LEED® NC v2.2 – Warroad Border Crossing Station

EA Credit 1 – Optimize Energy Performance
Energy Model Narrative

1. General

The United States Land Port of Entry at Warroad, MN is a new construction project on the U.S./Canada border. The facility consists of three conditioned buildings serving port operations including office work, inspections, holding facilities, training, and a firing range. The building has been modeled using DOE2.2/eQuest 3.63b modeling software per ASHRAE 90.1-2004 Appendix G requirements. Each of the three buildings has been modeled as follows.

2. Main building

The main building utilizes a dedicated outside air system (DOAS), which provides pre-conditioned ventilation air to constant volume heat pump terminal units. There are two dedicated outside air units for redundancy (AHU-1 and AHU-2). The AHUs utilize a dual temperature water coil to provide either heating or cooling/dehumidification. The dual temperature water is supplied by redundant water to water ground source heat pumps. The heat pump terminal units provide cooling of minimum outside and return air, as well as reheat of minimum outside air quantities supplied by the DOAS units. Primary heating for the building is provided using in-slab radiant floor heating and finned tube radiation. The heating water for these systems is supplied by redundant water to water heat pumps. The ground source system consists of 400' deep vertical wells and also utilizes a dry cooler to add energy to the ground during warm summer months.

2.1. Exceptional Calculation Methods

The dedicated outside air system is modeled to serve an adiabatic "dummy zone", conditioned to the discharge air conditions of the DOAS, from which the terminal units pull "outside" air. Due to software limitations, the DOAS system does not model the air side economizer but does model the heat recovery system as designed.

Water to water heat pumps also cannot be modeled exactly as designed. For the chilled water mode, a water cooled chiller was selected as the cooling source, which rejects heat directly to the ground source loop. For heating mode on the dual temperature loop and for the floor heat and finned tube radiation, an electric boiler was substituted for the water to water heat pump. The electric input ration (EIR) was input to match an average coefficient of performance (COP) of 3.0. While not every detail of the ground source system can be modeled as designed, the pump energy for the ground source loop, as well as the pump and fan energy for the dry cooler, have also been taken into account.

The in-floor heating system has been modeled as baseboard radiation.

3. Secondary Building/Firing Range

Primary heating for the secondary building is provided using electric thermal storage boilers. Rate deductions are available during off-peak hours, and boilers which utilize ceramic thermal storage bricks provide off-peak "charging" of heat and then discharge energy to the hot water loop during on-peak hours. Per the utility Roseau Electric, the peak times during the winter are assumed to be 6 am – 12 pm and 5 pm – 10 pm. The peak summer times are assumed to be 9 am – 9 pm. The garage, firing range line, and other occupied areas utilize in-floor heating from the hot water loop. The secondary building office areas utilize a variable air volume AHU with hot water heating and DX cooling. The garage areas utilize heating only makeup air units with hot water heat. Finally, the firing range makeup air unit provides heating and cooling to the firing line, as well as adequate airflow down the firing range for safe operation. A HEPA filter serves to filter additional exhaust for the firing range. Outside airflow for all units is maintained using an airflow measuring station. Heat recovery systems are utilized on the garage and firing range makeup air units.

3.1. Exceptional Calculation Methods

Most systems in the secondary building have been modeled as designed. However, there are some exceptional calculation methods which have been utilized. The thermal storage boiler system has been modeled as a hot water storage tank, although capacities, charge rates, and discharge rates equal those of the as-built systems.

The in-floor heating system has been modeled as baseboard radiation.

4. Commercial Building

Primary heating for the Commercial Building is provided using water to water heat pumps, which also provide cooling water during the summer. The garage and office areas utilize in-floor heat for primary heat. A constant volume unit provides conditioning and ventilation to several service areas using a dual temperature water coil for heating and cooling/dehumidification. An additional constant volume water to air heat pump serves the office areas. The garage areas utilize heating only makeup air heat pumps. Outside airflow for all units is maintained using an airflow measuring station. Heat recovery systems are utilized on the garage units.

4.1. Exceptional Calculation Methods

Water to water heat pumps also cannot be modeled exactly as designed. For the chilled water mode, a water cooled chiller was selected as the cooling source, which rejects heat directly to the ground source loop. For heating mode on the dual temperature loop and for the floor heat and finned tube radiation, an electric boiler was substituted for the water to water heat pump. The electric input ration (EIR) was input to match an average coefficient of performance (COP) of 3.0. While not every detail of the ground source system can be modeled as designed, the pump energy for the ground source loop, as well as the pump and fan energy for the dry cooler, have also been taken into account.

The in-floor heating system has been modeled as baseboard radiation.

5. Inspection Booths

The three inspection booths are heated using hot water from the main building water to water heat pumps, as well as fan coil units. The fan coil units utilize electric heat and DX cooling.

5.1. Exceptional Calculation Methods

The in-floor heating system has been modeled as baseboard radiation.

6. Snow Melt

Water to water heat pumps serve driveway areas for snow melt functions during the winter.

6.1. Exceptional Calculation Methods

Because eQuest does not have the ability to model a snow melt system, the energy usage is calculated manually by using estimated run hours for the system. Note that this load is not considered a process load, as snow melt systems are included in ASHRAE 90.1-2004. The baseline system is modeled as an electric boiler with the same heating capacity as the heat pump system proposed. The proposed system electric input ration (EIR) was input to match an average coefficient of performance (COP) of 3.0. While not every detail of the ground source system can be modeled as designed, the pump energy for the ground source loop and snow melt loop, have been taken into account.

7. Other LEED Items

7.1. Energy Star Target Finder

Note that the Energy Star Target Finder field has been left blank, as there are no Energy Star buildings which satisfy the building space type or hours of operation.

7.2. Percent Process Loads

ASHRAE 90.1-2004 requires justification when process loads account for less than 25% of all energy usage. In this particular building, the process loads account for less than 1% of all energy usage. This is due in large part to the fact that there are very few process loads. The building does not have any elevators, escalators, or other large energy-consuming equipment. Due to the extremely cold climate and high outside air loads required by ASHRAE 62.1 and client standards, the energy usage is dominated by outside air heating loads. Nearly all other end-uses are dwarfed.

(Responsible Individual) (Company Name)

I, (name removed), from (company name removed)

verify that the information provided below is accurate, to the best of my knowledge.

CREDIT COMPLIANCE

The project meets the minimum energy efficiency requirements.

The project meets all the mandatory provisions (Sections 5.4, 6.4, 7.4, 8.4, 9.4, and 10.4) of ASHRAE/IESNA Standard 90.1-2004 (without amendments). ☒

-- AND --

Select the appropriate compliance path:

The prescriptive requirements (Sections 5.5, 6.5, 7.5, and 9.5) of ASHRAE 90.1-2004 (without amendments) ☐

-- OR --

The performance requirements (Section 11) of ASHRAE/IESNA Standard 90.1-2004 (without amendments) ☐

-- OR --

The project has used a computer simulation model to document improved building energy performance under EA Credit 1 ☒

NARRATIVE (Optional)

Please provide any additional comments or notes regarding special circumstances or considerations regarding the project's credit approach.

Please see attached uploads for 90.1-2004 Sections 5, 6, 7, and 9. Note that Section 9 lighting calculation compliance is documented utilizing DOE COMCheck software in lieu of ASHRAE 90.1-2004 forms. Section 11 is completed using the energy modeling results of EA Credit 1.

☐ The project is seeking point(s) for this credit using an alternate compliance approach. The compliance approach, including references to any applicable Credit Interpretation Rulings is fully documented in the narrative above.

Project Name: U.S. Border Station, Warroad, MN

Credit: EA Prerequisite 2: Minimum Energy Performance

Points Documented: Y

READY TO SAVE THIS TEMPLATE TO LEED-ONLINE? Please enter your first name, last name and today's date below, followed by your LEED-Online Username and Password associated with the Project listed above to confirm submission of this template.

(removed)	(removed)	2010-06-23	(removed)	
First Name	Last Name	Date	Username (Email Address)	Password

SAVE TEMPLATE TO LEED-ONLINE

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T0000494

Letter Template Version A1 .

Building Envelope Compliance Documentation — Part I

Project Name: U.S. Land Port of Entry, Warroad, MN		
Project Address:		Date: 6/4/2010
Designer of Record: (removed)		Telephone:
Contact Person:		Telephone:
City: Warroad	Climate Zone: 7	Criteria Table: 5.5-7

Mandatory Provisions Checklist

Insulation (§ 5.4.1)

- ☑ Insulation Materials are installed in accordance with manufacturer's recommendations and in such a manner as to achieve rated R-value of insulation
  - ❑ Exception: for metal building roofs or metal building walls.
- ☑ Loose-fill insulation is not used in attic roof spaces when the slope of the ceiling is more than three in twelve.
- ☑ Attic eave vents have baffling to deflect the incoming air above the surface of the insulation.
- ☑ Insulation is installed in a permanent manner in substantial contact with the inside surface.
- ☑ Batt insulation installed in floor cavities is supported in a permanent manner by supports no greater than 24 in. o.c.
- ☑ Lighting fixtures, HVAC, and other equipment are not be recessed in ceilings in such a manner to affect the insulation thickness unless.

Exceptions:

- ❑ The recessed area is less than one percent.
- ☑ The entire roof, wall, or floor is covered with insulation to the full depth required.
- ❑ The effects of reduced insulation are included in calculations using an area weighted averages.

- ☑ Roof insulation is not installed over suspended ceiling with removable ceiling panels.
- ☑ Exterior insulation is covered with a protective material to prevent damage. Insulation is protected in attics and mechanical rooms where access is needed.
- ☑ Foundation vents do not interfere with the insulation.
- ☑ Insulation materials in ground contact have a water absorption rate no greater than 0.3 percent.

Fenestration and Doors (§ 5.4.2)

- ☑ U-factors are determined in accordance with NFRC 100. U-factors for skylights shall be determined for a slope of 20° above the horizontal.

Exceptions:

- ❑ U-factors are taken from A.8.1 for glazed wall systems in vertical fenestration and/or skylights.
- ❑ U-factors are taken from A.8.2 other fenestration products.
- ❑ U-factors are taken from A.7 for opaque doors.
- ❑ U-factors are derived from DASMA 105 for garage doors.

- ☑ Solar heat gain coefficient (SHGC) is determined in accordance with NFRC 200.

Exceptions:

- ❑ SHGC is determined by multiplying the shading coefficient (SC) by 0.86. Shading coefficient is determined using a spectral data file determined in accordance with NFRC 300.
- ❑ SHGC for the center of glass is used. SHGC is determined using a spectral data file determined in accordance with NFRC 300.
- ❑ SHGC is taken from § A8 for glazed wall systems in vertical fenestration and skylights.

- ☑ Visible light transmittance is determined in accordance with NFRC 200.

Air Leakage (§ 5.4.3)

- ☑ The *building envelope* is sealed, caulked, gasketed, and/or weather-stripped to minimize air leakage.
- ☑ Air leakage through fenestration and doors is less than 0.4 cfm/ft² (1.0 cfm/ft² for glazed swinging entrance doors and for revolving doors) when tested in accordance with NFRC 400.

Exceptions:

- ❑ Field fabricated fenestration and doors.
- ❑ For garage *doors* tested in accordance with DASMA 105.

- ☑ Cargo doors and loading dock doors are equipped with weatherseals in climates zones 3 through 8.
- ☑ Entrance doors have vestibules.

Exceptions:

- ❑ Climate zone 1 or 2
- ☑ Building is less than four stories.
- ❑ Doors not intended as building entrance.
- ❑ Doors open from dwelling unit(s).
- ☑ Doors open from spaces smaller than 3,000 ft².
- ❑ Building has revolving doors.
- ❑ Doors for vehicular movement or material handling.

HVAC Mandatory Provisions

Project Name: U.S. Land Port of Entry, Warroad, MN			
Project Address:			Date:
HVAC System Designer of Record: (removed)			Telephone:
Contact Person:			Telephone:
City: Warroad, MN	Climate Zone: 7		
Zip: 56763	1% Summer DB Temp: 82.8	1% Summer WB Temp: 66.5	99.6% Winter Temp: -28.7

Mandatory Equipment Efficiency Worksheet (§ 6.4.1.1)

System Tag	Equipment Type (Tables 6.8.1A through G)	Size Category (Tables 6.8.1A through G)	Sub-Category or Rating Condition (Tables 6.8.1A through G)	Units of Efficiency (Tables 6.8.1A through G)	Minimum Efficiency (Tables 6.8.1A through G) Rated ≥ Required
	See Uploads				≥
					≥
					≥
					≥
					≥
					≥
					≥

Mandatory Non-Standard Centrifugal Chiller Worksheet (§ 6.4.1.1)

System Tag	Leaving CHW Temperature (°F)	Entering CW Temperature (°F)	Condenser Flow Rate (gpm/ton)	Size Category (Tables 6.8.1H through J)	Minimum Efficiency (Tables 6.8.1H through J) Rated ≥ Required
					≥
					≥
					≥
					≥

General Mandatory Requirements

- ☑ Load calculations are provided for selection of all equipment and systems (§ 6.4.2).
- ☑ Stair vents, elevator shaft vents, gravity hoods, gravity vents and gravity ventilations are provided with motorized dampers.
  - ☐ Exception: Gravity dampers are used since the building is less than 3 stories or in climate zones 1–3.
  - ☐ Exception: No vents are required as these systems ventilate unconditioned zones.
- ☑ Piping insulation meets or exceeds the requirements of the Standard (§ 6.4.4.1.3).
- ☑ Construction documents require record drawings (§ 6.7.2.1), manuals (§ 6.7.2.2), system balancing (§ 6.7.2.3) and system commissioning (§ 6.7.2.4).

Special Mandatory Requirements

- ☑ Freeze protection or snow/ice melting systems (if any) have controls to prevent operation in warm weather (§ 6.4.3.7).
- ☑ Independent perimeter heating systems (if any) comply with the control requirements of § 6.4.3.1.1 and § 6.4.3.2.
- ☑ Independent heating and cooling thermostatic controls (if any) are interlocked to prevent crossover of set points (§ 6.4.3.2).

Project Name: U.S. Land Port of Entry, Warroad, MN	
Contact Person:	Telephone:

Systems Worksheet (§ 6.4)

System Tag	See Uploads					
Supply CFM						
Supply ESP (in. w.c.)						
Fan System HP						
OA CFM (i.e. Outdoor Air CFM)						
Automatic Shutdown (§ 6.4.3.2.1)						
Deadband (§ 6.4.3.1.2)						
Setback Controls (§ 6.4.3.2.2)						
Setup Controls (§ 6.4.3.2.2)						
Optimum Start (§ 6.4.3.1.3)						
Zone Isolation (§ 6.4.3.1.4)						
Shutoff Dampers (§ 6.4.3.3.3)						
Heat Pump Aux Heat (§ 6.4.3.4)						
Humidifier Preheat (§ 6.4.3.5)						
Humidification/Dehumidification Deadband (§ 6.4.3.6)						
Ventilation Control (§ 6.4.3.8)						
Duct/Plenum Insulation (§ 6.4.4.2.1)						
Duct Sealing Levels (§ 6.4.4.2.1) Supply/Return						
Duct Leakage Test (§ 6.4.4.2.2)						

In the table above, enter the appropriate codes from this list:

Shutdown
- *C1 Complying nonresidential time switch with override*
- *C2 Complying residential time switch with override*
- *N1 N/A continuous operation*
- *N2 N/A ≤15 kbtu/h or ≤3/4 hp*
- *N3 N/A hotel/motel guestroom*

Dead Band
- *C1 Dual setpoint control*
- *C2 Manual change over control*
- *N1 N/A special occupancy (requires approval)*
- *N2 N/A heating or cooling only*

Setback Controls
- *C1 Setback provided (down to 55F)*
- *N1 N/A continuous operation*
- *N2 N/A ≤15 kbtu/h or ≤3/4 hp*
- *N3 N/A 99.6% Win DB>40F*
- *N4 N/A radiant heating*
- *N5 N/A no heating*

Setup Controls
- *C1 Setup provided (up to 90F)*
- *N1 N/A continuous operation*
- *N2 N/A ≤15 kbtu/h or ≤3/4 hp*
- *N3 N/A 1% Sum DB<=100F*
- *N4 N/A no cooling*

Optimum Start
- *C1 Optimum start provided*
- *N1 N/A continuous operation*
- *N2 N/A ≤15 kbtu/h or ≤3/4 hp*
- *N3 N/A supply<=10,000 cfm*

Shutoff Dampers
- *C1 Motorized shutoff dampers on OA and Exh*
- *C2 Gravity shutoff dampers on OA and Exh*
- *N1 N/A continuous operation*
- *N2 N/A ≤15 kbtu/h or ≤3/4 hp*
- *N3 N/A OA/EA <=300 cfm*

Zone Isolation
- *C1 Isolation zones provided*
- *N1 N/A continuous operation*
- *N2 N/A ≤15 kbtu/h or ≤3/4 hp*
- *N3 N/A all zones on same schedule*
- *N4 N/A OA/EA <=5,000 cfm*

Heat Pump Aux Heat
- *C1 Complying controls provided*
- *N1 N/A system is not a heat pump*
- *N2 N/A auxiliary is not electric or is not provided*
- *N3 N/A heat pump covered by NAECA*

Humidifier Preheat
- *C1 Complying controls provided*
- *N1 N/A no humidifier*

Humidification/Dehumidification Dead Band
- *C1 Complying controls provided*
- *N1 N/A no humidification and/or dehumidification*

Duct/Plenum Insulation
- *C1 Complying insulation provided*
- *N1 N/A all ducts located in conditioned space*

Duct Sealing
- *Enter highest seal level (A, B or C) for supply and return*

Duct Leakage Test
- *Y Ducts will be tested for leakage*
- *N Ducts will not be tested for leakage*

Service Water Heating Compliance Documentation

Project Name: U.S. Land Port of Entry, Warroad, MN	
Project Address:	Date:
Designer of Record: (removed)	Telephone:
Contact Person:	Telephone:
City: Warroad, MN	

Mandatory Provisions Checklist

- ☑ Load calculations have been provided for sizing of systems and equipment (§ 7.4.1).
- ☑ Equipment efficiencies meet or exceed the requirements of Table 7.8 (§ 7.4.2).
- ☑ Circulating systems are fully insulated (per Table 6.8.3) and have automatic pump controls (§ 7.4.3 and § 7.4.4.2).
- ☑ Non-circulating systems have insulated heat traps and outlet piping insulated (per Table 6.8.3) for 8 ft from the storage tank (§ 7.4.6).
- ❑ Tanks with remote heaters have circulation pump controls (§ 7.4.4.4).
- ☑ All water-heating systems have temperature controls that are adjustable down to 120°F or lower (§ 7.4.4.1).
- ☑ Systems designed with pipe heating systems such as heat trace have temperature or time controls (§ 7.4.4.2).
- ☑ Public lavatories have outlet temperature controls that limit the discharge temperature to 110°F (§ 7.4.4.3).
- ❑ Pool heaters have readily accessible controls and gas-fired heaters do not have standing pilot lights (§ 7.4.5.1).
- ❑ Heated swimming pools have vapor retardant covers (§ 7.4.5.2).
- ❑ Pool heaters and circulation pumps have time switches (§ 7.4.5.3).

