ASHRAE Std 62.1 and Std 90.1 Analysis Army National Guard Readiness Center Addition Arlington, Va.

Mitchell E. Peters Mechanical

Dr. Bahnfleth – Advisor



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Executive Summary

The purpose of this report is to determine compliance or non-compliance of the Army National Guard (referred hereafter as ArNG) Readiness Center Addition with ASHRAE Standards 62.1 and 90.1.

The ArNG building will function as an administrative headquarters in conjunction with the existing complex on site. It is an 8 story, 251,000 square foot facility which mainly houses open office spaces and conference centers but will contain an auditorium and training facility as well.

These spaces were analyzed against Standard 62.1 and found to be compliant with most all requirements as specified in Section 5. For the Section 6 analysis two out of the eight levels were studied. Calculations of the air handling units (AHU) on levels 2T and 1P gave a very close approximation for the building as a whole. It was shown that some critical spaces were lacking in ventilation requirements and need to be adjusted. This can be attributed to the use of default values for occupancy which many times are overestimated.

An analysis with respect to ASHRAE Standard 90.1 was also conducted to determine that the building complies with the minimum requirements for energy efficiency. Sections covered deal with the building envelope, HVAC systems, and lighting/electrical design. It was found that the ArNG building as a whole complies with nearly all stipulations from this standard falling short only in computer room air-conditioning (CRAC) units and their efficiencies.

In the end it was determined that the ArNG Building is close to compliance with ASHRAE Standards 62.1 and 90.1. This building is planning on being lead certified and needs to adhere closely to the above standards to be considered for such a status.

System Description

The ArNG building houses a hydronic HVAC system consisting of a heating and chilled water 4 pipe system. This water is supplied to mechanical rooms on every floor containing AHU's as well as VAV terminals. There are a total of 17 AHU with one specified per tower level. The 3 underground levels hold the majority of the units and they range anywhere from 500 cfm to 4250 cfm. Typical size for the 5 tower levels is 1550 cfm.

There are two 400 ton centrifugal water-cooled chillers specified in conjunction with two cooling towers.

For the 62.1 Section 6 analysis, the AHU considered were AHU-2T-A1(Level 2 Tower, other floors typical) and Level 1P (Underground level 1) which houses 5 AHU's. These particular units were selected for symmetry purposes and these spaces mimicked the rest of building appropriately.

ASHRAE 62.1 Analyses

Section 5 Analysis

Section 5.1 Natural Ventilation

None of the windows in the ArNG Readiness Center Addition are operable; the governmental use of the building makes this impossible. As a result, Natural Ventilation is not a valid ventilation method for this particular building.

Section 5.2 Ventilation Air Distribution

Most all spaces meet ventilation requirements. This can only be achieved with the assumption that the Variable Air Volume (VAV) Terminals are appropriately calibrated to allow the minimum flow through the box to maintain minimum ventilation rates as specified by ASHRAE.

Section 5.3 Exhaust Duct Location

Any spaces producing potentially harmful contaminants (restrooms) have negatively pressurized exhaust ducts. These ducts then exit the building directly to be in compliance with this section.

Section 5.4 Ventilation System Controls

Direct digital control is achieved through building automation systems (BAS) and building management systems. The BAS system controls all of the VAV terminals as well as damper systems. Along with this, energy conservation features such as optimal Start/Stop and night setbacks are available and specified to be implemented.

Section 5.5 Airstream Surfaces

All airstream surfaces in equipment and ducts in the HVAC system will be lined with an antimicrobial erosion-resistant coating. Such a coating is registered by the EPA specifically for use in HVAC systems.

Section 5.6 Outdoor Air Intakes

As specified in Table 5-1 of standard 62.1 the ArNG building maintains at least the minimum safe distance for air intakes. This is typical throughout the building including floors with more than one AHU or exhaust fan.

As specified, the intakes are provided with a rain hood as well as bird screening device. These devices are comprised of Aluminum, ½ inch square mesh, and 0.063 inch wire.

Section 5.7 Local Capture of Contaminants

Non-combustion equipment located inside the ArNG building are not producing contaminants which need a direct exhaust. This section does not apply to this building.

Section 5.8 Combustion Air

Combustion air mainly accumulates due to the condensing boilers within the building. This air is exhausted directly outdoors to comply with this section.

Section 5.9 Particulate Matter Removal

The filters specified have a minimum arrestance according to ASHRAE 52.1 and a minimum efficiency reporting value (MERV) according to ASHRAE 52.2.

The filters used are as follows

Washable Foam: 70 percent arrestance and 3 MERV. Glass Fiber Treated with Adhesive: 80 percent arrestance and 5 MERV. Pleated Cotton-Polyester Media: 90 percent arrestance and 7 MERV.

The whole system is to be sealed during construction to prevent particulates from accessing the system.

Section 5.10 Dehumidification Systems

The dehumidification provided by the AHU's is the only form of dehumidification involved with the ArNG building. All spaces in the building are designed to be less than 65% RH at the design condition. Positive pressurization minimizes infiltration.

Section 5.11 Drain Pans

The condensate drain pans are specified to be stainless-steel as instructed by this standard. The condensate pans will be fabricated with slopes in two planes to collect condensate from the cooling coils and humidifiers when the units are operating at maximum catalogued face velocity across coil.

Section 5.12 Finned-Tube Coils and Heat Exchangers

As specified, drain pans are to be provided for each heat exchanger in the building.

Section 5.13 Humidifiers and Water-Spray Systems

Humidification is to be performed in the AHU's. This section does not apply to the ArNG building.

Section 5.14 Access for Inspection, Cleaning and Maintenance

Access Door Sizes are as follows:

One-Hand or Inspection Access: 8 by 5 inches (200 by 125 mm). Two-Hand Access: 12 by 6 inches (300 by 150 mm).

Head and Hand Access: 18 by 10 inches (460 by 250 mm). Head and Shoulders Access: 21 by 14 inches (530 by 355 mm). Body Access: 25 by 14 inches (635 by 355 mm). Body plus Ladder Access: 25 by 17 inches (635 by 430 mm).

Sufficient work space is to be provided for all access, maintenance, and cleaning as needed.

Section 5.15 Building Envelope and Interior Surfaces

A sheet membrane waterproofing system (Bituthene 3000 or 4000) will be provided for the envelope of the building. All piping, with temperatures below the dew-point, is insulated to prevent condensation on the surfaces.

Section 5.16 Buildings with Attached Parking Garages

No parking structure is attached to the ArNG building; therefore this section does not apply.

Section 5.17 Air Classification and Recirculation

The return air utilized in the building is characterized as Class 1 (Air with low contaminant concentration and inoffensive odor and sensory-irritation intensity, suitable for recirculation or transfer to any space.) This air type comes from offices, conference rooms, and other similar spaces. All toilet room exhaust is Class 2 as well as the training facilities. The Class 2 air however cannot be resupplied to a space with a lower class.

