DESIGNER’S NOTES FOR DETAILS AND SCHEDULES

1. REFER TO DESIGNER’S NOTES ON THE DETAILS. REMOVE DESIGNER’S NOTES PRIOR TO ISSUING.

2. GROUP COMMON DETAILS, SUCH AS PIPING, AS MUCH AS POSSIBLE.

3. MANUAL AIR VENTS ARE REQUIRED ON CHILLED AND HEATING HOT WATER SYSTEMS AND AT LOCAL HIGH POINTS. LOCAL HIGH POINT IS A SECTION OF PIPE AT A HIGHER ELEVATION THAN THE SECTION OF PIPE IMMEDIATELY DOWNSTREAM AND IMMEDIATELY UPSTREAM.

4. FOR EQUIPMENT SCHEDULES:
   A. PROVIDE SCHEDULES FOR EXISTING FANS OR OTHER EQUIPMENT THAT MUST BE MODIFIED OR REBALANCED. SHOW EXISTING AND FUTURE CAPACITIES AND MOTOR SIZES.
   B. DO NOT USE DITTO MARKS FOR REPETITIVE ENTRIES.
   C. USE IN SCHEDULES WHERE THE COLUMN HEADING IS NOT APPLICABLE TO INDICATE THAT THE LACK OF AN ENTRY WAS NOT AN OMISSION.
   D. GROUP SCHEDULES AS MUCH AS POSSIBLE. SEE HVAC DESIGN MANUAL FOR SEQUENCE OF SCHEDULES.

5. ALL DUCTWORK, WITHOUT EXCEPTION, AND ALL PIPING 150mm [6"] AND LARGER SHALL BE SHOWN IN DOUBLE LINE.

ABBREVIATION AND SYMBOL NOTES

1. THE COMPOSITE LIST OF ABBREVIATIONS IS COORDINATED WITH THE UNITED STATES NATIONAL CAD STANDARD VERSION 4.0, LEGACY VA LIST OF ABBREVIATIONS, AND ASHRAE. THIS LIST SHALL BE USED FOR ALL VA PROJECTS AND EDITED, AS REQUIRED, TO BE PROJECT SPECIFIC. THE DESIGNER MAY SELECT AND USE ADDITIONAL ABBREVIATIONS, IF REQUIRED, FROM ANY KNOWN SOURCES.

2. THE LIST OF SYMBOLS IS MOSTLY BASED ON THE VA MASTER LIST OF STANDARD SYMBOLS AND HAS BEEN UPDATED IN CONSULTATION WITH OTHER SOURCES, SUCH AS, NATIONAL CAD STANDARD VERSION 4, AND ISA (THE INSTRUMENTATION, SYSTEMS, AND AUTOMATION SOCIETY). THIS LIST SHALL BE USED FOR ALL VA PROJECTS AND EDITED, AS REQUIRED, TO BE PROJECT SPECIFIC. THE DESIGNER CAN SELECT AND USE ADDITIONAL SYMBOLS, IF REQUIRED, FROM ANY KNOWN SOURCE.
GENERAL NOTES

1. ALL PIPING AND DUCTS IN FINISHED ROOMS OR SPACES SHALL BE CONCEALED IN A FURRED CHASE OR ABOVE HARD SUSPENDED CEILING, OR ACOUSTICAL CEILING.

2. THE FIRST FIGURE OF DUCT SIZE INDICATES DIMENSION OF FACE SHOWN OR INDICATED. DUCT SIZES ARE NET INSIDE DIMENSIONS.

3. ACCESS PANELS IN HARD SUSPENDED CEILINGS ARE REQUIRED FOR ALL VALVES, TRAPS, DAMPERS, CLEANOUTS, CONTROLS, ETC. ACCESS PANELS SHALL BE FURNISHED AND INSTALLED UNDER THE ARCHITECTURAL SPECIFICATIONS. COORDINATE LOCATION WITH MECHANICAL INSTALLATION AND DEMONSTRATE ACCESS TO EQUIPMENT SERVED.

4. TOTAL STATIC PRESSURE NOTED IN THE SCHEDULES INCLUDES DUCT SYSTEM, TERMINAL UNITS, FILTERS, COILS, ETC. LOSS FOR FILTERS SHALL BE FOR FILTERS AT 50% LOADING.

5. FOR TYPICAL STEAM AND WATER PIPING CONNECTIONS TO EQUIPMENT, SEE STANDARD EQUIPMENT DETAILS.

6. DIFFUSER, REGISTER AND GRILLE SIZES SHOWN ON FLOOR PLANS ARE NECK SIZES.

7. WATER PIPE CONNECTIONS TO AIR HEATING AND COOLING COILS SHALL BE MADE TO PROVIDE COUNTER FLOW BETWEEN WATER AND AIR.

8. WALL TYPE EXHAUST REGISTERS NOTED AS "BR" ON DRAWINGS ARE TO BE INSTALLED WITH BOTTOM ELEVATION OF REGISTER AT 175mm [7"] ABOVE FINISHED FLOOR.

9. REFER TO ARCHITECTURAL REFLECTED CEILING PLANS FOR EXACT LOCATIONS OF CEILING DIFFUSERS, REGISTERS, AND GRILLES.

10. STEAM HEADER SET PRESSURE: ___ kPa [PSIG] NORMAL ___ kPa [PSIG] LOW DEMAND PERIODS

11. ALTITUDE—BOILER ROOM FLOOR: ___ M [FT.] ABOVE SEA LEVEL

12. SEISMIC PROVISIONS // REQUIRED — SEE SPECS // NOT REQUIRED //
    ALL PRESSURES LISTED ARE GAGE PRESSURE UNLESS OTHERWISE NOTED
ABBREVIATIONS

A/E  ARCHITECT / ENGINEER
AAH  AIR TO AIR HEAT EXCHANGER
AAV  AUTOMATIC AIR VENT
AB   AIR BLENDER
AC  AIR COOLED CONDENSER
ACCH AIR COOLED CHILLER
ACC  AIR COOLED CONDENSING UNIT
ACD  AUTOMATIC CONTROL DAMPER, TO MODULATING
ACD–TP AUTOMATIC CONTROL DAMPER, TWO POSITION
ACU  AIR CONDITIONING UNIT
AD   ACCESS DOOR
AF   AFTER FILTER
AFCV AIR FLOW CONTROL VALVE
AFF  ABOVE FINISHED FLOOR
AFMS AIR FLOW MEASURING STATION
AFW  AIR FOIL WHEEL (FAN)
AHU AIR–HANDLING UNIT
AMP  AMPERE
AP   ACCESS PANEL
APD  AIR PRESSURE DROP
AOST  AQUASTAT
ARI  AIR CONDITIONING AND REFRIGERATION INSTITUTE
AS  AIR SEPARATOR
ASHRAE AMERICAN SOCIETY OF HEATING REFRIGERATION AIR CONDITIONING ENGINEERS
ASME AMERICAN SOCIETY OF MECHANICAL ENGINEERS
AW  AIR WASHER
AX  AXIAL FLOW

B  BOILER
BD  BUTTERFLY DAMPER
BDD  BACKDRAFT DAMPER
BOR  BASE BOARD RADIATOR
BFP  BACKFLOW PREVENTER
BFT  BOILER PLANT FIRE TUBE
BG  BOTTOM GRILLE
BHP  BRAKE HORSEPOWER
BHW  HOT WATER HEATING BOILER
BHX  BOILER BLOWDOWN HEAT EXCHANGER
BIW  BACKWARD INCLINED WHEEL (FAN)
BMT  BONE MARROW TRANSPLANT
BR  BOTTOM REGISTER
BSC  BIOLOGICAL SAFETY CABINETS
BT  BLOWOFF TANK
BTC  BLOWOFF TANK CONTROL VALVE
BTU  BRITISH THERMAL UNIT
BTUH  BRITISH THERMAL UNIT PER HOUR
BWT  BOILER PLANT WATER TUBE

C  CENTIGRADE (CELSIUS)
CAV  CONSTANT AIR VOLUME
CC  COOLING COIL
CCD  COOLING COIL CONDENSATE DRAIN
CD  CEILING DIFFUSER
CD–1  CONSTRUCTION DOCUMENTS (SUBMISSION 1)
CD–2  CONSTRUCTION DOCUMENTS (SUBMISSION 2)
CENT  CENTRIFUGAL
CFH  CUBIC FEET PER HOUR
CFM  CUBIC FEET PER MINUTE
CFT  CUBIC FEET
CFP  CHEMICAL FEED PUMP
CG  CEILING GRILLE
CH  CHILLER
CHP  CHILLED WATER PUMP
CHW  CHILLER WATER
CHR  CHILLED WATER RETURN
CHS  CHILLED WATER SUPPLY
CI  CAST IRON
CM  CARBON MONOXIDE
CM  CUBIC METER
CM/S  CUBIC METER PER SECOND
CO  CLEAN OUT
CO2  CARBON DIOXIDE
COMP  COMPRESSOR UNIT
COP  COEFFICIENT OF PERFORMANCE
CP  CONDENSATE PUMP
CR  CEILING REGISTER
CS  CONDENSATE STORAGE TANK
CSG  CLEAN STEAM GENERATOR
CT  COOLING TOWER
CU  CONDENSING UNIT
CUH  CABINET UNIT HEATER
CV  CONSTANT VOLUME
CW  COLD WATER (POTABLE)
CWCC  CHILLED WATER COOLING COIL
CWP  CONDENSER WATER PUMP
CWR  CONDENSER WATER RETURN (TO COOLING TOWER)
CWS  CONDENSER WATER SUPPLY (FROM COOLING TOWER)

D  DAMPER – AUTOMATIC
Db  DRY–BULB TEMPERATURE
DB  DECIBELS
DCW  DOMESTIC COLD WATER
DD–1  DESIGN DEVELOPMENT (SUBMISSION 1)
DD–2  DESIGN DEVELOPMENT (SUBMISSION 2)
DCC  DIRECT DIGITAL CONTROLS
DEG  DEGREE
DF  DIFFUSER
DHW  DOMESTIC HOT WATER
DHWR  DOMESTIC HOT WATER RETURN
DIA  DIAMETER
DIW  DEIONIZED WATER
DP  DEW POINT TEMPERATURE
DP  DIFFUSER PLATE
DPA  DIFFERENTIAL PRESSURE ASSEMBLY
DPS  DIFFERENTIAL PRESSURE SENSOR
DX  DIRECT EXPANSION
DXC  DIRECT EXPANSION COOLING COIL
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<thead>
<tr>
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<td>Exhaust Air</td>
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<tr>
<td>EAT</td>
<td>Entering Air Temperature</td>
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<tr>
<td>EC</td>
<td>Evaporative Cooler</td>
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<tr>
<td>ECC</td>
<td>Engineering Control Center</td>
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<tr>
<td>ECU</td>
<td>Evaporative Condenser Unit</td>
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<tr>
<td>EDH</td>
<td>Electric Duct Heater</td>
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<tr>
<td>EER</td>
<td>Energy Efficiency Ratio</td>
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<td>EF</td>
<td>Exhaust Fan</td>
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<td>EG</td>
<td>Exhaust Grille</td>
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<td>EGS</td>
<td>Emergency Gas Shutoff</td>
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<tr>
<td>EGT</td>
<td>Entering Glycol Temperature</td>
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<tr>
<td>EH</td>
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<tr>
<td>EJ</td>
<td>Expansion Joint</td>
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<tr>
<td>EMD</td>
<td>End of Main Drip (Steam)</td>
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<tr>
<td>ENT</td>
<td>Entering</td>
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<td>Electric Reheat Coil</td>
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<tr>
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<td>F&amp;T</td>
<td>Float and Thermostatic</td>
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<td>Combination Fire Smoke Damper</td>
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<td>FC</td>
<td>Flexible Connection</td>
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<td>Fan Coil Unit (4 Pipe)</td>
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<tr>
<td>FCUC</td>
<td>Fan Coil Unit Cooling Only</td>
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<tr>
<td>FCUH</td>
<td>Fan Coil Unit Heating Only</td>
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<td>FCW</td>
<td>Forward Curved Wheel (Fan)</td>
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<td>FD</td>
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<td>Flue Gas/Feedwater Heat Exchanger</td>
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<tr>
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<tr>
<td>FPM</td>
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<td>FR</td>
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<td>Flow Switch</td>
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<td>FreezeStat</td>
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<td>FT-LB</td>
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<td>FTR</td>
<td>Fin Tube Radiation</td>
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<tr>
<td>FV</td>
<td>Face Velocity</td>
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<td>GPM</td>
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<td>Humidifier</td>
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<td>Hose Bibb</td>
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<td>HC</td>
<td>Heating Coil</td>
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<td>HD</td>
<td>Hood</td>
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<tr>
<td>HOA</td>
<td>Hand/Off/Automatic</td>
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<tr>
<td>HP</td>
<td>Heat Pump</td>
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<tr>
<td>HP</td>
<td>Horsepower</td>
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<tr>
<td>HPDT</td>
<td>High Pressure Drip Trap</td>
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<tr>
<td>HPR</td>
<td>High Pressure Return (Steam Condensate)</td>
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<td>HPS</td>
<td>High Pressure Supply (Steam)</td>
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<tr>
<td>HRC</td>
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<td>Heat Recovery Device</td>
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<td>HVD</td>
<td>Hoistway Vent Damper</td>
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<td>Hertz</td>
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<td>Abbreviation</td>
<td>Description</td>
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<tr>
<td>I/O</td>
<td>Input/Output</td>
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<td>IAQ</td>
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<td>ICF</td>
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<td>IPLV</td>
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<tr>
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<td>M</td>
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<td>Meters Per Second (or Meters/Second)</td>
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<td>MCA</td>
<td>Minimum Branch Circuit Ampacity</td>
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<td>Millimeter</td>
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<tr>
<td>MOV</td>
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<td>MPR</td>
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<td>MRI</td>
<td>Magnetic Resonance Imaging</td>
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<td>MTD</td>
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<td>MVD</td>
<td>Manual Volume Damper</td>
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<td>MZ</td>
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<tr>
<td>NC</td>
<td>Noise Criteria</td>
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<td>NC-NC</td>
<td>Normally Closed</td>
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<td>NG</td>
<td>Natural Gas</td>
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<td>Newton Meter</td>
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<td>Non-Standard Part Load Value</td>
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<td>Net Positive Suction Head</td>
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<td>OR</td>
<td>Operating Room</td>
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<td>Abbreviation</td>
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<tr>
<td>PCF</td>
<td>POUNDS PER CUBIC FOOT (FEET)</td>
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<td>PD</td>
<td>PRESSURE DROP</td>
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<td>PROPELLER (TYPE) EXHAUST FAN</td>
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<td>PRE-FILTER</td>
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<td>PG</td>
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<td>PGW</td>
<td>PROPYLENE GLYCOL–WATER (SOLUTION)</td>
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<td>PPM</td>
<td>PARTS PER MILLION</td>
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<td>PRESSURE REGULATING (VALVE) STATION</td>
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<td>PRV</td>
<td>PRESSURE REGULATING VALVE</td>
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<td>PSI</td>
<td>POUNDS PER SQUARE INCH</td>
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<td>PSIA</td>
<td>POUNDS PER SQUARE INCH – ABSOLUTE</td>
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<td>POUNDS PER SQUARE INCH – GAGE</td>
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<td>PTAC</td>
<td>PACKAGED TERMINAL AIR CONDITIONER</td>
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<tr>
<td>R/E</td>
<td>RETURN OR EXHAUST</td>
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<tr>
<td>RA</td>
<td>RETURN AIR</td>
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<td>RETURN AIR DAMPER</td>
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<td>ROTARY AIR HEAT EXCHANGER</td>
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<tr>
<td>RF</td>
<td>RETURN FAN</td>
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<tr>
<td>RG</td>
<td>RETURN GRILLE</td>
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<tr>
<td>RH</td>
<td>RELATIVE HUMIDITY</td>
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<tr>
<td>RHC</td>
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<td>RHG</td>
<td>REFRIGERANT HOT GAS</td>
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<td>ROM</td>
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<td>SCHEMATIC DESIGN (SUBMISSION1)</td>
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<td>SUPPLY FAN</td>
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<td>SHC</td>
<td>STEAM HEATING COIL</td>
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<td>SPD</td>
<td>SUPPLY PROCESS AND DISTRIBUTION</td>
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<td>STEAM PRESSURE REDUCING VALVE</td>
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<td>THRU-WALL UNIT</td>
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<tr>
<td>Abbreviation</td>
<td>Description</td>
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<tr>
<td>UC</td>
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<td>UNIT HEATER</td>
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<td>VALVE</td>
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<td>VAF</td>
<td>VANE—AXIAL FAN</td>
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<td>VAV</td>
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<tr>
<td>VD</td>
<td>VOLUME DAMPER (MANUAL OPPOSED BLADE)</td>
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<td>VFD</td>
<td>VARIABLE FREQUENCY DRIVE</td>
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<td>VETERANS HEALTH ADMINISTRATION</td>
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<td>VIBRATION ISOLATOR</td>
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<td>VACUUM PUMP</td>
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<td>VPS</td>
<td>VARIABLE PRIMARY SYSTEM</td>
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<td>VR</td>
<td>VACUUM (STEAM CONDENSATE) RETURN</td>
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<td>VUH</td>
<td>VERTICAL UNIT HEATER</td>
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<td>WASTE ANESTHESIA GAS</td>
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<td>WET—BULB (TEMPERATURE)</td>
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<td>WATER COOLED</td>
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<td>WATER FLOW MEASURING DEVICE</td>
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<td>WATER GAGE</td>
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<td>WATER SIDE PRESSURE DROP</td>
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<td>YR</td>
<td>YEAR</td>
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DRAWING SYMBOLS

