
# APPENDIX C – WCPSS PROVIDED STANDARD DETAILS

WAKE COUNTY PUBLIC SCHOOL SYSTEM
1429 Rock Quarry Road, Suite 116
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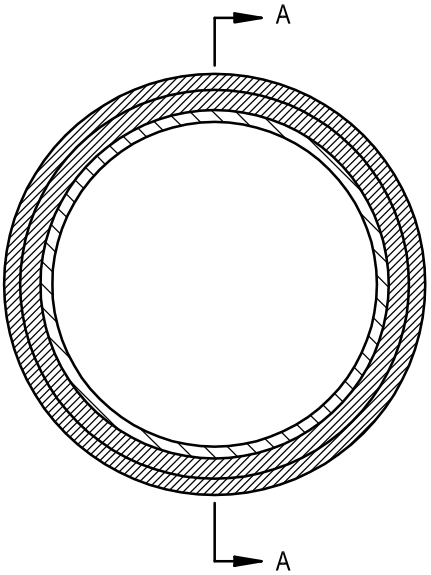
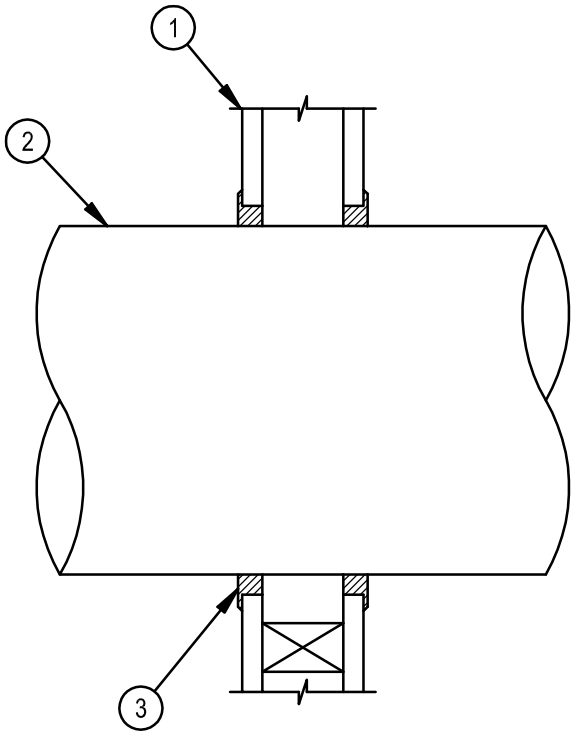
(919) 588-3608

U.L. SYSTEM NO. WL1052
METAL PIPE THROUGH 1-HR. GYPSUM WALL
F RATING = 1-HR.
T RATING = 0-HR.

FRONT VIEW




SECTION A-A




1. 1-HR. FIRE-RATED GYPSUM WALL ASSEMBLY.
2. 10" DIA. (OR SMALLER) STEEL PIPE, 4" DIA. (OR SMALLER) COPPER PIPE, EMT OR CONDUIT.
3. MIN. 5/8" DEPTH HILTI FS 601.

NOTE: NOMINAL ANNULAR SPACE OF 1/4" TO 1" REQUIRED

SEE HILTI FIRESTOP INSTALLATION MANUAL FOR ADDITIONAL INSTRUCTIONS
HILTI, INC. TULSA, OK 1-800-879-8000

P1.01

# 1-HR GYPSUM WALL U.L. DETAIL

SCALE: NONE

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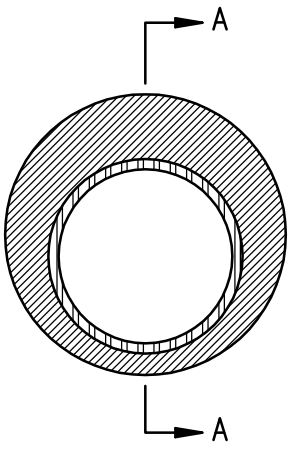
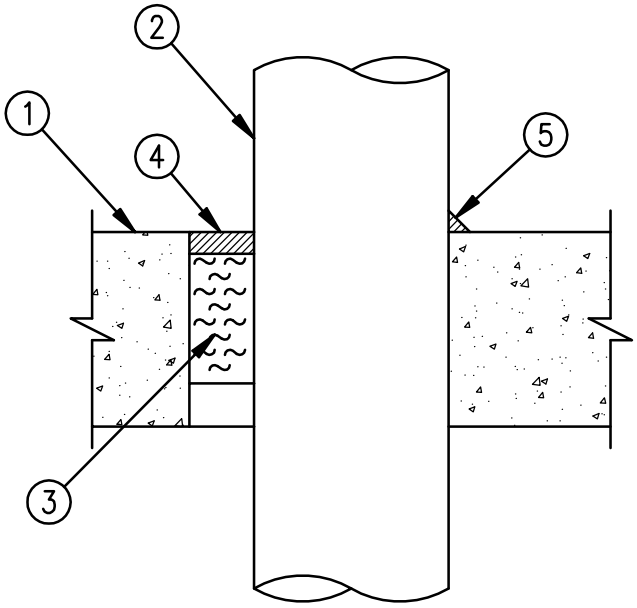
U.L. SYSTEM NO. CAJ1149
METAL PIPE THROUGH CONCRETE FLOOR/WALL OR BLOCK WALL
F RATING = 2-HR.
T RATING = 0-HR.

TOP VIEW




SECTION A-A




1. A. MIN. 4-1/2" THICK CONCRETE FLOOR.
   B. MIN. 4-1/2" THICK CONCRETE WALL.
   C. ANY U.L. CLASSIFIED CONCRETE BLOCK WALL.
2. 4" DIA. (OR SMALLER) STEEL PIPE, COPPER PIPE, EMT, OR CONDUIT.
3. MIN. 3" THICK MINERAL WOOL (MIN. 4 PCF DENSITY) TIGHTLY PACKED.
4. MIN. 1/2" DEPTH HILTI FS 601 FIRESTOP SEALANT.
5. 1/2" BEAD HILTI FS 601 FIRESTOP SEALANT.

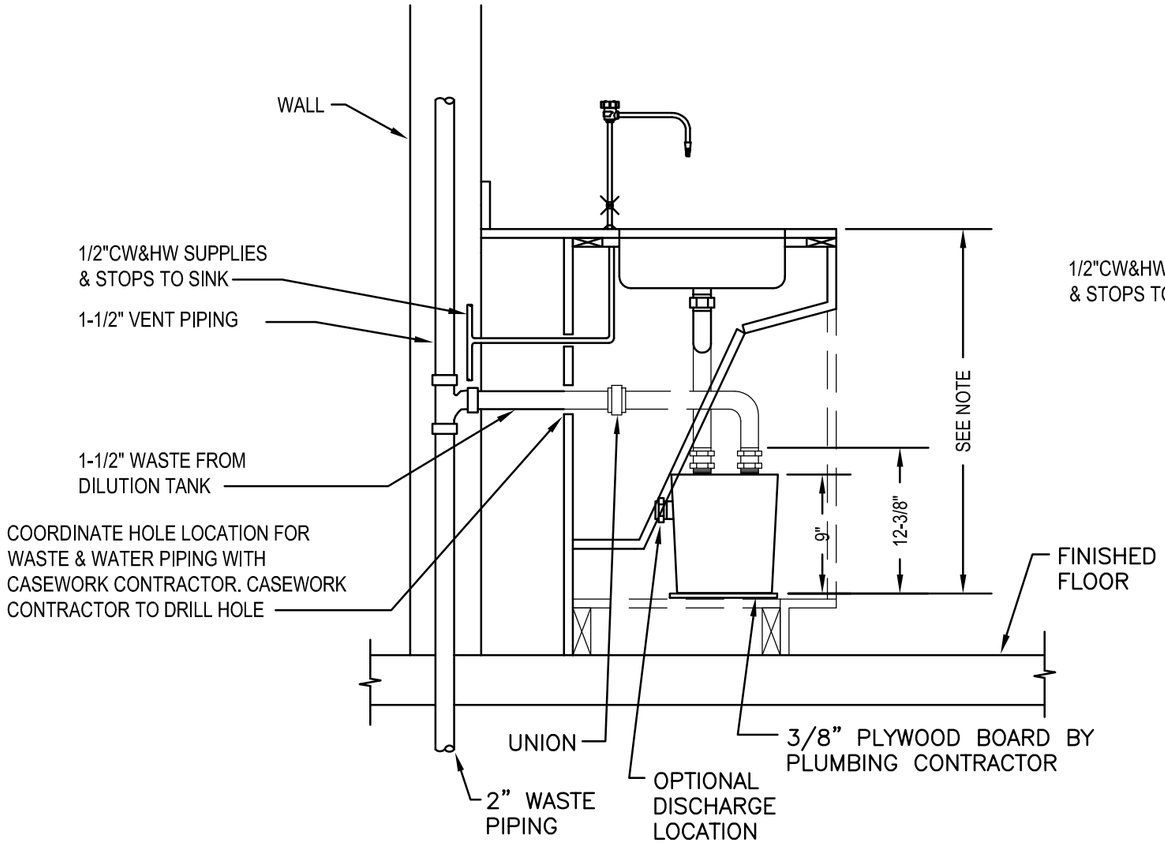
NOTE:
1. MAXIMUM DIAMETER OF OPENING = 6".
2. ANNULAR SPACE = MIN. 0" (POINT CONTACT), MAX. 2".
3. WALLS REQUIRE 1/2" OF SEALANT FLUSH WITH BOTH SIDES.

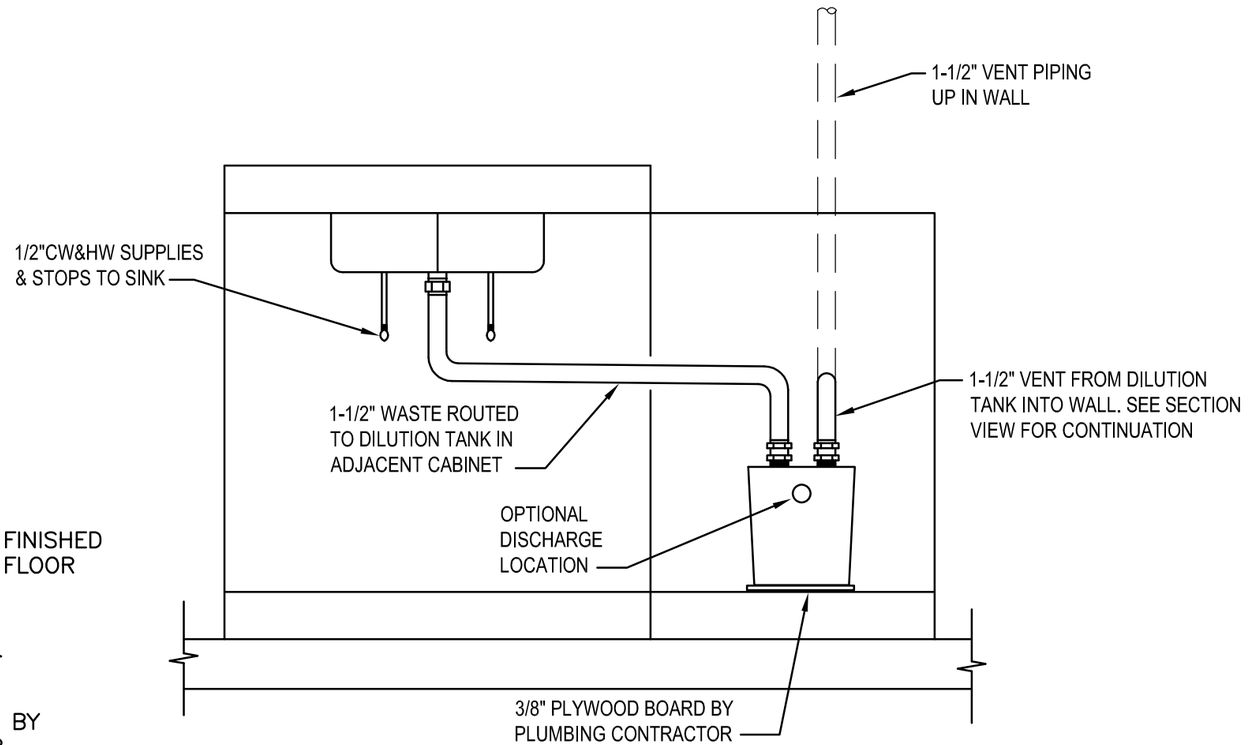
SEE HILTI FIRESTOP INSTALLATION MANUAL FOR ADDITIONAL INSTRUCTIONS
HILTI, INC. TULSA, OK 1-800-879-8000

# P1.02

## 2-HR CONCRETE WALL/FLR/ BLOCK WALL U.L. DETAIL

SCALE: NONE




# P1.03 ACID DILUTION TRAP INSTALLATION DETAIL

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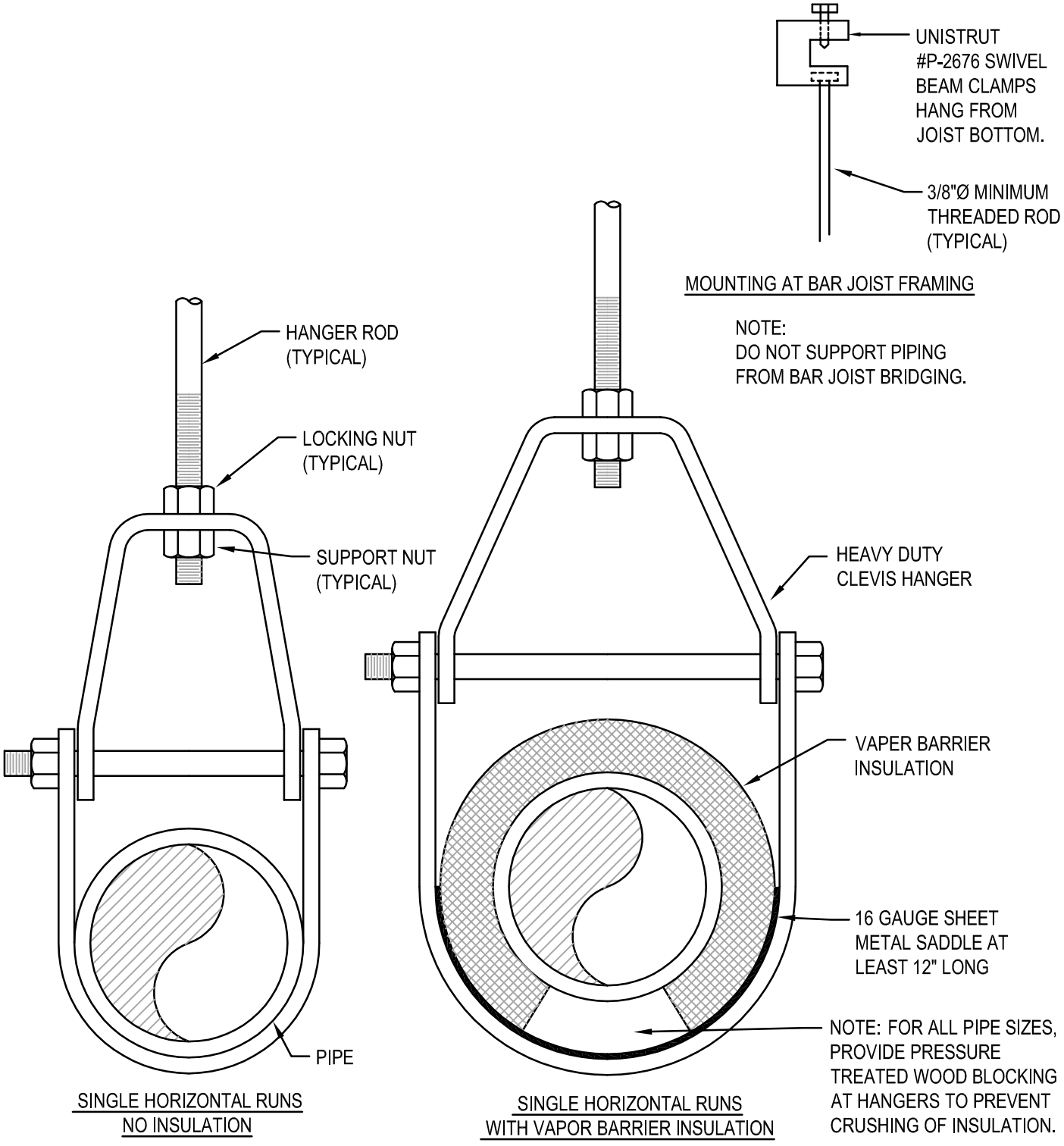


# P1.04 CLEVIS HANGER SUPPORT DETAIL

SCALE: NONE

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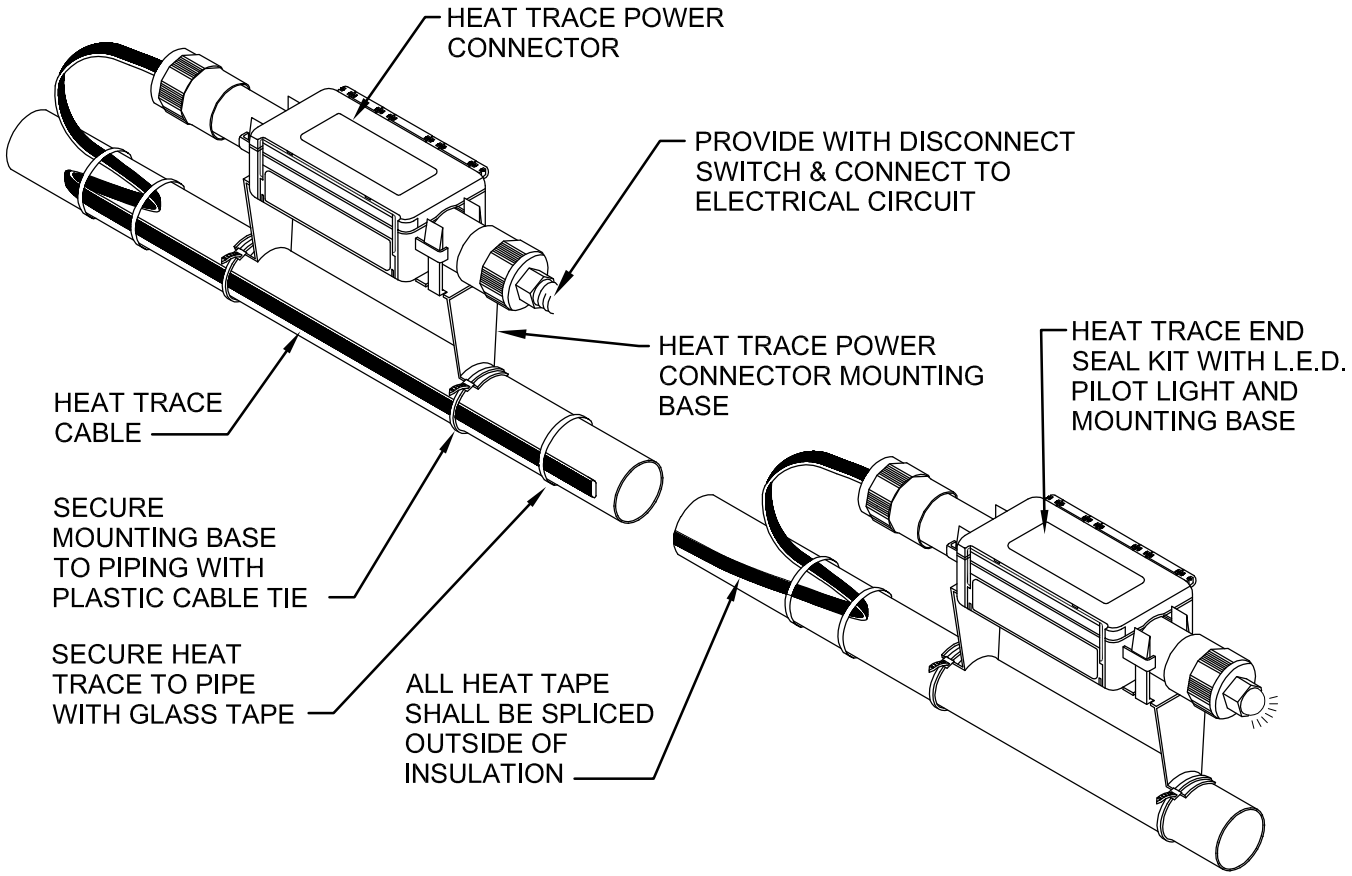
HEAT TRACE SPECIFICATION:

HEAT-TRACING CABLES: 5 W/FT OUTPUT. SELF-REGULATING, ELECTRIC HEATING CABLES SUITABLE FOR FREEZE PROTECTION OF METAL PIPING. CABLES: PAIR OF PARALLEL NO. 16 AWG TINNED-COPPER BUS WIRES EMBEDDED IN CROSS-LINKED CONDUCTIVE POLYMER CORE, WHICH VARIES POWER OUTPUT IN RESPONSE TO TEMPERATURE ALONG ITS LENGTH. CABLE SHALL BE CAPABLE OF CROSSING OVER ITSELF WITHOUT OVERHEATING. HEAT OUTPUT: AT LEAST 90 PERCENT OF RATING OVER A TEMPERATURE RANGE FROM 40 TO 150 DEG F PIPE TEMPERATURE. CABLE COVER: FABRICATED OF CROSS-LINKED, MODIFIED, POLYOLEFIN DIELECTRIC JACKET; WITH ULTRAVIOLET INHIBITOR. PIPE THERMOSTAT: UNIT WITH ADJUSTABLE TEMPERATURE RANGE FROM 35 TO 50 DEG F SNAP ACTION; OPEN-ON-RISE, SINGLE-POLE SWITCH WITH 25-A RATING; AND REMOTE BULB FOR DIRECTLY SENSING PIPE-WALL TEMPERATURE.




# P1.05 HEAT TRACE CABLE INSTALLATION DETAIL

SCALE: NONE

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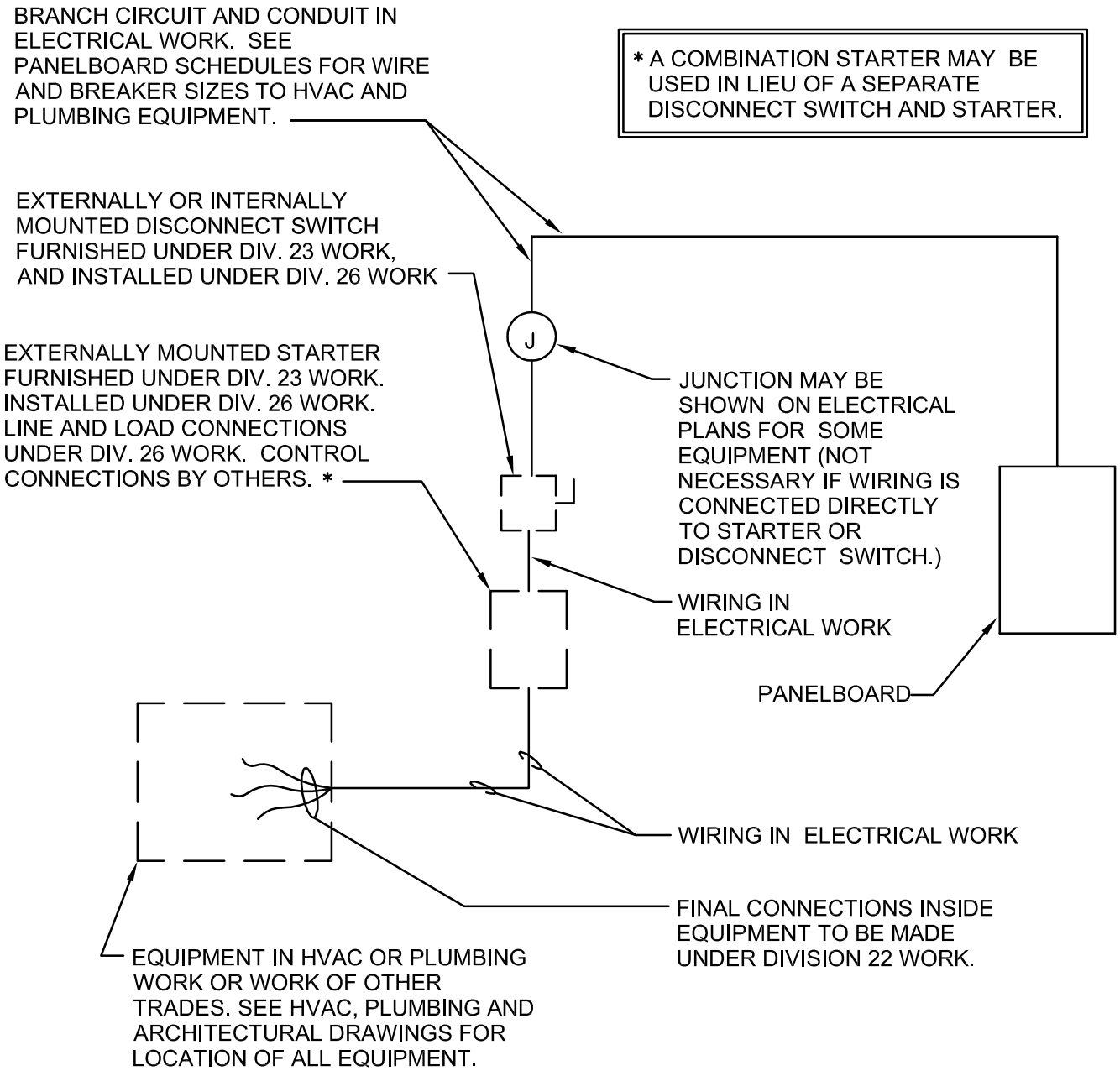


# P1.06

## PLUMBING EQUIPMENT ELECTRICAL CONNECTION DETAIL

SCALE: NONE

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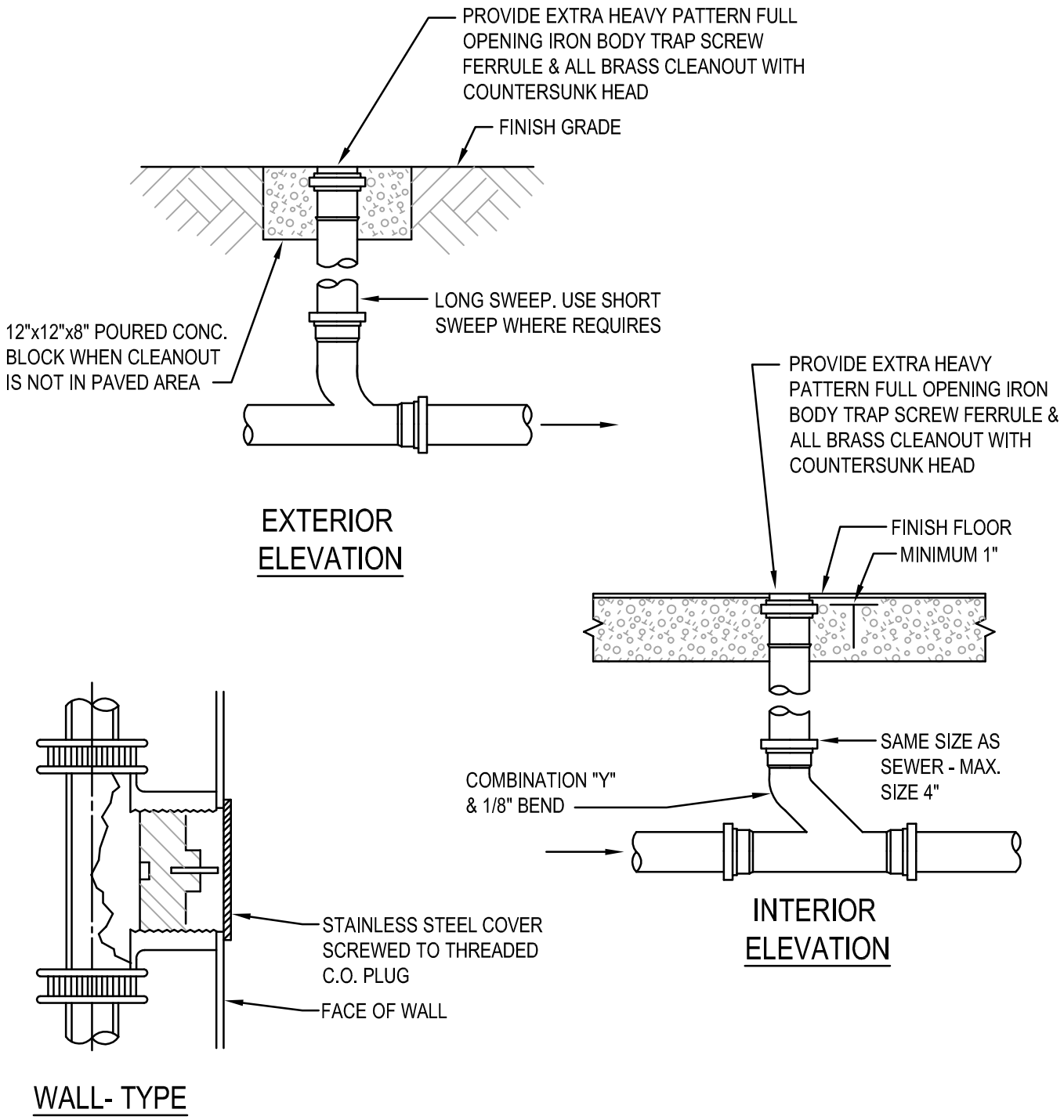


# P1.07 TYPICAL CLEANOUT DETAIL

SCALE: NONE

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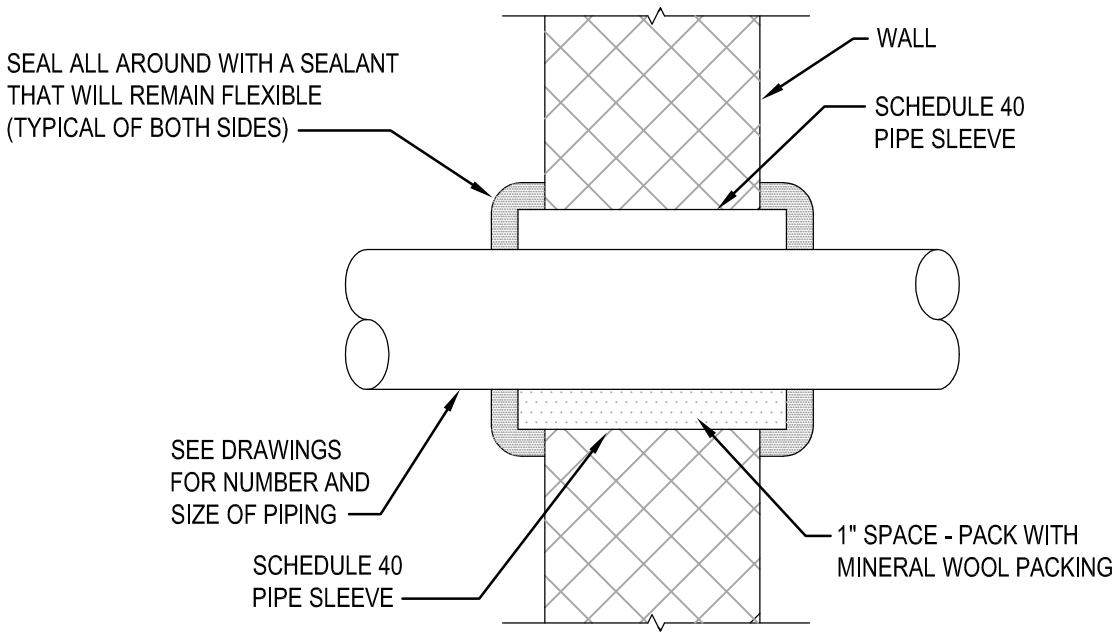


NOTES:

1. THE VOID BETWEEN FIBROUS PACKING AND SLEEVE SHALL BE FILLED WITH CAULKING MATERIAL.
2. SEE FLOOR PLANS FOR LOCATION OF ALL RATED WALLS.
3. CHROME ESCUTCHEONS TO BE PROVIDED FOR ALL EXPOSED PENETRATIONS.

# P1.08

## TYPICAL NON-RATED WALL PIPING SLEEVE DETAIL

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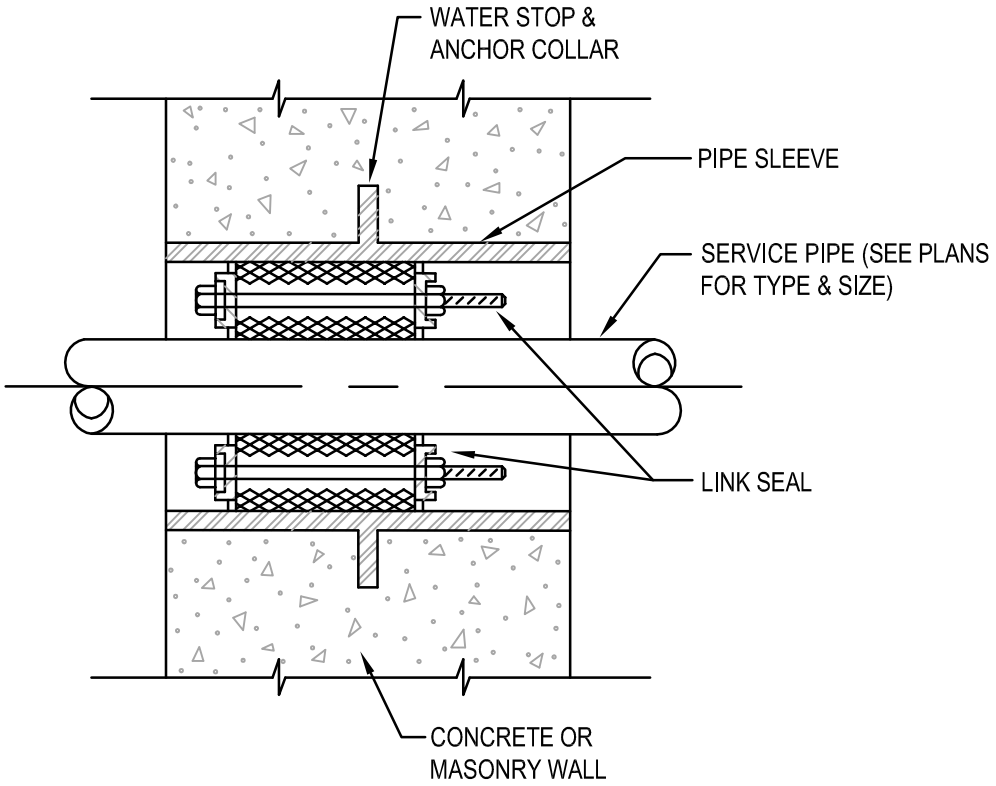


# P1.09 TYPICAL UNDERGROUND PIPING SLEEVE DETAIL

SCALE: NONE

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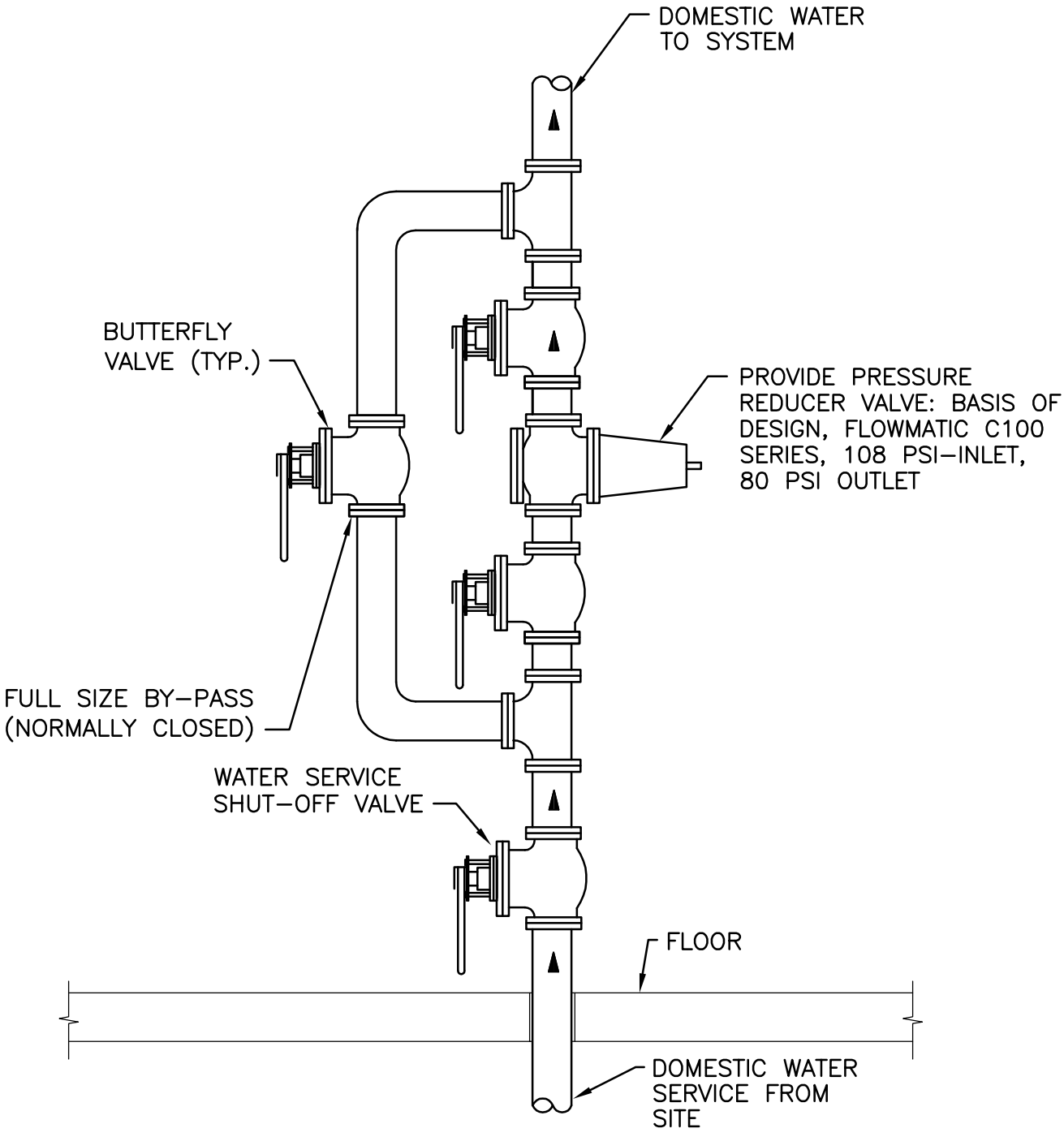


NOTES:
MIN. CLEARANCE ON EITHER SIDE OF PRV SHALL BE 18".
MIN . CLEARANCE IN FRONT SHALL BE 36"

# P1.10

## TYPICAL DOMESTIC WATER RISER DETAIL

SCALE: NONE

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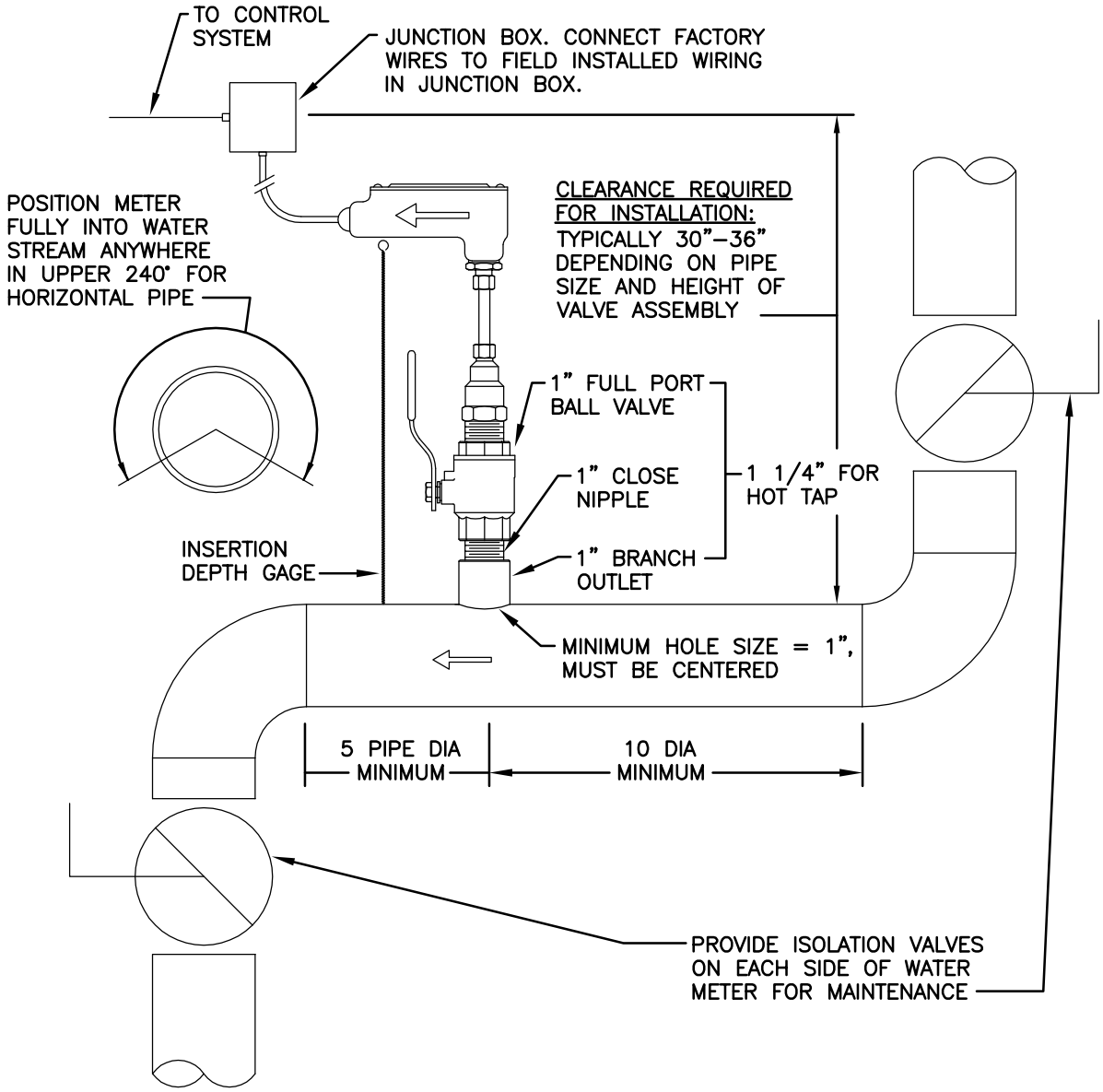


NOTE:

1. INSTALLATION KITS VARY BASED ON PIPE MATERIAL AND APPLICATION. FOR INSTALLATIONS IN PRESSURIZED SYSTEMS, USE "HOT TAP" 1 1/4" INSTALLATION KIT AND DRILL HOLE USING A 1" WET TAP DRILL.
2. METER IS ACCEPTABLE TO INSTALL IN VERTICAL PIPE
3. WATER METER SHALL BE ONICON, INC. MODEL F–1210, OR EQUAL. METER SHALL BE FURNISHED BY CONTROLS CONTRACTOR AND INSTALLED BY PLUMBING CONTRACTOR.
4. WATER METER SHALL BE INSTALLED IN AN ACCESSIBLE FASHION. CONTRACTOR SHALL MEET WITH ENGINEER AND INDICATE INSTALLATION LOCATION, PRIOR TO INSTALLING.

# P1.11

## TYPICAL BAS WATER METER INSTALLATION DETAIL

SCALE: NONE

# DDC FUNCTION BLOCK LOGIC SYMBOLS

| SYMBOL | DESCRIPTION |
|---|---|
| POINT NAME AO ADDRESS | OUTPUT POINT – TRANSMITS A VALUE FROM THE FB TO A PHYSICAL OUTPUT CHANNEL ON THE CONTROLLER.<br>DESCRIPTOR – CONTROLLER ADDRESS, POINTNAME AND POINT TYPE<br>AO – ANALOG OUTPUT<br>DO – DIGITAL OUTPUT |
| ADDRESS AI POINT NAME | INPUT POINT – READS A VALUE FROM A PHYSICAL INPUT ON THE CONTROLLER AND CONVERTS FOR USE INSIDE THE FB.<br>DESCRIPTOR – CONTROLLER ADDRESS, POINTNAME AND POINT TYPE<br>AI – ANALOG INPUT<br>DI – DIGITAL INPUT |
| POINT–NAME VP | VIRTUAL POINT – ANALOG OR DIGITAL VALUE USED WITHIN A FB OR BROADCAST ACROSS THE LAN. |
| | DIGITAL WIRE – DIGITAL LOGIC CONNECTION BETWEEN FB'S |
| | ANALOG WIRE – ANALOG LOGIC CONNECTION BETWEEN FB'S |
| CONST | CONSTANT – CONSTANT VALUE INPUTS |
| G VALUE DISPLAYED & EDITABLE ON GRAPHIC PAGE<br>G VALUE DISPLAYED ON GRAPHIC PAGE<br>A# | GRAPHIC INTERFACE – VALUE APPEARS ON GRAPHIC SCREEN. WHEN BLOCK PRECEEDS (IS TO THE LEFT OF) A CONSTANT BLOCK OR VERTUAL POINT BLOCK, THE VALUE SHALL BE EDITABLE FROM THE GRAPHIC SCREEN.<br>ALARM & PRIORITY – TRANSMITS AN ALARM AND ALARM PRIORITY TO THE ENTERPRISE BUILDING MANAGEMENT SYSTEM (EBMS). |
| M# | MESSAGE AND NUMBER – TRANSMITS A MESSAGE AND MESSAGE NUMBER TO THE ENTERPRISE BUILDING MANAGEMENT SYSTEM (EBMS). |
| | TREND – ESTABLISHES TREND IN CONTROLLER. |
| RTM | RUN TIME MONITOR – ACCUMULATES RUNTIME FOR DIGITAL OUTPUT AND CONVERTS TIME TO HOURS. |
| REF# | REFERENCE FLAG – USED AS CONNECTION TO FB'S BY REFERENCE INSTEAD OF WIRES. |
| AND | DIGITAL AND GATE– OUTPUT IS ON IF ALL INPUTS ARE TRUE |
| OR | DIGITAL OR GATE – OUTPUT IS ON IF ANY INPUT IS TRUE. |
| XOR | DIGITAL EXCLUSIVE OR GATE – OUTPUT IS ON IF ONLY ONE INPUT IS TRUE. |
| N | INVERSE (NOT)– IF INPUT = ON, OUTPUT = OFF;<br>CONVERSELY IF INPUT =OFF, OUTPUT =ON |
| RST LATCHO | LATCH OFF– OUTPUT IS OFF WHENEVER INPUT IS ON. OUTPUT REMAINS OFF UNTIL RESET CHANGES FROM OFF TO ON. |
| SET LATCHT | LATCH ON– OUTPUT IS ON WHENEVER INPUT IS ON. OUTPUT REMAINS ON UNTIL RESET CHANGES FROM OFF TO ON. |
| ON/OFF DELAY | ON/OFF DELAY TIMER– AFTER INPUT IS ON, OUTPUT IS ON/OFF AFTER A PREDETERMINED TIME (#) HAS ELAPSED. |
| CYCLE DELAY | CYCLE DELAY TIMER – WHEN SET TIME HAS ELAPSED, THE FIRST TIME INPUT IS ON, OUTPUT IS ON AND TIMER RESETS. BEFORE SET TIME HAS ELAPSED, OUTPUT IS OFF WHEN INPUT IS OFF. IF INPUT GOES FROM OFF TO ON BEFORE SET TIME HAS ELAPSED, OUTPUT WILL REMAIN OFF. |
| PWR | POWER FLAG – ON WHEN CONTROLLER IS INITIALLY POWERED ON AND NO PHASE LOSS IS DETECTED |
| S FF O | FLIP FLOP – CHANGE STATE OF OUTPUT WHEN INPUT CHANGES FROM OFF TO ON; OUTPUT SET TO OFF WHEN RESET (R) GOES CHANGES FROM OFF TO ON |
| OPTIMUM: DB, HI, I, O, INC, LO | SETPOINT OPTIMIZATION – RESET OF OUTPUT FROM A MAXIMUM VALUE TO A MINIMUM VALUE BASED ON VALUES OR REQUESTS)<br>DB – DEAD BAND<br>INC – INCREMENT/DECREMENT VALUE<br>HI – MAXIMUM RESET VALUE<br>LO – MINIMUM RESET VALUE |
| SP, INTVL, MX, >, +IE+OA, I, S & B, O, <, –IE–OA, MN | SAMPLE & BUMP – CHANGE IN OUTPUT (WITH DEFINED MINIMUM & MAXIMUM VALUES) BY A DEFINED AMOUNT WHEN INPUT DEVIATES FROM SETPOINT (SP) BY A DEFINED AMOUNT AT A DEFINED INTERVAL.<br>I – INPUT<br>O – OUTPUT<br>MX – MAXIMUM OUTPUT<br>MN – MINIMUM OUTPUT<br>INTVL – INTERVAL<br>> +IE, +OA – WHEN INPUT RISES ABOVE SETPOINT BY AMOUNT '+IE', OUTPUT IS INCREASED BY AMOUNT '+OA'<br>< –IE, –OA – WHEN INPUT FALLS BELOW SETPOINT BY AMOUNT '–IE', OUTPUT IS REDUCED BY AMOUNT '–OA' |

| SYMBOL | DESCRIPTION |
|---|---|
| SP P I D DA O | PID CONTROLLER – PROPORTIONAL, INTEGRAL, DERIVATIVE LOOPS USE STANDARD ALGORITHMS TO CALCULATE AN OUTPUT BASED ON A VARIABLE INPUT. PROPORTIONAL IS BASED ON THE DIFFERENCE BETWEEN THE INPUT AND THE SETPOINT. INTEGRAL IS BASED ON THE THE TIME THE INPUT DEVIATES FROM THE SETPOINT. DERIVATIVE IS BASED ON THE THE RATE THE INPUT IS APPROACHING THE SETPOINT. THE PID CAN BE EITHER DIRECT ACTING (DA) OR REVERSE ACTING (RA). IN A DA PID WHEN THE INPUT INCREASES THE OUTPUT INCREASES. IN A RA PID WHEN THE INPUT INCREASES THE OUTPUT DECREASES. OPTIONALLY, AN ADDITIONAL DIGITAL TRIGGER MAY BE ASSIGNED TO THE INPUT SECTION THAT WILL ENABLE/DISABLE CALCULATION OF THE PID LOOP. |
| SP F L T DA O | FLOATING CONTROLLER – OUTPUT WILL INCREASE OR DECREASE INCREMENTALLY AS INPUT DEVIATES FROM SETPOINT.<br>IN A DA CONTROLLER WHEN THE INPUT INCREASES THE OUTPUT INCREASES. IN A RA CONTROLLER WHEN THE INPUT INCREASES THE OUTPUT DECREASES. |
| RESET 100 I 0 100 180 0 | RESET CONTROLLER – USER DEFINED OUTPUT VALUE WILL RESET IN A LINEAR RELATIONSHIP BASED ON USER DEFINED INPUT VALUE. |
| OFF SR ON | SWITCHING RELAY – SWITCHES OUTPUT BETWEEN TWO INPUTS WHEN DIGITAL PILOT INPUT IS ON. SWITCH SHOWN IN NORMAL POSITION |
| OFF DSR SP2 ON SP1 | DEADBAND SWITCHING RELAY – DIGITAL OUTPUT CHANGES WHEN INPUT VALUE RISES/FALLS ABOVE/BELOW SETPOINT 1 (SP1). DIGITAL OUTPUT RESTORES TO NORMAL WHEN INPUT RISES/FALLS ABOVE/BELOW SETPOINT 2 (SP2). SWITCH SHOWN IN NORMAL POSITION |
| I IF > SP O | LOGICAL IF EXPRESSION – THE OUTPUT IS ON IF THE INPUT MEETS THE CONDITION OF THE SETPOINT. |
| RAMP CHNG% MAX # Sec MIN 0 | RAMP CONTROLLER – LIMITS THE RATE OF CHANGE OF AN OUTPUT ON AN INCREASE IN VALUE OR A DECREASE IN VALUE.<br>CHNG% – % OF TOTAL MAXIMUM OUTPUT VALUE ALLOWED FOR OUTPUT CHANGE #<br># = TIME IN SECONDS<br>MAX = MAXIMUM OUTPUT VALUE<br>MIN = MINIMUM OUTPUT VALUE |
| TMR I # O | TIMER – OUTPUT IS ON FOR A USER SPECIFIED TIME AFTER INPUT CHANGES FROM OFF TO ON |
| ATS I O OVRD TIME | AUTOMATIC TIME SCHEDULER – INCLUDES SCHEDULES ENTERED INTO CONTROLLER FOR 7 DAY SCHEDULING WITH HOLIDAYS AND OVERRIDE SCHEDULES. INCLUDES OVERRIDE INPUT FOR UNSCHEDULED OVERRIDE. OUTPUTS REFERENCE FLAGS CAN INCLUDE : HEATING SETBACK, COOLING SETBACK, AND UNOCCUPIED |
| OS/S I O OVRD TIME | OPTIMUM START/STOP TIME SCHEDULER – INCLUDES SCHEDULES ENTERED INTO CONTROLLER FOR 7 DAY SCHEDULING WITH HOLIDAYS AND OVERRIDE SCHEDULES. INCLUDES OPTIMUM START STOP ROUTINE. OUTPUTS REFERENCE FLAGS CAN INCLUDE : WARM–UP, COOL–DOWN, HEATING SETBACK, COOLING SETBACK, AND UNOCCUPIED. INCLUDES OVERRIDE INPUT (OVR) FOR UNSCHEDULED OVERRIDE |
| I CALC O | CALCULATION BLOCK – OUTPUT IS EQUAL TO CALCULATION USING INPUT(S). EQUATION CAN BE MATHEMATICAL OR A PREDEFINED INDUSTRY STANDARD ALGORITHM (ie. CFM, VELOCITY PRESSURE, ENTHALPY, DEW POINT ETC.) |
| H I | HIGH SELECTOR – SELECTS HIGHER OF INPUT VALUES |
| L O | LOW SELECTOR – SELECTS LOWER OF INPUT VALUES |
| AVE | AVERAGING BLOCK – MATHEMATICALLY AVERAGES INPUT VALUES. |
| DLY PROOF RST, MTR ALM, COM NML | PROOFING MODULE – GENERATES VALUES BASED ON A COMPARISON OF COMMAND AND MONITORING INPUTS.<br>DLY – PROOFING DELAY PERIOD<br>MTR – MONITOR (INPUT FOR PROOF)<br>COM – COMMAND (INPUT FOR PROOF)<br>RST – RESET (IF LATCHING IS USED)<br>ALM – (ON WHEN MONITOR INPUT IS NOT EQUAL TO COMMAND INPUT)<br>NML – OUTPUT IS ON WHEN MONITOR AND COMMAND INPUTS ARE ON AND NORMAL CONDITIONS ARE MET |
| | TIME AVERAGE BLOCK – OUTPUT IS EQUAL TO SUM OF INPUTS FROM USER SPECIFIED PREVIOUS TIME PERIOD (OR NUMBER OF SCANS) TO CURRENT TIME (OR SCAN) DIVIDED BY NUMBER OF DISCRETE POINTS IN THE SUMMATION PERIOD. OUTPUT IS A ROLLING TIME BASED AVERAGE OF THE INPUT VALUE. |
| REQUEST: ALG A, BLK B, CLK C, DLK D; ACK A–D | STAGER BLOCK – OUTPUT IS EQUAL TO SUM OF REQUESTS FROM USER SPECIFIED INPUTS. ROTATION SHALL BE DETERMINED BY USER DEFINED PARAMETERS. EACH INDIVIDUAL OUTPUT CAN BE LOCKED OUT BY USER DEFINED INDIVIDUAL INPUTS. LOCKED OUT OUTPUTS SHALL BE SKIPPED IN ROTATION. (SEE SEQUENCE OF OPERATION FOR DETAILS) |
| PWR, SWAP, FALA, FALB; ACK, OUTA, OUTB; LEAD/STANDBY | LEAD/STANDBY BLOCK – ON RUN COMMAND, LEAD OUTPUT IS SELECTED. LEAD OUTPUT CAN BE SWAPPED MANUALLY OR BY A TIME SCHEDULE. WHEN THE LEAD EQUIPMENT FAILS, THE STANDBY OUTPUT IS SELECTED. (SEE SEQUENCE OF OPERATION FOR DETAILS) |

| LEGEND | |
|---|---|
| TUBING DESIGNATIONS | |
| —— – —— | TUBING |
| WIRING DESIGNATIONS | |
| — · — · — | WIRING |

# CONTROL SYMBOLS

| SYMBOL | DESCRIPTION | SYMBOL | DESCRIPTION |
|---|---|---|---|
| AI POINT NAME<br>POINT NAME AO | DDC POINT DESCRIPTOR WITH NAME<br>AI – ANALOG INPUT<br>DI – DIGITAL INPUT<br>AO – ANALOG OUTPUT<br>DO – DIGITAL OUTPUT | | DISCONNECT SWITCH |
| TS1 | TEMPERATURE SENSOR WITH AVERAGING ELEMENT | 480V 120V | CONTROL TRANSFORMER |
| TS1 | TEMPERATURE SENSOR WITH SINGLE POINT ELEMENT | M SP S | RELAY COILS |
| TS1 | TEMPERATURE SENSOR WITH PIPE WELL | | FUSE |
| TS1 | SPACE TEMPERATURE SENSOR | OL | THERMAL OVERLOAD |
| HS1 | HUMIDITY SENSOR | | NORMALLY OPEN AND NORMALLY CLOSED CONTACTS |
| | CURRENT SENSOR | HAND AUTO OFF | HAND–OFF–AUTO SELECTOR SWITCH |
| SD1 | SMOKE DETECTOR | | WIRING DESIGNATION. (NO. OF HATCHES INDICATES NO. OF CONDUCTORS) |
| DPS2 | DIFFERENTIAL PRESSURE SWITCH | | WIRING CONNECTION |
| FS1 | WATER FLOW SWITCH | ON–OFF | ON–OFF SELECTOR SWITCH |
| V1 N.C. | TWO WAY CONTROL VALVE | V2 C. N.C. N.O. | THREE WAY CONTROL VALVE |
| | DAMPER ACTUATOR | LS1 | LIMIT SWITCH |
| DPT1 0–5" w.c. | AIR DIFFERENTIAL PRESSURE TRANSMITTER (0 – 5" RANGE) | D–1 | CONTROL DAMPER |
| VSD | VARIABLE SPEED DRIVE | DP | HYDRONIC DIFFERENTIAL PRESSURE TRANSMITTER |
| FZ1 | FREEZESTAT | FM1 | HYDRONIC FLOWMETER |
| AFMS1 | AIRFLOW MEASURING STATION | TS1 | THERMOSTAT |
| AFMS1 | FAN INLET AIRFLOW MEASURING STATION | | |

# ABBREVIATIONS

| | | | |
|---|---|---|---|
| ALM | ALARM | NC | NORMALLY CLOSED |
| AH | AIR HANDLER | NO | NORMALLY OPEN |
| BLDG | BUILDING | OA | OUTSIDE AIR |
| C | COMMON | OVRD | OVERRIDE |
| CL | COOL | RA | RETURN AIR |
| CHPS | CHILLED WATER PUMP, SECONDARY | REQ | REQUEST |
| CHWP | CHILLED WATER PUMP | RF | RETURN FAN |
| CHWR | CHILLED WATER RETURN | RLF | RELIEF FAN |
| CHWS | CHILLED WATER SUPPLY | S/S | START / STOP |
| COV | CHANGE OF VALUE | SA | SUPPLY AIR |
| CW | CONDENSER WATER | SD | SMOKE DETECTOR |
| CWP | CONDENSER WATER PUMP | SEC | SECONDARY OR SECONDS |
| CWR | CONDENSER WATER RETURN | SF | SUPPLY FAN |
| CWS | CONDENSER WATER SUPPLY | SCHWR | SECONDARY CHILLED WATER RETURN |
| DD | DOWN–DUCT | SCHWS | SECONDARY CHILLED WATER SUPPLY |
| DP | DIFFERENTIAL PRESSURE | SHWR | SECONDARY HOT WATER RETURN |
| EF | EXHAUST FAN | SHWS | SECONDARY HOT WATER SUPPLY |
| FBK | FEEDBACK | T | TEMPERATURE |
| FC | FAN COIL | TB | TERMINAL BOX |
| HOA | HAND – OFF – AUTOMATIC | TW | TEMPERED WATER |
| HT | HEAT | TWP | TEMPERED WATER PUMP |
| HWP | HOT WATER PUMP | TWR | TEMPERED WATER RETURN |
| HWPS | HOT WATER PUMP, SECONDARY | TWS | TEMPERED WATER SUPPLY |
| HWR | HOT WATER RETURN | VP | VELOCITY PRESSURE |
| HWS | HOT WATER SUPPLY | VSD | VARIABLE SPEED DRIVE |
| ISO | ISOLATION | | |
| MA | MIXED AIR | | |