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

The ArNG building is a smoke free facility. All designated smoking areas are located away from outdoor air supplies and building entrances. Thus section 5.18 does not apply.

Section 6 Analysis

The purpose of section 6 of ASHRAE Standard 62.1 is to determine the minimum outdoor air intake rates based on occupancy type, floor area, and design population. Ventilation rates were calculated for a descriptive section of the building. The ArNg Building has several different types of occupancies varying from offices to training facilities. By picking critical zones of the building it should provide a good representation of the rest of the building. From this it is then possible to label the building for compliance or non-compliance of Section 6 of ASHRAE Standard 62.1. The zones which were checked for ventilation are shown in Figures 62.1-1 and 62.1-2.



Level 1P (First Level Below Grade)





Level 2T (Second Floor of Tower)



Ventilation Rate Procedure

Breathing Zone Outdoor Airflow (Vbz):

 $Vbz = Rp \cdot Pz + Ra \cdot Az$ (Eq. 6-1)

Where,

Az = zone floor area (SF)

Pz = zone population, largest number of people expected to occupy the space during typical usage. (Estimated using values found in Table 6-1)

Rp = outdoor airflow rate per person (cfm/person) (Defined in Table 6-1)

Ra = outdoor airflow rate per unit area (cfm/ft2) (Defined in Table 6-1)

Zone Air Distribution Effectiveness (Ez)