2
H4

DETAIL NUMBER
DRAWING NUMBER WHERE DRAWN

A
H7

SECTION LETTER
DRAWING NUMBER WHERE SHOWN

BUILDING NO. WHERE EQUIPMENT IS LOCATED.
EQUIPMENT ABBREVIATION (SUPPLY FAN)
SUPPLY FAN NO. 3 IN BUILDING NO. 26
TYPICAL UNIT NO.

BUILDING NO. WHERE EQUIPMENT IS LOCATED
ITEM (TERMINAL UNIT SHOWN)
ITEM NUMBER (TERMINAL UNIT NO. 1)
SERVED BY AIR HANDLER UNIT NO. 1
DUCTWORK SYMBOLS

- **UP** | **DN** - Supply Duct (Up & Down)
- **UP** | **DN** - Exhaust Duct (Up & Down)
- **UP** | **DN** - Return Duct (Up & Down)

- Round and Square 4-Way Ceiling Diffusers
- Square 3-Way Ceiling Diffusers
- Square 2-Way Ceiling Diffusers
- Square 1-Way Ceiling Diffusers
- Linear Slot Diffuser

- Supply Top Register or Grille (Wall Type)
- Exhaust or Return Ceiling Register or Grille
- Exhaust or Return Bottom Register or Grille (Wall Type)
- Exhaust or Return Register or Top Grille (Wall Type)

- Vaned Elbow & Air Split Type Duct Take-Off
- Connect New Duct to Existing Duct

- Inclined Rise, in Direction of Air Flow
- Inclined Drop, in Direction of Air Flow

- Limit of Demolition

**Department of Veterans Affairs**

**Detail Title / Ductwork Symbols**

**Scale:** None

**Date Issued:** December 2008

**Cad Detail No.:** SD230511-09.DWG
DUCTWORK SYMBOLS

FLEXIBLE CONNECTION, EQUIPMENT, VIBRATION, OR SEISMIC

VANED ELBOW (PROVIDE ALL SQUARE OR RECTANGULAR ELBOWS WITH VANES EVEN IF SYMBOL IS MISSING)

VANED ELBOW (SHORT RADIUS)

STANDARD RADIUS ELBOW (LONG RADIUS)

NEW DUCT (INSIDE DIMENSIONS: WIDTH x DEPTH)

EXISTING DUCT TO REMAIN

EXISTING DUCT TO BE REMOVED

LOUVER (LOUVER SPECIFIED IN ARCHITECTURAL SECTION.)

FLEXIBLE DUCTWORK (INSULATED)

DUCT WITH SOUND LINING

MANUAL VOLUME DAMPER

FIRE DAMPER

BACK DRAFT DAMPER
DUCTWORK SYMBOLS

///FIRE///SMOKE/// DAMPER
(VA DOES NOT ALLOW COMBINATION FIRE/SMOKE DAMPERS.)

POINT OF CHANGE IN DUCT CONSTRUCTION BY STATIC PRESSURE CLASS. THE NUMBER ASSIGN STATIC PRESSURE CLASS (IN. OF WATER) WHICH WILL ACCOMMODATE MAXIMUM OPERATING PRESSURE IN THE DUCT SUBSECTION. THE SYMBOL CONTINUES THE ASSIGNMENT UNTIL THE DUCT TERMINATES OR ANOTHER SYMBOL APPEARS. A "N" SUPERSCRIPT INDICATES NEGATIVE PRESSURE.

AUTOMATIC CONTROL DAMPER MODULATING

AUTOMATIC CONTROL DAMPER TWO POSITION

STAINLESS STEEL DUCT

MANUAL SPLITTER DAMPER

STANDARD BRANCH SUPPLY OR RETURN, NO SPLITTER (45° TAP)

DUCT MOUNTED COIL (HOT WATER OR STEAM COIL)

DUCT MOUNTED COIL (ELECTRIC)
TERMINAL UNIT SYMBOLS

- CONVECTOR OR RADIATOR (RECESSED)
- CONVECTOR OR RADIATOR (WALL HUNG)
- FLOOR MOUNTED VERTICAL RECESSED FAN COIL UNIT. LETTER INDICATES UNIT SIZE.
- FLOOR MOUNTED VERTICAL CABINET FAN COIL UNIT. LETTER INDICATES UNIT SIZE.
- THRU WALL AIR CONDITIONING UNIT. LETTER INDICATES UNIT SIZE.
- WINDOW TYPE AIR CONDITIONING UNIT. LETTER INDICATES UNIT SIZE.
- FLOOR MOUNTED HEAT PUMP. LETTER INDICATES UNIT SIZE.
- AIR CURTAIN
- UNIT HEATER (HORIZONTAL)
- UNIT HEATER (VERTICAL)
- 2’x2’ RADIANT CEILING PANEL
- 2’x4’ RADIANT CEILING PANEL
AIR TERMINAL SYMBOLS

TERMINAL UNIT WITH REHEAT COIL

DOUBLE DUCT MIXING BOX.

FAN POWERED VARIABLE VOLUME TERMINAL UNIT WITH HEATING COIL.
PIPING SYMBOLS

--- S-60 ---
HIGH PRESSURE STEAM (60 PSIG AND ABOVE)

--- CR-60 ---
HIGH PRESSURE STEAM CONDENSATE RETURN

--- S-30 ---
MEDIUM PRESSURE STEAM (16 PSIG THRU 59 PSIG)

--- CR-30 ---
MEDIUM PRESSURE STEAM CONDENSATE RETURN

--- S-15 ---
LOW PRESSURE STEAM (15 PSIG AND BELOW)

--- CR-15 ---
LOW PRESSURE STEAM CONDENSATE RETURN

--- PC ---
CONDENSATE PUMP DISCHARGE

--- HWS ---
HOT WATER HEATING SUPPLY

--- HWR ---
HOT WATER HEATING RETURN

--- GHS ---
GLYCOL–WATER HEATING SUPPLY

--- GHR ---
GLYCOL–WATER HEATING RETURN

--- SWS ---
SOLAR WATER SUPPLY

--- SWR ---
SOLAR WATER RETURN

--- RL ---
REFRIGERANT LIQUID

--- RS ---
REFRIGERANT SUCTION

--- RHG ---
REFRIGERANT HOT GAS

--- CWS ---
CONDENSER WATER SUPPLY (FROM TOWER)

--- CWR ---
CONDENSER WATER RETURN (TO TOWER)

--- CHS ---
CHILLED WATER SUPPLY

--- CHR ---
CHILLED WATER RETURN

--- GCS ---
CHILLED GLYCOL–WATER SUPPLY

--- GCR ---
CHILLED GLYCOL–WATER RETURN

--- MW ---
MAKE–UP WATER

--- D ---
DRAIN LINE

--- V ---
VENT LINE

--- GRS ---
GLYCOL–WATER RUN AROUND SUPPLY

--- GRR ---
GLYCOL–WATER RUN AROUND RETURN

--- X ---
EXISTING PIPE TO BE REMOVED
<table>
<thead>
<tr>
<th>Symbol</th>
<th>Description</th>
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<tbody>
<tr>
<td>FWPD</td>
<td>FEEDWATER PUMP DISCHARGE</td>
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<tr>
<td>FWPS</td>
<td>FEEDWATER PUMP SUCTION</td>
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<tr>
<td>CTPD</td>
<td>CONDENSATE TRANSFER PUMP DISCHARGE</td>
</tr>
<tr>
<td>CTPS</td>
<td>CONDENSATE TRANSFER PUMP SUCTION</td>
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<tr>
<td>VR</td>
<td>VACUUM CONDENSATE RETURN</td>
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<tr>
<td>TC</td>
<td>TUBE CLEANER WATER SUPPLY</td>
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<tr>
<td>BO</td>
<td>BOILER BLOWOFF</td>
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<tr>
<td>CBD</td>
<td>CONTINUOUS BLOWDOWN</td>
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<td>BWS</td>
<td>BOILER WATER SAMPLE</td>
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<td>FWS</td>
<td>FEEDWATER SAMPLE (FROM DEAERATOR)</td>
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<td>A</td>
<td>COMPRESSED AIR</td>
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<td>G</td>
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<td>NATURAL GAS IGNITER FUEL</td>
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<td>LIQUEFIED PETROLEUM GAS IGNITER FUEL</td>
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<td>CW</td>
<td>COLD WATER (CITY WATER)</td>
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<td>RH</td>
<td>ROLLER-TYPE HANGER</td>
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<td>VARIABLE SPRING-TYPE HANGER (TYPE 51)*</td>
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<tr>
<td>SCH</td>
<td>SPRING CUSHION-TYPE HANGER (TYPE 48 OR 49)*</td>
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<tr>
<td>TH</td>
<td>CLEVIS-TYPE HANGER</td>
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<tr>
<td>TRAPEZE HANGER (PROVIDE U-BOLT PIPE ATTACHMENT TO TRAPEZE EXCEPT WHERE RH ARE INDICATED)</td>
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<tr>
<td>PS</td>
<td>FLOOR-SUPPORTED PIPE STAND</td>
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<tr>
<td>RC</td>
<td>RISER CLAMP (TYPE 42)*</td>
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<tr>
<td>WB</td>
<td>WALL BRACKET (TYPE 31, 32, 33)*</td>
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<tr>
<td>CSH</td>
<td>CONSTANT SUPPORT HANGER (TYPE 54, 55, 56)*</td>
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<tr>
<td>SS</td>
<td>SLIDING SUPPORTS (TYPE 35)*</td>
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</table>

* Type numbers refer to manufacturer’s standardization society standard practice SP-58
GENERAL PIPING SYMBOLS

- DIRECTION OF PIPE PITCH (DOWN)
- DIRECTION OF FLOW
- ANCHOR
- REDUCER OR INCREASE
- ECCENTRIC REDUCER
- TOP CONNECTION, 45° OR 90°
- BOTTOM CONNECTION, 45° OR 90°
- SIDE CONNECTION
- CAPPED OUTLET
- RISE OR DROP IN PIPE
- UNION
- PIPE UP
- PIPE DOWN
- INVERTED BUCKET TRAP SET INCLUDING PIPING ACCESSORIES SEE DETAIL
- FLOAT & THERMOSTATIC TRAP SET INCLUDING PIPING ACCESSORIES SEE DETAIL
- THERMOSTATIC TRAP SET INCLUDING PIPING ACCESSORIES SEE DETAIL
- THERMOMETER
- PRESSURE GAGE
- VENTURI FLOW METER
- REFRIGERANT SIGHT GLASS
- TEST PLUG (PRESSURE/TEMPERATURE)
- AUTOMATIC AIR VENT
- MANUAL AIR VENT
- QUICK-COUPLE HOSE CONNECTOR
VALVE SYMBOLS

- Gate Valve - Threaded/Flanged
- Globe Valve - Threaded/Flanged
- Gate Valve with 3/4" Hose Adapter
- Check Valve
- Wye Strainer (With Ball Valve & Hose Connection)
- Wye Strainer with Valved Drain and Quick-Couple Hose Connector
- Flexible Connection
- Angle Globe Valve
- Butterfly Valve
- Ball Valve
- Modulating Control Valve
- Modulating Control Butterfly Valve
- Two Position Control Valve
- Three-Way Modulating Control Valve
- Three-Way Two Position Control Valve
- Pressure Regulating Valve
- Pressure Safety Valve
- Automatic Balancing Control Valve
- Water Balance Device
- Circuit Setter Valve
- Gate Valve with Globe-Valved Bypass
- Plug Valve
- Control Valve (CV) - Float-Operated
- Pressure Reducing Valve (PRV)
- Water Level Controller
- Flow Meter
CONTROLS SYMBOLS

T  ROOM THERMOSTAT/TRANSMITTER - WALL MOUNT
M  ROOM HUMIDISTAT (MOISTURE)/TRANSMITTER - WALL MOUNT
TT  TEMPERATURE TRANSMITTER
TT~  TEMPERATURE TRANSMITTER, AVERAGING ELEMENT
MT  MOISTURE (HUMIDITY) TRANSMITTER
PT  PRESSURE TRANSMITTER
SPS  STATIC PRESSURE SENSOR
FT  FLOW TRANSMITTER
IT  CURRENT TRANSMITTER
CT  CONDUCTIVITY TRANSMITTER
SD  SMOKE DETECTOR
PDT  PRESSURE DIFFERENTIAL TRANSMITTER
PDS  PRESSURE DIFFERENTIAL SWITCH
HS  HAND SWITCH (HAND-OFF-AUTO SWITCH)
ZC  VALVE OR DAMPER POSITION CONTROLLER
KR  LOCAL RECORDING TIME CLOCK (RUNTIME)
TSL  TEMPERATURE SWITCH, LOW (FREEZESTAT)
TSH  TEMPERATURE SWITCH, HIGH (FREEZESTAT)
LC  LEVEL CONTROLLER
LT  LEVEL TRANSMITTER
**CONTROLS SYMBOLS**

- **PSH**: PRESSURE SWITCH HIGH
- **PSL**: PRESSURE SWITCH LOW
- **EPT**: ELECTRONIC TO PNEUMATIC TRANSDUCER
- **AT CO2**: CARBON DIOXIDE TRANSMITTER
- **AT CO**: CARBON MONOXIDE TRANSMITTER
- **AT OC**: OCCUPANCY SENSOR
- **LTCP**: LOCAL TEMPERATURE CONTROL PANEL
- **HAC**: HVAC CONTROL PANEL
- **VSMC**: VARIABLE SPEED MOTOR CONTROLLER
- **ECC**: INTEGRATE CONTROL POINT ON REMOTE GRAPHICS WORKSTATION AT ENERGY CONTROL CENTER
- **TC**: TEMPERATURE CONTROLLER. SEE SEQUENCE OF OPERATION
- **PC**: PRESSURE CONTROLLER. SEE SEQUENCE OF OPERATION
- **SC**: SPEED CONTROLLER. SEE SEQUENCE OF OPERATION
- **FC**: FLOW CONTROLLER. SEE SEQUENCE OF OPERATION
- **FSH**: FLOW SWITCH HIGH
- **FSL**: FLOW SWITCH LOW
- **KC**: TIME CLOCK CONTROLLING EQUIPMENT ON A SCHEDULE
CONTROLS SYMBOLS

- TEMPERATURE SENSING ELEMENT FOR TRANSMITTING TEMPERATURE TO EMCS
  (PROVIDE 12 INCHES [200mm] MINIMUM LENGTH IN DUCT WHEN SPACE PERMITS.)

