GENERAL HYDRONIC PIPING NOTES:

1. ALL DRAWINGS ARE DIAGRAMMATIC IN NATURE, AND ARE INTENDED TO SHOW THE GENERAL LAYOUT OF SYSTEMS AND EQUIPMENT. THE EXACT LOCATIONS OF EQUIPMENT AND THE FINAL PIPING LAYOUTS ARE THE RESPONSIBILITY OF THE CONTRACTOR, AND SHALL BE FIELD-DETERMINED. COORDINATE WITH THE BUILDING ARCHITECTURE AND STRUCTURE, AND WITH NEW AND EXISTING MECHANICAL AND ELECTRICAL SYSTEMS. WHERE THE LAYOUT DIFFERS SIGNIFICANTLY FROM DESIGN, COORDINATE WITH THE ARCHITECT/ENGINEER. RECORD ALL DIFFERENCES ON RECORD DRAWINGS.
2. PIPING PLANS DO NOT NECESSARILY INDICATE ALL VALVES, GAUGES, UNIONS AND OTHER ACCESSORIES. REFER TO SCHEMATIC DIAGRAMS AND DETAILS FOR ADDITIONAL INFORMATION.
3. INSTALL ALL THERMOSTATS/SPACE TEMPERATURE SENSORS AT 48 INCHES ABOVE FINISHED FLOOR (TO TOP OF SENSOR). WHERE APPLICABLE, ALIGN WITH LIGHT SWITCHES.
4. ALL THERMOSTATS AND SENSORS LOCATED ON EXTERIOR WALLS SHALL HAVE INSULATED BACKPLATES. PACK ALL WALL OPENINGS WITH FIBERGLASS INSULATION.
5. THE CONTRACTOR SHALL EXAMINE THE CONDITION OF ALL EQUIPMENT PRIOR TO INSTALLATION. DO NOT INSTALL DAMAGED EQUIPMENT.
6. INSTALL PIPING IN A MANNER WHICH ENABLES COMPLETE DRAINAGE OF PIPING AND EQUIPMENT, AND COMPLETE ELIMINATION OF AIR POCKETS. MINIMIZE THE NUMBER OF PIPE RISES AND DROPS. FURNISH AND INSTALL DRAIN VALVES WITH CAPS AT ALL LOW POINTS IN PIPING. FURNISH AND INSTALL MANUAL AIR VENTS AT ALL HIGH POINTS IN PIPING.
7. REFER TO ARCHITECTURAL CODE COMPLIANCE PLANS FOR THE LOCATIONS OF FIRE/SMOKE RATED ASSEMBLIES.
8. REFER TO SPECIFICATION 23 21 13 FOR THE REQUIREMENTS FOR PIPE PENETRATIONS THROUGH BUILDING ASSEMBLIES.
9. WHERE POSSIBLE, INSTALL VALVES, EQUIPMENT AND DEVICES REQUIRING SERVICE OR MAINTENANCE IN ACCESSIBLE LOCATIONS. WHERE NOT POSSIBLE, PROVIDE ACCESS DOORS, SIZED SUITABLY FOR THE REQUIRED PURPOSE. COORDINATE ACCESS DOOR LOCATIONS AND SIZES WITH THE ARCHITECT/ENGINEER.
10. INSTALL VALVES WITH HANDLES ON TOP OR SIDE.
11. PROVIDE MANUFACTURERS' RECOMMENDED CLEARANCES FOR AIR FLOW, ELECTRICAL AND MAINTENANCE AROUND EQUIPMENT. WHERE CLEARANCES ARE ALSO SHOWN ON THE DRAWINGS, PROVIDE THE MORE STRINGENT OF THE REQUIRED CLEARANCES.
12. PROVIDE OVERSIZED PIPE HANGERS ON ALL INSULATED HOT AND COLD PIPING. REFER TO SPECIFICATION 23 07 19.

GENERAL HVAC NOTES:

1. ALL DRAWINGS ARE DIAGRAMMATIC IN NATURE, AND ARE INTENDED TO SHOW THE GENERAL LAYOUT OF SYSTEMS AND EQUIPMENT. THE EXACT LOCATIONS OF EQUIPMENT AND THE FINAL DUCTWORK LAYOUTS ARE THE RESPONSIBILITY OF THE CONTRACTOR, AND SHALL BE FIELD-DETERMINED. COORDINATE WITH THE BUILDING ARCHITECTURE AND STRUCTURE, AND WITH NEW AND EXISTING MECHANICAL AND ELECTRICAL SYSTEMS. WHERE THE LAYOUT DIFFERS SIGNIFICANTLY FROM DESIGN, COORDINATE WITH THE ARCHITECT/ENGINEER. RECORD ALL DIFFERENCES ON RECORD DRAWINGS.
2. COORDINATE LOCATIONS OF REGISTERS, DIFFUSERS AND GRILLES WITH THE REFLECTED CEILING PLANS. COORDINATE ANY DISCREPANCIES WITH THE ARCHITECT/ENGINEER PRIOR TO INSTALLATION.
3. INSTALL ALL THERMOSTATS/SPACE TEMPERATURE SENSORS AT 48 INCHES ABOVE FINISHED FLOOR (TO TOP OF SENSOR). WHERE APPLICABLE, ALIGN WITH LIGHT SWITCHES.
4. ALL THERMOSTATS AND SENSORS LOCATED ON EXTERIOR WALLS SHALL HAVE INSULATED BACKPLATES.
5. WHERE INTERNALLY LINED OR DOUBLE-WALL DUCTWORK IS SHOWN, THE DIMENSIONS SHOWN INDICATE THE REQUIRED INSIDE FREE AREA DIMENSIONS.
6. THE CONTRACTOR SHALL EXAMINE THE CONDITION OF ALL EQUIPMENT PRIOR TO INSTALLATION. DO NOT INSTALL DAMAGED EQUIPMENT.
7. WHERE CONNECTING NEW DUCTWORK TO EXISTING, SEAL JOINTS AIRTIGHT AND REPAIR DAMAGED INSULATION TO MATCH NEW.
8. WHERE DUCTWORK IS EXPOSED, ROUTE AS HIGH AS PRACTICAL IN THE SPACE UNLESS INDICATED OTHERWISE.
9. REFER TO ARCHITECTURAL CODE COMPLIANCE PLANS FOR THE LOCATIONS OF FIRE/SMOKE RATED ASSEMBLIES.
10. PAINT VISIBLE INTERIOR SURFACES OF DUCTS AT REGISTERS, GRILLES, DIFFUSERS AND LOUVERS FLAT BLACK.
11. WHERE POSSIBLE, INSTALL EQUIPMENT AND DEVICES REQURING SERVICE OR MAINTENANCE IN ACCESSIBLE LOCATIONS. WHERE NOT POSSIBLE, PROVIDE ACCESS DOORS, SIZED SUITABLY FOR THE REQUIRED PURPOSE. COORDINATE ACCESS DOOR LOCATIONS AND SIZES WITH THE ARCHITECT/ENGINEER.
12. PROVIDE MANUFACTURERS' RECOMMENDED CLEARANCES FOR AIR FLOW, ELECTRICAL AND MAINTENANCE AROUND EQUIPMENT. WHERE CLEARANCES ARE ALSO SHOWN ON THE DRAWINGS, PROVIDE THE MORE STRINGENT OF THE REQUIRED CLEARANCES.
13. FLEXIBLE DUCTWORK CONNECTIONS TO RIGID DUCTWORK, TO AIR TERMINAL UNITS AND TO REGISTERS, GRILLES AND DIFFUSERS SHALL BE CLAMPED AND TAPED. ROUND CONNECTIONS SHALL HAVE VINYL DRAWBANDS AND TAPE. TAPE SHALL MEET THE REQUIREMENTS OF U.L. 181B-FX.

GENERAL INSTRUMENT SYMBOLS

	LOCAL DEVICE
TR / AL	BMS CONTROL POINT / FUNCTION (TR - TREND) (AL - ALARM)
	AVERAGING TEMPERATURE ELEMENT
	AIR FLOW TRANSMITTER
	OPPOSED BLADE DAMPER
	PARALLEL BLADE DAMPER
	BLADE DAMPER
C C	AIR COIL
	FAN
FILTERS	FILTER
	PUMP

LOCAL DEVICE ABBREVIATIONS

CO2	CARBON DIOXIDE LEVEL TRANSMITTER
CO	CARBON MONOXIDE LEVEL TRANSMITTER
ECM	ELECTRICALLY COMMUTATED MOTOR
FSH	FLOW SWITCH HIGH
FSL	FLOW SWITCH LOW
FT	FLOW TRANSMITTER
GCV	GAS CONTROL VALVE
HS	HAND SWITCH (HAND-OFF-AUTO)
HT	HUMIDITY TRANSMITTER
HTG	HEATING ELEMENT
KC	TIME CLOCK CONTROLLING EQPM SCHEDULE
LSL	LEVEL SWITCH LOW
LSH	LEVEL SWITCH HIGH
LT	LEVEL TRANSMITTER
M	MOTOR
MD	MOTORIZED CONTROL DAMPER
OCC	OCCUPANCY SENSOR
PDT	PRESSURE DIFFERENTIAL TRANSMITTER
PDS	PRESSURE DIFFERENTIAL SWITCH
PKG	PACKAGED EQUIPMENT CONTROLLER
PSH	PRESSURE SWITCH HIGH
PSL	PRESSURE SWITCH LOW
PT	PRESSURE TRANSMITTER
SD	SMOKE DETECTOR
SNW	SNOW/ICE SENSOR
TCV	TEMPERATURE CONTROL VALVE
TSL	TEMPERATURE SWITCH LOW (FREEZESTAT)
TSH	TEMPERATURE SWITCH HIGH
TT	TEMPERATURE TRANSMITTER
VCC	VARIABLE CAPACITY COMPRESSOR
VFD	VARIABLE FREQUENCY DRIVE

