ENTERED VALUES

ROOM BY ROOM

By Heapy Engineering

Room Description: 346 - OFFICE **Zone Description: FC3-02** **System Description: Unassigned**

GENERAL INFORMATION

Floor Area:	119 ft²	Flr-Flr Height:	14.1 ft
Plenum Height:	1.1 ft	Height Above Flr:	
Slab Cnstr Type:	8* LW Concrete		
Room Mass:	Time delay based on actual mass		
Ceiling R-Value:	1.786 hr·ft²·°F/Btu		
Is There Carpet?:	YES		
Design Clg DB / Drift Point:	75.0 °F / 81.0 °F		
Design Htg DB / Drift Point:	72.0 °F / 66.0 °F		
Design Relative Humidity:	50 %		
Moisture Capacitance:	Medium		
Clg Tstat:	None		
Htg Tstat:	None		
Thermostat Location:	Zone	Floor Multiplier:	1
Humidistat Location:	Room	Room Multiplier:	1
CO2 Sensor Location:	None		
Room Type:	Conditioned		

PEOPLE

People Type:	General Office Space
# of People:	143 sq ft/person
People Sensible:	250 Btu/h
People Latent :	200 Btu/h
People Schedule:	People - Elem Classroom non-summer
Workstation:	1.0 workstation/person

LIGHTS

Lighting Type:	Recessed fluorescent, not vented, 80% load to space
Fixture Type:	RECFL-NV
% Load to RA:	20 %
Lighting Schedule:	Lights - Elem Classroom non-summer
Lighting Amount:	1.1 W/sq ft
Ballast Factor:	1.0

AIRFLOW INFORMATION

	Cooling	Heating
Vent Type:	None	None
Vent Value:	16.00 cfm	16.00 cfm
Vent Schedule:	Wyoming FC MUA	
Infil Type:	HEAPY	HEAPY
Infil Value:	0.00 air changes/hr	0.08 cfm/sq ft of wall
Infil Schedule:	Available (100%)	
Vav Airflow:	Min: 0.40 cfm/sq ft	Max: 100.00 % Clg Airflow
Vav Sched:	Available (100%)	
Supply:	150.00 To be calculated	150.00 % Htg Airflow
Aux Supply:	To be calculated	To be calculated
Room Exhaust:		
Rm Exh Sched:	Available (100%)	

Description	Area/ Amount	Dir	Tilt	Const Type / Schedule	U Value Btu/h·ft²·°F	Alpha	Glass Type / Energy Type	Glass Area ft²	Glass Shade Coef	Glass U Value Btu/h·ft²·°F	Glass External Shading	Glass Internal Shading	Adj Temp/ Grnd Refl	Pct Sen/ Cool Tmp	Pct Rm/ Heat Tmp	Pct Ret/ Perm Len	Rad Frc/ Loss Coef
Roof - 1	119 ft²	0	90	Wyoming Existing	0.0783	0.90		0			Overhang - None	None					
W	91 ft²	270	0	Wyoming Existing	0.1059	0.90											
Opening - 1				Window			90.1-07 4a Window	25	0.46	0.55	Overhang - None	None	0.00				
Misc Load 1	300.000 W			Misc - Elementary School			Electricity							100	100	0	60.00
Partition - 1	100 ft²			0.75* Gyp Frame	0.3880								Adjacent Room: 347 - STORAGE				
Partition - 2	100 ft²			0.75* Gyp Frame	0.3880								Adjacent Room: 350 - CLASSROOM				

ENTERED VALUES

ROOM BY ROOM

By Heapy Engineering

Room Description: 347 - STORAGE **Zone Description: FC3-02** **System Description: Unassigned**

GENERAL INFORMATION

Floor Area: 86 ft² Flr-Flr Height: 14.1 ft
Plenum Height: 1.1 ft Height Above Flr:
Slab Cnstr Type: 8* LW Concrete
Room Mass: Time delay based on actual mass
Ceiling R-Value: 1.786 hr·ft²·°F/Btu
Is There Carpet?: YES
Design Clg DB / Drift Point: 75.0 °F / 81.0 °F
Design Htg DB / Drift Point: 72.0 °F / 66.0 °F
Design Relative Humidity: 50 %
Moisture Capacitance: Medium
Clg Tstat: None
Htg Tstat: None

Thermostat Location: Zone Floor Multiplier: 1
Humidistat Location: Room Room Multiplier: 1
CO2 Sensor Location: None
Room Type: Conditioned

PEOPLE

People Type: None
# of People: 0 sq ft/person
People Sensible: 250 Btu/h
People Latent : 250 Btu/h
People Schedule: People - Elem Classroom non-summer

Workstation: 1.0 workstation/person

LIGHTS

Lighting Type: Recessed fluorescent, not vented, 80% load to space
Fixture Type: RECFL-NV
% Load to RA: 20 %
Lighting Schedule: Lights - Elem Classroom non-summer
Lighting Amount: 0.8 W/sq ft
Ballast Factor: 1.0

AIRFLOW INFORMATION

	Cooling	Heating
Vent Type:	None	None
Vent Value:	0.00 cfm	0.00 cfm
Vent Schedule:	Wyoming FC MUA	
Infil Type:	HEAPY	HEAPY
Infil Value:	0.00 air changes/hr	0.08 cfm/sq ft of wall
Infil Schedule:	Available (100%)	
Vav Airflow:	Min: 0.40 cfm/sq ft	Max: 100.00 % Clg Airflow
Vav Sched:	Available (100%)	
Supply:	20.00 To be calculated	150.00 % Htg Airflow
Aux Supply:	To be calculated	To be calculated
Room Exhaust:		
Rm Exh Sched:	Available (100%)	

Description	Area/ Amount	Dir	Tilt	Const Type / Schedule	U Value Btu/h·ft²·°F	Alpha	Glass: Type / Energy Type	Glass: Area ft²	Glass: Shade Coef	Glass: U Value Btu/h·ft²·°F	Glass: External Shading	Glass: Internal Shading	Adj Temp/ Grnd Refl	Pct Sen/ Cool Tmp	Pct Rm/ Heat Tmp	Pct Ret/ Perm Len	Rad Frc/ Loss Coef
Roof - 1	86 ft²	0	90	Wyoming Existing	0.0783	0.90		0			Overhang - None	None					

Room Description: 348 - PREP **Zone Description: FC3-02** **System Description: Unassigned**

GENERAL INFORMATION

Floor Area: 73 ft² Flr-Flr Height: 14.1 ft
Plenum Height: 1.1 ft Height Above Flr:
Slab Cnstr Type: 8* LW Concrete
Room Mass: Time delay based on actual mass
Ceiling R-Value: 1.786 hr·ft²·°F/Btu
Is There Carpet?: YES
Design Clg DB / Drift Point: 75.0 °F / 81.0 °F
Design Htg DB / Drift Point: 72.0 °F / 66.0 °F
Design Relative Humidity: 50 %
Moisture Capacitance: Medium
Clg Tstat: None
Htg Tstat: None

Thermostat Location: Zone Floor Multiplier: 1
Humidistat Location: Room Room Multiplier: 1
CO2 Sensor Location: None
Room Type: Conditioned

PEOPLE

People Type: None
# of People: 0 sq ft/person
People Sensible: 250 Btu/h
People Latent : 250 Btu/h
People Schedule: People - Elem Classroom non-summer

Workstation: 1.0 workstation/person

LIGHTS

Lighting Type: Recessed fluorescent, not vented, 80% load to space
Fixture Type: RECFL-NV
% Load to RA: 20 %
Lighting Schedule: Lights - Elem Classroom non-summer
Lighting Amount: 1.4 W/sq ft
Ballast Factor: 1.0

AIRFLOW INFORMATION

	Cooling	Heating
Vent Type:	None	None
Vent Value:	13.00 cfm	13.00 cfm
Vent Schedule:	Wyoming FC MUA	
Infil Type:	HEAPY	HEAPY
Infil Value:	0.00 air changes/hr	0.08 cfm/sq ft of wall
Infil Schedule:	Available (100%)	
Vav Airflow:	Min: 0.40 cfm/sq ft	Max: 100.00 % Clg Airflow
Vav Sched:	Available (100%)	
Supply:	15.00 To be calculated	150.00 % Htg Airflow
Aux Supply:	To be calculated	To be calculated
Room Exhaust:	75.00 cfm	
Rm Exh Sched:	Wyoming General	

Description	Area/ Amount	Dir	Tilt	Const Type / Schedule	U Value Btu/h·ft²·°F	Alpha	Glass: Type / Energy Type	Glass: Area ft²	Glass: Shade Coef	Glass: U Value Btu/h·ft²·°F	Glass: External Shading	Glass: Internal Shading	Adj Temp/ Grnd Refl	Pct Sen/ Cool Tmp	Pct Rm/ Heat Tmp	Pct Ret/ Perm Len	Rad Frc/ Loss Coef
Roof - 1	73 ft²	0	90	Wyoming Existing	0.0783	0.90		0			Overhang - None	None					
Partition - 1	100 ft²			0.75* Gyp Frame	0.3880								Adjacent Room: 350 - CLASSROOM				

ENTERED VALUES

ROOM BY ROOM

By Heapy Engineering

Room Description: 349 - JANITOR CL | **Zone Description: FC3-02** | **System Description: Unassigned**

GENERAL INFORMATION

Floor Area: 35 ft² Flr-Flr Height: 14.1 ft
Plenum Height: 1.1 ft Height Above Flr:
Slab Cnstr Type: 8* LW Concrete
Room Mass: Time delay based on actual mass
Ceiling R-Value: 1.786 hr·ft²·°F/Btu
Is There Carpet?: YES
Design Clg DB / Drift Point: 75.0 °F / 81.0 °F
Design Htg DB / Drift Point: 72.0 °F / 66.0 °F
Design Relative Humidity: 50 %
Moisture Capacitance: Medium
Clg Tstat: None
Htg Tstat: None

Thermostat Location: Zone Floor Multiplier: 1
Humidistat Location: Room Room Multiplier: 1
CO2 Sensor Location: None
Room Type: Conditioned

PEOPLE

People Type: None
# of People: 0 sq ft/person
People Sensible: 250 Btu/h
People Latent : 250 Btu/h
People Schedule: People - Elem Classroom non-summer

Workstation: 1.0 workstation/person

LIGHTS

Lighting Type: Recessed fluorescent, not vented, 80% load to space
Fixture Type: RECFL-NV
% Load to RA: 20 %
Lighting Schedule: Lights - Elem Classroom non-summer
Lighting Amount: 0.9 W/sq ft
Ballast Factor: 1.0

AIRFLOW INFORMATION

	Cooling	Heating
Vent Type:	None	None
Vent Value:	0.00 cfm	0.00 cfm
Vent Schedule:	Wyoming FC MUA	
Infil Type:	HEAPY	HEAPY
Infil Value:	0.00 air changes/hr	0.08 cfm/sq ft of wall
Infil Schedule:	Available (100%)	
Vav Airflow:	Min: 0.40 cfm/sq ft	Max: 100.00 % Clg Airflow
Vav Sched:	Available (100%)	
Supply:	10.00 To be calculated	125.00 % Htg Airflow
Aux Supply:	To be calculated	To be calculated
Room Exhaust:	55.00 cfm	
Rm Exh Sched:	Wyoming General	

Description	Area/ Amount	Dir	Tilt	Const Type / Schedule	U Value Btu/h·ft²·°F	Alpha	Glass: Type / Energy Type	Glass: Area ft²	Glass: Shade Coef	Glass: U Value Btu/h·ft²·°F	Glass: External Shading	Glass: Internal Shading	Adj Temp/ Grnd Refl	Pct Sen/ Cool Tmp	Pct Rm/ Heat Tmp	Pct Ret/ Perm Len	Rad Frc/ Loss Coef
Roof - 1	35 ft²	0	90	Wyoming Existing	0.0783	0.90		0			Overhang - None	None					

Room Description: 303B - CORRIDOR | **Zone Description: FC3-03** | **System Description: Unassigned**

GENERAL INFORMATION

Floor Area: 475 ft² Flr-Flr Height: 14.1 ft
Plenum Height: 1.1 ft Height Above Flr:
Slab Cnstr Type: 8* LW Concrete
Room Mass: Time delay based on actual mass
Ceiling R-Value: 1.786 hr·ft²·°F/Btu
Is There Carpet?: YES
Design Clg DB / Drift Point: 75.0 °F / 81.0 °F
Design Htg DB / Drift Point: 72.0 °F / 66.0 °F
Design Relative Humidity: 50 %
Moisture Capacitance: Medium
Clg Tstat: None
Htg Tstat: None

Thermostat Location: Zone Floor Multiplier: 1
Humidistat Location: Room Room Multiplier: 1
CO2 Sensor Location: None
Room Type: Conditioned

PEOPLE

People Type: None
# of People: 0 sq ft/person
People Sensible: 250 Btu/h
People Latent : 250 Btu/h
People Schedule: People - Elem Classroom non-summer

Workstation: 1.0 workstation/person

LIGHTS

Lighting Type: Recessed fluorescent, not vented, 80% load to space
Fixture Type: RECFL-NV
% Load to RA: 20 %
Lighting Schedule: Lights - Elem Classroom non-summer
Lighting Amount: 0.5 W/sq ft
Ballast Factor: 1.0

AIRFLOW INFORMATION

	Cooling	Heating
Vent Type:	None	None
Vent Value:	38.00 cfm	38.00 cfm
Vent Schedule:	Wyoming FC MUA	
Infil Type:	HEAPY	HEAPY
Infil Value:	0.00 air changes/hr	0.08 cfm/sq ft of wall
Infil Schedule:	Available (100%)	
Vav Airflow:	Min: 0.40 cfm/sq ft	Max: 100.00 % Clg Airflow
Vav Sched:	Available (100%)	
Supply:	100.00 To be calculated	100.00 To be calculated
Aux Supply:	To be calculated	To be calculated
Room Exhaust:		
Rm Exh Sched:	Available (100%)	

Description	Area/ Amount	Dir	Tilt	Const Type / Schedule	U Value Btu/h·ft²·°F	Alpha	Glass: Type / Energy Type	Glass: Area ft²	Glass: Shade Coef	Glass: U Value Btu/h·ft²·°F	Glass: External Shading	Glass: Internal Shading	Adj Temp/ Grnd Refl	Pct Sen/ Cool Tmp	Pct Rm/ Heat Tmp	Pct Ret/ Perm Len	Rad Frc/ Loss Coef
Roof - 1	475 ft²	0	90	Wyoming Existing	0.0783	0.90		0			Overhang - None	None					
Partition - 1	300 ft²			0.75* Gyp Frame	0.3880								Adjacent Room: 301 - CLASSROOM				
Partition - 2	300 ft²			0.75* Gyp Frame	0.3880								Adjacent Room: 350 - CLASSROOM				

ENTERED VALUES

ROOM BY ROOM

By Heapy Engineering

Room Description: 305 - SMALL GROUP ROOM **Zone Description: FC3-03** **System Description: Unassigned**

GENERAL INFORMATION

Floor Area:	88 ft²	Flr-Flr Height:	14.1 ft
Plenum Height:	1.1 ft	Height Above Flr:	
Slab Cnstr Type:	8* LW Concrete		
Room Mass:	Time delay based on actual mass		
Ceiling R-Value:	1.786 hr·ft²·°F/Btu		
Is There Carpet?:	YES		
Design Clg DB / Drift Point:	75.0 °F / 81.0 °F		
Design Htg DB / Drift Point:	72.0 °F / 66.0 °F		
Design Relative Humidity:	50 %		
Moisture Capacitance:	Medium		
Clg Tstat:	None		
Htg Tstat:	None		
Thermostat Location:	Zone	Floor Multiplier:	1
Humidistat Location:	Room	Room Multiplier:	1
CO2 Sensor Location:	None		
Room Type:	Conditioned		

PEOPLE

People Type:	Conference Room
# of People:	4 People
People Sensible:	245 Btu/h
People Latent :	155 Btu/h
People Schedule:	People - Elem Classroom non-summer
Workstation:	1.0 workstation/person

LIGHTS

Lighting Type:	Recessed fluorescent, not vented, 80% load to space
Fixture Type:	RECFL-NV
% Load to RA:	20 %
Lighting Schedule:	Lights - Elem Classroom non-summer
Lighting Amount:	1.4 W/sq ft
Ballast Factor:	1.0

AIRFLOW INFORMATION

	Cooling	Heating
Vent Type:	None	None
Vent Value:	14.00 cfm	14.00 cfm
Vent Schedule:	Wyoming FC MUA	
Infil Type:	HEAPY	HEAPY
Infil Value:	0.00 air changes/hr	0.08 cfm/sq ft of wall
Infil Schedule:	Available (100%)	
Vav Airflow:	Min: 0.40 cfm/sq ft	Max: 100.00 % Clg Airflow
Vav Sched:	Available (100%)	
Supply:	145.00 To be calculated	145.00 To be calculated
Aux Supply:	To be calculated	To be calculated
Room Exhaust:		
Rm Exh Sched:	Available (100%)	

Description	Area/ Amount	Dir	Tilt	Const Type / Schedule	U Value Btu/h·ft²·°F	Alpha	Glass: Type / Energy Type	Glass: Area ft²	Glass: Shade Coef	Glass: U Value Btu/h·ft²·°F	Glass: External Shading	Glass: Internal Shading	Adj Temp/ Grnd Refl	Pct Sen/ Cool Tmp	Pct Rm/ Heat Tmp	Pct Ret/ Perm Len	Rad Frc/ Loss Coef
Roof - 1	88 ft²	0	90	Wyoming Existing	0.0783	0.90		0			Overhang - None	None					
Misc Load 1	155.000 W			Misc - Elementary School			Electricity							100	100	0	60.00

Room Description: 344 - EXTENDED LEARNING CENTER **Zone Description: FC3-04** **System Description: Unassigned**

GENERAL INFORMATION

Floor Area:	885 ft²	Flr-Flr Height:	14.1 ft
Plenum Height:	1.1 ft	Height Above Flr:	
Slab Cnstr Type:	8* LW Concrete		
Room Mass:	Time delay based on actual mass		
Ceiling R-Value:	1.786 hr·ft²·°F/Btu		
Is There Carpet?:	YES		
Design Clg DB / Drift Point:	75.0 °F / 81.0 °F		
Design Htg DB / Drift Point:	72.0 °F / 66.0 °F		
Design Relative Humidity:	50 %		
Moisture Capacitance:	Medium		
Clg Tstat:	None		
Htg Tstat:	None		
Thermostat Location:	Zone	Floor Multiplier:	1
Humidistat Location:	Room	Room Multiplier:	1
CO2 Sensor Location:	None		
Room Type:	Conditioned		

PEOPLE

People Type:	General Office Space
# of People:	143 sq ft/person
People Sensible:	250 Btu/h
People Latent :	200 Btu/h
People Schedule:	People - Elem Classroom non-summer
Workstation:	1.0 workstation/person

LIGHTS

Lighting Type:	Recessed fluorescent, not vented, 80% load to space
Fixture Type:	RECFL-NV
% Load to RA:	20 %
Lighting Schedule:	Lights - Elem Classroom non-summer
Lighting Amount:	1.4 W/sq ft
Ballast Factor:	1.0

AIRFLOW INFORMATION

	Cooling	Heating
Vent Type:	None	None
Vent Value:	105.00 cfm	105.00 cfm
Vent Schedule:	Wyoming FC MUA	
Infil Type:	HEAPY	HEAPY
Infil Value:	0.00 air changes/hr	0.08 cfm/sq ft of wall
Infil Schedule:	Available (100%)	
Vav Airflow:	Min: 0.40 cfm/sq ft	Max: 100.00 % Clg Airflow
Vav Sched:	Available (100%)	
Supply:	1,165.00 To be calculated	1,165.00 To be calculated
Aux Supply:	To be calculated	To be calculated
Room Exhaust:		
Rm Exh Sched:	Available (100%)	

Description	Area/ Amount	Dir	Tilt	Const Type / Schedule	U Value Btu/h·ft²·°F	Alpha	Glass: Type / Energy Type	Glass: Area ft²	Glass: Shade Coef	Glass: U Value Btu/h·ft²·°F	Glass: External Shading	Glass: Internal Shading	Adj Temp/ Grnd Refl	Pct Sen/ Cool Tmp	Pct Rm/ Heat Tmp	Pct Ret/ Perm Len	Rad Frc/ Loss Coef
Roof - 1	885 ft²	0	90	Wyoming Existing	0.0783	0.90		0			Overhang - None	None					
Misc Load 1	1,600.000 W			Misc - Elementary School			Electricity							100	100	0	60.00

ENTERED VALUES

ROOM BY ROOM

By Heapy Engineering

Room Description: 308 - SMALL GROUP ROOM **Zone Description: FC3-05** **System Description: Unassigned**

GENERAL INFORMATION

Floor Area: 105 ft² Flr-Flr Height: 14.1 ft
Plenum Height: 1.1 ft Height Above Flr:
Slab Cnstr Type: 8* LW Concrete
Room Mass: Time delay based on actual mass
Ceiling R-Value: 1.786 hr·ft²·°F/Btu
Is There Carpet?: YES
Design Clg DB / Drift Point: 75.0 °F / 81.0 °F
Design Htg DB / Drift Point: 72.0 °F / 66.0 °F
Design Relative Humidity: 50 %
Moisture Capacitance: Medium
Clg Tstat: None
Htg Tstat: None

Thermostat Location: Zone Floor Multiplier: 1
Humidistat Location: Room Room Multiplier: 1
CO2 Sensor Location: None
Room Type: Conditioned

PEOPLE

People Type: Conference Room
# of People: 4 People
People Sensible: 245 Btu/h
People Latent : 155 Btu/h
People Schedule: People - Elem Classroom non-summer

Workstation: 1.0 workstation/person

LIGHTS

Lighting Type: Recessed fluorescent, not vented, 80% load to space
Fixture Type: RECFL-NV
% Load to RA: 20 %
Lighting Schedule: Lights - Elem Classroom non-summer
Lighting Amount: 1.4 W/sq ft
Ballast Factor: 1.0

AIRFLOW INFORMATION

	Cooling	Heating
Vent Type:	None	None
Vent Value:	15.00 cfm	15.00 cfm
Vent Schedule:	Wyoming FC MUA	
Infil Type:	HEAPY	HEAPY
Infil Value:	0.00 air changes/hr	0.08 cfm/sq ft of wall
Infil Schedule:	Available (100%)	
Vav Airflow:	Min: 0.40 cfm/sq ft	Max: 100.00 % Clg Airflow
Vav Sched:	Available (100%)	
Supply:	155.00 To be calculated	155.00 To be calculated
Aux Supply:	To be calculated	To be calculated
Room Exhaust:		
Rm Exh Sched:	Available (100%)	

Description	Area/ Amount	Dir	Tilt	Const Type / Schedule	U Value Btu/h·ft²·°F	Alpha	Glass: Type / Energy Type	Glass: Area ft²	Glass: Shade Coef	Glass: U Value Btu/h·ft²·°F	Glass: External Shading	Glass: Internal Shading	Adj Temp/ Grnd Refl	Pct Sen/ Cool Tmp	Pct Rm/ Heat Tmp	Pct Ret/ Perm Len	Rad Frc/ Loss Coef
Roof - 1	105 ft²	0	90	Wyoming Existing	0.0783	0.90		0			Overhang - None	None					
Misc Load 1	155.000 W			Misc - Elementary School			Electricity							100	100	0	60.00

Room Description: 309 - CORRIDOR **Zone Description: FC3-05** **System Description: Unassigned**

GENERAL INFORMATION

Floor Area: 715 ft² Flr-Flr Height: 14.1 ft
Plenum Height: 1.1 ft Height Above Flr:
Slab Cnstr Type: 8* LW Concrete
Room Mass: Time delay based on actual mass
Ceiling R-Value: 1.786 hr·ft²·°F/Btu
Is There Carpet?: YES
Design Clg DB / Drift Point: 75.0 °F / 81.0 °F
Design Htg DB / Drift Point: 72.0 °F / 66.0 °F
Design Relative Humidity: 50 %
Moisture Capacitance: Medium
Clg Tstat: None
Htg Tstat: None

Thermostat Location: Zone Floor Multiplier: 1
Humidistat Location: Room Room Multiplier: 1
CO2 Sensor Location: None
Room Type: Conditioned

PEOPLE

People Type: None
# of People: 0 sq ft/person
People Sensible: 250 Btu/h
People Latent : 250 Btu/h
People Schedule: People - Elem Classroom non-summer

Workstation: 1.0 workstation/person

LIGHTS

Lighting Type: Recessed fluorescent, not vented, 80% load to space
Fixture Type: RECFL-NV
% Load to RA: 20 %
Lighting Schedule: Lights - Elem Classroom non-summer
Lighting Amount: 0.5 W/sq ft
Ballast Factor: 1.0

AIRFLOW INFORMATION

	Cooling	Heating
Vent Type:	None	None
Vent Value:	58.00 cfm	58.00 cfm
Vent Schedule:	Wyoming FC MUA	
Infil Type:	HEAPY	HEAPY
Infil Value:	0.00 air changes/hr	0.08 cfm/sq ft of wall
Infil Schedule:	Available (100%)	
Vav Airflow:	Min: 0.40 cfm/sq ft	Max: 100.00 % Clg Airflow
Vav Sched:	Available (100%)	
Supply:	150.00 To be calculated	150.00 % Htg Airflow
Aux Supply:	To be calculated	To be calculated
Room Exhaust:		
Rm Exh Sched:	Available (100%)	

Description	Area/ Amount	Dir	Tilt	Const Type / Schedule	U Value Btu/h·ft²·°F	Alpha	Glass: Type / Energy Type	Glass: Area ft²	Glass: Shade Coef	Glass: U Value Btu/h·ft²·°F	Glass: External Shading	Glass: Internal Shading	Adj Temp/ Grnd Refl	Pct Sen/ Cool Tmp	Pct Rm/ Heat Tmp	Pct Ret/ Perm Len	Rad Frc/ Loss Coef
Roof - 1	715 ft²	0	90	Wyoming Existing	0.0783	0.90		0			Overhang - None	None					
Partition - 1	300 ft²			0.75* Gyp Frame	0.3880								Adjacent Room: 307 - CLASSROOM				
Partition - 2	300 ft²			0.75* Gyp Frame	0.3880								Adjacent Room: 310 - CLASSROOM				

ENTERED VALUES

ROOM BY ROOM

By Heapy Engineering

Room Description: 342 - SMALL GROUP ROOM **Zone Description: FC3-06** **System Description: Unassigned**

GENERAL INFORMATION

Floor Area:	138 ft²	Flr-Flr Height:	14.1 ft
Plenum Height:	1.1 ft	Height Above Flr:	
Slab Cnstr Type:	8* LW Concrete		
Room Mass:	Time delay based on actual mass		
Ceiling R-Value:	1.786 hr·ft²·°F/Btu		
Is There Carpet?:	YES		
Design Clg DB / Drift Point:	75.0 °F / 81.0 °F		
Design Htg DB / Drift Point:	72.0 °F / 66.0 °F		
Design Relative Humidity:	50 %		
Moisture Capacitance:	Medium		
Clg Tstat:	None		
Htg Tstat:	None		
Thermostat Location:	Zone	Floor Multiplier:	1
Humidistat Location:	Room	Room Multiplier:	1
CO2 Sensor Location:	None		
Room Type:	Conditioned		

PEOPLE

People Type:	Conference Room
# of People:	4 People
People Sensible:	245 Btu/h
People Latent :	155 Btu/h
People Schedule:	People - Elem Classroom non-summer
Workstation:	1.0 workstation/person

LIGHTS

Lighting Type:	Recessed fluorescent, not vented, 80% load to space
Fixture Type:	RECFL-NV
% Load to RA:	20 %
Lighting Schedule:	Lights - Elem Classroom non-summer
Lighting Amount:	1.4 W/sq ft
Ballast Factor:	1.0

AIRFLOW INFORMATION

	Cooling	Heating
Vent Type:	None	None
Vent Value:	18.00 cfm	18.00 cfm
Vent Schedule:	Wyoming FC MUA	
Infil Type:	HEAPY	HEAPY
Infil Value:	0.00 air changes/hr	0.08 cfm/sq ft of wall
Infil Schedule:	Available (100%)	
Vav Airflow:	Min: 0.40 cfm/sq ft	Max: 100.00 % Clg Airflow
Vav Sched:	Available (100%)	
Supply:	165.00 To be calculated	165.00 To be calculated
Aux Supply:	To be calculated	To be calculated
Room Exhaust:		
Rm Exh Sched:	Available (100%)	

Description	Area/ Amount	Dir	Tilt	Const Type / Schedule	U Value Btu/h·ft²·°F	Alpha	Glass: Type / Energy Type	Glass: Area ft²	Glass: Shade Coef	Glass: U Value Btu/h·ft²·°F	Glass: External Shading	Glass: Internal Shading	Adj Temp/ Grnd Refl	Pct Sen/ Cool Tmp	Pct Rm/ Heat Tmp	Pct Ret/ Perm Len	Rad Frc/ Loss Coef
Roof - 1	138 ft²	0	90	Wyoming Existing	0.0783	0.90		0			Overhang - None	None					
Misc Load 1	155.000 W			Misc - Elementary School			Electricity							100	100	0	60.00

Room Description: 343 - SMALL GROUP ROOM **Zone Description: FC3-06** **System Description: Unassigned**

GENERAL INFORMATION

Floor Area:	138 ft²	Flr-Flr Height:	14.1 ft
Plenum Height:	1.1 ft	Height Above Flr:	
Slab Cnstr Type:	8* LW Concrete		
Room Mass:	Time delay based on actual mass		
Ceiling R-Value:	1.786 hr·ft²·°F/Btu		
Is There Carpet?:	YES		
Design Clg DB / Drift Point:	75.0 °F / 81.0 °F		
Design Htg DB / Drift Point:	72.0 °F / 66.0 °F		
Design Relative Humidity:	50 %		
Moisture Capacitance:	Medium		
Clg Tstat:	None		
Htg Tstat:	None		
Thermostat Location:	Zone	Floor Multiplier:	1
Humidistat Location:	Room	Room Multiplier:	1
CO2 Sensor Location:	None		
Room Type:	Conditioned		

PEOPLE

People Type:	Conference Room
# of People:	4 People
People Sensible:	245 Btu/h
People Latent :	155 Btu/h
People Schedule:	People - Elem Classroom non-summer
Workstation:	1.0 workstation/person

LIGHTS

Lighting Type:	Recessed fluorescent, not vented, 80% load to space
Fixture Type:	RECFL-NV
% Load to RA:	20 %
Lighting Schedule:	Lights - Elem Classroom non-summer
Lighting Amount:	1.4 W/sq ft
Ballast Factor:	1.0

AIRFLOW INFORMATION

	Cooling	Heating
Vent Type:	None	None
Vent Value:	18.00 cfm	18.00 cfm
Vent Schedule:	Wyoming FC MUA	
Infil Type:	HEAPY	HEAPY
Infil Value:	0.00 air changes/hr	0.08 cfm/sq ft of wall
Infil Schedule:	Available (100%)	
Vav Airflow:	Min: 0.40 cfm/sq ft	Max: 100.00 % Clg Airflow
Vav Sched:	Available (100%)	
Supply:	405.00 To be calculated	405.00 To be calculated
Aux Supply:	To be calculated	To be calculated
Room Exhaust:		
Rm Exh Sched:	Available (100%)	

Description	Area/ Amount	Dir	Tilt	Const Type / Schedule	U Value Btu/h·ft²·°F	Alpha	Glass: Type / Energy Type	Glass: Area ft²	Glass: Shade Coef	Glass: U Value Btu/h·ft²·°F	Glass: External Shading	Glass: Internal Shading	Adj Temp/ Grnd Refl	Pct Sen/ Cool Tmp	Pct Rm/ Heat Tmp	Pct Ret/ Perm Len	Rad Frc/ Loss Coef
Roof - 1	138 ft²	0	90	Wyoming Existing	0.0783	0.90		0			Overhang - None	None					
S	52 ft²	180	0	Wyoming Existing	0.1059	0.90											
Opening - 1				Window			90.1-07 4a Window	8	0.46	0.55	Overhang - None	None	0.00				
Misc Load 1	155.000 W			Misc - Elementary School			Electricity							100	100	0	60.00

ENTERED VALUES

ROOM BY ROOM

By Heapy Engineering

Room Description: 311 - GIRLS TLT **Zone Description: FC3-07** **System Description: Unassigned**

GENERAL INFORMATION

Floor Area:	238 ft²	Flr-Flr Height:	14.1 ft
Plenum Height:	1.1 ft	Height Above Flr:	
Slab Cnstr Type:	8* LW Concrete		
Room Mass:	Time delay based on actual mass		
Ceiling R-Value:	1.786 hr·ft²·°F/Btu		
Is There Carpet?:	YES		
Design Clg DB / Drift Point:	78.0 °F / 83.0 °F		
Design Htg DB / Drift Point:	72.0 °F / 66.0 °F		
Design Relative Humidity:	50 %		
Moisture Capacitance:	Medium		
Clg Tstat:	None		
Htg Tstat:	None		
Thermostat Location:	Zone	Floor Multiplier:	1
Humidistat Location:	Room	Room Multiplier:	1
CO2 Sensor Location:	None		
Room Type:	Conditioned		

PEOPLE

People Type:	None
# of People:	0 sq ft/person
People Sensible:	250 Btu/h
People Latent :	250 Btu/h
People Schedule:	People - Elem Classroom non-summer
Workstation:	1.0 workstation/person

LIGHTS

Lighting Type:	Recessed fluorescent, not vented, 80% load to space
Fixture Type:	RECFL-NV
% Load to RA:	20 %
Lighting Schedule:	Lights - Elem Classroom non-summer
Lighting Amount:	0.9 W/sq ft
Ballast Factor:	1.0

AIRFLOW INFORMATION

	Cooling	Heating
Vent Type:	None	None
Vent Value:	0.00 cfm	0.00 cfm
Vent Schedule:	Wyoming FC MUA	
Infil Type:	HEAPY	HEAPY
Infil Value:	0.00 air changes/hr	0.08 cfm/sq ft of wall
Infil Schedule:	Available (100%)	
Vav Airflow:	Min: 0.40 cfm/sq ft	Max: 100.00 % Clg Airflow
Vav Sched:	Available (100%)	
Supply:	455.00 To be calculated	200.00 % Htg Airflow
Aux Supply:	To be calculated	To be calculated
Room Exhaust:	490.00 cfm	
Rm Exh Sched:	Wyoming General	

Description	Area/ Amount	Dir	Tilt	Const Type / Schedule	U Value Btu/h·ft²·°F	Alpha	Glass Type / Energy Type	Glass Area ft²	Glass Shade Coef	Glass U Value Btu/h·ft²·°F	Glass External Shading	Glass Internal Shading	Adj Temp/ Grnd Refl	Pct Sen/ Cool Tmp	Pct Rm/ Heat Tmp	Pct Ret/ Perm Len	Rad Frc/ Loss Coef
Roof - 1	238 ft²	0	90	Wyoming Existing	0.0783	0.90		0			Overhang - None	None					
N	208 ft²	0	0	Wyoming Existing	0.1059	0.90											
Opening - 1				Window			90.1-07 4a Window	53	0.46	0.55	Overhang - None	None	0.00				
W	39 ft²	270	0	Wyoming Existing	0.1059	0.90											
Opening - 1				Window			90.1-07 4a Window	11	0.46	0.55	Overhang - None	None	0.00				
Partition - 1	100 ft²			0.75* Gyp Frame	0.3880								Adjacent Room: 310 - CLASSROOM				
Partition - 2	100 ft²			0.75* Gyp Frame	0.3880								Adjacent Room: 313 - CLASSROOM				
Partition - 3	100 ft²			0.75* Gyp Frame	0.3880								Adjacent Room: 314 - CORRIDOR				

ENTERED VALUES

ROOM BY ROOM

By Heapy Engineering

Room Description: 314 - CORRIDOR **Zone Description: FC3-07** **System Description: Unassigned**

GENERAL INFORMATION

Floor Area:	563 ft²	Flr-Flr Height:	14.1 ft
Plenum Height:	1.1 ft	Height Above Flr:	
Slab Cnstr Type:	8* LW Concrete		
Room Mass:	Time delay based on actual mass		
Ceiling R-Value:	1.786 hr·ft²·°F/Btu		
Is There Carpet?:	YES		
Design Clg DB / Drift Point:	75.0 °F / 81.0 °F		
Design Htg DB / Drift Point:	72.0 °F / 66.0 °F		
Design Relative Humidity:	50 %		
Moisture Capacitance:	Medium		
Clg Tstat:	None		
Htg Tstat:	None		
Thermostat Location:	Zone	Floor Multiplier:	1
Humidistat Location:	Room	Room Multiplier:	1
CO2 Sensor Location:	None		
Room Type:	Conditioned		

PEOPLE

People Type:	None
# of People:	0 sq ft/person
People Sensible:	250 Btu/h
People Latent :	250 Btu/h
People Schedule:	People - Elem Classroom non-summer
Workstation:	1.0 workstation/person

LIGHTS

Lighting Type:	Recessed fluorescent, not vented, 80% load to space
Fixture Type:	RECFL-NV
% Load to RA:	20 %
Lighting Schedule:	Lights - Elem Classroom non-summer
Lighting Amount:	0.5 W/sq ft
Ballast Factor:	1.0

AIRFLOW INFORMATION

	Cooling	Heating
Vent Type:	None	None
Vent Value:	46.00 cfm	46.00 cfm
Vent Schedule:	Wyoming FC MUA	
Infil Type:	HEAPY	HEAPY
Infil Value:	0.00 air changes/hr	0.08 cfm/sq ft of wall
Infil Schedule:	Available (100%)	
Vav Airflow:	Min: 0.40 cfm/sq ft	Max: 100.00 % Clg Airflow
Vav Sched:	Available (100%)	
Supply:	120.00 To be calculated	150.00 % Htg Airflow
Aux Supply:	To be calculated	To be calculated
Room Exhaust:		
Rm Exh Sched:	Available (100%)	

Description	Area/ Amount	Dir	Tilt	Const Type / Schedule	U Value Btu/h·ft²·°F	Alpha	Glass: Type / Energy Type	Glass: Area ft²	Glass: Shade Coef	Glass: U Value Btu/h·ft²·°F	Glass: External Shading	Glass: Internal Shading	Adj Temp/ Grnd Refl	Pct Sen/ Cool Tmp	Pct Rm/ Heat Tmp	Pct Ret/ Perm Len	Rad Frc/ Loss Coef
Roof - 1	563 ft²	0	90	Wyoming Existing	0.0783	0.90		0			Overhang - None	None					
Partition - 1	300 ft²			0.75* Gyp Frame	0.3880								Adjacent Room: 313 - CLASSROOM				
Partition - 2	300 ft²			0.75* Gyp Frame	0.3880								Adjacent Room: 339 - CLASSROOM				
Partition - 3	300 ft²			0.75* Gyp Frame	0.3880								Adjacent Room: 338 - CLASSROOM				

ENTERED VALUES

ROOM BY ROOM

By Heapy Engineering

Room Description: 316 - BOYS TLT **Zone Description: FC3-08** **System Description: Unassigned**

GENERAL INFORMATION

Floor Area:	185 ft²	Flr-Flr Height:	14.1 ft
Plenum Height:	1.1 ft	Height Above Flr:	
Slab Cnstr Type:	8* LW Concrete		
Room Mass:	Time delay based on actual mass		
Ceiling R-Value:	1.786 hr·ft²·°F/Btu		
Is There Carpet?:	YES		
Design Clg DB / Drift Point:	78.0 °F / 83.0 °F		
Design Htg DB / Drift Point:	72.0 °F / 66.0 °F		
Design Relative Humidity:	50 %		
Moisture Capacitance:	Medium		
Clg Tstat:	None		
Htg Tstat:	None		
Thermostat Location:	Zone	Floor Multiplier:	1
Humidistat Location:	Room	Room Multiplier:	1
CO2 Sensor Location:	None		
Room Type:	Conditioned		

PEOPLE

People Type:	None
# of People:	0 sq ft/person
People Sensible:	250 Btu/h
People Latent :	250 Btu/h
People Schedule:	People - Elem Classroom non-summer
Workstation:	1.0 workstation/person

LIGHTS

Lighting Type:	Recessed fluorescent, not vented, 80% load to space
Fixture Type:	RECFL-NV
% Load to RA:	20 %
Lighting Schedule:	Lights - Elem Classroom non-summer
Lighting Amount:	0.9 W/sq ft
Ballast Factor:	1.0

AIRFLOW INFORMATION

	Cooling	Heating
Vent Type:	None	None
Vent Value:	0.00 cfm	0.00 cfm
Vent Schedule:	Wyoming FC MUA	
Infil Type:	HEAPY	HEAPY
Infil Value:	0.00 air changes/hr	0.08 cfm/sq ft of wall
Infil Schedule:	Available (100%)	
Vav Airflow:	Min: 0.40 cfm/sq ft	Max: 100.00 % Clg Airflow
Vav Sched:	Available (100%)	
Supply:	465.00 To be calculated	200.00 % Htg Airflow
Aux Supply:	To be calculated	To be calculated
Room Exhaust:	490.00 cfm	
Rm Exh Sched:	Wyoming General	

Description	Area/ Amount	Dir	Tilt	Const Type / Schedule	U Value Btu/h·ft²·°F	Alpha	Glass: Type / Energy Type	Glass: Area ft²	Glass: Shade Coef	Glass: U Value Btu/h·ft²·°F	Glass: External Shading	Glass: Internal Shading	Adj Temp/ Grnd Refl	Pct Sen/ Cool Tmp	Pct Rm/ Heat Tmp	Pct Ret/ Perm Len	Rad Frc/ Loss Coef
Roof - 1	185 ft²	0	90	Wyoming Existing	0.0783	0.90		0			Overhang - None	None					
N	221 ft²	0	0	Wyoming Existing	0.1059	0.90											
Opening - 1				Window			90.1-07 4a Window	57	0.46	0.55	Overhang - None	None	0.00				
E	39 ft²	90	0	Wyoming Existing	0.1059	0.90											
Opening - 1				Window			90.1-07 4a Window	8	0.46	0.55	Overhang - None	None	0.00				
Partition - 1	100 ft²			0.75* Gyp Frame	0.3880								Adjacent Room: 313 - CLASSROOM				
Partition - 2	100 ft²			0.75* Gyp Frame	0.3880								Adjacent Room: 319 - CLASSROOM				
Partition - 3	100 ft²			0.75* Gyp Frame	0.3880								Adjacent Room: 317 - STAFF TLT				

ENTERED VALUES

ROOM BY ROOM

By Heapy Engineering

Room Description: 317 - STAFF TLT | **Zone Description: FC3-08** | **System Description: Unassigned**

GENERAL INFORMATION

Floor Area: 51 ft² Flr-Flr Height: 14.1 ft
Plenum Height: 1.1 ft Height Above Flr:
Slab Cnstr Type: 8* LW Concrete
Room Mass: Time delay based on actual mass
Ceiling R-Value: 1.786 hr·ft²·°F/Btu
Is There Carpet?: YES
Design Clg DB / Drift Point: 78.0 °F / 83.0 °F
Design Htg DB / Drift Point: 72.0 °F / 66.0 °F
Design Relative Humidity: 50 %
Moisture Capacitance: Medium
Clg Tstat: None
Htg Tstat: None

Thermostat Location: Zone Floor Multiplier: 1
Humidistat Location: Room Room Multiplier: 1
CO2 Sensor Location: None
Room Type: Conditioned

PEOPLE

People Type: None
# of People: 0 sq ft/person
People Sensible: 250 Btu/h
People Latent : 250 Btu/h
People Schedule: People - Elem Classroom non-summer

Workstation: 1.0 workstation/person

LIGHTS

Lighting Type: Recessed fluorescent, not vented, 80% load to space
Fixture Type: RECFL-NV
% Load to RA: 20 %
Lighting Schedule: Lights - Elem Classroom non-summer
Lighting Amount: 0.9 W/sq ft
Ballast Factor: 1.0

AIRFLOW INFORMATION

	Cooling	Heating
Vent Type:	None	None
Vent Value:	0.00 cfm	0.00 cfm
Vent Schedule:	Wyoming FC MUA	
Infil Type:	HEAPY	HEAPY
Infil Value:	0.00 air changes/hr	0.08 cfm/sq ft of wall
Infil Schedule:	Available (100%)	
Vav Airflow:	Min: 0.40 cfm/sq ft	Max: 100.00 % Clg Airflow
Vav Sched:	Available (100%)	
Supply:	10.00 To be calculated	200.00 % Htg Airflow
Aux Supply:	To be calculated	To be calculated
Room Exhaust:	70.00 cfm	
Rm Exh Sched:	Wyoming General	

Description	Area/ Amount	Dir	Tilt	Const Type / Schedule	U Value Btu/h·ft²·°F	Alpha	Glass: Type / Energy Type	Glass: Area ft²	Glass: Shade Coef	Glass: U Value Btu/h·ft²·°F	Glass: External Shading	Glass: Internal Shading	Adj Temp/ Grnd Refl	Pct Sen/ Cool Tmp	Pct Rm/ Heat Tmp	Pct Ret/ Perm Len	Rad Frc/ Loss Coef
Roof - 1	51 ft²	0	90	Wyoming Existing	0.0783	0.90		0			Overhang - None	None					
Partition - 1	200 ft²			0.75* Gyp Frame	0.3880								Adjacent Room: 314 - CORRIDOR				

Room Description: 339 - CLASSROOM | **Zone Description: FC3-09** | **System Description: Unassigned**

