

SEQUENCE OF OPERATION:
HEATING PLANT:

THE JETPORT TERMINAL EXPANSION HEATING SYSTEM CONSISTS OF A HIGH TEMPERATURE (180 DEG F) HEATING WATER LOOP AND A LOW TEMPERATURE (130 DEG F) HEATING WATER LOOP. THE HIGH TEMPERATURE LOOP SHALL CONSIST OF A BOILER PLANT WITH GAS/OIL FUEL FIRED HOT WATER BOILERS, CIRCULATING PUMPS, PIPING AND ASSOCIATED TERMINAL EQUIPMENT. THE LOW TEMPERATURE LOOP SHALL CONSIST OF A GEOTHERMAL WELL FIELD, HEAT PUMP, CIRCULATING PUMPS, PIPING AND ASSOCIATED TERMINAL EQUIPMENT.

BOILER PLANT FUEL OIL SUPPLY SYSTEM:
A 20,000 GALLON FUEL OIL TANK SHALL BE BURIED OUTSIDE THE WEST END OF THE NEW ADDITION. UPON A CALL FROM THE 200 GALLON FUEL OIL DAY TANK IN THE BOILER PLANT, A SUBMERSIBLE PUMP IN THE 20,000 GALLON OIL TANK SHALL RUN UNTIL THE DAY TANK LEVEL CONTROL SHUTS IT OFF. FROM THE 200 GALLON DAY TANK IN THE BOILER ROOM, THE FUEL SHALL BE DRAWN TO THE BOILERS AND WATER HEATERS WHEN THE BURNER MOTOR FUEL PUMPS RUN.

THE BOILER PLANT SHALL ALSO CONTAIN TWO NATURAL GAS/OIL 2 FUEL OIL FIRED HOT WATER BOILERS B-1 AND B-2. EACH BOILER SHALL BE EQUIPPED WITH A MODULATING BURNER INCLUDING A VFD ON THE BURNER MOTOR. THE DDC SYSTEM SHALL ENABLE THE BOILERS FOR OPERATION WHEN THE OUTDOOR AIR TEMPERATURE IS BELOW 40 DEG F. (ADJUSTABLE) THE BOILER BURNER SHALL MODULATE TO MAINTAIN THE BOILER WATER SUPPLY SET POINT WHICH WILL BE RESET BY THE DDC SYSTEM TO FOLLOW THE AMBIENT TEMPERATURE. AN ASSOCIATED BOILER CIRCULATING PUMP SHALL CYCLE TO PROVIDE HEAT TO THE HIGH TEMPERATURE HYDRONIC WATER LOOP TO MAINTAIN THE SYSTEM SUPPLY SETPOINT TEMPERATURE. WHEN ANY BOILER OR WATER HEATER CALLS FOR HEAT, SUPPLY FAN SF-2 MOTOR OPERATED DAMPER SHALL OPEN. IF THE OUTSIDE TEMPERATURE IS ABOVE 50 DEG F (ADJUSTABLE) SF-2 SHALL START AND RUN UNTIL THE CALL FOR HEAT IS SATISFIED. A SYSTEM OF EXHAUST FANS MOUNTED AT THE FLUE OUTLET SHALL MODULATE TO MAINTAIN A CONSTANT DRAFT PRESSURE SET POINT. THE BOILER PLANT SHALL PROVIDE HIGH TEMPERATURE WATER FOR THE HYDRONIC HEATING SYSTEM AND SHALL SUPPLY HEATING WATER TO THE DOMESTIC HOT WATER DURING THE HEATING SEASON DURING THE SUMMER MONTHS, THE BOILERS SHALL BE SHUT OFF.

BELOW 40 DEG F, THE BOILERS SHALL BE ARRANGED TO PROVIDE SUPPLEMENTAL HEATING TO THE LOW TEMPERATURE HYDRONIC LOOP AS REQUIRED.