BMS POINT ABBREVIATIONS

AL	GENERAL ALARM / ALARM LOW LIMIT
AI	ANALOG INPUT
AO	ANALOG OUTPUT
CC	EQUIPMENT CAPACITY SIGNAL
CO2	CARBON DIOXIDE LEVEL
CO	CARBON MONOXIDE LEVEL
DI	DIGITAL INPUT
DO	DIGITAL OUTPUT
EN	EQUIPMENT ENABLE
FI	FLOW INDICATE
HI	HUMIDITY INDICATE
LI	LEVEL INDICATE
NO2	NITROGEN DIOXIDE LEVEL
O/C	OPEN/CLOSE (2-POS DAMPER OR VALVE)
OI	OCCUPIED/UNOCCUPIED INDICATE
PC	POSITION CONTROL (MODULATING DAMPER OR VALVE)
PI	PRESSURE INDICATE
SC	SPEED CONTROL
SD	SMOKE DETECTOR
SI	STATUS INDICATE
SNWI	SNOW/ICE INDICATE
S/S	START/STOP
STPT	SETPOINT SIGNAL
TI	TEMPERATURE INDICATE
ZI	POSITION INDICATE

MECHANICAL LINE SERVICE DESIGNATIONS

BFW	BOILER FEED WATER
CDGR	CONDENSER GLYCOL RETURN
CDGS	CONDENSER GLYCOL SUPPLY
CHGR	CHILLED GLYCOL RETURN
CHGS	CHILLED GLYCOL SUPPLY
CHWR	CHILLED WATER RETURN
CHWS	CHILLED WATER SUPPLY
CTWR	COOLING TOWER WATER RETURN
CTWS	COOLING TOWER WATER SUPPLY
G	NATURAL GAS
GTWR	GEOTHERMAL WATER RETURN
GTWS	GEOTHERMAL WATER SUPPLY
HGR	HOT GLYCOL RETURN
HGS	HOT GLYCOL SUPPLY
HPCR	HIGH PRESSURE CONDENSATE RETURN
HPS	HIGH PRESSURE STEAM
HPWR	HEAT PUMP WATER RETURN
HPWS	HEAT PUMP WATER SUPPLY
HWR	HOT WATER RETURN (HEATING)
HWS	HOT WATER SUPPLY (HEATING)
LPS	LOW PRESSURE STEAM
LPCR	LOW PRESSURE CONDENSATE RETURN
MPS	MEDIUM PRESSURE STEAM
MPCR	MEDIUM PRESSURE CONDENSATE RETURN
RWR	RADIANT WATER RETURN
RWS	RADIANT WATER SUPPLY
SPWR	SWIMMING POOL WATER RETURN
SPWS	SWIMMING POOL WATER SUPPLY
SMR	SNOWMELT RETURN
SMS	SNOWMELT SUPPLY
PCR	PUMPED CONDENSATE RETURN
V	VENT

MECHANICAL ABBREVIATIONS

AFF	ABOVE FINISHED FLOOR
AHU	AIR HANDLING UNIT
BOD	BOTTOM OF DUCT
BOG	BOTTOM OF GRILLE
BOP	BOTTOM OF PIPE
BOS	BOTTOM OF STRUCTURE
CH	CABINET HEATER
CLG	CEILING
CO	CLEAN-OUT
CONN	CONNECTION
CONT	CONTINUATION
CONV	CONVECTOR
DN	DOWN
DWG	DRAWING
EA	EXHAUST AIR
EF	EXHAUST FAN
ETR	EXISTING TO REMAIN
ET	EXPANSION TANK
ERU	ENERGY RECOVERY UNIT
EX.	EXISTING
FLR	FLOOR
MAU	MAKE-UP AIR UNIT
MFR	MANUFACTURER
MAX	MAXIMUM
MIN	MINIMUM
OA	OUTSIDE AIR
RA	RETURN AIR
RTU	ROOF TOP UNIT
SA	SUPPLY AIR
SPECS.	SPECIFICATIONS
TOD	TOP OF DUCT
TOG	TOP OF GRILLE
TOP	TOP OF PIPE
TOS	TOP OF STRUCTURE
TYP	TYPICAL
UH	UNIT HEATER
UNO	UNLESS NOTED OTHERWISE
VD	VOLUME DAMPER
VTR	VENT THRU ROOF

HVAC SYMBOLS

T S	THERMOSTAT / SENSOR
T R	RADIANT FLOOR THERMOSTAT
H	HUMIDISTAT
CO_2	CARBON DIOXIDE SENSOR
	PARALLEL BLADE DAMPER
	OPPOSED BLADE DAMPER
M	MOTOR OPERATED DAMPER
	VOLUME DAMPER
	FIRE DAMPER (THRU FLOOR)
	FIRE DAMPER (THRU WALL)
S	SMOKE DAMPER (THRU FLOOR)
S	SMOKE DAMPER (THRU WALL)
FS	COMBINATION FIRE/SMOKE DAMPER (THRU FLOOR)
FS	COMBINATION FIRE/SMOKE DAMPER (THRU WALL)
SD	DUCT SMOKE DETECTOR
	CONNECT TO EXISTING

HVAC SHEETMETAL SYMBOLS

	DUCTWORK / DIFFUSER DEMOLITION
OR	MITERED ELBOW (RECTANGULAR, ROUND & OVAL) TURNING VANES REQUIRED PER SPECIFICATIONS
	RECTANGULAR DUCTWORK RISE
	RECTANGULAR DUCTWORK DROP
	ROUND DUCTWORK RISE
	ROUND DUCTWORK DROP
X"xY" SA	RECTANGULAR DUCTWORK
X"ø SA	ROUND DUCTWORK
X"xY"ø SA	OVAL DUCTWORK
X"xY" LINED SA	LINED RECTANGULAR DUCTWORK
R	DUCTWORK RISE SYMBOL
D	DUCTWORK DROP SYMBOL
	FLEXIBLE DUCTWORK (SUPPLY)
	SUPPLY DIFFUSER (S-X)
	RETURN GRILLE (R-X)
	EXHAUST GRILLE (E-X)
	LINEAR SLOT DIFFUSER (S-X)
	SIDEWALL DIFFUSER OR GRILLE
	RECTANGULAR OR ROUND MANUAL DAMPER
M	RECTANGULAR OR ROUND MOTORIZED DAMPER
FS	RECTANGULAR OR ROUND FIRE / SMOKE DAMPER
	RECTANGULAR OR ROUND FIRE DAMPER
	VAV TERMINAL BOX

PIPING & INSTR. SYMBOLS

	ECCENTRIC REDUCER
	CONCENTRIC REDUCER
T	GENERAL / THERMODYNAMIC TRAP
T	INVENTED BUCKET TRAP
SD	SUCTION DIFFUSER
	UNION
	FLEXIBLE CONNECTOR
	CAP
	BLIND FLANGE
"Y"	"Y" STRAINER W/ BLOWDOWN
	AIR VENT
F	COMPRESSED AIR COMB. FILTER, REG. & OILER
FS	FLOW SWITCH
PS	PRESSURE SWITCH
PT	PRESSURE TAP
TW	THERMOWELL
PI	PRESSURE GAUGE & SHUT OFF
PI	PRESSURE GAUGE W/ SIPHON
TI	THERMOMETER
	EMERGENCY EYE WASH / SHOWER
	ANCHOR
	GUIDE
T	FLOAT & THERMOSTATIC TRAP

VALVE SYMBOLS

	GATE VALVE
	BALL VALVE
	GLOBE VALVE
	BUTTERFLY VALVE
	CHECK VALVE
	SWING CHECK VALVE
	TRIPLE-DUTY VALVE
	PLUG VALVE
	DIAPHRAGM VALVE
	NEEDLE VALVE
	ANGLE VALVE
	PRESSURE REDUCING VALVE, SELF-CONTAINED
	EXT. PRESSURE REDUCING VALVE
	RELIEF / SAFETY VALVE
	HOSE BIBB
S	SOLENOID VALVE
	CALIBRATED BALANCING VALVE
	TEMPERATURE CONTROL VALVE
	CONTROL VALVE, 3-WAY
	BACKFLOW PREVENTER WITH DRIP PAN
	CONNECT TO EXISTING
	INDICATES VALVE IS FLANGED (TYP)

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PRELIMINARY NOT FOR CONSTRUCTION

NEW ELEMENTARY SCHOOL

LUDINGTON AREA SCHOOLS

LUDINGTON, MICHIGAN

ISSUANCES

11.01.2019 SCHEMATIC DESIGN

DRAWN BBH
REVIEWED JRR

PROJECT NO. 5-4960

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MECHANICAL GENERAL INFORMATION

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1 GENERAL

1.1 SCOPE OF WORK

A. The HVAC system scope of work shall be as follows:

1. Cooling system: Cooling for the air handling equipment shall be provided by (1) air cooled chiller (approx 375 tons). A chilled water/glycol distribution piping system shall be install as necessary to serve all areas. A main distribution and backup pump shall be installed with VFDs.
2. Heating system: Heating for the air handling equipment shall be provided by (2) high efficiency condensing boilers. A hot water distribution piping system shall be install as necessary to serve all areas. A main distribution and backup pump shall be installed with VFDs.
3. Classrooms: Heating, air conditioning and ventilation of the classrooms in these areas shall be provided by variable air volume, vertical unit ventilators. The unit ventilators will be typically installed in the corner of the classroom. The unit ventilator shall be provided with a chilled water cooling coil and hot water heating coil. The unit ventilator shall serve a new supply ductwork distribution system and associated supply diffusers. Relief fans that are factory mounted in the unit ventilators shall be utilized for space pressurization control.
4. Gym and cafeteria: Heating, air conditioning and ventilation of these areas shall be provided by single zone variable air volume, indoor central station air handling units. The HVAC system shall include new supply and return air ductwork, diffusers and grilles. The units shall have hot water heating and chilled water/glycol cooling coils.
5. VAV Air handling units: Heating, air conditioning and ventilation of these areas shall be provided by a multiple zone variable air volume, indoor central station air handling unit. The HVAC system shall include new supply and return air ductwork, VAV boxes, diffusers and grilles. The unit shall have hot water heating and chilled water/glycol cooling coils.
6. Miscellaneous Areas: Exhaust only areas including toilet rooms, storage rooms and janitor's closets shall be exhausted by new inline or roof mounted exhaust fans with EC motors, new ductwork and grilles. Corridors shall be served by individual constant volume fan/blower coil units with hot water heating and chilled water/glycol cooling coils. Electrical or IT rooms requiring cooling shall be served by wall mounted DX split system units with condensing units mounted on the roof.
7. Cabinet unit heaters shall be utilized to provide auxiliary heat for entrance vestibules and stairwells.
8. A new BMS/ATC system shall be installed to operate the HVAC equipment.

