

Indian Health Service Division of Engineering Services 100% Construction Documents



Contract Number: HHSI102201800005I

Task Order Number: 75H70119F30002

**Professional Architect-Engineer (A-E) Services for Design for an
Browning 18-Unit Apartment Building, Blackfeet Service Unit
Browning, Montana**



12.2 Final CD

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13.1(1) Final Space Comparison Report

1.1 A space comparison chart will not be provided since this is a new facility.

1.2 First Floor

A. 4 Bedroom Apartment	2,492 sf
B. (4) 1 Bedroom Apartment	819 sf
C. (2) 2 Bedroom Apartment	1,353 sf
D. Great Room	2,807 sf
E. Dining Room	712 sf
F. Public Toilet	80 sf
G. Janitor Closet	66 sf
H. Mechanical Room	599 sf
I. Electrical Room	132 sf
J. Storage Room	77 sf
K. (2) Quiet Room	76 sf
L. Kitchenette	224 sf
M. Vestibule	103 sf

1.3 Second Floor

A. 4 Bedroom Apartment	2,492 sf
B. (4) 1 Bedroom Apartment	819 sf
C. (2) 2 Bedroom Apartment	1,353 sf
D. Storage	26 sf
E. Reading Mezzanine	1,701 sf
F. Fitness Center	405 sf
G. Public Toilet	51 sf
H. Laundry	176 sf

13.1(3) Final Sustainable Design Status Report

1.1 HVAC SYSTEM

- A. The HVAC system selected for this project is a 4-pipe hydronic fan coil system. The heating hot water loop will be heated by high efficiency condensing boilers and water will be distributed at 140°F to maximize energy efficiency. The chilled water loop will be cooled by an air-cooled chiller.
- B. Energy recovery ventilators (ERVs) will be provided to temper the outside air introduced to the building. The fully conditioned exhaust air from the building will exchange energy with the outside to pre-cool (during the summer) or pre-heat (during the winter) the air before it is fully conditioned by the fan coil units. This exchange of energy reduces the load on the fan coil units and therefore increases energy efficiency and lowers operating costs.
- C. The building management system (BMS) will generate reset schedules for the heating hot water and chilled water loops. The supply water setpoint for both loops will be adjusted linearly based on the outdoor air temperature to save energy during part load conditions.
- D. The hydronic pumps will be provided with variable frequency drives (VFDs) to reduce the pump speed during part load conditions. Reducing the pump speed significantly reduces the energy consumption of the pump. For example, a 20% reduction in pump speed results in approximately 50% of the energy usage.

1.2 PLUMBING SYSTEM

- A. The domestic water heaters for this project will be high efficiency condensing heaters.

13.1(4) Final Projected Energy Use Report

1.1 See Appendix.

13.1(5) Final Commissioning Plan

1.1 See Appendix.

13.1(6) Final OPR/BOD

PART 1 - GENERAL

1.1 CODES, STANDARDS, AND GUIDELINES

- A. International Building Code (2018)
- B. International Residential Code (2018)
- C. International Energy Conservation Code (2018)
- D. 10 CFR Part 435
ASHRAE 62.2-2016
- E. ASHRAE 111-2008 (RA 2017)
- F. ASHRAE 188-2018
- G. IEEE Standards
- H. UL Standards
- I. TIA/ETA Standards
- J. NFPA Codes

1.2 DESIGN CONDITIONS

- A. Elevation: 4,380'
- B. Latitude/Longitude: 48°33'25"N 113°0'52"W
- C. Temperatures (Outdoor):
 - 1. Winter (Heating): -18 deg F (99.6%)
 - 2. Summer (Cooling): 89 deg F db, 60 deg F wb (0.4%)
- D. Temperatures (Indoor):
 - 1. Winter (Heating): 72 deg F, 30% RH
 - 2. Summer (Cooling): 75 deg F, 50% RH

PART 2 – HEATING, VENTILATION, AND AIR CONDITIONG (HVAC) SYSTEMS

2.1 CENTRAL UTILITY PLANT

- A. Provide a 4-pipe hydronic fan coil system. The system shall include distribution pumps, boilers, and an air-cooled chiller.
- B. The boiler system will consist of (2) high efficiency condensing boilers configured in a lead/lag control strategy. Each boiler will have a capacity of approximately 1,000,000 Btu/hr input with a rated efficiency of approximately 92% and a turndown ratio of 7:1.
- C. The chiller system will consist of a single air-cooled chiller with a remote evaporator plate and frame heat exchanger located in the mechanical room with a capacity of approximately 60 tons to provide cooling for the facility. The chilled water pumps will be rated for approximately 145 gpm.
- D. The hydronic solution for both the heating and cooling loops will be 100% water. Glycol will not be required.
- E. All heating and chilled water piping shall be insulated.

2.2 AIR HANDLING SYSTEMS

- A. Provide 4-pipe hydronic fan coil units. Each living unit shall have a dedicated unit for proper zone temperature control. Fan coil units shall be vertical style and located in mechanical rooms or mechanical closets. Above ceiling units are not acceptable.
- B. A small air-to-air energy recovery ventilator (ERV) shall be included for each fan coil unit to pre-condition ventilation air. The ERV shall have a static plate heat exchanger.
- C. All supply and return air ductwork for the fan coil units shall have internal acoustical liner.

2.3 TEMPERATURE CONTROL SYSTEMS

- A. Provide a direct digital control (DDC) building management system (BMS). The system should be Johnson Controls and shall connect to and integrate with the hospital's existing front-end control system.

PART 3 - ELECTRICAL SYSTEMS

3.1 MATERIALS

- A. Nonmetallic Sheathed Cable (Romex) will be the primary raceway type used within the facility. PVC 40 will be used for underground installations. Rigid Galvanized Steel (RGS) will be used for exposed exterior work and where conduits are subject to damage.
- B. Wiring devices will be white, specification grade, 15-amp minimum and have plastic cover plates. Exterior receptacles will be ground fault type and provided with weatherproof in-use covers.

3.2 ELECTRICAL SERVICE

- A. Electrical service will be provided by Glacier Electric Cooperative. The building will be served with a 208V, 3 phase, 4 wire electrical service. A single meter with integral surge suppression to main distribution panel will serve the entire facility. The individual apartments will not be metered separately.
- B. Calculations will be performed to determine the maximum available fault current and voltage drop throughout the building system. All electrical equipment will be fully rated based on the fault current available at that location. Refer to riser diagram within appendix for preliminary available fault current values and voltage drop analysis. Refer to riser diagram on drawings for final AIC ratings on panelboards.
- C. Preliminary building load analysis yields an estimated 31 Watts/ft² total with the following breakdown, refer to calculations within appendix for a detailed breakdown:
 - a. Lighting – 0.8 Watts/ft²
 - b. Receptacles – 11.6 Watts/ft²
 - c. HVAC – 7.6 Watts/ft²
 - d. Miscellaneous – 11 Watts/ft²

3.3 EMERGENCY POWER SYSTEM

- A. A natural gas generator will be located on grade adjacent to the building. Dedicated automatic transfer switches, panels, and branch circuit wiring will be provided for life safety and standby loads.
- B. Natural gas generator will be required to meet EPA standards outlined in Clean Air Act, 40 CFR Part 60, 1065, 1068, and 60. But this generator will not need to comply with one through four emission standards for non-road Diesel Engines.
- B. Summary of emergency power requirements:
 - 1. Life Safety Branch:
 - i. Emergency lighting (building and exterior)
 - ii. Fire alarm
 - iii. ADA doors
 - 2. Standby Branch:
 - i. Security/card access control panel
 - ii. Communication systems
 - iii. HVAC heating components (boilers, pumps, temperature control system, heat pumps, fan coil units, etc.)
 - iv. Miscellaneous duplex receptacles in the Common Area and Fitness Area
 - v. Single duplex receptacle in each corridor area of apartment units

3.4 POWER DISTRIBUTION

- A. There will be an electrical panel within each apartment. A "house" panel will be located in the mechanical/electrical room to handle the common area loads on each floor.
- B. Power will be provided as required to all mechanical equipment.
- C. Pedestal mounted receptacles will be provided for all parking lot stalls for vehicle block heaters.
- D. Emergency power system and normal power systems are located within dedicated electrical room on first floor as allowed per NFPA 110.

3.5 GROUNDING

- A. Grounding for the facility will be achieved by a single-point grounding system. The main ground bus at the meter center will be connected to the water service and a concrete encased electrode.

3.6 LIGHTING

- A. The lighting throughout the building will generally be residential grade, using luminaires with LED lamps. The ceiling/attic insulation will be at ceiling level, so all luminaires should be surface mounted or IC rated. Refer to luminaire cutsheets within appendix for preliminary selections.
- B. Exterior site lighting for entry plaza, parking lots and pathways to the hospital will be provided. All luminaires will be LED and full cutoff type.
- C. Lighting levels shall comply with IESNA recommended illuminance levels for the following general spaces
 - a. Corridors – 10 fc
 - b. Kitchen – 20 fc
 - c. Living Room – 3 fc
 - d. Bathroom – 10 fc
 - e. Equipment Room – 20 fc
 - f. Fitness Room – 15 fc
 - g. Parking Lot – 1 fc
 - h. Building Entries – 5 fc

3.7 EMERGENCY LIGHTING

- A. Exit lights will be surface mounted thermoplastic fixtures with LED lamps. All exit lights will be red in color. Emergency and exit lighting will be connected to the emergency generator system. Exterior emergency lighting will be provided at all building exits.

3.8 FIRE ALARM SYSTEM

- A. The facility will be equipped with a Johnson Controls (or equivalent) intelligent microprocessor based addressable fire alarm system. Notification and annunciation devices will be provided per applicable codes. The panel covers common spaces and sprinkler riser system.
- B. Horn/strobe devices tied to the main panel will be located in apartment units. Apartment units will also have 120V detectors located per code and interconnected with adjacent units.
- C. An LCD remote annunciator panel will be mounted at the main fire department entrance to the building. Audible/visual evacuation signals will be provided at all points along the path of egress and other areas required by code.
- D. Carbon Monoxide detection will be provided in areas with permanently installed fuel burning sources per NFPA 101.

3.9 SECURITY SYSTEMS

- A. Security system will be provided for a card access system at entrances/exits to the building and each apartment unit.
- B. Security system will also include surveillance cameras at corridors, common areas, entrances/exits, and parking lots.

3.10 TELECOMMUNICATION SYSTEMS

- A. Telephone and data capability will be provided to the building with empty conduits to the property line or location as directed by the utility provider. Telephone and data provider is 3 Rivers Communications.
- B. Main telecommunication room will be located such that no data cable exceeds the maximum 90 meter cable length. Other telecommunication rooms will be provided as necessary to not exceed maximum cable lengths.
- C. Horizontal cabling, patch panels, data racks, and conduits will be provided to provide telecommunication systems throughout. Telephone and data ports will be provided in each apartment unit and common areas as necessary.
- D. Horizontal cabling will be provided to support wireless access points in each apartment unit, corridors, and common areas to facilitate Public network access for occupants and guests throughout the building.

3.11 AV SYSTEMS

- A. Sound system will be provided for public systems in the indoor and outdoor common areas. Sound system will not include the exercise space.
- B. Coaxial connections will be provided in apartment units and common areas for satellite television systems. Satellite television system equipment and hardware will be located in the main telecommunication room.

3.12 LIGHTNING PROTECTION

- A. Simplified Lightning Risk Assessment conducted in accordance with NFPA 780 has yielded that the annual threat of occurrence is greater than the tolerable lightning frequency of the building. As a result, a lightning protection system will be provided. Refer to calculations within appendix for more detailed information.

PART 4 - PLUMBING SYSTEMS

4.1 SERVICES

- A. A single 3" domestic water service will be provided for the facility. The service is provided by Two Medicine Water Company. A domestic water booster pump will be required due to low incoming water pressure.
- B. Natural gas will serve the facility with a single meter. The service is provided by Northwestern Energy.
- C. The 6" sanitary sewer service will leave the building at a single location.
- D. Storm drainage will discharge on grade via gutter and downspouts.

4.2 TREATMENT SYSTEMS

- A. A water softener is required to treat the domestic hot water and HVAC makeup water systems. The domestic cold water will not be treated.

4.3 HOT WATER GENERATION SYSTEM

- A. A series of three (3) natural gas fired tank style water heaters will be provided to serve the facility. Each water heater shall have a capacity of approximately 100 gallons of storage and an input of 250,000 Btu/hr.

4.4 DISTRIBUTION SYSTEMS

- A. The main cold water and hot water piping throughout the facility will be insulated copper piping.
- B. A hot water circulation system will be provided to minimize hot water delivery delays.

4.5 FIXTURES

- A. Plumbing fixtures will be typical commercial style to ensure quality. However, all faucets and water closets will be manually operated. Water closets will be tank style in lieu of flush valve.
- B. Wall hydrants will be recessed with covers and have keyed operation.
- C. A natural gas indoor fireplace and outdoor fire pit will be provided for the building.

PART 5 - FIRE PROTECTION SYSTEMS

5.1 GENERAL

- A. An automatic wet pipe fire sprinkler system designed in accordance with NFPA 13R will be required for all residential areas of this facility. All public spaces and common mechanical rooms shall be designed in accordance with NFPA 13. A hydrant flow test was conducted 8 July 2019 which indicated that the main initially planned to be tapped has a static pressure of 40 PSI and a residual pressure of 18 PSI while flowing 9910 GPM on what was determined to be an existing 4" main that was presumed to be a located on a dead end run and a static pressure of 40 with a residual pressure of 24 while flowing 1,180 gpm on a newer main a bit further from the site. Additional research discovered a newer 10" PVC main was available near the site and it was feeding the better test noted above. Site piping shall be significantly improved with the addition of a new looped main around this facility that is planned as part of this project. New tests will be required to be performed once this main is in place prior to the creation of fire sprinkler shop drawing submittals. Existing domestic data has been researched; however, not all piping has been able to be located and pipe sizes could not all be confirmed. Based on existing hydrant data provided, it is assumed that the fire hydrant closest to the site is served from a dead-end run of piping. The existing data provided indicates water supply would be deficient in both flow and pressure if it were to have been served from that undersized main. Civil research determined that a newer 10" PVC main runs near the site and feeds all of the hydrants tested - results noted above. Flow and pressure will be greatly enhanced with the addition of new looped site piping; however, it is suspected that a fire pump will still be needed to meet the sprinkler demand. The 10" main supply should be capable of supplying the flow requirements. It is potentially possible, though highly unlikely, that, upon testing of the new mains, pressure is improved to the point that a fire pump will no longer be

required. At this point, the design team is currently working under the assumption that a fire pump will be still required.

- B. As primarily a residential (13R) system, all sprinklers installed within the individual apartment units shall be residential style. All common area, public spaces, and mechanical spaces will be designed in compliance with NFPA 13. Sprinklers in these areas shall be quick response style. All areas of the building will be protected with the exception of the following:
 - 1. Restrooms that do not exceed 55 SF located within the dwelling units, provided that walls and ceilings, including the walls and ceilings behind a shower enclosure or tub, are of noncombustible or limited combustible materials with a 15-minute thermal barrier rating.
 - 2. Closets used for clothing, linen and pantries located within the dwelling units that are less than or equal to 24 SF where the least dimension is 3'0" and smaller with non-combustible or limited-combustible materials used for the walls and ceiling, provided the closet does not contain heating or air conditioning equipment, washers, dryers, or water heaters.
 - 3. Combustible attic spaces, penthouse equipment rooms, elevator machine rooms, concealed spaces dedicated exclusively to and containing only dwelling unit ventilation equipment, crawl spaces, floor/ceiling spaces, elevator shafts where the elevator installation complies with ANSI A17.1, and other concealed spaces that are not intended for living purposes or storage and do not contain fuel-fired equipment.
 - 4. Sprinkler protection shall be provided for exterior balconies, decks, and ground floor patios of dwelling units and sleeping units where the building is of Class V Construction facilities; otherwise, they may be omitted. (Note: Building is Construction Class IIB; therefore, protection is not required on the overhangs and balconies.)
 - 5. Sprinklers shall not be required in closets on exterior balconies and exterior breezeway/corridors, regardless of size, as long as the closet does not have doors or unprotected penetrations directly into the dwelling unit.
- C. All piping for the facility shall be routed in the ceiling plenum space where ceilings have been provided and shall be routed exposed where construction is exposed.
- D. A 6" fire main has been provided to serve the new fire sprinkler system. The main will be equipped with a supervised backflow prevention which will be located within the fire pump house. A post indicator valve shall be installed on the 6" main at a minimum distance of 40' from the building. This valve shall be equipped with a tamper switch that is monitored by the building's fire alarm system.
- E. The fire sprinkler system shall be equipped with a fire department connection (FDC) that shall be flush wall mounted on the street/address side of the building and shall be equipped with threads that are compatible with the local responding fire department hose threads. Connections and a separate shut-off valve will be provided to allow the FDC to be used to conduct a full forward flow test of the backflow preventer.
- F. A system riser has been provided that includes a main shut-off valve and a riser manifold assembly that includes a flow switch and a combination main drain and inspector's test valve. The drain line shall route to the building exterior at an elevation that is six inches above external grade. A threaded outlet will be provided to allow the drain to be extended away from the building during testing of the system. A concrete splash block shall be installed beneath the outlet. An outside bell/strobe/sign device shall be provided that is connected to the riser pressure switch and is mounted with the device centered above the FDC at an elevation of 9'-0" above final exterior grade. All valves shall be equipped with tamper switches. All flow and tamper switches shall be monitored by the building's fire alarm system.

13.1(7) Project Review Comment File

1.1 See appendix.

13.1(9) Final Facility User Manual

PART 1 – HEATING, VENTILATION, AND AIR CONDITIONING

1.1 CENTRAL PLANT

A. General

1. Refer to all equipment manufacturer's Operation and Maintenance Manuals for specific maintenance requirements.
2. Refer to Sequence of Operation specifications for detailed sequences.
3. The hot water and chilled water loops will contain 100% water as the working fluid. It is recommended that a water treatment specialist is engaged to test and treat the hot water and chilled water systems every six (6) months to ensure proper water quality.
4. Check and clean pump and air/dirt separator strainers occasionally to minimize pressure drop through the system.
5. Inspect pump seals for leaks and shaft couplings for vibration or excessive heat.

B. Boiler System

1. The boiler shall be controlled from the building management system (BMS).
2. Refer to Sequence of Operation specifications for detailed sequences.
3. Each boiler has a dedicated circulation pump that is interlocked with the boiler operation.

C. Chiller System

1. The chiller shall be controlled from the BMS.
2. Refer to Sequence of Operation specifications for details sequences.
3. The chilled water system is configured as a variable primary pumping system.

1.2 TENANT SPACES

- A. Refer to all equipment manufacturer's Operation and Maintenance Manuals for specific maintenance requirements.
- B. Refer to Sequence of Operation specifications for detailed sequences.
- C. Each tenant space has a dedicated fan coil unit (FCU) and energy recovery ventilator (ERV).
- D. The FCUs will be controlled by thermostats connected to the BMS. The tenant shall be able to control the function of the FCU and the temperature setpoint at the thermostat. Limits can be put on the FCU function and temperature range adjustment via the BMS if desired by the building Owner.
- E. The ERVs shall operate continuously.
- F. Filters for the ERVs and FCUs shall be changed quarterly.
- G. The condensate drain pan and piping shall be inspected quarterly.

1.3 PUBLIC SPACES

- A. Refer to all equipment manufacturer's Operation and Maintenance Manuals for specific maintenance requirements.
- B. Refer to Sequence of Operation specifications for detailed sequences.
- C. Each public space has a dedicated FCU and ERV.
- D. The FCUs will be controlled by temperature sensors connected to the BMS. No local adjustments shall be provided at the sensor. All temperature setpoints will be set via the BMS.
- E. The ERVs shall operate continuously.
- F. Filters for the ERVs and FCUs shall be changed quarterly.
- G. The condensate drain pan and piping shall be inspected quarterly.

13.1(10) Final Cost Estimate

1.1 See Appendix.

13.1(11) Final BIM Design Model

1.1 See enclosed disk for final BIM models.

13.1(12) Project Specifications

1.1 See enclosed specification set.

13.1(13) Construction Documents

1.1 See enclosed drawings.

13.1(14) Bid Support Documents

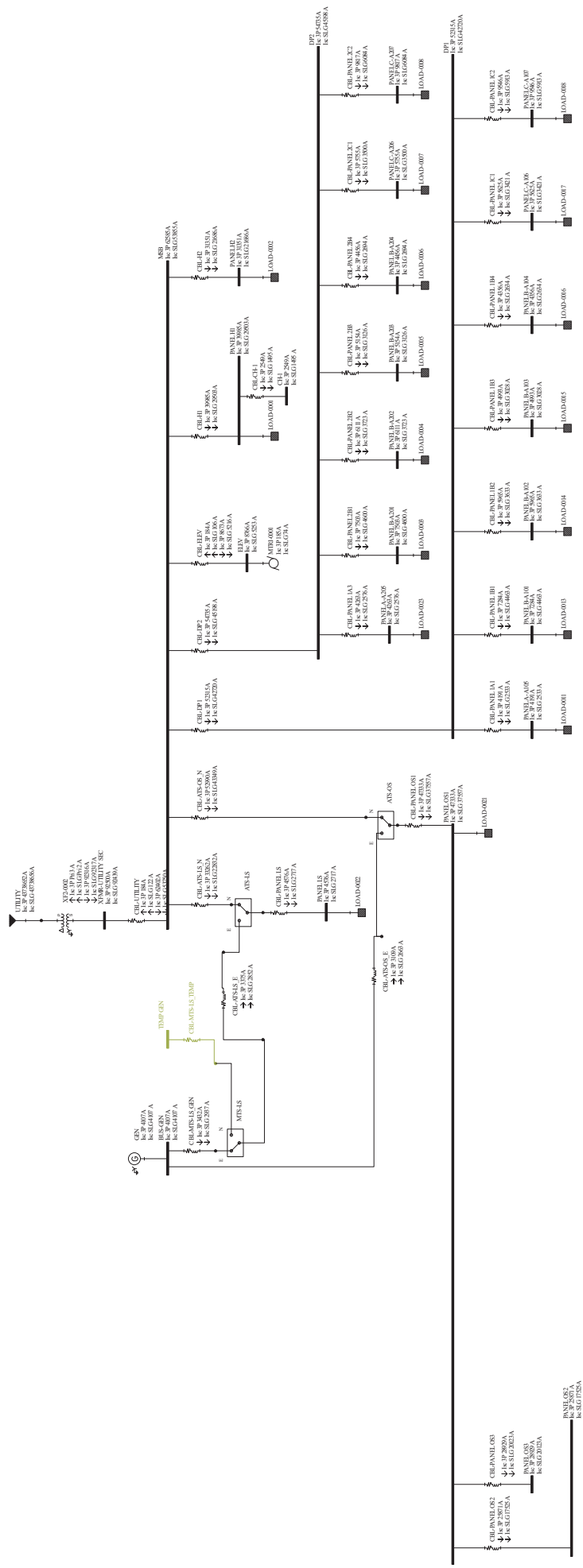
1.1 Bid support documents will be provided by IHS.

13.1(15) Review Comments and Design Review Meeting Minutes

1.1 See Appendix.

Appendix

- 1.1 Energy Use Report
- 1.2 Cost Estimate
- 1.3 Project Review Comments
- 1.4 Cost Estimate
- 1.5 95% Construction Documents Review Comments



System Checksums

By Farris Engineering

A101

Fan Coil

COOLING COIL PEAK										CLG SPACE PEAK				HEATING COIL PEAK				TEMPERATURES			
Peaked at Time: Outside Air:				Mo/Hr: 7 / 15 OADB/WB/HR: 89 / 62 / 52				Mo/Hr: Sum of OADB: Peaks				Mo/Hr: Heating Design OADB: -18				Cooling		Heating			
Sens. + Lat.		Space	Plenum		Net		Space		Percent		Space Peak		Coil Peak		Percent						
Btu/h		Btu/h	Sens. + Lat Btu/h		Total Btu/h		Sensible Btu/h		Of Total (%)		Space Sens Btu/h		Tot Sens Btu/h		Of Total (%)						
Envelope Loads																					
Skylite Solar		0	0		0		0		0		0		0		0		0				
Skylite Cond		0	0		0		0		0		0		0		0		0				
Roof Cond		0	0		0		0		0		0		0		0		0				
Glass Solar		0	0		0		0		0		0		0		0		0				
Glass/Door Cond		0	0		0		0		0		0		0		0		0				
Wall Cond		1,174	0		1,174		1,248		16		-3,021		-3,021		19.93		0				
Partition/Door		0	0		0		0		0		0		0		0		0				
Floor		0	0		0		0.00		0		0		0		0		0				
Adjacent Floor		0.00	0.00		0.00		0.00		0.00		0.00		0.00		0.00		0				
Infiltration		0	0		0		0		0		0		0		0		0				
Sub Total/ ==>		1,174	0		1,174		1,248		16		-3,021		-3,021		19.93		0				
Internal Loads																					
Lights		3,171	0		3,171		3,171		41		0		0		0		0				
People		3,350	0		3,350		1,975		26		0		0		0		0				
Misc		1,289	0		1,289		1,260		16		0		0		0		0				
Sub Total/ ==>		7,810	0		7,810		6,406		84		0		0		0		0				
Engineering CKS																					
Ceiling Load		0	0		0		0		0		0		0		0		0				
Ventilation Load		0	0		538		0		0		0		-9,417		62.13		0				
Adj Air Trans Heat		0	0		0		0		0		0		0		0		0				
Dehumid. Ov Sizing		0	0		0		0		0		-2,719		-2,719		17.94		0				
Ov/Undr Sizing			0		0		0		0		0		0		0		0				
Exhaust Heat			0		0		0		0		0		0		0		0				
Sup. Fan Heat			0		0		0		0		0		0		0		0				
Ret. Fan Heat			0		0		0		0		0		0		0		0				
Duct Heat PkUp			0		0		0		0		0		0		0		0				
Underfir Sup Ht PkUp			0		0		0		0		0		0		0		0				
Supply Air Leakage			0		0		0		0		0		0		0		0				
Grand Total/ ==>		8,983	0		9,521		7,654		100.00		-5,740		-15,157		100.00		0				

COOLING COIL SELECTION										AREAS				HEATING COIL SELECTION							
Total Capacity		Sens Cap.		Coil Airflow		Enter		DB/WB/HR		Leave		Gross Total		Glass		Capacity		Coil Airflow		Lvg	
ton		MBh		cfm		°F		°F gr/lb		°F gr/lb		ft²		(%)		MBh		cfm		°F	
Main Clg		0.8	9.5	396		78.7		60.4		55.0		784		Floor		-15.2		396		90.0	
Aux Clg		0.0	0.0	0		0		0.0		0.0		0		Part		0		0		0.0	
Opt Vent		0.0	0.0	0		0		0.0		0.0		0		Int Door		-1.8		396		55.0	
												ExFlr		Roof							
												406		Wall							
Total/		0.8	9.5									0		Ext Door		-15.2					

System Checksums

By Farris Engineering

A102

Fan Coil

COOLING COIL PEAK										CLG SPACE PEAK					HEATING COIL PEAK					TEMPERATURES																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																	
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System Checksums

By Farris Engineering

A103

Fan Coil

[illegible]

System Checksums

By Farris Engineering

A104

Fan Coil

[illegible]

Project Name:

Dataset Name: FP 191017.TRC

TRACE® 700 v6.3.4 calculated at 11:51 AM on 10/03/2019
Alternative - 1 System Checksums Report Page 4 of 22

System Checksums

By Farris Engineering

A105

Fan Coil

COOLING COIL PEAK										CLG SPACE PEAK					HEATING COIL PEAK					TEMPERATURES																																																											
Peaked at Time: Outside Air:					Mo/Hr: 7 / 14 OADBWB/HR: 88 / 61 / 51					Mo/Hr: Sum of OADB: Peaks					Mo/Hr: Heating Design OADB: -18					Cooling					Heating																																																						
Sens. + Lat.		Space		Plenum		Net		Percent		Space		Percent		Space Peak		Coil Peak		Percent		SADB					Ra Plenum					Return					Ret/OA					Fn MtrTD					Fn BldTD					Fn Frict																													
Btu/h		Btu/h		Btu/h		Btu/h		Of Total		Sensible		Of Total		Btu/h		Btu/h		Of Total		Btu/h					Btu/h					Btu/h					Btu/h					Btu/h					Btu/h					Btu/h					Btu/h																								
Envelope Loads																				Envelope Loads																				Envelope Loads																				Envelope Loads																			
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Roof Cond																				Roof Cond																				Roof Cond																				Roof Cond																			
Glass Solar																				Glass Solar																				Glass Solar																				Glass Solar																			
Glass/Door Cond																				Glass/Door Cond																				Glass/Door Cond																				Glass/Door Cond																			
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Dehumid. Ov Sizing																				Ov/Undr Sizing																				Ov/Undr Sizing																				Ov/Undr Sizing																			
Exhaust Heat																				Exhaust Heat																				Exhaust Heat																				Exhaust Heat																			
Sup. Fan Heat																				OA Preheat Diff.																				OA Preheat Diff.																				OA Preheat Diff.																			
Ret. Fan Heat																				RA Preheat Diff.																				RA Preheat Diff.																				RA Preheat Diff.																			
Duct Heat Pickup																				Additional Reheat																				Additional Reheat																				Additional Reheat																			
Underfir Sup Ht Pkup																				Underfir Sup Ht Pkup																				Underfir Sup Ht Pkup																				Underfir Sup Ht Pkup																			
Supply Air Leakage																				Supply Air Leakage																				Supply Air Leakage																				Supply Air Leakage																			
Grand Total/ ==>																				Grand Total/ ==>																				Grand Total/ ==>																				Grand Total/ ==>																			

Project Name:

Dataset Name: FP 191017.TRC

TRACE® 700 v6.3.4 calculated at 11:51 AM on 10/03/2019
Alternative - 1 System Checksums Report Page 5 of 22

System Checksums

By Farris Engineering

A106

Fan Coil

COOLING COIL PEAK				CLG SPACE PEAK				HEATING COIL PEAK				TEMPERATURES			
Peaked at Time: Outside Air:				Mo/Hr: 7 / 15 OADB/WB/HR: 89 / 62 / 52				Mo/Hr: Heating Design OADB: -18							
Sens. + Lat.	Space	Plenum	Net	Space	Percent	Sensible	Percent	Space Peak	Coil Peak	Percent		SADB	Cooling	Heating	
Sens. + Lat.	Btu/h	Sens. + Lat.	Total	Btu/h	Of Total	Btu/h	Of Total	Space Sens	Tot Sens	Of Total		Return			
Btu/h	Btu/h	Btu/h	Btu/h	Btu/h	(%)	Btu/h	(%)	Btu/h	Btu/h	(%)		Ret/OA			
Envelope Loads															
Skyliite Solar	0	0	0	0	0	0	0	0	0	0.00	Envelope Loads	Fn MtrTD	0.0	0.0	0.0
Skyliite Cond	0	0	0	0	0	0	0	0	0	0.00	Skyliite Solar	Fn BldTD	0.0	0.0	0.0
Roof Cond	0	0	0	0	0	0	0	0	0	0.00	Skyliite Cond	Fn Frict	0.0	0.0	0.0
Glass Solar	0	0	0	0	0	0	0	0	0	0.00	Roof Cond				
Glass/Door Cond	0	0	0	0	0	0	0	0	0	0.00	Glass Solar				
Wall Cond	6,000	0	6,000	7,591	34	7,591	48	-5,208	-5,208	21.45	Glass/Door Cond				
Partition/Door	0	0	0	0	0	0	0	0	0	0.00	Wall Cond				
Floor	0	0	0	0.00	0	0.00	0	0	0	0.00	Partition/Door				
Adjacent Floor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	Floor				
Infiltration	0	0	0	0	0	0	0	0	0	0.00	Adjacent Floor				
Sub Total ==>	6,000	0	6,000	7,591	34	7,591	48	-5,208	-5,208	21.45	Infiltration				
Internal Loads															
Lights	4,399	0	4,399	25	0	4,399	28	0	0	0.00	Internal Loads				
People	3,750	0	3,750	22	0	2,220	14	0	0	0.00	Lights				
Misc	1,561	0	1,561	9	0	1,526	10	0	0	0.00	People				
Sub Total ==>	9,710	0	9,710	56	0	8,145	52	0	0	0.00	Misc				
Ceiling Load	0	0	0	0	0	0	0	0	0	0.00	Sub Total ==>				
Ventilation Load	0	0	1,708	10	0	0	0	0	0	0.00	Ceiling Load				
Adj Air Trans Heat	0	0	0	0	0	0	0	0	0	0.00	Ventilation Load				
Dehumid. Ov Sizing	0	0	0	0	0	0	0	-6,593	-6,593	27.15	Adj Air Trans Heat				
Ov/Undr Sizing	0	0	0	0	0	0	0	0	0	0.00	Ov/Undr Sizing				
Exhaust Heat	0	0	0	0	0	0	0	0	0	0.00	Exhaust Heat				
Sup. Fan Heat	0	0	0	0	0	0	0	0	0	0.00	OA Preheat Diff.				
Ret. Fan Heat	0	0	0	0	0	0	0	0	0	0.00	RA Preheat Diff.				
Duct Heat PkUp	0	0	0	0	0	0	0	0	0	0.00	Additional Reheat				
Underflr Sup Ht PkUp	0	0	0	0	0	0	0	0	0	0.00	Underflr Sup Ht PkUp				
Supply Air Leakage	0	0	0	0	0	0	0	0	0	0.00	Supply Air Leakage				
Grand Total ==>	15,710	0	17,418	100.00	0	15,736	100.00	-11,801	-24,281	100.00	Grand Total ==>				
AIRFLOWS															
Diffuser											AIRFLOWS				
Terminal											Cooling				
Main Fan											Heating				
Sec Fan											813				
Nom Vent											813				
AHU Vent											813				
Infil											0				
MinStop/Rh											0				
Return											0				
Exhaust											773				
Rm Exh											98				
Auxiliary											41				
Leakage Dwn											0				
Leakage Ups											0				
ENGINEERING CKS															
% OA											ENGINEERING CKS				
cfm/ft²											Cooling				
cfm/ton											Heating				
Btu/hr-ft²											17.1				
No. People											0.63				
											560.35				
											885.28				
											13.56				
											12				
											-18.90				
HEATING COIL SELECTION															
Total Capacity	ton	1.5	17.4	16.0	813	77.4	58.1	52.5	55.0	49.7	52.5	Capacity	MBh	Ent	Lvg
Main Clg	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	Coil Airflow	cfm	°F	°F
Aux Clg	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	MBh			
Opt Vent	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0				
Total	1.5	17.4													
AREAS															
Gross Total															
Floor												Main Htg			
Part												Aux Htg			
Int Door												Preheat			
ExFlr												Humidif			
Roof												Opt Vent			
Wall												Total			
Ext Door															

