TECHNICAL REPORT 1

ASHRAE Standards 62.1 and 90.1 Compliance Evaluation

Northfield Mental Healthcare Center
Northfield, Ohio

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Executive Summary

This report examines the compliance of the Northfield Mental Healthcare Center with the ASHRAE Standard 62.1-2007: Ventilation for Acceptable indoor Air Quality and the ASHRAE Standard 90.1-2007: Energy Standard for Building except Low-Rise Residential Buildings.

The Northfield Mental Healthcare center is classified as a hospital. Hospitals have to meet more specific requirement in accordance of the ASHRAE 170 which defines ventilation system requirements only for health care facilities. The ASHRAE 170 mainly deals with a detailed program, such as temperature, pressure and humidity control requirements. Although ASHRAE 170 contains more sophistical topics for health care facilities, some of HVAC equipment is still required to comply with the ASHRAE Standard 62.1 and the ASHRAE Standard 90.1. However, this report will examine only the ASHRAE Standard 62.1 and the ASHRAE Standard 90.1, not ASHRAE 170.

The ventilation air distribution system, exhaust duct location, ventilation control systems, restrictions of outdoor air intake locations, building envelope, air classification, and restrictions of air re-circulations are analyzed in the ASHRAE Standard Section 5. Ventilation rate procedure is performed in section 6. However, due to too large total floor areas to examine the ventilation airflow, the Ventilation Rate Procedure is used to analyze areas in a patient wing only. For the last part of the report evaluates the ASHRAE Standard 90.1 which mainly deals with building envelope, heating, ventilating , and air conditioning requirements.

In general, the HVAC systems of the Northfield Mental Healthcare Center comply with ASHRAE Standard 62.1 but not completely comply with the ASHRAE Standard 90.1. For example, the efficiencies of water pumps do not meet required minimum efficiencies of water pumps. One of the possible reasons that cause low efficiencies is that oversizing the water pump for emergency uses. Water pumps with lower efficiencies can produces losses, but the losses can be covered by using variable frequency drives which are equipped inside of pumps.

Even if there might be inappropriate equipment selection, its performance can be improved by using integrated accessories. The Northfield Mental Healthcare Center is satisfactory in complying with most of the ASHRAE requirements.

Part1: ASHRAE Standard 62.1 Section 5 Evaluation

Section 5: Systems and Equipment

Section 5.1 - Natural Ventilation

Due to the function of facility, none of the window is operable, so the natural ventilation requirements do not apply. Mechanical ventilation is utilized in the facility.

Section 5.2 - Ventilation Air Distribution

Ventilating systems are designed to achieve at least the minimum ventilation airflow which can be calculated in accordance with ASHRAE Standard 62.1 Section 6. Significant amount of outdoor air is taken into spaces by rooftop air handling unit to provide better air quality.

Section 5.3 - Exhaust Duct Location

Exhaust ductworks that contains harmful contaminants from bathroom, patient isolation rooms, janitor's closets, and laboratories are negatively pressurized and perfectly sealed according to SMACNA Standards in order to avoid leakage into occupied spaces.

Section 5.4 - Ventilation System Controls

Direct Digital VAV terminal unit control system is used in order to achieve the minimum ventilation airflow and space temperature based on the occupancy of the room. All the exhaust fans send signals to nearest air handling unit's digital control panel to control exhaust damper when air ventilation is required within occupied spaces.

Section 5.5 - Airstream Surfaces

Galvanized steel metal is used for airstream surfaces in accordance of UL 181 and ASTMC 1338 Standards to resist mold growth and erosion.

Section 5.6 - Outdoor Air Intakes

The outdoor air intake devices are required to be located at least 15ft away from significantly contaminated exhaust, 30ft away from noxious or dangerous exhaust, and 15ft from vents and flues from combustion appliances and equipment. All other required air intake minimum separation distances are listed in ASHRAE Standard 62.1 Table 5-1.

Section 5.7 - Local Capture of Contaminants

All the contaminants generated by the equipment are designed properly to exhaust directly through rooftop vents in order to avoid penetration into occupied spaces within the building.

Section 5.8 - Combustion Air

Gas fired boilers located in the first floor mechanical room. 6" of combustion air intake connected to each boiler collects and discharges combustion air down to nearest floor drain.

