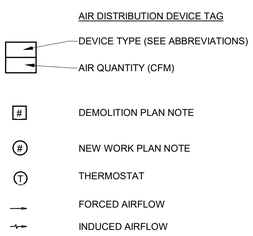
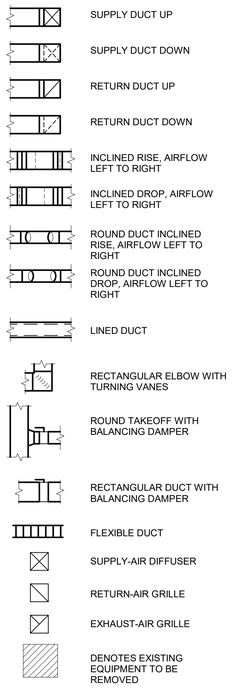
# HVAC SYMBOLS




# LEGEND




# ABBREVIATIONS

| | |
|---|---|
| ABV | ABOVE |
| AFF | ABOVE FINISHED FLOOR |
| BD | BACKDRAFT DAMPER |
| BOD | BOTTOM OF DUCT |
| BTUH | BRITISH THERMAL UNIT PER HOUR |
| CAV | CONSTANT AIR VOLUME |
| CFM | CUBIC FEET PER MINUTE |
| CLG | CEILING |
| CLR | CLEAR |
| DB | DRY BULB TEMPERATURE (DEG.F) |
| DEG | DEGREES |
| DEG.F | DEGREES FARENHEIT |
| DN | DOWN |
| DX | DIRECT EXPANSION |
| (E) | EXISTING |
| EAT | ENTERING AIR TEMPERATURE (DEG.F) |
| EXT | EXTERNAL |
| FD | FIRE DAMPER |
| FF | FINISHED FLOOR |
| FPM | FEET PER MINUTE |
| GC | GENERAL CONTRACTOR |
| HP | HORSEPOWER |
| HZ | HERTZ |
| IN. W.G. | INCHES OF WATER GAUGE |
| L | LOUVER |
| LAT | LEAVING AIR TEMPERATURE (DEG.F) |
| LB | POUND |
| LVG | LEAVING |
| MAL | MALLEABLE |
| MAX | MAXIMUM |
| MBH | THOUSAND BTU PER HOUR |
| MFR | MANUFACTURER |
| MIN | MINIMUM |
| MOD | MOTOR OPERATED DAMPER |
| MVD | MANUAL VOLUME DAMPER |
| NOM | NOMINAL |
| NTS | NOT TO SCALE |
| OA | OUTSIDE AIR |
| OED | OPEN-END DUCT |
| OPG | OPENING |
| PD | PRESSURE DROP |
| Ph | PHASE |
| PSIG | POUNDS PER SQUARE INCH GAUGE |
| R | RADIUS |
| RA | RETURN AIR |
| RH | RELATIVE HUMIDITY |
| RPM | REVOLUTIONS PER MINUTE |
| RTU | ROOFTOP UNIT |
| SA | SUPPLY AIR |
| SCH | SCHEDULE |
| SEN | SENSIBLE |
| SP | STATIC PRESSURE (INCHES OF WATER) |
| TYP | TYPICAL |
| V | VOLTS |
| VEL | VELOCITY |
| VD | VOLUME DAMPER |
| W | WIDTH |
| WB | WET BULB TEMPERATURE (DEF.F) |
| WMS | WIRE MESH SCREEN |
| WPD | WATER RESSURE DROP |
| VAV | VARIABLE AIR VOLUME |
| VFD | VARIABLE FREQUENCY DRIVE |

# GENERAL NOTES

1. WHERE DUCTWORK, PIPING, OR ANY OTHER MECHANICAL EQUIPMENT IS INSTALLED ABOVE THE CEILING STRUCTURE, SUFFICIENT CLEARANCE SHALL BE PROVIDED BELOW ALL LOW POINTS OF THIS EQUIPMENT FOR THE INSTALLATION OF THE FINISHED CEILING AND ITS STRUCTURE AND ALL CEILING-MOUNTED EQUIPMENT INCLUDING CEILING-MOUNTED MECHANICAL EQUIPMENT, LIGHT FIXTURES, PLUMBING LINES, SPRINKLER HEADS, ETC. CLEARANCES REQUIRED FOR THE INSTALLATION OF THIS CEILING-MOUNTED EQUIPMENT SHALL BE VERIFIED AND COORDINATED WITH THE GENERAL CONTRACTOR AND ALL INVOLVED SUBCONTRACTORS BEFORE INSTALLING THE MECHANICAL EQUIPMENT.
2. WHERE SPACE IS LIMITED, SUCH AS IN THE FURRED CEILING SPACES AND CHASES, ROUTES AND CLEARANCES AND INSTALLATION PROCEDURES FOR DUCTWORK, PIPING, VALVES, AND OTHER MECHANICAL EQUIPMENT SHALL BE VERIFIED AND COORDINATED WITH OTHER WORK BEFORE EQUIPMENT IS INSTALLED.
3. ALL STRUCTURAL STEEL AND OTHER MATERIALS REQUIRED FOR OVERHEAD-SUSPENDED MECHANICAL EQUIPMENT SHALL BE PROVIDED BY MECHANICAL CONTRACTOR UNLESS DETAILED ON STRUCTURAL DRAWINGS. ALL NECESSARY REINFORCING IN BUILDING STRUCTURE SHALL BE PROVIDED BY GENERAL CONTRACTOR.
4. GRILLE AND OTHER EQUIPMENT MOUNTING HEIGHTS WHERE SHOWN ON DRAWINGS ARE MEASURED FROM FINISHED FLOOR TO BOTTOM EDGE OF OPENING UNLESS OTHERWISE INDICATED.
5. MOUNT WALL SENSORS WITH SETPOINT ADJUSTMENT 5'-0" ABOVE FINISHED FLOOR.
6. IF ANY EQUIPMENT OTHER THAN THAT SHOWN OR SPECIFIED IS FURNISHED, THE CONTRACTOR SHALL VERIFY THAT THE EQUIPMENT CAN BE INSTALLED IN THE SPACE AVAILABLE, INCLUDING PASSAGE THROUGH DOORS AND ACCESS DOORS AND ACCESS TO THOSE PARTS OF THE EQUIPMENT REQUIRING SERVICE.
7. ALL DUCTS 30" WIDE OR WIDER SHOWN RUNNING SIDE-BY-SIDE ON THE PLANS SHALL BE INSTALLED WITH A MINIMUM CLEARANCE OF 6" BETWEEN THEM TO PROVIDE SPACE FOR CEILING SUSPENSION DEVICES.
8. OPEN ENDS OF ALL RETURN AND EXHAUST DUCTS IN THE FURRED SPACE ABOVE THE CEILING SHALL BE COVERED WITH 1/2" WIRE MESH SCREEN SECURELY ATTACHED TO THE DUCTS.
9. ALL DUCTWORK AND PIPING SHALL BE LOCATED ABOVE NEW OR EXISTING CEILING UNLESS NOTED OTHERWISE.
10. RUN CONDENSATE LINE FROM DRAINS ON AIR HANDLING UNITS TO NEARBY ROOF DRAINS UNLESS OTHERWISE SHOWN. DRAINS SHALL BE SAME SIZE AS TAPPING ON UNIT EXCEPT NOT SMALLER THAN 1"∅.
11. WHERE EXTERNAL INSULATION IS SHOWN ON DUCTS CONTAINING INTERNAL INSULATION, THE THICKNESS OF THE EXTERNAL INSULATION MAY BE REDUCED BY THE THICKNESS OF THE INTERNAL INSULATION.
12. ALL INTERNAL INSULATION IN DUCTWORK SHALL BE PROTECTED AT UPSTREAM AND DOWNSTREAM EDGES BY MITERED OFFSETS IN DUCT. OFFSETS SHALL BE SAME AS THICKNESS OF INSULATION.
13. SEE SPECIFICATIONS FOR DESCRIPTION OF DUCTWORK INSULATION.
14. ALL AIR INTAKE AND DISCHARGE LOUVERS TO EXTERIOR WALLS OF THE BUILDING SHALL BE FURNISHED BY MECHANICAL CONTRACTOR.
15. ALL DUCTWORK SHOWN LINED SHALL HAVE 1/2" DUCT LINER EQUAL TO JOHNS MANVILLE LINACOUSTIC RC. INSTALL PER MANUFACTURER'S RECOMMENDATIONS.
16. OFFSET DUCTS AND PIPING WHERE NECESSARY TO CLEAR OTHER WORK SUCH AS BEAMS, PIPES, ELECTRICAL EQUIPMENT, ETC., COORDINATE DUCTWORK INSTALLATION WITH OTHER TRADES TO AVOID SPACE CONFLICTS.
17. ALL CEILING-MOUNTED DIFFUSERS AND GRILLES IN FURRED CEILING SHALL BE SYMMETRICALLY LOCATED WITH RESPECT TO LIGHTING FIXTURES. DO NOT SCALE DRAWINGS FOR LOCATIONS. COORDINATE EXACT LOCATIONS WITH ELECTRICAL CONTRACTOR AND REFER TO REFLECTED CEILING PLAN.
18. DUCT SIZES SHOWN ON PLANS INDICATE CLEAR INSIDE DIMENSIONS OF DUCTS, NOT INCLUDING ALLOWANCE FOR DUCT LINER OR INTERNAL INSULATION.
19. WHERE CONNECTIONS OR ALTERATIONS ARE MADE TO EXISTING PIPING, OR OTHER MECHANICAL EQUIPMENT, THE EXACT LOCATION AND CONFIGURATION OF THIS EQUIPMENT SHALL BE DETERMINED ON THE JOB SITE. ROUTE AND CLEARANCES FOR NEW PIPING, OR OTHER MECHANICAL EQUIPMENT CONNECTING TO EXISTING EQUIPMENT SHALL BE VERIFIED ON THE JOB SITE BEFORE FABRICATING ANY NEW EQUIPMENT.
20. WHERE ANY PART OF BUILDING OR EXISTING EQUIPMENT IS CUT OR OTHERWISE DISFIGURED TO PERMIT INSTALLATION OF NEW EQUIPMENT OR RELOCATION OF EXISTING EQUIPMENT, THIS PART OF BUILDING OR EXISTING EQUIPMENT SHALL BE REPAIRED OR REPLACED TO MATCH EXISTING.
21. ITEMS REMOVED DURING DEMOLITION MAY BE REUSED. HANDLE WITH EXTREME CARE AND TOUCH-UP DAMAGED SURFACES OR REPLACE WITH NEW AT OWNER'S DISCRETION. ITEMS DAMAGED DURING DEMOLITION SHALL BE REPLACED AT NO COST TO OWNER. OWNER HAS FIRST REFUSAL ON ALL ITEMS REMOVED DURING DEMOLITION.
22. PROVIDE AND INSTALL ACCESS DOORS IN DRYWALL TO MATCH EXISTING FOR ACCESS TO ALL BALANCING DAMPERS AND NEW OR RELOCATED EQUIPMENT.
23. INSTALL ALL EQUIPMENT, ACCESSORIES, DIFFUSERS, GRILLES, LINER, AND INSULATION PER MANUFACTURER'S RECOMMENDATIONS.
24. AIR-BALANCE REPORT SHALL ACCOMPANY A SET OF AS-BUILT PLANS INDICATING EXACT TO-SCALE LOCATIONS AND FINAL BALANCE AIR RATES. MAINTAIN A MINIMUM OF ONE INTACT SET OF PROJECT PLANS AND SPECIFICATIONS AT JOB SITE MARKED TO SHOW ALL DEVIATIONS PERMITTED DURING CONSTRUCTION AS THE WORK IS INSTALLED. ALL MARKS SHALL BE RED IN COLOR, COMPLETE, CLEAR AND LEGIBLE.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BOTETOURT COUNTY
Botetourt, Virginia PROJECT NO.: 423-277

