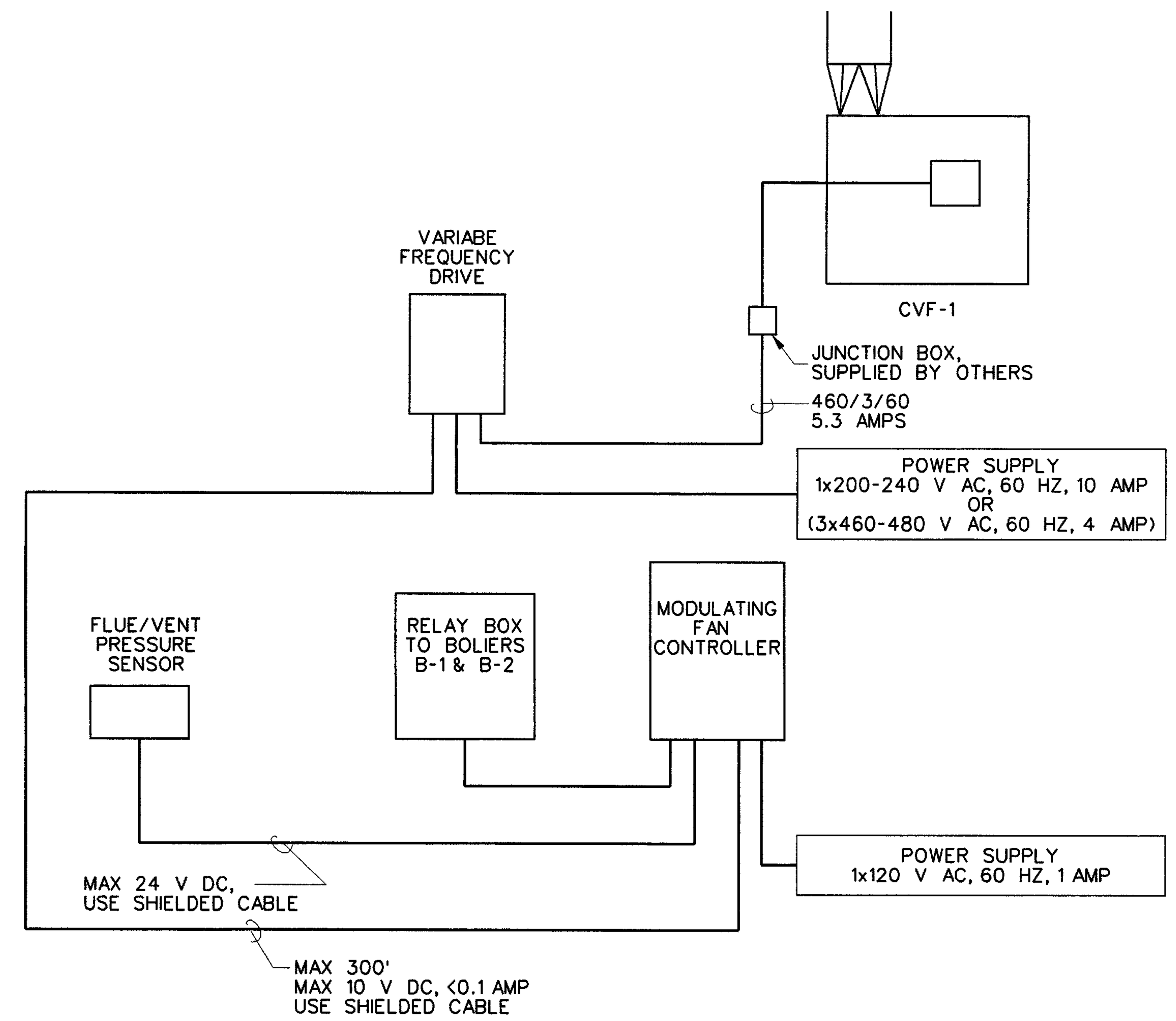
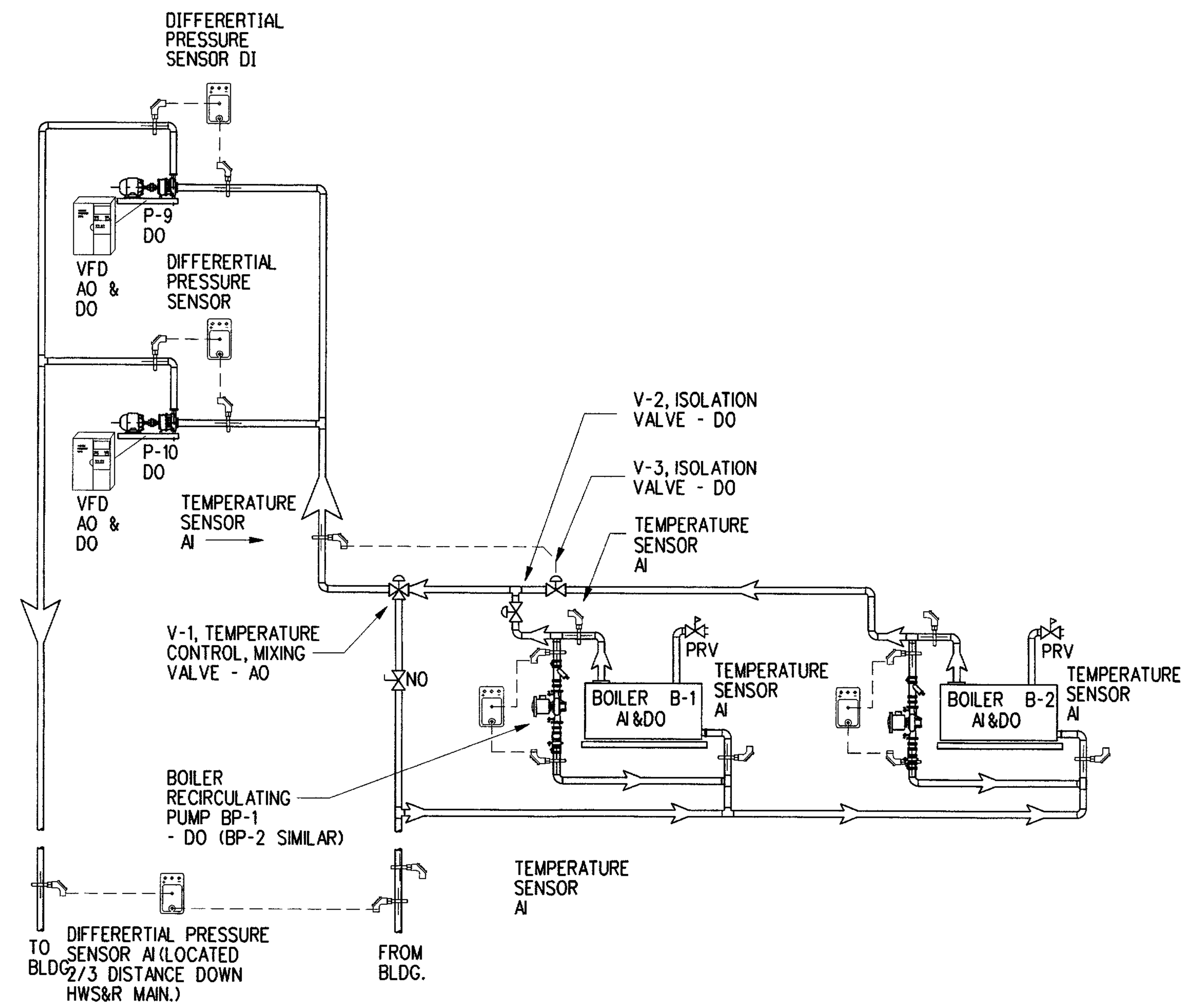
