

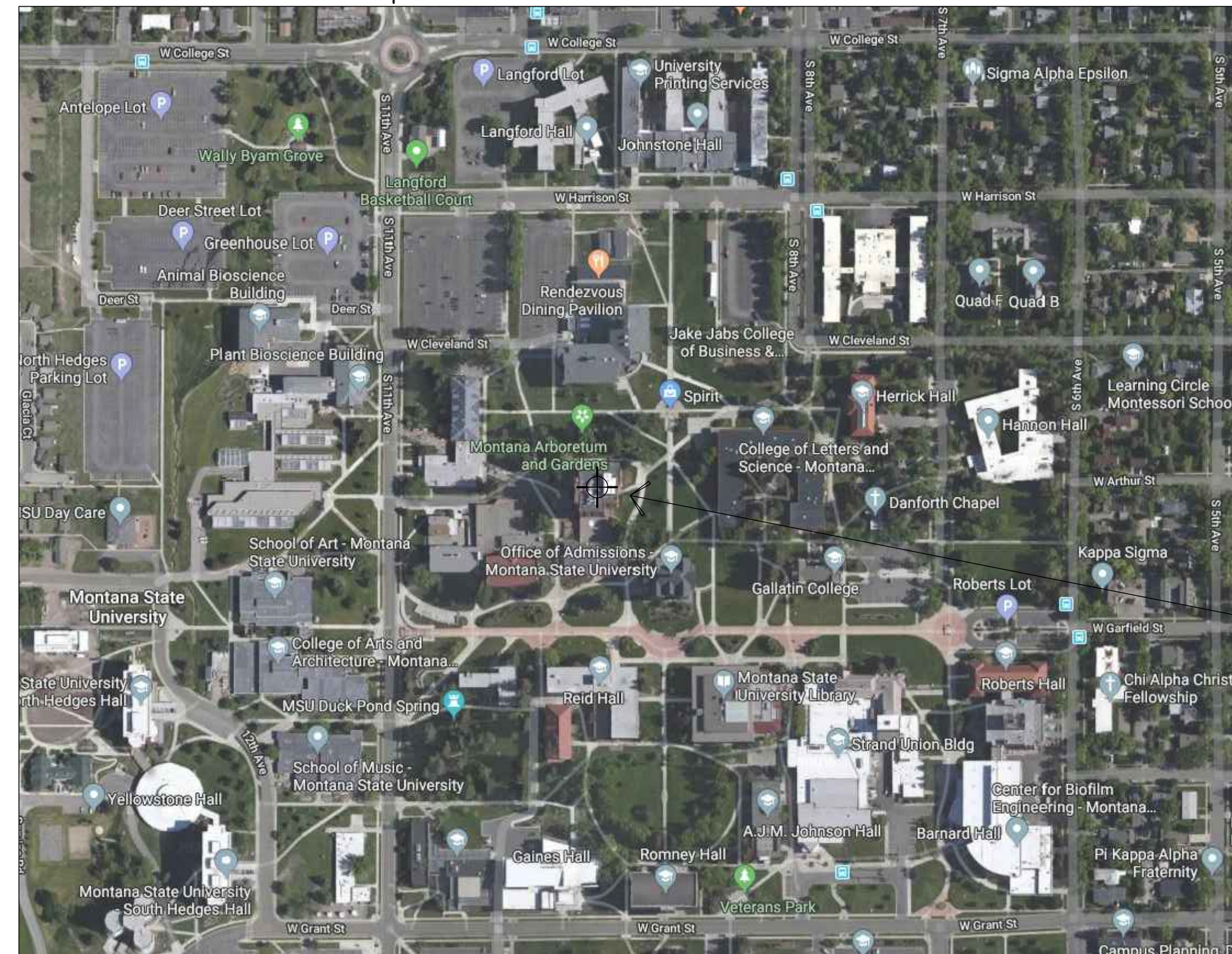
LEON JOHNSON HALL

REDUNDANT HEAT PUMP MODULE INSTALLATION

OCTOBER 15, 2021

LEON JOHNSON HALL
BOZEMAN, MT 59715

VICINITY MAP: *Locator* 



LEON JOHNSON HALL

OWNER
Montana State University
Bozeman, MT 59715

MECHANICAL
CUSHING TERRELL
RICK DEMARINIS, P.E.
316 Last Chance Gulch
Helena, MT 59601
(406) 495-9400

ELECTRICAL
CUSHING TERRELL
JEFF FAIN, P.E.
411 E. Main St.
Bozeman, MT 59715
(406) 556-7100

- 1.1 HEAT PUMP INSTALLATION CONSTRAINTS AND OUTAGE REQUIREMENTS
- A. HEATING HOT WATER AND COOLING CHILLED WATER MUST BE PROVIDED TO THE BUILDINGS AT ALL TIMES FOR THE DURATION OF THIS PROJECT TO RELOCATE THE EXISTING HEAT PUMP MODULES AND ADD THE NEW HEAT PUMP MODULE.
- B. THE HWS AND HWR ISOLATION VALVES TO THE HEAT PUMP MODULES ARE TO BE CLOSED, THE HEAT FUNCTION OF THE HEAT PUMP MODULES ARE TO BE DISABLED. THE STEAM HEAT EXCHANGER HX-2(E) IS TO PROVIDE HEAT FOR THE BUILDINGS. REFER TO THE EXISTING HEAT PUMP PLANT CONTROL SEQUENCE, PARAGRAPHS E. AND F. ON DRAWING M001.
- C. THE CWS AND CWR ISOLATION VALVES TO THE HEAT PUMP MODULES ARE TO BE CLOSED, THE COOLING FUNCTION FOR THE HEAT PUMP MODULES ARE TO BE DISABLED, THE HEAT PUMP BYPASS VALVE OPENED. AHU-1 AND AHU-4 ARE TO PROVIDE FREE COOLING FOR THE BUILDINGS. REFER TO THE EXISTING HEAT PUMP PLANT CONTROL SEQUENCE, PARAGRAPH G. ON DRAWING M001.
- D. IN ORDER FOR THE FREE COOLING TO BE EFFECTIVE, THE OUTSIDE AIR TEMPERATURE NEEDS TO BE LESS THAN 50 deg. F (adj.) WHEN THE HEAT PUMP MODULES ARE DISABLED. COORDINATE SHUTDOWN OF THE HEAT PUMP PLANT WITH MSU FACILITIES WHEN APPROPRIATE WEATHER IS ANTICIPATED.

SHEET INDEX

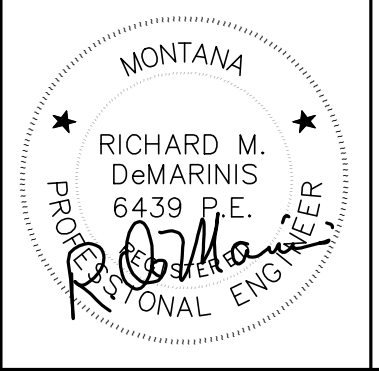
- GENERAL**
G001 COVER SHEET
- MECHANICAL**
M001 MECHANICAL SCHEDULES AND LEGEND
M010 MECHANICAL DEMOLITION PLAN
M100 MECHANICAL PLAN
M101 SEVENTH AND EIGHT FLOOR MECHANICAL PLANS
M200 MECHANICAL FLOW DIAGRAMS
- ELECTRICAL**
E100 ELECTRICAL PLANS AND SCHEDULES



**Leon Johnson Hall
Redundant Heat Pump
Module Installation**

CUSHING TERRELL
411 E. MAIN ST. SUITE 101
BOZEMAN, MT 59715
PH: 406.556.7100
FAX: 406.585.3031

DRAWN BY:	SB
REVIEWED BY:	RD
REV.	DESCRIPTION
	DATE



PPA#: 19-0042

COVER SHEET

G001
10-15-2021

PLAN CODE	LOCATION ROOM #	MFGR	MODEL	COOLING										HEATING										ELECTRICAL			REMARKS
				EVAPORATOR		CONDENSER		SOURCE		LOAD		TOT (MBH)	EER	EVAPORATOR		CONDENSER		SOURCE		LOAD		TOT (MBH)	EER	POWER (V/PH/Hz)	MCA	MCOP	
				GPM	PD (FT)	GPM	PD (FT)	EW(T)(F)	LWT(F)	EW(T)(F)	LWT(F)			GPM	PD (FT)	GPM	PD (FT)	EW(T)(F)	LWT(F)	EW(T)(F)	LWT(F)						
HP-1 (E)	1	CLIMACOOOL	UCH085AF ASAHB0S	210	14.8	255	13.3	85	95	55	45	975.8	15.8	110	3.8	190	7.8	82.0	62.0	105	120	1359	3.92	460/3/60	162	225	1, 4
HP-2 (E)	1	CLIMACOOOL	UCH085AF ASAHB0S	210	14.8	255	13.3	85	95	55	45	975.8	15.8	110	3.8	190	7.8	82.0	62.0	105	120	1359	3.92	460/3/60	162	225	1, 4
HP-3 (E)	1	CLIMACOOOL	UCH085AF ASAHB0S	210	14.8	255	13.3	85	95	55	45	975.8	15.8	110	3.8	190	7.8	82.0	62.0	105	120	1359	3.92	460/3/60	162	225	2, 4
HP-4 (E)	1	CLIMACOOOL	UCH085AF ASAHB0S	210	14.8	255	13.3	85	95	55	45	975.8	15.8	110	3.8	190	7.8	82.0	62.0	105	120	1359	3.92	460/3/60	162	225	2, 4
HP-5 (E)	1	CLIMACOOOL	UCH085AF ASAHB0S	210	14.8	255	13.3	85	95	55	45	975.8	15.8	110	3.8	190	7.8	82.0	62.0	105	120	1359	3.92	460/3/60	162	225	2, 4
HP-6	1	CLIMACOOOL	UCH085AF ASAHB0S	210	14.8	255	13.3	85	95	55	45	975.8	15.8	110	3.8	190	7.8	82.0	62.0	105	120	1359	3.92	460/3/60	162	225	3, 4
TOTAL				1260		1530						5854.8		660		1140						8154					

1.1 EXISTING HEAT PUMP PLANT CONTROL SEQUENCE (NEW WORK IS SHOWN BOLD)

A. HEAT PUMP SOURCE WATER PUMPS (HPP-1, 2): THE PUMPS ARE 100% REDUNDANT AND ALTERNATE ON A WEEKLY BASIS. DURING PUMP ALTERNATION LAG PUMP RAMP UP TO LEAD PUMP SPEED AND AFTER A 1 MINUTE DELAY THE LEAD PUMP RAMP DOWN AND SHUTS OFF. THE PUMPS ARE CONTROLLED IN A MANNER TO MAINTAIN THE SYSTEM DIFFERENTIAL PRESSURE DETERMINED BY THE TEST AND BALANCE CONTRACTOR. THE CONTROL CONTRACTOR FURNISHED THE VFD'S FOR EACH PUMP MOTOR. THE LEAD PUMP OPERATES CONTINUOUSLY TO MAINTAIN THE SYSTEM DIFFERENTIAL SETPOINT. IF THE LEAD PUMP FAILS, THE LAG PUMP IS ENABLED AND AN ALARM REQUIRING ACKNOWLEDGEMENT IS INITIATED AT THE OPERATOR WORKSTATION. CURRENT SENSORS FOR PROOF OF FLOW AND PUMP STATUS INDICATION AT THE OPERATOR WORKSTATION.

