EXISTING MECHANICAL SYSTEMS DESCRIPTION

The following are descriptions of the three main mechanical systems at the new student housing project, as well as their respective components. The three major systems analyzed are the geothermal heat pump system, the ventilation system with energy recovery, and the domestic service water system. A brief listing of abbreviations and symbols referenced in the following schematics is provided in Figure 6.1 below:

Figure 6.1: Abbreviations and Symbols Used in Following Schematics

ABBREVIATIONS AND SYMBOLS	
CS	CONDENSER WATER SUPPLY
CR	CONDENSER WATER RETURN
OA	OUTDOOR AIR
EA	EXHAUST AIR
FD	FIRE DAMPER
CW	DOMESTIC COLD WATER
HW	DOMESTIC HOT WATER
HWR	DOMESTIC RECIRCULATED HOT WATER
RPBFP	REDUCED PRESSURE BACK FLOW PREVENTER
	BALL VALVE
	BUTTERFLY VALVE

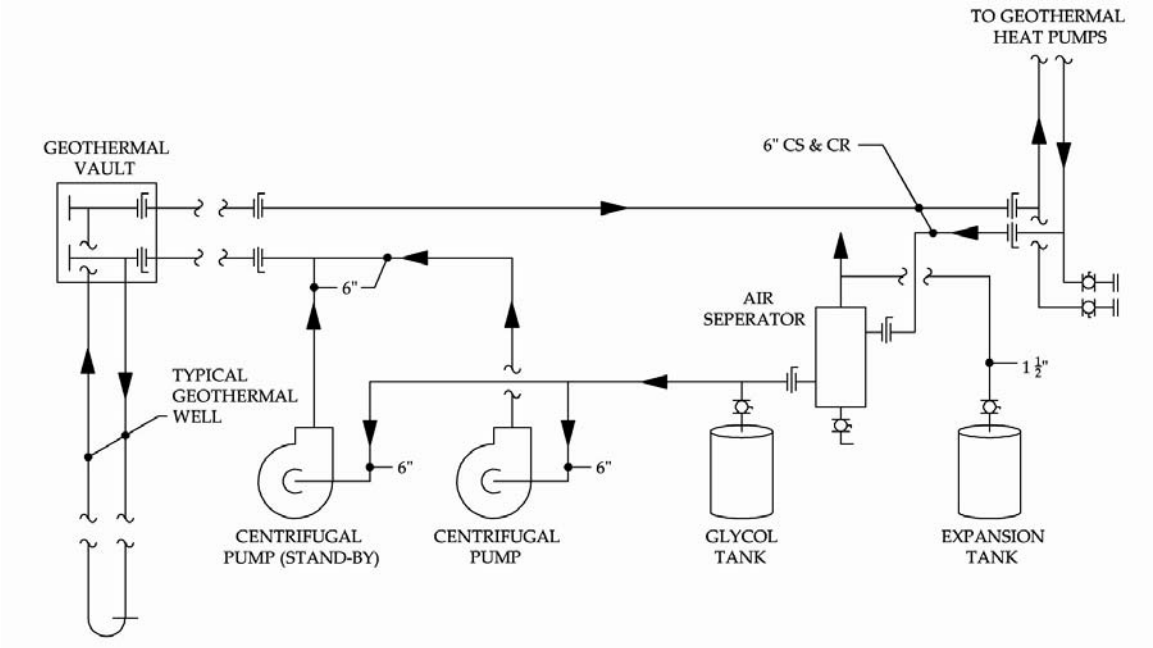
6.1. Geothermal Heat Pump System

The new student housing project at the Mount St. Mary's University utilizes a geothermal heat pump system to both heat and cool the building. Originally designed with 125 vertical wells, each 4 inches in diameter and 200 feet deep, the system has recently been redesigned with 64 vertical wells, each 4 inches in diameter and 400 feet deep. They are located around the front of the site and stem from a geothermal pipe distribution vault located beneath the main courtyard of the building. From this vault, the condenser water is distributed directly to the heat pumps located throughout the building for either heating or cooling.

The condenser water returns to the building's mechanical room, where it is sent through an air separator, and it is approximately here that both the 160 gallon expansion tank and the glycol tank are linked to the system. The water is then run through one of two centrifugal pumps capable of moving 375 GPM and back out to the geothermal vault for redistribution to the vertical wells.

