL.
- 9. PROVIDE 5-YEAR WARRANTY FOR FANS, FAN SHAFTS, FAN MOTOR, BEARINGS, SHEAVES, GEARBOXES, DRIVESHAFTS, COUPLINGS AND MECHANICAL EQUIPMENT SUPPORT.
- 10. FURNISH WITH MARLEY CONTROL PANEL. VFD WITH DISCONNECT SHALL BE FIELD-INSTALLED BY ELECTRICAL TRADES FOR EACH CELL. MARLEY SHALL INCLUDE FACTORY REPRESENTATIVE VFD STARTUP EXPENSES.
- 11. MANUFACTURER SHALL INCLUDE FIELD INSTALLATION BY FACTORY REPRESENTATIVE, AS WELL AS ALL START-UP EXPENSES. (MINIMUM OF 50 HOURS OF TIME FROM MANUFACTURER REPRESENTATIVE ON-SITE)
- 12. PROVIDE MARLEY SP BASIN SWEEPER SYSTEM OR EQUAL.
- 13. BAC, EVAPCO, TOWERTECH SHALL BE CONSIDERED EQUALS. REVISIONS TO EXISTING STEEL STRUCTURE, IN ADDITION TO BASE BID SCOPE, ASSOCIATED WITH A SPECIFIC MANUFACTURER SHALL BE INCLUDED IN BID COST.

	PUMP SCHEDULE												
MARK	SYSTEM	MANUFACTURER	MODEL	TYPE	DESIGN GPM	DESIGN	EL	ECTRICAL		NOTES			
						HEAD	VOLTS	PHASE	HP	1.0.1_0			
CHWP-1,2,3	CHW (PRIMARY LOOP)	BELL & GOSSETT	e-1510-6G	BASE-MOUNTED	1200	55	480	3	25	1,2,3,4			
CWP-4,5,6	CONDENSER WATER	BELL & GOSSETT	e-1510-5EB	BASE-MOUNTED	950	99	480	3	40	1,2,3,4			

- 1. PUMP MANUFACTURER SHALL FURNISH SYSTEM CHECK, TEST AND START-UP, ALONG WITH OWNER'S TRAINING.
- 2. ALL PUMPS, VALVES, ETC. SHALL BE INSTALLED IN ACCORDANCE WITH MANUFACTURER'S RECOMMNEDED INSTALLTION INSTRUCTIONS.
- 3. FURNISH CONCENTRIC PIPE REDUCER AT PUMP SUCTION AND DISCHARGE TO REDUCE FROM LISTED PIPE SIZE ON DRAWINGS TO PUMP CONNECTION SIZE.
- 4. PUMP SHALL BE WIRED TO AND OPERATED BY A REMOTE VFD. WIRING BY ELECTRICAL TRADES.
- 5. GRUNDFOS AND ARMSTRONG SHALL BE BID AS A VOLUNTARY ALTERNATE.

	PUMP SCHEDULE ALTERNATE #1												
MARK	SYSTEM	MANUFACTURER	MODEL	TYPE	DESIGN GPM	DESIGN	EL	NOTES					
	<u> </u>					HEAD	VOLTS	PHASE	HP				
CHWP-1,2,3	CHW (PRIMARY LOOP)	BELL & GOSSETT	e-1510-5BD	BASE-MOUNTED	1200	65	480	3	25	1,2,3,4			
CHWP-7,8,9	AHU LOOP	BELL & GOSSETT	e-1510-3BD	BASE-MOUNTED	600	58	480	3	15	1,2,3,4			

NOTE

- 1. PUMP MANUFACTURER SHALL FURNISH SYSTEM CHECK, TEST AND START-UP, ALONG WITH OWNER'S TRAINING.
- 2. ALL PUMPS, VALVES, ETC. SHALL BE INSTALLED IN ACCORDANCE WITH MANUFACTURER'S RECOMMNEDED INSTALLTION INSTRUCTIONS.
- 3. FURNISH CONCENTRIC PIPE REDUCER AT PUMP SUCTION AND DISCHARGE TO REDUCE FROM LISTED PIPE SIZE ON DRAWINGS TO PUMP CONNECTION SIZE.
- 4. PUMP SHALL BE WIRED TO AND OPERATED BY A REMOTE VFD. WIRING BY ELECTRICAL TRADES.
- 5. CONDENSER WATER PUMPS ARE THE SAME AS BASE BID.
- 6. GRUNDFOS AND ARMSTRONG SHALL BE BID AS A VOLUNTARY ALTERNATE.

BESSEY HALL
CHILLER REPLACEMENT

CAPITAL PROJ. NO. CP23031

LEAD MORGAN
ARCH. CHARLAND
MECH. WINKLER
ELEC. BEACH
CIVIL GARDNER
L.A. WILBER
INT DES
REP. MORGAN

APPR
DATE
SCALE
ISSUED

ISSUED FOR BIDS 10/23/2023

MECHANICAL

SCHEDULES

1013.0

Model Name: C:\Users\cwendling\Documents\2022-2504 MECH-Bessey Plotted By: Author

NOTES:

- 1. AHRI STANDARD 400.
- 2. HEAT EXCHANGER PLATES: THICKNESS=0.5 MM, QUANTITY OF PLATES=586, PLATE MATERIAL=304 STAINLESS STEEL.
- 3. SINGLE PASS DESIGN WITH ALL CONNECTIONS LOCATED ON THE FRAME PLATE (FIXED HEAD).
- 4. ALUMINUM SPLASH SHIELD COVERING THE SIDES AND TOP OF PLATE PACK.
- 5. FRAME PLATES SHALL HAVE INTEGRAL LIFTING EYES IN THE UPPER CORNERS. BOLTED OR WELDED ON LIFTING LUGS ARE NOT ALLOWED.
- 6. AIC, ALFA LAVAL, ARMSTRONG SHALL BE CONSIDERED EQUAL IF ALL REQUIREMENTS ARE MATCHED OR EXCEEDED.

AIR & SEDIMENT SEPARATOR SCHEDULE											
MARK	MANUFACTURER	MODEL	TYPE	CONNECTION SIZE	REMARKS						
SEP-1	BELL & GOSSETT	CRSN-10F	ASME AIR SEPARATOR	10"	PROVIDE AUTOMATIC AIR VENT, AND DRAIN VALVE, INSULATE PER SPECIFICATION						
	ALTERNATE #1										
SEP-2	BELL & GOSSETT	CRSN-8F	ASME AIR SEPARATOR	8"	PROVIDE AUTOMATIC AIR VENT, AND DRAIN VALVE, INSULATE PER SPECIFICATION						

				EXPA	ANSION TANK SCHEDULE								
MARK	MANUFACTURER	MODEL	TANK VOLUME (GAL)	ACCEPTANCE VOLUME (GAL)	TYPE	NOTES							
ET-1	BELL & GOSSETT (OR EQUAL)	B-165	44	44	ASME FLOOR MOUNTED BLADDER TANK	FILL PRESSURE OF TANK SHALL MATCH SYSTEM PRESSURE. PROVIDE TRIM INCLUDING TANK PURGE VALVE, TANK DRAIN AND AIR CONNECTION.							
	ALTERNATE #1												
ET-1	BELL & GOSSETT (OR EQUAL)	B-300	80	80	ASME FLOOR MOUNTED BLADDER TANK	FILL PRESSURE OF TANK SHALL MATCH SYSTEM PRESSURE. PROVIDE TRIM INCLUDING TANK PURGE VALVE, TANK DRAIN AND AIR CONNECTION.							
ET-2	BELL & GOSSETT (OR EQUAL)	B-165	44	44	ASME FLOOR MOUNTED BLADDER TANK	FILL PRESSURE OF TANK SHALL MATCH SYSTEM PRESSURE. PROVIDE TRIM INCLUDING TANK PURGE VALVE, TANK DRAIN AND AIR CONNECTION.							

	ICE STORAGE TANK SCHEDULE - ALTERNATE #1												
TAG	MANUFACTURER	MODEL	CAPACITY (TON HOURS)	MAX OPERATING PRESSURE (psi)	PIPING CONNECTIONS	VOLUME (gal)	WEIGHT (lbs)	OVERALL DIMENSIONS (W"xL"xH")	INDIVIDUAL TANK DIMENSIONS (DIA"xH")				
IT-1	CALMAC	1500CSF	486	90	4"	4,965	34,000	89"x273"x102"	89"x102"				

NOTES

- 1. PRE-ENGINEERED SYSTEM SHALL CONSIST OF (3) TANKS, INTEGRAL PIPING, REQUIRING ONLY A SINGLE INLET AND OUTLET PIPE CONNECTION.
- 2. STANDARD 5 YEAR HEAT EXCHANGER WARRANTY AND 10 YEAR TANK PARTS WARRANTY.
- 3. ALLOW 36" OVERHEAD CLEARANCE.
- 4. SEAMLESS ONE PIECE TANK WITH WELDED COUNTER-FLOW POLYETHYLENE HEAT EXCHANGER.
- 5. ICE TANKS IN SERIES TO BE PIPED IN REVERSE RETURN ORIENTATION.
- 6. SELECTION BASED ON CALMAC. EVAPCO ICE STORAGE SHALL BE CONSIDERED EQUAL IF TANK SYSTEMS UTILIZE THE SAME (OR SMALLER) FOOTPRINT ON SITE.

			WATE	R SOFTENER	R SCHEDULE				
TAG	SYSTEM MANUFACTURER	SYSTEM TYPE	RESIN TYPE	VOLUME (FT3)	LOW FLOW RATE PER TANK (GPM)	SERVICE FLOW RATE PER TANK (GPM)	MAXIMUM FLOW RATE PER TANK (GPM)	NUMBER OF TANKS	TANK SIZE (DIA" x H") EACH
WS-1	CHARGER	TWIN ALTERNATING	C-800	4.0	4	20	35	2	16"x65"

NOTE

- 1. WATER SOFTENER SYSTEM SHALL BE FURNISHED BY CHARGER WATER TREATMENT PRODUCTS, NO EXCEPTIONS.
- 2. SYSTEM SHALL UTILIZE ALDEX C-800 WATER SOFTENING RESIN.
- 3. SYSTEM SHALL UTILIZE CLACK MINERAL TANKS.
- 4. ENTIRE SOFTENER SYSTEM SHALL BE DESIGNED AND PROVIDED BY CHARGER. MECHANICAL CONTRACTOR SHALL INSTALL.

	CONDENSER WATER FILTRATION UNIT												
TAG	MANUFACTURER	MODEL	FLOW RATE (GPM)	PIPING CONNECTIONS	PUMP (HP)	PUMP ELECTRICAL	DIMENSIONS (W"xL"xH")						
CWF-1	PUROFLUX	PF-2036	140	2-1/2"	5	480V - 3PH, 8 AMPS	48" x 66" x 48"H						

NOTES

- NOTES

 1. FILTER MEDIA: SHPERICAL-BASED CRYSTALLINE SILICA, WITH GRAVEL SUPPORT MEDIA BELOW.
- 2. PROVIDE WITH AUTOMATIC CONTROLS, INCLUDING PRE-WIRED PANEL WITH DISCONNECT AND OVERLOAD/SHORT CIRCUIT
- PROTECTION.
- 3. ELECTRICAL TRADES SHALL PROVIDE POWER CONNECTION AT CONTROL PANEL.
- 4. FULLY-ASSEMBLED SKID WITH 304 STAINLESS STEEL FITLER VESSEL (RATED TO 75 PSI) AND VALVES, INTERCONNECTED PIPING AND
- 5. GWS, LAKOS OR PEP SAND/MEDIA FILTERS SHALL BE CONSIDERED EQUAL IF ALL REQUIREMENTS ARE MATCHED OR EXCEEDED.