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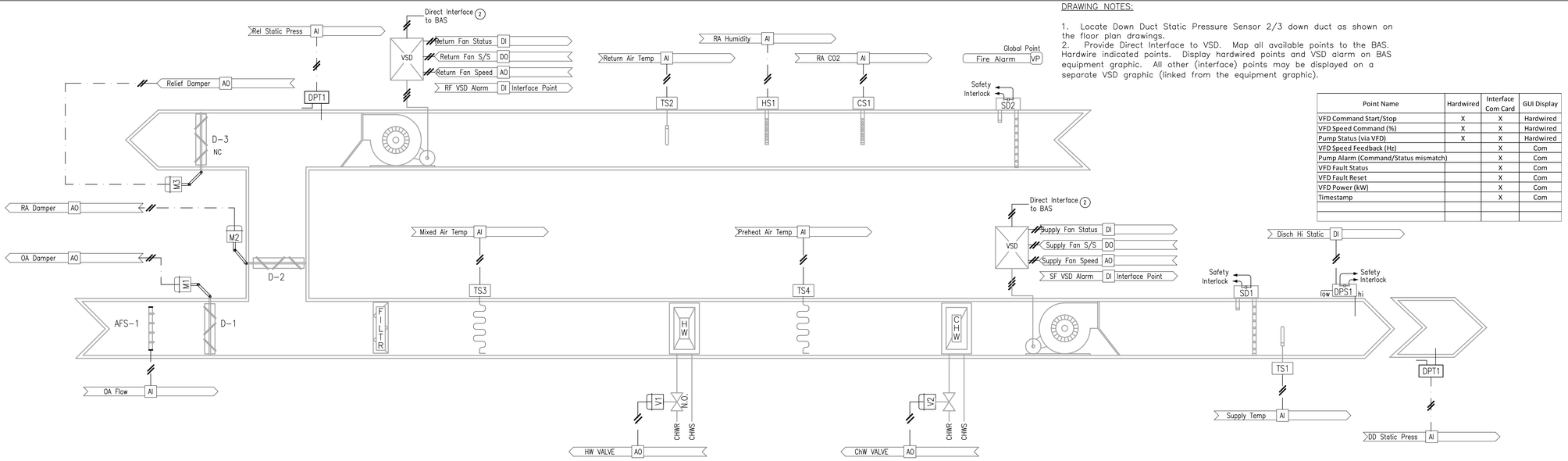


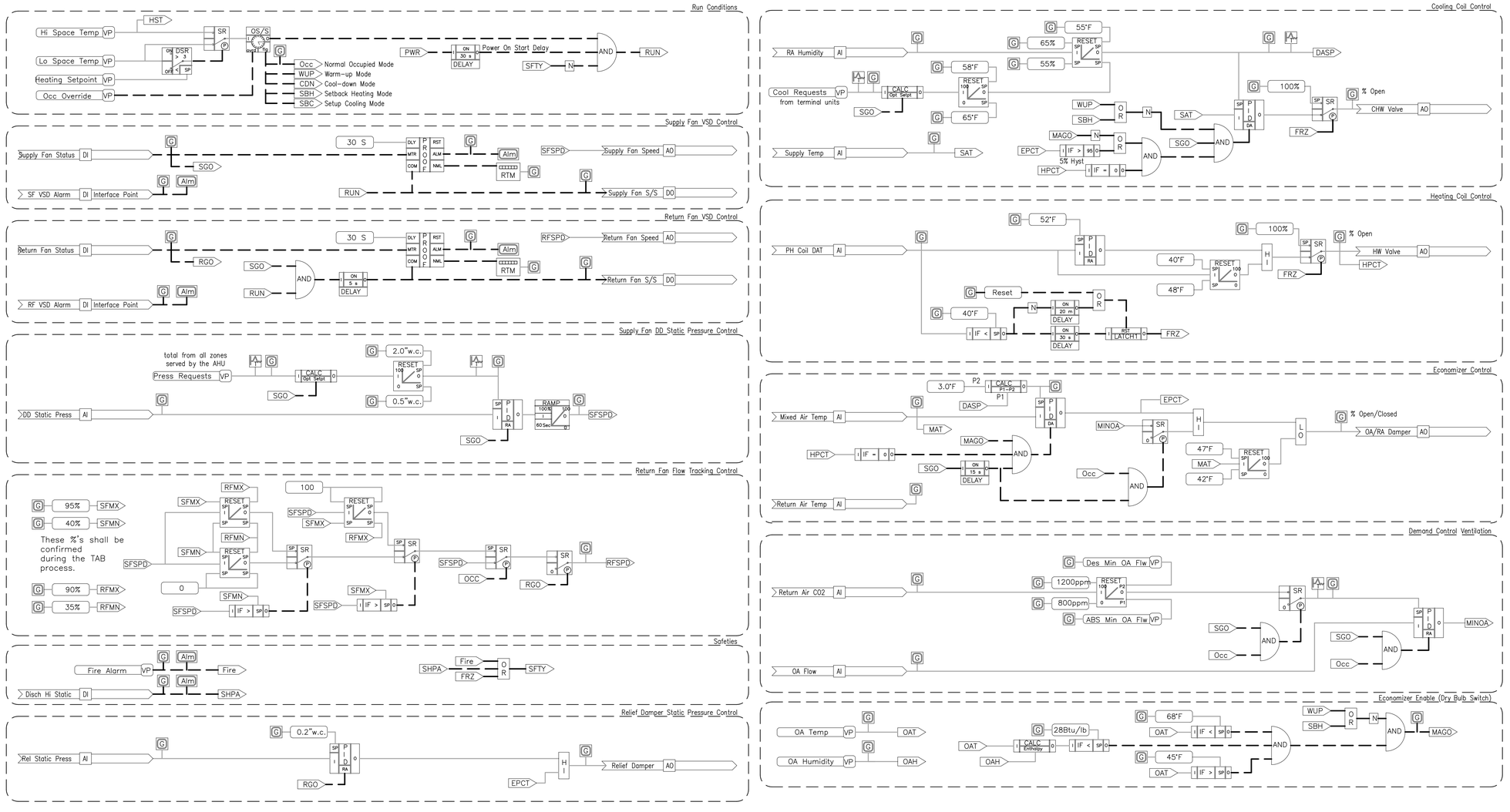

DRAWING NOTES:

1. Locate Down Duct Static Pressure Sensor 2/3 down duct as shown on the floor plan drawings.
2. Provide Direct Interface to VSD. Map all available points to the BAS. Hardwire indicated points. Display hardwired points and VSD alarm on BAS equipment graphic. All other (interface) points may be displayed on a separate VSD graphic (linked from the equipment graphic).

| Point Name | Hardwired | Interface Com Card | GUI Display |
|---|---|---|---|
| VFD Command Start/Stop | X | X | Hardwired |
| VFD Speed Command (%) | X | X | Hardwired |
| Pump Status (via VFD) | X | X | Hardwired |
| VFD Speed Feedback (Hz) | | X | Com |
| Pump Alarm (Command/Status mismatch) | | X | Com |
| VFD Fault Status | | X | Com |
| VFD Fault Reset | | X | Com |
| VFD Power (kW) | | X | Com |
| Timestamp | | X | Com |
| | | | |
| | | | |

## POINTS LIST

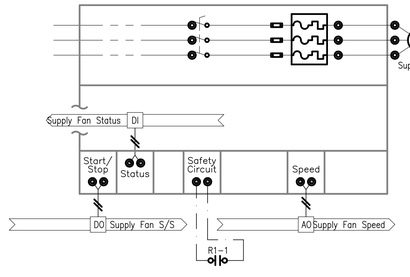
| POINT DESCRIPTOR | POINT TYPE DI | AI | DO | AO | VP | TREND | ALARM | ALARM CONDITION | REMARKS |
|---|---|---|---|---|---|---|---|---|---|
| Supply Fan S/S | | | • | | | COV | | | |
| Supply Fan Status | • | | | | | COV | | | |
| SF VSD Alarm | • | | | | | COV | • | NOT EQUAL TO COMMAND | Interface Point |
| Supply Fan Speed | | | | • | | COV | | | |
| Return Fan S/S | | | • | | | COV | | | |
| Return Fan Status | • | | | | | COV | | | |
| RF VSD Alarm | • | | | | | COV | • | NOT EQUAL TO COMMAND | Interface Point |
| Return Fan Speed | | | | • | | COV | | | |
| DD Static Press | | • | | | | 15 MIN | | | |
| Supply Temp | | • | | | | 15 MIN | | | |
| Fire Alarm | | | | | • | COV | | | Global Point |
| Disch Hi Static | • | | | | | COV | • | ABOVE HIGH LIMIT SETPOINT | |
| PH Coil DAT | | • | | | | 15 MIN | | | |
| Mixed Air Temp | | • | | | | 15 MIN | • | BELOW FREEZESTAT SETPOINT | |
| Return Air Temp | | • | | | | 15 MIN | | | |
| RA Humidity | | • | | | | 15 MIN | | | |
| RA CO2 | | • | | | | 15 MIN | • | ABOVE MAX SETPOINT | |
| CHW Valve | | | | • | | COV | | | |
| HW Valve | | | | • | | COV | | | |
| Rel Static Press | | • | | | | 15 MIN | | | |
| Relief Damper | | | | • | | COV | | | |
| OA/RA Damper | | | | • | | COV | | | |
| OA Flow | | • | | | | 15 MIN | | | |



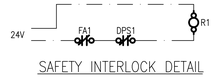

## LOGIC VARIABLES

| BINARY | ANALOG | DESCRIPTION |
|---|---|---|
| Occ | | ON WHEN OCCUPIED MODE ACTIVE |
| RUN | | ON WHEN UNIT COMMANDED TO START |
| SGO | | ON WHEN SUPPLY FAN ENERGIZED AND STATUS PROVEN |
| RGO | | ON WHEN RETURN FAN ENERGIZED AND STATUS PROVEN |
| MAGO | | ON WHEN CONDITIONS ALLOW ECONOMIZER CONTROL |
| SHPA | | ON WHEN THE SUPPLY HI PRESSURE ALARM IS ACTIVE |
| FRZ | | ON WHEN A FREEZE CONDITION IS ACTIVE AND IN ALARM |
| Fire | | ON WHEN FIRE ALARM IS ACTIVE |
| SFTY | | ON WHEN A UNIT SHUTDOWN ALARM IS ON |
| | | |
| | HST | VARIABLE CALCULATED VALUE OF HIGHEST SPACE TEMPERATURE |
| | OAT | VARIABLE VALUE OF OUTSIDE AIR TEMPERATURE |
| | SAT | VARIABLE VALUE OF SUPPLY AIR TEMPERATURE |
| | PHT | VARIABLE VALUE OF PREHEAT AIR TEMPERATURE |
| | MAT | VARIABLE VALUE OF MIXED AIR TEMPERATURE |
| | MINOA | VARIABLE VALUE OF MIN OA DAMPER POSITION (BASED ON OA FLOW PID OUT) |
| | DASP | VARIABLE CALCULATED VALUE OF DISCHARGE TEMPERATURE SETPOINT |
| | HPCT | VARIABLE CALCULATED VALUE OF HW VALVE POSITION |
| | EPCT | VARIABLE CALCULATED VALUE OF ECONOMIZER PID OUTPUT |
| | SFSPD | VARIABLE CALCULATED VALUE OF SUPPLY FAN SPEED OUTPUT |
| | SFMIN | SPEED THE SUPPLY FAN RUNS WHEN ALL TUs AT MIN (DETERMINED BY TAB) |
| | SFMAX | SPEED THE SUPPLY FAN RUNS WHEN ALL TUs AT MAX (DETERMINED BY TAB) |
| | RFMIN | SPEED THE RETURN FAN RUNS WHEN ALL TUs AT MIN (DETERMINED BY TAB) |
| | RFMAX | SPEED THE RETURN FAN RUNS WHEN ALL TUs AT MAX (DETERMINED BY TAB) |
| | RFSPD | VARIABLE CALCULATED VALUE OF RETURN FAN SPEED OUTPUT |
| | | |

## ELECTRIC LADDER DIAGRAMS

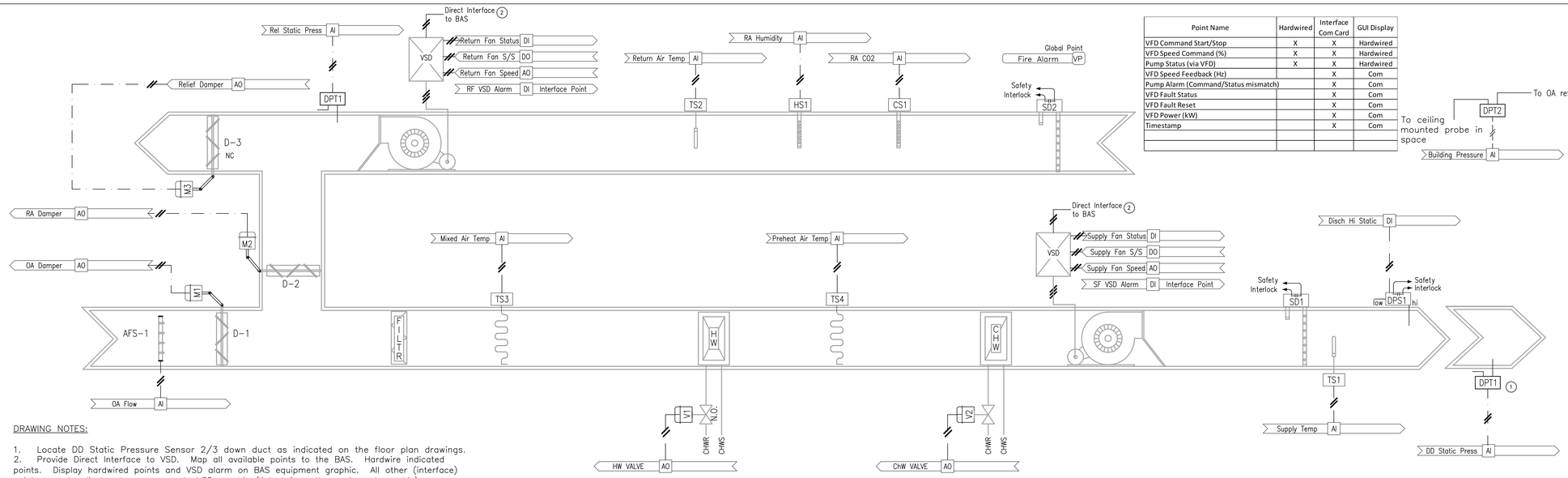



SUPPLY FAN VSD (TYPICAL FOR RETURN FAN VSD)




SAFETY INTERLOCK DETAIL

WAKE COUNTY PUBLIC SCHOOL SYSTEM
1429 Rock Quarry Road, Suite 116
Raleigh, NC 27610
(919) 588-3608



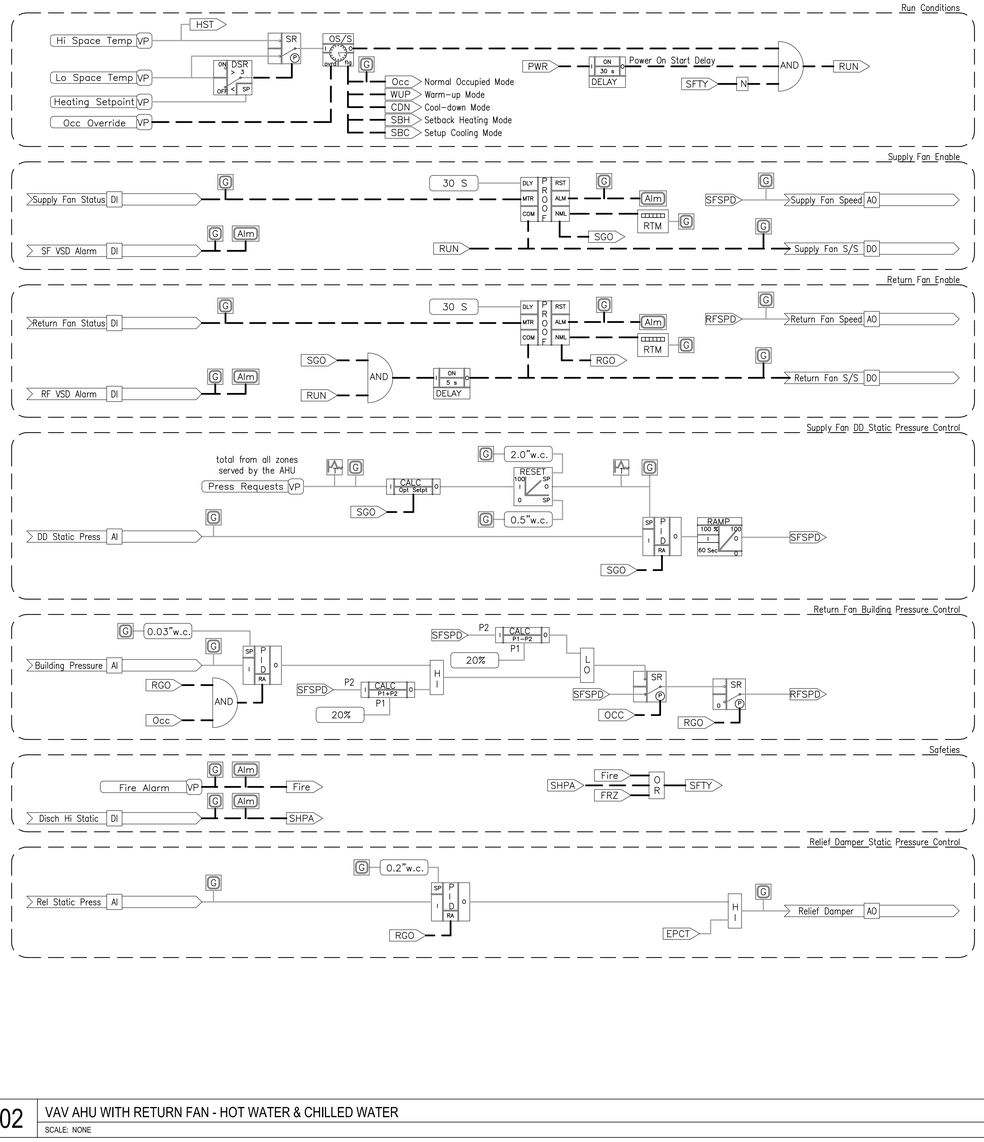

| Point Name | Hardwired | Interface Com Card | GUI Display |
|---|---|---|---|
| VFD Command Start/Stop | X | X | Hardwired |
| VFD Speed Command (%) | X | X | Hardwired |
| Pump Status (via VFD) | X | X | Hardwired |
| VFD Speed Feedback (Hz) | | X | Com |
| Pump Alarm (Command/Status mismatch) | | X | Com |
| VFD Fault Status | | X | Com |
| VFD Fault Reset | | X | Com |
| VFD Power (kW) | | X | Com |
| Timestamp | | X | Com |
| | | | |
| | | | |

DRAWING NOTES:

1. Locate DD Static Pressure Sensor 2/3 down duct as indicated on the floor plan drawings.
2. Provide Direct Interface to VSD. Map all available points to the BAS. Hardwire indicated points. Display hardwired points and VSD alarm on BAS equipment graphic. All other (interface) points may be displayed on a separate VSD graphic (linked from the equipment graphic).

## POINTS LIST

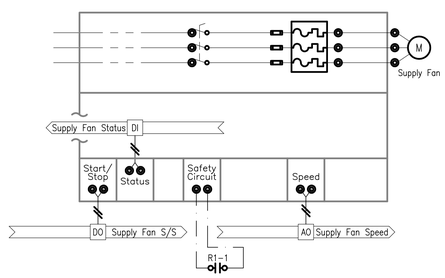
| POINT DESCRIPTOR | POINT TYPE DI | AI | DO | AO | VP | TREND | ALARM | ALARM CONDITION | REMARKS |
|---|---|---|---|---|---|---|---|---|---|
| Supply Fan S/S | | | • | | | COV | | | |
| Supply Fan Status | • | | | | | COV | | | |
| SF VSD Alarm | • | | | | | COV | • | NOT EQUAL TO COMMAND | Interface Point |
| Supply Fan Speed | | | | • | | COV | | | |
| Return Fan S/S | | | • | | | COV | | | |
| Return Fan Status | • | | | | | COV | | | |
| RF VSD Alarm | • | | | | | COV | • | NOT EQUAL TO COMMAND | Interface Point |
| Return Fan Speed | | | | • | | COV | | | |
| DD Static Press | | • | | | | 15 MIN | | | |
| Supply Temp | | • | | | | 15 MIN | | | |
| Fire Alarm | | | | | • | COV | | | Global Point |
| Disch Hi Static | • | | | | | COV | • | ABOVE HIGH LIMIT SETPOINT | |
| PH Coil DAT | | • | | | | 15 MIN | | | |
| Mixed Air Temp | | • | | | | 15 MIN | • | BELOW FREEZESTAT SETPOINT | |
| Return Air Temp | | • | | | | 15 MIN | | | |
| RA Humidity | | • | | | | 15 MIN | | | |
| RA CO2 | | • | | | | 15 MIN | • | ABOVE MAX SETPOINT | |
| CHW Valve | | | | • | | COV | | | |
| HW Valve | | | | • | | COV | | | |
| Rel Static Press | | • | | | | 15 MIN | | | |
| Relief Damper | | | | • | | COV | | | |
| OA/RA Damper | | | | • | | COV | | | |
| OA Flow | | • | | | | 15 MIN | | | |
| Building Pressure | | • | | | | 15 MIN | | | |



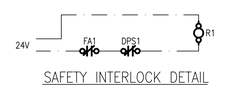

## LOGIC VARIABLES

| BINARY | ANALOG | DESCRIPTION |
|---|---|---|
| Occ | | ON WHEN OCCUPIED MODE ACTIVE |
| RUN | | ON WHEN UNIT COMMANDED TO START |
| SGO | | ON WHEN SUPPLY FAN ENERGIZED AND STATUS PROVEN |
| RGO | | ON WHEN RETURN FAN ENERGIZED AND STATUS PROVEN |
| MAGO | | ON WHEN CONDITIONS ALLOW ECONOMIZER CONTROL |
| SHPA | | ON WHEN THE SUPPLY HI PRESSURE ALARM IS ACTIVE |
| FRZ | | ON WHEN A FREEZE CONDITION IS ACTIVE AND IN ALARM |
| Fire | | ON WHEN FIRE ALARM IS ACTIVE |
| SFTY | | ON WHEN A UNIT SHUTDOWN ALARM IS ON |
| | | |
| | HST | VARIABLE CALCULATED VALUE OF HIGHEST SPACE TEMPERATURE |
| | OAT | VARIABLE VALUE OF OUTSIDE AIR TEMPERATURE |
| | SAT | VARIABLE VALUE OF SUPPLY AIR TEMPERATURE |
| | PHT | VARIABLE VALUE OF PREHEAT AIR TEMPERATURE |
| | MAT | VARIABLE VALUE OF MIXED AIR TEMPERATURE |
| | MINOA | VARIABLE VALUE OF MIN OA DAMPER POSITION (BASED ON OA FLOW PID OUT) |
| | DASP | VARIABLE CALCULATED VALUE OF DISCHARGE TEMPERATURE SETPOINT |
| | HPCT | VARIABLE CALCULATED VALUE OF HW VALVE POSITION |
| | EPCT | VARIABLE CALCULATED VALUE OF ECONOMIZER PID OUTPUT |
| | SFSPD | VARIABLE CALCULATED VALUE OF SUPPLY FAN SPEED OUTPUT |
| | RFSPD | VARIABLE CALCULATED VALUE OF RETURN FAN SPEED OUTPUT |

## ELECTRIC LADDER DIAGRAMS




SUPPLY FAN VSD (TYPICAL FOR RETURN FAN VSD)




SAFETY INTERLOCK DETAIL

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1429 Rock Quarry Road, Suite 116
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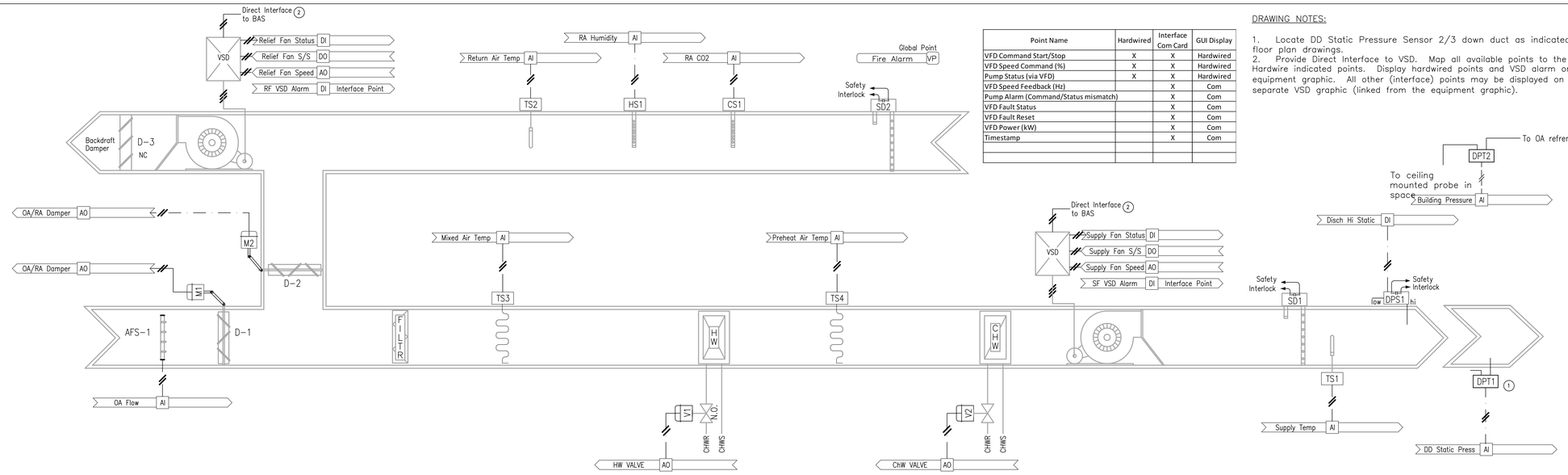
M4.02 VAV AHU WITH RETURN FAN - HOT WATER & CHILLED WATER

SCALE: NONE




| Point Name | Hardwired | Interface Com Card | GUI Display |
|---|---|---|---|
| VFD Command Start/Stop | X | X | Hardwired |
| VFD Speed Command (%) | X | X | Hardwired |
| Pump Status (via VFD) | X | X | Hardwired |
| VFD Speed Feedback (Hz) | | X | Com |
| Pump Alarm (Command/Status mismatch) | | X | Com |
| VFD Fault Status | | X | Com |
| VFD Fault Reset | | X | Com |
| VFD Power (kW) | | X | Com |
| Timestamp | | X | Com |
| | | | |
| | | | |

DRAWING NOTES:

1. Locate DD Static Pressure Sensor 2/3 down duct as indicated on the floor plan drawings.
2. Provide Direct Interface to VSD. Map all available points to the BAS. Hardwire indicated points. Display hardwired points and VSD alarm on BAS equipment graphic. All other (interface) points may be displayed on a separate VSD graphic (linked from the equipment graphic).

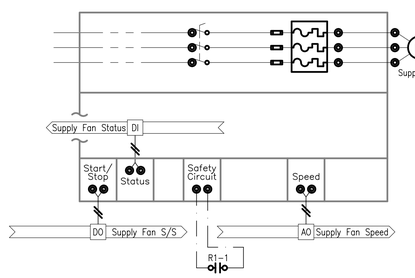
## POINTS LIST

| POINT DESCRIPTOR | POINT TYPE DI | AI | DO | AO | VP | TREND | ALARM | ALARM CONDITION | REMARKS |
|---|---|---|---|---|---|---|---|---|---|
| Supply Fan S/S | | | • | | | COV | | | |
| Supply Fan Status | • | | | | | COV | | | |
| SF VSD Alarm | • | | | | | COV | • | NOT EQUAL TO COMMAND | Interface Point |
| Supply Fan Speed | | | | • | | COV | | | |
| Return Fan S/S | | | • | | | COV | | | |
| Return Fan Status | • | | | | | COV | | | |
| RF VSD Alarm | • | | | | | COV | • | NOT EQUAL TO COMMAND | Interface Point |
| Relief Fan Speed | | | | • | | COV | | | |
| DD Static Press | | • | | | | 15 MIN | | | |
| Supply Temp | | • | | | | 15 MIN | | | |
| Fire Alarm | | | | | • | COV | | | Global Point |
| Disch Hi Static | • | | | | | COV | • | ABOVE HIGH LIMIT SETPOINT | |
| PH Coil DAT | | • | | | | 15 MIN | | | |
| Mixed Air Temp | | • | | | | 15 MIN | • | BELOW FREEZESTAT SETPOINT | |
| Return Air Temp | | • | | | | 15 MIN | | | |
| RA Humidity | | • | | | | 15 MIN | | | |
| RA CO2 | | • | | | | 15 MIN | • | ABOVE MAX SETPOINT | |
| CHW Valve | | | | • | | COV | | | |
| HW Valve | | | | • | | COV | | | |
| OA/RA Damper | | | | • | | 15 MIN | | | |
| OA Flow | | • | | | | COV | | | |
| Building Pressure | | • | | | | 15 MIN | | | |

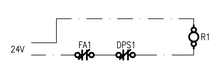
## LOGIC VARIABLES

| BINARY | ANALOG | DESCRIPTION |
|---|---|---|
| Occ | | ON WHEN OCCUPIED MODE ACTIVE |
| RUN | | ON WHEN UNIT COMMANDED TO START |
| SGO | | ON WHEN SUPPLY FAN ENERGIZED AND STATUS PROVEN |
| MAGO | | ON WHEN CONDITIONS ALLOW ECONOMIZER CONTROL |
| SHPA | | ON WHEN THE SUPPLY HI PRESSURE ALARM IS ACTIVE |
| FRZ | | ON WHEN A FREEZE CONDITION IS ACTIVE AND IN ALARM |
| Fire | | ON WHEN FIRE ALARM IS ACTIVE |
| SFTY | | ON WHEN A UNIT SHUTDOWN ALARM IS ON |
| RFAN | | ON WHEN RELIEF FAN COMMANDED TO START |
| RGO | | ON WHEN RELIEF FAN ENERGIZED AND STATUS PROVEN |
| | HST | VARIABLE CALCULATED VALUE OF HIGHEST SPACE TEMPERATURE |
| | OAT | VARIABLE VALUE OF OUTSIDE AIR TEMPERATURE |
| | SAT | VARIABLE VALUE OF SUPPLY AIR TEMPERATURE |
| | PHT | VARIABLE VALUE OF PREHEAT AIR TEMPERATURE |
| | MAT | VARIABLE VALUE OF MIXED AIR TEMPERATURE |
| | MINOA | VARIABLE VALUE OF MIN OA DAMPER POSITION (BASED ON OA FLOW PID OUT) |
| | DASP | VARIABLE CALCULATED VALUE OF DISCHARGE TEMPERATURE SETPOINT |
| | HPCT | VARIABLE CALCULATED VALUE OF HW VALVE POSITION |
| | EPCT | VARIABLE CALCULATED VALUE OF ECONOMIZER PID OUTPUT |

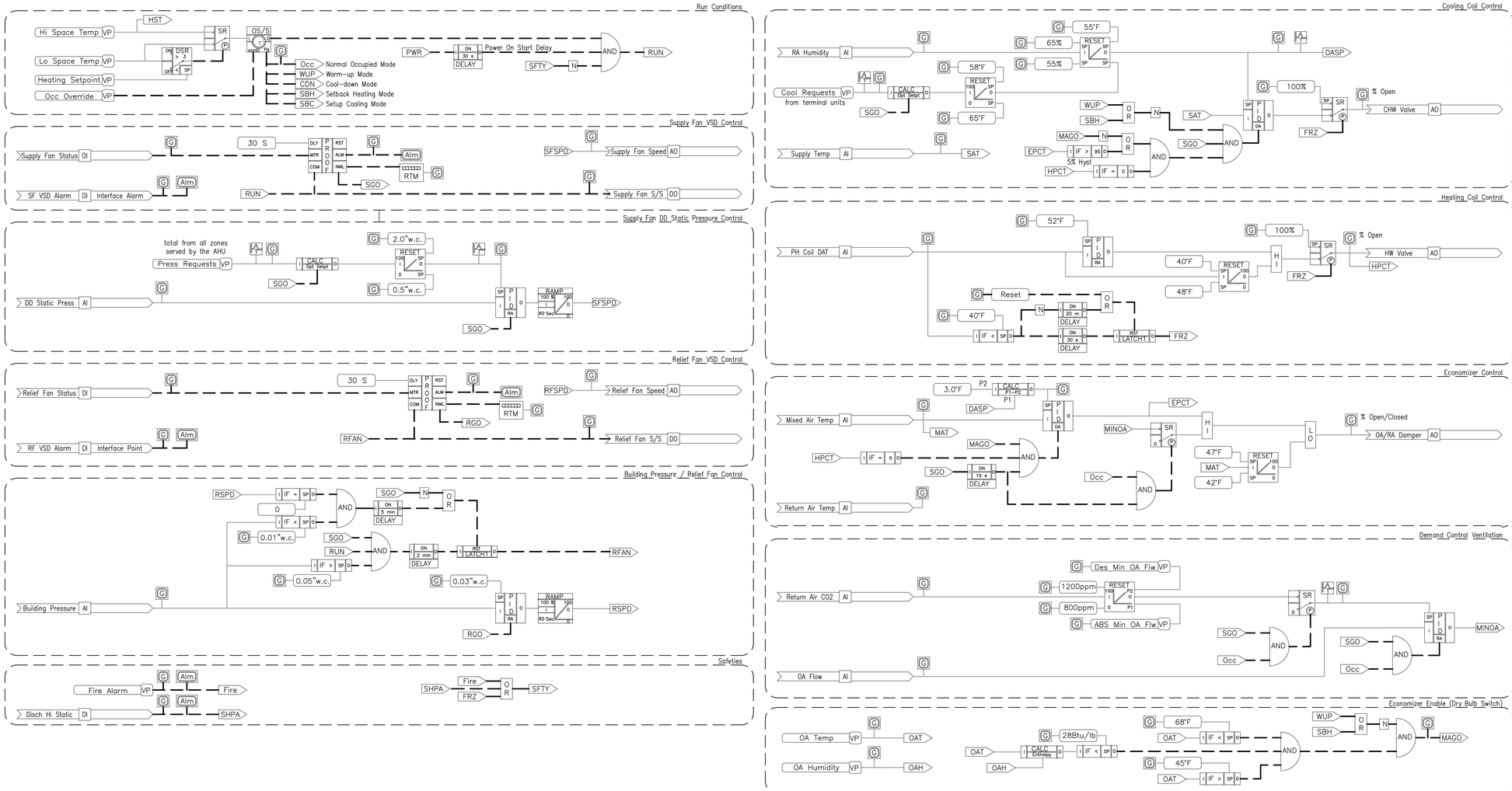
## ELECTRIC LADDER DIAGRAMS




SUPPLY FAN VSD (TYPICAL FOR RETURN FAN VSD)




SAFETY INTERLOCK DETAIL



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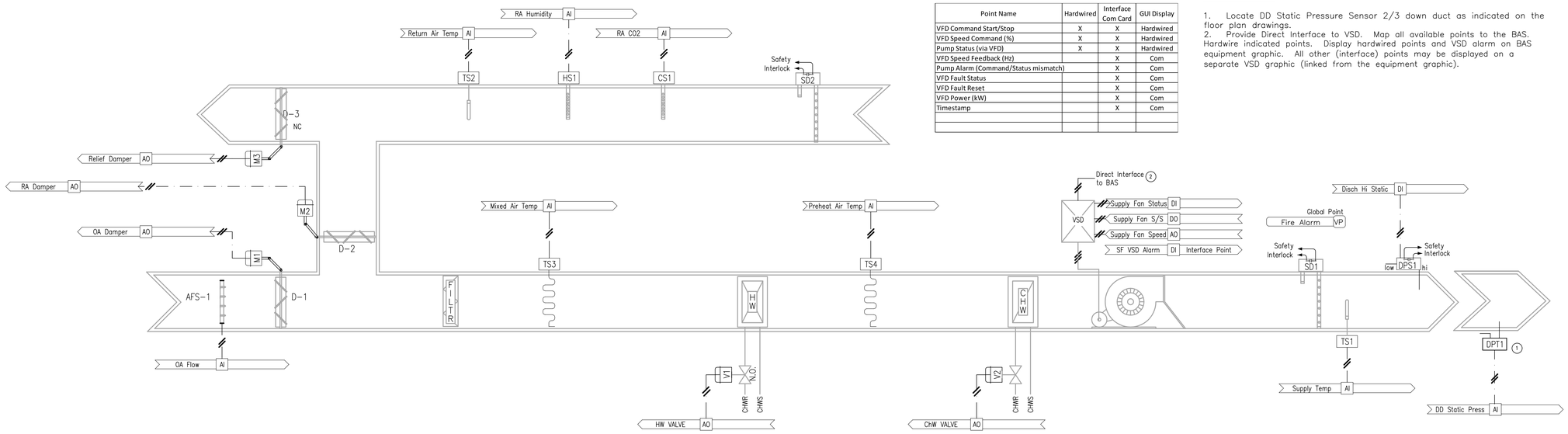


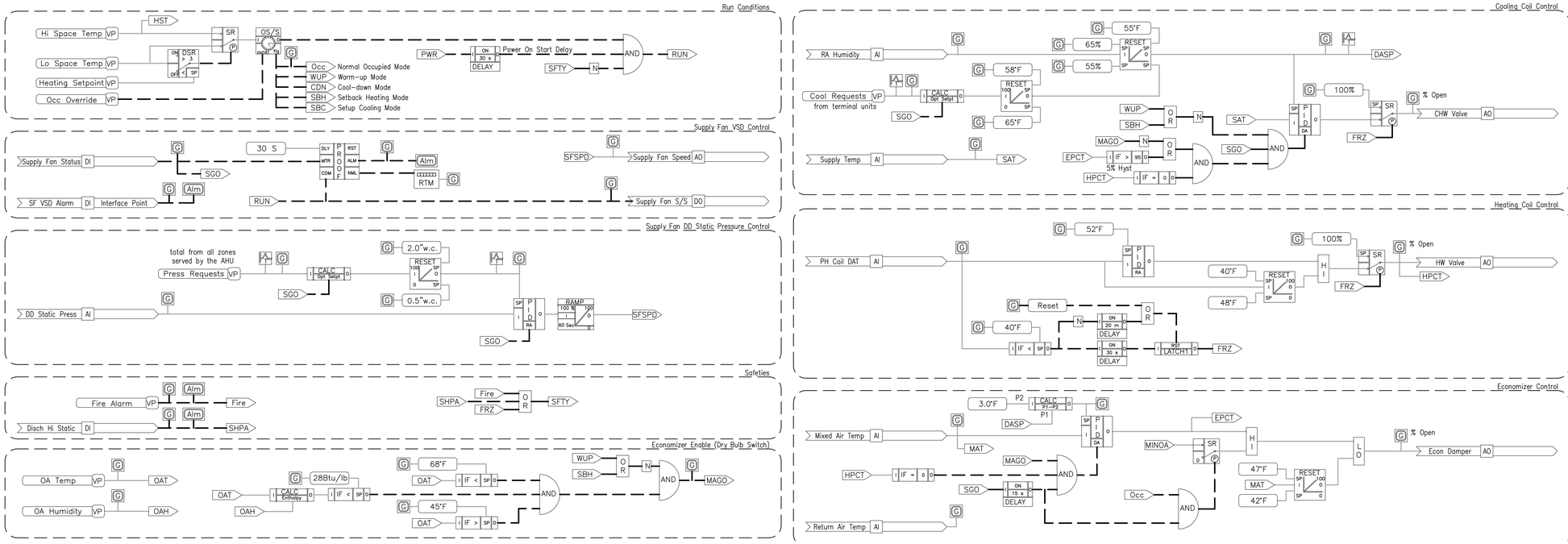

| Point Name | Hardwired | Interface Com Card | GUI Display |
|---|---|---|---|
| VFD Command Start/Stop | X | X | Hardwired |
| VFD Speed Command (%) | X | X | Hardwired |
| Pump Status (via VFD) | X | X | Hardwired |
| VFD Speed Feedback (Hz) | | X | Com |
| Pump Alarm (Command/Status mismatch) | | X | Com |
| VFD Fault Status | | X | Com |
| VFD Fault Reset | | X | Com |
| VFD Power (kW) | | X | Com |
| Timestamp | | X | Com |
| | | | |
| | | | |

DRAWING NOTES:

1. Locate DD Static Pressure Sensor 2/3 down duct as indicated on the floor plan drawings.
2. Provide Direct Interface to VSD. Map all available points to the BAS. Hardwire indicated points. Display hardwired points and VSD alarm on BAS equipment graphic. All other (interface) points may be displayed on a separate VSD graphic (linked from the equipment graphic).

## POINTS LIST

| POINT DESCRIPTOR | POINT TYPE DI | AI | DO | AO | VP | TREND | ALARM | ALARM CONDITION | REMARKS |
|---|---|---|---|---|---|---|---|---|---|
| Supply Fan S/S | | | • | | | COV | | | |
| Supply Fan Status | • | | | | | COV | | | |
| SF VSD Alarm | • | | | | | COV | • | NOT EQUAL TO COMMAND | Interface Point |
| Supply Fan Speed | | | | • | | COV | | | |
| DD Static Press | | • | | | | 15 MIN | | | |
| Supply Temp | | • | | | | 15 MIN | | | |
| Fire Alarm | | | | | • | COV | | | Global Point |
| Disch Hi Static | • | | | | | COV | • | ABOVE HIGH LIMIT SETPOINT | |
| PH Coil DAT | | • | | | | 15 MIN | | | |
| Mixed Air Temp | | • | | | | 15 MIN | • | BELOW FREEZESTAT SETPOINT | |
| Return Air Temp | | • | | | | 15 MIN | | | |
| RA Humidity | | • | | | | 15 MIN | | | |
| RA CO2 | | • | | | | 15 MIN | • | ABOVE MAX SETPOINT | |
| CHW Valve | | | | • | | COV | | | |
| HW Valve | | | | • | | COV | | | |
| OA/RA Damper | | | | • | | COV | | | |
| OA Flow | | • | | | | 15 MIN | | | |




## LOGIC VARIABLES

| BINARY | ANALOG | DESCRIPTION |
|---|---|---|
| Occ | | ON WHEN OCCUPIED MODE ACTIVE |
| RUN | | ON WHEN UNIT COMMANDED TO START |
| SGO | | ON WHEN SUPPLY FAN ENERGIZED AND STATUS PROVEN |
| MAGO | | ON WHEN CONDITIONS ALLOW ECONOMIZER CONTROL |
| SHPA | | ON WHEN THE SUPPLY HI PRESSURE ALARM IS ACTIVE |
| FRZ | | ON WHEN A FREEZE CONDITION IS ACTIVE AND IN ALARM |
| Fire | | ON WHEN FIRE ALARM IS ACTIVE |
| SFTY | | ON WHEN A UNIT SHUTDOWN ALARM IS ON |
| | | |
| | HST | VARIABLE CALCULATED VALUE OF HIGHEST SPACE TEMPERATURE |
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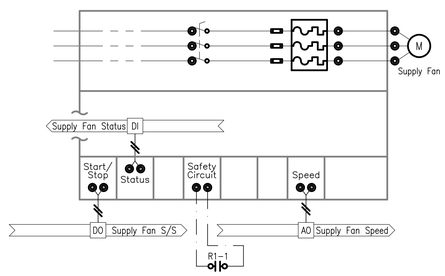
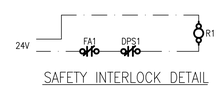
| | EPCT | VARIABLE CALCULATED VALUE OF ECONOMIZER PID OUTPUT |

## ELECTRIC LADDER DIAGRAMS




SUPPLY FAN VSD (TYPICAL FOR RETURN FAN VSD)




SAFETY INTERLOCK DETAIL

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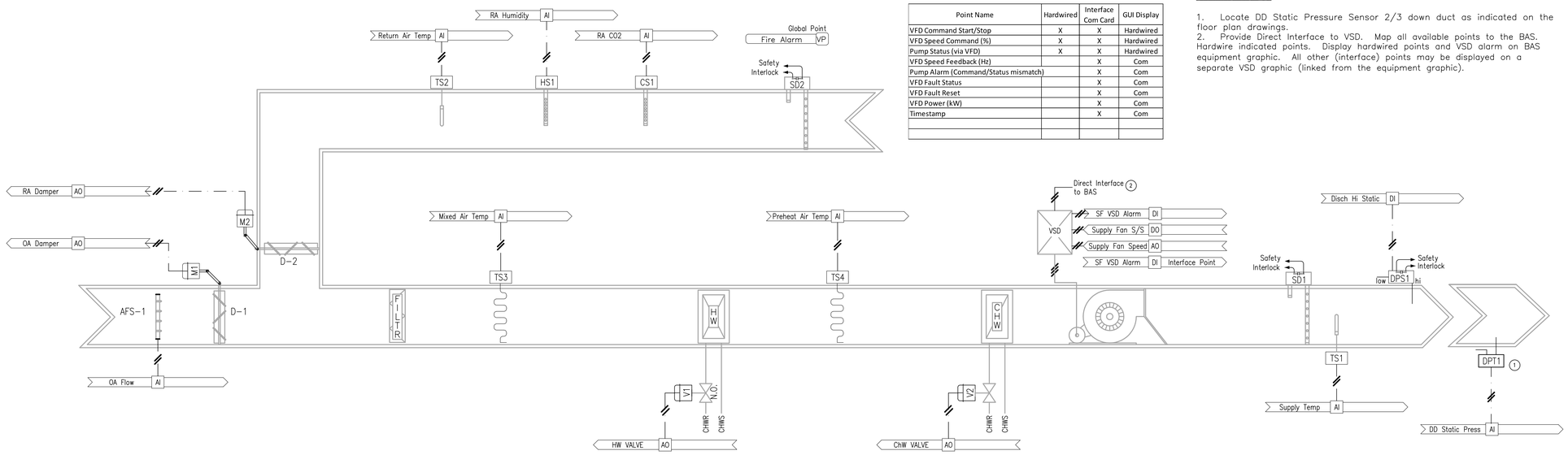
1429 Rock Quarry Road, Suite 116
Raleigh, NC 27610
(919) 588-3608

M4.04 VAV AHU WITH ECONOMIZER - HOT WATER & CHILLED WATER

SCALE: NONE



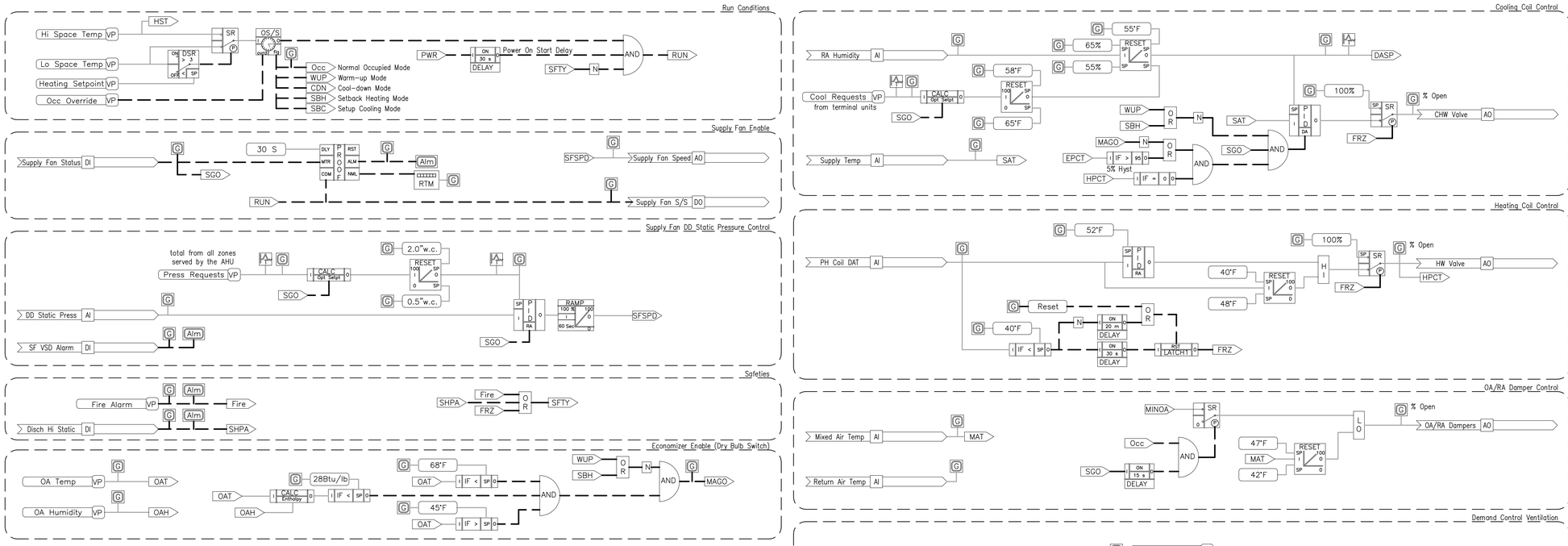

| Point Name | Hardwired | Interface Com Card | GUI Display |
|---|---|---|---|
| VFD Command Start/Stop | X | X | Hardwired |
| VFD Speed Command (%) | X | X | Hardwired |
| Pump Status (via VFD) | X | X | Hardwired |
| VFD Speed Feedback (Hz) | | X | Com |
| Pump Alarm (Command/Status mismatch) | | X | Com |
| VFD Fault Status | | X | Com |
| VFD Fault Reset | | X | Com |
| VFD Power (kW) | | X | Com |
| Timestamp | | X | Com |
| | | | |
| | | | |

DRAWING NOTES:

1. Locate DD Static Pressure Sensor 2/3 down duct as indicated on the floor plan drawings.
2. Provide Direct Interface to VSD. Map all available points to the BAS. Hardwire indicated points. Display hardwired points and VSD alarm on BAS equipment graphic. All other (interface) points may be displayed on a separate VSD graphic (linked from the equipment graphic).

## POINTS LIST

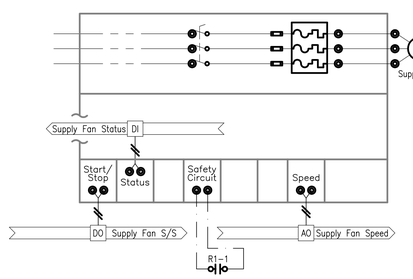
| POINT DESCRIPTOR | POINT TYPE DI | AI | DO | AO | VP | TREND | ALARM | ALARM CONDITION | REMARKS |
|---|---|---|---|---|---|---|---|---|---|
| Supply Fan S/S | | | • | | | COV | | | |
| Supply Fan Status | • | | | | | COV | | | |
| SF VSD Alarm | • | | | | | COV | • | NOT EQUAL TO COMMAND | Interface Point |
| Supply Fan Speed | | | | • | | COV | | | |
| DD Static Press | | • | | | | 15 MIN | | | |
| Supply Temp | | • | | | | 15 MIN | | | |
| Fire Alarm | | | | | • | COV | | | Global Point |
| Disch Hi Static | • | | | | | COV | • | ABOVE HIGH LIMIT SETPOINT | |
| PH Coil DAT | | • | | | | 15 MIN | | | |
| Mixed Air Temp | | • | | | | 15 MIN | • | BELOW FREEZESTAT SETPOINT | |
| Return Air Temp | | • | | | | 15 MIN | | | |
| RA Humidity | | • | | | | 15 MIN | | | |
| RA CO2 | | • | | | | 15 MIN | • | ABOVE MAX SETPOINT | |
| CHW Valve | | | | • | | COV | | | |
| HW Valve | | | | • | | COV | | | |
| OA/RA Damper | | | | • | | COV | | | |
| OA Flow | | • | | | | 15 MIN | | | |



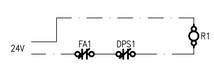

## LOGIC VARIABLES

| BINARY | ANALOG | DESCRIPTION |
|---|---|---|
| Occ | | ON WHEN OCCUPIED MODE ACTIVE |
| RUN | | ON WHEN UNIT COMMANDED TO START |
| SGO | | ON WHEN SUPPLY FAN ENERGIZED AND STATUS PROVEN |
| MAGO | | ON WHEN CONDITIONS ALLOW ECONOMIZER CONTROL |
| SHPA | | ON WHEN THE SUPPLY HI PRESSURE ALARM IS ACTIVE |
| FRZ | | ON WHEN A FREEZE CONDITION IS ACTIVE AND IN ALARM |
| Fire | | ON WHEN FIRE ALARM IS ACTIVE |
| SFTY | | ON WHEN A UNIT SHUTDOWN ALARM IS ON |
| | | |
| | HST | VARIABLE CALCULATED VALUE OF HIGHEST SPACE TEMPERATURE |
| | OAT | VARIABLE VALUE OF OUTSIDE AIR TEMPERATURE |
| | SAT | VARIABLE VALUE OF SUPPLY AIR TEMPERATURE |
| | PHT | VARIABLE VALUE OF PREHEAT AIR TEMPERATURE |
| | MAT | VARIABLE VALUE OF MIXED AIR TEMPERATURE |
| | MINOA | VARIABLE VALUE OF MIN OA DAMPER POSITION (BASED ON OA FLOW PID OUT) |
| | DASP | VARIABLE CALCULATED VALUE OF DISCHARGE TEMPERATURE SETPOINT |
| | HPCT | VARIABLE CALCULATED VALUE OF HW VALVE POSITION |

## ELECTRIC LADDER DIAGRAMS




SUPPLY FAN VSD (TYPICAL FOR RETURN FAN VSD)




SAFETY INTERLOCK DETAIL

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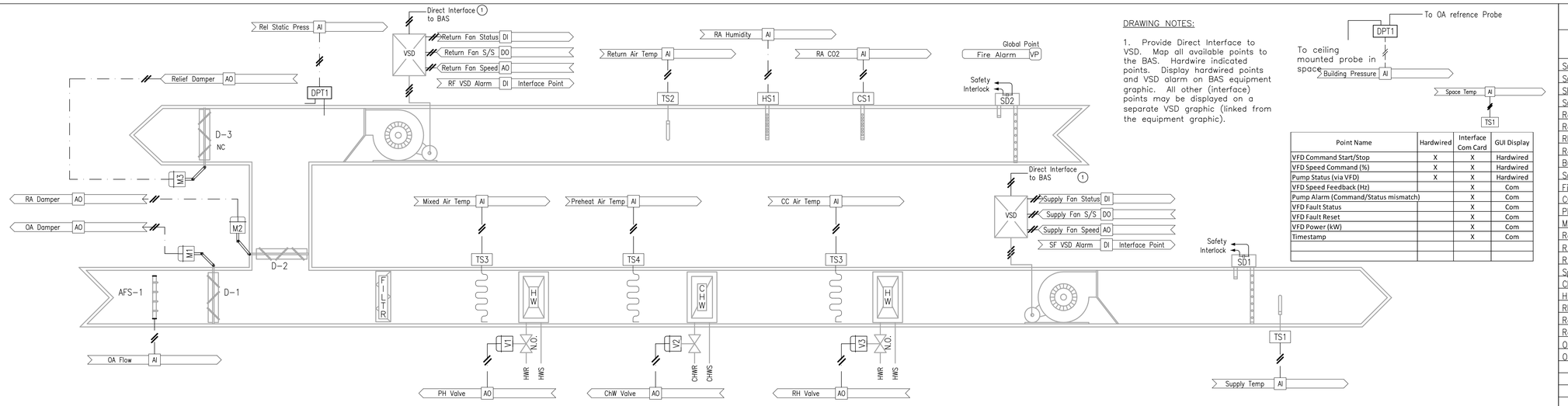



DRAWING NOTES:

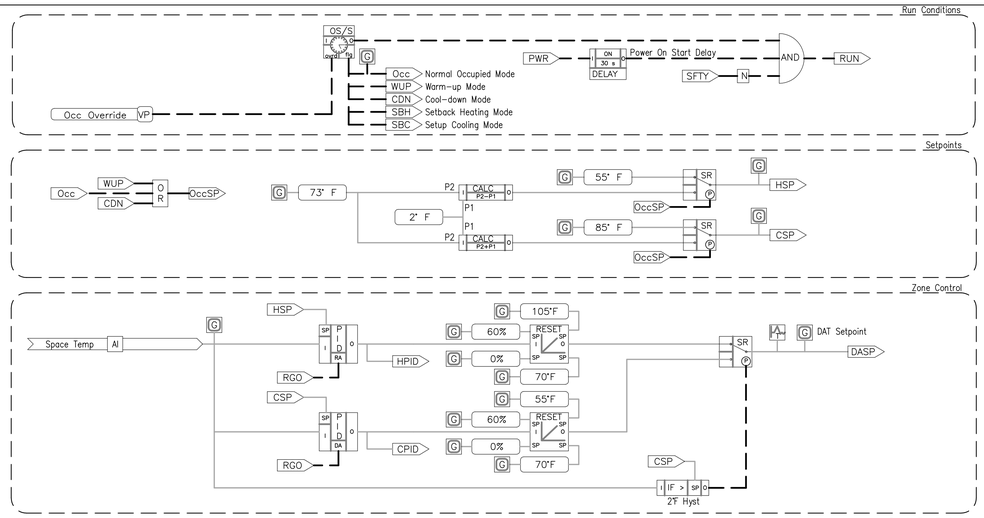
1. Provide Direct Interface to VSD. Map all available points to the BAS. Hardwire indicated points. Display hardwired points and VSD alarm on BAS equipment graphic. All other (interface) points may be displayed on a separate VSD graphic (linked from the equipment graphic).