A MODULAR WATER-TO-WATER HEAT PUMP WHB-1 SHALL PROVIDE 130 DEG F WATER FOR THE LOW TEMPERATURE HYDRONIC HEATING SYSTEM DURING THE HEATING SEASON. ONE HEAT PUMP MODULE SHALL ALWAYS OPERATE IN HEATING MODE AND ONE HEAT PUMP MODULE SHALL ALWAYS OPERATE IN COOLING MODE WHEN THE HEAT PUMP IS RUNNING. THE HEAT SOURCE FOR THE HEAT PUMP SHALL BE A GEOTHERMAL BOREFIELD ON THE JETPORT PROPERTY.

DOMESTIC WATER HEATING:

DURING THE WINTER MONTHS, THE BOILERS SHALL SUPPLY HOT WATER TO THE SUPERSTOR STORAGE TANKS HEATING COILS. THE SUPPLY TEMPERATURE TO THE STORAGE TANKS FROM THE BOILERS SHALL BE AT LEAST 145 DEG F TO KEEP THE DOMESTIC HOT WATER AT 140 DEG F.

DURING THE SUMMER MONTHS, THE BOILERS SHALL BE LOCKED OUT AND DOMESTIC HOT WATER SHALL BE SUPPLIED BY THE WATER-TO-WATER HEAT PUMP SYSTEM. A 1-1/2" VALVED SUMMER BYPASS LINE SHALL CONNECT THE OUTLET OF THE SUPERSTOR STORAGE TANKS TO THE INLET OF THE NATURAL GAS/OIL 2 FUEL OIL FIRED DOMESTIC WATER HEATERS. THE GAS/OIL FIRED WATER HEATERS SHALL FIRE AS REQUIRED TO MAINTAIN THE DOMESTIC HOT WATER AT A STORAGE TEMPERATURE OF 140 DEG F. A SYSTEM OF EXHAUST FANS MOUNTED AT THE FLUE OUTLET SHALL MODULATE TO MAINTAIN A CONSTANT DRAFT PRESSURE SET POINT. A DOMESTIC HOT WATER RECIRCULATION PUMP SHALL RUN CONTINUOUSLY TO MAINTAIN HOT WATER FLOW TO REMOTE FIXTURES. (NOTE: SEE PLUMBING DRAWING P00.30 WATER HEATER SCHEDULE FOR EQUIPMENT EXCEPT SUPERSTOR STORAGE TANKS SHALL BE FURNISHED WITH DIAL COILS. IN EACH STORAGE TANK, ONE COIL SHALL BE PIPED TO THE WATER-TO-WATER HEAT PUMP AND THE OTHER COIL SHALL BE PIPED TO THE BOILERS PLANT HIGH TEMP LOOP PIPING.)

HYDRONIC SYSTEM SUPPLY PUMPS:

THE DDC SYSTEM SHALL ENABLE THE HIGH TEMPERATURE AND LOW TEMPERATURE HYDRONIC SYSTEM SUPPLY PUMPS FOR OPERATION WHEN THE OUTDOOR AIR TEMPERATURE IS BELOW 50 DEG F. (ADJUSTABLE) THE HYDRONIC SYSTEMS SUPPLY PUMPS SHALL BE ARRANGED IN A LEAD/LAG SEQUENCE. IF A LEAD HYDRONIC SYSTEM SUPPLY PUMP FAILS TO START, THE LAG PUMP WILL BE STARTED AND THE DDC SYSTEM SHALL SEND AN ALARM TO THE DESIGNATED MAINTENANCE REPRESENTATIVE. THE LEAD AND LAG PUMPS SHALL BE SWITCHED OVER ON A WEEKLY BASIS. THE PUMPS SHALL BE FURNISHED WITH VFDs AND THE PUMP RPM SHALL BE MODULATED TO INJECT HIGH TEMPERATURE WATER TO MAINTAIN A LOW TEMPERATURE LOOP SUPPLY TEMPERATURE OF 130 DEG F.

HYDRONIC SYSTEM DDC CONNECTION:

THE DDC SYSTEM SHALL MONITOR THE HYDRONIC SYSTEMS SUPPLY TEMPERATURE, RETURN TEMPERATURE, SUPPLY PRESSURE OF THE PUMPS, RETURN PRESSURE JUST BEFORE THE PUMPS, AND GPM FLOW TO THE BOREFIELD.