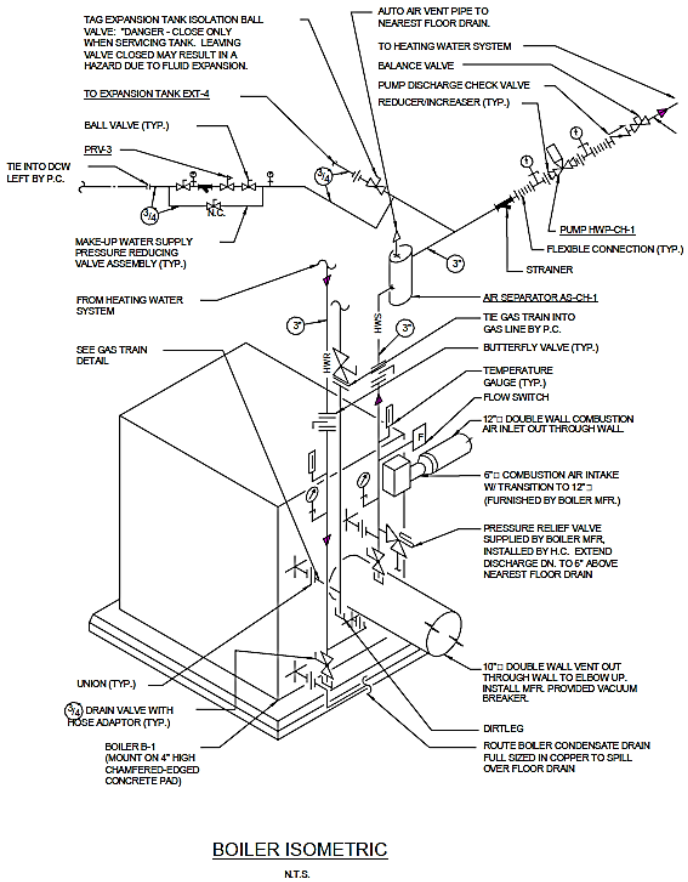


Figure 1. Boiler Isometric Drawing from Project Documentation

Section 5.9 - Particulate Matter Removal

Each air handling unit contains pre-filter and final filter with minimum efficiency reporting value (MERV) in accordance with ASHRAE Standard 52.2. The required minimum MERV is 6. The filters contained within each air handling unit are pre-filter of MERV 7 and final filter of MERV of 13 which comply with the ASHRAE Standard 52.2.

Section 5.10 – Dehumidification Systems

MAXIMUM OA (CFM)		MAXIMUM EA (CFM)	
AHU-1	20,000	EF-1A	2,200
AHU-2	20,000	EF-1B	2,200
AHU-3	3,700	EF-1C	1,300
AHU-4	2,450	EF-2A	2,200
AHU-5	6,200	EF-2B	2,200
AHU-6	5,000	EF-2C	1,300
AHU-7	5,000	EF-3	600
AHU-8	6,000	EF-4A	400
AHU-9	3,500	EF-4B	300
AHU-10	3,500	EF-5	2,000
		EF-6A	3,000
		EF-6B	3,000
		EF-7	5,000
		KEF-1	3,000
		KEF-2	2,700
		KEF-3	500
TOTAL	75,350	TOTAL	31,900

Table 1. Maximum Outdoor Air calculation and Maximum Exhaust Air Calculation

The design condition of the building is 72°F and 50% of humidity ratio, which complies with ASHRAE Standard 5.10.1. The design minimum outdoor air intake should be greater than the design maximum exhaust air for exfiltration in accordance with ASHRAE Standard 5.10.2. The total amount of maximum outdoor air that can be taken into air handling units is 68,350

CFM which is greater than the maximum air leaving through exhaust fans. This design condition complies with ASHRAE Standard 5.10.2.

Section 5.11 - Drain Pans

6" of cast iron floor drain is provided with vandal proof screws and 4" deep seal trap. Various sizes of cast iron combination roof drain are provided with gravel stop and cast iron dorm. All the drain pans are sloped at least 1/8" per foot. All the drain pans are designed to be sufficient to collect water drops that the water producing device creates. Condensate drain piping systems are sloped 1/8" per foot toward mob basins.

Section 5.12 - Finned-Tube Coils and Heat Exchangers

5/8" finned tube coils are equipped in the air handling units with adequate intervening access spaces of at least 18", in accordance with ASHRAE Standard 5.12.

Section 5.13 - Humidifiers and Water-Spray Systems

Infrared humidifier is equipped for the environmental conditioning unit which is located in administration area. Water supplying to the humidifier is directly originated from a portable water sources for better water quality. Emergency eye washers are installed following the minimum absorption distance and height recommended by manufacturer.

Section 5.14 - Access for Inspection, Cleaning, and Maintenance

All installed equipment including outdoor air intake, drain pans, drain seals, fans, and air handling units, have sufficient area for access of inspection, cleaning and maintenance. All of the airs handling units are built with accessible doors in order to replace installed components within the units.

Section 5.15 - Building Envelope and Interior Surfaces

The building uses adhered membrane roofing system which consists of outside film, 3 ½" polyiso rigid, 1" spray fire proof, and inside film. The polyiso rigid of membrane roofing system is moisture resistant, preventing water penetration into the building envelope.

Four different exterior wall types are used for the building envelope, CMU bearing, CMU with metal studs, face brick with metal stud, and curtain wall. CMU bearing is used for the new gymnasium. All the exterior walls are sealed and caulked to control the amount of water penetration. All the ducts and pipes are properly insulated in order to prevent from condensations.

Section 5.16 - Buildings with Attached Parking Garages

There is no parking garage attached to the building. Limiting the entry of vehicular exhaust into spaces is not a concern for this project.

Section 5.17 - Air Classification and Recirculation

Most of spaces in the building are classified as Class 1 in accordance of ASHRAE Standard 62.1 Table 6-1, except the bathrooms, kitchen, gymnasium, lavatories and janitor's closet areas. The bathroom areas and gymnasium area are classified as Class 2, the kitchen areas are classified as Class 3, and lavatories and janitor's closet areas are classified as Class4. Those areas that are classified above than Class 1 are restricted to be recirculated and directly exhausted to outside through rooftop exhaust fans.

Section 5.18 – Requirements for Buildings Containing ETS Areas and ETS-Free Areas

The building is smoke-free facility. Smoking is prohibited on the campus area or in any part of building. The requirements for ETS and ETS-Free areas do not apply to this project.

