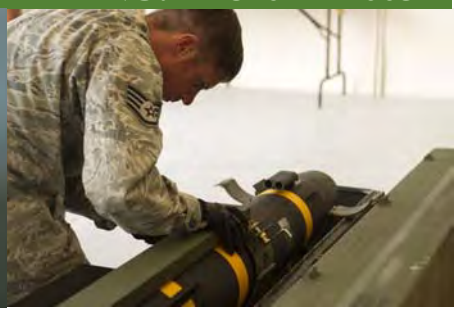
309th Software Engineering Group New Building

HILL AFB, UTAH

CAPITAL PROJECT NO. 1043925
USAF PROJECT NO. KRSM200806
DELIVERY ORDER NO. FA820122F0034





FINAL (100%) DESIGN SUBMITTAL

10 MAY 2022

DESIGN ANALYSIS VOLUME 01

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309th SWEG New Building | Hill Air Force Base, Utah
100% Design Submission

Design Analysis Narrative

01.00 Project Summary

This project provides the design of a new building at Hill AFB in support of the 309th Software Engineering Group (309th SWEG). The new building will be approximately 10,000 SF and will incorporate open/general office areas, several private offices, a break room, and other necessary support spaces. The project includes demolition and modifications to existing site features as indicated on the Civil drawings. These modifications include removal of the existing storm water retention basin located on the building site and re-routing of storm water. This building site is located at Hill Air Force Base immediately north of Georgia Street and east of Indigo Street, on vacant land north of B2720 (BOB) and south of B2721 (TINA).

The project is composed of a structurally independent office building. The new building is required to provide office space in support of the Users' ongoing mission. Project includes all supporting utilities, site improvements and pavements including access walks and connections to the existing parking lot immediately east of and adjacent to the site. Facilities are designed as permanent construction in accordance with DoD Unified Facilities Criteria (UFC) 1-200-01, General Building Requirements, and UFC 1-200-02, High Performance and Sustainable Building Requirements. This facility shall be fully accessible to all handicapped individuals in accordance with the Architectural Barriers Act (ABA).

All labor, equipment, transportation, material and supervision to perform the construction and delegated of the complete and operational facilities shall be provided by the Contractor. Construction includes all civil, architectural, geotechnical, structural, utilities, security, mechanical, electrical, demolition, and communications work to support the necessary construction.

The project includes all labor, materials, tools, equipment, and supervision necessary to provide a complete and usable project per the requirements specified in the contract documents.

This project includes Site, Civil, Utilities, Footings, Foundations and Structural, Mechanical, Electrical, Fire Protection, Fire Alarm, Communications, and Access Control Systems.

01.01 Life Safety Analysis

This facility is designed to meet or exceed the minimum construction and life safety standards as required by the referenced national and internal federal codes and criteria. The life safety design analysis is provided as required by UFC 3-600-01 Design: Fire Protection Engineering for Facilities, with the appropriate code references.

01.01.A **References:**

- UFC 1-200-01, Unified Facilities Criteria, DOD Building Code, 8 October 2019, Change 1, 1 October 2020
- UFC 3-600-01, Unified Facilities Criteria, Design: Fire Protection Engineering for Facilities, 8 August 2016 with Change 6, 6 May 2021
- International Building Code (IBC), 2021.
- NFPA 101, Life Safety Code, 2021.
- NFPA 10, Standard for Portable Fire Extinguisher, 2018.
- NFPA 80, Standard for Fire Doors and Fire Windows, 2019.
- NFPA 13, Installation of Sprinkler Systems, 2019.

01.01.B **Building Construction, Hazards and Occupancy:**

Construction:

- Comply with UFC 1-200-01, 1-1
- Comply with UFC 3-600-01, 1-3.2.1

Basic Criteria:

- Use **IBC 2018** for types of building construction, allowable floor area, building height limits, occupancy separation and building separation distance, except as modified by UFC 1-200-01 and UFC 3-600-01. (*UFC 1-200-01, 1-2; UFC 3-600-01, 2-1*)
- Use **NFPA 101** (most recent release) for means of egress, safety to life, interior finish ratings and fire resistance ratings of non-bearing partitions. For conflicts between IBC 2009 and NFPA
  101, conform to NFPA 101. (*UFC 3-600-01, 2-1.1 & 2-5*)

Occupancy:

- Business (B) Occupancy per IBC 307.4 and NFPA 101

Hazard:

- Office & support areas:
  Low Hazard per NFPA 101, 6.2.2.2

Type of Construction:

- Type IIB per IBC, Tables 503

  Note: NFPA 76 requires Type II (000) construction, as identified in NFPA 220. The IBC equivalent is given in UFC 3-600-01, Appendix E as Type IIB.

Automatic Sprinklers:

- Fully sprinklered required per UFC 3-600-01, 6-1.1

Separation of Occupancies:

- Not Applicable – Entire building is classified as B.

01.01.C **Building Height:**

For Type IIB Construction: B Occupancy
4 Stories, 75 feet IBC Allowed, Tables 504.3 and 504.4.
1 Story, 15 fee proposed.

Height and Story Modification (increase)
Not required

01.01.E **Exit Requirements:**

Occupant Load Factor
Business:
100 sf/person NFPA 101, Table 7.3.1.2
Maximum Occupancy:10,000 sf (100 sf/person) = 100 persons

Egress Capacity
Level Components:
0.2 inches/person NFPA 101, Table 7.3.3.1
20 inches and 2 exits minimum (72 inches to meet other minimum requirements for 2 individual exits)

Actual: 4 exits x 36 inches = 144 inches of exit width provided

Minimum Width of Doors.
32 inches per NFPA 101, 7.2.1.2.4
Pair of doors: at least one must be 32 inches in width.
Actual: all exit doors are 36 inches in width.

Capacity of Doors.
0.2 inches/person NFPA 101, Table 7.3.3.1

Business (B) Occupancy:
(4 doors) x (36 inches) / (0.4 inches/person) = 360 persons
Actual: 360 persons provided for;

Note: Para. 7.11.4, states not less than two means of egress shall be provided from each building or hazardous area thereof, unless all of the following criteria are met: 1) Rooms or spaces do not exceed 200 SF; 2) Rooms or spaces have an occupant load not exceeding three persons; 3) Rooms or spaces have travel distance to the room door not exceeding 25 feet.

Distance to Exits:
Business (B) Occupancy:
300 feet (with sprinklers) per NFPA 101, Table 40.2.6

Business (B) Occupancy Actual: ~100 feet (max.)

Dead End Corridors:
Business (B) Occupancy:
50’ (with sprinklers) per NFPA 101, Table A.7.6

Minimum Width of Path of Travel:
44 inches per NFPA 101, 38.2.3.2

Actual, minimum: 44 inches

Protection of Openings:
For walls & partitions with 2 hour fire-resistant-rated construction, provide 1 1/2 hour fire-resistance-rated doors per NFPA 101, Table 8.3.4.2

Maximum area of glazing in fire rated door: 1296 square inches, no dimension exceeding 54 inches per NFPA 80, Table 4.4.5, 4.4.5.1.

Interior Wall & Ceiling Finishes:
Per UFC 3-600-01, 8-1
Business (B) Occupancy:
Operating areas: Class A, Class B or Class C per NFPA 101, 40.3.3.2
Exit enclosures: as required by NFPA 101, 7.1.4

Interior Floor Finishes:
Per UFC 3-600-01, 8-1
Business (B) Occupancy:
Exits enclosures & exit access corridors: minimum Class II per NFPA 101, 40.3.3.3.1

All other areas: compliance not required per NFPA 101, 40.3.3.3.2

Roof Coverings and Roof Deck Assemblies:
Roof covering: minimum Class C per UFC 3-600-01, 2-8.1

Roof deck assemblies: no restrictions if fully sprinklered per UFC 3-600-01, 2-8.2

01.01.F **Fire Extinguishing System:**
Entire building must have sprinkler protection per UFC 3-600-01, 9-7.2

Actual: Fire sprinklers are provided

01.01.G **Portable Fire Extinguishers (GFGI):**
Light (Low) Hazard Occupancy, Class A Hazards (Office)
Minimum rated extinguisher:
2-A per NFPA 10, Table 6.2.1.1

Maximum floor area per unit of A:
3000 square feet per NFPA 10, Table 6.2.1.1

Maximum floor area per extinguisher: 11,250 square feet per NFPA 10, Table 6.2.1.1

Maximum travel distance to extinguisher: 75 feet per NFPA 10, Table 6.2.1.1

Fire Extinguishers provided: 2

01.02 **Clash Detection** Autodesk Navisworks is used for clash detection.

01.03 **Sustainability**

Design of the new facility incorporates a variety of features which recognize sustainable practices and occupant safety and comfort. Environmental sustainability will be demonstrated through a goal of achieving third party certification of Federal Guiding Principles sustainability practices. These goals have been developed and followed throughout the design and are to continue throughout construction of the facility with particular attention to providing as much natural daylight as possible to office areas, an energy conscious design through life cycle cost review of mechanical systems, careful selection of roof and other materials, landscaping for shade and water efficiency, and correct detailing and application of an insulative building envelope design. Energy modeling shows that the combination of measures results in a 36% reduction of annual energy cost over the ASHRAE baseline. An initial Federal Guiding Principles checklist has been provided as part of the submittal documentation.

02.00 Design Narratives

02.01 Civil

02.01.A **General:**

The work to include the demolition of existing improvements needed for the new improvements, building layout on site, utilities, drainage, grading, and surface improvements.

02.01.B **Site Development:**

Site work includes site grading and drainage, sidewalk, and landscaping with irrigation

02.01.C **Grading:**

Grading design complies with the following constraints:

- Away from buildings
- Earth areas minimum sloping 1% to 2%
- Earth areas for first 10-feet around building 5%
- Pipes, gutters, and swales minimum sloping 0.5%

02.01.D **Site Improvements:**

Site details will conform to Base CE details.

Pedestrian sidewalks will be 4" concrete over 6" compacted base course.

02.01.E **Storm Runoff and Drainage:**

Storm runoff has been calculated using the Hill AFB criteria. The storm frequency for the collection system shall be the 10-year storm and for surface drainage design shall be the 100-year storm. The Intensity-Duration-Frequency Curve for Hill AFB is included in the USACE criteria.

Storm drainage will be directed to existing storm collection system.

An existing storm retention basin with volume of 11,800 cubic feet will be replaced with a StormTech below ground chamber system with volume capacity of 12,190 cubic feet to maintain retention function with overflow from a new storm inlet box to flow away from buildings to Indigo Street.

02.01.F **Utilities:**

Service connection locations for water, sanitary sewer, natural gas, and electrical will be part of design. Utility water meter shall be located outside the building meeting requirements of Base Facility Standard Section 6.5 and be compatible with base EMS system as required. Non-ferrous piping will be used for the utility systems with the exception of fittings for the water system.

Cathodic protection will not be provided for all other water system ferrous fittings and appurtenances place below ground due to requirements of American Water.

Approximately 350 lineal feet of new 8-inch water main will be included in the project.

Contractor engaged by American Water will complete the construction of the 8” main line, 6” fire line to the building and the 2” water service line to the water meter. The project contractor will complete the construction of the 2” service line from the water meter to the building including providing the meter and meter can.

02.01.H **Sewer Service:**

American Water owns and operates the sewer distribution system. Sewer is operated by American water. Approximately 30 lineal feet of new sewer service lateral is needed to connect to an existing sewer main.

Contractor engaged by American Water will complete the construction of new sewer manhole and 6” sewer service line from the connection point to an existing sewer line to the sewer cleanout near the building. The project contractor will complete the construction of the 6” sewer service lateral from the sewer cleanout to the building.

02.02 Structural

02.02.A **Design Criteria:**

Referenced Codes:

- IBC 2018
- UFC 1-200-01
- UFC 3-301-01
- UFC 3-310-04
- UFC 4-010-01
- UFC 4-010-02

Risk Category: II
Roof Live Load: 20 psf
Ground Snow Load: 44 psf
Wind Criteria: 103 mph, Exposure C
Seismic Criteria: Ss = 1.246; S1 = 0.441; Sds = 0.997;
Frost Depth: 36 inches

02.02.B **Structural System:**

The foundation shall be constructed of conventional spread footings down to frost depth with foundation walls above. The exterior walls around the office space will be reinforced concrete masonry units (CMU). The roof framing shall consist predominately of steel wide flange rolled sections supported by the structural walls or wide flange steel girders, and interior tube columns. The structural roof deck shall consist of a steel corrugated deck. The lateral-force-resisting-system shall consist of shear walls made up of the reinforced masonry walls.

02.03 Architectural

This facility is intended as an office facility. The new facility will be fully accessible in keeping with USAF standards for accessibility.

02.03.A **Construction Type:**

Building is anticipated as a B Occupancy with a Type II-B construction type. Based on setback distances to other structures and provision of fire protection, this building's structure and exterior walls will be non-rated, except as required to provide required internal fire separations (if required).

02.03.B **Anti-terrorism / Force Protection:**

As a "primary gathering" building", this facility is subject to Force Protection and Anti-Terrorism criteria. These criteria are reflected primarily in placement of the building with stand-off distances to streets and POV parking in excess of that required for conventional construction. Other site features, such as refuse enclosure and landscaping will likewise be designed so as to conform with these criteria, as well as in conformance to the Hill AFB Architectural Compatibility Standards and Base Design Standards. Windows and other glazing are specified to meet AT/FP standards as applicable.

02.03.C **Site Layout:**

The site is an existing, partially-developed area, with existing paving, site storm drainage, curbs and gutters, sidewalks, and site utilities. The proposed building will be constructed as a structurally-independent, stand-alone facility. Proposed site layout is primarily determined by existing conditions. Floor elevation will, of necessity, be dictated by existing paving and accessible route, as well as site drainage requirements. The site will be leveled and the building pad developed as a component of removal of the existing storm water retention basin.

02.03.D **Building Layout:**

The new facility consists of a single primary function; that of an office facility to be occupied by 309th SWEG personnel. Building layout consists primarily of open/general office areas around the perimeter that will house systems furniture workstations. The main entry and the break room are located on opposite sides of the building. The building core contains conference rooms, private offices, restrooms, a mechanical room, and other support spaces.

Air intakes feeding air handling equipment will be mounted on the roof as required for AT/FP standards relating to fresh air intakes. Access to this equipment will be provided via an interior ladder

02.03.E **Interior Design:**

References:
U.S. Air Force Interior Design Guidelines
UFC 3-120-10, Interior Design

The selection of finishes takes environmentally sustainable attributes into consideration when selections are made. We have considered manufacturers for acoustical ceiling tile, carpet, resilient flooring, etc. as

much as possible that are closed-loop recyclable. Where possible, manufacturer's products will contain a recovered materials preference program, to assure the use of recovered materials to the maximum extent possible without jeopardizing the intended use of the item. Products meet or exceed the EPA guideline, unless written justification is provided that a product is not available competitively within a reasonable time frame, does not meet appropriate performance standards, or is only available at an unreasonable price.

Color/texture and finishes listed by manufacturer are preliminary only and are not intended to limit the selection to products of the manufacturers indicated. The selections named serve only to indicate the color and qualities which are minimum requirement guidelines, though several other materials may be appropriate. Finish selections are durable with maintenance in mind, suitable for the function and area in which they are used, and aesthetically pleasing. Finishes conform to Architectural and Interior Design Standards of Hill AFB.

Interior Finishes Color Boards are provided as a separate submittal.

02.03.F **Operation and Maintenance:**

A primary aspect of the overall and detail design will be to make this facility efficient to operate and easy to maintain. All equipment, whether interior or exterior, will be spaced and oriented to allow full and easy access for service and maintenance. Where applicable, ladders and catwalks will allow access to high- and overhead-mounted equipment. Fixtures, fittings, and equipment will be selected to comply strictly with Base standards and, where possible, to match the most common or desirable existing equipment on-base. Interconnected systems will be clearly and logically labeled to facilitate evaluation and diagnosis of any malfunction. Attic stock and replacement/service parts will be provided and labeled for ease of identification and use. Operations and Maintenance manuals will be fully assembled in a logical and understandable manner and will be labeled in coordination with equipment and systems in the building.

All O&M data will be provided in the format and media stipulated by the Government and in keeping with Base standards. As-built drawings and/or BIM model will be stipulated to be provided and will be annotated in close coordination with installed systems and the O&M manuals.

02.03.G **Landscape:**

References:
USAF Landscape Design Guide

The site will be level, the retaining wall on the west side of the site will remain undisturbed. The existing drainage basin will be converted into an underground storage basin. This basin will be placed between the building and the parking lot, allowing maximum setback from the parking lot to the building. Vegetation will provide a noise and sight buffer between the parking lot and the building. Vegetation selected is suited to the climate and compliments the surrounding landscape.

Circulation paths will provide pedestrian access around the exterior of the building. A patio will be placed at the west exit adjacent to the lunch-room area, providing an outdoor location for gathering. All hardscape areas will be ADA accessible. Site furnishings will reflect the style used on base.

02.04 Mechanical

02.04.A **Mechanical Design:**

Design Conditions:

Codes and Standards:
The new mechanical and plumbing system design will adhere to the following codes.
International Building Code – (IBC-2018 Edition)
International Mechanical Code – (IMC-2018 Edition)
International Plumbing Code – (IPC-2018 Edition)
International Fuel Gas Code – (IFGC-2018 Edition)
International Energy Conservation Code – (IECC-2018 Edition)
American Society of Heating Refrigeration and Air Conditioning Engineers (ASHRAE)
American Society of Plumbing Engineers (ASPE)
ASHRAE/IES Standard 90.1 - 2019 Edition
Current Base Facility Standard – Hill Air Force Base
United Facilities Criteria, UFC 3-410-01, Heating, Ventilating, and Air Conditioning Systems 21 Jul 2021
United Facilities Criteria, UFC 1-200-02, High Performance and Sustainable Building Requirements 03 Jan 2022
United Facilities Criteria, UFC 3-420-01, Plumbing Systems 01 April 2021

Weather Design Conditions:

Heating:	Outside Air Temperature: 12.1°F
Cooling:	90.4°F Dry Bulb / 60.4°F Wet Bulb
Interior Design Temperatures:	Heating: 70°F (Office Areas)
	68°F (Comm Room)
Cooling:	75°F (Office Areas and Comm Room)

Building Envelope:

Roof:	Overall R-Value is calculated at R-35.
Walls:	Overall R-Value is calculated at R-22.
Windows:	U=0.38, SHGC=0.38.

Outside Air and Ventilation Requirements:
Minimum outside airflow for occupant ventilation complying with the International Mechanical Code 2018 is 1,350 CFM (based on 10,000 square feet and 150 people)

02.04.B **HVAC System Summary:**

A lifecycle cost analysis (LCCA) has been performed to determine the most cost effective mechanical system for the building. The three systems that were compared are:

1. A VAV with reheat system consisting of a boiler, chiller, variable volume air handler and variable air volume zone boxes with hot water reheat.
2. Ground Source Heat Pump system with zone level heat pump units.
3. VRF System with zone level indoor VRF units.

The VAV with reheat system was proved to be the most cost effective over the 40 year life span.

The comm room will be served by a heat pump split AC unit. Exhaust will be provided in the toilet rooms, janitor closets and break room with a rooftop exhaust fan.

02.04.C **Controls System Summary:**

The facility will be UFC compliant with force protection HVAC shutdown for all fans and dampers connected to the outside air. Each zone will be controlled by temperature sensors. The provided system is of Info-Scan and MicroScan components and software, programing and graphics. Perform commissioning, point to point, functional testing and training.

02.04.2 Plumbing

02.04.1A **Plumbing System Summary:**

Plumbing systems for this facility will include required plumbing fixtures. Plumbing fixtures are specified for maximum water efficiency. Water heating will be provided by a 20-gallon electric storage type water heater with associated expansion tank, circulating pump and controls. Equipment will be laid out to provide required maintenance access space. The 140-degree F hot water will be distributed to the new plumbing fixtures per the International Plumbing and Energy Code requirements. The domestic hot water supplying the lavatory fixtures will be mixed through an ASSE 1070 listed thermostatic type mixing valve to provide <110-degree F water to these fixtures. Domestic water distribution piping will be type L copper within the building transitioning to type K copper to connect to the outside utility branch line. Piping will be laid out to ensure it is located within the building thermal envelope to prevent from freezing.

Domestic cold-water supply for the new building will be provided by a 2" water supply to meet the building peak water flow demand of approximately 35 gpm. Building static water pressure is 41 psi so a pressure reducing valve is not required. Plumbing fixtures will be specified to meet the current base standards.

Natural gas will be extended to the building to supply gas to the HVAC boiler system. A new gas meter will be provided to accommodate the new building load.

The toilet rooms, mechanical rooms, janitor, and breakroom waste will be collected and extended to connect to the sanitary waste system utilizing Schedule 40 solid wall PVC DWV pipe and fittings. Deep seal p-traps and trap guards will be specified for floor drains and floor sinks to protect drain traps from evaporation and sewer gas issues.

Roof drainage will be provided by primary and secondary (overflow) roof drains with connected drainage piping to direct the collected rainwater to the underground detention system. Piping will be 3" diameter or larger Schedule 40 solid wall PVC DWV piping.

02.05 Electrical

The Design Analysis discusses the items listed in UFC 3-501-01 Section 3-2.2.1 Electrical Analysis Software and 3-2.2.2 Electrical Calculation Summary.

Listed below is a narrative of the electrical portion of addition to existing building 831 at Hill Force Base, Utah.

02.05.A **Codes and Standards:**

Codes - the following codes and standards apply to the electrical portions of the work:
The electrical systems were designed based on the following:

- NFPA 70, National Electrical Code (NEC), 2020
- NFPA70E, Standard For Electrical Safety in the Workplace, 2015
- NFPA 101, Life Safety Code, 2021
- NFPA 780, Lightning Protection Systems, 2017
- Illuminating Engineering Society (IES)
- American National Standards Institute (ANSI)
- Institute of Electrical and Electronics Engineers (IEEE)
- National Electrical Manufacturers Association (NEMA)
- Underwriters Laboratories (UL)
- Base Facility Standard, Hill Air Force Base
- Tab K August 2011, 75th Communications Squadron Hill Air Force Base, Utah, /Telecommunications Installation Criteria for Facility Design and Renovation

02.05.B **Lighting:**

The lighting systems shall comply with the recommendations of IESNA and UFC 3-530-01for illuminance levels and controls. The lighting system consists of energy efficient linear LED luminaires. Exterior lighting will be controlled with an integral photocell and occupancy sensor. Lighting controls will follow the requirements listed in UFC-3-530-01. Interior lighting controls will use heat (passive infrared) only, no ultrasound components will be included. A lighting control system with “fail operation” will be provided for the corridor lighting.

02.05.C **Power:**

The new building electrical service will be a new 800A main switchboard and will utilize a new City Light and Power 300 kVA, 12,470V delta - 208Y/120V wye, edible seed oil-filled pad-mounted transformer. New medium voltage connections to be provided. Convenience power and power to specific equipment will be provided. Power service to all mechanical equipment will also be provided. Disconnects and controllers (either VFD's or starters) will be provided to match the mechanical equipment. The project has no external requirements for standby power. The project does not require a standby generator.

02.05.D **Lightning Protection**:

Not Applicable

02.05.E **Hazardous Classification:**

Not Applicable

02.05.F **Energy Conservation:**

The new luminaires will utilize energy saving LED lamps and drivers. The lighting component of the building energy consumption will be calculated using the lighting power density. ASHRAE 90.1 will be used to determine the allowable lighting Watts/square feet. Lighting controls will meet the requirements of UFC-3-530-01. Egress lighting will be provided by an integral battery.

02.05.G **Power Supply:**
A new 208 Volt building electric service will be used. The new switchboard will be fed from the new building transformer.

02.05.H **Fire Alarm:**
See 02.06 Fire Protection.

02.05.I **Communications Systems:**
A new 25-pair OSP copper cable and a new 72 strand fiber cable swill be provided to the building main telecommunications room and will be connected in a new telecommunications handhole west of the building. Communications distribution will be provided throughout the building with CAT6 cabling. All communications will meet TAB K requirements.

02.05.J **Access Control System and Intrusion Detection System**:
A new Access Control System (ACS) will be provided. The east and west exterior doors and the mother's room will have card readers. The main control panel will be a Vindicator V5. No Intrusion Detection System (IDS) will be included in the project.

02.05.K **Telephone Systems:**
Not Applicable.

02.05.L **System Control:**
Not Applicable.

02.05.M **Grounding:**
A new grounding system will be provided for the new building electrical service. Grounding will be provided for the communications system as outline in the EIA/TIA standards and applicable government standards.

02.05.N **Seismic Considerations:**
Seismic bracing will be provided for new electrical components as designed by the structural engineer.

02.05.P **Raised Floor Systems:**
Not Applicable.

02.05.Q **Electrical Load Analysis:**
A preliminary calculation is provided that shows the new electrical loads.

02.06 Fire Protection

02.06.A **Summary:**

Purpose: This project is required to provide the installation of a new wet-pipe automatic fire sprinkler system throughout the building.

Additional information is provided in the Architectural Design Analysis, Civil Design Analysis, Electrical Design Analysis, and Mechanical Design Analysis.

02.06.B **References:**

- International Building Code (IBC), 2018
- UFC 1-200-01, Unified Facilities Criteria, DOD Building Code, 8 October 2019, Change 1, 1 October 2020
- UFC 3-600-01, Unified Facilities Criteria, Design: Fire Protection Engineering for Facilities, 8 August 2016 with Change 6, 6 May 2021
- United Facilities Criteria (UFC) 4-010-01, DOD Minimum Antiterrorism Standards for Buildings, 1 October 2013
- United Facilities Criteria (UFC) 4-021-01, Design and O&M: Mass Notification Systems, 9 April 2008; Change 1, January 2010
- NFPA 10, Standard for Portable Fire Extinguisher, 2018
- NFPA 13, Installation of Sprinkler Systems, 2019
- NFPA 24, Installation of Private Fire Service Mains and Their Appurtenances, 2019
- NFPA 70, National Electrical Code, 2020
- NFPA 72, National Fire Alarm Code, 2019
- NFPA 90A, Standard for the Installation of Air-Conditioning and Ventilating System, 2021
- NFPA 101, Life Safety Code, 2021
- NFPA 291, Recommended Practice for Fire Flow Testing and Marking of Hydrants, 2019
- Hill Air Force Base Facility Design Guide

02.06.C **Building Code Analysis:**

Construction: New DoD facilities must comply with UFC 1-200-01
UFC 1-200-01, 1-1

New construction must comply with UFC 3-600-01
UFC 3-600-01, 1-3.2.1

Basic Criteria Use IBC 2018 for types of building construction, allowable floor area, building height limits, occupancy separation and building separation distance, except as modified by UFC 1-200-01 and UFC 3-600-01.
UFC 1-200-01, 1-2
UFC 3-600-01, 2-1

Basic Criteria Use NFPA 101 (most recent release) for means of egress, safety to life, interior finish ratings and fire resistance ratings of non-bearing partitions. For conflicts between IBC 2018 and NFPA 101, conform to NFPA 101.
UFC 3-600-01, 2-1.1 & 2-5

Refer to the architectural section of the design analysis for additional information.

02.06.D **Classification of Occupancy:**
Occupancy:
a) Offices: Business (B) Occupancy IBC 307.4

02.06.E **Compliance with UFC 3-600-01 and National Fire Codes:**
The design will comply with the UFC 3-600-01, IBC, & NFPA 101.

02.06.F **Compliance with UFC 4-021-01:**
The design will comply with the UFC 4-021-01 and NFPA 72. See electrical design analysis for additional information.

02.06.G **Requirements for Fire Rated Walls, Fire Rated Doors, Fire Dampers, Smoke Compartmentation, and Smoke Barriers:**
For fully sprinklered buildings:
No separation applicable in this building.

Note: UFC 3-600-01, Paragraph 6-2: Occupancy separation must comply with the IBC.

02.06.H **Compliance with Air Force Munitions Facilities Standards Guide (AFMFSG) and AFMAN 91-201:** (Not Applicable)

02.06.J **NFPA 101 Life Safety Code**
Hazard: Offices – Light Hazard

02.06.K **Analysis of Automatic Sprinkler Systems and Fire Suppression Systems:**
The facility contains multiple occupancy classifications as stipulated per NFPA 13 and UFC 3-600-01. Examples of such occupancy classifications are listed below:

Light Hazard:
Administrative Areas, Conference Rooms, Break Rooms, Corridors, Restrooms, etc.

Ordinary Hazard:
Janitor's Closets, Communication Rooms, Mechanical Rooms, Electrical Rooms.

02.06.L **Water Supply and Distribution, Fire Hydrants:**
A water flow test was performed near the project site. Below are the results:

Static: 41 psi
Residual: 37 psi
Flow: 870 gpm

Through calculation the fire flow available @ 20 psi is 2060 gpm

02.06.M **Smoke Control Methods and Systems:**

Smoke control for this project is provided by passive and active means. The passive means include rated construction and/or smoke barriers between exit corridors, office spaces, and occupancies. Active means of smoke control is provided by shutting down of all air handling units when duct smoke detectors activate or water switch activation. Additionally, fire/smoke dampers are located in rated construction with either duct smoke detectors or area coverage providing the detection to close the dampers.

02.06.N **Fire Alarm System, Notification**

An addressable fire alarm and mass notification system will be installed in accordance with UFC 4-021-01, UFC 3-600-01, & and NFPA 72. The system will include smoke detectors, heat detectors, duct smoke detectors, pull stations, flow switches, tamper switches, and ADA compliant notification devices. The system shall use Class B circuits. The fire alarm system and mass notification system will be interfaced and transmit signals by an RF transceiver panel to the base monitoring station. All fire alarm notification strobes will be synchronized in all areas of the building. The fire alarm/mass notification control panels will be located in a temperature and humidity controlled environment identified as the Comm Room. See the electrical portion of the design analysis for additional information.

02.06.P **Fire Detection System**

See above.

02.06.Q **Standpipes and Fire Extinguishers**

Standpipes are not required in this building by the IBC or UFC 3-600-01, 9-10.

Fire extinguishers will be provided in accordance with UFC 3-600-01 and NFPA 10.

02.06.R **Interior Finish Ratings**

Interior wall and ceiling finishes in exits shall be minimum Class A or Class B, and floor finishes in exits shall be lass I or II as outlined in NFPA 101 Section 10.2. No reduction in finish class is allowed for fully sprinklered buildings.

In all other areas Class A, B, or C ratings on walls and ceilings are acceptable.

02.06.S **Base Fire Alarm Reporting System and Connection**

The new combination fire alarm/mass notification control panel will be connected to a reporting panel and monitored by the base fire department. Coordination with the Base Fire Receiving Station and Base Fire Department will ensure proper signals are received and new transmitting equipment will be compatible with existing receiving equipment.

02.06.T **Occupancies and Hazardous Areas**

Any hazardous areas shall be identified on the architectural and fire protection drawings. An appropriate level of fire protection shall be provided in those areas.

02.06.U **Coordination with Security and Anti-terrorism Requirements**

Security and anti-terrorism/force protection guidelines applicable to the project are used as design criteria. Since the fire suppression systems are considered life safety devices, they shall be provided with sway bracing and retaining clips. Sway bracing shall be designed using a minimum seismic coefficient of 0.5g. Additionally, mass notification shall be provided in accordance with anti-terrorism requirements.

02.06.V **Fire Department Access**

Fire department access will be provided in accordance with UFC 3-600-01. All-weather ground surfaces will be provided for emergency vehicles for unimpeded access to the building. The access shall be paved, start from the road, and terminate no further than 33 ft. from the building.

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Attachment #1
Sustainability Scoresheets

Air Force Sustainability Requirements Scoresheet

HPSB COMPLIANCE (Updated Jan 2017)

* required entry

SURVEY INCOMPLETE

General Information		
	INCOMPLETE	
KRSM200806	Project ID (e.g. ABCD12345)	
	Real Property Unique ID (RPUID)	*
1043925	Facility Number	
309 SWEG	Building Name	
Hill AFB	Installation	
Ogden	City	
UT	State	
Yes	CONUS	
AFMC	MAJCOM	
	Construction Agent	*
Ramras, Jonathan	AFCEC DM/CM (Last Name, First Name)	
	PA	*
9,755	Building Size (SF)	
2022	Program Year (FY####)	
Design Complete	Project Phase	
01/08/22	Design Started (MM/DD/YY)	
05/10/22	BOD (MM/DD/YY)	
GBI GP	Guiding Principles Compliance Certification Method	
	Date Project Registered (MM/DD/YY)	
	Date Project Certified (MM/DD/YY)	
100%	HPSB Compliant	
36%	Energy Efficiency Achieved (% below ANSI/ASHRAE/IESNA Standard 90.1-2013)	
2017V1	Scoresheet version	

Air Force Sustainability Requirements Scoresheet

HPSB COMPLIANCE (Updated Jan 2017)

* required entry

Color Coding: See Instructions Tab for more detail	
Drop-Down Box	Yes or N/A
No Entry Required	No
Custom Entry	Recommended not Required

90.1-2013

HPSB I: Employ Integrated Design Principles (UFC 1-200-02 para 2-2)

Total Points 2 — Possible Points 2

Yes	HPSB I.1	**Integrated Design**	1
Yes	HPSB I.2	**Commissioning**	1

HPSB II: Optimize Energy Performance (UFC 1-200-02 para 2-3)

Total Points 5 — Possible Points 5

Yes	HPSB II.1	**Energy Efficiency**	1
		Yes — Reduce energy use 30% below ANSI/ASHRAE/IESNA Standard 90.1-2013 or IECC, or if not - achieve maximum energy efficiency that is lifecycle cost effective	
		36.0% — Insert percentage below ANSI/ASHRAE/IESNA Standard 90.1-2013 or IECC, in terms of energy use (e.g. 32)	
		79.4 — Insert building energy intensity (kBtu/yr-sqft) calculated IAW 10 CFR 433	
		Yes — Roof Attributes (Recommended)	
		1 — Select roof types (Check below)	
		☑ Cool roof ☐ Solar electric ☐ Solar Passive ☐ Green roof ☐ Solar thermal	
		Energy Efficient Products — Yes	1
Yes	HPSB II.2	**On-site Renewable Energy**	1
		Yes — Installed renewable energy elements or projects were not lifecycle cost effective	
		1 — Renewable energy types (check below)	
		☐ Solar PV ☐ Geothermal ☐ Hydro ☐ Waste to Energy ☐ Solar CP ☐ GSHP ☐ Wind ☑ Renewables were not lifecycle cost effective ☐ Solar Thermal Electric	
		0.0 — Insert generation capacity (kW)	
		0.0% — Insert percentage of total building	
Yes	HPSB II.3	**On-site Renewable Energy - Solar Hot Water Heater System**	1
		Yes — Installed solar hot water heater system or found installation not lifecycle cost effective	
		0.0 — Insert generation capacity (MMBtu/yr)	
		0.0% — Insert percentage of demand	
Yes	HPSB II.4	**Metering**	1
		Yes — Electric Metering: Select N/A if no service	
		Yes — Natural Gas Metering: Select N/A if no service	
		N/A — Steam Metering: Select N/A if no service	

HPSB III: Protect and Conserve Water (UFC 1-200-02 para 2-4)

Total Points 6 — Possible Points 6

Yes	HPSB III.1	**Indoor Water**	1
Yes		**Indoor Water Metering**	1
Yes	HPSB III.2	**Outdoor Water**	1
N/A		**Outdoor Water Metering**	1
N/A	HPSB III.3	**Alternative Water**	1
Yes	HPSB III.4	**Stormwater Management (LID Documentation per UFC 3-210-10)**	1
		14424.0 — Change in Impervious Area (SF)	
		$150,000.00 — Pre-Award Cost Estimate ($)	
		Yes — Project addressed EISA 438	
		1 — EISA Technical Constraints	
		☐ Retaining stormwater impact receving water flow ☐ Shallow bedrock, contaminated soil, high ground water table, underground utilities ☐ Soil infiltration capacity limited ☑ Site too small to infiltrate significant volume ☐ Non-potable water demand to small ☐ Structural, plumbing, and other mods not feasible ☐ State or local restrict water harvesting ☐ State or local restrict use of green ☐ Other	
		0.0% — Percent Increase in Stormwater Runoff for 95 Percentile Storm (%) - or- Percent Increase in Stormwater Runoff from continuous simulation model, published data, studies, or other established tools (Reference UFC 3-210-10 Figure 2-1 Implementation of EISA Section 438)	
		On-Site — LID Features Locations	
		2 — Integrated Management Practices Employed	

Air Force Sustainability Requirements Scoresheet

HPSB COMPLIANCE (Updated Jan 2017)

* required entry

☐ Bio-Retention	☐ Dry Wells	☐ Filter Strips	☐ Grassed Swells
☐ Infiltration Trench	☑ Inlet Pollution Removal Device	☐ Permeable Pavement/Pavers	☐ Rain Barrels/Cisterns
☐ Soil Amendments	☐ Tree Box Filters	☑ Vegetated Buffers	☐ Vegetated Roof
☐ Other			

$0.00	Final LID Construction Cost ($)	
Steve Jackson, PE	Post Construction Analysis (Name of DOR)	

HPSB IV: Enhance Indoor Environmental Quality (UFC 1-200-02 para 2-5)					
Total Points	**8**			Possible Points	8
Yes	HPSB IV.1	**Thermal Comfort**			1
Yes	HPSB IV.2	**Ventilation**			1
Yes	HPSB IV.3	**Daylighting**			1
Yes	HPSB IV.4	**Moisture Control**			1
Yes	HPSB IV.5	**Low Emitting Materials**			1
Yes	HPSB IV.6	**Protect Indoor Air Quality during Construction**			1
Yes	HPSB IV.7	**Environmental Tobacco Smoke Control**			1
N/A	HPSB IV.8	**Occupant Health and Wellness**			1
HPSB V: Reduce Environmental Impact of Materials (UFC 1-200-02 para 2-6)					
Total Points	**5**	**INCOMPLETE**		Possible Points	5
Yes	HPSB V.1	**Recycled Content**			1
Yes	HPSB V.2	**Biologically-based Products**			1
Yes	HPSB V.3	**Ozone Depleting Substances**			1
Yes	HPSB V.4	**Waste and Materials Management - Recycling**			1
N/A	HPSB V.5	**Waste and Materials Management - Divert 60% from Disposal**			1
		N/A	60% or greater diverted		
			Insert percentage diverted from landfill		*
HPSB VI: Address Climate Change Risk (UFC 1-200-02 para 2-7)					
Total Points	**1**			Possible Points	1
Yes	HPSB VI.1	**Address Climate Change Risk**			1
				Possible Points	**27**
27	**Federal Requirements - Yes or N/A**				
0	**Federal Requirements - No**				
100%	**Percentage of Federal Requirements Met**				

Federal Requirements for High Performance and Sustainable Buildings (HPSB) & UFC 1-200-02

Instructions: Provide a common or project specific justification for an element to be non-applicable, when completed, the Scoresheet tab will allow an N/A response.

Justification for Non-Applicable Answers		Common Justification	Project Specific Justification	Complete?
HPSB I: Employ Integrated Design Principles (UFC 1-200-02, 2-2)				
HPSB I.1	**Integrated Design**			Applicable
HPSB I.2	**Commissioning**			Applicable
HPSB II: Optimize Energy Performance (UFC 1-200-02, 2-3)				
HPSB II.1	**Energy Efficiency**			Applicable
HPSB II.1	**Energy Efficient Products**			Applicable
HPSB II.2	**On-site Renewable Energy**			Applicable
HPSB II.3	**On-site Renewable Energy - Solar Hot Water Heater System**			Applicable
HPSB II.4	**Metering**			
HPSB II.4	Electric Metering: Select N/A if no service			Applicable
HPSB II.4	Natural Gas Metering: Select N/A if no service			Applicable
HPSB II.4	Steam Metering: Select N/A if no service	NA Location/Regional Restriction	No steam provided to the building location.	**Yes**
HPSB III: Protect and Conserve Water (UFC 1-200-02, 2-4)				
HPSB III.1	**Indoor Water**			Applicable
HPSB III.1	Indoor Water Metering: Select N/A if no service			Applicable
HPSB III.2	**Outdoor Water**			Applicable
HPSB III.2	Outdoor Water Metering: Select N/A if no service	NA LCCE	Landscaping is less than 25,000sf and does not require metering.	**Yes**
HPSB III.3	**Alternative Water**	NA Location/Regional Restriction	No alternative water sources available. Rainwater collection is difficult in the desert climate and requires problematically large collection.	**Yes**
HPSB III.4	**Stormwater Management**			
HPSB III.4	Project addressed EISA 438	NA Locale Restriction	The building addition is constructed in an already developed area of base with exisitng paving for parking, sidewalks and stormwater conveyance.	Applicable
HPSB IV: Enhance Indoor Environmental Quality (UFC 1-200-02, 2-5)				
HPSB IV.1	**Thermal Comfort**			Applicable
HPSB IV.2	**Ventilation**			Applicable
HPSB IV.3	**Daylighting**			Applicable
HPSB IV.4	**Moisture Control**			Applicable
HPSB IV.5	**Low Emitting Materials**			Applicable
HPSB IV.6	**Protect Indoor Air Quality during Construction**			Applicable
HPSB IV.8	**Occupant Health and Wellness**	NA Location/Regional Restriction	Project is limited on space and facilities to provide fitness areas or opportunities for Occupant Health. However daylighting opportunities are being explored.	**Yes**
HPSB V: Reduce Environmental Impact of Materials (UFC 1-200-02, 2-6)				
HPSB V.1	**Recycled Content**			Applicable
HPSB V.2	**Biologically based products**			Applicable
HPSB V.3	**Ozone Depleting Substances**			Applicable
HPSB V.4	**Waste and Materials Management - Recycling**			Applicable

HPSB V.5	**Waste and Materials Management - Divert 60% from Disposal**		To be determined in construction.	Applicable
HPSB VI: Adress Climate Change Riskd (UFC 1-200-02, 2-7)				
HPSB VI.1	**Address Climate Change Risk**			Applicable

High Performance Sustainable Building Requirements	
References	
Executive Order (EO) 13693, Planning for Federal Sustainability in the Next Decade	
	HPSB I: Employ Integrated Design Principles
Integrated Design **HPSB I.1** **UFC 1-200-02 para 2-2.1**	Incorporate the following planning and evaluation into the integrated design, as described in ASHRAE 189.1 Informative Appendix F (Integrated Design). Follow the steps of design optimization, as applicable, in ASHRAE 189.1 Section F1.1.1 (Charrette Process). Use a collaborative, integrated planning and design team, composed of user, government support staff, and appropriate professionals, to identify requirements and to establish performance goals for siting, energy, water, materials, indoor environmental quality, and other comprehensive design goals. Ensure incorporation of these goals throughout the design and lifecycle of the building, including deconstruction. Evaluate the site and building components to determine whether passive and natural design strategies and features are cost effectively incorporated before the active and mechanical systems are designed. Incorporate these features where applicable. Take into account site attributes, including climate and local and regional context, which impact the design of the building. During the site selection process, meet the requirements of UFC 2-100-01. See Appendix B “Best Practices” for desirable site characteristics. During the planning and design process meet the requirements of applicable UFCs, and use the following site development considerations and passive strategies: • Site design elements that ensure safe and convenient pedestrian access. • Meet the requirements of UFC 3-201-02. • Incorporate results of site analysis, in order to design the building, focusing on orientation, configuration and massing. • Orient building to maximize energy efficiency, passive solar and daylighting potential. • Select, design and integrate into the overall building, high performance and sustainable systems (e.g., HVAC, plumbing, water heating systems, lighting systems, control systems, elevators, building envelope and fire protection systems). • Promote opportunities for occupants to voluntarily increase physical movement such as making stairwells a desirable option for circulation and active workstations.
Commissioning **HPSB I.2** **UFC 1-200-02 para 2-2.2**	In order to verify design and performance, and ensure that the Government requirements are met, employ commissioning practices appropriate to the size and complexity of the building and its system components. This must include an experienced commissioning provider, who should be independent of the project design and construction team, and the operations team. The choice of either contracted services or Government personnel to serve as the commissioning provider will be determined at project level. Meet the requirements of ASHRAE 189.1 Section 10.3.1.2 (Building Project Commissioning), with the following modifications: • For buildings and systems that are less complex6, commissioning may be tailored as determined by the DOD Component AHJ. • “Schematic design” is the design charrette or similar conceptual design activity. • Documentation as described in ASHRAE 55 Section 6.2 is not required. For Air Force projects, the Project Delivery Team must determine the level of commissioning activities required.
Requirement Source Document(s)	Executive Order 13693 UFGS 01 91 00.15, Total Building Commissioning

High Performance Sustainable Building Requirements	
	HPSB II: Optimize Energy Performance
Energy Efficiency **HPSB II.1** **UFC 1-200-02 para 2-3.1**	Energy Efficiency - Base energy efficiency design decisions on life-cycle cost as indicated in Chapter 1 of UFC 1-200-02. Commercial and Multi-Family High-Rise Residential Buildings: • Meet the requirements of ASHRAE 90.1. Use ASHRAE 90.1(2010) for all projects with design starts before November 6, 2016. Use ASHRAE 90.1(2013) thereafter. • Design the building to achieve at least 30% energy consumption reduction from ASHRAE 90.1 baseline. • If a 30% reduction is not LCCE, modify the design of the proposed building to achieve an energy consumption level at the highest level of energy efficiency that is LCCE. • Determine energy consumption levels for both the ASHRAE Baseline Building and proposed building by using the Performance Rating Method found in appendix G of ASHRAE 90.1, except the formula for calculating the Performance Rating. Replace the formula in G1.2 with the following: Percentage improvement = 100 × ((Baseline building consumption − Receptacle and process loads) − (Proposed building consumption − Receptacle and process loads)) / (Baseline building consumption − Receptacle and process loads) Low-Rise Residential Buildings: • Meet the requirements of International Energy Conservation Code (IECC). • Design the building to achieve at least 30% energy consumption reduction from the IECC baseline using the Simulated Performance Alternative found in Section 405 of the IECC. • If a 30% reduction is not LCCE, modify the design of the proposed building to achieve an energy consumption level at the highest level of energy efficiency that is LCCE. Renovations: • Renovation projects that replace everything above the foundation must either apply 2-3.1.1 or 2-3.1.2 as applicable. • All other renovations choose one of the following options: 1. Reduce measured building energy use by at least 30%, below FY 2003 energy use baseline. 2. Reduce measured building energy use by at least 20% below FY 2015 energy use baseline. 3. Reduce modeled energy use (from all sources including renewable energy) by 20% compared to the ASRHAE 90.1 baseline building design. • If none of the reduction choices is life-cycle cost-effective, modify the design of the proposed building system(s) to achieve an energy consumption level at the highest level of energy efficiency that is life-cycle cost-effective.
Energy Efficient Products **HPSB II.1** **UFC 1-200-02 para 2-3.1.4**	Energy Efficient Products – Per EISA 2007 Section 525, acquire products that are ENERGY STAR®-qualified or meet FEMP-designated efficiency requirements in all covered product categories. Select products based on life cycle cost, not initial cost. Link to EPA sites: http://www.energystar.gov/ or http://www1.eere.energy.gov/femp/ Per EISA 2007 Section 524, provide commercially available, off-the-shelf products that use no more than 1 watt in their standby mode.
Requirement Source Document(s)	10 CFR 433, EPAct 05
Links	Energy Star® Federal Energy Management Program

High Performance Sustainable Building Requirements	
On-site Renewable Energy **HPSB II.2** **UFC 3-440-01 para 2-3.2**	Provide on-site renewable energy systems in accordance with ASHRAE 189.1 Section 7.4.1.1 (On-Site Renewable Energy Systems) and UFC 3-440-01 where LCCE, considering climate, infrastructure condition, mission compatibility, and effects on base wide electrical system (grid) power quality. Exception: Do not use purchase of renewable energy certificates (RECs) as a substitute for the Section 7.4.1.1 new building requirement. Air Force will utilize an installation-level solution to renewable energy systems and will not require ASHRAE 189.1 Section 7.3.2 if a building-level solution is not LCCE.
Requirement Source Document(s):	Executive Order 13693
On-Site Renewable Energy – Solar Hot Water Heater System **HPSB II.3** **UFC 1-200-02 para 2-3.2.1**	Per EISA 2007 Section 523, meet at least 30% of the annual domestic hot water requirement through the installation of solar water heating unless SDHW is not LCCE. If 30% is not LCCE, modify the design of the proposed system to achieve the highest level of solar water heating that is LCCE.
Requirement Source Document(s):	

High Performance Sustainable Building Requirements	
Measurement and Verification **HPSB II.4** **UFC 1-200-02 para 2-3.4**	A utility meter must be installed at each building, for each utility serving the building (e.g., district steam, district hot and chilled water, electricity, natural gas, fuel oil, etc.) in the standard units of the measure. Meters must be connected to a base wide energy and utility monitoring and control system using the installation's advanced metering protocols. The installation of meters is required per DODI 4170.11, and as amended by DOD Utilities Meter Policy, 16 April 2013.
Requirement Source Document(s):	Federal Leadership in High Performance and Sustainable Buildings MOU
	HPSB III: Protect and Conserve Water
Indoor Water **HPSB III.1** **UFC 1-200-02 para 2-4.1**	Indoor Water – Base water efficiency design decisions on life-cycle cost as indicated in Chapter 1 of UFC 1-200-02. • Meet the requirements of ASHRAE 189.1 Section 6.3.2 (Building Water Use Reduction), which incorporates USEPA WaterSense-labeled products. Water closet replacements in renovations may have a flush value of up to 1.6 GPF (6.1 LPF) to accommodate existing plumbing capacity. • Meet the requirements of ASHRAE 189.1 Section 6.4.2 (Building Water Use Reduction). • Meet the requirements of ASHRAE 189.1 Section 6.4.3 (Special Water Features).
Indoor Water Metering **HPSB III.1** **UFC 1-200-02 para 2-4.1.1**	Indoor Water Metering -- Install advanced water meters to monitor building indoor potable water consumption, as required by DOD Utilities Meter Policy, 16 April 2013.
Requirement Source Document(s):	EPAct 1992
Outdoor Water **HPSB III.2** **UFC 1-200-02 para 2-4.2**	Outdoor Water -- • Limit potable irrigation water use by 50% compared to the conventional methods, and when LCCE, by using the methodologies in ASHRAE 189.1: Section 6.3.1 (Mandatory Provisions: Site Water Use Reduction) and either Section 6.4.1 (Prescriptive Option: Site Water Use Reduction) or Section 6.5.1 (Performance Option: Site Water Use Reduction). • For existing systems, if a building has a single water meter, reduce indoor and outdoor potable water use combined by at least 20% compared to building water use in 2007. Compare results to a baseline building, using the EPA WaterSense landscape water budget tool version 1.01 or later, or a Component approved tool. • Show preference for irrigation contractors who are certified through a WaterSense labeled program, or other industry-recognized credentialing programs. • Refer to UFC 3-201-02 for additional requirements.
Outdoor Water MeteringWater **HPSB III.2** **UFC 1-200-02 para 2-4.2.1**	Water metering for landscaping – When potable water is used, provide water meters for irrigation systems serving more than 25,000 square feet of landscape, when life-cycle cost-effective. Install advanced water meters to monitor outdoor potable water consumption, as required by DOD Utilities Meter Policy, 16 April 2013. For all other irrigation systems, separate water meters for locations with outdoor water use are encouraged.
Requirement Source Document(s):	Executive Order 13693
Alternative Water **HPSB III.3** **UFC 1-200-02 para 2-4.3**	Where life-cycle cost-effective and permitted by local laws and regulations, use alternative water sources, such as harvested rainwater, treated wastewater, air handler condensate capture, grey water, and reclaimed water.
Requirement Source Document(s):	

High Performance Sustainable Building Requirements	
Stormwater Management **HPSB III.4** **UFC 3-210-10 para 2-4.3.1**	The criteria and design standards in UFC 3-210-10 are required for the planning, design and construction of all Department of Defense (DoD) projects in the United States, United States Territories and Possessions of the United States that meet both of the following conditions: 1) The project includes construction or expansion of one or more buildings as part of its primary scope (i.e., primary facilities vice supporting facilities). 2) The “footprint” is greater than 5,000 gross square feet (464.5 square meters). “Footprint” consists of all new impervious surfaces associated with the building(s), including both building area and pavement area of associated supporting facilities (such as parking and sidewalks). “Footprint” does not include existing building area to be renovated, existing pavement area to be resurfaced, or new pavement area other than supporting facilities associated with the building(s). For projects in the United States, United States Territories, and Possessions of the United States that do not meet the applicability requirements above, LID techniques apply to the extent practical.
Requirement Source Document(s):	EISA 2007 Sec 438

High Performance Sustainable Building Requirements	
	HPSB IV: Enhance Indoor Environmental Quality
Thermal Comfort **HPSB IV.1** **UFC 1-200-02 para 2-5.1**	Meet the requirements of ASHRAE 55. Compliance with standards by providing passive (non-mechanical) thermal comfort methods are allowed and encouraged as described in paragraph entitled, “Integrated Design” in UFC 1-200-02. Exception: For Medical Treatment Facilities, refer to UFC 4-510-01 Medical Military Facilities for thermal comfort criteria.
Requirement Source Document(s):	Executive Order 13693
Ventilation **HPSB IV.2** **UFC 1-200-02 para 2-5.1**	Meet the requirements of ASHRAE 62.1 (62.2 for low-rise residential). Exception: For Medical Treatment Facilities, refer to UFC 4-510-01 Medical Military Facilities for ventilation criteria.
Requirement Source Document(s):	Executive Order 13693
Daylighting **HPSB IV.3** **UFC 1-200-02 para 2-5.2**	All regularly occupied spaces located on the exterior wall must have vision fenestration. Where mission precludes vision fenestration for regularly occupied spaces located on the exterior wall, daylighting is still required. All classrooms and offices must have daylighting. Meet the requirements of ASHRAE 189.1 Section 8.4.1.2 (Minimum Sidelighting effective Aperture for Office Spaces and Classrooms) or Section 8.5.1.2 (Usable Daylight Illuminance in Office Spaces and Classrooms). Provide automated lighting controls in accordance with UFC 3-530-01. Exception: For Medical Treatment Facilities, refer to UFC 4-510-01 Medical Military Facilities for additional daylighting criteria.
Requirement Source Document(s):	Executive Order 13693
Moisture Control **HPSB IV.4** **UFC 1-200-02 para 2-5.3.1**	Establish and implement a moisture control strategy for controlling moisture flows and condensation to prevent building damage, minimize mold contamination, and reduce health risks related to moisture. Meet the requirements of ASHRAE 189.1 Section 10.3.1.5 (Moisture Control), UFC 3-410-01, Chapter 3, Sections 3-2 and 3-3 (Ventilation Air), and UFC 3-101-01 Chapter 3 (Building Envelope Requirements). Refer to Appendix B “Protect Indoor Air Quality” for best practices.
Requirement Source Document(s):	Executive Order 13693
Low Emitting Materials **HPSB IV.5** **UFC 1-200-02 para 2-5.3.2**	Specify materials and products with low or no pollutant emissions, including composite wood products, adhesives, sealants, interior paints and finishes, carpet systems, and furnishings. Meet the requirements of ASHRAE 189.1 Section 8.4.2 (Prescriptive Option: Materials). Exception: Exclude compliance with 8.4.2, first sentence.
Requirement Source Document(s):	Executive Order 13693
Protect Indoor Air Quality during Construction **HPSB IV.6** **UFC 1-200-02 para 2-5.3.3**	For new construction and for renovation of unoccupied existing buildings, comply with ASHRAE 189.1 Section 10.3.1.4 (Indoor Air Quality (IAQ) Construction Management), with maximum outdoor air consistent with achieving relative humidity no greater than 60%. For renovation of occupied existing buildings, comply with ANSI/SMACNA 008-2008, 2nd Edition, SMACNA IAQ Guidelines for Occupied Buildings Under Construction.
Requirement Source Document(s):	Executive Order 13693

High Performance Sustainable Building Requirements	
Environmental Tobacco Smoke Control HPSB IV.7 UFC 1-200-02 para 2-5.3.4	Prohibit smoking within the building and within a minimum of 50 feet (15.24 meters) of all building entrances, operable windows, and building ventilation intakes. Verify if more stringent facility criteria or Installation policy applies.
Requirement Source Document(s):	Federal Register: December 22, 2008 (Volume 73, Number 246) - EO 13058
Occupant Health and Wellness HPSB IV.8 UFC 1-200-02 para 2-5.4	Promote opportunities for occupants to voluntarily increase physical movement such as making stairwells a desirable option for circulation, active workstations, fitness centers, and bicycle commuter facilities. Support occupant health by considering options such as providing convenient access to healthy dining options, potable water, daylight, plants, and exterior views. Indicate in the Integrated Design Process how these efforts were evaluated.
Requirement Source Document(s):	

High Performance Sustainable Building Requirements	
	HPSB V: Reduce Environmental Impact of Materials
Recycled Content **HPSB V.1** **UFC 1-200-02 para 2-6.1.1**	Use RCRA Section 6002 compliant products that meet or exceed EPA's recycled content recommendations, available on EPA's Comprehensive Procurement Guideline web site at http://www.epa.gov/
Requirement Source Document(s):	RCRA 2002, Sec 6002
Biologically-based Products **HPSB V.2** **UFC 1-200-02 para 2-6.1.2**	Per Section 9002 of the Farm Security and Rural Investment Act, specify products composed of the highest percentage of biobased content consistent with the USDA BioPreferred Program, if products meet performance requirements and are available at a reasonable cost. Exceptions taken to biobased product procurement must be documented. A preference for purchasing products with the highest biobased content per USDA recommendations for designated product categories must be included in all applicable solicitations. USDA's biobased product designations and biobased content (which includes certified sustainably-harvested and rapidly renewable resources) recommendations are available on USDA's BioPreferred web site at http://www.biopreferred.gov/
Requirement Source Document(s):	FSRIA 2002 Section 9002
Environmentally Preferable Products **HPSB V.3** **UFC 1-200-02 para 2-6.1.4**	Meet the requirements of ASHRAE 189.1 Section 9.3.3 (Refrigerants), if equipment or systems using ozone depleting substances are included in the project. Do not use ozone depleting substances (ODS) or high Global Warming Potential (GWP) chemicals where EPAs Significant New Alternative Policy (SNAP) has identified acceptable substitutes or where other environmentally preferable products are available for use in construction, repair or end-of-life replacements: www.epa.gov/snap Exceptions: Refer to UFC 3-600-01 for fire protection system requirements.
Requirement Source Document(s):	Executive Order 13693
Waste and Materials Management - Recycling **HPSB V.4** **UFC 1-200-02 para 2-6.2.1**	Meet the requirements of ASHRAE 189.1 Section 9.3.4.1 (Storage and Collection of Recyclables – Recyclables), where markets or onsite recycling exist.
Requirement Source Document(s):	Executive Order 13693
Waste and Materials Management, Divert 60% from Disposal **HPSB V.5** **UFC 1-200-02 para 2-6.2.2**	Divert minimum 60% of nonhazardous construction and demolition waste material from landfills.
Requirement Source Document(s):	Executive Order 13693
	UFGS 01 74 19, Construction and Demolition Waste Management

Attachment #2
Plumbing & Mechanical
Calculations and Cutsheets

309th SWEG New Building | Hill Air Force Base, Utah

100% Design Submission

Plumbing and Mechanical Data Sheets

Plumbing
Plumbing Calculations - Pages 2-4
Plumbing Equipment – Pages 5-33

Mechanical
Heating and Cooling Calculations – Pages 34-105
Air Handling Unit – Page 106-111
Chiller – Pages 112-122
Boiler – Pages 123-127
HW & CHW Pumps – Pages 128-133
VAVR Boxes – Page 134
Louvered Penthouse – Page 135
Relief Air Fans – Page 136
Rooftop Exhaust Fan – Page 137
Split AC Unit – Pages 138-145
LCCA – Pages 146-221

Domestic Water Pressure Calculations

Job Name	309th Software Engineering Group
Job No.	22008
Prepared By:	RJK
Checked By:	RJK
Rain Fall Rate:	1.2
Location:	Hill AFB

PRESSURE AVAILABLE FOR FRICTION

PRESSURE AT Entry	PRESSURE AT HIGH FIXTURE	MAX. RISE (FEET)	WATER METER (psi)	PRV LOSS (psi)	RPBP OR D.CHECK (psi)	AVAILABLE PRESS. FOR FRIC. (APF)	FRICTION LOSS/100 (FL) FEET
41	25	8	0	0	0	12.56	**6.41**
ASSUMED						FL/100 = APF x 100 / TDL	

DEVELOPED LENGTH (Assuming average diameter of 1-1/2"

DESCRIPTION	No.	FT.EQ.	TOTAL FT.EQ.
ELBOW-90	12	5.5	66
TEE	3	9	27
TEE-STRAIGHT	2	0.5	1
B.VALVES	4	0.5	2
	EQUIVALENT PIPE LENGTH		96
	DEVELOPED LENGTH		100
	TOTAL DEVELOPED LENGTH (TDL)		**196**

Water And Drainage Fixture Units (Total Building)

Job Name 309th Software Engineering Group
Job No. 22008
Prepared By: RJK
Checked By: RJK

FIXTURE DESCRIPTION		No.	Each Fixture F/U (H & CW)	Each Fixture F/U CW	Each Fixture F/U HW	Total F/U (H & CW)	Total F/U CW	Total F/U HW	Each Fixture F/U	Each Fixture Minimum Trap Size	Total F/U
WATER CLOSET	Private - Flush valve		6.0	6.0	-			-	4	Footnote d	
WATER CLOSET	Private - Flush Tank		2.2	2.2	-			-	3	Footnote d	
WATER CLOSET	Public - Flush Valve	5	10.0	10.0	-	**50**	**50**	-	6	Footnote d	**30**
WATER CLOSET	Public - Flush Tank		5.0	5.0	-			-	4	Footnote d	
URINAL	Public - 1" flush valve		10.0	10.0	-			-	4	Footnote d	
URINAL	Public - 3/4" flush valve	3	5.0	5.0	-	**15**	**15**	-	4	Footnote d	**12**
URINAL	Public - flush tank		3.0	3.0	-			-	2	1-1/2	
LAVATORY	Private		0.7	0.5	0.5				1	1-1/4	
LAVATORY	Public	6	2.0	1.5	1.5	**12**	**9**	**9**	1	1-1/4	**6**
WASH SINK	(circular or multiple)		2.0	1.5	1.5				2	1-1/2	
	each set of faucets		-	-	-	**-**	**-**	**-**	-	-	**-**
KITCHEN SINK	Private		1.4	1.0	1.0				2	1-1/2	
KITCHEN SINK	Hotel, restaurant		4.0	3.0	3.0				2	1-1/2	
SINK		1	1.4	1.0	1.0	**1**	**1**	**1**	2	1-1/2	**2**
SERVICE SINK	Offices, etc.	1	3.0	2.25	2.25	**3**	**2**	**2**	3	3	**3**
DRINKING FOUNTAIN	Offices, etc.	1	0.25	0.25	-	**0**	**0**	-	1/2	1-1/4	**1**
SHOWER HEAD	Public		4.0	3.0	3.0				2	1-1/2	
SHOWER HEAD	Private		1.4	1.0	1.0				2	1-1/2	
BATHTUB	Private		1.4	1.0	1.0				2	1-1/2	
BATHTUB	Public		4.0	3.0	3.0				2	1-1/2	
WASHING MACHINE	Private - Automatic - 8lbs.		1.4	1.0	1.0				2	2	
WASHING MACHINE	Public - Automatic - 8lbs.		3.0	2.25	2.25				3	2	
WASHING MACHINE	Public - Automatic - 15lbs.		4.0	3.0	3.0				3	2	
LAUNDRY TRAYS	Private		1.4	1.0	1.0				2	1-1/2	
DISHWASHING MACHIN	Private - Automatic		1.4	-	1.4				2	1-1/2	
EMERGENCY FLOOR DRAIN			-	-	-	**-**	**-**	**-**	0	2	
FLOOR DRAINS		7	-	-	-	**-**	**-**	**-**	2	2	**14**
COMBINATION FIXTURE	Private		3.0	2.25	2.25				2	1-1/2	
BATHROOM GROUP	Private - Flush Tank		3.6	2.7	1.5				5	-	
BATHROOM GROUP	Private - Flush Valve		8.0	6.0	3.0				6	-	
BIDET	Private		2.0	1.5	1.5				1	1-1/4	
DENTAL LAVATORY			0.7	0.5	0.5				1	1-1/4	
DENTAL UNIT	Or cuspidor		0.3	0.3	0.3				1	1-1/4	
					Total	**81.65**	**77.5**	**12.25**		Total	**67.5**

Equipment And Fixture Unit Calculations

Job Name 309th Software Engineering Group
Job No. 22008
Prepared By: RJK
Checked By: RJK

Building Domestic Cold Water Pipe Size Calculation:

81.65 Fixture Units = 61 GPM - Obtained from Table E102
( ) Flush Tank)
(x Flush Valve)

Obtain Pipe Size From Figure E103C (Attached)
Pipe Size = 2 1/2 " @ 5 F.P.S. with 2.6 max psi loss

Building Domestic Hot Water Pipe Size Calculation:

12.25 Fixture Units = 16 GPM - Obtained from Table E102

Obtain Pipe Size From Figure E103C (Attached)
Pipe Size = 1 1/4 " @ 5 F.P.S. with 5.0 max psi loss

Water Heating Sizing Calculations:

Total Demand (TD)	**56**
Demand Factor (DF)	**0.30**
Storage Factor (SF)	**1.00**
MINIMUM RECOVERY(gph) = TD * DF =	**16.8**
MINIMUM STORAGE CAPACITY (gallons) = TD * DF =	**16.8**
Water Heater Selection Calculations	
MBTUH Input Required = r(cw)(deltaT)/1000	**12.595**
ROUNDED STORAGE CAPACITY	**100**
r = Flow rate, gph (L/h)	
c = Specific heat of water (Btu/lb/degreef (kJ/kg/K)	
w = Weight of heated water, lb (kg)	
delta T = Change in heated water temperature (140-50=90)	

From ASPE Data Book, Page 4.14

Building Type	Demand Factors	Storage Factors
Apartment House	**0.30**	**1.25**
Club	**0.30**	**0.90**
Gymnasium	**0.40**	**1.00**
Hospital	**0.25**	**0.60**
Hotel	**0.25**	**0.80**
Ind. Plant	**0.40**	**1.00**
Office Building	**0.30**	**2.00**
Residence	**0.30**	**0.70**
School	**0.40**	**1.00**
YMCA	**0.40**	**1.00**

KOHLER®

Highcliff™ Ultra

Top spud flushometer bowl

K-96057

Features

- Elongated bowl offers added room and comfort.
- 1-1/2" (38 mm) top spud.
- 2-1/8" (54 mm) fully glazed trapway.
- 10" x 7" (254 mm x 178 mm) water surface.
- 1.0 gpf (3.8 lpf), 1.1 gpf (4.2 lpf), 1.28 (4.8 lpf), or 1.6 gpf (6.0 lpf) depending on flushometer specified.
- Also available with antimicrobial finish K-96057-SS.
- 10" or 12" (254 or 305 mm) rough-in.
- Supports static load of 2,500 lbs.

Material

- Vitreous china.

Technology

- Designed to outperform competitors in bowl cleanliness and plug resistance.
- Maximum waste removal.
- Enginnered for toilet seat cover removal.
- Excellent bowl rinse.
- Engineered to flush effectively in buildings with low supply pressure and flow.
- Maximum drain line carry at all flush volumes per ASME standard.

Installation

- Replaces Highcrest K-4302, Highcliff K-4368 and Highline K-4405. Height and footprint may vary.

Included Components

Additional Components:

Bolt cap accessory pack
Spud



WaterSense Meets EPA Criteria
Certified by IAPMO R&T

ADA | **CSA B651** | **OBC**

Codes/Standards

ASME A112.19.2/CSA B45.1
DOE - Energy Policy Act 1992
EPA WaterSense®
California Energy Commission (CEC)
ADA
ICC/ANSI A117.1
CSA B651
OBC

KOHLER® One-Year Limited Warranty

See website for detailed warranty information.

Available Colors/Finishes

Color tiles intended for reference only.

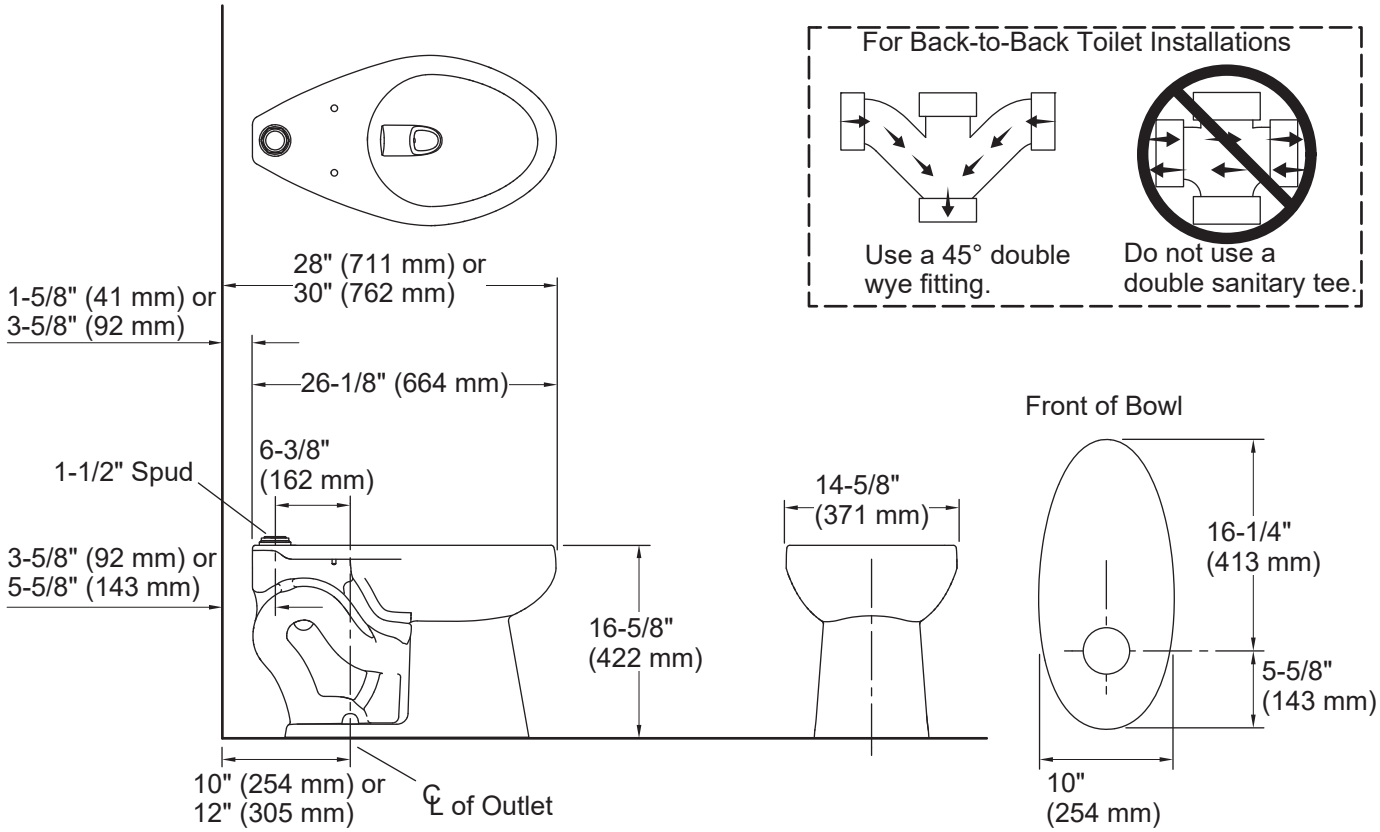
Color	Code	Description
	0	White
	96	Biscuit
	47	Almond
	7	Black Black™

KOHLER®

Highcliff™ Ultra

Top spud flushometer bowl

K-96057



Technical Information

All product dimensions are nominal.

Toilet type:	Flushometer, Floor-mount
Waste Outlet:	Floor
Bowl shape:	Elongated
Flush type:	Flushometer valve siphon
Spud size:	1 1/2, Inlet, Top
Trap passageway:	2-1/8" (54 mm)
Water Consumption	
Full:	1.6 gpf (6 lpf)
Reduced:	1 gpf (3.8 lpf)
Water surface size:	10" x 7" (254 mm x 178 mm)
Rim to water surface:	6" (152 mm)
Rough-in:	10" (254 mm)
Seat-mounting holes:	5-1/2" (140 mm)

Fixture Supply Requirements

Min static pressure: 35 psi (241.3 kPa)

Notes

Install this product according to the installation instructions.

For back-to-back toilet installations: Use only a 45° double wye fitting.

ADA, OBC, CSA B651 compliant when installed to the specific requirements of these regulations.

Plumbing codes may require elongated toilets and elongated, open-front seats in public bathrooms.

Accessibility standards may require controls to be located on the open side of the toilet.

REGAL 111

OPTIONS

Flush Volume

- 1.6 gpf (6.0 Lpf) (1.6)
- ✓ 1.28 gpf (4.8 Lpf) (1.28)

Water Efficiency

- Low Consumption
- ☐ High Efficiency

Outlet Tube

- Trap Primer (TP)

Bumper

- Angle Stop (YO)

Compliances & Certifications

- ✓ ADA Compliant
- BAA Compliant
- cUPC Certified
- BREEAM Materials Credit
- BREEAM Water Credit
- EPD
- Green Globes Materials & Resources Credit
- Green Globes Water Credit
- LEED Materials & Resources EPD Credit
- LEED V4 Water Efficiency Credit

NOTES

For product line drawings, view model-specific spec sheets.

All information contained within this document subject to change without notice.



Image for a standard REGAL 111 shown

DESCRIPTION

Regal® Exposed Manual Water Closet Flushometer

FEATURES

- Flush volumes start as low as 1.6 gpf/6.0 Lpf to meet water-efficiency objectives
- Water conservation is aided by the ADA-compliant, non-hold-open handle, which prevents toilet from exceeding intended flush volume
- Low Consumption flush accuracy controlled by Para-Flo™ Technology
- Integrity of the product is maintained with control stop plug
- Durability is facilitated with high copper, low zinc brass castings for dezincification resistance
- Adjustable tailpiece
- Valve body, Cover, Tailpiece and Control Stop shall be in compliance with ASTM Alloy Classification for Semi-Red Brass
- Valve shall be in compliance to the applicable sections of ASSE 1037.

DOWNLOADS

- Regal XL Exposed Installation Instructions
- Control Stop Repair and Maintenance Guide
- Flush Connections Flanges Repair and Maintenance Guide
- Tail Piece Repair and Maintenance Guide
- Regal Flushometers Repair and Maintenance Guide
- Flushometer Pressure gauges
- Additional Downloads

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Phone: 800.982.5839 • Fax: 800.447.8329 • sloan.com

Downloaded 04/11/22 • • View Latest Version

KOHLER®

Dexter™ Urinal K-5016-ET

Features
- Siphon jet.
- 3/4" (19 mm) top spud.
- 0.5 or 1.0 gpf (1.9 or 3.8 lpf) based on valve selected.
- Siphon jet.
- Includes inlet and outlet spuds and hangers.
- Includes anti-backsplash wall.
- 14-1/2" (368 mm) extended rim.
- 0.5 or 1.0 gpf (1.9 or 3.8 lpf).



Material
- Vitreous china.

Recommended Products/Accessories
K-23726 Drain treatment
K-23725 Cast iron cleaner
K-7526 Touchless hybrid 0.5 gpf urinal flushometer
K-7537 Exposed hybrid 0.5 gpf washdown urinal flushometer
K-7537-RF Exposed hybrid 0.5 gpf urinal flushometer retrofit
K-13519 Manual 0.5 GPF Urinal Flushometer
K-13519-RF Manual 0.5 GPF Urinal Flushometer
K-76318 Manual 0.5 GPF Urinal Flushometer
K-7527 Touchless hybrid 1.0 gpf washdown urinal flushometer
K-7542 Exposed hybrid 1.0 gpf urinal flushometer
K-76319 Manual 1.0 GPF Urinal Flushometer

Included Components
Additional Components:
2" outlet spud
3/4" inlet spud
Hanger(s)

ADA

Codes/Standards
ASME A112.19.2/CSA B45.1
DOE - Energy Policy Act 1992
EPA WaterSense®
ADA
ICC/ANSI A117.1

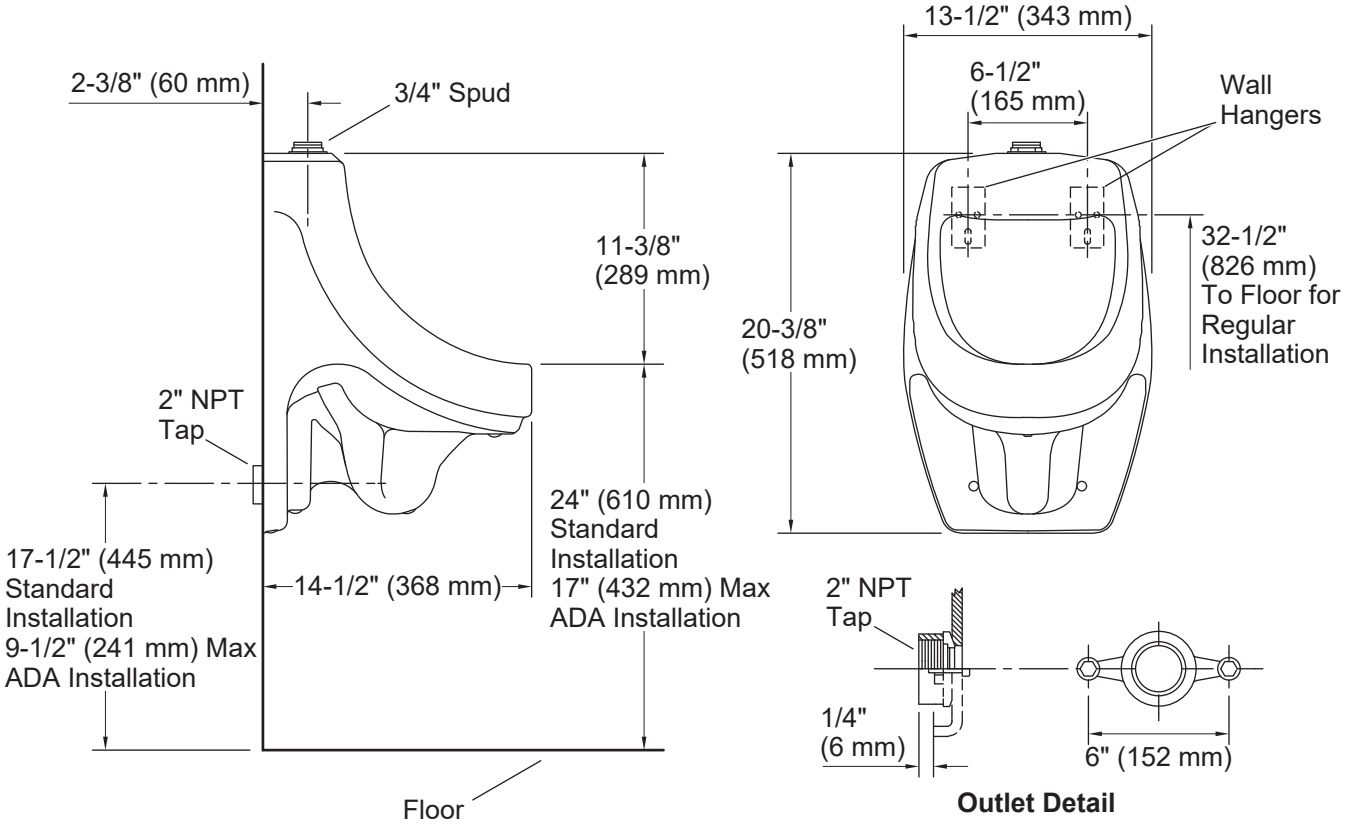
KOHLER® One-Year Limited Warranty
See website for detailed warranty information.

Available Colors/Finishes
Color tiles intended for reference only.

Color	Code	Description
	0	White
	96	Biscuit
	47	Almond
	7	Black Black™

KOHLER®

Dexter™
Urinal
K-5016-ET



Outlet Detail

Technical Information

All product dimensions are nominal.

Flush outlet technology:	Siphon jet
Spud size:	3/4", Inlet, Top
Max. Water per Flush:	0.5 gal (1.9 L)

Notes

Install this product according to the installation guide.

Refer to manufacturer's instructions and local codes for flushometer requirements.

Recommended ADA outlet spud height will account for normal product variation.

For ADA compliance, measurement must be 17" (432 mm) or less from the floor to the top of the lip.

ADA compliant when installed to the specific requirements of these regulations.

CODE NUMBER

3982628

DESCRIPTION

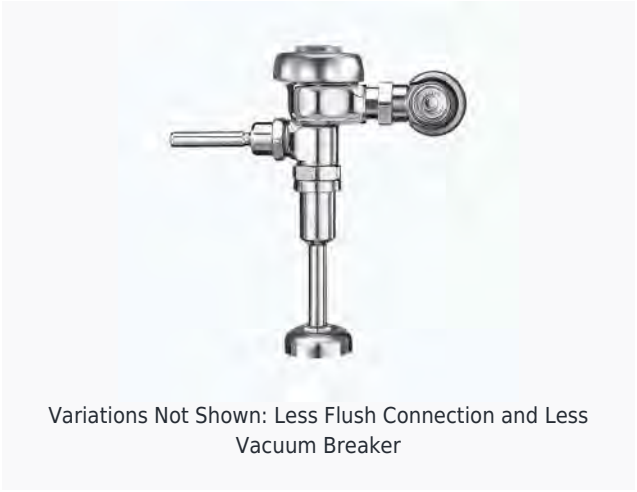
0.5 gpf, Polished Chrome Finish, Fixture Connection Top Spud, Single Flush, Regal® Exposed Manual Urinal Flushometer.

DETAILS

- Flush Volume: 0.5 gpf (1.9 Lpf)
- Finish: Polished Chrome (CP)
- Valve: Diaphragm
- Valve Body Material: Semi-red Brass
- Fixture Type: Urinal
- Fixture Connection: Top Spud
- Rough-In Dimension: 11 ½" (292mm)
- Spud Coupling: ¾" (19mm)
- Supply Pipe: ¾" (19mm)

FEATURES

- Non-Hold-Open Handle and No External Volume Adjustment to Ensure Water Conservation
- 3⁄4" I.P.S. Screwdriver Bak-Chek® Angle Stop with Vandal Resistant Stop Cap
- Spud Coupling and Spud Flange for 3⁄4" Top Spud
- ADA Compliant Metal Oscillating Non-Hold-Open Handle
- Sweat Solder Adapter with Cover Tube
- Cast Wall Flange with Set Screw
- Vacuum Breaker Flush Connection



Variations Not Shown: Less Flush Connection and Less Vacuum Breaker

COMPLIANCES & CERTIFICATIONS

(ADA Compliant, BAA Compliant, BREEAM Materials Credit, BREEAM Water Credit, cUPC Certified, cUPC Green Certified, EPD, Green Globes Materials & Resources Credit, Green Globes Water Credit, LEED Materials & Resources EPD Credit, LEED V4 Water Efficiency Credit, Satisfies LEED Credits, WaterSense Listed)

RECOMMENDED SPECIFICATION

Valve Body, Cover, Tailpiece and Control Stop shall be in conformance with ASTM Alloy Classification for Semi- Red Brass. Valve shall be in compliance with the applicable sections of ASSE 1037 and ANSI/ASME 112.19.2.

VALVE OPERATING PRESSURE (FLOWING)

15–80 PSI (103–552 kPa). Specific fixtures may require greater minimum flowing pressure - consult manufacturer requirements.

DOWNLOADS

- Regal XL Exposed Installation Instructions
- Control Stop Repair and Maintenance Guide
- Flush Connections Flanges Repair and Maintenance Guide
- Tail Piece Repair and Maintenance Guide
- Regal Flushometers Repair and Maintenance Guide
- Flushometer Pressure gauges
- Additional Downloads

NOTES

All information contained within this document subject to change without notice.

Looking for other variations of the REGAL 186 product? View the general spec sheet with all options.

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KOHLER®

CAXTON™

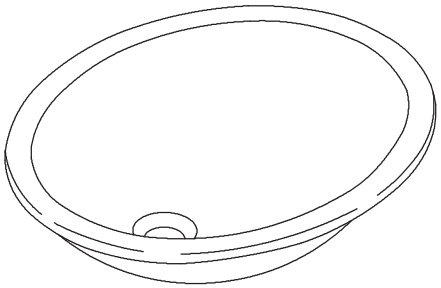
UNDERCOUNTER LAVATORY

K-2209, K-2210, K-2211

ADA

FEATURES

- *15” (38.1cm) x 12” (30.5cm) (K-2209)*
- *17” (43.2cm) x 14” (35.6cm) (K-2210)*
- *19” (48.3cm) x 15” (38.1cm) (K-2211)*
- *Vitreous china*
- *Undercounter*
- *With overflow*
- *ADA compliant*
- *Includes 52047 clamp assembly*



CODES/STANDARDS APPLICABLE

Specified model meets or exceeds the following:

- *ADA*
- *ASME/ANSI A112.19.2M*
- *CABO/ANSI A117.1*
- *IAPMO/UPC*
- *Canadian Standards Association (CSA)*
- *State of Massachusetts*

COLORS/FINISHES

- 0 White
- Other Refer to Price Book for additional colors

Accessories:

- CP Polished Chrome
- Other Refer to Price Book for additional finishes

SPECIFIED MODEL:

Model	Description	Colors/Finishes	
K-2209	15” (38.1cm) x 12” (30.5cm) lavatory	☐0 White	☐Other_____
K-2210	17” (43.2cm) x 14” (35.6cm) lavatory	☐0 White	☐Other_____
K-2210-G	17” (43.2cm) x 14” (35.6cm) lavatory with glazed underside without overflow	☐0 White	☐Other_____
K-2210-N	17” (43.2cm) x 14” (35.6cm) lavatory without overflow	☐0 White	☐Other_____
K-2211	19” (48.3cm) x 15” (38.1cm) lavatory	☐0 White	☐Other_____
K-2211-G	19” (48.3cm) x 15” (38.1cm) lavatory with glazed underside without overflow	☐0 White	☐Other_____

Recommended Accessories			
K-8998	Trap	☐CP	☐Other_____

PRODUCT SPECIFICATION:

The undercounter lavatory shall be 15” (38.1cm) in length, and 12” (30.5cm) in width (K-2209), 17” (43.2cm) in length, and 14” (35.6cm) in width (K-2210), or 19” (48.3cm) in length, and 15” (38.1cm) in width (K-2211). Lavatory shall be made of vitreous china. Lavatory shall have overflow. Lavatory shall be ADA compliant. Lavatory shall include 52047 clamp assembly. Lavatory shall be Kohler Model K-_____-_____.

We reserve the right to make revisions without notice in the design of fixtures or in packaging unless this right has specifically been waived at the time the order is accepted.

CAXTON™

PRODUCT INFORMATION

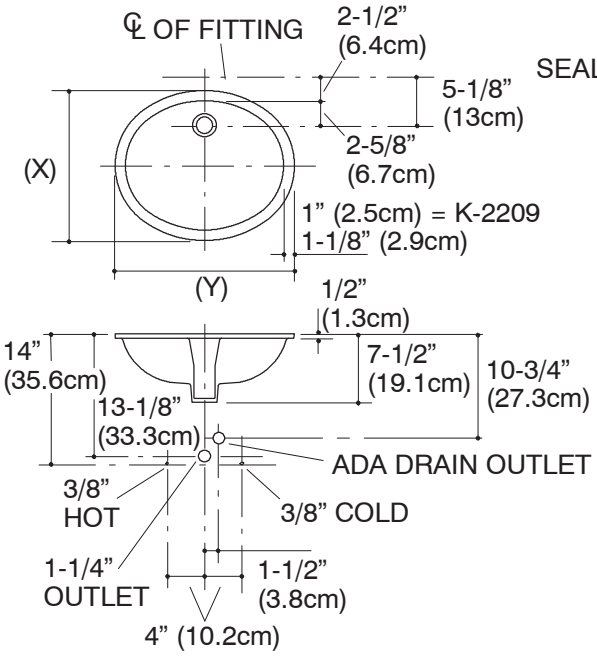
ADA compliant.			
Fixture*:		basin area	water depth
K-2209		15” (38.1cm) x 12” (30.5cm	4” (10.2cm)
K-2210/ K-2210-N		17” (43.2cm) x 14” (35.6cm)	4” (10.2cm)
K-2211		19” (48.3cm) x 15” (38.1cm)	4” (10.2cm)
Outlet	1-3/4” D. (4.4cm)		
* Approximate measurements for comparison only.			

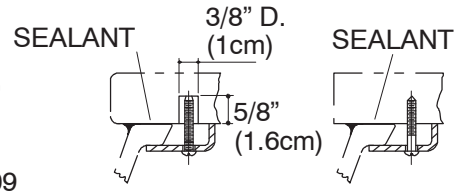
Included Components:	
Basin clamp assembly	52047
Adhesive sealant	63034
Cutout template, K-2209	85838-7
Cutout template, K-2210	1002975-7
Cutout template, K-2211	1018997-7

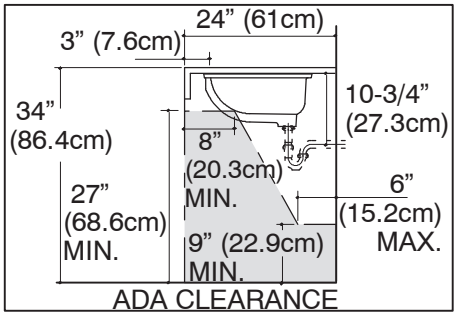
INSTALLATION NOTES

Install this product according to the installation guide.

Supplied basin clamp assemblies require 1” (2.5cm) minimum countertop thickness. Installer must supply anchors for thinner countertops.







Roughing-In Notes
K-2209: (X)=14” (35.6cm), (Y)=17” (43.2cm).
K-2210: (X)=16-1/4” (41.3cm), (Y)=19-1/4” (48.9cm).
K-2211: (X)=17-1/4” (43.8cm), (Y)=21-1/4” (54cm).

PRODUCT DIAGRAM

THE BOLD LOOK OF KOHLER®

SPEAKMAN®

COMMANDER®



SC-3065

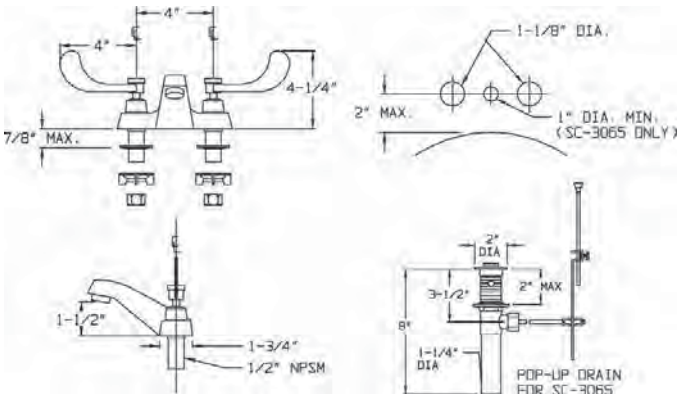


SC-3075-LD

Centerset Lavatory Combinations

❑ **SC-3065**
Polished chrome plated Commander vandal-resistant brass 4" centerset combination with Perfect® valves. 1/4 turn ceramic cartridges covered by a 25 year Silver warranty. Brass 4" wrist handles with color-coded indexes. Rigid shanks. 1-1/4" pop-up drain. Water conserving Autoflo® device reduces flow to 2.2 gpm/8.4 lpm, to meet existing ANSI A112.18.1M Standard.

❑ **SC-3075-LD**
Polished chrome plated Commander vandal-resistant brass 4" centerset combination with Perfect valves. 1/4 turn ceramic cartridges covered by a 25 year Silver warranty. Brass 4" wrist handles with color-coded indexes. Rigid shanks. Less strainer drain. Water conserving Autoflo device reduces flow to 2.2 gpm/8.4 lpm, to meet existing ANSI A112.18.1M Standard.



NOTE: Inlets are sized for either coupling or sweat connections. All dimensions are in inches and are subject to change without notice.

OPTIONS

SUFFIX	DESCRIPTION
❑ BO	Vandal-Resistant 0.5 gpm Flow Control
❑ LD	Less Drain Assembly (SC-3065 only)
❑ LF	Laminar Flow Outlet 2.0 gpm
❑ VR	Vandal-Resistant Flow Control
❑ 6WH	6" Wrist Handles

This space for Architect/Engineer approval.

Speakman Company
P.O. Box 191, Wilmington, DE 19899-0191 USA
1-800-537-2107 Fax: 1-800-977-2747
www.speakmancompany.com

Commander, Perfect and Autoflo — Registered T.M. Speakman Company
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Product Specification

Job Name _____ Contractor _____

Job Location _____ Approval _____

Engineer _____ Contractor's P.O. No. _____

Approval _____ Representative _____

LEAD FREE*

Series LFe480 and LFG480

Lavatory Tempering Valve



LFe480-00



LFe480-10



LFe480-50

Advanced Thermal Actuation

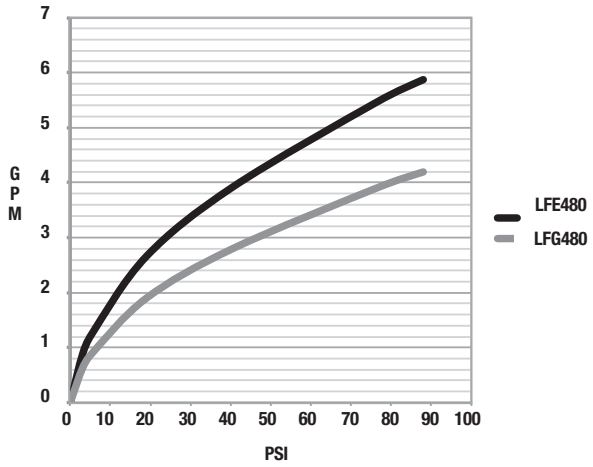
Features

- Adjustable temperature selection with locknut to prevent tampering
- Advanced thermal actuator improves performance
- Temperature controls to ASSE 1070, down to 0.5 gpm for LFe480 & 0.25 gpm for LFG480
- Lead Free* brass body for durability & to comply with Lead Free* installation requirements
- Corrosion resistant internal components for extended life
- Integral checks with screens prevents cross flow and filter out debris
- Factory set to 105°F (41°C)

Specifications

Connections	See ordering code
Maximum Operating Pressure	125 psi (861 kPa)
Maximum Hot Water Temperature	180°F (82°C)
Minimum Hot Water Supply Temperature	5°F (3°C) above set point+
Hot Water Inlet Temperature Range	120 – 180°F (49 – 82°C)
Cold Water Inlet Temperature Range	40 – 80°F (4 – 27°C)
Temperature Adjustment Range	80 – 120°F (27 – 49°C)
Minimum Flow	
LFe480	0.5 gpm (1.9 lpm)
LFG480	0.25 gpm (1.0 lpm)
Listing	ASSE 1070, IAPMO cUPC, NSF61-G
Approval	CSA B125.3

Flow Capacity



NOTICE

The information contained herein is not intended to replace the full product installation and safety information available or the experience of a trained product installer. You are required to thoroughly read all installation instructions and product safety information before beginning the installation of this product.

*** The wetted surface of this product contacted by consumable water contains less than 0.25% of lead by weight.**

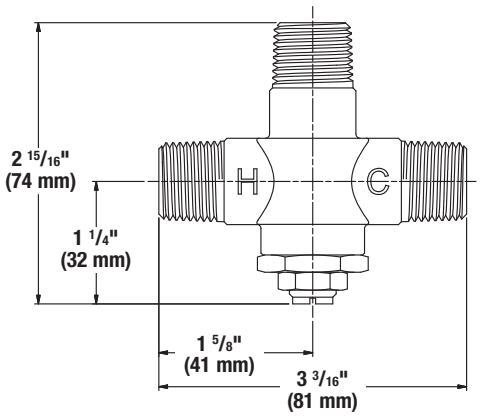
+ With Equal Pressure

Powers product specifications in U.S. customary units and metric are approximate and are provided for reference only. For precise measurements, please contact Powers Technical Service. Powers reserves the right to change or modify product design, construction, specifications, or materials without prior notice and without incurring any obligation to make such changes and modifications on Powers products previously or subsequently sold.

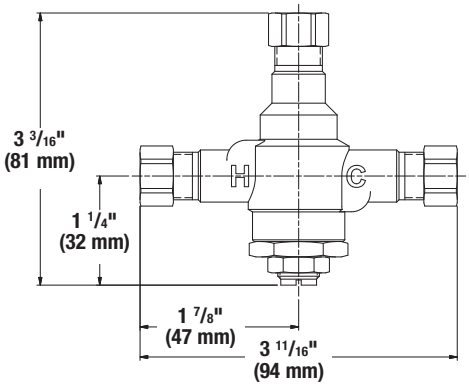
POWERS™
A WATTS Brand

Dimensions

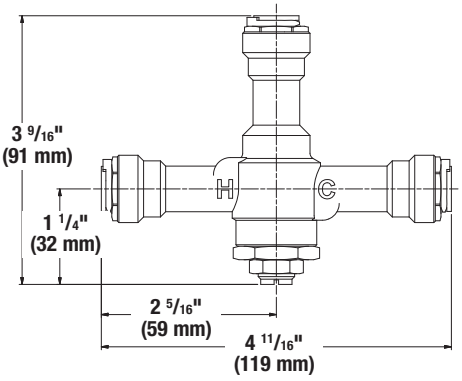
1/2" LFe480 / LFG480



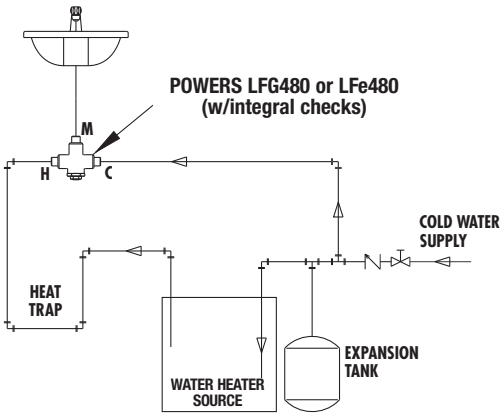
3/8" LFe480 / LFG480

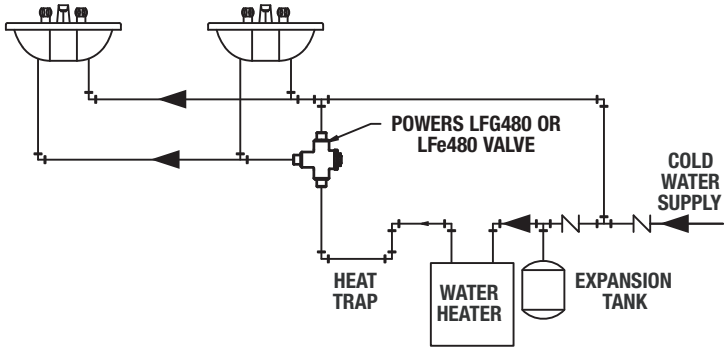


Quick-Connect LFe480 / LFG480



Piping Diagram





Ordering Code



Order Code

0.25 gpm minimum flow	LFG480
0.50 gpm minimum flow	LFE480
½" NPT Rough Bronze Finish	00
½" NPT Chrome Plated Finish	01
⅜" Compression Rough Bronze Finish	10
⅜" Compression Chrome Plated Finish	11
⅜" Quick-Connect Rough Bronze Finish	50
⅜" Quick-Connect Chrome Plated Finish	51

Typical Specification

Lavatory tempering valve shall be ASSE 1070 and cUPC listed. All internal components shall be from corrosion resistant material. The valve must control each performance standard down to 0.25 gpm (1.00 lpm) for LFG480 and 0.5 gpm (1.90 lpm) for LFe480.

Capacity of the valve must be 3 gpm (11 lpm) @ 45psi differential or 4 gpm (15 lpm) @ 45psi differential. Thermostatic lavatory tempering valve shall be constructed using Lead Free* brass material which shall comply with state codes and standards, where applicable requiring reduced lead content. Control temperature must be adjustable between 80–120° F (32–43°C) with a locking nut to prevent unauthorized or accidental adjustment. The valve shall contain integral checks to prevent cross flow and inlet screens to filter debris. The valve shall be a Powers Series LFe480 or LFG480.

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KOHLER.

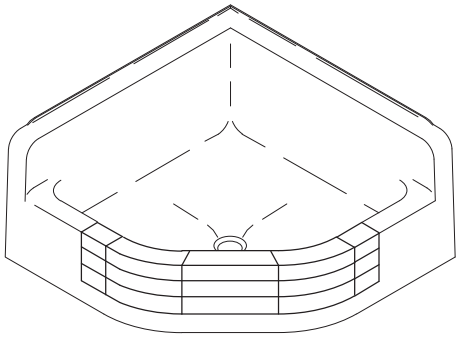
WHITBY™

SERVICE SINK

K-6710

FEATURES

- *28” x 28”*
- *Cast iron*
- *Acid resistant enamel finish*
- *Floor-mounted*
- *Corner sink*
- *Optional K-8940 coated wire rim guard*



CODES/STANDARDS APPLICABLE

Specified model meets or exceeds the following:

- *ASME/ANSI A112.19.1M*
- *IAPMO/UPC*
- *Canadian Standards Association (CSA)*
- *State of Massachusetts*

COLORS/FINISHES

- 0 White

Accessories:

- NA None Applicable

SPECIFIED MODEL:

Model	Description	Colors/Finishes
K-6710	Service sink	☐0 White

Optional Accessories		
K-8940	Coated wire rim guard	☐NA

PRODUCT SPECIFICATION:

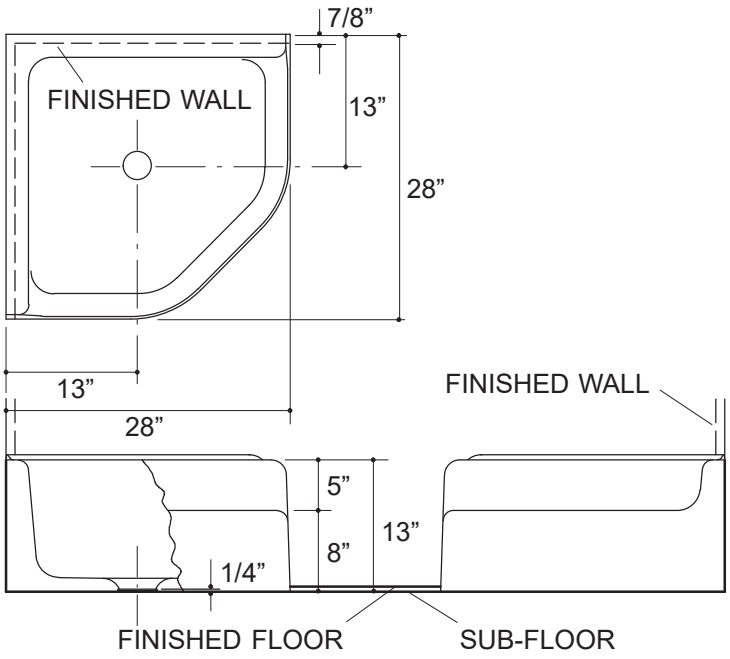
The floor-mount corner service sink shall be 28” in length, and 28” in width. Sink shall be made of cast iron with acid resistant enamel finish. Sink shall have optional K-8940 coated wire rim guard. Sink shall be Kohler Model K-6710-_____.

We reserve the right to make revisions without notice in the design of fixtures or in packaging unless this right has specifically been waived at the time the order is accepted.

WHITBY™

PRODUCT INFORMATION

Fixture*:		basin area	water depth
Sink		23” x 23”	6-3/4”
Outlet	2-7/8” D.		
* Approximate measurements for comparison only.			



.85<116

PRODUCT DIAGRAM

CHICAGO FAUCETS®

2100 SOUTH CLEARWATER DRIVE
DES PLAINES, ILLINOIS 60018-5999

FITTING NO.

897 Page 18

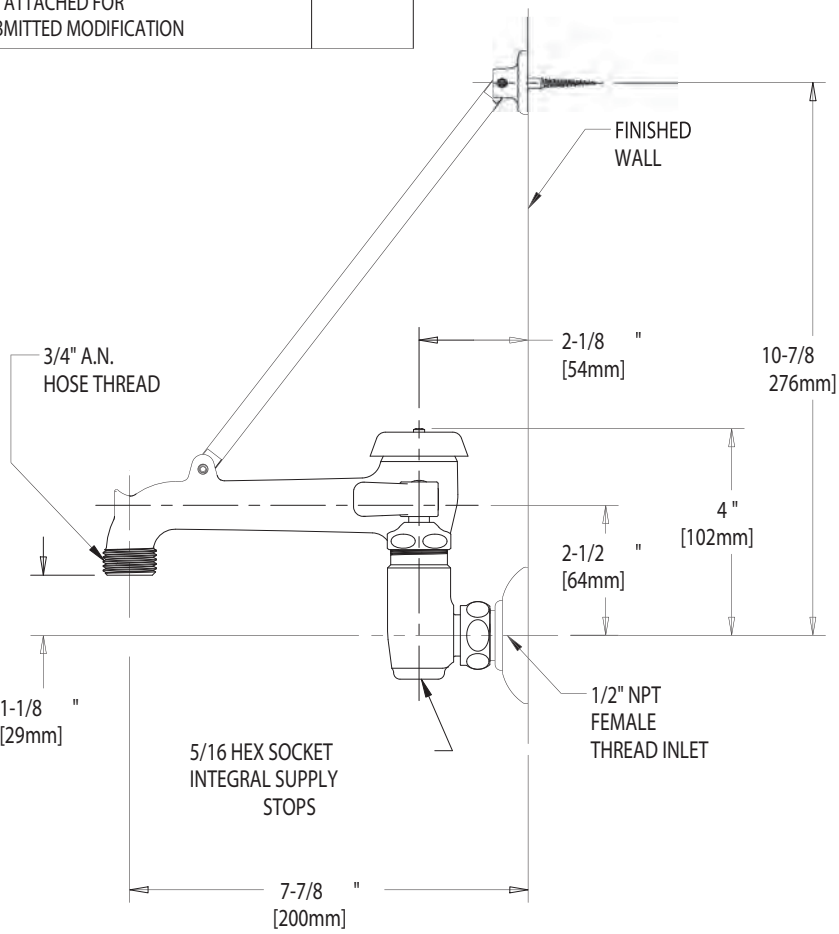
SUBMITTED MODEL NO.

JOB NAME

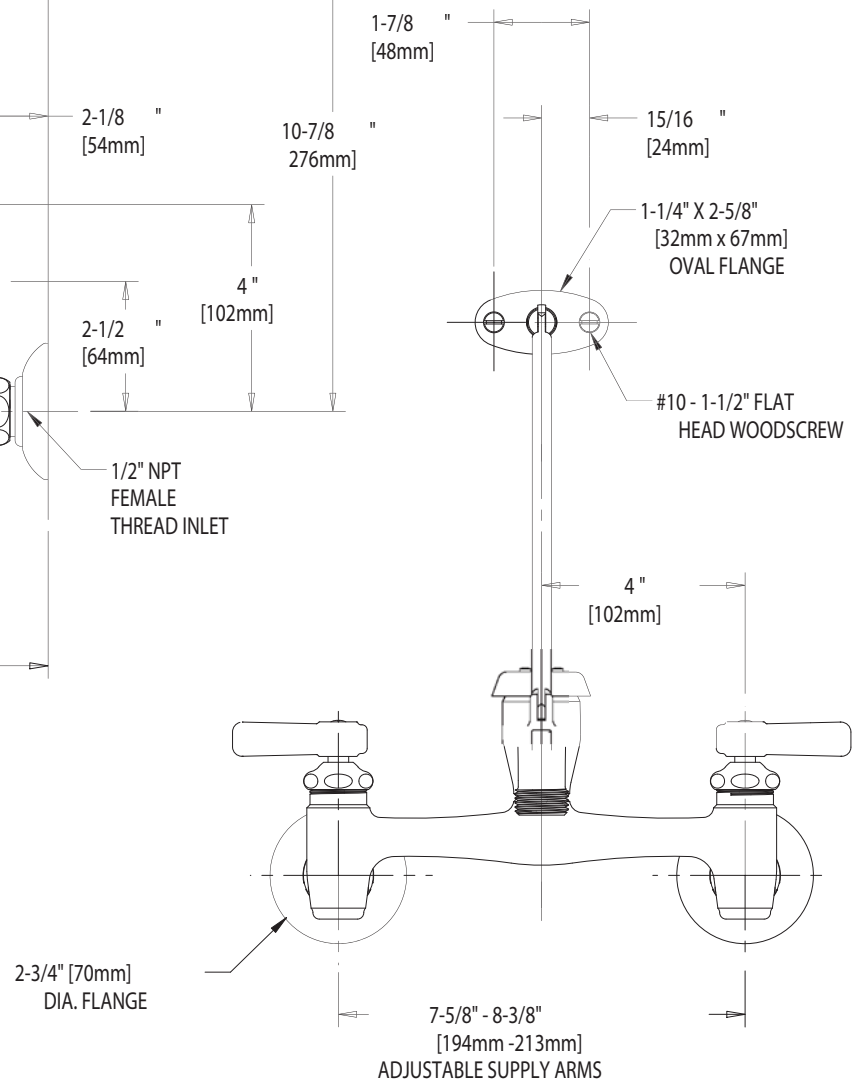
ITEM NO.

SUBMITTED AS SHOWN	
SUBMITTED AS NOTED	
SEE ATTACHED FOR SUBMITTED MODIFICATION	

ADA COMPLIANT



SIDE VIEW



FRONT VIEW

DIMENSIONS IN INCHES AND [MILLIMETERS].

TECHNICAL DATA

- COMBINATION SERVICE SINK FAUCET
- VACUUM BREAKER SPOUT
- 369 INDEXED LEVER HANDLES
- QUATURN UNITS
- FINISH AS SPECIFIED
- HOSE THREAD OUTLET
- ADJUSTABLE SUPPLY ARMS
- INTEGRAL SUPPLY STOPS

DATE: 10-02-00
BY: AJZ
CHK'D:
APP'D:
REV:

897

IS ASSUMED FOR USE OF SUPERCEDED OR VOIDED DATA. (0192-1)

ROUGHING IN DIMENSIONS MAY VARY AND ARE SUBJECT TO CHANGE. NO RESPONSIBILITY

ELKAY® SPECIFICATIONS

Lustertone® Single Bowl Sink
Models LR, LRQ, LRS and LRSQ Series

GENERAL

Highest quality sink seamlessly formed of #18 gauge, type 304 (18-8) nickel bearing stainless steel. Self-rimming.

DESIGN FEATURES

LR(Q) Bowl Depth: 8" (LR[Q]2521), 7-1/2" (LR[Q]1919), 7-5/8" (all others).

Coved Corners: 1-3/4" vertical and horizontal radius.

Bowl and Faucet Deck Recess: 3/16" below outside edge of sink.

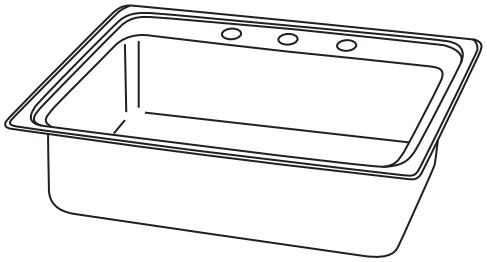
Finish: Exposed surfaces are hand blended to a lustrous high-lighted satin finish.

Underside: Fully undercoated to dampen sound and prevent condensation. LR(Q)2521 is fully protected by heavy duty Sound Guard® undercoating.

OTHER

Drain Opening: 3-1/2".

NOTE: Unless otherwise specified, models with one, two, three or OS4 faucet hole option are furnished with 3 faucet holes as shown; models with choice of one, two, three, four or five faucet hole option are furnished with 4 faucet holes standard.

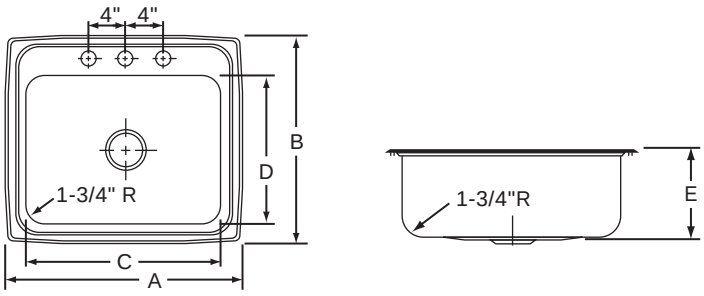


Model LR(Q)22193

SINK DIMENSIONS (INCHES)*

U-Channel Model Number	Quick-Clip® Model Number	Overall L A	Overall W B	Inside Bowl L C	Inside Bowl W D	Inside Bowl D E	Cutout in Countertop (1 1/2" Radius Corners) L	Cutout in Countertop (1 1/2" Radius Corners) W	No. of 1 1/2" Dia. Faucet Holes 4" Center	Minimum Cabinet Size	Ship. Wt. Lbs.
LR1316	**LRQ1316**	13	16	10	10	7 5/8	12 3/8	15 3/8	1, 2, MR2 or 3	18	9 1/2
LR1517	LRQ1517	15	17 1/2	12	12	7 5/8	14 3/8	16 7/8	1, 2, MR2 or 3	18	10
LR1522	LRQ1522	15	22	11 1/2	16	7 5/8	14 3/8	21 3/8	1, 2, MR2 or 3	18	12
LR1716	LRQ1716	17	16	14	10	7 5/8	16 3/8	15 3/8	1, 2, MR2, 3 or OS4	21	12
LR1720	LRQ1720	17	20	14	14	7 5/8	16 3/8	19 3/8	1, 2, MR2, 3 or OS4	21	12
LR1722	LRQ1722	17	22	13 1/2	16	7 5/8	16 3/8	21 3/8	1, 2, MR2, 3 or OS4	21	13
LR1918	LRQ1918	19	18	16	11 1/2	7 5/8	18 3/8	17 3/8	1, 2, MR2, 3 or OS4	24	13
LR1919	LRQ1919	19 1/2	19	16	13 1/2	7 1/2	18 7/8	18 3/8	1, 2, MR2, 3 or OS4	24	13
LR2022	LRQ2022	19 1/2	22	16	16	7 5/8	18 7/8	21 3/8	1, 2, MR2, 3 or OS4	24	14 1/2
LR2219	LRQ2219	22	19 1/2	18	14	7 5/8	21 3/8	18 7/8	1, 2, MR2, 3, 4 or 5	27	13
LR2222	LRQ2222	22	22	19	16	7 5/8	21 3/8	21 3/8	1, 2, MR2, 3, 4 or 5	27	13
LR2521	LRQ2521	25	21 1/4	21	15 3/4	8	24 3/8	20 5/8	1, 2, MR2, 3, 4 or 5	30	15
LR3122	LRQ3122	31	22	28	16	7 5/8	30 3/8	21 3/8	1, 2, MR2, 3, 4 or 5	36	19
LRS3322	LRSQ3322	33	22	28	16	7 5/8	32 3/8	21 3/8	1, 2, MR2, 3, 4 or 5	36	19 1/2

*Length is left to right. Width is front to back.



ALL DIMENSIONS IN INCHES, TO CONVERT TO MILLIMETERS MULTIPLY BY 25.4.

In keeping with our policy of continuing product improvement, Elkay reserves the right to change product specifications without notice.

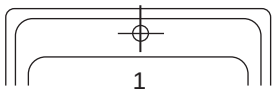
This specification describes an Elkay product with design, quality and functional benefits to the user. When making a comparison of other producers' offerings, be certain these features are not overlooked.

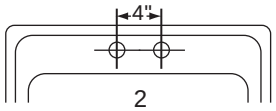
Printed in U.S.A.
©2004 Elkay

Lustertone® Single Bowl Sink
Models LR, LRQ, LRS and LRSQ Series

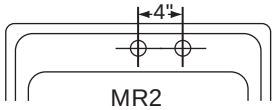
ELKAY®
SPECIFICATIONS

HOLE DRILLING CONFIGURATIONS

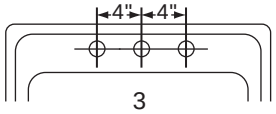

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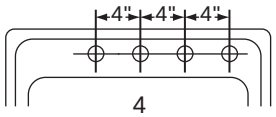
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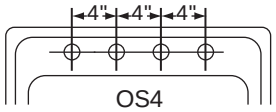


MR2



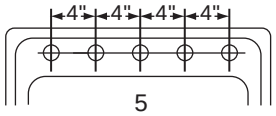
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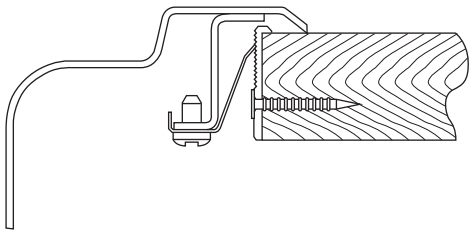


OS4

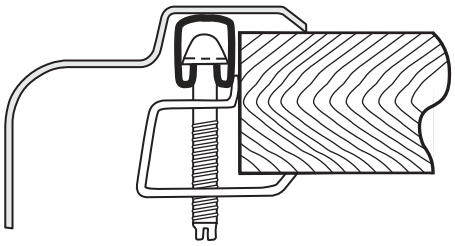


5

Quick-Clip® Mounting System



U-Channel Type Mounting System



2222 Camden Court
Oak Brook, IL 60523
www.elkayusa.com

Printed in U.S.A.
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CHICAGO FAUCETS

2100 SOUTH CLEARWATER DRIVE
DES PLAINES, ILLINOIS 60018-5999

FITTING NO.

786-E3VPCCP

SUBMITTED MODEL NO.

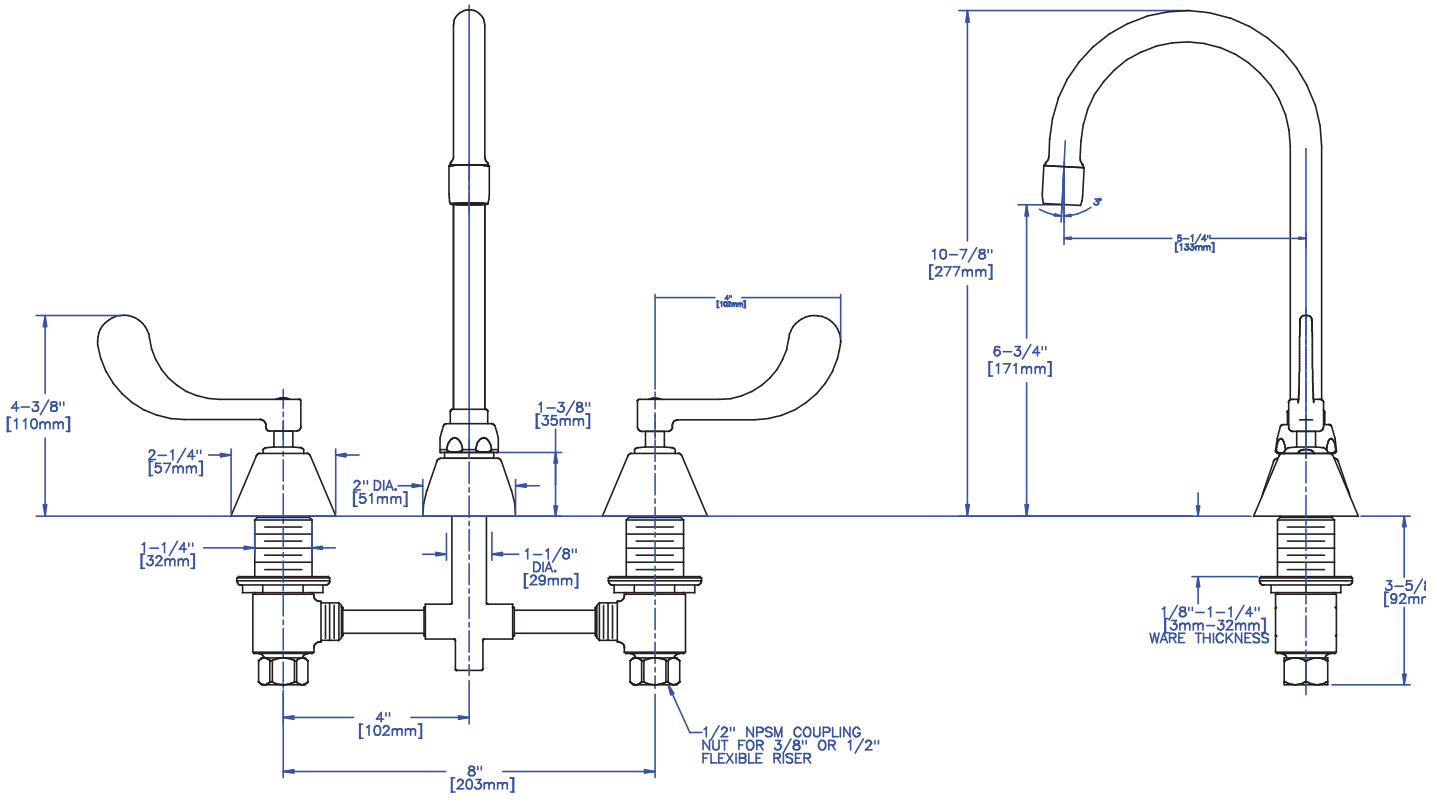
JOB NAME

ITEM NO.

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SUBMITTED AS NOTED	
SEE ATTACHED FOR SUBMITTED MODIFICATION	

ASME A112.18.1M
CSA B125
NSF 61, Section 9

ADA COMPLIANT



DIMENSIONS IN INCHES AND [MILLIMETERS].

TECHNICAL DATA

Deck Mounted Concealed Faucet
GN2A – Rigid/Swing Gooseneck Spout
E3VP – Vandal Resistant Softflo Aerator
317 – Wrist Blade Handles
Quaturn Operating Cartridge

1/2" NPSM Coupling Nuts for 3/8" or 1/2" Flexible Risers
2.2 GPM Maximum Flow Rate

DATE: 10/17/2001
BY: Web1.0.0
CHK'D:
APP'D:
REV:

ROUGHING IN DIMENSIONS MAY VARY AND ARE SUBJECT TO CHANGE. NO RESPONSIBILITY IS ASSUMED FOR USE OF SUPERCEDED OR VOIDED DATA. (0192-1)

For Commercial & Residential Applications

Job Name _____ Contractor _____

Job Location _____ Approval _____

Engineer _____ Contractor's P.O. No. _____

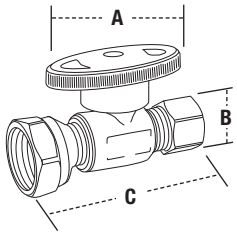
Approval _____ Representative _____

KwikStop®
Quarter-Turn Water Supply Stops

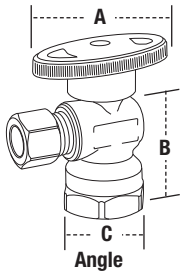

BV890013


BV389003

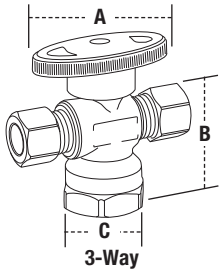

BV890003



Straight



Angle



3-Way

Features

- "Kwik" quarter-turn "On" or "Off"
- Ball valve style construction
- Available in straight and angle configurations
- Large, conventional handles
- Chrome-plated brass construction with PTFE seats
- Complies with NSF 61 Section 9
- Nuts and ferrules assembled
- Packaged in convenient window boxes; kits in plastic bags
- IAPMO Listed

MODEL NO.	✓ TO SUBMIT	TYPE	DESCRIPTION	DIMENSIONS						FINISH
				A		B		C		
				in	*mm*	*in*	*mm*	*in*	*mm*	
BV889013		Straight	⅜" IPS x ⅜" OD Comp	1 13/16	46	1 1/16	18	1 15/16	50	Chrome
BV892413		Straight	½" CPVC x ⅜" OD Comp	1 13/16	46	1 1/16	18	2 5/8	66	Chrome
BV891313		Straight	½" PEX x ½" PEX	1 13/16	46	½	12	2 3/16	56	Chrome
BV890013		Straight	½" IPS x ⅜" OD Comp	1 13/16	46	1 1/16	18	2 1/16	52	Chrome
BV892013		Straight	½" Copper Sweat x ⅜" OD Comp	1 13/16	46	1 1/16	18	2 ½	63	Chrome
BV894013		Straight	⅝" OD Comp x ⅜" OD Comp	1 13/16	46	1 1/16	27	2 3/8	60	Chrome
BV891213		Straight	½" PEX x ⅜" OD Comp	1 13/16	46	1 1/16	18	2 7/8	73	Chrome
BV890313		Straight	½" IPS x ½" - 7/16" Rbr SJ	1 13/16	46	1 ¼	32	2	51	Chrome
BV892513		Straight	½" Sweat w/5" Ext x ⅜" OD	1 13/16	46	7 5/8	194	2 ¼	57	Chrome
BV889003		Angle	⅜" IPS x ⅜" OD Comp	1 13/16	46	1/16	1	⅞	23	Chrome
BV892503		Angle	½" Comp with 5" Extension x ⅜" OD	1 13/16	46	6 13/16	173	2 ¼	57	Chrome
BV892403		Angle	½" CPVC x ⅜" OD Comp	1 13/16	46	1 7/8	48	⅞	22	Chrome
BV8910LK		Angle	⅝" OD x ⅜" OD loose key	1 13/16	46	1 5/8	41	1 ⅛	28	Chrome
BV890003		Angle	½" IPS x ⅜" OD Comp	1 13/16	46	1 ½	38	1 ⅛	28	Chrome
BV892003		Angle	½" Copper Sweat x ⅜" OD Comp	1 13/16	46	1 13/16	46	1 ⅛	28	Chrome
BV894003		Angle	⅝" OD Comp x ⅜" OD Comp	1 13/16	46	1 11/16	43	1 ⅛	28	Chrome
BV891203		Angle	½" PEX x ⅜" OD Comp	1 13/16	46	2 ¼	57	½	12	Chrome
BV890153		Angle	½" PEX x ¼" OD Comp	1 13/16	46	1 7/16	37	1 ⅛	28	Chrome
BV894153		Angle	⅝" OD Comp x ¼" OD Comp	1 13/16	46	1 ¾	44	1 ⅛	28	Chrome
BV890303		Angle	½" IPS x ½" - 7/16" Rbr SJ	1 13/16	46	1 7/16	37	1 ⅛	28	Chrome
BV8900PB		Angle	½" IPS x ⅜" OD Comp	1 13/16	46	1 ½	38	1 ⅛	28	Polished Brass
BV8940PB		Angle	⅝" OD x ⅜" OD Comp	1 13/16	46	1 11/16	43	1 ⅛	28	Polished Brass
BV389003		3-Way	½" IPS x ⅜" OD x ⅜" OD	1 13/16	46	1 7/16	37	1 ⅛	28	Chrome
BV389053		3-Way	½" IPS x ⅜" OD x ¼" OD	1 13/16	46	1 7/16	37	1 ⅛	28	Chrome
BV389403		3-Way	⅝" OD x ⅜" OD x ⅜" OD	1 13/16	46	1 9/16	40	1 ⅛	28	Chrome

Watts product specifications in U.S. customary units and metric are approximate and are provided for reference only. For precise measurements, please contact Watts Technical Service. Watts reserves the right to change or modify product design, construction, specifications, or materials without prior notice and without incurring any obligation to make such changes and modifications on Watts products previously or subsequently sold.

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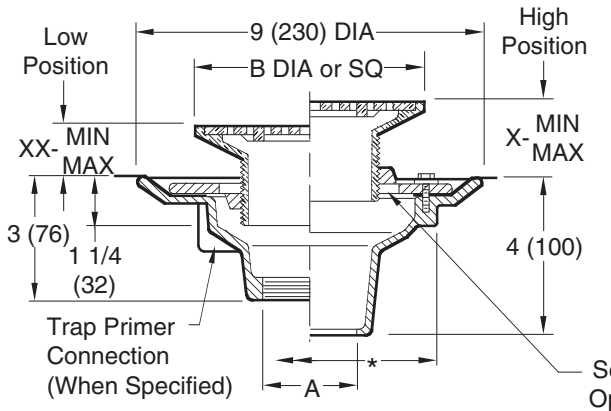
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DIVISION OF SMITH INDUSTRIES, INC.
POST OFFICE BOX 3237
MONTGOMERY, ALABAMA 36109-0237 (USA)
TEL: 334-277-8520 FAX: 334-272-7396 www.jrsmith.com
CUSTOMER DRIVEN
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LOCATION

FLOOR OR SHOWER DRAINS
WITH ADJUSTABLE STRAINER HEADS

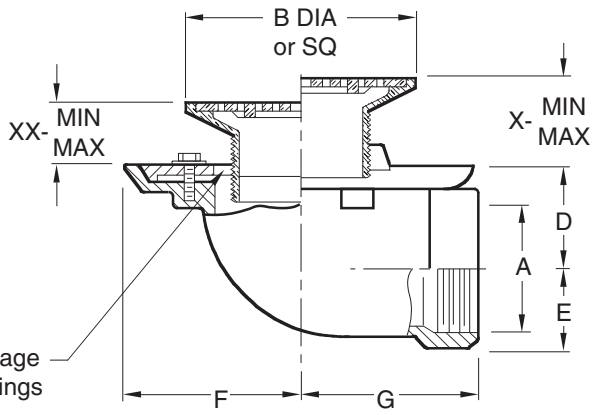
FUNCTION: General service floor drain for use in showers, toilets, kitchens, and other finished areas where foot traffic is expected. The round top strainer head is used for all types of poured finished floors. The square top is particularly adaptable to floors that are finished in material of square or straight line pattern. Reversible flashing collar permits adjustment to meet finished floor level.



A (Pipe Size) = 02(50), 03(80) or 04(100)

CAULK OUTLET

☐ **Fig. 2010C . . . . . (A) ROUND TOP**
☐ **Fig. 2010C . . . . . (B) SQUARE TOP**



THREADED OUTLET

☐ **Fig. 2015T. . . . . (A) ROUND TOP**
☐ **Fig. 2015T . . . . . (B) SQUARE TOP**

Strainer Size	*Collar In High Position		*Collar In Low Position		Free Area SQ IN (SQ CM)	
B DIA or SQ	X MIN	X MAX	XX MIN	XX MAX	ROUND	SQUARE
05 (125)	1 1/4 (32)	2 1/4 (57)	3/4 (19)	1 5/8 (41)	7 (45)	6.5 (42)
06 (150)	1 1/4 (32)	2 1/4 (57)	3/4 (19)	1 5/8 (41)	9 (58)	12.5 (81)
07 (180)	1 1/4 (32)	2 1/4 (57)	7/8 (22)	1 7/8 (48)	14 (90)	11 (71)
08 (205)	1 1/2 (38)	2 1/2 (64)	1 (25)	1 7/8 (48)	17 (110)	14 (90)
•09 (230)	1 1/2 (38)	2 3/8 (60)	1 (25)	1 7/8 (48)	18 (116)	16 (103)
•10 (255)	1 1/2 (38)	2 3/8 (60)	1 (25)	1 7/8 (48)	23 (148)	16 (103)

A SIZE	B	D	E	F	G	MIN-X-MAX		MIN-XX-MA	
02	05	2 3/4	1 1/4	4 3/4	5	1 1/4	2 1/4	3/4	1 5/8
(50)	(125)	(70)	(32)	(120)	(125)	(32)	(57)	(19)	(41)
03	06	2 3/4	2 1/4	4 3/4	5	1 1/4	2 1/4	3/4	1 5/8
(80)	(150)	(70)	(57)	(120)	(125)	(32)	(57)	(19)	(41)
04	08	3 1/4	3 1/4	6	4	1 1/2	2 1/2	-	-
(100)	(200)	(83)	(83)	(150)	(100)	(38)	(64)		

•Add 3/8" (10) to all min./max. dimensions for round strainer.
••Not available for 05" (125) size strainer.
*Collar is reversible to obtain extreme high and low strainer positions.

NOTE: Dimensions shown in parentheses are in millimeters.

REGULARLY FURNISHED:
Duco Cast Iron Body with Flashing Collar and Adjustable Strainer Head as Indicated by Suffix Letter Selected.

Meets ASME Standard A112.6.3-2001 02(50), 03(75) or 04"(100) sizes only.

SEE PM0457 FOR OPTIONAL STRAINER HEADS.

VARIATIONS:
☐ Ball Float Backwater Valve -BFV (Fig. 2015 only)
☐ •• Flapper Type Backwater Valve -V
☐ Hinged Grate -H
☐ Sediment Bucket -B
☐ Trap Primer Connection -P050 1/2" (13) & -P075 3/4" (19)
☐ Vandal Proof Screws -U
☐ Wide Flanged Strainer (Specify Fig. DX 2010)
☐ T Threaded Outlet

OPTIONAL MATERIALS:
☐ Bronze Body -BB (Fig. 2010 only)
☐ Chrome Plated Strainer -CP
☐ Galvanized Cast Iron Body -G
☐ Nickel Bronze Strainer -NB
☐ Polished Bronze Strainer -PB
☐ Stainless Steel (Specify Fig. 9700-A) (Fig. 2010 only)

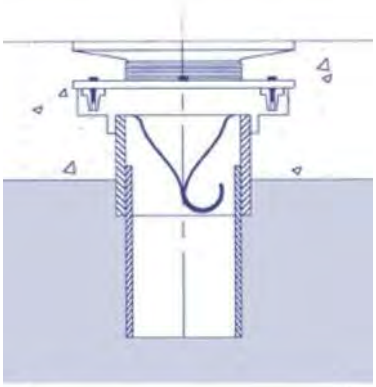
REV.	DATE	DESCRIPTION	BY	CKD. BY
K	9-22-06	Revised ANSI note	RN	CL
J	5-11-05	Revised ANSI note	JJ	AM
H	6-15-95	Added Millimeters	EMB	BS
G	7-1-94	Revised	CMB	BS

WEIGHT POUNDS | VOLUME CUBIC FEET | FIGURE NUMBER **2010,2015**

FIGURE NUMBER **2010, 2015** | DRAWN BY: **CR** | CHECKED BY: **TD** | APPROVED BY: **TD** | DATE: **5-17-85** | SCALE: **NONE** | SIZE **A** | DRAWING NUMBER **S2010, 2015** | **K**

DIMENSIONS ARE SUBJECT TO MANUFACTURERS TOLERANCE AND CHANGE WITHOUT NOTICE
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Underground Floor Drains



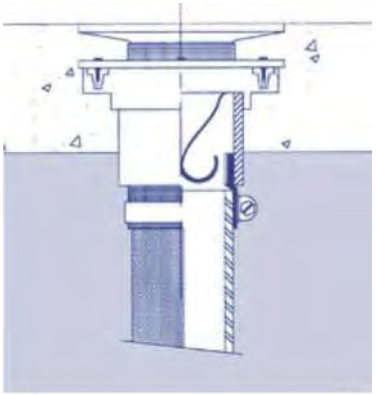
Connect to plastic pipe in ground floor slab

PART NO.	TRAP GUARD DESCRIPTION	PRICE
T25630-F-P	2" Adj. NB ED w/ PVC plastic hub joint	$ 110.75
T35630-F-P	3" Adj. NB ED w/ PVC plastic hub joint	$ 114.35
T45630-F-P	4" Adj. NB ED w/ PVC plastic hub joint	$ 116.80

- **All above Trap Guard drains have 5" Nickel Bronze round tops**

T35630-F-P-CP	Add CP to part no. for 5" chrome strainer and tailpiece	N.C.
T35630-F-P-PB	Add PB to part no. for 5" brass strainer and tailpiece	N.C.
T35630-F-P-SQ	Add SQ to part no. for 5" square strainer	Contact Factory
T35630-F-P-FU	Add FU for 2-3/8"X3-1/2" funnel top drain	Contact Factory

- Above square drain is Nickel Bronze—For Chrome or Brass add CP or PB
- **All above drain numbers are for 3". For 2" or 4", change the first number to 2 or 4**



Connect to cast iron pipe in ground floor

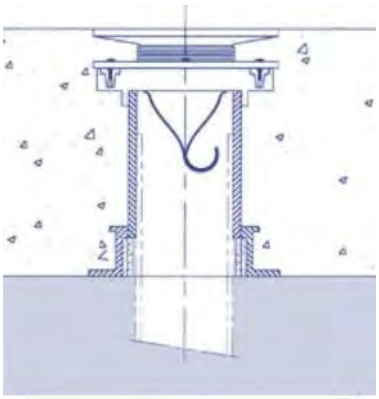
PART NO.	TRAP GUARD DESCRIPTION	PRICE
T25630-F-CI	2" Adj. NB ED w/ mechanical hub joint for C.I.	$ 114.55
T35630-F-CI	3" Adj. NB ED w/ mechanical hub joint for C.I.	$ 118.55
T45630-F-CI	4" Adj. NB ED w/ mechanical hub joint for C.I.	$122.05

- **All above Trap Guard drains have 5" Nickel Bronze round tops**

T35630-F-CI-CP	Add CP to part no. for 5" chrome strainer and tailpiece	N.C.
T35630-F-CI-PB	Add PB to part no. for 5" brass strainer and tailpiece	N.C.
T35630-F-CI-SQ	Add SQ to part no. for 5" square strainer	Contact Factory
T35630-F-CI-FU	Add FU for 2-3/8"X3-1/2" funnel top drain	Contact Factory

- Above square drain is Nickel Bronze—For Chrome or Brass add CP or PB
- **All above drain numbers are for 3". For 2" or 4", change the first number to 2 or 4**

Above Ground Floor Drains



Connect to plastic pipe above ground floor slab

PART NO.	TRAP GUARD DESCRIPTION	PRICE
T2563H-F-SSW	2" Adj. NB ED for plastic pipe above ground floor	$124.05
T3563H-F-SSW	3" Adj. NB ED for plastic pipe above ground floor	$143.40
T4563H-F-SSW	4" Adj. NB ED for plastic pipe above ground floor	$159.15

- H = pour depth of floor—Change the H in the part number to the pour height. e.g. H = 6"
- **All above Trap Guard drains have 5" Nickel Bronze round tops**

T3563H-F-SSW-CP	Add CP to part no. for 5" chrome strainer and tailpiece	N.C.
T3563H-F-SSW-PB	Add PB to part no. for 5" brass strainer and tailpiece	N.C.
T3563H-F-SSW-SQ	Add SQ to part no. for 5" square strainer	Contact Factory
T3563H-F-SSW-FU	Add FU for 2-3/8"X3-1/2" funnel top drain	Contact Factory

- Above square drain is Nickel Bronze—For Chrome or Brass add CP or PB
- **All above drain numbers are for 3". For 2" or 4", change the first number to 2 or 4**

Z1310

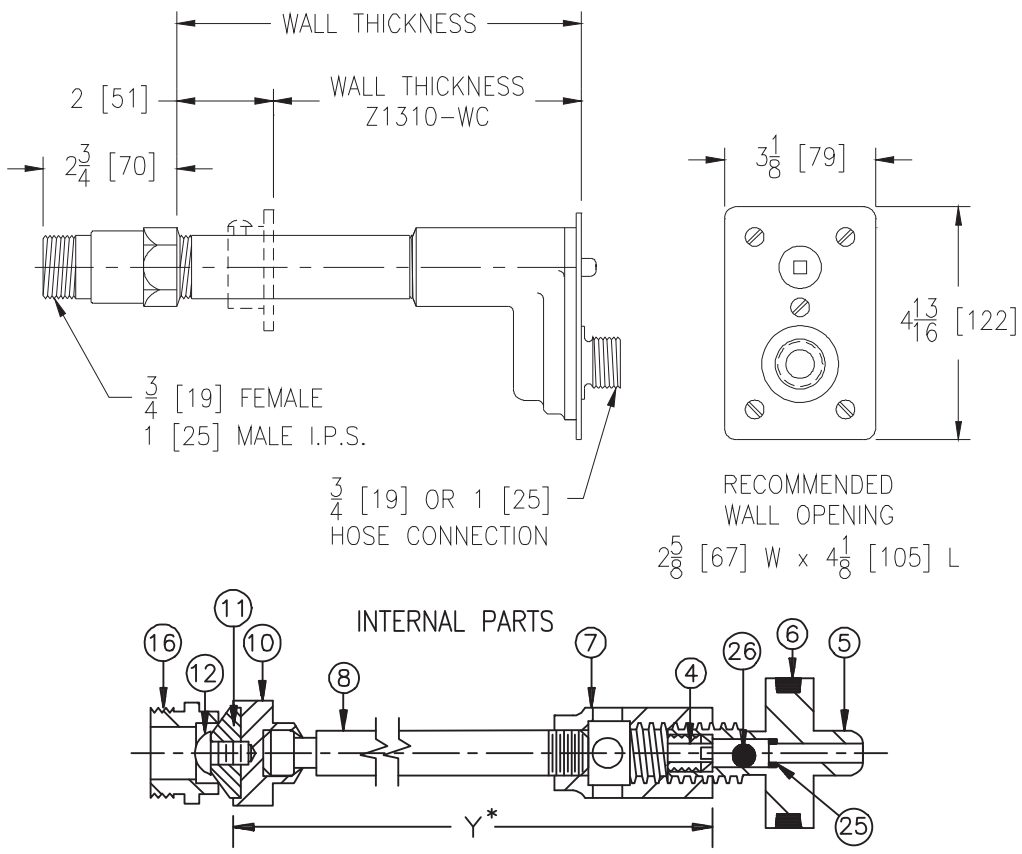
ECOLOTROL WALL HYDRANT

Exposed, Non-Freeze, Anti-Siphon, Automatic Draining

SPECIFICATION SHEET

TAG _____

Dimensional Data (inches and [mm]) are Subject to Manufacturing Tolerances and Change Without Notice



Wall Thickness Inches	Approx. Wt. Lbs. [kg]
4-6-8 [102-152-203]	5 [2]
10-12-14 [254-305-356]	8 [4]
16-18 [406-457]	11 [5]
20-22-24 [508-559-610]	14 [6]

ENGINEERING SPECIFICATION: ZURN Z1310 Exposed Ecolotrol "anti-siphon" automatic draining wall hydrant. Complete with non-freeze integral backflow preventer, bronze casing, all bronze interior parts, non-turning operating rod with free-floating compression closure valve, replaceable bronze seat and seat washer, and combination 3/4 [19] female or 1 [25] male straight IP inlet. Stainless steel face with operating key.

OPTIONS (Check/specify appropriate options)

SUFFIXES

____	-PB	Polished Bronze Face
____	-RA2	12 [305] Replacement Rod Assembly with Repair Kit (-RK)
____	-RA4	24 [610] Replacement Rod Assembly with Repair Kit (-RK)
____	-RK	Hydrant Parts Repair Kit
____	-SB	Statuary Bronze Face (Specify light, medium or dark finish)
____	-WC	Wall Clamp
____	-34FS	3/4 [19] Solder Female Inlet Adapter
____	-34UN	3/4 [19] IP 90º Inlet Elbow w/Union Nut

PARTS LIST

Item	Name	Quan.
6	O-Ring	1
4	Screw	1
5	Operating Screw	1
7	Operating Coupling	1
8	Operating Rod	1
10	Washer Guide	1
11	Washer (neoprene)	1
12	Screw	1
16	Removable Seat	1
25	O-Ring	1
26	Ball	1

*WHEN ORDERING REPLACEMENT PARTS SPECIFY Y DIM.

REV. F DATE: 10/22/10 C.N. NO. 111932

DWG. NO. 58869 PRODUCT NO. Z1310

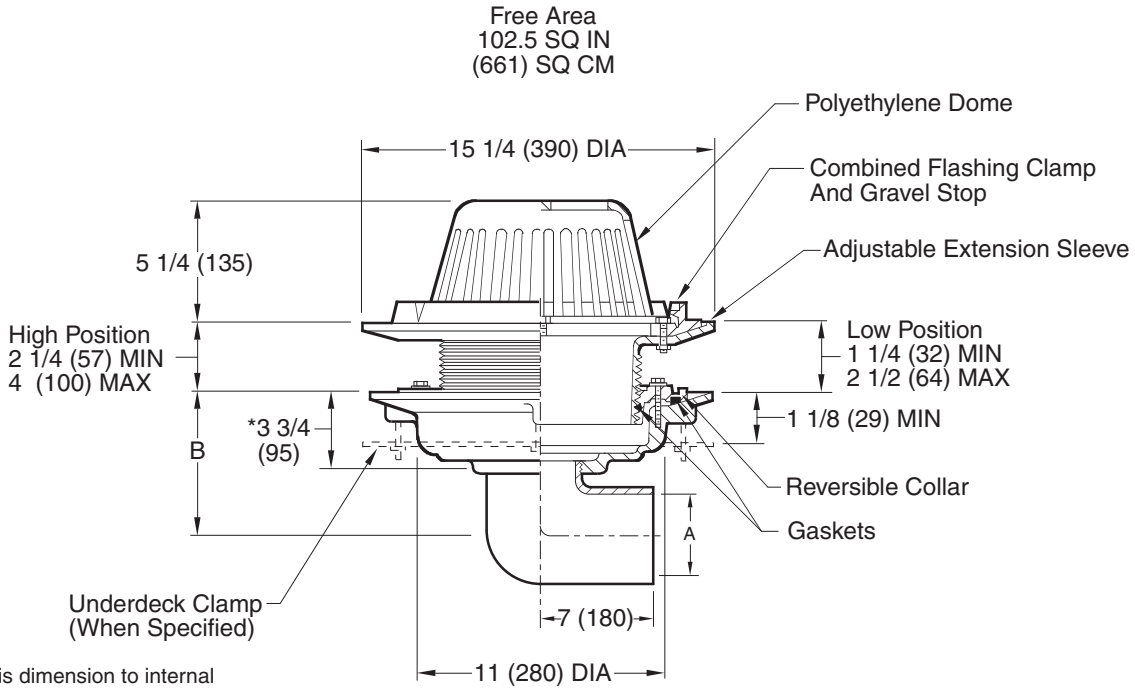
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MEMBER OF:

LOCATION

GENERAL PURPOSE ROOF DRAINS

ROOF DRAIN WITH ADJUSTABLE EXTENSION

FUNCTION: Used in flat roofs of any construction. The adjustable extension sleeve permits adjustment from a minimum of 1 1/4" (32) to a maximum of 4" (100), easily accommodating up to 2 3/4"(70) of varying insulation thicknesses. The positive threading allows smooth perimeter movement and circumferential support of the top at any adjusted elevation. Large low profile dome provides sufficient free area for quick drainage of rainwater and protection against debris.



*This dimension to internal stop of Speedi-Set Gasket
**Same for Caulk, NO-HUB and Speedi-Set, 3 3/4 (95) for Threaded

A(Pipe Size)	02(50)	03(75)	04(100)	05(125)	06(150)
B (DIA)	5 1/2(140)	6(150)	6 1/4(160)	7(180)	7 1/2(190)

recommended deck opening

with suffix -R	17 (430) DIA
less Suffix -R	14 (355) DIA

☐ Fig. 1015-SO . . . . . NO-HUB SIDE OUTLET

Note: See reverse side for assembly instructions.

REGULARLY FURNISHED:
Duco Cast Iron Body with Adjustable Extension Sleeve, Reversible Collar, Combined Flashing Clamp and Gravel Stop, with Polyethylene Dome.

VARIATIONS:
- ☐ Expansion Joint (Specify Fig. 1710)
- ☐ "L" Shaped Underdeck Clamp -CL
- ☐ L Speedi-Set Service Weight 02(50), 03(75) & 04(100)" sizes only
- ☐ LXH Speedi-Set Extra Heavy 02(50), 03(75) & 04(100)" sizes only
- ☐ Secondary Flashing Clamp -C2
- ☐ Sump Receiver -R
- ☐ Underdeck Clamp -C
- ☐ Vandal Proof Dome -U
- ☐ Side Outlet Drain (Specify Fig. 1025)
- ☐ T Threaded Outlet

OPTIONAL MATERIALS:
- ☐ Aluminum Dome -AD
- ☐ Cast Iron Dome -CID
- ☐ Galvanized Cast Iron -G
- ☐ Rough Bronze Dome -RBD

NOTE: Dimensions shown in parentheses are in millimeters.

REV.	DATE	DESCRIPTION	BY	CKD. BY

WEIGHT POUNDS | VOLUME CUBIC FEET | FIGURE NUMBER 1015-SO

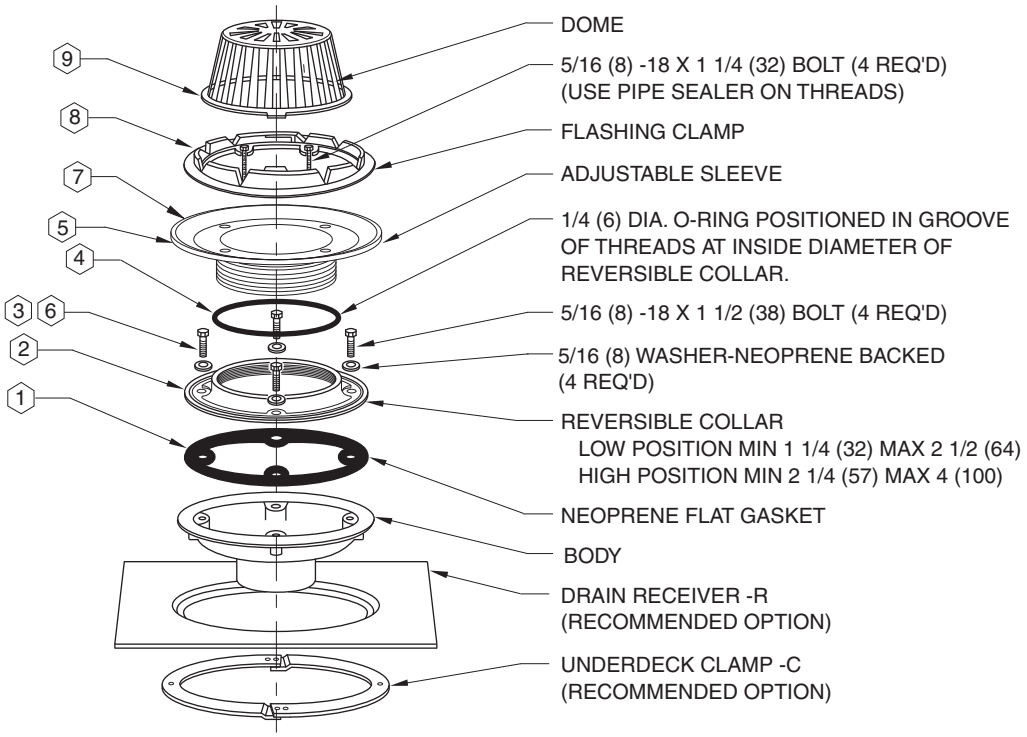
DRAWING NUMBER S1015-SO | SIZE A | SCALE: NONE | DATE: 4-8-08 | APPROVED BY: TWK | CHECKED BY: TK | DRAWN BY: TBW | FIGURE NUMBER 1015-SO

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ADJUSTABLE ROOF DRAIN



1. Position flat gasket on drain body, align holes in gasket with holes in body.
2. Determine if reversible collar is to be installed in the low (1 1/4" to 2 1/2") or high (2 1/4" to 4") position.
2a. Place reversible collar on body and align holes in collar with holes in gasket and body.
3. Secure collar to body with 1 1/2" long bolts insuring neoprene backed washers are installed at proper locations between top of reversible collar and bolt head. Tighten bolts in the following manner: 1, 3, 2 & 4. Tighten No. 1 bolt approximately one full turn then No. 3, No. 2 and No. 4 (same manner as for No. 1). Continue this method until reversible ring has been secured evenly all around.
4. Wipe "O" Ring recess in reversible collar clean. Insert "O" Ring in groove of threads at inside diameter of reversible collar. Lubricate "O" Ring in it's entirety with the lubricant provided. Lubricate the remaining threads.
5. Lubricate liberally the entire lead-in chamfer and first 2 threads of the adjustable sleeve. Thread adjustable sleeve into reversible collar and adjust to required height. Do not exceed minimum/maximum adjustment dimensions.
6. Check bolts a final time to insure tightness.
7. Run waterproofing membrane over top of adjustable sleeve to inside of bolt circle.
8. Install flashing clamp and secure with (4) bolts. Again tighten bolts in the 1, 3, 2, 4 manner. (See 3)
9. Install Dome

NOTE: Dimensions shown in parentheses are in millimeters.

REV.	DATE	DESCRIPTION	BY	CKD. BY

WEIGHT POUNDS	VOLUME CUBIC FEET	FIGURE NUMBER
		1015-SO BS

DRAWING NUMBER S1015-SO BS
SIZE A
SCALE: NONE
DATE: 4-8-08
APPROVED BY: TWK
CHECKED BY: TK
DRAWN BY: TBW
FIGURE NUMBER 1015-SO BS

DIMENSIONS ARE SUBJECT TO MANUFACTURERS TOLERANCE AND CHANGE WITHOUT NOTICE
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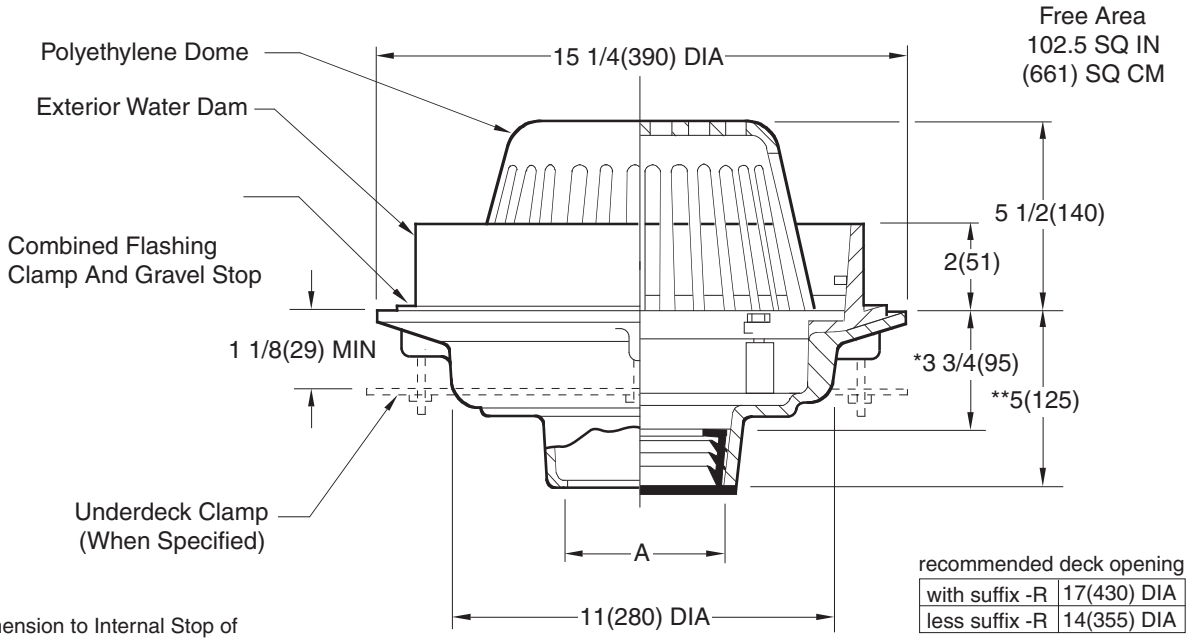
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MEMBER OF:

LOCATION

SPECIAL PURPOSE ROOF DRAINS

WATER DAM TYPE

FUNCTION: Used in flat roofs of any construction where a constant height of water is desired on the roof. It may also be used as an emergency overflow for conventional roofs, draining rain water when the depth of the water on the roof reaches the water dam height.



recommended deck opening

with suffix -R	17(430) DIA
less suffix -R	14(355) DIA

*This Dimension to Internal Stop of Speedi-Set Gasket
**Same for Caulk, NO-HUB and Speedi-Set. 3 3/4(95) for Threaded.

A (Pipe Size) 02(50), 03(75), 04(100), 05(125), 06(150) or 08(200)

☐ Fig. 1080C . . . . . CAULK OUTLET
☐ Fig. 1080Y . . . . . NO-HUB OUTLET

REGULARLY FURNISHED:
Duco Cast Iron Body, Flashing Clamp and Gravel Stop with Polyethylene Dome, and Cast Iron Water Dam.

NOTE: Dimensions shown in parentheses are in millimeters.

VARIATIONS:
- ☐ Adjustable Extension(Specify Fig. 1045)
- ☐ Expansion Joint (Specify Fig. 1710)
- ☐ Extension -E (Specify Height)
- ☐ "L" Shaped Underdeck Clamp -CL
- ☐ L Speedi-Set Service Weight 02(50), 03(75) & 04(100)" sizes only
- ☐ LXH Speedi-Set Extra Heavy 02(50), 03(75) & 04(100)" sizes only
- ☐ Secondary Flashing Clamp -C2
- ☐ Sump Receiver -R
- ☐ Underdeck Clamp -C
- ☐ Vandal Proof Dome -U
- ☐ T Threaded Outlet
- ☐ 2 1/2(64), 3(76) or 4"(100) Water Dams Available -WD

OPTIONAL MATERIALS:
- ☐ ▲ Aluminum Dome -AD
- ☐ ▲ Cast Iron Dome -CID
- ☐ Galvanized Cast Iron Body & Collar -G
- ☐ ▲ Galvanized Cast Iron Dome -CIDG
- ☐ ▲ Rough Bronze Dome -RBD

▲ Optional domes' free area are as follows:

Aluminum	98 (632)
Cast Iron	80 (516)
Bronze	95 (613)

REV.	DATE	DESCRIPTION	BY	CKD. BY
J H	06/04/09 9-8-08	Added Optional Dome Notes Rev. Variations	JJ RN	CL TK

WEIGHT POUNDS | VOLUME CUBIC FEET | FIGURE NUMBER 1080

J | DRAWING NUMBER S1080 | SIZE A | SCALE: NONE | DATE: 8-19-83 | APPROVED BY: JD | CHECKED BY: JD | DRAWN BY: CR | 1080 | FIGURE NUMBER

DIMENSIONS ARE SUBJECT TO MANUFACTURERS TOLERANCE AND CHANGE WITHOUT NOTICE
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Point-Of-Use Electric Commercial Water Heaters



120, 208, 240, 277 and 480 voltages

Available in Sizes Ranging From 2-1/2 – 30 Gallon Tank-Type Models

▶ 1440 Watts thru 6000 Watts

Rheem-Ruud point-of-use electric commercial water heaters are designed to provide hot water at the consumption point, eliminating costly temperature loss in long piping runs. Well suited for a wide variety of applications, point-of-use heaters are small enough for installation in limited spaces under counters, mop sinks, cabinets, or any remote area where modest quantities of hot water are required. They are ideally suited for applications in retail stores, public restrooms, office washrooms, kitchen and mop or bar sinks.

Construction Features:

- **Long life tank design –** proprietary steel formulation with a unique coat of high temperature porcelain enamel to maximize corrosion resistance resulting in a superior tank design. A patented R-Tech anode rod provides advanced technology; equalizing aggressive water action while prolonging the effective life of the anode rod and in turn the life of the tank.
- **Long life heating elements –** Our patented resistor elements are designed with a specially treated, double layer of magnesium oxide and copper to resist corrosion.
- **Efficient design –** Rigid polyurethane foam insulation provides superior insulating qualities resulting in reduced operating costs.
- **Optional wall mounting kit –** The wall mounting kit provides an easy way to mount the unit off the floor, out of the way for more useable floor space in a small area. Each kit is designed to be used on walls with 16" stud centers. All necessary parts are included in this easy to install kit. (Note: The 2-1/2 gallon model comes standard with a wall mounting kit.)
- **Automatic temperature control –** A surface mounted thermostat automatically cycles on and off to maintain the water temperature at a desired preset level.
- **Temperature limiting control –** Automatically and safely cuts off the power in the unlikely event that the water temperature exceeds 190°F.
- **Temperature and pressure relief valve –** AGA/ASME rated and factory installed.

Certifications and Ratings:

- **Efficiency –** these models meet or exceed thermal efficiency and standby loss requirements of current ASHRAE standards. (Part of the Federally mandated Energy Policy Act (EPact)). Also exceeds energy efficiency codes of all states including California Energy Commission (CEC).
- **Safety and construction –** these products are design certified by Underwriters Laboratories (UL) to meet UL standard 174 as electric storage tank water heaters. All models are North Carolina Code compliant. **CERTIFIED FOR A 150 PSI MAXIMUM WORKING PRESSURE.**

Continued on reverse.

DIMENSIONAL INFORMATION (All dimensions shown in English and Metric)

MODEL NUMBER	MIN WATTS	MAX WATTS	TANK CAPACITY		A		B		C		D		E		APPROXIMATE SHIPPING WEIGHT	
			GALLONS	LITERS	inches	mm	inches	mm	inches	mm	inches	mm	inches	mm	LBS.	KGS.
EGSP2	1,440	1,500	2.5	*9*	14	*356*	9-3/4	*248*	—	—	—	—	—	—	18	*8*
EGSP6	1,500	6,000	6	*23*	15-1/8	*384*	15-3/4	*400*	12-5/8	*321*	11-5/8	*295*	4-1/4	*108*	41	*19*
EGSP10	1,500	6,000	10	*38*	22-7/8	*581*	15-3/4	*400*	20-3/8	*518*	19-3/8	*492*	4-1/4	*108*	53	*24*
EGSP15	1,500	6,000	15	*57*	24-1/4	*616*	17-3/4	*451*	21-7/8	*556*	19-3/8	*492*	4-5/8	*117*	65	*29*
EGSP20	1,500	6,000	19.9	*75*	25-1/8	*638*	19-3/4	*502*	22-5/8	*575*	19-3/8	*492*	5-1/8	*130*	76	*34*
EGSP30	1,500	6,000	30	*114*	30	*762*	21-3/4	*533*	23	*584*	23	*584*	2-3/4	*70*	115	*52*

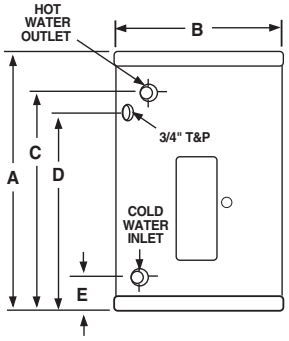
Water Temperature Ratings:	Thermostat Type: Surface Mounted	Minimum Temperature: 110°F *(43.3°C)*	Maximum Temperature: 170°F *(76.7°C)*	High Temperature Limit: 190°F *(87.8°C)*

NOTE: Basic model numbers are listed. When ordering, specify electrical input and kW to determine specific model number.