Equipment Efficiency Worksheet (§ 7.4.1)

System Tag	Equipment Type (From Table 7.8)	Sub-Category or Rating Condition (From Table 7.8)	Input Rating (Btu/h or kW)	Volume (gal)	Energy Factor or Et		Standby Loss	
					Rated	≥ Required	Rated	≤ Required
EWH-01	Electric Water Heater	>12 kW, > 20 gallon	18 kW	52	N/A	≥ N/A	231	≤ 272 Btu/h
EWH-02	Electric Water Heater	<= 12kW > 20 gallon	12 kW	52	0.98	≥ 0.86	N/A	≤ N/A
EWH-03	Electric Water Heater	<= 12kW > 20 gallon	12 kW	52	0.98	≥ 0.86	N/A	≤ N/A
						≥		≤

Combination Space and Water Heating Worksheet (§ 7.5.1)

System Tag	Standby Loss Method			or Energy Use Exception (attach calculations			or Size Exception	
	Equipment	≤	Requirement	Equipment	<	Requirement	Equipment	<Requirement
		≤			<			< 150,000 Btu/h
		≤			<			< 150,000 Btu/h
		≤			<			< 150,000 Btu/h
		≤			<			< 150,000 Btu/h

Lighting Compliance Documentation

Project Name: U.S. Land Port of Entry, Warroad, MN	
Project Address:	Date: 6/4/2010
Designer of Record: (removed)	Telephone:
Contact Person:	Telephone:
City: Warroad	

Mandatory Provisions Checklist

Automatic lighting shutoff controls are provided based on either a scheduling device or an occupant sensor.

- ☑ Exception: Space is intended for 24-hour operation.
- ☑ Exception: Space is smaller than 5,000 ft².
- ☐ Exception: Space for patient care.
- ☑ Exception: Space where automatic lighting shutoff would endanger safety or security.

☐ Each space enclosed by ceiling-height partitions has an independent, accessible control that operates general lighting in the space.

- ☑ Exception: The control is located in a remote location for safety or security reasons.

☑ For spaces less than or equal to 10,000 ft², a separate space control is provided for each 2,500 ft² of area.

☐ For spaces more than 10,000 ft², a separate space control is provided for each 10,000 ft² of area.

☑ Either a photosensor or an astronomical time switch controls exterior lighting applications.

- ☑ Exception: Lights must remain on for safety, security or eye adaptation reasons.

☑ Two-lamp tandem-wired ballasts.

☑ Display lighting has a separate control.

☑ Case lighting has a separate control.

☐ Hotel/motel guest rooms have a master switch at the main entry.

☑ Task lighting has a separate control.

☑ Nonvisual lighting has a separate control.

☐ Demonstration lighting has a separate control.

☑ Exit signs do not exceed 5 W per face.

☑ Exterior building grounds luminaires greater than 100 W have lamps with minimum efficacy of 60 lumens/W.

- ☐ Exception: Luminaire is activated with a motion sensor.

Interior Lighting Power Allowance (Building Area Method)

Building Type	Lighting Power Density (W/ft²)	Building Area (ft²)	Lighting Power Allowance (W)
7	5.5-7		
		Total	

Interior Lighting Power Allowance (Space-by-Space Method)

Building Type	Common/Specific Space Type	Lighting Power Density (W/ft²)	Space Area (ft²)	Lighting Power Allowance (W)
			Total	

US Land Port of Entry, Warroad, MN
EA Prerequisite 2
ASHRAE 90.1-2004, Section 6 Mandatory Provisions
Mandatory Equipment Efficiency Worksheet 6.4.1.1

System Tag	Mode	Equipment Type (Tables 6.8.1A through G)	Size Category (Tables 6.8.1A through G)	Sub-Category or Rating Condition (Tables 6.8.1A through G)	Units of Efficiency (Tables 6.8.1A through G)	Minimum Efficiency	
						Rated	Required
HPW-01/02	Heating	***No Rating Condition for Water to Water Heat Pumps (Table 6.8.1B and ISO-13256-1 apply only to air to water heat pumps)***	N/A	N/A	COP	2.83	N/A
HPW-03/04	Heating	***No Rating Condition for Water to Water Heat Pumps (Table 6.8.1B and ISO-13256-1 apply only to air to water heat pumps)***	N/A	N/A	COP	3.03	N/A
HPW-03/04	Cooling	***No Rating Condition for Water to Water Heat Pumps (Table 6.8.1B and ISO-13256-1 apply only to air to water heat pumps)***	N/A	N/A	EER	16.0	N/A
HPW-05/06	Heating	***No Rating Condition for Water to Water Heat Pumps (Table 6.8.1B and ISO-13256-1 apply only to air to water heat pumps)***	N/A	N/A	COP	3.03	N/A
HPW-07	Heating	***No Rating Condition for Water to Water Heat Pumps (Table 6.8.1B and ISO-13256-1 apply only to air to water heat pumps)***	N/A	N/A	COP	2.83	N/A
HPW-07	Cooling	***No Rating Condition for Water to Water Heat Pumps (Table 6.8.1B and ISO-13256-1 apply only to air to water heat pumps)***	N/A	N/A	EER	16.0	>13.4
HPA-01	Heating	6.8.1B - Heat Pump, Ground Source, Heating	<135,000 Btu/h	32° F Entering Water	COP	3.5	>3.1
HPA-01	Cooling	6.8.1B - Heat Pump, Ground Source, Cooling	<135,000 Btu/h	77° F Entering Water	EER	19	>13.4
HPA-02	Heating	6.8.1B - Heat Pump, Ground Source, Heating	<135,000 Btu/h	32° F Entering Water	COP	3.5	>3.1
HPA-02	Cooling	6.8.1B - Heat Pump, Ground Source, Cooling	<135,000 Btu/h	77° F Entering Water	EER	19	>13.4
HPA-03	Heating	6.8.1B - Heat Pump, Ground Source, Heating	<135,000 Btu/h	32° F Entering Water	COP	3.5	>3.1
HPA-03	Cooling	6.8.1B - Heat Pump, Ground Source, Cooling	<135,000 Btu/h	77° F Entering Water	EER	19.6	>13.4
HPA-04	Heating	6.8.1B - Heat Pump, Ground Source, Heating	<135,000 Btu/h	32° F Entering Water	COP	3.5	>3.1
HPA-04	Cooling	6.8.1B - Heat Pump, Ground Source, Cooling	<135,000 Btu/h	77° F Entering Water	EER	19.6	>13.4
HPA-05	Heating	6.8.1B - Heat Pump, Ground Source, Heating	<135,000 Btu/h	32° F Entering Water	COP	3.5	>3.1
HPA-05	Cooling	6.8.1B - Heat Pump, Ground Source, Cooling	<135,000 Btu/h	77° F Entering Water	EER	19.6	>13.4
HPA-06	Heating	6.8.1B - Heat Pump, Ground Source, Heating	<135,000 Btu/h	32° F Entering Water	COP	3.1	>3.1
HPA-06	Cooling	6.8.1B - Heat Pump, Ground Source, Cooling	<135,000 Btu/h	77° F Entering Water	EER	14.1	>13.4
HPA-07	Heating	6.8.1B - Heat Pump, Ground Source, Heating	<135,000 Btu/h	32° F Entering Water	COP	3.5	>3.1
HPA-07	Cooling	6.8.1B - Heat Pump, Ground Source, Cooling	<135,000 Btu/h	77° F Entering Water	EER	19.6	>13.4
HPA-08	Heating	6.8.1B - Heat Pump, Ground Source, Heating	<135,000 Btu/h	32° F Entering Water	COP	3.3	>3.1
HPA-08	Cooling	6.8.1B - Heat Pump, Ground Source, Cooling	<135,000 Btu/h	77° F Entering Water	EER	15.9	>13.4
HPA-09	Heating	6.8.1B - Heat Pump, Ground Source, Heating	<135,000 Btu/h	32° F Entering Water	COP	3.5	>3.1
HPA-09	Cooling	6.8.1B - Heat Pump, Ground Source, Cooling	<135,000 Btu/h	77° F Entering Water	EER	19	>13.4
HPA-10	Heating	6.8.1B - Heat Pump, Ground Source, Heating	<135,000 Btu/h	32° F Entering Water	COP	3.1	>3.1
HPA-10	Cooling	6.8.1B - Heat Pump, Ground Source, Cooling	<135,000 Btu/h	77° F Entering Water	EER	14.1	>13.4
HPA-11	Heating	6.8.1B - Heat Pump, Ground Source, Heating	<135,000 Btu/h	32° F Entering Water	COP	3.1	>3.1

US Land Port of Entry, Warroad, MN
EA Prerequisite 2
ASHRAE 90.1-2004, Section 6 Mandatory Provisions
Mandatory Equipment Efficiency Worksheet 6.4.1.1

System Tag	Mode	Equipment Type (Tables 6.8.1A through G)	Size Category (Tables 6.8.1A through G)	Sub-Category or Rating Condition (Tables 6.8.1A through G)	Units of Efficiency (Tables 6.8.1A through G)	Minimum Efficiency	
						Rated	Required
HPA-11	Cooling	6.8.1B - Heat Pump, Ground Source, Cooling	<135,000 Btu/h	77° F Entering Water	EER	14.1	>13.4
HPA-12	Heating	6.8.1B - Heat Pump, Ground Source, Heating	<135,000 Btu/h	32° F Entering Water	COP	3.1	>3.1
HPA-12	Cooling	6.8.1B - Heat Pump, Ground Source, Cooling	<135,000 Btu/h	77° F Entering Water	EER	14.1	>13.4
HPA-13	Heating	6.8.1B - Heat Pump, Ground Source, Heating	<135,000 Btu/h	32° F Entering Water	COP	3.5	>3.1
HPA-13	Cooling	6.8.1B - Heat Pump, Ground Source, Cooling	<135,000 Btu/h	77° F Entering Water	EER	19.6	>13.4
HPA-14	Heating	6.8.1B - Heat Pump, Ground Source, Heating	<135,000 Btu/h	32° F Entering Water	COP	3.1	>3.1
HPA-14	Cooling	6.8.1B - Heat Pump, Ground Source, Cooling	<135,000 Btu/h	77° F Entering Water	EER	14.1	>13.4
HPA-15	Heating	6.8.1B - Heat Pump, Ground Source, Heating	<135,000 Btu/h	32° F Entering Water	COP	3.1	>3.1
HPA-15	Cooling	6.8.1B - Heat Pump, Ground Source, Cooling	<135,000 Btu/h	77° F Entering Water	EER	14.1	>13.4
HPA-16	Heating	6.8.1B - Heat Pump, Ground Source, Heating	<135,000 Btu/h	32° F Entering Water	COP	3.1	>3.1
HPA-16	Cooling	6.8.1B - Heat Pump, Ground Source, Cooling	<135,000 Btu/h	77° F Entering Water	EER	14.1	>13.4
HPA-17	Heating	6.8.1B - Heat Pump, Ground Source, Heating	<135,000 Btu/h	32° F Entering Water	COP	3.1	>3.1
HPA-17	Cooling	6.8.1B - Heat Pump, Ground Source, Cooling	<135,000 Btu/h	77° F Entering Water	EER	14.1	>13.4
HPA-18	Heating	6.8.1B - Heat Pump, Ground Source, Heating	<135,000 Btu/h	32° F Entering Water	COP	3.1	>3.1
HPA-18	Cooling	6.8.1B - Heat Pump, Ground Source, Cooling	<135,000 Btu/h	77° F Entering Water	EER	14.1	>13.4
HPA-19	Heating	6.8.1B - Heat Pump, Ground Source, Heating	<135,000 Btu/h	32° F Entering Water	COP	3.1	>3.1
HPA-19	Cooling	6.8.1B - Heat Pump, Ground Source, Cooling	<135,000 Btu/h	77° F Entering Water	EER	14.1	>13.4
HPA-20	Heating	6.8.1B - Heat Pump, Ground Source, Heating	<135,000 Btu/h	32° F Entering Water	COP	3.5	>3.1
HPA-20	Cooling	6.8.1B - Heat Pump, Ground Source, Cooling	<135,000 Btu/h	77° F Entering Water	EER	19.6	>13.4
HPA-21	Heating	6.8.1B - Heat Pump, Ground Source, Heating	<135,000 Btu/h	32° F Entering Water	COP	3.1	>3.1
HPA-21	Cooling	6.8.1B - Heat Pump, Ground Source, Cooling	<135,000 Btu/h	77° F Entering Water	EER	14.1	>13.4
AHU-03/04	Heating	6.8.1B - Heat Pump, Ground Source, Heating	***No Rating Condition***	N/A	COP	3.9	N/A
FCU-01/02/03	Cooling	6.8.1A - Air Conditioner, Air-Cooled	<65,000 Btu/h	Split System	EER	12	>12
CRAC-01/02/03/04/05	Cooling	6.8.1A - Air Conditioner, Air-Cooled	<65,000 Btu/h	Split System	EER	12	>12
AHU-08 DX Coil	Cooling	6.8.1A - Air Conditioner, Air-Cooled	> 65,000 Btu/h and <135,000 Btu/h	Split System with HW Heat	EER	12	>9.5
AHU-09 DX Coil	Cooling	6.8.1A - Air Conditioner, Air-Cooled	> 240,000 Btu/h and <760,000 Btu/h	Split System with HW Heat	EER/IPLV	12	>9.3 EER/ >9.5 IPLV

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System Tag	HPA-01	HPA-02	HPA-03	HPA-04	HPA-05	HPA-06	HPA-07	HPA-08	HPA-09	HPA-10	HPA-11	HPA-12	HPA-13	HPA-14	HPA-15	HPA-16	HPA-17	HPA-18	HPA-19
Supply CFM	1,280	1,240	580	700	680	360	520	860	1,340	250	440	210	555	160	265	160	145	230	255
Supply ESP (in. w.c.)	0.7	0.7	0.7	0.7	0.7	0.5	0.7	0.7	0.7	0.4	0.7	0.4	0.4	0.4	0.4	0.4	0.3	0.4	0.4
Fan System HP	1/2	1/2	1/3	1/3	1/3	1/10	1/3	1/3	1/2	1/10	1/3	1/10	1/3	1/10	1/10	1/10	1/10	1/10	1/10
OA CFM (i.e. Outdoor Air CFM)	250	250	145	55	50	40	55	115	190	30	100	80	350	40	105	65	0	120	55
Automatic Shutdown (§ 6.4.3.2.1)	C1/N1/N2	C1/N1/N2	C1/N1/N2	C1/N1/N2	C1/N1/N2	C1/N1/N2	C1/N1/N2	C1/N1/N2	C1/N1/N2	C1/N1/N2	C1/N1/N2	C1/N1/N2	C1/N1/N2	C1/N1/N2	C1/N1/N2	C1/N1/N2	C1/N1/N2	C1/N1/N2	C1/N1/N2
Deadband (§ 6.4.3.1.2)	C1	C1	C1	C1	C1	C1	C1	C1	C1	C1	C1	C1	C1	C1	C1	C1	C1	C1	C1
Setback Controls (§ 6.4.3.2.2)	C1/N1/N2	C1/N1/N2	C1/N1/N2	C1/N1/N2	C1/N1/N2	C1/N1/N2	C1/N1/N2	C1/N1/N2	C1/N1/N2	C1/N1/N2	C1/N1/N2	C1/N1/N2	C1/N1/N2	C1/N1/N2	C1/N1/N2	C1/N1/N2	C1/N1/N2	C1/N1/N2	C1/N1/N2
Setup Controls (§ 6.4.3.2.2)	C1/N1/N2/N3	C1/N1/N2/N3	C1/N1/N2/N3	C1/N1/N2/N3	C1/N1/N2/N3	C1/N1/N2/N3	C1/N1/N2/N3	C1/N1/N2/N3	C1/N1/N2/N3	C1/N1/N2/N3	C1/N1/N2/N3	C1/N1/N2/N3	C1/N1/N2/N3	C1/N1/N2/N3	C1/N1/N2/N3	C1/N1/N2/N3	C1/N1/N2/N3	C1/N1/N2/N3	C1/N1/N2/N3
Optimum Start (§ 6.4.3.1.3)	N1/N2/N3	N1/N2/N3	N1/N2/N3	N1/N2/N3	N1/N2/N3	N1/N2/N3	N1/N2/N3	N1/N2/N3	N1/N2/N3	N1/N2/N3	N1/N2/N3	N1/N2/N3	N1/N2/N3	N1/N2/N3	N1/N2/N3	N1/N2/N3	N1/N2/N3	N1/N2/N3	N1/N2/N3
Shutoff Dampers (§ 6.4.3.3.3)	C1/N1/N2	C1/N1/N2	C1/N1/N2	C1/N1/N2	C1/N1/N2	C1/N1/N2	C1/N1/N2	C1/N1/N2	C1/N1/N2	C1/N1/N2	C1/N1/N2	C1/N1/N2	C1/N1/N2	C1/N1/N2	C1/N1/N2	C1/N1/N2	C1/N1/N2	C1/N1/N2	C1/N1/N2
Zone Isolation (§ 6.4.3.1.4)	C1/N1/N2/N3	C1/N1/N2/N3	C1/N1/N2/N3	C1/N1/N2/N3	C1/N1/N2/N3	C1/N1/N2/N3	C1/N1/N2/N3	C1/N1/N2/N3	C1/N1/N2/N3	C1/N1/N2/N3	C1/N1/N2/N3	C1/N1/N2/N3	C1/N1/N2/N3	C1/N1/N2/N3	C1/N1/N2/N3	C1/N1/N2/N3	C1/N1/N2/N3	C1/N1/N2/N3	C1/N1/N2/N3
Heat Pump Aux Heat (§ 6.4.3.4)	N2	N2	N2	N2	N2	N2	N2	N2	N2	N2	N2	N2	N2	N2	N2	N2	N2	N2	N2
Humidifier Preheat (§ 6.4.3.5)	N1	N1	N1	N1	N1	N1	N1	N1	N1	N1	N1	N1	N1	N1	N1	N1	N1	N1	N1
Humidification/Dehumidification Deadband (§ 6.4.3.6)	N1	N1	N1	N1	N1	N1	N1	N1	N1	N1	N1	N1	N1	N1	N1	N1	N1	N1	N1
Ventilation Control (§ 6.4.3.8)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Duct/Plenum Insulation (§ 6.4.4.2.1)	C1	C1	C1	C1	C1	C1	C1	C1	C1	C1	C1	C1	C1	C1	C1	C1	C1	C1	C1
Duct Sealing Levels (§ 6.4.4.2.1) Supply/Return	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
Duct Leakage Test (§ 6.4.4.2.2)	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N