SESSEY HALL
HILLER REPLACEMENT

MICHIGAN UNIVERS

CAPITAL PROJ. NO.
CP23031

LEAD MORGAN
ARCH. CHARLAND

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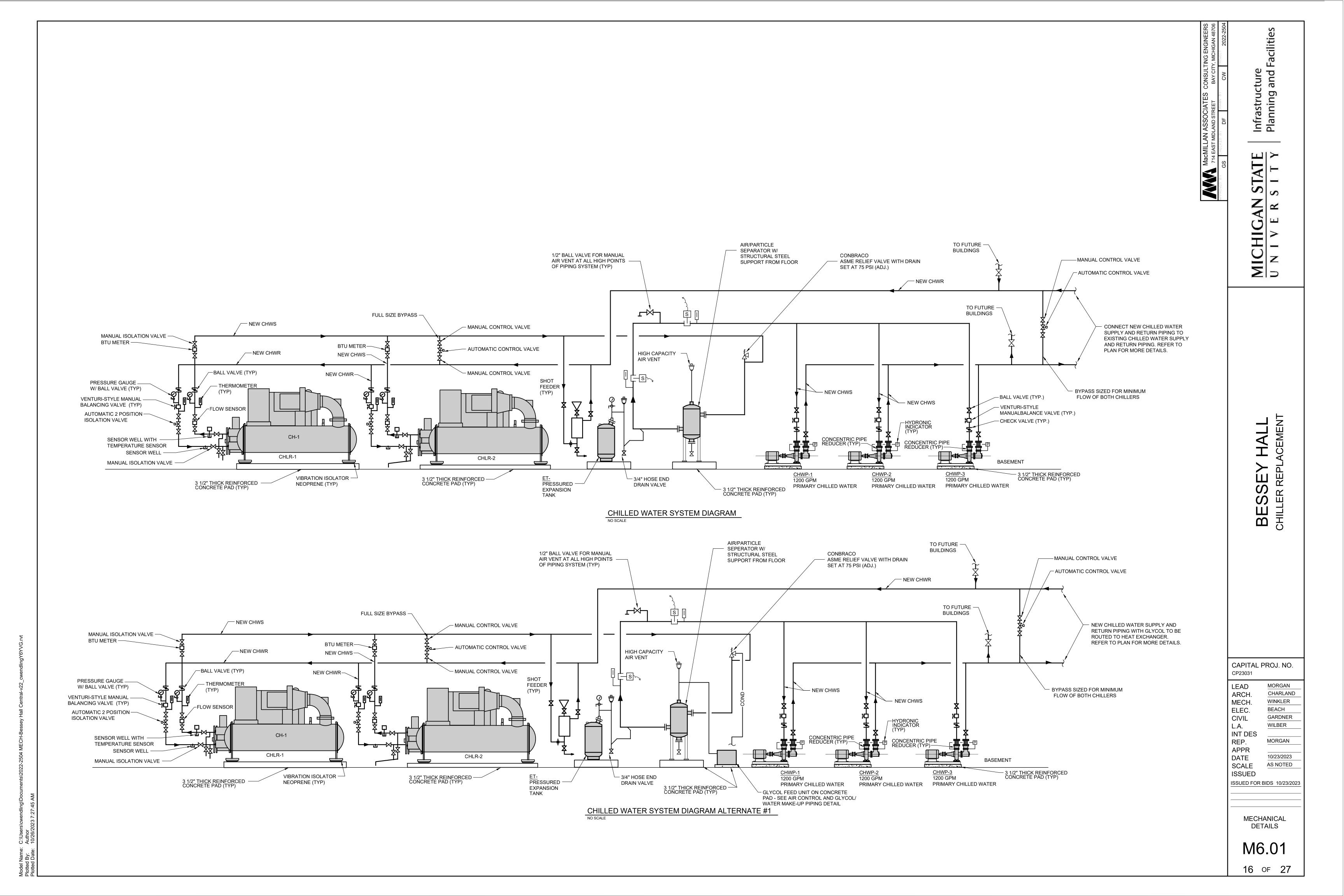
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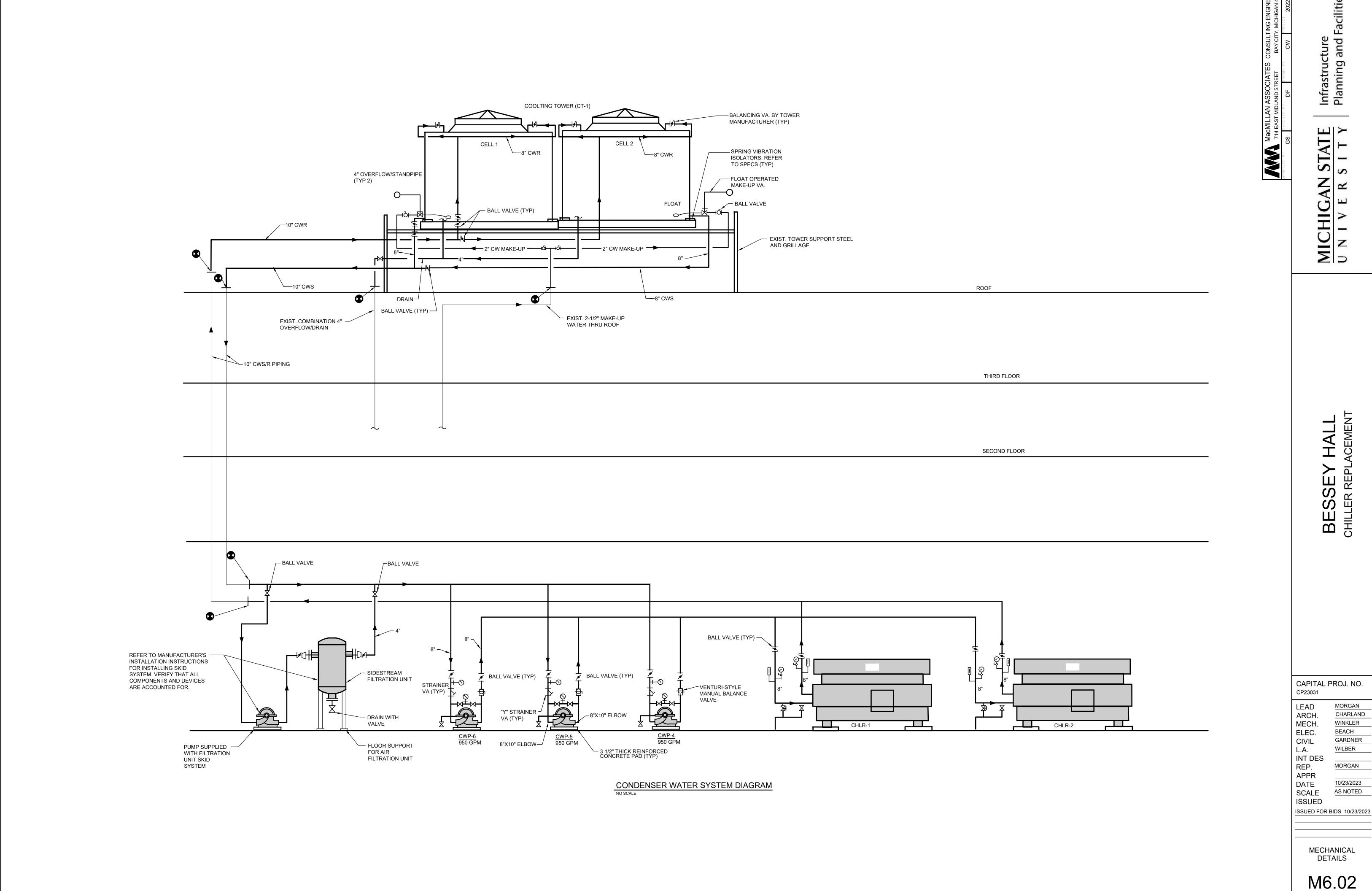
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MECHANICAL SCHEDULES

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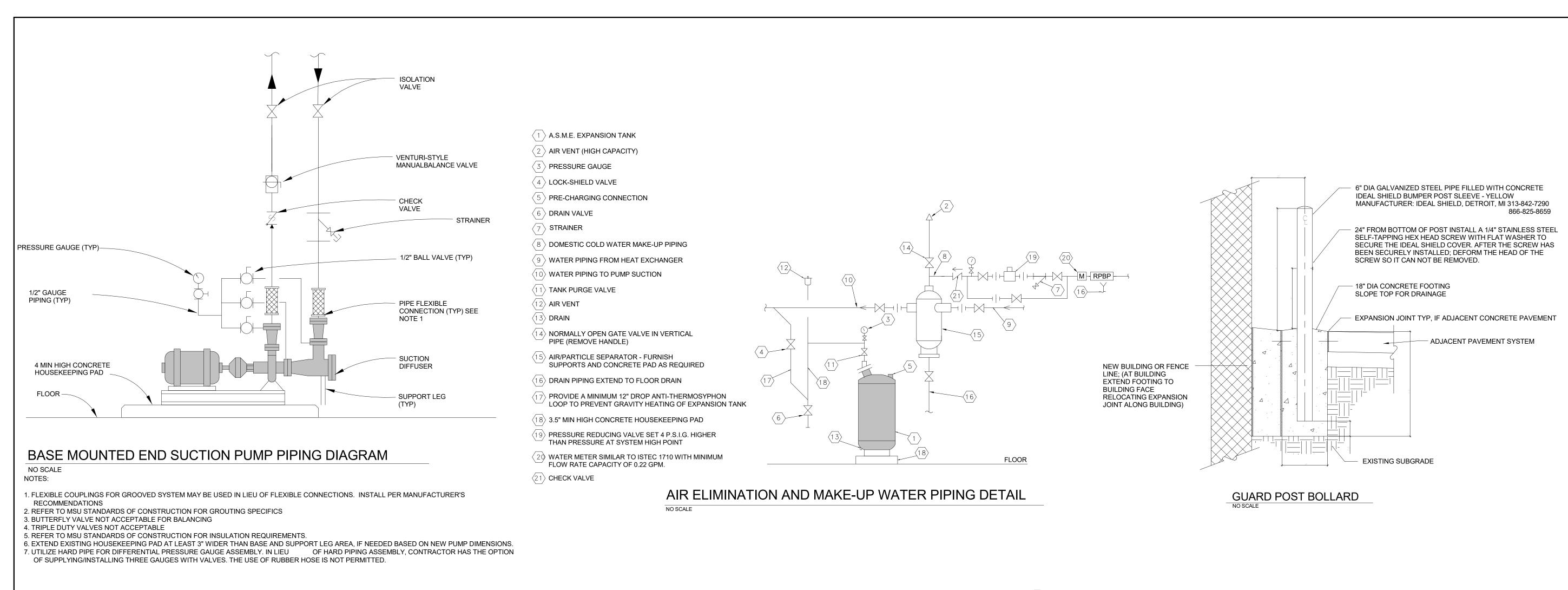


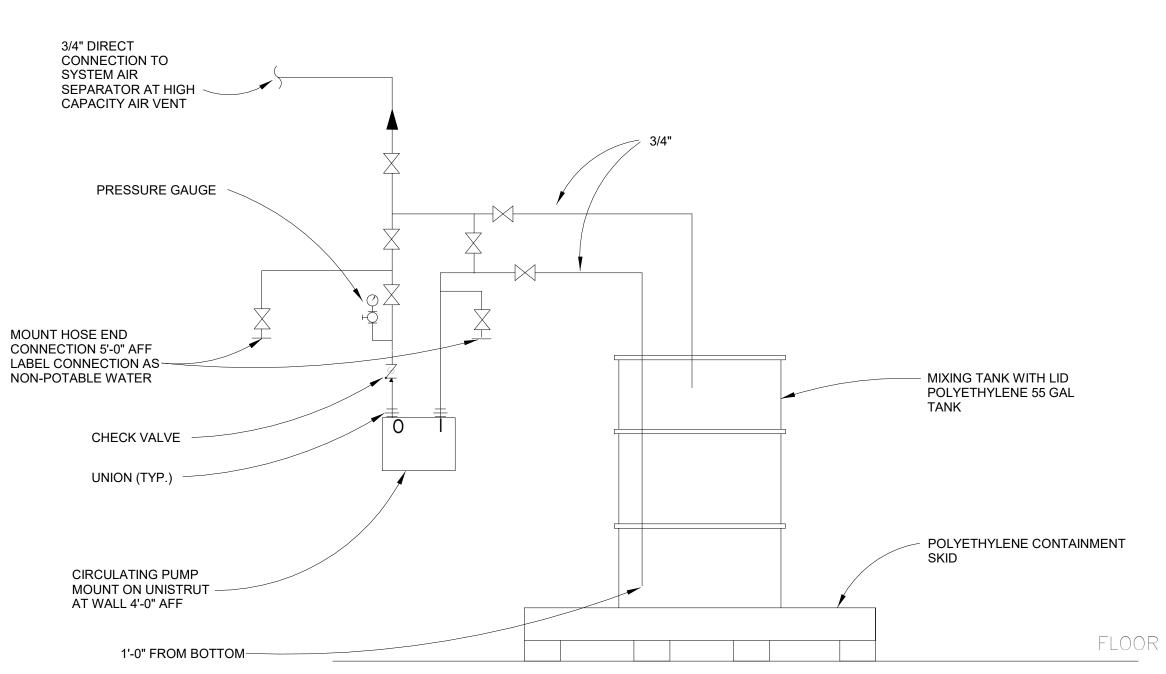


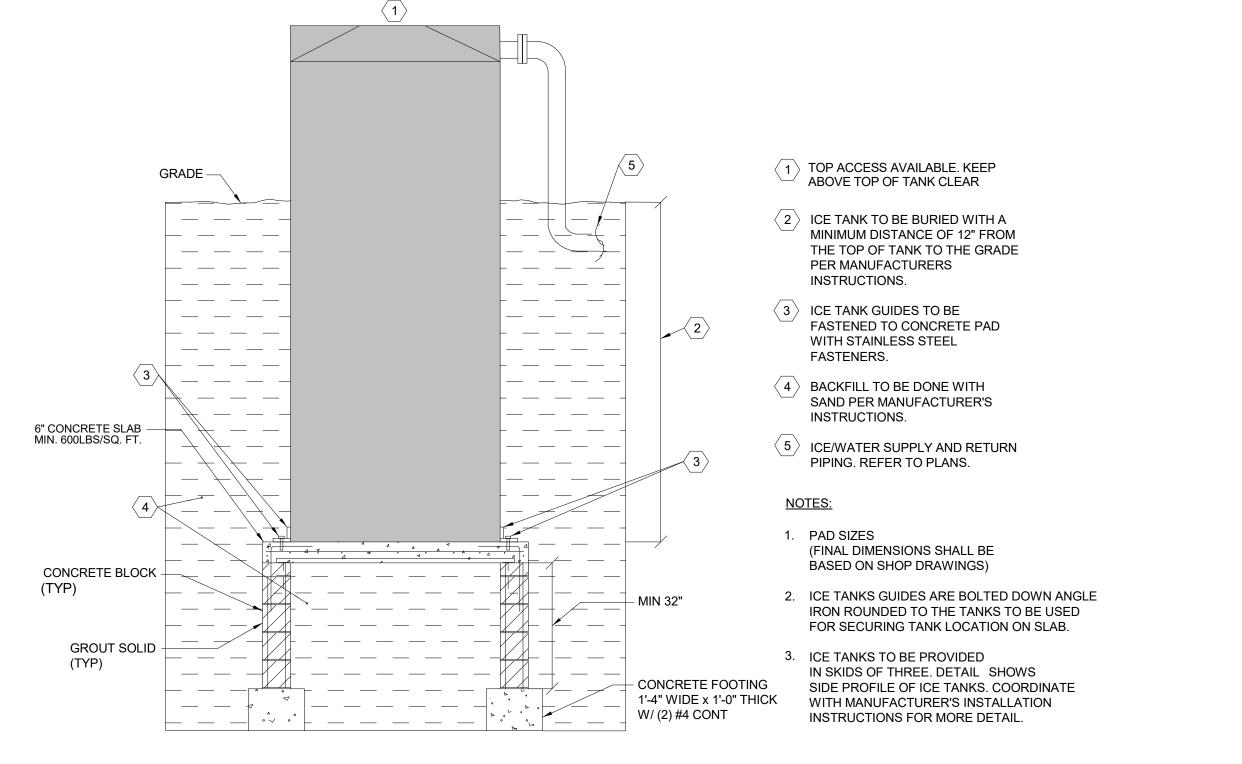
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GLYCOL SOLUTION FEED SYSTEM

NO SCALE

NOTES:

- GLYCOL FILL PUMP SHALL BE GRAINGER ITEM NO 30EK54, 115V, 1/2 HP WITH MANUAL SWITCH MOUNTED ON WALL NEXT TTO PUMP.
- 2. ALL PIPING SHALL BE COPPER.
- SOLUTION TO BE FILLED WITH PRE-MIXED GLYCOL SOLUTION.

WINKLER MECH. BEACH GARDNER CIVIL WILBER INT DES ICE TANK INSTALLATION DETAIL REP. MORGAN APPR 10/23/2023 SCALE AS NOTED **ISSUED** ISSUED FOR BIDS 10/23/2023 MECHANICAL **DETAILS** M6.03

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CAPITAL PROJ. NO.

MORGAN

CHARLAND

CP23031

LEAD

ARCH.

