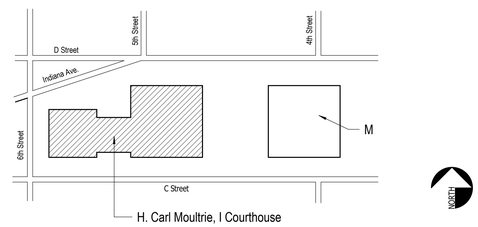
H. Carl Moultrie I Mech Rm 1000 Chilled Water Upgrade

SHEET LIST

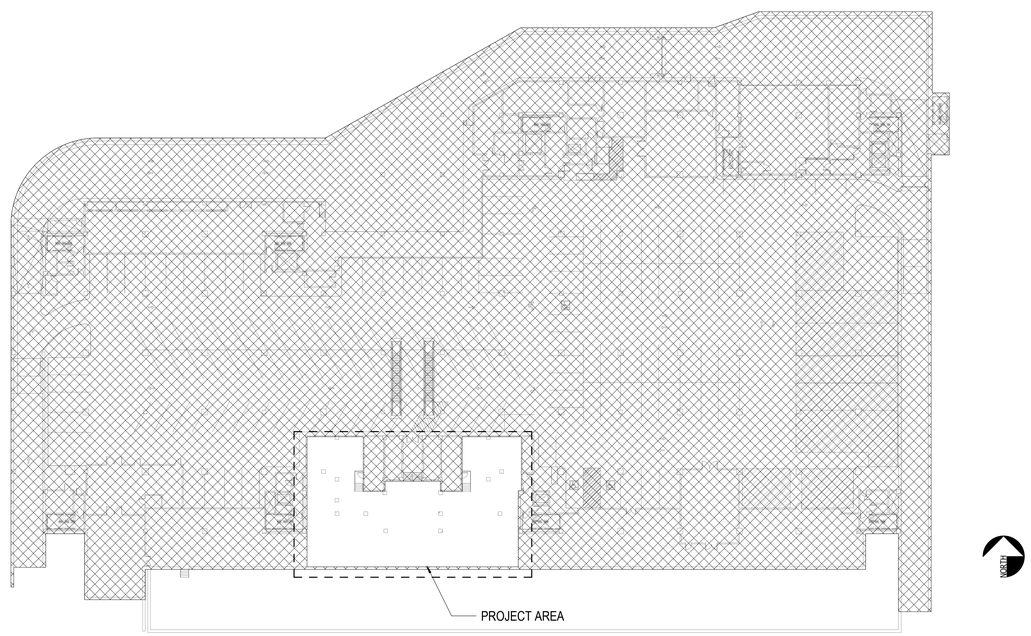
SHEET NUMBER	SHEET NAME
GENERAL	
G0.0	COVER SHEET
G0.1	BASEMENT LEVEL PHASING PLAN
STRUCTURAL	
S0.1	STRUCTURAL GENERAL NOTES
S2.1	SECTIONS AND DETAILS
MECHANICAL	
M0.1	MECHANICAL ABBREVIATIONS AND SYMBOLS
MD4.2.1	PHASE 1 DEMO ENLARGED MECHANICAL PLAN
MD4.2.2	PHASE 2 DEMO ENLARGED MECHANICAL PLAN
MD4.2.3	PHASE 3 DEMO ENLARGED MECHANICAL PLAN
MD5.2.1	PHASE 1 DEMO CHILLED AND CONDENSER WATER SYSTEM DIAGRAMS
MD5.2.2	PHASE 2 DEMO CHILLED AND CONDENSER WATER SYSTEM DIAGRAMS
MD5.2.3	PHASE 3 DEMO CHILLED AND CONDENSER WATER SYSTEM DIAGRAMS
M4.2.1	PHASE 1 NEW ENLARGED MECHANICAL PLAN
M4.2.2	PHASE 2 NEW ENLARGED MECHANICAL PLAN
M4.2.3	PHASE 3 NEW ENLARGED MECHANICAL PLAN
M4.2.4	PHASE 3 CHILLED WATER 3D AND SECTION VIEWS
M5.2.0	EXISTING CHILLED AND CONDENSER WATER PIPING DIAGRAM
M5.2.1	PHASE 1 NEW CHILLED AND CONDENSER WATER SYSTEM DIAGRAMS
M5.2.2	PHASE 2 NEW CHILLED AND CONDENSER WATER SYSTEM DIAGRAMS
M5.2.3	PHASE 3 NEW CHILLED AND CONDENSER WATER SYSTEM DIAGRAMS
M6.1	MECHANICAL DETAILS
M7.1	MECHANICAL SCHEDULES
M8.0	MECHANICAL CONTROLS - LEGEND
M8.1	MECHANICAL CONTROLS - CONDENSER WATER SYSTEM
M8.2	MECHANICAL CONTROLS - CHILLED WATER SYSTEM
M8.3	MECHANICAL CONTROLS - CHILLED AND CONDENSER WATER SYSTEM SEQUENCE OF OPERATIONS
ELECTRICAL	
E0.1	ELECTRICAL ABBREVIATIONS AND SYMBOLS
E0.2	ELECTRICAL SCHEDULES
ED2.1.1	PHASE 1 BASEMENT LEVEL ELECTRICAL DEMOLITION PLAN
ED2.1.2	PHASE 2 BASEMENT LEVEL ELECTRICAL DEMOLITION PLAN
ED2.1.3	PHASE 3 BASEMENT LEVEL ELECTRICAL DEMOLITION PLAN
E2.1.1	PHASE 1 BASEMENT LEVEL ELECTRICAL POWER PLAN
E2.1.2	PHASE 2 BASEMENT LEVEL ELECTRICAL POWER PLAN
E2.1.3	PHASE 3 BASEMENT LEVEL ELECTRICAL POWER PLAN
E5.1	ELECTRICAL ELEVATIONS
E7.0	ELECTRICAL MECHANICAL EQUIPMENT & PANELBOARD SCHEDULES
E7.1	PANELBOARD SCHEDULES

Grand total: 36

VICINITY MAP



PROJECT AREA PLAN



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4/30/2021

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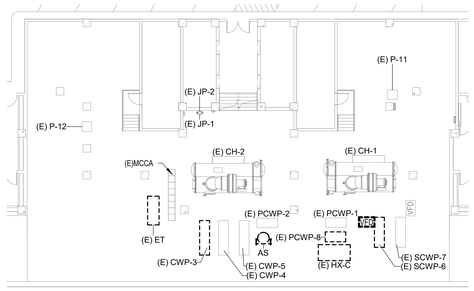
PHASE 1

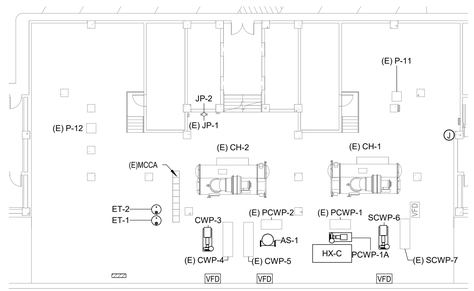
DEMO



4 PHASE 1 BASEMENT LEVEL MECHANICAL DEMOLITION PLAN
SCALE: 1/16" = 1'-0"

1. DEMO (E) CWP-3
2. DEMO (E) SCWP-6
3. DEMO (E) PCWP-8
4. DEMO (E) JP-2
5. DEMO (E) HX-C
6. DEMO (E) ET AND (E) AS

NEW

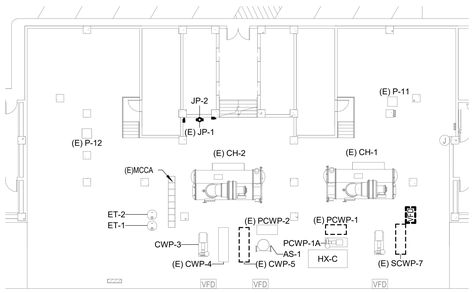


1 PHASE 1 BASEMENT LEVEL MECHANICAL NEW WORK PLAN
SCALE: 1/16" = 1'-0"

1. INSTALL NEW PCWP-1A
2. INSTALL NEW CWP-3
3. INSTALL NEW SCWP-6
4. INSTALL NEW HX-C
5. INSTALL NEW JP-2
6. INSTALL NEW ET-1,2
7. INSTALL NEW AS-1

PHASE 2

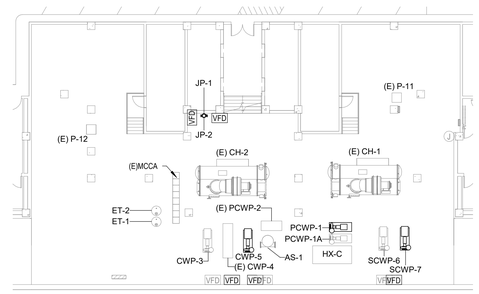
DEMO



5 PHASE 2 BASEMENT LEVEL MECHANICAL DEMOLITION PLAN
SCALE: 1/16" = 1'-0"

1. DEMO (E) CWP-5
2. DEMO (E) PCWP-1
3. DEMO (E) SCWP-7
4. DEMO (E) JP-1

NEW

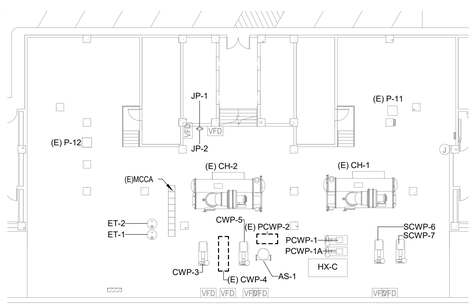


2 PHASE 2 BASEMENT LEVEL MECHANICAL NEW WORK PLAN
SCALE: 1/16" = 1'-0"

1. INSTALL NEW CWP-5
2. INSTALL NEW PCWP-1
3. INSTALL NEW SCWP-7
4. INSTALL NEW JP-1

PHASE 3

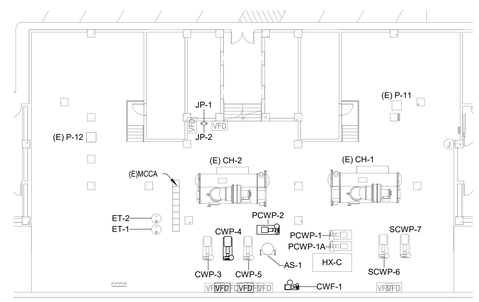
DEMO



6 PHASE 3 BASEMENT LEVEL MECHANICAL DEMOLITION PLAN
SCALE: 1/16" = 1'-0"

1. DEMO (E) CWP-4
2. DEMO (E) PCWP-2

NEW



3 PHASE 3 BASEMENT LEVEL MECHANICAL NEW WORK PLAN
SCALE: 1/16" = 1'-0"

1. INSTALL NEW CWP-4
2. INSTALL NEW PCWP-2
3. INSTALL NEW CWF-1

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75% CONSTRUCTION DOCUMENTS		3/18/2021

SEALS AND SIGNATURES

DISTRICT OF COLUMBIA
IONEL PETRUS
No. PE907217
MECHANICAL
PROFESSIONAL ENGINEER

Ionel Petrus

SHEET TITLE
BASEMENT LEVEL PHASING PLAN

PROJECT NUMBER
CD

SHEET NUMBER
G0.1

Author

Plot Date: 4/30/2021 4:25:31 PM

GR-1 AS USED IN THESE GENERAL NOTES:
"DRAWINGS" MEANS THE LATEST STRUCTURAL DESIGN DRAWINGS, UON.
"SPECIFICATIONS" MEANS THE LATEST PROJECT SPECIFICATIONS, UON.
"CONTRACT DOCUMENTS" IS DEFINED AS THE DESIGN DRAWINGS AND THE SPECIFICATIONS
"SER" IS DEFINED AS THE STRUCTURAL ENGINEER OF RECORD FOR THE STRUCTURE IN ITS FINAL CONDITION.
"DESIGN PROFESSIONALS" IS DEFINED AS THE OWNER'S ARCHITECT AND SER.
"MEP" INCLUDES, BUT IS NOT LIMITED TO MECHANICAL, ELECTRICAL, PLUMBING, FIRE PROTECTION.
"CONTRACTOR" IS DEFINED TO INCLUDE ANY OF THE FOLLOWING: GENERAL CONTRACTOR AND THEIR SUBCONTRACTORS, CONSTRUCTION MANAGER AND THEIR SUBCONTRACTORS, STRUCTURAL STEEL FABRICATOR OR STRUCTURAL STEEL ERECTOR.
"BASE BUILDING STRUCTURE" IS DEFINED AS THE STRUCTURAL FRAME DESIGNED BY THORNTON TOMASETTI.
"STRUCTURE IN ITS FINAL CONDITION" MEANS ALL STRUCTURAL ELEMENTS SHOWN ON THE STRUCTURAL CONTRACT DOCUMENTS ARE INSTALLED AND COMPLETELY CONNECTED AND INSPECTED WITH NO OUTSTANDING NON-COMPLIANCE ISSUES.
"DELEGATED DESIGN" MEANS A SCOPE OF WORK THAT MEETS PERFORMANCE CRITERIA ESTABLISHED IN THE CONTRACT DOCUMENTS AND IS TO BE COMPLETED BY THE CONTRACTOR'S LICENSED ENGINEER.
"SERVICE LEVEL" LOADS ARE DEFINED AS NOMINAL OR UNFACTORED LOADS TO BE COMBINED USING ALLOWABLE STRESS LOAD COMBINATIONS
"STRENGTH LEVEL" LOADS ARE DEFINED AS FACTORED LOADS TO BE COMBINED USING STRENGTH DESIGN LOAD COMBINATIONS

GR-2 THE CONTRACTOR IS RESPONSIBLE FOR COORDINATION OF THE STRUCTURAL WORK WITH THE ARCHITECTURAL, CIVIL, MEP CONTRACT DOCUMENTS, AS WELL AS ANY OTHER APPLICABLE TRADES.

GR-3 THE SPECIFICATIONS ARE AN INTEGRAL PART OF THE CONTRACT DOCUMENTS AND SHALL BE USED IN CONJUNCTION WITH THE STRUCTURAL DRAWINGS.

GR-4 THE CONTRACTOR SHALL VERIFY ALL EXISTING DIMENSIONS AND CONDITIONS AND COORDINATE WITH THE STRUCTURAL DRAWINGS, ARCHITECTURAL DRAWINGS, DRAWINGS FROM OTHER CONSULTANTS, PROJECT SHOP DRAWINGS AND FIELD CONDITIONS.

GR-5 IN CASES OF CONFLICT BETWEEN DRAWINGS AND/OR SPECIFICATIONS AND OTHER DISCIPLINES OR EXISTING CONDITIONS, CONTRACTOR SHALL NOTIFY THE DESIGN PROFESSIONALS AND OBTAIN CLARIFICATION PRIOR TO BIDDING AND PROCEEDING WITH WORK.

GR-6 APPLY DETAILS, SECTIONS, AND NOTES ON THE DRAWINGS WHERE CONDITIONS ARE SIMILAR TO THOSE INDICATED BY DETAIL, DETAIL TITLE OR NOTE.

GR-7 ONLY USE DIMENSIONS INDICATED ON THE DRAWINGS. DO NOT SCALE DRAWINGS.

GR-8 ASSUME EQUAL SPACING BETWEEN ESTABLISHED DIMENSIONS, IF NOT INDICATED ON DRAWINGS.

GR-9 THE CONTRACTOR SHALL PROTECT EXISTING FACILITIES, STRUCTURES AND UTILITIES FROM DAMAGE.

GR-10 THE CONTRACTOR SHALL VERIFY THAT CONSTRUCTION LOADS DO NOT EXCEED THE CAPACITY OF THE STRUCTURE AT THE TIME THE LOAD IS APPLIED.

GR-11 THE CONTRACTOR SHALL VERIFY ALL OPENING SIZES AND LOCATIONS WITH OTHER DISCIPLINES. THE DRAWINGS DO NOT SHOW ALL OPENINGS REQUIRED. ADDITIONAL OPENINGS, BLOCKOUTS AND SLEEVES MAY BE REQUIRED BY OTHER DISCIPLINES AND MUST BE APPROVED BY THE SER.

GR-12 ELEVATIONS INDICATED ON STRUCTURAL DRAWINGS ARE BASED ON A PROJECT DATUM INDICATED ON THE ARCHITECTURAL DRAWINGS.

GR-13 SEE ARCHITECTURAL AND MEP CONTRACT DOCUMENTS FOR ADDITIONAL INFORMATION RELATING TO THE COORDINATION OF STRUCTURAL COMPONENTS INCLUDING, BUT NOT LIMITED TO:

ARCHITECTURAL:
PLAN DIMENSIONS AND PROJECT DATUM
FINISH ELEVATIONS
EMBEDMENTS, INSERTS, BLOCKOUTS, ETC.
CONCRETE FINISHES
CONCRETE HOUSEKEEPING PADS
FIRE RATINGS

MEP:
EQUIPMENT CURBS

CD CODES AND DESIGN CRITERIA

CD-1 PERFORM ALL CONSTRUCTION IN CONFORMANCE WITH THE BUILDING AND DESIGN CODES REFERENCED WITHIN THESE DOCUMENTS. THE PROJECT DOCUMENTS REFER TO THE FOLLOWING CODES AND STANDARDS, UON:

CONSTRUCTION CODES, 2017 EDITION, WHICH INCORPORATES THE INTERNATIONAL BUILDING CODE (IBC), 2015 EDITION

STRUCTURAL CONCRETE:
"BUILDING CODE REQUIREMENTS FOR STRUCTURAL CONCRETE"
THE AMERICAN CONCRETE INSTITUTE (ACI 318-14)

CD-2 LIVE LOADS:
MECHANICAL ROOMS 100 PSF OR ACTUAL WEIGHT

CD-3 SUPERIMPOSED DEAD LOADS (MECHANICAL ROOM):
10 PSF, MINIMUM

CD-4 OCCUPANCY OR RISK CATEGORY: III

CD-5 SNOW LOADS (SERVICE LEVEL):
THE WORK DOES NOT AFFECT EXTERIOR PORTIONS OF THE STRUCTURE. SNOW LOAD ON EXISTING STRUCTURE IS NOT AFFECTED AND SNOW LOAD IS NOT RELEVANT TO NEW WORK.

CD-6 WIND LOAD DESIGN DATA (STRENGTH LEVEL):
THE WORK DOES NOT AFFECT EXTERIOR PORTIONS OF THE STRUCTURE. WIND LOAD ON EXISTING STRUCTURE IS NOT AFFECTED AND WIND LOAD IS NOT RELEVANT TO NEW WORK.

CD-7 SEISMIC LOAD DESIGN DATA (STRENGTH LEVEL):
THE WORK DOES NOT SIGNIFICANTLY AFFECT THE SEISMIC MASS OF THE STRUCTURE AS A WHOLE OR OF THE LOCAL AREAS INVOLVED.

SEISMIC IMPORTANCE FACTOR (I_e)	1.25
S_s	0.119 g
S_1	0.051 g
S_{DS}	0.095 g
S_{D1}	0.058 g
SITE CLASS	C
SEISMIC DESIGN CATEGORY	A
DESIGN BASE SHEAR	NOT SIGNIFICANTLY AFFECTED

CD-8 IN CASES WHERE THE CONTRACTOR DETERMINES THAT SUSPENDED OR FLOOR MOUNTED EQUIPMENT LOADS EXIST WHICH EXCEED DESIGN LOADS INDICATED ON CONTRACT DOCUMENTS, CONTRACTOR SHALL SUBMIT LOAD DATA TO DESIGN PROFESSIONALS FOR REVIEW PRIOR TO PROCEEDING WITH WORK.

CD-9 STRUCTURAL COMPONENTS ARE NOT DESIGNED FOR VIBRATING EQUIPMENT. MOUNT VIBRATING EQUIPMENT ON VIBRATION ISOLATORS.

CD-10 CONNECTIONS OF SYSTEMS DESIGNED BY CONTRACTOR'S ENGINEER SUCH AS, BUT NOT LIMITED TO, MEP EQUIPMENT SUPPORT FRAMES ARE ASSUMED TO IMPOSE VERTICAL AND/OR HORIZONTAL LOADS ON THE BASE BUILDING STRUCTURAL MEMBERS WITHOUT GENERATING TORSION IN THE SUPPORTING STRUCTURAL MEMBERS. CONTRACTOR IS RESPONSIBLE FOR FURNISHING AND INSTALLING ALL SUPPLEMENTARY BRACING MEMBERS AS REQUIRED TO PREVENT TORSION ON THE BASE BUILDING STRUCTURE.

CD-11 FOR FIRE RATING AND FIREPROOFING ASSEMBLY EVALUATIONS, CONSIDER THE FOLLOWING ASSEMBLIES RESTRAINED: COMPOSITE WIDE-FLANGE STEEL FRAMING, INTERIOR BAYS OF CONTINUOUS CAST-IN-PLACE CONCRETE CONSTRUCTION. CONSIDER ALL OTHER ASSEMBLIES UNRESTRAINED.

CD-12 THERE HAVE BEEN NO LOAD RESTRICTION FACTORS APPLIED TO THE STRUCTURAL DESIGN FOR THE PURPOSES OF SELECTING FIREPROOFING ASSEMBLIES.

DE DEMOLITION

DE-1 THE CONTRACTOR IS FULLY RESPONSIBLE FOR THE MEANS AND METHODS OF DEMOLITION AND THE INTEGRITY AND STABILITY OF THE EXISTING STRUCTURE DURING DEMOLITION UNTIL THE WORK IS COMPLETED. THE CONTRACTOR SHALL PROVIDE SHORING IN REQUIRED LOCATIONS WHERE EXISTING CONSTRUCTION TO REMAIN WILL BE AFFECTED BY DEMOLITION. CONTRACTOR SHALL RETAIN A PROFESSIONAL ENGINEER LICENSED IN THE STATE WHERE THE PROJECT IS LOCATED TO DESIGN SHORING.

DE-2 THE CONTRACTOR IS RESPONSIBLE FOR REPAIRS TO ANY STRUCTURAL ELEMENTS WHICH ARE TO REMAIN AND THAT HAVE BEEN DAMAGED DURING THE DEMOLITION PROCESS TO THE COMPLETE SATISFACTION OF THE OWNER. THE REPAIRS SHALL BE AT NO EXPENSE TO THE OWNER. ALL REPAIR WORK SHALL BE DESIGNED BY A PROFESSIONAL ENGINEER LICENSED IN THE STATE WHERE THE PROJECT IS LOCATED AND SUBMITTED TO THE SER FOR REVIEW AND APPROVAL PRIOR TO COMMENCING REPAIR WORK.

DE-3 ALL EXISTING FRAMING IS INDICATED FOR REFERENCE ONLY AND IS TO BE FIELD VERIFIED BY THE CONTRACTOR. VERIFY THE EXACT EXTENT OF DEMOLITION AT THE SITE. DETERMINE THE NATURE AND EXTENT OF DEMOLITION THAT WILL BE NECESSARY BY COMPARING THE CONTRACT DOCUMENTS WITH THE EXISTING CONSTRUCTION. IMMEDIATELY NOTIFY THE DESIGN PROFESSIONALS OF ANY INCONSISTENCIES.

DE-4 THE CONTRACTOR SHALL USE THE STRUCTURAL CONTRACT DOCUMENTS IN CONJUNCTION WITH THE ARCHITECTURAL AND MEP DEMOLITION CONTRACT DOCUMENTS. IN THE EVENT OF CONFLICTS, THE CONTRACTOR SHALL IMMEDIATELY NOTIFY THE DESIGN PROFESSIONALS.

DE-5 THE CONTRACTOR SHALL USE QUALIFIED, EXPERIENCED PERSONNEL FOR DEMOLITION AND REMOVAL OPERATIONS. PERFORM DEMOLITION AND REMOVAL OPERATIONS IN A CAREFUL AND ORDERLY MANNER TO PREVENT HAZARDS TO PERSONS, DAMAGE TO PROPERTY, AND THE SPREADING OF DUST AND DEBRIS.

DE-6 DO NOT PERMIT PORTIONS OF THE STRUCTURE TO FALL NOR DEBRIS TO DROP EXCEPT BY METHODS WHICH WILL INSURE INTEGRITY OF THE STRUCTURE.

DE-7 PRIOR TO THE START OF WORK, VERIFY THAT THE SCOPE OF DEMOLITION INDICATED ON THE CONTRACT DOCUMENTS SHALL NOT DAMAGE, CUT OR DISRUPT SERVICE OF ANY MECHANICAL SYSTEM, ELECTRICAL SYSTEM OR UTILITY EMBEDDED IN THE EXISTING STRUCTURE.

DE-8 DO NOT REMOVE MORE OF THE EXISTING STRUCTURE THAN INDICATED ON CONTRACT DOCUMENTS. DO NOT DAMAGE, MAR, CUT OR DEFACE THE REMAINING STRUCTURE OR MATERIALS TO BE REUSED.

DE-9 THE CONTRACTOR SHALL INCLUDE IN HIS BID THE COST OF REMOVING DEMOLISHED MATERIALS FROM THE SITE IN ACCORDANCE WITH ALL APPLICABLE LAWS, CODES, AND REGULATIONS.

DE-10 WHERE NEW OPENINGS IN EXISTING CONCRETE SLABS OR WALLS ARE TO BE CREATED, THE DEMOLITION CONTRACTOR SHALL CORE HOLES AT THE OUTSIDE CORNERS OF THE NEW OPENING PRIOR TO DEMOLITION. SAW-CUT AND DEMOLISH SLAB OR WALL ONLY AFTER THE INSTALLATION OF ALL REQUIRED NEW STRUCTURAL FRAMING AND/OR REINFORCEMENT IN PLAN OR SECTION, UON. SAW CUTTING SHALL BE STRAIGHT AND SHALL NOT EXTEND INTO EXISTING SLAB OR WALL TO REMAIN NOR BEYOND THE HOLES CORED AT THE CORNERS OF THE NEW OPENING.

DI DELEGATED DESIGN ITEMS

DI-1 THE CONTRACTOR SHALL EMPLOY OR RETAIN A PROFESSIONAL ENGINEER LICENSED IN THE STATE WHERE THIS PROJECT IS LOCATED TO DESIGN AND DETAIL DELEGATED DESIGN ITEMS TO MEET THE PERFORMANCE AND DESIGN CRITERIA ESTABLISHED AS PART OF THE BASE BUILDING STRUCTURE INDICATED IN THE CONTRACT DOCUMENTS INCLUDING BUT NOT LIMITED TO:

STRUCTURAL STEEL EQUIPMENT SUPPORT STANDS, BRACKETS, ETC.

SUSUBMITTALS

SU-1 TWENTY WORKING DAYS PRIOR TO SUBMITTING SHOP DRAWINGS, THE CONTRACTOR SHALL SUBMIT FOR SER'S REVIEW A SCHEDULE WHICH DETAILS THE ESTIMATED QUANTITY OF SHOP DRAWINGS AND THE DATE THE SHOP DRAWINGS WILL BE RECEIVED BY THE SER. THE SER SHALL HAVE THE OPPORTUNITY TO REVIEW THE PROPOSED SCHEDULE AND SUBMIT COMMENTS TO THE CONTRACTOR. THE FINAL SHOP DRAWING SCHEDULE SHALL BE DEVELOPED AND SUBMITTED TO THE SER. IN ACCORDANCE WITH THE SHOP DRAWING SCHEDULE, THE SER WILL RETURN THE SHOP DRAWING ITEMS WITHIN TEN WORKING DAYS AFTER HAVING RECEIVED THE ELECTRONIC SHOP DRAWING.

SU-2 THE CONTRACTOR IS TO REVIEW EACH SUBMITTAL PRIOR TO FORWARDING TO DESIGN PROFESSIONALS. THE CONTRACTOR IS TO STAMP EACH SUBMITTAL VERIFYING THAT THE FOLLOWING IS ADDRESSED:

1. THE SHOP DRAWING IS REQUESTED.
2. THE SHOP DRAWING IS BASED ON THE LATEST DESIGN.
3. THE DESIGN PROFESSIONALS' COMMENTS FROM ANY PREVIOUS SUBMITTALS ARE ADDRESSED.
4. THE WORK IS COORDINATED AMONG ALL CONSTRUCTION TRADES.
5. REVISIONS FROM PREVIOUS SUBMITTALS ARE CLEARLY MARKED BY CIRCLING OR CLOUDS.
6. SUBMITTAL IS COMPLETE.
7. SUBMITTAL DOES NOT INCLUDE SUBSTITUTION REQUEST
8. SUBMITTAL SHALL INCLUDE A STAMP INDICATING PROJECT NAME AND LOCATION, SUBMITTAL NUMBER, SPECIFICATION SECTION NUMBER.

THE SER SHALL RETURN, WITHOUT COMMENT, SUBMITTALS WHICH THE CONTRACTOR HAS NOT STAMPED OR WHICH DO NOT MEET THE ABOVE REQUIREMENTS. THE SER'S REVIEW OF SUBMITTALS SHALL BE FOR GENERAL CONFORMANCE WITH THE DESIGN INTENT. NO WORK SHALL BE STARTED WITHOUT SUCH REVIEW.

SU-3 FOR COMPONENTS THAT REQUIRE ENGINEERING BY THE CONTRACTOR, PROVIDE A NOTE ON EACH SHOP DRAWING, WRITTEN AND SIGNED BY THE SUPPLIER'S ENGINEER, INDICATING THAT THE SHOP DRAWING IS IN CONFORMANCE WITH THE CALCULATIONS OF THE CONTRACTOR'S ENGINEER.

SU-4 THE FOLLOWING ITEMS REQUIRE SUBMITTALS FOR STRUCTURAL REVIEW AS OUTLINED IN THE SPECIFICATIONS:

032000	S	CONCRETE REINFORCING LAYOUT
033000		CONCRETE MIX DESIGNS

S = SHOP DRAWINGS REQUIRED

CALC = SUPPORTING CALCULATIONS REQUIRED, SEALED AND SIGNED BY A PROFESSIONAL ENGINEER LICENSED IN THE STATE WHERE THE PROJECT IS LOCATED.

SU-5 THE ITEMS IN THIS SECTION REFER TO LOADS IMPOSED BY CONTRACTOR SELECTED SYSTEMS, SPECIFICALLY:

MEP EQUIPMENT

WHERE CONTRACTOR LOADS IMPOSED FOR THE FOLLOWING ITEMS EXCEED AND/OR CONNECTION CONDITIONS DIFFER FROM WHAT IS SHOWN IN THE STRUCTURAL DRAWINGS, SUBMIT FOR APPROVAL TO SER LOADS IMPOSED ON THE PRIMARY STRUCTURAL FRAME DUE TO THE DEAD AND LIVE LOADS ASSOCIATED WITH THE ITEMS.

FOR MEP SYSTEMS, THE LOADS IMPOSED SUBMITTAL SHALL BE COMPREHENSIVE INDICATING THE LOADS IMPOSED ON THE BASE BUILDING STRUCTURE AND SHALL INCLUDE THE REACTIONS BASED ON THE ACTUAL LOADS OF THE ENTIRE MECHANICAL, ELECTRICAL, PLUMBING, AND FIRE PROTECTION SYSTEM, INCLUDING BUT NOT LIMITED TO PIPING, DUCTS, ELECTRICAL RACEWAYS, AND EQUIPMENT WEIGHTS.

A SUBSTITUTION REQUEST MAY BE REQUIRED WHERE CONTRACTOR LOADS IMPOSED EXCEED AND/OR CONNECTION CONDITIONS DIFFER FROM THE BASIS OF DESIGN.

CM CONCRETE MATERIALS

CM-1 CONCRETE STRENGTH SHALL MEET A 28-DAY COMPRESSIVE STRENGTH (f' c) OF 4,000 PSI, UON:

CM-2 PROVIDE NORMALWEIGHT CONCRETE WITH CURED DENSITY OF 145 +/- 5 PCF, AND AGGREGATE CONFORMING TO ASTM C33, UON.

CM-3 THE USE OF CALCIUM CHLORIDE AND OTHER CHLORIDE CONTAINING AGENTS IS PROHIBITED. THE USE OF RECYCLED CONCRETE IS PROHIBITED. PLACEMENT WITHIN AND CONTACT BETWEEN ALUMINUM ITEMS, INCLUDING ALUMINUM CONDUIT, AND CONCRETE IS PROHIBITED.

CM-4 ALL CAST-IN-PLACE CONCRETE WILL EXPERIENCE DIFFERING VARIATIONS OF CRACKING. ANY ELEMENT EXPOSED TO DIRECT WEATHER AND/OR TEMPERATURE VARIATIONS DURING CONSTRUCTION OR IN THE FINAL CONDITION IS TO BE TREATED AND REGULARLY MAINTAINED TO PREVENT PROPAGATION OF CRACKS AND WATER PENETRATION. THE CONTRACTOR SHALL DEVELOP A REGULAR MAINTENANCE PROGRAM AND SUBMIT IT TO THE OWNER.

RE CONCRETE REINFORCEMENT

RE-1 ALL CONCRETE SHALL INCLUDE REINFORCEMENT. IF REINFORCEMENT IS NOT SPECIFICALLY INDICATED ON THE DRAWINGS VERIFY WITH THE SER.

RE-2 REINFORCEMENT SHALL CONFORM TO THE FOLLOWING STANDARDS AND MATERIAL PROPERTIES UON:

DEFORMED BARS:	ASTM A615
WELDED WIRE REINFORCEMENT	ASTM A1064

RE-3 DETAIL REINFORCEMENT BASED ON THE PROJECT REQUIREMENTS, ACI-318 AND ACI-315, UON.

RE-4 WHERE A 90-DEG, 135 –DEG OR 180-DEG HOOK IS GRAPHICALLY INDICATED, PROVIDE CORRESPONDING ACI STANDARD HOOKS UON.

RE-5 DOWELS SHALL MATCH SIZE AND SPACING OF MAIN REINFORCEMENT UON.

RE-6 REINFORCEMENT SHALL HAVE CONCRETE PROTECTION (CLEAR COVER) PER ACI 318 UNLESS OTHERWISE INDICATED ON THE DRAWINGS.

RE-7 LAP WELDED WIRE REINFORCEMENT TWO PANEL SPACINGS, UON.

SI SPECIAL INSPECTIONS

SI-1 THE FOLLOWING STRUCTURAL ITEMS REQUIRE SPECIAL TESTING AND/OR INSPECTIONS:

INSTALLATION OF ADHESIVE DOWELS
PLACEMENT OF REINFORCEMENT

PA POST-INSTALLED ANCHORS

PA-1 ADHESIVE ANCHOR SYSTEMS USED FOR DESIGN:

ADHESIVE: HILTI HIT-HY 200

OVERHEAD AND/OR CONSTANT TENSION ADHESIVE ANCHOR INSTALLATIONS NOT SHOWN ON THE DRAWINGS SHALL NOT BE PERMITTED UNLESS EACH CONDITION IS REVIEWED AND APPROVED IN WRITING BY THE SER.

PA-2 PROOF TESTING OF ADHESIVE ANCHORS SHALL BE PERFORMED IN ACCORDANCE WITH THE PROJECT SPECIFICATIONS. UNLESS NOTED OTHERWISE, ADHESIVE ANCHOR PROOF TENSION LOADS SHALL BE PER AS DETERMINED BY THE SER AFTER SUMBISSION OF ANCHOR SELECTIONS.

PA-2 ALTERNATIVE SYSTEM EQUIVALENT TO OR EXCEEDING THE PROPERTIES OF THE SYSTEM ABOVE WILL BE CONSIDERED AS A SUBSTITUTION REQUEST. SEE PROJECT SPECIFICATIONS.

PA-3 ANCHORS ARE TO BE MINIMUM 3/4" DIAMETER WITH A MINIMUM EMBEDMENT OF 6", UON.

PA-4 INSTALL ANCHORS TO MEET THE REQUIREMENTS INDICATED IN THE CONTRACT DOCUMENTS AND THE CURRENT MANUFACTURER'S PUBLISHED INSTALLATION INSTRUCTIONS (MPII).

PA-5 LOCATE, BY NON-DESTRUCTIVE MEANS, AND AVOID ALL EXISTING REINFORCEMENT PRIOR TO INSTALLATION OF ANCHORS. IF EXISTING REINFORCING LAYOUT PROHIBITS THE INSTALLATION OF ANCHORS AS INDICATED ON THE DRAWINGS, THE CONTRACTOR SHALL IMMEDIATELY NOTIFY THE DESIGN PROFESSIONALS.

PA-6 INSTALL ANCHORS IN SOLID MASONRY OR IN HOLLOW MASONRY THAT HAS BEEN GROUTED SOLID AT LEAST ONE COURSE ABOVE TO ONE COURSE BELOW THE ANCHOR, UON.

PA-7 SEE PROJECT SPECIFICATIONS FOR POST-INSTALLED ANCHOR INSPECTION REQUIREMENTS.

REQUIRED VERIFICATION AND INSPECTION OF CONCRETE CONSTRUCTION

VERIFICATION AND INSPECTION	CONTINUOUS	PERIODIC	CODE STANDARD(S) a	TT SPECIFICATION	TT SPECIFICATION SECTION
1. INSPECTION OF REINFORCING STEEL, AND PLACEMENT	-	X	ACI 318: 3.5, 7.1-7.7 IBC 1910.4	032000, 033800	1.8.B.2, 1.9.C
2. INSPECTION OF REINFORCING STEEL WELDING IN ACCORDANCE WITH TABLE 1705.2.2, ITEM 2B	-	X	AWS D1.4 ACI 318: 3.5.2	-	-
3. INSPECTION OF ANCHORS CAST IN CONCRETE WHERE ALLOWABLE LOADS HAVE BEEN INCREASED OR WHERE STRENGTH DESIGN IS USED	-	X	ACI 318: 8.1.3,21.2.8 IBC 1908.5, 1909.1	032000	1.8.B.2
4. INSPECTION OF ANCHORS POST-INSTALLED IN HARDENED CONCRETE MEMBERS b	-	X	ACI 318: 3.8.6,8.1.3,21.2.8 IBC 1909.1	032000	1.8.C, 1.8.D, 1.8.E
5. VERIFYING USE OF REQUIRED DESIGN MIX	-	X	ACI 318: CH. 4, 5.2-5.4 IBC 1904.2,1910.2,1910.3	033000	1.9.F.2.a.i
6. AT THE TIME FRESH CONCRETE IS SAMPLED TO FABRICATE SPECIMENS FOR STRENGTH TESTS, PERFORM SLUMP AND AIR CONTENT TESTS, AND DETERMINE THE TEMPERATURE OF THE CONCRETE	X	-	ASTM C 172 ASTMC31 ACI 318: 5.6, 5.8 IBC 1910.1	033000	1.9.F.2.a.iii, 1.9.F.3.a, 1.9.F.3.c, 1.9.F.3.e, 1.9.F.3.g, 1.9.F.3.h
7. INSPECTION OF CONCRETE PLACEMENT FOR PROPER APPLICATION TECHNIQUES	X	-	ACI 318: 5.9, 5.10 IBC 1910.6, 1910.7, 1910.8	033000	1.9.G
8. INSPECTION FOR MAINTENANCE OF SPECIFIED CURING TEMPERATURE AND TECHNIQUES	-	X	ACI 318: 5.1 1-5.13 IBC 1910.9	033000	1.9.F.2.a.ix
12. INSPECT FORMWORK FOR SHAPE, LOCATION AND DIMENSIONS OF THE CONCRETE MEMBER BEING FORMED	-	X	ACI 318: 6.1.1	031000	1.9.B.2

REFERENCE IBC 2015 TABLE 1705.3

a. WHERE APPLICABLE, SEE ALSO SECTION 1705.11, SPECIAL INSPECTIONS FOR SEISMIC RESISTANCE

b. SPECIFIC REQUIREMENTS FOR SPECIAL INSPECTION SHALL BE INCLUDED IN THE RESEARCH REPORT FOR THE ANCHOR ISSUED BY AN APPROVED SOURCE IN ACCORDANCE WITH ACI 355.2 OR OTHER QUALIFICATION PROCEDURES. WHERE SPECIFIC REQUIREMENTS ARE NOT PROVIDED, SPECIAL INSPECTION REQUIREMENTS SHALL BE SPECIFIED BY THE REGISTERED DESIGN PROFESSIONAL AND SHALL BE APPROVED BY THE BUILDING OFFICIAL PRIOR TO THE COMMENCEMENT OF THE WORK

* INDICATES TT SPECIFICATION REQUIRES MORE STRINGENT VERIFICATION AND INSPECTION THAN IBC

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75% CONSTRUCTION DOCUMENTS		03/18/2021

SEALS AND SIGNATURES

DISTRICT OF COLUMBIA
MATTHEW D. LOEFFLER
No. 10237
REGISTERED PROFESSIONAL ENGINEER

04/30/2021

SHEET TITLE
STRUCTURAL GENERAL NOTES

PROJECT NUMBER 13089.000

SHEET NUMBER CD S0.1

Author

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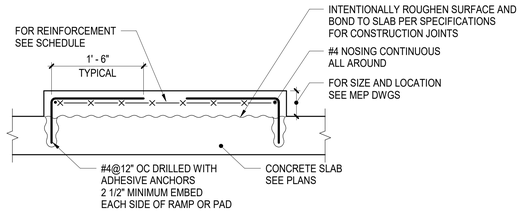
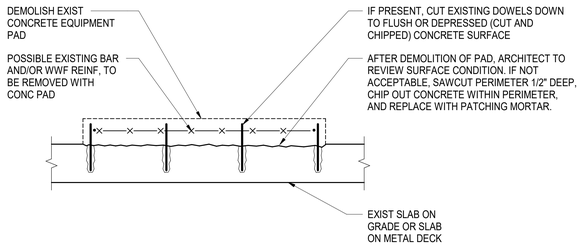


SECTION AT PAD

THICKNESS	REINFORCEMENT
≤ 3"	WWR 6x6 - W2.9xW2.9
≤ 4"	WWR 6x6 - W4.0xW4.0
≤ 6"	#4 @ 12" TOP EACH WAY
≤ 12"	#4 @ 12" TOP & BOTTOM EACH WAY

1 TYPICAL DETAIL OF CONCRETE FILL HOUSEKEEPING PAD/MECH PAD

NOT TO SCALE



2 TYPICAL EQUIPMENT PAD DEMOLITION DETAIL

1" = 1'-0"

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Matthew D. Loeffler

SHEET TITLE
SECTIONS AND DETAILS

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CD

SHEET NUMBER S2.1

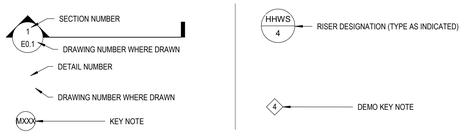
Plot Date: 3/18/2021 3:31:08 PM Author

MECHANICAL ABBREVIATIONS

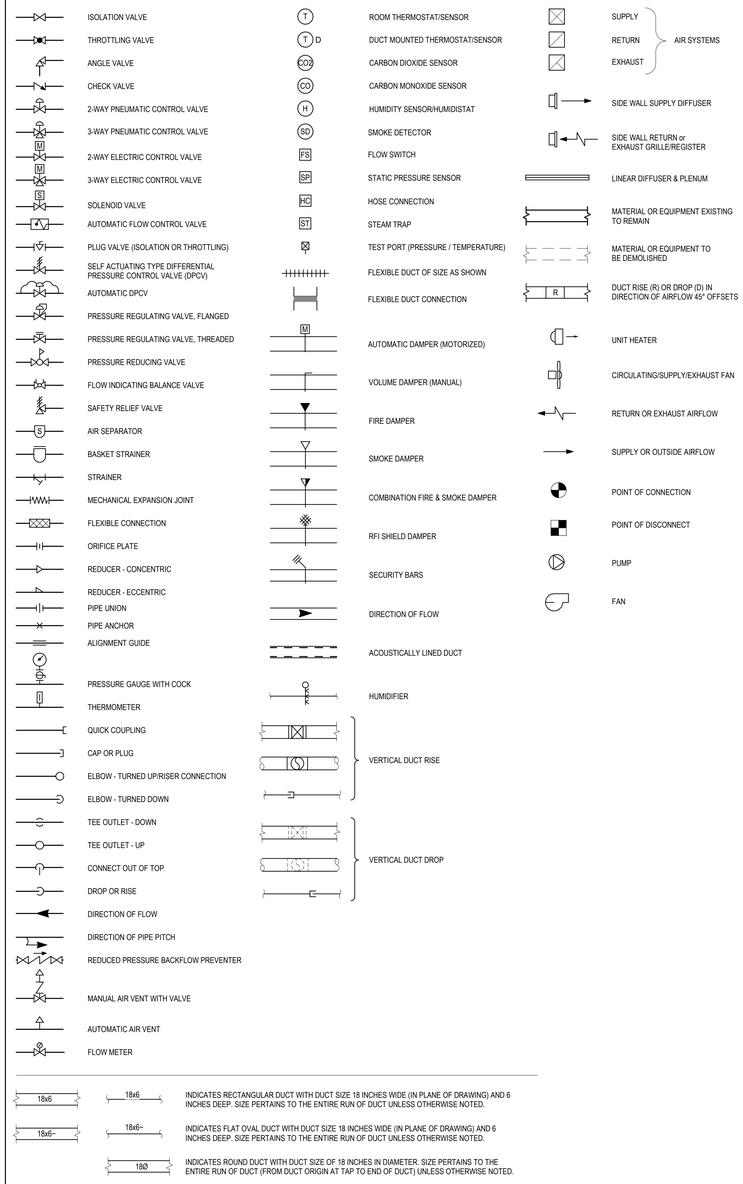
A	
AC	AIR CONDITIONING
ACB	ACTIVE CHILLED BEAM
ACC	AIR COOLED CHILLER
ACCU	AIR COOLED CONDENSING UNIT
ACFM	ABSOLUTE CUBIC FEET PER MINUTE
ACU	AIR CONDITIONING UNIT
AD	ACCESS DOOR
AFF	ABOVE FINISHED FLOOR
AFM	AIRFLOW MEASURING DEVICE
AFMS	AIRFLOW MEASURING STATION
AHU	AIR HANDLING UNIT
AMB	AMBIENT
AP	ACCESS PANEL
APPROX	APPROXIMATE
AS	AIR SEPARATOR
B	
B	BOILER
BHP	BRAKE HORSEPOWER
BOD	BOTTOM OF DUCT
BOP	BOTTOM OF PIPE
BTU(H)	BRITISH THERMAL UNIT (PER HOUR)
C	
CAP	CAPACITY
CC	COOLING COIL
CDSR	CONDENSER
CFH	CUBIC FEET PER HOUR
CFM	CUBIC FEET PER MINUTE
CH	CHILLER
CI	CAST IRON
COMP	COMPRESSOR
COND	CONDENSATE
CONT	CONTINUATION
CP	CONDENSATE PUMP
CS	CLEAN STEAM
CT	COOLING TOWER
CUH	CABINET UNIT HEATER
CV	CONSTANT VOLUME/CONTROL VALVE
CW	COLD WATER
D	
D&T	DRIP & TRAP
DB	DECIBELS
DBA	DECIBELS (A-WEIGHTED SCALE)
DBT	DRY BULB TEMPERATURE °F
DDC	DIRECT DIGITAL CONTROL
DIA	DIAMETER
DN	DOWN
DP	DIFFERENTIAL PRESSURE
DPS	DIFFERENTIAL PRESSURE SENSOR
DPT	DEW POINT TEMPERATURE °F
DWG	DRAWING
DX	DIRECT EXPANSION
E	
(E)	EXISTING
EA	EACH/EXHAUST AIR
EAT	ENTERING AIR TEMPERATURE
EER	ENERGY EFFICIENCY RATIO
EF	EXHAUST FAN
EFF	EFFICIENCY
EG	ETHYLENE GLYCOL WATER SOLUTION
EL	ELEVATION
ELEC	ELECTRICAL
ENT	ENTERING
EQ	EQUIVALENT
ERU	ENERGY RECOVERY UNIT
ESP	EXTERNAL STATIC PRESSURE
ET	EXPANSION TANK
EV	EXHAUST VALVE
EWC	ELECTRIC WATER COOLER
EWT	ENTERING WATER TEMPERATURE
EXH	EXHAUST
EXP	EXPANSION
EXT	EXTERAL
F	
F	FAHRENHEIT FAHRENHEIT
FCU	FAN COIL UNIT
FD	FIRE DAMPER
FH	FUME HOOD
FLA	FULL LOAD AMPERES
FLEX	FLEXIBLE CONNECTION
FLR	FLOOR
FM	FLOW METER
FPM	FEET PER MINUTE
FS	FLOW SWITCH
FSD	FIRE & SMOKE DAMPER
FT	FEET or FOOT
FTR	FIN TUBE RADIATION
G	
G	GLYCOL
GAL	GALLONS
GPH	GALLONS PER HOUR
GPM	GALLONS PER MINUTE
GR	GRAINS
H	
H	HEIGHT
HB	HOSE BIBB
HC	HEATING COIL
HEX	HEAT EXCHANGER
HG	MERCURY
HO	HUB OUTLET
HP	HORSE POWER
HR	HOUR
HUM	HUMIDIFEIR
HZ	HERTZ
I	
ID	INSIDE DIAMETER
IE	INVERT ELEVATION
IFB	INTEGRAL FACE AND BY-PASS
IN	INCHES
IPLV	INTEGRATED PART LOAD VALUE
K	
kW	KILOWATTS
KWH	KILOWATT HOURS