HIGH TEMPERATURE LOOP:

THE HIGH TEMPERATURE HYDRONIC LOOP SHALL SUPPLY HEAT TO THE FINNED RADIATION ALONG THE EXTERIOR WALLS, UNIT HEATERS IN STAIRWELLS AND BAGGAGE HANDLING SPACES, FAN COIL UNITS AND A SMALL NUMBER OF RADIANT FLOOR MANIFOLDS. THE TEMPERATURE SENSORS AND THERMOSTATS FOR THE FINNED RADIATION, UNIT HEATERS, AND FAN COILS SHALL BE SET AT 68 DEG F SPACE TEMPERATURE. THE HYDRONIC LOOP SUPPLY TEMPERATURE SHALL BE RESET FROM THE OUTDOOR AIR TEMPERATURE IN ACCORDANCE WITH THE FOLLOWING SCHEDULE:

OUTDOOR AIR TEMPERATURE	HIGH TEMP. HYDRONIC WATER SUPPLY TEMP	HIGH TEMP HYDRONIC SUPPLY PUMP SPEED
50 DEG F (ADJUSTABLE)	120 DEG F (ADJUSTABLE)	33% OF FULL FLOW
40 DEG F (ADJUSTABLE)	140 DEG F (ADJUSTABLE)	45% OF FULL FLOW
0 DEG F (ADJUSTABLE)	180 DEG F (ADJUSTABLE)	100% OF FULL FLOW

LOW TEMPERATURE LOOP:

THE LOW TEMPERATURE HYDRONIC LOOP SHALL SUPPLY HEAT TO AIR HANDLING UNIT 1 AND 2 HEATING COILS, VAV BOX HEATING COILS, MOST SNOW MELT AND RADIANT FLOOR MANIFOLDS AND ONE UNIT HEATER. THE WATER SUPPLY TEMPERATURE SHALL BE 130 DEG F SUPPLIED BY WATER-TO-WATER HEAT PUMP WHB-1. THE DDC SYSTEM SHALL CONTROL THE LOW TEMPERATURE HYDRONIC SUPPLY PUMP TO MAINTAIN A 20 DEG F TEMPERATURE DIFFERENTIAL (ADJUSTABLE) THE WATER-TO-WATER HEAT PUMP HEAT SOURCE SHALL BE THE GEOTHERMAL BOREFIELD AND THE SOURCE WATER SHALL BE CIRCULATED TO AND FROM THE BOREFIELD BY BOREFIELD/FLUID COOLER PUMP P-3 WITH PUMP P-4 AS BACKUP. THE HEAT SOURCE SHALL BE CONTROLLED AS FOLLOWS: PUMP P-3 SHALL RUN CONTINUOUSLY. ON A CALL FOR HEAT BY THE LOW TEMPERATURE HEATING LOOP, WHB-1 SHALL RUN TO PRODUCE 130 DEG F WATER AND SHALL REJECT COOLED WATER TO THE BOREFIELD. PUMP P-3 SHALL MODULATE ITS SPEED TO MAINTAIN THE BOREFIELD SUPPLY WATER TEMPERATURE BETWEEN 80 DEG F AND 39.5 DEG F. IF THE HEATING DEMAND ON THE LOW WATER TEMPERATURE LOOP EXCEEDS THE BOREFIELD SUPPLY CAPABILITY OF 475 GPM AND THE OUTDOOR AIR TEMPERATURE IS BELOW 40 DEG F, THE COOLING TOWER CONDENSER WATER SUPPLY CONTROL VALVE SHALL CLOSE AND THE COOLING TOWER BYPASS CONTROL VALVE SHALL OPEN AND PUMP P-3A SHALL START AND RUN. WATER SHALL CIRCULATE TO THE BOREFIELD AND TO HX-1. THE REMOTE PUMPS SHALL BE USED AS A SOURCE UNTIL THE WATER FROM THE PUMPS DROPS TO 55 DEG F, THEN PUMP P-3A SHALL BE SHUT OFF AND THE BOILER SHALL SUPPLEMENT THE LOW TEMPERATURE LOOP AS FOLLOWS: IF THE BOREFIELD SUPPLY TEMPERATURE DROPS TO 39.5 DEG F, THE GAS-FIRED BOILERS AND ASSOCIATED CONTROL VALVE SHALL MODULATE TO INJECT HIGH TEMPERATURE LOOP WATER TO MAINTAIN A WATER SUPPLY TEMPERATURE OF 130 DEG F IN THE LOW TEMPERATURE HEATING LOOP SUPPLY MAIN.