Ez = 1 (As defined by Table 6-2)

```
Zone Outdoor Airflow (Voz)
Voz = Vbz/Ez (Eq. 6-2)
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Zone Primary Outdoor Air Fraction (Zp)

Zp = Voz/Vpz (Eq. 6-5) Note: For VAV Systems, Vpz is the minimum expected primary airflow for design purposes. System Ventilation Efficiency (Ev)

Ev is found using the Maximum Zp value. (As defined by Table 6-3)

Uncorrected Outdoor Air Intake (Vou) Vou = $D\Sigma$ allzones(Rp · Pz) + Σ allzones(Ra · Az) (Eq. 6-6)

Where, D = diversity = $Ps/\Sigmaallzones(Pz)$ (Eq. 6-7) Ps = system population, total population in the area served by the system

Outdoor Air Intake Vot = Vout/Ev (Eq. 6-8)

Further calculations can be found in the Appendix attached at the end of the report. These tables contain all information from room areas, occupancy type, supply air, and max Z_p values for both of the calculated zones. See Appendix Tables 62.1-1 and 62.1-2

Outdoor Air Flow Calculation Assumptions

Levels 2T and 1P were used to gather an accurate representation of the building as a whole.
 Zone populations were tabulated based on table 6-1 in ASHRAE Standard 62.1.

Results (ASHRAE 62.1 section 6)

The critical spaces found were both an elevator lobby located in relatively that same area of the building but at different levels. This was the maximum Zp value resulting from the large default population which ASHRAE specified in table 6-1. The supply air to these spaces ended up being too low as a result. Another interesting note is the amount of cfm's for the primary supply for level 2T. The AHU for level 2T is specified to handle 11,900 cfm's. The calculations are fairly near to this value showing the unit running at an efficient level.

ASHRAE 62.1 Conclusion

From the above analyses it is safe to say that the ArNG building does a very good job of adhering to Section 5 and 6 of ASHRAE Standard 62.1. Areas for improvement would be to reanalyze Section 6 and try and account for the low ventilation rates for a few of the spaces.

ASHRAE 90.1

The purpose of the AHRAE Standard 90.1 analysis is to determine the compliance of the ArNG building's design on minimum requirements for energy efficiency. Sections covered deal with building envelope, HVAC systems, and lighting/electrical design.

Section 5 Analysis- Building Envelope

This section specifies minimum R-Values or maximum U-Values and glazing factors based on building location.

Section 5.1.4 Climate

The ArNG site is located in Arlington, VA. From Table B-1 of ASHRAE 90.1 this site is situated in Climate Zone 4A.

Section 5.2 Compliance Paths

The glazing on the ArNG building is well over the prescribed 40% maximum value given by ASHRAE Standard 90.1. This could be easily adjusted, however the glass specified has a U-value well below the maximum and could possibly still comply with this section. The skylight fenestration area does not exceed 5% of the gross roof area, and therefore does complies with this section.

Section 5.4 Mandatory Provisions

The exterior joints on all vertical surfaces are specified to be sealed appropriately. All exterior and interior joints in vertical surfaces and non-traffic horizontal surfaces shall be sealed. Such joints included fenestration, door frames, floor/roof/wall junctions, as well as utility service openings. This will significantly minimize infiltration issues and losses.

Section 5.5 Prescriptive Building Envelope Option

Two compliance paths for fenestration exist: the prescriptive option and the trade-off option. The following table 90.1-1 sums the building envelope analysis.

Value	Minimu R-Va	ım Roof alue	Minimu Va	m Wall R- alue	Fenestration Max U-Value	Percent Fenestration	Fenestration Max SHGC
Required	R-	20	R	-9.5	U-0.40	40%	0.4
Material	Roof Type 1	Roof Type 2	Wall Type 1	Wall Type 2	Curtain Wall 1		
						26400/40905=	
Design	24	28	20	23	0.29	65%	0.3
Compliance	Yes	Yes	Yes	Yes	Yes	No	Yes

Table 90.1-1

The above R-values were found from the following construction materials:

Roof Type 1: This is the tower roofing material which consists of a structural concrete slab covered with a vapor barrier, sloped rigid insulation, and a single-ply waterproofing membrane with a ballast topping.

Roof Type 2: This roofing material convers the plaza level and is a green roof. This system is comprised of a structural concrete slab with a topping of concrete slopped for drainage. Included is a rubberized membrane containing clay filler, flashing membrane, polyester fabric reinforcing, fiberglass root barrier, drainage retention mat, filter fabric and a specified soil for planting.

Wall Type 1: This wall type is a combination of batter/ribbed precast concrete panels and glazed aluminum.

Curtain Wall Type 1: This system is a glaze aluminum combination with glass panels. It consists of a clear Low e glass 1/4" panel, followed by a 1/2" air space, and then another 1/4" Low e panel for a total U-Value of 0.29. See Figure 90.1-1 on page 12.

The ArNG building is in accordance with a majority of ASHRAE Standard 90.1 section 5. Both the roof and wall construction adhere to the guidelines as specified above. The only non-compliance is that of the percent fenestration allowable for vertical walls as discussed above.



Curtain Wall

Figure 90.1-1

Section 6 Analysis- Heating Ventilating and Air Conditioning (HVAC)

This section provides minimum efficiencies of equipment to be used for HVAC systems.

Section 6.2 Compliance Path

There are two compliance paths for assessing the efficiency of the building's HVAC system: the Simplified Approach and the Mandatory Provisions and Prescriptive Path.

Section 6.3 Simplified Approach Option for HVAC Systems

The Simplified Approach to check for compliance can only be utilized for buildings fewer than 25,000 square feet. As the ArNG building is 251,000 square feet, this approach cannot be implemented.

Section 6.4 Mandatory Provisions

Thermostatic controls stipulate the supply of heating and cooling energy to each zone individually. These controls offer an accuracy of ± 0.5 °C. Automatic setbacks for minimum capacity loads have been determined and are set to come on at the end of the work day.

The use of dampers is throughout the ArNG building. These motorized dampers automatically shut when the spaces it serves are not in use.

All ductwork is sealed at the joints with either mastic sealer or slip and drive connections for a leakage of a max of 1%.

Section 6.5 Prescriptive Path

The following table 90.1-2 shows the supply fan compliance with section 6.2. Many of the supply fans meet the requirements as stipulated by standard 90.1 for fan power limitation however a few exceed the max HP allowable. These spaces are critical ones with sensitive equipment and as a result require the increased HP.

