Army Reserve Center
Newport, Rhode Island

Technical Report One:
ASHRAE Standard 62.1 Ventilation and Standard 90.1 Energy Design Evaluations

Alexander Hosko
Advisor: Dr. Treado
October 4, 2010

Table of Contents

List of Figures and Tables

Executive Summary

The Army Reserve Center, scheduled to be completed in fall of 2011, is to be a 59,000 square foot training center. It consists mostly of offices, but also contains several classrooms, an assembly area, and a large storage area. Most of the building is on one of two variable air volume air handling units. However, the assembly area is on a separate constant air volume unit, and several smaller unit ventilators handle the ventilation and loads in the classrooms. The Army Reserve Center is designed to be LEED silver or gold. This report analyzes the Army Reserve Center's compliance with ASHRAE Standards 62.1 and 90.1.

This report starts off by analyzing the Army Reserve Center's compliance with ASHRAE 62.1 Sections 5 and 6. Section 5, Systems and Equipment, covers matters dealing with ventilation of the building, the quality of the air, preventing mold growth, and other similar topics. Section 6, Procedures, describes in detail the requirements for the ventilation of the building. The Army Reserve Center complies with most of Sections 5 and 6 of ASHRAE 62.1. The only exception is Section 5.6 because several operable windows are within fifteen feet of an exhaust louver.

After discussing ASHRAE 62.1, the report next analyzes ASHRAE 90.1. ASHRAE 90.1 sets standards for the building construction based on its climate zone. It also sets standards for the efficiency of the equipment used in the building, the service water heating, the power, and the lighting. The Army Reserve Center does not comply entirely with ASHRAE 90.1. The electric fan motors have a greater horsepower than required by Section 6.5. The maximum leaving water temperature from the fixtures is 120 degrees Fahrenheit whereas it is required by Section 7 to be 110 degrees Fahrenheit. The voltage drop on the branch circuits is specified to be less than ten percent whereas it is required to be less than two percent in Section 8.

Overall, the Army Reserve Center was mostly compliant with ASHRAE Standards 62.1 and 90.1. A more detailed summary is contained throughout the report.

ASHRAE Standard 62.1 – Section 5 Analysis

Section 5.1 – Natural Ventilation

Although some of the aluminum windows are operable, the building has mechanical ventilation and thus does not require any natural ventilation.

Section 5.2 – Ventilation Air Distribution

The ventilation system is able to meet the minimum airflow as required by Section 6 under any load condition. Detailed analysis of this is contained in the report.

Section 5.3 – Exhaust Duct Location

The exhaust ducts shall be constructed and sealed in accordance with SMACNA Rectangle Duct Construction and/or SMACNA Round Duct Construction for a negative pressure.

Section 5.4 – Ventilation System Controls

A Direct Digital Control (DDC) system will be provided as a complete system suitable for the control of the heating, ventilating and air conditioning (HVAC) and other building-level systems as specified and shown.

Section 5.5 – Airstream Surfaces

Unless otherwise specified, the ductwork is to be installed according to SMACNA HVAC Duct Construction Standards. The ductwork thus meets the requirements on both resistance to mold growth and erosion.

Section 5.6 – Outdoor Air Intakes

TABLE 5-1 Air Intake Minimum Separation Distance

Object	Minimum Distance, ft (m)
Significantly contaminated exhaust (Note 1)	15 (5)
Noxious or dangerous exhaust (Notes 2 and 3)	30 (10)
Vents, chimneys, and flues from combustion appliances and equipment (Note 4)	15 (5)
Garage entry, automobile loading area, or drive-in queue (Note 5)	15 (5)
Truck loading area or dock, bus parking/idling area (Note 5)	25 (7.5)
Driveway, street, or parking place (Note 5)	5 (1.5)
Thoroughfare with high traffic volume	25 (7.5)
Roof, landscaped grade, or other surface directly below intake (Notes 6 and 7)	1 (0.30)
Garbage storage/pick-up area, dumpsters	15 (5)
Cooling tower intake or basin	15 (5)
Cooling tower exhaust	25 (7.5)