- SENSOR WITH AVERAGING ELEMENT TO TRANSMIT TEMPERATURE TO EMCS

- MOTOR STARTER

- ELECTRIC OPERATED CONTROL DAMPER/OR VALVE
HANGER ROD

INSULATION (VAPOR BARRIER TYPE IS REQUIRED FOR LOW TEMPERATURE PIPE)

PROVIDE HIGH COMpressive STRENGTH INSULATION (9 PSF MIN. DENSITY) UNDER INSULATION SHIELD

ADJUSTABLE CURVE HANGER TYPE 1 - SEE SPECIFICATIONS

ADJUSTABLE CURVE HANGER TYPE 43 - SEE SPECIFICATIONS

INSULATION SHIELD AT HANGER

SIDE VIEW TRAPEZEE HANGER FOR UP TO 45KGS (1000 LB) UNIFORM LOAD

15mm [1/2"] O.D. HANGER RODS WITH 900mm [36"] MAX. SPACING ON EACH CHANNEL

13mm [1/2"] 12 GAUGE CHANNEL ON 50x50x6.4mm [2"x2"x1/4"] ANGLE

MAXIMUM PIPE/TUBING SUPPORT SPACING

<table>
<thead>
<tr>
<th>SIZE</th>
<th>25</th>
<th>30</th>
<th>35</th>
<th>40</th>
<th>45</th>
<th>50</th>
<th>55</th>
<th>60</th>
<th>75</th>
<th>100</th>
<th>125</th>
<th>150</th>
<th>200</th>
<th>250</th>
<th>300</th>
<th>400</th>
<th>500</th>
<th>600</th>
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</thead>
<tbody>
<tr>
<td>PIPE</td>
<td>250</td>
<td>250</td>
<td>250</td>
<td>300</td>
<td>350</td>
<td>400</td>
<td>450</td>
<td>500</td>
<td>550</td>
<td>600</td>
<td>750</td>
<td>900</td>
<td>1000</td>
<td>1250</td>
<td>1500</td>
<td>2000</td>
<td>2500</td>
<td>3000</td>
</tr>
<tr>
<td>TUBING</td>
<td>100</td>
<td>110</td>
<td>120</td>
<td>130</td>
<td>140</td>
<td>150</td>
<td>160</td>
<td>170</td>
<td>180</td>
<td>190</td>
<td>200</td>
<td>210</td>
<td>220</td>
<td>230</td>
<td>240</td>
<td>250</td>
<td>260</td>
<td>270</td>
</tr>
</tbody>
</table>

NOTE: FOR TRAPEZEE HANGER TAKE SPACING OF SMALLEST SIZE ON TRAPEZEE

PIPE HANGERS

NTS
DETAIL FOR SUPPORTING PIPE ON ROOF

NOTES:
Provide restraining clamps 2438mm [8'-0"] O.C.
### PIPE ANCHOR SCHEDULE

<table>
<thead>
<tr>
<th>D</th>
<th>P</th>
<th>C</th>
<th>N</th>
<th>S</th>
<th>BOLT PATTERN</th>
</tr>
</thead>
<tbody>
<tr>
<td>mm</td>
<td>in</td>
<td>mm</td>
<td>in</td>
<td>mm</td>
<td>in</td>
</tr>
</tbody>
</table>
| 102 | 4 | 16 | ¾<sup>h</sup> | 19 | ¾ | 102 | 4 | 19 | ¾ | [Diagram]
| 76  | 3 | 13 | ½  | 13 | ½  | 102 | 4 | 16 | ¾ | [Diagram]
| 64  | 2½| 10 | ¾<sup>h</sup> | 10 | ¾<sup>h</sup> | 102 | 4 | 16 | ¾ | [Diagram]
| 51  | 2 | 10 | ¾<sup>h</sup> | 10 | ¾<sup>h</sup> | 102 | 4 | 16 | ¾ | [Diagram]
| 38  | 1½| 10 | ¾<sup>h</sup> | 6  | ¾  | 102 | 4 | 13 | ½" | [Diagram]

---

**Insulate as indicated for all chilled water. Insulate pipe only for steam, condensate & heating water.**

**D = PIPE O.D.**

**8mm [9/32"]**

**D = PIPE O.D.**

**D+84mm**

**D+121mm**

**D+25mm**

**D+[1"]**

**D+38mm**

**D+[1½"]**

**D+95mm**

**D+[3¼"]**

**D+[2½"]**

**NOTE A**

*Where used for copper tube or pipe, braze to fabricated steel anchor*

---

**SMALL PIPE ANCHOR 38–102mm [1½”–4”]**

**NTS**

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**DEPARTMENT OF VETERANS AFFAIRS**

**DETAIL TITLE:** SMALL PIPE ANCHOR 38–104mm [1–1/2”–4”]

**SCALE:** NONE

**DATE ISSUED:** 11/01/2017 **CAD DETAIL NO.:** SD230511–23.DWG
# LARGE PIPE ANCHOR 152-457mm [6” - 18”]

**NOTES:**
A. INSTALL WALL PLATE FIRST THEN WELD ON REMAINING ASSEMBLY. ONE WALL PLATE FOR BOTH CHILLED WATER S.&R. IS OPTIONAL.

**ANCHOR BOLTS**

- **N** = NUMBER
- **S** = SIZE
- DRILL $\phi$ = S + 3.175mm
- DRILL $\phi$ = S + $\frac{3}{8}$”

**PIPE ANCHOR SCHEDULE**

<table>
<thead>
<tr>
<th>D (mm)</th>
<th>L (mm)</th>
<th>P (in)</th>
<th>T (mm)</th>
<th>E (in)</th>
<th>N</th>
<th>S (in)</th>
<th>BOLT PATTERN</th>
</tr>
</thead>
<tbody>
<tr>
<td>152</td>
<td>6</td>
<td>216</td>
<td>8½</td>
<td>19</td>
<td>$\frac{3}{4}$</td>
<td>10</td>
<td>$\frac{3}{8}$</td>
</tr>
<tr>
<td>203</td>
<td>8</td>
<td>254</td>
<td>10</td>
<td>19</td>
<td>$\frac{3}{4}$</td>
<td>13</td>
<td>$\frac{1}{2}$</td>
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<tr>
<td>254</td>
<td>10</td>
<td>305</td>
<td>12</td>
<td>19</td>
<td>$\frac{3}{4}$</td>
<td>13</td>
<td>$\frac{1}{2}$</td>
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<tr>
<td>305</td>
<td>12</td>
<td>356</td>
<td>14</td>
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<td>406</td>
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<tr>
<td>406</td>
<td>16</td>
<td>457</td>
<td>18</td>
<td>19</td>
<td>$\frac{3}{4}$</td>
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<td>$\frac{1}{2}$</td>
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<tr>
<td>457</td>
<td>18</td>
<td>508</td>
<td>20</td>
<td>25</td>
<td>1</td>
<td>$\frac{3}{8}$</td>
<td>13</td>
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</tbody>
</table>

INSULATE AS INDICATED FOR ALL CHILLED WATER.
INSULATE PIPE ONLY FOR STEAM, CONDENSATE & HEATING WATER.
NOTES:
1. PROVIDE ANCHORS ONLY WHERE SHOWN ON DRAWINGS.

2. EXTEND SLEEVE ABOVE FLOOR WHERE SPECIFIED.

DESIGNER’S NOTE:
SHOW REQUIRED ANCHORS ON PLAN, SECTIONS OR DIAGRAMS.

## SUPPORT/ANCHOR FOR PIPE RISERS

- PIPE SLEEVE WHERE SPECIFIED
- RISER CLAMP
- BOLT
- FIRE-STopping MATERIAL
- PIPE
- INSULATION
- BOLT (TYPICAL)
- FLOOR SLAB
- PIPE SLEEVE WHERE SPECIFIED
- RISER CLAMP, BOTTOM CLAMP REQUIRED AT ANCHOR POINTS ONLY.

DETAIL TITLE: SUPPORT/ANCHOR FOR PIPE RISERS

SCALE: NONE

DATE ISSUED: 11/01/2017  CAD DETAIL NO.: SD230511-25.DWG

Department of Veterans Affairs
SUPPORT ANCHOR (CONDENSER WATER OR CHILLED WATER)
NOTES:
1. COORDINATE TRENCH DETAIL WITH ARCHITECTURAL & STRUCTURAL.
2. REFER TO SPECIFICATION, SEALING & CAULKING.

DESIGNER'S NOTE:
COORDINATE TRENCH DETAIL WITH ARCHITECTURAL & STRUCTURAL.
STEAM LINE

Provide two "U" bolts with nut & lock nut on steam line. Spot weld "U" bolt to pipe & bolt to channel.

Size of steam line governs size of channel.

CONDENSATE RETURN LINE

Provide one "U" bolt with nut & lock nut on return line. Spot weld "U" bolt to pipe & bolt to channel.

Channel to be set in side wall of trench.

CONCRETE TRENCH

PLAN VIEW

<table>
<thead>
<tr>
<th>SIZE OF PIPE INCH [mm]</th>
<th>SIZE OF &quot;U&quot; BOLT INCH [mm]</th>
<th>SIZE OF CHANNEL INCH [mm]</th>
</tr>
</thead>
</table>

Schedule for 8 ft. [2.4m] span or less.

ANCHOR INSTALLATION

STEAM/CONDENSATE PIPING IN TRENCH

# NTS

Department of Veterans Affairs

Detail Title: Anchor Installation - Steam/Condensate Piping in Trench

Scale: None

Date Issued: December 2008

CADD Detail No.: SD230511-28.DWG
NOTE:
1. SEISMIC SEPARATION ASSEMBLY DETAIL SHOWN IN NFPA 13 (SPRINKLER PIPING), UTILIZING FLEXIBLE MECHANICAL COUPLINGS, MAY BE USED IN LIEU OF PIPING DETAIL SHOW ABOVE.

SCHEDULE FOR PIPING CROSSING A SEISMIC JOINT

PIPING CROSSING A SEISMIC JOINT DETAIL "A"

DESIGNER'S NOTE:
1. THIS CONFIGURATION SHOWN IN THIS DETAIL IS A SUGGESTED ARRANGEMENT, NOT MANDATED FOR USE IN AS IS CONDITION. THE REGISTERED PROFESSIONAL STRUCTURAL ENGINEER IN CHARGE OF THE PROJECT SHALL PROVIDE SEISMIC CALCULATIONS AND MODIFY THE CONFIGURATION AS NEEDED TO MAKE THE ARRANGEMENT PROJECT-SPECIFIC. THE MECHANICAL DESIGNER SHALL COMPLETE THE BLANK SCHEDULES BY INSERTING THE DISTANCES, TO BE CALCULATED AND FURNISHED BY PROVIDED BY THE REGISTERED PROFESSIONAL STRUCTURAL ENGINEER.
SCHEDULE FOR PIPING CROSSING A SEISMIC JOINT

DETAIL "B"

(PLASTIC PIPE FOR PRESSURIZED SYSTEMS)

SCHEDULE FOR PIPING CROSSING A SEISMIC JOINT

<table>
<thead>
<tr>
<th>LOCATION</th>
<th>PIPE</th>
<th>DETAIL</th>
<th>DIMENSIONS INCHES [mm]</th>
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DESIGNER’S NOTE:
1. THIS CONFIGURATION SHOWN IN THIS DETAIL IS A SUGGESTED ARRANGEMENT, NOT MANDATED FOR USE IN AS IS CONDITION. THE REGISTERED PROFESSIONAL STRUCTURAL ENGINEER IN CHARGE OF THE PROJECT SHALL PROVIDE SEISMIC CALCULATIONS AND MODIFY THE CONFIGURATION AS NEEDED TO MAKE THE ARRANGEMENT PROJECT–SPECIFIC. THE MECHANICAL DESIGNER SHALL COMPLETE THE BLANK SCHEDULES BY INSERTING THE DISTANCES, TO BE CALCULATED AND FURNISHED BY PROVIDED BY THE REGISTERED PROFESSIONAL STRUCTURAL ENGINEER.
PIPING CROSSING A SEISMIC JOINT DETAIL "C"

DESIGNER'S NOTE:
1. THIS CONFIGURATION SHOWN IN THIS DETAIL IS A SUGGESTED ARRANGEMENT, NOT MANDATED FOR USE IN AS IS CONDITION. THE REGISTERED PROFESSIONAL STRUCTURAL ENGINEER IN CHARGE OF THE PROJECT SHALL PROVIDE SEISMIC CALCULATIONS AND MODIFY THE CONFIGURATION AS NEEDED TO MAKE THE ARRANGEMENT PROJECT-SPECIFIC. THE MECHANICAL DESIGNER SHALL COMPLETE THE BLANK SCHEDULES BY INSERTING THE DISTANCES, TO BE CALCULATED AND FURNISHED BY PROVIDED BY THE REGISTERED PROFESSIONAL STRUCTURAL ENGINEER.

Department of Veterans Affairs

SCHEDULE FOR PIPING CROSSING A SEISMIC JOINT

<table>
<thead>
<tr>
<th>LOCATION</th>
<th>PIPE</th>
<th>DETAIL</th>
<th>DIMENSIONS INCHES [mm]</th>
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</table>

SCALE : NONE

DATE ISSUED : DECEMBER 2008 CADD DETAIL NO. : SD230511-31.DWG
DESIGNER’S NOTE:
1. THIS CONFIGURATION SHOWN IN THIS DETAIL IS A SUGGESTED ARRANGEMENT, NOT MANDATED FOR USE IN AS IS CONDITION. THE REGISTERED PROFESSIONAL STRUCTURAL ENGINEER IN CHARGE OF THE PROJECT SHALL PROVIDE SEISMIC CALCULATIONS AND MODIFY THE CONFIGURATION AS NEEDED TO MAKE THE ARRANGEMENT PROJECT-SPECIFIC. THE MECHANICAL DESIGNER SHALL COMPLETE THE BLANK SCHEDULES BY INSERTING THE DISTANCES, TO BE CALCULATED AND FURNISHED BY PROVIDED BY THE REGISTERED PROFESSIONAL STRUCTURAL ENGINEER.

