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Executive Summary

ANSI/ASHRAE Standard 62.1 – 2007, Ventilation for Acceptable Indoor Air Quality, establishes the method for design engineers to achieve the minimum air quality for a building. Section 5 of the standard establishes how mechanical systems and equipment obtain the necessary requirements to provide acceptable air quality, where section 6 of the standard focuses on the calculation of the minimum ventilation air required for each space in the building.

ANSI/ASHRAE Standard 90.1 – 2007, Energy Standard for Buildings..., explains how to “provide minimum requirements for the energy efficient design of buildings...” Section 5, Building Envelope Requirements, establishes requirements for the exterior construction of the building to comply with in order to be considered energy efficient. Section 6, Heating, Ventilating, and Air Conditioning, establishes the requirements for the buildings mechanical system to comply so that it can perform efficiently. Section 9, Lighting, establishes the amount of energy the lighting system of a building can consume.

North Pocono High School is a 230,000 ft.² building that has a variety of spaces that have unique requirements for each space. North Pocono’s mechanical system consists of 16 direct expansion air handler units with heating water coils that provide air to approximately 100 reheat VAV terminal units. The water supplied to the reheat units is heated by 2 7,000 MBH oil fired boilers. There are also some split air systems that serve areas that are not supplied by the main mechanical system.

After reviewing the building compliance of the standards, North Pocono overall meets the requirements established by the two standards, but there are areas where improvement can be made. Such as in the lighting density of the gym and office area, and the outdoor ventilation that is supplied to some of the zones as seen in the appendix C.

Standard 62.1 - 2007

Systems and Equipment

North Pocono has a relatively simple design, with many redundancies in the mechanical system; therefore many of the requirements in Standard 62.1 Section 5 are not applicable or are already met due the nature of the system. List below are the sections where compliancy is required.

5.3 Exhaust Duct Locations

All exhaust ducts are negatively pressurized to ensure the contaminants carried by the ducts cannot leak into the spaces, and have a direct path to exhaust fans that are either roof mounted or ceiling mounted.

5.5.1 Resistance to Mold Growth

After reviewing the construction documents it is determined that all materials have been determined to resist mold growth.

5.6.1 Outdoor Air Intake Location

All outdoor intakes meet the minimum distance needed to comply with this section (see Appendix A).

5.6.2-5 Outdoor Conditions

After reviewing the construction documents all of the outdoor equipment is in compliance with these sections.

5.11 Drain Pans

After reviewing the construction documents all drain pans comply with this section.

5.12 Finned-Tube Coils and Heat Exchangers

After reviewing the construction documents all finned-tube coils are in compliance with this section.

5.14 Access for Inspection, Cleaning, and Maintenance

After reviewing the construction documents all equipment complies with this section.

5.15 Building Envelope

All exterior surfaces are specified to resist water permeation. All ductwork and piping is insulated in order to comply with this section.

Assumptions

- Architectural plans with the furniture provided the correct design occupancy.
- Floor areas were correctly calculated on architectural floor plans.
- Nurse's cot rooms were categorized as class rooms to simplify the calculation.
- Some storage spaces and closets along with the mechanical room were excluded because they did not receive any outdoor air.
- AHU - 4,6,11 and 16 are for economizer only so the exhaust or return fans that serve those zones are properly sized; therefore they were not included in the system analysis.

Procedure

The following procedure to determine the minimum outdoor air for each zone followed the steps set forth by Standard 62.1 Section 6.

Step 1 Determine floor area (A_z), design occupancy (P_z), and total supply air to the zone (V_{pz}).

Step 2 Calculate the breathing zone outdoor airflow (V_{bz}) using the following equation:

$$V_{bz} = A_z * R_a + P_z * R_p$$

R_a and R_p can be found in Table 6-1 of Standard 62.1

R_a = outdoor air required per unit area (cfm/ft²)

R_p = outdoor air required per person (cfm/occupant)

Step 3 Determine the zone distribution effectiveness (E_z) from table 6-2

Step 4 Determine the zone outdoor air flow (V_{oz}) from the equation

$$V_{oz} = V_{bz} / E_z$$

Step 5 Calculate the zone primary outdoor air fraction (Z_p) from the following equation

$$Z_p = V_{oz}/V_{pz}$$

Step 6 Determine the system ventilation efficiency (E_v) from table 6-3 from Standard 62.1

Step 7 Calculate the uncorrected outdoor air intake (V_{ou}) from the following equation

$$V_{ou} = \sum_{\text{all zones}} (A_z * R_p) + \sum_{\text{all zones}} (P_z * R_a)$$

Step 8 Calculate the outdoor air intake (V_{ot}) from the following equation

$$V_{ot} = V_{ou}/E_v$$

A zone calculation can be found in Appendix B.