Note 1: Significantly contaminated exhaust is exhaust air with significant contaminant concentration, significant sensory-irritation intensity, or offensive odor.
Note 2: Laboratory fume hood exhaust air outlets shall be in compliance with NFPA 45-1993 and ANSI/AIHA Z9.5-1992.4
Note 3: Noxious or dangerous exhaust is exhaust air with highly objectionable fumes or gases and/or exhaust air with potentially dangerous particles, bioaerosols, or gases at concentrations high enough to be considered harmful. Information on separation criteria for industrial environments can be found in the ACGIH Industrial Ventilation Manual 5 and in the *ASHRAE Handbook—HVAC Applications*.6
Note 4: Shorter separation distances are permitted when determined in accordance with (a) Chapter 7 of ANSI Z223.1/NFPA 54-2002[7] for fuel gas burning appliances and equipment, (b) Chapter 6 of NFPA 31-2001[8] for oil burning appliances and equipment, or (c) Chapter 7 of NFPA 211-2003[9] for other combustion appliances and equipment.
Note 5: Distance measured to closest place that vehicle exhaust is likely to be located.
Note 6: No minimum separation distance applies to surfaces that are sloped more than 45 degrees from horizontal or that are less than 1 in. (3 cm) wide.
Note 7: Where snow accumulation is expected, distance listed shall be increased by the expected average snow depth.

Table 1

Several windows are about five to ten feet below an exhaust louver that runs out of room 123, a mechanical room. This is less than the 15 feet required for significantly contaminated exhaust. The exhaust comes from the janitor's closet and toilet rooms and thus probably has an offensive odor, making it significantly contaminated. The rest of the outdoor air intakes meet the required separation distances.

Outside air intake louvers shall be designed to prevent moisture carryover below 1000 feet/minute. Intake louvers are designed for 500 feet/minute maximum and exhaust louvers are designed for 800 feet / minute maximum. All louvers have bird screens that are ½ inch square mesh, 14 or 16 gage aluminum or ¼ inch square mesh and 16 gage aluminum. Thus, the bird screens are compliant with Section 5.6.

Section 5.7 – Local Capture of Contaminants

On the subject of indoor air quality, the specifications state to provide equipment and components that comply with the requirements of ASHRAE 62.1 unless more stringent requirements are specified herein. No equipment in the Army Reserve Center needs to be exhausted.

Section 5.8 – Combustion Air

Sufficient air is provided into the mechanical room through intake louver L-13 and removed through exhaust louver LV-14. Boilers B-1 and B-2 thus have air in order to complete the combustion process. Unit heaters in the stairwells and vestibule also have sufficient air provided.

Section 5.9 – Particulate Matter Removal

Extended surface pleated panel filters with a MERV of 8 and cartridge type filters with a MERV of 13 are used. Both are tested according to ASHRAE 52.2.

Section 5.10 – Dehumidification Systems

Spaces are to be kept at 50% relative humidity. This is well less than the 65% recommended by Section 10. The intake louvers are bringing in a total of 32540 CFM of outside air while the exhaust louvers are sending 9390 CFM of air from the building. The building is thus positively pressured and compliant with Section 5.10.

Section 5.11 – Drain Pans

Drain pans are to be sized and located to collect any condensed water dripping from any item within the unit enclosure. They are to be constructed of 18 gauge steel, galvanized after fabrication, and thermally insulated to prevent condensation. Type 304 stainless steel is also allowed. Drain pans shall be pitched to ensure that all water drains whether fan is on or off.

Section 5.12 – Finned-Tube Coils and Heat Exchangers

A drain pan is required beneath all dehumidifying coils. Provisions shall be made for coil removal.

Section 5.13 – Humidifiers and Water-Spray Systems

A conductivity sensor will be provided to measure the quality of water in boilers, chilled water systems, condenser water systems, distillation systems, and potable water systems.

Section 5.14 – Access For Inspection, Cleaning, and Maintenance

Each air handling unit has access doors for inspection and maintenance on the right side. All other equipment, including unit ventilators, unit heaters, variable air volume boxes, and heat pumps, is accessible for routine maintenance.

