The roofing system consists of K-series steel joist supporting the metal roof deck. These joist tie into steel roof beams and girders which transfer the roof load to the steel columns.

2.3 FIRE PROTECTION AND TELECOMMUNICATION SYSTEMS BACKGROUND

The Supply Center will be fully protected from fire with a sprinkler system. The freezer and refrigerator areas contain a dry pipe or double interlock pre-action sprinkler system to prevent freezing. The loading dock and trash disposal areas have a dry pipe sprinkler system. All other areas such as the mechanical and electrical areas, the kitchen, and the bakery have a wet pipe sprinkler system for fire protection. Areas of the building with ceilings use fully concealed pendant type sprinkler heads. Areas without ceilings use upright sprinkler heads with a protective cage guard.

Telecommunications systems for the Supply Center include an intercom system, an analog phone system connected to the rest of the Milton Hershey School, cable television for the employee break rooms and training rooms, and wireless internet.

The fiber optic cables handling the telecommunication services will branch from an existing telecom manhole and be fed to the building through new a new duct bank. The main cables will run above the ceilings in runways until finally terminating in the main data room located in approximately the center of the building.

3.0 MECHANICAL SYSTEMS EXISTING CONDITIONS

The design of the HVAC systems for the Milton Hershey School New Supply Center is based on cost and energy saving criteria. The MEP engineer for the project is H.F. Lenz Company. H.F. Lenz Company's most general goals of the HVAC system design are:

- The complete HVAC system shall meet the requirements of the 2003 International Building Code, ASHRAE 62.1-2004 Standard for Indoor Air Quality, and all applicable National Fire Protection Association Standards.
- The system will be made as energy efficient as practical in accordance with LEED design principles. Variable volume hydronic pumping and air systems are used where possible.
- The amount of rooftop HVAC equipment is minimized as much as possible to ensure good access for maintenance and to maximize equipment life.

Along with these goals, the system is designed to integrate other building systems. The central kitchen of the supply center, as explained above, consists of large walk-in freezers and coolers. The walk-in coolers are cooled by fan coil units that are supplied 20˚F water from brine chillers. The walk-in freezers are refrigerated by split system DX units using water cooled condensing units. These condensers reject heat to a condenser water loop that is picked up by the HVAC system.

Integration of other building systems does not just apply to the chilled water system. The HVAC design objectives also include integrating the process heating loads, dishwashers and steam kettles, with the buildings boiler plant. The buildings boiler plant also provides domestic hot water heating along with HVAC hot water.

Elaborate kitchen exhaust systems are also required in the project's goals. Incorporating energy saving techniques with the exhaust hoods such as variable speed fans help reduce energy cost. Due to an extensive amount of exhaust air in the food service and loading dock sections of the building, the air side mechanical systems include ventilation make-up air units.

The HVAC system, as a whole, generally consists of centrally ducted air handling unit systems. Chilled and hot water systems from the central plant are piped to cooling and heating coils in the AHUs and terminal equipment that both provide the means of conditioning the spaces.

3.1 DESIGN INDOOR AND OUTDOOR CONDITIONS

The design indoor conditions are developed by H.F. Lenz Company and the Milton Hershey School personnel. Collaboration between the two parties results in design heating dry bulb temperatures, cooling dry bulb temperatures, and maximum relative humidity levels for each space. Table 3-1 includes charts summarizing the design indoor conditions for all occupancy types found in the supply center.

The design outdoor conditions used in building simulation models, calculating thermal loads on spaces, and sizing HVAC equipment are found in the ASHRAE Handbook of Fundamentals 2005 (ASHRAE 2005). Since temperature data for Hershey Pennsylvania is not available in the handbook, the design temperatures are from Harrisburg Pennsylvania. Table 3-2 includes a summary of the design outdoor conditions used in the design of the supply center's HVAC systems.