	Sup	ply F	an Complia	nce
Unit	CFM(max)	ΗР	CFM*0.0015	Compliance HP <cfm*0.0015< td=""></cfm*0.0015<>
AHU-3P-A1	11,800	15	17.7	Yes
AHU-3P-B1	9,500	15	14.25	No
AHU-3P-B2	2,900	5	4.35	No
AHU-3P-B3	1,650	3	2.475	No
AHU-3P-B4	12,000	15	18	Yes
AHU-3P-B5	12,000	15	18	Yes
AHU-2P-A1	11,800	15	17.7	Yes
AHU-1P-A1	13,400	20	20.1	Yes
AHU-1P-A1	9,100	7.5	13.65	Yes
AHU-1P-B1	5,700	7.5	8.55	Yes
AHU-1P-B2	5,400	7.5	8.1	Yes
AHU-1P-B3	6,400	7.5	9.6	Yes
AHU-1T-A1	11,900	15	17.85	Yes
AHU-2T-A1	11,900	15	17.85	Yes
AHU-3T-A1	11,900	15	17.85	Yes
AHU-4T-A1	11,900	15	17.85	Yes
AHU-5T-A1	12,600	20	18.9	No

Table 90.1-2

The following table 90.1-3 shows the exhaust fan power limitations for the ArNG building. All fans complied with this section.

	E	khaust	Fan Complia	ance
Unit	CFM(max)	HP	CFM*0.0015	Compliance HP <cfm*0.0015< td=""></cfm*0.0015<>
EF-3P-A1	200	0.25	0.3	Yes
EF-3P-A2	200	0.25	0.3	Yes
EF-3P-B1	200	0.25	0.3	Yes
EF-2P-A1	1,000	0.333	1.5	Yes
EF-1P-A1	28,000	10	42	Yes
EF-1P-A2	15,000	15	22.5	Yes
EF-1P-B1	400	0.25	0.6	Yes
EF-P-A1	14,200	7.5	21.3	Yes
EF-P-A2	9,700	5	14.55	Yes
EF-P-A3	4,500	1	6.75	Yes
EF-P-A4	3,750	1	5.625	Yes

Table 90.1-3

Section 6.7 Submittals

All HVAC systems are specified to be tested in the field to ensure that control elements are calibrated, adjusted, and in proper working condition.

Section 6.8 Minimum Equipment Efficiency Tables

There were three types of equipment tested for compliance with section 6.8. The ArNG building will use two 400 ton centrifugal chillers with a COP of 6.10. This exceeds the AHSRAE minimum of 5.50 COP.

These chillers are both connected to cooling towers with a capacity of 1,200 gpm (each) and a 25 HP fan motor. From this the design performance of the towers was calculated as 48 gpm/HP. This value clearly exceeds the 38.2 gpm/HP required by ASHRAE.

Next the CRAC units were analyzed and found to be slightly lower than the required EER values from ASHRAE.

Section 6.8 is met and exceeded for equipment efficiency ratings as seen in table 90.1-4. The CRAC units must be reassessed due to non-compliance.

	Equipm	ent Compliar	nce	
Unit	Capacity	Required	Design	Compliance
CH-1	400 tons	5.5COP	6.10COP	Yes
CH-2	400 tons	5.5COP	6.10COP	Yes
	1200gpm			
CT-1	@25HP	>38.3gpm/hp	48gpm/hp	Yes
	1200gpm			
CT-2	@25HP	>38.3gpm/hp	48gpm/hp	Yes
CRAC-1P-A1	245 MBH	9.8 EER	9.8 EER	Yes
CRAC-2P-A1	140 MBH	10.8 EER	9.33 EER	No
CRAC-2P-A2	140 MBH	10.8 EER	9.33 EER	No
CRAC-3P-BA	72 MBH	11.0 EER	4.8 EER	No

Table 90.1-4

Section 7 Analysis- Service Water Heating

Discusses requirements for service water heaters and its conveyance through the building.

Service water heating for the ArNG building is supplied by 5 condenser boilers. These boilers are 98% efficient which meet and exceed the ASHRAE minimum requirements of 80% for a gas fired boiler being used for service water heating.

Section 9 Analysis- Lighting

Contains information on the required power distribution and density for lighting systems.

There are two ways to calculate Lighting Power Density:

1. Find the total wattage serving the lighting and divide by the square footage of the building or

2. Calculate the density for each space and compare this to a specified density based on occupancy type. The first method yielded the following given in Table 90.1-5

	Li	ghting Po	wer Density	
Level	Total Watts	W/SF	ASHRAE W/SF	Compliance
2T	9011	0.5713	1	Yes
3P	24109	0.4818	1	Yes

Table 90.1-5

ASHRAE 90.1 Conclusion

The ArNG Readiness Center Addition was design very efficiently. The building is expected to reach a LEED Silver rating and this can easily be done with the appropriate use of equipment. From this analysis it was shown that much of the specified equipment is far more efficient than the requirements of ASHRAE Standard 90.1.

It was determined that the building is compliant with this standard with a few exceptions. First is the CRAC equipment compliance yielding EER values lower than desired. The second non-compliance deals with the percent of fenestration which was much larger than ASHRAE prescribed. With that said, a few minor changes could go a long way to allowing this building to truly achieve its LEED certification.

References

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

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

Appendix A

The following is the calculation spreadsheet used to check for compliance of ASHRAE Standard 62.1 Section 6. These tables show the two zones which were analyzed, level 2T and Level 3P respectively. As follows is all the appropriate spaces and their corresponding square footage, occupancy, and supply air.

Also attached is the lighting schedule used to calculate the lighting power density. These tables represent all of the lighting components on the levels 2T as well as 3P.

Building: System TagName:	Army Na Level 1P	ational G	iuard Readiness Center Addit P-A1,A2,Ba,B2,B3)	no	L						
Units (select from pull-down list)	9										
Inputs for System	Name	Units		System							
Population of area served by system (including diversity)	P 2	20	100% diversity	420m							
Design primary supply fan airflow rate OA regid per unit area for system (Weighted average)	Vped	ofmist		32.34	00						
OA req'd per person for systemarea (Weighted average) Inputs for Potentially Critical zones	Rps	cfimip		0	2						
Zone Name Zone Tan	Zone blk	e turns p	urple italic for critical zone(s)		Elec. Jan. Close	et Elev. Lo	obby	Corridor	IT/COMM	Pantry/Copy P108	Corridor
					Electrical Stages,	Lobb	les 0	orridors T	elephone/dat	Break rooms	Corridors
Space type		Select fr	om pull-dawn list		equipment studios				a entry		
Floor Area of zone	R	ST.	ALL PAR ANALY INST		112	88	340	340	151	331	460
Design population of zone	Pz	P	(default value listed; may be ov	erridden)	0 4	52	51	100	9.06	8,275	***0
Induction Terminal Unit, Dual Fan Dual Duct or Transfer Fan?		Select fr	om pull-down list or leave blank	INA							144
Local recirc air % representative of ave system recurn air Inputs for Operating Condition Analyzed	đ					ŀ					
Percent of total design airflow rate at conditioned analyzed Air distribution type at conditioned analyzed	8	% Select fr	om pull-down list	100	100% 10 CS	20%	100%	100%	100%	100%	100%
Zone air distribution effectiveness at conditioned analyzed Primary air fraction of supply air at conditioned analyzed	0 R				1.00 1	8	1.00	1.00	1.00	1.00	1.00
Results Ventilation Sustem Efficiency	2				Critical zone means more un	diston					
Outdoor all intake required for system	Vot	ofm		#VALUE							
Outdoor air per orm, novi orea Outdoor air person served by system (including diversity)	VouPs	ofmlo		WALUE							