Part 2: ASHRAE Standard 62.1 Section 6 Evaluation

Section 6.2 - Ventilation Rate Procedure

Ventilation calculation is performed in order to determine outdoor air intake flow for optimal ventilation system for breathing zone. The ventilation airflow rates depend on type of space, occupancy level, space orientation, and area of the space.

$$Vbz = Rp \times Pz + Ra \times Az \quad (6\text{-}1)$$

A_z = the net occupiable floor area of the zone (ft^2)

P_z = the largest number of people expected to occupy the zone

R_p = outdoor airflow rate required per person as determined from Table 6-1.

R_a= outdoor airflow rate required per unit area as determined from Table 6-1.

Zone Outdoor Airflow (Voz)

$V_{oz} = V_{bz} / E_z$ Where: E_z=1.0 (6-2)

100% Outdoor Air Systems (V_{ot})

$V_{ot} = \Sigma_{all\ zones} * V_{oz}$ (6-4)

Primary Outdoor Air Fraction (Z_p)

$Z_p = V_{oz} / V_{pz}$ Where: V_{pz} = the zone primary airflow (6-5)

The detailed calculation procedures are shown in Appendix A.

Part3: ASHRAE Standard 90.1 Evaluation

Section 5 – Building Envelope

Northfield Mental Healthcare Center, located in Northfield, OH, is classified as Climate Zone 5A in the figure below. The figure is taken from ASHRAE Standard 90.1, 2007.

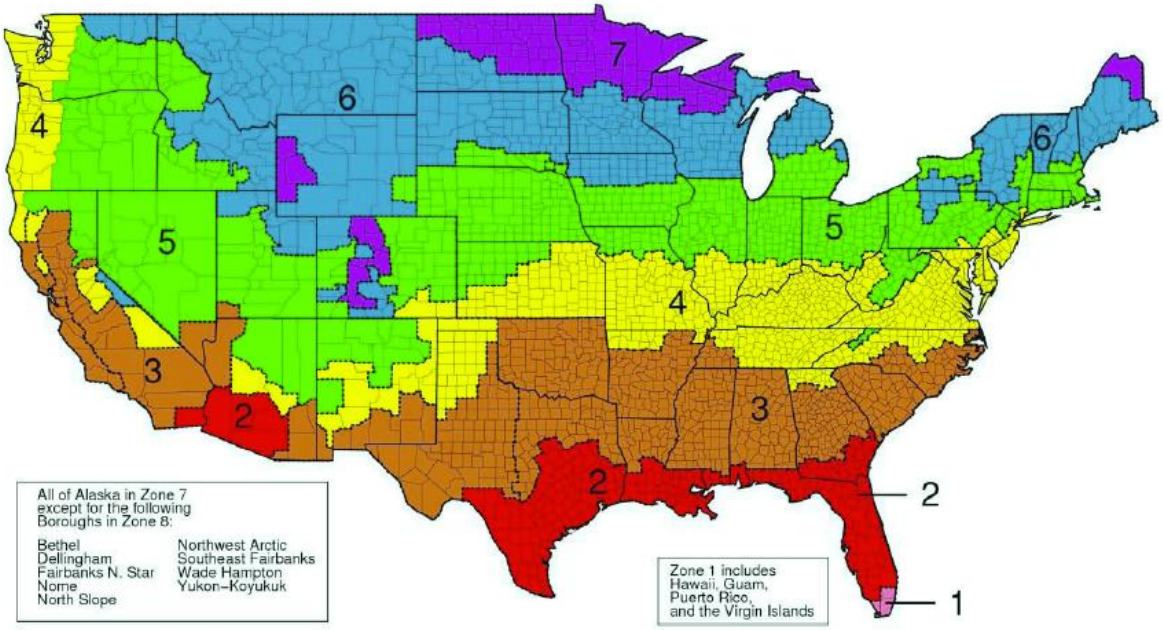


Figure 2. United Stats Climate Zones from the ASHRAE 90.1 Table 5.5-5.

The building envelope materials are compared with the maximum U-values of building elements and maximum SHGC values of glazing elements shown in the ASHRAE Standard 90.1 Table 5.5-5. The tables below show u-value calculations of each material and show if all the building envelope materials have appropriate U-values and SHGC values or not.

Walls	R-value	Thicknes	Conductivity
Surface Air Film (Vertical)	0.680		
Common 4" Brick	0.799	0.333	0.4167
Air Layer 3/4" to 4" (Vertical)	0.980		
2" Insulation	6.680	0.167	0.025
1/2" Gypsum or Plaster Board	0.454	0.042	0.0926
Mineral Wool/Fiber, Batt, R-21	22.611	0.511	0.0226
5/8" Gypsum or Plaster Board	0.562	0.052	0.0926
Overall R-Value	32.765		
Overall U-Value	**0.031**		

Roof	R-value
Outside Film	0.250
3 1/2" Polyiso Rigid	21.700
1" Spray Fire Proof	1.500
Inside Film	0.680
Overall R-Value	24.130
Overall U-Value	**0.041**

Windows	
Overall U-Value	**0.280**
SHGC	0.440
Visible Transmitance	0.810

Table 2. R-values and U-values calculations for building exterior materials

					Compliance	
Element	U-Value	Max. U-Value	SHGC	Max. SHGC	U-Value	SHGC
4" Face Brick Wall	0.031	0.090	N/A	N/A	Y	N/A
Adhered Membrane Roof	0.041	0.048	N/A	N/A	Y	N/A
Window	0.280	0.550	0.44	0.4	Y	N

Table 3. Summary of U-values and Compliance

Section 6 – Heating, Ventilating, and Air Conditioning

Section 6.2– Compliance Path

Due to large amount of gross area (greater than 25,000 ft^2), the simplified approach cannot be achieved for this section, but the mandatory provisions can be used for compliance.