System Checksums

By Farris Engineering

A107

Fan Coil

COOLING COIL PEAK				CLG SPACE PEAK				HEATING COIL PEAK				TEMPERATURES			
Peaked at Time: Outside Air:				Mo/Hr: 7 / 15 OADB/WB/HR: 89 / 62 / 52				Mo/Hr: Heating Design OADB: -18							
Sens. + Lat.	Space	Plenum	Net	Space	Percent	Sensible	Percent	Space Peak	Coil Peak	Percent		SADB	Cooling	Heating	
Sens. + Lat.	Btu/h	Sens. + Lat.	Total	Btu/h	Of Total	Btu/h	Of Total	Space Sens	Tot Sens	Of Total		Return	75.0	75.0	
Btu/h	Btu/h	Btu/h	Btu/h	Btu/h	(%)	Btu/h	(%)	Btu/h	Btu/h	(%)		Ret/OA	77.4	58.9	
Envelope Loads				Envelope Loads								Fn MtrTD			
Skyliite Solar	0	0	0	0	0	0	0	0	0	0.00		Fn BldTD	0.0	0.0	0.0
Skyliite Cond	0	0	0	0	0	0	0	0	0	0.00		Fn Frict	0.0	0.0	0.0
Roof Cond	0	0	0	0	0	0	0	0	0	0.00					
Glass Solar	0	0	0	0	0	0	0	0	0	0.00					
Glass/Door Cond	0	0	0	0	0	0	0	0	0	0.00					
Wall Cond	5,482	0	5,482	7,395	32	7,395	48	-4,479	-4,479	18.56					
Partition/Door	0	0	0	0	0	0	0	0	0	0.00					
Floor	0	0	0	0.00	0	0.00	0	0	0	0.00					
Adjacent Floor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00					
Infiltration	0	0	0	0	0	0	0	0	0	0.00					
Sub Total ==>	5,482	0	5,482	7,395	32	7,395	48	-4,479	-4,479	18.56					
Internal Loads				Internal Loads											
Lights	4,399	0	4,399	26	0	4,399	28	0	0	0.00					
People	3,750	0	3,750	22	0	2,220	14	0	0	0.00					
Misc	1,561	0	1,561	9	0	1,526	10	0	0	0.00					
Sub Total ==>	9,710	0	9,710	57	0	8,145	52	0	0	0.00					
Ceiling Load	0	0	0	0	0	0	0	0	0	0.00					
Ventilation Load	0	0	1,707	10	0	0	0	0	-12,480	51.71					
Adj Air Trans Heat	0	0	0	0	0	0	0	0	0	0					
Dehumid. Ov Sizing	0	0	0	0	0	0	0	-7,175	-7,175	29.73					
Ov/Undr Sizing	0	0	0	0	0	0	0	0	0	0.00					
Exhaust Heat	0	0	0	0	0	0	0	0	0	0.00					
Sup. Fan Heat	0	0	0	0	0	0	0	0	0	0.00					
Ret. Fan Heat	0	0	0	0	0	0	0	0	0	0.00					
Duct Heat PkUp	0	0	0	0	0	0	0	0	0	0.00					
Underflr Sup Ht PkUp	0	0	0	0	0	0	0	0	0	0.00					
Supply Air Leakage	0	0	0	0	0	0	0	0	0	0.00					
Grand Total ==>	15,192	0	16,899	100.00		15,540	100.00	-11,654	-24,134	100.00					
COOLING COIL SELECTION				COOLING COIL SELECTION				AREAS				HEATING COIL SELECTION			
Total Capacity	Sens Cap.	Coil Airflow	Enter	Sens Cap.	Coil Airflow	Enter	Leave	Gross Total	Glass			Capacity	Coil Airflow	Ent	Lvg
ton	MBh	cfm	°F	MBh	cfm	°F	°F		ft²	(%)		MBh	cfm	°F	°F
Main Clg	1.4	16.9	77.4	15.5	803	58.1	55.0	1,285				Main Htg	-24.1	803	58.9
Aux Clg	0.0	0.0	0.0	0.0	0	0.0	0.0	0				Aux Htg	0.0	0	0.0
Opt Vent	0.0	0.0	0.0	0.0	0	0.0	0.0	0				Preheat	0.0	0	0.0
Total	1.4	16.9						602				Humidif	0.0	0	0.0
								Ext Door				Opt Vent	0.0	0	0.0
												Total	-24.1		

Project Name:

Dataset Name: FP 191017.TRC

TRACE® 700 v6.3.4 calculated at 11:51 AM on 10/03/2019

Alternative - 1 System Checksums Report Page 7 of 22

System Checksums

By Farris Engineering

A108 CORRIDOR

Fan Coil

COOLING COIL PEAK				CLG SPACE PEAK				HEATING COIL PEAK				TEMPERATURES			
Peaked at Time: Outside Air:		Mo/Hr: 7 / 15 OADBWB/HR: 89 / 62 / 52		Mo/Hr: Sum of OADB: Peaks		Mo/Hr: Heating Design OADB: -18						Cooling		Heating	
Sens. + Lat.	Space	Plenum	Net	Space	Percent	Sensible	Percent	Space Peak	Coil Peak	Percent					
Sens. + Lat.	Btu/h	Sens. + Lat. Btu/h	Total Btu/h	Of Total Btu/h	(%)	Of Total Btu/h	(%)	Space Sens Btu/h	Tot Sens Btu/h	Of Total Btu/h	(%)				
Envelope Loads															
	0	0	0	0	0	0	0	0	0	0	0.00				
Skylite Solar	0	0	0	0	0	0	0	0	0	0	0.00				
Skylite Cond	0	0	0	0	0	0	0	0	0	0	0.00				
Roof Cond	1,884	0	1,884	28	37	2,198	18.44	-2,503	-2,503	18.44					
Glass Solar	0	0	0	0	0	0	0	0	0	0	0.00				
Glass/Door Cond	0	0	0	0	0	0	0	0	0	0	0.00				
Wall Cond	0	0	0	0	0	0	0	0	0	0	0.00				
Partition/Door	0	0	0	0	0	0	0	0	0	0	0.00				
Floor	0	0	0	0	0	0.00	0	0	0	0	0.00				
Adjacent Floor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00				
Infiltration	0	0	0	0	0	0	0	0	0	0	0.00				
Sub Total / ==>	1,884	0	1,884	28	37	2,198	18.44	-2,503	-2,503	18.44					
Internal Loads															
Lights	3,789	0	3,789	57	63	3,789	0	0	0	0	0.00				
People	0	0	0	0	0	0	0	0	0	0	0.00				
Misc	0	0	0	0	0	0	0	0	0	0	0.00				
Sub Total / ==>	3,789	0	3,789	57	63	3,789	0	0	0	0	0.00				
Ceiling Load	0	0	0	0	0	0	0	0	0	0	0.00				
Ventilation Load	0	0	974	15	0	0	0	0	-9,079	66.91					
Adj Air Trans Heat	0	0	0	0	0	0	0	0	0	0	0				
Dehumid. Ov Sizing	0	0	0	0	0	0	0	-1,987	-1,987	14.65					
Ov/Undr Sizing															
Exhaust Heat		0	0	0	0	0	0	0	0	0	0.00				
Sup. Fan Heat		0	0	0	0	0	0	0	0	0	0.00				
Ret. Fan Heat		0	0	0	0	0	0	0	0	0	0.00				
Duct Heat Pickup		0	0	0	0	0	0	0	0	0	0.00				
Underfir Sup Ht Pkup		0	0	0	0	0	0	0	0	0	0.00				
Supply Air Leakage		0	0	0	0	0	0	0	0	0	0.00				
Grand Total / ==>	5,673	0	6,647	100.00		5,987	100.00	-4,490	-13,569	100.00					
ENGINEERING CKS															
% OA													Cooling	Heating	
cfm/ft²													32.6	32.6	
cfm/ton													0.18	0.18	
ft²/ton													527.48		
Btu/hr-ft²													2,867.04		
No. People													4.19	-8.07	

COOLING COIL SELECTION				HEATING COIL SELECTION			
Total Capacity ton	Sens Cap. MBh	Coil Airflow cfm	Enter DBWB/HR °F	Leave DBWB/HR °F	Gross Total	Glass ft²	
0.6	7.0	309	79.6	59.8	1,682		
0.0	0.0	0	0.0	0.0	0		
0.0	0.0	0	0.0	0.0	0		
0.6	7.0	</td>					

Main Clg		Main Htg	
Aux Clg	Aux Htg	Aux Htg	Aux Htg
Opt Vent	Preheat	Preheat	Preheat
	ExFlr		
	Roof		
	Wall		
	Ext Door		
Total/	Humidif	Humidif	Humidif
	Opt Vent	Opt Vent	Opt Vent
	Total	Total	Total

System Checksums

By Farris Engineering

A109 STAIRS

Fan Coil

COOLING COIL PEAK										CLG SPACE PEAK					HEATING COIL PEAK					TEMPERATURES									
Peaked at Time: Outside Air:					Mo/Hr: 7 / 15 OADB/WB/HR: 89 / 62 / 52					Mo/Hr: Sum of OADB: Peaks					Mo/Hr: Heating Design OADB: -18					Cooling					Heating				
Sens. + Lat.		Space	Plenum		Net		Percent		Space		Percent		Space Peak		Coil Peak		Percent		SADB		Cooling		Heating						
Sens. + Lat.		Btu/h	Sens. + Lat.		Total		Of Total		Sensible		Of Total		Space Sens		Tot Sens		Of Total		Ra Plenum		55.0		90.0						
Btu/h		Btu/h	Btu/h		Btu/h		(%)		Btu/h		(%)		Btu/h		Btu/h		(%)		Return		75.0		75.0						
Envelope Loads																													
Skylite Solar		0	0		0		0		0		0		0		0		0		Fn MtrTD		0.0		0.0						
Skylite Cond		0	0		0		0		0		0		0		0		0		Fn BldTD		0.0		0.0						
Roof Cond		450	0		450		12		404		10		-598		-598		11.38		Ra Plenum		75.0		75.0						
Glass Solar		0	0		0		0		0		0		0		0		0		Ret/OA		76.6		64.5						
Glass/Door Cond		0	0		0		0		0		0		0		0		0		Fn MtrTD		0.0		0.0						
Wall Cond		2,336	0		2,336		60		2,862		70		-1,875		-1,875		35.66		Fn BldTD		0.0		0.0						
Partition/Door		0	0		0		0		0		0		0		0		0		Fn Frict		0.0		0.0						
Floor		0	0		0		0		0.00		0		0		0		0												
Adjacent Floor		0.00	0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00												
Infiltration		0	0		0		0		0		0		0		0		0												
Sub Total ==>		2,786	0		2,786		72		3,266		79		-2,473		-2,473		47.04												
Internal Loads																													
Lights		851	0		851		22		851		21		0		0		0.00		Diffuser		213		213						
People		0	0		0		0		0		0		0		0		0.00		Terminal		213		213						
Misc		0	0		0		0		0		0		0		0		0.00		Main Fan		213		213						
Sub Total ==>		851	0		851		22		851		21		0		0		0.00		Sec Fan		0		0						
Ceiling Load																													
Ventilation Load		0	0		0		0		0		0		0		0		0.00		Nom Vent		24		24						
Adj Air Trans Heat		0	0		0		0		0		0		0		0		0		AHU Vent		24		24						
Dehumid. Ov Sizing		0	0		0		0		0		0		0		0		0.00		Infil		0		0						
Ov/Undr Sizing		0	0		0		0		0		0		0		0		0.00		MinStop/Rh		0		0						
Exhaust Heat		0	0		0		0		0		0		0		0		0.00		Return		213		213						
Sup. Fan Heat		0	0		0		0		0		0		0		0		0.00		Exhaust		24		24						
Ret. Fan Heat		0	0		0		0		0		0		0		0		0.00		Rm Exh		0		0						
Duct Heat PkUp		0	0		0		0		0		0		0		0		0.00		Auxiliary		0		0						
Underflr Sup Ht PkUp		0	0		0		0		0		0		0		0		0.00		Leakage Dwn		0		0						
Supply Air Leakage		0	0		0		0		0		0		0		0		0.00		Leakage Ups		0		0						
Grand Total ==>		3,637	0		3,870		100.00		4,117		100.00		-3,088		-5,258		100.00												
ENGINEERING CKS																													
% OA		Cooling		Heating																									
cfm/ft²		11.3		11.3																									
cfm/ton		644.25		0.53																									
ft²/ton		1,217.09		0.53																									
Btu/hr-ft²		9.86		-13.08																									
No. People		0		0																									
HEATING COIL SELECTION																													
Total Capacity		Sens Cap.		Coil Airflow		Enter DB/WB/HR		Leave DB/WB/HR		Gross Total		Glass		Capacity		Coil Airflow		Ent		Lvg									
ton		MBh		cfm		°F		°F		ft²		(%)		MBh		cfm		°F		°F									
Main Clg		4.0		213		76.6		59.0		402		0		-5.3		213		64.5		90.0									
Aux Clg		0.0		0		0.0		0.0		0		0		0.0		0		0.0		0.0									
Opt Vent		0.0		0		0.0		0.0		0		0		0.0		0		0.0		0.0									
Total		0.3		4.0		213		76.6		402		0		0.0		0		0.0		0.0									
										201		0		0.0		0		0.0		0.0									
										252		0		0.0		0		0.0		0.0									
										0		0		0.0		0		0.0		0.0									
										0		0		0.0		0		0.0		0.0									

System Checksums

By Farris Engineering

A201

Fan Coil

COOLING COIL PEAK				CLG SPACE PEAK				HEATING COIL PEAK				TEMPERATURES			
Peaked at Time: Outside Air:				Mo/Hr: 7 / 16 OADB/WB/HR: 88 / 61 / 50				Mo/Hr: Heating Design OADB: -18				Cooling Heating			
Sens. + Lat.	Space	Plenum	Net	Percent	Space	Percent	Envelope Loads	Space Peak	Coil Peak	Percent		SADB	Cooling	Heating	
Sens. + Lat.	Btu/h	Sens. + Lat.	Total	Of Total	Sensible	Of Total		Space Sens	Tot Sens	Of Total		Ra Plenum	55.0	90.0	
		Btu/h	Btu/h	(%)	Btu/h	(%)		Btu/h	Btu/h	(%)		Return	75.0	75.0	
Envelope Loads												Ret/OA	77.8	55.5	
SkyLite Solar	0	0	0	0	0	0	SkyLite Solar	0	0	0.00		Fn MtrTD	0.0	0.0	
SkyLite Cond	0	0	0	0	0	0	SkyLite Cond	0	0	0.00		Fn BldTD	0.0	0.0	
Roof Cond	1,950	0	1,950	17	2,036	21	Roof Cond	-2,318	-2,318	14.10		Fn Frict	0.0	0.0	
Glass Solar	0	0	0	0	0	0	Glass Solar	0	0	0.00					
Glass/Door Cond	0	0	0	0	0	0	Glass/Door Cond	0	0	0.00					
Wall Cond	1,104	0	1,104	10	1,109	12	Wall Cond	-2,708	-2,708	16.47					
Partition/Door	0	0	0	0	0	0	Partition/Door	0	0	0.00					
Floor	0	0	0	0	0.00	0	Floor	0	0	0.00					
Adjacent Floor	0.00	0.00	0.00	0.00	0.00	0.00	Adjacent Floor	0.00	0.00	0.00					
Infiltration	0	0	0	0	0	0	Infiltration	0	0	0.00					
Sub Total ==>	3,053	0	3,053	27	3,145	33	Sub Total ==>	-5,026	-5,026	30.57					
Internal Loads				Internal Loads								AIRFLOWS			
Lights	3,120	0	3,120	28	3,120	33	Lights	0	0	0.00		Diffuser	492	492	
People	3,350	0	3,350	30	1,975	21	People	0	0	0.00		Terminal	492	492	
Misc	1,231	0	1,231	11	1,205	13	Misc	0	0	0.00		Main Fan	492	492	
Sub Total ==>	7,701	0	7,701	69	6,300	66	Sub Total ==>					Sec Fan	0	0	
Ceiling Load	0	0	0	0	0	0	Ceiling Load	0	0	0.00		Nom Vent	103	103	
Ventilation Load	0	0	383	3	0	0	Ventilation Load	0	0	0.00		AHU Vent	103	103	
Adj Air Trans Heat	0	0	0	0	0	0	Adj Air Trans Heat	0	0	0.00		Infil	0	0	
Dehumid. Ov Sizing	79	0	79	1	79	1	Ov/Undr Sizing	-2,117	-2,117	12.88		MinStop/Rh	0	0	
Ov/Undr Sizing							Exhaust Heat	0	0	0.00		Return	452	452	
Exhaust Heat							OA Preheat Diff.	0	0	0.00		Exhaust	63	63	
Sup. Fan Heat							RA Preheat Diff.	0	0	0.00		Rm Exh	41	41	
Ret. Fan Heat							Additional Reheat	0	0	0.00		Auxiliary	0	0	
Duct Heat PkUp							Underflr Sup Ht PkUp	0	0	0.00		Leakage Dwn	0	0	
Underflr Sup Ht PkUp							Supply Air Leakage	0	0	0.00		Leakage Ups	0	0	
Supply Air Leakage							Grand Total ==>	-7,143	-16,442	100.00					
Grand Total ==>	10,834	0	11,217	100.00	9,524	100.00	Grand Total ==>								
COOLING COIL SELECTION				HEATING COIL SELECTION				ENGINEERING CKS							
Total Capacity	Sens Cap.	Coil Airflow	Enter	Leave	Total	Glass		% OA	Cooling	Heating		Capacity	Coil Airflow	Ent	Lvg
ton	MBh	MBh	°F	°F	ft²	(%)		cfm/ft²	21.0	21.0		MBh	cfm	°F	°F
Main Clg	0.9	11.2	10.7	77.8	59.9	60.2	55.0	51.3	58.8			-16.4	492	55.5	90.0
Aux Clg	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			0.0	0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			0.0	0	0.0	0.0
Total	0.9	11.2										0.0	0	0.0	0.0
												0.0	0	0.0	0.0
												-16.4			

System Checksums

By Farris Engineering

A202

Fan Coil

COOLING COIL PEAK				CLG SPACE PEAK				HEATING COIL PEAK				TEMPERATURES			
Peaked at Time: Outside Air:				Mo/Hr: 7 / 16 OADB/WB/HR: 88 / 61 / 50				Mo/Hr: Heating Design OADB: -18				Cooling Heating			
Sens. + Lat.	Space	Plenum	Net	Space	Percent	Sensible	Percent	Space Peak	Coil Peak	Percent		SADB	Cooling	Heating	
Btu/h	Btu/h	Btu/h	Total	Btu/h	Of Total	Btu/h	Of Total	Space Sens	Tot Sens	Of Total		Ra Plenum	55.0	90.0	
			Btu/h		(%)		(%)	Btu/h	Btu/h	(%)		Return	75.0	75.0	
Envelope Loads				Envelope Loads								Ret/OA			
SkyLite Solar	0	0	0	0	0	0	0	0	0	0.00		Fn MtrTD	0.0	0.0	
SkyLite Cond	0	0	0	0	0	0	0	0	0	0.00		Fn BldTD	0.0	0.0	
Roof Cond	1,850	0	1,850	1,932	21	1,932	21	-2,199	-2,199	13.44		Fn Frict	0.0	0.0	
Glass Solar	0	0	0	0	0	0	0	0	0	0.00					
Glass/Door Cond	0	0	0	0	0	0	0	0	0	0.00					
Wall Cond	1,104	0	1,104	1,109	12	1,109	12	-2,708	-2,708	16.55					
Partition/Door	0	0	0	0	0	0	0	0	0	0.00					
Floor	0	0	0	0.00	0	0.00	0	0	0	0.00					
Adjacent Floor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00					
Infiltration	0	0	0	0	0	0	0	0	0	0.00					
Sub Total ==>	2,953	0	2,953	3,041	32	3,041	32	-4,907	-4,907	29.99					
Internal Loads				Internal Loads								AIRFLOWS			
Lights	3,120	0	3,120	3,120	33	3,120	33	0	0	0.00		Diffuser	Cooling	Heating	
People	3,350	0	3,350	1,975	21	1,975	21	0	0	0.00		Terminal	487	487	
Misc	1,231	0	1,231	1,205	13	1,205	13	0	0	0.00		Main Fan	487	487	
Sub Total ==>	7,701	0	7,701	6,300	67	6,300	67	0	0	0.00		Sec Fan	0	0	
Ceiling Load	0	0	0	0	0	0	0	0	0	0.00		Nom Vent	103	103	
Ventilation Load	0	0	383	0	0	0	0	0	0	0.00		AHU Vent	103	103	
Adj Air Trans Heat	0	0	0	0	0	0	0	0	0	0.00		Infil	0	0	
Dehumid. Ov Sizing	79	0	79	79	1	79	1	-2,158	-2,158	13.18		MinStop/Rh	0	0	
Ov/Undr Sizing	0	0	0	0	0	0	0	0	0	0.00		Return	446	446	
Exhaust Heat	0	0	0	0	0	0	0	0	0	0.00		Exhaust	63	63	
Sup. Fan Heat	0	0	0	0	0	0	0	0	0	0.00		Rm Exh	41	41	
Ret. Fan Heat	0	0	0	0	0	0	0	0	0	0.00		Auxiliary	0	0	
Duct Heat PkUp	0	0	0	0	0	0	0	0	0	0.00		Leakage Dwn	0	0	
Underflr Sup Ht PkUp	0	0	0	0	0	0	0	0	0	0.00		Leakage Ups	0	0	
Supply Air Leakage	0	0	0	0	0	0	0	0	0	0.00					
Grand Total ==>	10,734	0	11,117	9,420	100.00	9,420	100.00	-7,065	-16,364	100.00					
												ENGINEERING CKS			
												Cooling Heating			
												% OA	21.2	21.2	
												cfm/ft²	0.63	0.63	
												cfm/ton	525.57		
												ft²/ton	840.88		
												Btu/hr-ft²	14.27	-21.01	
												No. People	8		
												HEATING COIL SELECTION			
												Capacity Coil Airflow Ent Lvg			
												MBh cfm °F °F			
Main Clg	0.9	11.1	10.6	487	77.8	59.9	60.2	779	0	0		Main Htg	-16.4	487	55.3
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0	0.00		Aux Htg	0.0	0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0	0.00		Preheat	0.0	0	0.0
												AREAS			
												Gross Total Glass ft² (%)			
												Floor			
												Part			
												Int Door			
												ExFlr			
												Roof			
												Wall			
												Ext Door			
												Total			
												COOLING COIL SELECTION			
												Total Capacity Sens Cap. Coil Airflow Enter DB/WB/HR Leave DB/WB/HR			
												ton MBh MBh cfm °F °F gr/lb gr/lb			
												Main Clg			
												Aux Clg			
												Opt Vent			
												Total			

System Checksums

By Farris Engineering

A203

Fan Coil

COOLING COIL PEAK				CLG SPACE PEAK				HEATING COIL PEAK				TEMPERATURES			
Peaked at Time: Outside Air: OADBWB/HR: 88 / 61 / 50				Mo/Hr: Sum of OADB: Peaks				Mo/Hr: Heating Design OADB: -18							
Sens. + Lat.		Plenum	Net	Space	Percent	Space	Percent	Space Peak		Coil Peak	Percent	Cooling		Heating	
Btu/h		Sens. + Lat. Btu/h	Total Btu/h	Sensible Btu/h	Of Total (%)	Btu/h	Of Total (%)	Btu/h		Tot Sens Btu/h	Of Total (%)	cfm		°F	
Envelope Loads															
0		0	0	0	0	0	0	0		0	0	55.0		90.0	
0		0	0	0	0	0	0	0		0	0	75.0		75.0	
1,950		0	1,950	2,036	17	2,036	21	-2,318		-2,318	14.10	75.0		75.0	
0		0	0	0	0	0	0	0		0	0	77.8		55.5	
0		0	0	0	0	0	0	0		0	0	0.0		0.0	
0		0	0	0	0	0	0	0		0	0	0.0		0.0	
1,104		0	1,104	1,109	10	1,109	12	-2,708		-2,708	16.47	0.0		0.0	
0		0	0	0	0	0	0	0		0	0	0.0		0.0	
0		0	0	0.00	0	0.00	0	0		0	0	0.0		0.0	
0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	492		492	
0		0	0	0	0	0	0	0		0	0	492		492	
3,053		0	3,053	3,145	27	3,145	33	-5,026		-5,026	30.57	0		0	
Sub Total/ ==>								Sub Total/ ==>							
Internal Loads															
3,120		0	3,120	3,120	28	3,120	33	0		0	0	103		103	
3,350		0	3,350	1,975	30	1,975	21	0		0	0	0		0	
1,231		0	1,231	1,205	11	1,205	13	0		0	0	452		452	
7,701		0	7,701	6,300	69	6,300	66	0		0	0	63		63	
Sub Total/ ==>								Sub Total/ ==>				41		41	
0		0	0	0	0	0	0	0		0	0	0		0	
0		0	383	0	3	0	0	0		-9,299	56.55	0		0	
0		0	0	0	0	0	0	0		0	0	0		0	
79		0	79	79	1	79	1	-2,117		-2,117	12.88	21.0		21.0	
Ov/Undr Sizing								Ov/Undr Sizing				0.63		0.63	
Exhaust Heat								Exhaust Heat				526.66		526.66	
Sup. Fan Heat								OA Preheat Diff.				833.38		833.38	
Ret. Fan Heat								RA Preheat Diff.				14.40		-21.11	
Duct Heat Pkup								Additional Reheat							
Underfir Sup Ht Pkup								Underfir Sup Ht Pkup							
Supply Air Leakage								Supply Air Leakage							
Grand Total/ ==>		10,834	11,217	9,524	100.00	11,217	100.00	Grand Total/ ==>		-7,143	100.00	8			
ENGINEERING CKS															
% OA								% OA				Cooling		Heating	
cfm/ft²								cfm/ft²				21.0		21.0	
cfm/ton								cfm/ton				0.63		0.63	
ft²/ton								ft²/ton				526.66		526.66	
Btu/hr-ft²								Btu/hr-ft²				833.38		833.38	
No. People								No. People				14.40		-21.11	

COOLING COIL SELECTION				HEATING COIL SELECTION			
Total Capacity	Sens Cap.	Coil Airflow	Enter DBWB/HR	Leave DBWB/HR	Gross Total	Glass	Lvg
ton	MBh	cfm	°F	°F		ft²	Capacity
		MBh		gr/lb		(%)	Coil Airflow
0.9	11.2	10.7	492		779		-16.4
0.0	0.0	0.0	0	55.0	Floor		Main Htg
0.0	0.0	0.0	0	51.3	Part		Aux Htg
0.0	0.0	0.0	0	0.0	Int Door		Preheat
0.0	0.0	0.0	0	0.0	ExFlr		
0.9	11.2				Roof	0	Humidif
					Wall	0	Opt Vent
					Ext Door	0	Total
							-16.4

System Checksums

By Farris Engineering

A204

Fan Coil

COOLING COIL PEAK				CLG SPACE PEAK				HEATING COIL PEAK				TEMPERATURES			
Peaked at Time: Outside Air: OADBWB/HR: 88 / 61 / 50				Mo/Hr: 7 / 16				Mo/Hr: Sum of OADB: Peaks				Mo/Hr: Heating Design OADB: -18			
Sens. + Lat.		Plenum		Net		Percent		Space		Space Peak		Coil Peak		Percent	
Btu/h		Btu/h		Total		Of Total		Sensible		Space Sens		Tot Sens		Of Total	
				Btu/h		Btu/h		Btu/h		Btu/h		Btu/h		Btu/h	
				Btu/h		Btu/h		Btu/h		Btu/h		Btu/h		Btu/h	
				Btu/h		Btu/h		Btu/h		Btu/h		Btu/h		Btu/h	
				Btu/h		Btu/h		Btu/h		Btu/h		Btu/h		Btu/h	
				Btu/h		Btu/h		Btu/h		Btu/h		Btu/h		Btu/h	
				Btu/h		Btu/h		Btu/h		Btu/h		Btu/h		Btu/h	
				Btu/h		Btu/h		Btu/h		Btu/h		Btu/h		Btu/h	
				Btu/h		Btu/h		Btu/h		Btu/h		Btu/h		Btu/h	
				Btu/h		Btu/h		Btu/h		Btu/h		Btu/h		Btu/h	
				Btu/h		Btu/h		Btu/h		Btu/h		Btu/h		Btu/h	
				Btu/h		Btu/h		Btu/h		Btu/h		Btu/h		Btu/h	
				Btu/h		Btu/h		Btu/h		Btu/h		Btu/h		Btu/h	
				Btu/h		Btu/h		Btu/h		Btu/h		Btu/h		Btu/h	
				Btu/h		Btu/h		Btu/h		Btu/h		Btu/h		Btu/h	
				Btu/h		Btu/h		Btu/h		Btu/h		Btu/h		Btu/h	
				Btu/h		Btu/h		Btu/h		Btu/h		Btu/h		Btu/h	
				Btu/h		Btu/h		Btu/h		Btu/h		Btu/h		Btu/h	
				Btu/h		Btu/h		Btu/h		Btu/h		Btu/h		Btu/h	
				Btu/h		Btu/h		Btu/h		Btu/h		Btu/h		Btu/h	
				Btu/h		Btu/h		Btu/h		Btu/h		Btu/h		Btu/h	
				Btu/h		Btu/h		Btu/h		Btu/h		Btu/h		Btu/h	
				Btu/h		Btu/h		Btu/h		Btu/h		Btu/h		Btu/h	
				Btu/h		Btu/h		Btu/h		Btu/h		Btu/h		Btu/h	
				Btu/h		Btu/h		Btu/h		Btu/h		Btu/h		Btu/h	
				Btu/h		Btu/h		Btu/h		Btu/h		Btu/h		Btu/h	
				Btu/h		Btu/h		Btu/h		Btu/h		Btu/h		Btu/h	
				Btu/h		Btu/h		Btu/h		Btu/h		Btu/h		Btu/h	
				Btu/h		Btu/h		Btu/h		Btu/h		Btu/h		Btu/h	
				Btu/h		Btu/h		Btu/h		Btu/h		Btu/h		Btu/h	
				Btu/h		Btu/h		Btu/h		Btu/h		Btu/h		Btu/h	
				Btu/h		Btu/h		Btu/h		Btu/h		Btu/h		Btu/h	
				Btu/h		Btu/h		Btu/h		Btu/h		Btu/h		Btu/h	
				Btu/h		Btu/h		Btu/h		Btu/h		Btu/h		Btu/h	
				Btu/h		Btu/h		Btu/h		Btu/h		Btu/h		Btu/h	
				Btu/h		Btu/h		Btu/h		Btu/h		Btu/h		Btu/h	
				Btu/h		Btu/h		Btu/h		Btu/h		Btu/h		Btu/h	
				Btu/h		Btu/h		Btu/h		Btu/h		Btu/h		Btu/h	
				Btu/h		Btu/h		Btu/h		Btu/h		Btu/h		Btu/h	
				Btu/h		Btu/h		Btu/h		Btu/h		Btu/h		Btu/h	
				Btu/h		Btu/h		Btu/h		Btu/h		Btu/h		Btu/h	
				Btu/h		Btu/h		Btu/h		Btu/h		Btu/h		Btu/h	
				Btu/h		Btu/h		Btu/h		Btu/h		Btu/h		Btu/h	
				Btu/h		Btu/h		Btu/h		Btu/h		Btu/h		Btu/h	
				Btu/h		Btu/h		Btu/h		Btu/h		Btu/h		Btu/h	
				Btu/h		Btu/h		Btu/h		Btu/h		Btu/h		Btu/h	
				Btu/h		Btu/h		Btu/h		Btu/h		Btu/h		Btu/h	
				Btu/h		Btu/h		Btu/h		Btu/h		Btu/h		Btu/h	
				Btu/h		Btu/h		Btu/h		Btu/h		Btu/h		Btu/h	
				Btu/h		Btu/h		Btu/h		Btu/h		Btu/h		Btu/h	
				Btu/h		Btu/h		Btu/h		Btu/h		Btu/h		Btu/h	
				Btu/h		Btu/h		Btu/h		Btu/h		Btu/h		Btu/h	
				Btu/h		Btu/h		Btu/h		Btu/h		Btu/h		Btu/h	
				Btu/h		Btu/h		Btu/h		Btu/h		Btu/h		Btu/h	
				Btu/h		Btu/h		Btu/h		Btu/h		Btu/h		Btu/h	
				Btu/h		Btu/h		Btu/h		Btu/h		Btu/h		Btu/h	
				Btu/h		Btu/h		Btu/h		Btu/h					

System Checksums

By Farris Engineering

A205

Fan Coil

COOLING COIL PEAK					CLG SPACE PEAK					HEATING COIL PEAK					TEMPERATURES														
Peaked at Time: Outside Air:					Mo/Hr: 7 / 15 OADBWB/HR: 89 / 62 / 52					Mo/Hr: Heating Design OADB: -18					Cooling					Heating									
Sens. + Lat.		Plenum		Net		Space		Percent		Space Peak		Coil Peak		Percent		SADB		Ra Plenum		Return		Ret/OA		Fn MtrTD		Fn BltTD		Fn Frict	
Btu/h	Btu/h	Btu/h	Btu/h	Btu/h	Of Total	(%)	Sensible	Btu/h	(%)	Btu/h	Space Sens	Btu/h	Tot Sens	Btu/h	Of Total	(%)													
Envelope Loads										Envelope Loads																			
Skylite Solar	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00													
Skylite Cond	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00													
Roof Cond	5,222	0	5,222	14	14	14	4,741	14	14	-7,003	-7,003	-7,003	-7,003	-7,003	14.34														
Glass Solar	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00														
Glass/Door Cond	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00														
Wall Cond	10,510	0	10,510	28	38	38	13,068	28	38	-12,603	-12,603	-12,603	-12,603	-12,603	25.82														
Partition/Door	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00														
Floor	0	0	0	0	0	0	0.00	0	0	0	0	0	0	0	0.00														
Adjacent Floor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0.00	0.00	0.00	0.00	0.00	0.00														
Infiltration	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00														
Sub Total/ ==>	15,732	0	15,732	41	51	51	17,810	41	51	-19,606	-19,606	-19,606	-19,606	-19,606	40.16														
Internal Loads										Internal Loads																			
Lights	8,181	0	8,181	22	24	24	8,181	24	24	0	0	0	0	0	0.00														
People	7,750	0	7,750	20	13	13	4,670	13	13	0	0	0	0	0	0.00														
Misc	3,283	0	3,283	9	9	9	3,283	9	9	0	0	0	0	0	0.00														
Sub Total/ ==>	19,215	0	19,215	51	46	46	16,084	51	46	0	0	0	0	0	0.00														
Ceiling Load	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00														
Ventilation Load	0	0	2,105	6	0	0	0	0	0	0	0	0	-22,727	46.56															
Adj Air Trans Heat	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0														
Dehumid. Ov Sizing	891	0	891	2	3	3	891	2	3	-6,483	-6,483	-6,483	-6,483	13.28															
OvUndr Sizing	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00														
Exhaust Heat	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00														
Sup. Fan Heat	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00														
Ret. Fan Heat	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00														
Duct Heat Pickup	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00														
Underfir Sup Ht PkUp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00														
Supply Air Leakage	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00														
Grand Total/ ==>	35,837	0	37,943	100.00	100.00	100.00	34,785	100.00	100.00	-26,089	-26,089	-48,816	-48,816	100.00															

ENGINEERING CKS				
% OA		Cooling	Heating	
cfm/ft²		0.76	14.1	0.76
cfm/ton		568.63		
ft³/ton		744.18		
Btu/hr-ft²		16.13		-20.75
No. People		19		

HEATING COIL SELECTION				
Total Capacity		Sens Cap.	Coil Airflow	Capacity
ton		MBh	cfm	MBh
3.2		37.9	1,798	-48.8
Main Clg				
Aux Clg		0.0	0.0	0.0
Opt Vent		0.0	0.0	0.0
Total/		3.2	0.0	0.0

COOLING COIL SELECTION				
Total Capacity		Sens Cap.	Coil Airflow	Capacity
ton		MBh	cfm	MBh
3.2		37.9	1,798	-48.8
Main Clg				
Aux Clg		0.0	0.0	0.0
Opt Vent		0.0	0.0	0.0
Total/		3.2	0.0	0.0

AREAS				
Gross Total		Glass		
ft²		ft²	(%)	
2,353				
Floor				
Part				
Int Door				
ExFlr				
Roof				
Wall				
Ext Door				

HEATING COIL SELECTION				
Capacity		Coil Airflow	Ent	Lvg
MBh		cfm	°F	°F
-48.8		1,798	61.9	90.0
Main Htg				
Aux Htg		0.0	0.0	0.0
Preheat		0.0	0.0	0.0
Humidif		0.0	0.0	0.0
Opt Vent		0.0	0.0	0.0
Total/		-48.8		

Project Name:

Dataset Name: FP 191017.TRC

TRACE® 700 v6.3.4 calculated at 11:51 AM on 10/03/2019
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System Checksums