L	
L	LENGTH
LAT	LEAVING AIR TEMPERATURE
LBS	POUNDS
LBS/HR	POUNDS PER HOUR
LEF	LAB EXHAUST FAN
LP	LOW POINT
LRA	LOCKED ROTOR AMPERES
LVG	LEAVING
LWT	LEAVING WATER TEMPERATURE
M	
MAX	MAXIMUM
MBH	1000 BTU/HR
MCA	MAXIMUM CURRENT AMPACITY
MCC	MOTOR CONTROL CENTER
MD	MOTORIZED DAMPER
MECH	MECHANICAL
MER	MECHANICAL EQUIPMENT ROOM
MIN	MINIMUM
MISC	MISCELLANEOUS
MOCP	MAXIMUM OVER CURRENT PROTECTION
MTG	MOUNTING
N	
(NRL)	NEW LOCATION OF RELOCATED MATERIAL OR EQUIPMENT
N.C	NORMALLY CLOSED
N.O.	NORMALLY OPEN
NC	NOISE CRITERIA
NIC	NOT IN CONTRACT
NO.	NUMBER
NOM	NOMINAL
NPLV	NON STANDARD PART LOAD VALUE
NPSH	NET POSITIVE SUCTION HEAD
NTS	NOT TO SCALE
O	
OA	OUTSIDE AIR
OAD	OUTSIDE AIR DAMPER
OD	OUTSIDE DIAMETER
OPR	OPERATING
OV	OUTLET VELOCITY
P	
P	PUMP
PCB	PASSIVE CHILLED BEAM
PD	PRESSURE DROP (FEET OF WATER)
PG	PROPYLENE GLYCOL WATER SOLUTION
PH	PHASE
PRESS	PRESSURE
PRV	PRESSURE REGULATING VALVE
PSI	POUNDS PER SQUARE INCH
PSIG	POUNDS PER SQUARE INCH - GAUGE
Q	
QTY	QUANTITY
R	
(RL)	RELOCATED MATERIAL OR EQUIPMENT
RA	RETURN/RELIEF AIR
RC	ROOF CONDUCTOR
RE	REFERENCE
RET	RETURN
RF	RETURN FAN
RH	RELATIVE HUMIDITY
RHC	REHEAT COIL
RLA	RUNNING LOAD AMPS
RPM	REVOLUTIONS PER MINUTE
RTU	ROOFTOP UNIT
S	
SA	SUPPLY AIR
SA	SHOCK ABSORBER
SA	SOUND ATTENUATOR
SAN	SANITARY WASTE
SCFM	STANDARD CUBIC FEET PER MINUTE
SD	SMOKE DAMPER/SMOKE DETECTOR
SD	SMOKE DAMPER
SEER	SEASONAL ENERGY EFFICIENCY RATIO
SENS	SENSIBLE
SF	SQUARE FEET
SG	SPECIFIC GRAVITY
SL	SOUND LINING
SP	STATIC PRESSUR (INCHES OF WATER)
SPD	SPEED
SPL	SOUND POWER LEVEL
SPS	STATIC PRESSURE SENSOR
SS	STAINLESS STEEL
STM	STEAM
SV	SUPPLY VALVE
T	
T	TEMPERATURE
TAB	TESTING, ADJUSTING AND BALANCING
TEF	TOILET EXHAUST FAN
TOD	TOP OF DUCT
TOP	TOP OF PIPE
TP	TOTAL PRESSURE
TYP	TYPICAL
U	
UH	UNIT HEATER
UON	UNLESS OTHERWISE NOTED
V	
V	VOLTAGE/VENT
VAC	VACUUM
VAV	VARIABLE AIR VOLUME
VEL	VELOCITY
VFD	VARIABLE FREQUENCY DRIVE
VIFB	VERTICAL INTEGRAL FACE AND BYPASS
VTR	VENT THRU ROOF
W	
W	WATTS/WIDTH
W/	WITH
W/O	WITHOUT
WB	WET BULB TEMPERATURE
WG	WATER GAUGE
WMS	WIRE MESH SCREEN

REFERENCE SYMBOLS



MECHANICAL FLOOR PLAN SYMBOLS



HVAC PIPING LEGEND

CHWS	CHILLED WATER SUPPLY
CHWR	CHILLED WATER RETURN
CWS	CONDENSER WATER SUPPLY
CWR	CONDENSER WATER RETURN
RL	REFRIGERANT LIQUID
RS	REFRIGERANT SUCTION
RHG	REFRIGERANT HOT GAS
HHWS	HEATING HOT WATER SUPPLY
HHWR	HEATING HOT WATER RETURN
PHWS	PERIMETER HEATING WATER SUPPLY
PHWR	PERIMETER HEATING WATER RETURN
PCWS	PROCESS COOLING WATER SUPPLY
PCWR	PROCESS COOLING WATER RETURN
HTWS	HIGH TEMPERATURE WATER SUPPLY
HTWR	HIGH TEMPERATURE WATER RETURN
ERF	ENERGY RECOVERY FLUID
ATV	ATMOSPHERIC VENT (ATV)
(G)-SYSTEM	(G) PREFIX INDICATES A GLYCOL SOLUTION
HPS(PSIG)	HIGH PRESSURE STEAM
LPS(PSIG)	LOW PRESSURE STEAM
HPR(PSIG)	HIGH PRESSURE CONDENSATE RETURN
LPR(PSIG)	LOW PRESSURE CONDENSATE RETURN
CS(PSIG)	CLEAN STEAM
PS	PUMPED CONDENSATE
D	CONDENSATE DRAIN
SA	SUPPLY AIR
RA	RETURN AIR
TE	TOILET EXHAUST
GE	GENERAL EXHAUST

MECHANICAL GENERAL NOTES

A. INSTALL ALL WORK IN ACCORDANCE WITH THE INTERNATIONAL MECHANICAL CODE 2015 AND THE REGULATIONS OF ALL AUTHORITIES HAVING JURISDICTION.
B. TO OBTAIN ALL CONSTRUCTION INFORMATION, ALL SPECIFICATION AND DRAWINGS (E.G. ARCHITECTURAL, STRUCTURAL, CIVIL, MECHANICAL, ELECTRICAL, PLUMBING AND FIRE PROTECTION) MUST BE USED.
C. BRING TO THE ATTENTION OF THE ARCHITECT/ENGINEER ANY INFORMATIONAL CONFLICTS WITHIN THE SPECIFICATIONS AND DRAWINGS. THE CONTRACTOR(S) SHALL NOT PROCEED WITH ANY WORK, EXCEPT AT ITS OWN RISK, UNTIL ALL CONFLICTS ARE RESOLVED AND THE CLARIFYING INFORMATION IS ISSUED TO THE CONTRACTOR(S) BY THE ARCHITECT/ENGINEER.
D. PROVIDE OFFSETS AND TRANSITIONS IN DUCTWORK AND PIPING AS REQUIRED TO AVOID INTERFERENCE AT NO ADDITIONAL COST TO THE OWNER. THOUGH SOME OFFSETS & TRANSITIONS ARE SHOWN IN PIPING & SHEET METAL TO HELP INDICATE THE PHYSICAL RELATIONSHIP BETWEEN THEM, IT IS NOT THE INTENT OF THE DRAWINGS TO SHOW ALL PIPING & SHEET METAL OFFSETS & TRANSITIONS REQUIRED. THE CONTRACTOR SHALL FULLY COORDINATE THE MECHANICAL WORK WITHIN ITSELF & WITH THE WORK OF ALL TRADES TO PROVIDE COMPLETE & OPERABLE SYSTEMS WITHOUT INTERFERENCES.
E. INSTALL ALL EQUIPMENT LEVEL AND PLUMB. PROVIDE BLOCKING AND HARDWARE AS REQUIRED.
F. VERIFY ALL EQUIPMENT CONNECTIONS WITH MANUFACTURER'S CERTIFIED DRAWINGS. FIELD VERIFY ALL DIMENSIONS BEFORE FABRICATION OF WORK. PROVIDE TRANSITIONS AND MAKE FINAL CONNECTIONS TO EQUIPMENT, UNLESS OTHERWISE INDICATED.
G. INSTALL ALL EQUIPMENT REQUIRING PERIODIC SERVICE NOT LESS THAN 10 FEET FROM ROOF EDGE OR OPENING, UNLESS PROTECTIVE RAILING OR PARAPET OF 42 INCHES AFF. HAS BEEN PROVIDED. VERIFY WITH OTHER TRADES TO CONFIRM IF PROTECTIVE RAILING OR PARAPET OF 42 INCHES AFF IS PROVIDED.
H. CONCENTRATE LOADS AT JOIST AND/OR BEAM LOCATIONS. WHERE CONCENTRATED LOADS DUE TO EQUIPMENT, RISERS, OR SPECIAL DUCT CONSTRUCTION OCCUR AT OTHER LOCATIONS, PROVIDE ADDITIONAL SUPPORT FRAMING AND/OR ANGLE BRACING.
I. DUCT CONSTRUCTION SHALL COMPLY WITH THE LATEST VERSION OF SMACNA CONSTRUCTION STANDARDS FOR THE SPECIFIC PRESSURE CLASSIFICATIONS INDICATED BELOW. ALL 90 DEGREE ELBOWS SHALL BE LONG RADIUS TYPE UNLESS SPACE IS LIMITED. SHORT RADIUS AND RECTANGULAR ELBOWS SHALL HAVE TURNING VANES. UNLESS OTHERWISE NOTED FOR BRANCH CONNECTIONS, PROVIDE CONICAL TAPS FOR ROUND DUCTS AND 45 DEGREE TAPS FOR RECTANGULAR DUCTS.
J. FLEXIBLE DUCTWORK SHALL NOT BE USED IN RETURN OR EXHAUST DUCT SYSTEM. FLEXIBLE DUCTWORK MAY BE USED IN THE SUPPLY SYSTEM PROVIDED THE LENGTH IS LIMITED TO A TOTAL LENGTH OF FIVE (5) FEET.
K. INSTALL DUCTWORK AS CLOSE AS POSSIBLE TO UNDERSIDE OF BEAMS AND/OR JOISTS.
L. ALL DUCTWORK SIZES INDICATED ARE INSIDE CLEAR DIMENSIONS.
M. PROVIDE DUCTWORK TO TERMINAL AIR DEVICES AT SCHEDULED INLET SIZE UNLESS OTHERWISE INDICATED.
N. PROVIDE DUCTWORK FROM TERMINAL AIR BOXES AT MANUFACTURER'S OUTLET DIMENSION SIZE UNLESS OTHERWISE INDICATED. PROVIDE TRANSITIONS AS REQUIRED.
O. DUCTWORK PENETRATIONS OF ALL FIRE RATED AND SMOKE RESISTIVE CONSTRUCTION. COORDINATE WITH LIFE SAFETY PLANS FOR LOCATIONS. PENETRATION ASSEMBLY TO BE U.L. LISTED.
P. PAINT FLAT BLACK THE INSIDE OF ALL DUCTWORK VISIBLE THROUGH DIFFUSERS, GRILLES AND REGISTERS.
Q. PROVIDE OPEN END DUCTWORK (OED) WITH 2X2 MESH (1/2"X 1/2") ALUMINUM SCREEN WITH REMOVABLE FRAMES.
R. FURNISH AND INSTALL ALL MANUALLY OPERATED VOLUME CONTROL (BALANCING) DAMPERS NECESSARY TO PERFORM THE BALANCING WORK, AT EACH BRANCH TAKEOFF. AT EACH AIR TERMINAL DEVICE AND WHERE INDICATED.
S. DUCT SYSTEMS SHALL BE BALANCED TO AIRFLOWS INDICATED ON DRAWINGS. FANS SHALL BE FIELD TESTED TO ENSURE COMPLIANCE WITH SCHEDULED FAN PERFORMANCE AND SCHEDULED AIRFLOW AT THE DESIGN STATIC PRESSURES LISTED.
T. PROVIDE FLEXIBLE CONNECTIONS BETWEEN DUCTWORK AND ALL FANS AND ALL AIR HANDLING EQUIPMENT.
U. COORDINATE EXACT LOCATION OF DIFFUSERS, GRILLES AND REGISTERS WITH THE REFLECTED CEILING PLANS BEFORE INSTALLATION. PROVIDE SYMMETRY WITH THE ROOM LIGHTING SYSTEMS.
V. VERIFY DIFFUSER, GRILLE AND REGISTER MOUNTING FRAME TYPES WITH THE CEILING TYPES. PROVIDE FRAME TYPE THAT MATCHES CEILING CONFIGURATION.
W. PROVIDE CONCRETE HOUSEKEEPING PADS FOR FLOOR MOUNTED MECHANICAL EQUIPMENT. COORDINATE SIZE AND LOCATION WITH ALL TRADES.
X. PROVIDE ACCESS DOORS AND/OR PANELS FOR DUCT MOUNTED FIRE, SMOKE, AND FIRE/SMOKE DAMPERS AND SMOKE DETECTORS.
Y. PROVIDE ACCESS DOORS AND/OR PANELS IN HARD CEILINGS AND WALLS TO PERMIT SERVICE TO DAMPERS, VALVES, AND CONCEALED EQUIPMENT.
Z. REFER TO ARCHITECTURAL GENERAL INFORMATION SHEETS FOR MOUNTING HEIGHTS OF DEVICES. WHERE THIS INFORMATION IS NOT PROVIDED, MOUNT ROOM THERMOSTATS AT 48 INCHES AFF AND OCCUPANCY SENSORS AT 84 INCHES AFF UNLESS OTHERWISE INDICATED.
AA. COORDINATE ALL WALL MOUNTED DEVICES SUCH AS THERMOSTATS AND CONTROL PANELS WITH ARCHITECTURAL INTERIOR ELEVATIONS.
BB. COORDINATE ALL DOOR UNDER CUTS INDICATED AND AS REQUIRED WHERE RETURN/TRANSFER OPENS ARE NOT PROVIDED.
CC. WHERE SIZE OF MOTORIZED DAMPER EXCEEDS THE LIMITS OF A SINGLE OPERATOR, PROVIDE MULTIPLE OPERATORS IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS.
DD. PROVIDE RUNOUT PIPING AS SCHEDULED OR AS OTHERWISE INDICATED.
EE. M5 SERIES PIPING DIAGRAMS INCLUDE SOME PIPING VALVES AND ACCESSORIES IN ORDER TO PROVIDE A ONE-LINE DIAGRAM CONTAINING AS MUCH RELEVANT SYTSEM INFORMATION AS POSSIBLE; HOWEVER, THEY ARE NOT INTENDED TO INCLUDE ALL VALVES OR ACCESSORIES REQUIRED IN THE SYSTEM. REFER TO M6 SERIES DETAILS AND SPECIFICATIONS FOR ADDITIONAL REQUIRED VALVES AND ACCESSORIES.

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SEALS AND SIGNATURES

SHEET TITLE
MECHANICAL ABBREVIATIONS AND SYMBOLS

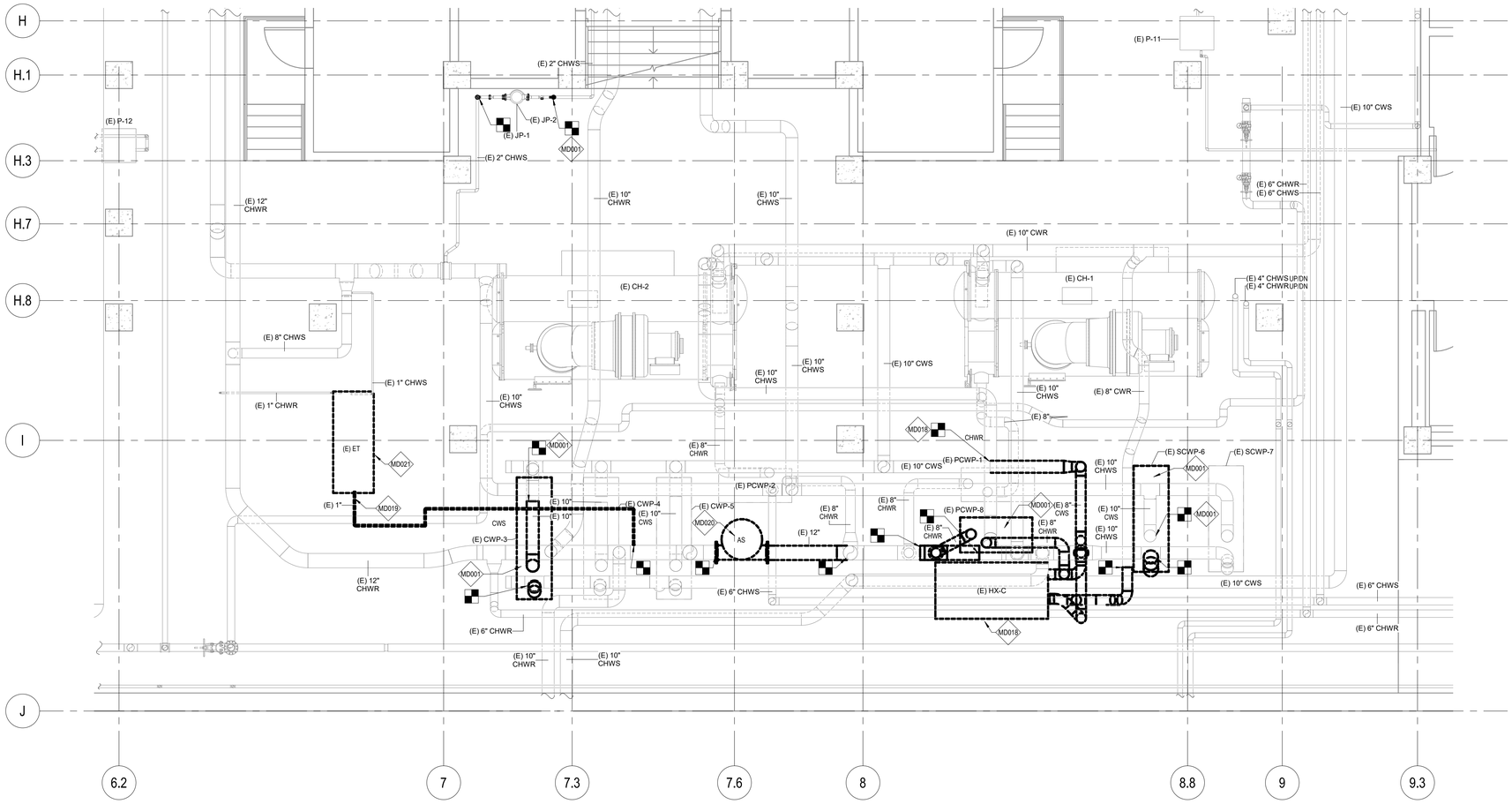
PROJECT NUMBER
CD

SHEET NUMBER
M0.1

Author

4/30/2021 4:20:57 PM

Plot Date:



1 PHASE 1 ENLARGED COOLING DEMO MECHANICAL PLAN
SCALE: 1/4" = 1'-0"

GENERAL SHEET NOTES

A. SEE M0.1 FOR MECHANICAL LEGEND, ABBREVIATIONS AND GENERAL NOTES.
B. EXISTING CONDITIONS SHOWN ARE BASED ON AS-BUILT DRAWINGS AND LIMITED SITE SURVEYING. CONTRACTOR SHALL FIELD VERIFY ALL EXISTING DUCTWORK, PIPING AND EQUIPMENT LOCATIONS PRIOR TO BEGINNING WORK.
C. CONTRACTOR SHALL COORDINATE ALL SHUTDOWN AND PHASING OF THE SYSTEM WITH THE OWNER PRIOR TO BEGINNING WORK.
D. DEMO EXISTING CONCRETE PAD AND PROVIDE NEW CONCRETE PAD FOR ALL EQUIPMENT.
E. TEST AND MEASURE THE EXISTING CHILLED WATER AND CONDENSER WATER SYSTEM FLOW PRIOR TO ANY DEMOLITION WORK.
F. TEST AND MEASURE THE EXISTING CHILLED WATER AND CONDENSER WATER SYSTEM PRESSURE PRIOR TO ANY DEMOLITION WORK.
G. PRIOR TO COMMENCING ANY NEW WORK OR ANY DEMOLITION WORK, SUBMIT TO THE OWNER AND THE ENGINEER OF RECORD FOR REVIEW TESTING REPORTS BASED ON THE WORK DESCRIBED ABOVE.

SHEET KEYNOTES

MD001	DISCONNECT AND REMOVE EXISTING PUMP AND ASSOCIATED PIPING UP TO POINT OF DISCONNECTION. SEE NEW WORK PLANS FOR ADDITIONAL INFORMATION.
MD018	DISCONNECT AND REMOVE EXISTING HEAT EXCHANGER AND ASSOCIATED PIPING/ACCESSORIES UP TO POINT OF DISCONNECTION. SEE SYSTEM DIAGRAM(S) MD5 FOR ADDITIONAL INFORMATION.
MD019	DISCONNECT AND REMOVE EXISTING MAKE UP WATER PIPING AND ACCESSORIES. SEE MECHANICAL DETAILS FOR MORE INFORMATION.
MD020	DISCONNECT AND REMOVE EXISTING AIR SEPARATOR AND ASSOCIATED PIPING AS INDICATED. SEE NEW WORK PLANS AND SYSTEM DIAGRAMS FOR ADDITIONAL INFORMATION.
MD021	DISCONNECT AND REMOVE EXISTING EXPANSION TANK AND ASSOCIATED PIPING/ACCESSORIES UP TO THE POINT OF DISCONNECTION. SEE NEW WORK PLANS AND SYSTEM DIAGRAMS FOR ADDITIONAL INFORMATION.

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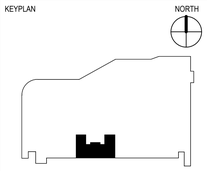

SHEET TITLE
PHASE 1 DEMO ENLARGED MECHANICAL PLAN

PROJECT NUMBER
CD

SHEET NUMBER
MD4.2.1

Author
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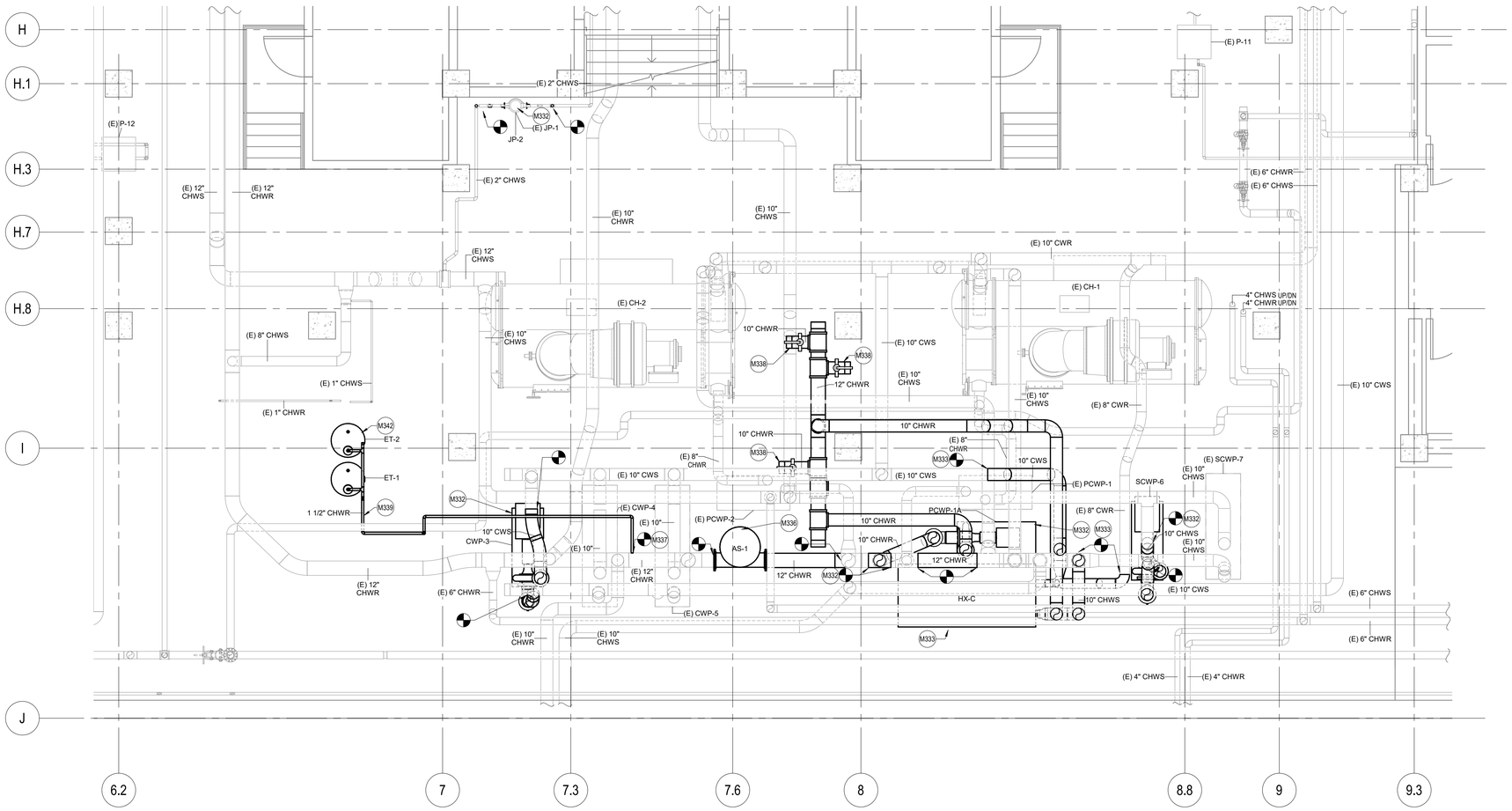
Plot Date:



1 PHASE 1 ENLARGED COOLING NEW MECHANICAL PLAN
SCALE: 1/4" = 1'-0"

GENERAL SHEET NOTES

A. SEE M0.1 FOR MECHANICAL LEGEND, ABBREVIATIONS AND GENERAL NOTES.
B. EXISTING CONDITIONS SHOWN ARE BASED ON AS-BUILT DRAWINGS AND LIMITED SITE SURVEYING. CONTRACTOR SHALL FIELD VERIFY ALL EXISTING DUCTWORK, PIPING AND EQUIPMENT LOCATIONS PRIOR TO BEGINNING WORK.
C. CONTRACTOR SHALL COORDINATE ALL SHUTDOWN AND PHASING OF THE SYSTEM WITH THE OWNER PRIOR TO BEGINNING WORK.
D. DEMO EXISTING CONCRETE PAD AND PROVIDE NEW CONCRETE PAD FOR ALL EQUIPMENT.
E. TEST AND MEASURE THE EXISTING CHILLED WATER AND CONDENSER WATER SYSTEM FLOW PRIOR TO ANY DEMOLITION WORK.
F. TEST AND MEASURE THE EXISTING CHILLED WATER AND CONDENSER WATER SYSTEM PRESSURE PRIOR TO ANY DEMOLITION WORK.
G. PRIOR TO COMMENCING ANY NEW WORK OR ANY DEMOLITION WORK, SUBMIT TO THE OWNER AND THE ENGINEER OF RECORD FOR REVIEW TESTING REPORTS BASED ON THE WORK DESCRIBED ABOVE.

SHEET KEYNOTES

M332	CONNECT NEW PUMP TO EXISTING PIPING AT THE POINT OF CONNECTION. SEE SYSTEM DIAGRAM(S) M5 FOR ADDITIONAL INFORMATION.
M333	CONNECT NEW HX TO EXISTING PIPING AT THE POINT OF CONNECTION. SEE SYSTEM DIAGRAM(S) M5 FOR ADDITIONAL INFORMATION.
M336	PROVIDE NEW AIR SEPARATOR AND CONNECT TO EXISTING PIPING AS INDICATED. SEE SCHEDULES FOR ADDITIONAL INFORMATION.
M337	PROVIDE NEW CHILLED WATER PIPING AND CONNECT INTO EXISTING 12" CHILLED WATER RETURN PIPING.
M338	PROVIDE ISOLATION VALVE AND CAP OPEN END FOR FUTURE PHASE.
M339	REPLACE MAKE-UP WATER VALVES AND ACCESSORIES IN KIND. SEE DETAILS FOR ADDITIONAL INFORMATION.
M342	PROVIDE NEW EXPANSIONS TANKS AND CONNECT TO EXISTING PIPING AS INDICATED. SEE SCHEDULES FOR ADDITIONAL INFORMATION.

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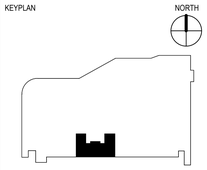
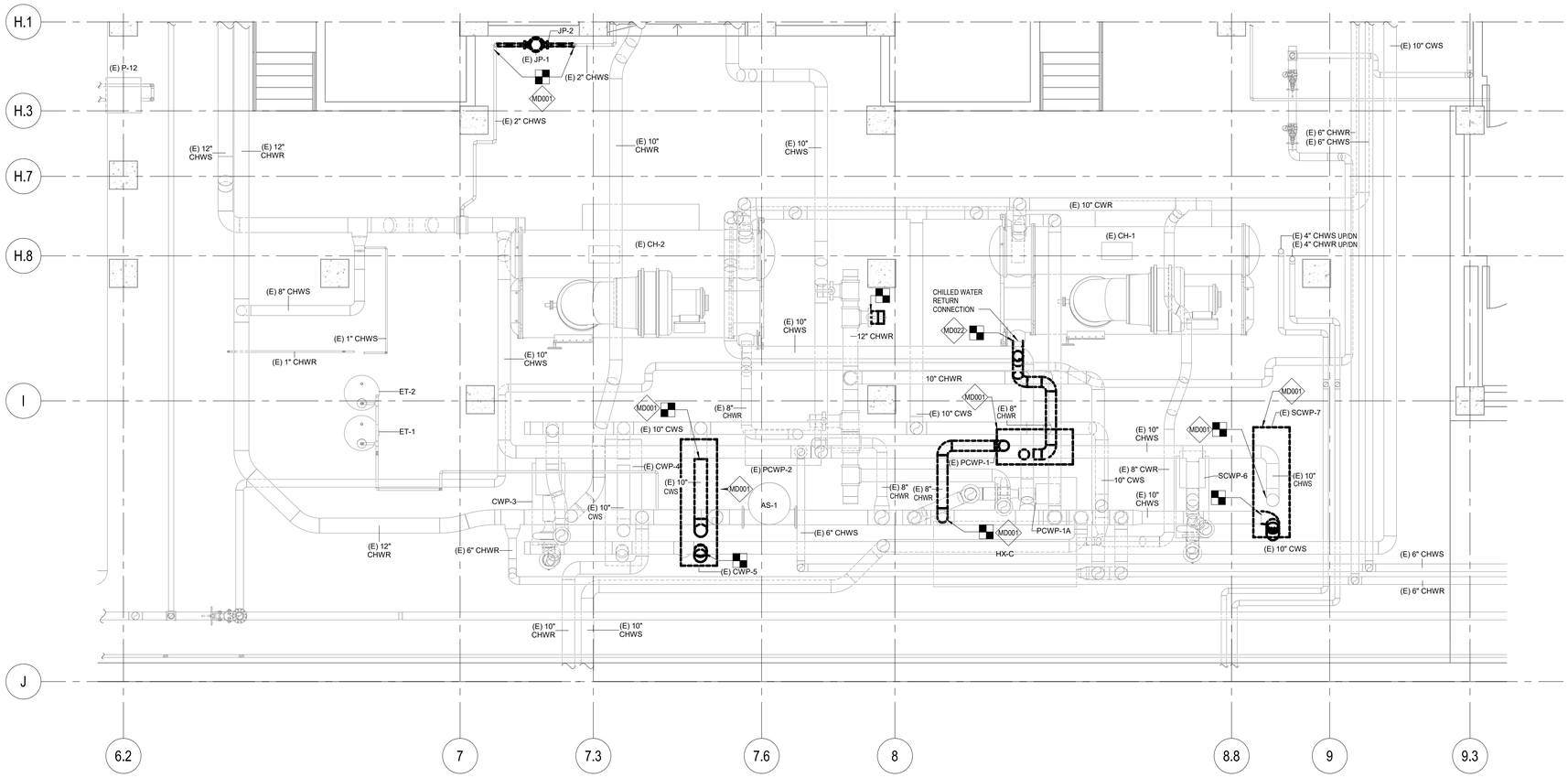


SHEET TITLE
PHASE 1 NEW ENLARGED MECHANICAL PLAN

PROJECT NUMBER
CD

SHEET NUMBER
M4.2.1

Author
Plot Date: 4/30/2021 4:26:59 PM



1 PHASE 2 ENLARGED COOLING DEMO MECHANICAL PLAN
SCALE: 1/4" = 1'-0"

GENERAL SHEET NOTES

A. SEE M0.1 FOR MECHANICAL LEGEND, ABBREVIATIONS AND GENERAL NOTES.
B. EXISTING CONDITIONS SHOWN ARE BASED ON AS-BUILT DRAWINGS AND LIMITED SITE SURVEYING. CONTRACTOR SHALL FIELD VERIFY ALL EXISTING DUCTWORK, PIPING AND EQUIPMENT LOCATIONS PRIOR TO BEGINNING WORK.
C. CONTRACTOR SHALL COORDINATE ALL SHUTDOWN AND PHASING OF THE SYSTEM WITH THE OWNER PRIOR TO BEGINNING WORK.
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F. TEST AND MEASURE THE EXISTING CHILLED WATER AND CONDENSER WATER SYSTEM PRESSURE PRIOR TO ANY DEMOLITION WORK.
G. PRIOR TO COMMENCING ANY NEW WORK OR ANY DEMOLITION WORK, SUBMIT TO THE OWNER AND THE ENGINEER OF RECORD FOR REVIEW TESTING REPORTS BASED ON THE WORK DESCRIBED ABOVE.

SHEET KEYNOTES

MD001	DISCONNECT AND REMOVE EXISTING PUMP AND ASSOCIATED PIPING UP TO POINT OF DISCONNECTION. SEE NEW WORK PLANS FOR ADDITIONAL INFORMATION.
MD022	DISCONNECT AND REMOVE EXISTING 8" CHILLED WATER PIPING UP TO THE CHILLER CHILLED WATER RETURN CONNECTION.

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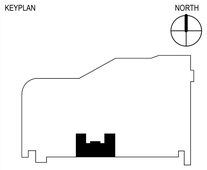

SHEET TITLE
PHASE 2 DEMO ENLARGED MECHANICAL PLAN

PROJECT NUMBER
CD

SHEET NUMBER
MD4.2.2

Author
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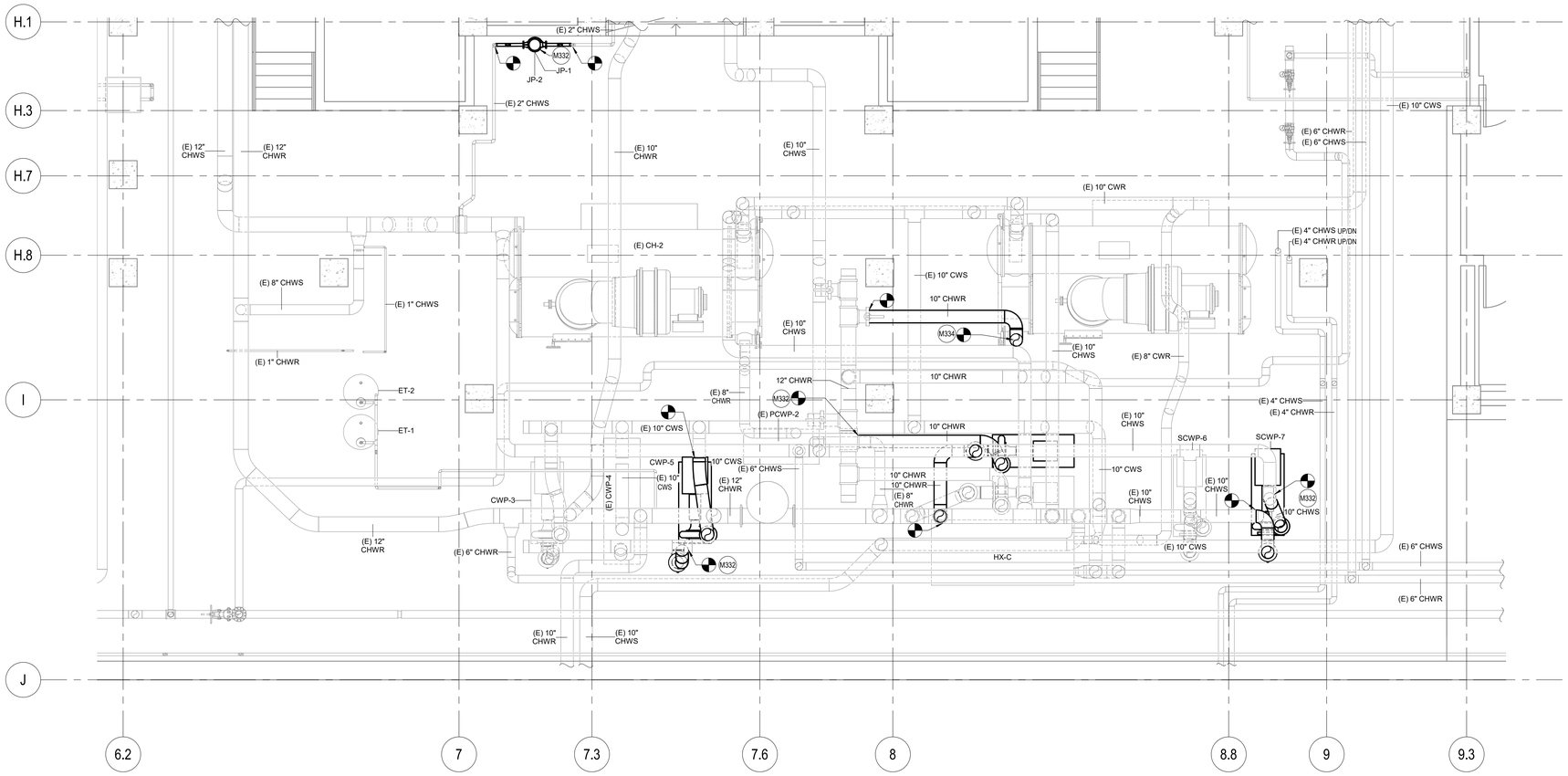
Plot Date:



1 PHASE 2 ENLARGED COOLING NEW MECHANICAL PLAN
SCALE: 1/4" = 1'-0"

GENERAL SHEET NOTES

A. SEE M0.1 FOR MECHANICAL LEGEND, ABBREVIATIONS AND GENERAL NOTES.
B. EXISTING CONDITIONS SHOWN ARE BASED ON AS-BUILT DRAWINGS AND LIMITED SITE SURVEYING. CONTRACTOR SHALL FIELD VERIFY ALL EXISTING DUCTWORK, PIPING AND EQUIPMENT LOCATIONS PRIOR TO BEGINNING WORK.
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F. TEST AND MEASURE THE EXISTING CHILLED WATER AND CONDENSER WATER SYSTEM PRESSURE PRIOR TO ANY DEMOLITION WORK.
G. PRIOR TO COMMENCING ANY NEW WORK OR ANY DEMOLITION WORK, SUBMIT TO THE OWNER AND THE ENGINEER OF RECORD FOR REVIEW TESTING REPORTS BASED ON THE WORK DESCRIBED ABOVE.

SHEET KEYNOTES

M332 CONNECT NEW PUMP TO EXISTING PIPING AT THE POINT OF CONNECTION. SEE SYSTEM DIAGRAM(S) M5 FOR ADDITIONAL INFORMATION.

M334 CONNECT CHILLER TO NEW PIPING HEADER. SEE SYSTEM DIAGRAM(S) M5 FOR ADDITIONAL INFORMATION.

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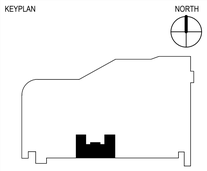

SHEET TITLE
PHASE 2 NEW ENLARGED MECHANICAL PLAN

PROJECT NUMBER
CD

SHEET NUMBER
M4.2.2

Author

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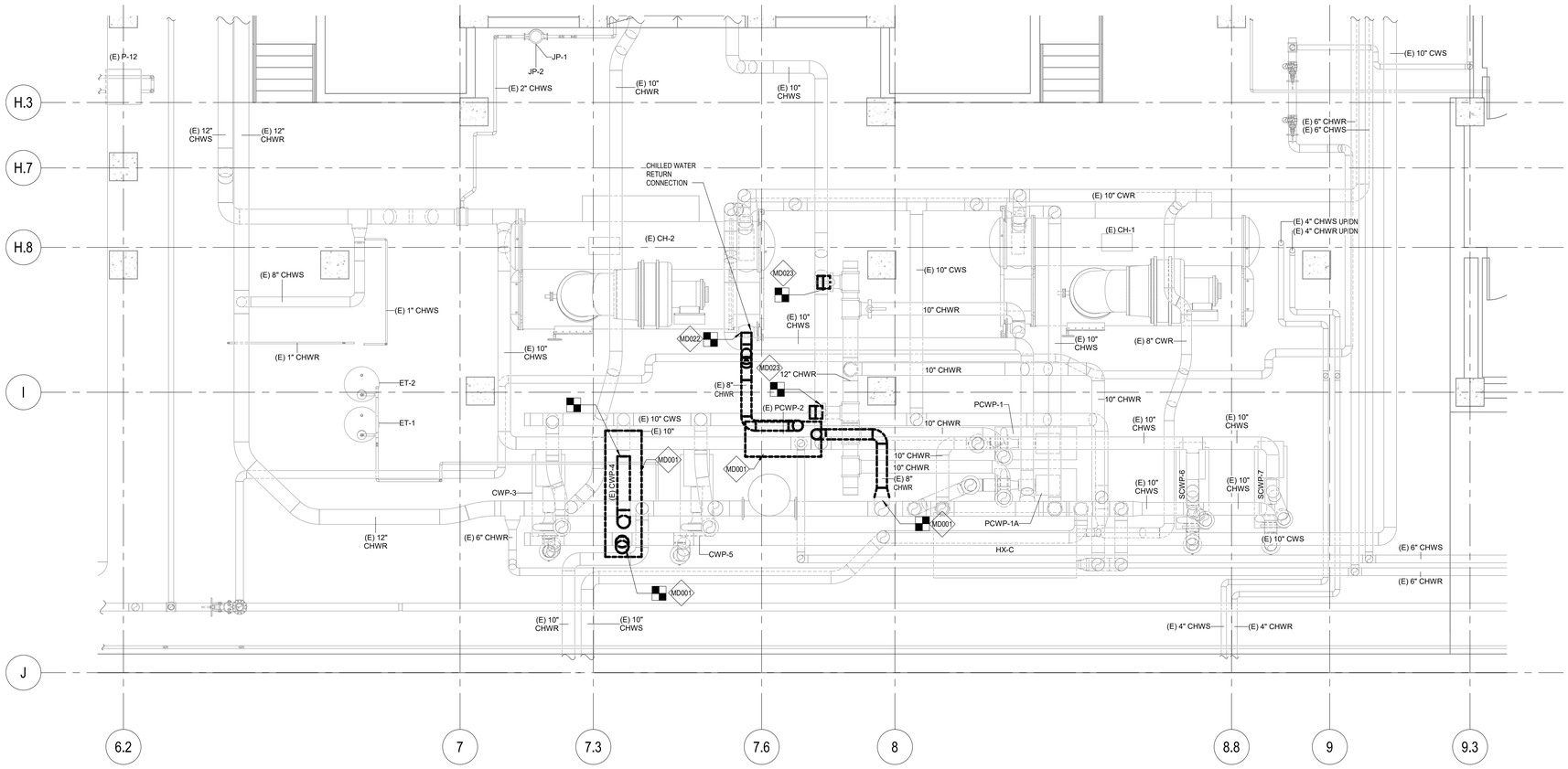

1 PHASE 3 ENLARGED COOLING DEMO MECHANICAL PLAN
SCALE: 1/4" = 1'-0"

GENERAL SHEET NOTES

A. SEE M0.1 FOR MECHANICAL LEGEND, ABBREVIATIONS AND GENERAL NOTES.
B. EXISTING CONDITIONS SHOWN ARE BASED ON AS-BUILT DRAWINGS AND LIMITED SITE SURVEYING. CONTRACTOR SHALL FIELD VERIFY ALL EXISTING DUCTWORK, PIPING AND EQUIPMENT LOCATIONS PRIOR TO BEGINNING WORK.
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SHEET KEYNOTES

MD001	DISCONNECT AND REMOVE EXISTING PUMP AND ASSOCIATED PIPING UP TO POINT OF DISCONNECTION. SEE NEW WORK PLANS FOR ADDITIONAL INFORMATION.
MD022	DISCONNECT AND REMOVE EXISTING 8" CHILLED WATER PIPING UP TO THE CHILLER CHILLED WATER RETURN CONNECTION.
MD023	DISCONNECT AND REMOVE PIPE CAPS FOR FUTURE CONNECTION.

