KEYED NOTES:

1. TRANSITION 56"x18" OVAL DUCT TO 58"x22" RECTANGULAR DUCT.
2. SEE FURNACE INSTALLATION DETAIL.
3. SEE HOT WATER COIL INSTALLATION DETAIL.
4. INSTALL COUPLER/KLF.
5. ROUTE ROOF DUCTS UP PERIMETER WALL AND CONNECT TO PERIMETER DUCT.
6. ROUTE EXHAUST VENTS FOR WH-2 & F-1 UP TO ROOF. SEE ROOF PLAN.
7. COORDINATE LOCATION OF DDC PANELS WITH DDC CONTRACTOR PRIOR TO INSTALLATION.
8. ROUTE DUCT SUPPLY DUCTS UP TO EXHAUST DUCTWORK.
9. INSTALL CORRUGATED TERRAZZO @ ACRYLITE DETAIL.
10. INSTALL 8" ROUND DUCT." 20" FROM WALL TO WALL PERPENDICULAR TO TALL WALL PLANNED.
11. PROVIDE DUCT SMOKE DETECTOR ON RETURN DUCT.

LAB EQUIPMENT LIST

<table>
<thead>
<tr>
<th>Equipment</th>
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<tbody>
<tr>
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PROJECT NUMBER
23239

ARCHITECT
D-1 Testing Laboratory

PRINCIPAL

PROJECT MANAGER

STATE OF IDAHO
WWW.MILLERSTAUFFER.COM
5/14/2024
KEYED NOTES:

1. ROUTE CONCENTRIC VENT FROM FLOOR BELOW. SEAL ROOF PENETRATION.
2. ROUTE 8" ROUND FROM FLOOR BELOW AND TERMINATE WITH ROOF CAP.
3. INSTALL CONDENSING UNIT ON MIRROR STAND PLATFORM PER DETAIL. ROUTE REFRIGERANT LINESET TO INDOOR FAN COIL UNIT. SEE DETAIL FOR REFRIGERANT PIPE ROUTING THROUGH ROOF.
4. ROUTE 3" STEAM LINE FROM FLOOR BELOW. SEE HYDROSTATIC FLOOR PLAN FOR CONTINUATION. CONNECT TO AIR HANDLING UNIT AS REQUIRED.
5. ROUTE FLUE AND INTAKE VENT FROM FLOOR BELOW. SEE FLOOR PLAN FOR CONTINUATION. PROVIDE GOOSENECK TURNDOWN ON INTAKE PER MANUFACTURER INSTALLATION REQUIREMENTS.
6. ROUTE CONCENTRIC VENT FROM BOILER BELOW. PROVIDE WITH ROOF TERMINATION KIT. SEE FLOOR PLAN FOR CONTINUATION. PROVIDE GOOSENECK TURNDOWN ON INTAKE PER MANUFACTURER INSTALLATION REQUIREMENTS.
7. AIR HANDLING UNIT INSTALLED ON ROOF CURB. SEE ROOF CURB DETAIL FOR INSTALLATION REQUIREMENTS.
8. SEE PENTHOUSE MOUNTING DETAIL FOR INSTALLATION REQUIREMENTS.
9. SEE EXHAUST FAN FLAT ROOF MOUNTING DETAIL FOR INSTALLATION REQUIREMENTS.

HVAC Roof Plan
1. REFER TO THE BOILER PIPING DETAIL ON THE DETAIL SHEETS FOR INSTALLATION REQUIREMENTS.
2. REFER TO THE IN BOILER PIPING DETAIL ON THE DETAIL SHEETS FOR INLINE PUMP INSTALLATION REQUIREMENTS.
3. REFER TO THE POT FEEDER PIPING DETAIL ON THE DETAIL SHEETS FOR INSTALLATION REQUIREMENTS.
4. REFER TO THE SEDIMENT SEPARATOR PIPING DETAIL ON THE DETAIL SHEETS FOR INSTALLATION REQUIREMENTS.
5. REFER TO THE FLOOR MOUNTED BLADDER TYPE EXPANSION TANK PIPING DETAIL ON THE DETAIL SHEETS FOR INSTALLATION REQUIREMENTS.
6. BYPASS CONTROL VALVE.
7. REFER TO THE WATER METER PIPING DETAIL ON THE DETAIL SHEETS FOR INSTALLATION REQUIREMENTS.
8. REFER TO THE FLOW METER PIPING DETAIL ON THE DETAIL SHEETS FOR INSTALLATION REQUIREMENTS.

SYMBOL USED FOR NOTE CALLOUT.

SCHEMATIC KEYED NOTES:

HEATING WATER PIPING SCHEMATIC KEYED NOTES:

- SYMBOL USED FOR NOTE CALL OUTS
- REFER TO THE IN BOILER PIPING DETAIL ON THE DETAIL SHEETS FOR INSTALLATION REQUIREMENTS.
- REFER TO THE POT FEEDER PIPING DETAIL ON THE DETAIL SHEETS FOR INSTALLATION REQUIREMENTS.
- REFER TO THE SEDIMENT SEPARATOR PIPING DETAIL ON THE DETAIL SHEETS FOR INSTALLATION REQUIREMENTS.
- REFER TO THE FLOOR MOUNTED BLADDER TYPE EXPANSION TANK PIPING DETAIL ON THE DETAIL SHEETS FOR INSTALLATION REQUIREMENTS.
- REFER TO THE BYPASS CONTROL VALVE.
- REFER TO THE WATER METER PIPING DETAIL ON THE DETAIL SHEETS FOR INSTALLATION REQUIREMENTS.
- REFER TO THE FLOW METER PIPING DETAIL ON THE DETAIL SHEETS FOR INSTALLATION REQUIREMENTS.

SYMBOLS USED:

- HWS: Heating Water Supply
- HWR: Heating Water Return
- (46 GPM): 46 GPM Flow Rate
- (27 GPM): 27 GPM Flow Rate

Notes:

1. INSTALL ALL VALVES IN ACCESSIBLE LOCATIONS FOR MAINTENANCE PURPOSES.
2. INSTALL ALL GAUGES IN ACCESSIBLE LOCATIONS FOR MAINTENANCE/VIEWING PURPOSES.