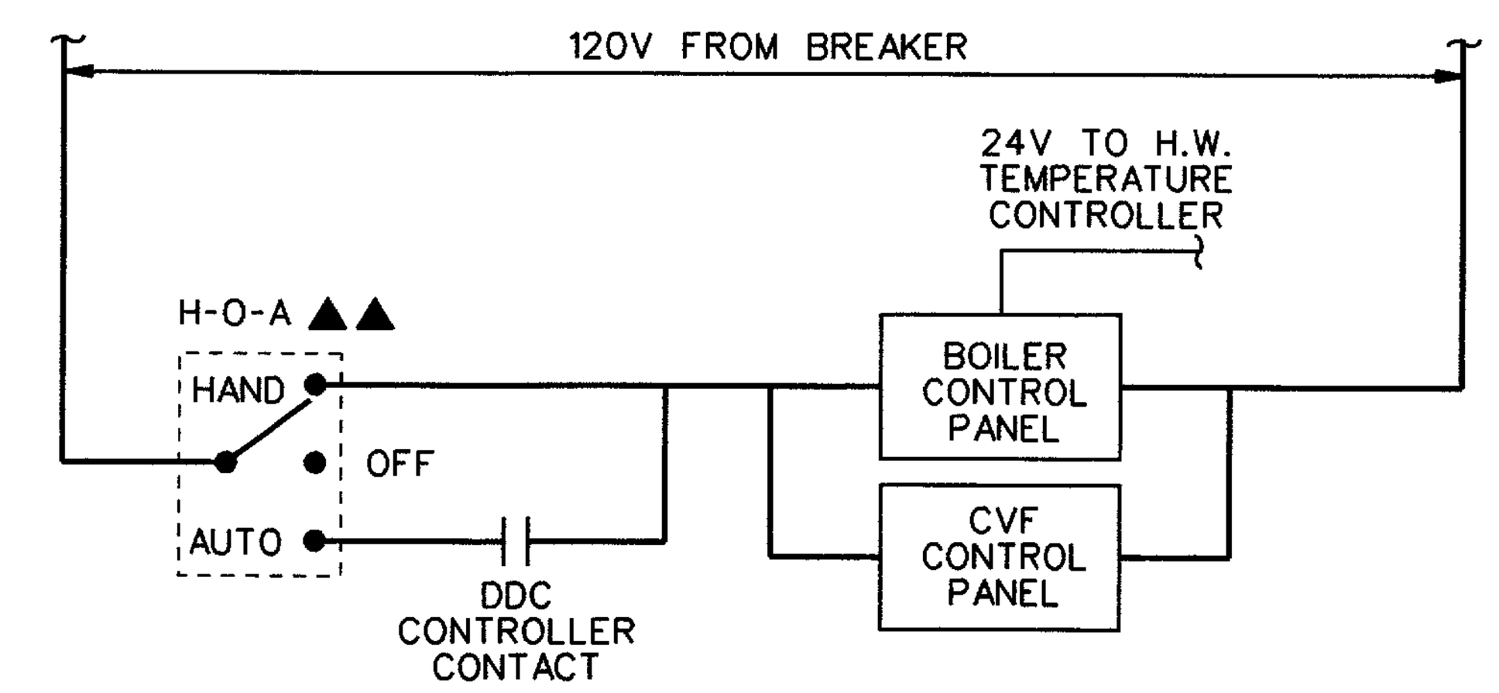