B. BUILDING CHILLED WATER PUMPS (CWP-1, 2): THE PUMPS ARE 100% REDUNDANT AND ALTERNATE ON A WEEKLY BASIS. DURING PUMP ALTERNATION LAG PUMP RAMP UP TO LEAD PUMP SPEED AND AFTER A 1 MINUTE DELAY THE LEAD PUMP RAMP DOWN AND SHUTS OFF. THE PUMPS ARE CONTROLLED IN A MANNER TO MAINTAIN THE SYSTEM DIFFERENTIAL PRESSURE DETERMINED BY THE TEST AND BALANCE CONTRACTOR. THE CONTROL CONTRACTOR FURNISHED THE VFD'S FOR EACH PUMP MOTOR. THE LEAD PUMP OPERATES CONTINUOUSLY TO MAINTAIN THE SYSTEM DIFFERENTIAL SETPOINT. IF THE LEAD PUMP FAILS, THE LAG PUMP IS ENABLED AND AN ALARM REQUIRING ACKNOWLEDGEMENT IS INITIATED AT THE OPERATOR WORKSTATION. CURRENT SENSORS FOR PROOF OF FLOW AND PUMP STATUS INDICATION AT THE OPERATOR WORKSTATION.

C. BUILDING PONY CHILLED WATER PUMP (CWP-3): WHEN OUTSIDE AIR TEMPERATURE DROPS BELOW 45°F (ADJ.) THE PONY PUMP TAKES OVER AS THE LEAD PUMP. THIS PUMP MODULATES TO MAINTAIN THE CHILLED WATER DIFFERENTIAL PRESSURE SETPOINT AS MEASURED ON THE 8TH FLOOR AT LEON JOHNSON. WHEN THIS PUMP IS RUNNING ABOVE 56 HERTZ FOR LONGER THAN 5 MINUTES, THE DESIGNATED LEAD PUMP WILL RESUME OPERATION AND THE PONY PUMP WILL BE DISABLED. CURRENT SENSORS FOR PROOF OF FLOW AND PUMP STATUS INDICATION AT THE OPERATOR WORKSTATION.

D. BUILDING HOT WATER PUMPS (HWP-1, 2): THE PUMPS ARE 100% REDUNDANT AND ALTERNATE ON A WEEKLY BASIS. DURING PUMP ALTERNATION LAG PUMP RAMP UP TO LEAD PUMP SPEED AND AFTER A 1 MINUTE DELAY THE LEAD PUMP RAMP DOWN AND SHUTS OFF. THE PUMPS ARE CONTROLLED IN A MANNER TO MAINTAIN THE SYSTEM DIFFERENTIAL PRESSURE DETERMINED BY THE TEST AND BALANCE CONTRACTOR OF THE HEAT PUMP DIFFERENTIAL PRESSURE SENSOR. THE CONTROL CONTRACTOR FURNISHED THE VFD'S FOR EACH PUMP MOTOR. THE LEAD PUMP OPERATES CONTINUOUSLY TO MAINTAIN THE SYSTEM DIFFERENTIAL SETPOINT. IF THE LEAD PUMP FAILS, THE LAG PUMP IS ENABLED AND AN ALARM REQUIRING ACKNOWLEDGEMENT IS INITIATED AT THE OPERATOR WORKSTATION. CURRENT SENSORS FOR PROOF OF FLOW AND PUMP STATUS INDICATION AT THE OPERATOR WORKSTATION.

E. HEAT PUMP (HP-1, 2, 3, 4, 5, 6): THE HEAT PUMPS ARE SUPPLIED WITH A LON COMPATIBLE MICROPROCESSOR CONTROL PANEL. THE CONTROL PANEL PROVIDES ALL CONTROL FUNCTIONS NECESSARY FOR THE HEAT PUMP TO MAINTAIN THE CHILLED AND HEATING HOT WATER SETPOINT CONTROL. **THE HEAT PUMP IS TO BE CONTROLLED BY THE MICROPROCESSOR CONTROL PANEL SIMILAR TO THE EXISTING HEAT PUMPS.** THE HEAT PUMP CONTROL SYSTEM MANAGES HEAT PUMP, STAGING, CYCLING AND CHANGE OVER IN ORDER TO MAINTAIN BOTH CHILLED AND HOT WATER LOOP TEMPERATURES. THE CONTROL CONTRACTOR WAS RESPONSIBLE FOR ENABLING AND DISABLING THE HEAT PUMP. THE CONTROL CONTRACTOR IS RESPONSIBLE FOR INTERFACING WITH THE CONTROL PANEL TO BRING BACK ALL POINTS TO THE FRONT END FOR MONITORING CONTROL ALARM CONDITIONS AT THE PANEL ARE ANNUNCIATED AT THE OPERATOR WORKSTATION IN CONFORMANCE WITH THE CURRENT MONTANA STATE UNIVERSITY ALARM PROTOCOL STANDARD.

F. HEATING WATER: HEATING WATER TEMPERATURE ARE RESET FROM 80°F AT 40°F OUTDOOR AIR TEMPERATURE TO 145°F AT -5°F OUTDOOR AIR TEMPERATURE (ADJ.). HEATING IS DISABLED, AND HWP 1 AND 2 DISABLED ABOVE 70°F OUTDOOR AIR TEMPERATURE (ADJ.). THE SETPOINT IS CONTROLLED UTILIZING STEAM INJECTION AS WELL AS CLIMA COOL OPERATION AS FOLLOWS: CLIMA COOL SETPOINT WAS SET BY THE CONTROLS CONTRACTOR. UPON ENABLING OF THE HEATING SYSTEM, THE HEATING WATER SETPOINT IS WRITTEN TO THE CLIMA COOL TO BE HIGHER THAN THE HOT WATER RETURN TEMPERATURE BY A VALUE SET BY THE FOLLOWING RESET SCHEDULE. THE RESET WILL BE BASED ON THE PID OUTPUT FROM THE CLIMA COOL. FROM A 11°F TEMPERATURE RISE AT 20% OUTPUT TO A 0°F TEMPERATURE RISE AT 62% OUTPUT (ADJ.). THE INTENTION OF THIS RESET IS TO LIMIT COMPRESSOR CYCLING.

HEATING FUNCTION OF THE CLIMA COOL IS DISABLED IF HEATING RETURN WATER TEMPERATURE GOES OVER 104°F AND RE-ENABLED WHEN THE RETURN WATER TEMPERATURE GOES UNDER 101.5°F (ADJ.). HEATING FUNCTION OF THE CLIMA COOL WILL BE DISABLED WHEN SOURCE WATER TEMPERATURE GOES BELOW 45°F, AND RE-ENABLED WHEN SOURCE WATER TEMPERATURE GOES ABOVE 49°F (ADJ.) OR WHEN SOURCE WATER TEMPERATURE GOES ABOVE 87°F, AND RE-ENABLED WHEN SOURCE WATER TEMPERATURE GOES BELOW 82°F (ADJ.). HEATING FUNCTION OF THE CLIMA COOL IS DISABLED IF WHEN THE OUTSIDE AIR TEMPERATURE IS BELOW 22°F (ADJ.).

G. STEAM INJECTION: THE 3-WAY DIVERTING VALVES ARE PERMANENTLY OPEN TO THE HEATING WATER LOOP AND CLOSED TO THE SOURCE LOOP. THE 2 1/2" 2-WAY VALVE MODULATES TO MAINTAIN A PRESSURE DIFFERENTIAL OF 4.5 PSID AS MEASURED ACROSS THE HEADERS OF THE CLIMA COOL HEAT PUMP. WHEN THIS VALVE IS FULLY OPEN AND CAN NO LONGER MAINTAIN PRESSURE DIFFERENTIAL, THE 8" 2-WAY VALVE MODULATES OPEN. THIS VALVE MODULATES IN INCREMENTS OF 10%, WITH BOTH VALVES CONTINUING TO MODULATE DOWN TO MAINTAIN DIFFERENTIAL PRESSURE ACROSS THE HEADERS. THE 8" VALVE IS FULLY OPENED WHEN THE HEATING FUNCTION OF THE CLIMA COOL UNIT IS DISABLED. THE STEAM HEAT EXCHANGER MODULATES 10 AND 20 VFD'S TO MAINTAIN SUPPLY WATER TEMPERATURE AT SETPOINT PER RESET SCHEDULE. A DIFFERENTIAL PRESSURE TRANSDUCER INSTALLED ACROSS THE STEAM HEAT

EXCHANGER IS USED TO PROVE FLOW, AND PREVENT STEAM VALVES FROM OPENING IN A LOW OR NO FLOW SITUATION.