1.2 SECTION INCLUDES

A. HVAC: Artificial means of maintaining interior space comfort and air quality, including heating, cooling, ventilation, and energy supply.
B. The HVAC system consists of the following elements used to maintain occupant comfort:
1. Energy Supply: Elements which provide energy.
2. Heat Generation: Elements required to heat the building.
a. Heat generation elements comprise of the existing boiler plant.
3. Refrigeration: Elements necessary to generate the cooling required.
a. Refrigeration elements comprise of a roof mounted air cooled chiller.
4. Air Distribution and Hydronic Distribution: Elements required to supply, return, and exhaust air associated with heating or cooling the building and required to distribute water and other liquids for heating or cooling.
5. Refrigerant Distribution: Elements required to distribute refrigerant for heating or cooling.
6. HVAC Controls: Elements required to monitor and control HVAC equipment and systems.
7. Smoke Control Systems: Elements required to control smoke in the event of a fire and to remove smoke after the fire is extinguished.
8. Energy Recovery Equipment.
9. Other HVAC elements required to maintain occupant comfort.
C. Products: Where specific products are required or allowed, use products complying with the additional requirements specified elsewhere.

1.3 REFERENCED STANDARDS

A. AABC MN-1 - AABC National Standards for Total System Balance; 2002
B. AMCA 210 - Laboratory Methods of Testing Fans for Aerodynamic Performance Rating; 2007 (ANSI/AMCA 210, same as ANSI/ASHRAE 51).
C. ANSI S1.4 - American National Standard Specification for Sound Level Meters; 1983 (R2006) with Amd.S1.4A-1985.
D. AHRI 210/240 - Standard for Performance Rating of Unitary Air-Conditioning and Air-Source Heat Pump Equipment; 2008.
E. AHRI 310/380 - Packaged Terminal Air-Conditioners and Heat Pumps; 2004.
F. AHRI 340/360 - Performance Rating of Commercial and Industrial Unitary Air-Conditioning and Heat Pump Equipment; 2007.
G. AHRI 880 - Air Terminals; 2008.
H. ASHRAE (HVACA) - ASHRAE Handbook - HVAC Applications; 2011
I. ASHRAE Std 15 - Safety Standard for Refrigeration Systems; 2010 (ANSI/ASHRAE Std 15)..
J. ASHRAE Std 52.2 - Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size; 2007.
K. ASHRAE Std 55 - Thermal Environmental Conditions for Human Occupancy; 2004.
L. ASHRAE Std 62.1 - Ventilation For Acceptable Indoor Air Quality; 2007 (errata 2008) .
M. SMACNA (DCS) - HVAC Duct Construction Standards; 2005.
N. ASHRAE/IESNA 90.1-2015. Energy Standard.
O. Michigan Plumbing Code 2015.
P. Michigan Mechanical Code 2015.
Q. International Fuel Gas Code 2015.

2 PRODUCTS

2.1 HVAC EQUIPMENT

A. Indoor Modular Air Handling Units
1. Units shall be modular construction, designed for indoor installation. Unit modules may be factory or field assembled, as project conditions warrant. Unit modules shall be 2-inch double-wall construction, with solid galvanized steel exterior walls and inner liners. Units shall include factory base rails, and shall include hinged access doors in all sections requiring periodic maintenance.
2. Approved Manufacturers:
a. Trane Performance Series
b. JCI/York Solution
c. Daikin/McQuay Vision
B. Blower Coil Units
1. Units shall be single-wall construction with 1" foil-faced insulation. Concealed horizontal units above ceilings shall have a contractor-furnished auxiliary drain pans. Units shall have hot water heating coils, chilled water cooling coils and 2" pleated MERV 8 filters.
2. Approved Manufacturers:
a. Trane
b. JCI/York
c. Daikin/McQuay
C. Fan Coil Units
1. Concealed units above ceilings shall have a contractor-furnished auxiliary drain pans.
2. Approved Manufacturers:
a. Trane
b. Daikin/McQuay
c. JCI/York
D. Unit Ventilators (Vertical)
1. Unit configuration shall be front return air grille, back outside air, top supply air. Each unit shall have an insulated rear plenum/factory base/factory top extension/factory discharge plenum. Unit cabinets shall be 18 gauge steel, with a standard textured baked enamel finish. Unit cabinets shall be fully lined with 1" glass fiber, coated on the air side. Units shall have two hinged doors, operable with 1/4 turn camlocks. Supply fans shall be in a draw-through configuration, and shall have EC motors with fully adjustable fan speeds. Electrical connections shall be single-point. Units shall have hot water heating coils and chilled water cooling coils.
2. Approved Manufacturers:
a. Change Air
b. Airdale Sentinel
c. Temspec, Inc.
E. Variable Air Volume Boxes with Reheat
1. Units shall be pressure-independent, with factory air flow sensors and low voltage electric damper actuators. Controllers shall provided by the BMS/ATC Contractor. Unit casings shall be minimum 22-gauge galvanized steel, with a 1" foil-faced liner. Dampers shall be single blade, galvanized steel. Hot water heating coils shall have copper tubes and aluminum fins. Units shall be selected for an overall pressure drop not to exceed 0.35" w.c. including heating coils.
2. Approved Manufacturers:
a. Trane
b. Titus
c. Price

2.2 AIR DISTRIBUTION

A. Ductwork
1. Use one or more of the following:
a. Galvanized sheet metal duct.
b. Ductwork shall meet SMACNA standards for weight and construction.
c. Manufacturers (round and flat oval ductwork):
(1) Metal-Fab, Inc.
(2) SEMCO Incorporated.
(3) United McGill Corporation.
(4) Eastern Sheet Metal.
(5) R.W. LaPine.
(6) Franklin Holwerda Company.
(7) Universal Spiral Air.
d. Flexible duct.
(1) Manufacturers:
(a) Thermaflex.
(b) Atco .
(c) Flexmaster USA.
(d) Hart & Cooley.
B. Diffusers, Registers, and Grilles:
1. Use one or more of the following:
a. Steel diffusers.
b. Manufacturers:
(1) Krueger.
(2) Price Industries.
(3) Titus.
(4) Anemostat.
(5) Nailor Industries, Inc.
C. Louvers:
1. Use one or more of the following:
a. Aluminum
b. Manufacturers:
(1) Ruskin Company.
(2) American Warming and Ventilating.
(3) Dowco.
(4) Greenheck.
(5) Construction Specialties, Inc.
D. Exhaust Fans and Relief/Intake Hoods:
a. Manufacturers:
(1) Greenheck
(2) Loren Cook Company
(3) PennBarry
(4) Twin City Fan & Blower Company
(5) Acme
E. Air Filters:
1. Use one or more of the following:
a. Pleated panel filters.
b. Manufacturers:
(1) American Air Filter
(2) Camfil Farr
(3) Flanders PrecisionAire

2.3 HYDRONIC DISTRIBUTION

A. Heating and Cooling Water Distribution Piping:
1. Use one or more of the following:
a. Pipes 2-1/2 Inches (63.5 mm) in Diameter and Smaller:
(1) Schedule 40, continuous welded steel pipe with threaded Class 125 cast iron fittings.
(2) Hard copper, Type L with brazed or silver soldered wrought copper fittings.
b. Pipes Larger than 3 Inches (76.2 mm) in Diameter:
(1) Schedule 40, electric resistance welded pipe.
(2) Joints and Fittings:
(a) Welded Class Standard wrought steel fittings.
(b) Flanged Class 150 wrought steel fittings (4" and larger).
(c) Flanged Class 125 fittings (3" and smaller).
(d) Grooved ductile iron fittings.

2.4 HVAC CONTROLS

A. Design Philosophy:
1. New Systems should be Direct Digital Control, web access based.
2. Where existing systems must be addressed evaluate the status of the existing system regarding its status relative to current technology and extend the existing system.
B. Description:
1. New BMS/ATC system shall consist of a high-speed, peer-to-peer network of DDC controllers, a control system server, and/or an operator workstation.
2. The control system server and/or operator workstation shall provide for overall system supervision and configuration, graphical user interface, management report generation, and alarm annunciation.
3. System software shall be based on a server/thin-client architecture, designed around the open standards of web technology. The control system server shall be accessed using a web browser over the control system network, the Owner's local area network, and remotely over the Internet (through the Owner's LAN).
4. The intent of the thin-client architecture is to provide operators complete access to the control system via a web browser. No special software other than a web browser shall be required to access graphics, point displays, and trends, configure trends, configure points and controllers, or to edit programming, with the proper password.
5. Owner shall provide internet access.
6. System shall be based on open integrated building technology that is non proprietary.
7. System shall be furnished and installed with the capability of both Bacnet and LonTalk/LonWorks/LonMark protocol and be able to handle additional protocols (e.g. ModBus), with no degradation of the two primary protocols.
C. Intent is to use packaged controls by equipment manufacturers where appropriate and interface the monitoring and fundamental control with them, and use total DDC where appropriate such as with control of air handling units or pumps.
D. System shall have an operator workstation with graphics for system monitoring and control. Computers, software, graphics, and communication software shall be provided by the BMS/ATC Contractor (Note: Telephone and data lines shall be by others). Location of workstation shall be coordinated with the Owner.
E. Provide sufficient interface and communications hardware and software to allow access to the BMS/ATC system using the owner's existing LAN/WAN.
F. Communication to/from the system must be available using internet/web browser capability, including the ability to contact the appropriate personnel following an alarm condition via email, land line phone or cellular phone as defined by the Owner.
G. The systems must be able to function from a direct connection at the dedicated BMS computer and still be controlled if the main servers for the owner are down and internet web access is not available.