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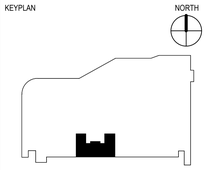

SHEET TITLE
PHASE 3 DEMO ENLARGED MECHANICAL PLAN

PROJECT NUMBER
CD

SHEET NUMBER
MD4.2.3

Author
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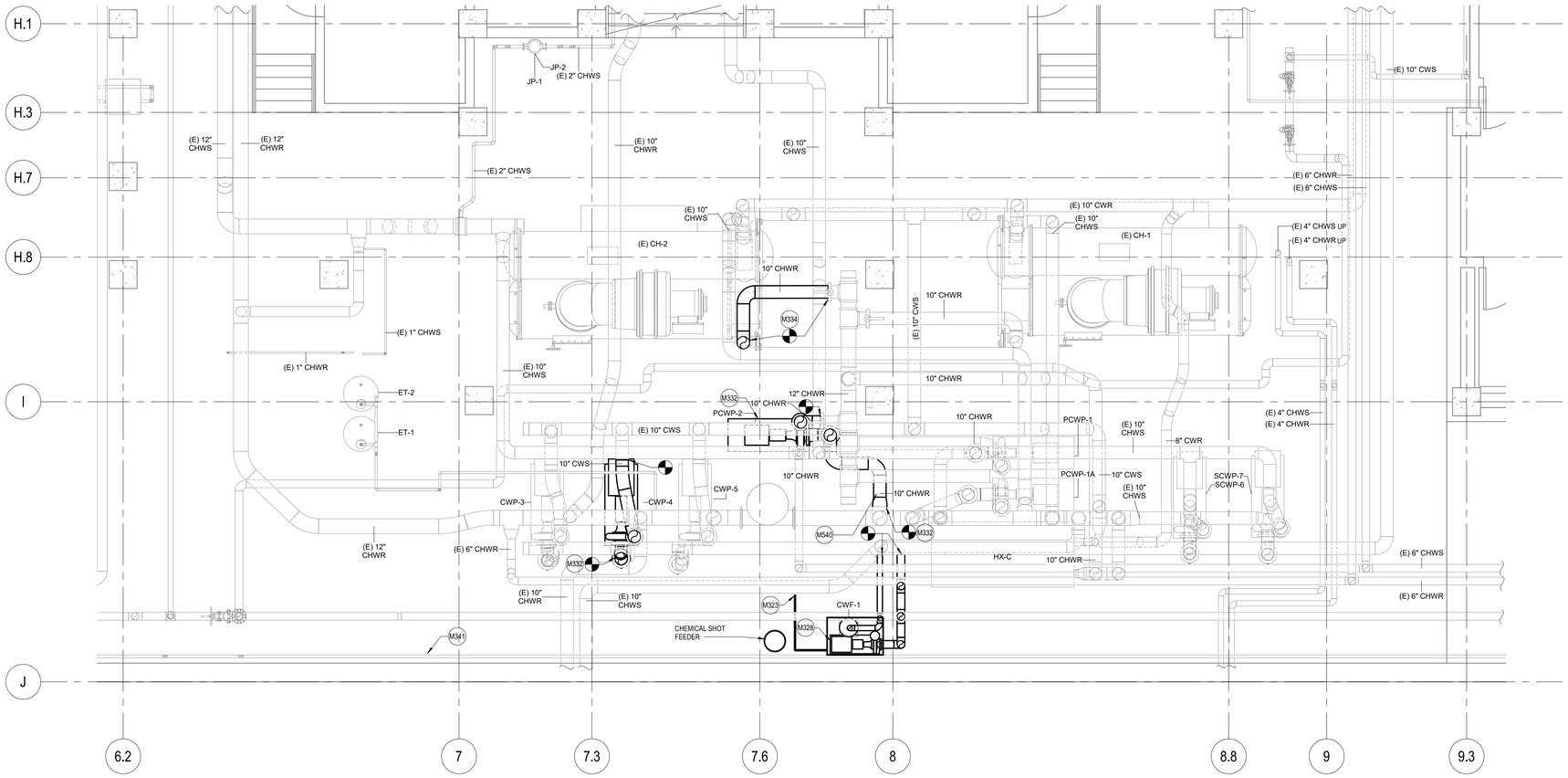

1 PHASE 3 ENLARGED COOLING NEW MECHANICAL PLAN
SCALE: 1/4" = 1'-0"

GENERAL SHEET NOTES

A. SEE M0.1 FOR MECHANICAL LEGEND, ABBREVIATIONS AND GENERAL NOTES.
B. EXISTING CONDITIONS SHOWN ARE BASED ON AS-BUILT DRAWINGS AND LIMITED SITE SURVEYING. CONTRACTOR SHALL FIELD VERIFY ALL EXISTING DUCTWORK, PIPING AND EQUIPMENT LOCATIONS PRIOR TO BEGINNING WORK.
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SHEET KEYNOTES

M323	ROUTE 3/4" DRAIN TO NEAREST FLOOR DRAIN.
M328	PROVIDE NEW CONDENSER WATER FILTRATION SYSTEM. SEE SPECIFICATION SECTION 232116 FOR ADDITIONAL INFORMATION
M332	CONNECT NEW PUMP TO EXISTING PIPING AT THE POINT OF CONNECTION. SEE SYSTEM DIAGRAM(S) M5 FOR ADDITIONAL INFORMATION.
M334	CONNECT CHILLER TO NEW PIPING HEADER. SEE SYSTEM DIAGRAM(S) M5 FOR ADDITIONAL INFORMATION.
M341	SEE E2 SERIES FOR FUTURE PANELBOARD NEC REQUIRED WORKING AND DEDICATED SPACE TO BE PRESERVED BY DIVISION 22 AND 23 NEW WORK.
M540	3/4" CHEMICAL SHOT FEEDER CONNECTION

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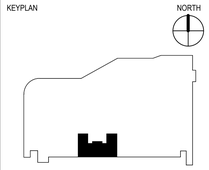

SHEET TITLE
PHASE 3 NEW ENLARGED MECHANICAL PLAN

PROJECT NUMBER
CD

SHEET NUMBER
M4.2.3

Author
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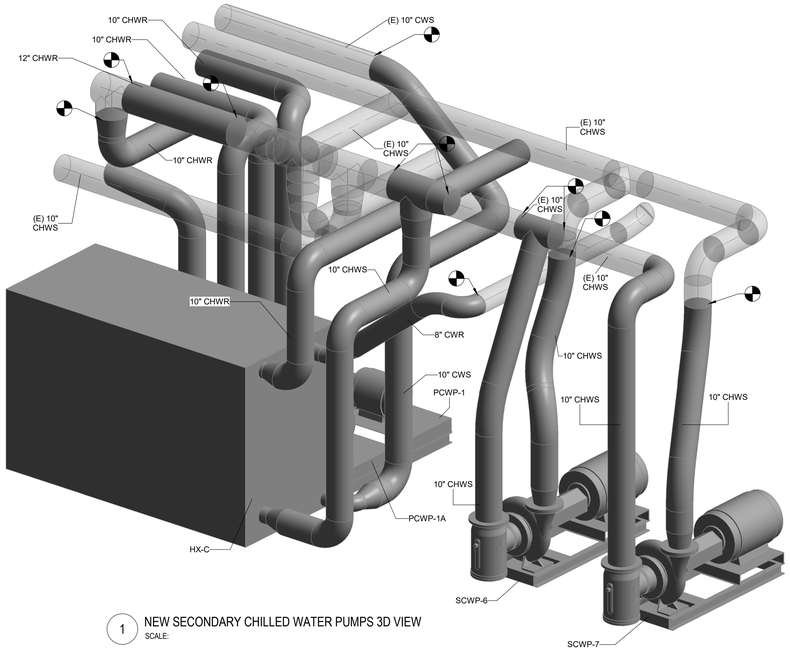
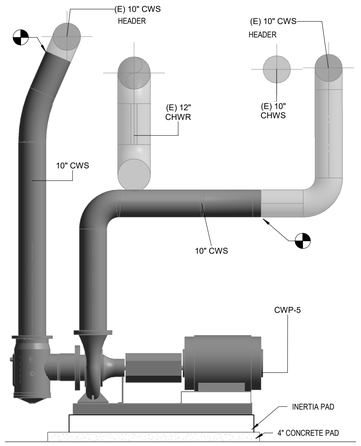
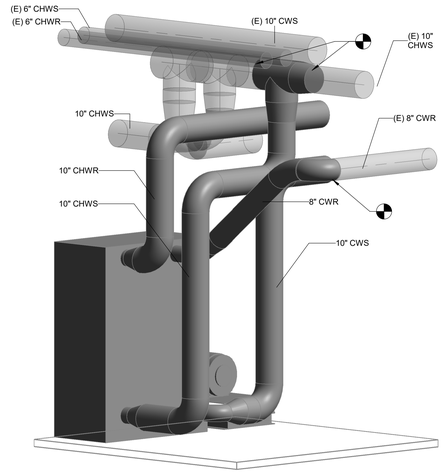
Plot Date:



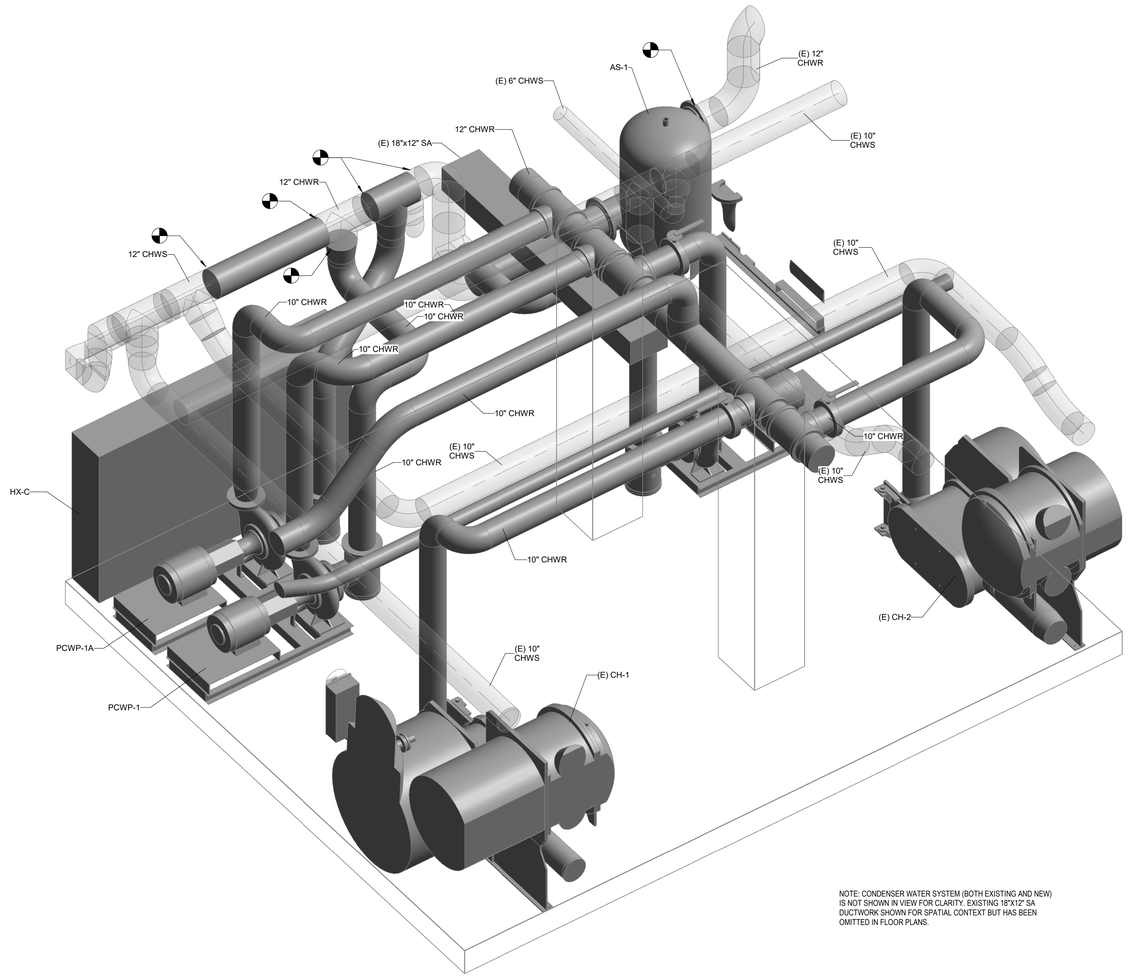
1 NEW SECONDARY CHILLED WATER PUMPS 3D VIEW
SCALE:



2 CWP-5 SECTION VIEW
SCALE: NTS



3 NEW HEAT EXCHANGER CHILLED WATER 3D VIEW
SCALE:



NOTE: CONDENSER WATER SYSTEM (BOTH EXISTING AND NEW) IS NOT SHOWN IN VIEW FOR CLARITY. EXISTING 18"X12" SA DUCTWORK SHOWN FOR SPATIAL CONTEXT BUT HAS BEEN OMITTED IN FLOOR PLANS.

NOTE: FOR ALL VIEWS SHOWN, EXISTING PIPING IS REPRESENTED AS TRANSPARENT.

4 NEW HEADER CHILLED WATER 3D VIEW
SCALE:

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SEALS AND SIGNATURES

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PROFESSIONAL ENGINEER

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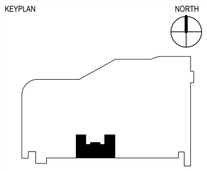
KEYPLAN

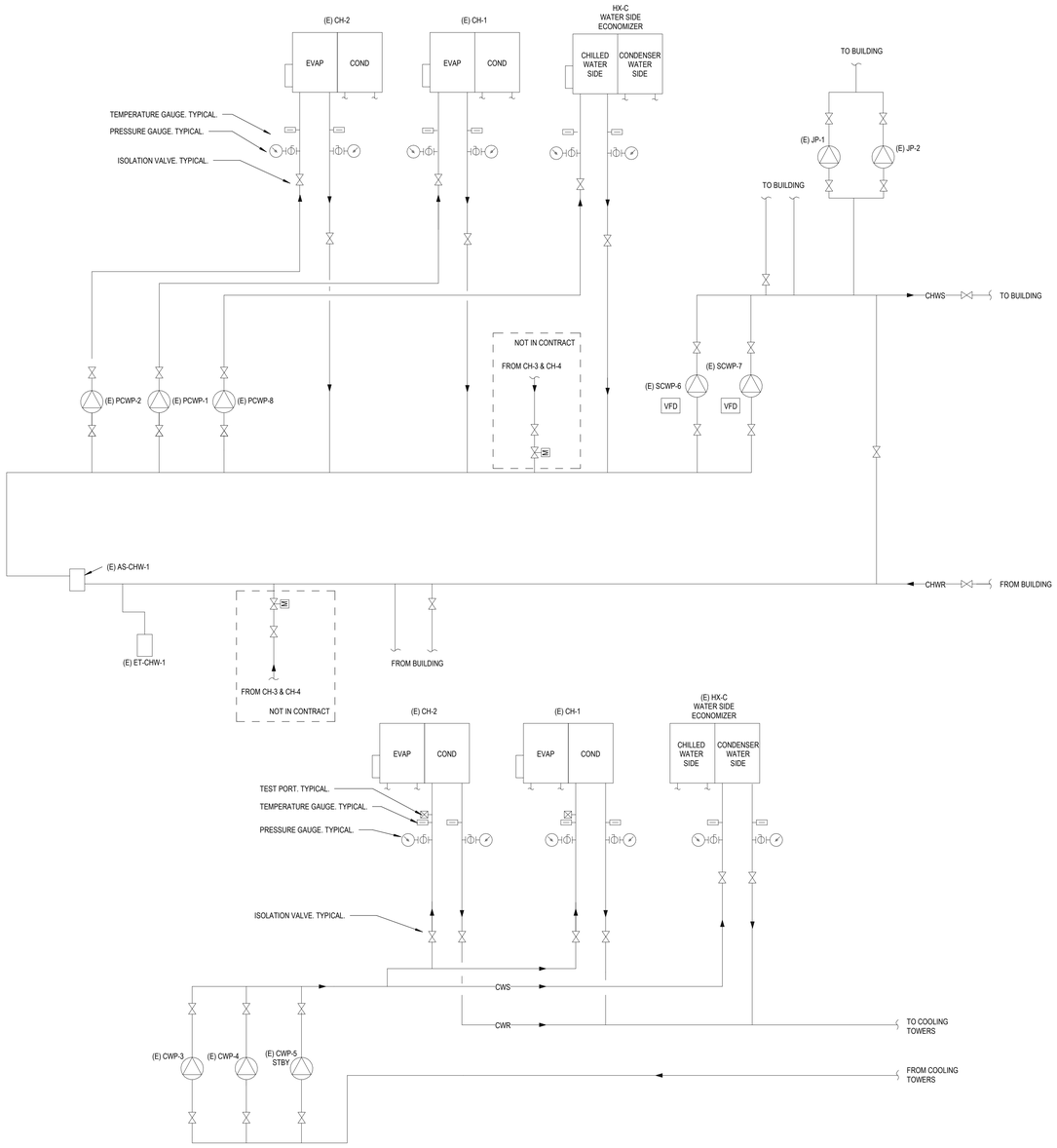


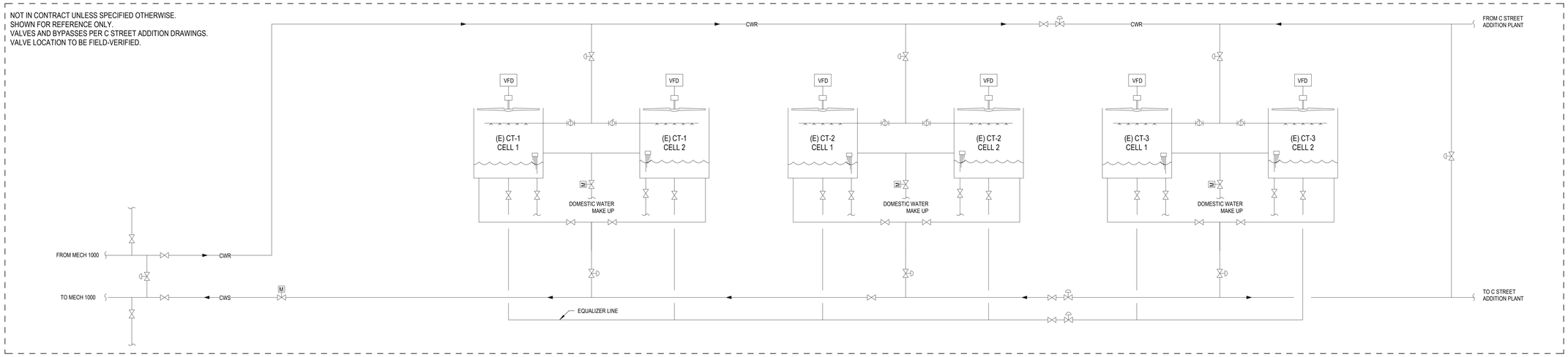
SHEET TITLE
PHASE 3 CHILLED WATER 3D AND SECTION VIEWS

PROJECT NUMBER
CD

SHEET NUMBER
M4.2.4

Plot Date: 4/30/2021 4:22:04 PM Author





NOTES:
1. DIAGRAMS ARE NOT INCLUSIVE OF ALL VALVES, ACCESSORIES, AND DEVICES. REFER TO M6 SERIES DETAILS FOR ADDITIONAL INFORMATION.

1 PHASE 1 DEMO CHILLED AND CONDENSER WATER SYSTEM DIAGRAMS
SCALE: NOT TO SCALE

Author

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Plot Date:

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KEYPLAN

NORTH

SHEET TITLE

EXISTING CHILLED AND CONDENSER WATER PIPING DIAGRAM

PROJECT NUMBER

CD

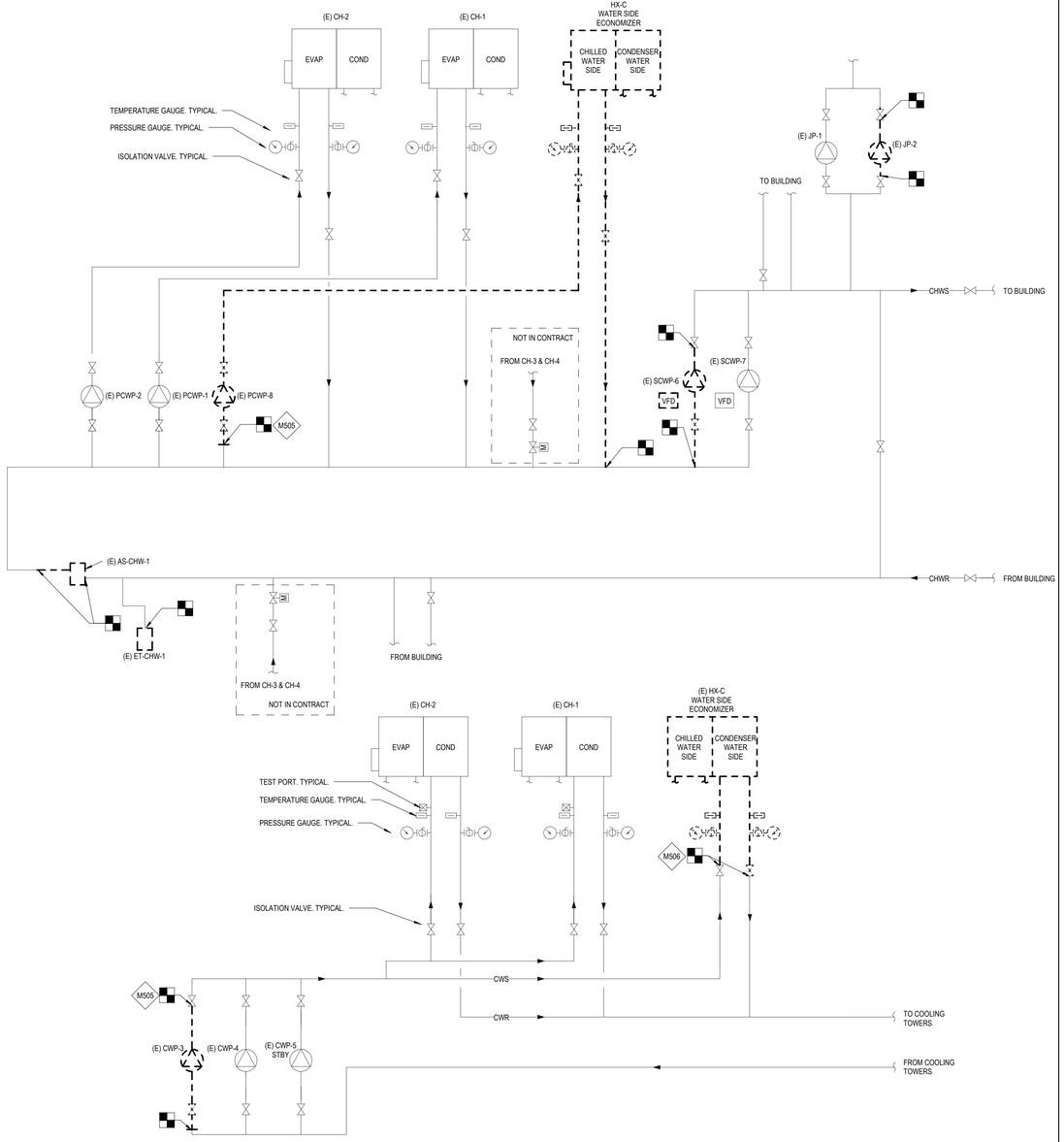
SHEET NUMBER

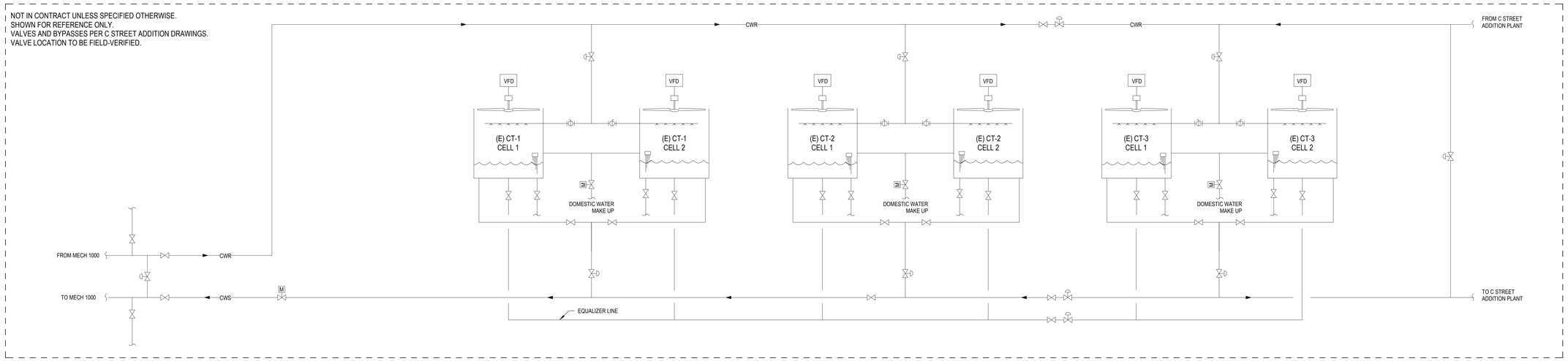
M5.2.0

SHEET KEYNOTES

M505 DISCONNECT AND REMOVE EXISTING PUMP AND ASSOCIATED PIPING AS SHOWN. SEE FLOOR PLAN FOR ADDITIONAL INFORMATION.

M506 DISCONNECT AND REMOVE HEAT EXCHANGER AND ASSOCIATED PIPING AS SHOWN. SEE FLOOR PLAN FOR ADDITIONAL INFORMATION.





NOTES:
1. DIAGRAMS ARE NOT INCLUSIVE OF ALL VALVES, ACCESSORIES, AND DEVICES. REFER TO M6 SERIES DETAILS FOR ADDITIONAL INFORMATION.

1 PHASE 1 DEMO CHILLED AND CONDENSER WATER SYSTEM DIAGRAMS
SCALE: NOT TO SCALE

H. CARL MOULTRIE I COURTHOUSE
MECHANICAL ROOM 1000 CHILLED WATER UPGRADE
500 INDIANA AVENUE N.W.
WASHINGTON DC 20001

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1700 NEW YORK AVENUE NW
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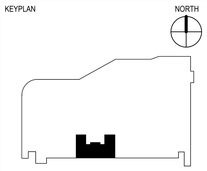
PROFESSIONAL ENGINEER

KEYPLAN



SHEET TITLE
PHASE 1 DEMO CHILLED AND CONDENSER WATER SYSTEM DIAGRAMS

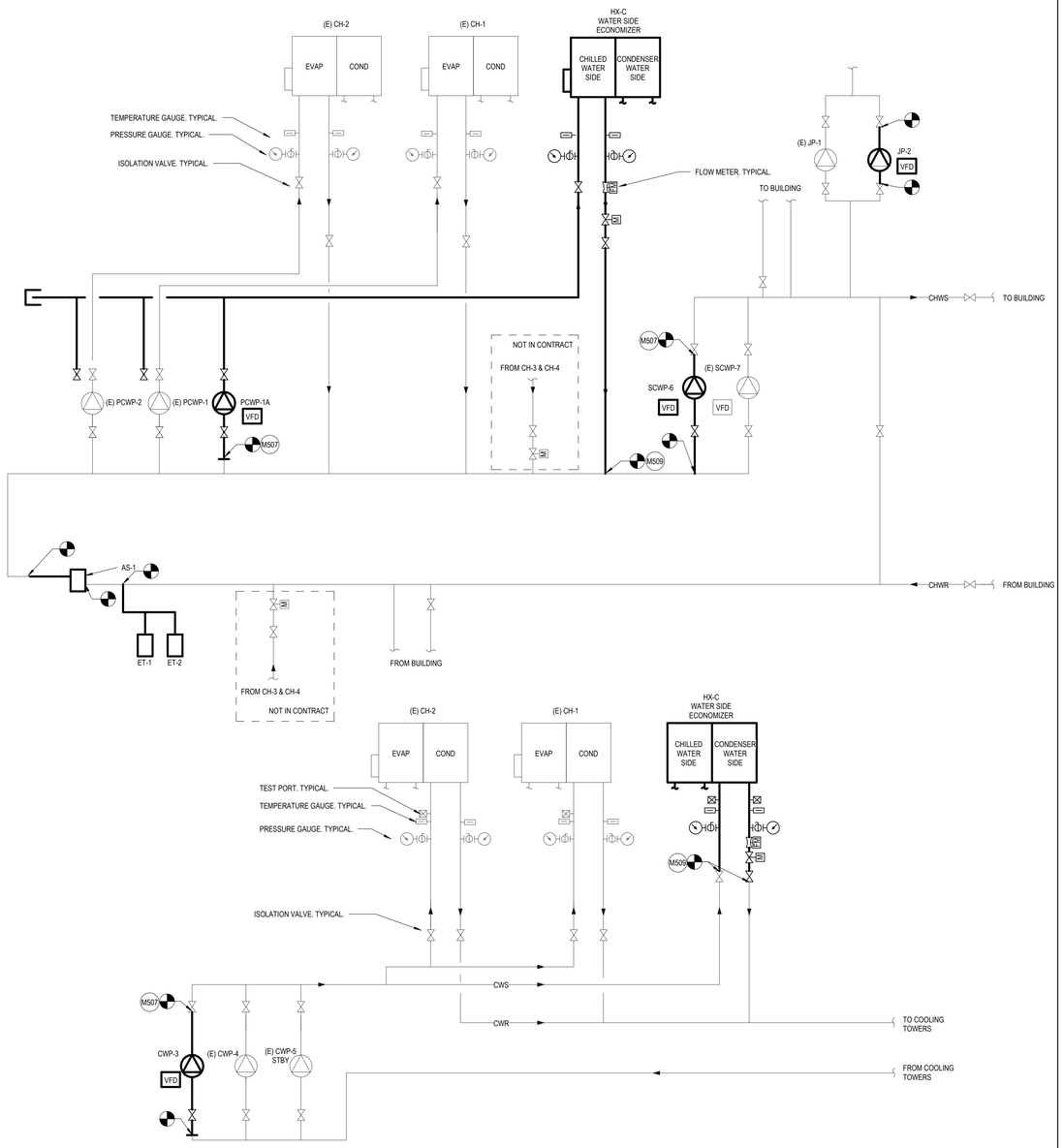
PROJECT NUMBER
CD

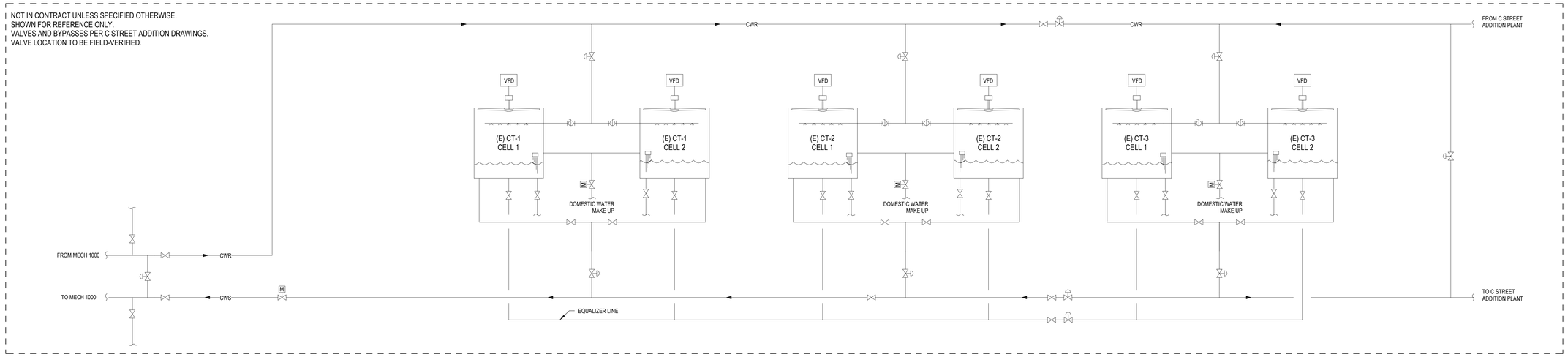
SHEET NUMBER
MD5.2.1

Author
4/30/2021 4:22:37 PM
Plot Date:

SHEET KEYNOTES

M507	PROVIDE NEW PUMP AND ASSOCIATED PIPING ACCESSORIES. SEE PUMP DETAIL ON M6.2 FOR ADDITIONAL INFORMATION.
M509	PROVIDE NEW HEAT EXCHANGER AND ASSOCIATED PIPING ACCESSORIES. SEE DETAIL AND CONTROLS FOR ADDITIONAL INFORMATION.





NOTES:
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1 PHASE 1 NEW CHILLED AND CONDENSER WATER SYSTEM DIAGRAMS
SCALE: NOT TO SCALE

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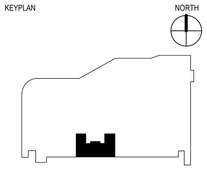
SEALS AND SIGNATURES

KEYPLAN



SHEET TITLE
PHASE 1 NEW CHILLED AND CONDENSER WATER SYSTEM DIAGRAMS

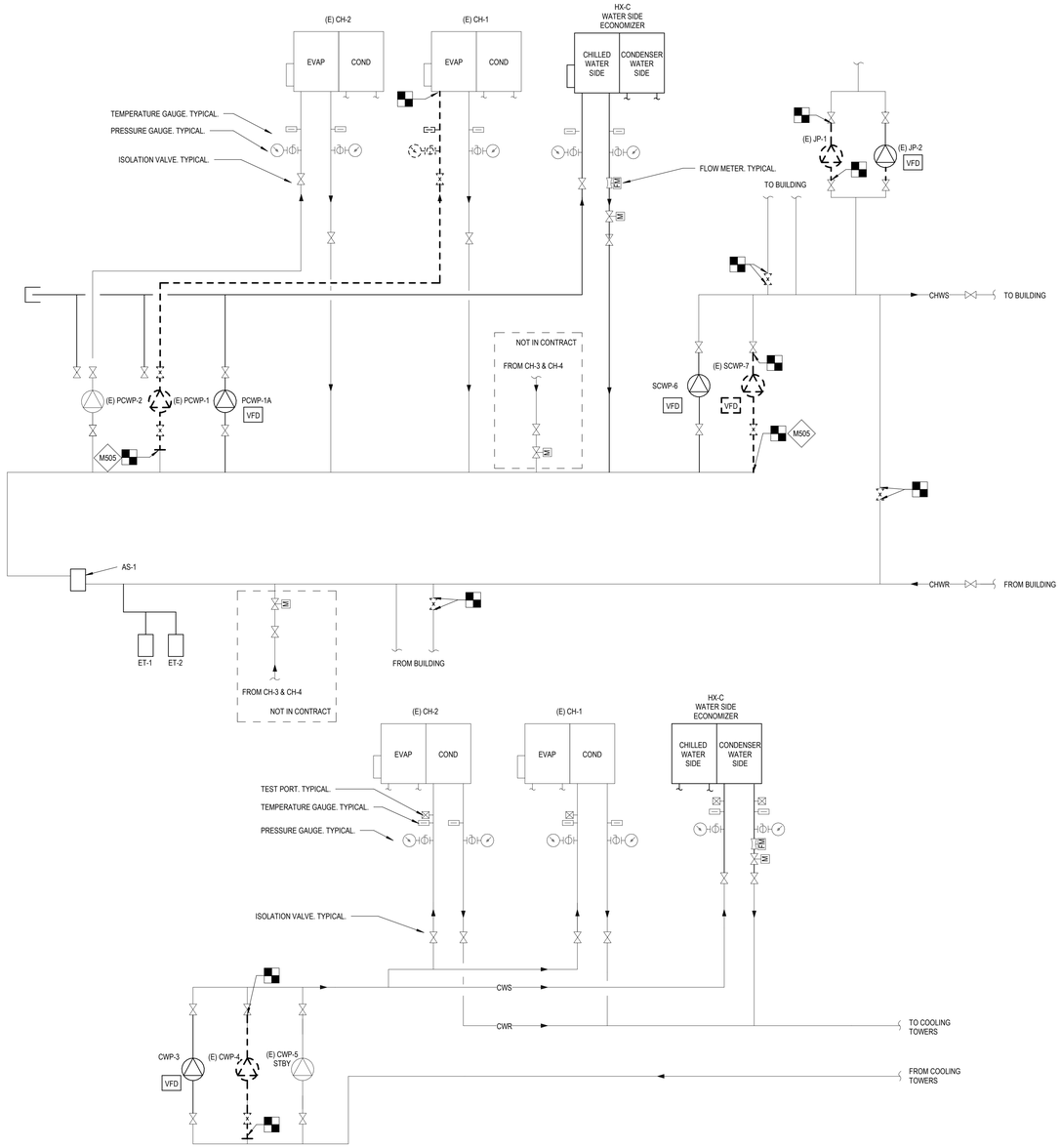
PROJECT NUMBER
CD

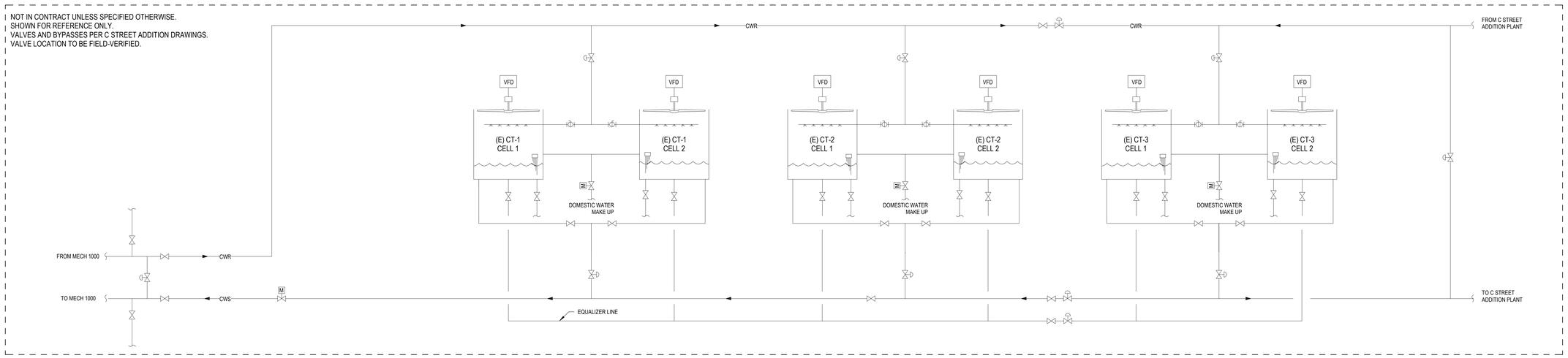
SHEET NUMBER
M5.2.1

Author
4/30/2021 4:22:08 PM
Plot Date:

SHEET KEYNOTES

M505 DISCONNECT AND REMOVE EXISTING PUMP AND ASSOCIATED PIPING AS SHOWN. SEE FLOOR PLAN FOR ADDITIONAL INFORMATION.





NOTES:
1. DIAGRAMS ARE NOT INCLUSIVE OF ALL VALVES, ACCESSORIES, AND DEVICES. REFER TO M6 SERIES DETAILS FOR ADDITIONAL INFORMATION.

1 PHASE 2 DEMO CHILLED AND CONDENSER WATER SYSTEM DIAGRAMS
SCALE: NOT TO SCALE

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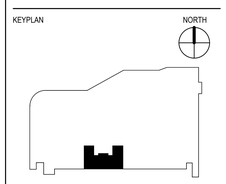


SHEET TITLE
PHASE 2 DEMO CHILLED AND CONDENSER WATER SYSTEM DIAGRAMS

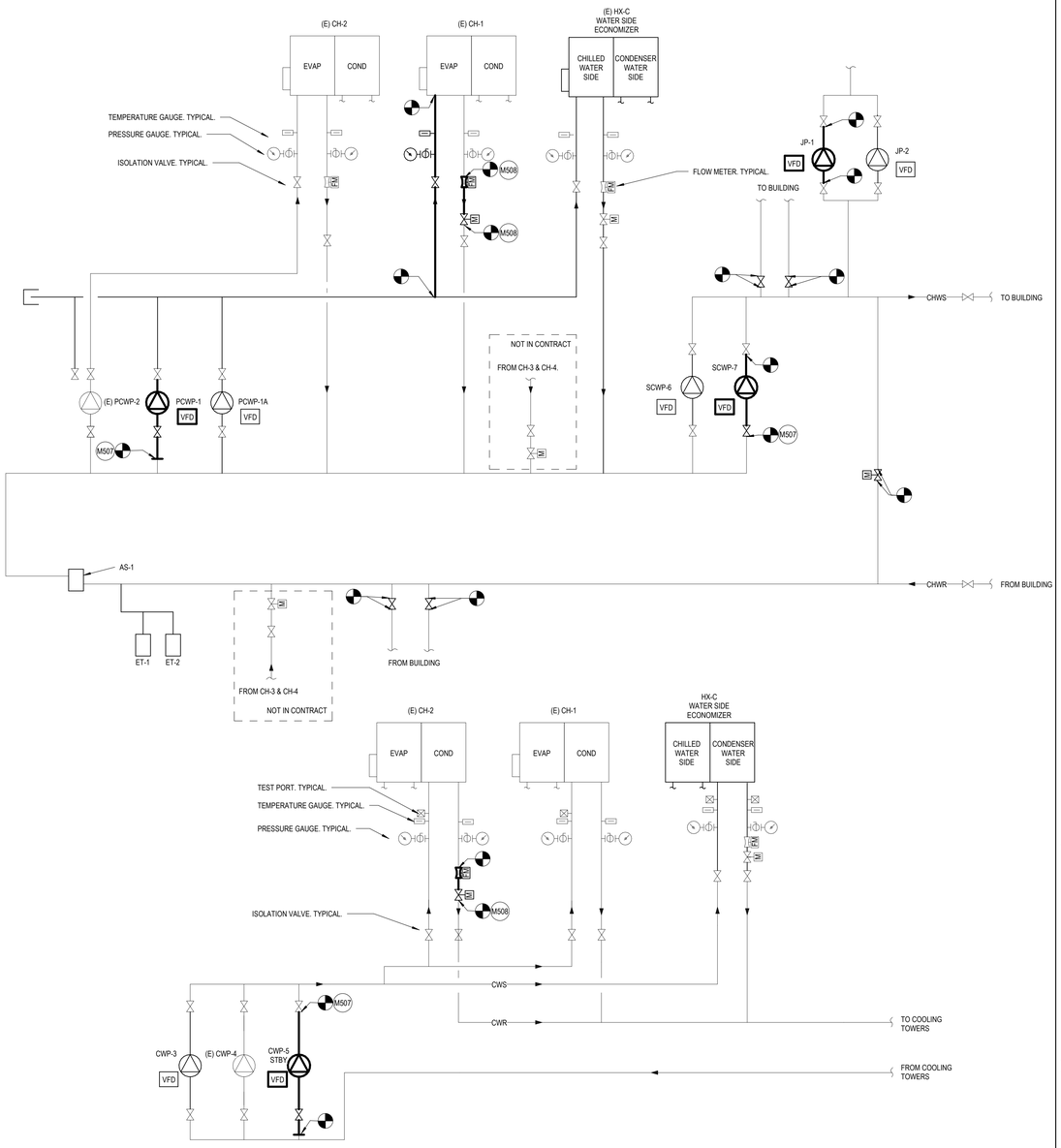
PROJECT NUMBER
CD

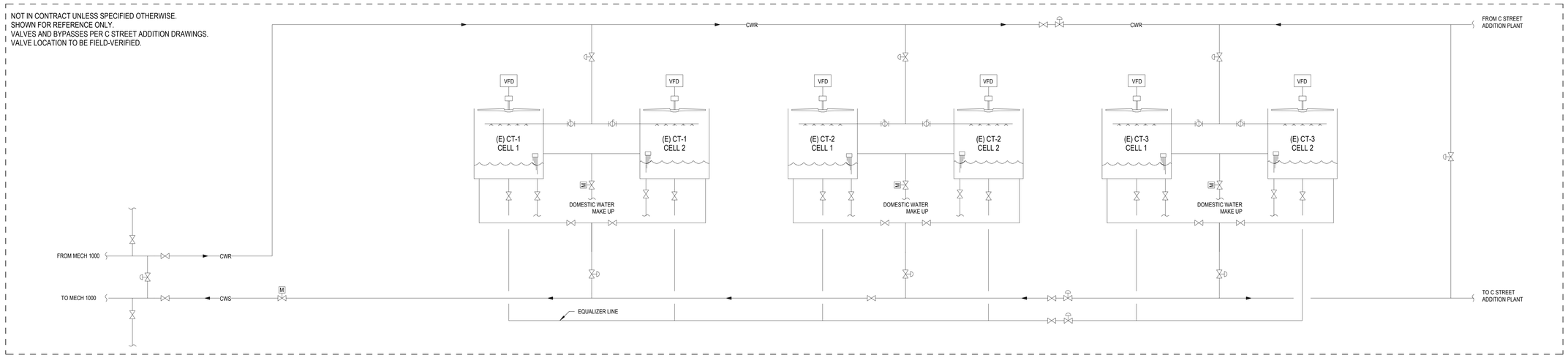
SHEET NUMBER
MD5.2.2

Author
4/30/2021 4:22:40 PM
Plot Date:

SHEET KEYNOTES

M507	PROVIDE NEW PUMP AND ASSOCIATED PIPING ACCESSORIES. SEE PUMP DETAIL ON M6.2 FOR ADDITIONAL INFORMATION.
M508	PROVIDE NEW FLOW METER AND MOTORIZED VALVE AS SHOWN. SEE DETAIL AND CONTROLS FOR ADDITIONAL INFORMATION.





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1 PHASE 2 NEW CHILLED AND CONDENSER WATER SYSTEM DIAGRAMS
SCALE: NOT TO SCALE

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SEALS AND SIGNATURES

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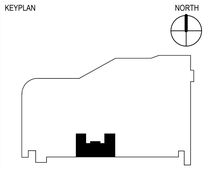
KEYPLAN



SHEET TITLE
PHASE 2 NEW CHILLED AND CONDENSER WATER SYSTEM DIAGRAMS

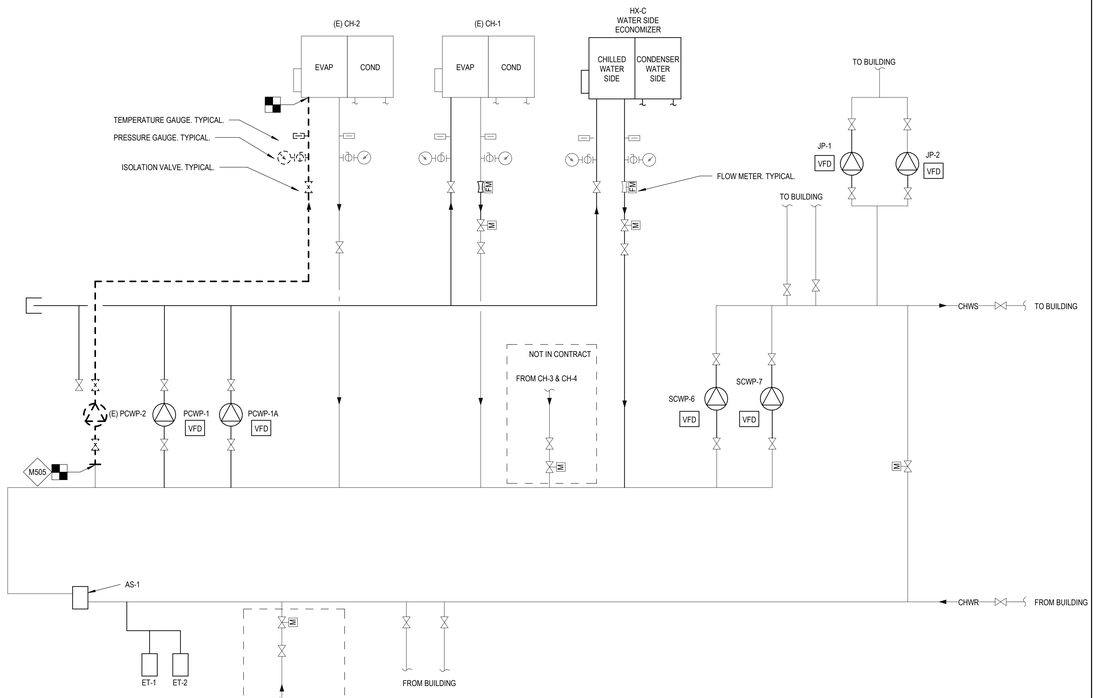
PROJECT NUMBER
CD

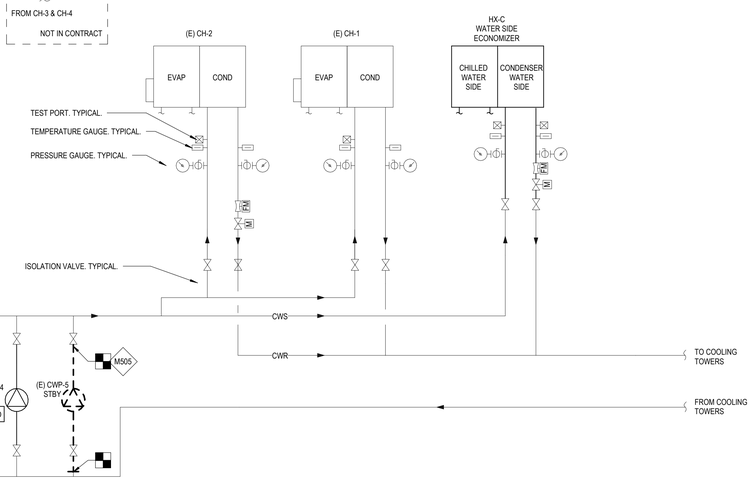
SHEET NUMBER
M5.2.2

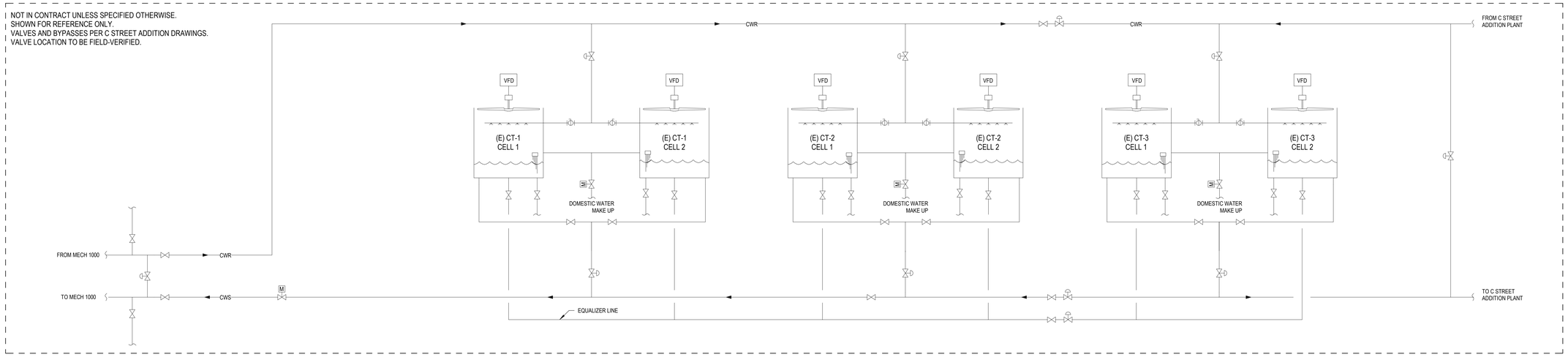
Author
4/30/2021 4:22:10 PM
Plot Date:

SHEET KEYNOTES

M505 DISCONNECT AND REMOVE EXISTING PUMP AND ASSOCIATED PIPING AS SHOWN. SEE FLOOR PLAN FOR ADDITIONAL INFORMATION.







NOTES:
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1 PHASE 3 DEMO CHILLED AND CONDENSER WATER SYSTEM DIAGRAMS
SCALE: NOT TO SCALE

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MECHANICAL ROOM 1000 CHILLED WATER UPGRADE
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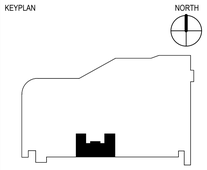
No. PE907217
MECHANICAL
PROFESSIONAL ENGINEER
Torel Petrus

KEYPLAN



SHEET TITLE
PHASE 3 DEMO CHILLED AND CONDENSER WATER SYSTEM DIAGRAMS

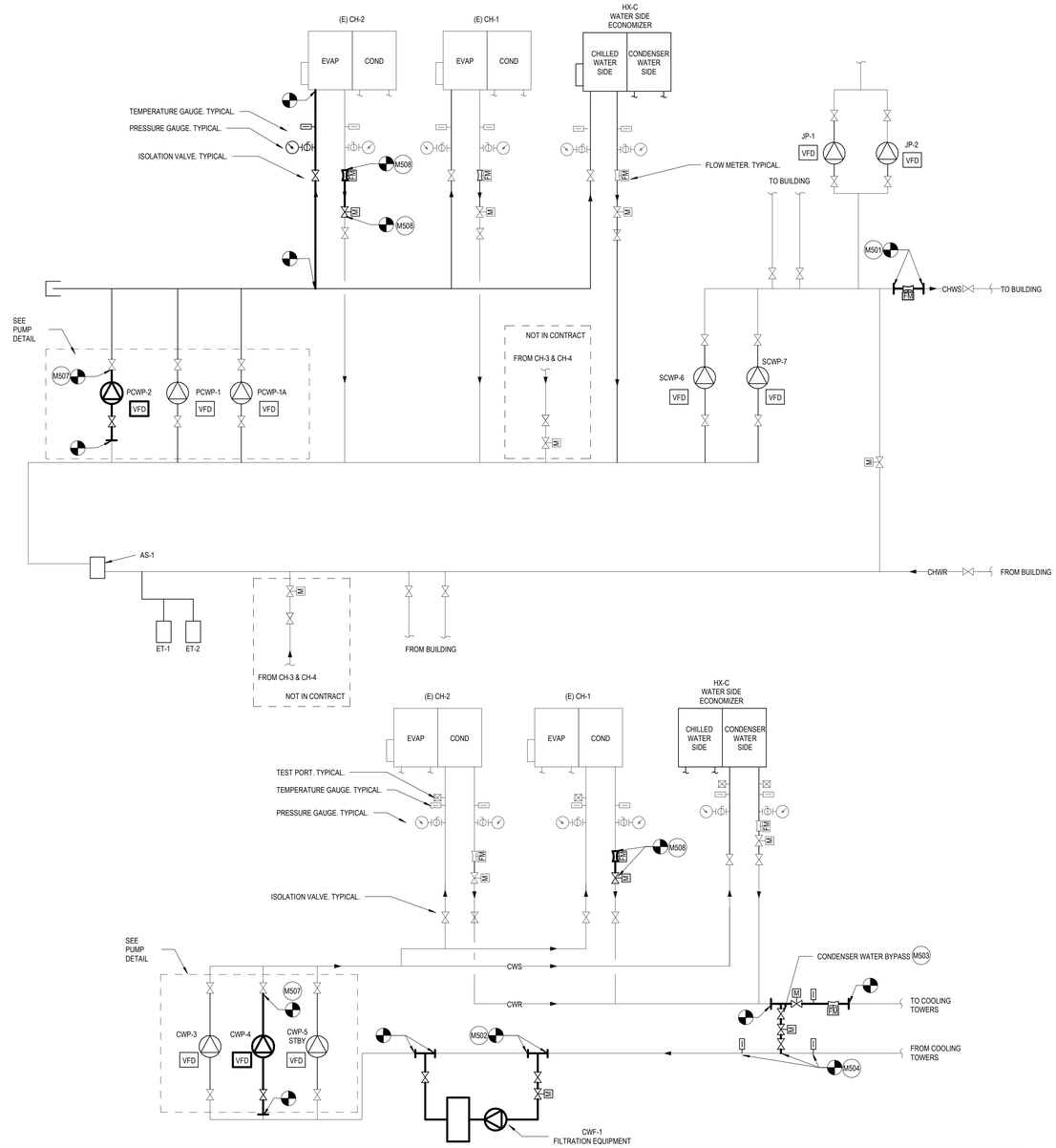
PROJECT NUMBER
CD

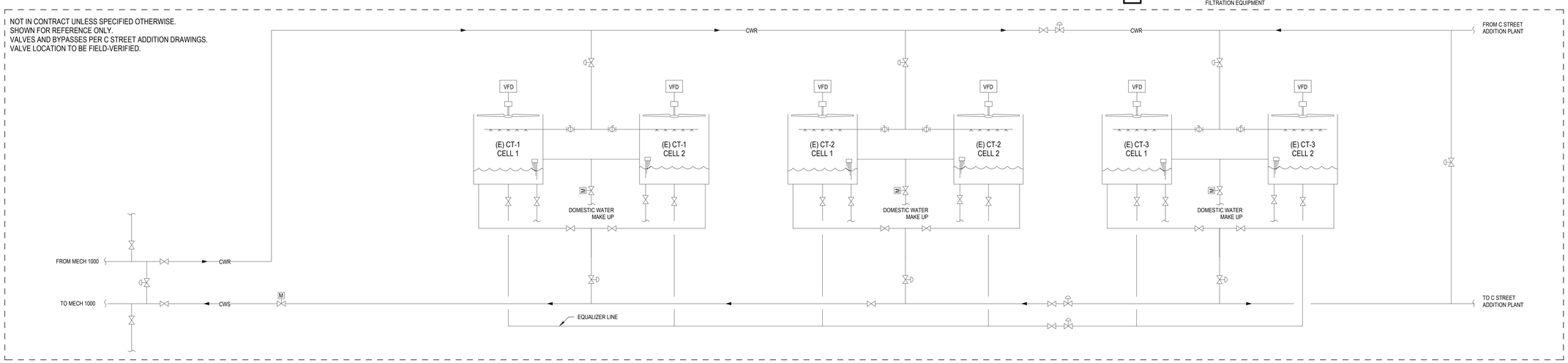
SHEET NUMBER
MD5.2.3

Author
Plot Date: 4/30/2021 4:22:42 PM

SHEET KEYNOTES

M501	PROVIDE FLOW METER FOR THE BUILDING CHILLED WATER SYSTEM.
M502	PROVIDE NEW CONDENSER WATER FILTRATION SYSTEM AS SHOWN. SEE PLAN FOR ADDITIONAL INFORMATION.
M503	PROVIDE NEW CONDENSER WATER LOOP BYPASS IN MECHANICAL ROOM 1000. COORDINATE FINAL LOCATION WITH NEW PIPING LAYOUT.
M504	PROVIDE NEW TEMPERATURE SENSORS AS SHOWN. SEE CONTROL DRAWINGS FOR ADDITIONAL INFORMATION.
M507	PROVIDE NEW PUMP AND ASSOCIATED PIPING ACCESSORIES. SEE PUMP DETAIL ON M6.2 FOR ADDITIONAL INFORMATION.
M508	PROVIDE NEW FLOW METER AND MOTORIZED VALVE AS SHOWN. SEE DETAIL AND CONTROLS FOR ADDITIONAL INFORMATION.