G. COOLING WATER: COOLING WATER TEMPERATURE SETPOINT IS 42°F WHEN OUTSIDE AIR TEMPERATURE IS ABOVE 43°F (ADJ.). WHEN OUTSIDE AIR TEMPERATURE IS BELOW 50°F (ADJ.), COOLING WATER TEMPERATURE IS RESET BY CLIMA COOL PID OUTPUT BASED ON RETURN WATER TEMPERATURE. DIFFERENTIAL WILL BE 11°F WITH A PID OUTPUT OF 20% UP TO A DIFFERENTIAL OF 0°F WITH A PID OUTPUT OF 62% (ADJ.). THIS IS TO LIMIT CYCLING. THE COOLING FUNCTION OF THE CLIMA COOL IS DISABLED WHEN RETURN WATER TEMPERATURE GOES BELOW 49°F, AND RE-ENABLED WHEN RETURN WATER TEMPERATURE GOES ABOVE 55°F (ADJ.). **RELOCATE CLIMA COOL SUPPLY WATER TEMPERATURE SENSOR TO THE LOCATION SHOWN, PROVIDE A NEW SYSTEM SUPPLY WATER TEMPERATURE SENSOR AT THE EXISTING LOCATION. WHEN CLIMA COOL IS DISABLED, CHILLED WATER VALVES AT AHU-1 AND AHU-4 AND PRE-CHILLED WATER VALVE AT AHU-2 ARE OPEN TO PROVIDE FREE COOLING. FREE COOLING CONTROL VALVE SHALL OPEN. THESE VALVES WILL CLOSE UPON CLIMA COOL ENABLING TO PREVENT SHORT CYCLING. HIGH PRESSURE 1/3 - 2/3 (CV-1 AND CV-2) CHILLED WATER BYPASS VALVES SHALL MODULATED TO MAINTAIN MAXIMUM CLIMA COOL DIFFERENTIAL AT 10 PSID (ADJ.). LOW PRESSURE (CV-3) CHILLED WATER BYPASS SHALL MODULATED TO MAINTAIN MINIMUM CLIMA COOL DIFFERENTIAL AT 2 PSID (ADJ.).** THE CLIMACOOOL IS DISABLED WHEN THE SOURCE WATER GOES ABOVE 106°F AND RE-ENABLED WHEN THE SOURCE WATER GOES BELOW 95°F (ADJ.).

THE MICROPROCESSOR CONTROL PANEL SHALL LIMIT TO FIVE (5) THE NUMBER OF HEAT PUMPS ALLOWED TO RUN IN COOLING MODE. DESIGNATION OF WHICH HEAT PUMP IS DISABLED TO OPERATE IN COOLING MODE IS TO BE SELECTED AT THE USER INTERFACE AT THE HEAT PUMP.

H. SOURCE WATER LOOP CONTROL: THE SOURCE WATER LOOP IS MAINTAINED BETWEEN 74°F (ADJ.) AND 80°F (ADJ.) UTILIZING THE COOLING TOWER OPERATION. THE SOURCE WATER IS CONTROLLED FROM A TEMPERATURE SENSOR LOCATED IN THE SOURCE WATER ENTERING THE HEAT PUMP.

I. HEAT INJECTION PUMPS (HIP-1, 2): THESE PUMPS HAVE BEEN REMOVED.

J. COOLING TOWER SEQUENCE: THE SOURCE WATER IS CONTROLLED FROM A TEMPERATURE SENSOR LOCATED IN THE SOURCE WATER ENTERING THE HEAT PUMP. WHEN THE LOOP TEMPERATURE RISES ABOVE THE COOLING SETPOINT OF 80°F (ADJ.), THE CONTROL SYSTEM ENABLES HRP 1 OR 2 AND ENABLES CTP 1 OR 2, AND DISABLES PUMPS WHEN SOURCE TEMPERATURE DROPS 8°F BELOW SETPOINT. UPON A FURTHER RISE IN TEMPERATURE, MODULATE IN SEQUENCE THE COOLING TOWER VALVE V1 AND COOLING TOWER FAN VFD BELOW 40°F OUTDOOR AIR TEMPERATURE (ADJ.). THE COOLING TOWER FAN IS DISABLED AND THE COOLING TOWER VALVE V1 IS CONTROLLED TO FULL BYPASS AND COOLING TOWER DRAIN VALVE V2 IS OPENED. A MANUAL POINT ON GRAPHICS WILL DISABLE TOWER, LOCK COOLING TOWER VALVE V1 TO BYPASS, AND OPEN DRAIN VALVE V2 TO ALLOW TOWER TO REMAIN DRAINED THROUGH WINTER.

K. SUMP FILL VALVE VALVE V3 IS OPENED AND CLOSED AS REQUIRED TO MAINTAIN SUMP LEVEL AT AN ADJUSTABLE SETPOINT. COORDINATED WITH OVERFLOW HEIGHT.

L. HEAT REJECTION PUMPS (HRP-1, 2): THE PUMPS ARE 100% REDUNDANT AND ALTERNATE BASED ON RUN TIME HOURS. PUMP OPERATION IS ENABLED THROUGH LOOP CONTROL SEQUENCE. IF THE LEAD PUMP FAILS, THE LAG PUMP IS ENABLED AND AN ALARM REQUIRING ACKNOWLEDGEMENT IS INITIATED AT THE OPERATOR WORKSTATION. CURRENT SENSORS FOR PROOF OF FLOW AND PUMP STATUS INDICATION AT THE OPERATOR WORKSTATION. LEVEL SWITCH IN THE SUMP TO LOCKOUT THE PUMP OPERATOR IF THE SUMP LEVEL FALLS BELOW SETPOINT.

M. COOLING TOWER PUMPS (CTP-1, 2): THE PUMPS ARE 100% REDUNDANT AND ALTERNATE BASED ON RUN TIME HOURS. PUMP OPERATION IS ENABLED THROUGH LOOP CONTROL SEQUENCE. IF THE LEAD PUMP FAILS, THE LAG PUMP IS ENABLED AND AN ALARM REQUIRING ACKNOWLEDGEMENT IS INITIATED AT THE OPERATOR WORKSTATION. CURRENT SENSORS FOR PROOF OF FLOW AND PUMP STATUS INDICATION AT THE OPERATOR WORKSTATION.

1.2 SNOW MELT SYSTEM: A. UTILIZES THE EXISTING SNOWMELT CONTROL SYSTEM. HEAT OUTPUT RELAY FROM THE EXISTING CONTROLLER. USE THE HEAT OUTPUT RELAY FROM THE EXISTING CONTROLLER AS AN INPUT TO THE BUILDING EMS SYSTEM. WHEN THE HEAT OUTPUT CONTACTS ARE CLOSED, VERIFY OUTDOOR AIR TEMPERATURE IS BELOW 32°F, OPEN THE 2-WAY VALVE AT THE SNOW MELT HEAT EXCHANGER AND ENERGIZE SMP-1. WHEN THE HEAT RELAY FROM THE CONTROLLER OPENS CLOSE THE 2-WAY VALVE AT THE SNOWMELT HEAT EXCHANGER AND STOP SMP-1. SUPPLY TEMP RESET IS 12°F WHEN OUTDOOR AIR TEMPERATURE IS -10°F AND 95°F WHEN THE OUTDOOR AIR TEMPERATURE IS 10°F (ADJ.). CURRENT SENSORS FOR PROOF OF FLOW AND PUMP STATUS INDICATION AT THE OPERATOR WORKSTATION.