GENERAL INFORMATION

Floor Area: 719 ft² Flr-Flr Height: 14.1 ft
Plenum Height: 1.1 ft Height Above Flr:
Slab Cnstr Type: 8* LW Concrete
Room Mass: Time delay based on actual mass
Ceiling R-Value: 1.786 hr·ft²·°F/Btu
Is There Carpet?: YES
Design Clg DB / Drift Point: 75.0 °F / 81.0 °F
Design Htg DB / Drift Point: 72.0 °F / 66.0 °F
Design Relative Humidity: 50 %
Moisture Capacitance: Medium
Clg Tstat: None
Htg Tstat: None

Thermostat Location: Zone Floor Multiplier: 1
Humidistat Location: Room Room Multiplier: 1
CO2 Sensor Location: None
Room Type: Conditioned

PEOPLE

People Type: Classroom
# of People: 19 People
People Sensible: 250 Btu/h
People Latent : 200 Btu/h
People Schedule: People - Elem Classroom non-summer

Workstation: 1.0 workstation/person

LIGHTS

Lighting Type: Fluorescent, hung below ceiling, 100% load to space
Fixture Type: SUSFLUOR
% Load to RA: 0 %
Lighting Schedule: Lights - Elem Classroom non-summer
Lighting Amount: 1.4 W/sq ft
Ballast Factor: 1.0

AIRFLOW INFORMATION

	Cooling	Heating
Vent Type:	None	None
Vent Value:	468.00 cfm	468.00 cfm
Vent Schedule:	Wyoming FC MUA	
Infil Type:	HEAPY	HEAPY
Infil Value:	0.00 air changes/hr	0.08 cfm/sq ft of wall
Infil Schedule:	Available (100%)	
Vav Airflow:	Min: 0.40 cfm/sq ft	Max: 100.00 % Clg Airflow
Vav Sched:	Available (100%)	
Supply:	860.00 To be calculated	860.00 To be calculated
Aux Supply:	To be calculated	To be calculated
Room Exhaust:		
Rm Exh Sched:	Available (100%)	

Description	Area/ Amount	Dir	Tilt	Const Type / Schedule	U Value Btu/h·ft²·°F	Alpha	Glass: Type / Energy Type	Glass: Area ft²	Glass: Shade Coef	Glass: U Value Btu/h·ft²·°F	Glass: External Shading	Glass: Internal Shading	Adj Temp/ Grnd Refl	Pct Sen/ Cool Tmp	Pct Rm/ Heat Tmp	Pct Ret/ Perm Len	Rad Frc/ Loss Coef
Roof - 1	719 ft²	0	90	Wyoming Existing	0.0783	0.90		0			Overhang - None	None					
Misc Load 1	800.000 W			Misc - Elementary School			Electricity							100	100	0	60.00

ENTERED VALUES

ROOM BY ROOM

By Heapy Engineering

Room Description: 338 - CLASSROOM **Zone Description: FC3-10** **System Description: Unassigned**

GENERAL INFORMATION

Floor Area: 418 ft² Flr-Flr Height: 14.1 ft
Plenum Height: 1.1 ft Height Above Flr:
Slab Cnstr Type: 8* LW Concrete
Room Mass: Time delay based on actual mass
Ceiling R-Value: 1.786 hr·ft²·°F/Btu
Is There Carpet?: YES
Design Clg DB / Drift Point: 75.0 °F / 81.0 °F
Design Htg DB / Drift Point: 72.0 °F / 66.0 °F
Design Relative Humidity: 50 %
Moisture Capacitance: Medium
Clg Tstat: None
Htg Tstat: None

Thermostat Location: Zone Floor Multiplier: 1
Humidistat Location: Room Room Multiplier: 1
CO2 Sensor Location: None
Room Type: Conditioned

PEOPLE

People Type: Classroom
# of People: 7 People
People Sensible: 250 Btu/h
People Latent : 200 Btu/h
People Schedule: People - Elem Classroom non-summer

Workstation: 1.0 workstation/person

LIGHTS

Lighting Type: Fluorescent, hung below ceiling, 100% load to space
Fixture Type: SUSFLUOR
% Load to RA: 0 %
Lighting Schedule: Lights - Elem Classroom non-summer
Lighting Amount: 1.4 W/sq ft
Ballast Factor: 1.0

AIRFLOW INFORMATION

	Cooling	Heating
Vent Type:	None	None
Vent Value:	270.00 cfm	270.00 cfm
Vent Schedule:	Wyoming FC MUA	
Infil Type:	HEAPY	HEAPY
Infil Value:	0.00 air changes/hr	0.08 cfm/sq ft of wall
Infil Schedule:	Available (100%)	
Vav Airflow:	Min: 0.40 cfm/sq ft	Max: 100.00 % Clg Airflow
Vav Sched:	Available (100%)	
Supply:	510.00 To be calculated	510.00 To be calculated
Aux Supply:	To be calculated	To be calculated
Room Exhaust:		
Rm Exh Sched:	Available (100%)	

Description	Area/ Amount	Dir	Tilt	Const Type / Schedule	U Value Btu/h·ft²·°F	Alpha	Glass: Type / Energy Type	Glass: Area ft²	Glass: Shade Coef	Glass: U Value Btu/h·ft²·°F	Glass: External Shading	Glass: Internal Shading	Adj Temp/ Grnd Refl	Pct Sen/ Cool Tmp	Pct Rm/ Heat Tmp	Pct Ret/ Perm Len	Rad Frc/ Loss Coef
Roof - 1	418 ft²	0	90	Wyoming Existing	0.0783	0.90		0			Overhang - None	None					
Misc Load 1	800.000 W			Misc - Elementary School			Electricity							100	100	0	60.00

ENTERED VALUES

ROOM BY ROOM

By Heapy Engineering

Room Description: 318 - CORRIDOR **Zone Description: FC3-11** **System Description: Unassigned**

GENERAL INFORMATION

Floor Area:	722 ft²	Flr-Flr Height:	14.1 ft
Plenum Height:	1.1 ft	Height Above Flr:	
Slab Cnstr Type:	8* LW Concrete		
Room Mass:	Time delay based on actual mass		
Ceiling R-Value:	1.786 hr·ft²·°F/Btu		
Is There Carpet?:	YES		
Design Clg DB / Drift Point:	75.0 °F / 81.0 °F		
Design Htg DB / Drift Point:	72.0 °F / 66.0 °F		
Design Relative Humidity:	50 %		
Moisture Capacitance:	Medium		
Clg Tstat:	None		
Htg Tstat:	None		
Thermostat Location:	Zone	Floor Multiplier:	1
Humidistat Location:	Room	Room Multiplier:	1
CO2 Sensor Location:	None		
Room Type:	Conditioned		

PEOPLE

People Type:	None
# of People:	0 sq ft/person
People Sensible:	250 Btu/h
People Latent :	250 Btu/h
People Schedule:	People - Elem Classroom non-summer
Workstation:	1.0 workstation/person

LIGHTS

Lighting Type:	Recessed fluorescent, not vented, 80% load to space
Fixture Type:	RECFL-NV
% Load to RA:	20 %
Lighting Schedule:	Lights - Elem Classroom non-summer
Lighting Amount:	0.5 W/sq ft
Ballast Factor:	1.0

AIRFLOW INFORMATION

	Cooling	Heating
Vent Type:	None	None
Vent Value:	58.00 cfm	58.00 cfm
Vent Schedule:	Wyoming FC MUA	
Infil Type:	HEAPY	HEAPY
Infil Value:	0.00 air changes/hr	0.08 cfm/sq ft of wall
Infil Schedule:	Available (100%)	
Vav Airflow:	Min: 0.40 cfm/sq ft	Max: 100.00 % Clg Airflow
Vav Sched:	Available (100%)	
Supply:	150.00 To be calculated	150.00 % Htg Airflow
Aux Supply:	To be calculated	To be calculated
Room Exhaust:		
Rm Exh Sched:	Available (100%)	

Description	Area/ Amount	Dir	Tilt	Const Type / Schedule	U Value Btu/h·ft²·°F	Alpha	Glass: Type / Energy Type	Glass: Area ft²	Glass: Shade Coef	Glass: U Value Btu/h·ft²·°F	Glass: External Shading	Glass: Internal Shading	Adj Temp/ Grnd Refl	Pct Sen/ Cool Tmp	Pct Rm/ Heat Tmp	Pct Ret/ Perm Len	Rad Frc/ Loss Coef
Roof - 1	722 ft²	0	90	Wyoming Existing	0.0783	0.90		0			Overhang - None	None					
Partition - 1	300 ft²			0.75* Gyp Frame	0.3880								Adjacent Room: 319 - CLASSROOM				
Partition - 2	300 ft²			0.75* Gyp Frame	0.3880								Adjacent Room: 321 - CLASSROOM				
Partition - 3	300 ft²			0.75* Gyp Frame	0.3880								Adjacent Room: 336 - CLASSROOM				
Partition - 4	200 ft²			0.75* Gyp Frame	1.0000								Adjacent Room: 314 - CORRIDOR				
Partition - 5	200 ft²			0.75* Gyp Frame	1.0000								Adjacent Room: 328A - CORRIDOR				

ENTERED VALUES

ROOM BY ROOM

By Heapy Engineering

Room Description: 320 - SMALL GROUP ROOM **Zone Description: FC3-11** **System Description: Unassigned**

GENERAL INFORMATION

Floor Area: 92 ft² Flr-Flr Height: 14.1 ft
Plenum Height: 1.1 ft Height Above Flr:
Slab Cnstr Type: 8* LW Concrete
Room Mass: Time delay based on actual mass
Ceiling R-Value: 1.786 hr·ft²·°F/Btu
Is There Carpet?: YES
Design Clg DB / Drift Point: 75.0 °F / 81.0 °F
Design Htg DB / Drift Point: 72.0 °F / 66.0 °F
Design Relative Humidity: 50 %
Moisture Capacitance: Medium
Clg Tstat: None
Htg Tstat: None

Thermostat Location: Zone Floor Multiplier: 1
Humidistat Location: Room Room Multiplier: 1
CO2 Sensor Location: None
Room Type: Conditioned

PEOPLE

People Type: Conference Room
# of People: 4 People
People Sensible: 245 Btu/h
People Latent : 155 Btu/h
People Schedule: People - Elem Classroom non-summer

Workstation: 1.0 workstation/person

LIGHTS

Lighting Type: Recessed fluorescent, not vented, 80% load to space
Fixture Type: RECFL-NV
% Load to RA: 20 %
Lighting Schedule: Lights - Elem Classroom non-summer
Lighting Amount: 1.4 W/sq ft
Ballast Factor: 1.0

AIRFLOW INFORMATION

	Cooling	Heating
Vent Type:	None	None
Vent Value:	14.00 cfm	14.00 cfm
Vent Schedule:	Wyoming FC MUA	
Infil Type:	HEAPY	HEAPY
Infil Value:	0.00 air changes/hr	0.08 cfm/sq ft of wall
Infil Schedule:	Available (100%)	
Vav Airflow:	Min: 0.40 cfm/sq ft	Max: 100.00 % Clg Airflow
Vav Sched:	Available (100%)	
Supply:	150.00 To be calculated	150.00 To be calculated
Aux Supply:	To be calculated	To be calculated
Room Exhaust:		
Rm Exh Sched:	Available (100%)	

Description	Area/ Amount	Dir	Tilt	Const Type / Schedule	U Value Btu/h·ft²·°F	Alpha	Glass Type / Energy Type	Glass Area ft²	Glass Shade Coef	Glass U Value Btu/h·ft²·°F	Glass External Shading	Glass Internal Shading	Adj Temp/ Grnd Refl	Pct Sen/ Cool Tmp	Pct Rm/ Heat Tmp	Pct Ret/ Perm Len	Rad Frc/ Loss Coef
Roof - 1	92 ft²	0	90	Wyoming Existing	0.0783	0.90		0			Overhang - None	None					
Misc Load 1	155.000 W			Misc - Elementary School			Electricity							100	100	0	60.00

ENTERED VALUES

ROOM BY ROOM

By Heapy Engineering

Room Description: 334 - SMALL GROUP ROOM **Zone Description: FC3-12** **System Description: Unassigned**

GENERAL INFORMATION

Floor Area:	126 ft²	Flr-Flr Height:	14.1 ft
Plenum Height:	1.1 ft	Height Above Flr:	
Slab Cnstr Type:	8* LW Concrete		
Room Mass:	Time delay based on actual mass		
Ceiling R-Value:	1.786 hr·ft²·°F/Btu		
Is There Carpet?:	YES		
Design Clg DB / Drift Point:	75.0 °F / 81.0 °F		
Design Htg DB / Drift Point:	72.0 °F / 66.0 °F		
Design Relative Humidity:	50 %		
Moisture Capacitance:	Medium		
Clg Tstat:	None		
Htg Tstat:	None		
Thermostat Location:	Zone	Floor Multiplier:	1
Humidistat Location:	Room	Room Multiplier:	1
CO2 Sensor Location:	None		
Room Type:	Conditioned		

PEOPLE

People Type:	Conference Room
# of People:	4 People
People Sensible:	245 Btu/h
People Latent :	155 Btu/h
People Schedule:	People - Elem Classroom non-summer
Workstation:	1.0 workstation/person

LIGHTS

Lighting Type:	Recessed fluorescent, not vented, 80% load to space
Fixture Type:	RECFL-NV
% Load to RA:	20 %
Lighting Schedule:	Lights - Elem Classroom non-summer
Lighting Amount:	1.4 W/sq ft
Ballast Factor:	1.0

AIRFLOW INFORMATION

	Cooling	Heating
Vent Type:	None	None
Vent Value:	17.00 cfm	17.00 cfm
Vent Schedule:	Wyoming FC MUA	
Infil Type:	HEAPY	HEAPY
Infil Value:	0.00 air changes/hr	0.08 cfm/sq ft of wall
Infil Schedule:	Available (100%)	
Vav Airflow:	Min: 0.40 cfm/sq ft	Max: 100.00 % Clg Airflow
Vav Sched:	Available (100%)	
Supply:	650.00 To be calculated	650.00 To be calculated
Aux Supply:	To be calculated	To be calculated
Room Exhaust:		
Rm Exh Sched:	Available (100%)	

Description	Area/ Amount	Dir	Tilt	Const Type / Schedule	U Value Btu/h·ft²·°F	Alpha	Glass: Type / Energy Type	Glass: Area ft²	Glass: Shade Coef	Glass: U Value Btu/h·ft²·°F	Glass: External Shading	Glass: Internal Shading	Adj Temp/ Grnd Refl	Pct Sen/ Cool Tmp	Pct Rm/ Heat Tmp	Pct Ret/ Perm Len	Rad Frc/ Loss Coef
Roof - 1	126 ft²	0	90	Wyoming Existing	0.0783	0.90		0			Overhang - None	None					
S	143 ft²	180	0	Wyoming Existing	0.1059	0.90											
Opening - 1				Window			90.1-07 4a Window	23	0.46	0.55	Overhang - None	None	0.00				
Misc Load 1	155.000 W			Misc - Elementary School			Electricity							100	100	0	60.00
Partition - 1	100 ft²			0.75* Gyp Frame	0.3880								Adjacent Room: 335 - SMALL GROU				
Partition - 2	100 ft²			0.75* Gyp Frame	0.3880								Adjacent Room: 336 - CLASSROOM				
Partition - 3	100 ft²			0.75* Gyp Frame	0.3880								Adjacent Room: 333 - EXTENDED LE				

ENTERED VALUES

ROOM BY ROOM

By Heapy Engineering

Room Description: 335 - SMALL GROUP ROOM **Zone Description: FC3-12** **System Description: Unassigned**

GENERAL INFORMATION

Floor Area: 131 ft² Flr-Flr Height: 14.1 ft
Plenum Height: 1.1 ft Height Above Flr:
Slab Cnstr Type: 8* LW Concrete
Room Mass: Time delay based on actual mass
Ceiling R-Value: 1.786 hr·ft²·°F/Btu
Is There Carpet?: YES
Design Clg DB / Drift Point: 75.0 °F / 81.0 °F
Design Htg DB / Drift Point: 72.0 °F / 66.0 °F
Design Relative Humidity: 50 %
Moisture Capacitance: Medium
Clg Tstat: None
Htg Tstat: None

Thermostat Location: Zone Floor Multiplier: 1
Humidistat Location: Room Room Multiplier: 1
CO2 Sensor Location: None
Room Type: Conditioned

PEOPLE

People Type: Conference Room
# of People: 4 People
People Sensible: 245 Btu/h
People Latent : 155 Btu/h
People Schedule: People - Elem Classroom non-summer

Workstation: 1.0 workstation/person

LIGHTS

Lighting Type: Recessed fluorescent, not vented, 80% load to space
Fixture Type: RECFL-NV
% Load to RA: 20 %
Lighting Schedule: Lights - Elem Classroom non-summer
Lighting Amount: 1.4 W/sq ft
Ballast Factor: 1.0

AIRFLOW INFORMATION

	Cooling	Heating
Vent Type:	None	None
Vent Value:	17.00 cfm	17.00 cfm
Vent Schedule:	Wyoming FC MUA	
Infil Type:	HEAPY	HEAPY
Infil Value:	0.00 air changes/hr	0.08 cfm/sq ft of wall
Infil Schedule:	Available (100%)	
Vav Airflow:	Min: 0.40 cfm/sq ft	Max: 100.00 % Clg Airflow
Vav Sched:	Available (100%)	
Supply:	160.00 To be calculated	160.00 To be calculated
Aux Supply:	To be calculated	To be calculated
Room Exhaust:		
Rm Exh Sched:	Available (100%)	

Description	Area/ Amount	Dir	Tilt	Const Type / Schedule	U Value Btu/h·ft²·°F	Alpha	Glass Type / Energy Type	Glass Area ft²	Glass Shade Coef	Glass U Value Btu/h·ft²·°F	Glass External Shading	Glass Internal Shading	Adj Temp/ Grnd Refl	Pct Sen/ Cool Tmp	Pct Rm/ Heat Tmp	Pct Ret/ Perm Len	Rad Frc/ Loss Coef
Roof - 1	131 ft²	0	90	Wyoming Existing	0.0783	0.90		0			Overhang - None	None					
Misc Load 1	155.000 W			Misc - Elementary School			Electricity							100	100	0	60.00

Room Description: 333 - EXTENDED LEARNING CENTER **Zone Description: FC3-13** **System Description: Unassigned**

GENERAL INFORMATION

Floor Area: 843 ft² Flr-Flr Height: 14.1 ft
Plenum Height: 1.1 ft Height Above Flr:
Slab Cnstr Type: 8* LW Concrete
Room Mass: Time delay based on actual mass
Ceiling R-Value: 1.786 hr·ft²·°F/Btu
Is There Carpet?: YES
Design Clg DB / Drift Point: 75.0 °F / 81.0 °F
Design Htg DB / Drift Point: 72.0 °F / 66.0 °F
Design Relative Humidity: 50 %
Moisture Capacitance: Medium
Clg Tstat: None
Htg Tstat: None

Thermostat Location: Zone Floor Multiplier: 1
Humidistat Location: Room Room Multiplier: 1
CO2 Sensor Location: None
Room Type: Conditioned

PEOPLE

People Type: General Office Space
# of People: 143 sq ft/person
People Sensible: 250 Btu/h
People Latent : 200 Btu/h
People Schedule: People - Elem Classroom non-summer

Workstation: 1.0 workstation/person

LIGHTS

Lighting Type: Recessed fluorescent, not vented, 80% load to space
Fixture Type: RECFL-NV
% Load to RA: 20 %
Lighting Schedule: Lights - Elem Classroom non-summer
Lighting Amount: 1.4 W/sq ft
Ballast Factor: 1.0

AIRFLOW INFORMATION

	Cooling	Heating
Vent Type:	None	None
Vent Value:	102.00 cfm	102.00 cfm
Vent Schedule:	Wyoming FC MUA	
Infil Type:	HEAPY	HEAPY
Infil Value:	0.00 air changes/hr	0.08 cfm/sq ft of wall
Infil Schedule:	Available (100%)	
Vav Airflow:	Min: 0.40 cfm/sq ft	Max: 100.00 % Clg Airflow
Vav Sched:	Available (100%)	
Supply:	1,155.00 To be calculated	1,155.00 To be calculated
Aux Supply:	To be calculated	To be calculated
Room Exhaust:		
Rm Exh Sched:	Available (100%)	

Description	Area/ Amount	Dir	Tilt	Const Type / Schedule	U Value Btu/h·ft²·°F	Alpha	Glass Type / Energy Type	Glass Area ft²	Glass Shade Coef	Glass U Value Btu/h·ft²·°F	Glass External Shading	Glass Internal Shading	Adj Temp/ Grnd Refl	Pct Sen/ Cool Tmp	Pct Rm/ Heat Tmp	Pct Ret/ Perm Len	Rad Frc/ Loss Coef
Roof - 1	843 ft²	0	90	Wyoming Existing	0.0783	0.90		0			Overhang - None	None					
Misc Load 1	1,600.000 W			Misc - Elementary School			Electricity							100	100	0	60.00

ENTERED VALUES

ROOM BY ROOM

By Heapy Engineering

Room Description: 323 - SMALL GROUP ROOM **Zone Description: FC3-14** **System Description: Unassigned**

GENERAL INFORMATION

Floor Area: 98 ft² Flr-Flr Height: 14.1 ft
Plenum Height: 1.1 ft Height Above Flr:
Slab Cnstr Type: 8* LW Concrete
Room Mass: Time delay based on actual mass
Ceiling R-Value: 1.786 hr·ft²·°F/Btu
Is There Carpet?: YES
Design Clg DB / Drift Point: 75.0 °F / 81.0 °F
Design Htg DB / Drift Point: 72.0 °F / 66.0 °F
Design Relative Humidity: 50 %
Moisture Capacitance: Medium
Clg Tstat: None
Htg Tstat: None

Thermostat Location: Zone Floor Multiplier: 1
Humidistat Location: Room Room Multiplier: 1
CO2 Sensor Location: None
Room Type: Conditioned

PEOPLE

People Type: Conference Room
# of People: 4 People
People Sensible: 245 Btu/h
People Latent : 155 Btu/h
People Schedule: People - Elem Classroom non-summer

Workstation: 1.0 workstation/person

LIGHTS

Lighting Type: Recessed fluorescent, not vented, 80% load to space
Fixture Type: RECFL-NV
% Load to RA: 20 %
Lighting Schedule: Lights - Elem Classroom non-summer
Lighting Amount: 1.4 W/sq ft
Ballast Factor: 1.0

AIRFLOW INFORMATION

	Cooling	Heating
Vent Type:	None	None
Vent Value:	15.00 cfm	15.00 cfm
Vent Schedule:	Wyoming FC MUA	
Infil Type:	HEAPY	HEAPY
Infil Value:	0.00 air changes/hr	0.08 cfm/sq ft of wall
Infil Schedule:	Available (100%)	
Vav Airflow:	Min: 0.40 cfm/sq ft	Max: 100.00 % Clg Airflow
Vav Sched:	Available (100%)	
Supply:	150.00 To be calculated	150.00 To be calculated
Aux Supply:	To be calculated	To be calculated
Room Exhaust:		
Rm Exh Sched:	Available (100%)	

Description	Area/ Amount	Dir	Tilt	Const Type / Schedule	U Value Btu/h·ft²·°F	Alpha	Glass Type / Energy Type	Glass Area ft²	Glass Shade Coef	Glass U Value Btu/h·ft²·°F	Glass External Shading	Glass Internal Shading	Adj Temp/ Grnd Refl	Pct Sen/ Cool Tmp	Pct Rm/ Heat Tmp	Pct Ret/ Perm Len	Rad Frc/ Loss Coef
Roof - 1	98 ft²	0	90	Wyoming Existing	0.0783	0.90		0			Overhang - None	None					
Misc Load 1	155.000 W			Misc - Elementary School			Electricity							100	100	0	60.00

Room Description: 328B - CORRIDOR **Zone Description: FC3-14** **System Description: Unassigned**

GENERAL INFORMATION

Floor Area: 475 ft² Flr-Flr Height: 14.1 ft
Plenum Height: 1.1 ft Height Above Flr:
Slab Cnstr Type: 8* LW Concrete
Room Mass: Time delay based on actual mass
Ceiling R-Value: 1.786 hr·ft²·°F/Btu
Is There Carpet?: YES
Design Clg DB / Drift Point: 75.0 °F / 81.0 °F
Design Htg DB / Drift Point: 72.0 °F / 66.0 °F
Design Relative Humidity: 50 %
Moisture Capacitance: Medium
Clg Tstat: None
Htg Tstat: None

Thermostat Location: Zone Floor Multiplier: 1
Humidistat Location: Room Room Multiplier: 1
CO2 Sensor Location: None
Room Type: Conditioned

PEOPLE

People Type: None
# of People: 0 sq ft/person
People Sensible: 250 Btu/h
People Latent : 250 Btu/h
People Schedule: People - Elem Classroom non-summer

Workstation: 1.0 workstation/person

LIGHTS

Lighting Type: Recessed fluorescent, not vented, 80% load to space
Fixture Type: RECFL-NV
% Load to RA: 20 %
Lighting Schedule: Lights - Elem Classroom non-summer
Lighting Amount: 0.5 W/sq ft
Ballast Factor: 1.0

AIRFLOW INFORMATION

	Cooling	Heating
Vent Type:	None	None
Vent Value:	38.00 cfm	38.00 cfm
Vent Schedule:	Wyoming FC MUA	
Infil Type:	HEAPY	HEAPY
Infil Value:	0.00 air changes/hr	0.08 cfm/sq ft of wall
Infil Schedule:	Available (100%)	
Vav Airflow:	Min: 0.40 cfm/sq ft	Max: 100.00 % Clg Airflow
Vav Sched:	Available (100%)	
Supply:	100.00 To be calculated	175.00 % Htg Airflow
Aux Supply:	To be calculated	To be calculated
Room Exhaust:		
Rm Exh Sched:	Available (100%)	

Description	Area/ Amount	Dir	Tilt	Const Type / Schedule	U Value Btu/h·ft²·°F	Alpha	Glass Type / Energy Type	Glass Area ft²	Glass Shade Coef	Glass U Value Btu/h·ft²·°F	Glass External Shading	Glass Internal Shading	Adj Temp/ Grnd Refl	Pct Sen/ Cool Tmp	Pct Rm/ Heat Tmp	Pct Ret/ Perm Len	Rad Frc/ Loss Coef
Roof - 1	475 ft²	0	90	Wyoming Existing	0.0783	0.90		0			Overhang - None	None					
Partition - 1	300 ft²			0.75* Gyp Frame	0.3880								Adjacent Room: 326 - CLASSROOM				
Partition - 2	300 ft²			0.75* Gyp Frame	0.3880								Adjacent Room: 327 - CLASSROOM				
Partition - 3	200 ft²			0.75* Gyp Frame	0.3880								Adjacent Room: 328A - CORRIDOR				

ENTERED VALUES

ROOM BY ROOM

By Heapy Engineering

Room Description: 329 - OFFICE **Zone Description: FC3-15** **System Description: Unassigned**

GENERAL INFORMATION

Floor Area:	100 ft²	Flr-Flr Height:	14.1 ft
Plenum Height:	1.1 ft	Height Above Flr:	
Slab Cnstr Type:	8* LW Concrete		
Room Mass:	Time delay based on actual mass		
Ceiling R-Value:	1.786 hr·ft²·°F/Btu		
Is There Carpet?:	YES		
Design Clg DB / Drift Point:	75.0 °F / 81.0 °F		
Design Htg DB / Drift Point:	72.0 °F / 66.0 °F		
Design Relative Humidity:	50 %		
Moisture Capacitance:	Medium		
Clg Tstat:	None		
Htg Tstat:	None		
Thermostat Location:	Zone	Floor Multiplier:	1
Humidistat Location:	Room	Room Multiplier:	1
CO2 Sensor Location:	None		
Room Type:	Conditioned		

PEOPLE

People Type:	General Office Space
# of People:	143 sq ft/person
People Sensible:	250 Btu/h
People Latent :	200 Btu/h
People Schedule:	People - Elem Classroom non-summer
Workstation:	1.0 workstation/person

LIGHTS

Lighting Type:	Recessed fluorescent, not vented, 80% load to space
Fixture Type:	RECFL-NV
% Load to RA:	20 %
Lighting Schedule:	Lights - Elem Classroom non-summer
Lighting Amount:	1.1 W/sq ft
Ballast Factor:	1.0

AIRFLOW INFORMATION

	Cooling	Heating
Vent Type:	None	None
Vent Value:	15.00 cfm	15.00 cfm
Vent Schedule:	Wyoming FC MUA	
Infil Type:	HEAPY	HEAPY
Infil Value:	0.00 air changes/hr	0.08 cfm/sq ft of wall
Infil Schedule:	Available (100%)	
Vav Airflow:	Min: 0.40 cfm/sq ft	Max: 100.00 % Clg Airflow
Vav Sched:	Available (100%)	
Supply:	265.00 To be calculated	210.00 % Htg Airflow
Aux Supply:	To be calculated	To be calculated
Room Exhaust:		
Rm Exh Sched:	Available (100%)	

Description	Area/ Amount	Dir	Tilt	Const Type / Schedule	U Value Btu/h·ft²·°F	Alpha	Glass Type / Energy Type	Glass Area ft²	Glass Shade Coef	Glass U Value Btu/h·ft²·°F	Glass External Shading	Glass Internal Shading	Adj Temp/ Grnd Refl	Pct Sen/ Cool Tmp	Pct Rm/ Heat Tmp	Pct Ret/ Perm Len	Rad Frc/ Loss Coef
Roof - 1	100 ft²	0	90	Wyoming Existing	0.0783	0.90		0			Overhang - None	None					
W	156 ft²	270	0	Wyoming Existing	0.1059	0.90											
Opening - 1				Window			90.1-07 4a Window	43	0.46	0.55	Overhang - None	None	0.00				
Misc Load 1	300.000 W			Misc - Elementary School			Electricity							100	100	0	60.00
Partition - 1	100 ft²			0.75* Gyp Frame	0.3880								Adjacent Room: 330 - STORAGE				
Partition - 2	100 ft²			0.75* Gyp Frame	0.3880								Adjacent Room: 333 - EXTENDED LE				

ENTERED VALUES

ROOM BY ROOM

By Heapy Engineering

Room Description: 330 - STORAGE **Zone Description: FC3-15** **System Description: Unassigned**

GENERAL INFORMATION

Floor Area: 92 ft² Flr-Flr Height: 14.1 ft
Plenum Height: 1.1 ft Height Above Flr:
Slab Cnstr Type: 8* LW Concrete
Room Mass: Time delay based on actual mass
Ceiling R-Value: 1.786 hr·ft²·°F/Btu
Is There Carpet?: YES
Design Clg DB / Drift Point: 75.0 °F / 81.0 °F
Design Htg DB / Drift Point: 72.0 °F / 66.0 °F
Design Relative Humidity: 50 %
Moisture Capacitance: Medium
Clg Tstat: None
Htg Tstat: None

Thermostat Location: Zone Floor Multiplier: 1
Humidistat Location: Room Room Multiplier: 1
CO2 Sensor Location: None
Room Type: Conditioned

PEOPLE

People Type: None
# of People: 0 sq ft/person
People Sensible: 250 Btu/h
People Latent : 250 Btu/h
People Schedule: People - Elem Classroom non-summer

Workstation: 1.0 workstation/person

LIGHTS

Lighting Type: Recessed fluorescent, not vented, 80% load to space
Fixture Type: RECFL-NV
% Load to RA: 20 %
Lighting Schedule: Lights - Elem Classroom non-summer
Lighting Amount: 0.8 W/sq ft
Ballast Factor: 1.0

AIRFLOW INFORMATION

	Cooling	Heating
Vent Type:	None	None
Vent Value:	0.00 cfm	0.00 cfm
Vent Schedule:	Wyoming FC MUA	
Infil Type:	HEAPY	HEAPY
Infil Value:	0.00 air changes/hr	0.08 cfm/sq ft of wall
Infil Schedule:	Available (100%)	
Vav Airflow:	Min: 0.40 cfm/sq ft	Max: 100.00 % Clg Airflow
Vav Sched:	Available (100%)	
Supply:	20.00 To be calculated	20.00 To be calculated
Aux Supply:	To be calculated	To be calculated
Room Exhaust:		
Rm Exh Sched:	Available (100%)	

Description	Area/ Amount	Dir	Tilt	Const Type / Schedule	U Value Btu/h·ft²·°F	Alpha	Glass: Type / Energy Type	Glass: Area ft²	Glass: Shade Coef	Glass: U Value Btu/h·ft²·°F	Glass: External Shading	Glass: Internal Shading	Adj Temp/ Grnd Refl	Pct Sen/ Cool Tmp	Pct Rm/ Heat Tmp	Pct Ret/ Perm Len	Rad Frc/ Loss Coef
Roof - 1	92 ft²	0	90	Wyoming Existing	0.0783	0.90		0			Overhang - None	None					
Partition - 1	100 ft²			0.75* Gyp Frame	0.3880								Adjacent Room: 331 - PREP				
Partition - 2	100 ft²			0.75* Gyp Frame	0.3880								Adjacent Room: 333 - EXTENDED LE				

Room Description: 331 - PREP **Zone Description: FC3-15** **System Description: Unassigned**

GENERAL INFORMATION

Floor Area: 115 ft² Flr-Flr Height: 14.1 ft
Plenum Height: 1.1 ft Height Above Flr:
Slab Cnstr Type: 8* LW Concrete
Room Mass: Time delay based on actual mass
Ceiling R-Value: 1.786 hr·ft²·°F/Btu
Is There Carpet?: YES
Design Clg DB / Drift Point: 75.0 °F / 81.0 °F
Design Htg DB / Drift Point: 72.0 °F / 66.0 °F
Design Relative Humidity: 50 %
Moisture Capacitance: Medium
Clg Tstat: None
Htg Tstat: None

Thermostat Location: Zone Floor Multiplier: 1
Humidistat Location: Room Room Multiplier: 1
CO2 Sensor Location: None
Room Type: Conditioned

PEOPLE

People Type: None
# of People: 0 sq ft/person
People Sensible: 250 Btu/h
People Latent : 250 Btu/h
People Schedule: People - Elem Classroom non-summer

Workstation: 1.0 workstation/person

LIGHTS

Lighting Type: Recessed fluorescent, not vented, 80% load to space
Fixture Type: RECFL-NV
% Load to RA: 20 %
Lighting Schedule: Lights - Elem Classroom non-summer
Lighting Amount: 1.4 W/sq ft
Ballast Factor: 1.0

AIRFLOW INFORMATION

	Cooling	Heating
Vent Type:	None	None
Vent Value:	16.00 cfm	16.00 cfm
Vent Schedule:	Wyoming FC MUA	
Infil Type:	HEAPY	HEAPY
Infil Value:	0.00 air changes/hr	0.08 cfm/sq ft of wall
Infil Schedule:	Available (100%)	
Vav Airflow:	Min: 0.40 cfm/sq ft	Max: 100.00 % Clg Airflow
Vav Sched:	Available (100%)	
Supply:	25.00 To be calculated	25.00 To be calculated
Aux Supply:	To be calculated	To be calculated
Room Exhaust:		
Rm Exh Sched:	Available (100%)	

Description	Area/ Amount	Dir	Tilt	Const Type / Schedule	U Value Btu/h·ft²·°F	Alpha	Glass: Type / Energy Type	Glass: Area ft²	Glass: Shade Coef	Glass: U Value Btu/h·ft²·°F	Glass: External Shading	Glass: Internal Shading	Adj Temp/ Grnd Refl	Pct Sen/ Cool Tmp	Pct Rm/ Heat Tmp	Pct Ret/ Perm Len	Rad Frc/ Loss Coef
Roof - 1	115 ft²	0	90	Wyoming Existing	0.0783	0.90		0			Overhang - None	None					
Partition - 1	150 ft²			0.75* Gyp Frame	0.3880								Adjacent Room: 327 - CLASSROOM				
Partition - 2	150 ft²			0.75* Gyp Frame	0.3880								Adjacent Room: 333 - EXTENDED LE				

ENTERED VALUES

ROOM BY ROOM

By Heapy Engineering

Room Description: 332 - JAN CL | **Zone Description: FC3-15** | **System Description: Unassigned**

GENERAL INFORMATION

Floor Area:	21 ft²	Flr-Flr Height:	14.1 ft
Plenum Height:	1.1 ft	Height Above Flr:	
Slab Cnstr Type:	8* LW Concrete		
Room Mass:	Time delay based on actual mass		
Ceiling R-Value:	1.786 hr·ft²·°F/Btu		
Is There Carpet?:	YES		
Design Clg DB / Drift Point:	75.0 °F / 81.0 °F		
Design Htg DB / Drift Point:	72.0 °F / 66.0 °F		
Design Relative Humidity:	50 %		
Moisture Capacitance:	Medium		
Clg Tstat:	None		
Htg Tstat:	None		
Thermostat Location:	Zone	Floor Multiplier:	1
Humidistat Location:	Room	Room Multiplier:	1
CO2 Sensor Location:	None		
Room Type:	Conditioned		

PEOPLE

People Type:	None
# of People:	0 sq ft/person
People Sensible:	250 Btu/h
People Latent :	250 Btu/h
People Schedule:	People - Elem Classroom non-summer
Workstation:	1.0 workstation/person

LIGHTS

Lighting Type:	Recessed fluorescent, not vented, 80% load to space
Fixture Type:	RECFL-NV
% Load to RA:	20 %
Lighting Schedule:	Lights - Elem Classroom non-summer
Lighting Amount:	0.9 W/sq ft
Ballast Factor:	1.0

AIRFLOW INFORMATION

	Cooling	Heating
Vent Type:	None	None
Vent Value:	0.00 cfm	0.00 cfm
Vent Schedule:	Wyoming FC MUA	
Infil Type:	HEAPY	HEAPY
Infil Value:	0.00 air changes/hr	0.08 cfm/sq ft of wall
Infil Schedule:	Available (100%)	
Vav Airflow:	Min: 0.40 cfm/sq ft	Max: 100.00 % Clg Airflow
Vav Sched:	Available (100%)	
Supply:	5.00 To be calculated	5.00 To be calculated
Aux Supply:	To be calculated	To be calculated
Room Exhaust:	25.00 cfm	
Rm Exh Sched:	Wyoming General	

Description	Area/ Amount	Dir	Tilt	Const Type / Schedule	U Value Btu/h·ft²·°F	Alpha	Glass: Type / Energy Type	Glass: Area ft²	Glass: Shade Coef	Glass: U Value Btu/h·ft²·°F	Glass: External Shading	Glass: Internal Shading	Adj Temp/ Grnd Refl	Pct Sen/ Cool Tmp	Pct Rm/ Heat Tmp	Pct Ret/ Perm Len	Rad Frc/ Loss Coef
Roof - 1	21 ft²	0	90	Wyoming Existing	0.0783	0.90		0			Overhang - None	None					

Room Description: 325 - SMALL GROUP ROOM | **Zone Description: FC3-16** | **System Description: Unassigned**

GENERAL INFORMATION

Floor Area:	100 ft²	Flr-Flr Height:	14.1 ft
Plenum Height:	1.1 ft	Height Above Flr:	
Slab Cnstr Type:	8* LW Concrete		
Room Mass:	Time delay based on actual mass		
Ceiling R-Value:	1.786 hr·ft²·°F/Btu		
Is There Carpet?:	YES		
Design Clg DB / Drift Point:	75.0 °F / 81.0 °F		
Design Htg DB / Drift Point:	72.0 °F / 66.0 °F		
Design Relative Humidity:	50 %		
Moisture Capacitance:	Medium		
Clg Tstat:	None		
Htg Tstat:	None		
Thermostat Location:	Zone	Floor Multiplier:	1
Humidistat Location:	Room	Room Multiplier:	1
CO2 Sensor Location:	None		
Room Type:	Conditioned		

PEOPLE

People Type:	Conference Room
# of People:	4 People
People Sensible:	245 Btu/h
People Latent :	155 Btu/h
People Schedule:	People - Elem Classroom non-summer
Workstation:	1.0 workstation/person

LIGHTS

Lighting Type:	Recessed fluorescent, not vented, 80% load to space
Fixture Type:	RECFL-NV
% Load to RA:	20 %
Lighting Schedule:	Lights - Elem Classroom non-summer
Lighting Amount:	1.4 W/sq ft
Ballast Factor:	1.0

AIRFLOW INFORMATION

	Cooling	Heating
Vent Type:	None	None
Vent Value:	15.00 cfm	15.00 cfm
Vent Schedule:	Wyoming FC MUA	
Infil Type:	HEAPY	HEAPY
Infil Value:	0.00 air changes/hr	0.08 cfm/sq ft of wall
Infil Schedule:	Available (100%)	
Vav Airflow:	Min: 0.40 cfm/sq ft	Max: 100.00 % Clg Airflow
Vav Sched:	Available (100%)	
Supply:	150.00 To be calculated	150.00 To be calculated
Aux Supply:	To be calculated	To be calculated
Room Exhaust:		
Rm Exh Sched:	Available (100%)	

Description	Area/ Amount	Dir	Tilt	Const Type / Schedule	U Value Btu/h·ft²·°F	Alpha	Glass: Type / Energy Type	Glass: Area ft²	Glass: Shade Coef	Glass: U Value Btu/h·ft²·°F	Glass: External Shading	Glass: Internal Shading	Adj Temp/ Grnd Refl	Pct Sen/ Cool Tmp	Pct Rm/ Heat Tmp	Pct Ret/ Perm Len	Rad Frc/ Loss Coef
Roof - 1	100 ft²	0	90	Wyoming Existing	0.0783	0.90		0			Overhang - None	None					
Misc Load 1	155.000 W			Misc - Elementary School			Electricity							100	100	0	60.00

ENTERED VALUES

ROOM BY ROOM

By Heapy Engineering

Room Description: 328A - CORRIDOR **Zone Description: FC3-16** **System Description: Unassigned**

GENERAL INFORMATION

Floor Area:	475 ft²	Flr-Flr Height:	14.1 ft
Plenum Height:	1.1 ft	Height Above Flr:	
Slab Cnstr Type:	8* LW Concrete		
Room Mass:	Time delay based on actual mass		
Ceiling R-Value:	1.786 hr·ft²·°F/Btu		
Is There Carpet?:	YES		
Design Clg DB / Drift Point:	75.0 °F / 81.0 °F		
Design Htg DB / Drift Point:	72.0 °F / 66.0 °F		
Design Relative Humidity:	50 %		
Moisture Capacitance:	Medium		
Clg Tstat:	None		
Htg Tstat:	None		
Thermostat Location:	Zone	Floor Multiplier:	1
Humidistat Location:	Room	Room Multiplier:	1
CO2 Sensor Location:	None		
Room Type:	Conditioned		

PEOPLE

People Type:	None
# of People:	0 sq ft/person
People Sensible:	250 Btu/h
People Latent :	250 Btu/h
People Schedule:	People - Elem Classroom non-summer
Workstation:	1.0 workstation/person

LIGHTS

Lighting Type:	Recessed fluorescent, not vented, 80% load to space
Fixture Type:	RECFL-NV
% Load to RA:	20 %
Lighting Schedule:	Lights - Elem Classroom non-summer
Lighting Amount:	0.5 W/sq ft
Ballast Factor:	1.0

AIRFLOW INFORMATION

	Cooling	Heating
Vent Type:	None	None
Vent Value:	38.00 cfm	38.00 cfm
Vent Schedule:	Wyoming FC MUA	
Infil Type:	HEAPY	HEAPY
Infil Value:	0.00 air changes/hr	0.08 cfm/sq ft of wall
Infil Schedule:	Available (100%)	
Vav Airflow:	Min: 0.40 cfm/sq ft	Max: 100.00 % Clg Airflow
Vav Sched:	Available (100%)	
Supply:	100.00 To be calculated	175.00 % Htg Airflow
Aux Supply:	To be calculated	To be calculated
Room Exhaust:		
Rm Exh Sched:	Available (100%)	

Description	Area/ Amount	Dir	Tilt	Const Type / Schedule	U Value Btu/h·ft²·°F	Alpha	Glass: Type / Energy Type	Glass: Area ft²	Glass: Shade Coef	Glass: U Value Btu/h·ft²·°F	Glass: External Shading	Glass: Internal Shading	Adj Temp/ Grnd Refl	Pct Sen/ Cool Tmp	Pct Rm/ Heat Tmp	Pct Ret/ Perm Len	Rad Frc/ Loss Coef
Roof - 1	475 ft²	0	90	Wyoming Existing	0.0783	0.90		0			Overhang - None	None					
Partition - 1	300 ft²			0.75* Gyp Frame	0.3880								Adjacent Room: 322 - CLASSROOM				
Partition - 2	300 ft²			0.75* Gyp Frame	0.3880								Adjacent Room: 324 - CLASSROOM				
Partition - 3	300 ft²			0.75* Gyp Frame	0.3880								Adjacent Room: 344 - EXTENDED LE				

System Checksums

By Heapy Engineering

AHU-1 — **Variable Volume Reheat (30% Min Flow Default)**

COOLING COIL PEAK

Peaked at Time: Mo/Hr: 8 / 14
Outside Air: OADB/WB/HR: 89 / 74 / 104

	Space Sens. + Lat. Btu/h	Plenum Sens. + Lat Btu/h	Net Total Btu/h	Percent Of Total (%)
Envelope Loads				
Skylite Solar	0	0	0	0
Skylite Cond	0	0	0	0
Roof Cond	0	19,663	19,663	2
Glass Solar	52,755	0	52,755	5
Glass/Door Cond	7,266	0	7,266	1
Wall Cond	2,823	279	3,102	0
Partition/Door	8,757		8,757	1
Floor	0		0	0
Adjacent Floor	0	0	0	0
Infiltration	0		0	0
Sub Total ==>	71,601	19,942	91,543	9
Internal Loads				
Lights	84,685	20,674	105,359	10
People	316,535	0	316,535	30
Misc	39,011	0	39,011	4
Sub Total ==>	440,232	20,674	460,905	44
Ceiling Load	12,460	-12,460	0	0
Ventilation Load	0	0	359,819	34
Adj Air Trans Heat	240		240	0
Dehumid. Ov Sizing			0	0
Ov/Undr Sizing	147,004		147,004	14
Exhaust Heat		-13,573	-13,573	-1
Sup. Fan Heat			0	0
Ret. Fan Heat		0	0	0
Duct Heat Pkup		0	0	0
Underflr Sup Ht Pkup			0	0
Supply Air Leakage		0	0	0
Grand Total ==>	671,538	14,582	1,045,938	100.00