**SCHEDULE FOR PIPING CROSSING A SEISMIC JOINT**

<table>
<thead>
<tr>
<th>LOCATION</th>
<th>PIPE</th>
<th>DETAIL</th>
<th>DIMENSIONS INCHES [mm]</th>
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**PIPING CROSSING A SEISMIC JOINT DETAIL "D"**

NTS

DEPARTMENT OF VETERANS AFFAIRS

DETAIL TITLE / PIPING CROSSING A SEISMIC JOINT DETAIL "D"

SCALE: NONE

DATE ISSUED: DECEMBER 2008  CADD DETAIL NO.: SD230511-32.DWG
DESIGNER’S NOTE:
1. THIS CONFIGURATION SHOWN IN THIS DETAIL IS A SUGGESTED ARRANGEMENT, NOT MANDATED FOR USE IN AS IS CONDITION. THE REGISTERED PROFESSIONAL STRUCTURAL ENGINEER IN CHARGE OF THE PROJECT SHALL PROVIDE SEISMIC CALCULATIONS AND MODIFY THE CONFIGURATION AS NEEDED TO MAKE THE ARRANGEMENT PROJECT-SPECIFIC. THE MECHANICAL DESIGNER SHALL COMPLETE THE BLANK SCHEDULES BY INSERTING THE DISTANCES, TO BE CALCULATED AND FURNISHED BY PROVIDED BY THE REGISTERED PROFESSIONAL STRUCTURAL ENGINEER.
TABLE OF FORCES AND MOMENTS DUE TO THERMAL EXPANSION AND WEIGHT OF STEAM LEAD AND VALVES

<table>
<thead>
<tr>
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TABLE OF FORCES AND MOMENTS DUE TO SEISMIC ACTION OF THE STEAM LEAD AND VALVES

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NOTES:
1. BOILERS SHALL BE DESIGNED TO WITHSTAND THE FORCES AND MOMENTS SHOWN ABOVE.
2. ADD ANY Fy FORCE (500 LB [230 Kg] MINIMUM) AS AN ESTIMATION OF THE WEIGHT EFFECT OF THE STEAM LEAD AND VALVE ON THE BOILER. BOILER AND PIPE HANGER SUPPLIERS SHALL COORDINATE TO DETERMINE THE EXACT Fy FORCE WHICH WILL BE IMPOSED ON THE STEAM NOZZLES.
3. DELETE THE SEISMIC TABLE ON NON-SEISMIC AREAS.

FORCES AND MOMENTS ON BOILER STEAM NOZZLES

NTS
NUMBER OF ISOLATION UNITS AS REQUIRED

TYPE "B"
WELDED STEEL BASE

NUMBER OF ISOLATION UNITS AS REQUIRED

TYPE "1"
CONCRETE INERTIA BASE

VIBRATION ISOLATION BASES

NTS

DETAIL TITLE / VIBRATION ISOLATION BASES

SCALE : NONE

DATE ISSUED : DECEMBER 2008  CADD DETAIL NO. : SD230541-01.DWG
NOTES:
1. ATTACH THRUST RESTRAINTS SYMMETRICALLY ON BOTH SIDES OF THE FAN DISCHARGE.
2. ADJUST RESTRAINT TO ALLOW 1/4” [6 mm] MOVEMENT OF FAN AT START AND STOP.

THRUSTR RESTRAIN FOR FANS

DESIGNER’S NOTE:
ON THE VIBRATION ISOLATION SCHEDULE OR UNDER THE TITLE OF THIS DETAIL DESIGNATE FANS REQUIRING RESTRAINT. THIS IS USUALLY SEPARATELY MOUNTED FAN SECTIONS FOR STATIC PRESSURE OVER 4” [100 mm] AND POSSIBLY FOR AXIAL FLOW FANS FOR STATIC PRESSURE OVER 4” [100 mm].
CONCRETE EQUIPMENT BASES

SECTION A-A (BASE NOT POURED WITH SLAB)

SECTION A-A (BASE POURED WITH FLOOR SLAB)

TYPICAL ANCHOR BOLT NUT & WASHER

EQUIPMENT BASE PLATE

NOTE:
L & W DIMENSIONS SHALL BE 6” [150mm] GREATER THAN THE EQUIPMENT BASE PLATE.

TYPICAL ANCHOR BOLT NUT & WASHER

EQUIPMENT BASE PLATE

PROVIDE #3 BARS 12” [300mm] O.C. EACH WAY IN THE BASE & DOWEL BASE TO FLOOR

CONCRETE EQUIPMENT BASES

DESIGNER’S NOTE:
THIS DETAIL IS PRIMARILY FOR PUMPS WITHOUT ISOLATORS. COORDINATE DETAIL WITH ARCHITECTURAL AND STRUCTURAL.
NOTE:
NOT REQUIRED FOR AIR TERMINAL UNITS.

EQUIPMENT WEIGHT 250 LBS. [114KG] OR LESS

SEISMIC BRACING FOR LIGHT SUSPENDED EQUIPMENT

FLOOR MOUNT EQUIPMENT RESTRAINED BY RESILIENT PADS (TYPE DS)

CROSS BRACING RODS ALL FOUR SIDES

ANCHOR BOLT
NEOPRENE WASHER & SLEEVE
BONDED STEEL PLATE
FLOOR
RESILIENT PAD

EQUIPMENT BASE

HANGER ROD (TYP)
LOCK NUTS (TYP)
CLAMP

SCALE: NONE

DATE ISSUED: DECEMBER 2008
CADD DETAIL NO.: SD230541-04.DWG
STEEL EXPANSION SHIELD FOR EXISTING CONSTRUCTION AND INSERTS FOR NEW CONSTRUCTION. THIS TYPE SHALL BE USED ONLY IN SLABS OR BEAMS OF 4" [100mm] MIN DEPTH.

3/8" [10mm] MIN DIA EXPANSION BOLTS FOR EXISTING CONSTRUCTION AND INSERTS FOR NEW CONSTRUCTION.

3/8" [10mm] MIN DIA INSERTS NEW CONSTRUCTION ONLY.

NUTS & WASHERS

TURNBUCLE

3/8" [10mm] MIN DIA HANGER RODS

FOR PIPES UNDER 2" [50mm] IN SIZE USE
1 1/2"x1 1/2"x1/4" [40x40x6.4mm] ANGLE.
ALL PIPES 2" [50mm] & LARGER USE
3"x3"x1/4" [75x75x6.4mm] ANGLE.

SECURING HANGER RODS IN CONCRETE

NTS
NOTES:

1. INSTALLATION OF SENSORS AND TRANSMITTERS SHALL CONFORM TO RECOMMENDATIONS OF MANUFACTURERS OF TRANSMITTERS.

PRESSURE TRANSMITTER INSTALLATION

NTS
CADD DETAIL NO.: SD230911-02.DWG
DATE ISSUED: DECEMBER 2008
CADD DETAIL NO.: SD230911-02.DWG

WATER METER INSTALLATION

- CW OR SW
- 80 MESH STRAINER
- SUPPORT BRACKET ANCHORED TO WALL OR COLUMN
- 3'-6" [1.1M] FLOOR
- N.C.
- BYPASS
- WATER METER

DETAIL TITLE / WATER METER INSTALLATION

SCALE: NONE
LEGEND

<table>
<thead>
<tr>
<th>ITEM NO.</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>ALARM BELL (WATER LEVEL)</td>
</tr>
<tr>
<td>2.</td>
<td>DRAFT GAUGES</td>
</tr>
<tr>
<td>A.</td>
<td>WINDBOX (0 TO _____mm(____IN) WC) (SEE NOTE 4)</td>
</tr>
<tr>
<td>B.</td>
<td>FURNACE (0 TO _____mm(____IN) WC) (SEE NOTE 4)</td>
</tr>
<tr>
<td>C.</td>
<td>BOILER OUTLET (-____mm(____IN) TO +____mm(____IN) WC) (SEE NOTE 5)</td>
</tr>
<tr>
<td>D.</td>
<td>ECONOMIZER OUTLET (-25mm(-1&quot;) TO +25mm(+1&quot;) WC) (SEE NOTE 5)</td>
</tr>
<tr>
<td>3.</td>
<td>ALARM HORN (FLAME FAILURE, LOW WATER CUTOUT)</td>
</tr>
<tr>
<td>4.</td>
<td>BURNER CONTROL SYSTEM ANNUNCIATOR</td>
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<tr>
<td>5.</td>
<td>ROW OF BURNER CYCLE PILOT-LIGHTS</td>
</tr>
<tr>
<td>6.</td>
<td>ROW OF BURNER CONTROL SWITCHES</td>
</tr>
<tr>
<td>7.</td>
<td>BOILER WATER LEVEL CONTROL STATION</td>
</tr>
<tr>
<td>8.</td>
<td>ECONOMIZER TEMPERATURE INDICATOR</td>
</tr>
<tr>
<td>9.</td>
<td>SELECTOR SWITCH FOR ECONOMIZER TEMPERATURE INDICATOR</td>
</tr>
<tr>
<td>10.</td>
<td>BURNER STOP SWITCH</td>
</tr>
</tbody>
</table>

NOTES:
1. INTERIOR OF PANEL SHALL BE UTILIZED FOR MOUNTING RELAYS, BURNER CONTROL PROGRAMMER, AND OTHER DEVICES.
2. PROVIDE FRONT OR REAR ACCESS DOORS FULL HEIGHT AND WIDTH OF PANEL.
3. PANEL DIMENSIONS APPROX. 1M(3'-0")Wx0.5M(1'-6")Dx2.3M(7'-6")H.
4. WINDBOX AND FURNACE DRAFT GAGE SCALE RANGES RECOMMENDED BY BOILER AND BURNER MANUFACTURER.
5. SCALE RANGE OF BOILER OUTLET DRAFT GAGE MUST BE COORDINATED WITH ECONOMIZER DRAFT LOSS. IF THERE IS NO ECONOMIZER, RANGE SHOULD BE -25mm(-1") TO +25mm(+1") WC.
6. BOILER COMBUSTION CONTROL SUBMASTER, DRAFT CONTROL AND OXYGEN TRIM CONTROL STATIONS MAY BE LOCATED ON THIS PANEL.

BURNER CONTROL PANEL
FOR WATER TUBE BOILERS
1. **BOILER / BOILER PLANT DIGITAL DATA RECORDER**
   - A. STEAM FLOW INDICATE, RECORD, INTEGRATE (0—____ KG/S [LB/HR])
   - B. BOILER OUTLET FUEL GAS TEMPERATURE RECORD (0—500°C [0—1000°F])
   - C. FUEL GAS OXYGEN CONTENT RECORD (0—10% OXYGEN)
   - D. HIGH PRESS STEAM OUT, RECORD, INTEGRATE, (0—____ KG/S [LB/HR])
   - E. MED PRESS STEAM OUT, RECORD, INTEGRATE, (0—____ KG/S [LB/HR])
   - F. LAUNDRY STEAM OUT, RECORD, INTEGRATE, (0—____ KG/S [LB/HR])
   - G. BOILER PLANT STEAM, RECORD, INTEGRATE, (0—____ KG/S [LB/HR])
   - H. STEAM HEADER PRESS, RECORD (0—2000 KPA [0—300 PSI])
   - I. BOILER FEEDWATER TEMP. RECORD (0—150°C [0—300°F])
   - J. OUTSIDE AIR TEMP. RECORD (-50°C [-50°F] TO +50°C [120°F])

2. **BOILER CONTROL STATIONS (MANUAL/AUTOMATIC, DNS)**
   - THESE CONTROL STATIONS MAY BE LOCATED ON THE BURNT CONTROL PANELS INSTEAD OF ON THE INSTRUMENTATION PANEL.
   - A. CONDENSATE CONTROL SUBMASTER
   - B. DRAFT CONTROL (WHEN SPECIFIED)
   - C. OXYGEN TRIM (WHEN SPECIFIED)

3. **MASTER STEAM PRESSURE CONTROLLER**

4. **CLOCK**

5. **ALARM ANNUNCIATOR**
   - A. CONDENSATE STORAGE TANK HIGH LEVEL
   - B. CONDENSATE STORAGE TANK LOW LEVEL
   - C. FEEDWATER HEATER HIGH LEVEL
   - D. FEEDWATER HEATER LOW LEVEL
   - E. HIGH STEAM HEADER PRESS
   - F. EMERGENCY GAS VALVE CLOSED
   - G. HIGH NATURAL GAS HEADER PRESS (SET AT 35 KPA [5 PSI]) ABOVE MAIN REGULATOR SET PRESS
   - H. LP ENTRANCE GAS IN USE-FOR EMERGENCY ONLY (PROVIDE HIGH PRESS SWITCH SET AT 14 KPA [2 PSI])
   - I. LOW EXCESS AIR BOILER NO. (PROVIDE ONE POINT FOR EACH BOILER, SET AT ____ % OXYGEN)

6. **ANNUNCIATOR ACKNOWLEDGE BUTTON**

7. **ANNUNCIATOR TEST BUTTON**

8. **ANNUNCIATOR BELL / HORN**

9. **EMERGENCY GAS SAFETY SHUT OFF VALVE CONTROL**

10. **PRESSURE GAGES**
    - A. STEAM HEADER (0—1500 KPA [0—200 PSI])
    - B. NATURAL GAS HEADER (0—100 KPA [0—15 PSI])
    - C. FUEL OIL HEADER (0—1500 KPA [0—200 PSI])
    - D. BOILER FEEDWATER HEADER (0—2000 KPA [0—300 PSI]) (WHEN HEADER SERVING ALL BOILERS IS PROVIDED)

11. **START-STOP BUTTONS AND PILOT LIGHTS FOR PUMPS**

12. **SMOKE DENSITY MONITOR (WHEN SPECIFIED)**

13. **REMOTE REGISTER FOR GAS METER (WHEN SPECIFIED)**

14. **FEEDWATER DEGASIFIER TANK AND CONDENSATE STORAGE TANK WATER LEVEL CONTROL STATION**

**DESIGNER NOTES:**
1. PANEL APPROX. 3810mm [12’-6"]x610mm [2’-0"]x2438mm [8’-0’] H. SHOW ACTUAL SIZE ON DWGS.
2. SOME RECORDING & MONITORING FUNCTIONS MAY BE HANDLED BY A COMPUTER WORK STATION & THEREFORE MAY BE DELETED FROM THE PANEL.
3. ON SOME PROJECTS, IT MAY BE DESIRABLE TO LOCATE EMERGENCY GENERATOR ANNUNCIATORS & METHERS ON THIS PANEL.
4. PROVIDE SMOKE DENSITY METERS ONLY ON PLANTS BURNING HEATED OIL OR WHERE REQUIRED BY LOCAL CODES.
5. ON PLANTS WHERE DRAFT CONTROL SYSTEMS ARE PROVIDED, CONSIDER LOCATING THE DRAFT GAGES ON THIS PANEL ABOVE THE OPERATOR RECORDERS. THE GAGES ARE USUALLY LOCATED ON THE BURNT CONTROL PANELS.
6. DELETE THE "ENGINEERING NOTES" FROM THE PROJECT DRAWINGS.
**GENERAL NOTES:**

1. MAINTAIN NEGATIVE AIR PRESSURE (0.01 INCH WATER COLUMN [2.5 PASCALS]) BETWEEN THE AIR ROOM AND THE ANTERIOR AND THE ANTERIOR AND THE CORRIDOR BY MODULATING VALVE V1. ALL ROOMS SHALL HAVE A PERMANENTLY INSTALLED DEVICE AND/OR MECHANISM TO CONSTANTLY MONITOR THE DIFFERENTIAL AIR PRESSURE BETWEEN THE PATIENT ROOM AND THE CORRIDOR. A LOCAL VISUAL MEANS SHALL BE PROMPTLY INFORMED WHENEVER NEGATIVE DIFFERENTIAL PRESSURE IS NOT MAINTAINED. (STROBE LIGHT)

2. MAINTAIN THE ATTACHED TOILET, IF ANY, AT NEGATIVE AIR PRESSURE WITH RESPECT TO THE AIR ROOM. HOWEVER, THE DESIGN NEED NOT INCLUDE A PRESSURE DIFFERENTIAL SENSOR FOR VERIFICATION.

3. LOCATE EXHAUST AIR REGISTER OVER THE PATIENT BED ON THE CEILING. AS AN ALTERNATE, THE EXHAUST AIR REGISTER CAN BE LOCATED ON THE WALL NEAR THE PATIENT HEAD, IF FEASIBLE.