An alternate calculation is needed to determine E_z if it is above .55 which happens in some instances in my building so here is the alternate way to calculate V_{ot}

Step 6a Determine X_s from the following equation

$$X_s = V_{ou}/V_{ps}$$

$$V_{ps} = \text{systems primary airflow (cfm)}$$

Step 7a Determine zone discharge airflow (V_{dz})

Step 8a Determine discharge outdoor air fraction (Z_d) from the following equation

$$Z_d = V_{oz}/V_{dz}$$

$$V_{dz} = \text{the overall air flow provided to the zone}$$

Step 9a Determine the system ventilation efficiency (E_{vz}) from the following equation

$$E_{vz} = 1 + X_s - Z_d$$

Then continue with step 7 above.

A zone calculation with this method can be found in Appendix C.

The systems that were analyzed can be found in Appendix D.

Summary of Compliance

Overall, the North Pocono mechanical system more than more than adequately ventilates the building, this could be due to the fact that airflows were calculated using the trace modeling program was used to determine the outdoor air required where the value for a Rp value for a classroom is 15 cfm/person and for an office it is 20 cfm/person, but there are some within most systems zones that fall short of meeting the requirement. This was probably due to cost restraints and therefore can easily be addresses with a simple change of equipment layout or duct work. A breakdown of each system analyzed is in Appendix D.

Standard 90.1- 2007

Building Envelope

Since the buildings fenestration percentage is less than 40% it is acceptable to use the prescriptive method. North Pocono is located in climate zone 5 and is a nonresidential building and will therefore have to comply with table 5.5-6.

Table 1 - Opaque Element Compliance

Element	Insulation R-Value	Standard Min. R-Value	Compliant	Assembly U-Value	Assembly Max. U-Value	Compliant
Roof	10	20	No	0.681	0.48	No
Wall Type 1	10	11.4	No	0.67	0.09	Yes
Wall Type 2	10	11.4	No	0.093	0.09	No
Slab on Grade	NR	NR	NR	0.213	0.73	Yes

Table 2 - Fenestration Element Compliance

Fenestration	Assembly U-Value	Assembly Max. U-Value	Assembly SHGC	Max SHGC	Compliant
Metal Framing	0.5	0.45	0.55	0.4	No

Heating, Ventilating, and Air Conditioning

Since the building is larger than 25,000 ft² the Mandatory provisions method will have to be followed in order to determine if the system is in compliance with 90.1 Section 6. In the following tables are performance evaluations of the building's mechanical equipment.

Table 3 – Boiler Efficiency

Boiler	Net MBH Output	Gross MBH Input	Efficiency	Complaint
B-1	5,880	7,000	84%	Yes
B-2	5,880	7,000	84%	Yes

Table 4 - Split System Air Conditioning Unit

Unit	SEER	Complaint
AC-1	10.5	Yes

Table 5 – Air Handler Efficiency

Air Handler	Air Flow (cfm)	CFM*0.0015	Fan HP	Complaint
AHU-1	15,850	23.8	25	No
AHU-2	16,415	24.6	25	No
AHU-3	36,000	54.0	25	Yes
AHU-4	3,700	5.6	5	Yes
AHU-5	6,800	10.2	15	No
AHU-6	19,500	29.3	20	Yes
AHU-7	13,500	20.3	20	Yes
AHU-8	12,650	19.0	20	No
AHU-9	14,195	21.3	25	No
AHU-10	8,565	12.8	15	No
AHU-11	3,000	4.5	5	No
AHU-12	3,800	5.7	NA	NA
AHU-13	18,200	27.3	30	No
AHU-14	10,300	15.5	10	Yes
AHU-15	15,300	23.0	25	No
AHU-16	3,000	4.5	5	No

Table 6 – Kitchen Make Up Air Efficiency

Unit	Air Flow (cfm)	CFM*0.0011	Fan HP	Complaint
MAU-1	11,230	12	10	Yes

Table 7 – Exhaust Fan Efficiency

Exhaust Fan	Air Flow (cfm)	CFM*0.0011	Fan HP	Complaint
EF-1	1,1230	1.35	0.25	Yes
EF-2	1,150	1.27	0.25	Yes
EF-3	1,725	1.90	0.33	Yes
EF-4	1,100	1.21	1.1	Yes
EF-5	4,035	4.44	1.5	Yes
EF-6	75	0.08	0.07	Yes
EF-7	200	0.22	0.06	Yes
EF-8	880	0.91	0.25	Yes