MODELS:

EGSP6
EGSP10
EGSP15
EGSP20
EGSP30

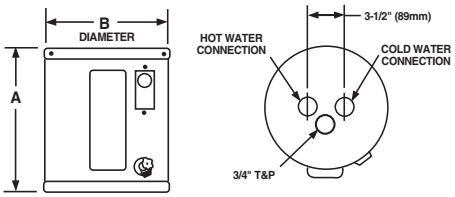
Water Connections 3/4" NPT



MODEL:

EGSP2

Water Connections 1/2" NPT



Recommended Specifications:

Water heater(s) shall be model _____, manufactured by RHEEM-RUUD, having electrical input of _____ kW and a recovery rate of _____ GPH at a 100°F temperature rise. Water heater(s) shall have a storage capacity of _____ gallons. Water heater(s) shall have the UL seal of certification and be factory equipped with an AGA/ASME rated temperature and pressure relief valve. Tank(s) interior shall be coated with a high temperature porcelain enamel and furnished with an R-Tech resistored magnesium anode rod rigidly supported. Water heater(s) shall meet or exceed the energy factor requirements of ASHRAE. Tanks shall have a working pressure rating of 150 psi, and shall be completely assembled. Water heater(s) shall be equipped with a copper, resistored, "screw-in" type element. Tank shall be insulated with rigid polyurethane foam insulation. Water heater(s) shall be equipped with a surface mounted thermostat with an integral, manual reset, high limit control. Water heater(s) shall be covered by a three year limited warranty against tank leaks.

Limited Warranty:

This product features a three year limited warranty against tank leaks. Please refer to Commercial Warranty Information brochure for complete warranty information.

PRODUCT AVAILABILITY

ELEMENT WATTAGE	SINGLE PHASE OPERATION ONLY				
	120 V	208 V	240 V	277 V	480 V
1,440	Y**	NA	NA	NA	NA
1,500	Y	Y	Y**	N/A	N/A
2,000	Y	Y	Y	Y	Y
2,500	Y	Y	Y	NA	NA
3,000	Y	Y	Y	Y	Y
4,500	NA	Y	Y*	Y*	Y*
6,000	NA	Y	Y	Y	Y

*Not available in EGSP6 & EGSP10
**EGSP2 available only in these configurations

ELECTRICAL CHARACTERISTICS

ELEMENT WATTAGE	SINGLE PHASE OPERATION ONLY – AMPS				
	120 V	208 V	240 V	277 V	480 V
1,440	12.0	NA	NA	NA	NA
1,500	12.5	7.2	6.3	N/A	N/A
2,000	16.7	9.6	8.3	7.2	4.2
2,500	20.8	12.0	10.4	NA	NA
3,000	25.0	14.4	12.5	10.8	6.3
4,500	NA	21.6	18.8	16.2	9.4
6,000	NA	28.8	25.0	21.7	12.5

All models employ 1 heating element resulting in a 2-wire outlet (single phase) electrical configuration.

RECOVERY CAPACITIES

Recovery in U.S. Gallons/Hr. (GPH) and Liters/Hr. (LPH) at Various Temperature Rises

ELEMENT WATTAGE	40°F *(22°C)*		60°F *(33°C)*		80°F *(45°C)*		100°F *(56°C)*		120°F *(67°C)*	
	GPH	LPH	GPH	LPH	GPH	LPH	GPH	LPH	GPH	LPH
1,440	15	*55*	10	*37*	7	*28*	6	*22*	5	*18*
1,500	15	*58*	10	*38*	8	*29*	6	*23*	5	*19*
2,000	20	*77*	14	*51*	10	*38*	8	*31*	7	*26*
2,500	25	*96*	17	*64*	13	*48*	10	*38*	8	*32*
3,000	30	*115*	20	*77*	15	*58*	12	*46*	10	*38*
4,500	46	*173*	30	*115*	23	*86*	18	*69*	15	*58*
6,000	61	*230*	41	*153*	30	*115*	24	*92*	20	*77*

Rheem RUUD

COMMERCIAL WATER HEATERS

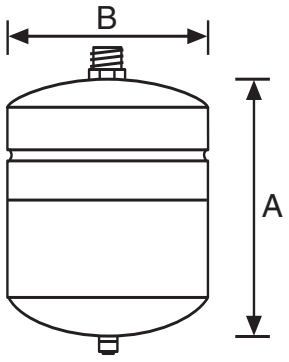
In keeping with its policy of continuous progress and product improvement, Rheem-Ruud reserves the right to make changes without notice.

Rheem Water Heating • 101 Bell Road, Montgomery, Alabama 36117-4305 • www.rheem.com
Rheem Canada Ltd./Ltée,128 Barton Street West, Hamilton, Ontario L8N 3P3

THERM-X-TROL®

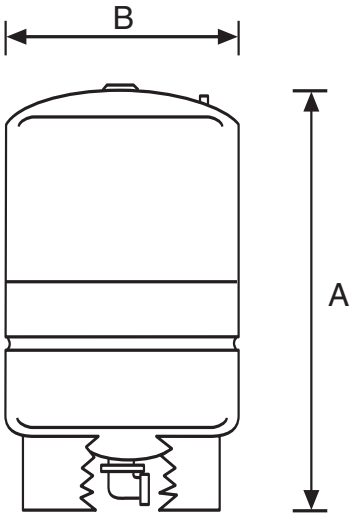
Thermal Expansion Absorbers, ST-Series (Non-ASME)

150 PSIG Working Pressure



ST-5, ST-12

ANSI/NSF 61



ST-25V through ST-210V

ANSI/NSF 61

In-Line Models

Model No.	Tank Vol.		Max. Accept. Factor	A Height		B Diameter		Sys. Conn.	Ship Wt.	
	Lit.	Gal.		cm	ins.	cm	ins.	NPTM	kg	lbs.
ST-5	8	2.0	0.45	321	12⅝	203	8	¾	2.3	5
ST-12	17	4.4	0.73	381	15	279	11	¾	4.0	9

Stand Models

Model No.	Tank Vol.		Max. Accept. Factor	A Height		B Diameter		Sys. Conn.	Ship Wt.	
	Lit.	Gal.		cm	ins.	cm	ins.	NPTF	kg	lbs.
ST-25V	39	10.3	1.00	489	19¼	391	15⅜	1	10.5	23
ST-30V	53	14.0	0.81	605	23⅞	391	15⅜	1	11.4	25
ST-42V	76	20.0	0.57	802	31⅝	391	15⅜	1	15.0	33
ST-60V	129	34.0	1.00	913	29⅝	559	22	1¼	28.0	61
ST-80V	167	44.0	0.77	913	36	559	22	1¼	31.0	69
ST-180V	235	62.0	0.55	1186	46¾	559	22	1¼	41.0	92
ST-210V	326	86.0	0.54	1199	47¼	660	26	1¼	56.0	123

Maximum Operating Conditions

Operating Temperature	200°F (93°C)
Working Pressure	150 PSIG (10.5 kg/cm²)

Specifications

Description	Standard Construction
Standard Factory Pre-charge	40 PSIG (2.8 kg/cm²)
System Connection	Brass (ST5,12)
	Stainless Steel (Stand Models)
Diaphragm	Butyl/EPDM
Liner Material	Polypropylene

All dimensions and weights are approximate.

Job Name _____ Contractor _____

Location _____ Contractor P.O. No. _____

_____ Sales Representative _____

_____ Model No. Ordered _____

Engineer _____

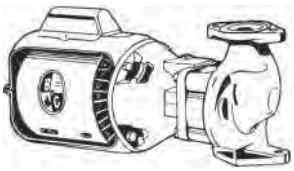
*Submittal data sheets can **ONLY** be ordered as a "Submittal Data Sheet Pack", using **MC# 4400**. They are not available to order on an individual basis, however each data sheet is available on the Amtrol Web Site and can be downloaded and printed for use as needed.*

Bell & Gossett®

SUBMITTAL

A-120G

JOB:	**REPRESENTATIVE:**	
UNIT TAG:	**ORDER NO.**	**DATE:**
ENGINEER:	**SUBMITTED BY:**	**DATE:**
CONTRACTOR:	**APPROVED BY:**	**DATE:**



Iron & Bronze* Booster Pump

*Where potable water is supplied, use a bronze pump.

DESCRIPTION

Bell & Gossett in-line three-piece booster pumps are designed for hydronic systems. Series 100 and HV are Listed with Underwriter's Laboratories.

CONSTRUCTION

Body: Cast Iron or Bronze

Seal: Mechanical, Carbon on Ceramic

Shaft: Carbon Steel, Heat Treated

Pump and Motor Bearings:
- −All except PD-38 and PD-40: Bronze Sleeve, Oil Lubricated
- −PD-38 and PD-40: Ball Bearing, Permanently Lubricated

Coupler:
- −All except PD38 and PD40: Flexible, Spring type
- −PD38 and PD40: Flexible, sleeve type.

Motor: Bell & Gossett 1/12 hp thru 1-1/2 hp standard single and three phase drip-proof motors are Recognized under the Component Program of Underwriter's Laboratories, Inc. Bell & Gossett boosters with their respective Bell & Gossett manufactured standard 60 hertz single and three phase motors are Certified by CSA.

OPERATIONAL DATA

Maximum Working Pressure: 125 PSI (682 kPa)
Maximum Operating Temperature:
- Standard Seal: 225°F (107°C) continuous
- Special Seals: 250°F (121°C) continuous (consult local B&G Representative)

Maximum Motor RPM: 1750

IMPELLER:

PUMP MODEL NO.	IRON BODY	BRONZE BODY
Series 100® Pump	Polypropylene* or Brass	Polypropylene* or Brass
Series HV & 2	Phenolic* or Brass	Phenolic* or Brass
PR, 2-1/2, LD3	Steel, Zinc Plated or Brass	Brass
HD3, PD35, PD37	Steel, Zinc Plated or Brass	Brass
PD38 & PD40	Cast Iron or Brass	Brass

* System temperatures above 225 °F (107 °C) require a brass impeller.

SCHEDULE

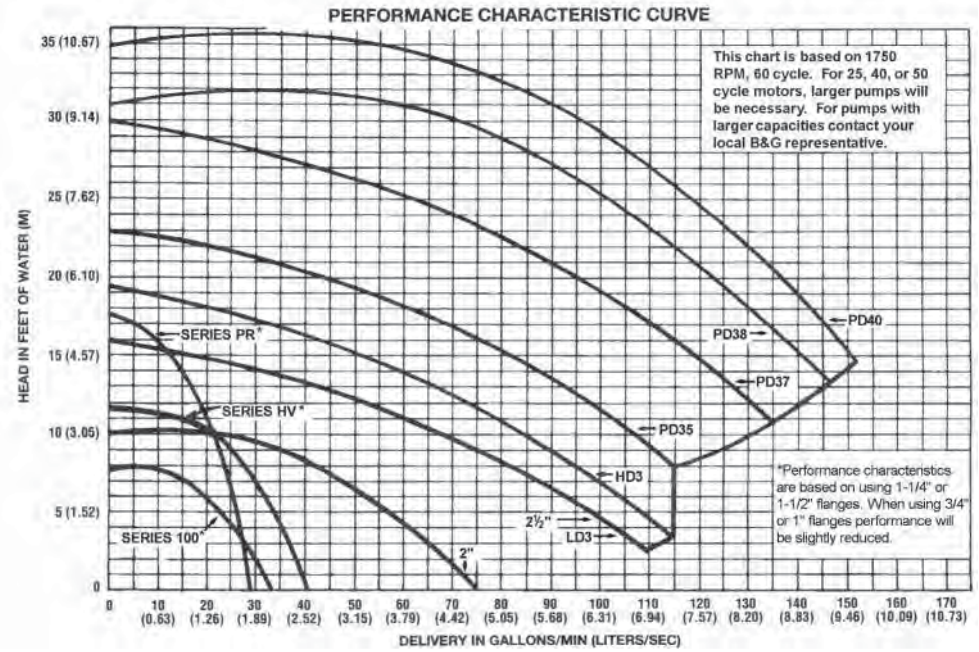
MODEL NO.	FLANGE SIZE NPT INCHES	**STANDARD 60 CYCLE CHARACTERISTICS					TAGGING INFORMATION	QUANTITY			
								Iron Body		Bronze Body	
		HP	PH	VOLTAGE*	F.L. AMPS	RPM		STD	BI	BI	NFI
Series 100	3/4, 1, 1-1/4 & 1-1/2	1/12	1	115	1.75	1725					
Series PR	3/4, 1, 1-1/4 & 1-1/2	1/6	1	115	1.9	1725					–
Series HV	1, 1-1/4 & 1-1/2	1/6	1	115	1.9	1725					
2	2	1/6	1	115	1.9	1725					
2-1/2	2-1/2	1/4	1	115	3.0	1725					–
LD3	3	1/4	1	115	3.0	1725					–
HD3	3	1/3	1	115/230	4.2/2.1	1725					–
PD-35S	3	1/2	1	115/230	5.2/2.6	1725					–
PD-35T	3	1/2	3	208-230/460	1.8-1.7/.85	1750					–
PD-37S	3	3/4	1	115/230	7.0/3.5	1725					–
PD-37T	3	3/4	3	208-230/460	2.45-2.4/1.2	1750					–
PD-38S	3	1	1	115/230	9.8/4.5	1725					–
PD-38T	3	1	3	208-230/460	3.4-3.4/1.7	1725					–
PD-40S	3	1-1/2	1	115/230	18.0/9.0	1725					–
PD-40T	3	1-1/2	3	208-230/460	4.8-4.8/2.4	1725					–

**Motors with special electrical characteristics are available on request at additional cost.

*1 PH Motors: Built-in overload protection
3 PH Motors: Overload protection must be provided
Bell & Gossett Booster Pumps equipped with a drip-proof motor are recommended for indoor use only.

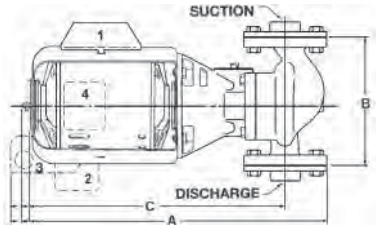
Bell & Gossett
ITT Industries
Engineered for life

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MODEL NO.	FLANGE SIZE NPT INCHES	DIMENSIONS IN INCHES (MM)			APPROX. SHPG. WT. LBS. (Kg)	
		A	B	C	IRON BODY	BRONZE BODY
Series 100	3/4, 1, 1-1/4 & 1-1/2	14-7/8 (378)	6-3/8 (162)	12-3/4 (324)	20 (9)	21 (10)
Series PR	3/4, 1, 1-1/4 & 1-1/2	15-1/4 (387)	8-1/2 (216)	12-3/4 (324)	30 (14)	32 (15)
Series HV	1, 1-1/4 & 1-1/2	15-3/8 (391)	8-1/2 (216)	13 (330)	28 (13)	30 (14)
2	2	16-5/8 (422)	8-1/2 (216)	14 (356)	36 (16)	39 (18)
2-1/2	2-1/2	17-1/4 (438)	10 (254)	14 (356)	54 (24)	58 (26)
LD3	3	17-1/4 (438)	10 (254)	14 (356)	53 (24)	57 (26)
HD3	3	17-1/2 (444)	10 (254)	14-1/4 (362)	55 (25)	59 (27)
PD-35S	3	20-1/4 (514)	12 (305)	16-7/8 (429)	75 (34)	80 (36)
PD-35T	3	20-1/4 (514)	12 (305)	16-7/8 (429)	75 (34)	80 (36)
PD-37S	3	20-1/4 (514)	12 (305)	16-7/8 (429)	75 (34)	80 (36)
PD-37T	3	20-1/4 (514)	12 (305)	16-7/8 (429)	75 (34)	80 (36)
PD-38S	3	22-11/16 (576)	14-1/2 (368)	18-15/16 (481)	128 (58)	138 (63)
PD-38T	3	23-15/16 (608)	14-1/2 (368)	20-3/16 (513)	125 (57)	135 (61)
PD-40S	3	24-3/4 (629)	14-1/2 (368)	21 (533)	130 (59)	140 (64)
PD-40T	3	21-7/8 (556)	14-1/2 (368)	18-1/8 (460)	127 (58)	137 (62)

Dimensions are subject to change.
Not to be used for construction purposes unless certified.



Electrical Box Arrangement for pumps with B&G Manufactured Motors

MODEL NO.	#1	#2	#3	#4
Series 100	115 & 230Volt 60Hz 1PH 110 & 220Volt 50Hz 1PH	–	–	–
Series HV, PR & 2	115 & 230Volt 60Hz 1PH 110 & 220Volt 50Hz 1PH	–	3PH	–
2-1/2", LD3 & HD3	–	1PH	–	–
PD35 & PD37	–	–	ALL	–
PD38 & PD40	–	–	–	ALL

TYPICAL SPECIFICATIONS

The Contractor shall furnish and install In-The-Line pumps as illustrated on the plans and in accordance with the following specifications:

1. The pumps shall be of the horizontal, oil-lubricated type. (Except PD-38, PD-40 are permanently lubricated) Specifically designed and guaranteed for quiet operation. Suitable for 125# (862 kPa) working pressure.

2.The pumps shall have a ground and polished steel shaft with a hardened integral thrust collar. The shaft shall be supported by two horizontal sleeve bearings designed to circulate oil. (Except PD-38, PD-40 are grease lubricated ball bearing design) The pumps are to be equipped with a mechanical seal with carbon seal face rotating against a ceramic seat. The motor shall be non-overloading at any point on pump curve.

3. The motor shall be of the drip-proof, sleeve-bearing, (Except PD-38, PD-40 are ball bearing) quiet operating, rubber-mounted construction. Motors shall have built-in thermal overload protectors. (Exception - PD models with 3-phase motors, see paragraph 4.)

4. For PD models with 3-phase motors, add the following: The Contractor shall furnish and install a magnetic starter for each booster pump with at least two thermal overload protectors. The starter shall be equipped with manual reset buttons.

All Units must be ITT Bell & Gossett Model No. _____, or approved equal with capacity of _____GPM at _____ft. head when directly driven through a self aligning flexible coupling by an oil lubricated motor, _____volts ____cycle___phase.

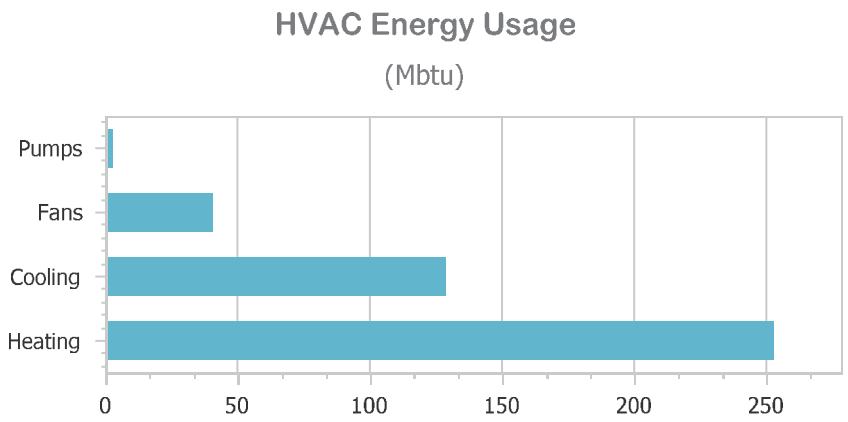
ITT Industries

Bell & Gossett
Bell & Gossett
8200 N. Austin Avenue, Morton Grove, IL 60053
Phone (847)966-3700
Facsimile (847)966-9052
www.bellgossett.com

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ISO 9001 Certified

Site Consumption Summary

Energy Consumption



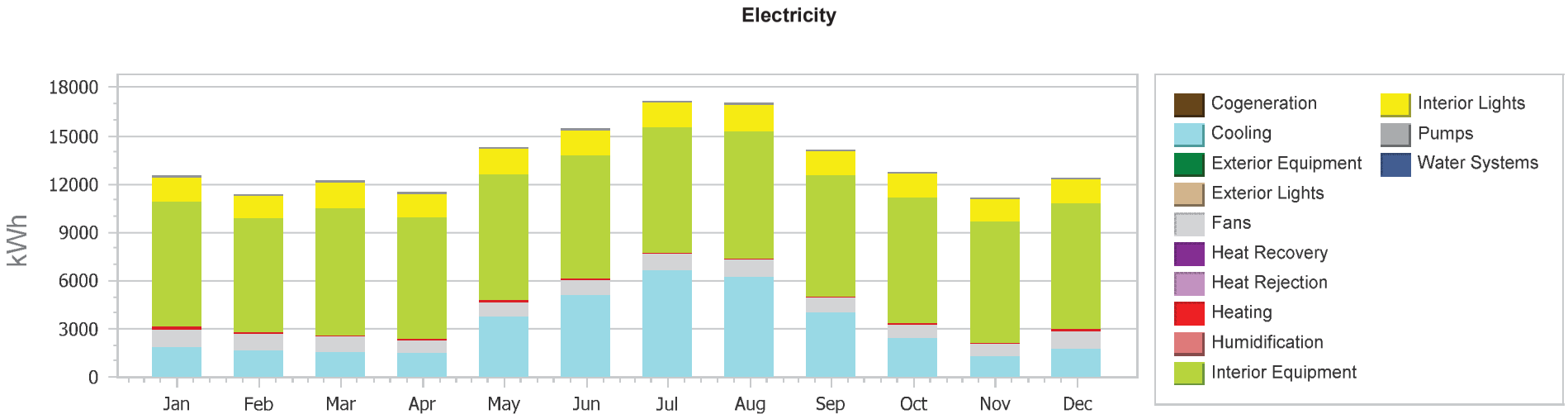


Component	Electricity (kWh)	Gas (Mbtu)	District Cooling (Mbtu)	District Heating (Mbtu)	Other Utilities (Mbtu)	Site Energy (kBtu)	Site Energy Use Intensity (kBtu/ft²)	Source Energy (kBtu)	Source Energy Use Intensity (kBtu/ft²)	Water (gal)
Heating	781	250	0	0	0	252,773	24.99	279,554	27.64	0
Cooling	37,867	0	0	0	0	129,206	12.77	409,197	40.46	0
Fans	11,944	0	0	0	0	40,756	4.03	129,075	12.76	0
Pumps	806	0	0	0	0	2,749	0.27	8,705	0.86	0
Heat Rejection	0	0	0	0	0	0	0	0	0	0
Humidification	0	0	0	0	0	0	0	0	0	0
Heat Recovery	0	0	0	0	0	0	0	0	0	0
HVAC	51,397	250	0	0	0	425,485	42.07	826,531	81.72	0
Water Systems	0	0	0	0	0	0	0	0	0	0
Interior Lighting	18,569	0	0	0	0	63,362	6.26	200,666	19.84	0
Exterior Lighting	0	0	0	0	0	0	0	0	0	0
Interior Equipment	92,075	0	0	0	0	314,173	31.06	994,986	98.38	0
Exterior Equipment	0	0	0	0	0	0	0	0	0	0
Refrigeration	0	0	0	0	0	0	0	0	0	0
Non-HVAC	110,644	0	0	0	0	377,535	37.33	1,195,652	118.22	0
Generators	0	0	0	0	0	0	0	0	0	0
Site Generation	0	0	0	0	0	0	0	0	0	0
Grand Total	162,042	250	0	0	0	803,019	79.4	2,022,182	199.94	0

Gross Floor Area: 10,111 ft² | Region: West | Building Type: Office | CBECS Survey Year: 2012 | Benchmark EUI: 69.2 kBtu/ft²/yr

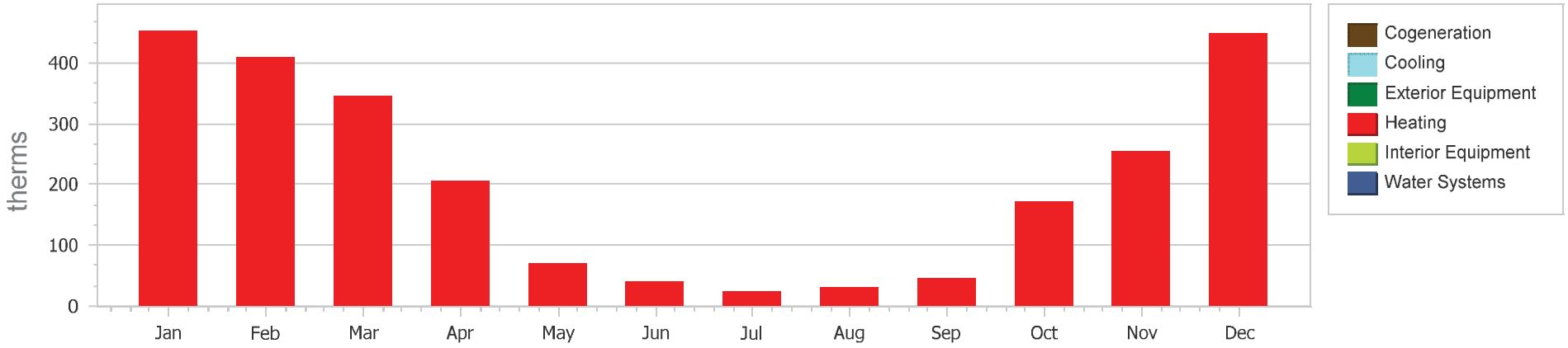
If the region reports as "All US" it means the data for the particular region was withheld because the Relative Standard Error was greater than 50 percent or fewer than 20 buildings were sampled.

Monthly Energy End Use



	January	February	March	April	May	June	July	August	September	October	November	December	Grand Total
Cogeneration	0	0	0	0	0	0	0	0	0	0	0	0	0
Cooling	1,873	1,678	1,565	1,500	3,780	5,104	6,631	6,231	4,013	2,417	1,299	1,777	37,867
Exterior Equipment	0	0	0	0	0	0	0	0	0	0	0	0	0
Exterior Lights	0	0	0	0	0	0	0	0	0	0	0	0	0
Fans	1,100	995	957	837	988	1,053	1,118	1,146	993	890	799	1,068	11,944
Heat Recovery	0	0	0	0	0	0	0	0	0	0	0	0	0
Heat Rejection	0	0	0	0	0	0	0	0	0	0	0	0	0
Heating	173	139	98	52	15	9	5	7	10	39	67	165	780
Humidification	0	0	0	0	0	0	0	0	0	0	0	0	0
Interior Equipment	7,774	7,060	7,874	7,567	7,840	7,614	7,794	7,874	7,567	7,807	7,514	7,794	92,076
Interior Lights	1,504	1,419	1,681	1,508	1,622	1,614	1,516	1,681	1,508	1,563	1,436	1,516	18,569
Pumps	74	67	58	44	66	78	90	96	73	50	39	70	807
Water Systems	0	0	0	0	0	0	0	0	0	0	0	0	0
Grand Total	12,498	11,358	12,233	11,508	14,311	15,470	17,154	17,035	14,163	12,766	11,154	12,390	162,043

Natural Gas



	January	February	March	April	May	June	July	August	September	October	November	December	Grand Total
Cogeneration	0	0	0	0	0	0	0	0	0	0	0	0	0
Cooling	0	0	0	0	0	0	0	0	0	0	0	0	0
Exterior Equipment	0	0	0	0	0	0	0	0	0	0	0	0	0
Heating	452	409	345	206	71	41	25	31	47	172	255	449	2,502
Interior Equipment	0	0	0	0	0	0	0	0	0	0	0	0	0
Water Systems	0	0	0	0	0	0	0	0	0	0	0	0	0
Grand Total	452	409	345	206	71	41	25	31	47	172	255	449	2,502

VAV RH (30% Min Default) (CW) (HWRH)

Coil Peak
Peak Time (Mo/D/H:M): 1/21/01:00
Outside Air (DB/WB/HR): 9.5 / 7.1 / 6.2

	Instant Sensible (Btu/h)	Time Delay Sensible (Btu/h)	Latent (Btu/h)	Total (Btu/h)	Percent of Total (%)	Btu/h per ft²
Roof	0	0	0	0	0.0	0.0
Other Roof	0	0	0	0	0.0	0.0
Glass	-29,728	0	0	-29,728	29.7	-24.7
Door	0	0	0	0	0.0	0.0
Wall	0	-7,608	0	-7,608	7.6	-2.1
Below-Grade Wall	0	0	0	0	0.0	0.0
Other Wall	0	0	0	0	0.0	0.0
Partition	0	-127	0	-127	0.1	0.0
Exterior Floor	0	0	0	0	0.0	0.0
Interior Floor	0	0	0	0	0.0	0.0
Slab	0	-3,047	0	-3,047	3.0	-0.3
Other Floor	0	0	0	0	0.0	0.0
Infiltration	-3,190	0	-20	-3,210	3.2	-0.9
Envelope Subtotal	-32,918	-10,782	-20	-43,720	43.7	-
People	0	0	0	0	0.0	0.0
Lights	0	0	0	0	0.0	0.0
RA Sensible (Lights)	0	0	0	0	0.0	0.0
Miscellaneous Loads	0	0	0	0	0.0	0.0
Internal Subtotal	0	0	0	0	0.0	-
Ventilation	-235,096	0	0	-235,096	234.7	-
DOAS Direct to Zone	0	0	0	0	0.0	-
Ceiling	0	-23,289	0	-23,289	23.3	-2.3
Refrigeration	0	0	0	0	0.0	0.0
Service Water	0	0	0	0	0.0	0.0
HVAC Equipment Losses	0	0	0	0	0.0	0.0
Adj Air Transfer Heat	0	0	0	0	0.0	0.0
Supply Fan Heat	0	0	-	0	0.0	-
Time Delay Correction	0	0	-	0	0.0	-
Sizing Factor Correction	-588	-	-	-588	0.6	-
Airflow Correction	202,545	0	0	202,545	-202.2	-
Grand Total	-66,056	-34,072	-20	-100,148	100.0	

Fan Peak
Peak Time (Mo/D/H:M): 7/21/19:00
Outside Air (DB/WB/HR): 85.6 / 58.7 / 45.1

	Instant Sensible (Btu/h)	Time Delay Sensible (Btu/h)	Total Sensible (Btu/h)	Percent of Total (%)	Related Area (ft²)
Roof	0	0	0	0.0	0
Other Roof	0	0	0	0.0	0
Glass	15,727	20,115	35,842	18.4	1,204
Door	0	0	0	0.0	0
Wall	0	2,632	2,632	1.4	3,601
Below-Grade Wall	0	0	0	0.0	0
Other Wall	0	0	0	0.0	3,601
Partition	0	-4,683	-4,683	-2.4	12,329
Exterior Floor	0	0	0	0.0	0
Interior Floor	0	0	0	0.0	0
Slab	0	-16,283	-16,283	-8.4	10,057
Other Floor	0	0	0	0.0	0
Infiltration	668	0	668	0.3	3,601
Envelope Subtotal	16,395	1,781	18,176	9.3	-
People	18,454	30,486	48,940	25.1	9,838
Lights	3,046	10,480	13,526	6.9	9,838
RA Sensible (Lights)	-	-	-	-	-
Miscellaneous Loads	59,983	0	59,983	30.8	9,838
Internal Subtotal	81,483	40,966	122,449	62.9	-
Ventilation	-	-	-	-	-
DOAS Direct to Zone			0	0.0	0
Ceiling	0	12,756	12,756	6.6	10,057
Refrigeration			0	0.0	9,838
Service Water			0	0.0	9,838
HVAC Equipment Losses			0	0.0	0
Adj Air Transfer Heat	0	0	0	0.0	0
Supply Fan Heat	-	-	-	-	-
Time Delay Correction	0	-1,102	-1,102	-0.6	-
Sizing Factor Correction	0	-	0	0.0	-
Airflow Correction	42,463	-	42,463	21.8	-
Grand Total	140,342	54,401	194,743	100.0	

Temperatures
°F

Supply	55.0
Return	72.0
Mixed Air	42.4
Fan Heat TD	0.0

Airflows
cfm

Main Fan	11,154
Ventilation	3,346
Infiltration	12
Min Stop / Reheat	8,731

Engineering Checks

% OA	37.08
cfm/ft²	1.13
Btu/h-ft²	-10.19
cfm/ton	-1,336.76
ft²/ton	-1,178.71
People	172
ft²/person	57.20

Areas
ft²

Roof	0
Other Roof	0
Ceiling	10,057
Window	1,204
Door	0
Wall	3,601
Below-Grade Wall	0
Other Wall	3,601
Partition	12,329
Exterior Floor	0
Internal Floor	0
Slab	10,057
Other Floor	0

Zone Cooling and Heating Loads by Component

ZONE_Zn-Room - 04 - Conference

Conditions at Time of Space Cooling Peak

Outside	DB / WB / HR	85.6 °F	/	58.7 °F	/	45.1 gr/lb
Zone	DB / RH / HR	74.0 °F	/	49.4 %	/	61.6 gr/lb

	Instant Sensible (Btu/h)	Time Delay Sensible (Btu/h)	Latent (Btu/h)	Total (Btu/h)	Percent of Total (%)
Roof	0	0	0	0	0.0
Other Roof	0	0	0	0	0.0
Glass	0	0	0	0	0.0
Door	0	0	0	0	0.0
Wall	0	0	0	0	0.0
Below-Grade Wall	0	0	0	0	0.0
Other Wall	0	0	0	0	0.0
Partition	0	-349	0	-349	-8.6
Exterior Floor	0	0	0	0	0.0
Interior Floor	0	0	0	0	0.0
Slab	0	-139	0	-139	-3.4
Other Floor	0	0	0	0	0.0
Infiltration	0	0	0	0	0.0
Envelope Subtotal	0	-488	0	-488	-
People	577	1210	1375	3162	77.8
Lights	38	162	0	200	4.9
RA Sensible (Lights)	161	0	0	161	4.0
Miscellaneous Loads	1000	0	0	1000	24.6
Internal Subtotal	1776	1372	1375	4522	-
RA (All Other)	0	0	0	0	0.0
DOA Direct to Zone	0	0	0	0	0.0
Ceiling	0	39	0	39	1.0
Refrigeration	0	0	0	0	0.0
Service Water	0	0	0	0	0.0
HVAC Equipment Losses	0	0	0	0	0.0
Adj Air Transfer Heat	0	0	0	0	0.0
Sizing Factor Correction	0	0	0	0	0.0
Time Delay Correction	0	-11	0	-11	-0.3
Grand Total	1776	912	1375	4063	100.0

Engineering Checks

Cooling tons	0.34	Input Ventilation cfm	32
Cooling cfm	145.06	Calculated Ventilation cfm	54
ft²/ton	330.06	Number of People	4.99
cfm/ton	428.40	People per 1000 ft²	45
Conditioned ft²	111.7		

Conditions at Time of Space Heating Peak

Outside	DB / WB / HR	9.5 °F	/	7.1 °F	/	6.2 gr/lb
Zone	DB / RH / HR	72.0 °F	/	5.9 %	/	6.9 gr/lb

	Instant Sensible (Btu/h)	Time Delay Sensible (Btu/h)	Latent (Btu/h)	Total (Btu/h)	Percent of Total (%)
Roof	0	0	0	0	0.0
Other Roof	0	0	0	0	0.0
Glass	0	0	0	0	0.0
Door	0	0	0	0	0.0
Wall	0	0	0	0	0.0
Below-Grade Wall	0	0	0	0	0.0
Other Wall	0	0	0	0	0.0
Partition	0	-109	0	-109	25.4
Exterior Floor	0	0	0	0	0.0
Interior Floor	0	0	0	0	0.0
Slab	0	-48	0	-48	11.1
Other Floor	0	0	0	0	0.0
Infiltration	0	0	0	0	0.0
Envelope Subtotal	0	-157	0	-157	-
People	0	0	0	0	0.0
Lights	0	0	0	0	0.0
RA Sensible (Lights)	0	0	0	0	0.0
Miscellaneous Loads	0	0	0	0	0.0
Internal Subtotal	0	0	0	0	-
RA (All Other)	0	0	0	0	0.0
DOA Direct to Zone	0	0	0	0	0.0
Ceiling	0	-272	0	-272	63.5
Refrigeration	0	0	0	0	0.0
Service Water	0	0	0	0	0.0
HVAC Equipment Losses	0	0	0	0	0.0
Adj Air Transfer Heat	0	0	0	0	0.0
Sizing Factor Correction	0	0	0	0	0.0
Time Delay Correction	0	0	0	0	0.0
Grand Total	0	-429	0	-429	100.0

Engineering Checks

Heating Mbh	-0.43	Input Ventilation cfm	40
Heating cfm	43.52	Calculated Ventilation cfm	44
ft²/Mbh	-260.38	Number of People	4.99
cfm/Mbh	-101.41	People per 1000 ft²	45
Conditioned ft²	111.7		

ZONE_Zn-Room - 05 - Office

Conditions at Time of Space Cooling Peak

Outside	DB / WB / HR	85.6 °F	/	58.7 °F	/	45.1 gr/lb
Zone	DB / RH / HR	74.0 °F	/	43.5 %	/	54.3 gr/lb

	Instant Sensible (Btu/h)	Time Delay Sensible (Btu/h)	Latent (Btu/h)	Total (Btu/h)	Percent of Total (%)
Roof	0	0	0	0	0.0
Other Roof	0	0	0	0	0.0
Glass	0	0	0	0	0.0
Door	0	0	0	0	0.0
Wall	0	2	0	2	0.0
Below-Grade Wall	0	0	0	0	0.0
Other Wall	0	0	0	0	0.0
Partition	0	94	0	94	1.6
Exterior Floor	0	0	0	0	0.0
Interior Floor	0	0	0	0	0.0
Slab	0	-249	0	-249	-4.3
Other Floor	0	0	0	0	0.0
Infiltration	0	0	0	0	0.0
Envelope Subtotal	0	-154	0	-154	-
People	630	1283	1200	3112	53.8
Lights	119	499	0	619	10.7
RA Sensible (Lights)	510	0	0	510	8.8
Miscellaneous Loads	1200	0	0	1200	20.7
Internal Subtotal	2459	1782	1200	5441	-
RA (All Other)	0	0	0	0	0.0
DOA Direct to Zone	0	0	0	0	0.0
Ceiling	0	506	0	506	8.8
Refrigeration	0	0	0	0	0.0
Service Water	0	0	0	0	0.0
HVAC Equipment Losses	0	0	0	0	0.0
Adj Air Transfer Heat	0	0	0	0	0.0
Sizing Factor Correction	0	0	0	0	0.0
Time Delay Correction	0	-9	0	-9	-0.2
Grand Total	2459	2125	1200	5784	100.0

Engineering Checks

Cooling tons	0.48	Input Ventilation cfm	52
Cooling cfm	233.50	Calculated Ventilation cfm	87
ft²/ton	745.03	Number of People	6.00
cfm/ton	484.33	People per 1000 ft²	17
Conditioned ft²	359.1		

Conditions at Time of Space Heating Peak

Outside	DB / WB / HR	9.5 °F	/	7.1 °F	/	6.2 gr/lb
Zone	DB / RH / HR	72.0 °F	/	5.9 %	/	6.9 gr/lb

	Instant Sensible (Btu/h)	Time Delay Sensible (Btu/h)	Latent (Btu/h)	Total (Btu/h)	Percent of Total (%)
Roof	0	0	0	0	0.0
Other Roof	0	0	0	0	0.0
Glass	0	0	0	0	0.0
Door	0	0	0	0	0.0
Wall	0	-8	0	-8	0.6
Below-Grade Wall	0	0	0	0	0.0
Other Wall	0	0	0	0	0.0
Partition	0	-339	0	-339	25.4
Exterior Floor	0	0	0	0	0.0
Interior Floor	0	0	0	0	0.0
Slab	0	-152	0	-152	11.4
Other Floor	0	0	0	0	0.0
Infiltration	0	0	0	0	0.0
Envelope Subtotal	0	-499	0	-499	-
People	0	0	0	0	0.0
Lights	0	0	0	0	0.0
RA Sensible (Lights)	0	0	0	0	0.0
Miscellaneous Loads	0	0	0	0	0.0
Internal Subtotal	0	0	0	0	-
RA (All Other)	0	0	0	0	0.0
DOA Direct to Zone	0	0	0	0	0.0
Ceiling	0	-837	0	-837	62.6
Refrigeration	0	0	0	0	0.0
Service Water	0	0	0	0	0.0
HVAC Equipment Losses	0	0	0	0	0.0
Adj Air Transfer Heat	0	0	0	0	0.0
Sizing Factor Correction	0	0	0	0	0.0
Time Delay Correction	0	0	0	0	0.0
Grand Total	0	-1336	0	-1336	100.0

Engineering Checks

Heating Mbh	-1.34	Input Ventilation cfm	64
Heating cfm	70.05	Calculated Ventilation cfm	70
ft²/Mbh	-268.81	Number of People	6.00
cfm/Mbh	-52.43	People per 1000 ft²	17
Conditioned ft²	359.1		

ZONE_Zn-Room - 06 - Conference

Conditions at Time of Space Cooling Peak

Outside	DB / WB / HR	85.6 °F	/	58.7 °F	/	45.1 gr/lb
Zone	DB / RH / HR	73.9 °F	/	54.1 %	/	67.6 gr/lb

	Instant Sensible (Btu/h)	Time Delay Sensible (Btu/h)	Latent (Btu/h)	Total (Btu/h)	Percent of Total (%)
Roof	0	0	0	0	0.0
Other Roof	0	0	0	0	0.0
Glass	0	0	0	0	0.0
Door	0	0	0	0	0.0
Wall	0	0	0	0	0.0
Below-Grade Wall	0	0	0	0	0.0
Other Wall	0	0	0	0	0.0
Partition	0	-738	0	-738	-9.1
Exterior Floor	0	0	0	0	0.0
Interior Floor	0	0	0	0	0.0
Slab	0	-331	0	-331	-4.1
Other Floor	0	0	0	0	0.0
Infiltration	0	0	0	0	0.0
Envelope Subtotal	0	-1069	0	-1069	-
People	1386	2565	3299	7250	89.5
Lights	92	349	0	441	5.4
RA Sensible (Lights)	392	0	0	392	4.8
Miscellaneous Loads	1000	0	0	1000	12.3
Internal Subtotal	2869	2914	3299	9082	-
RA (All Other)	0	0	0	0	0.0
DOA Direct to Zone	0	0	0	0	0.0
Ceiling	0	112	0	112	1.4
Refrigeration	0	0	0	0	0.0
Service Water	0	0	0	0	0.0
HVAC Equipment Losses	0	0	0	0	0.0
Adj Air Transfer Heat	0	0	0	0	0.0
Sizing Factor Correction	0	0	0	0	0.0
Time Delay Correction	0	-25	0	-25	-0.3
Grand Total	2869	1931	3299	8099	100.0

Engineering Checks

Cooling tons	0.67	Input Ventilation cfm	76
Cooling cfm	318.03	Calculated Ventilation cfm	118
ft²/ton	403.20	Number of People	11.98
cfm/ton	471.09	People per 1000 ft²	44
Conditioned ft²	272.1		

Conditions at Time of Space Heating Peak

Outside	DB / WB / HR	9.5 °F	/	7.1 °F	/	6.2 gr/lb
Zone	DB / RH / HR	72.0 °F	/	5.9 %	/	6.9 gr/lb

	Instant Sensible (Btu/h)	Time Delay Sensible (Btu/h)	Latent (Btu/h)	Total (Btu/h)	Percent of Total (%)
Roof	0	0	0	0	0.0
Other Roof	0	0	0	0	0.0
Glass	0	0	0	0	0.0
Door	0	0	0	0	0.0
Wall	0	0	0	0	0.0
Below-Grade Wall	0	0	0	0	0.0
Other Wall	0	0	0	0	0.0
Partition	0	-56	0	-56	7.2
Exterior Floor	0	0	0	0	0.0
Interior Floor	0	0	0	0	0.0
Slab	0	-115	0	-115	14.8
Other Floor	0	0	0	0	0.0
Infiltration	0	0	0	0	0.0
Envelope Subtotal	0	-171	0	-171	-
People	0	0	0	0	0.0
Lights	0	0	0	0	0.0
RA Sensible (Lights)	0	0	0	0	0.0
Miscellaneous Loads	0	0	0	0	0.0
Internal Subtotal	0	0	0	0	-
RA (All Other)	0	0	0	0	0.0
DOA Direct to Zone	0	0	0	0	0.0
Ceiling	0	-606	0	-606	78.1
Refrigeration	0	0	0	0	0.0
Service Water	0	0	0	0	0.0
HVAC Equipment Losses	0	0	0	0	0.0
Adj Air Transfer Heat	0	0	0	0	0.0
Sizing Factor Correction	0	0	0	0	0.0
Time Delay Correction	0	0	0	0	0.0
Grand Total	0	-777	0	-777	100.0

Engineering Checks

Heating Mbh	-0.78	Input Ventilation cfm	95
Heating cfm	95.41	Calculated Ventilation cfm	95
ft²/Mbh	-350.29	Number of People	11.98
cfm/Mbh	-122.81	People per 1000 ft²	44
Conditioned ft²	272.1		

ZONE_Zn-Room - 07 - Office

Conditions at Time of Space Cooling Peak

Outside	DB / WB / HR	85.6 °F	/ 58.7 °F	/ 45.1 gr/lb	
Zone	DB / RH / HR	74.0 °F	/ 43.8 %	/ 54.6 gr/lb	

	Instant Sensible (Btu/h)	Time Delay Sensible (Btu/h)	Latent (Btu/h)	Total (Btu/h)	Percent of Total (%)
Roof	0	0	0	0	0.0
Other Roof	0	0	0	0	0.0
Glass	0	0	0	0	0.0
Door	0	0	0	0	0.0
Wall	0	0	0	0	0.0
Below-Grade Wall	0	0	0	0	0.0
Other Wall	0	0	0	0	0.0
Partition	0	-57	0	-57	-0.8
Exterior Floor	0	0	0	0	0.0
Interior Floor	0	0	0	0	0.0
Slab	0	-307	0	-307	-4.1
Other Floor	0	0	0	0	0.0
Infiltration	0	0	0	0	0.0
Envelope Subtotal	0	-363	0	-363	-
People	840	1681	1600	4121	55.0
Lights	159	655	0	815	10.9
RA Sensible (Lights)	681	0	0	681	9.1
Miscellaneous Loads	1600	0	0	1600	21.4
Internal Subtotal	3280	2337	1600	7216	-
RA (All Other)	0	0	0	0	0.0
DOA Direct to Zone	0	0	0	0	0.0
Ceiling	0	646	0	646	8.6
Refrigeration	0	0	0	0	0.0
Service Water	0	0	0	0	0.0
HVAC Equipment Losses	0	0	0	0	0.0
Adj Air Transfer Heat	0	0	0	0	0.0
Sizing Factor Correction	0	0	0	0	0.0
Time Delay Correction	0	-12	0	-12	-0.2
Grand Total	3280	2606	1600	7486	100.0

Engineering Checks

Cooling tons	0.62	Input Ventilation cfm	69
Cooling cfm	298.33	Calculated Ventilation cfm	111
ft²/ton	767.95	Number of People	8.00
cfm/ton	478.15	People per 1000 ft²	17
Conditioned ft²	479.0		

Conditions at Time of Space Heating Peak

Outside	DB / WB / HR	9.5 °F	/ 7.1 °F	/ 6.2 gr/lb	
Zone	DB / RH / HR	72.0 °F	/ 5.9 %	/ 6.9 gr/lb	

	Instant Sensible (Btu/h)	Time Delay Sensible (Btu/h)	Latent (Btu/h)	Total (Btu/h)	Percent of Total (%)
Roof	0	0	0	0	0.0
Other Roof	0	0	0	0	0.0
Glass	0	0	0	0	0.0
Door	0	0	0	0	0.0
Wall	0	0	0	0	0.0
Below-Grade Wall	0	0	0	0	0.0
Other Wall	0	0	0	0	0.0
Partition	0	-390	0	-390	23.1
Exterior Floor	0	0	0	0	0.0
Interior Floor	0	0	0	0	0.0
Slab	0	-204	0	-204	12.1
Other Floor	0	0	0	0	0.0
Infiltration	0	0	0	0	0.0
Envelope Subtotal	0	-594	0	-594	-
People	0	0	0	0	0.0
Lights	0	0	0	0	0.0
RA Sensible (Lights)	0	0	0	0	0.0
Miscellaneous Loads	0	0	0	0	0.0
Internal Subtotal	0	0	0	0	-
RA (All Other)	0	0	0	0	0.0
DOA Direct to Zone	0	0	0	0	0.0
Ceiling	0	-1097	0	-1097	64.9
Refrigeration	0	0	0	0	0.0
Service Water	0	0	0	0	0.0
HVAC Equipment Losses	0	0	0	0	0.0
Adj Air Transfer Heat	0	0	0	0	0.0
Sizing Factor Correction	0	0	0	0	0.0
Time Delay Correction	0	0	0	0	0.0
Grand Total	0	-1691	0	-1691	100.0

Engineering Checks

Heating Mbh	-1.69	Input Ventilation cfm	86
Heating cfm	89.50	Calculated Ventilation cfm	89
ft²/Mbh	-283.26	Number of People	8.00
cfm/Mbh	-52.92	People per 1000 ft²	17
Conditioned ft²	479.0		

ZONE_Zn-Room - 11 - IT

Conditions at Time of Space Cooling Peak

Outside	DB / WB / HR	85.6 °F	/	58.7 °F	/	45.1 gr/lb
Zone	DB / RH / HR	74.0 °F	/	36.6 %	/	45.5 gr/lb

	Instant Sensible (Btu/h)	Time Delay Sensible (Btu/h)	Latent (Btu/h)	Total (Btu/h)	Percent of Total (%)
Roof	0	0	0	0	0.0
Other Roof	0	0	0	0	0.0
Glass	0	0	0	0	0.0
Door	0	0	0	0	0.0
Wall	0	0	0	0	0.0
Below-Grade Wall	0	0	0	0	0.0
Other Wall	0	0	0	0	0.0
Partition	0	117	0	117	0.9
Exterior Floor	0	0	0	0	0.0
Interior Floor	0	0	0	0	0.0
Slab	0	-47	0	-47	-0.4
Other Floor	0	0	0	0	0.0
Infiltration	0	0	0	0	0.0
Envelope Subtotal	0	70	0	70	-
People	0	0	0	0	0.0
Lights	35	141	0	176	1.4
RA Sensible (Lights)	151	0	0	151	1.2
Miscellaneous Loads	11997	0	0	11997	95.5
Internal Subtotal	12183	141	0	12324	-
RA (All Other)	0	0	0	0	0.0
DOA Direct to Zone	0	0	0	0	0.0
Ceiling	0	174	0	174	1.4
Refrigeration	0	0	0	0	0.0
Service Water	0	0	0	0	0.0
HVAC Equipment Losses	0	0	0	0	0.0
Adj Air Transfer Heat	0	0	0	0	0.0
Sizing Factor Correction	0	0	0	0	0.0
Time Delay Correction	0	0	0	0	0.0
Grand Total	12183	385	0	12568	100.0

Engineering Checks

Cooling tons	1.05	Input Ventilation cfm	0
Cooling cfm	711.17	Calculated Ventilation cfm	0
ft²/ton	87.78	Number of People	0.00
cfm/ton	678.92	People per 1000 ft²	0
Conditioned ft²	91.9		

Conditions at Time of Space Heating Peak

Outside	DB / WB / HR	9.5 °F	/	7.1 °F	/	6.2 gr/lb
Zone	DB / RH / HR	72.0 °F	/	5.9 %	/	6.9 gr/lb

	Instant Sensible (Btu/h)	Time Delay Sensible (Btu/h)	Latent (Btu/h)	Total (Btu/h)	Percent of Total (%)
Roof	0	0	0	0	0.0
Other Roof	0	0	0	0	0.0
Glass	0	0	0	0	0.0
Door	0	0	0	0	0.0
Wall	0	0	0	0	0.0
Below-Grade Wall	0	0	0	0	0.0
Other Wall	0	0	0	0	0.0
Partition	0	-40	0	-40	13.7
Exterior Floor	0	0	0	0	0.0
Interior Floor	0	0	0	0	0.0
Slab	0	-40	0	-40	13.8
Other Floor	0	0	0	0	0.0
Infiltration	0	0	0	0	0.0
Envelope Subtotal	0	-81	0	-81	-
People	0	0	0	0	0.0
Lights	0	0	0	0	0.0
RA Sensible (Lights)	0	0	0	0	0.0
Miscellaneous Loads	0	0	0	0	0.0
Internal Subtotal	0	0	0	0	-
RA (All Other)	0	0	0	0	0.0
DOA Direct to Zone	0	0	0	0	0.0
Ceiling	0	-211	0	-211	72.4
Refrigeration	0	0	0	0	0.0
Service Water	0	0	0	0	0.0
HVAC Equipment Losses	0	0	0	0	0.0
Adj Air Transfer Heat	0	0	0	0	0.0
Sizing Factor Correction	0	0	0	0	0.0
Time Delay Correction	0	0	0	0	0.0
Grand Total	0	-292	0	-292	100.0

Engineering Checks

Heating Mbh	-0.29	Input Ventilation cfm	0
Heating cfm	711.17	Calculated Ventilation cfm	0
ft²/Mbh	-314.97	Number of People	0.00
cfm/Mbh	-2,436.56	People per 1000 ft²	0
Conditioned ft²	91.9		

ZONE_Zn-Room - 12 - Mens RR

Conditions at Time of Space Cooling Peak

Outside	DB / WB / HR	89.3 °F	/	59.9 °F	/	45.2 gr/lb
Zone	DB / RH / HR	74.0 °F	/	37.3 %	/	46.4 gr/lb

	Instant Sensible (Btu/h)	Time Delay Sensible (Btu/h)	Latent (Btu/h)	Total (Btu/h)	Percent of Total (%)
Roof	0	0	0	0	0.0
Other Roof	0	0	0	0	0.0
Glass	3148	2039	0	5187	52.0
Door	0	0	0	0	0.0
Wall	0	264	0	264	2.6
Below-Grade Wall	0	0	0	0	0.0
Other Wall	0	0	0	0	0.0
Partition	0	-27	0	-27	-0.3
Exterior Floor	0	0	0	0	0.0
Interior Floor	0	0	0	0	0.0
Slab	0	-1053	0	-1053	-10.6
Other Floor	0	0	0	0	0.0
Infiltration	668	0	-34	634	6.4
Envelope Subtotal	3816	1223	-34	5005	-
People	115	216	275	607	6.1
Lights	318	1248	0	1566	15.7
RA Sensible (Lights)	1359	0	0	1359	13.6
Miscellaneous Loads	0	0	0	0	0.0
Internal Subtotal	1792	1464	275	3532	-
RA (All Other)	0	0	0	0	0.0
DOA Direct to Zone	0	0	0	0	0.0
Ceiling	0	1445	0	1445	14.5
Refrigeration	0	0	0	0	0.0
Service Water	0	0	0	0	0.0
HVAC Equipment Losses	0	0	0	0	0.0
Adj Air Transfer Heat	0	0	0	0	0.0
Sizing Factor Correction	0	0	0	0	0.0
Time Delay Correction	0	-4	0	-4	0.0
Grand Total	5608	4128	241	9978	100.0

Engineering Checks

Cooling tons	0.83	Input Ventilation cfm	30
Cooling cfm	1,441.82	Calculated Ventilation cfm	535
ft²/ton	1213.13	Number of People	1.00
cfm/ton	1,733.72	People per 1000 ft²	1
Conditioned ft²	1008.6		

Conditions at Time of Space Heating Peak

Outside	DB / WB / HR	9.5 °F	/	7.1 °F	/	6.2 gr/lb
Zone	DB / RH / HR	72.0 °F	/	5.9 %	/	6.8 gr/lb

	Instant Sensible (Btu/h)	Time Delay Sensible (Btu/h)	Latent (Btu/h)	Total (Btu/h)	Percent of Total (%)
Roof	0	0	0	0	0.0
Other Roof	0	0	0	0	0.0
Glass	-2320	0	0	-2320	25.6
Door	0	0	0	0	0.0
Wall	0	-553	0	-553	6.1
Below-Grade Wall	0	0	0	0	0.0
Other Wall	0	0	0	0	0.0
Partition	0	-199	0	-199	2.2
Exterior Floor	0	0	0	0	0.0
Interior Floor	0	0	0	0	0.0
Slab	0	-420	0	-420	4.6
Other Floor	0	0	0	0	0.0
Infiltration	-3190	0	-20	-3210	35.4
Envelope Subtotal	-5510	-1171	-20	-6702	-
People	0	0	0	0	0.0
Lights	0	0	0	0	0.0
RA Sensible (Lights)	0	0	0	0	0.0
Miscellaneous Loads	0	0	0	0	0.0
Internal Subtotal	0	0	0	0	-
RA (All Other)	0	0	0	0	0.0
DOA Direct to Zone	0	0	0	0	0.0
Ceiling	0	-2368	0	-2368	26.1
Refrigeration	0	0	0	0	0.0
Service Water	0	0	0	0	0.0
HVAC Equipment Losses	0	0	0	0	0.0
Adj Air Transfer Heat	0	0	0	0	0.0
Sizing Factor Correction	0	0	0	0	0.0
Time Delay Correction	0	0	0	0	0.0
Grand Total	-5510	-3539	-20	-9070	100.0

Engineering Checks

Heating Mbh	-9.07	Input Ventilation cfm	37
Heating cfm	432.55	Calculated Ventilation cfm	433
ft²/Mbh	-111.21	Number of People	1.00
cfm/Mbh	-47.69	People per 1000 ft²	1
Conditioned ft²	1008.6		

ZONE_Zn-Room - 16 - Mechanical

Conditions at Time of Space Cooling Peak

Outside	DB / WB / HR	89.5 °F	/ 60.0 °F	/ 45.2 gr/lb	
Zone	DB / RH / HR	74.0 °F	/ 36.6 %	/ 45.5 gr/lb	

	Instant Sensible (Btu/h)	Time Delay Sensible (Btu/h)	Latent (Btu/h)	Total (Btu/h)	Percent of Total (%)
Roof	0	0	0	0	0.0
Other Roof	0	0	0	0	0.0
Glass	866	693	0	1558	69.9
Door	0	0	0	0	0.0
Wall	0	255	0	255	11.4
Below-Grade Wall	0	0	0	0	0.0
Other Wall	0	0	0	0	0.0
Partition	0	129	0	129	5.8
Exterior Floor	0	0	0	0	0.0
Interior Floor	0	0	0	0	0.0
Slab	0	-331	0	-331	-14.8
Other Floor	0	0	0	0	0.0
Infiltration	0	0	0	0	0.0
Envelope Subtotal	866	746	0	1612	-
People	0	0	0	0	0.0
Lights	57	195	0	252	11.3
RA Sensible (Lights)	244	0	0	244	10.9
Miscellaneous Loads	0	0	0	0	0.0
Internal Subtotal	301	195	0	496	-
RA (All Other)	0	0	0	0	0.0
DOA Direct to Zone	0	0	0	0	0.0
Ceiling	0	121	0	121	5.4
Refrigeration	0	0	0	0	0.0
Service Water	0	0	0	0	0.0
HVAC Equipment Losses	0	0	0	0	0.0
Adj Air Transfer Heat	0	0	0	0	0.0
Sizing Factor Correction	0	0	0	0	0.0
Time Delay Correction	0	0	0	0	0.0
Grand Total	1167	1062	0	2229	100.0

Engineering Checks

Cooling tons	0.19	Input Ventilation cfm	0
Cooling cfm	369.21	Calculated Ventilation cfm	137
ft²/ton	1715.59	Number of People	0.00
cfm/ton	1,987.45	People per 1000 ft²	0
Conditioned ft²	318.6		

Conditions at Time of Space Heating Peak

Outside	DB / WB / HR	9.5 °F	/ 7.1 °F	/ 6.2 gr/lb	
Zone	DB / RH / HR	72.0 °F	/ 5.9 %	/ 6.9 gr/lb	

	Instant Sensible (Btu/h)	Time Delay Sensible (Btu/h)	Latent (Btu/h)	Total (Btu/h)	Percent of Total (%)
Roof	0	0	0	0	0.0
Other Roof	0	0	0	0	0.0
Glass	-797	0	0	-797	34.4
Door	0	0	0	0	0.0
Wall	0	-574	0	-574	24.8
Below-Grade Wall	0	0	0	0	0.0
Other Wall	0	0	0	0	0.0
Partition	0	2	0	2	-0.1
Exterior Floor	0	0	0	0	0.0
Interior Floor	0	0	0	0	0.0
Slab	0	-117	0	-117	5.0
Other Floor	0	0	0	0	0.0
Infiltration	0	0	0	0	0.0
Envelope Subtotal	-797	-689	0	-1486	-
People	0	0	0	0	0.0
Lights	0	0	0	0	0.0
RA Sensible (Lights)	0	0	0	0	0.0
Miscellaneous Loads	0	0	0	0	0.0
Internal Subtotal	0	0	0	0	-
RA (All Other)	0	0	0	0	0.0
DOA Direct to Zone	0	0	0	0	0.0
Ceiling	0	-832	0	-832	35.9
Refrigeration	0	0	0	0	0.0
Service Water	0	0	0	0	0.0
HVAC Equipment Losses	0	0	0	0	0.0
Adj Air Transfer Heat	0	0	0	0	0.0
Sizing Factor Correction	0	0	0	0	0.0
Time Delay Correction	0	0	0	0	0.0
Grand Total	-797	-1520	0	-2317	100.0

Engineering Checks

Heating Mbh	-2.32	Input Ventilation cfm	0
Heating cfm	110.76	Calculated Ventilation cfm	111
ft²/Mbh	-137.50	Number of People	0.00
cfm/Mbh	-47.80	People per 1000 ft²	0
Conditioned ft²	318.6		

ZONE_Zn-Room - 17 - Breakroom

Conditions at Time of Space Cooling Peak

Outside	DB / WB / HR	93.7 °F	/	61.4 °F	/	45.2 gr/lb
Zone	DB / RH / HR	74.0 °F	/	48.3 %	/	60.3 gr/lb

	Instant Sensible (Btu/h)	Time Delay Sensible (Btu/h)	Latent (Btu/h)	Total (Btu/h)	Percent of Total (%)
Roof	0	0	0	0	0.0
Other Roof	0	0	0	0	0.0
Glass	675	1451	0	2126	12.3
Door	0	0	0	0	0.0
Wall	0	185	0	185	1.1
Below-Grade Wall	0	0	0	0	0.0
Other Wall	0	0	0	0	0.0
Partition	0	-1284	0	-1284	-7.5
Exterior Floor	0	0	0	0	0.0
Interior Floor	0	0	0	0	0.0
Slab	0	-858	0	-858	-5.0
Other Floor	0	0	0	0	0.0
Infiltration	0	0	0	0	0.0
Envelope Subtotal	675	-505	0	169	-
People	2309	4296	5499	12104	70.3
Lights	172	697	0	869	5.0
RA Sensible (Lights)	735	0	0	735	4.3
Miscellaneous Loads	3199	0	0	3199	18.6
Internal Subtotal	6416	4992	5499	16907	-
RA (All Other)	0	0	0	0	0.0
DOA Direct to Zone	0	0	0	0	0.0
Ceiling	0	242	0	242	1.4
Refrigeration	0	0	0	0	0.0
Service Water	0	0	0	0	0.0
HVAC Equipment Losses	0	0	0	0	0.0
Adj Air Transfer Heat	0	0	0	0	0.0
Sizing Factor Correction	0	0	0	0	0.0
Time Delay Correction	0	-104	0	-104	-0.6
Grand Total	7091	4625	5499	17214	100.0

Engineering Checks

Cooling tons	1.43	Input Ventilation cfm	156
Cooling cfm	728.31	Calculated Ventilation cfm	270
ft²/ton	399.53	Number of People	20.02
cfm/ton	507.61	People per 1000 ft²	35
Conditioned ft²	573.1		

Conditions at Time of Space Heating Peak

Outside	DB / WB / HR	9.5 °F	/	7.1 °F	/	6.2 gr/lb
Zone	DB / RH / HR	72.0 °F	/	5.9 %	/	6.9 gr/lb

	Instant Sensible (Btu/h)	Time Delay Sensible (Btu/h)	Latent (Btu/h)	Total (Btu/h)	Percent of Total (%)
Roof	0	0	0	0	0.0
Other Roof	0	0	0	0	0.0
Glass	-1852	0	0	-1852	40.5
Door	0	0	0	0	0.0
Wall	0	-498	0	-498	10.9
Below-Grade Wall	0	0	0	0	0.0
Other Wall	0	0	0	0	0.0
Partition	0	-18	0	-18	0.4
Exterior Floor	0	0	0	0	0.0
Interior Floor	0	0	0	0	0.0
Slab	0	-222	0	-222	4.9
Other Floor	0	0	0	0	0.0
Infiltration	0	0	0	0	0.0
Envelope Subtotal	-1852	-737	0	-2589	-
People	0	0	0	0	0.0
Lights	0	0	0	0	0.0
RA Sensible (Lights)	0	0	0	0	0.0
Miscellaneous Loads	0	0	0	0	0.0
Internal Subtotal	0	0	0	0	-
RA (All Other)	0	0	0	0	0.0
DOA Direct to Zone	0	0	0	0	0.0
Ceiling	0	-1390	0	-1390	30.4
Refrigeration	0	0	0	0	0.0
Service Water	0	0	0	0	0.0
HVAC Equipment Losses	0	0	0	0	0.0
Adj Air Transfer Heat	0	0	0	0	0.0
Sizing Factor Correction	-592	0	0	-592	12.9
Time Delay Correction	0	0	0	0	0.0
Grand Total	-2444	-2128	0	-4571	100.0

Engineering Checks

Heating Mbh	-4.57	Input Ventilation cfm	195
Heating cfm	218.49	Calculated Ventilation cfm	218
ft²/Mbh	-125.37	Number of People	20.02
cfm/Mbh	-47.80	People per 1000 ft²	35
Conditioned ft²	573.1		

ZONE_Zn-Room - 18 - Electrical

Conditions at Time of Space Cooling Peak

Outside	DB / WB / HR	89.3 °F	/ 59.9 °F	/ 45.2 gr/lb	
Zone	DB / RH / HR	74.0 °F	/ 36.6 %	/ 45.5 gr/lb	

	Instant Sensible (Btu/h)	Time Delay Sensible (Btu/h)	Latent (Btu/h)	Total (Btu/h)	Percent of Total (%)
Roof	0	0	0	0	0.0
Other Roof	0	0	0	0	0.0
Glass	1158	752	0	1909	104.3
Door	0	0	0	0	0.0
Wall	0	161	0	161	8.8
Below-Grade Wall	0	0	0	0	0.0
Other Wall	0	0	0	0	0.0
Partition	0	-233	0	-233	-12.7
Exterior Floor	0	0	0	0	0.0
Interior Floor	0	0	0	0	0.0
Slab	0	-331	0	-331	-18.1
Other Floor	0	0	0	0	0.0
Infiltration	0	0	0	0	0.0
Envelope Subtotal	1158	348	0	1506	-
People	0	0	0	0	0.0
Lights	21	83	0	103	5.6
RA Sensible (Lights)	89	0	0	89	4.9
Miscellaneous Loads	0	0	0	0	0.0
Internal Subtotal	110	83	0	193	-
RA (All Other)	0	0	0	0	0.0
DOA Direct to Zone	0	0	0	0	0.0
Ceiling	0	132	0	132	7.2
Refrigeration	0	0	0	0	0.0
Service Water	0	0	0	0	0.0
HVAC Equipment Losses	0	0	0	0	0.0
Adj Air Transfer Heat	0	0	0	0	0.0
Sizing Factor Correction	0	0	0	0	0.0
Time Delay Correction	0	0	0	0	0.0
Grand Total	1268	562	0	1830	100.0

Engineering Checks

Cooling tons	0.15	Input Ventilation cfm	N/A
Cooling cfm	62.46	Calculated Ventilation cfm	N/A
ft²/ton	763.79	Number of People	0.00
cfm/ton	409.47	People per 1000 ft²	0
Conditioned ft²	116.5		

Conditions at Time of Space Heating Peak

Outside	DB / WB / HR	9.5 °F	/ 7.1 °F	/ 6.2 gr/lb	
Zone	DB / RH / HR	72.0 °F	/ 5.9 %	/ 6.9 gr/lb	

	Instant Sensible (Btu/h)	Time Delay Sensible (Btu/h)	Latent (Btu/h)	Total (Btu/h)	Percent of Total (%)
Roof	0	0	0	0	0.0
Other Roof	0	0	0	0	0.0
Glass	-753	0	0	-753	57.6
Door	0	0	0	0	0.0
Wall	0	-294	0	-294	22.5
Below-Grade Wall	0	0	0	0	0.0
Other Wall	0	0	0	0	0.0
Partition	0	97	0	97	-7.4
Exterior Floor	0	0	0	0	0.0
Interior Floor	0	0	0	0	0.0
Slab	0	-43	0	-43	3.3
Other Floor	0	0	0	0	0.0
Infiltration	0	0	0	0	0.0
Envelope Subtotal	-753	-240	0	-993	-
People	0	0	0	0	0.0
Lights	0	0	0	0	0.0
RA Sensible (Lights)	0	0	0	0	0.0
Miscellaneous Loads	0	0	0	0	0.0
Internal Subtotal	0	0	0	0	-
RA (All Other)	0	0	0	0	0.0
DOA Direct to Zone	0	0	0	0	0.0
Ceiling	0	-313	0	-313	24.0
Refrigeration	0	0	0	0	0.0
Service Water	0	0	0	0	0.0
HVAC Equipment Losses	0	0	0	0	0.0
Adj Air Transfer Heat	0	0	0	0	0.0
Sizing Factor Correction	0	0	0	0	0.0
Time Delay Correction	0	0	0	0	0.0
Grand Total	-753	-554	0	-1307	100.0

Engineering Checks

Heating Mbh	-1.31	Input Ventilation cfm	N/A
Heating cfm	62.46	Calculated Ventilation cfm	N/A
ft²/Mbh	-89.14	Number of People	0.00
cfm/Mbh	-47.80	People per 1000 ft²	0
Conditioned ft²	116.5		

ZONE_Zn-Room - 21 - Fire Riser

Conditions at Time of Space Cooling Peak

Outside	DB / WB / HR	89.3 °F	/ 59.9 °F	/ 45.2 gr/lb	
Zone	DB / RH / HR	74.0 °F	/ 36.6 %	/ 45.5 gr/lb	

	Instant Sensible (Btu/h)	Time Delay Sensible (Btu/h)	Latent (Btu/h)	Total (Btu/h)	Percent of Total (%)
Roof	0	0	0	0	0.0
Other Roof	0	0	0	0	0.0
Glass	1149	843	0	1992	123.4
Door	0	0	0	0	0.0
Wall	0	71	0	71	4.4
Below-Grade Wall	0	0	0	0	0.0
Other Wall	0	0	0	0	0.0
Partition	0	-338	0	-338	-20.9
Exterior Floor	0	0	0	0	0.0
Interior Floor	0	0	0	0	0.0
Slab	0	-245	0	-245	-15.2
Other Floor	0	0	0	0	0.0
Infiltration	0	0	0	0	0.0
Envelope Subtotal	1149	331	0	1480	-
People	0	0	0	0	0.0
Lights	12	52	0	64	4.0
RA Sensible (Lights)	50	0	0	50	3.1
Miscellaneous Loads	0	0	0	0	0.0
Internal Subtotal	61	52	0	114	-
RA (All Other)	0	0	0	0	0.0
DOA Direct to Zone	0	0	0	0	0.0
Ceiling	0	20	0	20	1.3
Refrigeration	0	0	0	0	0.0
Service Water	0	0	0	0	0.0
HVAC Equipment Losses	0	0	0	0	0.0
Adj Air Transfer Heat	0	0	0	0	0.0
Sizing Factor Correction	0	0	0	0	0.0
Time Delay Correction	0	0	0	0	0.0
Grand Total	1211	404	0	1614	100.0

Engineering Checks

Cooling tons	0.13	Input Ventilation cfm	N/A
Cooling cfm	47.49	Calculated Ventilation cfm	N/A
ft²/ton	483.31	Number of People	0.00
cfm/ton	352.95	People per 1000 ft²	0
Conditioned ft²	65.0		

Conditions at Time of Space Heating Peak

Outside	DB / WB / HR	9.5 °F	/ 7.1 °F	/ 6.2 gr/lb	
Zone	DB / RH / HR	72.0 °F	/ 5.9 %	/ 6.9 gr/lb	

	Instant Sensible (Btu/h)	Time Delay Sensible (Btu/h)	Latent (Btu/h)	Total (Btu/h)	Percent of Total (%)
Roof	0	0	0	0	0.0
Other Roof	0	0	0	0	0.0
Glass	-752	0	0	-752	75.6
Door	0	0	0	0	0.0
Wall	0	-139	0	-139	14.0
Below-Grade Wall	0	0	0	0	0.0
Other Wall	0	0	0	0	0.0
Partition	0	89	0	89	-9.0
Exterior Floor	0	0	0	0	0.0
Interior Floor	0	0	0	0	0.0
Slab	0	-24	0	-24	2.4
Other Floor	0	0	0	0	0.0
Infiltration	0	0	0	0	0.0
Envelope Subtotal	-752	-74	0	-826	-
People	0	0	0	0	0.0
Lights	0	0	0	0	0.0
RA Sensible (Lights)	0	0	0	0	0.0
Miscellaneous Loads	0	0	0	0	0.0
Internal Subtotal	0	0	0	0	-
RA (All Other)	0	0	0	0	0.0
DOA Direct to Zone	0	0	0	0	0.0
Ceiling	0	-168	0	-168	16.9
Refrigeration	0	0	0	0	0.0
Service Water	0	0	0	0	0.0
HVAC Equipment Losses	0	0	0	0	0.0
Adj Air Transfer Heat	0	0	0	0	0.0
Sizing Factor Correction	0	0	0	0	0.0
Time Delay Correction	0	0	0	0	0.0
Grand Total	-752	-242	0	-994	100.0

Engineering Checks

Heating Mbh	-0.99	Input Ventilation cfm	N/A
Heating cfm	47.49	Calculated Ventilation cfm	N/A
ft²/Mbh	-65.44	Number of People	0.00
cfm/Mbh	-47.80	People per 1000 ft²	0
Conditioned ft²	65.0		

ZONE_Zn-Room - 23 - Open Office

Conditions at Time of Space Cooling Peak

Outside	DB / WB / HR	85.6 °F	/ 58.7 °F	/ 45.1 gr/lb	
Zone	DB / RH / HR	74.0 °F	/ 41.4 %	/ 51.6 gr/lb	

	Instant Sensible (Btu/h)	Time Delay Sensible (Btu/h)	Latent (Btu/h)	Total (Btu/h)	Percent of Total (%)
Roof	0	0	0	0	0.0
Other Roof	0	0	0	0	0.0
Glass	2720	4170	0	6890	18.5
Door	0	0	0	0	0.0
Wall	0	633	0	633	1.7
Below-Grade Wall	0	0	0	0	0.0
Other Wall	0	0	0	0	0.0
Partition	0	-568	0	-568	-1.5
Exterior Floor	0	0	0	0	0.0
Interior Floor	0	0	0	0	0.0
Slab	0	-3338	0	-3338	-8.9
Other Floor	0	0	0	0	0.0
Infiltration	0	0	0	0	0.0
Envelope Subtotal	2720	898	0	3618	-
People	3149	4987	5999	14135	37.9
Lights	528	1688	0	2217	5.9
RA Sensible (Lights)	2257	0	0	2257	6.0
Miscellaneous Loads	12997	0	0	12997	34.8
Internal Subtotal	18932	6675	5999	31606	-
RA (All Other)	0	0	0	0	0.0
DOA Direct to Zone	0	0	0	0	0.0
Ceiling	0	2332	0	2332	6.2
Refrigeration	0	0	0	0	0.0
Service Water	0	0	0	0	0.0
HVAC Equipment Losses	0	0	0	0	0.0
Adj Air Transfer Heat	0	0	0	0	0.0
Sizing Factor Correction	0	0	0	0	0.0
Time Delay Correction	0	-223	0	-223	-0.6
Grand Total	21651	9682	5999	37332	100.0

Engineering Checks

Cooling tons	3.11	Input Ventilation cfm	252
Cooling cfm	1,840.06	Calculated Ventilation cfm	682
ft²/ton	545.51	Number of People	29.97
cfm/ton	591.35	People per 1000 ft²	18
Conditioned ft²	1696.9		

Conditions at Time of Space Heating Peak

Outside	DB / WB / HR	9.5 °F	/ 7.1 °F	/ 6.2 gr/lb	
Zone	DB / RH / HR	72.0 °F	/ 5.9 %	/ 6.9 gr/lb	

	Instant Sensible (Btu/h)	Time Delay Sensible (Btu/h)	Latent (Btu/h)	Total (Btu/h)	Percent of Total (%)
Roof	0	0	0	0	0.0
Other Roof	0	0	0	0	0.0
Glass	-5509	0	0	-5509	47.7
Door	0	0	0	0	0.0
Wall	0	-1600	0	-1600	13.9
Below-Grade Wall	0	0	0	0	0.0
Other Wall	0	0	0	0	0.0
Partition	0	180	0	180	-1.6
Exterior Floor	0	0	0	0	0.0
Interior Floor	0	0	0	0	0.0
Slab	0	-558	0	-558	4.8
Other Floor	0	0	0	0	0.0
Infiltration	0	0	0	0	0.0
Envelope Subtotal	-5509	-1978	0	-7487	-
People	0	0	0	0	0.0
Lights	0	0	0	0	0.0
RA Sensible (Lights)	0	0	0	0	0.0
Miscellaneous Loads	0	0	0	0	0.0
Internal Subtotal	0	0	0	0	-
RA (All Other)	0	0	0	0	0.0
DOA Direct to Zone	0	0	0	0	0.0
Ceiling	0	-4062	0	-4062	35.2
Refrigeration	0	0	0	0	0.0
Service Water	0	0	0	0	0.0
HVAC Equipment Losses	0	0	0	0	0.0
Adj Air Transfer Heat	0	0	0	0	0.0
Sizing Factor Correction	0	0	0	0	0.0
Time Delay Correction	0	0	0	0	0.0
Grand Total	-5509	-6041	0	-11550	100.0

Engineering Checks

Heating Mbh	-11.55	Input Ventilation cfm	315
Heating cfm	552.02	Calculated Ventilation cfm	552
ft²/Mbh	-146.94	Number of People	29.97
cfm/Mbh	-47.80	People per 1000 ft²	18
Conditioned ft²	1696.9		

ZONE_Zn-Room - 24 - Open Office

Conditions at Time of Space Cooling Peak

Outside	DB / WB / HR	93.7 °F	/	61.4 °F	/	45.2 gr/lb
Zone	DB / RH / HR	74.0 °F	/	41.6 %	/	51.8 gr/lb

	Instant Sensible (Btu/h)	Time Delay Sensible (Btu/h)	Latent (Btu/h)	Total (Btu/h)	Percent of Total (%)
Roof	0	0	0	0	0.0
Other Roof	0	0	0	0	0.0
Glass	2617	3771	0	6388	17.5
Door	0	0	0	0	0.0
Wall	0	441	0	441	1.2
Below-Grade Wall	0	0	0	0	0.0
Other Wall	0	0	0	0	0.0
Partition	0	-573	0	-573	-1.6
Exterior Floor	0	0	0	0	0.0
Interior Floor	0	0	0	0	0.0
Slab	0	-3591	0	-3591	-9.8
Other Floor	0	0	0	0	0.0
Infiltration	0	0	0	0	0.0
Envelope Subtotal	2617	48	0	2664	-
People	3149	4662	5999	13810	37.8
Lights	527	1701	0	2229	6.1
RA Sensible (Lights)	2253	0	0	2253	6.2
Miscellaneous Loads	12997	0	0	12997	35.6
Internal Subtotal	18926	6363	5999	31288	-
RA (All Other)	0	0	0	0	0.0
DOA Direct to Zone	0	0	0	0	0.0
Ceiling	0	2842	0	2842	7.8
Refrigeration	0	0	0	0	0.0
Service Water	0	0	0	0	0.0
HVAC Equipment Losses	0	0	0	0	0.0
Adj Air Transfer Heat	0	0	0	0	0.0
Sizing Factor Correction	0	0	0	0	0.0
Time Delay Correction	0	-243	0	-243	-0.7
Grand Total	21543	9009	5999	36551	100.0

Engineering Checks

Cooling tons	3.05	Input Ventilation cfm	252
Cooling cfm	2,017.54	Calculated Ventilation cfm	748
ft²/ton	556.14	Number of People	29.97
cfm/ton	662.24	People per 1000 ft²	18
Conditioned ft²	1693.8		

Conditions at Time of Space Heating Peak

Outside	DB / WB / HR	9.5 °F	/	7.1 °F	/	6.2 gr/lb
Zone	DB / RH / HR	72.0 °F	/	5.9 %	/	6.9 gr/lb

	Instant Sensible (Btu/h)	Time Delay Sensible (Btu/h)	Latent (Btu/h)	Total (Btu/h)	Percent of Total (%)
Roof	0	0	0	0	0.0
Other Roof	0	0	0	0	0.0
Glass	-6991	0	0	-6991	55.2
Door	0	0	0	0	0.0
Wall	0	-1439	0	-1439	11.4
Below-Grade Wall	0	0	0	0	0.0
Other Wall	0	0	0	0	0.0
Partition	0	300	0	300	-2.4
Exterior Floor	0	0	0	0	0.0
Interior Floor	0	0	0	0	0.0
Slab	0	-543	0	-543	4.3
Other Floor	0	0	0	0	0.0
Infiltration	0	0	0	0	0.0
Envelope Subtotal	-6991	-1683	0	-8673	-
People	0	0	0	0	0.0
Lights	0	0	0	0	0.0
RA Sensible (Lights)	0	0	0	0	0.0
Miscellaneous Loads	0	0	0	0	0.0
Internal Subtotal	0	0	0	0	-
RA (All Other)	0	0	0	0	0.0
DOA Direct to Zone	0	0	0	0	0.0
Ceiling	0	-3990	0	-3990	31.5
Refrigeration	0	0	0	0	0.0
Service Water	0	0	0	0	0.0
HVAC Equipment Losses	0	0	0	0	0.0
Adj Air Transfer Heat	0	0	0	0	0.0
Sizing Factor Correction	0	0	0	0	0.0
Time Delay Correction	0	0	0	0	0.0
Grand Total	-6991	-5673	0	-12663	100.0

Engineering Checks

Heating Mbh	-12.66	Input Ventilation cfm	315
Heating cfm	605.26	Calculated Ventilation cfm	605
ft²/Mbh	-133.77	Number of People	29.97
cfm/Mbh	-47.80	People per 1000 ft²	18
Conditioned ft²	1693.8		

ZONE_Zn-Room - 25 - Open Office

Conditions at Time of Space Cooling Peak

Outside	DB / WB / HR	85.6 °F	/	58.7 °F	/	45.1 gr/lb
Zone	DB / RH / HR	74.0 °F	/	41.4 %	/	51.6 gr/lb

	Instant Sensible (Btu/h)	Time Delay Sensible (Btu/h)	Latent (Btu/h)	Total (Btu/h)	Percent of Total (%)
Roof	0	0	0	0	0.0
Other Roof	0	0	0	0	0.0
Glass	3148	4297	0	7445	19.8
Door	0	0	0	0	0.0
Wall	0	542	0	542	1.4
Below-Grade Wall	0	0	0	0	0.0
Other Wall	0	0	0	0	0.0
Partition	0	-568	0	-568	-1.5
Exterior Floor	0	0	0	0	0.0
Interior Floor	0	0	0	0	0.0
Slab	0	-3438	0	-3438	-9.2
Other Floor	0	0	0	0	0.0
Infiltration	0	0	0	0	0.0
Envelope Subtotal	3148	833	0	3981	-
People	3149	4932	5999	14079	37.5
Lights	528	1668	0	2196	5.8
RA Sensible (Lights)	2255	0	0	2255	6.0
Miscellaneous Loads	12997	0	0	12997	34.6
Internal Subtotal	18929	6600	5999	31527	-
RA (All Other)	0	0	0	0	0.0
DOA Direct to Zone	0	0	0	0	0.0
Ceiling	0	2288	0	2288	6.1
Refrigeration	0	0	0	0	0.0
Service Water	0	0	0	0	0.0
HVAC Equipment Losses	0	0	0	0	0.0
Adj Air Transfer Heat	0	0	0	0	0.0
Sizing Factor Correction	0	0	0	0	0.0
Time Delay Correction	0	-221	0	-221	-0.6
Grand Total	22077	9500	5999	37576	100.0

Engineering Checks

Cooling tons	3.13	Input Ventilation cfm	252
Cooling cfm	1,825.22	Calculated Ventilation cfm	677
ft²/ton	541.53	Number of People	30.00
cfm/ton	582.78	People per 1000 ft²	18
Conditioned ft²	1695.5		

Conditions at Time of Space Heating Peak

Outside	DB / WB / HR	9.5 °F	/	7.1 °F	/	6.2 gr/lb
Zone	DB / RH / HR	72.0 °F	/	5.9 %	/	6.9 gr/lb

	Instant Sensible (Btu/h)	Time Delay Sensible (Btu/h)	Latent (Btu/h)	Total (Btu/h)	Percent of Total (%)
Roof	0	0	0	0	0.0
Other Roof	0	0	0	0	0.0
Glass	-5414	0	0	-5414	47.3
Door	0	0	0	0	0.0
Wall	0	-1603	0	-1603	14.0
Below-Grade Wall	0	0	0	0	0.0
Other Wall	0	0	0	0	0.0
Partition	0	191	0	191	-1.7
Exterior Floor	0	0	0	0	0.0
Interior Floor	0	0	0	0	0.0
Slab	0	-559	0	-559	4.9
Other Floor	0	0	0	0	0.0
Infiltration	0	0	0	0	0.0
Envelope Subtotal	-5414	-1971	0	-7385	-
People	0	0	0	0	0.0
Lights	0	0	0	0	0.0
RA Sensible (Lights)	0	0	0	0	0.0
Miscellaneous Loads	0	0	0	0	0.0
Internal Subtotal	0	0	0	0	-
RA (All Other)	0	0	0	0	0.0
DOA Direct to Zone	0	0	0	0	0.0
Ceiling	0	-4071	0	-4071	35.5
Refrigeration	0	0	0	0	0.0
Service Water	0	0	0	0	0.0
HVAC Equipment Losses	0	0	0	0	0.0
Adj Air Transfer Heat	0	0	0	0	0.0
Sizing Factor Correction	0	0	0	0	0.0
Time Delay Correction	0	0	0	0	0.0
Grand Total	-5414	-6043	0	-11456	100.0

Engineering Checks

Heating Mbh	-11.46	Input Ventilation cfm	315
Heating cfm	547.57	Calculated Ventilation cfm	548
ft²/Mbh	-148.01	Number of People	30.00
cfm/Mbh	-47.80	People per 1000 ft²	18
Conditioned ft²	1695.5		

ZONE_Zn-Room - 26 - Open Office

Conditions at Time of Space Cooling Peak

Outside	DB / WB / HR	93.7 °F	/	61.4 °F	/	45.2 gr/lb
Zone	DB / RH / HR	74.0 °F	/	41.6 %	/	51.9 gr/lb

	Instant Sensible (Btu/h)	Time Delay Sensible (Btu/h)	Latent (Btu/h)	Total (Btu/h)	Percent of Total (%)
Roof	0	0	0	0	0.0
Other Roof	0	0	0	0	0.0
Glass	2555	3695	0	6249	17.3
Door	0	0	0	0	0.0
Wall	0	309	0	309	0.9
Below-Grade Wall	0	0	0	0	0.0
Other Wall	0	0	0	0	0.0
Partition	0	-744	0	-744	-2.1
Exterior Floor	0	0	0	0	0.0
Interior Floor	0	0	0	0	0.0
Slab	0	-2648	0	-2648	-7.3
Other Floor	0	0	0	0	0.0
Infiltration	0	0	0	0	0.0
Envelope Subtotal	2555	612	0	3167	-
People	3149	4657	5999	13805	38.1
Lights	507	1617	0	2124	5.9
RA Sensible (Lights)	2167	0	0	2167	6.0
Miscellaneous Loads	12997	0	0	12997	35.9
Internal Subtotal	18820	6273	5999	31092	-
RA (All Other)	0	0	0	0	0.0
DOA Direct to Zone	0	0	0	0	0.0
Ceiling	0	2184	0	2184	6.0
Refrigeration	0	0	0	0	0.0
Service Water	0	0	0	0	0.0
HVAC Equipment Losses	0	0	0	0	0.0
Adj Air Transfer Heat	0	0	0	0	0.0
Sizing Factor Correction	0	0	0	0	0.0
Time Delay Correction	0	-249	0	-249	-0.7
Grand Total	21375	8821	5999	36195	100.0

Engineering Checks

Cooling tons	3.02	Input Ventilation cfm	248
Cooling cfm	1,937.42	Calculated Ventilation cfm	718
ft²/ton	540.14	Number of People	30.03
cfm/ton	642.21	People per 1000 ft²	18
Conditioned ft²	1629.0		

Conditions at Time of Space Heating Peak

Outside	DB / WB / HR	9.5 °F	/	7.1 °F	/	6.2 gr/lb
Zone	DB / RH / HR	72.0 °F	/	5.9 %	/	6.9 gr/lb

	Instant Sensible (Btu/h)	Time Delay Sensible (Btu/h)	Latent (Btu/h)	Total (Btu/h)	Percent of Total (%)
Roof	0	0	0	0	0.0
Other Roof	0	0	0	0	0.0
Glass	-6834	0	0	-6834	56.2
Door	0	0	0	0	0.0
Wall	0	-1331	0	-1331	10.9
Below-Grade Wall	0	0	0	0	0.0
Other Wall	0	0	0	0	0.0
Partition	0	303	0	303	-2.5
Exterior Floor	0	0	0	0	0.0
Interior Floor	0	0	0	0	0.0
Slab	0	-514	0	-514	4.2
Other Floor	0	0	0	0	0.0
Infiltration	0	0	0	0	0.0
Envelope Subtotal	-6834	-1542	0	-8377	-
People	0	0	0	0	0.0
Lights	0	0	0	0	0.0
RA Sensible (Lights)	0	0	0	0	0.0
Miscellaneous Loads	0	0	0	0	0.0
Internal Subtotal	0	0	0	0	-
RA (All Other)	0	0	0	0	0.0
DOA Direct to Zone	0	0	0	0	0.0
Ceiling	0	-3784	0	-3784	31.1
Refrigeration	0	0	0	0	0.0
Service Water	0	0	0	0	0.0
HVAC Equipment Losses	0	0	0	0	0.0
Adj Air Transfer Heat	0	0	0	0	0.0
Sizing Factor Correction	0	0	0	0	0.0
Time Delay Correction	0	0	0	0	0.0
Grand Total	-6834	-5326	0	-12161	100.0

Engineering Checks

Heating Mbh	-12.16	Input Ventilation cfm	310
Heating cfm	581.23	Calculated Ventilation cfm	581
ft²/Mbh	-133.97	Number of People	30.03
cfm/Mbh	-47.80	People per 1000 ft²	18
Conditioned ft²	1629.0		

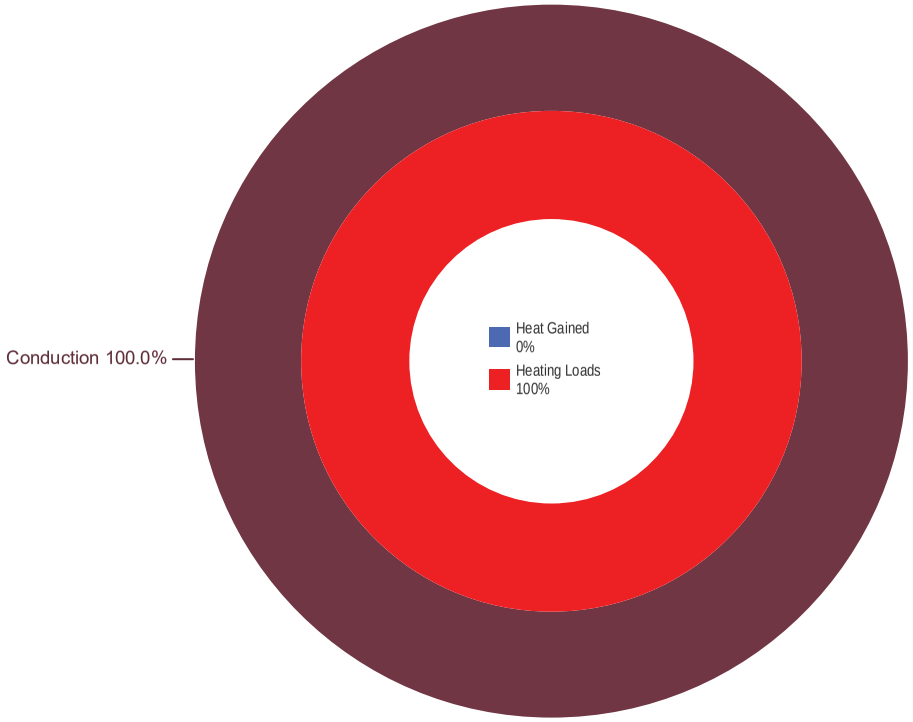
Zone Heating Loads by Component

ZONE_Zn-Room - 04 - Conference 1/21 24:00:00

Conditions at Time of Space Heating Peak

Outside	DB / WB / HR	9.5 °F	/ 7.1 °F	/	6.2 gr/lb
Zone	DB / RH / HR	72.0 °F	/ 5.9 %	/	6.9 gr/lb

	Instant Sensible (Btu/h)	Time Delay Sensible (Btu/h)	Latent (Btu/h)	Total (Btu/h)	Percent of Total (%)
Roof	0	0	0	0	0.0
Other Roof	0	0	0	0	0.0
Glass	0	0	0	0	0.0
Door	0	0	0	0	0.0
Wall	0	0	0	0	0.0
Below-Grade Wall	0	0	0	0	0.0
Other Wall	0	0	0	0	0.0
Partition	0	-109	0	-109	25.4
Exterior Floor	0	0	0	0	0.0
Interior Floor	0	0	0	0	0.0
Slab	0	-48	0	-48	11.1
Other Floor	0	0	0	0	0.0
Infiltration	0	0	0	0	0.0
Envelope Subtotal	0	-157	0	-157	-
People	0	0	0	0	0.0
Lights	0	0	0	0	0.0
RA Sensible (Lights)	0	0	0	0	0.0
Miscellaneous Loads	0	0	0	0	0.0
Internal Subtotal	0	0	0	0	-
RA (All Other)	0	0	0	0	0.0
DOA Direct to Zone	0	0	0	0	0.0
Ceiling	0	-272	0	-272	63.5
Refrigeration	0	0	0	0	0.0
Service Water	0	0	0	0	0.0
HVAC Equipment Losses	0	0	0	0	0.0
Adj Air Transfer Heat	0	0	0	0	0.0
Sizing Factor Correction	0	0	0	0	0.0
Time Delay Correction	0	0	0	0	0.0
Grand Total	0	-429	0	-429	100.0



*Does not reflect Time Delay and Sizing Factor Correction effects

Engineering Checks

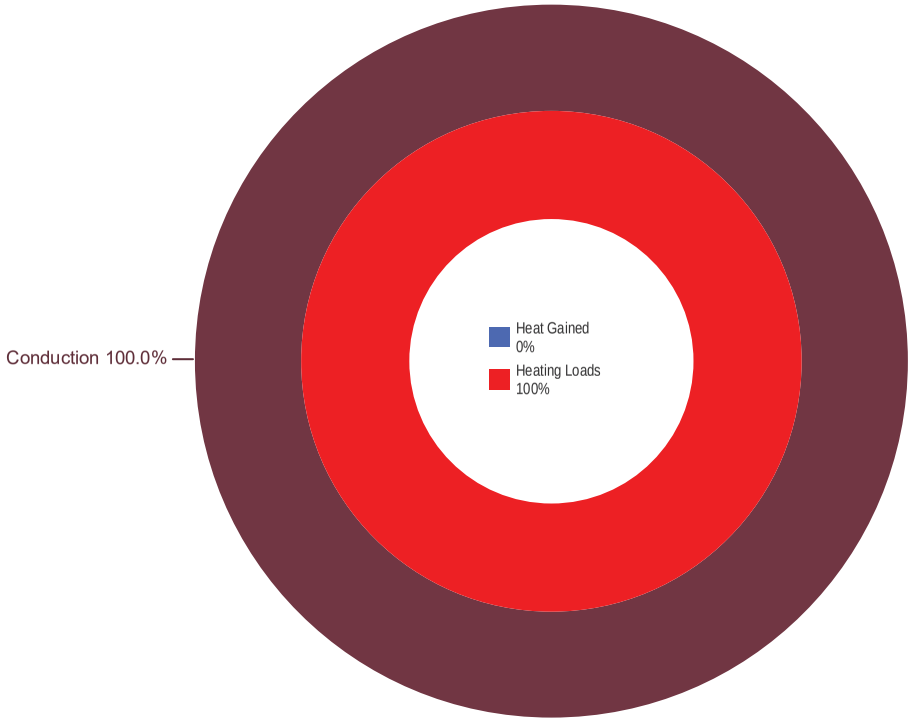
Heating Mbh	-0.43	Input Ventilation cfm	40
Heating cfm	43.52	Calculated Ventilation cfm	44
ft²/Mbh	-260.38	Number of People	4.99
cfm/Mbh	-101.41	People per 1000 ft²	45
Conditioned ft²	111.7		

ZONE_Zn-Room - 05 - Office 1/21 24:00:00

Conditions at Time of Space Heating Peak

Outside	DB / WB / HR	9.5 °F	/ 7.1 °F	/	6.2 gr/lb
Zone	DB / RH / HR	72.0 °F	/ 5.9 %	/	6.9 gr/lb

	Instant Sensible (Btu/h)	Time Delay Sensible (Btu/h)	Latent (Btu/h)	Total (Btu/h)	Percent of Total (%)
Roof	0	0	0	0	0.0
Other Roof	0	0	0	0	0.0
Glass	0	0	0	0	0.0
Door	0	0	0	0	0.0
Wall	0	-8	0	-8	0.6
Below-Grade Wall	0	0	0	0	0.0
Other Wall	0	0	0	0	0.0
Partition	0	-339	0	-339	25.4
Exterior Floor	0	0	0	0	0.0
Interior Floor	0	0	0	0	0.0
Slab	0	-152	0	-152	11.4
Other Floor	0	0	0	0	0.0
Infiltration	0	0	0	0	0.0
Envelope Subtotal	0	-499	0	-499	-
People	0	0	0	0	0.0
Lights	0	0	0	0	0.0
RA Sensible (Lights)	0	0	0	0	0.0
Miscellaneous Loads	0	0	0	0	0.0
Internal Subtotal	0	0	0	0	-
RA (All Other)	0	0	0	0	0.0
DOA Direct to Zone	0	0	0	0	0.0
Ceiling	0	-837	0	-837	62.6
Refrigeration	0	0	0	0	0.0
Service Water	0	0	0	0	0.0
HVAC Equipment Losses	0	0	0	0	0.0
Adj Air Transfer Heat	0	0	0	0	0.0
Sizing Factor Correction	0	0	0	0	0.0
Time Delay Correction	0	0	0	0	0.0
Grand Total	0	-1336	0	-1336	100.0



*Does not reflect Time Delay and Sizing Factor Correction effects

Engineering Checks

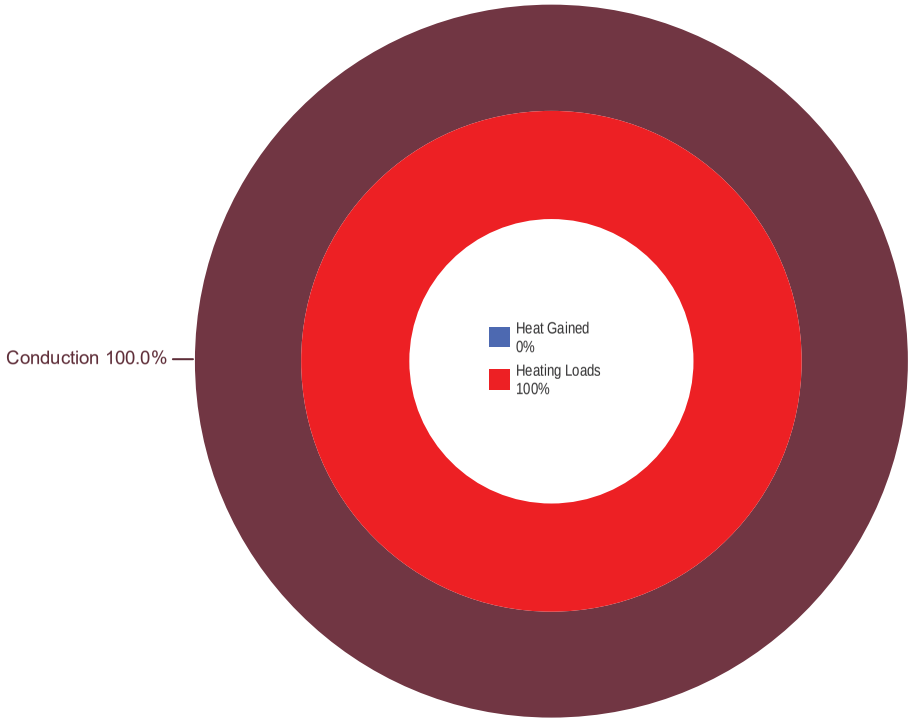
Heating Mbh	-1.34	Input Ventilation cfm	64
Heating cfm	70.05	Calculated Ventilation cfm	70
ft²/Mbh	-268.81	Number of People	6.00
cfm/Mbh	-52.43	People per 1000 ft²	17
Conditioned ft²	359.1		

ZONE_Zn-Room - 06 - Conference 1/21 24:00:00

Conditions at Time of Space Heating Peak

Outside	DB / WB / HR	9.5 °F	/	7.1 °F	/	6.2 gr/lb
Zone	DB / RH / HR	72.0 °F	/	5.9 %	/	6.9 gr/lb

	Instant Sensible (Btu/h)	Time Delay Sensible (Btu/h)	Latent (Btu/h)	Total (Btu/h)	Percent of Total (%)
Roof	0	0	0	0	0.0
Other Roof	0	0	0	0	0.0
Glass	0	0	0	0	0.0
Door	0	0	0	0	0.0
Wall	0	0	0	0	0.0
Below-Grade Wall	0	0	0	0	0.0
Other Wall	0	0	0	0	0.0
Partition	0	-56	0	-56	7.2
Exterior Floor	0	0	0	0	0.0
Interior Floor	0	0	0	0	0.0
Slab	0	-115	0	-115	14.8
Other Floor	0	0	0	0	0.0
Infiltration	0	0	0	0	0.0
Envelope Subtotal	0	-171	0	-171	-
People	0	0	0	0	0.0
Lights	0	0	0	0	0.0
RA Sensible (Lights)	0	0	0	0	0.0
Miscellaneous Loads	0	0	0	0	0.0
Internal Subtotal	0	0	0	0	-
RA (All Other)	0	0	0	0	0.0
DOA Direct to Zone	0	0	0	0	0.0
Ceiling	0	-606	0	-606	78.1
Refrigeration	0	0	0	0	0.0
Service Water	0	0	0	0	0.0
HVAC Equipment Losses	0	0	0	0	0.0
Adj Air Transfer Heat	0	0	0	0	0.0
Sizing Factor Correction	0	0	0	0	0.0
Time Delay Correction	0	0	0	0	0.0
Grand Total	0	-777	0	-777	100.0



*Does not reflect Time Delay and Sizing Factor Correction effects

Engineering Checks

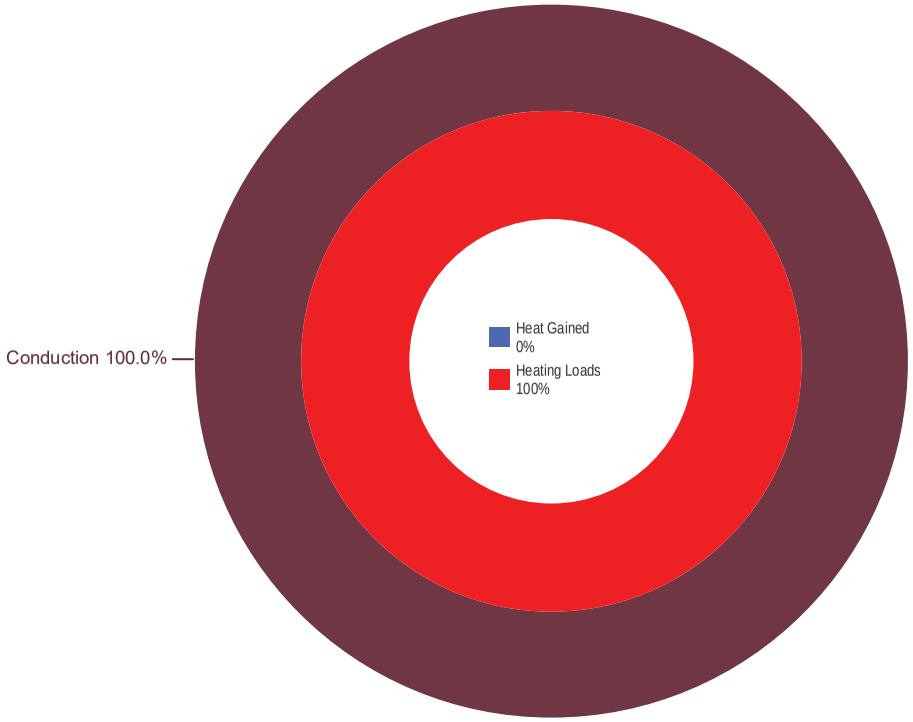
Heating Mbh	-0.78	Input Ventilation cfm	95
Heating cfm	95.41	Calculated Ventilation cfm	95
ft²/Mbh	-350.29	Number of People	11.98
cfm/Mbh	-122.81	People per 1000 ft²	44
Conditioned ft²	272.1		

ZONE_Zn-Room - 07 - Office 1/21 24:00:00

Conditions at Time of Space Heating Peak

Outside	DB / WB / HR	9.5 °F	/ 7.1 °F	/	6.2 gr/lb
Zone	DB / RH / HR	72.0 °F	/ 5.9 %	/	6.9 gr/lb

	Instant Sensible (Btu/h)	Time Delay Sensible (Btu/h)	Latent (Btu/h)	Total (Btu/h)	Percent of Total (%)
Roof	0	0	0	0	0.0
Other Roof	0	0	0	0	0.0
Glass	0	0	0	0	0.0
Door	0	0	0	0	0.0
Wall	0	0	0	0	0.0
Below-Grade Wall	0	0	0	0	0.0
Other Wall	0	0	0	0	0.0
Partition	0	-390	0	-390	23.1
Exterior Floor	0	0	0	0	0.0
Interior Floor	0	0	0	0	0.0
Slab	0	-204	0	-204	12.1
Other Floor	0	0	0	0	0.0
Infiltration	0	0	0	0	0.0
Envelope Subtotal	0	-594	0	-594	-
People	0	0	0	0	0.0
Lights	0	0	0	0	0.0
RA Sensible (Lights)	0	0	0	0	0.0
Miscellaneous Loads	0	0	0	0	0.0
Internal Subtotal	0	0	0	0	-
RA (All Other)	0	0	0	0	0.0
DOA Direct to Zone	0	0	0	0	0.0
Ceiling	0	-1097	0	-1097	64.9
Refrigeration	0	0	0	0	0.0
Service Water	0	0	0	0	0.0
HVAC Equipment Losses	0	0	0	0	0.0
Adj Air Transfer Heat	0	0	0	0	0.0
Sizing Factor Correction	0	0	0	0	0.0
Time Delay Correction	0	0	0	0	0.0
Grand Total	0	-1691	0	-1691	100.0



*Does not reflect Time Delay and Sizing Factor Correction effects

Engineering Checks

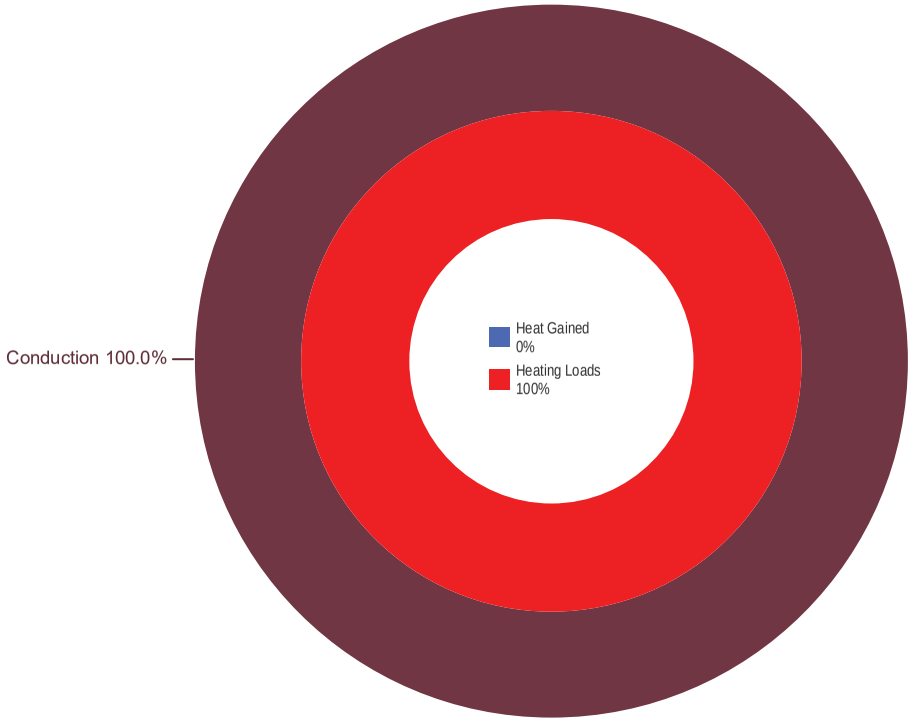
Heating Mbh	-1.69	Input Ventilation cfm	86
Heating cfm	89.50	Calculated Ventilation cfm	89
ft²/Mbh	-283.26	Number of People	8.00
cfm/Mbh	-52.92	People per 1000 ft²	17
Conditioned ft²	479.0		

ZONE_Zn-Room - 11 - IT 1/21 24:00:00

Conditions at Time of Space Heating Peak

Outside	DB / WB / HR	9.5 °F	/	7.1 °F	/	6.2 gr/lb
Zone	DB / RH / HR	72.0 °F	/	5.9 %	/	6.9 gr/lb

	Instant Sensible (Btu/h)	Time Delay Sensible (Btu/h)	Latent (Btu/h)	Total (Btu/h)	Percent of Total (%)
Roof	0	0	0	0	0.0
Other Roof	0	0	0	0	0.0
Glass	0	0	0	0	0.0
Door	0	0	0	0	0.0
Wall	0	0	0	0	0.0
Below-Grade Wall	0	0	0	0	0.0
Other Wall	0	0	0	0	0.0
Partition	0	-40	0	-40	13.7
Exterior Floor	0	0	0	0	0.0
Interior Floor	0	0	0	0	0.0
Slab	0	-40	0	-40	13.8
Other Floor	0	0	0	0	0.0
Infiltration	0	0	0	0	0.0
Envelope Subtotal	0	-81	0	-81	-
People	0	0	0	0	0.0
Lights	0	0	0	0	0.0
RA Sensible (Lights)	0	0	0	0	0.0
Miscellaneous Loads	0	0	0	0	0.0
Internal Subtotal	0	0	0	0	-
RA (All Other)	0	0	0	0	0.0
DOA Direct to Zone	0	0	0	0	0.0
Ceiling	0	-211	0	-211	72.4
Refrigeration	0	0	0	0	0.0
Service Water	0	0	0	0	0.0
HVAC Equipment Losses	0	0	0	0	0.0
Adj Air Transfer Heat	0	0	0	0	0.0
Sizing Factor Correction	0	0	0	0	0.0
Time Delay Correction	0	0	0	0	0.0
Grand Total	0	-292	0	-292	100.0



*Does not reflect Time Delay and Sizing Factor Correction effects

Engineering Checks

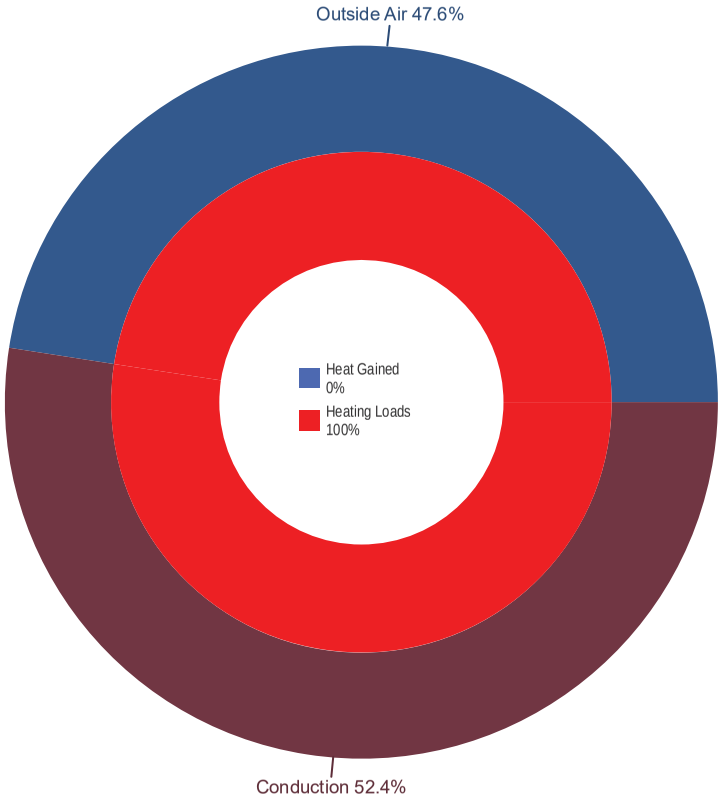
Heating Mbh	-0.29	Input Ventilation cfm	0
Heating cfm	711.17	Calculated Ventilation cfm	0
ft²/Mbh	-314.97	Number of People	0.00
cfm/Mbh	-2,436.56	People per 1000 ft²	0
Conditioned ft²	91.9		

ZONE_Zn-Room - 12 - Mens RR 1/21 24:00:00

Conditions at Time of Space Heating Peak

Outside	DB / WB / HR	9.5 °F	/	7.1 °F	/	6.2 gr/lb
Zone	DB / RH / HR	72.0 °F	/	5.9 %	/	6.8 gr/lb

	Instant Sensible (Btu/h)	Time Delay Sensible (Btu/h)	Latent (Btu/h)	Total (Btu/h)	Percent of Total (%)
Roof	0	0	0	0	0.0
Other Roof	0	0	0	0	0.0
Glass	-2320	0	0	-2320	25.6
Door	0	0	0	0	0.0
Wall	0	-553	0	-553	6.1
Below-Grade Wall	0	0	0	0	0.0
Other Wall	0	0	0	0	0.0
Partition	0	-199	0	-199	2.2
Exterior Floor	0	0	0	0	0.0
Interior Floor	0	0	0	0	0.0
Slab	0	-420	0	-420	4.6
Other Floor	0	0	0	0	0.0
Infiltration	-3190	0	-20	-3210	35.4
Envelope Subtotal	-5510	-1171	-20	-6702	-
People	0	0	0	0	0.0
Lights	0	0	0	0	0.0
RA Sensible (Lights)	0	0	0	0	0.0
Miscellaneous Loads	0	0	0	0	0.0
Internal Subtotal	0	0	0	0	-
RA (All Other)	0	0	0	0	0.0
DOA Direct to Zone	0	0	0	0	0.0
Ceiling	0	-2368	0	-2368	26.1
Refrigeration	0	0	0	0	0.0
Service Water	0	0	0	0	0.0
HVAC Equipment Losses	0	0	0	0	0.0
Adj Air Transfer Heat	0	0	0	0	0.0
Sizing Factor Correction	0	0	0	0	0.0
Time Delay Correction	0	0	0	0	0.0
Grand Total	-5510	-3539	-20	-9070	100.0



Engineering Checks

Heating Mbh	-9.07	Input Ventilation cfm	37
Heating cfm	432.55	Calculated Ventilation cfm	433
ft²/Mbh	-111.21	Number of People	1.00
cfm/Mbh	-47.69	People per 1000 ft²	1
Conditioned ft²	1008.6		

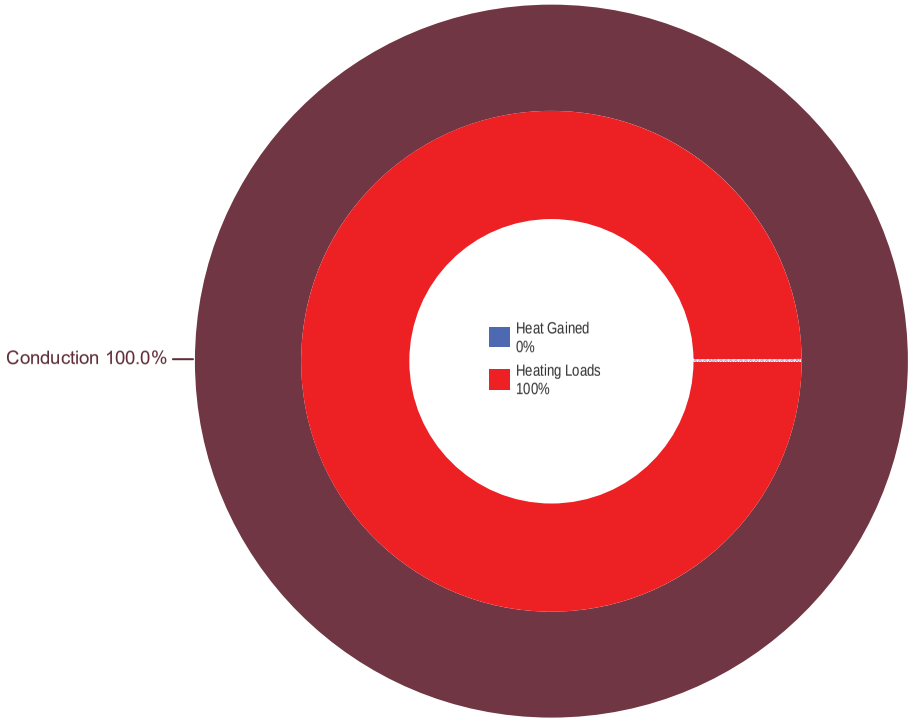
*Does not reflect Time Delay and Sizing Factor Correction effects

ZONE_Zn-Room - 16 - Mechanical 1/21 24:00:00

Conditions at Time of Space Heating Peak

Outside	DB / WB / HR	9.5 °F	/ 7.1 °F	/	6.2 gr/lb
Zone	DB / RH / HR	72.0 °F	/ 5.9 %	/	6.9 gr/lb

	Instant Sensible (Btu/h)	Time Delay Sensible (Btu/h)	Latent (Btu/h)	Total (Btu/h)	Percent of Total (%)
Roof	0	0	0	0	0.0
Other Roof	0	0	0	0	0.0
Glass	-797	0	0	-797	34.4
Door	0	0	0	0	0.0
Wall	0	-574	0	-574	24.8
Below-Grade Wall	0	0	0	0	0.0
Other Wall	0	0	0	0	0.0
Partition	0	2	0	2	-0.1
Exterior Floor	0	0	0	0	0.0
Interior Floor	0	0	0	0	0.0
Slab	0	-117	0	-117	5.0
Other Floor	0	0	0	0	0.0
Infiltration	0	0	0	0	0.0
Envelope Subtotal	-797	-689	0	-1486	-
People	0	0	0	0	0.0
Lights	0	0	0	0	0.0
RA Sensible (Lights)	0	0	0	0	0.0
Miscellaneous Loads	0	0	0	0	0.0
Internal Subtotal	0	0	0	0	-
RA (All Other)	0	0	0	0	0.0
DOA Direct to Zone	0	0	0	0	0.0
Ceiling	0	-832	0	-832	35.9
Refrigeration	0	0	0	0	0.0
Service Water	0	0	0	0	0.0
HVAC Equipment Losses	0	0	0	0	0.0
Adj Air Transfer Heat	0	0	0	0	0.0
Sizing Factor Correction	0	0	0	0	0.0
Time Delay Correction	0	0	0	0	0.0
Grand Total	-797	-1520	0	-2317	100.0



*Does not reflect Time Delay and Sizing Factor Correction effects

Engineering Checks

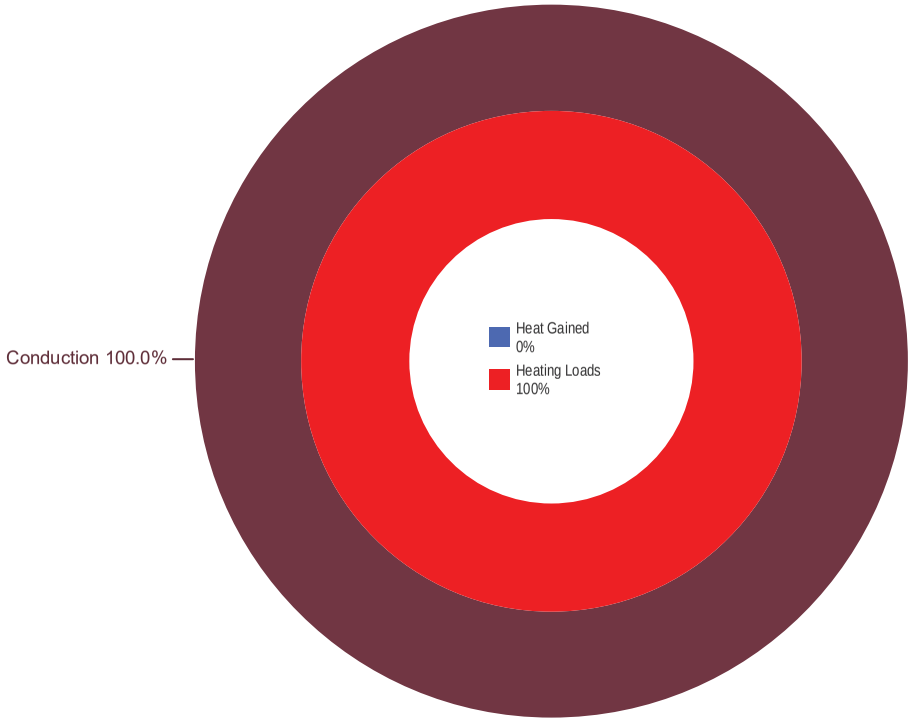
Heating Mbh	-2.32	Input Ventilation cfm	0
Heating cfm	110.76	Calculated Ventilation cfm	111
ft²/Mbh	-137.50	Number of People	0.00
cfm/Mbh	-47.80	People per 1000 ft²	0
Conditioned ft²	318.6		

ZONE_Zn-Room - 17 - Breakroom 1/21 24:00:00

Conditions at Time of Space Heating Peak

Outside	DB / WB / HR	9.5 °F	/ 7.1 °F	/	6.2 gr/lb
Zone	DB / RH / HR	72.0 °F	/ 5.9 %	/	6.9 gr/lb

	Instant Sensible (Btu/h)	Time Delay Sensible (Btu/h)	Latent (Btu/h)	Total (Btu/h)	Percent of Total (%)
Roof	0	0	0	0	0.0
Other Roof	0	0	0	0	0.0
Glass	-1852	0	0	-1852	40.5
Door	0	0	0	0	0.0
Wall	0	-498	0	-498	10.9
Below-Grade Wall	0	0	0	0	0.0
Other Wall	0	0	0	0	0.0
Partition	0	-18	0	-18	0.4
Exterior Floor	0	0	0	0	0.0
Interior Floor	0	0	0	0	0.0
Slab	0	-222	0	-222	4.9
Other Floor	0	0	0	0	0.0
Infiltration	0	0	0	0	0.0
Envelope Subtotal	-1852	-737	0	-2589	-
People	0	0	0	0	0.0
Lights	0	0	0	0	0.0
RA Sensible (Lights)	0	0	0	0	0.0
Miscellaneous Loads	0	0	0	0	0.0
Internal Subtotal	0	0	0	0	-
RA (All Other)	0	0	0	0	0.0
DOA Direct to Zone	0	0	0	0	0.0
Ceiling	0	-1390	0	-1390	30.4
Refrigeration	0	0	0	0	0.0
Service Water	0	0	0	0	0.0
HVAC Equipment Losses	0	0	0	0	0.0
Adj Air Transfer Heat	0	0	0	0	0.0
Sizing Factor Correction	-592	0	0	-592	12.9
Time Delay Correction	0	0	0	0	0.0
Grand Total	-2444	-2128	0	-4571	100.0



*Does not reflect Time Delay and Sizing Factor Correction effects

Engineering Checks

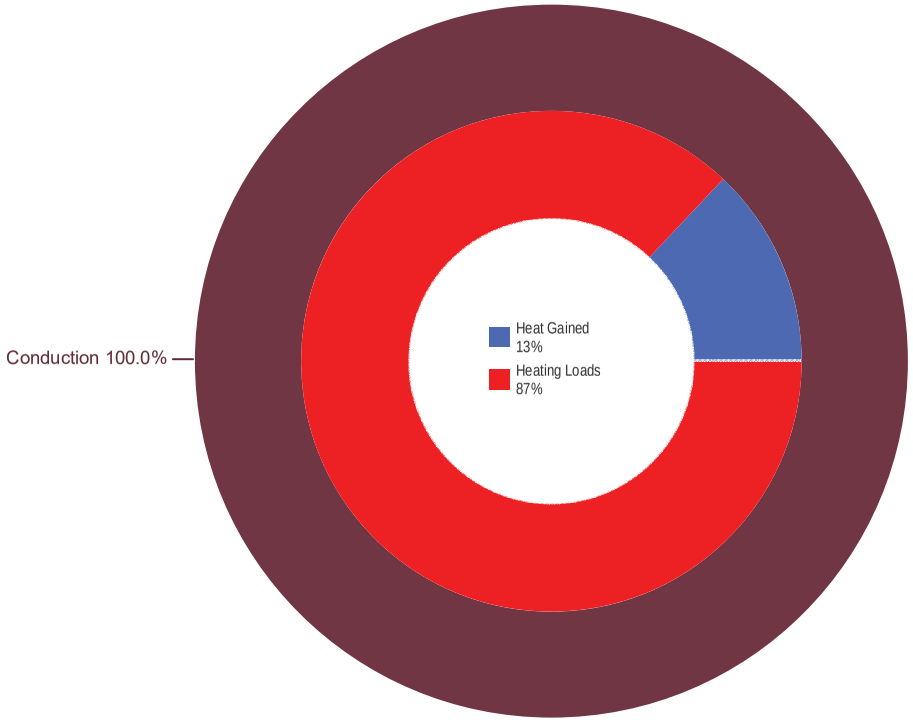
Heating Mbh	-4.57	Input Ventilation cfm	195
Heating cfm	218.49	Calculated Ventilation cfm	218
ft²/Mbh	-125.37	Number of People	20.02
cfm/Mbh	-47.80	People per 1000 ft²	35
Conditioned ft²	573.1		

ZONE_Zn-Room - 18 - Electrical 1/21 24:00:00

Conditions at Time of Space Heating Peak

Outside	DB / WB / HR	9.5 °F	/	7.1 °F	/	6.2 gr/lb
Zone	DB / RH / HR	72.0 °F	/	5.9 %	/	6.9 gr/lb

	Instant Sensible (Btu/h)	Time Delay Sensible (Btu/h)	Latent (Btu/h)	Total (Btu/h)	Percent of Total (%)
Roof	0	0	0	0	0.0
Other Roof	0	0	0	0	0.0
Glass	-753	0	0	-753	57.6
Door	0	0	0	0	0.0
Wall	0	-294	0	-294	22.5
Below-Grade Wall	0	0	0	0	0.0
Other Wall	0	0	0	0	0.0
Partition	0	97	0	97	-7.4
Exterior Floor	0	0	0	0	0.0
Interior Floor	0	0	0	0	0.0
Slab	0	-43	0	-43	3.3
Other Floor	0	0	0	0	0.0
Infiltration	0	0	0	0	0.0
Envelope Subtotal	-753	-240	0	-993	-
People	0	0	0	0	0.0
Lights	0	0	0	0	0.0
RA Sensible (Lights)	0	0	0	0	0.0
Miscellaneous Loads	0	0	0	0	0.0
Internal Subtotal	0	0	0	0	-
RA (All Other)	0	0	0	0	0.0
DOA Direct to Zone	0	0	0	0	0.0
Ceiling	0	-313	0	-313	24.0
Refrigeration	0	0	0	0	0.0
Service Water	0	0	0	0	0.0
HVAC Equipment Losses	0	0	0	0	0.0
Adj Air Transfer Heat	0	0	0	0	0.0
Sizing Factor Correction	0	0	0	0	0.0
Time Delay Correction	0	0	0	0	0.0
Grand Total	-753	-554	0	-1307	100.0



*Does not reflect Time Delay and Sizing Factor Correction effects

Engineering Checks

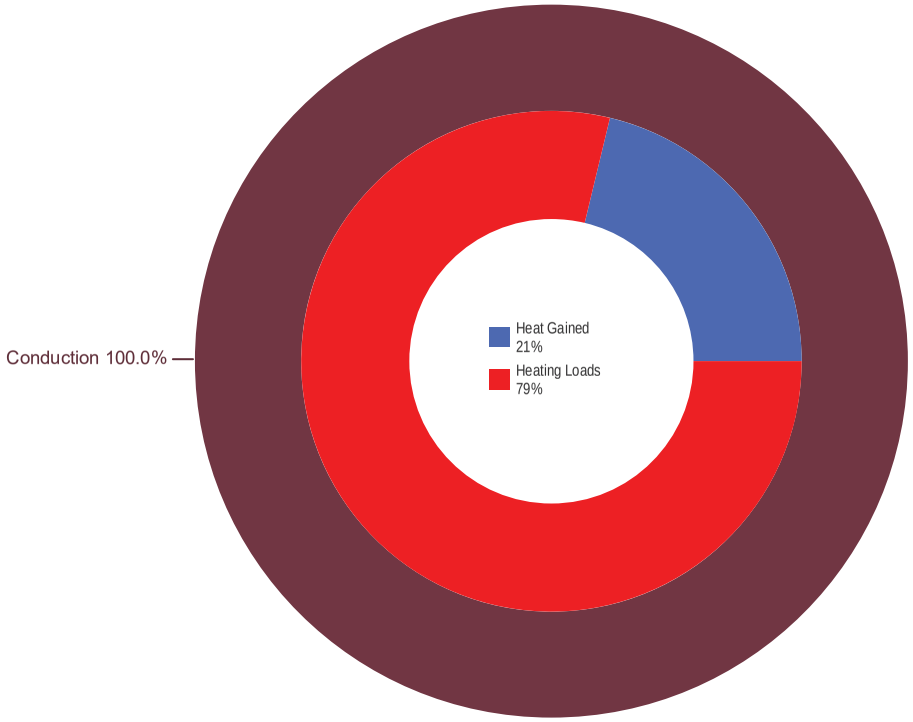
Heating Mbh	-1.31	Input Ventilation cfm	N/A
Heating cfm	62.46	Calculated Ventilation cfm	N/A
ft²/Mbh	-89.14	Number of People	0.00
cfm/Mbh	-47.80	People per 1000 ft²	0
Conditioned ft²	116.5		

ZONE_Zn-Room - 21 - Fire Riser 1/21 24:00:00

Conditions at Time of Space Heating Peak

Outside	DB / WB / HR	9.5 °F	/	7.1 °F	/	6.2 gr/lb
Zone	DB / RH / HR	72.0 °F	/	5.9 %	/	6.9 gr/lb

	Instant Sensible (Btu/h)	Time Delay Sensible (Btu/h)	Latent (Btu/h)	Total (Btu/h)	Percent of Total (%)
Roof	0	0	0	0	0.0
Other Roof	0	0	0	0	0.0
Glass	-752	0	0	-752	75.6
Door	0	0	0	0	0.0
Wall	0	-139	0	-139	14.0
Below-Grade Wall	0	0	0	0	0.0
Other Wall	0	0	0	0	0.0
Partition	0	89	0	89	-9.0
Exterior Floor	0	0	0	0	0.0
Interior Floor	0	0	0	0	0.0
Slab	0	-24	0	-24	2.4
Other Floor	0	0	0	0	0.0
Infiltration	0	0	0	0	0.0
Envelope Subtotal	-752	-74	0	-826	-
People	0	0	0	0	0.0
Lights	0	0	0	0	0.0
RA Sensible (Lights)	0	0	0	0	0.0
Miscellaneous Loads	0	0	0	0	0.0
Internal Subtotal	0	0	0	0	-
RA (All Other)	0	0	0	0	0.0
DOA Direct to Zone	0	0	0	0	0.0
Ceiling	0	-168	0	-168	16.9
Refrigeration	0	0	0	0	0.0
Service Water	0	0	0	0	0.0
HVAC Equipment Losses	0	0	0	0	0.0
Adj Air Transfer Heat	0	0	0	0	0.0
Sizing Factor Correction	0	0	0	0	0.0
Time Delay Correction	0	0	0	0	0.0
Grand Total	-752	-242	0	-994	100.0



Engineering Checks

Heating Mbh	-0.99	Input Ventilation cfm	N/A
Heating cfm	47.49	Calculated Ventilation cfm	N/A
ft²/Mbh	-65.44	Number of People	0.00
cfm/Mbh	-47.80	People per 1000 ft²	0
Conditioned ft²	65.0		

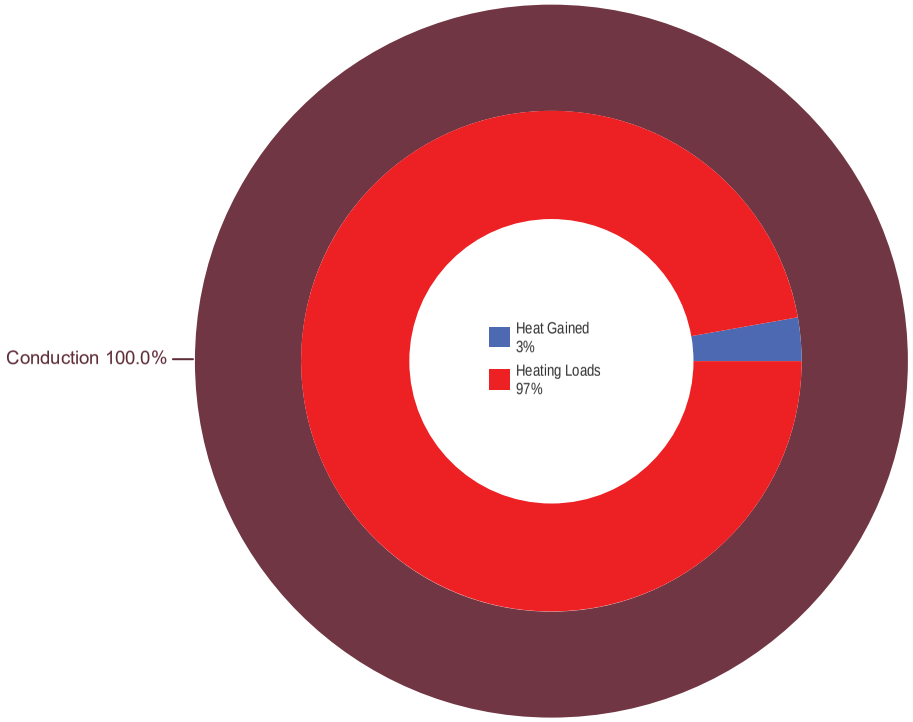
*Does not reflect Time Delay and Sizing Factor Correction effects

ZONE_Zn-Room - 23 - Open Office 1/21 24:00:00

Conditions at Time of Space Heating Peak

Outside	DB / WB / HR	9.5 °F	/	7.1 °F	/	6.2 gr/lb
Zone	DB / RH / HR	72.0 °F	/	5.9 %	/	6.9 gr/lb

	Instant Sensible (Btu/h)	Time Delay Sensible (Btu/h)	Latent (Btu/h)	Total (Btu/h)	Percent of Total (%)
Roof	0	0	0	0	0.0
Other Roof	0	0	0	0	0.0
Glass	-5509	0	0	-5509	47.7
Door	0	0	0	0	0.0
Wall	0	-1600	0	-1600	13.9
Below-Grade Wall	0	0	0	0	0.0
Other Wall	0	0	0	0	0.0
Partition	0	180	0	180	-1.6
Exterior Floor	0	0	0	0	0.0
Interior Floor	0	0	0	0	0.0
Slab	0	-558	0	-558	4.8
Other Floor	0	0	0	0	0.0
Infiltration	0	0	0	0	0.0
Envelope Subtotal	-5509	-1978	0	-7487	-
People	0	0	0	0	0.0
Lights	0	0	0	0	0.0
RA Sensible (Lights)	0	0	0	0	0.0
Miscellaneous Loads	0	0	0	0	0.0
Internal Subtotal	0	0	0	0	-
RA (All Other)	0	0	0	0	0.0
DOA Direct to Zone	0	0	0	0	0.0
Ceiling	0	-4062	0	-4062	35.2
Refrigeration	0	0	0	0	0.0
Service Water	0	0	0	0	0.0
HVAC Equipment Losses	0	0	0	0	0.0
Adj Air Transfer Heat	0	0	0	0	0.0
Sizing Factor Correction	0	0	0	0	0.0
Time Delay Correction	0	0	0	0	0.0
Grand Total	-5509	-6041	0	-11550	100.0



Engineering Checks

Heating Mbh	-11.55	Input Ventilation cfm	315
Heating cfm	552.02	Calculated Ventilation cfm	552
ft²/Mbh	-146.94	Number of People	29.97
cfm/Mbh	-47.80	People per 1000 ft²	18
Conditioned ft²	1696.9		

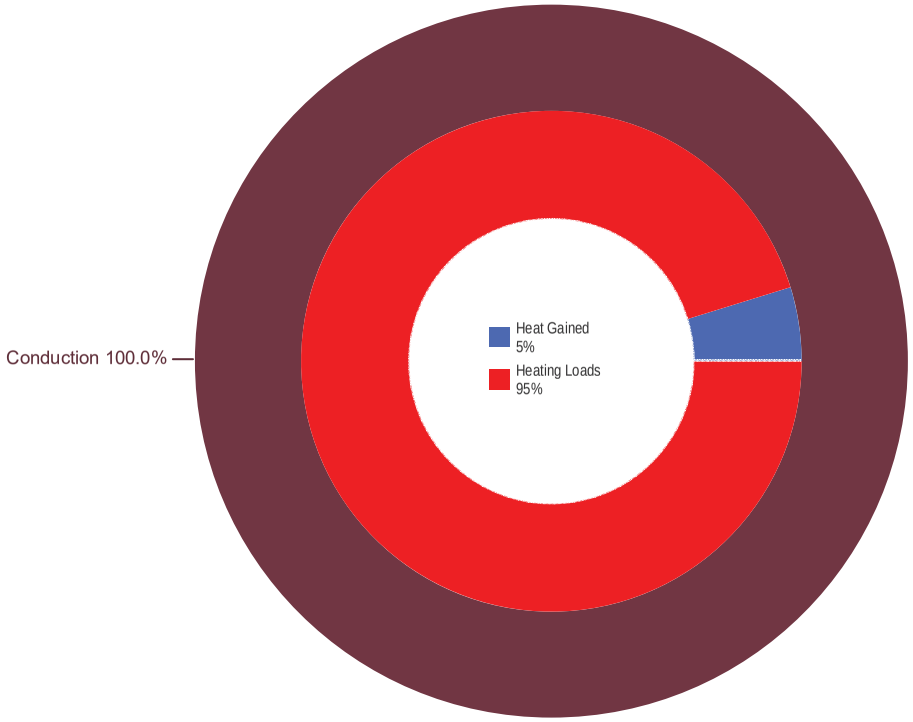
*Does not reflect Time Delay and Sizing Factor Correction effects

ZONE_Zn-Room - 24 - Open Office 1/21 24:00:00

Conditions at Time of Space Heating Peak

Outside	DB / WB / HR	9.5 °F	/	7.1 °F	/	6.2 gr/lb
Zone	DB / RH / HR	72.0 °F	/	5.9 %	/	6.9 gr/lb

	Instant Sensible (Btu/h)	Time Delay Sensible (Btu/h)	Latent (Btu/h)	Total (Btu/h)	Percent of Total (%)
Roof	0	0	0	0	0.0
Other Roof	0	0	0	0	0.0
Glass	-6991	0	0	-6991	55.2
Door	0	0	0	0	0.0
Wall	0	-1439	0	-1439	11.4
Below-Grade Wall	0	0	0	0	0.0
Other Wall	0	0	0	0	0.0
Partition	0	300	0	300	-2.4
Exterior Floor	0	0	0	0	0.0
Interior Floor	0	0	0	0	0.0
Slab	0	-543	0	-543	4.3
Other Floor	0	0	0	0	0.0
Infiltration	0	0	0	0	0.0
Envelope Subtotal	-6991	-1683	0	-8673	-
People	0	0	0	0	0.0
Lights	0	0	0	0	0.0
RA Sensible (Lights)	0	0	0	0	0.0
Miscellaneous Loads	0	0	0	0	0.0
Internal Subtotal	0	0	0	0	-
RA (All Other)	0	0	0	0	0.0
DOA Direct to Zone	0	0	0	0	0.0
Ceiling	0	-3990	0	-3990	31.5
Refrigeration	0	0	0	0	0.0
Service Water	0	0	0	0	0.0
HVAC Equipment Losses	0	0	0	0	0.0
Adj Air Transfer Heat	0	0	0	0	0.0
Sizing Factor Correction	0	0	0	0	0.0
Time Delay Correction	0	0	0	0	0.0
Grand Total	-6991	-5673	0	-12663	100.0



Engineering Checks

Heating Mbh	-12.66	Input Ventilation cfm	315
Heating cfm	605.26	Calculated Ventilation cfm	605
ft²/Mbh	-133.77	Number of People	29.97
cfm/Mbh	-47.80	People per 1000 ft²	18
Conditioned ft²	1693.8		

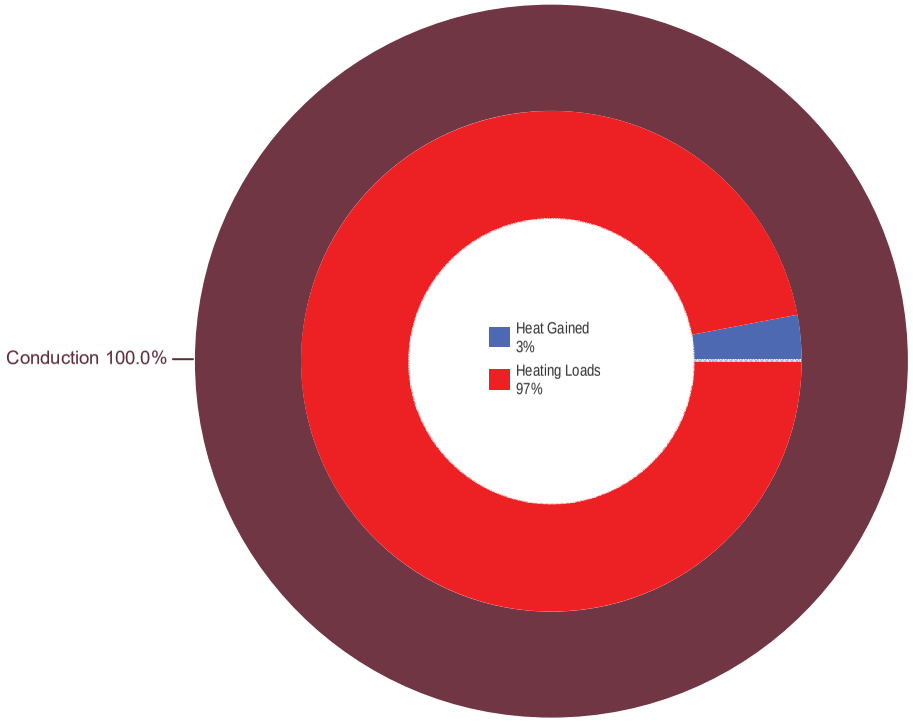
*Does not reflect Time Delay and Sizing Factor Correction effects

ZONE_Zn-Room - 25 - Open Office 1/21 24:00:00

Conditions at Time of Space Heating Peak

Outside	DB / WB / HR	9.5 °F	/ 7.1 °F	/	6.2 gr/lb
Zone	DB / RH / HR	72.0 °F	/ 5.9 %	/	6.9 gr/lb

	Instant Sensible (Btu/h)	Time Delay Sensible (Btu/h)	Latent (Btu/h)	Total (Btu/h)	Percent of Total (%)
Roof	0	0	0	0	0.0
Other Roof	0	0	0	0	0.0
Glass	-5414	0	0	-5414	47.3
Door	0	0	0	0	0.0
Wall	0	-1603	0	-1603	14.0
Below-Grade Wall	0	0	0	0	0.0
Other Wall	0	0	0	0	0.0
Partition	0	191	0	191	-1.7
Exterior Floor	0	0	0	0	0.0
Interior Floor	0	0	0	0	0.0
Slab	0	-559	0	-559	4.9
Other Floor	0	0	0	0	0.0
Infiltration	0	0	0	0	0.0
Envelope Subtotal	-5414	-1971	0	-7385	-
People	0	0	0	0	0.0
Lights	0	0	0	0	0.0
RA Sensible (Lights)	0	0	0	0	0.0
Miscellaneous Loads	0	0	0	0	0.0
Internal Subtotal	0	0	0	0	-
RA (All Other)	0	0	0	0	0.0
DOA Direct to Zone	0	0	0	0	0.0
Ceiling	0	-4071	0	-4071	35.5
Refrigeration	0	0	0	0	0.0
Service Water	0	0	0	0	0.0
HVAC Equipment Losses	0	0	0	0	0.0
Adj Air Transfer Heat	0	0	0	0	0.0
Sizing Factor Correction	0	0	0	0	0.0
Time Delay Correction	0	0	0	0	0.0
Grand Total	-5414	-6043	0	-11456	100.0



Engineering Checks

Heating Mbh	-11.46	Input Ventilation cfm	315
Heating cfm	547.57	Calculated Ventilation cfm	548
ft²/Mbh	-148.01	Number of People	30.00
cfm/Mbh	-47.80	People per 1000 ft²	18
Conditioned ft²	1695.5		

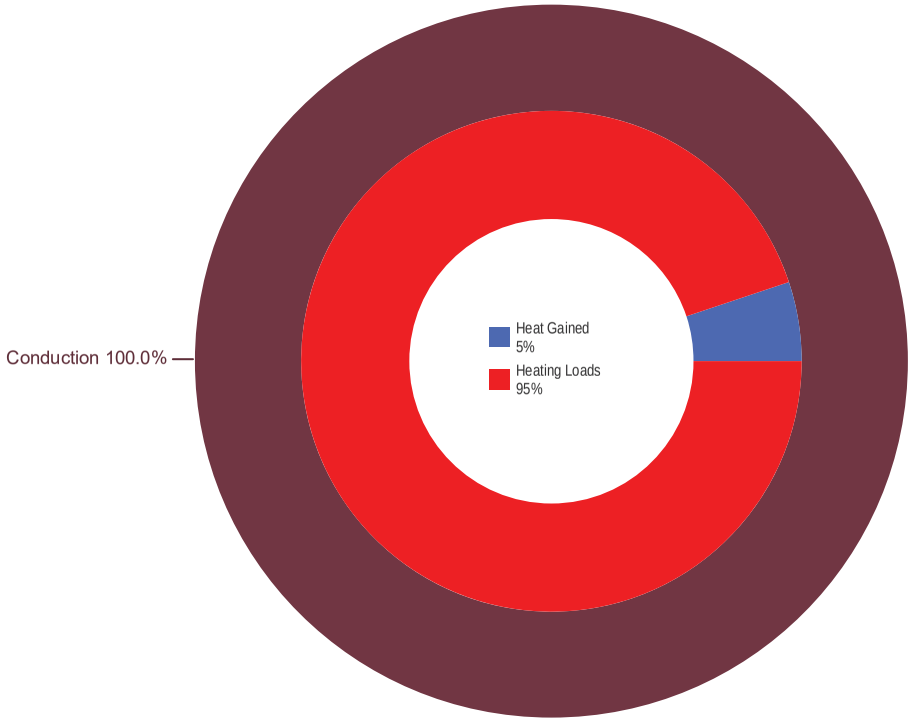
*Does not reflect Time Delay and Sizing Factor Correction effects

ZONE_Zn-Room - 26 - Open Office 1/21 24:00:00

Conditions at Time of Space Heating Peak

Outside	DB / WB / HR	9.5 °F	/	7.1 °F	/	6.2 gr/lb
Zone	DB / RH / HR	72.0 °F	/	5.9 %	/	6.9 gr/lb

	Instant Sensible (Btu/h)	Time Delay Sensible (Btu/h)	Latent (Btu/h)	Total (Btu/h)	Percent of Total (%)
Roof	0	0	0	0	0.0
Other Roof	0	0	0	0	0.0
Glass	-6834	0	0	-6834	56.2
Door	0	0	0	0	0.0
Wall	0	-1331	0	-1331	10.9
Below-Grade Wall	0	0	0	0	0.0
Other Wall	0	0	0	0	0.0
Partition	0	303	0	303	-2.5
Exterior Floor	0	0	0	0	0.0
Interior Floor	0	0	0	0	0.0
Slab	0	-514	0	-514	4.2
Other Floor	0	0	0	0	0.0
Infiltration	0	0	0	0	0.0
Envelope Subtotal	-6834	-1542	0	-8377	-
People	0	0	0	0	0.0
Lights	0	0	0	0	0.0
RA Sensible (Lights)	0	0	0	0	0.0
Miscellaneous Loads	0	0	0	0	0.0
Internal Subtotal	0	0	0	0	-
RA (All Other)	0	0	0	0	0.0
DOA Direct to Zone	0	0	0	0	0.0
Ceiling	0	-3784	0	-3784	31.1
Refrigeration	0	0	0	0	0.0
Service Water	0	0	0	0	0.0
HVAC Equipment Losses	0	0	0	0	0.0
Adj Air Transfer Heat	0	0	0	0	0.0
Sizing Factor Correction	0	0	0	0	0.0
Time Delay Correction	0	0	0	0	0.0
Grand Total	-6834	-5326	0	-12161	100.0



Engineering Checks

Heating Mbh	-12.16	Input Ventilation cfm	310
Heating cfm	581.23	Calculated Ventilation cfm	581
ft²/Mbh	-133.97	Number of People	30.03
cfm/Mbh	-47.80	People per 1000 ft²	18
Conditioned ft²	1629.0		

*Does not reflect Time Delay and Sizing Factor Correction effects

VAV RH (30% Min Default) (CW) (HWRH)

Coil Peak
Peak Time (Mo/D/H:M): 7/21/17:00
Outside Air (DB/WB/HR): 91.8 / 60.7 / 45.2

	Instant Sensible (Btu/h)	Time Delay Sensible (Btu/h)	Latent (Btu/h)	Total (Btu/h)	Percent of Total (%)	Btu/h per ft²
Roof	0	0	0	0	0.0	0.0
Other Roof	0	0	0	0	0.0	0.0
Glass	14,089	16,559	0	30,647	8.9	25.5
Door	0	0	0	0	0.0	0.0
Wall	0	2,234	0	2,234	0.6	0.6
Below-Grade Wall	0	0	0	0	0.0	0.0
Other Wall	0	0	0	0	0.0	0.0
Partition	0	-4,491	0	-4,491	-1.3	-0.4
Exterior Floor	0	0	0	0	0.0	0.0
Interior Floor	0	0	0	0	0.0	0.0
Slab	0	-15,406	0	-15,406	-4.5	-1.5
Other Floor	0	0	0	0	0.0	0.0
Infiltration	772	0	-35	737	0.2	0.2
Envelope Subtotal	14,861	-1,104	-35	13,721	4.0	-
People	18,454	30,033	37,240	85,726	24.8	8.7
Lights	3,046	10,498	0	13,544	3.9	2.7
RA Sensible (Lights)	6,575	0	0	6,575	1.9	0.0
Miscellaneous Loads	59,983	0	0	59,983	17.4	6.1
Internal Subtotal	88,058	40,531	37,240	165,828	48.0	-
Ventilation	75,134	0	-19,099	56,036	16.2	-
DOAS Direct to Zone	0	0	0	0	0.0	-
Ceiling	0	14,604	0	14,604	4.2	1.5
Refrigeration	0	0	0	0	0.0	0.0
Service Water	0	0	0	0	0.0	0.0
HVAC Equipment Losses	0	0	0	0	0.0	0.0
Adj Air Transfer Heat	0	0	0	0	0.0	0.0
Supply Fan Heat	25,148	0	-	25,148	7.3	-
Time Delay Correction	0	-1,067	-	-1,067	-0.3	-
Sizing Factor Correction	0	-	-	0	0.0	-
Airflow Correction	45,436	0	25,938	71,374	20.6	-
Grand Total	248,636	52,963	44,044	345,643	100.0	

Fan Peak
Peak Time (Mo/D/H:M): 7/21/19:00
Outside Air (DB/WB/HR): 85.6 / 58.7 / 45.1

	Instant Sensible (Btu/h)	Time Delay Sensible (Btu/h)	Total Sensible (Btu/h)	Percent of Total (%)	Related Area (ft²)
Roof	0	0	0	0.0	0
Other Roof	0	0	0	0.0	0
Glass	15,727	20,115	35,842	18.4	1,204
Door	0	0	0	0.0	0
Wall	0	2,632	2,632	1.4	3,601
Below-Grade Wall	0	0	0	0.0	0
Other Wall	0	0	0	0.0	3,601
Partition	0	-4,683	-4,683	-2.4	12,329
Exterior Floor	0	0	0	0.0	0
Interior Floor	0	0	0	0.0	0
Slab	0	-16,283	-16,283	-8.4	10,057
Other Floor	0	0	0	0.0	0
Infiltration	668	0	668	0.3	3,601
Envelope Subtotal	16,395	1,781	18,176	9.3	-
People	18,454	30,486	48,940	25.1	9,838
Lights	3,046	10,480	13,526	6.9	9,838
RA Sensible (Lights)	-	-	-	-	-
Miscellaneous Loads	59,983	0	59,983	30.8	9,838
Internal Subtotal	81,483	40,966	122,449	62.9	-
Ventilation	-	-	-	-	-
DOAS Direct to Zone			0	0.0	0
Ceiling	0	12,756	12,756	6.6	10,057
Refrigeration			0	0.0	9,838
Service Water			0	0.0	9,838
HVAC Equipment Losses			0	0.0	0
Adj Air Transfer Heat	0	0	0	0.0	0
Supply Fan Heat	-	-	-	-	-
Time Delay Correction	0	-1,102	-1,102	-0.6	-
Sizing Factor Correction	0	-	0	0.0	-
Airflow Correction	42,463	-	42,463	21.8	-
Grand Total	140,342	54,401	194,743	100.0	

Temperatures
°F

Supply	55.0
Return	75.7
Mixed Air	82.4
Fan Heat TD	2.5

Airflows
cfm

Main Fan	11,154
Ventilation	4,136
Infiltration	47
Min Stop / Reheat	8,731

Engineering Checks

% OA	37.08
cfm/ft²	1.13
Btu/h-ft²	35.16
cfm/ton	387.32
ft²/ton	341.52
People	172
ft²/person	57.20

Areas
ft²

Roof	0
Other Roof	0
Ceiling	10,057
Window	1,204
Door	0
Wall	3,601
Below-Grade Wall	0
Other Wall	3,601
Partition	12,329
Exterior Floor	0
Internal Floor	0
Slab	10,057
Other Floor	0

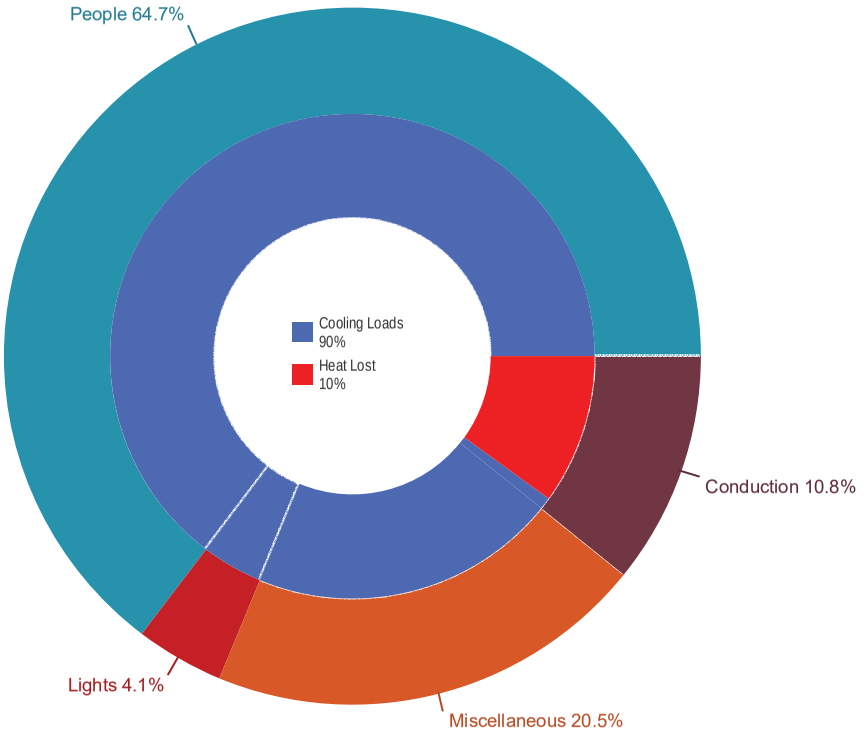
Zone Cooling Loads by Component

ZONE_Zn-Room - 04 - Conference 7/21 19:00:00

Conditions at Time of Space Cooling Peak

Outside	DB / WB / HR	85.6 °F	/	58.7 °F	/	45.1 gr/lb
Zone	DB / RH / HR	74.0 °F	/	49.4 %	/	61.6 gr/lb

	Instant Sensible (Btu/h)	Time Delay Sensible (Btu/h)	Latent (Btu/h)	Total (Btu/h)	Percent of Total (%)
Roof	0	0	0	0	0.0
Other Roof	0	0	0	0	0.0
Glass	0	0	0	0	0.0
Door	0	0	0	0	0.0
Wall	0	0	0	0	0.0
Below-Grade Wall	0	0	0	0	0.0
Other Wall	0	0	0	0	0.0
Partition	0	-349	0	-349	-8.6
Exterior Floor	0	0	0	0	0.0
Interior Floor	0	0	0	0	0.0
Slab	0	-139	0	-139	-3.4
Other Floor	0	0	0	0	0.0
Infiltration	0	0	0	0	0.0
Envelope Subtotal	0	-488	0	-488	-
People	577	1210	1375	3162	77.8
Lights	38	162	0	200	4.9
RA Sensible (Lights)	161	0	0	161	4.0
Miscellaneous Loads	1000	0	0	1000	24.6
Internal Subtotal	1776	1372	1375	4522	-
RA (All Other)	0	0	0	0	0.0
DOA Direct to Zone	0	0	0	0	0.0
Ceiling	0	39	0	39	1.0
Refrigeration	0	0	0	0	0.0
Service Water	0	0	0	0	0.0
HVAC Equipment Losses	0	0	0	0	0.0
Adj Air Transfer Heat	0	0	0	0	0.0
Sizing Factor Correction	0	0	0	0	0.0
Time Delay Correction	0	-11	0	-11	-0.3
Grand Total	1776	912	1375	4063	100.0



*Does not reflect Time Delay and Sizing Factor Correction effects

Engineering Checks

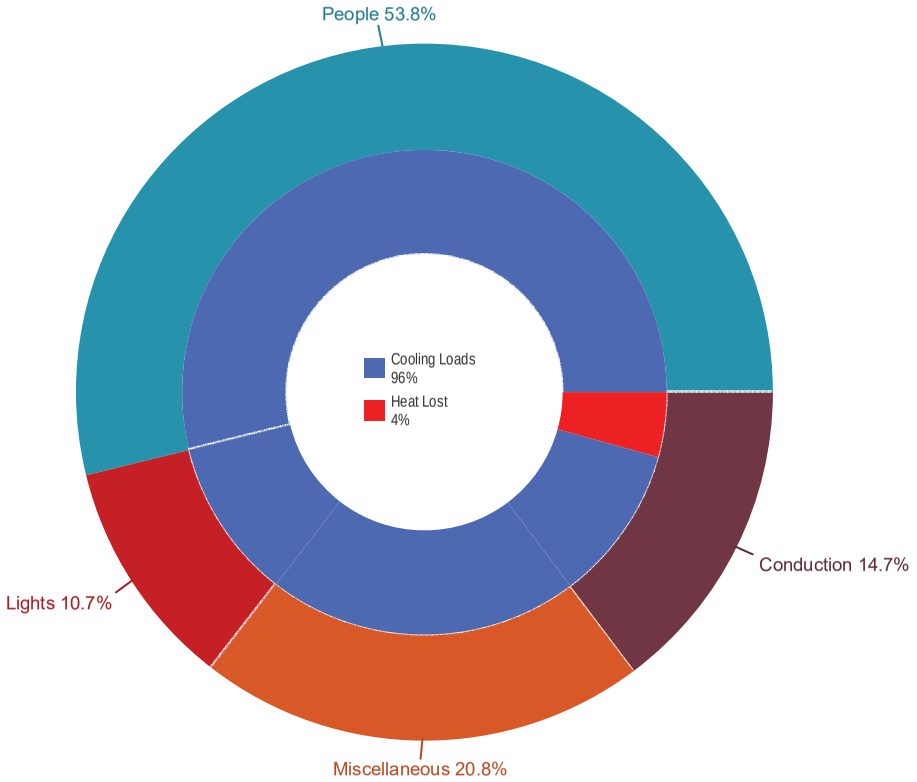
Cooling tons	0.34	Input Ventilation cfm	32
Cooling cfm	145.06	Calculated Ventilation cfm	54
ft²/ton	330.06	Number of People	4.99
cfm/ton	428.40	People per 1000 ft²	45
Conditioned ft²	111.7		