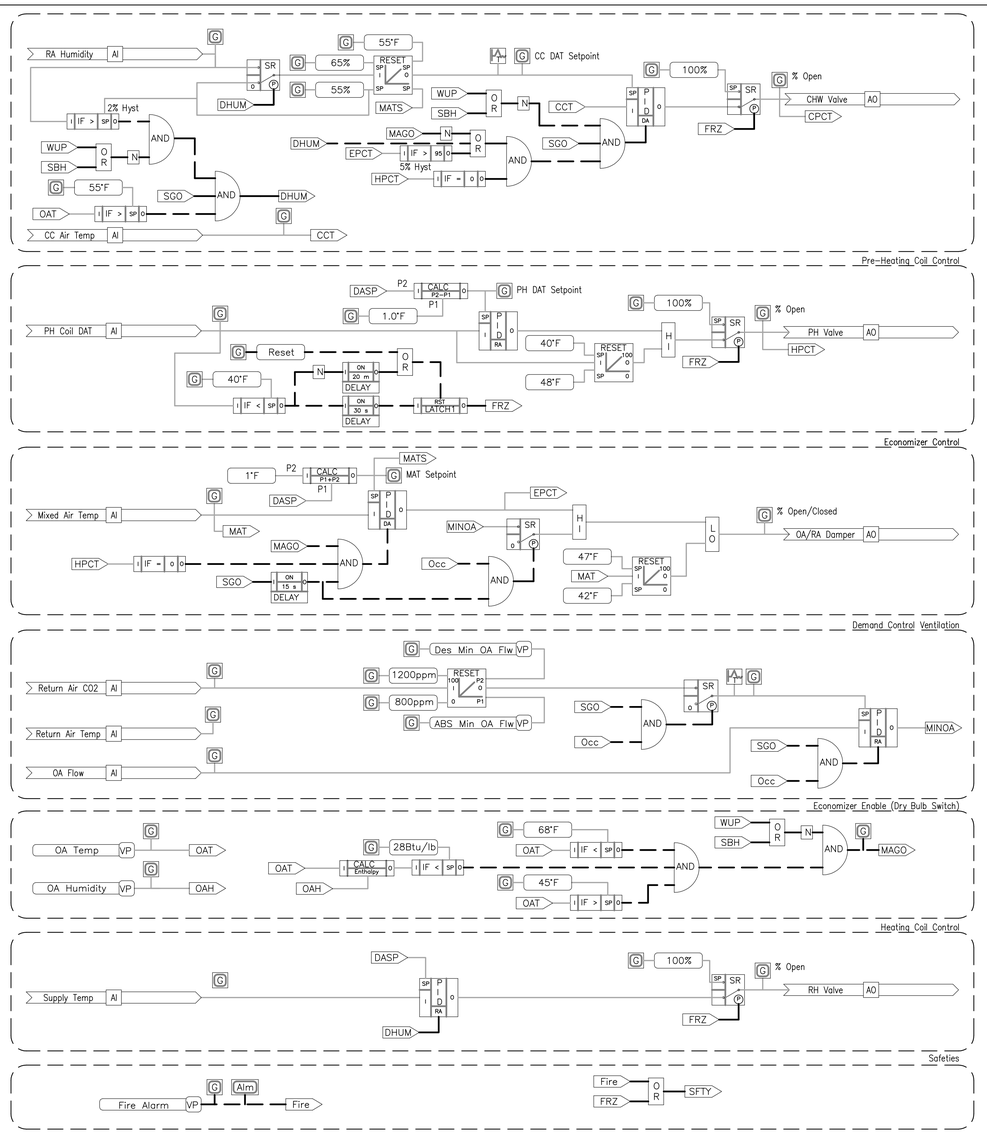



| Point Name | Hardwired | Interface Com Card | GUI Display |
|---|---|---|---|
| VFD Command Start/Stop | X | X | Hardwired |
| VFD Speed Command (%) | X | X | Hardwired |
| Pump Status (via VFD) | X | X | Hardwired |
| VFD Speed Feedback (Hz) | | X | Com |
| Pump Alarm (Command/Status mismatch) | | X | Com |
| VFD Fault Status | | X | Com |
| VFD Fault Reset | | X | Com |
| VFD Power (kW) | | X | Com |
| Timestamp | | X | Com |

## POINTS LIST

| POINT DESCRIPTOR | POINT TYPE DI | AI | DO | AO | VP | TREND | ALARM | ALARM CONDITION | REMARKS |
|---|---|---|---|---|---|---|---|---|---|
| Supply Fan S/S | | | • | | | COV | | | |
| Supply Fan Status | • | | | | | COV | | | |
| SF VSD Alarm | • | | | | | COV | • | NOT EQUAL TO COMMAND | Interface Point |
| Supply Fan Speed | | | | • | | COV | | | |
| Return Fan S/S | | | • | | | COV | | | |
| Return Fan Status | • | | | | | COV | | | |
| RF VSD Alarm | • | | | | | COV | • | NOT EQUAL TO COMMAND | Interface Point |
| Return Fan Speed | | | | • | | COV | | | |
| Building Pressure | | • | | | | 15 MIN | | | |
| Supply Temp | | • | | | | 15 MIN | | | |
| Fire Alarm | | | | | • | COV | | | Global Point |
| CC Air Temp | | • | | | | 15 MIN | | | |
| PH Coil DAT | | • | | | | 15 MIN | | | |
| Mixed Air Temp | | • | | | | 15 MIN | • | BELOW FREEZESTAT SETPOINT | |
| Return Air Temp | | • | | | | 15 MIN | | | |
| RA Humidity | | • | | | | 15 MIN | | | |
| RA CO2 | | • | | | | 15 MIN | • | ABOVE MAX SETPOINT | |
| Space Temp | | • | | | | 15 MIN | | | |
| CHW Valve | | | | • | | COV | | | |
| HW Valve | | | | • | | COV | | | |
| RH Valve | | | | • | | COV | | | |
| Relief Static Press | | • | | | | 15 MIN | | | |
| Relief Damper | | | | • | | COV | | | |
| OA/RA Damper | | | | • | | COV | | | |
| OA Flow | | • | | | | 15 MIN | | | |

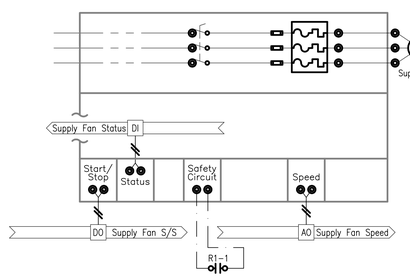



## LOGIC VARIABLES

| BINARY | ANALOG | DESCRIPTION |
|---|---|---|
| Occ | | ON WHEN OCCUPIED MODE ACTIVE |
| RUN | | ON WHEN UNIT COMMANDED TO START |
| SGO | | ON WHEN SUPPLY FAN ENERGIZED AND STATUS PROVEN |
| RGO | | ON WHEN RETURN FAN ENERGIZED AND STATUS PROVEN |
| MAGO | | ON WHEN CONDITIONS ALLOW ECONOMIZER OPERATION |
| OccSP | | ON WHEN THE UNIT IS CONTROLLING TO OCCUPIED SPACE TEMP SETPOINTS |
| DHUM | | ON WHEN THE UNIT IS OPERATING IN THE DEHUMIDIFICATION MODE |
| FRZ | | ON WHEN A FREEZE CONDITION IS ACTIVE AND IN ALARM |
| Fire | | ON WHEN FIRE ALARM IS ACTIVE |
| SFTY | | ON WHEN A UNIT SHUTDOWN ALARM IS ON |
| | HSP | VARIABLE CALCULATED VALUE OF ACTIVE HEATING SETPOINT |
| | CSP | VARIABLE CALCULATED VALUE OF ACTIVE COOLING SETPOINT |
| | OAT | VARIABLE VALUE OF OUTSIDE AIR TEMPERATURE |
| | OAH | VARIABLE VALUE OF OUTSIDE AIR RELATIVE HUMIDITY |
| | CCT | VARIABLE VALUE OF COOLING COIL DISCHARGE AIR TEMPERATURE |
| | MAT | VARIABLE VALUE OF MIXED AIR TEMPERATURE |
| | MINOA | VARIABLE VALUE OF MIN OA DAMPER POSITION (BASED ON OA FLOW PID OUT) |
| | DASP | VARIABLE CALCULATED VALUE OF DISCHARGE TEMPERATURE SETPOINT |
| | CPCT | VARIABLE CALCULATED VALUE OF CHW VALVE POSITION |
| | HPCT | VARIABLE CALCULATED VALUE OF PH VALVE POSITION |
| | EPCT | VARIABLE CALCULATED VALUE OF ECONOMIZER PID OUTPUT |
| | SFSPD | VARIABLE CALCULATED VALUE OF THE SUPPLY FAN SPEED OUTPUT |
| | RHP | VARIABLE CALCULATED VALUE OF CHW VALVE POSITION FOR DEHUMIDIFICATION |
| | HPID | VARIABLE CALCULATED VALUE OF THE SPACE TEMP HEATING PID LOOP OUTPUT |
| | CPID | VARIABLE CALCULATED VALUE OF THE SPACE TEMP COOLING PID LOOP OUTPUT |
| | RFSPD | VARIABLE CALCULATED VALUE OF THE RETURN FAN SPEED OUTPUT |

## ELECTRIC LADDER DIAGRAMS




SUPPLY FAN VSD (TYPICAL FOR RETURN FAN VSD)


SAFETY INTERLOCK DETAIL

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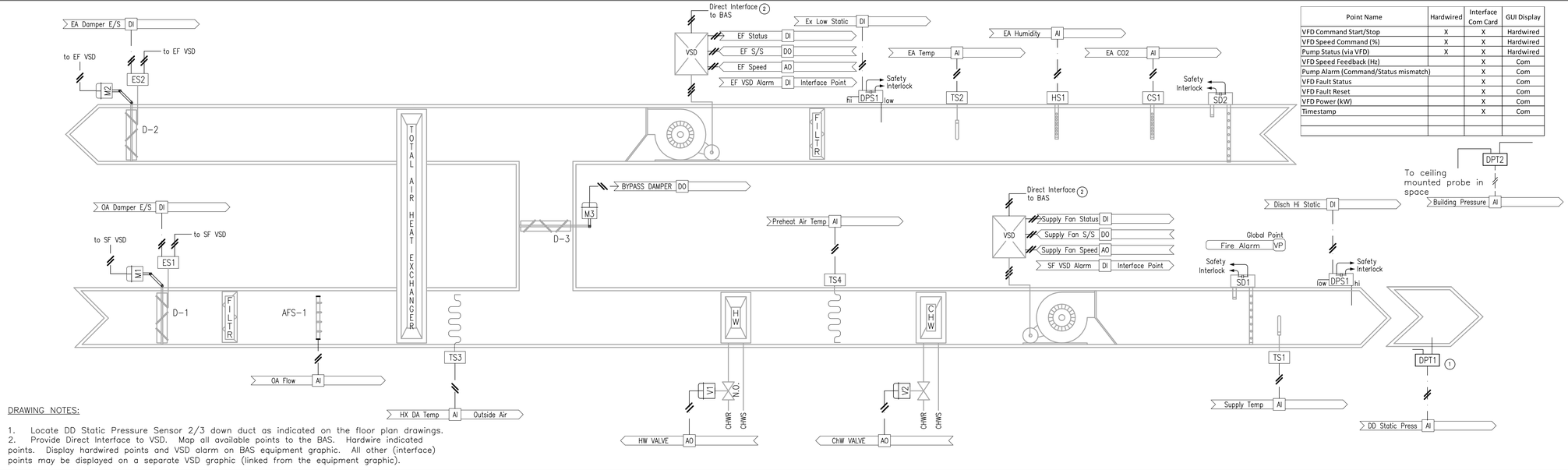


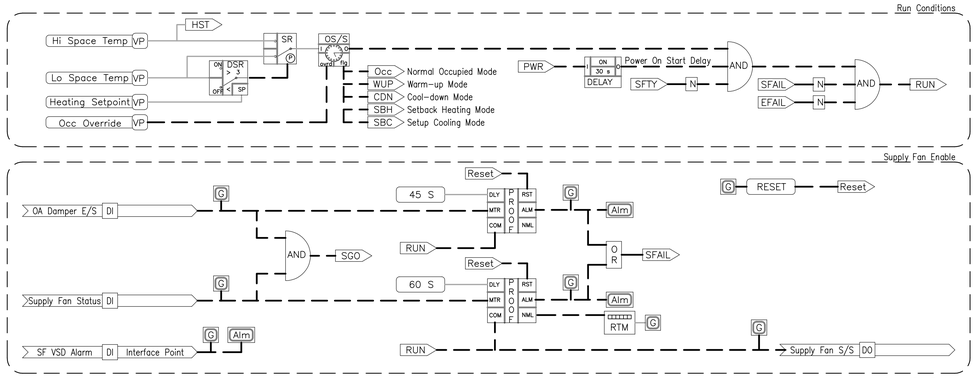

| Point Name | Hardwired | Interface Com Card | GUI Display |
|---|---|---|---|
| VFD Command Start/Stop | X | X | Hardwired |
| VFD Speed Command (%) | X | X | Hardwired |
| Pump Status (via VFD) | X | X | Hardwired |
| VFD Speed Feedback (Hz) | | X | Com |
| Pump Alarm (Command/Status mismatch) | | X | Com |
| VFD Fault Status | | X | Com |
| VFD Fault Reset | | X | Com |
| VFD Power (kW) | | X | Com |
| Timestamp | | X | Com |
| | | | |
| | | | |

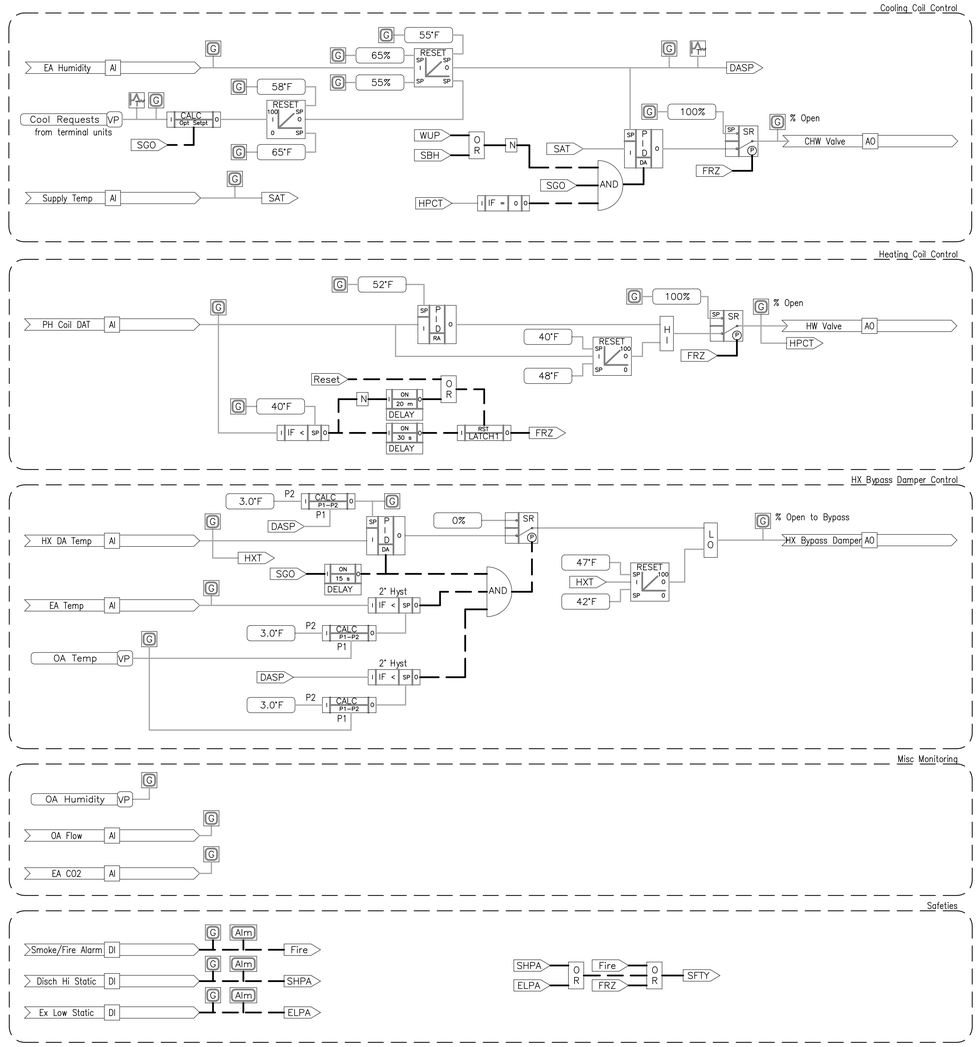
DRAWING NOTES:

1. Locate DD Static Pressure Sensor 2/3 down duct as indicated on the floor plan drawings.
2. Provide Direct Interface to VSD. Map all available points to the BAS. Hardwire indicated points. Display hardwired points and VSD alarm on BAS equipment graphic. All other (interface) points may be displayed on a separate VSD graphic (linked from the equipment graphic).

## POINTS LIST

| POINT DESCRIPTOR | POINT TYPE DI | AI | DO | AO | VP | TREND | ALARM | ALARM CONDITION | REMARKS |
|---|---|---|---|---|---|---|---|---|---|
| Supply Fan S/S | | | • | | | COV | | | |
| Supply Fan Status | • | | | | | COV | | | |
| SF VSD Alarm | • | | | | | COV | • | NOT EQUAL TO COMMAND | Interface Point |
| Supply Fan Speed | | | | • | | COV | | | |
| Exhaust Fan S/S | | | • | | | COV | | | |
| Exhaust Fan Status | • | | | | | COV | | | |
| EF VSD Alarm | • | | | | | COV | • | NOT EQUAL TO COMMAND | Interface Point |
| Exhaust Fan Speed | | | | • | | COV | | | |
| DD Static Press | | • | | | | 15 MIN | | | |
| Supply Temp | | • | | | | 15 MIN | | | |
| Fire Alarm | | | | | • | COV | | | Global Point |
| Disch Hi Static | | • | | | | COV | | | |
| PH Coil DAT | | • | | | | 15 MIN | | | |
| HX DAT | | • | | | | 15 MIN | | | |
| EA Temp | | • | | | | 15 MIN | | | |
| EA Humidity | | • | | | | 15 MIN | | | |
| EA CO2 | | • | | | | 15 MIN | • | ABOVE MAX SETPOINT | |
| CHW Valve | | | | • | | COV | | | |
| HW Valve | | | | • | | COV | | | |
| Rel Static Press | | • | | | | 15 MIN | | | |
| HX Bypass Damper | | | | • | | COV | | | |
| EX Damper E/S | | | | • | | COV | | | |
| OA Damper E/S | | | | • | | COV | | | |
| OA Flow | | • | | | | 15 MIN | | | |
| Building Pressure | | • | | | | 15 MIN | | | |

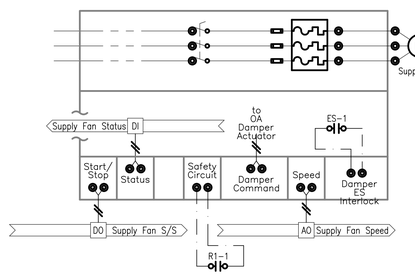


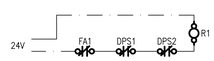

## LOGIC VARIABLES

| BINARY | ANALOG | DESCRIPTION |
|---|---|---|
| Occ | | ON WHEN OCCUPIED MODE ACTIVE (see logic diagram for Unocc modes) |
| RUN | | ON WHEN UNIT COMMANDED TO START |
| SGO | | ON WHEN SUPPLY FAN ENERGIZED AND FAN AND DAMPER STATUS PROVEN |
| EGO | | ON WHEN EXHAUST FAN ENERGIZED AND FAN AND DAMPER STATUS PROVEN |
| Reset | | ON WHEN USER RESETS ALL LATCHING ALARMS ON THE UNIT (TOGGLE POINT) |
| SHPA | | ON WHEN THE SUPPLY HI PRESSURE ALARM IS ACTIVE |
| ELPA | | ON WHEN THE EXHAUST LOW PRESSURE ALARM IS ACTIVE |
| FRZ | | ON WHEN A FREEZE CONDITION IS ACTIVE AND IN ALARM |
| Fire | | ON WHEN FIRE ALARM IS ACTIVE |
| SFTY | | ON WHEN A UNIT SHUTDOWN ALARM IS ON |
| SFAIL | | ON WHEN SUPPLY SIDE OF THE UNIT IS ASSESSED AS FAILED |
| EFAIL | | ON WHEN EXHAUST SIDE OF THE UNIT IS ASSESSED AS FAILED |
| | | |
| | | |
| | | |
| | HST | VARIABLE CALCULATED VALUE OF HIGHEST SPACE TEMPERATURE |
| | OAT | VARIABLE VALUE OF OUTSIDE AIR TEMPERATURE |
| | SAT | VARIABLE VALUE OF SUPPLY AIR TEMPERATURE |
| | PHT | VARIABLE VALUE OF PREHEAT AIR TEMPERATURE |
| | HXT | VARIABLE VALUE OF HEAT EXCHANGER DISCHARGE AIR TEMPERATURE (OA SIDE) |
| | MINOA | VARIABLE VALUE OF MIN OA DAMPER POSITION (BASED ON OA FLOW PID OUT) |
| | DASP | VARIABLE CALCULATED VALUE OF DISCHARGE TEMPERATURE SETPOINT |
| | HPCT | VARIABLE CALCULATED VALUE OF HW VALVE POSITION |
| | EPCT | VARIABLE CALCULATED VALUE OF ECONOMIZER PID OUTPUT |
| | SFSPD | VARIABLE CALCULATED VALUE OF SUPPLY FAN SPEED OUTPUT |
| | | |

## ELECTRIC LADDER DIAGRAMS




SUPPLY FAN VSD (TYPICAL FOR EXHAUST FAN VSD)




SAFETY INTERLOCK DETAIL

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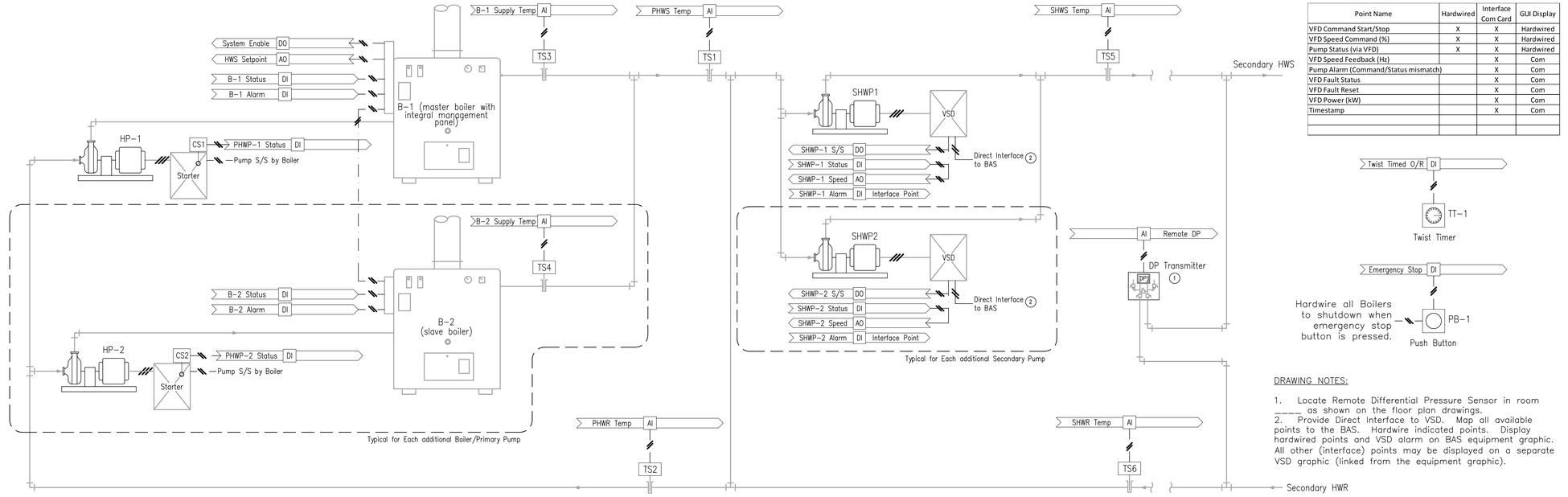



| Point Name | Hardwired | Interface Com Card | GUI Display |
|---|---|---|---|
| VFD Command Start/Stop | X | X | Hardwired |
| VFD Speed Command (%) | X | X | Hardwired |
| Pump Status (via VFD) | X | X | Hardwired |
| VFD Speed Feedback (Hz) | | X | Com |
| Pump Alarm (Command/Status mismatch) | | X | Com |
| VFD Fault Status | | X | Com |
| VFD Fault Reset | | X | Com |
| VFD Power (kW) | | X | Com |
| Timestamp | | X | Com |

DRAWING NOTES:

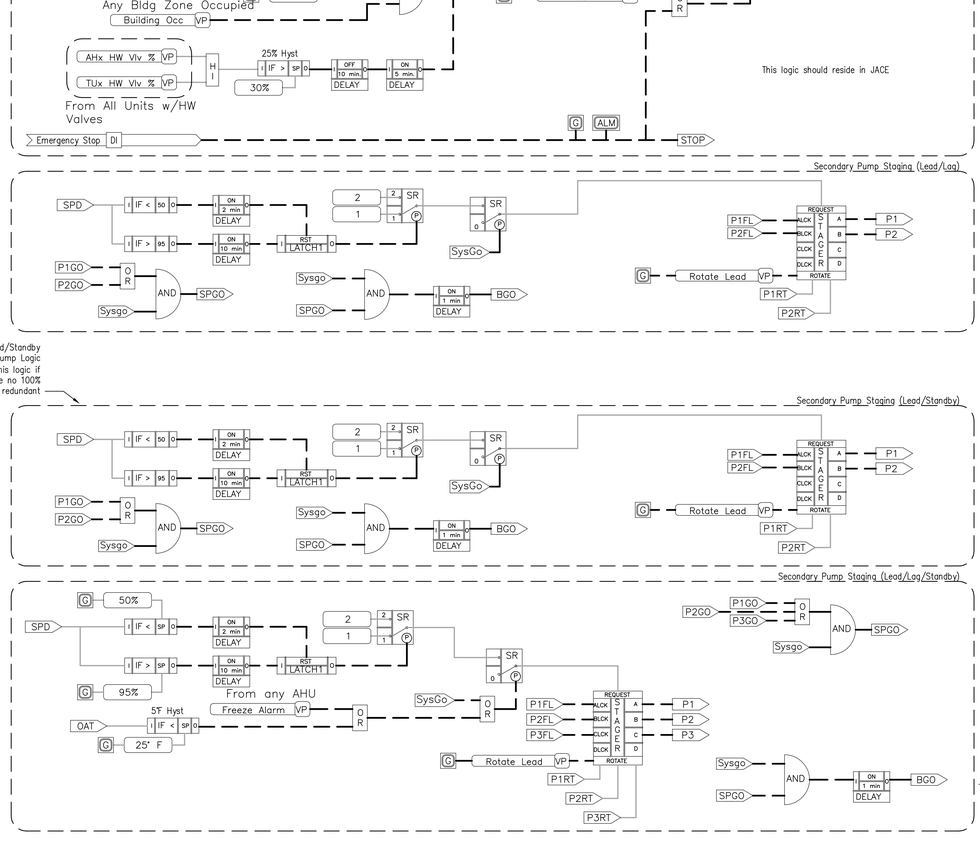
1. Locate Remote Differential Pressure Sensor in room ____ as shown on the floor plan drawings.
2. Provide Direct Interface to VSD. Map all available points to the BAS. Hardwire indicated points. Display hardwired points and VSD alarm on BAS equipment graphic. All other (interface) points may be displayed on a separate VSD graphic (linked from the equipment graphic).

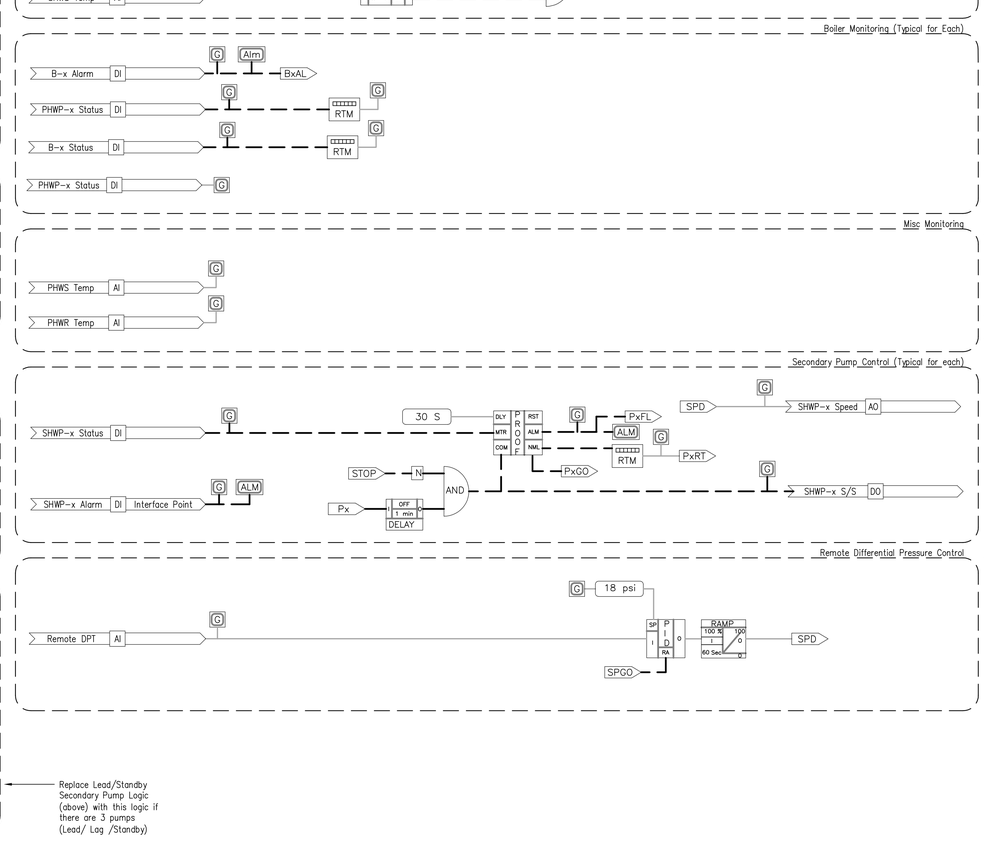
## POINTS LIST

| POINT DESCRIPTOR | POINT TYPE DI | AI | DO | AO | VP | TREND | ALARM | ALARM CONDITION | REMARKS |
|---|---|---|---|---|---|---|---|---|---|
| PHWS Temp | | • | | | | 15 MIN | | | |
| PHWR Temp | | • | | | | 15 MIN | | | |
| System Enable | | | • | | | COV | | | |
| HWS Setpoint | | | | • | | COV | | | |
| PHWP-x Status | • | | | | | COV | | | |
| B-x Supply Temp | | • | | | | 15 MIN | | | |
| B-x Alarm | • | | | | | COV | • | | |
| B-x Status | • | | | | | COV | | | |
| Remote DP | | • | | | | 15 MIN | | | Typical for each |
| SHWP-x S/S | | | • | | | COV | | | |
| SHWP-x Status | • | | | | | COV | | | |
| SHWP-x Speed | | | | • | | COV | | | |
| SHWP-x Alarm | • | | | | | COV | • | NOT EQUAL TO COMMAND | Interface Point |
| SHWS Temp | | • | | | | 15 MIN | | | |
| SHWR Temp | | • | | | | 15 MIN | | | |
| Twist Timed O/R | • | | | | | | | | |
| Emergency Stop | • | | | | | | | | |
| Outdoor Temp | | • | | | | 15 MIN | | | |
| Outdoor Humidity | | • | | | | 15 MIN | | | |
| Outdoor Enthalpy | | • | | | | 15 MIN | | | |

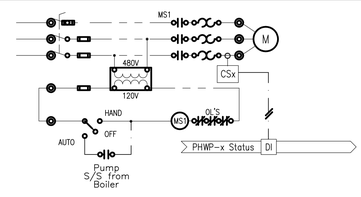
## LOGIC VARIABLES

| BINARY | ANALOG | DESCRIPTION |
|---|---|---|
| Sysgo | | ON WHEN CHILLED WATER SYSTEM IS REQUESTED TO RUN |
| Px | | ON WHEN PUMP Px IS REQUESTED TO RUN |
| PxGO | | ON WHEN PUMP Px IS REQUESTED TO RUN AND STATUS IS PROVEN |
| SPGO | | ON WHEN EITHER SECONDARY PUMP IS REQUESTED AND STATUS IS PROVEN |
| STOP | | ON WHEN THE EMERGENCY STOP BUTTON IS ON |
| PxFL | | ON WHEN SECONDARY PUMP Px IS ASSESSED AS FAILED |
| PPxFL | | ON WHEN PRIMARY PUMP Px IS ASSESSED AS FAILED |
| BxAL | | ON WHEN BOILER B-x'S ALARM POINT IS ON |
| | BxRT | TOTALIZED VALUE OF BOILER Bx'S RUNTIME |
| | PxRT | TOTALIZED VALUE OF PUMP Px'S RUNTIME |
| | OAT | VARIABLE VALUE OF OUTSIDE AIR TEMPERATURE |
| | SPD | VARIABLE CALCULATED VALUE OF REMOTE DP PID LOOP OUTPUT (PUMP SPEED) |
| | BFR | VARIABLE CALCULATED VALUE OF THE BOILER FIRING RATE |

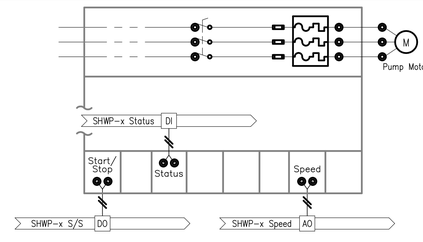



## ELECTRIC LADDER DIAGRAM




TYPICAL PRIMARY HW PUMP STARTER




TYPICAL SECONDARY HW PUMP VSD

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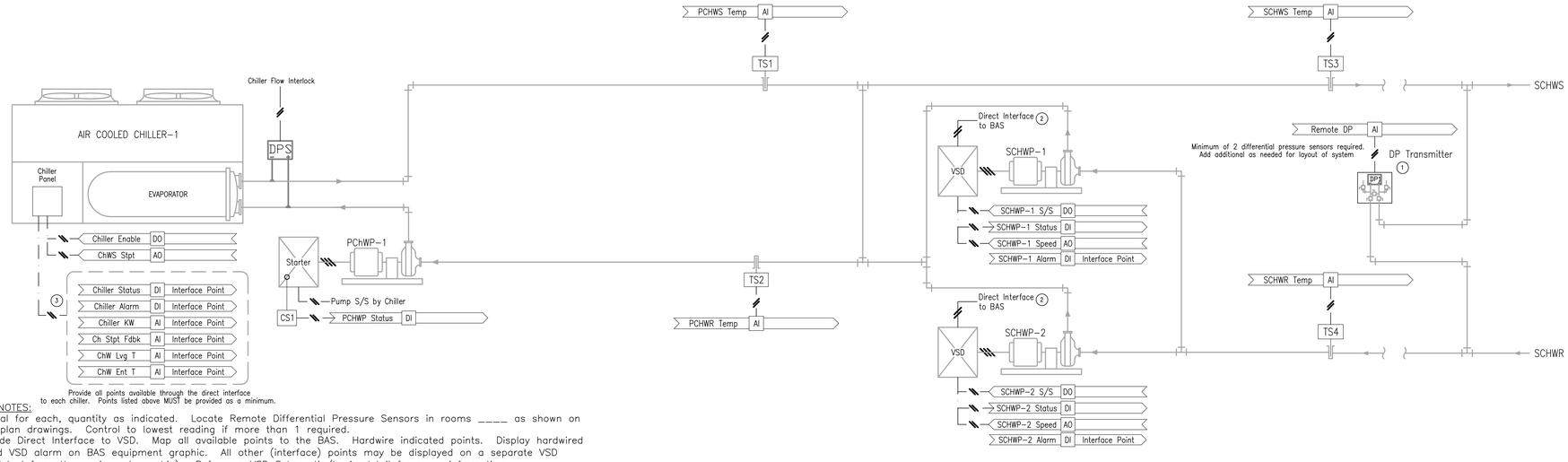


Provide all points available through the direct interface to each chiller. Points listed above MUST be provided as a minimum.

DRAWING NOTES:

1. Typical for each, quantity as indicated. Locate Remote Differential Pressure Sensors in rooms _____ as shown on the floor plan drawings. Control to lowest reading if more than 1 required.
2. Provide Direct Interface to VSD. Map all available points to the BAS. Hardwire indicated points. Display hardwired points and VSD alarm on BAS equipment graphic. All other (interface) points may be displayed on a separate VSD graphic (linked from the equipment graphic). Reference VSD Schematic/Logic detail for more information.
3. Provide Direct Interface to Chiller. Map all available points to the BAS. Hardwire indicated points. Display hardwired points and Chiller alarm on BAS System graphic. All other (interface) points may be displayed on a separate Chiller graphic (linked from the System graphic).

## POINTS LIST

| POINT DESCRIPTOR | POINT TYPE DI | AI | DO | AO | VP | TREND | ALARM | ALARM CONDITION | REMARKS |
|---|---|---|---|---|---|---|---|---|---|
| PCHWP-1-x Status | • | | | | | COV | | | |
| SCHWP-x S/S | | | • | | | COV | | | |
| SCHWP-x Status | • | | | | | COV | | | |
| SCHWP-x Speed | | | | • | | COV | | | |
| SCHWP-x Alarm | • | | | | | COV | • | NOT EQUAL TO COMMAND | Interface Point |
| SCHWS Temp | | • | | | | 15 MIN | | | |
| SCHWR Temp | | • | | | | 15 MIN | | | |
| PCHWS Temp | | • | | | | 15 MIN | | | |
| PCHWR Temp | | • | | | | 15 MIN | | | |
| ChWS Setpoint | | | | • | | COV | | | |
| Chiller Enable | | | • | | | COV | | | |
| Chiller Status | • | | | | | COV | | | Interface Point |
| Chiller Alarm | • | | | | | COV | | | Interface Point |
| Chiller kW | | • | | | | COV | | | Interface Point |
| Setpoint Fdbk | | • | | | | COV | | | Interface Point |
| ChW Ent Temp | | • | | | | 15 MIN | | | Interface Point |
| ChW Lvg Temp | | • | | | | 15 MIN | | | Interface Point |
| Remote DP | | • | | | | 15 MIN | | | Typical for each |
| Outdoor Temp | | • | | | | 15 MIN | | | |
| Outdoor Humidity | | • | | | | 15 MIN | | | |
| Outdoor Enthalpy | | • | | | | 15 MIN | | | |

## LOGIC VARIABLES

| BINARY | ANALOG | DESCRIPTION |
|---|---|---|
| Sysgo | | ON WHEN CHILLED WATER SYSTEM IS REQUESTED TO RUN |
| | | |
| Px | | ON WHEN PUMP Px IS REQUESTED TO RUN |
| PxGO | | ON WHEN PUMP Px IS REQUESTED TO RUN AND STATUS IS PROVEN |
| PPGO | | ON WHEN PRIMARY PUMP IS REQUESTED TO RUN AND STATUS IS PROVEN |
| SPGO | | ON WHEN EITHER SECONDARY PUMP IS REQUESTED AND STATUS IS PROVEN |
| CHST | | ON WHEN THE CHILLER STATUS IS ON |
| CHGO | | ON WHEN THE CHILLER IS REQUESTED TO RUN |
| CxFL | | ON WHEN THE CHILLER-x IS ASSESSED AS FAILED |
| | PxRT | TOTALIZED VALUE OF PUMP Px'S RUNTIME |
| | OAT | VARIABLE VALUE OF OUTSIDE AIR TEMPERATURE |
| | SPD | VARIABLE CALCULATED VALUE OF REMOTE DP PID LOOP OUTPUT (PUMP SPEED) |
| | CWSP | VARIABLE VALUE OF CHILLED WATER SUPPLY TEMPERATURE SETPOINT |
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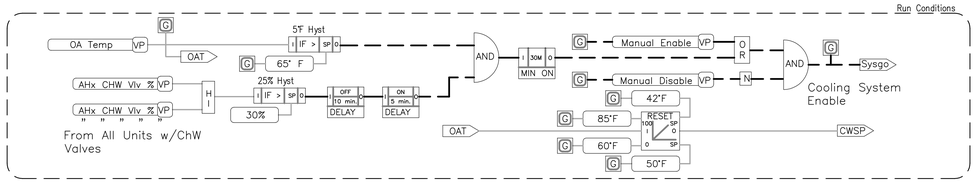
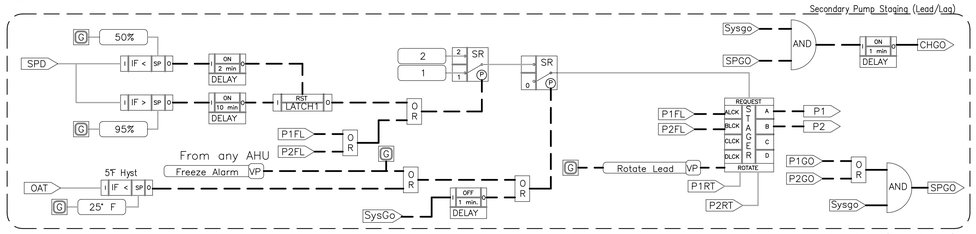
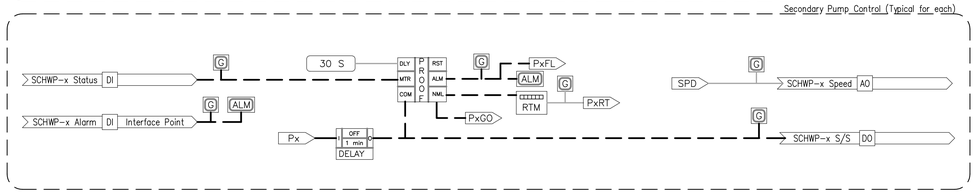
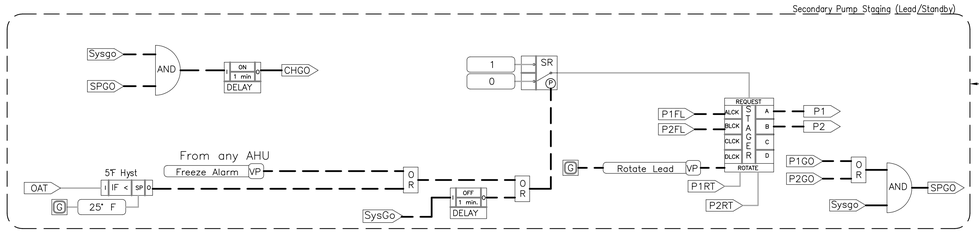
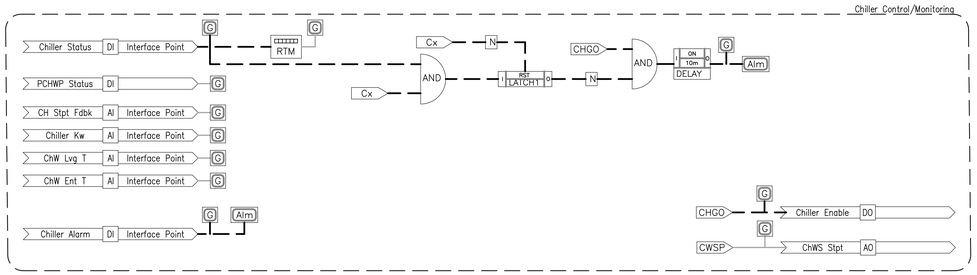


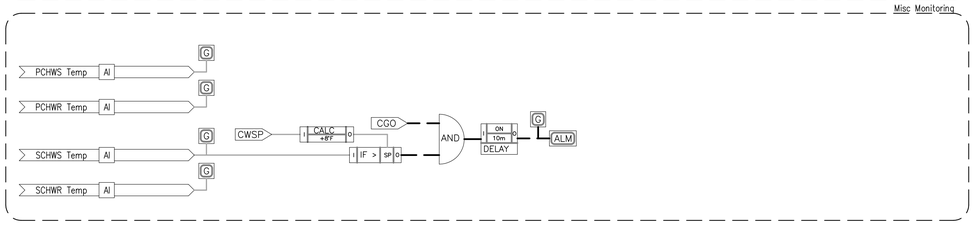




Replace Lead/Lag Secondary Pump Logic (above) with this logic, if pumps are 100% redundant

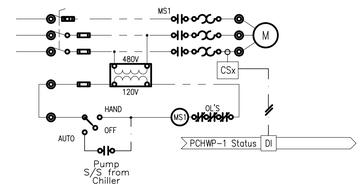




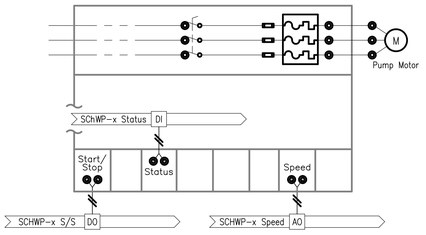



| Point Name | Hardwired | Interface Com Card | GUI Display |
|---|---|---|---|
| VFD Command Start/Stop | X | X | Hardwired |
| VFD Speed Command (%) | X | X | Hardwired |
| Pump Status (via VFD) | X | X | Hardwired |
| VFD Speed Feedback (Hz) | | X | Com |
| Pump Alarm (Command/Status mismatch) | | X | Com |
| VFD Fault Status | | X | Com |
| VFD Fault Reset | | X | Com |
| VFD Power (kW) | | X | Com |
| Timestamp | | X | Com |
| | | | |
| | | | |

## ELECTRIC LADDER DIAGRAM




TYPICAL PRIMARY CHW PUMP STARTER




TYPICAL SECONDARY CHW PUMP VSD

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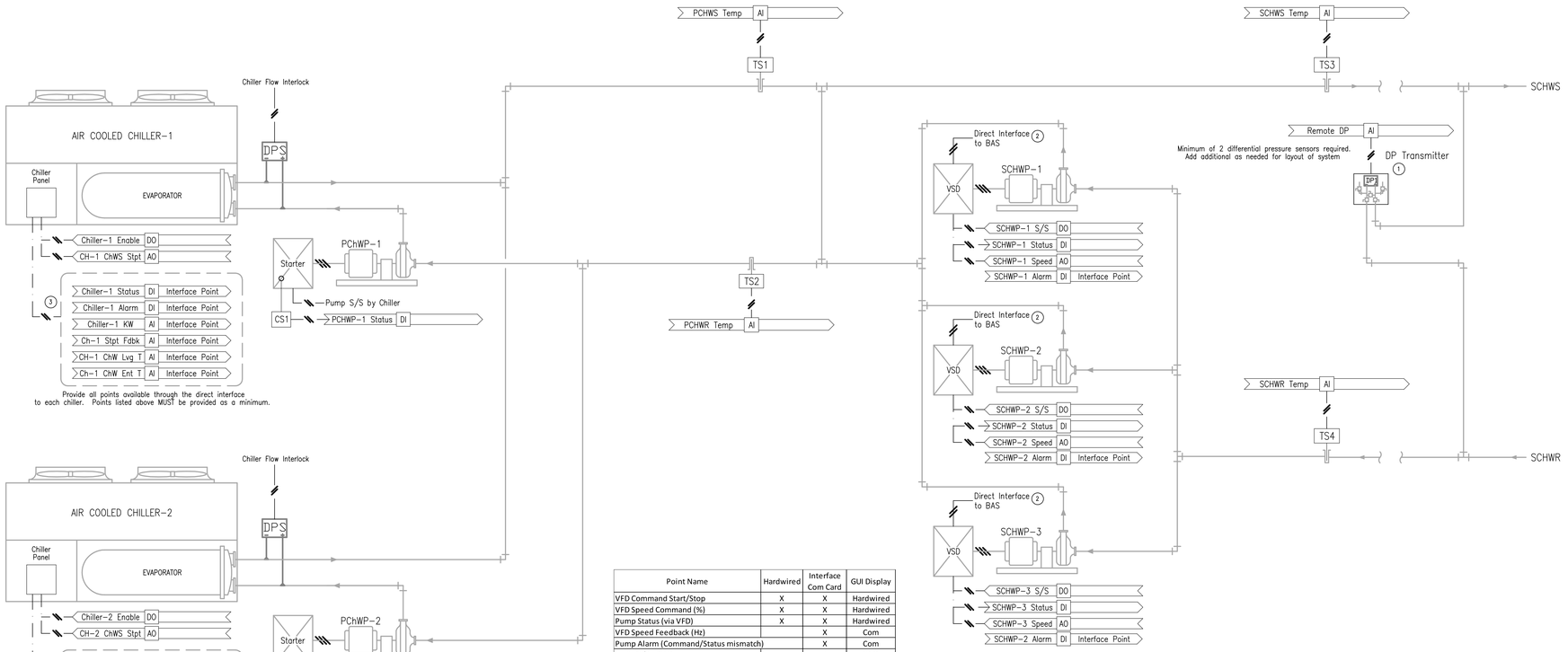



| Point Name | Hardwired | Interface Com Card | GUI Display |
|---|---|---|---|
| VFD Command Start/Stop | X | X | Hardwired |
| VFD Speed Command (%) | X | X | Hardwired |
| Pump Status (via VFD) | X | X | Hardwired |
| VFD Speed Feedback (Hz) | | X | Com |
| Pump Alarm (Command/Status mismatch) | | X | Com |
| VFD Fault Status | | X | Com |
| VFD Fault Reset | | X | Com |
| VFD Power (kW) | | X | Com |
| Timestamp | | X | Com |
| | | | |
| | | | |

DRAWING NOTES:

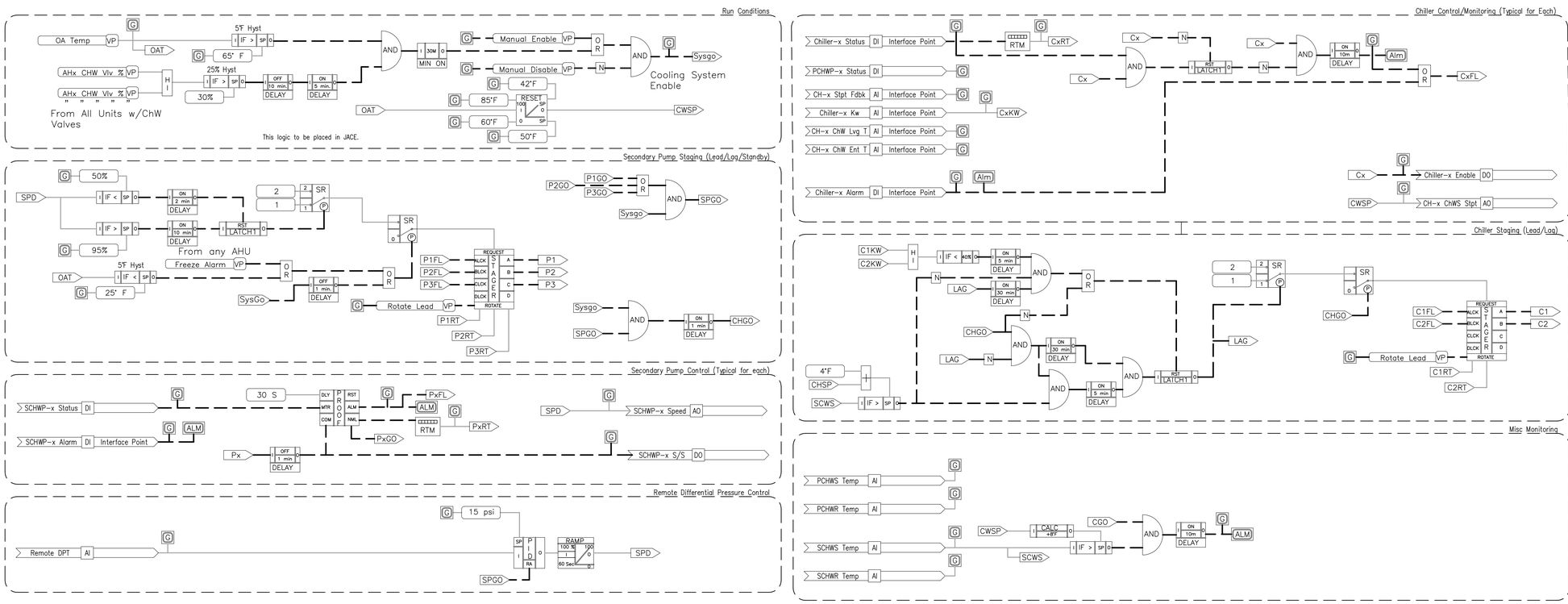
1. Typical for each, quantity as indicated. Locate Remote Differential Pressure Sensors in rooms _____ as shown on the floor plan drawings. Control to lowest reading if more than 1 required.
2. Provide Direct Interface to VSD. Map all available points to the BAS. Hardwire indicated points. Display hardwired points and VSD alarm on BAS equipment graphic. All other (interface) points may be displayed on a separate VSD graphic (linked from the equipment graphic). Reference VSD Schematic/Logic detail for more information.
3. Provide Direct Interface to Chiller. Map all available points to the BAS. Hardwire indicated points. Display hardwired points and Chiller alarm on BAS System graphic. All other (interface) points may be displayed on a separate Chiller graphic (linked from the System graphic).

## POINTS LIST

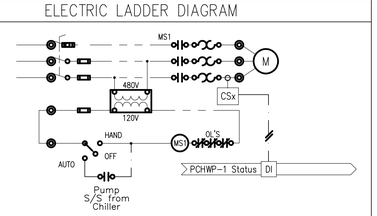
| POINT DESCRIPTOR | POINT TYPE DI | AI | DO | AO | VP | TREND | ALARM | ALARM CONDITION | REMARKS |
|---|---|---|---|---|---|---|---|---|---|
| PCHWP-x Status | • | | | | | COV | | | |
| SCHWP-x S/S | | | • | | | COV | | | |
| SCHWP-x Status | • | | | | | COV | | | |
| SCHWP-x Speed | | | | • | | COV | | | |
| SCHWP-x Alarm | • | | | | | COV | • | NOT EQUAL TO COMMAND | Interface Point |
| SCHWS Temp | | • | | | | 15 MIN | | | |
| SCHWR Temp | | • | | | | 15 MIN | | | |
| PCHWS Temp | | • | | | | 15 MIN | | | |
| PCHWR Temp | | • | | | | 15 MIN | | | |
| CH-x ChWS Setpoint | | | | • | | COV | | | |
| Chiller-x Enable | | | • | | | COV | | | |
| Chiller-x Status | • | | | | | COV | | | Interface Point |
| Chiller-x Alarm | • | | | | | COV | | | Interface Point |
| Chiller-x kW | | • | | | | COV | | | Interface Point |
| CH-x Setpoint Fdbk | | • | | | | COV | | | Interface Point |
| CH-x ChW Ent Temp | | • | | | | 15 MIN | | | Interface Point |
| CH-x ChW Lvg Temp | | • | | | | 15 MIN | | | Interface Point |
| Remote DP | | • | | | | 15 MIN | | | Typical for each |
| Outdoor Temp | | • | | | | 15 MIN | | | |
| Outdoor Humidity | | • | | | | 15 MIN | | | |
| Outdoor Enthalpy | | • | | | | 15 MIN | | | |

## LOGIC VARIABLES

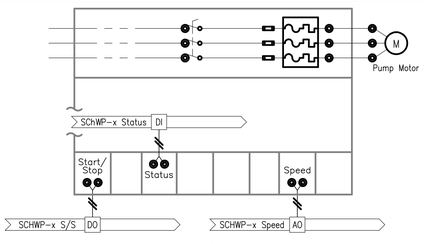
| BINARY | ANALOG | DESCRIPTION |
|---|---|---|
| Sysgo | | ON WHEN CHILLED WATER SYSTEM IS REQUESTED TO RUN |
| PxGO | | ON WHEN SECONDARY PUMP Px IS REQUESTED TO RUN AND STATUS IS PROVEN |
| Px | | ON WHEN SECONDARY PUMP Px IS REQUESTED TO RUN |
| CHGO | | ON WHEN THE PRIMARY SYSTEM ISREQUESTED TO RUN |
| SPGO | | ON WHEN ANY SECONDARY PUMP IS REQUESTED AND STATUS IS PROVEN |
| Cx | | ON WHEN THE CHILLER-x IS ENABLED |
| CxFL | | ON WHEN THE CHILLER-x IS ASSESSED AS FAILED |
| LAG | | ON WHEN THE LAG CHILLER IS REQUESTED |
| | | |
| | CxRT | TOTALIZED VALUE OF CHILLER-x'S RUNTIME |
| | PxRT | TOTALIZED VALUE OF PUMP Px'S RUNTIME |
| | OAT | VARIABLE VALUE OF OUTSIDE AIR TEMPERATURE |
| | SPD | VARIABLE CALCULATED VALUE OF REMOTE DP PID LOOP OUTPUT (PUMP SPEED) |
| | CWSP | VARIABLE VALUE OF CHILLED WATER SUPPLY TEMPERATURE SETPOINT |
| | CxKW | VARIABLE VALUE OF CHILLER-x KILLOWATTS |
| | SCWS | VARIABLE VALUE OF THE SECONDARY CHILLED WATER SUPPLY TEMPERATURE |
| | | |




## ELECTRIC LADDER DIAGRAM




TYPICAL PRIMARY CHW PUMP STARTER




TYPICAL SECONDARY CHW PUMP VSD

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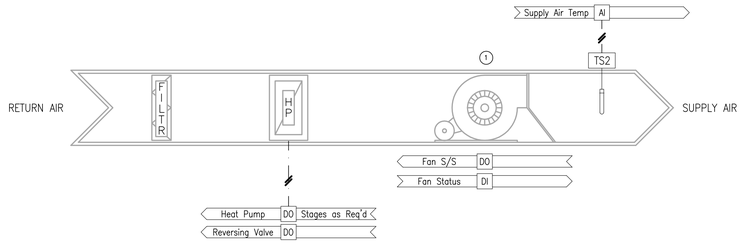
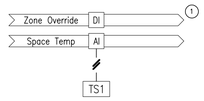
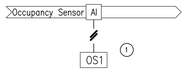
Raleigh, NC 27610
(919) 588-3608




LOCATE AS SHOWN ON MECHANICAL PLANS




NOTES

1. Where applicable
2. Physical configuration of FCU to be determined by designer including draw-through or blow-through fan

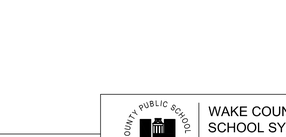
## POINTS LIST

| POINT DESCRIPTOR | POINT TYPE DI | AI | DO | AO | VP | TREND | ALARM | ALARM CONDITION | REMARKS |
|---|---|---|---|---|---|---|---|---|---|
| Space Temp | | • | | | | 15 MIN | | | |
| Occupancy Sensor | • | | | | | COV | | | Where Applicable |
| Zone Override | • | | | | | COV | | | Where Applicable |
| Heat Pump | | | • | | | COV | | | |
| Reversing Valve | | | • | | | COV | | | |
| Fan S/S | | | • | | | COV | | | |
| Fan Status | • | | | | | COV | | | |
| Supply Air Temp | | • | | | | 15 MIN | | | |
| Alarm | • | | | | | COV | • | | |
| | | | | | | | | | |

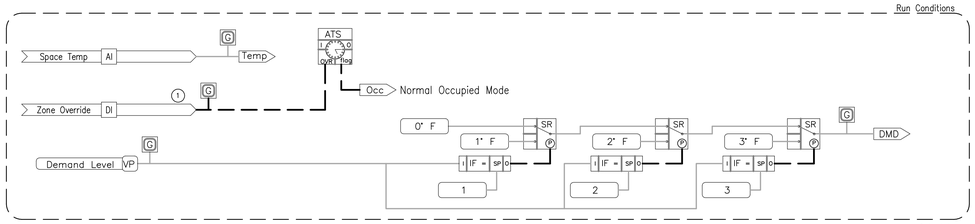
## LOGIC VARIABLES

| BINARY | ANALOG | DESCRIPTION |
|---|---|---|
| Occ | | ON WHEN OCCUPIED MODE ACTIVE |
| | | |
| | | |
| RUN | | ON WHEN FCU REQUESTED TO RUN |
| SGO | | ON WHEN SUPPLY FAN IS PROVEN ON |
| HTG | | ON WHEN ZONE REQUIRES HEATING |
| CLG | | ON WHEN ZONE REQUIRES COOLING |
| HTP | | ON WHEN THE HEAT PUMP COMPRESSOR IS ENABLED |
| | Temp | VARIABLE VALUE OF SPACE TEMPERATURE |
| | HSP | VARIABLE VALUE OF THE HEATING SPACE TEMPERATURE SETPOINT |
| | CSP | VARIABLE VALUE OF THE COOLING SPACE TEMPERATURE SETPOINT |

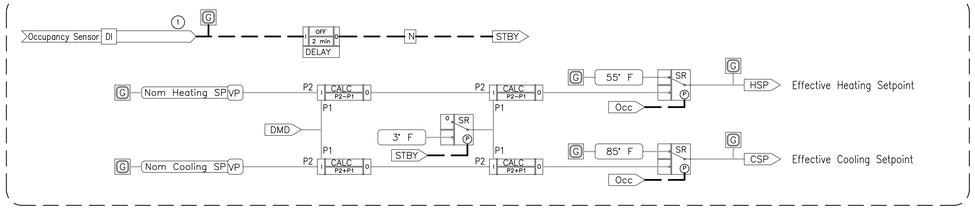
## ELECTRIC LADDER DIAGRAMS



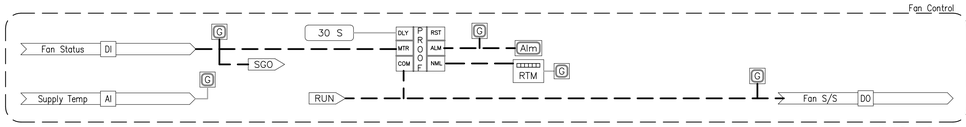

Run Conditions



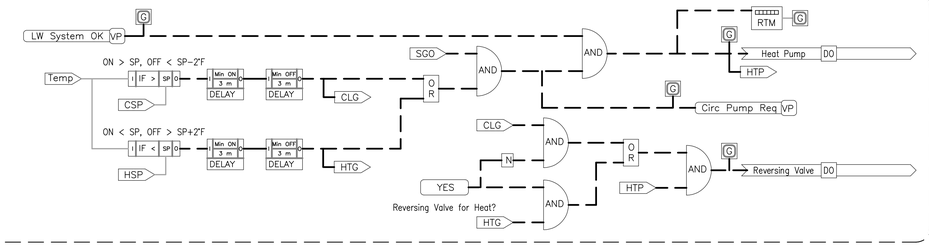

Setpoints




Fan Control




Heat Pump Control



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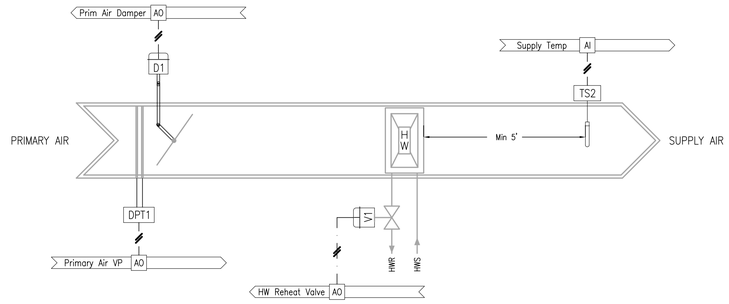
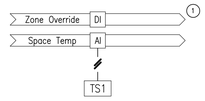
(919) 588-3608

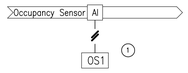
NOTES

1. Where applicable
2. Physical configuration of FCU to be determined by designer including draw-through or blow-through fan
3. Provide graphic link to the parent AHU from the primary AHU temperature displayed on the BAS graphic.