CLG SPACE PEAK

Mo/Hr: 10 / 14
OADB: 73

	Space Sensible Btu/h	Percent Of Total (%)
Envelope Loads		
Skylite Solar	0	0
Skylite Cond	0	0
Roof Cond	0	0
Glass Solar	81,215	16
Glass/Door Cond	-2,170	0
Wall Cond	-3,394	-1
Partition/Door	8,757	2
Floor	0	0
Adjacent Floor	0	0
Infiltration	0	0
Sub Total ==>	84,408	16
Internal Loads		
Lights	84,685	16
People	155,164	30
Misc	39,011	7
Sub Total ==>	278,860	54
Ceiling Load	6,294	1
Ventilation Load	0	0
Adj Air Trans Heat	240	0
Ov/Undr Sizing	151,140	29
Grand Total ==>	520,943	100.00

HEATING COIL PEAK

Mo/Hr: Heating Design
OADB: 5

	Space Peak Space Sens Btu/h	Coil Peak Tot Sens Btu/h	Percent Of Total (%)
Envelope Loads			
Skylite Solar	0	0	0.00
Skylite Cond	0	0	0.00
Roof Cond	0	-46,989	4.84
Glass Solar	0	0	0.00
Glass/Door Cond	-38,978	-38,978	4.02
Wall Cond	-27,184	-30,149	3.11
Partition/Door	-8,757	-8,757	0.90
Floor	-11,718	-11,718	1.21
Adjacent Floor	0	0	0
Infiltration	-56,147	-56,147	5.79
Sub Total ==>	-142,785	-192,739	19.86
Internal Loads			
Lights	0	0	0.00
People	0	0	0.00
Misc	2,560	2,560	-0.26
Sub Total ==>	2,560	2,560	-0.26
Ceiling Load	-16,022	0	0.00
Ventilation Load	0	-601,480	61.98
Adj Air Trans Heat	-325	-325	0
Ov/Undr Sizing	11,741	11,741	-1.21
Exhaust Heat		16,553	-1.71
OA Preheat Diff.		0	0.00
RA Preheat Diff.		-158,571	16.34
Additional Reheat		-48,199	4.97
Underflr Sup Ht Pkup		0	0.00
Supply Air Leakage		0	0.00
Grand Total ==>	-144,831	-970,461	100.00

TEMPERATURES

	Cooling	Heating
SADB	53.0	78.5
Ra Plenum	76.8	70.0
Return	76.8	70.0
Ret/OA	81.7	42.2
Fn MtrTD	0.0	0.0
Fn BldTD	0.0	0.0
Fn Frict	0.0	0.0

AIRFLOWS

	Cooling	Heating
Diffuser	21,630	19,372
Terminal	21,630	19,372
Main Fan	21,630	19,372
Sec Fan	0	0
Nom Vent	8,290	8,290
AHU Vent	8,290	8,290
Infil	0	781
MinStop/Rh	19,372	19,372
Return	20,399	18,792
Exhaust	7,059	7,710
Rm Exh	1,231	1,361
Auxiliary	0	0
Leakage Dwn	0	0
Leakage Ups	0	0

ENGINEERING CKS

	Cooling	Heating
% OA	38.3	42.8
cfm/ft²	0.71	0.64
cfm/ton	223.76	
ft²/ton	313.71	
Btu/hr·ft²	38.25	-45.18
No. People	645	

COOLING COIL SELECTION

	Total Capacity ton	Total Capacity MBh	Sens Cap. MBh	Coil Airflow cfm	Enter DB °F	Enter WB °F	Enter HR gr/lb	Leave DB °F	Leave WB °F	Leave HR gr/lb
Main Clg	96.7	1,160.0	724.3	21,182	81.7	67.1	79.5	53.0	48.5	45.1
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Total	96.7	1,160.0								

AREAS

	Gross Total	Glass ft²	Glass (%)
Floor	30,325		
Part	2,500		
Int Door	0		
ExFlr	330		
Roof	17,940	0	0
Wall	9,103	1,644	18
Ext Door	268	0	0

HEATING COIL SELECTION

	Capacity MBh	Coil Airflow cfm	Ent °F	Lvg °F
Main Htg	-1,370.0	19,372	53.0	79.2
Aux Htg	0.0	0	0.0	0.0
Preheat	0.0	8,290	5.0	53.0
Reheat	-845.0	19,372	53.0	71.9
Humidif	0.0	0	0.0	0.0
Opt Vent	0.0	0	0.0	0.0
Total	-1,370.0			

System Checksums

By Heapy Engineering

AHU-2 — **Variable Volume Reheat (30% Min Flow Default)**

COOLING COIL PEAK

Peaked at Time: Mo/Hr: 8 / 15
Outside Air: OADB/WB/HR: 90 / 74 / 104

	Space Sens. + Lat. Btu/h	Plenum Sens. + Lat Btu/h	Net Total Btu/h	Percent Of Total (%)
Envelope Loads				
Skylite Solar	0	0	0	0
Skylite Cond	0	0	0	0
Roof Cond	2,831	0	2,831	0
Glass Solar	0	0	0	0
Glass/Door Cond	0	0	0	0
Wall Cond	4,284	0	4,284	1
Partition/Door	0		0	0
Floor	0		0	0
Adjacent Floor	0	0	0	0
Infiltration	0		0	0
Sub Total ==>	7,115	0	7,115	1
Internal Loads				
Lights	4,703	0	4,703	1
People	447,134	0	447,134	74
Misc	980	0	980	0
Sub Total ==>	452,817	0	452,817	75
Ceiling Load	0	0	0	0
Ventilation Load	0	0	141,190	23
Adj Air Trans Heat	0		0	0
Dehumid. Ov Sizing			0	0
Ov/Undr Sizing	0		0	0
Exhaust Heat		0	0	0
Sup. Fan Heat			0	0
Ret. Fan Heat		0	0	0
Duct Heat Pkup		0	0	0
Underflr Sup Ht Pkup			0	0
Supply Air Leakage		0	0	0
Grand Total ==>	459,933	0	601,123	100.00

CLG SPACE PEAK

Mo/Hr: 8 / 22
OADB: 74

	Space Sensible Btu/h	Percent Of Total (%)
Envelope Loads		
Skylite Solar	0	0
Skylite Cond	0	0
Roof Cond	4,704	2
Glass Solar	0	0
Glass/Door Cond	0	0
Wall Cond	9,208	4
Partition/Door	0	0
Floor	0	0
Adjacent Floor	0	0
Infiltration	0	0
Sub Total ==>	13,912	6
Internal Loads		
Lights	4,703	2
People	211,755	92
Misc	44	0
Sub Total ==>	216,502	94
Ceiling Load	0	0
Ventilation Load	0	0
Adj Air Trans Heat	0	0
Ov/Undr Sizing	0	0
Exhaust Heat		
OA Preheat Diff.		
RA Preheat Diff.		
Additional Reheat		
Underflr Sup Ht Pkup		
Supply Air Leakage		
Grand Total ==>	230,414	100.00

HEATING COIL PEAK

Mo/Hr: Heating Design
OADB: 5

	Space Peak Space Sens Btu/h	Coil Peak Tot Sens Btu/h	Percent Of Total (%)
Envelope Loads			
Skylite Solar	0	0	0.00
Skylite Cond	0	0	0.00
Roof Cond	-6,754	-6,754	1.12
Glass Solar	0	0	0.00
Glass/Door Cond	0	0	0.00
Wall Cond	-28,515	-28,515	4.72
Partition/Door	0	0	0.00
Floor	-8,238	-8,238	1.36
Adjacent Floor	0	0	0
Infiltration	-42,080	-42,080	6.96
Sub Total ==>	-85,588	-85,588	14.15
Internal Loads			
Lights	0	0	0.00
People	0	0	0.00
Misc	0	0	0.00
Sub Total ==>	0	0	0.00
Ceiling Load	0	0	0.00
Ventilation Load	0	-437,506	72.34
Adj Air Trans Heat	0	0	0
Ov/Undr Sizing	0	0	0.00
Exhaust Heat		0	0.00
OA Preheat Diff.		0	0.00
RA Preheat Diff.		-81,684	13.51
Additional Reheat		0	0.00
Underflr Sup Ht Pkup		0	0.00
Supply Air Leakage		0	0.00
Grand Total ==>	-85,588	-604,778	100.00

TEMPERATURES

	Cooling	Heating
SADB	53.0	79.9
Ra Plenum	75.0	72.0
Return	75.0	72.0
Ret/OA	84.6	31.6
Fn MtrTD	0.0	0.0
Fn BldTD	0.0	0.0
Fn Frict	0.0	0.0

AIRFLOWS

	Cooling	Heating
Diffuser	9,672	10,000
Terminal	9,672	10,000
Main Fan	9,672	10,000
Sec Fan	0	0
Nom Vent	6,030	6,030
AHU Vent	6,030	6,030
Infil	0	580
MinStop/Rh	6,030	10,000
Return	9,672	10,580
Exhaust	6,030	6,610
Rm Exh	0	0
Auxiliary	0	0
Leakage Dwn	0	0
Leakage Ups	0	0

ENGINEERING CKS

	Cooling	Heating
% OA	62.3	60.3
cfm/ft²	1.10	1.14
cfm/ton	207.99	
ft²/ton	189.25	
Btu/hr·ft²	63.41	-78.07
No. People	553	

COOLING COIL SELECTION

	Total Capacity ton	Total Capacity MBh	Sens Cap. MBh	Coil Airflow cfm	Enter DB °F	Enter WB °F	Enter HR gr/lb	Leave DB °F	Leave WB °F	Leave HR gr/lb
Main Clg	46.5	558.0	299.4	9,426	84.6	71.8	100.3	53.0	53.0	61.6
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Total	46.5	558.0								

AREAS

	Gross Total	Glass ft²	Glass (%)
Floor	8,800		
Part	0		
Int Door	0		
ExFlr	232		
Roof	2,500	0	0
Wall	6,960	0	0
Ext Door	0	0	0

HEATING COIL SELECTION

	Capacity MBh	Coil Airflow cfm	Ent °F	Lvg °F
Main Htg	-260.0	9,672	53.0	79.9
Aux Htg	0.0	0	0.0	0.0
Preheat	-427.0	6,030	5.0	53.0
Reheat	-260.0	10,000	53.0	72.0
Humidif	0.0	0	0.0	0.0
Opt Vent	0.0	0	0.0	0.0
Total	-687.0			

System Checksums

By Heapy Engineering

AHU-3 — **Variable Volume Reheat (30% Min Flow Default)**

COOLING COIL PEAK

Peaked at Time: Mo/Hr: 7 / 14
Outside Air: OADB/WB/HR: 86 / 74 / 110

	Space Sens. + Lat. Btu/h	Plenum Sens. + Lat Btu/h	Net Total Btu/h	Percent Of Total (%)
Envelope Loads				
Skylite Solar	0	0	0	0
Skylite Cond	0	0	0	0
Roof Cond	0	5,611	5,611	2
Glass Solar	8,224	0	8,224	3
Glass/Door Cond	1,312	0	1,312	1
Wall Cond	709	188	897	0
Partition/Door	466		466	0
Floor	0		0	0
Adjacent Floor	0	0	0	0
Infiltration	0		0	0
Sub Total ==>	10,710	5,799	16,509	6
Internal Loads				
Lights	2,719	680	3,399	1
People	112,750	0	112,750	43
Misc	17,362	0	17,362	7
Sub Total ==>	132,832	680	133,511	51
Ceiling Load	1,294	-1,294	0	0
Ventilation Load	0	0	102,641	39
Adj Air Trans Heat	0		0	0
Dehumid. Ov Sizing			0	0
Ov/Undr Sizing	12,254		12,254	5
Exhaust Heat		-2,611	-2,611	-1
Sup. Fan Heat			0	0
Ret. Fan Heat		0	0	0
Duct Heat Pkup		0	0	0
Underflr Sup Ht Pkup			0	0
Supply Air Leakage		0	0	0
Grand Total ==>	157,090	2,573	262,304	100.00

CLG SPACE PEAK

Mo/Hr: 7 / 10
OADB: 76

	Space Sensible Btu/h	Percent Of Total (%)
Envelope Loads		
Skylite Solar	0	0
Skylite Cond	0	0
Roof Cond	0	0
Glass Solar	18,444	14
Glass/Door Cond	-124	0
Wall Cond	740	1
Partition/Door	466	0
Floor	0	0
Adjacent Floor	0	0
Infiltration	0	0
Sub Total ==>	19,525	15
Internal Loads		
Lights	2,719	2
People	74,375	57
Misc	20,669	16
Sub Total ==>	97,764	75
Ceiling Load	113	0
Ventilation Load	0	0
Adj Air Trans Heat	0	0
Ov/Undr Sizing	12,594	10
Grand Total ==>	129,996	100.00

HEATING COIL PEAK

Mo/Hr: Heating Design
OADB: 5

	Space Peak Space Sens Btu/h	Coil Peak Tot Sens Btu/h	Percent Of Total (%)
Envelope Loads			
Skylite Solar	0	0	0.00
Skylite Cond	0	0	0.00
Roof Cond	0	-11,289	3.34
Glass Solar	0	0	0.00
Glass/Door Cond	-9,030	-9,030	2.67
Wall Cond	-3,913	-5,020	1.49
Partition/Door	-466	-466	0.14
Floor	0	0	0.00
Adjacent Floor	0	0	0
Infiltration	-9,976	-9,976	2.95
Sub Total ==>	-23,385	-35,781	10.59
Internal Loads			
Lights	0	0	0.00
People	0	0	0.00
Misc	0	0	0.00
Sub Total ==>	0	0	0.00
Ceiling Load	-1,561	0	0.00
Ventilation Load	0	-182,113	53.88
Adj Air Trans Heat	0	0	0
Ov/Undr Sizing	-7,672	-7,672	2.27
Exhaust Heat		3,321	-0.98
OA Preheat Diff.		0	0.00
RA Preheat Diff.		-115,732	34.24
Additional Reheat		0	0.00
Underflr Sup Ht Pkup		0	0.00
Supply Air Leakage		0	0.00
Grand Total ==>	-32,618	-337,976	100.00

TEMPERATURES

	Cooling	Heating
SADB	53.0	75.5
Ra Plenum	76.0	70.8
Return	76.0	70.8
Ret/OA	81.0	51.4
Fn MtrTD	0.0	0.0
Fn BldTD	0.0	0.0
Fn Frict	0.0	0.0

AIRFLOWS

	Cooling	Heating
Diffuser	5,457	8,500
Terminal	5,457	8,500
Main Fan	5,457	8,500
Sec Fan	0	0
Nom Vent	2,510	2,510
AHU Vent	2,510	2,510
Infil	0	137
MinStop/Rh	2,927	8,500
Return	5,457	8,638
Exhaust	2,510	2,648
Rm Exh	0	0
Auxiliary	0	0
Leakage Dwn	0	0
Leakage Ups	0	0

ENGINEERING CKS

	Cooling	Heating
% OA	46.0	29.5
cfm/ft²	1.28	2.00
cfm/ton	186.02	
ft²/ton	144.95	
Btu/hr·ft²	82.78	-76.90
No. People	325	

COOLING COIL SELECTION

	Total Capacity ton	Total Capacity MBh	Sens Cap. MBh	Coil Airflow cfm	Enter DB °F	Enter WB °F	Enter HR gr/lb	Leave DB °F	Leave WB °F	Leave HR gr/lb
Main Clg	29.3	352.0	203.0	4,983	81.0	68.7	88.8	53.0	44.2	30.3
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Total	29.3	352.0								

AREAS

	Gross Total	Glass ft²	Glass (%)
Floor	4,252		
Part	200		
Int Door	0		
ExFlr	0		
Roof	4,252	0	0
Wall	1,650	420	25
Ext Door	0	0	0

HEATING COIL SELECTION

	Capacity MBh	Coil Airflow cfm	Ent °F	Lvg °F
Main Htg	-147.0	5,457	53.0	75.5
Aux Htg	0.0	0	0.0	0.0
Preheat	-180.0	2,510	5.0	53.0
Reheat	-147.0	8,500	53.0	72.0
Humidif	0.0	0	0.0	0.0
Opt Vent	0.0	0	0.0	0.0
Total	-327.0			

System Checksums

By Heapy Engineering

AHU-4 — **Variable Volume Reheat (30% Min Flow Default)**

COOLING COIL PEAK

Peaked at Time: Mo/Hr: 8 / 13
Outside Air: OADB/WB/HR: 87 / 73 / 101

	Space Sens. + Lat. Btu/h	Plenum Sens. + Lat Btu/h	Net Total Btu/h	Percent Of Total (%)
Envelope Loads				
Skylite Solar	0	0	0	0
Skylite Cond	0	0	0	0
Roof Cond	0	1,273	1,273	1
Glass Solar	467	0	467	0
Glass/Door Cond	35	0	35	0
Wall Cond	703	52	755	0
Partition/Door	0		0	0
Floor	0		0	0
Adjacent Floor	0	0	0	0
Infiltration	0		0	0
Sub Total ==>	1,205	1,325	2,530	1
Internal Loads				
Lights	4,141	1,035	5,177	2
People	8,243	0	8,243	4
Misc	51,008	0	51,008	23
Sub Total ==>	63,392	1,035	64,428	29
Ceiling Load	952	-952	0	0
Ventilation Load	0	0	134,296	61
Adj Air Trans Heat	0		0	0
Dehumid. Ov Sizing			0	0
Ov/Undr Sizing	17,726		17,726	8
Exhaust Heat		-89	-89	0
Sup. Fan Heat			0	0
Ret. Fan Heat		0	0	0
Duct Heat Pkup		0	0	0
Underflr Sup Ht Pkup			0	0
Supply Air Leakage		0	0	0
Grand Total ==>	83,276	1,319	218,891	100.00

CLG SPACE PEAK

Mo/Hr: 8 / 10
OADB: 77

	Space Sensible Btu/h	Percent Of Total (%)
Envelope Loads		
Skylite Solar	0	0
Skylite Cond	0	0
Roof Cond	0	0
Glass Solar	123	0
Glass/Door Cond	-5	0
Wall Cond	1,010	1
Partition/Door	0	0
Floor	0	0
Adjacent Floor	0	0
Infiltration	0	0
Sub Total ==>	1,128	1
Internal Loads		
Lights	4,981	6
People	3,170	4
Misc	58,799	73
Sub Total ==>	66,950	83
Ceiling Load	310	0
Ventilation Load	0	0
Adj Air Trans Heat	0	0
Ov/Undr Sizing	12,376	15
Grand Total ==>	80,763	100.00

HEATING COIL PEAK

Mo/Hr: Heating Design
OADB: 5

	Space Peak Space Sens Btu/h	Coil Peak Tot Sens Btu/h	Percent Of Total (%)
Envelope Loads			
Skylite Solar	0	0	0.00
Skylite Cond	0	0	0.00
Roof Cond	0	-5,468	2.15
Glass Solar	0	0	0.00
Glass/Door Cond	-258	-258	0.10
Wall Cond	-5,098	-5,510	2.17
Partition/Door	0	0	0.00
Floor	-3,729	-3,729	1.47
Adjacent Floor	0	0	0
Infiltration	-8,253	-8,253	3.25
Sub Total ==>	-17,337	-23,216	9.13
Internal Loads			
Lights	0	0	0.00
People	0	0	0.00
Misc	0	0	0.00
Sub Total ==>	0	0	0.00
Ceiling Load	-3,529	0	0.00
Ventilation Load	0	-226,734	89.18
Adj Air Trans Heat	0	0	0
Ov/Undr Sizing	-205	-205	0.08
Exhaust Heat		626	-0.25
OA Preheat Diff.		0	0.00
RA Preheat Diff.		-949	0.37
Additional Reheat		-3,767	1.48
Underflr Sup Ht Pkup		0	0.00
Supply Air Leakage		0	0.00
Grand Total ==>	-21,071	-254,245	100.00

TEMPERATURES

	Cooling	Heating
SADB	53.0	77.7
Ra Plenum	76.4	66.9
Return	76.4	66.9
Ret/OA	86.5	10.6
Fn MtrTD	0.0	0.0
Fn BldTD	0.0	0.0
Fn Frict	0.0	0.0

AIRFLOWS

	Cooling	Heating
Diffuser	3,390	3,438
Terminal	3,390	3,438
Main Fan	3,390	3,438
Sec Fan	0	0
Nom Vent	3,125	3,125
AHU Vent	3,125	3,125
Infil	0	114
MinStop/Rh	3,438	3,438
Return	325	427
Exhaust	60	114
Rm Exh	3,065	3,125
Auxiliary	0	0
Leakage Dwn	0	0
Leakage Ups	0	0

ENGINEERING CKS

	Cooling	Heating
% OA	92.2	90.9
cfm/ft²	1.55	1.57
cfm/ton	149.56	
ft²/ton	96.62	
Btu/hr·ft²	124.20	-176.71
No. People	47	

COOLING COIL SELECTION

	Total Capacity ton	Total Capacity MBh	Sens Cap. MBh	Coil Airflow cfm	Enter DB °F	Enter WB °F	Enter HR gr/lb	Leave DB °F	Leave WB °F	Leave HR gr/lb
Main Clg	22.7	272.0	154.1	3,390	86.5	71.9	97.7	53.0	45.4	34.1
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Total	22.7	272.0								

AREAS

	Gross Total	Glass ft²	Glass (%)
Floor	2,190		
Part	0		
Int Door	0		
ExFlr	105		
Roof	2,190	0	0
Wall	1,365	12	1
Ext Door	0	0	0

HEATING COIL SELECTION

	Capacity MBh	Coil Airflow cfm	Ent °F	Lvg °F
Main Htg	-147.0	3,390	53.0	77.7
Aux Htg	0.0	0	0.0	0.0
Preheat	-240.0	3,125	5.0	53.0
Reheat	-147.0	3,438	53.0	72.0
Humidif	0.0	0	0.0	0.0
Opt Vent	0.0	0	0.0	0.0
Total	-387.0			

System Checksums

By Heapy Engineering

FC **Fan Coil**

COOLING COIL PEAK

Peaked at Time: Mo/Hr: 8 / 14
Outside Air: OADB/WB/HR: 89 / 74 / 104

	Space Sens. + Lat. Btu/h	Plenum Sens. + Lat Btu/h	Net Total Btu/h	Percent Of Total (%)
Envelope Loads				
Skylite Solar	0	0	0	0
Skylite Cond	0	0	0	0
Roof Cond	0	8,421	8,421	5
Glass Solar	22,314	0	22,314	14
Glass/Door Cond	3,721	0	3,721	2
Wall Cond	1,253	72	1,325	1
Partition/Door	79,369		79,369	50
Floor	0		0	0
Adjacent Floor	0	0	0	0
Infiltration	0		0	0
Sub Total ==>	106,657	8,493	115,150	73
Internal Loads				
Lights	101,097	24,817	125,915	80
People	75,548	0	75,548	48
Misc	91,058	0	91,058	58
Sub Total ==>	267,704	24,817	292,521	185
Ceiling Load	33,325	-33,325	0	0
Ventilation Load	0	-148,598	-148,598	-94
Adj Air Trans Heat	533		533	0
Dehumid. Ov Sizing			0	0
Ov/Undr Sizing	-85,898		-85,898	-54
Exhaust Heat		-15,761	-15,761	-10
Sup. Fan Heat			0	0
Ret. Fan Heat		0	0	0
Duct Heat Pkup		0	0	0
Underflr Sup Ht Pkup			0	0
Supply Air Leakage		0	0	0
Grand Total ==>	322,321	-164,374	157,947	100.00

CLG SPACE PEAK

Mo/Hr: Sum of
OADB: Peaks

	Space Sensible Btu/h	Percent Of Total (%)
Envelope Loads		
Skylite Solar	0	0
Skylite Cond	0	0
Roof Cond	0	0
Glass Solar	45,114	14
Glass/Door Cond	444	0
Wall Cond	1,206	0
Partition/Door	79,369	25
Floor	0	0
Adjacent Floor	0	0
Infiltration	0	0
Sub Total ==>	126,133	39
Internal Loads		
Lights	105,608	33
People	45,173	14
Misc	100,644	31
Sub Total ==>	251,424	78
Ceiling Load	29,881	9
Ventilation Load	0	0
Adj Air Trans Heat	533	0
Ov/Undr Sizing	-85,898	-27
Exhaust Heat		
OA Preheat Diff.		
RA Preheat Diff.		
Additional Reheat		
Underflr Sup Ht Pkup		
Supply Air Leakage		
Grand Total ==>	322,072	100.00

HEATING COIL PEAK

Mo/Hr: Heating Design
OADB: 5

	Space Peak Space Sens Btu/h	Coil Peak Tot Sens Btu/h	Percent Of Total (%)
Envelope Loads			
Skylite Solar	0	0	0.00
Skylite Cond	0	0	0.00
Roof Cond	0	-24,678	4.89
Glass Solar	0	0	0.00
Glass/Door Cond	-25,695	-25,695	5.09
Wall Cond	-13,221	-14,733	2.92
Partition/Door	-81,604	-81,604	16.17
Floor	-7,528	-7,528	1.49
Adjacent Floor	0	0	0
Infiltration	-29,317	-29,317	5.81
Sub Total ==>	-157,365	-183,554	36.38
Internal Loads			
Lights	0	0	0.00
People	0	0	0.00
Misc	0	0	0.00
Sub Total ==>	0	0	0.00
Ceiling Load	-26,189	0	0.00
Ventilation Load	0	-74,071	14.68
Adj Air Trans Heat	-1,066	-1,066	0
Ov/Undr Sizing	-201,731	-201,731	39.98
Exhaust Heat		12,106	-2.40
OA Preheat Diff.		-56,223	11.14
RA Preheat Diff.		0	0.00
Additional Reheat		0	0.00
Underflr Sup Ht Pkup		0	0.00
Supply Air Leakage		0	0.00
Grand Total ==>	-386,350	-504,538	100.00

TEMPERATURES

	Cooling	Heating
SADB	65.1	84.5
Ra Plenum	79.1	69.0
Return	72.4	69.9
Ret/OA	72.4	70.1
Fn MtrTD	0.0	0.0
Fn BldTD	0.0	0.0
Fn Frict	0.0	0.0

AIRFLOWS

	Cooling	Heating
Diffuser	27,475	30,284
Terminal	27,475	30,284
Main Fan	27,475	30,284
Sec Fan	0	0
Nom Vent	3,521	3,600
AHU Vent	3,521	3,600
Infil	0	404
MinStop/Rh	0	0
Return	31,075	33,999
Exhaust	3,600	3,715
Rm Exh	164	289
Auxiliary	0	0
Leakage Dwn	0	0
Leakage Ups	0	0

ENGINEERING CKS

	Cooling	Heating
% OA	13.1	11.9
cfm/ft²	1.00	1.10
cfm/ton	297.93	
ft²/ton	298.91	
Btu/hr·ft²	40.15	-24.74
No. People	195	

COOLING COIL SELECTION

	Total Capacity ton	Total Capacity MBh	Sens Cap. MBh	Coil Airflow cfm	Enter DB °F	Enter WB °F	Enter HR gr/lb	Leave DB °F	Leave WB °F	Leave HR gr/lb
Main Clg	73.2	877.9	856.8	27,475	72.4	61.1	64.9	65.1	49.7	30.0
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Opt Vent	19.1	228.8	136.1	3,600	80.0	67.3	83.0	45.1	45.0	45.5
Total	92.2	1,106.7								

AREAS

	Gross Total	Glass ft²	Glass (%)
Floor	27,566		
Part	28,230		
Int Door	0		
ExFlr	212		
Roof	9,564	0	0
Wall	4,739	1,126	24
Ext Door	110	0	0

HEATING COIL SELECTION

	Capacity MBh	Coil Airflow cfm	Ent °F	Lvg °F
Main Htg	-638.9	30,284	65.0	84.5
Aux Htg	0.0	0	0.0	0.0
Preheat	-195.0	27,475	69.9	65.1
Humidif	0.0	0	0.0	0.0
Opt Vent	-43.2	3,600	43.9	55.0
Total	-682.1			

System Checksums

By Heapy Engineering

HEATING ONLY — **Unit Heaters**

COOLING COIL PEAK

Peaked at Time: Mo/Hr: 0 / 0
Outside Air: OADB/WB/HR: 0 / 0 / 0

	Space Sens. + Lat. Btu/h	Plenum Sens. + Lat Btu/h	Net Total Btu/h	Percent Of Total (%)
Envelope Loads				
Skylite Solar	0	0	0	0
Skylite Cond	0	0	0	0
Roof Cond	0	0	0	0
Glass Solar	0	0	0	0
Glass/Door Cond	0	0	0	0
Wall Cond	0	0	0	0
Partition/Door	0		0	0
Floor	0		0	0
Adjacent Floor	0	0	0	0
Infiltration	0		0	0
Sub Total ==>	0	0	0	0
Internal Loads				
Lights	0	0	0	0
People	0	0	0	0
Misc	0	0	0	0
Sub Total ==>	0	0	0	0
Ceiling Load	0	0	0	0
Ventilation Load	0	0	0	0
Adj Air Trans Heat	0		0	0
Dehumid. Ov Sizing			0	0
Ov/Undr Sizing	0		0	0
Exhaust Heat		0	0	0
Sup. Fan Heat			0	0
Ret. Fan Heat		0	0	0
Duct Heat Pkup		0	0	0
Underflr Sup Ht Pkup			0	0
Supply Air Leakage		0	0	0
Grand Total ==>	0	0	0	100.00

CLG SPACE PEAK

Mo/Hr: 0 / 0
OADB: 0

	Space Sensible Btu/h	Percent Of Total (%)
Envelope Loads		
Skylite Solar	0	0
Skylite Cond	0	0
Roof Cond	0	0
Glass Solar	0	0
Glass/Door Cond	0	0
Wall Cond	0	0
Partition/Door	0	0
Floor	0	0
Adjacent Floor	0	0
Infiltration	0	0
Sub Total ==>	0	0
Internal Loads		
Lights	0	0
People	0	0
Misc	0	0
Sub Total ==>	0	0
Ceiling Load	0	0
Ventilation Load	0	0
Adj Air Trans Heat	0	0
Ov/Undr Sizing	0	0
Grand Total ==>	0	100.00

HEATING COIL PEAK

Mo/Hr: Heating Design
OADB: 5

	Space Peak Space Sens Btu/h	Coil Peak Tot Sens Btu/h	Percent Of Total (%)
Envelope Loads			
Skylite Solar	0	0	0.00
Skylite Cond	0	0	0.00
Roof Cond	0	-633	1.14
Glass Solar	0	0	0.00
Glass/Door Cond	-2,860	-2,860	5.15
Wall Cond	-13,408	-14,522	26.13
Partition/Door	-1,940	-1,940	3.49
Floor	-5,733	-5,733	10.32
Adjacent Floor	0	0	0
Infiltration	-22,372	-22,372	40.25
Sub Total ==>	-46,313	-48,060	86.47
Internal Loads			
Lights	0	0	0.00
People	0	0	0.00
Misc	0	0	0.00
Sub Total ==>	0	0	0.00
Ceiling Load	-1,747	0	0.00
Ventilation Load	0	0	0.00
Adj Air Trans Heat	0	0	0
Ov/Undr Sizing	-7,519	-7,519	13.53
Exhaust Heat		0	0.00
OA Preheat Diff.		0	0.00
RA Preheat Diff.		0	0.00
Additional Reheat		0	0.00
Underflr Sup Ht Pkup		0	0.00
Supply Air Leakage		0	0.00
Grand Total ==>	-55,578	-55,578	100.00

TEMPERATURES

	Cooling	Heating
SADB	0.0	91.9
Ra Plenum	0.0	66.1
Return	0.0	71.8
Ret/OA	0.0	71.8
Fn MtrTD	0.0	0.0
Fn BldTD	0.0	0.0
Fn Frict	0.0	0.0

AIRFLOWS

	Cooling	Heating
Diffuser	0	2,564
Terminal	0	2,564
Main Fan	0	2,564
Sec Fan	0	0
Nom Vent	0	0
AHU Vent	0	0
Infil	0	312
MinStop/Rh	0	0
Return	0	2,877
Exhaust	0	312
Rm Exh	0	0
Auxiliary	0	0
Leakage Dwn	0	0
Leakage Ups	0	0

ENGINEERING CKS

	Cooling	Heating
% OA	0.0	0.0
cfm/ft²	0.00	0.40
cfm/ton	0.00	
ft²/ton	0.00	
Btu/hr·ft²	0.00	-19.07
No. People	0	

COOLING COIL SELECTION

	Total Capacity ton	Total Capacity MBh	Sens Cap. MBh	Coil Airflow cfm	Enter DB/WB/HR °F	Enter DB/WB/HR °F	Enter DB/WB/HR gr/lb	Leave DB/WB/HR °F	Leave DB/WB/HR °F	Leave DB/WB/HR gr/lb
Main Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Total	0.0	0.0								

AREAS

	Gross Total ft²	Glass ft²	Glass (%)
Floor	6,344		
Part	1,500		
Int Door	0		
ExFlr	165		
Roof	257	0	0
Wall	3,747	133	4
Ext Door	0	0	0

HEATING COIL SELECTION

	Capacity MBh	Coil Airflow cfm	Ent °F	Lvg °F
Main Htg	-121.0	2,564	71.8	91.9
Aux Htg	0.0	0	0.0	0.0
Preheat	0.0	0	0.0	0.0
Humidif	0.0	0	0.0	0.0
Opt Vent	0.0	0	0.0	0.0
Total	-121.0			

System Checksums

By Heapy Engineering

SPLIT AC — **Computer Room Unit**

COOLING COIL PEAK

Peaked at Time: Mo/Hr: 8 / 10
Outside Air: OADB/WB/HR: 77 / 66 / 80

	Space Sens. + Lat. Btu/h	Plenum Sens. + Lat Btu/h	Net Total Btu/h	Percent Of Total (%)
Envelope Loads				
Skylite Solar	0	0	0	0
Skylite Cond	0	0	0	0
Roof Cond	0	100	100	0
Glass Solar	0	0	0	0
Glass/Door Cond	0	0	0	0
Wall Cond	100	1	102	0
Partition/Door	497		497	2
Floor	0		0	0
Adjacent Floor	0	0	0	0
Infiltration	0		0	0
Sub Total ==>	597	101	698	3
Internal Loads				
Lights	4,573	1,143	5,716	24
People	302	0	302	1
Misc	8,682	0	8,682	36
Sub Total ==>	13,557	1,143	14,700	60
Ceiling Load	1,105	-1,105	0	0
Ventilation Load	0	0	0	0
Adj Air Trans Heat	0		0	0
Dehumid. Ov Sizing			0	0
Ov/Undr Sizing	8,911		8,911	37
Exhaust Heat		0	0	0
Sup. Fan Heat			0	0
Ret. Fan Heat		0	0	0
Duct Heat Pkup		0	0	0
Underflr Sup Ht Pkup			0	0
Supply Air Leakage		0	0	0
Grand Total ==>	24,169	139	24,309	100.00

CLG SPACE PEAK

Mo/Hr: Sum of
OADB: Peaks

	Space Sensible Btu/h	Percent Of Total (%)
Envelope Loads		
Skylite Solar	0	0
Skylite Cond	0	0
Roof Cond	0	0
Glass Solar	0	0
Glass/Door Cond	0	0
Wall Cond	100	0
Partition/Door	497	2
Floor	0	0
Adjacent Floor	0	0
Infiltration	0	0
Sub Total ==>	597	2
Internal Loads		
Lights	4,573	19
People	168	1
Misc	8,682	36
Sub Total ==>	13,422	56
Ceiling Load	1,107	5
Ventilation Load	0	0
Adj Air Trans Heat	0	0
Ov/Undr Sizing	8,911	37
Grand Total ==>	24,037	100.00

HEATING COIL PEAK

Mo/Hr: Heating Design
OADB: 5

	Space Peak Space Sens Btu/h	Coil Peak Tot Sens Btu/h	Percent Of Total (%)
Envelope Loads			
Skylite Solar	0	0	0.00
Skylite Cond	0	0	0.00
Roof Cond	0	-235	0.72
Glass Solar	0	0	0.00
Glass/Door Cond	0	0	0.00
Wall Cond	-637	-690	2.13
Partition/Door	-419	-419	1.29
Floor	-462	-462	1.42
Adjacent Floor	0	0	0
Infiltration	-1,022	-1,022	3.15
Sub Total ==>	-2,540	-2,828	8.72
Internal Loads			
Lights	0	0	0.00
People	0	0	0.00
Misc	0	0	0.00
Sub Total ==>	0	0	0.00
Ceiling Load	-288	0	0.00
Ventilation Load	0	0	0.00
Adj Air Trans Heat	0	0	0
Ov/Undr Sizing	-29,616	-29,616	91.28
Exhaust Heat		0	0.00
OA Preheat Diff.		0	0.00
RA Preheat Diff.		0	0.00
Additional Reheat		0	0.00
Underflr Sup Ht Pkup		0	0.00
Supply Air Leakage		0	0.00
Grand Total ==>	-32,444	-32,444	100.00

TEMPERATURES

	Cooling	Heating
SADB	64.6	86.0
Ra Plenum	83.9	69.7
Return	75.0	72.0
Ret/OA	75.0	72.0
Fn MtrTD	0.0	0.0
Fn BldTD	0.0	0.0
Fn Frict	0.0	0.0

AIRFLOWS

	Cooling	Heating
Diffuser	2,140	2,140
Terminal	2,140	2,140
Main Fan	2,140	2,140
Sec Fan	0	0
Nom Vent	0	0
AHU Vent	0	0
Infil	0	14
MinStop/Rh	0	0
Return	2,140	2,154
Exhaust	0	14
Rm Exh	0	0
Auxiliary	0	0
Leakage Dwn	0	0
Leakage Ups	0	0

ENGINEERING CKS

	Cooling	Heating
% OA	0.0	0.0
cfm/ft²	5.46	5.46
cfm/ton	414.19	
ft²/ton	75.87	
Btu/hr·ft²	158.16	-82.77
No. People	1	

COOLING COIL SELECTION

	Total Capacity ton	Total Capacity MBh	Sens Cap. MBh	Coil Airflow cfm	Enter DB °F	Enter WB °F	Enter HR gr/lb	Leave DB °F	Leave WB °F	Leave HR gr/lb
Main Clg	5.2	62.0	61.7	2,140	75.0	62.7	68.3	64.6	52.9	42.6
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Total	5.2	62.0								

AREAS

	Gross Total	Glass ft²	Glass (%)
Floor	392		
Part	180		
Int Door	0		
ExFlr	13		
Roof	90	0	0
Wall	169	0	0
Ext Door	0	0	0

HEATING COIL SELECTION

	Capacity MBh	Coil Airflow cfm	Ent °F	Lvg °F
Main Htg	-32.4	2,140	72.0	86.0
Aux Htg	0.0	0	0.0	0.0
Preheat	0.0	0	0.0	0.0
Reheat	0.0	0	0.0	0.0
Humidif	0.0	0	0.0	0.0
Opt Vent	0.0	0	0.0	0.0
Total	-32.4			

System Checksums

By Heapy Engineering

UV **Unit Ventilator**

COOLING COIL PEAK

Peaked at Time: Mo/Hr: 8 / 14
Outside Air: OADB/WB/HR: 89 / 74 / 104

	Space Sens. + Lat. Btu/h	Plenum Sens. + Lat Btu/h	Net Total Btu/h	Percent Of Total (%)
Envelope Loads				
Skylite Solar	0	0	0	0
Skylite Cond	0	0	0	0
Roof Cond	0	11,135	11,135	1
Glass Solar	158,610	0	158,610	8
Glass/Door Cond	28,992	0	28,992	1
Wall Cond	4,950	725	5,674	0
Partition/Door	31,536		31,536	2
Floor	0		0	0
Adjacent Floor	0	0	0	0
Infiltration	0		0	0
Sub Total ==>	224,087	11,859	235,946	11
Internal Loads				
Lights	40,896	1,640	42,536	2
People	415,366	0	415,366	20
Misc	104,366	0	104,366	5
Sub Total ==>	560,627	1,640	562,268	27
Ceiling Load	1,749	-1,749	0	0
Ventilation Load	0	0	734,679	35
Adj Air Trans Heat	0		0	0
Dehumid. Ov Sizing			0	0
Ov/Undr Sizing	544,037		544,037	26
Exhaust Heat		-3,033	-3,033	0
Sup. Fan Heat			0	0
Ret. Fan Heat		0	0	0
Duct Heat Pkup		0	0	0
Underflr Sup Ht Pkup			0	0
Supply Air Leakage		0	0	0
Grand Total ==>	1,330,501	8,718	2,073,897	100.00

CLG SPACE PEAK

Mo/Hr: Sum of
OADB: Peaks

	Space Sensible Btu/h	Percent Of Total (%)
Envelope Loads		
Skylite Solar	0	0
Skylite Cond	0	0
Roof Cond	0	0
Glass Solar	393,652	31
Glass/Door Cond	6,718	1
Wall Cond	4,762	0
Partition/Door	31,536	2
Floor	0	0
Adjacent Floor	0	0
Infiltration	0	0
Sub Total ==>	436,668	34
Internal Loads		
Lights	34,685	3
People	184,958	14
Misc	84,913	7
Sub Total ==>	304,555	24
Ceiling Load	1,235	0
Ventilation Load	0	0
Adj Air Trans Heat	0	0
Ov/Undr Sizing	544,037	42
Grand Total ==>	1,286,495	100.00

HEATING COIL PEAK

Mo/Hr: Heating Design
OADB: 5

	Space Peak Space Sens Btu/h	Coil Peak Tot Sens Btu/h	Percent Of Total (%)
Envelope Loads			
Skylite Solar	0	0	0.00
Skylite Cond	0	0	0.00
Roof Cond	0	-29,903	1.05
Glass Solar	0	0	0.00
Glass/Door Cond	-165,348	-165,348	5.80
Wall Cond	-43,775	-50,293	1.77
Partition/Door	-31,070	-31,070	1.09
Floor	-16,006	-16,006	0.56
Adjacent Floor	0	0	0
Infiltration	-121,571	-121,571	4.27
Sub Total ==>	-377,770	-414,192	14.54
Internal Loads			
Lights	0	0	0.00
People	0	0	0.00
Misc	0	0	0.00
Sub Total ==>	0	0	0.00
Ceiling Load	-4,572	0	0.00
Ventilation Load	0	-1,201,146	42.16
Adj Air Trans Heat	0	0	0
Ov/Undr Sizing	-1,241,634	-1,241,634	43.58
Exhaust Heat		8,138	-0.29
OA Preheat Diff.		0	0.00
RA Preheat Diff.		0	0.00
Additional Reheat		0	0.00
Underflr Sup Ht Pkup		0	0.00
Supply Air Leakage		0	0.00
Grand Total ==>	-1,623,976	-2,848,834	100.00

TEMPERATURES

	Cooling	Heating
SADB	57.0	95.3
Ra Plenum	75.2	71.6
Return	75.2	71.6
Ret/OA	78.7	54.9
Fn MtrTD	0.0	0.0
Fn BldTD	0.0	0.0
Fn Frict	0.0	0.0

AIRFLOWS

	Cooling	Heating
Diffuser	66,000	66,082
Terminal	66,000	66,082
Main Fan	66,000	66,082
Sec Fan	0	0
Nom Vent	11,983	16,555
AHU Vent	11,983	16,555
Infil	0	1,676
MinStop/Rh	0	0
Return	66,000	66,524
Exhaust	11,983	16,997
Rm Exh	0	1,233
Auxiliary	0	0
Leakage Dwn	0	0
Leakage Ups	0	0

ENGINEERING CKS

	Cooling	Heating
% OA	25.1	25.1
cfm/ft²	2.02	2.02
cfm/ton	388.39	
ft²/ton	192.05	
Btu/hr·ft²	62.48	-87.79
No. People	994	

COOLING COIL SELECTION

	Total Capacity ton	Total Capacity MBh	Sens Cap. MBh	Coil Airflow cfm	Enter DB °F	Enter WB °F	Enter HR gr/lb	Leave DB °F	Leave WB °F	Leave HR gr/lb
Main Clg	169.9	2,039.2	1,366.6	66,000	78.7	64.9	72.6	57.0	54.7	61.9
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Total	169.9	2,039.2								

AREAS

	Gross Total	Glass ft²	Glass (%)
Floor	32,636		
Part	13,190		
Int Door	0		
ExFlr	451		
Roof	11,142	0	0
Wall	19,752	7,465	38
Ext Door	356	0	0

HEATING COIL SELECTION

	Capacity MBh	Coil Airflow cfm	Ent °F	Lvg °F
Main Htg	-2,865.0	66,082	55.2	95.3
Aux Htg	0.0	0	0.0	0.0
Preheat	0.0	66,000	54.9	57.0
Humidif	0.0	0	0.0	0.0
Opt Vent	0.0	0	0.0	0.0
Total	-2,865.0			