EF-9	75	0.08	0.07	Yes
EF-10	75	0.08	0.07	Yes
EF-11	75	0.08	0.07	Yes
EF-12	1,500	1.65	0.25	Yes
EF-13	75	0.08	0.07	Yes
EF-14	75	0.08	0.07	Yes
EF-15	200	0.22	0.06	Yes
EF-16	200	0.22	0.06	Yes
EF-17	3,375	3.71	1.5	Yes
EF-18	770	0.85	0.25	Yes
EF-19	3,750	4.13	2.0	Yes
EF-20	3,750	4.13	2.0	Yes
EF-21	3,750	4.13	2.0	Yes
EF-22	105	0.12	0.07	Yes
EF-23	300	0.33	0.19	Yes
EF-24	75	0.08	0.07	Yes
EF-25	75	0.08	0.07	Yes
EF-26	200	0.22	0.06	Yes
EF-27	1,275	1.40	0.25	Yes
EF-28	125	0.14	0.02	Yes

While most the equipment complies with the 2007 standard the majority of the air handlers do not. They, however, did comply with the 2004 edition which was the standard used when the system was designed.

Service Water Heater

The two boilers are in compliance with this section, boilers are required to have efficiency greater than 78% and as already shown in Table 3 the boilers in this system are rated at 84%.

Lighting

Due to the size and number of rooms within in the school the building area method was used to calculate the power density for each area of the building. Table - 8 shows the areas that were used to divide up the school.

Table 8 – Lighting Density

Space	Area (ft²)	Actual Watts	Allowable Watts	Complaint
School	144,662	116,349	173,594	Yes
Gym	26,755	34,153	29,430	No
Office	6,186	6,508	6,186	No
Theater	10,720	5,166	17,152	Yes
Library	3,490	1,806	4,537	Yes
Cafeteria	13,620	8,784	19,068	Yes

The building complies with the overall lighting density but as the table above shows that the office and gym do not meet 90.1 requirements.

References

ASHRAE, 2007, ANSI/ASHRAE, Standard 62.1-2007, Ventilation for Acceptable Indoor Air Quality. American Society of Heating, Refrigerating, and Air Conditioning Engineers, Inc. Atlanta, GA. 2007.

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

GPI Inc., 2007. Mechanical Specifications. GPI Inc., Scranton, PA. 2008.

Appendix A Standard 62.1 Section 5.6.1

Object	Minimum Distance (ft.)	Actual Distance (ft.)
Significantly Contaminated Exhaust	15	20
Noxious or Dangerous Exhaust	30	NA
Vents, Chimneys, and Flues from Combustion Appliances and Equipment	15	NA
Garage Entry, automobile loading area, or drive in queue	15	60
Truck loading area or dock, bus parking/idling area	25	60
Driveway, street, or parking place	5	90
Thoroughfare with high traffic volume	25	NA
Roof, landscaped grade, or other surface directly below intake	1	NA
Garbage storage/pick-up area, dumpsters,	15	20
Cooling tower intake or basin	15	NA
Cooling tower exhaust	25	NA

Appendix B Outdoor Air Calculation

Outdoor Air Calculation for a typical classroom served by air handler 7 with a primary airflow of 1,280

Step 1 Determine A_z and P_z : $A_z = 802 \text{ ft}^2$, $P_z = 25$ occupants

Step 2 Calculate V_{bz} : From table 6-1 $R_a = 0.12 \text{ cfm/ft}^2$ and $R_z = 5 \text{ cfm/occupants}$

$$V_{bz} = 802 * 0.12 + 25 * 10 = 345 \text{ cfm}$$

Step 3 Determine E_z from table 6-2: $E_z = 1.0$

Step 4 Determine V_{oz} :

$$V_{oz} = 345 / 1.0 = 345 \text{ cfm}$$

Step 5 Determine Z_p :

$$Z_p = 345 / 1,280 = 0.27$$

Step 6 Determine E_v from Table 6-3: $E_v = 0.8$

Step 7 Determine V_{ou} :

$$V_{ou} = 4,525 \text{ cfm}$$

Step 8 Calculate V_{ot} :

$$V_{ot} = 4,525/0.8 = 5,655 \text{ cfm}$$

Appendix C Outdoor Air Calculation

Outdoor air calculation for a zone with a Z_p value greater than 0.55, the space is a waiting room classified as reception served by Air Handler 10 with a $V_{pz} = 100 \text{ cfm}$

Step 1 Determine A_z and P_z : $A_z = 370 \text{ ft}^2$, $P_z = 14$ occupants

Step 2 Calculate V_{bz} : From table 6-1 $R_a = 0.06 \text{ cfm/ft}^2$ and $R_p = 5 \text{ cfm/occupants}$

$$V_{bz} = 370*0.06+14*5 = 50 \text{ cfm}$$

Step 3 Determine E_z from table 6-2: $E_z = 0.8$ – This is because the air supplied to this space is 15°F greater than designed temperature.