Table 3-1 Design Indoor Conditions

	HEATING DBT (˚F)	COOLING DBT (˚F)	MAX % RELATIVE HUMIDITY
Main offices	70	74	None (3)
Lobby and Office Corridors	70	74	None (3)
Public Toilets	70	78	None (3)
Servery	70	74	None (3)
Dining / Conference	70	74	None (3)
Meal Van Loading Dock	60	82	65
Kitchen	70	80	60
Dishwashing	70	80	60
Kitchen Training	70	80	60
Chef's Office	70	74	None (1)
Bakery	70	80	60
Bakery Dry Storage	68	78	50 (4)
Food Service Offices	70	74	None (3)
Kitchen dry goods	68	78	50 (4)
Clothing Storage	68	78	None (3)
Clothing Shipping / Receiving	70	74	None (3)
Used Clothing	70	74	None (3)
Alterations	70	74	None (3)
Clothing Work Room	70	74	None (3)
Clothing Display and Waiting	70	74	None (3)
Dry Storage	68	78	50 (4)
Bulk Storage / Bulk Staging	68	78	None (3)
Staging and staging corridor	68	80	None (1)
Transportation Offices	70	74	None (3)
Washer / dryer	68	80	None (1)
Program Support Inventory	70 (5)	74 (5)	None (3)
Storage for “year round” experience	68	78	None (3)
Garbage / recycling	50	95	None
Receiving and General Building Storage	68	80	None (1)
Mail	70	74	None (3)
IT Rooms (2)	68	70	None (1)
Mechanical / Electrical Rooms	60	100	None
Custodial	70	80	60
Break Room	70	74	None (3)
Lockers	70	74	None (1)
Bread/Bakery Staging	68	80	None (1)
Catering Staging	68	80	None (1)

Footnotes:
(1) No direct, active humidity control is planned but should not rise above 60% RH under normal operating conditions
(2) Wintertime humidification may or may not be necessary.
(3) No direct humidity control is planned, but should not rise above 50% RH under normal operating conditions.
(4) Will require a separate de-humidification unit to control humidity.
(5) Assumes there will be staff working in this room consistently

Table 3-2 Design Conditions for Harrisburg, PA

LATITUDE	40.22°
Longitude	76.85°
Elevation	338 ft
Design Summer DBT	92.8°F
Design Summer WBT	73.7°F
Design Winter DBT	8.3°F

3.2 AIR SIDE EXISTING MECHANICAL SYSTEM

The air side mechanical system for the supply center uses fourteen air handling units. Four of the AHUs are part of multiple zone VAV systems. These air handling units serve offices, dining areas, clothing display and alterations areas, and staff spaces. The air is distributed to these spaces through VAV terminal units with hot water re-heat coils. The perimeter spaces also include fin-tube radiation systems for winter heating. The four VAV air handling units consists of a supply and return fans, 30% and 85% efficient filters, hot water pre-heat and re-heat coils, and a cooling coil.

The remaining ten air handling units are single zone spaces that are either part of VAV or CAV systems. However, since they are single zone units, VAV boxes are not used for air distribution to the spaces. All ten AHUs consists of 30% and 85% efficient filters, hot water pre-heat and re-heat coils, cooling coils, and supply fans.

Six of the ten single zone AHUs are part of constant volume systems. These units provide make up air for spaces requiring excessive amounts of exhaust (kitchens spaces, loading docks, recycling room). Even though the units operate at 100% outdoor air when the spaces are in operation, the AHUs also have the ability to return air during unoccupied times. The final four single zone air handling units not mentioned are part of VAV systems. These units serve dry storage and clothing warehouse areas. The AHUs vary the volume of air supplied at the supply fan via variable frequency drives.

The two data rooms located in the center of the building incorporate two systems to provide cooling year round. The data rooms are served by VAV systems, however, when the central VAV air handling unit is operating at an unoccupied mode, ductless split system air conditioners are used to handle the cooling loads.