System Checksums

By Heapy Engineering

HEATING ONLY **Unit Heaters**

COOLING COIL PEAK

Peaked at Time: Mo/Hr: 0 / 0
Outside Air: OADB/WB/HR: 0 / 0 / 0

	Space Sens. + Lat. Btu/h	Plenum Sens. + Lat Btu/h	Net Total Btu/h	Percent Of Total (%)
Envelope Loads				
Skylite Solar	0	0	0	0
Skylite Cond	0	0	0	0
Roof Cond	0	0	0	0
Glass Solar	0	0	0	0
Glass/Door Cond	0	0	0	0
Wall Cond	0	0	0	0
Partition/Door	0		0	0
Floor	0		0	0
Adjacent Floor	0	0	0	0
Infiltration	0		0	0
Sub Total ==>	0	0	0	0
Internal Loads				
Lights	0	0	0	0
People	0	0	0	0
Misc	0	0	0	0
Sub Total ==>	0	0	0	0
Ceiling Load	0	0	0	0
Ventilation Load	0	0	0	0
Adj Air Trans Heat	0		0	0
Dehumid. Ov Sizing			0	0
Ov/Undr Sizing	0		0	0
Exhaust Heat		0	0	0
Sup. Fan Heat			0	0
Ret. Fan Heat		0	0	0
Duct Heat Pkup		0	0	0
Underflr Sup Ht Pkup			0	0
Supply Air Leakage		0	0	0
Grand Total ==>	0	0	0	100.00

CLG SPACE PEAK

Mo/Hr: 0 / 0
OADB: 0

	Space Sensible Btu/h	Percent Of Total (%)
Envelope Loads		
Skylite Solar	0	0
Skylite Cond	0	0
Roof Cond	0	0
Glass Solar	0	0
Glass/Door Cond	0	0
Wall Cond	0	0
Partition/Door	0	0
Floor	0	0
Adjacent Floor	0	0
Infiltration	0	0
Sub Total ==>	0	0
Internal Loads		
Lights	0	0
People	0	0
Misc	0	0
Sub Total ==>	0	0
Ceiling Load	0	0
Ventilation Load	0	0
Adj Air Trans Heat	0	0
Ov/Undr Sizing	0	0
Grand Total ==>	0	100.00

HEATING COIL PEAK

Mo/Hr: Heating Design
OADB: 5

	Space Peak Space Sens Btu/h	Coil Peak Tot Sens Btu/h	Percent Of Total (%)
Envelope Loads			
Skylite Solar	0	0	0.00
Skylite Cond	0	0	0.00
Roof Cond	0	-1,070	1.21
Glass Solar	0	0	0.00
Glass/Door Cond	-31,171	-31,171	35.25
Wall Cond	-15,128	-16,725	18.91
Partition/Door	-1,940	-1,940	2.19
Floor	-7,896	-7,896	8.93
Adjacent Floor	0	0	0
Infiltration	-22,372	-22,372	25.30
Sub Total ==>	-78,508	-81,175	91.79
Internal Loads			
Lights	0	0	0.00
People	0	0	0.00
Misc	0	0	0.00
Sub Total ==>	0	0	0.00
Ceiling Load	-2,667	0	0.00
Ventilation Load	0	0	0.00
Adj Air Trans Heat	0	0	0
Ov/Undr Sizing	-7,260	-7,260	8.21
Exhaust Heat		0	0.00
OA Preheat Diff.		0	0.00
RA Preheat Diff.		0	0.00
Additional Reheat		0	0.00
Underflr Sup Ht Pkup		0	0.00
Supply Air Leakage		0	0.00
Grand Total ==>	-88,435	-88,435	100.00

TEMPERATURES

	Cooling	Heating
SADB	0.0	105.0
Ra Plenum	0.0	65.6
Return	0.0	71.7
Ret/OA	0.0	71.8
Fn MtrTD	0.0	0.0
Fn BldTD	0.0	0.0
Fn Frict	0.0	0.0

AIRFLOWS

	Cooling	Heating
Diffuser	0	4,015
Terminal	0	4,015
Main Fan	0	4,015
Sec Fan	0	0
Nom Vent	0	0
AHU Vent	0	0
Infil	0	312
MinStop/Rh	0	0
Return	0	4,327
Exhaust	0	312
Rm Exh	0	0
Auxiliary	0	0
Leakage Dwn	0	0
Leakage Ups	0	0

ENGINEERING CKS

	Cooling	Heating
% OA	0.0	0.0
cfm/ft²	0.00	0.63
cfm/ton	0.00	
ft²/ton	0.00	
Btu/hr·ft²	0.00	-22.78
No. People	0	

COOLING COIL SELECTION

	Total Capacity ton	Total Capacity MBh	Sens Cap. MBh	Coil Airflow cfm	Enter DB/WB/HR °F	Enter DB/WB/HR °F	Enter DB/WB/HR gr/lb	Leave DB/WB/HR °F	Leave DB/WB/HR °F	Leave DB/WB/HR gr/lb
Main Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Total	0.0	0.0								

AREAS

	Gross Total	Glass ft²	Glass (%)
Floor	6,344		
Part	1,500		
Int Door	0		
ExFlr	165		
Roof	257	0	0
Wall	3,746	830	22
Ext Door	0	0	0

HEATING COIL SELECTION

	Capacity MBh	Coil Airflow cfm	Ent °F	Lvg °F
Main Htg	-144.5	4,015	71.8	105.0
Aux Htg	0.0	0	0.0	0.0
Preheat	0.0	0	0.0	0.0
Humidif	0.0	0	0.0	0.0
Opt Vent	0.0	0	0.0	0.0
Total	-144.5			

System Checksums

By Heapy Engineering

System 3 **Single Zone**

COOLING COIL PEAK

Peaked at Time: Mo/Hr: 8 / 14
Outside Air: OADB/WB/HR: 89 / 74 / 104

	Space Sens. + Lat. Btu/h	Plenum Sens. + Lat Btu/h	Net Total Btu/h	Percent Of Total (%)
Envelope Loads				
Skylite Solar	0	0	0	0
Skylite Cond	0	0	0	0
Roof Cond	0	372	372	3
Glass Solar	1,404	0	1,404	10
Glass/Door Cond	128	0	128	1
Wall Cond	164	9	173	1
Partition/Door	497		497	4
Floor	0		0	0
Adjacent Floor	0	0	0	0
Infiltration	0		0	0
Sub Total ==>	2,192	381	2,573	19
Internal Loads				
Lights	1,589	397	1,986	15
People	302	0	302	2
Misc	8,682	0	8,682	64
Sub Total ==>	10,573	397	10,970	81
Ceiling Load	677	-677	0	0
Ventilation Load	0	0	0	0
Adj Air Trans Heat	0		0	0
Dehumid. Ov Sizing			0	0
Ov/Undr Sizing	0		0	0
Exhaust Heat		0	0	0
Sup. Fan Heat			0	0
Ret. Fan Heat		0	0	0
Duct Heat Pkup		0	0	0
Underflr Sup Ht Pkup			0	0
Supply Air Leakage		0	0	0
***Grand Total* ==>**	13,442	101	13,543	100.00

CLG SPACE PEAK

Mo/Hr: Sum of
OADB: Peaks

	Space Sensible Btu/h	Percent Of Total (%)
Envelope Loads		
Skylite Solar	0	0
Skylite Cond	0	0
Roof Cond	0	0
Glass Solar	1,404	11
Glass/Door Cond	128	1
Wall Cond	164	1
Partition/Door	497	4
Floor	0	0
Adjacent Floor	0	0
Infiltration	0	0
Sub Total ==>	2,192	16
Internal Loads		
Lights	1,589	12
People	168	1
Misc	8,682	65
Sub Total ==>	10,438	78
Ceiling Load	682	5
Ventilation Load	0	0
Adj Air Trans Heat	0	0
Ov/Undr Sizing	0	0
***Grand Total* ==>**	13,313	100.00

HEATING COIL PEAK

Mo/Hr: Heating Design
OADB: 5

	Space Peak Space Sens Btu/h	Coil Peak Tot Sens Btu/h	Percent Of Total (%)
Envelope Loads			
Skylite Solar	0	0	0.00
Skylite Cond	0	0	0.00
Roof Cond	0	-277	1.96
Glass Solar	0	0	0.00
Glass/Door Cond	-1,141	-1,141	8.09
Wall Cond	-891	-982	6.96
Partition/Door	-419	-419	2.97
Floor	-636	-636	4.51
Adjacent Floor	0	0	0
Infiltration	-1,022	-1,022	7.24
Sub Total ==>	-4,108	-4,476	31.73
Internal Loads			
Lights	0	0	0.00
People	0	0	0.00
Misc	0	0	0.00
Sub Total ==>	0	0	0.00
Ceiling Load	-368	0	0.00
Ventilation Load	0	0	0.00
Adj Air Trans Heat	0	0	0
Ov/Undr Sizing	-9,632	-9,632	68.27
Exhaust Heat		0	0.00
OA Preheat Diff.		0	0.00
RA Preheat Diff.		0	0.00
Additional Reheat		0	0.00
Underflr Sup Ht Pkup		0	0.00
Supply Air Leakage		0	0.00
***Grand Total* ==>**	-14,109	-14,109	100.00

TEMPERATURES

	Cooling	Heating
SADB	55.0	92.2
Ra Plenum	80.5	69.0
Return	75.0	72.0
Ret/OA	75.0	72.0
Fn MtrTD	0.0	0.0
Fn BldTD	0.0	0.0
Fn Frict	0.0	0.0

AIRFLOWS

	Cooling	Heating
Diffuser	694	694
Terminal	694	694
Main Fan	694	694
Sec Fan	0	0
Nom Vent	0	0
AHU Vent	0	0
Infil	0	14
MinStop/Rh	0	0
Return	694	709
Exhaust	0	14
Rm Exh	0	0
Auxiliary	0	0
Leakage Dwn	0	0
Leakage Ups	0	0

ENGINEERING CKS

	Cooling	Heating
% OA	0.0	0.0
cfm/ft²	1.77	1.77
cfm/ton	615.36	
ft²/ton	347.33	
Btu/hr·ft²	34.55	-38.70
No. People	1	

COOLING COIL SELECTION

	Total Capacity ton	Total Capacity MBh	Sens Cap. MBh	Coil Airflow cfm	Enter DB °F	Enter WB °F	Enter HR gr/lb	Leave DB °F	Leave WB °F	Leave HR gr/lb
Main Clg	1.1	13.5	13.4	694	75.0	57.4	44.2	55.0	49.2	44.2
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Total	1.1	13.5								

AREAS

	Gross Total ft²	Glass ft²	Glass (%)
Floor	392		
Part	180		
Int Door	0		
ExFlr	13		
Roof	90	0	0
Wall	169	30	18
Ext Door	0	0	0

HEATING COIL SELECTION

	Capacity MBh	Coil Airflow cfm	Ent °F	Lvg °F
Main Htg	-15.2	694	72.0	92.2
Aux Htg	0.0	0	0.0	0.0
Preheat	0.0	0	0.0	0.0
Humidif	0.0	0	0.0	0.0
Opt Vent	0.0	0	0.0	0.0
Total	-15.2			

System Checksums

By Heapy Engineering

System 5 Flr 1 — **Variable Volume Reheat (30% Min Flow Default)**

COOLING COIL PEAK

Peaked at Time: Mo/Hr: 8 / 14
Outside Air: OADB/WB/HR: 89 / 74 / 104

	Space Sens. + Lat. Btu/h	Plenum Sens. + Lat Btu/h	Net Total Btu/h	Percent Of Total (%)
Envelope Loads				
Skylite Solar	0	0	0	0
Skylite Cond	0	0	0	0
Roof Cond	10,785	42,091	52,876	2
Glass Solar	142,970	0	142,970	7
Glass/Door Cond	34,070	0	34,070	2
Wall Cond	33,862	3,451	37,313	2
Partition/Door	26,290		26,290	1
Floor	0		0	0
Adjacent Floor	0	0	0	0
Infiltration	0		0	0
Sub Total ==>	247,978	45,542	293,519	14
Internal Loads				
Lights	157,108	23,925	181,032	8
People	852,344	0	852,344	40
Misc	171,481	0	171,481	8
Sub Total ==>	1,180,933	23,925	1,204,858	56
Ceiling Load	16,327	-16,327	0	0
Ventilation Load	0	0	612,147	28
Adj Air Trans Heat	0		0	0
Dehumid. Ov Sizing			0	0
Ov/Undr Sizing	72,158		72,158	3
Exhaust Heat		-27,839	-27,839	-1
Sup. Fan Heat			0	0
Ret. Fan Heat		0	0	0
Duct Heat Pkup		0	0	0
Underflr Sup Ht Pkup			0	0
Supply Air Leakage		0	0	0
Grand Total ==>	1,517,395	25,301	2,154,844	100.00

CLG SPACE PEAK

Mo/Hr: 8 / 14
OADB: 89

	Space Sensible Btu/h	Percent Of Total (%)
Envelope Loads		
Skylite Solar	0	0
Skylite Cond	0	0
Roof Cond	10,785	1
Glass Solar	142,970	13
Glass/Door Cond	34,070	3
Wall Cond	33,862	3
Partition/Door	26,290	2
Floor	0	0
Adjacent Floor	0	0
Infiltration	0	0
Sub Total ==>	247,978	23
Internal Loads		
Lights	157,108	15
People	414,086	38
Misc	171,481	16
Sub Total ==>	742,674	69
Ceiling Load	16,924	2
Ventilation Load	0	0
Adj Air Trans Heat	0	0
Ov/Undr Sizing	71,944	7
Grand Total ==>	1,079,520	100.00

HEATING COIL PEAK

Mo/Hr: Heating Design
OADB: 5

	Space Peak Space Sens Btu/h	Coil Peak Tot Sens Btu/h	Percent Of Total (%)
Envelope Loads			
Skylite Solar	0	0	0.00
Skylite Cond	0	0	0.00
Roof Cond	-8,040	-41,089	1.25
Glass Solar	0	0	0.00
Glass/Door Cond	-184,279	-184,279	5.61
Wall Cond	-78,621	-85,348	2.60
Partition/Door	-27,454	-27,454	0.84
Floor	-65,038	-65,038	1.98
Adjacent Floor	0	0	0
Infiltration	-128,361	-128,361	3.91
Sub Total ==>	-491,793	-531,569	16.19
Internal Loads			
Lights	0	0	0.00
People	0	0	0.00
Misc	0	0	0.00
Sub Total ==>	0	0	0.00
Ceiling Load	-9,189	0	0.00
Ventilation Load	0	-1,433,975	43.67
Adj Air Trans Heat	0	0	0
Ov/Undr Sizing	-723,306	-723,306	22.03
Exhaust Heat		8,066	-0.25
OA Preheat Diff.		0	0.00
RA Preheat Diff.		-479,593	14.61
Additional Reheat		-122,941	3.74
Underflr Sup Ht Pkup		0	0.00
Supply Air Leakage		0	0.00
Grand Total ==>	-1,224,287	-3,283,318	100.00

TEMPERATURES

	Cooling	Heating
SADB	55.0	91.5
Ra Plenum	76.5	71.3
Return	76.5	71.5
Ret/OA	81.0	46.9
Fn MtrTD	0.0	0.0
Fn BldTD	0.0	0.0
Fn Frict	0.0	0.0

AIRFLOWS

	Cooling	Heating
Diffuser	49,119	53,421
Terminal	49,119	53,421
Main Fan	49,119	53,420
Sec Fan	0	0
Nom Vent	17,279	19,764
AHU Vent	17,279	19,764
Infil	0	1,769
MinStop/Rh	27,393	53,420
Return	49,101	50,783
Exhaust	17,261	17,127
Rm Exh	18	4,407
Auxiliary	0	0
Leakage Dwn	0	0
Leakage Ups	0	0

ENGINEERING CKS

	Cooling	Heating
% OA	35.2	37.0
cfm/ft²	0.98	1.06
cfm/ton	273.54	
ft²/ton	279.42	
Btu/hr·ft²	42.95	-63.38
No. People	1,405	

COOLING COIL SELECTION

	Total Capacity ton	Total Capacity MBh	Sens Cap. MBh	Coil Airflow cfm	Enter DB °F	Enter WB °F	Enter HR gr/lb	Leave DB °F	Leave WB °F	Leave HR gr/lb
Main Clg	179.6	2,154.8	1,371.8	49,105	81.0	68.1	85.5	55.0	54.1	62.7
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Total	179.6	2,154.8								

AREAS

	Gross Total	Glass ft²	Glass (%)
Floor	50,176		
Part	9,700		
Int Door	0		
ExFlr	1,330		
Roof	12,634	0	0
Wall	20,506	4,577	22
Ext Door	724	0	0

HEATING COIL SELECTION

	Capacity MBh	Coil Airflow cfm	Ent °F	Lvg °F
Main Htg	-2,110.0	49,119	55.0	94.7
Aux Htg	0.0	0	0.0	0.0
Preheat	-1,070.1	19,764	5.0	55.0
Reheat	-980.8	53,420	55.0	72.0
Humidif	0.0	0	0.0	0.0
Opt Vent	0.0	0	0.0	0.0
Total	-3,180.2			

System Checksums

By Heapy Engineering

System 5 Flr 2 — **Variable Volume Reheat (30% Min Flow Default)**

COOLING COIL PEAK

Peaked at Time: Mo/Hr: 8 / 14
Outside Air: OADB/WB/HR: 89 / 74 / 104

	Space Sens. + Lat. Btu/h	Plenum Sens. + Lat Btu/h	Net Total Btu/h	Percent Of Total (%)
Envelope Loads				
Skylite Solar	0	0	0	0
Skylite Cond	0	0	0	0
Roof Cond	0	47,161	47,161	4
Glass Solar	96,553	0	96,553	7
Glass/Door Cond	21,854	0	21,854	2
Wall Cond	17,838	2,190	20,028	2
Partition/Door	44,353		44,353	3
Floor	0		0	0
Adjacent Floor	0	0	0	0
Infiltration	0		0	0
Sub Total ==>	180,598	49,351	229,949	17
Internal Loads				
Lights	128,327	14,142	142,469	11
People	351,718	0	351,718	27
Misc	94,603	0	94,603	7
Sub Total ==>	574,648	14,142	588,790	45
Ceiling Load	16,803	-16,803	0	0
Ventilation Load	0	0	495,725	38
Adj Air Trans Heat	624		624	0
Dehumid. Ov Sizing			0	0
Ov/Undr Sizing	28,601		28,601	2
Exhaust Heat		-21,972	-21,972	-2
Sup. Fan Heat			0	0
Ret. Fan Heat		0	0	0
Duct Heat Pkup		0	0	0
Underflr Sup Ht Pkup			0	0
Supply Air Leakage		0	0	0
Grand Total ==>	801,274	24,718	1,321,717	100.00

CLG SPACE PEAK

Mo/Hr: 8 / 14
OADB: 89

	Space Sensible Btu/h	Percent Of Total (%)
Envelope Loads		
Skylite Solar	0	0
Skylite Cond	0	0
Roof Cond	0	0
Glass Solar	96,553	15
Glass/Door Cond	21,854	3
Wall Cond	17,838	3
Partition/Door	44,353	7
Floor	0	0
Adjacent Floor	0	0
Infiltration	0	0
Sub Total ==>	180,598	28
Internal Loads		
Lights	128,327	20
People	200,066	31
Misc	94,603	15
Sub Total ==>	422,996	65
Ceiling Load	16,803	3
Ventilation Load	0	0
Adj Air Trans Heat	624	0
Ov/Undr Sizing	28,601	4
Grand Total ==>	649,622	100.00

HEATING COIL PEAK

Mo/Hr: Heating Design
OADB: 5

	Space Peak Space Sens Btu/h	Coil Peak Tot Sens Btu/h	Percent Of Total (%)
Envelope Loads			
Skylite Solar	0	0	0.00
Skylite Cond	0	0	0.00
Roof Cond	0	-54,314	2.76
Glass Solar	0	0	0.00
Glass/Door Cond	-126,358	-126,358	6.41
Wall Cond	-59,704	-67,583	3.43
Partition/Door	-44,609	-44,609	2.26
Floor	0	0	0.00
Adjacent Floor	0	0	0
Infiltration	-87,246	-87,246	4.43
Sub Total ==>	-317,917	-380,109	19.28
Internal Loads			
Lights	0	0	0.00
People	0	0	0.00
Misc	2,560	2,560	-0.13
Sub Total ==>	2,560	2,560	-0.13
Ceiling Load	-15,386	0	0.00
Ventilation Load	0	-915,643	46.45
Adj Air Trans Heat	-1,092	-1,092	0
Ov/Undr Sizing	-383,147	-383,147	19.44
Exhaust Heat		22,180	-1.13
OA Preheat Diff.		0	0.00
RA Preheat Diff.		-294,157	14.92
Additional Reheat		-21,990	1.12
Underflr Sup Ht Pkup		0	0.00
Supply Air Leakage		0	0.00
Grand Total ==>	-714,981	-1,971,397	100.00

TEMPERATURES

	Cooling	Heating
SADB	55.0	91.8
Ra Plenum	76.8	70.3
Return	76.8	70.3
Ret/OA	82.1	44.3
Fn MtrTD	0.0	0.0
Fn BldTD	0.0	0.0
Fn Frict	0.0	0.0

AIRFLOWS

	Cooling	Heating
Diffuser	29,793	31,701
Terminal	29,793	31,701
Main Fan	29,793	31,701
Sec Fan	0	0
Nom Vent	12,620	12,620
AHU Vent	12,620	12,620
Infil	0	1,210
MinStop/Rh	17,423	31,701
Return	28,444	31,410
Exhaust	11,271	12,329
Rm Exh	1,349	1,501
Auxiliary	0	0
Leakage Dwn	0	0
Leakage Ups	0	0

ENGINEERING CKS

	Cooling	Heating
% OA	42.4	39.8
cfm/ft²	0.84	0.90
cfm/ton	270.49	
ft²/ton	320.37	
Btu/hr·ft²	37.46	-54.64
No. People	900	

COOLING COIL SELECTION

	Total Capacity ton	Total Capacity MBh	Sens Cap. MBh	Coil Airflow cfm	Enter DB °F	Enter WB °F	Enter HR gr/lb	Leave DB °F	Leave WB °F	Leave HR gr/lb
Main Clg	110.1	1,321.7	869.6	29,792	82.1	68.2	84.3	55.0	54.0	62.6
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Total	110.1	1,321.7								

AREAS

	Gross Total	Glass ft²	Glass (%)
Floor	35,287		
Part	15,220		
Int Door	0		
ExFlr	0		
Roof	14,648	0	0
Wall	14,515	3,330	23
Ext Door	0	0	0

HEATING COIL SELECTION

	Capacity MBh	Coil Airflow cfm	Ent °F	Lvg °F
Main Htg	-1,244.6	29,793	55.0	93.6
Aux Htg	0.0	0	0.0	0.0
Preheat	-683.3	12,620	5.0	55.0
Reheat	-578.7	31,701	55.0	71.9
Humidif	0.0	0	0.0	0.0
Opt Vent	0.0	0	0.0	0.0
Total	-1,928.0			

System Checksums

By Heapy Engineering

System 5 Flr 3 — **Variable Volume Reheat (30% Min Flow Default)**

COOLING COIL PEAK

Peaked at Time: Mo/Hr: 7 / 14
Outside Air: OADB/WB/HR: 86 / 74 / 110

	Space Sens. + Lat. Btu/h	Plenum Sens. + Lat Btu/h	Net Total Btu/h	Percent Of Total (%)
Envelope Loads				
Skylite Solar	0	0	0	0
Skylite Cond	0	0	0	0
Roof Cond	0	19,663	19,663	3
Glass Solar	50,204	0	50,204	7
Glass/Door Cond	8,538	0	8,538	1
Wall Cond	6,082	631	6,712	1
Partition/Door	46,816		46,816	6
Floor	0		0	0
Adjacent Floor	0	0	0	0
Infiltration	0		0	0
Sub Total ==>	111,640	20,294	131,934	18
Internal Loads				
Lights	69,662	4,292	73,954	10
People	185,710	0	185,710	25
Misc	56,197	0	56,197	7
Sub Total ==>	311,569	4,292	315,861	42
Ceiling Load	6,589	-6,589	0	0
Ventilation Load	0	0	300,751	40
Adj Air Trans Heat	149		149	0
Dehumid. Ov Sizing			0	0
Ov/Undr Sizing	11,306		11,306	2
Exhaust Heat		-9,154	-9,154	-1
Sup. Fan Heat			0	0
Ret. Fan Heat		0	0	0
Duct Heat Pkup		0	0	0
Underflr Sup Ht Pkup			0	0
Supply Air Leakage		0	0	0
Grand Total ==>	441,253	8,844	750,848	100.00

CLG SPACE PEAK

Mo/Hr: 8 / 14
OADB: 89

	Space Sensible Btu/h	Percent Of Total (%)
Envelope Loads		
Skylite Solar	0	0
Skylite Cond	0	0
Roof Cond	0	0
Glass Solar	51,644	15
Glass/Door Cond	11,305	3
Wall Cond	5,608	2
Partition/Door	46,816	13
Floor	0	0
Adjacent Floor	0	0
Infiltration	0	0
Sub Total ==>	115,373	33
Internal Loads		
Lights	69,662	20
People	96,587	27
Misc	56,197	16
Sub Total ==>	222,446	63
Ceiling Load	5,518	2
Ventilation Load	0	0
Adj Air Trans Heat	0	0
Ov/Undr Sizing	11,396	3
Grand Total ==>	354,732	100.00

HEATING COIL PEAK

Mo/Hr: Heating Design
OADB: 5

	Space Peak Space Sens Btu/h	Coil Peak Tot Sens Btu/h	Percent Of Total (%)
Envelope Loads			
Skylite Solar	0	0	0.00
Skylite Cond	0	0	0.00
Roof Cond	0	-100,025	9.25
Glass Solar	0	0	0.00
Glass/Door Cond	-75,284	-75,284	6.96
Wall Cond	-41,855	-46,397	4.29
Partition/Door	-47,165	-47,165	4.36
Floor	0	0	0.00
Adjacent Floor	0	0	0
Infiltration	-51,737	-51,737	4.78
Sub Total ==>	-216,040	-320,607	29.64
Internal Loads			
Lights	0	0	0.00
People	0	0	0.00
Misc	0	0	0.00
Sub Total ==>	0	0	0.00
Ceiling Load	-26,093	0	0.00
Ventilation Load	0	-560,559	51.82
Adj Air Trans Heat	-299	-299	0
Ov/Undr Sizing	-103,290	-103,290	9.55
Exhaust Heat		36,618	-3.39
OA Preheat Diff.		0	0.00
RA Preheat Diff.		-129,145	11.94
Additional Reheat		-4,454	0.41
Underflr Sup Ht Pkup		0	0.00
Supply Air Leakage		0	0.00
Grand Total ==>	-345,723	-1,081,737	100.00

TEMPERATURES

	Cooling	Heating
SADB	55.0	88.8
Ra Plenum	76.1	67.9
Return	76.1	67.9
Ret/OA	80.8	39.8
Fn MtrTD	0.0	0.0
Fn BldTD	0.0	0.0
Fn Frict	0.0	0.0

AIRFLOWS

	Cooling	Heating
Diffuser	16,356	17,257
Terminal	16,356	17,257
Main Fan	16,356	17,257
Sec Fan	0	0
Nom Vent	7,726	7,726
AHU Vent	7,726	7,726
Infil	0	713
MinStop/Rh	10,184	17,257
Return	16,331	17,869
Exhaust	7,701	8,338
Rm Exh	25	101
Auxiliary	0	0
Leakage Dwn	0	0
Leakage Ups	0	0

ENGINEERING CKS

	Cooling	Heating
% OA	47.2	44.8
cfm/ft²	0.81	0.85
cfm/ton	261.45	
ft²/ton	324.59	
Btu/hr·ft²	36.97	-57.97
No. People	455	

COOLING COIL SELECTION

	Total Capacity ton	Total Capacity MBh	Sens Cap. MBh	Coil Airflow cfm	Enter DB °F	Enter WB °F	Enter HR gr/lb	Leave DB °F	Leave WB °F	Leave HR gr/lb
Main Clg	62.6	750.7	453.0	16,221	80.8	68.7	89.1	55.0	54.0	62.7
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Total	62.6	750.7								

AREAS

	Gross Total	Glass ft²	Glass (%)
Floor	20,306		
Part	19,000		
Int Door	0		
ExFlr	0		
Roof	20,306	0	0
Wall	8,557	1,975	23
Ext Door	0	0	0

HEATING COIL SELECTION

	Capacity MBh	Coil Airflow cfm	Ent °F	Lvg °F
Main Htg	-758.7	16,356	55.0	97.8
Aux Htg	0.0	0	0.0	0.0
Preheat	-418.3	7,726	5.0	55.0
Reheat	-317.7	17,257	55.0	72.0
Humidif	0.0	0	0.0	0.0
Opt Vent	0.0	0	0.0	0.0
Total	-1,177.0			

SYSTEM ENTERED VALUES

By Heapy Engineering

AHU-1 - Variable Volume Reheat (30% Min Flow Default)

Design Air Conditions

	Max	Min				
Cooling supply:			Supply duct temperature diff:	0.0 °F	Design humidity ratio diff:	
Leaving cooling coil:	53.0 °F	52.0 °F	Reheat Temperature diff:	0.0 °F	Min room relative humidity:	
Heating supply:	95.0 °F	55.0 °F				

Economizer

Type: Enthalpy	"On" Point:	Btu/lb	Max Percent OA:	100%	Schedule:	Available (100%)

Evaporative Cooling

Type: None	Direct efficiency:	0%	Available (100%)	Indirect efficiency:	0% Available (100%)

Advanced Options

Cooling coil sizing method:	Block	Supply fan motor location:	Supply	Night purge schedule:	Off (0%)
Cooling coil location:	System	Return fan motor location:	Omit	Optimum start schedule:	Available 100%
Block cooling airflow:		Supply fan cofiguration:	Draw Thru	Optimum stop schedule:	Off (0%)
Ventilation deck location:	Return/Outdoor Deck	Supply fan sizing:	Block		
Supply duct location:	Return Air	Fan mechanical efficiency :	75%	CO2-based DCV:	None
Return air path:	PLENUM	Apply Std62 People Avg:	No		
		Std62 Max Vent (Z) Ratio:		System ventilation flag:	Sum Room OA Reqs

Reset per worst case room schedule:	Available 100%		Supply air path / duct location:	Return Air
Max reset:	7.0		Space convective gains to occupied layer:	100 %
Use system default outside air reset:	Yes		Underfloor plenum height:	0.0 ft
			Conductive resistance of raised floor:	0.8 hr·ft²·°F/Btu
			Upstream nominal leakage fraction:	0 %
			Downstream constant leakage fraction:	0 %
			Aux cooling coil losses to plenum:	0 %

	Control Method	Control Type
Auxiliary cooling coil	Activate After Primary System	None
Auxiliary heating coil	Activate After Primary System	None
Auxiliary fan	No Fan	

Coils

	Capacity	Schedule		
Main cooling:	1,160.0 Mbh	Available (100%)	People	100%
Aux cooling:		Available (100%)	Lights	100%
Main heating:	1,370.0 Mbh	Available (100%)	Misc loads	100%
Aux heating:		Available (100%)		
Preheat:	0.0Mbh	Available (100%)		
Reheat:	845.0 Mbh	Available (100%)		
Humidification:	100.0 % of Design Capacity	Available (100%)		

Fans

	Type	Static Press.	90.1 SP Adj	Full Load Energy Rate	Schedule	Efficiency	Priority
Primary	FC Centrifugal var freq drv	0.0 in. wg	0.0 in. wg	26.70000 Nominal Hp	Available (100%)	90	
Secondary	None	0.0 in. wg	NA	0.00000 kW	Available (100%)	85	
Return	None	0.0 in. wg	0.0 in. wg	0.00000 kW	Available (100%)	90	
System Exhaust	FC Centrifugal var freq drv	0.0 in. wg	0.0 in. wg	6.50000 Nominal Hp	Available (100%)	90	
Room Exhaust	None	0.0 in. wg	0.0 in. wg	0.00000 kW	Available (100%)	85	
Optional ventilation	None	0.0 in. wg	NA	0.00000 kW	Available (100%)	90	
Auxiliary	None	0.0 in. wg	NA	0.00000 kW	Available (100%)	85	

SYSTEM ENTERED VALUES

By Heapy Engineering

AHU-2 - Variable Volume Reheat (30% Min Flow Default)

Design Air Conditions

	Max	Min				
Cooling supply:			Supply duct temperature diff:	0.0 °F	Design humidity ratio diff:	
Leaving cooling coil:	53.0 °F	52.0 °F	Reheat Temperature diff:	0.0 °F	Min room relative humidity:	
Heating supply:	95.0 °F	75.0 °F				

Economizer

Type: Dry Bulb	"On" Point: 68 °F	Max Percent OA: 100%	Schedule: Available (100%)

Evaporative Cooling

Type: None	Direct efficiency:	0%	Available (100%)	Indirect efficiency:	0% Available (100%)

Advanced Options

Cooling coil sizing method:	Block	Supply fan motor location:	Supply	Night purge schedule:	Off (0%)
Cooling coil location:	System	Return fan motor location:	Omit	Optimum start schedule:	Available 100%
Block cooling airflow:		Supply fan cofiguration:	Draw Thru	Optimum stop schedule:	Off (0%)
Ventilation deck location:	Return/Outdoor Deck	Supply fan sizing:	Block		
Supply duct location:	Return Air	Fan mechanical efficiency :	75%	CO2-based DCV:	None
Return air path:	PLENUM	Apply Std62 People Avg:	No		
		Std62 Max Vent (Z) Ratio:		System ventilation flag:	Sum Room OA Reqs

Reset per worst case room schedule:	Off (0%)		Supply air path / duct location:	Return Air
Max reset:			Space convective gains to occupied layer:	100 %
Use system default outside air reset:	Yes		Underfloor plenum height:	0.0 ft
			Conductive resistance of raised floor:	0.8 hr·ft²·°F/Btu
			Upstream nominal leakage fraction:	0 %
			Downstream constant leakage fraction:	0 %
	Control Method	Control Type	Aux cooling coil losses to plenum:	0 %
Auxiliary cooling coil	Activate After Primary System	None		
Auxiliary heating coil	Activate After Primary System	None		
Auxiliary fan	No Fan			

Coils

	Capacity	Schedule		
Main cooling:	558.0 Mbh	Available (100%)	People	100%
Aux cooling:		Available (100%)	Lights	100%
Main heating:	260.0 Mbh	Available (100%)	Misc loads	100%
Aux heating:		Available (100%)		
Preheat:	427.0Mbh	Available (100%)		
Reheat:	260.0 Mbh	Available (100%)		
Humidification:	100.0 % of Design Capacity	Available (100%)		

Fans

	Type	Static Press.	90.1 SP Adj	Full Load Energy Rate	Schedule	Efficiency	Priority
Primary	FC Centrifugal var freq drv	0.0 in. wg	0.0 in. wg	13.00000 Nominal Hp	Available (100%)	90	
Secondary	None	0.0 in. wg	NA	0.00000 kW	Available (100%)	85	
Return	None	0.0 in. wg	0.0 in. wg	0.00000 kW	Available (100%)	90	
System Exhaust	FC Centrifugal var freq drv	0.0 in. wg	0.0 in. wg	5.10000 Nominal Hp	Available (100%)	90	
Room Exhaust	None	0.0 in. wg	0.0 in. wg	0.00000 kW	Available (100%)	85	
Optional ventilation	None	0.0 in. wg	NA	0.00000 kW	Available (100%)	90	
Auxiliary	None	0.0 in. wg	NA	0.00000 kW	Available (100%)	85	

SYSTEM ENTERED VALUES

By Heapy Engineering

AHU-3 - Variable Volume Reheat (30% Min Flow Default)

Design Air Conditions

	Max	Min				
Cooling supply:			Supply duct temperature diff:	0.0 °F	Design humidity ratio diff:	
Leaving cooling coil:	53.0 °F	52.0 °F	Reheat Temperature diff:	0.0 °F	Min room relative humidity:	
Heating supply:	95.0 °F	75.0 °F				

Economizer

Type: Dry Bulb	"On" Point: 68 °F	Max Percent OA: 100%	Schedule: Available (100%)

Evaporative Cooling

Type: None	Direct efficiency:	0%	Available (100%)	Indirect efficiency:	0% Available (100%)

Advanced Options

Cooling coil sizing method:	Block	Supply fan motor location:	Supply	Night purge schedule:	Off (0%)
Cooling coil location:	System	Return fan motor location:	Omit	Optimum start schedule:	Available 100%
Block cooling airflow:		Supply fan cofiguration:	Draw Thru	Optimum stop schedule:	Off (0%)
Ventilation deck location:	Return/Outdoor Deck	Supply fan sizing:	Block		
Supply duct location:	Return Air	Fan mechanical efficiency :	75%	CO2-based DCV:	None
Return air path:	PLENUM	Apply Std62 People Avg:	No		
		Std62 Max Vent (Z) Ratio:		System ventilation flag:	Sum Room OA Reqs

Reset per worst case room schedule:	Off (0%)	Supply air path / duct location:	Return Air
Max reset:		Space convective gains to occupied layer:	100 %
Use system default outside air reset:	Yes	Underfloor plenum height:	0.0 ft
		Conductive resistance of raised floor:	0.8 hr·ft²·°F/Btu
		Upstream nominal leakage fraction:	0 %
		Downstream constant leakage fraction:	0 %
		Aux cooling coil losses to plenum:	0 %

	Control Method	Control Type
Auxiliary cooling coil	Activate After Primary System	None
Auxiliary heating coil	Activate After Primary System	None
Auxiliary fan	No Fan	

Coils

	Capacity	Schedule	Diversity	
Main cooling:	352.0 Mbh	Available (100%)	People	100%
Aux cooling:		Available (100%)	Lights	100%
Main heating:	147.0 Mbh	Available (100%)	Misc loads	100%
Aux heating:		Available (100%)		
Preheat:	180.0Mbh	Available (100%)		
Reheat:	147.0 Mbh	Available (100%)		
Humidification:	100.0 % of Design Capacity	Available (100%)		

Fans

	Type	Static Press.	90.1 SP Adj	Full Load Energy Rate	Schedule	Efficiency	Priority
Primary	FC Centrifugal var freq drv	0.0 in. wg	0.0 in. wg	10.90000 Nominal Hp	Available (100%)	90	
Secondary	None	0.0 in. wg	NA	0.00000 kW	Available (100%)	85	
Return	None	0.0 in. wg	0.0 in. wg	0.00000 kW	Available (100%)	90	
System Exhaust	FC Centrifugal var freq drv	0.0 in. wg	0.0 in. wg	5.00000 Nominal Hp	Available (100%)	90	
Room Exhaust	None	0.0 in. wg	0.0 in. wg	0.00000 kW	Available (100%)	85	
Optional ventilation	None	0.0 in. wg	NA	0.00000 kW	Available (100%)	90	
Auxiliary	None	0.0 in. wg	NA	0.00000 kW	Available (100%)	85	

SYSTEM ENTERED VALUES

By Heapy Engineering

UV - Unit Ventilator

Design Air Conditions

	Max	Min				
Cooling supply:	57.0 °F	56.0 °F	Supply duct temperature diff:	0.0 °F	Design humidity ratio diff:	
Leaving cooling coil:			Reheat Temperature diff:	0.0 °F	Min room relative humidity:	
Heating supply:	95.0 °F	95.0 °F				

Economizer

Type: Enthalpy | "On" Point: 30 Btu/lb | Max Percent OA: 100% | Schedule: Available (100%)

Evaporative Cooling

Type: None | Direct efficiency: 0% Available (100%) | Indirect efficiency: 0% Available (100%)

Advanced Options

Cooling coil sizing method:	Block	Supply fan motor location:	Supply	Night purge schedule:	Off (0%)
Cooling coil location:	Room	Return fan motor location:	Return	Optimum start schedule:	Off (0%)
Block cooling airflow:		Supply fan cofiguration:	Blow Thru	Optimum stop schedule:	Off (0%)
Ventilation deck location:	Return/Outdoor Deck	Supply fan sizing:	Peak		
Supply duct location:	Return Air	Fan mechanical efficiency :	75%	CO2-based DCV:	None
Return air path:	PLENUM	Apply Std62 People Avg:	No		
		Std62 Max Vent (Z) Ratio:		System ventilation flag:	Sum Room OA Reqs

Reset per worst case room schedule:	Off (0%)		Supply air path / duct location:	Return Air
Max reset:			Space convective gains to occupied layer:	100 %
Use system default outside air reset:	Yes		Underfloor plenum height:	0.0 ft
			Conductive resistance of raised floor:	0.8 hr·ft²·°F/Btu
			Upstream nominal leakage fraction:	0 %
			Downstream constant leakage fraction:	0 %
			Aux cooling coil losses to plenum:	0 %

	Control Method	Control Type
Auxiliary cooling coil	Activate After Primary System	None
Auxiliary heating coil	Activate After Primary System	None
Auxiliary fan	No Fan	

Coils

	Capacity	Schedule	Diversity	
Main cooling:	2,039.2 Mbh	Available (100%)	People	100%
Aux cooling:		Available (100%)	Lights	100%
Main heating:	2,865.0 Mbh	Available (100%)	Misc loads	100%
Aux heating:		Available (100%)		
Preheat:	0.0Mbh	Available (100%)		
Reheat:	100.0 % of Design Capacity	Available (100%)		
Humidification:	100.0 % of Design Capacity	Available (100%)		

Fans

	Type	Static Press.	90.1 SP Adj	Full Load Energy Rate	Schedule	Efficiency	Priority
Primary	FC Centrifugal var freq drv	0.0 in. wg	0.0 in. wg	12.50000 Nominal Hp	Available (100%)	90	
Secondary	None	0.0 in. wg	NA	0.00000 kW	Available (100%)	85	
Return	None	0.0 in. wg	0.0 in. wg	0.00000 kW	Available (100%)	90	
System Exhaust	None	0.0 in. wg	0.0 in. wg	0.00000 kW	Available (100%)	90	
Room Exhaust	None	0.0 in. wg	0.0 in. wg	0.00000 kW	Available (100%)	85	
Optional ventilation	None	0.0 in. wg	NA	0.00000 kW	Available (100%)	90	
Auxiliary	None	0.0 in. wg	NA	0.00000 kW	Available (100%)	85	

SYSTEM ENTERED VALUES

By Heapy Engineering

FC - Fan Coil

Design Air Conditions

	Max	Min				
Cooling supply:	66.0 °F	64.5 °F	Supply duct temperature diff:	0.0 °F	Design humidity ratio diff:	
Leaving cooling coil:			Reheat Temperature diff:	0.0 °F	Min room relative humidity:	
Heating supply:	86.0 °F	84.0 °F				

Optional Ventilation

Configuration: Dehumidify (priority) or Cool / Heat	Cooling SADB:	Cooling SADB hi limit: 55 °F	Cooling schedule: Available (100%)
Control method: Optimize Supply Air Dry Bulb	Heating SADB:	Cooling SADB low limit: 53 °F	Heating schedule: Available (100%)
Deck location: Ducted	Cooling SADP: 45 °F	Cooling SADP hi limit:	
Level location:		Cooling SADP low limit:	

Economizer

Type: Enthalpy	"On" Point: Btu/lb	Max Percent OA: 100%	Schedule: Available (100%)

Stage 1 Exhaust Air Heat Recovery

Type: Total-energy wheel (OA precondition) | Sup-side deck: Ventilation upstream | Exh-side deck: System exhaust | Schedule: Available (100%)

Sensible

Clg effectiveness at 100% airflow: 60%		Htg effectiveness at 100% airflow: 60%	
Clg effectiveness at 75% airflow: 60%		HTg effectiveness at 75% airflow: 60%	

Latent

Clg effectiveness at 100% airflow: 60%		Htg effectiveness at 100% airflow: 60%	
Clg effectiveness at 75% airflow: 60%		HTg effectiveness at 75% airflow: 60%	

Supply Side Options

Design air leaving dry bulb:		Economizer lockout: Yes	
Design air leaving humidity ratio:		Part load control: Modulated	
Coolant type: N/A		Static pressure drop: 1.0 in. wg	
Coolant approach: N/A		Bypass dampers: Yes	

Parasitic energy: 0.4 kW

Exhaust Side Options

Percent airflow:		Evap precooler type: None	
Heat source: 0 °F		Evap precooler Eff:	
Fan static pressure : 0.0 in. wg		Frost prevention type: Outdoor air preheat	
Fan static pressure drop: 1.0 in. wg		Frost prevention set point: -5 °F	
Integral heat recovery: No		OA frost threshhold: -5 °F	
Bypass dampers: Yes			

Evaporative Cooling

Type: None	Direct efficiency: 0% Available (100%)	Indirect efficiency: 0% Available (100%)	

Advanced Options

Cooling coil sizing method:	Block	Supply fan motor location:	Supply	Night purge schedule:	Off (0%)
Cooling coil location:	Room	Return fan motor location:	Omit	Optimum start schedule:	Off (0%)
Block cooling airflow:		Supply fan cofiguration:	Blow Thru	Optimum stop schedule:	Off (0%)
Ventilation deck location:	Ducted	Supply fan sizing:	Peak		
Supply duct location:	Return Air	Fan mechanical efficiency :	75%	CO2-based DCV:	None
Return air path:	DUCTED	Apply Std62 People Avg:	No		
		Std62 Max Vent (Z) Ratio:		System ventilation flag:	Sum Room OA Reqs

Reset per worst case room schedule:	Off (0%)			Supply air path / duct location:	Return Air
Max reset:				Space convective gains to occupied layer:	100 %
Use system default outside air reset:	Yes			Underfloor plenum height:	0.0 ft
				Conductive resistance of raised floor:	0.8 hr·ft²·°F/Btu
				Upstream nominal leakage fraction:	0 %
				Downstream constant leakage fraction:	0 %
	Control Method	Control Type		Aux cooling coil losses to plenum:	0 %
Auxiliary cooling coil	Activate After Primary System	None			
Auxiliary heating coil	Activate After Primary System	None			
Auxiliary fan	No Fan				