COMBUSTION VENTILATION FAN CONTROL DETAIL

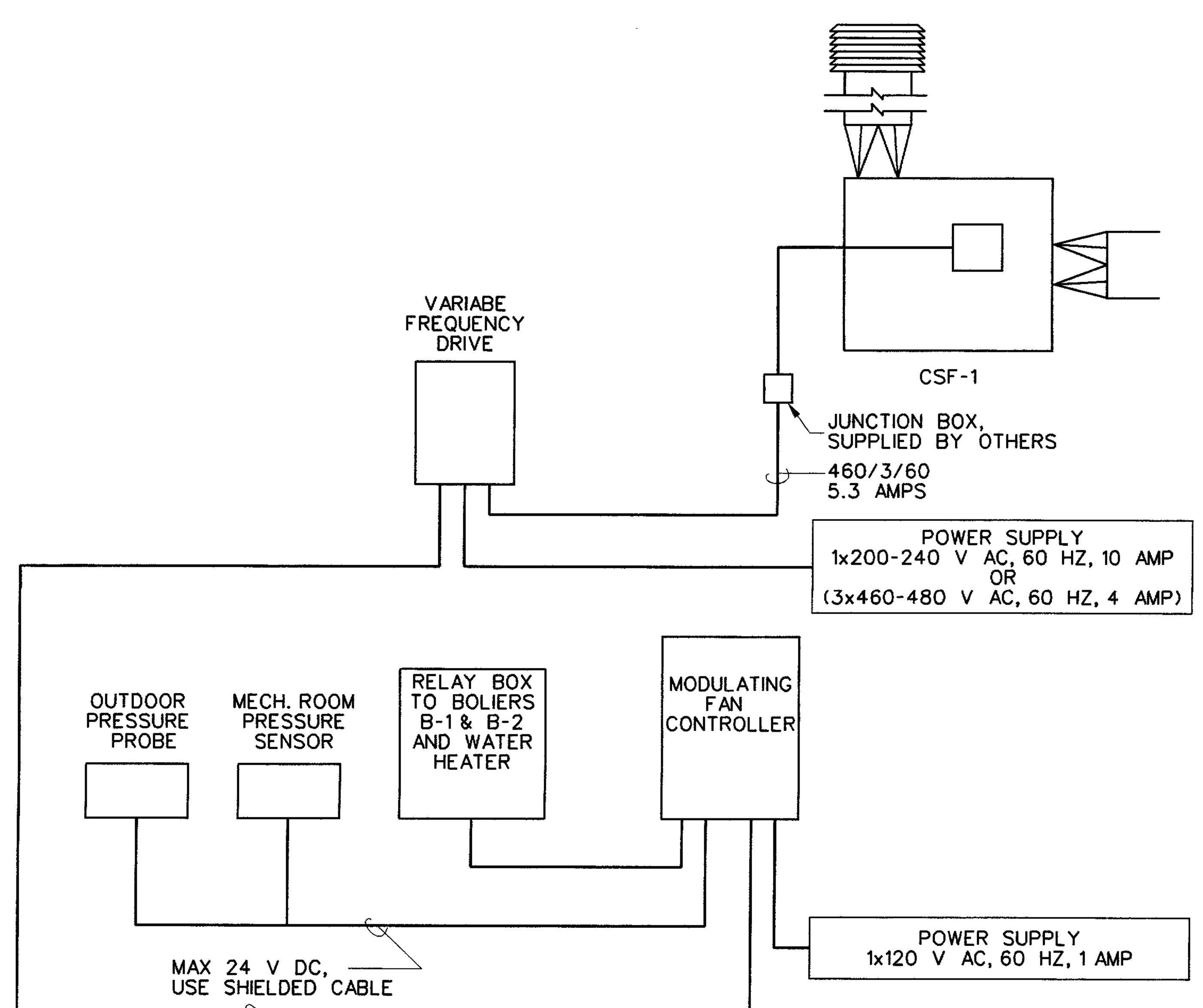
NO SCALE





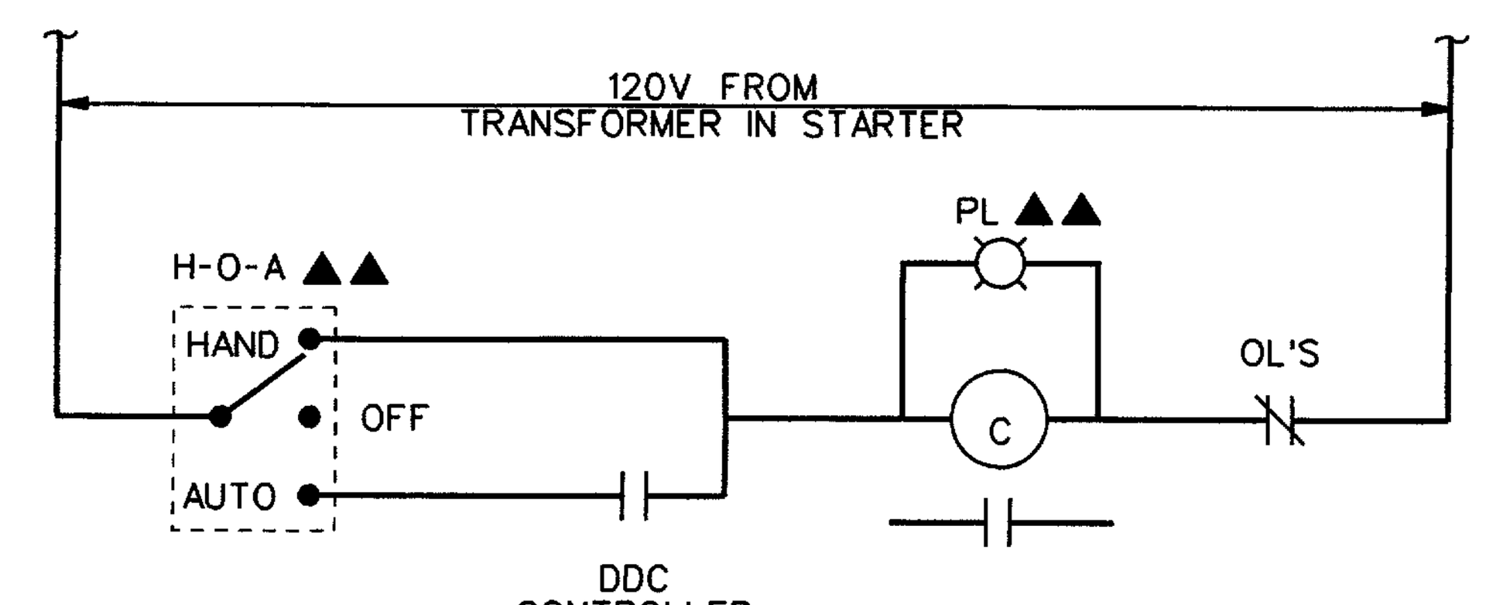
BOILER CONTROLS

NOTE: PROOF OF FLOW OF HWP-1 OR HWP-2 SHALL BE ESTABLISHED AND RESPECTIVE BP-1 OR BP-2 SHALL RUN 2 MINUTES (ADJUSTABLE) BEFORE DDC CONTROLLER ENERGIZES BOILER B-1 OR B-2.