Outdoor air as a % of design primary supply air	Ypd	ofm .		#VALUE	#VALUE!						
Detailed Calculations Initial Calculations for the System as a whole											
Primary supply air flow to system at conditioned analyzed	Vps	ofm	= VpdDs = Dre De + Dee As	= 3234	.0						
Uncorrected OA regid as a fraction of primary SA	Xs		= Vou / Vps	= 0.1	9						
DA rate per unit area for zone	Raz	c/m/sf			0.06 0	8	0.06	0.06	0.06	0.06	0.06
DA rate per person	Rpz	dmip	Publical young mando moves usen		0.00 10	7B	500	200	5.00	5.00	100
Unused OA regid to breathing zone	No.	ofm :	= Rpz Pz + Raz Az	-	6.7 5	0.2	275.4	20.4	54.4	61.2	27.6
Unused OA requirement for zone	Voz	dm	= Vho/Ez	н	7	50	275	20	2	61	28
Fraction of zone supply not directly recirc, from zone	Fa		= Ep + (1-Ep)Er	н	1.00 1	88	1.00	1.00	1.00	1.00	1.00
Fraction of zone supply from fully mixed primary air	5 7		= Ep		1.00 1	38	1.00	1.00	1.00	1.00	1.00
Fraction of zone GA fraction required in supply air to zone	Zd		 Voz / Voz Voz / Voz 		0.01	67	0.92	0.20	0.14	0.12	0.18
Unused OA fraction required in primary air to zone	20		 Voz / Vpz 	*	0.01	.67	0.92	0.20	D.14	0.12	0.18
System Ventilation Efficiency Zona Vantilation Efficiency (Zon & Method)	2		= /Fa+EhXe.Ec71/Fa	Gritical	tone needs over 100% OA in :	zone SA	70 ח	0 0.8	104	1 177	1 8
2019 Ventilation Efficiency (App A Method) System Ventilation Efficiency (App A Method)	EV		 (Fa + Foxs - Foz) / Fa min (Evz) 	= (0.2)	3 1.17	22	0.27	CR D	1.04	1.07	1.00
Ventilation System Efficiency (Table 6.3 Method)	P		= Value from Table 6.3	" . N							
Annimum outdoor Air Intake Flow required to System	Vot	ofm	= Vou / Ev	= No Solu	tion						
OA intake regid as a fraction of primary SA	~		= Vot / Vps	= Would n	eed over 100% OA intake						
Outdoor Air Intake Flow required to System (Table 6.3 Method) OA intake red'd as a fraction of primary SA (Table 6.3 Method)	Yor	cim	 Vou / Ev Vot / Vps 	* *							
OA Temp at which Min OA provides all cooling											
URBINE 28 STADI 24501 NO DOLM WORD I NO		- Far	= [[]](1=1)-	- NUMBER							

Building: System Tag/Name:	Army Na Level 1P	(AHU-1F	vard Readiness Center Addit vA1,A2,Ba,B2,B3)	ion							
Units (select from pull-down list)	P										
Inputs for System	Name	Units		System							
Population of area served by system (including diversity) Design primary supply fan airritow rate	Vpad I	đ	100% diversity	575							
DA reqd per unit area for system (weighted average) DA reqd per person for system area (Weighted average) Inputs for Potentially Critical zones	Rps	dimip		0.05							Pote
Zone Name	Zone Bille	turns po	rpie italic for critical zone(s)		Conference	Conference	Corridor	Telecom	Siprnet	Elev.Lobby	Open Office
Zone Tag					P111	P112 Conference/m	P113 Corridors	P114 Telephone/dat	Computer	P116 Lobbles	P117 Office space
Space type		Select fro	m oul-down list	_	eeting	eeting		a entry	(not printing)		
Floor Area of zone	Az	6			243	115	660	164	123	360	18408
Design population of zone	Pz	A P	(default value listed; may be ov	erridden)	12.15	5.75	0	9.84	0.492	200	92.04
Induction Terminal Unit, Dual Fan Dual Duct or Transfer Fan?	-	Select In	xm pull-down list or leave blank	INA		100					
Inputs for Operating Condition Analyzed	đ										
Percent of total design airflow rate at conditioned analyzed	8	Solart fo	en ni di nimun lint	100%	100%	100%	100%	100%	100%	100%	100%
Zone air distribution effectiveness at conditioned analyzed	5 F				1.00	1.00	1.00	1.00	1.00	1.00	1.00
Results											
Venulation System Enciency Outdoor air intake required for system	Vot -	dm		#VALUE							
Outdoor air per unit floor area	Vot/As	cím/sí		#VALUE							
Outdoor all per person served by system (including urversity) Outdoor all as a % of design primary supply air	Ypd Voti-s	ofm) ofm)		#VALUE							
Detailed Calculations Initial Calculations for the System as a whole											
Primary supply air flow to system at conditioned analyzed UncorrectedOA requirement for system	Vou u	of m	= VpdDs = Ros Ps + Ras As	= 32340 = 5984							
Uncorrected OA reqd as a fraction of primary SA	ξX		= Vou / Vps	= 0.19							
OA rate per unit area for zone	Raz	ofmist			0.06	0.06	0.06	0.06	0.06	0.06	0.06
UA rate per person Total supply air to zone (at condition being analyzed)	Ver I	dunio	Critical zone needs more ven	tilation	300	150	300	375	375	200	13648
Unused OA req'd to breathing zone	Vbz i	dm	= Rpz Pz + Raz Az		75.3	35.7	39.6	59.0	9.6	291.6	1564.7
Unused OA requirement for zone	Voz	dm	= Vbg/Ez		- 75	* 3 %	3 8	. 8	10	292	1565
Fraction of zone supply hos directly redired trimary air Fraction of zone supply from fully mixed primary air	Fo		- cp+(1-cp)ct		1.00	1.00	1.00	1.00	1.00	1.00	1.00
Fraction of zone OA not directly redire, from zone	Fo		= 1-(1-Ez)(1-Ep)(1-Er)	н	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Unused OA fraction required in supply air to zone Unused OA fraction required in primary air to zone	20 20		 Voz / Vdz Voz / Vpz 	• •	0.25	0.24	0.13	0.16	0.03	1.46	0.11
System Ventilation Efficiency				Critical zo				2	1		
Zone Ventilation Efficiency (App A Method)	2 2		= (Fa + FbXs - FcZ) / Fa	- 10.971	0.8.0	0.95	1.05	1,03	1.16	-0.27	1.07
Ventilation System Efficiency (Table 6.3 Method)	<u>۳</u>		= Value from Table 6.3	- 114							
Minimum outdoor air Intake airtiow Outdoor Air Intake Flow required to System	Vot		= Vou/Ev	= No Solutic							
OA intake req'd as a fraction of primary SA	£×		 Vot / Vps Vot / Vps 	= Would net							
OA intake regid as a fraction of primary SA (Table 6.3 Method)	~		 Vot / Vps 								
OA Temp at which Min OA provides all cooling OAT below which OA intake flow is @ minimum		Deo F	= ((Tp.dTsf)-(1-Y)*(Tr+dTrf	= #VALUEI							
THE REAL PARTY OF AND IN THE REAL PARTY IN THE REAL PARTY.		1 Plant	and the famous of the	Contraction of the local division of the loc							

System Tag/Name:	Army Na Level 1F	P(AHU-1)	P-A1,A2,Ba,B2,B3)	ion							
Units (select from pull-down list)	IP										
Inputs for System	Name	Units		System							
Population of area served by system (including diversity)	33	0 9	100% diversity	42042							
Design primary supply fan airflow rate	Vped	din .	former and the second	32,340							
OA regid per unit area for system (Weighted average) DA regid per person for system area (Weighted average)	Ras	ofmist		0.06							
Inputs for Potentially Critical zones	1				tially Critical Zor	105					
Zone Name Zone Tag	2000	o anns p	adate to a create adate		P119	P120	P123	P125	P129	P130	P131
Baasa tung					Electrical	Guard	Lobbles	Office space	Electrical	elephone/dat	Break rooms
at/i anato		Select In	om pull-dawn list		rooms	stations			rooms	a enuy	
Floor Area of zone	2	ar		_	112	161	378	11852	118	110	433