Section 6.4 – Mandatory Provision

Currently the Northfield Mental Healthcare Center is not built yet; any specified test procedures and verifications of equipment efficiencies cannot be done. Heating and cooling system design loads calculations are performed prior to the selection of equipment and sizes of equipment.

All air terminal units, heating terminals and reheat coils are provided with wall mounted thermostats. Spaces with similar function are bounded together and controlled by common thermostats.

Most of ventilation controls are done by sending signals to digital control panel. Minimum outdoor air requirement is met by controlling outdoor air damper at a minimum position. Each air handling unit uses a digital control panel which requires inputs, such as space temperature, return air temperature, mixed air temperature and supply air temperature. The digital control panel outputs changes in positions of outsider air damper, face and bypass damper, chilled water coil valve, return air damper, and relief air damper. The digital control panel also uses binary inputs and outputs, which have only two options of order: start and stop. Extension modules to digital control panel are provided as required.

All the supply fans and return fans within every air handling unit except air handler 9 and 10 use variable frequency drive to control startup and stages. The variable frequency drives are equipped in heating water pump, chilled water pump, cooling tower, and chiller.

In accordance with ASHRAE 90.1 section 6.4.4.1, all the duct and plenum are required to be thermally insulated and sealed properly. All the ducts and pipes have different sizes of insulations available, depending on typical temperatures of ducts and pipes.

Section 6.5 – Prescriptive Path

About total 10,400,000 Btu/hr of cooling capacity is calculated for the whole building. Thus, economizer is required for the building. 30% of outside air economizers are equipped in air handling unit 1,2,3,4 and 5 to modulate return and outdoor airflows. Variable water economizer is not required for zone 5A.

In addition, ASHRAE requires maximum fan power that equipment can have. All the exhaust fans are evaluated to see their compliance with the fan power limitation in the ASHRAE 90.1 Section 6.5. The table below shows fan power limitation calculations by using option 2 in Table 6.5.3.1.1A.

TABLE 6.5.3.1.1A Fan Power Limitation[a]

	Limit	Constant Volume	Variable Volume
Option 1: Fan System Motor Nameplate hp	Allowable Nameplate Motor hp	$hp \le CFM_S \cdot 0.0011$	$hp \le CFM_S \cdot 0.0015$
Option 2: Fan System bhp	Allowable Fan System bhp	$bhp \le CFM_S \cdot 0.00094 + A$	$bhp \le CFM_S \cdot 0.0013 + A$

[a] where
CFM_S = the maximum design supply airflow rate to conditioned spaces served by the system in cubic feet per minute
hp = the maximum combined motor nameplate horsepower
bhp = the maximum combined fan brake horsepower
A = sum of $(PD \times CFM_D/4131)$
where
PD = each applicable pressure drop adjustment from Table 6.5.3.1.1B in in. w.c.
CFM_D = the design airflow through each applicable device from Table 6.5.3.1.1B in cubic feet per minute

Table 4. Table 6.5.3.1.1A from the ASHRAE 90.1 Standard

	BHP	CFM	Fan Power Limitation	Compliance
EF-1A	1.20	2,200	2.67	Y
EF-1B	1.20	2,200	2.67	Y
EF-1C	0.59	1,300	1.52	Y
EF-2A	1.20	2,200	2.67	Y
EF-2B	1.20	2,200	2.67	Y
EF-2C	0.59	1,300	1.52	Y
EF-3	0.23	600	0.68	Y
EF-4A	0.15	400	0.45	Y
EF-4B	0.11	300	0.34	Y
EF-5	0.86	2,000	2.31	Y
EF-6A	1.09	3,000	3.37	Y
EF-6B	1.09	3,000	3.37	Y
EF-7	2.14	5,000	5.77	Y
KEF-1	0.78	3,000	3.21	Y
KEF-2	0.74	2,700	2.91	Y
KEF-3	0.10	500	0.52	Y

Table 5. Exhaust Fan power Limitation Calculation and Compliance

For the hydronic system design and control, since the HVAC hydronic systems in this building exceeds 10 hp, sections 6.5.4.1 through 6.5.4.1 need to be examined. When two chillers are operating, one of them needs to be turned off to drop the total flow in the chiller plant can be reduced. This pump isolation complies to the ASHRAE 90.1 Section 6.5.4.2.

The largest Kitchen exhaust hood in the building is 3000 CFM. There is no need of makeup air due to its smaller size.

Hot gas bypass systems are equipped inside of air handling units. Air handling unit 1,2, 3, 6, 7 and 8 have 25% of maximum hot gas bypass capacity, since their rated capacity of hot gas bypass exceeds 24,000 Btu/h. Air handling unit 4 and 5 have 50% of maximum hot gas bypass capacity in accordance with the ASHRAE 90.1 Table 6.5.9.

Section 6.7 – Submittals

All the HVAC systems need to be examined to ensure that all control devices are properly sized and that systems are balanced. It is required to submit compliance documentation which includes drawings, manuals, and system commissioning.

Section 7 – Service Water Heating

Section 7.4 – Mandatory Provisions

The gas fired hot water heating type boilers are used in this building. The minimum performance requirement for this type of boiler is 80% thermal efficiency. All of the gas fired boilers have 4,000 MBH input and 3,800 MBH output, thus they produce 95% of efficiency. This complies with the ASHRAE90.1 Standard Section 7.8.