Additional Information:

- HEATING WATER PIPING SCHEMATIC
- ENLARGED MECHANICAL PLAN
- KEYED NOTES
- SYMBOLS USED FOR CALLOUT

Keyed Notes:

1. EXTEND A FULL SIZE DUCT FROM THE ROOF-MOUNTED EXHAUST FAN THROUGH THE CEILING. TERMINATE THE DUCT WITH AN EXPANDED METAL SCREEN WITH A 1" FRAME. PAINT THE EXPANDED METAL AND ALL VISIBLE DUCTWORK THE SAME COLOR AS THE CEILING.
2. ROUTE HUMIDIFIER 3" INTAKE VENT AND FLUE UP TO ROOF ABOVE.
3. INSTALL LOUVER 9'-0" A.F.F.
4. MOUNT UNIT HEATER ON WALL 9'-0" A.F.F.
5. COMBINE FLUE AND INTAKE VENT WITH CONCENTRIC KIT AND ROUTE TO ROOF. SEE ROOF PLAN FOR CONTINUATION.
6. MOUNT PUMP FOR CONFOUND OF 2" INSTEAD TO AIR AMBULANCE.
7. ROUTE PUMPS AND PIPING FOR CONTINUATION OF 2" INSTEAD TO AIR AMBULANCE.
8. MOUNT PUMP FOR CONFOUND OF 2" INSTEAD TO AIR AMBULANCE.
9. RECOMMEND INSTALLATION OF DDC PANELS IN EXTERIOR CONDUCTOR FROM SITE TO LOCATION.
10. MOUNT PUMP FOR CONFOUND OF 1" INSTEAD TO AIR AMBULANCE.
11. INSTALL PIPE TEES A MAXIMUM OF 12" APART TO MAINTAIN DECOUPLED LOOP.
1. Provide flexible ductwork for indoor use only.
2. Supports shall not damage, crimp, or inhibit duct free area in any way.
3. Provide flexible ductwork with a minimum R-value of 6.0.
4. Provide flexmaster support system shall not damage, crimp, or inhibit duct free area in any way.
5. Provide flexible ductwork shall not be installed closer than two widths.
6. Provide flexible ductwork shall not be installed on an external insulation.
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REMARKS:

1. APPROVED ALTERNATE MANUFACTURERS: KEEVS, MONOXIVENT, NEDERMAN, & VENTAIRE.

2. PROVIDE WITH MANUFACTURER’S CLOSED CELL FOAM EXTERIOR INSULATION, COATED VALVE, DRAWBAND CLAMPS FOR INLET AND OUTLET CONNECTIONS, ON/OFF SWITCH, 24 VOLT POWER WITH LESS THAN 1 SECOND CONTROL TYPE, VAV CONTROLLER, ALUMINUM

3. SEE CONTROL DRAWINGS FOR SEQUENCE OF OPERATION.

3. PROVIDE WITH INTEGRAL VARIABLE SPEED DRIVE.

2. PROVIDE UNIT WITH PREMIUM EFFICIENCY MOTOR.

1. APPROVED ALTERNATE MANUFACTURERS: B&G, GRUNDFOS, TACO, PACO, & PATTERSON.

6. SEE SNORKEL HOOD DETAILS FOR DIMENSIONS.

3. ALL COMPONENTS SHALL BE KEPT OUT OF THE AIRSTREAM FOR A SMOOTH AND EVEN FLOW.

1. APPROVED ALTERNATE MANUFACTURERS: MONOXIVENT & VENTAIRE.

SYMBOL AREA SERVED UNIT TYPE

CH-2
CH-4
CH-3

BP-2
HWP-2

SN-5
SN-4

SECTION W/ COLLECTION HOOD.

1. APPROVED ALTERNATE MANUFACTURERS: ACME, GREENHECK, PENNBARRY, TWIN CITY FAN COMPANY, & SOLER & PALAU.

SYMBOL LOCATION SERVES EXHAUST

REMARKS:

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6. SEE SNORKEL HOOD DETAILS FOR DIMENSIONS.

3. ALL COMPONENTS SHALL BE KEPT OUT OF THE AIRSTREAM FOR A SMOOTH AND EVEN FLOW.

1. APPROVED ALTERNATE MANUFACTURERS: MONOXIVENT & VENTAIRE.
**REMARKS:**

1. **APPROVED ALTERNATE MANUFACTURERS:** Fulton Endura, Cleaver Brooks Clearfire, Aerco Benchmark.

2. **HC-7**
   - **CV-1**
   - **CV-2**
   - **CV-3**
   - **CV-4**
   - **CV-5**
   - **CV-6**
   - **CV-7**
   - **CV-8**
   - **CV-9**

3. **HC-5**
   - **CV-1**
   - **CV-2**
   - **CV-3**
   - **CV-4**
   - **CV-5**
   - **CV-6**
   - **CV-7**
   - **CV-8**

4. **HC-1**
   - **CV-1**
   - **CV-2**
   - **CV-3**
   - **CV-4**
   - **CV-5**
   - **CV-6**
   - **CV-7**
   - **CV-8**

5. **HC-9**
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   - **CV-2**
   - **CV-3**
   - **CV-4**
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   - **CV-6**
   - **CV-7**
   - **CV-8**

6. **CV-10**
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   - **CV-12**
   - **CV-13**
   - **CV-14**
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   - **CV-17**
   - **CV-18**

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10. **CV-46**
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11. **CV-55**
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    - **CV-62**
    - **CV-63**

12. **CV-64**
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    - **CV-69**
    - **CV-70**
    - **CV-71**
    - **CV-72**

**CONDONING HOT WATER BOILER SCHEDULE**

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<th>HEATING WATER SYSTEM</th>
<th>HEATING WATER SYSTEM</th>
<th>MANUFACTURER AND MODEL</th>
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**HOT WATER REHEAT COIL SCHEDULE**

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**CONTROL VALVE SCHEDULE (HOT WATER REHEAT COILS)**

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**BYPASS CONTROL VALVE SCHEDULE**

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**HUMIDIFIER SCHEDULE**

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**LAB EXHAUST FAN SCHEDULE**

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**DIFFUSER SCHEDULE**

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**RETURN AND EXHAUST GRILLE SCHEDULE**

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**DISTRIBUTOR AIR STREAM SYSTEM**

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<th>coordination Details</th>
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**HEATING WATER SYSTEM PRESSURE**

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**ARCHITECT**

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<td>1773 F 208.667.3174</td>
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**MECHANICAL SCHEDULES**

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REMARKS:

1. APPROVED ALTERNATE MANUFACTURERS: BRASCH, QMARK, INDEECO, OUELLET, AND CHROMALOX.

2. PROVIDE UNIT WITH MATCHING COOLING COIL, FIELD INSTALLED HARD START FOR SINGLE PHASE UNITS, SHORT CYCLING DEVICE, CRANKCASE HEATER, EXPANSION VALVE, HIGH/LOW PRESSURE SWITCH, NEUTRALIZING KIT - 3/4" LINE SIZE, LOW PRESSURE LIQUID FEEDER (CHEMICAL, HOT WATER LOOP CHEMICAL, POT FEEDER TANK WES SELS MODEL CPFT-2).