3 DESIGN CRITERIA

3.1 BASIC FUNCTION

A. Provide natural and artificial means of controlling temperature, relative humidity, velocity and direction of air motion in the interior spaces enclosed by the shell, and reduction of airborne odors, particulates, and contaminant gases.
1. Entering Heating Water Temperature: 140 degrees F.
a. Heating Water Reset: Reset temperature based on outside air temperature or demand based (based on valve position).
2. Leaving Heating Water Temperature: 110 degrees F.
3. Cooling Leaving Air Temperature: 55 degrees F.
4. Heating Leaving Air Temperature: 95 degrees F.
5. Weather Information: Based on Grand Rapids outdoor design conditions.
a. Outdoor design conditions: Summer: 89.3°F DB / 73.4°F WB / Winter: 0.3°F
b. Heating – ASHRAE 99.6% winter heating design conditions, 0.3°F
c. Cooling – ASHRAE 0.4% summer cooling design conditions, 89.3°F DB / 73.4°F WB
B. Provide the necessary equipment and infrastructure to deliver heat to the conditioned spaces.
C. Distribute air to maintain the required space conditions.
D. Distribute heating and cooling water to maintain the required space conditions.
E. Provide the elements necessary to control the building's indoor environment.
1. Provide a building control system which controls the indoor environment, manages energy consumption, schedules preventative maintenance, controls interior lighting, controls exterior lighting, integrates fire alarm and security functions, monitors fuel consumption, monitors water usage, and monitors packaged equipment controls.
a. Provide a sensor for each zone to maintain the required space conditions.
2. Zoning and Space Temperature Control:
a. Dedicated terminal unit and thermostat for each separated space.
F. Provide monitoring of all major pieces of HVAC equipment.
G. Substantiation:
1. Report conforming to the requirements of AABC Test & Balance Procedures.
2. Testing, adjusting, and balancing report indicating initial airflow, final airflow, initial temperature, and final temperature of each conditioned space. Measurement of parameters during summer when the outside air temperature is within 10 percent of the summer design conditions and during the winter when the outside air temperature is within 10 percent of the winter design conditions.
3. Commissioning: Construction and closeout and functional performance testing.

3.2 AMENITY AND COMFORT CRITERIA

A. Space Temperature Control: Coordination of air distribution system's design and installation with zoning and space temperature requirements.
1. Maintain winter effective temperature as defined by ASHRAE Std 55 between 68 degrees F (20 degrees C) and 74 degrees F (23.5 degrees C) with a design setpoint of 69 deg. F.
2. Maintain summer effective temperature as defined by ASHRAE Std 55 between 73 degrees F (23 degrees C) and 79 degrees F (26 degrees C) with a design setpoint of 75 deg. F.
B. Air Movement:
1. Provide an air distribution system that limits the air velocity to 50 fpm terminal velocity (occupied zone for low activity spaces), maximum.
2. Adjustments: Provide an air distribution system which allows relocating supply diffusers, adjusting direction of airflow from supply diffusers, adjusting dampers, and changing the thermostat setpoint.
C. Acoustical Performance:
1. Air Distribution Background Noise: Provide systems which comply with the acoustical requirements as defined in ASHRAE HVAC Applications Handbook. The intent is to not exceed the sound pressure level for any octave band at the specified NC.
a. Meeting Rooms: 25-35.
b. Halls, Corridors, and Lobbies: 35-45.
c. Private Offices: 25-35.
d. Conference Rooms: 25-35.
e. Teleconference Rooms: 25, maximum.
f. Open Plan Offices: 30-40.
g. Classrooms: 40, maximum.
h. Libraries: 30-40.
D. Indoor Air Quality: Provide sufficient ventilation to obtain acceptable indoor quality, determined using the Ventilation Rate Procedure of ASHRAE 62.1. Do not go below the following exhaust rates for the listed spaces:
1. Toilet rooms: 12 air changes per hour.
2. Storage rooms: 6 air changes per hour.
E. Cleanliness:
1. Provide filtration of the air distributed to the occupied spaces.
2. Filter Efficiency: MERV 8, minimum, in accordance with ASHRAE 52.2.

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MECHANICAL DESIGN NARRATIVE

M0.02

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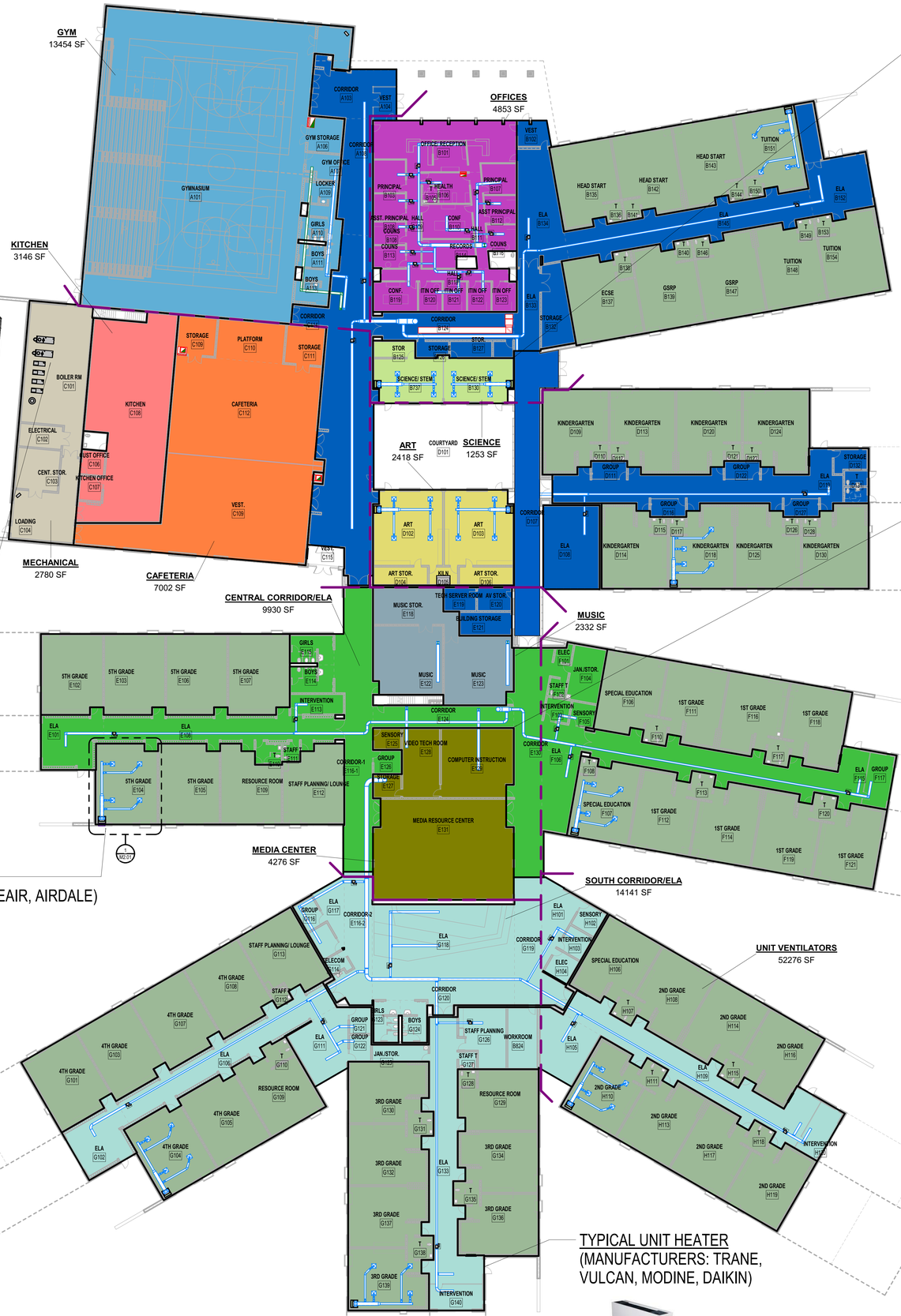
TYPICAL BASE MOUNTED PUMP
(MANUFACTURERS: B&G, TACO, ARMSTRONG)

AIR COOLED CHILLER (APPROX. 375 TONS)
(MANUFACTURERS: TRANE, DAIKIN, YORK)

CONDENSING BOILER
(MANUFACTURERS: FULTON, AERCO, LOCHINVAR)

size system for 3 boilers for additional backup

TYPICAL UNIT VENTILATOR
(MANUFACTURERS: CHANGEAIR, AIRDALE)

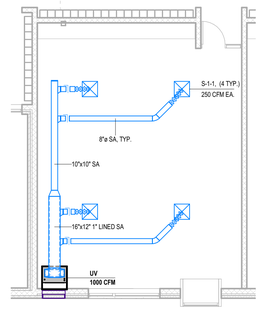


TYPICAL UNIT HEATER
(MANUFACTURERS: TRANE, VULCAN, MODINE, DAIKIN)

TYPICAL ENERGY RECOVERY UNIT - SCIENCE, ART AND KITCHEN ZONES
(MANUFACTURERS: TRANE, AAON)

TYPICAL VAV BOX
(MANUFACTURERS: TRANE, TITUS, DAIKIN, PRICE)

TYPICAL AIR HANDLING UNIT - CAFETERIA, CORRIDOR/ELA, GYM, MEDIA CENTER, MUSIC AND OFFICE ZONES
(MANUFACTURERS: TRANE, DAIKIN, YORK)



1 M2.01 TYPICAL CLASSROOM HVAC PLAN
1/8" = 1'-0"

- ART
- CAFETERIA
- CENTRAL CORRIDOR/ELA
- GYM
- KITCHEN
- MECHANICAL
- MEDIA CENTER
- MUSIC
- NORTH CORRIDOR/ELA
- OFFICES
- SCIENCE
- SOUTH CORRIDOR/ELA
- UNIT VENTILATORS

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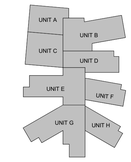
OVERALL FIRST FLOOR HVAC PLAN
3/64" = 1'-0"