BID SET

COMMONWEALTH OF VIRGINIA
RYAN D. COON
Lic. No. 057191
11/10/2021
PROFESSIONAL ENGINEER



| | |
|---|---|
| DATE: | 11/10/21 |
| DESIGNED: | RDC |
| DRAWN: | RDC |
| CHECKED: | RDC |
| REVISIONS: | |

HVAC LEGEND, NOTES, AND ABBREVIATIONS

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## LOUVER SCHEDULE

| MARK | DUTY | MODEL | SIZE | REMARKS |
|---|---|---|---|---|
| L-1 | EF-1 EXHAUST | ESD-403 | 24"x12" | 1,2,3 |

REMARKS:
1. MODEL NUMBER BASED ON GREENHECK.
2. PROVIDE WITH BIRDSCREEN.
3. COLOR TO BE SELECTED BY ARCHITECT.

## FAN SCHEDULE

| MARK | MODEL NUMBER | CFM | SP in Wg | WATTS/HP | SONES | DRIVE | RPM | V/Ph/Hz | REMARKS |
|---|---|---|---|---|---|---|---|---|---|
| EF-1 | GN-622 | 350 | 0.5 | 105 W | 2.5 | DIRECT | 1340 | 115/1/60 | 1,2,3,4,5 |
| EF-2 | GC-186 | 175 | 0.375 | 74 W | 4.0 | DIRECT | 972 | 115/1/60 | 1,2,3,4,5 |

REMARKS:
1. MODEL NUMBER BASED ON LOREN COOK.
2. PROVIDE FACTORY-MOUNTED AND WIRED DISCONNECT.
3. FURNISH FAN WITH INTEGRAL OVERLOAD PROTECTION.
4. FURNISH AND INSTALL BACKDRAFT DAMPER.
5. FURNISH FAN WITH FACTORY-MOUNTED FAN SPEED CONTROLLER.

## VAV BOX SCHEDULE

| MARK | MODEL NUMBER | SIZE | MAX AIRFLOW (CFM) | MIN COOLING AIRFLOW (CFM) | A.P.D. (IN W.G.) | HEATING EAT/LAT | HEATER kW | HEATER V/Ph/Hz | REMARKS |
|---|---|---|---|---|---|---|---|---|---|
| VAV-1-1 | VCEF12 | 12 | 1620 | 485 | 0.050 | 55.0/90.0 | 9.0 | 208/3/60 | 1,2,3,4 |
| VAV-1-2 | VCEF12 | 12 | 1620 | 485 | 0.050 | 55.0/90.0 | 9.0 | 208/3/60 | 1,2,3,4 |
| VAV-1-3 | VCEF12 | 12 | 1620 | 485 | 0.050 | 55.0/90.0 | 9.0 | 208/3/60 | 1,2,3,4 |
| VAV-1-4 | VCEF12 | 12 | 1620 | 485 | 0.050 | 55.0/90.0 | 9.0 | 208/3/60 | 1,2,3,4 |
| VAV-1-5 | VCEF05 | 5 | 300 | 90 | 0.020 | 55.0/86.5 | 1.5 | 208/3/60 | 1,2,3,4 |
| VAV-1-6 | VCEF05 | 5 | 255 | 75 | 0.020 | 55.0/92.8 | 1.5 | 208/3/60 | 1,2,3,4 |
| VAV-1-7 | VCEF08 | 8 | 750 | 225 | 0.070 | 55.0/97.0 | 5.0 | 208/3/60 | 1,2,3,4 |
| VAV-1-8 | VCEF08 | 8 | 715 | 215 | 0.070 | 55.0/99.3 | 5.0 | 208/3/60 | 1,2,3,4 |

REMARKS:
1. MODEL NUMBER BASED ON TRANE.
2. PROVIDE WITH SCR HEATER CONTROL.
3. PROVIDE WITH 1/2" MATTE INSULATION.
4. TEMPERATURE SENSOR WITH THUMBWHEEL CONTROL +/- 2 DEG.F.