By Farris Engineering

A206

Fan Coil

COOLING COIL PEAK				CLG SPACE PEAK				HEATING COIL PEAK				TEMPERATURES			
Peaked at Time: Outside Air:				Mo/Hr: 7 / 15 OADBWB/HR: 89 / 62 / 52				Mo/Hr: Heating Design OADB: -18				Cooling Heating			
Sens. + Lat.		Plenum	Net	Space	Percent	Space	Percent	Space Peak		Coil Peak	Percent	SADB		Ra Plenum	
Btu/h		Btu/h	Total	Sensible	Of Total	Btu/h	Of Total	Btu/h		Tot Sens	Of Total	Return		Return	
Btu/h		Btu/h	Btu/h	Btu/h	(%)	Btu/h	(%)	Btu/h		Btu/h	(%)	77.1		75.0	
Envelope Loads				Envelope Loads				Envelope Loads				Envelope Loads			
0		0	0	0	0	0	0	0		0	0	0.0		0.0	
0		0	0	0	0	0	0	0		0	0	0.0		0.0	
2,879		0	2,879	13	11	2,171	13.30	-3,824		-3,824	13.30	75.0		75.0	
0		0	0	0	0	0	0	0		0	0	0.0		0.0	
0		0	0	0	0	0	0	0		0	0	0.0		0.0	
6,054		0	6,054	27	39	7,735	18.11	-5,208		-5,208	18.11	0.0		0.0	
0		0	0	0	0	0	0	0		0	0	0.0		0.0	
0		0	0	0	0	0.00	0	0		0	0	0.0		0.0	
0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.0		0.0	
0		0	0	0	0	0	0	0		0	0	0.0		0.0	
8,933		0	8,933	39	50	9,907	31.40	-9,032		-9,032	31.40	0.0		0.0	
Sub Total/ ==>				Sub Total/ ==>				Sub Total/ ==>				Sub Total/ ==>			
Internal Loads				Internal Loads				Internal Loads				Internal Loads			
4,882		0	4,882	21	25	4,882	0	0		0	0	0		0	
4,950		0	4,950	22	15	2,955	0	0		0	0	988		988	
2,211		0	2,211	10	11	2,164	0	0		0	0	113		113	
12,043		0	12,043	53	50	10,002	0	0		0	0	41		41	
Sub Total/ ==>		Sub Total/ ==>		Sub Total/ ==>		Sub Total/ ==>		Sub Total/ ==>		Sub Total/ ==>		Sub Total/ ==>		Sub Total/ ==>	
Ceiling Load		0	0	0	0	0	0	0		0	0	0		0	
Ventilation Load		0	0	0	0	0	0	0		-13,829	48.08	0		0	
Adj Air Trans Heat		0	0	0	0	0	0	0		0	0	0		0	
Dehumid. Ov Sizing		0	0	0	0	0	0	-5,899		-5,899	20.51	0		0	
Ov/Undr Sizing		0	0	0	0	0	0	0		0	0	0		0	
Exhaust Heat		0	0	0	0	0	0	0		0	0	0		0	
Sup. Fan Heat		0	0	0	0	0	0	0		0	0	0		0	
Ret. Fan Heat		0	0	0	0	0	0	0		0	0	0		0	
Duct Heat PkUp		0	0	0	0	0	0	0		0	0	0		0	
Underfir Sup Ht Pkup		0	0	0	0	0	0	0		0	0	0		0	
Supply Air Leakage		0	0	0	0	0	0	0		0	0	0		0	
Grand Total/ ==>		20,976	22,836	100.00	100.00	19,908	-14,931	-28,760		-28,760	100.00	12		-22.38	
ENGINEERING CKS												ENGINEERING CKS			
% OA		Cooling		Heating		% OA		Cooling		Heating		14.9		14.9	
cfm/ft²		0.80		0.80		cfm/ft²		0.80		0.80		540.72		540.72	
cfm/ton		675.24		675.24		cfm/ton		675.24		675.24		17.77		17.77	
Btu/hr-ft²		12		12		Btu/hr-ft²		12		12		-22.38		-22.38	
No. People		12		12		No. People		12		12		12		12	

HEATING COIL SELECTION				AREAS				HEATING COIL SELECTION							
Total Capacity		Sens Cap.		Coil Airflow		Enter DBWB/HR		Gross Total		Glass		Capacity		Lvg/Ent	
ton		MBh		MBh		°F		Gr/lb		ft²		MBh		°F	
1.9		22.8		21.0		55.0		1,285		1,285		-28.8		1,029	
Main Clg		1.9		1,029		58.0		Floor		Floor		Main Htg		61.1	
Aux Clg		0.0		0.0		0.0		Part		0		Aux Htg		0.0	
Opt Vent		0.0		0.0		0.0		Int Door		0		Preheat		0.0	
Total/		1.9		22.8		0.0		ExFlr		0		Humidif		0.0	
Total/		1.9		22.8		0.0		Roof		0		Opt Vent		0.0	
Total/		1.9		22.8		0.0		Wall		700		Total/		-28.8	
Total/		1.9		22.8		0.0		Ext Door		0		Total/		-28.8	

Project Name:

Dataset Name: FP 191017.TRC

TRACE® 700 v6.3.4 calculated at 11:51 AM on 10/03/2019
Alternative - 1 System Checksums Report Page 15 of 22

By Farris Engineering

A207

Fan Coil

COOLING COIL PEAK										CLG SPACE PEAK					HEATING COIL PEAK					TEMPERATURES													
Peaked at Time: Outside Air:					Mo/Hr: 7 / 15 OADB/WB/HR: 89 / 62 / 52					Mo/Hr: Sum of OADB: Peaks					Mo/Hr: Heating Design OADB: -18					Cooling					Heating								
Sens. + Lat.		Space		Plenum		Net		Percent		Space		Percent		Space Peak		Coil Peak		Percent		SADB		Ra Plenum		Return		Ret/OA		Fn MtrTD		Fn BldTD		Fn Frict	
Btu/h		Btu/h		Sens. + Lat. Btu/h		Total Btu/h		Of Total (%)		Sensible Btu/h		Of Total (%)		Space Sens Btu/h		Tot Sens Btu/h		Of Total (%)															
Envelope Loads																																	
Skylite Solar		0		0		0		0		0		0		0		0		0															
Skylite Cond		0		0		0		0		0		0		0		0		0															
Roof Cond		2,879		3,750		2,879		21		3,359		29		-3,824		-3,824		18.12															
Glass Solar		0		0		0		0		0		0		0		0		0															
Glass/Door Cond		0		0		0		0		0		0		0		0		0															
Wall Cond		0		0		0		0		0		0		0		0		0															
Partition/Door		0		0		0		0		0		0		0		0		0															
Floor		0		0		0		0		0.00		0		0		0		0															
Adjacent Floor		0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00															
Infiltration		0		0		0		0		0		0		0		0		0															
Sub Total ==>		2,879		0		2,879		21		3,359		29		-3,824		-3,824		18.12															
Internal Loads																																	
Lights		4,399		0		4,399		33		4,399		38		0		0		0															
People		3,750		0		3,750		28		2,220		19		0		0		0															
Misc		1,561		0		1,561		12		1,526		13		0		0		0															
Sub Total ==>		9,710		0		9,710		72		8,145		71		Sub Total ==>		0		0															
Ceiling Load		0		0		0		0		0		0		0		0		0															
Ventilation Load		0		0		0		7		0		0		0		-12,480		59.12															
Adj Air Trans Heat		0		0		0		0		0		0		0		0		0															
Dehumid. Ov Sizing		0		0		0		0		0		0		Ov/Undr Sizing		-4,804		22.76															
Exhaust Heat		0		0		0		0		0		0		OA Preheat Diff.		0		0															
Sup. Fan Heat		0		0		0		0		0		0		RA Preheat Diff.		0		0															
Ret. Fan Heat		0		0		0		0		0		0		Additional Reheat		0		0															
Duct Heat PkUp		0		0		0		0		0		0		Underfir Sup Ht Pkup		0		0															
Underfir Sup Ht Pkup		0		0		0		0		0		0		Supply Air Leakage		0		0															
Supply Air Leakage		0		0		0		0		0		0																					
Grand Total ==>		12,589		0		13,526		100.00		11,504		100.00		-8,628		-21,108		100.00															

COOLING COIL SELECTION										AREAS					HEATING COIL SELECTION						
Total Capacity		Sens Cap.		Coil Airflow		Enter DB/WB/HR		Leave DB/WB/HR		Gross Total		Glass		Capacity		Coil Airflow		Ent		Lvg	
ton		MBh		MBh		°F		°F		gr/lb		ft²		MBh		cfm		°F		°F	
1.1		13.5		12.9		59.5		55.0		1,285		Floor		-21.1		595		90.0		90.0	
0.0		0.0		0.0		0.0		0.0		0		Part		0.0		0		0.0		0.0	
0.0		0.0		0.0		0.0		0.0		0		Int Door		-1.0		595		53.3		55.0	
										0		ExFlr									
1.1		13.5						1,285		Roof		0.0		0.0		0		0.0		0.0	
								0		Wall		0		0		0		0.0		0.0	
								0		Ext Door		0		-21.1							

System Checksums

By Farris Engineering

C ELEVATOR

Fan Coil

COOLING COIL PEAK										CLG SPACE PEAK										HEATING COIL PEAK										TEMPERATURES																																			
Peaked at Time: Outside Air:					Mo/Hr: 7 / 15 OADB/WB/HR: 89 / 62 / 52					Mo/Hr: Sum of OADB: Peaks					Mo/Hr: Heating Design OADB: -18					Cooling					Heating																																								
Sens. + Lat.		Space	Plenum		Net		Percent	Space		Percent	Space Peak		Coil Peak		Percent	SADB		Ra Plenum		Cooling		Heating																																											
Sens. + Lat.		Btu/h	Sens.	+ Lat	Total	Of Total	(%)	Sensible	Btu/h	Of Total	(%)	Space Sens	Btu/h	Tot Sens	Of Total	(%)	Return		80.0		75.0																																												
Btu/h		Btu/h	Btu/h	Btu/h	Btu/h	Btu/h	Btu/h	Btu/h	Btu/h	Btu/h	Btu/h	Btu/h	Btu/h	Btu/h	Btu/h	Btu/h	Ret/OA		80.0		75.0																																												
Envelope Loads																Envelope Loads										Envelope Loads																																							
Skylite Solar																Skylite Solar										Skylite Solar																																							
Skylite Cond																Skylite Cond										Skylite Cond																																							
Roof Cond																Roof Cond										Roof Cond																																							
Glass Solar																Glass Solar										Glass Solar																																							
Glass/Door Cond																Glass/Door Cond										Glass/Door Cond																																							
Wall Cond																Wall Cond										Wall Cond																																							
Partition/Door																Partition/Door										Partition/Door																																							
Floor																Floor										Floor																																							
Adjacent Floor																Adjacent Floor										Adjacent Floor																																							
Infiltration																Infiltration										Infiltration																																							
Sub Total ==>																Sub Total ==>										Sub Total ==>																																							
Internal Loads																Internal Loads										Internal Loads																																							
Lights																Lights										Lights																																							
People																People										People																																							
Misc																Misc										Misc																																							
Sub Total ==>																Sub Total ==>										Sub Total ==>																																							
Ceiling Load																Ceiling Load										Ceiling Load																																							
Ventilation Load																Ventilation Load										Ventilation Load																																							
Adj Air Trans Heat																Adj Air Trans Heat										Adj Air Trans Heat																																							
Dehumid. Ov Sizing																Ov/Undr Sizing										Ov/Undr Sizing																																							
Exhaust Heat																Exhaust Heat										Exhaust Heat																																							
Sup. Fan Heat																OA Preheat Diff.										OA Preheat Diff.																																							
Ret. Fan Heat																RA Preheat Diff.										RA Preheat Diff.																																							
Duct Heat Pkup																Additional Reheat										Additional Reheat																																							
Underflr Sup Ht Pkup																Underflr Sup Ht Pkup										Underflr Sup Ht Pkup																																							
Supply Air Leakage																Supply Air Leakage										Supply Air Leakage																																							
Grand Total ==>																Grand Total ==>										Grand Total ==>																																							
333																352										100.00										-264										-847										100.00									
COOLING COIL SELECTION										COOLING COIL SELECTION										AREAS										HEATING COIL SELECTION																																			
Total Capacity		Sens Cap.		Coil Airflow		Enter DB/WB/HR		Leave DB/WB/HR		Gross Total		Glass		Capacity		Coil Airflow		Ent																																															
ton		MBh		MBh		°F gr/lb		°F gr/lb		ft²		(%)		MBh		cfm		°F																																															
0.0		0.4		0.4		18		80.0		59.9		56.4		108		-0.9		18		41.9		90.0																																											
Aux Cig		0.0		0.0		0		0.0		0.0		0.0		0		0.0		0		0.0		0.0																																											
Opt Vent		0.0		0.0		0		0.0		0.0		0.0		Int Door		Preheat		18		41.9		55.0																																											
Total/		0.0		0.4						53		0		ExFlr		Humidif		0		0.0		0.0																																											
										Roof		0		Wall		Opt Vent		0		0.0		0.0																																											
										Ext Door		0				Total/																																																	

System Checksums

By Farris Engineering

C101 - GREATROOM

Fan Coil

COOLING COIL PEAK										CLG SPACE PEAK										HEATING COIL PEAK										TEMPERATURES									
Peaked at Time: Outside Air:										Mo/Hr: 7 / 15 OADB/WB/HR: 89 / 62 / 52										Mo/Hr: Heating Design OADB: -18										Cooling Heating									
Sens. + Lat.		Space		Plenum		Net		Percent		Space		Percent		Space Peak		Coil Peak		Percent		SADB		Cooling		Heating															
Sens. + Lat.		Btu/h		Sens. + Lat.		Btu/h		Of Total		Sensible		Of Total		Btu/h		Tot Sens		Of Total		Ra Plenum		55.0		90.0															
								%				%						%		Return		75.0		75.0															
Envelope Loads										Envelope Loads																													
Skylite Solar										Skylite Solar																													
Skylite Cond										Skylite Cond																													
Roof Cond										Roof Cond																													
Glass Solar										Glass Solar																													
Glass/Door Cond										Glass/Door Cond																													
Wall Cond										Wall Cond																													
Partition/Door										Partition/Door																													
Floor										Floor																													
Adjacent Floor										Adjacent Floor																													
Infiltration										Infiltration																													
Sub Total ==>										Sub Total ==>																													
Internal Loads										Internal Loads										AIRFLOWS																			
Lights										Lights										Cooling																			
People										People										1,707																			
Misc										Misc										200																			
Sub Total ==>										Sub Total ==>										Return																			
Ceiling Load										Ceiling Load										0																			
Ventilation Load										Ventilation Load										0																			
Adj Air Trans Heat										Adj Air Trans Heat										0																			
Dehumid. Ov Sizing										Ov/Undr Sizing										0																			
Ov/Undr Sizing										Exhaust Heat										0																			
Exhaust Heat										OA Preheat Diff.										0																			
Sup. Fan Heat										RA Preheat Diff.										0																			
Ret. Fan Heat										Additional Reheat										0																			
Duct Heat Pkup										Underflr Sup Ht Pkup										0																			
Underflr Sup Ht Pkup										Supply Air Leakage										0																			
Supply Air Leakage										Grand Total ==>										-24,775																			
Grand Total ==>										Grand Total ==>										-42,748																			
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Grand Total ==>										Grand Total ==>										100																			

System Checksums

By Farris Engineering

C107 - GREAT ROOM

Fan Coil

COOLING COIL PEAK				CLG SPACE PEAK				HEATING COIL PEAK				TEMPERATURES			
Peaked at Time: Outside Air:		Mo/Hr: 7 / 19 OADB/WB/HR: 79 / 57 / 43		Mo/Hr: Sum of OADB: Peaks		Mo/Hr: Heating Design OADB: -18									
Sens. + Lat.	Space	Plenum	Net	Space	Percent	Space Peak	Coil Peak	Percent	SADB	Cooling	Heating				
Sens. + Lat.	Btu/h	Sens. + Lat.	Total	Sensible	Of Total	Space Sens	Tot Sens	Of Total	Return						
Btu/h	Btu/h	Btu/h	Btu/h	Btu/h	(%)	Btu/h	Btu/h	(%)	Ret/OA						
Envelope Loads															
Skyli Solar	0	0	0	0	0	0	0	0.00	0	0	0	0.0	0.0	0.0	0.0
Skyli Cond	0	0	0	0	0	0	0	0.00	0	0	0	0.0	0.0	0.0	0.0
Roof Cond	1,807	0	1,807	4	4	-2,262	-2,262	3.49	0	0	0	0.0	0.0	0.0	0.0
Glass Solar	9,716	0	9,716	19	20	0	0	0.00	0	0	0	0.0	0.0	0.0	0.0
Glass/Door Cond	391	0	391	1	1	-5,237	-5,237	8.08	0	0	0	0.0	0.0	0.0	0.0
Wall Cond	15,029	0	15,029	30	31	-18,332	-18,332	28.28	0	0	0	0.0	0.0	0.0	0.0
Partition/Door	0	0	0	0	0	0	0	0.00	0	0	0	0.0	0.0	0.0	0.0
Floor	0	0	0	0	0	0	0	0.00	0	0	0	0.0	0.0	0.0	0.0
Adjacent Floor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0	0.0	0.0	0.0	0.0
Infiltration	0	0	0	0	0	0	0	0.00	0	0	0	0.0	0.0	0.0	0.0
Sub Total ==>	26,943	0	26,943	54	55	-25,831	-25,831	39.85	0	0	0	0.0	0.0	0.0	0.0
Internal Loads															
Lights	9,493	0	9,493	19	19	0	0	0.00	0	0	0	0.0	0.0	0.0	0.0
People	9,850	0	9,850	20	12	0	0	0.00	0	0	0	0.0	0.0	0.0	0.0
Misc	3,489	0	3,489	7	7	0	0	0.00	0	0	0	0.0	0.0	0.0	0.0
Sub Total ==>	22,832	0	22,832	45	39	0	0	0.00	0	0	0	0.0	0.0	0.0	0.0
Ceiling Load															
Ventilation Load	0	0	0	0	0	0	0	0.00	0	0	0	0.0	0.0	0.0	0.0
Adj Air Trans Heat	0	0	-2,419	-5	0	0	-28,251	43.58	0	0	0	0.0	0.0	0.0	0.0
Dehumid. Ov Sizing	0	0	0	0	0	0	0	0	0	0	0	0.0	0.0	0.0	0.0
Ov/Undr Sizing	2,945	0	2,945	6	6	-10,744	-10,744	16.57	0	0	0	0.0	0.0	0.0	0.0
Exhaust Heat	0	0	0	0	0	0	0	0.00	0	0	0	0.0	0.0	0.0	0.0
Sup. Fan Heat	0	0	0	0	0	0	0	0.00	0	0	0	0.0	0.0	0.0	0.0
Ret. Fan Heat	0	0	0	0	0	0	0	0.00	0	0	0	0.0	0.0	0.0	0.0
Duct Heat PkUp	0	0	0	0	0	0	0	0.00	0	0	0	0.0	0.0	0.0	0.0
Underflr Sup Ht PkUp	0	0	0	0	0	0	0	0.00	0	0	0	0.0	0.0	0.0	0.0
Supply Air Leakage	0	0	0	0	0	0	0	0.00	0	0	0	0.0	0.0	0.0	0.0
Grand Total ==>	52,720	0	50,301	100.00	100.00	-36,575	-64,825	100.00	0	0	0	0.0	0.0	0.0	0.0
COOLING COIL SELECTION															
Total Capacity	ton	MBh	Sens Cap.	Coil Airflow	Enter	Leave									
			MBh	cfm	°F	°F	gr/lb	gr/lb	Gross Total	Glass	ft²	Capacity	Coil Airflow	Ent	Lvg
												MBh	cfm	°F	°F
Main Clg	4.2	50.3	50.0	2,521	75.5	59.1	60.1	59.8	Floor	2,359	0	-64.8	2,521	63.4	90.0
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	Part	0	0	0.0	0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	Int Door	0	0	0.0	0	0.0	0.0
HEATING COIL SELECTION															
									ExFlr	0	0	0.0	0	0.0	0.0
									Roof	760	0	0.0	0	0.0	0.0
									Wall	2,590	126	0.0	0	0.0	0.0
									Ext Door	0	0	-64.8	0	0.0	0.0
Total	4.2	50.3													

Project Name:

Dataset Name: FP 191017.TRC

TRACE® 700 v6.3.4 calculated at 11:51 AM on 10/03/2019

Alternative - 1 System Checksums Report Page 19 of 22

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System Checksums

By Farris Engineering

C115 FITNESS CENTER

Fan Coil

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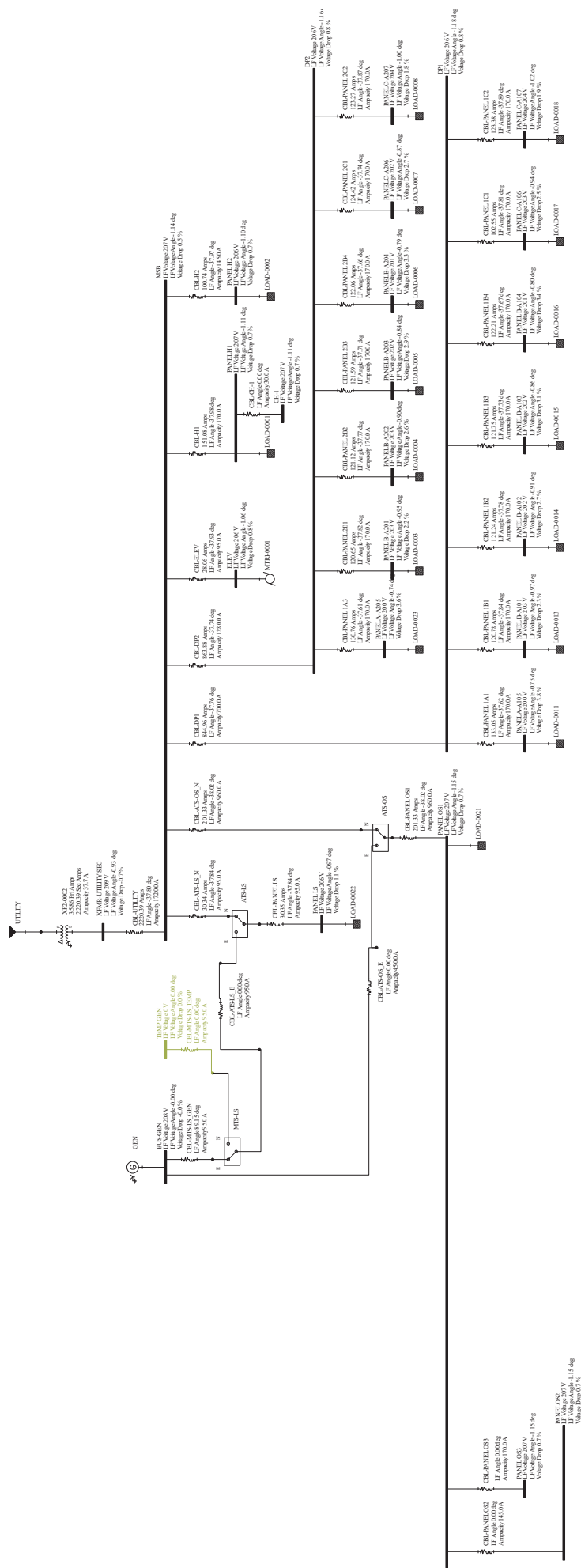
System Checksums

By Farris Engineering

C118 READING MEZZANINE

Fan Coil

[illegible]



MONTHLY UTILITY COSTS

By Farris Engineering

Utility	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
----- Monthly Utility Costs -----													
Alternative 1													
Electric													
On-Pk Cons. (\$)	329	307	357	386	627	729	818	820	537	559	339	286	6,094
Off-Pk Cons. (\$)	465	429	438	511	643	736	1,033	784	617	595	450	449	7,153
Total (\$):	794	737	795	897	1,270	1,466	1,851	1,604	1,155	1,154	790	735	13,246
Gas													
On-Pk Cons. (\$)	1,096	708	1,279	205	14	2	0	0	21	63	828	2,945	7,162
Off-Pk Cons. (\$)	887	536	928	238	35	13	2	11	52	78	673	2,553	6,007
Total (\$):	1,983	1,245	2,207	444	49	15	2	11	73	141	1,501	5,498	13,169
Monthly Total (\$):	2,777	1,981	3,002	1,341	1,319	1,481	1,853	1,615	1,227	1,296	2,291	6,233	26,415

Building Area = 25,620 ft²

Utility Cost Per Area = 1.03 \$/ft²

APARTMENT LOAD CALCULATION SHEET

	Unit - A	Unit - B	Unit - C
AREA	2400	780	1290
GEN. LTG @ 3 WATTS/SQ.FT.	7200	2340	3870
AMPS @ 120 VOLTS	60	19.5	32.25
15/1 CKTS (12A) REQUIRED	5.0	1.6	2.7
GENERAL LIGHTING (WATTS)	7200	2340	3870
SMALL APPLIANCE (WATTS)	3000	3000	3000
LAUNDRY (WATTS)	1500	1500	1500
T.C.L. (WATTS)	11700	6840	8370
1ST 3.0KW @ 100%	3000	3000	3000
NEXT 117.0KW @ 35%	3045	1344	1879.5
OVER 120.0KW @ 25%	0	0	0
TOTAL	6045	4344	4879.5
WATER HEATER	0	0	0
DISHWASHER	1200	1200	1200
LARGER OF ELEC. HEAT OR A/C (VA)	600	600	600
RANGE (VA)	12000	12000	12000
DISPOSER (VA)	0	0	0
DRYER (VA)	5000	5000	5000
MICROWAVE (VA)	1500	1500	1500
E.M.D. (VA)	26345	24644	25180
E.M.D. AMPS @ 208	126.7	118.5	121.1
T.C.L.	32000	27140	28670
QUANTITY OF UNITS	2	8	4
SINGLE PHASE VOLTAGE	208		

HOUSE PANEL SUMMARY				BLACKFEET APARTMENT BUILDING				
PANEL NAME	LOAD TYPE		VALUES IN VA		PROJECT NUMBER: 191017			
	LIGHTING	RECEPT.	HVAC	MISC.	EWH	DRYERS	WASHERS	KITCHEN
H1	2,983	10,100	4,670	5,892				
H2	1,627	9,600	500	5,800				
LS	1,955			1,700				
OS		41,200	134,900					
ELEV'			13,700					
SUBTOTAL	6,565	60,900	153,770	13,392	0	0	0	0
DEMAND FACTOR	1.25	NEC	1.25	1.00	1.25		1.25	0.65
SUBTOTAL	8,206	35,450	192,213	13,392	0	0	0	0
TOTAL CONNECTED	234,627 VA							
TOTAL EMD	249,261 VA							
AMPS AT USE	208	VOLTS =	691.9					
			AMP	FEEDER				

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 T5 and T8 lengths. Ideal for uplight and downlight in commercial, retail, manufacturing, warehouse, cove 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 row aligner included for continuous row mounting.

Finish: Paint options include high-gloss, baked white enamel (WH), galvanized (GALV), matte black (MB) and smoke gray (SKGY). 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. L/LENS option available.

ELECTRICAL — L70>60,000hours. 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 nominal 80 CRI at 3000 K, 3500 K, 4000 K, or 5000 K.

Lumen output up to 2,000 lumens per foot. In 86°F (30°C) ambient environments. Luminaire should be installed in applications where ambient temperatures do not exceed 86°F (30°C).

INSTALLATION — Tool-less channel cover for easy installation.

Fixture may be surface mounted (with or without ZSPRG hanger), pendant or stem mounted with appropriate mounting options. Three-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 to confirm which versions are qualified.

WARRANTY — 5-year limited warranty. Complete warranty terms located at: www.acuitybrands.com/CustomerResources/Terms_and_conditions.aspx

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.

Catalog Number
Notes
Type TYPE AA, AA1



LED Striplight

ZL1N

24", 48" and 96" Lengths



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

ZL1N 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: ZL1N L48 3000LM FST MVOLT 40K 80CRI WH

Series	Length	Reflectors ¹	Nominal lumens ²	Diffuser	Voltage
ZL1N LED striplight	L24 24"	(blank) Less reflector	1500LM 1,500 lumens	FST Snap on frosted, diffuse	MVOLT 120-277V
		SMR Symmetric	2500LM 2,500 lumens	L/LENS No diffuser	120 120V
			3500LM 3,500 lumens	SBL FST Straight blade louver with snap on frosted, diffuse	208 208V
	L46 46"	(blank) Less reflector	3000LM 3,000 lumens		240 240V
TZL1N LED striplight	L48 48"	ASR Asymmetric (L48 only)	5000LM 5,000 lumens		277 277V
		SMR Symmetric	7000LM 7,000 lumens		347 347V ³
					480 480V ³
	L92 92"	(blank) Less reflector	6000LM 6,000 lumens		
	L96 96"	SMR Symmetric	10000LM 10,000 lumens		
			14000LM 14,000 lumens		

Color temperature	Color rendering index	Options	Paint finish
30K 3000 K	80CRI 80 CRI	PLR___ Plug-in wiring ^{4,5}	WH White
35K 3500 K	90CRI 90 CRI	PLR1LVG Plug-in wiring-low voltage ^{4,5}	GALV Galvanized
40K 4000 K		E7W Emergency battery pack, 7W (not available for California) ^{6,7}	MB Matte black
50K 5000 K		2E7W Two Emergency battery packs, 7W (not available for California) ^{6,7,8}	SKGY Smoke gray
		E10WLCP Emergency battery pack, 10W Linear Constant Power, CA Title 20 compliant ^{6,7}	
		2E10WLCP Two Emergency battery packs, 10W Linear Constant Power, CA Title 20 Compliant ^{6,7,8}	
		E15WLCP Emergency battery pack, 15W Linear Constant Power, CA Title 20 compliant ^{6,7,8}	
		OUTEND Cord set to exit endplate of fixture	
		LBOZU 360° low mount motion sensor, pre-wired ⁹	
		LBHOSZU 360° low mount motion sensor with dimming, pre-wired ⁹	
		LBPZU 360° low mount motion sensor with photocell, pre-wired ⁹	
		LBMOSZU 360° low mount motion sensor, dimming & switching photocell, pre-wired ⁹	
		Cord sets: ¹⁰	
		CS1W Straight plug, 120V	
		CS3W Twist-lock, 120V	
		CS7W Straight plug, 277V	
		CS11W Twist-lock, 277V	
		CS25W Twist-lock, 347V	
		CS97W Twist-lock, 480V	
		CS93W 600V SE00W white cord, no plug (no voltage required)	

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		

Notes

- Optional. Reflectors ship separately.
- See Operational Data on page 3 for actual lumens.
- Not available with L24, 24" fixture. 347V and 480V utilize a step-down transformer.
- See ordering information on page 5. When choosing sensor options and and PLR configuration, contact factory representative.
- Not available with cordsets.
- 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)
- Must specify voltage. 120, 208, 240 or 277V.
- Only available with the 8' (96") fixtures.
- Voltage must be specified. This sensor configuration is suitable for minimum ambient temperature of 14°F (-10°C). See page 5 for low temperature option providing -4°F (-20°C) minimum ambient temperature. Sensors come prewired, they must be snapped into place at time of installation.
- Cordsets exit back of fixture unless OUTEND option is specified. Must specify voltage (not required when ordering CS93W).
- Not compatible with reflector.
- Order 2 for tandem double length fixtures (TZL1N).

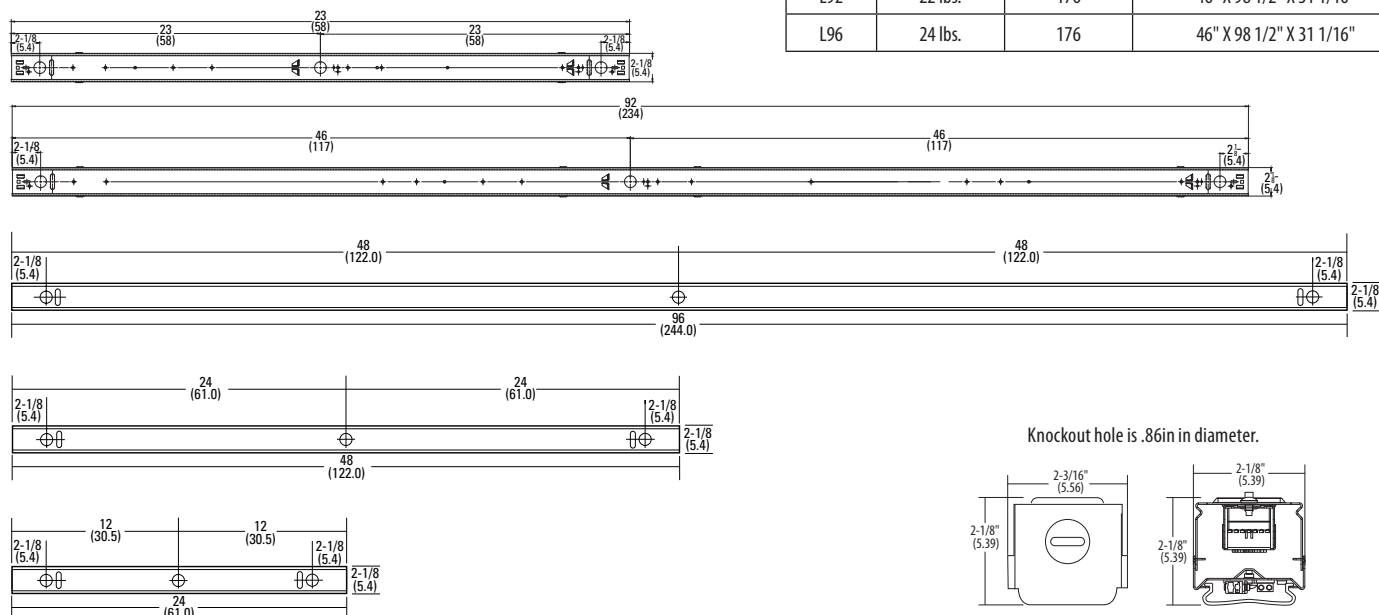
ZL1N LED Striplight

OPERATIONAL DATA												
	Nominal lumen package	Length (inches)	Delivered Lumens 3000 K CCT @ 77°F (25°C) ambient temperature		Delivered Lumens 3500 K CCT @ 77°F (25°C) ambient temperature		Delivered Lumens 4000 K CCT @ 77°F (25°C) ambient temperature		Delivered Lumens 5000 K CCT @ 77°F (25°C) ambient temperature		Wattage @ 120V/277V	Comparable Light Source
			80 CRI	90 CRI	80 CRI	90 CRI	80 CRI	90 CRI	80 CRI	90 CRI		
Lensed	1500LM	24	1738	1409	1777	1467	1804	1494	1871	1528	15	1-lamp 17W T8
	2500LM	24	2265	1846	2315	1900	2351	1947	2438	1991	19	1-lamp 17W T8
	3500LM	24	3586	2924	3666	3026	3723	3084	3860	3152	31	1-lamp 32W T8, 1-lamp 54W T5H0, 50W HID
	3000LM	46 or 48	3172	2586	3243	2677	3293	2728	3415	2788	25	1-lamp 32W T8, 1-lamp 54W T5H0, 50W HID
	5000LM	46 or 48	4417	3601	4515	3727	4585	3798	4754	3882	34	2-lamp 32W T8, 1-lamp 54W T5H0, 70W HID
	7000LM	46 or 48	6535	5328	6681	5515	6785	5619	7035	5744	52	3-lamp 32W T8, 2-lamp 54W T5H0, 100W HID
	6000LM	92 or 96	6561	5349	6708	5537	6812	5642	7063	5767	48	3-lamp 32W T8, 2-lamp 54W T5H0, 100W HID
	10000LM	92 or 96	8687	7082	8881	7331	9019	7470	9351	7636	68	4-lamp 32W T8, 2-lamp 54W T5H0, 100W HID
	14000LM	92 or 96	12457	10513	12735	10665	12933	10711	13409	10949	104	4-lamp 32W T8, 3-lamp 54W T5H0, 150W HID
Unlensed	1500LM	24	1881	1534	1923	1588	1953	1618	2025	1654	15	1-lamp 17W T8
	2500LM	24	2452	1999	2506	2069	2545	2108	2639	2155	19	1-lamp 17W T8
	3500LM	24	3882	3165	3969	3276	4031	3338	4179	3412	31	1-lamp 32W T8, 1-lamp 54W T5H0, 50W HID
	3000LM	46 or 48	3434	2800	3511	2898	3565	2953	3697	3019	25	1-lamp 32W T8, 1-lamp 54W T5H0, 50W HID
	5000LM	46 or 48	4781	3898	4888	4035	4964	4111	5147	4203	34	2-lamp 32W T8, 1-lamp 54W T5H0, 70W HID
	7000LM	46 or 48	7075	5768	7233	5971	7345	6083	7616	6219	52	3-lamp 32W T8, 2-lamp 54W T5H0, 100W HID
	6000LM	92 or 96	7103	5791	7261	5995	7374	6108	7646	6243	48	3-lamp 32W T8, 2-lamp 54W T5H0, 100W HID
	10000LM	92 or 96	9404	7667	9614	7937	9764	8087	10123	8266	68	4-lamp 32W T8, 2-lamp 54W T5H0, 100W HID
	14000LM	92 or 96	13485	10994	13786	11381	14001	11596	14516	11853	104	4-lamp 32W T8, 3-lamp 54W T5H0, 150W HID

DIMENSIONS

All dimensions are shown in inches (centimeters) unless otherwise noted.