4. LOCATE THE SUPPLY AIR OUTLET TO BLOW AIR TOWARDS THE OCCUPIED AREA.

5. PROVIDE A DEDICATED EXHAUST SYSTEM FOR THE AIR ROOMS WITHOUT MIXING IT WITH ANY OTHER EXHAUST.

**TYPICAL AIR BALANCE EXAMPLE:**

1. THE PATIENT BEDROOM IS KEPT UNDER NEGATIVE PRESSURE BY ENSURING AIR MOVEMENT INTO THE BEDROOM SPACE FROM THE ANTE ROOM AND ADJOINING CORRIDOR.

2. THE SUPPLY AIR SYSTEM SHALL CONSIST OF THE CONSTANT VOLUME AIR DELIVERY FROM A DEDICATED AIR TERMINAL UNIT WITH REHEAT COIL TO THE ISOLATION SUITE AS FOLLOWS:
   
   A - PATIENT BEDROOM
   
   MINIMUM 12 ACH SUPPLY AIR (ASHRAE STANDARD 170 2008).
   
   INCREASE SUPPLY AIR VOLUME, IF REQUIRED, TO MEET THE INSIDE DESIGN CONDITIONS IN COOLING AND/OR HEATING MODES.
   
   EXAMPLE: 400 CFM [190 L/S]

   B - ANTE ROOM
   
   MINIMUM 10 ACH (ASHRAE STANDARD 170 2008) OR MINIMUM 40
   
   CFM [19 L/S] SUPPLY + 100 CFM [47 L/S] INFLATRED INTO
   
   ANTE ROOM FROM CORRIDOR FOR A TOTAL OF 140 CFM [66 L/S].

   C - PATIENT TOILET
   
   DO NOT SUPPLY AIR INTO THE TOILET. DRAW MAKE-UP AIR FROM
   
   THE PATIENT'S BEDROOM AND EXHAUST AT THE RATE OF 10 ACH
   
   OR 60 CFM [28 L/S]. EXAMPLE: 60 CFM [28 L/S]

3. THE DEDICATED EXHAUST AIR SYSTEM SHALL BE BALANCED AS FOLLOWS:

   A - PATIENT BEDROOM
   
   400 CFM [190 L/S][SUPPLY] - 60 CFM [28 L/S][TOILET] + 40
   
   CFM [19 L/S] SUPPLY AIR TO ANTE ROOM + 100 CFM [47 L/S]
   
   INFLATRED FROM CORRIDOR INTO ANTE ROOM THEN 140 CFM [66 L/S]
   
   INTO AIR ROOM = 480 CFM [227 L/S] (EXHAUST), TOTAL
   
   EXHAUST 540 CFM [255 L/S]

4. COORDINATE DOOR UNDER CUTS FOR DOORS BETWEEN ANTE ROOM AND PATIENT (1")[2.54 CM],

**AIR SYSTEM FOR AIRBORNE INFECTION ISOLATION ROOM (AIR) WITH ANTE ROOM**

**DESIGNER'S NOTE:**

1. ENSURE FINAL DESIGN REFLECTS PROJECT SPECIFIC REQUIREMENTS AND MEETS ASHRAE 170,

   LATEST EDITION WITH ALL ADDENDUMS.
GENERAL NOTES:
1. MAINTAIN NEGATIVE AIR PRESSURE (0.01 INCH WATER COLUMN [2.5 PASCAL]) BETWEEN THE ALL ROOMS AND THE CORRIDOR BY MODULATING VALVE V1. ALL ROOMS SHALL HAVE A PERMANENTLY INSTALLED DEVICE AND/OR MECHANISM TO CONSTANTLY MONITOR THE DIFFERENTIAL AIR PRESSURE BETWEEN THE PATIENT ROOM AND THE CORRIDOR. A LOCAL VISUAL INDICATION SHALL BE PROVIDED TO INDICATE WHENEVER NEGATIVE DIFFERENTIAL PRESSURE IS NOT MAINTAINED. (STROBE LIGHT)

2. MAINTAIN THE ATTACHED TOILET, IF ANY, AT NEGATIVE AIR PRESSURE WITH RESPECT TO THE ALL ROOM. HOWEVER, THE DESIGN NEEDS NOT INCLUDE A PRESSURE DIFFERENTIAL SENSOR FOR VERIFICATION.

3. LOCATE EXHAUST AIR REGISTER OVER THE PATIENT BED ON THE CEILING. AS AN ALTERNATE, THE EXHAUST AIR REGISTER CAN BE LOCATED ON THE WALL NEAR THE PATIENT HEAD, IF FEASIBLE.

4. LOCATE THE SUPPLY AIR OUTLET TO BLOW AIR TOWARDS THE OCCUPIED AREA.

5. PROVIDE A DEDICATED EXHAUST SYSTEM FOR THE ALL ROOMS WITHOUT MIXING IT WITH ANY OTHER EXHAUST.

TYPICAL AIR BALANCE EXAMPLE:
1. THE PATIENT BEDROOM IS KEPT UNDER NEGATIVE PRESSURE BY ENSURING AIR MOVEMENT INTO THE BEDROOM SPACE FROM THE ADJOINING CORRIDOR.

2. THE SUPPLY AIR SYSTEM SHALL CONSIST OF THE CONSTANT VOLUME AIR DELIVERY FROM A DEDICATED AIR TERMINAL UNIT WITH REHEAT COIL TO THE ISOLATION SUITE AS FOLLOWS:

A – PATIENT BEDROOM MINIMUM 12 ACPH SUPPLY AIR (ASHRAE STANDARD 170 2008) INCREASE SUPPLY AIR VOLUME, IF REQUIRED, TO MEET THE INSIDE DESIGN CONDITIONS IN COOLING AND/OR HEATING MODES. "EXAMPLE: 400 CFM [190 L/S]"

B – PATIENT TOILET DO NOT SUPPLY AIR INTO THE TOILET, DRAW MAKE-UP AIR FROM THE PATIENT'S BEDROOM AND EXHAUST AT THE RATE OF 10 ACPH OR 60 CFM [28 L/S]. "EXAMPLE: 60 CFM [28 L/S]"

3. THE DEDICATED EXHAUST AIR SYSTEM SHALL BE BALANCED AS FOLLOWS:


AIR SYSTEM FOR AIRBORNE INFECTIOUS ISOLATION ROOM (AIL) (WITHOUT ANTEROOM)

nts NEGATIVE PRESSURE

DESIGNER'S NOTE:
1. ENSURE FINAL DESIGN REFLECTS PROJECT SPECIFIC REQUIREMENTS AND MEETS ASHRAE 170, LATEST EDITION WITH ALL ADDENDUMS.

SCALE: NONE

DATE ISSUED: MAY 2011

CAD DETAIL NO.: SD234003-D2.DWG
SEQUENCE OF OPERATION:

WHEN FILTER PRESSURE DROP RISES TO 2" [7 KPA] OF WATER COLUMN, FILTER STATUS LIGHT (RED) SHALL BE ENERGIZED.
SEQUENCE OF OPERATION FOR VARIABLE AIR VOLUME AIR HANDLING UNIT WITH MINIMUM OUTSIDE AIR

1. GENERAL
   _1.1_ UNIT IS NORMALLY STARTED AND STOPPED REMOTELY AT THE ECC. H-0-3-4 SWITCH SHALL BE KEPT IN THE "AUTO" POSITION. "HAND" AND "OFF" POSITIONS SHALL BE USED ONLY FOR MAINTENANCE. WHEN THE UNIT IS "OFF" D-2, D-3, SHALL BE FULLY CLOSED. WHEN THE UNIT IS "ON" D-1, D-2 AND D-3 SHALL BE FULLY OPEN. D-2 AND D-3 SHALL MODULATE IN ACCORDANCE WITH THE FOLLOWING SEQUENCE:

2. TEMPERATURE CONTROL
   _2.1_ SUPPLY AIR TEMPERATURE, SENSED BY TT-1, SHALL BE MAINTAINED AT SETPOINT VIA DIGITAL CONTROL PANEL BY MODULATING V-1 OR D-2 AND D-3 OR V-2 IN SEQUENCE.


   _2.3_ WHEN THE TEMPERATURE OF THE OUTSIDE AIR, SENSED BY TT-2, IS BETWEEN 65°F (18°C) AND THE SUPPLY AIR TEMPERATURE SENSED BY TT-1, DAMPER D-2 SHALL FULLY CLOSE AND D1 AND D3 SHALL BE FULLY OPEN (MAXIMUM OUTSIDE AIR POSITION). THE DIGITAL CONTROL PANEL SHALL MODULATE V-1 TO MAINTAIN THE SUPPLY AIR TEMPERATURE, SENSED BY TT-1.

   _2.4_ WHEN THE TEMPERATURE OF THE OUTSIDE AIR, SENSED BY TT-2, IS BELOW THE SUPPLY AIR TEMPERATURE, SENSED BY TT-1, DAMPERS D1, D-2 AND D-3 SHALL MODULATE TO MAINTAIN THE SCHEDULED SUPPLY AIR TEMPERATURE. IF D-2 IS CLOSED AND D-3 IS CLOSED TO MINIMUM OUTSIDE AIR, V-2 SHALL MODULATE TO MAINTAIN THE SUPPLY AIR TEMPERATURE, SENSED BY TT-1.

3. AIR FLOW CONTROL
   _3.1_ THE SUPPLY AIR FLOW SHALL BE CONTROLLED BY THE DIGITAL CONTROL PANEL MODULATING THE SUPPLY FAN VARIABLE SPEED MOTOR CONTROLLER TO MAINTAIN 1.0" [25mm] OF DUCT STATIC PRESSURE (FIELD ADJUSTABLE), SENSED BY SPS-1. RESET STATIC PRESSURE BASED ON ACTUAL BUILDING LOAD BY PULLING ALL ATU.

   _3.2_ THE DIGITAL CONTROL PANEL, USING TOTAL SUPPLY AIR AND RETURN AIR FLOW SIGNALS, SHALL RESET THE RETURN AIR FAN VSMC TO MAINTAIN A CONSTANT AIR FLOW DIFFERENCE BETWEEN THE SUPPLY AIR AND THE RETURN AIR EQUAL TO MINIMUM OUTSIDE AIR.

   _3.3_ USING HIGH PRESSURE SENSOR SPS-2 LOCATED AT THE SUPPLY FAN DISCHARGE, SHALL PREVENT THE SUPPLY FAN FROM DEVELOPING OVER 3" [75mm] OF STATIC PRESSURE (FIELD ADJUSTABLE). IF STATIC PRESSURE AT SPS-2 DOES EXCEED 3" [75mm] THE SUPPLY AIR FAN SHALL STOP. SPS-2 SHALL BE HARDWARE TO THE SUPPLY FAN VSMC AND UNIT SHALL BE SHUTDOWN IN HAND/AUTO OR BYPASS MODE. SPS-2 WILL REQUIRE MANUAL RESET AT THE DEVICE.

4. HUMIDITY CONTROL
   _4.1_ WHEN THE DIGITAL CONTROL PANEL IS NOT CALLING FOR HUMIDITY, SENSED BY RETURN AR Humidity H-1, AND "ON"-OFF CONTROL VALVE V-3 SHALL REMAIN CLOSED. WHEN THE DIGITAL CONTROL PANEL IS CALLING FOR HUMIDITY, V-3 SHALL REMAIN OPEN.

   _4.2_ RETURN AIR HUMIDITY SHALL BE MAINTAINED AT SETPOINT OF 35% RH (ADJ) VIA DIGITAL CONTROL PANEL BY MODULATING CONTROL VALVE V-4 TO MAINTAIN THE DESIRED HUMIDITY. THE DCP SHALL OVER-PHASE WHENEVER THE CAPACITY OF THE UNIT IS LESS THAN 80% AS SENSED BY H-2. DCP SHALE CLOSE VALVE V-3 WHENEVER THE SUPPLY FAN IS OFF.

5. FREEZE PROTECTION
   _5.1_ IF THE AIR TEMPERATURE AS SENSED BY TT-3 FALLS BELOW 45°F (7°C), AN ALARM SIGNAL SHALL BE ACTUATED VIA THE DCP AND ECC. THE SUPPLY AND RETURN FANS SHALL SHUT DOWN AND A CRITICAL ALARM SIGNAL SHALL BE ACTUATED VIA THE DIGITAL CONTROL PANEL AND ECC. THE SUPPLY AND RETURN AIR FANS SHALL BE SHUTDOWN IN HAND/AUTO OR BYPASS MODE. THE DCP WILL REQUIRE MANUAL RESET AT THE DEVICE.

6. AUTOMATIC SHUTDOWN/RESTART
   _6.1_ WHEN SMOKE IS DETECTED BY DUCT SMOKE DETECTOR, SMOKE AND RETURN FANS SHALL SHUT OFF AND AN ALARM SIGNAL SHALL BE TRANSMITTED TO THE FIRE ALARM SYSTEM. ALL SMOKE DAMPERS IN THE SUPPLY AND RETURN DUCTS SHALL BE SHUTDOWN IN HAND/AUTO OR BYPASS MODE. THE DCP WILL REQUIRE MANUAL RESET AT THE DEVICE.

7. EMERGENCY CONSTANT SPEED OPERATION
### Points List for VAV Air Handling Unit with Minimum Outside Air

**SYSTEM COMPONENT:**

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**NOTES:**

- Points listed are for a VAV air handling unit with minimum outside air.
- Binary and Analog inputs are specified for each point.
- Remarked for full communication and other notes as needed.
NOTES:

1. Emergency generator shall be interlocked with D3. When emergency generator is energized D3 shall open. When emergency generator is de-energized D3 shall close, provided room exhaust fan is off.

2. Room exhaust fan shall be interlocked with D3 & room thermostat T1. When room thermostat rises above 85°F [29°C] room exhaust fan shall run & D3 shall open. When room thermostat drops below 80°F [27°C] room exhaust fan shall stop & D3 shall close, provided emergency generator is de-energized.

3. Power operated, opposed blade, dampers D1 & D2 shall be interlocked with room thermostat T2 set at 60°F [16°C]. On a rise in room temperature above 60°F [16°C] D1 shall modulate open & D2 shall modulate closed. On a drop in room temperature below 60°F [16°C], D1 shall modulate closed & D2 shall modulate open.

4. Electric unit heater shall be interlocked with room thermostat T3 set at 45°F [7.2°C]. On a drop in room temperature below 43°F [6.1°C] electric unit heater shall be energized & on a rise in room temperature above 47°F [8.3°C].

EMERGENCY GENERATOR ROOM CONTROLS

DESIGNER’S NOTES:

1. If the project involves multiple emergency generators, each generator shall have a dedicated section of the outside air intake louver & damper motor(s) assigned to it. The designer shall show a schedule of the emergency generators & the specific interlocked louver/damper sections on the floor plans.

2. When the room exhaust fan is running alone, without any emergency generator, only a designated portion of the outside air intake louver shall open. The designer shall show this section on the floor plans.
NOTE:
MAINTAIN UPSTREAM AND DOWNSTREAM DISTANCES RECOMMENDED BY METER MANUFACTURERS

DESIGNER'S NOTE:
MODIFY DETAIL AS REQUIRED TO BE PROJECT SPECIFIC FOR THE TYPE OF METER BEING USED.

STEAM METER DETAIL

NTS
NOTES:
1. REPLACE EXISTING ECC WITH NEW BACNET (B-AWS) ENGINEERING CONTROL CENTER.
2. REPLACE ALL EXISTING CONTROLLERS WITH NEW BACNET CONTROLLERS.
3. INSTALL NEW BACNET COMMUNICATION NETWORK.
4. INSTALL MULTIPLE BUILDING CONTROLLERS (B-8C) AS REQUIRED.
5. INSTALL NEW CONTROLLERS (B-AAC, B-ASC) AS REQUIRED.
6. PROVIDE NEW PORTABLE OPERATORS TERMINAL.