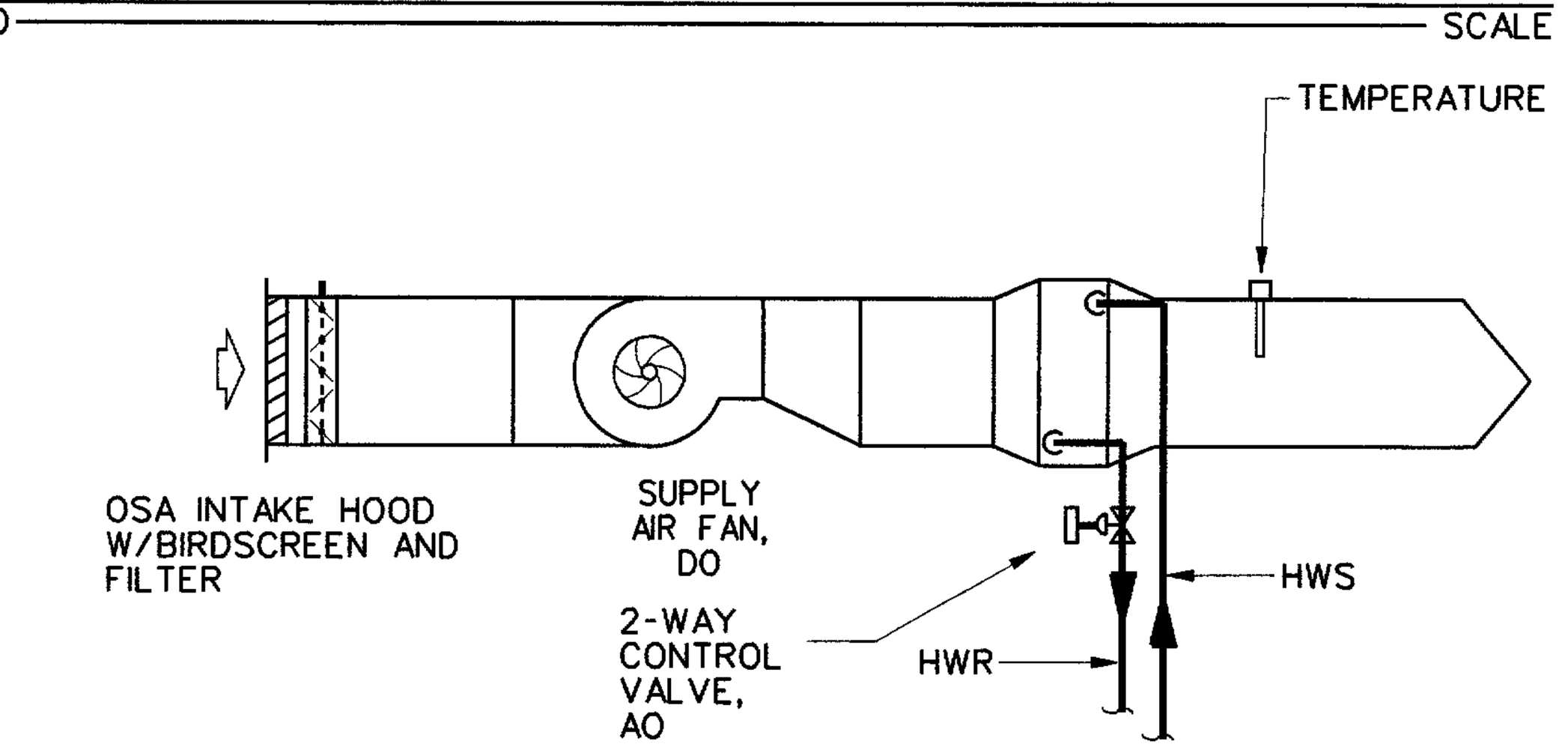
COMBUSTION SUPPLY FAN CONTROL DETAIL

NO SCALE

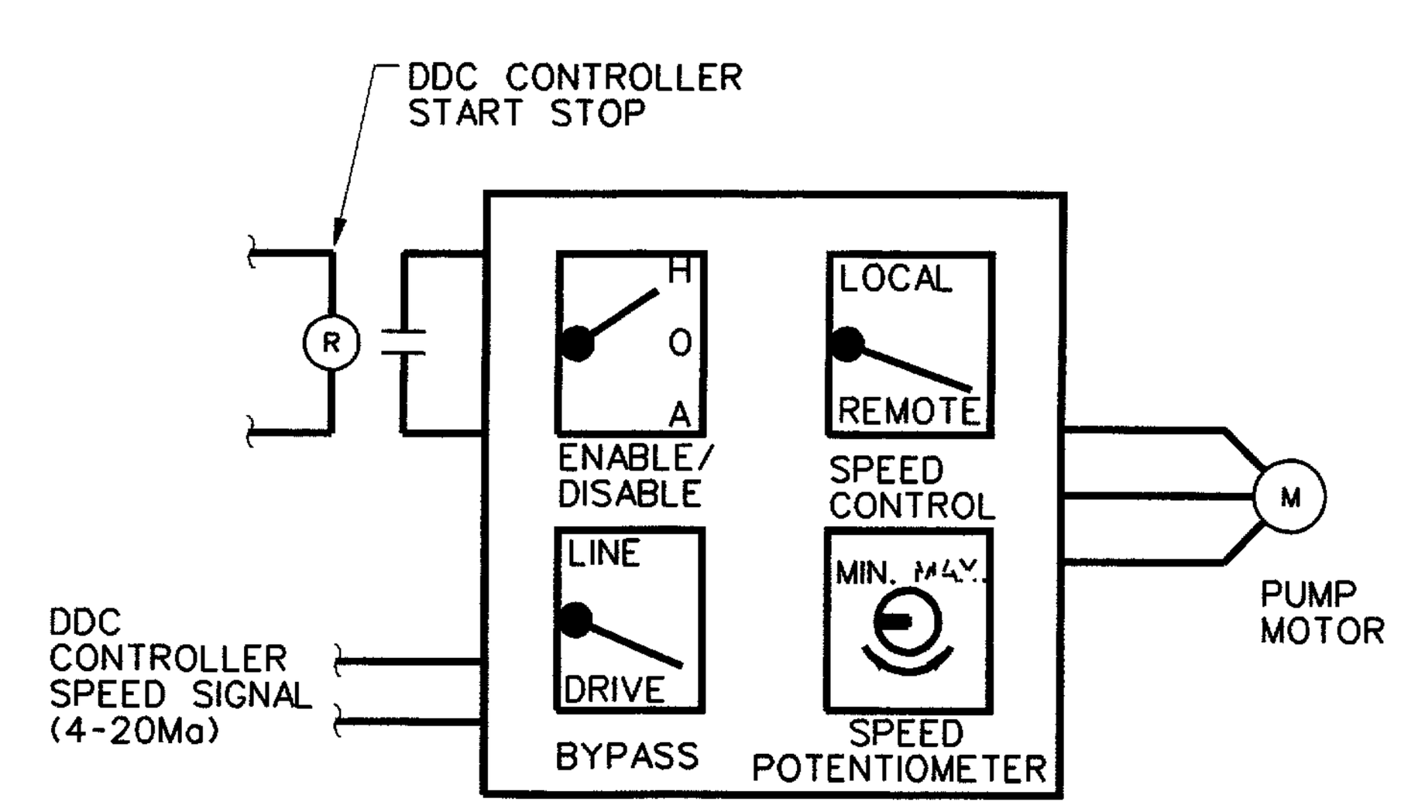


BOILER RECIRCULATING PUMP CONTROLS

NOTE: PUMP BP-1 SHALL RUN TWO MINUTES BEFORE B-1 IS ENERGIZED AND SHALL RUN FOR THIRTY MINUTES AFTER B-1 IS DE-ENERGIZED. BP-2 AND B-2 SIMILAR.



CSF TEMPERATURE CONTROL DIAGRAM



HOT WATER PUMP VFD

PANEL DESIGNATION: FT. MEADE DINFOS

LOCATION: MAIN MECHANICAL ROOM

POINT DESCRIPTION	HW Output Digital: Control Relay	HW Output Digital: Solenoid	HW Output Digital: Contactor	HW Output Analog: Electrical Transducer	HW Output Analog: 4-20MA Module	HW Input Digital: Pressure Switch	HW Input Digital: Auxiliary Contact	HW Input Analog: Temperature	HW Input Analog: Differential Pressure	HW Input Analog: Position	SW Alarms Digital: Equipment Status	SW Alarms Digital: Maintenance	SW Alarms Analog: High Limit	SW Alarms Analog: Low Limit	SW Alarms Analog: Run Time	HW/SW: Scheduled Start/Stop	HW/SW: Duty Cycling	HW/SW: VFD Speed Control	HW/SW: Lead/Lag Control	HW/SW: Temperature Control	HW/SW: Hot Water Boiler Opt.	HW/SW: HW OA Reset	HW/SW: Boiler Enable
BOILER NO. 1 S/S	●										●		●	●	●	●	●		●		●		●
BOILER NO. 2 S/S	●										●		●	●	●	●	●		●		●		●
BP-1	●										●				●	●					●		
BP-2	●										●				●	●					●		
HOT WTR PUMP P-9 VFD	●					●			●		●				●	●	●	●	●		●		
HOT WTR PUMP P-10 VFD	●				●	●			●		●				●	●	●	●	●		●		
HWS TEMP CTRL V-1										●										●		●	
ISOLATION VALVE V-2	●																●		●				
ISOLATION VALVE V-3	●																●		●				
COMBUSTION VENT FAN, CVF-1	●										●												
COMBUSTION SUPPLY FAN CSF-1	●										●												
COMBUSTION SUPPLY AIR								●						●									
HOT WATER VALVE					●																		
SECONDARY HWS TEMP SENSOR								●															
SECONDARY HWR TEMP SENSOR								●															
HWS TEMP B-1								●					●	●									
HWR TEMP B-1								●						●									
HWS TEMP B-2								●					●	●									
HWR TEMP B-2								●						●									
HW LOOP PRESSURE									●														
OUTSIDE AIR TEMP								●												●		●	
EXIST. REFRIG. SENSOR	●																						●

