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# Technical Assignment Three

## Mechanical Systems Existing Conditions Report



Richard T. Flood Jr. & Sally Elliot Flood Athletic Center  
Salisbury, CT

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# Table of Content

1.0 Executive Summary-----	3
2.0 Design Requirement	
2.1 Design Objectives -----	4
2.2 Design Ventilation Requirements -----	4
3.0 External Influences on Design	
3.1 Outdoor and Indoor Design Conditions -----	5
4.0 Major Hardware Components	
4.1 AHU, Boilers, and Pumps-----	5, 6
5.0 Operation Characteristics	
5.1 Schematic Drawings -----	7
5.2 Energy Sources and Rates -----	8
5.3 Annual Energy Use -----	8, 9
5.4 Critique of System -----	10

## 1.0 Executive Summary

Technical assignment three was assigned to AE481 class students. Mechanical option students were required to research about mechanical system existing conditions of the Richard T. Flood Jr., & Sally Elliot Flood Athletic Center.

The facts from previous technical assignments were put together. Information from technical assignment one was about checking the compliance of ventilation and efficiency using ASHRAE Standards 62.1. Technical assignment two was to research how much it would cost to operate mechanical systems. The factors of maintaining the building are supplying water, space heating, space cooling, ventilation, and water heating.

Critique of the system was written based on the facts from information. There can be improvement on the building providing more air flow on wrestling room. Most of the Air handling units supplies too much air and it increases the cost of operating the building. The building is not LEED certified building but it meets ASHRAE Standards 62.1 and ASHRAE Standards 90.1.

## 2.0 Design Requirement

### 2.1 Design Objectives

Richard T. Flood Jr., & Sally Elliot Flood Athletic Center is 102,000 ft<sup>2</sup> multi-purpose facility. It was operated by eleven air handling units, fourteen pumps and four boilers. The building includes the offices, gymnasium facilities, and ice rink.

The main objective of the building is to maintain the comfortable conditions. Using ASHRAE Standards 62.1 and ASHARE Standards 90.1, verifying compliance of ventilation, heating and lighting could be done. The secondary objective is to lower the cost of operating the building. Maintaining both good air quality and heat was difficult.

### 2.2 Design Ventilation Requirements

Table 1 describes the compliance of ventilation. Air handling units provide certain amount of outside air. Required outside air is calculated by software eQuest. All the air handling units complies except for air handling unit six.

	required OA	OA CFM		Comply?
AHU - 1, AHU - 2	4508	17600	basketball court	yes
AHU - 4	618	2950	Storage	yes
AHU - 5	1906	640	squash court	no
AHU - 6	1936	1500	wrestling room, locker room	no
AHU - 7	741	800	weight room, locker room	yes
AHU - 8	416	855	corridor of second floor	yes
AHU - 9	815	1400	athlete waiting room	yes
AHU - 10	69	360	Offices	yes

Table 1

### 3.0 External Influences on Design

#### 3.1 Outdoor and Indoor Design Conditions

Table 2 provides information about outdoor and indoor conditions. The location was put in as Hartford, Connecticut because the weather information could not be found. The closest location was chosen in order to calculate the energy use of the system using eQuest.

Location	Hartford, CT
Latitude	41°
Longitude	72°
Time Zone	5
Cooling Design Temperature	91.3 °F
Heating Design Temperature	2.9 °F
Indoor Design Temperature	72 °F
Indoor Relative Humidity	30%

Table 2

### 4.0 Major Hardware Components

#### 4.1 AHU, Boilers, and Pumps

From Table 3 to Table 5, capacity of air handling units, boilers, and pumps were described.

Air Handling Units								
Unit	Fan Capacity			Hot Water Coil				
	Total CFM	O.A. CFM	RPM	MBH	EAT °F	LAT °F	GPM	HP
AHU-1	15400	8800	649	1242	20.6	102.4	86.9	10
AHU-2	15400	8800	649	1242	20.6	102.4	86.9	10
AHU-4	5675	2950	650	454.3	33.1	102.9	48	3
AHU-5	11000	640	800	362.1	65.6	96.1	22.7	0
AHU-6	6950	1500	809	320.3	53.8	96.3	40.6	5
AHU-7	6270	800	812	283.8	60.4	102.4	30.5	5
AHU-8	10000	855	760	423.5	63.6	102.8	47.5	7.5
AHU-9	4550	1400	948	261.3	45.2	102	28.1	3
AHU-10	1200	360	1270	73.37	47.5	103.9	7.88	1

Table 3

Boilers			
Boiler	IBR Gross Output (MBH)	IBR Net Output(MBH)	GPM
B-1	3957	3441	34.5
B-2	3957	3441	34.5
B-3	1281	1114	11
B-4	1281	1114	11

Table 4

Pumps			
Pump	GPM	RPM	HP
P-1	980	1750	40
P-2	980	1750	40
P-3	396	1750	5
P-4	396	1750	5
P-5	396	1750	5
P-6	396	1750	5
P-7	200	1750	5
P-8	200	1750	5
P-9	200	1750	5
P-10	200	1750	5
P-11	5	3450	0.5
P-12	5	3450	0.5
P-13	15	3450	0.5
P-14	15	3450	0.5

Table 5

## 5.0 Operation Characteristics

### 5.1 Schematic Drawings

Figure 1 describes the hot water flow. It is flow diagram of schematic drawing.