## ELECTRIC HEATER SCHEDULE

| MARK | MODEL | CFM | WATTS | V/Ph/Hz | REMARKS |
|---|---|---|---|---|---|
| EUH-1 | F2F5103N | 400 | 3300 W | 208/3/60 | 1,2 |
| EWH-1 | E3321TD-RP | 175 | 750 W | 120/1/60 | 1,2 |
| EWH-2 | E3321TD-RP | 175 | 750 W | 120/1/60 | 1,3,4 |

REMARKS:
1. MODEL NUMBER BASED ON MARKEL.
2. PROVIDE WITH RECESSING BOX AND UNIT-MOUNTED THERMOSTAT.
3. PROVIDE WITH HANGER BRACKET.
4. PROVIDE WITH WALL-MOUNTED THERMOSTAT.

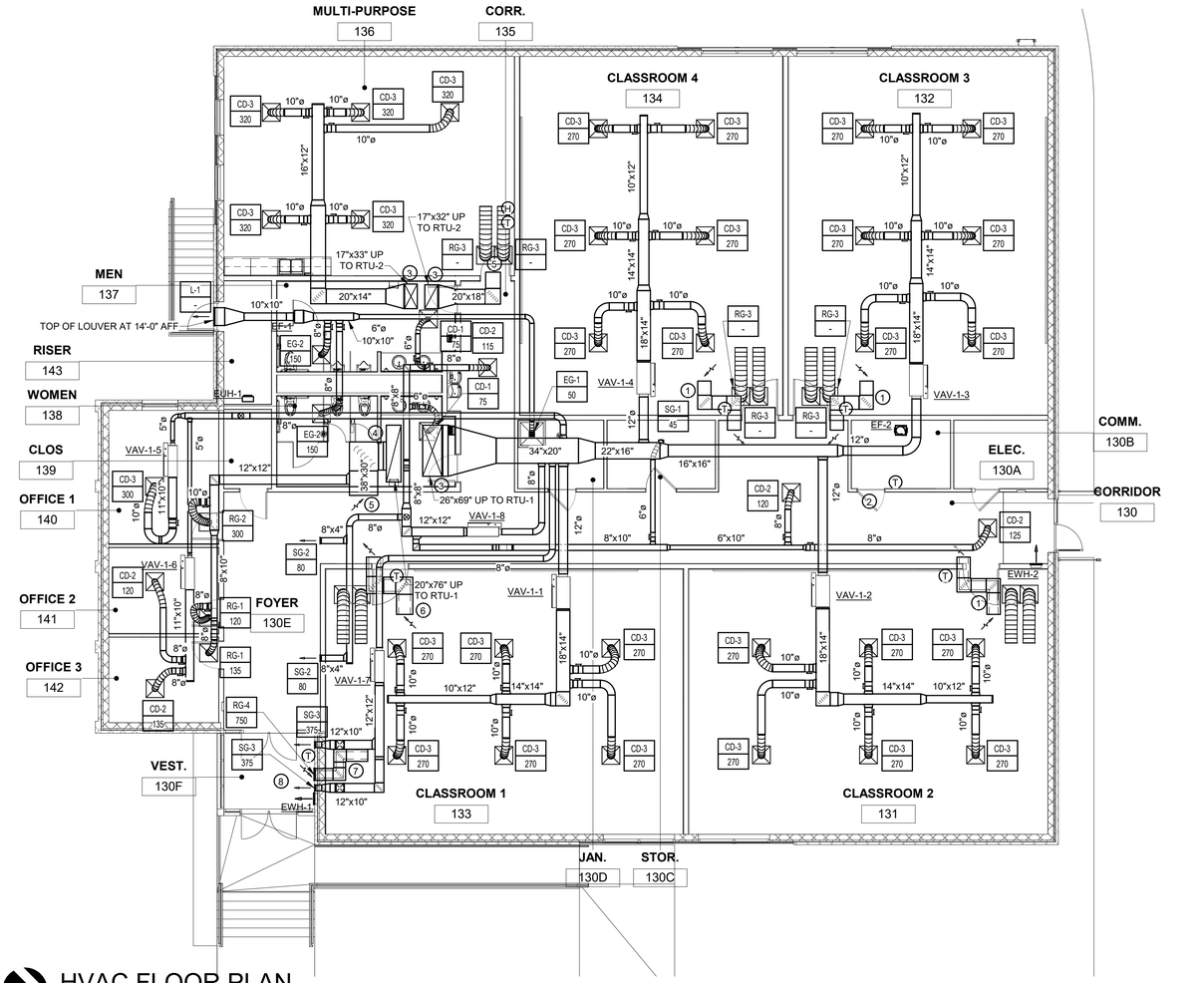
## AIR DISTRIBUTION SCHEDULE

| MARK | MODEL | NECK SIZE | MOUNTING | MATERIAL | COLOR | MAX NC | REMARKS |
|---|---|---|---|---|---|---|---|
| CD-1 | SCD | 6"ø | LAY-IN | STEEL | WHITE | 25 | 1,2 |
| CD-2 | SCD | 8"ø | LAY-IN | STEEL | WHITE | 25 | 1,2 |
| CD-3 | SCD | 10"ø | LAY-IN | STEEL | WHITE | 25 | 1,2 |
| EG-1 | 530 | 6"x6" | SURFACE | STEEL | WHITE | 25 | 1 |
| EG-2 | PDDR | 8"ø | LAY-IN | STEEL | WHITE | 25 | 1,2 |
| RG-1 | PDDR | 8"ø | LAY-IN | STEEL | WHITE | 25 | 1,2 |
| RG-2 | PDDR | 10"ø | LAY-IN | STEEL | WHITE | 25 | 1,2 |
| RG-3 | PDDR | 16"ø | LAY-IN | STEEL | WHITE | 25 | 1,2 |
| RG-4 | 530 | 16"x16" | SURFACE | STEEL | WHITE | 25 | 1 |
| SG-1 | 510 | 6"x4" | SURFACE | STEEL | WHITE | 25 | 1 |
| SG-2 | 510 | 8"x4" | SURFACE | STEEL | WHITE | 25 | 1 |
| SG-3 | 510 | 8"x16" | SURFACE | STEEL | WHITE | 25 | 1 |

REMARKS:
1. MODEL NUMBER BASED ON PRICE INDUSTRIES.
2. 24"X24" GRILLE OR DIFFUSER.

## PLAN NOTES

1. 18"x18" TRANSFER DUCT WITH ACOUSTICAL DUCT LINER. SEE RETURN-AIR PLENUM TRANSFER DUCT DETAIL. SEE SPECIFICATIONS FOR LINER REQUIREMENTS.
2. DOOR GRILLE - SEE ARCHITECTURAL.
3. PROVIDE ACOUSTICAL DUCT LINER IN DUCT ELBOW AND IN VERTICAL DUCT UP TO RTU. SEE SPECIFICATIONS FOR LINER REQUIREMENTS.
4. PROVIDE ACOUSTICAL DUCT LINER IN VERTICAL DUCT UP TO RTU. SEE SPECIFICATIONS FOR LINER REQUIREMENTS.
5. OPEN-END RETURN DUCT WITH WIRE MESH SCREEN. SEE DETAIL.
6. 22"x22" TRANSFER DUCT WITH ACOUSTICAL DUCT LINER. SEE RETURN-AIR PLENUM TRANSFER DUCT DETAIL. SEE SPECIFICATIONS FOR LINER REQUIREMENTS.
7. 16"x16" TRANSFER DUCT WITH ACOUSTICAL DUCT LINER. SEE RETURN-AIR PLENUM TRANSFER DUCT DETAIL. SEE SPECIFICATIONS FOR LINER REQUIREMENTS.
8. SEE ARCHITECTURAL FOR LOCATIONS AND ELEVATIONS OF GRILLES IN VESTIBULE.