DESCRIPTION

- A. THE CHILLER PLANT SYSTEM CONSISTS OF FOLLOWING MAJOR COMPONENTS: A WATER-COOLED CHILLER (REFERENCED AS CHILLER), TWO (2) CHILLED WATER (CHW) PUMPS WITH ONE UNIT REDUNDANT, TWO (2) CONDENSER WATER (CHW) PUMPS WITH ONE UNIT REDUNDANT, AND DIRECT DIGITAL CONTROLS. REFER TO THE FLOOR PLANS, DETAILS SHEET AND EQUIPMENT SCHEDULES FOR SYSTEM ANCILLARY EQUIPMENT/COMPONENTS AND QUANTITIES, AND FOR DESIGN CAPACITIES, PERFORMANCE AND OTHER INFORMATION.
- 1. THE CHILLED WATER SYSTEM IS A CONSTANT FLOW PRIMARY-ONLY CHILLED WATER LOOP TO MATCH EXISTING CONDITIONS (I.E. 3-WAY CHW VALVES AT
- HVAC UNITS SERVED BY THE SYSTEM). 2. LOAD-SHEDDING STRATEGY INTENDED IS TO PROVIDE CHW TO CRITICAL HVAC IN THE EVENT OF PARTIAL LOSS OF CHW CAPACITY DUE TO CHILLER

<u>GENERAL</u>

- A. THE CHILLER SHALL BE ENABLED/DISABLED MANUALLY OR AUTOMATICALLY FROM THE ENERGY MANAGEMENT CONTROL SYSTEM (EMCS).
- B. THE CHILLED WATER SYSTEM SHALL BE CONTROLLED THROUGH A SIEMENS CONTROL PANEL, HENCEFORTH REFERENCED AS COOLING PLANT CONTROLLER
- THE CONTROLS CONTRACTOR SHALL WORK WITH SIEMENS, CHILLER MANUFACTURER AND OWNER'S SYSTEM OPERATOR OR INFORMATION TECHNOLOGY (IT) REPRESENTATIVE, TO PROVIDE ALL REQUIRED HARDWARE AND WIRING TO FACILITATE THE CONNECTION FOR FULL INTEGRATION INTO THE OWNER'S EMCS. REFER TO THE CONTROL SPECIFICATIONS FOR REQUIREMENTS, AND SEE "EMCS SYSTEM ARCHITECTURE" CONTROLS DIAGRAM FOR ADDITIONAL
- THE CONTROLS CONTRACTOR SHALL WORK WITH THE CHILLER MANUFACTURER IN SETTING UP THE INTERFACE WITH THE FACTORY PROVIDED CHILLER CONTROLS, PROVIDE ALL REQUIRED PROGRAMMING FOR THE IMPLEMENTATION OF ALL NECESSARY SEQUENCES OF OPERATION, AND CONFIGURE ALL
- NECESSARY SETTINGS FOR A FULLY FUNCTIONAL HIGH PERFORMANCE CHILLED WATER SYSTEM. a. ALL CHILLER POINTS AVAILABLE VIA BACNET INTERFACE NOT ALREADY INDICATED IN THE CONTROLS DIAGRAMS/POINTS MATRIX SHALL BE MADE
- AVAILABLE AT THE EMCS INTERFACE, WITH THE APPROPRIATE GRAPHICS, BASED ON THEIR VALUE OR BENEFIT TO SYSTEM OPERATION AND TROUBLESHOOTING, AS COORDINATED WITH THE OWNER
- C. SETPOINTS AND TIMERS
- ALL SETPOINTS AND TIME INTERVALS DESCRIBED IN SEQUENCES ARE RECOMMENDED INITIAL VALUES, WHICH SHALL BE FIELD DETERMINED/ADJUSTED DURING THE COMMISSIONING PERIOD TO MEET THE REQUIREMENTS OF ACTUAL CONDITIONS.
- 2. AFTER SYSTEM RESPONSE HAS BEEN TUNED DURING COMMISSIONING, ALL REQUIRED SETPOINTS AND TIME INTERVALS SHALL BE SET AND SHALL BE
- ADJUSTABLE AT THE OPERATING WORKSTATION (OWS) VIA THE GRAPHICAL USER INTERFACE (GUI). A. TIMERS SHALL BE SET AS SPECIFIED OR AS NEEDED TO PREVENT DAMAGE OR EXCESSIVE WEAR TO EQUIPMENT.
- D. THE EMCS SHALL CALCULATE THE TOTAL RUNTIME FOR PUMP, AND STAGE ASSIGNMENTS SHALL BE ROTATED TO ACCUMULATE APPROXIMATELY EQUAL WEAR FOR EACH EQUIPMENT. AVAILABLE EQUIPMENT ROTATION OPTIONS FOR EACH PUMP SHALL BE AS FOLLOWS:
- 1. MANUALLY THROUGH A SOFTWARE SWITCH.
- 2. IF THE DESIGNATED PUMP HOURLY RUNTIME (ADJ.) IS EXCEEDED.
- MONTHLY

BO - Fan Start/Stop

AO - Fan VFD Speed

BI - Fan VFD Fault

BI - Fan Status

BI - High Water Level Switch

BI - Low Water Level Makeup Switch

BI - Low Water Level Switch

BI - Vibration Status (cox)

Al - Condenser Water Supply (Basin) Temp

- POSITION OF VALVES (APPLICABLE IF VFDs ARE PROVIDED AND CHW SYSTEM IS CONVERTED TO VARIABLE FLOW IN THE FUTURE):
- 1. A HARDWIRED FEEDBACK POINT FOR EACH VALVE (END-SWITCH) INDICATED SHALL BE PROVIDED IN ORDER TO THE DETERMINE THE POSITION OF THE VALVE
- 2. A CONTROL VALVE SHALL BE "FAILED IF ITS STATUS DOES NOT MATCH COMMANDED STATE WITHIN THE ALLOTTED TIME, AS DESCRIBED IN THE CORRESPONDING SEQUENCES. IF AN ALLOTTED TIME IS NOT SPECIFIED, ONE SHALL BE SET IF DETERMINED NECESSARY DURING THE COMMISSIONING PERIOD TO FULFILL THE SOO DESIGN INTENT, AND TO ENSURE RELIABLE/STABLE OPERATION.
- CURRENT SENSING RELAY SWITCHES USED FOR PROVING PUMP STATUS, SHALL BE SET UP SO THAT THEY WILL DETECT COUPLING FAILURE BY THE REDUCTION IN CURRENT DRAW ON LOSS OF COUPLED LOAD.
- G. EQUIPMENT AND CHW SYSTEM SHALL OPERATE PER THEIR CORRESPONDING DESIGNATION.
- 1. MAINTENANCE PERSONNEL SHALL HAVE THE ABILITY, THROUGH THE EMCS, TO SELECT WHICH PUMP SHALL BE DUTY AND STAND-BY.
- 2. IT SHALL BE POSSIBLE TO OPERATE THE CHILLER WITH ANY CHILLED OR CONDENSER WATER PUMP.
- H. THE CONTROLS CONTRACTOR (CC) SHALL COORDINATE ALL SAFETY AND INTERLOCK REQUIREMENTS WITH CHILLER MANUFACTURER. CC SHALL PROVIDE THE WIRING AND FIELD INSTALL THE CHILLED WATER FLOW SWITCH, AND ANY OTHER COMPONENTS OR DEVICES PROVIDED WITH THE CHILLER, AS REQUIRED FOR PROPER AND SAFE CHW SYSTEM OPERATION.
- I. THE CONTROLS CONTRACTOR SHALL FURNISH AND INSTALL THE WIRING IN CONDUIT DIRECTLY FROM THE DIFFERENTIAL PRESSURE TRANSMITTER TO THE CONTROLLER SERVING PUMP VFD (SIGNAL SHALL NOT BE TRANSMITTED ACROSS THE EMCS NETWORK).

BI - Vibration Status

AI - Condenser Water Supply (Basin) Temp

BO - Fan Start/Stop

AO - Fan VFD Speed

BI - Fan VFD Fault

BI - Fan Status

BI - High Water Level Switch

BI - Low Water Level Makeup Switch

BI - Low Water Level Switch

CHILLER CONTROL

- A. ENABLE/DISABLE THE FOLLOWING CONTROL ACTIONS SHALL OCCUR IN SEQUENCE
- 1. THE DUTY CW PUMP SHALL BE COMMANDED 'ON', (ONCE VFD IS PROVIDED IN THE FUTURE) SOFT STARTED TO MINIMUM SPEED BEFORE RAMPING UP TO THE
- 2. (APPLICABLE IF VFDs ARE PROVIDED AND CHW SYSTEM IS CONVERTED TO VARIABLE FLOW IN THE FUTURE) THE BYPASS MODULATION CONTROL VALVE SHALL BE COMMANDED CLOSED, IF NOT ALREADY CLOSED.
- UPON CONFIRMATION OF VALVE POSITION (IF APPLICABLE), THE DUTY CHW PUMP SHALL BE COMMANDED 'ON', (ONCE VFD IS PROVIDED IN THE FUTURE) SOFT STARTED TO MINIMUM SPEED BEFORE RAMPING UP TO THE CHW SYSTEM MINIMUM FLOW. REFER TO SECTION "CHILLED WATER SYSTEM MINIMUM
- FLOW CONTROL" FOR DETERMINATION. 4. IN THE EVENT PROOF OF PUMP OPERATION IS NOT CONFIRMED VIA ITS CURRENT SENSING RELAY SWITCH WITHIN 30 SECONDS (ADJ.) FROM START COMMAND. THE
- STAND-BY PUMP SHALL BE COMMANDED 'ON'. REFER TO "PUMP FAILURE" SECTION FOR MORE INFORMATION. 5. THE COOLING TOWER SHALL BE COMMANDED 'ON' VIA A SIGNAL TO ITS DEDICATED CONTROL PANEL. REFER TO EMCS ARCHITECTURE FOR MORE INFO.
- a. THE OPERATION OF THE CHILLER SHALL BE BY THE CHILLER'S FACTORY PROVIDED INTEGRAL CONTROL SYSTEM AND SHALL BE SUBJECT TO THE CHILLER'S SAFETY CHECKS. THE PROOF OF FLOW SAFETY CIRCUIT SHALL BE VIA THE FACTORY PROVIDED, FIELD INSTALLED DP FLOW SWITCH. THE CHILLER SHALL NOT START UNLESS THE FLOW SWITCH PROVES MINIMUM FLOW.
- IN THE EVENT NO FLOW AT THE EVAPORATOR IS REGISTERED WITHIN 30 SECONDS (ADJ.) AFTER THE CHILLED WATER PUMP STATUS IS PROVEN, A CORRESPONDING ALARM SHALL BE GENERATED THROUGH THE EMCS AND THE CHILLER SHALL BE ASSIGNED AS "FAILED/MAINTENANCE" AT THE
- b. FOR GENERAL INFORMATION ONLY, THE CHILLER'S INTEGRAL LOGIC SEQUENCES INCLUDES BUT NOT LIMITED TO:
- CHILLER SHALL START AFTER FLOW IS PROVEN. • THE CHILLER INTEGRAL CHILLER SPEED CONTROL SHALL MODULATE ITS CAPACITY TO MAINTAIN CHILLED WATER SETPOINT AT THE MOST
- EFFICIENT POINT OF CHILLER OPERATION, AND TO MAINTAIN MACHINE STABILITY. COMPRESSORS SHALL BE STAGED AS NEEDED TO MATCH CHILLED WATER DEMAND
- 7. (ONCE VFD AND DP SENSOR ARE PROVIDED IN THE FUTURE) THE CHW PUMP IS RELEASED TO CONTROL BASED ON DIFFERENTIAL PRESSURE (DP), AS DESCRIBED IN ON A COMMAND SIGNAL TO SHUT-DOWN THE CHILLER, THE REVERSE OCCURS (WITH SOME EXCEPTIONS)
- a. WITH THE CHILLER 'OFF', AFTER A 5 MINUTE (ADJ.) DELAY, THE DUTY CHW AND CW PUMPS SHALL BE COMMANDED 'OFF', (ONCE VFD IS PROVIDED IN THE FUTURE) SOFT STOPPING, AND THE BYPASS MODULATION CONTROL VALVE, IF APPLICABLE, SHALL BE COMMANDED CLOSED, IF NOT ALREADY CLOSED.
- B. CHILLER FAILURE IN THE EVENT OF CHILLER FAILURE, A CORRESPONDING ALARM SHALL BE GENERATED THROUGH THE EMCS, AND THE CHILLER SHALL BE
- REASSIGNED AS "FAILED/MAINTENANCE" AT THE OWS. 1. IN THE EVENT OF PARTIAL FAILURE RESULTING IN REDUCED COOLING CAPACITY, AN ALERT NOTIFICATION SHALL BE GENERATED THROUGH THE CPC, AND IF
- CERTAIN CONDITIONS ARE MET, THE LOAD SHEDDING SEQUENCE SHALL BE INITIATED, IF ENABLED TO ACTIVATE AUTOMATICALLY AT THE CPC. REFER TO LOAD-SHEDDING SEQUENCE OF OPERATION ON M8.2 FOR INFORMATIONAL PURPOSES.
- A. APPLICABLE FAILURES INCLUDE, BUT ARE NOT LIMITED TO, FAILURE OF A COMPRESSOR, FAILURE OF A REFRIGERANT LOOP SOLENOID VALVE, AND OIL
- B. THE LOAD SHEDDING SEQUENCE IS OWNER-PROVIDED AND NOT INTENDED TO BE PART OF THE SIEMENS COOLING PLANT CONTROL. THE SIEMENS CPC WILL OUTPUT THIS ALERT TO THE OWNER'S PLC BASED CONTROL SYSTEM FOR THIS PURPOSE. REFER TO SHEET M8.2 FOR INFORMATIONAL PURPOSES.
- 2. IF THE FAILED CHILLER DOES NOT SELF SHUT-DOWN BY ITS INTERNAL PROTECTIVE LOGIC OR SAFETY CIRCUITS, AND AN ADJUSTABLE TIME DELAY OF 3 MINUTES (ADJ.) HAS ELAPSED, THE CPC SHALL COMMAND THE CHILLER 'OFF' AND BEGIN AN ORDERLY SHUT-DOWN OF THE CHILLER SYSTEM, AS DESCRIBED IN THE "CHILLER CONTROL" SOO SECTION.