ZONE_Zn-Room - 05 - Office 7/21 19:00:00

Conditions at Time of Space Cooling Peak

Outside	DB / WB / HR	85.6 °F	/	58.7 °F	/	45.1 gr/lb
Zone	DB / RH / HR	74.0 °F	/	43.5 %	/	54.3 gr/lb

	Instant Sensible (Btu/h)	Time Delay Sensible (Btu/h)	Latent (Btu/h)	Total (Btu/h)	Percent of Total (%)
Roof	0	0	0	0	0.0
Other Roof	0	0	0	0	0.0
Glass	0	0	0	0	0.0
Door	0	0	0	0	0.0
Wall	0	2	0	2	0.0
Below-Grade Wall	0	0	0	0	0.0
Other Wall	0	0	0	0	0.0
Partition	0	94	0	94	1.6
Exterior Floor	0	0	0	0	0.0
Interior Floor	0	0	0	0	0.0
Slab	0	-249	0	-249	-4.3
Other Floor	0	0	0	0	0.0
Infiltration	0	0	0	0	0.0
Envelope Subtotal	0	-154	0	-154	-
People	630	1283	1200	3112	53.8
Lights	119	499	0	619	10.7
RA Sensible (Lights)	510	0	0	510	8.8
Miscellaneous Loads	1200	0	0	1200	20.7
Internal Subtotal	2459	1782	1200	5441	-
RA (All Other)	0	0	0	0	0.0
DOA Direct to Zone	0	0	0	0	0.0
Ceiling	0	506	0	506	8.8
Refrigeration	0	0	0	0	0.0
Service Water	0	0	0	0	0.0
HVAC Equipment Losses	0	0	0	0	0.0
Adj Air Transfer Heat	0	0	0	0	0.0
Sizing Factor Correction	0	0	0	0	0.0
Time Delay Correction	0	-9	0	-9	-0.2
Grand Total	2459	2125	1200	5784	100.0



*Does not reflect Time Delay and Sizing Factor Correction effects

Engineering Checks

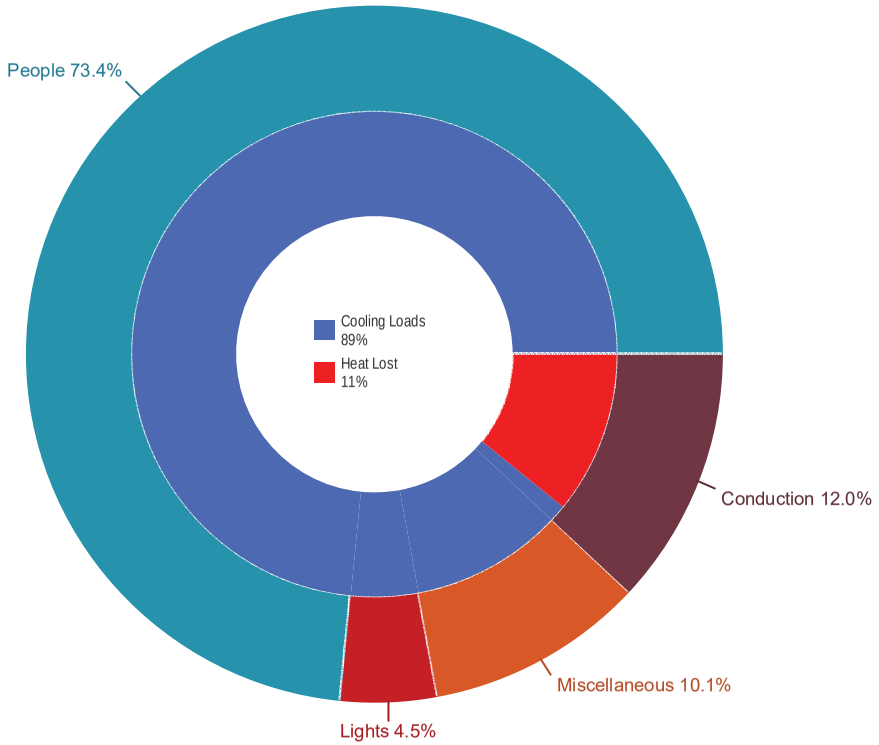
Cooling tons	0.48	Input Ventilation cfm	52
Cooling cfm	233.50	Calculated Ventilation cfm	87
ft²/ton	745.03	Number of People	6.00
cfm/ton	484.33	People per 1000 ft²	17
Conditioned ft²	359.1		

ZONE_Zn-Room - 06 - Conference 7/21 19:00:00

Conditions at Time of Space Cooling Peak

Outside	DB / WB / HR	85.6 °F	/	58.7 °F	/	45.1 gr/lb
Zone	DB / RH / HR	73.9 °F	/	54.1 %	/	67.6 gr/lb

	Instant Sensible (Btu/h)	Time Delay Sensible (Btu/h)	Latent (Btu/h)	Total (Btu/h)	Percent of Total (%)
Roof	0	0	0	0	0.0
Other Roof	0	0	0	0	0.0
Glass	0	0	0	0	0.0
Door	0	0	0	0	0.0
Wall	0	0	0	0	0.0
Below-Grade Wall	0	0	0	0	0.0
Other Wall	0	0	0	0	0.0
Partition	0	-738	0	-738	-9.1
Exterior Floor	0	0	0	0	0.0
Interior Floor	0	0	0	0	0.0
Slab	0	-331	0	-331	-4.1
Other Floor	0	0	0	0	0.0
Infiltration	0	0	0	0	0.0
Envelope Subtotal	0	-1069	0	-1069	-
People	1386	2565	3299	7250	89.5
Lights	92	349	0	441	5.4
RA Sensible (Lights)	392	0	0	392	4.8
Miscellaneous Loads	1000	0	0	1000	12.3
Internal Subtotal	2869	2914	3299	9082	-
RA (All Other)	0	0	0	0	0.0
DOA Direct to Zone	0	0	0	0	0.0
Ceiling	0	112	0	112	1.4
Refrigeration	0	0	0	0	0.0
Service Water	0	0	0	0	0.0
HVAC Equipment Losses	0	0	0	0	0.0
Adj Air Transfer Heat	0	0	0	0	0.0
Sizing Factor Correction	0	0	0	0	0.0
Time Delay Correction	0	-25	0	-25	-0.3
Grand Total	2869	1931	3299	8099	100.0



*Does not reflect Time Delay and Sizing Factor Correction effects

Engineering Checks

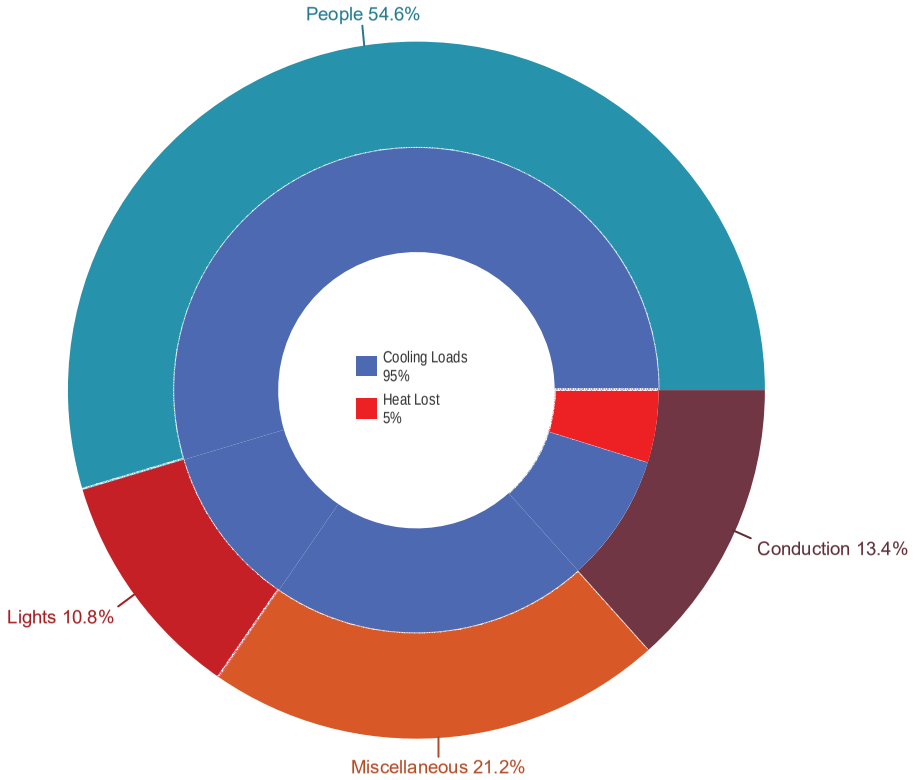
Cooling tons	0.67	Input Ventilation cfm	76
Cooling cfm	318.03	Calculated Ventilation cfm	118
ft²/ton	403.20	Number of People	11.98
cfm/ton	471.09	People per 1000 ft²	44
Conditioned ft²	272.1		

ZONE_Zn-Room - 07 - Office 7/21 19:00:00

Conditions at Time of Space Cooling Peak

Outside	DB / WB / HR	85.6 °F	/	58.7 °F	/	45.1 gr/lb
Zone	DB / RH / HR	74.0 °F	/	43.8 %	/	54.6 gr/lb

	Instant Sensible (Btu/h)	Time Delay Sensible (Btu/h)	Latent (Btu/h)	Total (Btu/h)	Percent of Total (%)
Roof	0	0	0	0	0.0
Other Roof	0	0	0	0	0.0
Glass	0	0	0	0	0.0
Door	0	0	0	0	0.0
Wall	0	0	0	0	0.0
Below-Grade Wall	0	0	0	0	0.0
Other Wall	0	0	0	0	0.0
Partition	0	-57	0	-57	-0.8
Exterior Floor	0	0	0	0	0.0
Interior Floor	0	0	0	0	0.0
Slab	0	-307	0	-307	-4.1
Other Floor	0	0	0	0	0.0
Infiltration	0	0	0	0	0.0
Envelope Subtotal	0	-363	0	-363	-
People	840	1681	1600	4121	55.0
Lights	159	655	0	815	10.9
RA Sensible (Lights)	681	0	0	681	9.1
Miscellaneous Loads	1600	0	0	1600	21.4
Internal Subtotal	3280	2337	1600	7216	-
RA (All Other)	0	0	0	0	0.0
DOA Direct to Zone	0	0	0	0	0.0
Ceiling	0	646	0	646	8.6
Refrigeration	0	0	0	0	0.0
Service Water	0	0	0	0	0.0
HVAC Equipment Losses	0	0	0	0	0.0
Adj Air Transfer Heat	0	0	0	0	0.0
Sizing Factor Correction	0	0	0	0	0.0
Time Delay Correction	0	-12	0	-12	-0.2
Grand Total	3280	2606	1600	7486	100.0



Engineering Checks

Cooling tons	0.62	Input Ventilation cfm	69
Cooling cfm	298.33	Calculated Ventilation cfm	111
ft²/ton	767.95	Number of People	8.00
cfm/ton	478.15	People per 1000 ft²	17
Conditioned ft²	479.0		

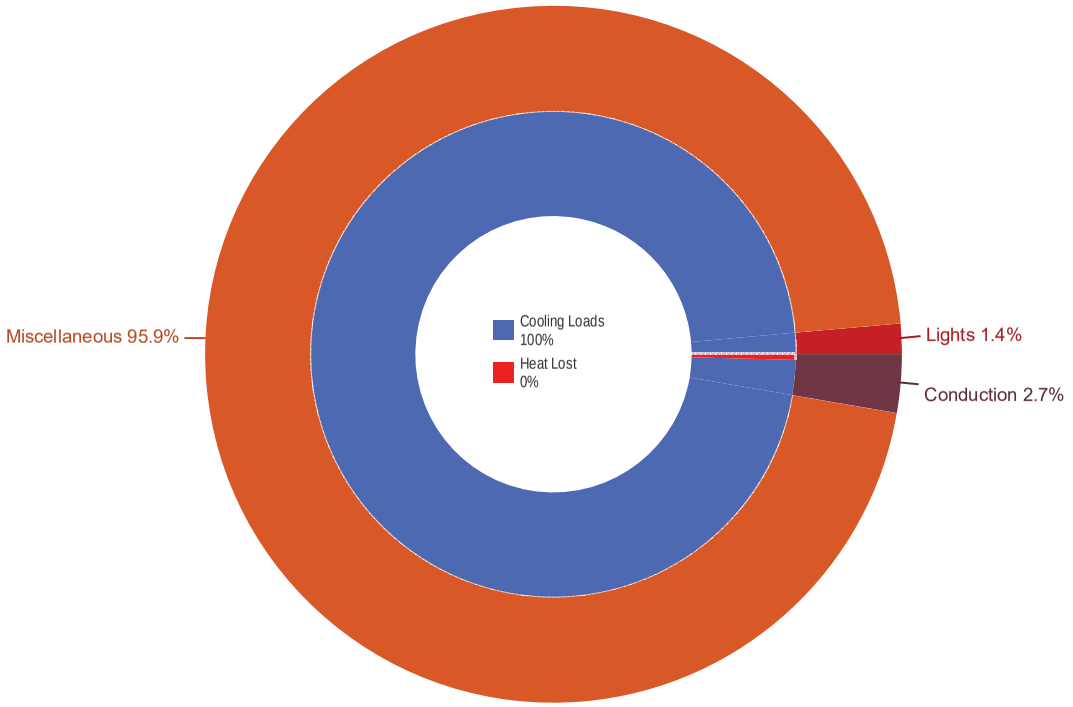
*Does not reflect Time Delay and Sizing Factor Correction effects

ZONE_Zn-Room - 11 - IT 7/21 19:00:00

Conditions at Time of Space Cooling Peak

Outside	DB / WB / HR	85.6 °F	/	58.7 °F	/	45.1 gr/lb
Zone	DB / RH / HR	74.0 °F	/	36.6 %	/	45.5 gr/lb

	Instant Sensible (Btu/h)	Time Delay Sensible (Btu/h)	Latent (Btu/h)	Total (Btu/h)	Percent of Total (%)
Roof	0	0	0	0	0.0
Other Roof	0	0	0	0	0.0
Glass	0	0	0	0	0.0
Door	0	0	0	0	0.0
Wall	0	0	0	0	0.0
Below-Grade Wall	0	0	0	0	0.0
Other Wall	0	0	0	0	0.0
Partition	0	117	0	117	0.9
Exterior Floor	0	0	0	0	0.0
Interior Floor	0	0	0	0	0.0
Slab	0	-47	0	-47	-0.4
Other Floor	0	0	0	0	0.0
Infiltration	0	0	0	0	0.0
Envelope Subtotal	0	70	0	70	-
People	0	0	0	0	0.0
Lights	35	141	0	176	1.4
RA Sensible (Lights)	151	0	0	151	1.2
Miscellaneous Loads	11997	0	0	11997	95.5
Internal Subtotal	12183	141	0	12324	-
RA (All Other)	0	0	0	0	0.0
DOA Direct to Zone	0	0	0	0	0.0
Ceiling	0	174	0	174	1.4
Refrigeration	0	0	0	0	0.0
Service Water	0	0	0	0	0.0
HVAC Equipment Losses	0	0	0	0	0.0
Adj Air Transfer Heat	0	0	0	0	0.0
Sizing Factor Correction	0	0	0	0	0.0
Time Delay Correction	0	0	0	0	0.0
Grand Total	12183	385	0	12568	100.0



*Does not reflect Time Delay and Sizing Factor Correction effects

Engineering Checks

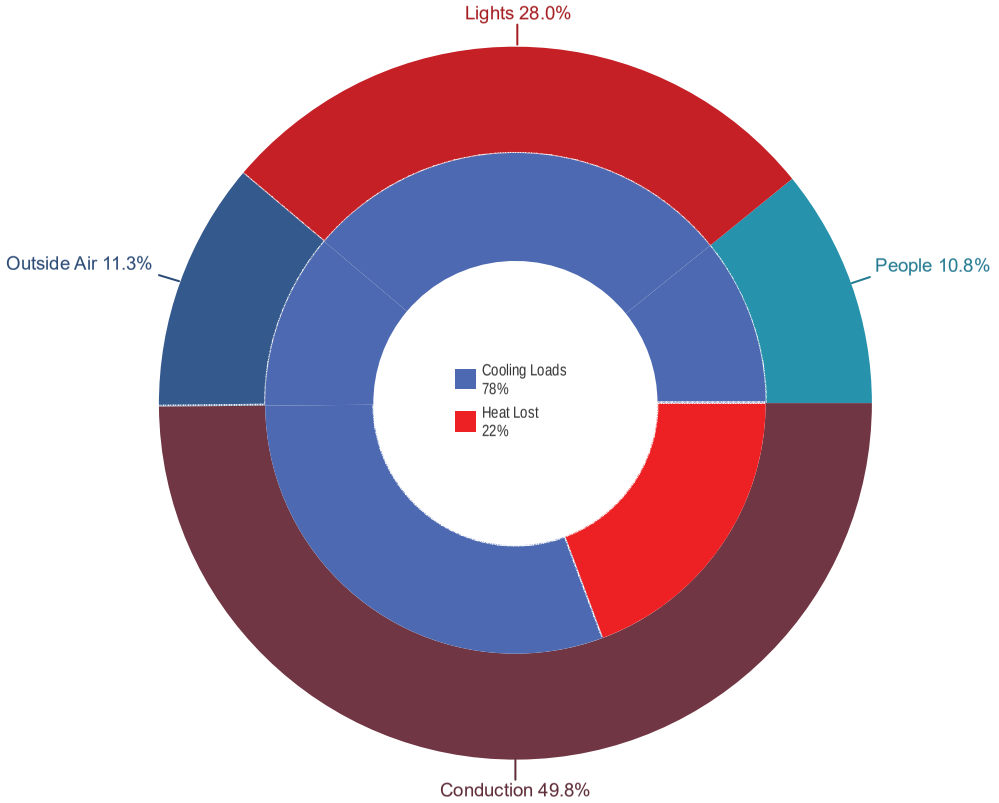
Cooling tons	1.05	Input Ventilation cfm	0
Cooling cfm	711.17	Calculated Ventilation cfm	0
ft²/ton	87.78	Number of People	0.00
cfm/ton	678.92	People per 1000 ft²	0
Conditioned ft²	91.9		

ZONE_Zn-Room - 12 - Mens RR 7/21 18:00:00

Conditions at Time of Space Cooling Peak

Outside	DB / WB / HR	89.3 °F	/	59.9 °F	/	45.2 gr/lb
Zone	DB / RH / HR	74.0 °F	/	37.3 %	/	46.4 gr/lb

	Instant Sensible (Btu/h)	Time Delay Sensible (Btu/h)	Latent (Btu/h)	Total (Btu/h)	Percent of Total (%)
Roof	0	0	0	0	0.0
Other Roof	0	0	0	0	0.0
Glass	3148	2039	0	5187	52.0
Door	0	0	0	0	0.0
Wall	0	264	0	264	2.6
Below-Grade Wall	0	0	0	0	0.0
Other Wall	0	0	0	0	0.0
Partition	0	-27	0	-27	-0.3
Exterior Floor	0	0	0	0	0.0
Interior Floor	0	0	0	0	0.0
Slab	0	-1053	0	-1053	-10.6
Other Floor	0	0	0	0	0.0
Infiltration	668	0	-34	634	6.4
Envelope Subtotal	3816	1223	-34	5005	-
People	115	216	275	607	6.1
Lights	318	1248	0	1566	15.7
RA Sensible (Lights)	1359	0	0	1359	13.6
Miscellaneous Loads	0	0	0	0	0.0
Internal Subtotal	1792	1464	275	3532	-
RA (All Other)	0	0	0	0	0.0
DOA Direct to Zone	0	0	0	0	0.0
Ceiling	0	1445	0	1445	14.5
Refrigeration	0	0	0	0	0.0
Service Water	0	0	0	0	0.0
HVAC Equipment Losses	0	0	0	0	0.0
Adj Air Transfer Heat	0	0	0	0	0.0
Sizing Factor Correction	0	0	0	0	0.0
Time Delay Correction	0	-4	0	-4	0.0
Grand Total	5608	4128	241	9978	100.0



*Does not reflect Time Delay and Sizing Factor Correction effects

Engineering Checks

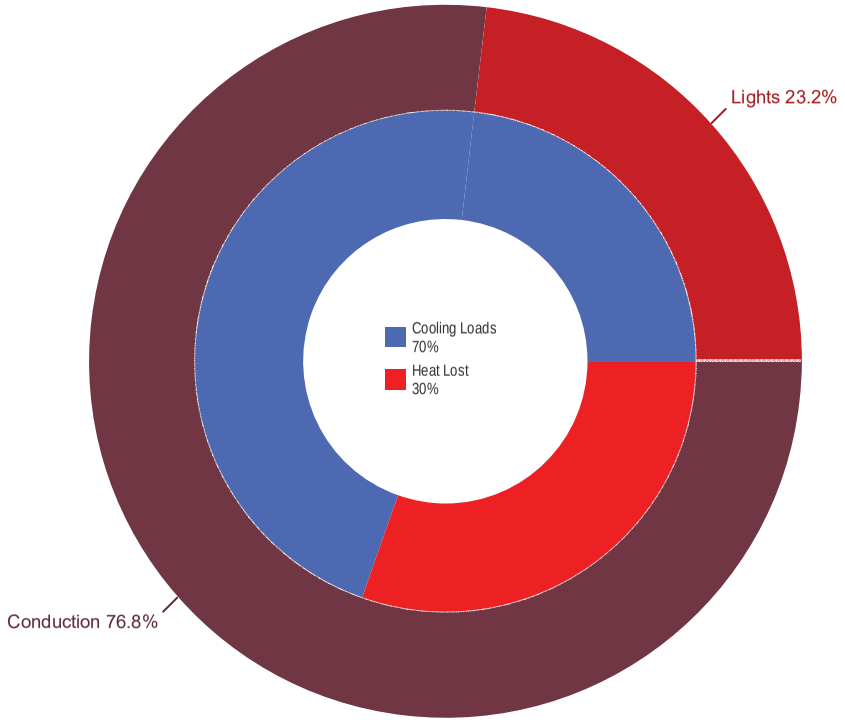
Cooling tons	0.83	Input Ventilation cfm	30
Cooling cfm	1,441.82	Calculated Ventilation cfm	535
ft²/ton	1213.13	Number of People	1.00
cfm/ton	1,733.72	People per 1000 ft²	1
Conditioned ft²	1008.6		

ZONE_Zn-Room - 16 - Mechanical 7/21 11:00:00

Conditions at Time of Space Cooling Peak

Outside	DB / WB / HR	89.5 °F	/ 60.0 °F	/ 45.2 gr/lb	
Zone	DB / RH / HR	74.0 °F	/ 36.6 %	/ 45.5 gr/lb	

	Instant Sensible (Btu/h)	Time Delay Sensible (Btu/h)	Latent (Btu/h)	Total (Btu/h)	Percent of Total (%)
Roof	0	0	0	0	0.0
Other Roof	0	0	0	0	0.0
Glass	866	693	0	1558	69.9
Door	0	0	0	0	0.0
Wall	0	255	0	255	11.4
Below-Grade Wall	0	0	0	0	0.0
Other Wall	0	0	0	0	0.0
Partition	0	129	0	129	5.8
Exterior Floor	0	0	0	0	0.0
Interior Floor	0	0	0	0	0.0
Slab	0	-331	0	-331	-14.8
Other Floor	0	0	0	0	0.0
Infiltration	0	0	0	0	0.0
Envelope Subtotal	866	746	0	1612	-
People	0	0	0	0	0.0
Lights	57	195	0	252	11.3
RA Sensible (Lights)	244	0	0	244	10.9
Miscellaneous Loads	0	0	0	0	0.0
Internal Subtotal	301	195	0	496	-
RA (All Other)	0	0	0	0	0.0
DOA Direct to Zone	0	0	0	0	0.0
Ceiling	0	121	0	121	5.4
Refrigeration	0	0	0	0	0.0
Service Water	0	0	0	0	0.0
HVAC Equipment Losses	0	0	0	0	0.0
Adj Air Transfer Heat	0	0	0	0	0.0
Sizing Factor Correction	0	0	0	0	0.0
Time Delay Correction	0	0	0	0	0.0
Grand Total	1167	1062	0	2229	100.0



*Does not reflect Time Delay and Sizing Factor Correction effects

Engineering Checks

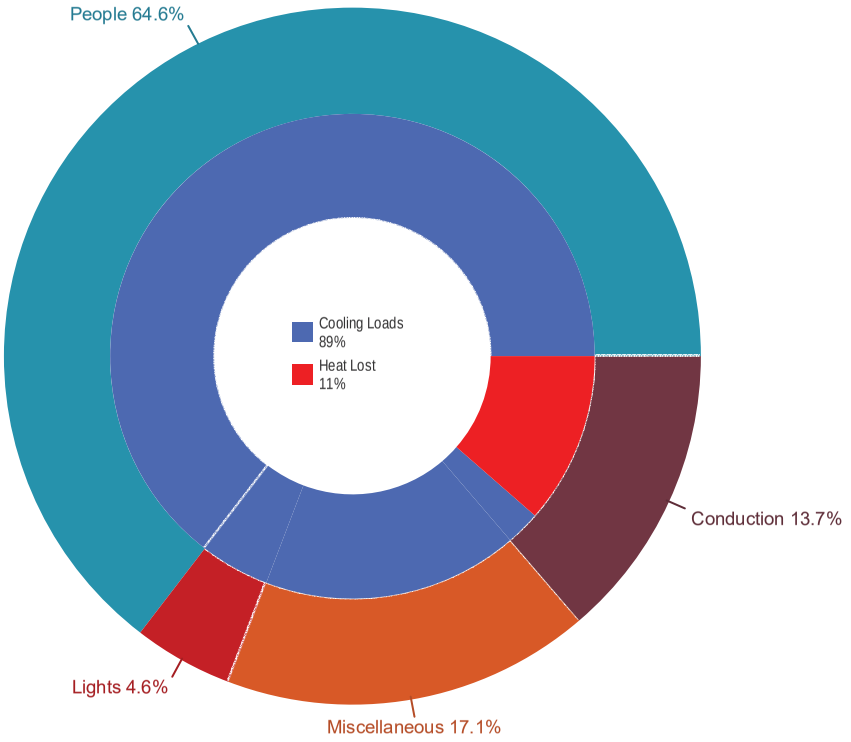
Cooling tons	0.19	Input Ventilation cfm	0
Cooling cfm	369.21	Calculated Ventilation cfm	137
ft²/ton	1715.59	Number of People	0.00
cfm/ton	1,987.45	People per 1000 ft²	0
Conditioned ft²	318.6		

ZONE_Zn-Room - 17 - Breakroom 7/21 16:00:00

Conditions at Time of Space Cooling Peak

Outside	DB / WB / HR	93.7 °F	/ 61.4 °F	/	45.2 gr/lb
Zone	DB / RH / HR	74.0 °F	/ 48.3 %	/	60.3 gr/lb

	Instant Sensible (Btu/h)	Time Delay Sensible (Btu/h)	Latent (Btu/h)	Total (Btu/h)	Percent of Total (%)
Roof	0	0	0	0	0.0
Other Roof	0	0	0	0	0.0
Glass	675	1451	0	2126	12.3
Door	0	0	0	0	0.0
Wall	0	185	0	185	1.1
Below-Grade Wall	0	0	0	0	0.0
Other Wall	0	0	0	0	0.0
Partition	0	-1284	0	-1284	-7.5
Exterior Floor	0	0	0	0	0.0
Interior Floor	0	0	0	0	0.0
Slab	0	-858	0	-858	-5.0
Other Floor	0	0	0	0	0.0
Infiltration	0	0	0	0	0.0
Envelope Subtotal	675	-505	0	169	-
People	2309	4296	5499	12104	70.3
Lights	172	697	0	869	5.0
RA Sensible (Lights)	735	0	0	735	4.3
Miscellaneous Loads	3199	0	0	3199	18.6
Internal Subtotal	6416	4992	5499	16907	-
RA (All Other)	0	0	0	0	0.0
DOA Direct to Zone	0	0	0	0	0.0
Ceiling	0	242	0	242	1.4
Refrigeration	0	0	0	0	0.0
Service Water	0	0	0	0	0.0
HVAC Equipment Losses	0	0	0	0	0.0
Adj Air Transfer Heat	0	0	0	0	0.0
Sizing Factor Correction	0	0	0	0	0.0
Time Delay Correction	0	-104	0	-104	-0.6
Grand Total	7091	4625	5499	17214	100.0



*Does not reflect Time Delay and Sizing Factor Correction effects

Engineering Checks

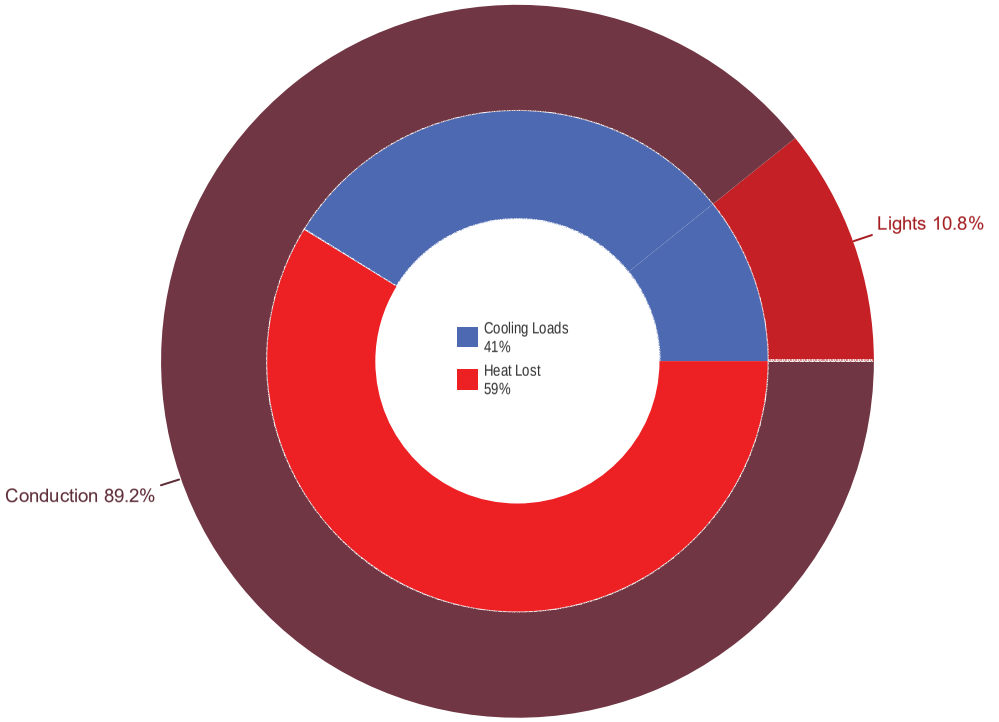
Cooling tons	1.43	Input Ventilation cfm	156
Cooling cfm	728.31	Calculated Ventilation cfm	270
ft²/ton	399.53	Number of People	20.02
cfm/ton	507.61	People per 1000 ft²	35
Conditioned ft²	573.1		

ZONE_Zn-Room - 18 - Electrical 7/21 18:00:00

Conditions at Time of Space Cooling Peak

Outside	DB / WB / HR	89.3 °F	/	59.9 °F	/	45.2 gr/lb
Zone	DB / RH / HR	74.0 °F	/	36.6 %	/	45.5 gr/lb

	Instant Sensible (Btu/h)	Time Delay Sensible (Btu/h)	Latent (Btu/h)	Total (Btu/h)	Percent of Total (%)
Roof	0	0	0	0	0.0
Other Roof	0	0	0	0	0.0
Glass	1158	752	0	1909	104.3
Door	0	0	0	0	0.0
Wall	0	161	0	161	8.8
Below-Grade Wall	0	0	0	0	0.0
Other Wall	0	0	0	0	0.0
Partition	0	-233	0	-233	-12.7
Exterior Floor	0	0	0	0	0.0
Interior Floor	0	0	0	0	0.0
Slab	0	-331	0	-331	-18.1
Other Floor	0	0	0	0	0.0
Infiltration	0	0	0	0	0.0
Envelope Subtotal	1158	348	0	1506	-
People	0	0	0	0	0.0
Lights	21	83	0	103	5.6
RA Sensible (Lights)	89	0	0	89	4.9
Miscellaneous Loads	0	0	0	0	0.0
Internal Subtotal	110	83	0	193	-
RA (All Other)	0	0	0	0	0.0
DOA Direct to Zone	0	0	0	0	0.0
Ceiling	0	132	0	132	7.2
Refrigeration	0	0	0	0	0.0
Service Water	0	0	0	0	0.0
HVAC Equipment Losses	0	0	0	0	0.0
Adj Air Transfer Heat	0	0	0	0	0.0
Sizing Factor Correction	0	0	0	0	0.0
Time Delay Correction	0	0	0	0	0.0
Grand Total	1268	562	0	1830	100.0



*Does not reflect Time Delay and Sizing Factor Correction effects

Engineering Checks

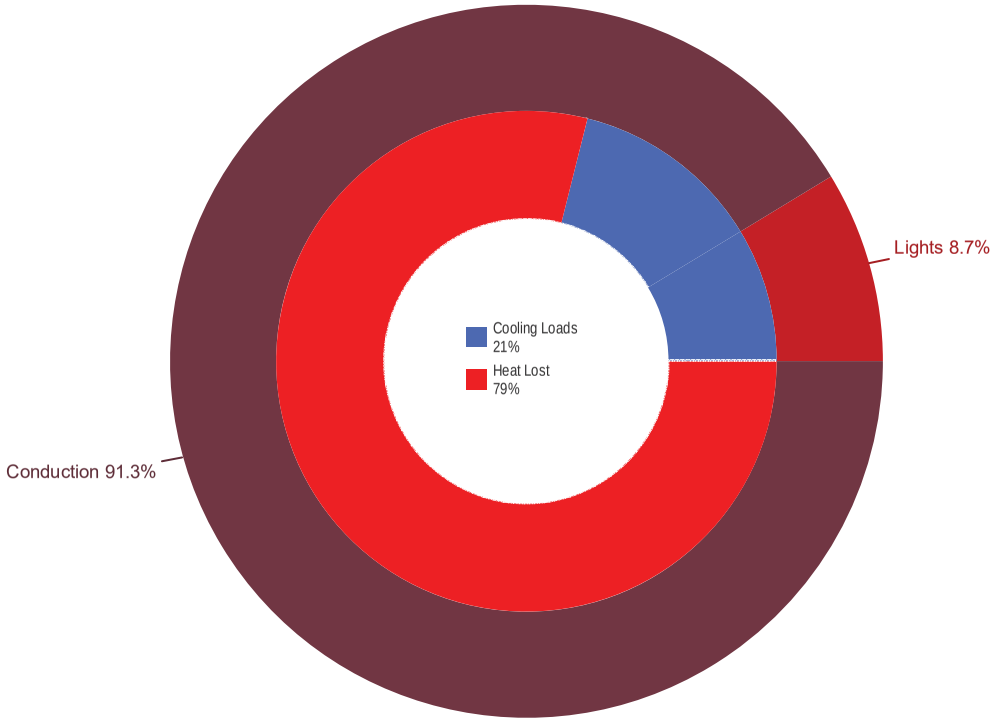
Cooling tons	0.15	Input Ventilation cfm	N/A
Cooling cfm	62.46	Calculated Ventilation cfm	N/A
ft²/ton	763.79	Number of People	0.00
cfm/ton	409.47	People per 1000 ft²	0
Conditioned ft²	116.5		

ZONE_Zn-Room - 21 - Fire Riser 7/21 18:00:00

Conditions at Time of Space Cooling Peak

Outside	DB / WB / HR	89.3 °F	/	59.9 °F	/	45.2 gr/lb
Zone	DB / RH / HR	74.0 °F	/	36.6 %	/	45.5 gr/lb

	Instant Sensible (Btu/h)	Time Delay Sensible (Btu/h)	Latent (Btu/h)	Total (Btu/h)	Percent of Total (%)
Roof	0	0	0	0	0.0
Other Roof	0	0	0	0	0.0
Glass	1149	843	0	1992	123.4
Door	0	0	0	0	0.0
Wall	0	71	0	71	4.4
Below-Grade Wall	0	0	0	0	0.0
Other Wall	0	0	0	0	0.0
Partition	0	-338	0	-338	-20.9
Exterior Floor	0	0	0	0	0.0
Interior Floor	0	0	0	0	0.0
Slab	0	-245	0	-245	-15.2
Other Floor	0	0	0	0	0.0
Infiltration	0	0	0	0	0.0
Envelope Subtotal	1149	331	0	1480	-
People	0	0	0	0	0.0
Lights	12	52	0	64	4.0
RA Sensible (Lights)	50	0	0	50	3.1
Miscellaneous Loads	0	0	0	0	0.0
Internal Subtotal	61	52	0	114	-
RA (All Other)	0	0	0	0	0.0
DOA Direct to Zone	0	0	0	0	0.0
Ceiling	0	20	0	20	1.3
Refrigeration	0	0	0	0	0.0
Service Water	0	0	0	0	0.0
HVAC Equipment Losses	0	0	0	0	0.0
Adj Air Transfer Heat	0	0	0	0	0.0
Sizing Factor Correction	0	0	0	0	0.0
Time Delay Correction	0	0	0	0	0.0
Grand Total	1211	404	0	1614	100.0



*Does not reflect Time Delay and Sizing Factor Correction effects

Engineering Checks

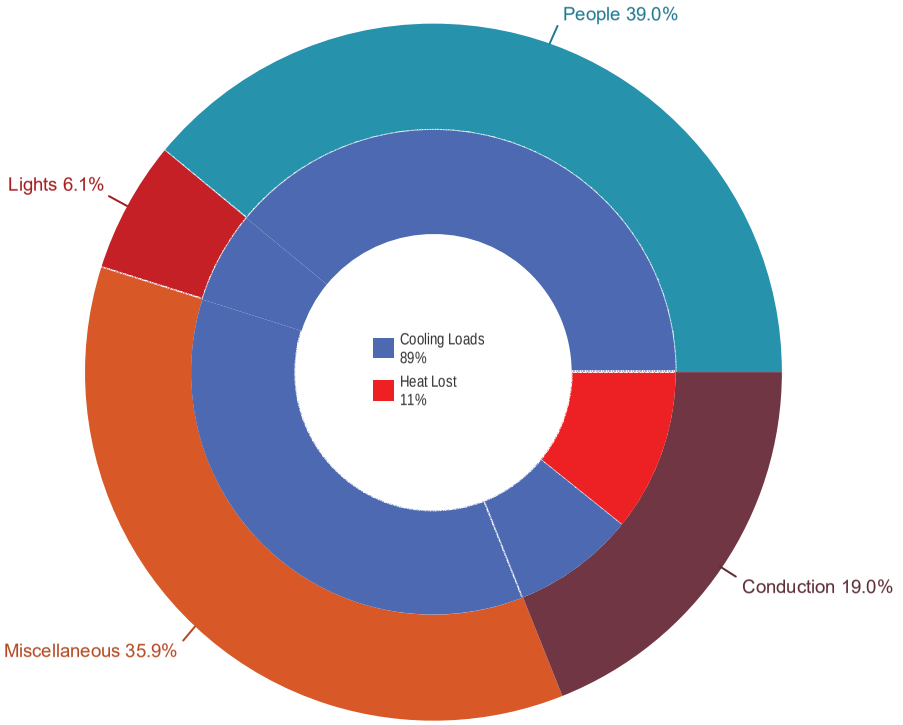
Cooling tons	0.13	Input Ventilation cfm	N/A
Cooling cfm	47.49	Calculated Ventilation cfm	N/A
ft²/ton	483.31	Number of People	0.00
cfm/ton	352.95	People per 1000 ft²	0
Conditioned ft²	65.0		

ZONE_Zn-Room - 23 - Open Office 7/21 19:00:00

Conditions at Time of Space Cooling Peak

Outside	DB / WB / HR	85.6 °F	/	58.7 °F	/	45.1 gr/lb
Zone	DB / RH / HR	74.0 °F	/	41.4 %	/	51.6 gr/lb

	Instant Sensible (Btu/h)	Time Delay Sensible (Btu/h)	Latent (Btu/h)	Total (Btu/h)	Percent of Total (%)
Roof	0	0	0	0	0.0
Other Roof	0	0	0	0	0.0
Glass	2720	4170	0	6890	18.5
Door	0	0	0	0	0.0
Wall	0	633	0	633	1.7
Below-Grade Wall	0	0	0	0	0.0
Other Wall	0	0	0	0	0.0
Partition	0	-568	0	-568	-1.5
Exterior Floor	0	0	0	0	0.0
Interior Floor	0	0	0	0	0.0
Slab	0	-3338	0	-3338	-8.9
Other Floor	0	0	0	0	0.0
Infiltration	0	0	0	0	0.0
Envelope Subtotal	2720	898	0	3618	-
People	3149	4987	5999	14135	37.9
Lights	528	1688	0	2217	5.9
RA Sensible (Lights)	2257	0	0	2257	6.0
Miscellaneous Loads	12997	0	0	12997	34.8
Internal Subtotal	18932	6675	5999	31606	-
RA (All Other)	0	0	0	0	0.0
DOA Direct to Zone	0	0	0	0	0.0
Ceiling	0	2332	0	2332	6.2
Refrigeration	0	0	0	0	0.0
Service Water	0	0	0	0	0.0
HVAC Equipment Losses	0	0	0	0	0.0
Adj Air Transfer Heat	0	0	0	0	0.0
Sizing Factor Correction	0	0	0	0	0.0
Time Delay Correction	0	-223	0	-223	-0.6
Grand Total	21651	9682	5999	37332	100.0



*Does not reflect Time Delay and Sizing Factor Correction effects

Engineering Checks

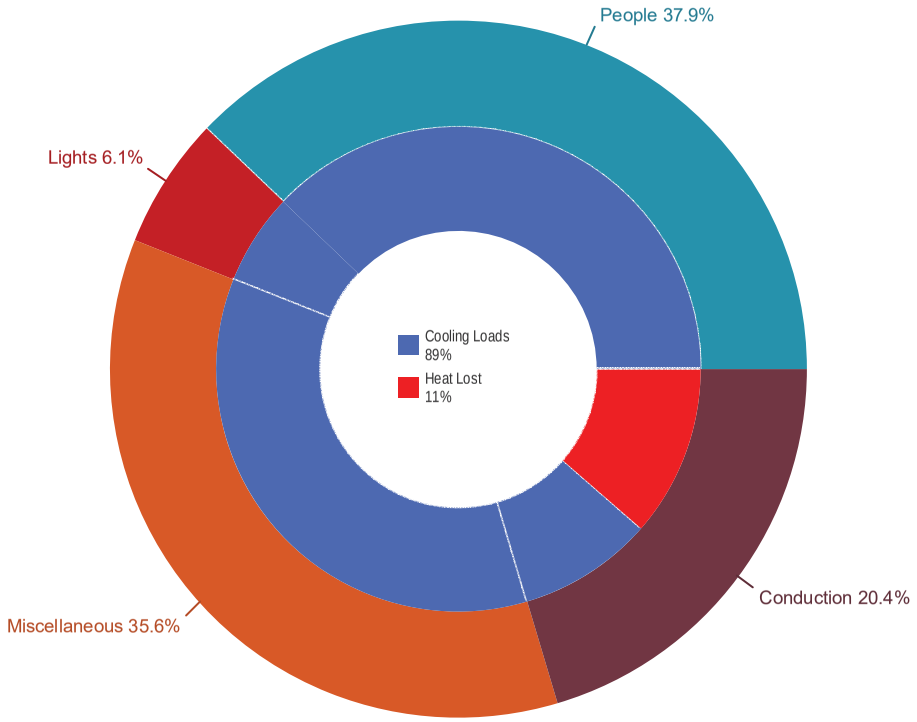
Cooling tons	3.11	Input Ventilation cfm	252
Cooling cfm	1,840.06	Calculated Ventilation cfm	682
ft²/ton	545.51	Number of People	29.97
cfm/ton	591.35	People per 1000 ft²	18
Conditioned ft²	1696.9		

ZONE_Zn-Room - 24 - Open Office 7/21 16:00:00

Conditions at Time of Space Cooling Peak

Outside	DB / WB / HR	93.7 °F	/ 61.4 °F	/ 45.2 gr/lb	
Zone	DB / RH / HR	74.0 °F	/ 41.6 %	/ 51.8 gr/lb	

	Instant Sensible (Btu/h)	Time Delay Sensible (Btu/h)	Latent (Btu/h)	Total (Btu/h)	Percent of Total (%)
Roof	0	0	0	0	0.0
Other Roof	0	0	0	0	0.0
Glass	2617	3771	0	6388	17.5
Door	0	0	0	0	0.0
Wall	0	441	0	441	1.2
Below-Grade Wall	0	0	0	0	0.0
Other Wall	0	0	0	0	0.0
Partition	0	-573	0	-573	-1.6
Exterior Floor	0	0	0	0	0.0
Interior Floor	0	0	0	0	0.0
Slab	0	-3591	0	-3591	-9.8
Other Floor	0	0	0	0	0.0
Infiltration	0	0	0	0	0.0
Envelope Subtotal	2617	48	0	2664	-
People	3149	4662	5999	13810	37.8
Lights	527	1701	0	2229	6.1
RA Sensible (Lights)	2253	0	0	2253	6.2
Miscellaneous Loads	12997	0	0	12997	35.6
Internal Subtotal	18926	6363	5999	31288	-
RA (All Other)	0	0	0	0	0.0
DOA Direct to Zone	0	0	0	0	0.0
Ceiling	0	2842	0	2842	7.8
Refrigeration	0	0	0	0	0.0
Service Water	0	0	0	0	0.0
HVAC Equipment Losses	0	0	0	0	0.0
Adj Air Transfer Heat	0	0	0	0	0.0
Sizing Factor Correction	0	0	0	0	0.0
Time Delay Correction	0	-243	0	-243	-0.7
Grand Total	21543	9009	5999	36551	100.0



*Does not reflect Time Delay and Sizing Factor Correction effects

Engineering Checks

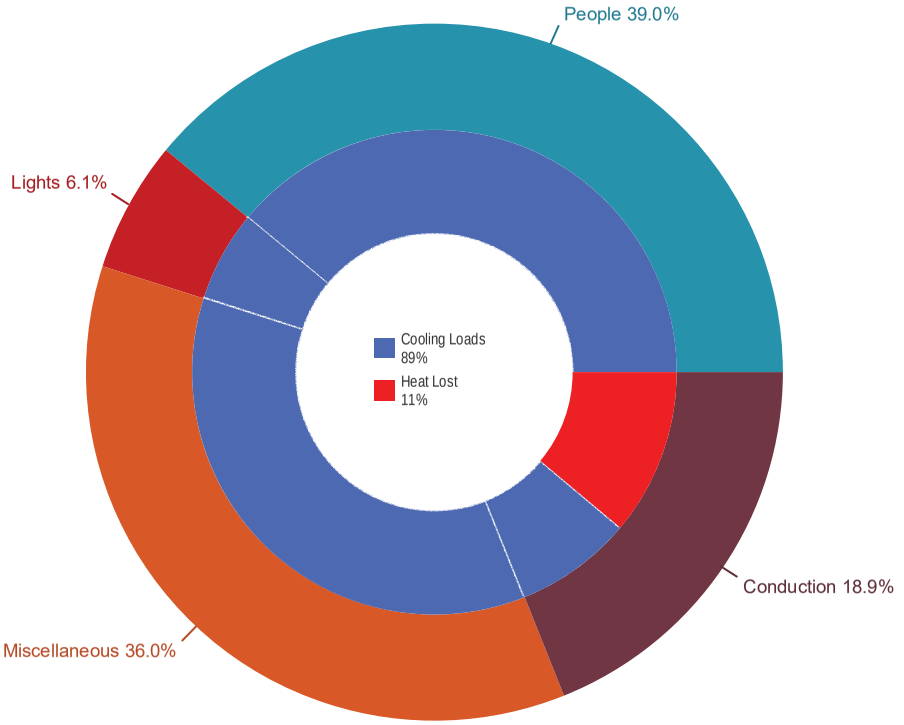
Cooling tons	3.05	Input Ventilation cfm	252
Cooling cfm	2,017.54	Calculated Ventilation cfm	748
ft²/ton	556.14	Number of People	29.97
cfm/ton	662.24	People per 1000 ft²	18
Conditioned ft²	1693.8		

ZONE_Zn-Room - 25 - Open Office 7/21 19:00:00

Conditions at Time of Space Cooling Peak

Outside	DB / WB / HR	85.6 °F	/ 58.7 °F	/ 45.1 gr/lb	
Zone	DB / RH / HR	74.0 °F	/ 41.4 %	/ 51.6 gr/lb	

	Instant Sensible (Btu/h)	Time Delay Sensible (Btu/h)	Latent (Btu/h)	Total (Btu/h)	Percent of Total (%)
Roof	0	0	0	0	0.0
Other Roof	0	0	0	0	0.0
Glass	3148	4297	0	7445	19.8
Door	0	0	0	0	0.0
Wall	0	542	0	542	1.4
Below-Grade Wall	0	0	0	0	0.0
Other Wall	0	0	0	0	0.0
Partition	0	-568	0	-568	-1.5
Exterior Floor	0	0	0	0	0.0
Interior Floor	0	0	0	0	0.0
Slab	0	-3438	0	-3438	-9.2
Other Floor	0	0	0	0	0.0
Infiltration	0	0	0	0	0.0
Envelope Subtotal	3148	833	0	3981	-
People	3149	4932	5999	14079	37.5
Lights	528	1668	0	2196	5.8
RA Sensible (Lights)	2255	0	0	2255	6.0
Miscellaneous Loads	12997	0	0	12997	34.6
Internal Subtotal	18929	6600	5999	31527	-
RA (All Other)	0	0	0	0	0.0
DOA Direct to Zone	0	0	0	0	0.0
Ceiling	0	2288	0	2288	6.1
Refrigeration	0	0	0	0	0.0
Service Water	0	0	0	0	0.0
HVAC Equipment Losses	0	0	0	0	0.0
Adj Air Transfer Heat	0	0	0	0	0.0
Sizing Factor Correction	0	0	0	0	0.0
Time Delay Correction	0	-221	0	-221	-0.6
Grand Total	22077	9500	5999	37576	100.0



*Does not reflect Time Delay and Sizing Factor Correction effects

Engineering Checks

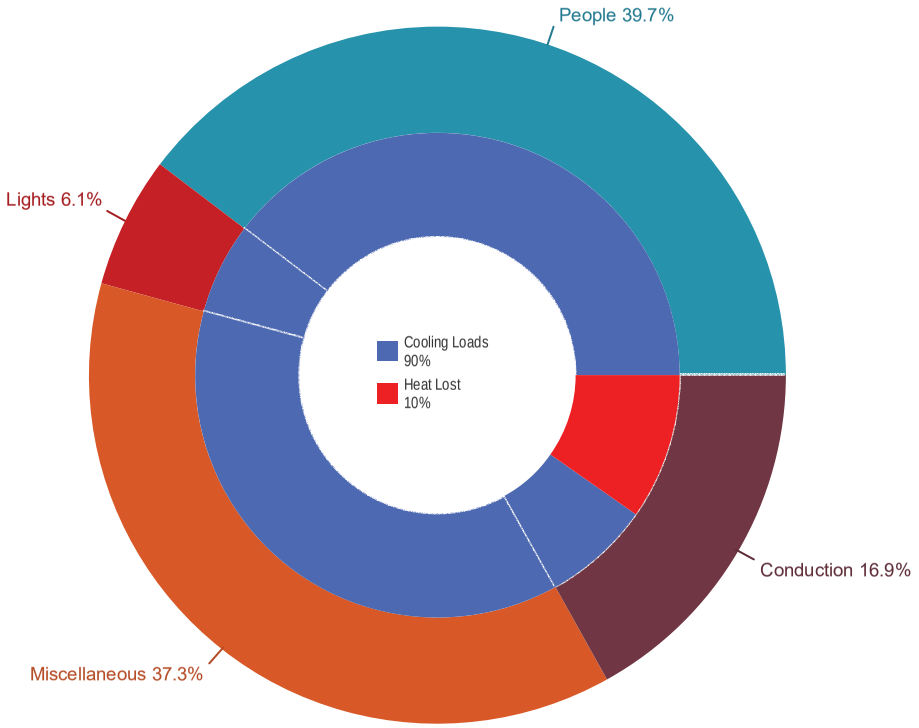
Cooling tons	3.13	Input Ventilation cfm	252
Cooling cfm	1,825.22	Calculated Ventilation cfm	677
ft²/ton	541.53	Number of People	30.00
cfm/ton	582.78	People per 1000 ft²	18
Conditioned ft²	1695.5		

ZONE_Zn-Room - 26 - Open Office 7/21 16:00:00

Conditions at Time of Space Cooling Peak

Outside	DB / WB / HR	93.7 °F	/	61.4 °F	/	45.2 gr/lb
Zone	DB / RH / HR	74.0 °F	/	41.6 %	/	51.9 gr/lb

	Instant Sensible (Btu/h)	Time Delay Sensible (Btu/h)	Latent (Btu/h)	Total (Btu/h)	Percent of Total (%)
Roof	0	0	0	0	0.0
Other Roof	0	0	0	0	0.0
Glass	2555	3695	0	6249	17.3
Door	0	0	0	0	0.0
Wall	0	309	0	309	0.9
Below-Grade Wall	0	0	0	0	0.0
Other Wall	0	0	0	0	0.0
Partition	0	-744	0	-744	-2.1
Exterior Floor	0	0	0	0	0.0
Interior Floor	0	0	0	0	0.0
Slab	0	-2648	0	-2648	-7.3
Other Floor	0	0	0	0	0.0
Infiltration	0	0	0	0	0.0
Envelope Subtotal	2555	612	0	3167	-
People	3149	4657	5999	13805	38.1
Lights	507	1617	0	2124	5.9
RA Sensible (Lights)	2167	0	0	2167	6.0
Miscellaneous Loads	12997	0	0	12997	35.9
Internal Subtotal	18820	6273	5999	31092	-
RA (All Other)	0	0	0	0	0.0
DOA Direct to Zone	0	0	0	0	0.0
Ceiling	0	2184	0	2184	6.0
Refrigeration	0	0	0	0	0.0
Service Water	0	0	0	0	0.0
HVAC Equipment Losses	0	0	0	0	0.0
Adj Air Transfer Heat	0	0	0	0	0.0
Sizing Factor Correction	0	0	0	0	0.0
Time Delay Correction	0	-249	0	-249	-0.7
Grand Total	21375	8821	5999	36195	100.0



*Does not reflect Time Delay and Sizing Factor Correction effects

Engineering Checks

Cooling tons	3.02	Input Ventilation cfm	248
Cooling cfm	1,937.42	Calculated Ventilation cfm	718
ft²/ton	540.14	Number of People	30.03
cfm/ton	642.21	People per 1000 ft²	18
Conditioned ft²	1629.0		

Outside Air / ASHRAE Standard 62.1 Summary

System Ventilation Requirements

System	Mode	ΣVpz (cfm)	Ps People	ΣPz People	D Ps / ΣPz	Vou (cfm)	Vps (cfm)	Xs	Ev	Vot (cfm)	%OA Vot / Vps
VAV RH (30% Min Default) (CW) (HWRH)	Cooling	11154	151	172	0.88	1315	11154	0.118	0.318	4136	37.1%
	Heating	3346	151	172	0.88	1315	3346	0.393	0.393	3346	100.0%

Ventilation Parameters

System Zone	Rp (cfm/p)	Pz People	Ra (cfm/ft²)	Az (ft²)	Vbz (cfm)	Cooling Ez	Cooling Voz (cfm)	Heating Ez	Heating Voz (cfm)
VAV RH (30% Min Default) (CW) (HWRH)	4.97	172.000000	0.06	9838	1417		1417		1771
Zn-Room - 04 - Conference	5	5.000000	0.06	112	32	1	32	0.8	40
Zn-Room - 05 - Office	5	6.000000	0.06	359	52	1	52	0.8	64
Zn-Room - 06 - Conference	5	12.000000	0.06	272	76	1	76	0.8	95
Zn-Room - 07 - Office	5	8.000000	0.06	479	69	1	69	0.8	86
Zn-Room - 12 - Mens RR	0	1.000000	0.03	1009	30	1	30	0.8	37
Zn-Room - 16 - Mechanical	0	0.000000	0	319	0	1	0	0.8	0
Zn-Room - 17 - Breakroom	5	20.000000	0.1	573	156	1	156	0.8	195
Zn-Room - 23 - Open Office	5	30.000000	0.06	1697	252	1	252	0.8	315
Zn-Room - 24 - Open Office	5	30.000000	0.06	1694	252	1	252	0.8	315
Zn-Room - 25 - Open Office	5	30.000000	0.06	1696	252	1	252	0.8	315
Zn-Room - 26 - Open Office	5	30.000000	0.06	1629	248	1	248	0.8	310

Ventilation Calculations for Cooling Design

System Zone	Box Type	Vpz (cfm)	Vdz (cfm)	Vpz-min (cfm)	Voz-clg (cfm)	Zpz	Ep	Er	Fa	Fb	Fc	Evz
VAV RH (30% Min Default) (CW) (HWRH)		11154	11154	3346	1417							
Zn-Room - 04 - Conference	Single Duct VAV Reheat	145	145	44	32	0.729	1	0	0	0	0	0.389
Zn-Room - 05 - Office	Single Duct VAV Reheat	233	233	70	52	0.736	1	0	0	0	0	0.382
Zn-Room - 06 - Conference	Single Duct VAV Reheat	318	318	95	76	0.8	1	0	0	0	0	0.318
Zn-Room - 07 - Office	Single Duct VAV Reheat	298	298	89	69	0.768	1	0	0	0	0	0.35
Zn-Room - 12 - Mens RR	Single Duct VAV Reheat	1442	1442	433	30	0.069	1	0	0	0	0	1.049
Zn-Room - 16 - Mechanical	Single Duct VAV Reheat	369	369	111	0	0	1	0	0	0	0	1.118

Ventilation Calculations for Cooling Design

System Zone	Box Type	Vpz (cfm)	Vdz (cfm)	Vpz-min (cfm)	Voz-clg (cfm)	Zpz	Ep	Er	Fa	Fb	Fc	Evz
Zn-Room - 17 - Breakroom	Single Duct VAV Reheat	728	728	218	156	0.714	1	0	0	0	0	0.404
Zn-Room - 23 - Open Office	Single Duct VAV Reheat	1840	1840	552	252	0.456	1	0	0	0	0	0.662
Zn-Room - 24 - Open Office	Single Duct VAV Reheat	2018	2018	605	252	0.416	1	0	0	0	0	0.702
Zn-Room - 25 - Open Office	Single Duct VAV Reheat	1825	1825	548	252	0.46	1	0	0	0	0	0.658
Zn-Room - 26 - Open Office	Single Duct VAV Reheat	1937	1937	581	248	0.426	1	0	0	0	0	0.692

Ventilation Calculations for Heating Design

System Zone	Box Type	Vpz (cfm)	Vdz (cfm)	Vpz-min (cfm)	Voz-htg (cfm)	Zpz	Ep	Er	Fa	Fb	Fc	Evz
VAV RH (30% Min Default) (CW) (HWRH)		3346	3346	3346	1771							
Zn-Room - 04 - Conference	Single Duct VAV Reheat	44	44	44	40	1	1	0	0	0	0	0.482
Zn-Room - 05 - Office	Single Duct VAV Reheat	70	70	70	64	1	1	0	0	0	0	0.473
Zn-Room - 06 - Conference	Single Duct VAV Reheat	95	95	95	95	1	1	0	0	0	0	0.393
Zn-Room - 07 - Office	Single Duct VAV Reheat	89	89	89	86	1	1	0	0	0	0	0.433
Zn-Room - 12 - Mens RR	Single Duct VAV Reheat	433	433	433	37	0.086	1	0	0	0	0	1.307
Zn-Room - 16 - Mechanical	Single Duct VAV Reheat	111	111	111	0	0	1	0	0	0	0	1.393
Zn-Room - 17 - Breakroom	Single Duct VAV Reheat	218	218	218	195	0.893	1	0	0	0	0	0.5
Zn-Room - 23 - Open Office	Single Duct VAV Reheat	552	552	552	315	0.57	1	0	0	0	0	0.823
Zn-Room - 24 - Open Office	Single Duct VAV Reheat	605	605	605	315	0.52	1	0	0	0	0	0.873
Zn-Room - 25 - Open Office	Single Duct VAV Reheat	548	548	548	315	0.575	1	0	0	0	0	0.818
Zn-Room - 26 - Open Office	Single Duct VAV Reheat	581	581	581	310	0.533	1	0	0	0	0	0.86

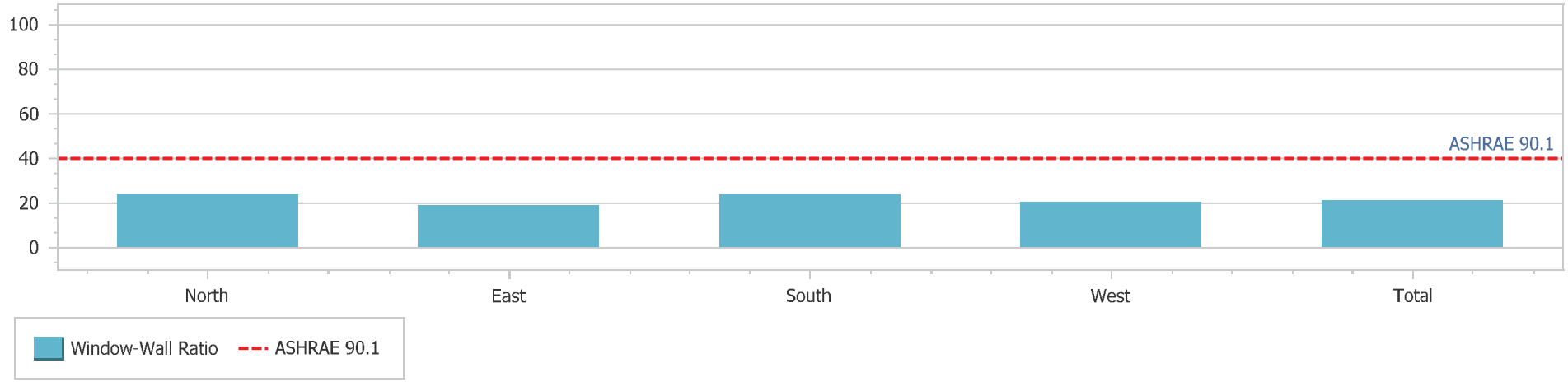
Single-Zone System Calculations

Zone	Room	Rp (cfm/p)	Pz People	Ra (cfm/ft²)	Az (ft²)	Vbz (cfm)	Cooling Ez	Cooling Voz (cfm)	Heating Ez	Heating Voz (cfm)
Zn-Room - 11 - IT		N/A	N/A	N/A	N/A	0.00	100.00	0	80.00	0
	Room - 11 - IT	0.00	0.00	0.00	92	0.00	100.00	0	80.00	0
Zn-Room - 18 - Electrical		N/A	N/A	N/A	N/A	0.00	100.00	0	80.00	0
	Room - 18 - Electrical	0.00	0.00	0.00	116	0.00	100.00	0	80.00	0
Zn-Room - 21 - Fire Riser		N/A	N/A	N/A	N/A	0.00	100.00	0	80.00	0
	Room - 21 - Fire Riser	0.00	0.00	0.00	65	0.00	100.00	0	80.00	0

Sum of Outdoor Air Calculations

System Zone Room	Supply (cfm)	Outdoor (cfm)	Outdoor (%)
CV PTAC	N/A	N/A	N/A
Zn-Room - 11 - IT	711	0	0%
Room - 11 - IT	709	0	N/A
Unit Heater	N/A	N/A	N/A
Zn-Room - 18 - Electrical	62	0	0%
Room - 18 - Electrical	63	0	N/A
Unit Heater001	N/A	N/A	N/A
Zn-Room - 21 - Fire Riser	47	0	0%
Room - 21 - Fire Riser	48	0	N/A

Envelope Summary



	North	East	South	West	Total
Gross Window-Wall Ratio	23.65	18.75	23.69	20.1	21.18

Ratios

	Units	North	East	South	West	Total
Gross Wall Area	ft²	1,214	1,722	1,212	1,724	5,871
Above Ground Wall Area	ft²	1,214	1,722	1,212	1,724	5,871
Window Opening Area	ft²	287	323	287	346	1,243
Gross Window-Wall Ratio	%	23.65	18.75	23.69	20.1	21.18
Above Ground Window-Wall Ratio	%	23.65	18.75	23.69	20.1	21.18
Gross Roof Area	ft²	0	0	0	0	10,345
Skylight Area	ft²	0	0	0	0	0
Skylight-Roof Ratio	%	0	0	0	0	0

Opaque Exterior

	Construction	Exterior Reflectance	Gross Area (ft²)	U-Factor With Film (BTU/h-ft²-°F)	U-Factor No Film (BTU/h-ft²-°F)	Azimuth	Tilt	Cardinal Direction
PLENUM WALL 179-ROOM - 25 - OPEN OFFICE_9	8 Inch Cmu Sweg	0.3	204	0.054	0.056	269.82°	90°	W

Opaque Exterior

	Construction	Exterior Reflectance	Gross Area (ft²)	U-Factor With Film (BTU/h-ft²-°F)	U-Factor No Film (BTU/h-ft²-°F)	Azimuth	Tilt	Cardinal Direction
PLENUM WALL 186-ROOM - 25 - OPEN OFFICE_9	8 Inch Cmu Sweg	0.3	211	0.054	0.056	359.82°	90°	N
PLENUM WALL 194-ROOM - 17 - BREAKROOM_9	8 Inch Cmu Sweg	0.3	120	0.054	0.056	89.82°	90°	E
PLENUM WALL 198-ROOM - 24 - OPEN OFFICE_9	8 Inch Cmu Sweg	0.3	210	0.054	0.056	179.82°	90°	S
PLENUM WALL 199-ROOM - 24 - OPEN OFFICE_9	8 Inch Cmu Sweg	0.3	204	0.054	0.056	89.82°	90°	E
PLENUM WALL 237-ROOM - 23 - OPEN OFFICE_9	8 Inch Cmu Sweg	0.3	204	0.054	0.056	269.85°	90°	W
PLENUM WALL 238-ROOM - 23 - OPEN OFFICE_9	8 Inch Cmu Sweg	0.3	211	0.054	0.056	179.82°	90°	S
PLENUM WALL 243-ROOM - 26 - OPEN OFFICE_9	8 Inch Cmu Sweg	0.3	2	0.054	0.056	150.88°	90°	S
PLENUM WALL 244-ROOM - 26 - OPEN OFFICE_9	8 Inch Cmu Sweg	0.3	1	0.054	0.056	269.82°	90°	W
PLENUM WALL 247-ROOM - 26 - OPEN OFFICE_9	8 Inch Cmu Sweg	0.3	181	0.054	0.056	89.82°	90°	E
PLENUM WALL 248-ROOM - 26 - OPEN OFFICE_9	8 Inch Cmu Sweg	0.3	211	0.054	0.056	359.82°	90°	N
PLENUM WALL 265-ROOM - 18 - ELECTRICAL_9	8 Inch Cmu Sweg	0.3	61	0.054	0.056	269.82°	90°	W
PLENUM WALL 267-ROOM - 21 - FIRE RISER_9	8 Inch Cmu Sweg	0.3	35	0.054	0.056	269.63°	90°	W
PLENUM WALL 269-ROOM - 22 - VESTIBULE_9	8 Inch Cmu Sweg	0.3	56	0.054	0.056	269.82°	90°	W
PLENUM WALL 272-ROOM - 16 - MECHANICAL_9	8 Inch Cmu Sweg	0.3	110	0.054	0.056	90.31°	90°	E
PLENUM WALL 273-ROOM - 05 - OFFICE_9	8 Inch Cmu Sweg	0.3	1	0.054	0.056	359.82°	90°	N
PLENUM WALL 274-ROOM - 20 - STORAGE_9	8 Inch Cmu Sweg	0.3	27	0.054	0.056	269.82°	90°	W
PLENUM WALL 275-ROOM - 20 - STORAGE_9	8 Inch Cmu Sweg	0.3	10	0.054	0.056	359.82°	90°	N
PLENUM WALL 276-ROOM - 19 - JANITOR_9	8 Inch Cmu Sweg	0.3	28	0.054	0.056	269.82°	90°	W
PLENUM WALL 277-ROOM - 19 - JANITOR_9	8 Inch Cmu Sweg	0.3	10	0.054	0.056	179.82°	90°	S
Roof 00-00	90.1-13 Min Roof Insulation Entirely Above Deck Zone 5 - Ahu	0.3	145	0.032	0.033	308.76°	0°	
Roof 00-00 - [1]	90.1-13 Min Roof Insulation Entirely Above Deck Zone 5 - Ahu	0.3	36	0.032	0.033	269.82°	0°	
Roof 00-00 - [2]	90.1-13 Min Roof Insulation Entirely Above Deck Zone 5 - Ahu	0.3	129	0.032	0.033	359.82°	0°	
Roof 00-00 - [3]	90.1-13 Min Roof Insulation Entirely Above Deck Zone 5 - Ahu	0.3	18	0.032	0.033	269.82°	0°	
Roof 01-01	90.1-13 Min Roof Insulation Entirely Above Deck Zone 5 - Ahu	0.3	370	0.032	0.033	269.82°	0°	

Opaque Exterior

	Construction	Exterior Reflectance	Gross Area (ft²)	U-Factor With Film (BTU/h-ft²-°F)	U-Factor No Film (BTU/h-ft²-°F)	Azimuth	Tilt	Cardinal Direction
Roof 03-03	90.1-13 Min Roof Insulation Entirely Above Deck Zone 5 - Ahu	0.3	1,716	0.032	0.033	269.82°	0°	
Roof 04-04	90.1-13 Min Roof Insulation Entirely Above Deck Zone 5 - Ahu	0.3	31	0.032	0.033	89.82°	0°	
Roof 04-04 - [1]	90.1-13 Min Roof Insulation Entirely Above Deck Zone 5 - Ahu	0.3	14	0.032	0.033	253.45°	0°	
Roof 04-04 - [2]	90.1-13 Min Roof Insulation Entirely Above Deck Zone 5 - Ahu	0.3	6	0.032	0.033	359.82°	0°	
Roof 04-04 - [3]	90.1-13 Min Roof Insulation Entirely Above Deck Zone 5 - Ahu	0.3	6	0.032	0.033	291.88°	0°	
Roof 04-04 - [4]	90.1-13 Min Roof Insulation Entirely Above Deck Zone 5 - Ahu	0.3	106	0.032	0.033	101.9°	0°	
Roof 04-04 - [5]	90.1-13 Min Roof Insulation Entirely Above Deck Zone 5 - Ahu	0.3	62	0.032	0.033	281.9°	0°	
Roof 04-04 - [6]	90.1-13 Min Roof Insulation Entirely Above Deck Zone 5 - Ahu	0.3	0	0.032	0.033	330.88°	0°	
Roof 06-06	90.1-13 Min Roof Insulation Entirely Above Deck Zone 5 - Ahu	0.3	127	0.032	0.033	269.82°	0°	
Roof 07-07	90.1-13 Min Roof Insulation Entirely Above Deck Zone 5 - Ahu	0.3	124	0.032	0.033	269.82°	0°	
Roof 08-08	90.1-13 Min Roof Insulation Entirely Above Deck Zone 5 - Ahu	0.3	281	0.032	0.033	269.82°	0°	
Roof 09-09	90.1-13 Min Roof Insulation Entirely Above Deck Zone 5 - Ahu	0.3	97	0.032	0.033	269.82°	0°	
Roof 10-10	90.1-13 Min Roof Insulation Entirely Above Deck Zone 5 - Ahu	0.3	126	0.032	0.033	269.82°	0°	
Roof 11-11	90.1-13 Min Roof Insulation Entirely Above Deck Zone 5 - Ahu	0.3	127	0.032	0.033	269.82°	0°	
Roof 12-12	90.1-13 Min Roof Insulation Entirely Above Deck Zone 5 - Ahu	0.3	124	0.032	0.033	269.82°	0°	
Roof 13-13	90.1-13 Min Roof Insulation Entirely Above Deck Zone 5 - Ahu	0.3	124	0.032	0.033	269.82°	0°	
Roof 14-14	90.1-13 Min Roof Insulation Entirely Above Deck Zone 5 - Ahu	0.3	93	0.032	0.033	269.82°	0°	
Roof 15-15	90.1-13 Min Roof Insulation Entirely Above Deck Zone 5 - Ahu	0.3	125	0.032	0.033	269.82°	0°	
Roof 17-17	90.1-13 Min Roof Insulation Entirely Above Deck Zone 5 - Ahu	0.3	47	0.032	0.033	316.41°	0°	
Roof 17-17 - [1]	90.1-13 Min Roof Insulation Entirely Above Deck Zone 5 - Ahu	0.3	12	0.032	0.033	269.82°	0°	
Roof 17-17 - [2]	90.1-13 Min Roof Insulation Entirely Above Deck Zone 5 - Ahu	0.3	101	0.032	0.033	136.41°	0°	

Opaque Exterior

	Construction	Exterior Reflectance	Gross Area (ft²)	U-Factor With Film (BTU/h-ft²-°F)	U-Factor No Film (BTU/h-ft²-°F)	Azimuth	Tilt	Cardinal Direction
Roof 17-17 - [3]	90.1-13 Min Roof Insulation Entirely Above Deck Zone 5 - Ahu	0.3	37	0.032	0.033	26.97°	0°	
Roof 17-17 - [4]	90.1-13 Min Roof Insulation Entirely Above Deck Zone 5 - Ahu	0.3	20	0.032	0.033	269.82°	0°	
Roof 17-17 - [5]	90.1-13 Min Roof Insulation Entirely Above Deck Zone 5 - Ahu	0.3	4	0.032	0.033	269.82°	0°	
Roof 18-18	90.1-13 Min Roof Insulation Entirely Above Deck Zone 5 - Ahu	0.3	45	0.032	0.033	331.7°	0°	
Roof 18-18 - [1]	90.1-13 Min Roof Insulation Entirely Above Deck Zone 5 - Ahu	0.3	37	0.032	0.033	308.11°	0°	
Roof 18-18 - [2]	90.1-13 Min Roof Insulation Entirely Above Deck Zone 5 - Ahu	0.3	29	0.032	0.033	219.8°	0°	
Roof 18-18 - [3]	90.1-13 Min Roof Insulation Entirely Above Deck Zone 5 - Ahu	0.3	3	0.032	0.033	359.82°	0°	
Roof 18-18 - [4]	90.1-13 Min Roof Insulation Entirely Above Deck Zone 5 - Ahu	0.3	36	0.032	0.033	39.8°	0°	
Roof 18-18 - [5]	90.1-13 Min Roof Insulation Entirely Above Deck Zone 5 - Ahu	0.3	20	0.032	0.033	359.82°	0°	
Roof 18-18 - [6]	90.1-13 Min Roof Insulation Entirely Above Deck Zone 5 - Ahu	0.3	12	0.032	0.033	349.35°	0°	
Roof 18-18 - [7]	90.1-13 Min Roof Insulation Entirely Above Deck Zone 5 - Ahu	0.3	20	0.032	0.033	359.82°	0°	
Roof 19-19	90.1-13 Min Roof Insulation Entirely Above Deck Zone 5 - Ahu	0.3	77	0.032	0.033	269.82°	0°	
Roof 20-20	90.1-13 Min Roof Insulation Entirely Above Deck Zone 5 - Ahu	0.3	47	0.032	0.033	89.82°	0°	
Roof 20-20 - [1]	90.1-13 Min Roof Insulation Entirely Above Deck Zone 5 - Ahu	0.3	111	0.032	0.033	102.42°	0°	
Roof 20-20 - [2]	90.1-13 Min Roof Insulation Entirely Above Deck Zone 5 - Ahu	0.3	23	0.032	0.033	89.82°	0°	
Roof 20-20 - [3]	90.1-13 Min Roof Insulation Entirely Above Deck Zone 5 - Ahu	0.3	41	0.032	0.033	289.17°	0°	
Roof 20-20 - [4]	90.1-13 Min Roof Insulation Entirely Above Deck Zone 5 - Ahu	0.3	24	0.032	0.033	57.96°	0°	
Roof 20-20 - [5]	90.1-13 Min Roof Insulation Entirely Above Deck Zone 5 - Ahu	0.3	24	0.032	0.033	89.82°	0°	
Roof 21-21	90.1-13 Min Roof Insulation Entirely Above Deck Zone 5 - Ahu	0.3	122	0.032	0.033	269.82°	0°	
Roof 22-22	90.1-13 Min Roof Insulation Entirely Above Deck Zone 5 - Ahu	0.3	55	0.032	0.033	269.82°	0°	
Roof 23-23	90.1-13 Min Roof Insulation Entirely Above Deck Zone 5 - Ahu	0.3	90	0.032	0.033	269.82°	0°	

Opaque Exterior

	Construction	Exterior Reflectance	Gross Area (ft²)	U-Factor With Film (BTU/h-ft²-°F)	U-Factor No Film (BTU/h-ft²-°F)	Azimuth	Tilt	Cardinal Direction
Roof 24-24	90.1-13 Min Roof Insulation Entirely Above Deck Zone 5 - Ahu	0.3	55	0.032	0.033	269.82°	0°	
Roof 25-25	90.1-13 Min Roof Insulation Entirely Above Deck Zone 5 - Ahu	0.3	69	0.032	0.033	269.63°	0°	
Roof 26-26	90.1-13 Min Roof Insulation Entirely Above Deck Zone 5 - Ahu	0.3	282	0.032	0.033	293.1°	0°	
Roof 26-26 - [1]	90.1-13 Min Roof Insulation Entirely Above Deck Zone 5 - Ahu	0.3	764	0.032	0.033	359.82°	0°	
Roof 26-26 - [2]	90.1-13 Min Roof Insulation Entirely Above Deck Zone 5 - Ahu	0.3	543	0.032	0.033	170.2°	0°	
Roof 26-26 - [3]	90.1-13 Min Roof Insulation Entirely Above Deck Zone 5 - Ahu	0.3	48	0.032	0.033	179.82°	0°	
Roof 26-26 - [4]	90.1-13 Min Roof Insulation Entirely Above Deck Zone 5 - Ahu	0.3	0	0.032	0.033	150.88°	0°	
Roof 26-26 - [5]	90.1-13 Min Roof Insulation Entirely Above Deck Zone 5 - Ahu	0.3	12	0.032	0.033	319.35°	0°	
Roof 26-26 - [6]	90.1-13 Min Roof Insulation Entirely Above Deck Zone 5 - Ahu	0.3	0	0.032	0.033	269.82°	0°	
Roof 27-27	90.1-13 Min Roof Insulation Entirely Above Deck Zone 5 - Ahu	0.3	1,714	0.032	0.033	269.82°	0°	
Roof 28-28	90.1-13 Min Roof Insulation Entirely Above Deck Zone 5 - Ahu	0.3	1,718	0.032	0.033	269.85°	0°	
Roof 29-29	90.1-13 Min Roof Insulation Entirely Above Deck Zone 5 - Ahu	0.3	117	0.032	0.033	269.82°	0°	
SLAB 00_0	90.1-13 Min Slab On Grade Unheated Floor, R-15 For 24 In., Zone 4-5_0	1	18	0.021	0.021		180°	
SLAB 00_1	90.1-13 Min Slab On Grade Unheated Floor, R-15 For 24 In., Zone 4-5_0	1	129	0.021	0.021		180°	
SLAB 00_2	90.1-13 Min Slab On Grade Unheated Floor, R-15 For 24 In., Zone 4-5_0	1	145	0.021	0.021		180°	
SLAB 00_3	90.1-13 Min Slab On Grade Unheated Floor, R-15 For 24 In., Zone 4-5_0	1	36	0.021	0.021		180°	
SLAB 01_0	90.1-13 Min Slab On Grade Unheated Floor, R-15 For 24 In., Zone 4-5_0	1	370	0.021	0.021		180°	
SLAB 03_0	90.1-13 Min Slab On Grade Unheated Floor, R-15 For 24 In., Zone 4-5_0	1	1,716	0.021	0.021		180°	
SLAB 04_0	90.1-13 Min Slab On Grade Unheated Floor, R-15 For 24 In., Zone 4-5_0	1	106	0.021	0.021		180°	
SLAB 04_1	90.1-13 Min Slab On Grade Unheated Floor, R-15 For 24 In., Zone 4-5_0	1	14	0.021	0.021		180°	
SLAB 04_2	90.1-13 Min Slab On Grade Unheated Floor, R-15 For 24 In., Zone 4-5_0	1	6	0.021	0.021		180°	

Opaque Exterior

	Construction	Exterior Reflectance	Gross Area (ft²)	U-Factor With Film (BTU/h-ft²-°F)	U-Factor No Film (BTU/h-ft²-°F)	Azimuth	Tilt	Cardinal Direction
SLAB 04_3	90.1-13 Min Slab On Grade Unheated Floor, R-15 For 24 In., Zone 4-5_0	1	6	0.021	0.021		180°	
SLAB 04_4	90.1-13 Min Slab On Grade Unheated Floor, R-15 For 24 In., Zone 4-5_0	1	31	0.021	0.021		180°	
SLAB 04_5	90.1-13 Min Slab On Grade Unheated Floor, R-15 For 24 In., Zone 4-5_0	1	62	0.021	0.021		180°	
SLAB 04_6	90.1-13 Min Slab On Grade Unheated Floor, R-15 For 24 In., Zone 4-5_0	1	0	0.021	0.021		180°	
SLAB 06_0	90.1-13 Min Slab On Grade Unheated Floor, R-15 For 24 In., Zone 4-5_0	1	127	0.021	0.021		180°	
SLAB 07_0	90.1-13 Min Slab On Grade Unheated Floor, R-15 For 24 In., Zone 4-5_0	1	124	0.021	0.021		180°	
SLAB 08_0	90.1-13 Min Slab On Grade Unheated Floor, R-15 For 24 In., Zone 4-5_0	1	281	0.021	0.021		180°	
SLAB 09_0	90.1-13 Min Slab On Grade Unheated Floor, R-15 For 24 In., Zone 4-5_0	1	97	0.021	0.021		180°	
SLAB 10_0	90.1-13 Min Slab On Grade Unheated Floor, R-15 For 24 In., Zone 4-5_0	1	126	0.021	0.021		180°	
SLAB 11_0	90.1-13 Min Slab On Grade Unheated Floor, R-15 For 24 In., Zone 4-5_0	1	127	0.021	0.021		180°	
SLAB 12_0	90.1-13 Min Slab On Grade Unheated Floor, R-15 For 24 In., Zone 4-5_0	1	124	0.021	0.021		180°	
SLAB 13_0	90.1-13 Min Slab On Grade Unheated Floor, R-15 For 24 In., Zone 4-5_0	1	124	0.021	0.021		180°	
SLAB 14_0	90.1-13 Min Slab On Grade Unheated Floor, R-15 For 24 In., Zone 4-5_0	1	93	0.021	0.021		180°	
SLAB 15_0	90.1-13 Min Slab On Grade Unheated Floor, R-15 For 24 In., Zone 4-5_0	1	125	0.021	0.021		180°	
SLAB 17_0	90.1-13 Min Slab On Grade Unheated Floor, R-15 For 24 In., Zone 4-5_0	1	20	0.021	0.021		180°	
SLAB 17_1	90.1-13 Min Slab On Grade Unheated Floor, R-15 For 24 In., Zone 4-5_0	1	37	0.021	0.021		180°	
SLAB 17_2	90.1-13 Min Slab On Grade Unheated Floor, R-15 For 24 In., Zone 4-5_0	1	101	0.021	0.021		180°	
SLAB 17_3	90.1-13 Min Slab On Grade Unheated Floor, R-15 For 24 In., Zone 4-5_0	1	47	0.021	0.021		180°	
SLAB 17_4	90.1-13 Min Slab On Grade Unheated Floor, R-15 For 24 In., Zone 4-5_0	1	12	0.021	0.021		180°	
SLAB 17_5	90.1-13 Min Slab On Grade Unheated Floor, R-15 For 24 In., Zone 4-5_0	1	4	0.021	0.021		180°	
SLAB 18_0	90.1-13 Min Slab On Grade Unheated Floor, R-15 For 24 In., Zone 4-5_0	1	20	0.021	0.021		180°	

Opaque Exterior

	Construction	Exterior Reflectance	Gross Area (ft²)	U-Factor With Film (BTU/h-ft²-°F)	U-Factor No Film (BTU/h-ft²-°F)	Azimuth	Tilt	Cardinal Direction
SLAB 18_1	90.1-13 Min Slab On Grade Unheated Floor, R-15 For 24 In., Zone 4-5_0	1	45	0.021	0.021		180°	
SLAB 18_2	90.1-13 Min Slab On Grade Unheated Floor, R-15 For 24 In., Zone 4-5_0	1	37	0.021	0.021		180°	
SLAB 18_3	90.1-13 Min Slab On Grade Unheated Floor, R-15 For 24 In., Zone 4-5_0	1	29	0.021	0.021		180°	
SLAB 18_4	90.1-13 Min Slab On Grade Unheated Floor, R-15 For 24 In., Zone 4-5_0	1	3	0.021	0.021		180°	
SLAB 18_5	90.1-13 Min Slab On Grade Unheated Floor, R-15 For 24 In., Zone 4-5_0	1	36	0.021	0.021		180°	
SLAB 18_6	90.1-13 Min Slab On Grade Unheated Floor, R-15 For 24 In., Zone 4-5_0	1	12	0.021	0.021		180°	
SLAB 18_7	90.1-13 Min Slab On Grade Unheated Floor, R-15 For 24 In., Zone 4-5_0	1	20	0.021	0.021		180°	
SLAB 19_0	90.1-13 Min Slab On Grade Unheated Floor, R-15 For 24 In., Zone 4-5_0	1	77	0.021	0.021		180°	
SLAB 20_0	90.1-13 Min Slab On Grade Unheated Floor, R-15 For 24 In., Zone 4-5_0	1	111	0.021	0.021		180°	
SLAB 20_1	90.1-13 Min Slab On Grade Unheated Floor, R-15 For 24 In., Zone 4-5_0	1	23	0.021	0.021		180°	
SLAB 20_2	90.1-13 Min Slab On Grade Unheated Floor, R-15 For 24 In., Zone 4-5_0	1	41	0.021	0.021		180°	
SLAB 20_3	90.1-13 Min Slab On Grade Unheated Floor, R-15 For 24 In., Zone 4-5_0	1	24	0.021	0.021		180°	
SLAB 20_4	90.1-13 Min Slab On Grade Unheated Floor, R-15 For 24 In., Zone 4-5_0	1	24	0.021	0.021		180°	
SLAB 20_5	90.1-13 Min Slab On Grade Unheated Floor, R-15 For 24 In., Zone 4-5_0	1	47	0.021	0.021		180°	
SLAB 21_0	90.1-13 Min Slab On Grade Unheated Floor, R-15 For 24 In., Zone 4-5_0	1	122	0.021	0.021		180°	
SLAB 22_0	90.1-13 Min Slab On Grade Unheated Floor, R-15 For 24 In., Zone 4-5_0	1	55	0.021	0.021		180°	
SLAB 23_0	90.1-13 Min Slab On Grade Unheated Floor, R-15 For 24 In., Zone 4-5_0	1	90	0.021	0.021		180°	
SLAB 24_0	90.1-13 Min Slab On Grade Unheated Floor, R-15 For 24 In., Zone 4-5_0	1	55	0.021	0.021		180°	
SLAB 25_0	90.1-13 Min Slab On Grade Unheated Floor, R-15 For 24 In., Zone 4-5_0	1	69	0.021	0.021		180°	
SLAB 26_0	90.1-13 Min Slab On Grade Unheated Floor, R-15 For 24 In., Zone 4-5_0	1	543	0.021	0.021		180°	
SLAB 26_1	90.1-13 Min Slab On Grade Unheated Floor, R-15 For 24 In., Zone 4-5_0	1	48	0.021	0.021		180°	

Opaque Exterior

	Construction	Exterior Reflectance	Gross Area (ft²)	U-Factor With Film (BTU/h-ft²-°F)	U-Factor No Film (BTU/h-ft²-°F)	Azimuth	Tilt	Cardinal Direction
SLAB 26_2	90.1-13 Min Slab On Grade Unheated Floor, R-15 For 24 In., Zone 4-5_0	1	0	0.021	0.021		180°	
SLAB 26_3	90.1-13 Min Slab On Grade Unheated Floor, R-15 For 24 In., Zone 4-5_0	1	12	0.021	0.021		180°	
SLAB 26_4	90.1-13 Min Slab On Grade Unheated Floor, R-15 For 24 In., Zone 4-5_0	1	0	0.021	0.021		180°	
SLAB 26_5	90.1-13 Min Slab On Grade Unheated Floor, R-15 For 24 In., Zone 4-5_0	1	764	0.021	0.021		180°	
SLAB 26_6	90.1-13 Min Slab On Grade Unheated Floor, R-15 For 24 In., Zone 4-5_0	1	282	0.021	0.021		180°	
SLAB 27_0	90.1-13 Min Slab On Grade Unheated Floor, R-15 For 24 In., Zone 4-5_0	1	1,714	0.021	0.021		180°	
SLAB 28_0	90.1-13 Min Slab On Grade Unheated Floor, R-15 For 24 In., Zone 4-5_0	1	1,718	0.021	0.021		180°	
SLAB 29_0	90.1-13 Min Slab On Grade Unheated Floor, R-15 For 24 In., Zone 4-5_0	1	117	0.021	0.021		180°	
WALL 04-ROOM - 16 - MECHANICAL_0	8 Inch Cmu Sweg	0.3	198	0.054	0.056	90.31°	90°	E
WALL 09-ROOM - 17 - BREAKROOM_0	8 Inch Cmu Sweg	0.3	217	0.054	0.056	89.82°	90°	E
WALL 126-ROOM - 18 - ELECTRICAL_0	8 Inch Cmu Sweg	0.3	110	0.054	0.056	269.82°	90°	W
WALL 129-ROOM - 19 - JANITOR_0	8 Inch Cmu Sweg	0.3	50	0.054	0.056	269.82°	90°	W
WALL 132-ROOM - 19 - JANITOR_0	8 Inch Cmu Sweg	0.3	18	0.054	0.056	179.82°	90°	S
WALL 134-ROOM - 22 - VESTIBULE_0	8 Inch Cmu Sweg	0.3	101	0.054	0.056	269.82°	90°	W
WALL 138-ROOM - 20 - STORAGE_0	8 Inch Cmu Sweg	0.3	49	0.054	0.056	269.82°	90°	W
WALL 140-ROOM - 20 - STORAGE_0	8 Inch Cmu Sweg	0.3	18	0.054	0.056	359.82°	90°	N
WALL 144-ROOM - 21 - FIRE RISER_0	8 Inch Cmu Sweg	0.3	63	0.054	0.056	269.63°	90°	W
WALL 147-ROOM - 25 - OPEN OFFICE_0	8 Inch Cmu Sweg	0.3	379	0.054	0.056	359.82°	90°	N
WALL 148-ROOM - 26 - OPEN OFFICE_0	8 Inch Cmu Sweg	0.3	326	0.054	0.056	89.82°	90°	E
WALL 149-ROOM - 26 - OPEN OFFICE_0	8 Inch Cmu Sweg	0.3	380	0.054	0.056	359.82°	90°	N
WALL 152-ROOM - 24 - OPEN OFFICE_0	8 Inch Cmu Sweg	0.3	379	0.054	0.056	179.82°	90°	S
WALL 153-ROOM - 24 - OPEN OFFICE_0	8 Inch Cmu Sweg	0.3	367	0.054	0.056	89.82°	90°	E
WALL 154-ROOM - 26 - OPEN OFFICE_0	8 Inch Cmu Sweg	0.3	3	0.054	0.056	150.88°	90°	S

Opaque Exterior

	Construction	Exterior Reflectance	Gross Area (ft²)	U-Factor With Film (BTU/h-ft²-°F)	U-Factor No Film (BTU/h-ft²-°F)	Azimuth	Tilt	Cardinal Direction
WALL 155-ROOM - 26 - OPEN OFFICE_0	8 Inch Cmu Sweg	0.3	1	0.054	0.056	269.82°	90°	W
WALL 156-ROOM - 05 - OFFICE_0	8 Inch Cmu Sweg	0.3	3	0.054	0.056	359.82°	90°	N
WALL 173-ROOM - 23 - OPEN OFFICE_0	8 Inch Cmu Sweg	0.3	367	0.054	0.056	269.85°	90°	W
WALL 174-ROOM - 23 - OPEN OFFICE_0	8 Inch Cmu Sweg	0.3	379	0.054	0.056	179.82°	90°	S
WALL 18-ROOM - 25 - OPEN OFFICE_0	8 Inch Cmu Sweg	0.3	366	0.054	0.056	269.82°	90°	W

Fenestration

	Construction	Area of One Opening (ft²)	Area of Openings (ft²)	U-Factor (BTU/h-ft²-°F)	SHGC	Visible Transmittance	Shade Control	Parent Surface	Azimuth	Cardinal Direction
DOOR 04_D - WALL 126-ROOM - 18 - ELECTRICAL_0	90.1-13 Metal Frame Ent. Door Zone 4-6	19	19	0.77	0.407	0.442	No	WALL 126-ROOM - 18 - ELECTRICAL_0	269.82°	W
DOOR 05_D - WALL 144-ROOM - 21 - FIRE RISER_0	90.1-13 Metal Frame Ent. Door Zone 4-6	19	19	0.77	0.407	0.442	No	WALL 144-ROOM - 21 - FIRE RISER_0	269.63°	W
DOOR 06_D - WALL 134-ROOM - 22 - VESTIBULE_0	90.1-13 Metal Frame Ent. Door Zone 4-6	48	48	0.77	0.407	0.442	No	WALL 134-ROOM - 22 - VESTIBULE_0	269.82°	W
WINDOW 17_W - WALL 134-ROOM - 22 - VESTIBULE_0	90.1-13 Window Zone 4-6 Metal Oper - Copy	10	10	0.42	0.401	0.442	No	WALL 134-ROOM - 22 - VESTIBULE_0	269.82°	W
WINDOW 18_W - WALL 134-ROOM - 22 - VESTIBULE_0	90.1-13 Window Zone 4-6 Metal Oper - Copy	10	10	0.42	0.401	0.442	No	WALL 134-ROOM - 22 - VESTIBULE_0	269.82°	W
WINDOW 24_W - WALL 18-ROOM - 25 - OPEN OFFICE_0	90.1-13 Window Zone 4-6 Metal Oper - Copy	60	60	0.42	0.401	0.442	No	WALL 18-ROOM - 25 - OPEN OFFICE_0	269.82°	W
WINDOW 25_W - WALL 18-ROOM - 25 - OPEN OFFICE_0	90.1-13 Window Zone 4-6 Metal Oper - Copy	60	60	0.42	0.401	0.442	No	WALL 18-ROOM - 25 - OPEN OFFICE_0	269.82°	W
WINDOW 26_W - WALL 173-ROOM - 23 - OPEN OFFICE_0	90.1-13 Window Zone 4-6 Metal Oper - Copy	60	60	0.42	0.401	0.442	No	WALL 173-ROOM - 23 - OPEN OFFICE_0	269.85°	W
WINDOW 27_W - WALL 173-ROOM - 23 - OPEN OFFICE_0	90.1-13 Window Zone 4-6 Metal Oper - Copy	60	60	0.42	0.401	0.442	No	WALL 173-ROOM - 23 - OPEN OFFICE_0	269.85°	W
DOOR 08_D - WALL 152-ROOM - 24 - OPEN OFFICE_0	90.1-13 Metal Frame Ent. Door Zone 4-6	19	19	0.77	0.407	0.442	No	WALL 152-ROOM - 24 - OPEN OFFICE_0	179.82°	S
WINDOW 28_W - WALL 174-ROOM - 23 - OPEN OFFICE_0	90.1-13 Window Zone 4-6 Metal Oper - Copy	60	60	0.42	0.401	0.442	No	WALL 174-ROOM - 23 - OPEN OFFICE_0	179.82°	S
WINDOW 29_W - WALL 174-ROOM - 23 - OPEN OFFICE_0	90.1-13 Window Zone 4-6 Metal Oper - Copy	60	60	0.42	0.401	0.442	No	WALL 174-ROOM - 23 - OPEN OFFICE_0	179.82°	S
WINDOW 30_W - WALL 152-ROOM - 24 - OPEN OFFICE_0	90.1-13 Window Zone 4-6 Metal Oper - Copy	60	60	0.42	0.401	0.442	No	WALL 152-ROOM - 24 - OPEN OFFICE_0	179.82°	S
WINDOW 34_W - WALL 152-ROOM - 24 - OPEN OFFICE_0	90.1-13 Window Zone 4-6 Metal Oper - Copy	44	44	0.42	0.401	0.442	No	WALL 152-ROOM - 24 - OPEN OFFICE_0	179.82°	S

Fenestration

	Construction	Area of One Opening (ft²)	Area of Openings (ft²)	U-Factor (BTU/h-ft²-°F)	SHGC	Visible Transmittance	Shade Control	Parent Surface	Azimuth	Cardinal Direction
WINDOW 35_W - WALL 152-ROOM - 24 - OPEN OFFICE_0	90.1-13 Window Zone 4-6 Metal Oper - Copy	44	44	0.42	0.401	0.442	No	WALL 152-ROOM - 24 - OPEN OFFICE_0	179.82°	S
DOOR 07_D - WALL 149-ROOM - 26 - OPEN OFFICE_0	90.1-13 Metal Frame Ent. Door Zone 4-6	19	19	0.77	0.407	0.442	No	WALL 149-ROOM - 26 - OPEN OFFICE_0	359.82°	N
WINDOW 21_W - WALL 149-ROOM - 26 - OPEN OFFICE_0	90.1-13 Window Zone 4-6 Metal Oper - Copy	60	60	0.42	0.401	0.442	No	WALL 149-ROOM - 26 - OPEN OFFICE_0	359.82°	N
WINDOW 22_W - WALL 147-ROOM - 25 - OPEN OFFICE_0	90.1-13 Window Zone 4-6 Metal Oper - Copy	60	60	0.42	0.401	0.442	No	WALL 147-ROOM - 25 - OPEN OFFICE_0	359.82°	N
WINDOW 23_W - WALL 147-ROOM - 25 - OPEN OFFICE_0	90.1-13 Window Zone 4-6 Metal Oper - Copy	60	60	0.42	0.401	0.442	No	WALL 147-ROOM - 25 - OPEN OFFICE_0	359.82°	N
WINDOW 36_W - WALL 149-ROOM - 26 - OPEN OFFICE_0	90.1-13 Window Zone 4-6 Metal Oper - Copy	44	44	0.42	0.401	0.442	No	WALL 149-ROOM - 26 - OPEN OFFICE_0	359.82°	N
WINDOW 37_W - WALL 149-ROOM - 26 - OPEN OFFICE_0	90.1-13 Window Zone 4-6 Metal Oper - Copy	44	44	0.42	0.401	0.442	No	WALL 149-ROOM - 26 - OPEN OFFICE_0	359.82°	N
DOOR 01_D - WALL 04-ROOM - 16 - MECHANICAL_0	90.1-13 Metal Frame Ent. Door Zone 4-6	19	19	0.77	0.407	0.442	No	WALL 04-ROOM - 16 - MECHANICAL_0	90.31°	E
DOOR 02_D - WALL 09-ROOM - 17 - BREAKROOM_0	90.1-13 Metal Frame Ent. Door Zone 4-6	19	19	0.77	0.407	0.442	No	WALL 09-ROOM - 17 - BREAKROOM_0	89.82°	E
WINDOW 19_W - WALL 148-ROOM - 26 - OPEN OFFICE_0	90.1-13 Window Zone 4-6 Metal Oper - Copy	60	60	0.42	0.401	0.442	No	WALL 148-ROOM - 26 - OPEN OFFICE_0	89.82°	E
WINDOW 20_W - WALL 148-ROOM - 26 - OPEN OFFICE_0	90.1-13 Window Zone 4-6 Metal Oper - Copy	60	60	0.42	0.401	0.442	No	WALL 148-ROOM - 26 - OPEN OFFICE_0	89.82°	E
WINDOW 31_W - WALL 153-ROOM - 24 - OPEN OFFICE_0	90.1-13 Window Zone 4-6 Metal Oper - Copy	60	60	0.42	0.401	0.442	No	WALL 153-ROOM - 24 - OPEN OFFICE_0	89.82°	E
WINDOW 32_W - WALL 153-ROOM - 24 - OPEN OFFICE_0	90.1-13 Window Zone 4-6 Metal Oper - Copy	60	60	0.42	0.401	0.442	No	WALL 153-ROOM - 24 - OPEN OFFICE_0	89.82°	E
WINDOW 33_W - WALL 09-ROOM - 17 - BREAKROOM_0	90.1-13 Window Zone 4-6 Metal Oper - Copy	44	44	0.42	0.401	0.442	No	WALL 09-ROOM - 17 - BREAKROOM_0	89.82°	E
Non-North Total or Average			956	0.474	0.402	0.442				
North Total or Average			287	0.444	0.401	0.442				
Total or Average			1,243	0.467	0.402	0.442				

Sunlit Fraction

* Sunlit Fraction is available for calculation timesteps of 15 minutes or less.

	March 21 9am	March 21 Noon	March 21 3pm	June 21 9am	June 21 Noon	June 21 3pm	December 21 9am	December 21 Noon	December 21 3pm
None	0	0	0	0	0	0	0	0	0

Window Controls

	Control Name	Type	Shaded	Control	Glare Control
None					

Economic Comparison

Project Information Summary

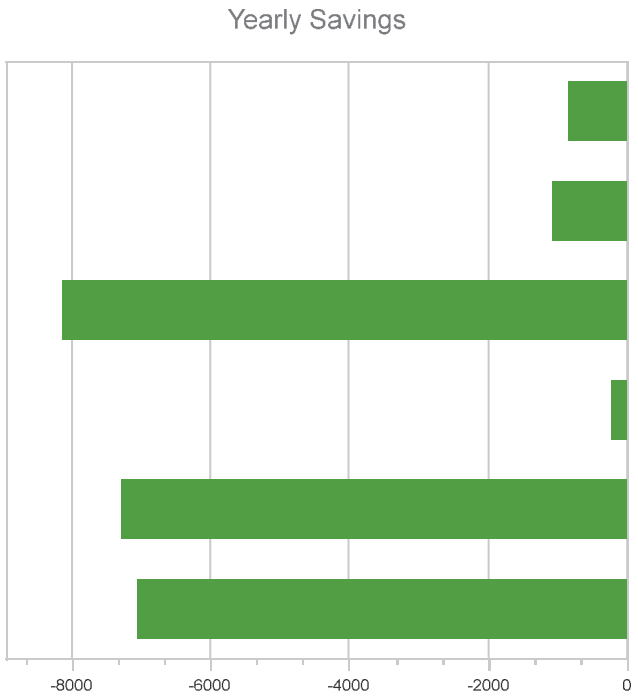
Alternatives

Baseline	AHU
Comparison 1	VRF
Comparison 2	Ground source Heat Pump
Comparison 3	ASHRAE Min

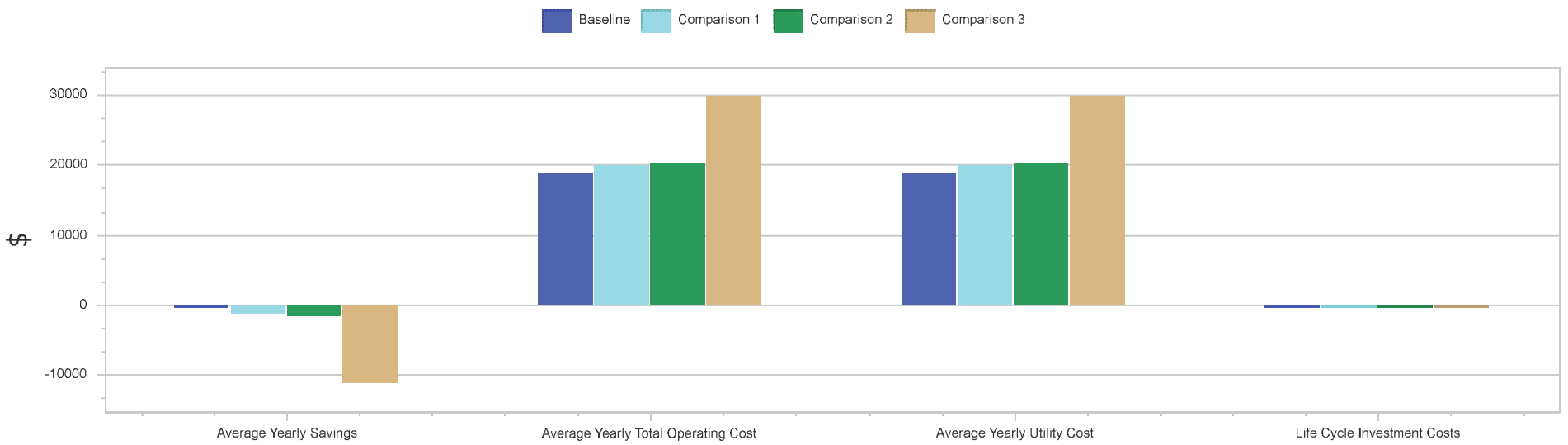
Life Cycle Cost Parameters

Length of Study	40 years
Real Discount Rate	-- N/A --
Nominal Discount Rate	0.0150
Inflation Rate	0.0150
Tax Rate	0.00%
Base Date	July 2019
Service Date	July 2019
Inflation Approach	CurrentDollar
Depreciation Method	None
Discounting Convention	EndOfYear

Comparison	Initial Investment Cost Difference ($)	First Year Utility Savings ($)	Simple Payback Period	Life Cycle Payback Period	Internal Rate of Return (IRR)
Comparison 1 vs Baseline	0.00	-849.82	N/A	N/A	N/A
Comparison 2 vs Baseline	0.00	-1,083.04	N/A	N/A	N/A
Comparison 3 vs Baseline	0.00	-8,134.64	N/A	N/A	N/A
Comparison 2 vs Comparison 1	0.00	-233.22	N/A	N/A	N/A
Comparison 3 vs Comparison 1	0.00	-7,284.82	N/A	N/A	N/A
Comparison 3 vs Comparison 2	0.00	-7,051.60	N/A	N/A	N/A

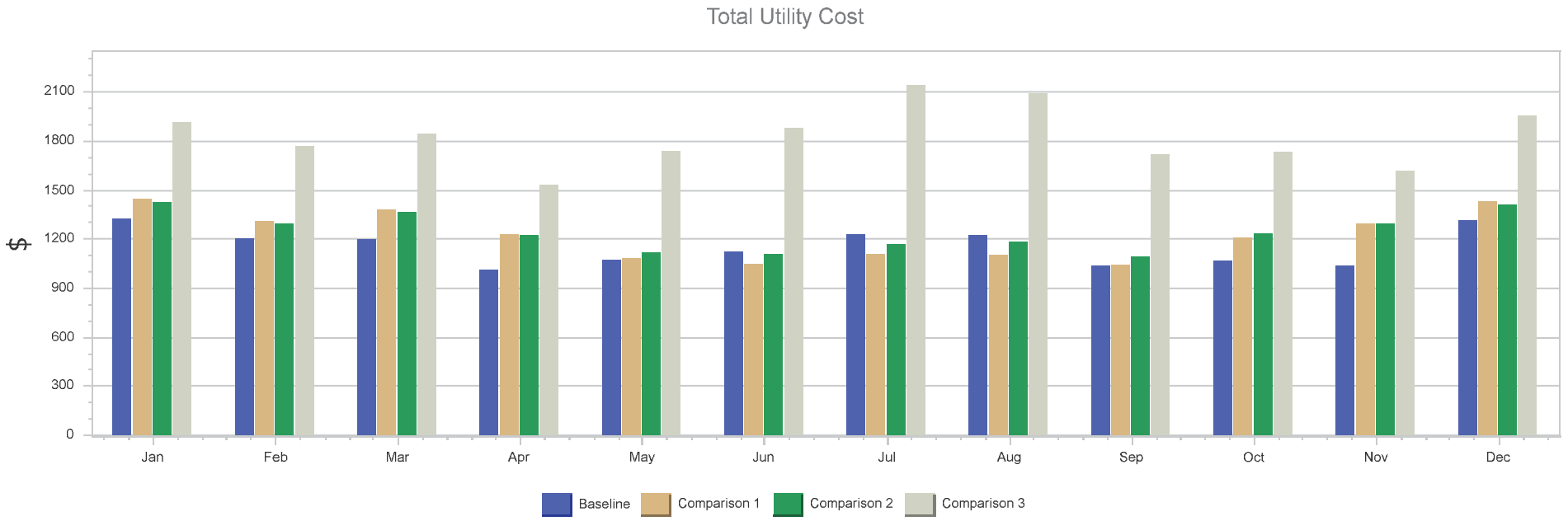


Economic Alternative Comparison

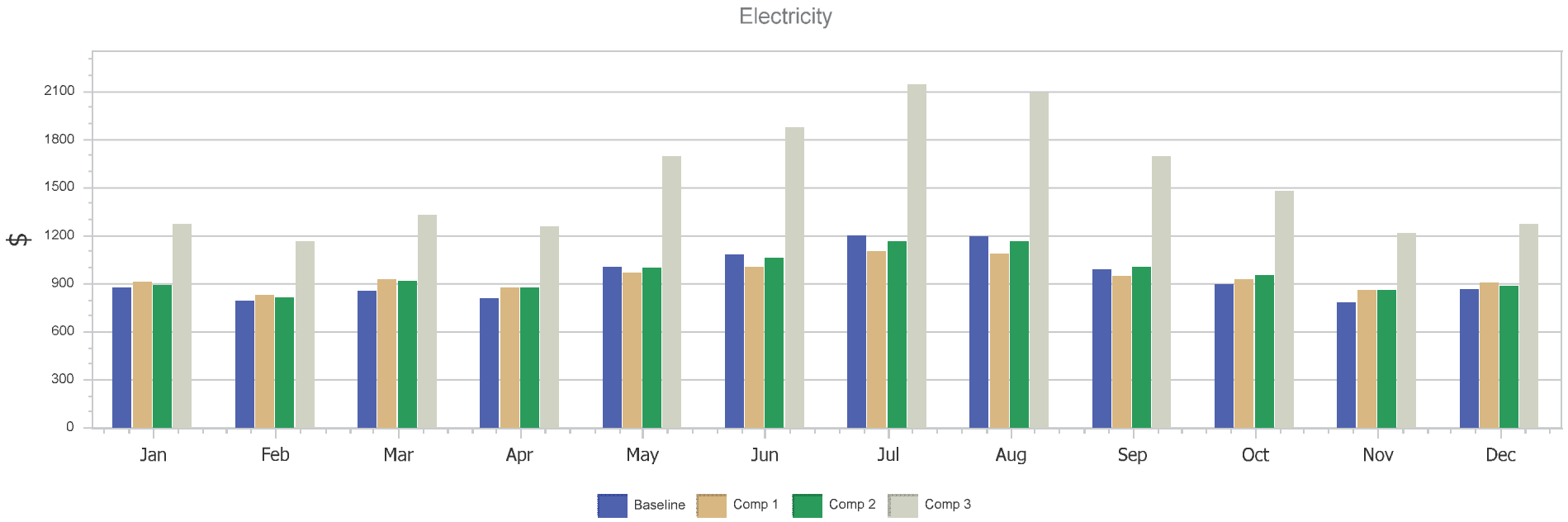


		Average Yearly			Life Cycle Investment Cost
		Savings vs Baseline ($)	Total Operating Cost ($)	Utility Cost ($)	USD ($)
Baseline	AHU		18,908.43	18,908.43	0.00
Comparison 1	VRF		20,061.37	20,061.37	0.00
Comparison 2	Ground source Heat Pump		20,377.78	20,377.78	0.00
Comparison 3	ASHRAE Min		29,944.67	29,944.67	0.00

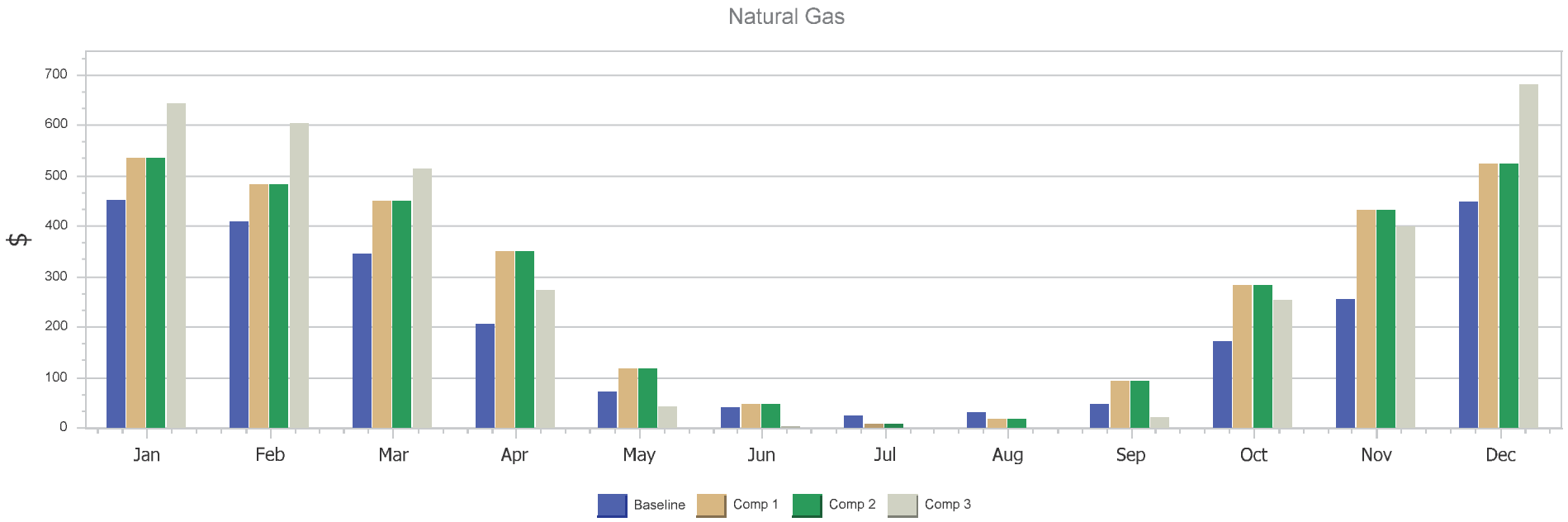
Monthly Utility Comparison



	Jan ($)	Feb ($)	Mar ($)	Apr ($)	May ($)	Jun ($)	Jul ($)	Aug ($)	Sep ($)	Oct ($)	Nov ($)	Dec ($)
Baseline	1,327	1,204	1,201	1,011	1,073	1,124	1,226	1,224	1,038	1,065	1,036	1,316
Comparison 1	1,447	1,312	1,379	1,226	1,085	1,049	1,108	1,103	1,042	1,211	1,294	1,431
Comparison 2	1,425	1,293	1,367	1,225	1,119	1,105	1,169	1,183	1,095	1,234	1,294	1,410
Comparison 3	1,916	1,767	1,845	1,530	1,739	1,879	2,140	2,089	1,718	1,731	1,615	1,954



	Jan ($)	Feb ($)	Mar ($)	Apr ($)	May ($)	Jun ($)	Jul ($)	Aug ($)	Sep ($)	Oct ($)	Nov ($)	Dec ($)
Baseline	875	795	856	806	1,002	1,083	1,201	1,193	991	894	781	867
Comparison 1	911	830	928	875	967	1,002	1,100	1,084	950	928	861	908
Comparison 2	890	811	917	874	1,000	1,058	1,162	1,164	1,002	951	861	886
Comparison 3	1,272	1,164	1,331	1,257	1,697	1,875	2,140	2,089	1,697	1,477	1,216	1,273



	Jan ($)	Feb ($)	Mar ($)	Apr ($)	May ($)	Jun ($)	Jul ($)	Aug ($)	Sep ($)	Oct ($)	Nov ($)	Dec ($)
Baseline	452	409	345	206	71	41	25	31	47	172	255	448
Comparison 1	536	482	451	351	119	47	7	18	93	283	433	524
Comparison 2	536	482	451	351	119	47	7	18	93	283	433	524
Comparison 3	643	603	515	272	42	4	0	0	21	254	399	680

Alternative Cash Flow Comparison

Comparison 1 vs Baseline

Year	Present Value Of Difference ($)	Net Present Value ($)
1	-837.26	-837.26
2	-837.26	-1,674.52
3	-837.26	-2,511.78
4	-837.26	-3,349.04
5	-837.26	-4,186.30
6	-837.26	-5,023.56
7	-837.26	-5,860.82
8	-837.26	-6,698.08
9	-837.26	-7,535.34
10	-837.26	-8,372.60
11	-837.26	-9,209.86
12	-837.26	-10,047.12
13	-837.26	-10,884.38
14	-837.26	-11,721.64
15	-837.26	-12,558.90
16	-837.26	-13,396.16
17	-837.26	-14,233.42
18	-837.26	-15,070.68
19	-837.26	-15,907.94
20	-837.26	-16,745.20
21	-837.26	-17,582.46
22	-837.26	-18,419.72
23	-837.26	-19,256.98
24	-837.26	-20,094.24
25	-837.26	-20,931.50
26	-837.26	-21,768.76
27	-837.26	-22,606.02
28	-837.26	-23,443.28
29	-837.26	-24,280.54
30	-837.26	-25,117.80
31	-837.26	-25,955.06
32	-837.26	-26,792.32
33	-837.26	-27,629.58
34	-837.26	-28,466.84

Comparison 2 vs Baseline

Year	Present Value Of Difference ($)	Net Present Value ($)
1	-1,067.04	-1,067.04
2	-1,067.04	-2,134.08
3	-1,067.04	-3,201.12
4	-1,067.04	-4,268.16
5	-1,067.04	-5,335.20
6	-1,067.04	-6,402.24
7	-1,067.04	-7,469.28
8	-1,067.04	-8,536.32
9	-1,067.04	-9,603.36
10	-1,067.04	-10,670.40
11	-1,067.04	-11,737.44
12	-1,067.04	-12,804.48
13	-1,067.04	-13,871.52
14	-1,067.04	-14,938.56
15	-1,067.04	-16,005.60
16	-1,067.04	-17,072.64
17	-1,067.04	-18,139.68
18	-1,067.04	-19,206.72
19	-1,067.04	-20,273.76
20	-1,067.04	-21,340.80
21	-1,067.04	-22,407.84
22	-1,067.04	-23,474.88
23	-1,067.04	-24,541.92
24	-1,067.04	-25,608.96
25	-1,067.04	-26,676.00
26	-1,067.04	-27,743.04
27	-1,067.04	-28,810.08
28	-1,067.04	-29,877.12
29	-1,067.04	-30,944.16
30	-1,067.04	-32,011.20
31	-1,067.04	-33,078.24
32	-1,067.04	-34,145.28
33	-1,067.04	-35,212.32
34	-1,067.04	-36,279.36

Comparison 2 vs Comparison 1

Year	Present Value Of Difference ($)	Net Present Value ($)
1	-229.78	-229.78
2	-229.78	-459.56
3	-229.78	-689.34
4	-229.78	-919.12
5	-229.78	-1,148.90
6	-229.78	-1,378.68
7	-229.78	-1,608.46
8	-229.78	-1,838.24
9	-229.78	-2,068.02
10	-229.78	-2,297.80
11	-229.78	-2,527.58
12	-229.78	-2,757.36
13	-229.78	-2,987.14
14	-229.78	-3,216.92
15	-229.78	-3,446.70
16	-229.78	-3,676.48
17	-229.78	-3,906.26
18	-229.78	-4,136.04
19	-229.78	-4,365.82
20	-229.78	-4,595.60
21	-229.78	-4,825.38
22	-229.78	-5,055.16
23	-229.78	-5,284.94
24	-229.78	-5,514.72
25	-229.78	-5,744.50
26	-229.78	-5,974.28
27	-229.78	-6,204.06
28	-229.78	-6,433.84
29	-229.78	-6,663.62
30	-229.78	-6,893.40
31	-229.78	-7,123.18
32	-229.78	-7,352.96
33	-229.78	-7,582.74
34	-229.78	-7,812.52

35	-837.26	-29,304.10
36	-837.26	-30,141.36
37	-837.26	-30,978.62
38	-837.26	-31,815.88
39	-837.26	-32,653.14
40	-837.26	-33,490.40

Life Cycle Cost Difference $-33,490.40

35	-1,067.04	-37,346.40
36	-1,067.04	-38,413.44
37	-1,067.04	-39,480.48
38	-1,067.04	-40,547.52
39	-1,067.04	-41,614.56
40	-1,067.04	-42,681.60

Life Cycle Cost Difference $-42,681.60

35	-229.78	-8,042.30
36	-229.78	-8,272.08
37	-229.78	-8,501.86
38	-229.78	-8,731.64
39	-229.78	-8,961.42
40	-229.78	-9,191.20

Life Cycle Cost Difference $-9,191.20

Comparison 3 vs Baseline

Year	Present Value Of Difference ($)	Net Present Value ($)
1	-8,014.42	-8,014.42
2	-8,014.42	-16,028.84
3	-8,014.42	-24,043.26
4	-8,014.42	-32,057.68
5	-8,014.42	-40,072.10
6	-8,014.42	-48,086.52
7	-8,014.42	-56,100.94
8	-8,014.42	-64,115.36
9	-8,014.42	-72,129.78
10	-8,014.42	-80,144.20
11	-8,014.42	-88,158.62
12	-8,014.42	-96,173.04
13	-8,014.42	-104,187.46
14	-8,014.42	-112,201.88
15	-8,014.42	-120,216.30
16	-8,014.42	-128,230.72
17	-8,014.42	-136,245.14
18	-8,014.42	-144,259.56
19	-8,014.42	-152,273.98
20	-8,014.42	-160,288.40
21	-8,014.42	-168,302.82
22	-8,014.42	-176,317.24
23	-8,014.42	-184,331.66
24	-8,014.42	-192,346.08
25	-8,014.42	-200,360.50
26	-8,014.42	-208,374.92
27	-8,014.42	-216,389.34
28	-8,014.42	-224,403.76
29	-8,014.42	-232,418.18
30	-8,014.42	-240,432.60
31	-8,014.42	-248,447.02
32	-8,014.42	-256,461.44
33	-8,014.42	-264,475.86
34	-8,014.42	-272,490.28
35	-8,014.42	-280,504.70
36	-8,014.42	-288,519.12

Comparison 3 vs Comparison 1

Year	Present Value Of Difference ($)	Net Present Value ($)
1	-7,177.16	-7,177.16
2	-7,177.16	-14,354.32
3	-7,177.16	-21,531.48
4	-7,177.16	-28,708.64
5	-7,177.16	-35,885.80
6	-7,177.16	-43,062.96
7	-7,177.16	-50,240.12
8	-7,177.16	-57,417.28
9	-7,177.16	-64,594.44
10	-7,177.16	-71,771.60
11	-7,177.16	-78,948.76
12	-7,177.16	-86,125.92
13	-7,177.16	-93,303.08
14	-7,177.16	-100,480.24
15	-7,177.16	-107,657.40
16	-7,177.16	-114,834.56
17	-7,177.16	-122,011.72
18	-7,177.16	-129,188.88
19	-7,177.16	-136,366.04
20	-7,177.16	-143,543.20
21	-7,177.16	-150,720.36
22	-7,177.16	-157,897.52
23	-7,177.16	-165,074.68
24	-7,177.16	-172,251.84
25	-7,177.16	-179,429.00
26	-7,177.16	-186,606.16
27	-7,177.16	-193,783.32
28	-7,177.16	-200,960.48
29	-7,177.16	-208,137.64
30	-7,177.16	-215,314.80
31	-7,177.16	-222,491.96
32	-7,177.16	-229,669.12
33	-7,177.16	-236,846.28
34	-7,177.16	-244,023.44
35	-7,177.16	-251,200.60
36	-7,177.16	-258,377.76

Comparison 3 vs Comparison 2

Year	Present Value Of Difference ($)	Net Present Value ($)
1	-6,947.38	-6,947.38
2	-6,947.38	-13,894.76
3	-6,947.38	-20,842.14
4	-6,947.38	-27,789.52
5	-6,947.38	-34,736.90
6	-6,947.38	-41,684.28
7	-6,947.38	-48,631.66
8	-6,947.38	-55,579.04
9	-6,947.38	-62,526.42
10	-6,947.38	-69,473.80
11	-6,947.38	-76,421.18
12	-6,947.38	-83,368.56
13	-6,947.38	-90,315.94
14	-6,947.38	-97,263.32
15	-6,947.38	-104,210.70
16	-6,947.38	-111,158.08
17	-6,947.38	-118,105.46
18	-6,947.38	-125,052.84
19	-6,947.38	-132,000.22
20	-6,947.38	-138,947.60
21	-6,947.38	-145,894.98
22	-6,947.38	-152,842.36
23	-6,947.38	-159,789.74
24	-6,947.38	-166,737.12
25	-6,947.38	-173,684.50
26	-6,947.38	-180,631.88
27	-6,947.38	-187,579.26
28	-6,947.38	-194,526.64
29	-6,947.38	-201,474.02
30	-6,947.38	-208,421.40
31	-6,947.38	-215,368.78
32	-6,947.38	-222,316.16
33	-6,947.38	-229,263.54
34	-6,947.38	-236,210.92
35	-6,947.38	-243,158.30
36	-6,947.38	-250,105.68

37	-8,014.42	-296,533.54
38	-8,014.42	-304,547.96
39	-8,014.42	-312,562.38
40	-8,014.42	-320,576.80

Life Cycle Cost Difference $-320,576.80

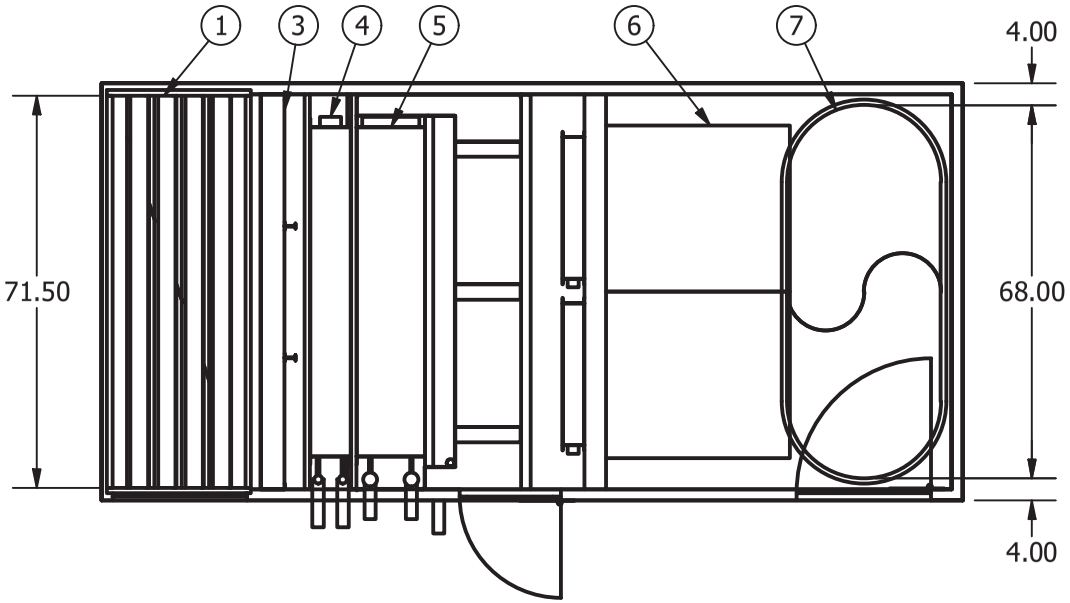
37	-7,177.16	-265,554.92
38	-7,177.16	-272,732.08
39	-7,177.16	-279,909.24
40	-7,177.16	-287,086.40

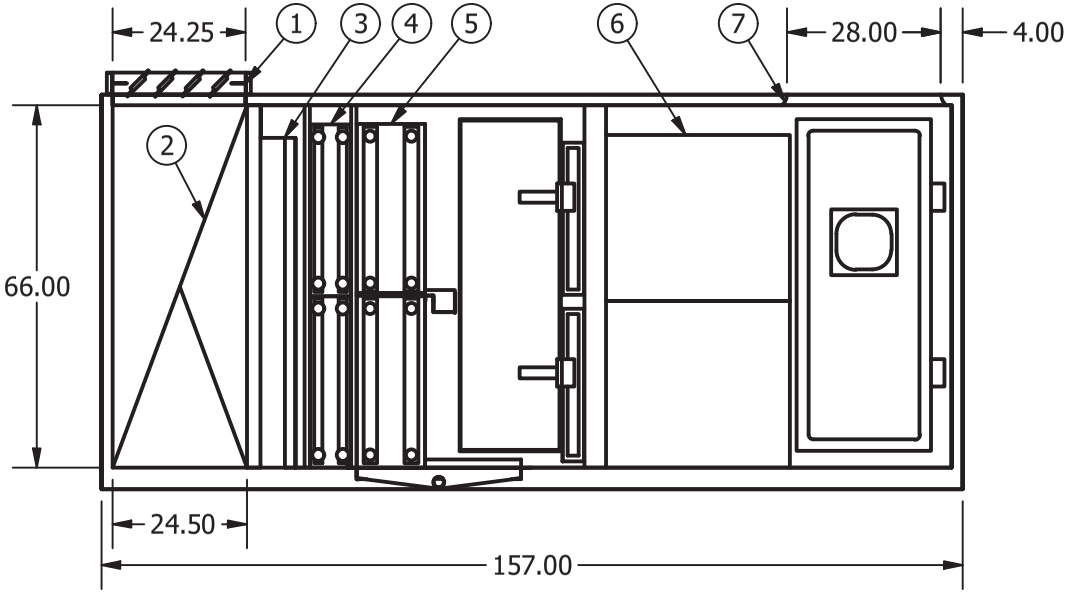
Life Cycle Cost Difference $-287,086.40

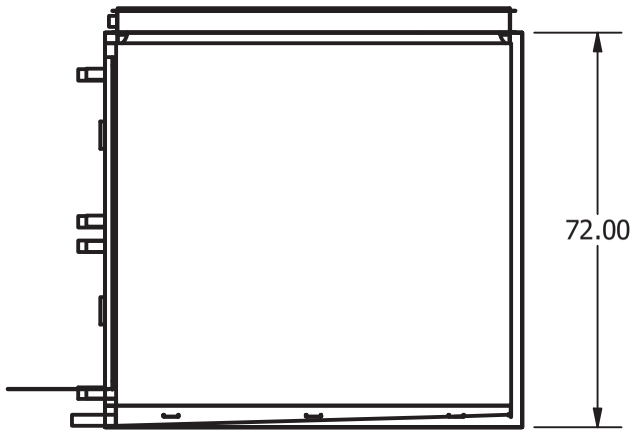
37	-6,947.38	-257,053.06
38	-6,947.38	-264,000.44
39	-6,947.38	-270,947.82
40	-6,947.38	-277,895.20

Life Cycle Cost Difference $-277,895.20

ITEM	QTY	PART NUMBER
1	1	71.5" Long X 24.25" High Return Air Damper
2	1	24.5" X 66" Outside Air Opening
3	1	(6) 24" X 24" Filters (3) 24" X 12" Filters
4	2	30" FH 60" FL Heating Coils
5	2	30" FH 60" FL Cooling Coils
6	4	5 hp MPLQN 150 Supply Fans
7	1	Oval Supply Bellmouth 68"/28" ID







WEIGHTS
SHIP WT. 6,700 LBS
OPERATING WT. 7,000 LBS

UNITECH MANUFACTURING, LLC
2700 South 900 West
Salt Lake City, Utah 84119-2418

SWEG HILL AFB
12,000 CFM

DATE DRAWN	DRAWING NO.	REV.
3/28/2022	AHU-1	1
DRAWN BY D.M.		

SUBMITTAL

Job Name: SWEG

Tag: N/A
Customer: Midgley-Huber Inc.
Job ID: SWEG
Date: March 25, 2022

MPLQN - Modular Plenum Fan, Airfoil 12-Blades, Arr.4, Insulated

Construction Features

• Type MPLQN wheels are constructed of aluminum using airfoil-shaped blades. All hollow blade wheels shall be continuously welded around all edges.

• Fan frame and panels are corrosion resistant, galvanized steel construction. The inlet panel incorporates a removable spun inlet cone designed for smooth airflow into the fan wheel.

• Fans shall be provided with minimum 2" insulation enclosure with perforated lining.

See Attached Centrifugal Drawing

Description	Fan Qty	Fans per Sys.	Model	Size	Width	Wt. per Fan (lb.)	Tot. Sys. Fan (lb.)
	4	4	MPLQN	150	SWSI	443	1772

Approximate weight each, includes fan, motor and accessories.

Configuration	Class	Rotation	Arr	Disch	M. Pos	Disch Dir
	II	CW	4	HOR	--	N/A

Performance	CFM	CFM per fan	SP (in WC)	RPM	Oper. BHP / fan	Tot. Oper. BHP
	12,000	3,000	5.500	3100	3.83	15

Performance based on (4) fans per system.

Temperature: 70 °F Altitude: 4500 ft

Department of Energy	FEI	FEP (KW)	System FEI	System FEP (KW)
	1.33	3.19	1.25	12.27

Note that the Fan Energy Index (FEI) is an overall efficiency (wire-to-air) metric which includes not only the impact of the fan efficiency, but also each of the drive components used to operate the fan. The Fan Electrical Input Power (FEP) is the amount of power of a given fan at an operating point characterized by a value of flow and pressure.

Motor Data	HP	RPM	Volt/Ph/Hz	Enclosure
	5	3600	230/460V/3/60	TEFC

Efficiency: Premium Using VFD

Indiv Sound Data	Octave Bands	1	2	3	4	5	6	7	8	LwA	dBA	Sones
	Level at Inlet	87	77	77	89	81	79	79	79	89	74	29
	Level at Outlet	85	85	78	80	80	80	76	78	86	72	27

LwA: The overall (single value) fan sound power level in dB re. 10^{-12} Watts, 'A' weighted.
dBA: Estimated sound pressure level (re:0.0002 microbar) based on a single ducted installation at 5 ft., using a directivity factor of 1.

Total Sound Data	Octave Bands	1	2	3	4	5	6	7	8	LwA	dBA	Sones
	Level at Inlet	93	83	83	95	87	85	85	85	95	80	43
	Level at Outlet	91	91	84	86	86	86	82	84	92	78	39

LwA: The overall (single value) fan sound power level in dB re. 10^{-12} Watts, 'A' weighted.
dBA: Estimated sound pressure level (re:0.0002 microbar) based on a single ducted installation at 5 ft., using a directivity factor of 1.

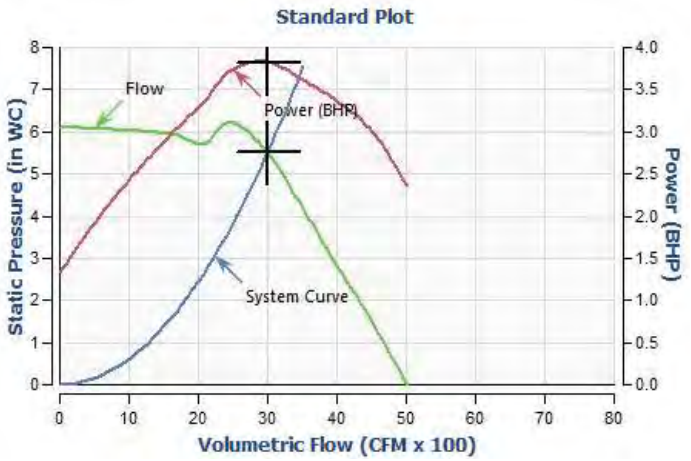
SUBMITTAL

Job Name: SWEG

Tag: N/A
Customer: Midgley-Huber Inc.
Job ID: SWEG
Date: March 25, 2022

Accessories Included

Screen - Inlet, Std Type
Nameplate - Stainless Steel
Ext. Lube Line, Impeller Side Motor Bearing for Regreasable Bearings
Shaft Grounding Ring
Mount TCF Motor

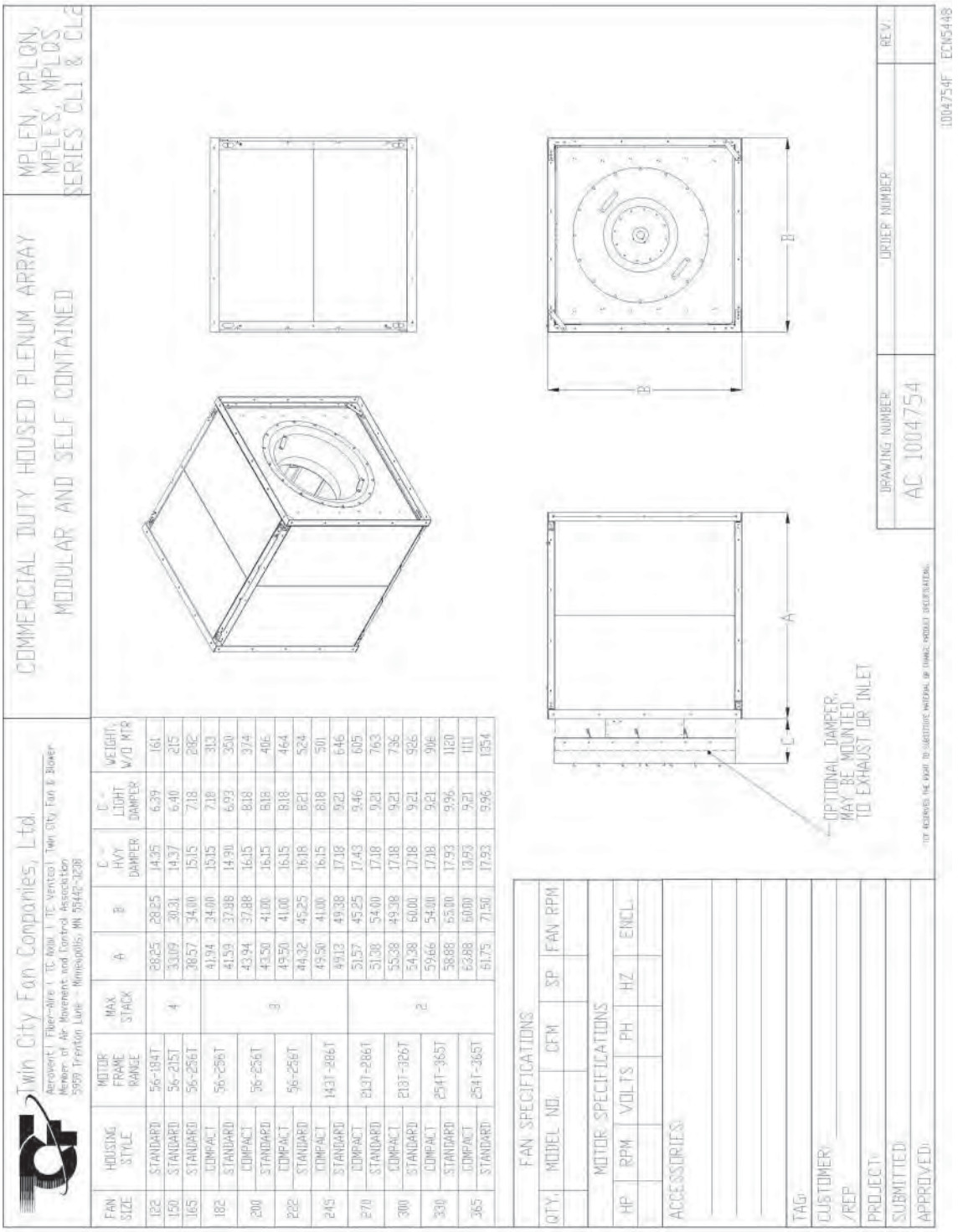


SUBMITTAL

Job Name: SWEG

TCF TWIN CITY FAN

Tag: N/A
Customer: Midgley-Huber Inc.
Job ID: SWEG
Date: March 25, 2022



FAN SIZE	HOUSING STYLE	MOTOR FRAME RANGE	MAX. STACK	A	B	C - HVY DAMPER	C - LIGHT DAMPER	WEIGHT, W/O MTR
122	STANDARD	56-184T	4	28.25	28.25	14.25	6.39	161
150	STANDARD	56-215T	4	33.09	30.31	14.37	6.40	215
165	STANDARD	56-256T	4	36.57	34.00	15.15	7.18	282
182	COMPACT	56-256T	3	41.94	34.00	15.15	7.18	313
	STANDARD			41.59	37.88	14.90	6.93	350
200	COMPACT	56-256T	3	43.94	37.88	16.15	8.18	374
	STANDARD			43.50	41.00	16.15	8.18	406
222	COMPACT	56-256T	3	43.50	41.00	16.15	8.18	464
	STANDARD			44.32	45.25	16.18	8.21	524
245	COMPACT	143T-286T	3	43.50	41.00	16.15	8.18	501
	STANDARD			49.13	49.38	17.18	9.21	646
270	COMPACT	213T-286T	2	51.57	45.25	17.43	9.46	605
	STANDARD			51.38	54.00	17.18	9.21	763
300	COMPACT	213T-326T	2	55.38	49.38	17.18	9.21	736
	STANDARD			54.38	60.00	17.18	9.21	926
330	COMPACT	254T-365T	2	59.66	54.00	17.18	9.21	906
	STANDARD			58.88	65.00	17.93	9.96	1120
365	COMPACT	254T-365T	2	63.88	60.00	17.93	9.21	1111
	STANDARD			61.75	71.50	17.93	9.96	1354

Rating Sheet

MIDGLEY-HUBER, INC.

P.O. BOX 26187 / SALT LAKE CITY, UT 841260000
Phone # - 8019725011 / Fax # - 8019734049
Kent Bailey

Customer: Sell To Customer Company Name **Job: SWEG**
Quote #: 1001352 **Item #: 1**

58W30X60-12-8-W-Z-R

CC-1

No. Coils:	2	Coil Type:	Water - Cooling
Fin Height (In.):	30	Fin Mat./Thickness/Type:	Aluminum/ 0.01/ Waffle
Fin Length (In.):	60	Tube Mat./Wall/OD:	Copper/ 0.035/ 5/8 Inch
Air Flow/Coil (ACFM/SCFM)	6000 / 4965 (A)	Tube Spacing:	1.5 x 1.299
Totals (ACFM/SCFM):	12000 / 9929	Tube Surface:	Smooth
ACFM/SCFM Velocity (fpm):	480 / 397.2	Casing Material:	Galv
EDB/EWB (°F):	83 / 62	Altitude (Feet):	4500
EWT (°F):	45	Fluid Type:	PG
Fluid Temp. Drop (°F):	10	% Glycol:	35
Rows/FPI:	8/12	FF Inside*:	0
Circuiting:	13/12/4/SE	FF Outside*:	0

	Per Coil	Total All Coils
LDB/LWB (°F):	54.3 / 52.0	
Total Heat (BTUH):	154,863	309,727
Sensible. Heat (BTUH):	154,863	309,727
LWT (°F):	55.0	
Fluid Flow (GPM):	33.3	66.5
Fluid Press. Drop (Feet):	12.07	
Tube Velocity (fps):	3.12	
Reynolds number:	2,504.34	
Air Pressure Drop (in W.G.):	0.66	
Connection Size (In.):	2	
Approximate Fluid Volume (Gal) :	12.3	24.6

Uncrated, Dry Coil Weight: 524.6

AHRI Limit – Glycol and Special Fluid coils are not AHRI Certified.
Coil is NOT certified by AHRI. Coil is within the scope of the AHRI Forced-Circulation Air-Cooling and Air-Heating Coils Certification Program.

Printed on 3/29/2022 using Total Package II; program version 3.22.2022.1 - DLL/Data 1.0.5.91/20210721.1

* (Hr*ft^2*°F/Btu) Fouling Factor Units

We reserve the right to change or revise specifications and product design in connection with any feature of our products. Such changes do not entitle the buyer to corresponding changes, improvements, additions, or replacements for equipment previously sold or shipped.

Rating Sheet

MIDGLEY-HUBER, INC.

P.O. BOX 26187 / SALT LAKE CITY, UT 841260000
Phone # - 8019725011 / Fax # - 8019734049
Kent Bailey

Customer: Sell To Customer Company Name **Job: SWEG**
Quote #: 1001352 **Item #: 2**

58W30X60-6-1-W-Z-R

HC-1

No. Coils:	2	Coil Type:	Water - Heating
Fin Height (In.):	30	Fin Mat./Thickness/Type:	Aluminum/ 0.01/ Waffle
Fin Length (In.):	60	Tube Mat./Wall/OD:	Copper/ 0.035/ 5/8 Inch
Air Flow/Coil (ACFM/SCFM)	6000 / 5317 (A)	Tube Spacing:	1.5 x 1.299
Totals (ACFM/SCFM):	12000 / 10635	Tube Surface:	Smooth
ACFM/SCFM Velocity (fpm):	480 / 425.4	Casing Material:	Galv
EDB (°F):	47	Altitude (Feet):	4500
EWT (°F):	180	Fluid Type:	PG
Fluid Temp. Drop (°F):	35	% Glycol:	35
Rows/FPI:	1/6	FF Inside*:	0
Circuiting:	3/6/2/SE	FF Outside*:	0

	Per Coil	Total All Coils
LDB (°F):	71.8	
Total Heat (BTUH):	142,361	284,722
Sensible. Heat (BTUH):	142,361	284,722
LWT (°F):	145.0	
Fluid Flow (GPM):	8.6	17.2
Fluid Press. Drop (Feet):	8.28	
Tube Velocity (fps):	3.50	
Reynolds number:	17,464.08	
Air Pressure Drop (in W.G.):	0.05	
Connection Size (In.):	0.75	
Approximate Fluid Volume (Gal) :	1.4	2.8

Uncrated, Dry Coil Weight: 83.4

Warning - Dropped Tubes (2) exceeds 5% of Total Tubes (20).
AHRI Limit - Dropped Tubes (2) exceeds 5% of Total Tubes (20).

Printed on 4/5/2022 using Total Package II; program version 3.22.2022.1 - DLL/Data 1.0.5.91/20210721.1

* (Hr*ft^2*°F/Btu) Fouling Factor Units

We reserve the right to change or revise specifications and product design in connection with any feature of our products. Such changes do not entitle the buyer to corresponding changes, improvements, additions, or replacements for equipment previously sold or shipped.

Unit Report For CH-2

Project: ~Untitled40
Prepared By:

03/25/2022
11:35AM

Unit Information

Tag Name:	**CH-2**	
Model Number:	**30RAP045**	
Condenser Type:	**Air Cooled**	
Compressor Type:	**Scroll**	
Nameplate Voltage:	**460-3-60**	V-Ph-Hz
Quantity:	**1**	
Manufacturing Source:	**Charlotte, NC USA**	
Refrigerant:	**R410A**	
Independent Refrigerant Circuits:	**2**	
Capacity Control Steps:	**44**	
Minimum Capacity:	**8.0**	%
Shipping Weight:	**2516**	lb
Operating Weight:	**2537**	lb
Unit Length:	**89**	in
Unit Width:	**93**	in
Unit Height:	**79**	in

Accessories and Installed Options

Evaporator Heater
Non-Fused Disconnect
Al Fin/Cu Tube
Ultra Low Sound
Digital Compressor
Security Grilles/Hail Guards
EMM, GFI Convenience Outlet and BACnet Communication
Single Point
High Efficiency Variable Condenser Fan

Chiller Warranty Information (Note: for US & Canada only)

First Year - Parts Only (Standard)
Start-Up with 1st Year Carrier CCS Labor - 1st Unit

Ordering Information

Part Number	Description	Quantity
30RAP0456L-0G9C4	Packaged Chiller	1
	Base Unit	
	Evaporator Heater	
	Non-Fused Disconnect	
	Al Fin/Cu Tube	
	Ultra Low Sound	
	Digital Compressor	
	Security Grilles/Hail Guards	
	EMM, GFI Convenience Outlet and BACnet Communication	
	Single Point	
	High Efficiency Variable Condenser Fan	

Certified Drawing for CH-2

Project: ~Untitled40
Prepared By:

03/25/2022
11:35AM

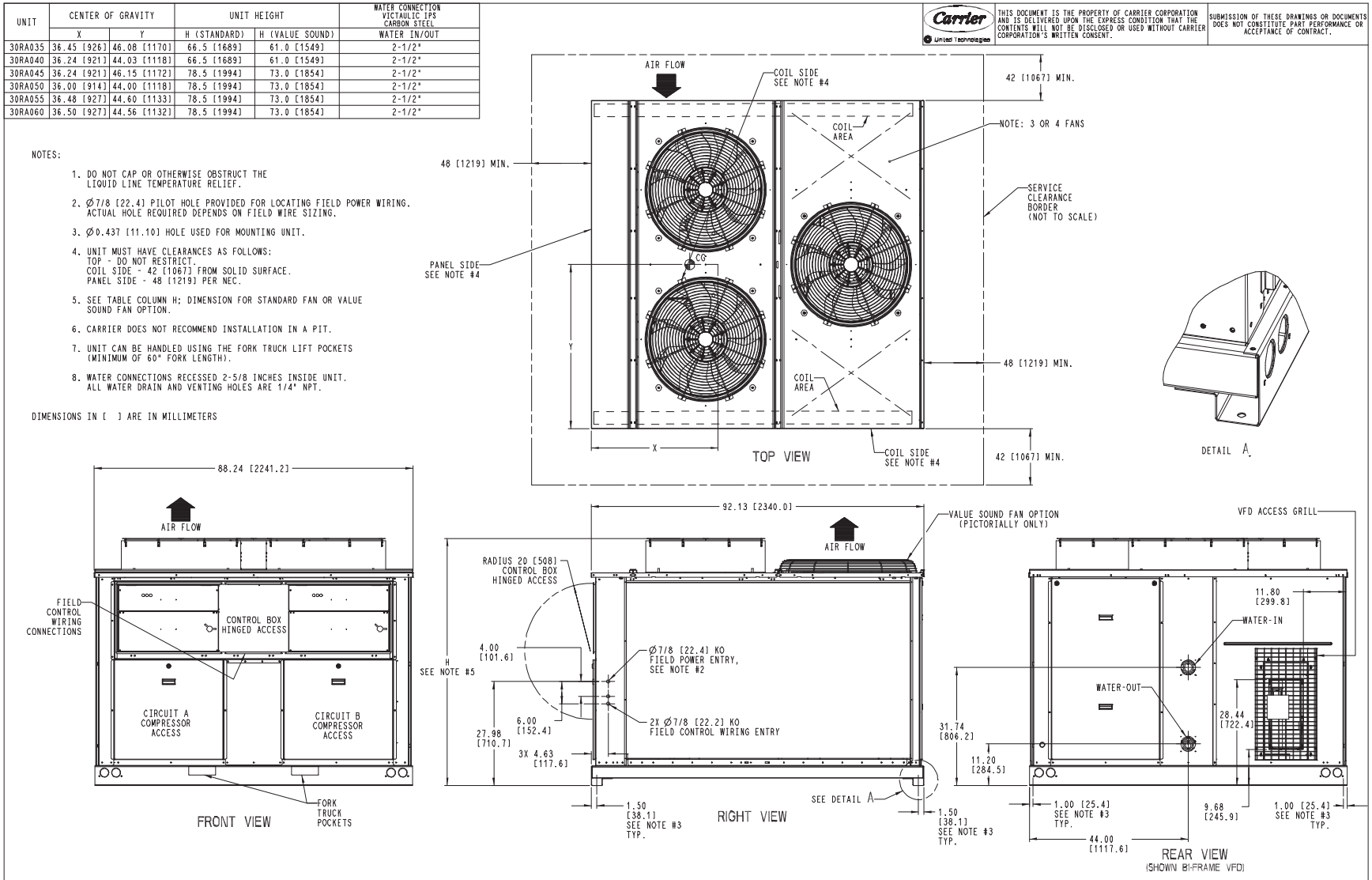
UNIT	CENTER OF GRAVITY		UNIT HEIGHT		WATER CONNECTION VICTAULIC IPS CARBON STEEL
	X	Y	H (STANDARD)	H (VALUE SOUND)	WATER IN/OUT
30RA035	36.45 [926]	46.08 [1170]	66.5 [1689]	61.0 [1549]	2-1/2"
30RA040	36.24 [921]	44.03 [1118]	66.5 [1689]	61.0 [1549]	2-1/2"
30RA045	36.24 [921]	46.15 [1172]	78.5 [1994]	73.0 [1854]	2-1/2"
30RA050	36.00 [914]	44.00 [1118]	78.5 [1994]	73.0 [1854]	2-1/2"
30RA055	36.48 [927]	44.60 [1133]	78.5 [1994]	73.0 [1854]	2-1/2"
30RA060	36.50 [927]	44.56 [1132]	78.5 [1994]	73.0 [1854]	2-1/2"

NOTES:

1. DO NOT CAP OR OTHERWISE OBSTRUCT THE LIQUID LINE TEMPERATURE RELIEF.
2. Ø7/8 [22.4] PILOT HOLE PROVIDED FOR LOCATING FIELD POWER WIRING. ACTUAL HOLE REQUIRED DEPENDS ON FIELD WIRE SIZING.
3. Ø0.437 [11.10] HOLE USED FOR MOUNTING UNIT.
4. UNIT MUST HAVE CLEARANCES AS FOLLOWS:
   TOP - DO NOT RESTRICT.
   COIL SIDE - 42 [1067] FROM SOLID SURFACE.
   PANEL SIDE - 48 [1219] PER NEC.
5. SEE TABLE COLUMN H; DIMENSION FOR STANDARD FAN OR VALUE SOUND FAN OPTION.
6. CARRIER DOES NOT RECOMMEND INSTALLATION IN A PIT.
7. UNIT CAN BE HANDLED USING THE FORK TRUCK LIFT POCKETS (MINIMUM OF 60" FORK LENGTH).
8. WATER CONNECTIONS RECESSED 2-5/8 INCHES INSIDE UNIT. ALL WATER DRAIN AND VENTING HOLES ARE 1/4" NPT.

DIMENSIONS IN [ ] ARE IN MILLIMETERS

Carrier
United Technologies
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FOR GREENSPEED OPTION

DATE	SUPERCEDES		
09/07/15	G	30RAP035-060 UNIT ASSY	30RA555556	REV H

Field Wiring Diagram for CH-2

Project: ~Untitled40
Prepared By:

03/25/2022
11:35AM

NOTES:

1. FACTORY WIRING IS IN ACCORDANCE WITH UL 1995 STANDARDS. FIELD MODIFICATIONS OR ADDITIONS MUST BE IN COMPLIANCE WITH ALL APPLICABLE CODES.

2. ALL UNITS OR MODULES HAVE SINGLE POINT PRIMARY POWER CONNECTION. MAIN POWER MUST BE SUPPLIED FROM A FIELD OR FACTORY SUPPLIED DISCONNECT.

3. WIRING FOR MAIN FIELD SUPPLY MUST BE RATED 75C. USE COPPER CONDUCTORS ONLY.
   a. INCOMING WIRE SIZE RANGE FOR TERMINAL BLOCK WITH MCA UPTO 175 AMPS IS 14 AWG TO 2/0 FOR 10-60 TON CHILLERS.
   b. INCOMING WIRE SIZE RANGE FOR TERMINAL BLOCK WITH MCA FROM 175.1 AMPS TO 335 AMPS IS 6 AWG TO 400 KCMIL FOR 10-60 TON CHILLERS.
   c. INCOMING WIRE SIZE RANGE FOR TERMINAL BLOCK WITH MCA UPTO 420 AMPS IS 2 AWG TO 600KCMIL FOR 70-150 TON CHILLER.
   d. INCOMING WIRE SIZE RANGE FOR TERMINAL BLOCK WITH MCA FROM 420.1 AMPS TO 760 AMPS IS 6 AWG TO 500 KCMIL(TWO OPENINGS PER POLE) FOR 70-150 TON CHILLERS.
   e. INCOMING WIRE SIZE RANGE FOR NON FUSED DISCONNECT WITH MCA UPTO 100 AMPS IS 14AWG TO 3/0.
   f. INCOMING WIRE SIZE RANGE FOR NON-FUSED DISCONNECT WITH MCA FROM 100.1 AMPS TO 250 AMPS IS 6AWG TO 350 KCMIL.
   g. INCOMING WIRE SIZE RANGE FOR NON FUSED DISCONNECT WITH MCA FROM 250.1 TO 600 AMPS IS 3/0 AWG TO 500KCMIL (TWO OPENINGS PER POLE)

4. REFER TO CERTIFIED DIMENSIONAL DRAWINGS FOR EXACT LOCATIONS OF THE MAIN POWER AND CONTROL POWER ENTRANCE LOCATIONS.

5. TERMINALS 21 AND 25 OF THE LVT ARE FOR CONTROL OF CHILLED WATER PUMP1 (CWP1) STARTER. TERMINALS 21 AND 24 OF THE LVT ARE FOR CONTROL OF CHILLED WATER PUMP2 (CWP2) STARTER. THE MAXIMUM LOAD ALLOWED FOR THE CHILLED WATER PUMP RELAY IS 5 VA SEALED, 10 VA INRUSH AT 24 V. FIELD POWER SUPPLY IS NOT REQUIRED.

6. TERMINALS 18 AND 21 OF LVT ARE FOR AN ALARM RELAY. THE MAXIMUM LOAD ALLOWED FOR THE ALARM RELAY IS 5 VA SEALED, 10 VA INRUSH AT 24V. FIELD POWER SUPPLY IS NOT REQUIRED.

7. MAKE APPROPRIATE CONNECTIONS TO LVT AS SHOWN FOR ENERGY MANAGEMENT BOARD OPTIONS. THE CONTACTS FOR DEMAND LIMIT AND ICE DONE OPTIONS MUST BE RATED FOR DRY CIRCUIT APPLICATION CAPABLE OF HANDLING A 24VAC LOAD UP TO 50 MA. INSTALLATION OF OPTIONAL ENERGY MANAGEMENT BOARD REQUIRED.

8. REMOVE JUMPER BETWEEN TERMINALS 11 AND 17 WHEN FIELD CWP1 IS INSTALLED.

9. TERMINALS 13 & 14 OF TB5 ARE FOR FIELD EXTERNAL CONNECTIONS FOR REMOTE ON-OFF. THE CONTACTS MUST BE RATED FOR DRY CIRCUIT APPLICATION CAPABLE OF HANDLING A 24VAC LOAD UP TO 50MA.

LEGEND:

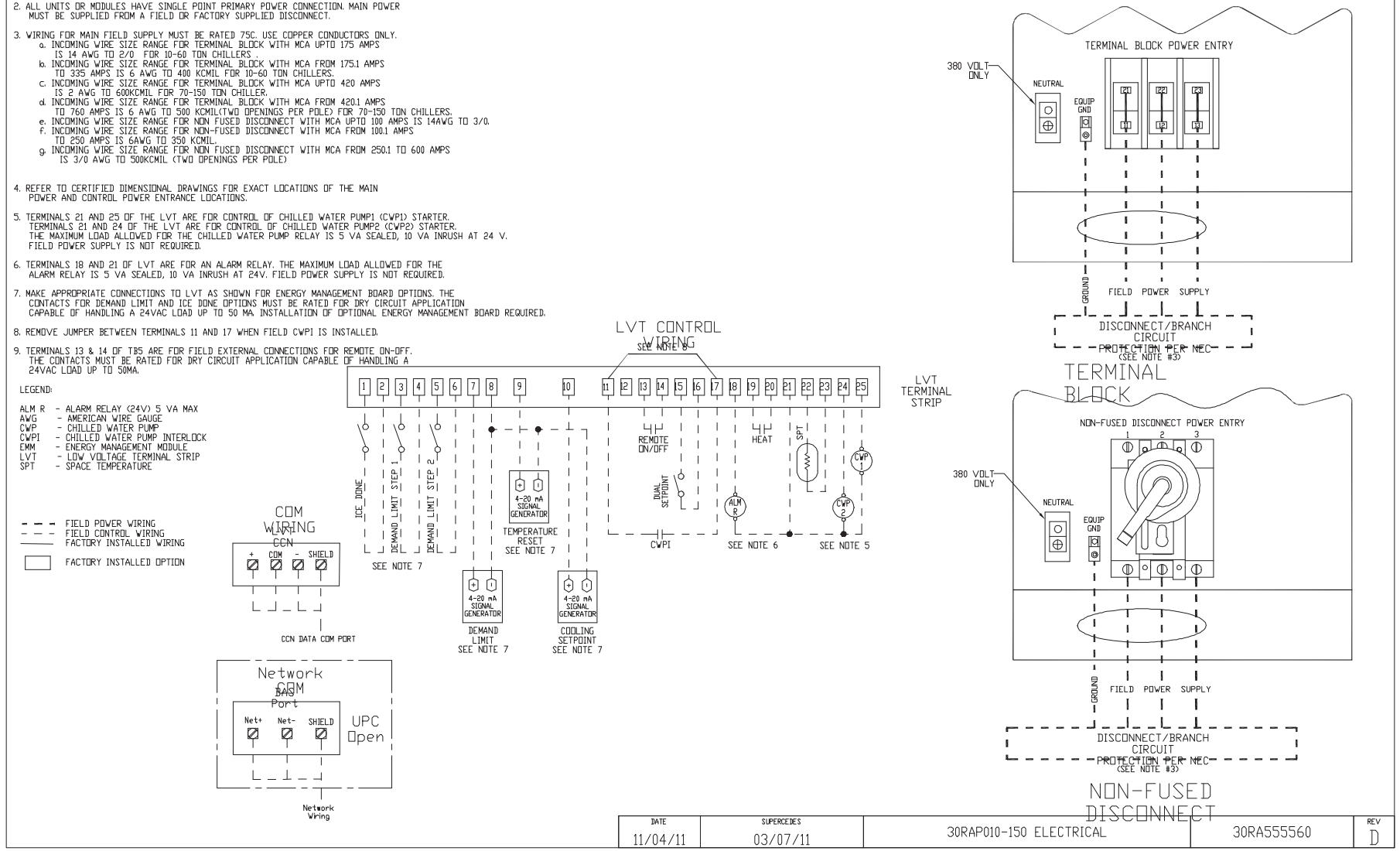
ALM R - ALARM RELAY (24V) 5 VA MAX
AWG - AMERICAN WIRE GAUGE
CWP - CHILLED WATER PUMP
CWPI - CHILLED WATER PUMP INTERLOCK
EMM - ENERGY MANAGEMENT MODULE
LVT - LOW VOLTAGE TERMINAL STRIP
SPT - SPACE TEMPERATURE

FIELD POWER WIRING
FIELD CONTROL WIRING
FACTORY INSTALLED WIRING
FACTORY INSTALLED OPTION

UNITED TECHNOLOGIES CARRIER — P.O. BOX 4808 SYRACUSE, NY 13221

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DATE	SUPERCEDES		
11/04/11	03/07/11	30RAP010-150 ELECTRICAL	30RA555560	REV D

Summary Performance Report For CH-2

Project: ~Untitled40 03/25/2022
Prepared By: 11:35AM

30RAP with Greenspeed®Intelligence



Unit Information

Tag Name:	**CH-2**	
Model Number:	**30RAP045**	
Quantity:	**1**	
Manufacturing Source:	**Charlotte, NC USA**	
ASHRAE 90.1:	**2013/2016, 2010, 2007**	
Refrigerant:	**R-410A**	
Independent Refrigerant Circuits:	**2**	
Shipping Weight:	**2516**	lb
Operating Weight:	**2537**	lb
Refrigerant Weight (Circuit A):	**35**	lb
Refrigerant Weight (Circuit B):	**35**	lb
Unit Length:	**89**	in
Unit Width:	**93**	in
Unit Height:	**79**	in
Chiller Pressure Drop*:	**12.3**	ft H2O

*Use Chiller Pressure Drop for sizing pumps. This value includes losses due to chiller piping, fittings, 40 mesh factory supplied strainer and BPHX.