Section 5.15 – Building Envelope and Interior Surfaces

A vapor retarder application is specified in order to prevent water condensation on cold surfaces within the envelope. A self-adhering underlayment is to be placed parallel to roof

slope to prevent water penetration. Fluid-applied waterproofing is applied to the rest of the building (concrete slabs, vertical walls, etc.) in order to prevent water penetration.

Section 5.16 – Buildings With Attached Parking Garages

A parking garage is not attached to the building. Thus, this section is not applicable.

Section 5.17 – Air Classification and Recirculation

Most of the air in the building qualifies as class 1 air except for the toilet rooms and janitor closets which are class 2 and 3 air respectively. This air is exhausted and not recirculated. The building will thus comply with Section 5.17.

Section 5.18 – Requirements For Buildings Containing ETS Areas and ETS Free Areas

The Army Reserve Center at Newport, Rhode Island is a smoke free building thus section 5.18 does not apply.

ASHRAE Standard 62.1 – Section 6 Analysis

For the Ventilation Rate Procedure (Section 6) analysis, all three air handling units were selected. The unit ventilators were ignored because they only cover several rooms.

The following equations were taken from ASHRAE Standard 62.1 Section 6 and used to determine the design outdoor airflow required in the breathing zone of the occupied areas.

$V_{bz} = R_p \times P_z + R_a \times A_z$ (Equation 6-1)

A_z = zone floor area: the net occupiable floor area of the zone (ft2)
P_z = zone population: the largest number of people expected to occupy the zone during typical usage.
R_p = outdoor airflow rate required per person as determined from Table 6-1 (CFM/person)
R_a = outdoor airflow rate required per unit area as determined from Table 6-1 (CFM/ft2)
V_{bz} = the breathing zone outdoor airflow

Zone Air Distribution Effectiveness (Ez) is a variable used to determine the amount of air that reaches the conditioned spaces. It is between zero and one. In this case the value of Ez will be one because it will be categorized as ceiling supply of cool air according to Table 6-2.

Zone Outdoor Airflow (Voz)

The zone outdoor airflow is calculated using Equation 6-2 from ASHRAE 62.1 which is shown below.

Voz = Vbz/Ez (Equation 6-2)

With Ez = 1 Equation 6-2 becomes:

Voz = Vbz

Primary Outdoor Air Fraction

Zp = Voz/Vpz (Equation 6-5)

Where Vpz = the outdoor air and return air from the air handler to the zone

Vou = DΣall zones(Rp x Pz) + Σall zones (Ra x Az) (Equation 6-6)

Where Vou = the uncorrected Outdoor Air Intake and D = Ps/Σall zones Pz (Equation 6-7)

Vot = Vou/Ev

Where Vot = the outdoor air intake flow

The detailed calculation for each space can be found in Appendix A. The spaces vary based on supply air to the room, room area, occupancy, and the purpose of the area. The detailed calculation was done using a spreadsheet that can be found in the ASHRAE 62.1 User's Manuel.

ASHRAE Standard 62.1 – Conclusion

Based on the above information, the Army Reserve Center is compliant with almost all of Section 5 and Section 6 of ASHRAE 62.1. Each occupant should receive enough ventilation air. The Army Reserve Center should not experience problems with mold or water leakage and the air quality also seems to be okay. The only problem experience by the reserve center is the exhaust louver in the first floor mechanical room appears to be too close to an operable window.