BACNET SYSTEM ARCHITECTURE OPTION 1
NOTES:
1. REPLACE EXISTING ECC WITH NEW BACNET (B-AWS) ENGINEERING CONTROL CENTER (ECC).
2. EXISTING CONTROLLERS TO REMAIN.
3. INSTALL NEW BACNET GATEWAY WITH FULL COMMUNICATION TO EXISTING CONTROLLERS.
4. INSTALL NEW BACNET COMMUNICATION NETWORK.
5. INSTALL MULTIPLE BUILDING CONTROLLERS AS REQUIRED.
6. INSTALL NEW CONTROLLERS (B-AAC/B-ASC) AS REQUIRED.
7. PROVIDE NEW PORTABLE OPERATORS TERMINAL.

BACNET SYSTEM ARCHITECTURE OPTION 2
BACNET SYSTEM ARCHITECTURE OPTION 3

NOTES:
1. INSTALL NEW BACNET (B-AWS) ENGINEERING CONTROL CENTER (ECC).
2. EXISTING ECC, ASSOCIATED COMMUNICATION NETWORK AND CONTROLLERS TO REMAIN.
3. INSTALL NEW BACNET COMMUNICATION NETWORK.
4. INSTALL MULTIPLE BUILDING CONTROLLERS (B-BC) AS REQUIRED.
5. INSTALL NEW CONTROLLERS (B-AAC, B-ASC) AS REQUIRED.
6. PROVIDE NEW PORTABLE OPERATORS TERMINAL.
BACNET SYSTEM ARCHITECTURE OPTION 4

NOTES:
1. INSTALL NEW BACNET SOFTWARE ON EXISTING ENGINEERING CONTROL CENTER (ECC).
2. REUSE EXISTING COMMUNICATION NETWORK.
3. EXISTING CONTROLLERS TO REMAIN.
4. INSTALL MULTIPLE BUILDING CONTROLLERS AS REQUIRED.
5. INSTALL NEW CONTROLLERS (B-AAC, B-ASC) AS REQUIRED.
6. PROVIDE NEW PORTABLE OPERATORS TERMINAL.
SEQUENCE OF OPERATION FOR AIR HANDLING UNIT FOR SURGICAL SUITE (VAV)

1. GENERAL

1.1 UNIT IS NORMALLY STARTED AND STOPPED REMOTELY AT THE ECC. THE UNIT WILL NORMALLY OPERATE 24 HOUR/DAY. H-O-A SWITCH SHALL BE KEPT IN THE "AUTO" POSITION. "HAND" AND "OFF" POSITIONS SHALL BE USED ONLY FOR MAINTENANCE WHEN THE UNIT IS "OFF" D-1, D-3, D-4 AND SHALL BE FULLY CLOSED. WHEN THE UNIT IS "ON" D-6, SD-1 AND SD-2 SHALL BE FULLY OPEN. D-1, D-2 AND D-3 SHALL MODULATE IN ACCORDANCE WITH THE FOLLOWING SEQUENCE:

2. TEMPERATURE CONTROL

2.1 SUPPLY AIR TEMPERATURE SETPOINT (AS SEEN BY ECC), SENSED BY SENSOR TT-1, SHALL BE MAINTAINED BY SEQUENCING V-1 AND V-2. HEATING AND COOLING CONTROL VALVES SHALL BE MODULATED VIA PID CONTROL LOOP TO MAINTAIN THE SUPPLY AIR TEMP. VALVES V-1 AND V-2 SHALL NOT BE OPENED SIMULTANEOUSLY.


2.3 WHEN THE OUTSIDE AIR ENTHALPY OR TEMPERATURE IS HIGHER THAN THE RETURN AIR ENTHALPY OR TEMPERATURE, THE ECONOMIZER SHALL BE DISABLED, DAMPERS D-1 AND D-3 SHALL CLOSE, D-2 SHALL OPEN AND D-4 SHALL MODULATE TO MAINTAIN THE MINIMUM OUTSIDE AIR CFM SETPOINT.

3. AIR FLOW CONTROL

3.1 THE SUPPLY AIR FLOW SHALL BE CONTROLLED BY THE DIGITAL CONTROL PANEL MODULATING THE SUPPLY FAN VARIABLE SPEED MOTOR CONTROLLER TO MAINTAIN THE TOTAL SUPPLY AIR CFM DURING OCCUPIED MODE. RESET SUPPLY AIR CFM AS EACH 2 POSITION AIR TERMINAL UNIT SWITCHES TO UNOCUPIED MODE.

3.2 THE DIGITAL CONTROL PANEL, USING TOTAL SUPPLY AIR AND RETURN AIR FLOW SIGNALS, SHALL RESET THE RETURN AIR FAN TO MAINTAIN A CONSTANT FLOW DIFFERENCE BETWEEN THE SUPPLY AIR AND THE RETURN AIR EQUAL TO MINIMUM OUTSIDE AIR.

3.3 USING HIGH PRESSURE SENSOR PSH LOCATED AT THE SUPPLY FAN DISCHARGE, SHALL PREVENT THE SUPPLY FAN FROM DEVELOPING OVER 3" (75mm) OF STATIC PRESSURE (FIELD ADJUSTABLE). IF STATIC PRESSURE AT PSH DOES EXCEED 3" (75mm) THE SUPPLY AIR FAN SHALL STOP. PSH SHALL BE HARDWIRED TO THE SUPPLY FAN AND UNIT SHALL BE SHUTDOWN IN HAND, AUTO OR BYPASS MODE. PSH WILL REQUIRE MANUAL RESET AT THE DEVICE.

3.4 USING LOW PRESSURE SENSOR PLS LOCATE AT THE RETURN FAN INLET, SHALL PREVENT THE RETURN FAN FROM DEVELOPING OVER - 3" (75mm) OF NEGATIVE STATIC PRESSURE (FIELD ADJUSTABLE). IF STATIC PRESSURE AT PLS DOES EXCEED - 3" (75mm) THE RETURN AIR FAN SHALL STOP. PLS SHALL BE HARDWIRED TO THE RETURN FAN AND UNIT SHALL BE SHUTDOWN IN HAND, AUTO OR BYPASS MODE. PLS WILL REQUIRE MANUAL RESET.

4. HUMIDITY CONTROL

4.1 WHEN THE DIGITAL CONTROL PANEL IS NOT CALLING FOR HUMIDITY, SENSED BY RETURN AIR HUMIDITY MT-1, 2-WAY "ON-OFF" CONTROL VALVE V-3 SHALL REMAIN CLOSED. WHEN THE DIGITAL CONTROL PANEL IS CALLING FOR HUMIDITY, V-3 SHALL REMAIN OPEN.

4.2 RETURN AIR HUMIDITY SHALL BE MAINTAINED AT SETPOINT OF 42° F (5.6° C) DEW POINT (DPL) VIA DIGITAL CONTROL PANEL BY MODULATING CONTROL VALVE V-4 TO MAINTAIN THE DESIRED HUMIDITY. THE DRYBULB TRANSMITTER T-4 AND HUMIDITY TRANSMITTER H-1 IN RETURN AIR SHALL BE USED TO CALCULATE RETURN AIR DEW POINT TEMPERATURE. V-3 SHALL BE CLOSED WHENEVER THE RETURN AIR DEWPOINT IS > 45° F (7° C). DPL SHALL CLOSE VALVE V-3 WHENEVER THE SUPPLY FAN IS OFF. VALVE V-4 SHALL BE INTERLOCKED WITH A TEMPERATURE SWITCH TO KEEP THE HUMIDIFIER OFF UNTIL CONDENSATE TEMPERATURE APPROACHES STEAM TEMPERATURE.

5. FREEZE PROTECTION

5.1 IF THE AIR TEMPERATURE AS SENSED BY TT-3 FALLS BELOW 45° F (7° C), AN ALARM SIGNAL SHALL INDICATE AT THE OCP AND ECC. IF THIS TEMPERATURE FALLS BELOW 40° F (4.4° C), AS SENSED BY THE TSL, THE SUPPLY AND RETURN FANS SHALL SHUT DOWN AND A CRITICAL ALARM SHALL INDICATE AT THE DIGITAL CONTROL PANEL AND ECC. TSL SHALL BE HARDWIRED TO THE SUPPLY FAN AND RETURN FAN AND BOTH SHALL BE SHUT DOWN IN HAND, AUTO OR BYPASS MODE. TSL WILL REQUIRE MANUAL RESET AT THE DEVICE.

6. LOSS OF COOLING PROTECTION

6.1 IF THE AIR TEMPERATURE AS SENSED BY TT-1 RAISES ABOVE 65° F (18° C), AN ALARM SIGNAL SHALL INDICATE AT THE OCP AND ECC. IF THIS TEMPERATURE RAISES ABOVE 70° F (21° C), AS SENSED BY TT-1, THE SUPPLY AND RETURN FANS SHALL SHUT DOWN AND A CRITICAL ALARM SHALL INDICATE AT THE DIGITAL CONTROL PANEL AND ECC.

7. AUTOMATIC SMOKE SHUTDOWN/RESTART

7.1 WHEN SMOKE IS DETECTED BY DUCT SMOKE DETECTOR, SO, THE SUPPLY AND RETURN FANS SHALL SHUT OFF AND AN ALARM SIGNAL SHALL BE TRANSMITTED TO THE FIRE ALARM SYSTEM. ALL SMOKE DAMPERS IN THE SUPPLY AND RETURN DUCTS SHALL CLOSE.

7.2 EXHAUST FANS SERVING AREA OF THE SUPPLY FAN SHALL CONTINUE TO RUN. SUPPLY AND RETURN FANS SHALL RESTART AND SMOKE DAMPERS SHALL SHUT DOWN WHEN FIRE ALARM CIRCUIT IS RESET.

8. EMERGENCY CONSTANT SPEED OPERATION

**GENERAL NOTES:**

1. MAINTAIN POSITIVE AIR PRESSURE (0.01 INCH WATER COLUMN [2.5 PASCAL]) BETWEEN THE PE ROOM AND THE ANTEROOM AND THE ANTEROOM AND THE CORRIDOR BY MODULATING VALVE V1. PE ROOMS SHALL HAVE A PERMANENTLY INSTALLED DEVICE AND/OR MECHANISM TO CONSTANTLY MONITOR THE DIFFERENTIAL AIR PRESSURE BETWEEN THE PATIENT ROOM AND THE CORRIDOR. A LOCAL VISUAL MEANS SHALL BE PROVIDED TO INDICATE WHENEVER POSITIVE DIFFERENTIAL PRESSURE IS NOT MAINTAINED. (STROSE, LITE)

2. MAINTAIN THE ATTACHED TOILET, IF ANY, AT NEGATIVE AIR PRESSURE WITH RESPECT TO THE PE ROOM. HOWEVER, THE DESIGN NEED NOT INCLUDE A PRESSURE DIFFERENTIAL SENSOR FOR VERIFICATION.

3. LOCATE THE SUPPLY AIR OUTLET OVER THE PATIENT BED ON THE CEILING WITHOUT CREATING A DRAFT CAUSING PATIENT DISCOMFORT. LOCATE RETURN AIR INLET NEAR THE ROOM DOOR.

**TYPICAL AIR BALANCE EXAMPLE:**

1. THE PATIENT BEDROOM IS KEPT UNDER POSITIVE PRESSURE BY ENSURING AIR MOVEMENT FROM THE BEDROOM SPACE AND THE ADJOINING CORRIDOR INTO THE ANTE ROOM.

2. THE SUPPLY AIR SYSTEM SHALL CONSIST OF THE CONSTANT VOLUME AIR DELIVERY FROM A DEDICATED AIR TERMINAL UNIT WITH REHEAT COIL TO THE ISOLATION SUITE, AS FOLLOWS:

   **A - PATIENT BEDROOM:**

   **B - ANTE ROOM:**
   SUPPLY AIR IS NOT REQUIRED FOR THIS SPACE. EXTRAFILTER 100 CFM [47 L/S] OF AIR FROM PATIENT ROOM, THRU ANTE ROOM INTO THE CORRIDOR. EXAMPLE: 100 CFM [28 L/S].

   **C - PATIENT TOILET:**
   DO NOT SUPPLY AIR INTO THE TOILET. DRAW MAKE-UP AIR FROM THE PATIENT'S BEDROOM AND EXHAUST AT THE RATE OF 10 ACH ON 60 CFM [28 L/S]. EXAMPLE: 60 CFM [28 L/S].

   **D - RETURN AIR FROM PATIENT ROOM:**
   400 CFM [189 L/S] (SUPPLY AIR) - 100 CFM [47 L/S] TO ANTE ROOM + 60 CFM [28 L/S] TO TOILET = 240 CFM [115 L/S] RETURN AIR SETTING OF AFCV V1, IN THE RA DUCT.

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**AIR SYSTEM FOR PROTECTIVE ENVIRONMENT ROOM (PE) (WITH ANTEROOM)**

**NOTES:**

- **DESIGNER'S NOTE:**
  - ENSURE FINAL DESIGN REFLECTS PROJECT SPECIFIC REQUIREMENTS AND MEETS ASHRAE 170, LATEST EDITION WITH ALL ADDENDUMS.
GENERAL NOTES:

1. MAINTAIN POSITIVE AIR PRESSURE (0.01 INCH WATER COLUMN [25 PASCAL]) BETWEEN THE PE ROOM AND THE SPACES THAT ARE NOT THE PE ROOMS INCLUDING THE CORRIDOR BY MODULATING VALVE V1. PE ROOMS SHALL HAVE A PERMANENTLY INSTALLED DEVICE AND/OR MECHANISM TO CONSTANTLY MONITOR THE DIFFERENTIAL AIR PRESSURE BETWEEN THE PATIENT ROOM AND THE CORRIDOR. A LOCAL VISUAL MEANS SHALL BE PROVIDED TO INDICATE WHENEVER POSITIVE DIFFERENTIAL PRESSURE IS NOT MAINTAINED. (STROBE LIGHT)

2. MAINTAIN THE ATTACHED TOILET, IF ANY, AT NEGATIVE AIR PRESSURE WITH RESPECT TO THE PE ROOM. HOWEVER, THE DESIGN NEED NOT INCLUDE A PRESSURE DIFFERENTIAL SENSOR FOR VERIFICATION.

3. LOCATE THE SUPPLY AIR OUTLET OVER THE PATIENT BED ON THE CEILING WITHOUT CREATING A DRAFT CAUSING PATIENT DISCOMFORT. LOCATE RETURN AIR INLET NEAR THE ROOM DOOR.

TYPICAL AIR BALANCE EXAMPLE:

1. THE PATIENT BEDROOM IS KEPT UNDER POSITIVE PRESSURE BY ENSURING AIR MOVEMENT FROM THE BEDROOM SPACE AND THE ADJOINING CORRIDOR.

2. THE SUPPLY AIR SYSTEM SHALL CONSIST OF THE CONSTANT VOLUME AIR DELIVERY FROM A DEDICATED AIR TERMINAL UNIT WITH REHEAT COIL TO THE ISOLATION SUITE, AS FOLLOWS:

A - PATIENT BEDROOM 12 ACFM (MINIMUM—ASHRAE STANDARD 170 2008). INCREASE THE SUPPLY AIR VOLUME IF REQUIRED TO MEET THE INSIDE DESIGN CONDITIONS IN COOLING AND/OR HEATING MODE.

EXAMPLE: 400 CFM [190 L/S]

B - PATIENT TOILET DO NOT SUPPLY AIR INTO THE TOILET. DRAW MAKE-UP AIR FROM THE PATIENT'S BEDROOM AND EXHAUST AT THE RATE OF 10 ACFM OR 60 CFM [28 L/S]. EXAMPLE: 60 CFM [28 L/S]

C - RETURN AIR FROM PATIENT ROOM 400 CFM [189 L/S] (SUPPLY AIR) - 100 CFM [47 L/S] TO CORRIDOR + 60 CFM [28 L/S] TO TOILET) = 240 CFM [115 L/S] SETTING OF AFCV V1, IN THE RA DUCT.