Specifications subject to change without notice.

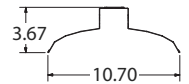
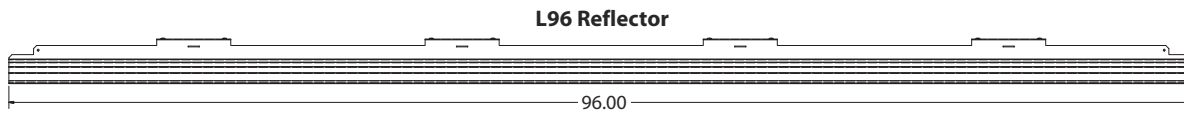
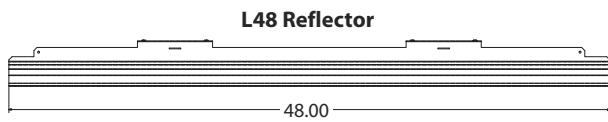
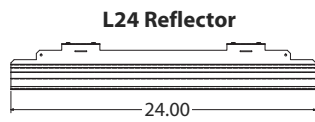


PALLET DIMENSIONS			
Length	Approximate weight	Fixtures per pallet	Approximate pallet dimensions (L x W x H)
L24	7 lbs.	408	46" X 51" X 32 11/16"
L46	11 lbs.	176	46" X 51" X 32 1/16"
L48	12 lbs.	176	46" X 51" X 31 3/8"
L92	22 lbs.	176	46" X 98 1/2" X 31 1/16"
L96	24 lbs.	176	46" X 98 1/2" X 31 1/16"

PHOTOMETRICS

Please see www.lithonia.com

REFLECTORS (Optional)



PHOTOMETRICS

Please see www.lithonia.com

PRODUCT INFORMATION

Advanced plug-in system with three-circuit capability. Available on industrial and strip products and a variety of architectural products mounted in continuous rows. 1, 2, 3 and 4-lamp fixtures. PLR22 (2-circuit) and PLR33 (3-circuit) crossover harness switches hot circuit serving next fixture in row. Reduces fixture types on job for alternating circuit applications (see example below.)

Easy one-step installation, saves up to 35% on labor costs. Expanded switching flexibility helps save energy.

Rows can be 50% longer with two-circuit systems. Polarized, lock-together nylon connectors prevent miswiring in the field. #12 THHN conductor, rated 600V, 90°C. White neutral wire included. Grounding accomplished by fixture in-row connectors.

CSA certified systems available with up to 2 circuits. G ground required.

Note: Specifications subject to change without notice.



Wiring

PLR

Advanced 3-Circuit Plug-In

ORDERING INFORMATION

Lead times will vary depending on options selected. Consult with your sales representative.

Series	Number of hot wires		Branch circuits				Dimming	Ground	
PLR	(blank)	Not required for 22 or 33	<u>Circuits to which ballast is connected</u>		B	Red wire	LV Low-voltage dimming	(blank)	No ground in PLR
PLR22	1	Black	(blank)	Not required for 22 or 33	C	Blue wire		G	Ground. Maximum 2 circuits
PLR33	2	Black and red	A	Black wire					
	3	Black, red and blue							

Typical Applications

- Multiple-circuit and single-circuit for longer continuous rows
- Multiple-circuit with alternating fixtures on separate circuits, 2-circuit (PLR 22) and 3-circuit (PLR 33)
- Multiple circuit with night-lights located along row as desired

TYPICAL APPLICATIONS										
PLR 3 C	PLR 3 C	PLR 3 C	PLR 3 C	PLR 2 B	PLR 2 B	PLR 2 B	PLR 2 B	PLR 1	PLR 1	PLR 1
(All PLR22)										
Circuit A	Circuit B	Circuit A	Circuit B	Circuit A	Circuit B	Circuit A	Circuit B	Circuit A	Circuit B	Circuit A
(All PLR33)										
Circuit A	Circuit B	Circuit C	Circuit A	Circuit B	Circuit C	Circuit A	Circuit B	Circuit C	Circuit A	Circuit B
PLR 3 A	PLR 3 A	PLR 3 A	PLR 3 C	PLR 3 B	PLR 3 B	PLR 3 B	PLR 3 C	PLR 3 A	PLR 3 A	PLR 3 A

ZL1N LED Striplight

LSXR — Fixture Mount Occupancy Sensor (see www.AcuityControls.com for additional information)

- Three interchangeable lens options to satisfy multiple mounting heights and coverage pattern requirements.
- Integrated mounting bracket drops lens down 3" from chase nipple.
- Single or dual relay versions — designed with robust protection from the harsh switching requirements of T5 and LED loads.
- Photocell and 0-10VDC dimming options.
- No PIR field calibration or sensitivity adjustments required.
- Sensor ambient temperature rating of 14°F (-10°C) to 131°F (55°C).

LSXR configuration	Comparable CMRB sensor	Old style sensor nomenclature
For shortest lead times use one of the following LSXR configurations		
LCOZU	CMRB 50	MSI
LCH0SZU	CMRB 50 D	MSID
LCPZU	CMRB 50 P	MSIPED
LAOZU	CMRB 6	MSI360
LAH0SZU	CMRB 6 D	MSI360D
LAPZU	CMRB 6 P	MSI360PED

SELECTIONS BELOW WILL EXTEND ORDER LEAD TIME. CONSULT YOUR SALES REPRESENTATIVE FOR DETAILS.

SINGLE RELAY

ORDERING INFORMATION

Example: LAH0SZU

Series	Lens option	Dimming/Photocell	Max. dim level	Min. dim level	Temp/Humidity	Default occupancy time delay	
L LSXR passive infrared indoor occupancy sensor	A High mount, 360°	O None ¹	0 10 VDC	S Minimum dim level of ballast	Z None	I 30 sec	
		H High/low occupancy operation	9 9 VDC	1 1 VDC	T Low temperature ²	D 2.5 min	
	B Low mount, 360°	P Switching photocell (on/off) ¹	8 8 VDC	2 2 VDC		X 5.0 min	
		C High mount aisleway	M Dimming and switching photocell	7 7 VDC		3 3 VDC	R 7.5 min
	4 4 VDC					U 10.0 min (with minimum 15 minute on time)	
	G Dimming and switching photocell with high/low occupancy operation		5 5 VDC			V 15.0 min	
			6 6 VDC			W 20.0 min	
						Y 30.0 min	

Notes

- 1 Max and min dim levels not applicable with this option.
- 2 Ambient temperature rating of -4°F (-20°C) to 131°F (55°C).

DUAL RELAY (Available with 120, 277, and 347V only)

ORDERING INFORMATION

Example: LA2KZU

Series	Lens option	Poles	Operating mode	Temp/Humidity	Default occupancy time delay
L LSXR passive infrared indoor occupancy sensor	A High mount, 360° B Low mount, 360° C High mount aisleway	2 Dual relay	J None	Z None	I 30 sec
			K Alternating off relays (promotes even lamp wear)	T Low temperature ¹	D 2.5 min
			O Alternating off relays w/photocell		X 5.0 min
			P Switching photocell (on/off)		R 7.5 min
			E Photocell on/off (pole 1 only)		U 10.0 min (with minimum 15 minute on time)
			F Photocell on/off - both poles (dual set-point)		V 15.0 min
					W 20.0 min
					Y 30.0 min

Example: LENS 50 J100

Notes

- 1 Ambient temperature rating of -4°F (-20°C) to 131°F (55°C).

Replacement lenses: Order as separate catalog number.		
Series	Lens type	Package quantity
LENS	6 High mount 360°	[blank] Single Lens
	10 Low mount 360°	J10 10-pack
	50 High mount aisleway	J100 100-pack

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



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		
		8H	8 VDC	2V	2 VDC		5M			5 minutes (LED only)	
		7H	7 VDC	3V	3 VDC		15M			15 minutes	
				4V	4 VDC		20M			20 minutes	
				5V	5 VDC		30M			30 minutes	
				6V	6 VDC						

For additional information see www.lithonia.com

OPTIONS AND ACCESSORIES

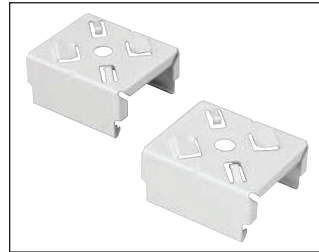
The Z Series fixture offers numerous options for almost every electrical and optical component, including a long list of field-installable accessories.



HANGER CHAIN

36" chain with Y hanger.

Order as:
HC36



Z SPRING HANGER

Snap 'n' lock design requires no fasteners and can be used on T-grid ceiling or universal mounting systems.

Order as:
ZSPRG



ZACVH HANGER

10' Aircraft cable with Y hanger.

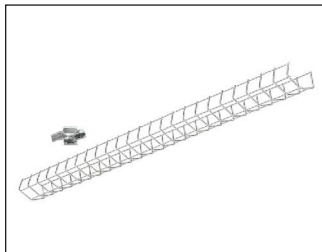
Order as:
ZACVH



ANGLE MOUNTING BRACKET

Luma-tilt™ angle bracket ships as a pair

Order as:
ZLANGBKT



WIRE GUARD

Order as:
WGZ24
WGZ48

FEATURES & SPECIFICATIONS

INTENDED USE — For areas that require good vertical illumination and excellent glare control at low mounting heights. Ideal for open areas, retail spaces and aisles. **Certain airborne contaminants can diminish the integrity of acrylic and/or polycarbonate.** [Click here for Acrylic-Polycarbonate Compatibility table for suitable uses.](#)

CONSTRUCTION — One-piece 5VA rated fiberglass housing with integral perimeter channel utilizes continuous poured-in-place NEMA 4X gasket. Simple two-piece design consists of housing and optical assembly to streamline installation process. Polymeric latches positively attach to housing and keep from becoming a hindrance during install.

OPTICS — Injection-molded, acrylic lens (.080" thick), provides high impact-resistance comparable to 100% DR. F1 rated for outdoor use, lenses resist breaking, yellowing or becoming brittle over time. UV stabilized polycarbonate diffuser available (.080" thick) in clear or frosted for additional impact strength. Polycarbonate lens is recommend for lower mounting heights where vandal protection is desired.

ELECTRICAL — Tool-less one piece optical assembly combines LEDs and lens into one component. Optical assembly easily connects to housing with plug and play harness, eliminating time consuming wiring connections. High-efficiency drivers operate 120-480V offered with 0-10V dimming, allowing granular control when coupled with wireless networking controls. Integral surge protection tested in accordance with IEEE/ANSI C62.41.2 to commercial indoor standards 2.5kV/2kA.

L85 at 60,000 hours.

INSTALLATION — Two-piece design makes installations faster than ever by simplifying wiring connections. Power connection is easily accommodated through pre-drilled holes at each end, optional wet location fittings available for maximum flexibility.

Stainless steel (#316) surface spring-mounting brackets with bail wires standard (2 included) allow for ceiling, wall or suspended mount.

Swivel stem(provided by others) when pendant mounting. Factory installed junction box option accommodates up to 4X4 sized boxes and includes integrated gasket to maintain wet location listings.

Quick Mount Bracket (QMB) ships installed on fixture and is recommended for fastest surface mount installs, ideal for end to end installations or larger jobs.

LISTINGS — CSA Certified to UL and C-UL standards. F1 rating makes luminaire suitable for wet locations without covered ceilings. NEMA 4X rated. IP ratings: IP65 and IP66 rated. 1500 PSI hose-down. See page 3 for ambients.

NSF listed for Splash Zone II.

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/CustomerResources/Terms_and_conditions.aspx

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.

Catalog Number	
Notes	
Type	TYPE B

LED Enclosed and Gasketed

DMW2



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.

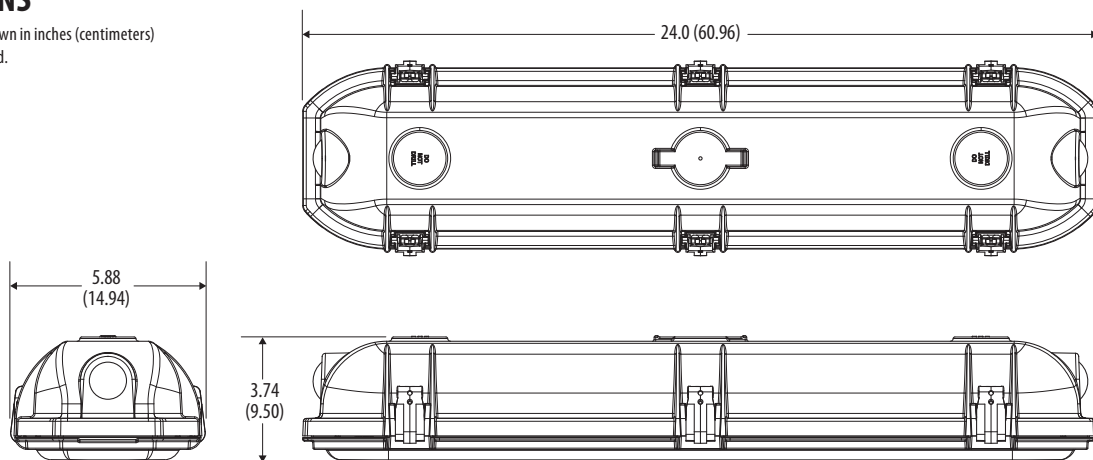
- All configurations of this luminaire meet the Acuity Brands' specification for chromatic consistency
- This luminaire is part of an A+ Certified solution for nLight® or XPoint™ Wireless control networks marked by a shaded background*

To learn more about A+, visit www.acuitybrands.com/aplus.

*See ordering tree for details

DIMENSIONS

All dimensions are shown in inches (centimeters) unless otherwise noted.



PHOTOMETRICS

Please see www.lithonia.com.

DMW2 LED Wet Location



A+ Capable options indicated by this color background.

ORDERING INFORMATION

Lead times will vary depending on options selected. Consult with your sales representative.

Example: DMW2 L24 4000LM PCL MD MVOLT GZ10 40K 80CRI

Series ¹	Length	Nominal lumens	Diffuser	Distribution	Voltage	Driver	Color temperature	Color rendering index
DMW2 LED wet location	L24 24"	2000LM 2,000 lumens	ACL Acrylic	MD Medium distribution	MVOLT 120-277V	GZ10 0-10V Dimming	30K 3000 K	80CRI 80 CRI
		3000LM 3,000 lumens	AFL Frosted acrylic		120 120V		35K 3500 K	90CRI 90 CRI
		4000LM 4,000 lumens	PCL Polycarbonate	WD Wide distribution	208 208V		40K 4000 K	
			PFL Frosted Polycarbonate		240 240V		50K 5000 K	
					277 277V			
					347 347V ¹			
					480 480V ¹			

Options									
PS1050	Emergency LED battery pack for 0°C and up (1400 lumens) ²	CS88	6' Brad Harrison 16/3 cord and straight blade plug set, NEMA 4X rated ⁸	MSI10XAWL10M DSCXAWL	Xpoint wireless integral motion sensor, On/Off operation for motion sensing, override Off due to daylight ¹¹				
E10WCP	EM Self-diagnostics battery pack, 10W, Constant Power CEC compliant ^{2,3}	CS88L12	12' Brad Harrison 16/3 cord and straight blade plug set, NEMA 4X rated ⁸	MSI10NWL	Low mount 360 integral motion sensor, wet location, On/Off operation ¹¹				
PMP4X	Pendant monopoint with NEMA4X fitting (not available with JSB option) ^{3,4}	CS88R	Brad Harrison receptacle, NEMA 4X rated ⁹	MSI102L3VWL	Low mount 360 integral motion sensor, wet location, High/Low operation (3 level) ¹¹				
WLFEND	Wet location fitting (one fitting out end) ⁵	NOM	Nom certified	MSI10NWL DSCNWL	low mount 360 integral motion sensor, wet location, On/Off operation for motion sensing, override Off due to daylight ¹¹				
WLFEND2	Wet location fitting (fittings out both ends) ⁶	TPS	TorxT10 tamper-resistant screws						
JSB	Junction box snap-bracket ⁷	STSL	Stainless steel latches						
QMB	Quick-mount ceiling bracket ⁷	SPD	10KV surge protection device ¹⁰	XAD	XPoint wireless relay ¹²				
CS89	6' white cord, 16/3, no plug, wet location ⁸			NLTAIR2 RSBOR10	nLight AIR Generation 2 enabled 360° low mount motion sensor ¹³				
CS89L12	12' white cord, 16/3, no plug, wet location ⁸								

Accessories: Order as separate catalog number.	
RK1 T10BIT W/PIN U	Hex-base driver bit, Torx TX10, for tamper-resistant screws with center reject pin
DMW2WLF	Wet location fitting
DMW2QMB	Quick-mount ceiling bracket

Notes

1. Plastic latches supplied as standard. Provided with 2X KO plugs at both ends
2. Not available with XAD, JSB, PMP4X mounting options. Not available with CS88 cord sets or CS88R receptacle. Must specify voltage. Not available with 347, 480V. Maximum ambient temperature 25°C.
3. Not for field install.
4. Not available with PS1050 option. Not available with QMB, JSB mounting options.
5. Not available with WLFEND2. Not available with PS1050. Not available with cordsets or sensors.
6. Not available with WLFEND, PS1050, CS cord sets, or MSI sensors
7. Not available with other mounting options
8. Not available with other cord sets. Not available with PS1050 option.
9. Receptacle only. Not available with PS1050.
10. Not available with 4000LM, PS1050, XAD, SBOR & RSBOR.
11. Not available with other external MSI sensors, WLFEND2, XAD. Must specify voltage.
12. Not available with external MSI sensors. Not available with PS1050 option. Must specify voltage. Minimum ambient temperature -20°C.
13. Not available with other external MSI sensors, WLFEND2, XAD

DMW2 LED Wet Location

OPERATIONAL DATA (80 CRI*)					
Package	Input Wattage	CCT	AFL	ACL	Comparable Light Source
			Lumens (LPW)	Lumens (LPW)	
2000LM	18	30K	2419 (134)	2419 (134)	1-32T8 lamp
		35K	2481 (138)	2556 (142)	
		40K	2536 (141)	2612 (145)	
		50K	2661 (148)	2740 (152)	
3000LM	27	30K	3483 (129)	3587 (133)	2-32T8 lamps
		35K	3572 (132)	3680 (136)	
		40K	3651 (135)	3761 (139)	
		50K	3831 (142)	3946 (146)	
4000LM	40	30K	4631 (116)	4770 (119)	3-32T8 Lamps, 2-54T5HO lamps
		35K	4751 (119)	4893 (122)	
		40K	4855 (121)	5001 (125)	
		50K	5094 (127)	5247 (131)	

CSA LISTED AMBIENT RATING*			
Package	Bare Fixture	X-Point/Sensor	Emergency
2000LM	40°C	35°C	0 to 25°C
3000LM	40°C	35°C	0 to 25°C
4000LM	-40 to 40°C	35°C	0 to 25°C

*Minimum Ambient is -20°C unless noted.

** Suspended 18" from ceiling.

OPTIONS AND ACCESSORIES

The DMW2 Series fixture offers numerous options for almost every electrical and optical component, including a long list of field-installable accessories.



SMB
Surface mounting bracket
(ships standard with fixture)



QMB
Quick mounting bracket
field installable option order as DMW2QMB



JSB
Junction mounting bracket
(factory installed only)
(Not intended for wall mounting.
Voids IP65 rating.)



PMP4X
Pendant monopoint
(factory installed only)

OPTIONS AND ACCESSORIES

The DMW2 Series fixture offers numerous options for almost every electrical and optical component, including a long list of field-installable accessories.

rSBOR/SBOR – Fixture Mount Sensor (see www.sensorswitch.com for additional information)

- 360° coverage
- On/Off dim
- Photocell optional
- IP66 rated
- Photocell and 0-10VDC dimming options.

Fixture sensor nomenclature	RSBOR/SBOR sensor nomenclature
For shortest lead times use one of the following SBOR configurations	
NLTAIR2 RSBOR10	RSBOR 10 EB4 WH G2
MSI10NWL	SBOR 10 OEX EB4 WH
MSI102L3VWL	SBOR 10 OEX D EB4 WH 3V
MSI10NWL DSCNWL	SBOR 10 OEX P EB4 WH



Sfera Chandelier

Lightology



Description:

The Sfera Chandelier features detailed center bands and rounded, sweeping curves offering a rustic design with a modern inspiration. Available in Mercury or Cafe tint glass and an Autumn Bronze finish. Available in two sizes. Available with incandescent or LED lighting. LED bulbs are included. LED Products are Energy Star rated. Damp location rated.

Shown in: Autumn Bronze / Cafe

List Price: \$481.13
Our Price: \$327.17

Shade Color: Cafe
Body Finish: Autumn Bronze
Lamp: 4 x A19/Medium (E26)/72W/120V Incandescent
Wattage: 288W
Dimmer: Incandescent
Dimensions: 164.25"L x 18.5"W x 24.5"H

Fax: (773) 883-6131

Phone: 866-954-4489

Address: 1718 W. Fullerton Ave. Chicago IL 60614

www.Lightology.com

Product Number: **SGL448543**

Company:		Fixture Type:		Date:	Jan 14, 2020
Project:		Approved By:			

Yin & Yang Wall Light

**Description:**

The Yin & Yang Wall Light offers a sleek, modern design featuring a an Alabaster glass shade placed off-center from its wall mount, yet maintaining a balance with its proportions. Available finished in Aged Brass, Old Bronze, or Polished Nickel in two sizes. Suitable for damp locations. UL and CUL listed. ADA compliant.

Shown in: Old Bronze / Alabaster

List Price: \$507.50

Our Price: \$406.00

Shade Color: Alabaster

Body Finish: Old Bronze

Lamp: 1 x LED/4.5W/120V LED

Wattage: 4.5W

Dimmer: Dimmable

Dimensions: 5.5"W x 13"H x 2.25"D

Technical Information

Luminous Flux: 1200 lumens

Lumens/Watt: 266.67

Lamp Color: 3000 K

Color Rendering: 90 CRI

Product Number: **S GL 485338**

Company:

Fixture Type:

Date:

Jan 14, 2020

Project:

Approved By:

Fax: (773) 883-6131

Phone: 866-954-4489

Address: 1718 W. Fullerton Ave. Chicago IL 60614

www.Lightology.com

Yin & Yang Wall Light



Description:

The Yin & Yang Wall Light offers a sleek, modern design featuring a an Alabaster glass shade placed off-center from its wall mount, yet maintaining a balance with its proportions. Available finished in Aged Brass, Old Bronze, or Polished Nickel in two sizes. Suitable for damp locations. UL and CUL listed. ADA compliant.

Shown in: Old Bronze / Alabaster

Price: \$417.60

Shade Color: Alabaster
Body Finish: Old Bronze
Lamp: 1 x LED/9W/120V LED
Wattage: 9W
Dimmer: Dimmable
Dimensions: 5.5"W x 18.5"H x 2.25"D

Technical Information

Luminous Flux: 1200 lumens
Lumens/Watt: 133.33
Lamp Color: 3000 K
Color Rendering: 90 CRI

Product Number: **S GL 48533**

Company:		Fixture Type:		Date:	Apr 14, 2020
Project:		Approved By:			

Fax: 773-883-6131

Phone: 866-954-4489

Address: 1718 W. Fullerton Ave. Chicago IL 60614

www.Lightology.com

DESCRIPTION

4 inch LED recessed narrow, medium, or wide beam downlight designed for glare free even illumination. Featuring a two-stage diffused reflector system producing smooth distribution with excellent light control and low aperture brightness. Lumen packages range from 1000 to 6000 with color temperatures of 2400K, 2700K, 3000K, 3500K, 4000K, and 5000K. VividTune: Dim-to-warm technology – similar to halogen at full power, the 3000K LED warms smoothly as dimmed to 1850K creating a rich warm glow within the space. Tunable white technology - adjust the color temperature from warm white to cool white while independently controlling intensity.

Catalog #	Type
Project	F,F1
Comments	Date
Prepared by	

SPECIFICATION FEATURES

Lower Shielding Reflector

Painted die cast aluminum or spun aluminum lower reflector with a lensed upper optical chamber providing superior lumen output with minimal source brightness. Spun reflectors are offered in all Portfolio Alzak® finishes. Available with non-conductive polymer trim. Reflector is retained with two torsion springs holding the flange tight to the finished ceiling surface. Plaster lathing ring accessory offered for flush reflector transition.

Plaster Frame / Collar

Die cast aluminum 1-1/2" deep collar accommodates ceiling materials up to 2". Universal mounting bracket accepts 1/2" EMT, C channel and bar hangers and adjusts 5" vertically from above and below the ceiling.

Junction Box

Listed for (8) #12 AWG (four in, four out) 90°C conductors and feed thru branch wiring. (4) 1/2" and (2) 3/4" trade size pry outts positioned to allow straight conduit runs. Lever connectors for simple push in wiring.

Thermal

Aluminum heat sink conducts heat away from the LED module for optimal performance and long life.

LED

Chip on board with a multitude of highly efficient white LED's, combined with a high reflectance upper reflector and convex transitional lens produce even distribution with no pixilation. Rated for 50,000 hours at 70% lumen maintenance. Auto resetting, thermally protected, LED's are turned off when safe operating temperatures are exceeded. Color variation within 3-step MacAdam ellipses. Quick disconnect allows for tool-less replacement of LED engine from below ceiling. Available in 80, 90 or 97 CRI. **D2W™** – dim-to-warm shifts CCT from 3000K to 1850K as fixture dims mimicking halogen sources. **W2N** - Tunable white CCT range 2700K to 6500K or 2000K to 5000K, 90 CRI.

Driver

Standard 120-277V 0-10V dimming driver provides flicker free dimming from 100% to 1%. Optional 120V leading edge, <1% 0-10V, Fifth Light, DMX or Lutron® Ecosystem. Driver can be serviced from above or through the aperture.

Connected Lighting Systems

WaveLinX tilemount daylight sensor includes control module, sensor and cable allowing use with the comprehensive lighting system.

LumaWatt Pro (powered by Enlighted) wireless tile mount sensor and relay accessory enables wireless control using a tile mount sensor accessory.

Distributed low voltage power system combines power, lighting, and controls with ease of installation.

Code Compliance

Thermally protected and cULus listed for wet locations with covered ceiling. IP66 rated when used with IP66 gasket kit accessory. Optional City of Chicago environmental air (CCEA) marking for plenum applications. EMI/RFI emissions per FCC 47CFR Part 18 Class B consumer limits. 2000 lumen and above are Non-IC rated - Insulation must be kept 3" from top and sides of housing. IC rated up to 1500 lumens. 5000 lumen and above are marked spacing and must follow spacing requirements. RoHS Compliant. Photometric testing completed in accordance with IES LM 79 and TM-30 standards. LED life testing completed in accordance with LM 80 standards.

Warranty

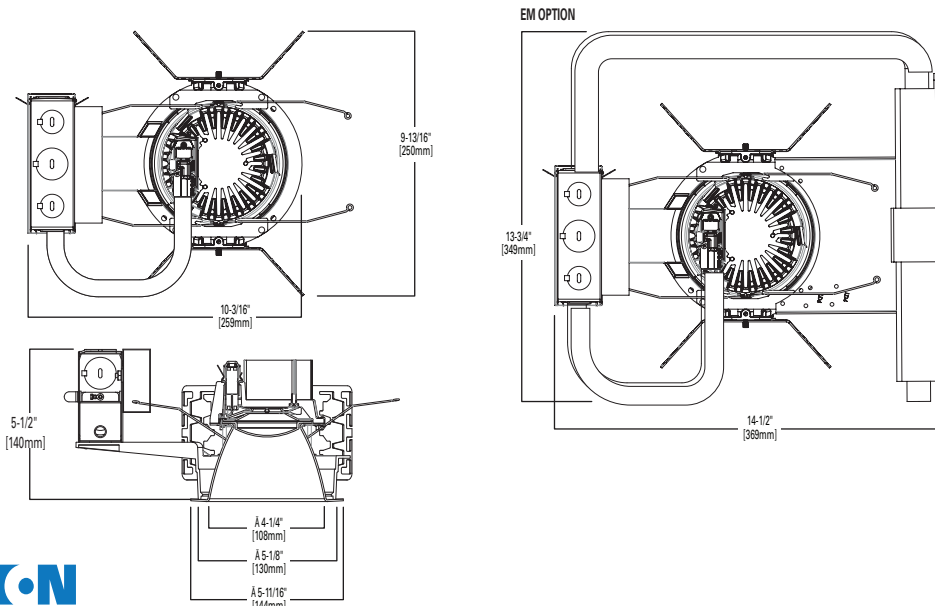
5-year warranty



**LD4B EU4B
4LBW 4LBM
4LBN**

1000-6000 Lumen LED

Narrow, Medium, or Wide Beam
New Construction



SAMPLE NUMBER: LD4B15D010IEMBOD

Housing	Lumens ¹	Voltage	Driver	Options ³
LD4B =LED Downlight 4” Nominal Aperture LD4BCP =LED Downlight 4” Nominal Aperture, Chicago Plenum	10 =1000 lumens 15 =1500 lumens 20 =2000 lumens 30 =3000 lumens 40 =4000 lumens 50 =5000 lumens ¹⁵ 60 =6000 lumens ¹⁵	Blank =120-277V 3 =347V (step down transformer)	1000-4000 D010 =0-10V Dimming, 1% to 100%, 120V-277V D010TR =0-10V or Line Voltage Dimming, 5% to 100%, 120V-277V DE010 =0-10V Linear Dimming, 0% to 100%, 120V-277V D5LT =Fifth Light® (DALI) Logarithmic Dimming, 0% to 100%, 120V-277V DMX =DMX/RDM Logarithmic Dimming, 0% to 100%, 120V-277V ¹³ DL2 =Lutron® Hi-Lume Forward Phase Dimming, 1% to 100%, 120V Only DLE =Lutron Ecosystem dimming 1% to 100%, 120V-277V DLV =Low voltage dimming driver (1-100%) for use with DLVP system (3000 lumen and below) ^{3,14} 5000-6000 D010TE =0-10V 1% or trailing edge 10%, 120-277V (120V only with trailing edge dimming) Tunable white 1000-2000 Lumens ¹⁶ 1DE010W2N2050 =0-10V dimming, 0% to 100%, 120V, 2000K - 5000K 1DE010W2N2765 =0-10V dimming, 0% to 100%, 120V, 2700K - 6500K 1D5LTW2N2050 =Fifth Light (DALI), 0% to 100%, 120, 2000K - 5000K 1D5LTW2N2765 =Fifth Light (DALI), 0% to 100%, 120V, 2700K - 6500K 2DE010W2N2050 =0-10V dimming, 0% to 100%, 277V, 2000K - 5000K 2DE010W2N2765 =0-10V dimming, 0% to 100%, 277V, 2700K - 6500K 2D5LTW2N2050 =Fifth Light (DALI), 0% to 100%, 277V, 2000K - 5000K 2D5LTW2N2765 =Fifth Light (DALI), 0% to 100%, 277V, 2700K - 6500K	EMBOD =Bodine® Emergency Module with Remote Test Switch EM7 =7W Emergency Module with Remote Test Switch EM14 =14W Emergency Module with Remote Test Switch IEMBOD =Bodine® Emergency Module with Integral Test Switch IEM7 =7W Emergency Module with Integral Test Switch IEM14 =14W Emergency Module with Integral Test Switch EMV7 =7W Low Voltage Emergency Module with Remote Test Switch ⁴ EMV14 =14W Low Voltage Emergency Module with Remote Test Switch ⁴ IEMV7 =7W Low Voltage Emergency Module with Integral Test Switch ⁴ IEMV14 =14W Low Voltage Emergency Module with Integral Test Switch ⁴ SWPD1 =Factory installed WaveLinx tilemount daylight sensor (includes control module, sensor, cable, and tile mount) LWTPD1 =Factory installed LumaWatt Pro wireless sensor kit

SAMPLE NUMBER: EU4B10208035

Power Module	Lumen Levels ¹	CRI	Color		
EU4B =4” Universal LED Module	1020 =1000, 1500, 2000 lumens 3040 =3000-4000 lumens 5000 =5000 lumens ¹⁵ 6000 =6000 lumens ¹⁵ 1015IC =1000, 1500 lumen IC rated	80 =80 CRI Minimum 90 =90 CRI Minimum 97 =97 CRI Minimum	80 CRI 27 =2700K 30 =3000K 35 =3500K 40 =4000K 50 =5000K	90 CRI 24 =2400K 27 =2700K 30 =3000K 35 =3500K 40 =4000K 50 =5000K	97 CRI 27 =2700K 30 =3000K
	Dim 2 Warm 109030D2W =1000 lumen, 90 CRI, Dim 2 Warm, IC rated 159030D2W =1500 lumen, 90 CRI, Dim 2 Warm, IC rated 209030D2W =2000 lumen, 90 CRI, Dim 2 Warm 309030D2W =3000 lumen, 90 CRI, Dim 2 Warm		Tunable white ¹⁶ 1020W2N902050 =1000, 1500, 2000 lumens, 90 CRI, tunable white 2000K-5000K 1020W2N902765 =1000, 1500, 2000 lumens, 90 CRI, tunable white 2700K-6500K		

SAMPLE NUMBER: 4LBM1LIE

Trim	Distribution ⁵	Flange	Finish	Options
4LB =4” LED	N =Narrow (30° Beam), Spun Aluminum M =Medium (50° Beam), Spun Aluminum W =Wide (75° Beam), Spun Aluminum S =Shallow (75° Beam), Spun Aluminum PS =Non-conductive Shallow (75° Beam), Injection Molded white ¹¹ CS =Cast Shallow (75° Beam), Die Cast Aluminum BA =Baffle, Spun Aluminum ⁷	0 =White Polymer Trim Ring 1 =Self-flanged ¹² 2 =White Painted Self-flanged	LI =Specular Clear ¹⁰ H =Semi-Specular Clear ¹⁰ WMH =Warm Haze ¹⁰ WH =Wheat ¹⁰ GPH =Graphite Haze ¹⁰ B =Specular Black ¹⁰ MW =Matte White MB =Matte Black ⁹ MMS =Matte Metallic Silver ⁸	E =Integral Emergency Test Switch Hole ⁶

Accessories

HSA4=Slope Adapter for 4” Aperture Housings, Specify Slope in 5° increments
TRM4=Metal Trim Ring, Specify Color²
TRR4=Rimless Trim Ring²
LGSKT4IP66=IP66 Gasket Kit
PRR4=Rimless Plaster Ring for Flush Mount²
Bar Hangers
HB26=C-channel Bar Hanger, 26” Long, Pair
HB50=C-channel Bar Hanger, 50” Long, Pair
RMB22=Wood Joist Bar Hanger, 22” Long, Pair
Transformers
H347=347 to 120V Step Down Transformer, 75VA
H347200=347 to 120V Step Down Transformer, 200VA
Connected Lighting Systems
PORLWTPD1=LumaWatt Pro wireless sensor kit (0-10V only) field installed¹⁴
TMSWPD1=WaveLinx tilemount daylight sensor (includes control module, sensor, cable and tile mount) field installed¹⁴

Notes:

- 1 Nominal Lumens will vary depending on selected color, driver and reflector finish.

2 Order spun trim with polymer trim ring or die cast with rimless flange (Consult specification sheet for color ordering information and options).

3 Not available with Chicago Plenum.

4 ULus approved only.

5 Beam angles are nominal with LI finish trims.

6 Only available with Narrow and Medium Spun Aluminum trims.
Required for use with all IEMBOD, IEM7, and IEM14 housings.

7 Only available with Matte White and Matte Black Finishes.

8 Only available on CS distribution.

9 Available only on BA and CS distributions.

10 Not available on PS, CS or BA distributions.
- 11 Matte white and self flanged only, 2000 lumen max.

12 Flange is same finish as the reflector.

13 DMX fixtures default to full on upon loss of DMX signal.

14 Refer to system specifications for additional information, features, and benefits.
Order either factory installed option or accessory.
Use with 0-10V driver.