LOCATE AS SHOWN ON MECHANICAL PLANS

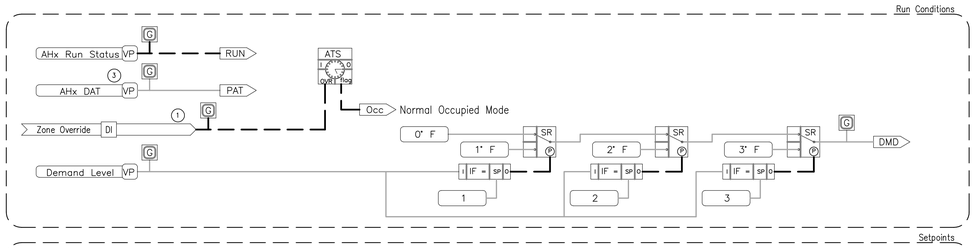


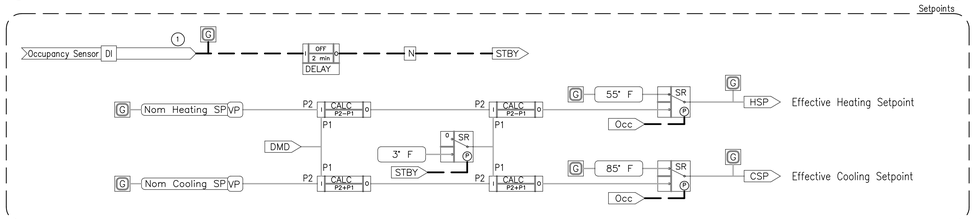

## POINTS LIST

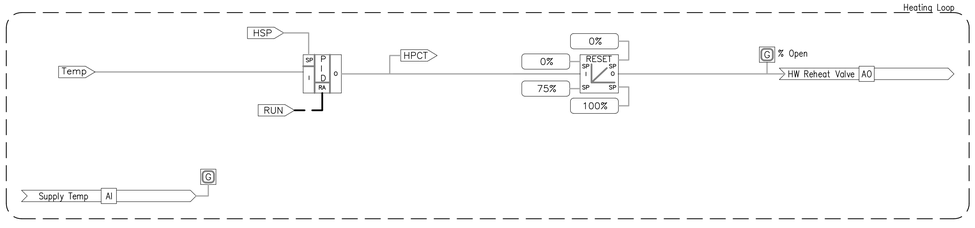
| POINT DESCRIPTOR | POINT TYPE DI | AI | DO | AO | VP | TREND | ALARM | ALARM CONDITION | REMARKS |
|---|---|---|---|---|---|---|---|---|---|
| Space Temp | | • | | | | 15 MIN | | | |
| Prim Air Damper | | | | • | | COV | | | |
| Primary Air VP | | • | | | | 15 MIN | | | |
| Supply Air Temp | | • | | | | 15 MIN | | | |
| HW Reheat Valve | | | | • | | COV | | | |
| Setpoint Adjust | | • | | | | COV | | | |
| Zone Override | • | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |

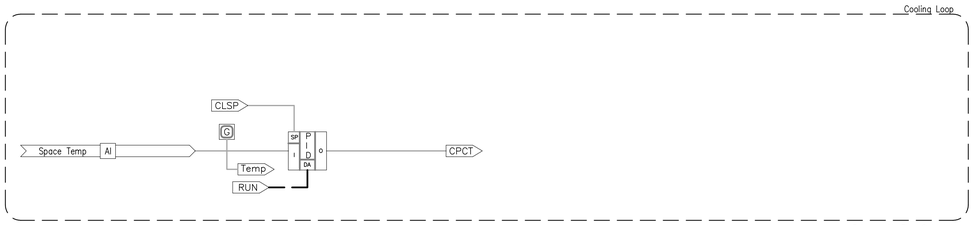
## LOGIC VARIABLES

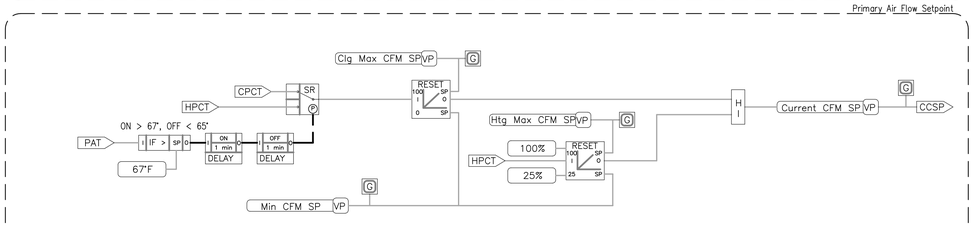
| BINARY | ANALOG | DESCRIPTION |
|---|---|---|
| Occ | | ON WHEN OCCUPIED MODE ACTIVE |
| RUN | | ON WHEN UNIT COMMANDED TO START |
| STBY | | ON WHEN ZONE IS IN THE "STANDBY" MODE (OCCUPANCY SENSOR NOT ON) |
| | Temp | VARIABLE VALUE OF SPACE TEMPERATURE |
| | HSP | VARIABLE CALCULATED VALUE OF ACTIVE HEATING SETPOINT |
| | CSP | VARIABLE CALCULATED VALUE OF ACTIVE COOLING SETPOINT |
| | CCSP | VARIABLE CALCULATED VALUE OF CURRENT CFM SETPOINT |
| | CPCT | VARIABLE CALCULATED VALUE OF THE COOLING LOOP OUTPUT (COOLING %) |
| | HPCT | VARIABLE CALCULATED VALUE OF THE HEATING LOOP OUTPUT (HEATING %) |
| | PAT | VARIABLE VALUE OF THE PRIMARY AIR TEMPERATURE (PARENT AHU TEMP) |
| | DMD | VARIABLE VALUE OF THE DEMAND LEVEL SPACE TEMPERATURE SETPT OFFSET |
| | | |
| | | |

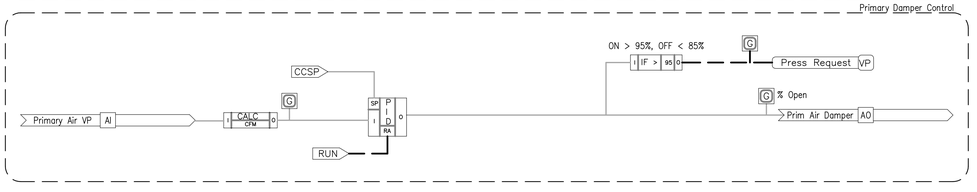
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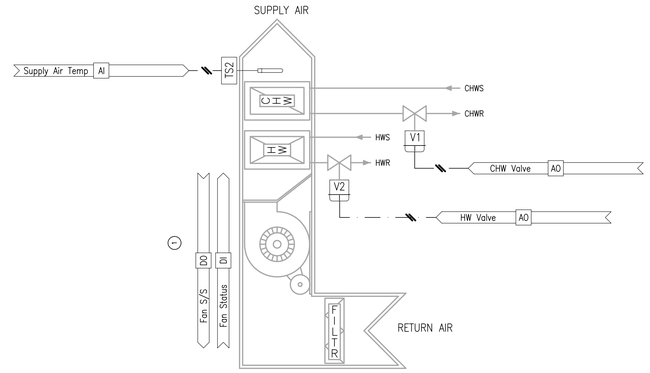
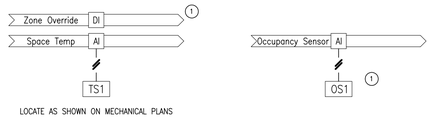



NOTES

1. Where applicable
2. Physical configuration of FCU to be determined by designer including draw-through or blow-through fan



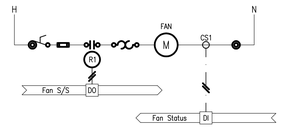

## POINTS LIST

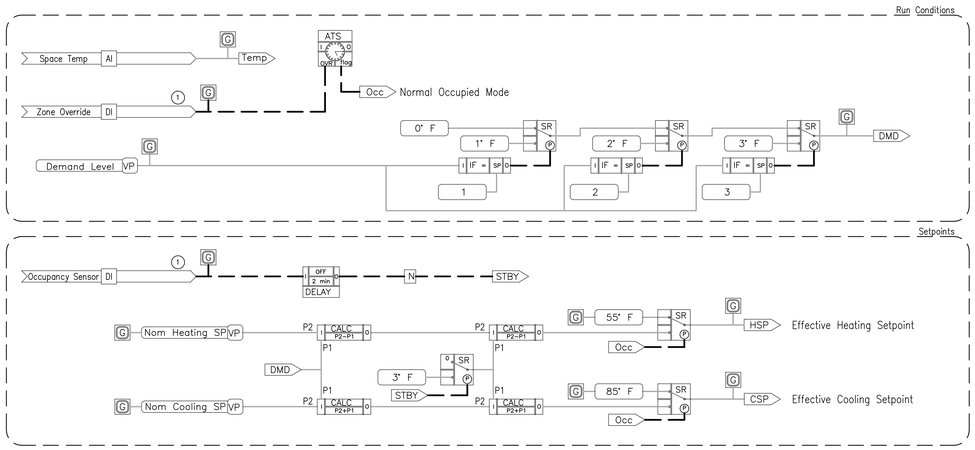
| POINT DESCRIPTOR | POINT TYPE DI | AI | DO | AO | VP | TREND | ALARM | ALARM CONDITION | REMARKS |
|---|---|---|---|---|---|---|---|---|---|
| Space Temp | | • | | | | 15 MIN | | | |
| Occupancy Sensor | • | | | | | COV | | | Where Applicable |
| Occ Override | • | | | | | COV | | | Where Applicable |
| CHW Valve | | | | • | | COV | | | |
| Supply Air Temp | | • | | | | 15 MIN | | | |
| HW Valve | | | | • | | COV | | | |
| Fan S/S | | | • | | | COV | | | |
| Fan Status | • | | | | | COV | • | | |
| | | | | | | | | | |
| | | | | | | | | | |

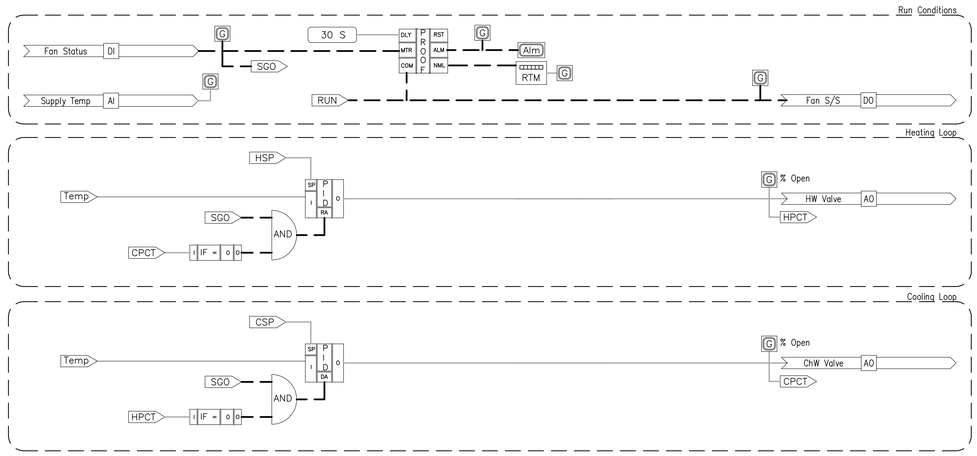
## LOGIC VARIABLES

| BINARY | ANALOG | DESCRIPTION |
|---|---|---|
| Occ | | ON WHEN OCCUPIED MODE ACTIVE |
| SBH | | ON WHEN SETBACK HEATING MODE ACTIVE |
| SBC | | ON WHEN SETBACK COOLING MODE ACTIVE |
| RUN | | ON WHEN FCU REQUESTED TO RUN |
| SGO | | ON WHEN SUPPLY FAN IS PROVEN ON |
| | Temp | VARIABLE VALUE OF SPACE TEMPERATURE |
| | | |
| | | |
| | | |

## ELECTRIC LADDER DIAGRAMS

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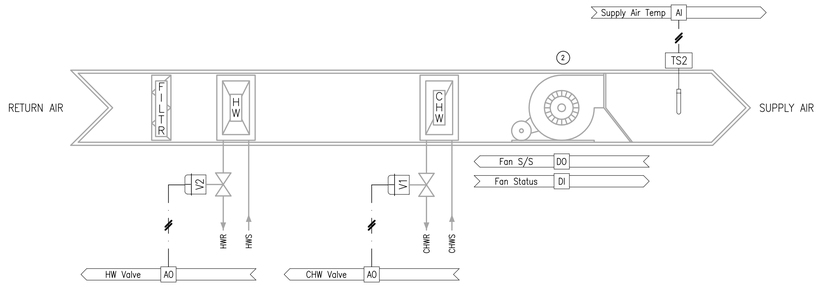
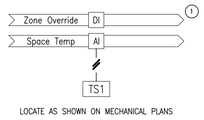
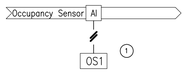



NOTES

1. Where applicable
2. Physical configuration of FCU to be determined by designer including draw-through or blow-through fan




LOCATE AS SHOWN ON MECHANICAL PLANS



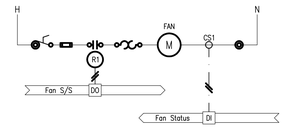

## POINTS LIST

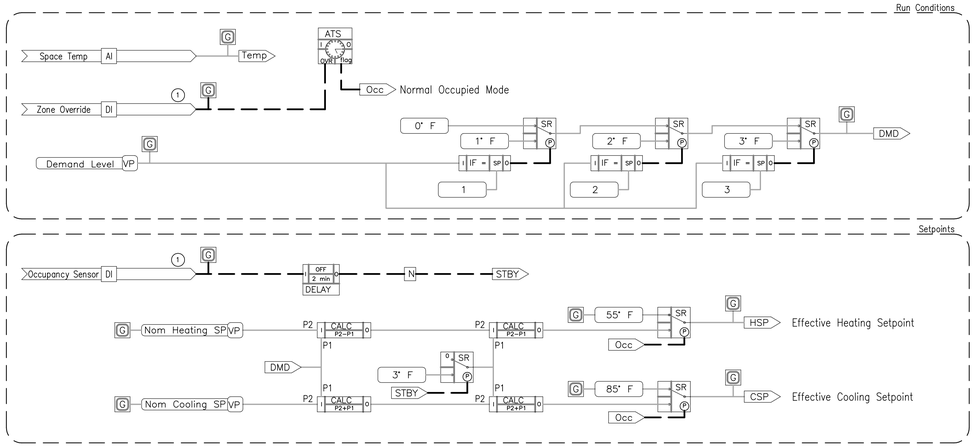
| POINT DESCRIPTOR | POINT TYPE DI | AI | DO | AO | VP | TREND | ALARM | ALARM CONDITION | REMARKS |
|---|---|---|---|---|---|---|---|---|---|
| Space Temp | | • | | | | 15 MIN | | | |
| Occupancy Sensor | • | | | | | COV | | | Where Applicable |
| Occ Override | • | | | | | COV | | | Where Applicable |
| CHW Valve | | | | • | | COV | | | |
| Supply Air Temp | | • | | | | 15 MIN | | | |
| HW Valve | | | | • | | COV | | | |
| Fan S/S | | | • | | | COV | | | |
| Fan Status | • | | | | | COV | • | | |
| | | | | | | | | | |
| | | | | | | | | | |

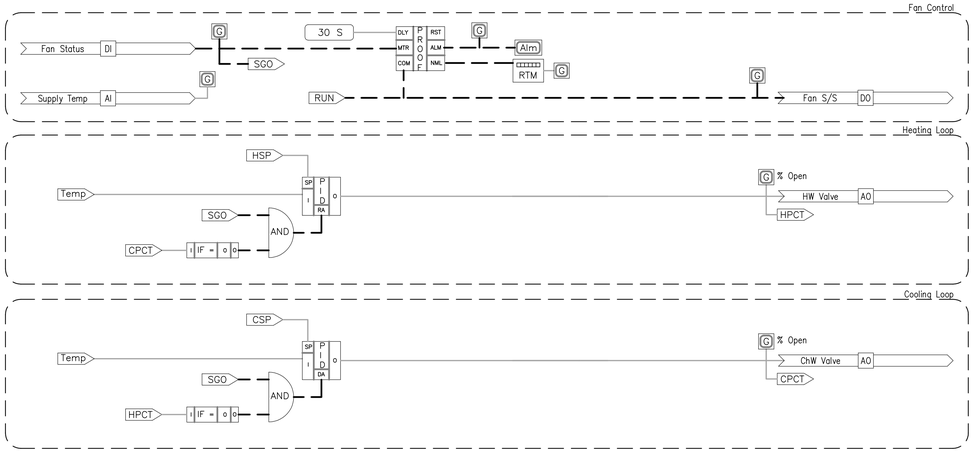
## LOGIC VARIABLES

| BINARY | ANALOG | DESCRIPTION |
|---|---|---|
| Occ | | ON WHEN OCCUPIED MODE ACTIVE |
| RUN | | ON WHEN FCU REQUESTED TO RUN |
| SGO | | ON WHEN SUPPLY FAN IS PROVEN ON |
| | Temp | VARIABLE VALUE OF SPACE TEMPERATURE |
| | | |
| | | |
| | | |
| | | |
| | | |

## ELECTRIC LADDER DIAGRAMS



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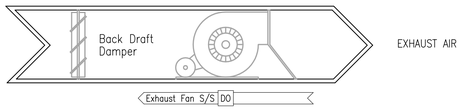
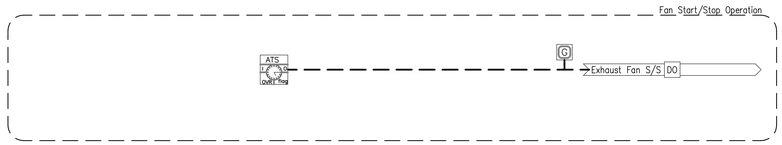
NOTES

1.

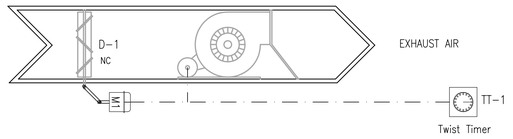



## Typical General Exhaust Fan

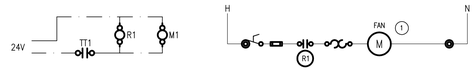



NOTES

1. Fan Motor or Motor Starter, as applicable

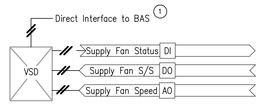



## Typical Science Room Exhaust Fan

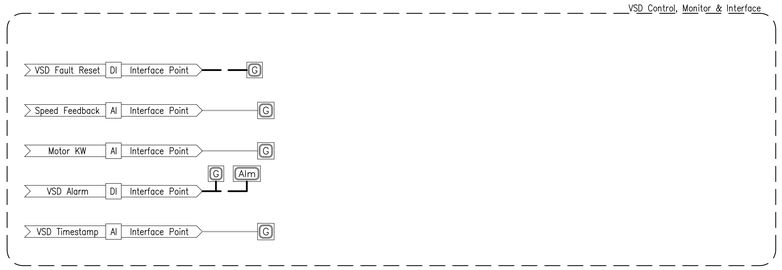


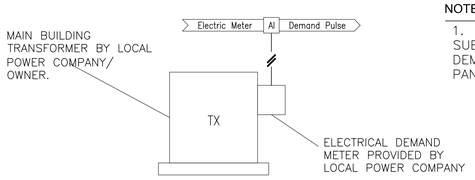

NOTES

1. PROVIDE DIRECT INTERFACE TO ALL VSDs (PUMPS, FANS, ETC.). SHOW ALL AVAILABLE POINTS VIA THE BAS INTERFACE. HARDWIRE INDICATED POINTS SHOWN ON THE SCHEMATIC DIAGRAM. MINIMUM REQUIRED INTERFACE POINTS ARE INDICATED IN LOGIC DIAGRAM BELOW.
2. SHOW HARDWIRED POINTS AND VSD ALARM POINT (INTERFACE POINT) ON THE EQUIPEMENT GRAPHIC. PROVIDE SEPERATE LINK TO VSD (FROM THE EQUIPMENT SCHEMATIC GRAPHIC) THAT DISPLAYS ALL ALL AVAILABLE INTERFACE POINTS.




## Typical Variable Speed Drive Control/Monitor

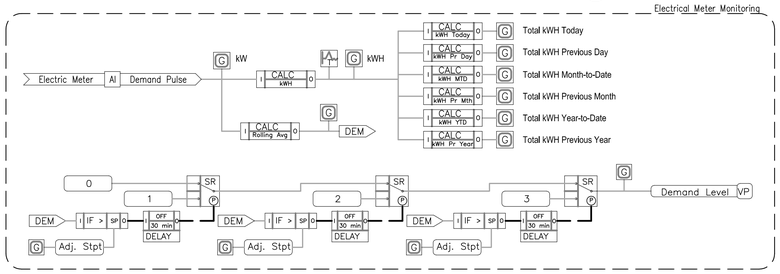



NOTES

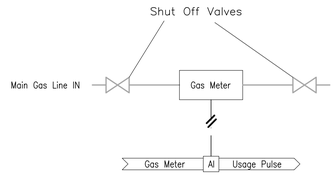
1. WIRING PROVIDED BY BAS SUBCONTRACTOR. CONDUIT FROM DEMAND METER TO BAS CONTROL PANEL BY ELECTRICAL CONTRACTOR.

## Electrical Meter Monitoring

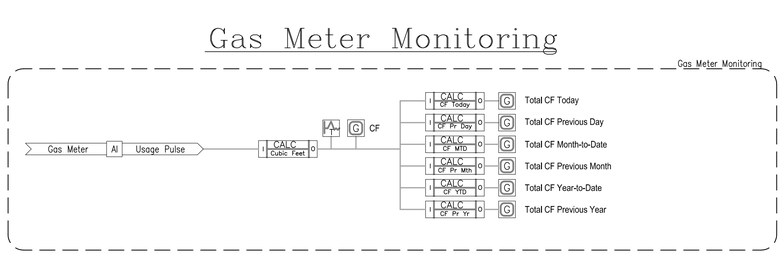



NOTES

1. LOCATED IN ROOM ____.
2. METER PROVIDED BY GAS UTILITY COMPANY.

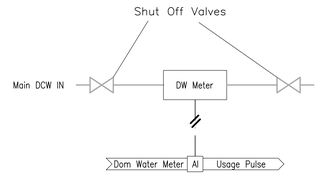



## Gas Meter Monitoring

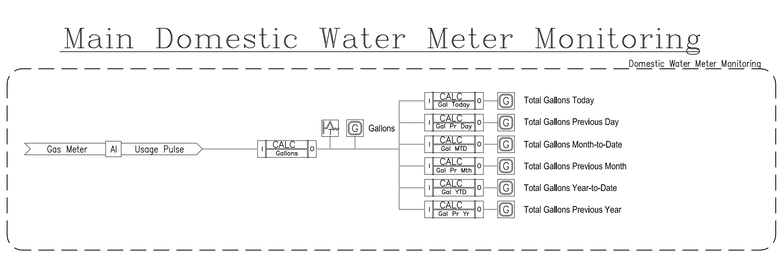



NOTES

1. LOCATED IN ROOM ____.
2. METER PROVIDED BY BAS CONTRACTOR & INSTALLED BY THE PLUMBING CONTRACTOR.

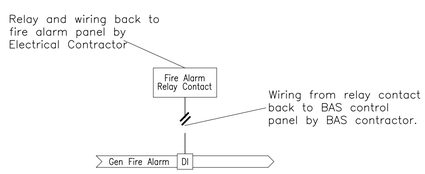



## Main Domestic Water Meter Monitoring




NOTES

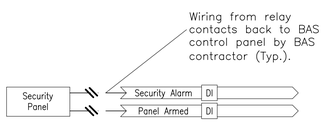
1. REFER TO FIRE ALARM RISER SHEET ____




## General Fire Alarm Signal Monitoring


NOTES

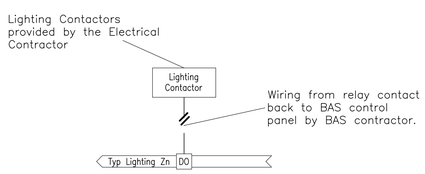
1.



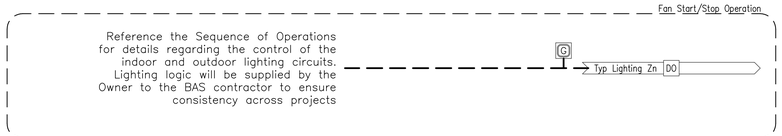

## Security Panel Monitoring


NOTES

1. REFER TO ELECTRICAL DRAWINGS SHEET ____




## Typical Lighting Circuit Control



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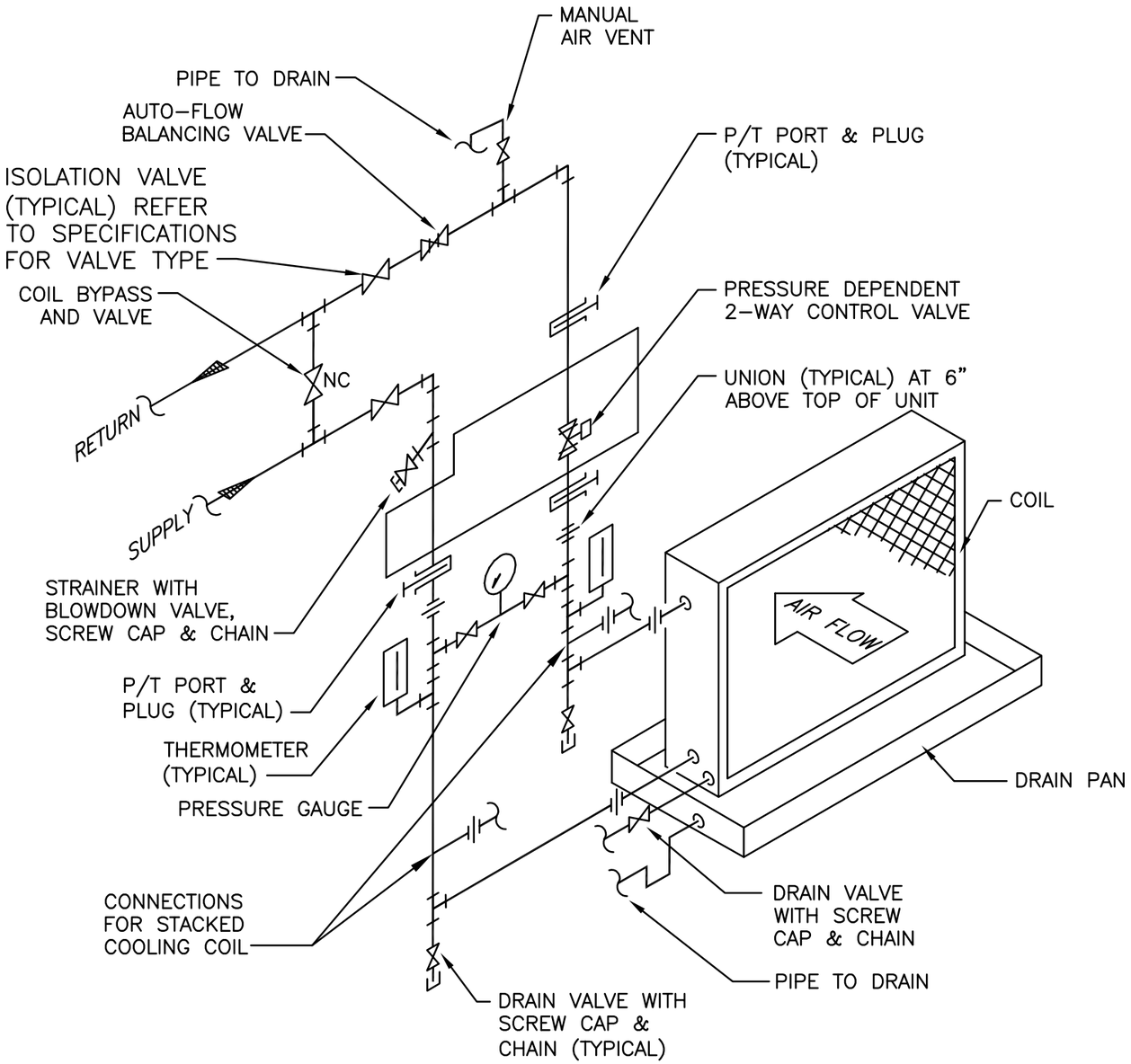
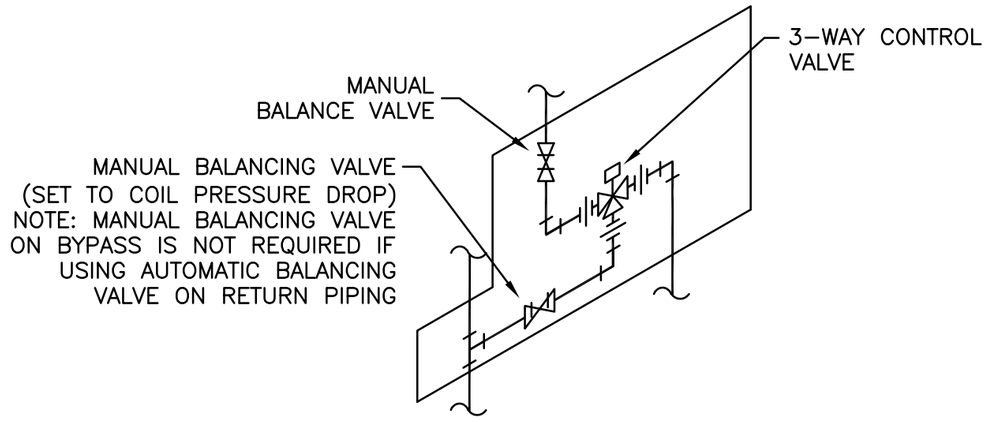
NOTES:

1. REFER TO SPECIFICATIONS FOR CONTROL AND BALANCING VALVE TYPES.
2. MANUAL BALANCING VALVE ON BYPASS IS NOT REQUIRED IF USING AUTOMATIC BALANCING VALVE
3. PROVIDE DRAIN PAN OVERFLOW SWITCH FOR COOLING COIL




M1.01

AIR HANDLING UNIT COIL DETAIL

SCALE: NONE

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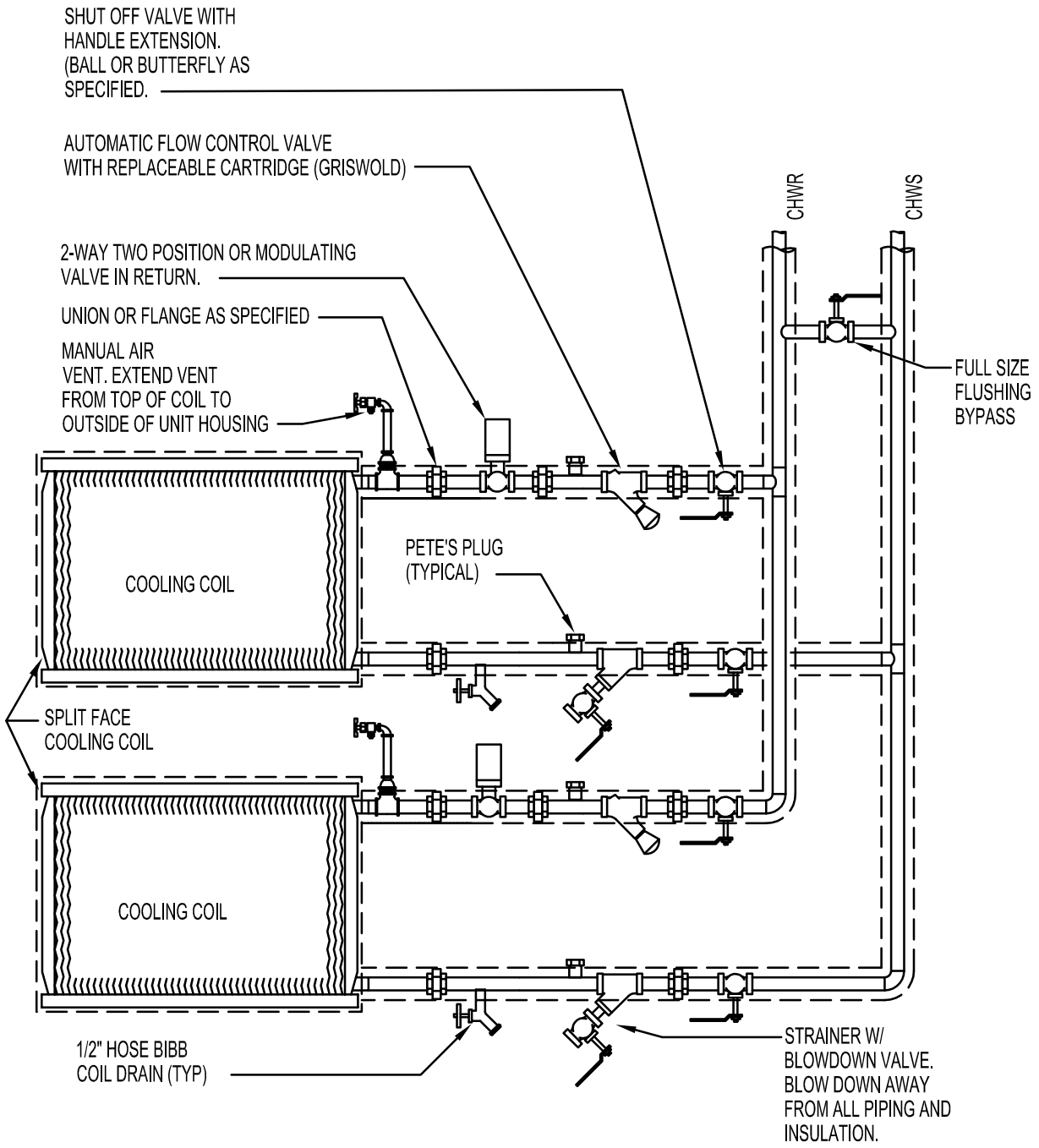


# M1.02

## SPLIT FACE COIL DETAIL

SCALE: NONE

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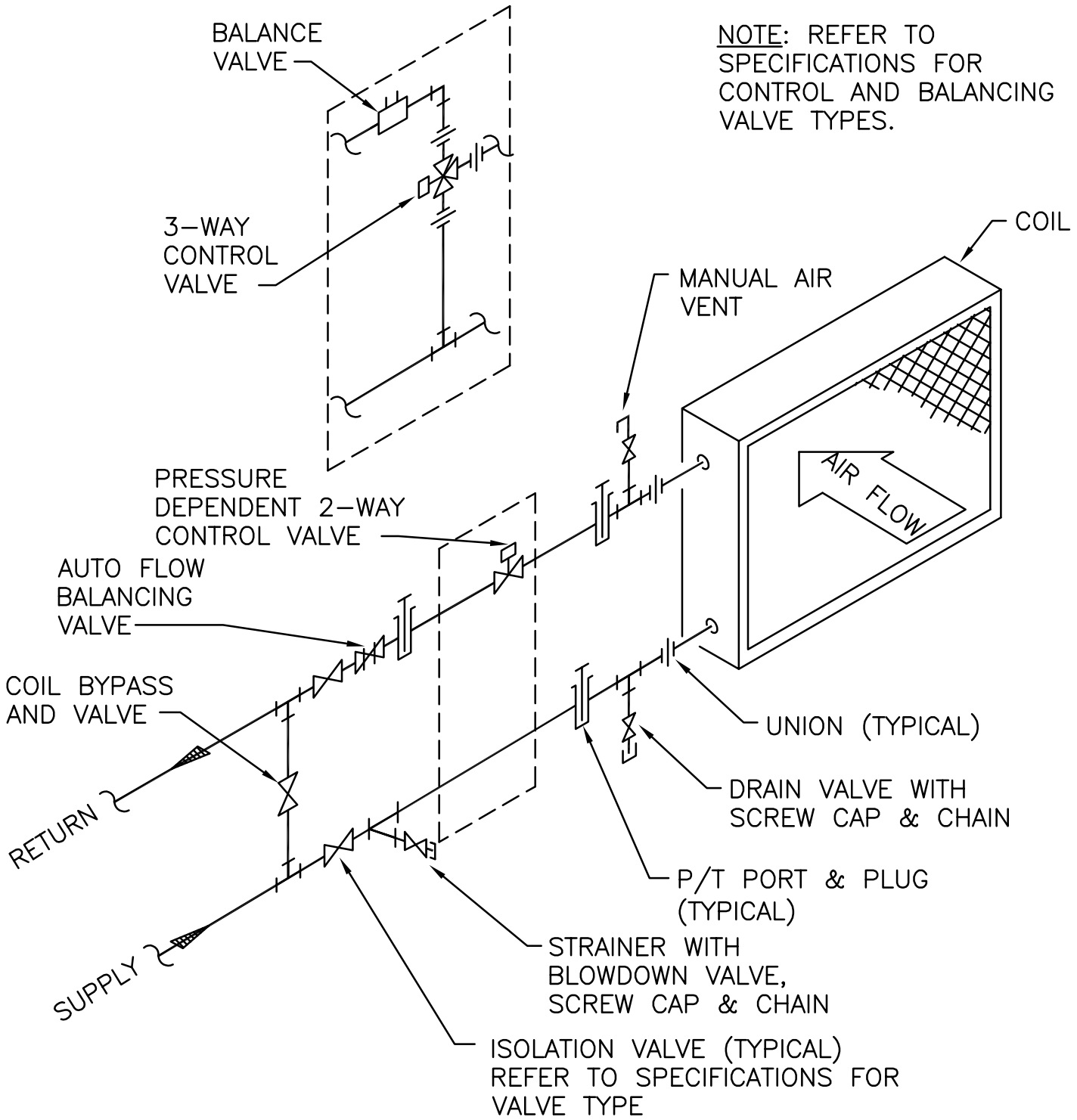


# M1.03

## TERMINAL UNIT COIL DETAIL

SCALE: NONE

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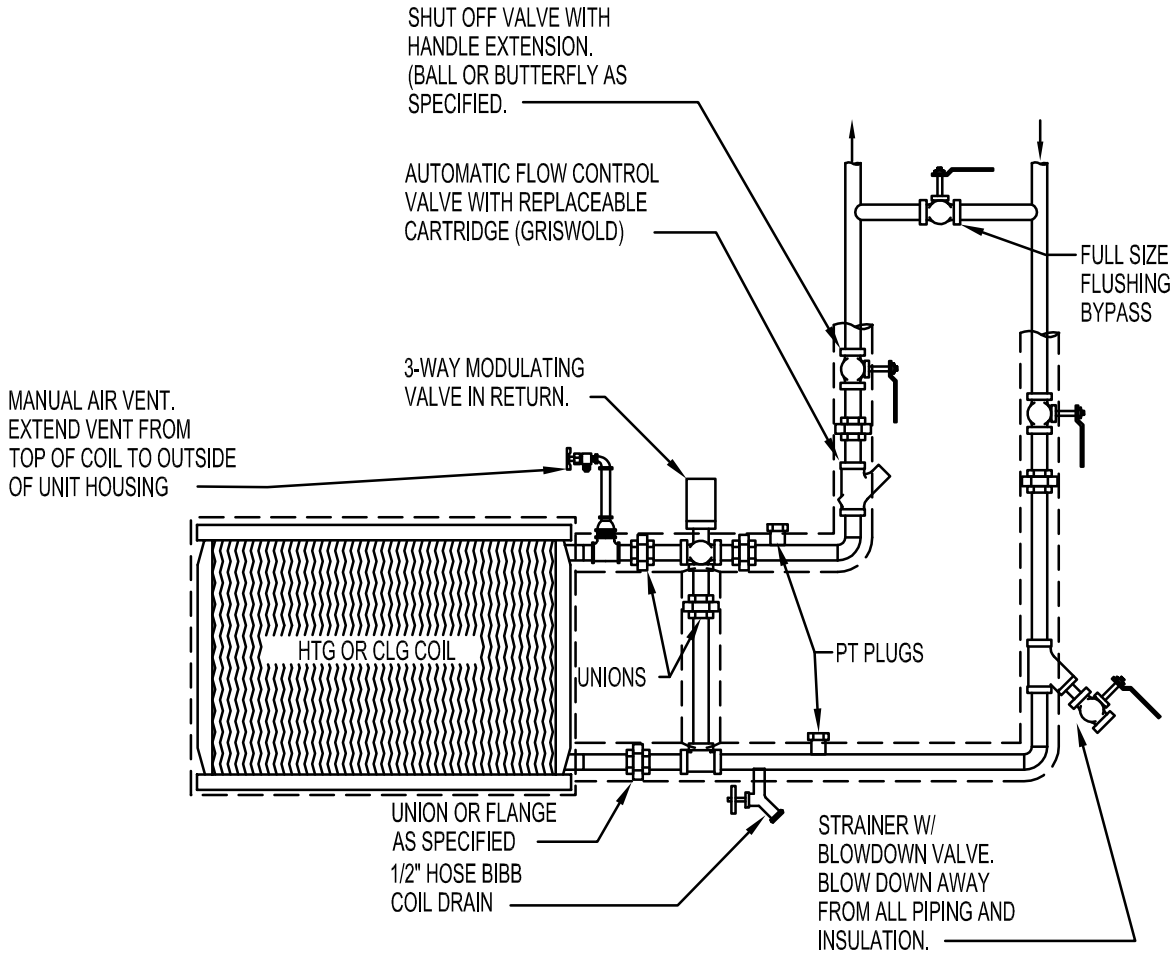


# M1.04

## THREE WAY COIL DETAIL

SCALE: NONE

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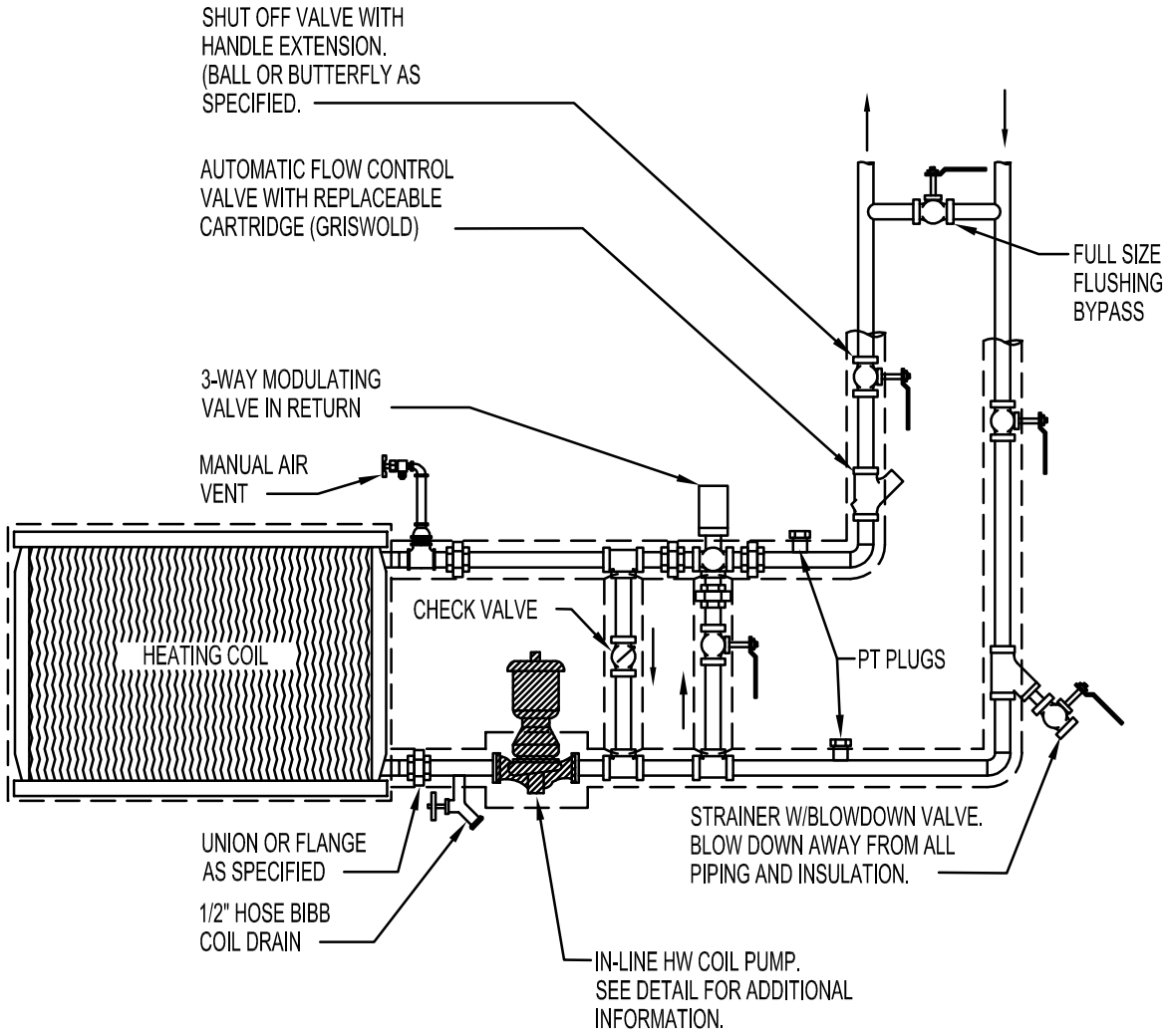


# M1.05

## THREE WAY COIL WITH PUMP DETAIL

SCALE: NONE

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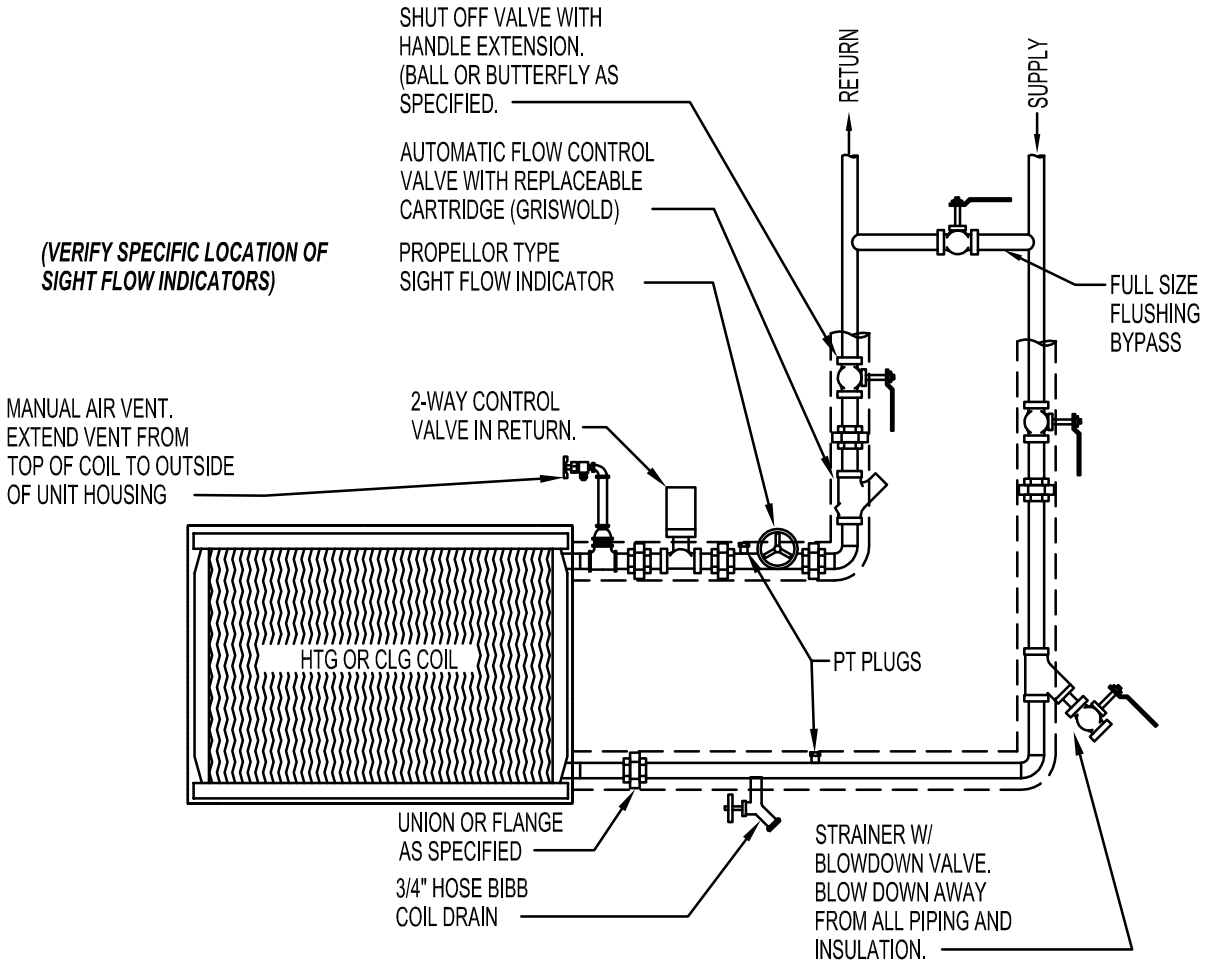
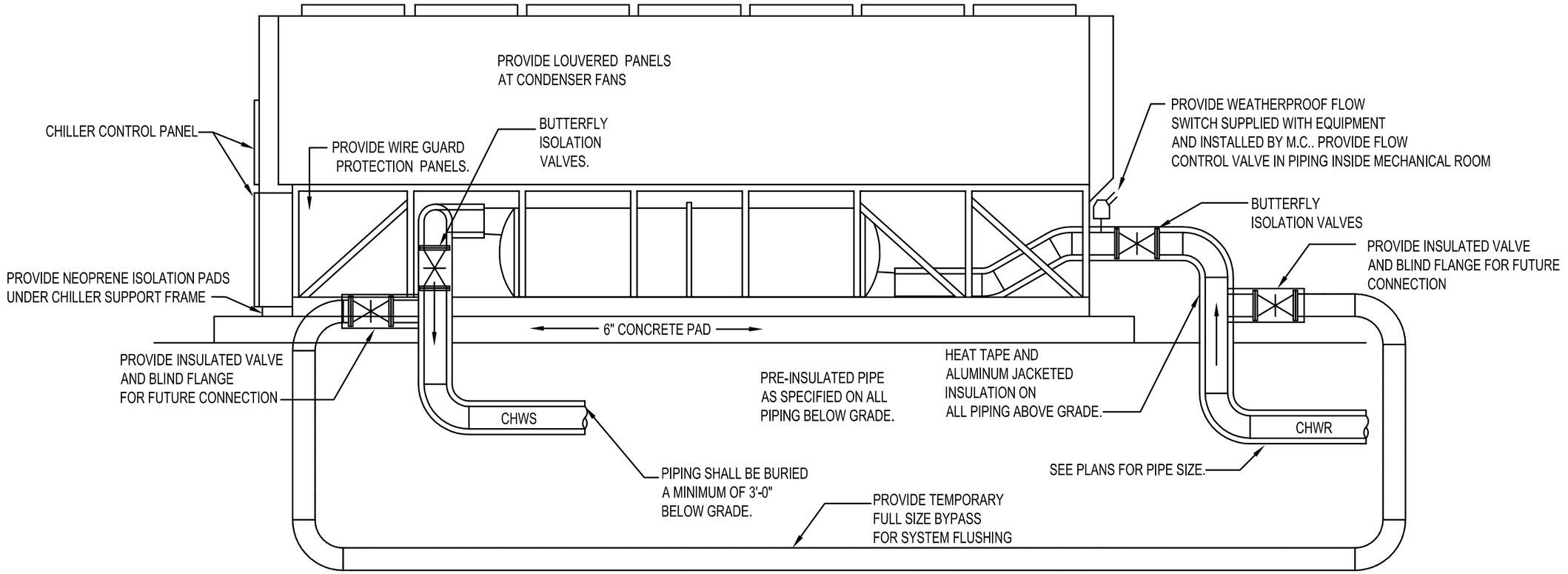



# M1.06

## TWO WAY COIL DETAIL

SCALE: NONE




NOTES:

1. PROVIDE LOUVERED PANELS AT CONDENSER FANS.
2. PPR PIPE AS SPECIFIED ON ALL PIPING BELOW GRADE.

# M1.11

## AIR COOLED CHILLER DETAIL

SCALE: NONE

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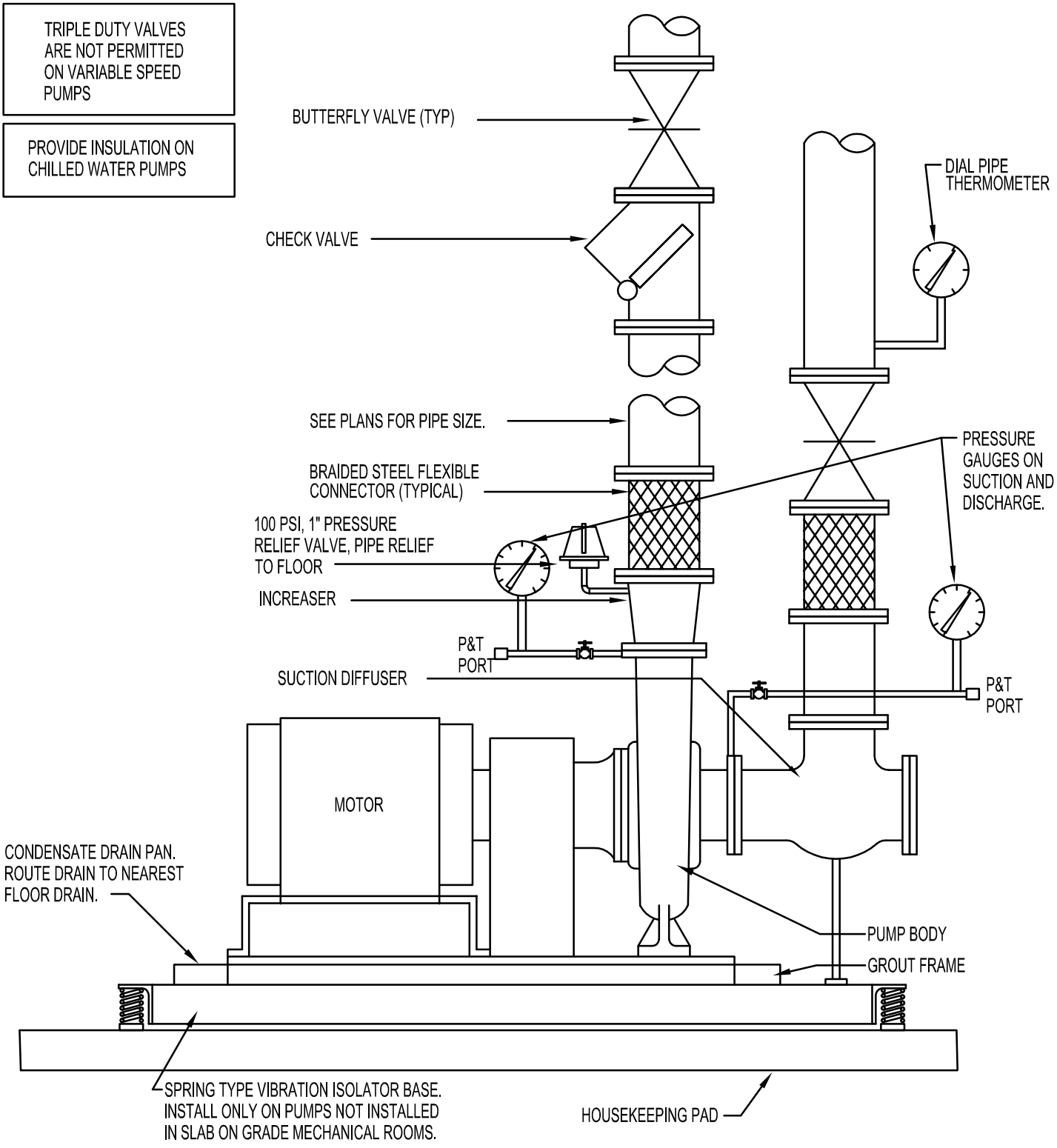
TRIPLE DUTY VALVES ARE NOT PERMITTED ON VARIABLE SPEED PUMPS

PROVIDE INSULATION ON CHILLED WATER PUMPS




# M1.12 BASE MOUNTED PUMP DETAIL

SCALE: NONE

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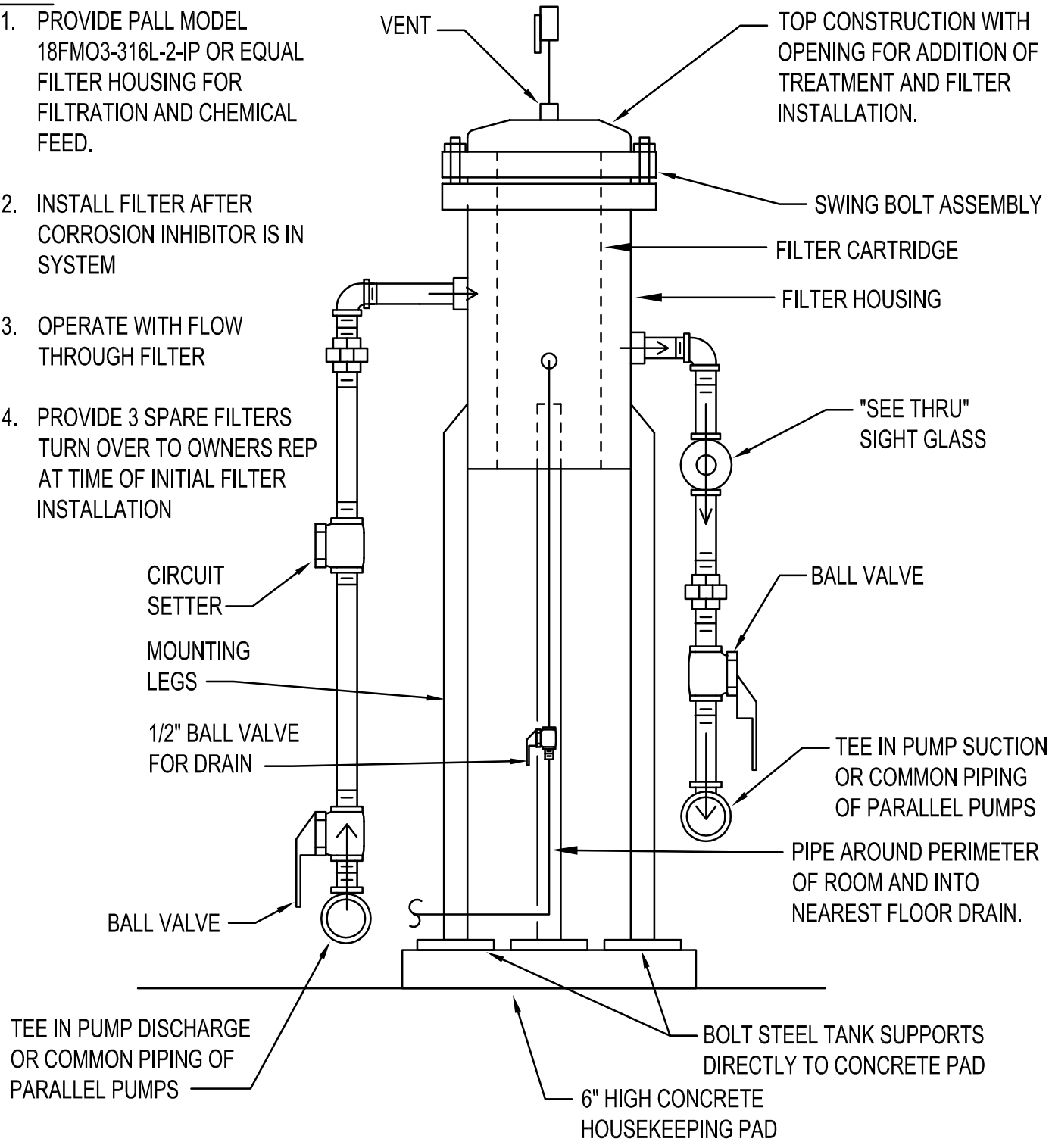
NOTES:

1. PROVIDE PALL MODEL 18FMO3-316L-2-IP OR EQUAL FILTER HOUSING FOR FILTRATION AND CHEMICAL FEED.
2. INSTALL FILTER AFTER CORROSION INHIBITOR IS IN SYSTEM
3. OPERATE WITH FLOW THROUGH FILTER
4. PROVIDE 3 SPARE FILTERS TURN OVER TO OWNERS REP AT TIME OF INITIAL FILTER INSTALLATION