HVAC FLOOR PLAN
1/8" = 1'-0"

## ROOFTOP UNIT SCHEDULE

| MARK | MODEL | SUPPLY CFM | OA CFM | FAN DRIVE | FAN HP | FAN EXT S.P. IN. W.G. | NOM COOLING TONS | COOLING NET SEN MBH | COOLING EAT db/wb | COOLING LAT db/wb | HEATER MBH INPUT/OUTPUT | HEATER FUEL | GAS PRESSURE (IN. W.G.) | HEATING EAT/LAT | V/Ph/Hz | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| RTU-1 | YHD240G3RL | 8500 | 2100 | BELT | 7.5 | 1.5 | 20.0 | 176.03 | 79.27/65.31 | 57.31/55.62 | 250/200 | NATURAL GAS | 2.5 - 14.0 | 58.1/79.8 | 208/3/60 | 1,2,3,4,5,6,8,9 |
| RTU-2 | YHC048E3 | 1600 | 250 | DIRECT | 1.0 | 0.75 | 4.0 | 35.57 | 77.7/64.3 | 56.05/54.09 | 80/64 | NATURAL GAS | 4.5 - 14.0 | 63.2/100.5 | 208/3/60 | 1,2,3,4,6,7 |

REMARKS:
1. MODEL NUMBER BASED ON TRANE.
2. FURNISH WITH LOUVERED STEEL HAIL GUARDS.
3. PROVIDE FACTORY-MOUNTED DISCONNECT SWITCH.
4. UNIT SHALL BE EQUIPPED WITH VFD FOR OPERATION IN VAV SYSTEM.
5. PROVIDE 100% COMPARATIVE ENTHALPY ECONOMIZER.
6. PROVIDE WITH INSULATED ROOF CURB. COORDINATE ROOF SLOPE WITH GC. SEE ARCHITECTURAL FOR ADDITIONAL CURB REQUIREMENTS.
7. PROVIDE WITH HOT-GAS REHEAT COIL.
8. PROVIDE POWER EXHAUST OPTION.
9. PROVIDE SUPPLY AND RETURN SMOKE DETECTORS. SMOKE DETECTORS SHALL INTERFACE TO FACILITY FIRE ALARM SYSTEM.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RYAN D. COON
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PROFESSIONAL ENGINEER



DATE: 11/10/21
DESIGNED: RDC
DRAWN: RDC
CHECKED: RDC
REVISIONS:

HVAC FLOOR PLAN AND SCHEDULES

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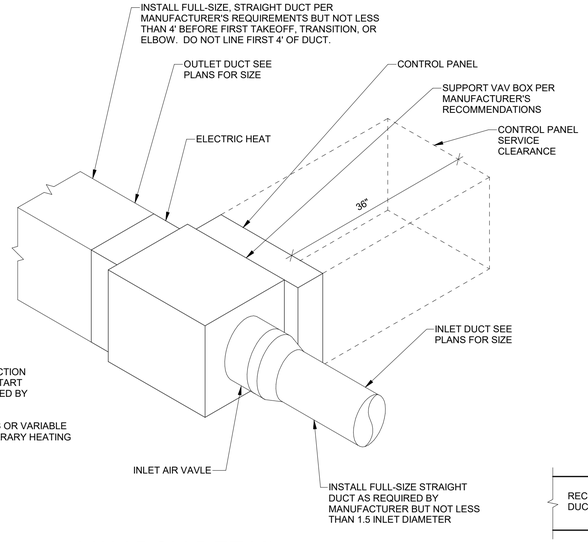
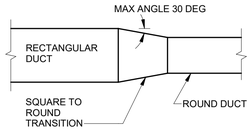


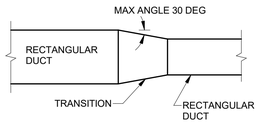

GENEREAL NOTES

1. REFER TO INSTALLATION INSTRUCTION INFORMATION FOR CHECK AND START REQUIREMENTS AS RECOMMENDED BY MANUFACTURER.
2. DO NOT USE AIR HANDLING UNITS OR VARIABLE AIR VOLUME SYSTEM FOR TEMPORARY HEATING DURING CONSTRUCTION.

## VAV BOX DETAIL

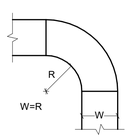
NOT TO SCALE



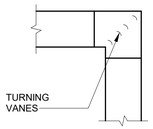




## DUCT TRANSITION DETAILS

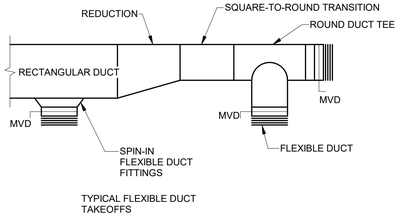
NOT TO SCALE




TYPICAL RADIUS ELBOW




TYPICAL MITERED ELBOW

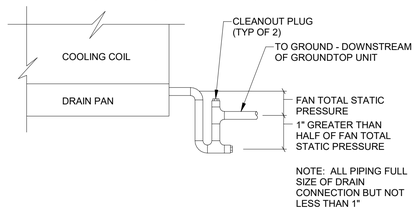



TYPICAL FLEXIBLE DUCT TAKEOFFS

## DUCT CONNECTION DETAILS

NOT TO SCALE

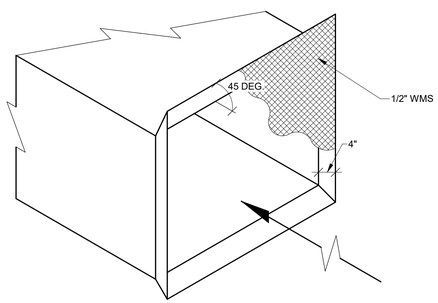
| CONDENSATE DRIP SIZING | |
|---|---|
| PIPE SIZE | CONNECTED LOAD |
| 1" | UP TO 5 |
| 1-1/4" | UP TO 30 |
| 1-1/2" | UP TO 50 |
| 2" | UP TO 175 |
| 3" | UP TO 300 |
| 4" | UP TO 400 |




NOTE: ALL PIPING FULL SIZE OF DRAIN CONNECTION BUT NOT LESS THAN 1"