Section 8 – Power

ASHRAE Standard 90.1 requires feeder conductors to be sized for a maximum of 2% voltage drop at design load and branch circuits to be sized for a maximum voltage drop of 3% at design load. The power system is designed to meet NEC requirement as well as ASHRAE Standard 90.1 requirements.

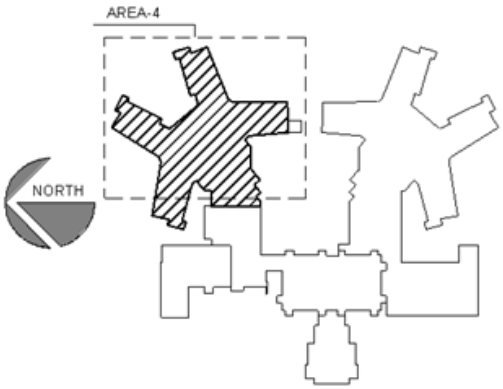
Section 9 – Lighting

Section 9.2 – compliance Path

Lighting systems and equipment can be examined by using two different methods: Building Area Method and Space-by-Space Method. The building area method will be used for this compliance analysis.

Section 9.5 – Building Area Method

Northfield Mental Healthcare Center is classified as hospital from Table 9.5.1, which requires maximum lighting power density of 1.2 Watts/ ft^2. The lighting fixtures in area 4 are counted below. The total area of area 4 is 62,254 ft^2.



	Counts	Watts/Fixture	Total (W)
D1	2	20	40
D1D	16	20	320
D2	30	27.5	825
D8	18	35	630
EL	8	84	672
EXIT	12	1.7	20.4
R2	62	56	3472
R3	32	56	1792
R4	11	56	616
R6	112	28	3136
R7	298	50	14900
R8B	192	50	9600
R9	78	56	4368
R10	60	84	5040
R11	16	24	384
R12	16	28	448
R13	8	112	896
R18	4	56	224
S1	16	56	896
S9	16	56	896
W2	3	56	168
W3	1	9.5	9.5
W4	3	28	84
Total	1014		49,437

Table 6. Location of Area 4 and Total Wattage Consumption by Lighting Fixtures

Wattage / Building Area= 49,437 Watts / 62,254 ft^2

LPD=0.79 W/ ft^2

The LPD value calculated for the area 4 is below than requirement by ASHRAE 90.1, Section 9. The patient wing of the Northfield Mental Healthcare Center complies with ASHRAE 90.1, Section 9.

Section10 – Other Equipment

The table 10.8 shows minimum nominal efficiency for general purpose design A and Design B motors. All the pumps used in the project are assumed to be enclosed motor.

Pump	Service	HP	GPM	Efficiency	RPM	Minimum Efficiency	Compliance
P-HWP-1	Heating Water	2	190	72	1160	86.5	N
P-HWP-2	Heating Water	2	190	72	1160	86.5	N
P-HWP-3	Heating Water	2	190	72	1160	86.5	N
P-HWP-4	Heating Water	2	190	72	1160	86.5	N
P-HWP-5	Heating Water	2	190	72	1160	86.5	N
P-HWP-6	Heating Water	2	190	72	1160	86.5	N
S-HWP-1	Heating Water	60	1900	81	1760	93.6	N
S-HWP-2	Heating Water	60	1900	81	1760	93.6	N
TWP-1	Tower Water	40	2700	52	1760	93.0	N
TWP-2	Tower Water	40	2700	52	1760	93.0	N
P-CWP-1	Chilled Water	25	1750	68	1160	91.7	N
P-CWP-2	Chilled Water	25	1750	68	1160	91.7	N
S-CWP-1	Chilled Water	50	1600	83	1760	93.0	N
S-CWP-2	Chilled Water	50	1600	83	1760	93.0	N

Table 7. Water Pump Efficiency calculations and compliance

According the pump schedule and pump specification, none of the pumps in the building meets the minimum efficiency for general motors. For the safety issue, generally pumps are oversized, which can cause lower efficiencies.

Standard 90.1 Summary

Building envelope, heating, ventilating, air conditioning, and mechanical equipment are analyzed in order to ensure everything meets ASHRAE Standard 90.1 requirements. Not all of the designs complies with the ASHRAE Standard90.1 SHGC value of window that are used for the building is slightly greater than maximum SHGC value required by ASHRAE Standard 90.1. Window material with higher SHGC value may be offered at better price, but will transmit more solar heat into the space.

All the heating, ventilating, and air conditioning control devices as well as lighting and power systems comply with the ASHRAE Standard 90.1, but the water pumps do not meet its requirement. Oversizing the equipment for safety issues may lower their efficiencies, but the losses due to lower efficiencies can be covered by variable frequency drives.

References

ANSI/ASHRAE. (2007). Standard 62.1 – 2007, Ventilation for Acceptable Indoor Air Quality. Atlanta, GA: American Society of Heating Refrigeration and Air Conditioning Engineers, Inc.

ANSI/ASHRAE. (2007). Standard 90.1 – 2007, Energy Standard for Buildings Except Low-Rise Residential Buildings. Atlanta, GA: American Society of Heating Refrigeration and Air Conditioning Engineers, Inc.