Evaporator Information

Fluid Type:	**Propylene Glycol**	
Brine Concentration:	**35.00**	%
Fouling Factor:	**0.000100**	(hr-sqft-F)/BTU
Leaving Temperature:	**44.00**	°F
Entering Temperature:	**55.71**	°F
Fluid Flow:	**90.00**	gpm
Evaporator Pressure Drop*:	**7.35**	ft H2O

*Refer to Chiller Pressure Drop for sizing pumps.

Condenser Information

Altitude:	**4,800**	ft
Number of Fans:	**3**	
Total Condenser Fan Air Flow:	**30,500**	CFM
Entering Air Temperature:	**98.0**	°F

Integrated Pump Information

No Pump Selected

Performance Information

Cooling Capacity:	**41.36**	Tons
Total Compressor Power:	**52.08**	kW
Total Fan Motor Power:	**3.173**	kW
Total Unit Power (without pump):	**55.25**	kW
Efficiency (without pump) (EER):	**8.984**	BTU/Wh
IPLV:.IP:	**17.20**	BTU/Wh

Accessories and Installed Options

Evaporator Heater
Non-Fused Disconnect
Al Fin/Cu Tube
Ultra Low Sound
Digital Compressor
Security Grilles/Hail Guards
EMM, GFI Convenience Outlet and BACnet Communication
Single Point
High Efficiency Variable Condenser Fan

Electrical Information

Unit Voltage:	**460-3-60**	V-Ph-Hz
Connection Type:	**Single Point**	

Amps	Electrical Circuit 1	Electrical Circuit 2
MCA	97.9	---
MOCP	110.0	---
ICF	223.5	---
Rec Fuse Size	110.0	---

Sound power measured in accordance with ANSI/AHRI Standard 370-2015.

Summary Performance Report For CH-2

Project: ~Untitled40 03/25/2022
Prepared By: 11:35AM



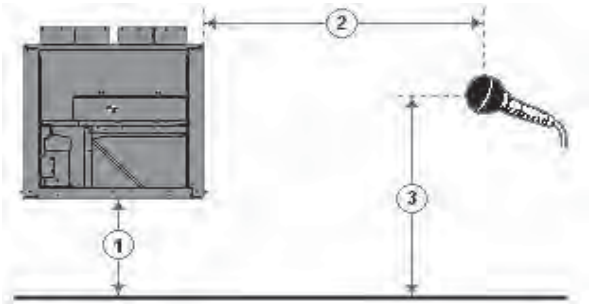
Certified in accordance with the AHRI Air-Cooled Water-Chilling Packages Certification Program, which is based on AHRI Standard 550/590 (I-P) and AHRI Standard 551/591 (SI). Certified units may be found in the AHRI Directory at www.ahridirectory.org. Unit contains freeze protection fluids in the evaporator with a leaving chilled fluid temperature above 32°F [0°C] is certified when rated per the Standard with water.

Summary Performance Report For CH-2

Project: ~Untitled40 03/25/2022
Prepared By: 11:35AM

Unit Parameters

Tag Name:	**CH-2**	
Model Number:	**30RAP045**	
Condenser Type:	**Air Cooled**	
Compressor Type:	**Scroll**	
Chiller Nameplate Voltage:	**460-3-60**	V-Ph-Hz
Quantity:	**1**	
Manufacturing Source:	**Charlotte, NC USA**	
Refrigerant:	**R-410A**	
Shipping Weight:	**2516**	lb
Operating Weight:	**2537**	lb
Refrigerant Weight (Circuit A):	**35**	lb
Refrigerant Weight (Circuit B):	**35**	lb
Unit Length:	**89**	in
Unit Width:	**93**	in
Unit Height:	**79**	in



1 - Chiller Height Above Ground
2 - Horizontal Distance From Chiller to Receiver
3 - Receiver Height Above Ground
(See Note 3)

Accessories and Installed Options

Evaporator Heater
Non-Fused Disconnect
Al Fin/Cu Tube
Ultra Low Sound
Digital Compressor
Security Grilles/Hail Guards
EMM, GFI Convenience Outlet and BACnet Communication
Single Point
High Efficiency Variable Condenser Fan

Acoustic Information

Table 1. A-Weighted Sound Power Levels (dB re 1 picowatt). See note #1.

Octave Band Center Frequency, Hz	31	63	125	250	500	1k	2k	4k	8k	Overall
100% Load	---	61	69	78	82	83	81	77	71	88
75% Load	---	60	71	76	80	82	80	75	67	86
50% Load	---	58	64	74	74	76	75	70	72	82
25% Load	---	56	58	76	72	72	70	67	67	80

Table 2. A-Weighted Sound Pressure Levels (dB re 20 micropascals) calculated based upon user defined input for dimensions 1, 2 and 3 as shown in above diagram. See note #2 and #3.

Octave Band Center Frequency, Hz	31	63	125	250	500	1k	2k	4k	8k	Overall
100% Load	---	33	41	49	54	55	53	49	43	60
75% Load	---	31	43	48	52	54	51	46	39	58
50% Load	---	30	36	46	46	48	47	42	43	54
25% Load	---	28	30	48	44	44	42	39	39	52

Notes: (1) Measurements performed in accordance with AHRI Standard 370-2015 for air cooled Chillers.
(2) Chiller is assumed to be a point source on a reflecting plane.
(3) Without user defined input, the default dimensions used to construct Table 2 are as follows:
1 - Chiller Height Above Ground = 0.0 ft
2 - Horizontal Distance From Chiller to Receiver = 30.0 ft
3 - Receiver Height Above Ground = 3.0 ft

Acoustic Summary For CH-2

Project: ~Untitled40 03/25/2022
Prepared By: 11:35AM

Please refer to Performance Output Summary or Detailed Performance Report for Acoustic information

Detailed Performance Summary For CH-2

Project: ~Untitled40 03/25/2022
Prepared By: 11:35AM

30RAP with Greenspeed®Intelligence



Unit Information

Tag Name:	**CH-2**	
Model Number:	**30RAP045**	
Condenser Type:	**Air Cooled**	
Compressor Type:	**Scroll**	
Nameplate Voltage:	**460-3-60**	V-Ph-Hz
Quantity:	**1**	
Manufacturing Source:	**Charlotte, NC USA**	
ASHRAE 90.1:	**2013/2016, 2010, 2007**	
Refrigerant:	**R-410A**	
Capacity Control Steps:	**44**	
Minimum Capacity:	**8.00**	%
Shipping Weight:	**2516**	lb
Operating Weight:	**2537**	lb
Refrigerant Weight (Circuit A):	**35**	lb
Refrigerant Weight (Circuit B):	**35**	lb
Unit Length:	**89**	in
Unit Width:	**93**	in
Unit Height:	**79**	in
Minimum Outdoor Operating Temp:	**-20.0**	°F
Chiller Pressure Drop*:	**12.3**	ft H2O

*Use Chiller Pressure Drop for sizing pumps. This value includes losses due to chiller piping, fittings, 40 mesh factory supplied strainer and BPHX.

Performance Information

Cooling Capacity:	**41.36**	Tons
Total Compressor Power:	**52.08**	kW
Total Fan Motor Power:	**3.173**	kW
Total Unit Power (without pump):	**55.25**	kW
Efficiency (without pump) (EER):	**8.984**	BTU/Wh

Evaporator Information

Fluid Type:	**Propylene Glycol**	
Brine Concentration:	**35.00**	%
Fouling Factor:	**0.000100**	(hr-sqft-F)/BTU
Leaving Temperature:	**44.00**	°F
Entering Temperature:	**55.71**	°F
Fluid Flow:	**90.00**	gpm
Fluid Flow Min:	**58.83**	gpm
Fluid Flow Max:	**209.0**	gpm

*Refer to Chiller Pressure Drop for sizing pumps.

Evaporator Pressure Drop*:	**7.35**	ft H2O

*Refer to Chiller Pressure Drop for sizing pumps.

Condenser Information

Altitude:	**4,800**	ft
Number of Fans:	**3**	
Total Condenser Fan Air Flow:	**30,500**	CFM
Entering Air Temperature:	**98.0**	°F

Detailed Performance Summary For CH-2

Project: ~Untitled40 03/25/2022
Prepared By: 11:35AM

Integrated Pump Information

No Pump Selected

Accessories and Installed Options

Evaporator Heater
Non-Fused Disconnect
Al Fin/Cu Tube
Ultra Low Sound
Digital Compressor
Security Grilles/Hail Guards
EMM, GFI Convenience Outlet and BACnet Communication
Single Point
High Efficiency Variable Condenser Fan

Electrical Information

Unit Voltage: **460-3-60** V-Ph-Hz
Connection Type: **Single Point**

Amps	Electrical Circuit 1	Electrical Circuit 2
MCA	97.9	---
MOCP	110.0	---
ICF	223.5	---
Rec Fuse Size	110.0	---

Detailed Performance Summary For CH-2

Project: ~Untitled40 03/25/2022
Prepared By: 11:35AM

Integrated Part Load Value (AHRI)

IPLV.IP: **17.20** BTU/Wh

Unit Performance				
Percent of Full Load Capacity, %	100.00	75.00	50.00	25.00
Percent of Full Load Power, %	100.00	53.06	26.40	12.63
Unloading Sequence	A	A	A	A
Cooling Capacity, Tons	45.09	33.82	22.54	11.27
Total Unit Power, kW	53.19	28.22	14.04	6.716
Efficiency (EER), BTU/Wh	10.17	14.38	19.27	20.14
Evaporator Data				
Fluid Entering Temperature, °F	54.00	51.49	48.99	46.50
Fluid Leaving Temperature, °F	44.00	44.00	44.00	44.00
Fluid Flow Rate, gpm	107.8	107.8	107.8	107.8
Fouling Factor, (hr-sqft-F)/BTU	0.000100	0.000100	0.000100	0.000100
Pressure Drop, psi	5.47	5.49	5.52	5.54
Condenser Data				
Entering Air Temperature, °F	95.0	80.0	65.0	55.0

For some 75% operating points, the efficiency may be calculated at a condenser inlet air operating temperature as much as 0.8 degrees higher.

Sound power measured in accordance with ANSI/AHRI Standard 370-2015.



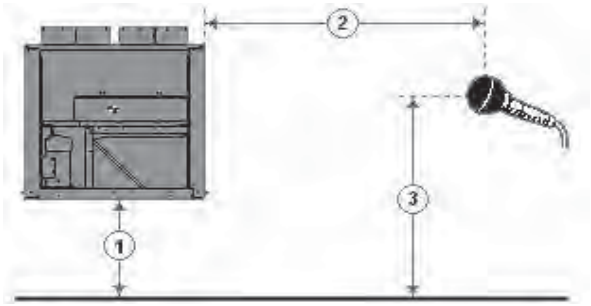
Certified in accordance with the AHRI Air-Cooled Water-Chilling Packages Certification Program, which is based on AHRI Standard 550/590 (I-P) and AHRI Standard 551/591 (SI). Certified units may be found in the AHRI Directory at www.ahridirectory.org. Unit contains freeze protection fluids in the evaporator with a leaving chilled fluid temperature above 32°F [0°C] is certified when rated per the Standard with water.

Detailed Performance Summary For CH-2

Project: ~Untitled40 03/25/2022
Prepared By: 11:35AM

Unit Parameters

Tag Name:	**CH-2**	
Model Number:	**30RAP045**	
Condenser Type:	**Air Cooled**	
Compressor Type:	**Scroll**	
Chiller Nameplate Voltage:	**460-3-60**	V-Ph-Hz
Quantity:	**1**	
Manufacturing Source:	**Charlotte, NC USA**	
Refrigerant:	**R-410A**	
Shipping Weight:	**2516**	lb
Operating Weight:	**2537**	lb
Refrigerant Weight (Circuit A):	**35**	lb
Refrigerant Weight (Circuit B):	**35**	lb
Unit Length:	**89**	in
Unit Width:	**93**	in
Unit Height:	**79**	in



1 - Chiller Height Above Ground
2 - Horizontal Distance From Chiller to Receiver
3 - Receiver Height Above Ground
(See Note 3)

Accessories and Installed Options

Evaporator Heater
Non-Fused Disconnect
Al Fin/Cu Tube
Ultra Low Sound
Digital Compressor
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Table 1. A-Weighted Sound Power Levels (dB re 1 picowatt). See note #1.

Octave Band Center Frequency, Hz	31	63	125	250	500	1k	2k	4k	8k	Overall
100% Load	---	61	69	78	82	83	81	77	71	88
75% Load	---	60	71	76	80	82	80	75	67	86
50% Load	---	58	64	74	74	76	75	70	72	82
25% Load	---	56	58	76	72	72	70	67	67	80

Table 2. A-Weighted Sound Pressure Levels (dB re 20 micropascals) calculated based upon user defined input for dimensions 1, 2 and 3 as shown in above diagram. See note #2 and #3.

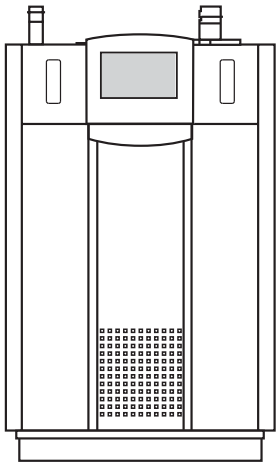
Octave Band Center Frequency, Hz	31	63	125	250	500	1k	2k	4k	8k	Overall
100% Load	---	33	41	49	54	55	53	49	43	60
75% Load	---	31	43	48	52	54	51	46	39	58
50% Load	---	30	36	46	46	48	47	42	43	54
25% Load	---	28	30	48	44	44	42	39	39	52

Notes: (1) Measurements performed in accordance with AHRI Standard 370-2015 for air cooled Chillers.
(2) Chiller is assumed to be a point source on a reflecting plane.
(3) Without user defined input, the default dimensions used to construct Table 2 are as follows:
1 - Chiller Height Above Ground = 0.0 ft
2 - Horizontal Distance From Chiller to Receiver = 30.0 ft
3 - Receiver Height Above Ground = 3.0 ft

NEOTHERM®

Hydronic Boiler

NTH	Hydronic Boiler



Date:

Project #:

Engineer:

Prepared By:

Bid Date:

Indoor Sizes 399-850

Submittal Data

LAARS® Heating Systems Company

Project Name:

Location:

Contractor:

Standard Equipment

- Integrated PID temperature and ignition control with large color touchscreen display
- Password-protected parameters for installer use
- Test feature allows forced min or max firing
- Complete diagnostics for analog and digital inputs
- Displays holds, alerts and errors in clear text form
- Dry alarm contacts for ignition failure
- High condensing efficiency
- Modulation down to 20% of full fire (5:1 turndown)
- Sealed combustion chamber
- Pre-mix stainless steel burner
- Low NOx system exceeds the most stringent regulations for air quality - 10 ppm NOx
- Horizontal or vertical direct vent
- Horizontal vent and air terminals
- Vent and air pipe lengths of up to 100 equivalent feet (each)
- Built-in condensate trap
- Vent temperature cutoff feature
- Direct spark ignition system
- Indirect water heater priority
- Cascades with other NeoTherms
- Sensor for indirect domestic water tank
- 160 psi maximum working pressure
- Stainless steel heat exchanger with welded construction (no gaskets)
- ASME "H" stamp
- 75 psi (517 kPa) ASME rated pressure relief valve
- Water flow switch
- Temperature & pressure gauge
- Drain valve
- Multiple pump control for boiler pump, system pump and indirect domestic water pump, each with delay
- Alarm output
- Accepts external 4-20mA (0-10V with optional converter) modulation signal
- Outdoor reset with customizable reset curves, domestic hot water override and warm weather shutdown
- Outdoor air temperature sensor
- On/off toggle switch
- Manual reset high limit
- Burner site glass
- Zero clearance to combustible surfaces
- 10-year limited warranty

Boiler Data

Number of Units:

Fuel

- [x] Natural
- [ ] Propane

Pump Options

- [ ] Pump included
- [ ] No pump

Factory Mounted Options

- [ ] CSD-1 (covers FM & GAP) (500-850)
- [ ] Low water cutoff (500-850)
- [ ] High & Low gas pressure switches (500-850)
- [ ] Additional auto reset high limit
- [ ] 30 psi pressure relief valve
- [ ] 50 psi pressure relief valve
- [ ] 60 psi pressure relief valve
- [x] 75 psi pressure relief valve (std)
- [ ] 125 psi pressure relief valve
- [ ] 150 psi pressure relief valve
- [ ] Bell for ignition failure

ENERGY STAR

AHRI CERTIFIED www.ahridirectory.org Ask About Our Certified Products

Accessories for Field Mounting

- ☐ Low water cutoff
- ☐ 0 - 10V converter for modulation control
- ☐ High & Low gas pressure switches
- ☐ Boiler pump
- ☐ Concentric vent terminal, 3"
- ☐ Flush-mount terminal, 3"
- ☐ Flush-mount terminal, 4"
- ☐ Propane conversion kit
- ☐ Condensate neutralizer kit
- ☐ Vari-Prime variable speed pump drive
- ☐ BACnet gateway
- ☐ LON gateway
- ☐ Common vent kit (399-500, one required for each unit)

Sizing Data

Model	Input BTU/h	Input kW	Output BTU/h	Output kW	Thermal Efficiency %	Comb. Efficiency %	Gas Conn. Size inches	Water Conn. Size inches	Shipping Weight Lbs	Shipping Weight kg
☐ NTH 399	**399,900**	*117.2*	**386,000**	*113.1*	96.5	96.5	¾ NPT	1¼ NPT	**364**	*165*
☐ NTH 500	**500,000**	*146.4*	**475,000**	*139.2*	95.0	95.0	1 NPT	1½ NPT	**419**	*190*
☐ NTH 600	**600,000**	*175.7*	**572,000**	*167.6*	95.3	96.0	1 NPT	1½ NPT	**426**	*193*
☐ NTH 750	**750,000**	*219.8*	**724,000**	*212.1*	96.6	96.6	1½ NPT	2 NPT	**481**	*218*
☐ NTH 850	**850,000**	*248.9*	**813,000**	*238.2*	95.7	95.7	1½ NPT	2 NPT	**503**	*228*

NOTES:
For other boiler ratings:
Boiler Horsepower: HP = $\frac{\text{Output}}{33{,}475}$ Radiation Surface: EDR sq. ft. = $\frac{\text{Output}}{150}$

Clearances

Appliance Surface	Suggested Service Access Clearance inches	cm
Left Side	**1**	*2.5*
Right Side	**12**	*31*
Top	**24**	*61*
Back	**6**	*15*
Closet, Front	**1**	*2.5*
Alcove, Front	**24**	*61*
Vent	Per Vent Manufacturer	

Certified by CSA for zero clearance to combustible materials on all sides.

Electrical Data

Boiler	Boiler Circuit		Boiler Pump Circuit*		
Size MBH	399-500	600-850	399	500	600-850
Voltage	120V 1PH	120V 1PH	120V 1PH	120V 1PH	120V 1PH
FLA	< 4 Amps	5 Amps	< 4 Amps	6 Amps	12 Amps
MCA	< 4 Amps	6 Amps	5 Amps	8 Amps	15 Amps
MOP	5 Amps	11 Amps	8 Amps	14 Amps	27 Amps

FLA = Full Load Amperage
MCA = Minimum Circuit Ampacity
MOP = Maximum Over-current Protection
* Note: For any pump(s) exceeding 7.4 FLA / 120V VAC, an external pump relay / contactor must be used. Units that are purchased with pumps include the contactor if the pump exceeds this limit.

Vent System

Size	Intake (Air) Pipe	Exhaust (Vent) Pipe	Maximum Allowable Equivalent Length*	
399	4"	4"	100 ft	*30 m*
500	4"	4"	100 ft	*30 m*
600	4"	4"	40 ft	*12 m*
	6"**	6"**	100 ft	*30 m*
750	4"	4"	40 ft	*12 m*
	6"	6"	100 ft**	*30 m***
850	4"	4"	40 ft	*12 m*
	6"	6"	100 ft	*30 m*

Installations in the U.S. require exhaust vent pipe that is a combination of PVC & CPVC complying with ANSI/ASTM D1785 F441, polypropylene pipe that complies with ULC S636, or stainless steel complying with UL1738. Installations in Canada require exhaust vent pipe that is certified to ULC S636.

Intake (air) pipe may be ABS, PVC, CPVC or galvanized material.

Installer must comply fully with manufacturer's installation instructions, including use of minimum exhaust length CPVC, to maintain ANSI Z21.13 safety certification.

Closet and alcove installations do not allow the use of PVC under any circumstances

* To calculate max equivalent length, measure the linear feet of the pipe, and add 5 feet *(1.5m)* for each elbow used.

** Allowed only if the vent pipe is no more than 20 equivalent feet longer than the air pipe.

Water Flow Requirements

Temperature Rise in °F

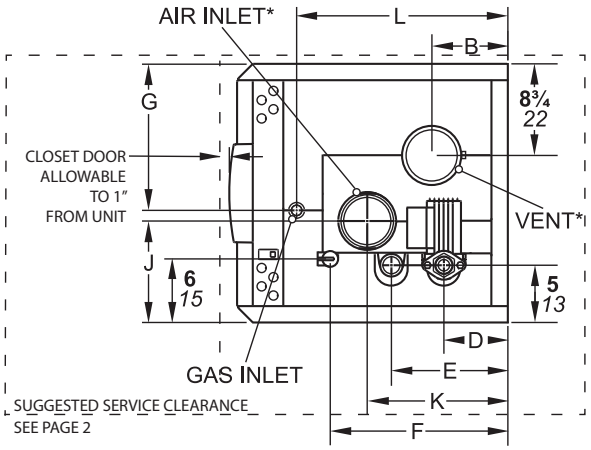
	20°F		30°F		40°F		50°F		60°F	
	Flow	H/L	Flow	H/L	Flow	H/L	Flow	H/L	Flow	H/L
Size	gpm	feet	gpm	feet	gpm	feet	gpm	feet	gpm	feet
399	39.0	22.8	25.0	11.5	19.0	7.6	15.2	5.4	12.6	4.0
500	48.0	22.2	32.0	11.1	24.0	6.8	19.0	4.6	15.8	3.4
600	58.0	30.5	38.0	14.9	29.0	9.4	22.8	6.3	19.0	4.6
750	72.0	38.0	48.0	17.5	36.0	10.1	28.5	6.5	23.8	4.6
850	81.0	34.8	54.0	17.4	41.0	10.9	32.3	7.3	26.9	5.3

Temperature Rise in °C

	11°C		*17°C*		*22°C*		*28°C*		*33°C*	
	Flow	*H/L*	*Flow*	*H/L*	*Flow*	*H/L*	*Flow*	*H/L*	*Flow*	*H/L*
Size	*lpm*	*m*	*lpm*	*m*	*lpm*	*m*	*lpm*	*m*	*lpm*	*m*
399	*147.6*	*6.9*	*94.6*	*3.5*	*71.9*	*2.3*	*57.5*	*1.6*	*47.7*	*1.2*
500	*181.7*	*6.8*	*121.1*	*3.4*	*90.8*	*2.1*	*71.9*	*1.4*	*59.8*	*1.0*
600	*219.6*	*9.3*	*143.8*	*4.5*	*109.8*	*2.9*	*86.3*	*1.9*	*71.9*	*1.4*
750	*272.5*	*11.6*	*181.7*	*5.3*	*136.3*	*3.1*	*107.9*	*2.0*	*90.1*	*1.4*
850	*306.6*	*10.6*	*204.4*	*5.3*	*155.2*	*3.3*	*122.3*	*2.2*	*101.8*	*1.6*

Note that pumps supplied with boilers are meant for primary-secondary piping systems, and are sized to serve the boiler and 30 feet of boiler loop piping with a typical number of fittings, for approximately 25-30°F temp rise across the boiler.

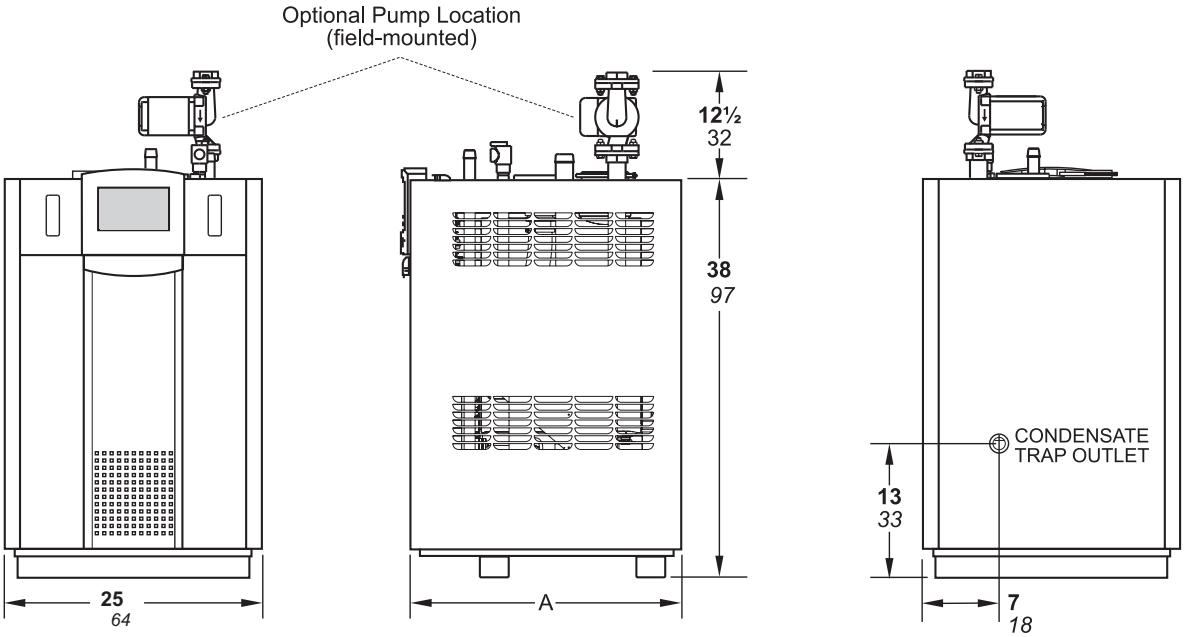
Dimensional Data, Sizes 399-500



TOP VIEW

*This unit is shipped with adapters for the air and vent that accept standard pipe of the proper size and type.

Dimensions shown in **inches**
cm.

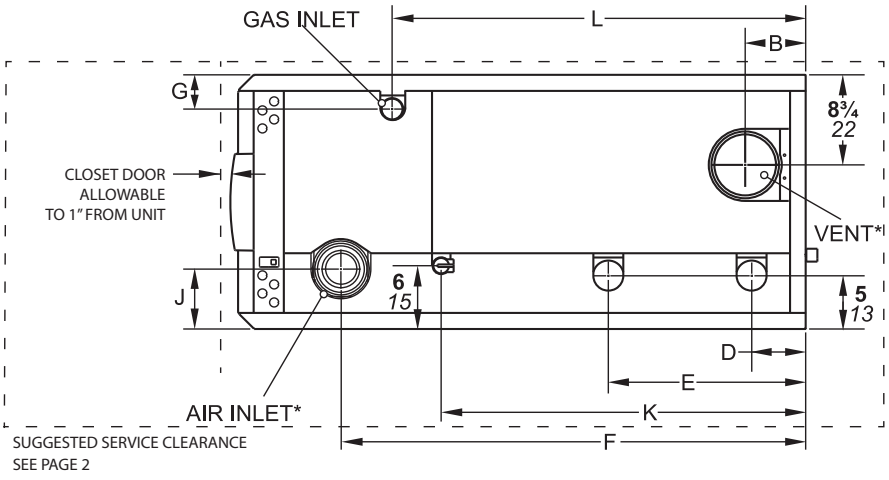


FRONT VIEW **RIGHT SIDE VIEW** **BACK VIEW**

NTH Size	A in	B in	D in	E in	F in	G in	J in	K in	L in	Ø AIR INLET* in	Ø VENT* in
399	**31½**	**5¼**	**4¼**	**14½**	**21½**	**19¼**	**8¼**	**18½**	**25**	**4**	**4**
500	**37¾**	**5¼**	**4¼**	**15**	**26**	**20½**	**5¾**	**20**	**27¼**	**4**	**4**
	cm	*cm*	*cm*	*cm*	*cm*	*cm*	*cm*	*cm*	*cm*	*cm*	*cm*
399	*80*	*13*	*11*	*37*	*55*	*49*	*21*	*47*	*64*	*11*	*11*
500	*96*	*13*	*11*	*38*	*66*	*52*	*15*	*51*	*69*	*11*	*11*

Dimensions are nominal.

Dimensional Data, Sizes 600-850

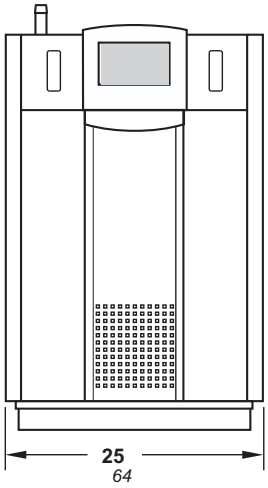


TOP VIEW

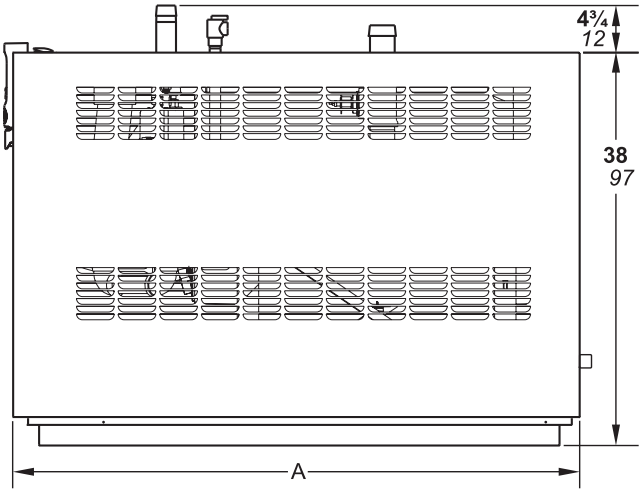
*This unit is shipped with adapters for the air and vent that accept standard pipe of the proper size and type.

Dimensions shown in **inches** *cm.*

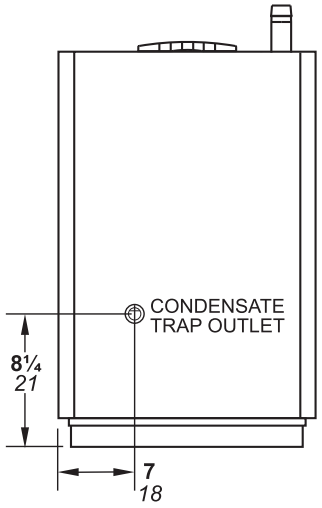
Optional pump is shipped loose and is not shown.



FRONT VIEW



RIGHT SIDE VIEW



BACK VIEW

NTH	A	B	D	E	F	G	J	K	L	AIR Ø INLET*	Ø VENT*
Size	in	in	in	in	in	in	in	in	in	in	in
600	**37¾**	**5**	**4¼**	**15**	**20**	**3**	**5¾**	**26**	**29¾**	**4**	**4**
750	**51**	**6**	**5¼**	**19**	**40½**	**3¼**	**5¾**	**30½**	**35½**	**4**	**6**
850	**55¼**	**6**	**5¼**	**19**	**44½**	**3½**	**5¾**	**35**	**39¾**	**4**	**6**
	cm	*cm*	*cm*	*cm*	*cm*	*cm*	*cm*	*cm*	*cm*	*cc*	*cm*
600	*96*	*13*	*11*	*38*	*51*	*8*	*15*	*66*	*76*	*11*	*11*
750	*130*	*13*	*13*	*48*	*103*	*8*	*15*	*77*	*90*	*11*	*17*
850	*140*	*13*	*13*	*48*	*113*	*9*	*15*	*89*	*101*	*11*	*17*

Dimensions are nominal.

FI Series Pump | Submittal Data

Submittal No: 301-2403 | **Model:** 1209C | **RPM:** 1760 - 60 Hz | **Effective:** January 27, 2020 | **Supersedes:** May 31, 2017

JOB: SWEG

REPRESENTATIVE:

ENGINEER:

CONTRACTOR:

PRODUCT DATA

ITEM NO. HWP-1,2 **MODEL NO.** 1209C

IMPELLER DIAMETER 7.80 **HORSEPOWER** 2.00

GPM 35 **VOLTAGE** 208/3/60

HEAD/FT 60 **RPM** 1760

WEIGHT **PUMP/MOTOR**

NSF 61 CERTIFIED ☐ YES ☐ NO

Configuration	DOE Basic Model Number	PEI Value		Energy Rating
Bare Pump	FI1209C-4P-BP	PEI_{cl}	0.86	14
Pump + Motor	FI1209C-4P-PM	PEI_{cl}	0.86	14

OPERATING SPECIFICATIONS

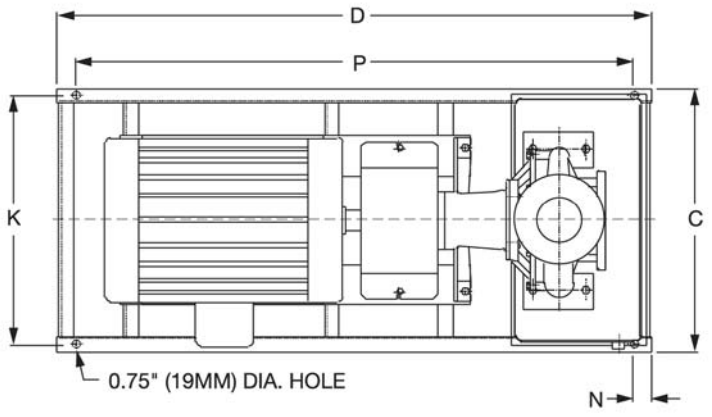
FLANGE	PRESSURE	TEMPERATURE
ANSI Class 125	175 PSIG* (1210 KPA)	250°F (120°C)
ANSI Class 250	300 PSIG** (2070 KPA)	250°F (120°C)

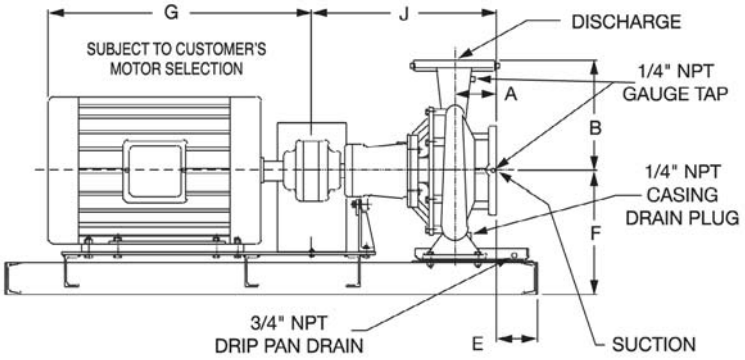
Motors: All NEMA Standard (T Frame)
* In accordance with ANSI Standard B16.1 Class 125
** In accordance with ANSI Standard B16.1 Class 250

DIMENSIONS

Model No. | 1209C
Flange Size (Suction x Discharge) | 1 ½ x 1 ¼ (38 x 32)

	HORSEPOWER	1.5	2	3	5
ODP	MOTOR FRAME	145T		182T	184T
ODP	G MAX	13.13 (333)		15.13 (384)	16.63 (422)
ODP	MAXIMUM ASSEMBLY WEIGHT LBS. (KG)	287 (130)		407 (185)	
TEFC	MOTOR FRAME	145T		182T	184T
TEFC	G MAX	15.67 (398)		18.19 (462)	
TEFC	MAXIMUM ASSEMBLY WEIGHT LBS. (KG)	287 (130)		407 (185)	
A		ANSI Class 125: 3.50 (89)			
		ANSI Class 250: 3.75 (95)			
B		ANSI Class 125: 9.10 (231)			
		ANSI Class 250: 9.36 (238)			
C		17.18 (436)			
D		40.0 (1016)			
E		ANSI Class 125: 2.53 (64)			
		ANSI Class 250: 2.28 (58)			
F		11.28 (287)			
J		ANSI Class 125: 17.05 (433)			
		ANSI Class 250: 17.30 (439)			
K		15.68 (398)			
N		2.00 (51)			
P		36.0 (914)			





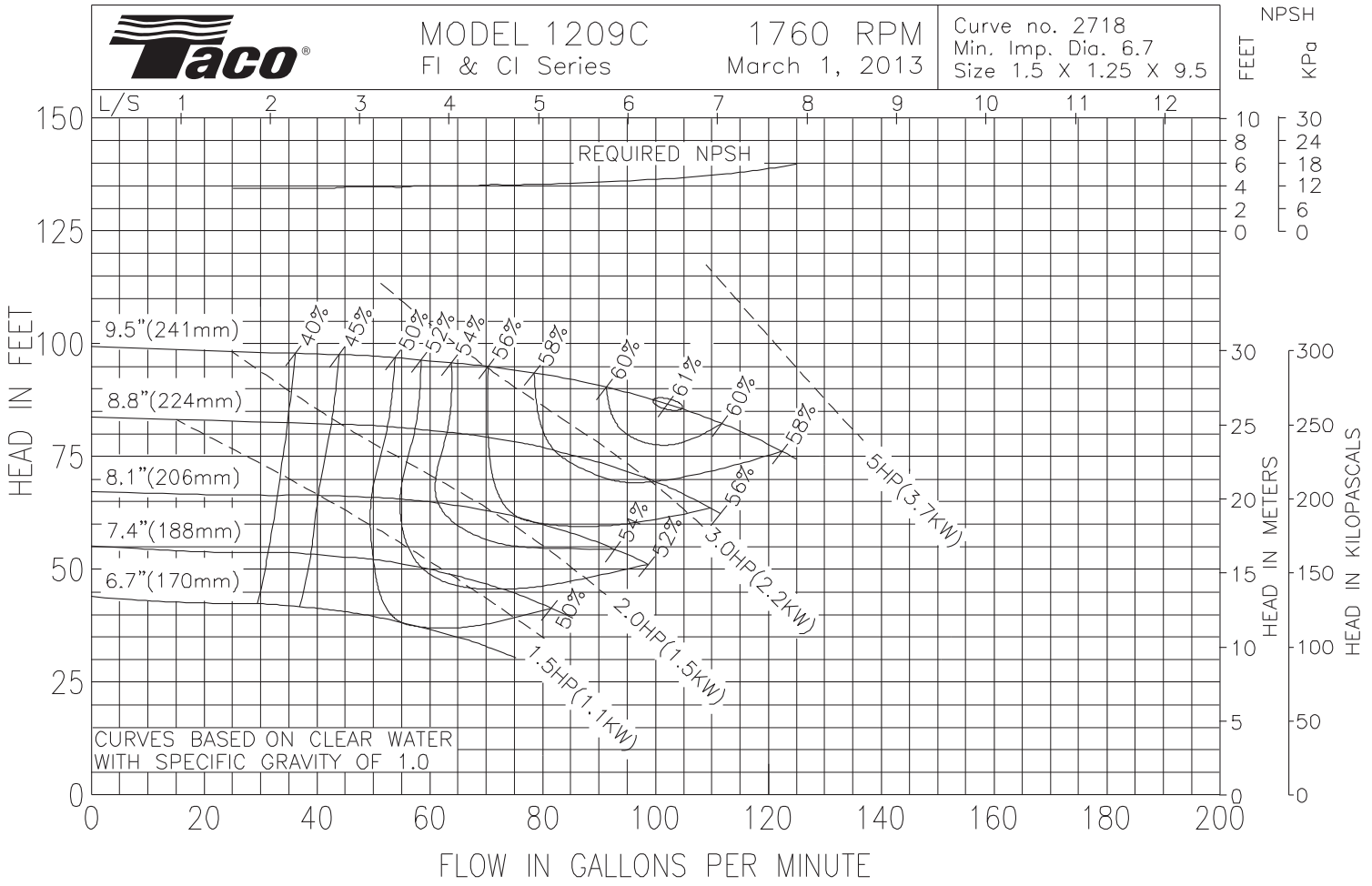
English dimensions are in inches. Metric dimensions are in millimeters.
Metric data is presented in ( ). Do not use for construction purposes unless certified.

MATERIALS OF CONSTRUCTION

	BRONZE FITTED			NSF 61		
	STANDARD PUMP CONSTRUCTION		OPTIONAL 125# or 250#	STANDARD PUMP CONSTRUCTION		OPTIONAL 125# or 250#
	125# Flange	250# Flange		125# Flange	250# Flange	
Casing	Cast Iron ASTM A48/A48M-03 Class 30A	Ductile Iron ASTM A536-84 Grade 65-45-12	N/A	Cast Iron ASTM A48/A48M-03 Class 30A	Ductile Iron ASTM A536-84 Grade 65-45-12	N/A
Cover	Cast Iron ASTM A48/A48M-03 Class 30A	Ductile Iron ASTM A536-84 Grade 65-45-12	N/A	Cast Iron ASTM A48/A48M-03 Class 30A	Ductile Iron ASTM A536-84 Grade 65-45-12	N/A
Impeller	Bronze ASTM B584 ALLOY C83600 or C84400	Bronze ASTM B584 ALLOY C83600 or C84400	N/A	Stainless Steel ASTM A351/A 351M-08	Stainless Steel ASTM A351/A 351M-08	N/A
Wear Ring	N/A	N/A	Bronze ASTM B584-98A C92200	N/A	N/A	Bronze ASTM B584-98A C92200
Shaft	Stainless Steel TYPE 416"T" or 410"T" ASTM A582	Stainless Steel TYPE 416"T" or 410"T" ASTM A582	N/A	Carbon Steel AISI 1045	Carbon Steel AISI 1045	Stainless Steel TYPE 416"T" or 410"T" ASTM A582
Shaft Sleeve	Bronze ASTM B584-98A C92200	Bronze ASTM B584-98A C92200	Stainless Steel TYPE 303 ASTM A276	Bronze ASTM B584-98A C92200	Bronze ASTM B584-98A C92200	N/A
Mechanical Seal	Ceramic/EPT	Ceramic/EPT	Tungsten Carbide/EPT or Silicon-Carbide/EPT	Ceramic/EPT	Ceramic/EPT	N/A
Seal Flush Line Assembly	N/A	N/A	Copper &Brass C3600	Copper & Brass C3600	Copper & Brass C3600	N/A

N/A - Not Available

Revised: 05/31/2017



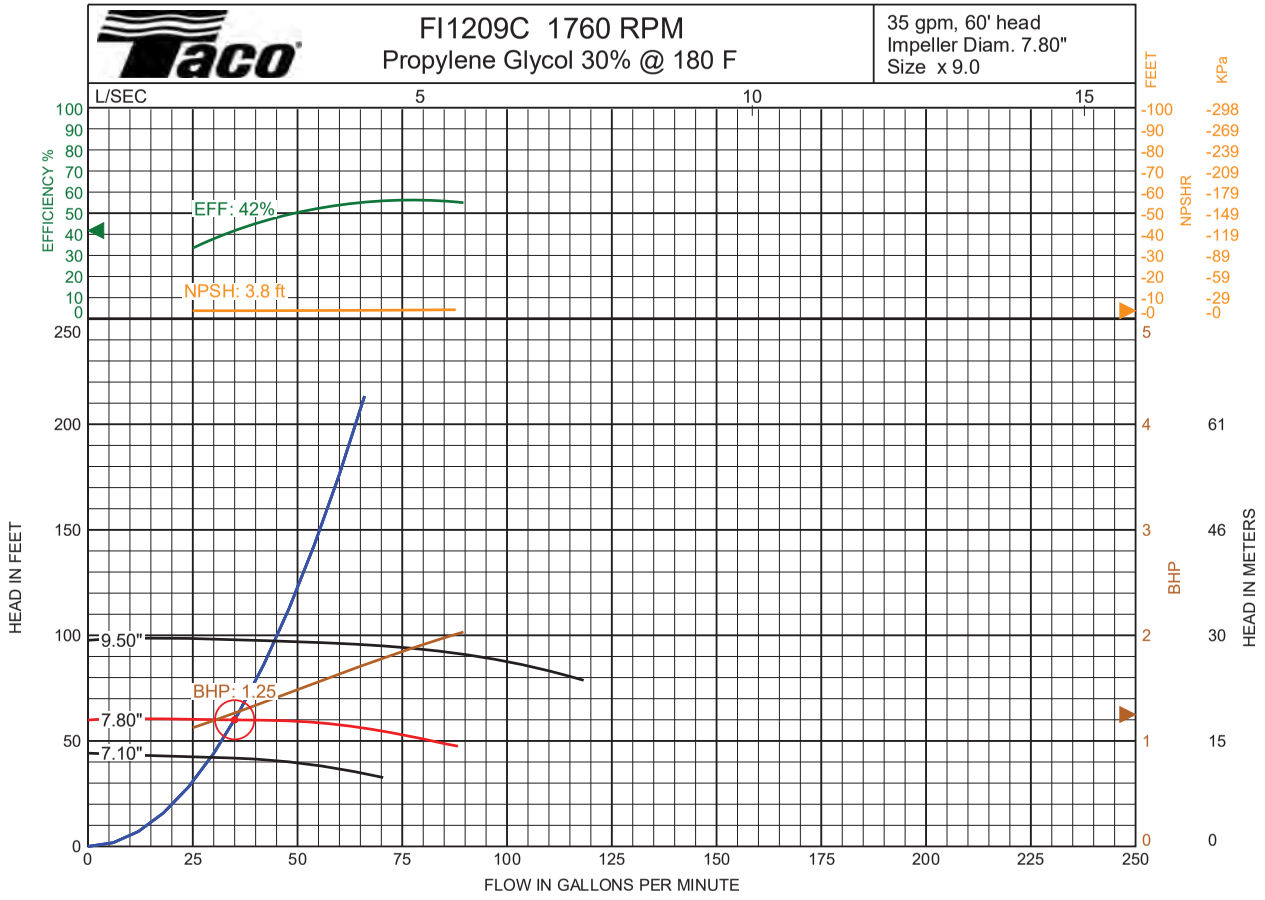
COMMENTS

 ©2020 Taco, Inc.

Base-mounted end suction Pumps Model: FI1209C

Tag: HWP-1,2

Flow Rate (GPM):	35
Head (FT):	60
Working Fluid:	Propylene Glycol 30% @ 180 F
Efficiency (%):	42%
Construction:	Iron
Design Hp:	1.25
Nol Hp:	2.09
Motor Hp:	2.00
Npsh (Ft):	4
RPM:	1760
Imp Dia:	7.80
Volt/Ph/Hz:	208/3/60
Notes:	



FI Series Pump | Submittal Data

Submittal No: 301-2141D | **Model:** 2009D | **RPM:** 1760 - 60 Hz | **Effective:** January 27, 2020 | **Supersedes:** July 12, 2018

JOB: SWEG

REPRESENTATIVE:

ENGINEER:

CONTRACTOR:

PRODUCT DATA

ITEM NO. CHWP-1,2 **MODEL NO.** 2009D

IMPELLER DIAMETER 8.20 **HORSEPOWER** 5.00

GPM 85 **VOLTAGE** 208/3/60

HEAD/FT 70 **RPM** 1760

WEIGHT **PUMP/MOTOR**

NSF 61 CERTIFIED ☐ YES ☐ NO

Configuration	DOE Basic Model Number	PEI Value		Energy Rating
Bare Pump	FI2009D-4P-BP	PEI_{cl}	0.86	14
Pump + Motor	FI2009D-4P-PM	PEI_{cl}	0.86	14

OPERATING SPECIFICATIONS

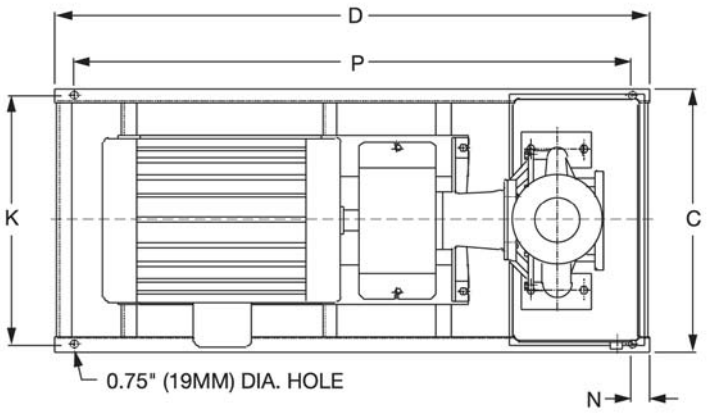
FLANGE	PRESSURE	TEMPERATURE
ANSI Class 125	175 PSIG* (1210 KPA)	250°F (120°C)
ANSI Class 250	300 PSIG** (2070 KPA)	250°F (120°C)

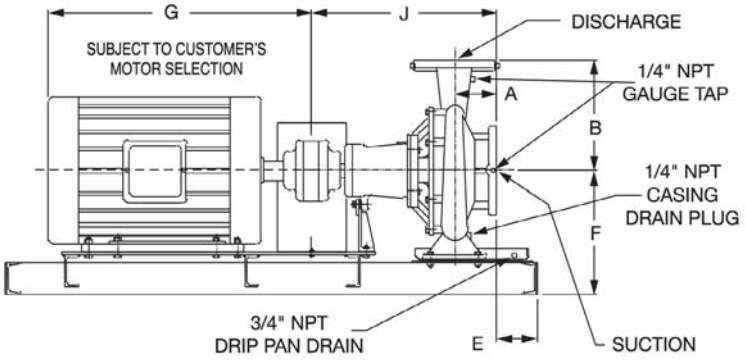
Motors: All NEMA Standard (T Frame)
* In accordance with ANSI Standard B16.1 Class 125
** In accordance with ANSI Standard B16.1 Class 250

DIMENSIONS

Model No. | 2009D
Flange Size (Suction x Discharge) | 2 ½ x 2 (64 x 51)

HORSEPOWER		2	3	5	7.5
ODP	MOTOR FRAME	145T	182T	184T	213T
	G MAX	13.13 (333)	15.13 (384)		19.08 (484)
	MAXIMUM ASSEMBLY WEIGHT LBS. (KG)	287 (130)	328 (149)		458 (208)
TEFC	MOTOR FRAME	145T	182T	184T	213T
	G MAX	15.67 (398)	18.19 (462)		20.65 (524)
	MAXIMUM ASSEMBLY WEIGHT LBS. (KG)	287 (130)	328 (149)		458 (208)
A		ANSI Class 125: 4.60 (117)			
		ANSI Class 250: 4.91 (125)			
B		ANSI Class 125: 9.75 (248)			
		ANSI Class 250: 10 (254)			
C		17.18 (436)			
D		40.0 (1016)			43.0 (1092)
E		ANSI Class 125: 1.47 (37)			
		ANSI Class 250: 1.16 (30)			
F		11.28 (287)			
J		ANSI Class 125: 17.93 (455)			
		ANSI Class 250: 18.24 (463)			
K		15.68 (398)			
N		2.00 (51)			
P		36.0 (914)			39.0 (991)

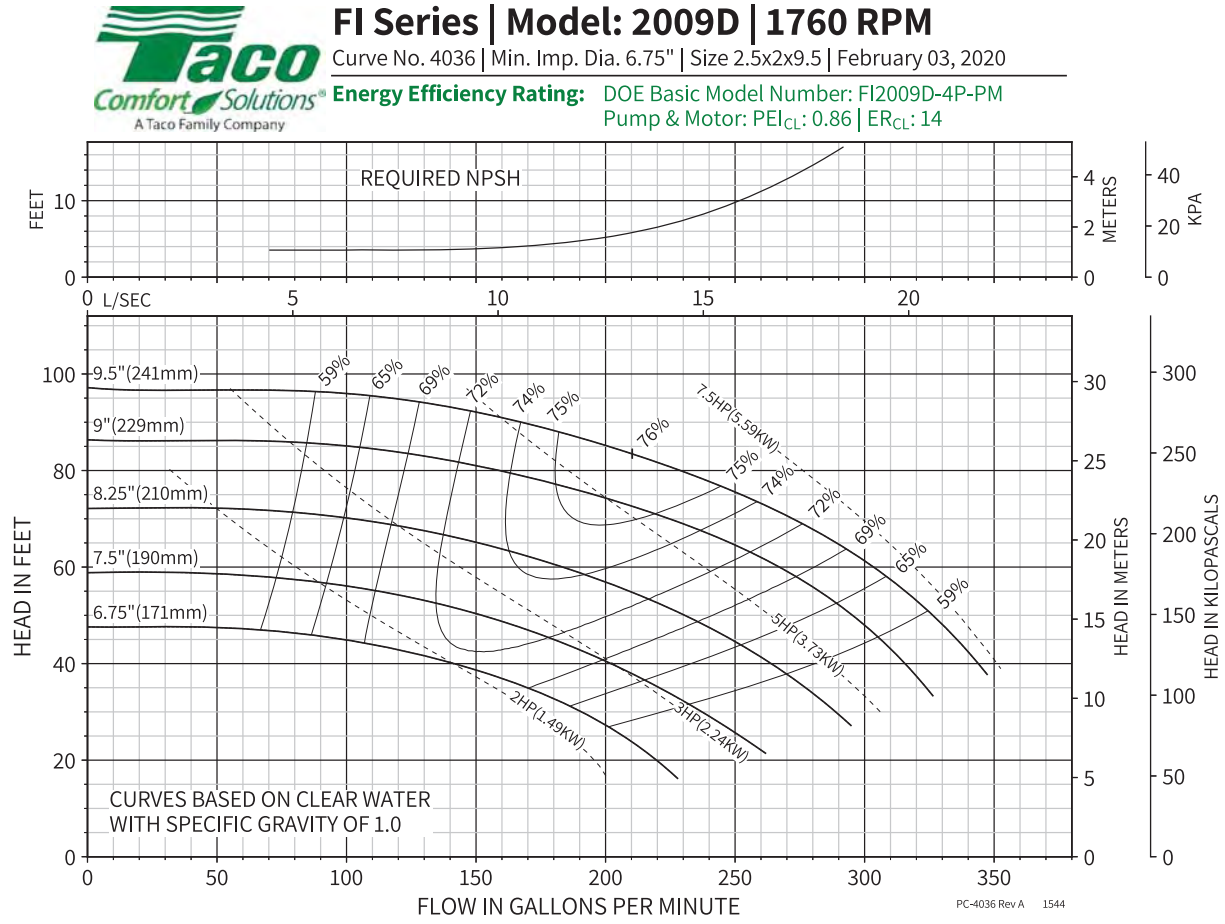




English dimensions are in inches. Metric dimensions are in millimeters.
Metric data is presented in ( ). Do not use for construction purposes unless certified.

MATERIALS OF CONSTRUCTION			CASING	COVER	IMPELLER	WEAR RING	SHAFT	SHAFT SLEEVE	MECHANICAL SEAL	SEAL FLUSH LINE ASSEMBLY
STANDARD CONSTRUCTION	BRONZE FITTED	125# FLANGE	Cast Iron ASTM A48/A48M-03 Class 30A	Cast Iron ASTM A48/A48M-03 Class 30A	Bronze ASTM B584 ALLOY C83600 or C84400	N/A	Stainless Steel TYPE 416"T ASTM A582	Bronze ASTM B584-98A C92200	Ceramic/EPT	N/A
		250# FLANGE	Ductile Iron ASTM A536-84 Grade 65-45-12	Cast Iron ASTM A48/A48M-03 Class 30A	Bronze ASTM B584 ALLOY C83600 or C84400	N/A	Stainless Steel TYPE 416"T ASTM A582	Bronze ASTM B584-98A C92200	Ceramic/EPT	N/A
OPTIONAL		125# OR 250#	N/A	N/A	Stainless Steel ASTM A351/A 351M-08	Bronze ASTM B584-98A C92200	N/A	Stainless Steel TYPE 303 ASTM A276	Tyngsten Carbide /EPT or Silicon-Carbide/EPT	Copper & Brass C3600
STANDARD CONSTRUCTION	NSF 61	125# FLANGE	Cast Iron ASTM A48/A48M-03 Class 30A	Cast Iron ASTM A48/A48M-03 Class 30A	Stainless Steel ASTM A351/A 351M-08	N/A	Stainless Steel TYPE 416"T" ASTM A582	Bronze ASTM B584-98A C92200	Ceramic/EPT	Copper & Brass C3600
		250# FLANGE	Ductile Iron ASTM A536-84 Grade: 65-45-12	Cast Iron ASTM A48/A48M-03 Class 30A	Stainless Steel ASTM A351/A 351M-08	N/A	Stainless Steel TYPE 416"T" ASTM A582	Bronze ASTM B584-98A C92200	Ceramic/EPT	Copper & Brass C3600
OPTIONAL		125# OR 250#	N/A	N/A	N/A	Bronze ASTM B584-98A C92200	N/A	N/A	N/A	N/A

N/A - Not Available

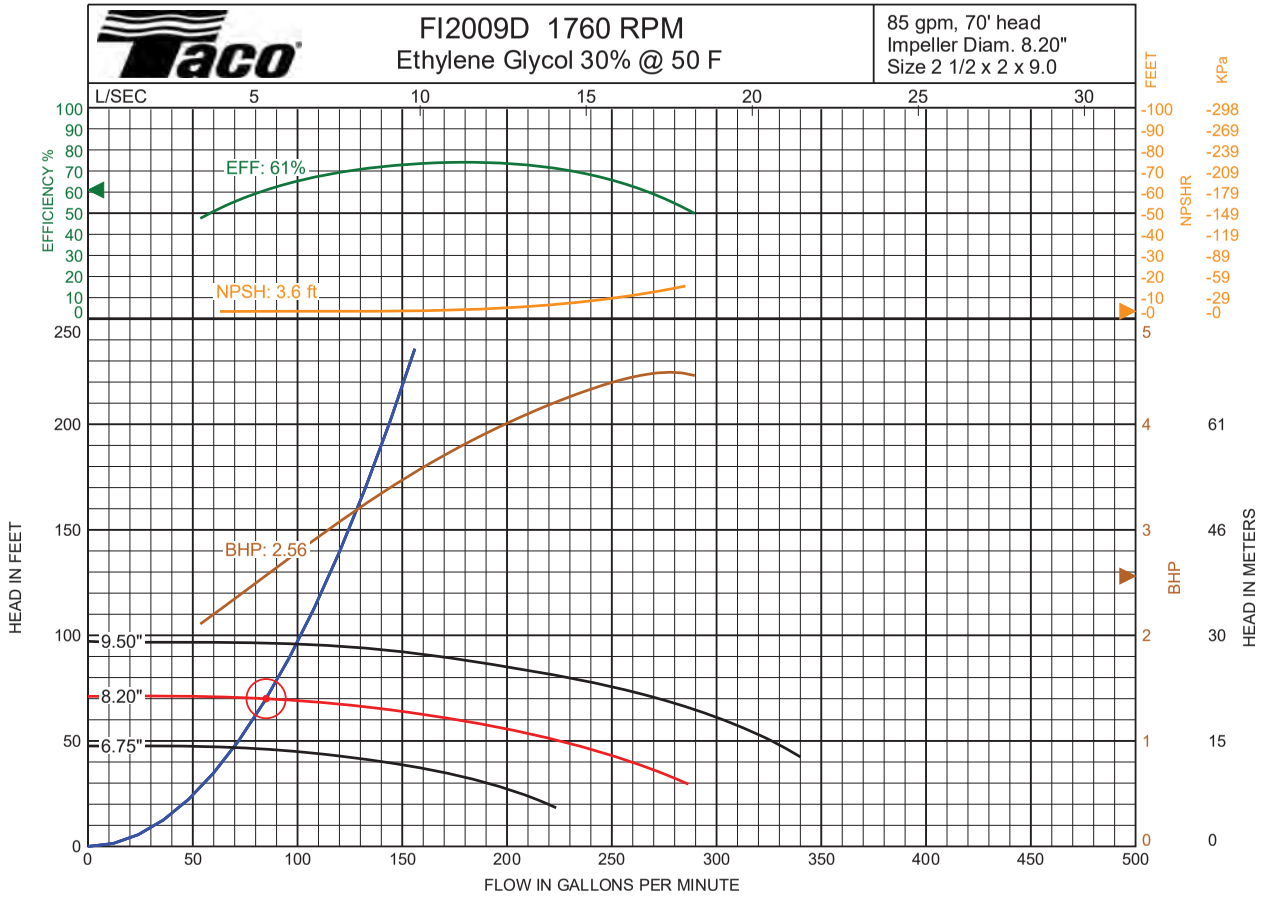


COMMENTS

Base-mounted end suction Pumps Model: FI2009D

Tag:
VzjWP-1,2

Flow Rate (GPM):	85
Head (FT):	70
Working Fluid:	Ethylene Glycol 30% @ 50 F
Efficiency (%):	61%
Construction:	Iron
Design Hp:	2.56
Nol Hp:	4.49
Motor Hp:	5.00
Npsh (Ft):	4
RPM:	1760
Imp Dia:	8.20
Volt/Ph/Hz:	208/3/60
Notes:	



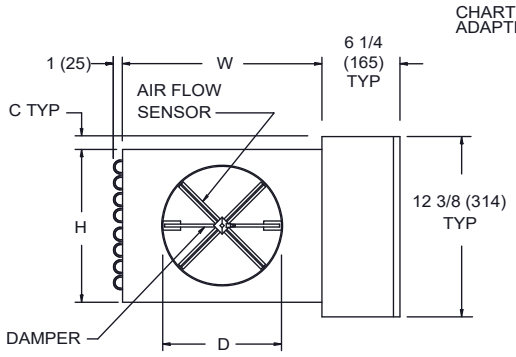
KRUEGER

JOB NAME
ENGINEER
CONTRACTOR
TAG

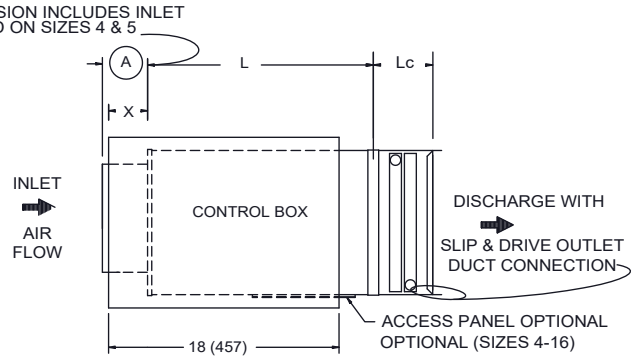
LMHS

HOT WATER HEAT
DIGITAL CONTROLS

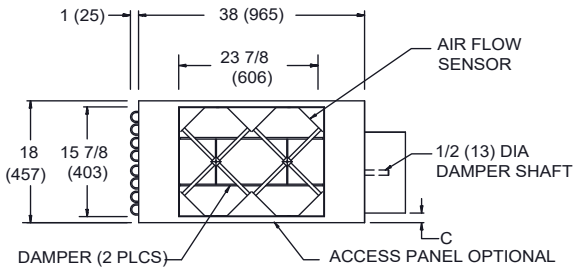
SUBMITTAL SHEET



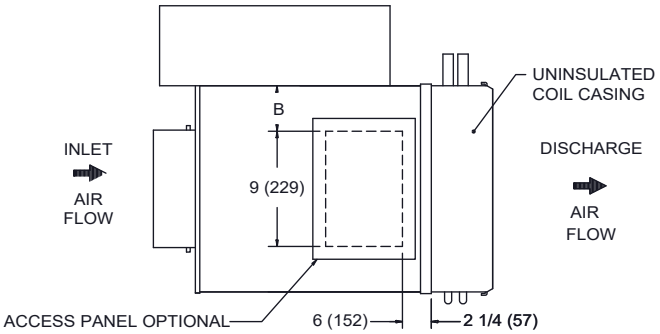
INLET VIEW - SIZES 4-16



SIDE VIEW



INLET VIEW - SIZE 22



BOTTOM VIEW

STANDARD FEATURES:

- 22 Ga. Zinc coated steel construction.
- **NEMA 1** steel control enclosure for electronic components
- 1/2" thick dual density fiberglass insulation meeting **NFPA 90A** and **UL 181** safety requirements.
- Four quadrant averaging cross flow sensor
- Hot water coils. See form TS0005 for dimensions and specifications
- Variety of analog and digital control packages for pressure independent systems.
- **AHRI** certified sound ratings

NOTE: Right hand configuration shown, left hand available.

DIMENSIONS ARE GIVEN AS INCHES (MM)

OPTIONAL FEATURES:

☐ 20 Ga. Zinc coated steel construction
☐ Liners:
- ☐ 1/2" dual density fiberglass
- ☐ 1" dual density fiberglass
- ☐ Perforated double wall 1/2"
- ☐ Perforated double wall 1"
- ☐ 1/2" Cellular - fibre free
- ☐ None
- ☐ Steriliner
- ☐ Sterilwall 1/2"
- ☐ Sterilwall 1"
- ☐ 1" Cellular - fibre free

☐ Linear averaging sensor.
☐ Disconnect switch for electronic controls
☐ 24 volt transformer.
☐ Left hand controls.
☐ Left hand water coil connection
☐ Dust tight control enclosure
☐ Right Hand Controls
☐ Right Hand Water Coil Connection
☐ Hanger Brackets
☐ Bottom access panel (not available in size 22)
☐ Cam lock bottom access panel (not available in size 22)

INLET SIZE	NOM MAX CFM (L/s)	L	W	H	A	B	C	D	X
4	230 (109)	15 1/2 (394)	12 (305)	8 (203)	5 3/8 (136)	1 1/2 (38)	2 1/8 (54)	3 7/8 (98)	7 1/4 (184)
5	360 (170)	15 1/2 (394)	12 (305)	8 (203)	5 3/8 (136)	1 1/2 (38)	2 1/8 (54)	4 7/8 (124)	7 1/4 (184)
6	520 (245)	15 1/2 (394)	12 (305)	8 (203)	3 3/8 (86)	1 1/2 (38)	2 1/8 (54)	5 7/8 (149)	7 1/4 (184)
7	710 (335)	15 1/2 (394)	12 (305)	10 (254)	3 3/8 (86)	1 1/2 (38)	1 1/8 (29)	6 7/8 (175)	7 1/4 (184)
8	925 (437)	15 1/2 (394)	12 (305)	10 (254)	3 3/8 (86)	1 1/2 (38)	1 1/8 (29)	7 7/8 (200)	7 1/4 (184)
9	1200 (566)	15 1/2 (394)	14 (356)	12 1/2 (318)	3 3/8 (86)	2 1/2 (64)	-	8 7/8 (225)	5 1/4 (133)
10	1450 (685)	15 1/2 (394)	14 (356)	12 1/2 (318)	3 3/8 (86)	2 1/2 (64)	-	9 7/8 (251)	5 1/4 (133)
12	2100 (991)	15 1/2 (394)	16 (406)	15 (381)	3 3/8 (86)	3 1/2 (89)	-	11 7/8 (302)	5 1/4 (133)
14	2900 (1369)	15 1/2 (394)	20 (508)	17 1/2 (445)	3 3/8 (86)	5 1/2 (140)	-	13 7/8 (352)	3 1/4 (83)
16	3700 (1746)	15 1/2 (394)	24 (610)	18 (457)	3 3/8 (86)	7 1/2 (191)	-	15 7/8 (403)	3 1/4 (83)
22	7100 (3351)	15 (381)	38 (965)	18 (457)	4 1/4 (108)	NA	1 1/8 (29)	SEE ABOVE	5 1/4 (133)

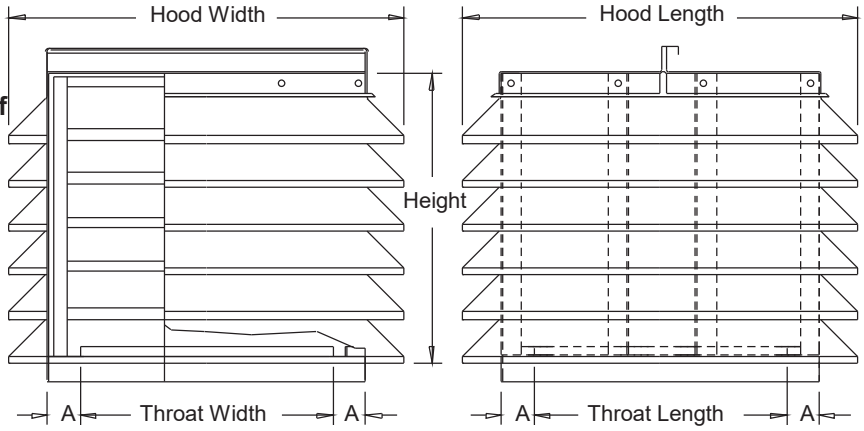
Product Information is Subject to Change Without Notice

MARK: LP-1	Page 135
PROJECT: HAFB SWEG BLDG FANS	
DATE: 4/11/2022	

TRE

Extruded Relief or Intake Ventilator

STANDARD CONSTRUCTION FEATURES:
Heavy gauge all aluminum construction - Birdscreen - Solid welded and mitered tier corners with a built in rain catch on each tier - Built in water trough - Welded curb cap corners - Anti-condensate coating on underneath side of topcap - Five year warranty.



Performance (Intake)

Qty	Catalog Number	Flow (CFM)	SP (inwc)	Face Velocity (mph)	Installation
1	26X72X8TRE	12000	.153	5.33	Ducted

Altitude (ft): 4500 Temperature (F): 70

Accessories:
BDI 25.75 X 71.75 (CURB MOUNTED)
ROOF CURB RCG 30X 76-13.5H W/TRAY
BURGLAR BARS-CURB
ALUMINUM BIRDSCREEN

Dimensions (inches)

Throat Width	26
Throat Length	72
Hood Width	37.75
Hood Length	83.75
Height	30
A	2.75
Free Area(Sq.ft)	25.56

NOTE: Accessories may affect dimensions shown.

Weight(lbs)***	Shipping	556	Unit	C/F

***Includes accessories.

COOK

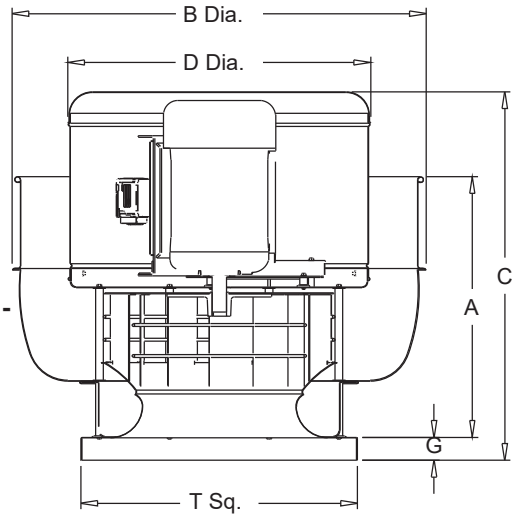
MARK: RAF-1, 2	Page 136
PROJECT: HAFB SWEG BLDG FANS	
DATE: 4/11/2022	

ACRUD-HP VF

Upblast Centrifugal Exhaust Ventilator Roof Mounted/Direct Drive Electronically Commutated Vari-Flow® Motor

STANDARD CONSTRUCTION FEATURES:

All aluminum housing - Backward inclined all aluminum wheel - Two piece top cap with stainless steel quick release latches - (size 120 - 300) - Welded curb cap corners - Birdscreen - Permanently lubricated ball bearing motors - Corrosion resistant fasteners - Transit tested packaging.



Performance

Qty	Catalog Number	Flow (CFM)	SP (inwc)	Fan RPM	Power (HP)	FEG	FEI	Speed Control
2	210RH17D (VF2)	6000	.300	1510	1.78	60	.68	EC

Altitude (ft): 4800 Temperature (F): 70

Motor/Controller Information

HP	RPM*	Volts/Ph/Hz	Enclosure	FLA	VFD Rated
3	1725	460/3/60	TEFC -PM	4.8	Yes

FLA based on NEC (2017) Table 430.250
*Motor programmed to max speed of 1797 RPM.

Sound Data Inlet Sound Power by Octave Band

1	2	3	4	5	6	7	8	LwA	dBA	Sones
80	85	87	87	80	77	76	71	87	76	25

Accessories:

FAN MOUNTED SPEED CONTROL
DISCONNECT NEMA 1 PRE-WIRED

Dimensions (inches)

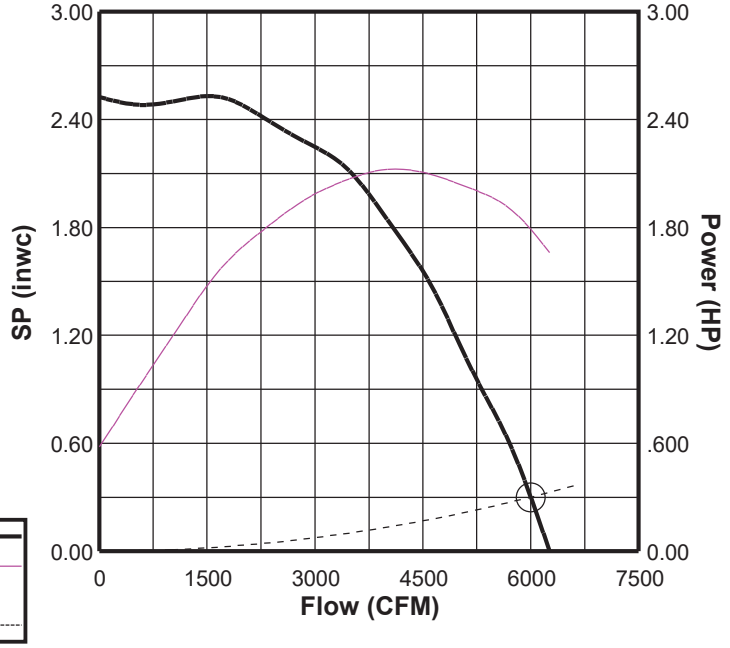
A	25-15/16
B	45-1/4
C	35-3/8
D	29-7/8
G	3
T Sq.	30
Roof Open. Sq.*	25-1/2

NOTE: Accessories may affect dimensions shown.

Weight(lbs)***	Shipping	304	Unit	175

* Roof opening size for curbs supplied by Cook only.
***Includes fan, motor & accessories.

Fan Curve



Fan Curve Legend

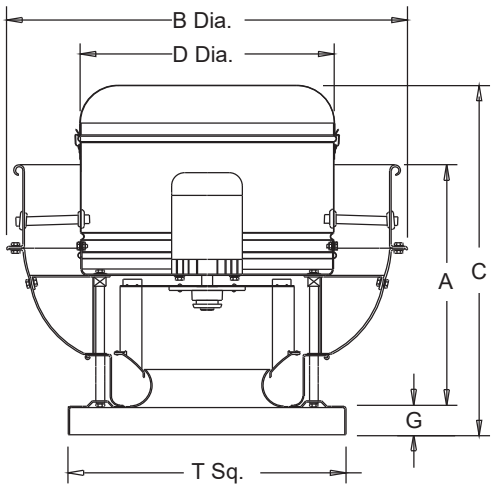
CFM vs SP	———
CFM vs HP	———
Point of Operation	◯
System Curve	- - - - -

COOK

MARK: REF-1	Page 137
PROJECT: HAFB SWEG BLDG FANS	
DATE: 4/11/2022	

ACRUH-EC

Upblast Centrifugal Exhaust Ventilator Electronically Commutated Vari-Flow® Motor Roof Mounted/Direct Drive



STANDARD CONSTRUCTION FEATURES:

All aluminum housing - Backward inclined all aluminum wheel - Two piece top cap with stainless steel quick release latches - (size 101 - 150) - Welded curb cap corners - Birdscreen - Permanently lubricated ball bearing electronically commutated motor - Corrosion resistant fasteners - Transit tested packaging.

Performance

Qty	Catalog Number	Flow (CFM)	SP (inwc)	Fan RPM	Input Watts	FEG	FEI	Speed Control
1	150RH17DEC	600	.800	1271	150	n/a(<1HP)	2.02	EC

Altitude (ft): 4800 Temperature (F): 70

Motor Information

HP	RPM	Volts/Ph/Hz	Enclosure
1/2	1725	115/1/60	OPEN -EC

Vari-Flow

Sound Data Inlet Sound Power by Octave Band

1	2	3	4	5	6	7	8	LwA	dBA	Sones
78	68	65	60	60	62	56	50	67	55	8.2

Accessories:

FAN MOUNTED SPEED CONTROL

Dimensions (inches)

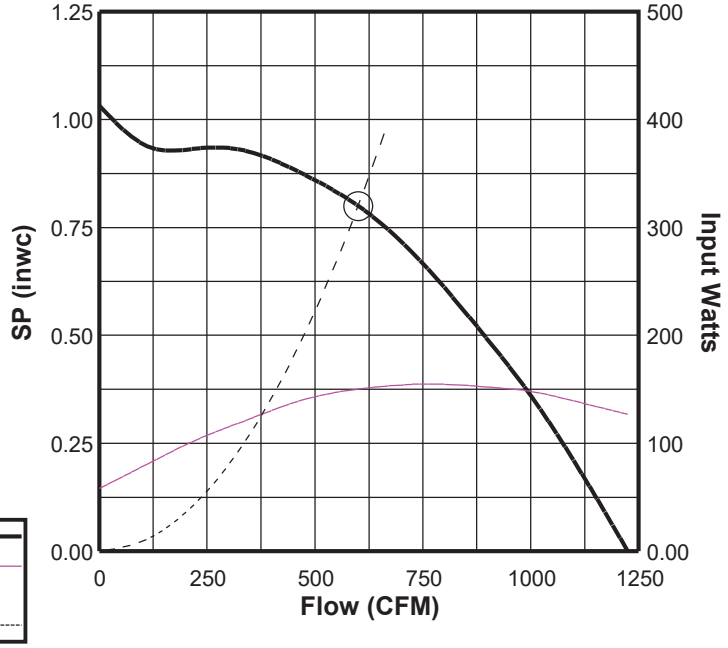
A	20-15/16
B	34-11/16
C	27-1/2
D	23-13/16
G	2
T Sq.	24
Roof Open. Sq.*	19-1/2

NOTE: Accessories may affect dimensions shown.

Weight(lbs)***	Shipping	68	Unit	43

* Roof opening size for curbs supplied by Cook only.
***Includes fan, motor & accessories.

Fan Curve



Fan Curve Legend

CFM vs SP	———
CFM vs Watts	———
Point of Operation	◯
System Curve	- - - - -



Performance™ High Wall Indoor Unit

FEATURES

- Available in 115V and 208/230V
- Modes: Cool, Heat, Dry, Fan, Auto
- Turbo Mode
- Four fan speeds
- Sleep Mode
- Up-down louver control (fixed or swing)
- *Follow Me* (senses temperature at handheld remote)
- Heating Setback (46° F Heating Mode)
- Quiet indoor operation, as low as 27 dB(A)
- Anti-corrosive fin coating

COMPATIBLE WITH:

- 38MA*R Outdoor Unit Single Zone
- 38MGR Outdoor Unit Multi-zone

Performance SERIES

Sizes: 09 / 12 / 18 / 24 / 30 / 36

KEY FEATURES

Follow Me
Temperature sensor built in the remote controller will sense its surrounding temperature. The unit will adjust the room temperature more accurately to give you comfort.

CONTROLS

Wireless Remote Controller included with indoor unit

Wired Remote Controller KSACN0101AAA (Timer Function) (Optional)

Wired Remote Controller KSACN0401AAA (7-Day Programmable) (Optional)*



Standard Wired Controller (Timer Function) KSACN0101AAA



Optional Wired Controller (7-Day Programmable) KSACN0401AAA



Wireless Remote Controller

ACCESSORIES

Wi-Fi® Smartphone control kit KSAIF0301AAA

24V Interface for third-party thermostat compatibility KSAIC0301230**

*7-Day Programmable compatible with indoor units starting with Serial Number 0216V10001.
**Compatible with indoor units starting with Serial Number 4216V10001.

Carrier

SPECIFICATIONS:

40MAQ High Wall								
Heat Pump								
System								
Size		12	9	12	18	24	30	36
Indoor Model		40MAQB12B--1	40MAQB09B--3	40MAQB12B--3	40MAQB18B--3	40MAQB24B--3	40MAQB30B--3	40MAQB36B--3
Electrical								
Voltage, Phase, Cycle	V/Ph/Hz	115-1-60	208/230-1-60	208/230-1-60	208/230-1-60	208/230-1-60	208/230-1-60	208/230-1-60
Power Supply		Indoor unit powered from outdoor unit						
MCA	A	0.4	0.2	0.2	0.27	0.4	0.4	0.4
Controls								
Wireless Remote Controller (° F / ° C Convertible)		Standard	Standard	Standard	Standard	Standard	Standard	Standard
Wired Remote Controller (° F / ° C Convertible)		Optional	Optional	Optional	Optional	Optional	Optional	Optional
Operating Range								
Cooling Outdoor DB Min - Max	° F (° C)	63~86 (17~30)	63~86 (17~30)	63~86 (17~30)	63~86 (17~30)	63~86 (17~30)	63~86 (17~30)	63~86 (17~30)
Heating Outdoor DB Min - Max	° F (° C)	32~86 (0~30)	32~86 (0~30)	32~86 (0 ~ 30)	32~86 (0~30)	32~86 (0~30)	32~86 (0~30)	32~86 (0~30)
Piping								
Pipe Connection Size - Liquid	in (mm)	1/4 (6.35)	1/4 (6.35)	1/4 (6.35)	1/4 (6.35)	3/8 (9.52)	3/8 (9.52)	3/8 (9.52)
Pipe Connection Size - Suction	in (mm)	1/2 (12.7)	3/8 (9.52)	1/2 (12.7)	1/2 (12.7)	5/8 (16)	5/8 (16)	5/8 (16)
Indoor								
Unit Width	in (mm)	32.87 (835)	32.87 (835)	32.87 (835)	38.98 (990)	46.69 (1,186)	46.69 (1,186)	46.69 (1,186)
Unit Height	in (mm)	11.02 (280)	11.02 (280)	11.02 (280)	12.40 (315)	13.39 (343)	13.39 (343)	13.39 (343)
Unit Depth	in (mm)	7.80 (198)	7.80 (198)	7.80 (198)	8.58 (218)	10.16 (258)	10.16 (258)	10.16 (258)
Net Weight	lb (kg)	19.18 (8.7)	19.18 (8.7)	19.18 (8.7)	26.46 (12.0)	40.12 (18.2)	40.12 (18.2)	40.12 (18.2)
Number of Fan Speeds		4	4	4	4	4	4	4
Airflow (lowest to highest)	cfm	210/300/360/380	210/290/360/380	210/300/360/380	310/450/650/680	520/620/780/870	520/620/780/870	520/620/780/870
Sound Pressure (lowest to highest)	dB(A)	27/34/42	27/34/42	27/34/42	33/40/46	39/45/50	39/45/50	39/45/50
Air Throw Data	ft (m)	23 (7)	23 (7)	23 (7)	30 (9)	36 (11)	36 (11)	36 (11)
Moisture Removal	Pint/h (L/h)	2.8 (1.3)	1.1 (0.5)	2.3 (1.1)	3.8 (1.8)	5.4 (2.6)	8.1 (3.9)	11.7 (5.6)
Field Drain Pipe Size O.D.	in (mm)	0.625 (16)	0.625 (16)	0.625 (16)	0.625 (16)	0.625 (16)	0.625 (16)	0.625 (16)

Performance may vary based on the compatible outdoor units. See respective pages for performance data.

COMPATIBILITY:

Indoor Unit	40MAQB12B--1	40MAQB09B--3	40MAQB12B--3	40MAQB18B--3	40MAQB24B--3	40MAQB30B--3	40MAQB36B--3
Outdoor Unit Single Zone	38MAQB12R--1	38MAQB09R--3	38MAQB12R--3	38MAQB18R--3	38MAQB24R--3	38MAQB30R--3	38MAQB36R--3
Outdoor Unit Multi-Zone		38MGRQ18B--3					
		38MGRQ24C--3					
		38MGRQ30D--3					
		38MGRQ36D--3					
		38MGRQ48E--3					

Backward compatible with 38MAQ Single Zone and 38MGQ Multi-zone Systems

Visit our website at **carrierductless.com**

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01-DLS-015-01 07/2020



Performance™ Heat Pump with Basepan Heater

FEATURES OUTDOOR

- 100% heating capacity at 5° F (–15° C) Sizes 9 – 24 (208/230V)
- Available in 115V and 208/230V
- Built-in basepan heater
- Auto-restart function
- Condenser high-temperature protection
- Refrigerant leakage detection
- Quiet outdoor operation, as low as 52.5 dB(A)
- Anti-corrosive fin coating
- Piping length 82 ~ 164 ft. (25 ~ 50 m.)
- Cooling operating range -13° ~ 122° F (-25° ~ 50° C)
- Heating operating range -22° ~ 86°F (-30° ~ 30° C) – Sizes 9–24 (208/230V) -13° ~ 86° F (-25° ~ 30° C) – Size 12 (115V) and 30, 36 (208/230V)

COMPATIBLE WITH

- 40MAQ High Wall
- 40MBCQ Cassette
- 40MBDQ Ducted
- 40MBFQ Console
- FMA4X Fan Coil
- FMC-FMU Fan Coil
- FV4C Fan Coil

Performance SERIES

Heat Pump With Basepan Heater

Inverter Compressor

Up to 25 SEER

Up to 12 HSPF

Sizes: 09 / 12 / 18 / 24 / 30 / 36

KEY FEATURES

Extra-Low Temperature Heating
Heat output up to 69% of rated capacity down to -22° F (-30° C), so when it's cold outside, it will be warm inside, making this a primary heat source and eliminating the need for a backup heat source.

Rapid Cooling and Heating
After startup, the compressor quickly gets up to maximum speed, cooling or heating the room in minutes.



High Wall



Cassette



Ducted



Floor Console Size 12



Console Size 18–58



Vertical Fan Coil FMA4X



Horizontal Fan Coil FMC/FMU



Fan Coil FV4C

Carrier

PERFORMANCE™ SERIES
38MA*R OUTDOOR UNITS

SPECIFICATIONS:

38MA*R Outdoor Unit								
Heat Pump								
System								
Size		12	9	12	18	24	30	36
Outdoor Model		38MAQB12R--1	38MAQB09R--3	38MAQB12R--3	38MAQB18R--3	38MAQB24R--3	38MAQB30R--3	38MAQB36R--3
Electrical								
Voltage, Phase, Cycle	V/Ph/Hz	115-1-60	208/230-1-60	208/230-1-60	208/230-1-60	208/230-1-60	208/230-1-60	208/230-1-60
MCA	A	15	9	9	18	20	20	25
MOCP – Fuse Rating	A	20	15	15	25	30	30	35
Operating Range								
Cooling Outdoor DB Min - Max	° F (° C)	-13~122 (-25~50)	-13~122 (-25~50)	-13~122 (-25~50)	-13~122 (-25~50)	-13~122 (-25~50)	-13~122 (-25~50)	-13~122 (-25~50)
Heating Outdoor DB Min - Max	° F (° C)	-13~86 (-25~30)	-22~86 (-30~30)	-22~86 (-30~30)	-22~86 (-30~30)	-22~86 (-30~30)	-13~86 (-25~30)	-13~86 (-25~30)
Piping								
Total Piping Length	ft (m)	82 (25)	82 (25)	82 (25)	98 (30)	164 (50)	164 (50)	164 (50)
Piping Lift*	ft (m)	32 (10)	32 (10)	32 (10)	65 (20)	65 (20)	82 (25)	82 (25)
Pipe Connection Size - Liquid	in (mm)	1/4 (6.35)	1/4 (6.35)	1/4 (6.35)	1/4 (6.35)	3/8 (9.52)	3/8 (9.52)	3/8 (9.52)
Pipe Connection Size - Suction	in (mm)	1/2 (12.7)	3/8 (9.52)	1/2 (12.7)	1/2 (12.7)	5/8 (16)	5/8 (16)	5/8 (16)
Refrigerant								
Type		R410A	R410A	R410A	R410A	R410A	R410A	R410A
Charge	lb (kg)	2.76 (1.25)	3.31 (1.5)	3.31 (1.5)	4.30 (1.95)	5.73 (2.60)	6.06 (2.75)	7.50 (3.40)
Compressor								
Type		Rotary Inverter	Rotary Inverter	Rotary Inverter	Rotary Inverter	Rotary Inverter	Rotary Inverter	Rotary Inverter
Outdoor								
Unit Width	in (mm)	32.09 (815)	32.09 (815)	32.09 (815)	33.66 (855)	37.24 (946)	37.24 (946)	37.24 (946)
Unit Height	in (mm)	21.81 (554)	21.81 (554)	21.81 (554)	27.63 (702)	31.89 (810)	31.89 (810)	31.89 (810)
Unit Depth	in (mm)	13.11 (333)	13.11 (333)	13.11 (333)	14.17 (360)	16.14 (410)	16.14 (410)	16.14 (410)
Net Weight	lb (kg)	82.9 (37.6)	91.5 (41.5)	91.5 (41.5)	118.2 (53.6)	145.5 (66)	139.8 (63.4)	147.3 (66.8)
Airflow	cfm	1,200	1,200	1,200	1,390	2,130	2,130	2,130
Sound Pressure	dB(A)	52.5	55.5	56.0	57.5	60.5	60.5	60.5

*Condensing unit above or below indoor unit.

COMPATIBILITY:

Indoor Unit		Outdoor Unit						
		38MAQB12R--1	38MAQB09R--3	38MAQB12R--3	38MAQB18R--3	38MAQB24R--3	38MAQB30R--3	38MAQB36R--3
High Wall	40MAQB12B--1	•						
	40MAQB09B--3		•					
	40MAQB12B--3			•				
	40MAQB18B--3				•			
	40MAQB24B--3					•		
	40MAQB30B--3						•	
	40MAQB36B--3							•
Cassette	40MBCQ09---3		•					
	40MBCQ12---3			•				
	40MBCQ18---3				•			
	40MBCQ24---3					•		
	40MBCQ36---3							
	40MBCQ48---3							
Ducted	40MBDQ09---3		•					
	40MBDQ12---3			•				
	40MBDQ18---3				•			
	40MBDQ24---3					•		
	40MBDQ36---3							
	40MBDQ48---3							
	40MBDQ58---3							
Console	40MBFQ12---3			•				
	40MBFQ18---3				•			
	40MBFQ24---3					•		
	40MBFQ36---3							
	40MBFQ48---3							
	40MBFQ58---3							
Vertical Fan Coil	FMA4X1800AL			•	•			
	FMA4X2400AL					•		
	FMA4X3000AL						•	
	FMA4X3600AL							•
Horizontal Fan Coil	FM(C,U)4Z1800AL			•	•			
	FM(C,U)4Z2400AL					•		
	FM(C,U)4Z3000AL						•	
	FM(C,U)4Z3600AL							•
FV4C Fan Coil	FV4CNF002L			•	•	•		
	FV4CN(B,F)003L						•	•

Cassette, Ducted and Console indoor units sizes 36, 48 and 58 ONLY compatible with 38MBR Outdoor Unit.

Carrier

PERFORMANCE:

40MAQ High Wall								
Indoor Model		40MAQB12B--1	40MAQB09B--3	40MAQB12B--3	40MAQB18B--3	40MAQB24B--3	40MAQB30B--3	40MAQB36B--3
ENERGY STAR®		YES	YES	YES	YES	YES	NO	NO
Cooling System Tons		1.0	0.75	1.0	1.4	2.0	2.5	3.0
Cooling Rated Capacity	Btu/h	12,000	9,000	12,000	17,000	24,000	30,000	36,000
Cooling Cap. Range Min - Max	Btu/h	4,000~13,000	3,500~13,000	4,000~13,800	4,500~18,800	5,500~24,500	8,000~30,500	8,000~36,200
SEER		22.0	25.0	22.5	20.0	20.5	19.8	16.0
EER		13	14.5	13	12.5	13	11.5	8.6
Heating Rated Capacity (47° F)	Btu/h	12,000	10,900	12,000	18,000	24,000	30,000	36,000
Heating Rated Capacity (17° F)	Btu/h	7,600	6,900	7,800	10,800	15,400	18,500	21,000
Heating Maximum Capacity (17° F)	Btu/h	7,600	10,900	12,000	18,000	24,000	18,500	21,000
Heating Maximum Capacity (5° F)	Btu/h	6,490	10,900	12,000	18,000	24,000	16,380	16,380
Heating Maximum Capacity (-13° F)	Btu/h	3,800	9,020	9,020	16,520	16,520	14,320	14,320
Heating Cap. Range Min - Max	Btu/h	5,000~13,500	4,500~14,500	5,000~15,500	5,500~24,000	6,000~32,000	9,000~34,000	9,000~37,000
HSPF		10.2	11.2	12.0	10.3	11.5	9.4	8.5
COP (47° F)	W/W	3.40	3.80	3.56	3.14	3.10	2.60	2.56
COP (17° F)	W/W	2.60	2.74	2.64	2.64	2.64	2.16	2.12
COP (5° F)	W/W	2.03	2.12	2.12	1.75	1.88	2.20	1.50

PERFORMANCE:

40MBCQ Cassette					
Indoor Model		40MBCQ09---3	40MBCQ12---3	40MBCQ18---3	40MBCQ24---3
ENERGY STAR®		YES	YES	YES	NO
Cooling System Tons		0.75	1.0	1.3	2.0
Cooling Rated Capacity	Btu/h	9,000	12,000	16,000	24,000
Cooling Cap. Range Min - Max	Btu/h	3,500~11,000	4,000~13,000	4,500~18,000	8,500~26,500
SEER		20.0	19.5	20.0	20.0
EER		13.0	12.5	12.5	11.0
Heating Rated Capacity (47° F)	Btu/h	10,000	12,000	18,000	24,000
Heating Rated Capacity (17° F)	Btu/h	6,700	8,700	12,000	16,200
Heating Maximum Capacity (17° F)	Btu/h	9,000	12,000	18,000	24,000
Heating Maximum Capacity (5° F)	Btu/h	9,000	12,000	18,000	24,000
Heating Maximum Capacity (-13° F)	Btu/h	7,320	7,540	12,590	18,500
Heating Cap. Range Min - Max	Btu/h	4,500~11,500	5,000~13,500	5,500~19,000	13,200~32,000
HSPF		10.8	10.6	10.5	11.5
COP (47° F)	W/W	3.30	3.67	3.43	3.46
COP (17° F)	W/W	2.37	2.40	2.55	2.73
COP (5° F)	W/W	1.83	1.84	2.07	1.88

PERFORMANCE:

40MBDQ Ducted					
Indoor Model		40MBDQ09---3	40MBDQ12---3	40MBDQ18---3	40MBDQ24---3
ENERGY STAR®		YES	YES	YES	YES
Cooling System Tons		0.75	1.0	1.4	2.0
Cooling Rated Capacity	Btu/h	9,000	12,000	16,500	24,000
Cooling Cap. Range Min - Max	Btu/h	3,500~12,000	4,000~12,900	4,500~18,000	5,500~24,500
SEER		23.0	20.5	19.6	20.5
EER		13.5	12.5	12.5	12.5
Heating Rated Capacity (47° F)	Btu/h	10,000	12,000	19,000	24,000
Heating Rated Capacity (17° F)	Btu/h	7,200	8,500	13,400	17,200
Heating Maximum Capacity (17° F)	Btu/h	10,000	13,000	20,200	25,400
Heating Maximum Capacity (5° F)	Btu/h	10,000	12,000	19,000	24,000
Heating Maximum Capacity (–13° F)	Btu/h	8,350	8,560	12,510	16,520
Heating Cap. Range Min - Max	Btu/h	4,000~15,000	4,500~15,700	5,500~19,000	6,000~26,000
HSPF		12.0	11.0	11.0	12.5
COP (47°F)	W/W	3.60	3.30	2.93	3.82
COP (17°F)	W/W	2.92	2.36	2.71	2.56
COP (5°F)	W/W	1.91	1.79	1.75	1.83

PERFORMANCE:

40MBFQ Console				
Indoor Model		40MBFQ12---3	40MBFQ18---3	40MBFQ24---3
ENERGY STAR®		YES	YES	NO
Cooling System Tons		1.0	1.4	2.0
Cooling Rated Capacity	Btu/h	12,000	17,000	24,000
Cooling Cap. Range Min - Max	Btu/h	4,000~13,000	6,830~19,800	8,000~28,150
SEER		19.4	19.9	20.0
EER		12.5	12.5	11.5
Heating Rated Capacity (47° F)	Btu/h	12,000	18,000	24,000
Heating Rated Capacity (17° F)	Btu/h	9,600	13,400	17,200
Heating Maximum Capacity (17° F)	Btu/h	12,000	21,500	26,600
Heating Maximum Capacity (5° F)	Btu/h	12,000	21,300	26,560
Heating Maximum Capacity (–13° F)	Btu/h	8,150	15,670	18,540
Heating Cap. Range Min - Max	Btu/h	5,000~13,500	12,900~29,000	20,500~36,750
HSPF		10.5	10.6	11.5
COP (47° F)	W/W	3.17	3.48	3.52
COP (17° F)	W/W	2.49	2.38	2.82
COP (5° F)	W/W	1.76	1.77	1.81

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01-DLS-008-01 07/2020

Wired Remote Controller
7 Day Programmable

Model: KSACN0701AAA

Submittal Data

Job Data: _____ Location: _____

Buyer: _____ Buyer P.O. #: _____ Carrier #: _____

Unit Number: _____ Model Number: _____

Performance Data Certified By: _____ Date: _____



Features

- LCD Display
- °F/°C Convertible
- Backlight display
- Follow Me default, temperature sensing on the controller
- 4-wire quick connect
- Room temperature display
- Troubleshooting error code display
- Infrared IR receiver built-in
- Clock
- 12 HR format (am/pm)

Functions

- Weekly Schedule 7 day programmable
- Mode: Auto-Cool-Dry-Heat-Fan
- Operation Mode Locking
  - CH Heat Pump
  - CC Cooling Only
  - HH Heating Only
  - NA No Auto Mode
- Fan Speed: Auto/Low/Med/High speed
- Set temperature range limit
- Airflow direction Horizontal and Vertical (on some models)
- Temperature Setting
- Child Lock

Parts included

- Wired Remote Controller
- Installation and owner's manual
- Screws M4X20
- Wall Plugs
- Plastic Screw Bars
- Battery
- Connection Cable 19 ft (6m)

Accessories, Sold Separately

- Additional extension cable 19 ft (6m) available through Replacement Components. **Part Number: 17401204000769**

Compatibility

Cassette, Ducted, Console & Air Handler. Refer to the compatibility charts for specific model numbers.

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Edition Date: 05/2020
Catalog No: SUB-KSACN0701AAA-01

Manufacturer reserves the right to change, at any time, specifications and designs without notice and without obligations.
Replaces: NEW

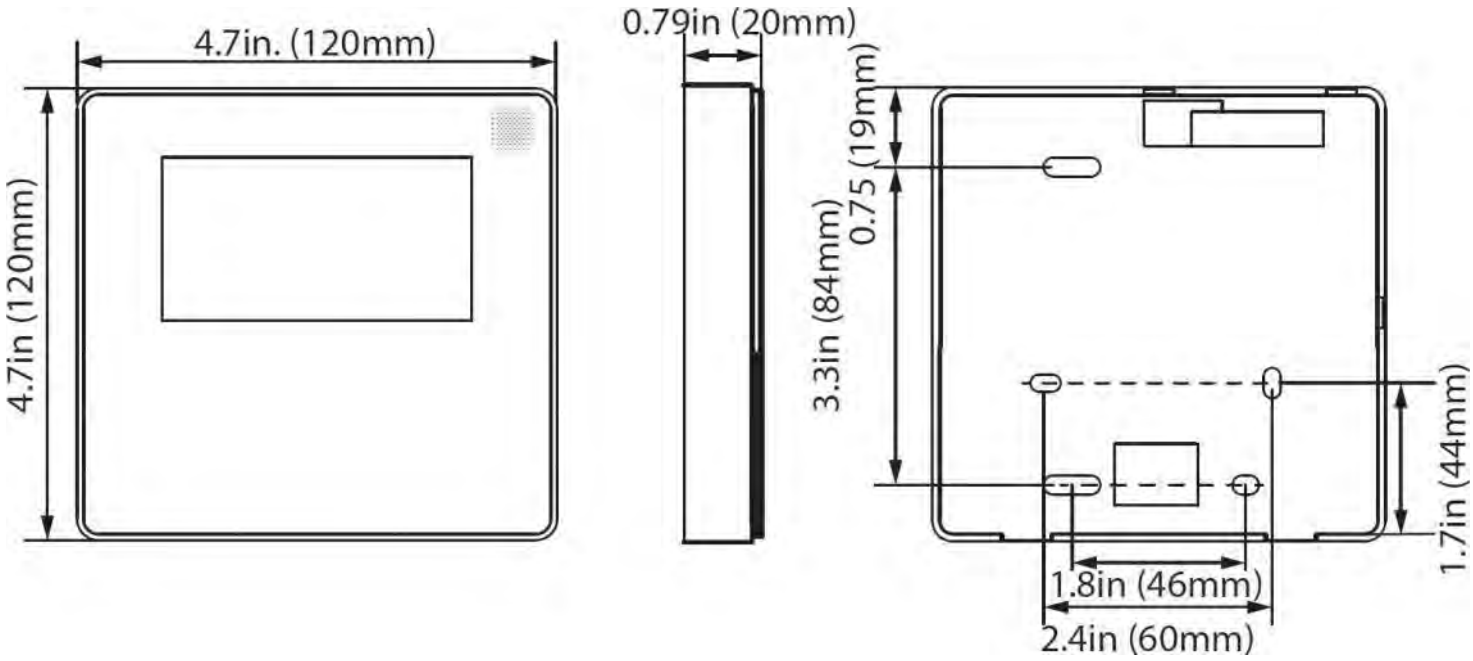
Specifications

Input Voltage	DC 12V
Ambient Temperature	23 ~ 110°F (-5 - 43°C)
Ambient Humidity	40%RH ~ 90%RH

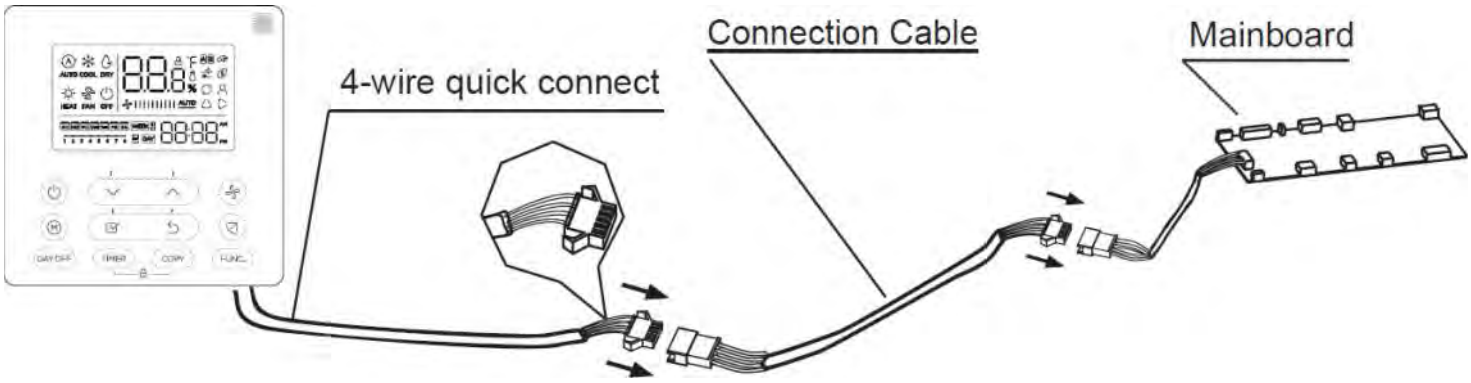
Wiring Specification

Wiring Type	Size	Maximum Length
Sheathed vinyl cord or cable	16 – 18AWG (0.75 – 1.25mm^2)	164ft (50m)

Construction View



Wiring



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Edition Date: 05/2020
Catalog No: SUB-KSACN0701AAA-01

Manufacturer reserves the right to change, at any time, specifications and designs without notice and without obligations.
Replaces: NEW

NIST BLCC 5.3-21: Summary LCC

Consistent with Federal Life Cycle Cost Methodology and Procedures, 10 CFR, Part 436, Subpart A

General Information

File Name:	J:\Project Files\2022 Jobs\22008 - HAFB SWEG Bldg\ENG\MECH\LCCA SWEG.xml
Date of Study:	Thu May 05 10:41:54 MDT 2022
Analysis Type:	FEMP Analysis, Energy Project
Project Name:	SWEG
Project Location:	Utah
Analyst:	Heath Engineering
Base Date:	April 1, 2021
Service Date:	April 1, 2022
Study Period:	40 years 0 months (April 1, 2021 through March 31, 2061)
Discount Rate:	1.5%
Discounting Convention:	End-of-Year

Discount and Escalation Rates are NOMINAL (inclusive of general inflation)

Alternative: AHU

LCC Summary

	Present Value	Annual Value
Initial Cost	$313,640	$10,485
Energy Consumption Costs	$301,505	$10,079
Energy Demand Costs	$0	$0
Energy Utility Rebates	$0	$0
Water Usage Costs	$0	$0
Water Disposal Costs	$0	$0
Annually Recurring OM&R Costs	$341,531	$11,417
Non-Annually Recurring OM&R Costs	$0	$0
Replacement Costs	$379,334	$12,681
Less Remaining Value	$0	$0
Total Life-Cycle Cost	$1,336,009	$44,661

Alternative: VRF

LCC Summary

	Present Value	Annual Value
Initial Cost	$292,535	$9,779
Energy Consumption Costs	$314,902	$10,527
Energy Demand Costs	$0	$0

Energy Utility Rebates	$0	$0
Water Usage Costs	$0	$0
Water Disposal Costs	$0	$0
Annually Recurring OM&R Costs	$384,222	$12,844
Non-Annually Recurring OM&R Costs	$0	$0
Replacement Costs	$443,074	$14,811
Less Remaining Value	$0	$0
Total Life-Cycle Cost	$1,434,733	$47,961

Alternative: Ground Sorce Heat Pump

LCC Summary

	Present Value	Annual Value
Initial Cost	$483,845	$16,174
Energy Consumption Costs	$328,224	$10,972
Energy Demand Costs	$0	$0
Energy Utility Rebates	$0	$0
Water Usage Costs	$0	$0
Water Disposal Costs	$0	$0
Annually Recurring OM&R Costs	$341,531	$11,417
Non-Annually Recurring OM&R Costs	$0	$0
Replacement Costs	$282,264	$9,436
Less Remaining Value	$0	$0
Total Life-Cycle Cost	$1,435,864	$47,999

NIST BLCC 5.3-21: Comparative Analysis

Consistent with Federal Life Cycle Cost Methodology and Procedures, 10 CFR, Part 436, Subpart A

Base Case: AHU

Alternative: Ground Sorce Heat Pump

General Information

File Name:	J:\Project Files\2022 Jobs\22008 - HAFB SWEG Bldg\ENG\MECH\LCCA SWEG.xml
Date of Study:	Thu May 05 10:43:47 MDT 2022
Project Name:	SWEG
Project Location:	Utah
Analysis Type:	FEMP Analysis, Energy Project
Analyst:	Heath Engineering
Base Date:	April 1, 2021
Service Date:	April 1, 2022
Study Period:	40 years 0 months(April 1, 2021 through March 31, 2061)
Discount Rate:	1.5%
Discounting Convention:	End-of-Year

Comparison of Present-Value Costs

PV Life-Cycle Cost

	Base Case	Alternative	Savings from Alternative
Initial Investment Costs:			
Capital Requirements as of Base Date	$313,640	$483,845	-$170,205
Future Costs:			
Energy Consumption Costs	$301,505	$328,224	-$26,719
Energy Demand Charges	$0	$0	$0
Energy Utility Rebates	$0	$0	$0
Water Costs	$0	$0	$0
Recurring and Non-Recurring OM&R Costs	$341,531	$341,531	$0
Capital Replacements	$379,334	$282,264	$97,069
Residual Value at End of Study Period	$0	$0	$0
Subtotal (for Future Cost Items)	$1,022,369	$952,019	$70,350
Total PV Life-Cycle Cost	$1,336,009	$1,435,864	-$99,855

Net Savings from Alternative Compared with Base Case

PV of Non-Investment Savings	-$26,719
- Increased Total Investment	$73,136

Net Savings	-$99,855

NOTE: Meaningful SIR, AIRR and Payback can not be computed unless incremental savings and total savings are both positive.

Energy Savings Summary

Energy Savings Summary (in stated units)

Energy Type	-----Average Annual Consumption----- Base Case	Alternative	Savings	Life-Cycle Savings
Electricity	162,056.0 kWh	165,369.0 kWh	-3,313.0 kWh	-129,200.2 kWh
Natural Gas	2,501.0 Therm	3,345.0 Therm	-844.0 Therm	-32,914.3 Therm

Energy Savings Summary (in MBtu)

Energy Type	-----Average Annual Consumption----- Base Case	Alternative	Savings	Life-Cycle Savings
Electricity	553.0 MBtu	564.3 MBtu	-11.3 MBtu	-440.8 MBtu
Natural Gas	250.1 MBtu	334.5 MBtu	-84.4 MBtu	-3,291.4 MBtu

Emissions Reduction Summary

Energy Type	-----Average Annual Emissions----- Base Case	Alternative	Reduction	Life-Cycle Reduction
Electricity				
CO2	117,472.93 kg	68,077.60 kg	49,395.33 kg	1,926,316.42 kg
SO2	54.84 kg	74.42 kg	-19.58 kg	-763.48 kg
NOx	120.19 kg	453.66 kg	-333.48 kg	-13,004.92 kg
Natural Gas				
CO2	13,210.05 kg	17,667.98 kg	-4,457.93 kg	-173,850.16 kg
SO2	106.61 kg	142.59 kg	-35.98 kg	-1,403.03 kg
NOx	1.85 kg	20.82 kg	-18.98 kg	-740.03 kg
Total:				
CO2	130,682.98 kg	85,745.59 kg	44,937.40 kg	1,752,466.27 kg
SO2	161.45 kg	217.01 kg	-55.55 kg	-2,166.50 kg
NOx	122.03 kg	474.49 kg	-352.45 kg	-13,744.95 kg

NIST BLCC 5.3-21: Comparative Analysis

Consistent with Federal Life Cycle Cost Methodology and Procedures, 10 CFR, Part 436, Subpart A

Base Case: AHU

Alternative: VRF

General Information

File Name:	J:\Project Files\2022 Jobs\22008 - HAFB SWEG Bldg\ENG\MECH\LCCA SWEG.xml
Date of Study:	Thu May 05 10:43:17 MDT 2022
Project Name:	SWEG
Project Location:	Utah
Analysis Type:	FEMP Analysis, Energy Project
Analyst:	Heath Engineering
Base Date:	April 1, 2021
Service Date:	April 1, 2022
Study Period:	40 years 0 months(April 1, 2021 through March 31, 2061)
Discount Rate:	1.5%
Discounting Convention:	End-of-Year

Comparison of Present-Value Costs

PV Life-Cycle Cost

	Base Case	Alternative	Savings from Alternative
Initial Investment Costs:			
Capital Requirements as of Base Date	$313,640	$292,535	$21,105
Future Costs:			
Energy Consumption Costs	$301,505	$314,902	-$13,398
Energy Demand Charges	$0	$0	$0
Energy Utility Rebates	$0	$0	$0
Water Costs	$0	$0	$0
Recurring and Non-Recurring OM&R Costs	$341,531	$384,222	-$42,691
Capital Replacements	$379,334	$443,074	-$63,740
Residual Value at End of Study Period	$0	$0	$0
Subtotal (for Future Cost Items)	$1,022,369	$1,142,198	-$119,829
Total PV Life-Cycle Cost	$1,336,009	$1,434,733	-$98,724

Net Savings from Alternative Compared with Base Case

PV of Non-Investment Savings	-$56,089
- Increased Total Investment	$42,635

Net Savings	-$98,724

NOTE: Meaningful SIR, AIRR and Payback can not be computed unless incremental savings and total savings are both positive.

Energy Savings Summary

Energy Savings Summary (in stated units)

Energy Type	Average Annual Consumption Base Case	Alternative	Savings	Life-Cycle Savings
Electricity	162,056.0 kWh	162,067.0 kWh	-11.0 kWh	-429.0 kWh
Natural Gas	2,501.0 Therm	3,345.0 Therm	-844.0 Therm	-32,914.3 Therm

Energy Savings Summary (in MBtu)

Energy Type	Average Annual Consumption Base Case	Alternative	Savings	Life-Cycle Savings
Electricity	553.0 MBtu	553.0 MBtu	-0.0 MBtu	-1.5 MBtu
Natural Gas	250.1 MBtu	334.5 MBtu	-84.4 MBtu	-3,291.4 MBtu

Emissions Reduction Summary

Energy Type	Average Annual Emissions Base Case	Alternative	Reduction	Life-Cycle Reduction
Electricity				
CO2	117,472.93 kg	66,718.26 kg	50,754.67 kg	1,979,327.78 kg
SO2	54.84 kg	72.93 kg	-18.09 kg	-705.53 kg
NOx	120.19 kg	444.61 kg	-324.42 kg	-12,651.66 kg
Natural Gas				
CO2	13,210.05 kg	17,667.98 kg	-4,457.93 kg	-173,850.16 kg
SO2	106.61 kg	142.59 kg	-35.98 kg	-1,403.03 kg
NOx	1.85 kg	2.47 kg	-0.62 kg	-24.31 kg
Total:				
CO2	130,682.98 kg	84,386.25 kg	46,296.74 kg	1,805,477.63 kg
SO2	161.45 kg	215.52 kg	-54.07 kg	-2,108.55 kg
NOx	122.03 kg	447.08 kg	-325.04 kg	-12,675.97 kg

NIST BLCC 5.3-21: Lowest LCC

Consistent with Federal Life Cycle Cost Methodology and Procedures, 10 CFR, Part 436, Subpart A

General Information

File Name:	J:\Project Files\2022 Jobs\22008 - HAFB SWEG Bldg\ENG\MECH\LCCA SWEG.xml
Date of Study:	Thu May 05 10:42:31 MDT 2022
Analysis Type:	FEMP Analysis, Energy Project
Project Name:	SWEG
Project Location:	Utah
Analyst:	Heath Engineering
Base Date:	April 1, 2021
Service Date:	April 1, 2022
Study Period:	40 years 0 months (April 1, 2021 through March 31, 2061)
Discount Rate:	1.5%
Discounting Convention:	End-of-Year

Lowest LCC

Comparative Present-Value Costs of Alternatives
(Shown in Ascending Order of Initial Cost, * = Lowest LCC)

Alternative	Initial Cost (PV)	Life Cycle Cost (PV)
VRF	$292,535	$1,434,733
AHU	$313,640	$1,336,009 *
Ground Sorce Heat Pump	$483,845	$1,435,864

NIST BLCC 5.3-21: Detailed LCC Analysis

Consistent with Federal Life Cycle Cost Methodology and Procedures, 10 CFR, Part 436, Subpart A

General Information

File Name:	J:\Project Files\2022 Jobs\22008 - HAFB SWEG Bldg\ENG\MECH\LCCA SWEG.xml
Date of Study:	Thu May 05 10:40:04 MDT 2022
Analysis Type:	FEMP Analysis, Energy Project
Project Name:	SWEG
Project Location:	Utah
Analyst:	Heath Engineering
Base Date:	April 1, 2021
Service Date:	April 1, 2022
Study Period:	40 years 0 months (April 1, 2021 through March 31, 2061)
Discount Rate:	1.5%
Discounting Convention:	End-of-Year

Discount and Escalation Rates are NOMINAL (inclusive of general inflation)

Alternative: AHU

Initial Cost Data (not Discounted)

Initial Capital Costs

(adjusted for price escalation)

Initial Capital Costs for All Components: $313,640

Component: AHU
Cost-Phasing

Date	Portion	Yearly Cost
April 1, 2021	100%	$313,640
Total (for Component)		$313,640

Energy Costs: Electricity

(base-year dollars)

Average Annual Usage	Average Price/Unit	Average Annual Cost	Average Annual Demand	Average Annual Rebate
162,056.0 kWh	$0.07000	$11,344	$0	$0

Energy Costs: Natural Gas

(base-year dollars)

Average Annual Usage	Average Price/Unit	Average Annual Cost	Average Annual Demand	Average Annual Rebate
2,501.0 Therm	$0.99935	$2,499	$0	$0

Life-Cycle Cost Analysis

	Present Value	Annual Value
Initial Capital Costs	$313,640	$10,485
Energy Costs		
Energy Consumption Costs	$301,505	$10,079
Energy Demand Charges	$0	$0
Energy Utility Rebates	$0	$0
Subtotal (for Energy):	$301,505	$10,079
Water Usage Costs	$0	$0
Water Disposal Costs	$0	$0
Operating, Maintenance & Repair Costs		
Component: AHU		
Annually Recurring Costs	$341,531	$11,417
Non-Annually Recurring Costs	$0	$0
Subtotal (for OM&R):	$341,531	$11,417
Replacements to Capital Components		
Component: AHU	$379,334	$12,681
Subtotal (for Replacements):	$379,334	$12,681
Residual Value of Original Capital Components		
Component: AHU	$0	$0
Subtotal (for Residual Value):	$0	$0
Residual Value of Capital Replacements		
Component: AHU	$0	$0
Subtotal (for Residual Value):	$0	$0

Total Life-Cycle Cost	$1,336,009	$44,661

Emissions Summary

Energy Name	Annual	Life-Cycle
Electricity:		
CO2	117,472.93 kg	4,581,203.07 kg
SO2	54.84 kg	2,138.75 kg
NOx	120.19 kg	4,687.05 kg
Natural Gas:		
CO2	13,210.05 kg	515,164.98 kg
SO2	106.61 kg	4,157.54 kg
NOx	1.85 kg	72.04 kg
Total:		
CO2	130,682.98 kg	5,096,368.05 kg
SO2	161.45 kg	6,296.29 kg
NOx	122.03 kg	4,759.09 kg

Alternative: VRF

Initial Cost Data (not Discounted)

Initial Capital Costs

(adjusted for price escalation)

Initial Capital Costs for All Components: $292,535

Component: VRF
Cost-Phasing

Date	Portion	Yearly Cost
April 1, 2021	100%	$292,535
	----------	----------
Total (for Component)		$292,535

Energy Costs: Natural Gas

(base-year dollars)

Average Annual Usage	Average Price/Unit	Average Annual Cost	Average Annual Demand	Average Annual Rebate
3,345.0 Therm	$0.99935	$3,343	$0	$0

Energy Costs: Electricity

(base-year dollars)

Average Annual Usage	Average Price/Unit	Average Annual Cost	Average Annual Demand	Average Annual Rebate

162,067.0 kWh	$0.07000	$11,345	$0	$0

Life-Cycle Cost Analysis

	Present Value	Annual Value
Initial Capital Costs	$292,535	$9,779
Energy Costs		
Energy Consumption Costs	$314,902	$10,527
Energy Demand Charges	$0	$0
Energy Utility Rebates	$0	$0
Subtotal (for Energy):	$314,902	$10,527
Water Usage Costs	$0	$0
Water Disposal Costs	$0	$0
Operating, Maintenance & Repair Costs		
Component: VRF		
Annually Recurring Costs	$384,222	$12,844
Non-Annually Recurring Costs	$0	$0
Subtotal (for OM&R):	$384,222	$12,844
Replacements to Capital Components		
Component: VRF	$443,074	$14,811
Subtotal (for Replacements):	$443,074	$14,811
Residual Value of Original Capital Components		
Component: VRF	$0	$0
Subtotal (for Residual Value):	$0	$0
Residual Value of Capital Replacements		
Component: VRF	$0	$0
Subtotal (for Residual Value):	$0	$0

Total Life-Cycle Cost	$1,434,733	$47,961

Emissions Summary

Energy Name	Annual	Life-Cycle
Natural Gas:		
CO2	17,667.98 kg	689,015.13 kg
SO2	142.59 kg	5,560.57 kg
NOx	2.47 kg	96.35 kg
Electricity:		
CO2	66,718.26 kg	2,601,875.28 kg
SO2	72.93 kg	2,844.28 kg
NOx	444.61 kg	17,338.71 kg
Total:		
CO2	84,386.25 kg	3,290,890.42 kg
SO2	215.52 kg	8,404.85 kg
NOx	447.08 kg	17,435.05 kg

Alternative: Ground Sorce Heat Pump

Initial Cost Data (not Discounted)

Initial Capital Costs

(adjusted for price escalation)

Initial Capital Costs for All Components: $483,845

Component: Ground Sorce Heat Pump
Cost-Phasing

Date	Portion	Yearly Cost
April 1, 2021	100%	$483,845
	----------	----------
Total (for Component)		$483,845

Energy Costs: Electricity

(base-year dollars)

Average Annual Usage	Average Price/Unit	Average Annual Cost	Average Annual Demand	Average Annual Rebate
165,369.0 kWh	$0.07000	$11,576	$0	$0

Energy Costs: Natural Gas

(base-year dollars)

Average	Average	Average	Average

Annual Usage	Price/Unit	Annual Cost	Annual Demand	Annual Rebate
3,345.0 Therm	$0.99935	$3,343	$0	$0

Life-Cycle Cost Analysis

	Present Value	Annual Value
Initial Capital Costs	$483,845	$16,174
Energy Costs		
Energy Consumption Costs	$328,224	$10,972
Energy Demand Charges	$0	$0
Energy Utility Rebates	$0	$0
Subtotal (for Energy):	$328,224	$10,972
Water Usage Costs	$0	$0
Water Disposal Costs	$0	$0
Operating, Maintenance & Repair Costs		
Component: Ground Sorce Heat Pump		
Annually Recurring Costs	$341,531	$11,417
Non-Annually Recurring Costs	$0	$0
Subtotal (for OM&R):	$341,531	$11,417
Replacements to Capital Components		
Component: Ground Sorce Heat Pump	$282,264	$9,436
Subtotal (for Replacements):	$282,264	$9,436
Residual Value of Original Capital Components		
Component: Ground Sorce Heat Pump	$0	$0
Subtotal (for Residual Value):	$0	$0
Residual Value of Capital Replacements		
Component: Ground Sorce Heat Pump	$0	$0
Subtotal (for Residual Value):	$0	$0

Subtotal (for Residual Value):	$0	$0
Total Life-Cycle Cost	$1,435,864	$47,999

Emissions Summary

Energy Name	Annual	Life-Cycle
Electricity:		
CO2	68,077.60 kg	2,654,886.65 kg
SO2	74.42 kg	2,902.23 kg
NOx	453.66 kg	17,691.97 kg
Natural Gas:		
CO2	17,667.98 kg	689,015.13 kg
SO2	142.59 kg	5,560.57 kg
NOx	20.82 kg	812.06 kg
Total:		
CO2	85,745.59 kg	3,343,901.78 kg
SO2	217.01 kg	8,462.80 kg
NOx	474.49 kg	18,504.03 kg

General Information

File Name:	J:\Project Files\2022 Jobs\22008 - HAFB SWEG Bldg\ENG\MECH\LCCA SWEG.xml
Date of Study:	Thu May 05 10:44:46 MDT 2022
Analysis Type:	FEMP Analysis, Energy Project
Project Name:	SWEG
Project Location:	Utah
Analyst:	Heath Engineering
Base Date:	April 1, 2021
Service Date:	April 1, 2022
Study Period:	40 years 0 months (April 1, 2021 through March 31, 2061)
Discount Rate:	1.5%
Discounting Convention:	End-of-Year

Discount and Escalation Rates are NOMINAL (inclusive of general inflation)

Alternative: AHU

Energy: Electricity

Annual Consumption:	162,056.0 kWh
Price per Unit:	$0.07000
Demand Charge:	$0
Utility Rebate:	$0
Location:	Utah
Rate Schedule:	Commercial
State:	Utah

Usage Indices

From Date	Duration	Usage Index
April 1, 2022	Remaining	100%

Escalation Rates

From Date	Duration	Escalation
April 1, 2021	1 year 0 months	-2.22%
April 1, 2022	1 year 0 months	-2.79%
April 1, 2023	1 year 0 months	-2.97%
April 1, 2024	1 year 0 months	-0.87%
April 1, 2025	1 year 0 months	-0.27%

April 1, 2026	1 year 0 months	-1.39%
April 1, 2027	1 year 0 months	-1.91%
April 1, 2028	1 year 0 months	-1.85%
April 1, 2029	1 year 0 months	-1.17%
April 1, 2030	1 year 0 months	-0.74%
April 1, 2031	1 year 0 months	-1.45%
April 1, 2032	1 year 0 months	-1.69%
April 1, 2033	1 year 0 months	-1.58%
April 1, 2034	1 year 0 months	-1.58%
April 1, 2035	1 year 0 months	-1.82%
April 1, 2036	1 year 0 months	-2.04%
April 1, 2037	1 year 0 months	-2.02%
April 1, 2038	1 year 0 months	-2.16%
April 1, 2039	1 year 0 months	-2.02%
April 1, 2040	1 year 0 months	-2.08%
April 1, 2041	1 year 0 months	-1.92%
April 1, 2042	1 year 0 months	-2.2%
April 1, 2043	1 year 0 months	-2.15%
April 1, 2044	1 year 0 months	-1.98%
April 1, 2045	1 year 0 months	-1.87%
April 1, 2046	1 year 0 months	-2.13%
April 1, 2047	1 year 0 months	-2.05%
April 1, 2048	1 year 0 months	-2.11%
April 1, 2049	1 year 0 months	-2.23%
April 1, 2050	1 year 0 months	-2.23%
April 1, 2051	Remaining	-2.15%

Energy: Natural Gas

Annual Consumption:	2,501.0 Therm
Price per Unit:	$0.99935
Demand Charge:	$0
Utility Rebate:	$0
End-Use:	Commercial Boiler, controlled-low NOx burners
Rate Schedule:	Commercial
State:	Utah

Usage Indices

From Date	Duration	Usage Index

April 1, 2022	Remaining	100%

Escalation Rates

From Date	Duration	Escalation
April 1, 2021	1 year 0 months	-0.56%
April 1, 2022	1 year 0 months	-2.2%
April 1, 2023	1 year 0 months	-2.67%
April 1, 2024	1 year 0 months	-1.5%
April 1, 2025	1 year 0 months	-0.79%
April 1, 2026	1 year 0 months	-0.44%
April 1, 2027	1 year 0 months	-0.33%
April 1, 2028	1 year 0 months	-0.35%
April 1, 2029	1 year 0 months	8.76%
April 1, 2030	1 year 0 months	1.49%
April 1, 2031	1 year 0 months	0%
April 1, 2032	1 year 0 months	-0.32%
April 1, 2033	1 year 0 months	-1.01%
April 1, 2034	1 year 0 months	-1.01%
April 1, 2035	1 year 0 months	-1.21%
April 1, 2036	1 year 0 months	-1.31%
April 1, 2037	1 year 0 months	-1.12%
April 1, 2038	1 year 0 months	-1.31%
April 1, 2039	1 year 0 months	-1.4%
April 1, 2040	1 year 0 months	-1.31%
April 1, 2041	1 year 0 months	-1.31%
April 1, 2042	1 year 0 months	-1.4%
April 1, 2043	1 year 0 months	-1.31%
April 1, 2044	1 year 0 months	-1.22%
April 1, 2045	1 year 0 months	-1.22%
April 1, 2046	1 year 0 months	-1.03%
April 1, 2047	1 year 0 months	-1.03%
April 1, 2048	1 year 0 months	-0.85%
April 1, 2049	1 year 0 months	-0.85%
April 1, 2050	1 year 0 months	-0.86%
April 1, 2051	Remaining	-0.92%

Component: AHU

Initial Investment

Initial Cost (base-year $):	$313,640
Annual Rate of Increase:	5%
Expected Asset Life:	0 years 0 months
Residual Value Factor:	0%

Cost-Phasing

Cost Adjustment Factor: -0%

Years/Months (from Date)	Date	Portion
0 years 0 months	April 1, 2021	100%

Replacement: Boiler

Years/Months:	25 years 0 months
Amount:	$45,000
Annual Rate Of Increase:	5%
Expected Asset Life:	25 years 0 months
Residual Value Factor:	0%

Replacement: Chiller

Years/Months:	23 years 0 months
Amount:	$91,800
Annual Rate Of Increase:	5%
Expected Asset Life:	23 years 0 months
Residual Value Factor:	0%

Replacement: AHU

Years/Months:	20 years 0 months
Amount:	$10,000
Annual Rate Of Increase:	5%
Expected Asset Life:	20 years 0 months
Residual Value Factor:	0%

Replacement: Pump

Years/Months:	20 years 0 months
Amount:	$21,200
Annual Rate Of Increase:	5%
Expected Asset Life:	20 years 0 months

Residual Value Factor: 0%

Recurring OM&R: Maintenance

Amount: $4,000

Annual Rate of Increase: 5%

Usage Indices

From Date	Duration	Factor
April 1, 2022	Remaining	100%

Alternative: VRF

Energy: Natural Gas

Annual Consumption: 3,345.0 Therm

Price per Unit: $0.99935

Demand Charge: $0

Utility Rebate: $0

End-Use: Commercial Boiler, controlled-low NOx burners

Rate Schedule: Residential

State: Utah

Usage Indices

From Date	Duration	Usage Index
April 1, 2022	Remaining	100%

Escalation Rates

From Date	Duration	Escalation
April 1, 2021	1 year 0 months	-2.34%
April 1, 2022	1 year 0 months	-3.97%
April 1, 2023	1 year 0 months	-4.29%
April 1, 2024	1 year 0 months	-3.39%
April 1, 2025	1 year 0 months	-2.69%
April 1, 2026	1 year 0 months	-1.13%
April 1, 2027	1 year 0 months	-0.48%
April 1, 2028	1 year 0 months	-0.4%
April 1, 2029	1 year 0 months	8.08%
April 1, 2030	1 year 0 months	1.79%
April 1, 2031	1 year 0 months	0.17%
April 1, 2032	1 year 0 months	-0.4%

April 1, 2033	1 year 0 months	-1.04%
April 1, 2034	1 year 0 months	-1.11%
April 1, 2035	1 year 0 months	-1.19%
April 1, 2036	1 year 0 months	-1.35%
April 1, 2037	1 year 0 months	-1.19%
April 1, 2038	1 year 0 months	-1.35%
April 1, 2039	1 year 0 months	-1.42%
April 1, 2040	1 year 0 months	-1.35%
April 1, 2041	1 year 0 months	-1.42%
April 1, 2042	1 year 0 months	-1.35%
April 1, 2043	1 year 0 months	-1.42%
April 1, 2044	1 year 0 months	-1.27%
April 1, 2045	1 year 0 months	-1.27%
April 1, 2046	1 year 0 months	-1.2%
April 1, 2047	1 year 0 months	-1.12%
April 1, 2048	1 year 0 months	-0.98%
April 1, 2049	1 year 0 months	-0.98%
April 1, 2050	1 year 0 months	-1.06%
April 1, 2051	Remaining	-1.07%

Energy: Electricity

Annual Consumption:	162,067.0 kWh
Price per Unit:	$0.07000
Demand Charge:	$0
Utility Rebate:	$0
Location:	Alaska
Rate Schedule:	Commercial
State:	Utah

Usage Indices

From Date	Duration	Usage Index
April 1, 2022	Remaining	100%

Escalation Rates

From Date	Duration	Escalation
April 1, 2021	1 year 0 months	-2.22%
April 1, 2022	1 year 0 months	-2.79%

April 1, 2023	1 year 0 months	-2.97%
April 1, 2024	1 year 0 months	-0.87%
April 1, 2025	1 year 0 months	-0.27%
April 1, 2026	1 year 0 months	-1.39%
April 1, 2027	1 year 0 months	-1.91%
April 1, 2028	1 year 0 months	-1.85%
April 1, 2029	1 year 0 months	-1.17%
April 1, 2030	1 year 0 months	-0.74%
April 1, 2031	1 year 0 months	-1.45%
April 1, 2032	1 year 0 months	-1.69%
April 1, 2033	1 year 0 months	-1.58%
April 1, 2034	1 year 0 months	-1.58%
April 1, 2035	1 year 0 months	-1.82%
April 1, 2036	1 year 0 months	-2.04%
April 1, 2037	1 year 0 months	-2.02%
April 1, 2038	1 year 0 months	-2.16%
April 1, 2039	1 year 0 months	-2.02%
April 1, 2040	1 year 0 months	-2.08%
April 1, 2041	1 year 0 months	-1.92%
April 1, 2042	1 year 0 months	-2.2%
April 1, 2043	1 year 0 months	-2.15%
April 1, 2044	1 year 0 months	-1.98%
April 1, 2045	1 year 0 months	-1.87%
April 1, 2046	1 year 0 months	-2.13%
April 1, 2047	1 year 0 months	-2.05%
April 1, 2048	1 year 0 months	-2.11%
April 1, 2049	1 year 0 months	-2.23%
April 1, 2050	1 year 0 months	-2.23%
April 1, 2051	Remaining	-2.15%

Component: VRF

Initial Investment

Initial Cost (base-year $):	$292,535
Annual Rate of Increase:	5%
Expected Asset Life:	15 years 0 months
Residual Value Factor:	0%

Cost-Phasing

Cost Adjustment Factor: -0%

Years/Months (from Date)	Date	Portion
0 years 0 months	April 1, 2021	100%

Replacement: Outdoor Units

Years/Months:	15 years 0 months
Amount:	$93,600
Annual Rate Of Increase:	5%
Expected Asset Life:	15 years 0 months
Residual Value Factor:	0%

Replacement: Indoor Units

Years/Months:	15 years 0 months
Amount:	$53,975
Annual Rate Of Increase:	5%
Expected Asset Life:	15 years 0 months
Residual Value Factor:	0%

Replacement: DOAS

Years/Months:	15 years 0 months
Amount:	$85,000
Annual Rate Of Increase:	5%
Expected Asset Life:	15 years 0 months
Residual Value Factor:	0%

Replacement: Branch Selector Box

Years/Months:	15 years 0 months
Amount:	$25,000
Annual Rate Of Increase:	5%
Expected Asset Life:	15 years 0 months
Residual Value Factor:	0%

Recurring OM&R: Maintenance

Amount:	$4,500
Annual Rate of Increase:	5%

Usage Indices

From Date	Duration	Factor
April 1, 2022	Remaining	100%

Alternative: Ground Sorce Heat Pump

Energy: Electricity

Annual Consumption:	165,369.0 kWh
Price per Unit:	$0.07000
Demand Charge:	$0
Utility Rebate:	$0
Location:	Alaska
Rate Schedule:	Commercial
State:	Utah

Usage Indices

From Date	Duration	Usage Index
April 1, 2022	Remaining	100%

Escalation Rates

From Date	Duration	Escalation
April 1, 2021	1 year 0 months	-2.22%
April 1, 2022	1 year 0 months	-2.79%
April 1, 2023	1 year 0 months	-2.97%
April 1, 2024	1 year 0 months	-0.87%
April 1, 2025	1 year 0 months	-0.27%
April 1, 2026	1 year 0 months	-1.39%
April 1, 2027	1 year 0 months	-1.91%
April 1, 2028	1 year 0 months	-1.85%
April 1, 2029	1 year 0 months	-1.17%
April 1, 2030	1 year 0 months	-0.74%
April 1, 2031	1 year 0 months	-1.45%
April 1, 2032	1 year 0 months	-1.69%
April 1, 2033	1 year 0 months	-1.58%
April 1, 2034	1 year 0 months	-1.58%
April 1, 2035	1 year 0 months	-1.82%
April 1, 2036	1 year 0 months	-2.04%
April 1, 2037	1 year 0 months	-2.02%
April 1, 2038	1 year 0 months	-2.16%

April 1, 2039	1 year 0 months	-2.02%
April 1, 2040	1 year 0 months	-2.08%
April 1, 2041	1 year 0 months	-1.92%
April 1, 2042	1 year 0 months	-2.2%
April 1, 2043	1 year 0 months	-2.15%
April 1, 2044	1 year 0 months	-1.98%
April 1, 2045	1 year 0 months	-1.87%
April 1, 2046	1 year 0 months	-2.13%
April 1, 2047	1 year 0 months	-2.05%
April 1, 2048	1 year 0 months	-2.11%
April 1, 2049	1 year 0 months	-2.23%
April 1, 2050	1 year 0 months	-2.23%
April 1, 2051	Remaining	-2.15%

Energy: Natural Gas

Annual Consumption:	3,345.0 Therm
Price per Unit:	$0.99935
Demand Charge:	$0
Utility Rebate:	$0
End-Use:	Industrial Boiler, uncontrolled
Rate Schedule:	Commercial
State:	Utah

Usage Indices

From Date	Duration	Usage Index
April 1, 2022	Remaining	100%

Escalation Rates

From Date	Duration	Escalation
April 1, 2021	1 year 0 months	-0.56%
April 1, 2022	1 year 0 months	-2.2%
April 1, 2023	1 year 0 months	-2.67%
April 1, 2024	1 year 0 months	-1.5%
April 1, 2025	1 year 0 months	-0.79%
April 1, 2026	1 year 0 months	-0.44%
April 1, 2027	1 year 0 months	-0.33%
April 1, 2028	1 year 0 months	-0.35%
April 1, 2029	1 year 0 months	8.76%

April 1, 2030	1 year 0 months	1.49%
April 1, 2031	1 year 0 months	0%
April 1, 2032	1 year 0 months	-0.32%
April 1, 2033	1 year 0 months	-1.01%
April 1, 2034	1 year 0 months	-1.01%
April 1, 2035	1 year 0 months	-1.21%
April 1, 2036	1 year 0 months	-1.31%
April 1, 2037	1 year 0 months	-1.12%
April 1, 2038	1 year 0 months	-1.31%
April 1, 2039	1 year 0 months	-1.4%
April 1, 2040	1 year 0 months	-1.31%
April 1, 2041	1 year 0 months	-1.31%
April 1, 2042	1 year 0 months	-1.4%
April 1, 2043	1 year 0 months	-1.31%
April 1, 2044	1 year 0 months	-1.22%
April 1, 2045	1 year 0 months	-1.22%
April 1, 2046	1 year 0 months	-1.03%
April 1, 2047	1 year 0 months	-1.03%
April 1, 2048	1 year 0 months	-0.85%
April 1, 2049	1 year 0 months	-0.85%
April 1, 2050	1 year 0 months	-0.86%
April 1, 2051	Remaining	-0.92%

Component: Ground Sorce Heat Pump

Initial Investment

Initial Cost (base-year $):	$483,845
Annual Rate of Increase:	5%
Expected Asset Life:	15 years 0 months
Residual Value Factor:	0%

Cost-Phasing

Cost Adjustment Factor: -0%

Years/Months (from Date)	Date	Portion
0 years 0 months	April 1, 2021	100%

Replacement: Indoor Units

Years/Months: 15 years 0 months

Years/Months:	15 years 0 months
Amount:	$53,975
Annual Rate Of Increase:	5%
Expected Asset Life:	15 years 0 months
Residual Value Factor:	0%

Replacement: Pumps

Years/Months:	20 years 0 months
Amount:	$21,200
Annual Rate Of Increase:	5%
Expected Asset Life:	20 years 0 months
Residual Value Factor:	0%

Replacement: DOAS

Years/Months:	15 years 0 months
Amount:	$85,000
Annual Rate Of Increase:	5%
Expected Asset Life:	15 years 0 months
Residual Value Factor:	0%

Recurring OM&R: Maintenance

Amount:	$4,000
Annual Rate of Increase:	5%

Usage Indices

From Date	Duration	Factor
April 1, 2022	Remaining	100%

NIST BLCC 5.3-21: Detailed LCC Analysis

Consistent with Federal Life Cycle Cost Methodology and Procedures, 10 CFR, Part 436, Subpart A

General Information

File Name:	J:\Project Files\2022 Jobs\22008 - HAFB SWEG Bldg\ENG\MECH\LCCA SWEG.xml
Date of Study:	Thu May 05 10:40:04 MDT 2022
Analysis Type:	FEMP Analysis, Energy Project
Project Name:	SWEG
Project Location:	Utah
Analyst:	Heath Engineering
Base Date:	April 1, 2021
Service Date:	April 1, 2022
Study Period:	40 years 0 months (April 1, 2021 through March 31, 2061)
Discount Rate:	1.5%
Discounting Convention:	End-of-Year

Discount and Escalation Rates are NOMINAL (inclusive of general inflation)

Alternative: AHU

Initial Cost Data (not Discounted)

Initial Capital Costs

(adjusted for price escalation)

Initial Capital Costs for All Components: $313,640

Component: AHU
Cost-Phasing

Date	Portion	Yearly Cost
April 1, 2021	100%	$313,640
Total (for Component)		$313,640

Energy Costs: Electricity

(base-year dollars)

Average Annual Usage	Average Price/Unit	Average Annual Cost	Average Annual Demand	Average Annual Rebate
162,056.0 kWh	$0.07000	$11,344	$0	$0

Energy Costs: Natural Gas

(base-year dollars)

Average Annual Usage	Average Price/Unit	Average Annual Cost	Average Annual Demand	Average Annual Rebate
2,501.0 Therm	$0.99935	$2,499	$0	$0

Life-Cycle Cost Analysis

	Present Value	Annual Value
Initial Capital Costs	$313,640	$10,485
Energy Costs		
Energy Consumption Costs	$301,505	$10,079
Energy Demand Charges	$0	$0
Energy Utility Rebates	$0	$0
Subtotal (for Energy):	$301,505	$10,079
Water Usage Costs	$0	$0
Water Disposal Costs	$0	$0
Operating, Maintenance & Repair Costs		
Component: AHU		
Annually Recurring Costs	$341,531	$11,417
Non-Annually Recurring Costs	$0	$0
Subtotal (for OM&R):	$341,531	$11,417
Replacements to Capital Components		
Component: AHU	$379,334	$12,681
Subtotal (for Replacements):	$379,334	$12,681
Residual Value of Original Capital Components		
Component: AHU	$0	$0
Subtotal (for Residual Value):	$0	$0
Residual Value of Capital Replacements		
Component: AHU	$0	$0
Subtotal (for Residual Value):	$0	$0

Total Life-Cycle Cost	$1,336,009	$44,661

Emissions Summary

Energy Name	Annual	Life-Cycle
Electricity:		
CO2	117,472.93 kg	4,581,203.07 kg
SO2	54.84 kg	2,138.75 kg
NOx	120.19 kg	4,687.05 kg
Natural Gas:		
CO2	13,210.05 kg	515,164.98 kg
SO2	106.61 kg	4,157.54 kg
NOx	1.85 kg	72.04 kg
Total:		
CO2	130,682.98 kg	5,096,368.05 kg
SO2	161.45 kg	6,296.29 kg
NOx	122.03 kg	4,759.09 kg

Alternative: VRF

Initial Cost Data (not Discounted)

Initial Capital Costs

(adjusted for price escalation)

Initial Capital Costs for All Components: $292,535

Component: VRF
Cost-Phasing

Date	Portion	Yearly Cost
April 1, 2021	100%	$292,535
	----------	----------
Total (for Component)		$292,535

Energy Costs: Natural Gas

(base-year dollars)

Average Annual Usage	Average Price/Unit	Average Annual Cost	Average Annual Demand	Average Annual Rebate
3,345.0 Therm	$0.99935	$3,343	$0	$0

Energy Costs: Electricity

(base-year dollars)

Average Annual Usage	Average Price/Unit	Average Annual Cost	Average Annual Demand	Average Annual Rebate

162,067.0 kWh	$0.07000	$11,345	$0	$0

Life-Cycle Cost Analysis

	Present Value	Annual Value
Initial Capital Costs	$292,535	$9,779
Energy Costs		
Energy Consumption Costs	$314,902	$10,527
Energy Demand Charges	$0	$0
Energy Utility Rebates	$0	$0
Subtotal (for Energy):	$314,902	$10,527
Water Usage Costs	$0	$0
Water Disposal Costs	$0	$0
Operating, Maintenance & Repair Costs		
Component: VRF		
Annually Recurring Costs	$384,222	$12,844
Non-Annually Recurring Costs	$0	$0
Subtotal (for OM&R):	$384,222	$12,844
Replacements to Capital Components		
Component: VRF	$443,074	$14,811
Subtotal (for Replacements):	$443,074	$14,811
Residual Value of Original Capital Components		
Component: VRF	$0	$0
Subtotal (for Residual Value):	$0	$0
Residual Value of Capital Replacements		
Component: VRF	$0	$0
Subtotal (for Residual Value):	$0	$0

Total Life-Cycle Cost	$1,434,733	$47,961

Emissions Summary

Energy Name	Annual	Life-Cycle
Natural Gas:		
CO2	17,667.98 kg	689,015.13 kg
SO2	142.59 kg	5,560.57 kg
NOx	2.47 kg	96.35 kg
Electricity:		
CO2	66,718.26 kg	2,601,875.28 kg
SO2	72.93 kg	2,844.28 kg
NOx	444.61 kg	17,338.71 kg
Total:		
CO2	84,386.25 kg	3,290,890.42 kg
SO2	215.52 kg	8,404.85 kg
NOx	447.08 kg	17,435.05 kg

Alternative: Ground Sorce Heat Pump

Initial Cost Data (not Discounted)

Initial Capital Costs

(adjusted for price escalation)

Initial Capital Costs for All Components: $483,845

Component: Ground Sorce Heat Pump
Cost-Phasing

Date	Portion	Yearly Cost
April 1, 2021	100%	$483,845
	----------	----------
Total (for Component)		$483,845

Energy Costs: Electricity

(base-year dollars)

Average Annual Usage	Average Price/Unit	Average Annual Cost	Average Annual Demand	Average Annual Rebate
165,369.0 kWh	$0.07000	$11,576	$0	$0

Energy Costs: Natural Gas

(base-year dollars)

Average	Average	Average	Average

Annual Usage	Price/Unit	Annual Cost	Annual Demand	Annual Rebate
3,345.0 Therm	$0.99935	$3,343	$0	$0

Life-Cycle Cost Analysis

	Present Value	Annual Value
Initial Capital Costs	$483,845	$16,174
Energy Costs		
Energy Consumption Costs	$328,224	$10,972
Energy Demand Charges	$0	$0
Energy Utility Rebates	$0	$0
Subtotal (for Energy):	$328,224	$10,972
Water Usage Costs	$0	$0
Water Disposal Costs	$0	$0
Operating, Maintenance & Repair Costs		
Component: Ground Sorce Heat Pump		
Annually Recurring Costs	$341,531	$11,417
Non-Annually Recurring Costs	$0	$0
Subtotal (for OM&R):	$341,531	$11,417
Replacements to Capital Components		
Component: Ground Sorce Heat Pump	$282,264	$9,436
Subtotal (for Replacements):	$282,264	$9,436
Residual Value of Original Capital Components		
Component: Ground Sorce Heat Pump	$0	$0
Subtotal (for Residual Value):	$0	$0
Residual Value of Capital Replacements		
Component: Ground Sorce Heat Pump	$0	$0
Subtotal (for Residual Value):	$0	$0

Subtotal (for Residual Value):	$0	$0
Total Life-Cycle Cost	$1,435,864	$47,999

Emissions Summary

Energy Name	Annual	Life-Cycle
Electricity:		
CO2	68,077.60 kg	2,654,886.65 kg
SO2	74.42 kg	2,902.23 kg
NOx	453.66 kg	17,691.97 kg
Natural Gas:		
CO2	17,667.98 kg	689,015.13 kg
SO2	142.59 kg	5,560.57 kg
NOx	20.82 kg	812.06 kg
Total:		
CO2	85,745.59 kg	3,343,901.78 kg
SO2	217.01 kg	8,462.80 kg
NOx	474.49 kg	18,504.03 kg

NIST BLCC 5.3-21: Cash Flow Analysis

Consistent with Federal Life Cycle Cost Methodology and Procedures, 10 CFR, Part 436, Subpart A

General Information

File Name:	J:\Project Files\2022 Jobs\22008 - HAFB SWEG Bldg\ENG\MECH\LCCA SWEG.xml
Date of Study:	Thu May 05 10:41:01 MDT 2022
Analysis Type:	FEMP Analysis, Energy Project
Project Name:	SWEG
Project Location:	Utah
Analyst:	Heath Engineering
Base Date:	April 1, 2021
Service Date:	April 1, 2022
Study Period:	40 years 0 months (April 1, 2021 through March 31, 2061)

End-of-year cash-flow convention used

All costs in current dollars (including general inflation)

Alternative: AHU

Initial Capital Costs

Component: AHU

Year Beginning	Total
Apr 2021	$313,640
Total	$313,640

Capital Investment Costs

Year Beginning	Initial	Replacement	Total
Apr 2021	$313,640	$0	$313,640
Apr 2022	$0	$0	$0
Apr 2023	$0	$0	$0
Apr 2024	$0	$0	$0
Apr 2025	$0	$0	$0
Apr 2026	$0	$0	$0
Apr 2027	$0	$0	$0
Apr 2028	$0	$0	$0
Apr 2029	$0	$0	$0
Apr 2030	$0	$0	$0
Apr 2031	$0	$0	$0
Apr 2032	$0	$0	$0
Apr 2033	$0	$0	$0
Apr 2034	$0	$0	$0

Apr 2035	$0	$0	$0
Apr 2036	$0	$0	$0
Apr 2037	$0	$0	$0
Apr 2038	$0	$0	$0
Apr 2039	$0	$0	$0
Apr 2040	$0	$0	$0
Apr 2041	$0	$0	$0
Apr 2042	$0	$86,919	$86,919
Apr 2043	$0	$0	$0
Apr 2044	$0	$0	$0
Apr 2045	$0	$296,064	$296,064
Apr 2046	$0	$0	$0
Apr 2047	$0	$159,995	$159,995
Apr 2048	$0	$0	$0
Apr 2049	$0	$0	$0
Apr 2050	$0	$0	$0
Apr 2051	$0	$0	$0
Apr 2052	$0	$0	$0
Apr 2053	$0	$0	$0
Apr 2054	$0	$0	$0
Apr 2055	$0	$0	$0
Apr 2056	$0	$0	$0
Apr 2057	$0	$0	$0
Apr 2058	$0	$0	$0
Apr 2059	$0	$0	$0
Apr 2060	$0	$0	$0
Total	$313,640	$542,978	$856,618

Operating-Related Costs

Year Beginning	Recurring	Energy Consumption	Energy Demand	Energy Rebate	Total
Apr 2021	$0	$0	$0	$0	$0
Apr 2022	$4,409	$13,216	$0	$0	$17,625
Apr 2023	$4,630	$12,830	$0	$0	$17,460
Apr 2024	$4,861	$12,703	$0	$0	$17,565
Apr 2025	$5,104	$12,657	$0	$0	$17,761
Apr 2026	$5,359	$12,503	$0	$0	$17,862
Apr 2027	$5,628	$12,301	$0	$0	$17,929

Apr 2027	$5,628	$12,301	$0	$0	$17,929
Apr 2028	$5,909	$12,108	$0	$0	$18,017
Apr 2029	$6,204	$12,192	$0	$0	$18,396
Apr 2030	$6,514	$12,158	$0	$0	$18,672
Apr 2031	$6,841	$12,018	$0	$0	$18,859
Apr 2032	$7,182	$11,850	$0	$0	$19,033
Apr 2033	$7,541	$11,677	$0	$0	$19,219
Apr 2034	$7,918	$11,507	$0	$0	$19,425
Apr 2035	$8,315	$11,312	$0	$0	$19,627
Apr 2036	$8,730	$11,099	$0	$0	$19,829
Apr 2037	$9,167	$10,897	$0	$0	$20,063
Apr 2038	$9,625	$10,682	$0	$0	$20,307
Apr 2039	$10,107	$10,480	$0	$0	$20,587
Apr 2040	$10,612	$10,280	$0	$0	$20,892
Apr 2041	$11,142	$10,097	$0	$0	$21,239
Apr 2042	$11,699	$9,893	$0	$0	$21,591
Apr 2043	$12,285	$9,698	$0	$0	$21,983
Apr 2044	$12,899	$9,523	$0	$0	$22,422
Apr 2045	$13,543	$9,359	$0	$0	$22,902
Apr 2046	$14,220	$9,183	$0	$0	$23,403
Apr 2047	$14,932	$9,017	$0	$0	$23,949
Apr 2048	$15,678	$8,853	$0	$0	$24,531
Apr 2049	$16,462	$8,684	$0	$0	$25,146
Apr 2050	$17,284	$8,519	$0	$0	$25,803
Apr 2051	$18,150	$8,361	$0	$0	$26,511
Apr 2052	$19,057	$8,206	$0	$0	$27,263
Apr 2053	$20,009	$8,054	$0	$0	$28,063
Apr 2054	$21,009	$7,905	$0	$0	$28,915
Apr 2055	$22,062	$7,759	$0	$0	$29,821
Apr 2056	$23,164	$7,617	$0	$0	$30,781
Apr 2057	$24,322	$7,477	$0	$0	$31,798
Apr 2058	$25,537	$7,339	$0	$0	$32,876
Apr 2059	$26,816	$7,205	$0	$0	$34,021
Apr 2060	$28,152	$7,073	$0	$0	$35,226
Total	$503,080	$394,291	$0	$0	$897,372

Sum of All Cash Flows

Sum of All Cash Flows

Year Beginning	Capital	OM&R	Total
Apr 2021	$313,640	$0	$313,640
Apr 2022	$0	$17,625	$17,625
Apr 2023	$0	$17,460	$17,460
Apr 2024	$0	$17,565	$17,565
Apr 2025	$0	$17,761	$17,761
Apr 2026	$0	$17,862	$17,862
Apr 2027	$0	$17,929	$17,929
Apr 2028	$0	$18,017	$18,017
Apr 2029	$0	$18,396	$18,396
Apr 2030	$0	$18,672	$18,672
Apr 2031	$0	$18,859	$18,859
Apr 2032	$0	$19,033	$19,033
Apr 2033	$0	$19,219	$19,219
Apr 2034	$0	$19,425	$19,425
Apr 2035	$0	$19,627	$19,627
Apr 2036	$0	$19,829	$19,829
Apr 2037	$0	$20,063	$20,063
Apr 2038	$0	$20,307	$20,307
Apr 2039	$0	$20,587	$20,587
Apr 2040	$0	$20,892	$20,892
Apr 2041	$0	$21,239	$21,239
Apr 2042	$86,919	$21,591	$108,511
Apr 2043	$0	$21,983	$21,983
Apr 2044	$0	$22,422	$22,422
Apr 2045	$296,064	$22,902	$318,966
Apr 2046	$0	$23,403	$23,403
Apr 2047	$159,995	$23,949	$183,944
Apr 2048	$0	$24,531	$24,531
Apr 2049	$0	$25,146	$25,146
Apr 2050	$0	$25,803	$25,803
Apr 2051	$0	$26,511	$26,511
Apr 2052	$0	$27,263	$27,263
Apr 2053	$0	$28,063	$28,063
Apr 2054	$0	$28,915	$28,915
Apr 2055	$0	$29,821	$29,821
Apr 2056	$0	$30,781	$30,781

Apr 2057	$0	$31,798	$31,798
Apr 2058	$0	$32,876	$32,876
Apr 2059	$0	$34,021	$34,021
Apr 2060	$0	$35,226	$35,226
Total	$856,618	$897,372	$1,753,990

Alternative: VRF

Initial Capital Costs

Component: VRF

Year Beginning	Total
Apr 2021	$292,535
Total	$292,535

Capital Investment Costs

Year Beginning	Initial	Replacement	Total
Apr 2021	$292,535	$0	$292,535
Apr 2022	$0	$0	$0
Apr 2023	$0	$0	$0
Apr 2024	$0	$0	$0
Apr 2025	$0	$0	$0
Apr 2026	$0	$0	$0
Apr 2027	$0	$0	$0
Apr 2028	$0	$0	$0
Apr 2029	$0	$0	$0
Apr 2030	$0	$0	$0
Apr 2031	$0	$0	$0
Apr 2032	$0	$0	$0
Apr 2033	$0	$0	$0
Apr 2034	$0	$0	$0
Apr 2035	$0	$0	$0
Apr 2036	$0	$0	$0
Apr 2037	$0	$562,254	$562,254
Apr 2038	$0	$0	$0
Apr 2039	$0	$0	$0
Apr 2040	$0	$0	$0
Apr 2041	$0	$0	$0
Apr 2042	$0	$0	$0

Apr 2043	$0	$0	$0
Apr 2044	$0	$0	$0
Apr 2045	$0	$0	$0
Apr 2046	$0	$0	$0
Apr 2047	$0	$0	$0
Apr 2048	$0	$0	$0
Apr 2049	$0	$0	$0
Apr 2050	$0	$0	$0
Apr 2051	$0	$0	$0
Apr 2052	$0	$0	$0
Apr 2053	$0	$0	$0
Apr 2054	$0	$0	$0
Apr 2055	$0	$0	$0
Apr 2056	$0	$0	$0
Apr 2057	$0	$0	$0
Apr 2058	$0	$0	$0
Apr 2059	$0	$0	$0
Apr 2060	$0	$0	$0
Total	$292,535	$562,254	$854,789

Operating-Related Costs

Year Beginning	Recurring	Energy Consumption	Energy Demand	Energy Rebate	Total
Apr 2021	$0	$0	$0	$0	$0
Apr 2022	$4,960	$13,921	$0	$0	$18,881
Apr 2023	$5,209	$13,466	$0	$0	$18,674
Apr 2024	$5,469	$13,273	$0	$0	$18,742
Apr 2025	$5,742	$13,167	$0	$0	$18,909
Apr 2026	$6,029	$12,991	$0	$0	$19,020
Apr 2027	$6,331	$12,783	$0	$0	$19,114
Apr 2028	$6,648	$12,587	$0	$0	$19,234
Apr 2029	$6,980	$12,694	$0	$0	$19,673
Apr 2030	$7,329	$12,676	$0	$0	$20,004
Apr 2031	$7,696	$12,542	$0	$0	$20,238
Apr 2032	$8,080	$12,369	$0	$0	$20,450
Apr 2033	$8,484	$12,191	$0	$0	$20,675
Apr 2034	$8,908	$12,012	$0	$0	$20,920

Apr 2035	$9,354	$11,811	$0	$0	$21,166
Apr 2036	$9,822	$11,591	$0	$0	$21,412
Apr 2037	$10,312	$11,381	$0	$0	$21,693
Apr 2038	$10,828	$11,159	$0	$0	$21,986
Apr 2039	$11,370	$10,949	$0	$0	$22,320
Apr 2040	$11,938	$10,742	$0	$0	$22,680
Apr 2041	$12,535	$10,550	$0	$0	$23,084
Apr 2042	$13,161	$10,341	$0	$0	$23,502
Apr 2043	$13,820	$10,138	$0	$0	$23,958
Apr 2044	$14,511	$9,955	$0	$0	$24,466
Apr 2045	$15,236	$9,785	$0	$0	$25,021
Apr 2046	$15,997	$9,600	$0	$0	$25,598
Apr 2047	$16,799	$9,427	$0	$0	$26,226
Apr 2048	$17,638	$9,256	$0	$0	$26,895
Apr 2049	$18,520	$9,081	$0	$0	$27,601
Apr 2050	$19,445	$8,907	$0	$0	$28,352
Apr 2051	$20,419	$8,742	$0	$0	$29,161
Apr 2052	$21,439	$8,580	$0	$0	$30,020
Apr 2053	$22,511	$8,422	$0	$0	$30,932
Apr 2054	$23,635	$8,266	$0	$0	$31,901
Apr 2055	$24,820	$8,113	$0	$0	$32,933
Apr 2056	$26,060	$7,964	$0	$0	$34,024
Apr 2057	$27,362	$7,818	$0	$0	$35,179
Apr 2058	$28,729	$7,674	$0	$0	$36,403
Apr 2059	$30,168	$7,533	$0	$0	$37,701
Apr 2060	$31,671	$7,395	$0	$0	$39,067
Total	$565,965	$411,850	$0	$0	$977,815

Sum of All Cash Flows

Year Beginning	Capital	OM&R	Total
Apr 2021	$292,535	$0	$292,535
Apr 2022	$0	$18,881	$18,881
Apr 2023	$0	$18,674	$18,674
Apr 2024	$0	$18,742	$18,742
Apr 2025	$0	$18,909	$18,909
Apr 2026	$0	$19,020	$19,020

Apr 2027	$0	$19,114	$19,114
Apr 2028	$0	$19,234	$19,234
Apr 2029	$0	$19,673	$19,673
Apr 2030	$0	$20,004	$20,004
Apr 2031	$0	$20,238	$20,238
Apr 2032	$0	$20,450	$20,450
Apr 2033	$0	$20,675	$20,675
Apr 2034	$0	$20,920	$20,920
Apr 2035	$0	$21,166	$21,166
Apr 2036	$0	$21,412	$21,412
Apr 2037	$562,254	$21,693	$583,947
Apr 2038	$0	$21,986	$21,986
Apr 2039	$0	$22,320	$22,320
Apr 2040	$0	$22,680	$22,680
Apr 2041	$0	$23,084	$23,084
Apr 2042	$0	$23,502	$23,502
Apr 2043	$0	$23,958	$23,958
Apr 2044	$0	$24,466	$24,466
Apr 2045	$0	$25,021	$25,021
Apr 2046	$0	$25,598	$25,598
Apr 2047	$0	$26,226	$26,226
Apr 2048	$0	$26,895	$26,895
Apr 2049	$0	$27,601	$27,601
Apr 2050	$0	$28,352	$28,352
Apr 2051	$0	$29,161	$29,161
Apr 2052	$0	$30,020	$30,020
Apr 2053	$0	$30,932	$30,932
Apr 2054	$0	$31,901	$31,901
Apr 2055	$0	$32,933	$32,933
Apr 2056	$0	$34,024	$34,024
Apr 2057	$0	$35,179	$35,179
Apr 2058	$0	$36,403	$36,403
Apr 2059	$0	$37,701	$37,701
Apr 2060	$0	$39,067	$39,067
Total	$854,789	$977,815	$1,832,604

Alternative: Ground Sorce Heat Pump

Initial Capital Costs

Component: Ground Sorce Heat Pump

Year Beginning	Total
Apr 2021	$483,845
Total	$483,845

Capital Investment Costs

Year Beginning	Initial	Replacement	Total
Apr 2021	$483,845	$0	$483,845
Apr 2022	$0	$0	$0
Apr 2023	$0	$0	$0
Apr 2024	$0	$0	$0
Apr 2025	$0	$0	$0
Apr 2026	$0	$0	$0
Apr 2027	$0	$0	$0
Apr 2028	$0	$0	$0
Apr 2029	$0	$0	$0
Apr 2030	$0	$0	$0
Apr 2031	$0	$0	$0
Apr 2032	$0	$0	$0
Apr 2033	$0	$0	$0
Apr 2034	$0	$0	$0
Apr 2035	$0	$0	$0
Apr 2036	$0	$0	$0
Apr 2037	$0	$303,365	$303,365
Apr 2038	$0	$0	$0
Apr 2039	$0	$0	$0
Apr 2040	$0	$0	$0
Apr 2041	$0	$0	$0
Apr 2042	$0	$59,060	$59,060
Apr 2043	$0	$0	$0
Apr 2044	$0	$0	$0
Apr 2045	$0	$0	$0
Apr 2046	$0	$0	$0
Apr 2047	$0	$0	$0
Apr 2048	$0	$0	$0
Apr 2049	$0	$0	$0

Apr 2050	$0	$0	$0
Apr 2051	$0	$0	$0
Apr 2052	$0	$0	$0
Apr 2053	$0	$0	$0
Apr 2054	$0	$0	$0
Apr 2055	$0	$0	$0
Apr 2056	$0	$0	$0
Apr 2057	$0	$0	$0
Apr 2058	$0	$0	$0
Apr 2059	$0	$0	$0
Apr 2060	$0	$0	$0
Total	$483,845	$362,425	$846,270

Operating-Related Costs

Year Beginning	Recurring	Energy Consumption	Energy Demand	Energy Rebate	Total
Apr 2021	$0	$0	$0	$0	$0
Apr 2022	$4,409	$14,256	$0	$0	$18,665
Apr 2023	$4,630	$13,842	$0	$0	$18,472
Apr 2024	$4,861	$13,702	$0	$0	$18,563
Apr 2025	$5,104	$13,649	$0	$0	$18,753
Apr 2026	$5,359	$13,488	$0	$0	$18,848
Apr 2027	$5,628	$13,280	$0	$0	$18,907
Apr 2028	$5,909	$13,080	$0	$0	$18,989
Apr 2029	$6,204	$13,229	$0	$0	$19,433
Apr 2030	$6,514	$13,206	$0	$0	$19,720
Apr 2031	$6,841	$13,064	$0	$0	$19,905
Apr 2032	$7,182	$12,890	$0	$0	$20,072
Apr 2033	$7,541	$12,705	$0	$0	$20,247
Apr 2034	$7,918	$12,524	$0	$0	$20,442
Apr 2035	$8,315	$12,315	$0	$0	$20,630
Apr 2036	$8,730	$12,088	$0	$0	$20,818
Apr 2037	$9,167	$11,873	$0	$0	$21,040
Apr 2038	$9,625	$11,644	$0	$0	$21,269
Apr 2039	$10,107	$11,427	$0	$0	$21,534
Apr 2040	$10,612	$11,214	$0	$0	$21,825
Apr 2041	$11,142	$11,017	$0	$0	$22,159

Apr 2042	$11,699	$10,799	$0	$0	$22,498
Apr 2043	$12,285	$10,591	$0	$0	$22,876
Apr 2044	$12,899	$10,404	$0	$0	$23,303
Apr 2045	$13,543	$10,228	$0	$0	$23,772
Apr 2046	$14,220	$10,042	$0	$0	$24,262
Apr 2047	$14,932	$9,865	$0	$0	$24,797
Apr 2048	$15,678	$9,692	$0	$0	$25,371
Apr 2049	$16,462	$9,515	$0	$0	$25,977
Apr 2050	$17,284	$9,340	$0	$0	$26,625
Apr 2051	$18,150	$9,173	$0	$0	$27,323
Apr 2052	$19,057	$9,009	$0	$0	$28,066
Apr 2053	$20,009	$8,848	$0	$0	$28,858
Apr 2054	$21,009	$8,691	$0	$0	$29,700
Apr 2055	$22,062	$8,536	$0	$0	$30,598
Apr 2056	$23,164	$8,384	$0	$0	$31,549
Apr 2057	$24,322	$8,236	$0	$0	$32,558
Apr 2058	$25,537	$8,090	$0	$0	$33,627
Apr 2059	$26,816	$7,947	$0	$0	$34,764
Apr 2060	$28,152	$7,808	$0	$0	$35,960
Total	$503,080	$429,693	$0	$0	$932,773

Sum of All Cash Flows

Year Beginning	Capital	OM&R	Total
Apr 2021	$483,845	$0	$483,845
Apr 2022	$0	$18,665	$18,665
Apr 2023	$0	$18,472	$18,472
Apr 2024	$0	$18,563	$18,563
Apr 2025	$0	$18,753	$18,753
Apr 2026	$0	$18,848	$18,848
Apr 2027	$0	$18,907	$18,907
Apr 2028	$0	$18,989	$18,989
Apr 2029	$0	$19,433	$19,433
Apr 2030	$0	$19,720	$19,720
Apr 2031	$0	$19,905	$19,905
Apr 2032	$0	$20,072	$20,072
Apr 2033	$0	$20,247	$20,247
Apr 2034	$0	$20,442	$20,442

Apr 2035	$0	$20,630	$20,630
Apr 2036	$0	$20,818	$20,818
Apr 2037	$303,365	$21,040	$324,405
Apr 2038	$0	$21,269	$21,269
Apr 2039	$0	$21,534	$21,534
Apr 2040	$0	$21,825	$21,825
Apr 2041	$0	$22,159	$22,159
Apr 2042	$59,060	$22,498	$81,558
Apr 2043	$0	$22,876	$22,876
Apr 2044	$0	$23,303	$23,303
Apr 2045	$0	$23,772	$23,772
Apr 2046	$0	$24,262	$24,262
Apr 2047	$0	$24,797	$24,797
Apr 2048	$0	$25,371	$25,371
Apr 2049	$0	$25,977	$25,977
Apr 2050	$0	$26,625	$26,625
Apr 2051	$0	$27,323	$27,323
Apr 2052	$0	$28,066	$28,066
Apr 2053	$0	$28,858	$28,858
Apr 2054	$0	$29,700	$29,700
Apr 2055	$0	$30,598	$30,598
Apr 2056	$0	$31,549	$31,549
Apr 2057	$0	$32,558	$32,558
Apr 2058	$0	$33,627	$33,627
Apr 2059	$0	$34,764	$34,764
Apr 2060	$0	$35,960	$35,960
Total	$846,270	$932,773	$1,779,044

NIST BLCC 5.3-21: Summary LCC

Consistent with Federal Life Cycle Cost Methodology and Procedures, 10 CFR, Part 436, Subpart A

General Information

File Name:	J:\Project Files\2022 Jobs\22008 - HAFB SWEG Bldg\ENG\MECH\LCCA SWEG.xml
Date of Study:	Thu May 05 10:41:54 MDT 2022
Analysis Type:	FEMP Analysis, Energy Project
Project Name:	SWEG
Project Location:	Utah
Analyst:	Heath Engineering
Base Date:	April 1, 2021
Service Date:	April 1, 2022
Study Period:	40 years 0 months (April 1, 2021 through March 31, 2061)
Discount Rate:	1.5%
Discounting Convention:	End-of-Year

Discount and Escalation Rates are NOMINAL (inclusive of general inflation)

Alternative: AHU

LCC Summary

	Present Value	Annual Value
Initial Cost	$313,640	$10,485
Energy Consumption Costs	$301,505	$10,079
Energy Demand Costs	$0	$0
Energy Utility Rebates	$0	$0
Water Usage Costs	$0	$0
Water Disposal Costs	$0	$0
Annually Recurring OM&R Costs	$341,531	$11,417
Non-Annually Recurring OM&R Costs	$0	$0
Replacement Costs	$379,334	$12,681
Less Remaining Value	$0	$0
Total Life-Cycle Cost	$1,336,009	$44,661

Alternative: VRF

LCC Summary

	Present Value	Annual Value
Initial Cost	$292,535	$9,779
Energy Consumption Costs	$314,902	$10,527
Energy Demand Costs	$0	$0

Energy Utility Rebates	$0	$0
Water Usage Costs	$0	$0
Water Disposal Costs	$0	$0
Annually Recurring OM&R Costs	$384,222	$12,844
Non-Annually Recurring OM&R Costs	$0	$0
Replacement Costs	$443,074	$14,811
Less Remaining Value	$0	$0
Total Life-Cycle Cost	$1,434,733	$47,961

Alternative: Ground Sorce Heat Pump

LCC Summary

	Present Value	Annual Value
Initial Cost	$483,845	$16,174
Energy Consumption Costs	$328,224	$10,972
Energy Demand Costs	$0	$0
Energy Utility Rebates	$0	$0
Water Usage Costs	$0	$0
Water Disposal Costs	$0	$0
Annually Recurring OM&R Costs	$341,531	$11,417
Non-Annually Recurring OM&R Costs	$0	$0
Replacement Costs	$282,264	$9,436
Less Remaining Value	$0	$0
Total Life-Cycle Cost	$1,435,864	$47,999

NIST BLCC 5.3-21: Lowest LCC

Consistent with Federal Life Cycle Cost Methodology and Procedures, 10 CFR, Part 436, Subpart A

General Information

File Name:	J:\Project Files\2022 Jobs\22008 - HAFB SWEG Bldg\ENG\MECH\LCCA SWEG.xml
Date of Study:	Thu May 05 10:42:31 MDT 2022
Analysis Type:	FEMP Analysis, Energy Project
Project Name:	SWEG
Project Location:	Utah
Analyst:	Heath Engineering
Base Date:	April 1, 2021
Service Date:	April 1, 2022
Study Period:	40 years 0 months (April 1, 2021 through March 31, 2061)
Discount Rate:	1.5%
Discounting Convention:	End-of-Year

Lowest LCC

Comparative Present-Value Costs of Alternatives
(Shown in Ascending Order of Initial Cost, * = Lowest LCC)

Alternative	Initial Cost (PV)	Life Cycle Cost (PV)
VRF	$292,535	$1,434,733
AHU	$313,640	$1,336,009 *
Ground Sorce Heat Pump	$483,845	$1,435,864

NIST BLCC 5.3-21: Comparative Analysis

Consistent with Federal Life Cycle Cost Methodology and Procedures, 10 CFR, Part 436, Subpart A

Base Case: AHU

Alternative: VRF

General Information

File Name:	J:\Project Files\2022 Jobs\22008 - HAFB SWEG Bldg\ENG\MECH\LCCA SWEG.xml
Date of Study:	Thu May 05 10:43:17 MDT 2022
Project Name:	SWEG
Project Location:	Utah
Analysis Type:	FEMP Analysis, Energy Project
Analyst:	Heath Engineering
Base Date:	April 1, 2021
Service Date:	April 1, 2022
Study Period:	40 years 0 months(April 1, 2021 through March 31, 2061)
Discount Rate:	1.5%
Discounting Convention:	End-of-Year

Comparison of Present-Value Costs

PV Life-Cycle Cost

	Base Case	Alternative	Savings from Alternative
Initial Investment Costs:			
Capital Requirements as of Base Date	$313,640	$292,535	$21,105
Future Costs:			
Energy Consumption Costs	$301,505	$314,902	-$13,398
Energy Demand Charges	$0	$0	$0
Energy Utility Rebates	$0	$0	$0
Water Costs	$0	$0	$0
Recurring and Non-Recurring OM&R Costs	$341,531	$384,222	-$42,691
Capital Replacements	$379,334	$443,074	-$63,740
Residual Value at End of Study Period	$0	$0	$0
Subtotal (for Future Cost Items)	$1,022,369	$1,142,198	-$119,829
Total PV Life-Cycle Cost	$1,336,009	$1,434,733	-$98,724

Net Savings from Alternative Compared with Base Case

PV of Non-Investment Savings	-$56,089
- Increased Total Investment	$42,635

Net Savings	-$98,724

NOTE: Meaningful SIR, AIRR and Payback can not be computed unless incremental savings and total savings are both positive.