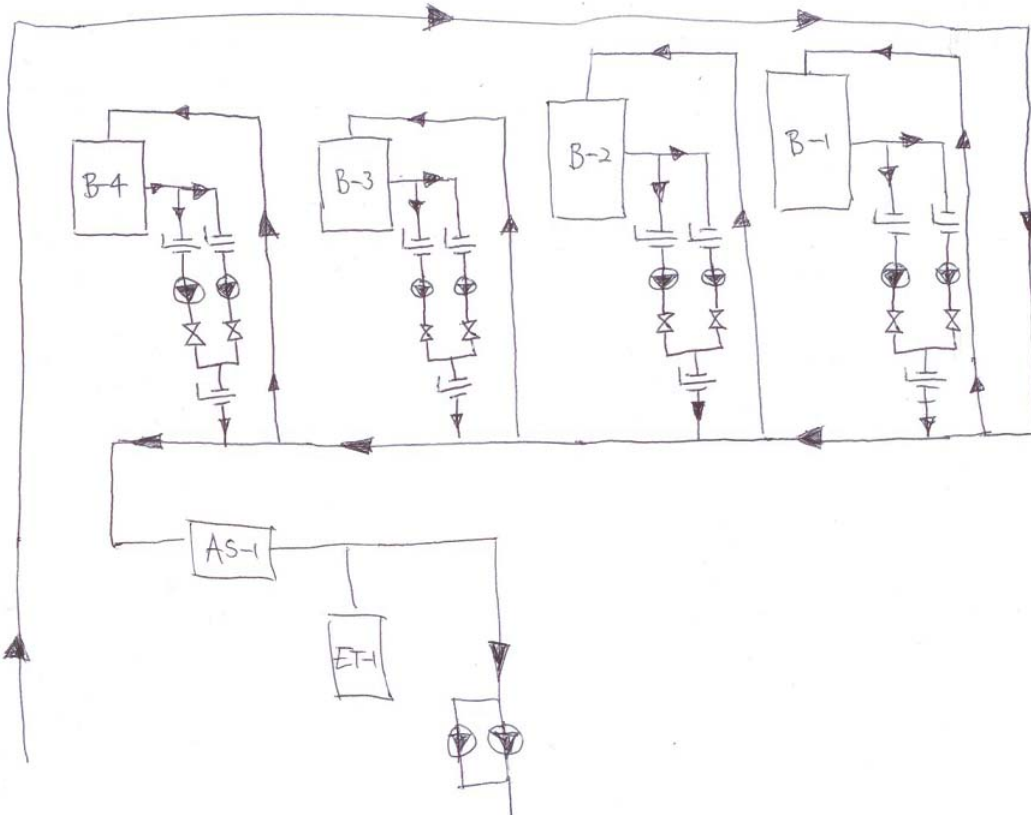


Figure 1.

## 5.2 Energy Sources and Rates

The gas and electricity were used as energy sources. Gas was used for space heating and water heating. Electricity was used for lighting, misc equipment, ventilation, pumps and space cooling.

Using Northeast Utilities supplier, the rate of electricity was \$0.09051/kWh for commercial buildings. And the rate of fuel cost was \$0.99 /liter and 1 liter can produce 30,489 BTU.

## 5.3 Annual Energy Use

Annual energy use of the Richard T. Flood Jr., & Sally Elliot Flood Athletic Center was taken from technical assignment two. Total use of the gas and electricity energy was 1,765,012 kWh as shown in Table 6. Figure 2 describes the percentage of annual usage.

Space heating	498,200	kWh
Water heating	134,812	kWh
Lighting	260,000	kWh
Misc. Equipment	195000	kWh
Ventilation	370000	kWh
Pumps	100000	kWh
Space Cooling	207000	kWh
Total Load	1,765,012	kWh