SYSTEM ENTERED VALUES

By Heapy Engineering

FC - Fan Coil

Coils	Capacity	Schedule	Diversity	
Main cooling:	877.9 Mbh	Available (100%)	People	100%
Aux cooling:		Available (100%)	Lights	100%
Main heating:	638.9 Mbh	Available (100%)	Misc loads	100%
Aux heating:		Available (100%)		
Preheat:	195.0Mbh	Available (100%)		
Reheat:	100.0 % of Design Capacity	Available (100%)		
Humidification:	100.0 % of Design Capacity	Available (100%)		

Fans	Type	Static Press.	90.1 SP Adj	Full Load Energy Rate	Schedule	Efficiency	Priority
Primary	FC Centrifugal var freq drv	0.0 in. wg	0.0 in. wg	5.67000 kW	Available (100%)	90	
Secondary	None	0.0 in. wg	NA	0.00000 kW	Available (100%)	85	
Return	None	0.0 in. wg	0.0 in. wg	0.00000 kW	Available (100%)	90	
System Exhaust	FC Centrifugal const vol	0.0 in. wg	0.0 in. wg	7.50000 Nominal Hp	Available (100%)	90	
Room Exhaust	None	0.0 in. wg	0.0 in. wg	0.00000 kW	Available (100%)	85	
Optional ventilation	FC Centrifugal const vol	0.0 in. wg	NA	10.00000 Nominal Hp	Available (100%)	90	
Auxiliary	None	0.0 in. wg	NA	0.00000 kW	Available (100%)	85	

SYSTEM ENTERED VALUES

By Heapy Engineering

HEATING ONLY - Unit Heaters

Design Air Conditions

	Max	Min				
Cooling supply:			Supply duct temperature diff:	0.0 °F	Design humidity ratio diff:	
Leaving cooling coil:			Reheat Temperature diff:	0.0 °F	Min room relative humidity:	
Heating supply:	105.0 °F					

Advanced Options

Cooling coil sizing method:	No Coil	Supply fan motor location:	Supply	Night purge schedule:	Off (0%)
Cooling coil location:	Room	Return fan motor location:	Return	Optimum start schedule:	Off (0%)
Block cooling airflow:		Supply fan cofiguration:	Draw Thru	Optimum stop schedule:	Off (0%)
Ventilation deck location:	Return/Outdoor Deck	Supply fan sizing:	No Fan		
Supply duct location:	Return Air	Fan mechanical efficiency :	75%	CO2-based DCV:	None
Return air path:	ROOMDK	Apply Std62 People Avg:	No		
		Std62 Max Vent (Z) Ratio:		System ventilation flag:	Sum Room OA Reqs

Reset per worst case room schedule:	Off (0%)		Supply air path / duct location:	Return Air
Max reset:			Space convective gains to occupied layer:	100 %
Use system default outside air reset:	Yes		Underfloor plenum height:	0.0 ft
			Conductive resistance of raised floor:	0.8 hr·ft²·°F/Btu
			Upstream nominal leakage fraction:	0 %
			Downstream constant leakage fraction:	0 %
	Control Method	Control Type	Aux cooling coil losses to plenum:	0 %
Auxiliary cooling coil	Activate After Primary System	None		
Auxiliary heating coil	Activate After Primary System	None		
Auxiliary fan	No Fan			

Coils

	Capacity	Schedule	Diversity	
Main cooling:	0.0 % of Design Capacity by adjusting airfl	Available (100%)	People	100%
Aux cooling:		Available (100%)	Lights	100%
Main heating:	121.0 Mbh	Available (100%)	Misc loads	100%
Aux heating:		Available (100%)		
Preheat:	100.0% of Design Capacity	Available (100%)		
Reheat:	100.0 % of Design Capacity	Available (100%)		
Humidification:	100.0 % of Design Capacity	Available (100%)		

Fans

	Type	Static Press.	90.1 SP Adj	Full Load Energy Rate	Schedule	Efficiency	Priority
Primary	None	0.0 in. wg	0.0 in. wg	0.00000 kW	Available (100%)	90	
Secondary	Unit vent supply fan	0.0 in. wg	NA	1.17000 Nominal Hp	Available (100%)	85	
Return	None	0.0 in. wg	0.0 in. wg	0.00000 kW	Available (100%)	90	
System Exhaust	None	0.0 in. wg	0.0 in. wg	0.00000 kW	Available (100%)	90	
Room Exhaust	None	0.0 in. wg	0.0 in. wg	0.00000 kW	Available (100%)	85	
Optional ventilation	None	0.0 in. wg	NA	0.00000 kW	Available (100%)	90	
Auxiliary	None	0.0 in. wg	NA	0.00000 kW	Available (100%)	85	

SYSTEM ENTERED VALUES

By Heapy Engineering

AHU-4 - Variable Volume Reheat (30% Min Flow Default)

Design Air Conditions

	Max	Min				
Cooling supply:			Supply duct temperature diff:	0.0 °F	Design humidity ratio diff:	
Leaving cooling coil:	53.0 °F	52.0 °F	Reheat Temperature diff:	0.0 °F	Min room relative humidity:	
Heating supply:	95.0 °F	75.0 °F				

Economizer

Type: Dry Bulb	"On" Point: 68 °F	Max Percent OA: 100%	Schedule: Available (100%)

Evaporative Cooling

Type: None	Direct efficiency:	0%	Available (100%)	Indirect efficiency:	0% Available (100%)

Advanced Options

Cooling coil sizing method:	Block	Supply fan motor location:	Supply	Night purge schedule:	Off (0%)
Cooling coil location:	System	Return fan motor location:	Omit	Optimum start schedule:	Off (0%)
Block cooling airflow:		Supply fan cofiguration:	Draw Thru	Optimum stop schedule:	Off (0%)
Ventilation deck location:	Return/Outdoor Deck	Supply fan sizing:	Block		
Supply duct location:	Return Air	Fan mechanical efficiency :	75%	CO2-based DCV:	None
Return air path:	PLENUM	Apply Std62 People Avg:	No		
		Std62 Max Vent (Z) Ratio:		System ventilation flag:	Sum Room OA Reqs

Reset per worst case room schedule:	Off (0%)		Supply air path / duct location:	Return Air
Max reset:			Space convective gains to occupied layer:	100 %
Use system default outside air reset:	Yes		Underfloor plenum height:	0.0 ft
			Conductive resistance of raised floor:	0.8 hr·ft²·°F/Btu
			Upstream nominal leakage fraction:	0 %
			Downstream constant leakage fraction:	0 %
	Control Method	Control Type	Aux cooling coil losses to plenum:	0 %
Auxiliary cooling coil	Activate After Primary System	None		
Auxiliary heating coil	Activate After Primary System	None		
Auxiliary fan	No Fan			

Coils

	Capacity	Schedule		
Main cooling:	272.0 Mbh	Available (100%)	People	100%
Aux cooling:		Available (100%)	Lights	100%
Main heating:	147.0 Mbh	Available (100%)	Misc loads	100%
Aux heating:		Available (100%)		
Preheat:	240.0Mbh	Available (100%)		
Reheat:	147.0 Mbh	Available (100%)		
Humidification:	100.0 % of Design Capacity	Available (100%)		

Fans

	Type	Static Press.	90.1 SP Adj	Full Load Energy Rate	Schedule	Efficiency	Priority
Primary	FC Centrifugal var freq drv	0.0 in. wg	0.0 in. wg	5.00000 Nominal Hp	Available (100%)	90	
Secondary	None	0.0 in. wg	NA	0.00000 kW	Available (100%)	85	
Return	None	0.0 in. wg	0.0 in. wg	0.00000 kW	Available (100%)	90	
System Exhaust	FC Centrifugal var freq drv	0.0 in. wg	0.0 in. wg	3.00000 Nominal Hp	Available (100%)	90	
Room Exhaust	None	0.0 in. wg	0.0 in. wg	0.00000 kW	Available (100%)	85	
Optional ventilation	None	0.0 in. wg	NA	0.00000 kW	Available (100%)	90	
Auxiliary	None	0.0 in. wg	NA	0.00000 kW	Available (100%)	85	

SYSTEM ENTERED VALUES

By Heapy Engineering

SPLIT AC - Computer Room Unit

Design Air Conditions

	Max	Min				
Cooling supply:	65.0 °F	55.0 °F	Supply duct temperature diff:	0.0 °F	Design humidity ratio diff:	
Leaving cooling coil:			Reheat Temperature diff:	0.0 °F	Min room relative humidity:	
Heating supply:	86.0 °F	86.0 °F				

Advanced Options

Cooling coil sizing method:	Peak	Supply fan motor location:	Supply	Night purge schedule:	Off (0%)
Cooling coil location:	Room	Return fan motor location:	Omit	Optimum start schedule:	Off (0%)
Block cooling airflow:		Supply fan cofiguration:	Draw Thru	Optimum stop schedule:	Off (0%)
Ventilation deck location:	Return/Outdoor Deck	Supply fan sizing:	Peak		
Supply duct location:	Return Air	Fan mechanical efficiency :	75%	CO2-based DCV:	None
Return air path:	ROOMDK	Apply Std62 People Avg:	No		
		Std62 Max Vent (Z) Ratio:		System ventilation flag:	Sum Room OA Reqs

Reset per worst case room schedule:	Off (0%)		Supply air path / duct location:	Return Air
Max reset:			Space convective gains to occupied layer:	100 %
Use system default outside air reset:	Yes		Underfloor plenum height:	0.0 ft
			Conductive resistance of raised floor:	0.8 hr·ft²·°F/Btu
			Upstream nominal leakage fraction:	0 %
			Downstream constant leakage fraction:	0 %
	Control Method	Control Type	Aux cooling coil losses to plenum:	0 %
Auxiliary cooling coil	Activate After Primary System	None		
Auxiliary heating coil	Activate After Primary System	None		
Auxiliary fan	No Fan			

Coils

	Capacity	Schedule	Diversity	
Main cooling:	62.0 Mbh	Available (100%)	People	100%
Aux cooling:		Available (100%)	Lights	100%
Main heating:	100.0 % of Design Capacity	Available (100%)	Misc loads	100%
Aux heating:		Available (100%)		
Preheat:	0.0% of Design Capacity	Available (100%)		
Reheat:	0.0 % of Design Capacity	Available (100%)		
Humidification:	0.0 % of Design Capacity	Available (100%)		

Fans

	Type	Static Press.	90.1 SP Adj	Full Load Energy Rate	Schedule	Efficiency	Priority
Primary	FC Centrifugal const vol	0.0 in. wg	0.0 in. wg	0.20000 kW	Available (100%)	90	
Secondary	None	0.0 in. wg	NA	0.00000 kW	Available (100%)	85	
Return	None	0.0 in. wg	0.0 in. wg	0.00000 kW	Available (100%)	90	
System Exhaust	None	0.0 in. wg	0.0 in. wg	0.00000 kW	Available (100%)	90	
Room Exhaust	None	0.0 in. wg	0.0 in. wg	0.00000 kW	Available (100%)	85	
Optional ventilation	None	0.0 in. wg	NA	0.00000 kW	Available (100%)	90	
Auxiliary	None	0.0 in. wg	NA	0.00000 kW	Available (100%)	85	

SYSTEM ENTERED VALUES

By Heapy Engineering

System 5 Flr 1 - Variable Volume Reheat (30% Min Flow Default)

Design Air Conditions

	Max	Min				
Cooling supply:	55.0 °F	55.0 °F	Supply duct temperature diff:	0.0 °F	Design humidity ratio diff:	
Leaving cooling coil:			Reheat Temperature diff:	0.0 °F	Min room relative humidity:	
Heating supply:	92.0 °F	92.0 °F				

Advanced Options

Cooling coil sizing method:	Block	Supply fan motor location:	Supply	Night purge schedule:	Off (0%)
Cooling coil location:	System	Return fan motor location:	Omit	Optimum start schedule:	Off (0%)
Block cooling airflow:		Supply fan cofiguration:	Draw Thru	Optimum stop schedule:	Off (0%)
Ventilation deck location:	Return/Outdoor Deck	Supply fan sizing:	Block		
Supply duct location:	Return Air	Fan mechanical efficiency :	75%	CO2-based DCV:	None
Return air path:	PLENUM	Apply Std62 People Avg:	No		
		Std62 Max Vent (Z) Ratio:		System ventilation flag:	Sum Room OA Reqs

Reset per worst case room schedule:	Cooling Only (Design)
Max reset:	5.0
Use system default outside air reset:	Yes

Supply air path / duct location:	Return Air
Space convective gains to occupied layer:	100 %
Underfloor plenum height:	0.0 ft
Conductive resistance of raised floor:	0.8 hr·ft²·°F/Btu
Upstream nominal leakage fraction:	0 %
Downstream constant leakage fraction:	0 %
Aux cooling coil losses to plenum:	0 %

	Control Method	Control Type
Auxiliary cooling coil	Activate After Primary System	None
Auxiliary heating coil	Activate After Primary System	None
Auxiliary fan	No Fan	

Coils

	Capacity	Schedule	Diversity	
Main cooling:	100.0 % of Design Cooling Capacity	Available (100%)	People	100%
Aux cooling:		Available (100%)	Lights	100%
Main heating:	100.0 % of Design Capacity	Available (100%)	Misc loads	100%
Aux heating:		Available (100%)		
Preheat:	100.0% of Design Capacity	Available (100%)		
Reheat:	100.0 % of Design Capacity	Available (100%)		
Humidification:	100.0 % of Design Capacity	Available (100%)		

Fans

	Type	Static Press.	90.1 SP Adj	Full Load Energy Rate	Schedule	Efficiency	Priority
Primary	90.1-04 Min VAV AF Centrifugal	0.0 in. wg	1.4 in. wg	0.00022 kW	Available (100%)	90	
Secondary	None	0.0 in. wg	NA	0.00000 kW	Available (100%)	85	
Return	None	0.0 in. wg	0.0 in. wg	0.00000 kW	Available (100%)	90	
System Exhaust	90.1-04 Min VAV AF Centrifugal	0.0 in. wg	1.4 in. wg	0.00022 kW	Available (100%)	90	
Room Exhaust	None	0.0 in. wg	0.0 in. wg	0.00000 kW	Available (100%)	85	
Optional ventilation	None	0.0 in. wg	NA	0.00000 kW	Available (100%)	90	
Auxiliary	None	0.0 in. wg	NA	0.00000 kW	Available (100%)	85	

SYSTEM ENTERED VALUES

By Heapy Engineering

HEATING ONLY - Unit Heaters

Design Air Conditions

	Max	Min				
Cooling supply:			Supply duct temperature diff:	0.0 °F	Design humidity ratio diff:	
Leaving cooling coil:			Reheat Temperature diff:	0.0 °F	Min room relative humidity:	
Heating supply:	105.0 °F	105.0 °F				

Advanced Options

Cooling coil sizing method:	No Coil	Supply fan motor location:	Supply	Night purge schedule:	Off (0%)
Cooling coil location:	Room	Return fan motor location:	Omit	Optimum start schedule:	Off (0%)
Block cooling airflow:		Supply fan cofiguration:	Draw Thru	Optimum stop schedule:	Off (0%)
Ventilation deck location:	Return/Outdoor Deck	Supply fan sizing:	No Fan		
Supply duct location:	Return Air	Fan mechanical efficiency :	75%	CO2-based DCV:	None
Return air path:	ROOMDK	Apply Std62 People Avg:	No		
		Std62 Max Vent (Z) Ratio:		System ventilation flag:	Sum Room OA Reqs

Reset per worst case room schedule:	Off (0%)		Supply air path / duct location:	Return Air
Max reset:			Space convective gains to occupied layer:	100 %
Use system default outside air reset:	Yes		Underfloor plenum height:	0.0 ft
			Conductive resistance of raised floor:	0.8 hr·ft²·°F/Btu
			Upstream nominal leakage fraction:	0 %
			Downstream constant leakage fraction:	0 %
	Control Method	Control Type	Aux cooling coil losses to plenum:	0 %
Auxiliary cooling coil	Activate After Primary System	None		
Auxiliary heating coil	Activate After Primary System	None		
Auxiliary fan	No Fan			

Coils

	Capacity	Schedule	Diversity	
Main cooling:	0.0 % of Design Capacity by adjusting airfl	Available (100%)	People	100%
Aux cooling:		Available (100%)	Lights	100%
Main heating:	100.0 % of Design Capacity	Available (100%)	Misc loads	100%
Aux heating:		Available (100%)		
Preheat:	100.0% of Design Capacity	Available (100%)		
Reheat:	100.0 % of Design Capacity	Available (100%)		
Humidification:	100.0 % of Design Capacity	Available (100%)		

Fans

	Type	Static Press.	90.1 SP Adj	Full Load Energy Rate	Schedule	Efficiency	Priority
Primary	None	0.0 in. wg	0.0 in. wg	0.00000 kW	Available (100%)	90	
Secondary	Unit vent supply fan	0.0 in. wg	NA	0.00030 kW/Cfm	Available (100%)	85	
Return	None	0.0 in. wg	0.0 in. wg	0.00000 kW	Available (100%)	90	
System Exhaust	None	0.0 in. wg	0.0 in. wg	0.00000 kW	Available (100%)	90	
Room Exhaust	None	0.0 in. wg	0.0 in. wg	0.00000 kW	Available (100%)	85	
Optional ventilation	None	0.0 in. wg	NA	0.00000 kW	Available (100%)	90	
Auxiliary	None	0.0 in. wg	NA	0.00000 kW	Available (100%)	85	

SYSTEM ENTERED VALUES

By Heapy Engineering

System 3 - Single Zone

Design Air Conditions

	Max	Min				
Cooling supply:	55.0 °F	55.0 °F	Supply duct temperature diff:	0.0 °F	Design humidity ratio diff:	
Leaving cooling coil:			Reheat Temperature diff:	0.0 °F	Min room relative humidity:	
Heating supply:	92.0 °F	92.0 °F				

Advanced Options

Cooling coil sizing method:	Peak	Supply fan motor location:	Supply	Night purge schedule:	Off (0%)
Cooling coil location:	Room	Return fan motor location:	Omit	Optimum start schedule:	Off (0%)
Block cooling airflow:		Supply fan cofiguration:	Draw Thru	Optimum stop schedule:	Off (0%)
Ventilation deck location:	Return/Outdoor Deck	Supply fan sizing:	Peak		
Supply duct location:	Return Air	Fan mechanical efficiency :	75%	CO2-based DCV:	None
Return air path:	ROOMDK	Apply Std62 People Avg:	No		
		Std62 Max Vent (Z) Ratio:		System ventilation flag:	Sum Room OA Reqs

Reset per worst case room schedule:	Off (0%)		Supply air path / duct location:	Return Air
Max reset:			Space convective gains to occupied layer:	100 %
Use system default outside air reset:	Yes		Underfloor plenum height:	0.0 ft
			Conductive resistance of raised floor:	0.8 hr·ft²·°F/Btu
			Upstream nominal leakage fraction:	0 %
			Downstream constant leakage fraction:	0 %
	Control Method	Control Type	Aux cooling coil losses to plenum:	0 %
Auxiliary cooling coil	Activate After Primary System	None		
Auxiliary heating coil	Activate After Primary System	None		
Auxiliary fan	No Fan			

Coils

	Capacity	Schedule	Diversity	
Main cooling:	100.0 % of Design Capacity by adjusting a	Available (100%)	People	100%
Aux cooling:		Available (100%)	Lights	100%
Main heating:	100.0 % of Design Capacity	Available (100%)	Misc loads	100%
Aux heating:		Available (100%)		
Preheat:	0.0% of Design Capacity	Available (100%)		
Reheat:	100.0 % of Design Capacity	Available (100%)		
Humidification:	100.0 % of Design Capacity	Available (100%)		

Fans

	Type	Static Press.	90.1 SP Adj	Full Load Energy Rate	Schedule	Efficiency	Priority
Primary	FC Centrifugal const vol	0.0 in. wg	0.0 in. wg	0.65200 kW	Available (100%)	90	
Secondary	None	0.0 in. wg	NA	0.00000 kW	Available (100%)	85	
Return	None	0.0 in. wg	0.0 in. wg	0.00000 kW	Available (100%)	90	
System Exhaust	None	0.0 in. wg	0.0 in. wg	0.00000 kW	Available (100%)	90	
Room Exhaust	None	0.0 in. wg	0.0 in. wg	0.00000 kW	Available (100%)	85	
Optional ventilation	None	0.0 in. wg	NA	0.00000 kW	Available (100%)	90	
Auxiliary	None	0.0 in. wg	NA	0.00000 kW	Available (100%)	85	

SYSTEM ENTERED VALUES

By Heapy Engineering

System 5 Flr 2 - Variable Volume Reheat (30% Min Flow Default)

Design Air Conditions

	Max	Min				
Cooling supply:	55.0 °F	55.0 °F	Supply duct temperature diff:	0.0 °F	Design humidity ratio diff:	
Leaving cooling coil:			Reheat Temperature diff:	0.0 °F	Min room relative humidity:	
Heating supply:	92.0 °F	92.0 °F				

Advanced Options

Cooling coil sizing method:	Block	Supply fan motor location:	Supply	Night purge schedule:	Off (0%)
Cooling coil location:	System	Return fan motor location:	Omit	Optimum start schedule:	Off (0%)
Block cooling airflow:		Supply fan cofiguration:	Draw Thru	Optimum stop schedule:	Off (0%)
Ventilation deck location:	Return/Outdoor Deck	Supply fan sizing:	Block		
Supply duct location:	Return Air	Fan mechanical efficiency :	75%	CO2-based DCV:	None
Return air path:	PLENUM	Apply Std62 People Avg:	No		
		Std62 Max Vent (Z) Ratio:		System ventilation flag:	Sum Room OA Reqs

Reset per worst case room schedule:	Cooling Only (Design)
Max reset:	5.0
Use system default outside air reset:	Yes

Supply air path / duct location:	Return Air
Space convective gains to occupied layer:	100 %
Underfloor plenum height:	0.0 ft
Conductive resistance of raised floor:	0.8 hr·ft²·°F/Btu
Upstream nominal leakage fraction:	0 %
Downstream constant leakage fraction:	0 %
Aux cooling coil losses to plenum:	0 %

	Control Method	Control Type
Auxiliary cooling coil	Activate After Primary System	None
Auxiliary heating coil	Activate After Primary System	None
Auxiliary fan	No Fan	

Coils

	Capacity	Schedule	Diversity	
Main cooling:	100.0 % of Design Cooling Capacity	Available (100%)	People	100%
Aux cooling:		Available (100%)	Lights	100%
Main heating:	100.0 % of Design Capacity	Available (100%)	Misc loads	100%
Aux heating:		Available (100%)		
Preheat:	100.0% of Design Capacity	Available (100%)		
Reheat:	100.0 % of Design Capacity	Available (100%)		
Humidification:	100.0 % of Design Capacity	Available (100%)		

Fans

	Type	Static Press.	90.1 SP Adj	Full Load Energy Rate	Schedule	Efficiency	Priority
Primary	90.1-04 Min VAV AF Centrifugal	0.0 in. wg	1.4 in. wg	0.00022 kW	Available (100%)	90	
Secondary	None	0.0 in. wg	NA	0.00000 kW	Available (100%)	85	
Return	None	0.0 in. wg	0.0 in. wg	0.00000 kW	Available (100%)	90	
System Exhaust	90.1-04 Min VAV AF Centrifugal	0.0 in. wg	1.4 in. wg	0.00022 kW	Available (100%)	90	
Room Exhaust	None	0.0 in. wg	0.0 in. wg	0.00000 kW	Available (100%)	85	
Optional ventilation	None	0.0 in. wg	NA	0.00000 kW	Available (100%)	90	
Auxiliary	None	0.0 in. wg	NA	0.00000 kW	Available (100%)	85	

SYSTEM ENTERED VALUES

By Heapy Engineering

System 5 Flr 3 - Variable Volume Reheat (30% Min Flow Default)

Design Air Conditions

	Max	Min				
Cooling supply:	55.0 °F	55.0 °F	Supply duct temperature diff:	0.0 °F	Design humidity ratio diff:	
Leaving cooling coil:			Reheat Temperature diff:	0.0 °F	Min room relative humidity:	
Heating supply:	92.0 °F	92.0 °F				

Advanced Options

Cooling coil sizing method:	Block	Supply fan motor location:	Supply	Night purge schedule:	Off (0%)
Cooling coil location:	System	Return fan motor location:	Omit	Optimum start schedule:	Off (0%)
Block cooling airflow:		Supply fan cofiguration:	Draw Thru	Optimum stop schedule:	Off (0%)
Ventilation deck location:	Return/Outdoor Deck	Supply fan sizing:	Block		
Supply duct location:	Return Air	Fan mechanical efficiency :	75%	CO2-based DCV:	None
Return air path:	PLENUM	Apply Std62 People Avg:	No		
		Std62 Max Vent (Z) Ratio:		System ventilation flag:	Sum Room OA Reqs

Reset per worst case room schedule:	Cooling Only (Design)
Max reset:	5.0
Use system default outside air reset:	Yes

Supply air path / duct location:	Return Air
Space convective gains to occupied layer:	100 %
Underfloor plenum height:	0.0 ft
Conductive resistance of raised floor:	0.8 hr·ft²·°F/Btu
Upstream nominal leakage fraction:	0 %
Downstream constant leakage fraction:	0 %
Aux cooling coil losses to plenum:	0 %

	Control Method	Control Type
Auxiliary cooling coil	Activate After Primary System	None
Auxiliary heating coil	Activate After Primary System	None
Auxiliary fan	No Fan	

Coils

	Capacity	Schedule	Diversity	
Main cooling:	100.0 % of Design Cooling Capacity	Available (100%)	People	100%
Aux cooling:		Available (100%)	Lights	100%
Main heating:	100.0 % of Design Capacity	Available (100%)	Misc loads	100%
Aux heating:		Available (100%)		
Preheat:	100.0% of Design Capacity	Available (100%)		
Reheat:	100.0 % of Design Capacity	Available (100%)		
Humidification:	100.0 % of Design Capacity	Available (100%)		

Fans

	Type	Static Press.	90.1 SP Adj	Full Load Energy Rate	Schedule	Efficiency	Priority
Primary	90.1-04 Min VAV AF Centrifugal	0.0 in. wg	1.4 in. wg	0.00022 kW	Available (100%)	90	
Secondary	None	0.0 in. wg	NA	0.00000 kW	Available (100%)	85	
Return	None	0.0 in. wg	0.0 in. wg	0.00000 kW	Available (100%)	90	
System Exhaust	90.1-04 Min VAV AF Centrifugal	0.0 in. wg	1.4 in. wg	0.00022 kW	Available (100%)	90	
Room Exhaust	None	0.0 in. wg	0.0 in. wg	0.00000 kW	Available (100%)	85	
Optional ventilation	None	0.0 in. wg	NA	0.00000 kW	Available (100%)	90	
Auxiliary	None	0.0 in. wg	NA	0.00000 kW	Available (100%)	85	

23 09 23 DIRECT DIGITAL CONTROL SYSTEM FOR HVAC

PART 1 - GENERAL

1.1 A complete system of automatic temperature controls shall be installed as required to accomplish the sequence of control for various items of equipment and systems as described on the HVAC drawings and in Division 23 specifications. The system shall be a Direct Digital Control System (DDCS) utilizing electric actuation.

1.2 The following sections constitute related work:

A. Section 23 09 25 – Instrumentation and Control Devices for HVAC

B. Section 23 09 47 – Control Power Wiring for HVAC

C. Section 23 09 93 – Sequence of Operations for HVAC Controls

D. Section 23 09 95 – Direct Digital Control System Points List

1.3 DDCS Overview

A. The intent of this specification and related sections is to provide a fully integrated, open, interoperable, peer-to-peer networked, distributed Direct Digital Control System. The following communication protocols are acceptable:

1) ANSI/ASHRAE Standard 135-2007 BACnet - A Data Communication Protocol for Building Automation and Control Networks

2) ANSI/EIA/CEA-709.1-B Control Network Protocol Specification

3) ANSI/EIA/CEA-709.3-A Free-Topology Twisted-Pair Channel Specification

4) ANSI/EIA/CEA-709.4 Fiber-Optic Channel Specification

5) ANSI/EIA/CEA-852-A Tunneling Device Area Network Protocols Over Internet Protocol Channels

6) ANSI/EIA/CEA-860-A Device Plug-In Interface to EIA/CEA-709.1 Network Tools

7) ANSI/TIA/EIA-568-B Commercial Building Telecommunications Cabling Standard

8) MODBUS Application Protocol V1.1b (applicable to factory packaged equipment controllers only)

B. The DDCS shall be comprised of:

1) Wide Area Network (WAN) Enterprise Server

2) Network Control Engines (NCE)

3) BACnet Operator Workstations (B-OWS)

4) Personal computers/devices with Web browser software

5) Routers

6) Repeaters

7) Equipment controllers (L-PCU, L-TDCU, B-AAC, B-ASC, MEC)

8) Sensors (refer to Section 23 09 25)

9) Controlled devices (refer to Section 23 09 25)

C. The NCE shall connect to the Owner's local or wide area network, depending on configuration. Access to the system, either locally in building, or remotely from a central site or sites, shall be accomplished through standard Web browsers and/or BACnet Operator Workstations (B-OWS), via the Internet and/or local area network.

D. Each NCE shall communicate to LonWorks (L-PCU), BACnet (B-AAC, B-ASC), and/or MODBUS (MEC) controllers and/or other open protocol systems/devices as described on the contract drawings and/or in the specifications.

E. The DDCS shall be based on a Java-based framework. Provide an open automation infrastructure that integrates diverse systems and devices (regardless of manufacturer, communication standard or software) into a unified platform that can be easily managed in real time over the Internet using a standard Web browser.

F. The owner shall provide a connection to the internet via high speed cable modem, ADSL, ISDN, T1 or through the facility ISP. The owner shall be responsible for all monthly internet access fees and connection charges.

G. The DDCS shall be supplied with a complete web enabled package. The system shall support unlimited users using standard web browsers such as Internet Explorer and Mozilla Firefox. The web server software shall operate on standard industry PC servers. Proprietary servers or "black boxes" are not acceptable. Web browser software shall be manufactured by the control system manufacturer and shall have the same look and feel as the operating system. Third party web software is not acceptable.

H. BACnet controllers (B-AAC, B-ASC) shall connect to the NCE via a BACnet Local Network (BLN). The BLN shall consist of a flat, open architecture utilizing ANSI/ASHRAE Standard 135-2007 BACnet Protocol.

I. LonWorks Programmable Controllers (L-PCU) shall connect to the NCE via a Local Operating Network (LON). The LON shall consist of a flat, open architecture utilizing ANSI/CEA-709-709.1-B Control Network (LonTalk™) Protocol. Where necessary or desired, LonTalk packets may be encapsulated into TCP/IP messages to take advantage of existing infrastructure or to increase network bandwidth.

J. MODBUS Controllers (MEC) shall connect to the NCE via a MODBUS Local Network (MLN). The MLN shall consist of a flat, open architecture utilizing MODBUS Application Protocol.

K. The basic control system includes all sensors, controllers, instruments, valves, actuators, devices, installation and service for a complete and functional control system. All control devices (valves, dampers, actuators, etc.) and associated power and control wiring shall be included. Refer to Section 23 09 47 Control Power and Wiring for HVAC.

The DDCS shall be designed to allow easy field adjustment of all set points and parameters.

L. Provide for future system expansion to include monitoring of the access, intrusion detection, fire alarm, and lighting control systems.

M. Identify active or inactive pneumatic tubing, control wiring, equipment, etc., and where requested assist in the actual removal. Remove all pneumatic tubing, control wiring, and control devices not required to accommodate the new control system.

1.4 Provider Requirements

A. Manufacturer Qualifications

1) All products used in the installation shall be new, currently under manufacture, and shall be applied in standard off the shelf products. The installation shall not be used as a test site for any new products unless explicitly approved by the Engineer in writing. Spare parts shall be made available for at least 10 years after completion of this contract.

B. Installer Qualifications

1) Installing Contractor shall have an established working relationship with Control System Manufacturer of not less than 5 years.

2) Installing Contractor and his Sub-Contractors shall have successfully completed manufacturer's control system training. Provide certification of completed training, including hours of instruction and course outlines, within 10 days after bid date.

3) Installing Contractor shall have an office within 75 miles of the project site and provide 24 hour response in the event of a customer call, 7-days per week, 365 days per year.

1.5 Approved Control System Manufacturers and Installing Contractors

A. The following control system manufacturers' products that are certified by either the BACnet Testing Laboratory or LonMark are pre-qualified:

1) Tridium – Niagara AX [BACnet/LonTalk]

B. The following Installing Contractors are pre-qualified:

1) Waibel Energy Systems, Inc. Building Logix [Tridium]

C. Any manufacturer or Installing Contractor not pre-qualified above shall submit credentials for the Engineer's review seven or more days prior to the bid date. Applications submitted after seven days prior to the bid date will not be considered. Credentials must attest that the manufacturer and installer meet all requirements above. The Engineer's judgment in reviewing any manufacturer or contractor will be final.

1.6 Codes and Standards

A. Work, materials, and equipment shall comply with the most restrictive of local, state, and federal authorities' codes and ordinances or these plans and specifications. As a minimum, the installation shall comply with the current editions of the following codes and standards:

1) National Electric Code (NEC)

2) Ohio Building Code (OBC) and Ohio Mechanical Code (OMC)

3) National Fire Protection Association (NFPA)

4) Ohio School Design Manual (OSDM)

5) ANSI/ASHRAE Standard 55 Thermal Environmental Conditions For Human Occupancy

6) ANSI/ASHRAE Standard 62 Ventilation For Acceptable Indoor Air Quality

7) ANSI/ASHRAE Standard 90.1 Energy Standard For Buildings Except Low-Rise Residential Buildings

8) ANSI/ASHRAE Standard 135, BACnet - A Data Communication Protocol for Building Automation and Control Networks

9) ANSI/CEA-709-709.1-B Control Network Protocol Specification

10) ANSI/CEA-709.3 LonMark TP/FT-10 Free-Topology and Bus Twisted-Pair Channel Specification

11) ANSI/CEA-852 LonMark IP-852 Internet-Tunneling Channel Specification

12) LonMark Application-Layer Interoperability Guidelines

13) LonMark Layer 1 – 6 Interoperability Guidelines

14) LonMark Standard Network Variable Type (SNVT) Master List

15) LonMark Standard Configuration Property Type (SCPT) Master List

16) LonMark Standard Functional Profile Types (SFPT) Master List

17) LonMark Device Interface File Reference Guide

18) FCC Regulation, Part 15

19) Underwriters Laboratories: Products shall be UL-916-PAZX Listed

20) Underwriters Laboratories: Products shall be UL-864-UUKL Listed

1.7 System Performance

A. Performance Standards. System shall conform to the following minimum standards over network connections:

1) Graphic Display. A graphic with 20 dynamic points/objects shall display with current data within 10 seconds.

2) Graphic Refresh. A graphic with 20 dynamic points/objects shall update with current data within 8 seconds.

3) Object Command. Devices shall react to command of a binary object within 2 seconds. Devices shall begin reacting to command of an analog object within with in 2 seconds.

4) Object Scan. Data used or displayed at a controller or workstation shall have been current within the previous 6 seconds.

5) Alarm Response Time. An object that goes into alarm shall be annunciated at the workstation within 45 seconds

6) Program Execution Frequency. Custom and standard applications shall be capable of running as often as once every 5 second. Select execution times consistent with the mechanical process under control.

7) Performance. Programmable controllers shall be able to completely execute DDC PID control loops at a frequency adjustable down to once per second. Select execution times consistent with the mechanical process under control.

8) Multiple Alarm Annunciation. Each workstation on the network shall receive alarms within 5 seconds of other workstations.

9) Reporting Accuracy. System shall report values with the minimum end-to-end accuracy listed in Table 1 of Section 23 09 25 Instrumentation and Control Devices.

10) Control Stability and Accuracy. Control loops shall maintain measured variable at setpoint within tolerances listed in Table 2 of Section 23 09 25 Instrumentation and Control Devices.

1.8 Submittals

A. Refer to Section 23 05 01 – Basic HVAC Requirements

B. Begin no work until submittals have been approved for conformity with design intent. Provide drawings as 11" x 17" prints of each drawing. When manufacturer's cutsheets apply to a product series rather than a specific product, clearly indicate applicable data by highlighting or by other means. Clearly reference covered specification and drawing on each submittal. General catalogs shall not be accepted as cut sheets to fulfill submittal requirements. Select and show submittal quantities appropriate to scope of work. Provide submittals within 12 weeks after contract award, including the following:

1) Direct Digital Control System Hardware

a) Complete bill of materials indicating quantity, manufacturer, model number, and other technical data of equipment to be used.

b) Manufacturer's description and technical data such as performance curves, product specification sheets, and installation and maintenance instructions for items listed below and for relevant items not listed below:

(1) Direct digital controllers (controller panels)

(2) Transducers and transmitters

(3) Sensors (including accuracy data)

(4) Actuators

(5) Valves

(6) Dampers

(7) Relays and switches

(8) Control panels

(9) Power supplies

(10) Batteries

(11) Operator interface equipment

(12) Wiring

c) Wiring diagrams and layouts for each control panel.

d) Floor plan schematic diagrams indicating field sensor, controller and power supply locations.

2) Network and Workstation Hardware and Software

a) Complete bill of material indicating quantity, manufacturer, model number, and relevant technical data of equipment used.

b) Manufacturer's description and technical data, such as product specifications and installation and maintenance instructions for items listed below and for relevant items furnished under this contract not listed below:

(1) Central Processing Unit (CPU)

(2) Monitors

(3) Keyboards

(4) Power supply

(5) Battery backup

(6) Interface equipment between CPU and control panels

(7) Routers

(8) Repeaters

(9) Operating System software

(10) Operator interface software

(11) Color graphic software

(12) Third-party software

c) Schematic diagrams of control, communication, and power wiring for central system installation. Label cables and ports with computer manufacturers' model numbers and functions. Show wiring to control system.

d) List of color graphics to be provided. Provide a conceptual layout of pictures and data for each graphic, showing or explaining which other graphics can be directly accessed.

3) Controlled Systems

a) Riser diagrams showing control network layout, communication protocol, and wire types.

b) Schematic diagram of each controlled system. Label control points/objects with point/object names. Graphically show locations of control elements.

c) Schematic wiring diagram of each controlled system. Label control elements and terminals. Where a control element is also shown on control system schematic, use the same name.

d) Instrumentation list for each controlled system. List each control system element in a table. Show element name, type of device, manufacturer, model number, and product data sheet number.

e) Mounting, wiring, and routing plan view drawing in ¼" scale. Take into account HVAC, electrical and other systems' design and elevation requirements. Show locations of concrete pads and bases and special wall bracing for panels to accommodate this work.

f) Complete description of control system operation including sequences of operation. Include and reference a schematic diagram of system.

g) Point/object list for each system controller including inputs and outputs (I/O), point/object numbers, controlled device associated with each I/O point/object, and location of I/O device. Indicate alarmed and trended points/objects.

4) Description of process, report formats, and checklists to be used in Part 3: "Control System Demonstration and Acceptance."

5) BACnet Protocol Implementation Conformance Statement (PICS) for each submitted type of BACnet controller (B-BC, B-AAC, B-ASC) and operator interface (B-OWS).

6) LonMark SNVT, SCPT, SFPT, XIF file for each submitted type of LonWorks controller (L-PCU).

C. Schedules

1) Schedule of work provided within one month of contract award indicating:

a) Intended sequence of work items

b) Start date of each work item

c) Duration of each work item

d) Planned delivery dates for ordered material and equipment, and expected lead time

e) Milestones indicating possible restraints on work by other trades or situations

2) Monthly written status reports indicating work completed and revisions to expected delivery dates. Include updated schedule of work.

D. Project Record Documents. Submit three copies of record (as-built) documents upon completion of installation for approval prior to final completion. Submittal shall consist of:

1) Project Record Drawings.

a) As-built versions of the submittal shop drawings provided as 11" x 17" prints.

b) Submittals to include complete electrical point-to-point wiring diagrams, component layouts, system and equipment component sequences of operation, start-up and checkout procedures. Include a list of all unit default safety and control settings, whether fixed or adjustable, as shipped from the factory. Where field modifications are required to meet the specification, provide all modification labor and materials, and submit a complete, detailed, step-by-step procedure for the modifications.

2) Testing and Commissioning Reports and Checklists. Completed versions checklists and trend logs used to meet requirements of Part 3: "Control System Demonstration and Acceptance."

3) Operation and Maintenance (O & M) Manual.

a) As-built versions of the submittal product data.

b) Names, addresses, and 24-hour telephone numbers of installing contractors and service representatives for equipment and control systems.

c) Operator's manual with procedures for operating control systems: logging on and off, handling alarms, producing point/object reports, trending data, overriding computer control, and changing setpoints and variables.

d) Programming manual or set of manuals with description of the programming language and syntax of statements for algorithms and calculations used of point/object database creation and modification, of program creation and modification, and editor use.

e) Engineering, installation, and maintenance manual or set of manuals that explains how to design and install new points/objects, panels, and other hardware; how to perform preventive maintenance and calibration; how to debug hardware problems; and how to repair or replace hardware.

f) Documentation of all programs created using custom programming language including setpoints, tuning parameters, and object database.

g) Graphic files, programs and database on magnetic or optical media.

h) List of recommended spare parts with part numbers and suppliers.

i) Complete original-issue documentation, installation, and maintenance information for furnished third-party hardware, including computer equipment and sensors.

j) Complete original-issue copies of furnished software, including operating systems, custom programming language, operator workstation software, and graphics software.

k) Licenses, guarantee, and warranty documents for equipment and systems.

l) Recommended preventive maintenance procedures for system components, including schedule of tasks such as inspection, cleaning, and calibration; time between tasks; and task descriptions.

4) Training Materials: Provide course outline and manuals for each class at least six weeks before the first class. Engineer will modify course outlines and manuals if necessary to meet Owner's needs. Engineer will review and approve course outlines and manuals at least three weeks before first class.

1.9 Warranty

A. Warrant all work as follows:

1) Warrant labor and materials for specified control system free from defects for a period of 12 months after final acceptance. Control system failures during warranty period shall be adjusted, repaired, or replaced at no additional cost or reduction in service to the Owner. Respond during Owner's business hours within 24 hours of Owner's warranty service request.

2) Work shall have a single warranty date, even if Owner receives beneficial use due to early system start-up. If specified work is split into multiple contracts or a multi-phase contract, each contract or phase shall have a separate warranty start date and period.

3) If Engineer determines that equipment and systems operate satisfactorily at the end of the final start-up, testing, and commissioning phase, Engineer will certify in writing that control system operation has been tested and accepted in accordance with the terms of this specification. Date of acceptance shall begin warranty period.

4) Provide updates to operator workstation software, project-specific software, graphic software, database software, and firmware which resolve Contractor identified software deficiencies at no charge during warranty period. If available, Owner can purchase in-warranty service agreement to receive upgrades for functional enhancements associated with above mentioned items. Do not install updates or upgrades without Owner's written authorization.

1.10 Ownership Of Proprietary Material

A. Project specific software and documentation shall become Owner's property. This includes, but is not limited to:

1) Graphics

2) Record drawings

3) Database

4) Application programming code

5) Documentation

PART 2 - PRODUCTS

2.1 Materials

A. The equipment specified shall be provided as defined herein, shown on the drawings and as required to accomplish the sequence of control.

B. Use new products that the manufacturer is currently manufacturing and that have been installed in a minimum of 25 installations. Do not use this installation as a product test site unless explicitly approved in writing by Owner or Owner's Representative. Spare parts shall be available for at least five-years after completion of this contract.

2.2 BACnet Communications

A. Control products, communication media, connectors, repeaters, hubs and routers shall comprise a BACnet internetwork. Controllers and operator interface communication shall conform to ANSI/ASHRAE Standard 135-2007, BACnet.

B. Each controller shall have a communication port for connections to an interface.

C. Project drawings indicate remote buildings or sites to be connected by a nominal 56,000 baud modem over voice-grade telephone lines. In each remote location, a modem and field device connection shall allow communication with each controller on internetwork as specified in Paragraph D below.

D. Internetwork operator interface and value passing shall be transparent to internetwork architecture.

1) An operator interface connected to a controller shall allow the operator to interface with internetwork controller as if directly connected. Controller information such as data, status, reports, system software, algorithms, and custom programs, shall be viewable and editable from each internetwork controller.

2) Inputs, outputs, and control variables used to integrate control strategies across multiple controllers shall be readable by each controller on the internetwork. Program and test all cross-controller links required to execute specified control system operation. An authorized operator shall be able to edit cross-controller links by typing a standard object address via the internetwork.

E. Controllers with real-time clocks shall use the BACnet Time Synchronization service. System shall automatically synchronize system clock daily from an operator designated device via the internetwork. If applicable, system shall automatically adjust for daylight saving and standard time.

F. System shall be expandable to at least twice the required input and output objects with additional controllers, associated devices, and wiring. Expansion shall not require operator interface hardware additions or software revisions.

2.3 Operator Interface

A. Operator Interface. PC-based workstations and Web server shall reside on high-speed network with building controllers as shown on drawings. Each workstation or each standard browser connected to server shall be able to access all system information.

B. Communication. Workstation(s), Web server and controllers shall communicate using BACnet protocol. Workstation(s) and Web server and control network backbone shall communicate using the ISO 8802-3 (Ethernet) Data Link/ Physical layer protocol, and BACnet/IP addressing as specified in ANSI/ASHRAE 135-2007, BACnet, Annex J.