ASHRAE Standard 90.1 – Analysis

Section 5 – Building Envelope

Section 5.1.4 - Climate

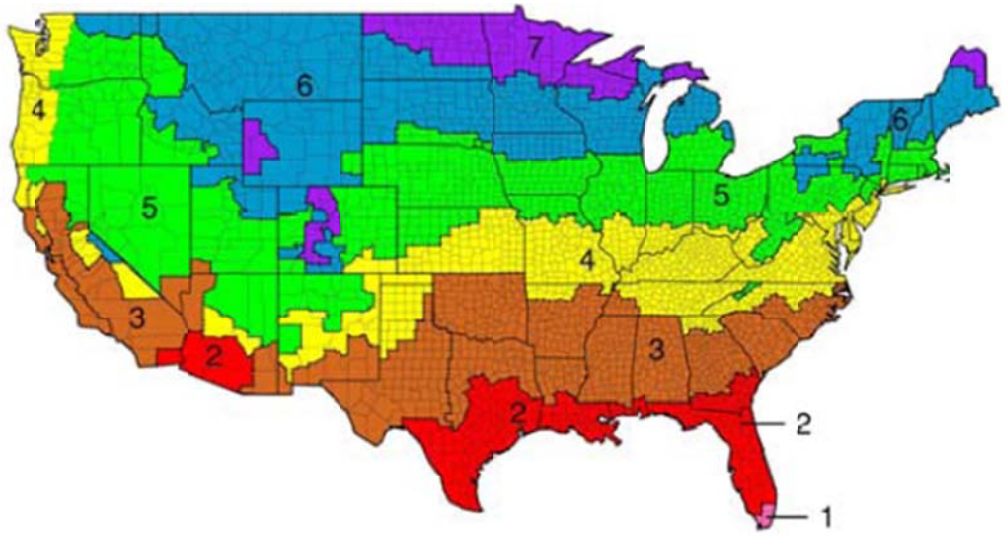

Figure 1

As shown above in Figure 1, the building is in climate zone 5A which encompasses all of Rhode Island.

Section 5.2 – Compliance Paths

There are no skylights on the building, thus it is well under the maximum 5% fenestration allowed on the roof area. It has a total of 12% glazing on the exterior, which is well under the maximum of 40%.

Section 5.4 – Mandatory Provisions

Caulking is specified around window, door, and louver frame. Joints between panels, the wall-to-floor interface, and the wall-to-roof interface are all required to be sealed. Air leakage through weather-stripped doors shall not exceed 1.25 CFM per square foot of door area.

Section 5.4.3.4 – Vestibules

An enclosed vestibule is provided at the main entrance with two sets of doors that are ten feet apart. This is above the required minimum of seven feet apart. This also allows only one set of doors to be open at a time.

Building Envelope Requirements for Climate Zone 5A			
	Type	**Required (R-value)**	**Actual (R-value)**
Roof	insulation entirely above deck	20	26
Walls, Above Grade	mass	11.4	13
	steel-framed wall	R-13+R-7.5 c.i.	32
Walls, Below Grade	below-grade wall	7.5	10
Slab-on-Grade Floors	unheated	NR	10

Table 2

As shown above in the Table 2, the building's roof, wall, and floor all meet the requirements for section 5.4.1 of ASHRAE 90.1. Shown below are the roof (Figure 2) and mass wall (Figure 3). Each has insulation with an R-value greater than that required by ASHRAE; thus there is no need to calculate the R-value for the entire assembly.

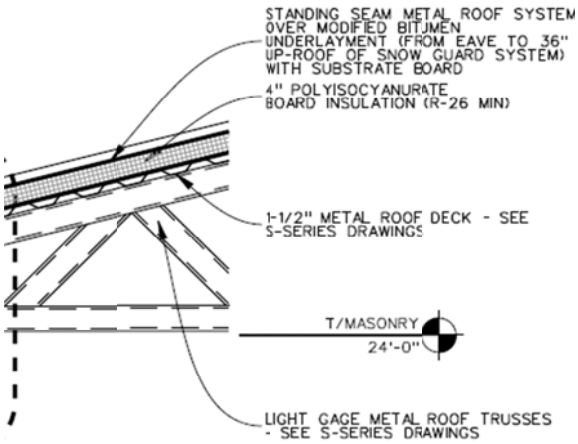

Figure 2 (above)