15 Product is marked spacing and must be installed with the following minimum spacing
- Center to center of adjacent luminaires: 36”
- Center of luminaire to side of building member: 18”
- Minimum overhead: ½”

16 Non-IC

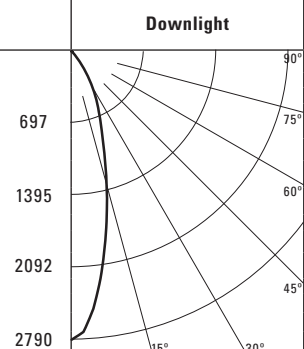
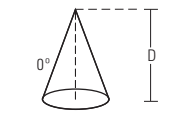
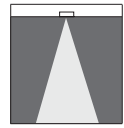
ENERGY

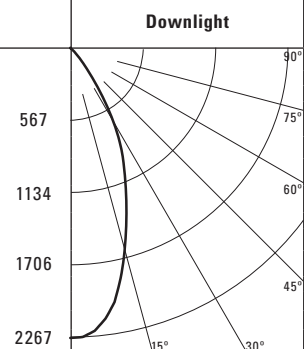
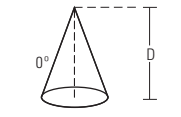
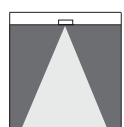
ENERGY DATA
Sound Rating: Class A standards
(Values at non-dimming line voltage)
Minimum Starting Temperature: -30°C (-22°F)
EM/RFI: FCC Title 47 CFR, Part 15, Class B (Consumer)
Input Voltage: UNV (120V - 277V)
Power Factor: >0.90 (at nominal input 120-277 VAC & 100% of Rated Output Power)
Input Frequency: 50/60Hz

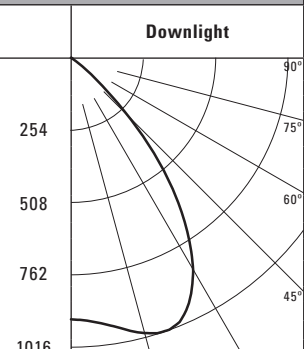
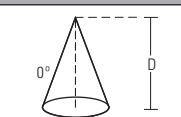
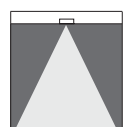
1000 Lumen D010		1500 Lumen D010	
Input Power: 11W	THD: <14%	Input Power: 15.5W	THD: <13%
120V Input Current: 0.09A	277V Input Current: 0.04A	120V Input Current: 0.13A	277V Input Current: 0.06A
2000 Lumen D010		3000 Lumen D010	
Input Power: 21.2W	THD: <9%	Input Power: 27.6W	THD: <10%
120V Input Current: 0.18A	277V Input Current: 0.08A	120V Input Current: 0.23A	277V Input Current: 0.10A
4000 Lumen D010		5000 Lumen D010TE	
Input Power: 41.6W	THD: <13%	Input Power: 57.9W	THD: <14%
120V Input Current: 0.35A	277V Input Current: 0.15A	120V Input Current: 0.49A	277V Input Current: 0.22A
6000 Lumen D010TE			
Input Power: 59.7W		THD: <14%	
120V Input Current: 0.50A		277V Input Current: 0.22A	

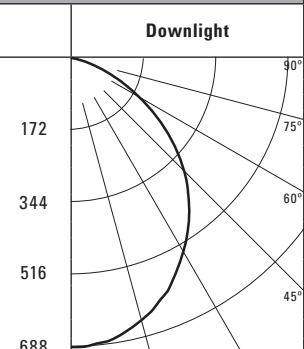
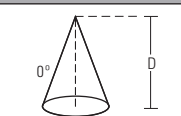
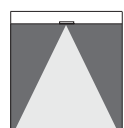
Lumens	120V		277V	
	Inrush (A)	Duration (ms)	Inrush (A)	Duration (ms)
1000 Lumen D010	1.02	0.041	2.18	0.021
1500 Lumen D010	1.02	0.042	2.24	0.064
2000 Lumen D010	1.02	0.077	2.43	0.027
3000 Lumen D010	1.15	0.067	3.26	0.027
4000 Lumen D010	1.2	0.088	3.9	0.03
5000 Lumen D010TE	5.1	0.132	10.2	0.153
6000 Lumen D010TE	5.4	0.123	10.8	0.154

PHOTOMETRY

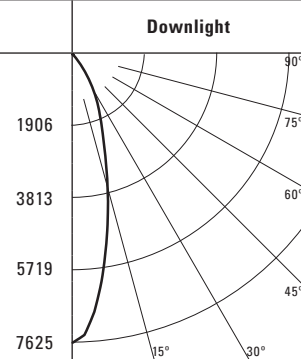
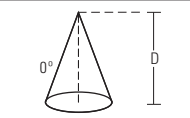
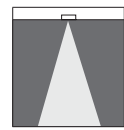
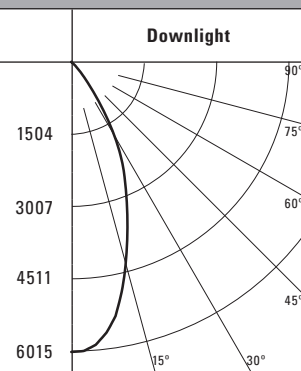
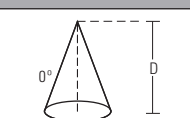
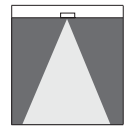
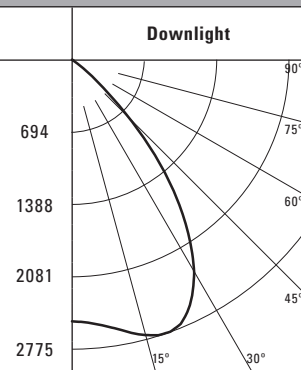
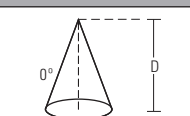
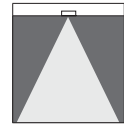
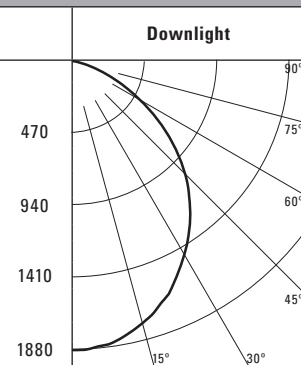
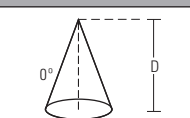
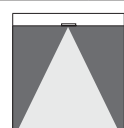
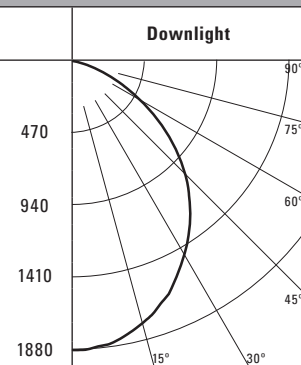
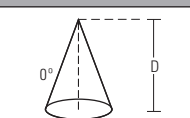
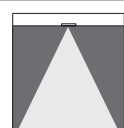
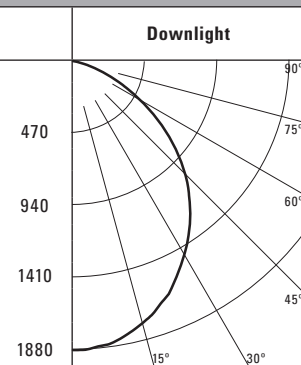
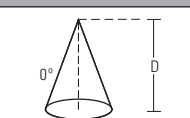
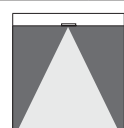
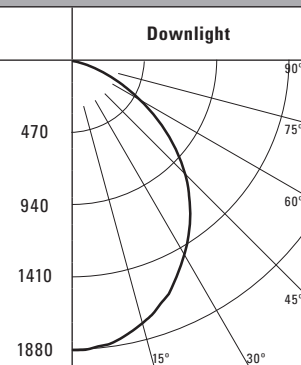
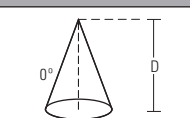
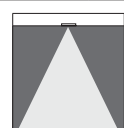
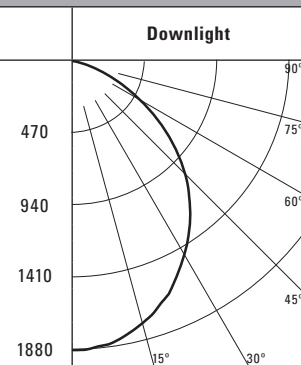
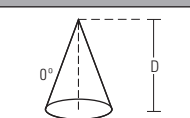
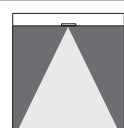
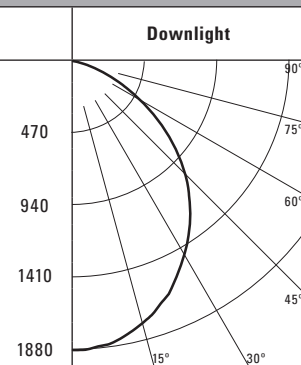
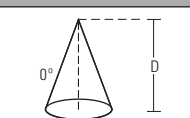
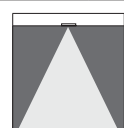
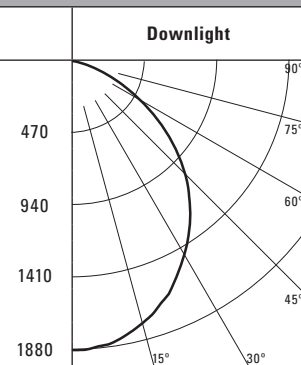
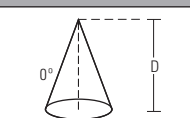
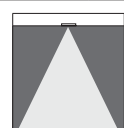
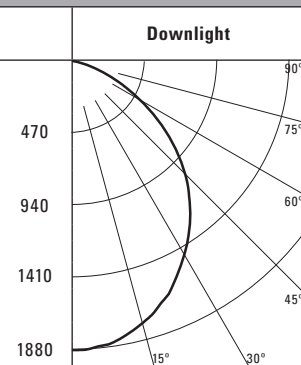
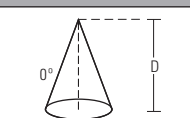
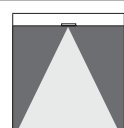
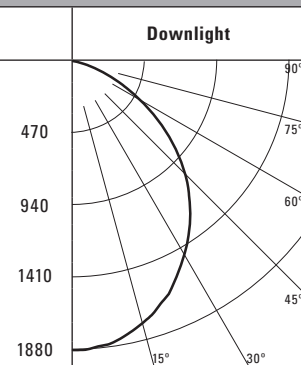
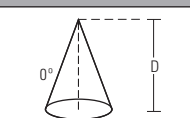
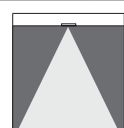
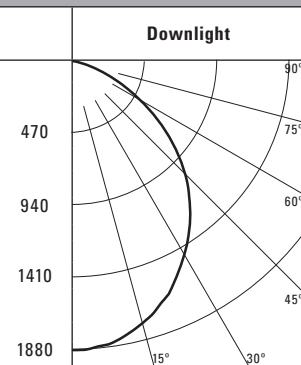
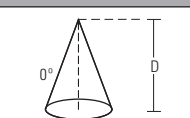
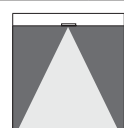
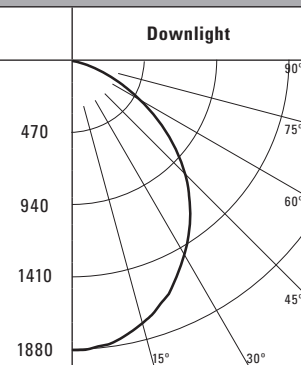
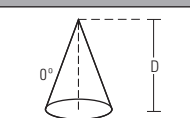
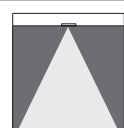
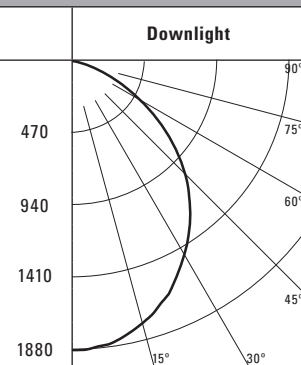
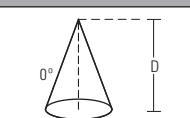
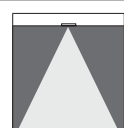
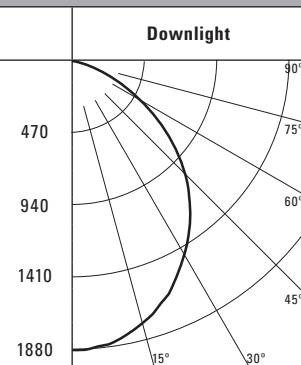
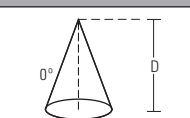
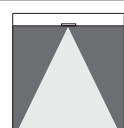
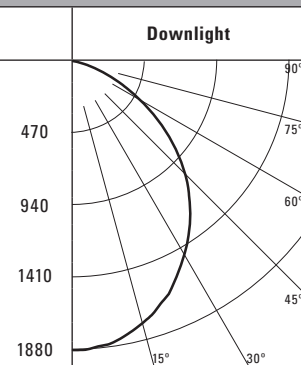
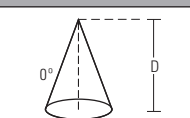
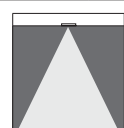
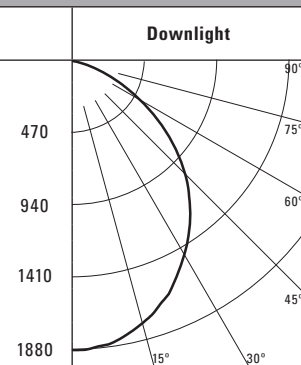
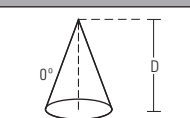
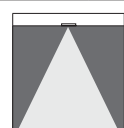
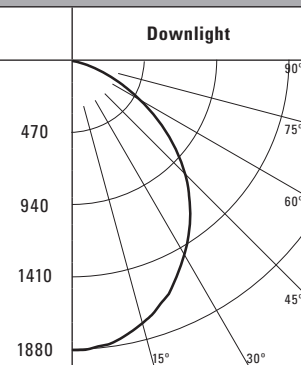
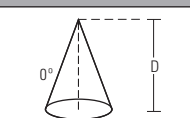
NARROW (30° BEAM)		CANDLEPOWER DISTRIBUTION		CONE OF LIGHT		CANDELA TABLE		ZONAL LUMEN SUMMARY			LUMINANCE	
Test Number	P201208					Degrees Vertical	Candela	Zone	Lumens	% Fixture	Average Candela Degrees	Average 0° Luminance
Housing	LD4B15D010					0	2790	0-30	926	82.1	45	489
Module	EU4B10208035					5	2550	0-40	1094	97	55	55
Trim	4LBN1LI					15	1421	0-60	1127	99.9	65	26
Lumens	1128					25	667	0-90	1128	100	75	0
Efficacy	78.9 Lm/W					35	266	90-180	0	0	85	0
SC	0.5					45	32	0-180	1128	100		
						55	3					
						65	1					
						75	0					
						85	0					
						90	0					

MEDIUM (50° BEAM)		CANDLEPOWER DISTRIBUTION		CONE OF LIGHT		CANDELA TABLE		ZONAL LUMEN SUMMARY			LUMINANCE	
Test Number	P201206					Degrees Vertical	Candela	Zone	Lumens	% Fixture	Average Candela Degrees	Average 0° Luminance
Housing	LD4B15D010					0	2267	0-30	1144	77.3	45	1072
Module	EU4B10208035					5	2227	0-40	1406	95	55	151
Trim	4LBM1LI					15	1690	0-60	1477	99.7	65	77
Lumens	1481					25	1027	0-90	1481	100	75	42
Efficacy	103.6 Lm/W					35	409	90-180	0	0	85	0
SC	0.71					45	70	0-180	1481	100		
						55	8					
						65	3					
						75	1					
						85	0					
						90	0					

WIDE (75° BEAM)		CANDLEPOWER DISTRIBUTION		CONE OF LIGHT		CANDELA TABLE		ZONAL LUMEN SUMMARY			LUMINANCE	
Test Number	P201204					Degrees Vertical	Candela	Zone	Lumens	% Fixture	Average Candela Degrees	Average 0° Luminance
Housing	LD4B15D010					0	914	0-30	816	53.8	45	4372
Module	EU4B10208035					5	925	0-40	1252	82.5	55	574
Trim	4LBW1LI					15	998	0-60	1513	99.7	65	100
Lumens	1518					25	977	0-90	1518	100	75	42
Efficacy	106.2 Lm/W					35	707	90-180	0	0	85	0
SC	1.3					45	286	0-180	1518	100		
						55	30					
						65	4					
						75	1					
						85	0					
						90	0					

SHALLOW (75° BEAM)		CANDLEPOWER DISTRIBUTION		CONE OF LIGHT		CANDELA TABLE		ZONAL LUMEN SUMMARY			LUMINANCE	
Test Number	P201210					Degrees Vertical	Candela	Zone	Lumens	% Fixture	Average Candela Degrees	Average 0° Luminance
Housing	LD4B15D010					0	688	0-30	512	34.2	45	5827
Module	EU4B10208035					5	682	0-40	816	54.5	55	4771
Trim	4LBCS1MMS					15	645	0-60	1333	89	65	3226
Lumens	1497					25	577	0-90	1497	100	75	1339
Efficacy	104.7 Lm/W					35	486	90-180	0	0	85	124
SC	1.16					45	380	0-180	1497	100		
						55	253					
						65	126					
						75	32					
						85	1					
						90	0					

PHOTOMETRY

NARROW (25° BEAM)		CANDLEPOWER DISTRIBUTION		CONE OF LIGHT		CANDELA TABLE		ZONAL LUMEN SUMMARY			LUMINANCE			
Test Number	PP201209					Degrees Vertical	Canдела	Zone	Lumens	% Fixture	Average Candela Degrees	Average 0° Luminance		
Housing	LD4B40D010					0	7625	0-30	2531	82.1	45	1337		
Module	EU4B30408035					5	6969	0-40	2989	97	55	149		
Trim	4LBN1LI					15	3883	0-60	3080	99.9	65	67		
Lumens	3083					25	1822	0-90	3083	100	75	0		
Efficacy	73.8 Lm/W					35	727	90-180	0	0	85	0		
SC	0.5							Degrees Vertical	Canдела	Zone	Lumens	% Fixture	Average Candela Degrees	Average 0° Luminance
Housing	LD4B40D010							0	6015	0-30	3036	77.3	45	2844
Module	EU4B30408035							5	5909	0-40	3731	95	55	400
Trim	4LBM1LI							15	4484	0-60	3918	99.7	65	205
Lumens	3929							25	2725	0-90	3929	100	75	113
Efficacy	94 Lm/W							35	1085	90-180	0	0	85	0
SC	0.71							Degrees Vertical	Canдела	Zone	Lumens	% Fixture	Average Candela Degrees	Average 0° Luminance
Housing	LD4B40D010							0	2499	0-30	2230	53.8	45	11948
Module	EU4B30408035							5	2528	0-40	3421	82.5	55	1569
Trim	4LBW1LI							15	2727	0-60	4134	99.7	65	274
Lumens	4148							25	2670	0-90	4148	100	75	113
Efficacy	99.2 Lm/W							35	1933	90-180	0	0	85	0
SC	1.3							Degrees Vertical	Canдела	Zone	Lumens	% Fixture	Average Candela Degrees	Average 0° Luminance
Housing	LD4B40D010							0	1880	0-30	1400	34.2	45	15933
Module	EU4B30508035							5	1864	0-40	2230	54.5	55	13046
Trim	4LBCS1MMS							15	1763	0-60	3645	89	65	8819
Lumens	4093							25	1578	0-90	4093	100	75	3657
Efficacy	97.9 Lm/W							35	1329	90-180	0	0	85	323
SC	1.16							Degrees Vertical	Canдела	Zone	Lumens	% Fixture	Average Candela Degrees	Average 0° Luminance
Housing	LD4B40D010							0	1880	0-30	1400	34.2	45	15933
Module	EU4B30508035							5	1864	0-40	2230	54.5	55	13046
Trim	4LBCS1MMS							15	1763	0-60	3645	89	65	8819
Lumens	4093							25	1578	0-90	4093	100	75	3657
Efficacy	97.9 Lm/W							35	1329	90-180	0	0	85	323
SC	1.16							Degrees Vertical	Canдела	Zone	Lumens	% Fixture	Average Candela Degrees	Average 0° Luminance
Housing	LD4B40D010							0	1880	0-30	1400	34.2	45	15933
Module	EU4B30508035							5	1864	0-40	2230	54.5	55	13046
Trim	4LBCS1MMS							15	1763	0-60	3645	89	65	8819
Lumens	4093							25	1578	0-90	4093	100	75	3657
Efficacy	97.9 Lm/W							35	1329	90-180	0	0	85	323
SC	1.16							Degrees Vertical	Canдела	Zone	Lumens	% Fixture	Average Candela Degrees	Average 0° Luminance
Housing	LD4B40D010							0	1880	0-30	1400	34.2	45	15933
Module	EU4B30508035							5	1864	0-40	2230	54.5	55	13046
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Housing	LD4B40D010							0	1880	0-30	1400	34.2	45	15933
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Trim	4LBCS1MMS							15	1763	0-60	3645	89	65	8819
Lumens	4093							25	1578	0-90	4093	100	75	3657
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SC	1.16							Degrees Vertical	Canдела	Zone	Lumens	% Fixture	Average Candela Degrees	Average 0° Luminance
Housing	LD4B40D010							0	1880	0-30	1400	34.2	45	15933
Module	EU4B30508035							5	1864	0-40	2230	54.5	55	13046
Trim	4LBCS1MMS							15	1763	0-60	3645	89	65	8819
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SC	1.16							Degrees Vertical	Canдела	Zone	Lumens	% Fixture	Average Candela Degrees	Average 0° Luminance
Housing	LD4B40D010							0	1880	0-30	1400	34.2	45	15933
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Housing	LD4B40D010							0	1880	0-30	1400	34.2	45	15933
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Lumens	4093							25	1578	0-90	4093	100	75	3657
Efficacy	97.9 Lm/W							35	1329	90-180	0	0	85	323
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Module	EU4B30508035							5	1864	0-40	2230	54.5	55	13046
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Efficacy	97.9 Lm/W							35	1329	90-180	0	0	85	323
SC	1.16							Degrees Vertical	Canдела	Zone	Lumens	% Fixture	Average Candela Degrees	Average 0° Luminance
Housing	LD4B40D010							0	1880	0-30	1400	34.2	45	15933
Module	EU4B30508035							5	1864	0-40	2230	54.5	55	13046
Trim	4LBCS1MMS							15						

DESCRIPTION

The Halo Surface LED Downlight (SLD) incorporates WaveStream™ technology to create an ultra-low profile surface mounting luminaire with the performance and look of a traditional downlight. SLD6-1200 UNV series is designed for installation in many 4" x 2-1/8" deep square junction boxes. Accessory mounting kit allows retrofit in 5" and 6" IC and Non-IC recessed housings.* Suitable for residential or commercial installations. Ideal for closets, storage areas, attics and basements. Compliant with NFPA® 70, NEC® Section 410.16 (A)(3) and 410.16 (C)(5).

SPECIFICATION FEATURES

CONSTRUCTION

- Die cast aluminum trim ring, and die formed aluminum frame

OPTICS

- WaveStream™ technology provides uniform luminance from a low profile flat lens
- AccuAim™ optics provide directional control for the "cone-of-light" beam distribution of a traditional downlight.
- Precision molded lens features high transmission polymer with UV stabilized protecting film

DESIGNER TRIMS

Accessories (sold separately)

SLD designer trims are accessory rings that attach to the SLD for a permanent finish.* Refer to SLD accessories specification sheet for details.

- White (Paintable)
- Satin Nickel
- Tuscan Bronze

*SLD accessory trims attach with permanent adhesion and are not interchangeable after installation.

ELECTRICAL JUNCTION BOX MOUNTING

- SLD may be used in compatible electrical junction boxes in direct contact with insulation including spray foam insulation
- Suitable for installation in many 4" x 2-1/8" deep square electrical junction boxes.
- Driver consumes 3 cubic inches of junction box.
- Compatible with other junction boxes with accessory SLD6EXT extension spacer ring.
- Installer must ensure compatibility of fit, wiring and proper mounting in the electrical junction box. This includes all applicable national and local electrical and building codes.

- Proprietary Slot-N-Lock quick installation system for junction box installation
- T-bracket with Slot-N-Lock mounting tabs included

OPTIONAL - RECESSED HOUSING MOUNTING

- Accessory SLD6ACCKIT required for mounting in 5" and 6" enclosed recessed housings
- May be installed in IC recessed housings in direct contact with insulation

* **Note:** Not for use in recessed housings in direct contact with spray foam insulation. Refer to NEMA LSD 57-2013

- The SLD6 may be used with any 5 or 6 inch diameter recessed housing constructed of steel or aluminum with an internal volume that exceeds 107.9 in³.

LED

- Linear LED arrays are integrated in trim perimeter
- Color Temperature: 2700K, 3000K, 3500K, 4000K
- CRI options: 80 and 90
 - 90 CRI can be used for California Title 24 compliance/certified to Title 20
 - 80 CRI can be used to comply with California Title 24 Non-Residential Lighting Controls as a LED luminaire.

WARRANTY

Eaton provides a five year limited warranty on the SLD LED

LED CHROMATICITY

- A tight chromaticity specification ensures LED color uniformity, sustainable Color Rendering Index (CRI) and Correlated Color Temperature (CCT) over the useful life of the LED
- LED chromaticity of 3 SDCM exceeds ENERGY STAR® color standards per ANSI.

Catalog #		Type
Project		H
Comments		Date
Prepared by		



SLD6 1200 UNV Series

Universal Voltage

SLD6128xxWHUNVJB

80CRI

2700K, 3000K, 3500K, and 4000K

SLD6129xxWHUNVJB

90CRI

2700K, 3000K, 3500K, and 4000K

6" Surface LED Downlight

High Lumen 1200 Series Universal Voltage 120V-277V

Suitable for ceiling or wall electrical junction boxes

ENERGY DATA

	80 CRI	90 CRI
Lumens (4000K models)	1215	1000
Input Voltage	120V-277V	120V-277V
Frequency	50/60 Hz	50/60 Hz
Input Current	0.12 A	0.12 A
Input Power	14.8 W	14.8 W
Efficiency (4000K models)	82 lm/W	68 lm/W
THD	≤ 20%	
Power Factor	≥ 0.90	
T Ambient	-30 - +40°C	
Sound Rating	Class A	

NOMENCLATURE

SLD612830WHUNVJB

612 = 6" SLD 1200 Series

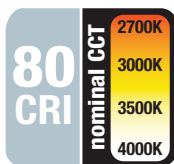
8 = >80 CRI

30 = 3000K

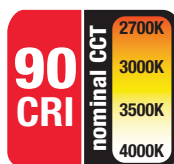
WH = Matte White

UNV = Universal Voltage 120V-277V

JB = Junction Box Kit only



Refer to ENERGY STAR® Certified Products List.



Refer to ENERGY STAR® Qualified Products List.
Can be used to comply with California Title 24 High Efficacy requirements.
Certified to California Appliance Efficiency Database under JA8.
Indoor LED nominal CCT of 4000K or less.

DIMMING - PHASE CONTROL

- Designed for continuous dimming capability to nominally 5% with many 120V Leading Edge (LE) and Trailing Edge (TE) Phase Control dimmers. (Dimmers with low end trim adjustment offer greater assurance of achieving 5% level.)
- Consult dimmer manufacturer for compatibility and conditions of use.
(Note some dimmers require a neutral in the wallbox.)

DIMMING - 0-10V

- Dimmable to 10% in typical operation with compatible 0-10V DC low voltage dimmers.
- 0-10V DC dimmers operate using two low voltage dimming wires (color coded violet and gray). The low voltage dimming wires are separate from the 120V AC or 277V AC power.
- Switching on/off is controlled via the line voltage (120V AC or 277V AC) power, and dimming is controlled via the 2-wire 0-10V DC low voltage wiring.

COMPLIANCE

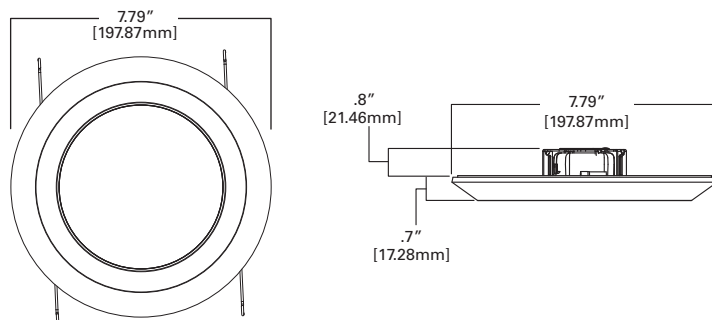
- cULus Listed ceiling and wall
- cULus Damp Location listed ceiling and wall
- cULus Wet Location Listed, ceiling only (shower rated)
- Suitable for use in closets, compliant with NFPA® 70, NEC® Section 410.16 (A)(3) and 410.16 (C)(5)
- SLD may be used in compatible electrical junction boxes in direct contact with insulation including spray foam insulation
- With accessory SLD6ACCKIT, may be installed in IC recessed housings in direct contact with insulation (Not for use in recessed housings in direct contact with spray foam insulation. Refer to NEMA LSD 57-2013)
- EMI/RFI: meets FCC 47CFR Part 15 Class B limits, and is suitable for use in residential and commercial installations
- Airtight certified per ASTM E283 (not exceeding 2.0 CFM under 75 Pascals pressure difference)
- 90 CRI: Can be used to comply with California Title 24 High Efficacy requirements. Certified to California Title 20 Appliance Efficiency Database.
- 80 CRI: Can be used to comply with California Title 24 Non-Residential Lighting Controls requirements as a LED luminaire.
- Can be used for International Energy Conservation Code (IECC) and Washington State Energy Code high efficiency luminaire compliance
- ENERGY STAR® certified luminaire - consult ENERGY STAR® Certified Product List
- Contains no mercury or lead and RoHS compliant.
- Photometric testing in accordance with IES LM-79
- Lumen maintenance projections in accordance with IES LM-80 and TM-21

**SLD6 1200 UNV Series****Universal Voltage****SLD6128xxWHUNVJB**

80CRI

**2700K, 3000K, 3500K,
and 4000K****SLD6129xxWHUNVJB**

90CRI

**2700K, 3000K, 3500K,
and 4000K****6" Surface LED
Downlight****High Lumen 1200 Series
Universal Voltage
120V-277V****Suitable for
ceiling or wall
electrical junction boxes****DIMENSIONS****ORDERING INFORMATION****SAMPLE NUMBER:** SLD612927WHUNVJB SLD6TRMSN**Junction Box Installation:** Order junction box separately, as supplied by others, to complete installation.**Recessed Installation:** Order Halo recessed housing separately to complete installation.

Models	Color Rendering Index	Color Temperature (CCT)	Finish	Voltage	Junction Box
SLD612 = 6" Surface LED Downlight, 1200 Series	8 =80 CRI 9 =90 CRI	27 =2700K 30 =3000K 35 =3500K 40 =4000K	WH =White	UNV =Universal Voltage 120V-277V	JB =Junction Box Kit only
Accessories					
Designer Trims Fit over the SLD for a designer finish SLD6TRMSN =6" SLD Satin Nickel SLD6TRMTBZ =6" SLD Tuscan Bronze SLD6TRMWH =6" SLD White (paintable) *SLD accessory trims attach with permanent adhesion and are not interchangeable after installation J-Box Spacer Extension Ring Add 15/16" depth when SLD driver cannot fit into installed junction box SLD6EXT =6" Surface LED J-Box Extender, 9.5" O.D.			RAD Adapters When junction box is mounted flat on a ceiling or beam surface (not recessed in ceiling) SLD6RAD =6" SLD Round Surface J-Box Adapter, 7.92" O.D. (for 4-inch round or octagon junction boxes.) SLD6SADPLT =6" SLD Square Surface J-Box Adapter Plate (For 4-inch square junction boxes, use with SLD6RAD.) Hardware Kits SLD6ACCKIT =6" Accessory Parts Replacement Kit (Screwbase adapter, torsion springs, friction blades) SLD6BRKT =6" Junction Box Bracket & Screws Refer to SLD Accessories specification sheet for further information.		

COMPATIBLE WITH EATON'S CROUSE-HINDS 4" SQUARE JUNCTION BOXES

TP450
for non-metallic cable
4" x 4" x 2-1/8"
(102mm x 102mm x 54mm)



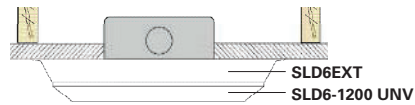
TP431†
for metal clad cable
4" x 4" x 2-1/8"
(102mm x 102mm x 54mm)

- **TP450** - for non-metallic cable
- **TP431** - for metal clad cable
- UL Listed
- Refer to www.crouse-hinds.com

†UL approved for use with aluminum interlocking grounding metal clad cable, Type MCIA (Southwire MCAP™). MCAP™ is a registered trademark of Southwire Company.

COMPATIBLE WITH 4" SQUARE JUNCTION BOXES*

4" square deep steel box
4" x 4" x 2-1/8"
(102mm x 102mm x 54mm)



Compatible with other boxes when used
with SLD6EXT extension spacer ring.

*This is a representative list of compatible junction boxes only. Information contained in this literature about other manufacturers' products is from published information made available by the manufacturer and is deemed to be reliable, but has not been verified. Eaton makes no specific recommendation on product selection and there are no warranties of performance or compatibility implied. Installer must determine that site conditions are suitable to allow proper installation of the SLD mounting bracket in the box.

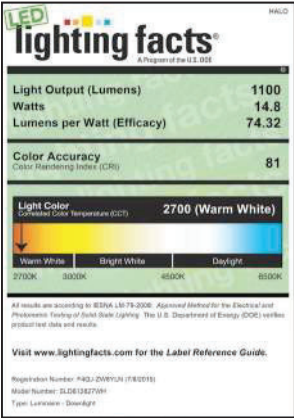
PRODUCT DATA

Cat No.	CRI	CCT	Lumens	Power (W)	LPW
SLD612827WHUNVJB	80	2700	1100	14.8	74
SLD612830WHUNVJB	80	3000	1150	14.8	78
SLD612835WHUNVJB	80	3500	1200	14.8	81
SLD612840WHUNVJB	80	4000	1215	14.8	82
SLD612927WHUNVJB	92	2700	880	14.8	59
SLD612930WHUNVJB	92	3000	925	14.8	63
SLD612935WHUNVJB	92	3500	965	14.8	65
SLD612940WHUNVJB	92	4000	1000	14.8	68

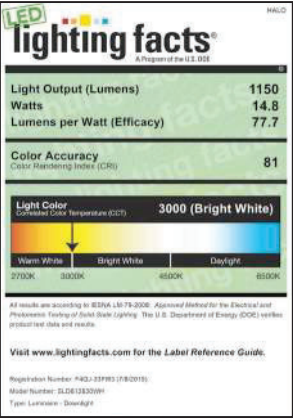
Performance values are presented as typical for the model(s) indicated. Field results may vary.