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1 PHASE 3 DEMO CHILLED AND CONDENSER WATER SYSTEM DIAGRAMS
SCALE: NOT TO SCALE

H. CARL MOULTRIE I COURTHOUSE
MECHANICAL ROOM 1000 CHILLED WATER UPGRADE
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SEALS AND SIGNATURES

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PROFESSIONAL ENGINEER

Ionel Petrus

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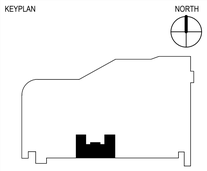
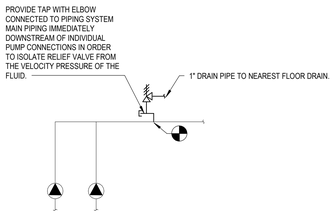


SHEET TITLE
PHASE 3 NEW CHILLED AND CONDENSER WATER SYSTEM DIAGRAMS

PROJECT NUMBER
CD

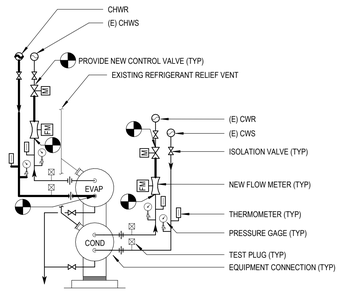
SHEET NUMBER
M5.2.3

Author
4/30/2021 4:22:12 PM
Plot Date:



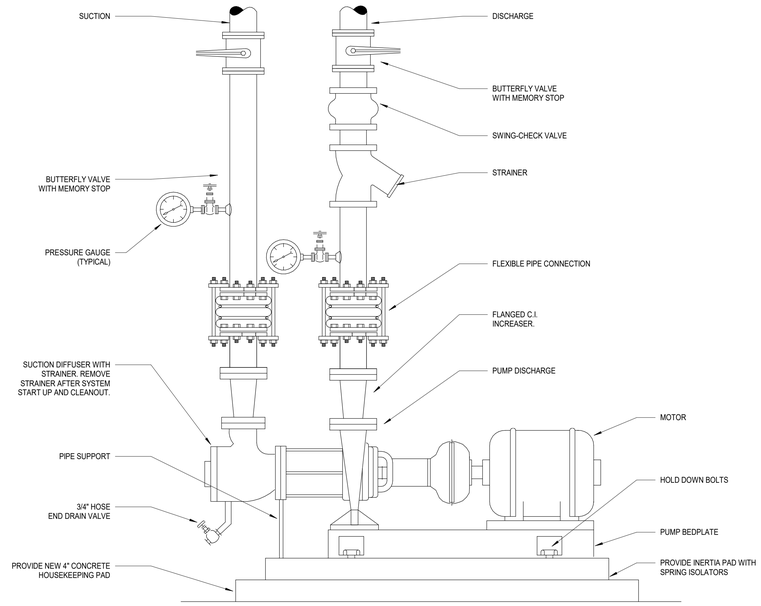
NOTES:
1. PROVIDE SAFETY RELIEF VALVE FOR EACH HEATING HOT WATER LOOP, THE CHILLED WATER LOOP, AND THE CONDENSER WATER LOOP.
2. SET VALVE FOR 120 PSI.
3. CONNECT TO NEW OR EXISTING TO REMAIN PIPING SYSTEM MAIN IMMEDIATELY DOWNSTREAM OF THE INDIVIDUAL PUMP CONNECTIONS TO THE MAINS.

5 PIPING SYSTEM SAFETY RELIEF VALVES
SCALE: NOT TO SCALE



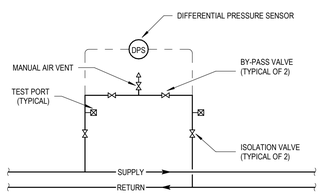
NOTES:
1. REFER TO CONTROLS SCHEMATIC FOR CONTROLS INSTRUMENTATION.
2. PROVIDE REMOVABLE SECTION OF PIPING BETWEEN UNION AND UNIT CONNECTION TO FACILITATE INSPECTION, CLEANING, AND REPAIR.
3. DETAIL ILLUSTRATES SAME SIDE CHILLER CONNECTIONS. REVISE CHILLER CONNECTION LOCATIONS BASED ON SELECTED CHILLER.

2 CONNECTION TO CHILLER CONDENSER AND EVAPORATOR
SCALE: NOT TO SCALE



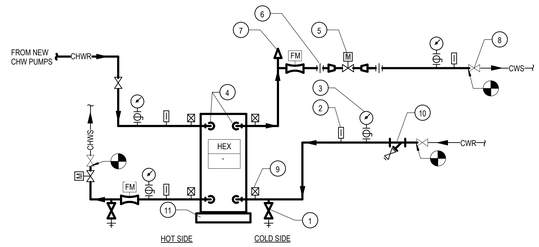
NOTES:
1. FOR CHILLED WATER PUMPS, MOUNT STRAINER ON SUCTION PIPING.
2. FOR CONDENSER WATER PUMPS, MOUNT STRAINER ON DISCHARGE PIPING.

1 BASE MOUNTED END-SUCTION PUMP
SCALE: NOT TO SCALE



NOTES:
1. MAINTAIN UPSTREAM AND DOWNSTREAM DISTANCES AS RECOMMENDED BY SENSOR MANUFACTURER.
2. SENSOR SHOULD BE SECURED TO A WALL, PIPE STAND OR OTHER STATIONARY NON-VIBRATING SURFACE.

3 DIFFERENTIAL PRESSURE SENSOR
SCALE: NOT TO SCALE

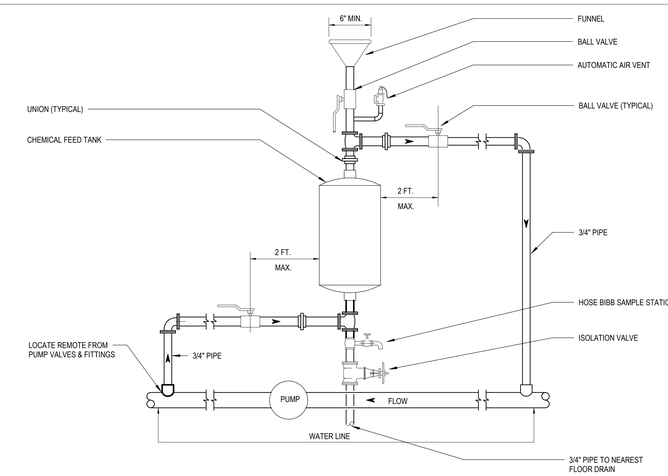


KEY NOTES:
1. 3/4" DRAIN VALVE WITH HOSE CONNECTION.
2. THERMOMETER.
3. PRESSURE GUAGE WITH ISOLATION VALVE.
4. IN/OUT NOZZLES/FLANGES. VERIFY SIZES WITH MANUFACTURER. PROVIDE REDUCER AS REQUIRED.
5. TWO WAY CONTROL VALVE PROVIDED BY CONTROL CONTRACTOR. INSTALLATION BY MECHANICAL CONTRACTOR.
6. UNION.
7. MANUAL AIR VENT.
8. ISOLATION VALVE.
9. PRESSURE AND TEMPERATURE TEST PLUGS.
10. STRAINER WITH BLOWDOWN VALVE. PROVIDE HOSE CONNECTION.
11. NEW 4" CONCRETE PAD

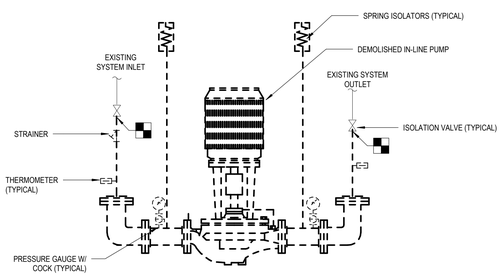
GENERAL NOTES:

A. VERIFY MANUFACTURER HOT/COLD IN/OUT NOZZLE LOCATION BEFORE PIPING HEAT EXCHANGER.

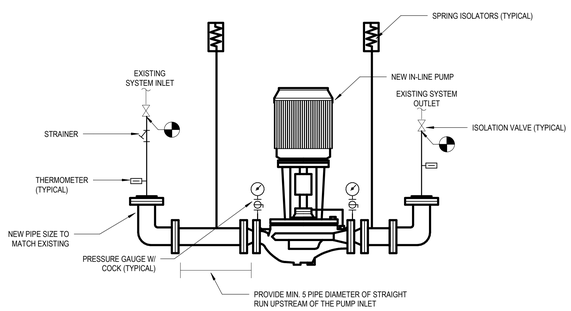
4 PLATE AND FRAME HEAT EXCHANGER PIPING DIAGRAM
SCALE: NOT TO SCALE



6 SHOT FEEDER
SCALE: NOT TO SCALE

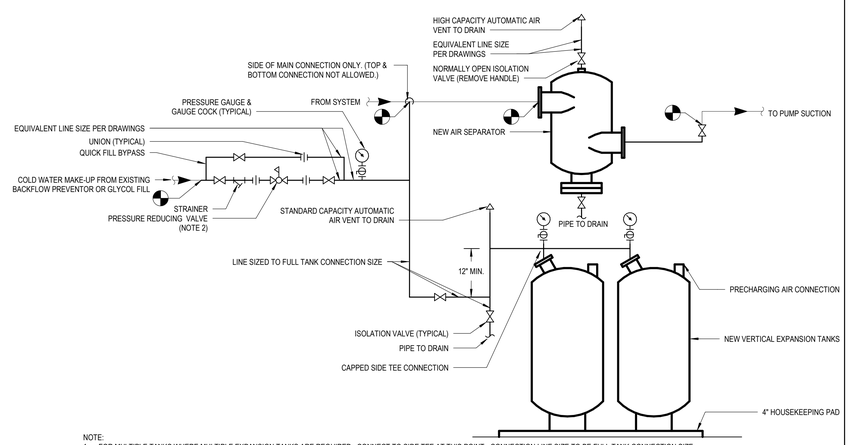


9 DEMOLISHED IN-LINE PUMP
SCALE: NONE



NOTES:
1. PIPING SHALL BE INSTALLED SUCH THAT PUMP MAY BE COMPLETELY REMOVED WITHOUT DISMANTLING PIPE OR FITTINGS, AND WITHOUT FORCING OR SPRINGING THE PIPING.
2. INSTALL PRESSURE GAGES AS SHOWN OR INSTALL SINGLE GAGE WITH MULTIPLE INPUT SELECTOR VALVE.
3. PUMPS CAN BE SUPPORTED FROM ABOVE VIA THREADED RODS AND UNISTRUCT. SEE SPECIFICATIONS FOR REQUIREMENTS.

8 NEW IN-LINE PUMP
SCALE: NONE



NOTE:
1. FOR MULTIPLE TANKS WHERE MULTIPLE EXPANSION TANKS ARE REQUIRED. CONNECT TO SIDE TEE AT THIS POINT - CONNECTION LINE SIZE TO BE FULL TANK CONNECTION SIZE.
2. INITIAL VALVE SETPOINT 85 PSI. ADJUST UP OR DOWN DURING TESTING/TUNING TO PROVIDE 5 PSI OF POSITIVE PRESSURE AT THE HIGHEST POINT IN THE CHILLED WATER SYSTEM.

7 BLADDER EXPANSION TANK AND AIR SEPARATOR - VERTICAL TANK
SCALE: NOT TO SCALE

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No. PE907217
MECHANICAL
PROFESSIONAL ENGINEER
Ionel Petrus

SHEET TITLE
MECHANICAL DETAILS

PROJECT NUMBER
CD

SHEET NUMBER
M6.1

Author
Plot Date: 4/30/2021 4:22:15 PM

(E) CHILLER SCHEDULE (FOR REFERENCE ONLY)

TAG	TYPE	NOMINAL CAPACITY TONS	EVAPORATOR SIDE DATA					CONDENSER SIDE DATA					ELECTRICAL DATA		BASIS OF DESIGN		REMARKS
			EWT [°F]	LWT [°F]	FLOW [GPM]	FOULING FACTOR	MAX PD	EWT [°F]	LWT [°F]	FLOW [GPM]	FOULING FACTOR	MAX PD [FT]	VOLTAGE [V]	PHASE	MANUFACTURER	MODEL	
(E) CH-1	CENTRIFUGAL WATER CHILLER	900	58	42	1350	0.0001	6.68	85	94	2700	0.00025	18.92	480	3	TRANE	CVHF1070	EXISTING TO REMAIN
(E) CH-2	CENTRIFUGAL WATER CHILLER	900	58	42	1350	0.0001	6.68	85	94	2700	0.00025	18.92	480	3	TRANE	CVHF1070	EXISTING TO REMAIN

(E) CHILLER SCHEDULE - RE-RATED PERFORMANCE

TAG	TYPE	NOMINAL CAPACITY TONS	EVAPORATOR SIDE DATA						CONDENSER SIDE DATA					ELECTRICAL DATA		BASIS OF DESIGN		REMARKS
			EWT [°F]	LWT [°F]	FLOW [GPM]	NUMBER OF PASSES	SCALE FACTOR	MAX PD [PSI]	EWT [°F]	LWT [°F]	FLOW [GPM]	SCALE FACTOR	MAX PD [FT]	VOLTAGE [V]	PHASE	MANUFACTURER	MODEL	
(E) CH-1	CENTRIFUGAL WATER CHILLER	900	55	42	1600	2	0.0001	9.14	85	94	2700	0.00025	18.92	480	3	TRANE	CVHF1070	RE-RATED VALUES
(E) CH-2	CENTRIFUGAL WATER CHILLER	900	55	42	1600	2	0.0001	9.14	85	94	2700	0.00025	18.92	480	3	TRANE	CVHF1070	RE-RATED VALUES

(E) PUMP SCHEDULE - CHILLED WATER (FOR REFERNECE ONLY)

TAG	SYSTEM	FLOW [GPM]	DISCHARGE HEAD [FT]	MOTOR DATA			REMARKS
				HP	VOLTAGE [V]	PHASE	
(E) CWP-3	CONDENSER	2700	130	125	460	3	TO BE DEMOLISHED
(E) CWP-4	CONDENSER	2700	130	125	460	3	TO BE DEMOLISHED
(E) CWP-5	CONDENSER	2700	130	125	460	3	TO BE DEMOLISHED
(E) PCWP-1	CHILLED WATER	1350	20	10	460	3	TO BE DEMOLISHED
(E) PCWP-2	CHILLED WATER	1350	20	10	460	3	TO BE DEMOLISHED
(E) PCWP-8	CHILLED WATER HX	900	30	10	460	3	TO BE DEMOLISHED
(E) SCWP-6	CHILLED WATER SECONDARY LOOP	3200	100	100	460	3	TO BE DEMOLISHED
(E) SCWP-7	CHILLED WATER SECONDARY LOOP	3200	100	100	460	3	TO BE DEMOLISHED

(E) HEAT EXCHANGER SCHEDULE (FOR REFERENCE ONLY)

TAG	SYSTEM	TYPE	CAPACITY [BTU/H]	MIN HEATING SURFACE [SF]	HOT SIDE DATA				COLD SIDE DATA				OPERATING WEIGHT [LBS]	BASIS OF DESIGN		REMARKS
					EWT [F]	LWT [F]	FLOW [GPM]	MAX PD [PSI]	EWT [F]	LWT [F]	FLOW [GPM]	MAX PD [PSI]		MANUFACTURER	MODEL	
(E) HX-C	CHILLED WATER	PLATE AND FRAME	0	0	0	0	0	150.00	0	0	0	150.00	0.00	SUPERCHANGER	UFX	TO BE DEMOLISHED

PLATE AND FRAME HEAT EXCHANGER SCHEDULE

TAG	SYSTEM	TYPE	CAPACITY [BTU/HR]	MIN HEATING SURFACE[SF]	HOT SIDE DATA				COLD SIDE DATA				OPERATING WEIGHT [LB]	BASIS OF DESIGN		REMARKS
					EWT [°F]	LWT [°F]	FLOW [GPM]	MAX PD [PSI]	EWT [°F]	LWT [°F]	FLOW [GPM]	MAX PD [PSI]		MANUFACTURER	MODEL	
HX-C	CHILLED WATER	PLATE AND FRAME	8027275	3130	55	45	1600	6.86	42	50	1950	10.09	7185	DANFOSS	PHE	ALL PIPE CONNECTIONS 6".

PUMP SCHEDULE - CHILLED WATER

TAG	SYSTEM	FLOW [GPM]	HEAD [FT]	PIPE CONNECTIONS		MINIMUM EFFICIENCY (%)	IMPELLER SIZE	MOTOR DATA					OPERATING WEIGHT [LBS]	BASIS OF DESIGN		REMARKS
				SUCTION	DISCHARGE			BHP	HP	RPM	VOLTAGE	PHASE		MANUFACTURER	MODEL	
CWF-1	CONDENSER FILTRATION SYSTEM	525	0.00	6"	4"	0	0"		15	1750	460	3	1080.00	LAKOS	HTX-0285-TC	IMPELLER SIZE NOT PROVIDED
CWP-3	CONDENSER WATER	2700	160.00	10"	8"	83	13 3/8"	130	150	1800	460	3	2570.00	BELL AND GOSSETT	E-1510	
CWP-4	CONDENSER WATER	2700	160.00	10"	8"	83	13 3/8"	130	150	1800	460	3	2570.00	BELL AND GOSSETT	E-1510	
CWP-5	CONDENSER WATER	2700	160.00	10"	8"	83	13 3/8"	130	150	1800	460	3	2570.00	BELL AND GOSSETT	E-1510	
JP-1	SECONDARY CHILLED WATER BOOSTER	150	50.00	2"	2"	66	7 3/4"	2.84	5	1800	480	3	210.00	BELL AND GOSSETT	E-80SC	
JP-2	SECONDARY CHILLED WATER BOOSTER	150	50.00	2"	2"	66	7 3/4"	2.84	5	1800	480	3	210.00	BELL AND GOSSETT	E-80SC	
PCWP-1	PRIMARY CHILLED WATER	1600	60.00	8"	6"	85	9"	28.5	30	1800	460	3	942.00	BELL AND GOSSETT	E-1510	
PCWP-1A	PRIMARY CHILLED WATER	1600	60.00	8"	6"	85	9"	28.5	30	1800	460	3	942.00	BELL AND GOSSETT	E-1510	
PCWP-2	PRIMARY CHILLED WATER	1600	60.00	8"	6"	85	9"	28.5	30	1800	460	3	942.00	BELL AND GOSSETT	E-1510	
SCWP-6	SECONDARY CHILLED WATER	3200	130.00	10"	8"	86	13 3/8"	121	125	1800	460	3	1962.00	BELL AND GOSSETT	E-1510	
SCWP-7	SECONDARY CHILLED WATER	3200	130.00	10"	8"	86	13 3/8"	121	125	1800	460	3	1962.00	BELL AND GOSSETT	E-1510	

NOTES:
1. PROVIDE MAXIMUM IMPELLER SIZE FOR SELECTED CASING.
2. PUMPS SHALL NOT BE RELEASED UNTIL THE PRE-TAB HAS BEEN COMPLETED AND THE FINAL SELECTION HAS BEEN CONFIRMED BY THE EOR.

EXPANSION TANK SCHEDULE

TAG	SYSTEM	TYPE	TEMPERATURE		TANK VOLUME [GAL]	MIN ACCEPTANCE VOLUME [GAL]	AIR CHARGE PRESSURE [PSI]	OPERATING WEIGHT [LBS]	BASIS OF DESIGN		REMARKS
			MIN [°F]	MAX [°F]					MANUFACTURER	MODEL	
ET-1	CHILLED WATER	BLADDER	42	90	211.0	211.0	12.00	2306.00	BELL AND GOSSETT	B-800	
ET-2	CHILLED WATER	BLADDER	42	90	211.0	211.0	12.00	2306.00	BELL AND GOSSETT	B-800	

AIR SEPARATOR SCHEDULE

TAG	SYSTEM	TYPE	CONNECTION SIZE	FLOW [GPM]	MAX WATER PD (FT)	OPERATING WEIGHT [LBS]	BASIS OF DESIGN		REMARKS
							MANUFACTURER	MODEL	
AS-1	CHILLED WATER	TANGENTIAL	12"	3200	2.75	3588.00	BELL AND GOSSETT	ROLAIRTROL	

H. CARL MOULTRIE I COURTHOUSE
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SEALS AND SIGNATURES

DISTRICT OF COLUMBIA
IONEL PETRUS
No. PE907217
MECHANICAL
PROFESSIONAL ENGINEER

Ionel Petrus

SHEET TITLE
MECHANICAL SCHEDULES

PROJECT NUMBER
CD

SHEET NUMBER
M7.1

Author

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CONTROL ABBREVIATIONS

#	
2-D	TWO-DIMENSIONAL
3-D	THREE-DIMENSIONAL
A	
AAC	ADVANCED APPLICATION CONTROLLER
AFMS	AIRFLOW MEASURING STATION
AHU	AIR HANDLING UNIT
AI	ANALOG INPUT
ALT	ALTERNATOR
AO	ANALOG OUTPUT
AR	ADDRESSIBLE RELAY (FIRE ALARM)
ASC	APPLICATION SPECIFIC CONTROLLER
AX	AUXILIARY CONTACT
B	
B	BOILER
BC	BUILDING CONTROLLER
BD	BACKDRAFT DAMPER
BMS	BUILDING MANAGEMENT SYSTEM
C	
CB	CHILLED BEAM
CBCHW	CHILLED BEAM CHILLED WATER
CBHW	CHILLED BEAM HOT WATER
CC	COOLING COIL
CCDT	COOLING COIL DISCHARGE TEMPERATURE
CH	CHILLER
CHW	CHILLED WATER
CHWR	CHILLED WATER RETURN
CHWS	CHILLED WATER SUPPLY
CI	CURRENT INPUT
CO	CARBON MONOXIDE
CO2	CARBON DIOXIDE
CSR	CURRENT SWITCH OR CURRENT SENSING RELAY
CR	CONTROL RELAY
CT	COOLING TOWER
CW	CONDENSER WATER
CWR	CONDENSER WATER RETURN
CWS	CONDENSER WATER SUPPLY
D	
D	DAMPER
DDC	DIRECT DIGITAL CONTROL
DF	DIESEL FUEL
DI	DIGITAL INPUT
DO	DIGITAL OUTPUT
DP	PRESSURE DIFFERENCE
DPS	DIFFERENTIAL PRESSURE SWITCH
DPT	DIFFERENTIAL PRESSURE SENSOR
DX	DIRECT EXPANSION
E	
EA	EXHAUST AIR
ED	ENABLE / DISABLE
EF	EXHAUST FAN
EP	ELECTRIC / PNEUMATIC RELAY
ES	END SWITCH
F	
F	DEGREES FAHRENHEIT
FA	FIRE ALARM
FACP	FIRE ALARM CONTROL PANEL
FD	FIRE DAMPER
FDAT	FAN DISCHARGE AIR TEMPERATURE
FD/SD	COMBINATION FIRE AND SMOKE DAMPER
FM	FLOW METER
FR	FIELD RELAY
FS	FLOW SWITCH
FZ	FREEZESTAT
G	
GCF	GARAGE CIRCULATION FAN
GEF	GARAGE EXHAUST FAN
GIF	GARAGE INTAKE FAN
H	
H	HUMIDITY
HC	HEATING COIL
HHW	HEATING HOT WATER
HHWR	HEATING HOT WATER RETURN
HHWS	HEATING HOT WATER SUPPLY
HI	HIGH
HL	HIGH LEVEL
HX	HEAT EXCHANGER
K	
KW	KILOWATTS
L	
LO	LOW
LL	LOW LEVEL
LV	LEVEL
M	
MAX	MAXIMUM
MAT	MIXED AIR TEMPERATURE
MIN	MINIMUM
MS	MOTOR STARTER
N	
N.C.	NORMALLY CLOSED
N.O.	NORMALLY OPEN
O	
OA	OUTDOOR AIR
OAH	OUTDOOR AIR HUMIDITY
OAT	OUTDOOR AIR TEMPERATURE
OWS	OPERATOR WORK STATION
P	
P	PUMP
PH	PENTHOUSE
PHDT	PREHEAT DISCHARGE TEMPERATURE
PMCS	POWER MONITORING & CONTROL SYSTEM
PPM	PARTS PER MILLION
PS	PRESSURE SWITCH
PSI	POUNDS PER SQUARE INCH
R	
RA	RETURN AIR; REFRIGERANT ALARM
RAH	RETURN AIR HUMIDITY
RAT	RETURN AIR TEMPERATURE
RET	RETURN
RF	RETURN FAN
RH	RELATIVE HUMIDITY
RLMS	REFRIGERANT LEAK MONITORING SYSTEM
RLF	RELIEF
ROT	ROTATION MONITORING SENSOR
S	
S	SOLENOID
SA	SUPPLY AIR
SC	SELF CONTAINED UNIT
SD	SMOKE DAMPER; SMOKE DETECTOR
SF	SUPPLY FAN
SP	STATIC PRESSURE
SS	START / STOP
SV	SOLENOID VALVE
SW	SWITCH
T	
T	TEMPERATURE SENSOR
TEF	TOILET EXHAUST FAN
TH	THERMOSTAT
V	
V	VALVE
VAV	VARIABLE AIR VOLUME
VFD	VARIABLE FREQUENCY DRIVE
VO	VOLTAGE OUTPUT
VS	VIBRATION SWITCH
W	
WC	WATER COLUMN

SEE CONTROL SYMBOLS, LEGENDS AND EQUIPMENT SCHEDULES FOR ADDITIONAL ABBREVIATIONS. ALL ABBREVIATIONS, SYMBOLS, AND LEGENDS SHOWN ON THIS DRAWINGS ARE NOT NECESSARILY USED.

CONTROL SYMBOLS

SENSING COMPONENTS

- AIR FLOW MEASURING STATION (DUCT)
- FAN INLET BELL HOUSING AIR FLOW MEASURING STATION
- T — TEMPERATURE SENSOR
- T — TEMPERATURE SENSOR (AVERAGING)
- FT — FREEZESTAT
- PS — PRESSURE SWITCH
- P — PRESSURE SENSOR OR PRESSURESTAT
- FS — FLOW SWITCH
- H — RELATIVE HUMIDITY SENSOR (DUCT)
- SD — SMOKE DETECTOR (DUCT) INSTALL BY MECHANICAL, PURCHASE AND CONNECTION TO FIRE ALARM SYSTEM BY OTHERS
- CO2 — CARBON DIOXIDE SENSOR (DUCT)
- CO — CARBON MONOXIDE SENSOR (DUCT)
- FM — FLOW METER
- L — LEVEL SENSOR
- R — REFRIGERANT LEAK SENSING POINT
- LOW / SP / HIGH — STATIC PRESSURE SENSOR
- DPS — DIFFERENTIAL PRESSURE SWITCH
- DPT — DIFFERENTIAL PRESSURE SENSOR
- WALL SWITCH
- S — SPACE TEMPERATURE SENSOR
- THERMOSTAT
- H — SPACE HUMIDITY SENSOR
- HU — HUMIDISTAT
- H — HYDROGEN SENSOR (WALL)
- CO2 — CARBON DIOXIDE SENSOR (WALL)
- CO — CARBON MONOXIDE SENSOR (WALL)
- G — AIR FILTER WITH DIFFERENTIAL PRESSURE SENSOR AND PRESSURE GAUGE

CONTROL COMPONENTS

- M — 2-WAY ELECTRIC CONTROL VALVE
- M — 3-WAY ELECTRIC CONTROL VALVE
- TH M — 2-WAY CONTROL VALVE WITH INTEGRAL THERMOSTAT
- TH M — 3-WAY CONTROL VALVE WITH INTEGRAL THERMOSTAT
- M — BUTTERFLY VALVE ELECTRIC ACTUATOR
- M — SEGMENTED BALL VALVE ELECTRIC ACTUATOR
- 2-WAY PNEUMATIC CONTROL VALVE
- 3-WAY PNEUMATIC CONTROL VALVE
- BUTTERFLY VALVE PNEUMATIC ACTUATOR
- SEGMENTED BALL VALVE PNEUMATIC ACTUATOR
- S — 2-WAY SOLENOID VALVE
- S — 3-WAY SOLENOID VALVE
- M — OPPOSED BLADE DAMPER - ELECTRIC ACTUATOR
- M — PARALLEL BLADE DAMPER - ELECTRIC ACTUATOR
- M — OPPOSED BLADE DAMPER WITH END SWITCH - ELECTRIC ACTUATOR
- ES M ES — PARALLEL BLADE DAMPER WITH END SWITCH - ELECTRIC ACTUATOR
- ES — OPPOSED BLADE DAMPER - PNEUMATIC ACTUATOR
- PARALLEL BLADE DAMPER - PNEUMATIC ACTUATOR
- ES — OPPOSED BLADE DAMPER WITH END SWITCH - PNEUMATIC ACTUATOR
- ES — PARALLEL BLADE DAMPER WITH END SWITCH - PNEUMATIC ACTUATOR
- ES — OPPOSED BLADE DAMPER- PNEUMATIC ACTUATOR WITH POSITIONER
- PARALLEL BLADE DAMPER- PNEUMATIC ACTUATOR WITH POSITIONER

CONTROL ELECTRICAL COMPONENTS

- M — INTEGRAL FACE & BYPASS STEAM HEATING COIL
- H/C — HOT WATER OR STEAM HEATING COIL
- C/C — CHILLED WATER COOLING COIL
- D/X — DIRECT EXPANSION HEATING & COOLING COIL
- E/C — WATERSIDE ECONOMIZER COOLING COIL
- R/C — ENERGY RECOVERY COIL
- DH — ELECTRIC DUCT HEATER
- GFH — GAS FIRED DUCT HEATER
- ELECTRIC HUMIDIFIER
- STEAM HUMIDIFIER
- GFH — GAS FIRED HUMIDIFIER
- UV — ULTRAVIOLET LIGHT AIR PURIFIER
- CENTRIFUGAL FAN OR PUMP
- FAN WITH PNEUMATIC VARIABLE INLET VANES
- PROPELLER TYPE FAN
- M — ROOF MOUNTED EXHAUST FAN (SINGLE PHASE)
- M — ROOF MOUNTED EXHAUST FAN (3 PHASE)
- PLATE AND FRAME HEAT EXCHANGER
- SHELL AND TUBE HEAT EXCHANGER

- AX — AUXILIARY CONTACT
- CI — CURRENT INPUT
- CSR — CURRENT SENSING RELAY
- CT — CURRENT TRANSDUCER
- EN — ENABLE / DISABLE
- SP — SET POINT
- SS — START / STOP
- VI — VOLTAGE INPUT
- VO — VOLTAGE OUTPUT
- VS — VIBRATION SWITCH
- CS — CURRENT SWITCH
- AR — ADDRESSIBLE RELAY (FIRE ALARM) SHOWN FOR REFERENCE ONLY
- TDR — TIME DELAY RELAY
- MS — MOTOR STARTER
- FA — FIRE ALARM INTERFACE
- VFD — VARIABLE FREQUENCY DRIVE
- ECM — ELECTRONICALLY COMMUTATED MOTOR
- EPS — ELECTRIC TO PNEUMATIC SWITCH
- EPV — ELECTRIC TO PNEUMATIC VALVE
- ROT — ROTATION MONITORING SENSOR
- UMCP — UNIT MANUFACTURER'S CONTROL PANEL
- RLMS — REFRIGERANT LEAK MONITORING SYSTEM
- FACP — FIRE ALARM CONTROL PANEL
- EPB — EMERGENCY PUSH BUTTON
- SW — WALL MOUNTED SWITCH
- OR — OCCUPANCY OVER RIDE SWITCH
- OS — OCCUPANCY SENSOR
- R — REFRIGERANT LEAK MONITORING SYSTEM COMBINATION HORN/STROBE
- HORN OR SIREN
- BELL
- ALT — ALTERNATOR
- R — RELAY
- T-1 — POINT NAME'S INDENIFICATION (CORRESPONDS TO CONTROL ABBREVIATIONS)
- 1 — POINT NAME'S NUMBER (CONSECUTIVELY COUNTED IN RESPECT TO CONTROL ABBREVIATIONS) POINT NUMBER (CONSECUTIVELY COUNTED)

FILTER TYPE DIAGRAMS

- FILTER
- BAG FILTER
- ROLL FILTER

BMS POINT FUNCTION DESCRIPTIONS

HVAC CONTROLS - BMS POINT FUNCTION SCHEDULE

		1 HARDWARE	2 FAIL MODE			3 SOFTWARE														4 ALARM LIMITS		
POINT NAME	TAG	POINT TYPE	FAIL ON (OPEN)	FAIL OFF (CLOSED)	LAST COMMANDED STATE	LOCAL DEFAULT	NETWORK POINT	CALCULATED POINT	MAINTENANCE ALARM	CRITICAL ALARM	24 HOUR OPERATION	PROGRAM START/STOP	OPTIMUM START	MORNING WARM/COOL	UNOCCUPIED SET POINT	DEMAND LIMIT	DIRECT DIGITAL CONTROL	SET POINT ADJUSTMENT	TOTALIZER	RUN TIME	ALARM INSTRUCTIONS	MAINTENANCE WORK ORDER	ALARM LIMITS	SOFTWARE INTERLOCKS	TREND	LOW LIMIT	HIGH LIMIT	NOTES

POINT NAME: UNIQUE MORE DISCRIPTIVE VERSION OF TAG (POINT TAG).

1 HARDWARE

TAG (POINT TAG): UNIQUE SENSOR/DEVICE IDENTIFICATION DESIGNATION.

POINT TYPE: TYPE OF INPUT OR OUTPUT CONNECTED TO A BMS CONTROL PANEL. EACH OF THE 4 TYPES (AI, AO, DI, DO) ARE DISCRIPBED BELOW:

AI (ANALOG INPUT): A SIGNAL INPUT TO THE BUILDING MANAGEMENT SYSTEM WHICH HAS A VARIABLE RANGE OF VALUES. ANALOG INPUTS PROVIDE NUMERIC DATA RATHER THAN SIMPLE "ON/OFF" STATES. EXAMPLES OF ANALOG INPUTS FROM SENSORS INCLUDE TEMPERATURE, PRESSURE, HUMIDITY, AND CHEMICAL CONCENTRATION.

AO (ANALOG OUTPUT): A SIGNAL OUTPUT FROM THE BUILDING MANAGEMENT SYSTEM WHICH HAS A VARIABLE RANGE OF VALUES. ANALOG OUTPUTS PROVIDE PROPORTIONAL CONTROL COMMANDS TO EQUIPMENT. EXAMPLES OF ANALOG OUTPUTS INCLUDE SET POINT ADJUSTMENT AND MOTOR SPEED.

DI (DIGITAL INPUT): A SIGNAL INPUT TO THE BUILDING MANAGEMENT SYSTEM WHICH HAS A BINARY (1 OR 0) VALUE. DIGITAL INPUTS PROVIDE DATA ABOUT THE STATUS OF A SPACE OR EQUIPMENT. EXAMPLES OF DIGITAL INPUTS INCLUDE MOTOR STATUS ("ON/OFF"), VALVE POSITION ("OPEN/CLOSED"), OCCUPANCY ("OCCUPIED/UNOCCUPIED"), OR LIMIT ALARMS SUCH AS HIGH VOLTAGE OR LOW FUEL.

DO (DIGITAL OUTPUT): A SIGNAL OUTPUT FROM THE BUILDING MANAGEMENT SYSTEM WHICH HAS A BINARY (1 OR 0) VALUE. THESE OUTPUTS CONTROL EQUIPMENT WHICH OPERATES IN TWO MAIN STATES (SUCH AS "ON" AND "OFF"). EXAMPLES OF THESE OUTPUTS INCLUDE MOTOR START/STOP AND DAMPER OR VALVE POSITION CONTROL ("OPEN/CLOSE").

2 FAIL MODE

FAIL ON (OPEN): CONTROLLED DEVICE REVERTS TO THE OPEN POSITION OR THE ENGAGED STATE WHEN POWER OR CONTROL SIGNAL IS LOST.

FAIL OFF (CLOSED): CONTROLLED DEVICE REVERTS TO THE CLOSED POSITION OR THE DISENGAGED STATE WHEN POWER OR CONTROL SIGNAL IS LOST.

LAST COMMANDED STATE: CONTROLLED DEVICE REMAINS IN THE SAME POSITION OR STATE, WHEN POWER OR CONTROL SIGNAL IS LOST.

3 SOFTWARE

NETWORK POINT: POINT IS EITHER DIRECTLY OR INDIRECTLY CONNECTED TO THE BMS. IT IS COMMUNICATED TO THE BMS THROUGH A COMMUNICATION GATEWAY FROM ANOTHER INTELLIGENT PIECE OF EQUIPMENT OR PROVIDED BY A COMMUNICATION PROTOCOL (I.E. BACNET, LONWORKS, OR MODBUS).

CALCULATED POINT: A POINT NOT CONNECTED DIRECTLY TO THE BMS, BUT ITS VALUE IS CALCULATED BY THE DDC USING INPUT DATA. DEFINED IN POINT SCHEDULE WHEN SPECIAL CALCULATED VALUES ARE REQUIRED BY SYSTEM DESIGN.

MAINTENANCE ALARM: NOTIFIES PERSONNEL OF REQUIRED MAINTENANCE.

CRITICAL ALARM: ALARM FOR FAILURES WHICH WOULD PROVE PARTICULARLY DAMAGING TO SYSTEMS OR ARCHITECTURE.

24 HOUR OPERATION: SPECIFIES PROCEDURE FOR RUNNING SYSTEM AT ALL HOURS OF DAY AND NIGHT.

PROGRAM START/STOP: BEGINS/ENDS SYSTEM CONTROL PROGRAM.

OPTIMUM START: USES PAST HISTORY TO DETERMINE ENERGY EFFICIENT TIMES TO ACTIVATE EQUIPMENT.

MORNING WARM/COOL: PROCEDURE FOR BRINGING SPACE TO OCCUPIED SET POINTS FROM UNOCCUPIED SET POINTS.

UNOCCUPIED SET POINT: SET POINT WHICH ALLOWS SYSTEM TO SAVE ENERGY BY DRIFTING FROM NORMAL TARGETS WHILE SPACE IS UNOCCUPIED.

DEMAND LIMIT: ELECTRICAL ENERGY CONSERVATION STRATEGY WHICH REDUCES KW DEMAND DURING PEAK UTILITY RATE PERIODS.

DIRECT DIGITAL CONTROL: MICRO PROCESSOR BASED DIGITAL CONTROLLER.

CONTROL POINT ADJUSTMENT: MODIFIES SET POINT.

TOTALIZER: PERFORMS A SUMMATION OF AN ANALOG INPUT.

RUN TIME: MONITORS HOW LONG A DIGITAL INPUT OR 2-STATE DIGITAL OUTPUT HAS REGISTERED A SPECIFIC STATE.

ALARM INSTRUCTIONS: PROVIDES INSTRUCTIONS FOR RESPONSE TO A GIVEN ALARM CONDITION.

MAINTENANCE WORK ORDER: CREATES WORK ORDER FOR USE BY MAINTENANCE PERSONNEL OR CONTRACTOR.

ALARM LIMITS: DETERMINES AT WHAT POINTS THE SYSTEM MUST REACH BEFORE ALARM IS INDICATED.

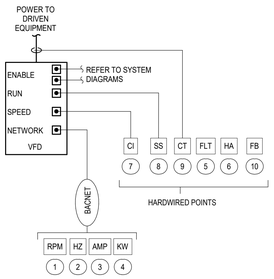
SOFTWARE INTERLOCKS: TRIGGERS AN EVENT TO TAKE PLACE IN THE SYSTEM.

TREND: TRACKS AND DISPLAYS POINT VALUES (ANALOG OR DIGITAL) OVER TIME.

4 ALARM LIMITS

LOW LIMIT: USER DEFINED MINIMUM VALUE BEFORE ALARMING.

HIGH LIMIT: USER DEFINED MAXIMUM .



VFD NOTES

A. UNLESS OTHERWISE NOTED, THIS DIAGRAM SHALL APPLY TO VFDs ON THE ENTIRE PROJECT SERVING PUMPS AND FANS WITH THE EXCEPTION OF VFDs THAT ARE INTEGRAL TO A PIECE OF EQUIPMENT SUCH AS A CHILLER COMPRESSOR VARIABLE SPEED DRIVE
B. PROVIDE INTEGRATION VIA BACNET IP. INTEGRATION VIA BACNET MS/TP SHALL ONLY BE ACCEPTABLE IF BACNET IP IS NOT AN OPTION FOR THE SELECTED VFD MANUFACTURER.
C. ALL VFDs ON THE ENTIRE PROJECT SHALL BE PROVIDED BY A SINGLE MANUFACTURER UNLESS OTHERWISE INDICATED.
D. REFER TO SPECIFIC DIAGRAMS FOR SAFETY AND RUN-ONLY REQUIREMENTS FOR EACH VFD.
E. PROVIDE A CURRENT TRANSDUCER TO MEASURE ACTUAL AMPERAGE (POINT 7). CREATE AND MAP A DIGITAL POINT TO THE INPUT OF THE CT FOR USE IN PROVEON/PROVE-OFF ALARM LOGIC. I.E. IF AMERAGE GREATER THAN x, THE DIGITAL POINT SHALL READ: ON = TRUE, AND VICE VERSA IF AMERAGE IS LESS THAN x. THE AMPERAGE VALUE "x" SHALL BE USER ADJUSTABLE AND DETERMINED DURING THE TESTING AND BALANCING PROCESS IN CONJUNCTION WITH THE DETERMINATION OF THE MINIMUM VFD SPEED. THE VALUE "x" SHALL BE SET TO A VALUE BELOW THE MEASURED AMPERAGE AT THE MINIMUM VFD SPEED. REFER TO TAB SPECIFICATION FOR ADDITIONAL INFORMATION.
F. HAND-OFF-AUTO (HOA) OPERATION
   1. PROVIDE HOA SETTINGS AS PART OF THE VARIABLE FREQUENCY DRIVE (VFD) THROUGH THE DRIVES KEYPAD FOR THE SUPPLY FAN.
   2. WHEN IN HAND MODE, THE MOTOR CONTROLLED BY THE VFD WILL START.
   3. WHEN IN OFF MODE, THE MOTOR CONTROLLED BY THE VFD WILL BE OFF.
   4. WHEN IN AUTO MODE, THE MOTOR CONTROLLED BY THE VFD WILL BE STARTED AND STOPPED THROUGH THE BAS.
   5. UPON ACTIVATION, SAFTIES WILL STOP THE MOTOR IN AUTO OR HAND MODES.
G. LOCAL-REMOTE SPEED CONTROL
   1. LOCAL-REMOTE SETTINGS WILL BE PROVIDED AS PART OF THE VFD THROUGH THE DRIVES KEYPAD.
   2. IN LOCAL MODE THE MOTOR SPEED WILL BE CONTROLLED THROUGH A MANUAL SPEED CONTROL LOCATED AT THE DRIVES CONTROL PANEL.
   3. IN REMOTE MODE, THE MOTOR SPEED WILL BE CONTROLLED BY THE BAS.

HVAC CONTROLS - BMS POINT FUNCTION SCHEDULE - GENERAL

				FAIL MODE				SOFTWARE			ALARM LIMITS		
	POINT NAME	TAG	HARDWARE POINT TYPE	FAIL ON (OPEN)	FAIL OFF (CLOSED)	LAST COMMANDED STATE	LOCAL DEFAULT	NETWORK POINT	CALCULATED POINT	ALARM LIMITS	LOW LIMIT	HIGH LIMIT	NOTES
VFD													
1	MOTOR SPEED (RPM)	RPM	AI					■					
2	OUTPUT FREQUENCY (HZ)	HZ	AI					■					
3	OUTPUT CURRENT (AMPS)	AMP	AI					■					
4	OUTPUT POWER (KW)	KW	AI					■					
5	FAULT ALARM	FLT	DI										
6	HAND MODE STATUS	HA	DI										
7	SPEED CONTROL	CI	AO		■								
8	START/STOP	SS	DO		■								
9	RUN STATUS	CT	AI										
10	FEEDBACK	FB	AI										

GENERAL NOTES:

1. ALL SETPOINTS SHOWN ON THE DIAGRAMS OR DESCRIBED IN THE SEQUENCE OF OPERATIONS SHALL BE OPERATOR ADJUSTABLE THROUGH THE BMS AT THE OWS. THIS APPLIES TO ALL CONTROLS SHEETS.
2. FOR ALL DAMPER AND VALVE ACTUATORS OF WHICH THEIR POSITION IS USED IN SEQUENCES OF OPERATION: PROVIDE ACTUATOR WITH POSITION FEEDBACK ANALOG INPUT POINT. SUBSTITUTION WITH VOLTAGE OUTPUTS TO APPROXIMATE DAMPER VALVE POSITION IS NOT ACCEPTABLE.
3. BAS: ALL RELEVANT POINTS SHALL BE CONFIGURED APPROPRIATELY TO BE LOGGED INTO EXISTING BAS LOGGING ROUTINE.
4. THE BMS SHALL NOT ALLOW OVERLAPPING HEATING AND COOLING TEMPERATURE SETPOINTS FOR A GIVEN ZONE.