EMERGENCY POWER OPERATION:

IN CASE OF A POWER OUTAGE THE BOILERS SHALL RUN FROM THE EMERGENCY GENERATOR TO PROVIDE HEAT TO THE HIGH AND LOW TEMPERATURE HYDRONIC LOOPS FOR FREEZE PROTECTION. THE FOLLOWING EQUIPMENT SHALL BE POWERED OFF THE EMERGENCY GENERATOR: LOW TEMPERATURE HYDRONIC CIRCULATOR PUMP, HIGH TEMPERATURE HYDRONIC CIRCULATOR PUMP, FUEL OIL TANK SUBMERSIBLE PUMP, AND BOILER BURNERS. PROVIDE POWER TO SELECTED VAV BOXES AS NOTED IN THE ELECTRICAL DRAWINGS. AND IN THE EVENT OF A POWER OUTAGE AND START OF THE EMERGENCY GENERATOR, RESET THE VAV BOX ASSOCIATED SPACE TEMPERATURE TO 45 DEG F. IF VAV BOX SPACE TEMPERATURE SENSORS CALL FOR HEAT DURING EMERGENCY POWER, STAGGER THE VAV BOX OPERATION AS FOLLOWS: VAV BOXES IN TICKETING SHALL RUN FOR 20 MINUTES, THEN VAV BOXES IN SECURITY SHALL RUN FOR 20 MINUTES, THEN VAV BOXES IN HOLDING SHALL RUN FOR 20 MINUTES. VAV BOXES SHALL BE CYCLED IN THIS FASHION UNTIL THE POWER OUTAGE IS OVER.

COOLING PLANT:

THE COOLING PLANT SHALL CONSIST OF WATER-TO-WATER MODULAR HEAT PUMP (WHB-1), CENTRIFUGAL CHILLER (C-1), A GEOTHERMAL BOREFIELD OF DRILLED WELLS, COOLING TOWER (CT-1) ON THE MECHANICAL ROOF, TWO REMOTE PUMPS IN THE MECHANICAL ROOM AND CHILLED WATER, GEOTHERMAL BOREFIELD AND COOLING TOWER CIRCULATING PUMPS. NOTE: THE CHILLER CONDENSER WATER SUPPLY AND RETURN PIPING IS REFERRED TO AS THE GEOTHERMAL BOREFIELD SUPPLY (GBFS) AND RETURN (GBFR) PIPING.