B. MINIMUM RUNTIME: MINIMUM RUNTIME IS 1/2 HOUR. THIS IS THE MINIMUM RUNTIME OF THE HEAT OUTPUT RELAY.

END OF SEQUENCE

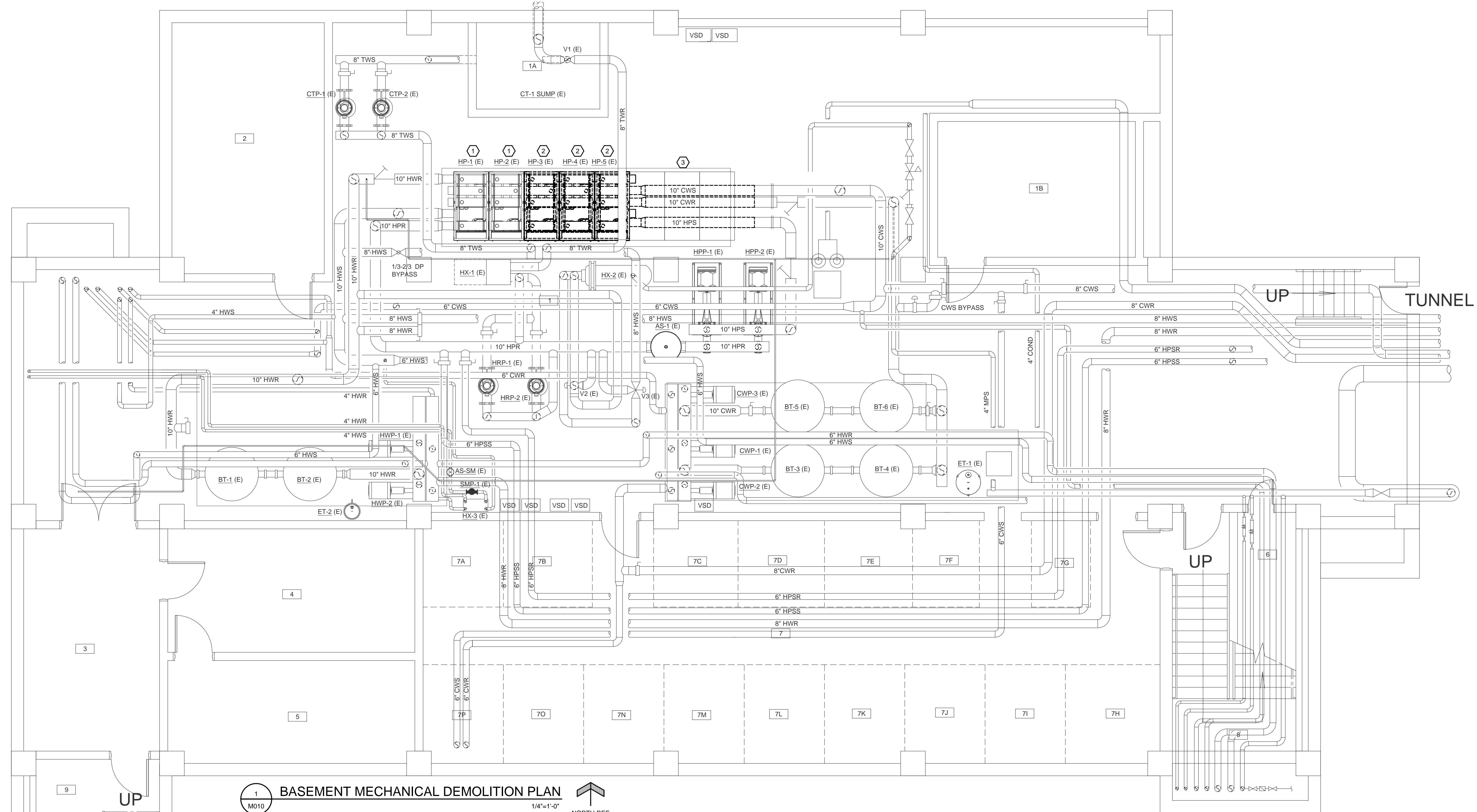
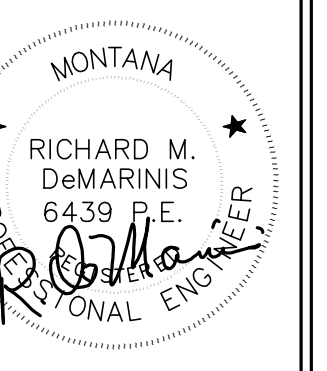
PLAN CODE	LOCATION	SERVICE	MFGR	MODEL NO	TYPE	GPM	HEAD (FT)	RPM	BHP	MOTOR HP	POWER (V/PH/Hz)	IMPELLER DIA.	MECH. EFF.	NOTES
CTP-1(E)	LJ BSMT MECH	CLG. TOWER	TACO	KS 5095	BASE MTD.	1,275	20	1,750	16.25	20	460/3/60	11.625	85%	NOTES 1
CTP-2(E)	LJ BSMT MECH	CLG. TOWER	TACO	KS 5095	BASE MTD.	1,275	20	1,750	16.25	20	460/3/60	11.625	85%	NOTES 1
HPP-1(E)	LJ BSMT MECH	HP SOURCE WATER	TACO	FI 8013	BASE MTD.	1,275	50	1,150	30.54	40	460/3/60	12.25	84%	NOTES 2
HPP-2(E)	LJ BSMT MECH	HP SOURCE WATER	TACO	FI 8013	BASE MTD.	1,275	50	1,150	30.54	40	460/3/60	12.25	84%	NOTES 2
CWP-1(E)	LJ BSMT MECH	HP CHILLED WATER	TACO	FI 6013	BASE MTD.	1,765	105	1,750	58.5	75	460/3/60	11.375	83%	NOTES 3
CWP-2(E)	LJ BSMT MECH	HP CHILLED WATER	TACO	FI 6013	BASE MTD.	1,765	105	1,750	58.5	75	460/3/60	11.375	83%	NOTES 3
CWP-3(E)	LJ BSMT MECH	HP CHILLED WATER	TACO	FI 3013	BASE MTD.	600	105	1,750	58.5	30	460/3/60	11.375	83%	NOTES 3
HWP-1(E)	LJ BSMT MECH	HP HEATING WATER	TACO	FI 5011	BASE MTD.	1,080	70	1,150	25.03	25	460/3/60	13.375	85%	NOTES 4
HWP-2(E)	LJ BSMT MECH	HP HEATING WATER	TACO	FI 5011	BASE MTD.	1,080	70	1,150	25.03	25	460/3/60	13.375	85%	NOTES 4
HIP-1(E)					REMOVED									
HIP-2(E)					REMOVED									
HRP-1(E)	LJ BSMT MECH	CLG. TOWER HX-1	TACO	KS 8011	INLINE	1,275	30	1,150	10.14	15	460/3/60	9.375	82%	NOTES 5
HRP-2(E)	LJ BSMT MECH	CLG. TOWER HX-1	TACO	KS 8011	INLINE	1,275	30	1,150	10.14	15	460/3/60	9.375	82%	NOTES 5
GSP-1(E)	JABS HALL	GRD. SOURCE WELLS							250					NOTES 6
GSP-2(E)	JABS HALL	GRD. SOURCE WELLS							250					NOTES 6
SWP-1(E)	JABS HALL	GRD. SOURCE HX							250					NOTES 6
SWP-2(E)	JABS HALL	GRD. SOURCE HX							250					NOTES 6
SMP-1(E)	LJ BSMT MECH	SNOW MELT HX-3	TACO	KS 1507	INLINE	63	45	1,750	1.44	1.5	460/3/60	6.625	57.9%	NOTES 6

PLAN CODE	LOCATION	SERVICE	VALVE TYPE	VALVE BODY	CV	GPM	HEAD (PSI)	REMARKS
CV-1	LJ BSMT MECH	HIGH PRESSURE 1/3 BYPASS	MODULATING	2 1/2"	51	161	10	
CV-2	LJ BSMT MECH	HIGH PRESSURE 2/3 BYPASS	MODULATING	3"	150	262	10	
CV-3	LJ 8TH FL MECH	LOW PRESSURE BYPASS	MODULATING	2 1/2"	51	114	5	

MECHANICAL LEGEND			
SYMBOL	DESCRIPTION	SYMBOL	DESCRIPTION
	DRAIN		ELECTRIC THERMOSTAT
	HEATING WATER SUPPLY		ELECTRIC THERMOSTAT W/GUARD
	HEATING WATER RETURN		PNEUMATIC THERMOSTAT OR DDC TEMPERATURE SENSOR (JOB SPECIFIC)
	CHILLED WATER SUPPLY		PNEUMATIC RECESSED ASPERATING THERMOSTAT
	CHILLED WATER RETURN		PNEUMATIC STAT W/GUARD
	REFRIGERANT SUCTION LINE		ACOUSTICALLY LINED SHEET METAL DUCT
	REFRIGERANT LIQUID LINE		MANUAL BALANCING DAMPER
	REFRIGERANT HOT GAS LINE		FLEX CONNECTOR
	FUEL OIL SUPPLY		ACCESS DOORS
	FUEL OIL RETURN		FIRE DAMPER
	FUEL OIL VENT		FIRE/SMOKE DAMPER
	DRY FLUID SUPPLY		MOTORIZED DAMPER
	DRY FLUID RETURN		TURNING VANE ELL
	LOW PRESSURE STEAM SUPPLY		45° LOW-LOSS TAKE-OFF FITTING W/ DAMPER & FLEX DUCT
	STEAM CONDENSATE RETURN		45° LOW-LOSS TAKE-OFF FITTING W/ DAMPER & RIGID ROUND DUCT
	GATE VALVE		90° TEE TAKE-OFF FITTING
	BALL VALVE		HOSE END DRAIN VALVE
	BUTTERFLY VALVE		PRESSURE REDUCING VA.
	GLOBE VALVE		SAFETY RELIEF VALVE
	TRIPLE DUTY VALVE		UNION
	SWING CHECK VALVE		MOTORIZED T.C. VA/2-WAY
	STRAINER		MOTORIZED T.C. VA/3-WAY
	FLEX CONNECTOR		ECCENTRIC PLUG BALANCING VALVE
	HOSE END DRAIN VALVE		VALVE IN RISER
	PRESSURE REDUCING VA.		TEE UP
	SAFETY RELIEF VALVE		TEE DOWN
	UNION		ELBOW UP
	MOTORIZED T.C. VA/2-WAY		ELBOW DOWN
	MOTORIZED T.C. VA/3-WAY		PIPE SIZE CHANGE
	ECCENTRIC PLUG BALANCING VALVE		MANUAL FLOW BALANCING VALVE (CIRCUIT SETTER)
	VALVE IN RISER		AUTOMATIC FLOW BALANCING VALVE
	TEE UP		PIPE GUIDE
	TEE DOWN		PIPE ANCHOR
	ELBOW UP		PRESSURE/TEMP. TEST PLUG
	ELBOW DOWN		DIAL THERMOMETER
	PIPE SIZE CHANGE		
	MANUAL FLOW BALANCING VALVE (CIRCUIT SETTER)		
	AUTOMATIC FLOW BALANCING VALVE		
	PIPE GUIDE		
	PIPE ANCHOR		
	PRESSURE/TEMP. TEST PLUG		
	DIAL THERMOMETER		

HVAC ABBREVIATIONS			
AFF	ABOVE FINISHED FLOOR	LAT	LEAVING AIR TEMPERATURE
ACFM	ACTUAL CFM	LWT	LEAVING WATER TEMPERATURE
AHU	AIR HANDLING UNIT	LF	LINEAR FEET
ANSI	AMERICAN NATIONAL STANDARDS INSTITUTE	MAX	MAXIMUM
AMP	AMPERE		

REV.	DESCRIPTION	DATE



1 BASEMENT MECHANICAL DEMOLITION PLAN
 M010 1/4"=1'-0"

- GENERAL DEMOLITION NOTES**
- THIS CONTRACTOR SHALL BE AWARE THAT THIS IS A REMODELING PROJECT AND AS SUCH, CERTAIN ITEMS AND SIZES CANNOT BE FULLY ILLUSTRATED NOR EXPLAINED WITHOUT FIELD OBSERVATION. THEREFORE, THIS CONTRACTOR IS ADVISED TO VISIT AND EXAMINE THE JOB SITE AND BUILDING IN EVERY DETAIL AS PERTAINS TO THIS PROJECT AND MAKE ALLOWANCES IN HIS PROPOSAL FOR ALL CONDITIONS THAT WILL AFFECT THE WORK INDICATED IN THE PROJECT SPECIFICATIONS AND CONTRACT DRAWINGS.
 - SEE ARCHITECTURAL AND ELECTRICAL DRAWINGS FOR ADDITIONAL REMOVAL ITEMS.
 - ALL REMOVED ITEMS, EXCEPT THOSE NOTED TO BE REUSED OR TO REMAIN THE PROPERTY OF THE OWNER, SHALL BECOME PROPERTY OF THE CONTRACTOR AND SHALL BE REMOVED FROM THE JOB SITE. THE OWNER RESERVES THE RIGHT TO KEEP ANY REMOVED ITEMS EVEN THOUGH NOT NOTED ON DRAWINGS.
 - WHERE EXISTING EQUIPMENT, DUCTS, ETC. ARE TO BE REMOVED, SUCH REMOVAL SHALL INCLUDE ALL ANCHORS, BASES, HANGERS, ETC.
 - THIS CONTRACTOR MUST MEET WITH THE OWNER OR HIS REPRESENTATIVE AND DISCUSS THE PROPOSED WORK SCHEDULE FOR REMOVAL, AND REMODELED WORK WITHIN CONTRACT DRAWINGS PRIOR TO PERFORMING ANY WORK. THE CONTRACTOR SHALL INFORM THE OWNER OR HIS REPRESENTATIVE, OF THE INTENT TO DO SO AT LEAST 48 HOURS BEFORE SUCH WORK BEGINS.
 - THIS CONTRACTOR SHALL BE AWARE THAT CERTAIN AREAS OF REMOVAL AND REMODELED WORK MUST BE DONE AFTER NORMAL BUSINESS HOURS.
 - THIS CONTRACTOR SHALL PERFORM ALL CUTTING AND PATCHING REQUIRED IN ACCORDANCE WITH DIVISION 1 "CUTTING AND PATCHING", OF SPECIFICATIONS.