SEQUENCES OF OPERATION

A. GENERAL
   1. UNLESS OTHERWISE INDICATED, CONTROL LOOPS SHALL BE ENABLED AND DISABLED BASED ON THE STATUS OF THE SYSTEM BEING CONTROLLED TO PREVENT WIND-UP.
   2. WHEN A CONTROL LOOP IS ENABLED, IT AND ALL ITS CONSTITUENTS (SUCH AS THE PROPORTIONAL AND INTEGRAL TERMS) SHALL BE SET TO A NEUTRAL VALUE.
   3. A CONTROL LOOP IN NEUTRAL SHALL CORRESPOND TO A CONDITION WHICH APPLIES THE MINIMUM CONTROL EFFECT, I.E. VALVES/DAMPERS CLOSED, VFDS AT MINIMUM SPEED, ETC.
   4. THE TERM "PROVEN" (I.E. "PROVEN ON" / "PROVEN OFF") SHALL MEAN THAT THE EQUIPMENT'S DI STATUS POINT MATCHES THE STATE SET BY THE EQUIPMENT'S DO COMMAND POINT.
   5. THE TERM "CONTROL LOOP" OR "LOOP" IS USED GENERICALLY FOR ALL CONTROL LOOPS. THESE WILL TYPICALLY BE PID LOOPS, BUT PROPORTIONAL PLUS INTEGRAL PLUS DERIVATIVE GAINS ARE NOT REQUIRED ON ALL LOOPS. UNLESS SPECIFICALLY INDICATED OTHERWISE, THE FOLLOWING GUIDELINES SHALL BE FOLLOWED:
      a. USE PROPORTIONAL ONLY (P-ONLY) LOOPS FOR LIMITING LOOPS.
      b. DO NOT USE THE DERIVATIVE TERM ON ANY LOOPS UNLESS FIELD TUNING IS NOT POSSIBLE WITHOUT IT.
   6. TO AVOID ABRUPT CHANGES IN EQUIPMENT OPERATION, THE OUTPUT OF EVERY CONTROL LOOP SHALL BE LIMITED TO A MAXIMUM RATE OF CHANGE OF 25% PER MINUTE UNLESS OTHERWISE NOTED.
   7. ALL SETPOINTS, TIMERS, DEADBANDS, PID GAINS, ETC. LISTED IN SEQUENCES SHALL BE CAPABLE OF BEING ADJUSTED BY THE OPERATOR THROUGH THE NORMAL BAS USER INTERFACE WHETHER INDICATED AS ADJUSTABLE IN SEQUENCES OR NOT. SOFTWARE (VIRTUAL) POINTS SHALL BE USED FOR THESE VARIABLES. FIXED SCALAR NUMBERS SHALL NOT BE EMBEDDED IN PROGRAMS EXCEPT FOR PHYSICAL CONSTANTS (E.G. CONVERSION FACTORS).
   8. VALUES FOR ALL POINTS, INCLUDING REAL (HARDWARE) POINTS USED IN CONTROL SEQUENCES SHALL BE CAPABLE OF BEING OVERRIDDEN BY THE USER (E.G. FOR TESTING AND COMMISSIONING). IF HARDWARE DESIGN PREVENTS THIS FOR HARDWARE POINTS, THEY SHALL BE EQUATED TO A SOFTWARE POINT AND THE SOFTWARE POINT SHALL BE USED IN ALL SEQUENCES. EXCEPTION: NOT REQUIRED FOR ALL ASC HARDWARE POINTS.
   9. VFD MINIMUM SPEED SETPOINTS:
      a. MINIMUM SPEED SETPOINTS FOR ALL VFD-DRIVEN EQUIPMENT SHALL BE DETERMINED IN ACCORDANCE WITHTHE TEST AND BALANCE SPECIFICATIONS.
      b. FOR EACH PIECE OF EQUIPMENT, THE MINIMUM SPEED SHALL BE STORED IN A SINGLE SOFTWARE POINT. THIS VALUE SHALL BE MAPPED TO THE VFD'S MINIMUM SPEED SETPOINT VIA THE DRIVE'S NETWORK INTERFACE; IN THE CASE OF A HARD-WIRED VFD INTERFACE, THE MINIMUM SPEED SHALL BE THE LOWEST SPEED COMMAND SENT TO THE DRIVE BY THE EMCS.
      c. THE MINIMUM SPEED SETPOINT SHALL BE STORED AS A POSITIVE PERCENTAGE OF FULL RANGE. I.E. 0% SPEED SHALL CORRESPOND TO FULLY STOPPED EQUIPMENT, AND THE MINIMUM SPEED SHALL BE A VALUE GREATER THAN 0%.

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SHEET TITLE
MECHANICAL CONTROLS - LEGEND

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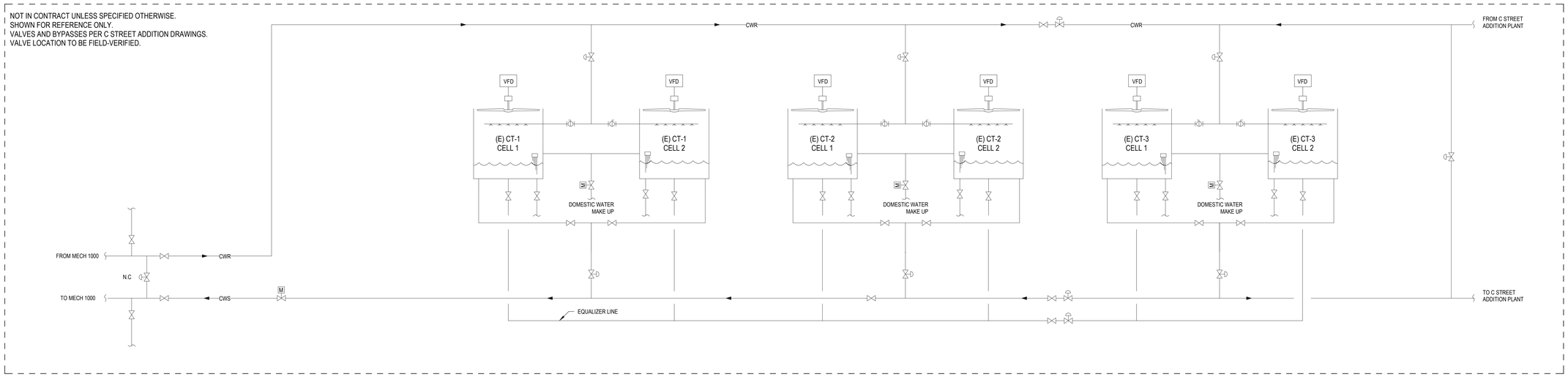
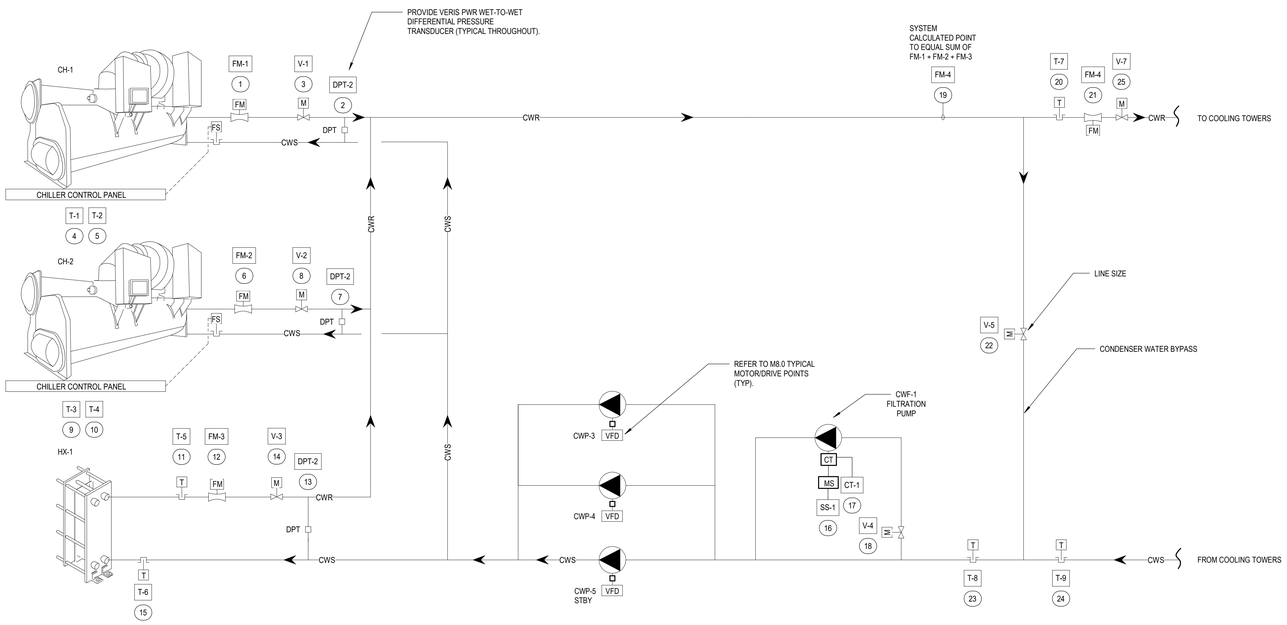


1 MECHANICAL CONTROLS - PENTHOUSE CONDENSER WATER DIAGRAM
SCALE: NONE



2 CONDENSER WATER SYSTEM B1 LEVEL - CONTROL DIAGRAM
SCALE: NONE

HVAC CONTROLS - BMS POINT FUNCTION SCHEDULE (CONDENSER WATER SYSTEM)

	POINT NAME	POINT TYPE	TAG	HARDWARE				SOFTWARE						NOTES
				FAIL MODE								ALARM LIMITS		
				FAIL ON (OPEN)	FAIL OFF (CLOSED)	LAST COMMANDED STATE	LOCAL DEFAULT	NETWORK POINT	CALCULATED POINT	ALARM LIMITS	TREND	LOW LIMIT	HIGH LIMIT	
1. CH-1														
1	CH-1 CWS FLOW	AI	FM-1							■	■			
2	CH-1 CW DIFFERENTIAL PRESSURE	AI	DPT-2							■	■			
3	CH-1 VALVE CONTROL	AO	V-1			■								
4	CWS TEMPERATURE	AI	T-1							■	■			
5	CWR TEMPERATURE	AI	T-2							■	■			
2. CH-2														
6	CH-2 CWS FLOW	AI	FM-2							■	■			
7	CH-2 CW DIFFERENTIAL PRESSURE	AI	DPT-2							■	■			
8	CH-2 VALVE CONTROL	AO	V-2			■								
9	CWS TEMPERATURE	AI	T-3							■	■			
10	CWR TEMPERATURE	AI	T-4							■	■			
3. HX-1														
11	CWR TEMPERATURE	AI	T-5							■	■			
12	HX-1 FLOW METER	AI	FM-3							■	■			
13	HX-1 CW DIFFERENTIAL PRESSURE	AI	DPT-2							■	■			
14	HX-1 VALVE CONTROL	AO	V-3			■								
15	CWS TEMPERATURE	AI	T-6							■	■			
4. FILTRATION SYSTEM														
16	CWF-1 START/STOP	DO	SS-1							■	■			
17	CWF-1 STATUS	AI	CT-1							■	■			
18	CWF-1 BYPASS VALVE CONTROL	DO	V-4			■								
5.CW SYSTEM														
19	SYSTEM-CALCULATED FLOW SUM	AI	FM-4							■	■			
20	CWR TEMPERATURE TO TOWERS	AI	T-7							■	■			
21	CWR FLOW METER	AI	FM-4							■	■			
22	CW BYPASS (2) 2-WAY VALVES CONTROL	AO	V-5			■								
23	CWS TEMPERATURE TO CHILLERS	AI	T-8							■	■			
24	CWS TEMPERATURE FROM TOWERS	AI	T-9							■	■			
25	CW RETURN MAIN CONTROL VALVE	AO	V-7			■								

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KEYPLAN

NORTH

SHEET TITLE
MECHANICAL CONTROLS - CONDENSER WATER SYSTEM

PROJECT NUMBER
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SHEET NUMBER
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Author

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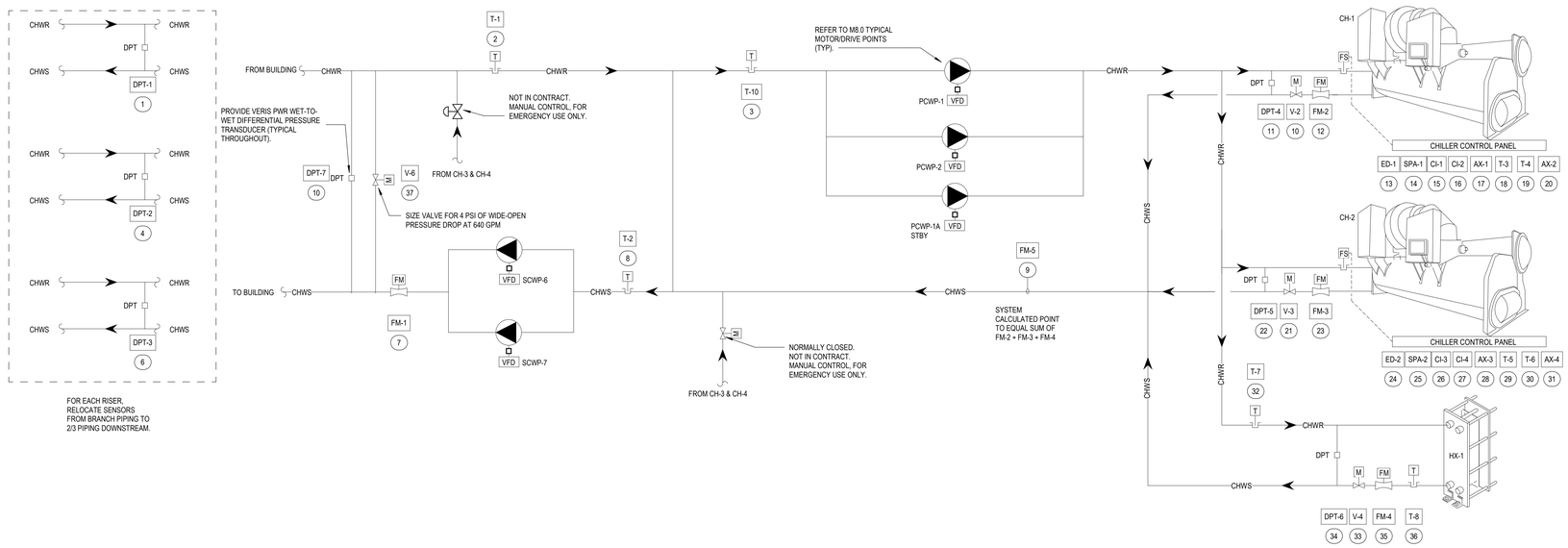

1 MECHANICAL CONTROLS - CHILLED WATER SYSTEM
SCALE: NOT TO SCALE

HVAC CONTROLS - BMS POINT FUNCTION SCHEDULE (CHILLED WATER SYSTEM)

	POINT NAME	POINT TYPE	TAG	HARDWARE: FAIL MODE: FAIL ON (OPEN)	HARDWARE: FAIL MODE: FAIL OFF (CLOSED)	HARDWARE: FAIL MODE: LAST COMMANDED STATE	HARDWARE: FAIL MODE: LOCAL DEFAULT	SOFTWARE: NETWORK POINT	SOFTWARE: CALCULATED POINT	SOFTWARE: ALARM LIMITS	SOFTWARE: TREND	SOFTWARE: ALARM LIMITS: LOW LIMIT	SOFTWARE: ALARM LIMITS: HIGH LIMIT	NOTES
1. CHILLED WATER COMMON														
1	CHWS DIFFERENTIAL PRESSURE	AI	DPT-1						■	■				LOCATE IN EAST PENTHOUSE
2	CHWR TEMPERATURE	AI	T-1						■	■				
3	CHWR TEMPERATURE	AI	T-10						■	■				
4	CHWS DIFFERENTIAL PRESSURE	AI	DPT-2						■	■				LOCATE IN WEST PENTHOUSE
5	BYPASS CONTROL VALVE	AO	V-1			■								
6	CHWS DIFFERENTIAL PRESSURE	AI	DPT-3						■	■				LOCATE IN NORTH GARAGE MECHANICAL ROOM
7	SCHWS FLOW	AI	FM-1						■	■				
8	CHWS TEMPERATURE	AI	T-2						■	■				
9	SYSTEM-CALCULATED FLOW SUM	AI	FM-5						■	■				
10	SYSTEM DIFFERENTIAL PRESSURE	AI	DPT-7						■	■				
37	SECONDARY CHILLED WATER BYPASS VALVE CONTROL	AO	V-6			■								
2. CH-1														
10	CH-1 VALVE CONTROL	AO	V-2			■								
11	CH-1 CHW DIFFERENTIAL PRESSURE	AI	DPT-4						■	■				
12	CH-1 FLOW	AI	FM-2						■	■				
13	CHILLER ENABLE/DISABLE	DO	ED-1						■	■				NETWORK POINTS
14	CHILLER SET POINT ADJUSTMENT	AO	SPA-1						■	■				NETWORK POINTS
15	CHILLER LOADING	AO	CI-1						■	■				NETWORK POINTS
16	CHILLER POWER CONSUMPTION	AO	CI-2						■	■				NETWORK POINTS
17	CHILLER STATUS	DI	AX-1						■	■				NETWORK POINTS
18	CHWS TEMPERATURE	AI	T-3						■	■				NETWORK POINTS
19	CHWR TEMPERATURE	AI	T-4						■	■				NETWORK POINTS
20	CHILLER REFRIGERANT PRESSURE	AI	AX-2						■	■				NETWORK POINTS
3. CH-2														
21	CH-2 VALVE CONTROL	AO	V-3			■								
22	CH-2 CHW DIFFERENTIAL PRESSURE	AI	DPT-5						■	■				
23	CH-2 FLOW	AI	FM-3						■	■				
24	CHILLER ENABLE/DISABLE	DO	ED-2						■	■				NETWORK POINTS
25	CHILLER SET POINT ADJUSTMENT	AO	SPA-2						■	■				NETWORK POINTS
26	CHILLER LOADING	AO	CI-3						■	■				NETWORK POINTS
27	CHILLER POWER CONSUMPTION	AO	CI-4						■	■				NETWORK POINTS
28	CHILLER STATUS	DI	AX-3						■	■				NETWORK POINTS
29	CHWS TEMPERATURE	AI	T-5						■	■				NETWORK POINTS
30	CHWR TEMPERATURE	AI	T-6						■	■				NETWORK POINTS
31	CHILLER REFRIGERANT PRESSURE	DI	AX-4						■	■				NETWORK POINTS
4. HX-1														
32	CHWR TEMPERATURE	AI	T-7						■	■				
33	HX-1 VALVE CONTROL	AO	V-4			■								
34	HX-1 CHW DIFFERENTIAL PRESSURE	AI	DPT-6						■	■				
35	HX-1 FLOW	AI	FM-4						■	■				
36	CHWS TEMPERATURE	AI	T-8						■	■				

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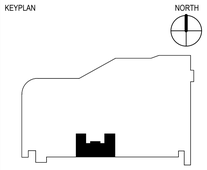

SHEET TITLE
MECHANICAL CONTROLS - CHILLED WATER SYSTEM

PROJECT NUMBER
CD

SHEET NUMBER
M8.2

Author

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CHILLED WATER SYSTEM SEQUENCE OF OPERATIONS

GENERAL

1. THE CHILLED AND CONDENSER WATER SYSTEMS SHALL CONSIST OF THE FOLLOWING:
A. TWO 900 TON CHILLERS (CH-1,2)
B. THREE 1600GPM PRIMARY CHILLED WATER PUMPS (PCWP-1, 1A, 2), TWO 3200GPM SECONDARY CHILLED WATER PUMP (SCWP-6, 7).
C. THREE 2700 GPM CONDENSER WATER PUMPS (CWP-3,4,5)
2. THE CHILLED WATER SYSTEM IS PRIMARY SECONDARY FLOW SYSTEM.
3. THE CONDENSER WATER SYSTEM IS A VARIABLE FLOW SYSTEM.
4. THE CHILLED WATER SYSTEM SHALL BE AUTOMATICALLY ENABLED AND DISABLED BY BMS TIME SCHEDULE.
5. MAINTENANCE PERSONNEL SHALL HAVE THE ABILITY, THROUGH THE BMS, TO SELECT WHICH EQUIPMENT SHALL START FIRST, SECOND, ETC.
A. IT SHALL BE POSSIBLE TO OPERATE ANY CHILLER WITH ANY PRIMARY CHILLED WATER PUMP.
B. IT SHALL BE POSSIBLE TO OPERATE ANY CHILLER WITH ANY SECONDARY CHILLED WATER PUMP.
C. IT SHALL BE POSSIBLE TO OPERATE ANY CHILLER WITH ANY COMBINATION OF CONDENSER WATER PUMPS AND COOLING TOWERS.
6. IN BYPASSES WHERE THERE IS BOTH A FLOW METER AND DIFFERENTIAL PRESSURE SENSOR ADJACENT TO EACH OTHER, THE FLOW METER WILL SERVE AS THE PRIMARY SENSOR OF FEEDBACK TO THE BAS AND DP IS THE SECONDARY. IF THE FLOW METER WERE TO FAIL, THE DIFFERENTIAL PRESSURE WILL SERVE AS THE MEANS OF FEEDBACK TO THE BAS.
7. THE SYSTEM HAS THREE DIFFERENT MODES OF OPERATION SEQUENTIALLY: MECHANICAL MODE, AIR SIDE ECONOMIZER, AND WATER SIDE ECONOMIZER. THE MODES ARE ADJUSTED AUTOMATICALLY ADJUSTED BASED ON OUTSIDE AIR TEMPERATURE.
A. THE MECHANICAL MODE IS ENABLED WHEN THE OUTSIDE AIR TEMPERATURE IS ABOVE 55 DEGREES (ADJ.) AND DISABLED WHEN THE OAT TEMPERATURE REACHES 53 DEGREES (ADJ). THE CHILLERS, PRIMARY CHILLED WATER PUMPS, SECONDARY CHILLED WATER PUMPS AND CONDENSER WATER PUMPS WILL BE ENABLED IN THIS MODE. HX-C WILL BE DISABLED.
B. THE AIR SIDE ECONOMIZER MODE IS ENABLED AT 55 DEGREES (ADJ) FROM MECHANICAL MODE AND 40 DEGREES (ADJ) FROM WATER SIDE ECONOMIZER MODE. THE AIR SIDE ECONOMIZER WILL DISABLE AT 55 DEGREES (ADJ) GOING INTO MECHANCIAL MODE AND 40 DEGREES (ADJ) GOING INTO WATER SIDE ECONOMIZER MODE. THE CHILLERS, PRIMARY CHILLED WATER PUMPS, SECONDARY CHILLED WATER PUMPS, HX, AND CONDENSER WATER PUMPS WILL BE DISABLED IN THIS MODE. THE AIR SIDE ECONOMIZER MODE IS EXISTING TO REMAIN, NOT IN CONTRACT, AND FOR REFERENCE ONLY.
C. THE WATER SIDE ECONOMIZER MODE WILL BE ENABLED AT 40 DEGREES WET BULB (ADJ) AND BELOW. THIS MODE WILL DISABLE WHEN OAT IS ABOVE 40 DEGREES (ADJ.). THE CHILLERS WILL BE DISABELED. PRIMARY CHILLED WATER PUMPS, SECONDARY CHILLED WATER PUMPS, CONDENSER WATER PUMPS AND HX WILL BE ENABLED IN THIS MODE.

STAGING:

1. THE BMS WILL STAGE CHILLER OPERATION BY ASSIGNING SEQUENCE CLASSIFICATIONS TO THE CHILLERS IN THE FOLLOWING MANNER:
A. "FIRST STAGE" CHILLER: THIS CHILLER IS THE FIRST TO LOAD AS DESCRIBED IN "CHILLER LOADING".
B. "SECOND STAGE" CHILLER: THIS CHILLER IS THE SECOND TO LOAD AS DESCRIBED IN "CHILLER LOADING".
C. "FAILED/MAINTENANCE" CHILLER: ANY CHILLER THAT EXPERIENCES A FAILURE WILL BE ASSIGNED THIS SEQUENCE CLASSIFICATION BY THE BMS.
2. THE BMS WILL STAGE CHILLED WATER PUMP OPERATION BY ASSIGNING SEQUENCE CLASSIFICATIONS TO THE PUMPS IN THE FOLLOWING MANNER:
A. "FIRST STAGE" PUMP: THIS PUMP IS THE FIRST TO LOAD AS DESCRIBED IN "CHILLER LOADING".
B. "SECOND STAGE" PUMP: THIS PUMP IS THE SECOND TO LOAD AS DESCRIBED IN "CHILLER LOADING".
C. "STANDBY" PUMP: THIS PUMP IS TO REMAIN IDLE DURING CHILLED WATER SYSTEM OPERATION. UPON FAILURE OF ANOTHER PUMP, THE BMS WILL AUTOMATICALLY REPLACE THE FAILED PUMP IN THE LOADING SEQUENCE WITH THE STANDBY PUMP.
D. "FAILED/MAINTENANCE" PUMP: ANY PUMP THAT EXPERIENCES A FAILURE WILL BE ASSIGNED THIS SEQUENCE CLASSIFICATION BY THE BMS.
3. THE BMS WILL STAGE CONDENSER WATER PUMP OPERATION BY ASSIGNING SEQUENCE CLASSIFICATIONS TO THE PUMPS IN THE FOLLOWING MANNER
A. "FIRST STAGE" PUMP: THIS PUMP IS THE FIRST TO LOAD AS DESCRIBED IN "CHILLER LOADING".
B. "SECOND STAGE" PUMP: THIS PUMP IS THE SECOND TO LOAD AS DESCRIBED IN "CHILLER LOADING"
C. "STANDBY" PUMP: THIS PUMP IS TO REMAIN IDLE DURING CHILLED WATER SYSTEM OPERATION. UPON FAILURE OF ANOTHER PUMP, THE BMS WILL AUTOMATICALLY REPLACE THE FAILED PUMP IN THE LOADING SEQUENCE WITH THE STANDBY PUMP.
D. "FAILED/MAINTENANCE" PUMP: ANY PUMP THAT EXPERIENCES A FAILURE WILL BE ASSIGNED THIS SEQUENCE CLASSIFICATION BY THE BMS.
4. THE BMS SHALL PROVIDE A TIME DELAY PREVENTING THE START/STOP OF ANOTHER CHILLER FOR AN ADJUSTABLE TIME PERIOD AFTER A CHILLER HAS BEEN STAGED ON/OFF. THE TIME DELAY SHALL BE INITIALLY SET AT 10 MINUTES TO PREVENT RAPID CYCLING. ADJUST THE TIMING TO PROVIDE A STABLE, YET RESPONSIVE OPERATIONAL SYSTEM. THE TIME DELAY SHALL NOT PREVENT THE IMMEDIATE START OF EQUIPMENT IN RESPONSE TO AN EQUIPMENT FAILURE.
5. STAGES FOR CHILLERS, CHILLED WATER PUMPS, COOLING TOWERS, AND CONDENSER WATER PUMPS WILL BE ROTATED ON A WEEKLY BASIS (ADJ), ACCORDING TO RUN TIME.

CHILLER LOADING (CH-1, 2) - ONE CHILLER OPERATION:

1. ONE CHILLER OPERATION: UPON A DEMAND FOR CHILLED WATER, THE BMS SHALL LOAD THE "FIRST STAGE" CHILLER IN THE FOLLOWING MANNER:
A. CHECK THAT THE CHILLER HAS BEEN OFF FOR THE LENGTH OF TIME REQUIRED BY MANUFACTURER BEFORE STARTING. IF NOT, WAIT UNTIL OFF-TIME LIMIT HAS EXPIRED.
B. OPEN THE CHILLED WATER AND CONDENSER WATER ISOLATION VALVES AT THE "FIRST STAGE" CHILLER AND THE CONDENSER WATER ISOLATION VALVE AT THE "FIRST STAGE" COOLING TOWER. WAIT FOR THE AMOUNT OF TIME REQUIRED FOR THE VALVES TO FULLY OPEN. CONTROL THE OPERATING COOLING TOWERS AS DESCRIBED IN THE SEQUENCE SECTIONS "COOLING TOWER CONTROL".
C. START THE "FIRST STAGE" CHILLED WATER PUMP AND THE "FIRST STAGE" CONDENSER WATER PUMP. CONTROL THE OPERATING PUMPS AS DESCRIBED IN SEQUENCE SECTIONS "PRIMARY CHILLED WATER PUMP CONTROL" AND "PRIMARY CONDENSER WATER PUMP CONTROL".
D. AFTER 15 SECONDS, CHECK TO SEE THAT THE PUMP STATUS SHOWS THE "FIRST STAGE" CHILLED WATER PUMP AND "FIRST STAGE" CONDENSER WATER PUMP ARE OPERATING.
E. THE BMS SHALL CHECK FOR MINIMUM FLOWRATES THROUGH THE "FIRST STAGE" CHILLER CONDENSER AND EVAPORATOR AS SEEN BY THE ASSOCIATED FLOW METERS. THE "FIRST STAGE" CHILLER CONTROL PANEL WILL CHECK FOR MINIMUM FLOWRATES THROUGH THE INTERLOCKED FACTORY PROVIDED, FIELD INSTALLED FLOW SWITCHES. THE CHILLER SHALL NOT START UNLESS BOTH THE FLOW METERS AND THE FLOW SWITCHES SHOW THAT MINIMUM FLOW IS ACHIEVED. MINIMUM FLOWRATE AT THE COOLING TOWER WILL ALSO BE CONFIRMED BEFORE THE CHILLER IS ALLOWED TO START.
a. IF NO FLOW IS REGISTERED ON THE EVAPORATOR SIDE 30 SECONDS (ADJUSTABLE) AFTER CHILLED WATER PUMP STATUS IS PROVEN, THE ASSOCIATED CHILLER'S CHILLED WATER ISOLATION VALVE WILL BE FAILED. FAILURE OF AN ISOLATION VALVE WILL FAIL THE ENTIRE CHILLER.
b. IF NO FLOW IS REGISTERED ON THE CONDENSER SIDE 30 SECONDS (ADJUSTABLE) AFTER CONDENSER WATER PUMP STATUS IS PROVEN, THE ASSOCIATED CHILLER'S CONDENSER WATER ISOLATION VALVE WILL BE FAILED. FAILURE OF AN ISOLATION VALVE WILL FAIL THE ENTIRE CHILLER.
c. IF NO FLOW IS REGISTERED AT THE COOLING TOWER 30 SECONDS (ADJUSTABLE) AFTER CONDENSER WATER PUMP STATUS IS PROVEN, THE ASSOCIATED COOLING TOWER WILL BE FAILED.
d. IF FAILURE IS SEEN IN ANY EQUIPMENT OR MINIMUM FLOW IS NOT ACHIEVED, GENERATE AN ALARM, AND MOVE ON TO NEXT ASSOCIATED UNIT IN THE RESPECTIVE SEQUENCE.
F. THE BMS WILL ENABLE THE "FIRST STAGE" CHILLER TO MAINTAIN CHILLED WATER SUPPLY SETPOINT.

CHILLER LOADING (CH-1, 2) - TWO CHILLER OPERATION:

1. CHILLERS ARE STAGED BASED ON SECONDARY CHILLED WATER SYSTEM FLOW RATE. WHEN THE SYSTEM IS ENABLED, THE FIRST STAGE CHILLER SHALL OPERATE. WHEN THE SECONDARY SYSTEM FLOW RATE EXCEEDS 1500 GPM (ADJ) FOR MORE THAN 15 MINUTES (ADJ), A STAGE UP EVENT SHALL OCCUR, AND THE SECOND STAGE CHILLER SHALL BE INITIATED AS DESCRIBED BELOW. IF THE SECOND STAGE CHILLER IS OPERATING, AND THE SECONDARY CHILLED WATER SYSTEM FLOW RATE FALLS BELOW 1800 GPM (ADJ) FOR MORE THAN 15 MINUTES (ADJ), A STAGE DOWN EVENT SHALL OCCUR. THE SYSTEM SHALL PROHIBIT A NEW STAGE UP/DOWN TRANSITION FOR 20 MINUTES (ADJ) AFTER A STAGE UP OR STAGE DOWN TRANSITION. THIS ALLOWS STEADY STATE TO BE ACHIEVED AND ENSURES A MINIMUM ON AND OFF TIME BEFORE CHANGING STAGES.
A. THE SECONDARY CHILLED WATER PUMP STAGING AND SPEED CONTROL LOGIC SHALL BE INDEPENDENT OF THE PRIMARY SYSTEM STAGING SEQUENCE DESCRIBED BELOW.
2. WHENEVER THERE IS A STAGE-UP COMMAND:
A. THE BMS SHALL CHECK FOR MINIMUM FLOWRATES THROUGH THE "FIRST STAGE" CHILLER CONDENSER AND EVAPORATOR AS SEEN BY THE ASSOCIATED FLOW METERS. THE "FIRST STAGE" CHILLER CONTROL PANEL WILL CHECK FOR MINIMUM FLOWRATES THROUGH THE INTERLOCKED FACTORY PROVIDED, FIELD INSTALLED FLOW SWITCHES. THE CHILLER SHALL NOT START UNLESS BOTH THE FLOW METERS AND THE FLOW SWITCHES SHOW THAT MINIMUM FLOW IS ACHIEVED. MINIMUM FLOWRATE AT THE COOLING TOWER WILL ALSO BE CONFIRMED BEFORE THE CHILLER IS ALLOWED TO START.
a. IF NO FLOW IS REGISTERED ON THE EVAPORATOR SIDE 30 SECONDS (ADJUSTABLE) AFTER CHILLED WATER PUMP STATUS IS PROVEN, THE ASSOCIATED CHILLER'S CHILLED WATER ISOLATION VALVE WILL BE FAILED. FAILURE OF AN ISOLATION VALVE WILL FAIL THE ENTIRE CHILLER.
b. IF NO FLOW IS REGISTERED ON THE CONDENSER SIDE 30 SECONDS (ADJUSTABLE) AFTER CONDENSER WATER PUMP STATUS IS PROVEN, THE ASSOCIATED CHILLER'S CONDENSER WATER ISOLATION VALVE WILL BE FAILED. FAILURE OF AN ISOLATION VALVE WILL FAIL THE ENTIRE CHILLER.
c. IF NO FLOW IS REGISTERED AT THE COOLING TOWER 30 SECONDS (ADJUSTABLE) AFTER CONDENSER WATER PUMP STATUS IS PROVEN, THE ASSOCIATED COOLING TOWER WILL BE FAILED.
B. IF FAILURE IS SEEN IN ANY EQUIPMENT OR MINIMUM FLOW IS NOT ACHIEVED, GENERATE AN ALARM, AND MOVE ON TO NEXT ASSOCIATED UNIT IN THE RESPECTIVE SEQUENCE
C. LOCK THE FIRST STAGE CHW PUMP AND CW PUMP SPEED AT THEIR CURRENT SETTING.
D. COMMAND OPERATING CHILLERS TO REDUCE DEMAND TO 50% OF THEIR CURRENT LOAD. WAIT UNTIL ACTUAL DEMAND <55% UP TO A MAXIMUM OF 5 MINUTES BEFORE PROCEEDING.
E. START THE NEXT CW PUMP AND SLOWLY OPEN CW ISOLATION VALVE OF THE CHILLER THAT IS TO BE STARTED. THE PURPOSE OF OPENING SLOWLY IS TO PREVENT SUDDEN DISRUPTION TO FLOW THROUGH ACTIVE CHILLER. VALVE TIMING AND PUMP RAMP UP TIMING TO BE DETERMINED IN THE FIELD AS THAT REQUIRED TO PREVENT NUISANCE TRIPS AND MINIMUM FLUCTUATION OF FLOW THROUGH THE FIRST STAGE CHILLER.
F. START THE NEXT CHW PUMP AND SLOWLY OPEN CHW ISOLATION VALVE OF THE CHILLER THAT IS TO BE STARTED. THE PURPOSE OF OPENING SLOWLY IS TO PREVENT SUDDEN DISRUPTION TO FLOW THROUGH ACTIVE CHILLER. VALVE TIMING AND PUMP RAMP UP TIMING TO BE DETERMINED IN THE FIELD AS THAT REQUIRED TO PREVENT NUISANCE TRIPS AND MINIMUM FLUCTUATION OF FLOW THROUGH THE FIRST STAGE CHILLER.
G. RAMP UP THE SECOND STAGE CHW AND CW PUMPS UNTIL THEIR SPEED IS EQUAL TO THEIR ASSOCIATED FIRST STAGE PUMPS.
H. START THE NEXT STAGE CHILLER AFTER CHW ISOLATION VALVE IS FULL OPEN OR A MINIMUM TIME DELAY AS RECOMMENDED BY THE CHILLER MANUFACTURER, WHICHEVER IS MORE. THE FINAL TIME DELAY TO BE DETERMINED IN THE FIELD AS THAT REQUIRED TO PREVENT NUISANCE TRIPS.
I. RELEASE THE CHILLED WATER AND CONDENSER WATER PUMP SPEEDS. AND MODULATE THE FIRST AND SECOND STAGE PUMPS IN UNISON TO MAINTAIN THE SYSTEM FLOW RATE SETPOINT.
J. RELEASE THE FIRST STAGE CHILLER DEMAND LIMIT.
3. WHENEVER THERE IS A STAGE-DOWN COMMAND:
A. LOCK THE FIRST STAGE CHW PUMP AND CW PUMP SPEED AT THEIR CURRENT SETTING.
B. SHUT-OFF LAST STAGE CHILLER.
C. WHEN THE CONTROLLER OF THE CHILLER BEING SHUT OFF INDICATES NO REQUEST FOR CHILLED-WATER FLOW, RAMP DOWN AND TURN OFF THE SECOND STAGE CHW PUMP, AND SLOWLY CLOSE THE CHILLER'S CHW ISOLATION VALVE. VALVE TIMING AND PUMP RAMP DOWN SPEED AND SHUTOFF TIMING TO BE DETERMINED IN THE FIELD AS REQUIRED TO PREVENT NUISANCE TRIPS AND AVOID SUDDEN CHANGE IN FLOW THROUGH THE OTHER OPERATING CHILLER.
D. WHEN THE CONTROLLER OF THE CHILLER BEING SHUT OFF INDICATES NO REQUEST FOR CONDENSER WATER FLOW, RAMP DOWN AND TURN OFF THE SECOND STAGE CW PUMP AND SLOWLY CLOSE THE CHILLER'S CW ISOLATION VALVE. VALVE TIMING AND PUMP RAMP DOWN SPEED AND SHUTOFF TIMING TO BE DETERMINED IN THE FIELD AS REQUIRED TO PREVENT NUISANCE TRIPS AND AVOID SUDDEN CHANGE IN FLOW THROUGH THE OTHER OPERATING CHILLER.
E. ONCE THE SECOND STAGE CHILLER ISOLATION VALVES ARE CLOSED AND THE SECOND STAGE CW AND CHW PUMPS ARE OFF, RELEASE THE FIRST STAGE CHW AND CW PUMP SPEED COMMANDS. AND MODULATE THE PUMPS TO MAINTAIN THEIR RESPECTIVE SYSTEM FLOW RATE SETPOINTS.

CHILLER FAILURE:

1. IF AT ANY TIME AN ENABLED CHILLER SHOULD FAIL, AN ALARM SHALL BE GENERATED.
A. ONCE THE FAILED CHILLER HAS BEEN PROVEN TO BE OFF, THE BMS SHALL INITIATE A TIME DELAY, SET AT 3 MINUTES (ADJUSTABLE).
B. AFTER THE TIME DELAY HAS EXPIRED THE BMS SHALL CLOSE THE ASSOCIATED CHILLER ISOLATION VALVES AND:
a. IF ANOTHER CHILLER IS AVAILABLE, START THE NEXT CHILLER IN THE SAME MANNER AS DESCRIBED IN THE ASSOCIATED CHILLER LOADING SEQUENCE.
b. IF ANOTHER CHILLER IS NOT AVAILABLE, SHUT DOWN ASSOCIATED "STAGED" PRIMARY CHILLED AND CONDENSER WATER PUMPS AND COOLING TOWER IN THE SAME MANNER AS DESCRIBED IN THE ASSOCIATED CHILLER UNLOADING SEQUENCE.
c. THE FAILED CHILLER IS TAKEN OUT OF OPERATION BY THE BMS BY REASSIGNING THE SEQUENCE ORDER OF THAT CHILLER TO "FAILED/MAINTENANCE". ONCE THE PROBLEM IS CORRECTED THE OPERATOR MUST SET THE CHILLER TO THE APPROPRIATE "STAGE" BEFORE CHILLER IS AVAILABLE FOR FURTHER OPERATION.

TABLE: SYSTEM GPM PER EQUIPMENT OPERATION MODES

SYSTEM GPM SETPOINT	CH-1 OR CH-2 SINGLE CHILLER OPERATION	CH-1 AND CH-2 DUAL CHILLER OPERATION	WATER-SIDE ECONOMIZER OPERATION
PRIMARY CHILLED WATER	1600 GPM	3200 GPM	1600 GPM
CONDENSER WATER	2700 GPM	5400 GPM	1950 GPM

VIRTUAL, 2 POSITION TOGGLE FOR CWP CONTROL

FLOW MODE DPS MODE

VIRTUAL, 2 POSITION TOGGLE FOR CHWP CONTROL

FLOW MODE DPS MODE

PRIMARY CHILLED WATER PUMP CONTROL (PCWP-1, 1A, 2)

1. PRIMARY CHILLED WATER PUMP SEQUENCING:
A. PRIMARY CHILLED WATER PUMPS SHALL BE STARTED AND STOPPED IN ACCORDANCE WITH THE CHILLER LOADING AND CHILLER UNLOADING SEQUENCES WHEN A CHILLER IS ENABLED OR DISABLED . WHEN ONE CHILLER IS OPERATING, THE FIRST STAGE PUMP SHALL OPERATE. WHEN TWO CHILLERS ARE OPERATING, BOTH THE FIRST STAGE AND SECOND STAGE PUMPS SHALL OPERATE
B. THE BMS SHALL ASSIGN TO EACH CHILLED WATER PUMP A CORRESPONDING STAGE NUMBER BASED ON RUNTIME.
2. PRIMARY CHILLED WATER PUMP FAILURE:
A. IF A PRIMARY CHILLED WATER PUMP SHOULD FAIL, AN ALARM SHALL BE GENERATED. THE BMS SHALL AUTOMATICALLY START THE NEXT PUMP TO REPLACE THE FAILED PUMP. THE ENABLED CHILLERS SHALL REMAIN ENABLED. THE "FAILED" PRIMARY CHILLED WATER PUMP SHALL BE DISABLED. SHOULD NO OTHER PRIMARY CHILLED WATER PUMP BE AVAILABLE, THE BMS WILL STAGE OFF THE ASSOCIATED CHILLER, COOLING TOWER AND CONDENSER WATER PUMP.
B. PRIMARY CHILLED WATER PUMPS THAT FAIL DURING OPERATION SHALL AUTOMATICALLY BE ASSIGNED A DESIGNATION OF"FAILED/MAINTENANCE". PRIMARY CHILLED WATER PUMP FAILURE SHALL INCLUDE: LOSS OF STATUS AND VFD FAULT. DESIGNATION OF "FAILED/MAINTENANCE." FAILED PUMPS MUST BE MANUALY RESET BY THE OPERATOR AT THE OWS.
3. PRIMARY CHILLED WATER PUMP SPEED CONTROL: NORMAL AND DIFFERENTIAL PRESSURE CONTROL OPERATION CAN BE MANUALLY OVERRIDEN AT THE BAS INTERFACE VIA A VIRTUAL TOGGLE FOR TESTING PURPOSES. SEE INTERFACE GRAPHIC "VIRTUAL, 2 POSITION TOGGLE FOR PCWP CONTROL" BELOW.
A. NORMAL OPERATION:
a. THE BMS SHALL VARY THE SPEED OF THE PRIMARY CHILLED WATER PUMPS TO MAINTAIN THE PRIMARY CHILLED WATER FLOW RATE SETPOINT. THE PRIMARY CHILLED WATER FLOW RATE SEPOINT SHALL BE A FUNCTION OF THE EQUIPMENT OPERATING AS DEFINIED IN TABLE "SYSTEM GPM PER EQUIPMENT OPERATION MODES" AS SENESED BY THE CALCULATED POINT, FM-4.
a. WHEN MULTIPLE CHILLERS ARE ENERGIZED, PUMPS SHALL OPERATE IN UNISON
B. DIFFERENTIAL PRESSURE CONTROL OPERATION: OPERATION IF A FLOW METER WERE TO FAIL.
a. IF THE FLOW METER FAILS AND IS IN MECHANICAL COOLING MODE WITH ONE CHILLER OPERATION:
• THE TAB CONTRACTOR SHALL DEFINE THE CHILLER DIFFERENTIAL PRESSURE SETPOINT FOR EACH CHILLER THAT COORESPONDS TO THE CHILLERS FLOW RATE AS DEFINED IN TABLE "SYSTEM GPM PER EQUIPMENT OPERATION MODES." DURING DIFFERENTIAL PRESSURE CONTROL MODE, THE PRIMARY CHILLED WATER PUMP SHALL MODULATE TO MAINTAIN THE DIFFERENTIAL PRESSURE SETPOINT FOR THE OPERATING CHILLER.
b. IF THE FLOW METER FAILS AND IS IN MECHANICAL COOLING MODE WITH TWO CHILLERS OPERATING.
• THE TAB CONTRACTOR SHALL DEFINE THE CHILLER DIFFERENTIAL PRESSURE SETPOINT THAT CORRESPONDS TO THE CHILLERS FLOW RATE AS DEFINED IN TABLE "SYSTEM GPM PER EQUIPMENT OPERATION MODES." DURING DIFFERENTIAL PRESSURE CONTROL MODE, BAS SHALL MONITOR THE DIFFERENTIAL PRESSURE ACROSS THE TWO OPERATING CHILLERS. THE BAS SHALL MODULATE THE TWO OPERATING PUMPS IN UNISON AS REQUIRED SUCH THAT THE DIFFERENTIAL PRESSURE ACROSS BOTH CHILLERS IS GREATER THAN OR EQUAL TO SETPOINT.
c. IF FLOW METER FAILS AND IS IN WATER-SIDE ECONOMIZER MODE:
• THE TAB CONTRACTOR SHALL DEFINE THE HEAT EXCHANGER DIFFERENTIAL PRESSURE SETPOINT FOR THE HX THAT COORESPONDS TO THE HX FLOW RATE AS DEFINED IN TABLE "SYSTEM GPM PER EQUIPMENT OPERATION MODES." DURING DIFFERENTIAL PRESSURE CONTROL MODE, THE PRIMARY CHILLED WATER PUMP SHALL MODULATE TO MAINTAIN THE DIFFERENTIAL PRESSURE SETPOINT FOR THE HX.

SECONDARY WATER PUMP CONTROL (SCWP-6, 7)

1. SECONDARY CHILLED WATER PUMP SEQUENCING:
A. SECONDARY CHILLED WATER PUMPS SHALL BE STARTED AND STOPPED ACCORDING TO THE EXISTING CHILLER LOADING AND CHILLER UNLOADING SEQUENCES WHEN A CHILLER IS ENABLED OR DISABLED .
B. THE BMS SHALL ASSIGN TO EACH CHILLED WATER PUMP A CORRESPONDING STAGE NUMBER BASED ON RUNTIME.
2. SECONDARY CHILLED WATER PUMP FAILURE:
A. IF A SECONDARY CHILLED WATER PUMP SHOULD FAIL, AN ALARM SHALL BE GENERATED. THE BMS SHALL AUTOMATICALLY START THE NEXT PUMP TO REPLACE THE FAILED PUMP. THE ENABLED CHILLERS SHALL REMAIN ENABLED. THE "FAILED" SECONDARY CHILLED WATER PUMP SHALL BE DISABLED. SHOULD NO OTHER SECONDARY CHILLED WATER PUMP BE AVAILABLE, THE BMS WILL STAGE OFF THE ASSOCIATED CHILLER, COOLING TOWER AND CONDENSER WATER PUMP.
B. SECONDARY CHILLED WATER PUMPS THAT FAIL DURING OPERATION SHALL AUTOMATICALLY BE ASSIGNED A DESIGNATION OF"FAILED/MAINTENANCE". SECONDARY CHILLED WATER PUMP FAILURE SHALL INCLUDE: LOSS OF STATUS AND VFD FAULT. DESIGNATION OF "FAILED/MAINTENANCE." FAILED PUMPS MUST BE MANUALY RESET BY THE OPERATOR AT THE OWS.
3. SECONDARY CHILLED WATER PUMP SPEED CONTROL:
A. THE SECONDARY PUMP FLOW RATE TOTAL SHALL BE A MAXIMUM OF 3200 GPM.
B. DIFFERENTIAL PRESSURE SETPOINT SHALL BE OPTIMIZED USING TRIM AND RESPOND LOGIC, REFER TO SECTION M8.0 FOR ADDITIONAL INFORMATION
C. THE BMS SHALL VARY THE SPEED OF THE SECONDARY CHILLED WATER PUMPS TO MAINTAIN DIFFERENTIAL PRESSURE SETPOINTS, AS SENSED BY THE DIFFERENTIAL PRESSURE SENSORS CONNECTED BETWEEN THE SUPPLY AND RETURN CHILLED WATER PIPING.
a. THE BMS SHALL AUTOMATICALLY ALTERNATE THE OPERATION OF THE DUTY AND STANDBY PUMP ON A LEAD-LAG ARRANGEMENT, BASED ON A RUN TIME SCHEDULE. THE CHILLED WATER PUMPS ARE CONFIGURED IN A MANNER THAT IF THE OPERATING DUTY PUMP SHOULD FAIL, AS SENSED BY A MISMATCH BETWEEN THE BMS'S OCNTROLLED VALVE AND THE BMS STATUS MONITERED BY ASSOCIATED CURRENT TRANSDUCERS, THE BMS WOULD START THE STANDBY PUMP AND DISABBLE THE FAILED PUMP FROM THE BMS CONTROLLED OPERATION. .
D. THE REMOTE DP SETPOINTS WILL BE MAINTAINED BETWEEN MAXIMUM AND MINIMUM PRESSURES. THE MAXIMUM PRESSURE LIMIT IS THE PRESSURE REQUIRED TO PROVIDE FULL FLOW TO ALL CCVs SIMULTANEOUSLY (PER TAB). THE MINIMUM PRESSURE LIMIT IS THE PRESSURE CORRELATING TO THE LOWEST SPEED THE PUMP IS ALLOWED TO BE OPERATE AT (BASED ON MINIMUM CHILLED WATER FLOW AND MINIMUM PUMP FLOW).

SECONDARY CHILLED WATER BYPASS VALVE CONTROL:

1. UPON SENSING THAT THE PUMPS CANNOT MAINTAIN THE DIFFERENTIAL PRESSURE SETPOINT (ASSOCIATED WITH EACH RISER) AND IF THE DP VALUE READ BY THE BMS IS AT LEAST 20% SMALLER THAN THE SETPOINT, THEN THE BMS SHALL GENERATE AN ALARM AT THE OWS THAT READS AS FOLLOWS: POSSIBLE LEAK IN THE CHILLED WATER SYSTEM; PLEASE INVESTIGATE.
2. WHEN CHILLED WATER PUMP(S) ARE OPERATING AT MINIMUM SPEED AND THE CHILLED WATER DIFFERENTIAL PRESSURE IN THE SYSTEM IS GREATER THAN ITS MAXIMUM LIMIT, THE BYPASS VALVE WILL MODULATE OPEN TO RELIEVE PRESSURE IN THE CHILLED WATER SYSTEM.
3. BYPASS VALVE SHALL MODULATE OPEN TO MAINTAIN A MINIMUM SYSTEM FLOW RATE AS DETERMINED DURING START UP/ TUNING. THE MINIMUM FLOW RATE SHALL CORRESPOND TO THE PUMP FLOW AT ITS MINIMUM OPERATING POINT.