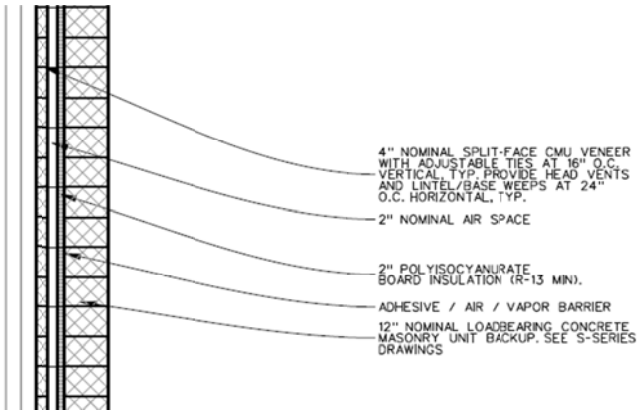

Figure 3 (above)

Section 6 – Heating, Ventilation, and Air Conditioning

Section 6.3 – Simplified Approach Option for HVAC Systems

Although the Army Reserve Center at Newport, Rhode Island is only two stories, it is 59,000 square feet. This is greater than the 25,000 square feet maximum for Section 6.3 to be applicable. Thus, the simplified approach cannot be used.

Section 6.4 – Mandatory Provisions

Since the building is still under construction, the manufacturer cannot yet verify the efficiency of the equipment.

Thermostats controlling the variable air volume boxes are shown on the mechanical drawings.

Section 6.5 – Prescriptive Path

Each air handling unit has an economizer as required by Section 6.5.1.1.1 since the cooling load on each air handler is greater than 135,000 BTU/h. AHU-1 and AHU-2 are both variable air volume while AHU-3 is constant volume. According to Section 6.5, the maximum horsepower is determined by the following formula: $HP \leq CFM * 0.0011$. For the CFM, the maximum supply airflow was used.

Tag	Supply CFM	HP	Allowable HP	Compliant
AHU-1 Supply Fan	3700	7.50	4.07	no
AHU-2 Supply Fan	13200	20.00	14.52	no
AHU-3 Supply Fan	2100	3.00	2.31	no
AHU-1 Return Fan	3700	3.00	4.07	yes
AHU-2 Return Fan	13200	10.00	14.52	yes
UV-1	625	0.50	0.6875	yes
UV-2	440	0.50	0.484	no
UV-3	440	0.50	0.484	no
UV-4	606	0.50	0.6666	yes
UV-5	650	0.50	0.715	yes
UV-6	975	0.50	1.0725	yes
UV-7	1575	0.75	1.7325	yes
UV-8	375	0.50	0.4125	no
HV-1	1300	2.00	1.43	no
HV-2	2000	1.00	2.2	yes
UH-1	270	0.04	0.297	yes
UH-2	270	0.04	0.297	yes
CUH-1	230	0.07	0.253	yes
CUH-2	230	0.07	0.253	yes
CUH-3	430	0.10	0.473	yes
CUH-4	230	0.07	0.253	yes
CUH-5	230	0.07	0.253	yes
CUH-6	230	0.07	0.253	yes
EF-1	840	0.25	0.924	yes
EF-2	60	0.11	0.066	no
EF-3	2000	0.75	2.2	yes
EF-4	150	0.17	0.165	no
EF-5	300	0.18	0.33	yes
EF-6	300	0.10	0.33	yes
EF-7	55	0.11	0.0605	no
EF-8	1000	0.25	1.1	yes
EF-9	55	0.07	0.0605	no

EF-10	250	0.11	0.275	yes
EF-11	1100	0.25	1.21	yes
EF-12	1100	0.25	1.21	yes
EF-13	370	0.10	0.407	yes
EF-14	190	0.03	0.209	yes
EF-15	380	0.13	0.418	yes
EF-16	380	0.13	0.418	yes
EF-30	185	0.06	0.2035	yes
EF-31	2200	0.50	2.42	yes
EF-32	300	0.10	0.33	yes
EF-33	200	0.03	0.22	yes

Table 3
Note: The non-standard size horse powers were converted from watts.

Standard Horse Powers:
1, 1 1/2, 2, 3, 5, 7 1/2, 10, 15, 20, 25, 30, 40, 50, 60, 75, 100, 125, 150, 200, 250, 300, 350, 400, 450, 500, 600, 700, 800, 900, 1000, 1250, 1500, 1750, 2000, 2250, 2500, 3000, 3500, 4000

As shown in Table 3, not all of the motors qualify. However, several of them are covered under section 6.5.3.1.2 which provides an exception allowing larger motors to be used. The standard horse powers, listed above, are used in motor sizing. One is usually not going to select a motor that is not one of the standard horse powers for cost reasons which is another reason not all of the motors are compliant with section 6.5.