LIGHTING FACTS®

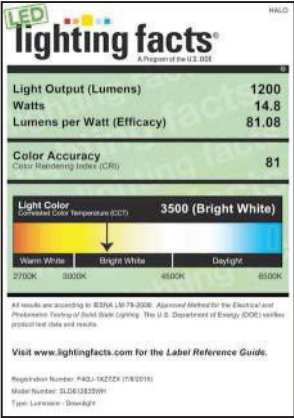
SLD612827WHUNVJB - 80 CRI



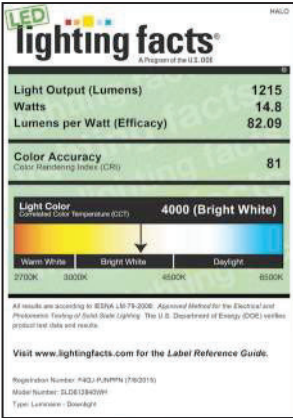
SLD612830WHUNVJB - 80 CRI



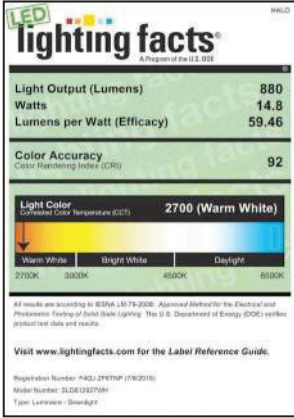
SLD612835WHUNVJB - 80 CRI



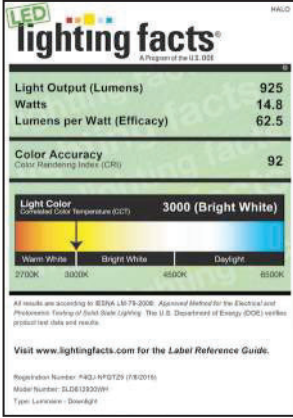
SLD612840WHUNVJB - 80 CRI



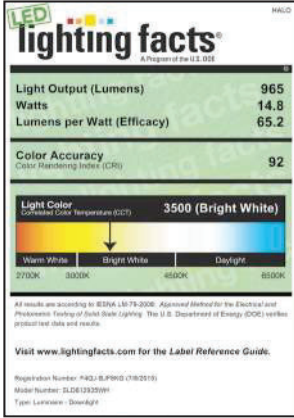
SLD612927WHUNVJB - 90 CRI



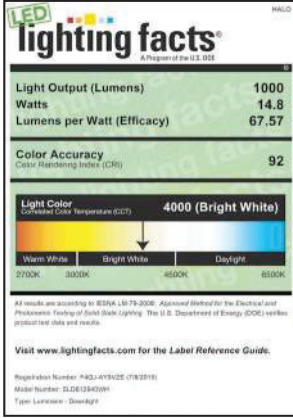
SLD612930WHUNVJB - 90 CRI



SLD612935WHUNVJB - 90 CRI



SLD612940WHUNVJB - 90 CRI



Impello Bathroom Vanity Light

Description:

The Impello Bathroom Vanity Light features subtle metallic bars in Olde Bronze or Chrome finish a Satin Etched glass diffuser. Three sizes available. Integrated 120 volt 90CRI, 3000K LED light source. Mounts horizontally or vertically. UL listed for damp locations. ADA compliant.



Shown in: Chrome / Satin Etched

List Price: \$720.00
Our Price: \$432.00

Shade Color: Satin Etched
Body Finish: Chrome
Lamp: 1 x LED/30W/120V LED
Wattage: 30W
Dimmer: Dimmable
Dimensions: 30.25"W x 5.5"H x 3.5"D

Technical Information
Color Rendering: 90 CRI

Product Number: SGL4853 3					
Company:		Fixture Type:		Date:	Jan 14, 2020
Project:		Approved By:			

Fax: (773) 883-6131

Phone: 866-954-4489

Address: 1718 W. Fullerton Ave. Chicago IL 60614

www.Lightology.com

FEATURES & SPECIFICATIONS

INTENDED USE — For wall or ceiling mounting, vertical or horizontal. The WL combines digital LED lighting and controls technologies with high-performance optical design to offer the most advanced wall-mount luminaire for general ambient lighting applications. High-efficacy light engine delivers long life and excellent color, ensuring a superior quality lighting installation that is highly efficient and sustainable.

CONSTRUCTION — Housing is roll formed from code-gauge steel.

Reflector is retained in die cast ends providing secure installation and easy maintenance.

Decorative die-cast end caps provide added durability.

Finish: All metal parts are post-painted in white polyester powder coat for smooth, finished edges and uniform light distribution.

OPTICS — Impact modified linear faceted refractor. Optically engineered for superior light distribution and maximum efficacy.

Crescent-shape linear faceted refractor system obscures and integrates individual LED images and uniformly washes fixture surface with light.

ELECTRICAL — Long-life LEDs, coupled with high-efficiency drivers, provide superior quantity and quality of illumination for extended service life. 90% LED lumen maintenance at 60,000 hours (L90/60,000). The LEDs have a CRI of 82.

eldoLED driver options deliver choice of dimming range and choice for control, while assuring flicker-free, low-current inrush, 89% efficiency and low EMI.

Driver disconnect provided where required to comply with US and Canadian codes.

Optional nLight® embedded controls continuously monitor system performance and allow for constant lumen management function.

Lumen Management: Unique lumen management system (option N80) provides onboard intelligence that actively manages the LED light source so that constant lumen output is maintained over the system life, preventing energy waste created by the traditional practice of over-lighting.

SENSOR — **Integrated sensor (individual control):** Sensor Switch MSD7 (Passive Infrared (PIR)) integrated occupancy sensor photocell allows the luminaire to power off when the space is unoccupied. See page 4 for more details on the integrated sensor.

Integrated Sensor (nLight Wired Networking): The sensor is nLight-enabled, meaning it has the ability to communicate over an nLight network. When wired using CAT-5 cabling with other nLight-enabled sensors, power packs, or WallPods, an nLight control zone is created. Once linked to a Gateway, directly or via a Bridge, the zone becomes capable of remote status monitoring and control via SensorView software. See page 4 for the nLight sensor options.

Interated Smart Sensor (nLight AIR Wireless Platform): The RES7 sensor is nLight AIR enabled, meaning it has the ability to communicate over the wireless nLight control platform. It is available with an automatic dimming photocell, and either a digital PIR or a microphonics dual technology occupancy sensor. It pairs to other luminaires and wall switches through our mobile app, CLAIRITY, which allows for simple sensor adjustment. See page 4 for more details on the Integrated Smart Sensor.

LISTINGS — CSA certified to meet U.S. and Canadian standards. Suitable for damp location (excluding sensor option).

Patents pending. 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/CustomerResources/Terms_and_conditions.aspx

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.

Catalog Number
Notes
Type K

W SERIES

Wall bracket & Surface Mount LED



WL2

2'
LED



eldoLED



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 when ordered with drivers marked by a **shaded background***

To learn more about A+, visit www.acuitybrands.com/aplus.

*See ordering tree for details

WL2 Wall Bracket & Surface Mount LED



A+ Capable options indicated by this color background.

ORDERING INFORMATION

Lead times will vary depending on options selected. Consult with your sales representative.

Example: WL2 18L EZ1 LP840

WL2					
Series	Lumens ¹	Voltage	Driver	Color temperature	nLight Interface
WL2 2' wall-mount LED	08L 800 lumens 12L 1200 lumens 18L 1800 lumens 22L 2200 lumens	(blank) MVOLT	EZ1 eldoLED dims to 1%, 0-10V EZB eldoLED dims to dark, 0-10V GZ1 Dims to 1% (0-10V dimming) ² GZ10 Dims to 10% (0-10V dimming) ²	LP830 3000 K LP835 3500 K LP840 4000 K LP850 5000 K	nLight Wired (blank) No nLight® interface N80 nLight® with 80% lumen management N80EMG nLight® with 80% lumen management. For use with generator supply EM power ³ N100 nLight® without lumen management N100EMG nLight® without lumen management. For use with generator supply EM power ³ nLight Wireless (blank) No nLight® interface NLTAIR2 nLight® Air Generation 2 enabled ⁴

Control ⁴	Standby mode ⁹	Options	Finish ¹¹
nLight Wired (blank) No nLight control NES7 nLight® nES 7 PIR integral occupancy sensor ⁶ NESPDT7 nLight® nES PDT 7 dual technology integral occupancy control ⁶ NES7ADCX nLight® nES 7 ADCX PIR integral occupancy sensor with automatic dimming photocell ⁶ nLight Wireless RES7 nLight® AIR PIR integral occupancy sensor with automatic dimming photocell RES7PDT nLight® AIR microphonics dual technology integral occupancy sensor with automatic dimming photocell Individual Control MSD7 Sensor Switch® MSD 7 PIR Integral Occupancy Control ⁷	(blank) Fixture turns off when unoccupied DIM10 Fixture dims to approximately 10% light output when unoccupied DIM50 Fixture dims to approximately 50% light output when unoccupied	SC Surface conduit end cap provisions	(blank) White

Notes

- 1 Approximate lumen output.
- 2 GZ1, GZ10 not available with any Controls or sensor options
- 3 nLight EMG option requires a connection to existing nLight network. Power is provided from a separate N80 or N100 enabled fixture
- 4 Must order with RES7, RES7PDT. Only available with EZ1 driver.
- 5 See sensor options on page 4.
- 6 Requires N80, N100, N80EMG, or N100EMG.
- 7 Not available with nLight options or EZB.
- 8 Not available with nLight options or Standby Mode. Gateway not included. Requires on-site commissioning. Visit www.lightingcontrols.com/XPointWireless for more information.
- 9 Requires Occupancy Control.
- 10 Occupancy sensor disabled at factory but can be re-enabled upon commissioning.
- 11 For additional paint finishes, [Architectural Colors](#).

WL2 Wall Bracket & Surface Mount LED

nLight® Wired Control Accessories: <i>Order as separate catalog number. Visit www.acuitybrands.com/products/controls/nlight.</i>			
WallPod stations	Model number	Occupancy sensors	Model number
On/Off	nPODM [color]	Small motion 360°, ceiling (PIR / dual tech)	nCM 9 RJB / nCM PDT 9 RJB
On/Off & raise/lower	nPODM DX [color]	Large motion 360°, ceiling (PIR / dual tech)	nCM10 RJB / nCM PDT 10 RJB
Graphic touchscreen	nPOD GFX [color]	Wall switch with raise/lower	nWSX PDT LV DX [color]
Photocell controls	Model number	Cat-5 cable (plenum rated)	Model number
Full range dimming	nCM ADCX RJB	10' cable	CAT5 10FT J1
		30' cable	CAT5 30FT J1

nLight® AIR Control Accessories: <i>Order as separate catalog number. Visit www.acuitybrands.com/products/controls/nlightair.</i>	
Wall switches	Model number
On/Off single pole	rPODB [color] G2
On/Off two pole	rPODB 2P [color] G2
On/Off & raise/lower single pole	rPODB DX [color] G2
On/Off & raise/lower two pole	rPODB 2P DX [color] G2
On/Off & raise/lower single pole	rPODBZ DX WH G2

ORDERING INFORMATION				
rCMS				Example: RCMS PDT 10 AR G2
Series/Detection	Occupancy Detection	Lens (Required)	Operating Mode	Generation
RCMS ¹ nLight AIR occupancy and daylight sensor	(blank) PIR Detection PDT ¹ Dual Tech PIR/ Microphonics	10 Large Motion/Extended Range 360°	(blank) None AIR Auxiliary Relay	G2 Generation 2 compatibility
		9 Small Motion/Extended Range 360°		
		6 High Bay 360° Lens		

1 RCMS requires low voltage power from either RPP20 DS 24V G2 or PS 150.

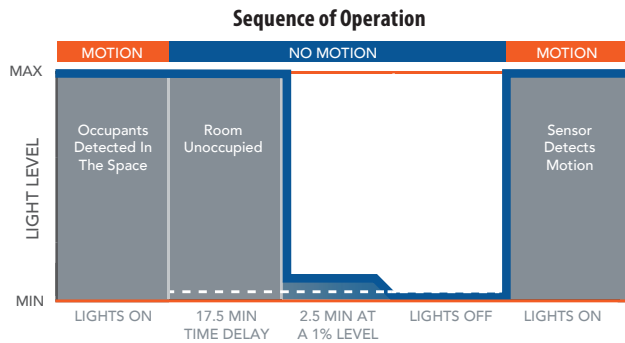


WL2 Wall Bracket & Surface Mount LED

Sensor Options					
Option	Automatic Dimming Photocell	Occupancy Sensing		nLight Wired Networking	nLight AIR Networking
		PIR	PDT		
MSD7		X			
NES7		X		X	
NES7ADCX	X	X		X	
NESPDT7			X	X	
RES7	X	X			X
RES7PDT	X	X	X		X

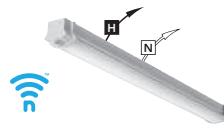
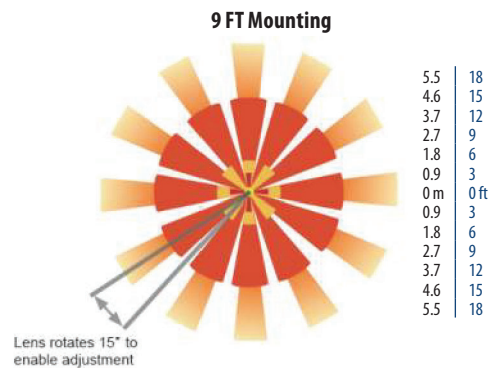
Integrated Sensor with Individual Control

The MSD7 PIR occupancy sensor is ideal for areas without obstructions and where daylight harvesting may be desired. Suggested applications include, but not limited to, hallways, corridors, storage rooms, and breakrooms or other areas where people are typically moving.



Sensor Coverage Pattern Mini 360° Lens

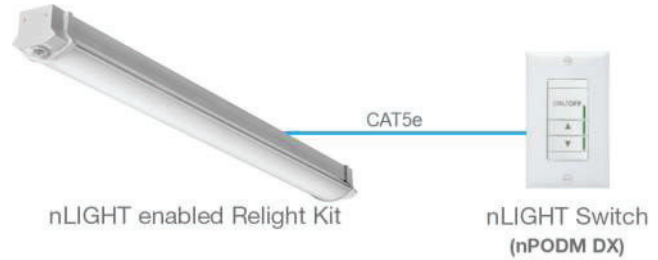
- Recommended for walking motion detection from mounting heights between 8 ft (2.44 m) and 20 ft (6.10 m)
- Initial detection of walking motion along sensor axes at distances of 2x the mounting height up to 15 ft (4.57 m) and 1.75x up to 20 ft (6.10 m).
- Provides 12 ft (3.66 m) radial detection of small motion when mounted at 9 ft (2.74 m)
- Initial detection will occur earlier when walking across sensor's field of view than when walking directly at sensor



Simple as 1,2,3

1. Install the nLight® AIR fixtures with embedded smart sensor
2. Install the wireless battery-powered wall switch
3. With CLAIRITY app, pair the fixtures with the wall switch and if desired, customize the sensor settings for the desired outcome

Basic nLight Zone



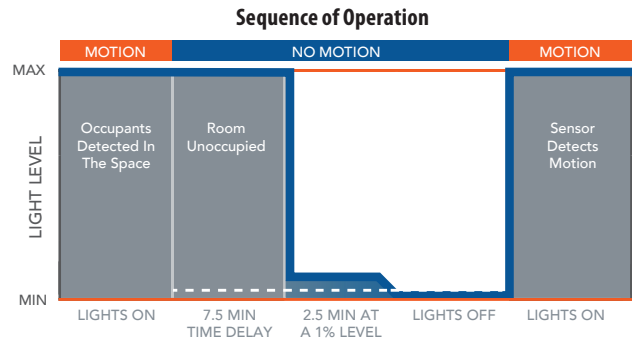
nLight Wired Networking

The nES 7 is ideal for small rooms without obstructions or areas with primarily walking motion. Ideal areas include hallways, corridors, storage rooms, and breakrooms. Additionally, the NES7ADCX includes an integrated photocell, which enables daylight harvesting controls.

For areas like restrooms, private offices, open offices, conference rooms or any space with obstructions, the nES PDT 7 dual technology sensor is recommended. The nES PDT 7 utilizes both PIR (passive infrared) and Microphonics technologies to detect occupancy.

nLight AIR Wireless

nLight AIR is the ideal solution for retrofit or new construction spaces where adding additional wiring can be labor intensive and costly. nLight AIR is available with or without an integral sensor. The integrated RES7 or RES7PDT smart sensors are part of each luminaire in the nLight AIR network, which can be grouped to control multiple luminaires. The granularity of control with the digital PIR occupancy detection and daylight sensing makes a great solution for any application.



*The presetting on the automatic dimming photocell is 5fc.

WL2 Wall Bracket & Surface Mount LED

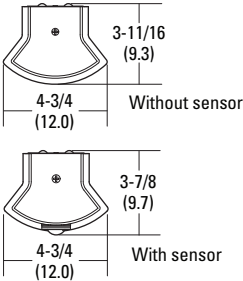
Performance Data			
Lumen package	Input watts ¹	Lumens	LPW
08L LP830	7.5	771	102.80
08L LP835	7.5	809	107.87
08L LP840	7.5	848	113.07
08L LP850	7.5	877	116.93
12L LP830	12.2	1190	97.54
12L LP835	12.2	1249	102.38
12L LP840	12.2	1311	107.46
12L LP850	12.2	1364	111.80
18L LP830	17.5	1711	97.77
18L LP835	17.5	1796	102.63
18L LP840	17.5	1889	107.94
18L LP850	17.5	1966	112.34
22L LP830	21.0	2086	99.33
22L LP835	21.0	2120.5	100.98
22L LP840	21.0	2189.4	104.26
22L LP850	21.0	2258.4	107.54

Notes
1 Actual wattage may differ by +/- 5% when operating between 120-277V +/- 10%.

DIMENSIONS

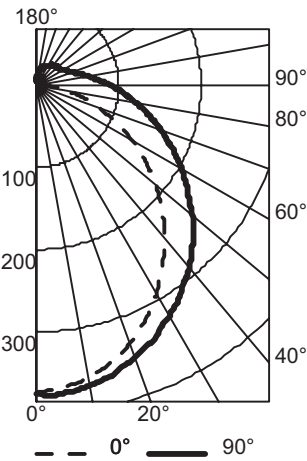
All dimensions are inches (centimeters) unless otherwise noted.

Specifications	
Length: with sensor -	25-7/8 (65.7)
without sensor -	23-3/8 (59.4)
Height: with sensor -	3-11/16 (9.3)
without sensor -	3-7/8 (9.7)
Width: 4-3/4	(12.1)



PHOTOMETRICS

WL2 12L EZ1 LP840, 1310.5 delivered lumens, test no. LTL25476P5, tested in accordance to IESNA LM-79



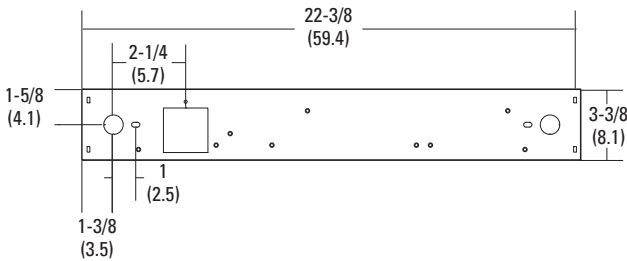
CP Summary		
	0°	90°
0°	374	374
5°	367	376
15°	350	364
25°	315	340
35°	267	306
45°	216	269
55°	162	224
65°	109	182
75°	58	141
85°	17	105
90°	2	88

Coefficients of Utilization									
pc	80%			70%			50%		
	70%	50%	30%	50%	30%	10%	50%	30%	10%
0	116	116	116	112	112	112	104	104	104
1	104	99	94	95	91	87	88	85	82
2	94	85	78	82	75	70	77	71	66
3	86	74	66	72	64	58	67	60	55
4	78	66	57	64	55	49	59	52	47
5	72	59	49	57	48	42	53	46	40
6	66	53	44	51	43	36	48	41	35
7	61	48	39	46	38	32	44	36	31
8	57	43	35	42	34	29	40	33	28
9	53	40	32	39	31	26	37	30	25
10	50	37	29	36	28	23	34	27	22

Zonal Lumen Summary			
Zone	Lumens	% Lamp	% Fixture
0° - 30°	286	21.9	21.9
0° - 40°	466	35.6	35.6
0° - 60°	824	62.9	62.9
0° - 90°	1143	87.2	87.2
90° - 120°	101	7.7	7.7
90° - 130°	122	9.3	9.3
90° - 150°	154	11.7	11.7
90° - 180°	168	12.8	12.8
0° - 180°	1310	100.0	100.0

MOUNTING DATA

For unit installation; surface ceiling or wall mounting.



Item # F534L-ORB	UPC Code: 706411056185
Product Family Name: Lun-Aire	Finish: Oil Rubbed Bronze
Category: INTERIOR FAN	Category Type: Ceiling Fan
Certification E75795	
Patents: D833,596, D837,363	
Notes:	



Image File Name: **F534L-ORB.jpg**



MEASUREMENTS

Blade Finish:		Reversible Blades:	
		No	
Blade Material:		Slope:	
PLYWOOD W/PAPER OVERLAY		Yes	
Blade Sweep:	No. of Blades:	Blade Pitch:	Hanging Weight:
54"	5	12 degrees	19.91
Downrod 1:	Downrod 1:	Downrod 2:	Downrod 2:
6	0.75	0.75	0.75
Ceiling to Lowest Point: (Dim A)	Ceiling to Blade (Dim B)	Lead Wire:	Motor Size:
15.25	11.75	80"	172 X 17MM

	Low	Low/Med.	Medium	Med/High	High
RPM:	72		122		161
Amps:	0.25		0.38		0.54
Watts:	13.7		24.26		0.54
CFM:	2175.0		3678.0		65.01
CFM/Watts:	158.76		151.61		120.39



CONTROLS

Pull Chain Control:	Works with Remote Control:	Works with Wall Control:
Yes	Yes	Yes
Reversible:	Included Remote Control:	Included Wall Control:
Yes		
Smart Control:	Compatible Remote Control(s):	Compatible Wall Control(s):
No	RCS213	WSC213
Integrated Smart Control:		Compatible Smart Control:

LAMPING

No. of Bulbs:	Light Type:	Light Kit Optional:	No
1	LED		
Max Bulb Wattage:	Socket:		
17	LED MODULE		
Integrated Light Kit:	Dimmable:	Ballast:	Rated Life Hours:
Yes	Yes		30000
Bulb/LED Included:	Color Temp.:	CRI:	Initial Lumens:
Yes	3000	80	1100.0

GLASS

Description:	Material:
Etched Opal	GLASS
Part No.:	Quantity:
	1
Width:	Height:
10.0	3.16
	Length:
	10.0



SHIPPING

Carton Width:	Carton Height:	Carton Length:
14.38	10.63	26.63
Carton Weight:	Carton Cubic Feet:	Small Package Shippable:
22.79	2.356	Yes
Master Pack Width:	Master Pack Height:	Master Pack Length:
Master Pack Weight:	Master Cubic Feet:	Multi-Pack: Master Pack:
		1 1

LED



LED

UL Listed



WARNING: Handling this product can expose you to chemicals including lead, which is known to the State of California to cause cancer and birth defects or other reproductive harm. Wash hands with soap and water after installing, handling, cleaning or otherwise touching this product. For more information go to: www.P65Warnings.ca.gov.

For additional information, please contact Customer Care: 1-800-221-7977 | Product depicted on this spec sheet is protected by United States Federal and/or State laws including US Patent, Trademark and/or Copyright and unfair competition laws. Unauthorized reproduction or use carries severe legal penalties.

CORE 400 LX

UP + DOWN PENDANT

PROJECT

Job		Notes
Type	TYPE M	
Part #		

SPECIFICATIONS

- Source** Two Xicato XTM LED modules - up to 4000 lumens each
- CCT** 2700K, 3000K, 3500K or 4000K
- Color Consistency** 1x2 SDCM (MacAdam) along BBL, CCT +/- 40K to 70K, Duv +/- .001
- CRI (Ra)** 83 or 98
- Driver / Location** Included / Internal with remote or deep canopy options
- Dimming** 0-10V or phase dimming to 10% standard; DALI, DMX and 1% dimming available
- Input Voltage** 100 to 277VAC, phase dimmable versions are 120VAC only
- Power** Up to 71 watts max, depending on LED module / driver
- Reflector** 11°, 25°, 41°, 51°, or 83° - field replaceable without tools
- Material** CNC machined aluminum with stainless steel hardware
- Finish** Powder coat - TGIC polyester for exterior and interior use
- Weight** 8.5 lb. [3.9 kg]
- Location** Listed for Wet & Damp locations
- Approvals** ETL Listed to UL 1598, 2108, 8750 and CSA C22.2# 9 & #250.0
- L80 Life** > 50,000 hours at 80% lumen maintenance based on IESNA LM-80-08
- Warranty** Lifetime Limited Warranty - see warranty for details
- IES Files** LM-79-08 IES files available
- Modifications** Any modification or customization is possible - consult factory



ORDERING LOGIC

Model	Driver		# of Circuits	Mounting Location	Up Direction				Down Direction				Shell Color	Suspension	Options
	Location	Dimming			Output	CRI *	C.C.T.	Reflector	Output	CRI *	C.C.T.	Reflector			
C4LT															
	N=Internal	N=None	1	D=Damp	07=700lm	83=83	27=2700K	11=11° **	07=700lm	83=83	27=2700K	11=11° **	XX	BK=Black Cord	
	R=Remote	P=Phase	2	W=Wet	10=950lm	98=98*	30=3000K	25=25°	10=950lm	98=98*	30=3000K	25=25°	(see chart on page 4)	CS=Clear Cord	
	D=Deep	V=0-10V			13=1300lm		35=3500K	41=41°	13=1300lm		35=3500K	41=41°			
	Canopy	Z=Other			20=2000lm		40=4000K	51=51°	20=2000lm		40=4000K	51=51°	ZZ=Custom		
					30=3000lm			83=83° **	30=3000lm			83=83° **			
					40=4000lm				40=4000lm						

* 98 CRI not available in 4000 lm

** Not available with wet location

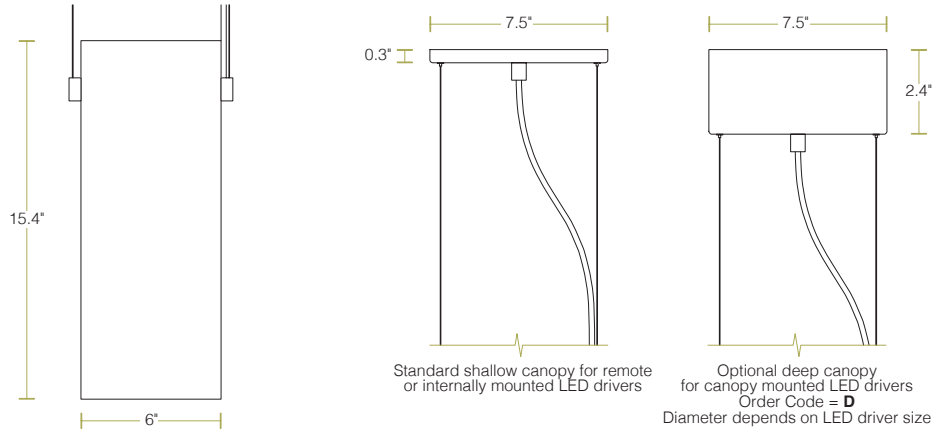
Example Part Number: **C4LT-RN1D-13832725-20832741-S3BK**

CORE 400 LX Pendant - Remote Driver, No Dimming, 1 Circuit, Damp Location - UP= 1300 lm, 83 CRI, 2700K, 25° Reflector - DOWN= 2000 lm, 83 CRI, 2700K, 41° Reflector - S3 Red, Black Cord

CORE 400 LX

UP + DOWN PENDANT

DIMENSIONS



Dual aircraft cable + cord suspension
Standard cable length = 6'
Cable length is field adjustable
To order longer cable put length in options section at the end of the part number
Canopies fit standard 3.5" and 4" round and octagonal junction boxes
Not to scale, dimensions are nominal
Consult factory for CAD drawings

LED OPTIONS

Reflector Option	LES ¹	CRI	LED Specifications		
			Lumens ^{2,3}	Wattage ⁴ (W)	Efficacy ⁵ (lm/W)
11°, 25°, 41°, 51° & 83°	19mm	Ra = 83 ± 3	700	5.6	129
			950	8.2	118
			1300	11.7	111
			2000	19.5	102
			3000	29.3	102
		Ra = 98 R9 ≥ 90 R15 ≥ 95	4000	39.1	102
			700	7.4	97
			950	10.9	89
			1300	15.6	83
			2000	26.4	76
			3000	34.1	88

¹ LES: Light Emitting Surface diameter

² ±10%

³ Source lumens - see photometrics on page 3 for LOR to calculate delivered lumens

⁴ Maximum luminaire wattage including LED driver = LED wattage x 1.2

⁵ Higher efficacies are available via lower drive currents - consult factory

CONTROL OPTIONS

Standard LED Drivers* (included in base price)	Order Code V = 0-10V dimming to 10%
	Order Code P = Phase dimming to 10% Compatible with both forward and reverse phase dimmers
Optional LED Drivers*	eldoLED 0-10V, DALI, or DMX dimming to 0%
	Lutron Hi-lume™ A-series, EcoSystem or forward phase dimming to 1% Lutron Hi-lume™ 5-series, EcoSystem dimming to 5%

* Standard LED drivers are suitable for Wet Location

* Optional LED drivers are suitable for Damp Location

* All LED drivers must be mounted in a deep canopy or remote

* Dual LED drivers available for independent Up + Down control

* Choosing different lumen outputs for Up + Down may require dual drivers
Consult factory for details

* For EM applications:

All LED drivers may be used with 3rd party inverter style systems

CORD OPTIONS



Clear Silver
Order Code = **CS**

For dry and damp locations



Black
Order Code = **BK**

For all locations

CORE 400 LX

UP + DOWN PENDANT

PHOTOMETRICS

LM-79-08 IES files available

Beam Angle	Order Code	Intensity Plot (cd) (3000lm)	Polar Plot (cd) (3000lm)	Cone Diagram (3000lm)	Description
11°	11			<p>Illuminance at Center</p> <p>Beam Diameter</p> <p>5' 1178 fc 1.0'</p> <p>10' 295 fc 1.9'</p> <p>15' 131 fc 2.9'</p> <p>20' 74 fc 3.8'</p>	<p>CBCP = 29,547 cd</p> <p>Beam Angle = 11°</p> <p>Field Angle = 23°</p> <p>LOR = 89.1 %</p> <p>Beam = full width @ 50%</p> <p>Field = full width @ 90%</p>
25°	25			<p>Illuminance at Center</p> <p>Beam Diameter</p> <p>5' 311 fc 2.2'</p> <p>10' 78 fc 4.5'</p> <p>15' 35 fc 6.7'</p> <p>20' 19 fc 8.9'</p>	<p>CBCP = 7,785 cd</p> <p>Beam Angle = 25°</p> <p>Field Angle = 59°</p> <p>LOR = 87.5 %</p> <p>Beam = full width @ 50%</p> <p>Field = full width @ 90%</p>
41°	41			<p>Illuminance at Center</p> <p>Beam Diameter</p> <p>5' 205 fc 3.7'</p> <p>10' 51 fc 7.4'</p> <p>15' 23 fc 11.1'</p> <p>20' 13 fc 14.8'</p>	<p>CBCP = 5,127 cd</p> <p>Beam Angle = 41°</p> <p>Field Angle = 62°</p> <p>LOR = 82.4 %</p> <p>Beam = full width @ 50%</p> <p>Field = full width @ 90%</p>
51°	51			<p>Illuminance at Center</p> <p>Beam Diameter</p> <p>5' 143 fc 4.8'</p> <p>10' 36 fc 9.6'</p> <p>15' 16 fc 14.4'</p> <p>20' 9 fc 19.1'</p>	<p>CBCP = 3,564 cd</p> <p>Beam Angle = 51°</p> <p>Field Angle = 76°</p> <p>LOR = 83.0 %</p> <p>Beam = full width @ 50%</p> <p>Field = full width @ 90%</p>
83°	83			<p>Illuminance at Center</p> <p>Beam Diameter</p> <p>5' 72 fc 8.9'</p> <p>10' 18 fc 17.8'</p> <p>15' 8 fc 26.7'</p> <p>20' 5 fc 35.6'</p>	<p>CBCP = 1,802 cd</p> <p>Beam Angle = 83°</p> <p>Field Angle = 96°</p> <p>LOR = 84.8 %</p> <p>Beam = full width @ 50%</p> <p>Field = full width @ 90%</p>

Beam Shaping Options

Add the order code shown below to the options box at the end of the part number:

Order Code	Description
-HL	Honeycomb Louver
-DF	Diffusion Lens
-SF	Satin finish on any standard reflector
-LS	Linear Spread Lens (60° x 1°)
-WW	Wall Wash Lens (shifts beam 20° from vertical)

CORE 400 LX

UP + DOWN PENDANT

COLOR OPTIONS

Basic Powder Coat



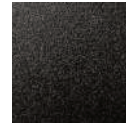
GW
Gloss White



SW
Satin White
AW Antimicrobial option



TW
Textured
Matte White



TB
Textured
Matte Black

Satin Anodized Effect Powder Coat



CS
Clear Silver



OB
Oil-Rubbed
Bronze



DB
Dark Bronze



SB
Satin Black

Metallic Powder Coat



SG
Silver Gray



CG
Charcoal
Gray



CU
Copper



BR
Brass

Gloss Powder Coat (80-95% Gloss)



GO
Orange
(RAL 2003)



GR
Red
(RAL 3020)



GM
Magenta
(RAL 4010)



GB
Blue
(RAL 5015)

Aluminum



BA
Brushed Aluminum
Cost adder applies.

Special Order



RAL _ _ _ _
Most RAL Classic Colors (80-95% Gloss) are available for powder coat - consult ALW. Minimum setup fee applies. See: alwusa.com/finishes for more information



CAT _ _ _ _
The complete range of powder coat colors from the Tiger Drylac and TCI catalogs are available - consult ALW. Minimum setup fee applies.

Custom



CCM _ _ _ _
Custom powder coat color matching is available - consult ALW. Premium setup fee applies.

Printed or on-screen colors are only approximations - consult actual Color Chip Set before specifying
Note: An individual setup fee will apply to each unique Special Order/Custom Finish per purchase order.
(ex: RAL 5023 and RAL 2008 are specified for multiple line items on a purchase order. 2x setup fees will apply)



trimless mud-in



trim flange



grid



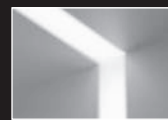
end detail



corner detail



regress lens



wall to ceiling
companion



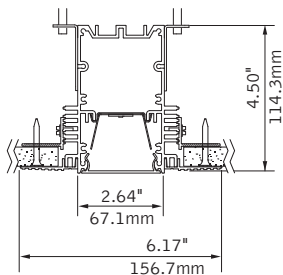
perimeter
companion



suspended & wall
mount companions

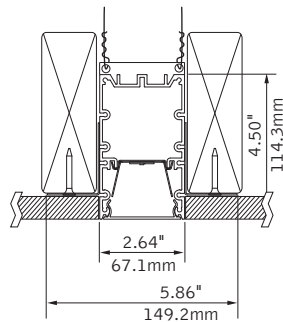
DIMENSIONAL DATA

trimless mud-in



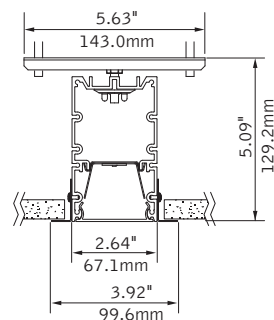
note: 0.375"min - 2.125"max ceiling thickness

trimless hard surface

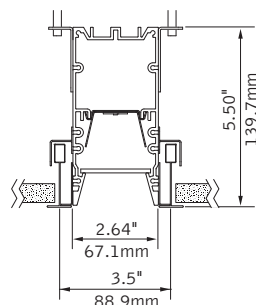


note: 0.375"min - 2.125"max ceiling thickness

trim flange



grid - regress lens shown



FEATURES

Narrow extruded aluminum 2.5" aperture recessed slot LED.

Integrates with ceiling or wall in a variety of mounting styles for a clean, unobtrusive aesthetic.

Individual units and continuous runs in 1" increments.

Frosted acrylic lens provides uninterrupted illumination, without pixels or shadows.

LED position and lens material optimized to provide the perfect blend of high performance and visual comfort.

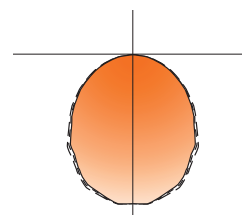
Connected Solutions: Integrates with wired and wireless building lighting control systems.

Preferred Light: Lighting for better color rendition and human preference.