# M1.13

## CHEMICAL FEEDER DETAIL

SCALE: NONE

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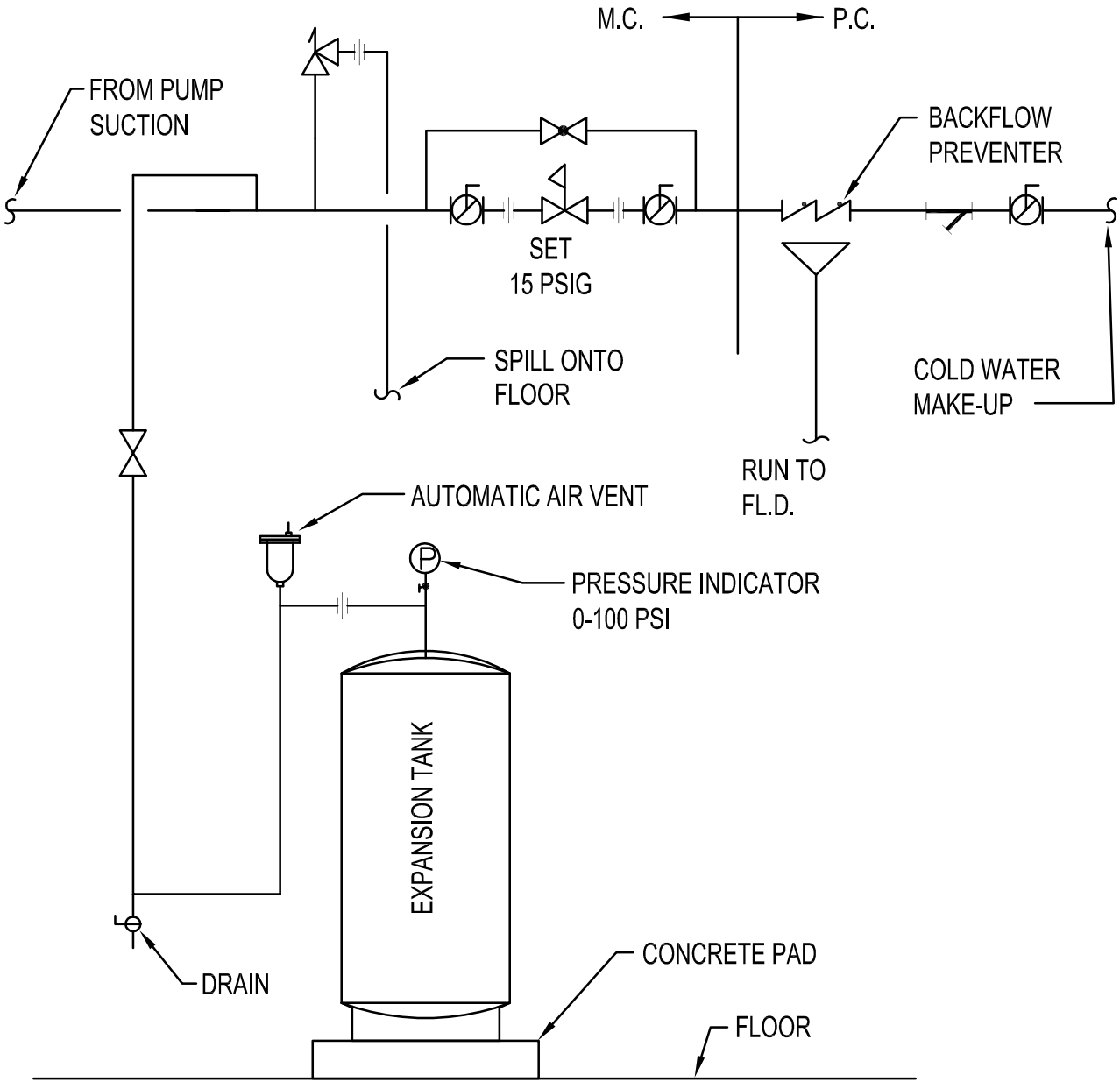
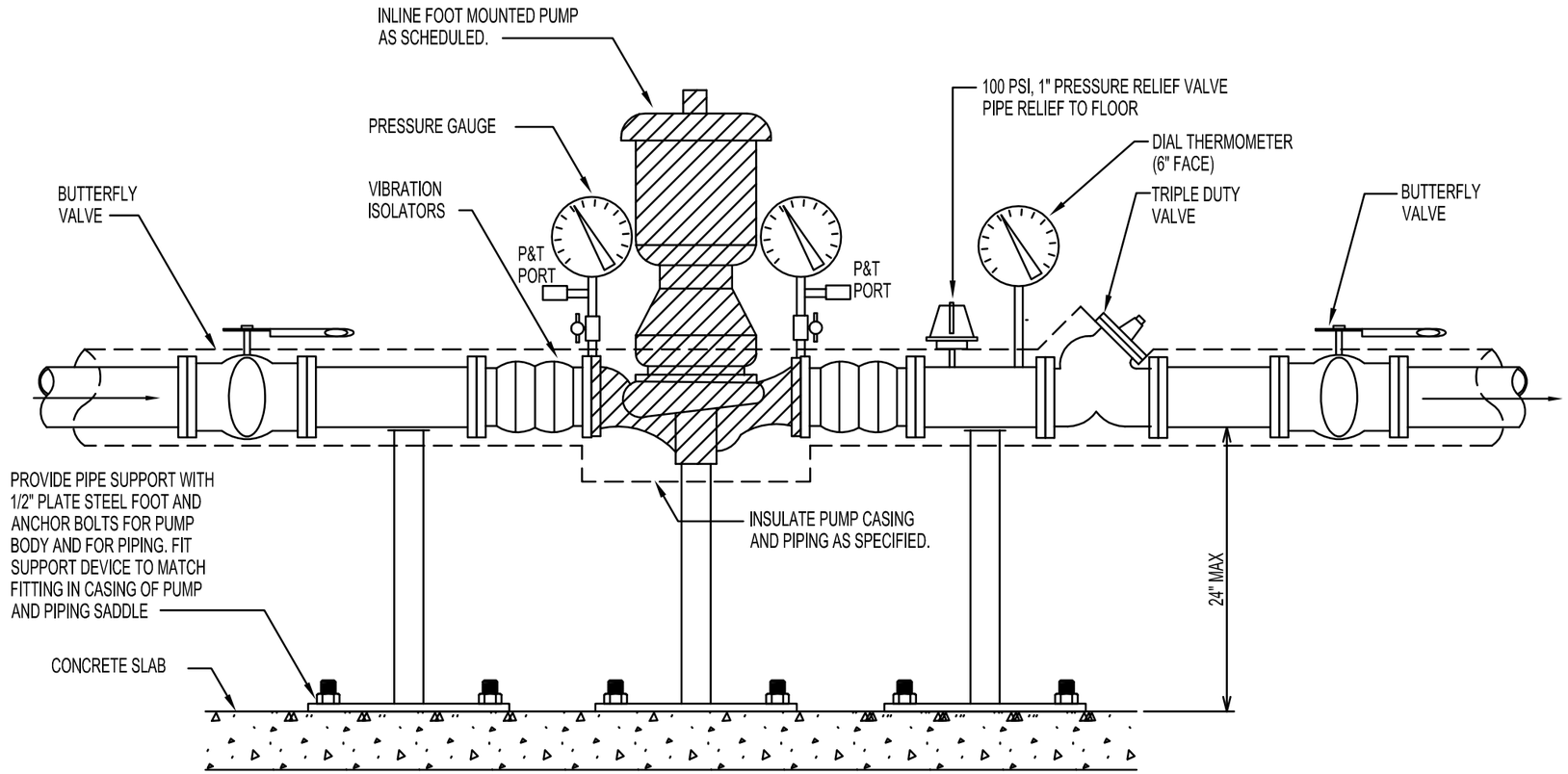



# M1.14

## EXPANSION TANK PIPING INSTALLATION DETAIL

SCALE: NONE




# M1.15 FLOOR MOUNTED INLINE CIRCULATION PUMP DETAIL

SCALE: NONE

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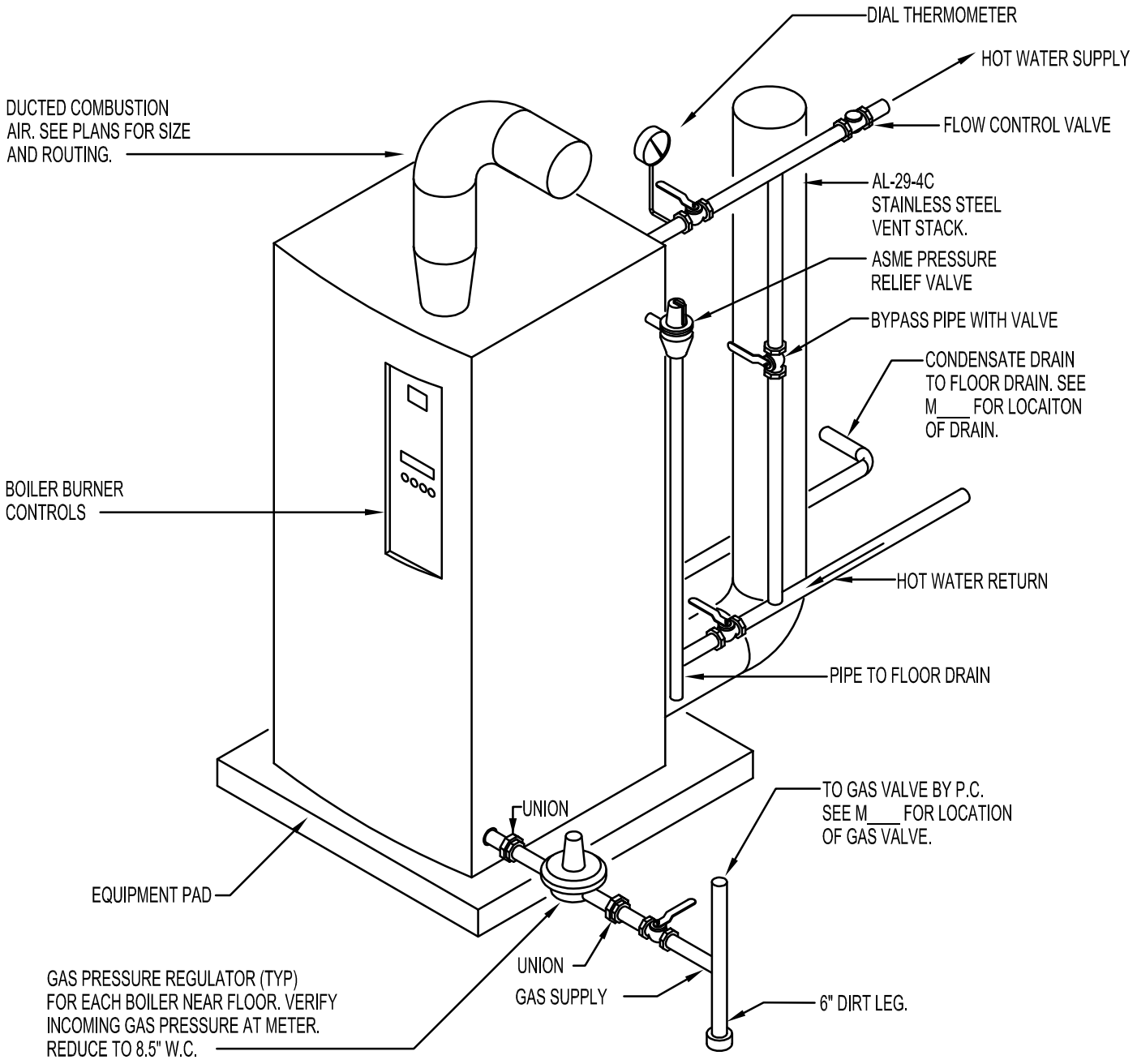


# M1.16 LARGE CONDENSING BOILER DETAIL

SCALE: NONE

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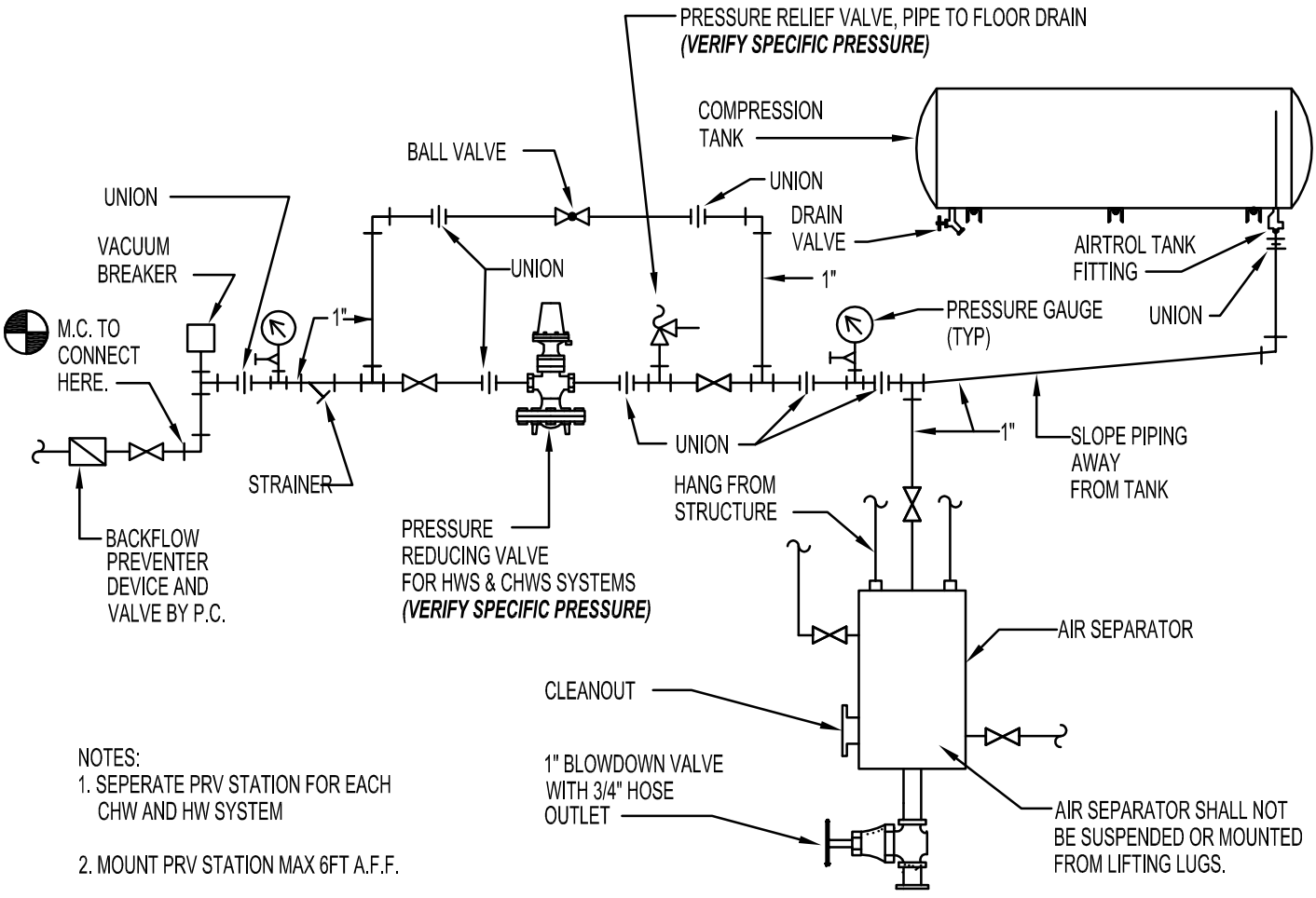


NOTES:
1. SEPERATE PRV STATION FOR EACH CHW AND HW SYSTEM

2. MOUNT PRV STATION MAX 6FT A.F.F.

# M1.17

## MAKEUP WATER STATION DETAIL

SCALE: NONE

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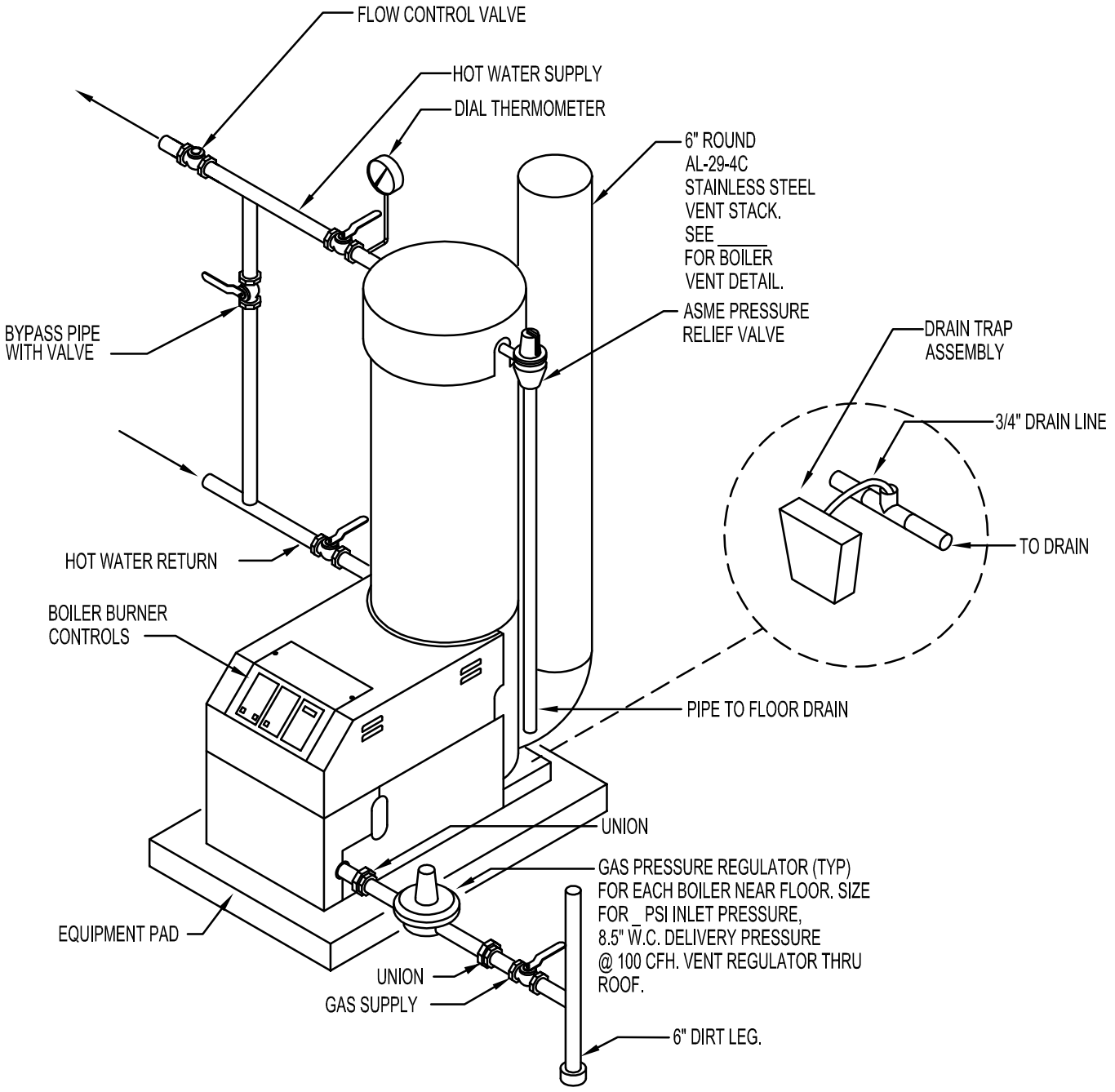


# M1.18 SMALL BOILER DETAIL

SCALE: NONE

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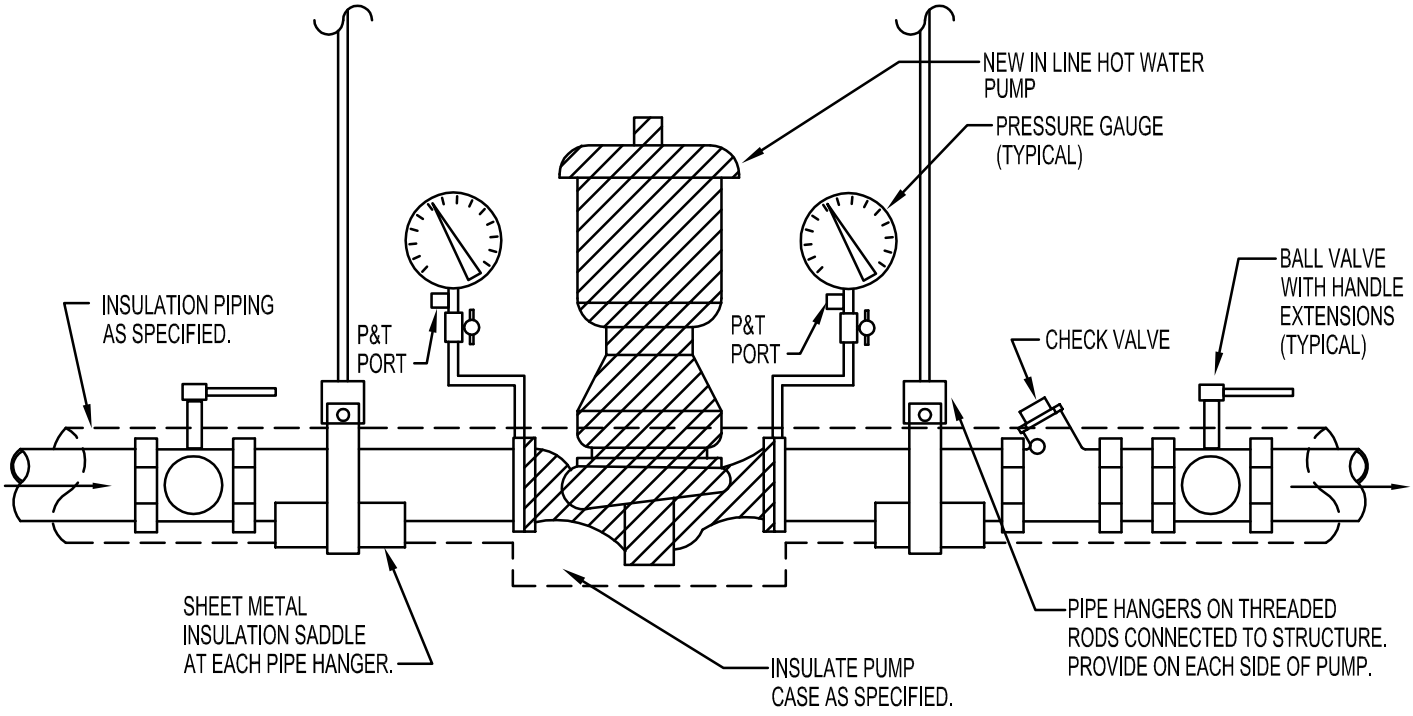


# M1.19 SUSPENDED INLINE CIRCULATION PUMP DETAIL

SCALE: NONE

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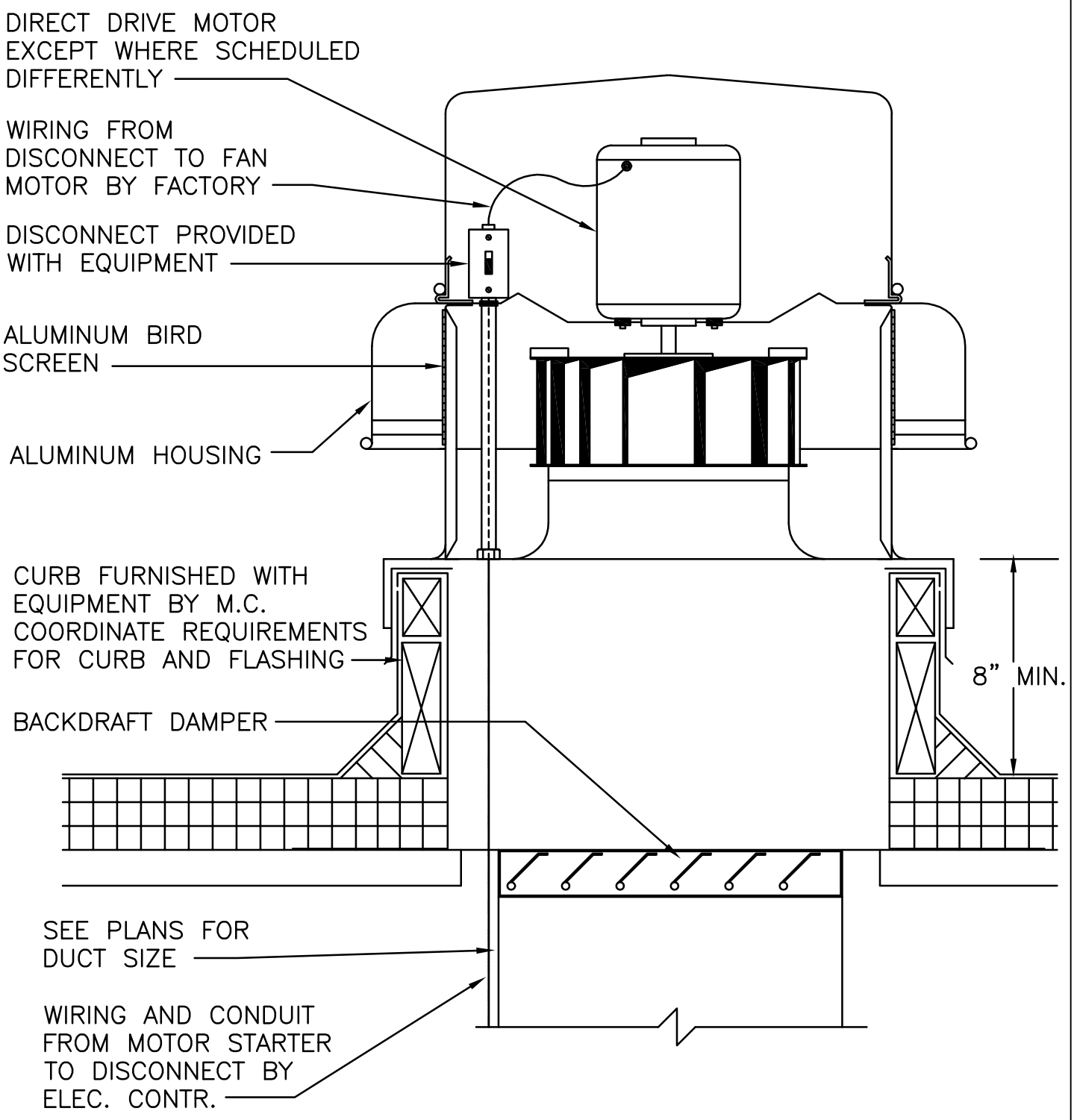


# M1.20 ROOF MOUNTED FAN DETAIL

SCALE: NONE

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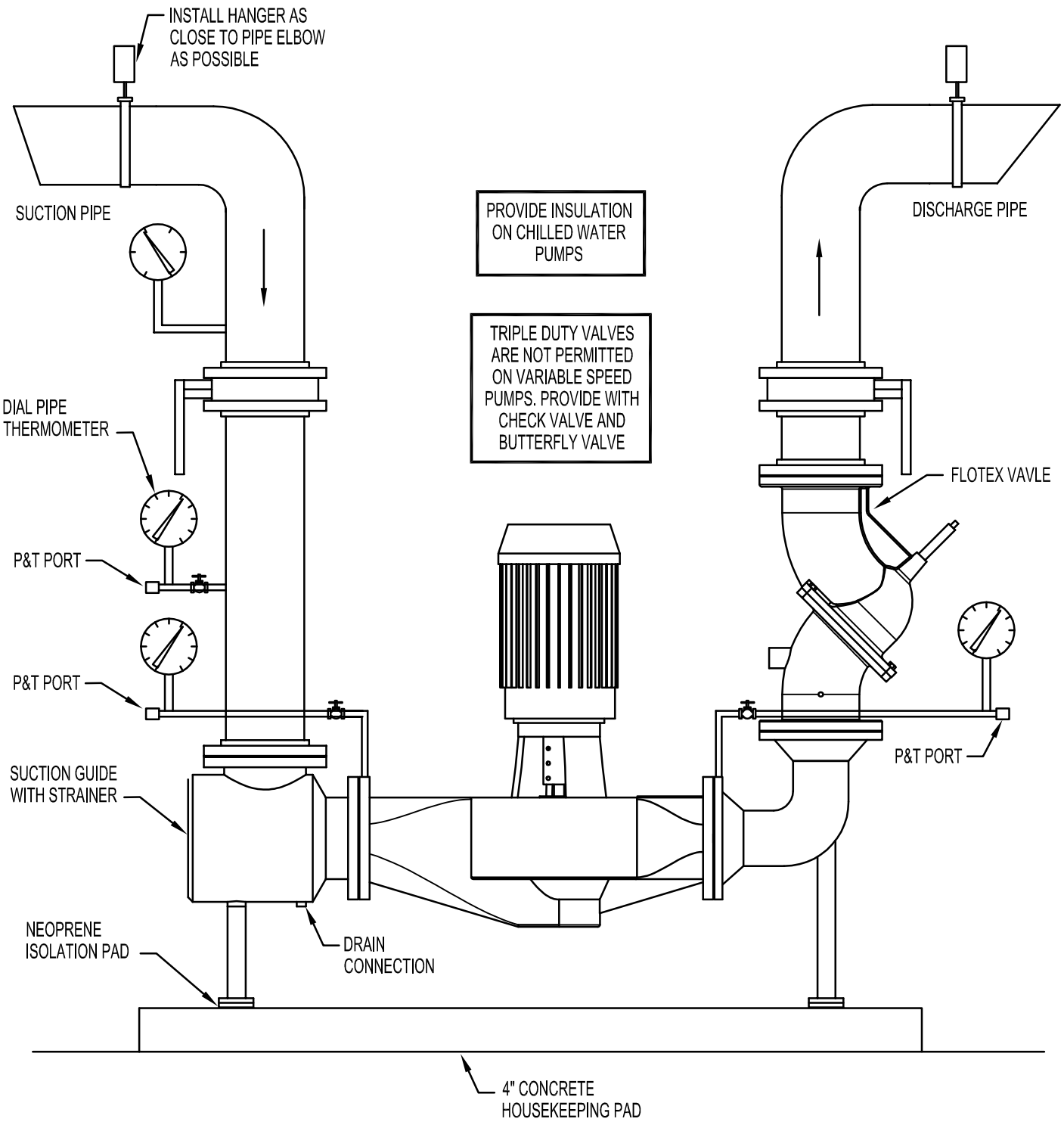


# M1.21

## PAD MOUNTED VERTICAL PUMP INSTALLATION DETAIL

SCALE: NONE

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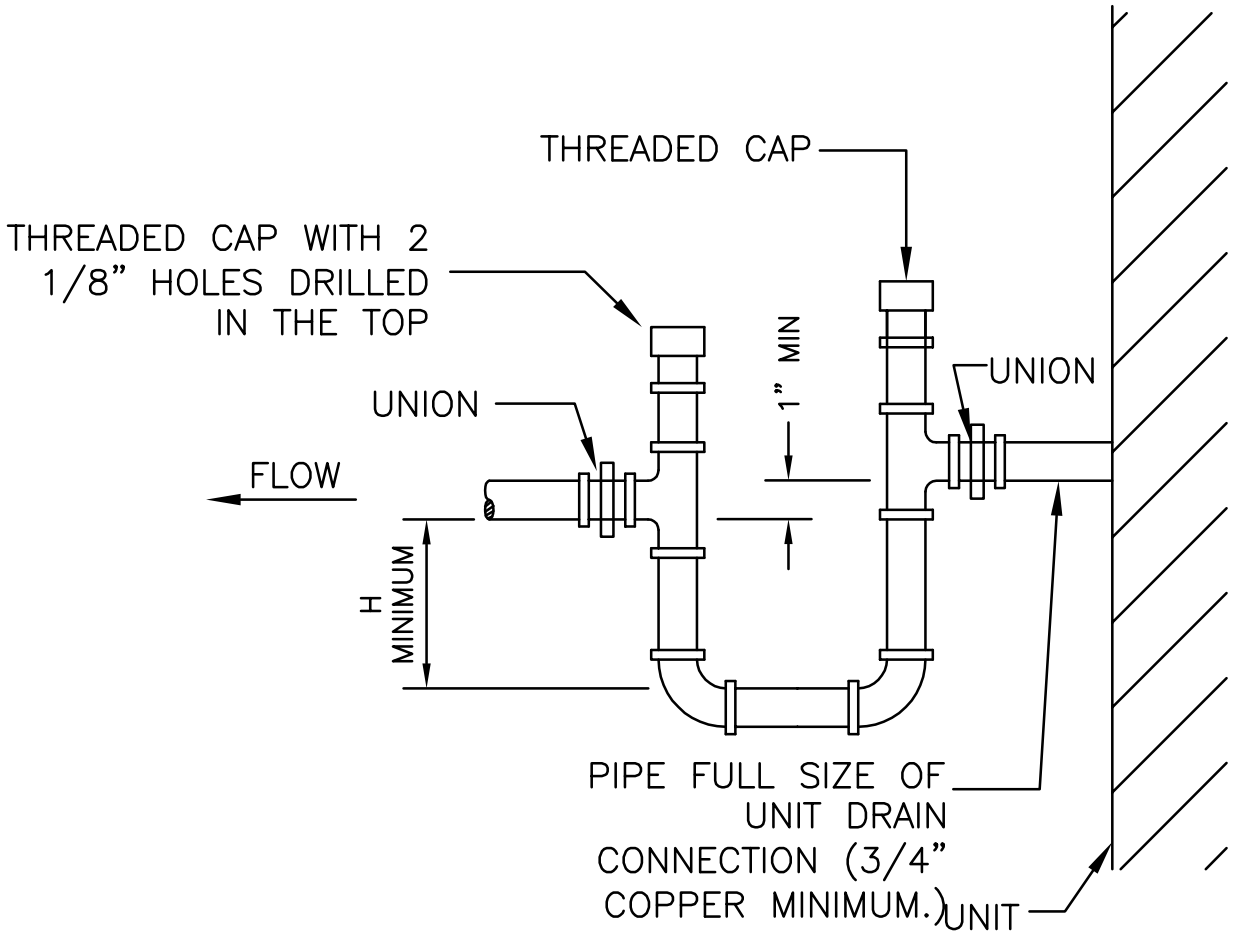
(919) 588-3608

NOTES:

1. LOCATE TRAP SO AS TO BE ACCESSIBLE FOR CLEANING.

2. H = FAN OUTLET PRESSURE (IN. W.C.) + 1 IN. MINIMUM




# M1.31

## BLOW-THRU CONDENSATE DRAIN DETAIL

SCALE: NONE

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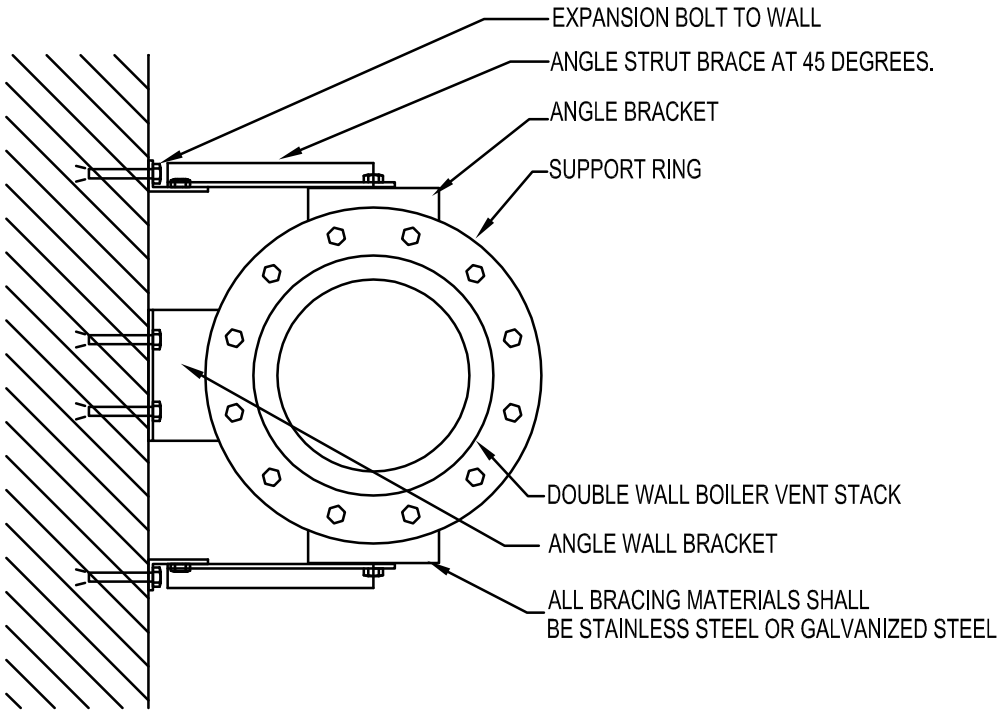


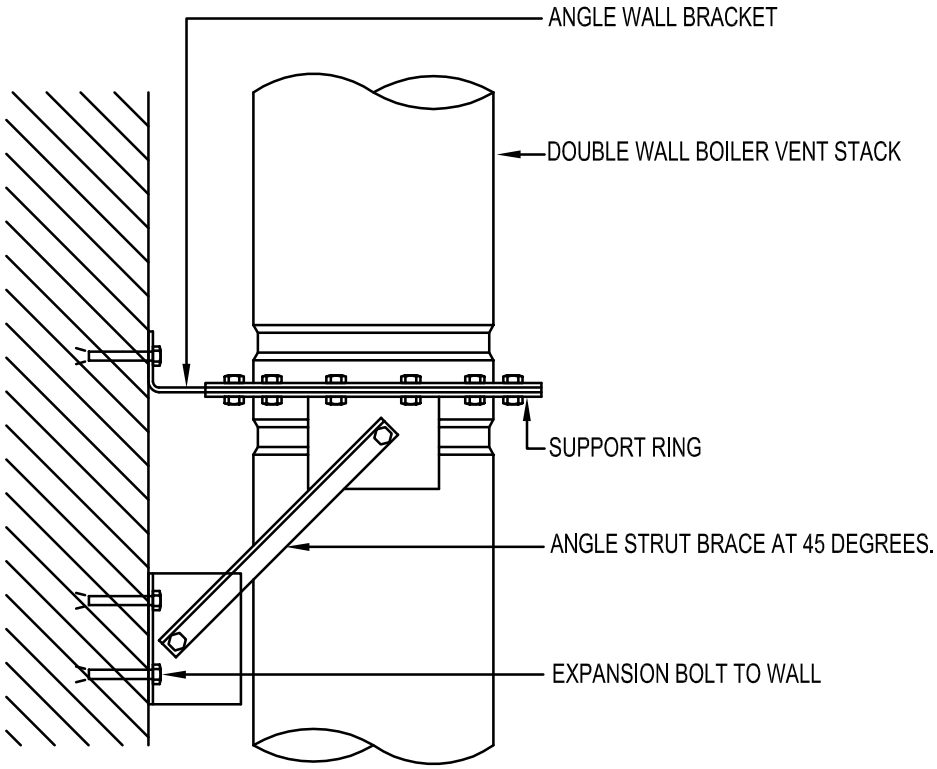


NOTE:
INSTALL AT JOINT DIRECTLY ABOVE TEE AT WALL PENETRATION AND EVERY 15'-0" O.C. VERTICAL. EXTEND BOILER VENT MINIMUM 3'-0" ABOVE ROOF / PARAPET.

# M1.32

## BOILER STACK SUPPORT DETAIL

SCALE: NONE

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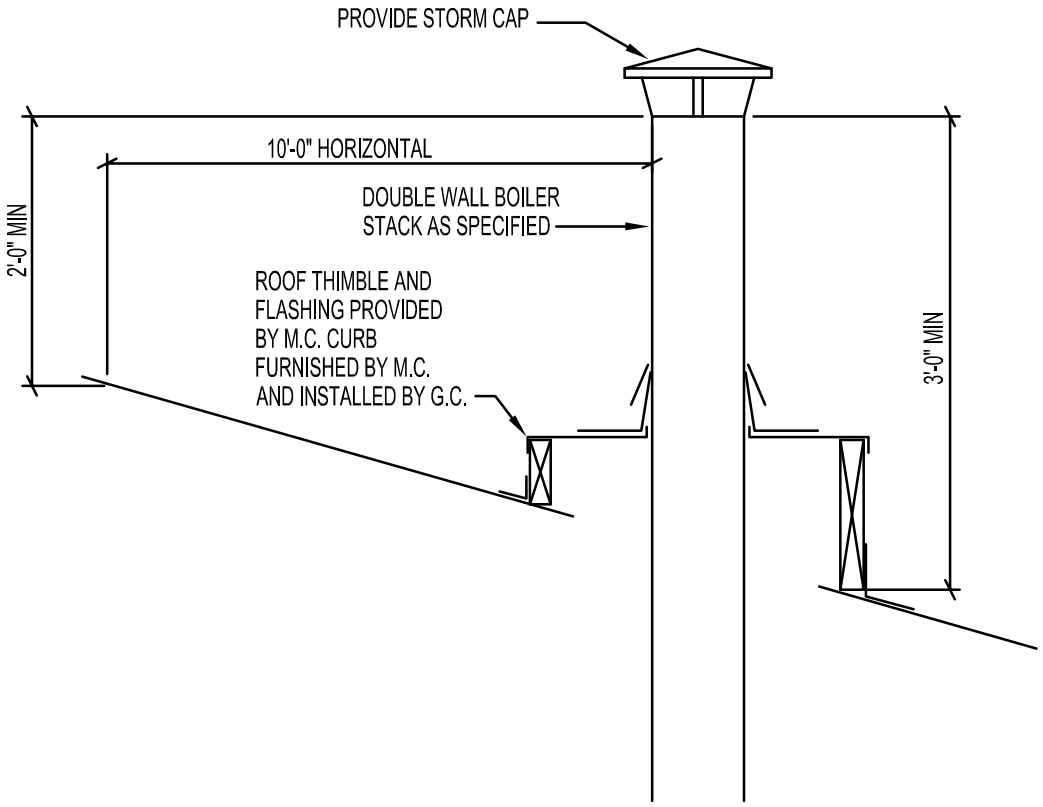



# M1.33

## BOILER STACK THRU SLOPED ROOF DETAIL

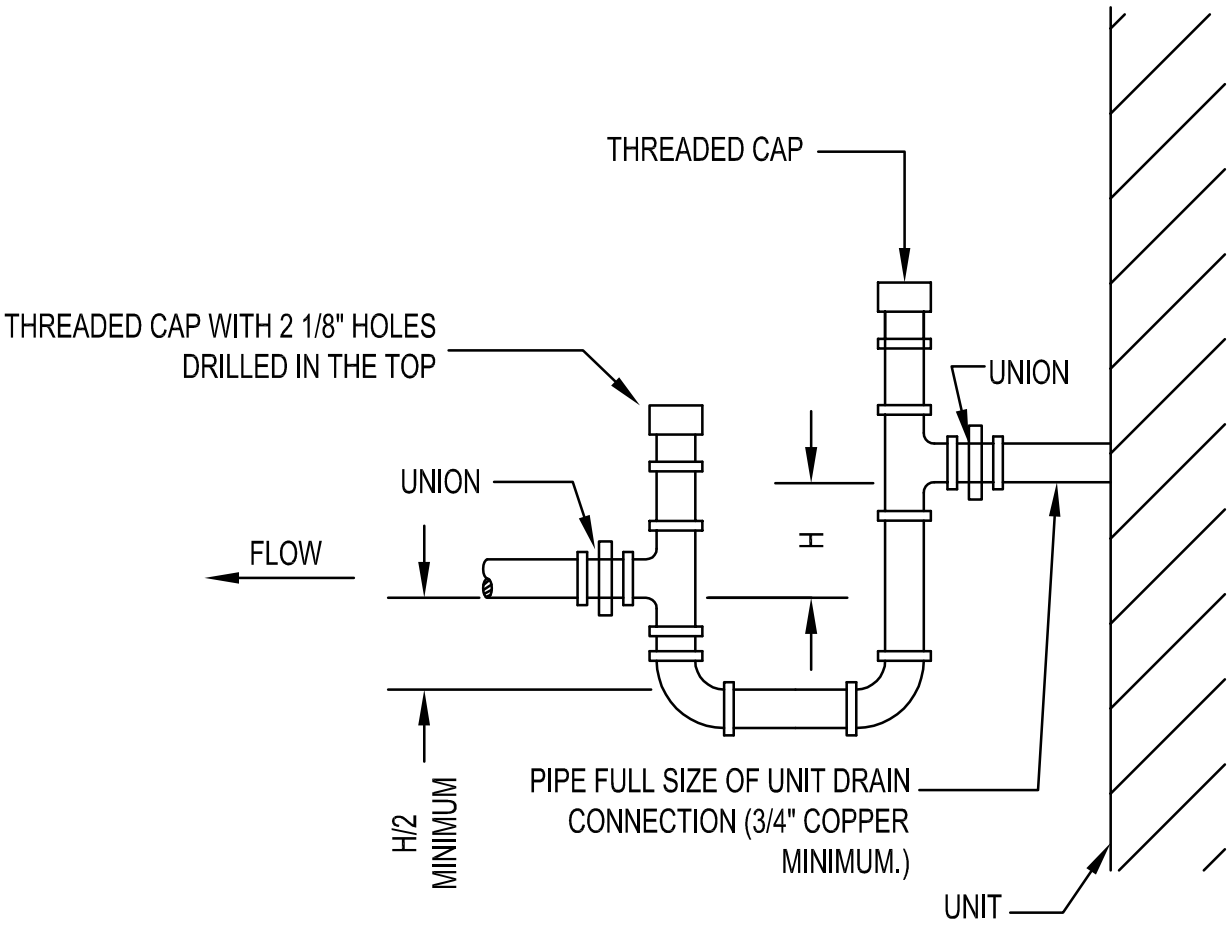
SCALE: NONE

WAKE COUNTY PUBLIC SCHOOL SYSTEM
1429 Rock Quarry Road, Suite 116
Raleigh, NC 27610
(919) 588-3608

NOTES:

1. LOCATE TRAP SO AS TO BE ACCESSIBLE FOR CLEANING.

2. H = FAN INLET PRESSURE (IN. W.C.) + 1 IN.

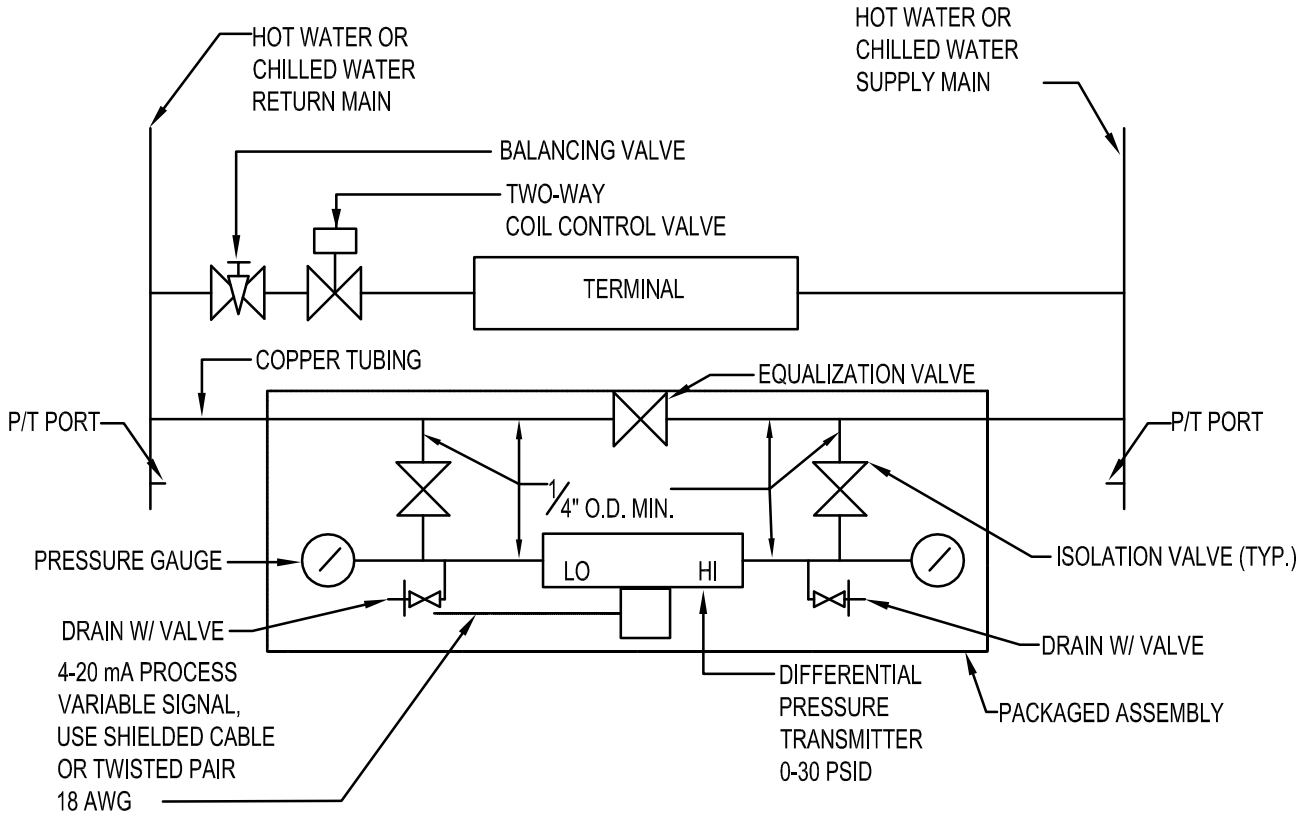



# M1.34

## DRAW THROUGH CONDENSATE DRAIN DETAIL

SCALE: NONE

WAKE COUNTY PUBLIC SCHOOL SYSTEM
1429 Rock Quarry Road, Suite 116
Raleigh, NC 27610
(919) 588-3608




NOTES:

1. GROUND SHIELD AT CONTROL PANEL ONLY.
2. PURGE AIR FROM TUBING PRIOR TO START-UP USING VENT VALVES ON TRANSMITTER.
3. OPEN EQUALIZATION VALVE TO BALANCE PRESSURE, CLOSE PRIOR TO SYSTEM START-UP.
4. PIPING SHALL BE TYPE 'L' RIGID COPPER ONLY WITH SOLDERED FITTINGS. NO SOFT COPPER ALLOWED.

# M1.41

## DIFFERENTIAL PRESSURE TRANSMITTER DETAIL

SCALE: NONE

WAKE COUNTY PUBLIC SCHOOL SYSTEM
1429 Rock Quarry Road, Suite 116
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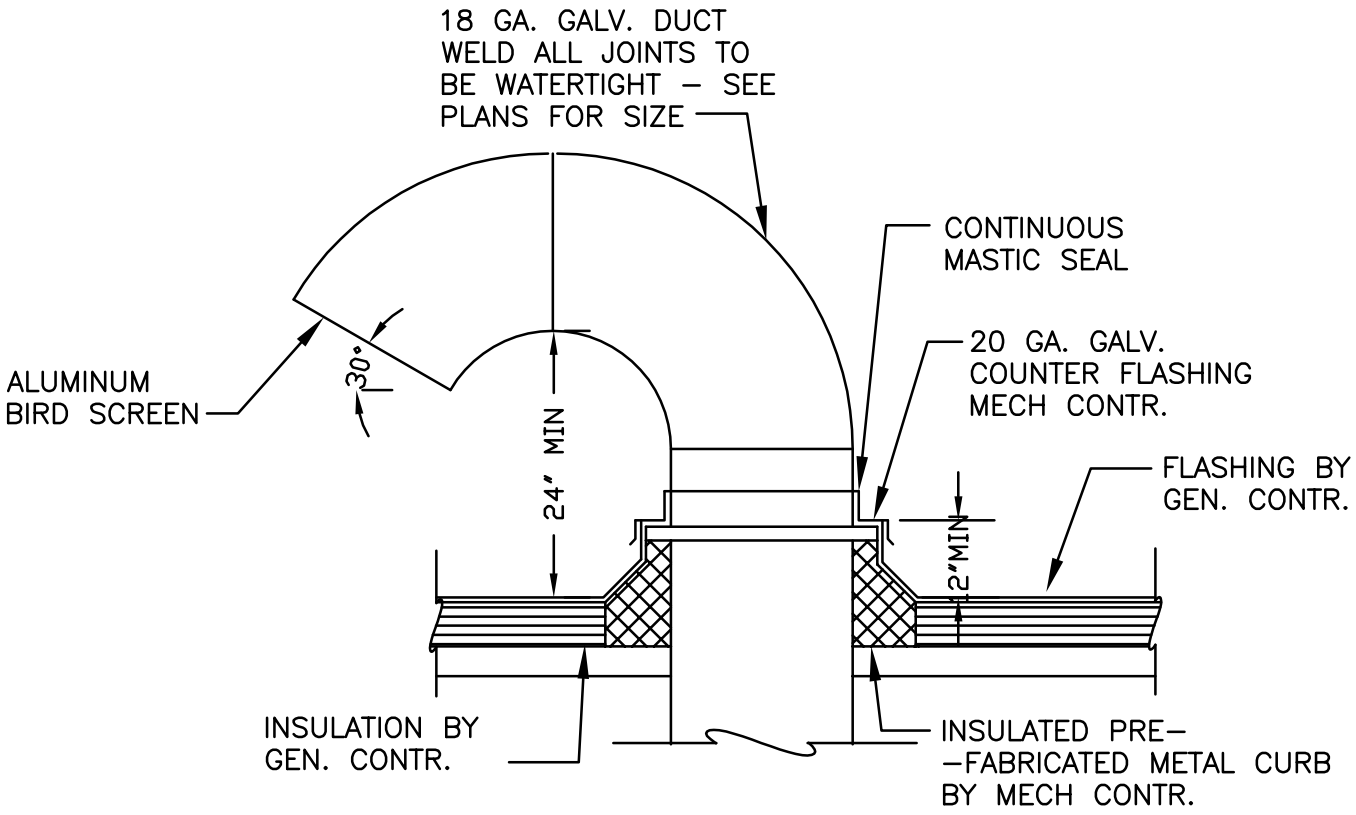


# M1.42

## GOOSENECK ROOF PENETRATION DETAIL

SCALE: NONE

WAKE COUNTY PUBLIC SCHOOL SYSTEM
1429 Rock Quarry Road, Suite 116
Raleigh, NC 27610
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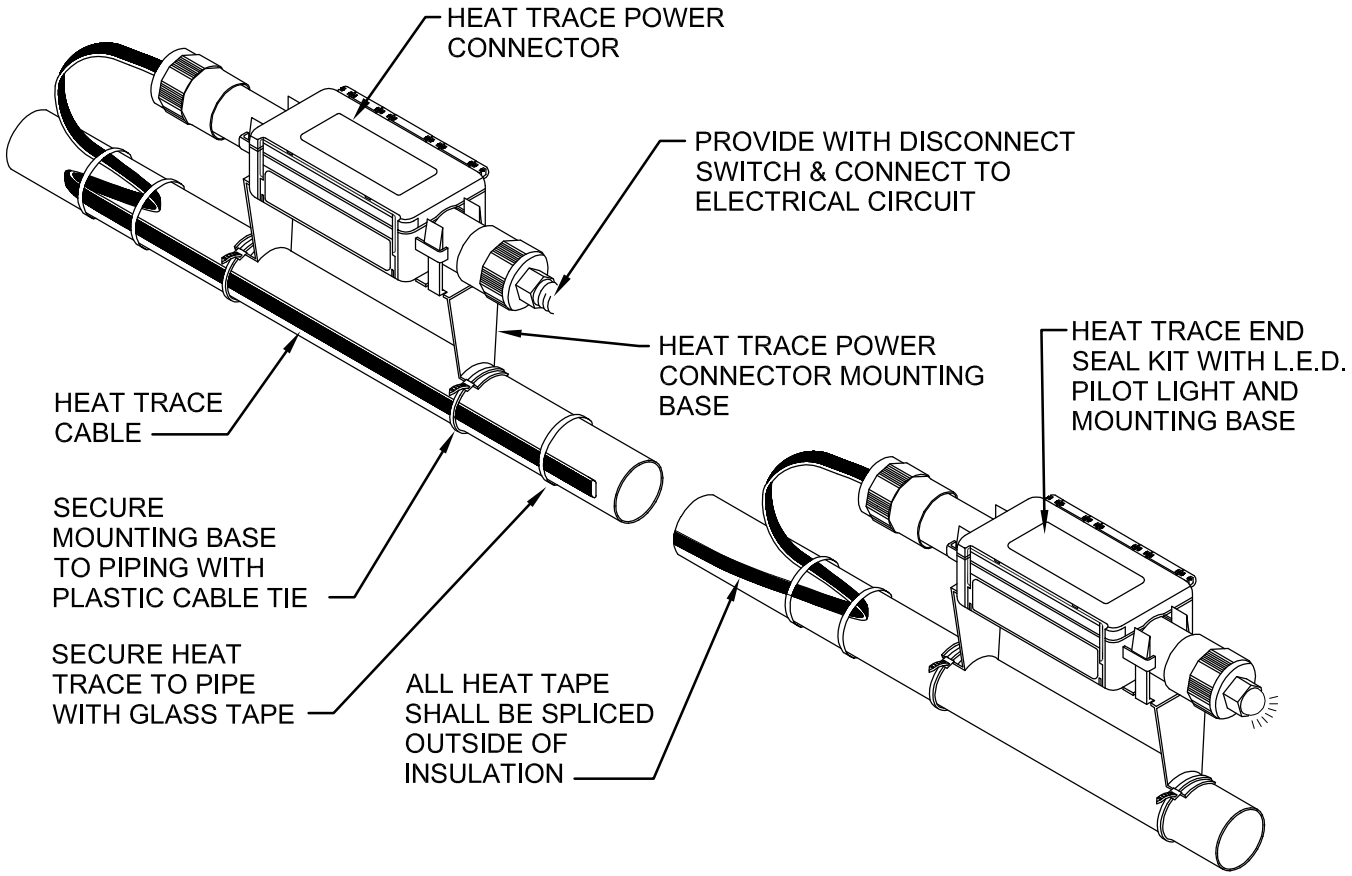
HEAT TRACE SPECIFICATION:

HEAT-TRACING CABLES: 5 W/FT OUTPUT. SELF-REGULATING, ELECTRIC HEATING CABLES SUITABLE FOR FREEZE PROTECTION OF METAL PIPING. CABLES: PAIR OF PARALLEL NO. 16 AWG TINNED-COPPER BUS WIRES EMBEDDED IN CROSS-LINKED CONDUCTIVE POLYMER CORE, WHICH VARIES POWER OUTPUT IN RESPONSE TO TEMPERATURE ALONG ITS LENGTH. CABLE SHALL BE CAPABLE OF CROSSING OVER ITSELF WITHOUT OVERHEATING. HEAT OUTPUT: AT LEAST 90 PERCENT OF RATING OVER A TEMPERATURE RANGE FROM 40 TO 150 DEG F PIPE TEMPERATURE. CABLE COVER: FABRICATED OF CROSS-LINKED, MODIFIED, POLYOLEFIN DIELECTRIC JACKET; WITH ULTRAVIOLET INHIBITOR. PIPE THERMOSTAT: UNIT WITH ADJUSTABLE TEMPERATURE RANGE FROM 35 TO 50 DEG F SNAP ACTION; OPEN-ON-RISE, SINGLE-POLE SWITCH WITH 25-A RATING; AND REMOTE BULB FOR DIRECTLY SENSING PIPE-WALL TEMPERATURE.




# M1.43 HEAT TRACE CABLE INSTALLATION DETAIL

SCALE: NONE

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1429 Rock Quarry Road, Suite 116
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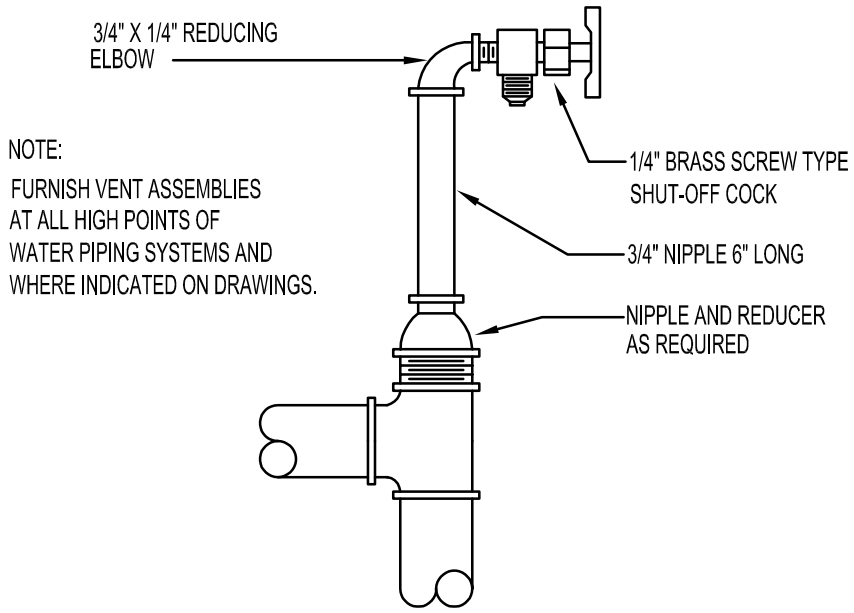


NOTE:
FURNISH VENT ASSEMBLIES AT ALL HIGH POINTS OF WATER PIPING SYSTEMS AND WHERE INDICATED ON DRAWINGS.