Energy Savings Summary

Energy Savings Summary (in stated units)

Energy Type	Average Annual Consumption Base Case	Alternative	Life-Cycle Savings Savings
Electricity	162,056.0 kWh	162,067.0 kWh	-11.0 kWh -429.0 kWh
Natural Gas	2,501.0 Therm	3,345.0 Therm	-844.0 Therm -32,914.3 Therm

Energy Savings Summary (in MBtu)

Energy Type	Average Annual Consumption Base Case	Alternative	Life-Cycle Savings Savings
Electricity	553.0 MBtu	553.0 MBtu	-0.0 MBtu -1.5 MBtu
Natural Gas	250.1 MBtu	334.5 MBtu	-84.4 MBtu -3,291.4 MBtu

Emissions Reduction Summary

Energy Type	Average Annual Emissions Base Case	Alternative	Life-Cycle Reduction Reduction
Electricity			
CO2	117,472.93 kg	66,718.26 kg	50,754.67 kg 1,979,327.78 kg
SO2	54.84 kg	72.93 kg	-18.09 kg -705.53 kg
NOx	120.19 kg	444.61 kg	-324.42 kg -12,651.66 kg
Natural Gas			
CO2	13,210.05 kg	17,667.98 kg	-4,457.93 kg -173,850.16 kg
SO2	106.61 kg	142.59 kg	-35.98 kg -1,403.03 kg
NOx	1.85 kg	2.47 kg	-0.62 kg -24.31 kg
Total:			
CO2	130,682.98 kg	84,386.25 kg	46,296.74 kg 1,805,477.63 kg
SO2	161.45 kg	215.52 kg	-54.07 kg -2,108.55 kg
NOx	122.03 kg	447.08 kg	-325.04 kg -12,675.97 kg

NIST BLCC 5.3-21: Comparative Analysis

Consistent with Federal Life Cycle Cost Methodology and Procedures, 10 CFR, Part 436, Subpart A

Base Case: AHU

Alternative: Ground Sorce Heat Pump

General Information

File Name:	J:\Project Files\2022 Jobs\22008 - HAFB SWEG Bldg\ENG\MECH\LCCA SWEG.xml
Date of Study:	Thu May 05 10:43:47 MDT 2022
Project Name:	SWEG
Project Location:	Utah
Analysis Type:	FEMP Analysis, Energy Project
Analyst:	Heath Engineering
Base Date:	April 1, 2021
Service Date:	April 1, 2022
Study Period:	40 years 0 months(April 1, 2021 through March 31, 2061)
Discount Rate:	1.5%
Discounting Convention:	End-of-Year

Comparison of Present-Value Costs

PV Life-Cycle Cost

	Base Case	Alternative	Savings from Alternative
Initial Investment Costs:			
Capital Requirements as of Base Date	$313,640	$483,845	-$170,205
Future Costs:			
Energy Consumption Costs	$301,505	$328,224	-$26,719
Energy Demand Charges	$0	$0	$0
Energy Utility Rebates	$0	$0	$0
Water Costs	$0	$0	$0
Recurring and Non-Recurring OM&R Costs	$341,531	$341,531	$0
Capital Replacements	$379,334	$282,264	$97,069
Residual Value at End of Study Period	$0	$0	$0
Subtotal (for Future Cost Items)	$1,022,369	$952,019	$70,350
Total PV Life-Cycle Cost	$1,336,009	$1,435,864	-$99,855

Net Savings from Alternative Compared with Base Case

PV of Non-Investment Savings	-$26,719
- Increased Total Investment	$73,136

Net Savings	-$99,855

NOTE: Meaningful SIR, AIRR and Payback can not be computed unless incremental savings and total savings are both positive.

Energy Savings Summary

Energy Savings Summary (in stated units)

Energy Type	Average Annual Consumption Base Case	Alternative	Savings	Life-Cycle Savings
Electricity	162,056.0 kWh	165,369.0 kWh	-3,313.0 kWh	-129,200.2 kWh
Natural Gas	2,501.0 Therm	3,345.0 Therm	-844.0 Therm	-32,914.3 Therm

Energy Savings Summary (in MBtu)

Energy Type	Average Annual Consumption Base Case	Alternative	Savings	Life-Cycle Savings
Electricity	553.0 MBtu	564.3 MBtu	-11.3 MBtu	-440.8 MBtu
Natural Gas	250.1 MBtu	334.5 MBtu	-84.4 MBtu	-3,291.4 MBtu

Emissions Reduction Summary

Energy Type	Average Annual Emissions Base Case	Alternative	Reduction	Life-Cycle Reduction
Electricity				
CO2	117,472.93 kg	68,077.60 kg	49,395.33 kg	1,926,316.42 kg
SO2	54.84 kg	74.42 kg	-19.58 kg	-763.48 kg
NOx	120.19 kg	453.66 kg	-333.48 kg	-13,004.92 kg
Natural Gas				
CO2	13,210.05 kg	17,667.98 kg	-4,457.93 kg	-173,850.16 kg
SO2	106.61 kg	142.59 kg	-35.98 kg	-1,403.03 kg
NOx	1.85 kg	20.82 kg	-18.98 kg	-740.03 kg
Total:				
CO2	130,682.98 kg	85,745.59 kg	44,937.40 kg	1,752,466.27 kg
SO2	161.45 kg	217.01 kg	-55.55 kg	-2,166.50 kg
NOx	122.03 kg	474.49 kg	-352.45 kg	-13,744.95 kg

NIST BLCC 5.3-21: Cash Flow Analysis

Consistent with Federal Life Cycle Cost Methodology and Procedures, 10 CFR, Part 436, Subpart A

General Information

File Name:	J:\Project Files\2022 Jobs\22008 - HAFB SWEG Bldg\ENG\MECH\LCCA SWEG.xml
Date of Study:	Thu May 05 10:41:01 MDT 2022
Analysis Type:	FEMP Analysis, Energy Project
Project Name:	SWEG
Project Location:	Utah
Analyst:	Heath Engineering
Base Date:	April 1, 2021
Service Date:	April 1, 2022
Study Period:	40 years 0 months (April 1, 2021 through March 31, 2061)

End-of-year cash-flow convention used

All costs in current dollars (including general inflation)

Alternative: AHU

Initial Capital Costs

Component: AHU

Year Beginning	Total
Apr 2021	$313,640
Total	$313,640

Capital Investment Costs

Year Beginning	Initial	Replacement	Total
Apr 2021	$313,640	$0	$313,640
Apr 2022	$0	$0	$0
Apr 2023	$0	$0	$0
Apr 2024	$0	$0	$0
Apr 2025	$0	$0	$0
Apr 2026	$0	$0	$0
Apr 2027	$0	$0	$0
Apr 2028	$0	$0	$0
Apr 2029	$0	$0	$0
Apr 2030	$0	$0	$0
Apr 2031	$0	$0	$0
Apr 2032	$0	$0	$0
Apr 2033	$0	$0	$0
Apr 2034	$0	$0	$0

Apr 2035	$0	$0	$0
Apr 2036	$0	$0	$0
Apr 2037	$0	$0	$0
Apr 2038	$0	$0	$0
Apr 2039	$0	$0	$0
Apr 2040	$0	$0	$0
Apr 2041	$0	$0	$0
Apr 2042	$0	$86,919	$86,919
Apr 2043	$0	$0	$0
Apr 2044	$0	$0	$0
Apr 2045	$0	$296,064	$296,064
Apr 2046	$0	$0	$0
Apr 2047	$0	$159,995	$159,995
Apr 2048	$0	$0	$0
Apr 2049	$0	$0	$0
Apr 2050	$0	$0	$0
Apr 2051	$0	$0	$0
Apr 2052	$0	$0	$0
Apr 2053	$0	$0	$0
Apr 2054	$0	$0	$0
Apr 2055	$0	$0	$0
Apr 2056	$0	$0	$0
Apr 2057	$0	$0	$0
Apr 2058	$0	$0	$0
Apr 2059	$0	$0	$0
Apr 2060	$0	$0	$0
Total	$313,640	$542,978	$856,618

Operating-Related Costs

Year Beginning	Recurring	Energy Consumption	Energy Demand	Energy Rebate	Total
Apr 2021	$0	$0	$0	$0	$0
Apr 2022	$4,409	$13,216	$0	$0	$17,625
Apr 2023	$4,630	$12,830	$0	$0	$17,460
Apr 2024	$4,861	$12,703	$0	$0	$17,565
Apr 2025	$5,104	$12,657	$0	$0	$17,761
Apr 2026	$5,359	$12,503	$0	$0	$17,862
Apr 2027	$5,628	$12,301	$0	$0	$17,929

Apr 2027	$5,628	$12,301	$0	$0	$17,929
Apr 2028	$5,909	$12,108	$0	$0	$18,017
Apr 2029	$6,204	$12,192	$0	$0	$18,396
Apr 2030	$6,514	$12,158	$0	$0	$18,672
Apr 2031	$6,841	$12,018	$0	$0	$18,859
Apr 2032	$7,182	$11,850	$0	$0	$19,033
Apr 2033	$7,541	$11,677	$0	$0	$19,219
Apr 2034	$7,918	$11,507	$0	$0	$19,425
Apr 2035	$8,315	$11,312	$0	$0	$19,627
Apr 2036	$8,730	$11,099	$0	$0	$19,829
Apr 2037	$9,167	$10,897	$0	$0	$20,063
Apr 2038	$9,625	$10,682	$0	$0	$20,307
Apr 2039	$10,107	$10,480	$0	$0	$20,587
Apr 2040	$10,612	$10,280	$0	$0	$20,892
Apr 2041	$11,142	$10,097	$0	$0	$21,239
Apr 2042	$11,699	$9,893	$0	$0	$21,591
Apr 2043	$12,285	$9,698	$0	$0	$21,983
Apr 2044	$12,899	$9,523	$0	$0	$22,422
Apr 2045	$13,543	$9,359	$0	$0	$22,902
Apr 2046	$14,220	$9,183	$0	$0	$23,403
Apr 2047	$14,932	$9,017	$0	$0	$23,949
Apr 2048	$15,678	$8,853	$0	$0	$24,531
Apr 2049	$16,462	$8,684	$0	$0	$25,146
Apr 2050	$17,284	$8,519	$0	$0	$25,803
Apr 2051	$18,150	$8,361	$0	$0	$26,511
Apr 2052	$19,057	$8,206	$0	$0	$27,263
Apr 2053	$20,009	$8,054	$0	$0	$28,063
Apr 2054	$21,009	$7,905	$0	$0	$28,915
Apr 2055	$22,062	$7,759	$0	$0	$29,821
Apr 2056	$23,164	$7,617	$0	$0	$30,781
Apr 2057	$24,322	$7,477	$0	$0	$31,798
Apr 2058	$25,537	$7,339	$0	$0	$32,876
Apr 2059	$26,816	$7,205	$0	$0	$34,021
Apr 2060	$28,152	$7,073	$0	$0	$35,226
Total	$503,080	$394,291	$0	$0	$897,372

Sum of All Cash Flows

Sum of All Cash Flows

Year Beginning	Capital	OM&R	Total
Apr 2021	$313,640	$0	$313,640
Apr 2022	$0	$17,625	$17,625
Apr 2023	$0	$17,460	$17,460
Apr 2024	$0	$17,565	$17,565
Apr 2025	$0	$17,761	$17,761
Apr 2026	$0	$17,862	$17,862
Apr 2027	$0	$17,929	$17,929
Apr 2028	$0	$18,017	$18,017
Apr 2029	$0	$18,396	$18,396
Apr 2030	$0	$18,672	$18,672
Apr 2031	$0	$18,859	$18,859
Apr 2032	$0	$19,033	$19,033
Apr 2033	$0	$19,219	$19,219
Apr 2034	$0	$19,425	$19,425
Apr 2035	$0	$19,627	$19,627
Apr 2036	$0	$19,829	$19,829
Apr 2037	$0	$20,063	$20,063
Apr 2038	$0	$20,307	$20,307
Apr 2039	$0	$20,587	$20,587
Apr 2040	$0	$20,892	$20,892
Apr 2041	$0	$21,239	$21,239
Apr 2042	$86,919	$21,591	$108,511
Apr 2043	$0	$21,983	$21,983
Apr 2044	$0	$22,422	$22,422
Apr 2045	$296,064	$22,902	$318,966
Apr 2046	$0	$23,403	$23,403
Apr 2047	$159,995	$23,949	$183,944
Apr 2048	$0	$24,531	$24,531
Apr 2049	$0	$25,146	$25,146
Apr 2050	$0	$25,803	$25,803
Apr 2051	$0	$26,511	$26,511
Apr 2052	$0	$27,263	$27,263
Apr 2053	$0	$28,063	$28,063
Apr 2054	$0	$28,915	$28,915
Apr 2055	$0	$29,821	$29,821
Apr 2056	$0	$30,781	$30,781

Apr 2057	$0	$31,798	$31,798
Apr 2058	$0	$32,876	$32,876
Apr 2059	$0	$34,021	$34,021
Apr 2060	$0	$35,226	$35,226
Total	$856,618	$897,372	$1,753,990

Alternative: VRF

Initial Capital Costs

Component: VRF

Year Beginning	Total
Apr 2021	$292,535
Total	$292,535

Capital Investment Costs

Year Beginning	Initial	Replacement	Total
Apr 2021	$292,535	$0	$292,535
Apr 2022	$0	$0	$0
Apr 2023	$0	$0	$0
Apr 2024	$0	$0	$0
Apr 2025	$0	$0	$0
Apr 2026	$0	$0	$0
Apr 2027	$0	$0	$0
Apr 2028	$0	$0	$0
Apr 2029	$0	$0	$0
Apr 2030	$0	$0	$0
Apr 2031	$0	$0	$0
Apr 2032	$0	$0	$0
Apr 2033	$0	$0	$0
Apr 2034	$0	$0	$0
Apr 2035	$0	$0	$0
Apr 2036	$0	$0	$0
Apr 2037	$0	$562,254	$562,254
Apr 2038	$0	$0	$0
Apr 2039	$0	$0	$0
Apr 2040	$0	$0	$0
Apr 2041	$0	$0	$0
Apr 2042	$0	$0	$0

Apr 2043	$0	$0	$0
Apr 2044	$0	$0	$0
Apr 2045	$0	$0	$0
Apr 2046	$0	$0	$0
Apr 2047	$0	$0	$0
Apr 2048	$0	$0	$0
Apr 2049	$0	$0	$0
Apr 2050	$0	$0	$0
Apr 2051	$0	$0	$0
Apr 2052	$0	$0	$0
Apr 2053	$0	$0	$0
Apr 2054	$0	$0	$0
Apr 2055	$0	$0	$0
Apr 2056	$0	$0	$0
Apr 2057	$0	$0	$0
Apr 2058	$0	$0	$0
Apr 2059	$0	$0	$0
Apr 2060	$0	$0	$0
Total	$292,535	$562,254	$854,789

Operating-Related Costs

Year Beginning	Recurring	Energy Consumption	Energy Demand	Energy Rebate	Total
Apr 2021	$0	$0	$0	$0	$0
Apr 2022	$4,960	$13,921	$0	$0	$18,881
Apr 2023	$5,209	$13,466	$0	$0	$18,674
Apr 2024	$5,469	$13,273	$0	$0	$18,742
Apr 2025	$5,742	$13,167	$0	$0	$18,909
Apr 2026	$6,029	$12,991	$0	$0	$19,020
Apr 2027	$6,331	$12,783	$0	$0	$19,114
Apr 2028	$6,648	$12,587	$0	$0	$19,234
Apr 2029	$6,980	$12,694	$0	$0	$19,673
Apr 2030	$7,329	$12,676	$0	$0	$20,004
Apr 2031	$7,696	$12,542	$0	$0	$20,238
Apr 2032	$8,080	$12,369	$0	$0	$20,450
Apr 2033	$8,484	$12,191	$0	$0	$20,675
Apr 2034	$8,908	$12,012	$0	$0	$20,920

Apr 2035	$9,354	$11,811	$0	$0	$21,166
Apr 2036	$9,822	$11,591	$0	$0	$21,412
Apr 2037	$10,312	$11,381	$0	$0	$21,693
Apr 2038	$10,828	$11,159	$0	$0	$21,986
Apr 2039	$11,370	$10,949	$0	$0	$22,320
Apr 2040	$11,938	$10,742	$0	$0	$22,680
Apr 2041	$12,535	$10,550	$0	$0	$23,084
Apr 2042	$13,161	$10,341	$0	$0	$23,502
Apr 2043	$13,820	$10,138	$0	$0	$23,958
Apr 2044	$14,511	$9,955	$0	$0	$24,466
Apr 2045	$15,236	$9,785	$0	$0	$25,021
Apr 2046	$15,997	$9,600	$0	$0	$25,598
Apr 2047	$16,799	$9,427	$0	$0	$26,226
Apr 2048	$17,638	$9,256	$0	$0	$26,895
Apr 2049	$18,520	$9,081	$0	$0	$27,601
Apr 2050	$19,445	$8,907	$0	$0	$28,352
Apr 2051	$20,419	$8,742	$0	$0	$29,161
Apr 2052	$21,439	$8,580	$0	$0	$30,020
Apr 2053	$22,511	$8,422	$0	$0	$30,932
Apr 2054	$23,635	$8,266	$0	$0	$31,901
Apr 2055	$24,820	$8,113	$0	$0	$32,933
Apr 2056	$26,060	$7,964	$0	$0	$34,024
Apr 2057	$27,362	$7,818	$0	$0	$35,179
Apr 2058	$28,729	$7,674	$0	$0	$36,403
Apr 2059	$30,168	$7,533	$0	$0	$37,701
Apr 2060	$31,671	$7,395	$0	$0	$39,067
Total	$565,965	$411,850	$0	$0	$977,815

Sum of All Cash Flows

Year Beginning	Capital	OM&R	Total
Apr 2021	$292,535	$0	$292,535
Apr 2022	$0	$18,881	$18,881
Apr 2023	$0	$18,674	$18,674
Apr 2024	$0	$18,742	$18,742
Apr 2025	$0	$18,909	$18,909
Apr 2026	$0	$19,020	$19,020

Apr 2027	$0	$19,114	$19,114
Apr 2028	$0	$19,234	$19,234
Apr 2029	$0	$19,673	$19,673
Apr 2030	$0	$20,004	$20,004
Apr 2031	$0	$20,238	$20,238
Apr 2032	$0	$20,450	$20,450
Apr 2033	$0	$20,675	$20,675
Apr 2034	$0	$20,920	$20,920
Apr 2035	$0	$21,166	$21,166
Apr 2036	$0	$21,412	$21,412
Apr 2037	$562,254	$21,693	$583,947
Apr 2038	$0	$21,986	$21,986
Apr 2039	$0	$22,320	$22,320
Apr 2040	$0	$22,680	$22,680
Apr 2041	$0	$23,084	$23,084
Apr 2042	$0	$23,502	$23,502
Apr 2043	$0	$23,958	$23,958
Apr 2044	$0	$24,466	$24,466
Apr 2045	$0	$25,021	$25,021
Apr 2046	$0	$25,598	$25,598
Apr 2047	$0	$26,226	$26,226
Apr 2048	$0	$26,895	$26,895
Apr 2049	$0	$27,601	$27,601
Apr 2050	$0	$28,352	$28,352
Apr 2051	$0	$29,161	$29,161
Apr 2052	$0	$30,020	$30,020
Apr 2053	$0	$30,932	$30,932
Apr 2054	$0	$31,901	$31,901
Apr 2055	$0	$32,933	$32,933
Apr 2056	$0	$34,024	$34,024
Apr 2057	$0	$35,179	$35,179
Apr 2058	$0	$36,403	$36,403
Apr 2059	$0	$37,701	$37,701
Apr 2060	$0	$39,067	$39,067
Total	$854,789	$977,815	$1,832,604

Alternative: Ground Sorce Heat Pump

Initial Capital Costs

Component: Ground Sorce Heat Pump

Year Beginning	Total
Apr 2021	$483,845
Total	$483,845

Capital Investment Costs

Year Beginning	Initial	Replacement	Total
Apr 2021	$483,845	$0	$483,845
Apr 2022	$0	$0	$0
Apr 2023	$0	$0	$0
Apr 2024	$0	$0	$0
Apr 2025	$0	$0	$0
Apr 2026	$0	$0	$0
Apr 2027	$0	$0	$0
Apr 2028	$0	$0	$0
Apr 2029	$0	$0	$0
Apr 2030	$0	$0	$0
Apr 2031	$0	$0	$0
Apr 2032	$0	$0	$0
Apr 2033	$0	$0	$0
Apr 2034	$0	$0	$0
Apr 2035	$0	$0	$0
Apr 2036	$0	$0	$0
Apr 2037	$0	$303,365	$303,365
Apr 2038	$0	$0	$0
Apr 2039	$0	$0	$0
Apr 2040	$0	$0	$0
Apr 2041	$0	$0	$0
Apr 2042	$0	$59,060	$59,060
Apr 2043	$0	$0	$0
Apr 2044	$0	$0	$0
Apr 2045	$0	$0	$0
Apr 2046	$0	$0	$0
Apr 2047	$0	$0	$0
Apr 2048	$0	$0	$0
Apr 2049	$0	$0	$0

Apr 2050	$0	$0	$0
Apr 2051	$0	$0	$0
Apr 2052	$0	$0	$0
Apr 2053	$0	$0	$0
Apr 2054	$0	$0	$0
Apr 2055	$0	$0	$0
Apr 2056	$0	$0	$0
Apr 2057	$0	$0	$0
Apr 2058	$0	$0	$0
Apr 2059	$0	$0	$0
Apr 2060	$0	$0	$0
Total	$483,845	$362,425	$846,270

Operating-Related Costs

Year Beginning	Recurring	Energy Consumption	Energy Demand	Energy Rebate	Total
Apr 2021	$0	$0	$0	$0	$0
Apr 2022	$4,409	$14,256	$0	$0	$18,665
Apr 2023	$4,630	$13,842	$0	$0	$18,472
Apr 2024	$4,861	$13,702	$0	$0	$18,563
Apr 2025	$5,104	$13,649	$0	$0	$18,753
Apr 2026	$5,359	$13,488	$0	$0	$18,848
Apr 2027	$5,628	$13,280	$0	$0	$18,907
Apr 2028	$5,909	$13,080	$0	$0	$18,989
Apr 2029	$6,204	$13,229	$0	$0	$19,433
Apr 2030	$6,514	$13,206	$0	$0	$19,720
Apr 2031	$6,841	$13,064	$0	$0	$19,905
Apr 2032	$7,182	$12,890	$0	$0	$20,072
Apr 2033	$7,541	$12,705	$0	$0	$20,247
Apr 2034	$7,918	$12,524	$0	$0	$20,442
Apr 2035	$8,315	$12,315	$0	$0	$20,630
Apr 2036	$8,730	$12,088	$0	$0	$20,818
Apr 2037	$9,167	$11,873	$0	$0	$21,040
Apr 2038	$9,625	$11,644	$0	$0	$21,269
Apr 2039	$10,107	$11,427	$0	$0	$21,534
Apr 2040	$10,612	$11,214	$0	$0	$21,825
Apr 2041	$11,142	$11,017	$0	$0	$22,159

Apr 2042	$11,699	$10,799	$0	$0	$22,498
Apr 2043	$12,285	$10,591	$0	$0	$22,876
Apr 2044	$12,899	$10,404	$0	$0	$23,303
Apr 2045	$13,543	$10,228	$0	$0	$23,772
Apr 2046	$14,220	$10,042	$0	$0	$24,262
Apr 2047	$14,932	$9,865	$0	$0	$24,797
Apr 2048	$15,678	$9,692	$0	$0	$25,371
Apr 2049	$16,462	$9,515	$0	$0	$25,977
Apr 2050	$17,284	$9,340	$0	$0	$26,625
Apr 2051	$18,150	$9,173	$0	$0	$27,323
Apr 2052	$19,057	$9,009	$0	$0	$28,066
Apr 2053	$20,009	$8,848	$0	$0	$28,858
Apr 2054	$21,009	$8,691	$0	$0	$29,700
Apr 2055	$22,062	$8,536	$0	$0	$30,598
Apr 2056	$23,164	$8,384	$0	$0	$31,549
Apr 2057	$24,322	$8,236	$0	$0	$32,558
Apr 2058	$25,537	$8,090	$0	$0	$33,627
Apr 2059	$26,816	$7,947	$0	$0	$34,764
Apr 2060	$28,152	$7,808	$0	$0	$35,960
Total	$503,080	$429,693	$0	$0	$932,773

Sum of All Cash Flows

Year Beginning	Capital	OM&R	Total
Apr 2021	$483,845	$0	$483,845
Apr 2022	$0	$18,665	$18,665
Apr 2023	$0	$18,472	$18,472
Apr 2024	$0	$18,563	$18,563
Apr 2025	$0	$18,753	$18,753
Apr 2026	$0	$18,848	$18,848
Apr 2027	$0	$18,907	$18,907
Apr 2028	$0	$18,989	$18,989
Apr 2029	$0	$19,433	$19,433
Apr 2030	$0	$19,720	$19,720
Apr 2031	$0	$19,905	$19,905
Apr 2032	$0	$20,072	$20,072
Apr 2033	$0	$20,247	$20,247
Apr 2034	$0	$20,442	$20,442

Apr 2035	$0	$20,630	$20,630
Apr 2036	$0	$20,818	$20,818
Apr 2037	$303,365	$21,040	$324,405
Apr 2038	$0	$21,269	$21,269
Apr 2039	$0	$21,534	$21,534
Apr 2040	$0	$21,825	$21,825
Apr 2041	$0	$22,159	$22,159
Apr 2042	$59,060	$22,498	$81,558
Apr 2043	$0	$22,876	$22,876
Apr 2044	$0	$23,303	$23,303
Apr 2045	$0	$23,772	$23,772
Apr 2046	$0	$24,262	$24,262
Apr 2047	$0	$24,797	$24,797
Apr 2048	$0	$25,371	$25,371
Apr 2049	$0	$25,977	$25,977
Apr 2050	$0	$26,625	$26,625
Apr 2051	$0	$27,323	$27,323
Apr 2052	$0	$28,066	$28,066
Apr 2053	$0	$28,858	$28,858
Apr 2054	$0	$29,700	$29,700
Apr 2055	$0	$30,598	$30,598
Apr 2056	$0	$31,549	$31,549
Apr 2057	$0	$32,558	$32,558
Apr 2058	$0	$33,627	$33,627
Apr 2059	$0	$34,764	$34,764
Apr 2060	$0	$35,960	$35,960
Total	$846,270	$932,773	$1,779,044

General Information

File Name:	J:\Project Files\2022 Jobs\22008 - HAFB SWEG Bldg\ENG\MECH\LCCA SWEG.xml
Date of Study:	Thu May 05 10:44:46 MDT 2022
Analysis Type:	FEMP Analysis, Energy Project
Project Name:	SWEG
Project Location:	Utah
Analyst:	Heath Engineering
Base Date:	April 1, 2021
Service Date:	April 1, 2022
Study Period:	40 years 0 months (April 1, 2021 through March 31, 2061)
Discount Rate:	1.5%
Discounting Convention:	End-of-Year

Discount and Escalation Rates are NOMINAL (inclusive of general inflation)

Alternative: AHU

Energy: Electricity

Annual Consumption:	162,056.0 kWh
Price per Unit:	$0.07000
Demand Charge:	$0
Utility Rebate:	$0
Location:	Utah
Rate Schedule:	Commercial
State:	Utah

Usage Indices

From Date	Duration	Usage Index
April 1, 2022	Remaining	100%

Escalation Rates

From Date	Duration	Escalation
April 1, 2021	1 year 0 months	-2.22%
April 1, 2022	1 year 0 months	-2.79%
April 1, 2023	1 year 0 months	-2.97%
April 1, 2024	1 year 0 months	-0.87%
April 1, 2025	1 year 0 months	-0.27%

April 1, 2026	1 year 0 months	-1.39%
April 1, 2027	1 year 0 months	-1.91%
April 1, 2028	1 year 0 months	-1.85%
April 1, 2029	1 year 0 months	-1.17%
April 1, 2030	1 year 0 months	-0.74%
April 1, 2031	1 year 0 months	-1.45%
April 1, 2032	1 year 0 months	-1.69%
April 1, 2033	1 year 0 months	-1.58%
April 1, 2034	1 year 0 months	-1.58%
April 1, 2035	1 year 0 months	-1.82%
April 1, 2036	1 year 0 months	-2.04%
April 1, 2037	1 year 0 months	-2.02%
April 1, 2038	1 year 0 months	-2.16%
April 1, 2039	1 year 0 months	-2.02%
April 1, 2040	1 year 0 months	-2.08%
April 1, 2041	1 year 0 months	-1.92%
April 1, 2042	1 year 0 months	-2.2%
April 1, 2043	1 year 0 months	-2.15%
April 1, 2044	1 year 0 months	-1.98%
April 1, 2045	1 year 0 months	-1.87%
April 1, 2046	1 year 0 months	-2.13%
April 1, 2047	1 year 0 months	-2.05%
April 1, 2048	1 year 0 months	-2.11%
April 1, 2049	1 year 0 months	-2.23%
April 1, 2050	1 year 0 months	-2.23%
April 1, 2051	Remaining	-2.15%

Energy: Natural Gas

Annual Consumption:	2,501.0 Therm
Price per Unit:	$0.99935
Demand Charge:	$0
Utility Rebate:	$0
End-Use:	Commercial Boiler, controlled-low NOx burners
Rate Schedule:	Commercial
State:	Utah

Usage Indices

From Date	Duration	Usage Index

April 1, 2022	Remaining	100%

Escalation Rates

From Date	Duration	Escalation
April 1, 2021	1 year 0 months	-0.56%
April 1, 2022	1 year 0 months	-2.2%
April 1, 2023	1 year 0 months	-2.67%
April 1, 2024	1 year 0 months	-1.5%
April 1, 2025	1 year 0 months	-0.79%
April 1, 2026	1 year 0 months	-0.44%
April 1, 2027	1 year 0 months	-0.33%
April 1, 2028	1 year 0 months	-0.35%
April 1, 2029	1 year 0 months	8.76%
April 1, 2030	1 year 0 months	1.49%
April 1, 2031	1 year 0 months	0%
April 1, 2032	1 year 0 months	-0.32%
April 1, 2033	1 year 0 months	-1.01%
April 1, 2034	1 year 0 months	-1.01%
April 1, 2035	1 year 0 months	-1.21%
April 1, 2036	1 year 0 months	-1.31%
April 1, 2037	1 year 0 months	-1.12%
April 1, 2038	1 year 0 months	-1.31%
April 1, 2039	1 year 0 months	-1.4%
April 1, 2040	1 year 0 months	-1.31%
April 1, 2041	1 year 0 months	-1.31%
April 1, 2042	1 year 0 months	-1.4%
April 1, 2043	1 year 0 months	-1.31%
April 1, 2044	1 year 0 months	-1.22%
April 1, 2045	1 year 0 months	-1.22%
April 1, 2046	1 year 0 months	-1.03%
April 1, 2047	1 year 0 months	-1.03%
April 1, 2048	1 year 0 months	-0.85%
April 1, 2049	1 year 0 months	-0.85%
April 1, 2050	1 year 0 months	-0.86%
April 1, 2051	Remaining	-0.92%

Component: AHU

Initial Investment

Initial Cost (base-year $):	$313,640
Annual Rate of Increase:	5%
Expected Asset Life:	0 years 0 months
Residual Value Factor:	0%

Cost-Phasing

Cost Adjustment Factor: -0%

Years/Months (from Date)	Date	Portion
0 years 0 months	April 1, 2021	100%

Replacement: Boiler

Years/Months:	25 years 0 months
Amount:	$45,000
Annual Rate Of Increase:	5%
Expected Asset Life:	25 years 0 months
Residual Value Factor:	0%

Replacement: Chiller

Years/Months:	23 years 0 months
Amount:	$91,800
Annual Rate Of Increase:	5%
Expected Asset Life:	23 years 0 months
Residual Value Factor:	0%

Replacement: AHU

Years/Months:	20 years 0 months
Amount:	$10,000
Annual Rate Of Increase:	5%
Expected Asset Life:	20 years 0 months
Residual Value Factor:	0%

Replacement: Pump

Years/Months:	20 years 0 months
Amount:	$21,200
Annual Rate Of Increase:	5%
Expected Asset Life:	20 years 0 months

Residual Value Factor: 0%

Recurring OM&R: Maintenance

Amount: $4,000

Annual Rate of Increase: 5%

Usage Indices

From Date	Duration	Factor
April 1, 2022	Remaining	100%

Alternative: VRF

Energy: Natural Gas

Annual Consumption: 3,345.0 Therm

Price per Unit: $0.99935

Demand Charge: $0

Utility Rebate: $0

End-Use: Commercial Boiler, controlled-low NOx burners

Rate Schedule: Residential

State: Utah

Usage Indices

From Date	Duration	Usage Index
April 1, 2022	Remaining	100%

Escalation Rates

From Date	Duration	Escalation
April 1, 2021	1 year 0 months	-2.34%
April 1, 2022	1 year 0 months	-3.97%
April 1, 2023	1 year 0 months	-4.29%
April 1, 2024	1 year 0 months	-3.39%
April 1, 2025	1 year 0 months	-2.69%
April 1, 2026	1 year 0 months	-1.13%
April 1, 2027	1 year 0 months	-0.48%
April 1, 2028	1 year 0 months	-0.4%
April 1, 2029	1 year 0 months	8.08%
April 1, 2030	1 year 0 months	1.79%
April 1, 2031	1 year 0 months	0.17%
April 1, 2032	1 year 0 months	-0.4%

April 1, 2033	1 year 0 months	-1.04%
April 1, 2034	1 year 0 months	-1.11%
April 1, 2035	1 year 0 months	-1.19%
April 1, 2036	1 year 0 months	-1.35%
April 1, 2037	1 year 0 months	-1.19%
April 1, 2038	1 year 0 months	-1.35%
April 1, 2039	1 year 0 months	-1.42%
April 1, 2040	1 year 0 months	-1.35%
April 1, 2041	1 year 0 months	-1.42%
April 1, 2042	1 year 0 months	-1.35%
April 1, 2043	1 year 0 months	-1.42%
April 1, 2044	1 year 0 months	-1.27%
April 1, 2045	1 year 0 months	-1.27%
April 1, 2046	1 year 0 months	-1.2%
April 1, 2047	1 year 0 months	-1.12%
April 1, 2048	1 year 0 months	-0.98%
April 1, 2049	1 year 0 months	-0.98%
April 1, 2050	1 year 0 months	-1.06%
April 1, 2051	Remaining	-1.07%

Energy: Electricity

Annual Consumption:	162,067.0 kWh
Price per Unit:	$0.07000
Demand Charge:	$0
Utility Rebate:	$0
Location:	Alaska
Rate Schedule:	Commercial
State:	Utah

Usage Indices

From Date	Duration	Usage Index
April 1, 2022	Remaining	100%

Escalation Rates

From Date	Duration	Escalation
April 1, 2021	1 year 0 months	-2.22%
April 1, 2022	1 year 0 months	-2.79%

April 1, 2023	1 year 0 months	-2.97%
April 1, 2024	1 year 0 months	-0.87%
April 1, 2025	1 year 0 months	-0.27%
April 1, 2026	1 year 0 months	-1.39%
April 1, 2027	1 year 0 months	-1.91%
April 1, 2028	1 year 0 months	-1.85%
April 1, 2029	1 year 0 months	-1.17%
April 1, 2030	1 year 0 months	-0.74%
April 1, 2031	1 year 0 months	-1.45%
April 1, 2032	1 year 0 months	-1.69%
April 1, 2033	1 year 0 months	-1.58%
April 1, 2034	1 year 0 months	-1.58%
April 1, 2035	1 year 0 months	-1.82%
April 1, 2036	1 year 0 months	-2.04%
April 1, 2037	1 year 0 months	-2.02%
April 1, 2038	1 year 0 months	-2.16%
April 1, 2039	1 year 0 months	-2.02%
April 1, 2040	1 year 0 months	-2.08%
April 1, 2041	1 year 0 months	-1.92%
April 1, 2042	1 year 0 months	-2.2%
April 1, 2043	1 year 0 months	-2.15%
April 1, 2044	1 year 0 months	-1.98%
April 1, 2045	1 year 0 months	-1.87%
April 1, 2046	1 year 0 months	-2.13%
April 1, 2047	1 year 0 months	-2.05%
April 1, 2048	1 year 0 months	-2.11%
April 1, 2049	1 year 0 months	-2.23%
April 1, 2050	1 year 0 months	-2.23%
April 1, 2051	Remaining	-2.15%

Component: VRF

Initial Investment

Initial Cost (base-year $):	$292,535
Annual Rate of Increase:	5%
Expected Asset Life:	15 years 0 months
Residual Value Factor:	0%

Cost-Phasing

Cost Adjustment Factor: -0%

Years/Months (from Date)	Date	Portion
0 years 0 months	April 1, 2021	100%

Replacement: Outdoor Units

Years/Months:	15 years 0 months
Amount:	$93,600
Annual Rate Of Increase:	5%
Expected Asset Life:	15 years 0 months
Residual Value Factor:	0%

Replacement: Indoor Units

Years/Months:	15 years 0 months
Amount:	$53,975
Annual Rate Of Increase:	5%
Expected Asset Life:	15 years 0 months
Residual Value Factor:	0%

Replacement: DOAS

Years/Months:	15 years 0 months
Amount:	$85,000
Annual Rate Of Increase:	5%
Expected Asset Life:	15 years 0 months
Residual Value Factor:	0%

Replacement: Branch Selector Box

Years/Months:	15 years 0 months
Amount:	$25,000
Annual Rate Of Increase:	5%
Expected Asset Life:	15 years 0 months
Residual Value Factor:	0%

Recurring OM&R: Maintenance

Amount:	$4,500
Annual Rate of Increase:	5%

Usage Indices

From Date	Duration	Factor
April 1, 2022	Remaining	100%

Alternative: Ground Sorce Heat Pump

Energy: Electricity

Annual Consumption:	165,369.0 kWh
Price per Unit:	$0.07000
Demand Charge:	$0
Utility Rebate:	$0
Location:	Alaska
Rate Schedule:	Commercial
State:	Utah

Usage Indices

From Date	Duration	Usage Index
April 1, 2022	Remaining	100%

Escalation Rates

From Date	Duration	Escalation
April 1, 2021	1 year 0 months	-2.22%
April 1, 2022	1 year 0 months	-2.79%
April 1, 2023	1 year 0 months	-2.97%
April 1, 2024	1 year 0 months	-0.87%
April 1, 2025	1 year 0 months	-0.27%
April 1, 2026	1 year 0 months	-1.39%
April 1, 2027	1 year 0 months	-1.91%
April 1, 2028	1 year 0 months	-1.85%
April 1, 2029	1 year 0 months	-1.17%
April 1, 2030	1 year 0 months	-0.74%
April 1, 2031	1 year 0 months	-1.45%
April 1, 2032	1 year 0 months	-1.69%
April 1, 2033	1 year 0 months	-1.58%
April 1, 2034	1 year 0 months	-1.58%
April 1, 2035	1 year 0 months	-1.82%
April 1, 2036	1 year 0 months	-2.04%
April 1, 2037	1 year 0 months	-2.02%
April 1, 2038	1 year 0 months	-2.16%

April 1, 2039	1 year 0 months	-2.02%
April 1, 2040	1 year 0 months	-2.08%
April 1, 2041	1 year 0 months	-1.92%
April 1, 2042	1 year 0 months	-2.2%
April 1, 2043	1 year 0 months	-2.15%
April 1, 2044	1 year 0 months	-1.98%
April 1, 2045	1 year 0 months	-1.87%
April 1, 2046	1 year 0 months	-2.13%
April 1, 2047	1 year 0 months	-2.05%
April 1, 2048	1 year 0 months	-2.11%
April 1, 2049	1 year 0 months	-2.23%
April 1, 2050	1 year 0 months	-2.23%
April 1, 2051	Remaining	-2.15%

Energy: Natural Gas

Annual Consumption:	3,345.0 Therm
Price per Unit:	$0.99935
Demand Charge:	$0
Utility Rebate:	$0
End-Use:	Industrial Boiler, uncontrolled
Rate Schedule:	Commercial
State:	Utah

Usage Indices

From Date	Duration	Usage Index
April 1, 2022	Remaining	100%

Escalation Rates

From Date	Duration	Escalation
April 1, 2021	1 year 0 months	-0.56%
April 1, 2022	1 year 0 months	-2.2%
April 1, 2023	1 year 0 months	-2.67%
April 1, 2024	1 year 0 months	-1.5%
April 1, 2025	1 year 0 months	-0.79%
April 1, 2026	1 year 0 months	-0.44%
April 1, 2027	1 year 0 months	-0.33%
April 1, 2028	1 year 0 months	-0.35%
April 1, 2029	1 year 0 months	8.76%

April 1, 2030	1 year 0 months	1.49%
April 1, 2031	1 year 0 months	0%
April 1, 2032	1 year 0 months	-0.32%
April 1, 2033	1 year 0 months	-1.01%
April 1, 2034	1 year 0 months	-1.01%
April 1, 2035	1 year 0 months	-1.21%
April 1, 2036	1 year 0 months	-1.31%
April 1, 2037	1 year 0 months	-1.12%
April 1, 2038	1 year 0 months	-1.31%
April 1, 2039	1 year 0 months	-1.4%
April 1, 2040	1 year 0 months	-1.31%
April 1, 2041	1 year 0 months	-1.31%
April 1, 2042	1 year 0 months	-1.4%
April 1, 2043	1 year 0 months	-1.31%
April 1, 2044	1 year 0 months	-1.22%
April 1, 2045	1 year 0 months	-1.22%
April 1, 2046	1 year 0 months	-1.03%
April 1, 2047	1 year 0 months	-1.03%
April 1, 2048	1 year 0 months	-0.85%
April 1, 2049	1 year 0 months	-0.85%
April 1, 2050	1 year 0 months	-0.86%
April 1, 2051	Remaining	-0.92%

Component: Ground Sorce Heat Pump

Initial Investment

Initial Cost (base-year $):	$483,845
Annual Rate of Increase:	5%
Expected Asset Life:	15 years 0 months
Residual Value Factor:	0%

Cost-Phasing

Cost Adjustment Factor: -0%

Years/Months (from Date)	Date	Portion
0 years 0 months	April 1, 2021	100%

Replacement: Indoor Units

Years/Months: 15 years 0 months

Years/Months:	15 years 0 months
Amount:	$53,975
Annual Rate Of Increase:	5%
Expected Asset Life:	15 years 0 months
Residual Value Factor:	0%

Replacement: Pumps

Years/Months:	20 years 0 months
Amount:	$21,200
Annual Rate Of Increase:	5%
Expected Asset Life:	20 years 0 months
Residual Value Factor:	0%

Replacement: DOAS

Years/Months:	15 years 0 months
Amount:	$85,000
Annual Rate Of Increase:	5%
Expected Asset Life:	15 years 0 months
Residual Value Factor:	0%

Recurring OM&R: Maintenance

Amount:	$4,000
Annual Rate of Increase:	5%

Usage Indices

From Date	Duration	Factor
April 1, 2022	Remaining	100%

Attachment #3
Electrical Service Calculations

Hill AFB, Utah
New B309 SWEG 22-004
Electrical Service Size Calculation

Hill AFB B517 Electrical Service Size Calculation										
Description	SQ FT	Watts/SF	QTY	HP	Volt	Ph	kVA	Multiplier	kVA	Notes
480/277 Volt Loads										
Mechanical Loads										
Office Area	0	12					0.0	1.00	0.0	
Lighting	0	1			277	1	0.0	1.25	0.0	
480 volt subtotal									0	kVA
									0	Amps at 480/277 volts
208/120 Volt Loads										
Mechanical Loads										
Office Area	10,581	12					127.0	1.00	127.0	
Lighting	10,581	1					10.6	1.25	13.2	
Misc										
Office Areas	10,581	1.5					15.9	1.00	15.9	
Receptacles										
Office Areas	10,581	4					42.3			
Subtotal RCPT (100% < 10kVA)							10.0	1.00	10.0	
Subtotal RCPT (50% > 10kVA)							32.3	0.50	16.2	
208 volt subtotal									182	kVA
									506	Amps at 208/120 volts
Total 480/277 volt service										
480/277 volt loads									0	
208/120 volt loads									182	
									182	**kVA**
									506	**Amps at 208/120 volts**
Transformer Sizing - Total KVA x 120%									**219**	**KVA**
Switchboard Sizing - Total Amps x 120%									**607**	**Amps**

Attachment #4
Construction Cost Estimate

PROJECT ESTIMATE	CONSTRUCTION CONTROL CORPORATION				5/9/2022
PROJECT NAME……..…..HAFB SWEG BUILDING					**BUILDING**
LOCATION……..……LAYTON, UT					
ARCHITECT…..……..…CRSA				10,560	SF
STAGE OF DESIGN…..…..100% DESIGN					

CSI #	DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL
	BUILDING COST SUMMARY				
02	**EXISTING CONDITIONS**			$ 3.18	$ 33,536
03	**CONCRETE**			$ 18.27	$ 192,936
04	**MASONRY**			$ 28.48	$ 300,758
05	**METALS**			$ 41.91	$ 442,594
06	**WOODS & PLASTICS**			$ 4.43	$ 46,745
07	**THERMAL & MOISTURE PROTECTION**			$ 31.69	$ 334,607
08	**DOORS & WINDOWS**			$ 19.01	$ 200,723
09	**FINISHES**			$ 33.07	$ 349,195
10	**SPECIALTIES**			$ 2.10	$ 22,200
11	**EQUIPMENT**			$ -	$ -
12	**FURNISHINGS**			$ -	$ -
13	**SPECIAL CONSTRUCTION**			$ -	$ -
14	**CONVEYING SYSTEMS**			$ -	$ -
21	**FIRE SUPPRESSION**			$ 4.50	$ 47,520
22	**PLUMBING**			$ 13.17	$ 139,065
23	**HVAC**			$ 56.31	$ 594,639
26	**ELECTRICAL**			$ 44.86	$ 473,697
27	**COMMUNICATION**			$ 19.55	$ 206,440
28	**ELECTRONIC SAFETY & SECURITY**			$ 12.57	$ 132,703
31	**EARTHWORK**			$ 9.47	$ 100,054
32	**EXTERIOR IMPROVEMENTS**			$ 13.73	$ 144,975
33	**UTILITIES**			$ 23.54	$ 248,573
	SUBTOTAL			$ 379.83	$ 4,010,960
	GENERAL CONDITIONS	9%		$ 34.18	$ 360,986
	BONDS & INSURANCE	2%		$ 8.28	$ 87,439
	OVERHEAD & PROFIT	6%		$ 25.34	$ 267,563
	DESIGN CONTINGENCY	5%		$ 18.99	$ 200,548
	TOTAL CONSTRUCTION COST			$ 466.62	$ 4,927,497

PROJECT ESTIMATE	CONSTRUCTION CONTROL CORPORATION				5/9/2022
PROJECT NAME……..…..HAFB SWEG BUILDING					**BUILDING**
LOCATION……..……LAYTON, UT					
ARCHITECT…..……..…CRSA				10,560	SF
STAGE OF DESIGN…..…..100% DESIGN					

CSI #	DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL
02	**EXISTING CONDITIONS**				
	Site Clearing & Demolition	25,000	SF	$ 0.89	$ 22,250
	Demo Shed	2,400	CF	$ 0.50	$ 1,200
	Demo Concrete Slab	329	SF	$ 1.89	$ 622
	Demo Sidewalk	102	SF	$ 2.00	$ 204
	Demo Curb and Gutter	23	LF	$ 12.00	$ 276
	Remove Asphalt Paving	3,226	SF	$ 1.39	$ 4,484
	Sawcutting	1	Allow	$ 4,500.00	$ 4,500
	TOTAL EXISTING CONDITIONS				**$ 33,536**
03	**CONCRETE**				
	Continuous Footing	50	CY	$ 505.00	$ 25,096
	Spot Footing	13	CY	$ 515.00	$ 6,792
	Foundation Wall	1,780	SF	$ 55.00	$ 97,900
	Slab on Grade	10,560	SF	$ 5.68	$ 59,981
	Vapor Barrier	10,560	SF	$ 0.30	$ 3,168
	TOTAL CONCRETE				**$ 192,936**
04	**MASONRY**				
	Exterior CMU	6,327	SF	$ 24.00	$ 151,848
	CMU Split Faced	2,413	SF	$ 26.00	$ 62,738
	CMU Honed	1,059	SF	$ 28.00	$ 29,652
	CMU	2,099	SF	$ 24.00	$ 50,376
	Column	192	SF	$ 32.00	$ 6,144
	TOTAL MASONRY				**$ 300,758**
05	**METALS**				
	Roof Structural Steel	91,558	LB	$ 3.60	$ 329,610
	Miscellaneous Metals	9,156	LB	$ 6.00	$ 54,935
	Metal Roof Deck	11,445	SF	$ 4.65	$ 53,218
	Metal Roof Canopy	1,050	SF	$ 4.60	$ 4,830
	TOTAL METALS				**$ 442,594**
06	**WOOD & PLASTICS**				
	Carpentry				
	Wood Plates & Blocking	10,560	SF	$ 0.75	$ 7,920
	Subtotal for Carpentry				**$ 7,920**
	Millwork				
	Base Cabinet	11	LF	$ 455.00	$ 5,005
	Upper Cabinet	9	LF	$ 325.00	$ 2,925
	Vanity	23	LF	$ 425.00	$ 9,775
	Miscellaneous Millwork	10,560	SF	$ 2.00	$ 21,120
	Subtotal for Millwork				**$ 38,825**
	TOTAL WOOD & PLASTICS				**$ 46,745**
07	**THERMAL & MOISTURE PROTECTION**				
	Roof Membrane	10,560	SF	$ 5.25	$ 55,440
	Standing Seam Metal Roof	885	SF	$ 15.95	$ 14,113
	Rigid Roof Insulation	10,560	SF	$ 5.60	$ 59,136
	Roof Protection Board	10,560	SF	$ 2.45	$ 25,872
	Roof Vapor Barrier	10,560	SF	$ 3.25	$ 34,320
	Metal Soffit	885	SF	$ 30.00	$ 26,544

PROJECT ESTIMATE	CONSTRUCTION CONTROL CORPORATION	5/9/2022

PROJECT NAME……..…..HAFB SWEG BUILDING **BUILDING**
LOCATION……..……LAYTON, UT
ARCHITECT…..……..…CRSA 10,560 SF
STAGE OF DESIGN…..…..100% DESIGN

CSI #	DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL
	Spray Insulation at exterior wall	4,429	SF	$ 4.05	$ 17,937
	Rigid Foundation Insulation	1,780	SF	$ 3.00	$ 5,340
	Sound Batt	16,090	SF	$ 1.25	$ 20,113
	Spray Foam Insulation	6,327	SF	$ 4.05	$ 25,624
	Metal Wall Panel	633	SF	$ 52.00	$ 32,900
	Metal Roof Cap	445	LF	$ 16.50	$ 7,343
	Flashing & Sheet Metal	890	SF	$ 7.00	$ 6,230
	Caulking & Sealing	10,560	SF	$ 0.35	$ 3,696
	TOTAL THERMAL & MOISTURE PROTECTION				**$ 334,607**
08	**DOORS & WINDOWS**				
	Interior Wood Single with glaze	13	EA	$ 1,980.00	$ 25,740
	Int. Wood	7	EA	$ 1,656.00	$ 11,592
	HM	3	EA	$ 14.65	$ 44
	Door Double Aluminum	2	EA	$ 7,850.00	$ 15,700
	Al. Insulated Ext. Door	2	EA	$ 3,025.00	$ 6,050
	Al. Tempered Glass	1	EA	$ 4,125.00	$ 4,125
	Shading Devices	960	SF	$ 90.00	$ 86,400
	Ribbon Window Glaze	1,064	SF	$ 48.00	$ 51,072
	TOTAL DOORS & WINDOWS				**$ 200,723**
09	**FINISHES**				
	Exterior MS Wall Furring	6,327	SF	$ 3.95	$ 24,992
	Ext. Wall	695	SF	$ 3.95	$ 2,745
	Int. Plumbing Wall	3,851	SF	$ 4.05	$ 15,597
	Interior Partition Framing	5,912	SF	$ 3.95	$ 23,352
	Gyp. Wallboard	25,853	SF	$ 2.35	$ 60,755
	Carpet	8,265	SF	$ 5.50	$ 45,458
	Sealed Concrete	666	SF	$ 2.00	$ 1,332
	Porcelain 2x2 Mosaic	508	SF	$ 18.00	$ 9,144
	Porcelain Tile 12x24	435	SF	$ 24.00	$ 10,440
	Porcelain Tile 12x12	58	SF	$ 20.00	$ 1,160
	Luxury Vinyl Tile	628	SF	$ 12.65	$ 7,944
	Porcelain Wall Tile	1,357	SF	$ 16.00	$ 21,712
	Gyp. Board Ceiling	827	SF	$ 6.00	$ 4,962
	Open to Structure	643	SF	$ -	$ -
	Acoustical Panel Ceiling	9,090	SF	$ 6.00	$ 54,540
	Base	1,724	LF	$ 4.00	$ 6,894
	Paint Gyp. Wallboard	25,853	SF	$ 1.25	$ 32,316
	Wall Finishes	25,853	SF	$ 1.00	$ 25,853
	TOTAL FINISHES				**$ 349,195**
10	**SPECIALTIES**				
	Fire Protection Specialties	1	LS	$ 1,500.00	$ 1,500
	Identifying Devices	1	Allow	$ 7,500.00	$ 7,500
	ADA 42" Grab Bars	3	EA	$ 265.00	$ 795
	ADA 36" Grab Bars	3	EA	$ 225.00	$ 675
	ADA 18" Vertical Grab Bars	3	EA	$ 195.00	$ 585
	Urinal Partition	2	EA	$ 600.00	$ 1,200
	Toilet Partition	2	EA	$ 1,360.00	$ 2,720
	ADA Partition	2	EA	$ 1,450.00	$ 2,900
	Toilet Paper Dispenser	5	EA	$ 115.00	$ 575

PROJECT ESTIMATE	CONSTRUCTION CONTROL CORPORATION					5/9/2022
PROJECT NAME……..…..HAFB SWEG BUILDING						**BUILDING**
LOCATION……..……LAYTON, UT						
ARCHITECT…..……..…CRSA				10,560	SF	
STAGE OF DESIGN…..…..100% DESIGN						

CSI #	DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL
	Paper Towel Dispenser	5	EA	$ 295.00	$ 1,475
	24"x36" Mirror	7	EA	$ 325.00	$ 2,275
	TOTAL SPECIALTIES				**$ 22,200**
11	**EQUIPMENT**				
	TOTAL EQUIPMENT				**$ -**
12	**FURNISHINGS**				
	TOTAL FURNISHINGS				**$ -**
13	**SPECIAL CONSTRUCTION**				
	TOTAL SPECIAL CONSTRUCTION				**$ -**
14	**CONVEYING SYSTEMS**				
	TOTAL CONVEYING SYSTEMS				**$ -**
21	**FIRE SUPPRESSION**				
	Fire Suppression System	10,560	SF	$ 4.50	$ 47,520
	TOTAL FIRE SUPPRESSION				**$ 47,520**
22	**PLUMBING**				
	Toilets	2	EA	$ 1,465.00	$ 2,930
	ADA Water Closets	3	EA	$ 2,050.00	$ 6,150
	Lav Undermount Oval Sink	7	EA	$ 980.00	$ 6,860
	Urinal	2	EA	$ 1,950.00	$ 3,900
	ADA Urinal	2	EA	$ 2,150.00	$ 4,300
	Water Fountain	1	EA	$ 2,950.00	$ 2,950
	Circulation Pump	1	EA	$ 965.00	$ 965
	Water Heater	1	EA	$ 3,850.00	$ 3,850
	Mop Sink	1	EA	$ 895.00	$ 895
	Mixing Valve	1	EA	$ 860.00	$ 860
	Floor Drains	8	EA	$ 165.00	$ 1,320
	Supply Piping	1,160	LF	$ 30.00	$ 34,800
	Waste Vent Piping	777	LF	$ 34.00	$ 26,425
	Roof Drains	8	EA	$ 365.00	$ 2,920
	Roof Drain Piping	480	LF	$ 34.00	$ 16,320
	Gas Piping	10,560	SF	$ 2.00	$ 21,120
	Clean and Flush Lines	1	LS	$ 2,500.00	$ 2,500
	TOTAL PLUMBING				**$ 139,065**
23	**HVAC**				
	Registers/ Grilles	85	EA	$ 225.00	$ 19,125
	Air Handler 12,000 CFM	1	EA	$ 108,000.00	$ 108,000
	VFD	5	EA	$ 8,650.00	$ 43,250
	Airflow Measurement Station	1	EA	$ 2,850.00	$ 2,850
	Split AC Unit 1.5 ton	1	EA	$ 7,850.00	$ 7,850
	Exhaust Fan 600 CFM	1	EA	$ 1,165.00	$ 1,165
	Motorized Damper	1	EA	$ 3,650.00	$ 3,650
	Louvered Penthouse	1	EA	$ 9,500.00	$ 9,500
	VAV with Reheat	12	EA	$ 3,150.00	$ 37,800
	Relief Fan	2	EA	$ 7,850.00	$ 15,700
	Boiler 600 MBH	1	EA	$ 36,500.00	$ 36,500

PROJECT ESTIMATE	CONSTRUCTION CONTROL CORPORATION				5/9/2022
PROJECT NAME……..…..HAFB SWEG BUILDING					**BUILDING**
LOCATION……..……LAYTON, UT					
ARCHITECT…..……..…CRSA				10,560	SF
STAGE OF DESIGN…..…..100% DESIGN					

CSI #	DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL
	Chiller 45 Ton	1	EA	$ 72,000.00	$ 72,000
	Cabinet Heaters	1	EA	$ 2,950.00	$ 2,950
	Chilled Water Pumps	2	EA	$ 3,650.00	$ 7,300
	Heating Water Pumps	2	EA	$ 3,650.00	$ 7,300
	Expansion Tank	2	EA	$ 2,950.00	$ 5,900
	Air Separator	2	EA	$ 2,650.00	$ 5,300
	Glycol Feed	1	LS	$ 2,950.00	$ 2,950
	Electric Unit Heater	1	EA	$ 2,850.00	$ 2,850
	HVAC Piping	1,550	LF	$ 26.00	$ 40,300
	Balancing Valves	15	EA	$ 765.00	$ 11,475
	Temperature Controls	10,560	SF	$ 4.05	$ 42,768
	Ductwork	8,976	LB	$ 9.15	$ 82,130
	Ductliner	6,373	SF	$ 2.75	$ 17,526
	Test and Balance	100	HR	$ 85.00	$ 8,500
	TOTAL HVAC				**$ 594,639**
26	**ELECTRICAL**				
	Service & Distribution				
	800 A MDP	1	EA	$ 15,850.00	$ 15,850
	225 A Distribution Panel	5	EA	$ 3,950.00	$ 19,750
	100 A Distribution Panel	1	EA	$ 2,850.00	$ 2,850
	Emergency Power	1	LS	$ 50,000.00	$ 50,000
	Grounding	1	LS	$ 3,500.00	$ 3,500
	Meter Base	1	EA	$ 1,650.00	$ 1,650
	CT Enclosure	1	EA	$ 2,650.00	$ 2,650
	Feeders to Panels	660	LF	$ 39.00	$ 25,740
	Transformer Vault	1	EA	$ 4,850.00	$ 4,850
	Electrical manhole	1	EA	$ 4,850.00	$ 4,850
	Ductbank	290	LF	$ 300.00	$ 87,000
	Primary Feeder	70	LF	$ 129.00	$ 9,030
	Subtotal Service & Distribution				**$ 227,720**
	Power				
	Junction Box	13	EA	$ 105.00	$ 1,365
	Duplex Receptacle	78	EA	$ 65.00	$ 5,070
	GFCI Duplex Receptacle	7	EA	$ 75.00	$ 525
	WP GFCI Receptacle	6	EA	$ 80.00	$ 480
	Branch Circuitry	2,496	LF	$ 9.15	$ 22,838
	Motor Hookups	18	EA	$ 450.00	$ 8,100
	Branch Circuitry for Motors	1,080	LF	$ 24.65	$ 26,622
	Subtotal for Power				**$ 65,000**
	Lighting				
	6" Open Round Recessed Downlight	33	EA	$ 325.00	$ 10,725
	4' LED Grid Light	146	EA	$ 365.00	$ 53,290
	4' LED Strip Light	12	EA	$ 330.00	$ 3,960
	3" Wide Ext. Recessed LED	4	EA	$ 365.00	$ 1,460
	Vac. Sensor	33	EA	$ 345.00	$ 11,385
	Outdoor Wall Pack	9	EA	$ 565.00	$ 5,085
	Dimming Controller	14	EA	$ 385.00	$ 5,390
	Occ. Sensor	11	EA	$ 365.00	$ 4,015
	Room Controller	1	EA	$ 375.00	$ 375
	Exit Sign	9	EA	$ 325.00	$ 2,925
	Switch	28	EA	$ 60.00	$ 1,680
	Photocell	8	EA	$ 400.00	$ 3,200
	Branch Circuitry	7,392	LF	$ 9.15	$ 67,637

PROJECT ESTIMATE	CONSTRUCTION CONTROL CORPORATION					5/9/2022
PROJECT NAME……..…..HAFB SWEG BUILDING						**BUILDING**
LOCATION……..……LAYTON, UT						
ARCHITECT…..……..…CRSA				10,560	SF	
STAGE OF DESIGN…..…..100% DESIGN						

CSI #	DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL
	Lighitng Control Panel	1	EA	$ 9,850.00	$ 9,850
	Subtotal for Lighting			]	**$ 180,977**
	TOTAL ELECTRICAL				**$ 473,697**
27	**COMMUNICATIONS**				
	Telecommunications				
	Data Outlet	118	EA	$ 85.00	$ 10,030
	Equipment Racks	2	EA	$ 2,950.00	$ 5,900
	Branch Circuitry	9,600	LF	$ 8.90	$ 85,440
	Cable Tray	530	LF	$ 29.00	$ 15,370
	Telecom Junction Box	1	LF	$ 1,850.00	$ 1,850
	Telecom Feeder	310	LF	$ 79.00	$ 24,490
	Telecommunications				**$ 143,080**
	A/V	10,560	SF	$ 6.00	**$ 63,360**
	TOTAL COMMUNICATIONS				**$ 206,440**
28	**ELECTRONIC SAFETY & SECURITY**				
	Fire/Smoke System				
	Card Reader	5	EA	$ 365.00	$ 1,825
	Smoke Detector	4	EA	$ 375.00	$ 1,500
	Dual Hornstrobe	12	EA	$ 395.00	$ 4,740
	Hornstrobe	15	EA	$ 365.00	$ 5,475
	WP Speaker Evacuation	4	EA	$ 345.00	$ 1,380
	Fire Alarm Control Pannel	1	EA	$ 8,650.00	$ 8,650
	Annunciator Panel	1	EA	$ 3,650.00	$ 3,650
	Control Modules	8	EA	$ 560.00	$ 4,480
	Speaker Evacuation	1	EA	$ 365.00	$ 365
	Fire Alarm Manual Pull Station	2	EA	$ 165.00	$ 330
	Junction Box	11	EA	$ 60.00	$ 660
	Branch Circuitry	5,120	LF	$ 9.15	$ 46,848
	Security System	10,560	SF	$ 5.00	$ 52,800
	TOTAL ELECTRONIC SAFETY & SECURITY				**$ 132,703**
31	**EARTHWORK**				
	Building Excavation	1,956	CY	$ 8.00	$ 15,644
	Backfill & Compaction w/ Imported Fill	880	CY	$ 35.00	$ 30,800
	Haul Away Excess	1,956	CY	$ 8.00	$ 15,644
	Building Grading	10,560	SF	$ 1.25	$ 13,200
	Gravel Under Slab	207	Ton	$ 50.00	$ 10,325
	Site Grading	14,440	SF	$ 1.00	$ 14,440
	TOTAL EARTHWORK				**$ 100,054**
32	**SITE IMPROVEMENTS**				
	Sidewalk	4,107	SF	$ 6.25	$ 25,669
	Stairs	60	SF	$ 40.00	$ 2,400
	New Striping & 2 Handicap Paintings	296	SF	$ 1.00	$ 296
	Misc. Site Repairs	10,000	SF	$ 10.00	$ 100,000
	Curb & Gutter	12	LF	$ 40.00	$ 480
	Asphalt Patch	3,226	SF	$ 5.00	$ 16,130
	TOTAL SITE IMPROVEMENTS				**$ 144,975**
33	**UTILITIES**				

PROJECT ESTIMATE	CONSTRUCTION CONTROL CORPORATION	5/9/2022

PROJECT NAME……..…..HAFB SWEG BUILDING **BUILDING**
LOCATION……..……LAYTON, UT
ARCHITECT…..……..…CRSA 10,560 SF
STAGE OF DESIGN…..…..100% DESIGN

CSI #	DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL
	Storm Drain Line	67	LF	$ 50.00	$ 3,350
	4'x4' Storm Inlet Box	2	LF	$ 4,250.00	$ 8,500
	3'x3' Storm Inlet Box	1	EA	$ 3,650.00	$ 3,650
	2'x2' Storm Drain Box	2	EA	$ 2,250.00	$ 4,500
	Below Grnd Storm Water Infiltration System	12,798	CF	$ 12.00	$ 153,576
	6" Fire Water Line	133	LF	$ 48.00	$ 6,384
	2" Water Service Line	127	LF	$ 38.00	$ 4,826
	Water Meter w/ Vault	1	LF	$ 4,250.00	$ 4,250
	Water Vallve	3	EA	$ 1,650.00	$ 4,950
	8" Water Line	371	LF	$ 52.00	$ 19,292
	Sewer Manhole	1	EA	$ 4,850.00	$ 4,850
	Cleanout	2	EA	$ 650.00	$ 1,300
	6" Sewer Line	27	LF	$ 50.00	$ 1,350
	2" Gas Line	350	LF	$ 40.00	$ 14,000
	1' Water Irrigation Line	5	LF	$ 29.00	$ 145
	Connect to existing	1	LS	$ 10,000.00	$ 10,000
	Gas Meter	1	EA	$ 3,650.00	$ 3,650
	TOTAL UTILITIES				**$ 248,573**

Attachment #6
Structural Calculations

STRUCTURAL CALCULATIONS

For

309th Software Engineering Group Building

Prepared for

CRSA Architects
175 S Main Street, Suite 300
Salt Lake City, UT 84111

By

CALDER RICHARDS
CONSULTING ENGINEERS
634 S. 400 W, Suite 100
Salt Lake City, UT 84101
801-466-1699



CALDER RICHARDS CONSULTING ENGINEERS

JOB TITLE: HAFB 309th SWEG **BY:** NAM **DATE:** 05/06/22
SUBJECT: Load Sheet **CHECKED:** **SHEET:**

CODE: 2018 INTERNATIONAL BUILDING CODE

RISK CATEGORY: II

ROOF LOADS

DEAD LOAD:

Steel Deck	= 2.3 psf
Roofing	= 3.0 psf
Framing	= 6.0 psf
Insulation	= 4.0 psf
Ceiling	= 3.0 psf
Mech./Misc	= 6.7 psf
	Σ = 25.0 psf

SNOW LOAD:

P_g	= 47.0 psf
I_s	= 1.0
C_e	= 1.0
C_t	= 1.0
P_f	= 33.0 psf

ROOF LIVE LOAD:
RLL= 20 psf

SEISMIC:

S_S	= 1.251
S_1	= 0.443
S_{DS}	= 1.001
S_{D1}	= N/A

I_e = 1.0
Seismic Design Category= D
Site Class = D (Default)

LATERAL FORCE RESISTING SYSTEM:
Special Reinforced Masonry Shear Walls

R	= 5.0
Ω_0	= 2.5
C_d	= 3.5

WIND
V = 105 mph
Exposure Category = C

SOILS
Allowable Soil Bearing Pressure = 1800 psf (per soils report)
Frost Depth = 36 in

SEISMIC: Base Standard (use higher values in design)

S_S	= 1.325
S_1	= 0.477
S_{DS}	= 0.883
S_{D1}	= N/A

CALDER RICHARDS

Component & Cladding Wind Loads for
Low-Rise Buildings with heights less than 60'
Design per ASCE 7-16, section 30.4

Project	HAFB 309th SWEG
Date	4/8/2022
Designer	JL

V (mph)	105	Basic Wind Speed
Exposure	C	B, C, or D
Rf Ht, h (ft)	16	Mean Roof Height
Elev (ft)	4611	Ground Elevation

Ke	0.85	
Kzt	1.00	Topographic Factor per Section 26.8.2 and Figure 26.8-1
Kd	0.85	Wind Directionality Factor per Section 26.6 and Table 26.6-1
GCpi	0.18	Internal Pressure Coefficient per Table 26.13-1

Exposure	B	C	D
alpha	7.0	9.5	11.5
zg	1200	900	700
Kz @ h	0.59	0.86	1.04
Kz min	0.70	0.85	1.03
qh	14.22	17.47	21.15

$q_h = 0.00256 * Kz * Kzt * Kd * Ke * V^2$

Windward pressure			
$p = qh(GC_p) - qh(-GC_{pi})$			
Typical and Corner Areas			
p (psf)	p (psf)	area (ft^2)	GCp
12.37	20.62	0	**1.00**
12.37	20.62	10	**1.00**
11.85	19.75	20	0.95
11.53	19.22	30	0.92
11.32	18.87	40	0.90
11.11	18.52	50	0.88
11.01	18.35	60	0.87
10.90	18.17	70	0.86
10.80	18.00	80	0.85
10.69	17.82	90	0.84
10.59	17.65	100	0.83
10.28	17.13	150	0.80
10.07	16.78	200	0.78
9.23	15.38	500	**0.70**
9.23	15.38	1000	**0.70**
ASD	**LRFD**		

Leeward pressure			
$p = qh(GC_p) - qh(-GC_{pi})$			
Typical Areas			
p (psf)	p (psf)	area (ft^2)	GCp
-13.42	-22.37	0	**-1.10**
-13.42	-22.37	10	**-1.10**
-12.89	-21.49	20	-1.05
-12.58	-20.97	30	-1.02
-12.37	-20.62	40	-1.00
-12.16	-20.27	50	-0.98
-12.06	-20.10	60	-0.97
-11.95	-19.92	70	-0.96
-11.85	-19.75	80	-0.95
-11.74	-19.57	90	-0.94
-11.64	-19.40	100	-0.93
-11.32	-18.87	150	-0.90
-11.11	-18.52	200	-0.88
-10.28	-17.13	500	**-0.80**
-10.28	-17.13	1000	**-0.80**
ASD	**LRFD**		

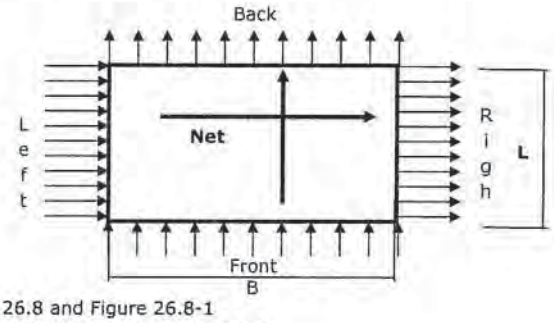
Leeward pressure			
$p = qh(GC_p) - qh(-GC_{pi})$			
Corner Areas			
p (psf)	p (psf)	area (ft^2)	GCp
-16.57	-27.61	0	**-1.40**
-16.57	-27.61	10	**-1.40**
-15.52	-25.86	20	-1.30
-14.89	-24.81	30	-1.24
-14.36	-23.94	40	-1.19
-14.05	-23.41	50	-1.16
-13.73	-22.89	60	-1.13
-13.52	-22.54	70	-1.11
-13.31	-22.19	80	-1.09
-13.10	-21.84	90	-1.07
-12.89	-21.49	100	-1.05
-12.27	-20.45	150	-0.99
-11.85	-19.75	200	-0.95
-10.28	-17.13	500	**-0.80**
-10.28	-17.13	1000	**-0.80**
ASD	**LRFD**		

Notes:
Values for GCp in bold were taken directly from Figure 30.3-1 of ASCE 7-16. The other values have been interpolated.

CALDER RICHARDS

Main Force Wind Resistance For Any Flat-Roof Building
Design Per ASCE 7-16, Section 27.3

Project	**HAFB 309th SWEG**
Date	**4/8/2022**
Designer	**JL**



V (mph)	**105**	Basic Wind Speed
Exposure	**C**	B, C, or D
Ground Elev	**4611**	Ground Elevation
Rf Ht, h (ft)	**16**	Mean Roof Height
L (ft)	**86**	See Diagram Below
B (ft)	**124**	See Diagram Below
K_{zt}	**1.00**	Topographic Factor Per Section 26.8 and Figure 26.8-1
K_d	**0.85**	Wind Directionality Factor Per Section 26.6 and Table 26.6-1
$\pm GC_{pi}$	**0.18**	Product Of Internal Coefficient And Gust Effect Factor per Table 26.13-1
G	**0.85**	Gust Effect Factor For High Rise Buildings Section 26.11.1

For Front To Back		
C_p For q_z	0.80	External Pressure Coefficient Per Figure 27.3-1
C_p For q_h	-0.50	External Pressure Coefficient Per Figure 27.3-1
For Left To Right		
C_p For q_z	0.80	External Pressure Coefficient Per Figure 27.3-1
C_p For q_h	-0.41	External Pressure Coefficient Per Figure 27.3-1
Sidewalls		
C_p For q_h	-0.70	External Pressure Coefficient Per Figure 27.3-1

α	9.5
z_g	900.0
K_z @ h	0.86
K_z min	0.85
Ke	0.85
q_h	17.5

Z - Heights (ft)	K_z @ z	K_z used	q_z	Sidewalls (psf)	Front To Back (psf)		Left To Right (psf)	
					Windward	Leeward	Windward	Leeward
Roof @ 16 ft	0.86	0.86	17.47	-13.54	15.02	-10.57	15.02	-9.22
11.25	0.80	0.85	17.23	-13.54	14.86	-10.57	14.86	-9.22

Net Pressure			Roof Pressure (psf)				
Heights	Front To Back (psf)	Left To Right (psf)	Distance From Windward Wall	Front To Back			
				0 to 8	8 to 16	16 to 32	32+
Roof @ 16 ft	**19.30**	**17.96**	Max Uplift (psf)	**-16.51**	**-16.51**	**-10.57**	**-7.60**
15	**19.14**	**17.80**	C_p Used For Uplift	-0.90	-0.90	-0.50	-0.30
5			Max Down (psf)	**0.47**	**0.47**	**0.47**	**0.47**
1			C_p Used For Down	-0.18	-0.18	-0.18	-0.18
			Distance From Windward Wall	Left To Right			
				0 to 8	8 to 16	16 to 32	32+
			Max uplift (psf)	**-16.51**	**-16.51**	**-10.57**	**-7.60**
			C_p Used For Uplift	-0.90	-0.90	-0.50	-0.30
			Max Down (psf)	**0.47**	**0.47**	**0.47**	**0.47**
			C_p Used For Down	-0.18	-0.18	-0.18	-0.18

\+ Denotes Pushing On Surface
\- Denotes Pulling On Surface
Windward Is Pressure Acting On The Windward Face Of The Building
Leeward Is Pressure Acting On The Leeward Face Of The Building
Net Is The Net Pressure Acting On The Building

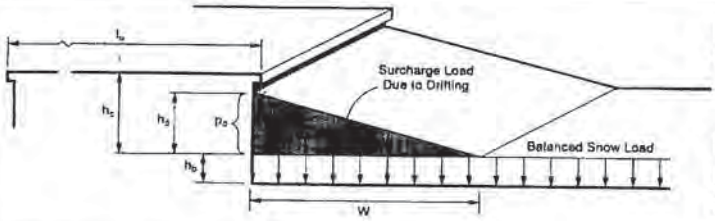
GC_{pnWW}:	1.5		
GC_{pnLW}:	-1		
$GC_{pntotal}$:	2.5		
$p_{parapet}$:	43.68	psf	(Unfactored)
$p_{parapet}$:	26.21	psf	(ASD)

CALDER RICHARDS

Snow Drift Analysis

Design per ASCE 7-16 and IBC 2018

Project:		HAFB 309th SWEG						
Date:		5/3/2022						
Ground Snow:	P_g:	47	PSF	Flat Roof	P_f:	33	PSF
Importance Factor:	I_s:	1.0		Sloped Roof Snow:	P_s:	33	PSF
Thermal Factor:	C_t:	1.0		Snow density:	γ:	20.11	PCF
Exposure Factor:	C_e:	1.0		Snow base depth:	h_b:	1.64	FT
Slope Factor:	C_s:	1.0					



High To Low Roof
L_w = Low Roof Length
L_l = High Roof Length

Parapet
L_w = Roof Length
L_l = 0

Drift Location 1:	**Grids A and G**				Drift Required?		Yes
Windward Length:	L_w:	124.0	FT	Leeward Drift:	h_{dl}:	0.00	FT
Leeward Length:	L_l:	0.0	FT	Leeward Drift Max	h_{dlmax}:	0.00	FT
Roof Height Change:	h_r:	3.3	FT	Windward Drift:	h_{dw}:	3.29	FT
Effective L_w	L_{we}:	124.00	FT	Windward Drift Max:	h_{dwmax}:	999	FT
Effective L_l	L_{le}:	0.00	FT	Drift Depth:	h_d:	3.29	FT
Clear Height	h_c:	1.61	FT	Actual Drift Depth:	h_d:	**1.61**	FT
Max Drift Pressure:	p_d:	32.5	PSF	**Drift Width:**	w:	12.9	FT

Drift Location 2:	**Rear Canopy**				Drift Required?		Yes
Windward Length:	L_w:	16.0	FT	Leeward Drift:	h_{dl}:	3.67	FT
Leeward Length:	L_l:	84.0	FT	Leeward Drift Max	h_{dlmax}:	9.60	FT
Roof Height Change:	h_r:	6.0	FT	Windward Drift:	h_{dw}:	1.28	FT
Effective L_w	L_{we}:	20.00	FT	Windward Drift Max:	h_{dwmax}:	2.29	FT
Effective L_l	L_{le}:	84.00	FT	Drift Depth:	h_d:	3.67	FT
Clear Height	h_c:	4.36	FT	Actual Drift Depth:	h_d:	**3.67**	FT
Max Drift Pressure:	p_d:	73.9	PSF	**Drift Width:**	w:	14.7	FT

Drift Location 3:	**Grids 1 and 5**				Drift Required?		Yes
Windward Length:	L_w:	84.0	FT	Leeward Drift:	h_{dl}:	0.00	FT
Leeward Length:	L_l:	0.0	FT	Leeward Drift Max	h_{dlmax}:	0.00	FT
Roof Height Change:	h_r:	2.5	FT	Windward Drift:	h_{dw}:	2.76	FT
Effective L_w	L_{we}:	84.00	FT	Windward Drift Max:	h_{dwmax}:	999	FT
Effective L_l	L_{le}:	0.00	FT	Drift Depth:	h_d:	2.76	FT
Clear Height	h_c:	0.86	FT	Actual Drift Depth:	h_d:	**0.86**	FT
Max Drift Pressure:	p_d:	17.4	PSF	**Drift Width:**	w:	6.9	FT

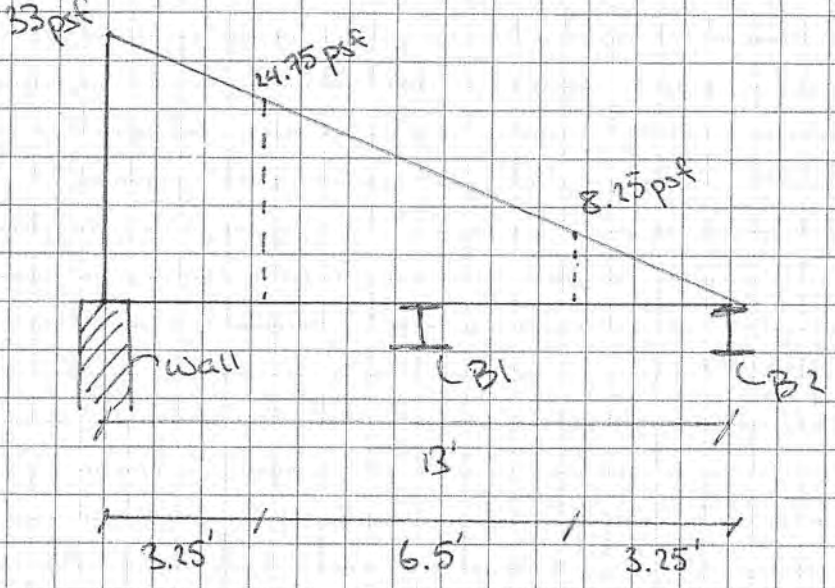
Drift Location 4:	**Front Canopy**				Drift Required?		Yes
Windward Length:	L_w:	12.0	FT	Leeward Drift:	h_{dl}:	3.67	FT
Leeward Length:	L_l:	84.0	FT	Leeward Drift Max	h_{dlmax}:	7.20	FT
Roof Height Change:	h_r:	6.0	FT	Windward Drift:	h_{dw}:	1.28	FT
Effective L_w	L_{we}:	20.00	FT	Windward Drift Max:	h_{dwmax}:	1.99	FT
Effective L_l	L_{le}:	84.00	FT	Drift Depth:	h_d:	3.67	FT
Clear Height	h_c:	4.36	FT	Actual Drift Depth:	h_d:	**3.67**	FT
Max Drift Pressure:	p_d:	73.9	PSF	**Drift Width:**	w:	12.0	FT

CALDER RICHARDS
CONSULTING ENGINEERS

JOB TITLE HAFB 309th SWEG BY JL DATE 4/7/22

SUBJECT Drift (plf loads) CHECKED SHEET OF

Framing Parallel



$S_{wall} = 24.75\,psf\,(3.25') + \frac{1}{2}(33psf - 24.75)(3.25') = 93.8plf \approx \underline{\underline{94\,plf}}$

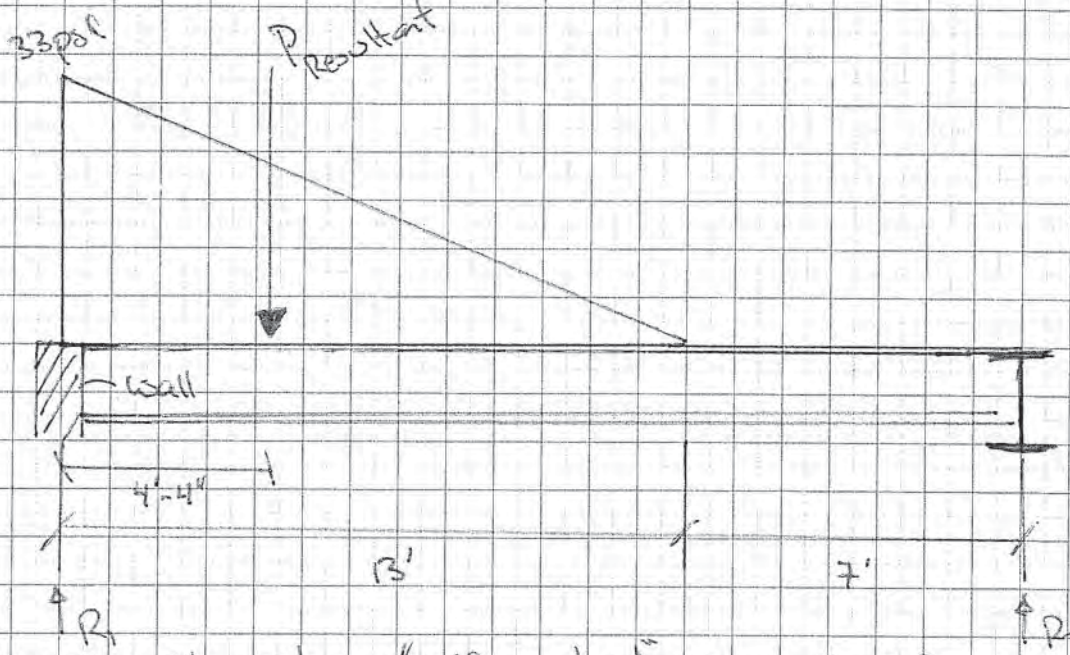
$S_{B1} = 8.25psf\,(6.5') + \frac{1}{2}(24.75 - 8.25\,psf)(6.5') = 107.25plf \approx \underline{\underline{108\,plf}}$

$S_{B2} = \frac{1}{2}(8.25psf)(3.25') = 13.4\,plf \approx \underline{\underline{14\,plf}}$

CALDER RICHARDS
CONSULTING ENGINEERS

JOB TITLE HAFB 30th SWEG BY JL DATE 4/7/22

SUBJECT Drift Cplf loads) CHECKED SHEET OF



Assume joists place "uniform load" on wall, plf on wall from drift will be.

$P_{Resultant} = 1/2(33psf)(13') = \underline{215plf}$

$R_1 = \frac{215plf(20' - 4.33')}{20'} = \underline{168plf}$

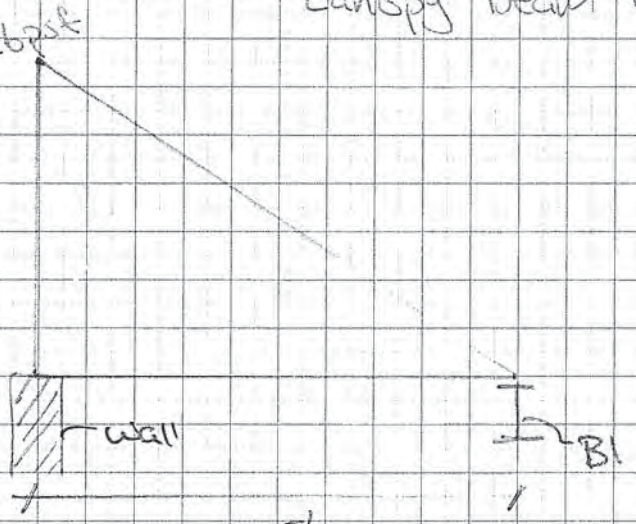
$R_2 = 215 - 168 = \underline{47plf}$

CALDER RICHARDS
CONSULTING ENGINEERS

JOB TITLE HAFB 309th SWEG BY JL DATE 4/7/22

SUBJECT Drift PIF load CHECKED SHEET OF

Canopy Beam Drift Perpendicular



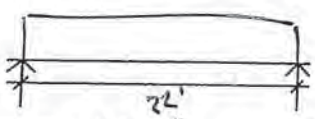
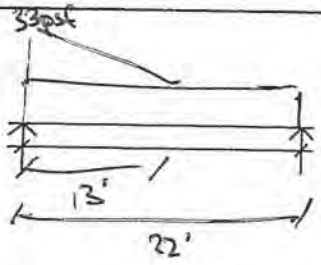
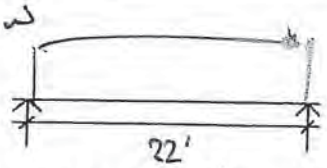
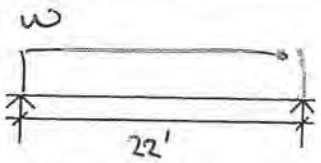
$S_{wall} = (26psf)(5')(1/2)(2/3) = 43.33plf \approx \underline{44plf}$

$S_{B1} = (26psf)(5')(1/2)(1/3) = 21.67plf \approx \underline{22plf}$

CALDER RICHARDS CONSULTING ENGINEERS

JOB TITLE HAFB 309th SWEG BY JL DATE 4/17/22

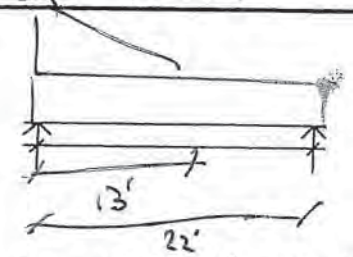
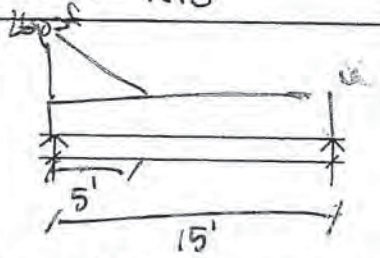
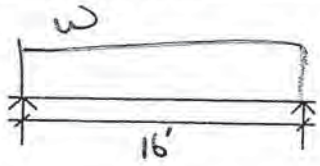
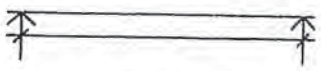
SUBJECT BEAM DESIGN CHECKED SHEET OF

BEAM MARK	LOADING (SKETCH)	V (K)	M (K-FT)	SIZE	DEFL (IN)
Typical Joist	 DL = 25psf (6.5') = 163plf SL = 33psf (6.5') = 215plf w = 378plf	4.2	22.9	W12x14	Δ_L = 0.44 Δ_T = 0.8
Joist with ⊥ Drift		5.4	26.8	W12x14	Δ_L = 0.547 Δ_T = 0.94
Joist with ∥ Drift	 DL = 25psf (6.5') = 163plf SL = 33psf (6.5') = 215plf Drift = 108plf w = 486	5.3	29.4	W12x14	Δ_L = 0.663 Δ_T = 1.026
Girder Typical	 DL = 25psf (22') = 550plf SL = 33psf (22') = 726plf w = 1276plf	14.0	77.2	W16x26	Δ_L = 0.438 Δ_T = 0.786

CALDER RICHARDS CONSULTING ENGINEERS

JOB TITLE HAFB 309th SWEG BY JL DATE 4/7/22

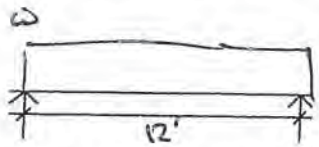
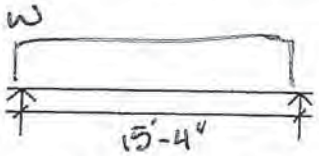
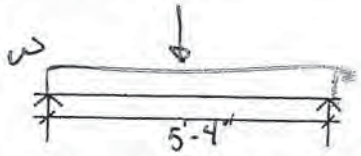
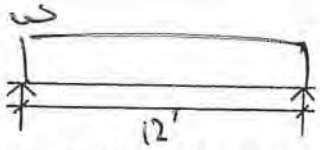
SUBJECT BEAM DESIGN CHECKED SHEET OF

BEAM MARK	LOADING (SKETCH)	V (K)	M (K-FT)	SIZE	DEFL (IN)
Girder with L Drift	 DL = 25psf(22') = 550plf SL = 33psf(22') = 726plf w = 1276	18	89	W16x26	Δ_L = 0.542 Δ_T = 0.89
Canopy Girder with Drift	 DL = 16'(25psf) = 400plf SL = 33psf(16') = 528plf w = 928plf	8.1	27.7	W16x26	Δ_L = 0.074 Δ_T = 0.129
Canopy Joist with Drift	 DL = 25psf(5') = 125 SL = 33psf(5') = 165 Drift = 22plf w = 312plf	2.5	10.0	W12x14	Δ_L = 0.107 Δ_T = 0.187
Low Roof Joist	 Same as canopy joist Low Roof Girder				Δ_L = Δ_T =

CALDER RICHARDS CONSULTING ENGINEERS

JOB TITLE HAFB 309th SWEG BY JL DATE 4/7/22

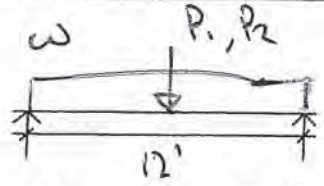
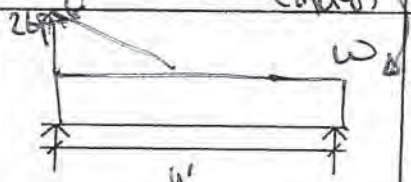
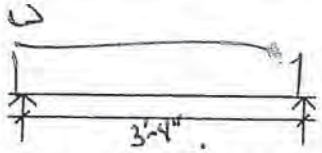
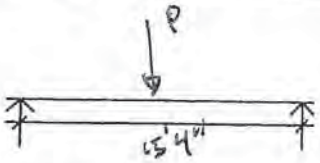
SUBJECT BEAM DESIGN CHECKED SHEET OF

BEAM MARK	LOADING (SKETCH)	V (K)	M (K-FT)	SIZE	DEFL (IN)
12' Masonry Beam	 DL = 25psf(4') = 275plf DL_{wall} = 78psf(10.67') = 832plf SL = 33psf(11') = 363plf Drift = 166 plf w = 1638 plf	9.8	29.5	Masonry Beam 32" Deep w/(2) #5 bars & #4 stirrups @ 16" oc	Δ_L = Δ_T =
15'-4" Masonry Beam	 DL = 25psf(6') = 150plf DL_{wall} = 78psf(3.33') = 260plf SL = 33psf(6') = 198plf Drift = 0plf w = 608plf	4.66	17.9	24" Deep w/(2) #4 & #4 stirrups @ 16" oc	Δ_L = Δ_T =
5'-4" Masonry Beam	 $w = DL_{wall}$ = 260 plf P = 2.5 kip (see Low Roof Joist calc)	2.0	4.26	24" Deep w/(2) #4 & #4 stirrups @ 16" oc (can be w/o stirrups)	Δ_L = Δ_T =
12' Masonry Beam parallel to joist Fenwy (uniform)	 DL = 25psf(3.25') = 81plf SL = 33psf(3.25') = 107plf DL_{wall} = 832 plf Drift = 94plf w = 1114 plf	6.7	20.1		Δ_L = Δ_T =

CALDER RICHARDS CONSULTING ENGINEERS

JOB TITLE HAFB 309th SWEG BY JL DATE 4/7/22

SUBJECT BEAM DESIGN CHECKED SHEET OF

BEAM MARK	LOADING (SKETCH)	V (K)	M (K-FT)	SIZE	DEFL (IN)
12' Masonry Beam Parallel to Joist Framing (Point load)	 P = 18 kip (Girder) $w = DL_{wall}$ = 832 plf P_2 = 6.1 kip (Low Roof Girder)	17	87	40" Deep Beam (4) #5, #4 stirrups @ 8" oc	Δ_L = Δ_T =
Low Roof Girder	 DL = 25psf(16') = 400plf SL = 33psf(16') = 528plf	6.1	15.1	W12x14	Δ_L = 0.076 Δ_T = 0.129
3'-4" Masonry Beam @ entry w/ low roof	 DL = 25psf(6.5') = 163plf SL = 33psf(6.5') = 215 plf Drift = 44plf + 44plf DL_{wall} = 832plf w = 1348plf	2.25	1.9	24" Deep Beam w/ (2) #4 & #4 stirrups @ 16" oc	Δ_L = Δ_T =
15'-4" Masonry Beam with Point Load	 P = 5.3L	2.7	20.3	24" Deep Beam w/ (2) #4 & #4 stirrups	Δ_L = Δ_T =

Gravity Beam Design

RAM SBeam v5.01

Joist Typical

04/07/22 14:08:30

STEEL CODE: AISC 360-05 ASD

SPAN INFORMATION (ft): I-End (0.00,0.00) J-End (22.00,0.00)

Beam Size (Optimum) = W12X14 Fy = 50.0 ksi

Total Beam Length (ft) = 22.00

Mp (kip-ft) = 72.50

Top flange braced by decking.

LINE LOADS (k/ft):

Load	Dist (ft)	DL	LL
1	0.000	0.014	0.000
	22.000	0.014	0.000
2	0.000	0.163	0.215
	22.000	0.163	0.215

SHEAR: Max Va (DL+LL) = 4.31 kips Vn/1.67 = 42.75 kips

MOMENTS:

Span	Cond	LoadCombo	Ma kip-ft	@ ft	Lb ft	Cb	Ω	Mn / Ω kip-ft
Center	Max +	DL+LL	23.7	11.0	0.0	1.00	1.67	43.41
Controlling		DL+LL	23.7	11.0	0.0	1.00	1.67	43.41

REACTIONS (kips):

	Left	**Right**
DL reaction	1.95	1.95
Max +LL reaction	2.36	2.36
Max +total reaction	4.31	4.31

DEFLECTIONS:

Dead load (in)	at	11.00 ft =	-0.363	L/D =	726
Live load (in)	at	11.00 ft =	-0.441	L/D =	599
Net Total load (in)	at	11.00 ft =	-0.804	L/D =	328

Gravity Beam Design

RAM SBeam v5.01

Joist with L Drift

04/07/22 14:08:57

STEEL CODE: AISC 360-05 ASD

SPAN INFORMATION (ft): I-End (0.00,0.00) J-End (22.00,0.00)

Beam Size (Optimum) = W12X14 Fy = 50.0 ksi

Total Beam Length (ft) = 22.00

Mp (kip-ft) = 72.50

Top flange braced by decking.

LINE LOADS (k/ft):

Load	Dist (ft)	DL	LL
1	0.000	0.014	0.000
	22.000	0.014	0.000
2	0.000	0.163	0.215
	22.000	0.163	0.215
3	0.000	0.000	0.215
	13.000	0.000	0.000

SHEAR: Max Va (DL+LL) = 5.44 kips Vn/1.67 = 42.75 kips

MOMENTS:

Span	Cond	LoadCombo	Ma kip-ft	@ ft	Lb ft	Cb	Ω	Mn / Ω kip-ft
Center	Max +	DL+LL	26.8	10.4	0.0	1.00	1.67	43.41
Controlling		DL+LL	26.8	10.4	0.0	1.00	1.67	43.41

REACTIONS (kips):

	Left	Right
DL reaction	1.95	1.95
Max +LL reaction	3.49	2.64
Max +total reaction	5.44	4.59

DEFLECTIONS:

Dead load (in)	at	11.00 ft	=	-0.363	L/D =	726
Live load (in)	at	10.89 ft	=	-0.547	L/D =	482
Net Total load (in)	at	10.89 ft	=	-0.911	L/D =	290

Gravity Beam Design

RAM SBeam v5.01

Joist with 11 Drift

04/07/22 14:09:08

STEEL CODE: AISC 360-05 ASD

SPAN INFORMATION (ft): I-End (0.00,0.00) J-End (22.00,0.00)

Beam Size (Optimum) = W12X14 Fy = 50.0 ksi

Total Beam Length (ft) = 22.00

Mp (kip-ft) = 72.50

Top flange braced by decking.

LINE LOADS (k/ft):

Load	Dist (ft)	DL	LL
1	0.000	0.014	0.000
	22.000	0.014	0.000
2	0.000	0.163	0.323
	22.000	0.163	0.323

SHEAR: Max Va (DL+LL) = 5.50 kips Vn/1.67 = 42.75 kips

MOMENTS:

Span	Cond	LoadCombo	Ma kip-ft	@ ft	Lb ft	Cb	Ω	Mn / Ω kip-ft
Center	Max +	DL+LL	30.3	11.0	0.0	1.00	1.67	43.41
Controlling		DL+LL	30.3	11.0	0.0	1.00	1.67	43.41

REACTIONS (kips):

	Left	**Right**
DL reaction	1.95	1.95
Max +LL reaction	3.55	3.55
Max +total reaction	5.50	5.50

DEFLECTIONS:

Dead load (in)	at	11.00 ft	=	-0.363	L/D =	726
Live load (in)	at	11.00 ft	=	-0.663	L/D =	398
Net Total load (in)	at	11.00 ft	=	-1.026	L/D =	257

Gravity Beam Design

RAM SBeam v5.01

Girder Typical

04/07/22 14:09:26

STEEL CODE: AISC 360-05 ASD

SPAN INFORMATION (ft): I-End (0.00,0.00) J-End (22.00,0.00)

Beam Size (Optimum) = W16X26 Fy = 50.0 ksi

Total Beam Length (ft) = 22.00

Mp (kip-ft) = 184.17

Top flange braced by decking.

LINE LOADS (k/ft):

Load	Dist (ft)	DL	LL
1	0.000	0.026	0.000
	22.000	0.026	0.000
2	0.000	0.550	0.726
	22.000	0.550	0.726

SHEAR: Max Va (DL+LL) = 14.32 kips Vn/1.67 = 70.51 kips

MOMENTS:

Span	Cond	LoadCombo	Ma kip-ft	@ ft	Lb ft	Cb	Ω	Mn / Ω kip-ft
Center	Max +	DL+LL	78.8	11.0	0.0	1.00	1.67	110.28
Controlling		DL+LL	78.8	11.0	0.0	1.00	1.67	110.28

REACTIONS (kips):

	Left	**Right**
DL reaction	6.34	6.34
Max +LL reaction	7.99	7.99
Max +total reaction	14.32	14.32

DEFLECTIONS:

Dead load (in)	at	11.00 ft =	-0.348	L/D =	759
Live load (in)	at	11.00 ft =	-0.438	L/D =	602
Net Total load (in)	at	11.00 ft =	-0.786	L/D =	336

Gravity Beam Design

RAM SBeam v5.01

Girder with 1 Drift

04/07/22 14:09:36

STEEL CODE: AISC 360-05 ASD

SPAN INFORMATION (ft): I-End (0.00,0.00) J-End (22.00,0.00)

Beam Size (Optimum) = W16X26 Fy = 50.0 ksi

Total Beam Length (ft) = 22.00

Mp (kip-ft) = 184.17

Top flange braced by decking.

LINE LOADS (k/ft):

Load	Dist (ft)	DL	LL
1	0.000	0.026	0.000
	22.000	0.026	0.000
2	0.000	0.550	0.726
	22.000	0.550	0.726
3	0.000	0.000	0.716
	13.000	0.000	0.000

SHEAR: Max Va (DL+LL) = 18.06 kips Vn/1.67 = 70.51 kips

MOMENTS:

Span	Cond	LoadCombo	Ma kip-ft	@ ft	Lb ft	Cb	Ω	Mn / Ω kip-ft
Center	Max +	DL+LL	89.0	10.4	0.0	1.00	1.67	110.28
Controlling		DL+LL	89.0	10.4	0.0	1.00	1.67	110.28

REACTIONS (kips):

	Left	Right
DL reaction	6.34	6.34
Max +LL reaction	11.72	8.90
Max +total reaction	18.06	15.24

DEFLECTIONS:

Dead load (in)	at	11.00 ft =	-0.348	L/D =	759
Live load (in)	at	10.89 ft =	-0.542	L/D =	487
Net Total load (in)	at	10.89 ft =	-0.890	L/D =	297

Gravity Beam Design

RAM SBeam v5.01

Canopy Girder with Drift

04/07/22 14:25:08

STEEL CODE: AISC 360-05 ASD

SPAN INFORMATION (ft): I-End (0.00,0.00) J-End (15.00,0.00)

Beam Size (User Selected) = W16X26 Fy = 50.0 ksi

Total Beam Length (ft) = 15.00

Mp (kip-ft) = 184.17

Top flange braced by decking.

LINE LOADS (k/ft):

Load	Dist (ft)	DL	LL
1	0.000	0.026	0.000
	15.000	0.026	0.000
2	0.000	0.400	0.528
	15.000	0.400	0.528
3	0.000	0.000	0.416
	5.000	0.000	0.000

SHEAR: Max Va (DL+LL) = 8.08 kips Vn/1.67 = 70.51 kips

MOMENTS:

Span	Cond	LoadCombo	Ma kip-ft	@ ft	Lb ft	Cb	Ω	Mn / Ω kip-ft
Center	Max +	DL+LL	27.7	7.4	0.0	1.00	1.67	110.28
Controlling		DL+LL	27.7	7.4	0.0	1.00	1.67	110.28

REACTIONS (kips):

	Left	Right
DL reaction	3.20	3.20
Max +LL reaction	4.88	4.08
Max +total reaction	8.08	7.27

DEFLECTIONS:

Dead load (in)	at	7.50 ft	=	-0.056	L/D =	3237
Live load (in)	at	7.50 ft	=	-0.074	L/D =	2449
Net Total load (in)	at	7.50 ft	=	-0.129	L/D =	1394

Gravity Beam Design

RAM SBeam v5.01

Canopy Joist

04/07/22 14:28:36

STEEL CODE: AISC 360-05 ASD

SPAN INFORMATION (ft): I-End (0.00,0.00) J-End (16.00,0.00)

Beam Size (User Selected) = W12X14 Fy = 50.0 ksi

Total Beam Length (ft) = 16.00

Mp (kip-ft) = 72.50

Top flange braced by decking.

LINE LOADS (k/ft):

Load	Dist (ft)	DL	LL
1	0.000	0.014	0.000
	16.000	0.014	0.000
2	0.000	0.125	0.187
	16.000	0.125	0.187

SHEAR: Max Va (DL+LL) = 2.61 kips Vn/1.67 = 42.75 kips

MOMENTS:

Span	Cond	LoadCombo	Ma kip-ft	@ ft	Lb ft	Cb	Ω	Mn / Ω kip-ft
Center	Max +	DL+LL	10.4	8.0	0.0	1.00	1.67	43.41
Controlling		DL+LL	10.4	8.0	0.0	1.00	1.67	43.41

REACTIONS (kips):

	Left	**Right**
DL reaction	1.11	1.11
Max +LL reaction	1.50	1.50
Max +total reaction	2.61	2.61

DEFLECTIONS:

Dead load (in)	at	8.00 ft =	-0.080	L/D =	2404
Live load (in)	at	8.00 ft =	-0.107	L/D =	1789
Net Total load (in)	at	8.00 ft =	-0.187	L/D =	1026

Gravity Beam Design

RAM SBeam v5.01

Low Roof Girder

04/07/22 17:44:10

STEEL CODE: AISC 360-05 ASD

SPAN INFORMATION (ft): I-End (0.00,0.00) J-End (11.00,0.00)

Beam Size (User Selected) = W12X14 Fy = 50.0 ksi

Total Beam Length (ft) = 11.00

Mp (kip-ft) = 72.50

Top flange braced by decking.

LINE LOADS (k/ft):

Load	Dist (ft)	DL	LL
1	0.000	0.014	0.000
	11.000	0.014	0.000
2	0.000	0.400	0.528
	11.000	0.400	0.528
3	0.000	0.000	0.416
	5.000	0.000	0.000

SHEAR: Max Va (DL+LL) = 6.06 kips Vn/1.67 = 42.75 kips

MOMENTS:

Span	Cond	LoadCombo	Ma kip-ft	@ ft	Lb ft	Cb	Ω	Mn / Ω kip-ft
Center	Max +	DL+LL	15.1	5.3	0.0	1.00	1.67	43.41
Controlling		DL+LL	15.1	5.3	0.0	1.00	1.67	43.41

REACTIONS (kips):

	Left	Right
DL reaction	2.28	2.28
Max +LL reaction	3.79	3.06
Max +total reaction	6.06	5.34

DEFLECTIONS:

Dead load (in)	at	5.50 ft =	-0.053	L/D =	2486
Live load (in)	at	5.44 ft =	-0.076	L/D =	1742
Net Total load (in)	at	5.44 ft =	-0.129	L/D =	1024

HAFB 309th SWEG

CALDER RICHARDS
CONSULTING ENGINEERS

8" MASONRY LINTEL DESIGN

Design Based Upon Requirements in Chapter 8 of TMS 402-16

*Special Inspection Required
MASONRY TYPE: CONCRETE

b =	7.63	in	Rebar	Fs =	32000	psi
f'm =	2000	psi		Es =	29000	ksi
Em =	1800	ksi	Stirrups	As =	0.2	in^2
Fb =	900	psi	Spacing	s =	16	in^2
Fvm =	25.2	psi		n =	16.11	

DEPTH (in)	REINFORCEMENT	M_m (K-ft)	M_s (K-ft)	M_{allow} (K-ft)	$V_{NO\ S}$ (K)	$V_{W/\ S}$ (K)	I_{cr} (in^4)
16	(2) - # 4	13.1	12.5	**12.5**	**2.2**	**4.8**	684.4
16	(2) - # 5	15.3	18.9	**15.3**	**2.2**	**4.8**	952.0
24	(2) - # 4	28.5	20.6	**20.6**	**3.7**	**7.9**	1966.1
24	(2) - # 5	33.7	31.3	**31.3**	**3.6**	**7.8**	2793.7
32	(2) - # 4	47.8	28.7	**28.7**	**5.2**	**11.0**	3955.8
32	(2) - # 5	56.9	43.8	**43.8**	**5.1**	**10.9**	5689.6
40	(2) - # 4	70.4	36.9	**36.9**	**6.6**	**14.0**	6671.1
40	(2) - # 5	84.1	56.4	**56.4**	**6.5**	**13.9**	9673.2
48	(2) - # 5	115.0	69.1	**69.1**	**8.0**	**17.0**	14766.3
48	(2) - # 6	132.3	96.8	**96.8**	**7.9**	**16.9**	19768.1
56	(2) - # 5	149.2	81.8	**81.8**	**9.5**	**20.1**	20984.5
56	(2) - # 6	172.0	114.8	**114.8**	**9.4**	**20.0**	28215.1
64	(2) - # 5	186.5	94.6	**94.6**	**11.0**	**23.2**	28339.9
64	(2) - # 6	215.4	132.7	**132.7**	**10.8**	**23.0**	38238.1
72	(2) - # 5	226.5	107.4	**107.4**	**12.5**	**26.3**	36841.8
72	(2) - # 6	262.1	150.8	**150.8**	**12.3**	**26.1**	49853.4
80	(2) - # 5	269.2	120.2	**120.2**	**13.9**	**29.3**	46498.3
80	(2) - # 6	312.0	168.8	**168.8**	**13.8**	**29.2**	63074.0
88	(2) - # 6	364.8	186.9	**186.9**	**15.3**	**32.3**	77911.0
96	(2) - # 6	420.6	205.1	**205.1**	**16.8**	**35.4**	94373.9
102	(2) - # 6	464.1	218.7	**218.7**	**17.9**	**37.7**	107793.1
108	(2) - # 6	509.2	232.3	**232.3**	**19.0**	**40.0**	122134.6
114	(2) - # 6	555.8	246.0	**246.0**	**20.1**	**42.3**	137401.2
120	(2) - # 6	603.7	259.6	**259.6**	**21.2**	**44.6**	153595.6

$$\rho = \frac{A_s}{bd}$$

$$k = \sqrt{2n\rho + (n\rho)^2} - n\rho$$

$$j = 1 - \frac{k}{3}$$

$$M_m = \tfrac{1}{2} F_b k j b d^2$$

$$M_s = F_s \rho j b d^2$$

$E_m = 900\ f'_m$ — TMS 402-16 (Table 4.2.2)
$E_m = 700\ f'_m$ — TMS 402-16 (Table 4.2.2)
$F_b = 0.45\ f'_m$ — TMS 402-16 (8.4.3.2.2)
$F_v = (F_{vm} + F_{vs})\gamma_g$ — TMS 402-16 (Equation 8-22)
$F_{vm} = 1/4\ [(4.0 - 1.75(M/Vd))\sqrt{f'_m}] + 0.25P / A_n \geq 0$ — TMS 402-16 (Equation 8-25)*
$F_{vs} = 0.5^* (A_v F_s d) / (A_{nv} s)$ — TMS 402-16 (Equation 8-27)
$V_s = 0.5^* (A_v F_s d) / (A_{nv} s) + V_m$ (with stirrups)
$V_m = F_v bjd$ (without stirrups)
*Special Reinforced Masonry Shear Walls, Conservatively assume P / A = 0

As=AREA OF REINFORCMENT
b=WIDTH OF LINTEL
d=LINTEL DEPTH TO CENTER OF TENSILE REINFORCEMENT (DEPTH - 3)

HAFB 309th SWEG

CALDER RICHARDS
CONSULTING ENGINEERS

8" MASONRY LINTEL DESIGN
*Special Inspection Required
MASONRY TYPE: CONCRETE

Design Based Upon Requirements in Chapter 8 of TMS 402-16

b =	7.63	in	Rebar	Fs =	32000	psi
f'm =	2000	psi		Es =	29000	ksi
Em =	1800	ksi	Stirrups	As =	0.2	in^2
Fb =	900	psi	Spacing	s =	8	in^2
Fvm =	25.2	psi		n =	16.11	

DEPTH (in)	REINFORCEMENT	M_m (K-ft)	M_s (K-ft)	M_{allow} (K-ft)	$V_{NO\ S}$ (K)	$V_{W/\ S}$ (K)	I_{cr} (in^4)
16	(2) - # 4	6.8	8.2	**6.8**	**1.5**	**5.0**	281.4
16	(2) - # 5	7.9	12.5	**7.9**	**1.4**	**4.9**	383.4
24	(2) - # 4	19.8	16.3	**16.3**	**2.9**	**9.6**	1198.6
24	(2) - # 5	23.2	24.7	**23.2**	**2.9**	**9.6**	1686.9
32	(2) - # 4	37.1	24.4	**24.4**	**4.4**	**14.3**	2809.4
32	(2) - # 5	44.0	37.1	**37.1**	**4.3**	**14.2**	4017.5
40	(4) - # 4	76.3	63.5	**63.5**	**5.7**	**18.8**	9122.9
40	(4) - # 5	89.6	96.5	**89.6**	**5.6**	**18.7**	12826.7
48	(2) - # 5	98.2	62.4	**62.4**	**7.2**	**23.5**	11921.4
48	(2) - # 6	112.7	87.3	**87.3**	**7.1**	**23.4**	15915.1
56	(2) - # 5	130.7	75.1	**75.1**	**8.7**	**28.2**	17540.2
56	(2) - # 6	150.4	105.2	**105.2**	**8.6**	**28.1**	23532.5
64	(2) - # 5	166.3	87.8	**87.8**	**10.2**	**32.9**	24290.1
64	(2) - # 6	191.9	123.2	**123.2**	**10.1**	**32.8**	32716.1
72	(2) - # 5	204.9	100.6	**100.6**	**11.7**	**37.6**	32181.9
72	(2) - # 6	236.9	141.2	**141.2**	**11.5**	**37.4**	43483.7
80	(2) - # 5	246.2	113.4	**113.4**	**13.2**	**42.3**	41224.1
80	(2) - # 6	285.1	159.2	**159.2**	**13.0**	**42.1**	55850.0
88	(2) - # 6	336.4	177.3	**177.3**	**14.5**	**46.8**	69827.0
96	(2) - # 6	390.6	195.4	**195.4**	**16.0**	**51.5**	85425.0
102	(2) - # 6	433.1	209.0	**209.0**	**17.1**	**55.0**	98192.8
108	(2) - # 6	477.1	222.7	**222.7**	**18.2**	**58.5**	111880.6
114	(2) - # 6	522.6	236.3	**236.3**	**19.3**	**62.0**	126491.7
120	(2) - # 6	569.6	250.0	**250.0**	**20.4**	**65.5**	142028.6

$$\rho = \frac{A_s}{bd}$$

$$k = \sqrt{2n\rho + (n\rho)^2} - n\rho$$

$$j = 1 - \frac{k}{3}$$

$$M_m = \tfrac{1}{2} F_b kjbd^2$$

$$M_s = F_s \rho jbd^2$$

$E_m = 900\ f'_m$ — TMS 402-16 (Table 4.2.2)
$E_m = 700\ f'_m$ — TMS 402-16 (Table 4.2.2)
$F_b = 0.45\ f'_m$ — TMS 402-16 (8.4.3.2.2)
$F_v = (F_{vm} + F_{vs})Y_g$ — TMS 402-16 (Equation 8-22)
$F_{vm} = 1/4\ [(4.0 - 1.75(M/Vd))\sqrt{f'_m}] + 0.25P / A_n \geq 0$ — TMS 402-16 (Equation 8-25)*
$F_{vs} = 0.5^*\ (A_v F_s d) / (A_{nv} s)$ — TMS 402-16 (Equation 8-27)
$V_s = 0.5^*\ (A_v F_s d) / (A_{nv} s) + V_m$ (with stirrups)
$V_m = F_v bjd$ (without stirrups)
*Special Reinforced Masonry Shear Walls, Conservatively assume P / A = 0

As=AREA OF REINFORCMENT
b=WIDTH OF LINTEL
d=LINTEL DEPTH TO CENTER OF TENSILE REINFORCEMENT (DEPTH - 7.25)

CALDER RICHARDS CONSULTING ENGINEERS

JOB TITLE HAFB 309th SWEG BY JL DATE 4/7/22

SUBJECT Columns CHECKED SHEET OF

Column supporting Girders (Main Bldg)

Max Girder Reaction = 18 kip

(2) Girders per column ⇒ $P = 18(2) = \underline{36 \text{ kip}}$

$l_e = 13.5'$

TABLE 4-4 of steel manual (Assume concentric loading)

HSS4x4x1/4 $P_a = 41.3$ kip (ASD) for 14' height

$DCR = \frac{36}{41.3} = 0.876 < 1.0 \Rightarrow$ OK

↳ This assumes two girders with drift, this will not occur

Typical girder Reaction = 14 kip

$P = 2(14k) = 28k$ $DCR = \frac{28}{41.3} = 0.68 < 1.0$

Columns supporting canopy

$P_{max} = R_{canopy\ girder} + (R_{canopy\ joist})2 = 8.1k + 2.61(2) = \underline{13.32k}$

$l_e = 10'$

8x16 masonry column w/ #5 in each cell $P_a = 42.7k$

$DCR = \frac{13.3}{42.7} = 0.31 < 1.0 \Rightarrow \underline{OK}$

Columns within walls supporting Typical Girders (Main Bldg)

$P = 18k < 42.3k \Rightarrow \underline{OK}$

CALDER RICHARDS

ACI 530-05 Gravity Column Design Table

f'_m = 2000 psi

F_s = 32000 psi

Reinforcement

Bar Size 5

Bar per cell 1

Column Size	8 x 16	8 x 24	8 x 32	8 x 40	10 x 16	10 x 24	10 x 32	10 x 40	12 x 16	12 x 24	12 x 32	12 x 40
r (in)	2.20	2.20	2.20	2.20	2.78	2.78	2.78	2.78	3.36	3.36	3.36	3.36
A_s (in^2)	0.62	0.93	1.24	1.55	0.62	0.93	1.24	1.55	0.62	0.93	1.24	1.55
Effective Pier Height (ft)	P_{allow} (kips)											
6	46.0	69.0	91.9	114.9	57.5	86.2	114.9	143.7	68.8	103.2	137.6	172.0
8	44.6	66.9	89.2	111.5	56.4	84.6	112.8	141.0	67.9	101.9	135.8	169.8
10	42.7	64.1	85.5	106.9	55.0	82.5	110.0	137.5	66.8	100.2	133.6	167.0
12	40.4	60.6	80.8	101.0	53.3	79.9	106.5	133.1	65.4	98.1	130.8	163.5
14	37.4	56.2	74.9	93.6	51.1	76.7	102.2	127.8	63.7	95.6	127.4	159.3
16	33.8	50.7	67.6	84.5	48.5	72.8	97.1	121.3	61.7	92.5	123.4	154.2
18	-	-	-	-	45.5	68.2	91.0	113.7	59.4	89.0	118.7	148.4
20	-	-	-	-	41.9	62.8	83.8	104.7	56.6	85.0	113.3	141.6
22	-	-	-	-	-	-	-	-	53.5	80.3	107.1	133.8
24	-	-	-	-	-	-	-	-	50.0	75.0	99.9	124.9

for $h/r < 99$

$$P_a = (0.25 f'_m A_n + 0.65 A_{st} F_s)\left[1 - \left(\frac{h}{140r}\right)^2\right] \quad ACI\ 530-05\ (2-17)$$

for $h/r \geq 99$

$$P_a = (0.25 f'_m A_n + 0.65 A_{st} F_s)\left(\frac{70r}{h}\right)^2 \quad ACI\ 530-05\ (2-18)$$

$$\frac{f_a}{F_a} + \frac{f_b}{F_b} \leq 1$$

Variable Definitions:

P_a	*Allowable Pier load (kips)*
h	*Effective Height (in.)*
r	*Radius of Gyration (in.)*
A_n	*Net Area (in^2)*
A_{st}	*Area of Steel (in^2)*
F_s	*Compressive Strength of Steel (psi)*
f'_m	*Compressive Strength of Masonry (psi)*

~The ratio between the effective height and the least nominal dimension shall not exceed 25 *(ACI 530-05 2.1.6.2)*

~Columns designed to resist an eccentricity = 0.1 times block thickness *(ACI 530-05 2.1.6.3)*

~Vertical reinforcement designed to meet $0.0025A_n < A_s < 0.04A_n$, with a minimum of 4 bars per column *(ACI 530-05 2.1.6.4)*

CALDER RICHARDS
CONSULTING ENGINEERS

JOB TITLE HAFB 309th SWEG BY JL DATE 4/7/22
SUBJECT Spot FTG Sizes CHECKED SHEET OF

Interior Column FTG

$P_{allow} = 1800 psf$

$P_{col,max} = 18K + 18K = 36K$

$b_{min} = \sqrt{\frac{36{,}000 lbf}{1800 psf}} = 4.47 \Rightarrow$ use 4.5' square FTG

Canopy Column FTG

$P_{max} = 13.32K$

$b_{min} = \sqrt{\frac{13320 lbf}{1800 psf}} = 2.72' \Rightarrow$ use 3'x3' FTG

CALDER RICHARDS
CONSULTING ENGINEERS

JOB TITLE HAFB 309th SWEG BY JL DATE 4/7/22
SUBJECT Strip FTG Sizes CHECKED SHEET OF

Assume any girder/joist loads to wall spread out evenly by the time it gets to the bottom of masonry wall and bottom of FDTN wall & FTG.

wall load:

$DL = 25psf(11') = 275plf$

$SL = 33psf(11') = 363plf$

$Drift = 215plf$

$D_{wall} = 78psf(18') = 1404plf$

$w_{TOTAL} = 2257plf$

$b_{min} = \frac{2257plf}{1800psf} = 1.25' \Rightarrow$ use 2' strip FTG

CALDER RICHARDS
CONSULTING ENGINEERS

Continous Footing Design

Design based upon requirements in ACI 318-14 & IBC 2018

Net Allowable Bearing Pressure (psf)	1800
Average Load Factor	1.5
Factored Bearing Pressure (psf)	2700

fy (psi)	60000
f'c (psi)	3000
phi bending	0.9
phi shear	0.75
phi for plain concrete	0.6
Wall Thickness (in)	8

Notes:

1. Bending checked at face of support
2. One-Way shear checked at d/2 from face of support
3. Depth d used in design is footing depth minus 4"
4. Rho minimum equals 0.0018
5. fr equals 6*f'c^0.5
6. Plane concrete uses the total depth minus 2"

Footing Size & Reinforcement		Transverse	Longitudinal	P allow	One-Way Shear		Bending	
Width (in)	Depth (in)	As min (in^2/ft)	As min (in^2)	(klf)	Vu (k/ft)	phi Vc (k/ft)	Mu (k-ft/ft)	phi Mn (k-ft/ft)
24	12	phi*fr*S > Mu	0.52	3.6	0.90	7.89	0.60	3.01
30	12	phi*fr*S > Mu	0.65	4.5	1.58	7.89	1.13	3.01
36	12	phi*fr*S > Mu	0.78	5.4	2.25	7.89	1.84	3.01
42	12	phi*fr*S > Mu	0.91	6.3	2.93	7.89	2.71	3.01
48	12	0.26	1.04	7.2	3.60	7.89	3.75	9.03
54	12	0.26	1.17	8.1	4.28	7.89	4.96	9.03
60	12	0.26	1.30	9.0	4.95	7.89	6.34	9.03
66	12	0.30	1.43	9.9	5.63	7.89	7.88	10.41
72	12	0.32	1.56	10.8	6.30	7.89	9.60	10.96
78	12	0.33	1.68	11.7	6.98	7.89	11.48	11.48
84	12	0.40	1.81	12.6	7.65	7.89	13.54	13.54
90	13	0.41	2.11	13.5	8.21	8.87	15.76	15.76
96	14	0.42	2.42	14.4	8.78	9.86	18.15	18.15
102	14	0.48	2.57	15.3	9.45	9.86	20.71	20.71
108	15	0.50	2.92	16.2	10.01	10.84	23.44	23.44
114	15	0.56	3.08	17.1	10.69	10.84	26.33	26.33
120	16	0.57	3.46	18.0	11.25	11.83	29.40	29.40
126	17	0.58	3.86	18.9	11.81	12.82	32.63	32.63
132	17	0.65	4.04	19.8	12.49	12.82	36.04	36.04
138	18	0.66	4.47	20.7	13.05	13.80	39.61	39.61
144	18	0.72	4.67	21.6	13.73	13.80	43.35	43.35

CALDER RICHARDS
CONSULTING ENGINEERS

Spot Footing Design

Design based upon requirements in ACI 318-14 & IBC 2018

Net Allowable Bearing Pressure (psf)	**1800**
Average Load Factor	**1.5**
Factored Bearing Pressure (psf)	2700

fy (psi)	**60000**
f'c (psi)	**4000**
phi bending	0.9
phi shear	0.75

Square pedestal size (in)	**6**

Notes:

1. Bending checked at face of support
2. Punching and One-Way shear checked at d/2 from face of support
3. Depth d used in design is footing depth minus 4"
4. Rho minimum equals 0.0018

Footing Size & Reinforcement Each Direction			P allow	One-Way Shear		Punching Shear		Bending	
L & W (in)	Depth (in)	As min (in^2)	(kips)	Vu (kips)	phi Vc (kips)	Vu (kips)	phi Vc (kips)	Mu (k-ft)	phi Mn (k-ft)
24	12	0.52	7.2	0.45	18.21	7.13	85.00	1.52	18.22
30	12	0.65	11.3	2.25	22.77	13.20	85.00	3.38	22.77
36	12	0.78	16.2	4.73	27.32	20.63	85.00	6.33	27.33
42	12	0.91	22.1	7.88	31.88	29.40	85.00	10.63	31.88
48	12	1.04	28.8	11.70	36.43	39.53	85.00	16.54	36.44
54	12	1.17	36.5	16.20	40.98	51.00	85.00	24.30	40.99
60	12	1.30	45.0	21.38	45.54	63.83	85.00	34.17	45.54
66	12	1.76	54.5	27.23	50.09	78.00	85.00	46.41	61.40
72	13	2.06	64.8	32.40	61.47	92.98	102.46	61.26	81.07
78	14	2.39	76.1	38.03	74.00	109.28	121.43	78.98	104.55
84	15	2.74	88.2	44.10	87.66	126.88	141.92	99.82	132.17
90	16	3.12	101.3	50.63	102.46	145.80	163.93	124.03	164.26
96	17	3.53	115.2	57.60	118.40	166.03	187.46	151.88	201.16
102	18	3.96	130.1	65.03	135.47	187.58	212.51	183.60	243.22
108	18	4.74	145.8	74.93	143.44	211.20	212.51	219.46	290.47
114	19	5.23	162.5	83.36	162.22	235.41	239.07	259.71	343.80
120	20	5.75	180.0	92.25	182.15	260.93	267.15	304.59	403.29
126	21	6.30	198.5	101.59	203.21	287.76	296.75	354.38	469.26
132	22	6.87	217.8	111.38	225.41	315.90	327.86	409.30	542.06
138	23	7.46	238.1	121.61	248.74	345.36	360.50	469.63	622.02
144	24	8.08	259.2	132.30	273.22	376.13	394.65	535.61	709.47

CALDER RICHARDS

Bearing plate spreadsheet for beams and joists on Masonry

per TMS 402-16 and IBC 2018

Project:	HAFB 309th SWEG		
by:	JL	Date:	4/11/2022

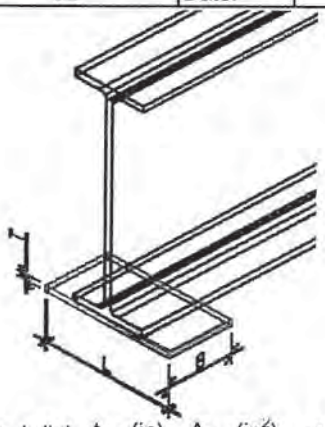
f 'm (psi) = 2000
f_p (psi) = 660
F_y (ksi) = 36

$$M = \frac{1'' \cdot f_p \cdot n^2}{2} = \frac{F_y \cdot Z}{\Omega}$$

$$Z = \frac{1'' \cdot t_{min}^{\ 2}}{4} \qquad \Omega = \frac{5}{3}$$

$$n = \frac{L - 2 \cdot k}{2}$$

$$t_{min} = \sqrt{\frac{10 \cdot f_p \cdot n^2}{3 \cdot F_y}}$$



Beam/Joist	Location	Reaction (k)	L (in)	B (in)	t (in)	k (in)	t_{min} (in)	A_{min} (in^2)	Do baseplate dimensions suffice?
W12x14	Low Roof Girder/Joist	6.1	8	6	3/4	0.53	0.38	9.24	yes
W16x26	Girder	18	8	6	3/4	0.75	0.61	27.27	yes

Assumptions:

1) Area A_1 = A_2 (see TMS 402-16 section 4.3.4)
2) Loads used above should be allowable (ASD), not ultimate

RAM BasePlate V1.5

HAFB 309th SWEG

Detailed Design Results
4/11/22 16:30

CRITERIA:
Analysis
Maintain Strain Compatibility
Use min. effective plate area for axial only compression load on plate.
Design
Use ASD 9th to check plate bending
Max concrete bearing per AISC J9.
Anchor Shear Values Only.
Anchor Tension Values Only.

INPUT DATA:
Column
Column Size..... HSS4X4X3/16

Dim:	BfTop	TfTop	BfBot	TfBot	TW	Depth
(in)	4.00	0.174	4.00	0.174	0.174	4.00

Base Plate
Plate Fy (ksi) 36.000
N (Parallel to Web) (in)..... 10.000
B (Perpendicular to Web) (in)..... 10.000
Plate Thickness (in)..... 0.500
Anchor
Anchor Size..... 3/4"
Anchor Area (in^2)..... 0.442
Anchor Material..... A325-120
Anchor Modulus (ksi) 29000.00
Anchor Strength Fu (ksi) 120.00
Footing
Footing Strength f'c (ksi) 3.00
Concrete Modulus (ksi) 3122.02
Dimension (Parallel to web) (ft)..... 4.50
Dimension (Perpendicular to web) (ft)... 4.50
Design Load
Building Code: - None -
Load combination: Single Load Case
Axial (kip)..... 18.00
Vx (kip)..... 0.36
Mx (kip-ft)..... 0.00
Allowable Stress Increase Factor 1.00

RESULTS:
Analysis
Uniform Load on Base Plate.
Plate Bending
Max bending moment from concrete compression
Allowable Stress Increase Factor 1.00
N Eff (in)..... 5.510
B Eff (in)..... 5.510
m [N-0.95d]/2.0 (in)..... 0.855
n [B-0.95b]/2.0 (in)..... 0.855
Controlling effective width to resist moment (in) ... 5.510
Controlling plate bending moment (kip-ft) 0.10
fb (ksi) 5.20
Fb (ksi) 27.00
fb/Fb 0.19
Thickness Required (in)..... 0.219

Thickness controlled by cantilever action.

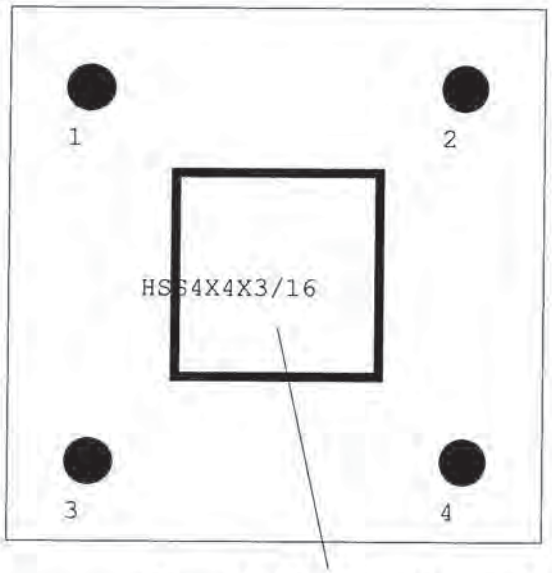
Anchors

Anchor	X(in)	Y(in)	V(kip)	T(kip)
1	-3.50	3.50	0.09	0.00
2	3.50	3.50	0.09	0.00
3	-3.50	-3.50	0.09	0.00
4	3.50	-3.50	0.09	0.00

Bearing

Eff Area of Support A2 (in^2).....	121.44
Plate Area A1 (in^2).....	30.36
Sqrt(A2/A1).....	2.00
Allowable Bearing Pressure (ksi)	2.10
Actual Bearing Stress (ksi)	0.59

DIAGRAM:



#	X(in)	Y(in)
1	-3.500	3.500
2	3.500	3.500
3	-3.500	-3.500
4	3.500	-3.500

PL 10.00 X 10.00 X 0.50 (in)
4 - 3/4" A325 Anchor Bolts

This Wall in File: x:\project files\2022\22033 hafb 309th sweg\calculations\screen wall.RPX

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Cantilevered Retaining Wall

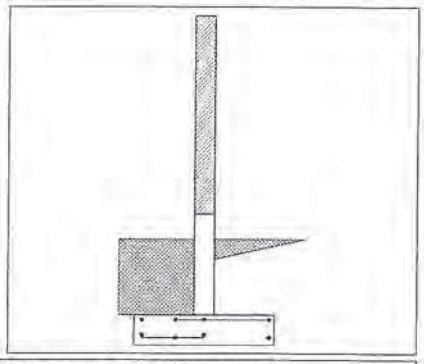
Code: IBC 2018,ACI 318-14,TMS 402-16

Criteria

Retained Height	=	2.50 ft
Wall height above soil	=	7.33 ft
Slope Behind Wall	=	0.00
Height of Soil over Toe	=	30.00 in
Water height over heel	=	0.0 ft

Soil Data

Allow Soil Bearing	=	1,500.0 psf
Equivalent Fluid Pressure Method		
Active Heel Pressure	=	50.0 psf/ft
	=	
Passive Pressure	=	300.0 psf/ft
Soil Density, Heel	=	110.00 pcf
Soil Density, Toe	=	0.00 pcf
Footing||Soil Friction	=	0.400
Soil height to ignore for passive pressure	=	12.00 in



Surcharge Loads

Surcharge Over Heel	=	0.0 psf
Used To Resist Sliding & Overturning		
Surcharge Over Toe	=	0.0 psf
Used for Sliding & Overturning		

Lateral Load Applied to Stem

Lateral Load	=	46.5 #/ft
...Height to Top	=	9.83 ft
...Height to Bottom	=	2.67 ft
Load Type	=	Seismic (E) (Service Level)
Wind on Exposed Stem (Service Level)	=	0.0 psf

Adjacent Footing Load

Adjacent Footing Load	=	0.0 lbs
Footing Width	=	0.00 ft
Eccentricity	=	0.00 in
Wall to Ftg CL Dist	=	0.00 ft
Footing Type		Line Load
Base Above/Below Soil at Back of Wall	=	0.0 ft
Poisson's Ratio	=	0.300

Axial Load Applied to Stem

Axial Dead Load	=	0.0 lbs
Axial Live Load	=	0.0 lbs
Axial Load Eccentricity	=	0.0 in

Design Summary

Wall Stability Ratios

Overturning	=	1.80 OK
Sliding	=	3.84 OK
Total Bearing Load	=	1,912 lbs
...resultant ecc.	=	13.12 in
Soil Pressure @ Toe	=	1,102 psf OK
Soil Pressure @ Heel	=	0 psf OK
Allowable	=	1,500 psf
Soil Pressure Less Than Allowable		
ACI Factored @ Toe	=	1,543 psf
ACI Factored @ Heel	=	0 psf
Footing Shear @ Toe	=	6.6 psi OK
Footing Shear @ Heel	=	6.7 psi OK
Allowable	=	88.7 psi

Sliding Calcs

Lateral Sliding Force	=	639.2 lbs
less 100% Passive Force	= -	1,687.5 lbs
less 100% Friction Force	= -	764.8 lbs
Added Force Req'd	=	0.0 lbs OK
....for 1.5 Stability	=	0.0 lbs OK

Vertical component of active lateral soil pressure IS NOT considered in the calculation of soil bearing

Load Factors

Building Code	IBC 2018,ACI
Dead Load	1.200
Live Load	1.600
Earth, H	1.600
Wind, W	1.000
Seismic, E	1.000

Stem Construction

		2nd	Bottom
		Stem OK	Stem OK
Design Height Above Ftg	ft =	3.33	0.00
Wall Material Above "Ht"	=	Masonry	Concrete
Design Method	=	ASD	LRFD
Thickness	=	8.00	8.00
Rebar Size	=	# 5	# 4
Rebar Spacing	=	24.00	12.00
Rebar Placed at	=	Center	Center
Design Data			
fb/FB + fa/Fa	=	**0.700**	**0.664**
Total Force @ Section			
Service Level	lbs =	302.3	
Strength Level	lbs =		582.9
Moment....Actual			
Service Level	ft-# =	982.3	
Strength Level	ft-# =		2,289.2
Moment.....Allowable	ft-# =	1,404.2	3,448.3
Shear.....Actual			
Service Level	psi =	9.5	
Strength Level	psi =		12.1
Shear.....Allowable	psi =	52.1	88.7
Anet (Masonry)	in2 =	31.69	
Rebar Depth 'd'	in =	3.75	4.00
Masonry Data			
f'm	psi =	2,000	
Fs	psi =	32,000	
Solid Grouting	=	No	
Modular Ratio 'n'	=	16.11	
Wall Weight	psf =	58.0	100.0
Short Term Factor	=	1.000	
Equiv. Solid Thick.	in =	5.20	
Masonry Block Type	=	Medium Weight	
Masonry Design Method	=	ASD	
Concrete Data			
f'c	psi =		3,500.0
Fy	psi =		60,000.0

Concrete Stem Rebar Area Details

Bottom Stem	Vertical Reinforcing	Horizontal Reinforcing
As (based on applied moment) :	0.1382 in2/ft	
(4/3) * As :	0.1843 in2/ft	Min Stem T&S Reinf Area 0.639 in2
200bd/fy : 200(12)(4)/60000 :	0.16 in2/ft	Min Stem T&S Reinf Area per ft of stem Height : 0.192 in2/ft
0.0018bh : 0.0018(12)(8) :	0.1728 in2/ft	Horizontal Reinforcing Options :
	==========	One layer of : Two layers of :
Required Area :	0.16 in2/ft	#4@ 12.50 in #4@ 25.00 in
Provided Area :	0.2 in2/ft	#5@ 19.38 in #5@ 38.75 in
Maximum Area :	0.7586 in2/ft	#6@ 27.50 in #6@ 55.00 in

Footing Dimensions & Strengths

Toe Width	=	1.92 ft
Heel Width	=	2.58
Total Footing Width	=	4.50
Footing Thickness	=	12.00 in
Key Width	=	12.00 in
Key Depth	=	0.00 in
Key Distance from Toe	=	2.00 ft

f'c = 3,500 psi Fy = 60,000 psi
Footing Concrete Density = 150.00 pcf
Min. As % = 0.0018
Cover @ Top 2.00 @ Btm.= 3.00 in

Footing Design Results

		Toe	Heel
Factored Pressure	=	1,543	0 psf
Mu' : Upward	=	2,312	52 ft-#
Mu' : Downward	=	937	937 ft-#
Mu: Design	=	1,375	885 ft-#
Actual 1-Way Shear	=	6.59	6.69 psi
Allow 1-Way Shear	=	47.33	47.33 psi

Toe Reinforcing = # 5 @ 16.00 in
Heel Reinforcing = # 5 @ 16.00 in
Key Reinforcing = None Spec'd

Other Acceptable Sizes & Spacings

Toe: Not req'd: Mu < phi*5*lambda*sqrt(f'c)*Sm
Heel: Not req'd: Mu < phi*5*lambda*sqrt(f'c)*Sm
Key: Not req'd: Mu < phi*5*lambda*sqrt(f'c)*Sm

Min footing T&S reinf Area 1.17 in2
Min footing T&S reinf Area per foot 0.26 in2 /ft

If one layer of horizontal bars:	If two layers of horizontal bars:
#4@ 9.26 in	#4@ 18.52 in
#5@ 14.35 in	#5@ 28.70 in
#6@ 20.37 in	#6@ 40.74 in

Summary of Overturning & Resisting Forces & Moments

		.....OVERTURNING..... Force lbs	Distance ft	Moment ft-#			.....RESISTING..... Force lbs	Distance ft	Moment ft-#
Heel Active Pressure	=	306.3	1.17	357.3	Soil Over Heel	=	527.1	3.54	1,866.8
Surcharge over Heel	=				Sloped Soil Over Heel	=			
Surcharge Over Toe	=				Surcharge Over Heel	=			
Adjacent Footing Load	=				Adjacent Footing Load	=			
Added Lateral Load	=	332.9	7.25	2,413.8	Axial Dead Load on Stem	=			
Load @ Stem Above Soil	=				* Axial Live Load on Stem	=			
	=				Soil Over Toe	=		0.96	
					Surcharge Over Toe	=			
Total		639.2	O.T.M.	2,771.1	Stem Weight(s)	=	710.0	2.25	1,597.5
	=		=		Earth @ Stem Transitions	=			
					Footing Weight	=	675.0	2.25	1,518.8
					Key Weight	=		2.50	
					Vert. Component	=			
					Total =		1,912.1 lbs	R.M.=	4,983.0

Resisting/Overturning Ratio = 1.80
Vertical Loads used for Soil Pressure = 1,912.1 lbs

* Axial live load NOT included in total displayed, or used for overturning resistance, but is included for soil pressure calculation.

Vertical component of active lateral soil pressure IS NOT considered in the calculation of Sliding Resistance.

Vertical component of active lateral soil pressure IS NOT considered in the calculation of Overturning Resistance.

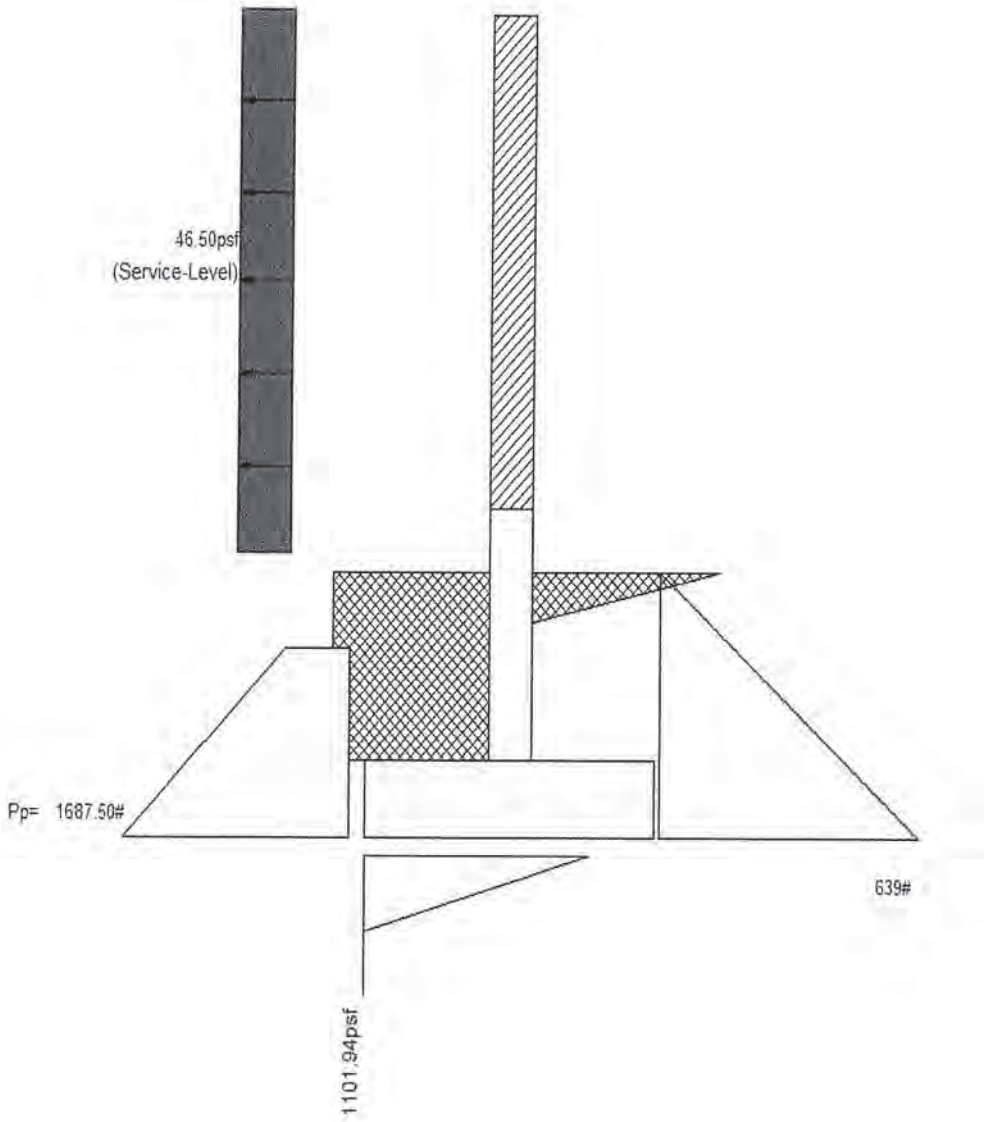
Tilt

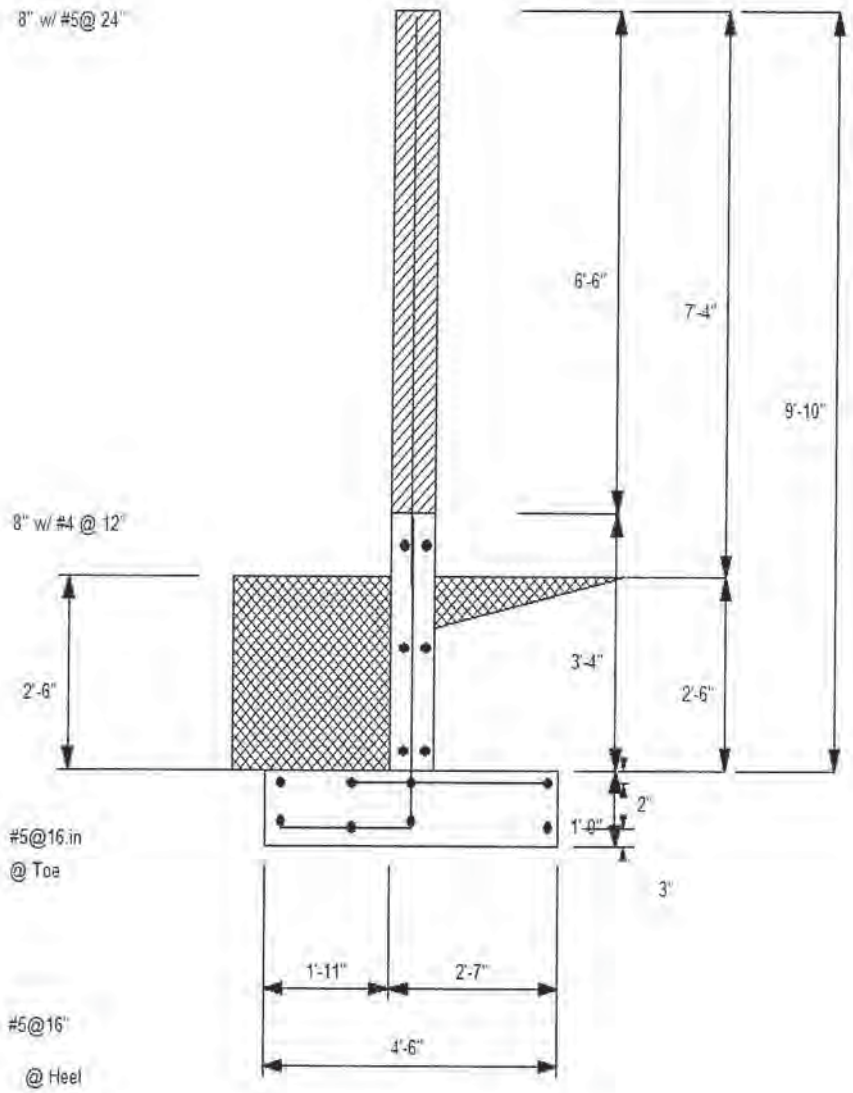
Horizontal Deflection at Top of Wall due to settlement of soil

(Deflection due to wall bending not considered)

Soil Spring Reaction Modulus	250.0	pci
Horizontal Defl @ Top of Wall (approximate only)	0.067	in

The above calculation is not valid if the heel soil bearing pressure exceeds that of the toe, because the wall would then tend to rotate into the retained soil.


46.50psf
(Service-Level)
Pp= 1687.50#
639#
1101.94psf


8" w/ #5@ 24"
6'-6"
7'-4"
9'-10"
8" w/ #4 @ 12"
2'-6"
3'-4"
2'-6"
2"
1'-0"
#5@16.in
@ Toe
3"
1'-11"
2'-7"
#5@16"
4'-6"
@ Heel

CALDER RICHARDS

MASONRY SLENDER WALL SPREADSHEET

Design per IBC 2018 and TMS 402. Assumes a simply supported wall.