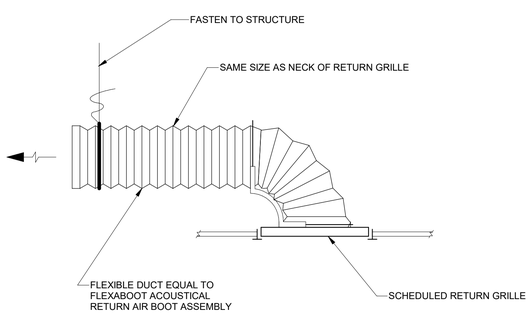
## CONDENSATE TRAP DETAIL

NOT TO SCALE



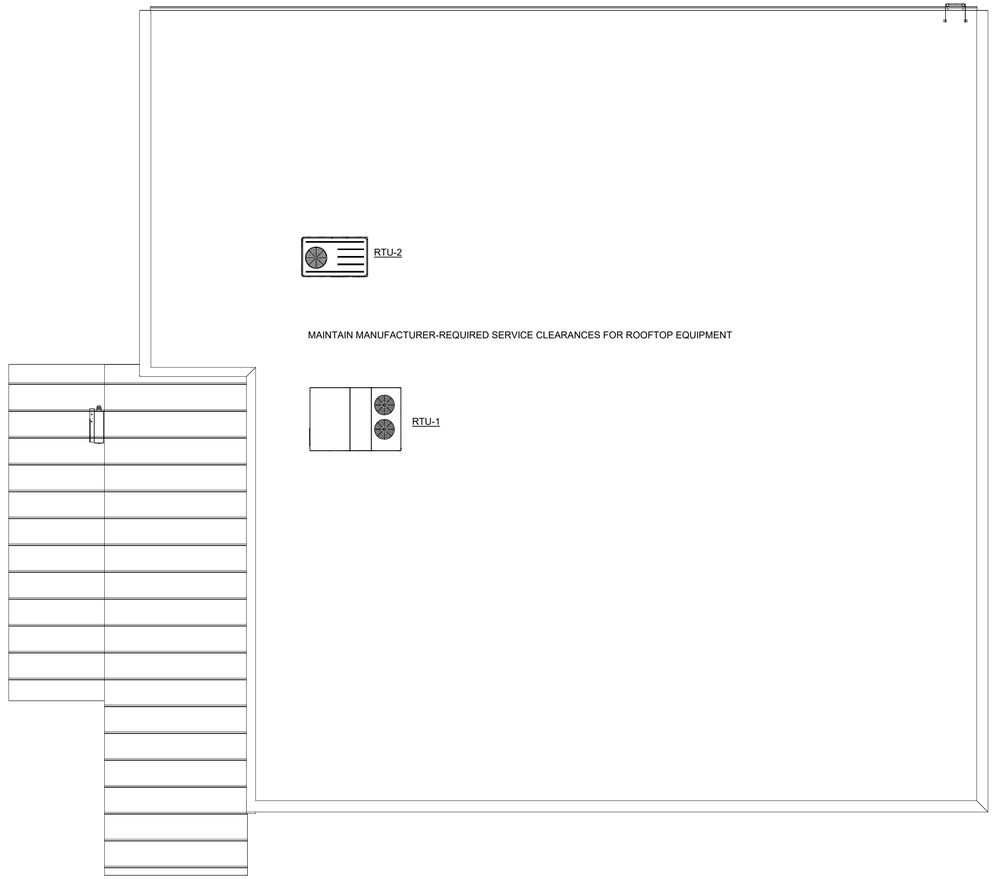

## OPEN-END RETURN DUCT DETAIL

NOT TO SCALE




## PLENUM RETURN GRILLE DETAIL

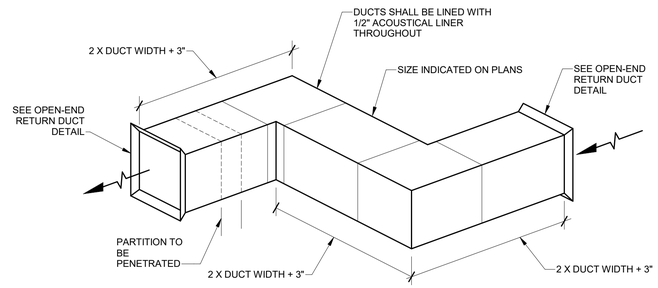
NOT TO SCALE




MAINTAIN MANUFACTURER-REQUIRED SERVICE CLEARANCES FOR ROOFTOP EQUIPMENT

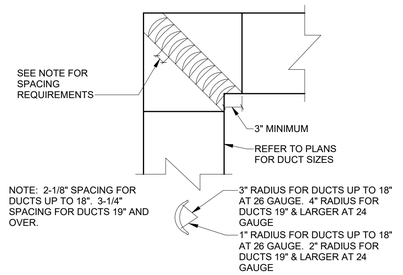
## HVAC ROOF PLAN

1/8" = 1'-0"




## RETURN-AIR PLENUM TRANSFER DUCT

NOT TO SCALE




NOTE: 2-1/8" SPACING FOR DUCTS UP TO 18". 3-1/4" SPACING FOR DUCTS 19" AND OVER.

## SQUARE ELBOW TURNING VANES DETAIL

NOT TO SCALE

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COMMONWEALTH OF VIRGINIA
RYAN D. COON
Lic. No. 057191
11/10/2021
PROFESSIONAL ENGINEER



| | |
|---|---|
| DATE: | 11/10/21 |
| DESIGNED: | RDC |
| DRAWN: | RDC |
| CHECKED: | RDC |
| REVISIONS: | |

HVAC ROOF PLAN AND DETAILS

M2.0

MASTER ENGINEERS & DESIGNERS
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423-277



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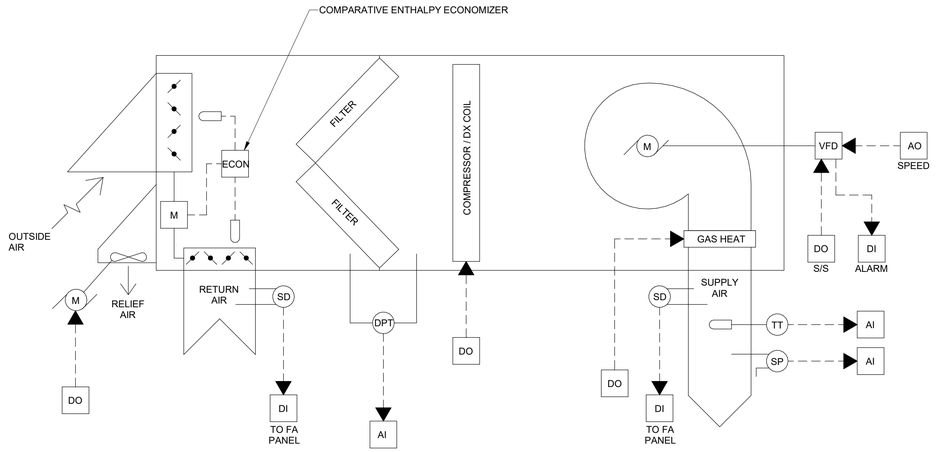



## RTU-1 CONTROLS

## SEQUENCE OF OPERATION

ALL MODES:

ALL CONTROL FUNCTIONS INDICATED IN THIS SEQUENCE OF OPERATION SHALL BE ACCOMPLISHED BY A TRANE TRACER SUMMIT APPLICATION SPECIFIC CONTROLLER WHICH IS CONNECTED TO THE OWNER'S EXISTING TRANE TRACER SUMMIT DDC CONTROL SYSTEM. COMMUNICATION POINTS ARE LISTED AT THE END OF THIS SEQUENCE OF OPERATION.

OCCUPIED MODE:

RTU-1 SHALL BE OCCUPIED BASED ON A USER-DEFINED SCHEDULE. THE ASC SHALL COMMAND THE RTU TO START IN THE OCCUPIED MODE. THE RTU CONTROLLER SHALL COMMAND THE SUPPLY FAN TO RUN. THE ASC SHALL COMMAND THE ZONE-RELATED EXHAUST FAN, EF-1, TO RUN BASED ON THE SAME USER PROGRAMMABLE OCCUPANCY SCHEDULE. WHEN OCCUPIED, THE UNIT SUPPLY FAN SHALL RUN CONTINUOUSLY. THE SUPPLY FAN SPEED SHALL MODULATE TO MAINTAIN THE DISCHARGE AIR STATIC PRESSURE AT THE STATIC PRESSURE SETPOINT OF 0.75" (ADJ).

THE ASC SHALL ENABLE STAGES OF COOLING AND ELECTRIC HEATING TO MAINTAIN THE DISCHARGE AIR TEMPERATURE AT 55 DEG.F. (ADJ).

UNOCCUPIED MODE:

THE ASC SHALL DISABLE THE RTU BASED ON A USER PROGRAMMABLE OCCUPANCY SCHEDULE. WHEN IN AN UNOCCUPIED MODE, THE UNIT MOUNTED CONTROLLER SHALL DISABLE THE SUPPLY FAN.