Some of the benefits of this geothermal system, impacting first cost, maintenance costs, and energy costs, are that it eliminates the need for chillers, boilers, and cooling towers. Partially because of this, the heat pumps themselves are capable of achieving higher coefficients of performance and energy efficiency ratings than conventional heat pumps.

Figure 6.1.1: Geothermal Heat Pump System Schematic



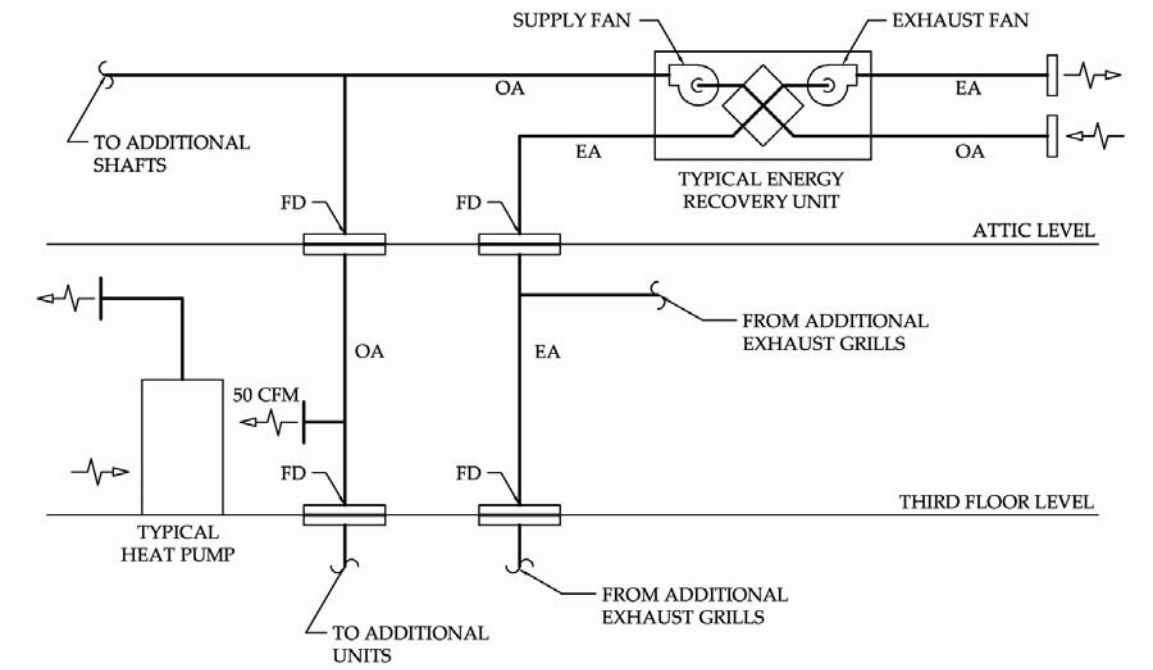
6.2. Ventilation System

The building's ventilation system serves a supplemental function and is coupled with natural ventilation. It consists of three energy recovery units located in the attic of the building, which were incorporated into the system in place of exhaust fans in an attempt to keep the building pressurized and to increase the amount of outdoor air reaching the occupied spaces.

Exhaust air is pulled from bathrooms and mechanical rooms throughout the building at a rate comparable to that of the ventilation air being brought in. These energy recovery units utilize the wasted energy in the exhaust streams to pretreat the ventilation air being brought into the building. Electric duct heaters may also be utilized during winter months to raise the temperature of the air further. This air is then supplied directly to the closets housing the individual heat pumps at a constant rate of 50 CFM, where it is mixed with recirculated air and conditioned further before being supplied to the space.

Using energy recovery to pretreat the ventilation air saves a great deal of energy later in the process of heating and cooling. During the extremes of the summer and winter, pretreating the ventilation air can reduce the overall outdoor air load to as low as 20% of what it would be without energy recovery.

Figure 6.2.1: Ventilation System with Energy Recovery Schematic



6.3. Domestic Service Water System

The building's incoming domestic service water is brought in through a reduced pressure back flow preventer into the mechanical room in the basement. From there, the water is split from a 4 inch pipe into 3 and 2 ½ inch pipes, the latter of which then feeds into a 750 GPH domestic hot water heater connected to a 35 gallon expansion tank. Bother the cold and hot water are then fed to all the various bathrooms, janitor's closets, and water fountains located throughout the building. The hot water is recirculated through a 15 GPM in-line pump located in the mechanical room.

Figure 6.3.1: Domestic Water Service System Schematic