PRIMARY CONDENSER WATER PUMP CONTROL (CWP-3,4,5)

1. PRIMARY CONDENSER WATER PUMP SEQUENCING:
A. PRIMARY CONDENSER WATER PUMPS SHALL BE STARTED AND STOPPED ACCORDING TO THE EXISTING "CHILLER LOADING" AND "CHILLER UNLOADING" SEQUENCES WHEN A CHILLER IS ENABLED OR DISABLED.
B. THE BMS SHALL ASSIGN TO EACH CONDENSER WATER PUMP A CORRESPONDING STAGE NUMBER BASED ON RUNTIME.
2. PRIMARY CONDENSER WATER PUMP FAILURE:
A. IF A PRIMARY CONDENSER WATER PUMP SHOULD FAIL, AN ALARM SHALL BE GENERATED. THE BMS SHALL AUTOMATICALLY START THE NEXT PUMP TO REPLACE THE FAILED PUMP. THE ENABLED CHILLERS SHALL REMAIN ENABLED. THE "FAILED" PRIMARY CONDENSER WATER PUMP SHALL BE DISABLED. SHOULD NO OTHER PRIMARY CONDENSER WATER PUMP BE AVAILABLE, THE BMS WILL STAGE OFF THE ASSOCIATED CHILLER, COOLING TOWER AND CHILLED WATER PUMP.
B. PRIMARY CONDENSER WATER PUMPS THAT FAIL DURING OPERATION SHALL AUTOMATICALLY BE ASSIGNED A DESIGNATION OF "FAILED/MAINTENANCE". PRIMARY CONDENSER WATER PUMP FAILURE SHALL INCLUDE: LOSS OF STATUS AND VFD FAULT.
C. ANY PRIMARY CONDENSER WATER PUMP THAT IS TAKEN OUT OF OPERATION FOR MAINTENANCE SHALL BE ASSIGNED A DESIGNATION OF "FAILED/MAINTENANCE" BY THE BMS. THE BMS SHALL NOT ATTEMPT TO START PUMPS WITH AN ASSIGNED DESIGNATION OF "FAILED/MAINTENANCE".
3. PRIMARY CONDENSER WATER PUMP SPEED CONTROL: NORMAL AND DIFFERENTIAL PRESSURE CONTROL OPERATION CAN BE MANUALLY OVERRIDEN AT THE BAS INTERFACE VIA A VIRTUAL TOGGLE FOR TESTING PURPOSES. SEE INTERFACE GRAPHIC "VIRTUAL, 2 POSITION TOGGLE FOR CWP CONTROL" TO THE RIGHT.
A. NORMAL OPERATION:
a. THE BMS SHALL MODULATE THE CONDENSER WATER PUMPS TO MAINTAIN THE CONDNENSER WATER FLOW RATE SETPOINT. THE CONDENSER WATER FLOW RATE SEPOINT SHALL BE A FUNCTION OF THE EQUIPMENT OPERATING AS DEFINIED IN TABLE "SYSTEM GPM PER EQUIPMENT OPERATION MODES" AS SENESED BY THE CALCULATED POINT, FM-4.
b. WHEN MULTIPLE CHILLERS ARE ENERGIZED, PUMP SHALL OPERATE IN PARALLEL.
B. DIFFERENTIAL PRESSURE CONTROL OPERATION: OPERATION IF A FLOW METER WERE TO FAIL.
a. IF THE FLOW METER FAILS AND IS IN MECHANICAL COOLING MODE WITH ONE CHILLER OPERATION:
• THE TAB CONTRACTOR SHALL DEFINE THE CHILLER DIFFERENTIAL PRESSURE SETPOINT FOR EACH CHILLER THAT COORESPONDS TO THE CHILLERS FLOW RATE AS DEFINED IN TABLE "SYSTEM GPM PER EQUIPMENT OPERATION MODES." DURING DIFFERENTIAL PRESSURE CONTROL MODE, THE CONDENSER PUMP SHALL MODULATE TO MAINTAIN THE DIFFERENTIAL PRESSURE SETPOINT FOR THE OPERATING CHILLER..
b. IF THE FLOW METER FAILS AND IS IN MECHANICAL COOLING MODE WITH TWO CHILLERS OPERATING.
• THE TAB CONTRACTOR SHALL DEFINE THE CHILLER DIFFERENTIAL PRESSURE SETPOINT THAT COORESPONDS TO THE CHILLERS FLOW RATE AS DEFINED IN TABLE "SYSTEM GPM PER EQUIPMENT OPERATION MODES." DURING DIFFERENTIAL PRESSURE CONTROL MODE, BAS SHALL MONITOR THE DIFFERENTIAL PRESSURE ACROSS THE TWO OPERATING CHILLERS. THE BAS SHALL MODULATE THE TWO OPERATING PUMPS IN UNISON AS REQUIRED SUCH THAT THE DIFFERENTIAL PRESSURE ACROSS BOTH CHILLERS IS GREATER THAN OR EQUAL TO SETPOINT.
c. IF FLOW METER FAILS AND IS IN WATER-SIDE ECONOMIZER MODE:
• THE TAB CONTRACTOR SHALL DEFINE THE HEAT EXCHANGER DIFFERENTIAL PRESSURE SETPOINT FOR THE HX THAT COORESPONDS TO THE HX FLOW RATE AS DEFINED IN TABLE "SYSTEM GPM PER EQUIPMENT OPERATION MODES." DURING DIFFERENTIAL PRESSURE CONTROL MODE, THE CONDENSER PUMP SHALL MODULATE TO MAINTAIN THE DIFFERENTIAL PRESSURE SETPOINT FOR THE HX.

TRIM & RESPOND SETPOINT RESET LOGIC

1. TRIM & RESPOND SETPOINT RESET LOGIC AND ZONE/SYSTEM RESET REQUESTS WHERE REFERENCED IN SEQUENCES SHALL BE IMPLEMENTED AS DESCRIBED BELOW.
2. A "REQUEST" IS A CALL TO RESET CHILLED WATER SUPPLY TEMPERATURE SETPOINT, GENERATED BY AND AIR HANDLING SYSTEM WITH A CHILLED WATER COOLING COIL. AN AIR HANDLING SYSTEM WITH A CHILLED WATER COIL SHALL ISSUE A "REQUEST FOR CHILLED WATER IN THE FOLLOWING CASES: FOR AIR HANDLING SYSTEMS WITH MODULATING CHILLED WATER COILS, A REQUEST SHALL BE ISSUED WHEN THE AIR HANDLING SYSTEM IS OPERATING, AND THE CHILLED WATER CONTROL VALVE IS GREATER THAN 90% OPEN (ADJ). FOR AIR HANDLING SYSTEMS WITH TWO-POSITION CHILLED WATER COILS, A REQUEST SHALL BE ISSUED WHEN THE AIR HANDLING SYSTEM IS OPERATING, AND THE ASSOCIATED TEMPERATURE SETPOINT IS MORE THAN 2 DEG F (ADJ) ABOVE SETPOINT FOR MORE THAN 10 MINUTES (ADJ).
A. FOR EACH DOWNSTREAM ZONE OR SYSTEM, AND FOR EACH TYPE OF SETPOINT RESET REQUEST LISTED FOR THE ZONE/SYSTEM, PROVIDE THE FOLLOWING SOFTWARE POINTS:
• IMPORTANCE MULTIPLIER (DEFAULT = 1)
• REQUEST-HOURS. EVERY X MINUTES (DEFAULT 5 MINUTES), ADD X/60 TIMES THE CURRENT NUMBER OF REQUESTS TO THIS REQUEST-HOURS ACCUMULATOR POINT. THE REQUEST-HOURS POINT IS RESET TO ZERO UPON A GLOBAL COMMAND FROM THE SYSTEM/PLANT SERVING THE ZONE/SYSTEM – THIS GLOBAL POINT SIMULTANEOUSLY RESETS THE REQUEST-HOURS POINT FOR ALL ZONES/SYSTEMS SERVED BY THIS SYSTEM/PLANT.
• CUMULATIVE%-REQUEST-HOURS. THIS IS THE ZONE/SYSTEM REQUEST-HOURS DIVIDED BY THE ZONE/SYSTEM RUN-HOURS (THE HOURS IN ANY MODE OTHER THAN UNOCCUPIED MODE) SINCE THE LAST RESET, EXPRESSED AS A PERCENTAGE.
• A LEVEL 4 ALARM IS GENERATED IF THE ZONE IMPORTANCE MULTIPLIER IS GREATER THAN ZERO, THE ZONE/SYSTEM CUMULATIVE%-REQUEST-HOURS EXCEEDS 70%, AND THE TOTAL NUMBER OF ZONE/SYSTEM RUN-HOURS EXCEEDS 40.
B. SEE ZONE AND AIR HANDLING SYSTEM CONTROL SEQUENCES FOR LOGIC TO GENERATE REQUESTS.
C. MULTIPLY THE NUMBER OF REQUESTS DETERMINED FROM ZONE/SYSTEM LOGIC TIMES THE IMPORTANCE MULTIPLIER AND SEND TO THE SYSTEM/PLANT THAT SERVES THE ZONE/SYSTEM. SEE SYSTEM/PLANT LOGIC TO SEE HOW REQUESTS ARE USED IN TRIM & RESPOND LOGIC.
• FOR EACH UPSTREAM SYSTEM OR PLANT SETPOINT BEING CONTROLLED BY A T&R LOOP, DEFINE THE FOLLOWING VARIABLES. ALL VARIABLES BELOW SHALL BE ADJUSTABLE FROM A RESET GRAPHIC ACCESSIBLE FROM A HYPERLINK ON THE ASSOCIATED SYSTEM/PLANT GRAPHIC. INITIAL VALUES ARE DEFINED IN SYSTEM/PLANT SEQUENCES BELOW. VALUES FOR TRIM, RESPOND, TIME STEP, ETC. SHALL BE TUNED TO PROVIDE STABLE CONTROL.

TRIM AND RESPOND VARIABLES AND SETTINGS

VARIABLE	DEFINITION	CHILLED WATER DP SETPOINT
SP_0	INITIAL SETPOINT	80% OF SPmax
SP_{min}	MINIMUM SETPOINT	10 FEET
SP_{max}	MAXIMUM SETPOINT	PER TAB
T_d	DELAY TIMER	5 MINS
T	TIME STEP	2 MINS
I	NUMBER OF IGNORED REQUESTS	1
R	NUMBER OF REQUESTS FROM ZONES/SYSTEMS	CALCULATED
SP_{trim}	TRIM AMOUNT	-2 FEET
SP_{res}	RESPOND AMOUNT (MUST BE OPPOSITE IN SIGN TO SP_{trim} AND SHOULD GENERALLY BE HIGHER)	4 FEET
$SP_{res\text{-}max}$	MAXIMUM RESPONSE PER TIME INTERVAL (MUST BE SAME SIGN AS SP_{res})	6 FEET

d. TRIM & RESPOND LOGIC SHALL RESET SETPOINT WITHIN THE RANGE SPMIN TO SPMAX. WHEN THE ASSOCIATED DEVICE (E.G. FAN, PUMP) IS OFF, THE SETPOINT SHALL BE SP_0. THE RESET LOGIC SHALL BE ACTIVE WHILE THE ASSOCIATED DEVICE IS PROVEN ON, STARTING T_d AFTER INITIAL DEVICE START COMMAND. WHEN ACTIVE, EVERY TIME STEP T, TRIM THE SETPOINT BY SP_{trim}. IF THERE ARE MORE THAN I REQUESTS, RESPOND BY CHANGING THE SETPOINT BY SP_{res} * (R-I), (I.E. THE NUMBER OF REQUESTS MINUS THE NUMBER OF IGNORED REQUESTS), BUT NO MORE THAN $SP_{res\text{-}max}$. IN OTHER WORDS, EVERY TIME STEP T:

CHANGE SETPOINT BY SP_{TRIM}
IF R>I, ALSO CHANGE SETPOINT BY (R-I)*SP_{res} BUT NO LARGER THAN $SP_{res\text{-}max}$

e. FOR EACH TRIM AND RESPOND LOOP, GENERATE A GRAPHIC SIMILAR TO FIGURE B.1.E. THE GRAPHIC DOES NOT NEED TO BE CUSTOMIZED TO MATCH THE FIGURE IN TERMS OF AESTHETICS; HOWEVER, IT MUST CONTAIN ALL OF THE INFORMATION AND FUNCTIONALITY SHOWN IN THE FIGURE. SUBMIT A SAMPLE OF THE INTENDED GRAPHIC FOR APPROVAL. THE FIGURE MUST BE CONSISTENT FOR EACH TRIM & RESPOND LOOP IN THE PROJECT.

CHILLED WATER DIFFERENTIAL PRESSURE RESET

SHADE GREEN IF ON, RED IF OFF

SHADE ROW OR PROVIDE SOME OTHER VISUAL MEANS OF EASILY IDENTIFYING WHICH ZONES ARE SENDING REQUESTS

CC TAG	INCLUDE/OMIT	VALVE POSITION	IMPORTANCE MULTIPLIER	AREA SERVED	REQUEST HOURS	CUMULATIVE% REQUEST HOURS
AHU-1-1	ON	85%	1	101,102,103	5	1%
VAV-X-X	OFF	XX%	2	XX	0	0%
VAV-X-X	ON	XX%	1	XX	165	17%
VAV-X-X	ON	XX%	1	XX	X	X
VAV-X-X	ON	XX%	1	XX	X	X
VAV-X-X	ON	XX%	1	XX	X	X
VAV-X-X	ON	XX%	1	XX	X	X
VAV-X-X	ON	XX%	3	XX	X	X
VAV-X-X	ON	XX%	1	XX	X	X
VAV-X-X	ON	XX%	1	XX	X	X
VAV-X-X	ON	XX%	1	XX	X	X
VAV-X-X	ON	XX%	1	XX	X	X
VAV-X-X	ON	XX%	1	XX	X	X
VAV-X-X	ON	XX%	1	XX	X	X
VAV-X-X	ON	XX%	1	XX	X	X
VAV-X-X	ON	XX%	1	XX	X	X
VAV-X-X	ON	XX%	1	XX	X	X
VAV-X-X	ON	XX%	1	XX	X	X
VAV-X-X	ON	XX%	1	XX	X	X
VAV-X-X	ON	XX%	1	XX	X	X
VAV-X-X	ON	XX%	1	XX	X	X
VAV-X-X	ON	XX%	1	XX	X	X
VAV-X-X	ON	XX%	1	XX	X	X
VAV-X-X	ON	XX%	1	XX	X	X

SHADE GREEN IF ON, RED IF OFF
GREYED OUT AND NOT EDITABLE WHEN T&R LOGIC IS ENABLED/ON

CURRENT SYSTEM STATUS:

ON		TRIM AND RESPOND LOGIC ENABLE/DISABLE
1		CURRENT NUMBER OF REQUESTS
15	FEET	CURRENT SETPOINT
20	FEET	SETPOINT OVERRIDE

TRIM AND RESPOND SETTINGS:

XX	UNIT	SP_0	INITIAL SETPOINT
XX	UNIT	SP_{min}	MINIMUM SETPOINT
XX	UNIT	SP_{max}	MAXIMUM SETPOINT
XX	UNIT	T_d	DELAY TIMER
XX	UNIT	T	TIME STEP
XX	UNIT	I	NUMBER OF IGNORED REQUESTS
XX	UNIT	SP_{trim}	TRIM AMOUNT
XX	UNIT	SP_{res}	RESPOND AMOUNT (MUST BE OPPOSITE IN SIGN TO SP_{trim} AND SHOULD GENERALLY BE HIGHER)
XX	UNIT	$SP_{res\text{-}max}$	MAXIMUM RESPONSE PER TIME INTERVAL (MUST BE SAME SIGN AS SP_{res})

RESETS

RESET — RESET REQUEST-HOURS COUNTER
RESET — RESET CUMULATIVE%-REQUEST-HOURS COUNTER

VIRTUAL BUTTONS

FIGURE B.1.E - SAMPLE TRIM & RESPOND BAS GRAPHIC

WATER-SIDE ECONOMIZER (ECONOMIZER MODE)

WHEN THE OUTDOOR WET BULB TEMPERATURE IS AT OR BELOW THE ECONOMIZER SETPOINT (INITIALLY SET AT 25.0 DEG F, ADJUSTABLE), THE BMS SWITCHES THE CHILLED WATER SYSTEM INTO ECONOMIZER MODE. THE BMS WILL PERFORM THE FOLLOWING ACTIONS:
1. IF BOTH CHILLERS ARE RUNNING, THE BMS WILL NOT BEGIN INITIATING WATER-SIDE ECONOMIZER MODE. THE BMS WILL REMAIN IN AN ECONOMIZER MODE "READY" UNTIL TWO OR LESS CHILLERS ARE RUNNING. ECONOMIZER MODE "READY" WILL BE CANCELLED IF THE OUTDOOR WET BULB TEMPERATURE RISES BACK ABOVE THE ECONOMIZER SETPOINT.
2. THE BMS WILL UNLOAD THE RUNNING CHILLERS AND OPEN THE CHILLED WATER AND CONDENSER WATER VALVES TO HX-C.
3. WATER-SIDE ECONOMIZER SHALL ONLY BE ENABLED IF THE SYSTEM LOAD IS LESS THAN THE HX CAPACITY AND STAGING SHALL BE AS FOLLOWS.
A. OPERATE THE PRIMARY CHILLED WATER PUMPS TO MAINTAIN CONSTANT DESIGN FLOW THROUGH THE ECONOMIZER.
B. OPERATE THE SECONDARY CHILLED WATER PUMPS AS USUAL.
C. OPERATE THE CONDENSER WATER PUMPS TO MAINTAIN DESIGN FLOW THROUGH THE HEAT EXCHANGER.
D. OPERATE THE COOLING TOWERS (FAN SPEED + BYPASS) AS DESCRIBED IN THE SEQUENCE.
4. DURING ECONOMIZER MODE, THE CHILLED WATER SUPPLY TEMPERATURE WILL BE CONTROLLED AS FOLLOWS:
A. AS THE CHILLED WATER TEMPERATURE RISES ABOVE SETPOINT, THE COOLING TOWER FANS SPEEDS WILL INCREASE FROM THEIR MINIMUM TO ITS MAXIMUM.
B. AS THE CHILLED WATER TEMPERATURE BEGINS TO FALL, THE COOLING TOWER FANS WILL DECREASE TOWARD THEIR MINIMUM.
C. ON A CONTINUED FALL IN CHILLED WATER TEMPERATURE, THE COOLING TOWER FANS WILL BE DISABLED AND WATER WILL FLOW OVER THE CELLS WITH THE FANS OFF.
D. ON A FURTHER FALL IN CHILLED WATER TEMPERATURE, THE COOLING TOWER BYPASS VALVE WILL BEGIN TO MODULATE OPEN.
E. ON AN INCREASE IN CHILLED WATER TEMPERATURE THE REVERSE WILL OCCUR.
F. THE PID LOOP CONTROLLING THE CHILLED WATER SETPOINT DURING ECONOMIZER MODE WILL BE LIMITED SO THAT THE CONDENSER WATER SUPPLY TEMPERATURE DOES NOT FALL BELOW 42 DEG F.
5. WHENEVER OUTDOOR WET BULB TEMPERATURE RISES ABOVE THE SETPOINT, OR IF CHILLED WATER TEMPERATURE CANNOT BE MAINTAIN FOR A SET PERIOD OF TIME, THE BMS SWITCHES THE CHILLED WATER PLANT OUT OF ECONOMIZER MODE. THE BMS WILL PERFORM THE FOLLOWING ACTIONS:
A. THE OPERATING PUMPS WILL REMAIN ENABLED.
B. THE BMS WILL OPEN THE ISOLATION VALVES TO THE NUMBER OF CHILLERS EQUAL TO THE CURRENT STAGE OF ECONOMIZER MODE AND CLOSE THE HEAT EXCHANGER ISOLATION VALVES.
C. UPON PROOF OF FLOW, THE ASSOCIATED CHILLERS WILL BE ENABLED.
D. THE COOLING TOWERS WILL RESUME NORMAL OPERATION.
E. THE TWO 2-WAY CONDENSER WATER VALVES IN THE CUP MECHANICAL ROOM WILL MODULATE TO MAINTAIN A CHILLER ENTERING CONDENSER WATER TEMPERATURE OF 65 DEGREES (ADJ).
a. THESE TWO VALVES WILL ONLY MODULATE DURING THE TRANSITION FROM ECONOMIZER MODE BACK TO MECHANICAL COOLING MODE.
b. IF THE DIFFERENTIAL REFRIGERANT PRESSURE DOES NOT REACH ITS MINIMUM VALUE OF 4 PSI WITHIN 15 MINUTES, AN ALARM WILL BE SENT TO THE OPERATOR WORKSTATION.

CHILLER DIFFERENTIAL REFRIGERANT PRESSURE CONTROL

1. IF THE CHILLER REFRIGERANT DIFFERENTIAL PRESSURE FALLS BELOW 4 PSI (ADJ) AS INDICATED VIA THE CHILLER BACNET CONNECTION, THE FOLLOWING SHALL OCCUR.
A. THE CONDENSER WATER SYSTEM SHALL SWITCH INTO DIFFERENTIAL PRESSURE CONTROL MODE. THIS WILL ALLOW THE CHILLER CONTROL VALVES TO REDUCE THE AMOUNT OF FLOW TO THE CONDENSER WITHOUT THE PUMPS RAMPING UP.
B. THE CONDENSER WATER VALVES FOR EACH CHILLER SHALL BE MODULATED TO MAINTAIN A DIFFERENTIAL PRESSURE OF 4 PSI (ADJ)
C. IF THE DIFFERENTIAL REFRIGERANT PRESSURE DOES NOT REACH IT'S MINIMUM VALUE OF 4 PSI WITHIN 15 MINUTES, AN ALARM WILL BE SENT TO THE OPERATOR WORKSTATION.
D. THE SYSTEM SHALL AUTOMATICALLY SWITCH BACK INTO FLOW CONTROL MODE WHEN THE MINIMUM CHILLER DIFFERENTIAL REFRIGERANT SETPOINT (ADJ - 4 PSI INITIALLY) HAS BEEN SATISFIED FOR A MINIMUM OF 15 MINUTES (ADJ).

CONDENSER WATER FILTRATION PUMP

1. WHEN ANY OF THE CONDENSER WATER PUMPS ARE ENABLED, THE CWF-1 VALVE SHALL FULLY OPEN. WHEN THE VALVE IS READ AS FULLY OPEN, THE CWF-1 PUMP SHALL START.
2. WHEN ALL OF THE CONDENSER WATER PUMPS ARE DISABLED, THE CWF-1 VALVE SHALL FULLY CLOSE. WHEN THE VALVE IS READ AS FULLY OPEN, THE CWF-1 PUMP SHALL STOP.

(EXISTING) COOLING TOWER CONTROL - NOT IN CONTRACT. SHOWN FOR REFERENCE ONLY

RUN CONDITIONS:
THE COOLING TOWER WILL BE ENABLED TO RUN WHENEVER MECHANICAL OR ECONOMIZER COOLING IS ENABLED.
TWO COOLING TOWERS, EACH WITH TWO CELLS, WILL OPERATE IN LEAD/1ST LAG CONFIGURATION. EACH CELL IS EQUIPPED WITH A VARIABLE SPEED FAN, WHICH WILL MODULATE TO MAINTAIN SEQUENCE OF CONDENSER WATER SUPPLY TEMPERATURE SETPOINT. CONDENSER WATER SUPPLY TEMPERATURE SETPOINT WILL INITIALLY BE SET AS FOLLOWS:
• ECONOMIZER COOLING = 42F (ADJ)
• MECHANICAL COOLING = 65F (ADJ)

EMERGENCY SHUTDOWN:
THE COOLING TOWER WILL SHUTDOWN AND AN ALARM GENERATED UPON RECEIVING AN EMERGENCY SHUTDOWN SIGNAL STATUS.

VIBRATION SWITCH:
THE COOLING TOWER WILL SHUTDOWN AND AN ALARM GENERATED UPON RECEIVING A VIBRATION SWITCH STATUS.

COOLING TOWER BYPASS VALVE
CONDENSER WATER TEMPERATURE CONTROL: THE CONTROLLER WILL MEASURE THE CONDENSER WATER SUPPLY TEMPERATURE AND MODULATE THE BYPASS VALVE OPEN TO TOWER TO MAINTAIN SETPOINT. THE BYPASS VALVE WILL CLOSED WHEN COOLING TOWER CONTROL IS DISABLED.

COOLING TOWER FAN
CONDENSER WATER TEMPERATURE CONTROL: THE CONTROLLER WILL MEASURE THE CONDENSER WATER SUPPLY TEMPERATURE AND MODULATE THE FAN VFD TO MAINTAIN SETPOINT.

ALARMS WILL BE PROVIDED AS FOLLOWS:
• FAN FAILURE: COMMANDED ON, BUT THE STATUS IS OFF.
• FAN RUNNING IN HAND: COMMANDED OFF, BUT THE STATUS IS ON.
• FAN RUNTIME EXCEEDED: STATUS RUNTIME EXCEEDS A USER DEFINABLE LIMIT.
• FAN VFD FAULT.

COOLING TOWER ISOLATION VALVES:
UPON ENABLE REQUEST, OPEN BOTH INLET VALVES AND THE TOWER OUTLET ISOLATION VALVE FOR THE ENABLED TOWER. ALL VALVE POSITIONS WILL BE MONITORED VIA ACTUATOR END SWITCHES.

COOLING TOWER FAN VFD FEEDBACK MONITOR:
THE CONTROLLER WILL MONITOR THE COOLING TOWER FAN SPEED AS FEEDBACK FROM THE VARIABLE FREQUENCY DRIVE.

BASIN WATER TEMPERATURE MONITORING: THE BASIN WATER TEMPERATURE WILL BE MONITORED.
ALARMS WILL BE PROVIDED AS FOLLOWS:
• HIGH BASIN WATER TEMP: IF THE BASIN WATER TEMPERATURE IS GREATER THAN 86°F (ADJ.).
• LOW BASIN WATER TEMP: IF THE BASIN WATER TEMPERATURE IS LESS THAN 38°F (ADJ.).

CONDENSER WATER RETURN TEMPERATURE MONITORING: THE CONDENSER WATER RETURN TEMPERATURE WILL BE MONITORED.
ALARMS WILL BE PROVIDED AS FOLLOWS:
• HIGH CONDENSER WATER RETURN TEMP: IF THE CONDENSER WATER RETURN TEMPERATURE IS GREATER THAN 100°F (ADJ.).
• LOW CONDENSER WATER RETURN TEMP: IF THE CONDENSER WATER RETURN TEMPERATURE IS LESS THAN 75°F (ADJ.).

COOLING TOWER ROTATION:
THE DESIGNATED ROTATION ORDER (USER DEFINABLE) OF THE COOLING TOWERS WILL ALTERNATE UPON ONE OF THE FOLLOWING CONDITIONS (USER SELECTABLE):
• MANUALLY THROUGH A SOFTWARE SWITCH
• IF CT RUNTIME (ADJ.) IS EXCEEDED
• DAILY
• WEEKLY
• MONTHLY

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SEALS AND SIGNATURES

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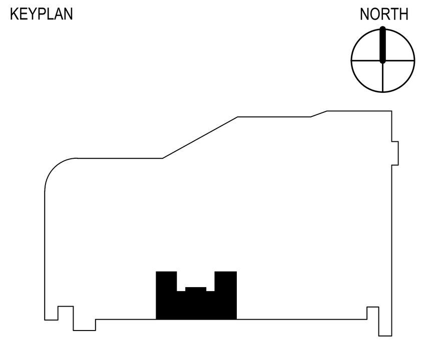
MECHANICAL
PROFESSIONAL ENGINEER
Ionel Petrus

KEYPLAN

NORTH



SHEET TITLE
MECHANICAL CONTROLS - CHILLED AND CONDENSER WATER SYSTEM SEQUENCE OF OPERATIONS

PROJECT NUMBER
CD
M8.3
SHEET NUMBER

Plot Date: 4/30/2021 4:22:25 PM Author

ELECTRICAL ABBREVIATIONS

(A)	
A	AMPERES
AC	ALTERNATING CURRENT
AF	AMPERE FRAME (BREAKER RATING)
AFC	ABOVE FINISHED COUNTER
AFF	ABOVE FINISHED FLOOR
AFG	ABOVE FINISHED GRADE
AHU	AIR HANDLING UNIT
AIC	AMPERE INTERRUPTING CAPACITY
ALT	ALTERNATE
ARCH	ARCHITECT
AT	AMPERES TRIP
ATS	AUTOMATIC TRANSFER SWITCH
AUTO	AUTOMATIC
AUX	AUXILIARY
AWG	AMERICAN WIRE GAUGE
(B)	
BLDG	BUILDING
BRKR, BKR	BREAKER
(C)	
C	CONDUIT
CATV	CABLE TELEVISION
CB	CIRCUIT BREAKER
CCTV	CLOSED CIRCUIT TELEVISION
CKT	CIRCUIT
CLG	CEILING
COM, COMM	COMMUNICATIONS
CP	CONTROL PANEL
CPT	CONTROL POWER TRANSFORMER
CT	CURRENT TRANSFORMER
CU	COPPER
(D)	
DC	DIRECT CURRENT
DISC	DISCONNECT
DIST	DISTRIBUTION
DIV	DIVISION
DN	DOWN
DP	DISTRIBUTION PANEL
DPDT	DOUBLE POLE DOUBLE THROW
DPST	DOUBLE POLE SINGLE THROW
DWG	DRAWING
(E)	
E, (E), EX, EXIST	EXISTING
EG	EQUIPMENT GROUND
ELEC	ELECTRIC, ELECTRICAL
ELEV	ELEVATOR
EM, EMEG	EMERGENCY
EMT	ELECTRIC METALLIC CONDUIT
ENCL	ENCLOSURE
EQ, EQIP	EQUIPMENT
EWC	ELECTRIC WATER COOLER
EWH	ELECTRIC WATER HEATER
(F)	
F	FUSE
FA	FIRE ALARM
FAAP	FIRE ALARM ANNUNCIATOR PANEL
FACP	FIRE ALARM CONTROL PANEL
FAEP	FIRE ALARM EXTENDER PANEL
FC	FOOT CANDLE
FDR	FEEDER
FL, FLR	FLOOR
FLA	FULL LOAD AMPS
FLEX	FLEXIBLE
FLUOR	FLUORESCENT
FS	FAUCET/FLUSH SENSOR
FT	FOOT / FEET (')
(G)	
G, GND, GRD	GROUND
GEN	GENERATOR
GFI	GROUND FAULT INTERRUPTER
(H)	
H	HORIZONTAL MOUNTING
HH	HAND HOLE
HOA	HAND-OFF-AUTOMATIC
HP	HORSEPOWER
HPS	HIGH PRESSURE SODIUM
HR	HOUR
HT	HEIGHT
HTR	HEATER
HVAC	HEATING VENTILATION AND AIR CONDITIONING
HZ	HERTZ
(I)	
IG	ISOLATED GROUND
IN	INCH / INCHES (")
INCAND	INCANDESCENT
(J)	
JB, JBOX	JUNCTION BOX
(K)	
K	KEY INTERLOCK
Kcmil	1000 CIRCULAR mils
KV	KILOVOLTS (THOUSAND VOLTS)
KVA	KILOVOLTS-AMPERES (THOUSAND VOLT-AMPS)
kW	KILOWATTS (THOUSAND WATTS)
KWH	KILOWATT-HOURS
(L)	
L-G	LINE TO GROUND
L-L	LINE TO LINE
L-N	LINE TO NEUTRAL
LA	LIGHTNING ARRESTOR
LAN	LOCAL AREA NETWORK
LC, LCP	LIGHTING CONTROL PANEL
LP	LIGHTING PANEL
LSI	LONG-TIME, SHORT-TIME, INSTANTANEOUS
LSIA	LONG-TIME, SHORT-TIME, INSTANTANEOUS,GROUND-FAULT ALARM ONLY
LSIG	LONG-TIME, SHORT-TIME, INSTANTANEOUS,GROUND-FAULT
LTG	LIGHTING
LV	LOW VOLTAGE (BELOW 50 VOLTS)
(M)	
MCA	MINIMUM CIRCUIT AMPACITY
MCB	MAIN CIRCUIT BREAKER
MCC	MOTOR CONTROL CENTER
MCP	MOTOR CIRCUIT PROTECTOR
MECH	MECHANICAL
MFR	MANUFACTURER
MH	MANHOLE
MIN	MINIMUM
MISC	MISCELLANEOUS
MLO	MAIN LUGS ONLY
MOCP	MAXIMUM OVERCURRENT PROTECTION
MTD	MOUNTED
MTG	MOUNTING
MTS	MANUAL TRANSFER SWITCH
MV	MEDIUM VOLTAGE (OVER 600V LESS THAN 35KV)
(N)	
N	NEUTRAL
N.C.	NORMALLY CLOSED - ELECTRICALLY OPERATED
N.O.	NORMALLY OPEN - ELECTRICALLY OPERATED
NC	NORMALLY CLOSED
NEC	NATIONAL ELECTRICAL CODE
NEMA	NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION
NIC	NOT IN CONTRACT
NO	NORMALLY OPEN
NO., NUM. #	NUMBER
NTS	NOT TO SCALE
(O)	
OC	ON CENTER
OCPD	OVERCURRENT PROTECTION DEVICE
OFCI	OWNER FURNISHED, CONTRACTOR INSTALLED
OFOI	OWNER FURNISHED, OWNER INSTALLED
OH	OVERHEAD
OHE/T	OVERHEAD ELECTRIC/TELEPHONE
OPP	OPPOSITE
(P)	
P	POLE
PA	PUBLIC ADDRESS
PB	PULL BOX
PDP	POWER DISTRIBUTION PANEL
PE	PHOTO ELECTRIC
PF	POWER FACTOR
PH, Ø	PHASE
PNL	PANEL
PRI	PRIMARY
PT	POTENTIAL TRANSFORMER
PVC	POLYVINYL CHLORIDE
PWR	POWER
(Q)	
QTY	QUANTITY
(R)	
R, RE	RELOCATE AS SHOWN
RCLP	REMOTE CONTROL LIGHTING PANEL
RCPT	RECEPTACLE
REF	REFRIGERATOR
RF	RADIO FREQUENCY
RLA	RATED (RUNNING) LOAD AMPS
RM	ROOM
RP	RECEPTACLE PANELBOARD
RSC	RIGID STEEL CONDUIT
(S)	
SCH, SCHED	SCHEDULE
SEC	SECONDARY
SF	SQUARE FOOT
SPD	SURGE PROTECTIVE DEVICE
SPDT	SINGLE POLE DOUBLE THROW
SPEC(S)	SPECIFICATION(S)
SPKR	SPEAKER
SPST	SINGLE POLE SINGLE THROW
STD	STANDARD
SW	SWITCH
SWBD	SWITCHBOARD
SWGR	SWITCHGEAR
SYM	SYMMETRICAL
(T)	
TB	TERMINAL BLOCK
TBB	TELEPHONE BACKBOARD
TC	TIME CLOCK
TEL, TELE	TELEPHONE
TELECOM	TELECOMMUNICATIONS
TP	TAMPERPROOF
TV	TELEVISION
TYP	TYPICAL
(U)	
UG	UNDERGROUND
UGP	UNDERGROUND PRIMARY
UGS	UNDERGROUND SECONDARY
UGT	UNDERGROUND TELEPHONE
UL	UNDERWRITER'S LABORATORY
UON	UNLESS OTHERWISE NOTED
UPS	UNINTERRUPTIBLE POWER SUPPLY
(V)	
V	VOLTS
VA	VOLT-AMPERES
VFD	VARIABLE FREQUENCY DRIVE/ VARIABLE FREQUENCY MOTOR CONTROLLER
(W)	
W	WIRE
W/	WITH
W/O	WITHOUT
WHM	WATT HOUR METER
WP	WEATHERPROOF
(X)	
X	REMOVE DEVICE
XFMR	TRANSFORMER
(Z)	
%Z	PERCENT IMPEDANCE

ALL ABBREVIATIONS, SYMBOLS AND LEGENDS SHOWN ON THIS DRAWING ARE NOT NECESSARILY USED.

ELECTRICAL EQUIPMENT NAMING CONVENTION KEY

XX-X-X

PREFIX — SYSTEM — PANEL NUMBER

PREFIX	DESCRIPTION
DP	DISTRIBUTION PANELBOARD
MCC	MOTOR CONTROL CENTER

SYSTEM	DESCRIPTION
A	VAULT A
B	VAULT B

ELECTRICAL LIGHTING SYMBOLS

- WALL MOUNTED LIGHTING FIXTURE- TYPE AS INDICATED
- a — LIGHTING FIXTURE - TYPE AS INDICATED (SUBSCRIPT INDICATES SWITCH CONTROL)
- LIGHTING FIXTURE - TYPE AS INDICATED
- WALLWASH LIGHT FIXTURE
- SHADING INDICATES FIXTURE CONNECTED TO CRITICAL BRANCH
- SHADING INDICATES FIXTURE CONNECTED TO LIFE SAFETY BRANCH
- LIGHTING TRACK - "X" DENOTES TYPE
- EXIT LIGHT - WALL/CEILING MOUNTED - DIRECTIONAL ARROWS AS INDICATED SHADING INDICATES ILLUMINATED FACE
- SITE LIGHTING FIXTURE TYPE AS INDICATED
- XX — LIGHTING FIXTURE TYPE DESIGNATION - "XX" INDICATES SPECIFIC TYPE
- SINGLE OR DOUBLE, REMOTE EMERGENCY LIGHTING FIXTURE
- a — SINGLE POLE SWITCH (SUBSCRIPT INDICATES FIXTURES CONTROLLED)
- 3 — THREE-WAY SWITCH (S3P-THREE-WAY SWITCH WITH PILOT LIGHT)
- 4 — FOUR - WAY SWITCH
- P — SINGLE POLE SWITCH WITH PILOT LIGHT
- K — KEY OPERATED SWITCH
- 3 — DUAL LEVEL SWITCHING. PROVIDE BALLASTS/DRIVERS REQUIRED TO PROVIDE DUAL LEVEL SWITCHING.
- L — LOW VOLTAGE SWITCH
- L1 — SINGLE ZONE LOW VOLTAGE ON/OFF SWITCH
- L1D — SINGLE ZONE LOW VOLTAGE DIMMER SWITCH
- L2 — 2 ZONE LOW VOLTAGE ON/OFF SWITCH
- L2D — 2 ZONE LOW VOLTAGE DIMMER SWITCH
- L4 — 4 ZONE LOW VOLTAGE ON/OFF SWITCH
- L4D — 4 ZONE LOW VOLTAGE DIMMER SWITCH
- D — DIMMER SWITCH
- OS — OCCUPANCY SENSOR WALL SWITCH
- PI — PASSIVE INFRARED OCCUPANCY SENSOR (WALL/CEILING)
- U — ULTRASONIC OCCUPANCY SENSOR (WALL/CEILING)
- DT — PASSIVE INFRARED/ULTRASONIC OCCUPANCY SENSOR (WALL/CEILING)
- PH — PHOTO CELL
- CS — COMBINATION PHOTOCELL/OCCUPANCY SENSOR

DISTRIBUTION AND DIAGRAM SYMBOLS

- SWITCH - SINGLE THROW
- FUSED SWITCH
- T — TRANSFORMER - TYPE AND RATING AS INDICATED
- POTENTIAL TRANSFORMER
- CPT — CONTROL POWER TRANSFORMER
- CURRENT TRANSFORMER
- DELTA CONNECTION
- WYE CONNECTION - SOLID GROUND
- E — ELECTRIC INTERLOCK SYSTEM
- K — KEY INTERLOCKING SYSTEM
- DRAWOUT TYPE, CIRCUIT BREAKER
- STATIONARY CIRCUIT BREAKER
- FUSE
- ATS — AUTOMATIC TRANSFER SWITCH
- BUS DUCT PLUG-IN UNIT
- LIGHTNING ARRESTOR
- GROUND
- SURGE PROTECTION DEVICE, ONE-LINE
- M / EMU — ELECTRONIC METERING UNIT
- SPD — SURGE PROTECTIVE DEVICE
- DISTRIBUTION PANELBOARD
- PANELBOARD - (FLUSH/SURFACE)
- LCP — LIGHTING CONTROL PANEL, SURFACE MTD. UON.
- LRP — LOW VOLTAGE LIGHTING RELAY PANEL, SURFACE MTD. UON
- MOTOR CONTROL CENTER
- UPS — UNINTERRUPTIBLE POWER SUPPLY
- TBB — TELECOMMUNICATIONS BACKBOARD
- RP-XXXX — SYMBOL INDICATES TO WHICH PANELBOARD INDICATED CIRCUITS IN THE ROOM ARE TO BE CONNECTED.
- GAP — GENERATOR ANNUNCIATOR (DERANGEMENT) PANEL
- G — GENERATOR

ELECTRICAL WIRING SYMBOLS

- A-1 — HOMERUN TO PANEL WITH CIRCUIT NUMBER(S) AS INDICATED
- CONDUIT RUN CONCEALED IN FINISHED AREAS, EXPOSED IN UNFINISHED AREAS OR BELOW ACCESS FLOORS
- DEMOLITION WORK
- UG — UNDERGROUND CONDUIT/DUCTBANK
- FB — FEEDER BUSWAY
- PB — PLUG-IN BUSWAY
- G — GROUND CABLE, SIZE AS INDICATED
- GB — GROUND BUS
- CT — CABLE TRAY
- CONDUIT TURNED UP
- CONDUIT TURNED DOWN
- EMH — ELECTRIC MANHOLE
- EHH — ELECTRIC HANDHOLE
- TMH — TELEPHONE MANHOLE
- GROUND ROD

ELECTRICAL POWER SYMBOLS

- SINGLE RECEPTACLE, 20A, 125V, 2P, 3W. (SLASH INDICATES MOUNTING ABOVE FINISH COUNTER)
- DUPLEX RECEPTACLE, 20A, 125V, 2P, 3W. (SLASH INDICATES MOUNTING ABOVE FINISH COUNTER)
- GFI, DUPLEX RECEPTACLE, 20A, 125V, 2P, 3W. (SLASH INDICATES MOUNTING ABOVE FINISH COUNTER)
- QUADRUPLEX RECEPTACLE, (2)20A, 125V, 2P, 3W, DUPLEX RECEPTACLES WITH A COMMON FACEPLATE. (SLASH INDICATES MOUNTING ABOVE FINISH COUNTER)
- SINGLE ISOLATED GROUND RECEPTACLE, 20A, 125V, 2P, 3W. (SLASH INDICATES MOUNTING ABOVE FINISH COUNTER)
- DUPLEX ISOLATED GROUND RECEPTACLE, 20A, 125V, 2P, 3W. (SLASH INDICATES MOUNTING ABOVE FINISH COUNTER)
- QUADRUPLEX ISOLATED GROUND RECEPTACLE, (2)20A, 125V, 2P, 3W, DUPLEX ISOLATED GROUND RECEPTACLES WITH A COMMON FACEPLATE. (SLASH INDICATES MOUNTING ABOVE FINISH COUNTER)
- FULLY CONTROLLED DUPLEX/QUADRUPLEX RECEPTACLE. PROVIDE ALL WIRING, EQUIPMENT, POWER PACKS, AND OCCUPANCY SENSOR INTEGRATION REQUIRED TO TURN OFF RECEPTACLE(S) WHEN SPACE IS UNOCCUPIED.
- HALF CONTROLLED DUPLEX/QUADRUPLEX RECEPTACLE. PROVIDE ALL WIRING, EQUIPMENT, POWER PACKS, AND OCCUPANCY SENSOR INTEGRATION REQUIRED TO TURN OFF HALF OF RECEPTACLE(S) WHEN SPACE IS UNOCCUPIED.
- HALF SWITCHED DUPLEX RECEPTACLE, 20A, 125V, 2P, 3W.
- EMERGENCY DUPLEX RECEPTACLE, 20A, 125V, 2P, 3W. (SHADING INDICATING EMERGENCY RECEPTACLE TYPICAL FOR ALL OTHER RECEPTACLE TYPES)
- COMBINATION USB DUPLEX RECEPTACLE, 20A, 125V, 2P, 3W WITH (2) 5VDC, 2.1A USB CHARGING PORTS
- 6-30R — SPECIAL PURPOSE RECEPTACLE. TYPE AS INDICATED ON DRAWINGS. COORDINATE RECEPTACLE TYPE WITH ACTUAL EQUIPMENT PRIOR TO INSTALLATION.
- CEILING MOUNTED SINGLE RECEPTACLE, 20A, 125V, 2P, 3W.
- CEILING MOUNTED SINGLE ISOLATED GROUND RECEPTACLE, 20A, 125V, 2P, 3W.
- CEILING MOUNTED DUPLEX RECEPTACLE, 20A, 125V, 2P, 3W. ("CR" SUBSCRIPT INDICATES CORD REEL)
- CEILING MOUNTED DUPLEX ISOLATED GROUND RECEPTACLE, 20A, 125V, 2P, 3W.
- CEILING MOUNTED QUADRUPLEX RECEPTACLE, (2) 20A, 125V, 2P, 3W, DUPLEX RECEPTACLES WITH A COMMON FACEPLATE.
- CEILING MOUNTED QUADRUPLEX ISOLATED GROUND RECEPTACLE, (2)20A, 125V, 2P, 3W, DUPLEX ISOLATED GROUND RECEPTACLES WITH A COMMON FACEPLATE.
- RECEPTACLES MOUNTED ABOVE THE CEILING.
- SINGLE RECEPTACLE, 20A, 125V, 2P, 3W., FLOOR MTD SERVICE FITTING, FLUSH TYPE UON ("S" DENOTES SURFACE TYPE)
- SINGLE IG RECEPTACLE, 20A, 125V, 2P, 3W., FLOOR MTD SERVICE FITTING, FLUSH TYPE UON ("S" DENOTES SURFACE TYPE)
- DUPLEX RECEPTACLE, 20A, 125V, 2P, 3W., FLOOR MTD SERVICE FITTING, FLUSH TYPE UON ("S" DENOTES SURFACE TYPE)
- DUPLEX IG RECEPTACLE, 20A, 125V, 2P, 3W., FLOOR MTD SERVICE FITTING, FLUSH TYPE UON ("S" DENOTES SURFACE TYPE)
- QUADRUPLEX RECEPTACLE, (2) 20A, 125V, 2P, 3W., FLOOR MTD SERVICE FITTING, FLUSH TYPE UON ("S" DENOTES SURFACE TYPE)
- QUADRUPLEX IG RECEPTACLE, (2) 20A, 125V, 2P, 3W., FLOOR MTD SERVICE FITTING, FLUSH TYPE UON ("S" DENOTES SURFACE TYPE)

WHERE INDICATED IN AN EXISTING FLOOR, PROVIDE CORE DRILL PACKAGE TO MAINTAIN FIRE RATING OF FLOOR. EXTEND CONDUIT AND WIRING IN CEILING SPACE OF FLOOR BELOW TO ELECTRICAL CLOSET OR PANELBOARD.

- FBX — FLOOR BOX ("X" DENOTES TYPE AS SPECIFIED)
- PTX — POKE-THROUGH ASSEMBLY ("X" DENOTES TYPE AS SPECIFIED)
- AFX — ACCESS FLOOR BOX ("X" DENOTES TYPE AS SPECIFIED)
- J — JUNCTION BOX (CEILING, FLOOR OR WALL MOUNTED) INDICATED IN POWER, LIGHTING & FIRE ALARM SYSTEMS PLANS.
- DIRECT CONNECTION TO EQUIPMENT
- P — POWER SERVICE FITTING (CEILING, FLOOR OR WALL MOUNTED) FOR CONNECTION TO FURNITURE SYSTEM AS SPECIFIED.
- SR-X — SURFACE RACEWAY ("X" DENOTES TYPE AS SPECIFIED)
- HC — ADA DOOR ACTUATOR
- PD — COMBINATION POWER AND TELECOMMUNICATIONS BOX (CEILING, FLOOR OR WALL MOUNTED) FOR POWER AND DATA CONNECTION INDICATED IN POWER & SPECIAL SYSTEMS PLANS.
- FS — FAUCET/FLUSH SENSOR FOR PLUMBING FIXTURES. COORDINATE ELECTRICAL CONNECTIONS WITH INSTALLATION OF PLUMBING FIXTURES.

ELECTRICAL EQUIPMENT SYMBOLS

- MOTOR AND CONNECTION
- DISCONNECT SWITCH, NON-FUSED PROVIDE SWITCH AMPACITY EQUAL TO OR GREATER THAN FEEDER AMPACITY, UON
- DISCONNECT SWITCH, FUSED. PROVIDE SWITCH AND FUSE AMPACITY EQUAL TO OR GREATER THAN FEEDER AMPACITY, UON
- CB — CIRCUIT BREAKER IN NEMA 1 ENCLOSURE (FLUSH/SURFACE)
- COMBINATION MOTOR STARTER WITH DISCONNECT SWITCH. PROVIDE SWITCH AND FUSE AMPACITY EQUAL TO OR GREATER THAN FEEDER AMPACITY, UON
- HAND-OFF-AUTO SELECTOR SWITCH WITH PILOT LIGHT
- M — MANUAL MOTOR STARTER WITH PILOT LIGHT AS INDICATED.
- PC — PACKAGE CONTROL UNIT (PROVIDED BY EQUIPMENT SUPPLIER)
- VFD — VARIABLE FREQUENCY DRIVE/VARIABLE FREQUENCY MOTOR CONTROLLER WITH CIRCUIT BREAKER INPUT POWER DISCONNECTING MEANS PER DIVISION 26 SPECIFICATIONS.
- PUSHBUTTON STATION
- EMERGENCY POWER OFF
- C — CONTACTOR
- GROUNDING BUS BAR

GENERAL NOTES

A. PROVIDE 1#12 + 1#12N + 1#12G FOR 20A BRANCH CIRCUITING, UON; MAXIMUM OF THREE CIRCUITS PER CONDUIT; MINIMUM CONDUIT SIZE OF 3/4" C, UON.