3. PROVIDE MANUFACTURERS CRANKCASE HEATER, LOW AMBIENT CONTROLS & (TO 0°F) WIND BAFFLES, REFRIGERATION LINE SET SIZED BY MANUFACTURER, AND TAMPER PROOF PORT CAPS.

4. SEE CONTROL DRAWINGS FOR SEQUENCE OF OPERATION.
REMARKS:
1. APPROVED ALTERNATE MANUFACTURERS: SCOTT SPRINGFIELD, TEMPTROL, HUNT AIR, & ENERGY LABS.
2. PROVIDE FAN ASSEMBLY WITH ECM MOTORIZED IMPELLER FANS.
3. EXTERNAL STATIC PRESSURE (ESP) DOES NOT INCLUDE THE COILS, FILTERS, OR OTHER INTERNAL AIR HANDLER LOSSES.
4. CAPACITIES FOR FANS AND COILS ARE BASED ON 2,200 FEET ELEVATION.
5. PROVIDE WITH 20" TALL VIBRATION ISOLATION ROOF CURB.
6. SEE HUMIDIFIER SCHEDULE FOR ADDITIONAL INFORMATION.
### Controls Legend

**Symbol** | **Description**
--- | ---
**S** | SPACE
**I** | INPUT
**O** | OUTPUT
**L** | LIMIT
**C** | CONTROL
**M** | MOISTURE
**P** | PRESSURE

### Controls Legend

**Symbol** | **Description**
--- | ---
**H** | HEAT
**C** | COOL
**O** | OUTDOOR

### Controls Legend

**Symbol** | **Description**
--- | ---
**L** | LIMIT
**M** | MOTOR
**P** | PRESSURE
**D** | DAMPER
**V** | VALVE
**P** | PRESSURE
**S** | SENSOR
**T** | TEMPERATURE

### Controls Legend

**Symbol** | **Description**
--- | ---
**T** | TEMPERATURE

### Controls Legend

**Symbol** | **Description**
--- | ---
**F** | FAN

---

**The Space Temperature Increases Above the Cooling Set Point.**

The heat relief mode of operation shall be enabled whenever the following conditions both exist:

1. The space temperature exceeds above the cooling set point.
2. The outdoor air temperature is below the cooling set point.

When the above conditions exist, the DDC controller shall sequence the following:

- **Space Temperature Sensor**
- **Space Pressure Sensor**
- **Space Humidity Sensor**
- **Space Sensing Transmitter**
- **Space Pressure Transmitter**

### Controls Legend

**Symbol** | **Description**
--- | ---
**DI** | DIGITAL INPUT
**DO** | DIGITAL OUTPUT
**AO** | ANALOG OUTPUT
**AI** | ANALOG INPUT

---

**The Space Temperature Reaches 3°F Below the Cooling Set Point.**

The heat relief mode of operation shall be disabled whenever the following conditions exist:

1. The space temperature reaches 3°F below the cooling set point.
2. The space temperature reaches 3°F below the cooling set point.

When the above conditions exist, the DDC controller shall sequence the following:

- **Space Temperature Sensor**
- **Space Pressure Sensor**
- **Space Humidity Sensor**
- **Space Sensing Transmitter**
- **Space Pressure Transmitter**

---

**Outdoor Air Temperature Sequence of Operation**

The outdoor air temperature shall be measured to determine the need for supplementary heating or cooling. The outdoor air temperature sensor shall be installed on the north side of the building to provide a continuous reading of the outdoor air temperature.

1. If the outdoor air temperature is below the cooling set point, the DDC controller shall enable the heat relief fans to operate continuously. This system shall be standalone. The control contractor shall monitor space temperature and provide an alarm if the set point is exceeded.

---

**Ductless Split System Sequence of Operation**

The ductless split system shall consist of a condenser coil, a ductless split unit, and a manufacturer-provided controller.

The condenser coil shall provide dehumidification and cooling for the conditioned space. The ductless split unit shall provide heating and cooling for the conditioned space. The manufacturer-provided controller shall control the operation of the ductless split system.

---

**Heat Relief Fan Sequence of Operation**

The heat relief fan control schematic shows the sequence of operation for the heat relief fan.

---

**Ductless Split System Control Schematic**

The ductless split control schematic shows the control system architecture for the ductless split system.

---

**Controls Legend**

- **Symbol:** Indicates the type of control used.
- **Description:** Provides a brief explanation of the control function.
THE FUME HOOD EXHAUST FANS SHALL RUN CONTINUOUSLY. DEDICATED TO THE COMPLETE OPERATION OF THE SYSTEM.

THE LABORATORY EXHAUST FAN SYSTEM SHALL CONSIST OF TWO FUME EXHAUST FANS WITH VARIABLE FREQUENCY DRIVES, A DUCT STATIC SAFETIES:

1. IF THE STATIC PRESSURE SET POINT IS NOT MAINTAINED (TOO HIGH OR TOO LOW) FOR 5 MINUTES (ADJUSTABLE), AN ALARM OF THE EVENT SHALL BE SENT TO THE OPERATOR’S WORKSTATION.
2. SEND AN ALARM TO THE OUTSIDE AIR DAMPER.
3. IF THE SPACE TEMPERATURE INCREASES ABOVE THE SPACE TEMPERATURE COOLING SET POINT.