PERFORMANCE

PRODUCT OVERVIEW

Lumen Output:	500-2500lm
Wattage:	5-43W
LPW:	71-89
SDCM:	3



4' Flush Lens
Nominal output:
250 Lumens per foot

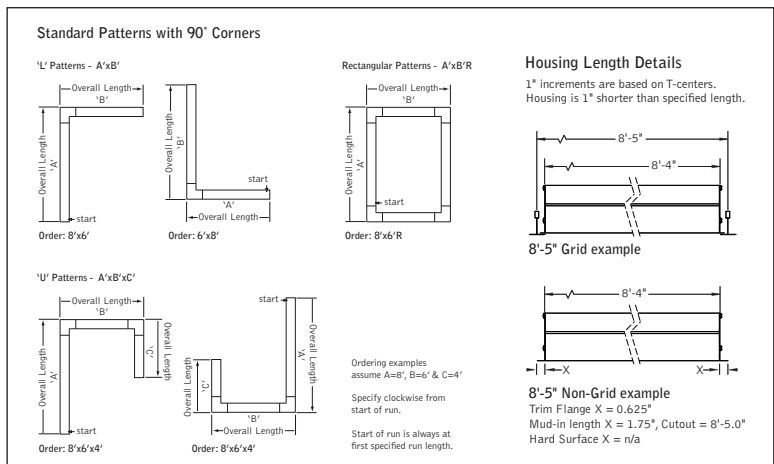
Delivered Lumens: 1000lm
Total System Watts: 14W

Photometric performance is measured in accordance with IESNA LM-79.
Visit focalpointlights.com for complete photometric data.

fixture:

project:

DETAILS



SPECIFICATIONS

LED System

Proprietary linear LED module incorporates premium LEDs on a robust platform to achieve excellent thermal management. LEDs are placed to promote a uniform appearance. Available in 2700K, 3000K, 3500K or 4000K with CRI>80 or CRI>90, 3SDCM. LED modules and drivers are replaceable from below.

Construction

One piece extruded aluminum housing. 20 Ga. steel end caps. Housing for new construction applications. 2' unit: 5.1 lbs., 3' unit: 7.6 lbs., 4' unit: 10.1 lbs., 5' unit: 12.6 lbs.

Optic

Reflectors fabricated of 22 Ga. steel finished in High Reflectance White powder coat. Extruded acrylic lens .07" thick with satin finish, up to 8' continuous.

Electrical

Luminaires are pre-wired with factory installed branch circuit wiring and over-molded quick connects. Standard 120-277V constant current driver includes 0-10V analog dimming. Power factor > .9.

Emergency

Emergency Battery output - 10 watts for 90 minutes. Maximum mounting height: 17.9ft. Emergency Circuit with Connected Solutions (NLT1, ENL1, CLM1, CLMZ1, DLM1) shipped standard with leads to connect UL924 compliant device, by others. See EM/EC Guide for default locations and ordering details.

Labels

UL and cUL listed. Suitable for Dry or Damp Locations, indoor use only.

Finish

Polyester powder coat applied over a multi-stage pre-treatment.

Lumen Maintenance

Reported: L70 at >61,000 hours Calculated: L70 at 270,000 hours
L90 at >61,000 hours L90 at 73,000 hours
(Derived from EPA TM-21 calculator. Based on typical conditions, consult factory for additional data.)

Reliability

At Focal Point, our products are designed to stand the test of time. Each luminaire is engineered using superior components, manufactured with the utmost care and rigorously tested. Contact us for reliability data.

Warranty

LED system rated for operation in ambient environments up to 25°C. 5-year limited warranty.

4' PERFORMANCE CHART

Shielding	Lumens per Foot	Delivered Lumens	Tested System Watts	LPW
Flush Lens	125LF	500	5	89
	250LF	1000	14	88
	375LF	1500	18	88
	625LF	2500	31	87
Regress Lens	125LF	500	7	72
	250LF	1000	16	72
	375LF	1500	26	71
	625LF	2500	43	72
Regress High Performance Lens	125LF	500	6	84
	250LF	1000	13	83
	375LF	1500	19	84
	625LF	2500	33	83

Based on 3500K, 80 CRI, 4' lengths. Lumen multipliers: Preferred Light = 0.65, 90+ CRI = 0.87. Lumen output may vary +/- 5%. Actual wattage may vary +/- 5%.

Focal Point LLC reserves the right to change specifications for product improvement without notification.

ORDERING

Luminaire Series

Seem 2 LED

Shielding

Flush Satin Lens

Regress Lens

(Housing height 5.5". Ceiling applications only)

Regress High Performance Lens

(Housing height 5.5". Ceiling applications only)

Lumen Output

125 Lumens per foot

(LD1, L11 & D11 only. 4' minimum.)

250 Lumens per foot

(Not available with LU5 & LH1. 4' minimum with D11 & FL lens.)

375 Lumens per foot

(4' minimum with LU5 & LH1 or D11 with FL lens.)

625 Lumens per foot

(3' minimum with LU5 & LH1)

Color Temperature

2700K, 80+ CRI or 90+ CRI

3000K, 80+ CRI or 90+ CRI

3500K, 80+ CRI or 90+ CRI

4000K, 80+ CRI or 90+ CRI

3500K, Preferred Light

(Flush Lens only. 6" increments.

Not available with Emergency Battery or patterns.)

Circuit

Single Circuit

Voltage

UNV 120/277 Volt

Control System & Dimming Level

0-10V - 10% Dimming

0-10V - 1% Dimming

Lutron Hi-Lume EcoSystem (LDE1) -

1% Dimming

Lutron 5-Series EcoSystem (LDE5) -

5% Dimming

DALI 1% Dimming

Acuity nLight - 1% Dimming

(3' minimum length. Not available with CP. Grid only.)

Enlighted Smart Sensor - 1% Dimming

(3' minimum length. Grid only.)

Osram Connected Lighting Module for

ENCELIUM systems - 1% Dimming

(3' minimum length. Grid only. Compatible with Osram

ENCELIUM and ENCELIUM EDGE systems only.)

Osram Connected Lighting Module for

ZigBee Wireless Networks - 1% Dimming

(3' minimum length. Grid only.

Not compatible with Osram ENCELIUM systems.)

Wattstopper® DLM - 1% Dimming

(3' minimum length. Grid only.)

Ceiling Configuration

Std. 15/16" Lay-in

Std. 15/16" Tegular

Std. 9/16" Lay-in

Std. 9/16" Tegular

9/16" Slot-tee Tegular

Tall 15/16" Lay-in

Tall 15/16" Tegular

Tall 9/16" Lay-in

Tall 9/16" Tegular

Node 9/16" Tegular

Trim Flange Drywall

Trim Flange Wood

Mud-in Trimless, pre-set for 1/2" Drywall

Mud-in Trimless, pre-set for 5/8" Drywall

Mud-in Trimless, set thickness in field

(Mounting equipment assembled in field)

Non-Drywall Hard Surface

Hard Surface, Wood

Factory Options

Chicago Plenum

Emergency Circuit*

(4' minimum. 7' minimum with CLM1, CLMZ1, DLM1, ENL1 & NLT1.)

Emergency Battery Pack*

(4' minimum. 7' minimum with CLM1, CLMZ1, DLM1,

ENL1 & NLT1. Not available at corners.

See EM/EC Guide for default locations and ordering details.)

6' New York City Flex Whip (120V)

6' New York City Flex Whip (277V)

6' Flex Whip

Finish

Matte White Housing

Luminaire Length

Specify luminaire/row length in 1" increments

(2' minimum, lengths are nominal 1" increments based on

T-centers. Housing length is 1" shorter than specified. Leave

blank for patterns. Smaller increments available, consult factory.)

Pattern Options

(3' minimum length)

'L' pattern

'U' pattern

Rectangular pattern

(Consult factory for other pattern options)

FSM2L

1C

UNV

LD1

LH1

LU5

D11

NLT1

ENL1

CLM1

CLMZ1

DLM1

G1

T1

G2

T2

G3

G4

T4

G5

T5

T6

TF

TFW

XF1

XF2

XFF

XFN

XFW

CP

_EC

_EM

FNY1

FNY2

FW

WH

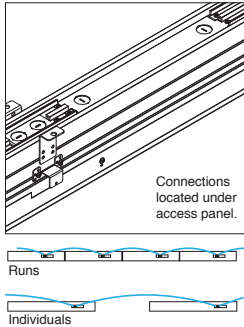
ft in



Options in orange qualify for the Quickship program. 400' total. Refer to Quickship Guide for complete details including EM/EC options.

For more information visit focalpointlights.com/reference or consult factory.

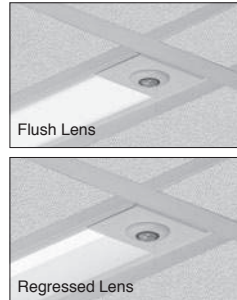
Focal Point provides flexibility in meeting the needs of each project by integrating with several building lighting control systems. A variety of sensors, drivers and other components can be specified that allow the luminaires to communicate with wired and wireless networks. All zoning can be digitally reconfigured through the application software. Daylight harvesting, occupancy sensing, integration with HVAC systems, and individual controls enable the monitoring and modulating of light levels and temperature in order to save energy, reduce costs and maximize occupants' comfort. All Connected Solutions luminaires require a compatible building control system.†



nLight[®] provides a two-way wired digital lighting system allowing for on/off and dimming functionality, occupancy sensing, and multi-zone daylight harvesting.

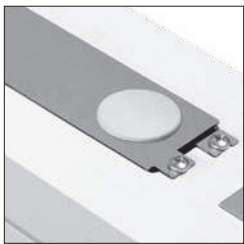
Acuity nLight - 1% Dimming (NLT1)
Acuity Model #nEPS-60-IO

CAT-5 Cable provided by others. Serial labels will be provided on outside of luminaires and control unit.



Enlighted smart sensor allows for occupancy sensing, daylight harvesting, energy usage, temperature and light level control. Communicates wirelessly with the Enlighted network.

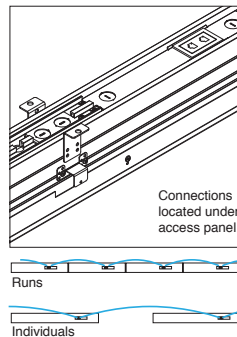
Enlighted Smart Sensor - 1% Dimming (ENL1)
Enlighted Model SU-5E-IOT



Connected Lighting Module (CLM) enables each luminaire to be independently controlled and configured. Communicates wirelessly with Daintree Networks[®], Osram ENCELIUM[®], Osram ENCELIUM EDGE[™], and other networks using the ZigBee[®] HA communication protocol to allow for on/off and dimming functionality, occupancy sensing and multi-zone daylight harvesting.

Osram CLM - 1% Dimming (CLM1 & CLMZ1)
Osram Model #ZBHA-CLM DIM

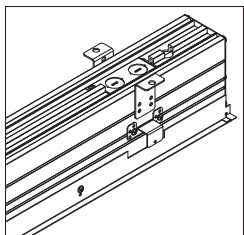
Serial labels will be provided on outside of luminaires and control unit.



A Digital Lighting Management (DLM) system that provides two-way wired communication between networked luminaires and control system to allow for on/off and dimming functionality, occupancy sensing and multi-zone daylight harvesting.

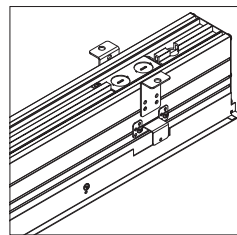
Wattstopper DLM - 1% Dimming (DLM1)
Wattstopper Model #LMFC-011

CAT-5 Cable provided by others. Serial labels will be provided on outside of luminaires and control unit.



A two-way digital network that enables on/off and dimming functionality, occupancy sensing, and multi-zone daylight harvesting working with Quantum[®], Energi Savr Node[™], and Energi TriPak[®] using EcoSystem[®] communication protocol.

Lutron Hi-Lume EcoSystem - 1% Dimming (LH1)
Lutron Model #LDE1
Lutron 5-Series EcoSystem - 5% Dimming (LU5)
Lutron Model #LDE5



A two-way digital network that enables on/off and dimming functionality, occupancy sensing, and multi-zone daylight harvesting. Communicates with Züm wireless and SpaceBuilder working with Züm hub scheduling or FUSION management.

DALI - 1% Dimming (D11)
0-10V - 1% Dimming (L11)

Note: 0-10V is not a digital network but is compatible with Creston Züm[™] system.

CONNECTED SOLUTIONS DETAILS

Connected Solution	Model #	Protocol	Compatible Networks*	Occupancy	Daylight	Temperature Reporting	Communication to Luminaire	Drivers
Acuity nLight (NLT1)	nEPS-60-IO**	nLight	nLight	Enabled	Enabled	No	Wired	eldoLED ECOdrive , eldoLED SOLOdrive
Crestron (D11, L11)	Specified Driver	DALI 0-10V	Crestron Züm Wireless & SpaceBuilder	Enabled	Enabled	No	Wired	eldoLED ECOdrive (DALI) , Advance by Signify
Enlighted Smart Sensor (ENL1)	SU-5E-IOT**	Enlighted RF	Enlighted	Integrated	Integrated	Yes	Wireless	Advance by Signify , Osram Optotronic
Legrand Wattstopper DLM (DLM1)	LMFC-011**	DLM	DLM	Enabled	Enabled	No	Wired	Advance by Signify , Osram Optotronic
Lutron EcoSystem (LH1 & LU5)	LDE1**, LDE5**	EcoSystem	Quantum, Energi Savr Node, Energi TriPak	Enabled	Enabled	No	Wired	Lutron Hi-Lume Lutron 5-Series
Osram CLM for ENCELIUM systems (CLM1)	ZBHA-CLM**	ZigBee HA	Osram ENCELIUM & ENCELIUM EDGE	Enabled	Enabled	No	Wireless	Osram Optotronic
Osram CLM for ZigBee Wireless Networks (CLMZ1)	ZBHA-CLM**	ZigBee HA	Daintree Networks & open ZigBee Networks	Enabled	Enabled	No	Wireless	Osram Optotronic

*Not all compatible networks may be listed. **For performance data and additional control system details please visit the connected solutions manufacturer websites. Primary drivers are listed in **bold**. To specify a particular driver please consult factory. †Controls systems supplied by others.

Item # 4650-579	UPC Code: 747396105178
Product Family Name: Elyton	Finish: Downtown Bronze with Gold Highlights
Category: MINI-PENDANTS	Category Type: Mini Pendant
Certification E314733	
Patents:	
Notes:	



Image File Name: **4650-579.jpg**



MEASUREMENTS

Width: 3.25	Length: 3.25	Height: 7.75	Extension:
Height Adjustable: Yes	Min Overall Height: 18.5	Max Overall Height: 54.53	Slope: Yes
Wire Length: 72"	Chain Length:	Safety Cable Included: No	Net Weight: 2.73
Canopy Width: 4.75	Canopy Height: 0.75	Canopy Length: 4.75	Center to Bottom:
Backplate Width:	Backplate Height:	Center to Top:	

LAMPING

No. of Bulbs: 1	Light Type: T10,CAND			
Max Bulb Wattage: 60	Socket: E26,CAND			
Dimmable: Yes	Ballast:	Rated Life Hours:	Photocell Included: No	Bulb/LED Included:
Bulb/LED Included:	Color Temp.:	CRI:	Initial Lumens:	Delivered Lumens:

SHADE / GLASS

Description:	Material: GLASS
Part No.: G4653	Quantity: 1
Width: 3.15	Height: 6.97
	Length: 3.15



SHIPPING

Carton Width: 7.13	Carton Height: 6.13	Carton Length: 17.38
Carton Weight: 3.32	Carton Cubic Feet: 0.44	Small Package Shippable: Yes
Master Pack Width:	Master Pack Height:	Master Pack Length:
Master Pack Weight:	Master Cubic Feet:	Multi-Pack: Master Pack: 1 1



UL Listed



WARNING: Handling this product can expose you to chemicals including lead, which is known to the State of California to cause cancer and birth defects or other reproductive harm. Wash hands with soap and water after installing, handling, cleaning or otherwise touching this product. For more information go to: www.P65Warnings.ca.gov.

For additional information, please contact Customer Care: 1-800-221-7977 | Product depicted on this spec sheet is protected by United States Federal and/or State laws including US Patent, Trademark and/or Copyright and unfair competition laws. Unauthorized reproduction or use carries severe legal penalties.

Rev 08.05.2019 02:01 PM

DATE	PROJECT	FIRM	TYPE O, OA
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THE L50 INCLUDES PATENTED OPTICAL DESIGN THAT DELIVERS THE WIDEST RANGE OF BEAM ANGLE OPTIONS FOR PRECISE COVE, WALL GRAZING, WALL WASHING OR LINE OF LIGHT APPLICATIONS. EXCLUSIVE FLIP TO FLAT™ HINGE DESIGN PROVIDES FLEXIBILITY WHEN MANAGING SMALL COVE DETAILS. TROV OFFERS SMOOTH, FLICKER FREE DIMMING DOWN TO 0%.

FEATURES :

- DIM TO 0%, ELV REVERSE PHASE
- 24 BEAM ANGLES
- MULTI-VOLT
- FLIP TO FLAT™
- 6 CCT OPTIONS
- 80+ AND 90+ CRI OPTIONS
- IP54 INTERIOR AND IP66 EXTERIOR OPTIONS

MODEL/ SIZE	INTERIOR/ EXTERIOR	LENGTH	POWER	CCT	CRI	VOLTAGE	OPTICS
L50	I E	12" 48"	02 04 06 08 10 12	WHITE CCT 22 27 30 35 40 50	MONO COLOR GR**** BL AM RD***	80 90* Blank For Color	MULT (120-277V) GRAZING 9 x 9 9 x 17 9 x 29 9 x 59 15 x 15 15 x 23 15 x 35 15 x 65 COVE 120** Asym LINE OF LIGHT LOL WASHING 25 x 25 25 x 33 25 x 45 25 x 75 39 x 9 55 x 25 40 x 40 40 x 48 40 x 60 40 x 90 45 x 15 70 x 40 70 x 70

EXAMPLE: L50-I-48-10-27-90-MULT-15x65 *90 CRI not available in 2200K or 5000K **120 is only available with Exterior option. See L35 spec sheet for interior cove options. ***Red is not available in 12W or 10W. ****Green is not available in 12W.

PERFORMANCE	WATTS	OPTIC	LUMEN OUTPUT	EFFICACY
	2W	40°x 60°	110 lm/LF (361 lm/m)	55 lm/W
	4W	40°x 60°	302 lm/LF (1037 lm/m)	76 lm/W
	6W	40°x 60°	482 lm/LF (1614 lm/m)	80 lm/W
	8W	40°x 60°	675 lm/LF (2224 lm/m)	84 lm/W
	10W	40°x 60°	785 lm/LF (2644 lm/m)	79 lm/W
	12W	40°x 60°	923 lm/LF (3201 lm/m)	77 lm/W

ALL LUMEN DATA IS FROM 4000K 80CRI FIXTURES. PLEASE SEE PHOTOMETRY SPEC SHEET FOR ADDITIONAL LUMEN DATA.

COLOR RENDERING INDEX	80+, 90+					*CALCULATIONS FOR LED FIXTURES ARE BASED ON MEASUREMENTS THAT COMPLY WITH IES LM-80 TESTING PROCEDURES AND IES TM-21 CALCULATOR
COLOR CONSISTENCY	2-STEP MACADAM ELLIPSE					
LUMEN DEPRECIATION / RATED LIFE	WATTS	L70 @ 25C	L70 @ 50C	L90 @ 25C	L90 @ 50C	
	2W-12W	>150,000	>70,000	>50,000	>25,000	

* CALCULATIONS FOR LED FIXTURES ARE BASED ON MEASUREMENTS THAT COMPLY WITH IES LM-80 TESTING PROCEDURES AND IES TM-21 CALCULATOR

ELECTRICAL

POWER CONSUMPTION

2W*/LF (6.6W/M); 4W/LF (13.2W/M); 6W/LF (19.8W/M); 8W/LF (26.4W/M); 10W/LF (33W/M); 12W/FL (39.6W/M)
* 3W/LF (9.9W/M) at 220V -277V

MAX FIXTURE RUN LENGTH

	2W/LF		4W/LF		6W/LF		8W/LF		10W/LF		12W/LF	
Volts	Max Run all 1'	Max Run all 4'	Max Run all 1'	Max Run all 4'	Max Run all 1'	Max Run all 4'	Max Run all 1'	Max Run all 4'	Max Run all 1'	Max Run all 4'	Max Run all 1'	Max Run all 4'
120	214	214	186	186	152	152	114	114	91	91	76	76
220	374	392	340	340	277	277	209	209	95	167	95	139
277	374	494	374	428	349	349	263	263	95	190	95	175

POWER FACTOR
4W, 6W, 8W, 10W, 12W >0.9, 2W<0.9





OPERATING VOLTAGE
MULTIVOLT: 110-277VAC, 50/60 Hz

DRIVER
INTEGRAL TO FIXTURE; DE-RATED POWER AND SYNCHRONOUS START-UP AT FULL BRIGHTNESS

STARTUP TEMPERATURE
-40°F TO 122°F (-40°C TO 50°C)

OPERATING TEMPERATURE
-40°F TO 122°F (-40°C TO 50°C)

STORAGE TEMPERATURE
-40°F TO 176°F (-40°C TO 80°C)

DATE	PROJECT	FIRM	TYPE
CONTROL	DIMMING	110-277VAC, ELV TYPE 0.07%-100%, REVERSE PHASE, TRAILING EDGE ETC control systems require 0-10V control using EcoSense LDCM. TROV will not work with ETC phase dimmers.	
PHYSICAL	DIMENSIONS HOUSING / LENS	W 1.6" x H 2" x L 12"/48" ; (41.6mm x 50.5mm x 304.7mm/1201mm) EXTRUDED ALUMINUM; UV STABILIZED POLYCARBONATE; STAINLESS STEEL FASTENERS; PLASTIC ENDCAPS RUBBER OVERMOLD FOR CABLE ASSEMBLY	
	WEIGHT CONNECTORS ENVIRONMENT	1.52LBS / 0.69KG (1FT) ; 4.95LBS / 2.25KG (4FT) INTEGRAL MALE/ FEMALE CONNECTORS INDOOR • ETL CERTIFIED FOR DRY/DAMP LOCATIONS IP54 OUTDOOR • ETL CERTIFIED FOR WET LOCATIONS IP66 IMPACT RATED TO IK10 Not intended to be used in water features such as waterfalls, fountains, etc.	
	BEAM ANGLE MOUNTING OPTIONS	GRAZING, WASHING, COVE, ASYMMETRIC, LINE OF LIGHT INTEGRAL MOUNTING AND ADJUSTABLE AIMING FROM 0°-180° IN 15° INCREMENTS	
FIXTURE RATING & CERTIFICATIONS	CE, ETL CERTIFIED RoHS COMPLIANT ENERGY STAR COMPLIANT RCM CERTIFIED	    	
LIMITED WARRANTY	5 YEARS		

WIRING OPTIONS (MVOLT): 110-277VAC

Power Cable Assembly, TROV, Leader/Jumper, 10 foot.....	CBL-3P-L-UNV-10*
Power Cable Assembly, TROV, Leader/Jumper, 50 foot.....	CBL-3P-L-UNV-50*
Power Cable Assembly, TROV, Jumper, 5 foot.....	CBL-3P-L-UNV-05**
Power Cable Assembly, TROV, Jumper, 1 foot	CBL-3P-L-UNV-01**
Power Cable Assembly, TROV, Male and Female terminator caps.....	CBL-3P-L-UNV-CAPS

*Two (2) terminators are included with the 10' and 50' power cable. One Leader need per circuit/fixture run. Cables are not plenum rated.

** If using the 5' or 1' power cable assembly as a leader to power a run one set of CBL-3P-L-UNV-CAPS will also be need per cable.

0-10V CONTROL OPTIONS

100-120VAC / 277VAC Linear Dimming Control Module 0-10V - Plenum Rated	LDCM-PL-120-277-010V-GR
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All products come standard with ELV dimming capabilities. 0-10V Control options required for operation at 0-10V.

OPTIONAL ACCESSORIES**Mounting**

Mounting Track and Clips Set, 48 Inch Track, 8 Clips	MNT-L-TRKCLIP-48	48" track and clips set will work with one 48" fixture or four 12" fixtures.
Mounting Track and Clips Set, 12 Inch Track, 2 Clips.....	MNT-L-TRKCLIP-12	12" track will not work with 48" fixtures.
Mounting Track Clip, TROV, Set of 2.....	MNT-L-CLIP	Clips needed = 12" fixtures need 1 set of 2 and 48" fixture needs 2 sets of 2.
90 Degree L bracket, TROV, Set of 2	MNT-L-LBKT	L-Brackets needed = 12" fixtures need 1 set of 2 and 48" fixture needs 1 set of 2.
Angle Locking Clip, TROV, Pack of 10.....	MNT-L-ANGLOCK	Angle Locks needed = 12" fixtures need 1 and 48" fixtures need 2. (Must order separately)
Mounting, Fine Adjustment Bracket, TROV	MNT-L-FAB	Fine Adjustment Brackets needed = 12" fixtures need 1 and 48" fixtures need 2.
*Fine Adjustment Bracket is highly recommended for Grazing Optics.		
Mounting, Fine Adjustment L-Bracket, TROV	MNT-L-LFAB	Fine Adjustment L-Brackets needed = 12" fixtures need 1 and 48" fixtures need 2.
*Fine Adjustment L-Bracket is recommended for Asymetric Optics when aiming is needed.		

Snap-on Lenses

Snap-on Lens, Frosted, 12 inch, L50	LENS-L50-FROST-12
Snap-on Lens, Frosted, 48 inch, L50	LENS-L50-FROST-48
Snap-on Lens, Clear, 12 inch, L50	LENS-L50-CLEAR-12
Snap-on Lens, Clear, 48 inch, L50	LENS-L50-CLEAR-48

Snap-on Lenses need = One 12" lens is needed per 12" fixture and one 48" lens is needed per 48" fixture. Snap on Lenses will not work with the asymmetric fixture. Clear lenses can be used to hold colored filters to customize the output color of any TROV fixture, except the ASYM. Color filters supplied by others.

Wall Mount Arm

Wall Mount Arm, 6 inch, TROV	WMA-L-CA-06
Wall Mount Arm, 12 inch, TROV	WMA-L-CA-12
Wall Mount Arm, 18 inch, TROV	WMA-L-CA-18
Wall Mount Arm, 24 inch, TROV	WMA-L-CA-24
Wall Mount Arm End Plate Set, TROV, Includes Left and Right.....	WMA-L-END
Wall Mount Arm Joiner Plate, TROV	WMA-L-JNR

Wall Mount Arms needed = For individual fixture installations two arms and one end set will be needed per fixture. For continuous run installation one endset will be needed per run. Each end set contains one left and one right end plate. One joining set will be needed per joint. One arm per fixture will be need plus one extra arm to complete the run. For example: A 10ft run made with two 4ft and two 1ft fixtures will contain; 1 x WMA-L-END, 3 x WMA-L-JNR, and 5 x WMA-L-CA-12. Leader cables are not included with wall mount arms, end sets, or joiners sets.

Louvers

Louver, Asymmetric, 12 inch, L50	LV-L50-ASYM-12
Louver, Asymmetric, 48 inch, L50	LV-L50-ASYM-48
Louver, Symmetric, 12 inch, L50	LV-L50-SYM-12
Louver, Symmetric, 48 inch, L50	LV-L50-SYM-48
Louver, Honeycomb, 12 inch, L50	LV-L50-HCOMB-12
Louver, Honeycomb, 48 inch, L50	LV-L50-HCOMB-48

Louvers Needed = One 12" louver is needed per 12" fixture and one 48" louver is needed per 48" fixture. 48" louver is made up of four 12" louvers. Louvers cannot be used with the asymmetric fixture



TYPE X, X2

LES Series

Surface-Mount AC Edge-Lit LED Exit Sign

Catalog Number	
Comments	Type

FEATURES

Application

The LES Series provides bright, even letter illumination in an energy-saving LED edge-lit exit sign configuration. AC only operation. Special Wording ("SW") option allows customizing the stencil field to convey important information.

Construction

Water-clear injection-molded acrylic EXIT plaque is available with clear, white or mirror backgrounds. High strength extruded aluminum trim available in six finishes. Exit face design in single or double face with red or green letters. Custom printed directional chevron arrows. Standard EXIT stencil with 6" letters and 3/4" stroke.

Installation

Mounts to standard electrical boxes up to 4" square via universal adaptor plate and mounting canopy assembly. All mounting hardware is fully concealed.

Illumination

Exit face illumination is provided by energy saving, long life red or green LEDs. Exceeds UL 924 requirements for brightness and uniformity.

Compliances

UL 924 Listed
NFPA 70
NFPA 101
CEC T20 Compliant

Warranty

5 years full



Ceiling Mount



Wall Mount



End Mount



Special Wording Option

ORDERING GUIDE

LES

Model	Mounting	Faces	Letter Color	Arrows	Finish	Operation	Options
	C Ceiling mount W Wall mount E End mount	S Single D Double ⁵	R Red G Green	X No arrows EXIT R *Right arrow ³ EXIT> L *Left arrow ³ <EXIT D Double arrows <EXIT> C **L/R arrows ⁴ <EXIT/EXIT>	N Satin Aluminum W White C Chrome B Black S Satin Brass Z Dark Bronze	A AC Only	SW See available special wording choices on page 3 ² W White plaque background M Mirror-plaque background ¹

*not for use with double face models.

Use "C" L/R arrow designator

**Double face models only. Provides reversible right or left arrow indicator

1 For use with single face models only. Standard on double face models

2 Enter Special Wording choice on page 3 example: SW41. Special wording option not available with 8" letter plaque. Some special wording signs not available with directional arrows

3. Not for use with double face models. Use "C" L/R arrows designator

4. Double face models only. Provides reversible right or left arrow indicator

5. Not for use with wall mounted models



LES Series

Surface-Mount AC Edge-Lit LED Exit Sign

SPECIFICATIONS

Electronics

Available in AC only operation. All components mounted inside housing. Includes AC-on indicator and pre-stripped AC input pigtail leads.

AC Input: 120/277VAC, 60 Hz.

Operating Temperature Range: 20°C to 30°C (68°F to 86°F)

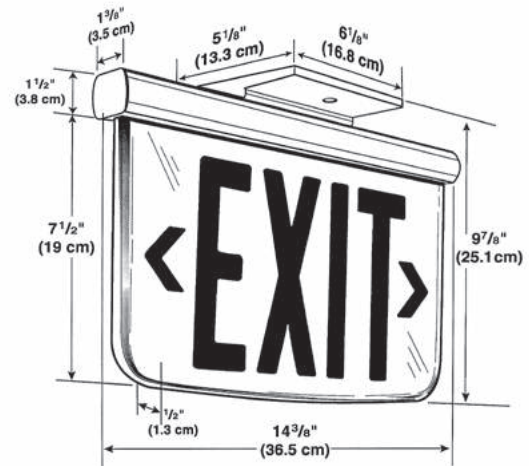
Power Consumption: (120/277VAC)

POWER CONSUMPTION

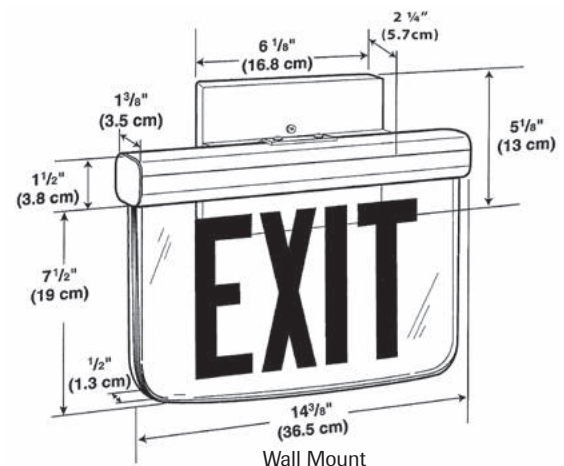
Model	Single Face	Double Face
Red AC Only	2.2 watts	3.4 watts
Green AC Only	2.5 watts	4.0 watts

* Wattage figures include LED lamps, transformer and electronics power requirements.

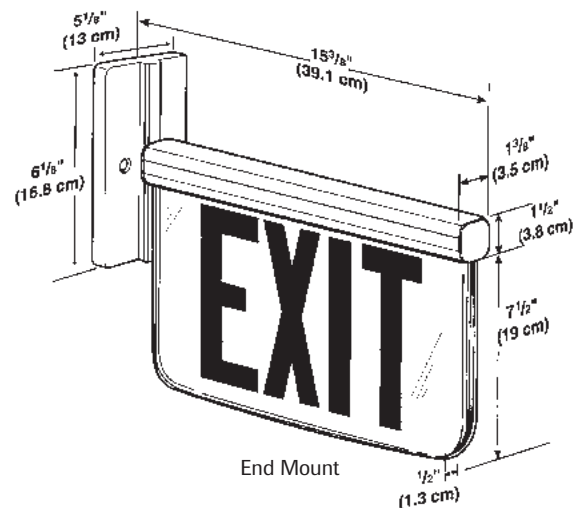
DIMENSIONS



Ceiling Mount



Wall Mount



End Mount



LES Series

Surface-Mount AC Edge-Lit LED Exit Sign

LES Series architectural surface-mounted LED edge-lit exit signs feature an option for standard or custom special-wording. The images below represent standard special-worded signs available for the LES Series. The artwork and silk-screening for the standard signs shown below were previously developed therefore pricing for these special-worded signs do not incur a setup charge. If your special-worded requirements do not appear on this page, please contact the factory to request your custom special-wording sign. Custom special wording signs incur a one time set-up charge for each development.

STANDARD SPECIAL WORDING SIGNS WITH DIRECTIONAL ARROWS



SW118



SW41 (Arabic/Exit)



SW13



SW10



SW69



SW11

STANDARD SPECIAL WORDING SIGNS WITHOUT DIRECTIONAL ARROWS



SW4



SW3



SW31



SW2

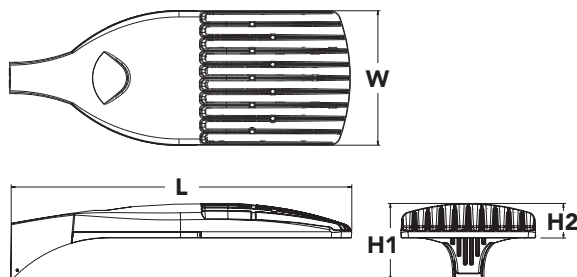
STANDARD SPECIAL WORDING SIGNS

Category	Special Wording Number	Description
EXIT	SW 2	NOT AN EXIT
	SW 142	EXIT (TEXT IS INVERTED)
	SW 144	EXIT (W/ WHEELCHAIR SYMBOL)
DO NOT ENTER	SW 3	IN USE
EVACUATION	SW 10	AREA OF REFUGE
	SW 11	AREA OF REFUGE WITH WHEELCHAIR SYMBOL
	SW 13	AREA OF RESCUE ASSISTANCE WITH WHEELCHAIR SYMBOL
	SW 48	STAIRS
	SW 149	AREA OF/ RESCUE
LABORATORY	SW 4	X-RAY IN USE
	SW 31	LASER IN USE
	SW 181	BEAM OFF
RESTROOM/FACILITIES	SW 118	HANDICAPPED (SYMBOL ONLY)
INTERNATIONAL EXITS	SW 41	ARABIC/ EXIT
	SW 69	SALIDA
	SW 165	SALIDA (INVERTED TEXT)
AREA/ALERTS	SW 178	EMERGENCY CALL STATION
	SW 180	ELEVATOR (NO CHEVRONS)

NOTE: Special worded signs do not meet letter size requirements of UL 924.



EPA:	1.01 ft ² (0.09 m ²)
Length:	33" (83.8 cm)
Width:	13" (33.0 cm)
Height H1:	7-1/2" (19.0 cm)
Height H2:	3-1/2"
Weight (max):	27 lbs (12.2 kg)



Number

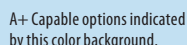
Type

Z, ZA

Hit the Tab key or mouse over the page to see all interactive elements

The modern styling of the D-Series is striking yet unobtrusive - making a bold, progressive statement even as it blends seamlessly with its environment. The D-Series distills the benefits of the latest in LED technology into a high performance, high efficacy, long-life luminaire.

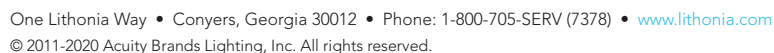
The outstanding photometric performance results in sites with excellent uniformity, greater pole spacing and lower power density. It is ideal for replacing up to 750W metal halide in pedestrian and area lighting applications with typical energy savings of 65% and expected service life of over 100,000 hours.