Step 4 Determine V_{oz} :

$$V_{oz} = 50/0.8 = 65 \text{ cfm}$$

Step 5 Determine Z_p :

$$Z_p = 345/1,280 = 0.27$$

Step 6a Determine X_s :

$$X_s = 1,670/8,565 = 0.19$$

Step 7a Determine V_{dz} : $V_{dz} = 100 \text{ cfm}$

Step 8a Determine Z_d :

$$Z_d = 65/100 = 0.65$$

Step 9a Determine E_{vz} :

$$E_{vz} = 1 + 0.19 - 0.65 = 0.54$$

Step 10 Determine V_{ou} :

$$V_{ou} = 1,670 \text{ cfm}$$

Step 11 Determine V_{ot} :

$$V_{ot} = 1,670/0.54 = 3,090 \text{ cfm}$$

Appendix D System Ventilation Analysis

Air Handler 1		SA cfm = 15,850	Min OA cfm = 4,335															
Space	Use	P _z (# of Occupants)	R _p cfm/person	A _z Area (sq. ft.)	R _g cfm/sq.ft.	V _{bz} (cfm)	E _z	V _{oz} (cfm)	OA _{sup} (cfm)	V _{pz} (cfm)	Z _p							
Corridor-D001	Corridor	NA	NA	3,524	0.06	210	1.0	210	55	100	0.55							
FCS Lab-D014	Classroom	25	10	1,273	0.12	405	1.0	405	460	1,400	0.33							
Storage-D016	Storage	NA	NA	306	0.12	40	1.0	40	50	300	0.17							
Classroom-D017	Classroom	25	10	805	0.12	350	1.0	350	350	1,280	0.27							
Classroom-D018	Classroom	25	10	807	0.12	350	1.0	350	350	1,280	0.27							
Electrical-D025	Electrical	NA	NA	120	0.06	10	1.0	10	15	225	0.07							
Business Room-D113	Classroom	25	10	785	0.12	345	1.0	345	350	1,140	0.31							
Business Lab-D114	Computer Lab	29	10	788	0.12	385	1.0	345	480	2,480	0.19							
Classroom-D117	Classroom	25	10	802	0.12	345	1.0	345	350	1,280	0.27							
Corridor-D118	Corridor	NA	NA	1,490	0.06	90	1.0	90	35	100	0.85							
Room-D120		9	10	380	0.12	135	1.0	135	170	645	0.26							
Classroom-D121	Classroom	25	10	796	0.12	345	1.0	345	350	1,280	0.27							
Classroom-D122	Classroom	25	10	802	0.12	345	1.0	345	350	1,280	0.27							
Classroom-D123	Classroom	25	10	802	0.12	345	1.0	345	350	1,280	0.27							
Electrical-D133	Electrical	NA	NA	115	0.06	10	1.0	10	15	225	0.07							
Corridor-A101	Corridor	NA	NA	1,006	0.06	60	1.0	60	75	150	0.50							
Training-A105	Classroom	7	10	551	0.12	70	0.8	90	70	500	0.14							
Office-A106	Office	3	5	258	0.06	30	1.0	30	40	300	0.13							
Classroom-A107	Classroom	25	10	800	0.12	345	1.0	345	390	1,220	0.32							
								Total		4,195								

Air Handler 3		SA cfm = 36,000	Min OA cfm = 10,270															
Space	Use	P _z (# of Occupants)	R _p cfm/person	A _z Area (sq. ft.)	R _g cfm/sq.ft.	V _{bz} (cfm)	E _z	V _{oz} (cfm)	OA _{sup} (cfm)	V _{pz} (cfm)	Z _p							
Tickets-D226	Office	2	5	152	0.06	20	1.0	20	100	250	0.40							
Gymnasium-D125	Gymnasium	NA	NA	14,921	0.3	4,475	1.0	4,475	9,005	30,000	0.30							
Lobby - A202	Lobby	NA	NA	5,240	0.06	315	1.0	315	1,165	2,560	0.46							
								Total		4,810								