Design population of zone	2	, D	(default value listed; may be or	remidden)	0	2.415	56.7	59.26	0	6.6	10,825
Lesign total suppy to zone (printary prus local recirculated) Induction Terminal Unit, Dual Fan Dual Duct or Transfer Fan?	AdZd	Select In	om puli-down list or leave blani	CITNIA	0/0	200	SUC	7617	900	375	1000
Local recirc. air % representative of ave system return air	Щ					-	-		-		
Inputs for Operating Condition Analyzed)	č.									
Percent of total design airriow rate at conditioned analyzed Air distribution type at conditioned analyzed	8	Select fn	om pull-down list	SCOL	100%	TUU%	100m	100%	100%	S.D	100%
Zone air distribution effectiveness at conditioned analyzed Primary air fraction of supply air at conditioned analyzed	5 17			_	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Results Ventiletion System Efficiency	ŗ										
Outdoor air intake required for system	Vot	dm		#VALUE							
Outdoor air per unit floor area	Vot/As	ofm/sf		#VALUE							
Outdoor air per person served by system (including urversity) Outdoor air as a % of design primary supply air	Ypd Y	ofm		#VALUE							
Detailed Calculations Initial Calculations for the System as a whole											
Primary supply air flow to system at conditioned analyzed	Vps	ofm	= VpdDs	= 32340							
Uncorrected OA regularities for system Uncorrected OA regid as a fraction of primary SA	Xs	CIII)	 Vou / Vps Vou / Vps 	= 0.19							
Initial Calculations for individual zones	047	nimiot			20.02	0.02	20.0	0.08	20.0	0.08	202
OA rate per unit area for zone OA rate person	Rpz	olunio			0.00	6.00	5.00	5.00	0.00	5,00	5.00
Total supply air to zone (at condition being analyzed)	Vdz	dm	Critical zone needs more ver	tilation	575	200	300	7192	006	375	1550
Unused OA req'd to breathing zone	1 Pz	dm	= Rpz Pz + Raz Az		6.7	21.7	306.2	1007.4	7.1	39.6	80.1
Unused CA requirement for zone	VQZ	om			å -	1 8 8	300	100/	, 8 -	3.8	38
Fraction of zone supply fixe unequity require from a prime Fraction of zone supply from fully mixed primary air	53		- cp+(i-cyci		1.00	1.00	1.00	1.00	1.00	1.00	1.00
Fraction of zone OA not directly regire, from zone	F		= 1-(1-Ez)(1-Ep)(1-Er)	H	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Unused OA fraction required in supply air to zone	Zd		= Voz / Vdz	*	0.01	0.11	1.02	0.14	0.01	0.11	0.05
Unused OA fraction required in primary sir to zone	20		= Voz / Vpz		0.01	0.11	1.02	0.14	0.01	0.11	0.05
Zone Ventilaton Efficiency (App A Method)	EX		= (Fa + FbXs - FcZ) / Fa	-	1,17	1.08	0,16	1.04	1,18	1.08	1.13
System Ventilation Efficiency (App A Method)	P		= min (Evz)	= (0.27)							
Ventilation System Efficiency (Table 6.3 Method)	Ę		= Value from Table 6.3	= n/a							
Outdoor Air Intake Flow required to System	Vot	n n	= Vou / Ev	= No Solutic							
OA intake regid as a fraction of primary SA	~		= Vot / Vps	= Would net							
Outdoor Air Intake Flow required to System (Table 5.3 Method) OA intake recif as a fraction of mimary SA (Table 5.3 Method)	< Vot	dim	 Vou / Ev Vot / Vos 								
OA Temp at which Min OA provides all cooling											
OAT below which OA Intake flow is @ minimum		Deg F	= {{Tp-dTsf}-{1-Y}*{Tr+dTrf	= #VALUEI							

Building: System Tag/Name:	Army Na Level 1P	AHU 1P	hard Readiness Center Additi 1 A1,A2,Ba,82,83}	on							
Units (select from pull-down list)	q										
Inputs for System	Name	Units		System							
Floor area served by system (including diversity) Population of area served by system (including diversity)	PB	চ প্র	100% diversity	42342							
DA read per unit area for system (Weighted average) DA read per unit area for system area (Meighted average)	Ras	ofmist		50.0 50.0							
Inputs for Potentially Critical zones	Jama Alla	tion of	unter Antin Environtional annuales		Corridor	Brafination	Training	I area Can	TICOABA	Man Look	Winnen Lock
Zone Tag		- 100 m	and the set of the set of the		P132	P133	P135	P136	P137	P138	P139
Snace type					Corridors	Lobbies/pretu	(play area)	eeting	a entry	club/weigi	t club/weight
and to an address of the second		Select fro	m puli-davn list				and much	e e e e e e e e e e e e e e e e e e e	fann a	rooms	rooms
Floor Area of zone	28	1 9	whether it can be a list and more that we we	and shake as	825	1700	2	81 01	4 T	8	566
Design population of zone Design total supply to zone (primery due todal regionalshed)	Vrian	n r	cerauit value insted, may be ow	(naccili	300	400	101	9 00 N	30	75	000 000 28
Induction Terminal Unit, Dual Fan Dual Duct or Transfer Fan?	ņ	Select fro	m pull-down list or leave blank	INA							
Inputs for Operating Condition Analyzed											
Air distribution type at conditioned analyzed	8	Select fro	m pull-down list	1000	CS CS	NO1		001	01 8C	01	SO SO RUD
Zone air distribution effectiveness at conditioned analyzed Primary air fraction of supply air at conditioned analyzed	0.0			_	1.00	1.00	1.1	1 00	1.	1 00	00 100
Results VanHistion Sustem Efficience	2			INVALUE:							
Outdoor all intake required for system	Vot Vot/As	ofmisf		#VALUE							
Outdoor air per person served by system (including diversity) Outdoor air as a % of design primary supply air	YouPs Ypd	dm)p		#VALUE							
Detailed Calculations											
Initial Calculations for the System as a whole	1 mar	-		-							
UncorrectedOA requirement for system	Vou	dm	= Rps Ps + Ras As	= 5984							
Uncorrected OA regid as a fraction of primary SA Initial Calculations for individual zones	Xs		= Vau / Vps	= 0.19							
OA rate per unit area for zone	Raz	cfm/sf			0.06	0.05		5 0	0	38	0.06
Total supply air to zone (at condition being analyzed)	Vdz Apr	dm .	Critical zone needs more vent	ilation	300	400	8	000	38	38	00 300
Unused OA regid to breathing zone	Vbz	ofm	= Rpz Pz + Raz Az		37.5	484.5	176	.7 578	3.8 30	5.0 12	7.9 147.2
Unused OA requirement for zone	Voz	dim		0.0	1 38	495	1	* 5	3 2 2	38	128 147
Fraction of zone supply from fully mixed primary air	5.9		= Ep		1.00	1.00	1.0	1.	1.	1 .	1.00
Fraction of zone OA not directly recirc. from zone	Fo		= 1-(1-Ez)(1-Ep)(1-Er)	11	1.00	1.00	1.0	1.	1.	100	00 1.00
Unused OA fraction required in supply air to zone	Zd		= Voz / Voz		0 13	1.2		8 8	98		43 0.49
Unused UA fraction required in primary air to zone System Ventilation Efficiency	47		zdA (ZDA =	Critical zo	0.13	i.		24 10	HO L	10	4.5
Zone Ventilation Efficiency (App A Method)	Eva		= (Fa+FbXs-FcZ) / Fa		1.06	-0.02	5 02	0	22 1	09 00	76 0.69
System Vertilation Efficiency (App A Method)	2		= mn (Evz)	= (0.27)							
Ventration System Efficiency (Lable 5.3 Method) Minimum outdoor air intake airflow	ų		 Value from Lable 6.3 	evu =							
Outdoor Air Intake Flow required to System	Vot	ofm	= Vou/Ev	= No Solutic							
OA intake req'd as a fradion of primary SA	*		= Vot / Vips	= Would net							
OA intake regid as a fraction of primary SA (Table 6.3 Method)	~		 Vat/Vps 	- 14							