Appendix A

Patient Wing Area 4									
Zone #	Zone Description	Area	Clg. Cfm	Height	Occ/1000	OA/person	Pz	OA/1000ft2	Required Ventilation Air (CFM)
1	sp-1-room	198	100	8	10	5	1.98	0.06	22
2	sp-2-room	280	175	8	10	5	2.80	0.06	31
3	sp-3-room	198	100	8	10	5	1.98	0.06	22
4	sp-4-room	198	100	8	10	5	1.98	0.06	22
5	sp-5-room	198	100	8	10	5	1.98	0.06	22
6	sp-6-room	198	100	8	10	5	1.98	0.06	22
7	sp-7-corridor	4207.5	1375	8	0	0	0.00	0.12	505
8	sp-8-group	243.31	275	8	10	5	2.43	0.06	27
9	sp-9-room	198	75	8	10	5	1.98	0.06	22
10	sp-10-room	198	75	8	10	5	1.98	0.06	22
11	sp-11-room	198	75	8	10	5	1.98	0.06	22
12	sp-12-room	198	75	8	10	5	1.98	0.06	22
13	sp-13-room	198	75	8	10	5	1.98	0.06	22
14	sp-14-room	280	175	8	10	5	2.80	0.06	31
15	sp-15-room	290	150	8	10	5	2.90	0.06	32
16	sp-16-room	190	100	8	10	5	1.90	0.06	21
17	sp-17-room	190	100	8	10	5	1.90	0.06	21
18	sp-18-room	190	100	8	10	5	1.90	0.06	21
19	sp-19-room	190	100	8	10	5	1.90	0.06	21
20	sp-20-office	79.39	75	8	5	5	0.40	0.06	7
21	sp-21-office	177.84	125	8	5	5	0.89	0.06	15
22	sp-22-dinning	553.97	625	8	5	25	2.77	0.06	102
23	sp-24-corridor	4155.9	1625	8	0	0	0.00	0.12	499
24	sp-25-dinning	541.98	625	8	5	25	2.71	0.06	100
25	sp-26-gorup	746.66	625	8	10	5	7.47	0.06	82
26	sp-27-group	186.6	75	8	10	5	1.87	0.06	21
27	sp-28-office	164.17	125	8	5	5	0.82	0.06	14
28	sp-29-rm	195	100	8	10	5	1.95	0.06	21
29	sp-30-rm	195	100	8	10	5	1.95	0.06	21
30	sp-31-rm	290	150	8	10	5	2.90	0.06	32
31	sp-32-rm	195	100	8	10	5	1.95	0.06	21
32	sp-33-rm	195	100	8	10	5	1.95	0.06	21
33	sp-34-laundry	77.14	75	8	10	5	0.77	0.12	13
34	sp-35-visitation	402.47	400	8	5	5	2.01	0.06	34
35	sp-36-off	98.91	100	8	5	5	0.49	0.06	8
36	sp-37-off	95	75	8	5	5	0.48	0.06	8
37	sp-40-rm	127.33	75	8	10	5	1.27	0.06	14
38	sp-41-off	109.99	150	8	5	5	0.55	0.06	9
39	sp-43-rm	94.68	50	8	10	5	0.95	0.06	10
40	sp-44-corridor	221.71	350	8	0	0	0.00	0.12	27
41	sp-46-corridor	1079.6	975	8	0	0	0.00	0.12	130
42	sp-49-corridor	639.39	600	8	0	0	0.00	0.12	77
43	sp-50-clean Room	154.62	150	8	0	0	0.00	0.12	19
44	sp-52-soil	138.03	75	8	0	0	0.00	0.12	17
45	sp-53-off	92.3	50	8	5	5	0.46	0.06	8
46	sp-54-staff Lounge	184.76	175	8	5	25	0.92	0.12	45
47	sp-55-off	90	125	8	5	5	0.45	0.06	8
48	sp-56-off	96.87	75	8	5	5	0.48	0.06	8
49	sp-57-off	90	125	8	5	5	0.45	0.06	8
50	sp-58-off	90	125	8	5	5	0.45	0.06	8
51	sp-59-off	89.8	75	8	5	5	0.45	0.06	8
52	sp-60-locker	80.41	75	8	5	5	0.40	0.06	7
53	sp-61-off	89.8	125	8	5	5	0.45	0.06	8
54	sp-62-off	89.8	125	8	5	5	0.45	0.06	8
55	sp-63-visitation	437.26	400	8	5	5	2.19	0.06	37