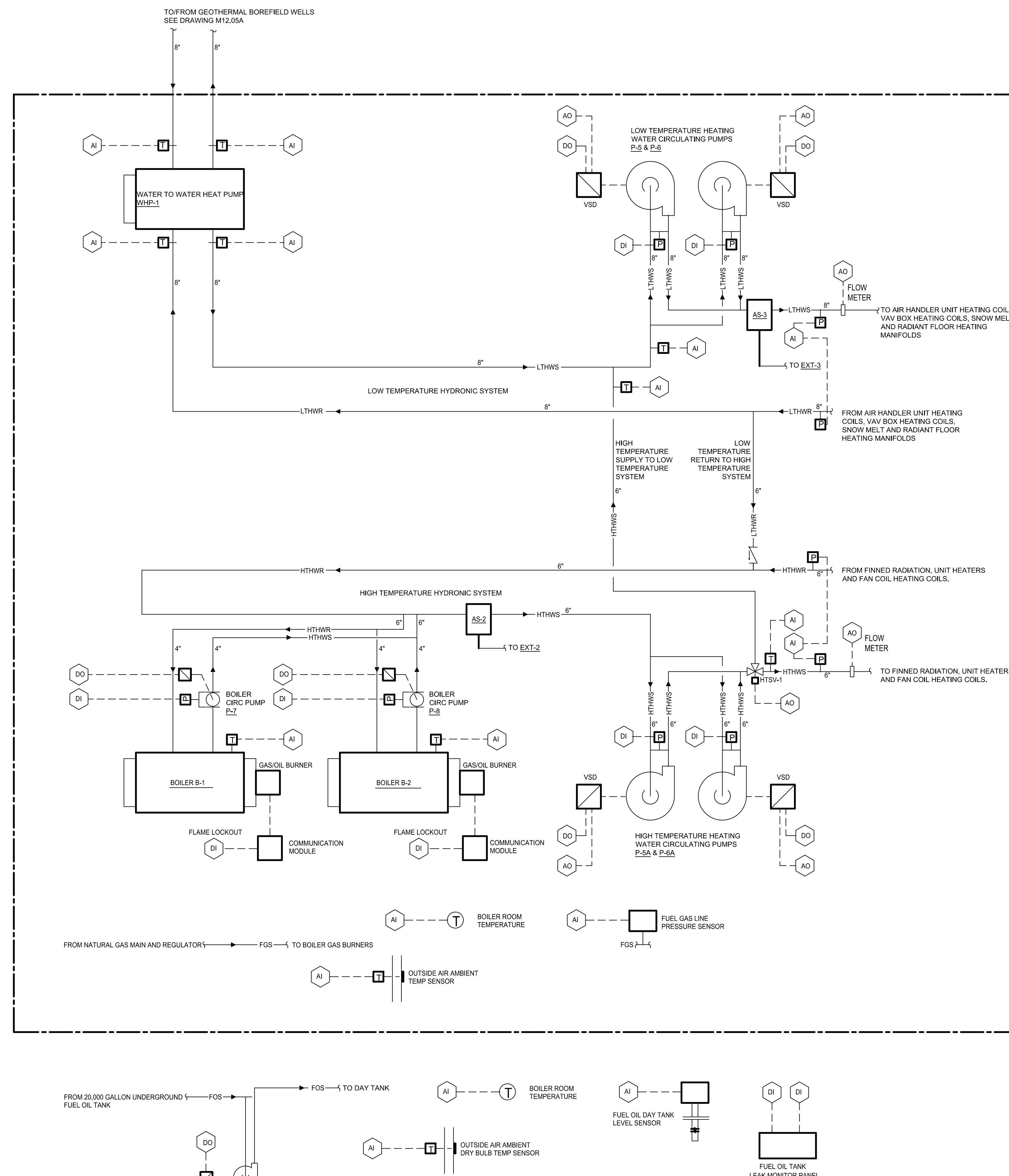
THE COOLING PLANT SHALL BE ENABLED AS FOLLOWS: THE WATER-TO-WATER MODULAR HEAT PUMP SHALL BE ENABLED AT ALL TIMES. ONE HEAT PUMP MODULE SHALL ALWAYS OPERATE IN HEATING MODE AND ONE HEAT PUMP MODULE SHALL ALWAYS OPERATE IN COOLING MODE WHEN THE HEAT PUMP IS RUNNING. THE CENTRIFUGAL CHILLER SHALL BE ENABLED WHEN THE OUTDOOR TEMPERATURE IS ABOVE 55 DEG F. (ADJUSTABLE) BOTH THE WATER TO WATER HEAT PUMP AND THE CENTRIFUGAL CHILLER SHALL BE UNDER LOCAL CONTROL AUTHORITY, BUT BOTH SHALL BE CAPABLE OF REPORTING AND DOCUMENTING OPERATING PARAMETERS TO THE OWNERS DDC SYSTEM, INCLUDING PRODUCTION OF DAILY REPORTS AND STORAGE OF 12 MONTHS WORTH OF OPERATING DATA AS DESCRIBED IN THE SPECIFICATIONS.