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FIRST FLOOR HVAC PLAN

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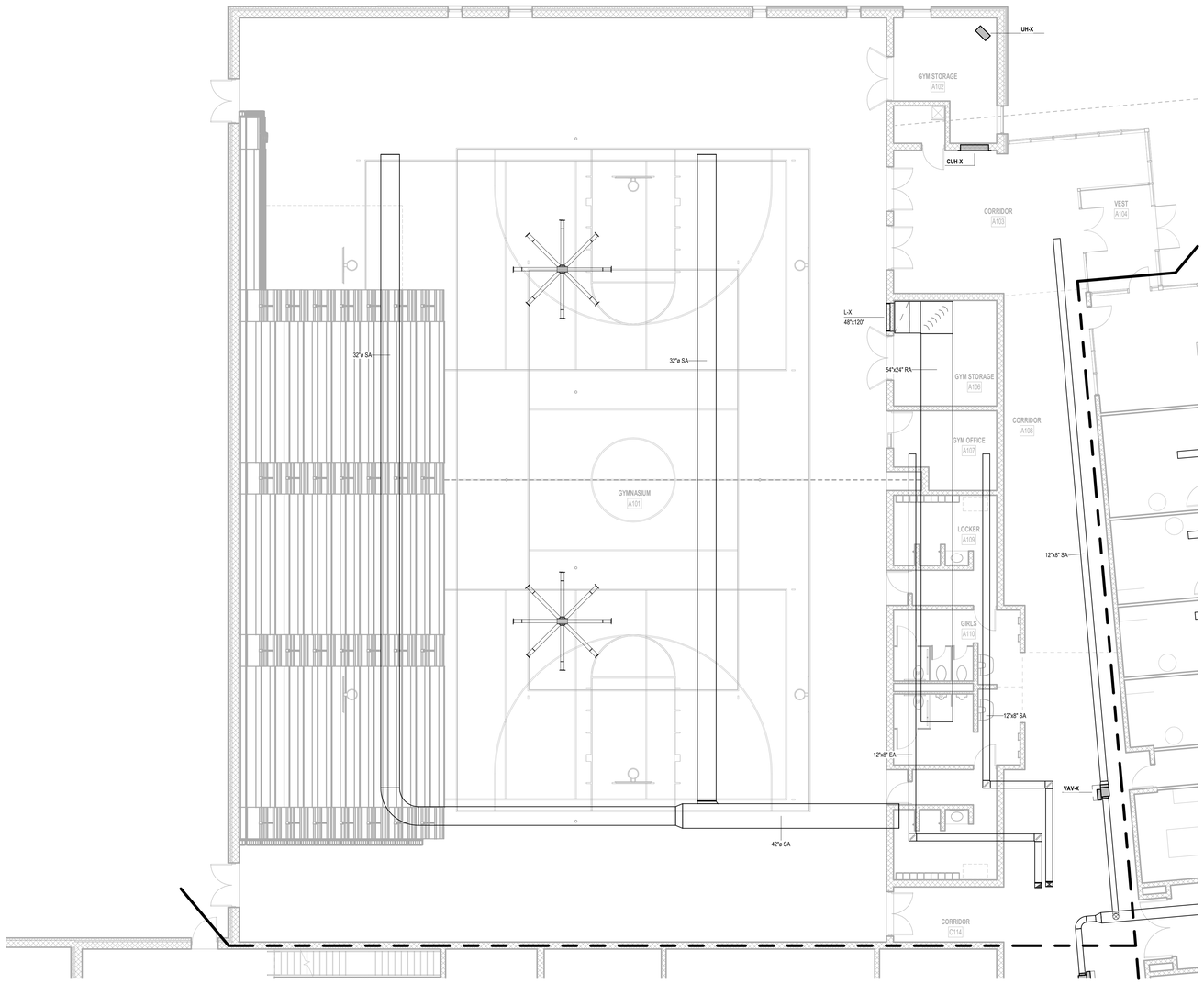
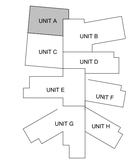


UNIT 'A' FIRST FLOOR HVAC PLAN
1/8" = 1'-0"



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UNIT 'A' FIRST FLOOR HVAC PLAN

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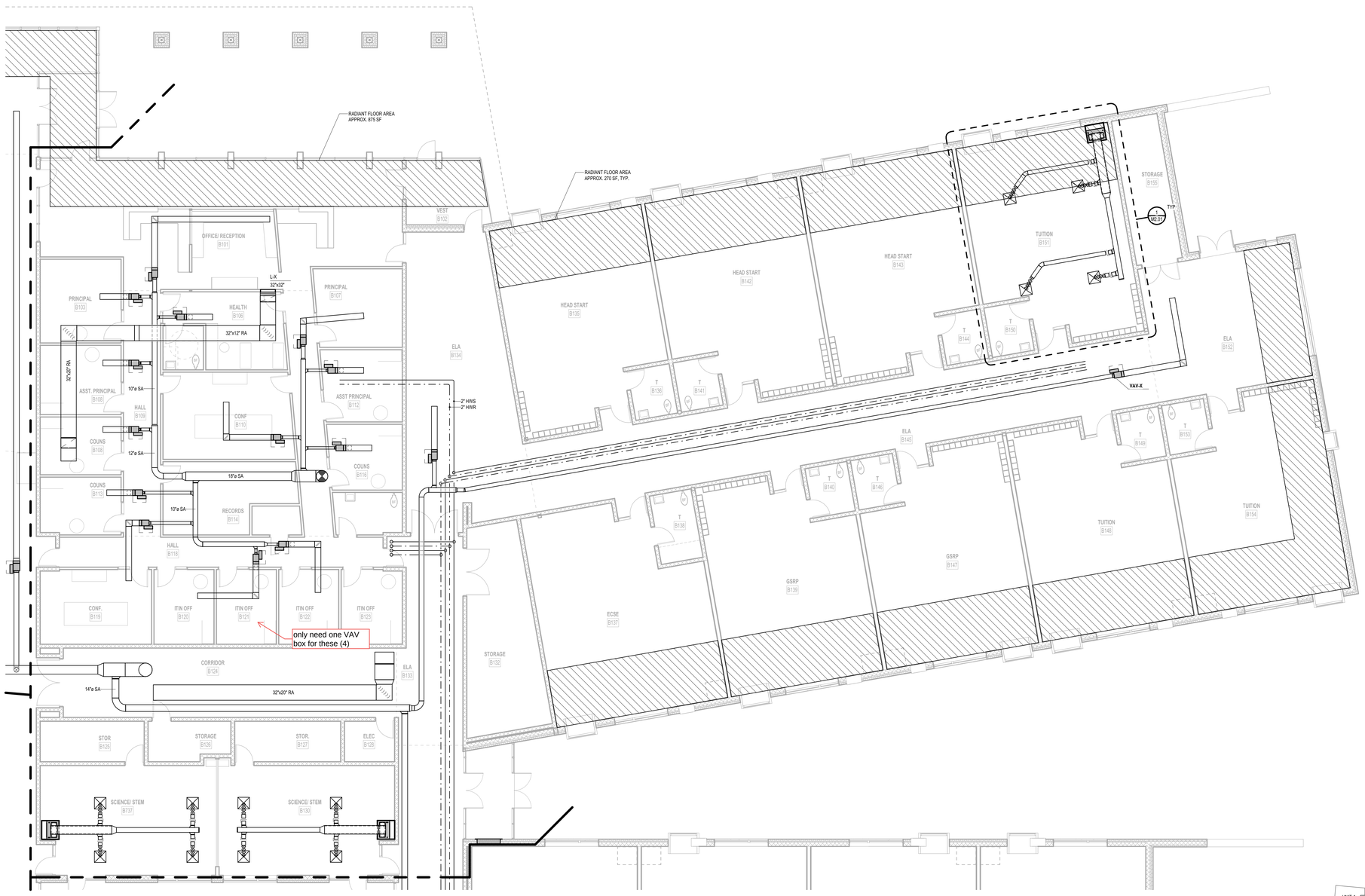

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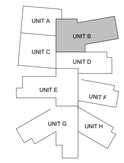
UNIT 'B' FIRST FLOOR HVAC PLAN

1/8" = 1'-0"