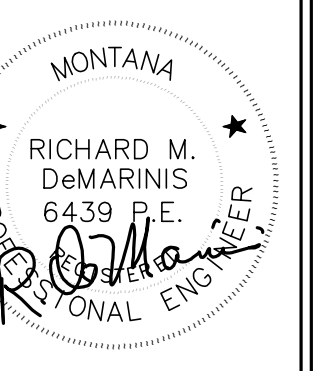
- SHEET NOTES**
- EXISTING HEAT PUMP TO REMAIN. SEE 1/M100.
 - RELOCATE EXISTING HEAT PUMP. SEE 1/M100 FOR NEW LOCATION.
 - REMOVE SECTION OF CWS, CWR AND HPS PIPING AS REQUIRED FOR INSTALLATION OF HP-6, REFER TO 1/M100.

Leon Johnson Hall
Redundant Heat Pump
Module Installation

CUSHING TERRELL
411 E. MAIN ST., SUITE 101
BOZEMAN, MT 59715
PH: 406.556.7100
FAX: 406.585.3031

DRAWN BY: SB
REVIEWED BY: RD

REV.	DESCRIPTION	DATE

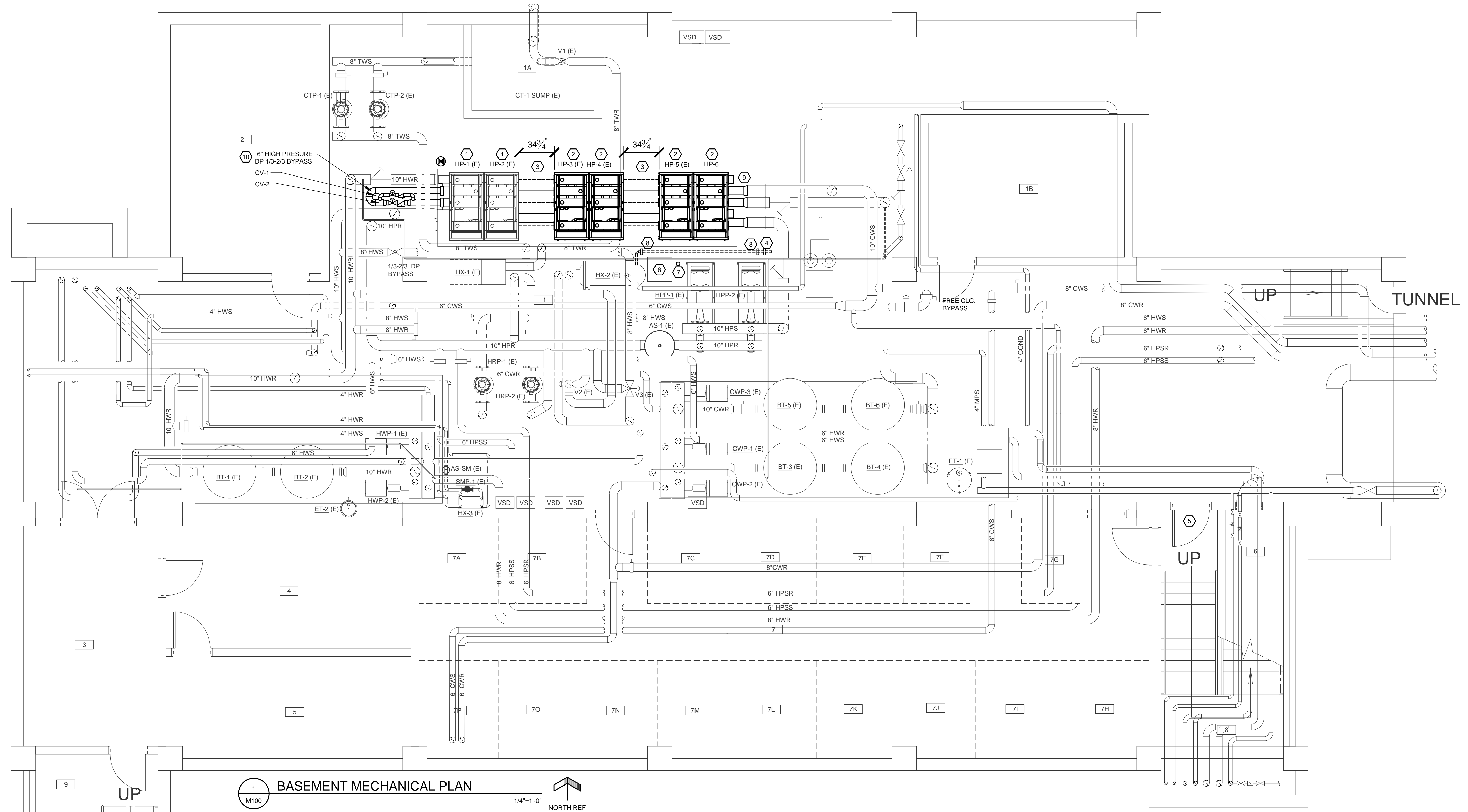


PPA#: 19-0042

MECHANICAL
PLAN

M100

10-15-2021



1 BASEMENT MECHANICAL PLAN
M100
1/4"=1'-0"
NORTH REF

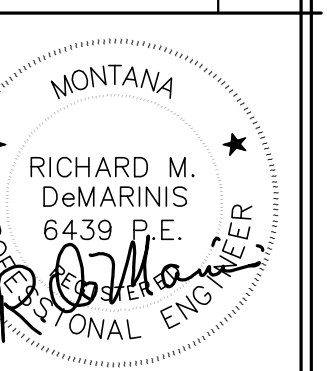
- SHEET NOTES**
- 1 HP-1,2 TO REMAIN IN PLACE.
 - 2 NEW PLACEMENT OF HP-3,4,5 AND ADDITION OF HP-6.
 - 3 PROVIDE SPOOL PIECES TO ALLOW FUTURE UNITS TO BE ADDED WITHOUT MOVEMENT OF EXISTING UNITS. FIELD VERIFY HEAT PUMP SPOOL PIECE LENGTHS AND CONNECTION CONFIGURATION.
 - 4 FLANGES TO BE ADDED FOR REMOVAL OF 2" CONDENSATE PIPE FOR MAINTENANCE.
 - 5 PROPOSED BEST PATH FOR RIGGING HP-6 TO THE MECHANICAL ROOM.
 - 6 REMOVE EXISTING WALL HANGER FOR 2" CONDENSATE PIPE. MAINTAIN CLEARANCE FROM EXISTING COLUMN TO RELOCATED HP-5.
 - 7 EXISTING 3" WASTE RISER TO REMAIN.
 - 8 PROVIDE FLOOR PIPE SUPPORTS FOR EXISTING 2" CONDENSATE PIPE.
 - 9 REMOVE, RELOCATE AND RECONNECT EXISTING VALVING, STAINERS, PIPE FITTINGS AND CONTROLS AS REQUIRED FOR THE INSTALLATION OF HP-6.
 - 10 PROVIDE 6" HIGH PRESSURE 1/3 - 2/3 DP BYPASS AT THE ENDS OF THE CHILLED WATER SUPPLY AND RETURN HEADER.