56	sp-64-off	102.93	100	8	5	5	0.51	0.06	9
57	sp-65-off	95	75	8	5	5	0.48	0.06	8
58	sp-68-rm	127.37	75	8	10	5	1.27	0.06	14
59	sp-69-off	109.95	150	8	5	5	0.55	0.06	9
60	sp-71-rm	94.68	75	8	10	5	0.95	0.06	10
61	sp-72-off	143.5	125	8	5	5	0.72	0.06	12
62	sp-73-off	174.25	300	8	5	5	0.87	0.06	15
63	sp-74-off	128.5	200	8	5	5	0.64	0.06	11
64	sp-75-off	89.89	125	8	5	5	0.45	0.06	8
65	sp-76-nourisment	317.51	350	8	5	5	1.59	0.06	27
66	sp-77-IT	90.36	125	8	0	0	0.00	0	0
67	sp-78-off	90	75	8	5	5	0.45	0.06	8
68	sp-79-off	128.78	125	8	5	5	0.64	0.06	11
69	sp-80-off	174.25	275	8	5	5	0.87	0.06	15
70	sp-81-off	143.5	125	8	5	5	0.72	0.06	12
71	sp-82-group	195.11	75	8	10	5	1.95	0.06	21
72	sp-83-off	152	300	8	5	5	0.76	0.06	13
73	sp-84-laundry	88.06	75	8	10	5	0.88	0.12	15
74	sp-85-rm	190	75	8	10	5	1.90	0.06	21
75	sp-86-rm	190	75	8	10	5	1.90	0.06	21
76	sp-87-em	163.54	75	8	10	5	1.64	0.06	18
77	sp-88-rm	190	75	8	10	5	1.90	0.06	21
78	sp-89-rm	290	175	8	10	5	2.90	0.06	32
79	sp-90-rm	280	175	8	10	5	2.80	0.06	31
80	sp-91-rm	162.2	75	8	10	5	1.62	0.06	18
81	sp-92-rm	190	75	8	10	5	1.90	0.06	21
82	sp-93-rm	190	100	8	10	5	1.90	0.06	21
83	sp-94-rm	190	75	8	10	5	1.90	0.06	21
84	sp-95-rm	195	75	8	10	5	1.95	0.06	21
85	sp-96-group	277.86	325	8	10	5	2.78	0.06	31
86	sp-97-group	476.01	300	8	10	5	4.76	0.06	52
87	sp-98-group	247.37	375	8	10	5	2.47	0.06	27
88	sp-99-group	183.43	175	8	10	5	1.83	0.06	20
89	sp-100-off	83.67	125	8	5	5	0.42	0.06	7
90	sp-101-rm	190	125	8	10	5	1.90	0.06	21
91	sp-102-rm	190	150	8	10	5	1.90	0.06	21
92	sp-103-rm	195	125	8	10	5	1.95	0.06	21
93	sp-104-rm	195	75	8	10	5	1.95	0.06	21
94	sp-105-rm	195	150	8	10	5	1.95	0.06	21
95	sp-106-rm	195	150	8	10	5	1.95	0.06	21
96	sp-107-rm	195	75	8	10	5	1.95	0.06	21
97	sp-108-rm	195	75	8	10	5	1.95	0.06	21
98	sp-109-rm	195	150	8	10	5	1.95	0.06	21
99	sp-110-rm	280	250	8	10	5	2.80	0.06	31
100	sp-111-rm	290	125	8	10	5	2.90	0.06	32
101	sp-112-rm	280	175	8	10	5	2.80	0.06	31

Patient Wing Area 4									
Zone #	Zone Description	Area	Clg. Cfm	Height	Occ/1000	OA/person	Pz	OA/1000ft2	Required Ventilation Air (CFM)
102	sp-113-rm	198	250	8	10	5	1.98	0.06	22
103	sp-114-rm	162.19	225	8	10	5	1.62	0.06	18
104	sp-115-corridor	4862.2	1575	8	0	0	0.00	0.12	583
105	sp-116-rm	190	250	8	10	5	1.90	0.06	21
106	sp-117-rm	280	350	8	10	5	2.80	0.06	31
107	sp-118-rm	190	250	8	10	5	1.90	0.06	21
108	sp-119-rm	190	250	8	10	5	1.90	0.06	21
109	sp-120-rm	190	250	8	10	5	1.90	0.06	21
110	sp-121-rm	190	250	8	10	5	1.90	0.06	21
111	sp-122-rm	190	250	8	10	5	1.90	0.06	21
112	sp-123-rm	190	250	8	10	5	1.90	0.06	21
113	sp-124-off	152	200	8	5	5	0.76	0.06	13
114	sp-125-laundry	88	125	8	10	5	0.88	0.12	15
115	sp-126-group	196	225	8	10	5	1.96	0.06	22
116	sp-127-group	279	450	8	10	5	2.79	0.06	31
117	sp-128-group	474	525	8	10	5	4.74	0.06	52
118	sp-129-group	245	325	8	10	5	2.45	0.06	27
119	sp-130-rm	190	250	8	10	5	1.90	0.06	21
120	sp-131-rm	190	250	8	10	5	1.90	0.06	21
121	sp-132-rm	190	250	8	10	5	1.90	0.06	21
122	sp-133-rm	190	250	8	10	5	1.90	0.06	21
123	sp-134-rm	190	250	8	10	5	1.90	0.06	21
124	sp-135-rm	280	425	8	10	5	2.80	0.06	31
125	sp-136-rm	290	375	8	10	5	2.90	0.06	32
126	sp-137-rm	190	250	8	10	5	1.90	0.06	21
127	sp-138-rm	190	250	8	10	5	1.90	0.06	21
128	sp-139-rm	190	250	8	10	5	1.90	0.06	21
129	sp-140-rm	190	275	8	10	5	1.90	0.06	21
130	sp-141-off	86	175	8	5	5	0.43	0.06	7
131	sp-142-group	180	250	8	10	5	1.80	0.06	20
132	sp-143-off	146	200	8	5	5	0.73	0.06	12
133	sp-144-off	175	275	8	5	5	0.88	0.06	15
134	sp-145-off	129	150	8	5	5	0.65	0.06	11
135	sp-146-corridor	640	550	8	0	0	0.00	0.12	77
136	sp-148-rm	78	100	8	5	5	0.39	0.06	7
137	sp-149-rm	127	150	8	5	5	0.64	0.06	11
138	sp-150-off	110	125	8	5	5	0.55	0.06	9
139	sp-153-off	105	175	8	5	5	0.53	0.06	9
140	sp-154-off	95	100	8	5	5	0.48	0.06	8
141	sp-155-visitation	400	575	8	5	5	2.00	0.06	34
142	sp-158-corridor	281	425	8	0	0	0.00	0.12	34
143	sp-159-corridor	1167	1700	8	0	0	0.00	0.12	140
144	sp-160-corridor	1079	975	8	0	0	0.00	0.12	129
145	sp-161-visitation	442	600	8	5	5	2.21	0.06	38
146	sp-162-off	139	125	8	5	5	0.70	0.06	12
147	sp-163-off	139	125	8	5	5	0.70	0.06	12
148	sp-165-off	92.3	125	8	5	5	0.46	0.06	8
149	sp-166-off	95	125	8	5	5	0.48	0.06	8
150	sp-167-off	103	175	8	5	5	0.52	0.06	9
151	sp-170-off	109.75	150	8	5	5	0.55	0.06	9
152	sp-171-rm	127	150	8	5	5	0.64	0.06	11
153	sp-173-off	89.8	125	8	5	5	0.45	0.06	8
154	sp-174-off	89.8	125	8	5	5	0.45	0.06	8
155	sp-175-locker	80.38	75	8	5	5	0.40	0.06	7
156	sp-176-lounge	174.75	275	8	5	25	0.87	0.06	32
157	sp-177-off	90	125	8	5	5	0.45	0.06	8
158	sp-178-off	90	125	8	5	5	0.45	0.06	8
159	sp-179-off	90	125	8	5	5	0.45	0.06	8
160	sp-180-off	90.36	150	8	5	5	0.45	0.06	8
161	sp-181-off	90	125	8	5	5	0.45	0.06	8
162	sp-182-nourisment	317.51	375	8	5	5	1.59	0.06	27
163	sp-183-off	89.89	125	8	5	5	0.45	0.06	8
164	sp-184-off	128.5	150	8	5	5	0.64	0.06	11
165	sp-185-off	174.25	275	8	5	5	0.87	0.06	15