CHILLED WATER SUPPLY TEMPERATURE CONTROL

AI - Condenser Water Supply Temp

BO - Condenser Water Pump 2 Start/Stop

AO - Condenser Water Pump 2 VFD Speed

BI - Condenser Water Pump 2 VFD Fault

BI - Condenser Water Pump 2 Status

BI - Condenser Water Pump 2 Status

BO - Condenser Water Pump 2 Start/Stop

AO - Condenser Water Pump 2 VFD Speed

BI - Condenser Water Pump 2 VFD Fault

BI - Condenser Water Pump 2 Status

BO - Condenser Water Pump 2 Start/Stop

AO - Condenser Water Pump 2 VFD Speed

BI - Condenser Water Pump 2 VFD Fault

BI - Refrigerant Monitoring Sensor (Multiple Locations, See Plans)

- A. THE DESIGN CHILLED WATER SUPPLY TEMPERATURE SETPOINT IS 42.0°F (ADJ.).
- 1. THE CHILLER SHALL OPERATE THROUGH ITS INTERNAL CONTROLS TO MAINTAIN CHWS TEMPERATURE SETPOINT, VIA THE FACTORY PROVIDED UNIT MOUNTED CONTROL PANEL (UMCP).

AI - Condenser Water Return Temp

BO - Chiller Enable

BI - Chiller Status

BO - Chiller Enable

AI - Chilled Water Return Temp

BI - Chiller Status

BI - Refrigerant Leak Shutdown

BI - Refrigerant Leak Shutdown

BO - Chilled Water Isolation Valve

BI - Chilled Water Isolation Valve Status

BO - Chilled Water Isolation Valve

BI - Chilled Water Isolation Valve Status

BO - Makeup Valve

AI - BTU Meter Calculator

AI - Chilled Water BTU Mete

AI - BTU Meter Calculator

AI - Chilled Water BTU Meter

AO - Chilled Water Bypass Valve

Al - Chilled Water Supply Temp

2. FOR OPTIMIZED CHILLER PERFORMANCE, THE INTEGRAL LOGIC ALSO INCLUDES STAGING AND COMPRESSOR SPEED CONTROL AT PART LOAD CONDITIONS.

PUMP CONTROL

- A. CHILLED WATER AND CONDENSER WATER PUMP SEQUENCING:
- THE PUMPS ARE STARTED/STOPPED AUTOMATICALLY THROUGH THE EMCS, OR MANUALLY THROUGH THE VFD'S H-O-A SWITCH.
 - THE PUMPS ARE IN A DUTY/STAND-BY CONFIGURATION AND ASSIGNED THESE DESIGNATIONS. a. THE DUTY PUMP SHALL RUN CONTINUOUSLY, WHENEVER THE CHILLER IS ACTIVE.
 - b. THE EMCS SHALL ASSIGN THE OPERATING PUMP BASED ON AN HOURLY RUNTIME SCHEDULE (ADJ.) THAT ALTERNATES DUTY/STAND-BY DESIGNATIONS.
- B. CHILLED WATER PUMP SPEED CONTROL:
- 1. PUMP SHALL OPERATE AT CONSTANT SPEED/CONSTANT FLOW.
- 2. FUTURE UPON CONVERSION OF THE CHW SYSTEM FROM CONSTANT FLOW TO VARIABLE FLOW. THE CHW PUMP SHALL BE CONTROLLED AS FOLLOWS: a. THE DDC PID CONTROL LOOP SHALL MODULATE THE PUMP SPEED TO MAINTAIN DIFFERENTIAL PRESSURE (DP) SETPOINT, AS SENSED BY THE DP TRANSMITTER BETWEEN THE CHILLED WATER SUPPLY AND RETURN MAINS PIPING, WHILE MAINTAINING CHW SYSTEM MINIMUM FLOW. REFER TO
 - "CHILLED WATER SYSTEM MINIMUM FLOW CONTROL" SOO SECTION FOR DETAILS. UPON A DECREASE IN CHW DEMAND, WITH THE DIFFERENTIAL PRESSURE ABOVE SETPOINT, THE PUMP SHALL RAMP-DOWN AS NECESSARY LIMITED
 - TO MINIMUM PUMP SPEED. UPON AN INCREASE IN CHW DEMAND, THE PUMP SHALL RAMP-UP AS NECESSARY LIMITED TO MAXIMUM SPEED.
- VFD RAMP RATE SHALL BE DETERMINED AND SET DURING THE COMMISSIONING PERIOD WITH APPROPRIATE RESPONSE TIME RELATIVE TO THE EMCS CONTROL LOOP RATE TO AVOID HUNTING.
- C. CONDENSER WATER PUMP SPEED CONTROL:
- 1. PUMP SHALL OPERATE CONTINUOUSLY AT CONSTANT SPEED/CONSTANT FLOW.
- 1. UPON A PUMP FAILURE, THE STANDBY PUMP SHALL BE ASSIGNED AS DUTY AND COMMANDED 'ON', WHILE THE FAILED PUMP SHALL BE COMMANDED 'OFF' AND ASSIGNED A DESIGNATION OF "FAILED/MAINTENANCE", GENERATING AN ALARM THROUGH THE EMCS.
- a. PUMP FAILURE SHALL INCLUDE: LOSS OF STATUS AND VFD FAULT. 2. ANY PUMP THAT IS TAKEN OUT OF OPERATION FOR MAINTENANCE SHALL BE ASSIGNED A DESIGNATION OF "FAILED/MAINTENANCE" BY THE OPERATOR.
- a. NO ATTEMPT SHALL BE MADE TO START A PUMP WITH AN ASSIGNED DESIGNATION OF "FAILED/MAINTENANCE". 3. FAILED PUMPS DUE TO INTERMITTENT POWER LOSS SHALL AUTOMATICALLY RESUME OPERATION BASED ON THEIR DESIGNATIONS WHEN POWER IS
- RESTORED. FAILURE DUE TO VFD FAULT MUST BE MANUALLY RESET BY THE OPERATOR. 4. ALARMS WILL BE PROVIDED FOR EACH PUMP AS FOLLOWS:
- a. FAILURE: COMMANDED 'ON', BUT THE STATUS IS 'OFF'.
- b. RUNNING IN HAND: COMMANDED 'OFF', BUT THE STATUS IS 'ON'.
- c. RUNTIME EXCEEDED: STATUS RUNTIME EXCEEDS A USER DEFINABLE LIMIT.

CHILLED WATER SYSTEM MINIMUM FLOW CONTROL (APPLICABLE IF VFDs ARE PROVIDED AND CHW SYSTEM IS CONVERTED TO VARIABLE FLOW IN THE FUTURE)

- A. SYSTEM MINIMUM FLOW_BYPASS VALVE CONTROL
- 1. THE BYPASS VALVES SHALL MODULATE TO MAINTAIN SYSTEM FLOW, AS MEASURED AT THE FLOW METER, AT SETPOINT.
- a. FLOW SETPOINT SHALL BE THE LARGER OF FLOW CORRESPONDING TO MINIMUM ALLOWED PUMP SPEED, AND THE MANUFACTURER PRESCRIBED CHILLER MINIMUM FLOW (TYPICALLY DETERMINES THE SYSTEM MINIMUM FLOW).
- UPON A DECREASE IN CHW FLOW BELOW SETPOINT, THE BYPASS VALVE SHALL MODULATE OPEN.
- c. UPON AN INCREASE IN CHW FLOW ABOVE SETPOINT, THE BYPASS VALVE SHALL MODULATE CLOSE.
- 2. PID CONTROL LOOP DEADBAND AND THE RESPONSE SPEED OF THE PUMP AND SYSTEM BYPASS VALVE SHALL BE FINE TUNED DURING THE COMMISSIONING
- PERIOD TO PREVENT HUNTING. 3. THE BYPASS VALVE SHALL FAIL IN PLACE.

TEMPERATURE, FLOW AND ENERGY MONITORING

- A. THE TOTAL CHILLED WATER SYSTEM COOLING ENERGY CONSUMPTION RATE SHALL BE DETERMINED VIA A FLOW METER AND TEMPERATURE SENSORS FOR USE IN POWER COMPUTATIONS.
- B. THE TOTAL CHW COOLING ENERGY CONSUMPTION RATE SHALL BE CALCULATED AS FOLLOWS:
- CHW POWER IN KBTU/HR (MBH) = (GPM x (Tret Tsup) x CONSTANT) / 1,000
- GPM TOTAL CHW FLOW, AS MEASURED BY TWO FLOW METERS.
- Tret, Tsup CHILLED WATER RETURN AND SUPPLY, RESPECTIVELY, AS MEASURED BY THE CORRESPONDING TEMPERATURE SENSORS.
- CONSTANT EQUAL TO 470 FOR 30% GLYCOL WATER SOLUTION.
- C. PROGRAMMING AND RELATED GRAPHICS SHALL BE PROVIDED SUCH THAT THE TOTAL PLANT ENERGY CONSUMPTION RATE (BTU/HR AND COOLING TONS), AND TOTALIZED ANNUAL ENERGY CONSUMPTION (BTU AND kWh), ARE SHOWN AT THE OWS.

SAFETIES AND ALARMS

BO - Chilled Water Pump 1 Start/Stop

AO - Chilled Water Pump 1 VFD Speed Bl - Chilled Water Pump 1 VFD Fault

BI - Chilled Water Pump 1 Status

BI - Chilled Water Pump 2 Status

BO - Chilled Water Pump 2 Start/Stop

AO - Chilled Water Pump 2 VFD Speed

BI - Chilled Water Pump 2 VFD Fault

AI - Chilled Water Flow

BI - Chilled Water Pump 2 Status

BO - Chilled Water Pump 2 Start/Stop

BI - Chilled Water Pump 2 VFD Fault

AO - Chilled Water Pump 2 VFD Speed

- A. THE CHILLER PLANT CONTROL PANEL SHALL INDICATE ALL ALARMS TO THE EMCS. IF A CRITICAL ALARM IS GENERATED AT THE CHILLER, RENDERING COOLING CAPACITY TO ZERO, THE CPC SHALL SHUT DOWN THE CHILLER IN AN ORDERLY MANNER AS DESCRIBED IN CHILLER CONTROLS SEQUENCES, AND AN ALARM SHALL BE GENERATED THROUGH THE EMCS.
- B. THE CHILLED WATER SUPPLY TEMPERATURE SHALL BE MONITORED AND CAPABLE TO ALERT THE FRIB PLC-BASED SYSTEM.
- TEMPERATURE ALERT SETTINGS SHALL BE ADJUSTABLE OFFSETS ABOVE AND BELOW THE ACTIVE SETPOINT, NOT FIXED VALUES AND SHALL BE 'OFF' FOR THE FIRST 10
- CONSECUTIVE MINUTES (ADJ.) AFTER UNIT STARTUP TO ALLOW SYSTEM TO STABILIZE. THE ALERTS SHALL BE RECORDED IN THE ALERT EVENT LOG AND SENT TO THE OWS.
- ALERTS SHALL BE INDICATED WHENEVER THE FOLLOWING CONDITIONS OCCUR:

AO - Chilled Water Bypass Valve

- 1. CHILLED WATER SUPPLY TEMPERATURE IS 2°F (ADJ.) OR MORE ABOVE ACTIVE SETPOINT FOR AT LEAST 20 CONSECUTIVE MINUTES (ADJ.)
- a. THE SIEMENS CPC WILL OUTPUT THIS ALERT TO THE OWNER'S CONTROL SYSTEM FOR THE LOAD SHEDDING SEQUENCE. REFER TO SHEET M8.2 FOR INFORMATIONAL PURPOSES.
- A. (APPLICABLE IF VFDs ARE PROVIDED AND CHW SYSTEM IS CONVERTED TO VARIABLE FLOW IN THE FUTURE) THE CHILLED WATER SUPPLY/RETURN DIFFERENTIAL PRESSURE (DP) SHALL BE MONITORED AND CAPABLE FOR ALARMING. ALARMS SHALL BE INDICATED AS FOLLOWS:
 - 1. DP IS 5 PSID (ADJ.) OR MORE ABOVE ACTIVE SETPOINT FOR AT LEAST 20 CONSECUTIVE MINUTES (ADJ.). 2. DP IS 5 PSID (ADJ.) OR MORE BELOW ACTIVE SETPOINT FOR AT LEAST 20 CONSECUTIVE MINUTES (ADJ.).
- B. THE EMCS SHALL MONITOR THE STATUS OF THE CHILLED WATER PUMPS THROUGH CURRENT SENSING RELAYS. IF THE STATUS INDICATED DOES NOT MATCH THE COMMANDED STATE, A CORRESPONDING ALARM SHALL BE GENERATED THROUGH THE EMCS, AND, IF AVAILABLE FOR OPERATION, THE STANDBY PUMP SHALL BE REASSIGNED FOR DUTY, AND SHALL BE COMMANDED 'ON'.
- C. (APPLICABLE IF CHW SYSTEM IS CONVERTED TO VARIABLE FLOW IN THE FUTURE) THE EMCS SHALL MONITOR THE STATUS OF VALVES THROUGH THEIR POSITION

INDICATORS. IF THE STATUS INDICATED DOES NOT MATCH THE COMMANDED STATE, A CORRESPONDING ALARM SHALL BE GENERATED THROUGH THE EMCS. AI - Chilled Water Differential Pressure

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MORGAN REP. **APPR** 10/23/2023 DATE AS NOTED **SCALE ISSUED** ISSUED FOR BIDS 10/23/2023 **MECHANICAL** CONTROLS

CAPITAL PROJ. NO.

MORGAN

WINKLER

GARDNER

BEACH

WILBER

CHARLAND

CP23031

LEAD

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DESCRIPTION

- A. THE CHILLER PLANT SYSTEM CONSISTS OF FOLLOWING MAJOR COMPONENTS: A WATER-COOLED CHILLER (REFERENCED AS CHILLER), TWO (2) CHILLED WATER (CHW) PUMPS WITH ONE UNIT REDUNDANT, TWO (2) CONDENSER WATER (CHW) PUMPS WITH ONE UNIT REDUNDANT, AND DIRECT DIGITAL CONTROLS. REFER TO THE FLOOR PLANS, DETAILS SHEET AND EQUIPMENT SCHEDULES FOR SYSTEM ANCILLARY EQUIPMENT/COMPONENTS AND QUANTITIES, AND FOR DESIGN CAPACITIES, PERFORMANCE AND OTHER INFORMATION.
- THE CHILLED WATER SYSTEM IS A CONSTANT FLOW PRIMARY-ONLY CHILLED WATER LOOP TO MATCH EXISTING CONDITIONS (I.E. 3-WAY CHW VALVES AT HVAC UNITS SERVED BY THE SYSTEM).
- 2. LOAD-SHEDDING STRATEGY INTENDED IS TO PROVIDE CHW TO CRITICAL HVAC IN THE EVENT OF PARTIAL LOSS OF CHW CAPACITY DUE TO CHILLER COMPONENT FAILURE.