RTU-1 SHALL BE UNOCCUPIED BASED ON A USER-DEFINED SCHEDULE. WHEN ENABLED, BASED ON THE ASSOCIATED ZONE TEMPERATURE SENSORS, THE ASC SHALL COMMAND THE RTU TO START IN THE UNOCCUPIED MODE. THE RTU CONTROLLER SHALL COMMAND THE SUPPLY FAN TO RUN. THE ASC SHALL COMMAND THE ZONE-RELATED EXHAUST FAN, EF-1, TO RUN BASED ON THE SAME USER PROGRAMMABLE OCCUPANCY SCHEDULE. WHEN ENABLED, THE UNIT SUPPLY FAN SHALL RUN CONTINUOUSLY. THE SUPPLY FAN SPEED SHALL MODULATE TO MAINTAIN THE DISCHARGE AIR STATIC PRESSURE AT THE STATIC PRESSURE SETPOINT OF 0.75" (ADJ).

THE ASC SHALL ENABLE STAGES OF COOLING AND NATURAL GAS HEATING TO MAINTAIN THE DISCHARGE AIR TEMPERATURE AT 55 DEG.F. (ADJ).

ALL MODES:

THE ASC SHALL ANNUNCIATE THE FILTER CHANGE STATUS BASED ON THE FILTER PRESSURE DROP COMPARED TO A PRE-PROGRAMMED SETPOINT (ADJ).

POINTS COMMUNICATED TO/FROM THE TRANE TRACER SUMMIT SYSTEM:

| | |
|---|---|
| ENABLE/DISABLE | DO |
| DISCHARGE TEMPERATURE | AI |
| COMPRESSOR ENABLE | DO |
| ALARM | DO |
| DIRTY FILTERS | AI |
| NATURAL GAS HEAT | DO |
| EXHAUST FAN | DO |
| RETURN AIR HUMIDITY | AI |
| VFD SPEED | AO |
| VFD ALARM | DI |

ECONOMIZER:

A UNIT-MOUNTED CONTROLLER SHALL CONTINOUSLY MONITOR THE RETURN AIR AND OUTSIDE AIR ENTHALPY CONDITIONS. WHEN CONDITIONS ARE APPROPRIATE (AS DETERMINED BY THE CONTROLLER) THE CONTROLLER SHALL OPEN THE OUTSIDE AIR DAMPER AND CLOSE THE RETURN AIR DAMPER TO MAINTAIN THE SPACE TEMPERATURE SETPOINT. WHEN THE OUTSIDE AIR DAMPER IS OPEN GREATER THAN 30% (ADJ) THE EXHAUST FAN SHALL START AND OPERATE CONTINUOUSLY.

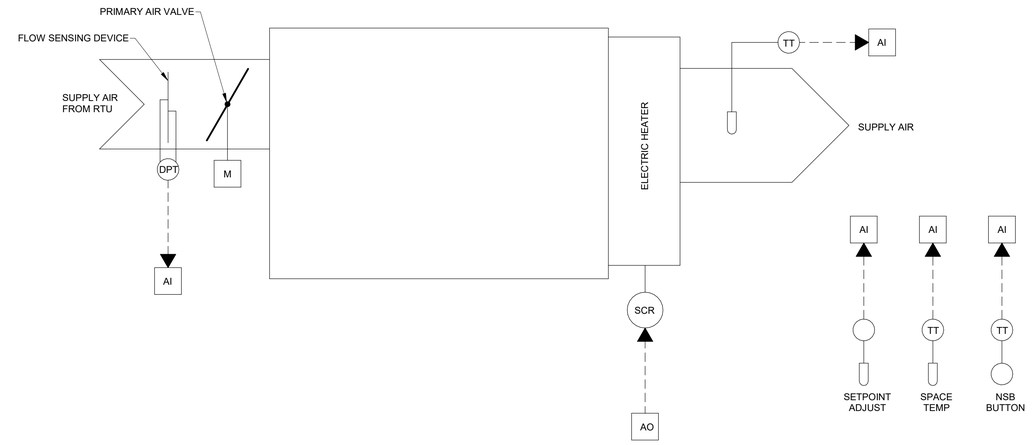
## CONTROLS LEGEND

SYMBOLS

| | |
|---|---|
| AI | ANALOG INPUT (0-10, 1-5V, 4-20 mA OR THE LIKE) |
| AO | ANALOG OUTPUT (0-10, 1-5V, 4-20 mA OR THE LIKE) |
| DI | DIGITAL INPUT (2-STATE, ON/OFF) |
| DO | DIGITAL OUTPUT (2-STATE, ON/OFF) |
| JS | MOTOR STARTER |
| RH | RELATIVE HUMIDITY |
| VFD | VARIABLE FREQUENCY DRIVE |
| CSS | CURRENT SENSING SWITCH |
| M | MOTORIZED ACTUATOR |
| M | MOTOR |
| TT | TEMPERATURE TRANSMITTER |
| SD | SMOKE DETECTOR |
| DPT | DIFFERENTIAL PRESSURE TRANSMITTER |

ABBREVIATIONS

| | |
|---|---|
| (ADJ) | ADJUSTABLE |
| ASC | APPLICATION SPECIFIC CONTROLLER |
| DEG. F | DEGREES FAHRENHEIT |
| DX | DIRECT EXPANSION |
| HGR | HOT GAS REHEAT |
| NG | NATURAL GAS |
| OA | OUTSIDE AIR |
| RH | RELATIVE HUMIDITY |
| S/S | START/STOP |
| TEMP | TEMPERATURE |
| TOD | TIME OF DAY |




## VAV BOX CONTROLS

## SEQUENCE OF OPERATION

OCCUPIED MODE:

THE ASC SHALL MODULATE THE PRIMARY AIR VALVE TO MAINTAIN COOLING SETPOINT. AS TEMPERATURE IN THE SPACE AS SENSED BY THE SPACE TEMPERATURE ELEMENT CONTINUES TO DROP, THE ASC SHALL ENABLE THE ELECTRIC HEATING COIL.

SETPOINTS:
COOLING = 75°F (ADJ)
HEATING = 70°F (ADJ)

UNOCCUPIED MODE:

SPACE OCCUPANTS MAY OVERRIDE UNOCCUPIED MODE BY DEPRESSING THE OVERRIDE PUSHBUTTON ON EACH SPACE TEMPERATURE SENSOR. WHEN DEPRESSED, THE VAV BOX SHALL CHANGE TO OCCUPIED MODE. IF COOLING IS REQUIRED, THE DDC SYSTEM SHALL START THE ASSOCIATED RTU IN UNOCCUPIED MODE. WHEN ENABLED IN UNOCCUPIED COOLING MODE, ALL ASSOCIATED VAV BOXES SHALL OPEN TO 100% UNTIL ALL ZONES FALL BELOW THE UNOCCUPIED COOLING SETPOINT MINUS 3°F (ADJ). CHANGE TO UNOCCUPIED MODE SHALL OCCUR AFTER ADJUSTABLE TIME PERIOD. INITIAL SETPOINT = 2 HOURS (ADJ).