THE SUPPLY FAN SHALL START AND STOP ON THE MASTER WEEKLY AND HOLIDAY SCHEDULE. THE BUILDING AUTOMATION SYSTEM SHALL BE ABLE TO REMOTELY RESET THE SPLIT SYSTEM OF ALL ALARMS AND RESTART FROM THE OPERATOR’S WORKSTATION WITHOUT PHYSICALLY TURNING ON AND OFF THE DISCONNECT.

THE COMPRESSOR WILL NOT BE ALLOWED TO OPERATE UNLESS FAN STATUS IS PROVEN.

A DRAIN PAN OVERFLOW SENSOR SHALL SEND AN ALARM THE WORKSTATION AND SHUT DOWN THE SPLIT SYSTEM IF OVERFLOW ALARM

THE UNOCCUPIED MODE SPACE TEMPERATURE COOLING SET POINT SHALL BE SET AT 85°F (ADJUSTABLE). STEEPLY CURVE WITH FACTORS TO CALCULATE THE SCHEDULED HEATING/COOLING MODULATION TIME PERIOD (ADJUSTABLE) UPON A SIGNAL FROM AN OVERRIDE BUTTON LOCATED ON THE TEMPERATURE SENSOR.

THE NEW SPACE TEMPERATURE SENSOR SHALL SIGNAL THE DDC CONTROLLER ITS TEMPERATURE AND THE FOLLOWING VARIABLES IN ORDER TO DETERMINE THE OPTIMAL START / STOP TIMES:
1. OUTSIDE AIR TEMPERATURE.
2. THE SPACE IS CALLING FOR HEAT AND THE SUPPLY AIR TEMPERATURE FAILS TO INCREASE BY 5°F (ADJUSTABLE) AFTER 5 MINUTES (ADJUSTABLE), AN ALARM OF THE EVENT SHALL BE SENT TO THE OPERATOR’S WORKSTATION.
3. SEND AN OPEN COMMAND TO THE OUTSIDE AIR DAMPER.
4. LOW AIR TEMPERATURE.

THE FAN STATUS

1. IF EITHER FAN FAILS TO ENABLE, AN ALARM OF THE EVENT SHALL BE SENT TO THE OPERATOR’S WORKSTATION.
2. IF THE DAMPER FAILS TO CLOSE, AN ALARM OF THE EVENT SHALL BE SENT TO THE OPERATOR’S WORKSTATION.
3. IF THE SUPPLY FAN FAILS TO DISABLING, AN ALARM OF THE EVENT SHALL BE SENT TO THE OPERATOR’S WORKSTATION.
4. IF THE CURRENT SENSING RELAY FAILS TO SIGNAL, AN ALARM OF THE EVENT SHALL BE SENT TO THE OPERATOR’S WORKSTATION.

THE DDC CONTROLLER MANDATORY COMMANDS ARE:
1. SEND AN ENABLE COMMAND TO THE SUPPLY FAN TO RUN CONTINUOUSLY.
2. SEND AN OPEN COMMAND TO THE OUTSIDE AIR DAMPER.
3. SEND AN OPEN COMMAND TO THE condensing unit compressor.
4. USE THE SPACE TEMPERATURE TO START OR STOP THE COMpressor.
5. CAPTURE THE CURRENT SENSING RELAY STATUS.
6. USE THE CURRENT SENSING RELAY STATUS TO START OR STOP THE COMpressor.

THE SPLIT SYSTEM SEQUENCE OF OPERATION:
1. THE SPACE TEMPERATURE COOLING MODE ABOVE THE SPACE TEMPERATURE HEATING SET POINT.
2. SEND AN ALARM TO THE OPERATORS ASSOCIATION.
3. THE SUPPLY AIR TEMPERATURE FALLS BELOW THE SPACE TEMPERATURE UNIQUER SET POINT.
4. USE THE SPACE TEMPERATURE TO START OR STOP THE COMpressor.

THE SPLIT SYSTEM CONTROL SCHEMATIC:

THE SPLIT SYSTEM SEQUENCE OF OPERATION:
1. IF THE SPACE IS CALLING FOR HEAT AND THE SUPPLY AIR TEMPERATURE FAILS TO INCREASE BY 5°F (ADJUSTABLE) AFTER 5 MINUTES (ADJUSTABLE), AN ALARM OF THE EVENT SHALL BE SENT TO THE OPERATOR’S WORKSTATION.
HEATING WATER SYSTEM SEQUENCE OF OPERATION

1. The DDC controller shall provide a MAKE-UP WATER control function.

2. Send an Enable Command to the Boilers.

3. Send an Enable Command to the Heating Water Pumps.

4. Send an Enable Command to the Heating Water BYPASS Control Valve.

OPERATION:

1. The DDC controller shall provide a MAKE-UP WATER control function.

2. Send an Enable Command to the Boilers.

3. Send an Enable Command to the Heating Water Pumps.

4. Send an Enable Command to the Heating Water BYPASS Control Valve.

NOTE

1. The Outside Air Temperature decreases to the Heating Enable Set Point for a period of 10 CONSECUTIVE MINUTES (ADJUSTABLE).

2. Send an Enable Command to the Heating Water BYPASS Control Valve.

3. The DDC controller shall provide a new flow schedule that is not less than the minimum flow requirement.

4. If the lead pump fails to start, the lag pump shall be enabled.

NOTE

1. THE HEATING WATER SYSTEM SEQUENCE OF OPERATION IS AS FOLLOWS:

   - THE VFD CONTROL INTERFACE SHALL PROVIDE BUT NOT BE LIMITED TO THE FOLLOWING:
     - STATUS
     - ALARM
     - CAPACITY FEEDBACK
     - SPEED CONTROL
     - OUTPUT

   - THE DDC CONTROLLER SHALL PROVIDE LEAD / LAG CONTROL AS WELL AS AN AUTOMATIC ROTATION OF THE LEAD BOILER BASED ON AN OPTIMIZED ALGORITHM. IN ADDITION, MANUAL OVERRIDE AND OPERATOR OVERRIDE CAPABILITIES SHALL ALSO BE PROVIDED.

   - THE BOILER SYSTEM'S CONTROLLER SHALL PROVIDE LEAD / LAG CONTROL AS WELL AS AN AUTOMATIC ROTATION OF THE LEAD BOILER BASED ON AN OPTIMIZED ALGORITHM. IN ADDITION, MANUAL OVERRIDE AND OPERATOR OVERRIDE CAPABILITIES SHALL ALSO BE PROVIDED.