OA Temp at which Min OA provides all cooling OAT below which OA intake flow is @ minimum		Deg F	= {{Tp.dTsf}-{1-Y}*{Tr+dTrf	= #VALUEI							

Induction Turninal Unit, Dail Fan Duil Dud or Transfer Fan? c) Select from pull-down list or leave blank (INV. Operating Condition Conditioned analyzed IV distribution effectiveness at conditioned analyzed Perinary at factor or are sity and conditioned analyzed Perinary at factor or an india conditioned analyzed Perinary at factor or are sity and conditioned analyzed Perinary at factor or are sity of design primary supply at Outcor at a sit per perinar at conditioned analyzed Perinary at factor or system Outcor at a sit per perinary supply at Perinary at flow to system at conditioned analyzed Perinary supply at Perinary supply at Perinary supply at Perinary supply at Perinary supply at Perinary supply at to zone Perinary supply at to zone Praction of zone supply not alectly learn from zone Practic of zone Supply not alectly learned primary supply prime vertication Efficiency (App A Method) System Vertication Efficiency Provide as a fraction of primary SA Provide Supplement of system Provide Supplement of system Provide Provide System Provide Provide System Provide Provide System Provide Provide Prover Provide Provide Prover Provide Provide Prover Provide Provere

Building: System TagiName:	Army Nat Level 2T(AHU-2T	A1)	2							
Unite (select from pull-down liet)	q										
Inpute for Byetem	Name	Inite		System							
Priodr area served by system (including diversity)	35	0 1	100% diversity	15,00	1011						
Design primary supply fan alrflow rate	Vped o		[11,64							
OA req'd per unit area for system (Weighted average)	Ra				3 0						
UA rego per person for system area (Weighted average) inputs for Potentially Critical zones	ND2 C	dump		y							
Zone Name	Zone the	turns pu	ple halic for critical zone(s)		Eleo.	Jan. Closet	Elev, Lobby	Corridor	IT/COMM	Pantny/Copy	Corridor
Zone Tag					Fiectrical	Atorage	1 obbles	Corridore	Talanhonaldat	Break rooms	Contdors
Space type					equipment	roome			a entry		
Class Area of some		Jelect fro	m puli-down list		noome		5	140	12	m	22
From Area of Zone Design population of zone			default value listed: may be over	midden)			2	ore o	906	8 12 8	
Design total supply to zone (primary plus local recirculated)		it ,		1. Caracteria	52	76	0	100	175	500	15
Induction Terminal Unit, Dual Fan Dual Duct or Transfer Fan?	(0)	elect fro	m pull-down list or leave blank if	INA							
Local recirc, air % representative of ave system return air	ŭ						1	J		1	
Include for Cooperating Cooperation Analyzed		F		1004	2005	1006	1004	2005	1001	1006	1006
Air distribution type at conditioned analyzed	(0)	select fro	m puli-down list		CS.	SO	8	05	8	2	CS.
Zone air distribution effectiveness as conditioned analyzed Primary air fraction of supply air as conditioned analyzed					1.00	1.90	1.00	1.00	1.00	1.00	1.00
Recuite Violation Curion England	ņ										
Outdoor air intake required for system	vot :	if.		7838							
Outdoor air per unit floor area	VotiAs o	im'sf		0.60							
Outdoor air per person served by system (including diversity) Outdoor air as a % of design primary supply air	Ypd o			831.4							
Detailed Calouistions											
initial Caloulations for the system as a whole	i	ł	1 State	1121							
Firmary supply air now to system at conducting analyzed Uncorrected/OA requirement for system	Vou o	1 I	 Ros Ps + Ras As 	204							
Uncorrected OA regid as a fraction of primary SA	Xs		 Vou / Vps 	- 0.1	œ						
CA rate net unit size for some		dan la f			20.02		20.0	0.06	0.05	0.02	20.02
OA rate per person	Rpz	d(m)p			0.00	0.00	5.00	0.00	5.00	5.00	0.00
Total supply air to zone (at condition being analyzed)	Vdz c	in			575	75	200	150	375	\$20	150
Unused CA reg'd to breasting zone	Voz	13	- Roz Pz + Raz Az		5.5	7.8	275.4	20.4	54.4	61.6	27.5
Fraction of zone supply not directly recirc, from zone	Fat	100	 Ep + (1-Ep)Er 	• •	1.0	1.00	1.00	1.00	1.0 %	10 2	8 :
Fraction of zone supply from fully mixed primary air	7			•	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Fraction of zone OA not directly recirc, from zone	Pc		 1-(1-Ez)(1-Ep)(1-Er) 	•	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Unused OA fraction required in supply air to zone	12		Voz / Vdz		0.01	0.10	0.92	0.14	0.14	0.12	0.18
Evision Ventilation Etholeney	1		- test the	2							
Zone Ventilation Efficiency (App A Method)	Evz		 (Fa + FbXs - FcZ) / Fa 		1.15	1.07	0.26	1.04	1.03	1.06	0.99
System Ventilation Efficiency (App A Method)	Ev		- min (Evz)	- 0.26							
Ventilation System Efficiency (Table 5.3 Method)	P		 Value from Table 6.3 								
Outdoor Air Intake Flow required to System	Vot c	i i	- Vou / Ev	- 783	-						
OA intake reg/d as a fraction of primary SA	4	ļ	 Vict / Vips 	- 0.8							
Outdoor Air Intake Flow required to System (Table 6.3 Method)	voi o	-	- Volt av								
OA Tento at which Min OA provides all cooling			- 1001.000								
OAT below which OA intake flow is @ minimum		Deg F	 - ((Tp-dTst)-(1-Y))(Tr+dTrt 	•	7						

Bullding: System TagiName:	Army Na Level 21	(AHU-2T	uard Readiness Center Additio	2							
Unite (select from pull-down liet)	ġ										
inpute for System	Name	Unite		System	_						
 From and served by system (including diversity) 	33	2 0	100% diversity	212							
OA regid per unit area for system (Weighted average)	Ras	clm/sf		0.06							
OA req'0 per person for system area (Weighted average) Inputs for Potentially Critical zones	Rps	cimp		50		Potentially Cr	tioal Zones				
Zone Name Zone Tao	Zone Ibi	turns pu	inple halls for critical zone(s)		Conference T211	Conference T212	Corridor	T214	Eleo. T216	alpmet T218	Lobby T217
					Conference/m	Conference/m	Corridore	Telephone/dat	Electrical	Computer lab	Lobbles
Space type		Select fro	om pul-down liet		onting	ooting		a entry	equipment		
Floor Area of zone	2	a			255	114	420	186	35	79	285
Design population of zone	Pz	0	(default value listed; may be over	(nidden)	12.8	5.7	0	11.16	0	1.975	42.75
Design avail suppry to zone (primary plus rocal recirculates) Induction Terminal Unit, Dual Pan Dual Duct or Transfer Pan?	1.000	Select fro	om pull-down list or leave blank if	NXA		100	100	910	210	216	
Local recirc, air % representative of ave system return air	ű)	1		1		
Induce for Coverating Condition Analyzed Percent of total design althow rate at conditioned analyzed	2	8		100%	100%	100%	100%	100%	100%	100%	100%
Air distribution type at conditioned analyzed Zone air distribution etteräveness at conditioned analyzed	87	Select fro	om pul-down list		18	18	100	8	ŝ	88	8
Primary air fraction of supply air at conditioned analyzed	ũ										
Ventilation System Efficiency	m.			0.26							