166	sp-186-off	146	200	8	5	5	0.73	0.06	12
167	sp-187-corridor	4374.9	1400	8	0	0	0.00	0.12	525
168	sp-188-dinning	606	1025	8	5	25	3.03	0.06	112
169	sp-189-group	195	225	8	5	5	0.98	0.06	17
170	sp-190-rm	78	100	8	5	5	0.39	0.06	7
171	sp-191-office	152	200	8	5	5	0.76	0.06	13
172	sp-192-laundry	89	125	8	10	5	0.89	0.12	15
173	sp-193-rm	190	250	8	5	5	0.95	0.06	16
174	sp-194-rm	190	250	8	5	5	0.95	0.06	16
175	sp-195-rm	190	250	8	5	5	0.95	0.06	16
176	sp-196-rm	190	250	8	5	5	0.95	0.06	16
177	sp-197-rm	290	425	8	5	5	1.45	0.06	25
178	sp-198-rm	280	425	8	5	5	1.40	0.06	24
179	sp-199-rm	190	250	8	5	5	0.95	0.06	16
180	sp-200-rm	190	250	8	5	5	0.95	0.06	16
181	sp-201-rm	190	250	8	5	5	0.95	0.06	16
182	sp-202-rm	190	250	8	5	5	0.95	0.06	16
183	sp-203-rm	190	250	8	5	5	0.95	0.06	16
184	sp-204-group	279	350	8	5	5	1.40	0.06	24
185	sp-205-group	475	575	8	5	5	2.38	0.06	40
186	sp-206-group	245	375	8	5	5	1.23	0.06	21
187	sp-207-rm	190	250	8	5	5	0.95	0.06	16
188	sp-208-off	84	150	8	5	5	0.42	0.06	7
189	sp-209-rm	169	250	8	5	5	0.85	0.06	14
190	sp-210-rm	190	250	8	5	5	0.95	0.06	16
191	sp-211-rm	190	250	8	5	5	0.95	0.06	16
192	sp-212-rm	190	250	8	5	5	0.95	0.06	16
193	sp-213-rm	190	250	8	5	5	0.95	0.06	16
194	sp-214-rm	190	250	8	5	5	0.95	0.06	16
195	sp-215-rm	190	250	8	5	5	0.95	0.06	16
196	sp-216-rm	190	250	8	5	5	0.95	0.06	16
197	sp-217-rm	290	375	8	5	5	1.45	0.06	25
198	sp-218-rm	280	475	8	5	5	1.40	0.06	24
199	cor sp-4-gathering	286.88	50	8	5	25	1.43	0.12	70
200	cor sp-9-gym Entrance	208.84	225	8	0	0	0.00	0.12	25
201	cor sp-10-office	83.19	100	8	5	5	0.42	0.06	7
202	cor sp-11-waiting	257.89	50	8	5	5	1.29	0.06	22
203	cor sp-12-elevator Lobby	358.11	150	8	0	0	0.00	0.12	43

Patient Wing Area 4									
Zone #	Zone Description	Area	Clg. Cfm	Height	Occ/1000	OA/person	Pz	OA/1000ft2	Required Ventilation Air (CFM)
204	cor sp-16-corridor	1901	975	8	0	0	0.00	0.12	228
205	cor sp-84-cooridor	781.84	225	8	0	0	0.00	0.12	94
	TOTALS:	62254	2475						6458