Notes
1. Firing Range A

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System Tag	HPA-20	HPA-21	AHU-01	AHU-02	AHU-03	AHU-04	AHU-05	AHU-06	AHU-07	AHU-08	AHU-09	AHU-11	FCU-1,2,3	CRAC Units
Supply CFM	640	300	3,200	3,200	3,000	3,000	1,000	1,900	1,900	2,175	10,400	1,350	700	525
Supply ESP (in. w.c.)	0.7	0.5	1	1	1.75	1.75	0.5	0.5	0.5	1.5	1.75	0.75	0.25	0
Fan System HP	1/3	1/10	5	5	2	2	3/4	3	3	3	15	1	1/6	0.075
OA CFM (i.e. Outdoor Air CFM)	205	150	2,505	2,505	3,000	3,000	375	1,900	1,900	1,245	10,400	1,350	200	0
Automatic Shutdown (§ 6.4.3.2.1)	C1/N1/N2	C1/N2	C1	C1	C1	C1	C1	C1	C1	C1	C1	C1	C1/N2	C1/N2
Deadband (§ 6.4.3.1.2)	C1	C1	C1	C1	C1	C1	C1	C1	C1	C1	C1	N2	C1	N2
Setback Controls (§ 6.4.3.2.2)	C1/N1/N2	C1/N2	N1	N1	N4	N4	N1	N4	N4	C1	N4	N1	C1/N2	N1/N2
Setup Controls (§ 6.4.3.2.2)	C1/N1/N2/N3	C1/N2/N3	N1	N1	N4	N4	N1	N4	N4	C1	C1	N1/N4	C1/N3	N1/N2
Optimum Start (§ 6.4.3.1.3)	N1/N2/N3	N1/N2/N3	C1/N1	C1/N1	N3	N3	N1/N3	N3	N3	N3	Note 1	N1	N2/N3	N1/N2/N3
Shutoff Dampers (§ 6.4.3.3.3)	C1/N1/N2	C1/N1/N2	C1/N1	C1/N1	C1	C1	C1/N1	C1	C1	C1	C1	C1/N1	C1/N2/N3	N1/N2/N3
Zone Isolation (§ 6.4.3.1.4)	C1/N1/N2/N3	C1/N2	C1/N1/N4	C1/N1/N4	N3/N4	N3/N4	C1/N1/N4	N3/N4	N3/N4	N3/N4	N3	N1/N3/N4	C1/N2/N3/N4	C1/N1/N2/N3
Heat Pump Aux Heat (§ 6.4.3.4)	N2	N2	N1	N1	C1	C1	N1	N1	N1	N1	N1	N1	N1	N1
Humidifier Preheat (§ 6.4.3.5)	N1	N1	C1	C1	N1	N1	N1	N1	N1	C1	N1	N1	N1	N1
Humidification/Dehumidification Deadband (§ 6.4.3.6)	N1	N1	C1	C1	N1	N1	N1	N1	N1	C1	N1	N1	N1	N1
Ventilation Control (§ 6.4.3.8)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Duct/Plenum Insulation (§ 6.4.4.2.1)	C1	C1	C1	C1	C1	C1	C1	C1	C1	C1	C1	C1	C1	C1
Duct Sealing Levels (§ 6.4.4.2.1) Supply/Return	A	A	A	A	A	A	A	A	A	A	A	A	A	No Duct
Duct Leakage Test (§ 6.4.4.2.2)	N	N	N	N	N	N	N	N	N	N	N	N	N	N/A

\HU is turned on only when firing range usage is required. Optimum start, which would be useful for an office-type building with a regular schedule, would not apply in this case.

General Project Data Input

General Project Information

Project file name:	Z:\Projects\MPLS\Project 2\569700.00 Warroad Border Station\Mech\loads\CHVAC Files and Outputs\Warroad_Commercial.CHV
Project title:	United States Port Of Entry
Project city, state, ZIP:	Warroad, MN
Project date:	Monday, February 11, 2008
Weather reference city:	WARROAD, MINNESOTA, USA
Client name:	

Barometric pressure:	28.668	in.Hg.
Altitude:	1179	feet
Latitude:	49	Degrees
Mean daily temperature range:	26	Degrees
Starting & ending time for HVAC load calculations:	1am - 12am	
Number of unique zones in this project:	11	

Building Default Values

Calculations performed:	Both heating and cooling loads	
Lighting requirements:	1.50	Watts per square foot
Equipment requirements:	0.50	Watts per square foot
People sensible load multiplier:	250	Btuh per person
People latent load multiplier:	200	Btuh per person
Zone sensible safety factor:	0	%
Zone latent safety factor:	0	%
Zone heating safety factor:	0	%
People diversity factor:	100	%
Lighting profile number:	2	
Equipment profile number:	1	
People profile number:	1	
Building default ceiling height:	9.00	feet
Building default wall height:	22.00	feet

Internal Operating Load Profiles (C = 100)

	hr 1	hr 2	hr 3	hr 4	hr 5	hr 6	hr 7	hr 8	hr 9	hr 10	hr 11	hr 12	hr 13	hr 14	hr 15	hr 16	hr 17	hr 18	hr 19	hr 20	hr 21	hr 22	hr 23	hr 24
1	25	25	25	25	50	75	C	C	C	C	C	C	C	C	C	C	C	C	75	50	50	25	25	25
2	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C
3	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C
4	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C
5	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C
6	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C
7	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C
8	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C
9	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C
10	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C

General Project Data Input (cont'd)

Building-Level Design Conditions

Design Month	Outdoor Dry Bulb	Outdoor Wet Bulb	Indoor Rel.Hum	Indoor Dry Bulb	Grains Diff	In/Outdoor Correction
January	34	29	30%	72	-18.39	-58
February	39	34	30%	72	-15.00	-53
March	47	39	30%	72	-10.50	-46
April	73	55	30%	72	3.42	-19
May	83	64	50%	75	-4.93	-12
June	89	69	50%	75	11.57	-6
July	85	69	50%	75	20.49	-10
August	91	70	50%	75	15.58	-5
September	78	62	50%	75	-5.87	-17
October	68	55	50%	75	-20.70	-28
November	49	43	30%	72	-2.88	-43
December	37	32	30%	72	-16.42	-55
Winter	-24			72		

Master Roofs

Roof No.	ASHRAE Roof#	Roof U-Fac	Dark Color	Susp. Ceil
1	1	0.030	No	Yes

Master Walls

Wall No.	ASHRAE Group	Wall U-Fac	Wall Color
1	G	0.046	D
2	C	0.045	D
3	C	0.045	D
4	G	0.045	D
6	G	0.070	L
7	G	0.095	M

Master Partitions

Partition No.	Partition U-Factor	Cool T-D	Heat T-D
1	0.080	30	10
2	0.250	30	10

Master Glass

Glass No.	Summer U-Factor	Winter U-Factor	Glass Shd.Coef.	Interior Shading	Interior Shd.Coef
1	0.260	0.290	0.440	3	0.000
2	0.260	0.290	0.440	3	0.000

Master Shading Devices

Shade No.	Dist Horiz Overh Projects	Dist Beyond Right W.Edge	Dist Beyond Left W.Edge	Dist Overh Above Wind	Dist Right Fin Proj	Dist R-Fin Beyond W.Edge	Ht Of Right Fin	Dist Left Fin Proj	Dist L-Fin Beyond W.Edge	Ht Of Left Fin
1	10.00	60.00	60.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2	60.00	60.00	60.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
3	6.00	20.00	20.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
4	60.00	10.00	60.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
5	60.00	60.00	10.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
6	5.00	60.00	10.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00

General Project Data Input (cont'd)

Master Shading Devices

7	20.00	20.00	20.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
8	60.00	20.00	20.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	30.00	60.00	60.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Building Envelope Report

Envelope Report Using Summer U-Factors

Material Types		Gross Area	Glass Area	Net Area	-U-Factor	Area x U-Factor	Average U-Factor
Roof	1	5,987.8	0.0	5,987.8	0.030	179.633	0.030
Tot.Roof		5,987.8	0.0	5,987.8	N/A	179.633	0.030
Wall	3	6,036.5	35.0	6,001.5	0.045	270.068	0.045
Wall	6	24.0	0.0	24.0	0.070	1.680	0.070
Wall	7	228.0	0.0	228.0	0.095	21.660	0.095
Tot.Wall		6,288.5	35.0	6,253.5	N/A	293.408	0.047
Glass	1	35.0	N/A	35.0	0.260	9.100	0.260
Tot.Glass		35.0	N/A	35.0	N/A	9.100	0.260
Totals				12,276.3		482.140	0.039

Wall Direction	Wall Area	Glass Area	Wall Net Area	Wall Avg U-Factor	Glass Avg U-Factor	Glass Avg Shd.Coef
N	1,557.0	0.0	1,557.0	0.045	0.000	0.000
NE	0.0	0.0	0.0	0.000	0.000	0.000
E	1,107.0	35.0	1,072.0	0.045	0.260	0.440
SE	1,693.0	0.0	1,693.0	0.050	0.000	0.000
S	243.0	0.0	243.0	0.059	0.000	0.000
SW	0.0	0.0	0.0	0.000	0.000	0.000
W	1,688.5	0.0	1,688.5	0.045	0.000	0.000
NW	0.0	0.0	0.0	0.000	0.000	0.000
Totals	6,288.5	35.0	6,253.5	0.047	0.260	0.440

Building Summary Loads

Building peaks in August at 3pm.

Bldg Load Descriptions	Area Quan	Sen Loss	%Tot Loss	Lat Gain	Sen Gain	Net Gain	%Net Gain
Roof	5,988	17,191	2.07	0	1,324	1,324	2.89
Wall	6,254	28,079	3.38	0	1,688	1,688	3.68
Glass	35	971	0.12	0	621	621	1.36
Floor Slab	320	17,163	2.07	0	0	0	0.00
Skin Loads		63,404	7.63	0	3,633	3,633	7.93
Lighting	8,827	0	0.00	0	5,924	5,924	12.93
Equipment	6,104	0	0.00	0	12,761	12,761	27.84
People	6	0	0.00	600	750	1,350	2.95
Partition	1,208	1,624	0.20	0	2,779	2,779	6.06
Cool. Pret.	0	0	0.00	0	0	0	0.00
Heat. Pret.	6,910	171,608	20.66	0	0	0	0.00
Cool. Vent.	629	0	0.00	6,264	9,950	16,214	35.38
Heat. Vent.	7,539	577,344	69.52	0	0	0	0.00
Cool. Infil.	0	0	0.00	0	0	0	0.00
Heat. Infil.	0	0	0.00	0	0	0	0.00
Draw-Thru Fan	0	0	0.00	0	1,169	1,169	2.55
Blow-Thru Fan	0	0	0.00	0	0	0	0.00
Reserve Cap.	0	0	0.00	0	774	774	1.69
Reheat Cap.	0	0	0.00	0	0	0	0.00
Supply Duct	0	15,196	1.83	0	614	614	1.34
Return Duct	0	1,343	0.16	0	614	614	1.34
Misc. Supply	0	0	0.00	0	0	0	0.00
Misc. Return	0	0	0.00	0	0	0	0.00
Building Totals		830,519	100.00	6,864	38,968	45,833	100.00

Building Summary	Sen Loss	%Tot Loss	Lat Gain	Sen Gain	Net Gain	%Net Gain
Ventilation	577,344	69.52	6,264	9,950	16,214	35.38
Infiltration	0	0.00	0	0	0	0.00
Pretreated Air	171,608	20.66	0	0	0	0.00
Zone Loads	65,028	7.83	600	26,622	27,222	59.39
Plenum Loads	0	0.00	0	0	0	0.00
Fan & Duct Loads	16,539	1.99	0	2,397	2,397	5.23
Building Totals	830,519	100.00	6,864	38,968	45,833	100.00

Check Figures

Total Building Supply Air (based on a 19° TD):	1,462	CFM
Total Building Vent. Air (43.05% of Supply):	629	CFM
Total Conditioned Air Space:	6,176	Sq.ft
Supply Air Per Unit Area:	0.2367	CFM/Sq.ft
Area Per Cooling Capacity:	1,617.0700	Sq.ft/Ton
Cooling Capacity Per Area:	0.0006	Tons/Sq.ft
Heating Capacity Per Area:	134.47	Btuh/Sq.ft
Total Heating Required With Outside Air:	830,519	Btuh
Total Cooling Required With Outside Air:	3.82	Tons

Air Handler #1 - AHU-01 Main - Summary Loads

Zn No	Description Peak Time	Area People Volume	Htg.Loss Htg.CFM CFM/Sqft	Sen.Gain Clg.CFM CFM/Sqft	Lat.Gain S.Exh W.Exh	Htg.O.A. Req.CFM Act.CFM	Clg.O.A. Req.CFM Act.CFM
1	172 - Truck Docking	4,727	45,293	0	0	Direct	Direct
	-	3	6,910	0	6,910	570	0
		56,724	1.46	0.00	6,910	6,910	0
	Zone Peak Totals:	4,727	45,293	0	0		
	Total Zones: 1	3	6,910	0	6,910	570	0
	Unique Zones: 1	56,724	1.46	0.00	6,910	6,910	0

Air Handler #1 - AHU-01 Main - Total Load Summary

Air Handler Description:	AHU-01 Main Constant Volume - Sum of Peaks
Supply Air Fan:	Draw-Thru with program estimated horsepower of 0.00 HP
Fan Input:	0% motor and fan efficiency with 0 in. water across the fan
Outdoor Conditions:	-24° DB (System is Heating Only)

Winter: Exhaust controls outside air.

Zone Space sensible loss:	45,293	Btuh			
Infiltration sensible loss:	0	Btuh	0	CFM	
Outside Air sensible loss:	514,823	Btuh	6,910	CFM	
Supply Duct sensible loss:	14,301	Btuh			
Return Duct sensible loss:	0	Btuh			
Return Plenum sensible loss:	0	Btuh			
Total System sensible loss:					574,416 Btuh
Heating Supply Air: 59,593 / (.958 X 1.08 X 8) =			6,910	CFM	
Winter Vent Outside Air (100.0% of supply) =			6,910	CFM	
Zone space sensible gain:	0	Btuh			
Infiltration sensible gain:	0	Btuh			
Draw-thru fan sensible gain:	0	Btuh			
Supply duct sensible gain:	0	Btuh			
Reserve sensible gain:	0	Btuh			
Total sensible gain on supply side of coil:					0 Btuh
Cooling Supply Air: 0 / (.958 X 1.1 X 0) =			0	CFM	
Summer Vent Outside Air (0.0% of supply) =			0	CFM	
Return duct sensible gain:	0	Btuh			
Return plenum sensible gain:	0	Btuh			
Outside air sensible gain:	0	Btuh	0	CFM	
Blow-thru fan sensible gain:	0	Btuh			
Total sensible gain on return side of coil:					0 Btuh
Total sensible gain on air handling system:					0 Btuh
Zone space latent gain:	0	Btuh			
Infiltration latent gain:	0	Btuh			
Outside air latent gain:	0	Btuh			
Total latent gain on air handling system:					0 Btuh
Total system sensible and latent gain:					0 Btuh

Check Figures

Total Air Handler Supply Air (based on a 8° TD):	6,910	CFM
Total Air Handler Vent. Air (100.00% of Supply):	6,910	CFM
Total Conditioned Air Space:	4,727	Sq.ft
Supply Air Per Unit Area:	1.4618	CFM/Sq.ft
Area Per Cooling Capacity:	0.0000	Sq.ft/Ton
Cooling Capacity Per Area:	0.0000	Tons/Sq.ft
Heating Capacity Per Area:	121.52	Btuh/Sq.ft
Total Heating Required With Outside Air:	574,416	Btuh
Total Cooling Required With Outside Air:	0.00	Tons

Air Handler #2 - Ahu-05 - Summary Loads

Zn No	Description Peak Time	Area People Volume	Htg.Loss Htg.CFM CFM/Sqft	Sen.Gain Clg.CFM CFM/Sqft	Lat.Gain S.Exh W.Exh	Htg.O.A. Req.CFM Act.CFM	Clg.O.A. Req.CFM Act.CFM
8	170 - Elec	62	270	10,780	0	4/Hr	4/Hr
	6pm December	0	11	572	0	37	37
		554	0.18	9.30	0	11	263
9	168 - Stor	329	3,118	2,762	0	0.12/ft²	0.12/ft²
	3pm June	0	131	147	0	39	39
		3,948	0.40	0.45	0	122	67
10	171 - Mech	410	6,946	3,050	0	4/Hr	4/Hr
	4pm June	0	292	162	0	328	328
		4,920	0.71	0.39	0	272	74
	Zone Peak Totals:	801	10,334	16,592	0		
	Total Zones: 3	0	434	880	0	404	404
	Unique Zones: 3	9,422	0.54	1.10	0	404	405

Air Handler #2 - Ahu-05 - Total Load Summary

Air Handler Description: Ahu-05 Constant Volume - Sum of Peaks
Supply Air Fan: Draw-Thru with program estimated horsepower of 0.43 HP
Fan Input: 65% motor and fan efficiency with 2 in. water across the fan
Sensible Heat Ratio: 1.00 --- This system occurs 1 time(s) in the building. ---

Air System Peak Time: 3pm in August.
Outdoor Conditions: 91° DB, 70° WB, 83.10 grains

Because of the diversity in zone, plenum and ventilation loads, the zone sensible peak time in June at 3pm is different from the total system peak time, hence the air system CFM was computed using a zone sensible load of 16,578.