BOTH THE WATER-TO-WATER HEAT PUMP AND THE CENTRIFUGAL CHILLER SHALL TAKE HEAT FROM THE BUILDING AND REJECT IT TO THE BOREFIELD AND/OR THE COOLING TOWER. (VIA THE COOLING TOWER HEAT EXCHANGER) THE HEAT REJECTION CONTROL SHALL BE AS FOLLOWS: AS THE COOLING LOAD (AND ASSOCIATED CONDENSER LOAD) INCREASES, THE GEOTHERMAL BOREFIELD WELL SYSTEM PUMP SPEED SHALL INCREASE UP TO UP TO 475 GPM DIRECTED TO THE BOREFIELD. AS THE BOREFIELD RETURN WATER TEMPERATURE INCREASES ABOVE 80 DEG F, THE CTGBF CONTROL VALVES WILL OPEN TO THE COOLING TOWER HEAT EXCHANGER AND THROTTLE TO THE BOREFIELD AND THE PUMP SPEED WILL INCREASE TO SUPPLY BOTH THE BOREFIELD AND THE COOLING TOWER HEAT EXCHANGER. AT MAXIMUM COOLING LOAD, THE BOREFIELD RETURN WATER TEMPERATURE SHALL BE NO HIGHER THAN 80 DEG F. WHEN THE OUTDOOR AIR TEMPERATURE IS BELOW 40 DEG F (ADJUSTABLE), THE COOLING TOWER SHALL BE SHUT OFF AND THE COOLING TOWER BASIN SHALL BE DRAINED.

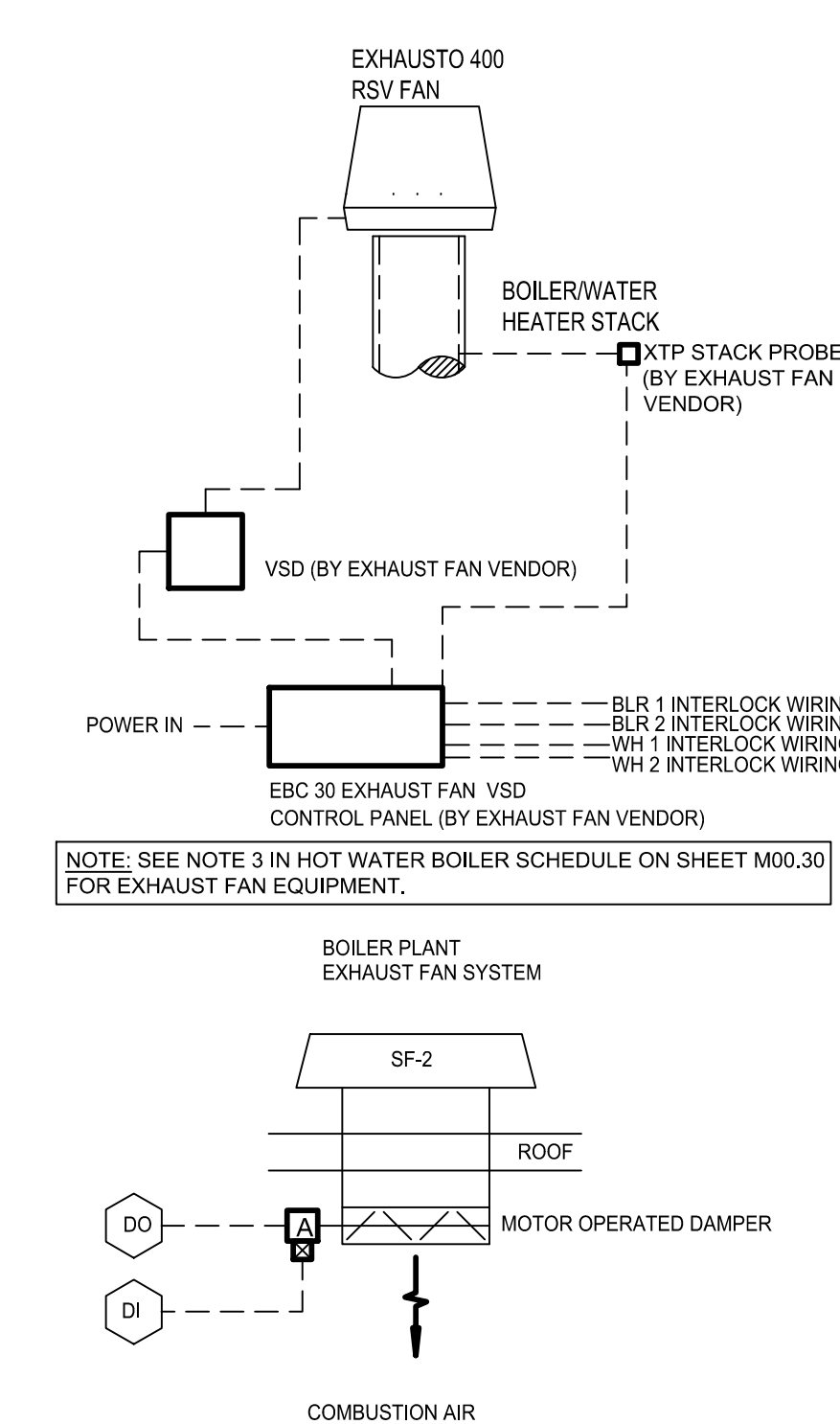
THE CHILLED WATER SUPPLY LEAD PUMP AND THE GEOTHERMAL BOREFIELD SUPPLY LEAD PUMP SHALL RUN CONTINUOUSLY (YEAR ROUND). IF A LEAD SUPPLY PUMP FAILS TO START, THE LAG PUMP WILL BE STARTED AND THE DDC SYSTEM SHALL SEND AN ALARM TO THE DESIGNATED MAINTENANCE REPRESENTATIVE. THE LEAD AND LAG PUMPS SHALL BE SWITCHED OVER ON A WEEKLY BASIS.