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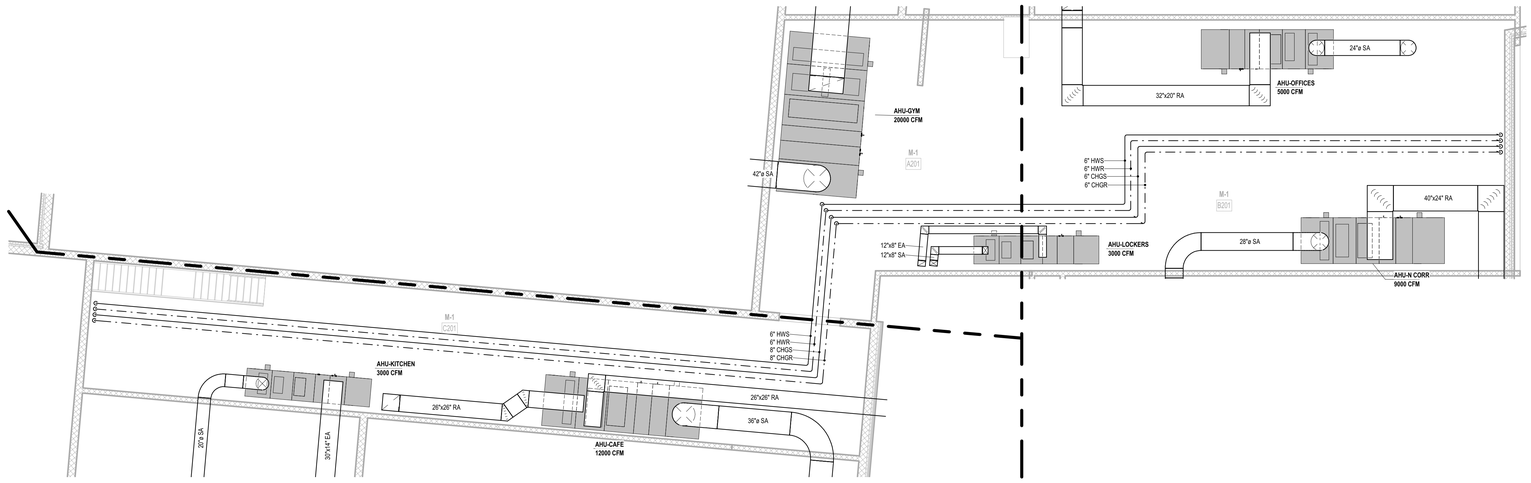
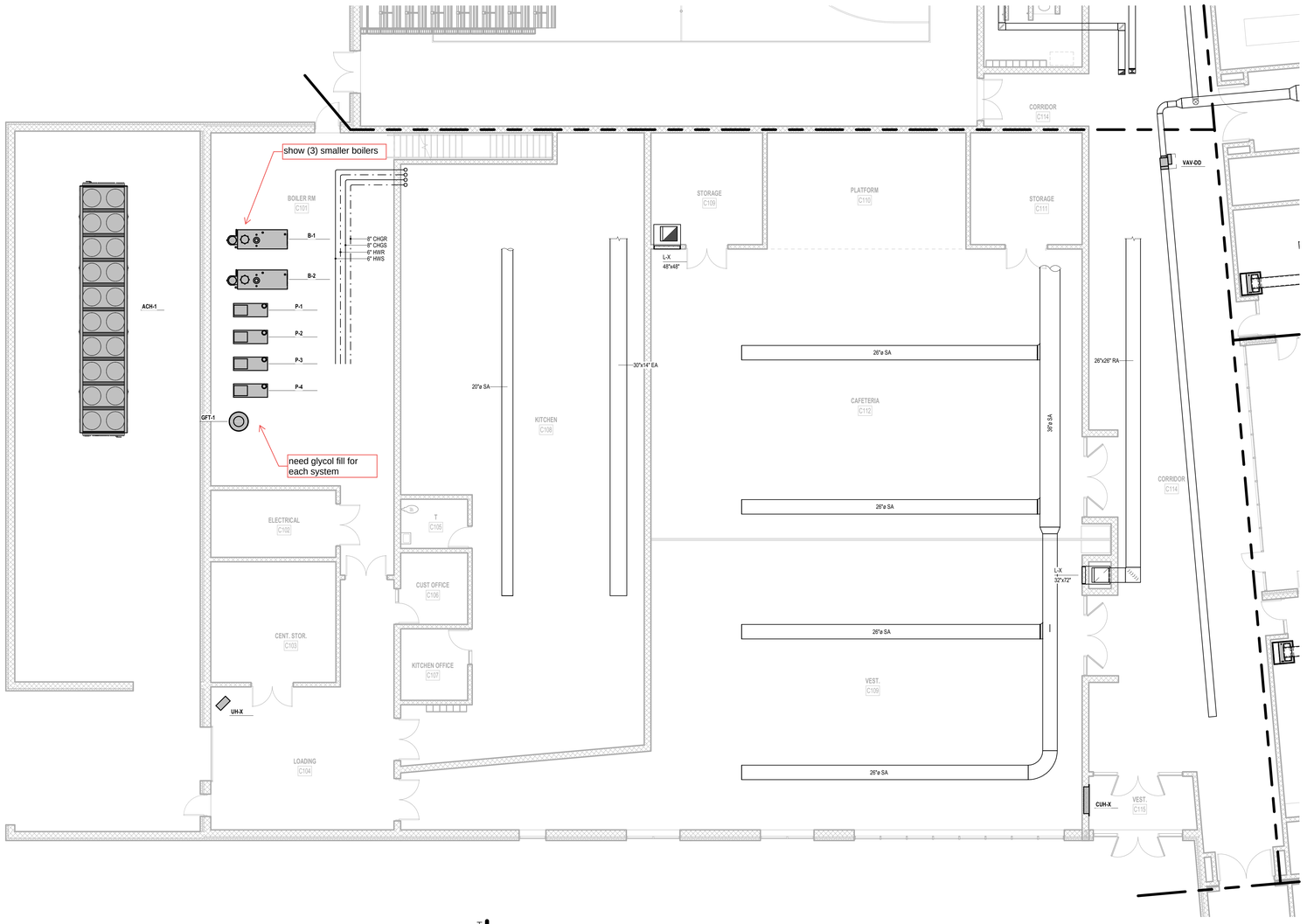
UNIT 'B' FIRST FLOOR HVAC PLAN

M2.1B



1 / M2.1C UNIT 'B' MECHANICAL PLATFORM HVAC PLAN

1/8" = 1'-0"



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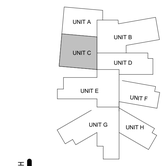
UNIT 'C' FIRST FLOOR HVAC PLAN

1/8" = 1'-0"



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UNIT 'C' FIRST FLOOR HVAC PLAN

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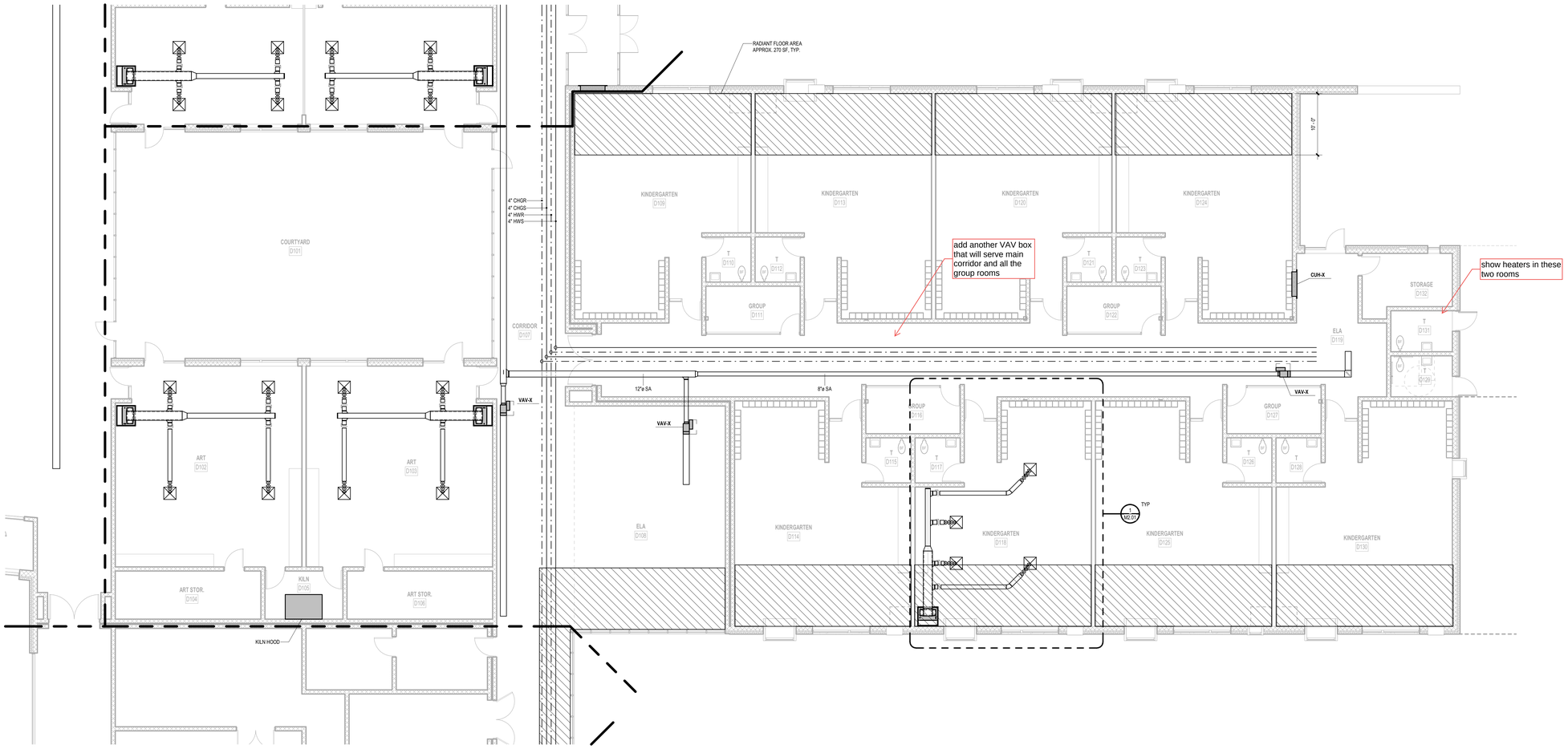

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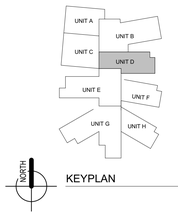
UNIT 'D' FIRST FLOOR HVAC PLAN

1/8" = 1'-0"