Summer: Ventilation controls outside air, ----- Winter: Ventilation controls outside air.

Zone Space sensible loss:	10,334 Btuh			
Infiltration sensible loss:	0 Btuh	0 CFM		
Outside Air sensible loss:	40,171 Btuh	404 CFM		
Supply Duct sensible loss:	0 Btuh			
Return Duct sensible loss:	0 Btuh			
Return Plenum sensible loss:	0 Btuh			
Total System sensible loss:			50,505	Btuh
Heating Supply Air: 10,334 / (.958 X 1.08 X 23) =		434 CFM		
Winter Vent Outside Air (93.1% of supply) =		404 CFM		
Zone space sensible gain:	16,422 Btuh			
Infiltration sensible gain:	0 Btuh			
Draw-thru fan sensible gain:	1,035 Btuh			
Supply duct sensible gain:	0 Btuh			
Reserve sensible gain:	0 Btuh			
Total sensible gain on supply side of coil:			17,457	Btuh
Cooling Supply Air: 17,614 / (.958 X 1.1 X 19) =		880 CFM		
Summer Vent Outside Air (46.0% of supply) =		404 CFM		
Return duct sensible gain:	0 Btuh			
Return plenum sensible gain:	0 Btuh			
Outside air sensible gain:	6,393 Btuh	404 CFM		
Blow-thru fan sensible gain:	0 Btuh			
Total sensible gain on return side of coil:			6,393	Btuh
Total sensible gain on air handling system:			23,850	Btuh
Zone space latent gain:	0 Btuh			
Infiltration latent gain:	0 Btuh			
Outside air latent gain:	4,025 Btuh			
Total latent gain on air handling system:			4,025	Btuh
Total system sensible and latent gain:			27,875	Btuh

Check Figures

Total Air Handler Supply Air (based on a 19° TD):	880	CFM
Total Air Handler Vent. Air (45.98% of Supply):	404	CFM
Total Conditioned Air Space:	801	Sq.ft
Supply Air Per Unit Area:	1.0988	CFM/Sq.ft
Area Per Cooling Capacity:	344.6093	Sq.ft/Ton
Cooling Capacity Per Area:	0.0029	Tons/Sq.ft
Heating Capacity Per Area:	63.09	Btuh/Sq.ft
Total Heating Required With Outside Air:	50,505	Btuh
Total Cooling Required With Outside Air:	2.32	Tons

Air Handler #4 - AHU-02 Garage - Summary Loads

Zn No	Description Peak Time	Area People Volume	Htg.Loss Htg.CFM CFM/Sqft	Sen.Gain Clg.CFM CFM/Sqft	Lat.Gain S.Exh W.Exh	Htg.O.A. Req.CFM Act.CFM	Clg.O.A. Req.CFM Act.CFM
2	160 - Vest	190	4,347	4,451	0	0.12/ft²	0.12/ft²
	9am June	0	200	225	0	23	23
		3,135	1.05	1.18	0	104	87
3	162 - Office	138	647	2,311	200	Direct	Direct
	3pm June	1	30	117	0	15	15
		1,238	0.22	0.85	0	15	45
4	164 - Lan	60	1,989	2,074	0	0.12/ft²	0.12/ft²
	6pm August	0	92	105	0	7	7
		540	1.53	1.75	0	48	40
5	165 - Drive	81	233	1,460	400	Direct	Direct
	3pm June	2	11	74	0	15	15
		975	0.13	0.91	0	6	28
6	166 - Toilet	70	201	430	0	0.12/ft²	0.12/ft²
	3pm June	0	9	22	75	8	8
		630	0.13	0.31	75	5	8
7	167 - Toilet	70	1,053	563	0	0.12/ft²	0.12/ft²
	3pm June	0	48	28	75	8	8
		630	0.69	0.41	75	25	11
11	163 - Jan	40	931	257	0	0.12/ft²	0.12/ft²
	5pm August	0	43	13	75	5	5
		360	1.07	0.32	75	22	5
	Zone Peak Totals:	649	9,401	11,546	600		
	Total Zones: 7	3	433	583	225	82	82
	Unique Zones: 7	7,508	0.67	0.90	225	225	225

Air Handler #4 - AHU-02 Garage - Total Load Summary

Air Handler Description:	AHU-02 Garage Constant Volume - Sum of Peaks
Supply Air Fan:	Draw-Thru with program estimated horsepower of 0.05 HP
Fan Input:	0% motor and fan efficiency with 0 in. water across the fan
Sensible Heat Ratio:	0.95 --- This system occurs 1 time(s) in the building. ---
Air System Peak Time:	3pm in August.
Outdoor Conditions:	91° DB, 70° WB, 83.10 grains

Because of the diversity in zone, plenum and ventilation loads, the zone sensible peak time in June at 9am is different from the total system peak time, hence the air system CFM was computed using a zone sensible load of 10,757.

Summer: Exhaust controls outside air, ----- Winter: Exhaust controls outside air.

Zone Space sensible loss:	9,401	Btuh		
Infiltration sensible loss:	0	Btuh	0	CFM
Outside Air sensible loss:	22,351	Btuh	225	CFM
Supply Duct sensible loss:	895	Btuh		
Return Duct sensible loss:	1,343	Btuh		
Return Plenum sensible loss:	0	Btuh		
Total System sensible loss:				33,990 Btuh
Heating Supply Air: 10,296 / (.958 X 1.08 X 23) =			433	CFM
Winter Vent Outside Air (52.0% of supply) =			225	CFM
Zone space sensible gain:	9,426	Btuh		
Infiltration sensible gain:	0	Btuh		
Draw-thru fan sensible gain:	134	Btuh		
Supply duct sensible gain:	614	Btuh		
Reserve sensible gain:	774	Btuh		
Total sensible gain on supply side of coil:				10,947 Btuh
Cooling Supply Air: 12,279 / (.958 X 1.1 X 20) =			582	CFM
Summer Vent Outside Air (38.6% of supply) =			225	CFM
Return duct sensible gain:	614	Btuh		
Return plenum sensible gain:	0	Btuh		
Outside air sensible gain:	3,557	Btuh	225	CFM
Blow-thru fan sensible gain:	0	Btuh		
Total sensible gain on return side of coil:				4,171 Btuh
Total sensible gain on air handling system:				15,118 Btuh
Zone space latent gain:	600	Btuh		
Infiltration latent gain:	0	Btuh		
Outside air latent gain:	2,239	Btuh		
Total latent gain on air handling system:				2,839 Btuh
Total system sensible and latent gain:				17,958 Btuh

Check Figures

Total Air Handler Supply Air (based on a 20° TD):	582	CFM
Total Air Handler Vent. Air (38.63% of Supply):	225	CFM
Total Conditioned Air Space:	649	Sq.ft
Supply Air Per Unit Area:	0.8979	CFM/Sq.ft
Area Per Cooling Capacity:	433.5151	Sq.ft/Ton
Cooling Capacity Per Area:	0.0023	Tons/Sq.ft
Heating Capacity Per Area:	52.39	Btuh/Sq.ft
Total Heating Required With Outside Air:	33,990	Btuh
Total Cooling Required With Outside Air:	1.50	Tons

Air System #1 (AHU-01 Main) Psychrometric Analysis

System Load Analysis	Latent	Grains	Sensible	Temp	CFM
Leaving Coil Condition		0.000		0.000	
Draw-Thru Fan			0	0.000	0
Misc Load on Supply Side			0	0.000	0
Supply Air Duct			0	1.000	0
Zone Loads	0	0.000	0	0.000	0
Sensible Reserve			0	0.000	0
Zone Condition	0	0.000	0	72.000	0
Return Air Duct			0	1.000	
Return Air Plenum			0	0.000	
Misc Load on Return Side			0	0.000	
Vent Air 0 CFM	0	0.000	0	0.000	
Blow-Thru Fan			0	0.000	
Entering Coil Condition	0	0.000	0	0.000	0

General Psychrometric Equations Used In Analysis:

PR = (Barometric pressure of site / Standard ASHRAE pressure of 29.921)
TSH = PR x 1.10 x CFM x (DB entering - DB leaving)
TLH = PR x 0.68 x CFM x (Grains entering - Grains leaving)
GTH = PR x 4.50 x CFM x (Enthalpy entering - Enthalpy leaving)

TSH	=	0.958	x	1.10	x	0	x (	0.000	-	0.000	) =	0	Btuh
TLH	=	0.958	x	0.68	x	0	x (	0.000	-	0.000	) =	0	Btuh

SUM	=											0	Btuh
GTH	=	0.958	x	4.50	x	0	x (	0.000	-	0.000	) =	0	Btuh
Total System Load											=	0	Btuh

Chilled and Hot Water Flow Rates and Steam Requirement

Cooling GPM	=	0	/ (	0.00	x	500	)	=	0.0 GPM
Heating GPM	=	574,416	/ (	30.00	x	500	)	=	38.3 GPM
Steam Req.	=	574,416	/	970				=	592.2 lb./hr

Entering Cooling Coil Conditions

Dry bulb temperature:	.00	
Wet bulb temperature:	.00	
Relative humidity:	.00	
Enthalpy:	.00	Btu/lbm

Entering Heating Coil Conditions

Dry bulb temperature:	.00

Leaving Cooling Coil Conditions

Dry bulb temperature:	.00	
Wet bulb temperature:	.00	
Relative humidity:	.00	
Enthalpy:	.00	Btu/lbm

Leaving Heating Coil Conditions

Dry bulb temperature:	80.33

Air System #2 (Ahu-05) Psychrometric Analysis

System Load Analysis	Latent	Grains	Sensible	Temp	CFM
Leaving Coil Condition		67.508		56.000	
Draw-Thru Fan			1,035	1.117	52
Misc Load on Supply Side			0	0.000	0
Supply Air Duct			0	0.000	0
Zone Loads	0	0.000	16,578	17.884	828
Sensible Reserve			0	0.000	0
Zone Condition	0	67.508	17,614	75.000	880
Return Air Duct			0	0.000	
Return Air Plenum			0	0.000	
Misc Load on Return Side			0	0.000	
Vent Air 404 CFM	4,025	7.024	6,393	6.896	
Blow-Thru Fan			0	0.000	
Entering Coil Condition	4,025	74.532	24,007	81.896	880

General Psychrometric Equations Used In Analysis:

PR = (Barometric pressure of site / Standard ASHRAE pressure of 29.921)
TSH = PR x 1.10 x CFM x (DB entering - DB leaving)
TLH = PR x 0.68 x CFM x (Grains entering - Grains leaving)
GTH = PR x 4.50 x CFM x (Enthalpy entering - Enthalpy leaving)

TSH	=	0.958	x	1.10	x	880	x (	81.896	-	56.000	) =	24,006	Btuh
TLH	=	0.958	x	0.68	x	880	x (	74.532	-	67.508	) =	4,025	Btuh
SUM	=											28,031	Btuh
GTH	=	0.958	x	4.50	x	880	x (	31.341	-	23.914	) =	28,166	Btuh
Total System Load											=	27,875	Btuh

Chilled and Hot Water Flow Rates and Steam Requirement

Cooling GPM	=	28,166	/ (	0.00	x	500	)	=	0.0 GPM
Heating GPM	=	50,505	/ (	0.00	x	500	)	=	0.0 GPM
Steam Req.	=	50,505	/	970				=	52.1 lb./hr

Entering Cooling Coil Conditions

Dry bulb temperature:	81.90	
Wet bulb temperature:	66.03	
Relative humidity:	43.92	
Enthalpy:	31.34	Btu/lbm

Entering Heating Coil Conditions

Dry bulb temperature:	-17.40

Leaving Cooling Coil Conditions

Dry bulb temperature:	56.00	
Wet bulb temperature:	55.46	
Relative humidity:	96.86	
Enthalpy:	23.91	Btu/lbm

Leaving Heating Coil Conditions

Dry bulb temperature:	95.00

Air System #4 (AHU-02 Garage) Psychrometric Analysis

System Load Analysis	Latent	Grains	Sensible	Temp	CFM
Leaving Coil Condition		65.926		55.000	
Draw-Thru Fan			134	0.218	6
Misc Load on Supply Side			0	0.000	0
Supply Air Duct			614	1.000	29
Zone Loads	600	1.581	10,757	17.522	510
Sensible Reserve			774	1.261	37
Zone Condition	600	67.507	12,279	75.000	582
Return Air Duct			614	1.000	
Return Air Plenum			0	0.000	
Misc Load on Return Side			0	0.000	
Vent Air 225 CFM	2,239	5.901	3,557	5.408	
Blow-Thru Fan			0	0.000	
Entering Coil Condition	2,839	73.409	16,450	81.408	582

General Psychrometric Equations Used In Analysis:

PR = (Barometric pressure of site / Standard ASHRAE pressure of 29.921)
TSH = PR x 1.10 x CFM x (DB entering - DB leaving)
TLH = PR x 0.68 x CFM x (Grains entering - Grains leaving)
GTH = PR x 4.50 x CFM x (Enthalpy entering - Enthalpy leaving)

TSH	=	0.958	x	1.10	x	582	x (	81.408	-	55.000	) =	16,212	Btuh
TLH	=	0.958	x	0.68	x	582	x (	73.409	-	65.926	) =	2,840	Btuh
SUM	=											19,052	Btuh
GTH	=	0.958	x	4.50	x	582	x (	31.046	-	23.424	) =	19,141	Btuh
Total System Load											=	17,958	Btuh

Chilled and Hot Water Flow Rates and Steam Requirement

Cooling GPM	=	19,141	/ (	0.00	x	500	)	=	0.0 GPM
Heating GPM	=	33,990	/ (	30.00	x	500	)	=	2.3 GPM
Steam Req.	=	33,990	/	970				=	35.0 lb./hr

Entering Cooling Coil Conditions

Dry bulb temperature:	81.41	
Wet bulb temperature:	65.65	
Relative humidity:	43.96	
Enthalpy:	31.05	Btu/lbm

Entering Heating Coil Conditions

Dry bulb temperature:	20.63

Leaving Cooling Coil Conditions

Dry bulb temperature:	55.00	
Wet bulb temperature:	54.69	
Relative humidity:	98.12	
Enthalpy:	23.42	Btu/lbm

Leaving Heating Coil Conditions

Dry bulb temperature:	95.00

Heat Pump Number	Interior / Exterior		People	Zone sq ft	People Density (people/1000 sf)	Vent CFM/ person	Vent CFM / sq ft	OA Vent CFM	OA Vent*1.3+Exhaust Makeup + press	Exhaust Air CFM	Pressurization CFM	Cooling CFM (Max)	Cool CFM sq ft	Net Sensible Cooling (Tons)	Net Latent Cooling (Tons)	Net Total Cooling (Tons)	Heat Pump Supply (Min CFm)	Heatin/Cooling Supply Min (CFM)	Cooling CFM / sq ft	Heating LAT	OA Heating Cap. (Btuh)	Infiltration Heat Loss (Btuh)	Heating Capacity (MBH)
1	Ext	Heat Pump 101 Public Waiting Half 2	3	355	8.5	7.5	0.06	60	250	0	250	1280	3.6	1.9	0.1	2.1	450	450	1.3	95	22356	0	22.4
2	Ext	Heat Pump 101 Public Waiting Half 1	3	340	8.8	7.5	0.06	60	250	0	250	1240	3.6	2.2	0.0	2.2	450	450	1.3	95	22356	0	22.4
3	Int	Heat Pump 102 Work Area Interior	8	810	9.9	5	0.06	90	145	0	145	580	0.7	0.9	0.1	1.1	280	280	0.3	75	7862	0	7.9
4	Ext	Heat Pump 102 Work Area Exterior Half 1	2	400	5.0	5	0.06	35	55	0	55	700	1.8	1.2	0.0	1.3	280	280	0.7	95	13910	0	13.9
5	Ext	Heat Pump 102 Work Area Exterior Half 2	2	345	5.8	5	0.06	35	50	0	50	680	2.0	1.2	0.0	1.2	280	280	0.8	95	13910	0	13.9
6	Ext	Heat Pump 103 Supply Office	3	175	17.1	5	0.06	30	40	0	40	360	2.1	0.6	0.0	0.6	300	300	1.7	95	14904	0	14.9
7	Ext	Heat Pump 104 Dir Office	5	230	21.7	5	0.06	40	55	0	55	520	2.3	0.9	0.1	0.9	280	280	1.2	95	13910	0	13.9
8	Ext	Heat Pump 105 Conference	12	415	28.9	5	0.06	85	115	0	115	860	2.1	1.4	0.2	1.6	300	300	0.7	95	14904	0	14.9
9	Ext	Heat Pump 106 Break	11	330	33.3	7.5	0.18	145	190	200	-10	1340	4.1	2.2	0.2	2.4	450	450	1.4	95	22356	0	22.4
10	Ext	Heat Pump 107 Lan/109 Tele	0	155	0.0	0	0.12	20	30	0	30	205	1.3	0.3	0.0	0.3	150	150	1.0	75	4212	0	4.2
11	Ext	Heat Pump 108,122,134 Mail, Corr, Trash	1	558	1.8	7.5	0.12	75	100	435	-335	440	0.8	0.6	0.0	0.6	280	280	0.5	95	13910	0	13.9
12	Int	Heat Pump 110 Gen. Storage	0	481	0.0	0	0.12	60	80	0	80	210	0.4	0.3	0.0	0.2	150	150	0.3	75	4212	0	4.2
13	Ext	Heat Pump 115-118,120,137	5	756	6.6	5	0.06	75	350	250	100	555	0.7	0.8	0.0	0.8	280	350	0.5	95	17388	0	17.4
14	Int	Heat Pump 115 Display Alcove	2	235	8.5	7.5	0.06	30	40	150	-110	160	0.7	0.2	0.0	0.3	150	150	0.6	75	4212	0	4.2
15	Ext	Heat Pump 125,126,127 Hold, Sec Corr	3	475	6.3	7.5	0.12	80	105	275	-170	265	0.6	0.1	0.0	0.1	150	150	0.3	95	7452	0	7.5
16	Int	Heat Pump 129,130 Int, Search	4	282	14.2	7.5	0.06	50	65	220	-155	160	0.6	0.1	0.0	0.2	150	150	0.5	75	4212	0	4.2
17	Ext	Heat Pump 102 Work Area Adjac. To Booth	0	0	0.0	5	0.06	0	0	0	0	145	0.0	0.2	0.1	0.3	150	150	0.0	95	7452	11438	18.9
18	Ext	Heat Pump 136/139 Women's/Men's	0	720	0.0	0	0.12	90	120	550	-430	230	0.3	0.3	0.0	0.3	150	150	0.2	95	7452	0	7.5
19	Ext	Heat Pump 140,141,121 GSA, FireCom, Corr	2	470	4.3	5	0.06	40	55	0	55	255	0.5	0.4	0.0	0.4	150	150	0.3	95	7452	0	7.5
20	Ext	Heat Pump 142 Physical Train	6	268	22.4	20	0.12	155	205	220	-15	640	2.4	0.7	0.5	1.2	280	280	1.0	95	13910	0	13.9
			72	7799			2	1255	2300.00	2300	0	10825	1.4	17	2	18	5110	5180	0.7				249.7722