B. PROVIDE A DEDICATED NEUTRAL WIRE FOR EACH BRANCH CIRCUIT.

C. COORDINATE DEVICE LOCATIONS AND MOUNTING HEIGHTS WITH ARCHITECTURAL DRAWINGS PRIOR TO ROUGH-IN.

D. PROVIDE FIRE STOPPING FOR CONDUITS AND ELECTRICAL EQUIPMENT FOR FLOOR SLABS, WALLS AND CEILINGS TO MAINTAIN FIRE RATING.

E. INSTALL ELECTRICAL WORK IN ACCORDANCE WITH THE NATIONAL ELECTRICAL CODE AND LOCAL BUILDING AND FIRE CODES, IN A NEAT AND WORKMANLIKE MANNER.

F. LIMIT VOLTAGE DROP TO 2% FOR FEEDERS AND 3% FOR BRANCH CIRCUITS. INCLUDE DERATING FACTOR FOR ROOF-MOUNTED CONDUITS.

G. REFER TO ARCH. REFLECTED CEILING PLANS FOR EXACT LOCATION OF CEILING MOUNTED DEVICES AND LIGHT FIXTURES, UNLESS OTHERWISE INDICATED.

H. WHERE MULTIPLE SWITCHES, RECEPTACLES, AND OTHER OUTLETS (EXCEPT WALL PHONES) ARE INDICATED PROVIDE MULTI-GANG BACK BOXES WITH GANG BARRIERS AND A COMMON FACEPLATE.

I. WHERE DIFFERENT RECESSED ELECTRICAL DEVICES WITH THE SAME MOUNTING HEIGHTS ARE INDICATED SIDE-BY-SIDE, MOUNT THE DEVICES SO THAT THERE IS FOUR INCHES BETWEEN ADJACENT VERTICAL EDGES OF THE FACEPLATES, UON.

J. WHERE ELECTRICAL DEVICES WITH DIFFERENT MOUNTING HEIGHTS ARE LOCATED IN THE SAME AREA ALIGN DEVICES VERTICALLY THROUGH THEIR CENTERLINES, UON.

K. WHERE EXIT SIGNS ARE INDICATED ABOVE DOOR MOUNT AS FOLLOWS, CENTER THE EXIT SIGN BETWEEN TOP OF DOOR FRAME AND CEILING IF DISTANCE BETWEEN TOP OF DOOR FRAME AND CEILING IS 24 INCHES OR LESS; OTHERWISE MOUNT BOTTOM OF EXIT SIGN 6 INCHES FROM TOP OF DOOR FRAME, MOUNT OTHER WALL MOUNTED EXIT SIGNS IN THE SAME AREA AT THE SAME HEIGHT. COORDINATE WITH ARCHITECTURAL DETAILS.

L. EXIT SIGNS ARE TO BE TYPE "X1", UON.

M. PROVIDE SEPARATE NEUTRALS FOR DIMMING CIRCUITS.

N. PROVIDE FEEDERS AND BRANCH CIRCUITS WHICH HAVE AN AMPACITY EQUAL TO OR GREATER THAN THE CIRCUIT OVERCURRENT PROTECTIVE DEVICE RATING, U.O.N.

O. FURNITURE LAYOUTS ARE FOR REFERENCE ONLY. COORDINATE THE FINAL LOCATION OF ELECTRICAL DEVICES AND OUTLETS WITH ARCHITECT, OWNER AND FINAL FURNITURE PLANS PRIOR TO INSTALLATION.

P. MOUNT DEVICES FLUSH WITH CONCEALED CONDUIT, EXCEPT AS NOTED ON THE DRAWINGS AND IN MECHANICAL AND ELECTRICAL EQUIPMENT ROOMS.

Q. THE DRAWINGS REPRESENT ELECTRICAL DESIGN INTENT. THEY ARE DIAGRAMMATIC. PROVIDE ALL COMPONENTS NECESSARY FOR COMPLETE OPERATING ELECTRICAL SYSTEMS.

R. PROVIDE GALVANIZED RIGID CONDUIT (GRC) RACEWAY FOR ALL NEW RACEWAY INSTALLED IN SCOPE OF WORK (MECHANICAL ROOM, PARKING GARAGE, ETC.) PER SPECIFICATION SECTION 260533.

S. WHEN MORE THAN ONE 20A., 1P., 120 VOLT CIRCUIT FEEDS A SURFACE RACEWAY CONNECT RECEPTACLES TO ALTERNATE CIRCUITS AS FOLLOWS - U.O.N.

A B C A B C

MOUNTING HEIGHTS

DIMMERS/LIGHT SWITCHES	4'-0" AFF
DISCONNECT SWITCHES	5'-6" AFF
INDIVIDUAL CIRCUIT BREAKERS	5'-6" AFF
MOTOR STARTERS	5'-6" AFF
PANELBOARDS & CABINETS	6'-0" AFF TO TOP
PUSHBUTTONS	4'-0" AFF
RECEPTACLES	1'-6" AFF
RECEPTACLES ABOVE FINISHED COUNTER	8" AFC
VANITY LIGHT IN TOILET	6" ABOVE THE MIRROR, UON
VOLUME CONTROLS	4'-0" AFF
WALL SWITCHES	4'-0" AFF
TELECOMMUNICATIONS OUTLETS	1'-6" AFF
TV OUTLETS	5'-0" AFF

MOUNTING HEIGHT NOTES:

1. ALL ELEVATIONS ARE TO CENTER LINE OF DEVICE, UNLESS OTHERWISE NOTED.
2. REFER TO EQUIPMENT ELEVATION DRAWINGS FOR COORDINATION WITH CASEWORK.
3. MOUNT MANUAL MOTOR STARTER ADJACENT TO OR ON UNIT.
4. REFER TO ARCHITECTURAL A0 SERIES FOR ADDITIONAL ELECTRICAL DEVICE MOUNTING HEIGHTS AND DEVICE ALIGNMENT RULES.

REFERENCE SYMBOLS

- SECTION NUMBER
- E0.1 — DRAWING NUMBER WHERE DRAWN
- DETAIL NUMBER
- DRAWING NUMBER WHERE DRAWN
- XXX — KEY NOTE

H. CARL MOULTRIE I COURTHOUSE
MECHANICAL ROOM 1000 CHILLED WATER UPGRADES
500 INDIANA AVENUE N.W.
WASHINGTON DC 20001

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1700 NEW YORK AVENUE NW
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100% CONSTRUCTION DOCUMENTS		04/30/2021
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SEALS AND SIGNATURES

DISTRICT OF COLUMBIA — ROBERT A. PFARF — No. PE906485 — ELECTRICAL — PROFESSIONAL ENGINEER

SHEET TITLE

ELECTRICAL ABBREVIATIONS AND SYMBOLS

13089.000

PROJECT NUMBER

CD

SHEET NUMBER

E0.1

Author

Plot Date: 4/30/2021 12:58:27 PM

FEEDER & BRANCH CIRCUIT SIZING SCHEDULE - NONLINEAR LOADS

(NOTES 1 & 2)

OVERCURRENT DEVICE RATING (AMPERES)	WIRE SIZE - AWG OR KCMIL		CONDUIT SIZE			NOTE
	PHASE & NEUTRAL	E.G.	4 WIRE (2PH & 2N)	5 WIRE (NOTE-7)	6 WIRE (3PH & 3N)	
15-20	12	12	3/4"	3/4"	3/4"	
25-30	10	10	3/4"	3/4"	3/4"	
35-40	8	10	3/4"	1"	1"	
45-50	8(6)	10	3/4"(1")	1"	1"(1 1/4")	
60	6(4)	10	1"(1 1/4")	1"(1 1/4")	1 1/4"	
70	6(4)	8	1"(1 1/4")	1"(1 1/4")	1 1/4"	
80-90	4(2)	8	1 1/4"	1 1/4"(1 1/2")	1 1/4"(1 1/2")	
100	3(2)	8	1 1/4"	1 1/2"	1 1/2"	
110	2(1)	6	1 1/2"	2"	2"	
125	1(1/0)	6	1 1/2"(2")	2"	2"	
150	1/0	6	2"	2"	2"	
175	2/0	6	2"	2"	2 1/2"	
200	3/0	6	2"	2 1/2"	2 1/2"	
225	4/0	4	2 1/2"	2 1/2"	3"	
250	250	4	3"	3"	3"	
300	350	4	3"	3 1/2"	3 1/2"	
350	500	3	3 1/2"	4"	4"	
400	2-3/0	2-3	2-2"	2-2 1/2"	2-2 1/2"	
450	2-4/0	2-2	2-2 1/2"	2-2 1/2"	2-3"	
500	2-250	2-2	2-3"	2-3"	2-3"	
600	2-350	2-1	2-3"	2-3 1/2"	2-3 1/2"	
700	2-500	2-1/0	2-3 1/2"	2-4"	2-4"	
800	3-300	3-1/0	3-3"	3-3 1/2"	3-3 1/2"	
1000	3-400	3-2/0	3-3"	3-3 1/2"	3-4"	
1200	4-350	4-3/0	4-3"	4-3 1/2"	4-3 1/2"	
1600	5-400	5-4/0	5-3"	5-3 1/2"	5-4"	
2000	6-400	6-250	6-3"	6-3 1/2"	6-4"	

FEEDER & BRANCH CIRCUIT SIZING SCHEDULE - GENERAL PURPOSE

(NOTES 1 & 2)

OVERCURRENT DEVICE RATING (AMPERES)	WIRE SIZE - AWG OR KCMIL		CONDUIT SIZE			NOTE
	PHASE & NEUTRAL	E.G.	2 WIRE	3 WIRE	4 WIRE	
15-20	12	12	3/4"	3/4"	3/4"	
25-30	10	10	3/4"	3/4"	3/4"	
35-40	8	10	3/4"	3/4"	3/4"	
45-50	8(6)	10	3/4"	3/4"	3/4"(1")	
60	6(4)	10	3/4"(1")	3/4"(1")	1"(1 1/4")	
70	6(4)	8	3/4"(1")	3/4"(1")	1"(1 1/4")	
80-90	4(2)	8	1"	1"(1 1/4")	1 1/4"	
100	3(2)	8	1"(1 1/4")	1 1/4"	1 1/4"	
110	2(1)	6	1 1/4"	1 1/4"(1 1/2")	1 1/4"(1 1/2")	
125	1(1/0)	6	1 1/4"	1 1/2"	1 1/2"(2")	
150	1/0	6	1 1/4"	1 1/2"	2"	
175	2/0	6	1 1/2"	2"	2"	
200	3/0	6	1 1/2"	2"	2"	
225	4/0	4	2"	2"	2 1/2"	
250	250	4	2"	2 1/2"	2 1/2"	
300	350	4	2 1/2"	3"	3"	
350	500	3	3"	3"	3 1/2"	
400	2-3/0	2-3	2-2"	2-2"	2-2"	
450	2-4/0	2-2	2-2"	2-2"	2-2 1/2"	
500	2-250	2-2	2-2"	2-2 1/2"	2-2 1/2"	
600	2-350	2-1	2-2 1/2"	2-3"	2-3"	
700	2-500	2-1/0	2-3"	2-3"	2-3 1/2"	
800	3-300	3-1/0	3-2 1/2"	3-3"	3-3"	
1000	3-400	3-2/0	3-2 1/2"	3-3"	3-3"	
1200	4-350	4-3/0	4-2 1/2"	4-3"	4-3"	
1600	5-400	5-4/0	5-2 1/2"	5-3"	5-3"	
2000	6-400	6-250	6-2 1/2"	6-3"	6-3"	

DRAWING NOTES

CIRCUIT SIZING SCHEDULES NOTES:

1. BASED ON THHN/THWN, 90°., 600V., INSULATED, COPPER WIRE APPLIED AT 75°FOR TERMINATIONS RATED AT 60°C/75°C AND 75°C. FOR TERMINATIONS RATED AT 60°C PROVIDE WIRE AND CONDUIT SIZES INDICATED IN PARENTHESIS.
2. BASED ON WIRE OUTSIDE DIAMETERS AND RIGID METALLIC CONDUIT INSIDE DIAMETERS AS PROVIDED IN THE NEC. DO NOT REDUCE CONDUIT SIZE FOR NON-RIGID METALLIC APPLICATION. REFER TO NEC FOR CONDUIT TYPES MORE RESTRICTIVE THAN RIGID METALLIC.
3. BASED ON MOTOR FULL LOAD AMPERES AS PROVIDED BY THE NEC.
4. BASED ON MOTOR RUNNING OVERLOAD PROTECTION PROVIDED BY THERMAL OVERLOAD RELAYS.
5. MOTOR STARTING TYPE BASED ON 460V., 3 PHASE, FULL VOLTAGE NON-REVERSING EXCEPT FOR MOTORS SIZED 75HP OR GREATER WHICH ARE BASED ON 460V., 3 PHASE, PART WINDING REDUCED VOLTAGE STARTING.
6. TRANSFORMER CIRCUITS BASED ON 480V TO 208/120V., 3 PHASE, 4 WIRE,DRY TYPE.

480V., THREE PHASE CIRCUIT LENGTH TABLE

BREAKER AMPACITY (AMPS)	MAX. CIRCUIT LOAD (AMPS)	MAXIMUM LENGTH IN FEET																							
		NO.12	NO.10	NO.8	NO.6	NO.4	NO.2	NO.1	1/0	2/0	3/0	4/0	250	350	500	2-3/0	2-4/0	2-250	2-350	2-500	3-300	3-400	4-350	5-400	6-400	6-500
20	16	253	403	642	1019	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
30	24	-	269	428	679	1079	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
40	32	-	-	321	509	809	1293	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
50	40	-	-	-	408	648	1034	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
60	48	-	-	-	-	540	862	1083	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
70	56	-	-	-	-	-	739	928	1169	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
80	64	-	-	-	-	-	646	812	1023	1286	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
90	72	-	-	-	-	-	574	722	909	1143	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
100	80	-	-	-	-	-	-	650	818	1029	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
125	100	-	-	-	-	-	-	-	655	823	1043	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
150	120	-	-	-	-	-	-	-	546	689	869	1107	-	-	-	-	-	-	-	-	-	-	-	-	-	-
175	140	-	-	-	-	-	-	-	-	588	745	949	1110	-	-	-	-	-	-	-	-	-	-	-	-	-
200	160	-	-	-	-	-	-	-	-	-	652	830	971	1360	-	-	-	-	-	-	-	-	-	-	-	-
225	180	-	-	-	-	-	-	-	-	-	-	738	863	1209	1743	-	-	-	-	-	-	-	-	-	-	-
250	200	-	-	-	-	-	-	-	-	-	-	-	777	1088	1569	1043	-	-	-	-	-	-	-	-	-	-
300	240	-	-	-	-	-	-	-	-	-	-	-	-	907	1307	869	1107	-	-	-	-	-	-	-	-	-
350	280	-	-	-	-	-	-	-	-	-	-	-	-	-	1120	745	949	1110	-	-	-	-	-	-	-	-
400	320	-	-	-	-	-	-	-	-	-	-	-	-	-	-	652	830	971	1360	-	-	-	-	-	-	-
450	360	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	738	863	1209	-	-	-	-	-	-	-
500	400	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	777	1088	1569	-	-	-	-	-	-
600	480	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	907	1307	1165	-	-	-	-	-
700	560	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1120	999	1346	-	-	-	-
800	640	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	874	1177	1360	-	-	-
1000	800	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	942	1088	1569	-	-
1200	960	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	907	1307	-	-
1600	1200	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	980	1226	1307
1800	1440	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1089	1177
2000	1600	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	980	1137

MOTOR CIRCUIT SIZING SCHEDULE

(FOR 460V, 3 PHASE MOTORS) (NOTES 3,4,5)

MOTOR HP	SWITCH/FUSE	CIRCUIT BREAKER	STARTER	CONDUIT & WIRE		
			SIZE/TYPE	PHASE	E.G.	CONDUIT
1/2	30/3A.	15A	1	12	12	3/4"
3/4	30/3A.	15A	1	12	12	3/4"
1	30/6A.	15A	1	12	12	3/4"
1 1/2	30/6A.	15A	1	12	12	3/4"
2	30/6A.	15A	1	12	12	3/4"
3	30/10A.	15A	1	12	12	3/4"
5	30/15A.	20A	1	12	12	3/4"
7 1/2	30/20A.	25A	1	12	12	3/4"
10	30/25A.	35A	1	12	12	3/4"
15	60/40A.	50A	2	10	10	3/4"
20	60/50A.	60A	2	8	10	3/4"
25	60/60A.	80A	2	6	8	3/4"
30	100/70A.	100A	3	6	8	3/4"
40	100/100A.	125A	3	4	6	1"
50	200/125A.	150A	3	3	6	1 1/4"
60	200/150A.	175A	4	1	6	1 1/4"
75	200/175A.	225A	4	1/0	4	1 1/2"
100	400/225A.	300A	4	2/0	4	2"
125	400/300A.	350A	5	3/0	3	2"
150	400/350A.	450A	5	4/0	2	2"
200	600/450A.	600A	5	350	1	2 1/2"

MOTOR CIRCUIT SIZING SCHEDULE

(FOR 208V, 3 PHASE MOTORS NOTES 3,4,5)

MOTOR HP	SWITCH/FUSE	CIRCUIT BREAKER	STARTER	CONDUIT & WIRE		
			SIZE/TYPE	PHASE	E.G.	CONDUIT
1/2	30/4A.	15A	1	12	12	3/4"
3/4	30/6.25A.	15A	1	12	12	3/4"
1	30/8A.	15A	1	12	12	3/4"
1 1/2	30/15A.	20A	1	12	12	3/4"
2	30/15A.	20A	1	12	12	3/4"
3	30/20A.	25A	1	12	12	3/4"
5	30/30A.	40A	1	10	10	3/4"
7 1/2	60/45A.	60A	1	8	10	3/4"
10	60/60A.	70A	2	8	8	3/4"
15	100/90A.	110A	3	4	6	1"
20	200/110A.	125A	3	3	6	1 1/4"
25	200/150A.	175A	3	2	6	1 1/4"
30	200/175A.	200A	4	1	6	1 1/4"
40	200/200A.	250A	4	1/0	4	1 1/2"
50	400/250A.	350A	5	3/0	3	2"
60	400/300A.	400A	5	4/0	3	2"
75	400/400A.	500A	5	300	2	2 1/2"
100	600/500A.	600A	6	500	1	3"
125	800/700A.	800A	6	2-4/0	2-1/0	2-2"
150	800/700A.	800A	6	2-250	2-1/0	2-2"
200	1200/1000A	1200A	7	2-400	2-3/0	2-2 1/2"

TRANSFORMER CIRCUIT SIZING SCHEDULE - GENERAL PURPOSE TYPE

(NOTE 6)

TRANSF. KVA	PRIMARY CIRCUIT (480V.)		SECONDARY CIRCUIT (208/120V.)		
	SWITCH/FUSE OR CIRCUIT BREAKER	PRIMARY FEEDER	SWITCH/FUSE OR CIRCUIT BREAKER	SYSTEM/EQUIPMENT BONDING JUMPER (GROUND WIRE)	SECONDARY FEEDER
9	30/20A.	20A., 3W.	30/30A.	#8	30A., 4W.
15	30/25A.	25A., 3W.	60/60A.	#8	60A., 4W.
30	60/45A.	45A., 3W.	100/100A.	#8	100A., 4W.
45	100/70A.	70A., 3W.	200/175A.	#4	175A., 4W.
75	200/125A.	125A., 3W.	400/300A.	#2	300A., 4W.
112 1/2	200/175A.	175A., 3W.	400/400A.	#1/0	400A., 4W.
150	400/225A.	225A., 3W.	600/600A.	#2/0	600A., 4W.
225	400/350A.	350A., 3W.	800/800A.	#3/0	800A., 4W.
300	600/500A.	500A., 3W.	1200/1000A.	#3/0	1000A., 4W.

TRANSFORMER CIRCUIT SIZING SCHEDULE -NONLINEAR LOAD TYPE

(NOTE 6)

TRANSF. KVA	PRIMARY CIRCUIT (480V.)		SECONDARY CIRCUIT (208/120V.)		
	SWITCH/FUSE OR CIRCUIT BREAKER	PRIMARY FEEDER	SWITCH/FUSE OR CIRCUIT BREAKER	SYSTEM/EQUIPMENT BONDING JUMPER (GROUND WIRE)	SECONDARY FEEDER
9	30/20A.	20A., 3W.	30/30A.	#8	30A., 5W.-NL
15	30/25A.	25A., 3W.	60/60A.	#8	60A., 5W.-NL
30	60/45A.	45A., 3W.	100/100A.	#8	100A., 5W.-NL
45	100/70A.	70A., 3W.	200/175A.	#4	175A., 5W.-NL
75	200/125A.	125A., 3W.	400/300A.	#2	300A., 5W.-NL
112 1/2	200/175A.	175A., 3W.	400/400A.	#1/0	400A., 5W.-NL
150	400/225A.	225A., 3W.	600/600A.	#2/0	600A., 5W.-NL
225	400/350A.	350A., 3W.	800/800A.	#3/0	800A., 5W.-NL

120V. SINGLE PHASE CIRCUIT LENGTH TABLE

BREAKER AMPACITY (AMPS)	MAX. CIRCUIT CURRENT (AMPS)	MAX. CIRCUIT LOAD (VA)	MAXIMUM LENGTH IN FEET				
			NO.12	NO.10	NO.8	NO.6	NO.4
20	4	480	220	349	556	882	-
	8	960	110	174	278	441	701
	12	1440	73	116	185	294	467
	16	1920	55	87	139	221	350
30	24	2880	-	58	93	147	234
40	32	3840	-	-	70	110	175
50	40	4800	-	-	-	88	140
60	48	5760	-	-	-	-	117

208V. SINGLE PHASE CIRCUIT LENGTH TABLE

BREAKER AMPACITY (AMPS)	MAX. CIRCUIT CURRENT (AMPS)	MAX. CIRCUIT LOAD (VA)	MAXIMUM LENGTH IN FEET				
			NO.12	NO.10	NO.8	NO.6	NO.4
20	4	832	380	605	964	-	-
	8	1664	190	302	482	765	-
	12	2496	127	202	321	510	810
	16	3328	95	151	241	382	607
30	24	4992	-	101	161	255	405
40	32	6656	-	-	121	191	304
50	40	8320	-	-	-	153	243
60	48	9984	-	-	-	-	202

208V. THREE PHASE CIRCUIT LENGTH TABLE

BREAKER AMPACITY (AMPS)	MAX. CIRCUIT CURRENT (AMPS)	MAX. CIRCUIT LOAD (VA)	MAXIMUM LENGTH IN FEET				
			NO.12	NO.10	NO.8	NO.6	NO.4
20	4	1440	439	698	1113	-	-
	8	2880	220	349	557	883	-
	12	4320	127	233	371	589	935
	16	5760	95	175	278	442	701
30	24	8640	-	116	186	294	468
40	32	11520	-	-	139	221	351
50	40	14400	-	-	-	177	281
60	48	17280	-	-	-	-	234

277V. SINGLE PHASE CIRCUIT LENGTH TABLE

BREAKER AMPACITY (AMPS)	MAXIMUM LENGTH IN FEET		
	NO.12	NO.10	
20	200	300	

CIRCUIT MAXIMUM DISTANCE TABLES

NOTES:

A. CIRCUIT MAXIMUM DISTANCE IS BASED ON NEC CHAPTER 9, TABLE 8 CONDUCTOR PROPERTIES FOR COATED COPPER CONDUCTORS AT 75 DEGREES CELSIUS.

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SEALS AND SIGNATURES

DISTRICT OF COLUMBIA
ROBERT A. PFAFF
No. PE906485
ELECTRICAL
PROFESSIONAL ENGINEER

SHEET TITLE

ELECTRICAL SCHEDULES

PROJECT NUMBER 13089.000

CD

SHEET NUMBER E0.2

Author

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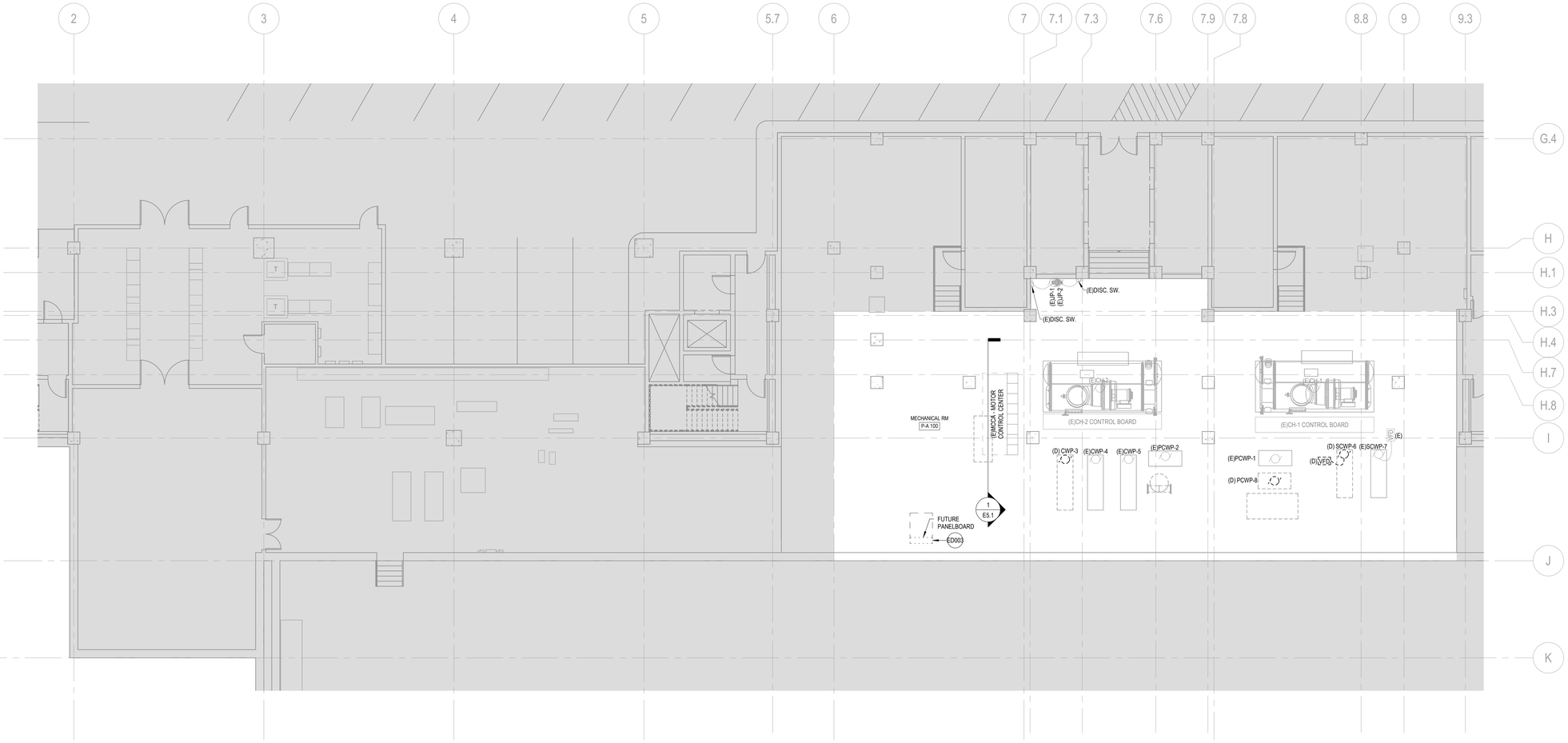

1 PHASE 1 BASEMENT LEVEL ELECTRICAL DEMOLITION PLAN
SCALE: 1/8" = 1'-0"

GENERAL SHEET NOTES

A. SEE DRAWING E0.1 FOR ABBREVIATIONS, SYMBOLS, GENERAL NOTES AND DEVICE MOUNTING HEIGHT OF WALL MOUNTED DEVICES, UON.
B. ALL EQUIPMENT/DEVICES WITH AN '(D)' SUBSCRIPT, INDICATED WITH HEAVY WEIGHT DASHED LINES, AND/OR INDICATED WITH KEYNOTES SHALL BE DEMOLISHED. REMOVE ALL ASSOCIATED EXISTING ELECTRICAL DEVICES, EQUIPMENT, BRANCH CIRCUITS AND FEEDERS IN THEIR ENTIRETY BACK TO THEIR POINT OF ORIGIN UNLESS OTHERWISE INDICATED. TURN OFF AND LABEL CIRCUIT BREAKERS AS SPARES FOR NEW WORK.
C. ALL EQUIPMENT/DEVICES WITH AN '(E)' SUBSCRIPT ARE EXISTING TO REMAIN. MAINTAIN ALL CONDUIT, WIRING, CIRCUIT CONTINUITY. PROTECT FROM DAMAGE DURING CONSTRUCTION. FOR EXISTING TO REMAIN RECEPTACLES, DEMOLISH WIRING AND MAINTAIN CONDUIT FOR REUSE WHERE FEASIBLE.
D. OUT OF SCOPE AREA IS INDICATED BY GRAY HATCH. MAINTAIN AND PRESERVE OUT OF SCOPE EXISTING SYSTEMS AND THEIR OPERATIONS.
E. SEE DRAWING SERIES E5 FOR POWER RISER DIAGRAM AND DRAWING SERIES E7 FOR ALL SCHEDULES.
F. QUANTITY AND LOCATION OF DEVICES SHOWN ON PLANS ARE APPROXIMATE. FIELD VERIFY DEVICES AND LOCATIONS.
G. PROTECT EXISTING-TO-REMAIN CEILING, FLOORS, WALLS AND PANELS AND DEVICES.
H. SELECT DEMOLITION MAY BE REQUIRED FOR NEW CONSTRUCTION AND MAY NOT BE DELINEATED ON THIS DRAWING. CAREFULLY COORDINATE DEMOLITION WITH NEW CONSTRUCTION (PARTITION AND REFLECTED CEILING) PLANS TO VERIFY ACTUAL EXTENT OF DEMOLITION.
I. EXAMINE THE DRAWINGS OF OTHER TRADES AND BE FAMILIAR WITH THE DEMOLITION REQUIRED BY OTHER TRADES. PERFORM INCIDENTAL ELECTRICAL DEMOLITION WORK AND/OR RELOCATION REQUIRED TO FACILITATE THE DEMOLITION WORK OF OTHER TRADES, WHETHER OR NOT SPECIFICALLY INDICATED
J. THOROUGHLY SURVEY THE EXISTING BUILDING AND SYSTEMS PRIOR TO SUBMITTING THE BID PRICE. INCLUDE A REMOVAL OF ALL ASSOCIATED COMPONENTS OF SYSTEMS INDICATED TO BE REMOVED. DEMOLISHED ELECTRICAL COMPONENTS SHALL NOT BE ABANDONED IN PLACE.
K. PROVIDE BLANK COVER PLATES WHERE DEVICES ARE REMOVED BUT EXISTING WALLS REMAIN INTACT.
L. PROVIDE NEW TYPED DIRECTORIES FOR PANELS AND MOTOR CONTROL CENTERS AFFECTED BY THIS ALTERATION.
M. FOR ALL EXISTING TO REMAIN MECHANICAL EQUIPMENT SHOWN ON THE MECHANICAL DRAWINGS, MAINTAIN ALL ASSOCIATED ELECTRICAL DEVICES AND CIRCUIT CONTINUITY. COORDINATE ALL MECHANICAL CONNECTIONS TO BE DEMOLISHED WITH THE MECHANICAL DRAWINGS. FOR DEMOLISHED EQUIPMENT, REMOVE ALL WIRING AND CONDUIT BACK TO PANEL.
N. RECYCLE OR DISPOSE MATERIALS OFF SITE AND INCLUDE ALL COSTS IN BID. HANDLE ALL MATERIALS IN ACCORDANCE WITH LEED REQUIREMENTS, ALL FEDERAL, STATE, AND LOCAL REGULATIONS.
O. POWER SHUT DOWNS ARE LIMITED DUE TO FULL TIME BUILDING OPERATION. CONTRACTOR TO COORDINATE ALL REQUIRED SHUT DOWNS WITH THE OWNER AT THE START OF THE PROJECT DURING THE INITIAL DEVELOPMENT OF THE CONSTRUCTION SCHEDULE. INCLUDE ALL ASSOCIATED OVERTIME COSTS TO PERFORM THIS WORK DURING WEEKENDS AND EVENINGS. INCLUDE ALL COSTS FOR PROVIDING TEMPORARY POWER WHERE SHUT DOWN MUST OCCUR FOR PERIODS LONGER THAN THESE HOURS. COORDINATE FINAL TIMING OF THE ELECTRICAL SHUT DOWNS WITH THE OWNER TWO WEEKS PRIOR TO SHUT DOWN.
P. PROVIDE CODE-COMPLIANT SUPPORT TO EXISTING-TO-REMAIN UNSUPPORTED CONDUITS AND BOXES WHERE CEILINGS ARE TO BE REMOVED. RE-ROUTE BRANCH CIRCUITS AND RELOCATE JUNCTION BOXES AS REQUIRED TO FACILITATE INSTALLATION OF NEW EQUIPMENT AND SYSTEMS IN CEILING SPACES.
Q. MAINTAIN ELECTRICAL SERVICE TO LIGHTING FIXTURES AND DEVICES THAT ARE TO REMAIN. EXTEND CONDUIT AND WIRE AS REQUIRED WHERE DEMOLITION WORK AFFECTS ELECTRICAL SERVICE TO DOWNSTREAM DEVICES THAT ARE TO REMAIN.

SHEET KEYNOTES

ED003 COORDINATE WITH GENERAL CONTRACTOR AND MECHANICAL CONTRACTOR FOR DIVISION 23 WORK TO PRESERVE FUTURE NEC REQUIRED WORKING AND DEDICATED SPACE REQUIREMENTS.

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SEALS AND SIGNATURES

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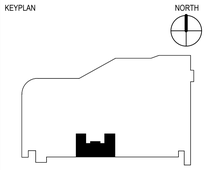
No. PE906485
ELECTRICAL
PROFESSIONAL ENGINEER

KEYPLAN



SHEET TITLE
PHASE 1 BASEMENT LEVEL ELECTRICAL DEMOLITION PLAN

PROJECT NUMBER
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SHEET NUMBER
ED2.1.1

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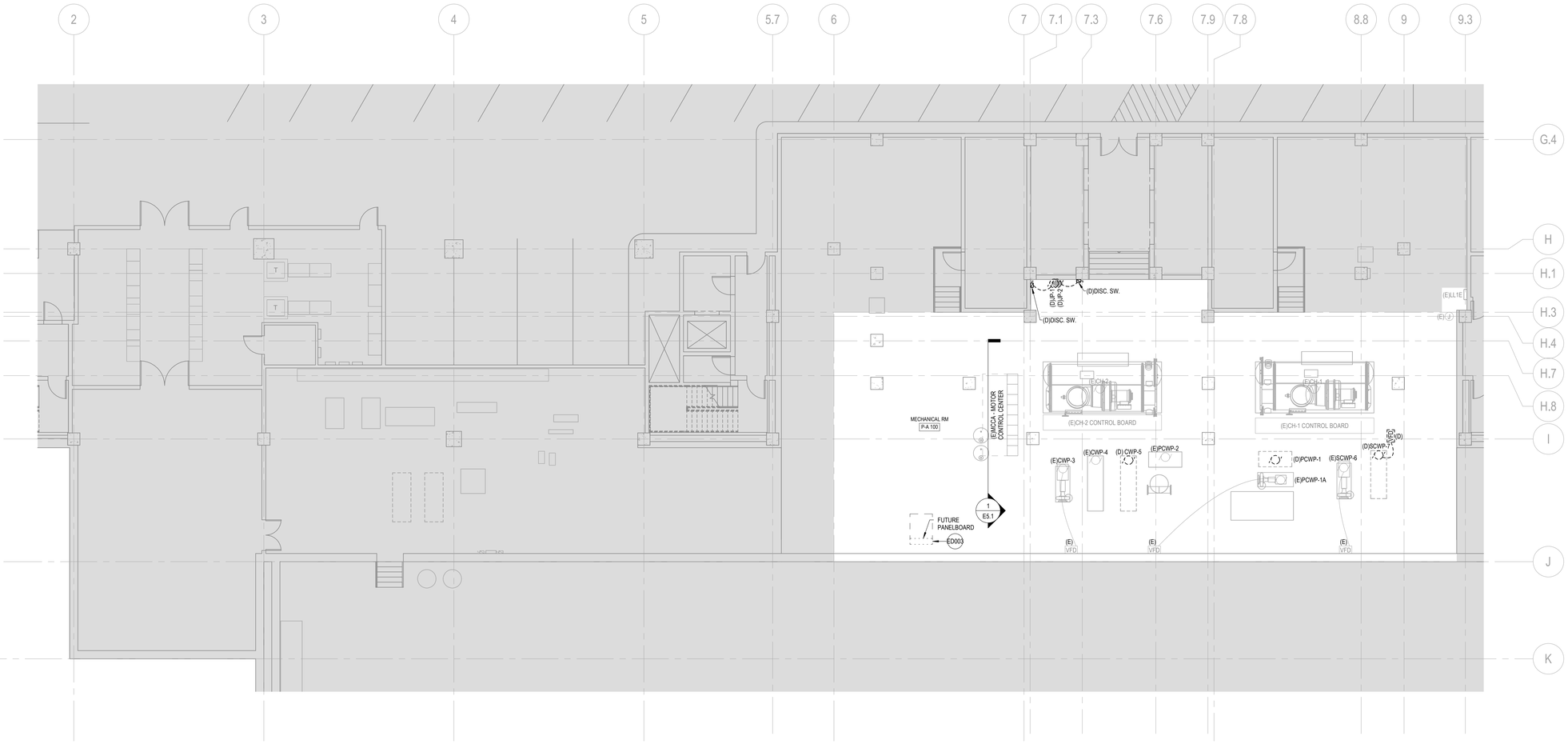

1 PHASE 2 BASEMENT LEVEL ELECTRICAL DEMOLITION PLAN
SCALE: 1/8" = 1'-0"

GENERAL SHEET NOTES

A. SEE DRAWING E0.1 FOR ABBREVIATIONS, SYMBOLS, GENERAL NOTES AND DEVICE MOUNTING HEIGHT OF WALL MOUNTED DEVICES, UON.
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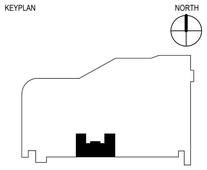

SHEET TITLE
PHASE 2 BASEMENT LEVEL ELECTRICAL DEMOLITION PLAN

PROJECT NUMBER
13089.000

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SHEET NUMBER
ED2.1.2

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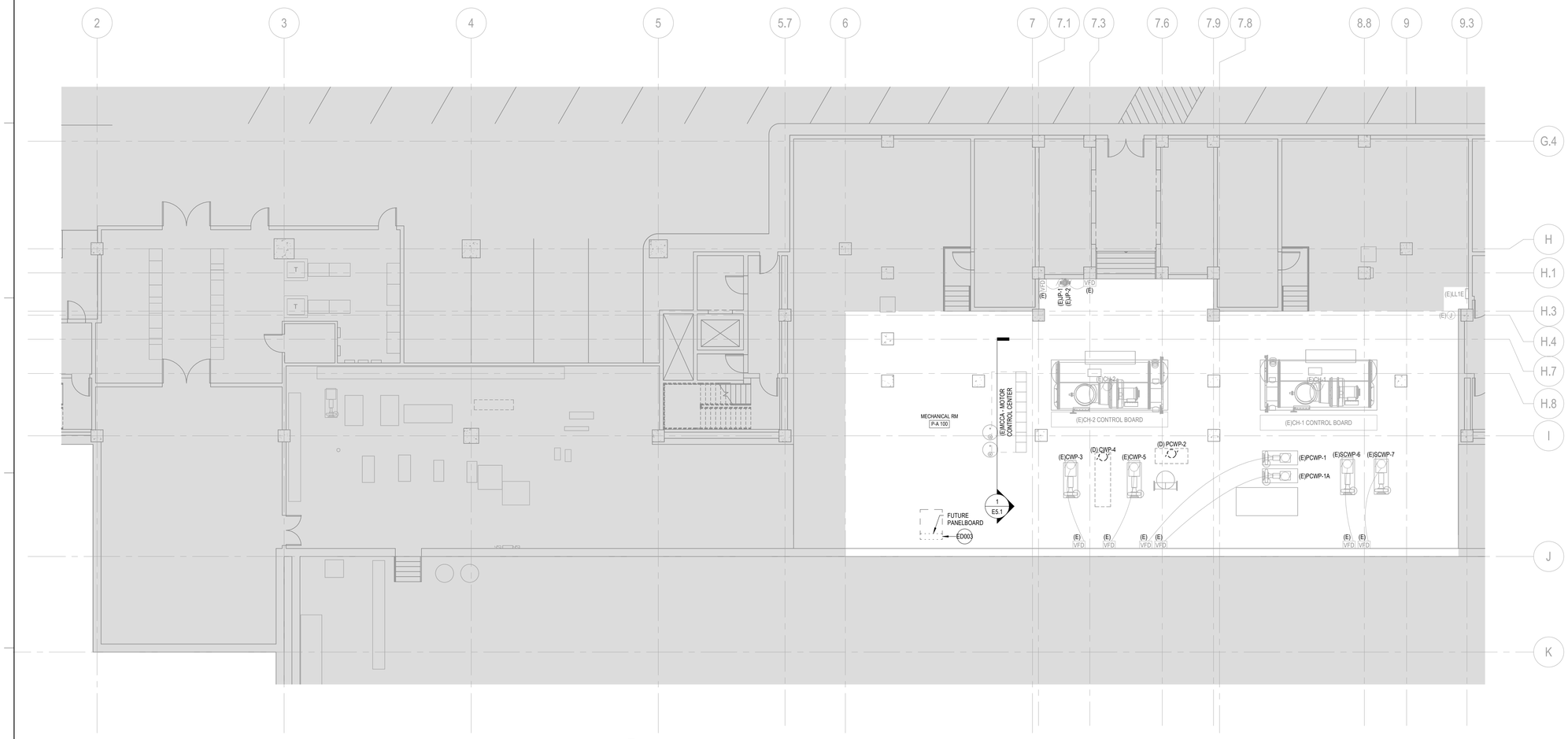

1 PHASE 3 BASEMENT LEVEL ELECTRICAL DEMOLITION PLAN
SCALE: 1/8" = 1'-0"

GENERAL SHEET NOTES

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SHEET KEYNOTES

ED003	COORDINATE WITH GENERAL CONTRACTOR AND MECHANICAL CONTRACTOR FOR DIVISION 23 WORK TO PRESERVE FUTURE NEC REQUIRED WORKING AND DEDICATED SPACE REQUIREMENTS.

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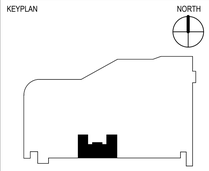
KEYPLAN



SHEET TITLE
PHASE 3 BASEMENT LEVEL ELECTRICAL DEMOLITION PLAN

PROJECT NUMBER
13089.000

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SHEET NUMBER
ED2.1.3

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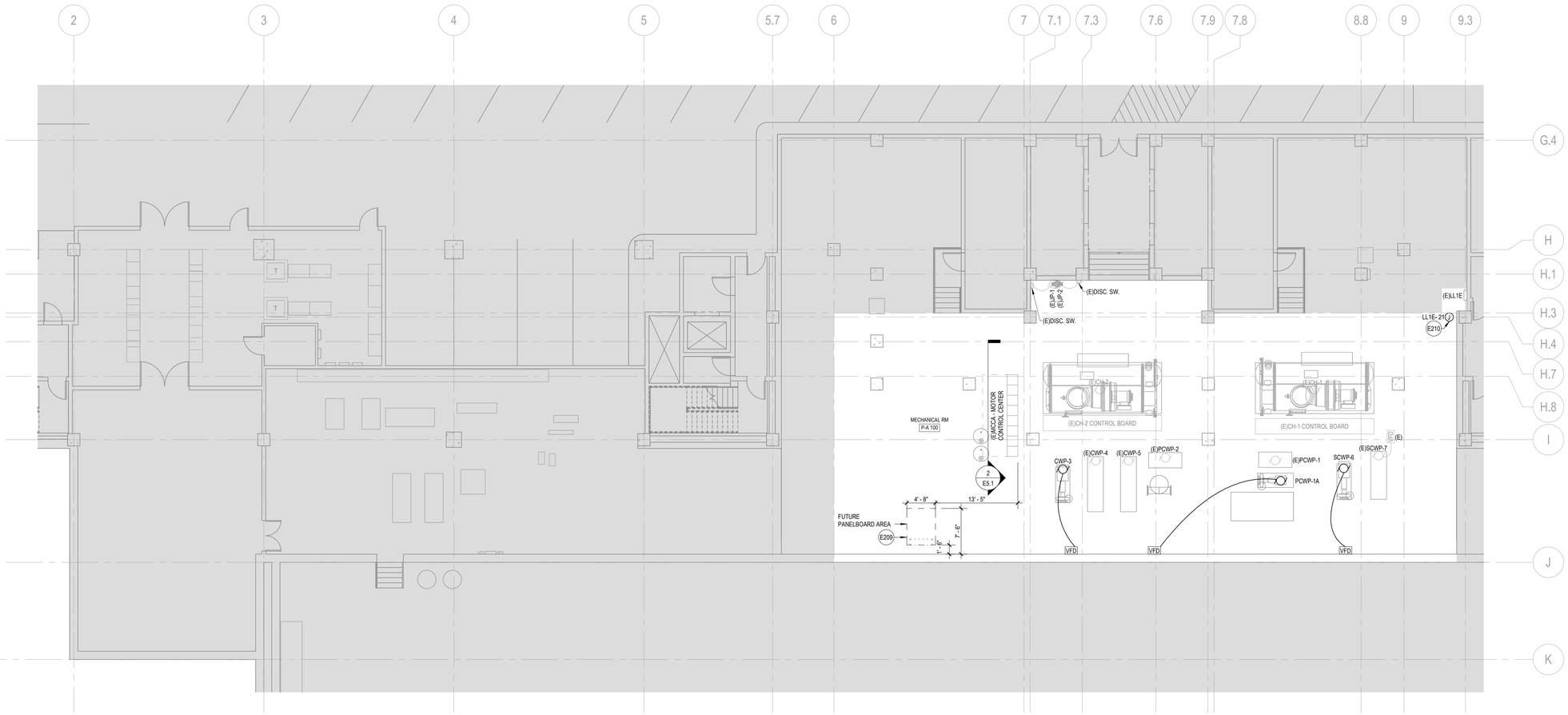

1 PHASE 1 BASEMENT LEVEL ELECTRICAL POWER PLAN
SCALE: 1/8" = 1'-0"

GENERAL SHEET NOTES

A. SEE DRAWING E0.1 FOR ABBREVIATIONS, SYMBOLS, GENERAL NOTES AND DEVICE MOUNTING HEIGHT OF WALL MOUNTED DEVICES, UON.
B. ALL MECHANICAL, ELECTRICAL, AND FIRE ALARM EQUIPMENT/DEVICES WITH AN 'ID' SUBSCRIPT ARE EXISTING TO REMAIN. MAINTAIN ALL CONDUIT, WIRING, CIRCUIT CONTINUITY. PROTECT FROM DAMAGE DURING CONSTRUCTION. FOR EXISTING TO REMAIN RECEPTACLES, DEMOLISH WIRING AND MAINTAIN CONDUIT FOR REUSE WHERE FEASIBLE.
C. OUT OF SCOPE AREA IS INDICATED BY GRAY HATCH. MAINTAIN AND PRESERVE OUT OF SCOPE EXISTING SYSTEMS AND THEIR OPERATIONS.
D. THE CONTRACTOR SHALL COORDINATE EXACT LOCATION OF EQUIPMENT POWER CONNECTIONS WITH EQUIPMENT INSTALLER PRIOR TO ROUGH-IN.
E. SEE MECHANICAL EQUIPMENT SCHEDULE FOR ASSOCIATED OVERCURRENT DEVICES, DISCONNECT SWITCHES, STARTERS, AND WIRES.
F. PROVIDE WIRING METHODS COMPLIANT WITH UL 2196 STANDARD FOR FIRE RESISTIVE CABLING.
G. VOLTAGE DROP SHALL BE LIMITED TO LESS THAN 3% FOR ALL BRANCH CIRCUITS AND 2% FOR ALL FEEDERS.
H. CONTRACTOR SHALL COORDINATE AND FIELD VERIFY REQUIREMENT OF NEUTRAL CONDUCTOR FOR ALL EQUIPMENT AND PROVIDE NEUTRAL CONDUCTOR AS NECESSARY.
I. NO MORE THAN 3 CIRCUITS MAY SHARE A HOMERUN.
J. FOR ALL MECHANICAL EQUIPMENT, PROVIDE ADDITIONAL 120V CONNECTIONS REQUIRED BY MANUFACTURER.
K. PROVIDE 120V CIRCUITS FOR CONTROL PANELS AS REQUIRED BY CONTROL VENDOR. CIRCUIT TO PANELBOARD, 'IEILL1E' WITHIN THE SPACE.
L. ALL UNUSED WALL OUTLETS TO BE COVERED WITH BLANK PLATE. ALL BLANK PLATE COLORS TO MATCH WALL COLOR.
M. COORDINATE FINAL LOCATION OF MECHANICAL AND PLUMBING EQUIPMENT AND ASSOCIATED DISCONNECT SWITCHES, STARTERS, VFDS, CONTROL POWER AND OTHER POWER REQUIREMENTS WITH DIV 22 AND 23.
N. CONTRACTOR IS RESPONSIBLE FOR ALL WIRING FROM VFDs AND DISCONNECTS SHOWN IN DRAWINGS TO THE EQUIPMENT AND IS TO COORDINATE WITH EQUIPMENT MANUFACTURER AND INSTALLATION INSTRUCTIONS.
O. ALL NEW MECHANICAL PIPING, DUCTWORK, AND ANY OTHER ASSOCIATED WORK MUST MAINTAIN WORKING SPACE PER NEC 110.26 REQUIREMENTS FOR ALL SWITCHGEAR, DISTRIBUTION PANELS, PANELBOARDS, MOTOR CONTROL CENTER, DISCONNECTS, VFD'S, AND ETC. ALL DEDICATED SPACE PER NEC 110.26(E) REQUIREMENTS MUST BE MAINTAINED FOR ALL SWITCHBOARDS, SWITCHGEAR, PANELBOARDS, AND MOTOR CONTROL CENTERS.
P. LIGHTING SHALL BE RELOCATED AS REQUIRED PER CONSTRUCTION TO MAINTAIN 15-20 FOOT-CANDLES (FC) PER DISTRICT OF COLUMBIA COURTS 2018 DESIGN STANDARDS.
Q. PROVIDE GALVANIZED RIGID CONDUIT (GRC) RACEWAY FOR ALL NEW RACEWAY INSTALLED IN SCOPE OF WORK (MECHANICAL ROOM, PARKING GARAGE, ETC.) PER SPECIFICATION SECTION 260533.