<u>GENERAL</u>

- A. THE CHILLER SHALL BE ENABLED/DISABLED MANUALLY OR AUTOMATICALLY FROM THE ENERGY MANAGEMENT CONTROL SYSTEM (EMCS).
- B. THE CHILLED WATER SYSTEM SHALL BE CONTROLLED THROUGH A SIEMENS CONTROL PANEL, HENCEFORTH REFERENCED AS COOLING PLANT CONTROLLER
- 1. THE CONTROLS CONTRACTOR SHALL WORK WITH SIEMENS, CHILLER MANUFACTURER AND OWNER'S SYSTEM OPERATOR OR INFORMATION TECHNOLOGY (IT) REPRESENTATIVE, TO PROVIDE ALL REQUIRED HARDWARE AND WIRING TO FACILITATE THE CONNECTION FOR FULL INTEGRATION INTO THE OWNER'S EMCS. REFER TO THE CONTROL SPECIFICATIONS FOR REQUIREMENTS, AND SEE "EMCS SYSTEM ARCHITECTURE" CONTROLS DIAGRAM FOR ADDITIONAL
- 2. THE CONTROLS CONTRACTOR SHALL WORK WITH THE CHILLER MANUFACTURER IN SETTING UP THE INTERFACE WITH THE FACTORY PROVIDED CHILLER CONTROLS, PROVIDE ALL REQUIRED PROGRAMMING FOR THE IMPLEMENTATION OF ALL NECESSARY SEQUENCES OF OPERATION, AND CONFIGURE ALL NECESSARY SETTINGS FOR A FULLY FUNCTIONAL HIGH PERFORMANCE CHILLED WATER SYSTEM.
- a. ALL CHILLER POINTS AVAILABLE VIA BACNET INTERFACE NOT ALREADY INDICATED IN THE CONTROLS DIAGRAMS/POINTS MATRIX SHALL BE MADE AVAILABLE AT THE EMCS INTERFACE, WITH THE APPROPRIATE GRAPHICS, BASED ON THEIR VALUE OR BENEFIT TO SYSTEM OPERATION AND TROUBLESHOOTING, AS COORDINATED WITH THE OWNER
- C. SETPOINTS AND TIMERS
- 1. ALL SETPOINTS AND TIME INTERVALS DESCRIBED IN SEQUENCES ARE RECOMMENDED INITIAL VALUES, WHICH SHALL BE FIELD DETERMINED/ADJUSTED DURING THE COMMISSIONING PERIOD TO MEET THE REQUIREMENTS OF ACTUAL CONDITIONS.
- AFTER SYSTEM RESPONSE HAS BEEN TUNED DURING COMMISSIONING, ALL REQUIRED SETPOINTS AND TIME INTERVALS SHALL BE SET AND SHALL BE
 ADJUSTABLE AT THE OPERATING WORKSTATION (OWS) VIA THE GRAPHICAL USER INTERFACE (GUI).
 A. TIMERS SHALL BE SET AS SPECIFIED OR AS NEEDED TO PREVENT DAMAGE OR EXCESSIVE WEAR TO EQUIPMENT.
- D. THE EMCS SHALL CALCULATE THE TOTAL RUNTIME FOR PUMP, AND STAGE ASSIGNMENTS SHALL BE ROTATED TO ACCUMULATE APPROXIMATELY EQUAL WEAR FOR EACH EQUIPMENT. AVAILABLE EQUIPMENT ROTATION OPTIONS FOR EACH PUMP SHALL BE AS FOLLOWS:
- 1. MANUALLY THROUGH A SOFTWARE SWITCH.
- 2. IF THE DESIGNATED PUMP HOURLY RUNTIME (ADJ.) IS EXCEEDED.
- WEEKLY
 MONTHLY

BO - Fan Start/Stop

AO - Fan VFD Speed

- E. POSITION OF VALVES (APPLICABLE IF VFDs ARE PROVIDED AND CHW SYSTEM IS CONVERTED TO VARIABLE FLOW IN THE FUTURE):
- 1. A HARDWIRED FEEDBACK POINT FOR EACH VALVE (END-SWITCH) INDICATED SHALL BE PROVIDED IN ORDER TO THE DETERMINE THE POSITION OF THE VALVE ACTUATOR.
- 2. A CONTROL VALVE SHALL BE "FAILED IF ITS STATUS DOES NOT MATCH COMMANDED STATE WITHIN THE ALLOTTED TIME, AS DESCRIBED IN THE CORRESPONDING SEQUENCES. IF AN ALLOTTED TIME IS NOT SPECIFIED, ONE SHALL BE SET IF DETERMINED NECESSARY DURING THE COMMISSIONING PERIOD TO FULFILL THE SOO DESIGN INTENT, AND TO ENSURE RELIABLE/STABLE OPERATION.
- F. CURRENT SENSING RELAY SWITCHES USED FOR PROVING PUMP STATUS, SHALL BE SET UP SO THAT THEY WILL DETECT COUPLING FAILURE BY THE REDUCTION IN CURRENT DRAW ON LOSS OF COUPLED LOAD.
- G. EQUIPMENT AND CHW SYSTEM SHALL OPERATE PER THEIR CORRESPONDING DESIGNATION.
- 1. MAINTENANCE PERSONNEL SHALL HAVE THE ABILITY, THROUGH THE EMCS, TO SELECT WHICH PUMP SHALL BE DUTY AND STAND-BY.

BO - Fan Start/Stop

AO - Fan VFD Speed

- 2. IT SHALL BE POSSIBLE TO OPERATE THE CHILLER WITH ANY CHILLED OR CONDENSER WATER PUMP.
- H. THE CONTROLS CONTRACTOR (CC) SHALL COORDINATE ALL SAFETY AND INTERLOCK REQUIREMENTS WITH CHILLER MANUFACTURER. CC SHALL PROVIDE THE WIRING AND FIELD INSTALL THE CHILLED WATER FLOW SWITCH, AND ANY OTHER COMPONENTS OR DEVICES PROVIDED WITH THE CHILLER, AS REQUIRED FOR PROPER AND SAFE CHW SYSTEM OPERATION.
- I. THE CONTROLS CONTRACTOR SHALL FURNISH AND INSTALL THE WIRING IN CONDUIT DIRECTLY FROM THE DIFFERENTIAL PRESSURE TRANSMITTER TO THE CONTROLLER SERVING PUMP VFD (SIGNAL SHALL NOT BE TRANSMITTED ACROSS THE EMCS NETWORK).

CHILLER CONTROL

- A. **ENABLE/DISABLE** THE FOLLOWING CONTROL ACTIONS SHALL OCCUR IN SEQUENCE
- 1. THE DUTY CW PUMP SHALL BE COMMANDED 'ON', (ONCE VFD IS PROVIDED IN THE FUTURE) SOFT STARTED TO MINIMUM SPEED BEFORE RAMPING UP TO THE DESIGN CW FLOW
- 2. (APPLICABLE IF VFDs ARE PROVIDED AND CHW SYSTEM IS CONVERTED TO VARIABLE FLOW IN THE FUTURE) THE BYPASS MODULATION CONTROL VALVE SHALL BE COMMANDED CLOSED, IF NOT ALREADY CLOSED.
- 3. UPON CONFIRMATION OF VALVE POSITION (IF APPLICABLE), THE DUTY CHW PUMP SHALL BE COMMANDED 'ON', (ONCE VFD IS PROVIDED IN THE FUTURE) SOFT STARTED TO MINIMUM SPEED BEFORE RAMPING UP TO THE CHW SYSTEM MINIMUM FLOW. REFER TO SECTION "CHILLED WATER SYSTEM MINIMUM FLOW CONTROL" FOR DETERMINATION.
- 4. IN THE EVENT PROOF OF PUMP OPERATION IS NOT CONFIRMED VIA ITS CURRENT SENSING RELAY SWITCH WITHIN 30 SECONDS (ADJ.) FROM START COMMAND, THE STAND-BY PUMP SHALL BE COMMANDED 'ON'. REFER TO "PUMP FAILURE" SECTION FOR MORE INFORMATION.
- 5. THE COOLING TOWER SHALL BE COMMANDED 'ON' VIA A SIGNAL TO ITS DEDICATED CONTROL PANEL. REFER TO EMCS ARCHITECTURE FOR MORE INFO.
 6. THE CHILLER IS COMMANDED 'ON'.
- a. THE OPERATION OF THE CHILLER SHALL BE BY THE CHILLER'S FACTORY PROVIDED INTEGRAL CONTROL SYSTEM AND SHALL BE SUBJECT TO THE CHILLER'S SAFETY CHECKS. THE PROOF OF FLOW SAFETY CIRCUIT SHALL BE VIA THE FACTORY PROVIDED, FIELD INSTALLED DP FLOW SWITCH. THE CHILLER SHALL NOT START UNLESS THE FLOW SWITCH PROVES MINIMUM FLOW.
- IN THE EVENT NO FLOW AT THE EVAPORATOR IS REGISTERED WITHIN 30 SECONDS (ADJ.) AFTER THE CHILLED WATER PUMP STATUS IS PROVEN, A
 CORRESPONDING ALARM SHALL BE GENERATED THROUGH THE EMCS AND THE CHILLER SHALL BE ASSIGNED AS "FAILED/MAINTENANCE" AT THE
 OWS.
- b. FOR GENERAL INFORMATION ONLY, THE CHILLER'S INTEGRAL LOGIC SEQUENCES INCLUDES BUT NOT LIMITED TO:
- CHILLER SHALL START AFTER FLOW IS PROVEN.
 THE CHILLER INTEGRAL CHILLER SPEED CONTROL SHALL MODULATE ITS CAPACITY TO MAINTAIN CHILLED WATER SETPOINT AT THE MOST EFFICIENT POINT OF CHILLER OPERATION, AND TO MAINTAIN MACHINE STABILITY.
- COMPRESSORS SHALL BE STAGED AS NEEDED TO MATCH CHILLED WATER DEMAND.
 (ONCE VFD AND DP SENSOR ARE PROVIDED IN THE FUTURE) THE CHW PUMP IS RELEASED TO CONTROL BASED ON DIFFERENTIAL PRESSURE (DP), AS DESCRIBED IN
- THE "PUMP CONTROL" SOO SECTION.

 8. ON A COMMAND SIGNAL TO SHUT-DOWN THE CHILLER, THE REVERSE OCCURS (WITH SOME EXCEPTIONS):

 9. WITH THE CHILLED OFF: AFTER A 5 MINUTE (AD L) DELAY THE DUTY CHIW AND CW PLIMBS SHALL BE COMMANDED OFF: (ONCE VED IS PROVIDED IN 1)
- a. WITH THE CHILLER 'OFF', AFTER A 5 MINUTE (ADJ.) DELAY, THE DUTY CHW AND CW PUMPS SHALL BE COMMANDED 'OFF', (ONCE VFD IS PROVIDED IN THE FUTURE) SOFT STOPPING, AND THE BYPASS MODULATION CONTROL VALVE, IF APPLICABLE, SHALL BE COMMANDED CLOSED, IF NOT ALREADY CLOSED.
- B. CHILLER FAILURE IN THE EVENT OF CHILLER FAILURE, A CORRESPONDING ALARM SHALL BE GENERATED THROUGH THE EMCS, AND THE CHILLER SHALL BE
- REASSIGNED AS "FAILED/MAINTENANCE" AT THE OWS.

 1. IN THE EVENT OF PARTIAL FAILURE RESULTING IN REDUCED COOLING CAPACITY, AN ALERT NOTIFICATION SHALL BE GENERATED THROUGH THE CPC, AND IF CERTAIN CONDITIONS ARE MET, THE LOAD SHEDDING SEQUENCE SHALL BE INITIATED, IF ENABLED TO ACTIVATE AUTOMATICALLY AT THE CPC. REFER TO
- LOAD-SHEDDING SEQUENCE OF OPERATION ON M8.2 FOR INFORMATIONAL PURPOSES.

 A. APPLICABLE FAILURES INCLUDE, BUT ARE NOT LIMITED TO, FAILURE OF A COMPRESSOR, FAILURE OF A REFRIGERANT LOOP SOLENOID VALVE, AND OIL
- LEVEL SWITCH ACTIVATION.

 B. THE LOAD SHEDDING SEQUENCE IS OWNER-PROVIDED AND NOT INTENDED TO BE PART OF THE SIEMENS COOLING PLANT CONTROL. THE SIEMENS CPC WILL OUTPUT THIS ALERT TO THE OWNER'S PLC BASED CONTROL SYSTEM FOR THIS PURPOSE, REFER TO SHEET M8.2 FOR INFORMATIONAL PURPOSES.
- 2. IF THE FAILED CHILLER DOES NOT SELF SHUT-DOWN BY ITS INTERNAL PROTECTIVE LOGIC OR SAFETY CIRCUITS, AND AN ADJUSTABLE TIME DELAY OF 3 MINUTES (ADJ.) HAS ELAPSED, THE CPC SHALL COMMAND THE CHILLER 'OFF' AND BEGIN AN ORDERLY SHUT-DOWN OF THE CHILLER SYSTEM, AS DESCRIBED IN THE "CHILLER CONTROL" SOO SECTION.

CHILLED WATER SUPPLY TEMPERATURE CONTROL

- A. THE DESIGN CHILLED WATER SUPPLY TEMPERATURE SETPOINT IS 42.0°F (ADJ.).
- 1. THE CHILLER SHALL OPERATE THROUGH ITS INTERNAL CONTROLS TO MAINTAIN CHWS TEMPERATURE SETPOINT, VIA THE FACTORY PROVIDED UNIT MOUNTED CONTROL PANEL (UMCP).
- 2. FOR OPTIMIZED CHILLER PERFORMANCE, THE INTEGRAL LOGIC ALSO INCLUDES STAGING AND COMPRESSOR SPEED CONTROL AT PART LOAD CONDITIONS.