C. Hardware Base. Industry-standard hardware shall meet or exceed DDC system manufacturer's recommended specifications and shall meet response times specified in paragraph 1.7. Hard disk shall have sufficient memory to store system software, one year of data for trended points, and a system database at least twice the size of the existing database at system acceptance. Configure computers and network connections if multiple computers are required to meet specified memory and performance. Web server or workstations shall be IBM-compatible PCs with a minimum of:

1) Personal Computer. Furnish, install and configure IBM compatible PCs with a minimum of:

a) Intel Pentium 3.0 GHz processor

b) 6 GB RAM

c) optical drive

d) 1TB hard disk providing data at 100 MB/sec

e) mouse

f) keyboard

g) 19" active matrix TFT flat-panel LCD monitor

h) Serial, parallel, and network communication ports, and required cables for proper system operation

i) Ethernet adapter (10/100 MB with RJ-45 connector)

2) Alarm Printers. Alarm printer equivalent to a Hewlitt-Packard HP Color LaserJet 2600n and associated cables.

3) BACnet workstation shall have demonstrated interoperability during at least one BMA Interoperability Workshop and shall substantially conform to BACnet Operator Workstation (B-OWS) device profile as specified in ANSI/ASHRAE 135-2007, BACnet, Annex L.

Operator Workstation BACnet Services	*Initiate*	*Execute*
Acknowledge Alarms	x	x
Confirmed COV Notification	x	x
Confirmed Event Notification	x	x
Get Alarm Summary	x	x
Get Enrollment Summary	x	x
Subscribe COV	x	x
Unconfirmed COV Notification	x	x
Unconfirmed Event Notification	x	x
Atomic Read File	x	x
Atomic Write File	x	x
Add List Element	--	x
Remove List Element	--	x
Create Object	x	x
Delete Object	x	x
Read Property	x	x
Read Property Multiple	x	x
Write Property	x	x
Read Range	x	x
Write Property Multiple	x	x
Device Communication Control	x	x
Confirmed Private Transfer	x	x
Unconfirmed Private Transfer	x	x
Reinitialize Device	x	--

Operator Workstation BACnet Services	*Initiate*	*Execute*
Time Synchronization	x	--
Who-Has	--	x
I-Have	x	--
Who-Is	x	x
I-Am	x	x

4) BACnet Functional Groups. The Operator Workstation shall support the following BACnet functional groups: Clock, Event Initiation, Event Response, COV Event Response, Files, Reinitialize, Device Communication, Time Master and Router.

5) The Operator Workstation shall have the capability to create, delete and support the following BACnet Objects:

a) ANALOG INPUT, ANALOG OUTPUT AND ANALOG VALUE: These objects shall have the following writeable properties: Object Name; Object Value; Description; COV Increment; Out of Service and Units. In addition, these objects shall support the properties: Device type; Reliability; Min./Max. Values; Update Interval and Resolution.

b) BINARY INPUT, BINARY OUTPUT AND BINARY VALUE: These objects shall have the following writeable properties: Object Name; Object Value; Description; Polarity; Default Value; Min On/Off and Out of Service. In addition, these objects shall support the properties: Device Type; Reliability; Active/Inactive Texts; Update Interval; Resolution; Change-of-State Time; Count Times and Time Reset.

c) CALENDAR: This object shall have the following writeable properties: Object Name; Object Value; Description; and Date List

d) DEVICE: This object shall have the following writeable properties: Object Name; Description; Location; and UTC Offset.

e) EVENT ENROLMENT: This object shall have the following writeable properties: Object Name; Object Value; Description; Out-of-Service; Event & Notify Types; Paramenters; Property Ref; Enable; and Notification Class.

f) FILE: This object shall have the following writeable properties: Object Name; Description; File Type; and File Access.

g) LOOP (PID): This object shall have the following writeable properties: Object Name; Object Value; Description; Polarity; Output and Input Refs.; Input Value & Units; Setpoint Value; PID Values; Bias; Write Priority and COV Increment. In addition, this object shall support the properties: Reliability; Update Interval; Proportional Constant & Units; Derivative Constant & Units and Min./Max. Outputs.

h) NOTIFICATION CLASS: This object shall have the following writeable properties: Object Name; Object Value; Description; Priority and Ack Required.

i) PROGRAM: This object shall have the following writeable properties: Object Name; Object Value and Description. In addition, this object shall support the property Reliability.

j) SCHEDULE: This object shall have the following writeable properties: Object Name; Object Value and Description; Effective period; Schedule; Exception; Controlled Properties and Write Properties.

k) TREND LOG: This object shall have the following writeable properties: Object Name; Description; Log Enable; Start/stop Times; Log Device Object Property; Log Interval; Stop When Full; Buffer Size; and Record Count.

D. Operator Functions. Operator interface shall allow each authorized operator to execute the following functions as a minimum:

1) Log In and Log Out. System shall require user name and password to log in to operator interface.

2) Point-and-click Navigation. Operator interface shall be graphically based and shall allow operators to access graphics for equipment and geographic areas using point-and-click navigation.

3) View and Adjust Equipment Properties. Operators shall be able to view controlled equipment status and to adjust operating parameters such as setpoints, PID gains, on and off controls, and sensor calibration.

4) View and Adjust Operating Schedules. Operators shall be able to view scheduled operating hours of each schedulable piece of equipment on a weekly or monthly calendar-based graphical schedule display, to select and adjust each schedule and time period, and to simultaneously schedule related equipment. System shall clearly show exception schedules and holidays on the schedule display.

5) View and Respond to Alarms. Operators shall be able to view a list of currently active system alarms, to acknowledge each alarm, and to clear (delete) unneeded alarms.

6) View and Configure Trends. Operators shall be able to view a trend graph of each trended point and to edit graph configuration to display a specific time period or data range. Operator shall be able to create custom trend graphs to display on the same page data from multiple trended points.

7) View and Configure Reports. Operators shall be able to run preconfigured reports, to view report results, and to customize report configuration to show data of interest.

8) Manage Control System Hardware. Operators shall be able to view controller status, to restart (reboot) each controller, and to download new control software to each controller.

9) Manage Operator Access. Typically, only a few operators are authorized to manage operator access. Authorized operators shall be able to view a list of operators with system access and of functions they can perform while logged in.

Operators shall be able to add operators, to delete operators, and to edit operator function authorization. Operator shall be able to authorize each operator function separately.

E. System Software

1) Operating System. Furnish a concurrent multi-tasking operating system. The operating system also shall support the use of other common software applications. Examples include Microsoft Excel, Microsoft Word, Microsoft Access. Acceptable operating systems are Windows 2000, Windows XP, Windows Server 2008, Red Hat Linux, Sun Solaris and UNIX.

2) System Graphics. The operator workstation software shall be graphically oriented. The system shall allow display of up to 10 dynamic and animated graphic screens at once for comparison and monitoring of system status. Provide a method for the operator to easily move between graphic displays and change the size and location of graphic displays on the screen. The system graphics shall be able to be modified while on-line. An operator with the proper password level shall be able to add, delete, or change dynamic objects on a graphic. Dynamic objects shall include analog and binary values, dynamic text, static text, and animation files. Graphics shall have the ability to show animation by shifting image files based on the status of the object.

3) Custom Graphics. Custom graphic files shall be created with the use of a graphics generation package furnished with the system. The graphics generation package shall be a graphically based system that uses the mouse to create and modify graphics in industry standard formats. The graphics generation package also shall provide the capability of capturing or converting graphics from other programs such as Visio or AutoCAD.

a) Operator interface shall include at least one graphic per piece of equipment or occupied zone, graphics for each chilled water and hot water system, and graphics that summarize conditions on each floor of each building included in this contract. Indicate thermal comfort on floor plan summary graphics using dynamic colors to represent zone temperature relative to zone setpoint.

(1) Functionality. Graphics shall allow operator to monitor system status, to view a summary of the most important data for each controlled zone or piece of equipment, to use point-and-click navigation between zones or equipment, and to edit setpoints and other specified parameters.

(2) Animation. Graphics shall be able to animate by displaying different image files for changed object status.

(3) Floor plans. Provide detailed floor plans showing each piece of equipment, control zoning and space temperatures (green if within setpoint range; red if out of setpoint range), and all alarm points.

(4) Alarm Indication. Indicate areas or equipment in an alarm condition using color or other visual indicator.

(5) Format. Graphics shall be saved in an industry-standard format such as BMP, JPEG, PNG, or GIF. Web-based system graphics shall be viewable on browsers compatible with World Wide Web Consortium browser standards. Web graphic format shall require no plug-in (such as HTML and JavaScript) or shall only require widely available no-cost plug-ins (such as Active-X and Macromedia Flash).

b) Graphics Library. Furnish a complete library of standard HVAC equipment graphics such as chillers, boilers, air handlers, terminals, fan coils, and unit ventilators. This library also shall include standard symbols for other equipment including fans, pumps, coils, valves, piping, dampers, and ductwork. The library shall be furnished in a file format compatible with the graphics generation package program. Graphics shall be created by drag-and-drop selection of graphic symbols and drag-and-link with BACnet objects with dynamic and interactive display fields.

4) Multilingual. Software shall be supported in the following languages English, Spanish, French, German, Chinese.

5) Dynamic Data Exchange (DDE). Software shall support dynamic data sharing with other Windows-based programs for third party add-on functionality e.g. preventative maintenance, tenant billing, etc.

F. System Applications. Each workstation and web server shall provide operator interface and off-line storage of system information. Provide the following applications at each workstation and web server:

1) Automatic System Database Save and Restore. Each workstation shall store on the hard disk a copy of the current database of each NCE. This database shall be updated whenever a change is made in any system panel. The storage of these data shall be automatic and not require operator intervention. In the event of a database loss in a building management panel, the first workstation to detect the loss shall automatically restore the database for that panel. This capability may be disabled by the operator.

2) Manual Database Save and Restore. A system operator with the proper password clearance shall be able to save the database from any system panel. The operator shall be able to clear a panel database via the network and manually initiate a download of a specified database to any panel in the system from the network.

3) System Configuration. The workstation and web server software shall provide a method of configuring the system. This shall allow for future system changes or additions by users under proper password protection. Each workstation and web server shall store on its hard disk a copy of the current system database, including controller firmware and software. Stored database shall be automatically updated with each system configuration or controller firmware or software change

4) On-Line Help. Provide a context-sensitive, on-line help system to assist the operator in operating and editing the system. On- line help shall be available for all applications and shall provide the relevant data for that particular screen. Additional help information shall be available through the use of hypertext.

5) Security. Each operator shall be required to log on to the system with a user name and password in order to view, edit, add, or delete data. System security shall be selectable for each operator. Each user name and password combination shall define accessible viewing, editing, adding, and deleting functions in each system application, editor, and object. The system supervisor shall have the ability to set passwords and security levels for all other operators. Each operator password shall be able to restrict the functions accessible to viewing and/or changing each system application, editor, and object. Each operator shall automatically be logged off of the system if no keyboard or mouse activity is detected. This auto logoff time period shall be user-adjustable. All system security data shall be stored in an encrypted format.

6) System Diagnostics. The system shall automatically monitor the operation of all workstations, web servers, printers, modems, network connections, building management panels, and controllers. The failure of any device shall be annunciated to the operator. System shall automatically monitor controller and I/O point operation. System shall annunciate controller failure and I/O point locking (manual overriding to a fixed value).

7) Alarm Processing. Any object in the system shall be configurable to alarm in and out of normal state. The operator shall be able to configure the alarm limits, alarm limit differentials, states, and reactions for each object in the system. Alarms shall be BACnet alarm objects and shall use BACnet alarm services.

8) Alarm Messages. Alarm messages shall use the English language descriptor for the object in alarm, in such a way that the operator will be able to recognize the source, location, and nature of the alarm without relying upon acronyms or other mnemonics.

9) Alarm Reactions. The operator shall be able to determine (by object) what if any actions are to be taken during an alarm. Actions shall include logging, printing, starting programs, send email, displaying messages, dialing out to remote stations, paging, providing audible annunciation, or displaying specific system graphics. Each of these actions shall be configurable by workstation and time of day.

10) Trend Logs. The operator shall be able to define a custom trend log for any data object in the system. This definition shall include change-of-value digital, change-of-value analog, time interval, start time, and stop time. Trend data shall be sampled and stored on the NCE or server and be archived on the hard disk and be retrievable for use in spreadsheets and standard database programs. Trends shall be BACnet trend objects.

11) Alarm and Event Log. The operator shall be able to view all system alarms and change of states from any location in the system. Events shall be listed chronologically. An operator with the proper security level may acknowledge and clear alarms. All that have not been cleared by the operator shall be archived to the hard disk on the workstation.

12) Object and Property Status and Control. Provide a method for the operator to view, and edit if applicable, the status of any object and property in the system. The status shall be available by menu, on graphics, or through custom programs.

13) Clock Synchronization. The real-time clocks in all building control panels and workstations shall use the BACnet Time Synchronization service. The system also shall be able to automatically synchronize all system clocks daily from any operator-designated device in the system. The system shall automatically adjust for daylight savings and standard time, if applicable.

14) Reports and Logs. Provide a reporting package that allows the operator to select, modify, or create reports. Each report shall be definable as to data content, format, interval, and date. Report data shall be achievable on the hard disk for historical reporting. Provide the ability for the operator to obtain real-time logs of all objects by type or status (e.g., alarm, lockout, normal). Reports and logs shall be stored on the PC hard disk in a format that is readily accessible by other standard software applications, including spreadsheets and word processing. Reports and logs shall be readily printed to the system printer and shall be set to be printed either on operator command or at a specific time each day.

15) Standard Reports. The following standard system reports shall be provided for this project. Provide ability for the owner to readily customize these reports for this project.

a) All Objects: All system (or subsystem) objects and their current values filtered by object type, by status (in alarm, locked, normal), by equipment, by geographic location, or by combination of filter criteria filtered by object type, by status (in alarm, locked, normal), by equipment, by geographic location, or by combination of filter criteria.

b) Alarm Summary: All current alarms (except those in alarm lockout).

c) Disabled Objects: All objects that are disabled.

d) Alarm Lockout Objects: All objects in alarm lockout (whether manual or automatic).

e) Alarm Lockout Objects in Alarm: All objects in alarm lockout that are currently in alarm.

f) Logs:

(1) Alarm History

(2) System Messages

(3) System Events

(4) Trends

(5) Operator Activity. At a minimum, system shall log operator log in and log out, control parameter changes, schedule changes, and alarm acknowledgment and deletion. System shall date and time stamp logged activity

16) Custom Reports. Provide the capability for the operator to easily define any system data into a daily, weekly, monthly, or annual report. Operator shall be

able to create custom reports that retrieve data, including archived trend data, from the system, that analyze data using common algebraic calculations, and that present results in tabular or graphical format. These reports shall be time and date stamped and shall contain a report title and the name of the facility.

17) Electrical, Gas, and Weather Reports

a) Weather Data Report: Provide a monthly report showing the daily minimum, maximum, and average outdoor air temperature, as well as the number of heating and cooling degree-days for each day. Provide an annual (12-month) report showing the minimum, maximum, and average outdoor air temperature for the month, as well as the number of heating and cooling degree-days for the month.

G. Workstation Applications Editors. Each PC workstation shall support editing of all system applications. Provide editors for each application at the PC workstation. The applications shall be downloaded and executed at one or more of the controller panels.

1) Controller. Provide a full-screen editor for each type of application that shall allow the operator to view and change the configuration, name, control parameters, and setpoints for all controllers.

2) Scheduling. An editor for the scheduling application shall be provided at each workstation. Provide a method of selecting the desired schedule and month. This shall consist of a monthly calendar for each schedule. Exception schedules and holidays shall be shown clearly on the calendar. Provide a method for allowing several related objects to follow a schedule. The start and stop times for each object shall be adjustable from this master schedule. Schedules shall be easy to copy to other objects and/or dates.

3) Custom Application Programming. Provide the tools to create, modify, debug, and download custom application programming. The operator shall be able to create, edit, and download custom programs at the same time that all other system applications are operating. The system shall be fully operable while custom routines are edited, compiled, and downloaded. The programming language shall have the following features:

a) The language shall be English language oriented, be based on the syntax of BASIC, FORTRAN, C, or PASCAL, and allow for free-form programming (i.e., not column-oriented or "fill in the blanks"). Alternatively, the programming language can be graphically based using function blocks as long as blocks are available that directly provide the functions listed below and that custom or compound function blocks can be created.

b) A full-screen character editor/programming environment shall be provided. The editor shall be cursor/mouse-driven and allow the user to insert, add, modify, and delete custom programming code. It also shall incorporate word processing features such as cut/paste and find/replace.

c) The programming language shall allow independently executing program modules to be developed. Each module shall be able to independently enable and disable other modules.

d) The editor/programming environment shall have a debugging/simulation capability that allows the user to step through the program and observe any intermediate values and/or results. The debugger also shall provide error messages for syntax and execution errors.

e) The programming language shall support conditional statements (IF/THEN/ELSE/ELSE-IF) using compound Boolean (AND, OR, and NOT) and/or relations (EQUAL, LESS THAN, GREATER THAN, NOT EQUAL) comparisons.

f) The programming language shall support floating point arithmetic using the following operators: +, -, /, x, square root, and x-to-the-y-power. The following mathematical functions also shall be provided: natural log, log, trigonometric functions (sine, cosine, etc.), absolute value, and minimum/maximum value from a list of values.

g) The programming language shall have predefined variables that represent time of day, day of the week, month of the year, and the date. Other predefined variables shall provide elapsed time in seconds, minutes, hours, and days. These elapsed time variables shall be able to be reset by the language so that interval-timing functions can be stopped and started within a program. Values from all of the above variables shall be readable by the language so that they can be used in a program for such purposes as IF/THEN comparisons, calculations, etc.

h) The language shall be able to read the values of the variables and use them in programming statement logic, comparisons, and calculations.

i) The programming Language shall have predefined variables representing the status and results of the System Software and shall be able to enable, disable, and change the setpoints of the System Software described below.

j) The programs shall support online changes with the ability to read real time values without exiting the program. Sample programs and syntax help functions shall be resident in the program.

H. Portable Operator's Terminal. Furnish a Portable Operator's Terminal that shall be capable of accessing all system data. This device may be connected to any point on the system network or may be connected directly to any controller for programming, setup, and troubleshooting. This device may be connected to any point on the system network or it may be connected directly to controllers using the BACnet PTP (Point-To-Point) Data Link/ Physical layer protocol. The terminal shall use the Read (Initiate) and Write (Execute) Services as defined in Clauses 15.5 and 15.8, respectively, of ASHRAE Standard 135-2007, to communicate with BACnet objects in the internetwork. The Portable Operator's Terminal shall be an IBM compatible tablet-style PC including all software and hardware required. The PC shall contain at minimum:

1) 1 GHz Intel Core Duo Processor

2) 1 GB RAM

3) 7" LCD display, 1024 x 600 screen resolution

4) Multi-touch capacitive screen

5) Full Adobe® Flash® enabled

6) Micro USB and Micro HDMI ports

7) Wi-Fi 802.11 a / b / g / n connectivity

8) Operating System powered by QNX Technology

2.4 Web Server

A. Functionality

1) The Web Servers shall provide the interface between the LAN or WAN and the field control devices, and provide global supervisory control functions over the control devices connected to the Web Servers. It shall be capable of executing application control programs to provide:

a) Hosting of the graphical HTML pages

b) Calendar functions

c) Scheduling (if no other means available)

d) Data Logging (if no other means available)

e) Alarm monitoring and routing (if no other means available)

f) Time synchronization (if no other means available

g) Soap/XML interface

h) Static or Dynamic IP addressing

i) SNVT access via web pages and via XML interface

j) SMTP Server for alarm email notification

k) Messages and message management

B. Software Licensee

1) The Software License for the Web Server(s) must be open and enable any Systems Integrator to engineer, change or modify the application once the project is complete. Restrictive engineering access to the Web server will not be acceptable.

C. Event alarm notification and actions

1) The Web Server shall provide alarm recognition, storage, routing, management, and analysis to supplement distributed capabilities of equipment or application specific controllers.

2) The Web Server shall be able to route any alarm condition to any defined user location whether connected to a local network or remote via dial-up, telephone connection, or wide-area network.

3) Alarm generation shall be selectable for annunciation type and acknowledgement requirements.

4) Control equipment and network failures shall be treated as alarms and annunciated.

5) Alarms shall be annunciated via email notification to specific, configurable email address.

6) Alarms shall be visually identified via the HTML graphics pages. Overrides and setpoint changes shall be configured via the HTML interface.

7) Alarms shall be annunciated in any of the following manners as defined by the user:

   a) Screen message text

   b) Pagers via paging services that initiate a page on receipt of email message

   c) Graphic with flashing alarm object(s)

8) Alarms shall be logged for a period of no less than 1 week

9) Alarm logs shall be able to be transferred from the web server to a host

10) The following shall be recorded by the Web Server for each alarm (at a minimum):

   a) Time and date

   b) Location (building, floor, zone, office number, etc.)

   c) Equipment (air handler #, access way, etc.)

D. Data logging and storage

1) The web server shall have the ability to collect data for any object and store this data for future use. Data logging shall be performed either by a dedicated logger on the control network, via a combined web server/data logger, or by a central host PC attached to the network. Whichever way data logging is to be performed it must:

   a) Store data logs for at least 1 week before being overwritten

   b) Automatically update the host storage PC that the logs are approaching their full level

   c) Data logs shall be able to be transferred from the web server to a host

d) Be easily able to append a new log to a previously saved log

E. Security and user administration

1) Communications between the Web Server and Web Browser are to adopt proven 'Secure User Authentication' employing 128-bit industry standard MD5 digital signatures. All transactions to/from the Web Server are to adopt the MD5 security procedures as a minimum to ensure the data on the system is protected from unauthorized access.

2) Individual web graphics pages shall have their own password protection. Groups of pages may have the same password for the same level of user. Provide at least 3 levels of user access.

2.5 Web Browser Client

A. The system shall be capable of supporting an unlimited number of clients using a standard Web browser such as Internet Explorer™, Mozilla Firefox™, or Netscape Navigator™. Systems requiring additional software (to enable a standard Web browser) to be resident on the client machine, or manufacture-specific browsers shall not be acceptable.

B. The Web browser software shall run on any operating system and system configuration that is supported by the Web browser. Systems that require specific machine requirements in terms of processor speed, memory, etc., in order to allow the Web browser to function with the BAS, shall not be acceptable.

C. The Web browser shall provide the same view of the system, in terms of graphics, schedules, calendars, logs, etc., and provide the same interface methodology as is provided by the Graphical User Interface. Systems that require different views or that require different means of interacting with objects such as schedules, or logs, shall not be permitted.

D. The Web browser client shall support at a minimum, the following functions:

1) User log-on identification and password shall be required. If an unauthorized user attempts access, a blank web page shall be displayed. Security using Java authentication and encryption techniques to prevent unauthorized access shall be implemented.

2) Graphical screens developed for the GUI shall be the same screens used for the Web browser client. Any animated graphical objects supported by the GUI shall be supported by the Web browser interface.

3) HTML programming shall not be required to display system graphics or data on a Web page. HTML editing of the Web page shall be allowed if the user desires a specific look or format.

4) Storage of the graphical screens shall be in the Server, without requiring any graphics to be stored on the client machine. Systems that require graphics storage on each client are not acceptable.

5) Real-time values displayed on a Web page shall update automatically without requiring a manual "refresh" of the Web page.

E. User's shall have administrator-defined access privileges. Depending on the access privileges assigned, the user shall be able to perform the following:

1) Modify common application objects, such as schedules, calendars, and set points in a graphical manner.

F. Holidays shall be set by using a graphical calendar, without requiring any keyboard entry from the operator.

G. Commands to start and stop binary objects shall be done by right-clicking the selected object and selecting the appropriate command from the pop-up menu. No entry of text shall be required.

H. The system shall provide the capability to specify a user's (as determined by the log-on user identification) home page. Provide the ability to limit a specific user to just their defined home page. From the home page, links to other views, or pages in the system shall be possible, if allowed by the system administrator.

I. Graphic screens on the Web Browser client shall support hypertext links to other locations on the Internet or on Intranet sites, by specifying the Uniform Resource Locator (URL) for the desired link.

2.6 Controller Software

A. Local system control shall be performed by a field programmable Direct Digital Controller microprocessor based, which incorporates Direct Digital Control, and all necessary energy management functions. Field programming shall be via a user-programmable software package which allows the user (programmer) to write unique programs thru the local operators terminal. Digital Control Systems which require off-site software development or which are not programmable (burned-in sequences) are not acceptable.

B. The Direct Digital Controller shall perform its assigned control and energy management functions as a stand-alone unit, however it shall be incorporated into a DDCS local network (BACnet, LonTalk, MODBUS) for communication with local or remote operator workstations, web browsers, or servers. The digital controller shall perform its full control and energy management functions, regardless of the condition of communications link with local or remote operator workstations, web browsers, or servers. In addition, when more than one digital controller is required to meet these specifications, the digital control system shall be capable of sharing information between digital controllers to develop complex strategies and common point sensing. Permanently connect all controllers and system equipment displays, computers, modems, routers, etc., together via a communications network for a complete and interoperable system.

C. Energy Management. The DDCS shall have software capable of performing all the energy management functions necessary to reduce energy consumption. These programs include, but are not limited to: supply air reset using space load demand, enthalpy economizer control, supply water reset, optimal start using an adaptive algorithm to prevent the need for manual adjustment of parameters.

D. Owner tailored programs. A library of routines shall be resident in the digital control system, capable of generating additional programs thru the local program terminal as may be required for specified owner requirements. These include, in part: demand control, intermediate season (dead zone) control, variable air volume fan matching and

supply fan control, trending of variables, historical data storage (60 values for 30 changes of value minimum), totalizing, holiday programming.

E. Furnish the following applications software for building and energy management. All software applications shall reside and operate in the system controllers. Editing of applications shall occur at the operator workstation.

F. System Security

1) User access shall be secured using individual security passwords and user names.

2) Passwords shall restrict the user to the objects, applications, and system functions as assigned by the system manager.

3) User Log On/Log Off attempts shall be recorded.

4) The system shall protect itself from unauthorized use by automatically logging off following the last keystroke. The delay time shall be user-definable.

G. Scheduling. Provide the capability to schedule each object or group of objects in the system. Each schedule shall consist of the following:

1) Weekly Schedule. Provide separate schedules for each day of the week. Each of these schedules should include the capability for start, stop, optimal start and night economizer. Each schedule may consist of up to 10 events. When a group of objects are scheduled together, provide the capability to adjust the start and stop times for each member.

2) Exception Schedules. Provide the ability for the operator to designate any day of the year as an exception schedule. Exception schedules may be defined up to one year in advance. Once an exception schedule is executed, it will be discarded and replaced by the standard schedule for that day of the week.

3) Holiday Schedules. Provide the capability for the operator to define up to 99 special or holiday schedules. These schedules may be placed on the scheduling calendar and will be repeated each year. The operator shall be able to define the length of each holiday period.

H. System Coordination. Provide a standard application for the proper coordination of equipment. This application shall provide the operator with a method of grouping together equipment based on function and location. This group may then be used for scheduling and other applications.

I. Binary Alarms. Each binary object shall be set to alarm based on the operator-specified state. Provide the capability to automatically and manually disable alarming.

J. Analog Alarms. Each analog object shall have both high and low alarm limits. Alarming must be able to be automatically and manually disabled.

K. Alarm Reporting. The operator shall be able to determine the action to be taken in the event of an alarm. Alarms shall be routed to the appropriate workstations based on time and other conditions. An alarm shall be able to start programs, print, be logged in the event log, generate custom messages, and display graphics.

L. Remote Communication. System shall automatically contact operator workstation or server on receipt of critical alarms. The system shall have the ability to dial out in the event of an alarm using BACnet Point-To-Point at a minimum of 56K baud. Receivers shall be BACnet workstations.

M. Maintenance Management. The system shall monitor equipment status and generate maintenance messages based upon user-designated run-time, starts, and/or calendar date limits.

N. Sequencing. Provide application software based upon the sequences of operation specified to properly sequence chillers, boilers, and pumps.

O. PID Control. A PID (proportional-integral-derivative) algorithm with direct or reverse action and anti-windup shall be supplied. The algorithm shall calculate a time-varying analog value that is used to position an output or stage a series of outputs. The controlled variable, setpoint, and PID gains shall be user-selectable.

P. Staggered Start. This application shall prevent all controlled equipment from simultaneously restarting after a power outage. The order in which equipment (or groups of equipment) is started, along with the time delay between starts, shall be user-selectable.

Q. Energy Calculations.

1) Provide software to allow instantaneous power (e.g., kW) or flow rates (e.g., L/s GPM) to be accumulated and converted to energy usage data.

2) Provide an algorithm that calculates a sliding-window average (e.g., rolling average). The algorithm shall be flexible to allow window intervals to be user specified (e.g., 15-minutes, 30-minutes, 60-minutes).

3) Provide an algorithm that calculates a fixed-window average. A digital input signal shall define the start of the window period (e.g., signal from utility meter) to synchronize the fixed window average with that used by the utility.

R. Anti-Short Cycling. All binary output objects shall be protected from short cycling. This feature shall allow minimum on-time and off-time to be selected.

S. On/Off Control with Differential. Provide an algorithm that allows a binary output to be cycled based on a controlled variable and setpoint. The algorithm shall be direct-acting or reverse-acting, and incorporate an adjustable differential.

T. Run-time Totalization. Provide software to totalize run-times for all binary objects. A high run-time alarm shall be assigned, if required, by the operator.

U. Demand-Controlled Ventilation. Provide a program to adjust the quantity of outdoor ventilation air supplied to a zone by a central air handling unit based on the ventilation rate required to provide adequate indoor air quality in accordance with ASHRAE Standard 62.

2.7 BACnet Building Controller (B-BC)

A. General. Provide an adequate number of BACnet Building Controllers (B-BC) to achieve the performance specified in the Part 1 Article on "System Performance." Each of these panels shall meet the following requirements.

1) The Building Automation System shall be comprised of one or more independent, standalone, microprocessor-based building controllers to manage the global strategies described in the System Software section.

2) The building controller shall have sufficient memory to support its operating system, database, and programming requirements.

3) Data shall be shared between networked building controllers.

4) The operating system of the building controller shall manage the input and output communication signals to allow distributed controllers to share real and virtual object information, and allow central monitoring and alarms.

5) Controllers that perform scheduling shall have a real-time clock.

6) The building controller shall continually check the status of its processor and memory circuits. If an abnormal operation is detected, the controller shall

   a) Assume a predetermined failure mode,

   b) Generate an alarm notification.

7) The building controller shall communicate with other BACnet devices on the internetwork using the Read (Execute and Initiate) and Write (Execute and Initiate) Property services as defined in Clauses 15.5 and 15.8, respectively, of ASHRAE Standard 135-2007.

Building Controller BACnet Services	*Initiate*	*Execute*
Acknowledge Alarms	--	x
Confirmed COV Notification	x	x
Confirmed Event Notification	x	x
Get Alarm Summary	x	x
Get Enrollment Summary	x	x
Subscribe COV	x	x
Unconfirmed COV Notification	x	x
Unconfirmed Event Notification	x	x
Atomic Read File	--	x
Atomic Write File	--	x
Add List Element	--	x
Remove List Element	--	x
Create Object	--	x
Delete Object	--	x
Read Property	x	x
Read Property Multiple	x	x
Write Property	x	x

Building Controller BACnet Services	*Initiate*	*Execute*
Read Range	--	x
Write Property Multiple	x	x
Device Communication Control	--	x
Confirmed Private Transfer	x	x
Unconfirmed Private Transfer	x	x
Reinitialize Device	--	x
Time Synchronization	x	x
Who-Has	--	x
I-Have	x	x
Who-Is	x	x
I-Am	x	x

8) BACnet Functional Groups. The Building Controller shall support the following BACnet functional groups: Clock, Event Initiation, COV Event Response, Files, Device Communication and Time Master.

B. Communication

1) Each building controller shall reside on a BACnet network using the ISO 8802-3 (Ethernet) Data Link/ Physical layer protocol. Each building controller also shall perform BACnet routing if connected to a network of advanced application and application specific controllers.

2) The controller shall provide a service communication port using BACnet Data Link/Physical layer protocol for connection to a portable operator's terminal.

C. Environment. Controller hardware shall be suitable for the anticipated ambient conditions.

1) Controllers used outdoors and/or in wet ambient conditions shall be mounted within waterproof enclosures, and shall be rated for operation at 0°C to 65°C [32°F to 150°F] and 10 to 90% RH.

2) Controllers used in conditioned space shall be mounted in dust-proof enclosures, and shall be rated for operation at 0°C to 50°C [32°F to 120°F].

D. Keypad. A local keypad and display shall be provided for each controller. The keypad shall be provided for interrogating and editing data. An optional system security password shall be available to prevent unauthorized use of the keypad and display. If the manufacturer does not provide this keypad and display, provide a portable operator terminal.

E. Serviceability. Provide diagnostic LEDs for power, communication, and processor. All wiring connections shall be made to field-removable, modular terminal strips or to a termination card connected by a ribbon cable.

F. Memory. The building controller shall maintain all BIOS and programming information in the event of a power loss for at least 72 hours.

G. Immunity to power and noise. Controller shall be able to operate at 90% to 110% of nominal voltage rating and shall perform an orderly shutdown below 80% nominal voltage. Operation shall be protected against electrical noise of 5 to 120 Hz and from keyed radios up to 5 W at 1 m [3 ft].

2.8 BACnet Advanced Application Controller (B-AAC)

A. General. Provide an adequate number of BACnet Advanced Application Controllers (B-AAC) to achieve the performance specified in the Part 1 Article on "System Performance". Each of these panels shall meet the following requirements.

1) The B-AAC shall have sufficient memory to support its operating system, database, and programming requirements.

2) Data shall be shared between networked B-AACs.

3) The operating system of the controller shall manage the input and output communication signals to allow distributed controllers to share real and virtual object information, and allow central monitoring and alarms.

4) Controllers that perform scheduling shall have a real-time clock.

5) The B-AAC shall continually check the status of its processor and memory circuits. If an abnormal operation is detected, the controller shall

a) Assume a predetermined failure mode,

b) Generate an alarm notification.

6) The B-AAC shall communicate with other BACnet devices on the internetwork using the Read (Execute and Initiate) and Write (Execute and Initiate) Property services as defined in Clauses 15.5 and 15.8, respectively, of ASHRAE Standard 135-2007. All B-AACs shall bear the applicable BACnet Testing Laboratory™ logo on each product delivered.

7) The application control program shall be resident within the same enclosure as the input/output circuitry, which translates the sensor signals.

8) Provide documentation for each device, with the following information:

a) BACnet Device; MAC address, name, type and instance number,

b) BACnet Objects; name, type and instance number.

B. Communication

1) Each B-AAC shall reside on a BACnet network using the MS/TP or Ethernet Data Link/ Physical layer protocol.

2) The controller shall provide a service communication port using BACnet Data Link/Physical layer protocol for connection to a portable operator's terminal.

C. Environment. Controller hardware shall be suitable for the anticipated ambient conditions.

1) Controllers used outdoors and/or in wet ambient conditions shall be mounted within waterproof enclosures, and shall be rated for operation at 32°F to 150°F and 10 to 90% RH.

2) Controllers used in conditioned space shall be mounted in dust-proof enclosures, and shall be rated for operation at 32°F to 120°F.

D. Keypad. A local keypad and display shall be provided for each controller. The keypad shall be provided for interrogating and editing data. An optional system security password shall be available to prevent unauthorized use of the keypad and display. If the manufacturer does not provide this keypad and display, provide a portable operator terminal.

E. Serviceability. Provide diagnostic LEDs for power, communication, and processor. All wiring connections shall be made to field-removable, modular terminal strips or to a termination card connected by a ribbon cable.

F. Memory. The custom application controller shall maintain all BIOS and programming information in the event of a power loss for at least 72 hours.

G. Immunity to power and noise. Controller shall be able to operate at 90% to 110% of nominal voltage rating and shall perform an orderly shutdown below 80% nominal voltage. Operation shall be protected against electrical noise of 5 to 120 Hz and from keyed radios up to 5 W at 3 ft.

2.9 BACnet Application Specific Controller (B-ASC)

A. General. BACnet Application Specific Controllers (B-ASCs) are microprocessor-based DDC controllers which through hardware or firmware design are dedicated to control a specific piece of equipment. They are not fully user-programmable, but are customized for operation within the confines of the equipment they are designed to serve. Application Specific Controllers shall communicate with other BACnet devices on the internetwork using the Read (Execute) Property service as defined in Clause 15.5 of ASHRAE Standard 135-2007. All B-ASCs shall bear the applicable BACnet Testing Laboratory™ logo on each product delivered.

1) Each B-ASC shall be capable of stand-alone operation and shall continue to provide control functions without being connected to the network

2) Each B-ASC will contain sufficient I/O capacity to control the target system.

3) The application control program shall be resident within the same enclosure as the input/output circuitry, which translates the sensor signals.

4) Provide documentation for each device, with the following information:

a) BACnet Device; MAC address, name, type and instance number,

b) BACnet Objects; name, type and instance number.

B. Communication

1) Each controller shall reside on a BACnet network using the MS/TP or Ethernet Data Link/ Physical layer protocol. Each network of controllers shall be connected to one building controller.

2) Each controller shall have a BACnet Data Link/Physical layer compatible connection for a laptop computer or a portable operator's tool. This connection shall be extended to a space temperature sensor port where shown and allow access to the entire network.

3) Each controller shall have a secondary sub network for communicating sensors or I/O expansion modules.

C. Environment. Controller hardware shall be suitable for the anticipated ambient conditions.

1) Controllers used outdoors and/or in wet ambient conditions shall be mounted within waterproof enclosures, and shall be rated for operation at 32°F to 150°F and 10 to 90% RH.

2) Controllers used in conditioned space shall be mounted in dust-proof enclosures, and shall be rated for operation at 32°F to 120°F.

D. Serviceability. Provide diagnostic LEDs for power, communication, and processor. All wiring connections shall be made to field-removable, modular terminal strips or to a termination card connected by a ribbon cable.

E. Memory. The application specific controller shall use nonvolatile memory and maintain all BIOS and programming information in the event of a power loss.

F. Immunity to power and noise. Controller shall be able to operate at 90% to 110% of nominal voltage rating and shall perform an orderly shutdown below 80% nominal voltage. Operation shall be protected against electrical noise of 5 to 120 Hz and from keyed radios up to 5 W at 3 ft.

G. Transformer. Power supply for the ASC must be rated at a minimum of 125% of ASC power consumption and shall be of the fused or current limiting type.

2.10 LonMark or LonWorks Programmable Control Unit (L-PCU)

A. General. LonMark or LonWorks Programmable Control Unit (L-PCU) are microprocessor-based DDC controllers. All L-PCUs shall bear the applicable LonMark™ interoperability logo on each product delivered. All L-PCU shall operate totally standalone and independent of a central computer or NCE for all specified control applications.

1) System controllers shall share network variable data with other LON-based devices that utilize the same transceivers as referenced previously.

2) Operating system software, custom operating sequence software and application programs shall be stored in programmable, non-volatile memory.

3) The complete programmable controller including accessory devices such as relay, transducers, power supplies, etc., shall be wired and housed in an enclosure or as required by the location and local code requirements.

4) Provide programmable controller boards with external interface jacks to provide an optional communication link.

5) Equip programmable controller with diagnostic indicators for the following:

a) Transmit.

b) Receive.

B. Provide publicly available specifications for the Applications Programming Interface (API) for each LonWorks / LonMark controller defining the programming or setup of each device. Provide all programming, documentation and programming tools necessary to set up and configure the supplied devices per the specified sequences of operation.

C. A maximum of 126 devices may occupy any one LonWorks trunk and must be installed using the appropriate trunk termination device. All LonWorks and LonMark devices must be supplied using FTT-10A LonWorks communications transceivers.

D. The Network Control Engine (NCE) will provide all scheduling, alarming, trending, and network management for the LonMark / LonWorks based devices.

E. The L-PCUs shall communicate with the NCE at a baud rate of not less than 78.8K baud. The L-PCU shall provide LED indication of communication and controller performance to the technician, without cover removal.

F. All L-PCUs shall be fully application programmable and shall at all times maintain their LONMARK certification. Controllers offering application selection only (non-programmable), require a 10% spare point capacity to be provided for all applications. All control sequences within or programmed into the L-PCU shall be stored in non-volatile memory, which is not dependent upon the presence of a battery, to be retained.

G. Provide documentation for each device, with the following information:

1) Network Variable Inputs (NVI's); name and type

2) Network Variable Outputs (NVO's); name and type

3) Network configuration parameters (NCI, NCO); name and type

H. The supplier of any programmable L-PCU shall provide one copy of the manufacturer's programming tool, with documentation, to the owner.

2.11 LonMark™ or LonWorks Terminal Device Control Unit (L-TDCU)

A. General. Control Units shall be equipped with an appropriate Neuron microprocessor controller, programmable non-volatile memory for general data processing, power supply, input/output modules, termination blocks and network transceivers of adequate size and quantity to perform the function they were intended to.

B. System controllers shall be capable of sharing network variable data with other LON-based devices.

C. Operating system software, custom operating sequence software and application programs shall be stored in programmable, non-volatile memory.

D. It shall be possible to make changes to the application program and/or configuration of any controller in real-time with no interruption of the operation of the controlled equipment. Systems that require that the controller be taken offline and/or require the shutdown of the controlled equipment are not acceptable.

E. The TDCU shall synchronize time with a PCU on the network upon power up of the network.

F. A TDCU shall operate totally standalone and independent of a central computer for all specified control applications. Software shall include a complete Operating System (O.S.), communications handler, point processing, standard control algorithms, and specific control sequences.

G. O.S. software shall reside in programmable flash memory, operate in real-time, provide prioritized task scheduling, control time programs, and scan inputs and outputs. O.S. shall also contain built in diagnostics.

H. TDCU's shall have application specific programs to minimize configuration and installation time. Application specific programs shall be able to be changed so the same hardware component can be utilized in the event the mechanical equipment is removed, and new mechanical equipment has been added.

I. Input/Output Point Processing Software shall include:

1) Continuous update of input and output values and conditions

2) All connected points are to be updated at a minimum of one-second intervals

3) Assignment of proper engineering units and status condition identifiers to all analog and digital input and outputs.

J. A "fixed mode" option shall be supported to allow inputs to, and outputs from DDC control programs to set to a fixed state or value. When in the "fixed mode" inputs and output shall be assigned a high residual command priority to prevent override by application programs.

2.12 LonMark™ Network Interfaces, Routers, Bridges, Repeaters and Transceivers

A. General. Equip each Internet server, router and bridge with a network transceiver on each network port (inbound and outbound) as dictated by the network type (Type 1 - FTT, Type 2 - TP, Type 3 - PL, Type 4 - LP, Type 5 - RF).

1) The network router shall be designed to route messages from a segment, sub-net, or domain in full duplex communication mode.

2) Routers and bridges shall utilize LonTalk protocol transport, network, and session layers to transparently route messages bound for a node address in another sub-net or domain exclusively.

3) Routers, bridges and repeaters shall be fully configurable and permit a systems integrator to define message traffic, destination, and other network management functions utilizing LonWorks software tool.

4) The routers, bridges, and repeaters shall be capable of DIN rail or panel mounting and be equipped with status LED lights for Network traffic and power.

5) Provide a minimum of two Neuron 3120 or 3150 processors for use as the network communication controller.

B. Ethernet IP Router

1) Equip each router with an Ethernet IP communication on one side and a LonTalk® transceiver Type 1 FTT or Type 2 - TP on the other side.

2) The network router shall be designed to route messages from a segment, sub-net, or domain in full duplex communication mode.

3) On Ethernet IP side, the router shall utilize Ethernet IP protocol transport to route messages.

4) On the LonTalk® side, the routers shall utilize LonTalk® protocol transport, network, and session layers to transparently route messages bound for a node address in another sub-net or domain.

5) Routers shall be fully programmable and permit a systems integrator to define message traffic, destination, and other network management functions utilizing LonWorks® software tool.

6) The routers shall be capable of DIN rail or panel mounting and be equipped with status LED lights for Network traffic and power.

C. Transceivers

1) Type 1 network transceiver, free topology, twisted pair: Provide a transformer isolated, twisted pair transceiver capable of mounting directly on a printed circuit board. The transceiver shall meet the following specifications:

a) Meets LonMark™ Interoperability Association Standards.

b) Differential Manchester encoded signaling for polarity insensitive network wiring.

c) Transformer isolated for common mode rejection.

d) 78kbs network bit rate up to distances of 2000 meters.

e) Free topology supports star, home run, multidrop and loop wiring topologies.

f) Complies with FCC and VDE requirements.

g) UL recognized component.

2) Type 2 Network Transceiver, Twisted Pair: Provide a transformer isolated twisted pair transceiver capable of mounting directly on a printed circuit board. The transceiver shall meet the following specifications:

a) Meets LONWORKS® interoperability standards.

b) Differential Manchester encoded signaling for polarity insensitive network wiring.

c) Transformer isolation for common mode rejection.

d) 1.25Mbs network bit rate up to distances of 1000 meters.

e) FCC and VDE Level B requirements compliance.

f) UL recognized component.

2.13 LonWorks Network Management

A. Provide a complete set of integrated LonWorks network management tools for working with LonWorks networks. These tools shall manage a database for all LonWorks devices by type and revision, and shall provide a software mechanism for identifying each device on the network. These tools shall also be capable of defining network data connections between LonWorks devices, known as "binding". Systems requiring the use of third party LonWorks network management tools shall not be accepted.

B. Network management shall include the following services: device identification, device installation, device configuration, device diagnostics, device maintenance and network variable binding.

C. The network configuration tool shall also provide diagnostics to identify devices on the network, to reset devices, and to view health and status counters within devices.

D. These tools shall provide the ability to "learn" an existing LonWorks network, regardless of what network management tool(s) were used to install the existing network, so that existing LonWorks devices and newly added devices are part of a single network management database.

E. The network management database shall be resident in the NCE, ensuring that anyone with proper authorization has access to the network management database at all times. Systems employing network management databases that are not resident, at all times, within the control system, shall not be accepted.