SEQUENCE OF OPERATION BOILERS & HOT WATER PUMPS

1. THE BUILDING IS SERVED BY TWO HEATING WATER BOILERS B-1 AND B-2. BOILERS ARE CONTROLLED BY UNIT-MOUNTED, FACTORY-FURNISHED DDC MICROPROCESSORS, WITH A GATEWAY TO THE EXISTING ANDOVER DDC SYSTEM TO COMMUNICATE STATUS AND ALARMS AND ISSUE BOILER START/STOP. HOT WATER SYSTEM TO RUN CONTINUOUSLY TO SATISFY BUILDING HEATING LOAD AND VAV REHEAT COIL PERFORMANCE AND TO CONTROL HUMIDITY AS REQUIRED AT CONSTANT VOLUME AHU REHEAT HUMIDITY CONTROL.

2. HOT WATER PUMPS P-9 AND P-10 ARE ENERGIZED THROUGH ACTION OF H-O-A LOCATED IN STARTER. MANUAL START WHEN IN HAND POSITION OR BY DDC CONTROLLER WHEN IN AUTO POSITION. AFTER ENERGIZED, PUMPS SHALL START IN THE MINIMUM SPEED POSITION. PUMP SPEED SHALL RAMP UP OR DOWN AS REQUIRED VIA DDC CONTROL SIGNAL TO PUMP VFD TO MAINTAIN DIFFERENTIAL PRESSURE (INITIALLY SET AT 6 PSI) MEASURED APPROXIMATELY TWO-THIRDS ALONG HEATING WATER SUPPLY AND RETURN MAIN HEADER.

3. AFTER PROOF OF FLOW OF P-9 OR P-10 AS DETERMINED BY PUMP DIFFERENTIAL PRESSURE SWITCH IS ESTABLISHED, BOILERS B-1 AND B-2 MAY BE ENERGIZED THROUGH ACTION OF UNIT MOUNTED H-O-A- SWITCH. BOILERS MAY BE STARTED MANUALLY WHEN IN THE HAND POSITION OR BY DDC WHEN IN AUTO POSITION.
   A) RESPECTIVE RECIRCULATING PUMPS BP-1 (FOR BOILER B-1) AND BP-2 (FOR BOILER B-2) SHALL BE ENERGIZED WHEN RESPECTIVE BOILER IS ENERGIZED. RECIRCULATING PUMPS SHALL BE STARTED AND RUN FOR TWO MINUTES BEFORE BOILER IS ENERGIZED AND SHALL CONTINUE TO RUN FOR THIRTY MINUTES AFTER BOILER IS DE-ENERGIZED. COMBUSTION VENTILATION FAN CVF IS ENABLED WHEN EITHER BOILER B-1 OR B-2 IS ENABLED. WHEN BOILER IS ENERGIZED AND BOILER DISCHARGE TEMPERATURE SETPOINT IS ACHIEVED, ASSOCIATED ISOLATION VALVE (V2 OR V3) SHALL OPEN AND REMAIN OPEN UNTIL BOILER IS DE-ENERGIZED BY THE DDC SYSTEM.
   B) ON A CALL FOR HEAT FROM LEAD/LAG BOILER, CVF-1 CONTROLS SHALL BE ENABLED. STACK PRESSURE PROBE SHALL SIGNAL THAT PRESSURE DIFFERNETIAL REQUIREMENT IN STACK HAS CHANGED AND CONTROLLER WILL ENABLE CVF-1 VFD TO RAMP UP FAN SPEED TO MEET DIFFERENTIAL REQUIREMENT. ONCE DIFFERENTIAL REQUIREMENT IS MET, CVF-1 CONTROLLER SHALL ENABLE LEAD/LAG BOILER BURNER. IF AT ANYTIME THERE IS FAILURE TO ESTABLISH DIFFERENTIAL PRESSURE REQUIREMENT (40% BELOW SETPOINT FOR MORE THAN 12 SECONDS), CVF-1 CONTROLLER SHALL DISABLE BOILERS AND GENERATE AN ALARM AT THE BAS. CVF-1 SHALL CONTINUE TO RUN FOR 3 MINUTES AFTER BOILERS ARE DEENERGIZED.
   C) ON A CALL FOR HEAT FROM LEAD/LAG BOILER OR WATER HEATER, CSF-1 CONTROLS SHALL BE ENABLED. CSF-1 CONTROLLER SHALL MONITOR MECHANICAL ROOM PRESSURE COMPARED TO OUTDOOR PRESSURE AND RAMP VFD FOR CSF-1 UP OR DOWN AS REQUIRED TO MAINTAIN POSSITIVE PRESSURE CONDITION IN MECHANICAL ROOM. IF ROOM PRESSURE DROPS BELOW ESTABLISHED SETPOINT, CSF-1 CONTROLLER SHALL SHUT-DOWN WATER HEATER AND BOILERS AS REQUIRED AND ALARM THE DDC SYSTEM. HOT WATER HEATING VALVE FOR HC-1 (CSF-1) SHALL MODULATE OPEN TO CLOSED AS REQUIRED TO MAINTAIN A MINIMUM OF 50°F DISCHARGE TEMPERATURE.