Project	HAFB 309th SWEG	Typical Jamb Perpendicular to Joists for 12' Opening	
Date	4/8/2022		

Wall Type	CMU	Total Thickness (in)	7.625	fy (psi)	60000
CMU LW/MW	Medium Weight	Equivalent Thickness (in)	7.625	Es (psi)	29000000
Nominal Wall Thickness (in)	8	Avg Wall Weight (psf)	78	a / c ratio	0.8
Bar Size	5	Steel Depth (in)	3.8125	fr (psi)	163.00
Bar Spacing (in)	16	Area Stl (in^2/ft)	0.2325	ϕ	0.9
Solid Grout	Yes	I-gross (in^4)	443	εu	0.0025
Bar Location	Center	f'm (psi)	2500	S (in^3)	116.197
Ie (Importance Factor)	1.00	Em (psi)	2250000	n	12.889

Clear Span (ft)	12.25
Parapet / Wall Above (ft)	3.75
Wall / Pier Width (ft)	1.33
Wall Opening Width (ft)	12.00

Service Loads	uniform	wall / pier factor	applied	
Lintel and Wall Above Dead (plf)	676.26	4.51		
Roof / Floor Dead (plf)	275.00	5.51	4566.40	plf
Snow or Live (plf)	498.00	5.51	2744.62	plf
Eccentricity (in)	2.00			

Ultimate Loads	uniform	wall / pier factor	applied	
Wind (psf)	23.94	5.51	131.94	psf
Seismic (psf)	31.23	5.51	172.12	psf
S_{DS}	1.001			

Max Steel Check

ρ	0.00508
ρbal	0.01550
%ρbal	32.8
ρmax	0.00796
	ok

Axial Stress Check

ult stress (psi)	117.98
r (in)	2.20
h/r	66.81
max stress (psi)	1235.65
	ok
h/t	19.28
h/t>30 0.05f'm (psi)	125.00
h/t<30 0.2f'm (psi)	500.00
	ok

ASD Load Factors (adjust as needed)

load combinations	D+(S or L)+W	D+(S or L)+W	D+(S or L)+E+Ev	D+(S or L)+E+Ev
D	1.000	1.000	1.140	1.105
S or L	0.000	0.750	0.000	0.750
W or E	0.600	0.450	0.700	0.525

Service Check

a (in)	0.804	0.889	0.835	0.913
c (in)	1.005	1.112	1.043	1.141
Ase (in^2)	0.321	0.356	0.334	0.365
Icr (in^4)	36.722	38.942	37.544	39.527
Ps (plf)	5336.648	7395.111	6084.526	7956.019
Mcr (lb-in)	25717.126	28331.187	26666.864	29043.490
Ms (lb-in)	22658.804	20328.859	33859.817	27947.558
Mn (lb-in)	65780.872	71886.282	68019.502	73519.330
FOS	2.903	3.536	2.009	2.631
service defl (in)	0.051	0.046	0.252	0.063
	ok	ok	ok	ok

service defl max (in): 1.029

ULT Load Factors (adjust as needed)

load combinations	D+(S or L)+W	D+(S or L)+W	D+(S or L)+W	D+(S or L)+W	D+(S or L)+W	D+(S or L)+E+Ev	D+(S or L)+E-Ev
D	1.400	1.200	1.200	1.200	0.900	1.400	0.700
S or L	0.000	0.500	1.600	0.500	0.000	0.700	0.000
W or E	0.000	0.000	0.500	1.000	1.000	1.000	1.000

Ultimate Check

a (in)	0.927	0.941	1.081	0.941	0.804	1.016	0.754
c (in)	1.116	1.132	1.289	1.132	0.977	1.216	0.921
Ase (in^2)	0.357	0.362	0.412	0.362	0.313	0.389	0.295
Icr (in^4)	39.022	39.340	42.419	39.340	36.122	41.001	34.886
Pu (plf)	7471.308	7776.286	10795.365	7776.286	4802.984	9393.607	3734.587
Mcr (lb-in)	28427.951	28815.246	32649.202	28815.246	25039.420	30869.096	23682.653
ultimate defl (in)	0.015	0.016	0.057	0.326	0.345	0.603	0.646
Mu (lb-in)	6502.68	6974.47	25338.24	39088.51	35467.40	52723.13	44353.10
ϕMn (lb-in)	67066.66	67944.48	76401.98	67944.48	59202.78	72527.64	55961.67
	ok	ok	ok	ok	ok	ok	ok

Design controlled by Blast Design.

CALDER RICHARDS

MASONRY SLENDER WALL SPREADSHEET

Design per IBC 2018 and TMS 402. Assumes a simply supported wall.

Project	HAFB 309th SWEG
Date	4/8/2022

Typical Jamb Parallel to Joists for 12' Opening

Wall Type	CMU	Total Thickness (in)	7.625	fy (psi)	60000
CMU LW/MW	Medium Weight	Equivalent Thickness (in)	7.625	Es (psi)	29000000
Nominal Wall Thickness (in)	8	Avg Wall Weight (psf)	78	a / c ratio	0.8
Bar Size	5	Steel Depth (in)	3.8125	fr (psi)	163.00
Bar Spacing (in)	16	Area Stl (in^2/ft)	0.2325	ϕ	0.9
Solid Grout	Yes	I-gross (in^4)	443	εu	0.0025
Bar Location	Center	f'm (psi)	2500	S (in^3)	116.197
Ie (Importance Factor)	1.00	Em (psi)	2250000	n	12.889

Clear Span (ft)	12.25
Parapet / Wall Above (ft)	3.75
Wall / Pier Width (ft)	1.33
Wall Opening Width (ft)	12.00

Service Loads	uniform	wall / pier factor	applied
Lintel and Wall Above Dead (plf)	676.26	4.51	
Roof / Floor Dead (plf)	81.25	5.51	3498.59 plf
Snow or Live (plf)	201.25	5.51	1109.14 plf
Eccentricity (in)	2.00		

Ultimate Loads	uniform	wall / pier factor	applied
Wind (psf)	23.94	5.51	131.94 psf
Seismic (psf)	31.23	5.51	172.12 psf
S_{DS}	1.001		

Max Steel Check

ρ	0.00508
ρbal	0.01550
%ρbal	32.8
ρmax	0.00938
	ok

Axial Stress Check

ult stress (psi)	75.38
r (in)	2.20
h/r	66.81
max stress (psi)	1235.65
	ok
h/t	19.28
h/t>30 0.05f'm (psi)	125.00
h/t<30 0.2f'm (psi)	500.00
	ok

ASD Load Factors (adjust as needed)

load combinations	D+(S or L)+W	D+(S or L)+W	D+(S or L)+E+Ev	D+(S or L)+E+Ev
D	1.000	1.000	1.140	1.105
S or L	0.000	0.750	0.000	0.750
W or E	0.600	0.450	0.700	0.525
Service Check				
a (in)	0.759	0.794	0.784	0.812
c (in)	0.949	0.992	0.980	1.016
Ase (in^2)	0.304	0.318	0.314	0.325
Icr (in^4)	35.511	36.458	36.195	36.957
Ps (plf)	4268.838	5100.697	4867.073	5549.373
Mcr (lb-in)	24361.104	25417.489	25120.808	25987.267
Ms (lb-in)	21525.426	17901.144	32359.628	25356.544
Mn (lb-in)	62544.195	65069.760	64363.379	66419.994
FOS	2.906	3.635	1.989	2.619
service defl (in)	0.049	0.040	0.257	0.057
	ok	ok	ok	ok

service defl max (in) 1.029

ULT Load Factors (adjust as needed)

load combinations	D+(S or L)+W	D+(S or L)+W	D+(S or L)+W	D+(S or L)+W	D+(S or L)+W	D+(S or L)+E+Ev	D+(S or L)+E-Ev
D	1.400	1.200	1.200	1.200	0.900	1.400	0.700
S or L	0.000	0.500	1.600	0.500	0.000	0.700	0.000
W or E	0.000	0.000	0.500	1.000	1.000	1.000	1.000
Ultimate Check							
a (in)	0.858	0.844	0.901	0.844	0.759	0.894	0.720
c (in)	1.038	1.022	1.086	1.022	0.927	1.078	0.882
Ase (in^2)	0.332	0.327	0.347	0.327	0.297	0.345	0.282
Icr (in^4)	37.426	37.098	38.416	37.098	35.013	38.263	33.989
Pu (plf)	5976.374	5677.178	6897.238	5677.178	3841.955	6753.629	2987.333
Mcr (lb-in)	26529.519	26149.568	27698.933	26149.568	23819.000	27516.563	22733.708
ultimate defl (in)	0.011	0.011	0.048	0.334	0.350	0.612	0.652
Mu (lb-in)	4965.04	4814.61	21151.84	36348.46	34193.14	48553.59	43140.05
ϕMn (lb-in)	62701.51	61815.45	65402.64	61815.45	56289.78	64983.98	53663.38
	ok	ok	ok	ok	ok	ok	ok

Design controlled by Blast Design

CALDER RICHARDS
CONSULTING ENGINEERS

JOB TITLE HAFB 309th SWEG BY JL DATE 4/8/22
SUBJECT Load to Pier from Girder CHECKED SHEET OF

This shows conversion of load of Girder Point load to load input into stander wall spreadsheet

Reaction of Girder: DL = 6.3 K, SL = 11.7 K] From beam calcs

2' Pier

$$DL = \frac{6300\,lbf}{(6'+2')} = 788\,psf$$

6' = half opening width
2' = 2' pier width

$$SL = \frac{11700\,lbf}{(6'+2')} = 1463\,psf$$

16" Pier

$$DL = \frac{6300\,lbf}{(6+1.33)} = 860\,psf$$

$$SL = \frac{11700\,lbf}{(6+1.33)} = 1596\,psf$$

CALDER RICHARDS

MASONRY SLENDER WALL SPREADSHEET

Design per IBC 2018 and TMS 402. Assumes a simply supported wall.

Project	HAFB 309th SWEG	Jamb with Girder framing directly into it	
Date	4/8/2022		

Wall Type	CMU	Total Thickness (in)	7.625	fy (psi)	60000
CMU LW/MW	Medium Weight	Equivalent Thickness (in)	7.625	Es (psi)	29000000
Nominal Wall Thickness (in)	8	Avg Wall Weight (psf)	78	a / c ratio	0.8
Bar Size	5	Steel Depth (in)	5.3125	fr (psi)	163.00
Bar Spacing (in)	16	Area Stl (in^2/ft)	0.2325	ϕ	0.9
Solid Grout	Yes	I-gross (in^4)	443	εu	0.0025
Bar Location	Face	f'm (psi)	2500	S (in^3)	116.197
Ie (Importance Factor)	1.00	Em (psi)	2250000	n	12.889

Clear Span (ft)	12.25
Parapet / Wall Above (ft)	3.75
Wall / Pier Width (ft)	1.33
Wall Opening Width (ft)	12.00

Service Loads	uniform	wall / pier factor	applied
Lintel and Wall Above Dead (plf)	676.26	4.51	
Roof / Floor Dead (plf)	860.00	5.51	7790.50 plf
Snow or Live (plf)	1596.00	5.51	8796.00 plf
Eccentricity (in)	2.00		

Ultimate Loads	uniform	wall / pier factor	applied
Wind (psf)	23.94	5.51	131.94 psf
Seismic (psf)	31.23	5.51	172.12 psf
S_{DS}	1.001		

Max Steel Check

ρ	0.00365
ρbal	0.01550
%ρbal	23.5
ρmax	0.00553
	ok

Axial Stress Check

ult stress (psi)	266.08
r (in)	2.20
h/r	66.81
max stress (psi)	1235.65
	ok
h/t	19.28
h/t>30 0.05f'm (psi)	125.00
h/t<30 0.2f'm (psi)	500.00
	ok

ASD Load Factors (adjust as needed)

load combinations	D+(S or L)+W	D+(S or L)+W	D+(S or L)+E+Ev	D+(S or L)+E+Ev
D	1.000	1.000	1.140	1.105
S or L	0.000	0.750	0.000	0.750
W or E	0.600	0.450	0.700	0.525

Service Check

a (in)	0.938	1.213	0.988	1.250
c (in)	1.172	1.516	1.235	1.563
Ase (in^2)	0.335	0.414	0.349	0.425
Icr (in^4)	80.430	90.809	82.376	92.206
Ps (plf)	8560.746	15157.746	9760.449	16057.523
Mcr (lb-in)	29811.439	38189.032	31334.953	39331.668
Ms (lb-in)	26114.697	28735.651	37414.418	36884.476
Mn (lb-in)	96190.268	114247.014	99608.892	116569.278
FOS	3.683	3.976	2.662	3.160
service defl (in)	0.059	0.065	0.145	0.083
	ok	ok	ok	ok

service defl max (in): 1.029

ULT Load Factors (adjust as needed)

load combinations	D+(S or L)+W	D+(S or L)+W	D+(S or L)+W	D+(S or L)+W	D+(S or L)+W	D+(S or L)+E+Ev	D+(S or L)+E-Ev
D	1.400	1.200	1.200	1.200	0.900	1.400	0.700
S or L	0.000	0.500	1.600	0.500	0.000	0.700	0.000
W or E	0.000	0.000	0.500	1.000	1.000	1.000	1.000

Ultimate Check

a (in)	1.136	1.260	1.708	1.260	0.938	1.421	0.859
c (in)	1.351	1.491	1.995	1.491	1.128	1.672	1.039
Ase (in^2)	0.376	0.408	0.524	0.408	0.325	0.450	0.304
Icr (in^4)	85.891	90.055	106.048	90.055	79.014	95.487	76.089
Pu (plf)	11985.045	14670.895	24346.495	14670.895	7704.672	18143.957	5990.810
Mcr (lb-in)	34159.988	37570.775	49857.912	37570.775	28724.301	41981.249	26547.853
ultimate defl (in)	0.025	0.032	0.091	0.179	0.184	0.296	0.317
Mu (lb-in)	11210.11	14217.65	40498.35	46076.56	38127.43	61179.19	46094.65
ϕMn (lb-in)	98451.29	105472.68	127998.15	105472.68	86571.24	114056.86	81576.66
	ok	ok	ok	ok	ok	ok	ok

Design controlled by Blast Design

CALDER RICHARDS

MASONRY SLENDER WALL SPREADSHEET

Design per IBC 2018 and TMS 402. Assumes a simply supported wall.

Project	HAFB 309th SWEG	3'-4" Pier	
Date	4/8/2022		

Wall Type	CMU	Total Thickness (in)	7.625	fy (psi)	60000
CMU LW/MW	Medium Weight	Equivalent Thickness (in)	7.625	Es (psi)	29000000
Nominal Wall Thickness (in)	8	Avg Wall Weight (psf)	78	a / c ratio	0.8
Bar Size	5	Steel Depth (in)	5.3125	fr (psi)	163.00
Bar Spacing (in)	8	Area Stl (in^2/ft)	0.4650	ϕ	0.9
Solid Grout	Yes	I-gross (in^4)	443	εu	0.0025
Bar Location	Face	f'm (psi)	2500	S (in^3)	116.197
Ie (Importance Factor)	1.00	Em (psi)	2250000	n	12.889

Clear Span (ft)	12.25
Parapet / Wall Above (ft)	3.75
Wall / Pier Width (ft)	0.67
Wall Opening Width (ft)	3.33

Service Loads	uniform	wall / pier factor	applied	
Lintel and Wall Above Dead (plf)	676.26	2.49		
Roof / Floor Dead (plf)	81.25	3.49	1963.72	plf
Snow or Live (plf)	201.25	3.49	701.37	plf
Eccentricity (in)	2.00			

Ultimate Loads	uniform	wall / pier factor	applied	
Wind (psf)	23.94	3.49	83.43	psf
Seismic (psf)	31.23	3.49	108.84	psf
S_{DS}	1.001			

Max Steel Check

ρ	0.00729
ρbal	0.01550
%ρbal	47.0
ρmax	0.01075
	ok

Axial Stress Check

ult stress (psi)	48.12
r (in)	2.20
h/r	66.81
max stress (psi)	1235.65
	ok
h/t	19.28
h/t>30 0.05f'm (psi)	125.00
h/t<30 0.2f'm (psi)	500.00
	ok

ASD Load Factors (adjust as needed)

load combinations	D+(S or L)+W	D+(S or L)+W	D+(S or L)+E+Ev	D+(S or L)+E+Ev
D	1.000	1.000	1.140	1.105
S or L	0.000	0.750	0.000	0.750
W or E	0.600	0.450	0.700	0.525

Service Check

a (in)	1.276	1.298	1.292	1.310
c (in)	1.596	1.623	1.615	1.638
Ase (in^2)	0.498	0.504	0.502	0.507
Icr (in^4)	104.873	105.527	105.349	105.887
Ps (plf)	2733.969	3259.997	3117.107	3547.351
Mcr (lb-in)	22411.959	23079.967	22898.510	23444.881
Ms (lb-in)	13314.029	11021.973	19526.295	15684.237
Mn (lb-in)	139091.172	140419.460	140059.785	141140.195
FOS	10.447	12.740	7.173	8.999
service defl (in)	0.030	0.025	0.044	0.035
	ok	ok	ok	ok

service defl max (in): 1.029

ULT Load Factors (adjust as needed)

load combinations	D+(S or L)+W	D+(S or L)+W	D+(S or L)+W	D+(S or L)+W	D+(S or L)+W	D+(S or L)+E+Ev	D+(S or L)+E-Ev
D	1.400	1.200	1.200	1.200	0.900	1.400	0.700
S or L	0.000	0.500	1.600	0.500	0.000	0.700	0.000
W or E	0.000	0.000	0.500	1.000	1.000	1.000	1.000

Ultimate Check

a (in)	1.340	1.331	1.366	1.331	1.276	1.362	1.251
c (in)	1.652	1.642	1.682	1.642	1.581	1.678	1.553
Ase (in^2)	0.511	0.508	0.518	0.508	0.494	0.517	0.488
Icr (in^4)	106.239	105.992	106.970	105.992	104.536	106.863	103.864
Pu (plf)	3827.556	3631.448	4402.957	3631.448	2460.572	4319.063	1913.231
Mcr (lb-in)	23800.716	23551.676	24531.422	23551.676	22064.769	24424.885	21369.696
ultimate defl (in)	0.006	0.006	0.029	0.049	0.047	0.090	0.093
Mu (lb-in)	2773.18	2729.53	12997.99	21665.00	20662.34	28128.45	26052.74
ϕMn (lb-in)	128605.59	128119.76	130020.77	128119.76	125182.05	129815.39	123787.02
	ok	ok	ok	ok	ok	ok	ok

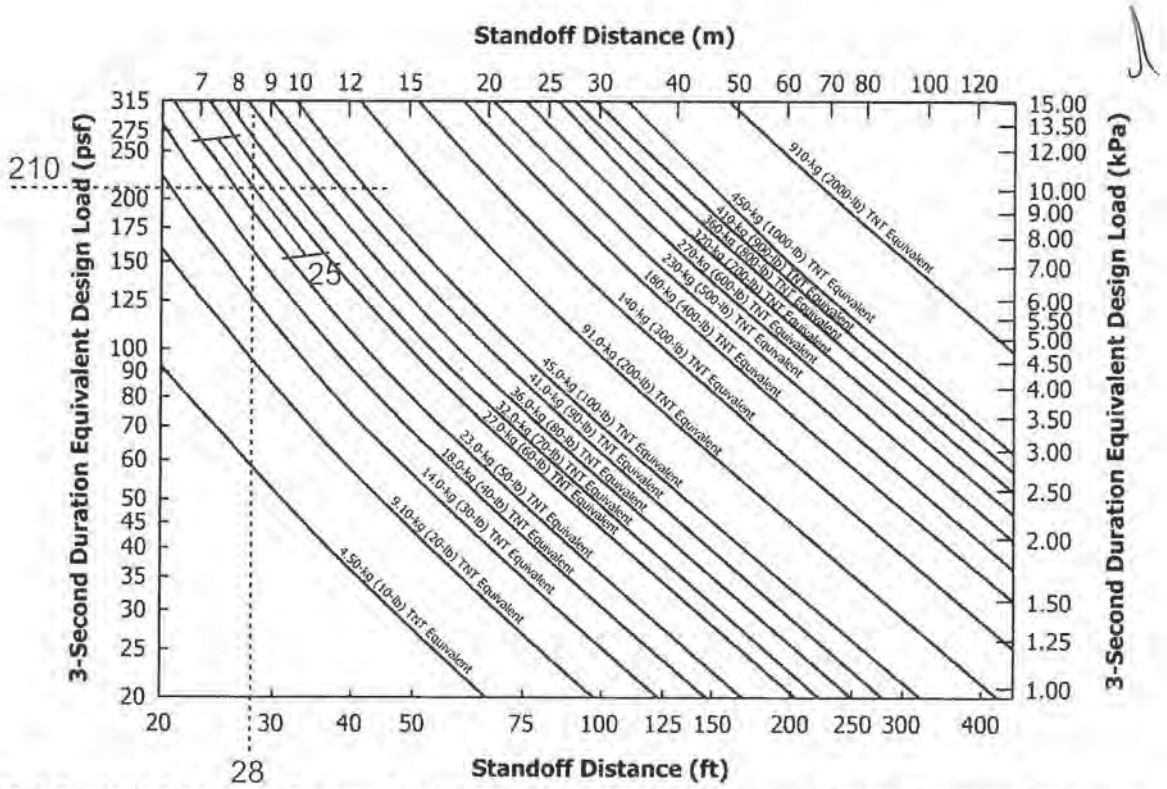


FIG. 1 Graphical Relationship Between Standoff Distance, TNT Charge Mass, and 3-Second Equivalent Design Load (1, 2)

APPENDIX

(Nonmandatory Information)

X1. RECOMMENDATIONS FOR BLAST RESISTANT GLAZING PLACED IN FIXED AND STOREFRONT OPENINGS BY THE STATIC APPROACH

X1.1 Blast resistant glazing in fixed and storefront openings shall be adhered to its supporting frame using structural silicone sealant or adhesive glazing tape. The width of the structural silicone sealant bead shall be at least equal to the larger of 10-mm (⅜-in.) or the thickness designation of the glass to which it adheres but not larger than two times the thickness designation of the glass to which it adheres. The minimum thickness of the structural silicone bead shall be 5-mm (3⁄16-in.). The width of glazing tape shall be at least equal to two times but not more than four times the thickness designation of the glass to which it adheres. The width of silicone or glazing tape is referred to as bite and is shown and discussed in Guide C1564. The structural silicone bead or glazing tape shall be applied to both sides of single lite laminated glass, but need only be applied to the inboard (protected) side of insulating glass.

X1.2 The framing system supporting blast resistant glazing in fixed and storefront openings shall restrict deflections of edges of blast resistant glazing they support to $L/60$ under 2.0× the load resistance of the blast resistant glazing for inward loading, where L denotes the length of the supported edge. The torsional rotation of a framing member should be limited to approximately 3° unless it can be shown that more rotation will not allow the glazing to disengage from the frame bite.

X1.3 The framing system supporting blast resistant glazing in fixed and storefront openings shall attach mechanically to the structural framing system. The system shall be designed to ensure that the glazing fails prior to the framing system that supports the glazing and its attachment to the structural framing system. The fasteners that attach the framing system that supports the glazing to the structural framing system shall be designed to resist a uniform load acting on the blast resistant glazing that has a magnitude of at least:

X1.3.1 Two (2.0) times the magnitude of the load resistance of the blast resistant glazing if the maximum air blast pressure is greater than one half the magnitude of the load resistance of the blast resistant glazing, or

X1.3.2 One (1.0) times the magnitude of the load resistance of the blast resistant glazing if the maximum air blast pressure is less than one half the magnitude of the load resistance of the blast resistant glazing.

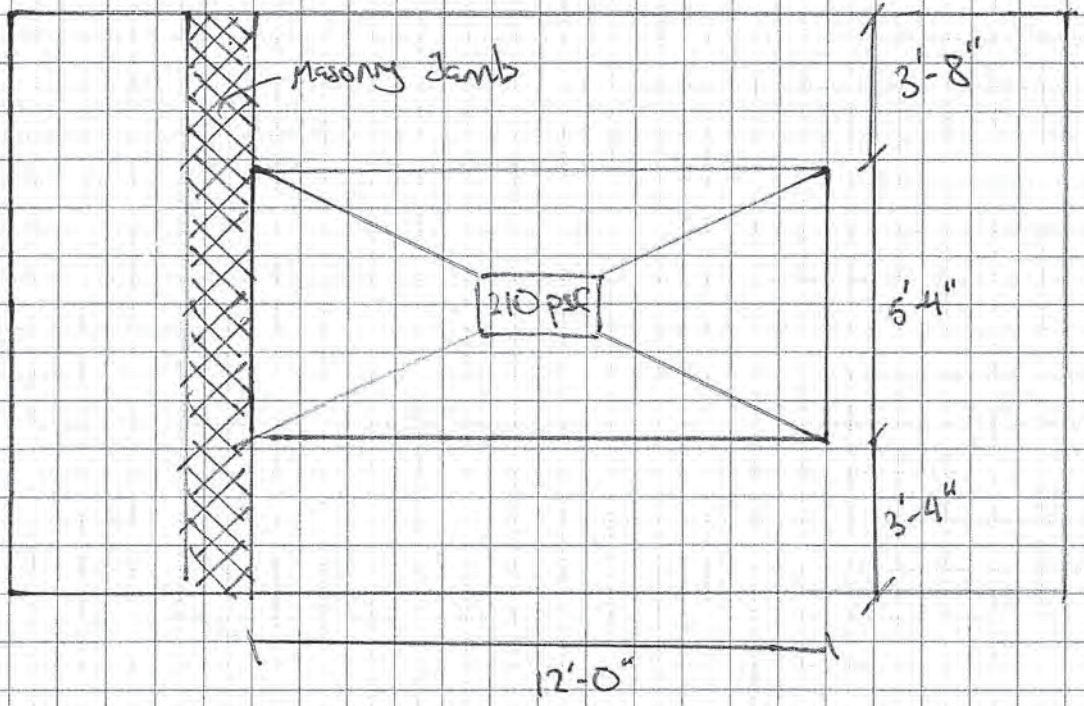
X1.4 Glazing system designs achieved using this standard practice may be validated through blast testing following

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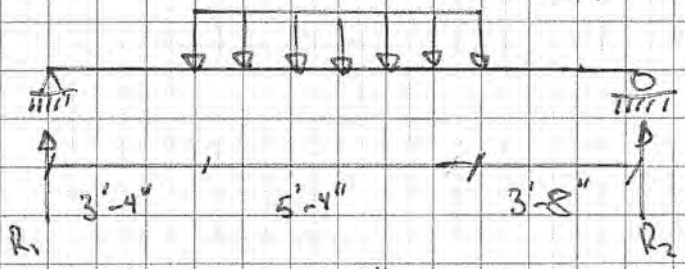
CALDER RICHARDS CONSULTING ENGINEERS

JOB TITLE HAFB 309th SWEG BY JL DATE 4/8/22

SUBJECT Blast Design Loading CHECKED SHEET OF



$w = 210 psf (12') (\frac{1}{2}) = 1260 plf$



$a = 3'-4"$ $\quad \ell = 12'-4"$

$b = 5'-4"$

$c = 3'-8"$

$$R_1 = \frac{wb}{2\ell}(2c+b) = \frac{1260 plf (5.33)}{2(12.33)}\left(2(3.67)+5.33\right) = 3450 lbf$$

$$R_2 = 1260(5.33) - R_1 = 3266 lbf$$

$$M_{max} = R_1\left(a + \frac{R_1}{2w}\right) = 3450\left(3.33 + \frac{3450}{2(1260)}\right) = 16,211 lbf\text{-}ft = 194,532 lbf\text{-}in$$

$$= 16.2 k\text{-}ft$$

Equivalent uniform load $= w = \frac{8M}{\ell^2} = \frac{8(16,211)}{12.33^2} = 853 plf = 7\frac{853}{6+7} = 107 psf$

CALDER RICHARDS

MASONRY SLENDER WALL SPREADSHEET

Design per IBC 2018 and TMS 402. Assumes a simply supported wall.

Project	HAFB 309th SWEG
Date	4/8/2022

Typical Jamb Perpendicular to Joists for 12' Opening (BLAST)

Wall Type	CMU	Total Thickness (in)	7.625	fy (psi)	60000
CMU LW/MW	Medium Weight	Equivalent Thickness (in)	7.625	Es (psi)	29000000
Nominal Wall Thickness (in)	8	Avg Wall Weight (psf)	78	a / c ratio	0.8
Bar Size	5	Steel Depth (in)	5.3125	fr (psi)	163.00
Bar Spacing (in)	8	Area Stl (in^2/ft)	0.4650	ϕ	0.9
Solid Grout	Yes	I-gross (in^4)	443	εu	0.0025
Bar Location	Face	f'm (psi)	2500	S (in^3)	116.197
Ie (Importance Factor)	1.00	Em (psi)	2250000	n	12.889

Clear Span (ft)	12.25
Parapet / Wall Above (ft)	3.75
Wall / Pier Width (ft)	2.00
Wall Opening Width (ft)	12.00

Service Loads	uniform	wall / pier factor	applied
Lintel and Wall Above Dead (plf)	676.26	3.00	
Roof / Floor Dead (plf)	275.00	4.00	3128.78 plf
Snow or Live (plf)	498.00	4.00	1992.00 plf
Eccentricity (in)	2.00		

Ultimate Loads	uniform	wall / pier factor	applied
Wind (psf)	23.94	4.00	95.76 psf
Seismic (psf)	107.00	4.00	428.00 psf
S_{DS}	1.001		

Max Steel Check

ρ	0.00729
ρbal	0.01550
%ρbal	47.0
ρmax	0.00984
	ok

Axial Stress Check

ult stress (psi)	85.97
r (in)	2.20
h/r	66.81
max stress (psi)	1235.65
	ok
h/t	19.28
h/t>30 0.05f'm (psi)	125.00
h/t<30 0.2f'm (psi)	500.00
	ok

ASD Load Factors (adjust as needed)

load combinations	D+(S or L)+W	D+(S or L)+W	D+(S or L)+E+Ev	D+(S or L)+E+Ev
D	1.000	1.000	1.140	1.105
S or L	0.000	0.750	0.000	0.750
V or E	0.600	0.450	0.700	0.525
Service Check				
a (in)	1.325	1.387	1.348	1.404
c (in)	1.656	1.734	1.685	1.755
Ase (in^2)	0.512	0.530	0.518	0.534
Icr (in^4)	106.329	108.250	107.024	108.789
Ps (plf)	3899.030	5393.030	4445.440	5802.838
Mcr (lb-in)	23891.481	25788.726	24585.372	26309.144
Ms (lb-in)	16204.453	14499.110	73275.498	57541.665
Mn (lb-in)	142017.587	145687.472	143370.584	146677.875
FOS	8.764	10.048	1.957	2.549
service defl (in)	0.037	0.033	0.511	0.347
	ok	ok	ok	ok

service defl max (in): 1.029

ULT Load Factors (adjust as needed)

load combinations	D+(S or L)+W	D+(S or L)+W	D+(S or L)+W	D+(S or L)+W	D+(S or L)+W	D+(S or L)+E+Ev	D+(S or L)+E-Ev
D	1.400	1.200	1.200	1.200	0.900	1.400	0.700
S or L	0.000	0.500	1.600	0.500	0.000	0.700	0.000
W or E	0.000	0.000	0.500	1.000	1.000	1.000	1.000
Ultimate Check							
a (in)	1.415	1.425	1.527	1.425	1.325	1.480	1.289
c (in)	1.737	1.749	1.863	1.749	1.636	1.810	1.595
Ase (in^2)	0.530	0.533	0.559	0.533	0.507	0.547	0.498
Icr (in^4)	108.336	108.620	111.610	108.620	105.839	110.203	104.867
Pu (plf)	5458.642	5674.836	7866.036	5674.836	3509.127	6853.822	2728.541
Mcr (lb-in)	25872.047	26146.594	28929.220	26146.594	23396.339	27643.799	22405.066
ultimate defl (in)	0.010	0.011	0.041	0.064	0.064	0.787	0.798
Mu (lb-in)	4434.96	4812.21	18039.69	26667.85	24596.09	107512.82	100705.94
ϕMn (lb-in)	132577.35	133094.55	138214.40	133094.55	127815.83	135876.93	125859.99
	ok	ok	ok	ok	ok	ok	ok

CALDER RICHARDS

MASONRY SLENDER WALL SPREADSHEET

Design per IBC 2018 and TMS 402. Assumes a simply supported wall.

Project	HAFB 309th SWEG
Date	4/8/2022

Typical Jamb Parallel to Joists for 12' Opening (BLAST)

Wall Type	CMU	Total Thickness (in)	7.625	fy (psi)	60000
CMU LW/MW	Medium Weight	Equivalent Thickness (in)	7.625	Es (psi)	29000000
Nominal Wall Thickness (in)	8	Avg Wall Weight (psf)	78	a / c ratio	0.8
Bar Size	5	Steel Depth (in)	5.3125	fr (psi)	163.00
Bar Spacing (in)	8	Area Stl (in^2/ft)	0.4650	ϕ	0.9
Solid Grout	Yes	I-gross (in^4)	443	εu	0.0025
Bar Location	Face	f'm (psi)	2500	S (in^3)	116.197
Ie (Importance Factor)	1.00	Em (psi)	2250000	n	12.889

Clear Span (ft)	12.25
Parapet / Wall Above (ft)	3.75
Wall / Pier Width (ft)	2.00
Wall Opening Width (ft)	12.00

Service Loads	uniform	wall / pier factor	applied
Lintel and Wall Above Dead (plf)	676.26	3.00	
Roof / Floor Dead (plf)	81.25	4.00	2353.78 plf
Snow or Live (plf)	201.25	4.00	805.00 plf
Eccentricity (in)	2.00		

Ultimate Loads	uniform	wall / pier factor	applied
Wind (psf)	23.94	4.00	95.76 psf
Seismic (psf)	107.00	4.00	428.00 psf
S_{DS}	1.001		

Max Steel Check

ρ	0.00729
ρbal	0.01550
%ρbal	47.0
ρmax	0.01058
	ok

Axial Stress Check

ult stress (psi)	55.05
r (in)	2.20
h/r	66.81
max stress (psi)	1235.65
	ok
h/t	19.28
h/t>30 0.05f'm (psi)	125.00
h/t<30 0.2f'm (psi)	500.00
	ok

ASD Load Factors (adjust as needed)

load combinations	D+(S or L)+W	D+(S or L)+W	D+(S or L)+E+Ev	D+(S or L)+E+Ev
D	1.000	1.000	1.140	1.105
S or L	0.000	0.750	0.000	0.750
V or E	0.600	0.450	0.700	0.525

Service Check

a (in)	1.293	1.318	1.311	1.332
c (in)	1.616	1.647	1.639	1.664
Ase (in^2)	0.502	0.510	0.508	0.514
Icr (in^4)	105.357	106.113	105.905	106.528
Ps (plf)	3124.030	3727.780	3561.832	4056.131
Mcr (lb-in)	22907.301	23674.009	23463.269	24090.985
Ms (lb-in)	15395.383	12764.731	71941.637	55188.766
Mn (lb-in)	140077.230	141590.985	141176.424	142407.868
FOS	9.099	11.092	1.962	2.580
service defl (in)	0.035	0.029	0.511	0.346
	ok	ok	ok	ok

service defl max (in): 1.029

ULT Load Factors (adjust as needed)

load combinations	D+(S or L)+W	D+(S or L)+W	D+(S or L)+W	D+(S or L)+W	D+(S or L)+W	D+(S or L)+E+Ev	D+(S or L)+E-Ev
D	1.400	1.200	1.200	1.200	0.900	1.400	0.700
S or L	0.000	0.500	1.600	0.500	0.000	0.700	0.000
W or E	0.000	0.000	0.500	1.000	1.000	1.000	1.000

Ultimate Check

a (in)	1.365	1.355	1.396	1.355	1.293	1.391	1.264
c (in)	1.681	1.669	1.715	1.669	1.600	1.710	1.567
Ase (in^2)	0.517	0.515	0.525	0.515	0.499	0.524	0.491
Icr (in^4)	106.932	106.649	107.786	106.649	104.969	107.657	104.198
Pu (plf)	4373.642	4151.336	5036.836	4151.336	2811.627	4937.767	2186.196
Mcr (lb-in)	24494.195	24211.887	25336.392	24211.887	22510.577	25210.583	21716.337
ultimate defl (in)	0.008	0.007	0.034	0.062	0.064	0.790	0.798
Mu (lb-in)	3328.16	3257.58	15061.35	25041.30	23852.27	104100.47	99732.11
ϕMn (lb-in)	129949.04	129403.80	131562.04	129403.80	126069.51	131322.38	124484.47
	ok	ok	ok	ok	ok	ok	ok

CALDER RICHARDS

MASONRY SLENDER WALL SPREADSHEET

Design per IBC 2018 and TMS 402. Assumes a simply supported wall.

Project	HAFB 309th SWEG	Jamb with Girder framing directly into it (BLAST)	
Date	4/8/2022		

Wall Type	CMU	Total Thickness (in)	7.625	fy (psi)	60000
CMU LW/MW	Medium Weight	Equivalent Thickness (in)	7.625	Es (psi)	29000000
Nominal Wall Thickness (in)	8	Avg Wall Weight (psf)	78	a / c ratio	0.8
Bar Size	5	Steel Depth (in)	5.3125	fr (psi)	163.00
Bar Spacing (in)	8	Area Stl (in^2/ft)	0.4650	ϕ	0.9
Solid Grout	Yes	I-gross (in^4)	443	εu	0.0025
Bar Location	Face	f'm (psi)	2500	S (in^3)	116.197
Ie (Importance Factor)	1.00	Em (psi)	2250000	n	12.889

Clear Span (ft)	12.25
Parapet / Wall Above (ft)	3.75
Wall / Pier Width (ft)	2.00
Wall Opening Width (ft)	12.00

Service Loads	uniform	wall / pier factor	applied
Lintel and Wall Above Dead (plf)	676.25	3.00	
Roof / Floor Dead (plf)	788.00	4.00	5180.78 plf
Snow or Live (plf)	1463.00	4.00	5852.00 plf
Eccentricity (in)	2.00		

Ultimate Loads	uniform	wall / pier factor	applied
Wind (psf)	23.94	4.00	95.76 psf
Seismic (psf)	107.00	4.00	428.00 psf
S_{DS}	1.001		

Max Steel Check

ρ	0.00729
ρbal	0.01550
%ρbal	47.0
ρmax	0.00758
	ok

Axial Stress Check

ult stress (psi)	180.38
r (in)	2.20
h/r	66.81
max stress (psi)	1235.65
	ok
h/t	19.28
h/t>30 0.05f'm (psi)	125.00
h/t<30 0.2f'm (psi)	500.00
	ok

ASD Load Factors (adjust as needed)

load combinations	D+(S or L)+W	D+(S or L)+W	D+(S or L)+E+Ev	D+(S or L)+E+Ev
D	1.000	1.000	1.140	1.105
S or L	0.000	0.750	0.000	0.750
V or E	0.600	0.450	0.700	0.525

Service Check

a (in)	1.410	1.593	1.445	1.619
c (in)	1.763	1.992	1.807	2.024
Ase (in^2)	0.536	0.589	0.546	0.596
Icr (in^4)	108.986	115.275	110.109	116.260
Ps (plf)	5951.030	10340.030	6785.007	10965.513
Mcr (lb-in)	26497.335	32070.968	27556.411	32865.275
Ms (lb-in)	18360.523	19730.249	76803.129	64490.990
Mn (lb-in)	147034.297	157175.533	149023.054	158555.433
FOS	8.008	7.966	1.940	2.459
service defl (in)	0.041	0.045	0.510	0.346
	ok	ok	ok	ok

service defl max (in): 1.029

ULT Load Factors (adjust as needed)

load combinations	D+(S or L)+W	D+(S or L)+W	D+(S or L)+W	D+(S or L)+W	D+(S or L)+W	D+(S or L)+E+Ev	D+(S or L)+E-Ev
D	1.400	1.200	1.200	1.200	0.900	1.400	0.700
S or L	0.000	0.500	1.600	0.500	0.000	0.700	0.000
W or E	0.000	0.000	0.500	1.000	1.000	1.000	1.000

Ultimate Check

a (in)	1.548	1.629	1.927	1.629	1.410	1.738	1.355
c (in)	1.887	1.977	2.313	1.977	1.732	2.100	1.670
Ase (in^2)	0.565	0.585	0.662	0.585	0.529	0.614	0.515
Icr (in^4)	112.273	114.853	126.308	114.853	108.201	118.671	106.666
Pu (plf)	8331.442	10067.236	16504.436	10067.236	5355.927	12429.032	4164.531
Mcr (lb-in)	29520.243	31724.544	39899.206	31724.544	25741.608	34723.812	24228.643
ultimate defl (in)	0.017	0.021	0.062	0.071	0.066	0.775	0.796
Mu (lb-in)	7392.18	9355.64	27378.08	31412.08	26570.07	117319.90	103281.32
ϕMn (lb-in)	139273.23	143133.82	156232.97	143133.82	132330.87	148162.68	129436.23
	ok	ok	ok	ok	ok	ok	ok

CALDER RICHARDS

MASONRY SLENDER WALL SPREADSHEET

Design per IBC 2018 and TMS 402. Assumes a simply supported wall.

Project	HAFB 309th SWEG	Typical Wall Parallel to Joists	
Date	4/8/2022		

Wall Type	CMU	Total Thickness (in)	7.625	fy (psi)	60000
CMU LW/MW	Medium Weight	Equivalent Thickness (in)	7.625	Es (psi)	29000000
Nominal Wall Thickness (in)	8	Avg Wall Weight (psf)	78	a / c ratio	0.8
Bar Size	5	Steel Depth (in)	3.8125	fr (psi)	163.00
Bar Spacing (in)	32	Area Stl (in^2/ft)	0.1163	ϕ	0.9
Solid Grout	Yes	I-gross (in^4)	443	εu	0.0025
Bar Location	Center	f'm (psi)	2500	S (in^3)	116.197
Ie (Importance Factor)	1.00	Em (psi)	2250000	n	12.889

Clear Span (ft)	12.25
Parapet / Wall Above (ft)	4
Wall / Pier Width (ft)	1.33
Wall Opening Width (ft)	0.00

Service Loads	uniform	wall / pier factor	applied
Lintel and Wall Above Dead (plf)	1248.00	0.00	
Roof / Floor Dead (plf)	81.25	1.00	81.25 plf
Snow or Live (plf)	201.25	1.00	201.25 plf
Eccentricity (in)	2.00		

Ultimate Loads	uniform	wall / pier factor	applied
Wind (psf)	23.94	1.00	23.94 psf
Seismic (psf)	31.23	1.00	31.23 psf
S_{DS}	1.001		

Max Steel Check

ρ	0.00254
ρbal	0.01550
%ρbal	16.4
ρmax	0.01140
	ok

Axial Stress Check

ult stress (psi)	14.94
r (in)	2.20
h/r	66.81
max stress (psi)	1235.65
	ok
h/t	19.28
h/t>30 0.05f'm (psi)	125.00
h/t<30 0.2f'm (psi)	500.00
	ok

ASD Load Factors (adjust as needed)

load combinations	D+(S or L)+W	D+(S or L)+W	D+(S or L)+E+Ev	D+(S or L)+E+Ev
D	1.000	1.000	1.140	1.105
S or L	0.000	0.750	0.000	0.750
W or E	0.600	0.450	0.700	0.525

Service Check

a (in)	0.327	0.333	0.332	0.337
c (in)	0.409	0.417	0.415	0.421
Ase (in^2)	0.131	0.133	0.133	0.135
Icr (in^4)	19.801	20.101	20.044	20.281
Ps (plf)	871.000	1021.938	993.062	1113.484
Mcr (lb-in)	20046.157	20237.834	20201.164	20354.089
Ms (lb-in)	3321.029	2663.269	5024.869	3941.361
Mn (lb-in)	28630.381	29156.012	29055.528	29474.354
FOS	8.621	10.947	5.782	7.478
service defl (in)	0.008	0.006	0.011	0.009
	ok	ok	ok	ok

service defl max (in): 1.029

ULT Load Factors (adjust as needed)

load combinations	D+(S or L)+W	D+(S or L)+W	D+(S or L)+W	D+(S or L)+W	D+(S or L)+W	D+(S or L)+E+Ev	D+(S or L)+E-Ev
D	1.400	1.200	1.200	1.200	0.900	1.400	0.700
S or L	0.000	0.500	1.600	0.500	0.000	0.700	0.000
W or E	0.000	0.000	0.500	1.000	1.000	1.000	1.000

Ultimate Check

a (in)	0.347	0.344	0.354	0.344	0.327	0.354	0.319
c (in)	0.427	0.423	0.434	0.423	0.404	0.434	0.395
Ase (in^2)	0.137	0.135	0.139	0.135	0.129	0.139	0.126
Icr (in^4)	20.489	20.345	20.777	20.345	19.627	20.764	19.275
Pu (plf)	1219.400	1145.825	1367.200	1145.825	783.900	1360.449	609.526
Mcr (lb-in)	20488.593	20395.160	20676.286	20395.160	19935.548	20667.713	19714.108
ultimate defl (in)	0.000	0.000	0.007	0.013	0.012	0.017	0.016
Mu (lb-in)	114.06	198.64	3123.52	5601.36	5471.56	7307.04	7096.58
ϕMn (lb-in)	27280.92	27025.83	27792.61	27025.83	25767.34	27769.26	25158.84
	ok	ok	ok	ok	ok	ok	ok

CALDER RICHARDS

MASONRY SLENDER WALL SPREADSHEET

Design per IBC 2018 and TMS 402. Assumes a simply supported wall.

Project	HAFB 309th SWEG
Date	4/8/2022

Typical Wall Perpendicular to Joists

Wall Type	CMU	Total Thickness (in)	7.625	fy (psi)	60000
CMU LW/MW	Medium Weight	Equivalent Thickness (in)	7.625	Es (psi)	29000000
Nominal Wall Thickness (in)	8	Avg Wall Weight (psf)	78	a / c ratio	0.8
Bar Size	5	Steel Depth (in)	3.8125	fr (psi)	163.00
Bar Spacing (in)	32	Area Stl (in^2/ft)	0.1163	ϕ	0.9
Solid Grout	Yes	I-gross (in^4)	443	εu	0.0025
Bar Location	Center	f'm (psi)	2500	S (in^3)	116.197
Ie (Importance Factor)	1.00	Em (psi)	2250000	n	12.889

Clear Span (ft)	12.25
Parapet / Wall Above (ft)	4
Wall / Pier Width (ft)	1.33
Wall Opening Width (ft)	0.00

Service Loads	uniform	wall / pier factor	applied
Lintel and Wall Above Dead (plf)	1248.00	0.00	
Roof / Floor Dead (plf)	275.00	1.00	275.00 plf
Snow or Live (plf)	498.00	1.00	498.00 plf
Eccentricity (in)	2.00		

Ultimate Loads	uniform	wall / pier factor	applied
Wind (psf)	23.94	1.00	23.94 psf
Seismic (psf)	31.23	1.00	31.23 psf
S_{DS}	1.001		

Max Steel Check

ρ	0.00254
ρbal	0.01550
%ρbal	16.4
ρmax	0.01114
	ok

Axial Stress Check

ult stress (psi)	22.67
r (in)	2.20
h/r	66.81
max stress (psi)	1235.65
	ok
h/t	19.28
h/t>30 0.05f'm (psi)	125.00
h/t<30 0.2f'm (psi)	500.00
	ok

ASD Load Factors (adjust as needed)

load combinations	D+(S or L)+W	D+(S or L)+W	D+(S or L)+E+Ev	D+(S or L)+E+Ev
D	1.000	1.000	1.140	1.105
S or L	0.000	0.750	0.000	0.750
W or E	0.600	0.450	0.700	0.525

Service Check

a (in)	0.335	0.351	0.341	0.355
c (in)	0.419	0.438	0.427	0.444
Ase (in^2)	0.134	0.140	0.136	0.142
Icr (in^4)	20.185	20.914	20.478	21.130
Ps (plf)	1064.750	1438.250	1213.964	1550.161
Mcr (lb-in)	20292.202	20766.513	20481.690	20908.629
Ms (lb-in)	3516.703	3083.450	5248.892	4383.472
Mn (lb-in)	29304.931	30600.874	29823.360	30988.042
FOS	8.333	9.924	5.682	7.069
service defl (in)	0.008	0.007	0.012	0.010
	ok	ok	ok	ok

service defl max (in) 1.029

ULT Load Factors (adjust as needed)

load combinations	D+(S or L)+W	D+(S or L)+W	D+(S or L)+W	D+(S or L)+W	D+(S or L)+W	D+(S or L)+E+Ev	D+(S or L)+E-Ev
D	1.400	1.200	1.200	1.200	0.900	1.400	0.700
S or L	0.000	0.500	1.600	0.500	0.000	0.700	0.000
W or E	0.000	0.000	0.500	1.000	1.000	1.000	1.000

Ultimate Check

a (in)	0.360	0.361	0.387	0.361	0.335	0.376	0.325
c (in)	0.441	0.443	0.471	0.443	0.413	0.459	0.402
Ase (in^2)	0.141	0.142	0.151	0.142	0.132	0.147	0.129
Icr (in^4)	21.015	21.085	22.120	21.085	19.975	21.680	19.549
Pu (plf)	1490.650	1526.700	2074.500	1526.700	958.275	1839.463	745.112
Mcr (lb-in)	20833.056	20878.836	21574.493	20878.836	20156.988	21276.017	19886.290
ultimate defl (in)	0.001	0.001	0.009	0.014	0.013	0.018	0.016
Mu (lb-in)	386.30	581.00	3839.16	5988.39	5648.47	7795.99	7234.57
ϕMn (lb-in)	28219.22	28343.66	30227.28	28343.66	26374.44	29420.80	25632.11
	ok	ok	ok	ok	ok	ok	ok

CALDER RICHARDS

MASONRY SLENDER WALL SPREADSHEET

Design per IBC 2018 and TMS 402. Assumes a simply supported wall.

Project	HAFB 309th SWEG
Date	4/8/2022

5'-4" Pier

Wall Type	CMU	Total Thickness (in)	7.625	fy (psi)	60000
CMU LW/MW	Medium Weight	Equivalent Thickness (in)	7.625	Es (psi)	29000000
Nominal Wall Thickness (in)	8	Avg Wall Weight (psf)	78	a / c ratio	0.8
Bar Size	5	Steel Depth (in)	5.3125	fr (psi)	163.00
Bar Spacing (in)	8	Area Stl (in^2/ft)	0.4650	ϕ	0.9
Solid Grout	Yes	I-gross (in^4)	443	εU	0.0025
Bar Location	Face	f'm (psi)	2500	S (in^3)	116.197
Ie (Importance Factor)	1.00	Em (psi)	2250000	n	12.889

Clear Span (ft)	9.33
Parapet / Wall Above (ft)	3.75
Wall / Pier Width (ft)	0.67
Wall Opening Width (ft)	5.33

Service Loads	uniform	wall / pier factor	applied
Lintel and Wall Above Dead (plf)	103.74	3.98	
Roof / Floor Dead (plf)	293.75	4.98	1874.81 plf
Snow or Live (plf)	387.75	4.98	1930.07 plf
Eccentricity (in)	2.00		

Max Steel Check	
ρ	0.00729
ρbal	0.01550
%ρbal	47.0
ρmax	0.01030
	ok

Ultimate Loads	uniform	wall / pier factor	applied
Wind (psf)	23.94	4.98	119.16 psf
Seismic (psf)	31.23	4.98	155.46 psf
S_{DS}	1.001		

Axial Stress Check	
ult stress (psi)	66.95
r (in)	2.20
h/r	50.88
max stress (psi)	1388.65
	ok
h/t	14.68
h/t>30 0.05f'm (psi)	125.00
h/t<30 0.2f'm (psi)	500.00
	ok

ASD Load Factors (adjust as needed)

load combinations	D+(S or L)+W	D+(S or L)+W	D+(S or L)+E+Ev	D+(S or L)+E+Ev
D	1.000	1.000	1.140	1.105
S or L	0.000	0.750	0.000	0.750
V or E	0.600	0.450	0.700	0.525

Service Check

a (in)	1.268	1.328	1.283	1.339
c (in)	1.585	1.660	1.603	1.674
Ase (in^2)	0.495	0.513	0.500	0.516
Icr (in^4)	104.623	106.430	105.062	106.768
Ps (plf)	2531.181	3978.733	2885.901	4244.773
Mcr (lb-in)	22154.436	23992.696	22604.898	24330.543
Ms (lb-in)	11247.896	10378.298	16408.542	14255.406
Mn (lb-in)	138576.028	142215.719	139476.003	142875.145
FOS	12.320	13.703	8.500	10.023
service defl (in)	0.015	0.014	0.021	0.019
	ok	ok	ok	ok

service defl max (in) 0.784

ULT Load Factors (adjust as needed)

load combinations	D+(S or L)+W	D+(S or L)+W	D+(S or L)+W	D+(S or L)+W	D+(S or L)+W	D+(S or L)+E+Ev	D+(S or L)+E-Ev
D	1.400	1.200	1.200	1.200	0.900	1.400	0.700
S or L	0.000	0.500	1.600	0.500	0.000	0.700	0.000
W or E	0.000	0.000	0.500	1.000	1.000	1.000	1.000

Ultimate Check

a (in)	1.327	1.348	1.446	1.348	1.268	1.389	1.245
c (in)	1.638	1.662	1.772	1.662	1.572	1.708	1.545
Ase (in^2)	0.507	0.513	0.538	0.513	0.492	0.524	0.486
Icr (in^4)	105.882	106.460	109.219	106.460	104.311	107.602	103.690
Pu (plf)	3543.653	4002.452	6125.528	4002.452	2278.063	4895.208	1771.320
Mcr (lb-in)	23440.185	24022.817	26718.931	24022.817	21832.999	25156.537	21189.482
ultimate defl (in)	0.003	0.004	0.017	0.025	0.023	0.032	0.030
Mu (lb-in)	2636.98	3231.75	13223.82	18873.41	17298.60	24431.35	21664.39
ϕMn (lb-in)	127901.69	129037.36	134165.77	129037.36	124718.43	131219.29	123423.06
	ok	ok	ok	ok	ok	ok	ok

CALDER RICHARDS CONSULTING ENGINEERS

JOB TITLE: HAFB 309th SWEG **BY:** JL **DATE:** 04/08/22
SUBJECT: Lateral Loads **CHECKED:** **SHEET:**

BUILDING DIMENSIONS:

$B := 124\ ft$
$L := 85.5\ ft$
$A_{roof} := B \cdot L = 10602\ ft^2$
$h_{roof} := 12.33\ ft$
$h_{parapet} := 16\ ft - h_{roof} = 3.7\ ft$

WEIGHTS & MATERIAL PROPERTIES:

$w_{CMU} := 78\ psf + 5\ psf$ Assumed Weight of CMU & Interior Furring if applicable
$w_{roof} := 25\ psf$ Dead Weigth of Roof
$w_{snow} := 33\ psf$ Snow Load
$f_y := 32000\ psi$

LATERAL LOAD VARIABLES:

$p_{wind} := 19.3\ psf$ Wind Pressure MWFRS
$p_{parapet} := 43.68\ psf$
$S_{DS} := 1.001$
$R := 5$
$I_e := 1$
$C_s := \frac{S_{DS}}{\left(\frac{R}{I_e}\right)} = 0.2$

SHEAR WALL SCHEDULE AND CAPACITIES:

SW1: Horizontal (2) #4 @ 48" oc w/ Verts grouted @ 32" oc $v_{a1} := 1.54\ klf$
SW2: Horizontal (2) #4 Solid Grouted $v_{a2} := 2.6\ klf$

BASE SHEARS:

$A_{windNS} := h_{roof} \cdot B = 1528.9\ ft^2$
$A_{windEW} := h_{roof} \cdot L = 1054.2\ ft^2$
$A_{parapetNS} := h_{parapet} \cdot B = 455.1\ ft^2$
$A_{parapetEW} := h_{parapet} \cdot L = 313.8\ ft^2$

$A_{wall} := 2 \cdot (L + B) \cdot (0.5 \cdot h_{roof} + h_{parapet}) = 4120.9\ ft^2$
$W := A_{roof} \cdot w_{roof} + A_{wall} \cdot w_{CMU} + A_{roof} \cdot 0.2 \cdot w_{snow} = 677.1\ kip$

$V_{eq} := 0.7 \cdot C_s \cdot W = 94.9\ kip$ (ASD)

$V_{windNS} := 0.6 \cdot (A_{windNS} \cdot p_{wind} + A_{parapetNS} \cdot p_{parapet}) = 29.6\ kip$ (ASD)
$V_{windEW} := 0.6 \cdot (A_{windEW} \cdot p_{wind} + A_{parapetEW} \cdot p_{parapet}) = 20.4\ kip$ (ASD)

$V_{base} := V_{eq} = 94.9\ kip$ (ASD) Seismic is significantly larger and will govern the design

The building is a box with only exterior shear walls. Therefore half of the shear load will go to each shear wall line. This will be true for both directions

$V_{wall} := \frac{V_{base}}{2} = 47.4\ kip$

CALDER RICHARDS CONSULTING ENGINEERS

JOB TITLE: HAFB 309th SWEG **BY:** JL **DATE:** 04/08/22

SUBJECT: Lateral Loads **CHECKED:** **SHEET:**

DIAPHRAGM DESIGN CAPACITY CHECKS:

$$V_{dA.G} := \frac{V_{wall}}{L} = 554.9\ \boldsymbol{plf}$$

$$V_{d.1.5} := \frac{V_{wall}}{B} = 382.6\ \boldsymbol{plf}$$

CHORD CAPACITY CHECKS:

$$w_{NS} := \frac{V_{base}}{B} = 765.2\ \boldsymbol{plf}$$

$$M_{NS} := \frac{w_{NS} \cdot B^2}{8} = 1470.7\ \boldsymbol{kip \cdot ft}$$

$$T_{NS} := \frac{M_{NS}}{L} = 17.2\ \boldsymbol{kip}$$

$$w_{EW} := \frac{V_{base}}{L} = 1109.7\ \boldsymbol{plf}$$

$$M_{EW} := \frac{w_{EW} \cdot L^2}{8} = 1014.1\ \boldsymbol{kip \cdot ft}$$

$$T_{EW} := \frac{M_{EW}}{B} = 8.2\ \boldsymbol{kip}$$

$T_a := 2 \cdot 0.31\ \boldsymbol{in^2} \cdot f_y = 19.8\ \boldsymbol{kip}$

USE (2) # 5 bars in bond beams @ dipahragms to resist chord forces

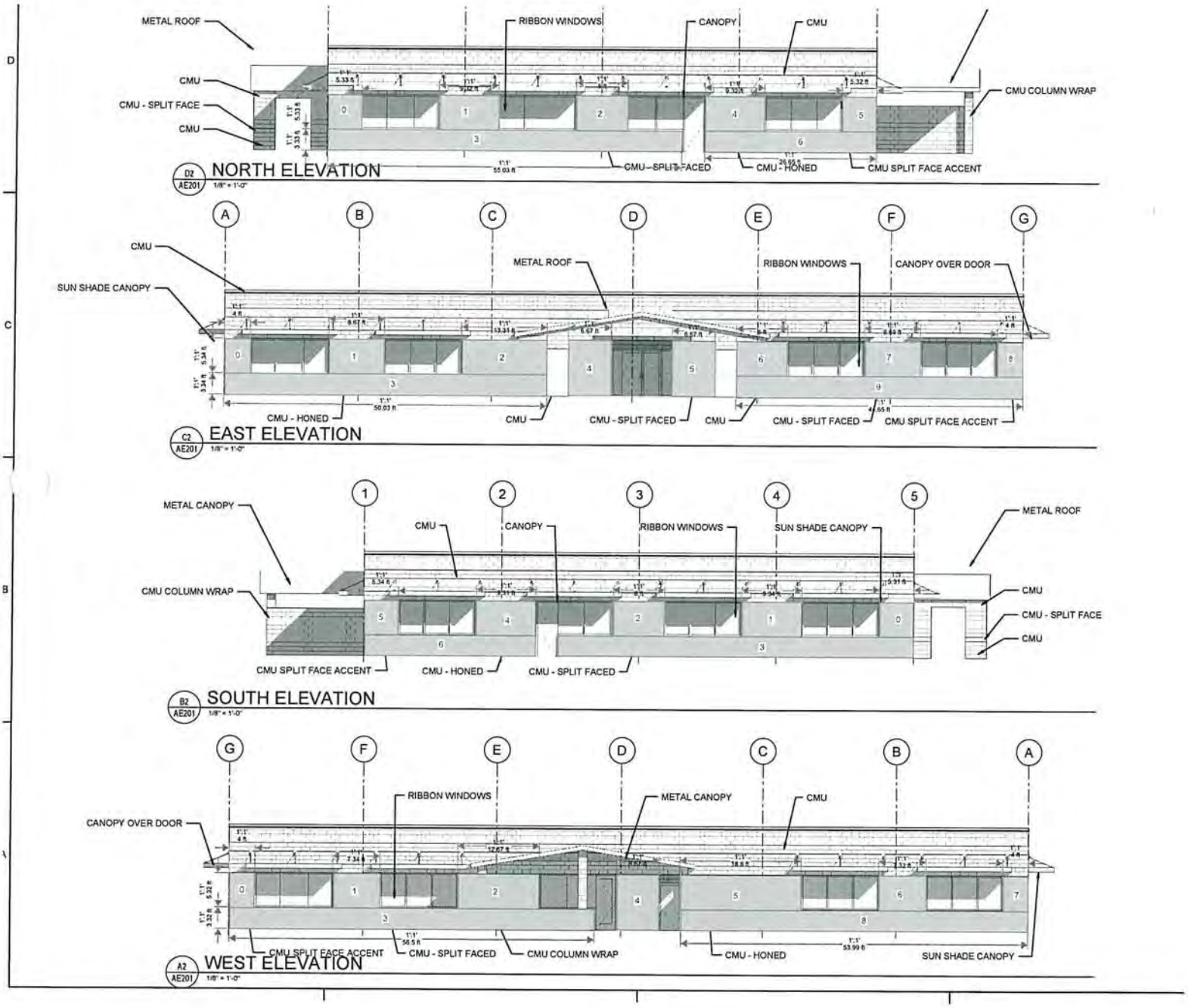
$$DCR := \frac{T_{NS}}{T_a} = 0.87$$

$$DCR := \frac{T_{EW}}{T_a} = 0.41$$

L3x3x1/4 LEDGER ANGLE ATTACH @ 4'-0" OC

$C_{\Omega} = 21.8^k > 17.2^k \therefore$ OK

Relative Rigidity wall Pier Key Plans



WALL RELATIVE RIGIDITIES (WALL LINES A&G):

n	d (ft)	h (ft)	t (in)
0	5.33	5.33	7.625
1	9.33	5.33	7.625
2	8	5.33	7.625
3	55	3.33	7.625
4	9.33	5.33	7.625
5	5.33	5.33	7.625
6	26.67	3.33	7.625

$r := \text{rows}(n) - 1 = 6$

$$\Delta_F := \left(\frac{\left(0.1 \cdot \left(\frac{h}{d} \right)^3 + 0.3 \cdot \left(\frac{h}{d} \right) \right)}{\frac{t}{in}} \right) = \begin{bmatrix} 0.052 \\ 0.025 \\ 0.030 \\ 0.002 \\ 0.025 \\ 0.052 \\ 0.005 \end{bmatrix} \qquad R_F := \frac{1}{\Delta_F} = \begin{bmatrix} 19.1 \\ 40.1 \\ 33.2 \\ 419.3 \\ 40.1 \\ 19.1 \\ 202.5 \end{bmatrix}$$

Distribute Shear through 0123 and 456:

$R_{F012} := R_{F_0} + R_{F_1} + R_{F_2} = 92.4$

$\Delta_{F012} := \frac{1}{R_{F012}} = 0.011$

$\Delta_{F0123} := \Delta_{F012} + \Delta_{F_3} = 0.013$

$R_{F0123} := \frac{1}{\Delta_{F0123}} = 75.7$

$R_{F45} := R_{F_4} + R_{F_5} = 59.2$

$\Delta_{F45} := \frac{1}{R_{F45}} = 0.017$

$\Delta_{F456} := \Delta_{F45} + \Delta_{F_6} = 0.022$

$R_{F456} := \frac{1}{\Delta_{F456}} = 45.8$

$R_{F0123456} := R_{F0123} + R_{F456} = 121.5$

$V_{0123} := \frac{R_{F0123}}{R_{F0123456}} \cdot V_{wall} = 29.6 \ \boldsymbol{kip}$

$V_{456} := \frac{R_{F456}}{R_{F0123456}} \cdot V_{wall} = 17.9 \ \boldsymbol{kip}$

Distribute shear to piers 0,1,2,3:

$V_0 := \frac{R_{F_0}}{R_{F012}} \cdot V_{0123} = 6.1 \ \boldsymbol{kip}$ Total Shear in Wall Pier 0

$v_0 := \frac{V_0}{d_0} = 1144 \ \boldsymbol{plf}$ $v_{a1} = 1540 \ \boldsymbol{plf}$ Shear/ft in Wall Pier 0 (SW1)

$V_1 := \frac{R_{F_1}}{R_{F012}} \cdot V_{0123} = 12.8 \ \boldsymbol{kip}$ Total Shear in Wall Pier 1

$v_1 := \frac{V_1}{d_1} = 1375.6 \ \boldsymbol{plf}$ $v_{a1} = 1540 \ \boldsymbol{plf}$ Shear/ft in Wall Pier 1 (SW1)

$V_2 := \frac{R_{F_2}}{R_{F012}} \cdot V_{0123} = 10.6\ \textbf{kip}$ Total Shear in Wall Pier 2

$v_2 := \frac{V_2}{d_2} = 1328.7\ \textbf{plf}$ $v_{a1} = 1540\ \textbf{plf}$ Shear/ft in Wall Pier 2 (SW1)

$V_3 := V_0 + V_1 + V_2 = 29.6\ \textbf{kip}$ Total Shear in Wall Pier 3

$v_3 := \frac{V_3}{d_3} = 537.5\ \textbf{plf}$ $v_{a1} = 1540\ \textbf{plf}$ Shear/ft in Wall Pier 3 (SW1)

Distribute shear to piers 4,5,6:

$V_4 := \frac{R_{F_4}}{R_{F45}} \cdot V_{456} = 12.1\ \textbf{kip}$ Total Shear in Wall Pier 4

$v_4 := \frac{V_4}{d_4} = 1299.2\ \textbf{plf}$ $v_{a1} = 1540\ \textbf{plf}$ Shear/ft in Wall Pier 4 (SW1)

$V_5 := \frac{R_{F_5}}{R_{F45}} \cdot V_{456} = 5.8\ \textbf{kip}$ Total Shear in Wall Pier 5

$v_5 := \frac{V_5}{d_5} = 1080.4\ \textbf{plf}$ $v_{a1} = 1540\ \textbf{plf}$ Shear/ft in Wall Pier 5 (SW1)

$V_6 := V_4 + V_5 = 17.9\ \textbf{kip}$ Total Shear in Wall Pier 6

$v_6 := \frac{V_6}{d_6} = 670.4\ \textbf{plf}$ $v_{a1} = 1540\ \textbf{plf}$ Shear/ft in Wall Pier 6 (SW1)

Check In-Plane Flexure:

$$V := \begin{bmatrix} V_0 \\ V_1 \\ V_2 \\ V_3 \\ V_4 \\ V_5 \\ V_6 \end{bmatrix} \quad h := \begin{bmatrix} h_0 \\ h_1 \\ h_2 \\ h_3 \\ h_4 \\ h_5 \\ h_6 \end{bmatrix} \quad d := \begin{bmatrix} d_0 - 8\ \textbf{in} \\ d_1 - 8\ \textbf{in} \\ d_2 - 8\ \textbf{in} \\ d_3 - 8\ \textbf{in} \\ d_4 - 8\ \textbf{in} \\ d_5 - 8\ \textbf{in} \\ d_6 - 8\ \textbf{in} \end{bmatrix} \quad M := \overrightarrow{0.5 \cdot V \cdot h} = \begin{bmatrix} 16.2 \\ 34.2 \\ 28.3 \\ 49.2 \\ 32.3 \\ 15.3 \\ 29.8 \end{bmatrix} \textbf{kip} \cdot \textbf{ft} \quad T := \frac{M}{d} = \begin{bmatrix} 3.5 \\ 3.9 \\ 3.9 \\ 0.9 \\ 3.7 \\ 3.3 \\ 1.1 \end{bmatrix} \textbf{kip} \quad DCR := \frac{T}{T_a} = \begin{bmatrix} 0.2 \\ 0.2 \\ 0.2 \\ 0 \\ 0.2 \\ 0.2 \\ 0.1 \end{bmatrix}$$

CALDER RICHARDS CONSULTING ENGINEERS

JOB TITLE: HAFB 309th SWEG **BY:** JL **DATE:** 04/08/22

SUBJECT: Lateral Loads **CHECKED:** **SHEET:**

WALL RELATIVE RIGIDITIES (WALL LINE 1):

n	d (ft)	h (ft)	t (in)
0	4	5.33	7.625
1	7.33	5.33	7.625
2	12.67	5.33	7.625
3	56.5	3.33	7.625
4	6.67	8.67	7.625
5	18.8	5.33	7.625
6	7.33	5.33	7.625
7	4	5.33	7.625
8	54	3.33	7.625

$r := \text{rows}(n) - 1 = 8$

$$\Delta_F := \left(\frac{\left(0.1 \cdot \left(\frac{h}{d} \right)^3 + 0.3 \cdot \left(\frac{h}{d} \right) \right)}{\frac{t}{in}} \right) = \begin{bmatrix} 0.083 \\ 0.034 \\ 0.018 \\ 0.002 \\ 0.080 \\ 0.011 \\ 0.034 \\ 0.083 \\ 0.002 \end{bmatrix} \qquad R_F := \frac{1}{\Delta_F} = \begin{bmatrix} 12 \\ 29.7 \\ 57.1 \\ 430.7 \\ 12.5 \\ 87.3 \\ 29.7 \\ 12 \\ 411.6 \end{bmatrix}$$

Distribute Shear through 0123 and 4, and 5678:

$R_{F012} := R_{F_0} + R_{F_1} + R_{F_2} = 98.8$

$\Delta_{F012} := \frac{1}{R_{F012}} = 0.01$

$\Delta_{F0123} := \Delta_{F012} + \Delta_{F_3} = 0.012$

$R_{F0123} := \frac{1}{\Delta_{F0123}} = 80.3$

$R_{F567} := R_{F_5} + R_{F_6} + R_{F_7} = 129$

$\Delta_{F567} := \frac{1}{R_{F567}} = 0.008$

$\Delta_{F5678} := \Delta_{F567} + \Delta_{F_8} = 0.0102$

$R_{F5678} := \frac{1}{\Delta_{F5678}} = 98.2$

$\Sigma R_F := R_{F0123} + R_{F_4} + R_{F5678} = 191.1$

$V_{0123} := \frac{R_{F0123}}{\Sigma R_F} \cdot V_{wall} = 19.9\ \boldsymbol{kip}$

$V_{5678} := \frac{R_{F5678}}{\Sigma R_F} \cdot V_{wall} = 24.4\ \boldsymbol{kip}$

$V_4 := \frac{R_{F_4}}{R_{F012} + R_{F567} + R_{F_4}} \cdot V_{wall} = 2.5\ \boldsymbol{kip}$

Total Shear in Wall Pier 4

$v_4 := \frac{V_4}{d_4} = 370.3\ \boldsymbol{plf}$ $\quad v_{a1} = 1540\ \boldsymbol{plf}$ Shear/ft in Wall Pier 4 (SW1)

Distribute shear to piers 0,1,2,3:

$V_0 := \frac{R_{F_0}}{R_{F012}} \cdot V_{0123} = 2.4\ \boldsymbol{kip}$

Total Shear in Wall Pier 0

$v_0 := \frac{V_0}{d_0} = 605.1\ \boldsymbol{plf}$ $\quad v_{a1} = 1540\ \boldsymbol{plf}$ Shear/ft in Wall Pier 0 (SW1)

$V_1 := \frac{R_{F_1}}{R_{F012}} \cdot V_{0123} = 6\ kip$ Total Shear in Wall Pier 1

$v_1 := \frac{V_1}{d_1} = 818.9\ plf$ $v_{a1} = 1540\ plf$ Shear/ft in Wall Pier 1 (SW1)

$V_2 := \frac{R_{F_2}}{R_{F012}} \cdot V_{0123} = 11.5\ kip$ Total Shear in Wall Pier 2

$v_2 := \frac{V_2}{d_2} = 909.5\ plf$ $v_{a1} = 1540\ plf$ Shear/ft in Wall Pier 2 (SW1)

$V_3 := V_0 + V_1 + V_2 = 19.9\ kip$ Total Shear in Wall Pier 3

$v_3 := \frac{V_3}{d_3} = 353\ plf$ $v_{a1} = 1540\ plf$ Shear/ft in Wall Pier 3 (SW1)

Distribute shear to piers 5,6,7 & 8:

$V_5 := \frac{R_{F_5}}{R_{F567}} \cdot V_{5678} = 16.5\ kip$ Total Shear in Wall Pier 5

$v_5 := \frac{V_5}{d_5} = 878\ plf$ $v_{a1} = 1540\ plf$ Shear/ft in Wall Pier 5 (SW1)

$V_6 := \frac{R_{F_6}}{R_{F567}} \cdot V_{5678} = 5.6\ kip$ Total Shear in Wall Pier 6

$v_6 := \frac{V_6}{d_6} = 766.4\ plf$ $v_{a1} = 1540\ plf$ Shear/ft in Wall Pier 6 (SW1)

$V_7 := \frac{R_{F_7}}{R_{F567}} \cdot V_{5678} = 2.3\ kip$ Total Shear in Wall Pier 7

$v_7 := \frac{V_7}{d_7} = 566.3\ plf$ $v_{a1} = 1540\ plf$ Shear/ft in Wall Pier 7 (SW1)

$V_8 := V_5 + V_6 + V_7 = 24.4\ kip$ Total Shear in Wall Pier 8

$v_8 := \frac{V_8}{d_8} = 451.6\ plf$ $v_{a1} = 1540\ plf$ Shear/ft in Wall Pier 8 (SW1)

CALDER RICHARDS CONSULTING ENGINEERS

JOB TITLE: HAFB 309th SWEG **BY:** JL **DATE:** 04/08/22

SUBJECT: Lateral Loads **CHECKED:** **SHEET:**

Check In-Plane Flexure:

$$V := \begin{bmatrix} V_0 \\ V_1 \\ V_2 \\ V_3 \\ V_4 \\ V_5 \\ V_6 \\ V_7 \\ V_8 \end{bmatrix} \quad h := \begin{bmatrix} h_0 \\ h_1 \\ h_2 \\ h_3 \\ h_4 \\ h_5 \\ h_6 \\ h_7 \\ h_8 \end{bmatrix} \quad d := \begin{bmatrix} d_0 - 8\ in \\ d_1 - 8\ in \\ d_2 - 8\ in \\ d_3 - 8\ in \\ d_4 - 8\ in \\ d_5 - 8\ in \\ d_6 - 8\ in \\ d_7 - 8\ in \\ d_8 - 8\ in \end{bmatrix} \quad M := \overrightarrow{0.5 \cdot V \cdot h} = \begin{bmatrix} 6.5 \\ 16 \\ 30.7 \\ 33.2 \\ 10.7 \\ 44 \\ 15 \\ 6 \\ 40.6 \end{bmatrix} kip \cdot ft \quad T := \frac{M}{d} = \begin{bmatrix} 1.9 \\ 2.4 \\ 2.6 \\ 0.6 \\ 1.8 \\ 2.4 \\ 2.2 \\ 1.8 \\ 0.8 \end{bmatrix} kip \quad DCR := \frac{T}{T_a} = \begin{bmatrix} 0.1 \\ 0.12 \\ 0.13 \\ 0.03 \\ 0.09 \\ 0.12 \\ 0.11 \\ 0.09 \\ 0.04 \end{bmatrix}$$

CALDER RICHARDS CONSULTING ENGINEERS

JOB TITLE: HAFB 309th SWEG **BY:** JL **DATE:** 04/08/22

SUBJECT: Lateral Loads **CHECKED:** **SHEET:**

WALL RELATIVE RIGIDITIES (WALL LINE 5):

n	d (ft)	h (ft)	t (in)
0	4	5.33	7.625
1	8.67	5.33	7.625
2	13.33	5.33	7.625
3	50	3.33	7.625
4	6.67	8.67	7.625
5	6.67	8.67	7.625
6	8	5.33	7.625
7	8.67	5.33	7.625
8	4	5.33	7.625
9	44.67	3.33	7.625

$r := \text{rows}(n) - 1 = 9$

$$\Delta_F := \left(\frac{\left(0.1 \cdot \left(\frac{h}{d} \right)^3 + 0.3 \cdot \left(\frac{h}{d} \right) \right)}{\frac{t}{in}} \right) = \begin{bmatrix} 0.083 \\ 0.027 \\ 0.017 \\ 0.003 \\ 0.080 \\ 0.080 \\ 0.030 \\ 0.027 \\ 0.083 \\ 0.003 \end{bmatrix} \qquad R_F := \frac{1}{\Delta_F} = \begin{bmatrix} 12 \\ 36.7 \\ 60.3 \\ 381.1 \\ 12.5 \\ 12.5 \\ 33.2 \\ 36.7 \\ 12 \\ 340.3 \end{bmatrix}$$

Distribute Shear through 0123 and 4, 5, and 6789:

$R_{F012} := R_{F_0} + R_{F_1} + R_{F_2} = 109$

$\Delta_{F012} := \frac{1}{R_{F012}} = 0.009$

$\Delta_{F0123} := \Delta_{F012} + \Delta_{F_3} = 0.012$

$R_{F0123} := \frac{1}{\Delta_{F0123}} = 84.8$

$R_{F678} := R_{F_6} + R_{F_7} + R_{F_8} = 81.9$

$\Delta_{F678} := \frac{1}{R_{F678}} = 0.012$

$\Delta_{F6789} := \Delta_{F678} + \Delta_{F_9} = 0.0151$

$R_{F6789} := \frac{1}{\Delta_{F6789}} = 66$

$\Sigma R_F := R_{F0123} + R_{F_4} + R_{F5678} = 195.5$

$V_{0123} := \frac{R_{F0123}}{\Sigma R_F} \cdot V_{wall} = 20.6 \ \boldsymbol{kip}$

$V_{6789} := \frac{R_{F6789}}{\Sigma R_F} \cdot V_{wall} = 16 \ \boldsymbol{kip}$

$V_4 := \frac{R_{F_4}}{R_{F012} + R_{F678} + R_{F_4} + R_{F_5}} \cdot V_{wall} = 2.7 \ \boldsymbol{kip}$

Total Shear in Wall Pier 4

$v_4 := \frac{V_4}{d_4} = 411.9 \ \boldsymbol{plf}$ $\quad v_{a1} = 1540 \ \boldsymbol{plf}$

Shear/ft in Wall Pier 4 (SW1)

$V_5 := \frac{R_{F_5}}{R_{F012} + R_{F678} + R_{F_4} + R_{F_5}} \cdot V_{wall} = 2.7 \ \boldsymbol{kip}$

Total Shear in Wall Pier 5

Shear/ft in Wall Pier 5 (SW1)

$v_5 := \frac{V_5}{d_5} = 411.9 \ \boldsymbol{plf}$

CALDER RICHARDS CONSULTING ENGINEERS

JOB TITLE: HAFB 309th SWEG **BY:** JL **DATE:** 04/08/22

SUBJECT: Lateral Loads **CHECKED:** **SHEET:**

Distribute shear to piers 0,1,2,3:

$V_0 := \frac{R_{F_0}}{R_{F012}} \cdot V_{0123} = 2.3\ \textbf{kip}$ Total Shear in Wall Pier 0

$v_0 := \frac{V_0}{d_0} = 565.1\ \textbf{plf}$ $v_{a1} = 1540\ \textbf{plf}$ Shear/ft in Wall Pier 0 (SW1)

$V_1 := \frac{R_{F_1}}{R_{F012}} \cdot V_{0123} = 6.9\ \textbf{kip}$ Total Shear in Wall Pier 1

$v_1 := \frac{V_1}{d_1} = 799\ \textbf{plf}$ $v_{a1} = 1540\ \textbf{plf}$ Shear/ft in Wall Pier 1 (SW1)

$V_2 := \frac{R_{F_2}}{R_{F012}} \cdot V_{0123} = 11.4\ \textbf{kip}$ Total Shear in Wall Pier 2

$v_2 := \frac{V_2}{d_2} = \underline{\underline{854.1\ \textbf{plf}}}$ $v_{a1} = 1540\ \textbf{plf}$ Shear/ft in Wall Pier 2 (SW1)

$V_3 := V_0 + V_1 + V_2 = 20.6\ \textbf{kip}$ Total Shear in Wall Pier 3

$v_3 := \frac{V_3}{d_3} = 411.5\ \textbf{plf}$ $v_{a1} = 1540\ \textbf{plf}$ Shear/ft in Wall Pier 3 (SW1)

Distribute shear to piers 6,7,8 & 9:

$V_6 := \frac{R_{F_6}}{R_{F678}} \cdot V_{6789} = 6.5\ \textbf{kip}$ Total Shear in Wall Pier 6

$v_6 := \frac{V_6}{d_6} = 812.3\ \textbf{plf}$ $v_{a1} = 1540\ \textbf{plf}$ Shear/ft in Wall Pier 6 (SW1)

$V_7 := \frac{R_{F_7}}{R_{F678}} \cdot V_{6789} = 7.2\ \textbf{kip}$ Total Shear in Wall Pier 7

$v_7 := \frac{V_7}{d_7} = 828.2\ \textbf{plf}$ $v_{a1} = 1540\ \textbf{plf}$ Shear/ft in Wall Pier 7 (SW1)

$V_8 := \frac{R_{F_8}}{R_{F678}} \cdot V_{6789} = 2.3\ \textbf{kip}$ Total Shear in Wall Pier 8

$v_8 := \frac{V_8}{d_8} = 585.8\ \textbf{plf}$ $v_{a1} = 1540\ \textbf{plf}$ Shear/ft in Wall Pier 8 (SW1)

CALDER RICHARDS CONSULTING ENGINEERS

JOB TITLE: HAFB 309th SWEG **BY:** JL **DATE:** 04/08/22

SUBJECT: Lateral Loads **CHECKED:** **SHEET:**

$V_9 := V_6 + V_7 + V_8 = 16\ \boldsymbol{kip}$ Total Shear in Wall Pier 9

$v_9 := \frac{V_9}{d_9} = 358.7\ \boldsymbol{plf}$ $v_{a1} = 1540\ \boldsymbol{plf}$ Shear/ft in Wall Pier 9 (SW1)

Check In-Plane Flexure:

$$V := \begin{bmatrix} V_0 \\ V_1 \\ V_2 \\ V_3 \\ V_4 \\ V_5 \\ V_6 \\ V_7 \\ V_8 \\ V_9 \end{bmatrix} \quad h := \begin{bmatrix} h_0 \\ h_1 \\ h_2 \\ h_3 \\ h_4 \\ h_5 \\ h_6 \\ h_7 \\ h_8 \\ h_9 \end{bmatrix} \quad d := \begin{bmatrix} d_0 - 8\ \boldsymbol{in} \\ d_1 - 8\ \boldsymbol{in} \\ d_2 - 8\ \boldsymbol{in} \\ d_3 - 8\ \boldsymbol{in} \\ d_4 - 8\ \boldsymbol{in} \\ d_5 - 8\ \boldsymbol{in} \\ d_6 - 8\ \boldsymbol{in} \\ d_7 - 8\ \boldsymbol{in} \\ d_8 - 8\ \boldsymbol{in} \\ d_9 - 8\ \boldsymbol{in} \end{bmatrix} \quad M := \overrightarrow{0.5 \cdot V \cdot h} = \begin{bmatrix} 6 \\ 18.5 \\ 30.3 \\ 34.3 \\ 11.9 \\ 11.9 \\ 17.3 \\ 19.1 \\ 6.2 \\ 26.7 \end{bmatrix} \boldsymbol{kip \cdot ft} \quad T := \frac{M}{d} = \begin{bmatrix} 1.8 \\ 2.3 \\ 2.4 \\ 0.7 \\ 2 \\ 2 \\ 2.4 \\ 2.4 \\ 1.9 \\ 0.6 \end{bmatrix} \boldsymbol{kip} \quad DCR := \frac{T}{T_a} = \begin{bmatrix} 0.09 \\ 0.12 \\ 0.12 \\ 0.03 \\ 0.1 \\ 0.1 \\ 0.12 \\ 0.12 \\ 0.09 \\ 0.03 \end{bmatrix}$$

Type HSB®-36

- 36/7 Weld Pattern at Supports
- Sidelaps connected with Button Punch or 1½" Top Seam Weld



V_{max} = 854 plf

Allowable Diaphragm Shear Strength, q (plf) and Flexibility Factors, F ((in./lb)x10^6)

DECK GAGE	SIDELAP ATTACHMENT		SPAN (ft-in.) 4'-0"	5'-0"	6'-0"	7'-0"	8'-0"	9'-0"	10'-0"	11'-0"	12'-0"
22	BP @ 24"	q	398	327	267	235	202	186	168		
		F	9.9+27R	11.9+20R	14+15R	15.7+12R	17.6+9R	19.1+7R	20.9+5R		
	BP @ 12"	q	434	355	303	266	238	218	204		
		F	9.5+27R	11.4+21R	13.1+16R	14.6+13R	16.1+10R	17.4+8R	18.7+6R		
	TSW @ 24"	q	770	777	661	682	601	627	566		
		F	5.1+30R	5.3+24R	6.1+20R	6.1+17R	6.6+15R	6.5+13R	7+12R		
	TSW @ 18"	q	937	911	781	785	787	710	720		
		F	4.4+30R	4.8+24R	5.4+20R	5.5+17R	5.6+15R	6+13R	6.1+12R		
	TSW @ 12"	q	1084	1033	998	972	952	936	924		
		F	4+30R	4.4+24R	4.7+20R	4.9+17R	5.1+15R	5.2+13R	5.3+12R		
	TSW @ 6"	q	1504	1476	1456	1442	1430	1236	1001		
		F	3.2+30R	3.6+24R	3.8+20R	4+17R	4.2+15R	4.3+14R	4.4+12R		
20	BP @ 24"	q	564	466	383	338	292	267	240	228	209
		F	9.3+16R	11+12R	12.8+8R	14.3+6R	16+4R	17.3+2R	19+1R	20.1+0R	21.7-1R
	BP @ 12"	q	616	507	434	382	343	313	292	274	260
		F	8.8+16R	10.5+12R	12+9R	13.3+7R	14.6+5R	15.8+3R	16.9+2R	18+1R	19+0R
	TSW @ 24"	q	1024	1026	873	896	793	821	742	772	711
		F	4.8+19R	4.9+15R	5.6+12R	5.5+11R	6+9R	5.8+8R	6.2+7R	6.1+7R	6.4+6R
	TSW @ 18"	q	1236	1197	1026	1027	1028	926	937	946	875
		F	4.2+19R	4.4+15R	5+13R	5+11R	5.1+9R	5.4+8R	5.4+7R	5.4+7R	5.7+6R
	TSW @ 12"	q	1425	1354	1304	1267	1239	1217	1200	1085	912
		F	3.8+19R	4.1+15R	4.3+13R	4.5+11R	4.6+10R	4.7+8R	4.7+8R	4.8+7R	4.8+6R
	TSW @ 6"	q	1970	1930	1901	1880	1864	1621	1313	1085	912
		F	3.1+19R	3.4+15R	3.5+13R	3.7+11R	3.7+10R	3.8+9R	3.9+8R	3.9+7R	4+6R
18	BP @ 24"	q	979	812	670	595	516	475	423	400	366
		F	8.1+7R	9.5+4R	11+2R	12.2+1R	13.7+0R	14.8-1R	16.2-2R	17.2-3R	18.6-4R
	BP @ 12"	q	1070	885	761	673	607	556	515	483	458
		F	7.7+7R	9+5R	10.3+3R	11.4+2R	12.5+1R	13.5+0R	14.4-1R	15.3-2R	16.2-2R
	TSW @ 24"	q	1617	1598	1359	1383	1224	1258	1141	1177	1085
		F	4.3+9R	4.2+7R	4.7+6R	4.6+5R	5+4R	4.9+4R	5.2+3R	5+3R	5.3+3R
	TSW @ 18"	q	1928	1851	1586	1577	1570	1414	1425	1434	1326
		F	3.7+9R	3.8+7R	4.2+6R	4.2+5R	4.2+4R	4.5+4R	4.5+4R	4.4+3R	4.7+3R
	TSW @ 12"	q	2208	2084	1998	1935	1886	1848	1817	1659	1394
		F	3.4+9R	3.5+7R	3.6+6R	3.7+5R	3.8+5R	3.8+4R	3.9+4R	3.9+3R	3.9+3R
	TSW @ 6"	q	3036	2962	2910	2872	2842	2478	2007	1659	1394
		F	2.7+9R	2.9+8R	3+6R	3+5R	3.1+5R	3.1+4R	3.1+4R	3.2+3R	3.2+3R
16	BP @ 24"	q	1255	1052	869	780	677	629	561	532	485
		F	7.2+3R	8.4+1R	9.7+0R	10.8-1R	12.1-2R	13.1-2R	14.3-3R	15.2-4R	16.4-4R
	BP @ 12"	q	1395	1167	1013	902	820	756	704	662	628
		F	6.8+3R	8+2R	9.1+1R	10.1+0R	11-1R	11.9-2R	12.7-2R	13.5-3R	14.3-3R
	TSW @ 24"	q	2083	2073	1766	1805	1599	1649	1497	1548	1428
		F	3.7+5R	3.7+4R	4.1+3R	4+3R	4.3+2R	4.2+2R	4.5+2R	4.3+2R	4.6+1R
	TSW @ 18"	q	2496	2408	2067	2062	2058	1856	1874	1889	1748
		F	3.2+5R	3.3+4R	3.7+3R	3.6+3R	3.6+2R	3.9+2R	3.8+2R	3.8+2R	4+2R
	TSW @ 12"	q	2862	2713	2609	2532	2473	2427	2389	2310	1941
		F	2.9+5R	3.1+4R	3.1+3R	3.2+3R	3.2+3R	3.3+2R	3.3+2R	3.3+2R	3.4+2R
	TSW @ 6"	q	3918	3833	3773	3729	3695	3451	2795	2310	1941
		F	2.4+5R	2.5+4R	2.5+4R	2.6+3R	2.6+3R	2.6+2R	2.6+2R	2.7+2R	2.7+2R

See footnotes on page 28.

CALDER RICHARDS CONSULTING ENGINEERS

JOB TITLE HAFB 309th SWEG BY HTL DATE 5-2022

SUBJECT Wind uplift on roof CHECKED SHEET OF

Per ASCE 7-16 section 30.3.2:

$p = q_h [GC_p - GC_{pi}] \times 0.6$ ← ASD

$q_h = 0.00256 \cdot K_z \cdot K_{zt} \cdot K_d \cdot K_e \cdot V^2$

$K_z = 0.85$

$K_{zt} = 1.0$

$K_d = 0.85$

$K_e = 0.844$

$V = 105$ mph

$q_h = 17.21$ psf

$GC_{pi} = \pm 0.18$

GC_p:	$\leq 10 ft^2$	$50 ft^2$	$100 ft^2$
Zone 1	-1.7	-1.4	-1.3
Zone 1'	-0.9	-0.9	-0.9
Zone 2	-2.3	-1.9	-1.8
Zone 3	-3.2	-2.5	-2.1

$p =$

	Area $\leq 10 ft^2$	$50 ft^2$	$100 ft^2$
Zone 1	-19.41	-16.31	-15.28
Zone 1'	-11.15	-11.15	-11.15
Zone 2	-25.61	-21.48	-20.45
Zone 3	-34.9	-27.67	-23.54

in psf ASD Level

→ on parapet caps, unfactored

$= \frac{-34.9 \text{ psf}}{0.6} = \underline{\underline{-58.2 \text{ psf}}}$

Typ DL + SL + Drift @ 22' (C to D)

Simple Beam Program

Project	HAFB 309th SWEG
Description	Typical Steel Roof Joists
Date	5/6/2022

Code Check	ASD, AISC 14th Edition		
E	29000 ksi		
Fy	50 ksi		
Simple Span	22 ft	Lb_bot cantilever	0 ft
Cantilever	0 ft	Cb_simple_pos	1.000 ft
Lb_top simple	2.00 ft	Cb_simple_neg	1.136 ft
Lb_bot simple	22.00 ft	Cb_cantilever	1 ft
Lb_top cantilever	0 ft		

defl	Span/?	allow	2*Cantilever/?	allow
DL	360	0.73 in	360	0.00 in
LL	360	0.73 in	360	0.00 in
TL	240	1.10 in	240	0.00 in

uniform	25	33	6.5	x	x
partial	0	21	1	0	22
triangular	0	0	0	0	0.01
point 1	0	0	x	0	x
point 2	0	0	x	0	x
point 3	0	0	x	0	x

Result Type
- ○ Single Shape
- ◉ Top 5 Options

Standard Shape: W8X10

Reactions

R1	4378 lbs
R2	4378 lbs
R total	8756 lbs

Shear -4369 lbs

Moment
- 24079 lb*ft (span pos)
- 0 lb*ft (span neg)
- 0 lb*ft (cant pos)
- 0 lb*ft (cant neg)

Simple Span Deflection

DL defl*ei	-495660 lb*ft^3
LL defl*ei	-718326 lb*ft^3
TL defl*ei	-1213987 lb*ft^3

Cantilever Span Deflection

DL defl*ei	0 lb*ft^3
LL defl*ei	0 lb*ft^3
TL defl*ei	0 lb*ft^3

I minimum 65.76 in^4

Shape	W12X14	W10X15	W8X21	#N/A	#N/A
V DCR	0.10	0.10	0.11	#N/A	#N/A
M+ Span DCR	0.56	0.60	0.47	#N/A	#N/A
M- Span DCR	0.00	0.00	0.00	#N/A	#N/A
M+ Cant DCR	0.00	0.00	0.00	#N/A	#N/A
M- Cant DCR	0.00	0.00	0.00	#N/A	#N/A
Span LL D	-0.48	-0.62	-0.57	#N/A	#N/A
Span TL D	-0.82	-1.05	-0.96	#N/A	#N/A
Cant LL D	0.00	0.00	0.00	#N/A	#N/A
Cant TL D	0.00	0.00	0.00	#N/A	#N/A
Lp	2.66	2.86	4.45	#N/A	#N/A
Lr	7.73	8.61	14.80	#N/A	#N/A

Vn (kips)
Mn_span+(k-ft)
Mn_span-(k-ft)
Mn_cant+(k-ft)
Mn_cant-(k-ft)
LL_span (in)
TL_span (in)
LL_cant (in)
TL_cant (in)

Ix (in^4)
Zx (in^3)
Sx (in^3)

1. Program uses numerical integration that is accurate to plus/minus 5%.
2. "Standard Shape" analyzes an individual W shape of your choosing.
3. "Top 5 Options" determines the most economical shape and the lightest beams of the next four lower depth classes.
4. 'b' value within the triangular loading must be entered as 0.01 or greater.
5. Downward loading is entered as positive.
6. Lb for the bottom of the cantilever is always taken equal to the cantilever length.
7. Cb_span is calculated only if the unbraced length is equal to the total span and assumed to be 1.0 otherwise
8. Cb_cantilever is always considered 1.0.
7. Program does **not** take into account Transverse Shear Deformation in analysis.

C to D

Zone 2 uplift

0.6x 25psf

20.45psf

Simple Beam Program

Project	HAFB 309th SWEG
Description	Typical Steel Roof Joists w/ uplift
Date	5/6/2022

Code Check	ASD, AISC 14th Edition				
E	29000 ksi				
Fy	50 ksi				
Simple Span	22 ft		Lb_bot cantilever	0 ft	
Cantilever	0 ft		Cb_simple_pos	1.136 ft	
Lb_top simple	22.00 ft		Cb_simple_neg	1.136 ft	
Lb_bot simple	22.00 ft		Cb_cantilever	1 ft	
Lb_top cantilever	0 ft				

defl	Span/?	allow		2*Cantilever/?	allow
DL	360	0.73 in		360	0.00 in
LL	360	0.73 in		360	0.00 in
TL	240	1.10 in		240	0.00 in
uniform	15	21	6.5	x	x
partial	0	0	0	0	0
triangular	0	0	0	0	0.01
point 1	0	0	x	0	x
point 2	0	0	x	0	x
point 3	0	0	x	0	x

Result Type
(●) Single Shape
( ) Top 5 Options

Standard Shape: W12X22

Reactions

R1	2574 lbs
R2	2574 lbs
R total	5148 lbs
Shear	-2569 lbs
Moment	14157 lb*ft (span pos)
	0 lb*ft (span neg)
	0 lb*ft (cant pos)
	0 lb*ft (cant neg)

Simple Span Deflection

DL defl*ei	-297396 lb*ft^3
LL defl*ei	-416355 lb*ft^3
TL defl*ei	-713751 lb*ft^3

Cantilever Span Deflection

DL defl*ei	0 lb*ft^3
LL defl*ei	0 lb*ft^3
TL defl*ei	0 lb*ft^3
I minimum	38.66 in^4

Shape	W12X22
V DCR	0.04
M+ Span DCR	0.91
M- Span DCR	0.00
M+ Cant DCR	0.00
M- Cant DCR	0.00
Span LL D	-0.16
Span TL D	-0.27
Cant LL D	0.00
Cant TL D	0.00
Lp	3.00
Lr	9.13

Vn (kips)	63.96 OK	**Ix (in^4)**	156
Mn_span+(k-ft)	15.50 OK	**Zx (in^3)**	29.3
Mn_span-(k-ft)	15.50 OK	**Sx (in^3)**	25.4
Mn_cant+(k-ft)	73.00 OK		
Mn_cant-(k-ft)	73.00 OK		
LL_span (in)	-0.16 OK		
TL_span (in)	-0.27 OK		
LL_cant (in)	0.00 OK		
TL_cant (in)	0.00 OK		

1. Program uses numerical integration that is accurate to plus/minus 5%.
2. "Standard Shape" analyzes an individual W shape of your choosing.
3. "Top 5 Options" determines the most economical shape and the lightest beams of the next four lower depth classes.
4. 'b' value within the triangular loading must be entered as 0.01 or greater.
5. Downward loading is entered as positive.
6. Lb for the bottom of the cantilever is always taken equal to the cantilever length.
7. Cb_span is calculated only if the unbraced length is equal to the total span and assumed to be 1.0 otherwise
8. Cb_cantilever is always considered 1.0.
7. Program does **not** take into account Transverse Shear Deformation in analysis.

C to D
Zone 1 uplift

Simple Beam Program

Project	HAFB 309th SWEG
Description	Typical Steel Roof Joists w/ uplift
Date	5/6/2022

Code Check	ASD, AISC 14th Edition				
E	29000 ksi				
Fy	50 ksi				
Simple Span	22 ft		Lb_bot cantilever	0 ft	
Cantilever	0 ft		Cb_simple_pos	1.136 ft	
Lb_top simple	22.00 ft		Cb_simple_neg	1.136 ft	
Lb_bot simple	22.00 ft		Cb_cantilever	1 ft	
Lb_top cantilever	0 ft				

defl	Span/?	allow	2*Cantilever/?	allow
DL	360	0.73 in	360	0.00 in
LL	360	0.73 in	360	0.00 in
TL	240	1.10 in	240	0.00 in

uniform	15	15.28	6.5	x	x	
partial	0	0	0	0	0	
triangular	0	0	0	0	0.01	
point 1	0	0	x	0	x	
point 2	0	0	x	0	x	
point 3	0	0	x	0	x	

Result Type
(●) Single Shape
( ) Top 5 Options

Standard Shape: W12X22

Reactions

R1	2165 lbs
R2	2165 lbs
R total	4330 lbs
Shear	-2161 lbs
Moment	11908 lb*ft (span pos)
	0 lb*ft (span neg)
	0 lb*ft (cant pos)
	0 lb*ft (cant neg)

Simple Span Deflection

DL defl*ei	-297396 lb*ft^3
LL defl*ei	-302948 lb*ft^3
TL defl*ei	-600344 lb*ft^3

Cantilever Span Deflection

DL defl*ei	0 lb*ft^3
LL defl*ei	0 lb*ft^3
TL defl*ei	0 lb*ft^3
I minimum	32.52 in^4

Shape	W12X22
V DCR	0.03
M+ Span DCR	0.77
M- Span DCR	0.00
M+ Cant DCR	0.00
M- Cant DCR	0.00
Span LL D	-0.12
Span TL D	-0.23
Cant LL D	0.00
Cant TL D	0.00
Lp	3.00
Lr	9.13

Vn (kips)	63.96 OK	**Ix (in^4)**	156
Mn_span+(k-ft)	15.50 OK	**Zx (in^3)**	29.3
Mn_span-(k-ft)	15.50 OK	**Sx (in^3)**	25.4
Mn_cant+(k-ft)	73.00 OK		
Mn_cant-(k-ft)	73.00 OK		
LL_span (in)	-0.12 OK		
TL_span (in)	-0.23 OK		
LL_cant (in)	0.00 OK		
TL_cant (in)	0.00 OK		

1. Program uses numerical integration that is accurate to plus/minus 5%.
2. "Standard Shape" analyzes an individual W shape of your choosing.
3. "Top 5 Options" determines the most economical shape and the lightest beams of the next four lower depth classes.
4. 'b' value within the triangular loading must be entered as 0.01 or greater.
5. Downward loading is entered as positive.
6. Lb for the bottom of the cantilever is always taken equal to the cantilever length.
7. Cb_span is calculated only if the unbraced length is equal to the total span and assumed to be 1.0 otherwise
8. Cb_cantilever is always considered 1.0.
7. Program does **not** take into account Transverse Shear Deformation in analysis.

C to D
Zone 1' uplift

Simple Beam Program

Project	HAFB 309th SWEG
Description	Typical Steel Roof Joists w/ uplift
Date	5/6/2022

Code Check: ASD, AISC 14th Edition

E	29000	ksi
Fy	50	ksi

Simple Span	22	ft	Lb_bot cantilever	0	ft
Cantilever	0	ft	Cb_simple_pos	1.136	ft
Lb_top simple	22.00	ft	Cb_simple_neg	1.136	ft
Lb_bot simple	22.00	ft	Cb_cantilever	1	ft
Lb_top cantilever	0	ft			

defl	Span/?	allow	2*Cantilever/?	allow
DL	360	0.73 in	360	0.00 in
LL	360	0.73 in	360	0.00 in
TL	240	1.10 in	240	0.00 in

uniform	15	11.2	6.5	x	x
partial	0	0	0	0	0
triangular	0	0	0	0	0.01
point 1	0	0	x	0	x
point 2	0	0	x	0	x
point 3	0	0	x	0	x

Result Type
(●) Single Shape
( ) Top 5 Options

Standard Shape: W12X19

Reactions

R1	1873	lbs
R2	1873	lbs
R total	3747	lbs
Shear	-1870	lbs
Moment	10303	lb*ft (span pos)
	0	lb*ft (span neg)
	0	lb*ft (cant pos)
	0	lb*ft (cant neg)

Simple Span Deflection

DL defl*ei	-297396	lb*ft^3
LL defl*ei	-222056	lb*ft^3
TL defl*ei	-519452	lb*ft^3

Cantilever Span Deflection

DL defl*ei	0	lb*ft^3
LL defl*ei	0	lb*ft^3
TL defl*ei	0	lb*ft^3
I minimum	28.14	in^4

Shape	W12X19
V DCR	0.03
M+ Span DCR	0.92
M- Span DCR	0.00
M+ Cant DCR	0.00
M- Cant DCR	0.00
Span LL D	-0.10
Span TL D	-0.24
Cant LL D	0.00
Cant TL D	0.00
Lp	2.90
Lr	8.61

Vn (kips)	57.34	OK	**Ix (in^4)**	130
Mn_span+(k-ft)	11.20	OK	**Zx (in^3)**	24.7
Mn_span-(k-ft)	11.20	OK	**Sx (in^3)**	21.3
Mn_cant+(k-ft)	62.00	OK		
Mn_cant-(k-ft)	62.00	OK		
LL_span (in)	-0.10	OK		
TL_span (in)	-0.24	OK		
LL_cant (in)	0.00	OK		
TL_cant (in)	0.00	OK		

1. Program uses numerical integration that is accurate to plus/minus 5%.
2. "Standard Shape" analyzes an individual W shape of your choosing.
3. "Top 5 Options" determines the most economical shape and the lightest beams of the next four lower depth classes.
4. 'b' value within the triangular loading must be entered as 0.01 or greater.
5. Downward loading is entered as positive.
6. Lb for the bottom of the cantilever is always taken equal to the cantilever length.
7. Cb_span is calculated only if the unbraced length is equal to the total span and assumed to be 1.0 otherwise
8. Cb_cantilever is always considered 1.0.
7. Program does **not** take into account Transverse Shear Deformation in analysis.

21'-0"

Simple Beam Program

Project	HAFB 309th SWEG
Description	Typical Steel Roof Joists w/ uplift
Date	5/6/2022

Zone 1 uplift

Code Check	ASD, AISC 14th Edition		
E	29000 ksi		
Fy	50 ksi		
Simple Span	21 ft	Lb_bot cantilever	0 ft
Cantilever	0 ft	Cb_simple_pos	1.136 ft
Lb_top simple	21.00 ft	Cb_simple_neg	1.136 ft
Lb_bot simple	21.00 ft	Cb_cantilever	1 ft
Lb_top cantilever	0 ft		

defl	Span/?	allow		2*Cantilever/?	allow
DL	360	0.70 in		360	0.00 in
LL	360	0.70 in		360	0.00 in
TL	240	1.05 in		240	0.00 in
uniform	15	15.28	6.5	x	x
partial	0	0	0	0	0
triangular	0	0	0	0	0.01
point 1	0	0	x	0	x
point 2	0	0	x	0	x
point 3	0	0	x	0	x

Result Type
(●) Single Shape
( ) Top 5 Options

Standard Shape: W12X19

Reactions

R1	2067 lbs
R2	2067 lbs
R total	4133 lbs
Shear	-2062 lbs
Moment	10850 lb*ft (span pos)
	0 lb*ft (span neg)
	0 lb*ft (cant pos)
	0 lb*ft (cant neg)

Simple Span Deflection

DL defl*ei	-246900 lb*ft^3
LL defl*ei	-251509 lb*ft^3
TL defl*ei	-498410 lb*ft^3

Cantilever Span Deflection

DL defl*ei	0 lb*ft^3
LL defl*ei	0 lb*ft^3
TL defl*ei	0 lb*ft^3
I minimum	28.28 in^4

Shape	W12X19
V DCR	0.04
M+ Span DCR	0.92
M- Span DCR	0.00
M+ Cant DCR	0.00
M- Cant DCR	0.00
Span LL D	-0.12
Span TL D	-0.23
Cant LL D	0.00
Cant TL D	0.00
Lp	2.90
Lr	8.61

Vn (kips)	57.34 OK	**Ix (in^4)**	130
Mn_span+(k-ft)	11.85 OK	**Zx (in^3)**	24.7
Mn_span-(k-ft)	11.85 OK	**Sx (in^3)**	21.3
Mn_cant+(k-ft)	62.00 OK		
Mn_cant-(k-ft)	62.00 OK		
LL_span (in)	-0.12 OK		
TL_span (in)	-0.23 OK		
LL_cant (in)	0.00 OK		
TL_cant (in)	0.00 OK		

1. Program uses numerical integration that is accurate to plus/minus 5%.
2. "Standard Shape" analyzes an individual W shape of your choosing.
3. "Top 5 Options" determines the most economical shape and the lightest beams of the next four lower depth classes.
4. 'b' value within the triangular loading must be entered as 0.01 or greater.
5. Downward loading is entered as positive.
6. Lb for the bottom of the cantilever is always taken equal to the cantilever length.
7. Cb_span is calculated only if the unbraced length is equal to the total span and assumed to be 1.0 otherwise
8. Cb_cantilever is always considered 1.0.
7. Program does **not** take into account Transverse Shear Deformation in analysis.

A to B & F to G

Zone 2 uplift

Simple Beam Program

Project	HAFB 309th SWEG
Description	Typical Steel Roof Joists w/ uplift
Date	5/6/2022

Code Check	ASD, AISC 14th Edition				
E	29000 ksi				
Fy	50 ksi				
Simple Span	20 ft		Lb_bot cantilever	0 ft	
Cantilever	0 ft		Cb_simple_pos	1.136 ft	
Lb_top simple	20.00 ft		Cb_simple_neg	1.136 ft	
Lb_bot simple	20.00 ft		Cb_cantilever	1 ft	
Lb_top cantilever	0 ft				

defl	Span/?	allow	2*Cantilever/?	allow
DL	360	0.67 in	360	0.00 in
LL	360	0.67 in	360	0.00 in
TL	240	1.00 in	240	0.00 in

uniform	15	20.45	6.5	x	x
partial	0	0	0	0	0
triangular	0	0	0	0	0.01
point 1	0	0	x	0	x
point 2	0	0	x	0	x
point 3	0	0	x	0	x

Result Type
(●) Single Shape
( ) Top 5 Options

Standard Shape: W12X19

Reactions

R1	2304 lbs
R2	2304 lbs
R total	4609 lbs
Shear	-2300 lbs
Moment	11521 lb*ft (span pos)
	0 lb*ft (span neg)
	0 lb*ft (cant pos)
	0 lb*ft (cant neg)

Simple Span Deflection

DL defl*ei	-203126 lb*ft^3
LL defl*ei	-276928 lb*ft^3
TL defl*ei	-480054 lb*ft^3

Cantilever Span Deflection

DL defl*ei	0 lb*ft^3
LL defl*ei	0 lb*ft^3
TL defl*ei	0 lb*ft^3
I minimum	28.60 in^4

Shape	W12X19
V DCR	0.04
M+ Span DCR	0.91
M- Span DCR	0.00
M+ Cant DCR	0.00
M- Cant DCR	0.00
Span LL D	-0.13
Span TL D	-0.22
Cant LL D	0.00
Cant TL D	0.00
Lp	2.90
Lr	8.61

Vn (kips)	57.34 OK	**Ix (in^4)**	130
Mn_span+(k-ft)	12.59 OK	**Zx (in^3)**	24.7
Mn_span-(k-ft)	12.59 OK	**Sx (in^3)**	21.3
Mn_cant+(k-ft)	62.00 OK		
Mn_cant-(k-ft)	62.00 OK		
LL_span (in)	-0.13 OK		
TL_span (in)	-0.22 OK		
LL_cant (in)	0.00 OK		
TL_cant (in)	0.00 OK		

1. Program uses numerical integration that is accurate to plus/minus 5%.
2. "Standard Shape" analyzes an individual W shape of your choosing.
3. "Top 5 Options" determines the most economical shape and the lightest beams of the next four lower depth classes.
4. 'b' value within the triangular loading must be entered as 0.01 or greater.
5. Downward loading is entered as positive.
6. Lb for the bottom of the cantilever is always taken equal to the cantilever length.
7. Cb_span is calculated only if the unbraced length is equal to the total span and assumed to be 1.0 otherwise
8. Cb_cantilever is always considered 1.0.
7. Program does **not** take into account Transverse Shear Deformation in analysis.

Simple Beam Program

Project	HAFB 309th SWEG
Description	Typical Steel Roof Girders w/ uplift
Date	5/6/2022

Code Check	ASD, AISC 14th Edition
E	29000 ksi
Fy	50 ksi

Simple Span	21 ft	Lb_bot cantilever	0 ft
Cantilever	0 ft	Cb_simple_pos	1.000 ft
Lb_top simple	6.50 ft	Cb_simple_neg	1.136 ft
Lb_bot simple	21.00 ft	Cb_cantilever	1 ft
Lb_top cantilever	0 ft		

defl	Span/?	allow	2*Cantilever/?	allow
DL	360	0.70 in	360	0.00 in
LL	360	0.70 in	360	0.00 in
TL	240	1.05 in	240	0.00 in

uniform	15	20.45	6.5	x	x
partial	0	0	0	0	0
triangular	0	0	0	0	0.01
point 1	0	0	x	0	x
point 2	0	0	x	0	x
point 3	0	0	x	0	x

Result Type
(●) Single Shape
( ) Top 5 Options

Standard Shape: W16X26

Reactions

R1	2419 lbs
R2	2419 lbs
R total	4839 lbs

Shear -2415 lbs

Moment
12702 lb*ft (span pos)
0 lb*ft (span neg)
0 lb*ft (cant pos)
0 lb*ft (cant neg)

Simple Span Deflection

DL defl*ei	-246900 lb*ft^3
LL defl*ei	-336608 lb*ft^3
TL defl*ei	-583508 lb*ft^3

Cantilever Span Deflection

DL defl*ei	0 lb*ft^3
LL defl*ei	0 lb*ft^3
TL defl*ei	0 lb*ft^3

I minimum 33.11 in^4

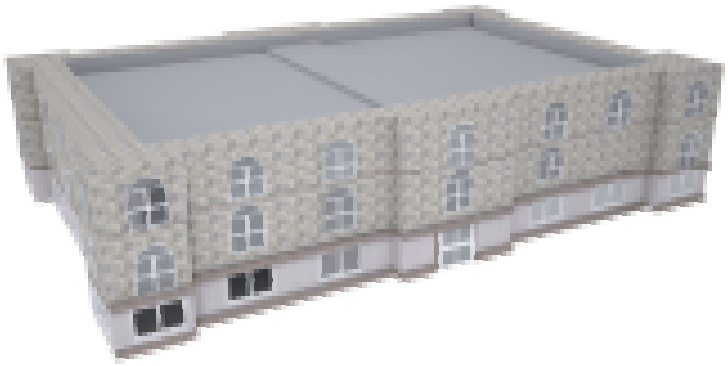
Shape	W16X26
V DCR	0.03
M+ Span DCR	0.13
M- Span DCR	0.00
M+ Cant DCR	0.00
M- Cant DCR	0.00
Span LL D	-0.07
Span TL D	-0.12
Cant LL D	0.00
Cant TL D	0.00
Lp	3.96
Lr	11.17

Vn (kips)	70.50 OK	**Ix (in^4)**	301
Mn_span+(k-ft)	94.85 OK	**Zx (in^3)**	44.2
Mn_span-(k-ft)	27.42 OK	**Sx (in^3)**	38.4
Mn_cant+(k-ft)	110.00 OK		
Mn_cant-(k-ft)	110.00 OK		
LL_span (in)	-0.07 OK		
TL_span (in)	-0.12 OK		
LL_cant (in)	0.00 OK		
TL_cant (in)	0.00 OK		

1. Program uses numerical integration that is accurate to plus/minus 5%.
2. "Standard Shape" analyzes an individual W shape of your choosing.
3. "Top 5 Options" determines the most economical shape and the lightest beams of the next four lower depth classes.
4. 'b' value within the triangular loading must be entered as 0.01 or greater.
5. Downward loading is entered as positive.
6. Lb for the bottom of the cantilever is always taken equal to the cantilever length.
7. Cb_span is calculated only if the unbraced length is equal to the total span and assumed to be 1.0 otherwise
8. Cb_cantilever is always considered 1.0.
7. Program does **not** take into account Transverse Shear Deformation in analysis.

Attachment #7
Mechanical LCCA

HAFB SWEG



Building Owner:
Location: HAFB

Created by: Heath Engineering
Heath Engineering

File name: HAFB SWEG.mdfz

Simulated by: TRACE™ 3D Plus 4.12.74

Outside Air / ASHRAE Standard 62.1 Summary

System Ventilation Requirements

System	Mode	ΣVpz (cfm)	Ps People	ΣPz People	D Ps / ΣPz	Vou (cfm)	Vps (cfm)	Xs	Ev	Vot (cfm)	%OA Vot / Vps
VAV RH (30% Min Default) (CW) (HWRH)	Cooling	10555	151	172	0.88	1315	10555	0.125	0.325	4050	38.4%
	Heating	3166	151	172	0.88	1315	3166	0.415	0.415	3166	100.0%

Ventilation Parameters

System Zone	Rp (cfm/p)	Pz People	Ra (cfm/ft²)	Az (ft²)	Vbz (cfm)	Cooling Ez	Cooling Voz (cfm)	Heating Ez	Heating Voz (cfm)
VAV RH (30% Min Default) (CW) (HWRH)	4.97	172.000000	0.06	9838	1417		1417		1771
Zn-Room - 04 - Conference	5	5.000000	0.06	112	32	1	32	0.8	40
Zn-Room - 05 - Office	5	6.000000	0.06	359	52	1	52	0.8	64
Zn-Room - 06 - Conference	5	12.000000	0.06	272	76	1	76	0.8	95
Zn-Room - 07 - Office	5	8.000000	0.06	479	69	1	69	0.8	86
Zn-Room - 12 - Mens RR	0	1.000000	0.03	1009	30	1	30	0.8	37
Zn-Room - 16 - Mechanical	0	0.000000	0	319	0	1	0	0.8	0
Zn-Room - 17 - Breakroom	5	20.000000	0.1	573	156	1	156	0.8	195
Zn-Room - 23 - Open Office	5	30.000000	0.06	1697	252	1	252	0.8	315
Zn-Room - 24 - Open Office	5	30.000000	0.06	1694	252	1	252	0.8	315
Zn-Room - 25 - Open Office	5	30.000000	0.06	1696	252	1	252	0.8	315
Zn-Room - 26 - Open Office	5	30.000000	0.06	1629	248	1	248	0.8	310

Ventilation Calculations for Cooling Design

System Zone	Box Type	Vpz (cfm)	Vdz (cfm)	Vpz-min (cfm)	Voz-clg (cfm)	Zpz	Ep	Er	Fa	Fb	Fc	Evz
VAV RH (30% Min Default) (CW) (HWRH)		10555	10555	3166	1417							
Zn-Room - 04 - Conference	Single Duct VAV Reheat	145	145	43	32	0.73	1	0	0	0	0	0.394
Zn-Room - 05 - Office	Single Duct VAV Reheat	233	233	70	52	0.739	1	0	0	0	0	0.386
Zn-Room - 06 - Conference	Single Duct VAV Reheat	318	318	95	76	0.8	1	0	0	0	0	0.325
Zn-Room - 07 - Office	Single Duct VAV Reheat	297	297	89	69	0.771	1	0	0	0	0	0.354
Zn-Room - 12 - Mens RR	Single Duct VAV Reheat	1394	1394	418	30	0.071	1	0	0	0	0	1.054
Zn-Room - 16 - Mechanical	Single Duct VAV Reheat	333	333	100	0	0	1	0	0	0	0	1.125

Ventilation Calculations for Cooling Design

System Zone	Box Type	Vpz (cfm)	Vdz (cfm)	Vpz-min (cfm)	Voz-clg (cfm)	Zpz	Ep	Er	Fa	Fb	Fc	Evz
Zn-Room - 17 - Breakroom	Single Duct VAV Reheat	677	677	203	156	0.768	1	0	0	0	0	0.357
Zn-Room - 23 - Open Office	Single Duct VAV Reheat	1719	1719	516	252	0.488	1	0	0	0	0	0.636
Zn-Room - 24 - Open Office	Single Duct VAV Reheat	1904	1904	571	252	0.44	1	0	0	0	0	0.684
Zn-Room - 25 - Open Office	Single Duct VAV Reheat	1704	1704	511	252	0.492	1	0	0	0	0	0.632
Zn-Room - 26 - Open Office	Single Duct VAV Reheat	1830	1830	549	248	0.451	1	0	0	0	0	0.673

Ventilation Calculations for Heating Design

System Zone	Box Type	Vpz (cfm)	Vdz (cfm)	Vpz-min (cfm)	Voz-htg (cfm)	Zpz	Ep	Er	Fa	Fb	Fc	Evz
VAV RH (30% Min Default) (CW) (HWRH)		3166	3166	3166	1771							
Zn-Room - 04 - Conference	Single Duct VAV Reheat	43	43	43	40	1	1	0	0	0	0	0.503
Zn-Room - 05 - Office	Single Duct VAV Reheat	70	70	70	64	1	1	0	0	0	0	0.492
Zn-Room - 06 - Conference	Single Duct VAV Reheat	95	95	95	95	1	1	0	0	0	0	0.415
Zn-Room - 07 - Office	Single Duct VAV Reheat	89	89	89	86	1	1	0	0	0	0	0.451
Zn-Room - 12 - Mens RR	Single Duct VAV Reheat	418	418	418	37	0.089	1	0	0	0	0	1.326
Zn-Room - 16 - Mechanical	Single Duct VAV Reheat	100	100	100	0	0	1	0	0	0	0	1.415
Zn-Room - 17 - Breakroom	Single Duct VAV Reheat	203	203	203	195	0.96	1	0	0	0	0	0.455
Zn-Room - 23 - Open Office	Single Duct VAV Reheat	516	516	516	315	0.61	1	0	0	0	0	0.805
Zn-Room - 24 - Open Office	Single Duct VAV Reheat	571	571	571	315	0.551	1	0	0	0	0	0.865
Zn-Room - 25 - Open Office	Single Duct VAV Reheat	511	511	511	315	0.616	1	0	0	0	0	0.8
Zn-Room - 26 - Open Office	Single Duct VAV Reheat	549	549	549	310	0.564	1	0	0	0	0	0.851

Single-Zone System Calculations

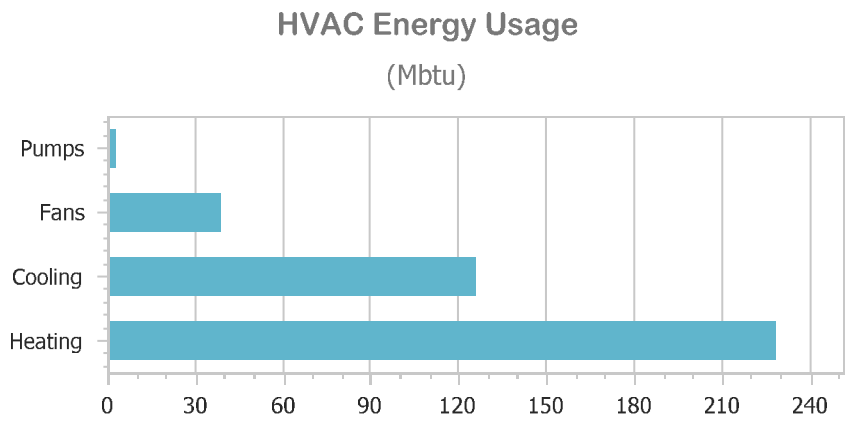
Zone / Room	Rp (cfm/p)	Pz People	Ra (cfm/ft²)	Az (ft²)	Vbz (cfm)	Cooling Ez	Cooling Voz (cfm)	Heating Ez	Heating Voz (cfm)
Zn-Room - 11 - IT	N/A	N/A	N/A	N/A	0.00	100.00	0	80.00	0
Room - 11 - IT	0.00	0.00	0.00	92	0.00	100.00	0	80.00	0
Zn-Room - 18 - Electrical	N/A	N/A	N/A	N/A	0.00	100.00	0	80.00	0
Room - 18 - Electrical	0.00	0.00	0.00	116	0.00	100.00	0	80.00	0
Zn-Room - 21 - Fire Riser	N/A	N/A	N/A	N/A	0.00	100.00	0	80.00	0
Room - 21 - Fire Riser	0.00	0.00	0.00	65	0.00	100.00	0	80.00	0

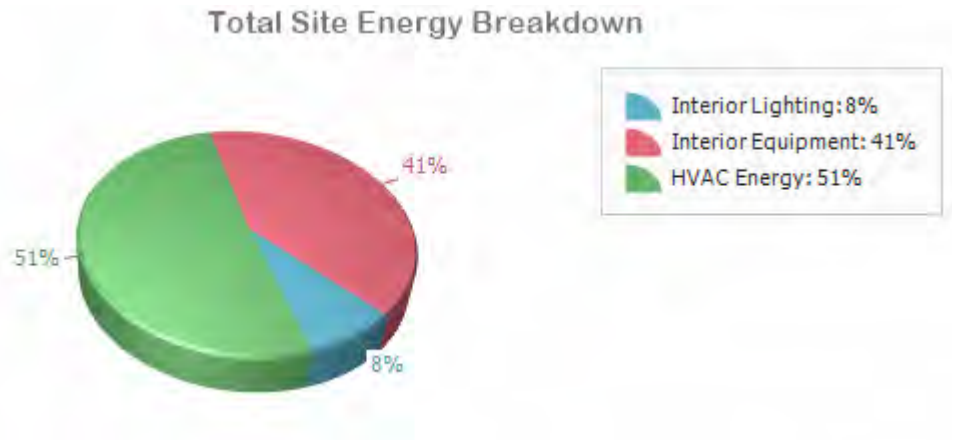
Sum of Outdoor Air Calculations

System Zone Room	Supply (cfm)	Outdoor (cfm)	Outdoor (%)
CV PTAC	N/A	N/A	N/A
Zn-Room - 11 - IT	711	0	0%
Room - 11 - IT	709	0	N/A
Unit Heater	N/A	N/A	N/A
Zn-Room - 18 - Electrical	57	0	0%
Room - 18 - Electrical	58	0	N/A
Unit Heater001	N/A	N/A	N/A
Zn-Room - 21 - Fire Riser	45	0	0%
Room - 21 - Fire Riser	46	0	N/A

Site Consumption Summary

Energy Consumption



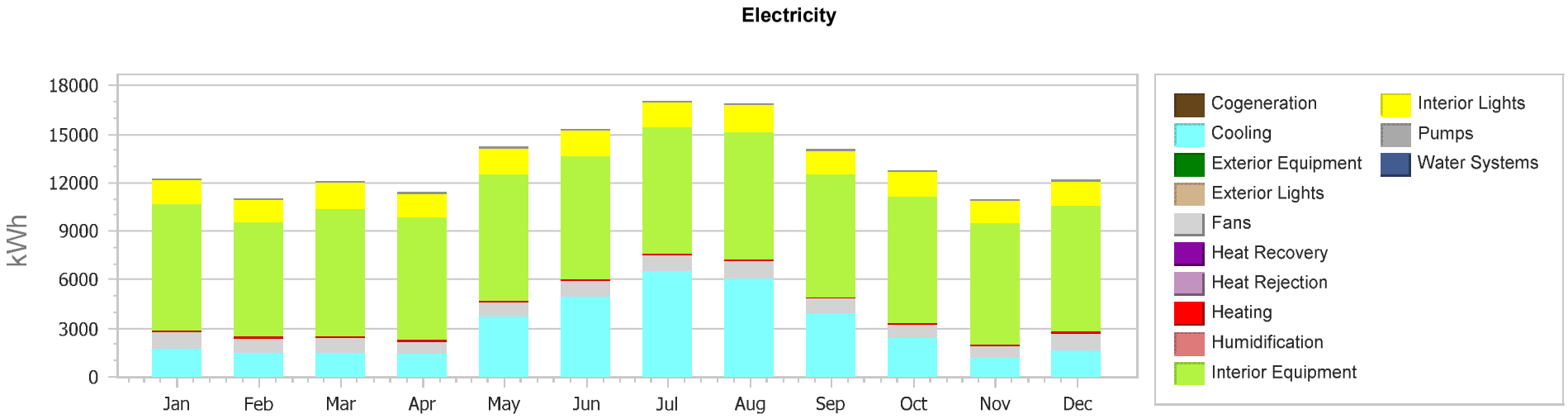


Component	Electricity (kWh)	Gas (Mbtu)	District Cooling (Mbtu)	District Heating (Mbtu)	Other Utilities (Mbtu)	Site Energy (kBtu)	Site Energy Use Intensity (kBtu/ft²)	Source Energy (kBtu)	Source Energy Use Intensity (kBtu/ft²)	Water (gal)
Heating	697	226	0	0	0	228,282	22.57	252,413	24.96	0
Cooling	36,817	0	0	0	0	125,624	12.42	397,850	39.34	0
Fans	11,431	0	0	0	0	39,003	3.86	123,521	12.21	0
Pumps	764	0	0	0	0	2,606	0.26	8,255	0.82	0
Heat Rejection	0	0	0	0	0	0	0	0	0	0
Humidification	0	0	0	0	0	0	0	0	0	0
Heat Recovery	0	0	0	0	0	0	0	0	0	0
HVAC	49,708	226	0	0	0	395,515	39.11	782,039	77.32	0
Water Systems	0	0	0	0	0	0	0	0	0	0
Interior Lighting	18,569	0	0	0	0	63,362	6.26	200,666	19.84	0
Exterior Lighting	0	0	0	0	0	0	0	0	0	0
Interior Equipment	92,075	0	0	0	0	314,173	31.06	994,986	98.38	0
Exterior Equipment	0	0	0	0	0	0	0	0	0	0
Refrigeration	0	0	0	0	0	0	0	0	0	0
Non-HVAC	110,644	0	0	0	0	377,535	37.33	1,195,652	118.22	0
Generators	0	0	0	0	0	0	0	0	0	0
Site Generation	0	0	0	0	0	0	0	0	0	0
Grand Total	160,353	226	0	0	0	773,049	76.43	1,977,691	195.54	0

Gross Floor Area: 10,111 ft² | Region: West | Building Type: Office | CBECS Survey Year: 2012 | Benchmark EUI: 69.2 kBtu/ft²/yr

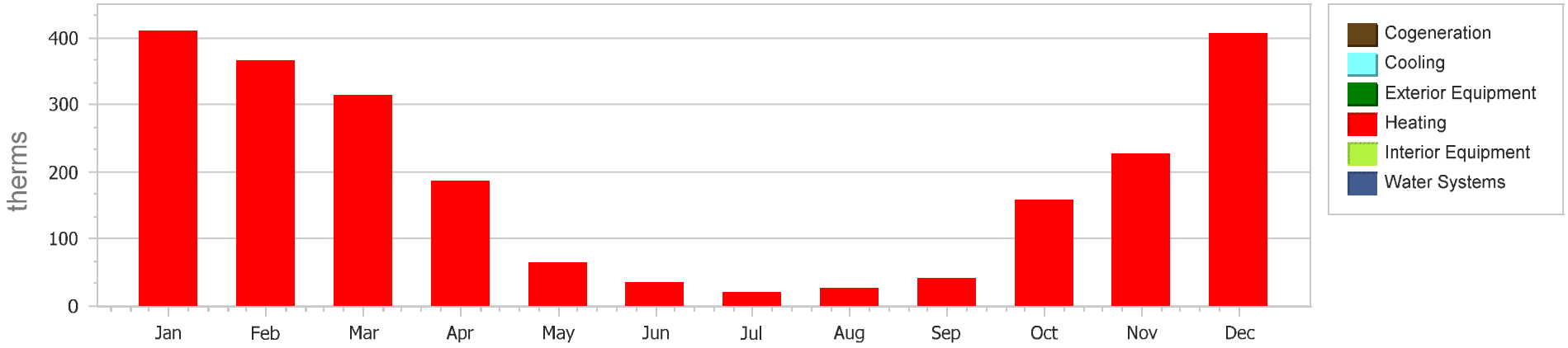
If the region reports as "All US" it means the data for the particular region was withheld because the Relative Standard Error was greater than 50 percent or fewer than 20 buildings were sampled.

Monthly Energy End Use



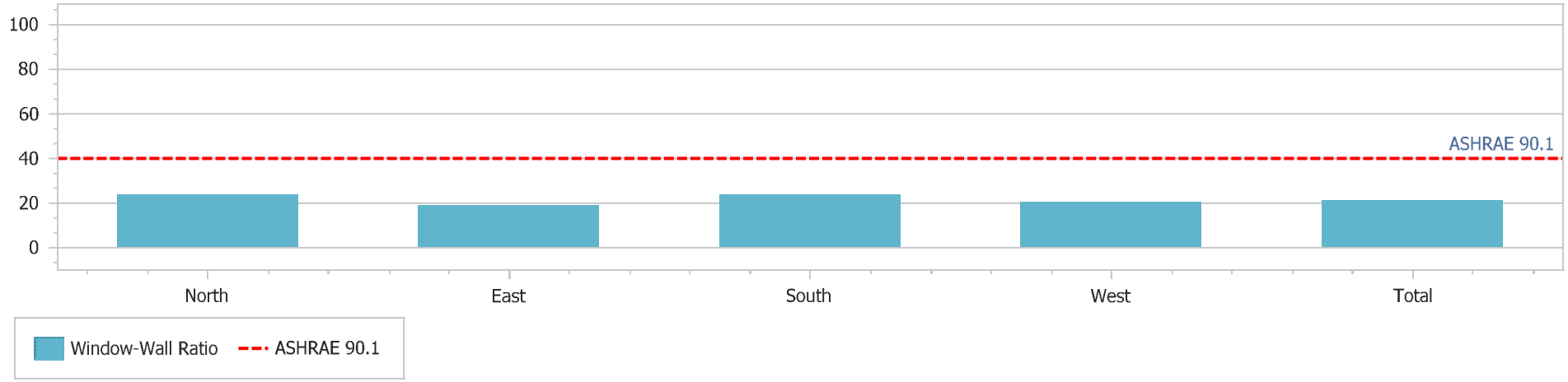
	January	February	March	April	May	June	July	August	September	October	November	December	Grand Total
Cogeneration	0	0	0	0	0	0	0	0	0	0	0	0	0
Cooling	1,731	1,493	1,508	1,454	3,717	5,007	6,532	6,130	3,962	2,415	1,201	1,667	36,816
Exterior Equipment	0	0	0	0	0	0	0	0	0	0	0	0	0
Exterior Lights	0	0	0	0	0	0	0	0	0	0	0	0	0
Fans	1,015	893	907	797	966	1,032	1,104	1,128	978	874	739	996	11,431
Heat Recovery	0	0	0	0	0	0	0	0	0	0	0	0	0
Heat Rejection	0	0	0	0	0	0	0	0	0	0	0	0	0
Heating	155	122	89	48	15	8	5	6	10	36	58	147	698
Humidification	0	0	0	0	0	0	0	0	0	0	0	0	0
Interior Equipment	7,774	7,060	7,874	7,567	7,840	7,614	7,794	7,874	7,567	7,807	7,514	7,794	92,076
Interior Lights	1,504	1,419	1,681	1,508	1,622	1,614	1,516	1,681	1,508	1,563	1,436	1,516	18,569
Pumps	66	58	54	42	65	76	89	96	71	49	34	64	763
Water Systems	0	0	0	0	0	0	0	0	0	0	0	0	0
Grand Total	12,245	11,045	12,113	11,415	14,224	15,350	17,040	16,914	14,096	12,744	10,982	12,184	160,354

Natural Gas



	January	February	March	April	May	June	July	August	September	October	November	December	Grand Total
Cogeneration	0	0	0	0	0	0	0	0	0	0	0	0	0
Cooling	0	0	0	0	0	0	0	0	0	0	0	0	0
Exterior Equipment	0	0	0	0	0	0	0	0	0	0	0	0	0
Heating	410	366	315	187	65	36	21	27	42	158	227	406	2,260
Interior Equipment	0	0	0	0	0	0	0	0	0	0	0	0	0
Water Systems	0	0	0	0	0	0	0	0	0	0	0	0	0
Grand Total	410	366	315	187	65	36	21	27	42	158	227	406	2,260

Envelope Summary



	North	East	South	West	Total
Gross Window-Wall Ratio	23.65	18.75	23.69	20.1	21.18

Ratios

	Units	North	East	South	West	Total
Gross Wall Area	ft²	1,214	1,722	1,212	1,724	5,871
Above Ground Wall Area	ft²	1,214	1,722	1,212	1,724	5,871
Window Opening Area	ft²	287	323	287	346	1,243
Gross Window-Wall Ratio	%	23.65	18.75	23.69	20.1	21.18
Above Ground Window-Wall Ratio	%	23.65	18.75	23.69	20.1	21.18
Gross Roof Area	ft²	0	0	0	0	10,345
Skylight Area	ft²	0	0	0	0	0
Skylight-Roof Ratio	%	0	0	0	0	0

Opaque Exterior

	Construction	Exterior Reflectance	Gross Area (ft²)	U-Factor With Film (BTU/h-ft²-°F)	U-Factor No Film (BTU/h-ft²-°F)	Azimuth	Tilt	Cardinal Direction
PLENUM WALL 179-ROOM - 25 - OPEN OFFICE_9	8 Inch Cmu Sweg	0.3	204	0.036	0.038	269.82°	90°	W

Opaque Exterior

	Construction	Exterior Reflectance	Gross Area (ft²)	U-Factor With Film (BTU/h-ft²-°F)	U-Factor No Film (BTU/h-ft²-°F)	Azimuth	Tilt	Cardinal Direction
PLENUM WALL 186-ROOM - 25 - OPEN OFFICE_9	8 Inch Cmu Sweg	0.3	211	0.036	0.038	359.82°	90°	N
PLENUM WALL 194-ROOM - 17 - BREAKROOM_9	8 Inch Cmu Sweg	0.3	120	0.036	0.038	89.82°	90°	E
PLENUM WALL 198-ROOM - 24 - OPEN OFFICE_9	8 Inch Cmu Sweg	0.3	210	0.036	0.038	179.82°	90°	S
PLENUM WALL 199-ROOM - 24 - OPEN OFFICE_9	8 Inch Cmu Sweg	0.3	204	0.036	0.038	89.82°	90°	E
PLENUM WALL 237-ROOM - 23 - OPEN OFFICE_9	8 Inch Cmu Sweg	0.3	204	0.036	0.038	269.85°	90°	W
PLENUM WALL 238-ROOM - 23 - OPEN OFFICE_9	8 Inch Cmu Sweg	0.3	211	0.036	0.038	179.82°	90°	S
PLENUM WALL 243-ROOM - 26 - OPEN OFFICE_9	8 Inch Cmu Sweg	0.3	2	0.036	0.038	150.88°	90°	S
PLENUM WALL 244-ROOM - 26 - OPEN OFFICE_9	8 Inch Cmu Sweg	0.3	1	0.036	0.038	269.82°	90°	W
PLENUM WALL 247-ROOM - 26 - OPEN OFFICE_9	8 Inch Cmu Sweg	0.3	181	0.036	0.038	89.82°	90°	E
PLENUM WALL 248-ROOM - 26 - OPEN OFFICE_9	8 Inch Cmu Sweg	0.3	211	0.036	0.038	359.82°	90°	N
PLENUM WALL 265-ROOM - 18 - ELECTRICAL_9	8 Inch Cmu Sweg	0.3	61	0.036	0.038	269.82°	90°	W
PLENUM WALL 267-ROOM - 21 - FIRE RISER_9	8 Inch Cmu Sweg	0.3	35	0.036	0.038	269.63°	90°	W
PLENUM WALL 269-ROOM - 22 - VESTIBULE_9	8 Inch Cmu Sweg	0.3	56	0.036	0.038	269.82°	90°	W
PLENUM WALL 272-ROOM - 16 - MECHANICAL_9	8 Inch Cmu Sweg	0.3	110	0.036	0.038	90.31°	90°	E
PLENUM WALL 273-ROOM - 05 - OFFICE_9	8 Inch Cmu Sweg	0.3	1	0.036	0.038	359.82°	90°	N
PLENUM WALL 274-ROOM - 20 - STORAGE_9	8 Inch Cmu Sweg	0.3	27	0.036	0.038	269.82°	90°	W
PLENUM WALL 275-ROOM - 20 - STORAGE_9	8 Inch Cmu Sweg	0.3	10	0.036	0.038	359.82°	90°	N
PLENUM WALL 276-ROOM - 19 - JANITOR_9	8 Inch Cmu Sweg	0.3	28	0.036	0.038	269.82°	90°	W
PLENUM WALL 277-ROOM - 19 - JANITOR_9	8 Inch Cmu Sweg	0.3	10	0.036	0.038	179.82°	90°	S
Roof 00-00	90.1-13 Min Roof Insulation Entirely Above Deck Zone 5 - Ahu	0.3	145	0.032	0.033	308.76°	0°	
Roof 00-00 - [1]	90.1-13 Min Roof Insulation Entirely Above Deck Zone 5 - Ahu	0.3	36	0.032	0.033	269.82°	0°	
Roof 00-00 - [2]	90.1-13 Min Roof Insulation Entirely Above Deck Zone 5 - Ahu	0.3	129	0.032	0.033	359.82°	0°	
Roof 00-00 - [3]	90.1-13 Min Roof Insulation Entirely Above Deck Zone 5 - Ahu	0.3	18	0.032	0.033	269.82°	0°	
Roof 01-01	90.1-13 Min Roof Insulation Entirely Above Deck Zone 5 - Ahu	0.3	370	0.032	0.033	269.82°	0°	

Opaque Exterior

	Construction	Exterior Reflectance	Gross Area (ft²)	U-Factor With Film (BTU/h-ft²-°F)	U-Factor No Film (BTU/h-ft²-°F)	Azimuth	Tilt	Cardinal Direction
Roof 03-03	90.1-13 Min Roof Insulation Entirely Above Deck Zone 5 - Ahu	0.3	1,716	0.032	0.033	269.82°	0°	
Roof 04-04	90.1-13 Min Roof Insulation Entirely Above Deck Zone 5 - Ahu	0.3	31	0.032	0.033	89.82°	0°	
Roof 04-04 - [1]	90.1-13 Min Roof Insulation Entirely Above Deck Zone 5 - Ahu	0.3	14	0.032	0.033	253.45°	0°	
Roof 04-04 - [2]	90.1-13 Min Roof Insulation Entirely Above Deck Zone 5 - Ahu	0.3	6	0.032	0.033	359.82°	0°	
Roof 04-04 - [3]	90.1-13 Min Roof Insulation Entirely Above Deck Zone 5 - Ahu	0.3	6	0.032	0.033	291.88°	0°	
Roof 04-04 - [4]	90.1-13 Min Roof Insulation Entirely Above Deck Zone 5 - Ahu	0.3	106	0.032	0.033	101.9°	0°	
Roof 04-04 - [5]	90.1-13 Min Roof Insulation Entirely Above Deck Zone 5 - Ahu	0.3	62	0.032	0.033	281.9°	0°	
Roof 04-04 - [6]	90.1-13 Min Roof Insulation Entirely Above Deck Zone 5 - Ahu	0.3	0	0.032	0.033	330.88°	0°	
Roof 06-06	90.1-13 Min Roof Insulation Entirely Above Deck Zone 5 - Ahu	0.3	127	0.032	0.033	269.82°	0°	
Roof 07-07	90.1-13 Min Roof Insulation Entirely Above Deck Zone 5 - Ahu	0.3	124	0.032	0.033	269.82°	0°	
Roof 08-08	90.1-13 Min Roof Insulation Entirely Above Deck Zone 5 - Ahu	0.3	281	0.032	0.033	269.82°	0°	
Roof 09-09	90.1-13 Min Roof Insulation Entirely Above Deck Zone 5 - Ahu	0.3	97	0.032	0.033	269.82°	0°	
Roof 10-10	90.1-13 Min Roof Insulation Entirely Above Deck Zone 5 - Ahu	0.3	126	0.032	0.033	269.82°	0°	
Roof 11-11	90.1-13 Min Roof Insulation Entirely Above Deck Zone 5 - Ahu	0.3	127	0.032	0.033	269.82°	0°	
Roof 12-12	90.1-13 Min Roof Insulation Entirely Above Deck Zone 5 - Ahu	0.3	124	0.032	0.033	269.82°	0°	
Roof 13-13	90.1-13 Min Roof Insulation Entirely Above Deck Zone 5 - Ahu	0.3	124	0.032	0.033	269.82°	0°	
Roof 14-14	90.1-13 Min Roof Insulation Entirely Above Deck Zone 5 - Ahu	0.3	93	0.032	0.033	269.82°	0°	
Roof 15-15	90.1-13 Min Roof Insulation Entirely Above Deck Zone 5 - Ahu	0.3	125	0.032	0.033	269.82°	0°	
Roof 17-17	90.1-13 Min Roof Insulation Entirely Above Deck Zone 5 - Ahu	0.3	47	0.032	0.033	316.41°	0°	
Roof 17-17 - [1]	90.1-13 Min Roof Insulation Entirely Above Deck Zone 5 - Ahu	0.3	12	0.032	0.033	269.82°	0°	
Roof 17-17 - [2]	90.1-13 Min Roof Insulation Entirely Above Deck Zone 5 - Ahu	0.3	101	0.032	0.033	136.41°	0°	

Opaque Exterior

	Construction	Exterior Reflectance	Gross Area (ft²)	U-Factor With Film (BTU/h-ft²-°F)	U-Factor No Film (BTU/h-ft²-°F)	Azimuth	Tilt	Cardinal Direction
Roof 17-17 - [3]	90.1-13 Min Roof Insulation Entirely Above Deck Zone 5 - Ahu	0.3	37	0.032	0.033	26.97°	0°	
Roof 17-17 - [4]	90.1-13 Min Roof Insulation Entirely Above Deck Zone 5 - Ahu	0.3	20	0.032	0.033	269.82°	0°	
Roof 17-17 - [5]	90.1-13 Min Roof Insulation Entirely Above Deck Zone 5 - Ahu	0.3	4	0.032	0.033	269.82°	0°	
Roof 18-18	90.1-13 Min Roof Insulation Entirely Above Deck Zone 5 - Ahu	0.3	45	0.032	0.033	331.7°	0°	
Roof 18-18 - [1]	90.1-13 Min Roof Insulation Entirely Above Deck Zone 5 - Ahu	0.3	37	0.032	0.033	308.11°	0°	
Roof 18-18 - [2]	90.1-13 Min Roof Insulation Entirely Above Deck Zone 5 - Ahu	0.3	29	0.032	0.033	219.8°	0°	
Roof 18-18 - [3]	90.1-13 Min Roof Insulation Entirely Above Deck Zone 5 - Ahu	0.3	3	0.032	0.033	359.82°	0°	
Roof 18-18 - [4]	90.1-13 Min Roof Insulation Entirely Above Deck Zone 5 - Ahu	0.3	36	0.032	0.033	39.8°	0°	
Roof 18-18 - [5]	90.1-13 Min Roof Insulation Entirely Above Deck Zone 5 - Ahu	0.3	20	0.032	0.033	359.82°	0°	
Roof 18-18 - [6]	90.1-13 Min Roof Insulation Entirely Above Deck Zone 5 - Ahu	0.3	12	0.032	0.033	349.35°	0°	
Roof 18-18 - [7]	90.1-13 Min Roof Insulation Entirely Above Deck Zone 5 - Ahu	0.3	20	0.032	0.033	359.82°	0°	
Roof 19-19	90.1-13 Min Roof Insulation Entirely Above Deck Zone 5 - Ahu	0.3	77	0.032	0.033	269.82°	0°	
Roof 20-20	90.1-13 Min Roof Insulation Entirely Above Deck Zone 5 - Ahu	0.3	47	0.032	0.033	89.82°	0°	
Roof 20-20 - [1]	90.1-13 Min Roof Insulation Entirely Above Deck Zone 5 - Ahu	0.3	111	0.032	0.033	102.42°	0°	
Roof 20-20 - [2]	90.1-13 Min Roof Insulation Entirely Above Deck Zone 5 - Ahu	0.3	23	0.032	0.033	89.82°	0°	
Roof 20-20 - [3]	90.1-13 Min Roof Insulation Entirely Above Deck Zone 5 - Ahu	0.3	41	0.032	0.033	289.17°	0°	
Roof 20-20 - [4]	90.1-13 Min Roof Insulation Entirely Above Deck Zone 5 - Ahu	0.3	24	0.032	0.033	57.96°	0°	
Roof 20-20 - [5]	90.1-13 Min Roof Insulation Entirely Above Deck Zone 5 - Ahu	0.3	24	0.032	0.033	89.82°	0°	
Roof 21-21	90.1-13 Min Roof Insulation Entirely Above Deck Zone 5 - Ahu	0.3	122	0.032	0.033	269.82°	0°	
Roof 22-22	90.1-13 Min Roof Insulation Entirely Above Deck Zone 5 - Ahu	0.3	55	0.032	0.033	269.82°	0°	
Roof 23-23	90.1-13 Min Roof Insulation Entirely Above Deck Zone 5 - Ahu	0.3	90	0.032	0.033	269.82°	0°	

Opaque Exterior

	Construction	Exterior Reflectance	Gross Area (ft²)	U-Factor With Film (BTU/h-ft²-°F)	U-Factor No Film (BTU/h-ft²-°F)	Azimuth	Tilt	Cardinal Direction
Roof 24-24	90.1-13 Min Roof Insulation Entirely Above Deck Zone 5 - Ahu	0.3	55	0.032	0.033	269.82°	0°	
Roof 25-25	90.1-13 Min Roof Insulation Entirely Above Deck Zone 5 - Ahu	0.3	69	0.032	0.033	269.63°	0°	
Roof 26-26	90.1-13 Min Roof Insulation Entirely Above Deck Zone 5 - Ahu	0.3	282	0.032	0.033	293.1°	0°	
Roof 26-26 - [1]	90.1-13 Min Roof Insulation Entirely Above Deck Zone 5 - Ahu	0.3	764	0.032	0.033	359.82°	0°	
Roof 26-26 - [2]	90.1-13 Min Roof Insulation Entirely Above Deck Zone 5 - Ahu	0.3	543	0.032	0.033	170.2°	0°	
Roof 26-26 - [3]	90.1-13 Min Roof Insulation Entirely Above Deck Zone 5 - Ahu	0.3	48	0.032	0.033	179.82°	0°	
Roof 26-26 - [4]	90.1-13 Min Roof Insulation Entirely Above Deck Zone 5 - Ahu	0.3	0	0.032	0.033	150.88°	0°	
Roof 26-26 - [5]	90.1-13 Min Roof Insulation Entirely Above Deck Zone 5 - Ahu	0.3	12	0.032	0.033	319.35°	0°	
Roof 26-26 - [6]	90.1-13 Min Roof Insulation Entirely Above Deck Zone 5 - Ahu	0.3	0	0.032	0.033	269.82°	0°	
Roof 27-27	90.1-13 Min Roof Insulation Entirely Above Deck Zone 5 - Ahu	0.3	1,714	0.032	0.033	269.82°	0°	
Roof 28-28	90.1-13 Min Roof Insulation Entirely Above Deck Zone 5 - Ahu	0.3	1,718	0.032	0.033	269.85°	0°	
Roof 29-29	90.1-13 Min Roof Insulation Entirely Above Deck Zone 5 - Ahu	0.3	117	0.032	0.033	269.82°	0°	
SLAB 00_0	90.1-13 Min Slab On Grade Unheated Floor, R-15 For 24 In., Zone 4-5_0	1	18	0.021	0.021		180°	
SLAB 00_1	90.1-13 Min Slab On Grade Unheated Floor, R-15 For 24 In., Zone 4-5_0	1	129	0.021	0.021		180°	
SLAB 00_2	90.1-13 Min Slab On Grade Unheated Floor, R-15 For 24 In., Zone 4-5_0	1	145	0.021	0.021		180°	
SLAB 00_3	90.1-13 Min Slab On Grade Unheated Floor, R-15 For 24 In., Zone 4-5_0	1	36	0.021	0.021		180°	
SLAB 01_0	90.1-13 Min Slab On Grade Unheated Floor, R-15 For 24 In., Zone 4-5_0	1	370	0.021	0.021		180°	
SLAB 03_0	90.1-13 Min Slab On Grade Unheated Floor, R-15 For 24 In., Zone 4-5_0	1	1,716	0.021	0.021		180°	
SLAB 04_0	90.1-13 Min Slab On Grade Unheated Floor, R-15 For 24 In., Zone 4-5_0	1	106	0.021	0.021		180°	
SLAB 04_1	90.1-13 Min Slab On Grade Unheated Floor, R-15 For 24 In., Zone 4-5_0	1	14	0.021	0.021		180°	
SLAB 04_2	90.1-13 Min Slab On Grade Unheated Floor, R-15 For 24 In., Zone 4-5_0	1	6	0.021	0.021		180°	

Opaque Exterior

	Construction	Exterior Reflectance	Gross Area (ft²)	U-Factor With Film (BTU/h-ft²-°F)	U-Factor No Film (BTU/h-ft²-°F)	Azimuth	Tilt	Cardinal Direction
SLAB 04_3	90.1-13 Min Slab On Grade Unheated Floor, R-15 For 24 In., Zone 4-5_0	1	6	0.021	0.021		180°	
SLAB 04_4	90.1-13 Min Slab On Grade Unheated Floor, R-15 For 24 In., Zone 4-5_0	1	31	0.021	0.021		180°	
SLAB 04_5	90.1-13 Min Slab On Grade Unheated Floor, R-15 For 24 In., Zone 4-5_0	1	62	0.021	0.021		180°	
SLAB 04_6	90.1-13 Min Slab On Grade Unheated Floor, R-15 For 24 In., Zone 4-5_0	1	0	0.021	0.021		180°	
SLAB 06_0	90.1-13 Min Slab On Grade Unheated Floor, R-15 For 24 In., Zone 4-5_0	1	127	0.021	0.021		180°	
SLAB 07_0	90.1-13 Min Slab On Grade Unheated Floor, R-15 For 24 In., Zone 4-5_0	1	124	0.021	0.021		180°	
SLAB 08_0	90.1-13 Min Slab On Grade Unheated Floor, R-15 For 24 In., Zone 4-5_0	1	281	0.021	0.021		180°	
SLAB 09_0	90.1-13 Min Slab On Grade Unheated Floor, R-15 For 24 In., Zone 4-5_0	1	97	0.021	0.021		180°	
SLAB 10_0	90.1-13 Min Slab On Grade Unheated Floor, R-15 For 24 In., Zone 4-5_0	1	126	0.021	0.021		180°	
SLAB 11_0	90.1-13 Min Slab On Grade Unheated Floor, R-15 For 24 In., Zone 4-5_0	1	127	0.021	0.021		180°	
SLAB 12_0	90.1-13 Min Slab On Grade Unheated Floor, R-15 For 24 In., Zone 4-5_0	1	124	0.021	0.021		180°	
SLAB 13_0	90.1-13 Min Slab On Grade Unheated Floor, R-15 For 24 In., Zone 4-5_0	1	124	0.021	0.021		180°	
SLAB 14_0	90.1-13 Min Slab On Grade Unheated Floor, R-15 For 24 In., Zone 4-5_0	1	93	0.021	0.021		180°	
SLAB 15_0	90.1-13 Min Slab On Grade Unheated Floor, R-15 For 24 In., Zone 4-5_0	1	125	0.021	0.021		180°	
SLAB 17_0	90.1-13 Min Slab On Grade Unheated Floor, R-15 For 24 In., Zone 4-5_0	1	20	0.021	0.021		180°	
SLAB 17_1	90.1-13 Min Slab On Grade Unheated Floor, R-15 For 24 In., Zone 4-5_0	1	37	0.021	0.021		180°	
SLAB 17_2	90.1-13 Min Slab On Grade Unheated Floor, R-15 For 24 In., Zone 4-5_0	1	101	0.021	0.021		180°	
SLAB 17_3	90.1-13 Min Slab On Grade Unheated Floor, R-15 For 24 In., Zone 4-5_0	1	47	0.021	0.021		180°	
SLAB 17_4	90.1-13 Min Slab On Grade Unheated Floor, R-15 For 24 In., Zone 4-5_0	1	12	0.021	0.021		180°	
SLAB 17_5	90.1-13 Min Slab On Grade Unheated Floor, R-15 For 24 In., Zone 4-5_0	1	4	0.021	0.021		180°	
SLAB 18_0	90.1-13 Min Slab On Grade Unheated Floor, R-15 For 24 In., Zone 4-5_0	1	20	0.021	0.021		180°	

Opaque Exterior

	Construction	Exterior Reflectance	Gross Area (ft²)	U-Factor With Film (BTU/h-ft²-°F)	U-Factor No Film (BTU/h-ft²-°F)	Azimuth	Tilt	Cardinal Direction
SLAB 18_1	90.1-13 Min Slab On Grade Unheated Floor, R-15 For 24 In., Zone 4-5_0	1	45	0.021	0.021		180°	
SLAB 18_2	90.1-13 Min Slab On Grade Unheated Floor, R-15 For 24 In., Zone 4-5_0	1	37	0.021	0.021		180°	
SLAB 18_3	90.1-13 Min Slab On Grade Unheated Floor, R-15 For 24 In., Zone 4-5_0	1	29	0.021	0.021		180°	
SLAB 18_4	90.1-13 Min Slab On Grade Unheated Floor, R-15 For 24 In., Zone 4-5_0	1	3	0.021	0.021		180°	
SLAB 18_5	90.1-13 Min Slab On Grade Unheated Floor, R-15 For 24 In., Zone 4-5_0	1	36	0.021	0.021		180°	
SLAB 18_6	90.1-13 Min Slab On Grade Unheated Floor, R-15 For 24 In., Zone 4-5_0	1	12	0.021	0.021		180°	
SLAB 18_7	90.1-13 Min Slab On Grade Unheated Floor, R-15 For 24 In., Zone 4-5_0	1	20	0.021	0.021		180°	
SLAB 19_0	90.1-13 Min Slab On Grade Unheated Floor, R-15 For 24 In., Zone 4-5_0	1	77	0.021	0.021		180°	
SLAB 20_0	90.1-13 Min Slab On Grade Unheated Floor, R-15 For 24 In., Zone 4-5_0	1	111	0.021	0.021		180°	
SLAB 20_1	90.1-13 Min Slab On Grade Unheated Floor, R-15 For 24 In., Zone 4-5_0	1	23	0.021	0.021		180°	
SLAB 20_2	90.1-13 Min Slab On Grade Unheated Floor, R-15 For 24 In., Zone 4-5_0	1	41	0.021	0.021		180°	
SLAB 20_3	90.1-13 Min Slab On Grade Unheated Floor, R-15 For 24 In., Zone 4-5_0	1	24	0.021	0.021		180°	
SLAB 20_4	90.1-13 Min Slab On Grade Unheated Floor, R-15 For 24 In., Zone 4-5_0	1	24	0.021	0.021		180°	
SLAB 20_5	90.1-13 Min Slab On Grade Unheated Floor, R-15 For 24 In., Zone 4-5_0	1	47	0.021	0.021		180°	
SLAB 21_0	90.1-13 Min Slab On Grade Unheated Floor, R-15 For 24 In., Zone 4-5_0	1	122	0.021	0.021		180°	
SLAB 22_0	90.1-13 Min Slab On Grade Unheated Floor, R-15 For 24 In., Zone 4-5_0	1	55	0.021	0.021		180°	
SLAB 23_0	90.1-13 Min Slab On Grade Unheated Floor, R-15 For 24 In., Zone 4-5_0	1	90	0.021	0.021		180°	
SLAB 24_0	90.1-13 Min Slab On Grade Unheated Floor, R-15 For 24 In., Zone 4-5_0	1	55	0.021	0.021		180°	
SLAB 25_0	90.1-13 Min Slab On Grade Unheated Floor, R-15 For 24 In., Zone 4-5_0	1	69	0.021	0.021		180°	
SLAB 26_0	90.1-13 Min Slab On Grade Unheated Floor, R-15 For 24 In., Zone 4-5_0	1	543	0.021	0.021		180°	
SLAB 26_1	90.1-13 Min Slab On Grade Unheated Floor, R-15 For 24 In., Zone 4-5_0	1	48	0.021	0.021		180°	

Opaque Exterior

	Construction	Exterior Reflectance	Gross Area (ft²)	U-Factor With Film (BTU/h-ft²-°F)	U-Factor No Film (BTU/h-ft²-°F)	Azimuth	Tilt	Cardinal Direction
SLAB 26_2	90.1-13 Min Slab On Grade Unheated Floor, R-15 For 24 In., Zone 4-5_0	1	0	0.021	0.021		180°	
SLAB 26_3	90.1-13 Min Slab On Grade Unheated Floor, R-15 For 24 In., Zone 4-5_0	1	12	0.021	0.021		180°	
SLAB 26_4	90.1-13 Min Slab On Grade Unheated Floor, R-15 For 24 In., Zone 4-5_0	1	0	0.021	0.021		180°	
SLAB 26_5	90.1-13 Min Slab On Grade Unheated Floor, R-15 For 24 In., Zone 4-5_0	1	764	0.021	0.021		180°	
SLAB 26_6	90.1-13 Min Slab On Grade Unheated Floor, R-15 For 24 In., Zone 4-5_0	1	282	0.021	0.021		180°	
SLAB 27_0	90.1-13 Min Slab On Grade Unheated Floor, R-15 For 24 In., Zone 4-5_0	1	1,714	0.021	0.021		180°	
SLAB 28_0	90.1-13 Min Slab On Grade Unheated Floor, R-15 For 24 In., Zone 4-5_0	1	1,718	0.021	0.021		180°	
SLAB 29_0	90.1-13 Min Slab On Grade Unheated Floor, R-15 For 24 In., Zone 4-5_0	1	117	0.021	0.021		180°	
WALL 04-ROOM - 16 - MECHANICAL_0	8 Inch Cmu Sweg	0.3	198	0.036	0.038	90.31°	90°	E
WALL 09-ROOM - 17 - BREAKROOM_0	8 Inch Cmu Sweg	0.3	217	0.036	0.038	89.82°	90°	E
WALL 126-ROOM - 18 - ELECTRICAL_0	8 Inch Cmu Sweg	0.3	110	0.036	0.038	269.82°	90°	W
WALL 129-ROOM - 19 - JANITOR_0	8 Inch Cmu Sweg	0.3	50	0.036	0.038	269.82°	90°	W
WALL 132-ROOM - 19 - JANITOR_0	8 Inch Cmu Sweg	0.3	18	0.036	0.038	179.82°	90°	S
WALL 134-ROOM - 22 - VESTIBULE_0	8 Inch Cmu Sweg	0.3	101	0.036	0.038	269.82°	90°	W
WALL 138-ROOM - 20 - STORAGE_0	8 Inch Cmu Sweg	0.3	49	0.036	0.038	269.82°	90°	W
WALL 140-ROOM - 20 - STORAGE_0	8 Inch Cmu Sweg	0.3	18	0.036	0.038	359.82°	90°	N
WALL 144-ROOM - 21 - FIRE RISER_0	8 Inch Cmu Sweg	0.3	63	0.036	0.038	269.63°	90°	W
WALL 147-ROOM - 25 - OPEN OFFICE_0	8 Inch Cmu Sweg	0.3	379	0.036	0.038	359.82°	90°	N
WALL 148-ROOM - 26 - OPEN OFFICE_0	8 Inch Cmu Sweg	0.3	326	0.036	0.038	89.82°	90°	E
WALL 149-ROOM - 26 - OPEN OFFICE_0	8 Inch Cmu Sweg	0.3	380	0.036	0.038	359.82°	90°	N
WALL 152-ROOM - 24 - OPEN OFFICE_0	8 Inch Cmu Sweg	0.3	379	0.036	0.038	179.82°	90°	S
WALL 153-ROOM - 24 - OPEN OFFICE_0	8 Inch Cmu Sweg	0.3	367	0.036	0.038	89.82°	90°	E
WALL 154-ROOM - 26 - OPEN OFFICE_0	8 Inch Cmu Sweg	0.3	3	0.036	0.038	150.88°	90°	S

Opaque Exterior

	Construction	Exterior Reflectance	Gross Area (ft²)	U-Factor With Film (BTU/h-ft²-°F)	U-Factor No Film (BTU/h-ft²-°F)	Azimuth	Tilt	Cardinal Direction
WALL 155-ROOM - 26 - OPEN OFFICE_0	8 Inch Cmu Sweg	0.3	1	0.036	0.038	269.82°	90°	W
WALL 156-ROOM - 05 - OFFICE_0	8 Inch Cmu Sweg	0.3	3	0.036	0.038	359.82°	90°	N
WALL 173-ROOM - 23 - OPEN OFFICE_0	8 Inch Cmu Sweg	0.3	367	0.036	0.038	269.85°	90°	W
WALL 174-ROOM - 23 - OPEN OFFICE_0	8 Inch Cmu Sweg	0.3	379	0.036	0.038	179.82°	90°	S
WALL 18-ROOM - 25 - OPEN OFFICE_0	8 Inch Cmu Sweg	0.3	366	0.036	0.038	269.82°	90°	W

Fenestration

	Construction	Area of One Opening (ft²)	Area of Openings (ft²)	U-Factor (BTU/h-ft²-°F)	SHGC	Visible Transmittance	Shade Control	Parent Surface	Azimuth	Cardinal Direction
DOOR 04_D - WALL 126-ROOM - 18 - ELECTRICAL_0	90.1-13 Metal Frame Ent. Door Zone 4-6	19	19	0.77	0.407	0.442	No	WALL 126-ROOM - 18 - ELECTRICAL_0	269.82°	W
DOOR 05_D - WALL 144-ROOM - 21 - FIRE RISER_0	90.1-13 Metal Frame Ent. Door Zone 4-6	19	19	0.77	0.407	0.442	No	WALL 144-ROOM - 21 - FIRE RISER_0	269.63°	W
DOOR 06_D - WALL 134-ROOM - 22 - VESTIBULE_0	90.1-13 Metal Frame Ent. Door Zone 4-6	48	48	0.77	0.407	0.442	No	WALL 134-ROOM - 22 - VESTIBULE_0	269.82°	W
WINDOW 17_W - WALL 134-ROOM - 22 - VESTIBULE_0	90.1-13 Window Zone 4-6 Metal Oper - Copy	10	10	0.42	0.401	0.442	No	WALL 134-ROOM - 22 - VESTIBULE_0	269.82°	W
WINDOW 18_W - WALL 134-ROOM - 22 - VESTIBULE_0	90.1-13 Window Zone 4-6 Metal Oper - Copy	10	10	0.42	0.401	0.442	No	WALL 134-ROOM - 22 - VESTIBULE_0	269.82°	W
WINDOW 24_W - WALL 18-ROOM - 25 - OPEN OFFICE_0	90.1-13 Window Zone 4-6 Metal Oper - Copy	60	60	0.42	0.401	0.442	No	WALL 18-ROOM - 25 - OPEN OFFICE_0	269.82°	W
WINDOW 25_W - WALL 18-ROOM - 25 - OPEN OFFICE_0	90.1-13 Window Zone 4-6 Metal Oper - Copy	60	60	0.42	0.401	0.442	No	WALL 18-ROOM - 25 - OPEN OFFICE_0	269.82°	W
WINDOW 26_W - WALL 173-ROOM - 23 - OPEN OFFICE_0	90.1-13 Window Zone 4-6 Metal Oper - Copy	60	60	0.42	0.401	0.442	No	WALL 173-ROOM - 23 - OPEN OFFICE_0	269.85°	W
WINDOW 27_W - WALL 173-ROOM - 23 - OPEN OFFICE_0	90.1-13 Window Zone 4-6 Metal Oper - Copy	60	60	0.42	0.401	0.442	No	WALL 173-ROOM - 23 - OPEN OFFICE_0	269.85°	W
DOOR 08_D - WALL 152-ROOM - 24 - OPEN OFFICE_0	90.1-13 Metal Frame Ent. Door Zone 4-6	19	19	0.77	0.407	0.442	No	WALL 152-ROOM - 24 - OPEN OFFICE_0	179.82°	S
WINDOW 28_W - WALL 174-ROOM - 23 - OPEN OFFICE_0	90.1-13 Window Zone 4-6 Metal Oper - Copy	60	60	0.42	0.401	0.442	No	WALL 174-ROOM - 23 - OPEN OFFICE_0	179.82°	S
WINDOW 29_W - WALL 174-ROOM - 23 - OPEN OFFICE_0	90.1-13 Window Zone 4-6 Metal Oper - Copy	60	60	0.42	0.401	0.442	No	WALL 174-ROOM - 23 - OPEN OFFICE_0	179.82°	S
WINDOW 30_W - WALL 152-ROOM - 24 - OPEN OFFICE_0	90.1-13 Window Zone 4-6 Metal Oper - Copy	60	60	0.42	0.401	0.442	No	WALL 152-ROOM - 24 - OPEN OFFICE_0	179.82°	S
WINDOW 34_W - WALL 152-ROOM - 24 - OPEN OFFICE_0	90.1-13 Window Zone 4-6 Metal Oper - Copy	44	44	0.42	0.401	0.442	No	WALL 152-ROOM - 24 - OPEN OFFICE_0	179.82°	S

Fenestration

	Construction	Area of One Opening (ft²)	Area of Openings (ft²)	U-Factor (BTU/h-ft²-°F)	SHGC	Visible Transmittance	Shade Control	Parent Surface	Azimuth	Cardinal Direction
WINDOW 35_W - WALL 152-ROOM - 24 - OPEN OFFICE_0	90.1-13 Window Zone 4-6 Metal Oper - Copy	44	44	0.42	0.401	0.442	No	WALL 152-ROOM - 24 - OPEN OFFICE_0	179.82°	S
DOOR 07_D - WALL 149-ROOM - 26 - OPEN OFFICE_0	90.1-13 Metal Frame Ent. Door Zone 4-6	19	19	0.77	0.407	0.442	No	WALL 149-ROOM - 26 - OPEN OFFICE_0	359.82°	N
WINDOW 21_W - WALL 149-ROOM - 26 - OPEN OFFICE_0	90.1-13 Window Zone 4-6 Metal Oper - Copy	60	60	0.42	0.401	0.442	No	WALL 149-ROOM - 26 - OPEN OFFICE_0	359.82°	N
WINDOW 22_W - WALL 147-ROOM - 25 - OPEN OFFICE_0	90.1-13 Window Zone 4-6 Metal Oper - Copy	60	60	0.42	0.401	0.442	No	WALL 147-ROOM - 25 - OPEN OFFICE_0	359.82°	N
WINDOW 23_W - WALL 147-ROOM - 25 - OPEN OFFICE_0	90.1-13 Window Zone 4-6 Metal Oper - Copy	60	60	0.42	0.401	0.442	No	WALL 147-ROOM - 25 - OPEN OFFICE_0	359.82°	N
WINDOW 36_W - WALL 149-ROOM - 26 - OPEN OFFICE_0	90.1-13 Window Zone 4-6 Metal Oper - Copy	44	44	0.42	0.401	0.442	No	WALL 149-ROOM - 26 - OPEN OFFICE_0	359.82°	N
WINDOW 37_W - WALL 149-ROOM - 26 - OPEN OFFICE_0	90.1-13 Window Zone 4-6 Metal Oper - Copy	44	44	0.42	0.401	0.442	No	WALL 149-ROOM - 26 - OPEN OFFICE_0	359.82°	N
DOOR 01_D - WALL 04-ROOM - 16 - MECHANICAL_0	90.1-13 Metal Frame Ent. Door Zone 4-6	19	19	0.77	0.407	0.442	No	WALL 04-ROOM - 16 - MECHANICAL_0	90.31°	E
DOOR 02_D - WALL 09-ROOM - 17 - BREAKROOM_0	90.1-13 Metal Frame Ent. Door Zone 4-6	19	19	0.77	0.407	0.442	No	WALL 09-ROOM - 17 - BREAKROOM_0	89.82°	E
WINDOW 19_W - WALL 148-ROOM - 26 - OPEN OFFICE_0	90.1-13 Window Zone 4-6 Metal Oper - Copy	60	60	0.42	0.401	0.442	No	WALL 148-ROOM - 26 - OPEN OFFICE_0	89.82°	E
WINDOW 20_W - WALL 148-ROOM - 26 - OPEN OFFICE_0	90.1-13 Window Zone 4-6 Metal Oper - Copy	60	60	0.42	0.401	0.442	No	WALL 148-ROOM - 26 - OPEN OFFICE_0	89.82°	E
WINDOW 31_W - WALL 153-ROOM - 24 - OPEN OFFICE_0	90.1-13 Window Zone 4-6 Metal Oper - Copy	60	60	0.42	0.401	0.442	No	WALL 153-ROOM - 24 - OPEN OFFICE_0	89.82°	E
WINDOW 32_W - WALL 153-ROOM - 24 - OPEN OFFICE_0	90.1-13 Window Zone 4-6 Metal Oper - Copy	60	60	0.42	0.401	0.442	No	WALL 153-ROOM - 24 - OPEN OFFICE_0	89.82°	E
WINDOW 33_W - WALL 09-ROOM - 17 - BREAKROOM_0	90.1-13 Window Zone 4-6 Metal Oper - Copy	44	44	0.42	0.401	0.442	No	WALL 09-ROOM - 17 - BREAKROOM_0	89.82°	E
Non-North Total or Average			956	0.474	0.402	0.442				
North Total or Average			287	0.444	0.401	0.442				
Total or Average			1,243	0.467	0.402	0.442				

Sunlit Fraction

* Sunlit Fraction is available for calculation timesteps of 15 minutes or less.