F. Network management functions shall include:

1) Discovering new nodes as they are physically attached to the network

2) Network configuration and commissioning of nodes

3) Receiving service pins

4) Importing node self-documentation and self-identification information

5) Importing node external interface files

6) Copying configuration network variable values from one node to another

7) Installing, removing, and replacing nodes

8) Connecting and disconnecting network variables and message tags

9) Loading application images into nodes

10) Querying and setting node properties, such as locations, priority slots, self-documentation, and network variable attributes

11) Resetting, winking, and testing nodes.

2.14 MODBUS System Integration

A. The NCE shall support the integration of device data from MODBUS RTU, ACSII, or TCP control system devices. The connection to the MODBUS system shall be via an RS-232, RS485, or Ethernet IP as required by the device.

B. Provide the required objects in the library, included with the Graphical User Interface programming software, to support the integration of the MODBUS system data into the FPMS. Objects provided shall include at a minimum:

1) Read/Write MODBUS AI Registers

2) Read/Write MODBUS AO Registers

3) Read/Write MODBUS BI Registers

4) Read/Write MODBUS BO Registers

C. All scheduling, alarming, logging and global supervisory control functions, of the MODBUS system devices, shall be performed by the Network Area Controller.

D. The DDCS supplier shall provide a MODBUS system communications driver. The equipment system vendor that provided the equipment utilizing MODBUS shall provide documentation of the system's MODBUS interface and shall provide factory support at no charge during system commissioning.

2.15 Input/Output Interface

A. Hardwired inputs and output points/objects may be wired into the system through building, advanced application, or application specific controllers.

B. All input and output points shall be protected such that shorting of the point to itself, to another point, or to ground, shall cause no damage to the controller. All input and output points shall be protected from voltage up to 24 volts of any duration, such that contact with this voltage will cause no damage to the controller.

C. Binary inputs shall allow the monitoring of ON/OFF signals from remote devices. The binary inputs shall provide a wetting current of at least 12 mA to be compatible with commonly available control devices and shall be protected against the effects of contact bounce and noise. Binary inputs shall sense "dry contact" closure without external power (other than that provided by the controller) being applied.

D. Pulse accumulation input objects. This type of object shall conform to all the requirements of binary input objects and also accept up to 10 pulses per second for pulse accumulation.

E. Analog inputs shall allow the monitoring of low-voltage (0-10 VDC), current (4-20 mA), or resistance signals (thermistor, RTD). Analog inputs shall be compatible with – and field configurable to – commonly available sensing devices.

F. Binary outputs shall provide for ON/OFF operation or a pulsed low-voltage signal for pulse width modulation control. Binary outputs on building and custom application controllers shall have three-position (On/Off/Auto) override switches, and status lights. Outputs shall be selectable for either normally open or normally closed operation.

G. Analog outputs shall provide a modulating signal for the control of end devices. Outputs shall provide either a 0 to 10 VDC signal or a 4 to 20 mA signal as required to provide proper control of the output device. Analog outputs on building or custom application controllers shall have status lights and a two-position (AUTO/MANUAL) switch and manually adjustable potentiometer for manual override. Analog outputs shall not exhibit a drift of greater than 0.4% of range per year.

H. Tri-State Outputs. Provide tri-state outputs (two coordinated binary outputs) for control of three-point floating type electronic actuators without feedback. Use of three-point floating devices shall be limited to zone control and terminal unit control applications (VAV terminal units, duct mounted heating coils, zone dampers, radiation, etc.) Control algorithms shall run the zone actuator to one end of its stroke once every 24 hours for verification of operator tracking.

I. Input/Output points shall be universal type, i.e., controller input or output may be designated (in software) as either a binary or analog type point with appropriate properties. Application specific controllers are exempted from this requirement.

J. System Object Capacity. The system size shall be expandable to at least twice the number of input/output objects required for this project. Additional controllers (along with associated devices and wiring) shall be all that is necessary to achieve this capacity requirement. The operator interfaces installed for this project shall not require any hardware additions or software revisions in order to expand the system.

K. Each controlled device or function shall be a separate output of the digital controller (i.e., Economizer, Heating Valve, Cooling Valve are three (3) separate output points). When a points' list is provided the greater number of points and their configuration shall govern. Multiplexers or programmable logic controllers utilized with digital controller input and output points to expend the digital controller I/O capabilities will not be allowed.

L. Refer to section 23 09 13 Instrumentation and Control Devices for HVAC.

PART 3 - EXECUTION

3.1 Examination

A. The project plans shall be thoroughly examined for control device and equipment locations. Any discrepancies, conflicts, or omissions shall be reported to the Engineer for resolution before rough-in work is started.

B. Inspect the site to verify that equipment may be installed as shown. Any discrepancies, conflicts, or omissions shall be reported to the Engineer for resolution before rough-in work is started.

C. Examine the drawings and specifications for other parts of the work. If head room or space conditions appear inadequate or if any discrepancies occur between the plans and the Contractor's work and the plans and the work of others, then report these discrepancies to the Engineer and obtain written instructions for any changes necessary to accommodate the temperature control work with the work of others. Any changes in the work covered by this specification made necessary by the failure or neglect to report such discrepancies shall be made by and the costs borne by the HVAC Contractor.

3.2 Protection

A. Protect all work and material from damage by his work or employees, and shall be liable for all damage thus caused.

B. The installing contractor shall be responsible for his work and equipment until finally inspected, tested, and accepted. Protect any material that is not immediately installed. Close all open ends of work with temporary covers or plugs during storage and construction to prevent entry of foreign objects.

3.3 Coordination

A. Site

1) Where the temperature control work will be installed in close proximity to, or will interfere with work of other trades, assist in working out space conditions to make a satisfactory adjustment. If temperature control work is installed before coordinating with other trades, so as to cause any interference with work of other trades, the temperature control work shall be re-worked to correct the condition without extra charge.

2) Coordinate and schedule work with all other work in the same area, or with work which is dependent upon other work, to facilitate mutual progress.

B. Test and Balance

1) Furnish all tools necessary to interface to the control system for test and balance purposes.

2) Provide training in the use of these tools. This training will be planned for a minimum of 4 hours.

3) In addition provide a qualified technician to assist in the test and balance process, until the first 20 terminal units are balanced.

4) The tools used during the test and balance process will be returned at the completion of the testing and balancing.

C. Coordination with controls specified in other sections or divisions. Other sections and/or divisions of this specification include controls and control devices that are to be part of or interfaced to the control system specified in this section. These controls shall be integrated into the system and coordinated as follows:

1) All communication media and equipment shall be provided as specified in Part 2: "Communication" of this specification.

2) Each supplier of controls product is responsible for the configuration, programming, start-up, and testing of that product to meet the sequences of operation described in this section.

3) Coordinate and resolve any incompatibility issues that arise between the control products provided under this Section and those provided under other sections or divisions of this specification.

D. Revise equipment tagging and nomenclature, room numbering, etc. to reflect as-built conditions or an Owner's preference for integration into his existing naming numbering convention.

3.4 Field Quality Control

A. All work, materials, and equipment shall comply with the rules and regulations of applicable local, state, and federal codes and ordinances as identified in Part 1 of this specification.

B. Continually monitor the field installation for code compliance and quality of workmanship.

C. Have work inspected by authorities having jurisdiction over the work.

3.5 Controllers

A. Provide a separate controller for each AHU or other HVAC system. A DDC controller may control more than one system provided that all points/objects associated with the system are assigned to the same DDC controller. Points/objects used for control loop reset such as outside air or space temperature are exempt from this requirement.

B. Building Controllers and Custom Application Controllers shall be selected to provide a minimum of 15% spare I/O point/object capacity for each point/object type found at each location. If input /objects are not universal, 15% of each type is required. If outputs are not universal, 15% of each type is required. A minimum of one spare is required for each type of point/object used.

1) Future use of spare capacity shall require providing the field device, field wiring, point/object database definition, and custom software. No additional controller boards or point/object modules shall be required to implement use of these spare points.

3.6 Programming

A. Provide sufficient internal memory for the specified sequences of operation and trend logging. There shall be a minimum of 25% of available memory free for future use.

B. Point/object Naming: System point/object names shall be modular in design, allowing easy operator interface without the use of a written point/object index. Use the following naming convention:

AAABBBCCCDDDEEE where:

AAA is used to designate the location of the point/object within the building such as mechanical room, wing, or level, or the building itself in a multi-building environment.

BBB is used to designate the mechanical system with which the point/object is associated (e.g., A01, HTG, CLG, LTG).

CCC represents the equipment or material referenced (e.g., SAF for supply air fan , EXF for exhaust fan, RAF for return air fan).

D or *DD* or *DDD* may be used for clarification or for identification if more than one of CCC exists (e.g., SAF10, EXF121).

EE represents the action or state of the equipment or medium (e.g., T for temperature, RH for humidity, CO for control, S for status, D for damper control, I for current).

C. Software Programming

1) Provide programming for the system and adhere to the sequences of operation provided. All other system programming necessary for the operation of the system, but not specified in this document, also shall be provided. Imbed into the control program sufficient comment statements to clearly describe each section of the program. The comment statements shall reflect the language used in the sequences of operation. Use the appropriate technique based on the following programming types:

a) Text-based:

(1) must provide actions for all possible situations

(2) must be modular and structured

(3) must be commented

b) Graphic-based

(1) must provide actions for all possible situations

(2) must be documented

c) Parameter-based

(1) must provide actions for all possible situations

(2) must be documented

2) After submittal and review of control software, offer to schedule a meeting with the Engineer and Commissioning Agent (CxA) to review system function.

D. Operator Interface

1) Standard Graphics. Provide graphics for all controlled systems and floor plans of the building. Point/object information on the graphic displays shall dynamically update. Show on each graphic all input and output points/objects for the system. Also show relevant calculated points/objects such as setpoints.

2) Show terminal equipment information on a "graphic" summary table. Provide dynamic information for each point/object show.

3) Provide all the labor necessary to install, initialize, start up, and troubleshoot all operator interface software and their functions as described in this section. This includes any operating system software, the operator interface database, and any third-party software installation and integration required for successful operation of the operator interface.

3.7 Control System Checkout And Testing

A. Start-up Testing: All testing listed in this article shall make up part of the necessary verification of an operating control system. This testing shall be completed before the Owner's Representative is notified of the system demonstration.

1) Upon completion of the control system, adjust all components of the system. Make all adjustments in the control system required and as directed by the balancer to achieve the desired air balance quantities. All instruments shall be carefully calibrated and each control function shall be demonstrated to function properly, to the satisfaction of the Engineer and the Owner. Provide a complete instruction manual covering the function and operation of all components. At the time of demonstration, each function shall be simulated to ensure that controls respond properly to all signals, and the Owner shall be instructed in the proper operation of the system.

2) Furnish all labor and test apparatus required to calibrate and prepare for service of all instruments, controls, and accessory equipment furnished under this specification.

3) Verify that all control wiring is properly connected and free of all shorts and ground faults. Verify that terminations are tight.

4) Enable the control systems and verify calibration of all input devices individually. Perform calibration procedures per manufacturers' recommendations.

5) Verify that all binary output devices (relays, solenoid valves, two-position actuators and control valves, magnetic starters, etc.) operate properly and that the normal positions are correct.

6) Verify that all analog output devices (transducers, actuators, etc.) are functional, that start and span are correct, and that direction and normal positions are correct. Check all control valves and automatic dampers to ensure proper action and closure. Make any necessary adjustments to valve stem and damper blade travel.

7) Verify that the system operation adheres to the Sequences of Operation. Simulate and observe all modes of operation by overriding and varying inputs and schedules. Tune all DDC loops and optimum Start/Stop routines.

8) Alarms and Interlocks

a) Check each alarm separately by including an appropriate signal at a value that will trip the alarm.

b) Interlocks shall be tripped using field contacts to check the logic, as well as to ensure that the fail-safe condition for all actuators is in the proper direction.

c) Interlock actions shall be tested by simulating alarm conditions to check the initiating value of the variable and interlock action.

9) Each unit and associated controls, safeties and wiring shall be checked out, started and adjusted by a factory trained service technician. Submit a startup report including a list of all unit safety and control settings, whether fixed or adjustable, as field checked and setup per the specified design conditions five days after unit startup. Submit service technician certification upon request.

3.8 Control System Demonstration And Acceptance

A. Demonstration

1) Prior to commissioning and acceptance, the control system shall undergo a series of performance tests to verify operation and compliance with this specification. These tests shall occur after the temperature controls have been completed, started up and performed its own tests.

2) The tests described in this section are to be performed in addition to the tests that are performed as a necessary part of the installation, startup, and debugging process and as specified in the "Control System Checkout and Testing" Article in Part 3 of this specification. The Engineer may be present to observe and review these tests. The Engineer shall be notified at least 10 days in advance of the start of the testing procedures.

3) The demonstration process shall follow that approved in Part 1: "Submittals." The approved checklists and forms shall be completed for all systems as part of the demonstration.

4) Provide at least two persons equipped with two-way communication, and demonstrate actual field operation of each control and sensing point for all modes of operation including day, night, occupied, unoccupied, fire/smoke alarm, seasonal changeover, and power failure modes. The purpose is to demonstrate the calibration, response, and action of every point/object and system. Provide and operate any test equipment required to prove the proper operation.

5) Trend log every point/object for one week continuous operation following demonstration period. Review report and correct any operational deficiencies and submit correction report and trend logs for record purposes. Also, submit to the Commissioning Agent for their review, prior to start of Commissioning.

6) As each control input and output is checked, a log shall be completed showing the date, technician's initials, and any corrective action taken or needed.

7) Demonstrate compliance with Part 1: "System Performance.

8) Demonstrate compliance with Sequences of Operation through all modes of operation.

9) Demonstrate complete operation of Operator Interface.

10) Additionally, the following items shall be demonstrated:

a) DDC Loop Response. Supply trend data output in a graphical form showing the step response of each DDC loop. The test shall show the loop's response to a change in setpoint, which represents a change of actuator position of at least 25% of its full range. The sampling rate of the trend shall be from 10 seconds to 3 minutes, depending on the speed of the loop. The trend data shall show for each sample the setpoint, actuator position, and controlled variable values. Further tune any loop that yields unreasonably under-damped or over-damped control.

b) Optimum Start. Supply a trend data output showing the capability of the algorithm. The hour-by-hour trends shall include the output status of all optimally started equipment, as well as temperature sensor inputs of affected areas.

c) Interface to the building fire alarm system.

d) Operational logs for each system that indicate all setpoints, operating points, valve positions, mode, and equipment status shall be submitted to the Engineer. These logs shall cover three 48-hour periods and have a sample frequency of not more than 10 minutes. The logs shall be provided in both printed and disk formats.

11) Any tests that fail to demonstrate the operation of the system shall be repeated at a later date, and any necessary repairs or revisions to the hardware or software to successfully complete all tests shall be made.

B. Acceptance

1) All tests described in this specification shall have been performed to the satisfaction of both the Engineer and Owner prior to the acceptance of the control system as meeting the requirements of Completion. Any tests that cannot be performed due to circumstances beyond the control of the contractor may be exempt from the Completion requirements if stated as such in writing by the Engineer. Such tests shall then be performed as part of the warranty.

2) The system shall not be accepted until all forms and checklists completed as part of the demonstration are submitted and approved as required in Part 1: Submittals.

C. During the first year of operation, after acceptance by the Owner, provide complete service to adjust or assist the Owner in adjusting the equipment to obtain optimum performance from the control equipment and from the heating and air conditioning systems in general. This shall be done without additional expense to the Owner. This work shall include revisions to DDC software programs and controller, and all PC front end software upgrades. All software shall be provided to the Owner in disk form, including back-ups of final field programs.

3.9 Cleaning

A. Clean up all debris resulting from its activities daily. Remove all cartons, containers, crates, etc., under its control as soon as their contents have been removed. Waste shall be collected and placed in a designated location.

B. At the completion of work in any area, clean all work, equipment, etc., keeping it free from dust, dirt, and debris, etc.

C. At the completion of work, all equipment furnished under this section shall be checked for paint damage, and any factory-finished paint that has been damaged shall be repaired to match the adjacent areas. Any cabinet or enclosure that has been deformed shall be replaced with new material and repainted to match the adjacent areas.

3.10 Training

A. Provide a minimum of three onsite training classes 8 hours in length during the construction period for personnel designated by the owner.

B. Provide two additional training sessions at 6 and 12 months following building's turnover. Each session shall be 8 hrs in length and must be coordinated with the building Owner.

C. Train the designated staff of Owner's Representative and Owner to enable them to:

1) Day-to-day Operators:

a) Proficiently operate the system

b) Understand control system architecture and configuration

c) Understand DDC system components

d) Understand system operation, including DDC system control and optimizing routines (algorithms)

e) Operate the workstation and peripherals

f) Log on and off the system

g) Access graphics, point/object reports, and logs

h) Adjust and change system setpoints, time schedules, and holiday schedules

i) Recognize malfunctions of the system by observation of the printed copy and graphical visual signals

j) Understand system drawings, and Operation and Maintenance manual

k) Understand the job layout and location of control components

l) Access data from DDC controllers

m) Operate portable operator's terminals

2) Advanced Operators:

a) Make and change graphics on the workstation

b) Create, delete, and modify alarms, including annunciation and routing of these

c) Create, delete, and modify point/object trend logs, and graph or print these

d) Create, delete, and modify reports

e) Add, remove, and modify system's physical points/objects

f) Create, modify, and delete programming

g) Add panels when required

h) Add operator interface stations

i) Create, delete, and modify system displays — both graphical and otherwise

j) Perform DDC system field checkout procedures

k) Perform DDC controller unit operation and maintenance procedures

l) Perform workstation and peripheral operation and maintenance procedures

m) Perform DDC system diagnostic procedures

n) Configure hardware including PC boards, switches, communication, and I/O points/objects

o) Maintain, calibrate, troubleshoot, diagnose, and repair hardware

p) Adjust, calibrate, and replace system components

3) System Managers/Administrators:

a) Maintain software and prepare backups

b) Interface with job-specific, third-party operator software

c) Add new users and understand password security procedures

D. Provide course outline and materials as per "Submittals" Article in Part 1 of this specification. The instructor(s) shall provide one copy of training material per student.

E. The instructor(s) shall be factory-trained instructors experienced in presenting this material.

F. Classroom training shall be done using a network of working controllers representative of the installed hardware.

3.11 Outdoor temperature and humidity sensors shall be mounted on the north face of the building unless otherwise approved by the Engineer. Exact location shall be approved by the Architect.

3.12 In addition to the adjustments and fine tuning, include as a part of this contract the equivalent of five (5) man-days of service technician time for work as may be specified by the Engineer.

END OF SECTION

26 51 13 INTERIOR LUMINAIRES, LAMPS AND BALLASTS

PART 1 - GENERAL

1.1 Refer to schedule on the drawings for information on luminaires, lamps and manufacturers. Luminaires of manufacturers other than those listed, if offered, shall be on a substitute basis and so listed as a substitute with the bid. (Refer to Section 26 05 01, para. 2.4.B.)

1.2 The catalog numbers listed on the schedule do not necessarily have complete prefix and suffix designations for placing the luminaire order. The Contractor shall verify these numbers and include in his bid the necessary plaster frames, accessories, trim, mounting hardware, etc. to achieve a coordinated installation with ceiling types indicated on the architectural drawings and in specifications. The Contractor shall provide any hardware indicated by notes on the fixture schedule.

1.3 Luminaires, ballasts and individual components shall bear UL label. All ballasts including compact fluorescents shall be high efficiency and high power factor (HPF).

1.4 Fluorescent luminaires utilizing double-ended lamps and ballast(s) shall have an internal disconnect means, integral with the unit, complying with NEC Article 410. Means shall disconnect all supply conductors including the grounded conductor.

PART 2 - PRODUCTS

2.1 Fluorescent and HID Luminaire Components

A. Electronic solid-state ballasts for fluorescent luminaires with F17T8, F28T8, F25T8 or F32T8 rapid-start lamps shall be Class "P", high power factor, UL listed, independent testing laboratory certified, sound rated "A", contain no PCB's, incorporate thermal protection, 20,000 Hz or greater frequency operation, operate without visible flicker and meet FCC rules as they pertain to low EMI or RFI radiation output levels.

B. Total harmonic distortion shall not exceed 10%, crest factor shall not exceed 1.7 and the ballast shall have a power factor of .98 or greater and a minimum ballast factor of .88 for program start and .87 for instant start.

C. Provide multiple ballasts in luminaires to facilitate multi-level switching when such switching is indicated on the electrical drawings. Ballast shall be NEMA premium type when available. Ballast shall have a 5-year warranty from date of project acceptance by the Engineer.

D. Either instant or rapid start technology is acceptable and shall be designed for:

1) Programmed rapid start for frequently switched applications such as with an occupancy sensor or other control having series operation for two lamps.

2) Programmed rapid start for frequently switched applications (such as with an occupancy sensor or other control) having series parallel operation for 3 and 4 lamps.

E. The following is a summary of acceptable ballast manufacturers and types:

Ballast Catalog Numbers

1 - Lamp 32 Watt T8
High Efficiency .88/.87 Ballast Factor

Manufacturer	Instant Start	Programmed Start
Osram Sylvania	QHE 1X32T8/UNV ISN-SC	QTP 1X32T8/UNV PSN-TC
Universal	B132IUNVHE-A	B132PUNVHP-A
Advance	IOP-1P32-SC	IOP-1S32-SC
GE	GE-132MAX-N/ULTRA	GE-132-MVPS-N

1 - Lamp 28 Watt T8
High Efficiency .88/.87 Ballast Factor

Manufacturer	Instant Start	Programmed Start
Osram Sylvania	QHE 1X32T8/UNV ISN-SC	QTP 1X32T8/UNV PSN-TC
Universal	B132IUNVHE-A	B132PUNVHP-A
Advance	IOP-1P32-SC	IOP-2S32-SC
GE	GE-132MAX-N/ULTRA	GE-132-MVPS-N

Note: Per specifications all ballasts will have <10% THD, .98 PF, and 120/277V universal voltage ballast unless indicated otherwise.

2 - Lamp 32 Watt T8
High Efficiency .88/.87 Ballast Factor

Manufacturer	Instant Start	Programmed Start
Osram Sylvania	QHE 2X32T8/UNV ISN-SC	QTP 2X32T8/UNV PSN-TC
Universal	B232IUNVHP-B	B232PUNVHP-A
Advance	IOP-2P32-SC	IOP-2S32-SC
GE	GE-232MAX-N/ULTRA	GE-232-MVPS-N

2 - Lamp 28 Watt T8
High Efficiency .88/.87 Ballast Factor

Manufacturer	Instant Start	Programmed Start
Osram Sylvania	QHE 2X32T8/UNV ISN-SC	QTP 2X32T8/UNV PSN-TC
Universal	B232IUNVHP-B	B232PUNVHP-A
Advance	IOP-2P32-SC	IOP-2S32-SC
GE	GE-232MAX-N/ULTRA	GE-232-MVPS-N

Note: Per specifications all ballasts will have <10% THD, .98 PF, and 120/277V universal voltage ballast unless indicated otherwise.

3 - Lamp 32 Watt T8
High Efficiency .88/.87 Ballast Factor

Manufacturer	Instant Start	Programmed Start
Osram Sylvania	QHE 3X32T8/UNV ISN-SC	QTP 3X32T8/UNV PSN-TC
Universal	B332IUNVHP-A	B432PUNVHP-A
Advance	IOP-3P32-SC	IOP-3S32-SC
GE	GE-332MAX-N/ULTRA	GE-332-MVPS-N

3 - Lamp 28 Watt T8
High Efficiency .88/.87 Ballast Factor

Manufacturer	Instant Start	Programmed Start
Osram Sylvania	QHE 3X32T8/UNV ISN-SC	QTP 3X32T8/UNV PSN-TC
Universal	B332IUNVHE-A	B332PUNVHP-A
Advance	IOP-3P32-SC	IOP-3S32-SC
GE	GE-332MAX-N/ULTRA	GE-432-MVPS-N

Note: Per specifications all ballasts will have <10% THD, .98 PF, and 120/277V universal voltage ballast unless indicated otherwise.

4 - Lamp 32 Watt T8
High Efficiency .88/.87 Ballast Factor

Manufacturer	Instant Start	Programmed Start
Osram Sylvania	QHE 4X32T8/UNV ISN-SC	QTP 4X32T8/UNV PSN-TC
Universal	B432IUNVHP-A	B432PUNVHP-A
Advance	IOP-4P32-SC	IOP-4S32-SC
GE	GE-432MAX-N/ULTRA	GE-432-MVPS-N

4 - Lamp 28 Watt T8
High Efficiency .88/.87 Ballast Factor

Manufacturer	Instant Start	Programmed Start
Osram Sylvania	QHE 4X32T8/UNV ISN-SC	QTP 4X32T8/UNV PSN-TC
Universal	B432IUNVHE-A	B432PUNVHP-A
Advance	IOP-4P32-SC	IOP-4S32-SC
GE	GE-432MAX-N/ULTRA	GE-432-MVPS-N

Note: Per specifications all ballasts will have <10% THD, .98 PF, and 120/277V universal voltage ballast unless indicated otherwise.

F. Dimming Ballast

1) Dimming electronic solid-state ballast for fluorescent luminaires with F32T8 rapid start or compact fluorescent lamps shall be programmed rapid start and shall be a high frequency electronic type and operate lamps above 20 kHz. Lamp current crest factor shall be 1.6 or less throughout dimming range.

2) Ballast shall provide full-range dimming down to 5% for T8 and 1% for T5 light output and have a minimum ballast factor of .88, contain no PCB's, Class "P" high power factor, UL listed, independent testing laboratory certified, sound rated "A", incorporate thermal protection, operate without visible flicker and meet FCC rules as they pertain to low EMI and RFI radiation output levels.

3) Total harmonic distortion shall not exceed 10%. Ballast shall have a power factor greater than 98% at full light output and greater than 90% throughout dimming range. Ballast shall tolerate sustained open circuit and short circuit output conditions without damage and shall ignite the lamps at any light output setting selected without first having to go to full light output.

4) Ballast shall have 5-year warranty from date of project acceptance by the Engineer.

5) Equal to Advance Mark X, Mark VII, Lutron or Sylvania Power Sense in new construction applications or pre-approved equal. Ballast shall be compatible with the dimming system provided. For special dimming system refer to Section 26 09 36 for ballast requirements.

G. Bi-level switching of ballasts shall conform with above electronic ballast specifications with the addition of the following: Ballast shall only be Instant Start Parallel, utilize standard wall switch, shall be wired to toggle between 2 and 4 lamp operation and 2 and 3 lamp operation (depending on application).

H. Ballasts for the compact fluorescent product family including quad, twin, triple and 2D lamps shall be electronic solid-state, Class "P", programmed rapid start, have an operating frequency greater than 20kHz, have a crest factor of 1.7 or less, tolerate sustained open circuit and short circuit conditions without damage, have a minimum ballast factor of .93 for 13 – 42 watt compact fluorescent lamps, Class "A+" sound rating, incorporate lamp shutdown circuitry for end of lamp life protection, allow for re-lamping without the need to cycle power, high power factor, UL listed and contain no PCB's. Ballast pre-heat start shall be less than 1 sec., 0°F. Starting temperature, less than 10% THD, less than 3% flicker and carry a 5-year warranty.

I. HID Lamp Ballasts

1) Metal halide lamps in the 150W – 500W range shall utilize magnetic or electronic pulse start ballasts with a minimum 88% ballast efficiency rating to comply with EISA-2007 Legislation.

2) HID lamp ballasts other than those in J.1) shall be constant wattage, high power factor, solid fill type, low noise level.

3) Manufacturers: Advance, Sylvania, Universal, Venture, and Eye.

J. Lamp holders shall be highest quality ETL or UL approved.

K. Ballasts for all fluorescent and HID luminaires shall be of the type that does not attenuate the carrier control signal of the master time system. The supplier shall verify with this Contractor and the electronic control supplier that all ballasts are of the correct type.

L. All HID lamp ballasts for outdoor lighting and indoor lighting shall be protected with type GLR fuse in HLR fuse holder and outdoor lighting with type "KTK" fuse in NEB waterproof in-line holder or approved equal fuse. Fuse sizes and type shall be as recommended by the manufacturer and factory wired in the line to each ballast. Field install fuse holders behind hand hole for parking lot lighting standards.

1) UL Listed Class P outdoor for fluorescent with 70°C max. case temp.

2) UL Listed Type 1 for HID with 80°C max. case temp.

M. Where located outside or subject to effect from cold, HID and fluorescent ballasts shall be low temperature type.

1) Rated –18°C min. for fluorescent.

2) Rated –30°C min. for HID.

N. Fluorescent troffers shall be designed for end-to-end grid mounting.

O. All recessed incandescent luminaires shall be furnished with an automatically resetting thermal protection device.

P. Provide chain or cable safety supports from the ballast housing to the building structure and from the optical assembly to the ballast housing. Install safety support per directions provided by the manufacturer.

Q. All open/non-lensed HID fixtures shall be provided with protected (PROTEC) lamps.

R. Lamps shall be manufactured by G.E., Philips or Osram/Sylvania, equal to catalog number listed in the "Lighting Luminaire Schedule" on the drawings. Venture Lighting and EYE are approved manufacturers for metal halide lamps only.

S. Plastic shielding (lens) shall be 0.125 inch thick, virgin acrylic unless otherwise noted.

2.2 LED Luminaire Components

A. LED Luminaire

1) LED Luminaire shall be rated for an installation/ambient temperature from -40 degrees C to +40 degrees C.

2) LED luminaire shall be modular in design (when applicable per the basis of design) with the ability to replace drivers, light engines, arrays, optics, reflectors, etc., without having to replace the entire luminaire.

3) The heat sink shall be easily accessible for maintenance or cleaning to maintain the overall thermal performance of the luminaire within specifications. The light engine and driver shall be easily accessible for maintenance.

4) LED luminaire shall have a minimum CRI of 70.

5) LED luminaire (type V distribution) shall have an even distribution of luminous intensity within the 0 degree to 90 degree zone. Luminous intensity at any angle within this zone shall not differ from the mean luminous intensity for the entire 0 degree to 90 degree by more than 10 percent.

6) Exterior LED luminaire shall be full cutoff or fully shielded as defined by IESNA-RP-8.

7) LED luminaire shall come standard with dimming capability.

8) LED Luminaire shall have a minimum of 5 year warranty.

9) Solid State Lighting (LED) – UL 1598.

B. LED/LED Module

1) LED/LED Module(s) shall be manufactured by:

a) Nichia

b) Cree

c) Achriche

d) Phillips

e) Osram/Sylvania

f) Approved Equal (By Engineers approval)

2) LEDs shall be of the highest production quality.

3) LED/LED Module shall be rated for 50,000 hours of life at 70 percent output (L70) and shall have been tested in accordance with IESNA LM-79, LM-80, and TM-21.

4) LED/LED Module manufacturers shall adhere to LED package manufacturer guidelines, certification programs, and test procedures for thermal management.

5) LED/LED Module(s) shall be rated for a minimum luminous efficacy of 80 Lumens per Watt (lm/W).

6) Color consistency NEMA SSL-3.

7) LED/LED Module(s) shall have one of the following designated CCTs (Correlated Color Temperature) per ANSI C78.377-2008 and all within the 7-step chromaticity quadrangles as defined below:

a) 2700 K

b) 3000 K

c) 3500 K

d) 4100 K

e) 5000 K

8) LED/LED Modules shall originate from a common manufactured batch source. Electrical Contractor shall provide 5 percent of each module specified as spare in original sealed packaging and transport to the Building (and put in storage) as directed by the Owner.

C. LED Driver

1) The driver shall have 50,000 hrs. of anticipated/rated life. Minimum efficiency of 85 percent at full load conditions.

2) UL 8750 approved.

3) Driver shall meet UL Class 2, FCC 47CFR Part 15, Class A minimum compliant.

4) Driver shall have inherent short-circuit protection, self-limited, overload protected.

5) Driver shall have a Class A sound rating.

6) 100 to 277 volt input rating. Power factor .90 or higher.

7) Driver shall have a minimum of 5 year warranty.

8) EC shall provide 5 percent of each driver specified as spare in original sealed packaging and transport to the building (and put in storage) as directed by the Owner.

D. The complete LED luminaire assembly shall be of the latest and highest efficacy design available.

2.3 Battery Powered Emergency Lighting Luminaires

A. Each unit shall consist of a battery, lights, lamps, automatic controls and connection to the lighting circuit ahead of all switches. Operation shall be such that the battery is maintained constantly charged under normal conditions; upon a loss of normal power, the light shall be switched on and the operating current obtained from the battery.

B. Units shall be UL approved. Refer to drawings for mounting, capacity and manufacturer.

C. Fasten battery operated emergency lighting units to wall or ceiling using factory-furnished bracket and make rear concealed electrical connection.

D. Electric source shall be from unswitched active lighting circuits only, to ensure that battery will be charged from an active circuit.

PART 3 - EXECUTION

3.1 Submittals

A. Detailed cut sheets for all HID and fluorescent ballasts including compact fluorescent and LED luminaire complete assembly shall be submitted for approval with shop drawings. Identifying pertinent information such as the manufacturer, frequency operation, THD, crest and ballast factor, reset thermal protection, etc. Also, submit emergency battery ballast cut sheets for review. Shop drawings will be rejected if required information is not submitted.

B. Submittals shall include dimensions, ratings, performance data and components of each luminaire. Where indicated on schedule, submit two (2) color chips illustrating luminaire finish color.

3.2 Luminaire Hanging and Supporting

A. Support each surface mounted or suspended luminaire in a minimum of two locations. In addition, where luminaires are in a continuous row, they shall be fastened together on each end in two places. For suspended luminaires provide pendant length required to suspend luminaire at indicated height.

B. Recessed luminaires shall be supported at all four corners. Additionally, securely fasten each luminaire to the ceiling framing member by mechanical means such as bolts, screws, rivets or approved clips; install a minimum of one on each of the four sides of luminaire. This Contractor shall coordinate luminaire locations and luminaire weight with the trade installing the ceiling system to ensure adequate hangers are installed to support the weight of the ceiling plus twice the weight of each luminaire.

C. Surface or flush fluorescent luminaires in ceilings of the suspended lay-in type shall be installed so that the long dimension of the luminaire is supported on the main support members of the ceiling system.

D. In addition, all recessed fluorescent luminaires for lay-in ceilings shall be equipped with at least two galvanized steel safety support wires, or chains, attached from the luminaire housing to the structure independent of the ceiling system; hangers supporting ceiling system shall not be used.

E. Install safety cable / chain support for gymnasium luminaires per manufacturers direction. Coordinate structural connection with Architect.

F. Do not support light fixtures directly from light weight roof decks. Provide supplemental angle iron support as required. Do not connect to bottom cord of roof joist without supplemental angle iron ties to the upper cord of joist.

G. Wire battery powered emergency fixtures to circuit constantly on. For fixtures switched the circuit is to be extended from ahead of room switch.

3.3 Alignment and Cleaning

A. Luminaires shall be mounted straight, level and true to the building lines. Warped or damaged luminaires shall be replaced or repaired to the satisfaction of the Architect and Owner.

B. Immediately preceding the final inspection, this Contractor shall thoroughly clean all luminaires of dust, dirt, grease, fingermarks, etc. All lamps shall be operating at the time of Owner's acceptance.

C. Coordinate location of luminaires carefully with the Architectural reflected ceiling plan. Verify that no surface mounted luminaire interferes with door swings.

1) Coordinate locations of luminaires with mechanical ducts, sprinkler pipes/heads, smoke alarms and fire alarm devices prior to rough-in to prevent conflicts.

2) Where reflected ceiling plans indicate a larger quantity of luminaires than that shown on the electrical drawings for a particular space, the reflected ceiling plan shall be followed for that space.

D. Adjust all adjustable fixtures to the satisfaction of the Engineer and the Owner.

END OF SECTION

TRANE

Trane U.S. Inc.
3600 Pammel Creek Road
La Crosse WI 54601-7599

For questions concerning this invoice, please call 888-832-5266.

REMIT TO:

TRANE
PO BOX 845053
DALLAS, TX 75284-5053

TYPE	INVOICE
* NUMBER	33875008
DATE	14-AUG-14
PAGE	1 of 1
PURCHASE ORDER NUMBER	816488
PROJECT/JOB NAME	Wyoming Middle School -
ORIGINAL SYSTEM NUMBER	2348025_KOD
CUSTOMER ACCOUNT #	3402877
PREVIOUS #	

SOLD TO:

WYOMING CITY SCHOOL DISTRICT
ATTN: ACCOUNTS PAYABLE
420 SPRINGFIELD PIKE
WYOMING, OH 45215

SHIP TO/SERVICE LOCATION:

WYOMING CITY SCHOOL DISTRICT
WYOMING MIDDLE SCHOOL
14 WORTHINGTON AVE
WYOMING, OH 45215

ORDERING LOCATION	CREDIT JOB/PROJECT #	SALES ORDER#/CALL#/CONTRACT#
	N213976	N2H985

PAYMENT TERMS	DUE DATE	FOB	FREIGHT TERMS	SHIP/CLOSE DATE	SHIP VIA	SHIPPING REFERENCE
N30	13-SEP-14		FA-PPD	14-AUG-14	0000013222	

ITEM	DESCRIPTION	UOM / MULT	QUANTITY	UNIT PRICE	EXTENDED AMOUNT
1	Mini-Splits		1		
2	Mini-Split Linesets (Qty. 5)		1		

Approved
2/11/15
$14,332.00

* PLEASE REFERENCE NUMBER WITH YOUR PAYMENT 33875008

** PAY IN 10 DAYS FOR 0.5% DISCOUNT: ACCOUNT MUST BE CURRENT

SPECIAL INSTRUCTIONS:

* * * SUBTOTAL	TAX	FREIGHT	TOTAL
14,332.00	0.00	0.00	14,332.00

Currency: USD

To view or pay your invoice online,
Visit www.comfortsite.com.
New users sign up at www.trane.com/invoices.

Federal Tax ID: 25-0900465

0.5% Discount:
*Payment within 10 days of invoice date
*Account must be current

Form: 021013IDS

Trane U.S. Inc.

3600 PAMMEL CREEK ROAD
LA CROSSE, WI 54601-7599

For questions concerning this invoice,
please call 888-832-5266

REMIT TO:
Trane U.S. Inc.
PO BOX 845053
DALLAS, TX 75284-5053

TYPE: INVOICE
*NUMBER: 34529667
DATE: 1/14/2015
PAGE: 1 of 1
PURCHASE ORDER NUMBER: 816488
PROJECT/JOB NAME: Wyoming Middle School - Sta
ORIGINAL SYSTEM NUMBER: 2454091_KOD
CUSTOMER ACCOUNT#: 3402877
PREVIOUS #:

SOLD TO:
WYOMING CITY SCHOOL DISTRICT
ATTN: ACCOUNTS PAYABLE
420 SPRINGFIELD PIKE
WYOMING, OH 45215

SHIP TO/SERVICE LOCATION:
WYOMING CITY SCHOOL DISTRICT
Wyoming Middle School
14 Worthington Ave
WYOMING, OH 45215

ORDERING LOCATION:
CREDIT JOB/PROJECT#: N213976
SALES ORDER # / CALL# / CONTRACT #: N2J176

PAYMENT TERMS	DUE DATE	FOB	FREIGHT TERMS	SHIP / CLOSE DATE	SHIP VIA	SHIPPING REFERENCE
N30	2/13/2015	SHIP POINT	FA-PPD	1/14/2015	USF HOLLAN	1037543358

ITEM	DESCRIPTION	UOM	MULT	QUANTITY	UNIT PRICE	EXTENDED AMOUNT
1	BCHD024A1**A4N02Z000000A05J00 00000KB0C00:BCXD Blower Coil - Direct Drive Model Number: BCHD024A1**A4N02Z000000A05J0000000KB0C00 Serial Number: T14M56669 Tag Number: BC- 4 LH CO1			1.00		
2	BCXC Controls: Model Number: BCXC Controls			1.00		
3	2705-0001-02-00:Year 2 parts warranty whole unit Model Number: 2705-0001-02-00			1.00		
4	2705-1000-01-00:1st year labor warranty whole unit Model Number: 2705-1000-01-00			1.00		
5	2705-1000-02-00:2nd year labor warranty whole unit Model Number: 2705-1000-02-00			1.00		

APPROVED
$2,286.84
2/10/15
OK to pay
2/12/15

JAN 20 2015

*PLEASE REFERENCE NUMBER 34529667 WITH YOUR PAYMENT

**PAY IN 10 DAYS FOR 0.50% DISCOUNT: ACCOUNT MUST BE CURRENT

SPECIAL INSTRUCTIONS:

SUBTOTAL	TAX	FREIGHT	TOTAL
2,286.84	0.00	0.00	2,286.84

To view or pay your invoice online,
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Currency: US

0.50% DISCOUNT:
*PAYMENT W/IN 10 DAYS OF INVOICE DATE.
*ACCOUNT MUST BE CURRENT TO QUALIFY.

Digitally printed on environmentally friendly paper; produced using fewer trees and chemicals and less ene

PURCHASE ORDER

Date	Purchase Order No.
07/01/2014	817364
	Page
	001

THESE NUMBER MUST APPEAR ON ALL LETTERS, INVOICES, SHIPPING MEMOS, BILLS OF LADING, EXPRESS RECEIPTS AND PACKAGES.

G CITY SCHOOL DISTRICT
ACCOUNTS PAYABLE
PRINGFIELD PIKE
OMING, OH 45215-4298
3-206-7014

53165 FAX:5137727281
ISSUED TO
TRANE U.S., INC.
10300 SPRINGFIELD PIKE
WYOMING, OH 45215-1118

SHIP TO
WYOMING CITY SCHOOLS
420 SPRINGFIELD PIKE
WYOMING OH 45215

ATTN:
TERMS:
REQUISITION NO. ST0826

PLEASE ACKNOWLEDGE RECEIPT AND ACCEPTANCE OF THIS ORDER.

QUANTITY	UNIT	DESCRIPTION	UNIT PRICE	AMOUNT
1.00		SUPER BLANKET FY2015 HVAC - REPAIRS AND SERVICE	29,000.00	29,000.00
			PAGE TOTAL	29,000.00
			GRAND TOTAL	29,000.00

	TI	FUND	FUNC.	OBJ.	SPCC.	SUBJ.	OPU	IL	JOB	AMOUNT
VERIFICATION OF RECEIPT OF GOODS		001	2720	410	0027	000000	000	00	000	29,000.00

_____ Order Complete

_____ Items Back Ordered (Circle)

Materials Checked by: _____

Date: _____

Return to Treasurer's Office Upon Completion

IT IS HEREBY CERTIFIED THAT THE ABOVE AMOUNT REQUIRED TO MEET THE CONTRACT, AGREEMENT, OBLIGATION, PAYMENT OR EXPENDITURE FOR THE ABOVE, HAS BEEN LAWFULLY APPROPRIATED OR AUTHORIZED OR DIRECTED FOR SUCH PURPOSE AND IS IN THE TREASURY OR IN PROCESS OR COLLECTION TO THE CREDIT OF THE FUNDS OF THE BOARD OF EDUCATION FREE FROM ANY OBLIGATION OR CERTIFICATION NOW OUTSTANDING.
THIS IS A THEN AND NOW CERTIFICATE.

School Districts Are Exempt From Federal Excise Taxes And Ohio Sales Tax. TAX EXEMPT STATE ID: FED ID: 316001020

THIS ORDER IS VOID UNLESS TREASURER'S CERTIFICATE IS SIGNED

F Steven R Bair
TREASURER, BOARD OF EDUCATION

Dr. Susan Lang
SUPERINTENDENT

FILE COPY

PURCHASE ORDER

Date	Purchase Order No.
02/19/2014	816488
	Page
	001

NG CITY SCHOOL DISTRICT
. ACCOUNTS PAYABLE
SPRINGFIELD PIKE
YOMING, OH 45215-4298
513-206-7014

THESE NUMBER MUST APPEAR ON ALL LETTERS, INVOICES, SHIPPING MEMOS, BILLS OF LADING, EXPRESS RECEIPTS AND PACKAGES.

ISSUED TO

53165 FAX:5137727281
TRANE U.S., INC.
10300 SPRINGFIELD PIKE
WYOMING, OH 45215-1118

SHIP TO

WYOMING CITY SCHOOLS
420 SPRINGFIELD PIKE
WYOMING OH 45215

ATTN:
TERMS:
REQUISITION NO. RJ000324

PLEASE ACKNOWLEDGE RECEIPT AND ACCEPTANCE OF THIS ORDER.

QUANTITY	UNIT	DESCRIPTION	UNIT PRICE	AMOUNT
		WMS Equipment per State Purchasing BOE APPROVAL 11/25/13		
1.00		WMS Equipment - State Purchasing	998,986.00	998,986.00
1.00		WMS Controls - State Purchasing	377,815.00	377,815.00
			PAGE TOTAL	1,376,801.00
			GRAND TOTAL	1,376,801.00

	TI	FUND	FUNC.	OBJ.	SPCC.	SUBJ.	OPU	IL	JOB	AMOUNT
VERIFICATION OF RECEIPT OF GOODS		004	5500	620	9012	000000	030	00	000	1,376,801.00
_____ Order Complete										
_____ Items Back Ordered (Circle)										
Materials Checked by: _____										
Date: _____										
Return to Treasurer's Office Upon Completion										

IT IS HEREBY CERTIFIED THAT THE ABOVE AMOUNT REQUIRED TO MEET THE CONTRACT, AGREEMENT, OBLIGATION, PAYMENT OR EXPENDITURE FOR THE ABOVE, HAS BEEN LAWFULLY APPROPRIATED DR AUTHORIZED OR DIRECTED FDR SUCH PURPOSE AND IS IN THE TREASURY OR IN PROCESS OR COLLECTIDN TO THE CREDIT OF THE FUNDS OF THE BOARD DF EDUCATION FREE FROM ANY OBLIGATION OR CERTIFICATION NOW OUTSTANDING.
THIS IS A THEN AND NOW CERTIFICATE.