Air Handler 2		SA cfm = 16,415	Min OA cfm = 7,675								
Space	Use	P ₂ (# of Occupants)	R _p cfm/person	A _z Area (sq. ft.)	R _s cfm/sq.ft.	V _{bz} (cfm)	E _z	V _{az} (cfm)	OA _{sup} (cfm)	V _{pz} (cfm)	Z _p
Faculty Room-D027	Office	20	5	1,750	0.06	205	1.0	310	375	1,640	0.23
Classroom-D010	Classroom	25	10	802	0.12	345	1.0	345	550	1,280	0.43
Classroom-D011	Classroom	25	10	890	0.12	360	1.0	360	570	1,280	0.45
Faculty Room-D135	Office	20	5	1,744	0.06	205	1.0	310	375	1,740	0.22
SGI-D136	Classroom	6	10	219	0.12	85	0.8	105	205	335	0.61
Classroom-D137	Classroom	25	10	835	0.12	350	1.0	350	560	880	0.64
Classroom-D138	Classroom	25	10	835	0.12	350	1.0	350	560	880	0.64
SGI-D139	Classroom	6	10	219	0.12	85	0.8	105	205	335	0.61
Aerobics-D140	Aerobics	30	20	1,178	0.06	670	1.0	670	810	810	1.00
Corridor-D001	Corridor	NA	NA	3,524	0.06	210	1.0	210	50	100	0.50
General Science-D106	Classroom	25	10	1,278	0.12	405	1.0	405	625	1,110	0.56
Storage-D107	Storage	NA	NA	133	0.12	15	1.0	15	20	125	0.16
Classroom-D109	Classroom	25	10	1,278	0.12	405	1.0	405	625	1,280	0.49
Classroom-D110	Classroom	25	10	802	0.12	345	1.0	345	550	1,280	0.43
Business Lab-D111	Computer Lab	25	10	789	0.12	345	1.0	345	550	2,440	0.23
Electrical Room-D250	Storage	NA	NA	415	0.12	50	1.0	50	180	225	0.80
Classroom-D206	Classroom	25	10	802	0.12	345	1.0	345	550	1,115	0.49
							Total	5,025			

Air Handler 5		SA cfm = 6,800	Min OA cfm = 3,945								
Space	Use	P ₂ (# of Occupants)	R _p cfm/person	A _z Area (sq. ft.)	R _s cfm/sq.ft.	V _{bz} (cfm)	E _z	V _{az} (cfm)	OA _{sup} (cfm)	V _{pz} (cfm)	Z _p
Control Rcom-D232	Media Center	2	10	122	0.12	35	1.0	35	85	180	0.47
Studio-D233	Office	4	5	186	0.06	30	1.0	30	80	100	0.80
Corridor-D237	Corridor	NA	NA	1,565	0.06	95	1.0	95	80	150	0.53
Choral Room-D238	Music	100	10	1,677	0.06	1,100	1.0	1,100	1,225	2,100	0.58
Health-D240	Classroom	26	10	759	0.12	350	1.0	350	550	1,410	0.39
Music Classroom-D242	Music	22	10	594	0.06	255	1.0	255	375	880	0.43
Practice-D243	Music	5	10	133	0.06	60	1.0	60	100	100	1.00
Practice-D244	Music	5	10	133	0.06	60	1.0	60	100	100	1.00
Practice-D245	Music	5	10	156	0.06	60	1.0	60	100	100	1.00
Music Classroom-D246	Music	22	10	594	0.06	255	1.0	255	340	880	0.39
Music Office-D247	Office	3	5	560	0.06	50	0.8	65	275	550	0.50
Music Lab-D248	Music	33	10	911	0.06	385	1.0	385	550	920	0.60
							Total	2,750			