The following figure is a representation of the HVAC air side system zoning plan.

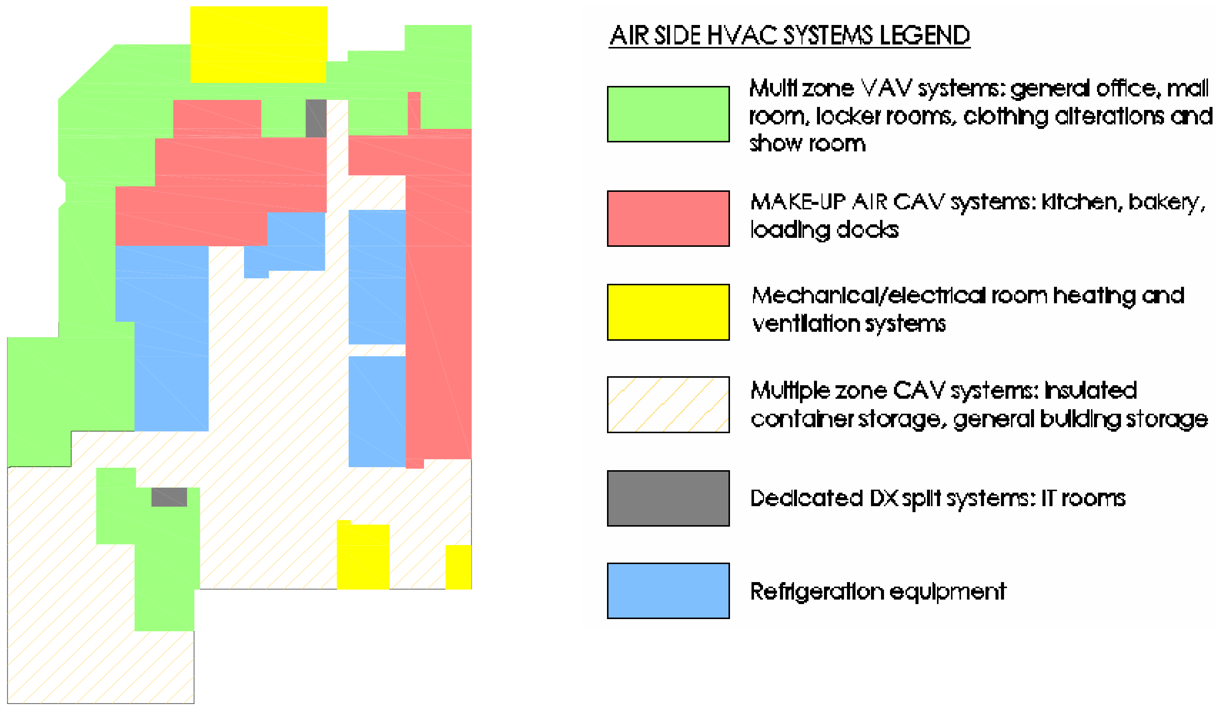

Figure 3-1 Air side mechanical systems zoning plan

3.3 CHILLED WATER EXISTING SYSTEM

The chiller plant of the supply center consists of two (one duty one standby) 270 ton electric driven centrifugal water cooled chillers that produce 45°F water. These chillers are used to meet the normal HVAC building loads. Also included in the chilled water system are two (one duty one standby) water cooled brine chillers that produce 20°F water. These chillers service fan coil units located in walk-in-coolers and refrigerated rooms year round. The two sets of chillers in the plant are interconnected in that they all have the capabilities to produce either 45°F or 20°F water for emergency purposes. All four of the chillers operate with R-134a refrigerant and the entire chilled water system (both the HVAC and brine loops) are provided with a 35% propylene glycol solution.

As mentioned above, the 45°F water loop also serves two plate frame heat exchangers to pick up the rejected heat from the walk-in freezers. The rejected heat from the freezers is distributed to a condenser water loop. This water loop is then cooled by the chilled water system before returning to the freezer's condensing units.