Leon Johnson Hall
Redundant Heat Pump
Module Installation

CUSHING TERRELL
 411 E. MAIN ST., SUITE 101
 BOZEMAN, MT 59715
 PH: 406.556.7100
 FAX: 406.585.3031

DRAWN BY: SB
 REVIEWED BY: RD

REV.	DESCRIPTION	DATE

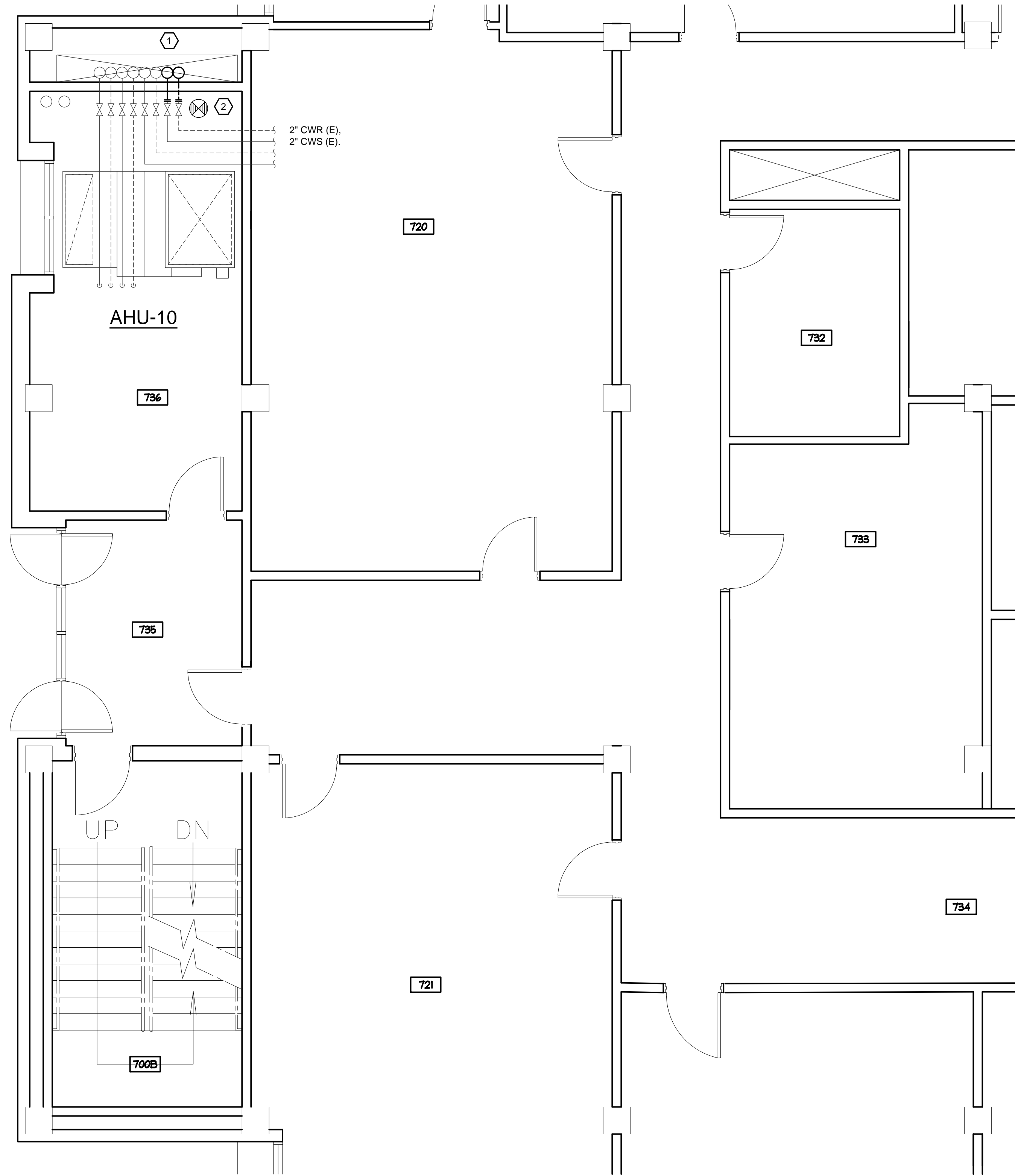


PPA#: 19-0042

MECHANICAL PLAN

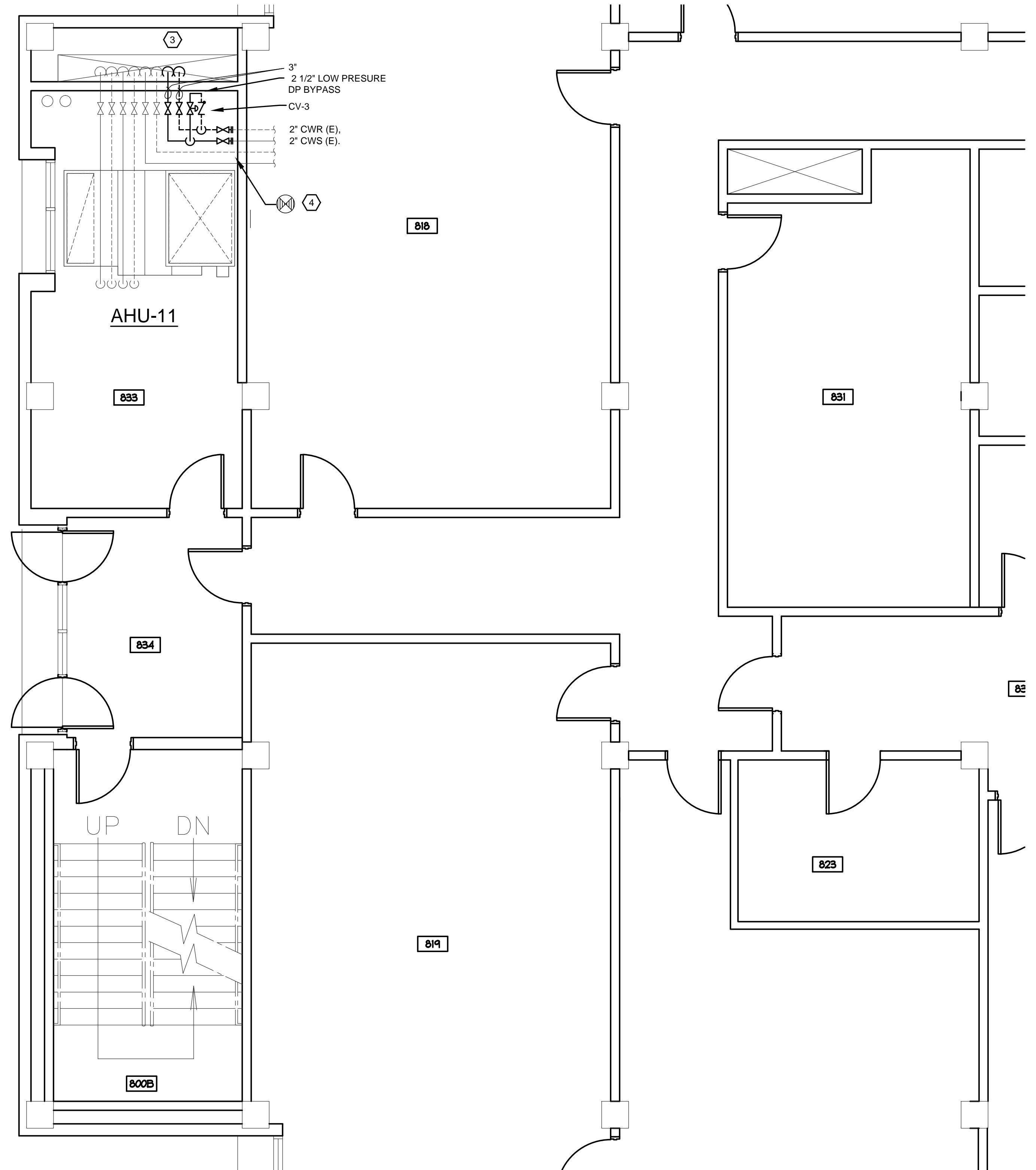
M101

10-15-2021



1 SEVENTH FLOOR MECHANICAL PLAN
 M100 1/4"=1'-0" NORTH REF

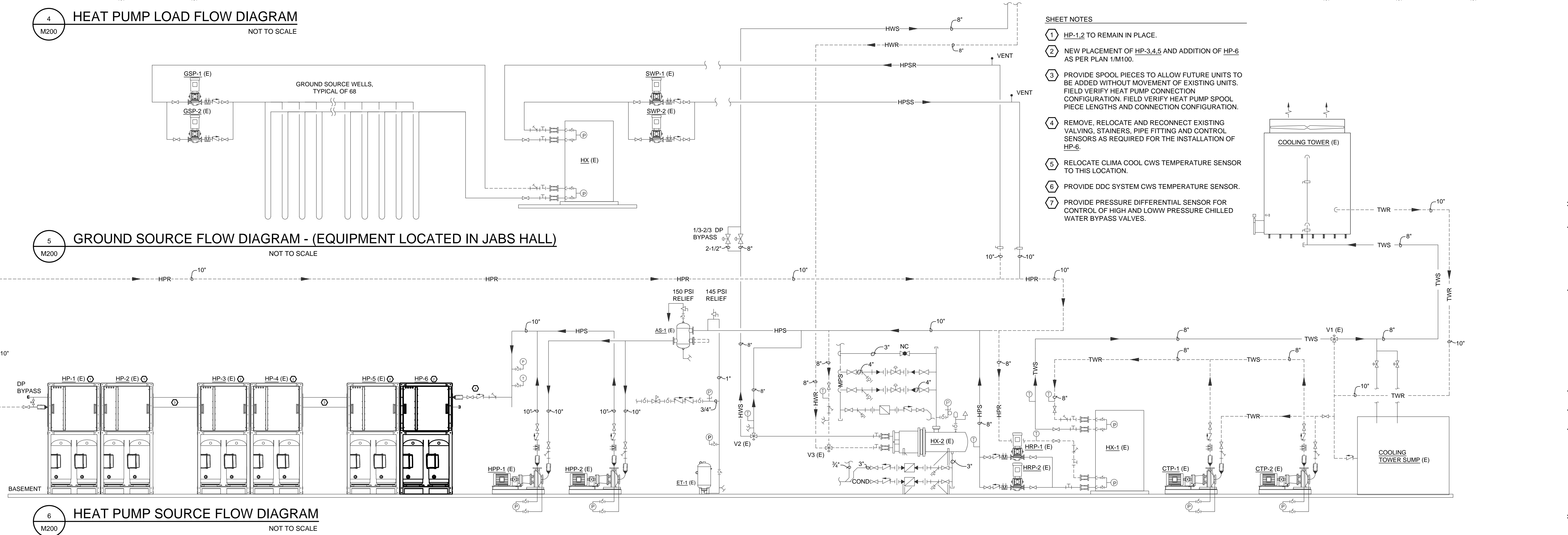
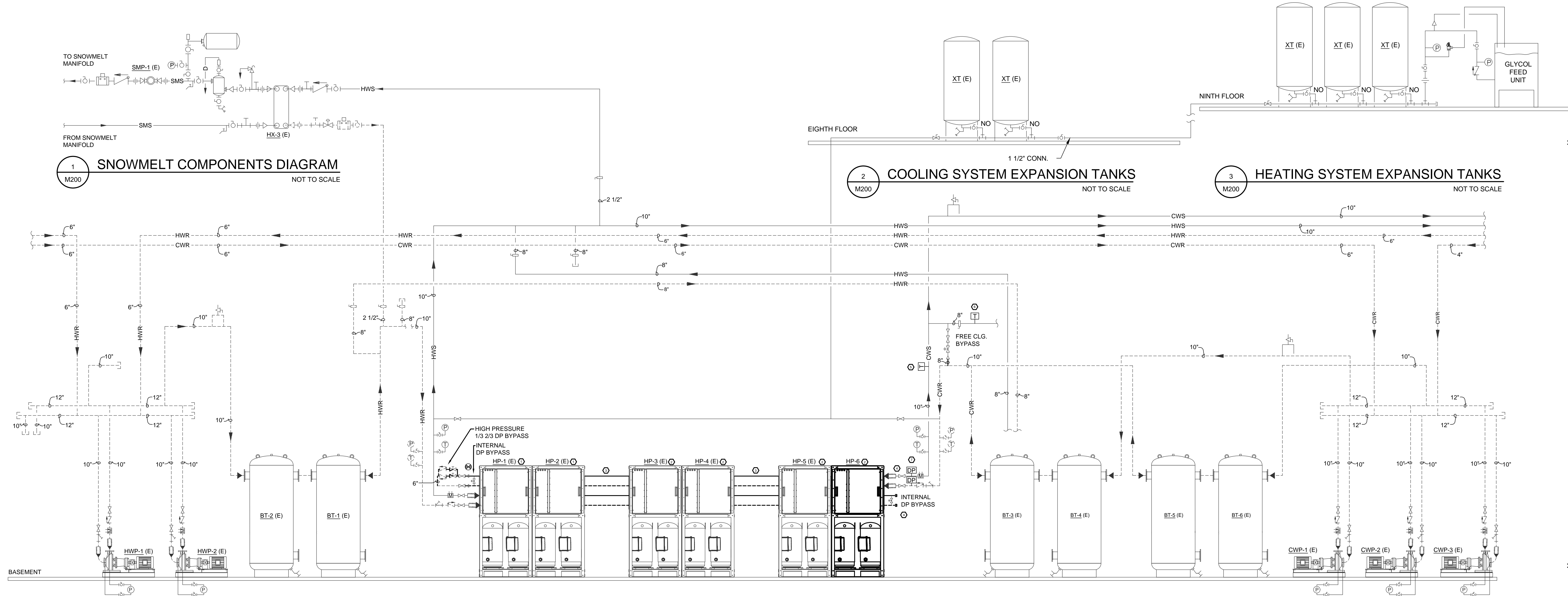
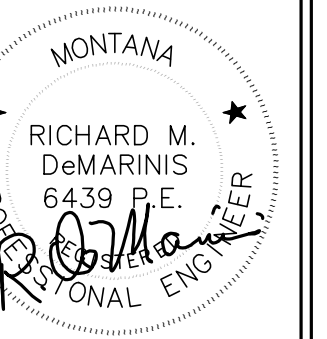
- SHEET NOTES
- ① EXISTING 3" CWS AND CWR RISERS DOWN TO REMAIN. REMOVE EXISTING 2" CWS AND RETURN RISERS UP TO THE EIGHTH FLOOR ABOVE. REPLACE WITH 3" CWS AND CWR RISERS UP TO EIGHTH FLOOR AND RECONNECT.
 - ② RECONNECTING 2" CWS AND CWR BRANCH MAINS THE CWS AND CWR RISERS.
 - ③ PROVIDE LOW PRESSURE DP BYPASS.
 - ④ RELOCATE EXISTING VALVING AND RECONNECT 2" CWS AND CWR BRANCH MAINS.