As mentioned above, AHU-1 and AHU-2 are variable air volume, and the CFM used for calculating the allowable horse power was the maximum CFM. The maximum CFM is not always going to be supplied thus the motors are even more inefficient most of the time.

The building does not need to have condenser heat recovery for service water heating systems because the faculty does not operate 24 hours a day.

Section 7 – Service Water Heating

A natural gas fired water heater will be provided for the Army Reserve Center. Water will be distributed at a maximum temperature of 120°F. This is greater than the 110°F maximum water temperature required by section 7.4.4.3 of ASHRAE Standard 90.1.

The gas fired heater has a maximum efficiency of 96%. This easily surpasses the minimum efficiency of 80% required by Table 7.8 in ASHRAE 90.1.

Section 8 – Power

Section 8 of ASHRAE 90.1 sets the requirements of the maximum voltage drop for feeders and branch circuits. They are 2% and 3% respectively. It is specified that for circuits, the voltage drop should not exceed 10% of the nominal voltage. There is no mention of the sizing of the feeder conductors in relation to voltage drop.

Section 9 – Lighting

The lighting in the Army Reserve Center was designed to meet ASHRAE 90.1 as well as to obtain LEED credits by providing energy efficient T8 lamps in the majority of the building.

Exit signs are specified to be no more than five watts which meets Section 9.4.3 of ASHRAE 90.1. Switching, timers, and occupancy sensors will also be designed to meet ASHRAE 90.1.

The average lighting power density for the Army Reserve Center is 0.71 watts per square foot. To comply with Section 9.5 of ASHRAE 90.1, Building Area Method Compliance Path, the lighting power density for the whole building needs to be less than the amount given for that type of building. 0.71 watts per square foot is less than the minimum lighting power density required in Table 9.5.1 in ASHRAE 90.1 for both schools (1.2 W/ft2) and offices (1.0 W/ft2); either of which the Army Reserve Center could be considered.

The Army Reserve Center meets exterior lighting requirements set forth in Table 9.4.5 of ASHRAE 90.1. The parking lot of the Army Reserve Center has a lighting power density of 0.073 W/ft2 whereas the maximum required lighting power density is 0.15 W/ft2.

ASHRAE Standard 90.1 – Conclusion

Based on the above information, the Army Reserve Center is compliant with much of ASHRAE 90.1. As shown in detail above, the Army Reserve Center is entirely compliant and has even exceeded the requirements for Section 5, Building Envelope. This is due to caulking and sealing the joints of windows, doors, and louvers in order to limit infiltration. Also, the R-values of the building materials exceed those required. However, the Army Reserve Center does not comply with Section 6, Heating, Ventilation, and Air Conditioning. It exceeds the maximum horsepower required for fans in Section 6.5. The Army Reserve Center does not follow Sections 7, Service Water Heating, and Section 8, Power, either. The water supplied to fixtures is ten degrees hotter than that required in Section 7 and the maximum voltage drop in branch circuits required is 10% versus the 2% allowed in Section 8. However, the Army Reserve Center not only meets, but exceeds all the requirements of Section 9, Lighting.

Although the Army Reserve Center fell short in meeting several requirements of ASHRAE 90.1, it still met most all of the requirements. The several that were not met may still be met after construction. For example, the maximum voltage drop in branch circuits may be less than 2% even though less than 10% was specified. Overall, the design of the building, which will achieve at least LEED Silver, met the requirements of ASHRAE 90.1.

References

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

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.

Michel Baker Corporation. Construction Documents & Specifications. 101 Airside Drive, Pittsburgh, PA, 15108.