Air Handler /	SA cfm = 13,500	Min OA cfm = 4,355	P _i (# of Occupants)	R _p cfm/person	A _z Area (sq. ft.)	R _s cfm/sq.ft.	V _{hr} (cfm)	E _z	V _{nr} (cfm)	OA _{sup} (cfm)	V _{nr} (cfm)	Z _p
Corridor-C201	Corridor	NA	NA	NA	2,221	0.06	135	1.0	135	175	580	0.30
Corridor-C202	Corridor	NA	NA	NA	1,557	0.06	95	1.0	95	90	290	0.31
Corridor-C203	Corridor	NA	NA	NA	1,173	0.06	70	1.0	70	90	290	0.31
Classroom-C210	Classroom	25	10	10	814	0.12	350	1.0	350	350	1,280	0.27
Classroom-C211	Classroom	25	10	10	802	0.12	345	1.0	345	350	1,280	0.27
Classroom-C212	Classroom	25	10	10	802	0.12	345	1.0	345	350	1,280	0.27
Classroom-C213	Classroom	25	10	10	802	0.12	345	1.0	345	350	1,280	0.27
Classroom-C214	Classroom	25	10	10	802	0.12	345	1.0	345	350	1,280	0.27
Classroom-C215	Classroom	25	10	10	802	0.12	345	1.0	345	350	1,280	0.27
Classroom-C216	Classroom	25	10	10	814	0.12	345	1.0	345	350	1,280	0.27
Classroom-C217	Classroom	25	10	10	802	0.12	345	1.0	345	390	1,280	0.30
Classroom-C218	Classroom	25	10	10	802	0.12	345	1.0	345	390	1,280	0.30
Classroom-C219	Classroom	25	10	10	802	0.12	345	1.0	345	390	1,280	0.30
Classroom-C220	Classroom	25	10	10	802	0.12	345	1.0	345	390	1,280	0.30
Classroom-C221	Classroom	25	10	10	802	0.12	345	1.0	345	390	1,280	0.30
Dressing Room-C225	Office	4	5	5	200	0.06	30	0.8	40	20	200	0.10
Dressing Room C230	Office	4	5	5	200	0.06	30	0.8	40	25	200	0.13
								Total	4,525			

Air Handler 8	SA cfm = 13,500	Min OA cfm = 4,355	P _i (# of Occupants)	R _p cfm/person	A _i Area (sq. ft.)	R _s cfm/sq.ft.	V _{bz} (cfm)	E _z	V _{az} (cfm)	OA _{sup} (cfm)	V _{pz} (cfm)	Z _p
Corridor-C101	Corridor	NA	NA	NA	1,387	0.06	85	1.0	85	70	200	0.35
Classroom-C103	Classroom	25	10	10	802	0.12	345	1.0	345	410	1,280	0.32
Classroom-C104	Classroom	25	10	10	802	0.12	345	1.0	345	410	1,280	0.32
Classroom-C105	Classroom	25	10	10	802	0.12	345	1.0	345	410	1,280	0.32
Classroom-C105	Classroom	25	10	10	802	0.12	345	1.0	345	410	1,280	0.32
Electrical-C115	Electrical	NA	NA	NA	129	0.06	10	1.0	10	15	225	0.07
Classroom-C113	Classroom	25	10	10	815	0.12	350	1.0	350	370	1,280	0.29
Classroom-C119	Classroom	25	10	10	802	0.12	345	1.0	345	370	1,280	0.29
Classroom C120	Classroom	25	10	10	802	0.12	345	1.0	345	370	1,280	0.29
Classroom-C121	Classroom	25	10	10	802	0.12	345	1.0	345	370	1,280	0.29
Classroom-C122	Classroom	25	10	10	802	0.12	345	1.0	345	370	1,280	0.29
Classroom-C123	Classroom	25	10	10	802	0.12	345	1.0	345	370	1,280	0.29
Classroom-C124	Classroom	25	10	10	802	0.12	345	1.0	345	370	1,280	0.29
								Total	3,895			

Air Handler 9	SA cfm = 14,195	Min OA cfm = 6,245	P _z (# of Occupants)	R _p cfm/person	A _z Area (sq. ft.)	R _s cfm/sq.ft.	V _{bz} (cfm)	E _z	V _{oz} (cfm)	OA _{sup} (cfm)	V _{pz} (cfm)	Z _p
Chemistry-C222	Science Lab		25	10	1,280	0.18	480	1.0	710	500	1,180	0.42
Science Prep-C223	Classroom		3	10	279	0.12	65	1.0	65	135	400	0.34
Chemistry-C224	Science Lab		25	10	1,282	0.18	480	1.0	480	550	1,180	0.47
Earth Science C107	Science Lab		25	10	1,280	0.18	480	1.0	710	500	1,180	0.42
Science Prep-C108	Science Lab		3	10	279	0.18	80	1.0	130	80	400	0.20
Earth Science-C109	Science Lab		25	10	1,273	0.18	480	1.0	480	605	1,180	0.51
Corridor-C001	Corridor		NA	NA	1,390	0.06	85	1.0	85	85	200	0.43
Classroom-C003	Classroom		25	10	802	0.17	345	1.0	345	560	1,280	0.44
Classroom-C004	Classroom		25	10	802	0.12	345	1.0	345	560	1,280	0.44
Art Classroom-C005	Art Class		25	10	1,254	0.18	475	0.8	595	840	1,830	0.46
Storage-C006	Storage		NA	NA	247	0.12	30	0.8	40	100	295	0.34
Art Classroom-C008	Art Class		25	10	1,280	0.18	480	0.8	600	750	1,635	0.46
Corridor-C011	Corridor		NA	NA	980	0.06	60	1.0	60	60	100	0.60
Corridor-C018	Corridor		NA	NA	459	0.06	30	1.0	30	30	100	0.30
Classroom-C020	Classroom		25	10	811	0.12	350	1.0	350	435	1,280	0.34
Classroom-C021	Classroom		25	10	802	0.12	345	1.0	345	435	1,280	0.34
Total									5,370			

