MECHANICAL SCHEMATIC DESIGN INTENT NARRATIVE

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OVERVIEW

In the selection of mechanical systems for Spirit I and Spirit II, we must take in consideration followed:

1. The first cost of the mechanical system for both Spirit I and Spirit II.
2. The diversity of the mechanical system used in both Spirit I and Spirit II.
3. The total energy cost to operate the mechanical system for both Spirit I and Spirit II.
4. The operational cost of the mechanical system for both Spirit I and Spirit II.
5. A geothermal water to water heat pump system to provide chilled and hot water to fan coil units through a 4 pipe distribution system.

The geothermal water to water heat pump with fan coils give both Spirit I and Spirit II the best mechanical system using the criteria above. The block cooling (the maximum amount of cooling required at any one time for the building) for Spirit I is approximately 80 tons and the block load for Spirit II is approximately 75 tons. But if you look at the diversity the geothermal water to water heat pump system gives you, the block load for both Spirit I & II would only be approximately 100 tons (this assumes the Church and Social Hall are not fully occupied at the same time). This system not only gives you the best diversity for both buildings, it also gives you the lowest operating and operational cost. The installed cost for Spirit I will be higher then the other system, but the combined installed cost for Spirit I and Spirit II will be less then the other systems. This system also allows you to dehumidify and heat spaces in the spring, summer and fall, when the system is in the cooling mode, with rejected waste heat. This reuse of the waste heat is at no additional cost. In the heating mode, this system also allows some cooling by using waste cooling at no additional cost.

DESIGN CRITERIA

The design of the mechanical systems for the Holy Spirit Catholic Church facility will conform to the following codes and standards:

- Kentucky Building Code
- Kentucky Plumbing Code
- International Mechanical Code
- International Fuel Gas Code
- National Electrical Code
- NFPA-13 (Fire Sprinklers)
- NFPA-90A (Heating and Air Conditioning Ductwork)
- International Energy Conservation Code
- American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE)
- National Fire Protection Association Pamphlets (NFPA)
- American National Standards Institute (ANSI)
- American Society of Mechanical Engineers (ASME)
- Sheet Metal and Air Conditioning Contractors National Association (SMACNA)

HVAC LOAD

PRELIMINARY LOAD CALCULATIONS

Design development HVAC load calculations were made using engineering calculations.

The calculations were based on the following:

Roof construction: u value = 0.033

Wall construction: u value = 0.036

Glass construction: u value = 0.42, solar heat gain coefficient = 0.46

Lighting: based on lighting lay-out per room

Infiltration: 0.1 air changes / hour (summer & winter)

Ventilation: 20 cfm / person of outside air for offices and 15 cfm / person for classroom and social hall

Outdoor Air Design Conditions: 94°F db, 78°F wb (summer), -2°F db (winter)

Indoor Air Design Conditions: 75°F ±3°F, 50% Relative Humidity (summer), 70°F ±3°F, 35% Relative Humidity (winter)

SITE UTILITIES

SANITARY SEWER

The underground sanitary sewer piping shall be Schedule 40, Type 1, Grade 1, polyvinyl chloride produced and labeled as ASTM D 1784-755 LF. The main building sewer size will be 6" and will exit the building on the south side. A second 4" building sewer will exit the building at the kitchen area and drain into a 500 gallon grease interceptor, then reenter the building. Both building sewers will have a double-grade cleanout within the first 5 LF outside the building.

STORM SEWER

The underground storm sewer piping shall be Schedule 40, Type 1, Grade 1, polyvinyl chloride produced and labeled as ASTM D 1784-755 LF. A double-grade cleanout will be provided within the first 5 LF outside the building.

DOMESTIC WATER

A 3" ductile iron pipe with cement mortar lining will be installed from the main at Smallhouse Road to the building entrance. The maximum design flow rate is estimated at 150 gpm.

FIRE SERVICE

A 6" ductile iron pipe for fire service will be installed from the main at Smallhouse Road to the building entrance. The pipe will be suitable for domestic water. A post indicator valve with alarmed tamper switch will be installed between the main and at least 40 ft from the building. A fire department connection will be installed in a location acceptable to the authority having jurisdiction, on the building exterior wall near the fire service entrance, or using a remote sidewalk Siamese. Piping to the fire department connection will be pitched so water will drain to the inside building if wall mounted or to a French drain if a remote sidewalk Siamese is used.

GAS SERVICE

The gas service will be provided by the local utility. The Contractor will arrange for work in a timely manner and pay all fees. The utility will provide the appropriate service from the main at Smallhouse Road to the north side of the building and install the gas pressure regulator, relief valve, and meter.

HEATING VENTILATING AND AIR CONDITIONING

With each of the following building zones will be served by a 4-pipe fan coil units. The Office area has 11 zones with a total connected cooling load of 11.5 tons and heating load of 203 MBH. The classroom / preschool area has 16 zones with a total connected cooling load of 30 tons and heating load of 457 MBH. The Foyer, Social Hall, and Kitchen areas has 8 zones with a total connected cooling load of 43.4 tons of cooling and heating load of 398 MBH of heating.