# M1.44

## MANUAL AIR VENT DETAIL

SCALE: NONE

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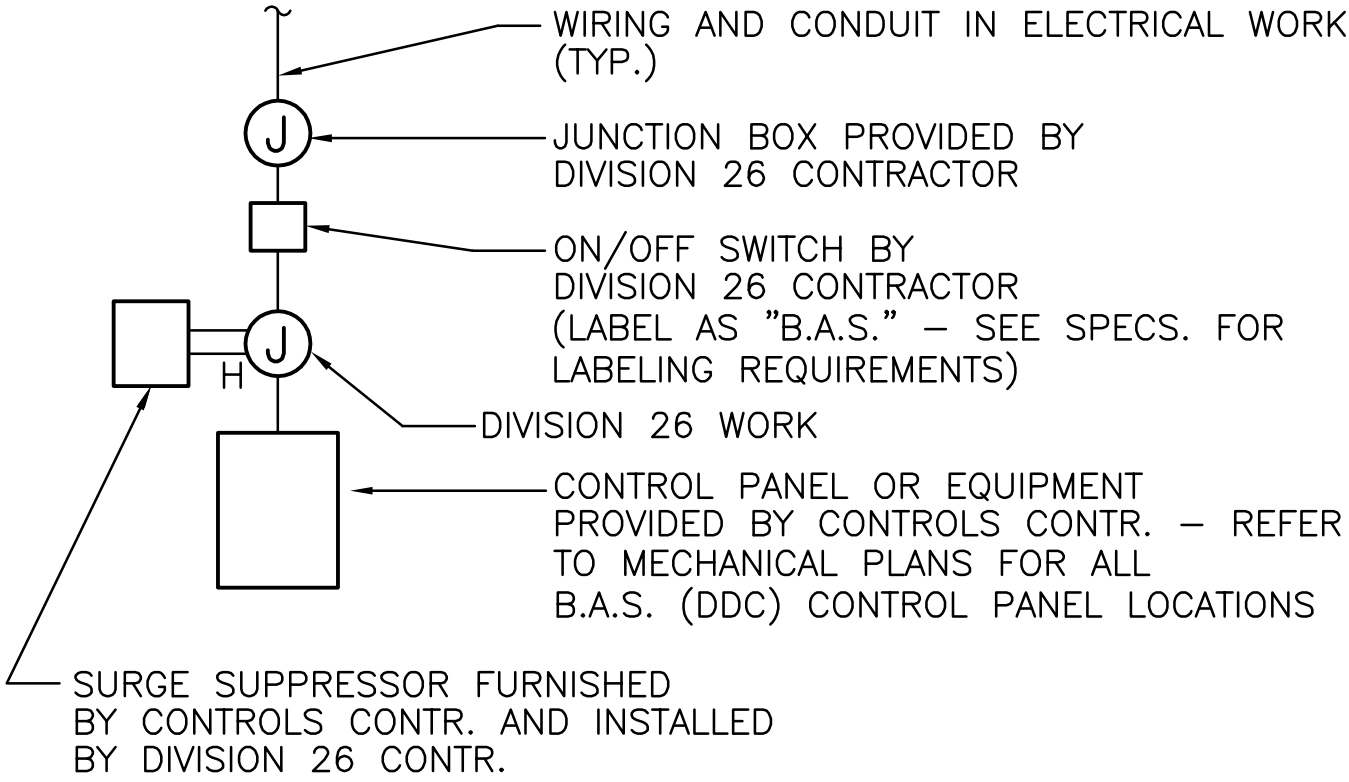
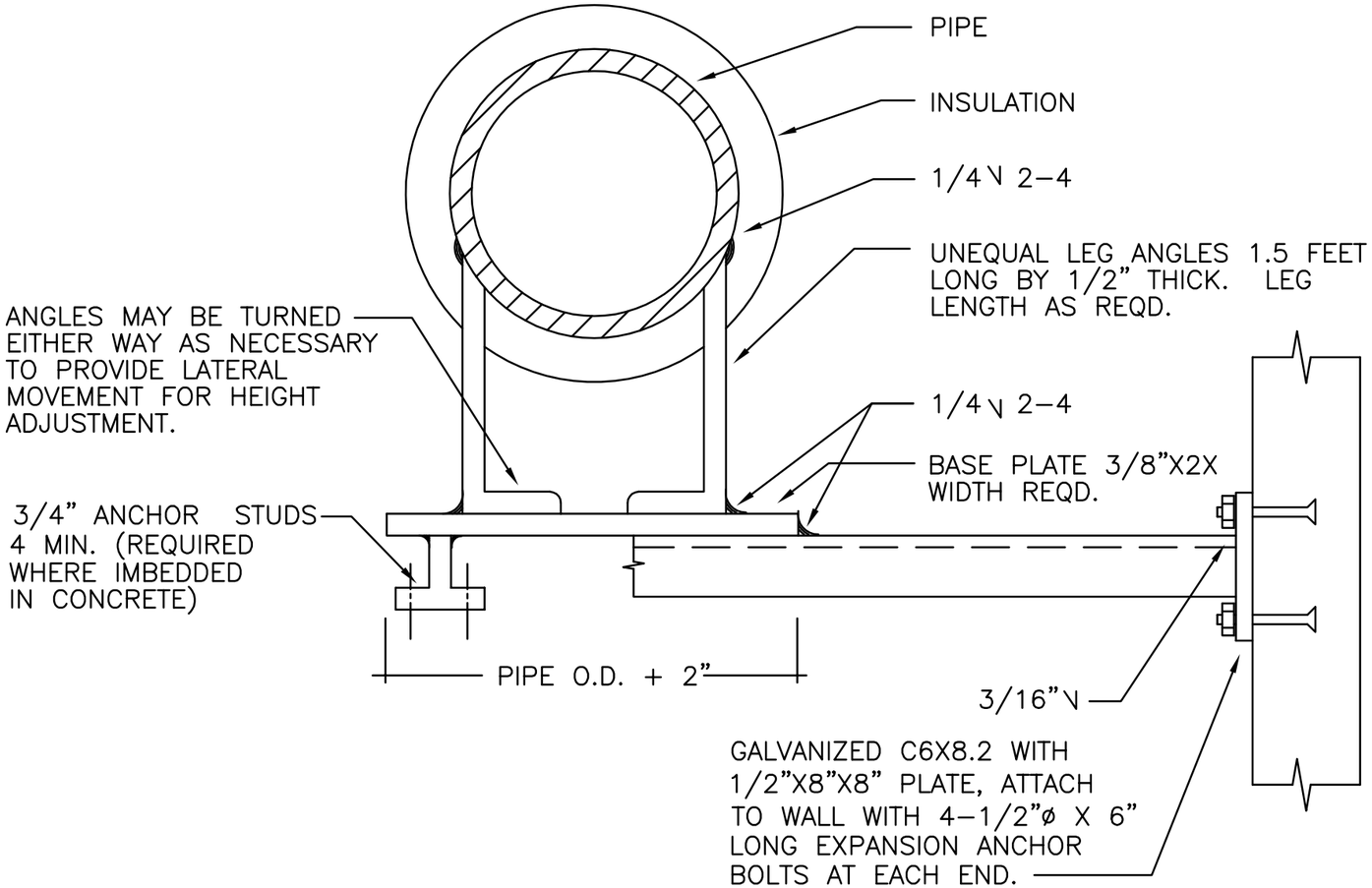
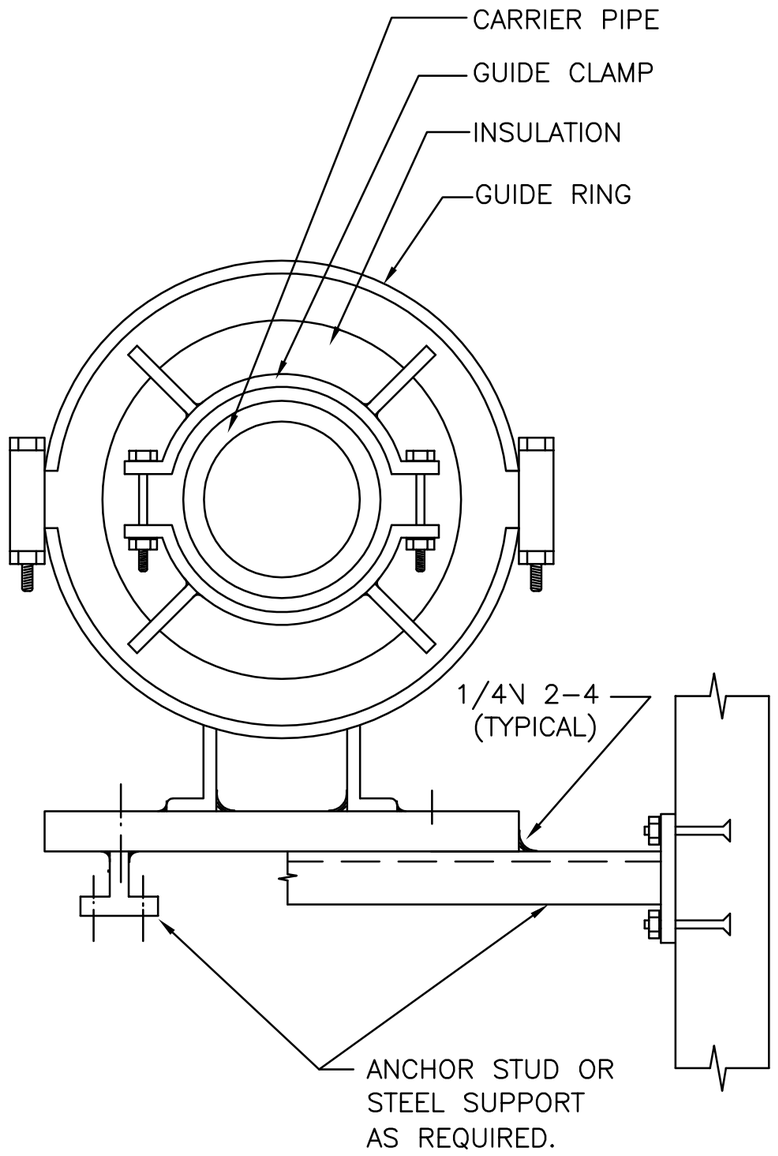



# M1.45

## POWER SUPPLY FOR CONTROLS DETAIL

SCALE: NONE




M1.51

PIPE EXPANSION ANCHOR AND GUIDE DETAIL

SCALE: NONE

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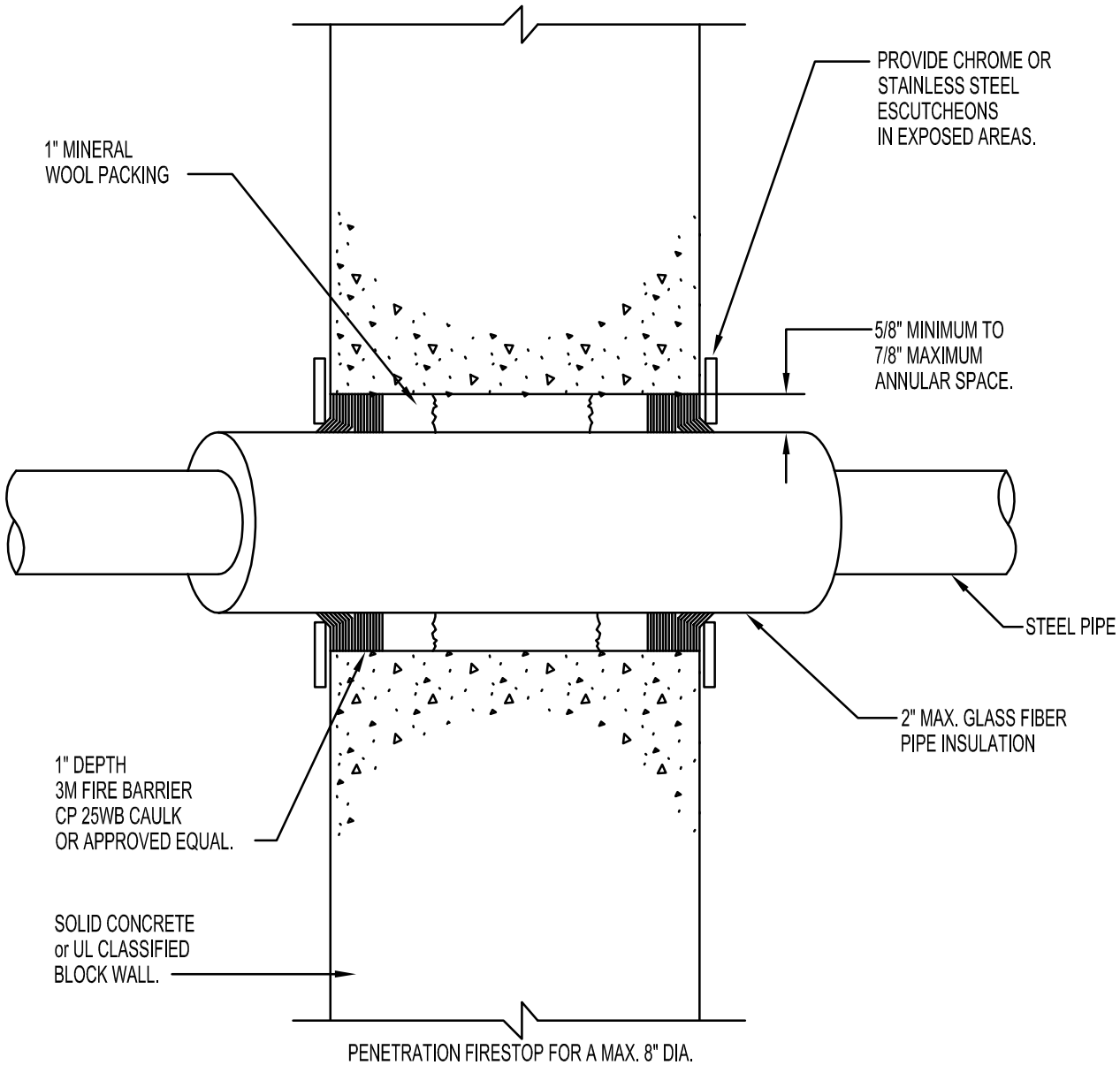
(919) 588-3608




PENETRATION FIRESTOP FOR A MAX. 8" DIA. INSULATED STEEL PIPE THROUGH A CONCRETE WALL. (TYPICAL FOR 2 HR RATED WALLS)

NOTE:
FOR NON-FIRE RATED WALL PENETRATIONS INSTALL AS DETAILED ABOVE AND SUBSTITUTE ACRYLIC SILICONE CAULK FOR FIRE BARRIER CAULK.

# M1.52

## PIPING PENETRATION THRU CONCRETE WALL DETAIL

SCALE: NONE

WAKE COUNTY PUBLIC SCHOOL SYSTEM
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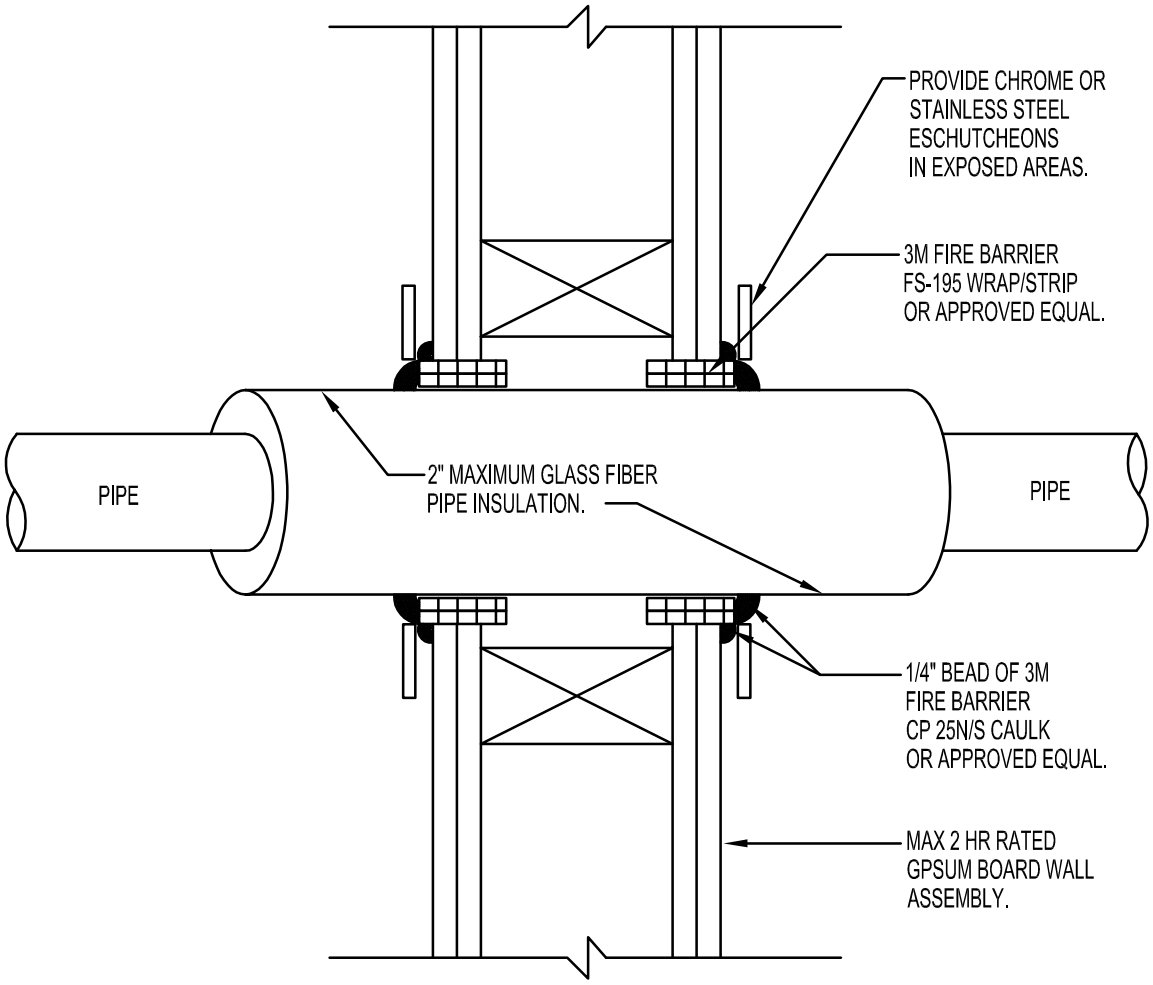


PENETRATION FIRESTOP FOR A MAX. 12" DIA. INSULATED STEEL PIPE THROUGH A GYPSUM BOARD WALL. (UL SYSTEM WL1002 TYPICAL FOR 1 & 2HR. RATED WALLS)

NOTE:
FOR NON-FIRE RATED WALL PENETRATIONS INSTALL AS DETAILED ABOVE AND SUBSTITUTE ACRYLIC SILICONE CAULK FOR FIRE BARRIER CAULK.

# M1.53

## PIPING PENETRATION THRU STUD WALL DETAIL

SCALE: NONE

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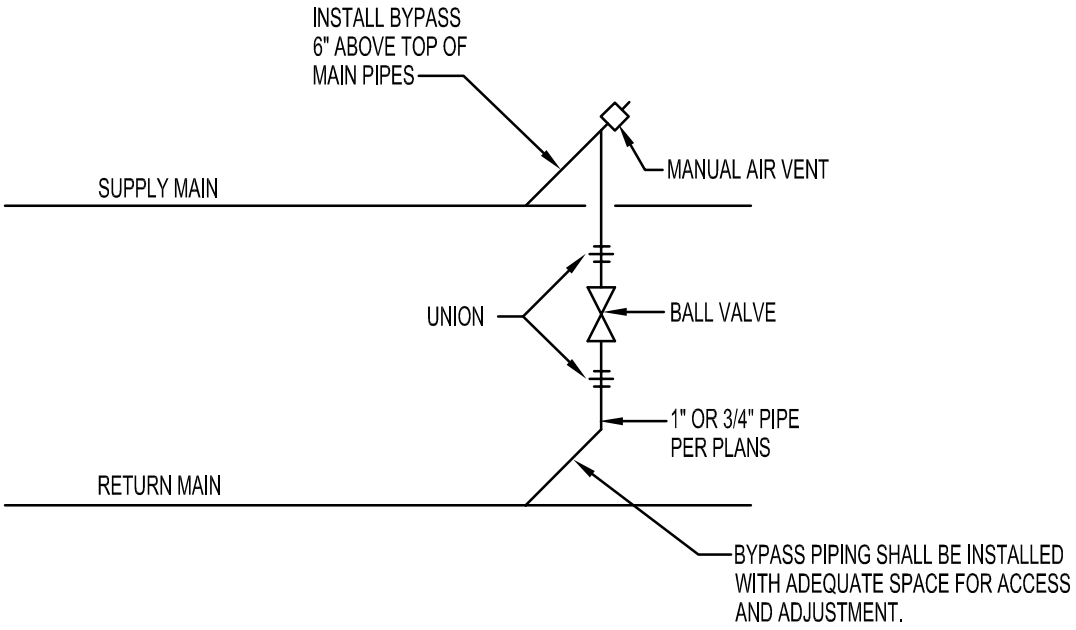
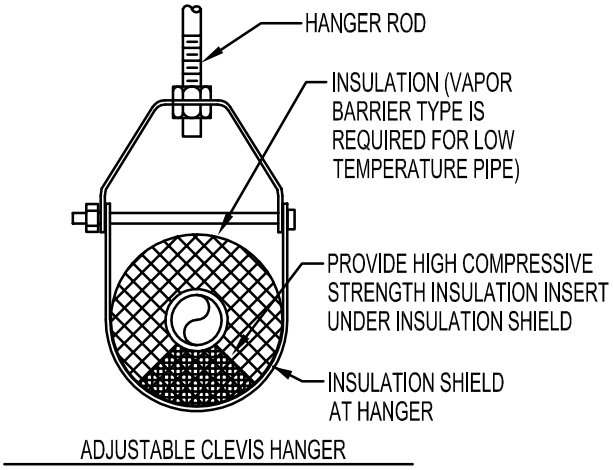



# M1.54

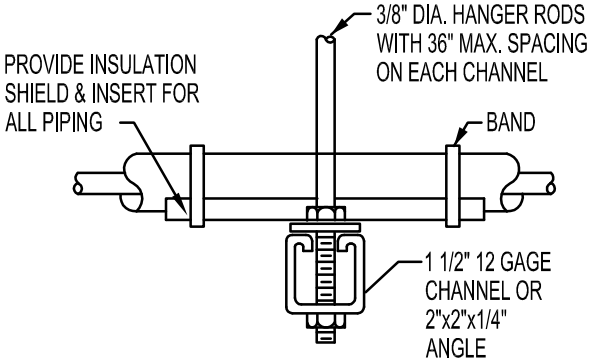
## PIPING BYPASS DETAIL

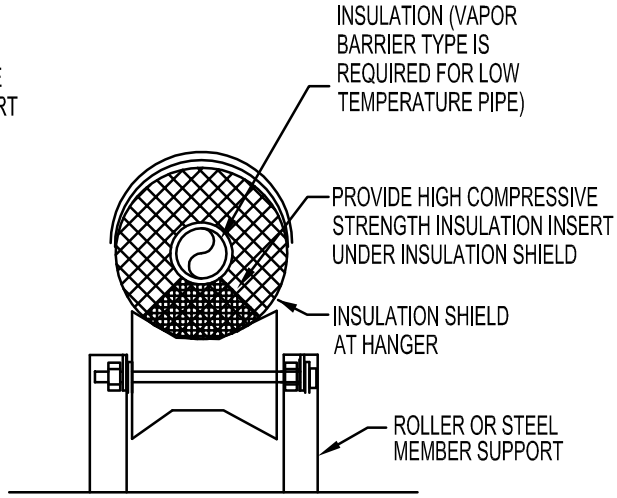
SCALE: NONE

WAKE COUNTY PUBLIC SCHOOL SYSTEM
1429 Rock Quarry Road, Suite 116
Raleigh, NC 27610
(919) 588-3608




ADJUSTABLE CLEVIS HANGER




ROLLER OR BOTTOM PIPE SUPPORT

# M1.55

## PIPING SUPPORT DETAIL

SCALE: NONE

WAKE COUNTY PUBLIC SCHOOL SYSTEM
1429 Rock Quarry Road, Suite 116
Raleigh, NC 27610
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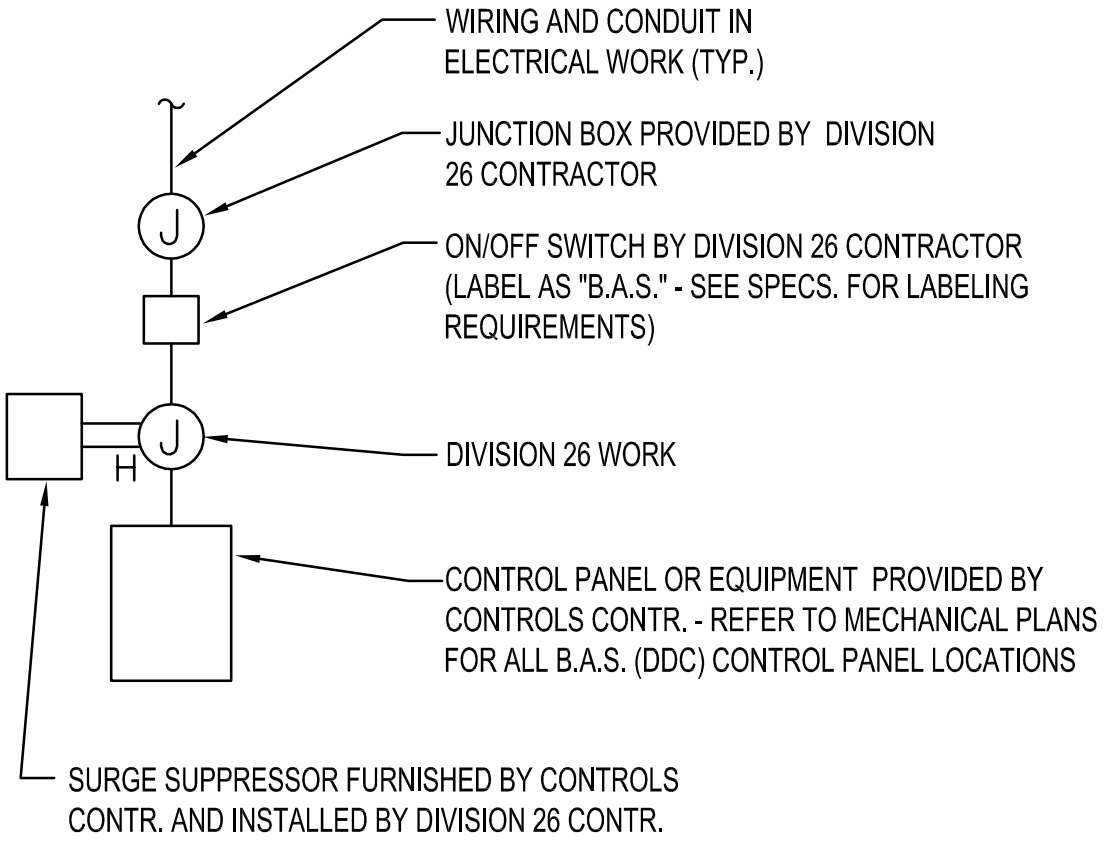
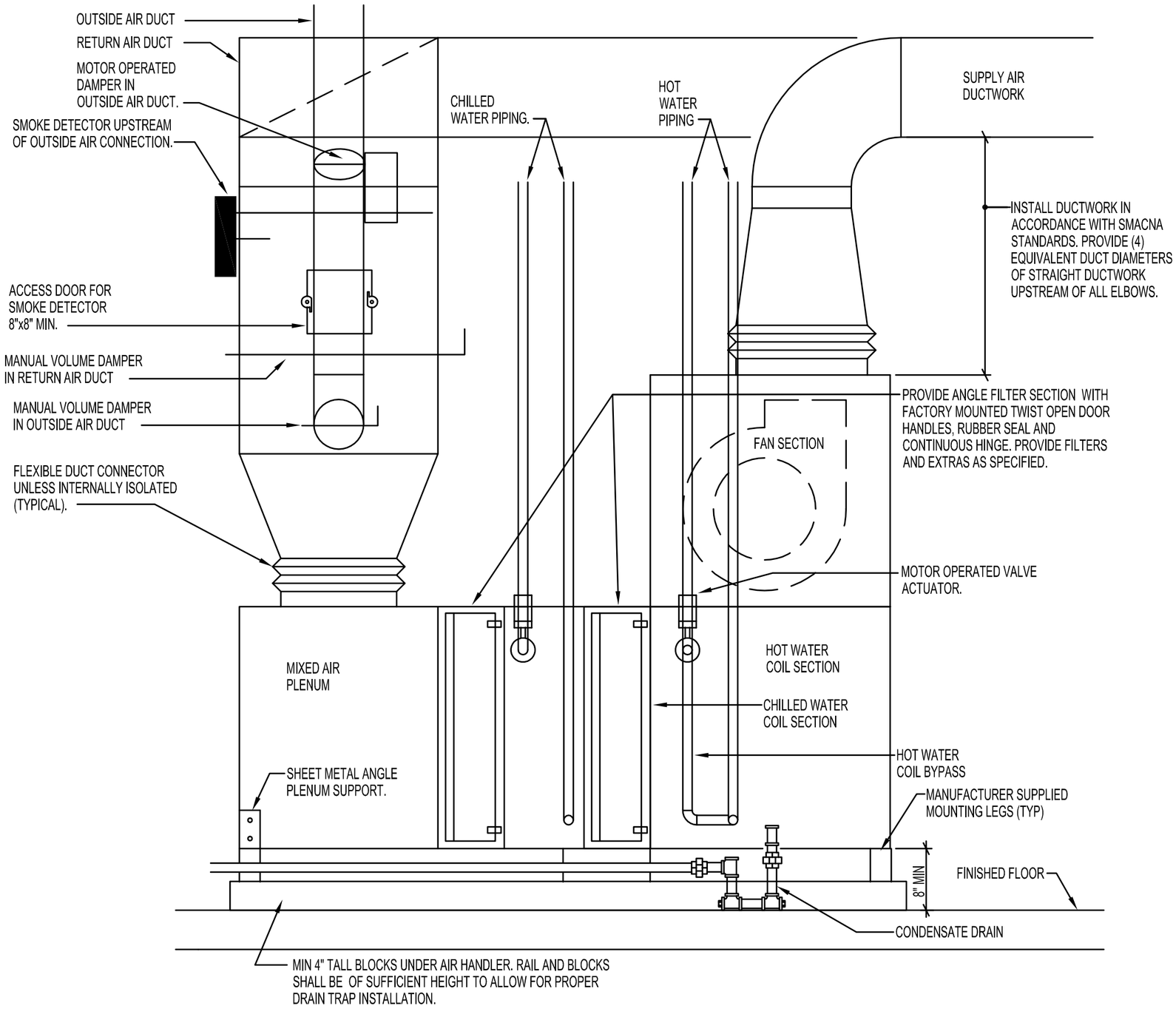



# M1.56

## TYPICAL ELECTRICAL CONNECTION DETAIL

SCALE: NONE




# M2.01

## CONSTANT VOLUME AIR HANDLING UNIT DETAIL

SCALE: NONE

WAKE COUNTY PUBLIC SCHOOL SYSTEM
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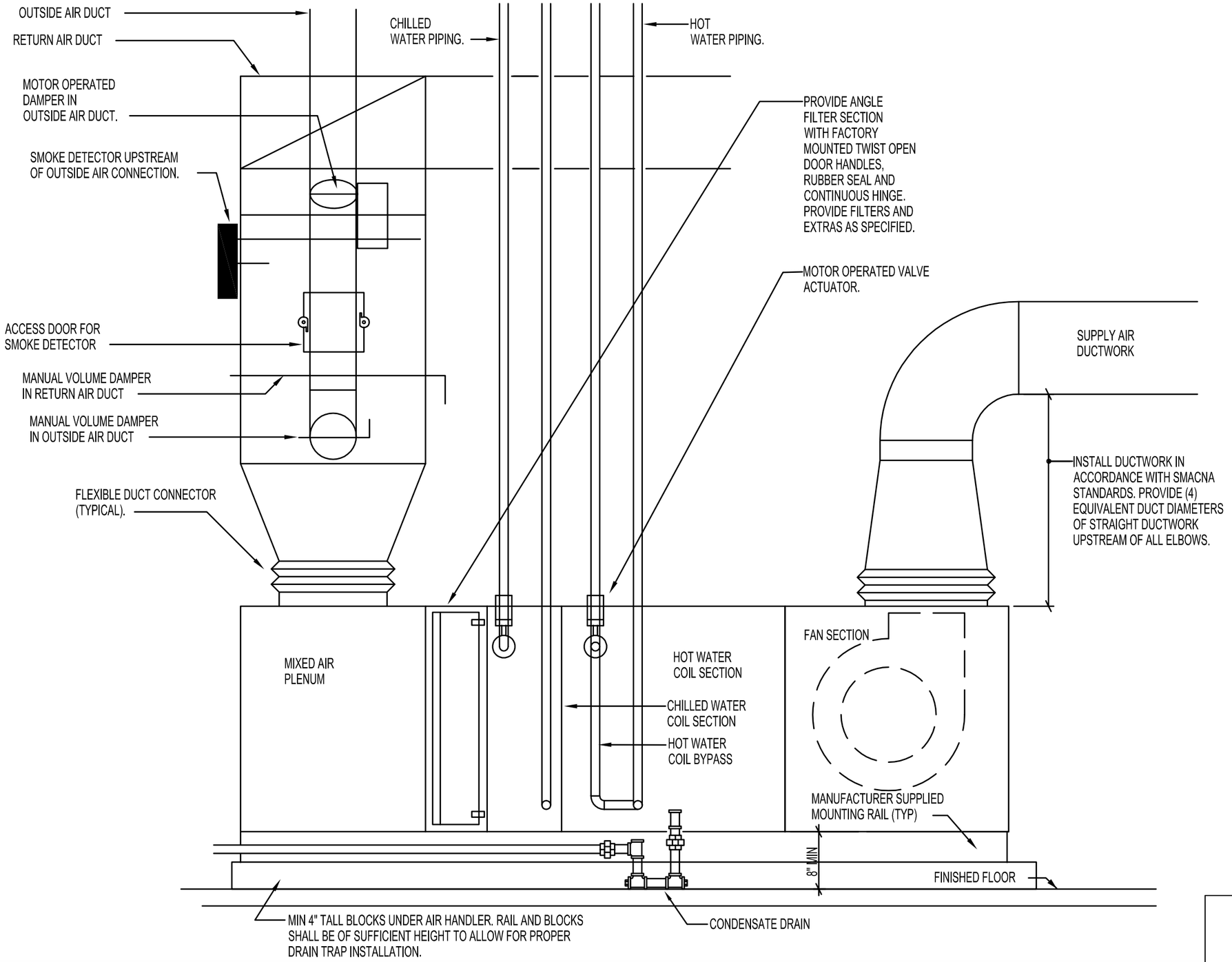


# M2.02 CONSTANT VOLUME HORIZONTAL AIR HANDLING UNIT DETAIL

WAKE COUNTY PUBLIC SCHOOL SYSTEM
1429 Rock Quarry Road, Suite 116
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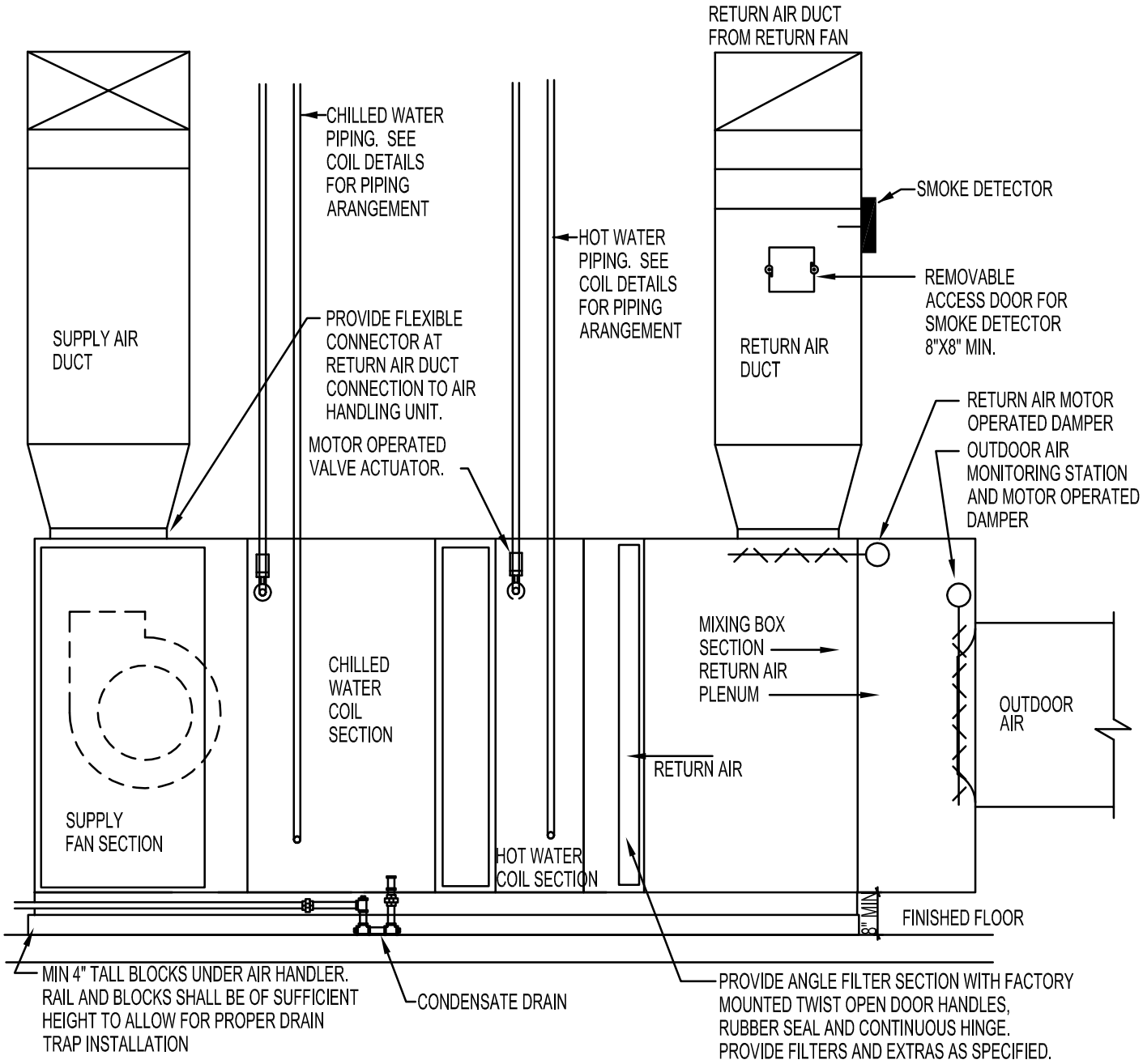
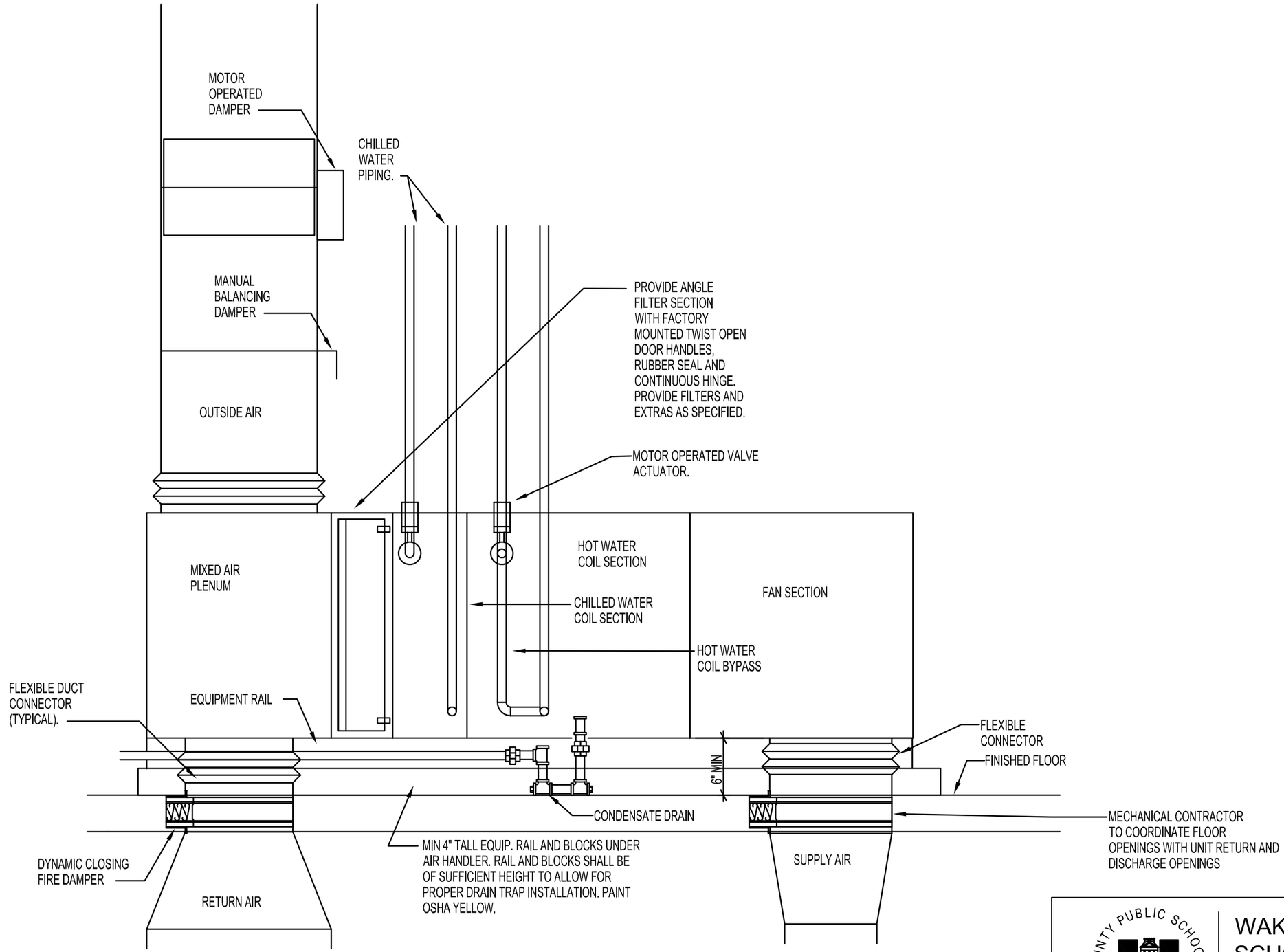
Raleigh, NC 27610
(919) 588-3608




# M2.03

## CONSTANT VOLUME HORIZONTAL AHU WITH ECONOMIZER

SCALE: NONE




# M2.04 CONSTANT VOLUME HORIZONTAL AIR HANDLING UNIT DETAIL

SCALE: NONE

WAKE COUNTY PUBLIC SCHOOL SYSTEM
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Raleigh, NC 27610
(919) 588-3608

SUPPLY AIR DUCT

OUTDOOR AIR DUCT

AFMS

AIRFLOW MONITORING STATION

RELIEF AIR DUCT

RETURN AIR DUCT

HIGH PRESSURE SENSOR

INSTALL DUCTWORK IN ACCORDANCE WITH SMACNA STANDARDS. PROVIDE (4) EQUIVALENT DUCT DIAMETERS OF STRAIGHT DUCTWORK UPSTREAM OF ALL ELBOWS.

CHILLED WATER PIPING. SEE COIL DETAILS FOR PIPING ARANGEMENT

HOT WATER PIPING. SEE COIL DETAILS FOR PIPING ARANGEMENT

SMOKE DETECTOR

REMOVABLE ACCESS DOOR FOR SMOKE DETECTOR

8"X8" MIN. ACCESS DOOR

SUPPLY AIR

HOT WATER COIL SECTION

MOTOR OPERATED DAMPER IN AIR HANDLING UNIT.

OUTDOOR AIR

FLEXIBLE DUCT CONNECTION UNLESS INTERNALLY ISOLATED

RELIEF AIR

RETURN AIR DUCT

SUPPLY FAN SECTION

MOTOR OPERATED VALVE ACTUATOR

MIXING BOX SECTION

RELIEF AIR MOTOR OPERATED DAMPER

PROVIDE ANGLE FILTER SECTION WITH FACTORY MOUNTED TWIST OPEN DOOR HANDLES, RUBBER SEAL AND CONTINUOUS HINGE. PROVIDE FILTERS AND EXTRAS AS SPECIFIED.

MIXING BOX SECTION

RETURN AIR FAN SECTION

CHILLED WATER COIL SECTION

RETURN AIR

RETURN AIR

MIXED AIR

RETURN AIR MOTOR OPERATED DAMPER

SLOPE PIPE TOWARDS DRAIN

6" MIN

MIN 4" TALL EQUIP. RAIL AND BLOCKS UNDER AIR HANDLER. RAIL OR BLOCKS SHALL BE OF SUFFICIENT HEIGHT TO ALLOW FOR PROPER DRAIN TRAP INSTALLATION. PAINT OSHA YELLOW.

CONDENSATE DRAIN

FINISHED FLOOR

# M2.05 VARIABLE VOLUME AIR HANDLING UNIT DETAIL

SCALE: NONE

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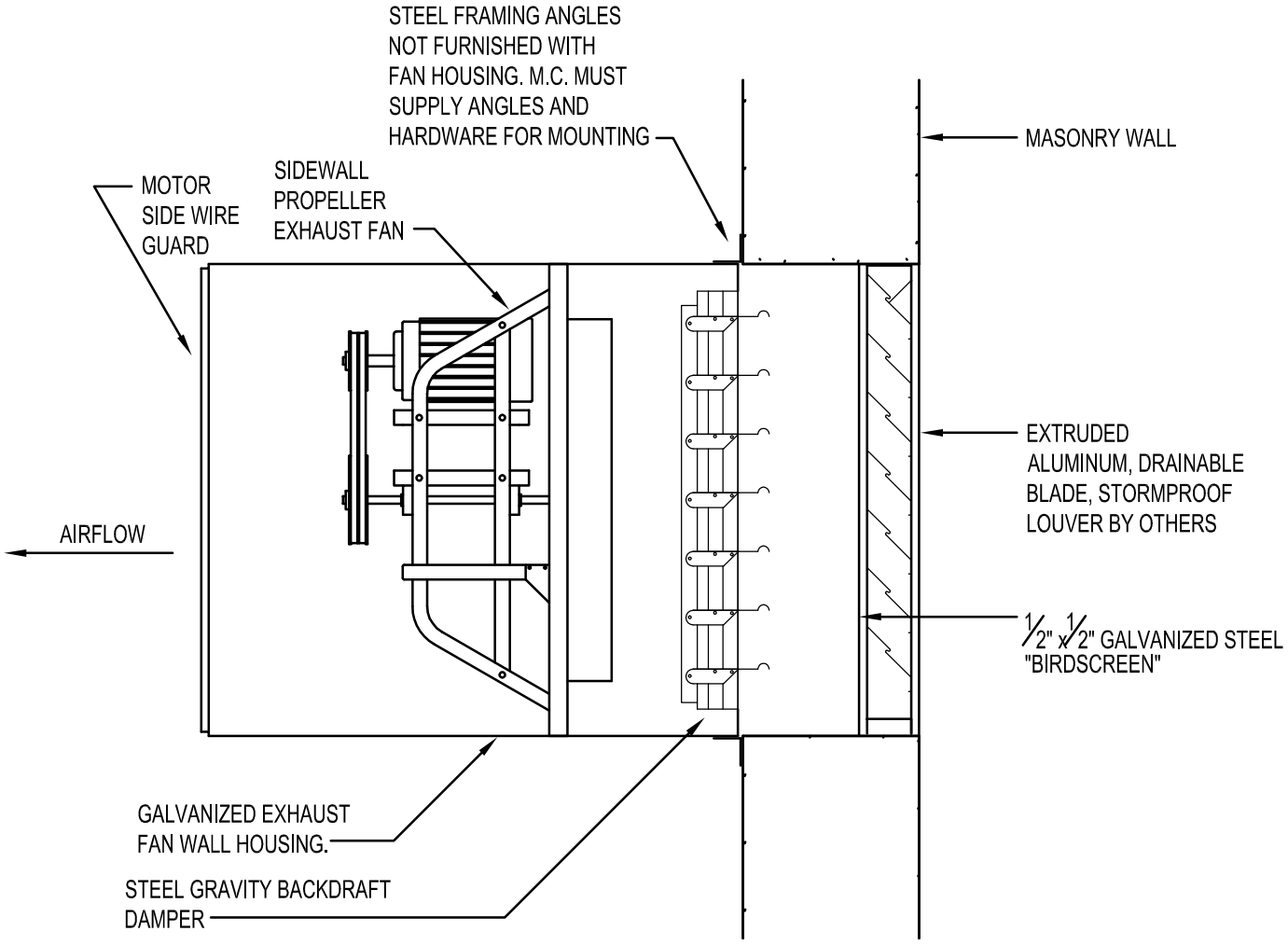
(919) 588-3608




# M2.07 PROPELLER FAN DETAIL

SCALE: NONE

WAKE COUNTY PUBLIC SCHOOL SYSTEM
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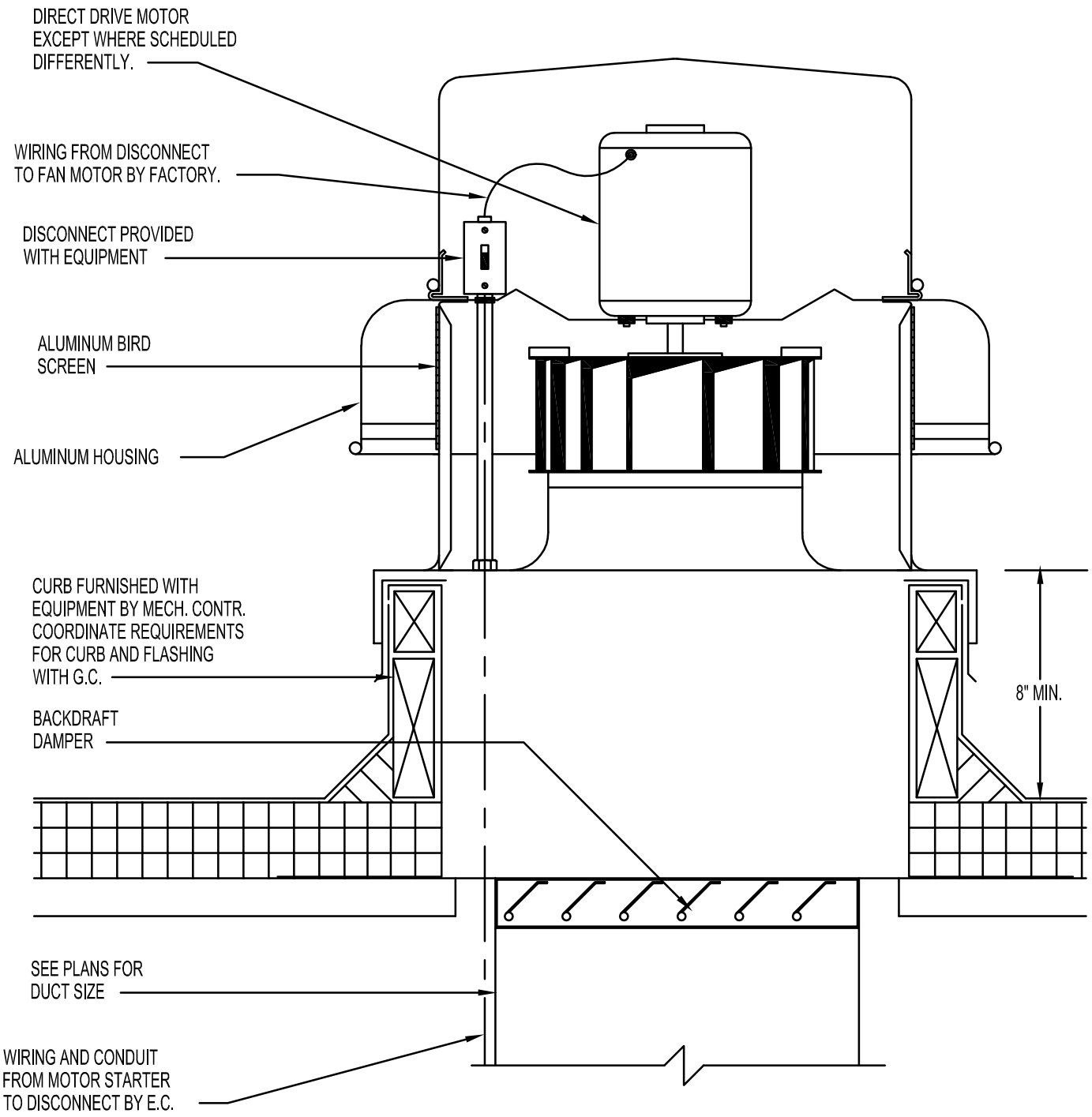


# M2.08

## ROOF MOUNTED FAN INSTALLATION DETAIL

SCALE: NONE

WAKE COUNTY PUBLIC SCHOOL SYSTEM
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Raleigh, NC 27610
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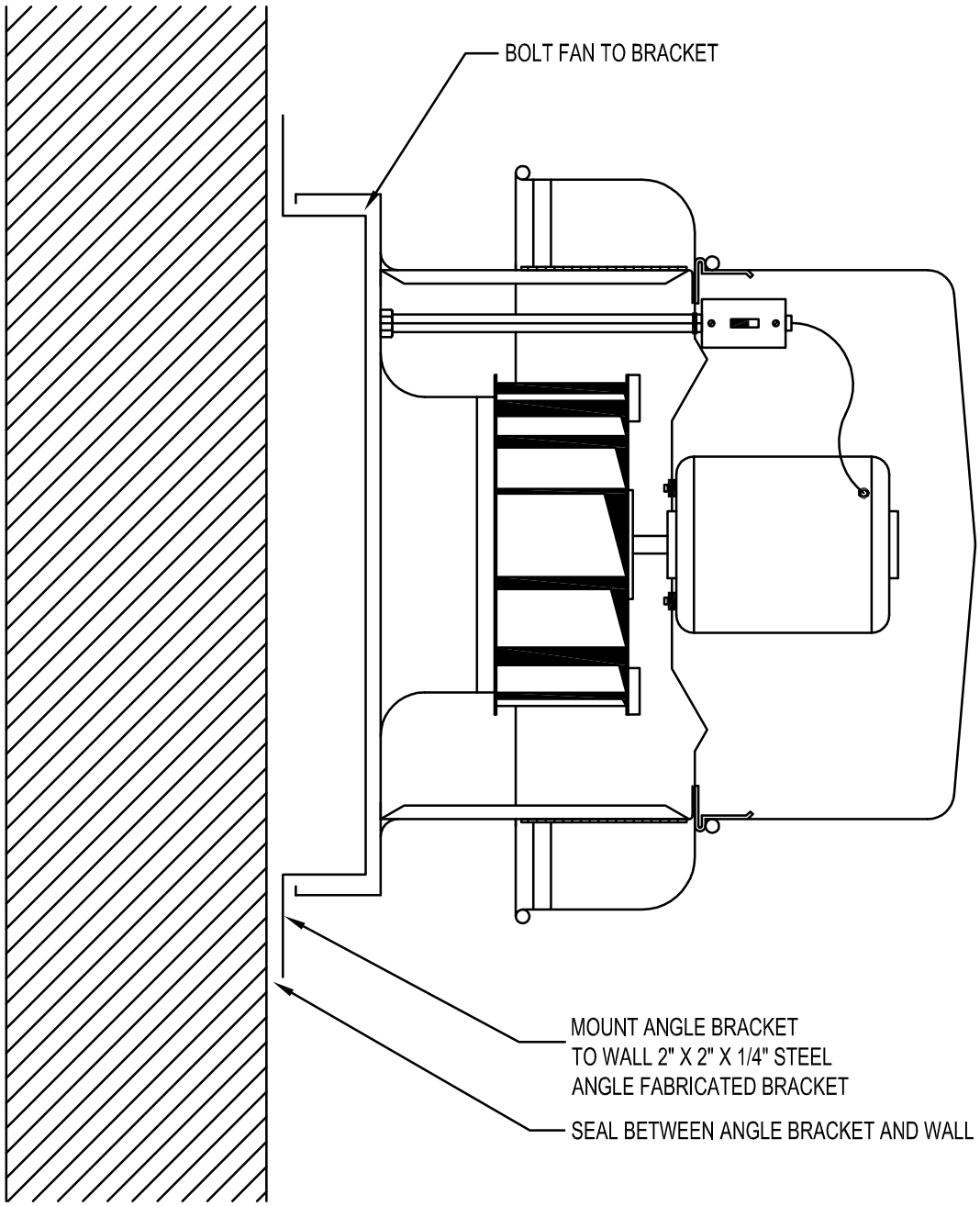


# M2.09

## WALL MOUNTED FAN INSTALLATION DETAIL

SCALE: NONE

WAKE COUNTY PUBLIC SCHOOL SYSTEM
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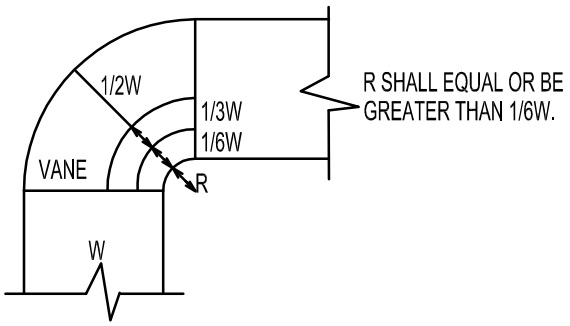
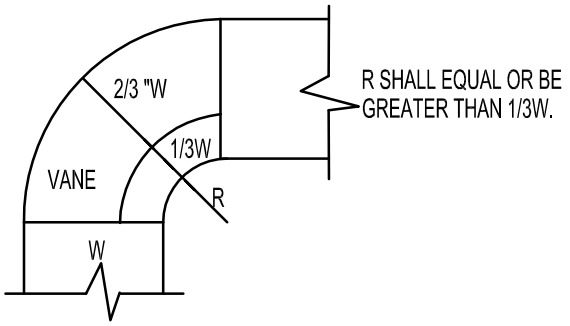
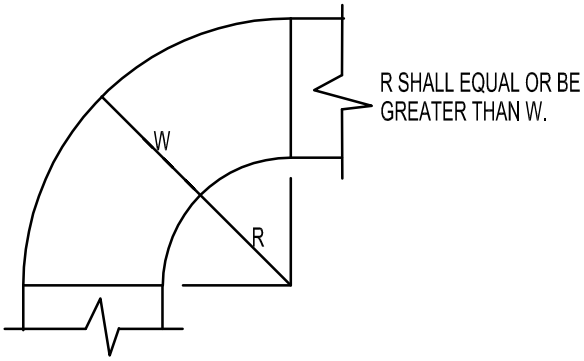



SHORT RADIUS ELBOW WITH TWO VANES




SHORT RADIUS ELBOW WITH ONE VANE




STANDARD RADIUS ELBOW

NOTES:

1. THE INTERIOR SURFACE OF ALL RADIUS ELBOWS SHALL BE MADE ROUND

2. ALL STANDARD RADIUS ELBOWS SHOWN ON PLANS MAY BE MADE SHORT RADIUS ELBOW. ALL SHORT RADIUS ELBOWS SHALL HAVE VANES. VANES SHALL BE CONSTRUCTED, SUPPORTED AND FASTENED AS RECOMMENDED BY SMACNA.