Interior Zones

Max 1500 sq ft

max 3 offices per zone

OA CFM (Vent + Exh make-up) **2300**

Total OA /sq ft 0.32

Total OA CFM *10% **2505**

Column M is the same as L except rows 3,4,5 & 13 which have additional exhaust make-up added to the zones.
The total OA cfm formula at line J32 has 25 cfm subtracted because zone 13 (rrom 116) had 250 cfm exhaust added at the very end of CD's. I added 250 oa to the AHU schedules but didn't adjust this spread sheet
J32 multiplies by 10% so J32 if off by 25 cfm (250*0.1) which is why 25 cfm is subtracted from the formula

General Project Data Input

General Project Information

Project file name:	Z:\Projects\MPLS\Project 2\569700.00 Warroad Border Station\Mech\loads\CHVAC Files and Outputs\Warroad_Secondary bldg firing range.CHV
Project title:	United States Port Of Entry
Project city, state, ZIP:	Warroad, MN
Project date:	Monday, February 11, 2008
Weather reference city:	WARROAD, MINNESOTA, USA
Client name:	

Barometric pressure:	28.668	in.Hg.
Altitude:	1179	feet
Latitude:	49	Degrees
Mean daily temperature range:	26	Degrees
Starting & ending time for HVAC load calculations:	1am - 12am	
Number of unique zones in this project:	17	

Building Default Values

Calculations performed:	Both heating and cooling loads	
Lighting requirements:	1.50	Watts per square foot
Equipment requirements:	0.50	Watts per square foot
People sensible load multiplier:	250	Btuh per person
People latent load multiplier:	200	Btuh per person
Zone sensible safety factor:	0	%
Zone latent safety factor:	0	%
Zone heating safety factor:	0	%
People diversity factor:	100	%
Lighting profile number:	2	
Equipment profile number:	1	
People profile number:	1	
Building default ceiling height:	9.00	feet
Building default wall height:	22.00	feet

Internal Operating Load Profiles (C = 100)

	hr 1	hr 2	hr 3	hr 4	hr 5	hr 6	hr 7	hr 8	hr 9	hr 10	hr 11	hr 12	hr 13	hr 14	hr 15	hr 16	hr 17	hr 18	hr 19	hr 20	hr 21	hr 22	hr 23	hr 24
1	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C
2	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C
3	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C
4	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C
5	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C
6	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C
7	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C
8	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C
9	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C
10	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C

General Project Data Input (cont'd)

Building-Level Design Conditions

Design Month	Outdoor Dry Bulb	Outdoor Wet Bulb	Indoor Rel.Hum	Indoor Dry Bulb	Grains Diff	In/Outdoor Correction
January	34	29	30%	72	-18.39	-58
February	39	34	30%	72	-15.00	-53
March	47	39	30%	72	-10.50	-46
April	73	55	30%	72	3.42	-19
May	83	64	50%	75	-4.93	-12
June	89	69	50%	75	11.57	-6
July	85	69	50%	75	20.49	-10
August	91	70	50%	75	15.58	-5
September	78	62	50%	75	-5.87	-17
October	68	55	50%	75	-20.70	-28
November	49	43	30%	72	-2.88	-43
December	37	32	30%	72	-16.42	-55
Winter	-24			72		

Master Roofs

Roof No.	ASHRAE Roof#	Roof U-Fac	Dark Color	Susp. Ceil
1	1	0.030	No	Yes

Master Walls

Wall No.	ASHRAE Group	Wall U-Fac	Wall Color
1	G	0.046	D
2	C	0.045	D
3	C	0.045	D
4	G	0.045	D
6	G	0.070	L
7	G	0.095	M

Master Partitions

Partition No.	Partition U-Factor	Cool T-D	Heat T-D
1	0.080	30	10
2	0.250	30	10
3	0.500	30	25

Master Glass

Glass No.	Summer U-Factor	Winter U-Factor	Glass Shd.Coef.	Interior Shading	Interior Shd.Coef
1	0.260	0.290	0.440	3	0.000

Building Envelope Report

Envelope Report Using Summer U-Factors

Material Types		Gross Area	Glass Area	Net Area	-U-Factor	Area x U-Factor	Average U-Factor
Roof	1	7,542.1	0.0	7,542.1	0.030	226.264	0.030
Tot.Roof		7,542.1	0.0	7,542.1	N/A	226.264	0.030
Wall	2	633.0	0.0	633.0	0.045	28.485	0.045
Wall	3	2,970.5	105.0	2,865.5	0.045	128.948	0.045
Wall	4	1,718.4	0.0	1,718.4	0.045	77.327	0.045
Wall	6	84.0	0.0	84.0	0.070	5.880	0.070
Wall	7	1,038.0	0.0	1,038.0	0.095	98.610	0.095
Tot.Wall		6,443.9	105.0	6,338.9	N/A	339.249	0.054
Glass	1	105.0	N/A	105.0	0.260	27.300	0.260
Tot.Glass		105.0	N/A	105.0	N/A	27.300	0.260
Totals				13,986.0		592.813	0.042

Wall Direction	Wall Area	Glass Area	Wall Net Area	Wall Avg U-Factor	Glass Avg U-Factor	Glass Avg Shd.Coef
N	1,318.0	0.0	1,318.0	0.046	0.000	0.000
NE	0.0	0.0	0.0	0.000	0.000	0.000
E	2,204.0	45.0	2,159.0	0.060	0.260	0.440
SE	0.0	0.0	0.0	0.000	0.000	0.000
S	645.8	0.0	645.8	0.046	0.000	0.000
SW	0.0	0.0	0.0	0.000	0.000	0.000
W	2,276.1	60.0	2,216.1	0.054	0.260	0.440
NW	0.0	0.0	0.0	0.000	0.000	0.000
Totals	6,443.9	105.0	6,338.9	0.054	0.260	0.440

Building Summary Loads

Building peaks in August at 3pm.

Bldg Load Descriptions	Area Quan	Sen Loss	%Tot Loss	Lat Gain	Sen Gain	Net Gain	%Net Gain
Roof	7,542	19,971	1.31	0	2,738	2,738	0.50
Wall	6,339	29,563	1.95	0	3,468	3,468	0.63
Glass	105	2,914	0.19	0	4,048	4,048	0.73
Floor Slab	435	21,798	1.43	0	0	0	0.00
Skin Loads		74,246	4.89	0	10,254	10,254	1.86
Lighting	12,391	0	0.00	0	18,833	18,833	3.41
Equipment	6,745	0	0.00	0	7,734	7,734	1.40
People	20	0	0.00	600	3,952	4,552	0.83
Partition	1,397	17,466	1.15	0	20,959	20,959	3.80
Cool. Pret.	360	0	0.00	18,074	34,148	52,221	9.47
Heat. Pret.	360	8,940	0.59	0	0	0	0.00
Cool. Vent.	10,760	0	0.00	103,514	135,958	239,473	43.41
Heat. Vent.	14,570	1,391,114	91.53	0	0	0	0.00
Cool. Infil.	0	0	0.00	0	0	0	0.00
Heat. Infil.	0	0	0.00	0	0	0	0.00
Draw-Thru Fan	0	0	0.00	0	9,735	9,735	1.76
Blow-Thru Fan	0	0	0.00	0	0	0	0.00
Reserve Cap.	0	0	0.00	0	171,805	171,805	31.15
Reheat Cap.	0	0	0.00	0	0	0	0.00
Supply Duct	0	24,158	1.59	0	13,503	13,503	2.45
Return Duct	0	3,952	0.26	0	2,543	2,543	0.46
Misc. Supply	0	0	0.00	0	0	0	0.00
Misc. Return	0	0	0.00	0	0	0	0.00
Building Totals		1,519,877	100.00	122,188	429,424	551,612	100.00

Building Summary	Sen Loss	%Tot Loss	Lat Gain	Sen Gain	Net Gain	%Net Gain
Ventilation	1,391,114	91.53	103,514	135,958	239,473	43.41
Infiltration	0	0.00	0	0	0	0.00
Pretreated Air	8,940	0.59	18,074	34,148	52,221	9.47
Zone Loads	91,712	6.03	600	233,537	234,137	42.45
Plenum Loads	0	0.00	0	0	0	0.00
Fan & Duct Loads	28,111	1.85	0	25,781	25,781	4.67
Building Totals	1,519,877	100.00	122,188	429,424	551,612	100.00

Check Figures

Total Building Supply Air (based on a 19° TD):	12,812	CFM
Total Building Vent. Air (83.98% of Supply):	10,760	CFM
Total Conditioned Air Space:	7,712	Sq.ft
Supply Air Per Unit Area:	1.6614	CFM/Sq.ft
Area Per Cooling Capacity:	167.7660	Sq.ft/Ton
Cooling Capacity Per Area:	0.0060	Tons/Sq.ft
Heating Capacity Per Area:	197.08	Btuh/Sq.ft
Total Heating Required With Outside Air:	1,519,877	Btuh
Total Cooling Required With Outside Air:	45.97	Tons

Air Handler #1 - AHU-08 Support Bldg - Summary Loads

Zn No	Description Peak Time	Area People Volume	Htg.Loss Htg.CFM CFM/Sqft	Sen.Gain Clg.CFM CFM/Sqft	Lat.Gain S.Exh W.Exh	Htg.O.A. Req.CFM Act.CFM	Clg.O.A. Req.CFM Act.CFM
3	182 - Vest	140	4,383	7,561	0	0.06/ft²	0.06/ft²
	9am June	0	202	382	0	8	8
		1,925	1.44	2.73	0	57	57
4	185 - Weapons Stor	77	1,257	1,863	0	0.12/ft²	0.12/ft²
	4pm June	0	58	94	0	9	9
		1,052	0.76	1.23	0	16	14
5	183 - Locker	185	2,631	5,117	800	0.12/ft²	0.12/ft²
	3pm June	4	121	258	95	22	22
		2,220	0.65	1.40	95	34	39
8	180 - Toilet	54	1,490	550	0	0.12/ft²	0.12/ft²
	5pm June	0	69	28	75	6	6
		486	1.27	0.51	75	19	4
9	178 - Work Area	81	2,257	3,637	200	0.12/ft²	0.12/ft²
	3pm June	1	104	184	0	10	10
		727	1.29	2.28	0	29	27
11	176 - Aqi	181	6,675	14,547	361	Direct	Direct
	5pm June	2	307	735	0	30	30
		1,807	1.70	4.07	0	87	110
13	179 - Storage	57	811	1,224	0	0.12/ft²	0.12/ft²
	3pm June	0	37	62	0	7	7
		513	0.65	1.08	0	11	9
14	184 - Cleaning	100	3,388	5,016	400	0.12/ft²	0.12/ft²
	3pm June	2	156	253	95	12	12
		1,200	1.56	2.53	95	44	38
15	186 - Vest	80	1,280	2,462	200	0.12/ft²	0.12/ft²
	3pm June	1	59	124	95	10	10
		720	0.74	1.55	95	17	19
16	187 - Control Office	120	1,696	2,425	200	0.12/ft²	0.12/ft²
	5pm June	1	78	122	0	14	14
		1,080	0.65	1.02	0	22	18
17	174 - Waiting	98	1,799	3,382	400	0.12/ft²	0.12/ft²
	3pm June	2	83	171	0	12	12
		878	0.85	1.75	0	23	25
	Zone Peak Totals:	1,171	27,667	47,782	2,561		
	Total Zones: 11	13	1,273	2,414	360	140	140
	Unique Zones: 11	12,607	1.09	2.06	360	360	360

Air Handler #1 - AHU-08 Support Bldg - Total Load Summary

Air Handler Description:	AHU-08 Support Bldg Constant Volume - Sum of Peaks
Supply Air Fan:	Draw-Thru with program estimated horsepower of 0.23 HP
Fan Input:	0% motor and fan efficiency with 0 in. water across the fan
Sensible Heat Ratio:	0.95 --- This system occurs 1 time(s) in the building. ---
Air System Peak Time:	5pm in June.
Outdoor Conditions:	87° DB, 69° WB, 83.28 grains

Summer: Exhaust controls outside air, ----- Winter: Exhaust controls outside air.

Zone Space sensible loss:	27,667	Btuh		
Infiltration sensible loss:	0	Btuh	0	CFM
Outside Air sensible loss:	26,821	Btuh	360	CFM
Supply Duct sensible loss:	2,635	Btuh		
Return Duct sensible loss:	3,952	Btuh		
Return Plenum sensible loss:	0	Btuh		
Total System sensible loss:				61,076 Btuh
Heating Supply Air: 30,302 / (.958 X 1.08 X 23) =			1,273	CFM
Winter Vent Outside Air (28.3% of supply) =			360	CFM
Zone space sensible gain:	44,426	Btuh		
Infiltration sensible gain:	0	Btuh		
Draw-thru fan sensible gain:	554	Btuh		
Supply duct sensible gain:	2,543	Btuh		
Reserve sensible gain:	3,337	Btuh		
Total sensible gain on supply side of coil:				50,860 Btuh
Cooling Supply Air: 50,860 / (.958 X 1.1 X 20) =			2,413	CFM
Summer Vent Outside Air (14.9% of supply) =			360	CFM
Return duct sensible gain:	2,543	Btuh		
Return plenum sensible gain:	0	Btuh		
Outside air sensible gain:	-28,456	Btuh	360	CFM
Blow-thru fan sensible gain:	0	Btuh		
Total sensible gain on return side of coil:				-25,913 Btuh
Total sensible gain on air handling system:				24,947 Btuh
Zone space latent gain:	2,561	Btuh		
Infiltration latent gain:	0	Btuh		
Outside air latent gain:	-14,490	Btuh		
Total latent gain on air handling system:				-11,929 Btuh
Total system sensible and latent gain:				13,018 Btuh

Check Figures

Total Air Handler Supply Air (based on a 20° TD):	2,413	CFM
Total Air Handler Vent. Air (14.92% of Supply):	360	CFM
Total Conditioned Air Space:	1,171	Sq.ft
Supply Air Per Unit Area:	2.0597	CFM/Sq.ft
Area Per Cooling Capacity:	563.4835	Sq.ft/Ton
Cooling Capacity Per Area:	0.0018	Tons/Sq.ft
Heating Capacity Per Area:	52.14	Btuh/Sq.ft
Total Heating Required With Outside Air:	61,076	Btuh
Total Cooling Required With Outside Air:	2.08	Tons

Note: Due to the system's negative latent gain, tonnage is based solely on sensible gain.

Air Handler #2 - Garage, Storage, & Mech - Summary Loads

Zn No	Description Peak Time	Area People Volume	Htg.Loss Htg.CFM CFM/Sqft	Sen.Gain Clg.CFM CFM/Sqft	Lat.Gain S.Exh W.Exh	Htg.O.A. Req.CFM Act.CFM	Clg.O.A. Req.CFM Act.CFM
1	193 - Main Elec	969	3,950	0	0	100%	100%
	-	0	355	0	0	0	0
		13,317	0.37	0.00	0	355	0
2	191 - Garage	969	9,429	0	0	100%	100%
	-	0	847	0	1,320	0	0
		13,317	0.87	0.00	1,320	847	0
7	181 - Janitor	33	732	0	0	100%	100%
	-	0	66	0	75	0	0
		330	1.99	0.00	75	66	0
10	177 - Mech	243	611	0	0	100%	100%
	-	0	55	0	0	0	0
		5,354	0.23	0.00	0	55	0
12	175 - Garage	2,460	27,695	0	0	100%	100%
	-	4	2,488	0	2,415	0	0
		54,120	1.01	0.00	2,415	2,488	0
	Zone Peak Totals:	4,673	42,417	0	0		
	Total Zones: 5	4	3,810	0	3,810	0	0
	Unique Zones: 5	86,438	0.82	0.00	3,810	3,810	0

Air Handler #2 - Garage, Storage, & Mech - Total Load Summary

Air Handler Description:	Garage, Storage, & Mech Constant Volume - Sum of Peaks
Supply Air Fan:	Draw-Thru with program estimated horsepower of 0.00 HP
Fan Input:	65% motor and fan efficiency with 1.5 in. water across the fan
Outdoor Conditions:	-24° DB (System is Heating Only)

Winter: Ventilation controls outside air.