Appendix A

AHU-1

Building:	Delete Zone	Army Reserve Center - Newport, Rhode Island											
System Tag/Name:		AHU - 1											
Operating Condition Description:	Add Zone												
Units (select from pull-down list)		IP											
Inputs for System		**Name**	**Units**			**System**							
Floor area served by system		As	sf			6862							
Population of area served by system (including diversity)		Ps	P	100%	diversity	65							
Design primary supply fan airflow rate		Vpsd	cfm			2,975							
OA req'd per unit area for system (Weighted average)		Ras	cfm/sf			0.08							
OA req'd per person for system area (Weighted average)		Rps	cfm/p			4.9							
Inputs for Potentially Critical zones												Potentially Critical Zones	
Zone Name		*Zone title turns purple italic for critical zone(s)*					Chair Storage	Lobby	Rec / Ret Office	Breakroom	Office	North Corridor	East Corridor	West Corridor
Zone Tag	Show Values per Zone						105	101	102	103	108-112	185	184	187
Space type		Select from pull-down list					Storage rooms	Lobbies	Office space	Office space	Office space	Corridors	Corridors	Corridors
Floor Area of zone		Az	sf				310	912	289	310	625	884	400	400
Design population of zone		Pz	P	(default value listed; may be overridden)			0	2	1	6	5	0	0	0
Design total supply to zone (primary plus local recirculated)		Vdzd	cfm				70	195	90	495	625	120	50	50
Induction Termina Unit, Dual Fan Dual Duct or Transfer Fan?		Select from pull-down list or leave blank if N/A												
Local recirc. air % representative of ave system return air		Er												
Inputs for Operating Condition Analyzed														
Percent of total design airflow rate at conditioned analyzed		Ds	%			100%	100%	100%	100%	100%	100%	100%	100%	100%
Air distribution type at conditioned analyzed		Select from pull-down list					CS	CS	CS	CS	CS	CS	CS	CS
Zone air distribution effectiveness at conditioned analyzed	Show codes for Ez	Ez					1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Primary air fraction of supply air at conditioned analyzed		Ep												
Results														
Ventilation System Efficiency		Ev				0.56								
Outdoor air intake required for system		Vot	cfm			1502								
Outdoor air per unit floor area		Vot/As	cfm/sf			0.22								
Outdoor air per person served by system (including diversity)		Vot/Ps	cfm/p			23.1								
Outdoor air as a % of design primary supply air		Ypd	cfm			50%								

South Corridor	Armory	Fac Storage	Library	Learning Center / Library Storage	Fam Readiness
188	134	126	119	115	114
Corridors	Office space	Storage rooms	Libraries	Libraries	Office space
721	121	253	522	825	290
0	1	1	12	36	1
60	85	135	200	700	100
100%	100%	100%	100%	100%	100%
CS	CS	CS	CS	CS	CS
1.00	1.00	1.00	1.00	1.00	1.00

AHU – 2

Building:	Delete Zone	Army Reserve Center - Newport, Rhode Island									
System Tag/Name:		AHU-2									
Operating Condition Description:	Add Zone										
Units (select from pull-down list)		IP									
Inputs for System		**Name**	**Units**			**System**					
Floor area served by system		As	sf			20592					
Population of area served by system (including diversity)		Ps	P	100%	diversity	216					
Design primary supply fan airflow rate		Vpsd	cfm			12,470					
OA req'd per unit area for system (Weighted average)		Ras	cfm/sf			0.06					
OA req'd per person for system area (Weighted average)		Rps	cfm/p			5.3					
Inputs for Potentially Critical zones											
Zone Name		*Zone title turns purple italic for critical zone(s)*					Office	Office	Office	Office	Offices
Zone Tag	Show Values per Zone						208	207	201	202	203-206
Space type			Select from pull-down list				Office space	Office space	Office space	Office space	Office space
Floor Area of zone		Az	sf				125	125	150	125	500
Design population of zone		Pz	P	(default value listed; may be overridden)			1	1	1	1	4
Design total supply to zone (primary plus local recirculated)		Vdzd	cfm				85	75	125	85	300
Induction Termina Unit, Dual Fan Dual Duct or Transfer Fan?			Select from pull-down list or leave blank if N/A								
Local recirc. air % representative of ave system return air		Er									
Inputs for Operating Condition Analyzed											
Percent of total design airflow rate at conditioned analyzed		Ds	%			100%	100%	100%	100%	100%	100%
Air distribution type at conditioned analyzed			Select from pull-down list		Show codes for Ez		CS	CS	CS	CS	CS
Zone air distribution effectiveness at conditioned analyzed		Ez					1.00	1.00	1.00	1.00	1.00
Primary air fraction of supply air at conditioned analyzed		Ep									