AIR SYSTEM FOR PROTECTIVE ENVIRONMENT ROOM (PE) WITHOUT ANTEROOM

DESIGNER'S NOTE:
1. ENSURE FINAL DESIGN REFLECTS PROJECT SPECIFIC REQUIREMENTS AND MEETS ASHRAE 170, LATEST EDITION WITH ALL ADDENDUMS.
GENERAL NOTES:

1. ANTEROOM SHALL BE MAINTAINED AT A NEGATIVE PRESSURE (0.01 INCH WATER COLUMN [2.5 PASCAL]) WITH RESPECT TO BOTH AIR/PE ROOM AND THE CORRIDOR OR ANY ADJOINING SPACE BY MODULATING VALVE V2. VALVE V1 IS USED TO MAINTAIN A POSITIVE PRESSURE BETWEEN THE PATIENT ROOM AND THE ANTE ROOM. CORRIDOR ROOMS SHALL HAVE PERMANENTLY INSTALLED DEVICES AND/OR MECHANISMS TO CONSTANTLY MONITOR THE DIFFERENTIAL AIR PRESSURE BETWEEN THE PATIENT ROOM AND ANTE ROOM AND THE CORRIDOR AND THE ANTE ROOM. A LOCAL VISUAL MEANS SHALL BE PROVIDED TO INDICATE WHENEVER POSITIVE DIFFERENTIAL PRESSURE IS NOT MAINTAINED IN THE PATIENT ROOM WITH RESPECT TO THE ANTE ROOM (STROBE LIGHT). A LOCAL VISUAL MEANS SHALL BE PROVIDED TO INDICATE WHENEVER NEGATIVE DIFFERENTIAL PRESSURE IS NOT MAINTAINED IN THE ANTE ROOM WITH RESPECT TO THE CORRIDOR (STROBE LIGHT).

2. MAINTAIN THE ATTACHED TOILET, IF ANY, AT NEGATIVE AIR PRESSURE WITH RESPECT TO THE AIR/PE ROOM. HOWEVER, THE DESIGN NEED NOT INCLUDE A PRESSURE DIFFERENTIAL SENSOR FOR VERIFICATION.

3. LOCATE THE SUPPLY AIR OUTLET OVER THE PATIENT BED ON THE CEILING WITHOUT CREATING A DRAFT CAUSING PATIENT DISCOMFORT. LOCATE EXHAUST AIR INLET NEAR THE PATIENT ROOM DOOR.

TYPICAL AIR BALANCE EXAMPLE:

1. THE PATIENT BEDROOM IS KEPT UNDER POSITIVE PRESSURE BY ENSURING AIR MOVEMENT FROM THE BEDROOM SPACE TO THE ANTE ROOM BY MODULATING VALVE V1. THE ANTE ROOM IS KEPT AT NEGATIVE PRESSURE WITH RESPECT TO THE CORRIDOR BY MODULATING VALVE V2.

2. THE SUPPLY AIR SYSTEM SHALL CONSIST OF THE CONSTANT VOLUME AIR DELIVERED FROM A DEDICATED AIR TERMINAL UNIT WITH HEATCOIL TO THE ISOLATION SUITE AS FOLLOWS:

A - PATIENT BEDROOM
   MINIMUM 12 ACH AIR SUPPLY (ASHRAE STANDARD 170 2008). INCREASE SUPPLY AIR VOLUME, IF REQUIRED, TO MEET THE INSIDE DESIGN CONDITIONS IN COOLING AND/OR HEATING MODES.
   EXAMPLE: 400 CFM [190 L/S]

B - ANTE ROOM
   SUPPLY AIR IS NOT REQUIRED FOR THIS SPACE. EX-FILTRATE PATIENT ROOM AIR AND CORRIDOR AIR TO EXHAUST MINIMUM 10 ACH AIR (ASHRAE STANDARD 170) AS MEASURED AND CONTROLLED BY VALVE V-2. FOR THIS EXAMPLE INFLATE 100 CFM [47 L/S] FROM CORRIDOR INTO THE ANTE ROOM + 60 CFM [28 L/S] FROM THE AIR/PE ROOM. THIS WILL ENSURE THE ANTE ROOM IS NEGATIVE WITH RESPECT TO THE AIR/PE ROOM AND WITH RESPECT TO THE CORRIDOR.

C - PATIENT TOILET
   DO NOT SUPPLY AIR INTO THE TOILET. DRAW MAKE-UP AIR FROM THE PATIENT'S BEDROOM AND EXHAUST AT THE RATE OF 10 ACH OR 60 CFM [28 L/S]. EXAMPLE: 60 CFM [28 L/S]

3. THE DEDICATED EXHAUST AIR SYSTEM SHALL BE BALANCED AS FOLLOWS:

A - PATIENT BEDROOM
   100 CFM [47 L/S] INFLATED FROM CORRIDOR INTO ANTE ROOM + 40 CFM [19 L/S] EXFILTRATE FROM AIR/PE ROOM INTO ANTE ROOM, 140 CFM [65 L/S] EXHAUST, TOTAL EXHAUST 500 CFM [240 L/S]

4. COORDINATE DOORS UNDER CUTS FOR DOOR BETWEEN ANTE ROOM AND PATIENT [1'0' 2.44 CM] DOOR TO CORRIDOR.

AIR SYSTEM FOR COMBINATION AIRBORNE INFECTION ISOLATION (AI)/PROTECTIVE ENVIRONMENT (PE) ROOM WITH NEGATIVE ANTEROOM

DESIGNER'S NOTE:

1. ENSURE FINAL DESIGN REFLECTS PROJECT SPECIFIC REQUIREMENTS AND MEETS ASHRAE 170, LATEST EDITION WITH ALL ADDENDUMS.
GENERAL NOTES:

1. ANTEROOM SHALL BE MAINTAINED AT A POSITIVE PRESSURE (0.01 INCH WATER COLUMN [2.5 PASCAL]) WITH RESPECT TO BOTH AIR/PE ROOM AND THE CORRIDOR OR ANY ADJOINING SPACE BY MODULATING VALVE V1. COMBO ROOMS SHALL HAVE PERMANENTLY INSTALLED DEVICES AND/OR MECHANISMS TO CONSTANTLY MONITOR THE DIFFERENTIAL AIR PRESSURE BETWEEN THE PATIENT ROOM AND ANTE ROOM AND THE CORRIDOR AND ANTE ROOM. A LOCAL VISUAL METER SHALL BE PROVIDED TO INDICATE WHENEVER POSITIVE DIFFERENTIAL PRESSURE IS NOT MAINTAINED WITH RESPECT TO ANTE ROOM AND EITHER THE AIR/PE ROOM OR THE CORRIDOR. (STORIE LITE)

2. MAINTAIN THE ATTACHED TOILET, IF ANY, AT NEGATIVE AIR PRESSURE WITH RESPECT TO THE PE ROOM, HOWEVER, THE DESIGN NEEDS NOT INCLUDE A PRESSURE DIFFERENTIAL SENSOR FOR VERIFICATION.

3. LOCATE THE SUPPLY AIR OUTLET OVER THE PATIENT BED ON THE CEILING WITHOUT CREATING A DRAFT CAUSING PATIENT DISCOMFORT. LOCATE EXHAUST AIR INLET NEAR THE PATIENT ROOM DOOR.

TYPICAL AIR BALANCE EXAMPLE:

1. THE PATIENT BEDROOM IS KEPT UNDER POSITIVE PRESSURE WITH RESPECT TO THE ADJOINING CORRIDOR BY MODULATING VALVE V1.

2. THE SUPPLY AIR SYSTEM SHALL CONSIST OF THE CONSTANT VOLUME AIR DELIVERY FROM A DEDICATED AIR TERMINAL UNIT WITH REHEAT COIL TO THE ISOLATION SUITE AS FOLLOWS:

   A – PATIENT BEDROOM: MINIMUM 12 ACPH SUPPLY AIR (ASHRAE STANDARD 170 2008). INCREASE SUPPLY AIR VOLUME, IF REQUIRED, TO MEET INSIDE DESIGN CONDITIONS IN COOLING AND/OR HEATING MODES. EXAMPLE: 400 CFM [190 L/S]


3. THE DEDICATED EXHAUST AIR SYSTEM SHALL BE BALANCED AS FOLLOWS:


4. COORDINATE DOORS UNDER CUTS FOR DOOR BETWEEN ANTE ROOM AND PATIENT (1") [2.54 CM] DOOR TO CORRIDOR.

AIR SYSTEM FOR COMBINATION AIRBORNE
INFECTION ISOLATION (AI) / PROTECTIVE
ENVIRONMENT (PE) ROOM WITH POSITIVE ANTEROOM

NOTES

DESIGNER'S NOTE:

* ENSURE FINAL DESIGN REFLECTS PROJECT SPECIFIC REQUIREMENTS AND MEETS ASHRAE 170, LATEST EDITION WITH ALL ADDENDUMS.

SCALE: NONE

DATE ISSUED: MAY 2011

CAD DETAIL NO.: SD235923-20.DWG
NOTE: THIS DETAIL SHOWS BASIC REQUIREMENTS ONLY AND IS NOT INTENDED FOR USE ON PROJECT DRAWINGS. THE PROJECT ENGINEER MUST PROVIDE A COMPLETE DESIGN WHICH CONFORMS TO PROJECT REQUIREMENTS.

UNDERGROUND FUEL OIL STORAGE TANK

REINFORCED CONCRETE BALLAST PAD DESIGN FOR BUOYANCY OF EMPTY TANK WITH CREDIT FOR BACKFILL.

LEAK DETECTOR SENSOR FOR DOUBLE WALL TANK.

LADDER OR ALUMINUM 2 1/2" [64mm] WIDE STRINGERS
3/4" [19mm] DIA. RUNG
ANCHOR AT BOTTOM GUIDE AT TOP.

WEAR PLATE 1/4" [6mm] THICK, 12" [304mm] SQ STEEL (TYP.)

SOUNDING ROD FOR WEAR PLATE

BEDDING MATERIAL

REINFORCED CONCRETE SLAB

MANHOLE COVER

LEAK DETECTOR SENSOR

OVERFILL PREVENT ON VALVE

FOOT VALVE

TANK

SOIL SEPARATOR 22" [559mm] DIA. MANWAY (TYPICAL)

ACCESS COVER SEALED WATER TIGHT

VENT CAP

GRADE

3" [76mm] MAXIMUM

42" [1067mm] DIA. MANWAY ENCLOSURE SEALED WATER TIGHT (TYP.)

6" [150mm] DIA. MANWAY (TYPICAL)
STEAM LINE DRIP POCKET AND STEAM TRAP ASSEMBLY

20mm [3/4"] DRAIN (ALTERNATE LOCATIONS) (TYPICAL)

20mm [3/4"] MIN.

FROM Drip CONNECTION

10mm [3/8"] TEST CONNECTION

DRIP RETURN

STEAM TRAP ASSEMBLY

NOTE:
DRIP POCKET PIPE SIZE SAME AS STEAM MAIN UNLESS OTHERWISE NOTED.
NOTES:
1. UNLESS OTHERWISE SHOWN ON THE DRAWINGS, SIZE THE VENT PIPE SO THAT STEAM IS NOT BLOWN OUT AT THE VENT PIPE ENTRANCE. UTILIZE THE CALCULATION METHOD CONTAINED IN ANSI B31.1 POWER PIPING CODE, APPENDIX II.

2. VENT PIPE SHALL TERMINATE 1829mm [6'] MIN. ABOVE FINISHED ROOF.

3. DISCHARGE OF DRAIN SHALL BE DIRECTED AWAY FROM PLATFORMS OR OTHER AREAS WHICH PERSONNEL MAY OCCUPY.

4. NO OTHER DRAIN SHALL BE CONNECTED TO THE DRIP PAN ELBOW DRAIN PIPE.

STEAM SAFETY VALVE

NTS
BASIC FLOW DIAGRAM - CONDENSATE AND BOILER FEEDWATER

NOTES:
1. Generator overflow only permitted to go to condensate tank if the condensate tank is a waste code tank with same ramp as the generator.
2. For complete piping see referenced details.
Condensate Storage and Transfer Flow Diagram

Designer's Note:
See 3D3211 for basic flow diagram - condensate and boiler feedwater for complete system.
NOTE:
CAPACITY OF EACH PUMP APPROX.
125% OF ONE BOILER

DESIGNER'S NOTE:
SEE 30232111-04 BASIC FLOW DIAGRAM - CONDENSATE AND BOILER FEEDWATER FOR COMPLETE SYSTEM.

BOILER FEEDWATER PUMPS FLOW DIAGRAM

nts
EXPANDED RETURN MAIN

INCREASER

RETURN MAIN

FLOW

PERFORATED TUBE 1"x1/8" [25x6mm]
THICK GUIDE FINS WELDED TO
PERFORATED TUBE

SECTION A-A

SECTION EXPANDED RETURN MAIN

A  SIZE, TRAP DISCHARGE LINE  15mm [1/2"]  20mm [3/4"]
B  SIZE, 45° WELDING NIPPLE  25mm [1"]  32mm [1-1/4"]
C  LENGTH OF EXPANDED MAIN AHEAD OF TRAP
    DISCHARGE PIPE  175mm [7"]  175mm [7”]
D  LENGTH OF PERFORATED PIPE  415mm [16-1/2"]  415mm [16-1/2”]
E  LENGTH OF EXPANDED MAIN FOLLOWING
    PERFORATED PIPE  50mm [2"]  50mm [2”]

RETURN MAIN SIZE  UP TO 40mm [1-1/2"]  50mm [2"]  75mm [3"] & OVER
EXPANDED RETURN MAIN SIZE  65mm [2-1/2"]  SAME SIZE

NOTES:
1. 15mm [1/2"] PERFORATED TUBE SHALL HAVE 40 - 16mm [1/8"] DIAMETER HOLES SPACED
   40mm [1-1/2”] O.C. IN 4 ROWS.
2. 20mm [3/4"] PERFORATED TUBE SHALL HAVE 78 - 6mm [1/8"] DIAMETER HOLES SPACED
   40mm [1-1/2”] O.C. IN 6 ROWS.
3. HOLES IN TUBE SHALL BE SPACED EQUALLY AROUND PERIMETER.

DESIGNER'S NOTE:
THIS DETAIL SHALL ONLY BE USED FOR LIMITED SITUATIONS WHERE THE DESIGNER CONDUCTS A FULL ANALYSIS OF
THE SYSTEM AND ITS IMPACTS, TO ENSURE THAT CONDENSATE DOES NOT FLASH AND CREATE A WATER HAMMER.
REFERENCE THE STEAM DESIGN MANUAL VOLUME 3.

HIGH PRESSURE STEAM TRAP
DISCHARGE INTO PUMPED CONDENSATE RETURN LINE

NTS

Department of Veterans Affairs

DETAIL TITLE: HIGH PRESSURE STEAM TRAP DISCHARGE
INTO PUMPED CONDENSATE RETURN LINE

SCALE : NONE

DATE ISSUED: 11/01/2017 CAD DETAIL NO.: SD232111-09.DWG
NOTE:
Maintain upstream and downstream distances recommended by meter manufacturers.

DESIGNER’S NOTE:
Modify detail as required to be project specific for the type of meter being used.

WATER FLOW MEASURING STATION
(WITH BTU METER)
INSTALLATION OF THERMOMETER WELLS

NOTE:
PROVIDE THE APPROPRIATE WELL DEPTH TO HAVE THE NECESSARY INSULATION STAND-OFF DISTANCE.