# M2.11

## EXPOSED DUCT PENETRATION DETAIL

SCALE: NONE

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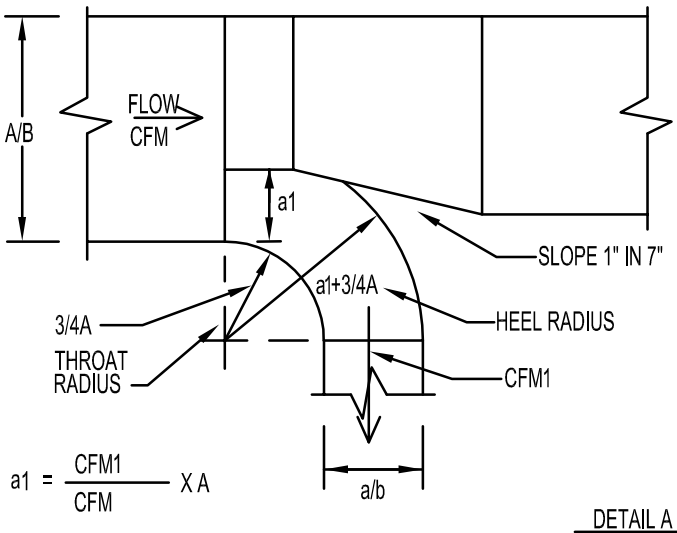
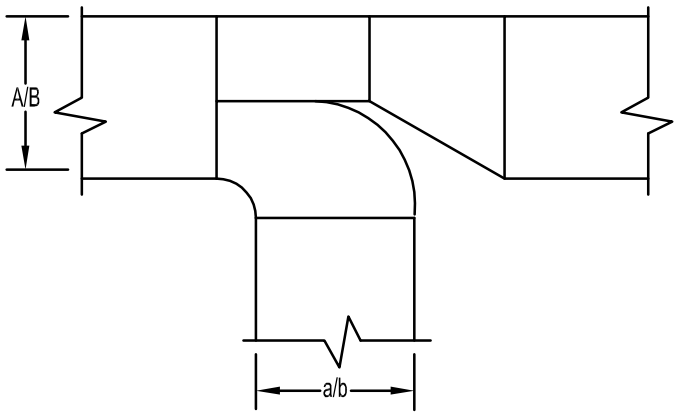
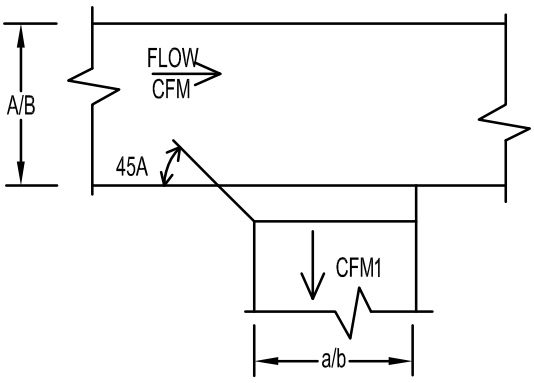



$a1 = \frac{CFM1}{CFM} \times A$

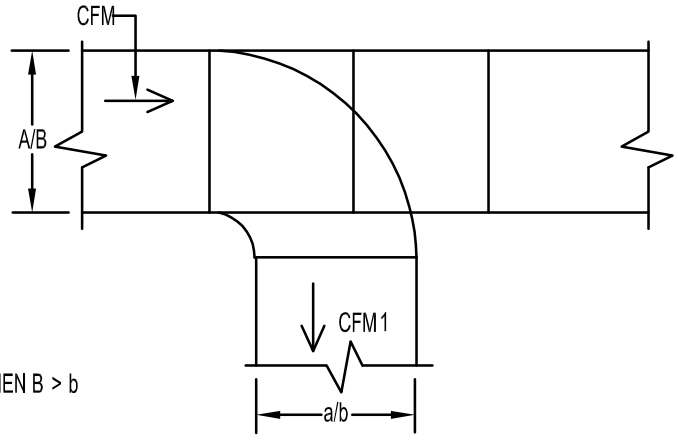
DETAIL A




NORMAL WHEN B = b




DETAIL B




WHEN B > b

DETAIL C

WHEN $\frac{CFM1}{CFM} \leq 0.1$

# M2.12

## DUCT TAKEOFF DETAIL

SCALE: NONE

WAKE COUNTY PUBLIC SCHOOL SYSTEM
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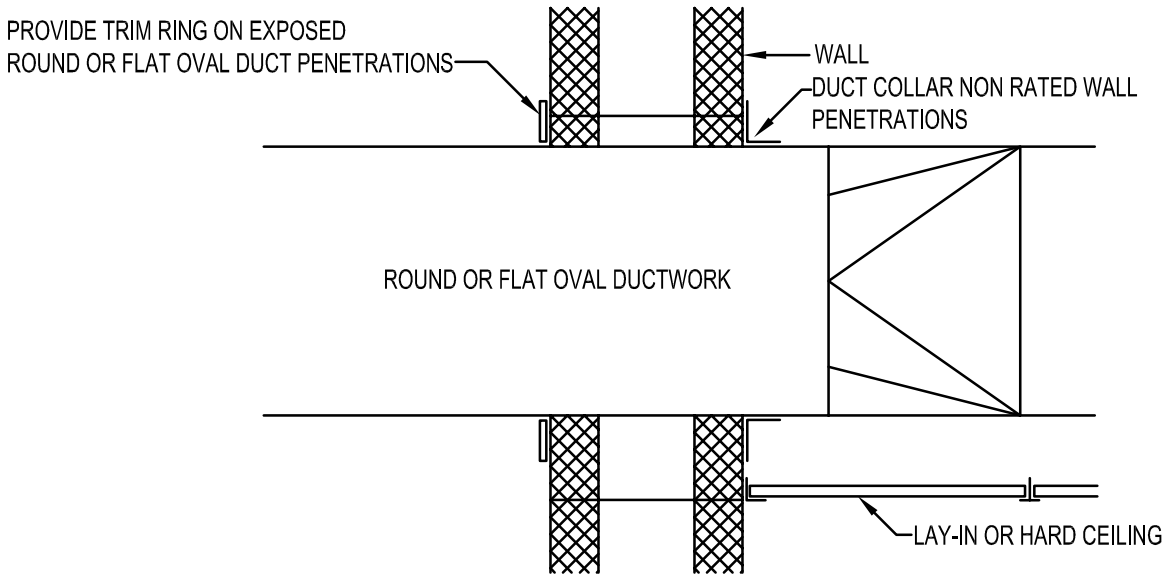


# M2.13 EXPOSED DUCT PENETRATION DETAIL

SCALE: NONE

WAKE COUNTY PUBLIC SCHOOL SYSTEM
1429 Rock Quarry Road, Suite 116
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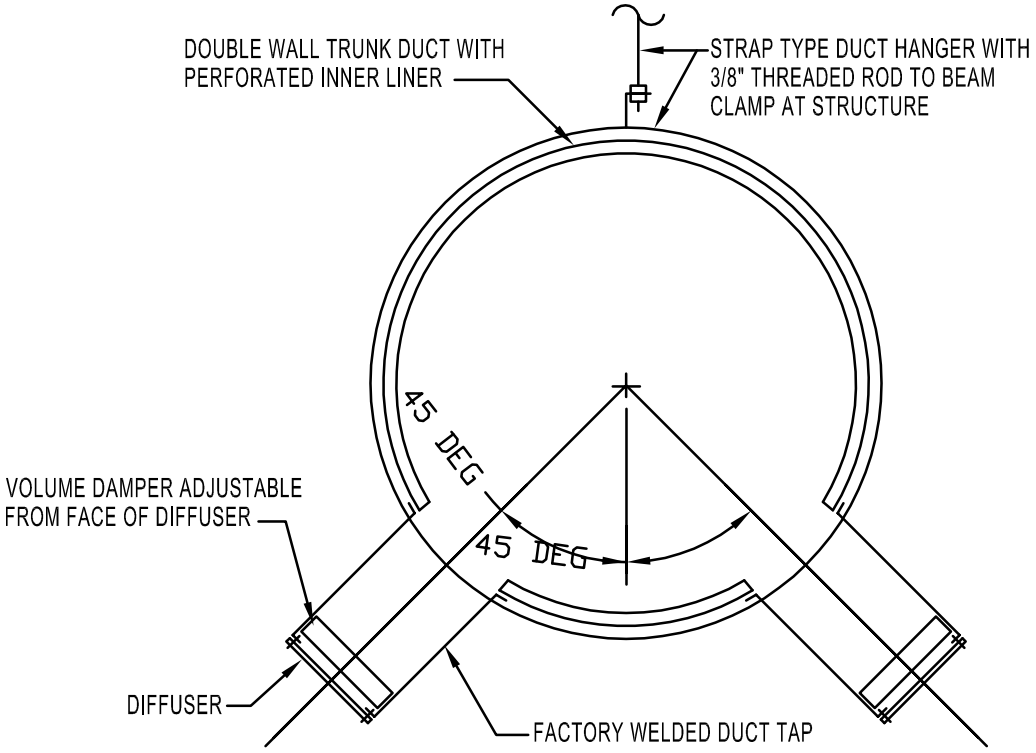
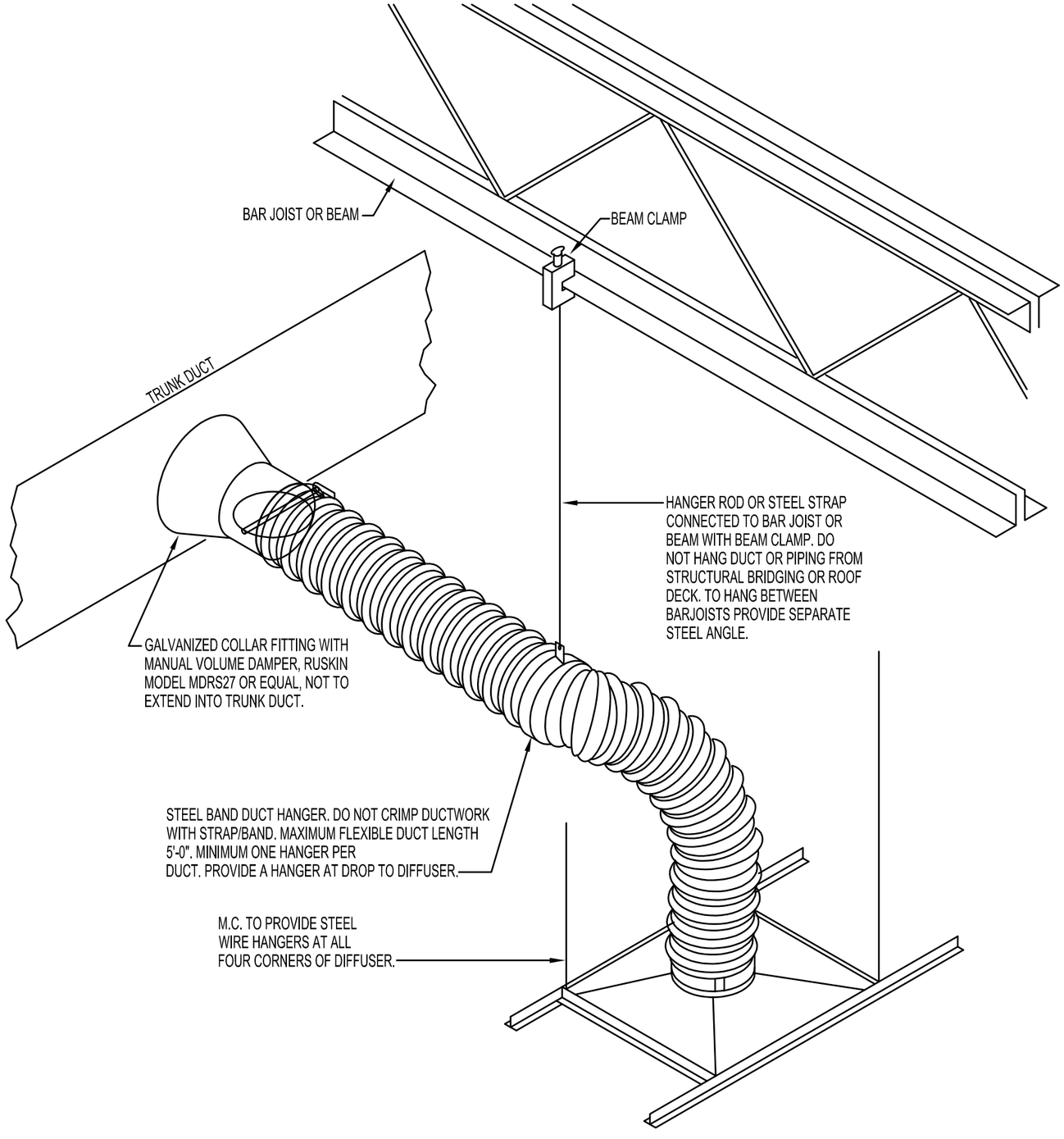
(919) 588-3608




# M2.14 EXPOSED SPIRAL DUCT DETAIL

SCALE: NONE




# M2.15

## FLEXIBLE DUCTWORK INSTALLATION DETAIL

SCALE: NONE

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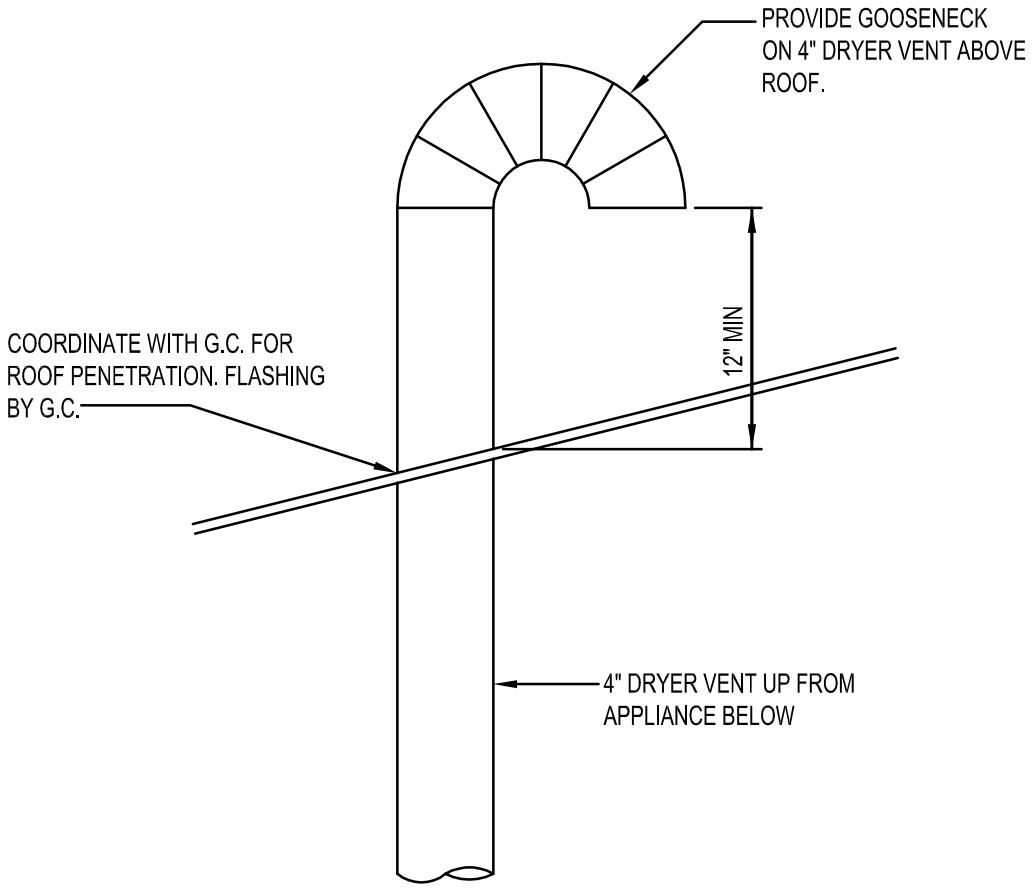


# M2.16

## DRYER VENT ROOF PENETRATION DETAIL

SCALE: NONE

WAKE COUNTY PUBLIC SCHOOL SYSTEM
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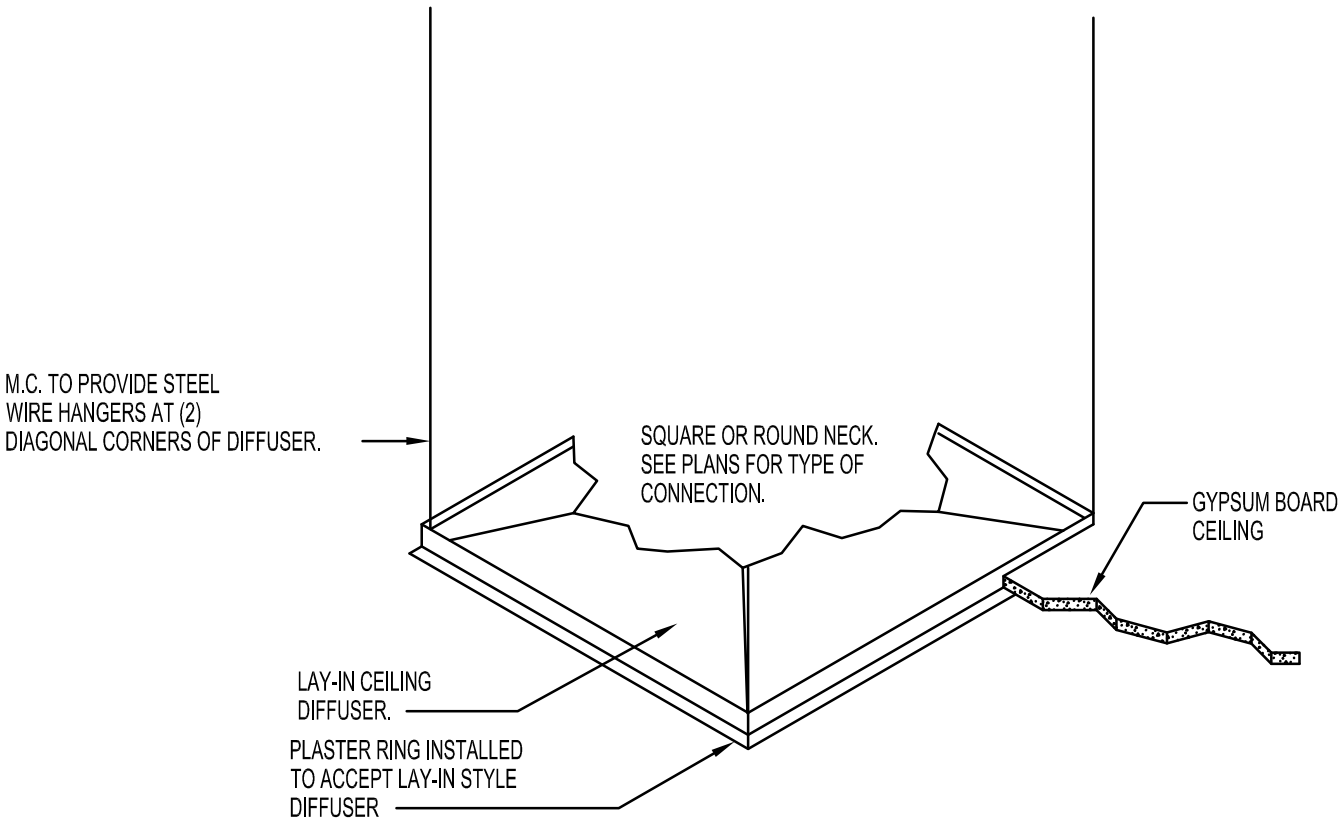


# M2.21

## GYPSUM CEILING DIFFUSER INSTALLATION DETAIL

SCALE: NONE

WAKE COUNTY PUBLIC SCHOOL SYSTEM
1429 Rock Quarry Road, Suite 116
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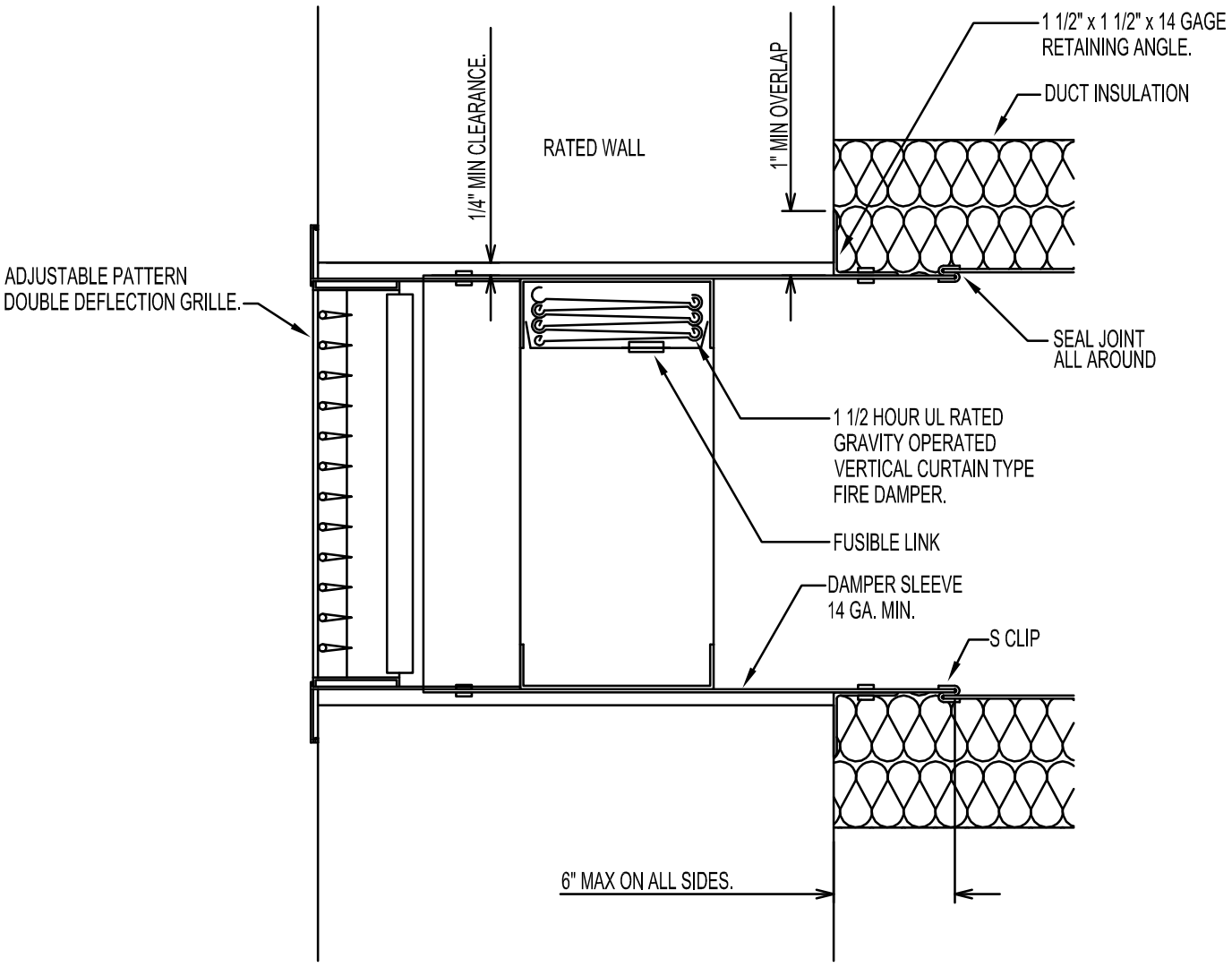


# M2.22

## RATED SIDEWALL GRILLE DETAIL

SCALE: NONE

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Raleigh, NC 27610
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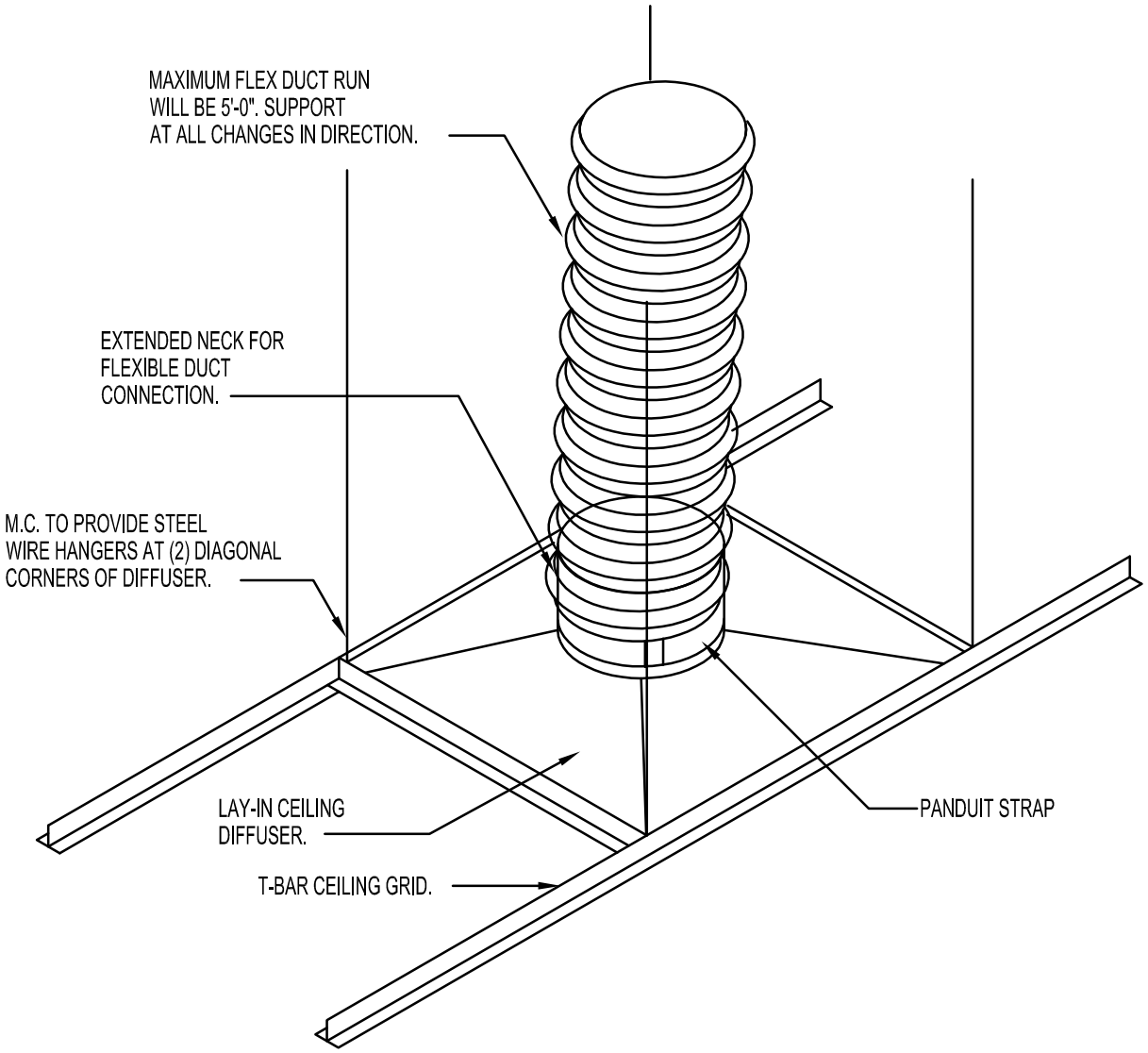
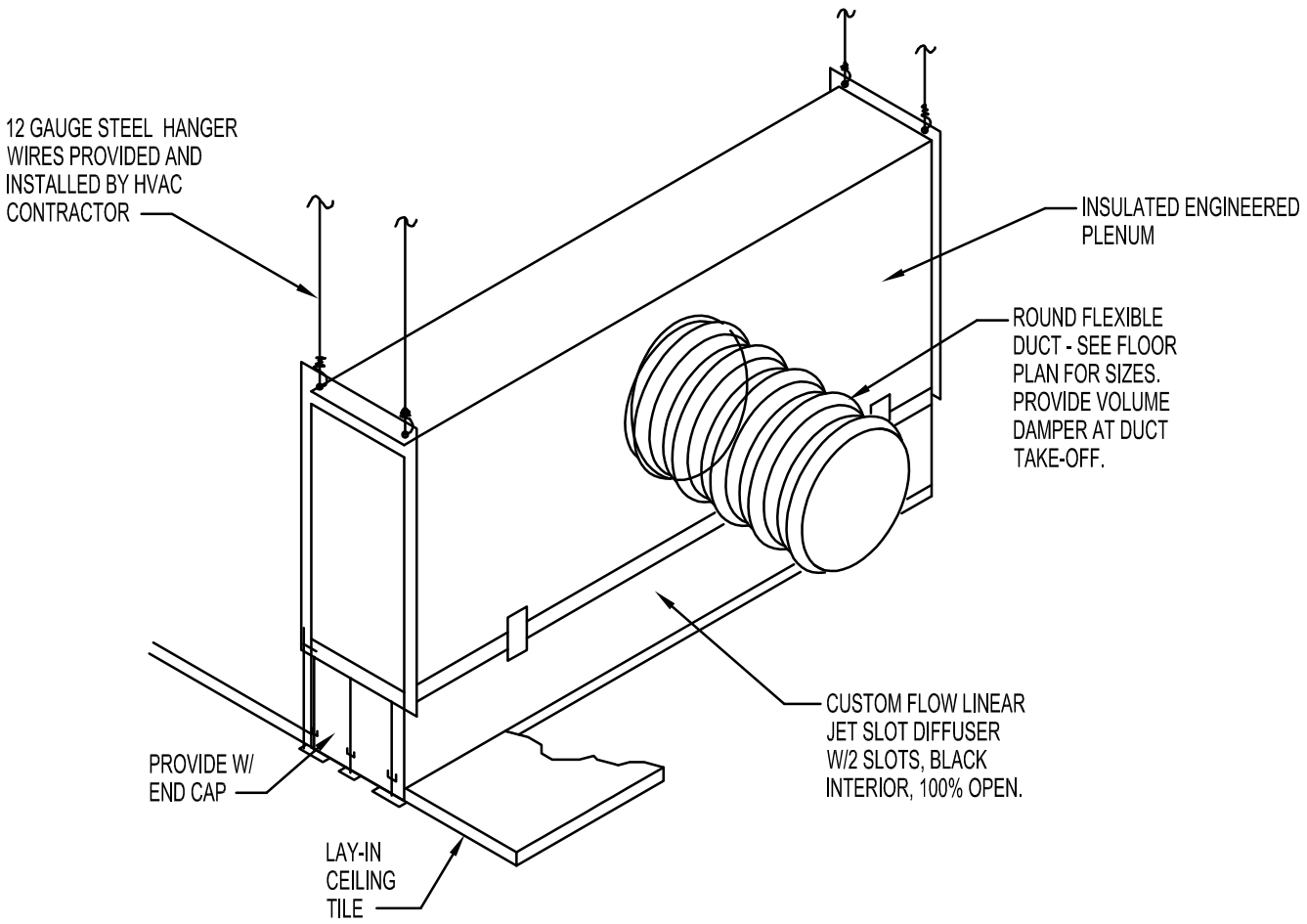



# M2.23

## ROUND NECK LAY-IN DIFFUSER DETAIL

SCALE: NONE

WAKE COUNTY PUBLIC SCHOOL SYSTEM
1429 Rock Quarry Road, Suite 116
Raleigh, NC 27610
(919) 588-3608

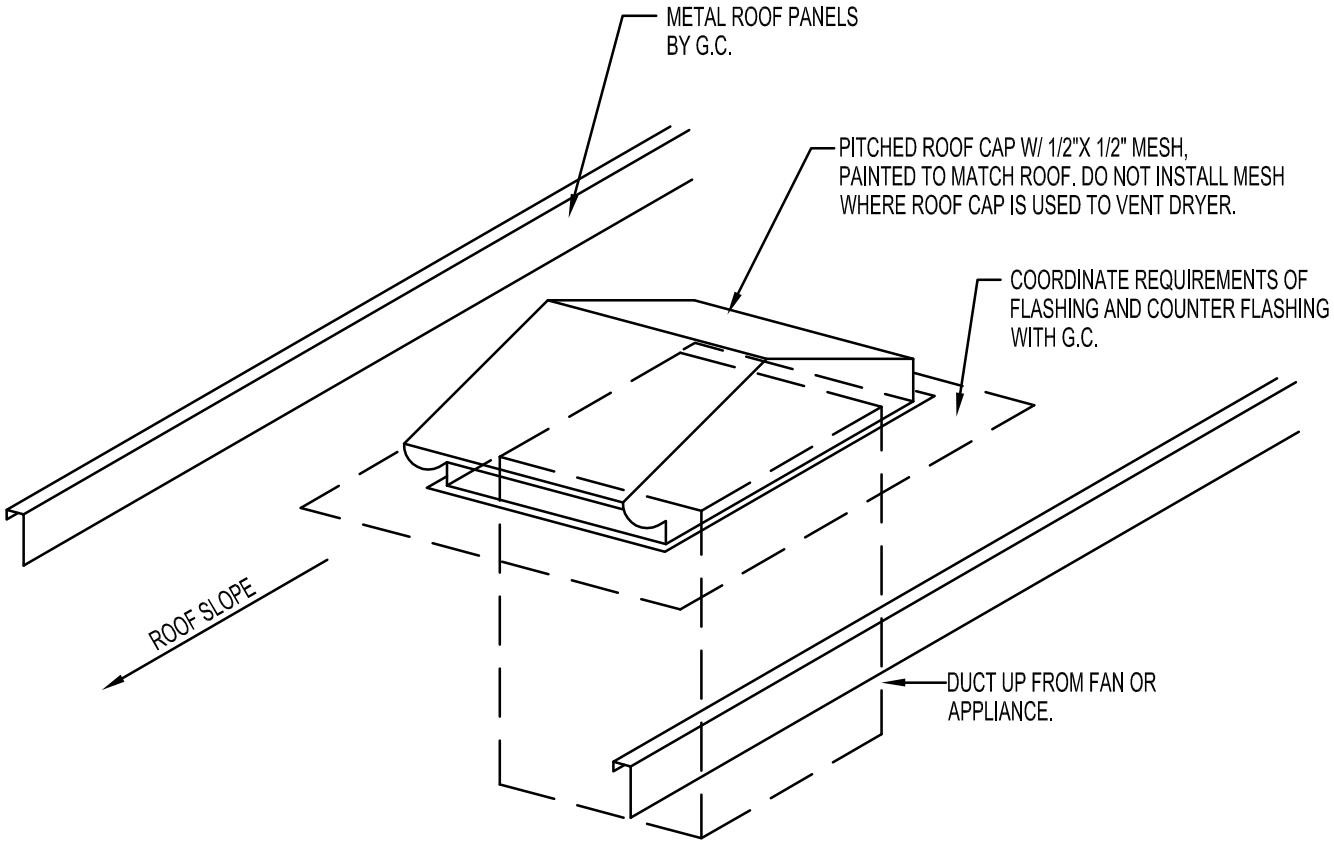



# M2.24

## SLOT DIFFUSER DETAIL

SCALE: NONE

WAKE COUNTY PUBLIC SCHOOL SYSTEM
1429 Rock Quarry Road, Suite 116
Raleigh, NC 27610
(919) 588-3608

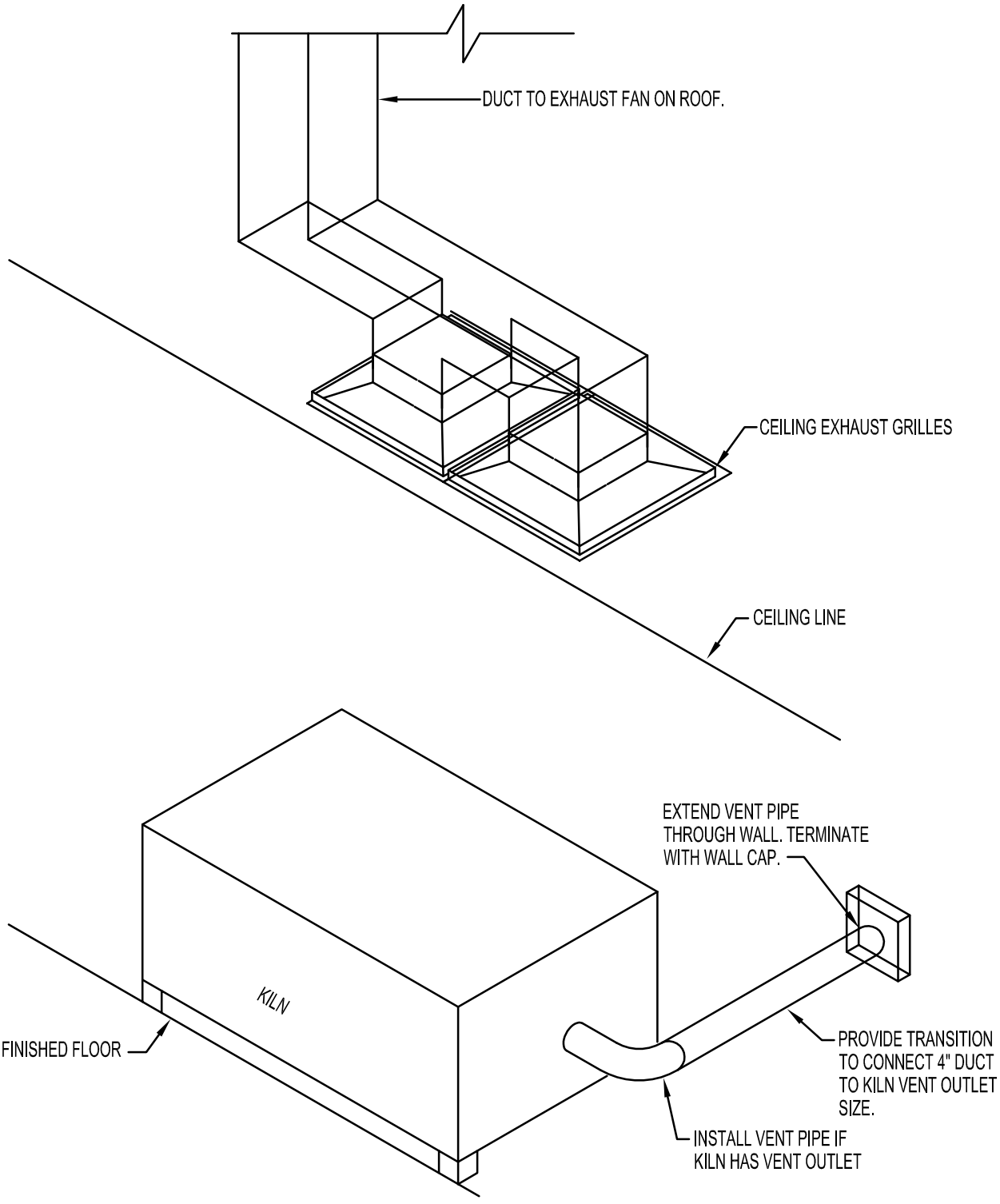



# M2.31

## SLOPED ROOF CAP DETAIL

SCALE: NONE

WAKE COUNTY PUBLIC SCHOOL SYSTEM
1429 Rock Quarry Road, Suite 116
Raleigh, NC 27610
(919) 588-3608

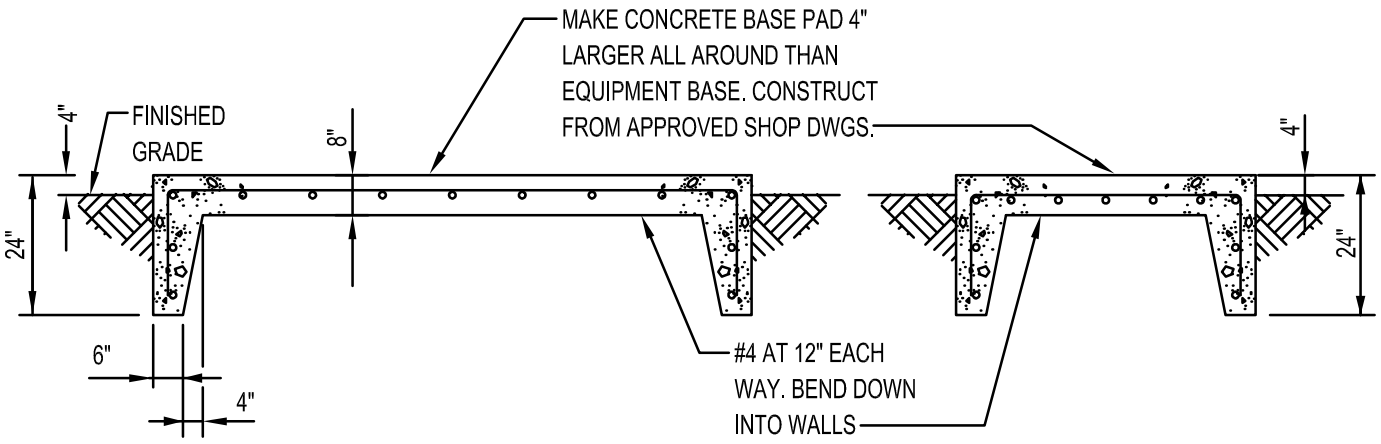



# M2.41

## KILN EXHAUST DETAIL

SCALE: NONE

WAKE COUNTY PUBLIC SCHOOL SYSTEM
1429 Rock Quarry Road, Suite 116
Raleigh, NC 27610
(919) 588-3608




Side Elevation

End Elevation

# M2.51

## CONCRETE EQUIPMENT PAD DETAIL

SCALE: NONE

WAKE COUNTY PUBLIC SCHOOL SYSTEM
1429 Rock Quarry Road, Suite 116
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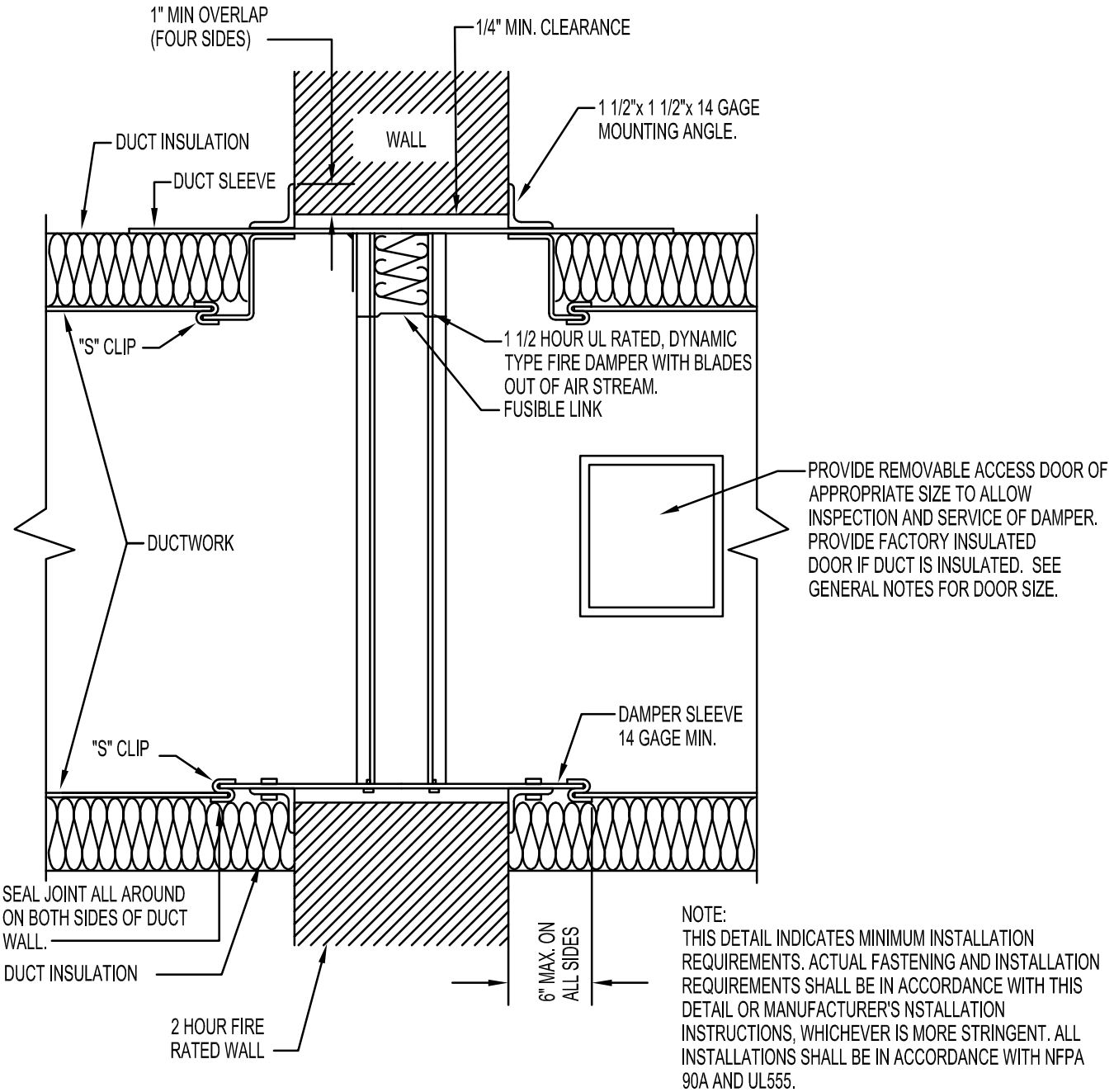


NOTE:
THIS DETAIL INDICATES MINIMUM INSTALLATION REQUIREMENTS. ACTUAL FASTENING AND INSTALLATION REQUIREMENTS SHALL BE IN ACCORDANCE WITH THIS DETAIL OR MANUFACTURER'S NSTALLATION INSTRUCTIONS, WHICHEVER IS MORE STRINGENT. ALL INSTALLATIONS SHALL BE IN ACCORDANCE WITH NFPA 90A AND UL555.

# M2.52

## FIRE DAMPER DETAIL

SCALE: NONE

WAKE COUNTY PUBLIC SCHOOL SYSTEM
1429 Rock Quarry Road, Suite 116
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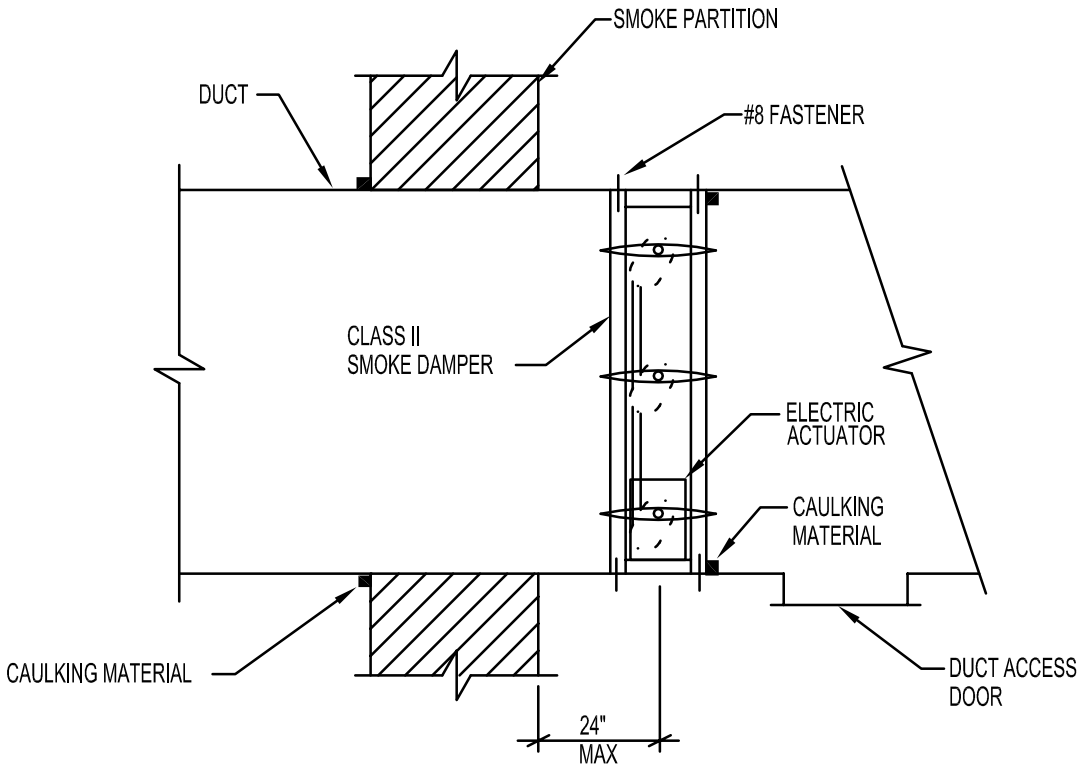
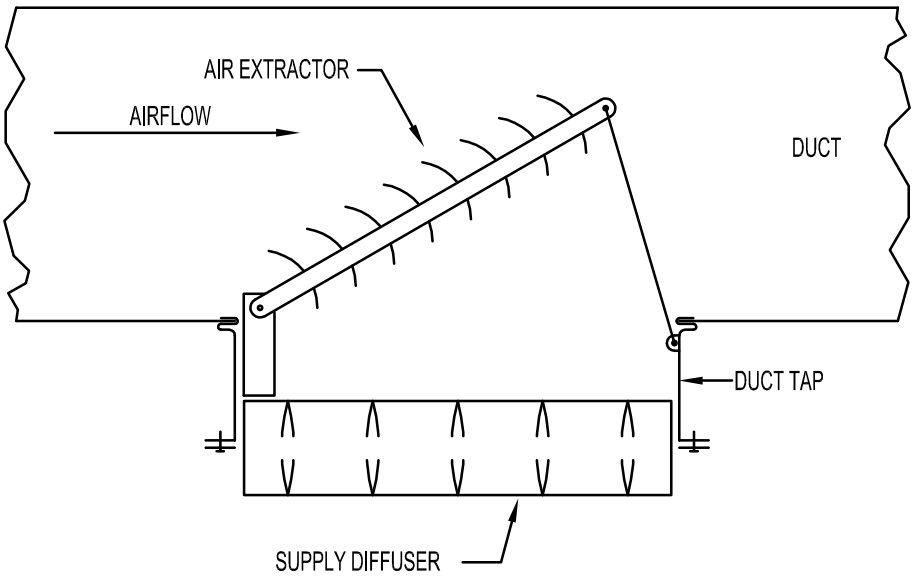



# M2.53

## SMOKE DAMPER DETAIL

SCALE: NONE

WAKE COUNTY PUBLIC SCHOOL SYSTEM
1429 Rock Quarry Road, Suite 116
Raleigh, NC 27610
(919) 588-3608




# M2.54

## AIR EXTRACTOR DETAIL

SCALE: NONE

WAKE COUNTY PUBLIC SCHOOL SYSTEM
1429 Rock Quarry Road, Suite 116
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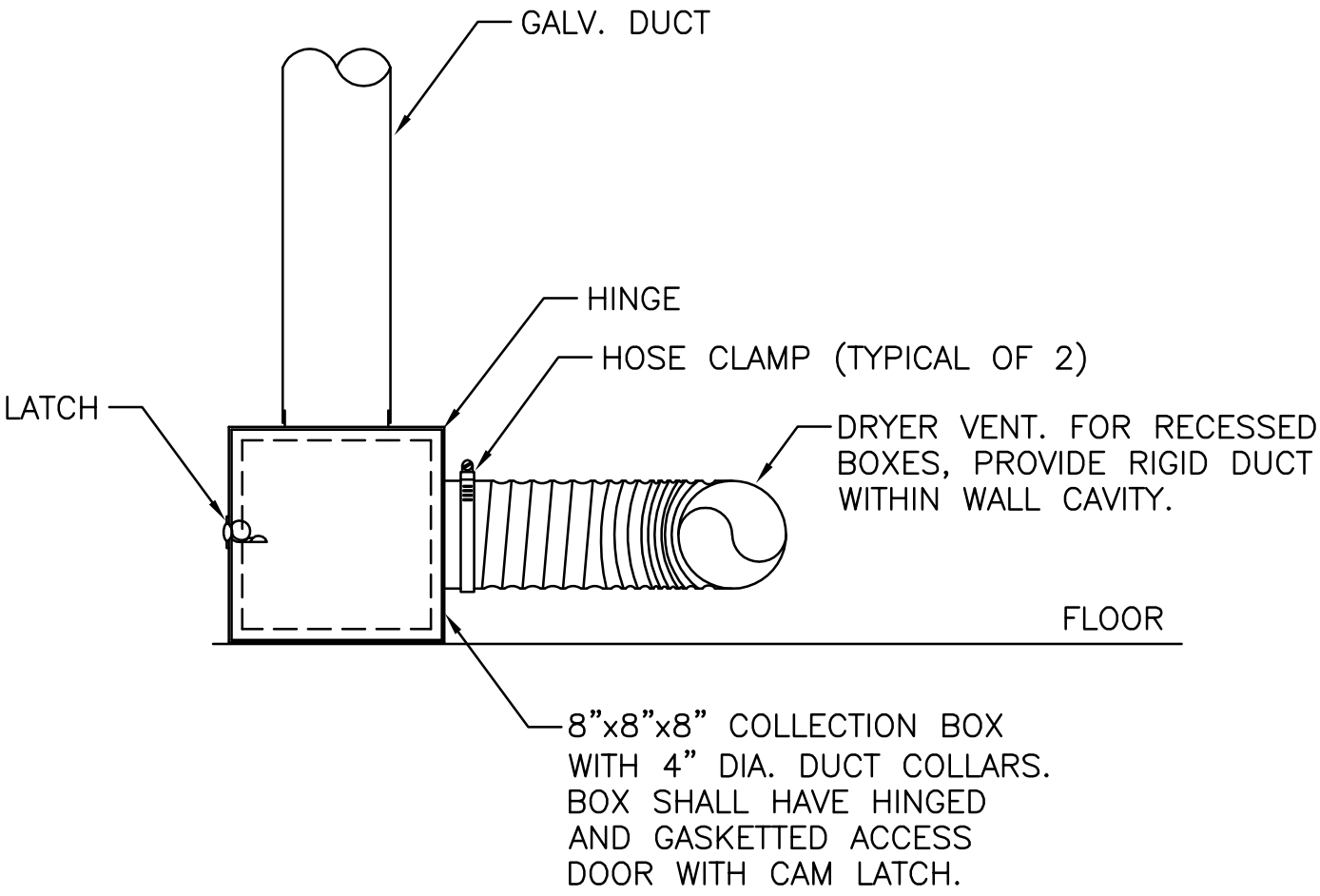


# M2.55

## DRYER VENT COLLECTION BOX DETAIL

SCALE: NONE

WAKE COUNTY PUBLIC SCHOOL SYSTEM
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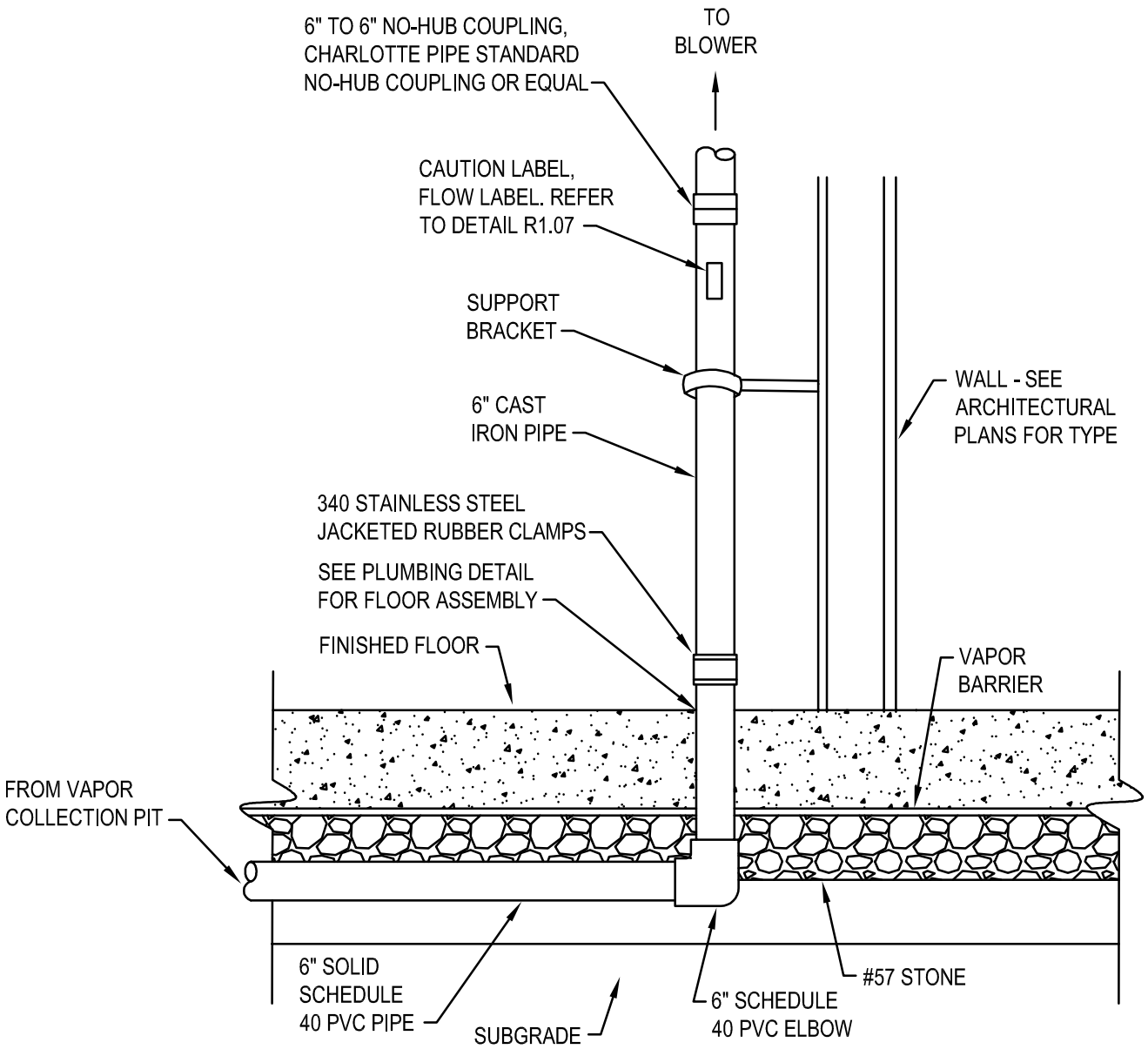


# V1.01

## VAPOR MITIGATION SYSTEM - VENT PIPE AT RISER DETAIL

SCALE: NONE

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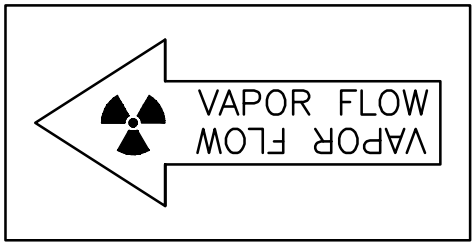


# V1.02 VAPOR MITIGATION SYSTEM - CAUTION AND FLOW LABEL DETAIL

SCALE: NONE

WAKE COUNTY PUBLIC SCHOOL SYSTEM
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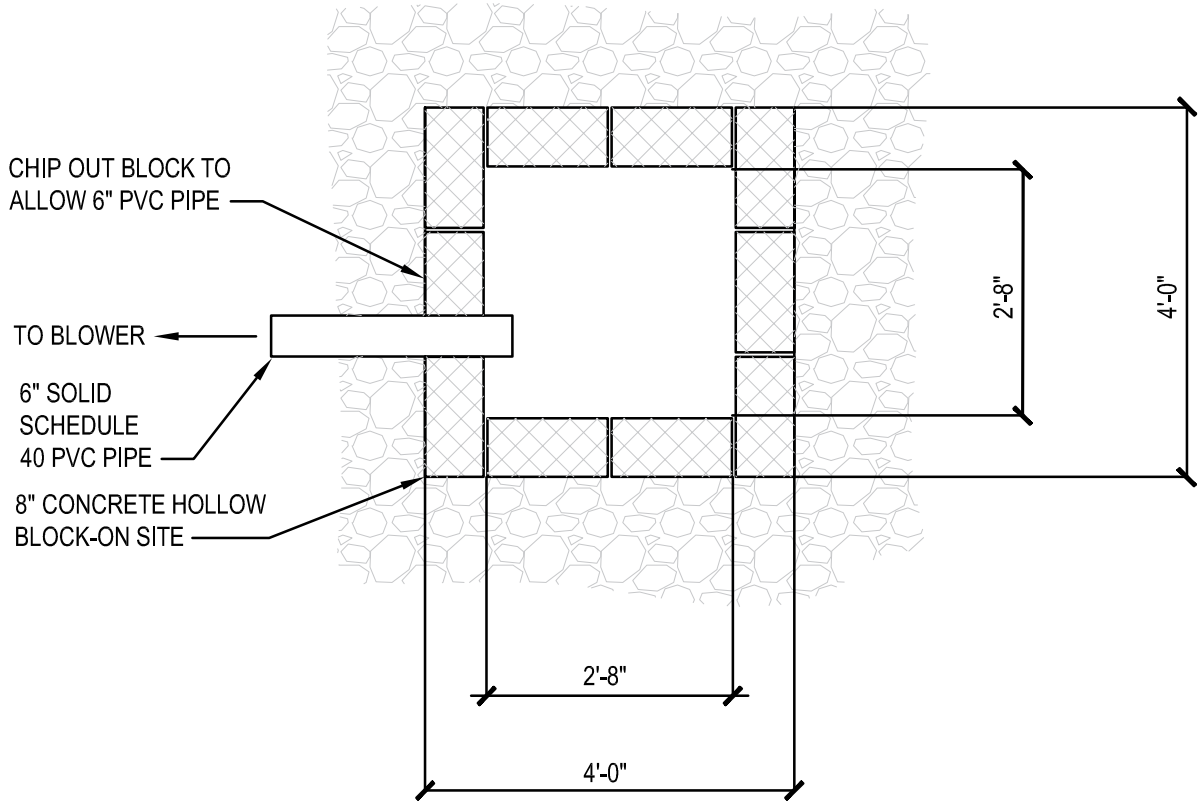
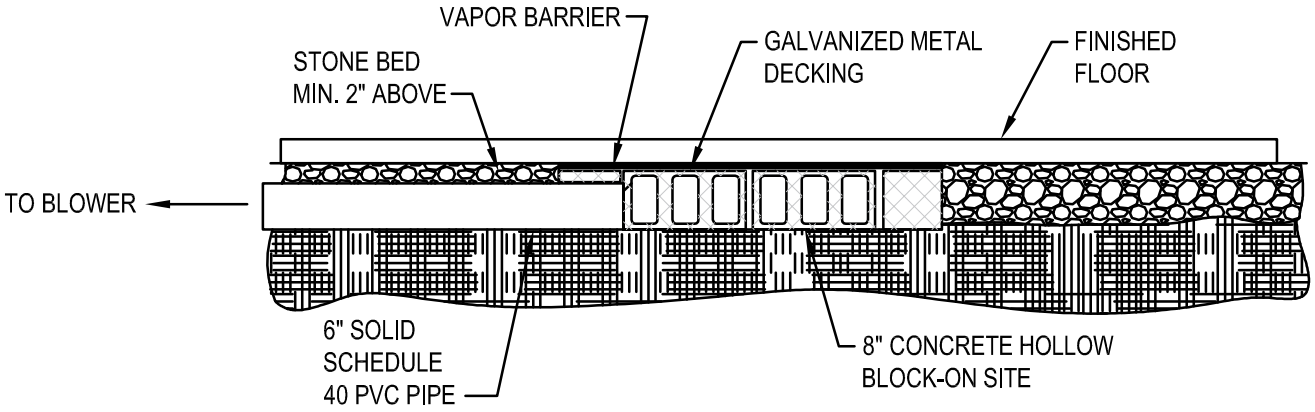



TOP VIEW




SIDE VIEW

# V1.03

## VAPOR MITIGATION SYSTEM - SUCTION PIT DETAIL

SCALE: NONE

WAKE COUNTY PUBLIC SCHOOL SYSTEM
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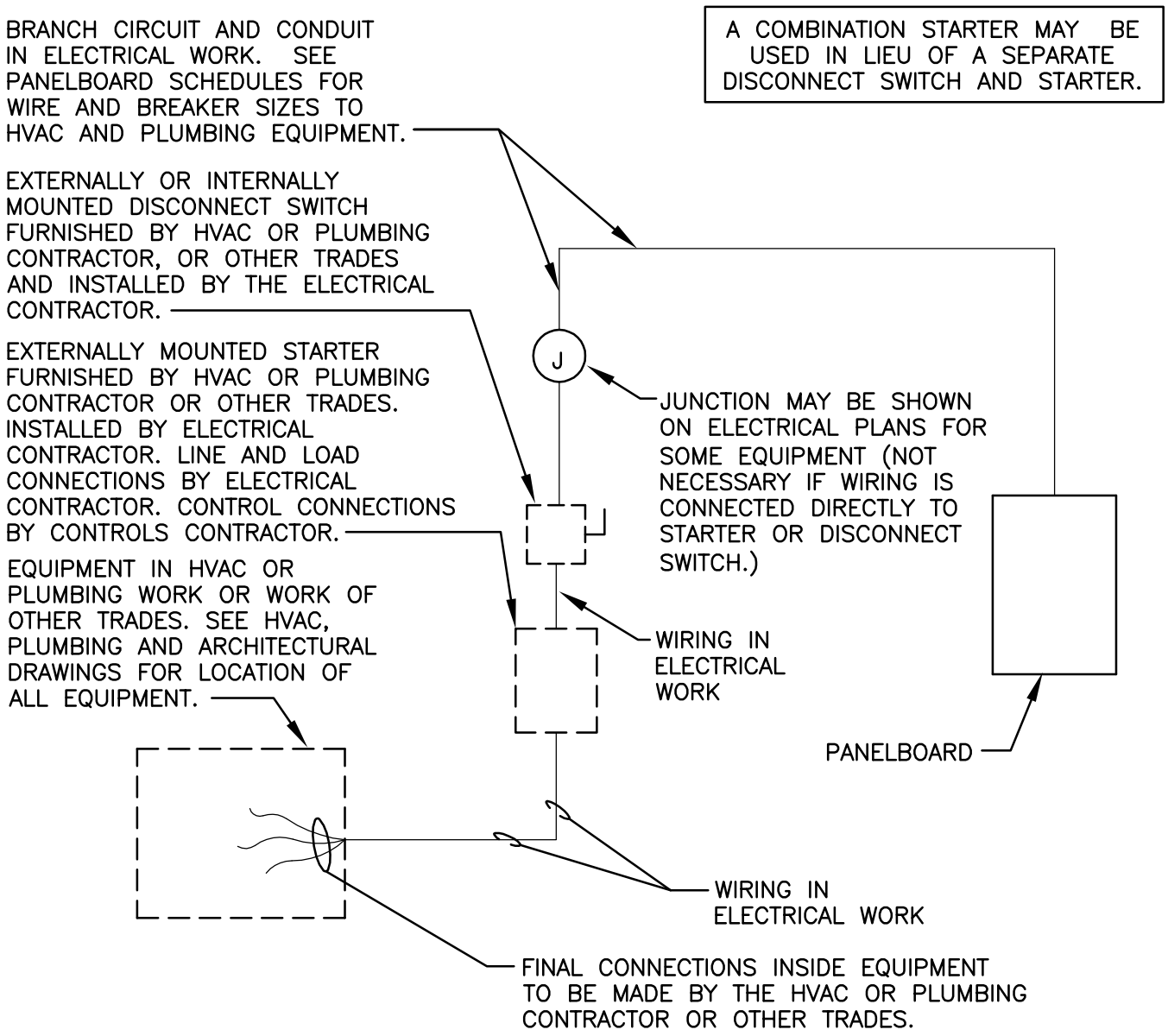