PUMP CONTROL

- A. CHILLED WATER AND CONDENSER WATER PUMP SEQUENCING:
- 1. THE PUMPS ARE STARTED/STOPPED AUTOMATICALLY THROUGH THE EMCS, OR MANUALLY THROUGH THE VFD'S H-O-A SWITCH.
- THE PUMPS ARE IN A DUTY/STAND-BY CONFIGURATION AND ASSIGNED THESE DESIGNATIONS.
 a. THE DUTY PUMP SHALL RUN CONTINUOUSLY, WHENEVER THE CHILLER IS ACTIVE.
- b. THE EMCS SHALL ASSIGN THE OPERATING PUMP BASED ON AN HOURLY RUNTIME SCHEDULE (ADJ.) THAT ALTERNATES DUTY/STAND-BY DESIGNATIONS.
- B. CHILLED WATER PUMP SPEED CONTROL:
- 1. PUMP SHALL OPERATE AT CONSTANT SPEED/CONSTANT FLOW.
- 2. FUTURE UPON CONVERSION OF THE CHW SYSTEM FROM CONSTANT FLOW TO VARIABLE FLOW, THE CHW PUMP SHALL BE CONTROLLED AS FOLLOWS:

 a. THE DDC PID CONTROL LOOP SHALL MODULATE THE PUMP SPEED TO MAINTAIN DIFFERENTIAL PRESSURE (DP) SETPOINT, AS SENSED BY THE DP
 TRANSMITTER BETWEEN THE CHILLED WATER SUPPLY AND RETURN MAINS PIPING, WHILE MAINTAINING CHW SYSTEM MINIMUM FLOW. REFER TO
 - "CHILLED WATER SYSTEM MINIMUM FLOW CONTROL" SOO SECTION FOR DETAILS.

 UPON A DECREASE IN CHW DEMAND, WITH THE DIFFERENTIAL PRESSURE ABOVE SETPOINT, THE PUMP SHALL RAMP-DOWN AS NECESSARY LIMITED TO MINIMUM PLIMAR SPEED.
 - TO MINIMUM PUMP SPEED.
 - UPON AN INCREASE IN CHW DEMAND, THE PUMP SHALL RAMP-UP AS NECESSARY LIMITED TO MAXIMUM SPEED.
 VED RAMP RATE SHALL BE DETERMINED AND SET DURING THE COMMISSIONING PERIOD WITH APPROPRIATE RESPONSE TIME RELATIVE TO
- VFD RAMP RATE SHALL BE DETERMINED AND SET DURING THE COMMISSIONING PERIOD WITH APPROPRIATE RESPONSE TIME RELATIVE TO THE EMCS CONTROL LOOP RATE TO AVOID HUNTING.
- C. CONDENSER WATER PUMP SPEED CONTROL:
- 1. PUMP SHALL OPERATE CONTINUOUSLY AT CONSTANT SPEED/CONSTANT FLOW.

D. PUMP FAILURE

- UPON A PUMP FAILURE, THE STANDBY PUMP SHALL BE ASSIGNED AS DUTY AND COMMANDED 'ON', WHILE THE FAILED PUMP SHALL BE COMMANDED 'OFF'
 AND ASSIGNED A DESIGNATION OF "FAILED/MAINTENANCE", GENERATING AN ALARM THROUGH THE EMCS.
- a. PUMP FAILURE SHALL INCLUDE: LOSS OF STATUS AND VFD FAULT.
- 2. ANY PUMP THAT IS TAKEN OUT OF OPERATION FOR MAINTENANCE SHALL BE ASSIGNED A DESIGNATION OF "FAILED/MAINTENANCE" BY THE OPERATOR.

 a. NO ATTEMPT SHALL BE MADE TO START A PUMP WITH AN ASSIGNED DESIGNATION OF "FAILED/MAINTENANCE".
- 3. FAILED PUMPS DUE TO INTERMITTENT POWER LOSS SHALL AUTOMATICALLY RESUME OPERATION BASED ON THEIR DESIGNATIONS WHEN POWER IS RESTORED. FAILURE DUE TO VFD FAULT MUST BE MANUALLY RESET BY THE OPERATOR.
- 4. ALARMS WILL BE PROVIDED FOR EACH PUMP AS FOLLOWS:
- a. FAILURE: COMMANDED 'ON', BUT THE STATUS IS 'OFF'.
- b. RUNNING IN HAND: COMMANDED 'OFF', BUT THE STATUS IS 'ON'.
 c. RUNTIME EXCEEDED: STATUS RUNTIME EXCEEDS A USER DEFINABLE LIMIT.

CHILLED WATER SYSTEM MINIMUM FLOW CONTROL (APPLICABLE IF VFDs ARE PROVIDED AND CHW SYSTEM IS CONVERTED TO VARIABLE FLOW IN THE FUTURE)

- A. SYSTEM MINIMUM FLOW BYPASS VALVE CONTROL
- 1. THE BYPASS VALVES SHALL MODULATE TO MAINTAIN SYSTEM FLOW, AS MEASURED AT THE FLOW METER, AT SETPOINT.

 a. FLOW SETPOINT SHALL BE THE LARGER OF FLOW CORRESPONDING TO MINIMUM ALLOWED PUMP SPEED, AND THE MANUFACTURER PRESCRIBED
- CHILLER MINIMUM FLOW (TYPICALLY DETERMINES THE SYSTEM MINIMUM FLOW).
- b. UPON A DECREASE IN CHW FLOW BELOW SETPOINT, THE BYPASS VALVE SHALL MODULATE OPEN.c. UPON AN INCREASE IN CHW FLOW ABOVE SETPOINT, THE BYPASS VALVE SHALL MODULATE CLOSE.
- 2. PID CONTROL LOOP DEADBAND AND THE RESPONSE SPEED OF THE PUMP AND SYSTEM BYPASS VALVE SHALL BE FINE TUNED DURING THE COMMISSIONING
- PERIOD TO PREVENT HUNTING.

 3. THE BYPASS VALVE SHALL FAIL IN PLACE.

TEMPERATURE, FLOW AND ENERGY MONITORING

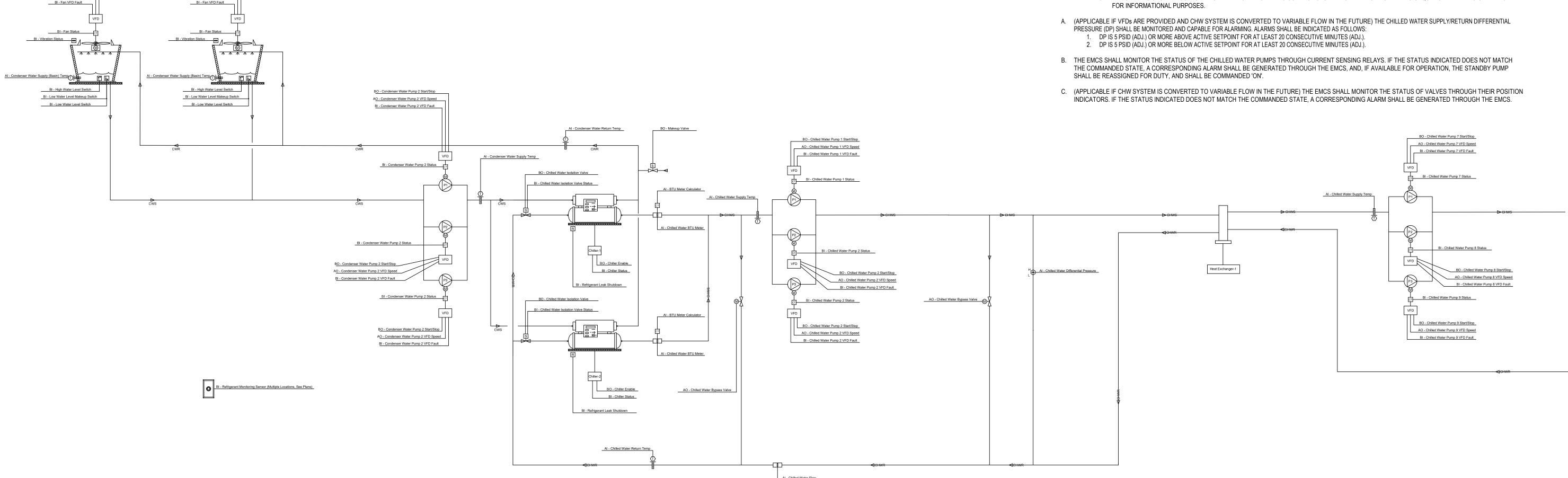
- A. THE TOTAL CHILLED WATER SYSTEM COOLING ENERGY CONSUMPTION RATE SHALL BE DETERMINED VIA A FLOW METER AND TEMPERATURE SENSORS FOR USE IN POWER COMPUTATIONS.
- B. THE TOTAL CHW COOLING ENERGY CONSUMPTION RATE SHALL BE CALCULATED AS FOLLOWS:
- CHW POWER IN KBTU/HR (MBH) = (GPM x (Tret Tsup) x CONSTANT) / 1,000 WHERE.
- GPM TOTAL CHW FLOW, AS MEASURED BY TWO FLOW METERS.
- Tret, Tsup CHILLED WATER RETURN AND SUPPLY, RESPECTIVELY, AS MEASURED BY THE CORRESPONDING TEMPERATURE SENSORS. CONSTANT EQUAL TO 470 FOR 30% GLYCOL WATER SOLUTION.
- PROGRAMMING AND RELATED GRAPHICS SHALL BE PROVIDED SLICH THAT THE TOTAL PLANT ENERGY CONSUMPTION
- C. PROGRAMMING AND RELATED GRAPHICS SHALL BE PROVIDED SUCH THAT THE TOTAL PLANT ENERGY CONSUMPTION RATE (BTU/HR AND COOLING TONS), AND TOTALIZED ANNUAL ENERGY CONSUMPTION (BTU AND kWh), ARE SHOWN AT THE OWS.

SAFETIES AND ALARMS

- A. THE CHILLER PLANT CONTROL PANEL SHALL INDICATE ALL ALARMS TO THE EMCS. IF A CRITICAL ALARM IS GENERATED AT THE CHILLER, RENDERING COOLING CAPACITY TO ZERO, THE CPC SHALL SHUT DOWN THE CHILLER IN AN ORDERLY MANNER AS DESCRIBED IN CHILLER CONTROLS SEQUENCES, AND AN ALARM SHALL BE GENERATED THROUGH THE EMCS.
- B. THE CHILLED WATER SUPPLY TEMPERATURE SHALL BE MONITORED AND CAPABLE TO ALERT THE FRIB PLC-BASED SYSTEM.
- THE CHILLED WATER SUPPLY TEMPERATURE SHALL BE MONITORED AND CAPABLE TO ALERT THE FRIB PLC-BASED SYSTEM.

 1. TEMPERATURE ALERT SETTINGS SHALL BE ADJUSTABLE OFFSETS ABOVE AND BELOW THE ACTIVE SETPOINT, NOT FIXED VALUES AND SHALL BE 'OFF' FOR THE FIRST 10
- CONSECUTIVE MINUTES (ADJ.) AFTER UNIT STARTUP TO ALLOW SYSTEM TO STABILIZE. THE ALERTS SHALL BE RECORDED IN THE ALERT EVENT LOG AND SENT TO THE OWS.
- THE ALERTS SHALL BE RECORDED IN THE ALERT EVENT LOG AND SENT TO THE OWS.
 ALERTS SHALL BE INDICATED WHENEVER THE FOLLOWING CONDITIONS OCCUR:
- 1. CHILLED WATER SUPPLY TEMPERATURE IS 2°F (ADJ.) OR MORE ABOVE ACTIVE SETPOINT FOR AT LEAST 20 CONSECUTIVE MINUTES (ADJ.).

 a. THE SIEMENS CPC WILL OUTPUT THIS ALERT TO THE OWNER'S CONTROL SYSTEM FOR THE LOAD SHEDDING SEQUENCE. REFER TO SHEET M8.2