The HVAC chilled water loop incorporates a primary-secondary pumping system. Three primary pumps are located in the chilled water plant and are of a duty-duty-standby configuration. Two secondary pumps with VFDs distribute chilled water to the building loop. A similar pumping configuration is used for the brine loop, however, only four pumps are needed (2 primary, 2 secondary).

The chiller room includes a refrigerant leak detection and exhaust system that complies with ASHRAE Standard 15.

3.4 CONDENSER WATER EXISTING SYSTEM

The condenser water system for the chilled water plant includes two induced draft cooling towers for the heat rejection equipment. These service all four of the chiller's condensers. The walk-in freezer's condenser water loop also utilizes the chiller plant's condenser water system. As stated above, the freezer's rejected heat is handled by the HVAC chilled water loop. This operation occurs in the summer months, or when the ambient outdoor temperature is above 50°F. The freezer's condenser water loop bypasses the plate frame heat exchangers that are served by 45°F chilled water and enters a third plate frame heat exchanger served directly by 60°F condensing water from the cooling tower. This process is used for water side "free" cooling in seasons where the outdoor temperature is below 50°F.

The chilled water flow diagram, shown in Figure 3-2, show the three main water loops (condenser water, chilled water, and freezer condenser water). Design temperatures at which each water loop operates is also located on the flow diagram. The freezer's condenser water loop shows the 3-way valve that is used to bypass the chilled water heat exchangers when the system is operating in "free" cooling mode.