   - THE DDC CONTROLLER SHALL PROVIDE LEAD / LAG CONTROL OF THE HEATING WATER PUMPS. IT SHALL INCLUDE AN AUTOMATIC ROTATION OF THE LEAD PUMP BASED ON THE MONTH. THE EVEN NUMBERED PUMP SHALL BE THE LEAD PUMP.

   - THE HVAC SYSTEM'S UNIT CONTROLLER (UCP) SHALL PROVIDE LEAD / LAG CONTROL AS WELL AS AN AUTOMATIC ROTATION OF THE LEAD BOILER BASED ON AN OPTIMIZED ALGORITHM. IN ADDITION, MANUAL OVERRIDE AND OPERATOR OVERRIDE CAPABILITIES SHALL ALSO BE PROVIDED.

   - THE DDC CONTROLLER SHALL PROVIDE LEAD / LAG CONTROL OF THE HEATING WATER PUMPS. IT SHALL INCLUDE AN AUTOMATIC ROTATION OF THE LEAD PUMP BASED ON THE MONTH. THE EVEN NUMBERED PUMP SHALL BE THE LEAD PUMP.

   - THE HVAC SYSTEM'S CONTROLLER SHALL PROVIDE LEAD / LAG CONTROL OF THE HEATING WATER PUMPS. IT SHALL INCLUDE AN AUTOMATIC ROTATION OF THE LEAD PUMP BASED ON THE MONTH. THE EVEN NUMBERED PUMP SHALL BE THE LEAD PUMP.

   - THE HVAC SYSTEM'S CONTROLLER SHALL PROVIDE LEAD / LAG CONTROL OF THE HEATING WATER PUMPS. IT SHALL INCLUDE AN AUTOMATIC ROTATION OF THE LEAD PUMP BASED ON THE MONTH. THE EVEN NUMBERED PUMP SHALL BE THE LEAD PUMP.

   - THE HVAC SYSTEM'S CONTROLLER SHALL PROVIDE LEAD / LAG CONTROL OF THE HEATING WATER PUMPS. IT SHALL INCLUDE AN AUTOMATIC ROTATION OF THE LEAD PUMP BASED ON THE MONTH. THE EVEN NUMBERED PUMP SHALL BE THE LEAD PUMP.
COOLING MODE OF OPERATION (DX COOLING)

GENERAL

CONDITION EXISTS:

THE DX COOLING MODE OF OPERATION SHALL BE ENABLED WHENEVER THE FOLLOWING

MORNING WARM-UP / COOL-DOWN OCCUPIED/UNOCCUPIED SCHEDULE.

THE AIR HANDLING UNIT SHALL OPERATE CONTINUOUSLY BASED ON THE MASTER

THE CONTROL CONTRACTOR SHALL PROVIDE A NEW DDC CONTROL PACKAGE DEDICATED TO

THE DDC CONTROLLER SHALL SEQUENCE THE FOLLOWING:

CALCULATE, AND ADJUST THE FOLLOWING VARIABLES IN ORDER TO DETERMINE THE

THE DDC CONTROLLER OPTIMUM START / STOP MODE SHALL CONTINUOUSLY MONITOR,

COMFORT UNTIL THE ZONE IS VACANT.

FOLLOWING:

WHEN THE ABOVE CONDITIONS ARE MET THE DDC CONTROLLER SHALL SEQUENCE THE

1. THE SUPPLY AIR TEMPERATURE INCREASES 2°F ABOVE THE SUPPLY AIR

2. RATE OF WARM-UP / COOL-DOWN IN EACH ZONE AFTER EQUIPMENT START-UP.

3. COOLING SET POINTS.

b. THE UNIT'S CONTROLLER SHALL CONTINUOUSLY MODULATE THE INVERTER:

COMPRESSORS TO MAINTAIN THE SUPPLY AIR COOLING SET POINT.

OUTSIDE AIRFLOW (AS INDICATED IN THE AIR HANDLING UNIT SCHEDULE - SET BY

1) IF THE DAMPERS FAIL TO PROVIDE THE MINIMUM AMOUNT OF OUTSIDE AIR,

2) IF A TEMPERATURE INCREASE CANNOT BE DETECTED FOR A PERIOD OF 2

AN ALARM OF THE EVENT SHALL BE SENT TO THE OPERATOR'S WORKSTATION.

3. IF THE BUILDING PRESSURE INCREASES ABOVE 0.25" W.G. FOR A PERIOD OF 60

CONSECUTIVE SECONDS, AN ALARM OF THE EVENT SHALL BE SENT TO THE

THE UNIT SHALL BE DISABLED AND AN ALARM OF THE EVENT SHALL BE SENT TO THE

THE UNIT SHALL BE DISABLED AND AN ALARM OF THE EVENT SHALL BE SENT TO THE

THE N/A CONDITION EXISTS:

THE HEATING MODE OF OPERATION SHALL BE DISABLED WHENEVER THE FOLLOWING

HEATING MODE OF OPERATION (GAS-FIRED)

WHEN THE ABOVE CONDITION IS MET, THE DDC CONTROLLER SHALL SEQUENCE THE

SUPPLY AIR TEMPERATURE RESET SCHEDULE BASED ON THE POSITION OF THE HOT WATER REHEAT CONTROL VALVES. WHEN THE SYSTEM (ADJUSTABLE) OR MORE. AS ONE OR MORE HOT WATER REHEAT CONTROL VALVES

THE DEHUMIDIFICATION MODE OF OPERATION SHALL BE DISABLED WHENEVER THE

THE HUMIDIFICATION MODE OF OPERATION SHALL BE ENABLED WHENEVER THE FOLLOWING

WHEN A RUNNING STATUS FROM THE UNIT CONTROL PANEL (UCP) HAS BEEN CONFIRMED, THE HEAT EXCHANGER CONTROLLER (HEX-1) SHALL SEND A DISABLED COMMAND TO THE HUMIDIFIER (HUM-1) TO DISABLE THE HUMIDIFIER FOR A PERIOD OF 30 CONSECUTIVE SECONDS.