1 EIGHTH FLOOR MECHANICAL PLAN
 M100 1/4"=1'-0" NORTH REF

- SHEET NOTES
- ① EXISTING 3" CWS AND CWR RISERS DOWN TO REMAIN. REMOVE EXISTING 2" CWS AND RETURN RISERS UP TO THE EIGHTH FLOOR ABOVE. REPLACE WITH 3" CWS AND CWR RISERS UP TO EIGHTH FLOOR AND RECONNECT.
 - ② RECONNECTING 2" CWS AND CWR BRANCH MAINS THE CWS AND CWR RISERS.
 - ③ PROVIDE LOW PRESSURE DP BYPASS.
 - ④ RELOCATE EXISTING VALVING AND RECONNECT 2" CWS AND CWR BRANCH MAINS.

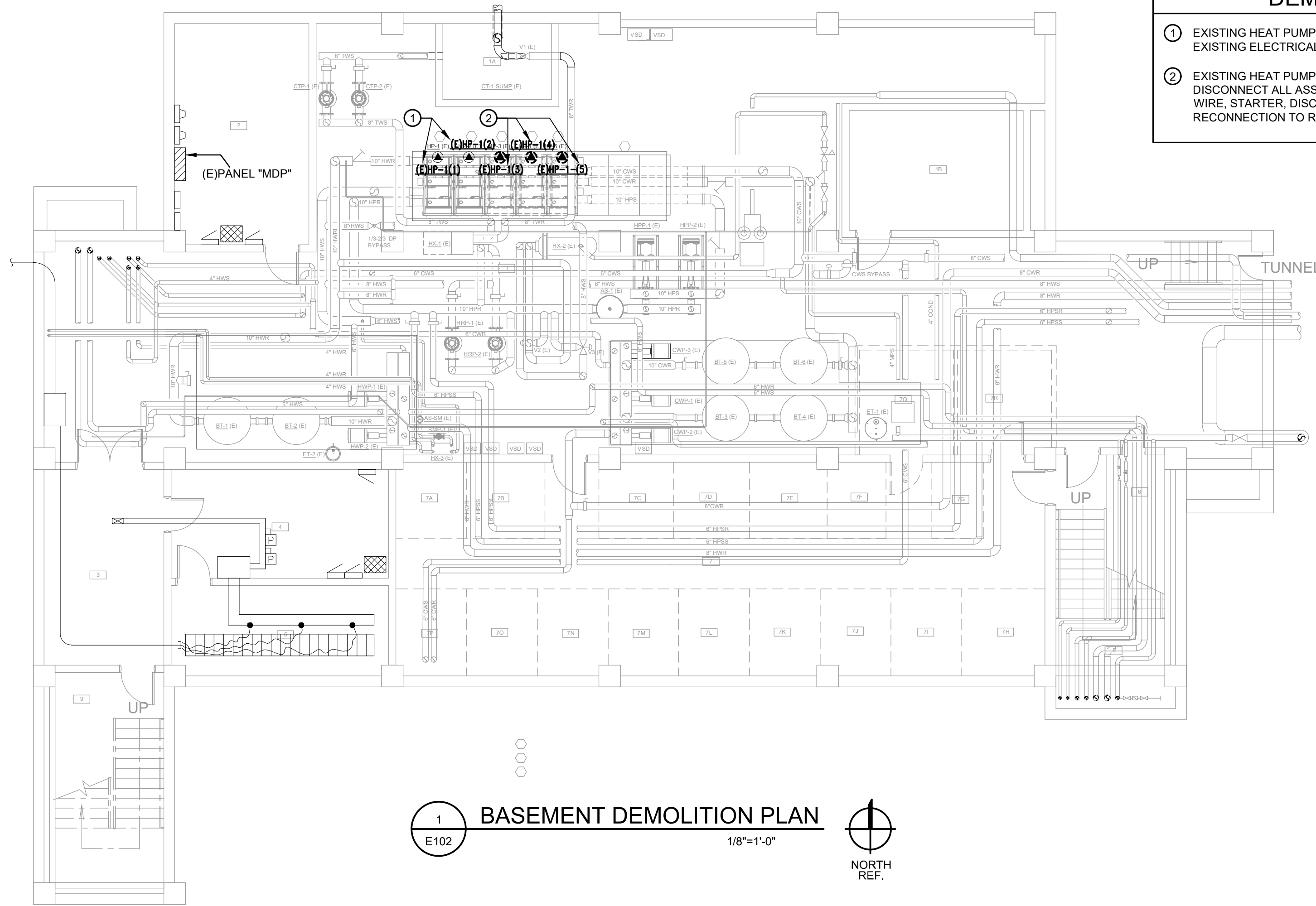
REV.	DESCRIPTION	DATE



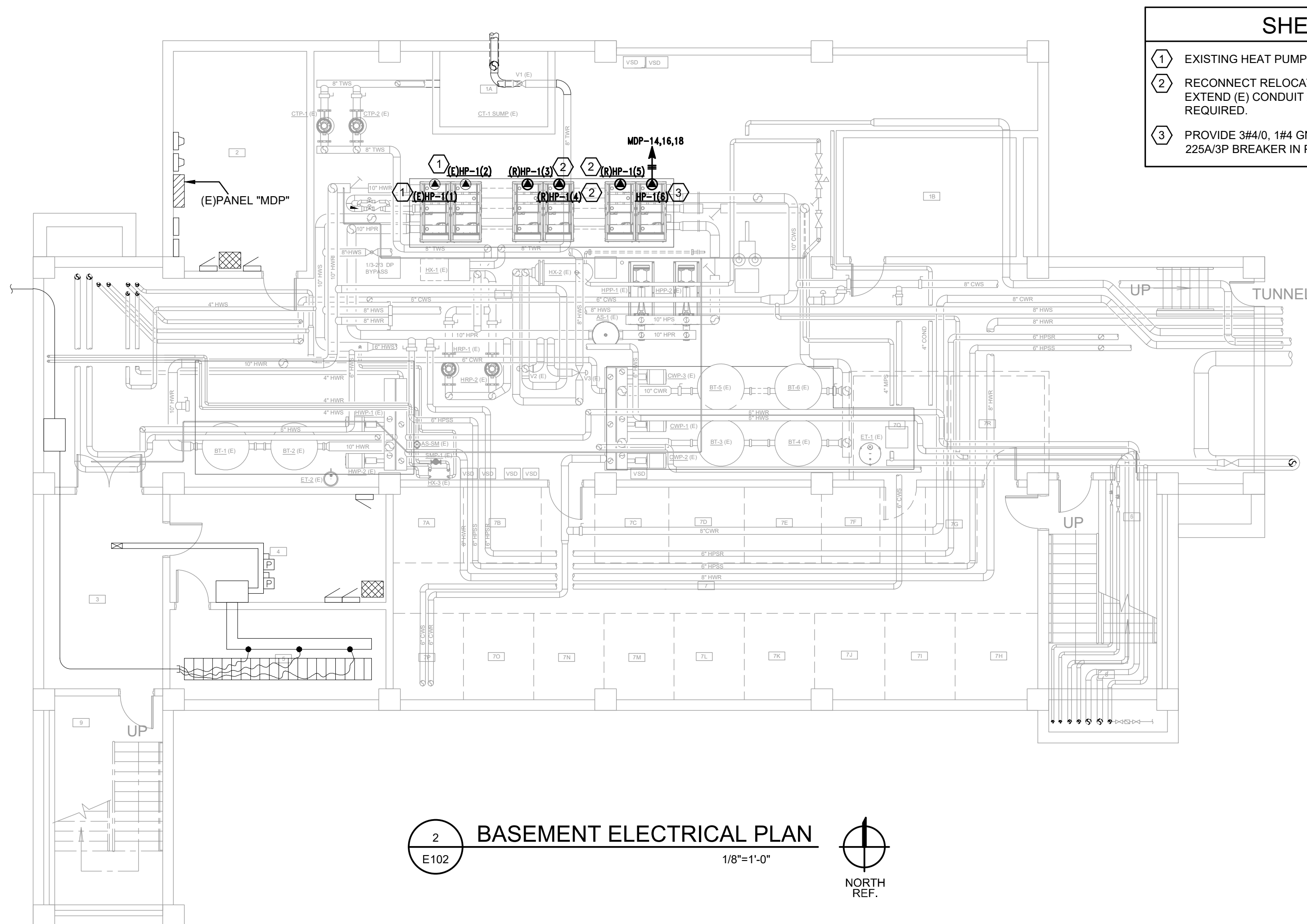
- SHEET NOTES**
- HP-1,2 TO REMAIN IN PLACE.
 - NEW PLACEMENT OF HP-3,4,5 AND ADDITION OF HP-6 AS PER PLAN 1/M100.
 - PROVIDE SPOOL PIECES TO ALLOW FUTURE UNITS TO BE ADDED WITHOUT MOVEMENT OF EXISTING UNITS. FIELD VERIFY HEAT PUMP CONNECTION CONFIGURATION. FIELD VERIFY HEAT PUMP SPOOL PIECE LENGTHS AND CONNECTION CONFIGURATION.
 - REMOVE, RELOCATE AND RECONNECT EXISTING VALVING, STAINERS, PIPE FITTING AND CONTROL SENSORS AS REQUIRED FOR THE INSTALLATION OF HP-6.
 - RELOCATE CLIMA COOL CWS TEMPERATURE SENSOR TO THIS LOCATION.
 - PROVIDE DDC SYSTEM CWS TEMPERATURE SENSOR.
 - PROVIDE PRESSURE DIFFERENTIAL SENSOR FOR CONTROL OF HIGH AND LOW PRESSURE CHILLED WATER BYPASS VALVES.