SETPOINTS:
COOLING = 82°F (ADJ)
HEATING = 64°F (ADJ)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RTU-1 AND VAV BOX CONTROLS

M3.0



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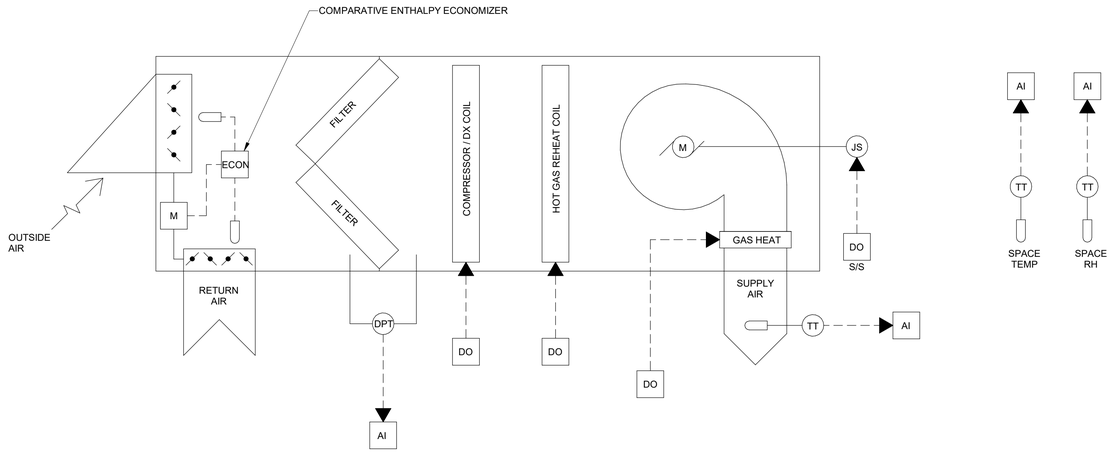


# RTU-2 CONTROLS

## SEQUENCE OF OPERATION

ALL MODES:

ALL CONTROL FUNCTIONS INDICATED IN THIS SEQUENCE OF OPERATION SHALL BE ACCOMPLISHED BY A TRANE TRACER SUMMIT APPLICATION SPECIFIC CONTROLLER WHICH IS CONNECTED TO THE OWNER'S EXISTING TRANE TRACER SUMMIT DDC CONTROL SYSTEM. COMMUNICATION POINTS ARE LISTED AT THE END OF THIS SEQUENCE OF OPERATION.

OCCUPIED MODE:

RTU-2 SHALL BE OCCUPIED BASED ON A USER-DEFINED SCHEDULE. THE ASC SHALL COMMAND THE RTU TO START IN THE OCCUPIED MODE. THE RTU CONTROLLER SHALL COMMAND THE SUPPLY FAN TO RUN. THE ASC SHALL COMMAND THE ZONE-RELATED EXHAUST FANS TO RUN BASED ON THE SAME USER PROGRAMMABLE OCCUPANCY SCHEDULE. WHEN OCCUPIED, THE UNIT SUPPLY FAN SHALL RUN CONTINUOUSLY AT THE PRE-DETERMINED AND BALANCED AIRFLOWS.

THE ASC SHALL CONTINUOUSLY MONITOR THE DISCHARGE AIR TEMPERATURE.

INITIAL OCCUPIED SPACE SETPOINTS:
HEATING = 70 DEG. F (ADJ)
COOLING = 75 DEG. F (ADJ)

IF THE SPACE TEMPERATURE RISES ABOVE THE SPACE COOLING SETPOINT, THE ASC SHALL ENABLE THE COMPRESSOR. THE REVERSE ACTION SHALL OCCUR ON A FALL IN SPACE TEMPERATURE BELOW THE SPACE COOLING SETPOINT. IF THE SPACE TEMPERATURE FALLS BELOW THE SPACE HEATING SETPOINT, THE ASC SHALL ENABLE THE NATURAL GAS HEAT TO MAINTAIN SETPOINT. THE REVERSE ACTION SHALL OCCUR ON A RISE IN SPACE TEMPERATURE ABOVE THE SPACE HEATING SETPOINT.

UNOCCUPIED MODE:

THE ASC SHALL DISABLE THE RTU BASED ON A USER PROGRAMMABLE OCCUPANCY SCHEDULE. WHEN IN AN UNOCCUPIED MODE, THE UNIT MOUNTED CONTROLLER SHALL DISABLE THE SUPPLY FAN.

DURING UNOCCUPIED MODE, THE UNIT MOUNTED CONTROLLER SHALL MONITOR THE SPACE TEMPERATURE. WHEN THE SPACE TEMPERATURE RISES OR FALLS BEYOND THE UNOCCUPIED SETPOINTS, THE RTU SHALL BE ENABLED. WHEN ENABLED IN UNOCCUPIED MODE, THE SUPPLY FAN SHALL BE ENABLED UNTIL THE SPACE TEMPERATURE RETURNS TO WITHIN THE UNOCCUPIED SETPOINTS.

UNOCCUPIED SPACE SETPOINTS
HEATING = 64 DEG. F (ADJ)
COOLING = 82 DEG. F (ADJ)

IF THE SPACE TEMPERATURE RISES ABOVE THE SPACE COOLING SETPOINT, THE ASC SHALL ENABLE THE COMPRESSOR. THE REVERSE ACTION SHALL OCCUR ON A FALL IN SPACE TEMPERATURE BELOW THE SPACE COOLING SETPOINT. IF THE SPACE TEMPERATURE FALLS BELOW THE SPACE HEATING SETPOINT, THE ASC SHALL ENABLE THE NATURAL GAS HEAT TO MAINTAIN SETPOINT. THE REVERSE ACTION SHALL OCCUR ON A RISE IN SPACE TEMPERATURE ABOVE THE SPACE HEATING SETPOINT.

ALL MODES:

THE ASC SHALL ANNUNCIATE THE FILTER CHANGE STATUS BASED ON THE FILTER PRESSURE DROP COMPARED TO A PRE-PROGRAMMED SETPOINT (ADJ).

POINTS COMMUNICATED TO/FROM THE JCI METASYS SYSTEM:

| | |
|---|---|
| ENABLE/DISABLE | DO |
| SPACE TEMPERATURE | AI |
| DISCHARGE TEMPERATURE | AI |
| COMPRESSOR ENABLE | DO |
| ALARM | DO |
| DIRTY FILTERS | AI |
| NATURAL GAS HEAT | DO |
| HOT GAS REHEAT | DO |
| SPACE HUMIDITY | AI |

HOT GAS REHEAT/DEHUMIDIFICATION MODE:

THE ASC SHALL CONTINOUSLY MONITOR THE SPACE HUMIDITY. WHEN THE SPACE TEMPERATURE IS GREATER THAN THE ACTIVE HEATING SETPOINT, LOWER THAN THE ACTIVE COOLING SETPOINT, AND THE SPACE RELATIVE HUMIDITY IS GREATER THAN 60% (ADJ), THE ASC SHALL ENABLE DEHUMIDIFICATION MODE. WHEN ENABLED IN DEHUMIDIFICATION MODE, RTU-2 SHALL ENABLE THE COMPRESSOR AND ENABLE THE HOT GAS REHEAT COIL TO DEHUMIDIFY WHILE MAINTAINING SPACE TEMPERATURE AT SETPOINT. DEHUMIDIFICATION MODE SHALL BE DISABLED WHEN THE SPACE RELATIVE HUMIDITY FALLS BELOW 50% (ADJ).