Unit Common / Interior Corridor	Unit Commion	Corridor / Unit Commion	Offices						
291	292	293	210-211						
Break rooms	Break rooms	Break rooms	Office space						
1824	2800	5800	250						
16	59	59	2						
985	1510	2860	130						
100%	100%	100%	100%						
CS	CS	CS	CS						
1.00	1.00	1.00	1.00						

Offices	Office	Office	Office	Office	Office	Office	Office	Office	NSTR Classroom	Office	Office	Office
213-214 , 216-217	212	215 , 218 Office	261	262	264	222	263	265	271	225	228,231,234	224
Office space	Office space	Office space	Office space	Office space	Office space	Office space	Office space	Office space	Classrooms (age 9	Office space	Office space	Office space
560	125	280	165	140	125	125	140	125	480	125	375	125
4	1	2	1	1	1	1	1	1	13	1	3	1
260	130	340	75	65	65	170	125	125	450	130	390	65
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
CS	CS	CS	CS	CS	CS	CS	CS	CS	CS	CS	CS	CS
1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Office	Office	Office	Office	Office	Office	Offices	Offices	Offices	Office	Offices	Offices	Office
220 , 223	226-227, 250-251	230,233,245, 248,277,278	229,232,244, 247,279	274,275	276	253 , 255 , 257 , 259	254 , 256 , 258 , 260	246 , 249 , 252	209	239 - 242	236 - 238	235
Office space	Office space	Office space	Office space	Office space	Office space	Office space	Office space	Office space	Office space	Office space	Office space	Office space
300	500	750	750	250	150	560	921	375	216	500	375	216
2	4	6	5	2	1	4	4	3	1	4	3	1
130	260	390	325	130	65	260	540	360	170	500	450	220
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
CS	CS	CS	CS	CS	CS	CS	CS	CS	CS	CS	CS	CS
1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Office
243
Office space
140
1
125
100%
CS
1.00

AHU-3

Building:	Delete Zone	Army Reserve Center - Newport , Rhode Island						
System Tag/Name:		AHU-3						
Operating Condition Description:	Add Zone							
Units (select from pull-down list)		IP						
Inputs for System		**Name**	**Units**			**System**		
	Floor area served by system	As	sf			2898		
	Population of area served by system (including diversity)	Ps	P	100%	diversity	180		
	Design primary supply fan airflow rate	Vpsd	cfm			2,100		
	OA req'd per unit area for system (Weighted average)	Ras	cfm/sf			0.06		
	OA req'd per person for system area (Weighted average)	Rps	cfm/p			5.0		
Inputs for Potentially Critical zones							**Potentially Critical Zones**	
	Zone Name	*Zone title turns purple italic for critical zone(s)*					***Assembly***	**enter name**
	Zone Tag	Show Values per Zone					**104**	**enter tag**
	Space type		Select from pull-down list				**Auditorium seating area**	**Office space**
	Floor Area of zone	Az	sf				2,898	
	Design population of zone	Pz	P	(default value listed; may be overridden)			180	0
	Design total supply to zone (primary plus local recirculated)	Vdzd	cfm				2,100	
	Induction Terminal Unit, Dual Fan Dual Duct or Transfer Fan?		Select from pull-down list or leave blank if N/A					
	Local recirc. air % representative of ave system return air	Er						
Inputs for Operating Condition Analyzed								
	Percent of total design airflow rate at conditioned analyzed	Ds	%			100%	100%	100%
	Air distribution type at conditioned analyzed		Select from pull-down list		Show codes for Ez		CS	CS
	Zone air distribution effectiveness at conditioned analyzed	Ez					1.00	1.00
	Primary air fraction of supply air at conditioned analyzed	Ep						