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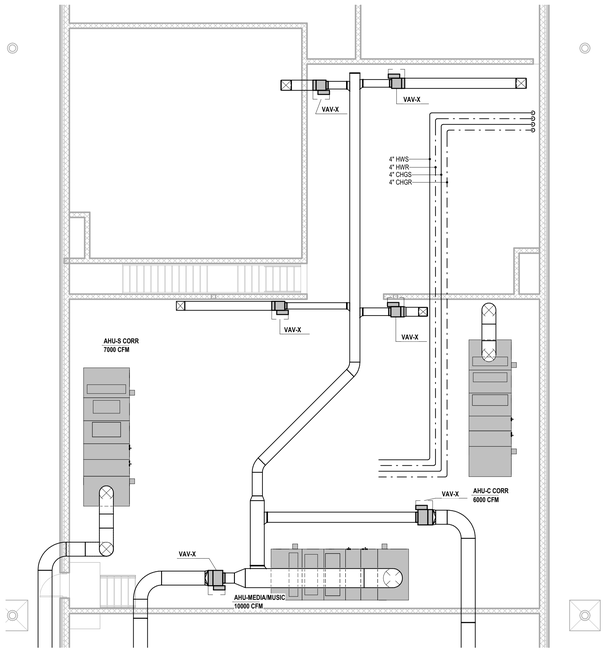
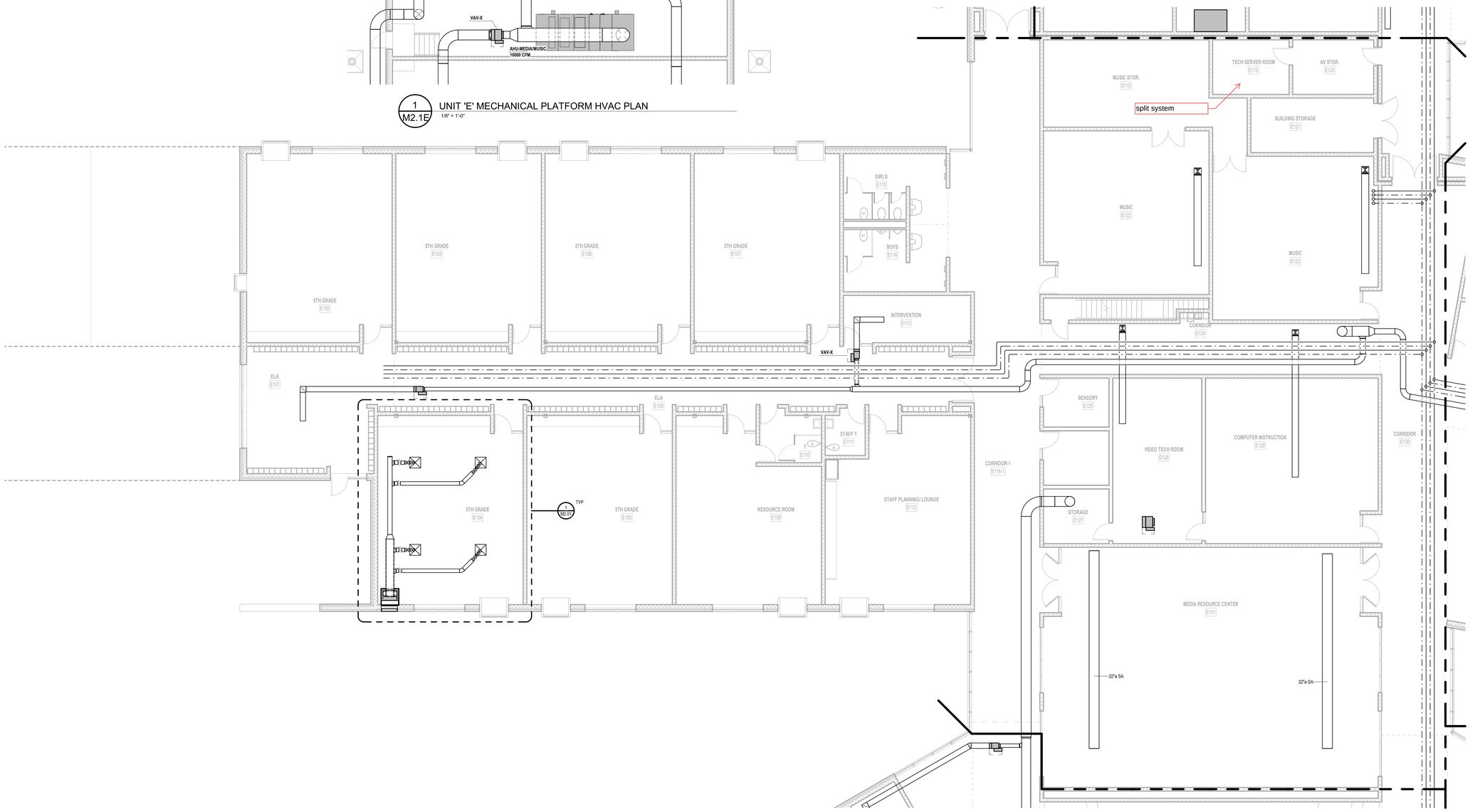
UNIT 'D' FIRST FLOOR HVAC PLAN

M2.1D



1 M2.1E UNIT 'E' MECHANICAL PLATFORM HVAC PLAN
1/8" = 1'-0"



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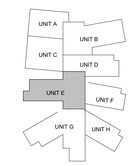
UNIT 'E' FIRST FLOOR HVAC PLAN
1/8" = 1'-0"



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UNIT 'E' FIRST FLOOR HVAC PLAN

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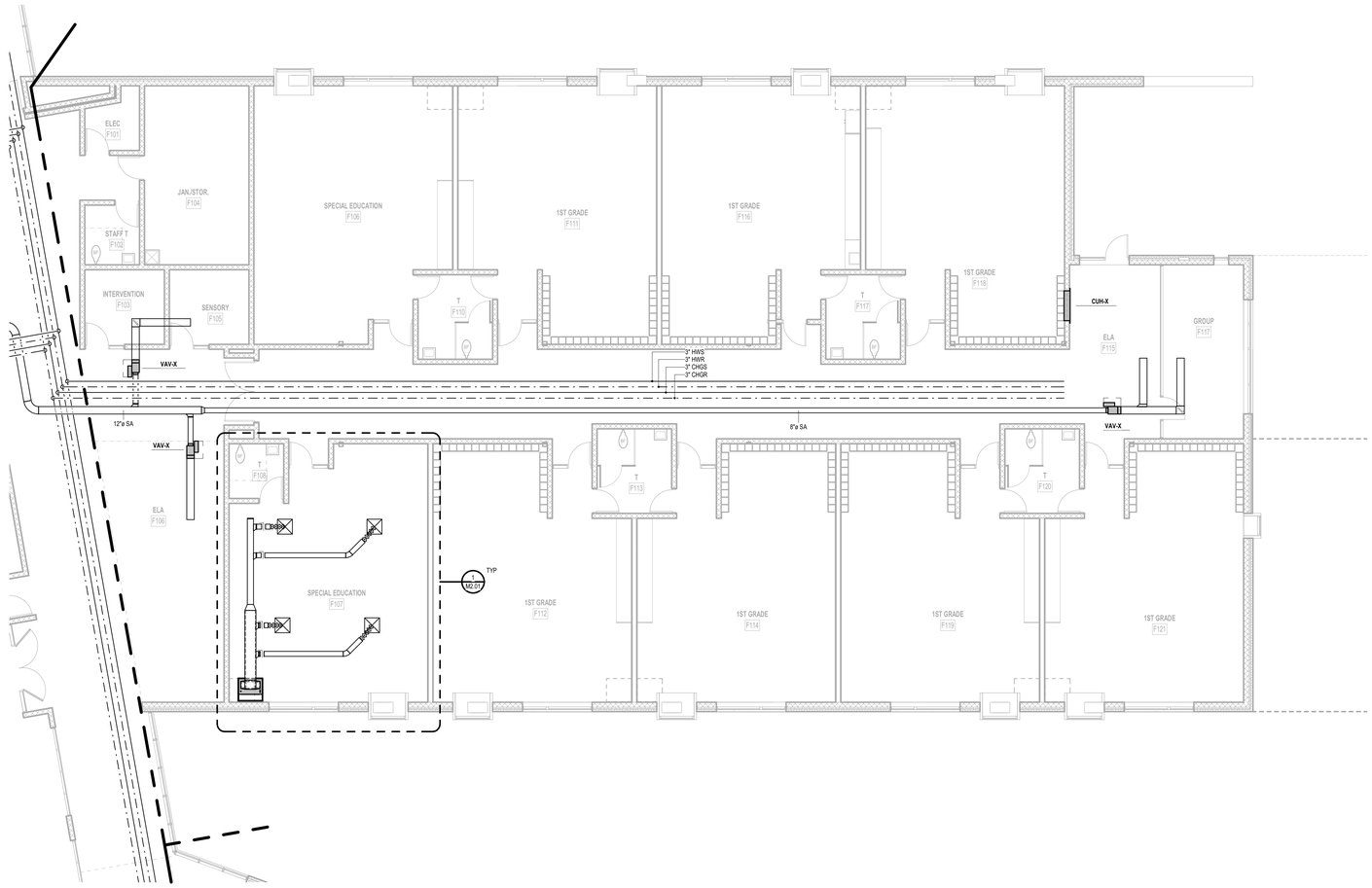

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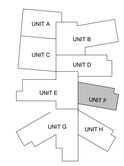
UNIT 'F' FIRST FLOOR HVAC PLAN

1/8" = 1'-0"



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UNIT 'F' FIRST FLOOR HVAC PLAN

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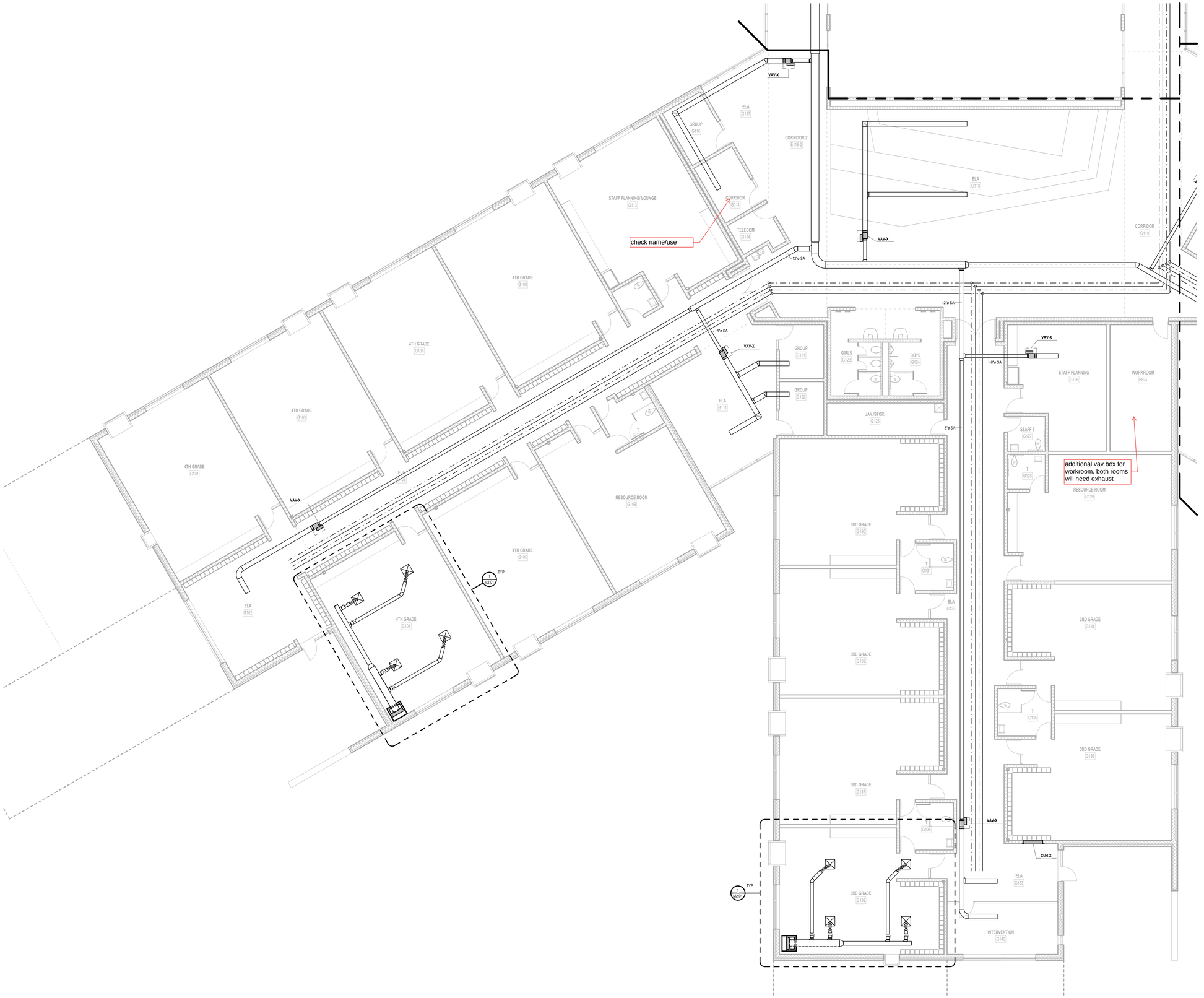