THE DDC SYSTEM SHALL ENABLE THE COOLING TOWER SUPPLY PUMPS FOR OPERATION WHEN THE OUTDOOR AIR TEMPERATURE IS ABOVE 40 DEG F. (ADJUSTABLE) THE COOLING TOWER SUPPLY PUMPS SHALL BE ARRANGED IN A LEAD/LAG SEQUENCE. IF A LEAD COOLING TOWER SUPPLY PUMP FAILS TO START, THE LAG PUMP WILL BE STARTED AND THE DDC SYSTEM SHALL SEND AN ALARM TO THE DESIGNATED MAINTENANCE REPRESENTATIVE. THE LEAD AND LAG PUMPS SHALL BE SWITCHED OVER ON A WEEKLY BASIS. THE PUMPS SHALL BE FURNISHED WITH VFDs AND THE PUMP RPM SHALL BE MODULATED AS FOLLOWS: ON STARTUP, THE LEAD COOLING TOWER SUPPLY PUMP SHALL RUN AT 25% OF FULL RPM FOR 5 MINUTES. AFTER THE 5 MINUTE INTERVAL, THE PUMP SHALL BE PLACED UNDER THE AUTHORITY OF THE DDC SYSTEM AND SHALL MODULATE TO MAINTAIN A 10 DEG F DIFFERENTIAL BETWEEN THE CHILLER CONDENSER SUPPLY AND RETURN TEMPERATURES AT THE COOLING TOWER HEAT EXCHANGER.

THE COOLING TOWER FAN SHALL BE CONTROLLED BY A VFD TO MAINTAIN A CONSTANT TEMPERATURE DIFFERENCE OF 21 DEG F (ADJUSTABLE) BETWEEN THE CONDENSER WATER ENTERING THE COOLING TOWER HEAT EXCHANGER AND THE AMBIENT WET BULB.



VALE GRANT BOUNDARY: WORK INSIDE THESE LINES FALLS UNDER THE VALE GRANT PROVISIONS



HEATING PLANT SCHEMATIC

SCALE: NOT TO SCALE

THESE DRAWINGS ARE ISSUED FOR CONSTRUCTION AND REFLECT ALL AMEC ISSUED BULLETINS AND SKETCHES.

Issue	Date & Issue Description	By	Check
01	05/21/10	PWZ	RHB
02	03/30/11	PWZ	RHB
03	09/01/11	PWZ	RHB

ISSUED FOR CONSTRUCTION

GENERAL NOTES

- A SEE SHEET M00.00 FOR LEGEND AND GENERAL NOTES.
- B SEE SPECIFICATION SECTION 23 09 00 INSTRUMENTATION AND CONTROL FOR HVAC FOR MATERIALS AND LABOR REQUIREMENTS.

Signature: *Robert Brown*
ROBERT BROWN
No. 4602
09/01/11

Project Name: P1W Terminal Enhancement
Project Number: 08.0395.000
CAD File Name: T:\3330101\Sheets\M12.07.dwg
Description: HEATING PLANT SCHEMATIC

Scale: NOT TO SCALE