THE WATER TO WATER GEOTHERMAL HEAT PUMP SYSTEM

The building will be heated and cooled by means of water to water geothermal heat pumps that heat or cool water. The water is then distributed to fan coil units (4 pipes) by means of a steel piping system and in-line centrifugal circulation pumps. In cooling mode, the load side of the water to water heat pumps will produce 42 deg chilled water and the source side will produce 100 deg. water. The 42 deg. load water is pumped to the fan coil's main coil for cooling. The 100 deg. source water rejection from the water to water heat pumps is pumped to the fan coil's reheat coil if space dehumidification or space heating is needed (during the cooling mode). The return water from the fan coil's reheat coils is mixed with the remaining source water and piped to the geothermal ground loop for the remaining heat rejection. In heating mode, the load side of the water to water heat pumps will produce 110. deg heating water and the source side will produce 45 deg. water. The 110 deg. load water is pumped to the fan coil's main coil for heating. The 45 deg source water rejection from the water to water heat pumps is pumped to the fan coil's reheat coil if the space needs cooling (during the heating mode). The return water from the fan coil's reheat coils is mixed with the remaining source water and piped to the geothermal ground loop for the remaining heat rejection.

The geothermal ground loop will be sized for the total cooling load of 80 tons. This would equate to approximately 40 wells spaced 15 to 20 feet apart and drilled to an approximate depth of 400 feet. The wells will connect to six circuits. 2 circuits will have 6 wells per circuit and 4 circuits 7 wells per circuit. Each circuit will be piped in a reverse return configuration. All six circuit's supply and return piping will connect the headers to the building loop.

A centrifugal air separator and pressurized bladder tank will be used for air control of the water system. Propylene glycol will be used for chemical treatment and freeze protection. A glycol feed system will introduce the glycol into the system.

Inside loop water piping will be ASTM A583, schedule 40 black iron or hard drawn type L copper. Piping will be insulated with glass fiber piping insulation with all service jackets.

Outside loop water piping will be ASTM D 2447 Schedule 40, high density polyethylene pipe, type PE3408.

VENTILATION

Typical ventilation throughout the facility will be 20 cfm / person of outside air for offices and 15 cfm / person for classroom and social hall.

An energy recovery unit will provide neutral temperature ventilation air as required for the Social Hall in accordance with ASHRAE 62 recommendations. This unit will also provide the makeup air needed for the kitchen exhaust hood. This makeup air units is sized for 10,000 cfm and requires 40 ton of cooling and 210 MBH of heating

In the Office and Classroom areas, ventilation air will be ducted to each fan coil using small energy recovery units.

The small energy recovery units will exhaust restrooms, toilets, and janitor's closets at the rate of 75 cfm per water closet or urinal fixtures.

AIR DISTRIBUTION

Distribution ducts will be galvanized steel construction, insulated, sealed, and installed per the latest SMACNA standards. Rectangular supply and return air duct mains will be insulated with 1" acoustical

duct liner. Round run-outs to diffusers will be wrapped with 1-1/2" mineral fiber blanket insulation. Spiral ductwork without insulation will be provided when exposed in finished spaces.

In areas with ceilings, supply air will be delivered to the space through flat plate ceiling diffusers. All return air will also be ducted to prevent negative pressures in the building. The return and exhaust air systems will use perforated return air grilles.

Final connections to diffusers and grilles may be made with flexible duct only when concealed from finished spaces. Length of flexible duct shall not exceed 36" and path shall not exceed 45°.

ACOUSTICS

Duct mains serving the building will maintain maximum 1,000 FPM velocity. Duct branches will maintain maximum 500 FPM velocity.

Rectangular duct mains will utilize 1" acoustical duct liner.

As much as possible, mechanical equipment will be physically isolated from noise sensitive areas.

TEMPERATURE CONTROL

The facility will be controlled by an electronic microprocessor base Direct Digital Control (DDC) system, which will be the primary control mechanism for all heating, cooling, and ventilation. All schedule and setpoint modifications will be readily accomplished through an on-site terminal. Each zone will have individual control and be addressable from the central operator station to assist in trouble-shooting.

Control of fans, dampers and coils at the fan coil unit will be provided by the DDC control system. All fan coil units will be controlled based on the time schedules entered into the DDC system and modified as required for special activities and holidays.

The makeup air units will be controlled by the DDC system. Control of pumps will be provided by the DDC control system. All pumps will be set up as lead/lag and controlled based on the time schedules entered into the DDC system and modified as required for special activities and holidays.

All zones will have thermostat/humidistat with override adjustment and temperature readouts.

PLUMBING

DOMESTIC WATER SYSTEM

A new 3" water service will be provided to handle the demand of the building. The water main will be metered and provided with back-flow prevention as required by code. A 1-1/4" water line and backflow preventer will be provided and stubbed out for lawn irrigation. A domestic water distribution piping system will be provided to serve plumbing fixtures and specialties throughout the facility. Water piping will be type 'L' copper with fiberglass piping insulation. Vapor barriers will be maintained on all cold water piping.