CMT NO.	DESCRIPTION	LOCATION:			AIC RATING:				35K SURFACE				PANEL NAME:		PANEL DATA	MCP (EXISTING)
		BREAKER	REF.	NOTE	MTOR	EQUIP	HEATING	COOLING	VA	AMPS	AMP	POLE	TYPE	VA		
1	HP-1 SECTION 1 (EXISTING UNIT AND BREAKER TO REMAIN)	225	3					39777	143.6				39777	143.6	AMPERAGE	1300
3	HP-1 SECTION 1 (EXISTING UNIT AND BREAKER TO REMAIN)	--	--					39777	143.6				39777	143.6	VOLTAGE	480/277
5	HP-1 SECTION 1 (EXISTING UNIT AND BREAKER TO REMAIN)	--	--					39777	143.6				39777	143.6	PHASE	3
7	HP-1 SECTION 2 (EXISTING UNIT AND BREAKER TO REMAIN)	225	3					39777	143.6				39777	143.6	WIRE	4
9	HP-1 SECTION 2 (EXISTING UNIT AND BREAKER TO REMAIN)	--	--					39777	143.6				39777	143.6	MAINS	
11	HP-1 SECTION 2 (EXISTING UNIT AND BREAKER TO REMAIN)	--	--					39777	143.6				39777	143.6	CKT. BKR.	1000 MCR NOTE 1
13	FUTURE HP-1 (EXISTING BREAKER TO REMAIN)	225	3					39777	143.6				39777	143.6	LUGS ONLY	
15	FUTURE HP-1 (EXISTING BREAKER TO REMAIN)	--	--					39777	143.6				39777	143.6	GROUND BUSS	
17	FUTURE HP-1 (EXISTING BREAKER TO REMAIN)	--	--					39777	143.6				39777	143.6	EQUIPMENT	YES
19	HP-1 SECTION 3 (RELOCATED UNIT / EXISTING BREAKER)	225	3					39777	143.6				39777	143.6	ISOLATED	
21	HP-1 SECTION 3 (RELOCATED UNIT / EXISTING BREAKER)	--	--					39777	143.6				39777	143.6	NEUTRAL BUSSING	
23	HP-1 SECTION 3 (RELOCATED UNIT / EXISTING BREAKER)	--	--					39777	143.6				39777	143.6	100%	YES
25	225A3P PROVISION							0	0.0				0	0.0	200%	
27	225A3P PROVISION							0	0.0				0	0.0	BUSSING	
29	225A3P PROVISION							0	0.0				0	0.0	COPPER	YES
								0	0.0				0	0.0	ALUMINUM	
								0	0.0				0	0.0	TOP FEED	
								0	0.0				0	0.0	ROTTOM FEED	
								0	0.0				0	0.0	FEED THRU LUGS	
								0	0.0				0	0.0	SUB FEED LUGS	
								0	0.0				0	0.0	CONNECTED TOTALS	
								0	0.0				0	0.0	(INCLUDES FEED-THRU CONTRIBUTION)	
								LOAD	KVA	AMPS						
2	HP-1 SECTION 4 (RELOCATED UNIT / EXISTING BREAKER)	225	3					39777	143.6				39777	143.6	LIGHTING	0.0
4	HP-1 SECTION 4 (RELOCATED UNIT / EXISTING BREAKER)	--	--					39777	143.6				39777	143.6	RECEPTACLES	0.0
6	HP-1 SECTION 4 (RELOCATED UNIT / EXISTING BREAKER)	--	--					39777	143.6				39777	143.6	MOTOR	716.0
8	HP-1 SECTION 5 (RELOCATED UNIT / EXISTING BREAKER)	225	3					39777	143.6				39777	143.6	EQUIPMENT	0.0
10	HP-1 SECTION 5 (RELOCATED UNIT / EXISTING BREAKER)	--	--					39777	143.6				39777	143.6	HEATING	0.0
12	HP-1 SECTION 5 (RELOCATED UNIT / EXISTING BREAKER)	--	--					39777	143.6				39777	143.6	COOLING	0.0
14	HP-1 SECTION 6 (NEW UNIT / EXISTING BREAKER)	225	3					39777	143.6				39777	143.6		
16	HP-1 SECTION 6 (NEW UNIT / EXISTING BREAKER)	--	--					39777	143.6				39777	143.6	TOTALS	716.0
18	HP-1 SECTION 6 (NEW UNIT / EXISTING BREAKER)	--	--					39777	143.6				39777	143.6		861.2
20	FUTURE HP-1 (EXISTING BREAKER TO REMAIN)	225	3					0	0.0				0	0.0	PHASE	KVA
22	FUTURE HP-1 (EXISTING BREAKER TO REMAIN)	--	--					0	0.0				0	0.0	A	238.7
24	FUTURE HP-1 (EXISTING BREAKER TO REMAIN)	--	--					0	0.0				0	0.0	B	238.7
26	225A3P PROVISION							0	0.0				0	0.0	C	238.7
28	225A3P PROVISION							0	0.0				0	0.0	TOTAL	716.0
30	225A3P PROVISION							0	0.0				0	0.0	FEEDER DEMAND TOTALS	
								LOAD	KVA	AMPS						
								0	0.0				0	0.0	LIGHTING	0.0
								0	0.0				0	0.0	RECEPTACLES	0.0
								0	0.0				0	0.0	MOTOR	716.0
								0	0.0				0	0.0	EQUIPMENT	0.0
								0	0.0				0	0.0	HEAT/COOL	0.0
								0	0.0				0	0.0	LARGEST MOTOR	0.0
								TOTAL	716.0	861.2						
								DATE	05/13/19							

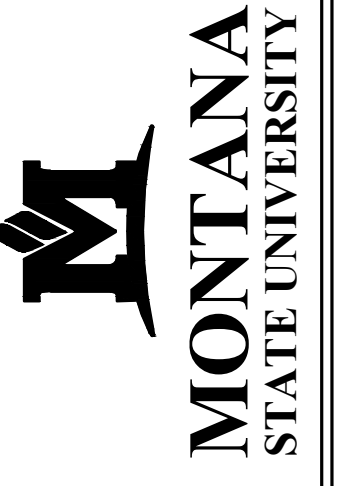
REFERENCE NOTES:



- DEMOLITION NOTES**
- EXISTING HEAT PUMP UNITS HP-1 AND HP-2 TO REMAIN. RETAIN ALL EXISTING ELECTRICAL.
 - EXISTING HEAT PUMP UNITS HP-3, HP-4 AND HP-5 TO BE RELOCATED. DISCONNECT ALL ASSOCIATED ELECTRICAL COMPONENTS (CONDUIT, WIRE, STARTER, DISC. SWITCH, ETC) AND PRESERVE IN PLACE FOR RECONNECTION TO RELOCATED EQUIPMENT OF SAME TYPE.



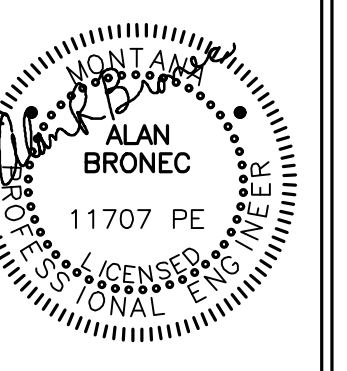
- SHEET WORK NOTES**
- EXISTING HEAT PUMP UNITS HP-1 AND HP-2 FEEDERS.
 - RECONNECT RELOCATED HEAT PUMP UNITS HP-3, HP-4 AND HP-5. EXTEND (E) CONDUIT AND PROVIDE NEW 3#4/0, 1#4 GND AS REQUIRED.
 - PROVIDE 3#4/0, 1#4 GND, IN 2.5"C, COPPER FEEDER FROM EXISTING 225A3P BREAKER IN PANEL "MDP" TO NEW HEAT PUMP UNIT HP-6.



Leon Johnson Hall
Redundant Heat Pump
Module Installation

CUSHING TERRELL
411 E. MAIN ST. SUITE 101
BOZEMAN, MT 59715
PH: 406.556.7100
FAX: 406.585.3031

DRAWN BY: SRG
REVIEWED BY: ARB



PPA#: 19-0042

ELECTRICAL
PLANS
AND
SCHEDULES

E100
10-15-2021