Air Handler 15	SA cfm = 15,300	Min OA cfm = 6,120	P _z (# of Occupants)	R _p cfm/person	A _z Area (sq. ft.)	R _s cfm/sq.ft.	V _{bz} (cfm)	E _z	V _{oz} (cfm)	OA _{sup} (cfm)	V _{pz} (cfm)	Z _p
Physics-D203	Classroom		25	10	1,282	0.12	405	1.0	405	630	1,350	0.47
Science Prep-D204	Classroom		3	10	279	0.12	65	1.0	65	145	400	0.36
Physics-D205	Classroom		25	10	1,282	0.12	405	1.0	405	585	1,340	0.44
Corridor-D101	Corridor		NA	NA	3,558	0.06	215	1.0	215	270	350	0.77
Biology Classroom-D103	Classroom		25	10	1,281	0.12	405	1.0	405	630	1,340	0.47
Science Prep-D104	Classroom		3	10	279	0.12	65	1.0	65	245	400	0.61
Biology Classroom-D105	Classroom		25	10	1,281	0.12	405	1.0	405	585	1,340	0.44
Electrical-C016	Electrical		NA	NA	109	0.06	10	1.0	10	90	225	0.40
Corridor-D001	Corridor		NA	NA	3,524	0.06	210	1.0	210	80	150	0.53
Communication Lab-D003	Computer		25	10	1,380	0.12	415	0.8	520	705	1,700	0.41
Press Room-D004	Office		4	5	336	0.06	40	0.8	50	330	770	0.43
Dark Room-D005	Classroom		3	10	269	0.12	60	0.8	75	75	130	0.58
CADD Lab-D007	Computer		21	10	869	0.12	315	0.8	395	570	1,190	0.48
Wood Shop-D008	Wood Shop		20	10	1,850	0.18	535	0.8	670	750	1,600	0.47
Custodial BreakRoom	BreakRoom		7	5	355	0.06	55	1.0	55	200	360	0.56
Total									3,950			