	March 21 9am	March 21 Noon	March 21 3pm	June 21 9am	June 21 Noon	June 21 3pm	December 21 9am	December 21 Noon	December 21 3pm
None	0	0	0	0	0	0	0	0	0

Window Controls

	Control Name	Type	Shaded	Control	Glare Control
None					

VAV RH (30% Min Default) (CW) (HWRH)

Coil Peak	
Peak Time (Mo/D/H:M):	1/21/01:00
Outside Air (DB/WB/HR):	9.5 / 7.1 / 6.2

	Instant Sensible (Btu/h)	Time Delay Sensible (Btu/h)	Latent (Btu/h)	Total (Btu/h)	Percent of Total (%)	Btu/h per ft²
Roof	0	0	0	0	0.0	0.0
Other Roof	0	0	0	0	0.0	0.0
Glass	-29,826	0	0	-29,826	30.9	-24.8
Door	0	0	0	0	0.0	0.0
Wall	0	-5,188	0	-5,188	5.4	-1.4
Below-Grade Wall	0	0	0	0	0.0	0.0
Other Wall	0	0	0	0	0.0	0.0
Partition	0	-114	0	-114	0.1	0.0
Exterior Floor	0	0	0	0	0.0	0.0
Interior Floor	0	0	0	0	0.0	0.0
Slab	0	-3,092	0	-3,092	3.2	-0.3
Other Floor	0	0	0	0	0.0	0.0
Infiltration	-3,190	0	-20	-3,210	3.3	-0.9
Envelope Subtotal	-33,016	-8,394	-20	-41,430	42.9	-
People	0	0	0	0	0.0	0.0
Lights	0	0	0	0	0.0	0.0
RA Sensible (Lights)	0	0	0	0	0.0	0.0
Miscellaneous Loads	0	0	0	0	0.0	0.0
Internal Subtotal	0	0	0	0	0.0	-
Ventilation	-230,244	0	0	-230,244	238.5	-
DOAS Direct to Zone	0	0	0	0	0.0	-
Ceiling	0	-21,766	0	-21,766	22.5	-2.2
Refrigeration	0	0	0	0	0.0	0.0
Service Water	0	0	0	0	0.0	0.0
HVAC Equipment Losses	0	0	0	0	0.0	0.0
Adj Air Transfer Heat	0	0	0	0	0.0	0.0
Supply Fan Heat	0	0	-	0	0.0	-
Time Delay Correction	0	0	-	0	0.0	-
Sizing Factor Correction	-513	-	-	-513	0.5	-
Airflow Correction	197,397	0	0	197,397	-204.4	-
Grand Total	-66,376	-30,160	-20	-96,556	100.0	

Fan Peak	
Peak Time (Mo/D/H:M):	7/21/19:00
Outside Air (DB/WB/HR):	85.6 / 58.7 / 45.1

	Instant Sensible (Btu/h)	Time Delay Sensible (Btu/h)	Total Sensible (Btu/h)	Percent of Total (%)	Related Area (ft²)
	0	0	0	0.0	0
	0	0	0	0.0	0
	15,766	19,980	35,747	19.4	1,204
	0	0	0	0.0	0
	0	1,322	1,322	0.7	3,601
	0	0	0	0.0	0
	0	0	0	0.0	3,601
	0	-4,521	-4,521	-2.5	12,329
	0	0	0	0.0	0
	0	0	0	0.0	0
	0	-15,893	-15,893	-8.6	10,057
	0	0	0	0.0	0
	668	0	668	0.4	3,601
	16,434	888	17,322	9.4	-
	18,454	30,514	48,968	26.6	9,838
	3,046	10,461	13,508	7.3	9,838
	-	-	-	-	-
	59,983	0	59,983	32.6	9,838
	81,483	40,976	122,459	66.5	-
	-	-	-	-	-
			0	0.0	0
	0	12,165	12,165	6.6	10,057
			0	0.0	9,838
			0	0.0	9,838
			0	0.0	0
	0	0	0	0.0	0
	-	-	-	-	-
	0	-1,093	-1,093	-0.6	-
	0	-	0	0.0	-
	33,414	-	33,414	18.1	-
	131,331	52,936	184,267	100.0	

Temperatures °F	
Supply	55.0
Return	72.0
Mixed Air	42.7
Fan Heat TD	0.0

Airflows cfm	
Main Fan	10,555
Ventilation	3,166
Infiltration	12
Min Stop / Reheat	8,649

Engineering Checks	
% OA	38.38
cfm/ft²	1.07
Btu/h-ft²	-9.82
cfm/ton	-1,311.92
ft²/ton	-1,222.56
People	172
ft²/person	57.20

Areas ft²	
Roof	0
Other Roof	0
Ceiling	10,057
Window	1,204
Door	0
Wall	3,601
Below-Grade Wall	0
Other Wall	3,601
Partition	12,329
Exterior Floor	0
Internal Floor	0
Slab	10,057
Other Floor	0

VAV RH (30% Min Default) (CW) (HWRH)

Coil Peak	
Peak Time (Mo/D/H:M):	7/21/16:00
Outside Air (DB/WB/HR):	93.7 / 61.4 / 45.2

	Instant Sensible (Btu/h)	Time Delay Sensible (Btu/h)	Latent (Btu/h)	Total (Btu/h)	Percent of Total (%)	Btu/h per ft²
Roof	0	0	0	0	0.0	0.0
Other Roof	0	0	0	0	0.0	0.0
Glass	13,470	15,297	0	28,768	8.7	23.9
Door	0	0	0	0	0.0	0.0
Wall	0	966	0	966	0.3	0.3
Below-Grade Wall	0	0	0	0	0.0	0.0
Other Wall	0	0	0	0	0.0	0.0
Partition	0	-4,272	0	-4,272	-1.3	-0.3
Exterior Floor	0	0	0	0	0.0	0.0
Interior Floor	0	0	0	0	0.0	0.0
Slab	0	-14,564	0	-14,564	-4.4	-1.4
Other Floor	0	0	0	0	0.0	0.0
Infiltration	855	0	-38	817	0.2	0.2
Envelope Subtotal	14,325	-2,572	-38	11,715	3.6	-
People	18,454	29,144	37,240	84,837	25.8	8.6
Lights	3,046	10,475	0	13,522	4.1	2.7
RA Sensible (Lights)	6,708	0	0	6,708	2.0	0.0
Miscellaneous Loads	59,983	0	0	59,983	18.2	6.1
Internal Subtotal	88,191	39,620	37,240	165,050	50.2	-
Ventilation	73,583	0	-19,141	54,442	16.6	-
DOAS Direct to Zone	0	0	0	0	0.0	-
Ceiling	0	13,853	0	13,853	4.2	1.4
Refrigeration	0	0	0	0	0.0	0.0
Service Water	0	0	0	0	0.0	0.0
HVAC Equipment Losses	0	0	0	0	0.0	0.0
Adj Air Transfer Heat	0	0	0	0	0.0	0.0
Supply Fan Heat	23,795	0	-	23,795	7.2	-
Time Delay Correction	0	-1,056	-	-1,056	-0.3	-
Sizing Factor Correction	0	-	-	0	0.0	-
Airflow Correction	38,615	0	22,537	61,151	18.6	-
Grand Total	238,508	49,844	40,598	328,950	100.0	

Fan Peak	
Peak Time (Mo/D/H:M):	7/21/19:00
Outside Air (DB/WB/HR):	85.6 / 58.7 / 45.1

	Instant Sensible (Btu/h)	Time Delay Sensible (Btu/h)	Total Sensible (Btu/h)	Percent of Total (%)	Related Area (ft²)
	0	0	0	0.0	0
	0	0	0	0.0	0
	15,766	19,980	35,747	19.4	1,204
	0	0	0	0.0	0
	0	1,322	1,322	0.7	3,601
	0	0	0	0.0	0
	0	0	0	0.0	3,601
	0	-4,521	-4,521	-2.5	12,329
	0	0	0	0.0	0
	0	0	0	0.0	0
	0	-15,893	-15,893	-8.6	10,057
	0	0	0	0.0	0
	668	0	668	0.4	3,601
	16,434	888	17,322	9.4	-
	18,454	30,514	48,968	26.6	9,838
	3,046	10,461	13,508	7.3	9,838
	-	-	-	-	-
	59,983	0	59,983	32.6	9,838
	81,483	40,976	122,459	66.5	-
	-	-	-	-	-
			0	0.0	0
	0	12,165	12,165	6.6	10,057
			0	0.0	9,838
			0	0.0	9,838
			0	0.0	0
	0	0	0	0.0	0
	-	-	-	-	-
	0	-1,093	-1,093	-0.6	-
	0	-	0	0.0	-
	33,414	-	33,414	18.1	-
	131,331	52,936	184,267	100.0	

Temperatures °F	
Supply	55.0
Return	75.7
Mixed Air	82.6
Fan Heat TD	2.5

Airflows cfm	
Main Fan	10,555
Ventilation	4,050
Infiltration	47
Min Stop / Reheat	8,649

Engineering Checks	
% OA	38.38
cfm/ft²	1.07
Btu/h-ft²	33.46
cfm/ton	385.08
ft²/ton	358.86
People	172
ft²/person	57.20

Areas ft²	
Roof	0
Other Roof	0
Ceiling	10,057
Window	1,204
Door	0
Wall	3,601
Below-Grade Wall	0
Other Wall	3,601
Partition	12,329
Exterior Floor	0
Internal Floor	0
Slab	10,057
Other Floor	0

Zone Cooling and Heating Loads by Component

ZONE_Zn-Room - 04 - Conference

Conditions at Time of Space Cooling Peak

Outside	DB / WB / HR	85.6 °F	/	58.7 °F	/	45.1 gr/lb
Zone	DB / RH / HR	74.0 °F	/	49.4 %	/	61.6 gr/lb

	Instant Sensible (Btu/h)	Time Delay Sensible (Btu/h)	Latent (Btu/h)	Total (Btu/h)	Percent of Total (%)
Roof	0	0	0	0	0.0
Other Roof	0	0	0	0	0.0
Glass	0	0	0	0	0.0
Door	0	0	0	0	0.0
Wall	0	0	0	0	0.0
Below-Grade Wall	0	0	0	0	0.0
Other Wall	0	0	0	0	0.0
Partition	0	-355	0	-355	-8.7
Exterior Floor	0	0	0	0	0.0
Interior Floor	0	0	0	0	0.0
Slab	0	-139	0	-139	-3.4
Other Floor	0	0	0	0	0.0
Infiltration	0	0	0	0	0.0
Envelope Subtotal	0	-494	0	-494	-
People	577	1213	1375	3165	78.0
Lights	38	163	0	200	4.9
RA Sensible (Lights)	161	0	0	161	4.0
Miscellaneous Loads	1000	0	0	1000	24.6
Internal Subtotal	1776	1375	1375	4526	-
RA (All Other)	0	0	0	0	0.0
DOA Direct to Zone	0	0	0	0	0.0
Ceiling	0	36	0	36	0.9
Refrigeration	0	0	0	0	0.0
Service Water	0	0	0	0	0.0
HVAC Equipment Losses	0	0	0	0	0.0
Adj Air Transfer Heat	0	0	0	0	0.0
Sizing Factor Correction	0	0	0	0	0.0
Time Delay Correction	0	-11	0	-11	-0.3
Grand Total	1776	907	1375	4057	100.0

Engineering Checks

Cooling tons	0.34	Input Ventilation cfm	32
Cooling cfm	144.76	Calculated Ventilation cfm	56
ft²/ton	330.49	Number of People	4.99
cfm/ton	428.07	People per 1000 ft²	45
Conditioned ft²	111.7		

Conditions at Time of Space Heating Peak

Outside	DB / WB / HR	9.5 °F	/	7.1 °F	/	6.2 gr/lb
Zone	DB / RH / HR	72.0 °F	/	5.9 %	/	6.9 gr/lb

	Instant Sensible (Btu/h)	Time Delay Sensible (Btu/h)	Latent (Btu/h)	Total (Btu/h)	Percent of Total (%)
Roof	0	0	0	0	0.0
Other Roof	0	0	0	0	0.0
Glass	0	0	0	0	0.0
Door	0	0	0	0	0.0
Wall	0	0	0	0	0.0
Below-Grade Wall	0	0	0	0	0.0
Other Wall	0	0	0	0	0.0
Partition	0	-102	0	-102	24.6
Exterior Floor	0	0	0	0	0.0
Interior Floor	0	0	0	0	0.0
Slab	0	-48	0	-48	11.6
Other Floor	0	0	0	0	0.0
Infiltration	0	0	0	0	0.0
Envelope Subtotal	0	-150	0	-150	-
People	0	0	0	0	0.0
Lights	0	0	0	0	0.0
RA Sensible (Lights)	0	0	0	0	0.0
Miscellaneous Loads	0	0	0	0	0.0
Internal Subtotal	0	0	0	0	-
RA (All Other)	0	0	0	0	0.0
DOA Direct to Zone	0	0	0	0	0.0
Ceiling	0	-263	0	-263	63.7
Refrigeration	0	0	0	0	0.0
Service Water	0	0	0	0	0.0
HVAC Equipment Losses	0	0	0	0	0.0
Adj Air Transfer Heat	0	0	0	0	0.0
Sizing Factor Correction	0	0	0	0	0.0
Time Delay Correction	0	0	0	0	0.0
Grand Total	0	-413	0	-413	100.0

Engineering Checks

Heating Mbh	-0.41	Input Ventilation cfm	40
Heating cfm	43.43	Calculated Ventilation cfm	43
ft²/Mbh	-270.64	Number of People	4.99
cfm/Mbh	-105.19	People per 1000 ft²	45
Conditioned ft²	111.7		

ZONE_Zn-Room - 05 - Office

Conditions at Time of Space Cooling Peak

Outside	DB / WB / HR	85.6 °F	/ 58.7 °F	/ 45.1 gr/lb	
Zone	DB / RH / HR	74.0 °F	/ 43.5 %	/ 54.3 gr/lb	

	Instant Sensible (Btu/h)	Time Delay Sensible (Btu/h)	Latent (Btu/h)	Total (Btu/h)	Percent of Total (%)
Roof	0	0	0	0	0.0
Other Roof	0	0	0	0	0.0
Glass	0	0	0	0	0.0
Door	0	0	0	0	0.0
Wall	0	1	0	1	0.0
Below-Grade Wall	0	0	0	0	0.0
Other Wall	0	0	0	0	0.0
Partition	0	79	0	79	1.4
Exterior Floor	0	0	0	0	0.0
Interior Floor	0	0	0	0	0.0
Slab	0	-249	0	-249	-4.3
Other Floor	0	0	0	0	0.0
Infiltration	0	0	0	0	0.0
Envelope Subtotal	0	-170	0	-170	-
People	630	1293	1200	3123	54.1
Lights	119	503	0	623	10.8
RA Sensible (Lights)	510	0	0	510	8.8
Miscellaneous Loads	1200	0	0	1200	20.8
Internal Subtotal	2459	1797	1200	5456	-
RA (All Other)	0	0	0	0	0.0
DOA Direct to Zone	0	0	0	0	0.0
Ceiling	0	493	0	493	8.5
Refrigeration	0	0	0	0	0.0
Service Water	0	0	0	0	0.0
HVAC Equipment Losses	0	0	0	0	0.0
Adj Air Transfer Heat	0	0	0	0	0.0
Sizing Factor Correction	0	0	0	0	0.0
Time Delay Correction	0	-9	0	-9	-0.2
Grand Total	2459	2110	1200	5770	100.0

Engineering Checks

Cooling tons	0.48	Input Ventilation cfm	52
Cooling cfm	232.66	Calculated Ventilation cfm	89
ft²/ton	746.93	Number of People	6.00
cfm/ton	483.81	People per 1000 ft²	17
Conditioned ft²	359.1		

Conditions at Time of Space Heating Peak

Outside	DB / WB / HR	9.5 °F	/ 7.1 °F	/ 6.2 gr/lb	
Zone	DB / RH / HR	72.0 °F	/ 5.9 %	/ 6.9 gr/lb	

	Instant Sensible (Btu/h)	Time Delay Sensible (Btu/h)	Latent (Btu/h)	Total (Btu/h)	Percent of Total (%)
Roof	0	0	0	0	0.0
Other Roof	0	0	0	0	0.0
Glass	0	0	0	0	0.0
Door	0	0	0	0	0.0
Wall	0	-6	0	-6	0.4
Below-Grade Wall	0	0	0	0	0.0
Other Wall	0	0	0	0	0.0
Partition	0	-319	0	-319	24.8
Exterior Floor	0	0	0	0	0.0
Interior Floor	0	0	0	0	0.0
Slab	0	-153	0	-153	11.8
Other Floor	0	0	0	0	0.0
Infiltration	0	0	0	0	0.0
Envelope Subtotal	0	-478	0	-478	-
People	0	0	0	0	0.0
Lights	0	0	0	0	0.0
RA Sensible (Lights)	0	0	0	0	0.0
Miscellaneous Loads	0	0	0	0	0.0
Internal Subtotal	0	0	0	0	-
RA (All Other)	0	0	0	0	0.0
DOA Direct to Zone	0	0	0	0	0.0
Ceiling	0	-811	0	-811	62.9
Refrigeration	0	0	0	0	0.0
Service Water	0	0	0	0	0.0
HVAC Equipment Losses	0	0	0	0	0.0
Adj Air Transfer Heat	0	0	0	0	0.0
Sizing Factor Correction	0	0	0	0	0.0
Time Delay Correction	0	0	0	0	0.0
Grand Total	0	-1289	0	-1289	100.0

Engineering Checks

Heating Mbh	-1.29	Input Ventilation cfm	64
Heating cfm	69.80	Calculated Ventilation cfm	70
ft²/Mbh	-278.57	Number of People	6.00
cfm/Mbh	-54.14	People per 1000 ft²	17
Conditioned ft²	359.1		

ZONE_Zn-Room - 06 - Conference

Conditions at Time of Space Cooling Peak

Outside	DB / WB / HR	85.6 °F	/ 58.7 °F	/ 45.1 gr/lb	
Zone	DB / RH / HR	73.9 °F	/ 54.2 %	/ 67.7 gr/lb	

	Instant Sensible (Btu/h)	Time Delay Sensible (Btu/h)	Latent (Btu/h)	Total (Btu/h)	Percent of Total (%)
Roof	0	0	0	0	0.0
Other Roof	0	0	0	0	0.0
Glass	0	0	0	0	0.0
Door	0	0	0	0	0.0
Wall	0	0	0	0	0.0
Below-Grade Wall	0	0	0	0	0.0
Other Wall	0	0	0	0	0.0
Partition	0	-738	0	-738	-9.1
Exterior Floor	0	0	0	0	0.0
Interior Floor	0	0	0	0	0.0
Slab	0	-329	0	-329	-4.1
Other Floor	0	0	0	0	0.0
Infiltration	0	0	0	0	0.0
Envelope Subtotal	0	-1067	0	-1067	-
People	1386	2558	3299	7243	89.5
Lights	92	348	0	440	5.4
RA Sensible (Lights)	392	0	0	392	4.8
Miscellaneous Loads	1000	0	0	1000	12.4
Internal Subtotal	2869	2906	3299	9074	-
RA (All Other)	0	0	0	0	0.0
DOA Direct to Zone	0	0	0	0	0.0
Ceiling	0	110	0	110	1.4
Refrigeration	0	0	0	0	0.0
Service Water	0	0	0	0	0.0
HVAC Equipment Losses	0	0	0	0	0.0
Adj Air Transfer Heat	0	0	0	0	0.0
Sizing Factor Correction	0	0	0	0	0.0
Time Delay Correction	0	-25	0	-25	-0.3
Grand Total	2869	1924	3299	8092	100.0

Engineering Checks

Cooling tons	0.67	Input Ventilation cfm	76
Cooling cfm	318.03	Calculated Ventilation cfm	122
ft²/ton	403.56	Number of People	11.98
cfm/ton	471.52	People per 1000 ft²	44
Conditioned ft²	272.1		

Conditions at Time of Space Heating Peak

Outside	DB / WB / HR	9.5 °F	/ 7.1 °F	/ 6.2 gr/lb	
Zone	DB / RH / HR	72.0 °F	/ 5.9 %	/ 6.9 gr/lb	

	Instant Sensible (Btu/h)	Time Delay Sensible (Btu/h)	Latent (Btu/h)	Total (Btu/h)	Percent of Total (%)
Roof	0	0	0	0	0.0
Other Roof	0	0	0	0	0.0
Glass	0	0	0	0	0.0
Door	0	0	0	0	0.0
Wall	0	0	0	0	0.0
Below-Grade Wall	0	0	0	0	0.0
Other Wall	0	0	0	0	0.0
Partition	0	-49	0	-49	6.5
Exterior Floor	0	0	0	0	0.0
Interior Floor	0	0	0	0	0.0
Slab	0	-115	0	-115	15.2
Other Floor	0	0	0	0	0.0
Infiltration	0	0	0	0	0.0
Envelope Subtotal	0	-164	0	-164	-
People	0	0	0	0	0.0
Lights	0	0	0	0	0.0
RA Sensible (Lights)	0	0	0	0	0.0
Miscellaneous Loads	0	0	0	0	0.0
Internal Subtotal	0	0	0	0	-
RA (All Other)	0	0	0	0	0.0
DOA Direct to Zone	0	0	0	0	0.0
Ceiling	0	-593	0	-593	78.3
Refrigeration	0	0	0	0	0.0
Service Water	0	0	0	0	0.0
HVAC Equipment Losses	0	0	0	0	0.0
Adj Air Transfer Heat	0	0	0	0	0.0
Sizing Factor Correction	0	0	0	0	0.0
Time Delay Correction	0	0	0	0	0.0
Grand Total	0	-757	0	-757	100.0

Engineering Checks

Heating Mbh	-0.76	Input Ventilation cfm	95
Heating cfm	95.41	Calculated Ventilation cfm	95
ft²/Mbh	-359.30	Number of People	11.98
cfm/Mbh	-125.97	People per 1000 ft²	44
Conditioned ft²	272.1		

ZONE_Zn-Room - 07 - Office

Conditions at Time of Space Cooling Peak

Outside	DB / WB / HR	85.6 °F	/ 58.7 °F	/ 45.1 gr/lb	
Zone	DB / RH / HR	74.0 °F	/ 43.8 %	/ 54.7 gr/lb	

	Instant Sensible (Btu/h)	Time Delay Sensible (Btu/h)	Latent (Btu/h)	Total (Btu/h)	Percent of Total (%)
Roof	0	0	0	0	0.0
Other Roof	0	0	0	0	0.0
Glass	0	0	0	0	0.0
Door	0	0	0	0	0.0
Wall	0	0	0	0	0.0
Below-Grade Wall	0	0	0	0	0.0
Other Wall	0	0	0	0	0.0
Partition	0	-58	0	-58	-0.8
Exterior Floor	0	0	0	0	0.0
Interior Floor	0	0	0	0	0.0
Slab	0	-304	0	-304	-4.1
Other Floor	0	0	0	0	0.0
Infiltration	0	0	0	0	0.0
Envelope Subtotal	0	-361	0	-361	-
People	840	1668	1600	4107	55.0
Lights	159	650	0	809	10.8
RA Sensible (Lights)	681	0	0	681	9.1
Miscellaneous Loads	1600	0	0	1600	21.4
Internal Subtotal	3280	2318	1600	7197	-
RA (All Other)	0	0	0	0	0.0
DOA Direct to Zone	0	0	0	0	0.0
Ceiling	0	643	0	643	8.6
Refrigeration	0	0	0	0	0.0
Service Water	0	0	0	0	0.0
HVAC Equipment Losses	0	0	0	0	0.0
Adj Air Transfer Heat	0	0	0	0	0.0
Sizing Factor Correction	0	0	0	0	0.0
Time Delay Correction	0	-12	0	-12	-0.2
Grand Total	3280	2587	1600	7466	100.0

Engineering Checks

Cooling tons	0.62	Input Ventilation cfm	69
Cooling cfm	297.20	Calculated Ventilation cfm	114
ft²/ton	769.97	Number of People	8.00
cfm/ton	477.60	People per 1000 ft²	17
Conditioned ft²	479.0		

Conditions at Time of Space Heating Peak

Outside	DB / WB / HR	9.5 °F	/ 7.1 °F	/ 6.2 gr/lb	
Zone	DB / RH / HR	72.0 °F	/ 5.9 %	/ 6.9 gr/lb	

	Instant Sensible (Btu/h)	Time Delay Sensible (Btu/h)	Latent (Btu/h)	Total (Btu/h)	Percent of Total (%)
Roof	0	0	0	0	0.0
Other Roof	0	0	0	0	0.0
Glass	0	0	0	0	0.0
Door	0	0	0	0	0.0
Wall	0	0	0	0	0.0
Below-Grade Wall	0	0	0	0	0.0
Other Wall	0	0	0	0	0.0
Partition	0	-366	0	-366	22.4
Exterior Floor	0	0	0	0	0.0
Interior Floor	0	0	0	0	0.0
Slab	0	-205	0	-205	12.5
Other Floor	0	0	0	0	0.0
Infiltration	0	0	0	0	0.0
Envelope Subtotal	0	-571	0	-571	-
People	0	0	0	0	0.0
Lights	0	0	0	0	0.0
RA Sensible (Lights)	0	0	0	0	0.0
Miscellaneous Loads	0	0	0	0	0.0
Internal Subtotal	0	0	0	0	-
RA (All Other)	0	0	0	0	0.0
DOA Direct to Zone	0	0	0	0	0.0
Ceiling	0	-1066	0	-1066	65.1
Refrigeration	0	0	0	0	0.0
Service Water	0	0	0	0	0.0
HVAC Equipment Losses	0	0	0	0	0.0
Adj Air Transfer Heat	0	0	0	0	0.0
Sizing Factor Correction	0	0	0	0	0.0
Time Delay Correction	0	0	0	0	0.0
Grand Total	0	-1637	0	-1637	100.0

Engineering Checks

Heating Mbh	-1.64	Input Ventilation cfm	86
Heating cfm	89.16	Calculated Ventilation cfm	89
ft²/Mbh	-292.66	Number of People	8.00
cfm/Mbh	-54.47	People per 1000 ft²	17
Conditioned ft²	479.0		

ZONE_Zn-Room - 11 - IT

Conditions at Time of Space Cooling Peak

Outside	DB / WB / HR	85.6 °F	/ 58.7 °F	/ 45.1 gr/lb	
Zone	DB / RH / HR	74.0 °F	/ 36.6 %	/ 45.5 gr/lb	

	Instant Sensible (Btu/h)	Time Delay Sensible (Btu/h)	Latent (Btu/h)	Total (Btu/h)	Percent of Total (%)
Roof	0	0	0	0	0.0
Other Roof	0	0	0	0	0.0
Glass	0	0	0	0	0.0
Door	0	0	0	0	0.0
Wall	0	0	0	0	0.0
Below-Grade Wall	0	0	0	0	0.0
Other Wall	0	0	0	0	0.0
Partition	0	116	0	116	0.9
Exterior Floor	0	0	0	0	0.0
Interior Floor	0	0	0	0	0.0
Slab	0	-47	0	-47	-0.4
Other Floor	0	0	0	0	0.0
Infiltration	0	0	0	0	0.0
Envelope Subtotal	0	69	0	69	-
People	0	0	0	0	0.0
Lights	35	141	0	176	1.4
RA Sensible (Lights)	151	0	0	151	1.2
Miscellaneous Loads	11997	0	0	11997	95.5
Internal Subtotal	12183	141	0	12324	-
RA (All Other)	0	0	0	0	0.0
DOA Direct to Zone	0	0	0	0	0.0
Ceiling	0	173	0	173	1.4
Refrigeration	0	0	0	0	0.0
Service Water	0	0	0	0	0.0
HVAC Equipment Losses	0	0	0	0	0.0
Adj Air Transfer Heat	0	0	0	0	0.0
Sizing Factor Correction	0	0	0	0	0.0
Time Delay Correction	0	0	0	0	0.0
Grand Total	12183	382	0	12565	100.0

Conditions at Time of Space Heating Peak

Outside	DB / WB / HR	9.5 °F	/ 7.1 °F	/ 6.2 gr/lb	
Zone	DB / RH / HR	72.0 °F	/ 5.9 %	/ 6.9 gr/lb	

	Instant Sensible (Btu/h)	Time Delay Sensible (Btu/h)	Latent (Btu/h)	Total (Btu/h)	Percent of Total (%)
Roof	0	0	0	0	0.0
Other Roof	0	0	0	0	0.0
Glass	0	0	0	0	0.0
Door	0	0	0	0	0.0
Wall	0	0	0	0	0.0
Below-Grade Wall	0	0	0	0	0.0
Other Wall	0	0	0	0	0.0
Partition	0	-38	0	-38	13.2
Exterior Floor	0	0	0	0	0.0
Interior Floor	0	0	0	0	0.0
Slab	0	-40	0	-40	14.2
Other Floor	0	0	0	0	0.0
Infiltration	0	0	0	0	0.0
Envelope Subtotal	0	-78	0	-78	-
People	0	0	0	0	0.0
Lights	0	0	0	0	0.0
RA Sensible (Lights)	0	0	0	0	0.0
Miscellaneous Loads	0	0	0	0	0.0
Internal Subtotal	0	0	0	0	-
RA (All Other)	0	0	0	0	0.0
DOA Direct to Zone	0	0	0	0	0.0
Ceiling	0	-207	0	-207	72.6
Refrigeration	0	0	0	0	0.0
Service Water	0	0	0	0	0.0
HVAC Equipment Losses	0	0	0	0	0.0
Adj Air Transfer Heat	0	0	0	0	0.0
Sizing Factor Correction	0	0	0	0	0.0
Time Delay Correction	0	0	0	0	0.0
Grand Total	0	-285	0	-285	100.0

Engineering Checks

Cooling tons	1.05	Input Ventilation cfm	0
Cooling cfm	711.04	Calculated Ventilation cfm	0
ft²/ton	87.80	Number of People	0.00
cfm/ton	678.91	People per 1000 ft²	0
Conditioned ft²	91.9		

Engineering Checks

Heating Mbh	-0.28	Input Ventilation cfm	0
Heating cfm	711.04	Calculated Ventilation cfm	0
ft²/Mbh	-322.69	Number of People	0.00
cfm/Mbh	-2,495.77	People per 1000 ft²	0
Conditioned ft²	91.9		

ZONE_Zn-Room - 12 - Mens RR

Conditions at Time of Space Cooling Peak

Outside	DB / WB / HR	89.3 °F	/ 59.9 °F	/ 45.2 gr/lb	
Zone	DB / RH / HR	74.0 °F	/ 37.3 %	/ 46.4 gr/lb	

	Instant Sensible (Btu/h)	Time Delay Sensible (Btu/h)	Latent (Btu/h)	Total (Btu/h)	Percent of Total (%)
Roof	0	0	0	0	0.0
Other Roof	0	0	0	0	0.0
Glass	3150	2038	0	5187	52.6
Door	0	0	0	0	0.0
Wall	0	148	0	148	1.5
Below-Grade Wall	0	0	0	0	0.0
Other Wall	0	0	0	0	0.0
Partition	0	-23	0	-23	-0.2
Exterior Floor	0	0	0	0	0.0
Interior Floor	0	0	0	0	0.0
Slab	0	-1036	0	-1036	-10.5
Other Floor	0	0	0	0	0.0
Infiltration	668	0	-35	633	6.4
Envelope Subtotal	3818	1127	-35	4910	-
People	115	217	275	607	6.2
Lights	318	1250	0	1568	15.9
RA Sensible (Lights)	1359	0	0	1359	13.8
Miscellaneous Loads	0	0	0	0	0.0
Internal Subtotal	1792	1467	275	3534	-
RA (All Other)	0	0	0	0	0.0
DOA Direct to Zone	0	0	0	0	0.0
Ceiling	0	1414	0	1414	14.3
Refrigeration	0	0	0	0	0.0
Service Water	0	0	0	0	0.0
HVAC Equipment Losses	0	0	0	0	0.0
Adj Air Transfer Heat	0	0	0	0	0.0
Sizing Factor Correction	0	0	0	0	0.0
Time Delay Correction	0	-4	0	-4	0.0
Grand Total	5610	4004	240	9854	100.0

Engineering Checks

Cooling tons	0.82	Input Ventilation cfm	30
Cooling cfm	1,394.29	Calculated Ventilation cfm	535
ft²/ton	1228.33	Number of People	1.00
cfm/ton	1,697.59	People per 1000 ft²	1
Conditioned ft²	1008.6		

Conditions at Time of Space Heating Peak

Outside	DB / WB / HR	9.5 °F	/ 7.1 °F	/ 6.2 gr/lb	
Zone	DB / RH / HR	72.0 °F	/ 5.9 %	/ 6.8 gr/lb	

	Instant Sensible (Btu/h)	Time Delay Sensible (Btu/h)	Latent (Btu/h)	Total (Btu/h)	Percent of Total (%)
Roof	0	0	0	0	0.0
Other Roof	0	0	0	0	0.0
Glass	-2324	0	0	-2324	26.5
Door	0	0	0	0	0.0
Wall	0	-377	0	-377	4.3
Below-Grade Wall	0	0	0	0	0.0
Other Wall	0	0	0	0	0.0
Partition	0	-187	0	-187	2.1
Exterior Floor	0	0	0	0	0.0
Interior Floor	0	0	0	0	0.0
Slab	0	-422	0	-422	4.8
Other Floor	0	0	0	0	0.0
Infiltration	-3190	0	-20	-3210	36.6
Envelope Subtotal	-5514	-986	-20	-6519	-
People	0	0	0	0	0.0
Lights	0	0	0	0	0.0
RA Sensible (Lights)	0	0	0	0	0.0
Miscellaneous Loads	0	0	0	0	0.0
Internal Subtotal	0	0	0	0	-
RA (All Other)	0	0	0	0	0.0
DOA Direct to Zone	0	0	0	0	0.0
Ceiling	0	-2252	0	-2252	25.7
Refrigeration	0	0	0	0	0.0
Service Water	0	0	0	0	0.0
HVAC Equipment Losses	0	0	0	0	0.0
Adj Air Transfer Heat	0	0	0	0	0.0
Sizing Factor Correction	0	0	0	0	0.0
Time Delay Correction	0	0	0	0	0.0
Grand Total	-5514	-3238	-20	-8772	100.0

Engineering Checks

Heating Mbh	-8.77	Input Ventilation cfm	37
Heating cfm	418.29	Calculated Ventilation cfm	418
ft²/Mbh	-114.99	Number of People	1.00
cfm/Mbh	-47.69	People per 1000 ft²	1
Conditioned ft²	1008.6		

ZONE_Zn-Room - 16 - Mechanical

Conditions at Time of Space Cooling Peak

Outside	DB / WB / HR	89.5 °F	/ 60.0 °F	/ 45.2 gr/lb	
Zone	DB / RH / HR	74.0 °F	/ 36.6 %	/ 45.5 gr/lb	

	Instant Sensible (Btu/h)	Time Delay Sensible (Btu/h)	Latent (Btu/h)	Total (Btu/h)	Percent of Total (%)
Roof	0	0	0	0	0.0
Other Roof	0	0	0	0	0.0
Glass	867	490	0	1357	63.7
Door	0	0	0	0	0.0
Wall	0	149	0	149	7.0
Below-Grade Wall	0	0	0	0	0.0
Other Wall	0	0	0	0	0.0
Partition	0	203	0	203	9.5
Exterior Floor	0	0	0	0	0.0
Interior Floor	0	0	0	0	0.0
Slab	0	-226	0	-226	-10.6
Other Floor	0	0	0	0	0.0
Infiltration	0	0	0	0	0.0
Envelope Subtotal	867	616	0	1483	-
People	0	0	0	0	0.0
Lights	57	136	0	193	9.1
RA Sensible (Lights)	244	0	0	244	11.4
Miscellaneous Loads	0	0	0	0	0.0
Internal Subtotal	301	136	0	437	-
RA (All Other)	0	0	0	0	0.0
DOA Direct to Zone	0	0	0	0	0.0
Ceiling	0	211	0	211	9.9
Refrigeration	0	0	0	0	0.0
Service Water	0	0	0	0	0.0
HVAC Equipment Losses	0	0	0	0	0.0
Adj Air Transfer Heat	0	0	0	0	0.0
Sizing Factor Correction	0	0	0	0	0.0
Time Delay Correction	0	0	0	0	0.0
Grand Total	1168	963	0	2131	100.0

Engineering Checks

Cooling tons	0.18	Input Ventilation cfm	0
Cooling cfm	332.99	Calculated Ventilation cfm	128
ft²/ton	1794.43	Number of People	0.00
cfm/ton	1,874.86	People per 1000 ft²	0
Conditioned ft²	318.6		

Conditions at Time of Space Heating Peak

Outside	DB / WB / HR	9.5 °F	/ 7.1 °F	/ 6.2 gr/lb	
Zone	DB / RH / HR	72.0 °F	/ 5.9 %	/ 6.9 gr/lb	

	Instant Sensible (Btu/h)	Time Delay Sensible (Btu/h)	Latent (Btu/h)	Total (Btu/h)	Percent of Total (%)
Roof	0	0	0	0	0.0
Other Roof	0	0	0	0	0.0
Glass	-800	0	0	-800	38.3
Door	0	0	0	0	0.0
Wall	0	-392	0	-392	18.7
Below-Grade Wall	0	0	0	0	0.0
Other Wall	0	0	0	0	0.0
Partition	0	-14	0	-14	0.7
Exterior Floor	0	0	0	0	0.0
Interior Floor	0	0	0	0	0.0
Slab	0	-119	0	-119	5.7
Other Floor	0	0	0	0	0.0
Infiltration	0	0	0	0	0.0
Envelope Subtotal	-800	-525	0	-1325	-
People	0	0	0	0	0.0
Lights	0	0	0	0	0.0
RA Sensible (Lights)	0	0	0	0	0.0
Miscellaneous Loads	0	0	0	0	0.0
Internal Subtotal	0	0	0	0	-
RA (All Other)	0	0	0	0	0.0
DOA Direct to Zone	0	0	0	0	0.0
Ceiling	0	-766	0	-766	36.6
Refrigeration	0	0	0	0	0.0
Service Water	0	0	0	0	0.0
HVAC Equipment Losses	0	0	0	0	0.0
Adj Air Transfer Heat	0	0	0	0	0.0
Sizing Factor Correction	0	0	0	0	0.0
Time Delay Correction	0	0	0	0	0.0
Grand Total	-800	-1290	0	-2090	100.0

Engineering Checks

Heating Mbh	-2.09	Input Ventilation cfm	0
Heating cfm	99.90	Calculated Ventilation cfm	100
ft²/Mbh	-152.46	Number of People	0.00
cfm/Mbh	-47.80	People per 1000 ft²	0
Conditioned ft²	318.6		

ZONE_Zn-Room - 17 - Breakroom

Conditions at Time of Space Cooling Peak

Outside	DB / WB / HR	93.7 °F	/ 61.4 °F	/ 45.2 gr/lb	
Zone	DB / RH / HR	74.0 °F	/ 48.5 %	/ 60.5 gr/lb	

	Instant Sensible (Btu/h)	Time Delay Sensible (Btu/h)	Latent (Btu/h)	Total (Btu/h)	Percent of Total (%)
Roof	0	0	0	0	0.0
Other Roof	0	0	0	0	0.0
Glass	676	1385	0	2062	12.1
Door	0	0	0	0	0.0
Wall	0	109	0	109	0.6
Below-Grade Wall	0	0	0	0	0.0
Other Wall	0	0	0	0	0.0
Partition	0	-1166	0	-1166	-6.8
Exterior Floor	0	0	0	0	0.0
Interior Floor	0	0	0	0	0.0
Slab	0	-803	0	-803	-4.7
Other Floor	0	0	0	0	0.0
Infiltration	0	0	0	0	0.0
Envelope Subtotal	676	-475	0	202	-
People	2309	4127	5499	11935	69.8
Lights	172	668	0	840	4.9
RA Sensible (Lights)	735	0	0	735	4.3
Miscellaneous Loads	3199	0	0	3199	18.7
Internal Subtotal	6416	4795	5499	16710	-
RA (All Other)	0	0	0	0	0.0
DOA Direct to Zone	0	0	0	0	0.0
Ceiling	0	289	0	289	1.7
Refrigeration	0	0	0	0	0.0
Service Water	0	0	0	0	0.0
HVAC Equipment Losses	0	0	0	0	0.0
Adj Air Transfer Heat	0	0	0	0	0.0
Sizing Factor Correction	0	0	0	0	0.0
Time Delay Correction	0	-99	0	-99	-0.6
Grand Total	7092	4510	5499	17101	100.0

Engineering Checks

Cooling tons	1.43	Input Ventilation cfm	156
Cooling cfm	677.30	Calculated Ventilation cfm	260
ft²/ton	402.17	Number of People	20.02
cfm/ton	475.18	People per 1000 ft²	35
Conditioned ft²	573.1		

Conditions at Time of Space Heating Peak

Outside	DB / WB / HR	9.5 °F	/ 7.1 °F	/ 6.2 gr/lb	
Zone	DB / RH / HR	72.0 °F	/ 5.9 %	/ 6.9 gr/lb	

	Instant Sensible (Btu/h)	Time Delay Sensible (Btu/h)	Latent (Btu/h)	Total (Btu/h)	Percent of Total (%)
Roof	0	0	0	0	0.0
Other Roof	0	0	0	0	0.0
Glass	-1856	0	0	-1856	43.7
Door	0	0	0	0	0.0
Wall	0	-339	0	-339	8.0
Below-Grade Wall	0	0	0	0	0.0
Other Wall	0	0	0	0	0.0
Partition	0	-14	0	-14	0.3
Exterior Floor	0	0	0	0	0.0
Interior Floor	0	0	0	0	0.0
Slab	0	-224	0	-224	5.3
Other Floor	0	0	0	0	0.0
Infiltration	0	0	0	0	0.0
Envelope Subtotal	-1856	-577	0	-2433	-
People	0	0	0	0	0.0
Lights	0	0	0	0	0.0
RA Sensible (Lights)	0	0	0	0	0.0
Miscellaneous Loads	0	0	0	0	0.0
Internal Subtotal	0	0	0	0	-
RA (All Other)	0	0	0	0	0.0
DOA Direct to Zone	0	0	0	0	0.0
Ceiling	0	-1302	0	-1302	30.6
Refrigeration	0	0	0	0	0.0
Service Water	0	0	0	0	0.0
HVAC Equipment Losses	0	0	0	0	0.0
Adj Air Transfer Heat	0	0	0	0	0.0
Sizing Factor Correction	-516	0	0	-516	12.1
Time Delay Correction	0	0	0	0	0.0
Grand Total	-2372	-1879	0	-4251	100.0

Engineering Checks

Heating Mbh	-4.25	Input Ventilation cfm	195
Heating cfm	203.19	Calculated Ventilation cfm	203
ft²/Mbh	-134.82	Number of People	20.02
cfm/Mbh	-47.80	People per 1000 ft²	35
Conditioned ft²	573.1		

ZONE_Zn-Room - 18 - Electrical

Conditions at Time of Space Cooling Peak

Outside	DB / WB / HR	89.3 °F	/ 59.9 °F	/ 45.2 gr/lb	
Zone	DB / RH / HR	74.0 °F	/ 36.6 %	/ 45.5 gr/lb	

	Instant Sensible (Btu/h)	Time Delay Sensible (Btu/h)	Latent (Btu/h)	Total (Btu/h)	Percent of Total (%)
Roof	0	0	0	0	0.0
Other Roof	0	0	0	0	0.0
Glass	1159	754	0	1913	107.9
Door	0	0	0	0	0.0
Wall	0	89	0	89	5.0
Below-Grade Wall	0	0	0	0	0.0
Other Wall	0	0	0	0	0.0
Partition	0	-223	0	-223	-12.6
Exterior Floor	0	0	0	0	0.0
Interior Floor	0	0	0	0	0.0
Slab	0	-320	0	-320	-18.1
Other Floor	0	0	0	0	0.0
Infiltration	0	0	0	0	0.0
Envelope Subtotal	1159	299	0	1458	-
People	0	0	0	0	0.0
Lights	21	83	0	104	5.9
RA Sensible (Lights)	89	0	0	89	5.0
Miscellaneous Loads	0	0	0	0	0.0
Internal Subtotal	110	83	0	193	-
RA (All Other)	0	0	0	0	0.0
DOA Direct to Zone	0	0	0	0	0.0
Ceiling	0	121	0	121	6.8
Refrigeration	0	0	0	0	0.0
Service Water	0	0	0	0	0.0
HVAC Equipment Losses	0	0	0	0	0.0
Adj Air Transfer Heat	0	0	0	0	0.0
Sizing Factor Correction	0	0	0	0	0.0
Time Delay Correction	0	0	0	0	0.0
Grand Total	1269	503	0	1772	100.0

Engineering Checks

Cooling tons	0.15	Input Ventilation cfm	N/A
Cooling cfm	57.31	Calculated Ventilation cfm	N/A
ft²/ton	788.64	Number of People	0.00
cfm/ton	387.96	People per 1000 ft²	0
Conditioned ft²	116.5		

Conditions at Time of Space Heating Peak

Outside	DB / WB / HR	9.5 °F	/ 7.1 °F	/ 6.2 gr/lb	
Zone	DB / RH / HR	72.0 °F	/ 5.9 %	/ 6.9 gr/lb	

	Instant Sensible (Btu/h)	Time Delay Sensible (Btu/h)	Latent (Btu/h)	Total (Btu/h)	Percent of Total (%)
Roof	0	0	0	0	0.0
Other Roof	0	0	0	0	0.0
Glass	-756	0	0	-756	63.0
Door	0	0	0	0	0.0
Wall	0	-201	0	-201	16.7
Below-Grade Wall	0	0	0	0	0.0
Other Wall	0	0	0	0	0.0
Partition	0	86	0	86	-7.1
Exterior Floor	0	0	0	0	0.0
Interior Floor	0	0	0	0	0.0
Slab	0	-44	0	-44	3.7
Other Floor	0	0	0	0	0.0
Infiltration	0	0	0	0	0.0
Envelope Subtotal	-756	-159	0	-915	-
People	0	0	0	0	0.0
Lights	0	0	0	0	0.0
RA Sensible (Lights)	0	0	0	0	0.0
Miscellaneous Loads	0	0	0	0	0.0
Internal Subtotal	0	0	0	0	-
RA (All Other)	0	0	0	0	0.0
DOA Direct to Zone	0	0	0	0	0.0
Ceiling	0	-284	0	-284	23.7
Refrigeration	0	0	0	0	0.0
Service Water	0	0	0	0	0.0
HVAC Equipment Losses	0	0	0	0	0.0
Adj Air Transfer Heat	0	0	0	0	0.0
Sizing Factor Correction	0	0	0	0	0.0
Time Delay Correction	0	0	0	0	0.0
Grand Total	-756	-443	0	-1199	100.0

Engineering Checks

Heating Mbh	-1.20	Input Ventilation cfm	N/A
Heating cfm	57.31	Calculated Ventilation cfm	N/A
ft²/Mbh	-97.14	Number of People	0.00
cfm/Mbh	-47.80	People per 1000 ft²	0
Conditioned ft²	116.5		

ZONE_Zn-Room - 21 - Fire Riser

Conditions at Time of Space Cooling Peak

Outside	DB / WB / HR	89.3 °F	/ 59.9 °F	/ 45.2 gr/lb	
Zone	DB / RH / HR	74.0 °F	/ 36.6 %	/ 45.5 gr/lb	

	Instant Sensible (Btu/h)	Time Delay Sensible (Btu/h)	Latent (Btu/h)	Total (Btu/h)	Percent of Total (%)
Roof	0	0	0	0	0.0
Other Roof	0	0	0	0	0.0
Glass	1150	856	0	2006	126.6
Door	0	0	0	0	0.0
Wall	0	37	0	37	2.3
Below-Grade Wall	0	0	0	0	0.0
Other Wall	0	0	0	0	0.0
Partition	0	-339	0	-339	-21.4
Exterior Floor	0	0	0	0	0.0
Interior Floor	0	0	0	0	0.0
Slab	0	-244	0	-244	-15.4
Other Floor	0	0	0	0	0.0
Infiltration	0	0	0	0	0.0
Envelope Subtotal	1150	310	0	1461	-
People	0	0	0	0	0.0
Lights	12	54	0	66	4.1
RA Sensible (Lights)	50	0	0	50	3.1
Miscellaneous Loads	0	0	0	0	0.0
Internal Subtotal	61	54	0	115	-
RA (All Other)	0	0	0	0	0.0
DOA Direct to Zone	0	0	0	0	0.0
Ceiling	0	10	0	10	0.6
Refrigeration	0	0	0	0	0.0
Service Water	0	0	0	0	0.0
HVAC Equipment Losses	0	0	0	0	0.0
Adj Air Transfer Heat	0	0	0	0	0.0
Sizing Factor Correction	0	0	0	0	0.0
Time Delay Correction	0	0	0	0	0.0
Grand Total	1212	374	0	1585	100.0

Engineering Checks

Cooling tons	0.13	Input Ventilation cfm	N/A
Cooling cfm	44.90	Calculated Ventilation cfm	N/A
ft²/ton	492.15	Number of People	0.00
cfm/ton	339.77	People per 1000 ft²	0
Conditioned ft²	65.0		

Conditions at Time of Space Heating Peak

Outside	DB / WB / HR	9.5 °F	/ 7.1 °F	/ 6.2 gr/lb	
Zone	DB / RH / HR	72.0 °F	/ 5.9 %	/ 6.9 gr/lb	

	Instant Sensible (Btu/h)	Time Delay Sensible (Btu/h)	Latent (Btu/h)	Total (Btu/h)	Percent of Total (%)
Roof	0	0	0	0	0.0
Other Roof	0	0	0	0	0.0
Glass	-754	0	0	-754	80.2
Door	0	0	0	0	0.0
Wall	0	-95	0	-95	10.1
Below-Grade Wall	0	0	0	0	0.0
Other Wall	0	0	0	0	0.0
Partition	0	86	0	86	-9.1
Exterior Floor	0	0	0	0	0.0
Interior Floor	0	0	0	0	0.0
Slab	0	-24	0	-24	2.6
Other Floor	0	0	0	0	0.0
Infiltration	0	0	0	0	0.0
Envelope Subtotal	-754	-34	0	-787	-
People	0	0	0	0	0.0
Lights	0	0	0	0	0.0
RA Sensible (Lights)	0	0	0	0	0.0
Miscellaneous Loads	0	0	0	0	0.0
Internal Subtotal	0	0	0	0	-
RA (All Other)	0	0	0	0	0.0
DOA Direct to Zone	0	0	0	0	0.0
Ceiling	0	-152	0	-152	16.2
Refrigeration	0	0	0	0	0.0
Service Water	0	0	0	0	0.0
HVAC Equipment Losses	0	0	0	0	0.0
Adj Air Transfer Heat	0	0	0	0	0.0
Sizing Factor Correction	0	0	0	0	0.0
Time Delay Correction	0	0	0	0	0.0
Grand Total	-754	-186	0	-939	100.0

Engineering Checks

Heating Mbh	-0.94	Input Ventilation cfm	N/A
Heating cfm	44.90	Calculated Ventilation cfm	N/A
ft²/Mbh	-69.22	Number of People	0.00
cfm/Mbh	-47.80	People per 1000 ft²	0
Conditioned ft²	65.0		

ZONE_Zn-Room - 23 - Open Office

Conditions at Time of Space Cooling Peak

Outside	DB / WB / HR	85.6 °F	/ 58.7 °F	/ 45.1 gr/lb	
Zone	DB / RH / HR	74.0 °F	/ 41.5 %	/ 51.7 gr/lb	

	Instant Sensible (Btu/h)	Time Delay Sensible (Btu/h)	Latent (Btu/h)	Total (Btu/h)	Percent of Total (%)
Roof	0	0	0	0	0.0
Other Roof	0	0	0	0	0.0
Glass	2730	4202	0	6931	18.7
Door	0	0	0	0	0.0
Wall	0	311	0	311	0.8
Below-Grade Wall	0	0	0	0	0.0
Other Wall	0	0	0	0	0.0
Partition	0	-572	0	-572	-1.5
Exterior Floor	0	0	0	0	0.0
Interior Floor	0	0	0	0	0.0
Slab	0	-3251	0	-3251	-8.8
Other Floor	0	0	0	0	0.0
Infiltration	0	0	0	0	0.0
Envelope Subtotal	2730	690	0	3419	-
People	3149	5046	5999	14194	38.3
Lights	528	1709	0	2237	6.0
RA Sensible (Lights)	2257	0	0	2257	6.1
Miscellaneous Loads	12997	0	0	12997	35.1
Internal Subtotal	18932	6755	5999	31685	-
RA (All Other)	0	0	0	0	0.0
DOA Direct to Zone	0	0	0	0	0.0
Ceiling	0	2134	0	2134	5.8
Refrigeration	0	0	0	0	0.0
Service Water	0	0	0	0	0.0
HVAC Equipment Losses	0	0	0	0	0.0
Adj Air Transfer Heat	0	0	0	0	0.0
Sizing Factor Correction	0	0	0	0	0.0
Time Delay Correction	0	-225	0	-225	-0.6
Grand Total	21661	9354	5999	37014	100.0

Conditions at Time of Space Heating Peak

Outside	DB / WB / HR	9.5 °F	/ 7.1 °F	/ 6.2 gr/lb	
Zone	DB / RH / HR	72.0 °F	/ 5.9 %	/ 6.9 gr/lb	

	Instant Sensible (Btu/h)	Time Delay Sensible (Btu/h)	Latent (Btu/h)	Total (Btu/h)	Percent of Total (%)
Roof	0	0	0	0	0.0
Other Roof	0	0	0	0	0.0
Glass	-5529	0	0	-5529	51.2
Door	0	0	0	0	0.0
Wall	0	-1092	0	-1092	10.1
Below-Grade Wall	0	0	0	0	0.0
Other Wall	0	0	0	0	0.0
Partition	0	165	0	165	-1.5
Exterior Floor	0	0	0	0	0.0
Interior Floor	0	0	0	0	0.0
Slab	0	-568	0	-568	5.3
Other Floor	0	0	0	0	0.0
Infiltration	0	0	0	0	0.0
Envelope Subtotal	-5529	-1495	0	-7024	-
People	0	0	0	0	0.0
Lights	0	0	0	0	0.0
RA Sensible (Lights)	0	0	0	0	0.0
Miscellaneous Loads	0	0	0	0	0.0
Internal Subtotal	0	0	0	0	-
RA (All Other)	0	0	0	0	0.0
DOA Direct to Zone	0	0	0	0	0.0
Ceiling	0	-3765	0	-3765	34.9
Refrigeration	0	0	0	0	0.0
Service Water	0	0	0	0	0.0
HVAC Equipment Losses	0	0	0	0	0.0
Adj Air Transfer Heat	0	0	0	0	0.0
Sizing Factor Correction	0	0	0	0	0.0
Time Delay Correction	0	0	0	0	0.0
Grand Total	-5529	-5260	0	-10789	100.0

Engineering Checks

Cooling tons	3.08	Input Ventilation cfm	252
Cooling cfm	1,718.96	Calculated Ventilation cfm	660
ft²/ton	550.21	Number of People	29.97
cfm/ton	557.19	People per 1000 ft²	18
Conditioned ft²	1696.9		

Engineering Checks

Heating Mbh	-10.79	Input Ventilation cfm	315
Heating cfm	515.69	Calculated Ventilation cfm	516
ft²/Mbh	-157.29	Number of People	29.97
cfm/Mbh	-47.80	People per 1000 ft²	18
Conditioned ft²	1696.9		

ZONE_Zn-Room - 24 - Open Office

Conditions at Time of Space Cooling Peak

Outside	DB / WB / HR	93.7 °F	/ 61.4 °F	/ 45.2 gr/lb	
Zone	DB / RH / HR	74.0 °F	/ 41.6 %	/ 51.9 gr/lb	

	Instant Sensible (Btu/h)	Time Delay Sensible (Btu/h)	Latent (Btu/h)	Total (Btu/h)	Percent of Total (%)
Roof	0	0	0	0	0.0
Other Roof	0	0	0	0	0.0
Glass	2626	3801	0	6427	17.7
Door	0	0	0	0	0.0
Wall	0	220	0	220	0.6
Below-Grade Wall	0	0	0	0	0.0
Other Wall	0	0	0	0	0.0
Partition	0	-575	0	-575	-1.6
Exterior Floor	0	0	0	0	0.0
Interior Floor	0	0	0	0	0.0
Slab	0	-3549	0	-3549	-9.8
Other Floor	0	0	0	0	0.0
Infiltration	0	0	0	0	0.0
Envelope Subtotal	2626	-102	0	2523	-
People	3149	4697	5999	13845	38.1
Lights	527	1716	0	2243	6.2
RA Sensible (Lights)	2253	0	0	2253	6.2
Miscellaneous Loads	12997	0	0	12997	35.8
Internal Subtotal	18926	6413	5999	31338	-
RA (All Other)	0	0	0	0	0.0
DOA Direct to Zone	0	0	0	0	0.0
Ceiling	0	2678	0	2678	7.4
Refrigeration	0	0	0	0	0.0
Service Water	0	0	0	0	0.0
HVAC Equipment Losses	0	0	0	0	0.0
Adj Air Transfer Heat	0	0	0	0	0.0
Sizing Factor Correction	0	0	0	0	0.0
Time Delay Correction	0	-239	0	-239	-0.7
Grand Total	21552	8749	5999	36300	100.0

Conditions at Time of Space Heating Peak

Outside	DB / WB / HR	9.5 °F	/ 7.1 °F	/ 6.2 gr/lb	
Zone	DB / RH / HR	72.0 °F	/ 5.9 %	/ 6.9 gr/lb	

	Instant Sensible (Btu/h)	Time Delay Sensible (Btu/h)	Latent (Btu/h)	Total (Btu/h)	Percent of Total (%)
Roof	0	0	0	0	0.0
Other Roof	0	0	0	0	0.0
Glass	-7015	0	0	-7015	58.7
Door	0	0	0	0	0.0
Wall	0	-981	0	-981	8.2
Below-Grade Wall	0	0	0	0	0.0
Other Wall	0	0	0	0	0.0
Partition	0	290	0	290	-2.4
Exterior Floor	0	0	0	0	0.0
Interior Floor	0	0	0	0	0.0
Slab	0	-552	0	-552	4.6
Other Floor	0	0	0	0	0.0
Infiltration	0	0	0	0	0.0
Envelope Subtotal	-7015	-1243	0	-8258	-
People	0	0	0	0	0.0
Lights	0	0	0	0	0.0
RA Sensible (Lights)	0	0	0	0	0.0
Miscellaneous Loads	0	0	0	0	0.0
Internal Subtotal	0	0	0	0	-
RA (All Other)	0	0	0	0	0.0
DOA Direct to Zone	0	0	0	0	0.0
Ceiling	0	-3694	0	-3694	30.9
Refrigeration	0	0	0	0	0.0
Service Water	0	0	0	0	0.0
HVAC Equipment Losses	0	0	0	0	0.0
Adj Air Transfer Heat	0	0	0	0	0.0
Sizing Factor Correction	0	0	0	0	0.0
Time Delay Correction	0	0	0	0	0.0
Grand Total	-7015	-4937	0	-11952	100.0

Engineering Checks

Cooling tons	3.02	Input Ventilation cfm	252
Cooling cfm	1,904.20	Calculated Ventilation cfm	731
ft²/ton	560.00	Number of People	29.97
cfm/ton	629.37	People per 1000 ft²	18
Conditioned ft²	1693.8		

Engineering Checks

Heating Mbh	-11.95	Input Ventilation cfm	315
Heating cfm	571.26	Calculated Ventilation cfm	571
ft²/Mbh	-141.73	Number of People	29.97
cfm/Mbh	-47.80	People per 1000 ft²	18
Conditioned ft²	1693.8		

ZONE_Zn-Room - 25 - Open Office

Conditions at Time of Space Cooling Peak

Outside	DB / WB / HR	85.6 °F	/ 58.7 °F	/ 45.1 gr/lb	
Zone	DB / RH / HR	74.0 °F	/ 41.5 %	/ 51.7 gr/lb	

	Instant Sensible (Btu/h)	Time Delay Sensible (Btu/h)	Latent (Btu/h)	Total (Btu/h)	Percent of Total (%)
Roof	0	0	0	0	0.0
Other Roof	0	0	0	0	0.0
Glass	3157	4306	0	7463	20.0
Door	0	0	0	0	0.0
Wall	0	254	0	254	0.7
Below-Grade Wall	0	0	0	0	0.0
Other Wall	0	0	0	0	0.0
Partition	0	-568	0	-568	-1.5
Exterior Floor	0	0	0	0	0.0
Interior Floor	0	0	0	0	0.0
Slab	0	-3349	0	-3349	-9.0
Other Floor	0	0	0	0	0.0
Infiltration	0	0	0	0	0.0
Envelope Subtotal	3157	643	0	3799	-
People	3149	4959	5999	14106	37.8
Lights	528	1677	0	2205	5.9
RA Sensible (Lights)	2255	0	0	2255	6.0
Miscellaneous Loads	12997	0	0	12997	34.8
Internal Subtotal	18929	6636	5999	31564	-
RA (All Other)	0	0	0	0	0.0
DOA Direct to Zone	0	0	0	0	0.0
Ceiling	0	2161	0	2161	5.8
Refrigeration	0	0	0	0	0.0
Service Water	0	0	0	0	0.0
HVAC Equipment Losses	0	0	0	0	0.0
Adj Air Transfer Heat	0	0	0	0	0.0
Sizing Factor Correction	0	0	0	0	0.0
Time Delay Correction	0	-222	0	-222	-0.6
Grand Total	22086	9218	5999	37303	100.0

Engineering Checks

Cooling tons	3.11	Input Ventilation cfm	252
Cooling cfm	1,703.87	Calculated Ventilation cfm	654
ft²/ton	545.49	Number of People	30.00
cfm/ton	548.02	People per 1000 ft²	18
Conditioned ft²	1695.5		

Conditions at Time of Space Heating Peak

Outside	DB / WB / HR	9.5 °F	/ 7.1 °F	/ 6.2 gr/lb	
Zone	DB / RH / HR	72.0 °F	/ 5.9 %	/ 6.9 gr/lb	

	Instant Sensible (Btu/h)	Time Delay Sensible (Btu/h)	Latent (Btu/h)	Total (Btu/h)	Percent of Total (%)
Roof	0	0	0	0	0.0
Other Roof	0	0	0	0	0.0
Glass	-5434	0	0	-5434	50.8
Door	0	0	0	0	0.0
Wall	0	-1095	0	-1095	10.2
Below-Grade Wall	0	0	0	0	0.0
Other Wall	0	0	0	0	0.0
Partition	0	176	0	176	-1.6
Exterior Floor	0	0	0	0	0.0
Interior Floor	0	0	0	0	0.0
Slab	0	-568	0	-568	5.3
Other Floor	0	0	0	0	0.0
Infiltration	0	0	0	0	0.0
Envelope Subtotal	-5434	-1487	0	-6921	-
People	0	0	0	0	0.0
Lights	0	0	0	0	0.0
RA Sensible (Lights)	0	0	0	0	0.0
Miscellaneous Loads	0	0	0	0	0.0
Internal Subtotal	0	0	0	0	-
RA (All Other)	0	0	0	0	0.0
DOA Direct to Zone	0	0	0	0	0.0
Ceiling	0	-3774	0	-3774	35.3
Refrigeration	0	0	0	0	0.0
Service Water	0	0	0	0	0.0
HVAC Equipment Losses	0	0	0	0	0.0
Adj Air Transfer Heat	0	0	0	0	0.0
Sizing Factor Correction	0	0	0	0	0.0
Time Delay Correction	0	0	0	0	0.0
Grand Total	-5434	-5261	0	-10695	100.0

Engineering Checks

Heating Mbh	-10.69	Input Ventilation cfm	315
Heating cfm	511.16	Calculated Ventilation cfm	511
ft²/Mbh	-158.56	Number of People	30.00
cfm/Mbh	-47.80	People per 1000 ft²	18
Conditioned ft²	1695.5		

ZONE_Zn-Room - 26 - Open Office

Conditions at Time of Space Cooling Peak

Outside	DB / WB / HR	93.7 °F	/ 61.4 °F	/ 45.2 gr/lb	
Zone	DB / RH / HR	74.0 °F	/ 41.7 %	/ 51.9 gr/lb	

	Instant Sensible (Btu/h)	Time Delay Sensible (Btu/h)	Latent (Btu/h)	Total (Btu/h)	Percent of Total (%)
Roof	0	0	0	0	0.0
Other Roof	0	0	0	0	0.0
Glass	2562	3759	0	6321	17.6
Door	0	0	0	0	0.0
Wall	0	131	0	131	0.4
Below-Grade Wall	0	0	0	0	0.0
Other Wall	0	0	0	0	0.0
Partition	0	-749	0	-749	-2.1
Exterior Floor	0	0	0	0	0.0
Interior Floor	0	0	0	0	0.0
Slab	0	-2660	0	-2660	-7.4
Other Floor	0	0	0	0	0.0
Infiltration	0	0	0	0	0.0
Envelope Subtotal	2562	480	0	3042	-
People	3149	4738	5999	13886	38.6
Lights	507	1642	0	2149	6.0
RA Sensible (Lights)	2167	0	0	2167	6.0
Miscellaneous Loads	12997	0	0	12997	36.1
Internal Subtotal	18820	6380	5999	31198	-
RA (All Other)	0	0	0	0	0.0
DOA Direct to Zone	0	0	0	0	0.0
Ceiling	0	1998	0	1998	5.6
Refrigeration	0	0	0	0	0.0
Service Water	0	0	0	0	0.0
HVAC Equipment Losses	0	0	0	0	0.0
Adj Air Transfer Heat	0	0	0	0	0.0
Sizing Factor Correction	0	0	0	0	0.0
Time Delay Correction	0	-246	0	-246	-0.7
Grand Total	21382	8612	5999	35992	100.0

Engineering Checks

Cooling tons	3.00	Input Ventilation cfm	248
Cooling cfm	1,830.32	Calculated Ventilation cfm	702
ft²/ton	543.17	Number of People	30.03
cfm/ton	610.12	People per 1000 ft²	18
Conditioned ft²	1629.0		

Conditions at Time of Space Heating Peak

Outside	DB / WB / HR	9.5 °F	/ 7.1 °F	/ 6.2 gr/lb	
Zone	DB / RH / HR	72.0 °F	/ 5.9 %	/ 6.9 gr/lb	

	Instant Sensible (Btu/h)	Time Delay Sensible (Btu/h)	Latent (Btu/h)	Total (Btu/h)	Percent of Total (%)
Roof	0	0	0	0	0.0
Other Roof	0	0	0	0	0.0
Glass	-6857	0	0	-6857	59.7
Door	0	0	0	0	0.0
Wall	0	-908	0	-908	7.9
Below-Grade Wall	0	0	0	0	0.0
Other Wall	0	0	0	0	0.0
Partition	0	300	0	300	-2.6
Exterior Floor	0	0	0	0	0.0
Interior Floor	0	0	0	0	0.0
Slab	0	-522	0	-522	4.5
Other Floor	0	0	0	0	0.0
Infiltration	0	0	0	0	0.0
Envelope Subtotal	-6857	-1130	0	-7988	-
People	0	0	0	0	0.0
Lights	0	0	0	0	0.0
RA Sensible (Lights)	0	0	0	0	0.0
Miscellaneous Loads	0	0	0	0	0.0
Internal Subtotal	0	0	0	0	-
RA (All Other)	0	0	0	0	0.0
DOA Direct to Zone	0	0	0	0	0.0
Ceiling	0	-3501	0	-3501	30.5
Refrigeration	0	0	0	0	0.0
Service Water	0	0	0	0	0.0
HVAC Equipment Losses	0	0	0	0	0.0
Adj Air Transfer Heat	0	0	0	0	0.0
Sizing Factor Correction	0	0	0	0	0.0
Time Delay Correction	0	0	0	0	0.0
Grand Total	-6857	-4631	0	-11488	100.0

Engineering Checks

Heating Mbh	-11.49	Input Ventilation cfm	310
Heating cfm	549.10	Calculated Ventilation cfm	549
ft²/Mbh	-141.81	Number of People	30.03
cfm/Mbh	-47.80	People per 1000 ft²	18
Conditioned ft²	1629.0		

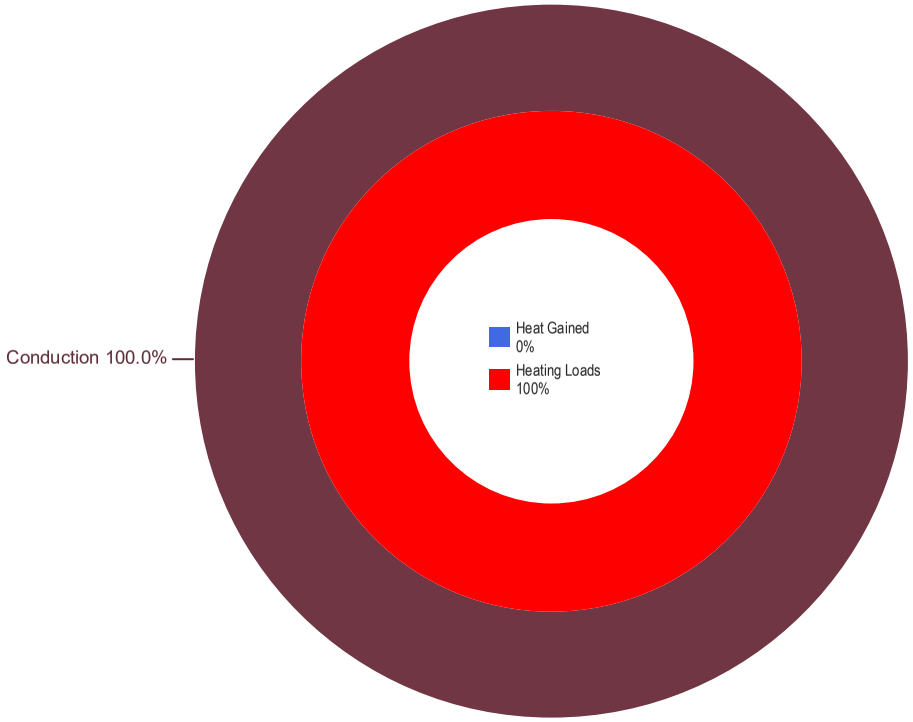
Zone Heating Loads by Component

ZONE_Zn-Room - 04 - Conference 1/21 24:00:00

Conditions at Time of Space Heating Peak

Outside	DB / WB / HR	9.5 °F	/ 7.1 °F	/	6.2 gr/lb
Zone	DB / RH / HR	72.0 °F	/ 5.9 %	/	6.9 gr/lb

	Instant Sensible (Btu/h)	Time Delay Sensible (Btu/h)	Latent (Btu/h)	Total (Btu/h)	Percent of Total (%)
Roof	0	0	0	0	0.0
Other Roof	0	0	0	0	0.0
Glass	0	0	0	0	0.0
Door	0	0	0	0	0.0
Wall	0	0	0	0	0.0
Below-Grade Wall	0	0	0	0	0.0
Other Wall	0	0	0	0	0.0
Partition	0	-102	0	-102	24.6
Exterior Floor	0	0	0	0	0.0
Interior Floor	0	0	0	0	0.0
Slab	0	-48	0	-48	11.6
Other Floor	0	0	0	0	0.0
Infiltration	0	0	0	0	0.0
Envelope Subtotal	0	-150	0	-150	-
People	0	0	0	0	0.0
Lights	0	0	0	0	0.0
RA Sensible (Lights)	0	0	0	0	0.0
Miscellaneous Loads	0	0	0	0	0.0
Internal Subtotal	0	0	0	0	-
RA (All Other)	0	0	0	0	0.0
DOA Direct to Zone	0	0	0	0	0.0
Ceiling	0	-263	0	-263	63.7
Refrigeration	0	0	0	0	0.0
Service Water	0	0	0	0	0.0
HVAC Equipment Losses	0	0	0	0	0.0
Adj Air Transfer Heat	0	0	0	0	0.0
Sizing Factor Correction	0	0	0	0	0.0
Time Delay Correction	0	0	0	0	0.0
Grand Total	0	-413	0	-413	100.0



*Does not reflect Time Delay and Sizing Factor Correction effects

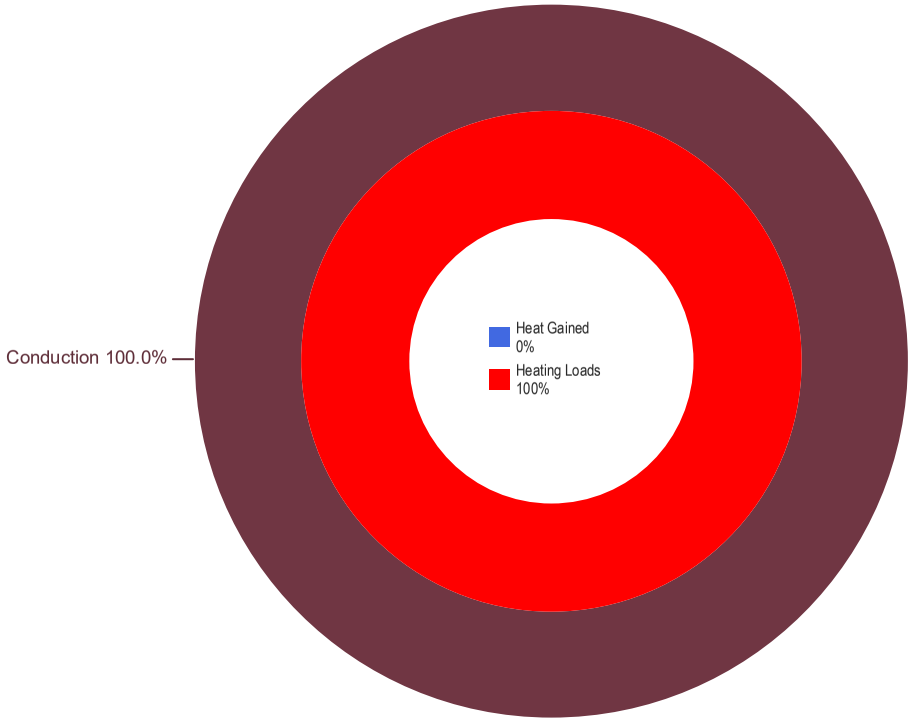
Engineering Checks

Heating Mbh	-0.41	Input Ventilation cfm	40
Heating cfm	43.43	Calculated Ventilation cfm	43
ft²/Mbh	-270.64	Number of People	4.99
cfm/Mbh	-105.19	People per 1000 ft²	45
Conditioned ft²	111.7		

Conditions at Time of Space Heating Peak

Outside	DB / WB / HR	9.5 °F	/	7.1 °F	/	6.2 gr/lb
Zone	DB / RH / HR	72.0 °F	/	5.9 %	/	6.9 gr/lb

	Instant Sensible (Btu/h)	Time Delay Sensible (Btu/h)	Latent (Btu/h)	Total (Btu/h)	Percent of Total (%)
Roof	0	0	0	0	0.0
Other Roof	0	0	0	0	0.0
Glass	0	0	0	0	0.0
Door	0	0	0	0	0.0
Wall	0	-6	0	-6	0.4
Below-Grade Wall	0	0	0	0	0.0
Other Wall	0	0	0	0	0.0
Partition	0	-319	0	-319	24.8
Exterior Floor	0	0	0	0	0.0
Interior Floor	0	0	0	0	0.0
Slab	0	-153	0	-153	11.8
Other Floor	0	0	0	0	0.0
Infiltration	0	0	0	0	0.0
Envelope Subtotal	0	-478	0	-478	-
People	0	0	0	0	0.0
Lights	0	0	0	0	0.0
RA Sensible (Lights)	0	0	0	0	0.0
Miscellaneous Loads	0	0	0	0	0.0
Internal Subtotal	0	0	0	0	-
RA (All Other)	0	0	0	0	0.0
DOA Direct to Zone	0	0	0	0	0.0
Ceiling	0	-811	0	-811	62.9
Refrigeration	0	0	0	0	0.0
Service Water	0	0	0	0	0.0
HVAC Equipment Losses	0	0	0	0	0.0
Adj Air Transfer Heat	0	0	0	0	0.0
Sizing Factor Correction	0	0	0	0	0.0
Time Delay Correction	0	0	0	0	0.0
Grand Total	0	-1289	0	-1289	100.0



*Does not reflect Time Delay and Sizing Factor Correction effects

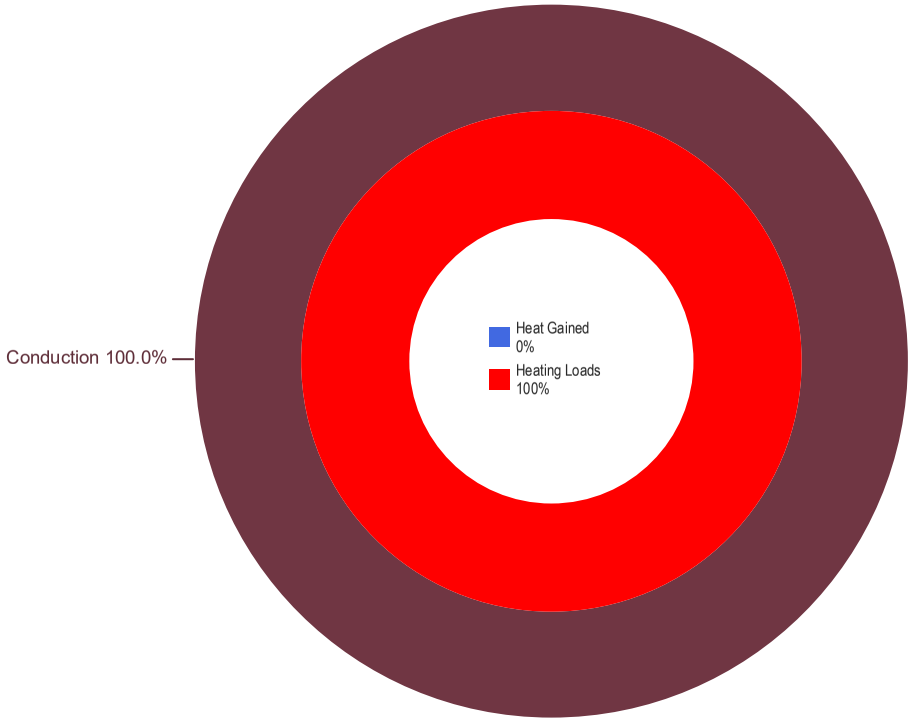
Engineering Checks

Heating Mbh	-1.29	Input Ventilation cfm	64
Heating cfm	69.80	Calculated Ventilation cfm	70
ft²/Mbh	-278.57	Number of People	6.00
cfm/Mbh	-54.14	People per 1000 ft²	17
Conditioned ft²	359.1		

Conditions at Time of Space Heating Peak

Outside	DB / WB / HR	9.5 °F	/	7.1 °F	/	6.2 gr/lb
Zone	DB / RH / HR	72.0 °F	/	5.9 %	/	6.9 gr/lb

	Instant Sensible (Btu/h)	Time Delay Sensible (Btu/h)	Latent (Btu/h)	Total (Btu/h)	Percent of Total (%)
Roof	0	0	0	0	0.0
Other Roof	0	0	0	0	0.0
Glass	0	0	0	0	0.0
Door	0	0	0	0	0.0
Wall	0	0	0	0	0.0
Below-Grade Wall	0	0	0	0	0.0
Other Wall	0	0	0	0	0.0
Partition	0	-49	0	-49	6.5
Exterior Floor	0	0	0	0	0.0
Interior Floor	0	0	0	0	0.0
Slab	0	-115	0	-115	15.2
Other Floor	0	0	0	0	0.0
Infiltration	0	0	0	0	0.0
Envelope Subtotal	0	-164	0	-164	-
People	0	0	0	0	0.0
Lights	0	0	0	0	0.0
RA Sensible (Lights)	0	0	0	0	0.0
Miscellaneous Loads	0	0	0	0	0.0
Internal Subtotal	0	0	0	0	-
RA (All Other)	0	0	0	0	0.0
DOA Direct to Zone	0	0	0	0	0.0
Ceiling	0	-593	0	-593	78.3
Refrigeration	0	0	0	0	0.0
Service Water	0	0	0	0	0.0
HVAC Equipment Losses	0	0	0	0	0.0
Adj Air Transfer Heat	0	0	0	0	0.0
Sizing Factor Correction	0	0	0	0	0.0
Time Delay Correction	0	0	0	0	0.0
Grand Total	0	-757	0	-757	100.0



*Does not reflect Time Delay and Sizing Factor Correction effects

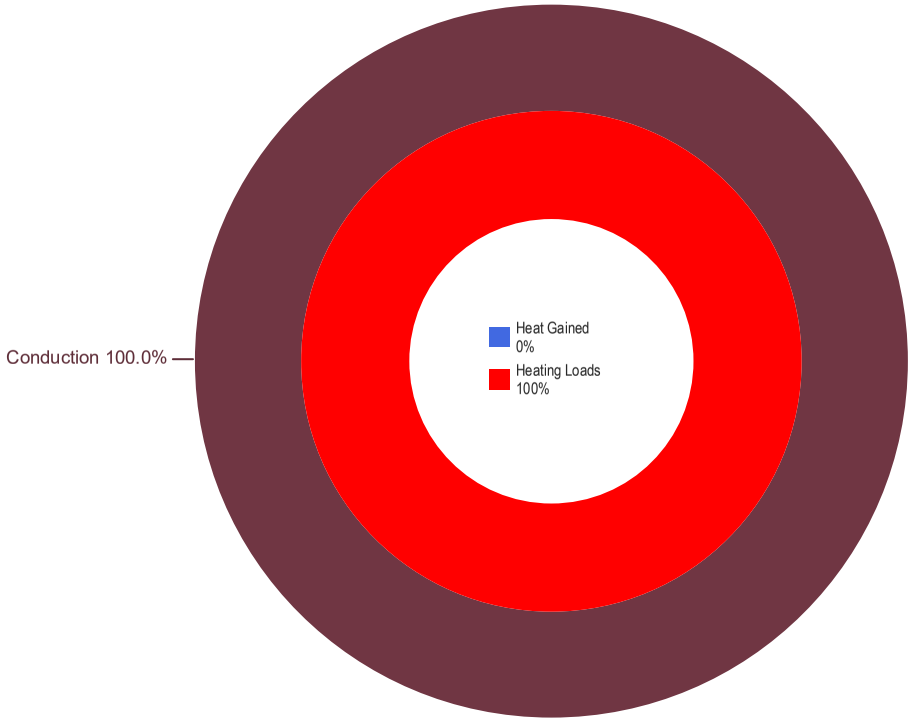
Engineering Checks

Heating Mbh	-0.76	Input Ventilation cfm	95
Heating cfm	95.41	Calculated Ventilation cfm	95
ft²/Mbh	-359.30	Number of People	11.98
cfm/Mbh	-125.97	People per 1000 ft²	44
Conditioned ft²	272.1		

Conditions at Time of Space Heating Peak

Outside	DB / WB / HR	9.5 °F	/	7.1 °F	/	6.2 gr/lb
Zone	DB / RH / HR	72.0 °F	/	5.9 %	/	6.9 gr/lb

	Instant Sensible (Btu/h)	Time Delay Sensible (Btu/h)	Latent (Btu/h)	Total (Btu/h)	Percent of Total (%)
Roof	0	0	0	0	0.0
Other Roof	0	0	0	0	0.0
Glass	0	0	0	0	0.0
Door	0	0	0	0	0.0
Wall	0	0	0	0	0.0
Below-Grade Wall	0	0	0	0	0.0
Other Wall	0	0	0	0	0.0
Partition	0	-366	0	-366	22.4
Exterior Floor	0	0	0	0	0.0
Interior Floor	0	0	0	0	0.0
Slab	0	-205	0	-205	12.5
Other Floor	0	0	0	0	0.0
Infiltration	0	0	0	0	0.0
Envelope Subtotal	0	-571	0	-571	-
People	0	0	0	0	0.0
Lights	0	0	0	0	0.0
RA Sensible (Lights)	0	0	0	0	0.0
Miscellaneous Loads	0	0	0	0	0.0
Internal Subtotal	0	0	0	0	-
RA (All Other)	0	0	0	0	0.0
DOA Direct to Zone	0	0	0	0	0.0
Ceiling	0	-1066	0	-1066	65.1
Refrigeration	0	0	0	0	0.0
Service Water	0	0	0	0	0.0
HVAC Equipment Losses	0	0	0	0	0.0
Adj Air Transfer Heat	0	0	0	0	0.0
Sizing Factor Correction	0	0	0	0	0.0
Time Delay Correction	0	0	0	0	0.0
Grand Total	0	-1637	0	-1637	100.0



*Does not reflect Time Delay and Sizing Factor Correction effects

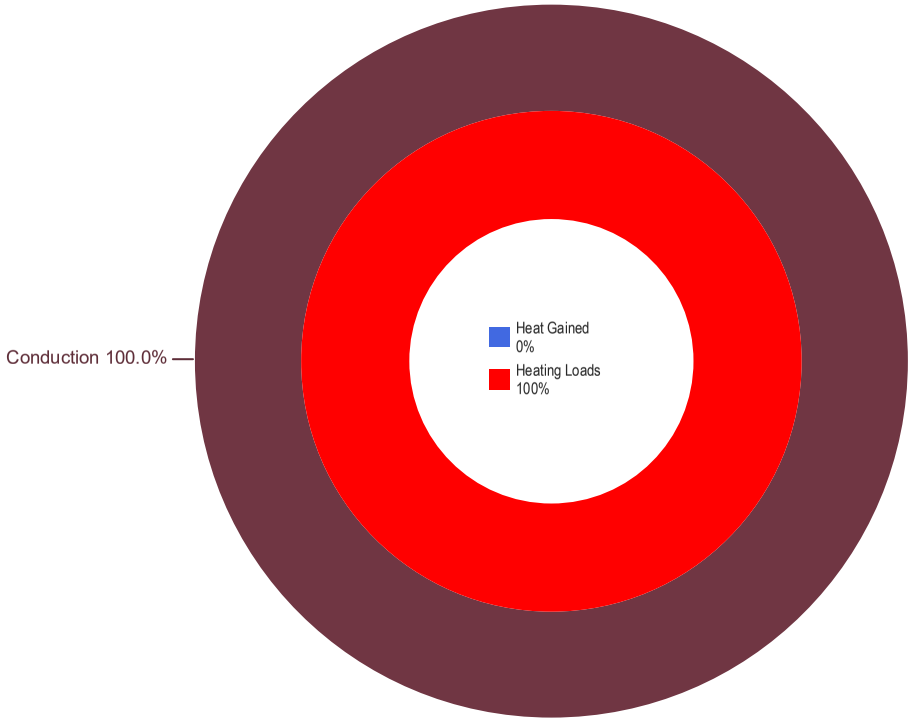
Engineering Checks

Heating Mbh	-1.64	Input Ventilation cfm	86
Heating cfm	89.16	Calculated Ventilation cfm	89
ft²/Mbh	-292.66	Number of People	8.00
cfm/Mbh	-54.47	People per 1000 ft²	17
Conditioned ft²	479.0		

Conditions at Time of Space Heating Peak

Outside	DB / WB / HR	9.5 °F	/ 7.1 °F	/	6.2 gr/lb
Zone	DB / RH / HR	72.0 °F	/ 5.9 %	/	6.9 gr/lb

	Instant Sensible (Btu/h)	Time Delay Sensible (Btu/h)	Latent (Btu/h)	Total (Btu/h)	Percent of Total (%)
Roof	0	0	0	0	0.0
Other Roof	0	0	0	0	0.0
Glass	0	0	0	0	0.0
Door	0	0	0	0	0.0
Wall	0	0	0	0	0.0
Below-Grade Wall	0	0	0	0	0.0
Other Wall	0	0	0	0	0.0
Partition	0	-38	0	-38	13.2
Exterior Floor	0	0	0	0	0.0
Interior Floor	0	0	0	0	0.0
Slab	0	-40	0	-40	14.2
Other Floor	0	0	0	0	0.0
Infiltration	0	0	0	0	0.0
Envelope Subtotal	0	-78	0	-78	-
People	0	0	0	0	0.0
Lights	0	0	0	0	0.0
RA Sensible (Lights)	0	0	0	0	0.0
Miscellaneous Loads	0	0	0	0	0.0
Internal Subtotal	0	0	0	0	-
RA (All Other)	0	0	0	0	0.0
DOA Direct to Zone	0	0	0	0	0.0
Ceiling	0	-207	0	-207	72.6
Refrigeration	0	0	0	0	0.0
Service Water	0	0	0	0	0.0
HVAC Equipment Losses	0	0	0	0	0.0
Adj Air Transfer Heat	0	0	0	0	0.0
Sizing Factor Correction	0	0	0	0	0.0
Time Delay Correction	0	0	0	0	0.0
Grand Total	0	-285	0	-285	100.0



*Does not reflect Time Delay and Sizing Factor Correction effects

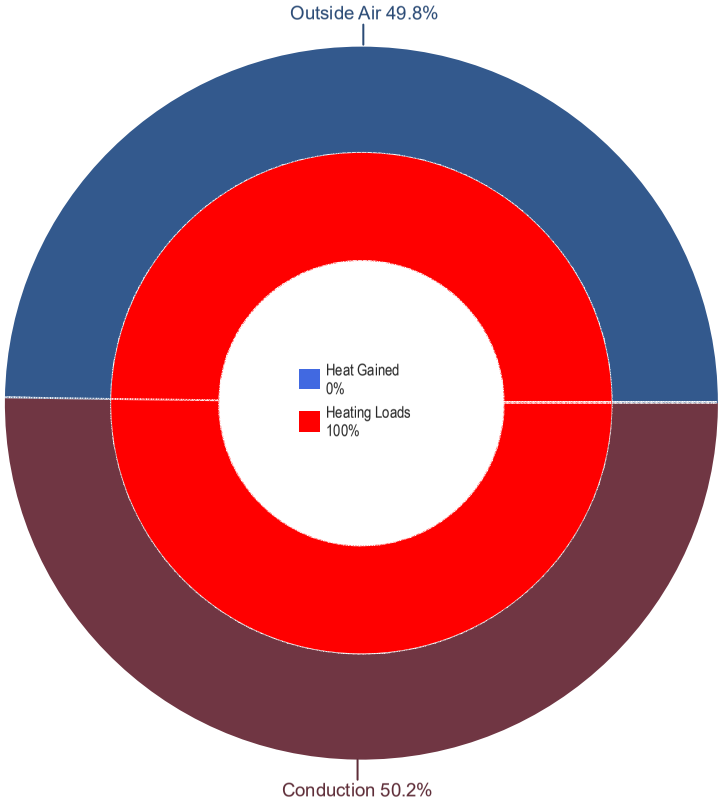
Engineering Checks

Heating Mbh	-0.28	Input Ventilation cfm	0
Heating cfm	711.04	Calculated Ventilation cfm	0
ft²/Mbh	-322.69	Number of People	0.00
cfm/Mbh	-2,495.77	People per 1000 ft²	0
Conditioned ft²	91.9		

Conditions at Time of Space Heating Peak

Outside	DB / WB / HR	9.5 °F	/	7.1 °F	/	6.2 gr/lb
Zone	DB / RH / HR	72.0 °F	/	5.9 %	/	6.8 gr/lb

	Instant Sensible (Btu/h)	Time Delay Sensible (Btu/h)	Latent (Btu/h)	Total (Btu/h)	Percent of Total (%)
Roof	0	0	0	0	0.0
Other Roof	0	0	0	0	0.0
Glass	-2324	0	0	-2324	26.5
Door	0	0	0	0	0.0
Wall	0	-377	0	-377	4.3
Below-Grade Wall	0	0	0	0	0.0
Other Wall	0	0	0	0	0.0
Partition	0	-187	0	-187	2.1
Exterior Floor	0	0	0	0	0.0
Interior Floor	0	0	0	0	0.0
Slab	0	-422	0	-422	4.8
Other Floor	0	0	0	0	0.0
Infiltration	-3190	0	-20	-3210	36.6
Envelope Subtotal	-5514	-986	-20	-6519	-
People	0	0	0	0	0.0
Lights	0	0	0	0	0.0
RA Sensible (Lights)	0	0	0	0	0.0
Miscellaneous Loads	0	0	0	0	0.0
Internal Subtotal	0	0	0	0	-
RA (All Other)	0	0	0	0	0.0
DOA Direct to Zone	0	0	0	0	0.0
Ceiling	0	-2252	0	-2252	25.7
Refrigeration	0	0	0	0	0.0
Service Water	0	0	0	0	0.0
HVAC Equipment Losses	0	0	0	0	0.0
Adj Air Transfer Heat	0	0	0	0	0.0
Sizing Factor Correction	0	0	0	0	0.0
Time Delay Correction	0	0	0	0	0.0
Grand Total	-5514	-3238	-20	-8772	100.0



*Does not reflect Time Delay and Sizing Factor Correction effects

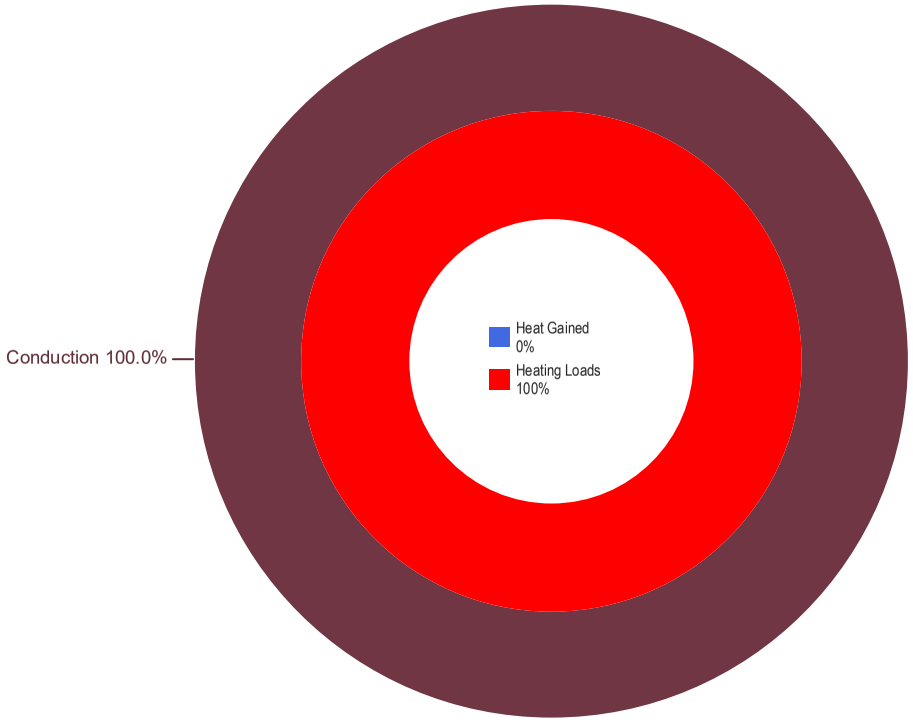
Engineering Checks

Heating Mbh	-8.77	Input Ventilation cfm	37
Heating cfm	418.29	Calculated Ventilation cfm	418
ft²/Mbh	-114.99	Number of People	1.00
cfm/Mbh	-47.69	People per 1000 ft²	1
Conditioned ft²	1008.6		

Conditions at Time of Space Heating Peak

Outside	DB / WB / HR	9.5 °F	/ 7.1 °F	/	6.2 gr/lb
Zone	DB / RH / HR	72.0 °F	/ 5.9 %	/	6.9 gr/lb

	Instant Sensible (Btu/h)	Time Delay Sensible (Btu/h)	Latent (Btu/h)	Total (Btu/h)	Percent of Total (%)
Roof	0	0	0	0	0.0
Other Roof	0	0	0	0	0.0
Glass	-800	0	0	-800	38.3
Door	0	0	0	0	0.0
Wall	0	-392	0	-392	18.7
Below-Grade Wall	0	0	0	0	0.0
Other Wall	0	0	0	0	0.0
Partition	0	-14	0	-14	0.7
Exterior Floor	0	0	0	0	0.0
Interior Floor	0	0	0	0	0.0
Slab	0	-119	0	-119	5.7
Other Floor	0	0	0	0	0.0
Infiltration	0	0	0	0	0.0
Envelope Subtotal	-800	-525	0	-1325	-
People	0	0	0	0	0.0
Lights	0	0	0	0	0.0
RA Sensible (Lights)	0	0	0	0	0.0
Miscellaneous Loads	0	0	0	0	0.0
Internal Subtotal	0	0	0	0	-
RA (All Other)	0	0	0	0	0.0
DOA Direct to Zone	0	0	0	0	0.0
Ceiling	0	-766	0	-766	36.6
Refrigeration	0	0	0	0	0.0
Service Water	0	0	0	0	0.0
HVAC Equipment Losses	0	0	0	0	0.0
Adj Air Transfer Heat	0	0	0	0	0.0
Sizing Factor Correction	0	0	0	0	0.0
Time Delay Correction	0	0	0	0	0.0
Grand Total	-800	-1290	0	-2090	100.0



*Does not reflect Time Delay and Sizing Factor Correction effects

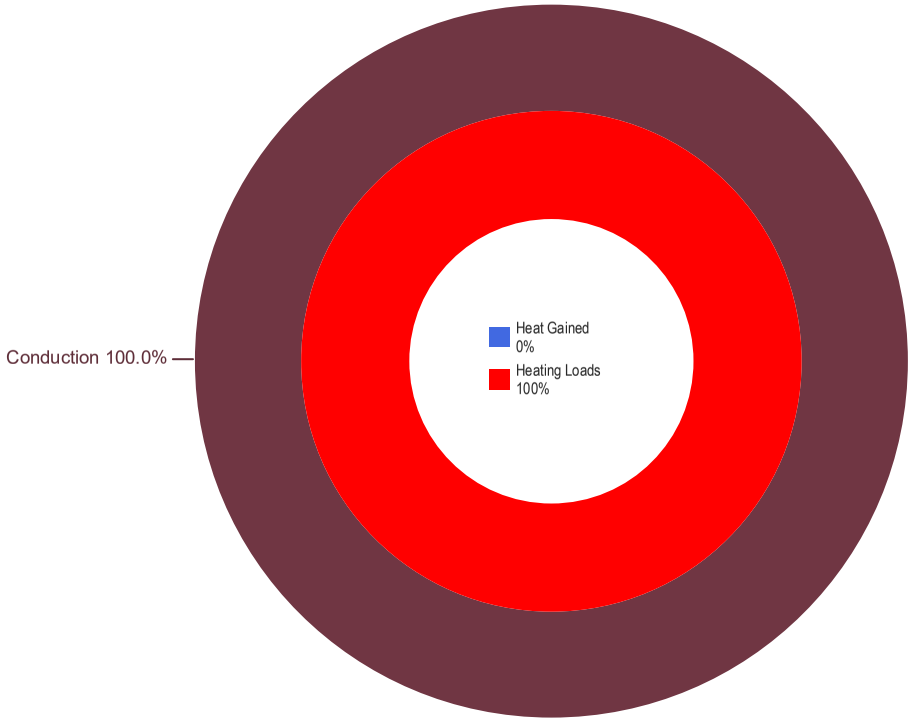
Engineering Checks

Heating Mbh	-2.09	Input Ventilation cfm	0
Heating cfm	99.90	Calculated Ventilation cfm	100
ft²/Mbh	-152.46	Number of People	0.00
cfm/Mbh	-47.80	People per 1000 ft²	0
Conditioned ft²	318.6		

Conditions at Time of Space Heating Peak

Outside	DB / WB / HR	9.5 °F	/	7.1 °F	/	6.2 gr/lb
Zone	DB / RH / HR	72.0 °F	/	5.9 %	/	6.9 gr/lb

	Instant Sensible (Btu/h)	Time Delay Sensible (Btu/h)	Latent (Btu/h)	Total (Btu/h)	Percent of Total (%)
Roof	0	0	0	0	0.0
Other Roof	0	0	0	0	0.0
Glass	-1856	0	0	-1856	43.7
Door	0	0	0	0	0.0
Wall	0	-339	0	-339	8.0
Below-Grade Wall	0	0	0	0	0.0
Other Wall	0	0	0	0	0.0
Partition	0	-14	0	-14	0.3
Exterior Floor	0	0	0	0	0.0
Interior Floor	0	0	0	0	0.0
Slab	0	-224	0	-224	5.3
Other Floor	0	0	0	0	0.0
Infiltration	0	0	0	0	0.0
Envelope Subtotal	-1856	-577	0	-2433	-
People	0	0	0	0	0.0
Lights	0	0	0	0	0.0
RA Sensible (Lights)	0	0	0	0	0.0
Miscellaneous Loads	0	0	0	0	0.0
Internal Subtotal	0	0	0	0	-
RA (All Other)	0	0	0	0	0.0
DOA Direct to Zone	0	0	0	0	0.0
Ceiling	0	-1302	0	-1302	30.6
Refrigeration	0	0	0	0	0.0
Service Water	0	0	0	0	0.0
HVAC Equipment Losses	0	0	0	0	0.0
Adj Air Transfer Heat	0	0	0	0	0.0
Sizing Factor Correction	-516	0	0	-516	12.1
Time Delay Correction	0	0	0	0	0.0
Grand Total	-2372	-1879	0	-4251	100.0



*Does not reflect Time Delay and Sizing Factor Correction effects

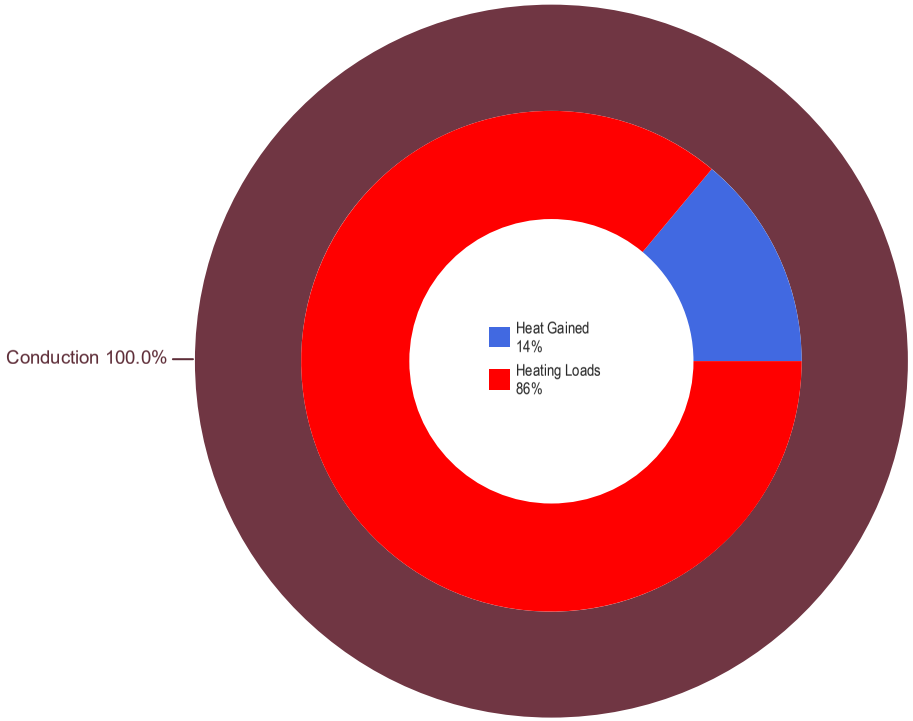
Engineering Checks

Heating Mbh	-4.25	Input Ventilation cfm	195
Heating cfm	203.19	Calculated Ventilation cfm	203
ft²/Mbh	-134.82	Number of People	20.02
cfm/Mbh	-47.80	People per 1000 ft²	35
Conditioned ft²	573.1		

Conditions at Time of Space Heating Peak

Outside	DB / WB / HR	9.5 °F	/ 7.1 °F	/	6.2 gr/lb
Zone	DB / RH / HR	72.0 °F	/ 5.9 %	/	6.9 gr/lb

	Instant Sensible (Btu/h)	Time Delay Sensible (Btu/h)	Latent (Btu/h)	Total (Btu/h)	Percent of Total (%)
Roof	0	0	0	0	0.0
Other Roof	0	0	0	0	0.0
Glass	-756	0	0	-756	63.0
Door	0	0	0	0	0.0
Wall	0	-201	0	-201	16.7
Below-Grade Wall	0	0	0	0	0.0
Other Wall	0	0	0	0	0.0
Partition	0	86	0	86	-7.1
Exterior Floor	0	0	0	0	0.0
Interior Floor	0	0	0	0	0.0
Slab	0	-44	0	-44	3.7
Other Floor	0	0	0	0	0.0
Infiltration	0	0	0	0	0.0
Envelope Subtotal	-756	-159	0	-915	-
People	0	0	0	0	0.0
Lights	0	0	0	0	0.0
RA Sensible (Lights)	0	0	0	0	0.0
Miscellaneous Loads	0	0	0	0	0.0
Internal Subtotal	0	0	0	0	-
RA (All Other)	0	0	0	0	0.0
DOA Direct to Zone	0	0	0	0	0.0
Ceiling	0	-284	0	-284	23.7
Refrigeration	0	0	0	0	0.0
Service Water	0	0	0	0	0.0
HVAC Equipment Losses	0	0	0	0	0.0
Adj Air Transfer Heat	0	0	0	0	0.0
Sizing Factor Correction	0	0	0	0	0.0
Time Delay Correction	0	0	0	0	0.0
Grand Total	-756	-443	0	-1199	100.0



*Does not reflect Time Delay and Sizing Factor Correction effects

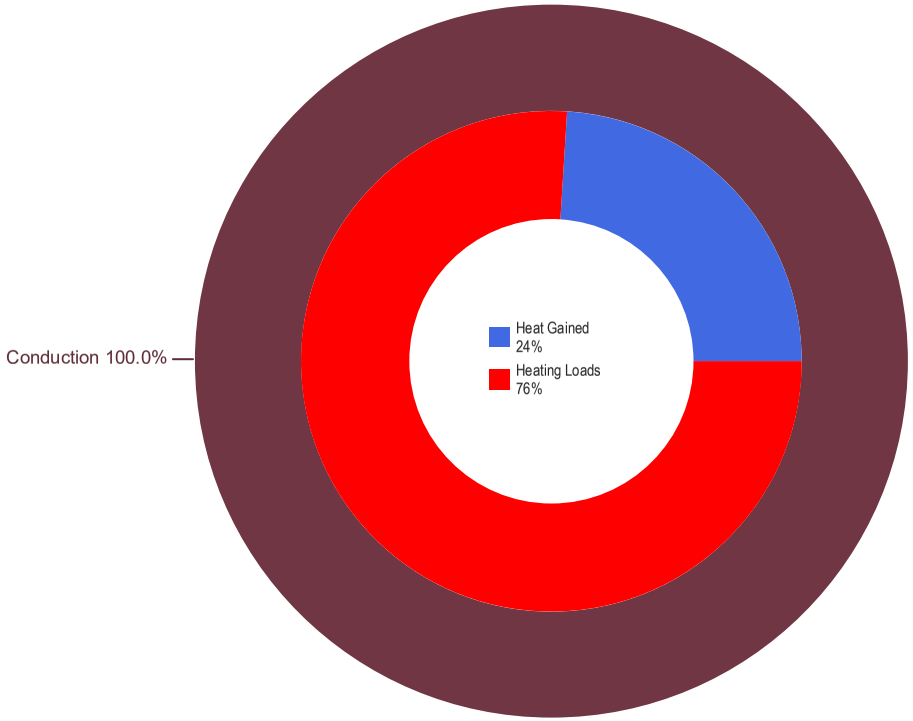
Engineering Checks

Heating Mbh	-1.20	Input Ventilation cfm	N/A
Heating cfm	57.31	Calculated Ventilation cfm	N/A
ft²/Mbh	-97.14	Number of People	0.00
cfm/Mbh	-47.80	People per 1000 ft²	0
Conditioned ft²	116.5		

Conditions at Time of Space Heating Peak

Outside	DB / WB / HR	9.5 °F	/	7.1 °F	/	6.2 gr/lb
Zone	DB / RH / HR	72.0 °F	/	5.9 %	/	6.9 gr/lb

	Instant Sensible (Btu/h)	Time Delay Sensible (Btu/h)	Latent (Btu/h)	Total (Btu/h)	Percent of Total (%)
Roof	0	0	0	0	0.0
Other Roof	0	0	0	0	0.0
Glass	-754	0	0	-754	80.2
Door	0	0	0	0	0.0
Wall	0	-95	0	-95	10.1
Below-Grade Wall	0	0	0	0	0.0
Other Wall	0	0	0	0	0.0
Partition	0	86	0	86	-9.1
Exterior Floor	0	0	0	0	0.0
Interior Floor	0	0	0	0	0.0
Slab	0	-24	0	-24	2.6
Other Floor	0	0	0	0	0.0
Infiltration	0	0	0	0	0.0
Envelope Subtotal	-754	-34	0	-787	-
People	0	0	0	0	0.0
Lights	0	0	0	0	0.0
RA Sensible (Lights)	0	0	0	0	0.0
Miscellaneous Loads	0	0	0	0	0.0
Internal Subtotal	0	0	0	0	-
RA (All Other)	0	0	0	0	0.0
DOA Direct to Zone	0	0	0	0	0.0
Ceiling	0	-152	0	-152	16.2
Refrigeration	0	0	0	0	0.0
Service Water	0	0	0	0	0.0
HVAC Equipment Losses	0	0	0	0	0.0
Adj Air Transfer Heat	0	0	0	0	0.0
Sizing Factor Correction	0	0	0	0	0.0
Time Delay Correction	0	0	0	0	0.0
Grand Total	-754	-186	0	-939	100.0



*Does not reflect Time Delay and Sizing Factor Correction effects

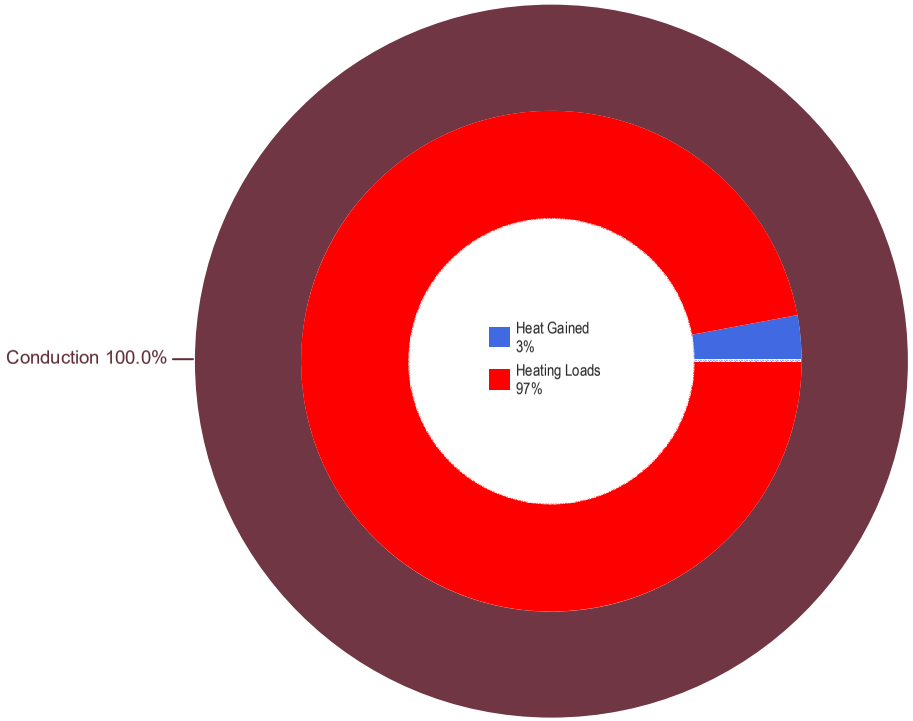
Engineering Checks

Heating Mbh	-0.94	Input Ventilation cfm	N/A
Heating cfm	44.90	Calculated Ventilation cfm	N/A
ft²/Mbh	-69.22	Number of People	0.00
cfm/Mbh	-47.80	People per 1000 ft²	0
Conditioned ft²	65.0		

Conditions at Time of Space Heating Peak

Outside	DB / WB / HR	9.5 °F	/	7.1 °F	/	6.2 gr/lb
Zone	DB / RH / HR	72.0 °F	/	5.9 %	/	6.9 gr/lb

	Instant Sensible (Btu/h)	Time Delay Sensible (Btu/h)	Latent (Btu/h)	Total (Btu/h)	Percent of Total (%)
Roof	0	0	0	0	0.0
Other Roof	0	0	0	0	0.0
Glass	-5529	0	0	-5529	51.2
Door	0	0	0	0	0.0
Wall	0	-1092	0	-1092	10.1
Below-Grade Wall	0	0	0	0	0.0
Other Wall	0	0	0	0	0.0
Partition	0	165	0	165	-1.5
Exterior Floor	0	0	0	0	0.0
Interior Floor	0	0	0	0	0.0
Slab	0	-568	0	-568	5.3
Other Floor	0	0	0	0	0.0
Infiltration	0	0	0	0	0.0
Envelope Subtotal	-5529	-1495	0	-7024	-
People	0	0	0	0	0.0
Lights	0	0	0	0	0.0
RA Sensible (Lights)	0	0	0	0	0.0
Miscellaneous Loads	0	0	0	0	0.0
Internal Subtotal	0	0	0	0	-
RA (All Other)	0	0	0	0	0.0
DOA Direct to Zone	0	0	0	0	0.0
Ceiling	0	-3765	0	-3765	34.9
Refrigeration	0	0	0	0	0.0
Service Water	0	0	0	0	0.0
HVAC Equipment Losses	0	0	0	0	0.0
Adj Air Transfer Heat	0	0	0	0	0.0
Sizing Factor Correction	0	0	0	0	0.0
Time Delay Correction	0	0	0	0	0.0
Grand Total	-5529	-5260	0	-10789	100.0



*Does not reflect Time Delay and Sizing Factor Correction effects

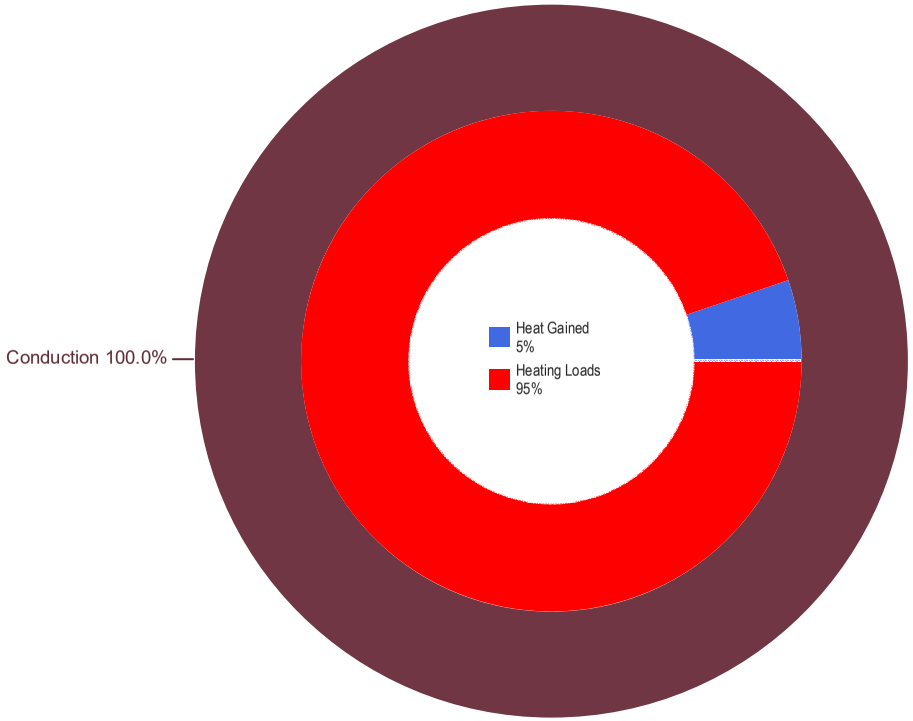
Engineering Checks

Heating Mbh	-10.79	Input Ventilation cfm	315
Heating cfm	515.69	Calculated Ventilation cfm	516
ft²/Mbh	-157.29	Number of People	29.97
cfm/Mbh	-47.80	People per 1000 ft²	18
Conditioned ft²	1696.9		

Conditions at Time of Space Heating Peak

Outside	DB / WB / HR	9.5 °F	/	7.1 °F	/	6.2 gr/lb
Zone	DB / RH / HR	72.0 °F	/	5.9 %	/	6.9 gr/lb

	Instant Sensible (Btu/h)	Time Delay Sensible (Btu/h)	Latent (Btu/h)	Total (Btu/h)	Percent of Total (%)
Roof	0	0	0	0	0.0
Other Roof	0	0	0	0	0.0
Glass	-7015	0	0	-7015	58.7
Door	0	0	0	0	0.0
Wall	0	-981	0	-981	8.2
Below-Grade Wall	0	0	0	0	0.0
Other Wall	0	0	0	0	0.0
Partition	0	290	0	290	-2.4
Exterior Floor	0	0	0	0	0.0
Interior Floor	0	0	0	0	0.0
Slab	0	-552	0	-552	4.6
Other Floor	0	0	0	0	0.0
Infiltration	0	0	0	0	0.0
Envelope Subtotal	-7015	-1243	0	-8258	-
People	0	0	0	0	0.0
Lights	0	0	0	0	0.0
RA Sensible (Lights)	0	0	0	0	0.0
Miscellaneous Loads	0	0	0	0	0.0
Internal Subtotal	0	0	0	0	-
RA (All Other)	0	0	0	0	0.0
DOA Direct to Zone	0	0	0	0	0.0
Ceiling	0	-3694	0	-3694	30.9
Refrigeration	0	0	0	0	0.0
Service Water	0	0	0	0	0.0
HVAC Equipment Losses	0	0	0	0	0.0
Adj Air Transfer Heat	0	0	0	0	0.0
Sizing Factor Correction	0	0	0	0	0.0
Time Delay Correction	0	0	0	0	0.0
Grand Total	-7015	-4937	0	-11952	100.0



*Does not reflect Time Delay and Sizing Factor Correction effects

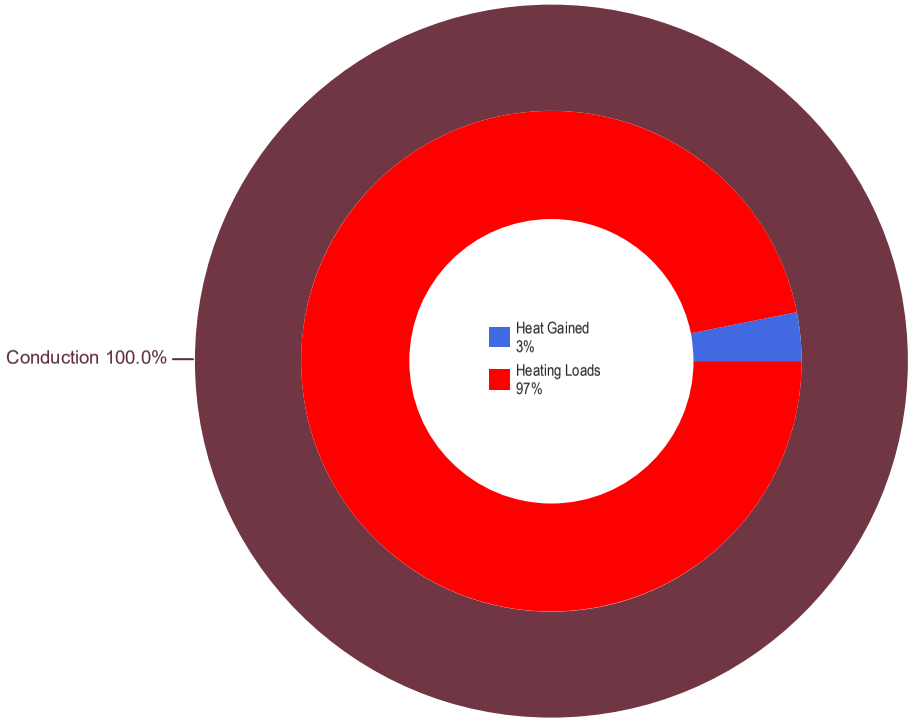
Engineering Checks

Heating Mbh	-11.95	Input Ventilation cfm	315
Heating cfm	571.26	Calculated Ventilation cfm	571
ft²/Mbh	-141.73	Number of People	29.97
cfm/Mbh	-47.80	People per 1000 ft²	18
Conditioned ft²	1693.8		

Conditions at Time of Space Heating Peak

Outside	DB / WB / HR	9.5 °F	/ 7.1 °F	/	6.2 gr/lb
Zone	DB / RH / HR	72.0 °F	/ 5.9 %	/	6.9 gr/lb

	Instant Sensible (Btu/h)	Time Delay Sensible (Btu/h)	Latent (Btu/h)	Total (Btu/h)	Percent of Total (%)
Roof	0	0	0	0	0.0
Other Roof	0	0	0	0	0.0
Glass	-5434	0	0	-5434	50.8
Door	0	0	0	0	0.0
Wall	0	-1095	0	-1095	10.2
Below-Grade Wall	0	0	0	0	0.0
Other Wall	0	0	0	0	0.0
Partition	0	176	0	176	-1.6
Exterior Floor	0	0	0	0	0.0
Interior Floor	0	0	0	0	0.0
Slab	0	-568	0	-568	5.3
Other Floor	0	0	0	0	0.0
Infiltration	0	0	0	0	0.0
Envelope Subtotal	-5434	-1487	0	-6921	-
People	0	0	0	0	0.0
Lights	0	0	0	0	0.0
RA Sensible (Lights)	0	0	0	0	0.0
Miscellaneous Loads	0	0	0	0	0.0
Internal Subtotal	0	0	0	0	-
RA (All Other)	0	0	0	0	0.0
DOA Direct to Zone	0	0	0	0	0.0
Ceiling	0	-3774	0	-3774	35.3
Refrigeration	0	0	0	0	0.0
Service Water	0	0	0	0	0.0
HVAC Equipment Losses	0	0	0	0	0.0
Adj Air Transfer Heat	0	0	0	0	0.0
Sizing Factor Correction	0	0	0	0	0.0
Time Delay Correction	0	0	0	0	0.0
Grand Total	-5434	-5261	0	-10695	100.0



*Does not reflect Time Delay and Sizing Factor Correction effects

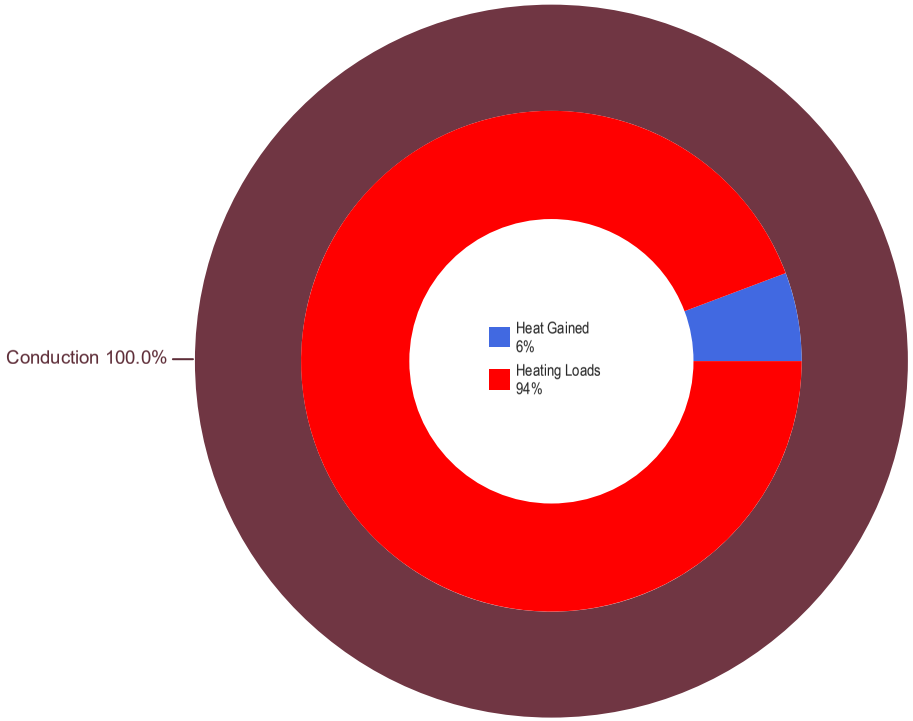
Engineering Checks

Heating Mbh	-10.69	Input Ventilation cfm	315
Heating cfm	511.16	Calculated Ventilation cfm	511
ft²/Mbh	-158.56	Number of People	30.00
cfm/Mbh	-47.80	People per 1000 ft²	18
Conditioned ft²	1695.5		

Conditions at Time of Space Heating Peak

Outside	DB / WB / HR	9.5 °F	/	7.1 °F	/	6.2 gr/lb
Zone	DB / RH / HR	72.0 °F	/	5.9 %	/	6.9 gr/lb

	Instant Sensible (Btu/h)	Time Delay Sensible (Btu/h)	Latent (Btu/h)	Total (Btu/h)	Percent of Total (%)
Roof	0	0	0	0	0.0
Other Roof	0	0	0	0	0.0
Glass	-6857	0	0	-6857	59.7
Door	0	0	0	0	0.0
Wall	0	-908	0	-908	7.9
Below-Grade Wall	0	0	0	0	0.0
Other Wall	0	0	0	0	0.0
Partition	0	300	0	300	-2.6
Exterior Floor	0	0	0	0	0.0
Interior Floor	0	0	0	0	0.0
Slab	0	-522	0	-522	4.5
Other Floor	0	0	0	0	0.0
Infiltration	0	0	0	0	0.0
Envelope Subtotal	-6857	-1130	0	-7988	-
People	0	0	0	0	0.0
Lights	0	0	0	0	0.0
RA Sensible (Lights)	0	0	0	0	0.0
Miscellaneous Loads	0	0	0	0	0.0
Internal Subtotal	0	0	0	0	-
RA (All Other)	0	0	0	0	0.0
DOA Direct to Zone	0	0	0	0	0.0
Ceiling	0	-3501	0	-3501	30.5
Refrigeration	0	0	0	0	0.0
Service Water	0	0	0	0	0.0
HVAC Equipment Losses	0	0	0	0	0.0
Adj Air Transfer Heat	0	0	0	0	0.0
Sizing Factor Correction	0	0	0	0	0.0
Time Delay Correction	0	0	0	0	0.0
Grand Total	-6857	-4631	0	-11488	100.0



Engineering Checks

Heating Mbh	-11.49	Input Ventilation cfm	310
Heating cfm	549.10	Calculated Ventilation cfm	549
ft²/Mbh	-141.81	Number of People	30.03
cfm/Mbh	-47.80	People per 1000 ft²	18
Conditioned ft²	1629.0		

*Does not reflect Time Delay and Sizing Factor Correction effects

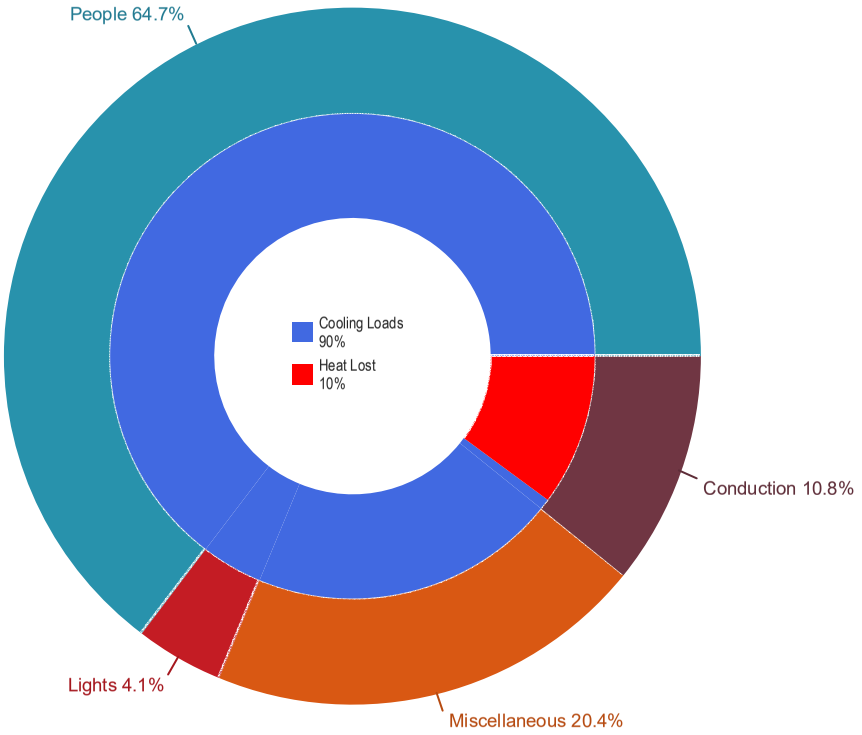
Zone Cooling Loads by Component

ZONE_Zn-Room - 04 - Conference 7/21 19:00:00

Conditions at Time of Space Cooling Peak

Outside	DB / WB / HR	85.6 °F	/	58.7 °F	/	45.1 gr/lb
Zone	DB / RH / HR	74.0 °F	/	49.4 %	/	61.6 gr/lb

	Instant Sensible (Btu/h)	Time Delay Sensible (Btu/h)	Latent (Btu/h)	Total (Btu/h)	Percent of Total (%)
Roof	0	0	0	0	0.0
Other Roof	0	0	0	0	0.0
Glass	0	0	0	0	0.0
Door	0	0	0	0	0.0
Wall	0	0	0	0	0.0
Below-Grade Wall	0	0	0	0	0.0
Other Wall	0	0	0	0	0.0
Partition	0	-355	0	-355	-8.7
Exterior Floor	0	0	0	0	0.0
Interior Floor	0	0	0	0	0.0
Slab	0	-139	0	-139	-3.4
Other Floor	0	0	0	0	0.0
Infiltration	0	0	0	0	0.0
Envelope Subtotal	0	-494	0	-494	-
People	577	1213	1375	3165	78.0
Lights	38	163	0	200	4.9
RA Sensible (Lights)	161	0	0	161	4.0
Miscellaneous Loads	1000	0	0	1000	24.6
Internal Subtotal	1776	1375	1375	4526	-
RA (All Other)	0	0	0	0	0.0
DOA Direct to Zone	0	0	0	0	0.0
Ceiling	0	36	0	36	0.9
Refrigeration	0	0	0	0	0.0
Service Water	0	0	0	0	0.0
HVAC Equipment Losses	0	0	0	0	0.0
Adj Air Transfer Heat	0	0	0	0	0.0
Sizing Factor Correction	0	0	0	0	0.0
Time Delay Correction	0	-11	0	-11	-0.3
Grand Total	1776	907	1375	4057	100.0



*Does not reflect Time Delay and Sizing Factor Correction effects

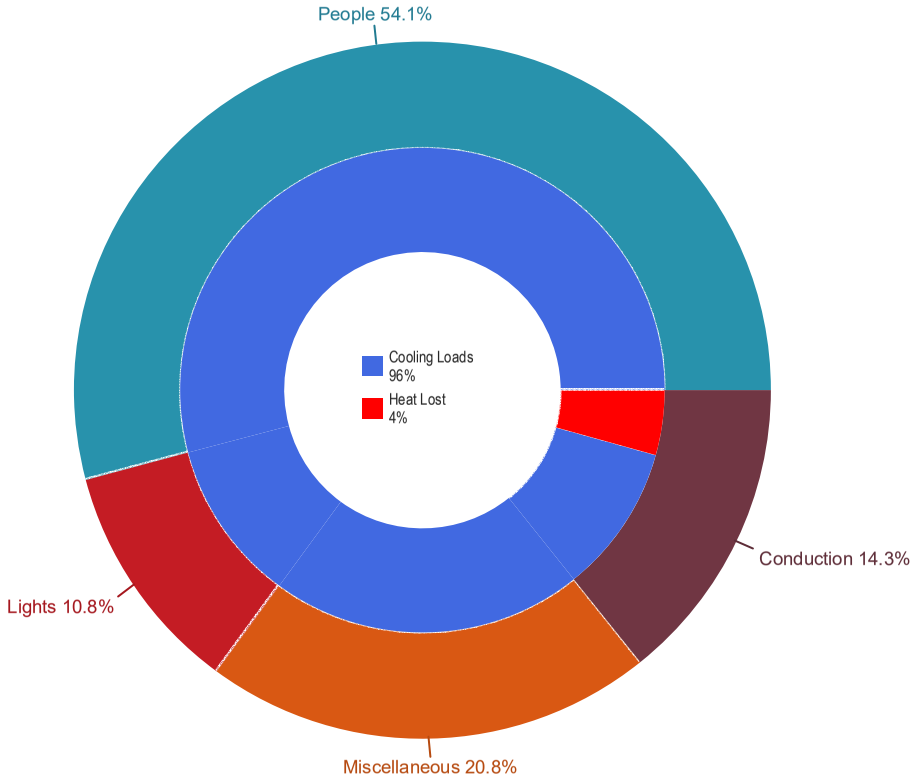
Engineering Checks

Cooling tons	0.34	Input Ventilation cfm	32
Cooling cfm	144.76	Calculated Ventilation cfm	56
ft²/ton	330.49	Number of People	4.99
cfm/ton	428.07	People per 1000 ft²	45
Conditioned ft²	111.7		

Conditions at Time of Space Cooling Peak

Outside	DB / WB / HR	85.6 °F	/ 58.7 °F	/ 45.1 gr/lb	
Zone	DB / RH / HR	74.0 °F	/ 43.5 %	/ 54.3 gr/lb	

	Instant Sensible (Btu/h)	Time Delay Sensible (Btu/h)	Latent (Btu/h)	Total (Btu/h)	Percent of Total (%)
Roof	0	0	0	0	0.0
Other Roof	0	0	0	0	0.0
Glass	0	0	0	0	0.0
Door	0	0	0	0	0.0
Wall	0	1	0	1	0.0
Below-Grade Wall	0	0	0	0	0.0
Other Wall	0	0	0	0	0.0
Partition	0	79	0	79	1.4
Exterior Floor	0	0	0	0	0.0
Interior Floor	0	0	0	0	0.0
Slab	0	-249	0	-249	-4.3
Other Floor	0	0	0	0	0.0
Infiltration	0	0	0	0	0.0
Envelope Subtotal	0	-170	0	-170	-
People	630	1293	1200	3123	54.1
Lights	119	503	0	623	10.8
RA Sensible (Lights)	510	0	0	510	8.8
Miscellaneous Loads	1200	0	0	1200	20.8
Internal Subtotal	2459	1797	1200	5456	-
RA (All Other)	0	0	0	0	0.0
DOA Direct to Zone	0	0	0	0	0.0
Ceiling	0	493	0	493	8.5
Refrigeration	0	0	0	0	0.0
Service Water	0	0	0	0	0.0
HVAC Equipment Losses	0	0	0	0	0.0
Adj Air Transfer Heat	0	0	0	0	0.0
Sizing Factor Correction	0	0	0	0	0.0
Time Delay Correction	0	-9	0	-9	-0.2
Grand Total	2459	2110	1200	5770	100.0



*Does not reflect Time Delay and Sizing Factor Correction effects

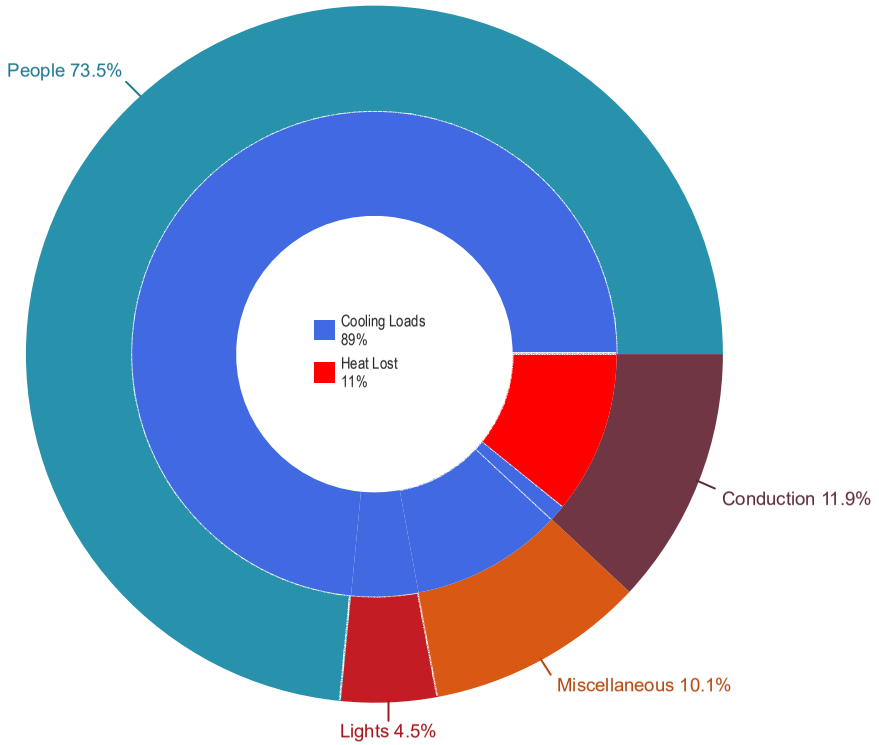
Engineering Checks

Cooling tons	0.48	Input Ventilation cfm	52
Cooling cfm	232.66	Calculated Ventilation cfm	89
ft²/ton	746.93	Number of People	6.00
cfm/ton	483.81	People per 1000 ft²	17
Conditioned ft²	359.1		

Conditions at Time of Space Cooling Peak

Outside	DB / WB / HR	85.6 °F	/	58.7 °F	/	45.1 gr/lb
Zone	DB / RH / HR	73.9 °F	/	54.2 %	/	67.7 gr/lb

	Instant Sensible (Btu/h)	Time Delay Sensible (Btu/h)	Latent (Btu/h)	Total (Btu/h)	Percent of Total (%)
Roof	0	0	0	0	0.0
Other Roof	0	0	0	0	0.0
Glass	0	0	0	0	0.0
Door	0	0	0	0	0.0
Wall	0	0	0	0	0.0
Below-Grade Wall	0	0	0	0	0.0
Other Wall	0	0	0	0	0.0
Partition	0	-738	0	-738	-9.1
Exterior Floor	0	0	0	0	0.0
Interior Floor	0	0	0	0	0.0
Slab	0	-329	0	-329	-4.1
Other Floor	0	0	0	0	0.0
Infiltration	0	0	0	0	0.0
Envelope Subtotal	0	-1067	0	-1067	-
People	1386	2558	3299	7243	89.5
Lights	92	348	0	440	5.4
RA Sensible (Lights)	392	0	0	392	4.8
Miscellaneous Loads	1000	0	0	1000	12.4
Internal Subtotal	2869	2906	3299	9074	-
RA (All Other)	0	0	0	0	0.0
DOA Direct to Zone	0	0	0	0	0.0
Ceiling	0	110	0	110	1.4
Refrigeration	0	0	0	0	0.0
Service Water	0	0	0	0	0.0
HVAC Equipment Losses	0	0	0	0	0.0
Adj Air Transfer Heat	0	0	0	0	0.0
Sizing Factor Correction	0	0	0	0	0.0
Time Delay Correction	0	-25	0	-25	-0.3
Grand Total	2869	1924	3299	8092	100.0



*Does not reflect Time Delay and Sizing Factor Correction effects

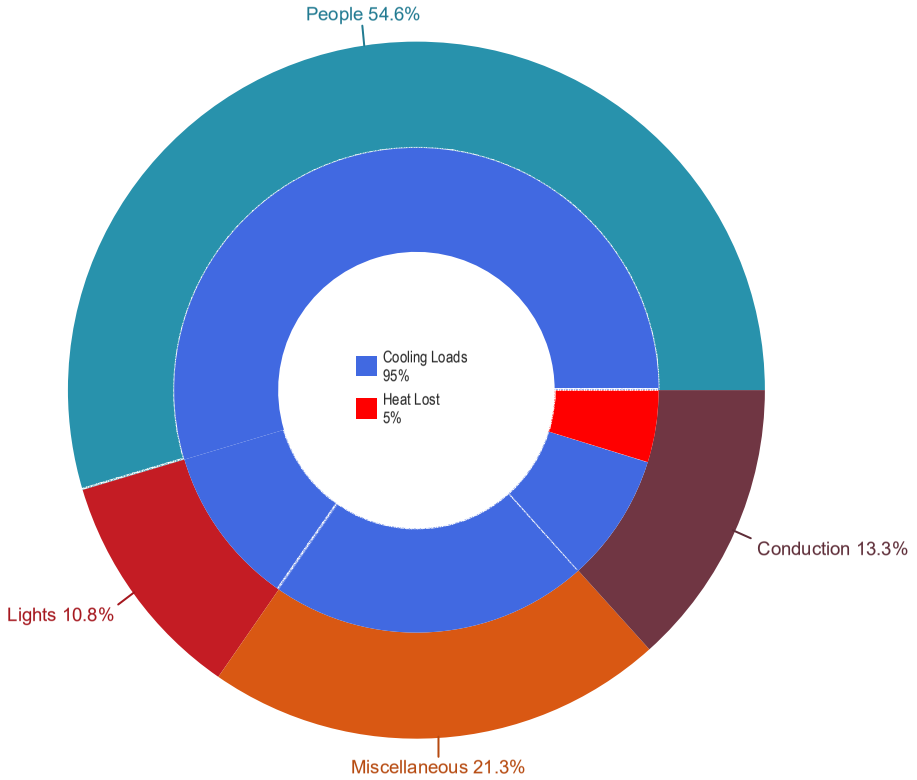
Engineering Checks

Cooling tons	0.67	Input Ventilation cfm	76
Cooling cfm	318.03	Calculated Ventilation cfm	122
ft²/ton	403.56	Number of People	11.98
cfm/ton	471.52	People per 1000 ft²	44
Conditioned ft²	272.1		

Conditions at Time of Space Cooling Peak

Outside	DB / WB / HR	85.6 °F	/	58.7 °F	/	45.1 gr/lb
Zone	DB / RH / HR	74.0 °F	/	43.8 %	/	54.7 gr/lb

	Instant Sensible (Btu/h)	Time Delay Sensible (Btu/h)	Latent (Btu/h)	Total (Btu/h)	Percent of Total (%)
Roof	0	0	0	0	0.0
Other Roof	0	0	0	0	0.0
Glass	0	0	0	0	0.0
Door	0	0	0	0	0.0
Wall	0	0	0	0	0.0
Below-Grade Wall	0	0	0	0	0.0
Other Wall	0	0	0	0	0.0
Partition	0	-58	0	-58	-0.8
Exterior Floor	0	0	0	0	0.0
Interior Floor	0	0	0	0	0.0
Slab	0	-304	0	-304	-4.1
Other Floor	0	0	0	0	0.0
Infiltration	0	0	0	0	0.0
Envelope Subtotal	0	-361	0	-361	-
People	840	1668	1600	4107	55.0
Lights	159	650	0	809	10.8
RA Sensible (Lights)	681	0	0	681	9.1
Miscellaneous Loads	1600	0	0	1600	21.4
Internal Subtotal	3280	2318	1600	7197	-
RA (All Other)	0	0	0	0	0.0
DOA Direct to Zone	0	0	0	0	0.0
Ceiling	0	643	0	643	8.6
Refrigeration	0	0	0	0	0.0
Service Water	0	0	0	0	0.0
HVAC Equipment Losses	0	0	0	0	0.0
Adj Air Transfer Heat	0	0	0	0	0.0
Sizing Factor Correction	0	0	0	0	0.0
Time Delay Correction	0	-12	0	-12	-0.2
Grand Total	3280	2587	1600	7466	100.0



*Does not reflect Time Delay and Sizing Factor Correction effects

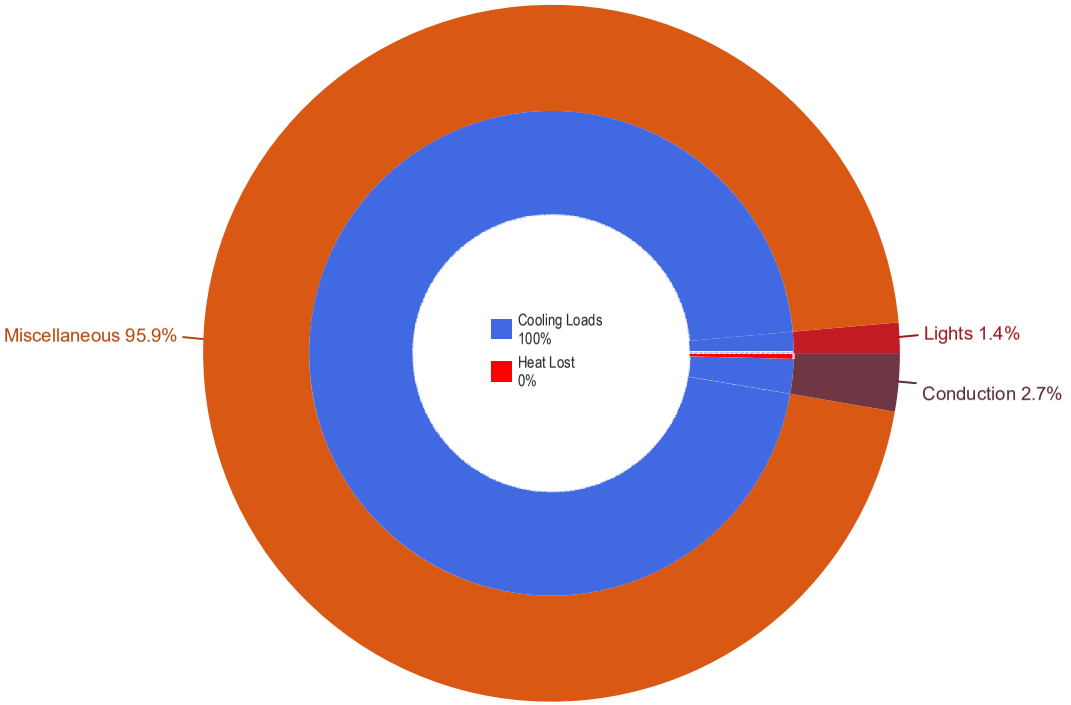
Engineering Checks

Cooling tons	0.62	Input Ventilation cfm	69
Cooling cfm	297.20	Calculated Ventilation cfm	114
ft²/ton	769.97	Number of People	8.00
cfm/ton	477.60	People per 1000 ft²	17
Conditioned ft²	479.0		

Conditions at Time of Space Cooling Peak

Outside	DB / WB / HR	85.6 °F	/	58.7 °F	/	45.1 gr/lb
Zone	DB / RH / HR	74.0 °F	/	36.6 %	/	45.5 gr/lb

	Instant Sensible (Btu/h)	Time Delay Sensible (Btu/h)	Latent (Btu/h)	Total (Btu/h)	Percent of Total (%)
Roof	0	0	0	0	0.0
Other Roof	0	0	0	0	0.0
Glass	0	0	0	0	0.0
Door	0	0	0	0	0.0
Wall	0	0	0	0	0.0
Below-Grade Wall	0	0	0	0	0.0
Other Wall	0	0	0	0	0.0
Partition	0	116	0	116	0.9
Exterior Floor	0	0	0	0	0.0
Interior Floor	0	0	0	0	0.0
Slab	0	-47	0	-47	-0.4
Other Floor	0	0	0	0	0.0
Infiltration	0	0	0	0	0.0
Envelope Subtotal	0	69	0	69	-
People	0	0	0	0	0.0
Lights	35	141	0	176	1.4
RA Sensible (Lights)	151	0	0	151	1.2
Miscellaneous Loads	11997	0	0	11997	95.5
Internal Subtotal	12183	141	0	12324	-
RA (All Other)	0	0	0	0	0.0
DOA Direct to Zone	0	0	0	0	0.0
Ceiling	0	173	0	173	1.4
Refrigeration	0	0	0	0	0.0
Service Water	0	0	0	0	0.0
HVAC Equipment Losses	0	0	0	0	0.0
Adj Air Transfer Heat	0	0	0	0	0.0
Sizing Factor Correction	0	0	0	0	0.0
Time Delay Correction	0	0	0	0	0.0
Grand Total	12183	382	0	12565	100.0



*Does not reflect Time Delay and Sizing Factor Correction effects

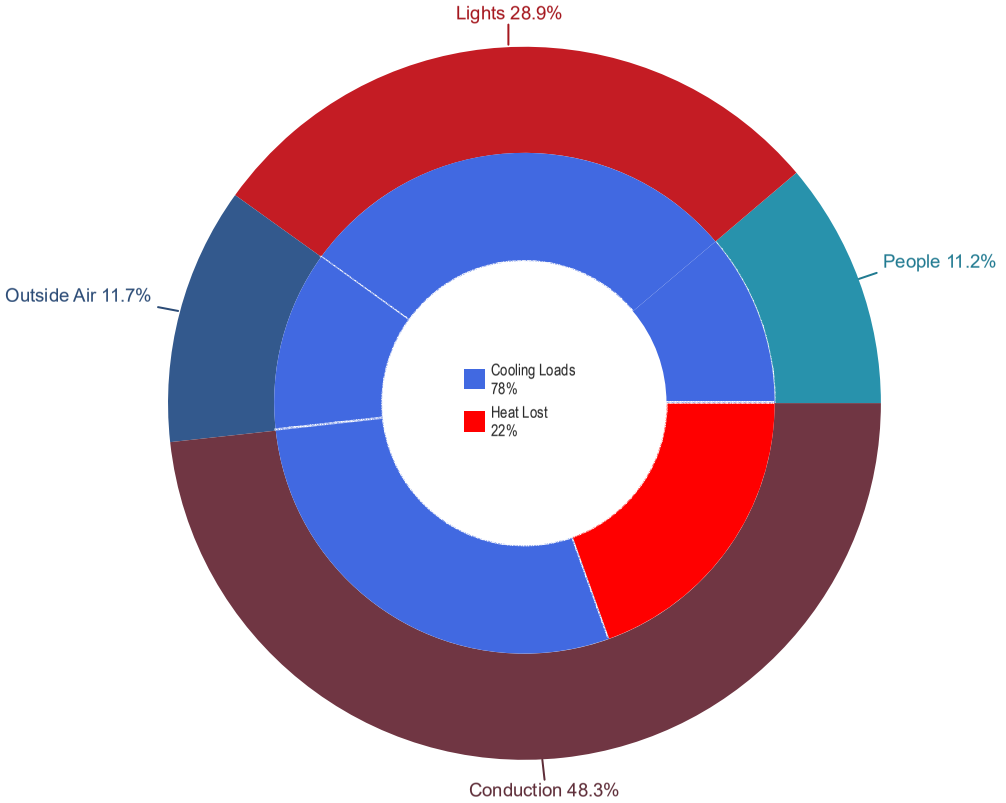
Engineering Checks

Cooling tons	1.05	Input Ventilation cfm	0
Cooling cfm	711.04	Calculated Ventilation cfm	0
ft²/ton	87.80	Number of People	0.00
cfm/ton	678.91	People per 1000 ft²	0
Conditioned ft²	91.9		

Conditions at Time of Space Cooling Peak

Outside	DB / WB / HR	89.3 °F	/	59.9 °F	/	45.2 gr/lb
Zone	DB / RH / HR	74.0 °F	/	37.3 %	/	46.4 gr/lb

	Instant Sensible (Btu/h)	Time Delay Sensible (Btu/h)	Latent (Btu/h)	Total (Btu/h)	Percent of Total (%)
Roof	0	0	0	0	0.0
Other Roof	0	0	0	0	0.0
Glass	3150	2038	0	5187	52.6
Door	0	0	0	0	0.0
Wall	0	148	0	148	1.5
Below-Grade Wall	0	0	0	0	0.0
Other Wall	0	0	0	0	0.0
Partition	0	-23	0	-23	-0.2
Exterior Floor	0	0	0	0	0.0
Interior Floor	0	0	0	0	0.0
Slab	0	-1036	0	-1036	-10.5
Other Floor	0	0	0	0	0.0
Infiltration	668	0	-35	633	6.4
Envelope Subtotal	3818	1127	-35	4910	-
People	115	217	275	607	6.2
Lights	318	1250	0	1568	15.9
RA Sensible (Lights)	1359	0	0	1359	13.8
Miscellaneous Loads	0	0	0	0	0.0
Internal Subtotal	1792	1467	275	3534	-
RA (All Other)	0	0	0	0	0.0
DOA Direct to Zone	0	0	0	0	0.0
Ceiling	0	1414	0	1414	14.3
Refrigeration	0	0	0	0	0.0
Service Water	0	0	0	0	0.0
HVAC Equipment Losses	0	0	0	0	0.0
Adj Air Transfer Heat	0	0	0	0	0.0
Sizing Factor Correction	0	0	0	0	0.0
Time Delay Correction	0	-4	0	-4	0.0
Grand Total	5610	4004	240	9854	100.0