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REVISIONS:

RTU-2 CONTROLS

M3.1



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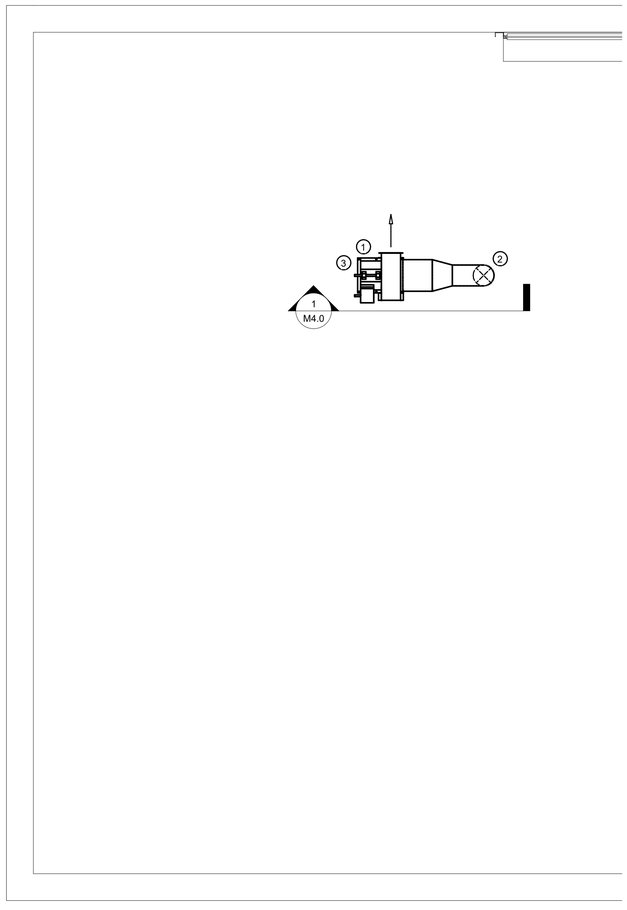
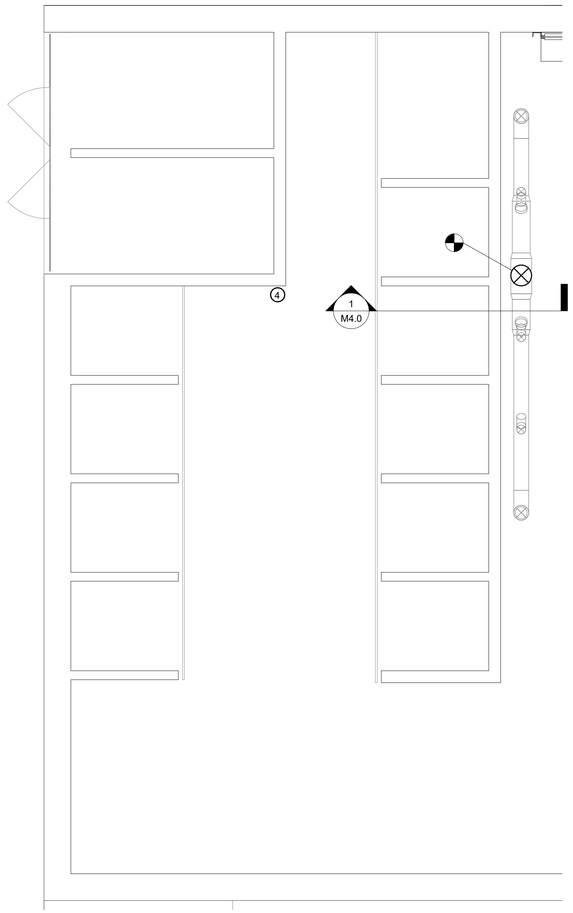
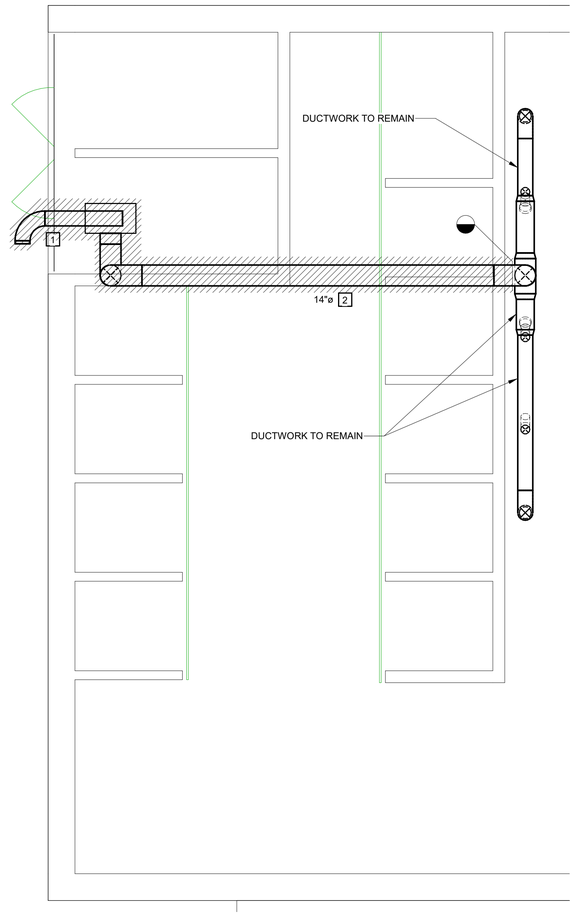



HVAC EXISTING WELDING LAB ROOF PLAN
1/4" = 1'-0"



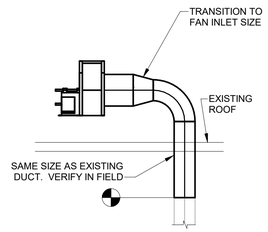

HVAC EXISTING WELDING LAB NEW WORK PLAN
1/4" = 1'-0"




HVAC EXISTING WELDING LAB DEMOLITION PLAN
1/4" = 1'-0"

## NEW WORK NOTES

1. FAN SHALL BE EQUIVALENT TO LOREN COOK MODEL 165CA-SWSI WITH AIRFLOW OF 4250 CFM AT 7.5 IN. W.G. 7.5 HP, BELT DRIVE, 460V/3PH/60HZ. PROVIDE VFD-RATED, PREMIUM EFFICIENCY MOTOR WITH SHAFT GROUNDING RING. PROVIDE VARIABLE FREQUENCY DRIVE WITH INTEGRAL START AND STOP PUSH BOTTONS. PROVIDE FACTORY-MOUNTED AND WIRED DISCONNECT. PROVIDE OSHA APPROVED BELT GUARD. PROVIDE ISOLATION BASE AND RUBBER-IN-SHEAR FLOOR ISOLATORS. PROVIDE GRAVITY DISCHARGE SHUTTER.
2. SEAL ROOF PENETRATION AROUND DUCT WATER-TIGHT. SEE ARCHITECTURAL DRAWINGS.
3. INSTALL FAN AND DUCT ON A SUPPORT FRAME. FRAME SHALL BE CONSTRUCTION OF "UNISTRUT" OR EQUAL MODULAR FRAMING SECTIONS AND SHALL BE DESIGNED BY THE INSTALLER. FRAMES SHALL BE ADEQUATE FOR GRAVITY LOADS AS WELL AS 25% WEIGHT OF FAN AND 20 PSF X EXPOSED SURFACE AREA OF DUCT IN LATERAL DIRECTION. FRAMES SHALL BE NO-PENETRATION TYPE WITH METAL BASE PLATES AND ADDITIONAL ELASTOMERIC PADS TO PREVENT PUNCTURE TO ROOFING SYSTEM BELOW. LOCATE LEGS OF FAN SUPPORT FRAME DIRECTLY ABOVE JOISTS BELOW OR PROVIDE ADDITIONAL SUPPORT DECK ANGLES AS SHOWN ON S0.1.
4. MOUNT VFD ON WALL AT LOCATION ACCEPTABLE TO OWNER TO SERVE AS CONTROL POINT FOR EXHAUST SYSTEM. WIRE FROM 480 V BUS DUCT BY PROVIDING A NEW PLUG (FUSED DISCONNECT TYPE). INSTALL 20 AMP FUSES AND WIRE WITH 3 #12 & 1 #12 EGC - 3/4" CONDUIT. ALL CONDUIT SHALL BE RIGID STEEL OR INTERMEDIATE METAL CONDUIT.




1 / M4.0 SECTION 1
1/4" = 1'-0"

## DEMOLITION NOTES

1. DEMOLISH FAN AND INDICATED DUCTWORK, INCLUDING HANGERS AND SUPPORTS, BACK TO VERTICAL. PATCH AND REPAIR WALL TO MATCH EXISTING. DEMOLISH ELECTRICAL FACILITIES ASSOCIATED WITH EXISTING FAN.
2. CONTRACTOR SHALL VERIFY SIZE IN FIELD.

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HVAC EXISTING WELDING LAB PLAN

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