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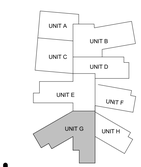
UNIT 'G' FIRST FLOOR HVAC PLAN

1/8" = 1'-0"



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UNIT 'G' FIRST FLOOR HVAC PLAN

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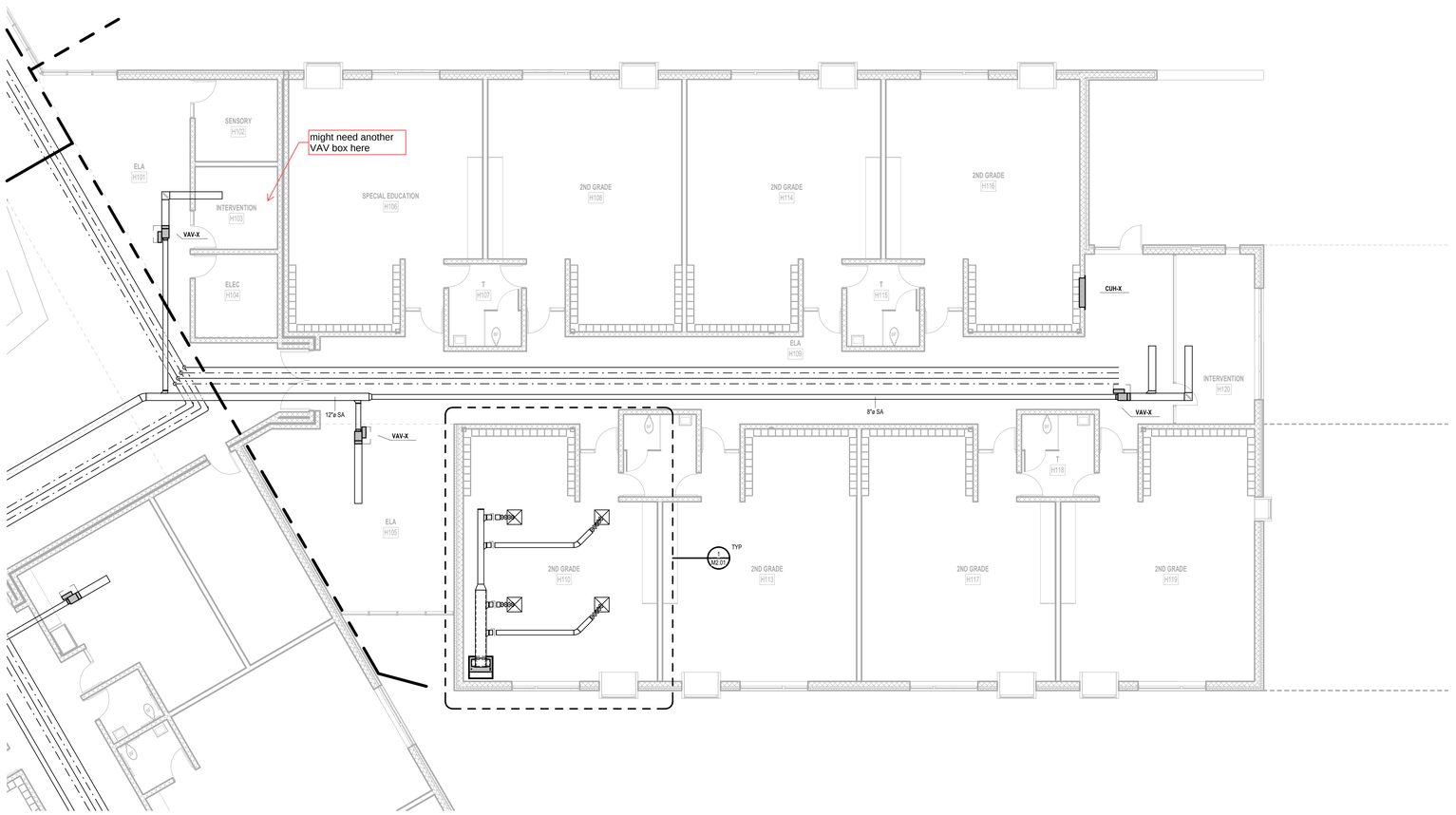

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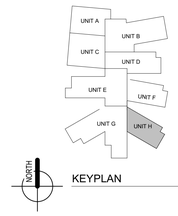
UNIT 'H' FIRST FLOOR HVAC PLAN

1/8" = 1'-0"



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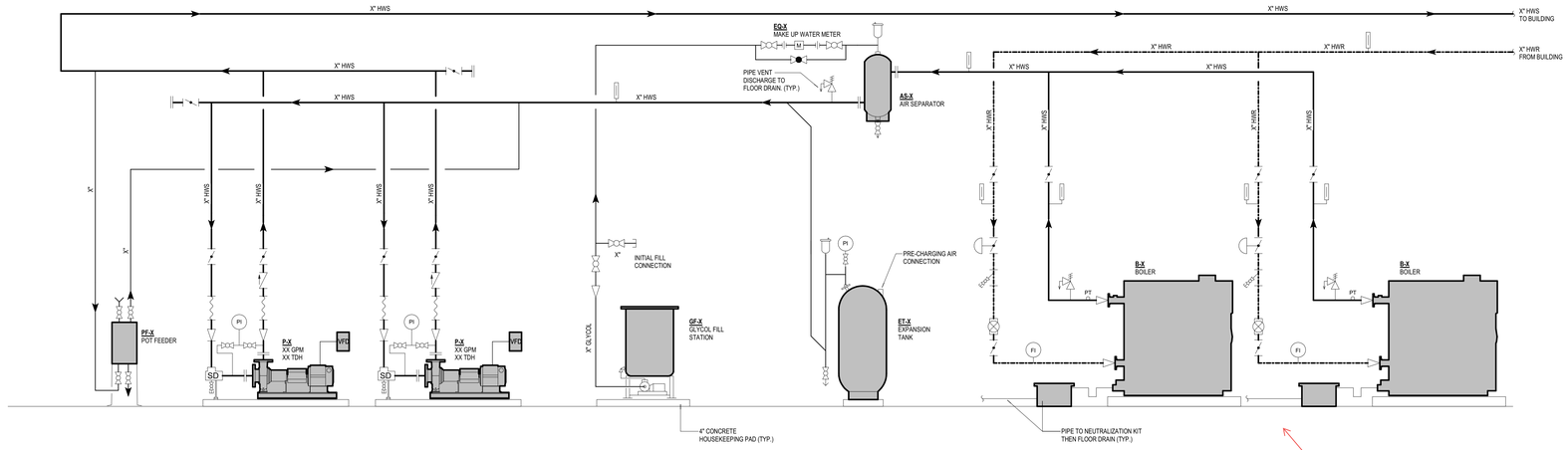
UNIT 'H' FIRST FLOOR HVAC PLAN

M2.1H



2 M4.01 HOT WATER HEATING SYSTEM SCHEMATIC

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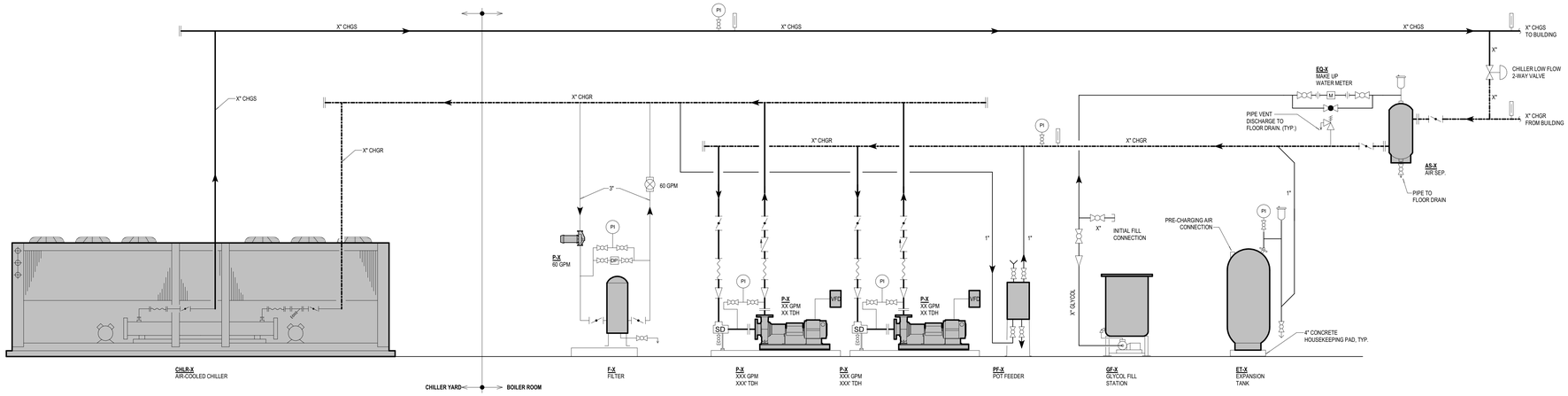

NOTES:
1. LAYOUT PIPING TO MINIMZE FITTINGS AND PRESSURE DROP.

1 M4.01 AIR COOLED CHILLER SYSTEM SCHEMATIC

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MECHANICAL SCHEMATICS

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