*Does not reflect Time Delay and Sizing Factor Correction effects

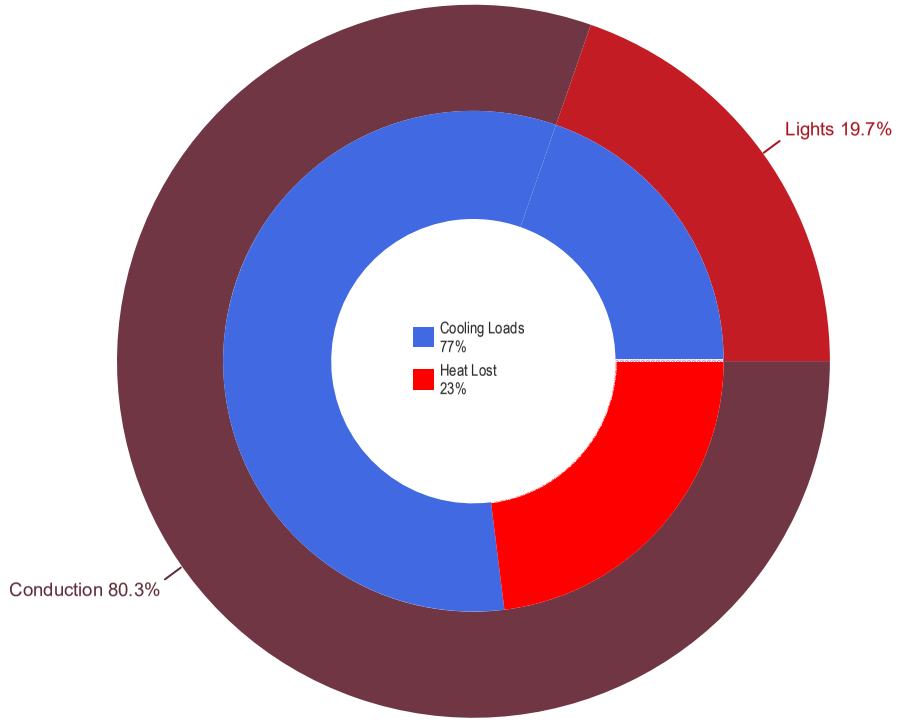
Engineering Checks

Cooling tons	0.82	Input Ventilation cfm	30
Cooling cfm	1,394.29	Calculated Ventilation cfm	535
ft²/ton	1228.33	Number of People	1.00
cfm/ton	1,697.59	People per 1000 ft²	1
Conditioned ft²	1008.6		

Conditions at Time of Space Cooling Peak

Outside	DB / WB / HR	89.5 °F	/ 60.0 °F	/ 45.2 gr/lb	
Zone	DB / RH / HR	74.0 °F	/ 36.6 %	/ 45.5 gr/lb	

	Instant Sensible (Btu/h)	Time Delay Sensible (Btu/h)	Latent (Btu/h)	Total (Btu/h)	Percent of Total (%)
Roof	0	0	0	0	0.0
Other Roof	0	0	0	0	0.0
Glass	867	490	0	1357	63.7
Door	0	0	0	0	0.0
Wall	0	149	0	149	7.0
Below-Grade Wall	0	0	0	0	0.0
Other Wall	0	0	0	0	0.0
Partition	0	203	0	203	9.5
Exterior Floor	0	0	0	0	0.0
Interior Floor	0	0	0	0	0.0
Slab	0	-226	0	-226	-10.6
Other Floor	0	0	0	0	0.0
Infiltration	0	0	0	0	0.0
Envelope Subtotal	867	616	0	1483	-
People	0	0	0	0	0.0
Lights	57	136	0	193	9.1
RA Sensible (Lights)	244	0	0	244	11.4
Miscellaneous Loads	0	0	0	0	0.0
Internal Subtotal	301	136	0	437	-
RA (All Other)	0	0	0	0	0.0
DOA Direct to Zone	0	0	0	0	0.0
Ceiling	0	211	0	211	9.9
Refrigeration	0	0	0	0	0.0
Service Water	0	0	0	0	0.0
HVAC Equipment Losses	0	0	0	0	0.0
Adj Air Transfer Heat	0	0	0	0	0.0
Sizing Factor Correction	0	0	0	0	0.0
Time Delay Correction	0	0	0	0	0.0
Grand Total	1168	963	0	2131	100.0



*Does not reflect Time Delay and Sizing Factor Correction effects

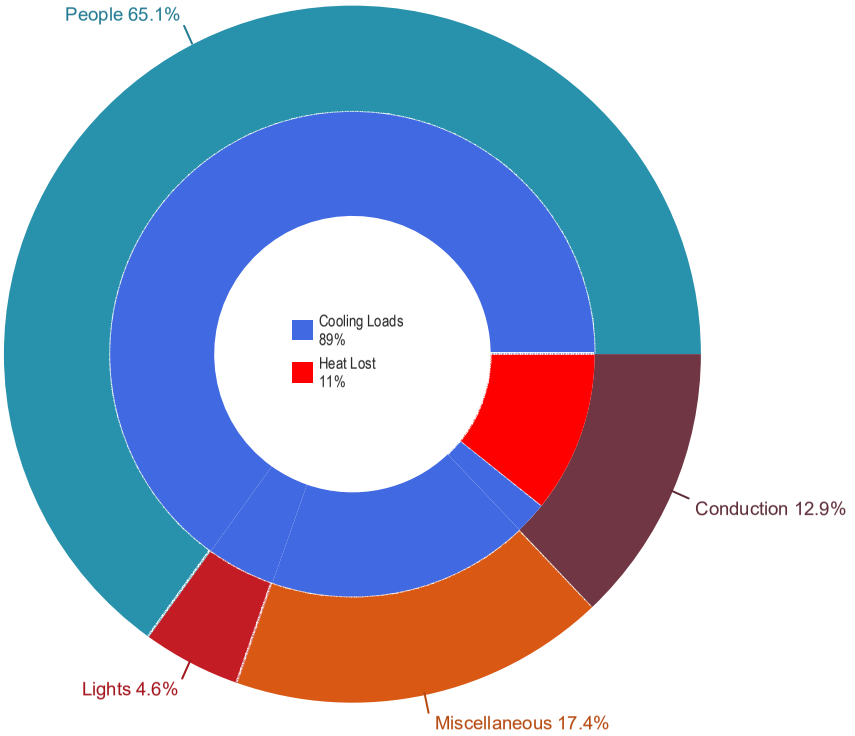
Engineering Checks

Cooling tons	0.18	Input Ventilation cfm	0
Cooling cfm	332.99	Calculated Ventilation cfm	128
ft²/ton	1794.43	Number of People	0.00
cfm/ton	1,874.86	People per 1000 ft²	0
Conditioned ft²	318.6		

Conditions at Time of Space Cooling Peak

Outside	DB / WB / HR	93.7 °F	/ 61.4 °F	/ 45.2 gr/lb	
Zone	DB / RH / HR	74.0 °F	/ 48.5 %	/ 60.5 gr/lb	

	Instant Sensible (Btu/h)	Time Delay Sensible (Btu/h)	Latent (Btu/h)	Total (Btu/h)	Percent of Total (%)
Roof	0	0	0	0	0.0
Other Roof	0	0	0	0	0.0
Glass	676	1385	0	2062	12.1
Door	0	0	0	0	0.0
Wall	0	109	0	109	0.6
Below-Grade Wall	0	0	0	0	0.0
Other Wall	0	0	0	0	0.0
Partition	0	-1166	0	-1166	-6.8
Exterior Floor	0	0	0	0	0.0
Interior Floor	0	0	0	0	0.0
Slab	0	-803	0	-803	-4.7
Other Floor	0	0	0	0	0.0
Infiltration	0	0	0	0	0.0
Envelope Subtotal	676	-475	0	202	-
People	2309	4127	5499	11935	69.8
Lights	172	668	0	840	4.9
RA Sensible (Lights)	735	0	0	735	4.3
Miscellaneous Loads	3199	0	0	3199	18.7
Internal Subtotal	6416	4795	5499	16710	-
RA (All Other)	0	0	0	0	0.0
DOA Direct to Zone	0	0	0	0	0.0
Ceiling	0	289	0	289	1.7
Refrigeration	0	0	0	0	0.0
Service Water	0	0	0	0	0.0
HVAC Equipment Losses	0	0	0	0	0.0
Adj Air Transfer Heat	0	0	0	0	0.0
Sizing Factor Correction	0	0	0	0	0.0
Time Delay Correction	0	-99	0	-99	-0.6
Grand Total	7092	4510	5499	17101	100.0



*Does not reflect Time Delay and Sizing Factor Correction effects

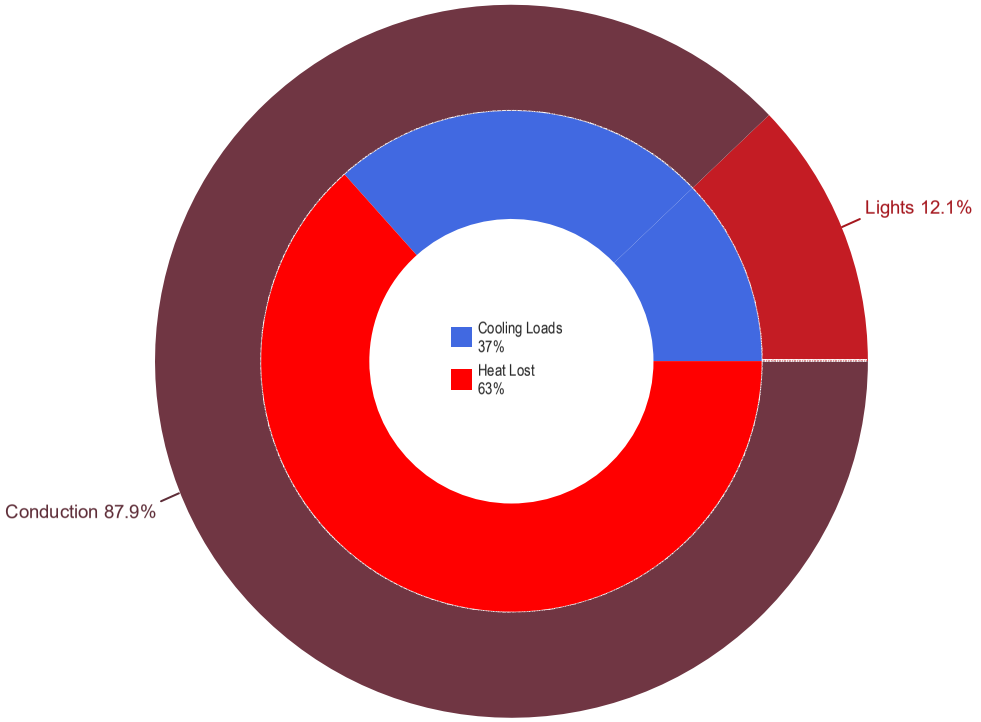
Engineering Checks

Cooling tons	1.43	Input Ventilation cfm	156
Cooling cfm	677.30	Calculated Ventilation cfm	260
ft²/ton	402.17	Number of People	20.02
cfm/ton	475.18	People per 1000 ft²	35
Conditioned ft²	573.1		

Conditions at Time of Space Cooling Peak

Outside	DB / WB / HR	89.3 °F	/	59.9 °F	/	45.2 gr/lb
Zone	DB / RH / HR	74.0 °F	/	36.6 %	/	45.5 gr/lb

	Instant Sensible (Btu/h)	Time Delay Sensible (Btu/h)	Latent (Btu/h)	Total (Btu/h)	Percent of Total (%)
Roof	0	0	0	0	0.0
Other Roof	0	0	0	0	0.0
Glass	1159	754	0	1913	107.9
Door	0	0	0	0	0.0
Wall	0	89	0	89	5.0
Below-Grade Wall	0	0	0	0	0.0
Other Wall	0	0	0	0	0.0
Partition	0	-223	0	-223	-12.6
Exterior Floor	0	0	0	0	0.0
Interior Floor	0	0	0	0	0.0
Slab	0	-320	0	-320	-18.1
Other Floor	0	0	0	0	0.0
Infiltration	0	0	0	0	0.0
Envelope Subtotal	1159	299	0	1458	-
People	0	0	0	0	0.0
Lights	21	83	0	104	5.9
RA Sensible (Lights)	89	0	0	89	5.0
Miscellaneous Loads	0	0	0	0	0.0
Internal Subtotal	110	83	0	193	-
RA (All Other)	0	0	0	0	0.0
DOA Direct to Zone	0	0	0	0	0.0
Ceiling	0	121	0	121	6.8
Refrigeration	0	0	0	0	0.0
Service Water	0	0	0	0	0.0
HVAC Equipment Losses	0	0	0	0	0.0
Adj Air Transfer Heat	0	0	0	0	0.0
Sizing Factor Correction	0	0	0	0	0.0
Time Delay Correction	0	0	0	0	0.0
Grand Total	1269	503	0	1772	100.0



*Does not reflect Time Delay and Sizing Factor Correction effects

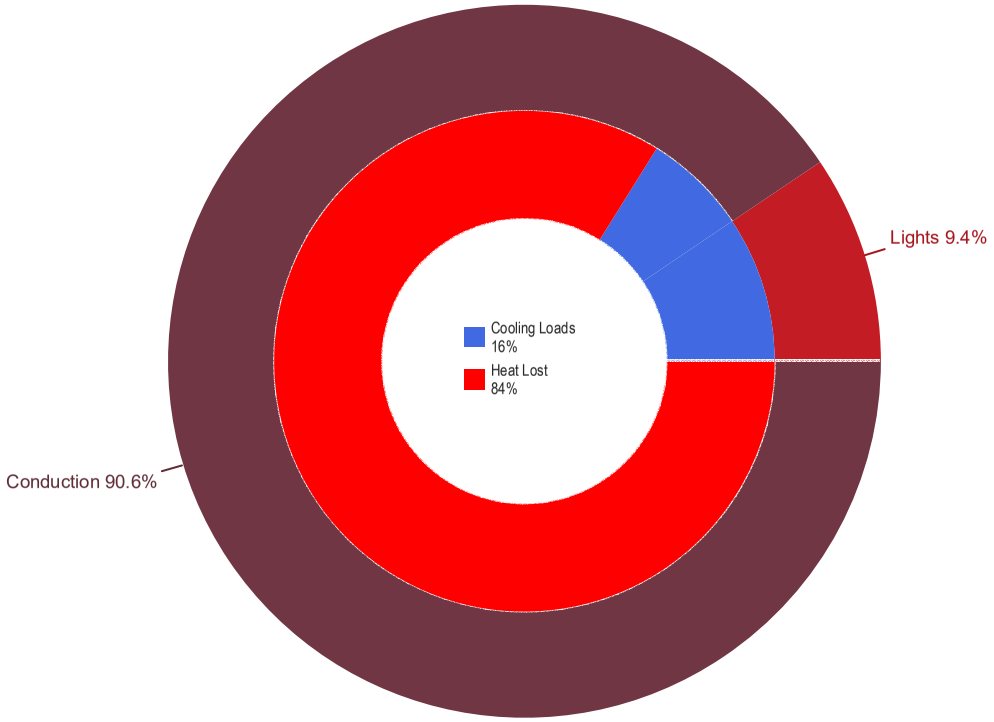
Engineering Checks

Cooling tons	0.15	Input Ventilation cfm	N/A
Cooling cfm	57.31	Calculated Ventilation cfm	N/A
ft²/ton	788.64	Number of People	0.00
cfm/ton	387.96	People per 1000 ft²	0
Conditioned ft²	116.5		

Conditions at Time of Space Cooling Peak

Outside	DB / WB / HR	89.3 °F	/	59.9 °F	/	45.2 gr/lb
Zone	DB / RH / HR	74.0 °F	/	36.6 %	/	45.5 gr/lb

	Instant Sensible (Btu/h)	Time Delay Sensible (Btu/h)	Latent (Btu/h)	Total (Btu/h)	Percent of Total (%)
Roof	0	0	0	0	0.0
Other Roof	0	0	0	0	0.0
Glass	1150	856	0	2006	126.6
Door	0	0	0	0	0.0
Wall	0	37	0	37	2.3
Below-Grade Wall	0	0	0	0	0.0
Other Wall	0	0	0	0	0.0
Partition	0	-339	0	-339	-21.4
Exterior Floor	0	0	0	0	0.0
Interior Floor	0	0	0	0	0.0
Slab	0	-244	0	-244	-15.4
Other Floor	0	0	0	0	0.0
Infiltration	0	0	0	0	0.0
Envelope Subtotal	1150	310	0	1461	-
People	0	0	0	0	0.0
Lights	12	54	0	66	4.1
RA Sensible (Lights)	50	0	0	50	3.1
Miscellaneous Loads	0	0	0	0	0.0
Internal Subtotal	61	54	0	115	-
RA (All Other)	0	0	0	0	0.0
DOA Direct to Zone	0	0	0	0	0.0
Ceiling	0	10	0	10	0.6
Refrigeration	0	0	0	0	0.0
Service Water	0	0	0	0	0.0
HVAC Equipment Losses	0	0	0	0	0.0
Adj Air Transfer Heat	0	0	0	0	0.0
Sizing Factor Correction	0	0	0	0	0.0
Time Delay Correction	0	0	0	0	0.0
Grand Total	1212	374	0	1585	100.0



*Does not reflect Time Delay and Sizing Factor Correction effects

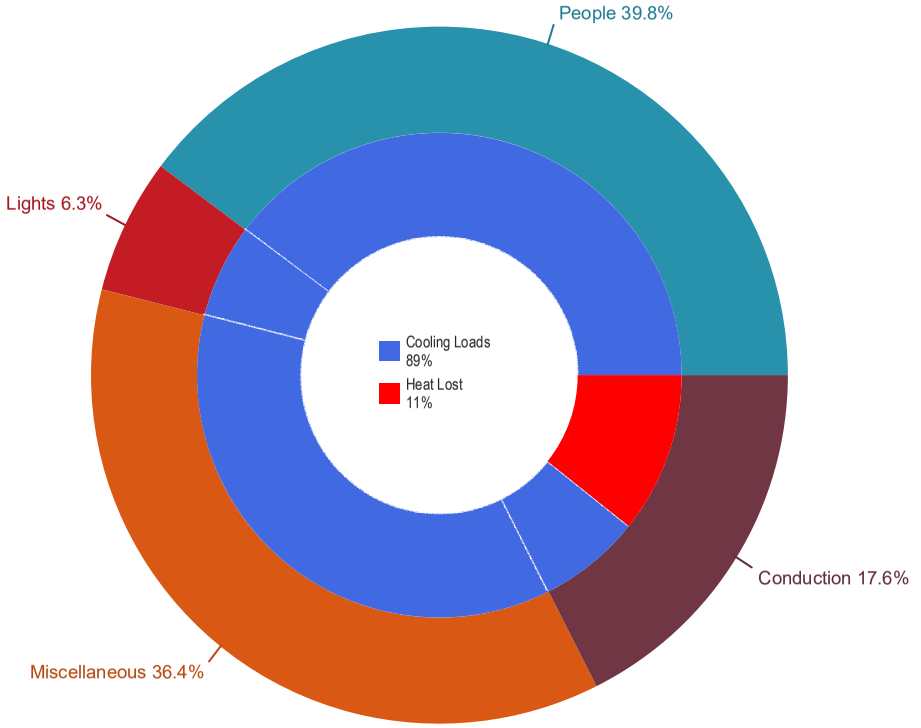
Engineering Checks

Cooling tons	0.13	Input Ventilation cfm	N/A
Cooling cfm	44.90	Calculated Ventilation cfm	N/A
ft²/ton	492.15	Number of People	0.00
cfm/ton	339.77	People per 1000 ft²	0
Conditioned ft²	65.0		

Conditions at Time of Space Cooling Peak

Outside	DB / WB / HR	85.6 °F	/	58.7 °F	/	45.1 gr/lb
Zone	DB / RH / HR	74.0 °F	/	41.5 %	/	51.7 gr/lb

	Instant Sensible (Btu/h)	Time Delay Sensible (Btu/h)	Latent (Btu/h)	Total (Btu/h)	Percent of Total (%)
Roof	0	0	0	0	0.0
Other Roof	0	0	0	0	0.0
Glass	2730	4202	0	6931	18.7
Door	0	0	0	0	0.0
Wall	0	311	0	311	0.8
Below-Grade Wall	0	0	0	0	0.0
Other Wall	0	0	0	0	0.0
Partition	0	-572	0	-572	-1.5
Exterior Floor	0	0	0	0	0.0
Interior Floor	0	0	0	0	0.0
Slab	0	-3251	0	-3251	-8.8
Other Floor	0	0	0	0	0.0
Infiltration	0	0	0	0	0.0
Envelope Subtotal	2730	690	0	3419	-
People	3149	5046	5999	14194	38.3
Lights	528	1709	0	2237	6.0
RA Sensible (Lights)	2257	0	0	2257	6.1
Miscellaneous Loads	12997	0	0	12997	35.1
Internal Subtotal	18932	6755	5999	31685	-
RA (All Other)	0	0	0	0	0.0
DOA Direct to Zone	0	0	0	0	0.0
Ceiling	0	2134	0	2134	5.8
Refrigeration	0	0	0	0	0.0
Service Water	0	0	0	0	0.0
HVAC Equipment Losses	0	0	0	0	0.0
Adj Air Transfer Heat	0	0	0	0	0.0
Sizing Factor Correction	0	0	0	0	0.0
Time Delay Correction	0	-225	0	-225	-0.6
Grand Total	21661	9354	5999	37014	100.0



*Does not reflect Time Delay and Sizing Factor Correction effects

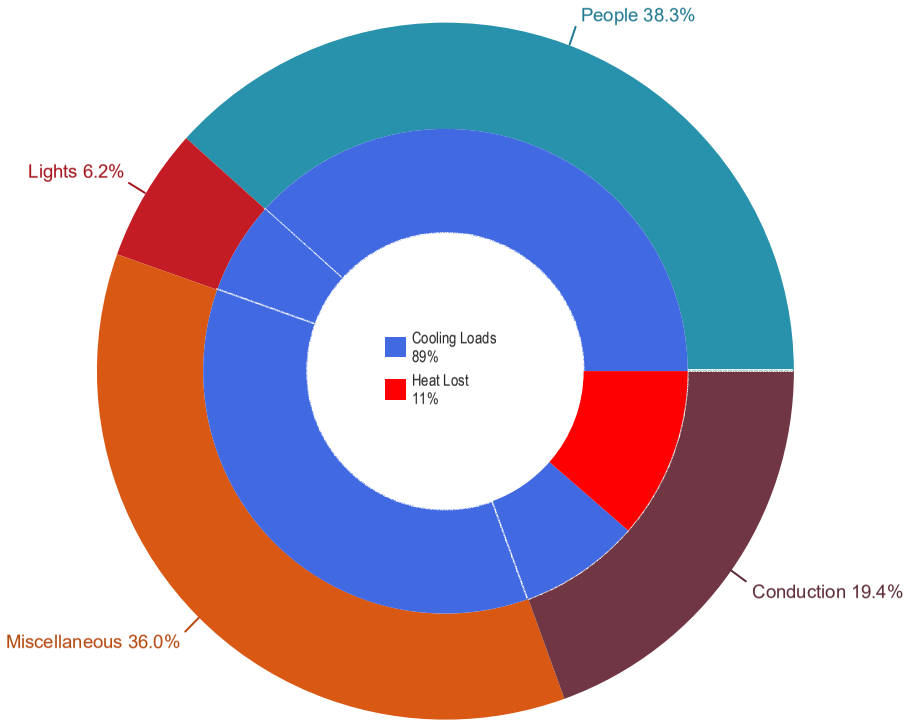
Engineering Checks

Cooling tons	3.08	Input Ventilation cfm	252
Cooling cfm	1,718.96	Calculated Ventilation cfm	660
ft²/ton	550.21	Number of People	29.97
cfm/ton	557.19	People per 1000 ft²	18
Conditioned ft²	1696.9		

Conditions at Time of Space Cooling Peak

Outside	DB / WB / HR	93.7 °F	/ 61.4 °F	/ 45.2 gr/lb	
Zone	DB / RH / HR	74.0 °F	/ 41.6 %	/ 51.9 gr/lb	

	Instant Sensible (Btu/h)	Time Delay Sensible (Btu/h)	Latent (Btu/h)	Total (Btu/h)	Percent of Total (%)
Roof	0	0	0	0	0.0
Other Roof	0	0	0	0	0.0
Glass	2626	3801	0	6427	17.7
Door	0	0	0	0	0.0
Wall	0	220	0	220	0.6
Below-Grade Wall	0	0	0	0	0.0
Other Wall	0	0	0	0	0.0
Partition	0	-575	0	-575	-1.6
Exterior Floor	0	0	0	0	0.0
Interior Floor	0	0	0	0	0.0
Slab	0	-3549	0	-3549	-9.8
Other Floor	0	0	0	0	0.0
Infiltration	0	0	0	0	0.0
Envelope Subtotal	2626	-102	0	2523	-
People	3149	4697	5999	13845	38.1
Lights	527	1716	0	2243	6.2
RA Sensible (Lights)	2253	0	0	2253	6.2
Miscellaneous Loads	12997	0	0	12997	35.8
Internal Subtotal	18926	6413	5999	31338	-
RA (All Other)	0	0	0	0	0.0
DOA Direct to Zone	0	0	0	0	0.0
Ceiling	0	2678	0	2678	7.4
Refrigeration	0	0	0	0	0.0
Service Water	0	0	0	0	0.0
HVAC Equipment Losses	0	0	0	0	0.0
Adj Air Transfer Heat	0	0	0	0	0.0
Sizing Factor Correction	0	0	0	0	0.0
Time Delay Correction	0	-239	0	-239	-0.7
Grand Total	21552	8749	5999	36300	100.0



Engineering Checks

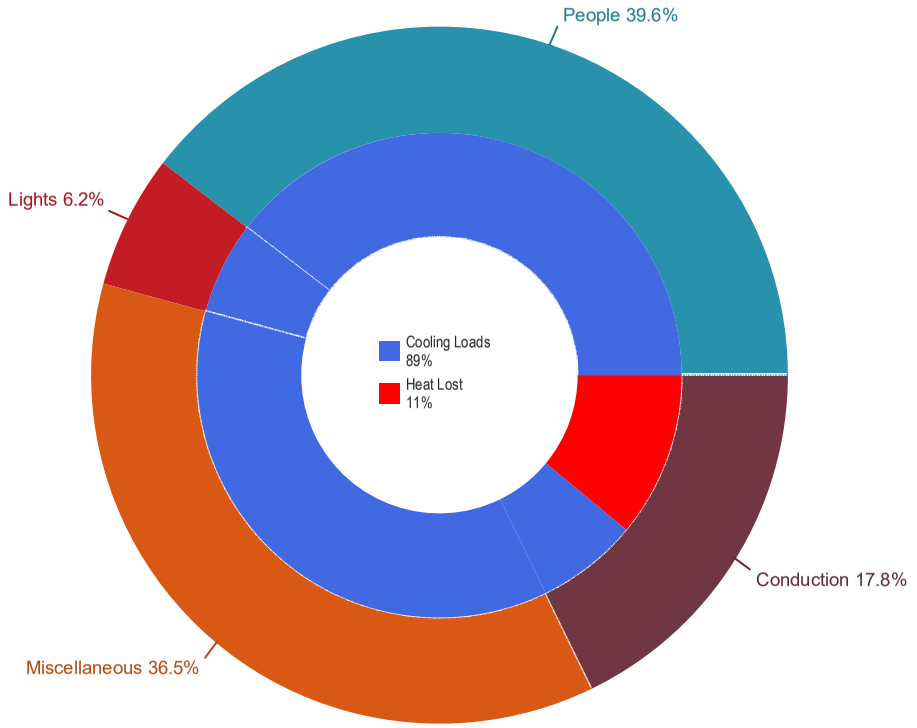
Cooling tons	3.02	Input Ventilation cfm	252
Cooling cfm	1,904.20	Calculated Ventilation cfm	731
ft²/ton	560.00	Number of People	29.97
cfm/ton	629.37	People per 1000 ft²	18
Conditioned ft²	1693.8		

*Does not reflect Time Delay and Sizing Factor Correction effects

Conditions at Time of Space Cooling Peak

Outside	DB / WB / HR	85.6 °F	/	58.7 °F	/	45.1 gr/lb
Zone	DB / RH / HR	74.0 °F	/	41.5 %	/	51.7 gr/lb

	Instant Sensible (Btu/h)	Time Delay Sensible (Btu/h)	Latent (Btu/h)	Total (Btu/h)	Percent of Total (%)
Roof	0	0	0	0	0.0
Other Roof	0	0	0	0	0.0
Glass	3157	4306	0	7463	20.0
Door	0	0	0	0	0.0
Wall	0	254	0	254	0.7
Below-Grade Wall	0	0	0	0	0.0
Other Wall	0	0	0	0	0.0
Partition	0	-568	0	-568	-1.5
Exterior Floor	0	0	0	0	0.0
Interior Floor	0	0	0	0	0.0
Slab	0	-3349	0	-3349	-9.0
Other Floor	0	0	0	0	0.0
Infiltration	0	0	0	0	0.0
Envelope Subtotal	3157	643	0	3799	-
People	3149	4959	5999	14106	37.8
Lights	528	1677	0	2205	5.9
RA Sensible (Lights)	2255	0	0	2255	6.0
Miscellaneous Loads	12997	0	0	12997	34.8
Internal Subtotal	18929	6636	5999	31564	-
RA (All Other)	0	0	0	0	0.0
DOA Direct to Zone	0	0	0	0	0.0
Ceiling	0	2161	0	2161	5.8
Refrigeration	0	0	0	0	0.0
Service Water	0	0	0	0	0.0
HVAC Equipment Losses	0	0	0	0	0.0
Adj Air Transfer Heat	0	0	0	0	0.0
Sizing Factor Correction	0	0	0	0	0.0
Time Delay Correction	0	-222	0	-222	-0.6
Grand Total	22086	9218	5999	37303	100.0



*Does not reflect Time Delay and Sizing Factor Correction effects

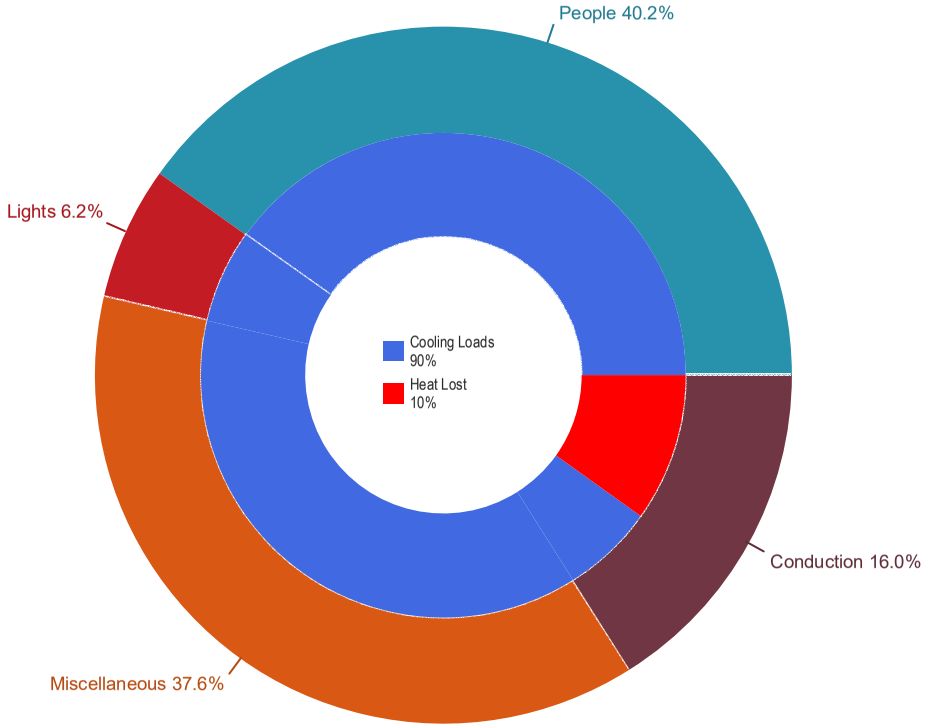
Engineering Checks

Cooling tons	3.11	Input Ventilation cfm	252
Cooling cfm	1,703.87	Calculated Ventilation cfm	654
ft²/ton	545.49	Number of People	30.00
cfm/ton	548.02	People per 1000 ft²	18
Conditioned ft²	1695.5		

Conditions at Time of Space Cooling Peak

Outside	DB / WB / HR	93.7 °F	/ 61.4 °F	/ 45.2 gr/lb	
Zone	DB / RH / HR	74.0 °F	/ 41.7 %	/ 51.9 gr/lb	

	Instant Sensible (Btu/h)	Time Delay Sensible (Btu/h)	Latent (Btu/h)	Total (Btu/h)	Percent of Total (%)
Roof	0	0	0	0	0.0
Other Roof	0	0	0	0	0.0
Glass	2562	3759	0	6321	17.6
Door	0	0	0	0	0.0
Wall	0	131	0	131	0.4
Below-Grade Wall	0	0	0	0	0.0
Other Wall	0	0	0	0	0.0
Partition	0	-749	0	-749	-2.1
Exterior Floor	0	0	0	0	0.0
Interior Floor	0	0	0	0	0.0
Slab	0	-2660	0	-2660	-7.4
Other Floor	0	0	0	0	0.0
Infiltration	0	0	0	0	0.0
Envelope Subtotal	2562	480	0	3042	-
People	3149	4738	5999	13886	38.6
Lights	507	1642	0	2149	6.0
RA Sensible (Lights)	2167	0	0	2167	6.0
Miscellaneous Loads	12997	0	0	12997	36.1
Internal Subtotal	18820	6380	5999	31198	-
RA (All Other)	0	0	0	0	0.0
DOA Direct to Zone	0	0	0	0	0.0
Ceiling	0	1998	0	1998	5.6
Refrigeration	0	0	0	0	0.0
Service Water	0	0	0	0	0.0
HVAC Equipment Losses	0	0	0	0	0.0
Adj Air Transfer Heat	0	0	0	0	0.0
Sizing Factor Correction	0	0	0	0	0.0
Time Delay Correction	0	-246	0	-246	-0.7
Grand Total	21382	8612	5999	35992	100.0



*Does not reflect Time Delay and Sizing Factor Correction effects

Engineering Checks

Cooling tons	3.00	Input Ventilation cfm	248
Cooling cfm	1,830.32	Calculated Ventilation cfm	702
ft²/ton	543.17	Number of People	30.03
cfm/ton	610.12	People per 1000 ft²	18
Conditioned ft²	1629.0		

Attachment #8
Electrical Cut Sheets

Project		**Catalog #**		**Type**	DF1
Prepared by		**Notes**		**Date**	



HALO Commercial

HC6 | HM6 | 61 | 61PS

6-inch LED downlight and wall wash

Typical Applications

Office • Healthcare • Hospitality • Institutional • Mixed-Use/Retail

Interactive Menu

- Order Information page 2
- Product Specifications page 4
- Photometric Data page 5
- Energy & Performance Data page 8
- Connected Systems page 9
- Product Warranty

Product Certification

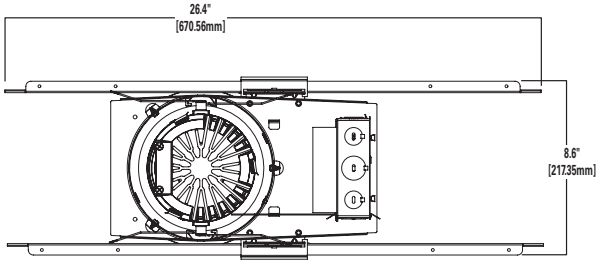
Product Features

WaveLinx

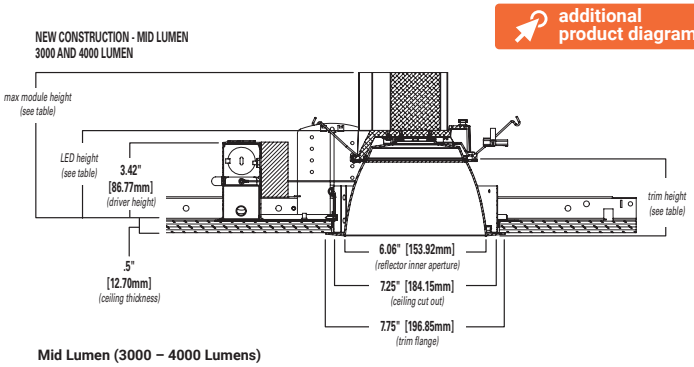
Top Product Features

- New construction/remodel series; 500 to 6,000 lumens
- Narrow, Medium and Wide distributions; Wall wash with rotatable linear spread lens
- 2700K, 3000K, 3500K, 4000K, 5000K CCT; 80 or 90 CRI
- Universal voltage 120V-277V; Standard 0-10V driver dims to 1%
- Mounting frame converts to remodel that installs from below the ceiling

Dimensional and Mounting Details



additional product diagrams



Mid Lumen (3000 – 4000 Lumens)

Distribution	Max. Module Height	Trim Height	LED Height
Narrow	6.6"	3.4"	3.8"
Medium	6.7"	3.5"	3.9"
Wide	6.5"	3.3"	3.7"
Baffle	6.5"	3.3"	3.7"

Order Information

Sample Number: HC620D010REM7 – HM60525835 - 61MDC

A complete luminaire consists of a housing frame, LED module, and reflector (ordered separately)

Mounting Frame	Lumens	Driver Options	Factory Installed Emergency & Connected Lighting Options	Accessories (Order & Install Separately)
HC6 = 6" new construction downlight housing **HC6CP** = 6" new construction housing, Chicago Plenum - CCEA compliant	**05** = 500 lm **07** = 750 lm **10** = 1000 lm **15** = 1500 lm **20** = 2000 lm **25** = 2500 lm **30** = 3000 lm **35** = 3500 lm **40** = 4000 lm **45** = 4500 lm (7) **50** = 5000 lm (7) **55** = 5500 lm (7) **60** = 6000 lm (7)	**D010**=UNV 120-277V, 50/60Hz, 0-10V 1%-100% dimming at 120-277V on 0-10V controls **Canada Option 500-5000 lumens:** **D010347** = 347VAC 50/60Hz 0-10V 1%-100% dimming. For 500, 750, 1000, 1500, 2000, 2500, 3000, 3500, 4000, 4500, 5000lm models only (1) **Canada Option 5500-6000 lumens:** **D010X347** = step down transformer factory installed (with standard "D010" 120V-277V LED driver). For 5500, 6000lm models only (1)	**REM7** = 7 watt emergency battery pack with remote test / indicator light, use with D010 only (1) (2) (6) **REM14** = 14 watt emergency battery pack with remote test / indicator light, use with D010 only (1) (2) (6) **IEM7** = 7 watt emergency battery pack with remote test / indicator light, use with D010 only (1) (2) (6) **IEM14** = 14 watt emergency battery pack with remote test / indicator light, use with D010 only (1) (2) (6) **BOD7ST** = 7.5 watt Bodine self-test emergency battery pack with remote test / indicator light, use with D010 only (1) (2) (6) **WTA** = Factory WaveLinx Tilemount Sensor Kit (4) **WTK** = Factory WaveLinx Lite Commercial Tilemount Sensor Kit (5)	**HB128APK** = L channel hanger bar, 26", pair (replacement) **RMB22** = Adjustable wood joist mounting bars, pair, extend to 22" long **HSA6** = Slope Adapter for 6" Aperture Housings, Specify Slope (refer to instructions for installing housing and trim) **H347** = 347 to 120V step down transformer, 75VA **H347200** = 347 to 120V step down transformer, 200VA **WTA** = Field WaveLinx Tilemount Sensor Kit (4) **WTK** = Field WaveLinx Lite Commercial Tilemount Sensor Kit (5)
		DLV = Distributed Low Voltage driver 1%-100% dimming. DLV for use with DLVP system only. Refer to DLVP low-voltage power module and DLVP specifications for details. (1)	**REMV7** = 7 watt emergency battery pack with remote test / indicator light, use with DLV only (1) (2) (3) (6) **REMV14** = 14 watt emergency battery pack with remote test / indicator light, use with DLV only (1) (2) (3) (6) **IEMV7** = 7 watt emergency battery pack with remote test / indicator light, use with DLV only (1) (2) (3) (6) **IEMV14** = 14 watt emergency battery pack with remote test / indicator light, use with DLV only (1) (2) (3) (6)	
Notes	**Notes** (7) Marked Spacing: Center to Center of Adjacent Luminaires = 36" Center of Luminaire to Building Member = 18" Minimum overhead = 0.5	**Notes** (1) Not available with CP models	**Notes** (1) Not available with CP models (2) Not available with D010347 (347V models) (3) ULus for U.S. only (4) WTA = WaveLinx tile mount sensor kit for daylight dimming, PIR motion sensing, and optional RLTS - Real Time Location Services, use with D010 only (Refer to WaveLinx specifications) (5) WTK = WaveLinx Lite tile mount sensor kit for daylight dimming, PIR motion sensing, use with D010 only (Refer to WaveLinx Lite specifications) (6) Emergency battery backup options are Non-IC only, and rated for a minimum starting temperature of 0°C	**Notes** (4) WTA = WaveLinx tile mount sensor kit for daylight dimming, PIR motion sensing, and optional RLTS - Real Time Location Services, use with D010 only (Refer to WaveLinx specifications) (5) WTK = WaveLinx Lite tile mount sensor kit for daylight dimming, PIR motion sensing, use with D010 only (Refer to WaveLinx Lite specifications)

LED Module	Lumens	CRI/CCT	
HM6 = 6" LED Modules For use with HC6 - HC6CP New Construction housings only	**0525** = 500 - 2500 lumen **3040** = 3000-4000 lumen **4560** = 4500-6000 lumen	**827** = 80CRI, 2700K **830** = 80CRI, 3000K **835** = 80CRI, 3500K **840** = 80CRI, 4000K **850** = 80CRI, 5000K	**927** = 90CRI, 2700K **930** = 90CRI, 3000K **935** = 90CRI, 3500K **940** = 90CRI, 4000K **950** = 90CRI, 5000K
Notes	**Notes**	**Notes**	

Order Information

Reflector	Distribution	Finish	Flange	Accessories
61 = 6" conical reflector	**ND** = narrow 55° beam angle 0.97 SC **MD** = medium 60° beam angle 1.10 SC **WD** = wide 65° beam angle 1.28 SC **RWW** = rotatable wall wash with linear spread lens	**C** = Specular clear **H** = Semi-specular clear **W** = White	**Blank** = Polished flange standard with C & H reflectors **Blank** = White flange standard with W reflector **WF** = White flange option available with C & H reflectors	**61RWWPK** = Replacement part kit - wall wash lens insert - for use with 61RWW* only.
Notes	**Notes** (8) Values are nominal, with specular clear reflector, other finishes and field results may vary.	**Notes**	**Notes**	**Notes**

Baffle	Distribution	Finish	Flange	Accessories
61 = 6" baffle reflector	**WD** = wide 65° beam angle 1.28 SC (nominal) **RWW** = rotatable wall wash with linear spread lens	**BB** = Black baffle **WB** = White baffle	**Blank** = White flange standard with BB, & WB **BF** = Black flange option available with BB	**61RWWPK** = Replacement part kit - wall wash lens insert - for use with 61RWW* only.
Notes	**Notes** (8) Values are nominal, with specular clear reflector, other finishes and field results may vary.	**Notes**	**Notes**	**Notes**

IEM Reflector	Distribution	Finish	Flange	Integral Emergency
61 = 6" IEM reflector for integral emergency only	**ND** = narrow 55° beam angle 0.97 SC **MD** = medium 60° beam angle 1.10 SC **WD** = wide 65° beam angle 1.28 SC	**C** = Specular clear **H** = Semi-specular clear **W** = White	**Blank** = Polished flange standard with C & H reflectors **Blank** = White flange standard with W reflector **WF** = White flange option available with C & H reflectors	**IEM** = Reflector for use with integral emergency housings only. Provides access hole for integral emergency test switch.
Notes	**Notes** (8) Values are nominal, with specular clear reflector, other finishes and field results may vary.	**Notes**	**Notes**	**Notes**

IEM Baffle	Distribution	Finish	Flange	Integral Emergency
61 = 6" IEM baffle reflector for integral emergency only	**WD** = wide 65° beam angle 1.28 SC (nominal)	**BB** = Black baffle **WB** = White baffle	**Blank** = White flange standard with BB, & WB **BF** = Black flange option with BB	**IEM** = Reflector for use with integral emergency housings only. Provides access hole for integral emergency test switch.
Notes	**Notes** (8) Values are nominal, with specular clear reflector, other finishes and field results may vary.	**Notes**	**Notes**	**Notes**

Reflector	Distribution	Finish	Flange
61PS = 6" non-conductive polymer 'dead front' conical reflector Use with HM6PS0525* LED modules only (9)	**MD** = medium 60° beam angle 1.10 SC (nominal)	**W** = White	**Blank** = White flange standard with W reflector
Notes (9) 61PS is 1000-2000 lumens Non-IC rated. 500 & 750 lumens IC rated. 61PS is not for use over 2000lm in Non-IC or over 750lm in IC.	**Notes** (8) Values are nominal, with specular clear reflector, other finishes and field results may vary.	**Notes**	**Notes**

ultra50

Photoluminescent Exit Sign

E1-1

BRIGHT PATH LIGHTING, INC.
1-877-343-7300



Viewing distance of 50'

Ultra Durable
Ultra Eco Friendly
Ultra Economical
Ultra Light Weight
Ultra Easy to Install
Ultra Easy to Wash
Ultra Thin



Lights off

15 Year Limited Warranty

NO FRAME NEEDED



Universal Kit

Includes everything you need!

- 1 Exit Sign, 9"Hx16"Lx1/8"W
- Pair of Peel & Stick Directional Chevrons
- Mounting Bracket, 4"x2.5" and Hardware

Available Colors



Non-electric
Non-radioactive
Non-hazardous
No expiration date
Energy efficient
LEED points qualified
Zero annual operating expense
No batteries
No bulbs
Low maintenance
100% reliable
High or low level
Simple installation
25+ year life expectancy

California State Fire Marshal Approved

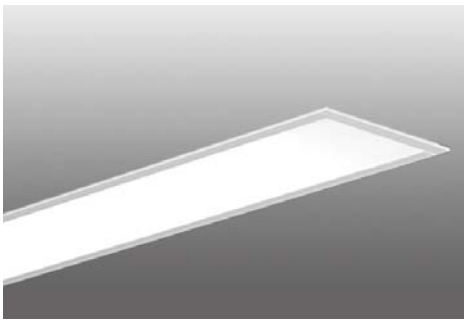
Proudly Made in USA

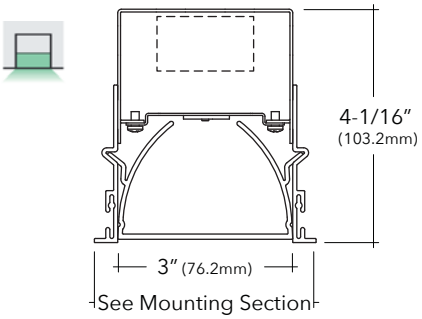
Designed for maximum durability, the BPL Ultra 50 Series Photoluminescent Exit Sign is constructed using a poly metal material. Ideal for high and low level applications. Easy peel and stick directional chevrons. UL 924 Listed with four external charging light sources: fluorescent, metal halide, LED, and mercury vapor.

PINNACLE ARCHITECTURAL LIGHTING®

Project Name _____

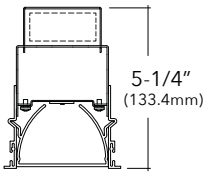
Date _____ Type RL1-4





EDGE EV3D

3" Recessed Linear



Key Features

- Extruded aluminum trim with formed cold rolled 18 gauge steel back box housing
- Highly reflective white painted steel reflector
- 5-year limited warranty covers LED, driver and fixture
- UL and ceUL listed. IC rated
- Approved for dry/damp location unless otherwise noted
- Maximum fixture weight is 15lbs per 4ft fixture
- Room-Side Maintenance for LED system
- Buy American Act compliant
- Indigo-Clean available, see Indigo-Clean specification sheets for details

Example Part #: EV3D-HE-830HO-26'-G1-U-OL2-1-0-W

EV3D - [ ] - [ ] - [ ] - [ ] - [ ] - [ ] - [ ] - [ ] - [ ] - [ ] - [ ] - [ ]

SHIELDING | SOURCE | LENGTH OR PATTERN | MOUNTING | VOLTAGE | DRIVER | CIRCUITING | BATTERY & EMERGENCY | FINISH | FIXTURE OPTIONS | CONTROLS

__ SHIELDING

A - Satine Lens QS
HE - High Efficiency Lens QS
BW - Batwing QS
WHE - Asymmetric QS
AL - Drop Lens
HED - Descent Lens
H - Arched Regress Lens
R - Regress Lens
Shielding pg. 2

_____ SOURCE QS[1]

_27__ - 2700K
_30__ - 3000K
_35__ - 3500K
_40__ - 4000K
TW3 - Tunable White *(Blanco 3)*
CL_____ - Custom Lumens
CW_____ - Custom Watts
MOD - Mod options available
Lumen Output pg. 2

_____ LENGTH OR PATTERN[2]

__ - Individual Fixture QS
__ - Continuous Row QS
L_x_ - L Shape QS
R_x_ - Rectangle QS
S_ - Square QS
U_x_ - U Shape QS
T_x_ - T Shape
X_x_x_ - X Shape
WC_x_ - Wall to Ceiling QS
MOD - Mod options available
Length and Pattern pg. 3-4

_____ MOUNTING[3]

G1(G) - 1" *(15/16")* T Bar QS
G9(G) - 9/16" T Bar QS
GB(G) - 9/16" Bevel T Bar
GS(G) - Screw Slot T Bar QS
FL(F) - 1/2" Flange QS
NF(N) - Non Flange QS
SF(S) - Spackle Flange QS
MOD - Mod options available
Mounting pg. 4

____ VOLTAGE

U - Universal QS
(120 thru 277V)
1 - 120V QS
2 - 277V QS
3 - 347V
Voltage pg. 4

_____ DRIVER

FSD - Factory Select Driver *(1%, 0-10v)* QS
PL2 - Advance Xitanium *(1%, 0-10v)* QS
OL4 - Osram 347v *(1%, 0-10v)*
EE1 - eldoLED ECOdrive *(1%, 0-10v)*
ES1 - eldoLED SOLOdrive *(0%, 0-10v)*
LH1 - Lutron Hi-lume *(1%, EcoSystem)* QS
PR1 - Advance Xitanium SR
OL2 - Osram *(1%, 0-10v)* QS
MOD - Mod options available
Driver pg. 5

_ CIRCUITING

1 - Single Circuit QS
M - Multi Circuit
E - Emergency QS
(entire fixture)
N - Night Light QS
(entire fixture)
Circuiting pg. 5

___ BATTERY & EMERGENCY[4]

0 - None QS
_FSG - Factory Select ALCR
_GI - Iota ETS DR
_GB - Bodine GTD
_P - Bodine 10W
_IC - Iota 10W *(CEC Listed)* QS
_E - Emergency Circuit Section
_N - Night Light Circuit Section
_L - Life Safety Circuit Section
Battery and Emergency pg. 6

___ FINISH

W - White QS
S - Metallic Silver
BL - Textured Black
BR - Bronze
GR - Graphite
CC - Custom Color
Finish pg. 6

__ FIXTURE OPTIONS[5]

QS - Quick Ship QS
CP - Chicago Plenum QS
FIL- Field Cut Illuminated Extension
LMRA - Adjustable MR16 *(LED)*
XLED - Fixed Xicato LED
RC - Rotating Crossbar
GLR - Internal Fast Blow Fuse QS
MOD - Mod options available
Fixture Options pg. 6

____ CONTROLS[6]

DLMFS - Wattstopper LLLC *(wireless)*
EASYS - Philips EasySense *(wireless)*
SNSLM - Encelium Sensilum *(wireless)*
WVLX - Eaton WaveLinx *(wireless)*
VDO - Lutron Vive Sensor *(wireless)*
VRF - Lutron Vive Connected *(wireless)*
MOD - Mod options available
Controls pg. 7

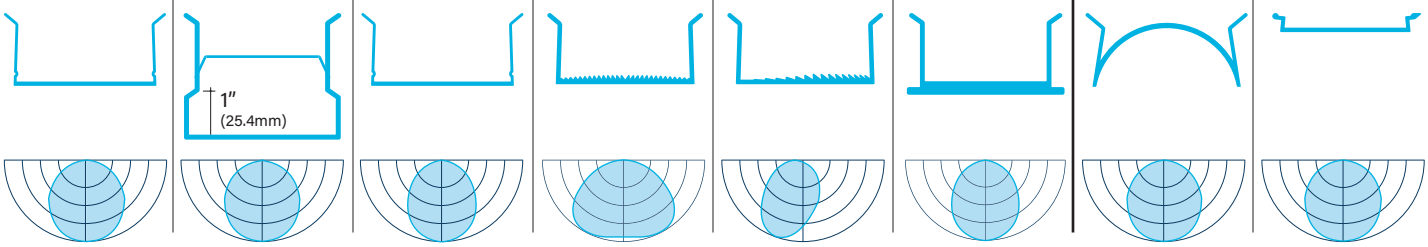
When specifying SOURCE the first _ is for specifying either 8 - 80CRI, 9 - 90CRI or B - BIOS. The ending __ are for specifying output, example HO - High Output. When specifying BIOS use B and then specify color temperature, either 3500K or 4000K, and output, example B35HO - BIOS 3500K High Output. If specifying QS output is 80 CRI, all color temperatures, all lumen packages. Does not include BIOS or Tunable White. See output charts for more information. BIOS dynamic available, please contact factory for more information

Specifications and dimensions subject to change without notice. Specification sheets that appear on pinnacle-ltg.com are the most recent version and supersede all other previously printed or electronic versions.

Shielding

These options use 5-1/4" Housing

A	AL	HE	BW	WHE	HED	H	R
Satine Lens	Drop Lens *(foot lengths only)*	High Efficiency	Batwing	Asymmetric	Descent Lens	Arched Regress	Flat Regress



Source: White LED[1]

- Specify either 80 or 90 CRI
- Longer lead-time may apply for 90 CRI. Consult factory
- 80 CRI = R9≥19 and 90 CRI = R9≥61
- QuickShip available for: "A" lens, 80 CRI, all color temperature, and all lumen packages
- Not all products qualify for DLC listing. For a complete listing of the EV3D products that qualify for DLC, please go to the DLC website.

Custom Output - Lumens OR Wattage

CL_____	Specify CRI, CCT and desired lumens (i.e. CL835500)	*Specify lumens between standard offering listed below. Lumens are specified per color temp*
CW_____	Specify CRI, CCT and desired wattage (i.e. CW9407)	*Specify watts between standard offering listed below*

80 CRI

	Color	Lumens per foot	Shielding[1] A Satine		AL Drop		HE High Efficiency		BW Batwing		WHE Asymmetric		HED Descent Lens		H Arched Regress		R Regress	
			LPW	*Watts/ft*	*LPW*	*Watts/ft*	*LPW*	*Watts/ft*	*LPW*	*Watts/ft*	*LPW*	*Watts/ft*	*LPW*	*Watts/ft*	*LPW*	*Watts/ft*	*LPW*	*Watts/ft*
830	3000K	500	119	4.2	123	4.1	134	3.7	126	4.0	131	3.8	116	4.3	100	5.0	117	4.3
830HO	3000K	750	119	6.3	127	5.9	139	5.4	131	5.7	135	5.5	115	6.5	100	7.5	117	6.4
830VHO	3000K	1000	122	8.2	131	7.7	140	7.1	132	7.6	136	7.3	118	8.5	101	9.9	119	8.4
835	3500K	500	123	4.1	127	3.9	138	3.6	130	3.8	135	3.7	120	4.2	103	4.8	121	4.1
835HO	3500K	750	123	6.1	131	5.7	144	5.2	135	5.6	140	5.3	119	6.3	103	7.3	120	6.2
835VHO	3500K	1000	126	7.9	133	7.5	144	6.9	136	7.4	141	7.1	122	8.2	104	9.6	123	8.1
840	4000K	500	123	4.1	127	3.9	138	3.6	130	3.8	135	3.7	120	4.2	103	4.8	121	4.1
840HO	4000K	750	123	6.1	131	5.7	144	5.2	135	5.6	140	5.3	119	6.3	103	7.3	120	6.2
840VHO	4000K	1000	126	7.9	133	7.5	144	6.9	136	7.4	141	7.1	122	8.2	104	9.6	123	8.1

90 CRI

927	2700K	500	99	5.1	104	4.8	113	4.4	106	4.7	110	4.5	96	5.2	81	6.2	97	5.2
927HO	2700K	750	99	7.6	106	7.1	112	6.7	108	6.9	109	6.9	97	7.7	82	9.1	98	7.6
927VHO	2700K	1000	100	10.0	107	9.3	116	8.6	109	9.2	113	8.9	97	10.3	N/A		98	10.2
930	3000K	500	106	4.7	113	4.4	123	4.1	116	4.3	120	4.2	103	4.9	88	5.7	103	4.8
930HO	3000K	750	108	7.0	113	6.7	123	6.1	115	6.5	120	6.3	105	7.2	89	8.4	106	7.1
930VHO	3000K	1000	108	9.2	116	8.6	126	8.0	118	8.5	123	8.2	106	9.4	89	11.2	107	9.3
935	3500K	500	105	4.7	113	4.4	122	4.1	115	4.3	119	4.2	102	4.9	88	5.7	103	4.9
935HO	3500K	750	107	7.0	112	6.7	122	6.1	115	6.5	119	6.3	104	7.2	89	8.4	105	7.1
935VHO	3500K	1000	108	9.3	116	8.7	125	8.0	118	8.5	122	8.2	106	9.5	88	11.4	107	9.4
940	4000K	500	105	4.7	113	4.4	122	4.1	115	4.3	119	4.2	102	4.9	88	5.7	103	4.9
940HO	4000K	750	107	7.0	112	6.7	122	6.1	115	6.5	119	6.3	104	7.2	89	8.4	105	7.1
940VHO	4000K	1000	108	9.3	116	8.7	125	8.0	118	8.5	122	8.2	106	9.5	88	11.4	107	9.4

Source: Blanco3[1]

- CRI >90, R9 >92
- 3 Channel tunable white for precise black body curve CCT
- Allows for high color consistency between fixtures
- Self-commissioning with Wattstopper DLM integrated controls
- Requires Control Ordering Code **B3LM** (pg. 6)
- Requires Drive Ordering Code **EC2** (pg. 4)

Blanco 3 Tunable White (TW3)

	Range	Shielding[1] A Satine			HE High Efficiency			BW Batwing		
		Lumens/ft	*LPW*	*Watts/ft*	*Lumens/ft*	*LPW*	*Watts/ft*	*Lumens/ft*	*LPW*	*Watts/ft*
TW3	2700-6500K	653	77	8.5	754	88	8.5	712	84	8.5

[1]LPW and watts/ft based off 47" fixture size.

Specifications and dimensions subject to change without notice. Specification sheets that appear on pinnacle-ltg.com are the most recent version and supersede all other previously printed or electronic versions.

LITHONIA LIGHTING®

Catalog Number	
Notes	
Type	SA-1

FEATURES & SPECIFICATIONS

INTENDED USE — Built on the compact, low-profile Z strip channel, this LED strip offers long maintenance-free life, several color temperatures, lumen outputs and lengths. Ideal for new construction and retrofit applications in T8 lengths. Ideal for use in commercial, retail, manufacturing, warehouse, and display applications. **Certain airborne contaminants can diminish the integrity of acrylic and/or polycarbonate.** **Click here for Acrylic-Polycarbonate Compatibility table for suitable uses.**

CONSTRUCTION — Compact-design channel and cover are formed from code-gauge cold-rolled steel. Easy to install six-point row aligner included for continuous row mounting.

Finish: Paint options include high-gloss, baked white enamel (WH), or matte black (MB). After fabrication, five-stage iron phosphate pre-treatment ensures superior paint adhesion and rust resistance.

OPTICS — Standard diffuse snap on/snap off lens eliminates pixels, improves uniformity and minimizes glare.

ELECTRICAL — Utilizes high-output LEDs integrated on a two-layer circuit board, ensuring cool-running operation. Optional internal pluggable wiring harness for reduced labor cost in row mounting applications (see PLR_ ordering information on page 3). Electronic LED driver is rated for 75 input watts maximum (see Operational Data on page two for actual wattage consumption), **multi-volt input and 0-10V dimming standard**. This fixture is designed to withstand a maximum line surge of 2.5kV at 0.75kA combination wave for indoor locations, for applications requiring higher level of protection additional surge protection must be provided.

LEDs provide 80CRI or 90 CRI at 3000 K, 3500 K,4000 K or 5000 K.

Lumen output up to 1,500 lumens per foot. Luminaire should be installed in applications where ambient temperatures do not exceed 86 °F (30 °C).

INSTALLATION — Fixture may be surface mounted (with or without ZSPRG hanger), pendant or stem mounted with appropriate mounting options. Six-point aligner locks in place for easy continuous row mounting.

LISTINGS — CSA certified to US and Canadian safety standards. For use in damp locations between -40 °F (-40 °C) and 86 °F (30 °C).

DesignLights Consortium® (DLC) qualified product. Not all versions of this product may be DLC qualified. Please check the DLC Qualified Products List at www.designlights.org/QPL to confirm which versions are qualified.

WARRANTY — 5-year limited warranty. Complete warranty terms located at: www.acuitybrands.com/resources/terms-and-conditions

Note: Actual performance may differ as a result of end-user environment and application.

All values are design or typical values, measured under laboratory conditions at 25 °C.

Specifications subject to change without notice.

Z SERIES

LED Striplight

ZL1D

24", 48" and 96" Lengths



A+ Capable Luminaire

This item is an A+ capable luminaire, which has been designed and tested to provide consistent color appearance and out-of-the-box control compatibility with simple commissioning.

- All configurations of this luminaire meet the Acuity Brands' specification for chromatic consistency
- This luminaire is part of an A+ Certified solution for nLight® or XPoint™ Wireless control networks marked by a shaded background*

To learn more about A+, visit www.acuitybrands.com/aplus.

*See ordering tree for details

ZL1D LED Striplight

A+ Capable options indicated by this color background.

ORDERING INFORMATION Lead times will vary depending on options selected. Consult with your sales representative.

Example: ZL1D L48 3000LM FST MVOLT 40K 80CRI WH

Series		Length		Reflectors[1]		Nominal lumens[2]		Diffuser		Voltage		Color temperature	
ZL1D	LED striplight	L24	24"	(blank)	Less reflector	1500LM	1,500 lumens	FST	Drop lens	MVOLT	120-277V	30K	3000 K
				SMR	Symmetric	2500LM	2,500 lumens			120	120V	35K	3500 K
						3500LM	3,500 lumens			208	208V	40K	4000 K
		L48	48"	(blank)	Less reflector	3000LM	3,000 lumens			240	240V	50K	5000 K
				ASR	Asymmetric	5000LM	5,000 lumens			277	277V		
				SMR	Symmetric	7000LM	7,000 lumens			347	347V[3]		
TZL1D	LED striplight	L96	96"	(blank)	Less reflector	6000LM	6,000 lumens			480	480V[3]		
				SMR	Symmetric	10000LM	10,000 lumens						
						14000LM	14,000 lumens						

Color rendering index		Options			Paint finish	
80CRI	80 CRI	PLR__	Plug-in wiring[4,5]	Cord sets:[10]	WH	White
90CRI	90 CRI	PLR1LVG	Plug-in wiring-low voltage[4,5]	CS1W Straight plug, 120V	MB	Matte black
		E7W	Emergency battery pack, 7W CA Title 20 Noncompliant[6,7]	CS3W Twist-lock, 120V	GALVB	Galvanized fixture with black plastic lens endcaps
		2E7W	Two Emergency battery packs, 7W CA Title 20 Noncompliant[6,7,8]	CS7W Straight plug, 277V	GALVW	Galvanized fixture with white plastic lens endcaps
		E10WLCP	Emergency battery pack, 10W Linear Constant Power, Certified in CA Title 20 MAEDBS[6,7]	CS11W Twist-lock, 277V		
		2E10WLCP	Two Emergency battery packs, 10W Linear Constant Power, Certified in CA Title 20 MAEDBS[6,7,8]	CS25W Twist-lock, 347V		
		E15WLCP	Emergency battery pack, 15W Linear Constant Power, Certified in CA Title 20 MAEDBS[6,7,8]	CS97W Twist-lock, 480V		
		OUTEND	Cord set to exit endplate of fixture	CS93W 600V SEOOW white cord, no plug (no voltage required)		
		LBOZU	360° low mount motion sensor, pre-wired[9]			
		LBH0SZU	360° low mount motion sensor with dimming, pre-wired[9]			
		LBPZU	360° low mount motion sensor with photocell, pre-wired[9]			
		LBM0SZU	360° low mount motion sensor, dimming & switching photocell, pre-wired[9]			

Accessories: *Order as separate catalog number.*

HC36	Hanger chain, 36"	ZLR L24 SYM WH	24" symmetric reflector, white finish
ZACVH	Aircraft cable 10' (one pair)	ZLR L46 SYM UPL WH	46" symmetric reflector with uplight, white finish
ZLANGBKT	Luma-tilt™ angle bracket for shelf or ledge mounting only	ZLR L46 SYM WH	46" symmetric reflector, white finish
SQ_	Stem kit, 2" increments up to 48"	ZLR L48 ASY WH	48" asymmetric reflector, white finish
NPP16D	nLight® switching/dimming module	ZLR L48 SYM UPL WH	48" symmetric reflector with uplight, white finish
rPP20D	nLight® Air switching/dimming module	ZLR L48 SYM WH	48" symmetric reflector, white finish
LSXR	Sensor Switch® LSXR occupancy sensor[4]	ZLR L92 SYM UPL WH	92" symmetric reflector with uplight, white finish
ZSPRG	For 15/16" T-grid only	ZLR L92 SYM WH	92" symmetric reflector, white finish
WGZ24	24" wireguard, white[11]	ZLR L96 SYM UPL WH	96" symmetric reflector with uplight, white finish
WGZ48	48" wireguard, white[11,12]	ZLR L96 SYM WH	96" symmetric reflector, white finish
ZLR L24 SYM UPL WH	24" symmetric reflector with uplight, white finish	UNIVERSAL REFL ALIGNER	Universal reflector aligners, quantity 1

Notes

1. Optional. Reflectors ship separately.
2. See Operational Data on page 2 for actual lumens.
3. Not available with L24, 24" fixture. 347V and 480V utilize a step-down transformer.
4. See ordering information on page 5. When choosing sensor options and and PLR configuration, contact factory representative.
5. Not available with cordsets.
6. Not available with L24, 24" fixture. See spec sheet PS1055LCP, PS1555LCP and PS750L for more information. Emergency battery backup only available from -4 °F (-20 °C) to 86 °F (30 °C)
7. Must specify voltage. 120, 208, 240 or 277V.
8. Only available with the 10,000LM and 14,000LM fixtures.
9. Voltage must be specified. This sensor configuration is suitable for minimum ambient temperature of 14°F (-10°C). See page 6 for low temperature option providing -4°F (-20°C) minimum ambient Sensors come prewired, they must be snapped into place at time of installation.
10. Cordsets exit back of fixture unless OUTEND option is specified. Must specify voltage (not required when ordering CS93W).
11. Not compatible with reflector.
12. Order 2 for tandem double length fixtures (TZL1D).

PRODUCT INFORMATION

A standard occupancy time delay is also present to ensure lights turn off (once minimum on timer has also elapsed) if no occupancy is detected.

This timer is factory set at 10 minutes to promote energy savings, but is adjustable between 30 seconds and 30 minutes. These adjustments may be done through the unit's push-button.

FEATURES

- Four interchangeable lenses - high mount 360°, low mount 360°, high mount aisleway, and small motion 360°.
- Integrated mounting bracket drops lens down 3" from chase nipple - no bracket accessory required.
- 100% digital PIR detection - provides excellent RF immunity

Note: Specifications subject to change without notice.

Passive Infrared Indoor Occupancy Sensor



LSXR

Single Relay

AcuityControls. Sensor Switch.

ORDERING INFORMATION Lead times will vary depending on options selected. Consult with your sales representative.

Example: LSXR 10 ADC HVOLT 30M

LSXR

Series		Lens option				Dimming/photocell	
LSXR	Passive Infrared Indoor Occupancy Sensor	(blank)	No lens	610	High and low mount 360°	(blank)	None
		6	High mount, 360®	650	High mount 360° and aisleway	HL	High/low occupancy operation
		10	Low mount, 360°	3PK	High and low mount 360° and aisleway	P	Switching photocell (on/off)
		50	High mount aisleway	4PK	All lenses	ADC	Dimming and switching photocell
		9	Small motion, 360°			ANL	Dimming and switching photocell with high/low occupancy operation

Voltage		Max dim level		Min dim level		Lead length		Temp humidity		Default time delay	
(blank)	120-277 VAC (MVOLT)	(blank)	10 VDC	(blank)	Minimum dimming level of ballast	(blank)	14"	(blank)	None	(blank)	10 minutes (with minimum 15 minutes on time)
HVOLT	347-480 VAC	9H	9 VDC	1V	1 VDC	42L	42"	LT	Low temperature	5M	5 minutes (LED only)
		8H	8 VDC	2V	2 VDC					15M	15 minutes
		7H	7 VDC	3V	3 VDC					20M	20 minutes
				4V	4 VDC					30M	30 minutes
				5V	5 VDC						
				6V	6 VDC						

For additional information see www.lithonia.com

PO number: _____ Signature: _____ Type: TB-1

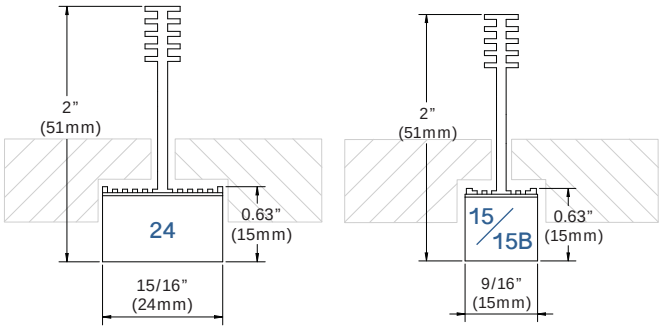
T-BAR LED Diffusing Lens | Order Specification Guide

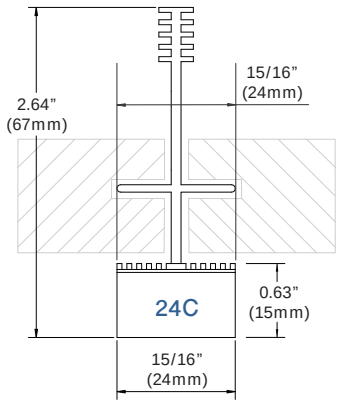
T-BAR LED™

Product Name	Type of LED/K Color	Size	Grid Type	Optic	Mounting Clips	Color
■ TBSL = T-BAR LED	☐ HW = Warm White 3000K ■ MW = Medium Warm 3500K ☐ MN = Medium Neutral 4000K ☐ HN = Neutral White 4500K	☐ 2 = 2 ft ■ 4 = 4 ft ☐ 5 = 5 ft ☐ 4L = 4 ft L ☐ 6 = 60 cm ☐ 12 = 120 cm ☐ 12L = 120 cm L	■ 24 = 15/16” ☐ 15 = 9/16” ☐ 15B = 9/16” Bolt Slot ☐ 24C = 15/16” Partially Concealed Grid	■ D = Diffusing Lens	■ U = Universal ☐ A = Armstrong ☐ C = Custom	■ W = White ☐ C = Custom

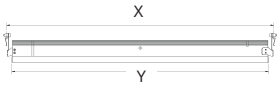
Patent No. 8,177,385; 9,879,850; 004481000-0002. Additional patents are pending.

Profile Dimensions





Length Dimensions



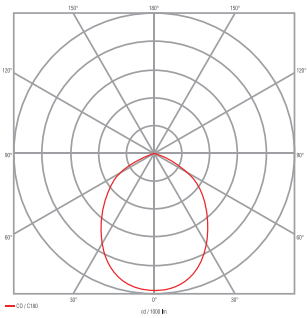
Size	Grid Type	X	Y
2 = 2ft	24 = 15/16”	24”	23”
4 = 4ft	24 = 15/16”	48”	47”
5 = 5ft	24 = 15/16"	60”	59”
4L = 4ft L	24 = 15/16”	48”	24”
2 = 2ft	15 = 9/16”	24”	23.4”
4 = 4ft	15 = 9/16”	48”	47.4”
5 = 5ft	15 = 9/16”	60”	59.4”
4L = 4ft L	15 = 9/16"	48”	24”

CRI = >82

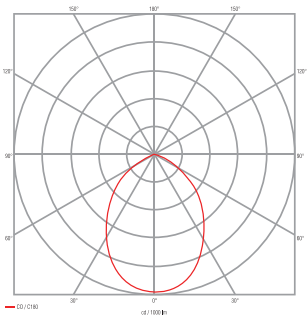
LIGHT OUTPUT:

15/16”- 584lm per foot
75lm/W

9/16”- 421lm per foot
54 lm/W



15/16” Diffusing Lens



9/16” Diffusing Lens

NOTES:

T-BAR LED modules can be parallel connected up to 12 linear feet max per power supply. Remote power supply includes JB compartment for AC input direct wiring with metal conduit. Max distance from power supply to fixtures is 30 feet with 18 AWG wire. Longer distance achievable if using higher gauge wire.

APPLICATIONS:

Executive, Medical, Health, Educational, Retail, Hotels, Airport, Hospitality and any open space areas that require a unique and elegant architectural lighting design.

MOUNTING:

Universal mounting brackets are for easy installation to standard 15/16” or 9/16” T-Bars of most manufacturers’ ceiling suspension systems. Armstrong compatible mounting clips for installation with Armstrong Ceiling 15/16” Prelude® and Clean Room™, 9/16” Suprafine®, Silhouette®, Sonata®, Interlude®, and DC FlexZone™ suspension systems.

MATERIALS:

Anodized and painted aluminum extruded body, steel mounting clips, white PC end caps, high transmitting acrylic PMMA lens.

ELECTRIC:

High output LEDs consume 16W total (2 foot) or 32W total (4 foot) or 40W total (5 foot). Power supply consumption not included. Input voltage 24VDC. Class 2 plenum rated cables at each end equipped with quick connectors to allow multiple modules to be easily connected together (max 12 linear feet of product). Use solid copper wire or wire ferrules to fit into quick connectors.

WARRANTY:

5 years

LISTINGS:

ETL/cETLus CE RoHS Indoor use only.

MADE IN USA

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WST LED

Architectural Wall Sconce

Buy American

Catalog Number	
Notes	
Type	OW

Hit the Tab key or mouse over the page to see all interactive elements.

Specifications

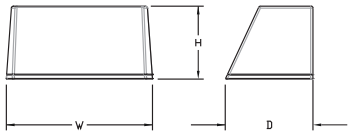
Luminaire

Height: 8-1/2″ *(21.59 cm)*

Width: 17″ *(43.18 cm)*

Depth: 10-3/16″ *(25.9 cm)*

Weight: 20 lbs *(9.1 kg)*

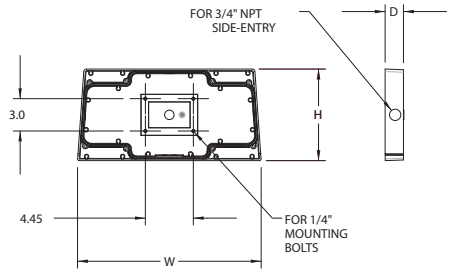


Optional Back Box (PBBW)

Height: 8.49″ *(21.56 cm)*

Width: 17.01″ *(43.21 cm)*

Depth: 1.70″ *(4.32 cm)*

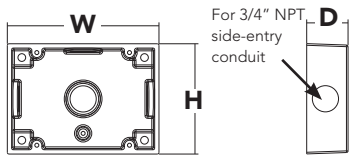


Optional Back Box (BBW)

Height: 4″ *(10.2 cm)*

Width: 5-1/2″ *(14.0 cm)*

Depth: 1-1/2″ *(3.8 cm)*



Capable Luminaire

This item is an A+ capable luminaire, which has been designed and tested to provide consistent color appearance and system-level interoperability.

- All configurations of this luminaire meet the Acuity Brands' specification for chromatic consistency
- This luminaire is A+ Certified when ordered with DTL® controls marked by a shaded background. DTL DLL equipped luminaires meet the A+ specification for luminaire to photocontrol interoperability1
- This luminaire is part of an A+ Certified solution for ROAM® or XPoint™ Wireless control networks, providing out-of-the-box control compatibility with simple commissioning, when ordered with drivers and control options marked by a shaded background[1]

To learn more about A+, visit www.acuitybrands.com/aplus.

See ordering tree for details.

A+ Certified Solutions for ROAM require the order of one ROAM node per luminaire. Sold Separately: Link to Roam; Link to DTL DLL

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A+ Capable options indicated by this color background.

Ordering Information

EXAMPLE: WST LED P1 40K VF MVOLT DDBTXD

WST LED					
Series	**Performance Package**	**Color temperature**	**Distribution**	**Voltage**	**Mounting**
WST LED	P1 1,500 Lumen package P2 3,000 Lumen package P3 6,000 Lumen package	27K 2700 K 30K 3000 K 40K 4000 K 50K 5000 K	VF Visual comfort forward throw VW Visual comfort wide	MVOLT[1] 120[2] 208[2] 240[2] 277[2] 347[2] 480[2]	**Shipped included** (blank) Surface mounting bracket **Shipped separately** BBW Surface-mounted back box[3] PBBW Premium surface-mounted back box[3,4]

Options

NLTAIR2 PIR	nLIGHT AIR Wireless enabled motion/ambient sensor for 8'-15' mounting heights[5,6,7]
NLTAIR2 PIRH	nLIGHT AIR Wireless enabled motion/ambient sensor for 15'-30' mounting heights[5,6,7]
PE	Photoelectric cell, button type[8]
PER	NEMA twist-lock receptacle only (controls ordered separate)[9]
PER5	Five-wire receptacle only (controls ordered separate)[9]
PER7	Seven-wire receptacle only (controls ordered separate)[9]
PIR	Motion/Ambient Light Sensor, 8-15' mounting height[5,6]
PIR1FC3V	Motion/ambient sensor, 8-15' mounting height, ambient sensor enabled at 1fc[5,6]
PIRH	180° motion/ambient light sensor, 15-30' mounting height[5,6]
PIRH1FC3V	Motion/ambient sensor, 15-30' mounting height, ambient sensor enabled at 1fc[5,6]
SF	Single fuse (120, 277, 347V)[2]
DF	Double fuse (208, 240, 480V)[2]
DS	Dual switching[10]
DMG	0-10V dimming extend out back of housing for external control (control ordered separate)[11]
E7WH	Emergency battery backup, Non CEC compliant (7W)[7]
E7WC	Emergency battery backup, CA Title 20 Noncompliant (cold, 7W)[7,12]
E7WHR	Remote emergency battery backup, CA Title 20 Noncompliant (remote 7W)[7,13]
E20WH	Emergency battery pack 18W constant power, Certified in CA Title 20 MAEDBS[7]
E20WC	Emergency battery pack -20°C 18W constant power, Certified in CA Title 20 MAEDBS[7,12]
E23WHR	Remote emergency battery backup, CA Title 20 Noncompliant (remote 20W)[7,12,14]
LCE	Left side conduit entry[15]
RCE	Right side conduit entry[15]
BAA	Buy America(n) Act Compliant

Shipped separately

RBPW	Retrofit back plate[3]
VG	Vandal guard[15]
WG	Wire guard[15]

Finish *(required)*

DDBXD	Dark bronze
DBLXD	Black
DNAXD	Natural aluminum
DWHXD	White
DSSXD	Sandstone
DDBTXD	Textured dark bronze
DBLBXD	Textured black
DNATXD	Textured natural aluminum
DWHGXD	Textured white
DSSTXD	Textured sandstone

Accessories

Ordered and shipped separately.

WSTVCPBBW DDBXD U	Premium Surface - mounted back box
WSBBW DDBTXD U	Surface - mounted back box
RBPW DDBXD U	Retrofit back plate
DLL127F 1.5 JU	Photocell - SSL twist-lock (120-277V)[17]
DLL347F 1.5 CUL JU	Photocell - SSL twist-lock (347V)[17]
DLL480F 1.5 CUL JU	Photocell - SSL twist-lock (480V)[17]

NOTES

1. MVOLT driver operates on any line voltage from 120-277V (50/60 Hz).
2. Single fuse (SF) requires 120V, 277V or 347V. Double fuse (DF) requires 208V, 240V or 480V.
3. Also available as a separate accessory; see accessories information.
4. Top conduit entry standard.
5. Not available with VG or WG. See PER Table.
6. Reference Motion Sensor table.
7. Not available with 347/480V.
8. Need to specify 120, 208, 240 or 277 voltage.
9. Photocell ordered and shipped as a separate line item from Acuity Brands Controls. Shorting Cap included.
10. Not available with Emergency options, PE or PER options.
11. DMG option not available with standalone or networked sensors/controls.
12. Battery pack rated for -20° to 40°C.
13. Comes with PBBW.
14. Warranty period is 3-years.
15. Not available with BBW.
16. Must order with fixture; not an accessory.
17. Requires luminaire to be specified with PER, PER5 or PER7 option. See PER Table.

Emergency Battery Operation

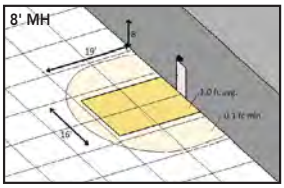
The emergency battery backup is integral to the luminaire — no external housing required! This design provides reliable emergency operation while maintaining the aesthetics of the product.

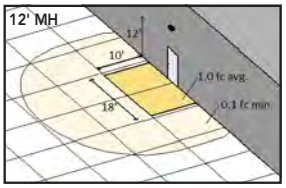
All emergency backup configurations include an independent secondary driver with an integral relay to immediately detect AC power loss, meeting interpretations of NFPA 70/NEC 2008 - 700.16

The emergency battery will power the luminaire for a minimum duration of 90 minutes (maximum duration of three hours) from the time supply power is lost, per International Building Code Section 1006 and NFPA 101 Life Safety Code Section 7.9, provided luminaires are mounted at an appropriate height and illuminate an open space with no major obstructions.

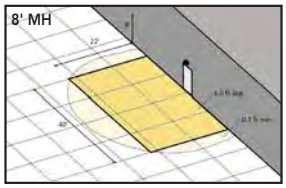
The examples below show illuminance of 1 fc average and 0.1 fc minimum of the P1 power package and VF distribution product in emergency mode.

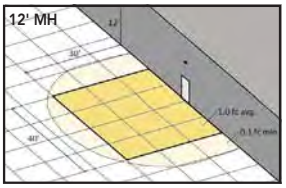
10' x 10' Gridlines
8' and 12' Mounting Height





WST LED P1 27K VF MVOLT E7WH





WST LED P2 40K VF MVOLT E20WH

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Attachment #9
Storm Drainage Calculations

DRAINAGE REPORT

HAFB 309 SWEG Drainage Report

Prepared by:
Jackson Engineering
3376 Stonehill Lane
Cottonwood Heights, UT 84121

Purpose

This drainage report documents the analysis used to support the drainage design for the proposed HAFB 309 SWEG facility. The 309 SWEG building is proposed to be located between Building 2720 (BOB) and Building 2721 (TINA). The proposed location is depicted below in Figure 1.

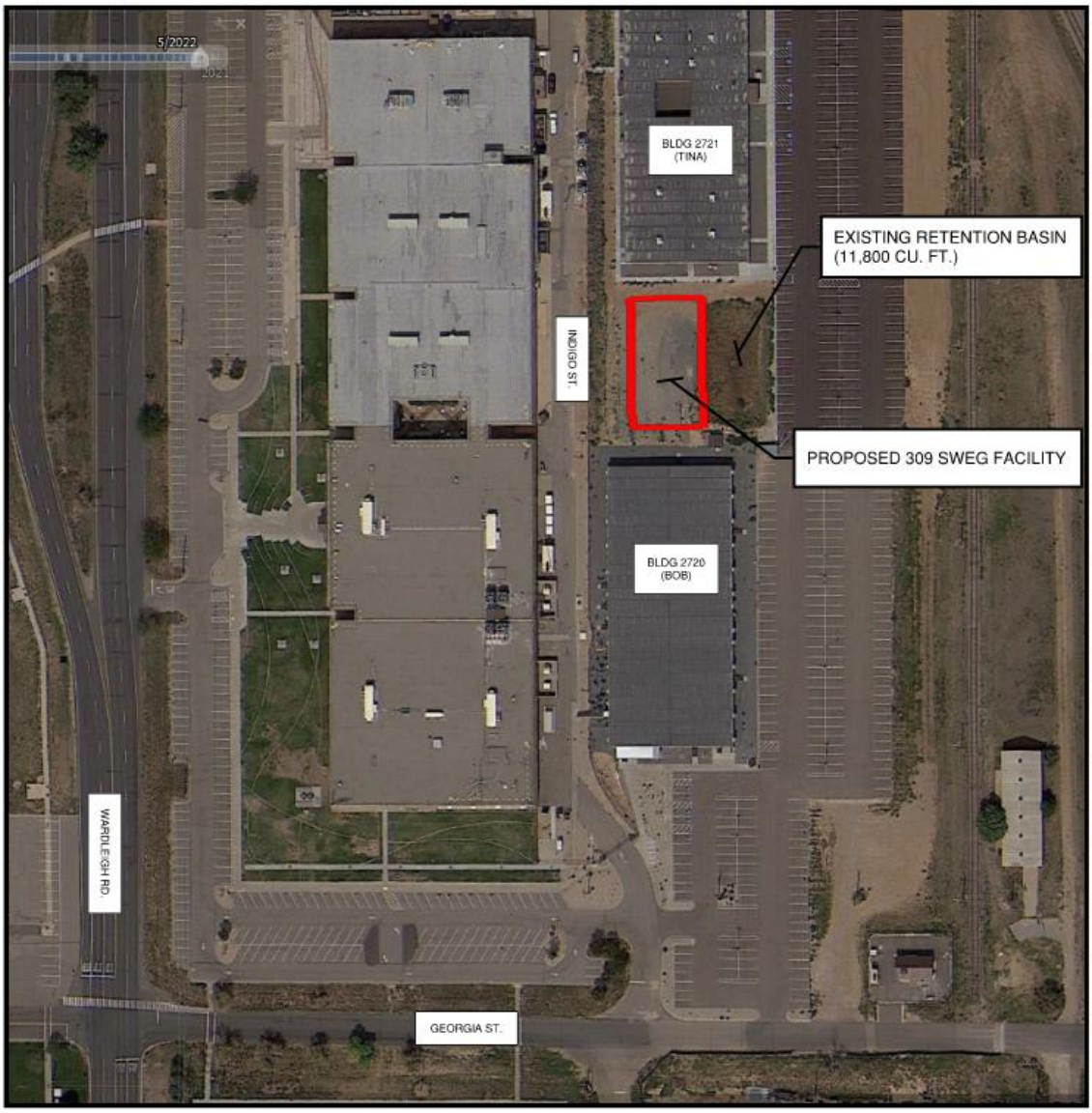


Figure 1: Vicinity Map

The existing open stormwater retention basin, with an existing volume capacity of 11,800 cubic feet, is to be converted to underground retention using subsurface chamber structure to capture and contain the full volume from the 100-Year event. As with any existing facilities, assumptions regarding this analysis were made based on a site-specific land survey combined with industry knowledge and other provided data.

In the existing condition, the slope generally drains from east to west over asphalt and existing natural land cover. This analysis assumes there is a hydrologic divide on the east side along the railroad that runs north/south approximately 100' west of Jonquil Lane. Runoff from asphalt area is captured in a catch basin and is conveyed to the existing retention basin. The Building 2720 roof drain collection system to the south of the project site was assumed to all drain north to the existing basin located at the project site. The parking area immediately east of the project site is diverted north by curb and gutter and curb inlet boxes to an existing storm water basin location immediately north of Building 2721 The new building's roof impervious surface was considered in the analysis. The landuse for the drainage area can be described as a mixture of urban with earthen cover mixed with dirt, small vegetation and some underlying grass.

Terracon (report dated 03-10-2022) performed testing at a depth of 6' to test the percolation at the site at boring holes B-1, B-2, P-3, and P-4 (see Appendix B). Of note Terrecon identified potential collapsible soils, as such careful consideration should be used to prohibit placing structures (buildings) in the structural influence of collapsible soils.

Percolation rates were derived by observing interval water level drop over time with lithology being noted. Test pits P-3 and P-4 are located within the existing retention basin are used in preparation of this document and analysis. P-3 and P-4 are reported to have a percolation rate of 17.14 and 120.00 mins per inch or 3.5 in/hr and 0.5 in/hr respectively. This results in an average percolation rate of 2 in/hr. Typically, the industry standard for retention systems is to require that the rate be at least 0.5 in/hr. This condition is satisfied by the testing data performed and validates the design. For a conservative measure, no percolation discharge into soils was considered in this analysis for retention volume calculations.

Drainage Analysis

The analysis has been prepared in accordance with the provisions of Specification Section 01 57 20 Environmental Protection and Section 438 of the EISA.

A singular drainage basin delineated with an area of 3.191 acres incorporates various factors including composite land use to represent the hydrologic condition. Stormwater generated within defined basin are conveyed through these various hydraulic systems, combine and terminate at the retention basin.

The area in the model represents the area that drains to the existing open retention basin and new infiltration system. Refer to Grading Plans for elevation data. The 100-YR, 6 HR event was used in this analysis for peak flow and total volume. Autodesk's Storm and Sanitary 2021 modeling program was used to model the proposed hydrologic conditions which is built on the SWMM engine.

National Oceanic and Atmospheric Administration (NOAA) Atlas 14 values were used to obtain point precipitation with 90% confidence intervals for the hydrologic modeling for this site. The Lag and Transform methods were used with The United States Department of Agriculture's (USDA's) TR-55 program was used. The USGS web survey was used to obtain the Hydrologic Soil Group (HSG) of "A". This rating is A-D, where A is the most pervious and has the least runoff. The HSG soil is then used to

obtain the Curve Number (CN) within the site. A composite curve number of 85.21 was used. Using sheet flow and shallow flow, the time of concentration and lag time are calculated with a minimum TOC of 5 minutes.

Retention Basin

A below grade chamber retention basin system as proposed is provided in Appendix A. This chamber system has been designed to capture 100% of the storm design volume is provided in Appendix B. The top of final grade in the area of the chamber system is generally elevation 4667.0'. The below grade chambers are 45" tall. The top of chamber is proposed at elevation 4665.0 with 12" of gravel/stone over the chamber to an elevation 4666.0'. Below the chambers is 24" of gravel/stone down to an elevation of 4659.25. The below grade storm retention system will include an emergency overflow via 3'x3' inlet box with grated cover elevation of 4666.0 which will then drain to the west between buildings 2720 and 309 SWEG to Indigo Street. Inflow pipes will be connected prior to entering the chamber. With no primary outlet for the basin, it will provide a high level of water quality service and will recharge groundwater and all contaminants will be remain onsite. Routine maintenance of the facility per manufacturer's recommendations must be followed. Although no percolation was considered in this analysis, the basin would infiltrate approximately 12" of water over a 6-hour period or 48" of water over a 24 hour period.

Storm Water Calculations Summary

Refer to Appendix B for full calculations

100-YR Peak Flow= 2.6 CFS

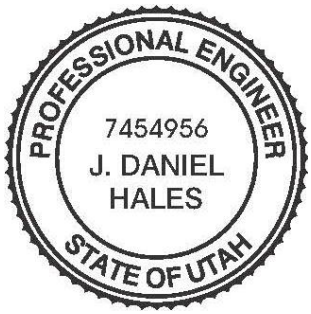
100-YR Peak Volume=12,072 CF or 0.28 AC-FT. The below grade chamber system is designed to capture 12,190 CF.

These results are similar to the previous design but account for a larger required volume due to the new structure. No history of flooding is known by the preparer of this document.

This drainage study complies with federal drainage guidelines.

I hereby certify that this report for the onsite drainage of the project was prepared by me (or under my direct supervision) in accordance with the provisions of Specification Section 01 57 20 Environmental Protection and Section 438 of the EISA, and was designed to comply with the provisions thereof. I understand that the Hill AFB project manager does not, and will not, assume responsibility for the calculations and resulting conclusions.

Daniel Hales P.E.



Appendices

Appendix A

Retention Chamber Details & Specifications (Preliminary)

Appendix B

Supporting Calculations and other data

Percolation report (excerpt)

Appendix A

PROJECT INFORMATION	
ENGINEERED PRODUCT MANAGER	
ADS SALES REP	
PROJECT NO.	

Advanced Drainage Systems, Inc.

SiteAssist®
FOR STORMTECH INSTALLATION INSTRUCTIONS VISIT OUR APP

HAFB 309 SWEG

HILL AFB, UT

MC-3500 STORMTECH CHAMBER SPECIFICATIONS

1. CHAMBERS SHALL BE STORMTECH MC-3500.
2. CHAMBERS SHALL BE ARCH-SHAPED AND SHALL BE MANUFACTURED FROM VIRGIN, IMPACT-MODIFIED POLYPROPYLENE COPOLYMERS.
3. CHAMBERS SHALL MEET THE REQUIREMENTS OF ASTM F2418, "STANDARD SPECIFICATION FOR POLYPROPYLENE (PP) CORRUGATED WALL STORMWATER COLLECTION CHAMBERS" CHAMBER CLASSIFICATION 45x76 DESIGNATION SS.
4. CHAMBER ROWS SHALL PROVIDE CONTINUOUS, UNOBSTRUCTED INTERNAL SPACE WITH NO INTERNAL SUPPORTS THAT WOULD IMPEDE FLOW OR LIMIT ACCESS FOR INSPECTION.
5. THE STRUCTURAL DESIGN OF THE CHAMBERS, THE STRUCTURAL BACKFILL, AND THE INSTALLATION REQUIREMENTS SHALL ENSURE THAT THE LOAD FACTORS SPECIFIED IN THE AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS, SECTION 12.12, ARE MET FOR: 1) LONG-DURATION DEAD LOADS AND 2) SHORT-DURATION LIVE LOADS, BASED ON THE AASHTO DESIGN TRUCK WITH CONSIDERATION FOR IMPACT AND MULTIPLE VEHICLE PRESENCES.
6. CHAMBERS SHALL BE DESIGNED, TESTED AND ALLOWABLE LOAD CONFIGURATIONS DETERMINED IN ACCORDANCE WITH ASTM F2787, "STANDARD PRACTICE FOR STRUCTURAL DESIGN OF THERMOPLASTIC CORRUGATED WALL STORMWATER COLLECTION CHAMBERS". LOAD CONFIGURATIONS SHALL INCLUDE: 1) INSTANTANEOUS (<1 MIN) AASHTO DESIGN TRUCK LIVE LOAD ON MINIMUM COVER 2) MAXIMUM PERMANENT (75-YR) COVER LOAD AND 3) ALLOWABLE COVER WITH PARKED (1-WEEK) AASHTO DESIGN TRUCK.
7. REQUIREMENTS FOR HANDLING AND INSTALLATION:
   - TO MAINTAIN THE WIDTH OF CHAMBERS DURING SHIPPING AND HANDLING, CHAMBERS SHALL HAVE INTEGRAL, INTERLOCKING STACKING LUGS.
   - TO ENSURE A SECURE JOINT DURING INSTALLATION AND BACKFILL, THE HEIGHT OF THE CHAMBER JOINT SHALL NOT BE LESS THAN 3".
   - TO ENSURE THE INTEGRITY OF THE ARCH SHAPE DURING INSTALLATION, a) THE ARCH STIFFNESS CONSTANT SHALL BE GREATER THAN OR EQUAL TO 450 LBS/FT/%, THE ASC IS DEFINED IN SECTION 6.2.8 OF ASTM F2418, AND b) TO RESIST CHAMBER DEFORMATION DURING INSTALLATION AT ELEVATED TEMPERATURES (ABOVE 73° F / 23° C), CHAMBERS SHALL BE PRODUCED FROM REFLECTIVE GOLD OR YELLOW COLORS.
8. ONLY CHAMBERS THAT ARE APPROVED BY THE SITE DESIGN ENGINEER WILL BE ALLOWED. UPON REQUEST BY THE SITE DESIGN ENGINEER OR OWNER, THE CHAMBER MANUFACTURER SHALL SUBMIT A STRUCTURAL EVALUATION FOR APPROVAL BEFORE DELIVERING CHAMBERS TO THE PROJECT SITE AS FOLLOWS:
   - THE STRUCTURAL EVALUATION SHALL BE SEALED BY A REGISTERED PROFESSIONAL ENGINEER.
   - THE STRUCTURAL EVALUATION SHALL DEMONSTRATE THAT THE SAFETY FACTORS ARE GREATER THAN OR EQUAL TO 1.95 FOR DEAD LOAD AND 1.75 FOR LIVE LOAD, THE MINIMUM REQUIRED BY ASTM F2787 AND BY SECTIONS 3 AND 12.12 OF THE AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS FOR THERMOPLASTIC PIPE.
   - THE TEST DERIVED CREEP MODULUS AS SPECIFIED IN ASTM F2418 SHALL BE USED FOR PERMANENT DEAD LOAD DESIGN EXCEPT THAT IT SHALL BE THE 75-YEAR MODULUS USED FOR DESIGN.
9. CHAMBERS AND END CAPS SHALL BE PRODUCED AT AN ISO 9001 CERTIFIED MANUFACTURING FACILITY.

IMPORTANT - NOTES FOR THE BIDDING AND INSTALLATION OF MC-3500 CHAMBER SYSTEM

1. STORMTECH MC-3500 CHAMBERS SHALL NOT BE INSTALLED UNTIL THE MANUFACTURER'S REPRESENTATIVE HAS COMPLETED A PRE-CONSTRUCTION MEETING WITH THE INSTALLERS.
2. STORMTECH MC-3500 CHAMBERS SHALL BE INSTALLED IN ACCORDANCE WITH THE "STORMTECH MC-3500/MC-4500 CONSTRUCTION GUIDE".
3. CHAMBERS ARE NOT TO BE BACKFILLED WITH A DOZER OR AN EXCAVATOR SITUATED OVER THE CHAMBERS. STORMTECH RECOMMENDS 3 BACKFILL METHODS:
   - STONESHOOTER LOCATED OFF THE CHAMBER BED.
   - BACKFILL AS ROWS ARE BUILT USING AN EXCAVATOR ON THE FOUNDATION STONE OR SUBGRADE.
   - BACKFILL FROM OUTSIDE THE EXCAVATION USING A LONG BOOM HOE OR EXCAVATOR.
4. THE FOUNDATION STONE SHALL BE LEVELED AND COMPACTED PRIOR TO PLACING CHAMBERS.
5. JOINTS BETWEEN CHAMBERS SHALL BE PROPERLY SEATED PRIOR TO PLACING STONE.
6. MAINTAIN MINIMUM - 6" (150 mm) SPACING BETWEEN THE CHAMBER ROWS.
7. INLET AND OUTLET MANIFOLDS MUST BE INSERTED A MINIMUM OF 12" (300 mm) INTO CHAMBER END CAPS.
8. EMBEDMENT STONE SURROUNDING CHAMBERS MUST BE A CLEAN, CRUSHED, ANGULAR STONE MEETING THE AASHTO M43 DESIGNATION OF #3 OR #4.
9. STONE MUST BE PLACED ON THE TOP CENTER OF THE CHAMBER TO ANCHOR THE CHAMBERS IN PLACE AND PRESERVE ROW SPACING.
10. THE CONTRACTOR MUST REPORT ANY DISCREPANCIES WITH CHAMBER FOUNDATION MATERIALS BEARING CAPACITIES TO THE SITE DESIGN ENGINEER.
11. ADS RECOMMENDS THE USE OF "FLEXSTORM CATCH IT" INSERTS DURING CONSTRUCTION FOR ALL INLETS TO PROTECT THE SUBSURFACE STORMWATER MANAGEMENT SYSTEM FROM CONSTRUCTION SITE RUNOFF.

NOTES FOR CONSTRUCTION EQUIPMENT

1. STORMTECH MC-3500 CHAMBERS SHALL BE INSTALLED IN ACCORDANCE WITH THE "STORMTECH MC-3500/MC-4500 CONSTRUCTION GUIDE".
2. THE USE OF EQUIPMENT OVER MC-3500 CHAMBERS IS LIMITED:
   - NO EQUIPMENT IS ALLOWED ON BARE CHAMBERS.
   - NO RUBBER TIRED LOADER, DUMP TRUCK, OR EXCAVATORS ARE ALLOWED UNTIL PROPER FILL DEPTHS ARE REACHED IN ACCORDANCE WITH THE "STORMTECH MC-3500/MC-4500 CONSTRUCTION GUIDE".
   - WEIGHT LIMITS FOR CONSTRUCTION EQUIPMENT CAN BE FOUND IN THE "STORMTECH MC-3500/MC-4500 CONSTRUCTION GUIDE".
3. FULL 36" (900 mm) OF STABILIZED COVER MATERIALS OVER THE CHAMBERS IS REQUIRED FOR DUMP TRUCK TRAVEL OR DUMPING.

USE OF A DOZER TO PUSH EMBEDMENT STONE BETWEEN THE ROWS OF CHAMBERS MAY CAUSE DAMAGE TO CHAMBERS AND IS NOT AN ACCEPTABLE BACKFILL METHOD. ANY CHAMBERS DAMAGED BY USING THE "DUMP AND PUSH" METHOD ARE NOT COVERED UNDER THE STORMTECH STANDARD WARRANTY.

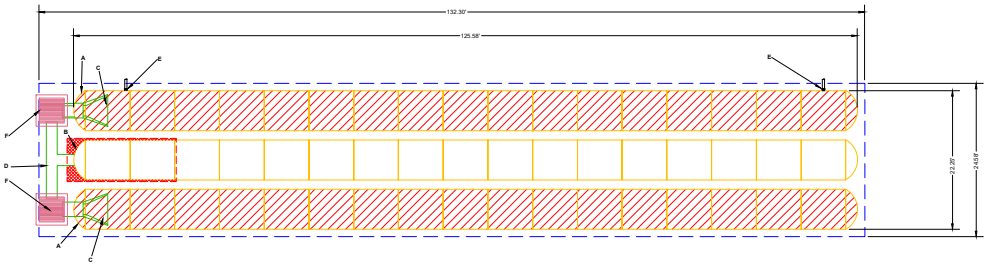
CONTACT STORMTECH AT 1-888-892-2694 WITH ANY QUESTIONS ON INSTALLATION REQUIREMENTS OR WEIGHT LIMITS FOR CONSTRUCTION EQUIPMENT.

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PROPOSED LAYOUT		PROPOSED ELEVATIONS	
51	STORMTECH MC-3500 CHAMBERS	MAXIMUM ALLOWABLE GRADE (TOP OF PAVEMENT/UNPAVED):	4673.17
6	STORMTECH MC-3500 END CAPS	MINIMUM ALLOWABLE GRADE (UNPAVED WITH TRAFFIC):	4667.17
12	STONE ABOVE (in)	MINIMUM ALLOWABLE GRADE (UNPAVED NO TRAFFIC):	4666.67
24	STONE BELOW (in)	MINIMUM ALLOWABLE GRADE (TOP OF RIGID CONCRETE PAVEMENT):	4666.67
40	STONE VOID	MINIMUM ALLOWABLE GRADE (BASE OF FLEXIBLE PAVEMENT):	4666.67
12200	INSTALLED SYSTEM VOLUME (CF) (PERIMETER STONE INCLUDED) (COVER STONE INCLUDED) (BASE STONE INCLUDED)	TOP OF STONE:	4666.00
		TOP OF MC-3500 CHAMBER:	4665.00
		4" INSERTA TEE INVERT:	4661.75
		24" ISOLATOR ROW PLUS INVERT:	4661.42
3252	SYSTEM AREA (SF)	24" ISOLATOR ROW PLUS INVERT:	4661.42
313.8	SYSTEM PERIMETER (ft)	24" ISOLATOR ROW PLUS INVERT:	4661.42
		18" x 18" BOTTOM MANIFOLD INVERT:	4661.40
		BOTTOM OF MC-3500 CHAMBER:	4661.25
		BOTTOM OF STONE:	4659.25

*INVERT ABOVE BASE OF CHAMBER

PART TYPE	ITEM ON LAYOUT	DESCRIPTION	INVERT*	MAX FLOW
PREFABRICATED END CAP	A	24" BOTTOM CORED END CAP, PART#: MC3500IEPP24BC / TYP OF ALL 24" BOTTOM CONNECTIONS AND ISOLATOR PLUS ROWS	2.06"	
PREFABRICATED END CAP	B	18" BOTTOM CORED END CAP, PART#: MC3500IEPP18BC / TYP OF ALL 18" BOTTOM CONNECTIONS	1.77"	
FLAMP	C	INSTALL FLAMP ON 24" ACCESS PIPE / PART#: MC350024RAMP (TYP 3 PLACES)		
MANIFOLD	D	18" x 18" BOTTOM MANIFOLD, ADS N-12	1.77"	
INSERTA TEE	E	6" DIAMETER INSERTA TEE	6.00"	
CONCRETE STRUCTURE	F	48"x48" PRECAST CONCRETE STORM DRAIN BOX WITH GRATED INLET		



ISOLATOR ROW PLUS
(SEE DETAIL/TYP 2 PLACES)

PLACE MINIMUM 17.50' OF ADSPLUS175 WOVEN GEOTEXTILE OVER BEDDING STONE AND UNDERNEATH CHAMBER FEET FOR SCOUR PROTECTION AT ALL CHAMBER INLET ROWS

BED LIMITS

NOTES

- MANIFOLD SIZE TO BE DETERMINED BY SITE DESIGN ENGINEER. SEE TECH NOTE #6.32 FOR MANIFOLD SIZING GUIDANCE.
- DUE TO THE ADAPTATION OF THIS CHAMBER SYSTEM TO SPECIFIC SITE AND DESIGN CONSTRAINTS, IT MAY BE NECESSARY TO CUT AND COUPLE ADDITIONAL PIPE TO STANDARD MANIFOLD COMPONENTS IN THE FIELD.
- THE SITE DESIGN ENGINEER MUST REVIEW ELEVATIONS AND IF NECESSARY ADJUST GRADING TO ENSURE THE CHAMBER COVER REQUIREMENTS ARE MET.
- THIS CHAMBER SYSTEM WAS DESIGNED WITHOUT SITE-SPECIFIC INFORMATION ON SOIL CONDITIONS OR BEARING CAPACITY. THE SITE DESIGN ENGINEER IS RESPONSIBLE FOR DETERMINING THE SUITABILITY OF THE SOIL AND PROVIDING THE BEARING CAPACITY OF THE INSITU SOILS. THE BASE STONE DEPTH MAY BE INCREASED OR DECREASED ONCE THIS INFORMATION IS PROVIDED.
- **NOT FOR CONSTRUCTION:** THIS LAYOUT IS FOR DIMENSIONAL PURPOSES ONLY TO PROVE CONCEPT & THE REQUIRED STORAGE VOLUME CAN BE ACHIEVED ON SITE.

HILL AIR FORCE BASE
HILL AFB, UT
DRAWN: WA
DATE:
CHECKED: N/A
PROJECT #:

DATE	DRW	CHK	DESCRIPTION

THE STORMTECH MC-3500 CHAMBER SYSTEM SHOWN IN THIS DRAWING IS INTENDED TO ASSIST ENGINEERS IN THE DESIGN PROCESS ONLY. THE SITE DESIGN ENGINEER SHALL REVIEW THIS DRAWING PRIOR TO CONSTRUCTION. IT IS THE ULTIMATE RESPONSIBILITY OF THE SITE DESIGN ENGINEER TO ENSURE THAT THE PROJECT COMPLIES WITH ALL APPLICABLE CODES AND REGULATIONS. CONTACT STORMTECH AT 1-800-733-7473 OR VISIT WWW.STORMTECH.COM FOR ADDITIONAL INFORMATION, CAD DETAILS AND SPECIFICATIONS.

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ADS

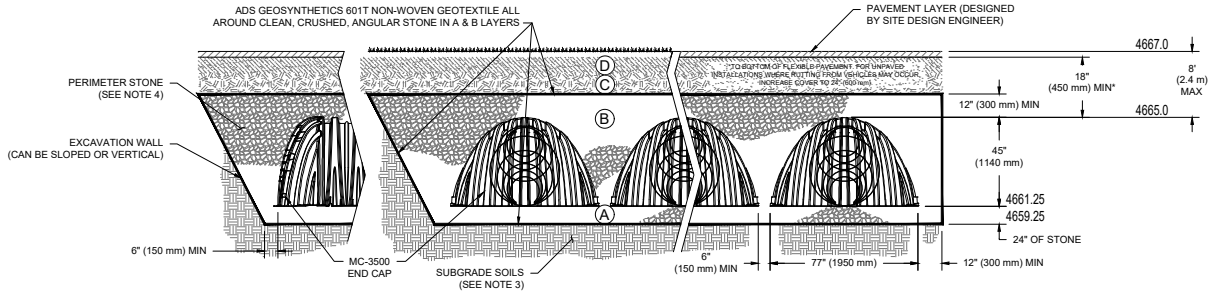
0 1.5' 30'

SHEET
2 OF 6

ACCEPTABLE FILL MATERIALS: STORMTECH MC-3500 CHAMBER SYSTEMS

	MATERIAL LOCATION	DESCRIPTION	AASHTO MATERIAL CLASSIFICATIONS	COMPACTION / DENSITY REQUIREMENT
D	**FINAL FILL:** FILL MATERIAL FOR LAYER 'D' STARTS FROM THE TOP OF THE 'C' LAYER TO THE BOTTOM OF FLEXIBLE PAVEMENT OR UNPAVED FINISHED GRADE ABOVE. NOTE THAT PAVEMENT SUBBASE MAY BE PART OF THE 'D' LAYER	ANY SOIL/ROCK MATERIALS, NATIVE SOILS, OR PER ENGINEER'S PLANS. CHECK PLANS FOR PAVEMENT SUBGRADE REQUIREMENTS.	N/A	PREPARE PER SITE DESIGN ENGINEER'S PLANS. PAVED INSTALLATIONS MAY HAVE STRINGENT MATERIAL AND PREPARATION REQUIREMENTS.
C	**INITIAL FILL:** FILL MATERIAL FOR LAYER 'C' STARTS FROM THE TOP OF THE EMBEDMENT STONE ('B' LAYER) TO 24" (600 mm) ABOVE THE TOP OF THE CHAMBER. NOTE THAT PAVEMENT SUBBASE MAY BE A PART OF THE 'C' LAYER.	GRANULAR WELL-GRADED SOIL/AGGREGATE MIXTURES, <35% FINES OR PROCESSED AGGREGATE. MOST PAVEMENT SUBBASE MATERIALS CAN BE USED IN LIEU OF THIS LAYER.	AASHTO M145[1] A-1, A-2-4, A-3 OR AASHTO M43[1] 3, 357, 4, 467, 5, 56, 57, 6, 67, 68, 7, 78, 8, 89, 9, 10	BEGIN COMPACTIONS AFTER 24" (600 mm) OF MATERIAL OVER THE CHAMBERS IS REACHED. COMPACT ADDITIONAL LAYERS IN 12" (300 mm) MAX LIFTS TO A MIN. 95% PROCTOR DENSITY FOR WELL GRADED MATERIAL AND 95% RELATIVE DENSITY FOR PROCESSED AGGREGATE MATERIALS.
B	**EMBEDMENT STONE:** FILL SURROUNDING THE CHAMBERS FROM THE FOUNDATION STONE ('A' LAYER) TO THE 'C' LAYER ABOVE.	CLEAN, CRUSHED, ANGULAR STONE	AASHTO M43[1] 3, 4	NO COMPACTION REQUIRED.
A	**FOUNDATION STONE:** FILL BELOW CHAMBERS FROM THE SUBGRADE UP TO THE FOOT (BOTTOM) OF THE CHAMBER.	CLEAN, CRUSHED, ANGULAR STONE	AASHTO M43[1] 3, 4	PLATE COMPACT OR ROLL TO ACHIEVE A FLAT SURFACE.[2,3]

PLEASE NOTE:
1. THE LISTED AASHTO DESIGNATIONS ARE FOR GRADATIONS ONLY. THE STONE MUST ALSO BE CLEAN, CRUSHED, ANGULAR. FOR EXAMPLE, A SPECIFICATION FOR #4 STONE WOULD STATE: "CLEAN, CRUSHED, ANGULAR NO. 4 (AASHTO M43) STONE".
2. STORMTECH COMPACTION REQUIREMENTS ARE MET FOR 'A' LOCATION MATERIALS WHEN PLACED AND COMPACTED IN 9" (230 mm) (MAX) LIFTS USING TWO FULL COVERAGES WITH A VIBRATORY COMPACTOR.
3. WHERE INFILTRATION SURFACES MAY BE COMPROMISED BY COMPACTION, FOR STANDARD DESIGN LOAD CONDITIONS, A FLAT SURFACE MAY BE ACHIEVED BY RAKING OR DRAGGING WITHOUT COMPACTION EQUIPMENT. FOR SPECIAL LOAD DESIGNS, CONTACT STORMTECH FOR COMPACTION REQUIREMENTS.
4. ONCE LAYER 'C' IS PLACED, ANY SOIL/MATERIAL CAN BE PLACED IN LAYER 'D' UP TO THE FINISHED GRADE. MOST PAVEMENT SUBBASE SOILS CAN BE USED TO REPLACE THE MATERIAL REQUIREMENTS OF LAYER 'C' OR 'D' AT THE SITE DESIGN ENGINEER'S DISCRETION.



NOTES:

1. CHAMBERS SHALL MEET THE REQUIREMENTS OF ASTM F2418, "STANDARD SPECIFICATION FOR POLYPROPYLENE (PP) CORRUGATED WALL STORMWATER COLLECTION CHAMBERS" CHAMBER CLASSIFICATION 45x76 DESIGNATION SS.
2. MC-3500 CHAMBERS SHALL BE DESIGNED IN ACCORDANCE WITH ASTM F2787 "STANDARD PRACTICE FOR STRUCTURAL DESIGN OF THERMOPLASTIC CORRUGATED WALL STORMWATER COLLECTION CHAMBERS".
3. THE SITE DESIGN ENGINEER IS RESPONSIBLE FOR ASSESSING THE BEARING RESISTANCE (ALLOWABLE BEARING CAPACITY) OF THE SUBGRADE SOILS AND THE DEPTH OF FOUNDATION STONE WITH CONSIDERATION FOR THE RANGE OF EXPECTED SOIL MOISTURE CONDITIONS.
4. PERIMETER STONE MUST BE EXTENDED HORIZONTALLY TO THE EXCAVATION WALL FOR BOTH VERTICAL AND SLOPED EXCAVATION WALLS.
5. REQUIREMENTS FOR HANDLING AND INSTALLATION:
   - TO MAINTAIN THE WIDTH OF CHAMBERS DURING SHIPPING AND HANDLING, CHAMBERS SHALL HAVE INTEGRAL, INTERLOCKING STACKING LUGS.
   - TO ENSURE A SECURE JOINT DURING INSTALLATION AND BACKFILL, THE HEIGHT OF THE CHAMBER JOINT SHALL NOT BE LESS THAN 3".
   - TO ENSURE THE INTEGRITY OF THE ARCH SHAPE DURING INSTALLATION, a) THE ARCH STIFFNESS CONSTANT SHALL BE GREATER THAN OR EQUAL TO 450 LBS/FT/%. THE ASC IS DEFINED IN SECTION 6.2.8 OF ASTM F2418. AND b) TO RESIST CHAMBER DEFORMATION DURING INSTALLATION AT ELEVATED TEMPERATURES (ABOVE 73° F / 23° C), CHAMBERS SHALL BE PRODUCED FROM REFLECTIVE GOLD OR YELLOW COLORS.

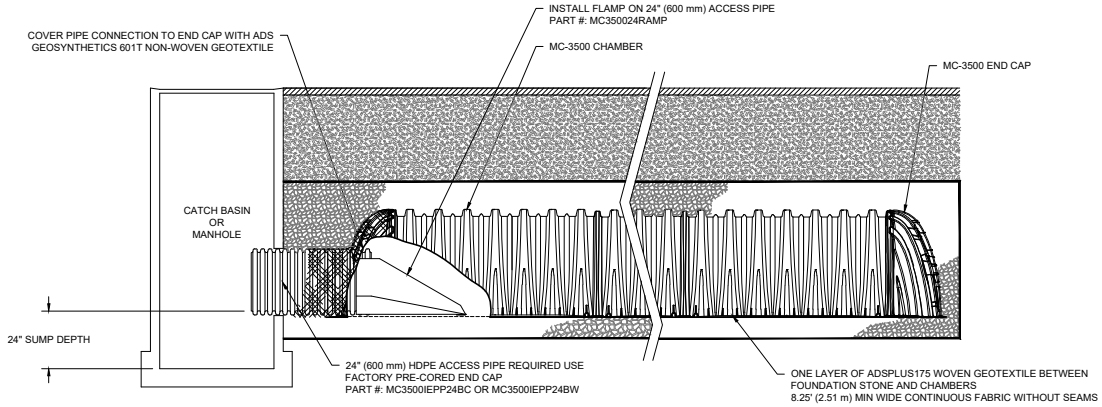
HILL AIR FORCE BASE
HILL AFB, UT
DRAWN: WA
DATE:
CHECKED: N/A
PROJECT #:

DATE	DRW	CHK	DESCRIPTION

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MC-3500 ISOLATOR ROW PLUS DETAIL
NTS

INSPECTION & MAINTENANCE

STEP 1) INSPECT ISOLATOR ROW PLUS FOR SEDIMENT
- A. INSPECTION PORTS (IF PRESENT)
  - A.1. REMOVE/OPEN LID ON NYLOPLAST INLINE DRAIN
  - A.2. REMOVE AND CLEAN FLEXSTORM FILTER IF INSTALLED
  - A.3. USING A FLASHLIGHT AND STADIA ROD, MEASURE DEPTH OF SEDIMENT AND RECORD ON MAINTENANCE LOG
  - A.4. LOWER A CAMERA INTO ISOLATOR ROW PLUS FOR VISUAL INSPECTION OF SEDIMENT LEVELS (OPTIONAL)
  - A.5. IF SEDIMENT IS AT, OR ABOVE, 3" (80 mm) PROCEED TO STEP 2. IF NOT, PROCEED TO STEP 3.
- B. ALL ISOLATOR PLUS ROWS
  - B.1. REMOVE COVER FROM STRUCTURE AT UPSTREAM END OF ISOLATOR ROW PLUS
  - B.2. USING A FLASHLIGHT, INSPECT DOWN THE ISOLATOR ROW PLUS THROUGH OUTLET PIPE
    - i) MIRRORS ON POLES OR CAMERAS MAY BE USED TO AVOID A CONFINED SPACE ENTRY
    - ii) FOLLOW OSHA REGULATIONS FOR CONFINED SPACE ENTRY IF ENTERING MANHOLE
  - B.3. IF SEDIMENT IS AT, OR ABOVE, 3" (80 mm) PROCEED TO STEP 2. IF NOT, PROCEED TO STEP 3.

STEP 2) CLEAN OUT ISOLATOR ROW PLUS USING THE JETVAC PROCESS
- A. A FIXED CULVERT CLEANING NOZZLE WITH REAR FACING SPREAD OF 45° (1.1 m) OR MORE IS PREFERRED
- B. APPLY MULTIPLE PASSES OF JETVAC UNTIL BACKFLUSH WATER IS CLEAN
- C. VACUUM STRUCTURE SUMP AS REQUIRED

STEP 3) REPLACE ALL COVERS, GRATES, FILTERS, AND LIDS; RECORD OBSERVATIONS AND ACTIONS.

STEP 4) INSPECT AND CLEAN BASINS AND MANHOLES UPSTREAM OF THE STORMTECH SYSTEM.

NOTES

1. INSPECT EVERY 6 MONTHS DURING THE FIRST YEAR OF OPERATION. ADJUST THE INSPECTION INTERVAL BASED ON PREVIOUS OBSERVATIONS OF SEDIMENT ACCUMULATION AND HIGH WATER ELEVATIONS.

2. CONDUCT JETTING AND VACTORING ANNUALLY OR WHEN INSPECTION SHOWS THAT MAINTENANCE IS NECESSARY.

HILL AIR FORCE BASE
HILL AFB, UT
DATE: | DRAWN: WA
PROJECT #: | CHECKED: N/A

DESCRIPTION	CHK	DRW	DATE

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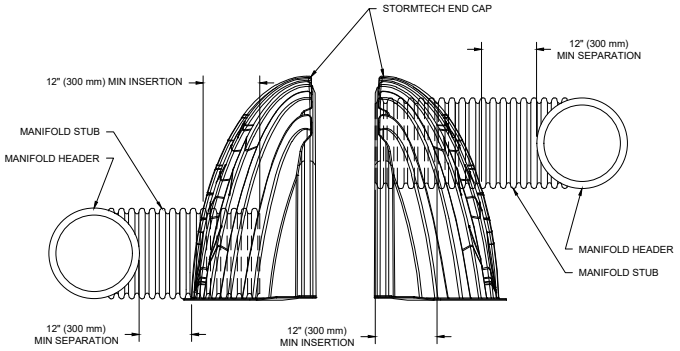
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SHEET
4 OF 6

MC-SERIES END CAP INSERTION DETAIL

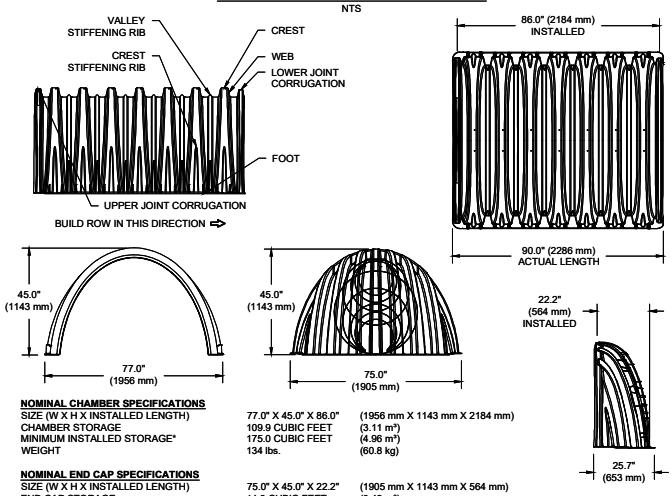
NTS



NOTE: MANIFOLD STUB MUST BE LAID HORIZONTAL
FOR A PROPER FIT IN END CAP OPENING.

MC-3500 TECHNICAL SPECIFICATION

NTS



NOMINAL CHAMBER SPECIFICATIONS

SIZE (W X H X INSTALLED LENGTH)	77.0" X 45.0" X 86.0"	(1956 mm X 1143 mm X 2184 mm)
CHAMBER STORAGE	109.9 CUBIC FEET	(3.11 m³)
MINIMUM INSTALLED STORAGE*	175.0 CUBIC FEET	(4.96 m³)
WEIGHT	134 lbs.	(60.8 kg)

NOMINAL END CAP SPECIFICATIONS

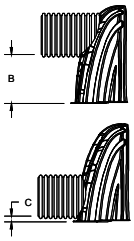
SIZE (W X H X INSTALLED LENGTH)	75.0" X 45.0" X 22.2"	(1905 mm X 1143 mm X 564 mm)
END CAP STORAGE	14.9 CUBIC FEET	(0.42 m³)
MINIMUM INSTALLED STORAGE*	45.1 CUBIC FEET	(1.28 m³)
WEIGHT	49 lbs.	(22.2 kg)

*ASSUMES 12" (305 mm) STONE ABOVE, 9" (229 mm) STONE FOUNDATION, 6" SPACING BETWEEN CHAMBERS, 6" (152 mm) STONE PERIMETER IN FRONT OF END CAPS AND 40% STONE POROSITY

STUBS AT BOTTOM OF END CAP FOR PART NUMBERS ENDING WITH "B"
STUBS AT TOP OF END CAP FOR PART NUMBERS ENDING WITH "T"
END CAPS WITH A WELDED CROWN PLATE END WITH "C"
END CAPS WITH A PREFABRICATED WELDED STUB END WITH "W"

PART #	STUB	B	C
MC3500IEPP06T	6" (150 mm)	33.21" (844 mm)	---
MC3500IEPP06B		---	0.66" (17 mm)
MC3500IEPP08T	8" (200 mm)	31.16" (791 mm)	---
MC3500IEPP08B		---	0.81" (21 mm)
MC3500IEPP10T	10" (250 mm)	29.04" (738 mm)	---
MC3500IEPP10B		---	0.93" (24 mm)
MC3500IEPP12T	12" (300 mm)	26.36" (670 mm)	---
MC3500IEPP12B		---	1.35" (34 mm)
MC3500IEPP15T	15" (375 mm)	23.39" (594 mm)	---
MC3500IEPP15B		---	1.50" (38 mm)
MC3500IEPP18TC	18" (450 mm)	20.03" (509 mm)	---
MC3500IEPP18TW			
MC3500IEPP18BC		---	1.77" (45 mm)
MC3500IEPP18BW			
MC3500IEPP24TC	24" (600 mm)	14.48" (368 mm)	---
MC3500IEPP24TW			
MC3500IEPP24BC		---	2.06" (52 mm)
MC3500IEPP24BW			
MC3500IEPP30BC	30" (750 mm)	---	2.75" (70 mm)

NOTE: ALL DIMENSIONS ARE NOMINAL



CUSTOM PRECORED INVERTS ARE AVAILABLE UPON REQUEST. INVENTORIED MANIFOLDS INCLUDE 12-24" (300-600 mm) SIZE ON SIZE AND 15-48" (375-1200 mm) ECCENTRIC MANIFOLDS. CUSTOM INVERT LOCATIONS ON THE MC-3500 END CAP CUT IN THE FIELD ARE NOT RECOMMENDED FOR PIPE SIZES GREATER THAN 10" (250 mm). THE INVERT LOCATION IN COLUMN 'B' ARE THE HIGHEST POSSIBLE FOR THE PIPE SIZE.

HILL AIR FORCE BASE
HILL AFB, UT
DRAWN: WA
DATE:
CHECKED: N/A
PROJECT #:

DATE	DRW	CHK	DESCRIPTION

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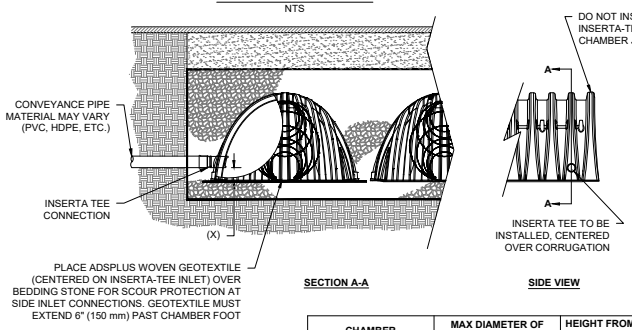
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ADS

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INSERTA TEE DETAIL

NTS



SECTION A-A **SIDE VIEW**

CHAMBER	MAX DIAMETER OF INSERTA TEE	HEIGHT FROM BASE OF CHAMBER (X)
SC-310	6" (150 mm)	4" (100 mm)
SC-740	10" (250 mm)	4" (100 mm)
DC-780	10" (250 mm)	4" (100 mm)
MC-3500	12" (300 mm)	6" (150 mm)
MC-4500	12" (300 mm)	8" (200 mm)
INSERTA TEE FITTINGS AVAILABLE FOR SDR 26, SDR 35, SCH 40 IPS GASKETED & SOLVENT WELD, N-12, HP STORM, C-900 OR DUCTILE IRON		

NOTES:

- PART NUMBERS WILL VARY BASED ON INLET PIPE MATERIALS. CONTACT STORMTECH FOR MORE INFORMATION.
- CONTACT ADS ENGINEERING SERVICES IF INSERTA TEE INLET MUST BE RAISED AS NOT ALL INVERTS ARE POSSIBLE.

HILL AIR FORCE BASE

HILL AFB, UT

DATE: DRAWN: WA

PROJECT #: CHECKED: NA

DATE	DRW	CHK	DESCRIPTION

Inserta Tee®
Lateral Connection

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SHEET
6 OF 6

Appendix B

Autodesk® Storm and Sanitary Analysis 2016 - Version 13.3.214 (Build 0)

****
Project Description
****
File Name ..... 05223 HAFB 309 SWEG Drainage Model.SPF
Description ..... C:\Users\admin\AppData\Local\Temp\HAFB 309 SWEG Base_1_24008_a4af90cb.sv$

****
Analysis Options
****
Flow Units ..... cfs
Subbasin Hydrograph Method. SCS TR-55
Time of Concentration..... SCS TR-55
Storage Node Exfiltration.. None
Starting Date MAR-07-2022 00:00:00
Ending Date MAR-08-2022 00:00:00
Report Time Step 00:05:00

****
Element Count
****
Number of rain gages 1
Number of subbasins 1
Number of nodes 1
Number of links 0

****
Subbasin Summary
****

Subbasin ID	Total Area acres	Peak Rate Factor
{Site 1}.PARCEL-SAM : 45	3.19	484.00

****
Node Summary
****

Node ID	Element Type	Invert Elevation ft	Maximum Elev. ft	Ponded Area ft²	External Inflow
Out-01	OUTFALL	0.00	0.00	0.00	

Runoff Quantity Continuity	Volume acre-ft	Depth inches
Total Precipitation	0.615	2.312
Surface Runoff	0.028	0.104
Continuity Error (%)	-0.001	

Flow Routing Continuity	Volume acre-ft	Volume Mgallons
External Inflow	0.000	0.000
External Outflow	0.277	0.090
Initial Stored Volume	0.000	0.000

```
Final Stored Volume ......          0.000         0.000
Continuity Error (%) .....          0.000


****************************************
Composite Curve Number Computations Report
****************************************

-----------------------------------
Subbasin {Site 1}.PARCEL-SAM : 45
-----------------------------------
                                                          Area           Soil
Soil/Surface Description                                (acres)         Group          CN
-------------------------------------------------------------------------------------------
-                                                         3.19             -        85.21
Composite Area & Weighted CN                              3.19                      85.21


************************************************
SCS TR-55 Time of Concentration Computations Report
************************************************

Sheet Flow Equation
-------------------

        Tc = (0.007 * ((n * Lf)^0.8)) / ((P^0.5) * (Sf^0.4))

        Where:

        Tc = Time of Concentration (hrs)
        n  = Manning's Roughness
        Lf = Flow Length (ft)
        P  = 2 yr, 24 hr Rainfall (inches)
        Sf = Slope (ft/ft)

Shallow Concentrated Flow Equation
----------------------------------

        V  = 16.1345 * (Sf^0.5) (unpaved surface)
        V  = 20.3282 * (Sf^0.5) (paved surface)
        V  = 15.0 * (Sf^0.5) (grassed waterway surface)
        V  = 10.0 * (Sf^0.5) (nearly bare & untilled surface)
        V  = 9.0 * (Sf^0.5) (cultivated straight rows surface)
        V  = 7.0 * (Sf^0.5) (short grass pasture surface)
        V  = 5.0 * (Sf^0.5) (woodland surface)
        V  = 2.5 * (Sf^0.5) (forest w/heavy litter surface)
        Tc = (Lf / V) / (3600 sec/hr)

        Where:

        Tc = Time of Concentration (hrs)
        Lf = Flow Length (ft)
        V  = Velocity (ft/sec)
        Sf = Slope (ft/ft)

Channel Flow Equation
---------------------

        V  = (1.49 * (R^(2/3)) * (Sf^0.5)) / n
        R  = Aq / Wp
        Tc = (Lf / V) / (3600 sec/hr)

        Where:

        Tc = Time of Concentration (hrs)
        Lf = Flow Length (ft)
        R  = Hydraulic Radius (ft)
```

```
          Aq = Flow Area (ft²)
          Wp = Wetted Perimeter (ft)
          V  = Velocity (ft/sec)
          Sf = Slope (ft/ft)
          n  = Manning's Roughness

  ------------------------------------
  Subbasin {Site 1}.PARCEL-SAM : 45
  ------------------------------------

  Sheet Flow Computations
  -----------------------
                                              Subarea A           Subarea B           Subarea
C
          Manning's Roughness:                     0.15                0.00
0.00
          Flow Length (ft):                      100.00                0.00
0.00
          Slope (%):                               2.00                0.00
0.00
          2 yr, 24 hr Rainfall (in):               1.64                0.00
0.00
          Velocity (ft/sec):                       0.12                0.00
0.00
          Computed Flow Time (minutes):           13.69                0.00
0.00

  Shallow Concentrated Flow Computations
  --------------------------------------
                                              Subarea A           Subarea B           Subarea
C
          Flow Length (ft):                      465.00                0.00
0.00
          Slope (%):                               3.50                0.00
0.00
          Surface Type:                           Paved             Unpaved
Unpaved
          Velocity (ft/sec):                       3.80                0.00
0.00
          Computed Flow Time (minutes):            2.04                0.00
0.00

=============================================================================================
          Total TOC (minutes):                    15.73

=============================================================================================


  **********************
  Subbasin Runoff Summary
  **********************

  ------------------------------------------------------------------------
  Subbasin             Total     Total      Peak  Weighted           Time of
  ID                  Precip    Runoff    Runoff     Curve     Concentration
                         in        in       cfs    Number    days  hh:mm:ss
  ------------------------------------------------------------------------
  {Site 1}.PARCEL-SAM : 45      2.31      1.04      2.56    85.210       0  00:15:43
  ------------------------------------------------------------------------


  Analysis began on:  Sat Apr 30 16:33:47 2022
  Analysis ended on:  Sat Apr 30 16:33:48 2022
  Total elapsed time: 00:00:01
```

NOAA Atlas 14, Volume 1, Version 5
Location name: Hill Afb, Utah, USA*
Latitude: 41.1344°, Longitude: -112.0147°
Elevation: 4667.54 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Sarah Dietz, Sarah Heim, Lillian Hiner, Kazungu Maitaria, Deborah Martin, Sandra Pavlovic, Ishani Roy, Carl Trypaluk, Dale Unruh, Fenglin Yan, Michael Yekta, Tan Zhao, Geoffrey Bonnin, Daniel Brewer, Li-Chuan Chen, Tye Parzybok, John Yarchoan

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	**0.136** (0.118-0.160)	**0.172** (0.150-0.202)	**0.234** (0.204-0.274)	**0.292** (0.252-0.342)	**0.386** (0.324-0.455)	**0.474** (0.386-0.565)	**0.578** (0.455-0.696)	**0.702** (0.532-0.862)	**0.903** (0.647-1.14)	**1.09** (0.743-1.41)
10-min	**0.208** (0.180-0.243)	**0.261** (0.228-0.306)	**0.357** (0.310-0.417)	**0.445** (0.383-0.521)	**0.588** (0.494-0.693)	**0.721** (0.587-0.860)	**0.880** (0.693-1.06)	**1.07** (0.809-1.31)	**1.37** (0.984-1.74)	**1.66** (1.13-2.15)
15-min	**0.257** (0.223-0.301)	**0.324** (0.283-0.380)	**0.442** (0.384-0.517)	**0.551** (0.475-0.646)	**0.729** (0.612-0.859)	**0.894** (0.728-1.07)	**1.09** (0.859-1.31)	**1.32** (1.00-1.63)	**1.70** (1.22-2.16)	**2.06** (1.40-2.67)
30-min	**0.347** (0.301-0.405)	**0.437** (0.382-0.512)	**0.595** (0.518-0.696)	**0.742** (0.639-0.869)	**0.982** (0.825-1.16)	**1.20** (0.980-1.44)	**1.47** (1.16-1.77)	**1.78** (1.35-2.19)	**2.29** (1.64-2.90)	**2.77** (1.89-3.59)
60-min	**0.429** (0.372-0.502)	**0.540** (0.472-0.633)	**0.737** (0.640-0.862)	**0.919** (0.791-1.08)	**1.22** (1.02-1.43)	**1.49** (1.21-1.78)	**1.82** (1.43-2.19)	**2.21** (1.67-2.71)	**2.84** (2.03-3.60)	**3.43** (2.34-4.45)
2-hr	**0.551** (0.486-0.633)	**0.688** (0.609-0.791)	**0.890** (0.782-1.02)	**1.08** (0.940-1.25)	**1.40** (1.19-1.63)	**1.69** (1.40-1.99)	**2.04** (1.64-2.43)	**2.45** (1.89-2.99)	**3.12** (2.27-3.91)	**3.74** (2.60-4.80)
3-hr	**0.639** (0.573-0.722)	**0.787** (0.707-0.893)	**0.984** (0.877-1.11)	**1.17** (1.03-1.33)	**1.47** (1.27-1.68)	**1.75** (1.49-2.02)	**2.10** (1.73-2.46)	**2.50** (2.00-2.99)	**3.17** (2.41-3.95)	**3.78** (2.76-4.85)
6-hr	**0.857** (0.783-0.943)	**1.05** (0.955-1.16)	**1.26** (1.15-1.40)	**1.46** (1.32-1.62)	**1.76** (1.57-1.97)	**2.01** (1.77-2.26)	**2.31** (1.99-2.63)	**2.65** (2.23-3.06)	**3.32** (2.70-3.99)	**3.92** (3.10-4.90)
12-hr	**1.10** (1.00-1.20)	**1.34** (1.23-1.47)	**1.61** (1.47-1.78)	**1.85** (1.68-2.04)	**2.22** (1.98-2.46)	**2.52** (2.22-2.82)	**2.84** (2.46-3.22)	**3.18** (2.71-3.66)	**3.74** (3.09-4.41)	**4.21** (3.38-5.05)
24-hr	**1.34** (1.24-1.45)	**1.64** (1.52-1.78)	**1.96** (1.81-2.12)	**2.22** (2.06-2.40)	**2.58** (2.38-2.80)	**2.86** (2.63-3.10)	**3.15** (2.88-3.42)	**3.44** (3.13-3.74)	**3.83** (3.46-4.45)	**4.25** (3.70-5.10)
2-day	**1.56** (1.45-1.69)	**1.92** (1.78-2.08)	**2.29** (2.12-2.47)	**2.59** (2.40-2.80)	**3.00** (2.78-3.25)	**3.32** (3.05-3.59)	**3.64** (3.34-3.94)	**3.96** (3.61-4.30)	**4.39** (3.96-4.78)	**4.70** (4.23-5.15)
3-day	**1.71** (1.59-1.85)	**2.10** (1.95-2.27)	**2.51** (2.33-2.71)	**2.85** (2.65-3.07)	**3.31** (3.07-3.57)	**3.67** (3.39-3.96)	**4.04** (3.71-4.37)	**4.41** (4.02-4.78)	**4.91** (4.44-5.34)	**5.29** (4.74-5.78)
4-day	**1.86** (1.73-2.00)	**2.28** (2.12-2.45)	**2.73** (2.54-2.94)	**3.11** (2.89-3.34)	**3.62** (3.36-3.90)	**4.03** (3.72-4.34)	**4.44** (4.08-4.80)	**4.86** (4.44-5.27)	**5.43** (4.91-5.91)	**5.87** (5.26-6.41)
7-day	**2.22** (2.07-2.39)	**2.73** (2.54-2.94)	**3.27** (3.04-3.51)	**3.71** (3.45-3.98)	**4.31** (3.99-4.62)	**4.77** (4.41-5.13)	**5.25** (4.82-5.65)	**5.72** (5.23-6.19)	**6.35** (5.75-6.92)	**6.84** (6.15-7.48)
10-day	**2.54** (2.36-2.72)	**3.11** (2.89-3.35)	**3.71** (3.45-3.98)	**4.18** (3.89-4.49)	**4.81** (4.46-5.15)	**5.27** (4.88-5.66)	**5.73** (5.29-6.17)	**6.18** (5.68-6.67)	**6.76** (6.17-7.33)	**7.19** (6.52-7.83)

20-day	**3.31** (3.09-3.54)	**4.07** (3.79-4.35)	**4.81** (4.49-5.15)	**5.38** (5.03-5.76)	**6.11** (5.70-6.53)	**6.63** (6.17-7.09)	**7.14** (6.63-7.64)	**7.61** (7.05-8.16)	**8.20** (7.56-8.83)	**8.61** (7.91-9.31)
30-day	**4.00** (3.75-4.28)	**4.91** (4.60-5.25)	**5.78** (5.41-6.17)	**6.44** (6.03-6.88)	**7.30** (6.81-7.78)	**7.90** (7.36-8.43)	**8.49** (7.88-9.08)	**9.04** (8.37-9.70)	**9.72** (8.95-10.5)	**10.2** (9.36-11.0)
45-day	**4.96** (4.63-5.31)	**6.07** (5.67-6.51)	**7.13** (6.66-7.63)	**7.95** (7.42-8.49)	**9.00** (8.38-9.61)	**9.75** (9.07-10.4)	**10.5** (9.71-11.2)	**11.2** (10.3-12.0)	**12.0** (11.0-12.9)	**12.6** (11.5-13.5)
60-day	**5.89** (5.51-6.30)	**7.22** (6.75-7.73)	**8.47** (7.93-9.06)	**9.44** (8.83-10.1)	**10.7** (9.95-11.4)	**11.5** (10.7-12.3)	**12.4** (11.5-13.2)	**13.1** (12.2-14.1)	**14.1** (13.0-15.2)	**14.7** (13.6-15.9)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

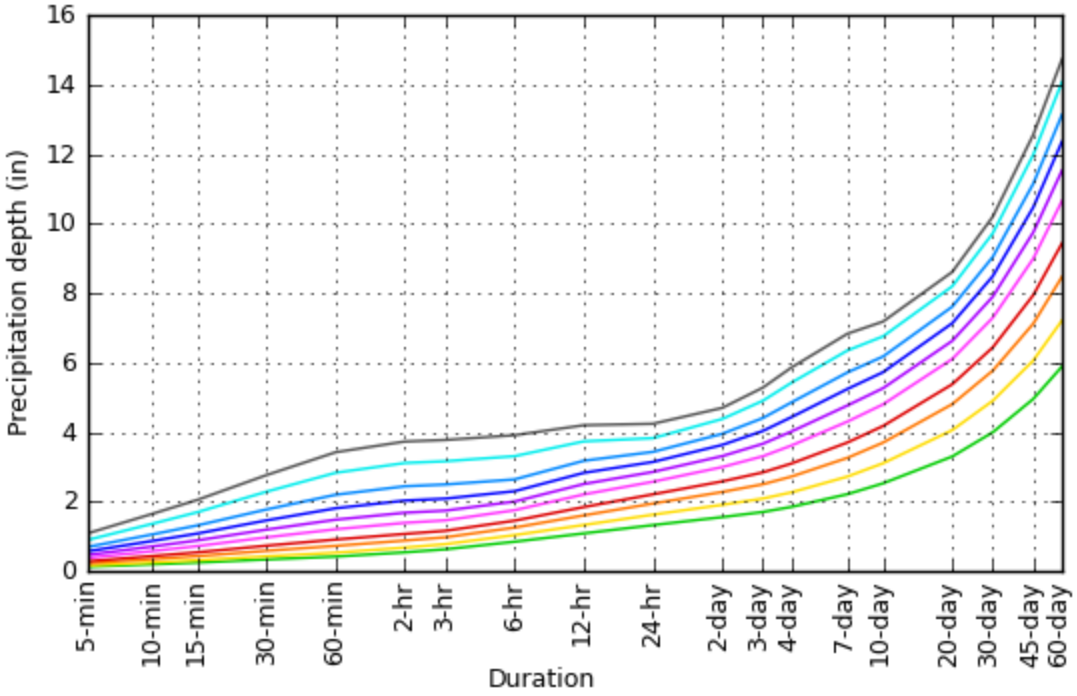
Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

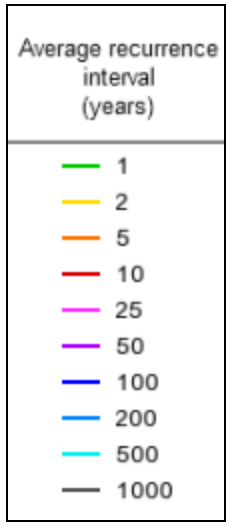
Please refer to NOAA Atlas 14 document for more information.

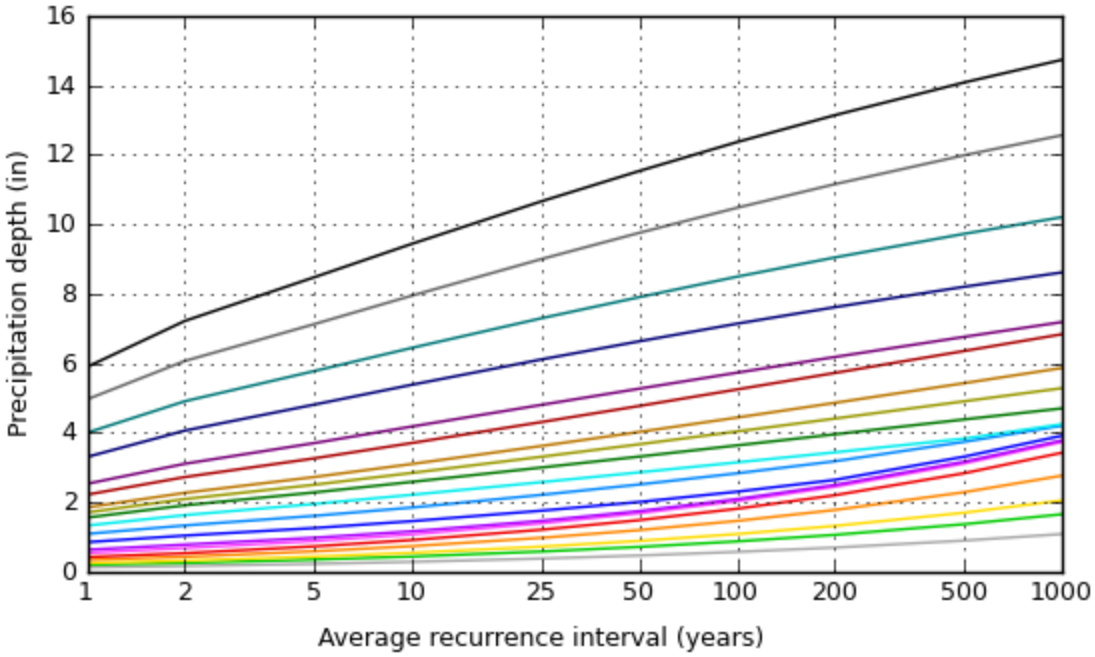
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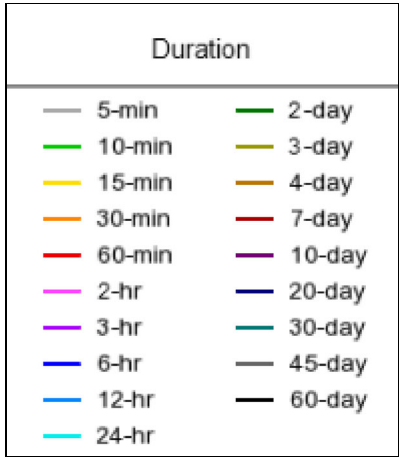
PF graphical

PDS-based depth-duration-frequency (DDF) curves
Latitude: 41.1344°, Longitude: -112.0147°









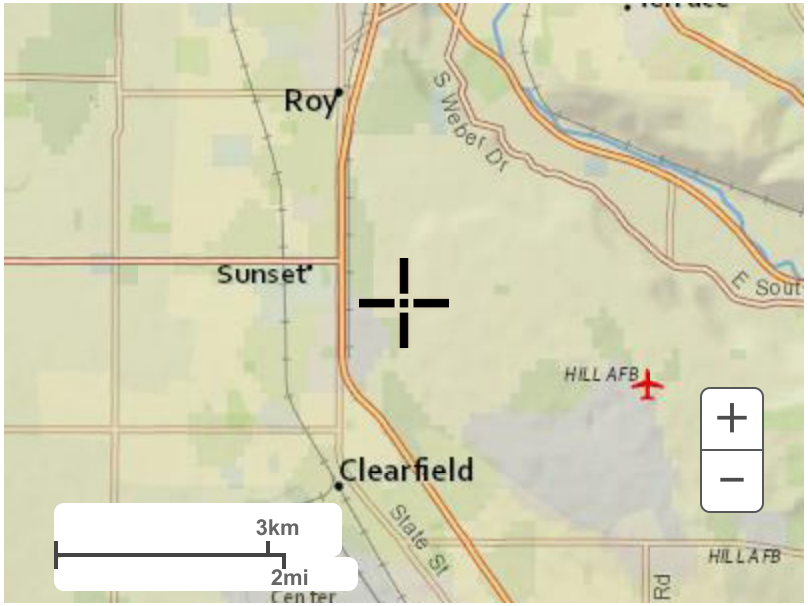
NOAA Atlas 14, Volume 1, Version 5

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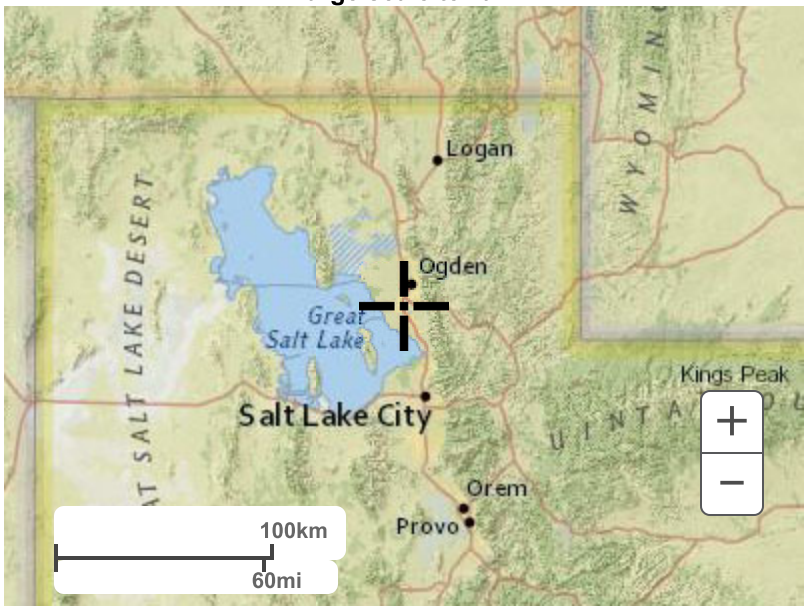
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Maps & aerials

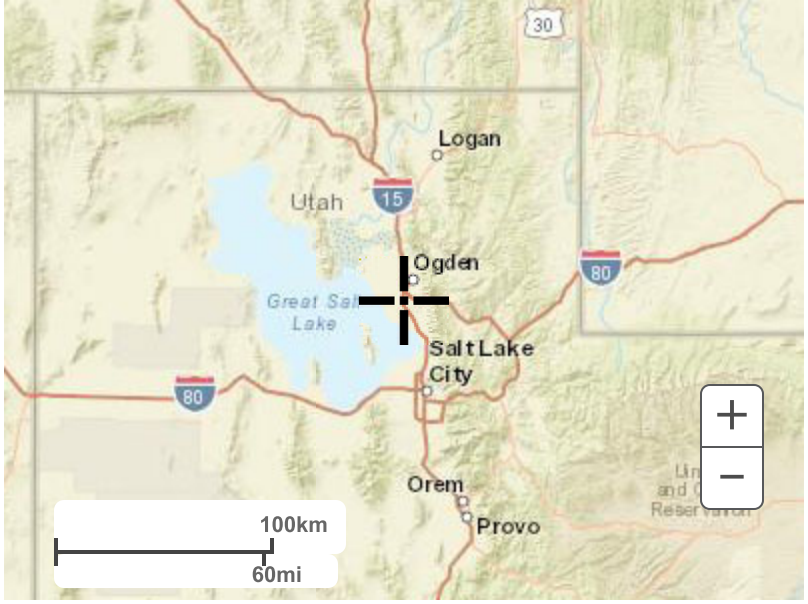
Small scale terrain



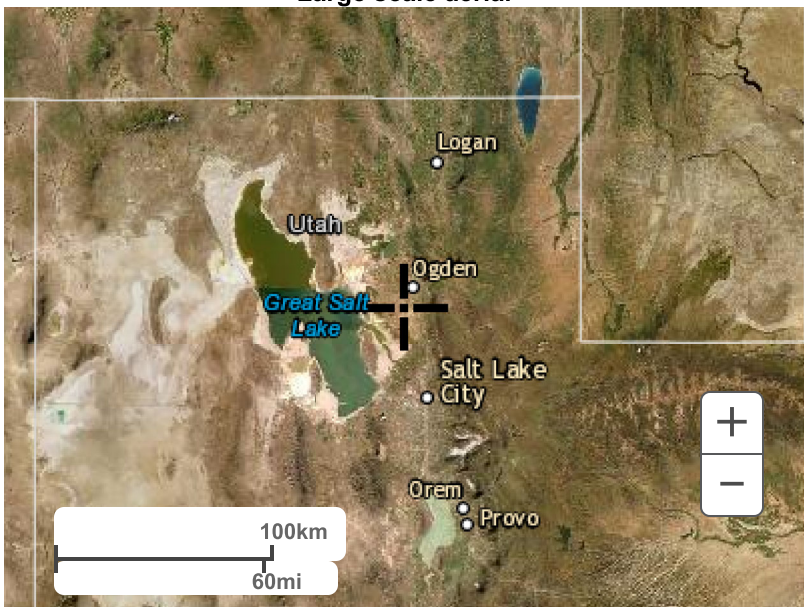
Large scale terrain



Large scale map



Large scale aerial

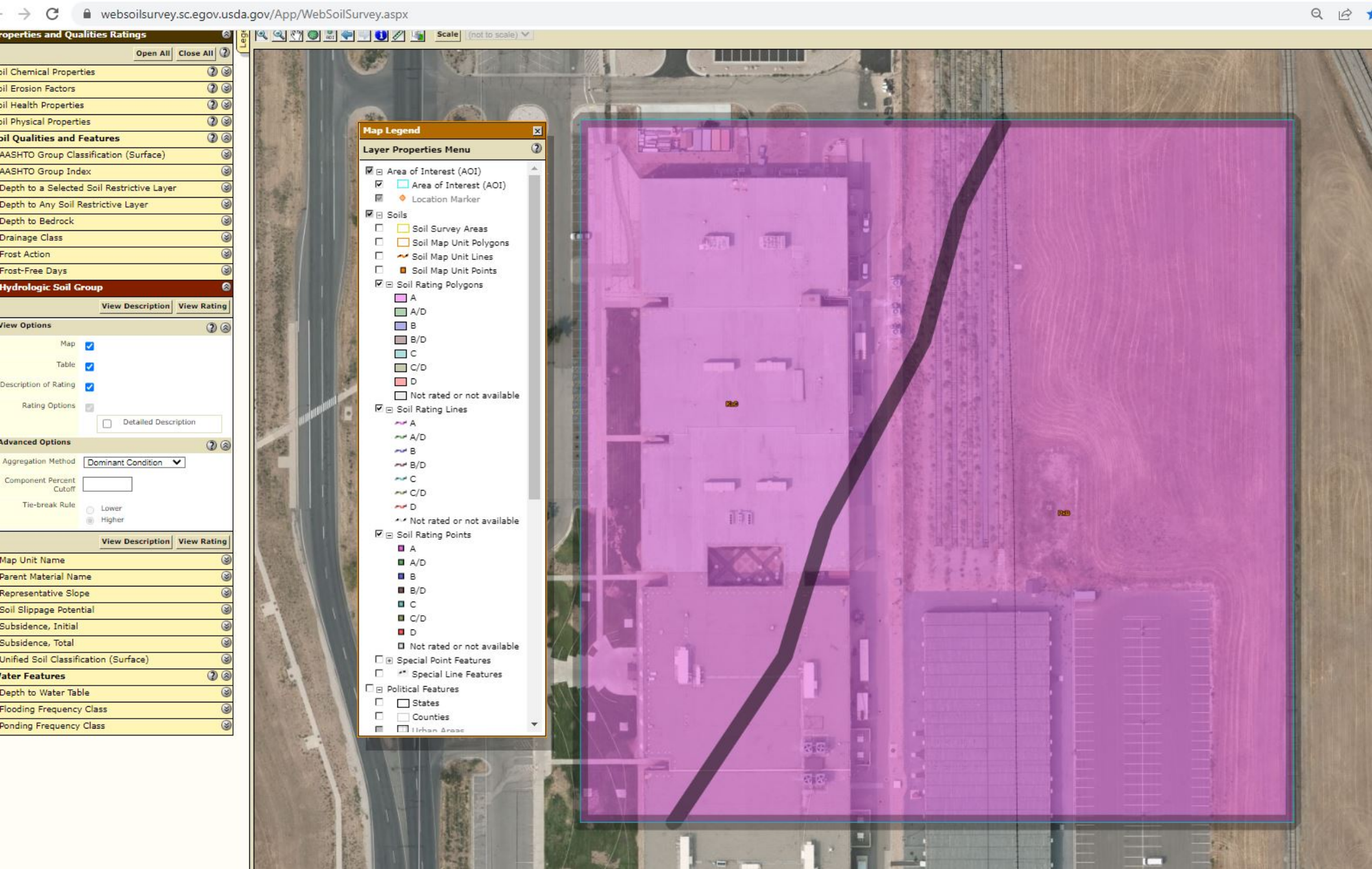


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National Water Center
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Silver Spring, MD 20910

Questions?: HDSC.Questions@noaa.gov

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Properties and Qualities Ratings
Open All
Close All
Soil Chemical Properties
Soil Erosion Factors
Soil Health Properties
Soil Physical Properties
Soil Qualities and Features
AASHTO Group Classification (Surface)
AASHTO Group Index
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Depth to Any Soil Restrictive Layer
Depth to Bedrock
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Frost-Free Days
Hydrologic Soil Group
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Tie-break Rule
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View Rating
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Subsidence, Initial
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Unified Soil Classification (Surface)
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Depth to Water Table
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Ponding Frequency Class
Scale
(not to scale)
Map Legend
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Area of Interest (AOI)
Location Marker
Soils
Soil Survey Areas
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Soil Map Unit Lines
Soil Map Unit Points
Soil Rating Polygons
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A/D
B
B/D
C
C/D
D
Not rated or not available
Soil Rating Lines
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A/D
B
B/D
C
C/D
D
Not rated or not available
Soil Rating Points
A
A/D
B
B/D
C
C/D
D
Not rated or not available
Special Point Features
Special Line Features
Political Features
States
Counties
PkB

SITE LOCATION

309th SWEG Office Building ■ HAFB, Utah
March 10, 2022 ■ Terracon Project No. 61225006



DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

MAP PROVIDED BY MICROSOFT BING MAPS


P-5
B-1
P-3
P-4
B-2
N
250 feet
bing
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Field Percolation Rate Test

Terracon

Test Hole P3

Project Name: HAFB SWEG	Date: 03/4/2022
Terracon Project No.: 61225006	Hole Diameter (inches): 4
Eng./Tech.: Kris Powell	Hole Depth (inches): 72

Time	Length of Interval (min)	Total Time (min)	Beginning Depth to Water Surface (in)	Ending Depth to Water Surface (in)	Water Level Drop (in)	Percolation Rate During Interval (min/in)
11:00	30	0	0.00	0.00	0.00	
11:05	30	30	0.00	1.75	1.75	17.14
11:10	30	60	1.75	3.50	1.75	17.14
11:15	30	90	3.50	5.25	1.75	17.14
11:20	30	120	5.25	7.00	1.75	**17.14**
Lithology:						
	0 to 3.5 ft	Sandy Silt	(ML)			
	3.5 to 5 ft	Silty Clay	(CL-ML)			
	5 to 6 ft	Sandy Lean Clay		(CL)		

REMARKS: Bottom of test pit is approximately 6 feet below site grade.

DRAFT

Field Percolation Rate Test

Terracon

Test Hole P4

Project Name: HAFB SWEG	Date: 03/04/2022
Terracon Project No.: 61225006	Hole Diameter (inches): 4
Eng./Tech.: Kris Powell	Hole Depth (inches): 72

Time	Length of Interval (min)	Total Time (min)	Beginning Depth to Water Surface (in)	Ending Depth to Water Surface (in)	Water Level Drop (in)	Percolation Rate During Interval (min/in)
13:22	30	0	0.00	0.00	0.00	
13:27	30	30	0.00	0.38	0.38	80.00
13:32	30	60	0.38	0.63	0.25	120.00
13:37	30	90	0.63	0.88	0.25	120.00
13:42	30	120	0.88	1.13	0.25	**120.00**
Lithology:						
	0 to 6 ft	Sandy Lean Clay		(CL)		

REMARKS: Bottom of test hole is approximately 6 feet below site grade.

DRAFT

Field Percolation Rate Test

Terracon

Test Hole P5

Project Name: HAFB SWEG	Date: 03/04/2022
Terracon Project No.: 61225006	Hole Diameter (inches): 4
Eng./Tech.: Kris Powell	Hole Depth (inches): 72

Time	Length of Interval (min)	Total Time (min)	Beginning Depth to Water Surface (in)	Ending Depth to Water Surface (in)	Water Level Drop (in)	Percolation Rate During Interval (min/in)
13:22	30	0	0.00	0.00	0.00	
13:27	30	30	0.00	0.00	0.00	#DIV/0!
13:32	30	60	0.00	0.00	0.00	#DIV/0!
13:37	30	90	0.00	0.00	0.00	#DIV/0!
13:42	30	120	0.00	0.00	0.00	#DIV/0!
13:47	30	180	0.00	0.00	0.00	#DIV/0!
Lithology:						
	0 to 6 ft	Sandy Lean Clay		(CL)		

REMARKS: Bottom of test hole is approximately 6 feet below site grade.

DRAFT