School Districts Are Exempt From Federal Excise Taxes And Ohio Sales Tax. TAX EXEMPT STATE ID: FED ID: 316001020

THIS ORDER IS VOID UNLESS TREASURER'S CERTIFICATE IS SIGNED

Ronda Johnson

TREASURER, BOARD OF EDUCATION

Dr. Susan Lang

SUPERINTENDENT

FILE COPY

Trane U.S. Inc.

3600 PAMMEL CREEK ROAD
LA CROSSE, WI 54601-7599

r questions concerning this invoice,
please call 888-832-5266

REMIT TO:

Trane U.S. Inc.
PO BOX 845053
DALLAS, TX 75284-5053

TYPE	INVOICE
*NUMBER	33779627
DATE	7/25/2014
PAGE	1 of 2
PURCHASE ORDER NUMBER	816488
PROJECT/JOB NAME	Wyoming Middle School - State
ORIGINAL SYSTEM NUMBER	2331343_KOD
CUSTOMER ACCOUNT#	3402877
PREVIOUS #	

SOLD TO:

WYOMING CITY SCHOOL DISTRICT
ATTN: ACCOUNTS PAYABLE
420 SPRINGFIELD PIKE
WYOMING, OH 45215

SHIP TO/SERVICE LOCATION:

WYOMING CITY SCHOOL DISTRICT
Wyoming Middle School
14 Worthington Ave
WYOMING, OH 45215

ORDERING LOCATION	CREDIT JOB/PROJECT#	SALES ORDER # / CALL# / CONTRACT #
	N213976	N2H976

PAYMENT TERMS	DUE DATE	FOB	FREIGHT TERMS	SHIP / CLOSE DATE	SHIP VIA	SHIPPING REFERENCE
N30	8/24/2014	SHIP POINT	FA-PPD	7/25/2014	ATS SPECIA	

ITEM	DESCRIPTION	UOM	MULT	QUANTITY	UNIT PRICE	EXTENDED AMOUNT
1	Air-Cooled Series R(TM) (RTAC) : Model Number: Air-Cooled Series R(TM) (RTAC) Tag Number: RTAC-1-300			1.00		
2	2716-1520-03-00:Year 2 parts warranty less compressor Model Number: 2716-1520-03-00			1.00		
3	2716-1450-C3-00:2nd-5th year compressor parts Model Number: 2716-1450-C3-00			1.00		
4	2716-2110-03-00:1st year labor warranty whole unit Model Number: 2716-2110-03-00			1.00		

Approved
8/4/14

RECEIVED
AUG 1 2014

Trane U.S. Inc.

3600 PAMMEL CREEK ROAD
LA CROSSE, WI 54601-7599

For questions concerning this invoice,
please call 888-832-5266

REMIT TO:

Trane U.S. Inc.
PO BOX 845053
DALLAS, TX 75284-5053

TYPE	INVOICE
*NUMBER	33779627
DATE	7/25/2014
PAGE	2 of 2
PURCHASE ORDER NUMBER	816488
PROJECT/JOB NAME	Wyoming Middle School - State
ORIGINAL SYSTEM NUMBER	2331343_KOD
CUSTOMER ACCOUNT#	3402877
PREVIOUS #	

SOLD TO:

WYOMING CITY SCHOOL DISTRICT
ATTN: ACCOUNTS PAYABLE
420 SPRINGFIELD PIKE
WYOMING, OH 45215

SHIP TO/SERVICE LOCATION:

WYOMING CITY SCHOOL DISTRICT
Wyoming Middle School
14 Worthington Ave
WYOMING, OH 45215

ORDERING LOCATION	CREDIT JOB/PROJECT#	SALES ORDER # / CALL# / CONTRACT #
	N213976	N2H976

PAYMENT TERMS	DUE DATE	FOB	FREIGHT TERMS	SHIP / CLOSE DATE	SHIP VIA	SHIPPING REFERENCE
N30	8/24/2014	SHIP POINT	FA-PPD	7/25/2014	ATS SPECIA	

ITEM	DESCRIPTION	UOM	MULT	QUANTITY	UNIT PRICE	EXTENDED AMOUNT
5	2716-2120-03-00:2nd year labor warr whole unit Model Number: 2716-2120-03-00			1.00		
6	2716-3110-03-00:1st Year Refrigerant Warranty Model Number: 2716-3110-03-00			1.00		
7	2716-3120-03-00:2nd year only refrigerant warranty Model Number: 2716-3120-03-00			1.00		
8	2705-0000-03-00:12/24 delayed startup warranty Model Number: 2705-0000-03-00			1.00		
9	Unit startup by Trane			1.00		

*PLEASE REFERENCE NUMBER 33779627 WITH YOUR PAYMENT

**PAY IN 10 DAYS FOR 0.50% DISCOUNT: ACCOUNT MUST BE CURRENT

SPECIAL INSTRUCTIONS:

SUBTOTAL	TAX	FREIGHT	TOTAL
165,372.43	0.00	0.00	165,372.43

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New users sign up at www.trane.com/invoices

Currency: USD

0.50% DISCOUNT:
*PAYMENT W/IN 10 DAYS OF INVOICE DATE.
*ACCOUNT MUST BE CURRENT TO QUALIFY.

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Trane U.S. Inc.

3600 PAMMEL CREEK ROAD
LA CROSSE, WI 54601-7599

or questions concerning this invoice,
please call 888-832-5266

REMIT TO:

Trane U.S. Inc.
PO BOX 845053
DALLAS, TX 75284-5053

TYPE	INVOICE
*NUMBER	33779614
DATE	7/25/2014
PAGE	1 of 2
PURCHASE ORDER NUMBER	816488
PROJECT/JOB NAME	Wyoming Middle School - State
ORIGINAL SYSTEM NUMBER	2331324_KOD
CUSTOMER ACCOUNT#	3402877
PREVIOUS #	

SOLD TO:

WYOMING CITY SCHOOL DISTRICT
ATTN: ACCOUNTS PAYABLE
420 SPRINGFIELD PIKE
WYOMING, OH 45215

SHIP TO/SERVICE LOCATION:

WYOMING CITY SCHOOL DISTRICT
Wyoming Middle School
14 Worthington Ave
WYOMING, OH 45215

ORDERING LOCATION	CREDIT JOB/PROJECT#	SALES ORDER # / CALL# / CONTRACT #
	N213976	N2H977

PAYMENT TERMS	DUE DATE	FOB	FREIGHT TERMS	SHIP / CLOSE DATE	SHIP VIA	SHIPPING REFERENCE
N30	8/24/2014	SHIP POINT	FA-PPD	7/25/2014	ATS SPECIA	

ITEM	DESCRIPTION	UOM	MULT	QUANTITY	UNIT PRICE	EXTENDED AMOUNT
1	CGAM070F2**2AXD2A1A1A1AXXA1D1 A4XXAXXXB1A:Air-Cooled Chiller, Scroll Compressors Model Number: CGAM070F2**2AXD2A1A1A1AXXA1D1A4XXAXXXB1A Tag Number: CGAM-1-70 ton			1.00		
2	2716-1520-00-70:Year 2 parts warranty less compressor Model Number: 2716-1520-00-70			1.00		
3	2716-1250-00-70:2nd-5th year compressor parts Model Number: 2716-1250-00-70			1.00		
4	2716-2110-00-70:1st year labor warranty Model Number: 2716-2110-00-70			1.00		

RECEIVED
AUG 1 2014

Approved
8/4/14

Trane U.S. Inc.

3600 PAMMEL CREEK ROAD
LA CROSSE, WI 54601-7599

For questions concerning this invoice,
please call 888-832-5266

REMIT TO:

Trane U.S. Inc.
PO BOX 845053
DALLAS, TX 75284-5053

TYPE	INVOICE
*NUMBER	33779614
DATE	7/25/2014
PAGE	2 of 2
PURCHASE ORDER NUMBER	816488
PROJECT/JOB NAME	Wyoming Middle School - State
ORIGINAL SYSTEM NUMBER	2331324_KOD
CUSTOMER ACCOUNT#	3402877
PREVIOUS #	

SOLD TO:

WYOMING CITY SCHOOL DISTRICT
ATTN: ACCOUNTS PAYABLE
420 SPRINGFIELD PIKE
WYOMING, OH 45215

SHIP TO/SERVICE LOCATION:

WYOMING CITY SCHOOL DISTRICT
Wyoming Middle School
14 Worthington Ave
WYOMING, OH 45215

ORDERING LOCATION	CREDIT JOB/PROJECT#	SALES ORDER # / CALL# / CONTRACT #
	N213976	N2H977

PAYMENT TERMS	DUE DATE	FOB	FREIGHT TERMS	SHIP / CLOSE DATE	SHIP VIA	SHIPPING REFERENCE
N30	8/24/2014	SHIP POINT	FA-PPD	7/25/2014	ATS SPECIA	

ITEM	DESCRIPTION	UOM	MULT	QUANTITY	UNIT PRICE	EXTENDED AMOUNT
5	2716-3110-00-70:1st year refrigerant warranty Model Number: 2716-3110-00-70			1.00		
6	2716-3120-00-70:2nd year refrigerant warranty Model Number: 2716-3120-00-70			1.00		
7	2705-0000-03-00:12/24 delayed startup warranty Model Number: 2705-0000-03-00			1.00		
8	2716-2120-00-70:2nd year labor warranty whole unit Model Number: 2716-2120-00-70			1.00		
9	Unit startup by Trane			1.00		

*PLEASE REFERENCE NUMBER 33779614 WITH YOUR PAYMENT

**PAY IN 10 DAYS FOR 0.50% DISCOUNT: ACCOUNT MUST BE CURRENT

SPECIAL INSTRUCTIONS:

SUBTOTAL	TAX	FREIGHT	TOTAL
98,428.70	0.00	0.00	98,428.70

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Currency: USD

0.50% DISCOUNT:
*PAYMENT W/IN 10 DAYS OF INVOICE DATE.
*ACCOUNT MUST BE CURRENT TO QUALIFY.

Trane U.S. Inc.

3600 PAMMEL CREEK ROAD
LA CROSSE, WI 54601-7599

For questions concerning this invoice,
please call 888-832-5266

REMIT TO:

Trane U.S. Inc.
PO BOX 845053
DALLAS, TX 75284-5053

TYPE	INVOICE
*NUMBER	33751156
DATE	7/21/2014
PAGE	1 of 1
PURCHASE ORDER NUMBER	816488
PROJECT/JOB NAME	Wyoming Middle School - State
ORIGINAL SYSTEM NUMBER	2325915_KOD
CUSTOMER ACCOUNT#	3402877
PREVIOUS #	

SOLD TO:

WYOMING CITY SCHOOL DISTRICT
ATTN: ACCOUNTS PAYABLE
420 SPRINGFIELD PIKE
WYOMING, OH 45215

SHIP TO/SERVICE LOCATION:

WYOMING CITY SCHOOL DISTRICT
TP Mechanical / Turner Construction
420 Springfield Pike
Suite L
CINCINNATI, OH 45212

ORDERING LOCATION	CREDIT JOB/PROJECT#	SALES ORDER # / CALL# / CONTRACT #
	N213976	N2J134

PAYMENT TERMS	DUE DATE	FOB	FREIGHT TERMS	SHIP / CLOSE DATE	SHIP VIA	SHIPPING REFERENCE
N30	8/20/2014	SHIP POINT	FA-PPD	7/17/2014	UPS GROUND	1Z2147440367010482

ITEM	DESCRIPTION	UOM	MULT	QUANTITY	UNIT PRICE	EXTENDED AMOUNT
1	UHSBA181T*A101A0000:Hydronic Unit Heaters Model Number: UHSBA181T*A101A0000 Serial Number: F14F33195 F14F33194 Tag Number: UH-2			2.00		
2	2705-0001-02-00:Year 2 Parts Warranty Whole Unit Model Number: 2705-0001-02-00			2.00		
3	2705-1000-01-00:1st Year Labor Warranty Whole Unit Model Number: 2705-1000-01-00			2.00		
4	2705-1000-02-00:2nd Year Labor Warranty Whole Unit Model Number: 2705-1000-02-00			2.00		

APPROVED
#1,564.69
7/30/14

RECEIVED
JUL 28 2014

ok to pay
8/4/14

*PLEASE REFERENCE NUMBER 33751156 WITH YOUR PAYMENT

**PAY IN 10 DAYS FOR 0.50% DISCOUNT: ACCOUNT MUST BE CURRENT

SPECIAL INSTRUCTIONS:

SUBTOTAL	TAX	FREIGHT	TOTAL
1,564.69	0.00	0.00	1,564.69

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Currency: USD

0.50% DISCOUNT:
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*ACCOUNT MUST BE CURRENT TO QUALIFY.

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PURCHASE ORDER

Date	Purchase Order No.
02/19/2014	816488
	Page
	001

...ING CITY SCHOOL DISTRICT
...N: ACCOUNTS PAYABLE
...0 SPRINGFIELD PIKE
...WYOMING, OH 45215-4298
...513-206-7014

THESE NUMBER MUST APPEAR ON ALL LETTERS, INVOICES, SHIPPING MEMOS, BILLS OF LADING, EXPRESS RECEIPTS AND PACKAGES.

53165 FAX:5137727281

ISSUED TO
TRANE U.S., INC.
10300 SPRINGFIELD PIKE
WYOMING, OH 45215-1118

SHIP TO
WYOMING CITY SCHOOLS
420 SPRINGFIELD PIKE
WYOMING OH 45215

ATTN:
TERMS:
REQUISITION NO. RJ000324

PLEASE ACKNOWLEDGE RECEIPT AND ACCEPTANCE OF THIS ORDER.

QUANTITY	UNIT	DESCRIPTION	UNIT PRICE	AMOUNT
		WMS Equipment per State Purchasing BOE APPROVAL 11/25/13		
1.00		WMS Equipment - State Purchasing	998,986.00	998,986.00
1.00		WMS Controls - State Purchasing	377,815.00	377,815.00
			PAGE TOTAL	1,376,801.00
			GRAND TOTAL	1,376,801.00

	TI	FUND	FUNC.	OBJ.	SPCC.	SUBJ.	OPU	IL	JOB	AMOUNT
VERIFICATION OF RECEIPT OF GOODS		004	5500	620	9012	000000	030	00	000	1,376,801.00
_____ Order Complete										
_____ Items Back Ordered (Circle)										
Materials Checked by: _____										
Date: _____										
Return to Treasurer's Office Upon Completion										

IT IS HEREBY CERTIFIED THAT THE ABOVE AMOUNT REQUIRED TO MEET THE CONTRACT, AGREEMENT, OBLIGATION, PAYMENT OR EXPENDITURE FOR THE ABOVE, HAS BEEN LAWFULLY APPROPRIATED OR AUTHORIZED OR DIRECTED FOR SUCH PURPOSE AND IS IN THE TREASURY OR IN PROCESS OR COLLECTION TO THE CREDIT OF THE FUNDS OF THE BOARD OF EDUCATION FREE FROM ANY OBLIGATION OR CERTIFICATION NOW OUTSTANDING.
THIS IS A THEN AND NOW CERTIFICATE.

School Districts Are Exempt From Federal Excise Taxes And Ohio Sales Tax. TAX EXEMPT STATE ID: FED ID: 316001020

THIS ORDER IS VOID UNLESS TREASURER'S CERTIFICATE IS SIGNED

Ronda Johnson
TREASURER, BOARD OF EDUCATION

Dr. Susan Lang
SUPERINTENDENT

FILE COPY

TRANE

Trane U.S. Inc.

3600 PAMMEL CREEK ROAD
LA CROSSE, WI 54601-7599

For questions concerning this invoice,
please call 888-832-5266

REMIT TO:

Trane U.S. Inc.
PO BOX 845053
DALLAS, TX 75284-5053

TYPE	INVOICE
*NUMBER	33557923
DATE	6/10/2014
PAGE	1 of 1
PURCHASE ORDER NUMBER	816488
PROJECT/JOB NAME	Wyoming Middle School - State
ORIGINAL SYSTEM NUMBER	2288162_KOD
CUSTOMER ACCOUNT#	3402877
PREVIOUS #	

SOLD TO:

WYOMING CITY SCHOOL DISTRICT
ATTN: ACCOUNTS PAYABLE
420 SPRINGFIELD PIKE
WYOMING, OH 45215

SHIP TO/SERVICE LOCATION:

WYOMING CITY SCHOOL DISTRICT
Wyoming Middle School
14 Worthington Ave
WYOMING, OH 45215

ORDERING LOCATION	CREDIT JOB/PROJECT#	SALES ORDER # / CALL# / CONTRACT #
	N213976	N2H985

PAYMENT TERMS	DUE DATE	FOB	FREIGHT TERMS	SHIP / CLOSE DATE	SHIP VIA	SHIPPING REFERENCE
N30	7/10/2014	SHIP POINT	FA-PPD	6/10/2014	Maverick T	

ITEM	DESCRIPTION	UOM	MULT	QUANTITY	UNIT PRICE	EXTENDED AMOUNT
1	VFDs			1.00		

APPROVED
6/18/2014
$ 26,518.00

RECEIVED
JUN 17 2014

*PLEASE REFERENCE NUMBER 33557923 WITH YOUR PAYMENT

**PAY IN 10 DAYS FOR 0.50% DISCOUNT: ACCOUNT MUST BE CURRENT

SPECIAL INSTRUCTIONS:

SUBTOTAL	TAX	FREIGHT	TOTAL
26,518.00	0.00	0.00	26,518.00

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Currency: USD

0.50% DISCOUNT:
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*ACCOUNT MUST BE CURRENT TO QUALIFY.

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PURCHASE ORDER

Date	Purchase Order No.
02/19/2014	816488
	Page
	001

THESE NUMBER MUST APPEAR ON ALL LETTERS, INVOICES, SHIPPING MEMOS, BILLS OF LADING, EXPRESS RECEIPTS AND PACKAGES.

WYOMING CITY SCHOOL DISTRICT
ATTN: ACCOUNTS PAYABLE
420 SPRINGFIELD PIKE
WYOMING, OH 45215-4298
513-206-7014

ISSUED TO:
53165 FAX:5137727281
TRANE U.S., INC.
10300 SPRINGFIELD PIKE
WYOMING, OH 45215-1118

SHIP TO:
WYOMING CITY SCHOOLS
420 SPRINGFIELD PIKE
WYOMING OH 45215

ATTN:
TERMS:
REQUISITION NO. RJ000324

PLEASE ACKNOWLEDGE RECEIPT AND ACCEPTANCE OF THIS ORDER.

QUANTITY	UNIT	DESCRIPTION	UNIT PRICE	AMOUNT
		WMS Equipment per State Purchasing BOE APPROVAL 11/25/13		
1.00		WMS Equipment - State Purchasing	998,986.00	998,986.00
1.00		WMS Controls - State Purchasing	377,815.00	377,815.00
			PAGE TOTAL	1,376,801.00
			GRAND TOTAL	1,376,801.00

	TI	FUND	FUNC.	OBJ.	SPCC.	SUBJ.	OPU	IL	JOB	AMOUNT
VERIFICATION OF RECEIPT OF GOODS		004	5500	620	9012	000000	030	00	000	1,376,801.00

_____ Order Complete

_____ Items Back Ordered (Circle)

Materials Checked by: _____

Date: _____

Return to Treasurer's Office Upon Completion

IT IS HEREBY CERTIFIED THAT THE ABOVE AMOUNT REQUIRED TO MEET THE CONTRACT, AGREEMENT, OBLIGATION, PAYMENT OR EXPENDITURE FOR THE ABOVE, HAS BEEN LAWFULLY APPROPRIATED OR AUTHORIZED OR DIRECTED FOR SUCH PURPOSE AND IS IN THE TREASURY OR IN PROCESS OR COLLECTION TO THE CREDIT OF THE FUNDS OF THE BOARD OF EDUCATION FREE FROM ANY OBLIGATION OR CERTIFICATION NOW OUTSTANDING.
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Ronda Johnson
TREASURER, BOARD OF EDUCATION

Dr. Susan Lang
SUPERINTENDENT

FILE COPY

PURCHASE ORDER

Date	Purchase Order No.
02/19/2014	816488
	Page
	001

THESE NUMBER MUST APPEAR ON ALL LETTERS, INVOICES, SHIPPING MEMOS, BILLS OF LADING, EXPRESS RECEIPTS AND PACKAGES.

...DISTRICT
...ABLE
...XE
...15-4298

...AX:5137727281
...U.S., INC.
...SPRINGFIELD PIKE
...OMING, OH 45215-1118

T
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T
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WYOMING CITY SCHOOLS
420 SPRINGFIELD PIKE
WYOMING OH 45215

ATTN:
TERMS:
REQUISITION NO. RJ000324

PLEASE ACKNOWLEDGE RECEIPT AND ACCEPTANCE OF THIS ORDER.

QUANTITY	UNIT	DESCRIPTION	UNIT PRICE	AMOUNT
		WMS Equipment per State Purchasing BOE APPROVAL 11/25/13		
1.00		WMS Equipment - State Purchasing	998,986.00	998,986.00
1.00		WMS Controls - State Purchasing	377,815.00	377,815.00
			PAGE TOTAL	1,376,801.00
			GRAND TOTAL	1,376,801.00

	TI	FUND	FUNC.	OBJ.	SPCC.	SUBJ.	OPU	IL	JOB	AMOUNT
VERIFICATION OF RECEIPT OF GOODS		004	5500	620	9012	000000	030	00	000	1,376,801.00
_____ Order Complete										
_____ Items Back Ordered (Circle)										
Materials Checked by: _____										
Date: _____										
Return to Treasurer's Office Upon Completion										

IT IS HEREBY CERTIFIED THAT THE ABOVE AMOUNT REQUIRED TO MEET THE CONTRACT, AGREEMENT, OBLIGATION, PAYMENT OR EXPENDITURE FOR THE ABOVE, HAS BEEN LAWFULLY APPROPRIATED OR AUTHORIZED OR DIRECTED FOR SUCH PURPOSE AND IS IN THE TREASURY OR IN PROCESS OR COLLECTION TO THE CREDIT OF THE FUNDS OF THE BOARD OF EDUCATION FREE FROM ANY OBLIGATION OR CERTIFICATION NOW OUTSTANDING.
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THIS ORDER IS VOID UNLESS TREASURER'S CERTIFICATE IS SIGNED

Ronda Johnson
TREASURER, BOARD OF EDUCATION

Dr. Susan Lang
SUPERINTENDENT

FILE COPY

U.S. Inc.

3600 PAMMEL CREEK ROAD
LA CROSSE, WI 54601-7599

64 Fax: 513-772-7281
OH

TO:

OMING CITY SCHOOL DISTRICT
ATTN: ACCOUNTS PAYABLE
420 SPRINGFIELD PIKE
WYOMING, OH 45215

REMIT TO:

Trane U.S. Inc.
PO BOX 845053
DALLAS, TX 75284-5053

SHIP TO/SERVICE LOCATION:

WYOMING CITY SCHOOL DISTRICT
WYOMING HIGH SCHOOL
106 PENDERY AVENUE
WYOMING, OH 45215

TYPE	INVOICE
*NUMBER	33495528
DATE	5/28/2014
PAGE	1 of 1
PURCHASE ORDER NUMBER	815031
PROJECT/JOB NAME	
ORIGINAL SYSTEM NUMBER	
CUSTOMER ACCOUNT#	3402877
PREVIOUS #	
ORDERING LOCATION	
CREDIT JOB/PROJECT#	
SALES ORDER # / CALL# / CONTRACT #	14-3955072

PAYMENT TERMS	DUE DATE	FOB	FREIGHT TERMS	SHIP / CLOSE DATE	SHIP VIA	SHIPPING REFERENCE
Due on Receipt				5/28/2014		

DATE	DESCRIPTION	UOM	MULT	QUANTITY	UNIT PRICE	EXTENDED AMOUNT
	CHECKED UNITS A2, E1 AND F1 FOR FAN FAILURE, RESET TRIPPED OVERLOADS AND REPLACED BLOWN FUSES. DIAGNOSED SHORTED CONDENSER FAN MOTOR ON UNIT A2, REMOVED AND REINSTALLED REBUILT MOTOR - UNIT WORKING PROPERLY AT THIS TIME.					
	***Repair - Installation Labor**					
5/22/2014	ST Daniel Spradling	HRS		3.00	95.00	285.00
5/21/2014	ST Daniel Spradling	HRS		4.00	95.00	380.00
					Sub Total	665.00
	***Other**					
5/21/2014	SWH TIME DELAY QTY. 4	EA		1.00	140.52	140.52
5/23/2014	A1 MOTOR REBUILD	EA		1.00	599.05	599.05
					Sub Total	739.57

OK TO PAY

RECEIVED
JUN - 6 2014

SPECIAL INSTRUCTIONS: THANK YOU FOR CHOOSING TRANE, QUESTIONS ABOUT YOUR INVOICE CALL TRANE BUILDING SERVICE @ 513.772.4555

SUBTOTAL	TAX	FREIGHT	TOTAL
1,404.57	0.00	0.00	1,404.57

To view or pay your invoice online,
Visit www.comfortsite.com
New users sign up at www.trane.com/invoices

Currency: USD

U.S. Inc.

3600 PAMMEL CREEK ROAD
LA CROSSE, WI 54601-7599

84 Fax: 513-772-7281
OH

TO:

YOMING CITY SCHOOL DISTRICT
ATTN: ACCOUNTS PAYABLE
420 SPRINGFIELD PIKE
WYOMING, OH 45215

REMIT TO:

Trane U.S. Inc.
PO BOX 845053
DALLAS, TX 75284-5053

SHIP TO/SERVICE LOCATION:

WYOMING CITY SCHOOL DISTRICT
WYOMING HIGH SCHOOL
106 PENDERY AVENUE
WYOMING, OH 45215

TYPE	INVOICE
*NUMBER	33491560
DATE	5/27/2014
PAGE	1 of 1
PURCHASE ORDER NUMBER	815031
PROJECT/JOB NAME	
ORIGINAL SYSTEM NUMBER	
CUSTOMER ACCOUNT#	3402877
PREVIOUS #	
ORDERING LOCATION	
CREDIT JOB/PROJECT#	
SALES ORDER # / CALL# / CONTRACT #	14-3954011

PAYMENT TERMS	DUE DATE	FOB	FREIGHT TERMS	SHIP / CLOSE DATE	SHIP VIA	SHIPPING REFERENCE
Due on Receipt				5/27/2014		

DATE	DESCRIPTION	UOM	MULT	QUANTITY	UNIT PRICE	EXTENDED AMOUNT
	DIAGNOSED AND REPLACED DEFECTIVE CONTACTOR COIL ON AHU C1, ADDED 30LBS R-22 REFRIGERANT AND VERIFIED OPERATION - CUSTOMER SUPPLIED PART.					
	***Repair - Installation Labor**					
5/20/2014	ST Daniel Spradling	HRS		3.00	95.00	285.00
					Sub Total	285.00
	***Other**					
5/22/2014	R-22 REFRIGERANT P0010017561	EA		1.00	425.00	425.00
					Sub Total	425.00

OK to pay

RECEIVED
JUN - 6 2014

SPECIAL INSTRUCTIONS: THANK YOU FOR CHOOSING TRANE, QUESTIONS ABOUT YOUR INVOICE CALL TRANE BUILDING SERVICE @ 513.772.4555

SUBTOTAL	TAX	FREIGHT	TOTAL
710.00	0.00	0.00	710.00

To view or pay your invoice online,
Visit www.comfortsite.com
New users sign up at www.trane.com/invoices

Currency: USD

PURCHASE ORDER

Date	Purchase Order No.
07/03/2013	815031
	Page
	001

THESE NUMBER MUST APPEAR ON ALL LETTERS, INVOICES, SHIPPING MEMOS, BILLS OF LADING, EXPRESS RECEIPTS AND PACKAGES.

...OL DISTRICT
...PAYABLE
...PIKE
...45215-4298

FAX:5137727281
...E U.S., INC.
...00 SPRINGFIELD PIKE
...YOMING, OH 45215-1118

T
O

S
H
I
P

T
O

WYOMING CITY SCHOOLS
420 SPRINGFIELD PIKE
WYOMING OH 45215

ATTN:
TERMS:
REQUISITION NO. ST0215

PLEASE ACKNOWLEDGE RECEIPT AND ACCEPTANCE OF THIS ORDER.

QUANTITY	UNIT	DESCRIPTION	UNIT PRICE	AMOUNT
1.00		SUPER BLANKET FY2014 HVAC - REPAIRS AND SERVICE	20,000.00	20,000.00
		5/7/14 added ST		5,000
		6/6/14 added ST		1000 -
			PAGE TOTAL	20,000.00
			GRAND TOTAL	20,000.00

	TI	FUND	FUNC.	OBJ.	SPCC.	SUBJ.	OPU	IL	JOB	AMOUNT
VERIFICATION OF RECEIPT OF GOODS		001	2720	410	0027	000000	000	00	000	20,000.00

_____ Order Complete

_____ Items Back Ordered (Circle)

Materials Checked by: _____

Date: _____

Return to Treasurer's Office Upon Completion

IT IS HEREBY CERTIFIED THAT THE ABOVE AMOUNT REQUIRED TO MEET THE CONTRACT, AGREEMENT, OBLIGATION, PAYMENT OR EXPENDITURE FOR THE ABOVE, HAS BEEN LAWFULLY APPROPRIATED OR AUTHORIZED OR DIRECTED FOR SUCH PURPOSE AND IS IN THE TREASURY OR IN PROCESS OR COLLECTION TO THE CREDIT OF THE FUNDS OF THE BOARD OF EDUCATION FREE FROM ANY OBLIGATION OR CERTIFICATION NOW OUTSTANDING.
THIS IS A THEN AND NOW CERTIFICATE.

School Districts Are Exempt From Federal Excise Taxes And Ohio Sales Tax. TAX EXEMPT STATE ID: FED ID: 316001020

THIS ORDER IS VOID UNLESS TREASURER'S CERTIFICATE IS SIGNED

Ronda Johnson
TREASURER, BOARD OF EDUCATION

Dr. Susan Lang
SUPERINTENDENT

FILE COPY

U.S. Inc.

3600 PAMMEL CREEK ROAD
LA CROSSE, WI 54601-7599

cerning this invoice,
-832-5266

TO:
OMING CITY SCHOOL DISTRICT
ATTN: ACCOUNTS PAYABLE
420 SPRINGFIELD PIKE
WYOMING, OH 45215

REMIT TO:
Trane U.S. Inc.
PO BOX 845053
DALLAS, TX 75284-5053

SHIP TO/SERVICE LOCATION:
WYOMING CITY SCHOOL DISTRICT
Wyoming Middle School
14 Worthington Ave
WYOMING, OH 45215

TYPE	INVOICE
NUMBER	33483835
DATE	5/23/2014
PAGE	1 of 25
PURCHASE ORDER NUMBER	816488
PROJECT/JOB NAME	Wyoming Middle School - State
ORIGINAL SYSTEM NUMBER	2273926_KOD
CUSTOMER ACCOUNT#	3402877
PREVIOUS #	
ORDERING LOCATION	
CREDIT JOB/PROJECT#	N213976
SALES ORDER # / CALL# / CONTRACT #	N2H983

PAYMENT TERMS	DUE DATE	FOB	FREIGHT TERMS	SHIP / CLOSE DATE	SHIP VIA	SHIPPING REFERENCE
N30	6/22/2014	SHIP POINT	FA-PPD	5/23/2014	DAYTON FRE	00024385069

ITEM	DESCRIPTION	UOM	MULT	QUANTITY	UNIT PRICE	EXTENDED AMOUNT
1	Variable Air Volume Single Duct Terminal: Model Number: Variable Air Volume Single Duct Terminal Serial Number: R14C16708 Tag Number: VAV 1-01			1.00		
2	DDC Controls: Model Number: DDC Controls			1.00		
3	2705-0001-02-00:Year 2 parts warranty whole unit Model Number: 2705-0001-02-00			1.00		
4	2705-1000-01-00:1st year labor warranty whole unit Model Number: 2705-1000-01-00			1.00		
5	2705-1000-02-00:2nd year labor warranty whole unit Model Number: 2705-1000-02-00			1.00		

APPROVED
$17,802.62
6/12/14

RECEIVED
JUN - 6 2014

U.S. Inc.

3600 PAMMEL CREEK ROAD
LA CROSSE, WI 54601-7599

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14 Worthington Ave
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TYPE	INVOICE
*NUMBER	33483835
DATE	5/23/2014
PAGE	2 of 25
PURCHASE ORDER NUMBER	816488
PROJECT/JOB NAME	Wyoming Middle School - State
ORIGINAL SYSTEM NUMBER	2273926_KOD
CUSTOMER ACCOUNT#	3402877
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ORDERING LOCATION	CREDIT JOB/PROJECT#	SALES ORDER # / CALL# / CONTRACT #
	N213976	N2H983

PAYMENT TERMS	DUE DATE	FOB	FREIGHT TERMS	SHIP / CLOSE DATE	SHIP VIA	SHIPPING REFERENCE
N30	6/22/2014	SHIP POINT	FA-PPD	5/23/2014	DAYTON FRE	00024385069

ITEM	DESCRIPTION	UOM	MULT	QUANTITY	UNIT PRICE	EXTENDED AMOUNT
6	Variable Air Volume Single Duct Terminal: Model Number: Variable Air Volume Single Duct Terminal Serial Number: R14C16709 Tag Number: VAV 1-02			1.00		
7	DDC Controls: Model Number: DDC Controls			1.00		
8	2705-0001-02-00:Year 2 parts warranty whole unit Model Number: 2705-0001-02-00			1.00		
9	2705-1000-01-00:1st year labor warranty whole unit Model Number: 2705-1000-01-00			1.00		
10	2705-1000-02-00:2nd year labor warranty whole unit Model Number: 2705-1000-02-00			1.00		

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N30	6/22/2014	SHIP POINT	FA-PPD	5/23/2014	DAYTON FRE	00024385069

ITEM	DESCRIPTION	UOM	MULT	QUANTITY	UNIT PRICE	EXTENDED AMOUNT
11	Variable Air Volume Single Duct Terminal: Model Number: Variable Air Volume Single Duct Terminal Serial Number: R14C16717 R14C16718 R14C16719 Tag Number: VAV 1-03 Tag Number: VAV 1-04 Tag Number: VAV 1-05			3.00		
12	DDC Controls: Model Number: DDC Controls			3.00		
13	2705-0001-02-00:Year 2 parts warranty whole unit Model Number: 2705-0001-02-00			3.00		
14	2705-1000-01-00:1st year labor warranty whole unit Model Number: 2705-1000-01-00			3.00		
15	2705-1000-02-00:2nd year labor warranty whole unit Model Number: 2705-1000-02-00			3.00		

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PAGE	3 of 25
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N30	6/22/2014	SHIP POINT	FA-PPD	5/23/2014	DAYTON FRE	00024385069

ITEM	DESCRIPTION	UOM	MULT	QUANTITY	UNIT PRICE	EXTENDED AMOUNT
11	Variable Air Volume Single Duct Terminal: Model Number: Variable Air Volume Single Duct Terminal Serial Number: R14C16717 R14C16718 R14C16719 Tag Number: VAV 1-03 Tag Number: VAV 1-04 Tag Number: VAV 1-05			3.00		
12	DDC Controls: Model Number: DDC Controls			3.00		
13	2705-0001-02-00:Year 2 parts warranty whole unit Model Number: 2705-0001-02-00			3.00		
14	2705-1000-01-00:1st year labor warranty whole unit Model Number: 2705-1000-01-00			3.00		
15	2705-1000-02-00:2nd year labor warranty whole unit Model Number: 2705-1000-02-00			3.00		

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ORDERING LOCATION	CREDIT JOB/PROJECT#	SALES ORDER # / CALL# / CONTRACT #
	N213976	N2H983

PAYMENT TERMS	DUE DATE	FOB	FREIGHT TERMS	SHIP / CLOSE DATE	SHIP VIA	SHIPPING REFERENCE
N30	6/22/2014	SHIP POINT	FA-PPD	5/23/2014	DAYTON FRE	00024385069

ITEM	DESCRIPTION	UOM	MULT	QUANTITY	UNIT PRICE	EXTENDED AMOUNT
16	Variable Air Volume Single Duct Terminal: Model Number: Variable Air Volume Single Duct Terminal Serial Number: R14C16720 Tag Number: VAV 1-06			1.00		
17	DDC Controls: Model Number: DDC Controls			1.00		
18	2705-0001-02-00:Year 2 parts warranty whole unit Model Number: 2705-0001-02-00			1.00		
19	2705-1000-01-00:1st year labor warranty whole unit Model Number: 2705-1000-01-00			1.00		
20	2705-1000-02-00:2nd year labor warranty whole unit Model Number: 2705-1000-02-00			1.00		

U.S. Inc.

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TYPE	INVOICE
*NUMBER	33483835
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N30	6/22/2014	SHIP POINT	FA-PPD	5/23/2014	DAYTON FRE	00024385069

ITEM	DESCRIPTION	UOM	MULT	QUANTITY	UNIT PRICE	EXTENDED AMOUNT
21	Variable Air Volume Single Duct Terminal: Model Number: Variable Air Volume Single Duct Terminal Serial Number: R14C16722 Tag Number: VAV 1-07			1.00		
22	DDC Controls: Model Number: DDC Controls			1.00		
23	2705-0001-02-00:Year 2 parts warranty whole unit Model Number: 2705-0001-02-00			1.00		
24	2705-1000-01-00:1st year labor warranty whole unit Model Number: 2705-1000-01-00			1.00		
25	2705-1000-02-00:2nd year labor warranty whole unit Model Number: 2705-1000-02-00			1.00		

Trane U.S. Inc.

3600 PAMMEL CREEK ROAD
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N30	6/22/2014	SHIP POINT	FA-PPD	5/23/2014	DAYTON FRE	00024385069

ITEM	DESCRIPTION	UOM	MULT	QUANTITY	UNIT PRICE	EXTENDED AMOUNT
21	Variable Air Volume Single Duct Terminal: Model Number: Variable Air Volume Single Duct Terminal Serial Number: R14C16722 Tag Number: VAV 1-07			1.00		
22	DDC Controls: Model Number: DDC Controls			1.00		
23	2705-0001-02-00:Year 2 parts warranty whole unit Model Number: 2705-0001-02-00			1.00		
24	2705-1000-01-00:1st year labor warranty whole unit Model Number: 2705-1000-01-00			1.00		
25	2705-1000-02-00:2nd year labor warranty whole unit Model Number: 2705-1000-02-00			1.00		

TRANE

Trane U.S. Inc.

3600 PAMMEL CREEK ROAD
LA CROSSE, WI 54601-7599

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TYPE	INVOICE
*NUMBER	33483835
DATE	5/23/2014
PAGE	7 of 25
PURCHASE ORDER NUMBER	816488
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Wyoming Middle School
14 Worthington Ave
WYOMING, OH 45215

ORDERING LOCATION	CREDIT JOB/PROJECT#	SALES ORDER # / CALL# / CONTRACT #
	N213976	N2H983

PAYMENT TERMS	DUE DATE	FOB	FREIGHT TERMS	SHIP / CLOSE DATE	SHIP VIA	SHIPPING REFERENCE
N30	6/22/2014	SHIP POINT	FA-PPD	5/23/2014	DAYTON FRE	00024385069

ITEM	DESCRIPTION	UOM	MULT	QUANTITY	UNIT PRICE	EXTENDED AMOUNT
31	Variable Air Volume Single Duct Terminal: Model Number: Variable Air Volume Single Duct Terminal Serial Number: R14C16723 Tag Number: VAV 1-09			1.00		
32	DDC Controls: Model Number: DDC Controls			1.00		
33	2705-0001-02-00:Year 2 parts warranty whole unit Model Number: 2705-0001-02-00			1.00		
34	2705-1000-01-00:1st year labor warranty whole unit Model Number: 2705-1000-01-00			1.00		
35	2705-1000-02-00:2nd year labor warranty whole unit Model Number: 2705-1000-02-00			1.00		

Trane U.S. Inc.

3600 PAMMEL CREEK ROAD
LA CROSSE, WI 54601-7599

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TYPE	INVOICE
*NUMBER	33483835
DATE	5/23/2014
PAGE	8 of 25
PURCHASE ORDER NUMBER	816488
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CUSTOMER ACCOUNT#	3402877
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	N213976	N2H983

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N30	6/22/2014	SHIP POINT	FA-PPD	5/23/2014	DAYTON FRE	00024385069

ITEM	DESCRIPTION	UOM	MULT	QUANTITY	UNIT PRICE	EXTENDED AMOUNT
36	Variable Air Volume Single Duct Terminal: Model Number: Variable Air Volume Single Duct Terminal Serial Number: R14C16724 Tag Number: VAV 1-10			1.00		
37	DDC Controls: Model Number: DDC Controls			1.00		
38	2705-0001-02-00:Year 2 parts warranty whole unit Model Number: 2705-0001-02-00			1.00		
39	2705-1000-01-00:1st year labor warranty whole unit Model Number: 2705-1000-01-00			1.00		
40	2705-1000-02-00:2nd year labor warranty whole unit Model Number: 2705-1000-02-00			1.00		

Trane U.S. Inc.

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TYPE	INVOICE
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N30	6/22/2014	SHIP POINT	FA-PPD	5/23/2014	DAYTON FRE	00024385069

ITEM	DESCRIPTION	UOM	MULT	QUANTITY	UNIT PRICE	EXTENDED AMOUNT
41	Variable Air Volume Single Duct Terminal: Model Number: Variable Air Volume Single Duct Terminal Serial Number: R14C16725 R14C16726 R14C16727 Tag Number: VAV 1-11 Tag Number: VAV 1-12 Tag Number: VAV 1-13			3.00		
42	DDC Controls: Model Number: DDC Controls			3.00		
43	2705-0001-02-00:Year 2 parts warranty whole unit Model Number: 2705-0001-02-00			3.00		
44	2705-1000-01-00:1st year labor warranty whole unit Model Number: 2705-1000-01-00			3.00		
45	2705-1000-02-00:2nd year labor warranty whole unit Model Number: 2705-1000-02-00			3.00		

Trane U.S. Inc.

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TYPE	INVOICE
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ITEM	DESCRIPTION	UOM	MULT	QUANTITY	UNIT PRICE	EXTENDED AMOUNT
46	Variable Air Volume Single Duct Terminal: Model Number: Variable Air Volume Single Duct Terminal Serial Number: R14C16721 Tag Number: VAV 1-15			1.00		
47	DDC Controls: Model Number: DDC Controls			1.00		
48	2705-0001-02-00:Year 2 parts warranty whole unit Model Number: 2705-0001-02-00			1.00		
49	2705-1000-01-00:1st year labor warranty whole unit Model Number: 2705-1000-01-00			1.00		
50	2705-1000-02-00:2nd year labor warranty whole unit Model Number: 2705-1000-02-00			1.00		

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ITEM	DESCRIPTION	UOM	MULT	QUANTITY	UNIT PRICE	EXTENDED AMOUNT
51	Variable Air Volume Single Duct Terminal: Model Number: Variable Air Volume Single Duct Terminal Serial Number: R14C16729 Tag Number: VAV 1-16			1.00		
52	DDC Controls: Model Number: DDC Controls			1.00		
53	2705-0001-02-00:Year 2 parts warranty whole unit Model Number: 2705-0001-02-00			1.00		
54	2705-1000-01-00:1st year labor warranty whole unit Model Number: 2705-1000-01-00			1.00		
55	2705-1000-02-00:2nd year labor warranty whole unit Model Number: 2705-1000-02-00			1.00		

TRANE

Trane U.S. Inc.

3600 PAMMEL CREEK ROAD
LA CROSSE, WI 54601-7599

For questions concerning this invoice,
please call 888-832-5266

REMIT TO:

Trane U.S. Inc.
PO BOX 845053
DALLAS, TX 75284-5053

TYPE	INVOICE
NUMBER	33483835
DATE	5/23/2014
PAGE	12 of 25
PURCHASE ORDER NUMBER	816488
PROJECT/JOB NAME	Wyoming Middle School - State
ORIGINAL SYSTEM NUMBER	2273926_KOD
CUSTOMER ACCOUNT#	3402877
PREVIOUS #	

SOLD TO:

WYOMING CITY SCHOOL DISTRICT
ATTN: ACCOUNTS PAYABLE
420 SPRINGFIELD PIKE
WYOMING, OH 45215

SHIP TO/SERVICE LOCATION:

WYOMING CITY SCHOOL DISTRICT
Wyoming Middle School
14 Worthington Ave
WYOMING, OH 45215

ORDERING LOCATION	CREDIT JOB/PROJECT#	SALES ORDER # / CALL# / CONTRACT #
	N213976	N2H983

PAYMENT TERMS	DUE DATE	FOB	FREIGHT TERMS	SHIP / CLOSE DATE	SHIP VIA	SHIPPING REFERENCE
N30	6/22/2014	SHIP POINT	FA-PPD	5/23/2014	DAYTON FRE	00024385069

ITEM	DESCRIPTION	UOM	MULT	QUANTITY	UNIT PRICE	EXTENDED AMOUNT
56	Variable Air Volume Single Duct Terminal: Model Number: Variable Air Volume Single Duct Terminal Serial Number: R14C16711 Tag Number: VAV 1-17			1.00		
57	DDC Controls: Model Number: DDC Controls			1.00		
58	2705-0001-02-00:Year 2 parts warranty whole unit Model Number: 2705-0001-02-00			1.00		
59	2705-1000-01-00:1st year labor warranty whole unit Model Number: 2705-1000-01-00			1.00		
60	2705-1000-02-00:2nd year labor warranty whole unit Model Number: 2705-1000-02-00			1.00		