4. LEAD/LAG CONTROL OF BOILERS AND HOT WATER PUMPS IS ACCOMPLISHED BY THE DDC SYSTEM. WHEN LEAD BOILER IS AT FULL FIRING AND HW LOOP IS 5°F BELOW SETPOINT FOR 20 MINUTES, DDC CONTROLLER SHALL ENERGIZE LAG BOILER. INTEGRAL BOILER CONTROL SHALL ENSURE EQUAL LOADING OF BOILERS. IF AFTER 20 MINUTES BOTH BOILERS ARE AT LESS THAN 50% FIRING, AND LOOP SETPOINT TEMPERATURE IS SATISFIED, DDC SYSTEM SHALL SHUT DOWN LAG BOILER. IF AFTER 10 MINUTES, LEAD PUMP CANNOT SATISFY LOOP DIFFERENTIAL PRESSURE SETPOINT (6 PSI ADJUSTABLE), DDC SYSTEM SHALL START LAG PUMP IN THE MINIMUM SPEED POSITION. OPTIMIZATION PROGRAM SHALL ENSURE EQUAL LOADING OF PUMPS. WHEN AFTER 10 MINUTES, BOTH PUMPS ARE OPERATING AT 23 HZ OR LESS (ADJUSTABLE) AND LOOP DIFFERENTIAL PRESSURE SETPOINT IS SATISFIED, DDC SHALL SHUT DOWN LAG PUMP.

5. TEMPERATURE CONTROL MIXING VALVE (V-1) TO MODULATE TO MAINTAIN HOT WATER TEMPERATURE IN HW LOOP AS INDICATED BY TEMPERATURE RESET SCHEDULE. TEMPERATURE CONTROL MIXING MODULATION SHALL BE LIMITED SUCH THAT BOILER ENTERING WATER TEMPEATURE DOES NOT FALL BELOW 150°F.

6. COMBUSTION SUPPLY FAN (CSF) SHALL RUN CONTINUOUSLY.

7. AN ALARM SHALL BE GENERATED AT THE CENTRAL CONTROL STATION IF BOILER ENTERING WATER TEMPERATURE IS BELOW 140°F OR BOILER LEAVING WATER TEMPERATURE EXCEEDS 205°F (ADJUSTABLE) OR A STATUS ALARM GENERATED BY INTEGRAL DDC BOILER CONTROL PANEL IS PASSED TO THE EXISTING CENTRAL ANDOVER SYSTEM.

8. UPON ACTIVATION OF MACHINERY ROOM REFRIGERANT LEAK DETECTION, THE DDC SYSTEM SHALL SHUT-DOWN BOILERS B-1 AND B-2.

HOT WATER TEMPERATURE RESET SCHEDULE

O.A. TEMP.	HOT WATER TEMP.
≥ 70°	170°F
<11°	200°F

STATE OF MARYLAND — WILLIAM THOMAS TINKER — REGISTERED — MECHANICAL ENGINEER

US ARMY ENGINEERING AND SUPPORT CENTER HUNTSVILLE

TASK ORDER #: FRR004
VANGUARD CONTRACTORS INC. PADUCAH, KENTUCKY VOICE 270-442-8620
ICT I.C. Thomasson Associates, Inc. NASHVILLE, TENNESSEE PHONE (615) 346-3400

Checked by: WTT | Date: 02/27/04
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DACA87-03-D-0006 | ICT Project No. 203121
Approved by: | Plot date: 02/27/04
Chief, Prj. Mgmt. Division | Plot scale:

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DEFENSE INFORMATION SCHOOL

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BOILER CONTROLS

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