Outdoor air intake required for system	Vot	clm		7938							
Outdoor air per unit floor area	Votine	clm/st		0.60							
Outdoor air ser person served og system (including orrensky) Outdoor air as a % of design primary supply air	Ypd	cfm		63%							
Ostalled Calculations Initial Calculations for the System as a whole											
Primary supply air flow to system at conditioned analyzed	Vps	1 8	VpdDs	- 11645							
Uncorrected OA regid as a fraction of primary SA	Xs		Vou / Vps	0.18							
initial Calculations for individual zones						2				,	2
OA rate per unit area for zone OA rate per person	Rpz	clim/st			5.00	5.00	0.00	5.00	0.00	10.00	5.00
Total supply air to zone (at condition being analyzed)	Vdz	clm			300	150	700	375	375	375	300
Unused OA reg'd to breathing zone	Vbz	l fil	- Roz Pz + Raz Az		79.4	35.3	25.2	67.0	21	: 22	230.9
Enaction of zone supply not directly redire, from zone	Fa	cim	 ED + (1-Eo)Er 		1 12	1 5	1.05	1.00	1.00	1 8 5	1.00
Fraction of zone supply from fully mixed primary air	3				1.00	1.00	1.00	1.00	1.00	1.00	1.00
Fraction of zone OA not directly recirc, from zone	FC		 1-(1-Ez)(1-Ep)(1-Er) 	'	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Unused OA fraction required in supply air to zone	12		 Voz / Vdz 		0.26	0.24	0.04	0.18		0.08	0.77
System Ventilation Efficiency	6		- VOL/ VDL		0.10	0.00		0.10	10.0	0U.U	110
Zone Ventilation Emclency (App A Method)	Evz		 (Fa + FbXs - FcZ) / Fa 		0.91	0.94	1.14	1.00	1.17	1.10	0.41
System Ventilation Efficiency (App A Method)	EV.		- min (Evz)	- 0.28							
Ventiliston System Efficiency (Table 5.3 Method)	EV		 Value from Table 5.3 	- 10							
Outdoor Air Intake Flow required to System	Vot	đ	- Vou / Ev	- 7938							
OA intake req'd as a fraction of primary 8A	*	1	- Vot / Vps	- 0.88							
Outdoor Air Intake Flow required to System (Table 5.3 Method) OA Intake regist as a fraction of outwary SA (Table 5.1 Method)	Yor (-	- Vot/Vot								
OA Temp at which Min OA provides all cooling											
OAT below which OA Intake flow is @ minimum		Deg F	- ((10-015f)-(1-Y)-(17+01f)	- 47							

Buildino:	Army N	ational	Guard	Readiness Center Additio	ă	Ц				
System TagiName: Operating Condition Description:	Level 2	TIAHU-	2T-A1)							
Unite (celect from pull-down lift)	d,					μ				
Inpute for System	Name	Unite			Syc	tem				
Floor area served by system	S	2				5,772				
Population of area served by system (including diversity)	P	U		100% diversity		212				
Design primary supply fan almow rate	Vprd	n n			-	245				
OA rego per unit area for system (weighted average)	Mas	Cuurse of			Т	0.00				
OA rego per person for system area (Weighted average)	Rps	climip			Γ	50				
Zone Name	Zone II	e turns	ourple.	talls for critical zone(s)			Conference	PA Studio	Storage	Open Office
Zone Tag						П	T220	T222	T228	T224
Alexandra da la constante da la						0	onference/m	Computer	Storage	Office space
obace obe		2.1		Sudman lint		_	ooting	(not printing)	rooms	
Floor Area of zone	2	1	1	an optimis man		-	405	378	249	0955
Design population of zone	Pz	0	(deta	uit value listed; may be ove	rridden)		20.25	1.512		47.8
Design total supply to zone (primary plus local recirculated)	Vdzd	cim				_	500	500	75	0585
Induction Terminal Unit, Dual Fan Dual Duct or Transfer Fan?		Select	from pi	Il-down list or leave blank	INA					
Local recirc, air % representative of ave system return air	ű									
Inputs for Operating Condition Analyzed					1					
Percent of total design armow rate at conditioned analyzed	2	0.9		findound line	Γ	000	100%	100%	100%	100M
Zone air distribution effectiveness at conditioned analyzed	62						1.00	1.00	1.00	1.00
Primary air fraction of supply air at conditioned analyzed	μņ					Ļ				
Ventilation System Efficiency	5					0.58				
Outdoor air intake required for system	≤ot !	clm				7938				
Outdoor air per unit floor area	VotiAs	cfm/sf			-	0.60				
Outdoor air per person served by system (including diversity)	VotiPs	cfm)p				37.4				
Outpoor air as a te or design primary supply air	Tpa	cim				60%				
Defailed Calculations Initial Calculations for the System as a whole										
Primary supply air flow to system at conditioned analyzed	Vps	clm	•	VpdDs	1	1645				
UncorrectedOA requirement for system	Vou	clm	•	Ros Ps + Ras As	'	2045				
Uncorrected OA regid as a fraction of primary SA	Xs		•	Vou / Vips	'	0.18				
OA rate per unit area for zone	R.M.	cfm/sf					0.05	0.05	0.12	0.06
OA rate per person	Rpz	cfm/p					5.00	5.00	0.00	5.00
Total supply air to zone (at condition being analyzed)	Vdz	clm					500	500	75	0585
Unused OA reg'd to breathing zone	VIDZ	clm	•	ROZ PZ + RAZ AZ	'		125.6	30.2	29.9	812.6
Unused OA requirement for zone	VOZ	cim	•	VODEZ	'		126	38	. 30	813
Fraction of some supply not discussion interaction and	9 2			eb + (1.eb/et			ŝŝ	1.0	1.00	1.00
Fraction of zone OA not directly recirc from zone	77 7		•	1-(1-Ez)(1-Ep)(1-Er)			1	10	1.00	1.00
Unused OA fraction required in supply air to zone	24		•	Voz / Vdz	1		0.25	0.05	0,40	0.14
Unused OA fraction required in primary air to zone	10		•	Voz / Vpz	9		30.0	0.06	0.40	0.14
Zystem ventilation emplement (Ann A Massoch	5		6	Fa + PhYs - Fr71 / Fa			Cen	112	0.78	1
System Ventilation Efficiency (App A Method)	m ;		•	min (Evz)	•	0.28				
Ventilation Bystem Efficiency (Table 5.3 Method)	P !		•	Value from Table 6.3	•	8				
Minimum outdoor air intake airflow		ł								
OA induce realities a fraction of ediment SA	< 2	-	6	Viet / Une						
Outdoor Air Intake Flow required to System (Table 5.3 Method)	Vot	8	• •	Vou / Ev	•	8				
OA intake reg'd as a fraction of primary SA (Table 6.3 Method)	×		•	Vot / Vps	•	D /2				
OA Temp at which Min OA provides all cooling										
UNI DEIDW WITCH UN INTERE TOW IS (2) INFIMUM		- Aan		(10-01-01) (1-01) (10-01)	ľ	4				

Tabulations for Lighting Power Density

		Level 3P	
Fixture	Amount	Watts/per fixture	Total Watts
КА	70	38	2660
KA-1	24	76	1824
KA-D	12	41	492
KA-1D	3	76	228
KB	115	29	3335
KB-D	23	29	667
КС	65	41	2665
KD	32	62	1984
KD-1	7	41	287
KD-2	1	33	33
KD-D	3	62	186
KF	6	46	276
KI	33	29	957
KI-D	57	31	1767
KJ	5	33	165
KL	2	36	72
KL-D	4	36	144
KP	11	33	363
KQ	7	20	140
KR	16	62	992
KR-1	4	41	164
KS	3	62	186
KS-D	15	62	930
K2	13	9	117
K3	11	9	99
L2	8	41	328
Α	42	32	1344
В	14	32	448
С	2	32	64
D	3	32	96
F	5	32	160
Н	9	104	936
		Total watts:	24109
		Total SF:	15772
		WATTS/SF:	1.53

		Level 2T	
Fixture	Amount	Watts/per fixture	Total Watts
KA	29	38	1102
KA-1	6	76	456
KB	34	29	986
КС	31	41	1271
KC-1	5	41	205
KD	25	62	1550
KD-1	9	41	369
KD-D	5	62	310
KE	2	33	66
KI	17	29	493
KL	1	36	36
KL-D	4	36	144
KP	7	33	231
KQ	6	20	120
KR	5	62	310
KR-1	4	41	164
KS-D	5	62	310
К2	13	9	117
К3	11	9	99
А	11	32	352
В	6	32	192
С	1	32	32
F	3	32	96
		Total watts:	9011
		Total SF:	15772
		WATTS/SF:	0.5713