# E1.01 TYPICAL MECH EQUIPMENT ELECTRICAL CONNECTION DETAIL

SCALE: NONE

WAKE COUNTY PUBLIC SCHOOL SYSTEM
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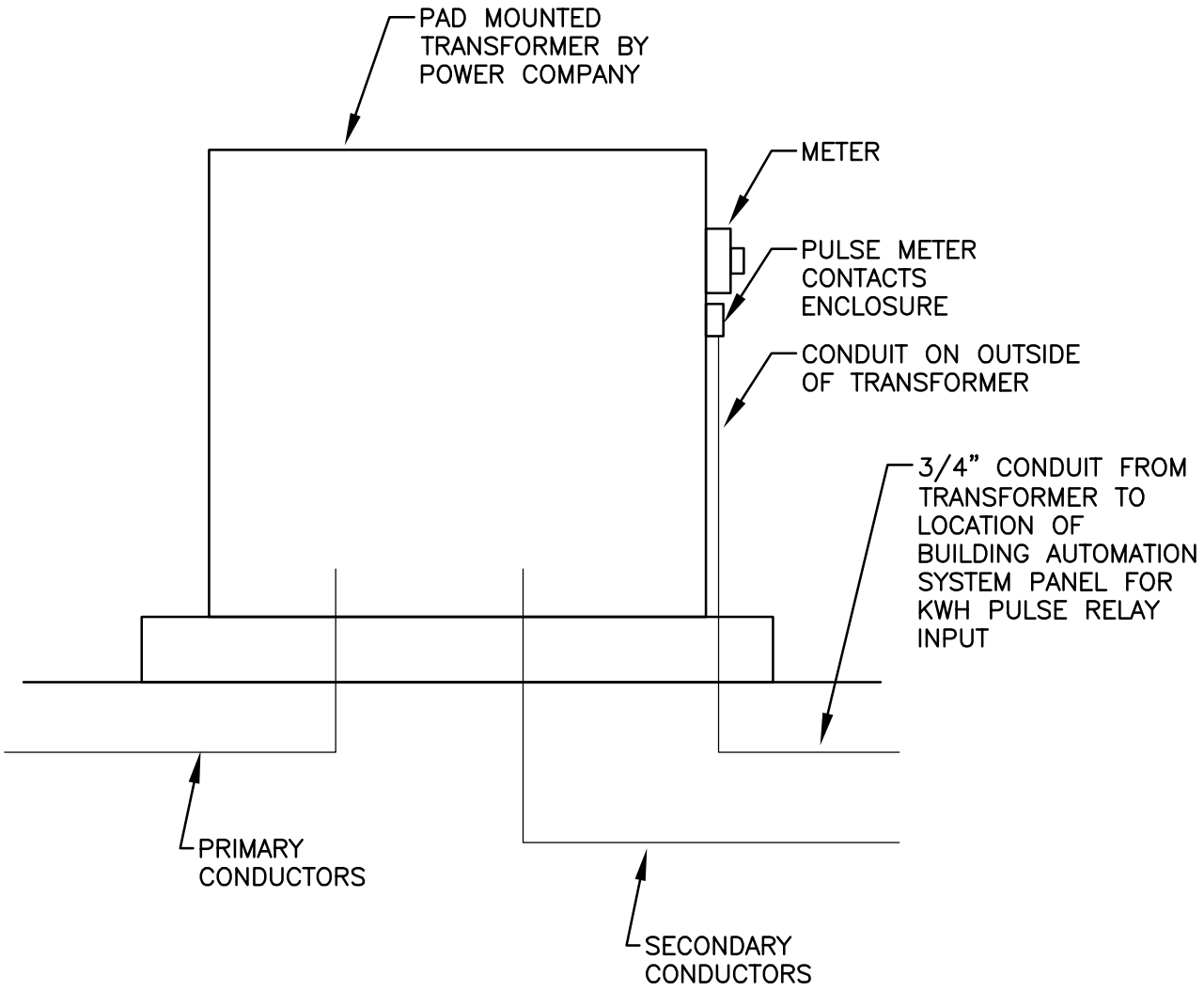


# E1.02 STANDARD PULSE RELAY CONDUIT DETAIL

SCALE: NONE

WAKE COUNTY PUBLIC SCHOOL SYSTEM
1429 Rock Quarry Road, Suite 116
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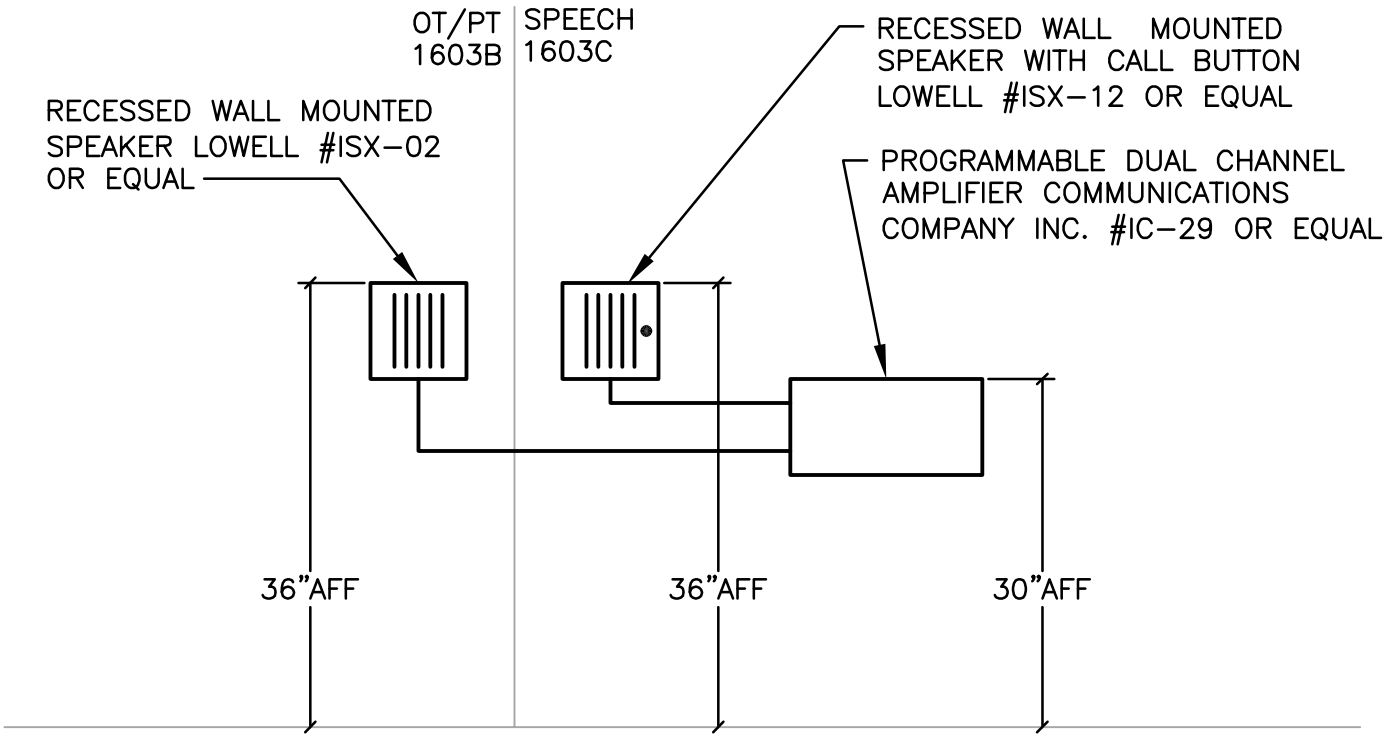


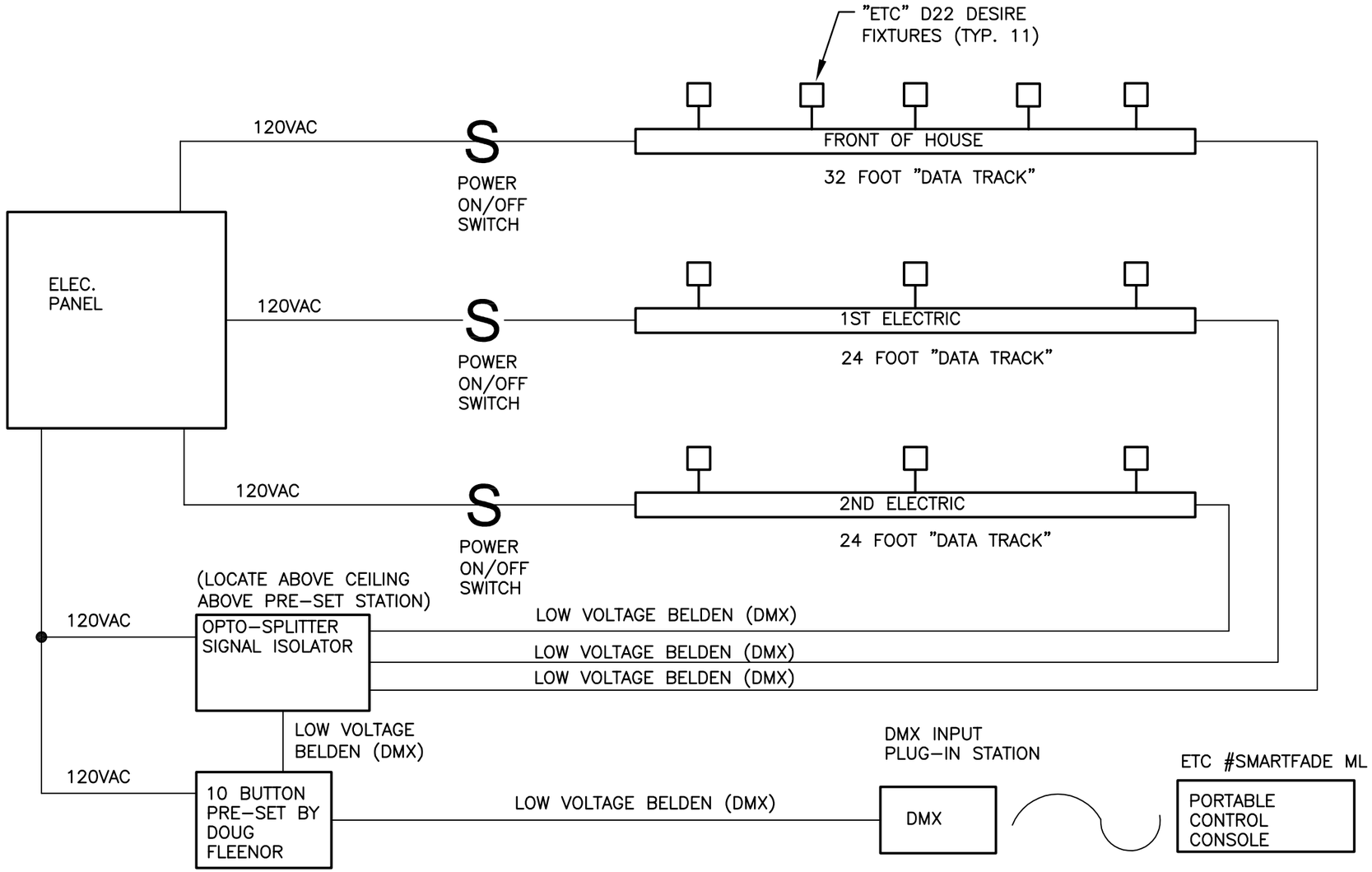

NOTES:

1. WALL MOUNTED SPEAKERS REQUIRE A STANDARD 2-GANG BACKBOX THAT WILL ACCOMODATE A 2 1/2" DEEP DEVICE.
2. PROVIDE ALL COMPONENTS FOR A COMPLETE OPERATING SYSTEM.
3. PROVIDE ALL WIRING PER MANUFACTURERS SPECIFICATIONS.
4. PROVIDE SPEAKER-TO-SPEAKER, PUSH TO TALK CONNECTION WITH SPEAKER IN SPEECH ALWAYS RETURNING TO LISTEN.
5. CONNECT TO NEAREST RECEPTACLE CIRCUIT.

# E1.03

## OT/PT & SPEECH LOCAL INTERCOM SYSTEM DETAIL

SCALE: NONE




## PLATFORM DIMMING RISER GENERAL NOTES:

1. THE PLATFORM DIMMING SYSTEM IS A PREFERRED BRAND ALTERNATE, REFER TO SPECIFICATIONS.
2. PROVIDE ALL NECESSARY PARTS, SUPPORTS, AND ACCESSORIES FOR A COMPLETE SYSTEM.
3. ALL WIRING SHALL BE IN CONDUIT (3/4" MINIMUM).
4. COORDINATE TRACK AND FIXTURE LOCATION WITH MANUFACTURER FOR OPTIMUM LOCATION.
5. REFER TO PLANS FOR EXACT EQUIPMENT LOCATION AND CIRCUIT INFORMATION.
6. DMX CABLING NOT SHOWN ON PLANS FOR CLARITY.

E1.04

PLATFORM DIMMING RISER DIAGRAM

SCALE: NONE

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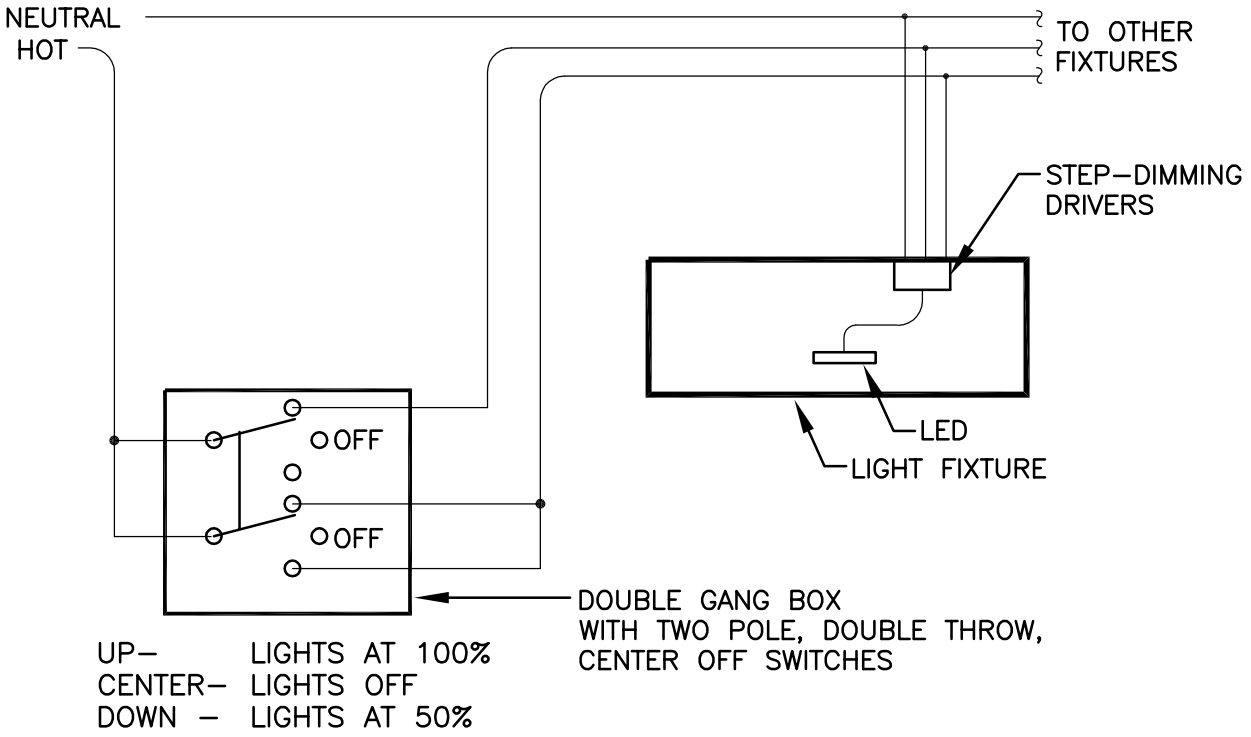
NOTE:
DETAIL IS TYPICAL FOR SWITCHES INDICATED ON LIGHTING PLAN BY "$S_2$".



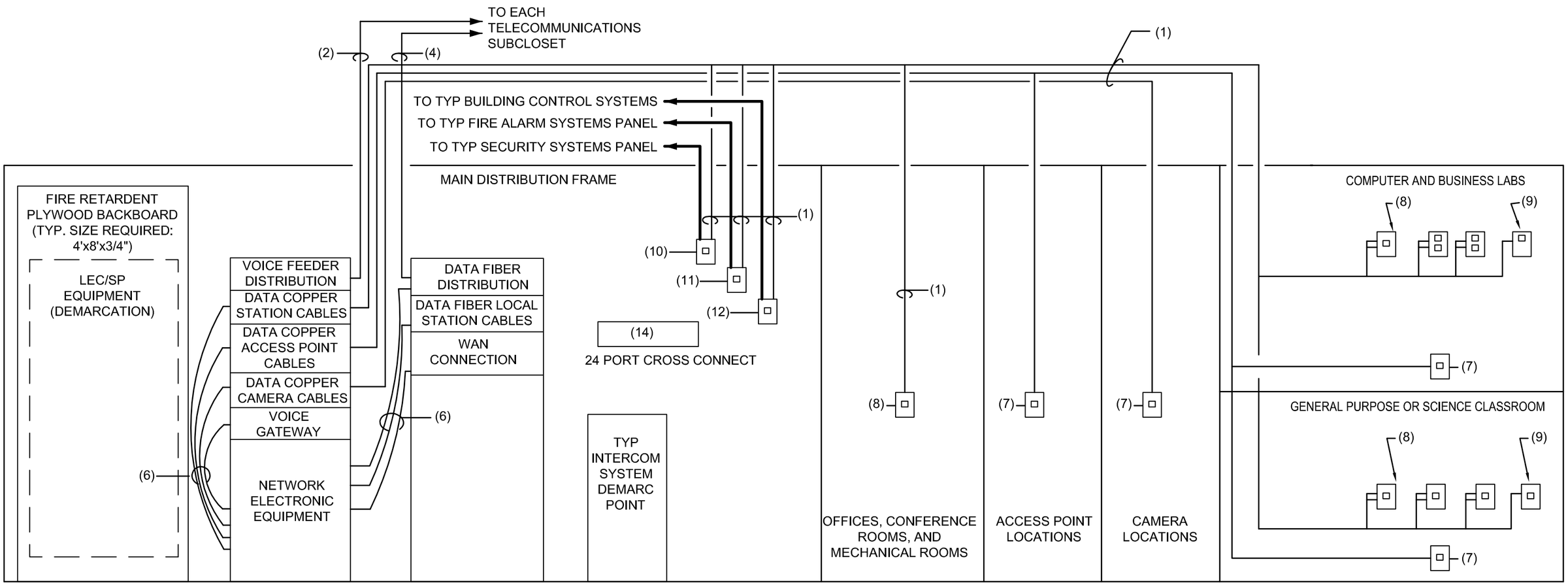

# E1.05 BI-LEVEL DIMMING CONTROL DIAGRAM

SCALE: NONE

# CABLE SCHEDULE

MARKS DESCRIPTION

(1) 1 - 4 PAIR Cat6 CABLE FOR DATA PER PORT.
(2) MULTI-PAIR Cat3 CABLE FOR VOICE DISTRIBUTION.
(3) 1 - 2 STRAND MULTIMODE FIBER CABLE FOR DATA TO SWITCH ENCLOSURE.
(4) MULTIPLE STRANDS OF MULTIMODE FIBER CABLE FOR DATA DISTRIBUTION TO MAIN BUILDING. SINGLEMODE TO ALL OUTBUILDINGS.
(5) COPPER PATCH CORDS TO BE PROVIDED BY CONTRACTOR AND INSTALLED BY WCPSS.
(6) PATCH CORDS TO BE PROVIDED AND INSTALLED BY WCPSS.
(7) ACCESS POINT OR CAMERA DROP TERMINATED WITH A MODULAR RJ45 PLUG.
(8) TYPICAL TCO - REFER TO 270000 FOR REQUIRED QUANTITY PER LOCATION.
(9) TCO FOR WALL MOUNTED TELEVISION.
(10) TYP FIRE PANEL DEMARCATION POINT
(11) TYP SECURITY DEMARCATION POINT
(12) TYP BUILDING SYSTEM CONTROL DEMARCATION POINT
(13) FOUR POST RACK (TWO RACKS FOR ELEMENTARY AND MIDDLE, THREE FOR HIGH SCHOOLS.) POSTS ARE TO BE INSTALLED WITH 32" FRONT TO BACK.
(14) 24 PORT PATCH PANEL TO CROSS CONNECT "VOICE" CONNECTIONS FOR LIFE SAFETY,BUILDING CONTROL, SECURITY, AND INTERCOM SYSTEMS. PORTS SHOULD CONNECT TO PORTS 1 - 24 ON COPPER DATA PATCH PANEL.




E2.00

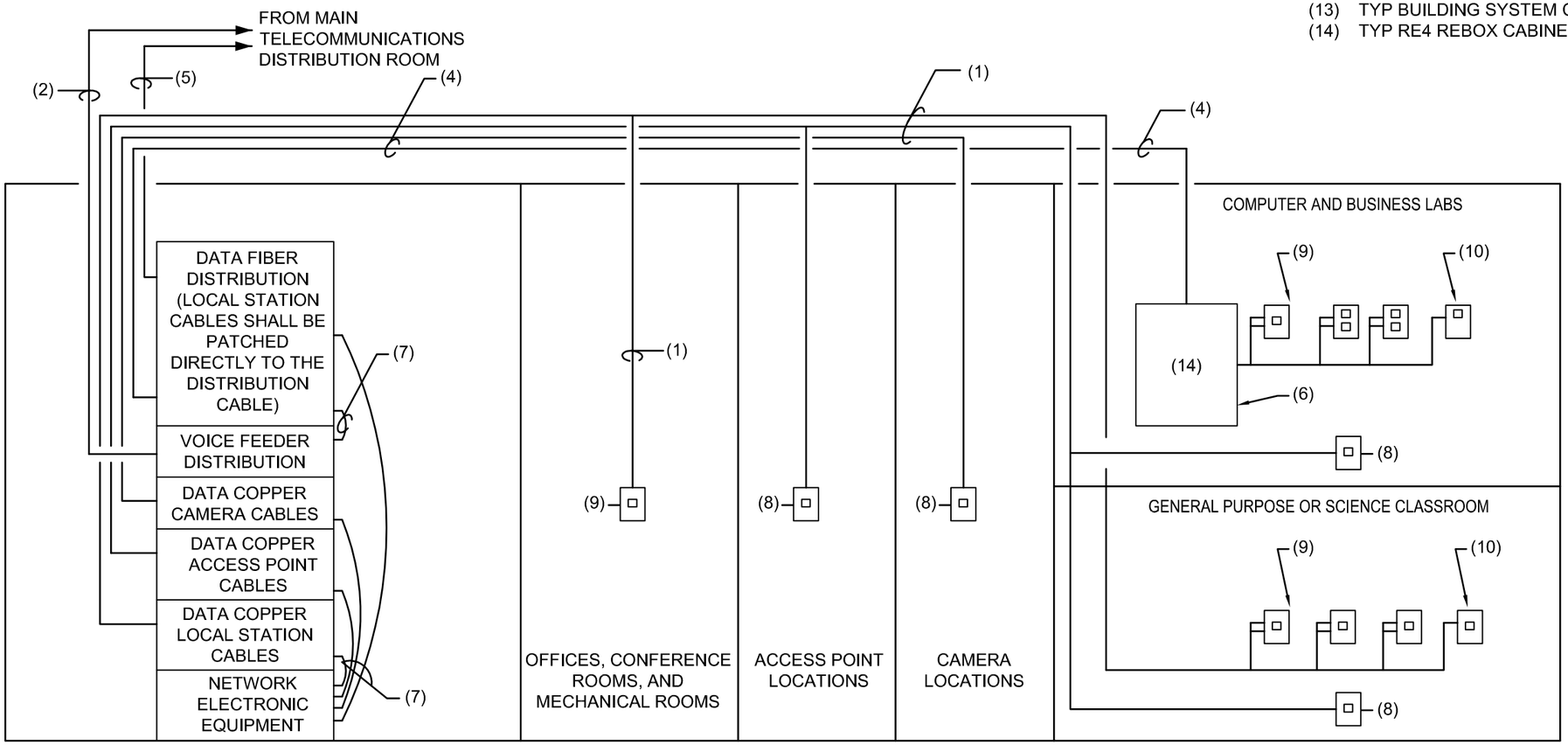
## MAIN TELECOMMUNICATIONS DISTRIBUTION ROOM TYPICAL DESIGN

SCALE: NONE


WAKE COUNTY PUBLIC SCHOOL SYSTEM
1429 Rock Quarry Road, Suite 116
Raleigh, NC 27610
(919) 588-3608

# CABLE SCHEDULE

| MARKS | DESCRIPTION |
|---|---|
| (1) | 1 - 4 PAIR Cat6 CABLE FOR DATA PER PORT. |
| (2) | MULTI-PAIR Cat3 CABLE FOR VOICE DISTRIBUTION. |
| (3) | 1 - 2 STRAND MULTIMODE FIBER CABLE FOR DATA TO SWITCH ENCLOSURE. |
| (4) | 1 - 6 STRAND MULTIMODE FIBER CABLE FOR DATA TO EACH REBOX CABINET IN COMPUTER LAB AND BUSINESS LABS. |
| (5) | MULTIPLE STRANDS ON MULTIMODE FIBER CABLE FOR DATA DISTRIBUTION. |
| (6) | COPPER PATCH CORDS TO BE PROVIDED BY CONTRACTOR AND INSTALLED BY WCPSS. |
| (7) | PATCH CORDS TO BE PROVIDED AND INSTALLED BY WCPSS. |
| (8) | ACCESS POINT OR CAMERA DROP TERMINATED WITH A MODULAR RJ45 PLUG. |
| (9) | TYPICAL TCO - REFER TO 270000 FOR REQUIRED QUANTITY PER LOCATION. |
| (10) | TCO FOR INTERACTIVE WHITE BOARD. |
| (11) | TYP FIRE PANEL DEMARCATION POINT |
| (12) | TYP SECURITY DEMARCATION POINT |
| (13) | TYP BUILDING SYSTEM CONTROL DEMARCATION POINT |
| (14) | TYP RE4 REBOX CABINET IN EACH COMPUTER AND BUSINESS LAB |




E2.01

## TELECOMMUNICATIONS SUBCLOSET TYPICAL DESIGN

SCALE: NONE


WAKE COUNTY PUBLIC SCHOOL SYSTEM

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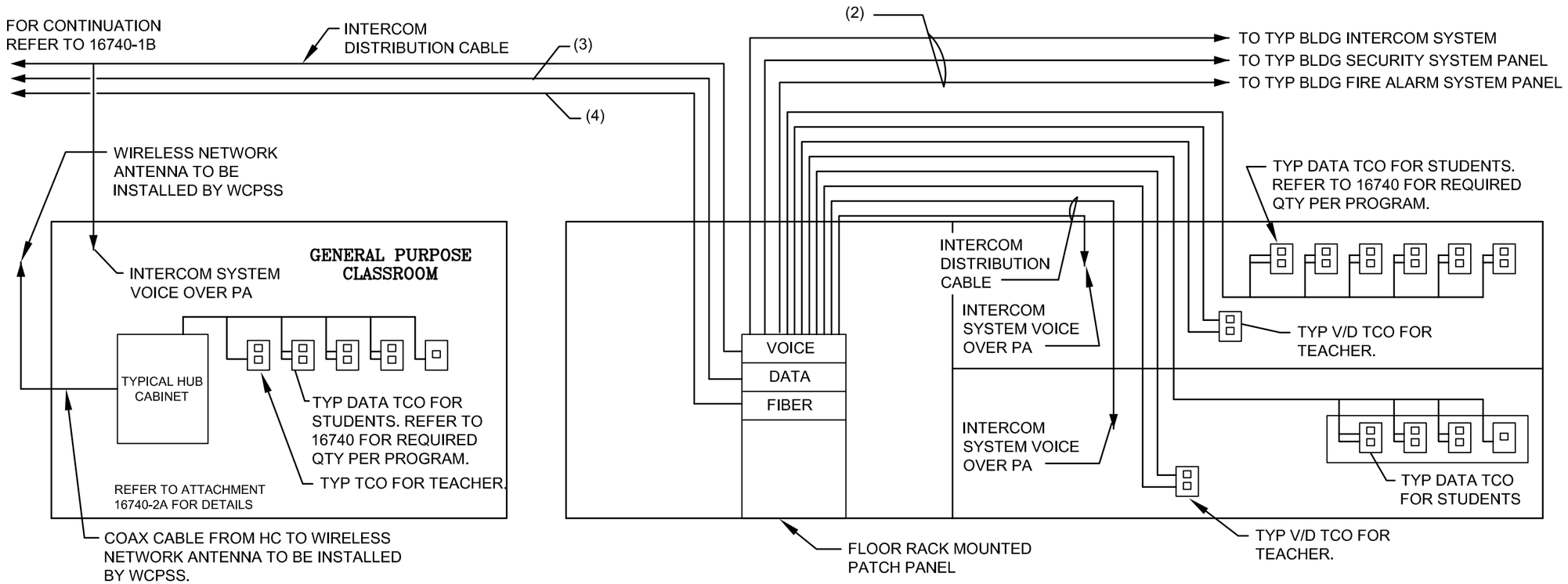
Raleigh, NC 27610
(919) 588-3608

# CABLE SCHEDULE

| MARKS | DESCRIPTION |
|---|---|
| (1) | 1 - 4 PAIR Cat5e CABLE FOR DATA. |
| (2) | 1 - 4 PAIR Cat5e CABLE FOR VOICE. |
| (3) | MULTI-PAIR Cat3 INDOOR/OUTDOOR CABLE FOR VOICE DISTRIBUTION. |
| (4) | 1 – 12 STRAND MULTIMODE FIBER CABLE FOR DATA TO OPEN 7FT RACK IN SINGLE OR MODULAR COMPLEX TELECOMMUNICATIONS SUB CLOSET. |




E2.02

MODULAR UNIT TELECOMMUNICATIONS TYPICAL DESIGN

SCALE: NONE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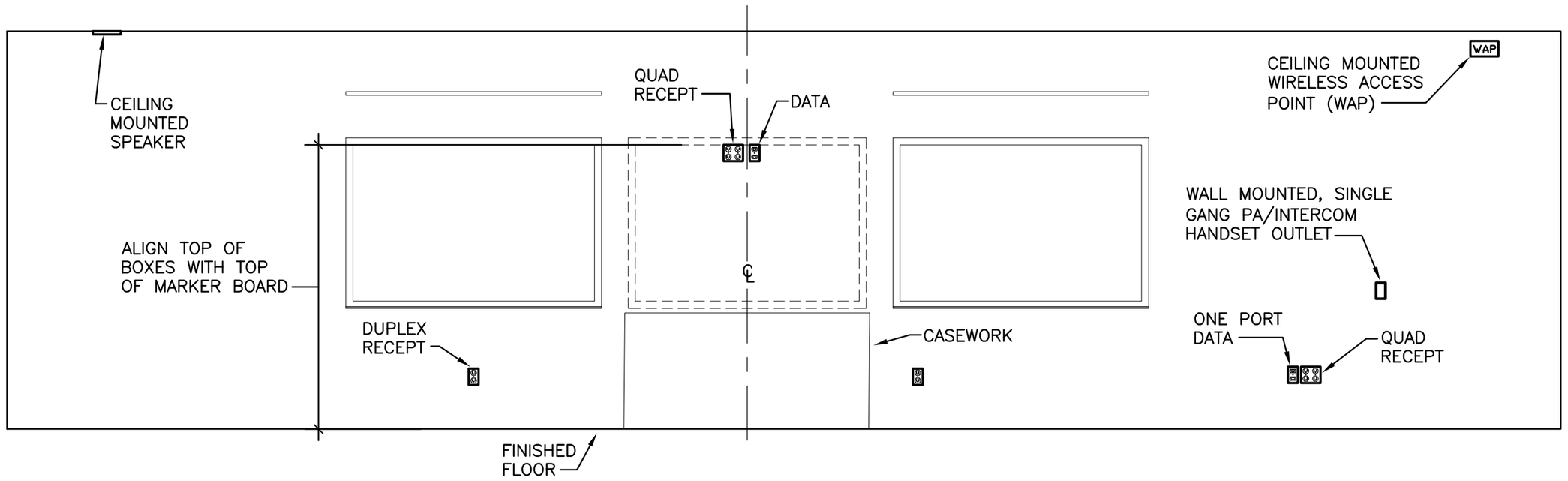


# E2.03

## PRIMARY TEACHER WALL ELECTRICAL REQUIREMENTS

SCALE: NONE

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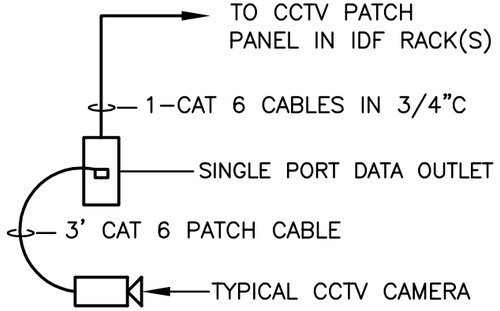
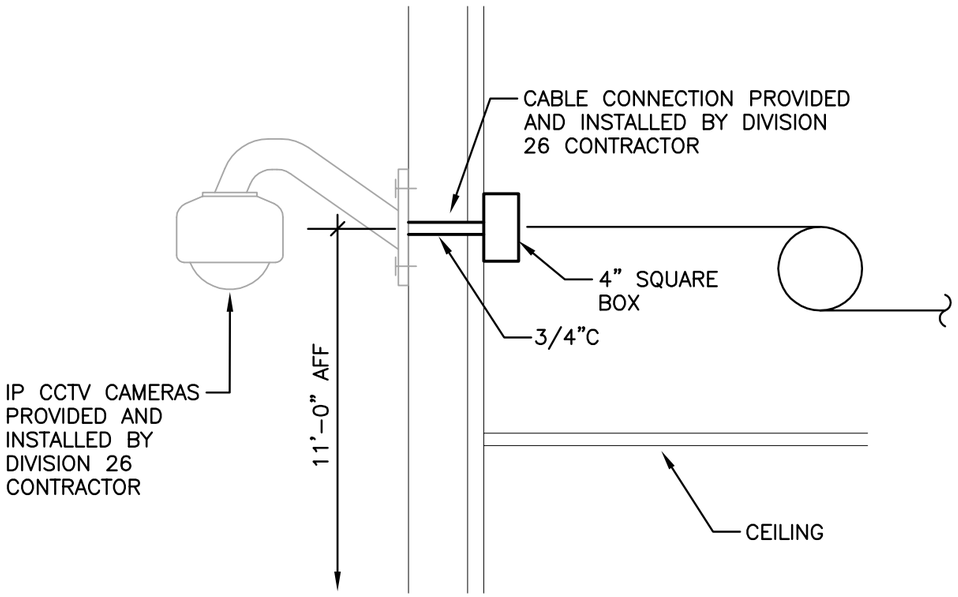
Raleigh, NC 27610
(919) 588-3608

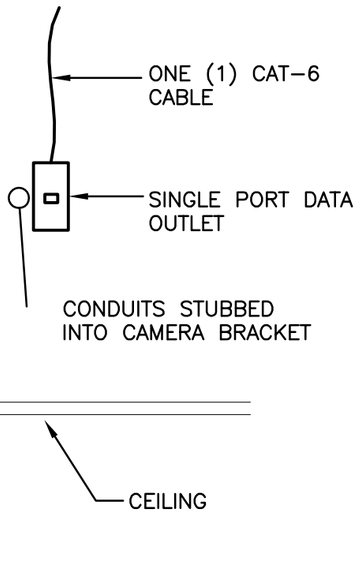
NOTES:

1. ALL CONDUIT AND OUTLET BOXES BY ELECTRICAL CONTRACTOR.
2. ALL CAMERA CABLING SHALL BE GREEN AND PROVIDED AND INSTALLED BY STRUCTURED WIRING CONTRACTOR.
3. SEE SPECIFICATIONS FOR FURTHER INSTALLATION REQUIREMENTS.
4. PROVIDE 15'–0" SERVICE LOOP AT EACH CAMERA LOCATION.
5. PLEASE NOTE: BECAUSE THE CAMERAS ARE OWNER PROVIDED AND INSTALLED, THE CAMERAS MAY BE ISNTALLED LATER. THE CONTRACTOR SHALL PLACE A YELLOW DOT ON CEILING WITH THE RESPECTIVE CABLE NUMBER. THE CABLE NUMBER SHALL BE TAGGED ON THE CABLE JACKET ABOVE THE CEILING. COORDINATE ALL WORK WITH THE OWNERS IT AND SECURITY DEPARTMENTS PRIOR TO INSTALLATION/ROUGH–IN.
6. CAMERAS CABLES SHALL BE TERMINATED ON SEPARATE PATCH PANEL IN DATA RACK AT MDF/IDF TELECOM CLOSETS. NETWORK POE SWITCHES SHALL BE PROVIDED AND INSTALLED BY THE OWNER.
7. PLENUM RATED CAT–6 CAMERA DATA CABLE LENGTHS SHALL NOT EXCEED 90 METERS. CONTRACTOR SHALL TAKE CARE IN MAINTAINING THESE LENGTHS.
8. ALL CAMERA CABLES SHALL BE TESTED IN COMPLIANCE WITH THE DATA CABLE REQUIREMENTS.
9. REFER TO ARCHITECT'S DIVISION 1 ALTERNATES SECTION.




SECTION




PLAN VIEW

E2.04

CCTV EXTERIOR CAMERA TERMINATION DETAIL

SCALE: NONE

WAKE COUNTY PUBLIC SCHOOL SYSTEM
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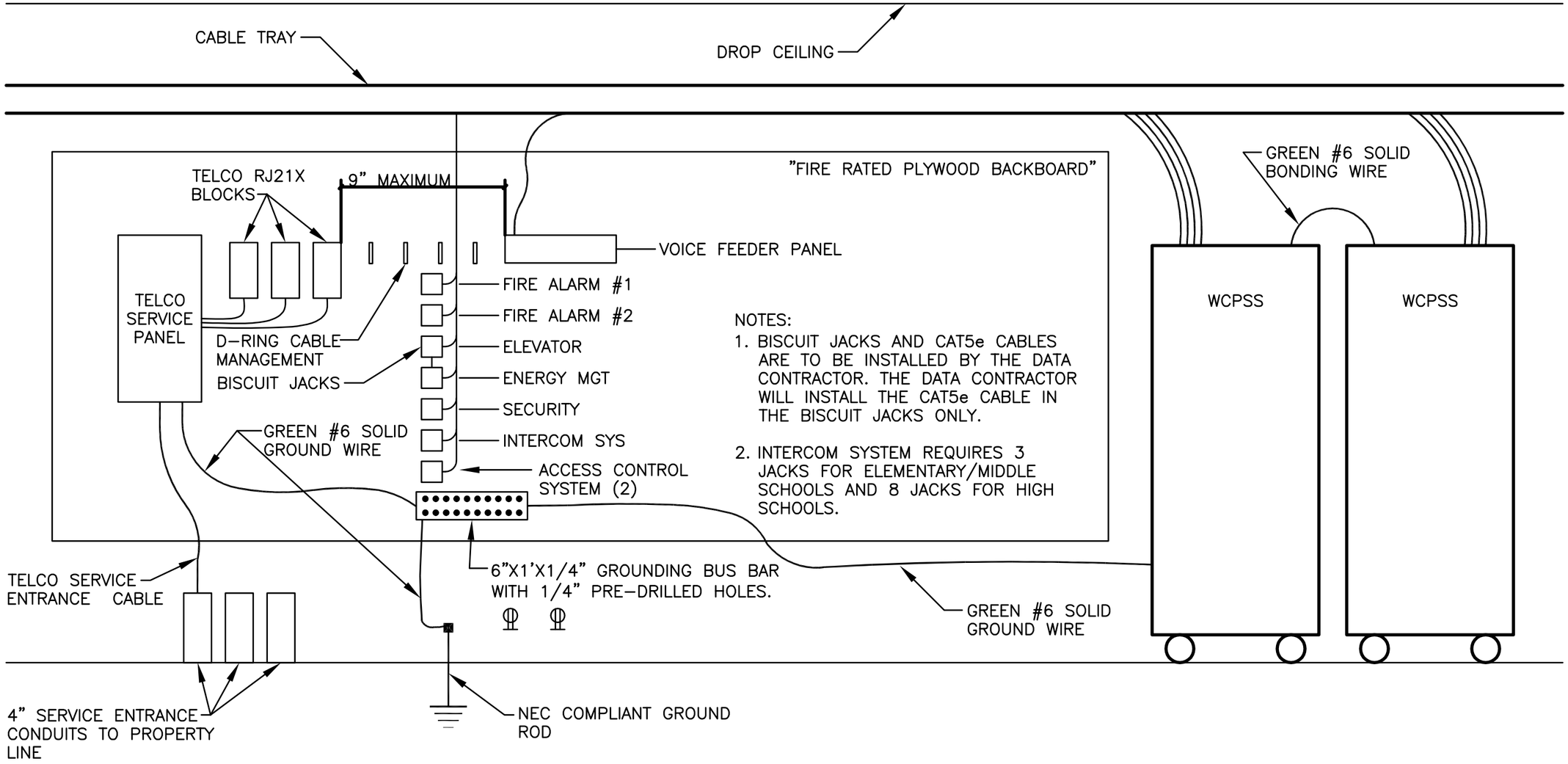


# E2.05

## MDF/DEMARC ROOM GROUNDING SYSTEM DETAIL

SCALE: NONE

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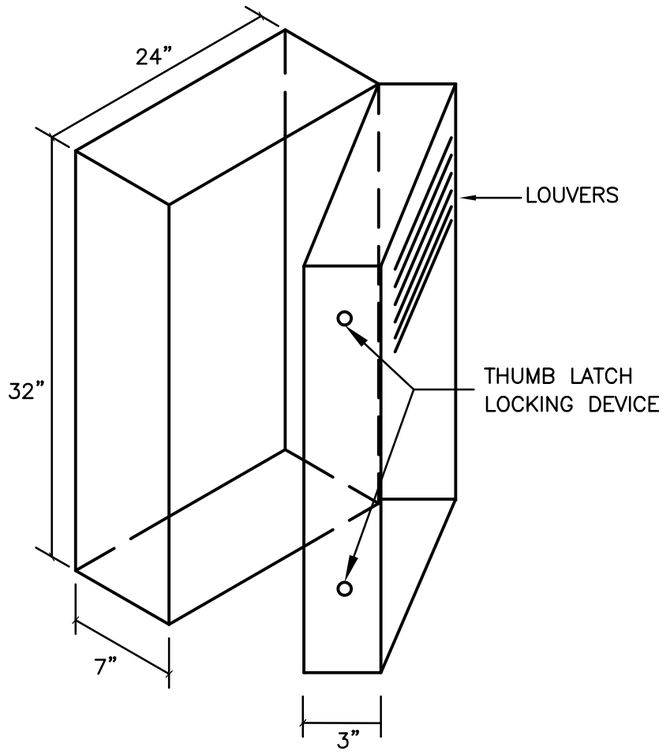
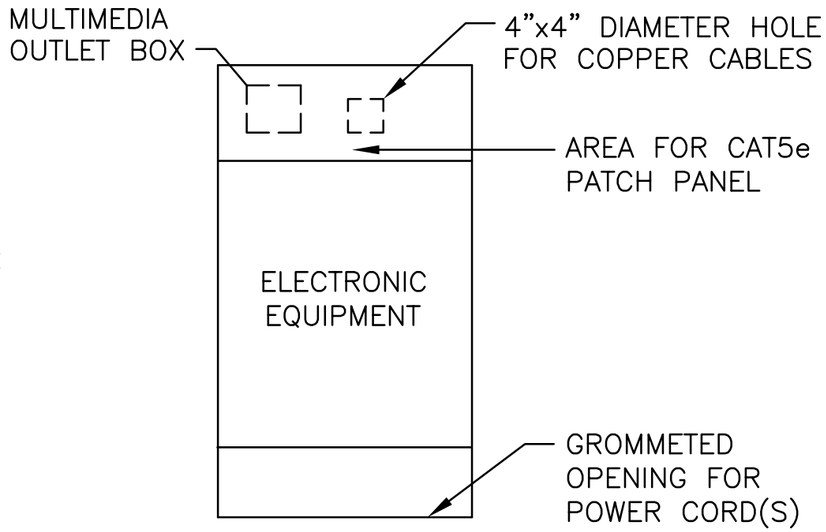



## REBOX DETAIL (RE4 ONLY)

(HUBBELL RE-4 OR EQUAL)




## REBOX EQUIPMENT ARRANGEMENT

NOTES (REBOX – RE4 ONLY):

1. CABINET SHALL BE CONSTRUCTED FROM 16 GAUGE COLD ROLLED STEEL. HINGES SHALL BE FORMED STEEL TYPE OR EQUIVALENT AND SWING FROM SIDE. FRONT PANEL SHALL HAVE LOUVERS TO AID IN THE DISSIPATION OF HEAT. UNIT SHALL HAVE THUMB LATCH LOCKING DEVICE. UNIT SHALL HAVE A POLYESTER POWDER ENAMEL OR EQUIVALENT TYPE FINISH (GRAY IN COLOR). MOUNT CABINET WITH LOUVERS HORIZONTAL.
2. CABINET SHALL BE EQUIPPED WITH 2 SETS OF UNIVERSAL MOUNTING RAILS WITH EIA STANDARD HOLE PATTERN FOR MOUNTING UP TO FOUR (4) 19" RACK MOUNT DEVICES. CABINET SHALL PROVIDE HINGED MOUNTING FOR 19" PATCH PANEL TO ALLOW FRONT ACCESS TERMINATION. UNIT SHALL PROVIDE GROUND STUDS FOR PROPER GROUNDING OF DOOR AND BASE, AND SHALL BE CAPABLE OF RECEIVING AN OPTIONAL FAN FOR EXTRA HEAT DISSIPATION.
3. CABINET SHALL CONTAIN A MULTIMEDIA OUTLET BOX WITH SC–SC FIBER CONNECTOR ADAPTER PLATE.
4. CONTRACTOR SHALL TERMINATE FIBER WITH SC STYLE CONNECTORS.
5. CABINET SHALL BE MOUNTED TO WALL WITH FOUR (4) 1/4" BOLTS INTO WALL ANCHORS. USE TOGGLE BOLTS FOR HOLLOW WALL PARTITIONS AND LEAD ANCHORS FOR SOLID MASONRY WALLS. BOLTS SHALL PASS THROUGH THE CABINET AND INTO THE WALL ANCHOR.
6. CONTRACTOR TO SUPPLY CAT5e CABLE FROM REBOX TO DEVICES IN RACEWAY OR BOX. CABLE SHALL BE ROUTED TO CABINET AS FOLLOWS:
7. NEW CONSTRUCTION – (REBOX MUST BE FED WITH A MINIMUM OF ONE (2) – 2" DIAMETER CONDUIT. ROUGHED IN WALL TO A DOUBLE GANG OUTLET BOX) CABINET SHALL HAVE A GROMETED 4"x4" OPENING IN BACK AND BE MOUNTED DIRECTLY OVER THE OUTLET BOX IN SUCH A MANNER TO ALLOW FOR THE INSTALLATION OF THE STATION COPPER CABLES. THE FIBER CABLE MUST HAVE ONE (1) 1" DIAMETER CONDUIT FOR THE MULTIMEDIA OUTLET BOX.

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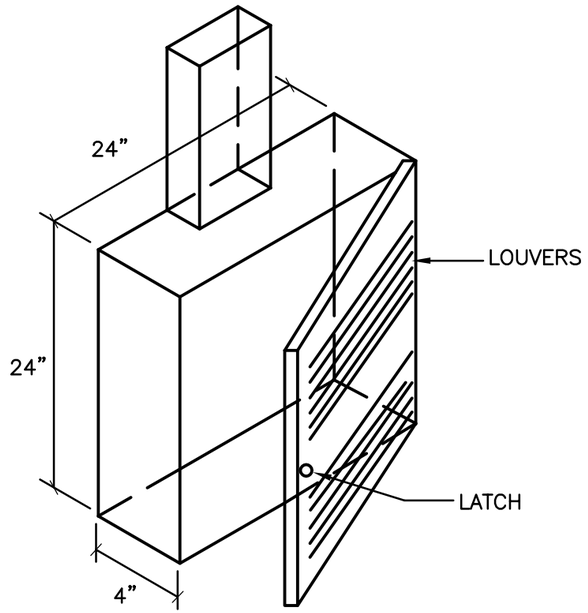
E2.06

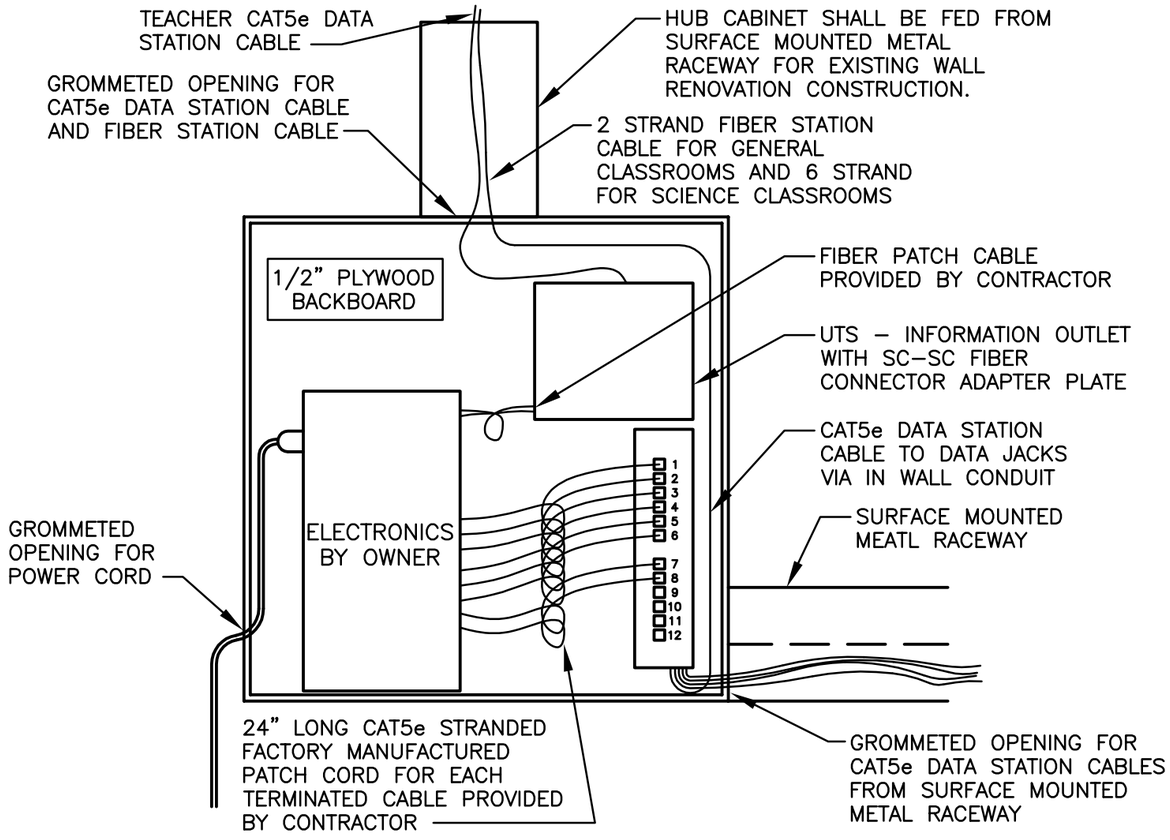
REBOX DETAIL

SCALE: NONE




NOTES: (HUB CABINET SURFACE MOUNTED)

1. CABINET SHALL BE CONSTRUCTED FROM 16 GAUGE COLD ROLLED STEEL. HINGES SHALL BE FORMED STEEL TYPE OR EQUIVALENT AND SWING FROM SIDE. FRONT PANEL SHALL HAVE LOUVERS TO AID IN THE DISSIPATION OF HEAT. UNIT SHALL HAVE THUMB LATCH LOCKING DEVICE. UNIT SHALL HAVE A POLYESTER POWDER ENAMEL OR EQUIVALENT TYPE FINISH. MOUNT CABINET WITH LOUVERS HORIZONTAL.
2. CABINET SHALL BE MOUNTED TO WALL WITH FOUR (4) 1/4" BOLTS INTO WALL ANCHORS. USE TOGGLE BOLTS FOR HOLLOW WALL PARTITIONS AND LEAD ANCHORS FOR SOLID MASONRY WALLS. BOLTS SHALL PASS THROUGH THE 1/2" PLYWOOD CABINET BACKBOARD, THE CABINET AND INTO THE WALL ANCHOR.
3. CABINET SHALL HAVE 1/2" PLYWOOD BACKBOARD TO MOUNT EQUIPMENT. CABINET SHALL HAVE SEALED RUBBER CABLE ENTRY GROMMETS WHERE REQUIRED. OWNER TO SUPPLY AND INSTALL ELECTRONICS ONLY.
4. CABINET SHALL CONTAIN A UTS INFORMATION OUTLET WITH SC–SC FIBER CONNECTOR ADAPTER PLATE.
5. CONTRACTOR SHALL TERMINATE FIBER WITH PRE–POLISHED, CRIMP–ON, SC STYLE CONNECTORS.
6. CABINET SHALL HAVE A 12 PORT VERTICAL CAT5e PATCH PANEL.
7. CONTRACTOR SHALL PROVIDE CAT5e 24" LONG STRANDED FACTORY MANUFACTURED PATCH CORDS ONE PER CABLE TERMINATED.
8. CONTRACTOR TO SUPPLY CAT5e CABLE FROM HUB CABINET TO ALL NEW OUTLETS.
9. HUB CABINET SHALL BE FED FROM SURFACE MOUNTED METAL RACEWAY FOR EXISTING WALL RENOVATION CONSTRUCTION.




NOTES:

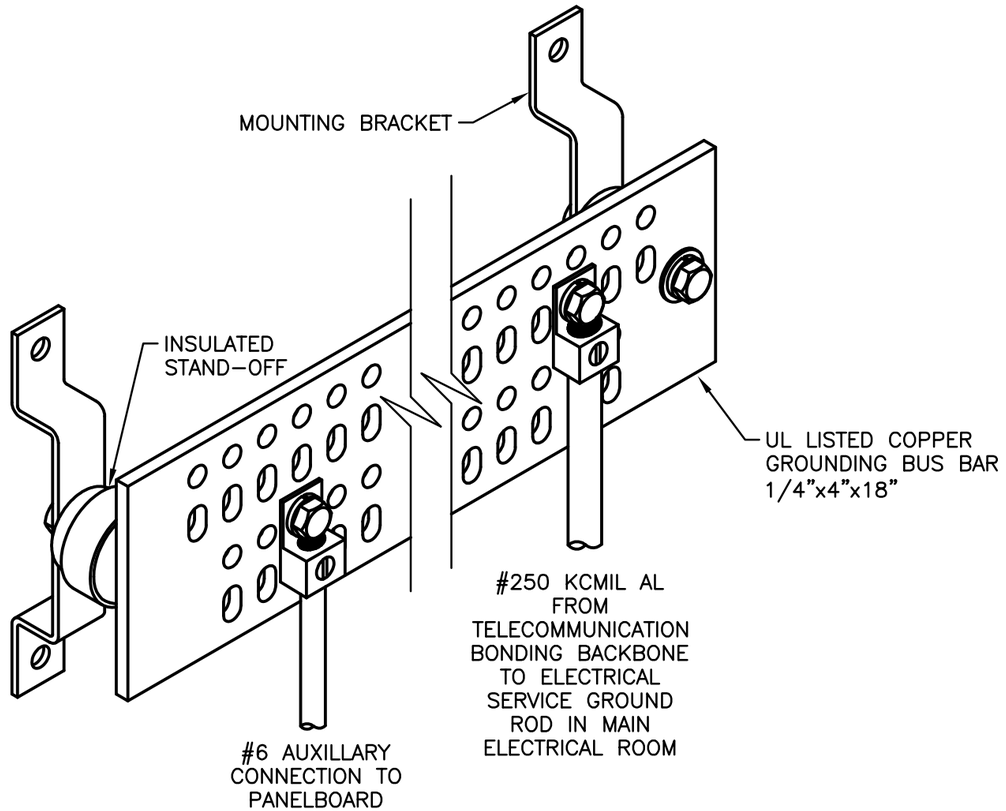
1. CABINET SHALL HAVE 1/2" PLYWOOD BACKBOARD TO MOUNT EQUIPMENT.
2. CABINET SHALL CONTAIN A UTS INFORMATION OUTLET WITH SC–SC FIBER CONNECTOR ADAPTER PLATE.
3. CONTRACTOR SHALL TERMINATE FIBER WITH PRE–POLISHED, CRIMP–PM, SC STYLE CONNECTORS.
4. CABINET SHALL HAVE A 12 PORT VERTICAL CAT5e PATCH PANEL AND A VERTICAL PATCH CORD MANAGER.
5. CONTRACTOR SHALL PROVIDE CAT5e 24" LONG STRANDED FACTORY MANUFACTURED PATCH CORDS FOR EACH TERMINATED CABLE.
6. CONTRACTOR TO SUPPLY CAT5e CABLE FROM HUB CABINET TO ALL NEW DEVICES.
7. NEW WALL – HOLLOW WALL: CABINET SHALL HAVE A SINGLE OPENING TO ACCOMODATE THE COPPER AND FIBER CONDUITS MOUNTED DIRECTLY IN THE WALL AS STATED IN ATTACHMENT 16740–2B.

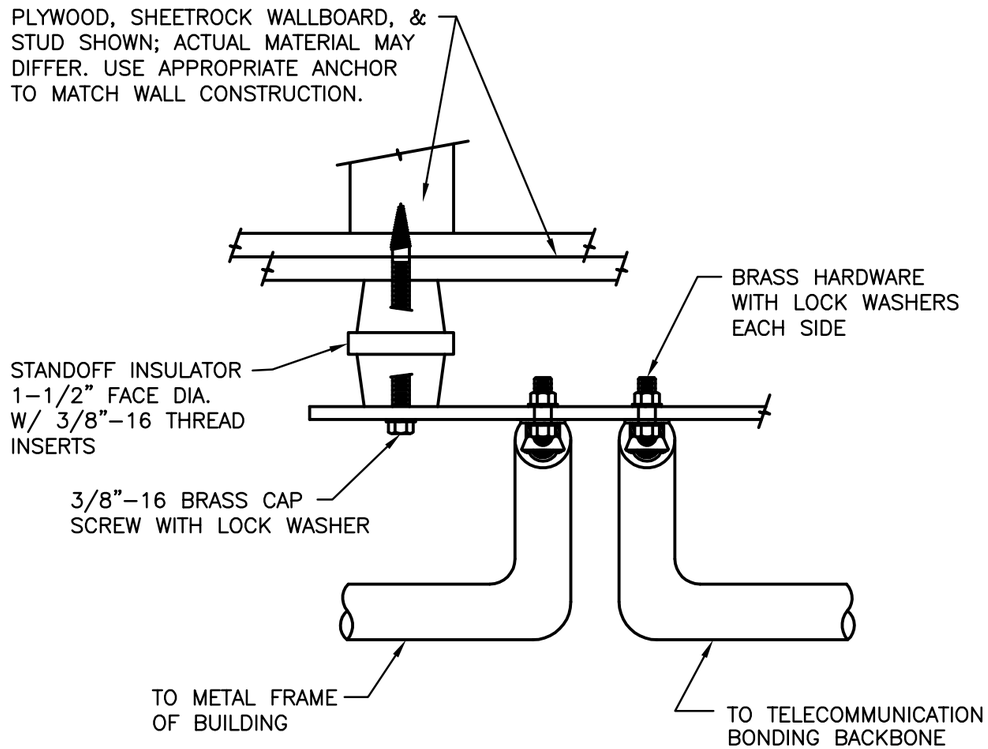
E2.07

# SWITCH ENCLOSURE DETAIL

SCALE: NONE

WAKE COUNTY PUBLIC SCHOOL SYSTEM
1429 Rock Quarry Road, Suite 116
Raleigh, NC 27610
(919) 588-3608




E2.08

TELECOMMUNICATIONS GROUNDING BUSSBAR DETAIL

SCALE: NONE

WAKE COUNTY PUBLIC SCHOOL SYSTEM
1429 Rock Quarry Road, Suite 116
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