THE HUMIDIFIER SHALL CONTINUE TO OPERATE UNDER ITS OWN INTERNAL CONTROLS BY

THE UNIT'S CONTROLLER SHALL MODULATE THE MODULATING GAS CONTROL VALVE TO A

THE SUPPLY AIR TEMPERATURE DECREASES 5°F BELOW THEIR RESPECTIVE SPACE TEMPERATURE SET POINT FOR A PERIOD OF 30 CONSECUTIVE SECONDS.

THE UNIT'S CONTROLLER SHALL MODULATE THE MODULATING HEAT CONTROL VALVE TO A

THE SUPPLY AIR TEMPERATURE DECREASES 5°F BELOW THEIR RESPECTIVE SPACE TEMPERATURE SET POINT FOR A PERIOD OF 30 CONSECUTIVE SECONDS.

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THE SUPPLY AIR TEMPERATURE SET POINT (AS INDICATED IN THE SUPPLY AIR TEMPERATURE RESET SCHEDULE) IS ADJUSTABLE.

THE UNIT'S CONTROLLER SHALL MODULATE THE MODULATING HEAT CONTROL VALVE TO A

THE SUPPLY AIR TEMPERATURE DECREASES 5°F BELOW THEIR RESPECTIVE SPACE TEMPERATURE SET POINT FOR A PERIOD OF 30 CONSECUTIVE SECONDS.

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THE SUPPLY AIR TEMPERATURE DECREASES 5°F BELOW THEIR RESPECTIVE SPACE TEMPERATURE SET POINT FOR A PERIOD OF 30 CONSECUTIVE SECONDS.
INDEPENDENT ROOM SUPPLY VALVE WITH A HOT WATER REHEAT COIL, (1) VARIABLE VOLUME / PRESSURE INDEPENDENT COMPLETE OPERATION OF THE SYSTEM.

WHEN THE ABOVE CONDITIONS ARE MET, THE DDC CONTROLLER SHALL SEQUENCE THE FOLLOWING:

1. SEND AN OPEN COMMAND TO THE ROOM SUPPLY VALVE.
2. THE SUPPLY AIRFLOW IS BELOW THE MINIMUM AIRFLOW REQUIRED TO MAINTAIN THE SPACE TEMPERATURE (AS INDICATED IN THE PRESSURE INDEPENDENT ROOM SUPPLY VALVE SCHEDULE).
3. THE LIQUID SUPPLY TEMPERATURE COULD BE SET Point 70°F.
4. THE SPACE TEMPERATURE SENSOR IS BELOW THE MINIMUM TEMPERATURE (AS INDICATED IN THE PRESSURE INDEPENDENT ROOM SUPPLY VALVE SCHEDULE).

AND:

1. SEND AN OVERRIDE COMMAND TO THE RESPECTIVE SUPPLY VALVE AND MODULATE THE DAMPER TO THE NEGATIVE ROOM OFFSET AIRFLOW VOLUME (REFER TO THE PRESSURE INDEPENDENT VALVE SCHEDULES).
2. THE SUPPLY AIRFLOW IS BELOW THE MINIMUM AIRFLOW REQUIRED TO MAINTAIN THE SPACE TEMPERATURE (AS INDICATED IN THE PRESSURE INDEPENDENT ROOM SUPPLY VALVE SCHEDULE).
3. THE LIQUID SUPPLY TEMPERATURE COULD BE SET Point 70°F.
4. THE SPACE TEMPERATURE SENSOR IS BELOW THE MINIMUM TEMPERATURE (AS INDICATED IN THE PRESSURE INDEPENDENT ROOM SUPPLY VALVE SCHEDULE).

THE AIR VALVE MANUFACTURER SHALL PROVIDE AN INTEGRATION GATEWAY TO FACILITATE COMMUNICATION BETWEEN THE LABORATORY CONTROL SYSTEM AND THE BUILDING AUTOMATION SYSTEM (BAS). THE SUPPLY / EXHAUST AIRFLOW MANUFACTURER SHALL PROVIDE A NEW DDC CONTROL PACKAGE DEDICATED TO THE COMPLETE OPERATION OF THE SYSTEM.

WHEN THE ABOVE CONDITIONS ARE MET, THE DDC CONTROLLER SHALL SEQUENCE THE FOLLOWING:

1. ALLOW THE SUPPLY VALVE TO ENTER BACK INTO ITS RESPECTIVE OCCUPIED / UNOCCUPIED AIRFLOW RATE.
2. THE SPACE TEMPERATURE IS EQUAL TO OR ABOVE THE SPACE TEMPERATURE SET POINT.
3. THE SPACE TEMPERATURE SENSOR IS BELOW THE MINIMUM TEMPERATURE (AS INDICATED IN THE PRESSURE INDEPENDENT ROOM SUPPLY VALVE SCHEDULE).
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3. THE SPACE TEMPERATURE SENSOR IS BELOW THE MINIMUM TEMPERATURE (AS INDICATED IN THE PRESSURE INDEPENDENT ROOM SUPPLY VALVE SCHEDULE).
4. THE SPACE TEMPERATURE COULD BE SET Point 70°F.
INDEPENDENT GENERAL EXHAUST VALVE, AND A SPACE TEMPERATURE AND HUMIDITY SENSOR. THE CONTROL PRESSURE INDEPENDENT ROOM SUPPLY VALVE W/ A HOT WATER RE-HEAT COIL, (1) VARIABLE VOLUME / PRESSURE COOLING MODE OF OPERATION:

OPERATING MODE:

OCCUPIED MODE

THE COOLING MODE OF OPERATION SHALL BE DISABLED WHENEVER THE FOLLOWING CONDITION EXISTS:

- WHEN THE LABORATORY VENTILATION WITH SNORKEL HOOD SYSTEM IS SCHEDULED INTO THE OCCUPIED MODE, THE DDC CONTROLLER SHALL SEQUENCE THE FOLLOWING:
  - THE GENERAL EXHAUST VALVE SHALL ADJUST ACCORDINGLY TO MAINTAIN THE REQUIRED OFFSET AIRFLOW (REFER TO THE PRESSURE INDEPENDENT VALVE SCHEDULES).
  - THE VALVE SHALL MODULATE TO PROVIDE THE MINIMUM OCCUPIED AIRFLOW RATE (AS INDICATED IN THE PRESSURE INDEPENDENT ROOM SUPPLY VALVE SCHEDULE).
  - VALIDATE THE OPERATION OF THE VALVE THROUGH THE CALCULATED AIRFLOW.