Air Handler 10	SA cfm = 8,565	Min OA cfm = 3,770	Use	P _z (# of Occupants)	R _p cfm/person	A _z Area (sq. ft.)	R _a cfm/sq.ft.	V _{bz} (ftm)	E _z	V _{oz} (ftm)	OA _{sup} (cfm)	V _{pz} (ftm)	Z _p
Corridor - A203	Corridor	NA	NA	NA	NA	578	0.06	35	0.8	45	45	100	0.45
Police - A205	Office	3	5	5	5	152	0.06	25	0.8	30	75	145	0.52
Waiting - A206	Reception	6	5	5	5	378	0.06	55	0.8	70	220	495	0.44
Administrative Area - A207	Reception	2	5	5	5	610	0.06	50	0.8	65	215	480	0.45
Work/Break Room - A208	Break	5	5	5	5	320	0.06	45	0.8	55	210	480	0.44
Storage - A209	Storage	NA	NA	NA	NA	91	0.12	10	0.8	15	75	140	0.54
Corridor - A210	Corridor	NA	NA	NA	NA	295	0.06	20	0.8	25	240	540	0.44
Administrative Area - A211	Reception	2	5	5	5	380	0.06	35	0.8	45	255	550	0.46
Vice Principle - A214	Office	3	5	5	5	261	0.06	30	0.8	40	95	450	0.21
Office - A215	Office	3	5	5	5	268	0.06	30	0.8	40	150	380	0.39
Principal's Office- A216	Office	7	5	5	5	284	0.06	50	0.8	65	190	420	0.45
Conference Room-A217	Conference	14	5	5	5	370	0.06	90	0.8	115	380	820	0.46
Waiting - A218	Reception	8	5	5	5	182	0.06	50	0.8	65	65	100	0.65
Nurses Office-A219	Office	3	5	5	5	544	0.06	50	0.8	65	165	480	0.34
Cot-A220	Classroom	3	10	10	10	174	0.12	50	0.8	65	65	120	0.54
Exam Room - A222	Office	2	5	5	5	132	0.06	20	0.8	25	95	200	0.48
Storage - A224	Storage	NA	NA	NA	NA	133	0.12	15	0.8	20	20	45	0.44
Hearing-A225	Office	4	5	5	5	108	0.12	35	0.8	45	100	200	0.50
Cot-A226	Classroom	3	10	10	10	201	0.06	40	0.8	50	65	120	0.54
Corridor-D211	Corridor	NA	NA	NA	NA	1,975	0.06	120	0.8	150	60	120	0.50
Corridor-D216	Corridor	NA	NA	NA	NA	306	0.6	20	0.8	25	25	100	0.25
Conference Room-D217	Conference	8	5	5	5	171	0.06	50	0.8	65	220	550	0.40
Office-D218	Office	4	5	5	5	208	0.06	30	0.8	40	75	200	0.38
Office-D219	Office	3	5	5	5	170	0.06	25	0.8	30	70	180	0.39
Office-D220	Office	4	5	5	5	171	0.06	30	0.8	40	75	180	0.42
Conference Room-D221	Conference	14	5	5	5	400	0.06	95	0.8	120	120	820	0.15
File Room-D222	Storage	NA	NA	NA	NA	165	0.12	20	0.8	25	25	40	0.63
Office-D223	Office	4	5	5	5	171	0.06	30	0.8	40	70	180	0.39
Office-D224	Office	4	5	5	5	149	0.06	30	0.8	40	70	180	0.39
Administrative Waiting-D225	Reception	9	5	5	5	690	0.06	85	0.8	105	105	320	0.33
Kitchenette-D271	Coffee Station	2	5	5	5	75	0.3	35	0.8	45	45	80	0.56
									Total	1,670			

Air Handler 12		SA cfm = 3,800	Min OA cfm = 2,250															
Space	Use	P _z	R _n	A _r	R _s	V _{kr}	E _r	V _{vr}	OA _{min}	V _{vr}	Z _n							
Corridor-D249	Corridor	NA	NA	1,654	0.12	200	1.0	200	230	300	0.77							
Band Room-D254	Music	150	10	3,249	0.06	1,695	1.0	1,890	2,000	3,300	0.61							
Corridor-D274	Corridor	NA	NA	395	0.06	25	1.0	25	25	100	0.25							
Total										2400								

Air Handler 13		SA cfm = 18,200	Min OA cfm = 10,800															
Space	Use	P _z	R _p	A _z	R _s	V _{bz}	E _z	V _{oz}	OA _{sup}	V _{pz}	Z _p							
Corridor-B202	Corridor	NA	NA	629	0.06	40	1.0	40	160	375	0.43							
Cafeteria-B203	Cafeteria	360	7.5	9,295	0.18	4,375	0.8	4,375	8,640	14,800	0.58							
Faculty Dining	Cafeteria	20	7.5	650	0.18	270	0.8	270	540	1,120	0.48							
Food Court-B208	Cafeteria	NA	NA	1,989	0.18	360	0.8	360	1,250	2,280	0.55							
Office-B214	Office	3	5	114	0.06	20	0.8	20	25	145	0.17							
School Store	Store	NA	NA	325	0.12	40	0.8	40	110	300	0.37							
Total										5,105								

Air Handler 14		SA cfm = 10,300	Min OA cfm = 2,575															
Space	Use	P _z	R _p	A _z	R _s	V _{bz}	E _z	V _{oz}	OA _{sup}	V _{pz}	Z _p							
Storage-D207	Storage	NA	NA	393	0.12	50	1.0	50	105	430	0.24							
Computer Lab-D208	Computer Lab	30	10	1,184	0.12	440	1.0	440	720	2,900	0.25							
Library-D209	Library	70	5	3,490	0.12	770	0.8	965	1,120	4,955	0.23							
Office-D210	Office	3	5	485	0.06	45	0.8	55	130	565	0.23							
Corridor-D211	Corridor	NA	NA	1,975	0.06	120	1.0	120	60	180	0.33							
Classroom-D212	Classroom	25	10	800	0.12	345	1.0	345	285	1,280	0.22							
Electrical Room-D235	Electrical	NA	NA	119	0.06	10	1.0	10	50	225	0.22							
Total										1,985								