DEPARTMENT OF VETERANS AFFAIRS

DETAIL TITLE: INSTALLATION OF THERMOMETER WELLS

SCALE: NONE

DATE ISSUED: 11/01/2017  CADD DETAIL NO.: SD232113-02.DWG
TUBING, PIPING, AND CONDUITS PASSING THROUGH PRE-FAB INSULATED WALL PANELS

EXTerior Skin
PREFAB WALL PANEL AS SPECIFIED

MASTIC

GASKET
INTERIOR SKIN

S.S. WALL PLATE SECURED WITH S.S. SCREWS

PIPE INSULATION AS SPECIFIED

SEAL INSULATION AGAINST SKIN OF WALL PANEL

FIELD APPLIED INSULATION AFTER INSERTION OF RESPECTIVE SERVICE FACILITY THRU REFRIGERATOR OR FREEZER WALL

DETAIL TITLE: TUBING, PIPING, AND CONDUITS PASSING THROUGH PRE-FAB INSULATED WALL PANELS

SCALE: NONE

DATE ISSUED: 11/01/2017
CADD DETAIL NO.: SD232113-03.DWG
HORIZONTAL EXPANSION TANK - PIPING CONNECTIONS

NOTES:
1. SEE EXPANSION TANK SYSTEM SCHEDULE FOR COMPONENT SIZES.
2. RELIEF VALVE FOR CHILLED WATER SYSTEM IS SHOWN, OMIT WHEN RELIEF VALVE IS SHOWN ON HEAT EXCHANGER DETAIL & SYSTEM IS USED ONLY FOR HOT WATER HEATING.
3. PROVIDE STRAINER IN AIR SEPARATOR WHEN INDICATED IN EXPANSION TANK SCHEDULE.
4. FOR HOT WATER SYSTEMS 50mm [2"] AND SMALLER AND CHILLED WATER SYSTEMS USE IN-LINE AIR PURGER IN LIEU OF AIR SEPARATOR.
5. SET PRESSURE REDUCING VALVE SO PRESSURE AT HIGHEST POINT IN SYSTEM HAS A MINIMUM OF 284kPa [4 PSI].

DESIGNER'S NOTE:
VALUES SHALL BE INDICATED ON EITHER SIDE OF AIR SEPARATOR AS REQUIRED BY CLOSURENESS OF VALUES SERVING ADJACENT EQUIPMENT. WHERE CHARGING OF TANK IS PROPOSED PROVIDE NECESSARY TAPINGS. PROVIDE AND SHOW A LOW WATER ALARM ON CHARGED SYSTEMS TO INDICATE NO WATER IN TANK.
Floor Mounted Expansion Tank - Piping Connections

Designer's Note:
Gate valves shall be indicated on either side of Air Separator as required by closeness of valves serving adjacent equipment. Where charging of tank is proposed provide necessary tappings. Provide and show a low water alarm on charged systems to indicate no water in tank.
INDIRECT GLYCOL MAKE-UP SYSTEM

(PIPING AND CONTROLS)

NOTES:
1. PROVIDE LOW WATER LEVEL ALARM. PROVIDE A LOW WATER LEVEL AT ECC. RELIEF VALVE
   DRAIN SHALL RETURN TO TANK AS SHOWN ON THIS DETAIL.

2. SET REGULATING VALVE TO MAINTAIN MAKE-UP PRESSURE AT 15 PSIG [103 kPa] ABOVE
   HIGHEST SYSTEM PRV SETTING.

3. MAKE-UP PIPING SYSTEM DOES NOT REQUIRE INSULATION.

4. OPERATE PUMP MANUALLY AS REQUIRED TO FILL.

DESIGNER'S NOTE:
PLUMBING DRAWINGS SHOULD INCLUDE DOMESTIC COLD-WATER HOSE BIB NEAR THE GLYCOL-
WATER MAKE-UP SYSTEM. FOR SMALL SYSTEMS (50 GAL [200 L] OR LESS) A POT FEEDER,
AT THE HIGH POINT IN THE PIPING, MAY BE USED FOR MAKE-UP IN LIEU OF THE PUMPED
MAKE-UP.
TYPICAL CHILLED AND HOT WATER PIPING DRAIN VALVE CONNECTIONS

NOTES:
1. DRAIN ALL LOW POINTS AS INDICATED ABOVE.
2. WHERE SCALE POCKETS ARE SHOWN ON PIPE RISER DIAGRAMS AND/OR PLANS LOCATE DRAIN AT BOTTOM OF SCALE POCKET.

DESIGNER'S NOTE:
SHOW SCALE POCKETS ON MAJOR CIRCULATING WATER PIPING RISER DIAGRAMS AND/OR PLANS.

NOTES:
1. VENT ALL HIGH POINTS INDICATED ABOVE.
2. IF AUTOMATIC AIR VENTS ARE USED, PIPE DISCHARGE TO DRAIN.

DRAIN VALVE AND AIR VENT CONNECTIONS (HYDRONIC SYSTEMS)
DRAIN LINE SHALL BE AT LEAST THE SAME SIZE AS THE NIPPLE ON THE DRAIN PAN. PIPING SHALL BE RIGID COPPER TYPE L OR TYPE M UNLESS NOTE BELOW IS MET.

PITCH DOWN TOWARD DRAIN

CLEAN OUT

FLOOR SINK

NOTE: 1. CPVC PIPE MAY BE USED ONLY IF APPROVED BY LOCAL VA AND IS INDOORS AND DOES NOT PASS THROUGH RATED BARRIERS.
2. DIELECTRIC FITTING TO BE USED WHEN TWO DISSIMILAR METALS ARE TO BE CONNECTED.

UNIT TYPE | A | B
---|---|---
DRAW THRU | 2” [50mm] PLUS X | X
BLOW THRU | 1” [25mm] MINIMUM | 2X

WHERE X = STATIC PRESSURE IN PAN
LONG RADIUS ELBOW (TYPICAL)

PIPE ALIGNMENT GUIDES (TYPICAL)

W + 25 FT. [7.6m]
APPROXIMATE MINIMUM

PLAN

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EXPANSION LOOP DETAIL

NTS

DETAIL TITLE / EXPANSION LOOP DETAIL

SCALE : NONE

DATE ISSUED : DECEMBER 2008 CADD DETAIL NO. : SD232113-09.DWG
SEQUENCE OF OPERATION:
1. STEAM CONTROL VALVE SHALL MODULATE TO MAINTAIN THE LEAVING HOT WATER TEMPERATURE AT SET POINT.
2. THE LEAVING HOT WATER TEMPERATURE SHALL BE RESET INVERSELY WITH THE OUTDOOR TEMPERATURE AS SCHEDULED.
3. THE LEAD AND LAG PUMPS AND HEAT EXCHANGERS SHALL BE SEQUENTIAL BY THE OPERATOR CONTROLS AT THE PRE-DETERMINED INTERVAL (USUALLY 7 DAYS). IN THE EVENT THE PUMP FAILS TO START WITHIN 30 SECONDS, AN ALARM SHALL BE INITIATED AND THE SECOND PUMP SHALL START AUTOMATICALLY.

VALVE SEQUENCE:
1. SUGGESTED VALVE SEQUENCE. DELETE THIS SEQUENCE FROM THIS DETAIL IF SEQUENCE IS SHOWN ON CONTROLS DRAWINGS OR SPECS.

2. V–1 (1/3) MODULATES TO MAINTAIN HW TEMPERATURE AT SETPOINT. WHEN V–1 HAS REACHED FULLY OPEN POSITIONS, V–2 (2/3) STARTS TO MODULATE OPEN.


DUAL HEAT EXCHANGER CONTROLS (HEATING SYSTEM)
SEE SCHEDULES FOR RELIEF VALVE SETTING

RUN DRAIN LINE FROM RELIEF VALVE TO NEAREST FLOOR DRAIN. (TYP.)

DDC TEMPERATURE SENSORS (TYP.)

HWS

DDC PRESSURE SENSORS (TYP.)

HPS STEAM SUPPLY

IF INSTALLED LOWER THAN MAIN HPS LINE, PROVIDE ANOTHER SCALE POCKET/TRAP HERE.

HPR TO FLASH TANK OR TO HPR MAIN LINE (TYP.)

THERMOSTATIC AIR VENT (TYP.)

15mm [1/2"] CHECK VALVE VACUUM BREAKER (TYP.)

BYPASS

TEST PLUG (TYP.)

CONTROL VALVES IN 2/3 & 1/3 SIZE ARRANGEMENT, TYP.

HPR TO FLASH TANK OR TO HPR MAIN LINE (TYP.)

HPS STEAM SUPPLY

IF THE SECOND HEAT EXCHANGER IS NOT A REDUNDANT 100% BACK UP UNIT, THEN PROVIDE A MOTORIZED ISOLATION VALVE HERE.

THEROMETER (TYP.)

HEAT EXCHANGER (TYP.)

SCALE POCKET (TYP.)

NOTES:

1. THE ABOVE DETAIL SHOWS REQUIRED PIPING FOR TWO HEAT EXCHANGERS IN PARALLEL. INDICATE IF 100% REDUNDANT OR NOT.

2. PROVIDE SADDLE SUPPORTS AND LEGS OR HANGERS FOR HEAT EXCHANGER. MOUNTING HEIGHT SHALL BE ADJUSTED TO FACILITATE GRAVITY RETURN OF STEAM CONDENSATE.

3. MAKE THE BYPASS THE SAME SIZE AS THE CONNECTIONS TO THE CONTROL VALVES.

4. CONTROL VALVES SHALL BE IN A 1/2 AND 3/4 SIZE ARRANGEMENT.

HEAT EXCHANGER - STEAM TO HOT WATER

NTS
TERMINAL UNIT WATER COILS - PIPING CONNECTIONS

NTS

DESIGNER’S NOTE:

1. THIS DETAIL IS APPLICABLE TO: 2-PIPE FAN COIL UNITS (CHILLED OR HOT WATER)
   ○ VAV/CV AIR TERMINAL UNITS (REHEAT COIL)
   ○ DUCT-MOUNTED REHEAT COIL
   ○ CABINET UNIT HEATERS
NOTE:

1. PROVIDE IN CHILLED WATER MAIN AND IN CONDENSER WATER MAIN.

2. LOCATE PILOT TUBE TAPS 20 PIPE DIAMETERS DOWNSTREAM AND 10 PIPE DIAMETERS UPSTREAM FROM THE NEAREST PIPE FITTING.

   EITHER TOP OR SIDE LOCATION. BOTH ARE NOT REQUIRED AT SAME LOCATION.

PITOT TEST CONNECTIONS

NOTE:

SHOW LOCATION OF PILOT TEST CONNECTIONS ON FLOOR PLANS FOR CONDENSER WATER PIPING TO COOLING TOWER. THIS IS REQUIRED FOR FLOW MEASUREMENT BY ASME COOLING TOWERS TEST CODE.
EXPANSION TANK

LOW WATER LEVEL ALARM
SEE NOTE NO. 1

RELIEF VALVE

GLYCOL PIPING SYSTEM

PUMP SUCTION

AIR SEPARATOR

QUICK DISCONNECT
3/8" [0.14mm]
150 PSI [1034 kPa]
HOSE ATTACHED
TO 50'-0" [15M]
HOSE REEL

HANDHELD
"ON-OFF" MOTOR
CONTROL—SEE
NOTE NO. 4
CHORD ATTACHED
50'-0" [15M] TO
CORD REEL

3-1/2"x3-1/2"x5/16"
[1.4cmx1.4cmx0.8cm]
STEEL FRAME

ELECTRICAL PLUG
ATTACHED TO 50'-0"
[15M] CORD REEL
GLYCOL-WATER
MAKE-UP PUMP
5 GPM @ 30 PSIG
[18 LPM @ 206 kPa]

3/4" [20mm]
BYPASS

55 GALLON [208L]
GLYCOL-WATER
STORAGE TANK
3-1/2"x3-1/2"x5/16"
[1.4cmx1.4cmx0.8cm]
STEEL FRAME
DOLLY 32"x68"
[12.6cmx26.8cm]

NOTES:
1. PROVIDE LOW WATER LEVEL ALARM. PROVIDE A LOW WATER LEVEL AT ECC. RELIEF VALVE
DRAIN SHALL RETURN TO A 55 GALLON DRUM.

2. SET REGULATING VALVE TO MAINTAIN MAKE-UP PRESSURE AT 15 PSIG [103 kPa] ABOVE
HIGHEST SYSTEM PRV SETTING.

3. MAKE-UP PIPING SYSTEM DOES NOT REQUIRE INSULATION.

4. OPERATE PUMP MANUALLY AS REQUIRED TO FILL.

MOBILE INDIRECT GLYCOL MAKE-UP SYSTEM
(PIPING AND CONTROLS)

DESIGNER'S NOTE:
PLUMBING DRAWINGS SHOULD INCLUDE DOMESTIC COLD-WATER HOSE BIB NEAR THE GLYCOL-
WATER MAKE-UP SYSTEM. FOR SMALL SYSTEMS (50 GAL [200 L] OR LESS) A POT FEEDER,
AT THE HIGH POINT IN THE PIPING, MAY BE USED FOR MAKE-UP IN LIEU OF THE PUMPED
MAKE-UP.
PIPE HANGERS — PROVIDE DOUBLE DEFLECTION NEOPRENE (TYPE HN) FOR FIRST TWO ON EACH SIDE OF PUMP (SEE NOTE NO. 1)

NOTES:
1. SUPPORT PUMP FROM PIPING ONLY. DO NOT SUPPORT PUMP FROM MOTOR.

IN-LINE PUMPS — CONNECTIONS

DESIGNER’S NOTE:
1. CHECK VALVE IS OPTIONAL FOR SINGLE PUMP, EXCEPT FOR COOLING TOWER PUMP.
2. ELIMINATE BALANCING DEVICE WHEN PUMP CONTROLLED BY VARIABLE SPEED DRIVE.
FIRST 3 HANGERS FOR EACH PIPE AND BRANCH SHALL BE SPRING & NEOPRENE TYPE. TYPE "H" FOR 4" [100mm] DIA. PIPE & SMALLER. TYPE "H-P" FOR 5" [125mm] DIA. PIPE & LARGER.

INSTALL HANGER AS CLOSE TO PIPE ELBOW AS POSSIBLE (TYPICAL)

CHECK VALVE

1/2" [15mm]

FLEXIBLE CONNECTOR (TYPICAL)

PUMP

FLOOR

VIBRATION ISOLATOR (TYPICAL)

CONCRETE INERTIA BASE

1" [25mm] MIN. DIA. PIPE STAND

NOTES:
SEE SPECIFICATION SECTION "PUMPS" FOR Y STRAINER OPTION

SINGLE SUCTION FLOOR-MOUNTED PUMPS - CONNECTIONS WITH FLEXIBLE CONNECTORS

DESIGNER'S NOTE:
CHECK VALVE IS OPTIONAL FOR SINGLE PUMP, EXCEPT FOR COOLING TOWER PUMP.
NOTES:
SEE SPECIFICATION SECTION "PUMPS" FOR Y STRAINER OPTION

SINGLE SUCTION FLOOR-MOUNTED PUMPS - CONNECTIONS WITH MECHANICAL COUPLINGS

DESIGNER'S NOTE:
1. CHECK VALVE IS OPTIONAL FOR SINGLE PUMP, EXCEPT FOR COOLING TOWER PUMP. USE THIS DETAIL ONLY FOR PUMPS IN A MECHANICAL BUILDING WHERE POSSIBLE VIBRATION WILL NOT BE OBJECTIONABLE AND WHERE APPROVED BY VA.

2. COUPLINGS SHALL NOT BE USED ON HOT WATER SYSTEMS.