Zone Space sensible loss:	42,417	Btuh			
Infiltration sensible loss:	0	Btuh	0	CFM	
Outside Air sensible loss:	331,170	Btuh	3,810	CFM	
Supply Duct sensible loss:	0	Btuh			
Return Duct sensible loss:	0	Btuh			
Return Plenum sensible loss:	0	Btuh			
Total System sensible loss:					373,587 Btuh
Heating Supply Air: 42,417 / (.958 X 1.08 X 11) =			3,810	CFM	
Winter Vent Outside Air (100.0% of supply) =			3,810	CFM	
Zone space sensible gain:	0	Btuh			
Infiltration sensible gain:	0	Btuh			
Draw-thru fan sensible gain:	0	Btuh			
Supply duct sensible gain:	0	Btuh			
Reserve sensible gain:	0	Btuh			
Total sensible gain on supply side of coil:					0 Btuh
Cooling Supply Air: 0 / (.958 X 1.1 X 0) =			0	CFM	
Summer Vent Outside Air (0.0% of supply) =			0	CFM	
Return duct sensible gain:	0	Btuh			
Return plenum sensible gain:	0	Btuh			
Outside air sensible gain:	0	Btuh	0	CFM	
Blow-thru fan sensible gain:	0	Btuh			
Total sensible gain on return side of coil:					0 Btuh
Total sensible gain on air handling system:					0 Btuh
Zone space latent gain:	0	Btuh			
Infiltration latent gain:	0	Btuh			
Outside air latent gain:	0	Btuh			
Total latent gain on air handling system:					0 Btuh
Total system sensible and latent gain:					0 Btuh

Check Figures

Total Air Handler Supply Air (based on a 11° TD):	3,810	CFM
Total Air Handler Vent. Air (100.00% of Supply):	3,810	CFM
Total Conditioned Air Space:	4,673	Sq.ft
Supply Air Per Unit Area:	0.8153	CFM/Sq.ft
Area Per Cooling Capacity:	0.0000	Sq.ft/Ton
Cooling Capacity Per Area:	0.0000	Tons/Sq.ft
Heating Capacity Per Area:	79.94	Btuh/Sq.ft
Total Heating Required With Outside Air:	373,587	Btuh
Total Cooling Required With Outside Air:	0.00	Tons

Air Handler #3 - AHU-09 Firing Range - Summary Loads

Zn No	Description Peak Time	Area People Volume	Htg.Loss Htg.CFM CFM/Sqft	Sen.Gain Clg.CFM CFM/Sqft	Lat.Gain S.Exh W.Exh	Htg.O.A. Req.CFM Act.CFM	Clg.O.A. Req.CFM Act.CFM
6	190 - Fire Range	1,867	21,628	19,637	600	Direct	Direct
	4pm June	3	10,400	10,399	0	10,400	10,400
		14,936	5.57	5.57	0	10,400	10,400
	Zone Peak Totals:	1,867	21,628	19,637	600		
	Total Zones: 1	3	10,400	10,399	0	10,400	10,400
	Unique Zones: 1	14,936	5.57	5.57	0	10,400	10,400

Air Handler #3 - AHU-09 Firing Range - Total Load Summary

Air Handler Description: AHU-09 Firing Range Constant Volume - Sum of Peaks
Supply Air Fan: Draw-Thru with program estimated horsepower of 3.77 HP
Fan Input: 65% motor and fan efficiency with 1.5 in. water across the fan
Sensible Heat Ratio: 1.00 --- This system occurs 1 time(s) in the building. ---

Air System Peak Time: 3pm in August.
Outdoor Conditions: 91° DB, 70° WB, 83.10 grains

Because of the diversity in zone, plenum and ventilation loads, the zone sensible peak time in June at 4pm is different from the total system peak time, hence the air system CFM was computed using a zone sensible load of 19,637.

Summer: Ventilation controls outside air, ----- Winter: Ventilation controls outside air.

Zone Space sensible loss:	21,628	Btuh		
Infiltration sensible loss:	0	Btuh	0	CFM
Outside Air sensible loss:	1,033,122	Btuh	10,400	CFM
Supply Duct sensible loss:	21,523	Btuh		
Return Duct sensible loss:	0	Btuh		
Return Plenum sensible loss:	0	Btuh		
Total System sensible loss:				1,076,273 Btuh
Heating Supply Air: 43,151 / (.958 X 1.08 X 4) =			10,400	CFM
Winter Vent Outside Air (100.0% of supply) =			10,400	CFM
Zone space sensible gain:	19,161	Btuh		
Infiltration sensible gain:	0	Btuh		
Draw-thru fan sensible gain:	9,181	Btuh		
Supply duct sensible gain:	10,960	Btuh		
Reserve sensible gain:	168,468	Btuh		
Total sensible gain on supply side of coil:				207,770 Btuh
Cooling Supply Air: 208,246 / (.958 X 1.1 X 19) =			10,399	CFM
Summer Vent Outside Air (100.0% of supply) =			10,400	CFM
Return duct sensible gain:	0	Btuh		
Return plenum sensible gain:	0	Btuh		
Outside air sensible gain:	164,415	Btuh	10,400	CFM
Blow-thru fan sensible gain:	0	Btuh		
Total sensible gain on return side of coil:				164,415 Btuh
Total sensible gain on air handling system:				372,185 Btuh
Zone space latent gain:	600	Btuh		
Infiltration latent gain:	0	Btuh		
Outside air latent gain:	103,514	Btuh		
Total latent gain on air handling system:				104,114 Btuh
Total system sensible and latent gain:				476,299 Btuh

Check Figures

Total Air Handler Supply Air (based on a 19° TD):	10,399	CFM
Total Air Handler Vent. Air (100.01% of Supply):	10,400	CFM
Total Conditioned Air Space:	1,867	Sq.ft
Supply Air Per Unit Area:	5.5701	CFM/Sq.ft
Area Per Cooling Capacity:	47.0377	Sq.ft/Ton
Cooling Capacity Per Area:	0.0213	Tons/Sq.ft
Heating Capacity Per Area:	576.47	Btuh/Sq.ft
Total Heating Required With Outside Air:	1,076,273	Btuh
Total Cooling Required With Outside Air:	39.69	Tons

Air System #1 (AHU-08 Support Bldg) Psychrometric Analysis

System Load Analysis	Latent	Grains	Sensible	Temp	CFM
Leaving Coil Condition		65.878		55.000	
Draw-Thru Fan			554	0.218	26
Misc Load on Supply Side			0	0.000	0
Supply Air Duct			2,543	1.000	121
Zone Loads	2,561	1.629	44,426	17.470	2,108
Sensible Reserve			3,337	1.312	158
Zone Condition	2,561	67.507	50,860	75.000	2,413
Return Air Duct			2,543	1.000	
Return Air Plenum			0	0.000	
Misc Load on Return Side			0	0.000	
Vent Air 360 CFM	-14,490	-9.217	-28,456	-11.190	
Blow-Thru Fan			0	0.000	
Entering Coil Condition	-11,929	58.290	24,947	64.810	2,413

General Psychrometric Equations Used In Analysis:

PR = (Barometric pressure of site / Standard ASHRAE pressure of 29.921)
TSH = PR x 1.10 x CFM x (DB entering - DB leaving)
TLH = PR x 0.68 x CFM x (Grains entering - Grains leaving)
GTH = PR x 4.50 x CFM x (Enthalpy entering - Enthalpy leaving)

TSH	=	0.958	x	1.10	x	2,413	x (	64.810	-	55.000	) =	24,947	Btuh
TLH	=	0.958	x	0.68	x	2,413	x (	58.290	-	65.878	) =	-11,929	Btuh
SUM	=											13,018	Btuh
GTH	=	0.958	x	4.50	x	2,413	x (	24.631	-	23.417	) =	12,628	Btuh
Total System Load											=	13,018	Btuh

Chilled and Hot Water Flow Rates and Steam Requirement

Cooling GPM	=	12,628	/ (	0.00	x	500	)	0.0	GPM
Heating GPM	=	61,076	/ (	30.00	x	500	)	4.1	GPM
Steam Req.	=	61,076	/	970				63.0	lb./hr

Entering Cooling Coil Conditions

Dry bulb temperature:	64.81	
Wet bulb temperature:	56.64	
Relative humidity:	61.24	
Enthalpy:	24.63	Btu/lbm

Entering Heating Coil Conditions

Dry bulb temperature:	49.49

Leaving Cooling Coil Conditions

Dry bulb temperature:	55.00	
Wet bulb temperature:	54.68	
Relative humidity:	98.06	
Enthalpy:	23.42	Btu/lbm

Leaving Heating Coil Conditions

Dry bulb temperature:	95.00

Air System #2 (Garage, Storage, & Mech) Psychrometric Analysis

System Load Analysis	Latent	Grains	Sensible	Temp	CFM
Leaving Coil Condition		65.878		55.000	
Draw-Thru Fan			0	0.000	0
Misc Load on Supply Side			0	0.000	0
Supply Air Duct			0	0.000	0
Zone Loads	0	0.000	0	0.000	2,108
Sensible Reserve			0	0.000	0
Zone Condition	0	67.507	0	60.000	0
Return Air Duct			0	0.000	
Return Air Plenum			0	0.000	
Misc Load on Return Side			0	0.000	
Vent Air 0 CFM	0	-9.217	0	-11.190	
Blow-Thru Fan			0	0.000	
Entering Coil Condition	0	58.290	0	64.810	0

General Psychrometric Equations Used In Analysis:

PR = (Barometric pressure of site / Standard ASHRAE pressure of 29.921)
TSH = PR x 1.10 x CFM x (DB entering - DB leaving)
TLH = PR x 0.68 x CFM x (Grains entering - Grains leaving)
GTH = PR x 4.50 x CFM x (Enthalpy entering - Enthalpy leaving)

TSH	=	0.958	x	1.10	x	0	x (	64.810	-	55.000	) =	0	Btuh
TLH	=	0.958	x	0.68	x	0	x (	58.290	-	65.878	) =	0	Btuh
SUM	=											0	Btuh
GTH	=	0.958	x	4.50	x	0	x (	24.631	-	23.417	) =	0	Btuh
Total System Load											=	0	Btuh

Chilled and Hot Water Flow Rates and Steam Requirement

Cooling GPM	=	0	/ (	0.00	x	500	)	=	0.0 GPM
Heating GPM	=	373,587	/ (	0.00	x	500	)	=	0.0 GPM
Steam Req.	=	373,587	/	970				=	385.1 lb./hr

Entering Cooling Coil Conditions

Dry bulb temperature:	64.81	
Wet bulb temperature:	56.64	
Relative humidity:	61.24	
Enthalpy:	24.63	Btu/lbm

Entering Heating Coil Conditions

Dry bulb temperature:	-24.00

Leaving Cooling Coil Conditions

Dry bulb temperature:	55.00	
Wet bulb temperature:	54.68	
Relative humidity:	98.06	
Enthalpy:	23.42	Btu/lbm

Leaving Heating Coil Conditions

Dry bulb temperature:	70.76

Air System #3 (AHU-09 Firing Range) Psychrometric Analysis

System Load Analysis	Latent	Grains	Sensible	Temp	CFM
Leaving Coil Condition		67.420		56.000	
Draw-Thru Fan			9,181	0.838	458
Misc Load on Supply Side			0	0.000	0
Supply Air Duct			10,960	1.000	547
Zone Loads	600	0.089	19,637	1.792	981
Sensible Reserve			168,468	15.371	8,413
Zone Condition	600	67.508	208,246	75.000	10,399
Return Air Duct			0	0.000	
Return Air Plenum			0	0.000	
Misc Load on Return Side			0	0.000	
Vent Air 10,400 CFM	103,514	15.277	164,415	15.000	
Blow-Thru Fan			0	0.000	
Entering Coil Condition	104,114	82.785	372,661	90.000	10,399

General Psychrometric Equations Used In Analysis:

PR = (Barometric pressure of site / Standard ASHRAE pressure of 29.921)
TSH = PR x 1.10 x CFM x (DB entering - DB leaving)
TLH = PR x 0.68 x CFM x (Grains entering - Grains leaving)
GTH = PR x 4.50 x CFM x (Enthalpy entering - Enthalpy leaving)

TSH	=	0.958	x	1.10	x	10,399	x (	90.000	-	56.000	) =	372,650 Btuh
TLH	=	0.958	x	0.68	x	10,399	x (	82.785	-	67.420	) =	104,108 Btuh
SUM	=											476,758 Btuh
GTH	=	0.958	x	4.50	x	10,399	x (	34.623	-	23.900	) =	480,771 Btuh
Total System Load											=	476,299 Btuh

Chilled and Hot Water Flow Rates and Steam Requirement

Cooling GPM	=	480,771	/ (	0.00	x	500	)	= 0.0 GPM
Heating GPM	=	1,076,273	/ (	30.00	x	500	)	= 71.8 GPM
Steam Req.	=	1,076,273	/	970				= 1,109.6 lb./hr

Entering Cooling Coil Conditions

Dry bulb temperature:	90.00	
Wet bulb temperature:	70.00	
Relative humidity:	37.60	
Enthalpy:	34.62	Btu/lbm

Entering Heating Coil Conditions

Dry bulb temperature:	-24.00

Leaving Cooling Coil Conditions

Dry bulb temperature:	56.00	
Wet bulb temperature:	55.44	
Relative humidity:	96.74	
Enthalpy:	23.90	Btu/lbm

Leaving Heating Coil Conditions

Dry bulb temperature:	76.01

	Branch	DFU	HWFU	CWFU	TSFU	CW DEMAND GPM[1]	HW DEMAND GPM[1]	TOTAL DEMAND GPM[1]	MIN. SANITARY DRAIN SIZE[2]	ACTUAL SANITARY DRAIN SIZE
Main Building West Branch	Public Area	16	3	25	26	37	4	40		
	Holding	23	3	23	24	37	4	40		
	Break	5	3	3	4	4	4	5		
	Branch Total	44	9	51	54	50	7	51		
East Branch	Locker Rooms	49	15	57	62	53	10	55		
	Janitor	10	3	3	4	4	4	5		
	Branch Total	59	18	60	66	55	12	57		
	Building Total	103	27	111	120	70	18	73		

	Branch	DFU	HWFU	CWFU	TSFU	CW DEMAND GPM[1]	HW DEMAND GPM[1]	TOTAL DEMAND GPM[1]	MIN. SANITARY DRAIN SIZE[2]	ACTUAL SANITARY DRAIN SIZE
Commercial Bulding	Janitor/ESS	7	4.5	4.5	7	10	10	15		
	Garage	18	3	3	4	4	4	5		
	Toilet Area	14	3	23	24	37	4	38		
	Mech	6	1.5	1.5	2	2	2	3		
	Building Total	45	12	32	37	42	10	45		

	Branch	DFU	HWFU	CWFU	TSFU	CW DEMAND GPM[1]	HW DEMAND GPM[1]	TOTAL DEMAND GPM[1]	MIN. SANITARY DRAIN SIZE[2]	ACTUAL SANITARY DRAIN SIZE
Secondary Bulding	AQI/Mech	14	4.5	4.5	6	5	5	5		
	Toilet Area	16	3	23	24	37	4	38		
	Garage	44	7.5	7.5	11	6	6	6		
	Building Total	74	15	35	41	44	10	46		

Three Building Total	222	54	178	198			90

Notes:
Values in red are calculated.
The total building demand GPM is not the sum of the individual branch GPMs. Diversity is taken account, so the GPM is calculated from the total building fixture units.
[1] Converted using chart on page 76 of the Minnesota Plumbing Code, 2007.
[2] Converted using page 55 of the Minnesota Plumbing Code, 2007, assuming a 1/4 inch per foot slope per drawings.

COM*check* Software Version 3.7.1

Envelope Compliance Certificate

90.1 (2004) Standard

Section 1: Project Information

Project Type: **New Construction**
Project Title : United States Land Port of Entry

Construction Site:
State Highway 313 N. at 410 St.
Warroad, MN 56763-9411

Owner/Agent:
GSA

Section 2: General Information

Building Location (for weather data): **Warroad, Minnesota**
Climate Zone: **7**
Building Type for Envelope Requirements: **Non-Residential**

Activity Type(s)	Floor Area
Common Space Types:Lobby	53
Common Space Types:Office - Open Plan	693
Common Space Types:Office - Open Plan	719
Common Space Types:Office - Enclosed	163
Common Space Types:Office - Enclosed	217
Common Space Types:Dining Area - General	290
Common Space Types:Conference/Meeting/Multipurpose	418
Common Space Types:Electrical/Mechanical	94
Common Space Types:Office - Enclosed	182
Common Space Types:Electrical/Mechanical	59
Common Space Types:Active Storage	398
Common Space Types:Active Storage	80
Common Space Types:Lobby	205
Common Space Types:Office - Enclosed	167
Common Space Types:Conference/Meeting/Multipurpose	69
Common Space Types:Restrooms	54
Common Space Types:Restrooms	53
Common Space Types:Corridor/Transition	724
Common Space Types:Corridor/Transition	110
Common Space Types:Corridor/Transition	118
Common Space Types:Lobby	42
Common Space Types:Office - Enclosed	80
Courthouse/Police Station/Penitentiary:Confinement Cell	96
Courthouse/Police Station/Penitentiary:Confinement Cell	81
Common Space Types:Corridor/Transition	189
Common Space Types:Lobby	70
Common Space Types:Lobby	18
Courthouse/Police Station/Penitentiary:Confinement Cell	80
Common Space Types:Stairs-Active	89
Common Space Types:Electrical/Mechanical	91
Common Space Types:Lobby	65
Common Space Types:Active Storage	91
Common Space Types:Dressing/Locker/Fitting Room	123
Common Space Types:Restrooms	167
Common Space Types:Electrical/Mechanical	35

Common Space Types:Dressing/Locker/Fitting Room	233
Common Space Types:Restrooms	163
Common Space Types:Office - Enclosed	195
Gymnasium/Exercise Center:Exercise Area	238
Common Space Types:Office - Enclosed	146
Common Space Types:Office - Enclosed	138
Common Space Types:Office - Enclosed	146
Common Space Types:Lobby	45
Common Space Types:Corridor/Transition	145
Common Space Types:Office - Enclosed	139
Common Space Types:Inactive Storage	39
Common Space Types:Electrical/Mechanical	60
Common Space Types:Office - Enclosed	79
Common Space Types:Restrooms	66
Common Space Types:Restrooms	67
Common Space Types:Active Storage	262
Common Space Types:Electrical/Mechanical	52
Common Space Types:Electrical/Mechanical	475
Manufacturing:Detailed Manufacturing	4477
Common Space Types:Electrical/Mechanical	37
Common Space Types:Audience/Seating Area	54
Manufacturing:Detailed Manufacturing	2444
Common Space Types:Laboratory	194
Common Space Types:Electrical/Mechanical	246
Common Space Types:Office - Enclosed	81
Common Space Types:Active Storage	56
Common Space Types:Restrooms	53
Common Space Types:Active Storage	31
Common Space Types:Lobby	155
Common Space Types:Dressing/Locker/Fitting Room	173
Common Space Types:Inactive Storage	74
Common Space Types:Active Storage	96
Common Space Types:Lobby	90
Common Space Types:Office - Enclosed	101
Sports Arena:Court Sports Area	1833
Automotive:Service/Repair	924
Common Space Types:Electrical/Mechanical	363
Common Space Types:Electrical/Mechanical	1818
Common Space Types:Electrical/Mechanical	886

Section 3: Requirements Checklist

Envelope TBD: No envelope assemblies specified

Climate-Specific Requirements:

Component Name/Description	Gross Area or Perimeter	Cavity R-Value	Cont. R-Value	Proposed U-Factor	Budget U-Factor(a)

(a) Budget U-factors are used for software baseline calculations ONLY, and are not code requirements.