WHEN THE ABOVE CONDITION EXISTS THE THERMOSTAT SHALL SEQUENCE THE FOLLOWING:

- THE GENERAL EXHAUST AIR VALVE (GEV-4) IS AT MAXIMUM AIRFLOW (AS INDICATED IN THE PRESSURE INDEPENDENT ROOM SUPPLY VALVE SCHEDULE).
- THE SUPPLY AIRFLOW IS BELOW THE MINIMUM AIRFLOW REQUIRED TO MAINTAIN THE SPACE TEMPERATURE (AS INDICATED IN THE PRESSURE INDEPENDENT ROOM SUPPLY VALVE SCHEDULE).
- THE SPACE TEMPERATURE IS EQUAL TO OR ABOVE THE SPACE TEMPERATURE SET POINT.

LAB VENTILATION WITH GENERAL EXHAUST SYSTEM SEQUENCE OF OPERATION

1) IF THE VALVE FAILS TO PROVIDE THE REQUIRED OFFSET WITHIN +/-10% FOR A PERIOD OF 30 CONSECUTIVE SECONDS, AN ALARM OF THE EVENT SHALL BE SENT TO THE OPERATOR'S WORKSTATION.

2) THE SPACE TEMPERATURE DECREASES BELOW THE SPACE TEMPERATURE SET POINT.

3) THE GENERAL EXHAUST FAN SHALL BE CONTROLLED THROUGH A WALL SWITCH. WHEN THE SWITCH IS ENABLED THE FAN SHALL START. WHEN THE SWITCH IS DISABLED THE FAN SHALL STOP.

4) THE UNOCCUPIED MODE SPACE TEMPERATURE COOLING SET POINT SHALL BE SET AT 80°F.

5) THE UNOCCUPIED MODE SPACE TEMPERATURE HEATING SET POINT SHALL BE SET AT 60°F.

6) IF MULTIPLE SMALLER LABS ENABLE A SIGNIFICANT AMOUNT OF EXHAUST THE D-1 LAB 23 WILL PROVIDE ADDITIONAL SUPPLY AIRFLOW TO MAINTAIN A SLIGHT NEGATIVE BUILDING PRESSURE. SUPPLY VALVE (SAV-4) SHALL PROVIDE ADDITIONAL AIRFLOW IF THE D-1 LAB 23 IS PHYSICALLY CONNECTED TO MULTIPLE SMALLER LABS WHICH HAVE MORE EXHAUST.

7) THE HEATING MODE OF OPERATION SHALL BE ENABLED WHENEVER BOTH OF THE FOLLOWING CONDITIONS EXIST:

- THE OCCUPIED MODE SPACE TEMPERATURE COOLING SET POINT SHALL BE SET AT 75°F.
- THE OCCUPIED MODE SPACE TEMPERATURE HEATING SET POINT SHALL BE SET AT 70°F.

8) THE DDC CONTROLLER SHALL PROVIDE AND INSTALL THE REQUIRED 110V TO 24V ELECTRIC UNIT HEATER SEQUENCE OF OPERATION:

- THE UNIT HEATER SHALL BE CONTROLLED THROUGH A WALL SWITCH. WHEN THE SWITCH IS ENABLED THE UNIT HEATER SHALL START. WHEN THE SWITCH IS DISABLED THE UNIT HEATER SHALL STOP.

- THE ELECTRIC UNIT HEATER SEQUENCE OF OPERATION IS ADJUSTED FOR A PERIOD OF 1 MINUTE (ADJUSTABLE). AN ADDITIONAL STATUS MONITORING CONTROL LOGIC IS TO BE PROVIDED FOR EACH ELECTRIC UNIT HEATER.

ELECTRIC UNIT HEATER SEQUENCE OF OPERATION

1. THE SPACE TEMPERATURE DECREASES BELOW THE SPACE TEMPERATURE SET POINT.

2. THE SPACE TEMPERATURE INCREASES ABOVE THE SPACE TEMPERATURE SET POINT.

3. THE SPACE TEMPERATURE IS EQUAL TO THE SPACE TEMPERATURE SET POINT.
KEYED NOTES:

1. STORM LINE LEAVING BUILDING AT 30" BFF. SEE CIVIL SITE PLAN FOR CONTINUATION.

2. THE WASTE LINE INVERT ELEVATION AT THIS LOCATION IS 54" BELOW FINISHED FLOOR (BFF). THE INVERT ELEVATION IS BASED ON A LINE SLOPE OF 1/4" PER FOOT. SEE CIVIL PLANS FOR CONTINUATION.

3. ROUTE 3" RD FROM ABOVE. SEE PLUMBING FLOOR PLAN FOR CONTINUATION.

4. GAS LINE FROM INTERMOUNTAIN GAS COMPANY. SEE CIVIL PLANS FOR CONTINUATION.

5. ROUTE VENT FROM TRENCH DRAIN UNDERGROUND.

6. ROUTE 4" RD FROM ABOVE. SEE PLUMBING FLOOR PLAN FOR CONTINUATION.

7. ROUTE 1-1/4" WASTE FROM ES-1 AND COMBINE WITH 4" WASTE FROM FD-2.


SYMBOL USED FOR CALLOUT:

A STARTING POINT OF 24 INCHES BFF WITH A LINE SLOPE OF 1/4" PER FOOT. SEE CIVIL SITE PLAN FOR CONTINUATION.
KEYED NOTES:

1. REPLACE ALL UPSTAIRS WATER 1-1/2" TEMPERED WATER TO EMERGENCY
2. REPLACE ALL UPSTAIRS AND DOWNSTAIRS BATHROOMS TO LAB EQUIPMENT PER DETAIL FOR CONTINUATION.
3. REPLACE ALL UPSTAIRS AND DOWNSTAIRS BATHROOMS TO LAB EQUIPMENT PER DETAIL FOR CONTINUATION.
4. GAS METER FURNISHED AND INSTALLED BY LOCAL GAS COMPANY. REFER TO GAS SIZING CHART FOR ADDITIONAL INFORMATION.
5. ELECTRONIC TRAP PRIMER LOCATED ON WALL. ROUTE 3/4" CW TO LAB EQUIPMENT LATERAL.
6. ROUTE 3" RD & OD FROM ROOF ABOVE. SEE PLUMBING ROOF PLAN FOR CONTINUATION.
7. ELECTRONIC TRAP PRIMER LOCATED ON WALL. ROUTE 3/4" CW TO LAB EQUIPMENT LATERAL.
8. ROUTE 1/2" HW FROM US-1 TO RPBP AND CONNECT TO EQ-29.
9. ROUTE 2" DRAIN FROM AHU ON ROOF. TERMINATE INDIRECTLY AT WALL.
10. ELECTRONIC TRAP PRIMER LOCATED ON WALL. ROUTE 3/4" CW TO LAB EQUIPMENT LATERAL.
11. ROUTE 1/2" HW FROM US-1 TO RPBP AND CONNECT TO EQ-29.
12. ROUTE 2" DRAIN FROM AHU ON ROOF. TERMINATE INDIRECTLY AT WALL.
13. ELECTRONIC TRAP PRIMER LOCATED ON WALL. ROUTE 3/4" CW TO LAB EQUIPMENT LATERAL.
15. ROUTE 3/4" CW & HW DOWN TO RPBP'S. CONNECT TO LAB EQUIPMENT AS REQUIRED.
16. ROUTE DRAIN FROM ROOF HYDRANT TO FLOOR SINK IN OFFICE.
17. ROUTE 1" UP TO ROOF HYDRANT ON ROOF ABOVE. SEE ROOF PLUMBING PLAN FOR CONTINUATION.
18. ROUTE EXPOSED NPCW DOWN AND CONNECT TO LAB EQUIPMENT AS REQUIRED.
19. ROUTE EXPOSED 1-1/2" TEMPERED WATER TO EMERGENCY SHOWER.
20. ROUTE 1-1/2" TEMPERED WATER TO EMERGENCY SHOWER.
21. ROUTE 1-1/2" TEMPERED WATER TO EMERGENCY SHOWER.

LAB EQUIPMENT LIST
KEYED NOTES:

1. ROUTE 1-1/4" MPG LINE UP THROUGH ROOF AND CONNECT TO AHU. SEE GAS PIPING CONNECTION DETAILS FOR INSTALLATION REQUIREMENTS. SEE PLUMBING FLOOR PLAN FOR CONTINUATION.

2. ROUTE 2" DRAIN DOWN THROUGH ROOF TO FLOOR BELOW. SEE PLUMBING FLOOR PLAN FOR CONTINUATION.

3. PLUMBING ROOF PLAN FOR CONTINUATION.
KEYED NOTES:
1. ROUTE 1" CW TOWARD RPBP. ROUTE FROM RPBP UP ABOVE CEILING AND OVER TO NON-POTABLE PLUMBING FIXTURES.
2. SEE HYDRONIC HOT WATER PIPING SCHEMATIC FOR MORE INFORMATION.
3. ROUTE 1" CW TO WATER SOFTENER. SEE WATER SOFTENER PIPING DETAIL FOR INSTALLATION REQUIREMENTS.
4. ROUTE 1" CW TO HUMIDIFIER.
5. ROUTE MPG LINE TO BOILER. SEE GAS CONNECTION DETAILS FOR INSTALLATION REQUIREMENTS.
6. ROUTE 3/4" CW TO AIR SEPARATOR WITH METER. SEE HYDRONIC HOT WATER PIPING SCHEMATIC FOR MORE INFORMATION.
7. ROUTE 1" CW TO WATER SOFTENER. SEE WATER SOFTENER PIPING DETAIL FOR INSTALLATION REQUIREMENTS.
8. ROUTE 1" CW TO NON-POTABLE PLUMBING FIXTURES. REFER TO GAS SIZING CHART FOR ADDITIONAL INFORMATION.
### PLUMBING SCHEDULE

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### AIR COMPRESSOR SCHEDULE

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### GAS SIZING CHART

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### PLUMBING CALCULATIONS SUMMARY
FIRE SPRINKLER NOTES:

A. THE FIRE SPRINKLER SYSTEM SHALL BE DESIGNED AND INSTALLED BY THE FIRE SPRINKLER CONTRACTOR. THIS PLAN INDICATES GENERAL PARAMETERS THE FIRE SPRINKLER CONTRACTOR MUST DESIGN AND INSTALL AROUND. THE ENGINEER/ARCHITECT/OWNER RESERVES THE RIGHT TO REVIEW AND APPROVE TEST VALVES, ZONING VALVES, FLOW SENSORS, ETC. DURING THE SUBMITTAL PROCESS.

B. FIRE SPRINKLER CONTRACTORS SHALL BE LICENSED BY THE IDAHO STATE FIRE MARSHAL, AND SHALL HAVE IN HIS/HER EMPLOY AND WITHIN 50 MILES OF THE JOB SITE AN ENGINEERING TECHNICIAN (LEVEL III), CERTIFIED BY NICET (NATIONAL INSTITUTE FOR CERTIFICATION IN ENGINEERING TECHNOLOGIES). PROOF OF BOTH MUST BE SUBMITTED TO THE ENGINEER PRIOR TO THE START OF ANY FIRE SPRINKLER DESIGN AND/OR INSTALLATION, NO EXCEPTIONS.


D. REFER TO FIRE SPRINKLER SPECIFICATIONS FOR ADDITIONAL REQUIREMENTS.

E. PROVIDE RECESSED HEADS IN ALL AREAS EXCEPT WHERE ROOM IS OPEN TO STRUCTURE.

F. NO STANDOFF SPRINKLER HEADS (THOSE THAT DROP BELOW CEILING OR SOFFIT TO PROVIDE BETTER COVERAGE) ALLOWED. ALL SPRINKLER HEADS MUST BE FLUSH WITH CEILING OR EXTERIOR SOFFIT.

G. REFERENCE ARCHITECTURAL SECTIONS FOR LOCATION OF BUILDING INSULATION ENVELOPES.

H. PIPE ALL AUXILIARY DRAINS TO EXTERIOR OF BUILDING OR APPROVED RECEPTACLE. COORDINATE WITH ARCHITECT.

I. IN COLD SPACES WHERE A NON-FREEZE FIRE SPRINKLER SYSTEM IS REQUIRED, CONTRACTOR SHALL PROVIDE A DRY PIPE SPRINKLER SYSTEM.

3/16" = 1'-0"