Table 6



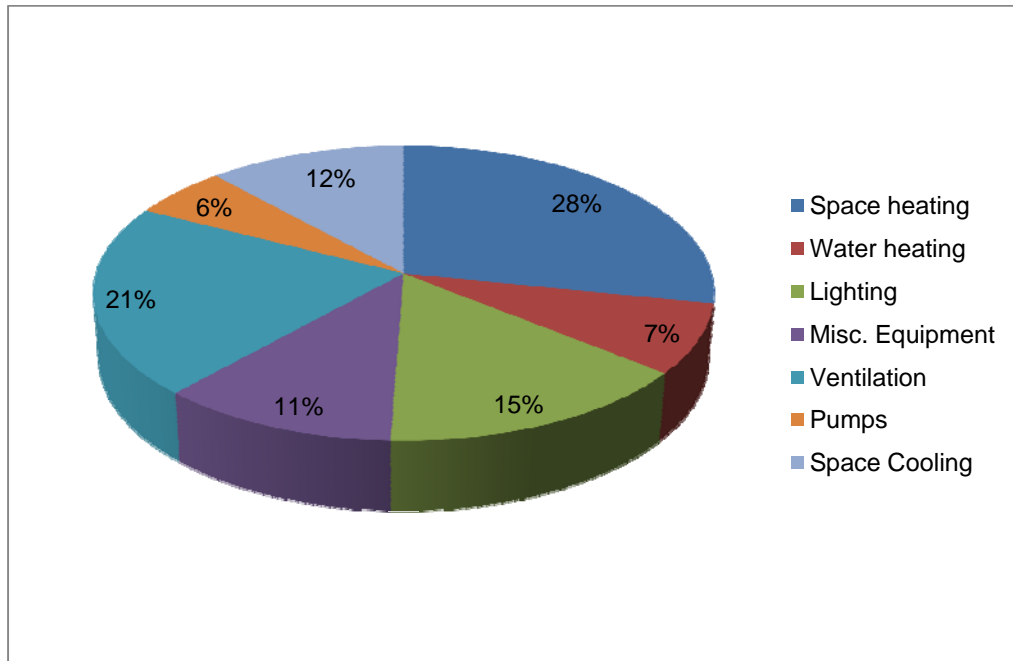


Figure 2

Figure 3 describes the annual usage of energy monthly

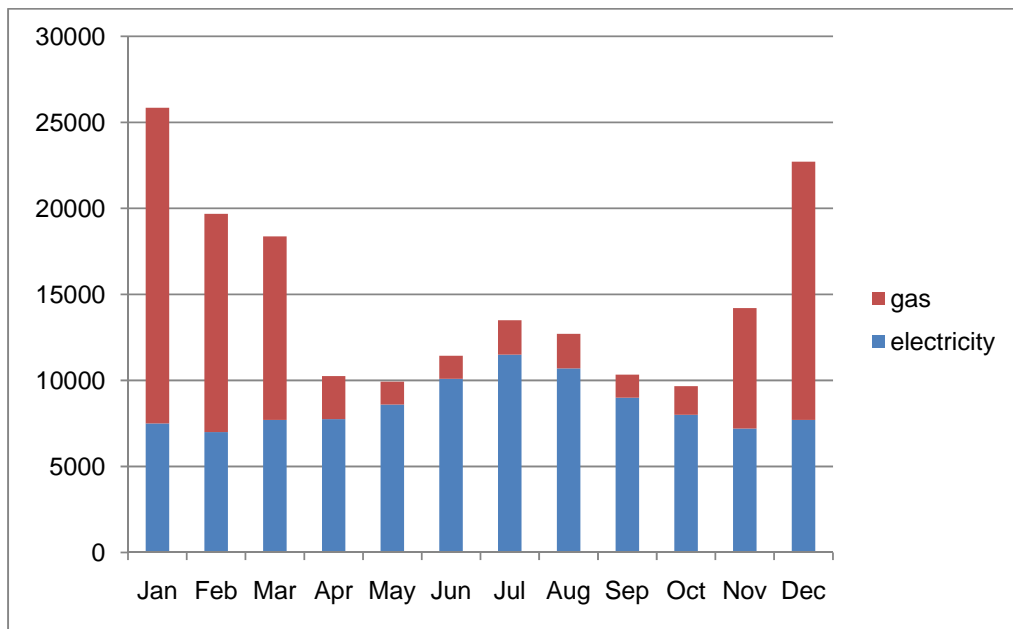


Figure 3

Using the data from eQuest, the annual cost for utility bill is \$175,933. The annual cost per square foot to operate the building is  $\$175,933 / 102,000 \text{ ft}^2 = \$1.72 / \text{ft}^2$ . The cost to operate the building is low compare to other commercial buildings because it is gymnasium.

## 5.4 Critique of System

Richard T. Flood Jr., & Sally Elliot Flood Athletic Center meets the compliance of ventilation and power usage of the building. But some of the air handling units provide too much outside air into the space. Mechanical system may use a lot more power than ASHRAE Standards require.

The air handling units that supply basketball court, storage spaces provide more than twice amount of outside air CFM. But the air handling units for squash court and wrestling room do not provide enough outside air. Supplying more outside air for squash court and wrestling room could increase the air quality of the Richard T. Flood Jr., & Sally Elliot Flood Athletic Center.

For the annual power usage, the building uses \$1.72 / ft<sup>2</sup>. The cost to operate the building is low compare to other commercial buildings because it is gymnasium.