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APPR

DATE 10/23/2023

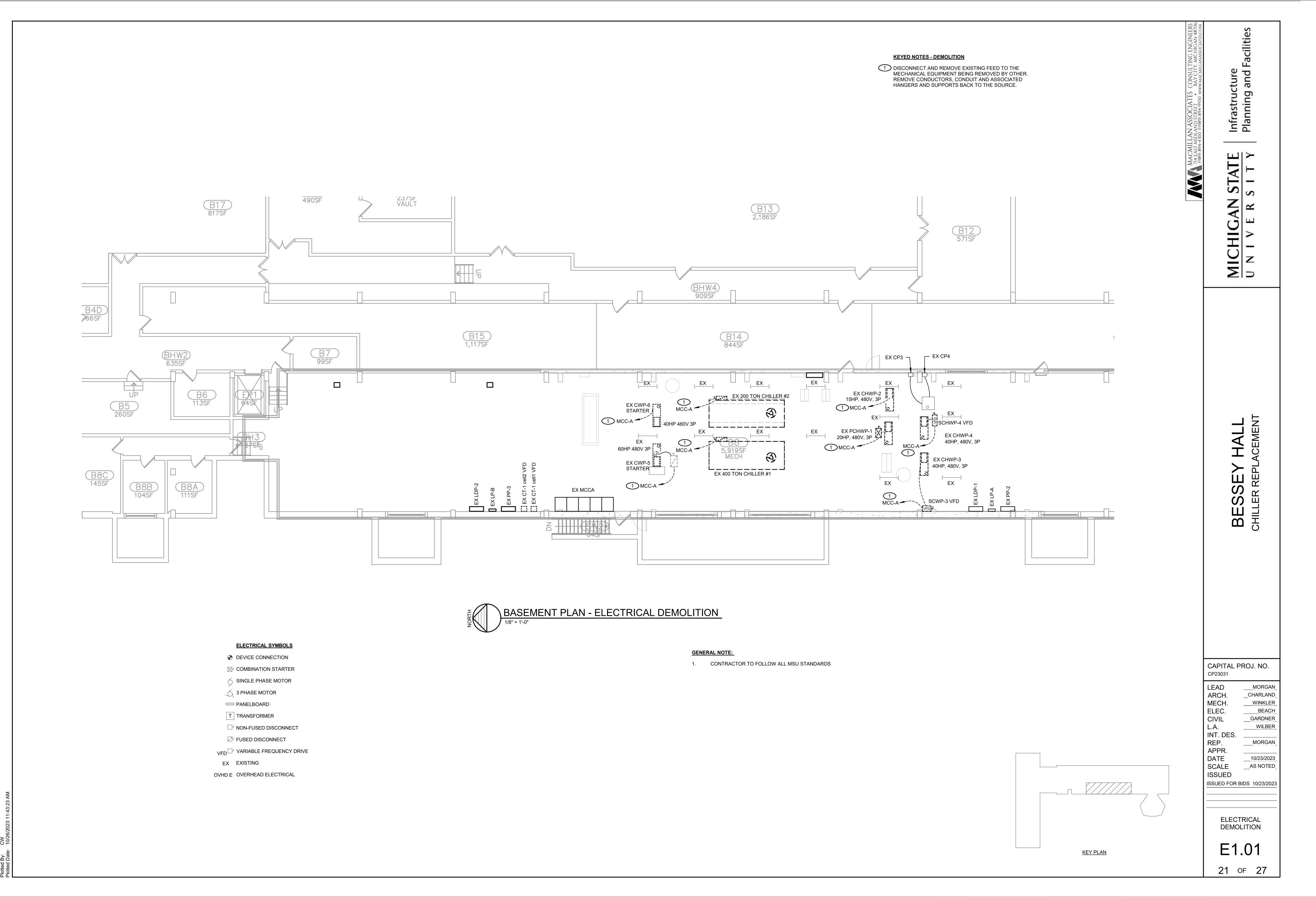
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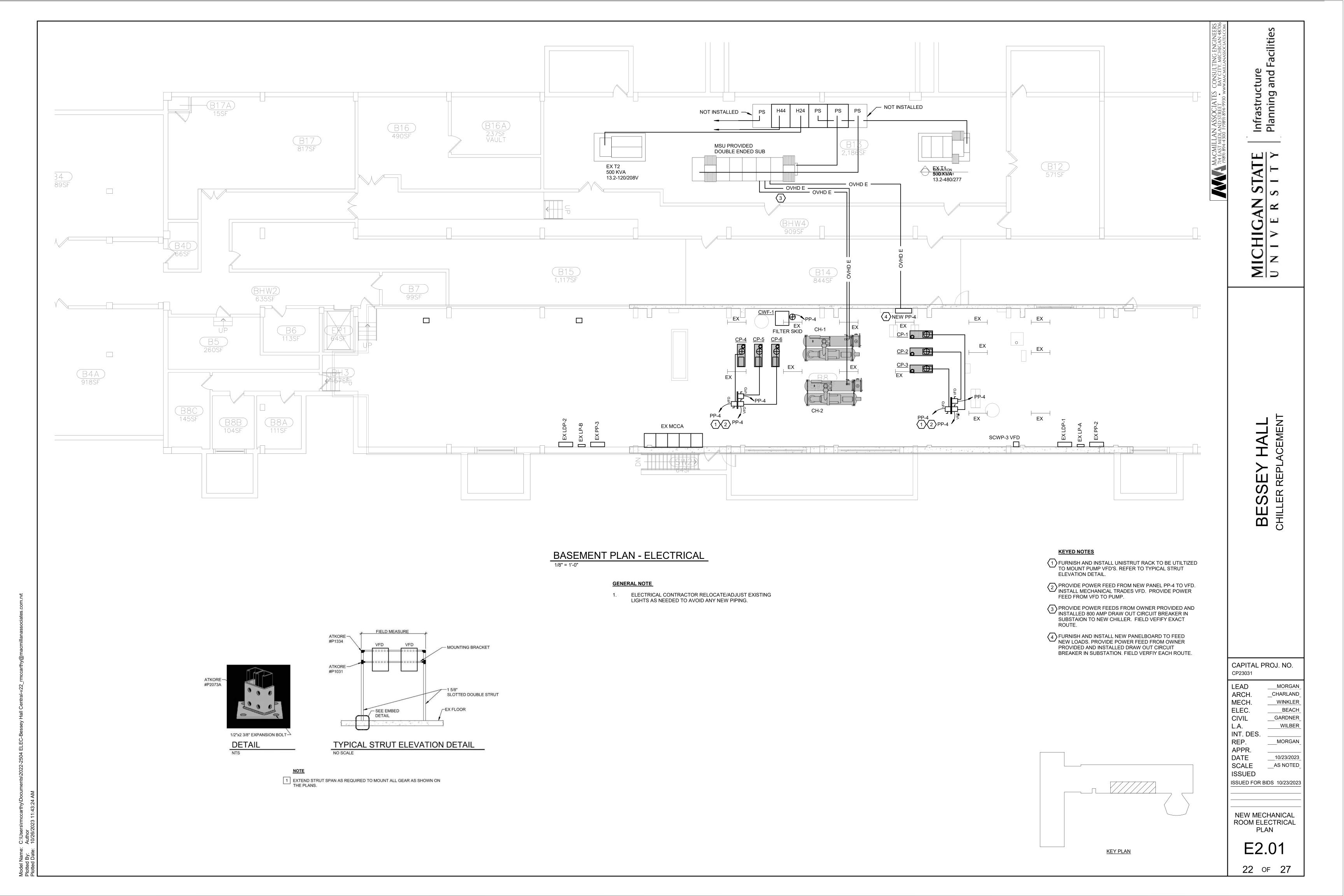
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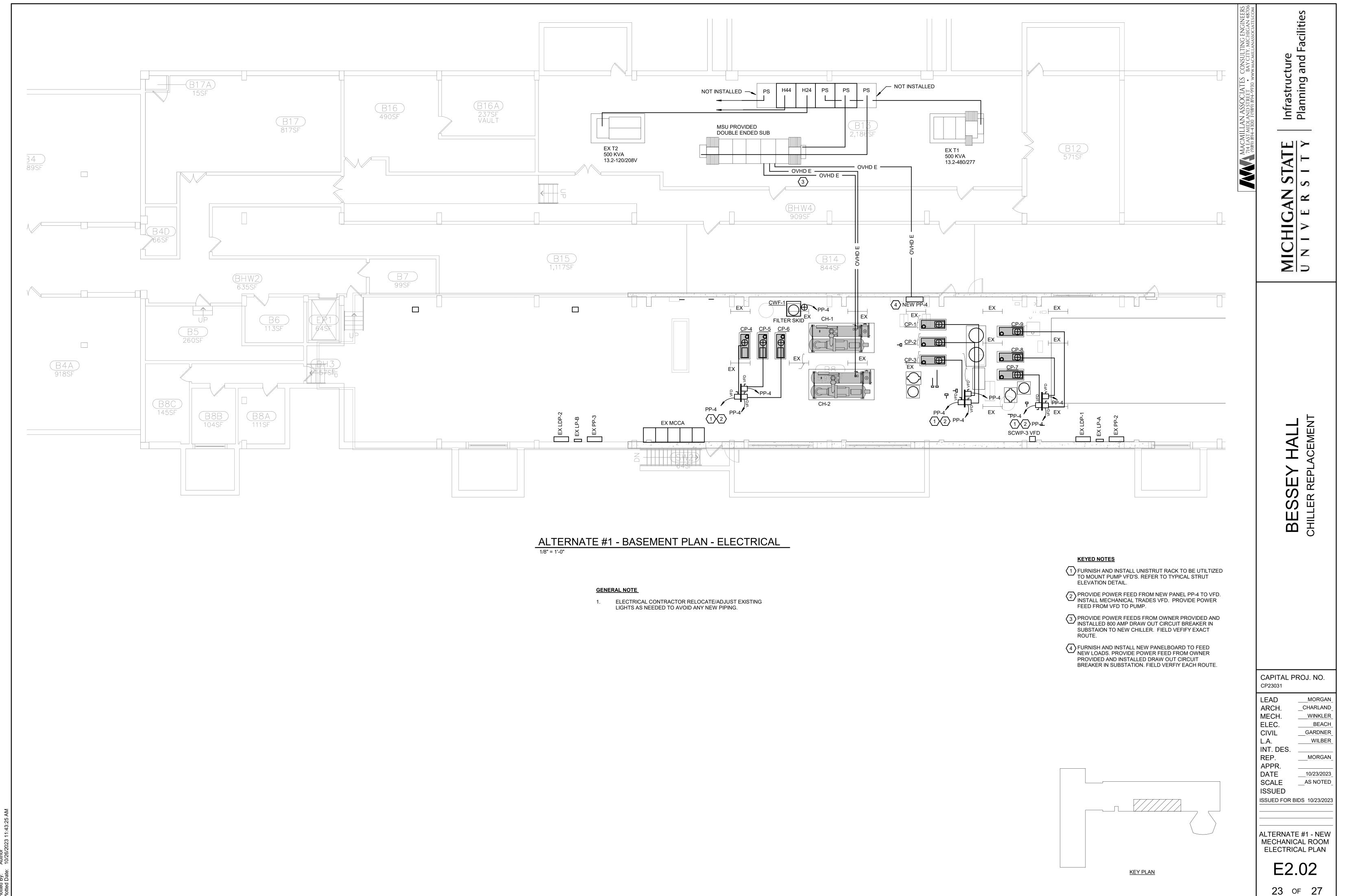
MECHANICAL CONTROLS -ALTERNATE

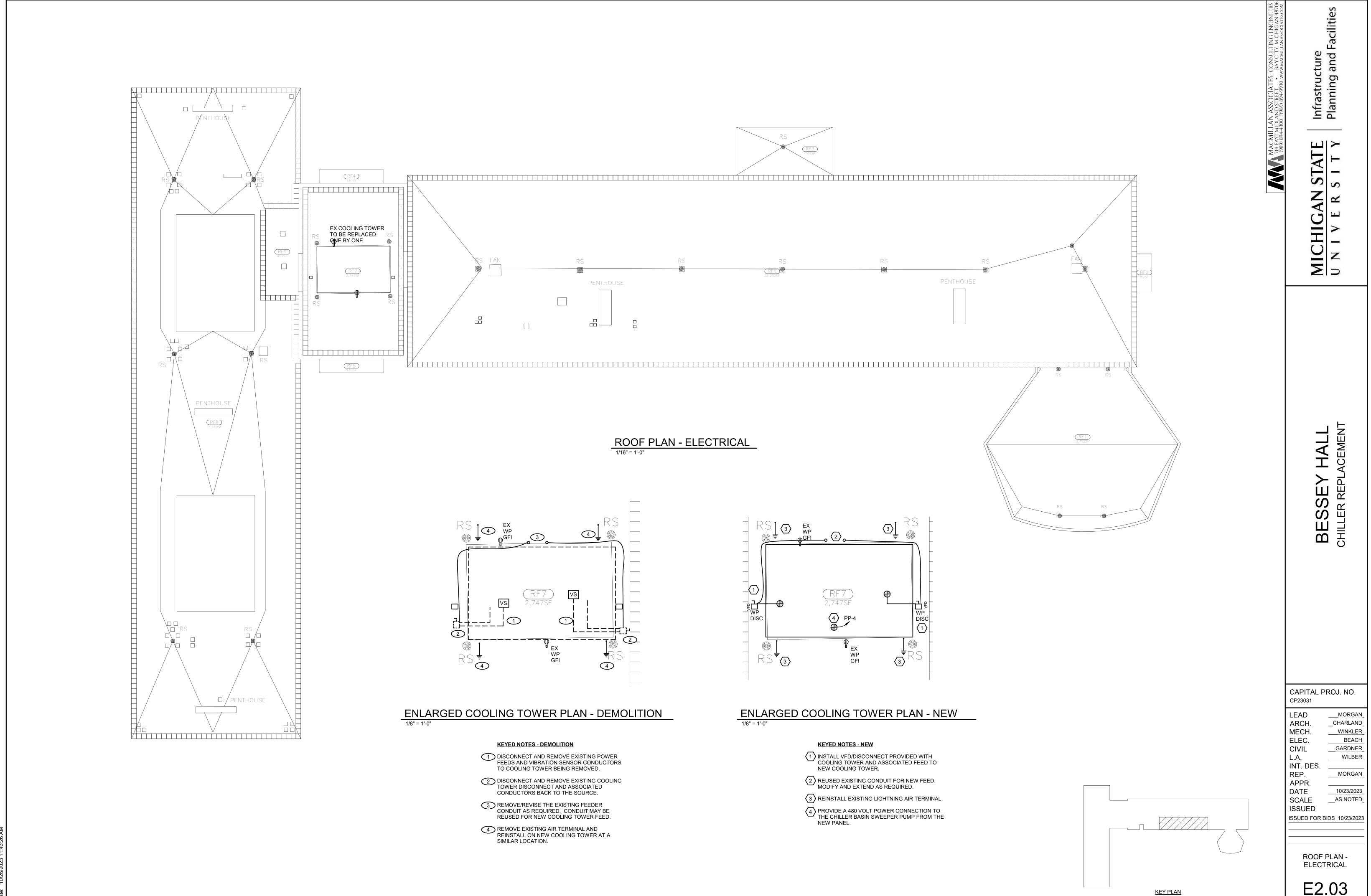
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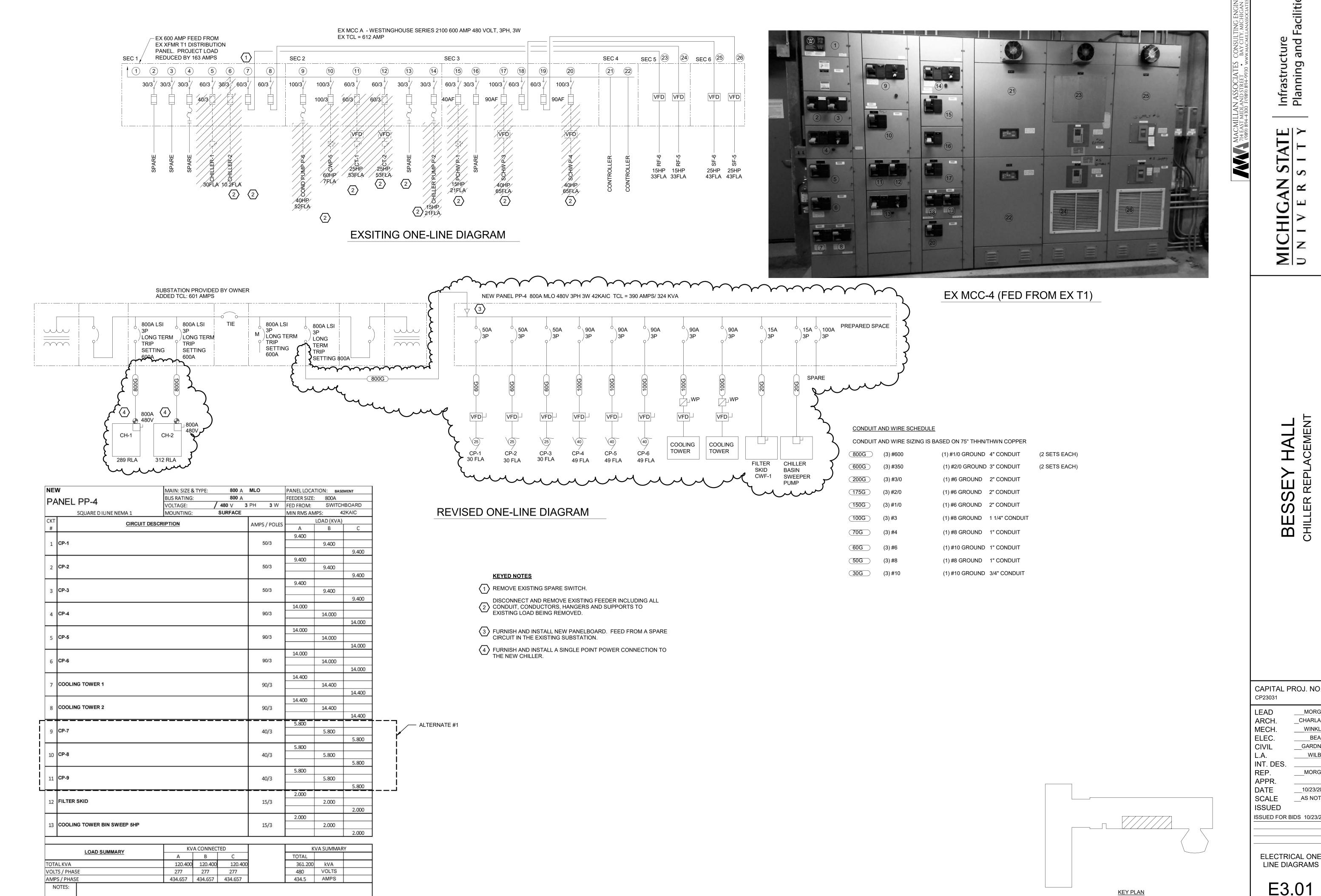