SHEET KEYNOTES

E209	COORDINATE WITH GENERAL CONTRACTOR AND MECHANICAL CONTRACTOR FOR DIVISION 23 WORK TO PRESERVE FUTURE NEC REQUIRED WORKING AND DEDICATED SPACE REQUIREMENTS.
E210	JUNCTION BOX SHOWN IS FOR MECHANICAL SENSORS THAT REQUIRE 24V POWER. COORDINATE WITH MC FOR FINAL LOCATION OF JUNCTION BOX AND FOR MC TO PROVIDE CONTROL POWER TRANSFORMER.

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2001 K ST NW #600 NORTH
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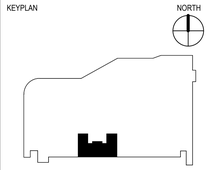
202.580.6300

ISSUED FOR	REV	DATE
100% CONSTRUCTION DOCUMENTS		04/30/2021
75% CONSTRUCTION DOCUMENTS		03/18/2021

SEALS AND SIGNATURES

DISTRICT OF COLUMBIA
ROBERT A. PFAFF
No. PE906485
ELECTRICAL
PROFESSIONAL ENGINEER

KEYPLAN



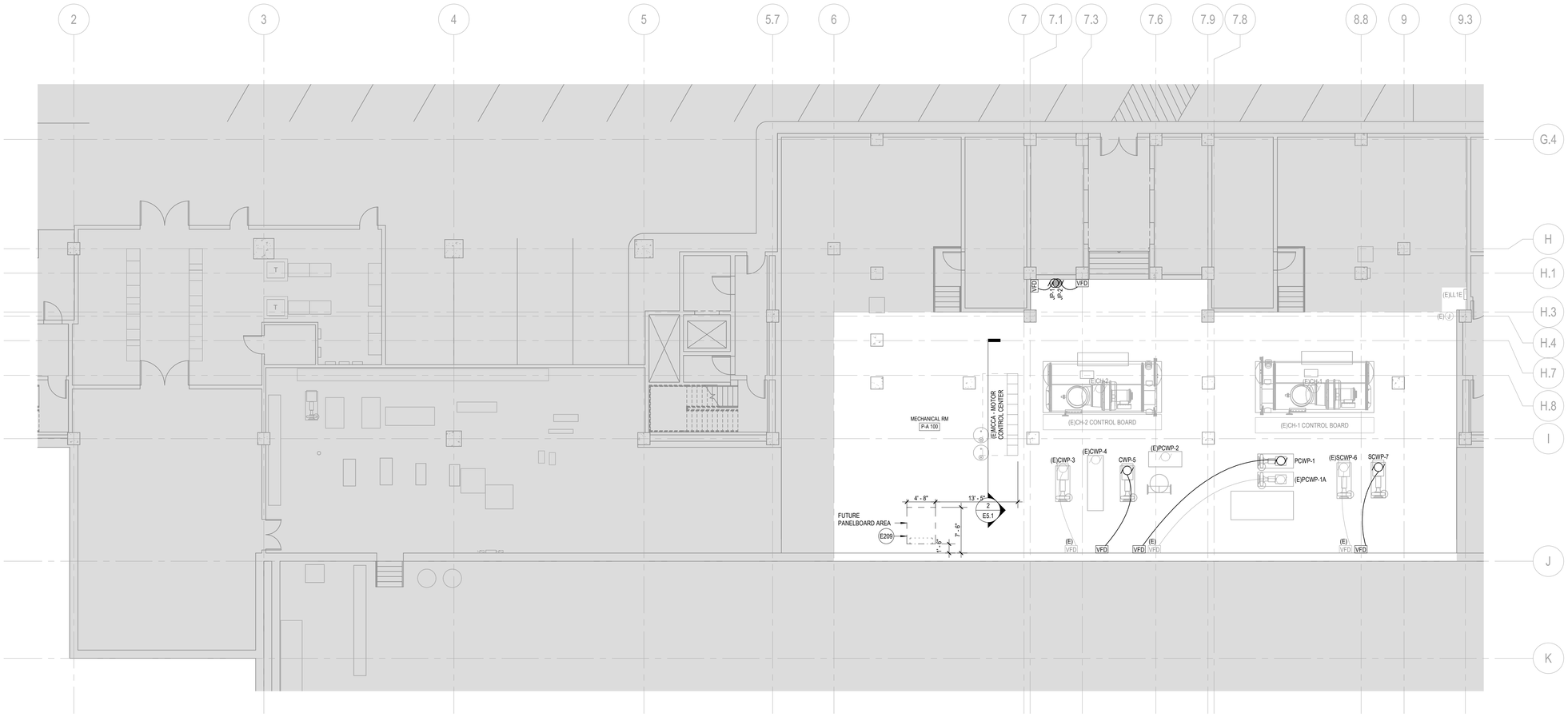
SHEET TITLE
PHASE 1 BASEMENT LEVEL ELECTRICAL POWER PLAN

PROJECT NUMBER
13089.000

CD

SHEET NUMBER
E2.1.1

Plot Date: 4/30/2021 12:58:35 PM Author



1 PHASE 2 BASEMENT LEVEL ELECTRICAL POWER PLAN
SCALE: 1/8" = 1'-0"

GENERAL SHEET NOTES

A. SEE DRAWING E0.1 FOR ABBREVIATIONS, SYMBOLS, GENERAL NOTES AND DEVICE MOUNTING HEIGHT OF WALL MOUNTED DEVICES, UON.
B. ALL MECHANICAL, ELECTRICAL, AND FIRE ALARM EQUIPMENT/DEVICES WITH AN 1(E)' SUBSCRIPT ARE EXISTING TO REMAIN. MAINTAIN ALL CONDUIT, WIRING, CIRCUIT CONTINUITY. PROTECT FROM DAMAGE DURING CONSTRUCTION. FOR EXISTING TO REMAIN RECEPTACLES, DEMOLISH WIRING AND MAINTAIN CONDUIT FOR REUSE WHERE FEASIBLE.
C. OUT OF SCOPE AREA IS INDICATED BY GRAY HATCH. MAINTAIN AND PRESERVE OUT OF SCOPE EXISTING SYSTEMS AND THEIR OPERATIONS.
D. THE CONTRACTOR SHALL COORDINATE EXACT LOCATION OF EQUIPMENT POWER CONNECTIONS WITH EQUIPMENT INSTALLER PRIOR TO ROUGH-IN.
E. SEE MECHANICAL EQUIPMENT SCHEDULE FOR ASSOCIATED OVERCURRENT DEVICES, DISCONNECT SWITCHES, STARTERS, AND WIRES.
F. PROVIDE WIRING METHODS COMPLIANT WITH UL 2196 STANDARD FOR FIRE RESISTIVE CABLING.
G. VOLTAGE DROP SHALL BE LIMITED TO LESS THAN 3% FOR ALL BRANCH CIRCUITS AND 2% FOR ALL FEEDERS.
H. CONTRACTOR SHALL COORDINATE AND FIELD VERIFY REQUIREMENT OF NEUTRAL CONDUCTOR FOR ALL EQUIPMENT AND PROVIDE NEUTRAL CONDUCTOR AS NECESSARY.
I. NO MORE THAN 3 CIRCUITS MAY SHARE A HOMERUN.
J. FOR ALL MECHANICAL EQUIPMENT, PROVIDE ADDITIONAL 120V CONNECTIONS REQUIRED BY MANUFACTURER.
K. PROVIDE 120V CIRCUITS FOR CONTROL PANELS AS REQUIRED BY CONTROL VENDOR. CIRCUIT TO PANELBOARD, '(E)LL1E' WITHIN THE SPACE.
L. ALL UNUSED WALL OUTLETS TO BE COVERED WITH BLANK PLATE. ALL BLANK PLATE COLORS TO MATCH WALL COLOR.
M. COORDINATE FINAL LOCATION OF MECHANICAL AND PLUMBING EQUIPMENT AND ASSOCIATED DISCONNECT SWITCHES, STARTERS, VFDS, CONTROL POWER AND OTHER POWER REQUIREMENTS WITH DIV 22 AND 23.
N. CONTRACTOR IS RESPONSIBLE FOR ALL WIRING FROM VFDs AND DISCONNECTS SHOWN IN DRAWINGS TO THE EQUIPMENT AND IS TO COORDINATE WITH EQUIPMENT MANUFACTURER AND INSTALLATION INSTRUCTIONS.
O. ALL NEW MECHANICAL PIPING, DUCTWORK, AND ANY OTHER ASSOCIATED WORK MUST MAINTAIN WORKING SPACE PER NEC 110.26 REQUIREMENTS FOR ALL SWITCHGEAR, DISTRIBUTION PANELS, PANELBOARDS, MOTOR CONTROL CENTER, DISCONNECTS, VFD'S, AND ETC. ALL DEDICATED SPACE PER NEC 110.26(E) REQUIREMENTS MUST BE MAINTAINED FOR ALL SWITCHBOARDS, SWITCHGEAR, PANELBOARDS, AND MOTOR CONTROL CENTERS.
P. LIGHTING SHALL BE RELOCATED AS REQUIRED PER CONSTRUCTION TO MAINTAIN 15-20 FOOT-CANDLES (FC) PER DISTRICT OF COLUMBIA COURTS 2018 DESIGN STANDARDS.
Q. PROVIDE GALVANIZED RIGID CONDUIT (GRC) RACEWAY FOR ALL NEW RACEWAY INSTALLED IN SCOPE OF WORK (MECHANICAL ROOM, PARKING GARAGE, ETC.) PER SPECIFICATION SECTION 260533.

SHEET KEYNOTES

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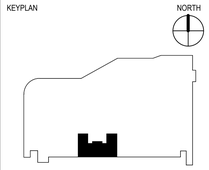
DISTRICT OF COLUMBIA
ROBERT A. PFAFF
No. PE906485
ELECTRICAL
PROFESSIONAL ENGINEER

KEYPLAN



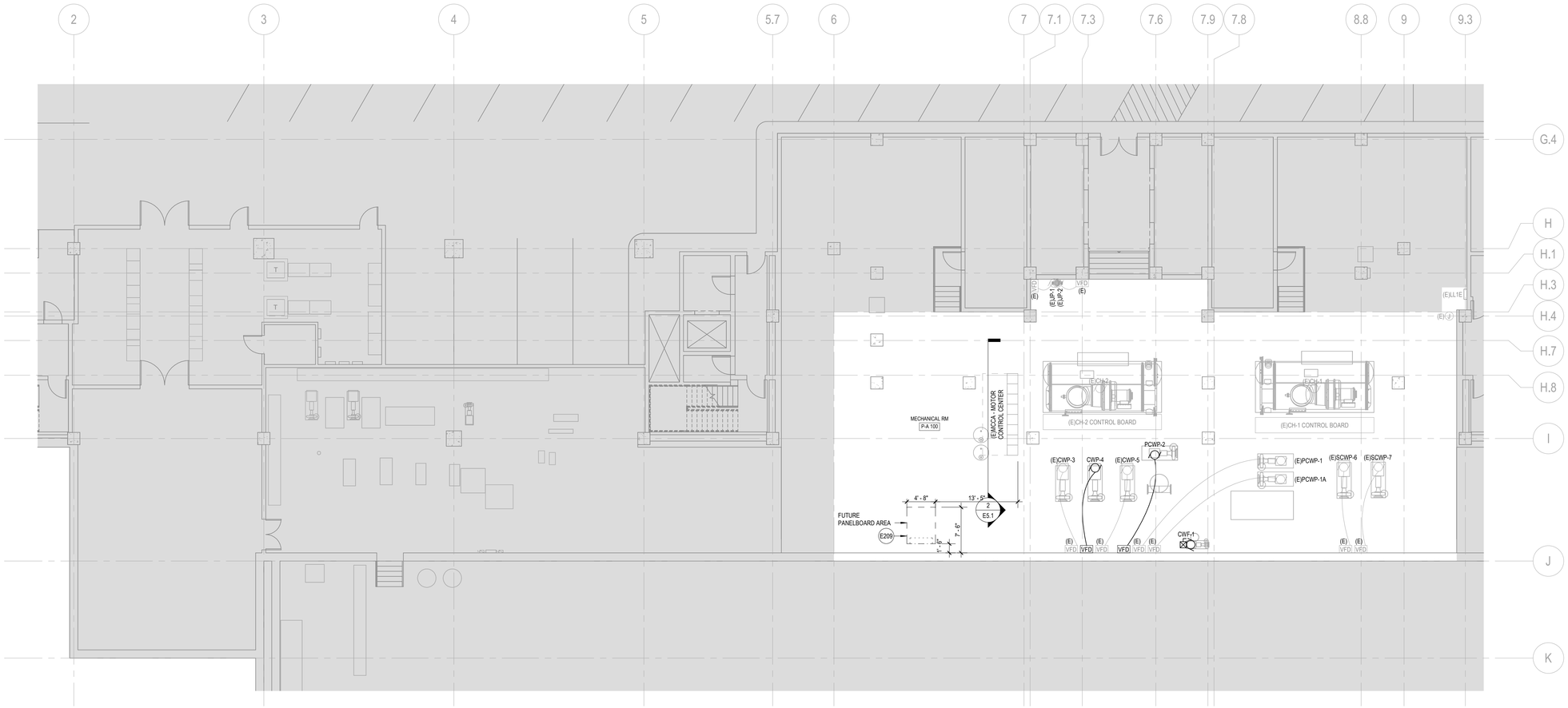
SHEET TITLE
PHASE 2 BASEMENT LEVEL ELECTRICAL POWER PLAN

PROJECT NUMBER
13089.000

CD

SHEET NUMBER
E2.1.2

Plot Date: 4/30/2021 12:58:38 PM Author



1 PHASE 3 BASEMENT LEVEL ELECTRICAL POWER PLAN
SCALE: 1/8" = 1'-0"

GENERAL SHEET NOTES

A. SEE DRAWING E0.1 FOR ABBREVIATIONS, SYMBOLS, GENERAL NOTES AND DEVICE MOUNTING HEIGHT OF WALL MOUNTED DEVICES, UON.
B. ALL MECHANICAL, ELECTRICAL, AND FIRE ALARM EQUIPMENT/DEVICES WITH AN '(E)' SUBSCRIPT ARE EXISTING TO REMAIN. MAINTAIN ALL CONDUIT, WIRING, CIRCUIT CONTINUITY. PROTECT FROM DAMAGE DURING CONSTRUCTION. FOR EXISTING TO REMAIN RECEPTACLES, DEMOLISH WIRING AND MAINTAIN CONDUIT FOR REUSE WHERE FEASIBLE.
C. OUT OF SCOPE AREA IS INDICATED BY GRAY HATCH. MAINTAIN AND PRESERVE OUT OF SCOPE EXISTING SYSTEMS AND THEIR OPERATIONS.
D. THE CONTRACTOR SHALL COORDINATE EXACT LOCATION OF EQUIPMENT POWER CONNECTIONS WITH EQUIPMENT INSTALLER PRIOR TO ROUGH-IN.
E. SEE MECHANICAL EQUIPMENT SCHEDULE FOR ASSOCIATED OVERCURRENT DEVICES, DISCONNECT SWITCHES, STARTERS, AND WIRES.
F. PROVIDE WIRING METHODS COMPLIANT WITH UL 2196 STANDARD FOR FIRE RESISTIVE CABLING.
G. VOLTAGE DROP SHALL BE LIMITED TO LESS THAN 3% FOR ALL BRANCH CIRCUITS AND 2% FOR ALL FEEDERS.
H. CONTRACTOR SHALL COORDINATE AND FIELD VERIFY REQUIREMENT OF NEUTRAL CONDUCTOR FOR ALL EQUIPMENT AND PROVIDE NEUTRAL CONDUCTOR AS NECESSARY.
I. NO MORE THAN 3 CIRCUITS MAY SHARE A HOMERUN.
J. FOR ALL MECHANICAL EQUIPMENT, PROVIDE ADDITIONAL 120V CONNECTIONS REQUIRED BY MANUFACTURER.
K. PROVIDE 120V CIRCUITS FOR CONTROL PANELS AS REQUIRED BY CONTROL VENDOR. CIRCUIT TO PANELBOARD, '(E)LL1E' WITHIN THE SPACE.
L. ALL UNUSED WALL OUTLETS TO BE COVERED WITH BLANK PLATE. ALL BLANK PLATE COLORS TO MATCH WALL COLOR.
M. COORDINATE FINAL LOCATION OF MECHANICAL AND PLUMBING EQUIPMENT AND ASSOCIATED DISCONNECT SWITCHES, STARTERS, VFDS, CONTROL POWER AND OTHER POWER REQUIREMENTS WITH DIV 22 AND 23.
N. CONTRACTOR IS RESPONSIBLE FOR ALL WIRING FROM VFDs AND DISCONNECTS SHOWN IN DRAWINGS TO THE EQUIPMENT AND IS TO COORDINATE WITH EQUIPMENT MANUFACTURER AND INSTALLATION INSTRUCTIONS.
O. ALL NEW MECHANICAL PIPING, DUCTWORK, AND ANY OTHER ASSOCIATED WORK MUST MAINTAIN WORKING SPACE PER NEC 110.26 REQUIREMENTS FOR ALL SWITCHGEAR, DISTRIBUTION PANELS, PANELBOARDS, MOTOR CONTROL CENTER, DISCONNECTS, VFD'S, AND ETC. ALL DEDICATED SPACE PER NEC 110.26(E) REQUIREMENTS MUST BE MAINTAINED FOR ALL SWITCHBOARDS, SWITCHGEAR, PANELBOARDS, AND MOTOR CONTROL CENTERS.
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SHEET KEYNOTES

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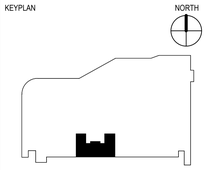
SEALS AND SIGNATURES

DISTRICT OF COLUMBIA
ROBERT A. PFAFF
No. PE906485
ELECTRICAL
PROFESSIONAL ENGINEER

KEYPLAN



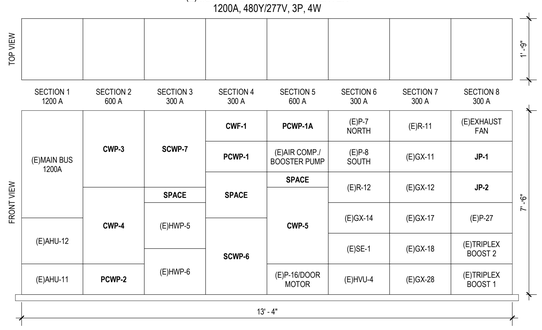
SHEET TITLE
PHASE 3 BASEMENT LEVEL ELECTRICAL POWER PLAN

PROJECT NUMBER
13089.000

SHEET NUMBER
CD
E2.1.3

Plot Date: 4/30/2021 12:58:41 PM Author

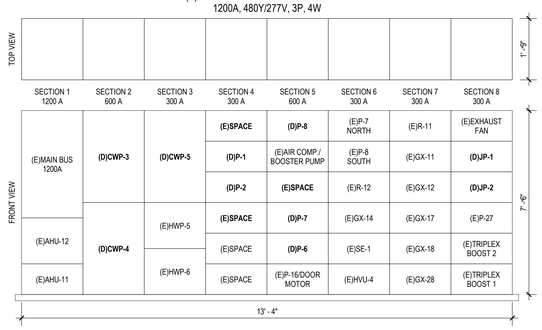
(E)MCCA - MOTOR CONTROL CENTER
1200A, 480Y/277V, 3P, 4W



NOTES:
1. SPARE CIRCUIT BREAKER IS FROM EXISTING CIRCUIT BREAKERS OF DEMOLISHED EQUIPMENT.
2. PANELBOARD/MOTOR CONTROL CENTER SCHEDULE IS INCLUSIVE OF ALL DESIGN PHASES. COORDINATE WITH E2 SERIES PLANS AND E7 SERIES MECHANICAL EQUIPMENT SCHEDULE FOR CONSTRUCTION PHASING. SEE MECHANICAL DRAWINGS FOR ADDITIONAL PHASING REQUIREMENTS AND INFORMATION.
3. COORDINATE WITH ED SERIES SHEET NOTES TO PROVIDE UPDATED PANELBOARD/MOTOR CONTROL CENTER SCHEDULES.
4. PROVIDE INFRARED SCANNING TESTING AND REPORTS OF NEW CIRCUIT BREAKERS AND EXISTING MCC AND EXISTING TO REMAIN CONTROL COMPONENTS PER DIVISION 26 MOTOR CONTROL CENTER SPECIFICATION.

2 NEW WORK - MOTOR CONTROL CENTER - MCCA ELEVATION
SCALE: NOT TO SCALE

(E)MCCA - MOTOR CONTROL CENTER
1200A, 480Y/277V, 3P, 4W



1 EXISTING MOTOR CONTROL CENTER - MCCA ELEVATION
SCALE: NOT TO SCALE

GENERAL SHEET NOTES

A. SEE DRAWING E0.1 FOR ABBREVIATIONS, SYMBOLS, GENERAL NOTES.
B. THE CONTRACTOR SHALL COORDINATE EXACT LOCATION OF EQUIPMENT POWER CONNECTIONS WITH EQUIPMENT INSTALLER PRIOR TO ROUGH-IN.
C. COORDINATE FINAL LOCATION OF MECHANICAL EQUIPMENT AND ASSOCIATED DISCONNECT SWITCHES, STARTERS, VFDS, CONTROL POWER AND OTHER POWER REQUIREMENTS WITH DIV 23 AND MECHANICAL DRAWINGS.
D. SEE MECHANICAL EQUIPMENT SCHEDULE FOR ASSOCIATED OVERCURRENT DEVICES, DISCONNECT SWITCHES, STARTERS AND WIRES.
E. FOR ALL MECHANICAL EQUIPMENT, PROVIDE ADDITIONAL 120V CONNECTIONS REQUIRED BY MANUFACTURER.
F. PROVIDE WIRING METHODS COMPLIANT WITH UL 2196 STANDARD FOR FIRE RESISTIVE CABLING.
G. VOLTAGE DROP SHALL BE LIMITED TO LESS THAN 3% FOR AL BRANCH CIRCUITS AND 2% FOR ALL FEEDERS.
H. CONTRACTOR SHALL COORDINATE AND FIELD VERIFY REQUIREMENT OF NEUTRAL CONDUCTOR FOR ALL EQUIPMENT AND PROVIDE NEUTRAL CONDUCTOR AS NECESSARY.
I. ALL PANELBOARDS SHALL BE EQUIPPED WITH BOLT ON BREAKERS ONLY.
J. CONTRACTOR TO VERIFY EXISTING AVAILABLE CIRCUITS. COORDINATE LOCATION OF AVAILABLE CIRCUITS WITH THOSE INDICATED IN PANEL SCHEDULES.
K. REUSE EXISTING CIRCUIT BREAKERS WHEN APPLICABLE. PROVIDE NEW BREAKERS IN EXISTING SPACES. COORDINATE NEW BREAKER TYPE WITH EXISTING TO REMAIN PANEL.
L. CONTRACTOR TO METER AND VERIFY EXISTING PANEL LOADS AND AVAILABLE PANEL CAPACITY PRIOR TO ADDING CIRCUITS.
M. PROVIDE PERMANENT PANEL NAMEPLATES AND TYPED PANEL SCHEDULES AFTER ALL WORK IS COMPLETE. SCHEDULES AND NAMEPLATES MUST MATCH PANEL INFORMATION, CIRCUIT BREAKERS, AND CONNECTED LOADS.
N. ALL FINAL PANEL LOADS SHALL BE BALANCED AMONG PHASES.

SHEET KEYNOTES

FEEDER SCHEDULE

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75% CONSTRUCTION DOCUMENTS		03/18/2021

SEALS AND SIGNATURES

DISTRICT OF COLUMBIA
ROBERT A. PFAFF
No. PE906485
ELECTRICAL
PROFESSIONAL ENGINEER

SHEET TITLE
ELECTRICAL ELEVATIONS

PROJECT NUMBER 13089.000

SHEET NUMBER CD E5.1

Author

Plot Date: 4/30/2021 12:58:42 PM

MECHANICAL EQUIPMENT SCHEDULE

PHASING COMMENTS*	TAG	PANEL	CIRCUIT NUMBER	HEATING INPUT POWER	MOTOR		VOLTAGE	PHASE	TOTAL POWER LOAD	MOTOR RATED SWITCH	COMBINATION STARTER NEMA SIZE	VFD	DISC. SWITCH			PHASE & NEUTRAL			GROUND		CONDUIT		COMMENTS
					HP1	HP2							AMPS	POLES	FUSED	SETS	NO. OF WIRES	AWG	NO. OF WIRES	AWG	SETS	SIZE	
PHASE 1	CWP-3	MCCA SEC 2	1	0 W	150		480 V	3	143460 VA	No		Yes				1	3	#4/0	1	#2	1	2"	
PHASE 1	PCWP-1A	MCCA SEC 5	1	0 W	30		480 V	3	31880 VA	No		Yes				1	3	#6	1	#8	1	3/4"	
PHASE 1	SCWP-6	MCCA SEC 4	5	0 W	125		480 V	3	124332 VA	No		Yes				1	3	#3/0	1	#3	1	2"	
PHASE 2	CWP-5	MCCA SEC 5	4	0 W	150		480 V	3	143460 VA	No		Yes				1	3	#4/0	1	#2	1	2"	
PHASE 2	JP-1	MCCA SEC 8	2	0 W	5		480 V	3	6057 VA	No		Yes				1	3	#12	1	#12	1	3/4"	
PHASE 2	JP-2	MCCA SEC 8	3	0 W	5		480 V	3	6057 VA	No		Yes				1	3	#12	1	#12	1	3/4"	
PHASE 2	PCWP-1	MCCA SEC 4	1	0 W	30		480 V	3	31880 VA	No		Yes				1	3	#6	1	#8	1	3/4"	
PHASE 2	SCWP-7	MCCA SEC 3	1	0 W	125		480 V	3	124332 VA	No		Yes				1	3	#3/0	1	#3	1	2"	
PHASE 3	CWF-1	MCCA SEC 4	2	0 W	15		480 V	3	16737 VA	No	2	No	60	3	50	1	3	#10	1	#10	1	3/4"	
PHASE 3	CWP-4	MCCA SEC 2	2	0 W	150		480 V	3	143460 VA	No		Yes				1	3	#4/0	1	#2	1	2"	
PHASE 3	PCWP-2	MCCA SEC 2	3	0 W	30		480 V	3	31880 VA	No		Yes				1	3	#6	1	#8	1	3/4"	

GENERAL NOTES:
COORDINATE WITH EXISTING BAS CONTROLLED GENERATOR LOAD SHED AND LOAD ADD PRIORITIES TO ADD NEW PUMPS TO LOAD SHED/ADD PRIORITY AS APPLICABLE. ASSOCIATE NEW PUMPS WITH PRIORITY TO MATCH EXISTING TO BE DEMOLISHED LOAD SHED/ADD PRIORITIES WHERE AN EXISTING PRIORITY IS ASSIGNED.
KEYED NOTES:
*PHASING INDICATED ON SCHEDULE ONLY REFLECTS NEW WORK. REFERENCE ED2 SERIES FOR PHASING FOR DEMOLITION WORK.

Panelboard: (E)LL1E

Location: MECHANICAL RM P-A 100
Supply From: (E)DLBB
Mounting: Surface
Enclosure: Type 1

Volts: 208Y/120
Phases: 3
Wires: 4

A.I.C. Rating: EXISTING
Mains Type: MLO
Bus Rating: 100 A

CKT	Circuit Description	Trip	Poles	A (VA)		B (VA)		C (VA)		Poles	Trip	Circuit Description	CKT
1	EXISTING LOAD	20 A	1	540	900					1	20 A	EXISTING LOAD	2
3	EXISTING LOAD	20 A	1			1080	720			1	20 A	EXISTING LOAD	4
5	EXISTING LOAD	20 A	1					360	180	1	20 A	EXISTING LOAD	6
7	EXISTING LOAD	20 A	1	750	180					1	20 A	EXISTING LOAD	8
9	EXISTING LOAD	20 A	1			750	500			1	20 A	EXISTING LOAD	10
11	EXISTING LOAD	20 A	1					500	828	1	20 A	EXISTING LOAD	12
13	SPACE	--	--	0	667					1	20 A	EXISTING LOAD	14
15	SPACE	--	--			0	1127			1	20 A	EXISTING LOAD	16
17	EXISTING LOAD	20 A	1					800	667	1	20 A	EXISTING LOAD	18
19	EXISTING LOAD	20 A	1	1127	0					1	20 A	(E)SPARE	20
21	**24V/120V POWER FOR MECH EQ**	**20 A**	**1**			**500**	0			1	20 A	(E)SPARE	22
23	EXISTING LOAD	20 A	1					800	0	1	20 A	(E)SPARE	24
25	EXISTING LOAD	20 A	1	667	1587					2	30 A	EXISTING LOAD	26
27	EXISTING LOAD	20 A	1			900	1587						28
29	(E)SPARE	20 A	1					0	0	1	20 A	(E)SPARE	30
			Total Load:	6418 VA		7164 VA		4135 VA					
			Total Amps:	56 A		63 A		34 A					

Load Classification	Connected Load	Demand Factor	Estimated Demand	Panel Totals	
Existing Load	16550 VA	125.00%	20688 VA		
Mechanical Equipment	1167 VA	80.00%	934 VA	**Total Conn. Load:**	17717 VA
				Total Est. Demand:	21621 VA
				Total Conn.:	49 A
				Total Est. Demand:	60 A

Notes:
*SPARE CIRCUIT BREAKER IS FROM EXISTING CIRCUIT BREAKERS IN EXISTING PANELBOARD.

GENERAL SHEET NOTES

A. COORDINATE ALL FINAL LOCATIONS, LOADS, AND CONNECTION REQUIREMENTS WITH MECHANICAL DRAWINGS AND FINAL EQUIPMENT SELECTION.
B. CONTRACTOR TO VERIFY THAT LUGS ON ALL MECHANICAL AND ELECTRICAL EQUIPMENT CAN ACCEPT THE WIRE SIZES INDICATED ON SCHEDULE AND PLANS.
C. CONTRACTOR TO VERIFY WIRE SIZES WITH FINAL EQUIPMENT LOCATIONS TO ACCOUNT FOR VOLTAGE DROP ON ALL MECHANICAL EQUIPMENT.
D. FOR ALL MECHANICAL EQUIPMENT, PROVIDE ADDITIONAL 120V CONNECTIONS AS REQUIRED BY MANUFACTURER.
E. COORDINATE ALL MECHANICAL DISCONNECT, VFD, STARTER AND CONTROLLER REQUIREMENTS WITH MANUFACTURER.

SHEET KEYNOTES

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SEALS AND SIGNATURES

DISTRICT OF COLUMBIA
ROBERT A. PFAFF
No. PE906485
ELECTRICAL
PROFESSIONAL ENGINEER

SHEET TITLE
ELECTRICAL MECHANICAL EQUIPMENT & PANELBOARD SCHEDULES

PROJECT NUMBER 13089.000
CD
SHEET NUMBER E7.0

Plot Date: 4/30/2021 12:58:43 PM Author

PANELBOARD SCHEDULE OF ALL PHASES OF (E)MCCA DEMOLITION WORK

Motor Control Center : (E)MCCA

Location: MECHANICAL RM P-A 100 | **Volts:** 480Y/277 | **A.I.C. Rating:** EXISTING
Supply From: (E)SUBSTATION 2B | **Phases:** 3 | **Mains Type:** MCB
Mounting: PAD MOUNTED | **Wires:** 4 | **Mains Rating:** 1200 A
Enclosure: EXISTING | **MCB Rating:** 1200 A

SECTION 1

Section Bus Rating: 1200 A
Section Space Height: 6' - 0"

CKT	Circuit Description	# of Poles	Unit Height	NEMA Starter Size	Motor Circuit Protector Rating	Load	Remarks
1	(E)MAIN BUS	3	3' - 6"	NIS*	1200 A	0 VA	
2	(E)AHU-12	3	1' - 6"	NIS*	225 A	41445 VA	
3	(E)AHU-11	3	1' - 0"	NIS*	100 A	27099 VA	
4	--	--	--	--	--	0 VA	--

Total Conn. Load: 68544 VA
Total Conn. Amps: 82 A

SECTION 2

Section Bus Rating: 600 A
Section Space Height: 6' - 0"

CKT	Circuit Description	# of Poles	Unit Height	NEMA Starter Size	Motor Circuit Protector Rating	Load	Remarks
1	(D)CWP-3	3	3' - 0"	5	250 A	124332 VA	
2	(D)CWP-4	3	3' - 0"	5	250 A	124332 VA	
3	--	--	--	--	--	0 VA	--
4	--	--	--	--	--	0 VA	--

Total Conn. Load: 248664 VA
Total Conn. Amps: 299 A

SECTION 3

Section Bus Rating: 300 A
Section Space Height: 6' - 0"

CKT	Circuit Description	# of Poles	Unit Height	NEMA Starter Size	Motor Circuit Protector Rating	Load	Remarks
1	(D)CWP-5	3	3' - 0"	5	250 A	124332 VA	
2	(E)HWP-5	3	1' - 6"	3	100 A	31881 VA	
3	(E)HWP-6	3	1' - 6"	3	100 A	31881 VA	
4	--	--	--	--	--	0 VA	--

Total Conn. Load: 188094 VA
Total Conn. Amps: 226 A

SECTION 4

Section Bus Rating: 300 A
Section Space Height: 6' - 0"

CKT	Circuit Description	# of Poles	Unit Height	NEMA Starter Size	Motor Circuit Protector Rating	Load	Remarks
1	SPACE	--	1' –0"	--	--	0 VA	--
2	(D)PCWP-1	3	1' - 0"	1	30 A	11157 VA	
3	(D)PCWP-2	3	1' - 0"	1	30 A	11157 VA	
4	SPACE	--	1' –0"	--	--	0 VA	--
5	SPACE	--	1' –0"	--	--	0 VA	--
6	SPACE	--	1' –0"	--	--	0 VA	--

Total Conn. Load: 22314 VA
Total Conn. Amps: 27 A

SECTION 5

Section Bus Rating: 600 A
Section Space Height: 6' - 0"

CKT	Circuit Description	# of Poles	Unit Height	NEMA Starter Size	Motor Circuit Protector Rating	Load	Remarks
1	(D)CWP-8	3	1' - 0"	1	30 A	11157 VA	
2	(E)AIR COMP/BOOSTER PUMP	3	1' - 0"	NIS*	70 A	6057 VA	
3	SPACE	--	1' –0"	--	--	0 VA	--
4	(D)CWP-7	3	1' - 0"	LOCAL VFD	150 A	98829 VA	
5	(D)CWP-6	3	1' - 0"	LOCAL VFD	150 A	98829 VA	
6	(E)P-16/DOOR MOTOR	3	1' - 0"	NIS*	30 A	3825 VA	

Total Conn. Load: 218697 VA
Total Conn. Amps: 263 A

SECTION 6

Section Bus Rating: 300 A
Section Space Height: 6' - 0"

CKT	Circuit Description	# of Poles	Unit Height	NEMA Starter Size	Motor Circuit Protector Rating	Load	Remarks
1	(E)P-7 NORTH	3	1' - 0"	1	15 A	8766 VA	
2	(E)P-8 SOUTH	3	1' - 0"	1	15 A	6057 VA	
3	(E)R-12	3	1' - 0"	NIS*	30 A	8766 VA	
4	(E)GX-14	3	1' - 0"	NIS*	20 A	2709 VA	
5	(E)SE-1	3	1' - 0"	NIS*	20 A	3825 VA	
6	(E)HVU-4	3	1' - 0"	NIS*	20 A	2709 VA	

Total Conn. Load: 32832 VA
Total Conn. Amps: 39 A

SECTION 7

Section Bus Rating: 300 A
Section Space Height: 6' - 0"

CKT	Circuit Description	# of Poles	Unit Height	NEMA Starter Size	Motor Circuit Protector Rating	Load	Remarks
1	(E)R-11	3	1' - 0"	NIS*	30 A	8766 VA	
2	(E)GX-11	3	1' - 0"	NIS*	7 A	2391 VA	
3	(E)GX-12	3	1' - 0"	NIS*	7 A	1674 VA	
4	(E)GX-17	3	1' - 0"	NIS*	20 A	2391 VA	
5	(E)GX-18	3	1' - 0"	NIS*	20 A	1674 VA	
6	(E)GX-28	3	1' - 0"	NIS*	20 A	2391 VA	

Total Conn. Load: 19287 VA
Total Conn. Amps: 23 A

SECTION 8

Section Bus Rating: 300 A
Section Space Height: 6' - 0"

CKT	Circuit Description	# of Poles	Unit Height	NEMA Starter Size	Motor Circuit Protector Rating	Load	Remarks
1	(E)EXHAUST FAN	3	1' - 0"	NIS*	20 A	6057 VA	
2	(D)P-1	3	1' - 0"	1	20 A	6057 VA	
3	(D)P-2	3	1' - 0"	1	20 A	6057 VA	
4	(E)P-27	3	1' - 0"	NIS*	20 A	6057 VA	
5	(E)TRIPLEX BOOST 2	3	1' - 0"	NIS*	20 A	6057 VA	
6	(E)TRIPLEX BOOST 1	3	1' - 0"	NIS*	20 A	6057 VA	

Total Conn. Load: 36342 VA
Total Conn. Amps: 44 A

Total MCC Conn. Load: 834774 VA
Total MCC Conn. Amps: 1004 A

Load Classification	Connected Load	Demand Factor	Estimated Demand	Panel Totals	
Mechanical Equipment	834774 VA	80.00%	667819 VA		
				Total Conn. Load:	834774 VA
				Total Est. Demand:	667819 VA
				Total Conn.:	1004 A
				Total Est. Demand:	803 A

Notes:
1. PANELBOARD/MOTOR CONTROL CENTER SCHEDULE IS INCLUSIVE OF ALL DEMOLITION WORK IN ALL DESIGN PHASES. COORDINATE WITH E2 SERIES PLANS AND E7 SERIES MECHANICAL EQUIPMENT SCHEDULE FOR CONSTRUCTION PHASING. SEE MECHANICAL DRAWINGS FOR ADDITIONAL PHASING REQUIREMENTS AND INFORMATION. COORDINATE WITH ED SERIES SHEET NOTES TO PROVIDE UPDATED PANELBOARD/MOTOR CONTROL CENTER SCHEDULES.
2. UNIT HEIGHT IS INDICATED FOR REFERENCE ONLY. PROVIDE UNIT DIMENSIONS PER MANUFACTURER RECOMMENDATION.
*NEMA STARTER SIZE ARE EXISTING, NOT IN SCOPE, AND NOT OBSERVED ON SURVEY.

PANELBOARD SCHEDULE OF ALL PHASES OF (E)MCCA'S NEW WORK

Motor Control Center : (E)MCCA

Location: MECHANICAL RM P-A 100 | **Volts:** 480Y/277 | **A.I.C. Rating:** EXISTING
Supply From: (E)SUBSTATION 2B | **Phases:** 3 | **Mains Type:** MCB
Mounting: PAD MOUNTED | **Wires:** 4 | **Mains Rating:** 1200 A
Enclosure: EXISTING | **MCB Rating:** 1200 A

SECTION 1

Section Bus Rating: 1200 A
Section Space Height: 6' - 0"

CKT	Circuit Description	# of Poles	Unit Height	Frame Size	Trip Rating	Load	Remarks
1	(E)MAIN BUS	3	3' - 6"	1200 A	1200 A	0 VA	
2	(E)AHU-12	3	1' - 6"	225 A	100 A	41445 VA	
3	(E)AHU-11	3	1' - 0"	100 A	70 A	27099 VA	
4	--	--	--	--	--	0 VA	--

Total Conn. Load: 68544 VA
Total Conn. Amps: 82 A

SECTION 2

Section Bus Rating: 600 A
Section Space Height: 6' - 0"

CKT	Circuit Description	# of Poles	Unit Height	Frame Size	Trip Rating	Load	Remarks
1	**CWP-3**	**3**	**2' - 6"**	**600 A**	**450 A**	**143460 VA**	
2	**CWP-4**	**3**	**2' - 6"**	**600 A**	**450 A**	**143460 VA**	
3	**PCWP-2**	**3**	**1' - 0"**	**150 A**	**100 A**	**31880 VA**	
4	--	--	--	--	--	0 VA	--

Total Conn. Load: 318800 VA
Total Conn. Amps: 383 A

SECTION 3

Section Bus Rating: 300 A
Section Space Height: 6' - 0"

CKT	Circuit Description	# of Poles	Unit Height	Frame Size	Trip Rating	Load	Remarks
1	**SCWP-7**	**3**	**2' - 6"**	**400 A**	**350 A**	**124332 VA**	
2	SPACE	--	0' –6"	--	--	0 VA	--
3	(E)HWP-5	3	1' - 6"	100 A	100 A	31880 VA	
4	(E)HWP-6	3	1' - 6"	100 A	100 A	31880 VA	

Total Conn. Load: 188092 VA
Total Conn. Amps: 226 A

SECTION 4

Section Bus Rating: 300 A
Section Space Height: 6' - 0"

CKT	Circuit Description	# of Poles	Unit Height	Frame Size	Trip Rating	Load	Remarks
1	**PCWP-1**	**3**	**1' - 0"**	**100 A**	**100 A**	**31880 VA**	
2	**CWF-1**	**3**	**1' - 0"**	**100 A**	**50 A**	**16737 VA**	
3	SPACE	--	1' –6"	--	--	0 VA	--
4	--	--	--	--	--	0 VA	--
5	**SCWP-6**	**3**	**2' - 6"**	**400 A**	**350 A**	**124332 VA**	
6	--	--	--	--	--	0 VA	--

Total Conn. Load: 172949 VA
Total Conn. Amps: 208 A

SECTION 5

Section Bus Rating: 600 A
Section Space Height: 6' - 0"

CKT	Circuit Description	# of Poles	Unit Height	Frame Size	Trip Rating	Load	Remarks
1	**PCWP-1A**	**3**	**1' - 0"**	**100 A**	**100 A**	**31880 VA**	
2	(E)AIR COMP/ BOOSTER PUMP	3	1' - 0"	100 A	70 A	6057 VA	
3	SPACE	--	0' –6"	--	--	0 VA	--
4	**CWP-5**	**3**	**2' - 6"**	**600 A**	**450 A**	**143460 VA**	
5	--	--	--	--	--	0 VA	--
6	(E)P-16/DOOR MOTOR	3	1' - 0"	100 A	30 A	3825 VA	

Total Conn. Load: 185222 VA
Total Conn. Amps: 223 A

SECTION 6

Section Bus Rating: 300 A
Section Space Height: 6' - 0"

CKT	Circuit Description	# of Poles	Unit Height	Frame Size	Trip Rating	Load	Remarks
1	(E)P-7 NORTH	3	1' - 0"	100 A	15 A	8767 VA	
2	(E)P-8 SOUTH	3	1' - 0"	100 A	15 A	6057 VA	
3	(E)R-12	3	1' - 0"	100 A	30 A	8766 VA	
4	(E)GX-14	3	1' - 0"	100 A	20 A	2709 VA	
5	(E)SE-1	3	1' - 0"	100 A	20 A	3825 VA	
6	(E)HVU-4	3	1' - 0"	100 A	20 A	2709 VA	

Total Conn. Load: 32833 VA
Total Conn. Amps: 39 A

SECTION 7

Section Bus Rating: 300 A
Section Space Height: 6' - 0"

CKT	Circuit Description	# of Poles	Unit Height	Frame Size	Trip Rating	Load	Remarks
1	(E)R-11	3	1' - 0"	100 A	30 A	8766 VA	
2	(E)GX-11	3	1' - 0"	100 A	7 A	2391 VA	
3	(E)GX-12	3	1' - 0"	100 A	7 A	1674 VA	
4	(E)GX-17	3	1' - 0"	100 A	20 A	2391 VA	
5	(E)GX-18	3	1' - 0"	100 A	20 A	1674 VA	
6	(E)GX-28	3	1' - 0"	100 A	20 A	2391 VA	

Total Conn. Load: 19287 VA
Total Conn. Amps: 23 A

SECTION 8

Section Bus Rating: 300 A
Section Space Height: 6' - 0"

CKT	Circuit Description	# of Poles	Unit Height	Frame Size	Trip Rating	Load	Remarks
1	(E)EXHAUST FAN	3	1' - 0"	100 A	20 A	6057 VA	
2	**JP-1**	**3**	**1' - 0"**	**100 A**	**20 A**	**6057 VA**	
3	**JP-2**	**3**	**1' - 0"**	**100 A**	**20 A**	**6057 VA**	
4	(E)P-27	3	1' - 0"	100 A	20 A	6057 VA	
5	(E)TRIPLEX BOOST 2	3	1' - 0"	100 A	20 A	6057 VA	
6	(E)TRIPLEX BOOST 1	3	1' - 0"	100 A	20 A	6057 VA	

Total Conn. Load: 36342 VA
Total Conn. Amps: 44 A

Total MCC Conn. Load: 1022070 VA
Total MCC Conn. Amps: 1229 A

Load Classification	Connected Load	Demand Factor	Estimated Demand	Panel Totals	
Mechanical Equipment	722398 VA	80.00%	577918 VA		
Mechanical Equipment (Standby)	299672 VA	0.01%	30 VA	**Total Conn. Load:**	1022070 VA
				Total Est. Demand:	577948 VA
				Total Conn.:	1229 A
				Total Est. Demand:	695 A

Notes:
1. PANELBOARD/MOTOR CONTROL CENTER SCHEDULE IS INCLUSIVE OF ALL DESIGN PHASES. COORDINATE WITH E2 SERIES PLANS AND E7 SERIES MECHANICAL EQUIPMENT SCHEDULE FOR CONSTRUCTION PHASING. SEE MECHANICAL DRAWINGS FOR ADDITIONAL PHASING REQUIREMENTS AND INFORMATION. COORDINATE WITH ED SERIES SHEET NOTES TO PROVIDE UPDATED PANELBOARD/MOTOR CONTROL CENTER SCHEDULES.
2. SEE MECHANICAL EQUIPMENT SCHEDULE ON E7 SERIES FOR NEMA STARTER SIZES.
3. UNIT HEIGHT IS INDICATED FOR REFERENCE ONLY. PROVIDE UNIT DIMENSIONS PER MANUFACTURER RECOMMENDATION.

GENERAL SHEET NOTES

A. SEE DRAWING E0.1 FOR ABBREVIATIONS, SYMBOLS, GENERAL NOTES AND DEVICE MOUNTING HEIGHT OF WALL MOUNTED DEVICES, UON.
B. SEE DRAWING SERIES E5 FOR POWER RISER DIAGRAM.
C. PROVIDE A MINIMUM OF 20% SPARE CIRCUIT BREAKERS ON EACH NEW PANEL.
D. CONTRACTOR TO VERIFY EXISTING AVAILABLE CIRCUITS. COORDINATE LOCATION OF AVAILABLE CIRCUTS WITH THOSE INDICATED IN PANEL SCHEDULES.
E. REUSE EXISTING CIRCUIT BREAKERS WHEN APPLICABLE. PROVIDE NEW BREAKERS IN EXISTING SPACES. COORDINATE NEW BREAKER TYPE WITH EXISTING TO REMAINING PANEL.
F. CONTRACTOR TO METER AND VERIFY EXISTING PANEL LOADS AND AVAILABLE PANEL CAPACITY PRIOR TO ADDING CIRCUITS.
G. PROVIDE PERMANENT PANEL NAMEPLATES AND TYPED PANEL SCHEDULES AFTER ALL WORK IS COMPLETE. SCHEDULES AND NAMEPLATES MUST MATCH PANEL INFORMATION, CIRCUIT BREAKERS, AND CONNECTED LOADS.
H. BREAKER TIES TO BE USED FOR ALL SYSTEMS FURNITURE CONNECTIONS PER NEC.
I. CONTRACTOR TO PROVIDE 3 PHASE CIRCUIT FOR ALL NEW SURGE PROTECTION DEVICES. COORDINATE FINAL CIRCUIT BREAKER SIZE WITH DEVICE.
J. ALL FINAL PANEL LOADS SHALL BE BALANCED AMONG PHASES.
K. EQUIPMENT TAGS WITH "(E)" NOTATION INDICATES EXISTING TO REMAIN EQUIPMENT. EQUIPMENT TAGS WITH "(R)" NOTATION INDICATES EXISTING TO RELOCATE EQUIPMENT.
L. BOLD CIRCUIT DESCRIPTIONS INDICATE NEW CIRCUITS AND CIRCUIT BREAKERS ON EXISTING MCC.

SHEET KEYNOTES

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ISSUED FOR	REV	DATE
100% CONSTRUCTION DOCUMENTS		04/30/2021
75% CONSTRUCTION DOCUMENTS		03/18/2021

SEALS AND SIGNATURES

DISTRICT OF COLUMBIA
ROBERT A. PFAFF
No. PE906485
ELECTRICAL
PROFESSIONAL ENGINEER

SHEET TITLE
PANELBOARD SCHEDULES

PROJECT NUMBER 13089.000

CD

SHEET NUMBER E7.1

Author

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