Insulation:

- ❑ 1. Open-blown or poured loose-fill insulation has not been used in attic roof spaces with ceiling slope greater than 3 in 12.
- ❑ 2. Wherever vents occur, they are baffled to deflect incoming air above the insulation.
- ❑ 3. Recessed lights, equipment and ducts are not affecting insulation thickness.
- ❑ 4. No roof insulation is installed on a suspended ceiling with removable ceiling panels.
- ❑ 5. All exterior insulation is covered with protective material.
- ❑ 6. Cargo and loading dock doors are equipped with weather seals.

Fenestration and Doors:

- ❑ 7. Windows and skylights are labeled and certified by the manufacturer for U-factor and SHGC.
- ❑ 8. Fixed windows and skylights unlabeled by the manufacturer have been site labeled using the default U-factor and SHGC.

❑ 9. Other unlabeled vertical fenestration, operable and fixed, that are unlabeled by the manufacturer have been site labeled using the default U-factor and SHGC. No credit has been given for metal frames with thermal breaks, low-emissivity coatings, gas fillings, or insulating spacers.

Air Leakage and Component Certification:

❑ 10. All joints and penetrations are caulked, gasketed, weather-stripped, or otherwise sealed.

❑ 11. Windows, doors, and skylights certified as meeting leakage requirements.

❑ 12. Component R-values & U-factors labeled as certified.

❑ 13. 'Other' components have supporting documentation for proposed U-Factors.

❑ 14. Building entrance doors have a vestibule equipped with self-closing devices. Interior and exterior doors in the closed position are no less than 7 ft apart.
Exceptions:

Buildings less than four stories above grade.

Building entrances with revolving doors.

Doors not intended to be used as a building entrance.

Doors that open directly from a space less than 3000 sq. ft. in area.

Doors used primarily to facilitate vehicular movement or materials handling and adjacent personnel doors.

❑ 15. Insulation installed according to manufacturer's instructions, in substantial contact with the surface being insulated, and in a manner that achieves the rated R-value without compressing the insulation.

COM*check* Software Version 3.7.1

Interior Lighting and Power Compliance Certificate

90.1 (2004) Standard

Section 1: Project Information

Project Type: **New Construction**
Project Title : United States Land Port of Entry

Construction Site:
State Highway 313 N. at 410 St.
Warroad, MN 56763-9411

Owner/Agent:
GSA

Designer/Contractor:
Sebesta Blomberg

Section 2: General Information

Building Use Description by: **Activity Type**

Activity Type(s)	Floor Area
Common Space Types:Lobby	53
Common Space Types:Office - Open Plan	693
Common Space Types:Office - Open Plan	719
Common Space Types:Office - Enclosed	163
Common Space Types:Office - Enclosed	217
Common Space Types:Dining Area - General	290
Common Space Types:Conference/Meeting/Multipurpose	418
Common Space Types:Electrical/Mechanical	94
Common Space Types:Office - Enclosed	182
Common Space Types:Electrical/Mechanical	59
Common Space Types:Active Storage	398
Common Space Types:Active Storage	80
Common Space Types:Lobby	205
Common Space Types:Office - Enclosed	167
Common Space Types:Conference/Meeting/Multipurpose	69
Common Space Types:Restrooms	54
Common Space Types:Restrooms	53
Common Space Types:Corridor/Transition	724
Common Space Types:Corridor/Transition	110
Common Space Types:Corridor/Transition	118
Common Space Types:Lobby	42
Common Space Types:Office - Enclosed	80
Courthouse/Police Station/Penitentiary:Confinement Cell	96
Courthouse/Police Station/Penitentiary:Confinement Cell	81
Common Space Types:Corridor/Transition	189
Common Space Types:Lobby	70
Common Space Types:Lobby	18
Courthouse/Police Station/Penitentiary:Confinement Cell	80
Common Space Types:Stairs-Active	89
Common Space Types:Electrical/Mechanical	91
Common Space Types:Lobby	65
Common Space Types:Active Storage	91
Common Space Types:Dressing/Locker/Fitting Room	123
Common Space Types:Restrooms	167
Common Space Types:Electrical/Mechanical	35
Common Space Types:Dressing/Locker/Fitting Room	233
Common Space Types:Restrooms	163

Common Space Types:Office - Enclosed	195
Gymnasium/Exercise Center:Exercise Area	238
Common Space Types:Office - Enclosed	146
Common Space Types:Office - Enclosed	138
Common Space Types:Office - Enclosed	146
Common Space Types:Lobby	45
Common Space Types:Corridor/Transition	145
Common Space Types:Office - Enclosed	139
Common Space Types:Inactive Storage	39
Common Space Types:Electrical/Mechanical	60
Common Space Types:Office - Enclosed	79
Common Space Types:Restrooms	66
Common Space Types:Restrooms	67
Common Space Types:Active Storage	262
Common Space Types:Electrical/Mechanical	52
Common Space Types:Electrical/Mechanical	475
Manufacturing:Detailed Manufacturing	4477
Common Space Types:Electrical/Mechanical	37
Common Space Types:Audience/Seating Area	54
Manufacturing:Detailed Manufacturing	2444
Common Space Types:Laboratory	194
Common Space Types:Electrical/Mechanical	246
Common Space Types:Office - Enclosed	81
Common Space Types:Active Storage	56
Common Space Types:Restrooms	53
Common Space Types:Active Storage	31
Common Space Types:Lobby	155
Common Space Types:Dressing/Locker/Fitting Room	173
Common Space Types:Inactive Storage	74
Common Space Types:Active Storage	96
Common Space Types:Lobby	90
Common Space Types:Office - Enclosed	101
Sports Arena:Court Sports Area	1833
Automotive:Service/Repair	924
Common Space Types:Electrical/Mechanical	363
Common Space Types:Electrical/Mechanical	1818
Common Space Types:Electrical/Mechanical	886

Section 3: Requirements Checklist

Interior Lighting:

❑ 1. Total proposed watts must be less than or equal to total allowed watts.

Allowed Watts	Proposed Watts	Complies
34337	30153	YES

❑ 2. Exit signs 5 Watts or less per sign.

Controls, Switching, and Wiring:

❑ 3. Independent manual or occupancy sensing controls for each space (remote switch with indicator allowed for safety or security).

❑ 4. Occupant sensing control in class rooms, conference/meeting rooms, and employee lunch and break rooms.
Exceptions:

Spaces with multi-scene control; shop classrooms, laboratory classrooms, and preschool through 12th grade classrooms.

❑ 5. Automatic shutoff control for lighting in >5000 sq.ft buildings by time-of-day device, occupant sensor, or other automatic control.
Exceptions:

24 hour operation lighting; patient care areas; where auto shutoff would endanger safety or security.

❑ 6. Master switch at entry to hotel/motel guest room.

❑ 7. Separate control device for display/accent lighting, case lighting, task lighting, nonvisual lighting, lighting for sale, and demonstration lighting.

❑ 8. Tandem wired one-lamp and three-lamp ballasted luminaires (No single-lamp ballasts).
Exceptions:

Electronic high-frequency ballasts;

Luminaires not on same switch;

Recessed luminaires 10 ft. apart or surface/pendant not continuous;

Luminaires on emergency circuits.

Voltage Drop:

❑ 9. Feeder conductors have been designed for a maximum voltage drop of 2 percent.

❑ 10. Branch circuit conductors have been designed for a maximum voltage drop of 3 percent.

Section 4: Compliance Statement

Compliance Statement: The proposed lighting design represented in this document is consistent with the building plans, specifications and other calculations submitted with this permit application. The proposed lighting system has been designed to meet the 90.1 (2004) Standard requirements in COM*check* Version 3.7.1 and to comply with the mandatory requirements in the Requirements Checklist.

Name - Title	Signature	Date

Section 5: Post Construction Compliance Statement

Record Drawings and Operating and Maintenance Manuals:

❑ 1. Construction documents with record drawings and operating and maintenance manuals provided to the owner.

Lighting Designer or Contractor Name	Signature	Date

COM*check* Software Version 3.7.1

Interior Lighting Application Worksheet

90.1 (2004) Standard

Section 1: Allowed Lighting Power Calculation

A Area Category	B Floor Area (ft2)	C Allowed Watts / ft2	D Allowed Watts (B x C)
Common Space Types:Lobby	53	1.3	69
Common Space Types:Office - Open Plan	693	1.1	762
Common Space Types:Office - Open Plan	719	1.1	791
Common Space Types:Office - Enclosed	163	1.1	179
Common Space Types:Office - Enclosed	217	1.1	239
Common Space Types:Dining Area - General	290	0.9	261
Common Space Types:Conference/Meeting/Multipurpose	418	1.3	543
Common Space Types:Electrical/Mechanical	94	1.5	141
Common Space Types:Office - Enclosed	182	1.1	200
Common Space Types:Electrical/Mechanical	59	1.5	89
Common Space Types:Active Storage	398	0.8	318
Common Space Types:Active Storage	80	0.8	64
Common Space Types:Lobby	205	1.3	267
Common Space Types:Office - Enclosed	167	1.1	184
Common Space Types:Conference/Meeting/Multipurpose	69	1.3	90
Common Space Types:Restrooms	54	0.9	49
Common Space Types:Restrooms	53	0.9	48
Common Space Types:Corridor/Transition	724	0.5	362
Common Space Types:Corridor/Transition	110	0.5	55
Common Space Types:Corridor/Transition	118	0.5	59
Common Space Types:Lobby	42	1.3	55
Common Space Types:Office - Enclosed	80	1.1	88
Courthouse/Police Station/Penitentiary:Confinement Cell	96	0.9	86
Courthouse/Police Station/Penitentiary:Confinement Cell	81	0.9	73
Common Space Types:Corridor/Transition	189	0.5	95
Common Space Types:Lobby	70	1.3	91
Common Space Types:Lobby	18	1.3	23
Courthouse/Police Station/Penitentiary:Confinement Cell	80	0.9	72
Common Space Types:Stairs-Active	89	0.6	53
Common Space Types:Electrical/Mechanical	91	1.5	137
Common Space Types:Lobby	65	1.3	85
Common Space Types:Active Storage	91	0.8	73
Common Space Types:Dressing/Locker/Fitting Room	123	0.6	74
Common Space Types:Restrooms	167	0.9	150
Common Space Types:Electrical/Mechanical	35	1.5	53
Common Space Types:Dressing/Locker/Fitting Room	233	0.6	140
Common Space Types:Restrooms	163	0.9	147
Common Space Types:Office - Enclosed	195	1.1	215
Gymnasium/Exercise Center:Exercise Area	238	0.9	214
Common Space Types:Office - Enclosed	146	1.1	161
Common Space Types:Office - Enclosed	138	1.1	152
Common Space Types:Office - Enclosed	146	1.1	161
Common Space Types:Lobby	45	1.3	59
Common Space Types:Corridor/Transition	145	0.5	73

Common Space Types:Office - Enclosed	139	1.1	153
Common Space Types:Inactive Storage	39	0.3	12
Common Space Types:Electrical/Mechanical	60	1.5	90
Common Space Types:Office - Enclosed	79	1.1	87
Common Space Types:Restrooms	66	0.9	59
Common Space Types:Restrooms	67	0.9	60
Common Space Types:Active Storage	262	0.8	210
Common Space Types:Electrical/Mechanical	52	1.5	78
Common Space Types:Electrical/Mechanical	475	1.5	713
Manufacturing:Detailed Manufacturing	4477	2.1	9402
Common Space Types:Electrical/Mechanical	37	1.5	56
Common Space Types:Audience/Seating Area	54	0.9	49
Manufacturing:Detailed Manufacturing	2444	2.1	5132
Common Space Types:Laboratory	194	1.4	272
Common Space Types:Electrical/Mechanical	246	1.5	369
Common Space Types:Office - Enclosed	81	1.1	89
Common Space Types:Active Storage	56	0.8	45
Common Space Types:Restrooms	53	0.9	48
Common Space Types:Active Storage	31	0.8	25
Common Space Types:Lobby	155	1.3	202
Common Space Types:Dressing/Locker/Fitting Room	173	0.6	104
Common Space Types:Inactive Storage	74	0.3	22
Common Space Types:Active Storage	96	0.8	77
Common Space Types:Lobby	90	1.3	117
Common Space Types:Office - Enclosed	101	1.1	111
Sports Arena:Court Sports Area	1833	2.3	4216
Automotive:Service/Repair	924	0.7	647
Common Space Types:Electrical/Mechanical	363	1.5	545
Common Space Types:Electrical/Mechanical	1818	1.5	2727
Common Space Types:Electrical/Mechanical	886	1.5	1329
		Total Allowed Watts =	34337

Section 2: Proposed Lighting Power Calculation

A Fixture ID : Description / Lamp / Wattage Per Lamp / Ballast	B Lamps/ Fixture	C # of Fixtures	D Fixture Watt.	E (C X D)
Common Space Types:Lobby (53 sq.ft.)				
Compact Fluorescent 1: D: 6" Open Reflector Can Light / Triple 4-pin 32W / Electronic	1	2	32	64
Common Space Types:Office - Open Plan (693 sq.ft.)				
Linear Fluorescent 1: A1: 4' pendant mount Linear / 46" T5 HO 54W / Electronic	1	16	63	1008
Common Space Types:Office - Open Plan (719 sq.ft.)				
Linear Fluorescent 2: A1: 4' pendant mount Linear / 46" T5 HO 54W / Electronic	1	16	63	1008
Common Space Types:Office - Enclosed (163 sq.ft.)				
Linear Fluorescent 3: A2: 4' surface mount Linear / 46" T5 HO 54W / Electronic	1	4	63	252
Common Space Types:Office - Enclosed (217 sq.ft.)				
Linear Fluorescent 4: A2: 4' surface mount Linear / 46" T5 HO 54W / Electronic	1	6	63	378
Common Space Types:Dining Area - General (290 sq.ft.)				
Linear Fluorescent 6: U: 4' Undercabinet Light / 48" T8 32W / Electronic	1	2	33	66
Linear Fluorescent 5: A2: 4' surface mount Linear / 46" T5 HO 54W / Electronic	1	6	63	378
Common Space Types:Conference/Meeting/Multipurpose (418 sq.ft.)				
Compact Fluorescent 2: D: 6" Open Reflector Can Light / Triple 4-pin 32W / Electronic	1	6	32	192
Linear Fluorescent 7: A2: 4' surface mount Linear / 46" T5 HO 54W / Electronic	1	8	63	504
Common Space Types:Electrical/Mechanical (94 sq.ft.)				
Linear Fluorescent 8: C: 4' surface strip light / 48" T8 32W (Super T8) / Electronic	2	2	62	124
Common Space Types:Office - Enclosed (182 sq.ft.)				
Linear Fluorescent 10: U: 4' Undercabinet Light / 48" T8 32W / Electronic	1	5	33	165
Linear Fluorescent 9: A: 2x4 recessed troffer / 48" T8 32W (Super T8) / Electronic	2	3	62	186
Common Space Types:Electrical/Mechanical (59 sq.ft.)				
Linear Fluorescent 11: C: 4' surface strip light / 48" T8 32W (Super T8) / Electronic	2	1	62	62

Common Space Types:Active Storage (398 sq.ft.)				
Linear Fluorescent 12: C: 4' surface strip light / 48" T8 32W (Super T8) / Electronic	2	7	62	434
Common Space Types:Active Storage (80 sq.ft.)				
Linear Fluorescent 13: C: 4' surface strip light / 48" T8 32W (Super T8) / Electronic	2	2	62	124
Common Space Types:Lobby (205 sq.ft.)				
Linear Fluorescent 16: C3: 8' staggered strip light / 48" T8 32W / Electronic	4	2	107	214
Linear Fluorescent 15: C2: 4' staggered strip light / 48" T8 32W / Electronic	2	4	62	248
Linear Fluorescent 14: C1: 3' staggered strip light / 36" T8 25W / Electronic	2	2	48	96
Common Space Types:Office - Enclosed (167 sq.ft.)				
Linear Fluorescent 17: A2: 4' surface mount Linear / 46" T5 HO 54W / Electronic	1	4	63	252
Common Space Types:Conference/Meeting/Multipurpose (69 sq.ft.)				
Linear Fluorescent 18: A: 2x4 recessed troffer / 48" T8 32W (Super T8) / Electronic	2	2	62	124
Common Space Types:Restrooms (54 sq.ft.)				
Linear Fluorescent 19: C1: 3' staggered strip light / 36" T8 25W / Electronic	2	2	48	96
Common Space Types:Restrooms (53 sq.ft.)				
Linear Fluorescent 20: C1: 3' staggered strip light / 36" T8 25W / Electronic	2	2	48	96
Common Space Types:Corridor/Transition (724 sq.ft.)				
Linear Fluorescent 22: C3: 8' staggered strip light / 48" T8 32W (Super T8) / Electronic	4	9	107	963
Linear Fluorescent 21: C2: 4' staggered strip light / 48" T8 32W (Super T8) / Electronic	2	11	62	682
Common Space Types:Corridor/Transition (110 sq.ft.)				
Linear Fluorescent 24: C3: 8' staggered strip light / 48" T8 32W (Super T8) / Electronic	4	1	107	107
Linear Fluorescent 23: C2: 4' staggered strip light / 48" T8 32W (Super T8) / Electronic	2	2	62	124
Common Space Types:Corridor/Transition (118 sq.ft.)				
Compact Fluorescent 3: D: 6" Open Reflector Can Light / Triple 4-pin 32W / Electronic	1	4	32	128
Common Space Types:Lobby (42 sq.ft.)				
Compact Fluorescent 4: D: 6" Open Reflector Can Light / Triple 4-pin 32W / Electronic	1	1	32	32
Common Space Types:Office - Enclosed (80 sq.ft.)				
Linear Fluorescent 25: A3: 1x4 surface fluorescent / 48" T8 32W (Super T8) / Electronic	2	2	62	124
Courthouse/Police Station/Penitentiary:Confinement Cell (96 sq.ft.)				
Linear Fluorescent 26: A3: 1x4 surface fluorescent / 48" T8 32W (Super T8) / Electronic	2	2	62	124
Courthouse/Police Station/Penitentiary:Confinement Cell (81 sq.ft.)				
Linear Fluorescent 27: A3: 1x4 surface fluorescent / 48" T8 32W (Super T8) / Electronic	2	2	62	124
Common Space Types:Corridor/Transition (189 sq.ft.)				
Linear Fluorescent 28: A: 2x4 recessed troffer / 48" T8 32W (Super T8) / Electronic	2	3	62	186
Common Space Types:Lobby (70 sq.ft.)				
Linear Fluorescent 29: A: 2x4 recessed troffer / 48" T8 32W (Super T8) / Electronic	2	1	62	62
Common Space Types:Lobby (18 sq.ft.)				
Compact Fluorescent 5: D: 6" Open Reflector Can Light / Triple 4-pin 32W / Electronic	1	1	32	32
Courthouse/Police Station/Penitentiary:Confinement Cell (80 sq.ft.)				
Linear Fluorescent 30: A3: 1x4 surface fluorescent / 48" T8 32W (Super T8) / Electronic	2	2	62	124
Common Space Types:Stairs-Active (89 sq.ft.)				
Linear Fluorescent 31: C5: 1x4 wall mount light fixture / 48" T8 32W (Super T8) / Electronic	2	2	62	124
Common Space Types:Electrical/Mechanical (91 sq.ft.)				
Linear Fluorescent 32: C: 4' surface strip light / 48" T8 32W (Super T8) / Electronic	2	3	62	186
Common Space Types:Lobby (65 sq.ft.)				
Compact Fluorescent 6: D: 6" Open Reflector Can Light / Triple 4-pin 32W / Electronic	1	2	32	64
Common Space Types:Active Storage (91 sq.ft.)				
Linear Fluorescent 33: C: 4' surface strip light / 48" T8 32W (Super T8) / Electronic	2	2	62	124
Common Space Types:Dressing/Locker/Fitting Room (123 sq.ft.)				
Compact Fluorescent 8: D1: 5" Recessed shower can light / Triple 4-pin 32W / Electronic	1	2	32	64
Compact Fluorescent 7: D: 6" Open Reflector Can Light / Triple 4-pin 32W / Electronic	1	2	32	64
Common Space Types:Restrooms (167 sq.ft.)				
Linear Fluorescent 35: C3: 8' staggered strip light / 48" T8 32W (Super T8) / Electronic	4	2	107	214
Linear Fluorescent 34: C1: 3' staggered strip light / 36" T8 25W / Electronic	2	2	26	52
Compact Fluorescent 9: D: 6" Open Reflector Can Light / Triple 4-pin 32W / Electronic	1	4	32	128
Common Space Types:Electrical/Mechanical (35 sq.ft.)				
Linear Fluorescent 36: C: 4' surface strip light / 48" T8 32W (Super T8) / Electronic	2	1	62	62
Common Space Types:Dressing/Locker/Fitting Room (233 sq.ft.)				