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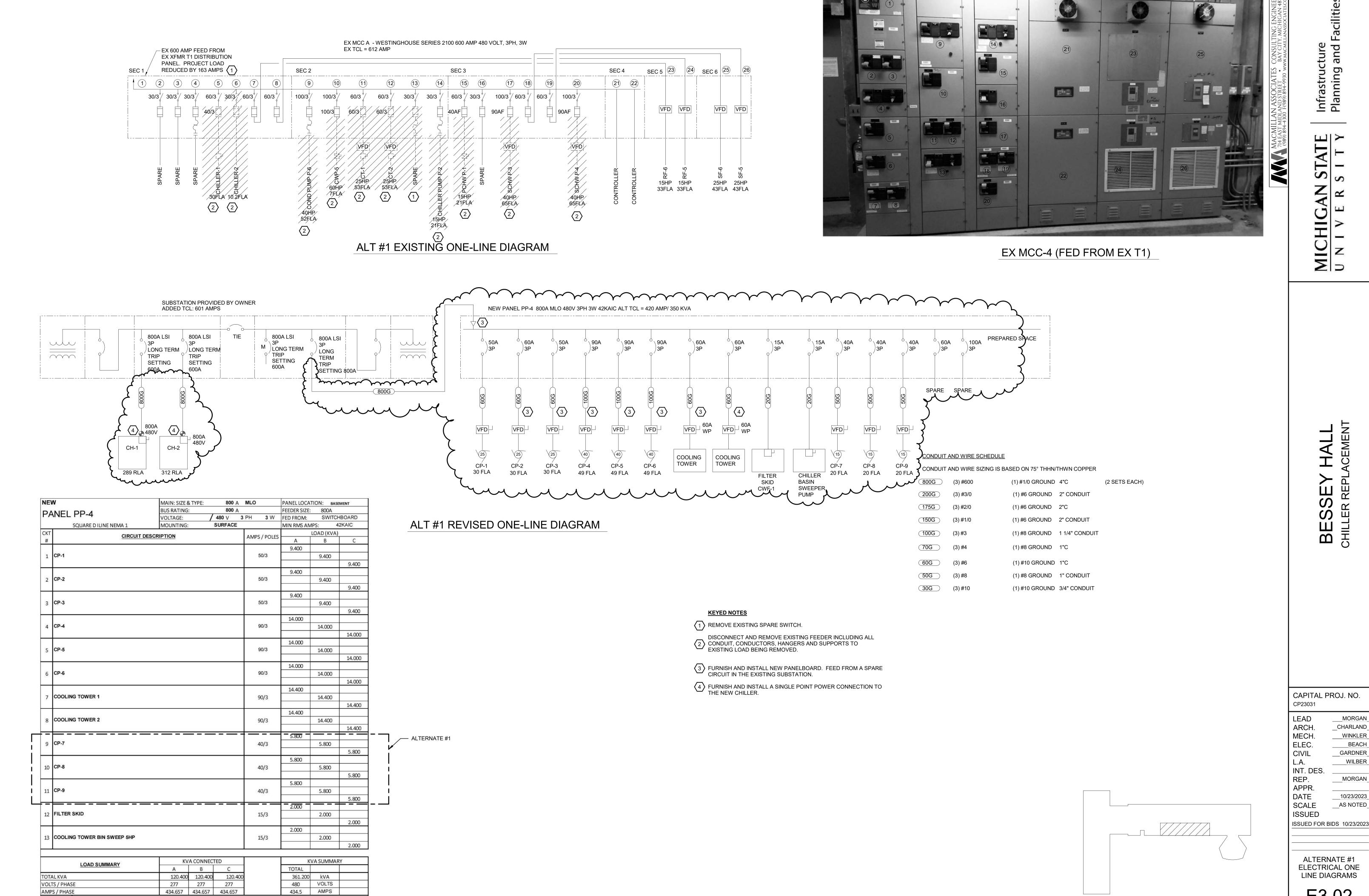
__MORGAN_ _CHARLAND_ ___WINKLER_ BEACH __GARDNER __WILBER_

MORGAN __10/23/2023_

AS NOTED **ISSUED FOR BIDS 10/23/2023**

ELECTRICAL ONE

E3.01



NOTES:

KEY PLAN

10/23/2023 AS NOTED

ISSUED FOR BIDS 10/23/2023

ALTERNATE #1 **ELECTRICAL ONE** LINE DIAGRAMS

3. ALL WORK SHALL CONFORM TO MICHIGAN BUILDING CODE 2015.

4. DESIGN LOADS

a. DESIGNED IN ACCORDANCE WITH MICHIGAN BUILDING CODE 2015.

b ROOF SNOW LOAD: GROUND SNOW LOAD PG = 30 PSF FLAT ROOF SNOW LOAD, PF = 28 PSF SNOW EXPOSURE FACTOR, CE = 1.0 SNOW LOAD IMPORTANCE FACTOR, I = 1.1 THERMAL FACTOR, CT = 1.2

c. PLATFORM LIVE LOAD: MEZZANINE LOADS

d. WIND LOADS: BASIC WIND SPEED $V_{ULT} = 120 \text{ MPH}$

> WIND EXPOSURE C INTERNAL PRESSURE COEFFICIENT, GC PI = 1.9 COOLING TOWER WIND LOADING: 62.2 PSF ULTIMATE

e. EARTHQUAKE DESIGN DATA: BUILDING RISK CATEGORY III SEISMIC IMPORTANCE FACTOR, I = 1.25 SPECTRAL RESPONSE COEFFICIENTS: SDS = .092, SD1 = .045 SITE CLASS D BASIC SEISMIC - FORCE - RESISTING SYSTEM: MOMENT FRAME SEISMIC DESIGN CATEGORY, B SEISMIC BASE SHEAR V = 1,300 LBS ULTIMATE, EACH DIRECTION

SPECIAL INSPECTIONS: a. SPECIAL INSPECTIONS SHALL BE IN ACCORDANCE WITH THE MICHIGAN BUILDING CODE 2015 SECTION 1700.

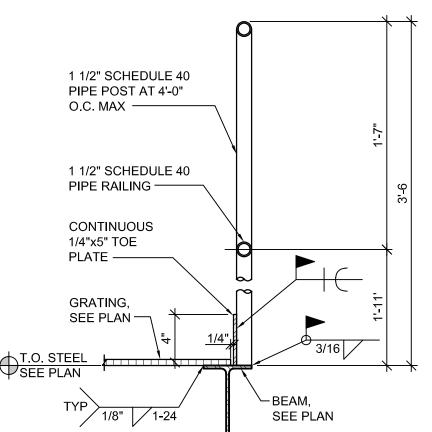
b. THE FOLLOWING TYPES OF WORK REQUIRE SPECIAL INSPECTIONS: (REFER TO THE BUILDING CODE AND SPECIFICATIONS FOR DETAILED INSPECTION REQUIREMENTS). 1. STEEL CONSTRUCTION.

STRUCTURAL STEEL

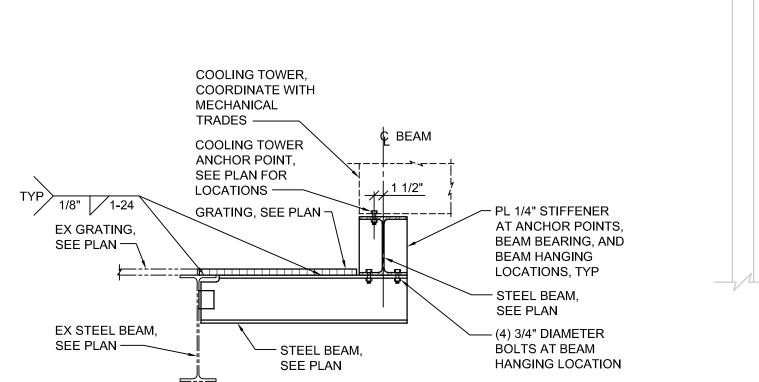
1. STRUCTURAL STEEL: FABRICATED AND ERECTED PER THE AISC MANUAL OF STEEL CONSTRUCTION.

> W-BEAMS: ASTM A-992 GR. 50. HSS: ASTM A-500 GRADE B. STEEL PIPE: ASTM A53, TYPE E, GRADE B. ALL OTHER SHAPES: ASTM A-36.

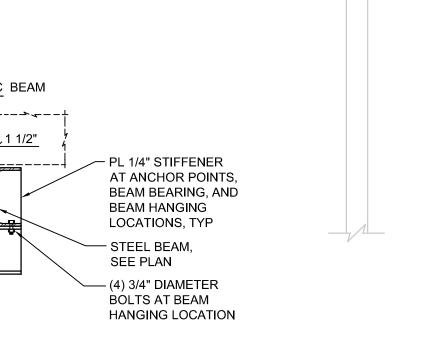
- 2. WELDS: TO BE 70 KSI LOW HYDROGEN FILLER METAL PLACED BY WELDERS CERTIFIED IN WELD AND POSITION BY AWS D1.1, STRUCTURAL WELDING CODE. ALL WELDS SHALL BE APPLIED TO SURFACES FREE OF GREASE, PAINT, DIRT, OR OTHER HARMFUL MATERIAL.
- 3. BOLTED CONNECTIONS: 3/4" DIAMETER A-325 BOLTS WITH HEAVY HEX NUTS UNLESS NOTED. DESIGNED FOR BEARING CONNECTIONS, TIGHTENED TO **SNUG TIGHT** CRITERIA UNLESS NOTED OTHERWISE.
- 4. STEEL PRIMER: RUST INHIBITING ALKYD INDUSTRIAL PRIMER, SSPC 6, 1.5 MIL MINIMUM THICKNESS.
- 6. BEAM CONNECTIONS SHALL BE DESIGNED TO SUPPORT ONE-HALF THE TOTAL UNIFORM LOAD CAPACITY PER AISC. WHEREVER POSSIBLE, EXTEND CONNECTIONS FULL DEPTH OF BEAM.
- 7. SHEAR TAB CONNECTIONS TO STEEL BEAMS ARE NOT ACCEPTABLE UNLESS BEAMS OF EQUAL DEPTHS ARE FASTENED ON OPPOSITE SIDES OF THE STEEL BEAM.
- 8. PROVIDE FITTED STIFFENER PLATES EACH SIDE FOR ALL CONDITIONS WHERE BEAMS BEAR ON COLUMNS, BEAMS BEAR ON BEAMS, BEAMS HANG FROM BEAMS, OR COLUMNS BEAR ON BEAMS. STIFFENER PLATES MINIMUM 1/4" THICK.
- 9. GRATING: 1" DEEP WELDED STEEL TYPE WITH 1" X 3/16" BEARING BARS 1 3/16" O.C. AND CROSSBARS 4" O.C. GRATING WELDED TO EACH SUPPORT MEMBER USING A 1/8" FILLET 1" LONG AT 2'-0" O.C. MAXIMUM. EXPOSED CUT EDGES OF GRATING SHALL HAVE BANDING BARS (EQUAL IN SIZES) WELDED TO THE BEARING BARS.
- 10. RAILING MATERIAL: SCHEDULE 40 PIPE, 1½" DIAMETER ASTM A 53, TYPE E, GRADE B.













17'-6 1/2" *

ய்| W10x17 (+0<u>'-9 3/4")</u>

EX W18x35

W8x13 (+0'-9 3/4")

-1"x3/16" 19W4

GRATING,

GRATING

DEPTH

MATCH EX

W10x17 (+0'-9 3/4")

W8x13 (+0'-9 3/4") EX W18x35

ှု | W10x17 (+0'-9 3/4") မျှ

GRATING, VIF

W8x13 (+0'-9 3/4")

1"x3/16" 19W4

GRATING,

GRATING

DEPTH -

GUARDRAIL POST,

. W8x13 (+0'-9 3/4")

— EX 19W4

GRATING, VIF

TYP OF (8), SEE DETAIL 1/S1.01 —

MATCH EX

VIF

GRATING, VIF

COOLING TOWER, WT = 31,000 LBS,COORDINATE EXACT SIZE AND LOCATION WITH

MECH TRADES

- KB L3X3X1/4 KNEE BRACE, 3/8" GUSSET PLATE TO EX W18 BOTTOM FLANGE AND W8 BEAM, (1) 3/4 BOLT EACH END
- X ANCHOR POINT LOCATION AS DETERMINED BY MECHANICAL UNIT SUPPLIER, PROVIDE 3/4" DIAMETER A307 BOLT WITH NUT AND WASHER PER MANUFACTURER'S RECOMMENDATIONS, COORDINATE EXACT LOCATION WITH MECHANICAL TRADES.
- * DIMENSION SHOWN FOR REFERENCE ONLY, COORDINATE FINAL UNIT DIMENSIONS AND LOCATION WITH MECHANICAL TRADES

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CAPITAL PROJ. NO.

LEAD MORGAN ARCH. CHARLAND MECH. WINKLER ELEC. BEACH CIVIL GARDNER WILBER INT. DES REP. MORGAN

CP23031

APPR. DATE 10/23/2023 SCALE AS NOTED

ISSUED ISSUED FOR BIDS 10/23/2023

STRUCTURAL FRAMING PLAN AND DETAILS