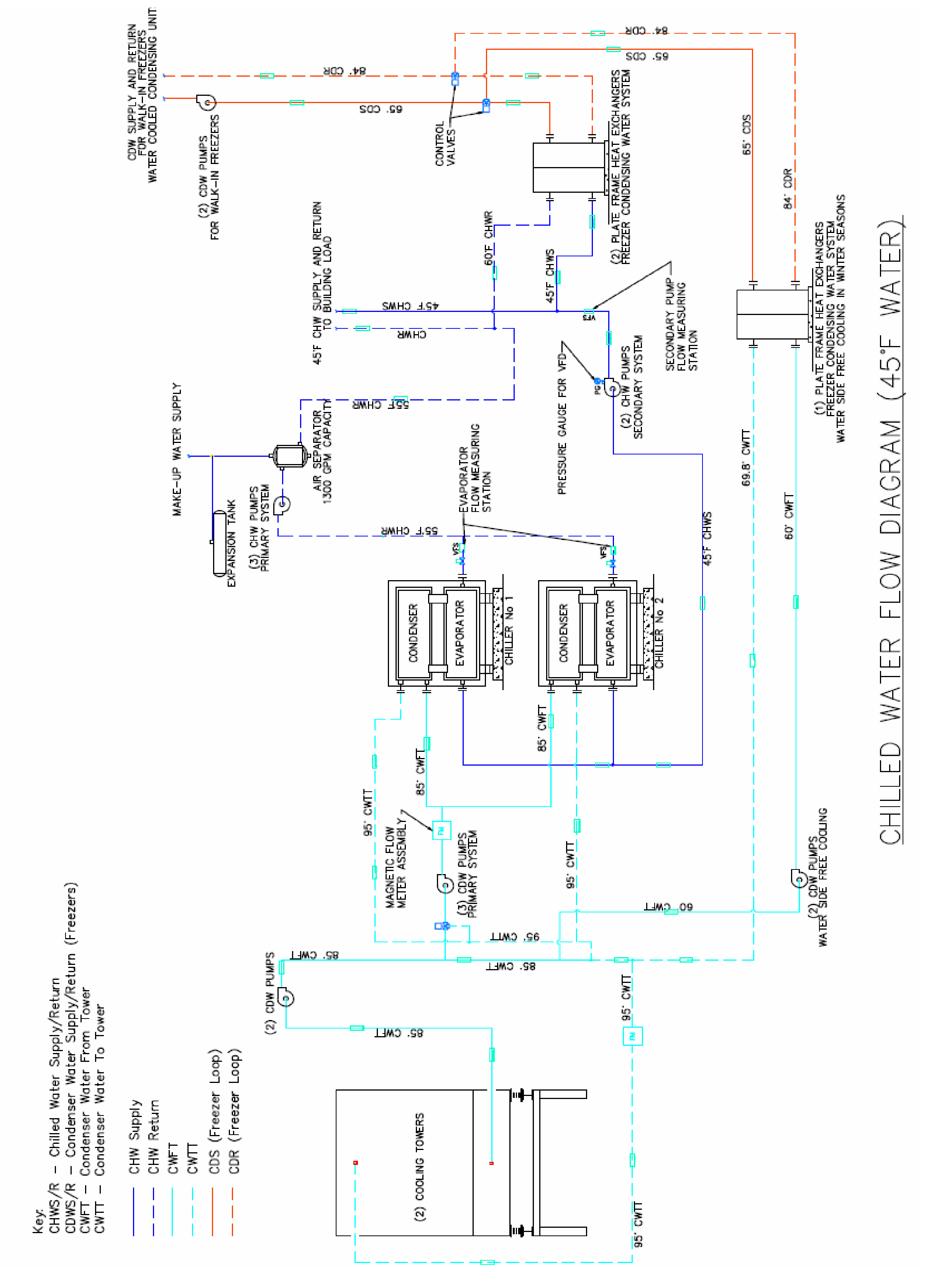

Figure 3-2 Chilled Water Flow Diagram

3.5 STEAM AND HOT WATER EXISTING SYSTEM

The boiler plant in the supply center consists of three natural gas-fired fire tube boilers. The two larger boilers, 200 BHP, service the building HVAC heating and domestic water heating loads. The third smaller boiler, 125 BHP, meets the kitchen equipment hot water demands. The boilers also incorporate flue gas recirculation to lower pollution levels. NO_X levels are held to 30 parts per million due to this configuration.

A combination deaerator and condensate storage tank is used to provide feed water to the boilers. Three active feed water pumps operate continuously with feed water valves located on the boilers. The feed water valves are controlled by level sensors so that minimum water levels are met to avoid potential hazards.

As stated above, the steam boilers produce 40 psig steam to service kitchen equipment loads, such as dishwashers. However, hot water for HVAC heating is also produced by these boilers. Hot water is needed to serve fin tube radiators, VAV box reheat coils, and cabinet and horizontal unit heaters. The hot water is produced by conversion of low pressure steam in two (one duty, one standby) shell and tube heat exchangers. Two hot water pumps with VFDs distribute the hot water to the HVAC equipment.

4.0 ASHRAE STANDARDS APPLICATIONS

This section includes summaries of compliance evaluations for the existing mechanical systems at the supply center for ASHRAE Standard 62.1-2004 and ASHRAE Standard 90.1-2004.

4.1 ASHRAE STANDARD 62.1 VENTILATION REQUIREMENTS

ASHRAE Standard 62.1-2004 Table 6-1 provides minimum ventilation rates for breathing zones and governs the design outdoor air requirements of the Supply Center. Table 6-1 includes a list of occupancy categories and the required minimum outdoor air rates per person and per square foot for those spaces.

The Ventilation Rate Procedure uses a series of equations in conjunction with tables found in Standard 62.1 which calculate the amount of ventilation air required for each space based on the it's use, occupancy, and floor area. This procedure then calculates the amount of outdoor air required for each AHU to intake in order to ensure that each space receives at least the minimum amount of outdoor air. Ventilation rates calculated for a compliance check are summarized in Table 4-1 shown below. The table illustrates the amount of outdoor air each AHU is to intake in order to comply with the standard and the