Compact Fluorescent 11: D1: 5" Recessed shower can light / Triple 4-pin 32W / Electronic	1	3	32	96
Compact Fluorescent 10: D: 6" Open Reflector Can Light / Triple 4-pin 32W / Electronic	1	4	32	128
Common Space Types:Restrooms (163 sq.ft.)				
Linear Fluorescent 38: C3: 8' staggered strip light / 48" T8 32W (Super T8) / Electronic	4	2	107	214
Linear Fluorescent 37: C1: 3' staggered strip light / 36" T8 25W / Electronic	2	2	26	52
Compact Fluorescent 12: D: 6" Open Reflector Can Light / Triple 4-pin 32W / Electronic	1	4	32	128
Common Space Types:Office - Enclosed (195 sq.ft.)				
Linear Fluorescent 40: A: 2x4 recessed troffer / 48" T8 32W (Super T8) / Electronic	2	4	62	248
Gymnasium/Exercise Center:Exercise Area (238 sq.ft.)				
Compact Fluorescent 13: D: 6" Open Reflector Can Light / Triple 4-pin 32W / Electronic	1	2	32	64
Linear Fluorescent 39: A2: 4' surface mount Linear / 46" T5 HO 54W / Electronic	1	4	63	252
Common Space Types:Office - Enclosed (146 sq.ft.)				
Compact Fluorescent 14: D2: 6" Lensed Can light - dimmable / Triple 4-pin 32W / Electronic	1	8	32	256
Common Space Types:Office - Enclosed (138 sq.ft.)				
Compact Fluorescent 15: D2: 6" Lensed Can light - dimmable / Triple 4-pin 32W / Electronic	1	8	32	256
Common Space Types:Office - Enclosed (146 sq.ft.)				
Compact Fluorescent 16: D2: 6" Lensed Can light - dimmable / Triple 4-pin 32W / Electronic	1	8	32	256
Common Space Types:Lobby (45 sq.ft.)				
Linear Fluorescent 41: C: 4' surface strip light / 48" T8 32W (Super T8) / Electronic	2	2	62	124
Common Space Types:Corridor/Transition (145 sq.ft.)				
Linear Fluorescent 42: C: 4' surface strip light / 48" T8 32W (Super T8) / Electronic	2	2	62	124
Common Space Types:Office - Enclosed (139 sq.ft.)				
Linear Fluorescent 77: A: 2x4 recessed troffer / 48" T8 32W (Super T8) / Electronic	2	2	62	124
Common Space Types:Inactive Storage (39 sq.ft.)				
Linear Fluorescent 43: C: 4' surface strip light / 48" T8 32W (Super T8) / Electronic	2	1	62	62
Common Space Types:Electrical/Mechanical (60 sq.ft.)				
Linear Fluorescent 44: C: 4' surface strip light / 48" T8 32W (Super T8) / Electronic	2	2	62	124
Common Space Types:Office - Enclosed (79 sq.ft.)				
Linear Fluorescent 45: A: 2x4 recessed troffer / 48" T8 32W (Super T8) / Electronic	2	2	62	124
Common Space Types:Restrooms (66 sq.ft.)				
Linear Fluorescent 46: C1: 3' staggered strip light / 36" T8 25W / Electronic	2	2	48	96
Common Space Types:Restrooms (67 sq.ft.)				
Linear Fluorescent 47: C1: 3' staggered strip light / 36" T8 25W / Electronic	2	2	48	96
Common Space Types:Active Storage (262 sq.ft.)				
Linear Fluorescent 48: C: 4' surface strip light / 48" T8 32W (Super T8) / Electronic	2	6	62	372
Common Space Types:Electrical/Mechanical (52 sq.ft.)				
Linear Fluorescent 49: C: 4' surface strip light / 48" T8 32W (Super T8) / Electronic	2	2	62	124
Common Space Types:Electrical/Mechanical (475 sq.ft.)				
Linear Fluorescent 50: C: 4' surface strip light / 48" T8 32W (Super T8) / Electronic	2	6	62	372
Manufacturing:Detailed Manufacturing (4477 sq.ft.)				
Incandescent 1: B: Incandescent Dock Light / Incandescent 40W	1	2	40	80
Linear Fluorescent 51: C4: T5HO High Bay Fluorescent / 46" T5 HO 54W / Electronic	6	16	361	5776
Common Space Types:Electrical/Mechanical (37 sq.ft.)				
Linear Fluorescent 52: C: 4' surface strip light / 48" T8 32W (Super T8) / Electronic	2	1	62	62
Common Space Types:Audience/Seating Area (54 sq.ft.)				
Linear Fluorescent 53: A: 2x4 recessed troffer / 48" T8 32W (Super T8) / Electronic	2	1	62	62
Manufacturing:Detailed Manufacturing (2444 sq.ft.)				
Compact Fluorescent 17: L: Cord & reel insepction light / Quad 4-pin 13W / Electronic	1	2	13	26
Linear Fluorescent 54: C4: T5HO High Bay Fluorescent / 46" T5 HO 54W / Electronic	6	10	361	3610
Common Space Types:Laboratory (194 sq.ft.)				
Linear Fluorescent 55: A3: 1x4 surface fluorescent / 48" T8 32W (Super T8) / Electronic	2	4	62	248
Linear Fluorescent 56: U1: 4' undercabinet light / 48" T8 32W / Electronic	1	2	33	66
Linear Fluorescent 57: U2: 3' undercabinet light / 36" T8 25W / Electronic	1	2	26	52
Common Space Types:Electrical/Mechanical (246 sq.ft.)				
Linear Fluorescent 59: C5: 1x4 wall mount light fixture / 48" T8 32W (Super T8) / Electronic	2	1	62	62
Linear Fluorescent 58: C: 4' surface strip light / 48" T8 32W (Super T8) / Electronic	2	4	62	248

Common Space Types:Office - Enclosed (81 sq.ft.)				
Linear Fluorescent 60: A: 2x4 recessed troffer / 48" T8 32W (Super T8) / Electronic	2	1	62	62
Common Space Types:Active Storage (56 sq.ft.)				
Linear Fluorescent 61: C: 4' surface strip light / 48" T8 32W (Super T8) / Electronic	2	1	62	62
Common Space Types:Restrooms (53 sq.ft.)				
Linear Fluorescent 62: C2: 4' staggered strip light / 48" T8 32W (Super T8) / Electronic	2	1	62	62
Common Space Types:Active Storage (31 sq.ft.)				
Linear Fluorescent 63: C: 4' surface strip light / 48" T8 32W (Super T8) / Electronic	2	1	62	62
Common Space Types:Lobby (155 sq.ft.)				
Compact Fluorescent 18: D: 6" Open Reflector Can Light / Triple 4-pin 32W / Electronic	1	4	32	128
Common Space Types:Dressing/Locker/Fitting Room (173 sq.ft.)				
Linear Fluorescent 64: A: 2x4 recessed troffer / 48" T8 32W (Super T8) / Electronic	2	3	62	186
Common Space Types:Inactive Storage (74 sq.ft.)				
Linear Fluorescent 65: C7: 1x4 recessed troffer / 48" T8 32W (Super T8) / Electronic	2	3	62	186
Common Space Types:Active Storage (96 sq.ft.)				
Linear Fluorescent 66: C7: 1x4 recessed troffer / 48" T8 32W (Super T8) / Electronic	2	3	62	186
Common Space Types:Lobby (90 sq.ft.)				
Linear Fluorescent 67: A: 2x4 recessed troffer / 48" T8 32W (Super T8) / Electronic	2	2	62	124
Common Space Types:Office - Enclosed (101 sq.ft.)				
Linear Fluorescent 68: A: 2x4 recessed troffer / 48" T8 32W (Super T8) / Electronic	2	3	62	186
Sports Arena:Court Sports Area (1833 sq.ft.)				
Linear Fluorescent 69: C6: 4' surface mount wraparound / 48" T8 32W (Super T8) / Electronic	2	24	62	1488
Linear Fluorescent 70: C7: 1x4 recessed troffer / 48" T8 32W (Super T8) / Electronic	2	12	62	744
Automotive:Service/Repair (924 sq.ft.)				
Linear Fluorescent 71: C: 4' surface strip light / 48" T8 32W (Super T8) / Electronic	2	8	62	496
Common Space Types:Electrical/Mechanical (363 sq.ft.)				
Linear Fluorescent 72: C: 4' surface strip light / 48" T8 32W (Super T8) / Electronic	2	6	62	372
Common Space Types:Electrical/Mechanical (1818 sq.ft.)				
Linear Fluorescent 73: C: 4' surface strip light / 48" T8 32W (Super T8) / Electronic	2	20	62	1240
Common Space Types:Electrical/Mechanical (886 sq.ft.)				
Linear Fluorescent 74: C: 4' surface strip light / 48" T8 32W (Super T8) / Electronic	2	10	62	620
			Total Proposed Watts =	30153

Section 3: Compliance Calculation

If the Total Allowed Watts minus the Total Proposed Watts is greater than or equal to zero, the building complies.

Total Allowed Watts =	34337
Total Proposed Watts =	30153
Project Compliance =	4184

Interior Lighting PASSES: Design 12% better than code.

COM*check* Software Version 3.7.1

Exterior Lighting Compliance Certificate

90.1 (2004) Standard

Section 1: Project Information

Project Type: **New Construction**
Project Title : United States Land Port of Entry

Construction Site:
State Highway 313 N. at 410 St.
Warroad, MN 56763-9411

Owner/Agent:
GSA

Designer/Contractor:
Sebesta Blomberg

Section 2: Exterior Lighting Area/Surface Power Calculation

A Exterior Area/Surface	B Quantity	C Allowed Watts / Unit	D Tradable Wattage	E Allowed Watts (C x D)	F Proposed Watts
Driveway	158122 ft2	0.15	Yes	23718	28630
Parking area(s)	8980 ft2	0.15	Yes	1347	3220
Attached canopy	13802 ft2	1.25	Yes	17253	15854
Guarded facility, uncovered entrance/inspection area	8410 ft2	1.25	No	10513	9660
Plaza area	16316 ft2	0.2	Yes	3263	460
			Total Tradable Watts* =	45581	48164
			Total Allowed Watts =	56094	
			Total Allowed Supplemental Watts** =	2805	

* Wattage tradeoffs are only allowed between tradable areas/surfaces.

** A supplemental allowance equal to 5% of total allowed wattage may be applied toward compliance of both non-tradable and tradable areas/surfaces.

Section 3: Exterior Lighting Fixture Schedule

A Fixture ID : Description / Lamp / Wattage Per Lamp / Ballast	B Lamps/ Fixture	C # of Fixtures	D Fixture Watt.	E (C X D)
Driveway (158122 ft2): Tradable Wattage				
HID 1: S1: Type II 25' Pole Light / Metal Halide 400W / Electronic	1	55	460	25300
HID 7: S3: Wall Fixture / Metal Halide 150W / Magnetic	1	18	185	3330
Parking area(s) (8980 ft2): Tradable Wattage				
HID 2: S1: Type III 25' Pole Light / Metal Halide 400W / Electronic	1	7	460	3220
Attached canopy (13802 ft2): Tradable Wattage				
HID 3: F: 100W Canopy Fixture (Induction) / Other / --	1	95	106	10070
HID 4: F2: 70W Canopy Fixture (MH) / Metal Halide 70W / Electronic	3	20	255	5100
Incandescent 1: F1: 18W Canopy Fixture (LED) / Other	1	38	18	684
Guarded facility, uncovered entrance/inspection area (8410 ft2): Non-tradable Wattage				
HID 5: S1: Type III 25' Pole Light / Metal Halide 400W / Electronic	1	21	460	9660
Plaza area (16316 ft2): Tradable Wattage				
HID 6: S1: Type III 25' Pole Light / Metal Halide 400W / Electronic	1	1	460	460
			Total Tradable Proposed Watts =	48164

Section 4: Requirements Checklist

Lighting Wattage:

❑ 1. Within each non-tradable area/surface, total proposed watts must be less than or equal to total allowed watts. Across all tradable areas/surfaces, total proposed watts must be less than or equal to total allowed watts.

Compliance: Passes using supplemental allowance watts.

Controls, Switching, and Wiring:

❑ 2. All exemption claims are associated with fixtures that have a control device independent of the control of the nonexempt lighting.

❑ 3. All lighting fixtures are controlled by a photosensor or astronomical time switch that is capable of automatically turning off the fixture when sufficient daylight is available or the lighting is not required.
Exceptions:

Covered vehicle entrance/exit areas requiring lighting for safety, security and eye adaptation.

Exterior Lighting Efficacy:

❑ 4. All exterior building grounds luminaires that operate at greater than 100W have minimum efficacy of 60 lumen/watt.
Exceptions:

Lighting that has been claimed as exempt and is identified as such in Section 3 table above.

Lighting that is specifically designated as required by a health or life safety statue, ordinance, or regulation.

Emergency lighting that is automatically off during normal building operation.

Lighting that is controlled by motion sensor.

Exterior Lighting PASSES: Design 0.0% better than code.

Section 5: Compliance Statement

Compliance Statement: The proposed exterior lighting design represented in this document is consistent with the building plans, specifications and other calculations submitted with this permit application. The proposed lighting system has been designed to meet the 90.1 (2004) Standard requirements in COM*check* Version 3.7.1 and to comply with the mandatory requirements in the Requirements Checklist.

Name - Title	Signature	Date

COM*check* Software Version 3.7.1

Mechanical Compliance Certificate

90.1 (2004) Standard

Section 1: Project Information

Project Type: **New Construction**
Project Title : United States Land Port of Entry

Construction Site:	Owner/Agent:	Designer/Contractor:
State Highway 313 N. at 410 St. Warroad, MN 56763-9411	GSA	Sebesta Blomberg

Section 2: General Information

Building Location (for weather data):	**Warroad, Minnesota**
Climate Zone:	**7**

Section 3: Mechanical Systems List

Quantity	System Type & Description

Section 4: Requirements Checklist

COM*check* Software Version 3.7.1

Mechanical Requirements Description

90.1 (2004) Standard

United States Land Port of Entry - Warroad, MN

Exterior Lighting Fixture Schedule

Tradable Surfaces

Drives

Light Fixture Type	Lamps per Fixture	Quantity of Fixture	Fixture Wattage	Proposed Wattage
S1 - 400W - MH	1	55	460	25300
S3 - 150W - MH	1	18	185	3330
Subtotal				28630

Parking Areas

Light Fixture Type	Lamps per Fixture	Quantity of Fixture	Fixture Wattage	Proposed Wattage
S1 - 400W - MH	1	7	460	3220
Subtotal				3220

Canopies and Overhangs

Light Fixture Type	Lamps per Fixture	Quantity of Fixture	Fixture Wattage	Proposed Wattage
F - 100W - Ind	1	95	106	10070
F2 - 70W - MH	3	20	255	5100
F1 - 18W - LED	1	38	18	684
Subtotal				15854

Plaza/Special Feature Areas/Walkways > 10 feet

Light Fixture Type	Lamps per Fixture	Quantity of Fixture	Fixture Wattage	Proposed Wattage
S1 - 400W - MH	1	1	460	460
Subtotal				460
Total proposed tradable surface wattage				**48164**

Non-Tradable Surfaces

Entrances and Gatehouse Inspection Stations at Guarded Facilities

Light Fixture Type	Lamps per Fixture	Quantity of Fixture	Fixture Wattage	Proposed Wattage
S1 - 400W - MH	1	21	460	9660
Subtotal				9660
Total proposed non-tradable surface wattage				**9660**