DOMESTIC HOT WATER

A hot water distribution piping system will be provided to serve plumbing fixtures and specialties throughout the facility. Water piping will be type 'L' copper with fiberglass piping insulation.

Domestic hot water (140°) will be heated by a gas-fired water heater and distributed to the kitchen dishwasher. A hot water circulating system will not be needed for this system.

Domestic hot water (120°) will be heated by a gas-fired hot water heater and distributed throughout the building. A hot water circulating system, including a circulating pump, will be provided to ensure hot water is available at the fixture outlets.

SANITARY WASTE AND VENT SYSTEMS

Sanitary waste and vent system piping will be Schedule 40, Type 1, Grade 1, polyvinyl chloride produced and labeled as ASTM D 1784-755 LF with gasketed joints under ground and solvent cement joints and fittings above ground.

PLUMBING FIXTURES

Plumbing fixtures will be commercial grade and designed to meet the Americans with Disabilities Act (ADA) where required. All vitreous china fixtures will be white in color. All fixtures will have ¼ turn water stops.

Some plumbing fixtures will be mounted at various heights to accommodate all ages and abilities.

Water closets with chases and urinals will be wall hung. Water closets without chases will be floor mounted. All water closets and urinals will have automatic battery powered flush valves.

Lavatories in the main restroom will be under counter mounted at ADA height and exposed piping will be protected with insulation. All other lavatories will be wall mounted at ADA height and exposed piping will be protected with insulation. All lavatory faucets will have automatic battery powered sensors.

Janitor closets will have floor set molded stone mop sinks with stainless wall guards, vinyl bumper guards, mop bracket, hose and bracket and wall hung faucets with wall brace.

Office break rooms will have single bowl, 18 gauge stainless steel sinks with single handle gooseneck faucets. Garbage disposals and sprayer will also be provided at the sink.

Classrooms will have single bowl, ADA, 18 gauge stainless steel sinks with single handle gooseneck faucets. On the children's sinks, a bubbler will also be provided.

Showers will be one piece fiberglass units that are ADA transfer compliant. They will have single handle non-scald type, pressure regulating-type faucets with a slide bar sprayer. Showers will be complete with fold up seats, shower rods and curtains.

Electric water coolers will be single and double high-low recessed stainless steel units. They will be manually operated and the single units will have glass fillers.

Wall hydrants will be located on each side of the building exterior. Additional cold water hydrants may be located at select locations around the site.

An emergency eye wash supplied with tepid water will be located in the mechanical room.

STORM SEWER SYSTEM

Roof drains, overflow drains and downspouts will be provided in accordance with applicable plumbing codes. Roof drains and downspouts will be piped under ground, but overflow drains will be day lighted. Roof and overflow drains will have cast iron bodies with cast iron domes.

Storm waste piping will be Schedule 40, Type 1, Grade 1, polyvinyl chloride produced and labeled as ASTM D 1784-755 LF with gasketed joints under ground and solvent cement joints and fittings above ground.

NATURAL GAS

A 2-psig gas system will be routed above ceilings to gas fired equipment throughout the facility. Pounds-to-ounces gas pressure regulators will be located at each individual piece of equipment; including boilers, kitchen equipment and water heaters. Gas pressure regulators located inside the building will be vented to the outside as required by the Authority Having Jurisdiction. Natural gas piping will be ASTM A53, schedule 40 black iron. Two inch piping and smaller will be threaded; 2-1/2" and larger will be welded.

FIRE PROTECTION

The entire building will be protected by a wet pipe fire sprinkler system in accordance with NFPA 13. Office, Classroom and Social Hall areas will be designed as light hazard. Mechanical rooms, Electrical rooms and Storage spaces will be designed as ordinary hazard.

A 6" fire water service will enter the building in the Mechanical Room to protect the entire facility. A double check back flow preventer will be provided. A main flow switch will indicate flow to the fire alarm system.

Fire sprinkler size will be verified when city water pressure data is available. Sprinkler piping will be thin wall steel and CPVC pipe located above ceilings and thin wall steel in exposed areas without ceilings.

A wet sprinkler system will be provided for all heated areas. Each connection to the riser will be provided with a flow switch and an OS&Y monitored valve.

A dry sprinkler system will be provided for the attic area. A dry-pipe valve will open, allowing water to enter the system when the air pressure is lost. The air compressors mounted on the water entrance will maintain air pressure inside the system.

A stand pipe will be provided with fire department valves. A stand pipe will be located in the wall between Men 102 and Foyer 101 by the future entry to the church.

A fire pump with a jockey pump will be provided if the site water pressure is not sufficient.

Sprinkler heads will be provided for all areas. Sprinkler heads are required to be centered in one direction if mounted in lay-in ceilings. See the following for sprinkler head types and locations:

1) Suspended Ceilings – painted enamel recessed pendant
2) Hard Ceilings - painted enamel recessed pendant
3) Exposed Areas – upright brass pendant
4) Sidewall areas - chrome plated semi-recessed pendant
5) Dry type exposed area – upright brass pendant
6) Dry type ceiling area – painted semi-recessed pendant