EXAMPLE: DSX1 LED P7 40K T3M MVOLT SPA NLTAIR2 PIRHN DDBXD

DSX1 LED						
Series	LEDs	Color temperature	Distribution	Voltage	Mounting	
DSX1 LED	Forward optics	30K 3000 K	T1S Type I short	T5VS Type V very short ²	MVOLT ⁴	Shipped included
	P1 P4 P7	40K 4000 K	(Automotive)	T5S Type V short ²	120 ⁵	SPA Square pole mounting
	P2 P5 P8	50K 5000 K	T2S Type II short	T5M Type V medium ²	208 ⁵	RPA Round pole mounting
	P3 P6 P9		T2M Type II medium	T5W Type V wide ²	240 ⁵	WBA Wall bracket ²
	Rotated optics		T3S Type III short	BLC Backlight control ³	277 ⁵	SPUMBA Square pole universal mounting adaptor ⁶
	P10 ¹ P12 ¹		T3M Type III medium	LCCO Left corner cutoff ³	347 ⁵	RPUMBA Round pole universal mounting adaptor ⁶
	P11 ¹ P13 ¹		T4M Type IV medium	RCCO Right corner cutoff ³	480 ⁵	Shipped separately
			TFTM Forward throw medium			KMA8 DDBXD U Mast arm mounting bracket adaptor (specify finish) ⁷

Control options		Other options		Finish <i>(required)</i>				
Shipped installed		Shipped installed		Shipped installed				
NLTAIR2	nLight AIR generation 2 enabled ⁸	PIR	High/low, motion/ambient sensor, 8–15’ mounting height, ambient sensor enabled at 5fc ^{16,17}	HS	House-side shield ¹⁸	DDBXD	Dark bronze	
PIRHN	Network, high/low motion/ambient sensor ⁹	PIRHS	High/low, motion/ambient sensor, 15–30’ mounting height, ambient sensor enabled at 5fc ^{16,17}	SF	Single fuse (120, 277, 347V) ⁵	DBLXD	Black	
PER	NEMA twist-lock receptacle only (controls ordered separate) ¹⁰	PIR1FC3V	High/low, motion/ambient sensor, 8–15’ mounting height, ambient sensor enabled at 1fc ^{16,17}	DF	Double fuse (208, 240, 480V) ⁵	DNAXD	Natural aluminum	
PER5	Five-pin receptacle only (controls ordered separate) ^{10,11}	PIRHS1FC3V	Bi-level, motion/ambient sensor, 15–30’ mounting height, ambient sensor enabled at 1fc ^{16,17}	L90	Left rotated optics ¹	DBTBD	Textured dark bronze	
PER7	Seven-pin receptacle only (controls ordered separate) ^{10,11}	FAO	Field adjustable output ¹⁵	R90	Right rotated optics ¹	DBLBD	Textured black	
DMG	0–10v dimming wires pulled outside fixture (for use with an external control, ordered separately) ¹³				Shipped separately	DNATXD	Textured natural aluminum	
DS	Dual switching ^{13,14,15}				BS	Bird spikes ¹⁹	DWHGXD	Textured white
					EGS	External glare shield		



Ordering Information

Accessories

Ordered and shipped separately.

DLL127F 1.5 JU	Photocell - SSL twist-lock (120-277V) ²⁰
DLL347F 1.5 CUL JU	Photocell - SSL twist-lock (347V) ²⁰
DLL480F 1.5 CUL JU	Photocell - SSL twist-lock (480V) ²⁰
DSHORT SBK U	Shorting cap ²⁰
DSX1HS 30C U	House-side shield for P1, P2, P3, P4 and P5 ¹⁸
DSX1HS 40C U	House-side shield for P6 and P7 ¹⁸
DSX1HS 60C U	House-side shield for P8, P9, P10, P11 and P12 ¹⁸
PUMBA DDBXD U*	Square and round pole universal mounting bracket (specify finish) ²¹
KMA8 DDBXD U	Mast arm mounting bracket adaptor (specify finish) ⁷
DSX1EGS (FINISH) U	External glare shield

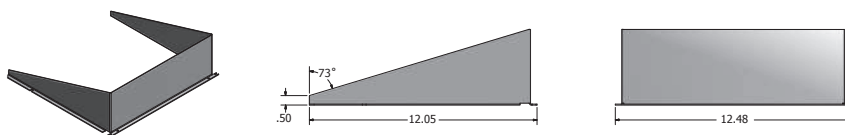
For more control options, visit [DTL](#) and [ROAM](#) online.

NOTES

- P10, P11, P12 or P13 and rotated optics (L90, R90) only available together.
- Any Type 5 distribution with photocell, is not available with WBA.
- Not available with HS.
- MVOLT driver operates on any line voltage from 120-277V (50/60 Hz).
- Single fuse (SF) requires 120V, 277V or 347V. Double fuse (DF) requires 208V, 240V or 480V.
- Universal mounting brackets intended for retrofit on existing, pre-drilled poles only. 1.5 G vibration load rating per ANCI C136.31.
- Must order fixture with SPA option. Must be ordered as a separate accessory; see Accessories information. For use with 2-3/8" mast arm (not included).
- Must be ordered with PIRHN. Sensor cover available only in dark bronze, black, white and natural aluminum colors.
- Must be ordered with NLTAR2. For more information on nLight Air 2 visit [this link](#).
- Photocell ordered and shipped as a separate line item from Acuity Brands Controls. See accessories. Not available with DS option. Shorting cap included.
- If ROAM[®] node required, it must be ordered and shipped as a separate line item from Acuity Brands Controls. Node with integral dimming.
- DMG not available with PIRHN, PER5, PER7, PIR, PIRH, PIR1FC3V or PIRH1FC3V.
- Provides 50/50 fixture operation via (2) independent drivers. Not available with PER, PER5, PER7, PIR or PIRH. Not available P1, P2, P3, P4 or P5.
- Requires (2) separately switched circuits with isolated neutral. See Outdoor Control Technical Guide for details.
- Reference Motion Sensor table on page 4.
- Reference controls options table on page 4 to see functionality.
- Not available with other dimming controls options
- Not available with BLC, LCCO and RCCO distribution. Also available as a separate accessory; see Accessories information.
- Must be ordered with fixture for factory pre-drilling.
- Requires luminaire to be specified with PER, PER5 or PER7 option. See PER Table on page 3.
- For retrofit use only.

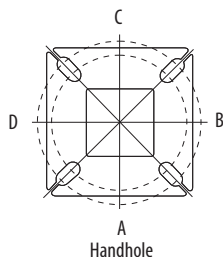
Options

EGS - External Glare Shield



Drilling

HANDHOLE ORIENTATION



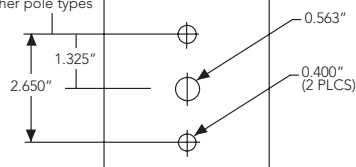
Tenon Mounting Slipfitter**

Tenon O.D.	Mounting	Single Unit	2 @ 180	2 @ 90	3 @ 120	3 @ 90	4 @ 90
2-3/8"	SPA/RPA	AS3-5 190	AS3-5 280	AS3-5 290	AS3-5 320	AS3-5 390	AS3-5 490
	SPUMBA	AS3-5 190	AS3-5 280	AS4-5 290	AS3-5 320	AS4-5 390	AS4-5 490
	RUPUMBA	AS3-5 190	AS3-5 280		AS3-5 320		
2-7/8"	SPA/RPA	AST25-190	AST25-280	AST25-290	AST25-320	AST25-390	AST25-490
	SPUMBA	AST25-190	AST25-280		AST25-320		
	RUPUMBA	AST25-190	AST25-280		AST25-320		
4"	SPA/RPA	AST35-190	AST35-280	AST35-290	AST35-320	AST35-390	AST35-490
	SPUMBA	AST35-190	AST35-280	AST35-290	AST35-320	AST35-390	AST35-490
	RUPUMBA	AST35-190	AST35-280		AST35-320		

Template #8

Top of Pole

1.75" for aluminum poles
2.75" for other pole types



Mounting Option	Drilling Template	Single	2 @ 180	2 @ 90	3 @ 90	3 @ 120	4 @ 90
Head Location		Side B	Side B & D	Side B & C	Side B, C & D	Round Pole Only	Side A, B, C & D
Drill Nomenclature	#8	DM19AS	DM28AS	DM29AS	DM39AS	DM32AS	DM49AS

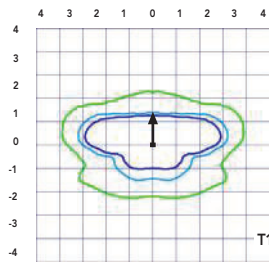
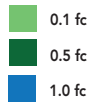
	Drilling Template	Minimum Acceptable Outside Pole Dimension					
SPA	#8	2-7/8"	2-7/8"	3.5"	3.5"	3"	3.5"
RPA	#8	2-7/8"	2-7/8"	3.5"	3.5"	3"	3.5"
SPUMBA	#5	2-7/8"	3"	4"	4"	3.5"	4"
RUPUMBA	#5	2-7/8"	3.5"	5"	5"	3.5"	5"

Photometric Diagrams

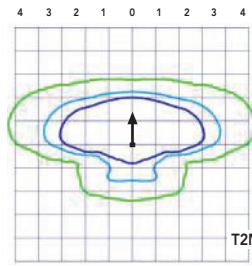
To see complete photometric reports or download .ies files for this product, visit Lithonia Lighting's [D-Series Area Size 1 homepage](#).

Isofootcandle plots for the DSX1 LED 60C 1000 40K. Distances are in units of mounting height (25').

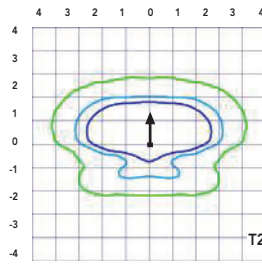
LEGEND



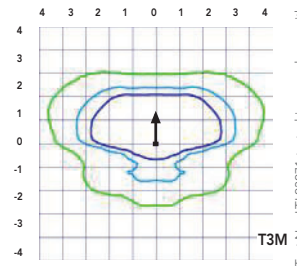
Test No. LTL23211 tested in accordance with IESNA LM-79-08.



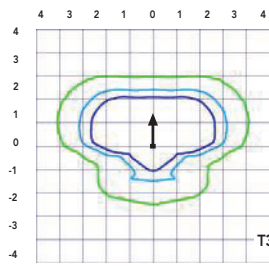
Test No. LTL23164B tested in accordance with IESNA LM-79-08.



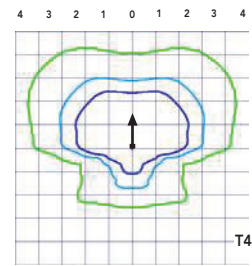
Test No. LTL23222 tested in accordance with IESNA LM-79-08.



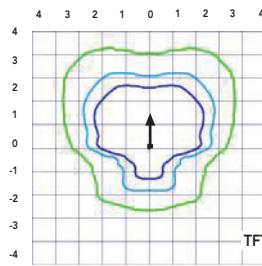
Test No. LTL23271 tested in accordance with IESNA LM-79-08.



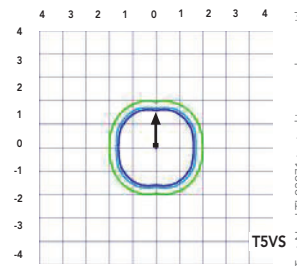
Test No. LTL23211 tested in accordance with IESNA LM-79-08.



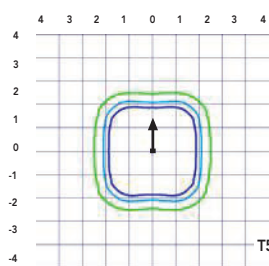
Test No. LTL23164B tested in accordance with IESNA LM-79-08.



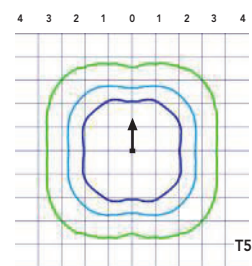
Test No. LTL23222 tested in accordance with IESNA LM-79-08.



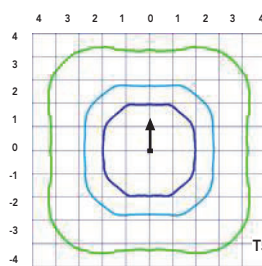
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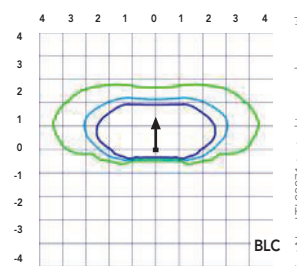
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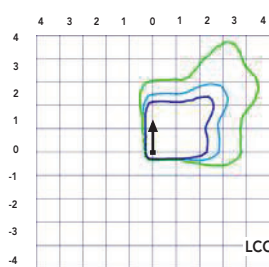
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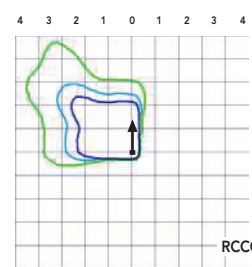
Test No. LTL23222 tested in accordance with IESNA LM-79-08.



Test No. LTL23271 tested in accordance with IESNA LM-79-08.



Test No. LTL23211 tested in accordance with IESNA LM-79-08.



Test No. LTL23164B tested in accordance with IESNA LM-79-08.

Performance Data

Lumen Ambient Temperature (LAT) Multipliers

Use these factors to determine relative lumen output for average ambient temperatures from 0-40°C (32-104°F).

Ambient		Lumen Multiplier
0°C	32°F	1.04
5°C	41°F	1.04
10°C	50°F	1.03
15°C	59°F	1.02
20°C	68°F	1.01
25°C	77°F	1.00
30°C	86°F	0.99
35°C	95°F	0.98
40°C	104°F	0.97

Projected LED Lumen Maintenance

Data references the extrapolated performance projections for the platforms noted in a **25°C ambient**, based on 10,000 hours of LED testing (tested per IESNA LM-80-08 and projected per IESNA TM-21-11).

To calculate LLF, use the lumen maintenance factor that corresponds to the desired number of operating hours below. For other lumen maintenance values, contact factory.

Operating Hours	Lumen Maintenance Factor
0	1.00
25,000	0.96
50,000	0.92
100,000	0.85

Motion Sensor Default Settings						
Option	Dimmed State	High Level (when triggered)	Photocell Operation	Dwell Time	Ramp-up Time	Ramp-down Time
PIR or PIRH	3V (37%) Output	10V (100%) Output	Enabled @ 5FC	5 min	3 sec	5 min
*PIR1FC3V or PIRH1FC3V	3V (37%) Output	10V (100%) Output	Enabled @ 1FC	5 min	3 sec	5 min

*for use when motion sensor is used as dusk to dawn control.

Electrical Load

					Current (A)					
	Performance Package	LED Count	Drive Current	Wattage	120	208	240	277	347	480
Forward Optics (Non-Rotated)	P1	30	530	54	0.45	0.26	0.23	0.19	0.10	0.12
	P2	30	700	70	0.59	0.34	0.30	0.25	0.20	0.16
	P3	30	1050	102	0.86	0.50	0.44	0.38	0.30	0.22
	P4	30	1250	125	1.06	0.60	0.52	0.46	0.37	0.27
	P5	30	1400	138	1.16	0.67	0.58	0.51	0.40	0.29
	P6	40	1250	163	1.36	0.78	0.68	0.59	0.47	0.34
	P7	40	1400	183	1.53	0.88	0.76	0.66	0.53	0.38
	P8	60	1050	207	1.74	0.98	0.87	0.76	0.64	0.49
	P9	60	1250	241	2.01	1.16	1.01	0.89	0.70	0.51
Rotated Optics (Requires L90 or R90)	P10	60	530	106	0.90	0.52	0.47	0.43	0.33	0.27
	P11	60	700	137	1.15	0.67	0.60	0.53	0.42	0.32
	P12	60	1050	207	1.74	0.99	0.87	0.76	0.60	0.46
	P13	60	1250	231	1.93	1.12	0.97	0.86	0.67	0.49

Controls Options

Nomenclature	Description	Functionality	Primary control device	Notes
FA0	Field adjustable output device installed inside the luminaire; wired to the driver dimming leads.	Allows the luminaire to be manually dimmed, effectively trimming the light output.	FA0 device	Cannot be used with other controls options that need the 0-10V leads
DS	Drivers wired independently for 50/50 luminaire operation	The luminaire is wired to two separate circuits, allowing for 50/50 operation.	Independently wired drivers	Requires two separately switched circuits. Consider nLight AIR as a more cost effective alternative.
PERS or PER7	Twist-lock photocell receptacle	Compatible with standard twist-lock photocells for dusk to dawn operation, or advanced control nodes that provide 0-10V dimming signals.	Twist-lock photocells such as DLL Elite or advanced control nodes such as ROAM.	Pins 4 & 5 to dimming leads on driver, Pins 6 & 7 are capped inside luminaire
PIR or PIRH	Motion sensors with integral photocell. PIR for 8-15' mounting; PIRH for 15-30' mounting	Luminaires dim when no occupancy is detected.	Acuity Controls SBGR	Also available with PIRH1FC3V when the sensor photocell is used for dusk-to-dawn operation.
NLTAIR2 PIRHN	nLight AIR enabled luminaire for motion sensing, photocell and wireless communication.	Motion and ambient light sensing with group response. Scheduled dimming with motion sensor over-ride when wirelessly connected to the nLight Eclipse.	nLight Air rSDGR	nLight AIR sensors can be programmed and commissioned from the ground using the CIAIRity Pro app.

Performance Data

Lumen Output

Lumen values are from photometric tests performed in accordance with IESNA LM-79-08. Data is considered to be representative of the configurations shown, within the tolerances allowed by Lighting Facts Contact factory for performance data on any configurations not shown here.

Forward Optics

LED Count	Drive Current	Power Package	System Watts	Dist. Type	30K (3000 K, 70 CRI)					40K (4000 K, 70 CRI)					50K (5000 K, 70 CRI)				
					Lumens	B	U	G	LPW	Lumens	B	U	G	LPW	Lumens	B	U	G	LPW
30	530	P1	54W	T1S	6,457	2	0	2	120	6,956	2	0	2	129	7,044	2	0	2	130
				T2S	6,450	2	0	2	119	6,949	2	0	2	129	7,037	2	0	2	130
				T2M	6,483	1	0	1	120	6,984	2	0	2	129	7,073	2	0	2	131
				T3S	6,279	2	0	2	116	6,764	2	0	2	125	6,850	2	0	2	127
				T3M	6,468	1	0	2	120	6,967	1	0	2	129	7,056	1	0	2	131
				T4M	6,327	1	0	2	117	6,816	1	0	2	126	6,902	1	0	2	128
				TFTM	6,464	1	0	2	120	6,963	1	0	2	129	7,051	1	0	2	131
				TSVS	6,722	2	0	0	124	7,242	3	0	0	134	7,334	3	0	0	136
				TSS	6,728	2	0	1	125	7,248	2	0	1	134	7,340	2	0	1	136
				TSM	6,711	3	0	1	124	7,229	3	0	1	134	7,321	3	0	2	136
				TSW	6,667	3	0	2	123	7,182	3	0	2	133	7,273	3	0	2	135
				BLC	5,299	1	0	1	98	5,709	1	0	2	106	5,781	1	0	2	107
				LCCO	3,943	1	0	2	73	4,248	1	0	2	79	4,302	1	0	2	80
				RCCO	3,943	1	0	2	73	4,248	1	0	2	79	4,302	1	0	2	80
30	700	P2	70W	T1S	8,249	2	0	2	118	8,886	2	0	2	127	8,999	2	0	2	129
				T2S	8,240	2	0	2	118	8,877	2	0	2	127	8,989	2	0	2	128
				T2M	8,283	2	0	2	118	8,923	2	0	2	127	9,036	2	0	2	129
				T3S	8,021	2	0	2	115	8,641	2	0	2	123	8,751	2	0	2	125
				T3M	8,263	2	0	2	118	8,901	2	0	2	127	9,014	2	0	2	129
				T4M	8,083	2	0	2	115	8,708	2	0	2	124	8,818	2	0	2	126
				TFTM	8,257	2	0	2	118	8,896	2	0	2	127	9,008	2	0	2	129
				TSVS	8,588	3	0	0	123	9,252	3	0	0	132	9,369	3	0	0	134
				TSS	8,595	3	0	1	123	9,259	3	0	1	132	9,376	3	0	1	134
				TSM	8,573	3	0	2	122	9,236	3	0	2	132	9,353	3	0	2	134
				TSW	8,517	3	0	2	122	9,175	4	0	2	131	9,291	4	0	2	133
				BLC	6,770	1	0	2	97	7,293	1	0	2	104	7,386	1	0	2	106
				LCCO	5,038	1	0	2	72	5,427	1	0	2	78	5,496	1	0	2	79
				RCCO	5,038	1	0	2	72	5,427	1	0	2	78	5,496	1	0	2	79
30	1050	P3	102W	T1S	11,661	2	0	2	114	12,562	3	0	3	123	12,721	3	0	3	125
				T2S	11,648	2	0	2	114	12,548	3	0	3	123	12,707	3	0	3	125
				T2M	11,708	2	0	2	115	12,613	2	0	2	124	12,773	2	0	2	125
				T3S	11,339	2	0	2	111	12,215	3	0	3	120	12,370	3	0	3	121
				T3M	11,680	2	0	2	115	12,582	2	0	2	123	12,742	2	0	2	125
				T4M	11,426	2	0	3	112	12,309	2	0	3	121	12,465	2	0	3	122
				TFTM	11,673	2	0	2	114	12,575	2	0	3	123	12,734	2	0	3	125
				TSVS	12,140	3	0	1	119	13,078	3	0	1	128	13,244	3	0	1	130
				TSS	12,150	3	0	1	119	13,089	3	0	1	128	13,254	3	0	1	130
				TSM	12,119	4	0	2	119	13,056	4	0	2	128	13,221	4	0	2	130
				TSW	12,040	4	0	3	118	12,970	4	0	3	127	13,134	4	0	3	129
				BLC	9,570	1	0	2	94	10,310	1	0	2	101	10,440	1	0	2	102
				LCCO	7,121	1	0	3	70	7,671	1	0	3	75	7,768	1	0	3	76
				RCCO	7,121	1	0	3	70	7,671	1	0	3	75	7,768	1	0	3	76
30	1250	P4	125W	T1S	13,435	3	0	3	107	14,473	3	0	3	116	14,657	3	0	3	117
				T2S	13,421	3	0	3	107	14,458	3	0	3	116	14,641	3	0	3	117
				T2M	13,490	2	0	2	108	14,532	3	0	3	116	14,716	3	0	3	118
				T3S	13,064	3	0	3	105	14,074	3	0	3	113	14,252	3	0	3	114
				T3M	13,457	2	0	2	108	14,497	2	0	2	116	14,681	2	0	2	117
				T4M	13,165	2	0	3	105	14,182	2	0	3	113	14,362	2	0	3	115
				TFTM	13,449	2	0	3	108	14,488	2	0	3	116	14,672	2	0	3	117
				TSVS	13,987	4	0	1	112	15,068	4	0	1	121	15,259	4	0	1	122
				TSS	13,999	3	0	1	112	15,080	3	0	1	121	15,271	3	0	1	122
				TSM	13,963	4	0	2	112	15,042	4	0	2	120	15,233	4	0	2	122
				TSW	13,872	4	0	3	111	14,944	4	0	3	120	15,133	4	0	3	121
				BLC	11,027	1	0	2	88	11,879	1	0	2	95	12,029	1	0	2	96
				LCCO	8,205	1	0	3	66	8,839	1	0	3	71	8,951	1	0	3	72
				RCCO	8,205	1	0	3	66	8,839	1	0	3	71	8,951	1	0	3	72
30	1400	P5	138W	T1S	14,679	3	0	3	106	15,814	3	0	3	115	16,014	3	0	3	116
				T2S	14,664	3	0	3	106	15,797	3	0	3	114	15,997	3	0	3	116
				T2M	14,739	3	0	3	107	15,878	3	0	3	115	16,079	3	0	3	117
				T3S	14,274	3	0	3	103	15,377	3	0	3	111	15,572	3	0	3	113
				T3M	14,704	2	0	3	107	15,840	3	0	3	115	16,040	3	0	3	116
				T4M	14,384	2	0	3	104	15,496	3	0	3	112	15,692	3	0	3	114
				TFTM	14,695	2	0	3	106	15,830	3	0	3	115	16,030	3	0	3	116
				TSVS	15,283	4	0	1	111	16,464	4	0	1	119	16,672	4	0	1	121
				TSS	15,295	3	0	1	111	16,477	4	0	1	119	16,686	4	0	1	121
				TSM	15,257	4	0	2	111	16,435	4	0	2	119	16,644	4	0	2	121
				TSW	15,157	4	0	3	110	16,328	4	0	3	118	16,534	4	0	3	120
				BLC	12,048	1	0	2	87	12,979	1	0	2	94	13,143	1	0	2	95
				LCCO	8,965	1	0	3	65	9,657	1	0	3	70	9,780	1	0	3	71
				RCCO	8,965	1	0	3	65	9,657	1	0	3	70	9,780	1	0	3	71

Performance Data

Lumen Output

Lumen values are from photometric tests performed in accordance with IESNA LM-79-08. Data is considered to be representative of the configurations shown, within the tolerances allowed by Lighting Facts. Contact factory for performance data on any configurations not shown here.

Forward Optics																			
LED Count	Drive Current	Power Package	System Watts	Dist. Type	30K (3000 K, 70 CRI)					40K (4000 K, 70 CRI)					50K (5000 K, 70 CRI)				
					Lumens	B	U	G	LPW	Lumens	B	U	G	LPW	Lumens	B	U	G	LPW
40	1250	P6	163W	T1S	17,654	3	0	3	108	19,018	3	0	3	117	19,259	3	0	3	118
				T2S	17,635	3	0	3	108	18,998	3	0	3	117	19,238	3	0	3	118
				T2M	17,726	3	0	3	109	19,096	3	0	3	117	19,337	3	0	3	119
				T3S	17,167	3	0	3	105	18,493	3	0	3	113	18,727	3	0	3	115
				T3M	17,683	3	0	3	108	19,049	3	0	3	117	19,290	3	0	3	118
				T4M	17,299	3	0	3	106	18,635	3	0	4	114	18,871	3	0	4	116
				TFTM	17,672	3	0	3	108	19,038	3	0	4	117	19,279	3	0	4	118
				TSVS	18,379	4	0	1	113	19,800	4	0	1	121	20,050	4	0	1	123
				T5S	18,394	4	0	2	113	19,816	4	0	2	122	20,066	4	0	2	123
				TSM	18,348	4	0	2	113	19,766	4	0	2	121	20,016	4	0	2	123
				TSW	18,228	5	0	3	112	19,636	5	0	3	120	19,885	5	0	3	122
				BLC	14,489	2	0	2	89	15,609	2	0	3	96	15,806	2	0	3	97
				LCCO	10,781	1	0	3	66	11,614	1	0	3	71	11,761	2	0	3	72
				RCCO	10,781	1	0	3	66	11,614	1	0	3	71	11,761	2	0	3	72
40	1400	P7	183W	T1S	19,227	3	0	3	105	20,712	3	0	3	113	20,975	3	0	3	115
				T2S	19,206	3	0	3	105	20,690	3	0	3	113	20,952	3	0	3	114
				T2M	19,305	3	0	3	105	20,797	3	0	3	114	21,060	3	0	3	115
				T3S	18,696	3	0	3	102	20,141	3	0	3	110	20,396	3	0	4	111
				T3M	19,258	3	0	3	105	20,746	3	0	3	113	21,009	3	0	3	115
				T4M	18,840	3	0	4	103	20,296	3	0	4	111	20,553	3	0	4	112
				TFTM	19,246	3	0	4	105	20,734	3	0	4	113	20,996	3	0	4	115
				TSVS	20,017	4	0	1	109	21,564	4	0	1	118	21,837	4	0	1	119
				T5S	20,033	4	0	2	109	21,581	4	0	2	118	21,854	4	0	2	119
				TSM	19,983	4	0	2	109	21,527	5	0	3	118	21,799	5	0	3	119
				TSW	19,852	5	0	3	108	21,386	5	0	3	117	21,656	5	0	3	118
				BLC	15,780	2	0	3	86	16,999	2	0	3	93	17,214	2	0	3	94
				LCCO	11,742	2	0	3	64	12,649	2	0	3	69	12,809	2	0	3	70
				RCCO	11,742	2	0	3	64	12,649	2	0	3	69	12,809	2	0	3	70
60	1050	P8	207W	T1S	22,490	3	0	3	109	24,228	3	0	3	117	24,535	3	0	3	119
				T2S	22,466	3	0	4	109	24,202	3	0	4	117	24,509	3	0	4	118
				T2M	22,582	3	0	3	109	24,327	3	0	3	118	24,635	3	0	3	119
				T3S	21,870	3	0	4	106	23,560	3	0	4	114	23,858	3	0	4	115
				T3M	22,527	3	0	4	109	24,268	3	0	4	117	24,575	3	0	4	119
				T4M	22,038	3	0	4	106	23,741	3	0	4	115	24,041	3	0	4	116
				TFTM	22,513	3	0	4	109	24,253	3	0	4	117	24,560	3	0	4	119
				TSVS	23,415	5	0	1	113	25,224	5	0	1	122	25,543	5	0	1	123
				T5S	23,434	4	0	2	113	25,244	4	0	2	122	25,564	4	0	2	123
				TSM	23,374	5	0	3	113	25,181	5	0	3	122	25,499	5	0	3	123
				TSW	23,221	5	0	4	112	25,016	5	0	4	121	25,332	5	0	4	122
				BLC	18,458	2	0	3	89	19,885	2	0	3	96	20,136	2	0	3	97
				LCCO	13,735	2	0	3	66	14,796	2	0	4	71	14,983	2	0	4	72
				RCCO	13,735	2	0	3	66	14,796	2	0	4	71	14,983	2	0	4	72
60	1250	P9	241W	T1S	25,575	3	0	3	106	27,551	3	0	3	114	27,900	3	0	3	116
				T2S	25,548	3	0	4	106	27,522	3	0	4	114	27,871	3	0	4	116
				T2M	25,680	3	0	3	107	27,664	3	0	3	115	28,014	3	0	3	116
				T3S	24,870	3	0	4	103	26,791	3	0	4	111	27,130	3	0	4	113
				T3M	25,617	3	0	4	106	27,597	3	0	4	115	27,946	3	0	4	116
				T4M	25,061	3	0	4	104	26,997	3	0	4	112	27,339	3	0	4	113
				TFTM	25,602	3	0	4	106	27,580	3	0	4	114	27,929	3	0	4	116
				TSVS	26,626	5	0	1	110	28,684	5	0	1	119	29,047	5	0	1	121
				T5S	26,648	4	0	2	111	28,707	5	0	2	119	29,070	5	0	2	121
				TSM	26,581	5	0	3	110	28,635	5	0	3	119	28,997	5	0	3	120
				TSW	26,406	5	0	4	110	28,447	5	0	4	118	28,807	5	0	4	120
				BLC	20,990	2	0	3	87	22,612	2	0	3	94	22,898	2	0	3	95
				LCCO	15,619	2	0	4	65	16,825	2	0	4	70	17,038	2	0	4	71
				RCCO	15,619	2	0	4	65	16,825	2	0	4	70	17,038	2	0	4	71

Performance Data

Lumen Output

Lumen values are from photometric tests performed in accordance with IESNA LM-79-08. Data is considered to be representative of the configurations shown, within the tolerances allowed by Lighting Facts. Contact factory for performance data on any configurations not shown here.

Rotated Optics

LED Count	Drive Current	Power Package	System Watts	Dist. Type	30K (3000 K, 70 CRI)					40K (4000 K, 70 CRI)					50K (5000 K, 70 CRI)				
					Lumens	B	U	G	LPW	Lumens	B	U	G	LPW	Lumens	B	U	G	LPW
60	530	P10	106W	T1S	13,042	3	0	3	123	14,050	3	0	3	133	14,228	3	0	3	134
				T2S	12,967	4	0	4	122	13,969	4	0	4	132	14,146	4	0	4	133
				T2M	13,201	3	0	3	125	14,221	3	0	3	134	14,401	3	0	3	136
				T3S	12,766	4	0	4	120	13,752	4	0	4	130	13,926	4	0	4	131
				T3M	13,193	4	0	4	124	14,213	4	0	4	134	14,393	4	0	4	136
				T4M	12,944	4	0	4	122	13,945	4	0	4	132	14,121	4	0	4	133
				TFTM	13,279	4	0	4	125	14,305	4	0	4	135	14,486	4	0	4	137
				TSVS	13,372	3	0	1	126	14,405	4	0	1	136	14,588	4	0	1	138
				TSS	13,260	3	0	1	125	14,284	3	0	1	135	14,465	3	0	1	136
				TSM	13,256	4	0	2	125	14,281	4	0	2	135	14,462	4	0	2	136
				TSW	13,137	4	0	3	124	14,153	4	0	3	134	14,332	4	0	3	135
				BLC	10,906	3	0	3	103	11,749	3	0	3	111	11,898	3	0	3	112
				LCCO	7,789	1	0	3	73	8,391	1	0	3	79	8,497	1	0	3	80
				RCCO	7,779	4	0	4	73	8,380	4	0	4	79	8,486	4	0	4	80
60	700	P11	137W	T1S	16,556	3	0	3	121	17,835	3	0	3	130	18,061	4	0	4	132
				T2S	16,461	4	0	4	120	17,733	4	0	4	129	17,957	4	0	4	131
				T2M	16,758	4	0	4	122	18,053	4	0	4	132	18,281	4	0	4	133
				T3S	16,205	4	0	4	118	17,457	4	0	4	127	17,678	4	0	4	129
				T3M	16,748	4	0	4	122	18,042	4	0	4	132	18,271	4	0	4	133
				T4M	16,432	4	0	4	120	17,702	4	0	4	129	17,926	4	0	4	131
				TFTM	16,857	4	0	4	123	18,159	4	0	4	133	18,389	4	0	4	134
				TSVS	16,975	4	0	1	124	18,287	4	0	1	133	18,518	4	0	1	135
				TSS	16,832	4	0	1	123	18,133	4	0	2	132	18,362	4	0	2	134
				TSM	16,828	4	0	2	123	18,128	4	0	2	132	18,358	4	0	2	134
				TSW	16,677	4	0	3	122	17,966	5	0	3	131	18,193	5	0	3	133
				BLC	13,845	3	0	3	101	14,915	3	0	3	109	15,103	3	0	3	110
				LCCO	9,888	1	0	3	72	10,652	2	0	3	78	10,787	2	0	3	79
				RCCO	9,875	4	0	4	72	10,638	4	0	4	78	10,773	4	0	4	79
60	1050	P12	207W	T1S	22,996	4	0	4	111	24,773	4	0	4	120	25,087	4	0	4	121
				T2S	22,864	4	0	4	110	24,631	5	0	5	119	24,943	5	0	5	120
				T2M	23,277	4	0	4	112	25,075	4	0	4	121	25,393	4	0	4	123
				T3S	22,509	4	0	4	109	24,248	5	0	5	117	24,555	5	0	5	119
				T3M	23,263	4	0	4	112	25,061	4	0	4	121	25,378	4	0	4	123
				T4M	22,824	5	0	5	110	24,588	5	0	5	119	24,899	5	0	5	120
				TFTM	23,414	5	0	5	113	25,223	5	0	5	122	25,543	5	0	5	123
				TSVS	23,579	5	0	1	114	25,401	5	0	1	123	25,722	5	0	1	124
				TSS	23,380	4	0	2	113	25,187	4	0	2	122	25,506	4	0	2	123
				TSM	23,374	5	0	3	113	25,181	5	0	3	122	25,499	5	0	3	123
				TSW	23,165	5	0	4	112	24,955	5	0	4	121	25,271	5	0	4	122
				BLC	19,231	4	0	4	93	20,717	4	0	4	100	20,979	4	0	4	101
				LCCO	13,734	2	0	3	66	14,796	2	0	4	71	14,983	2	0	4	72
				RCCO	13,716	4	0	4	66	14,776	4	0	4	71	14,963	4	0	4	72
60	1250	P13	231W	T1S	25,400	4	0	4	110	27,363	4	0	4	118	27,709	4	0	4	120
				T2S	25,254	5	0	5	109	27,205	5	0	5	118	27,550	5	0	5	119
				T2M	25,710	4	0	4	111	27,696	4	0	4	120	28,047	4	0	4	121
				T3S	24,862	5	0	5	108	26,783	5	0	5	116	27,122	5	0	5	117
				T3M	25,695	5	0	5	111	27,680	5	0	5	120	28,031	5	0	5	121
				T4M	25,210	5	0	5	109	27,158	5	0	5	118	27,502	5	0	5	119
				TFTM	25,861	5	0	5	112	27,860	5	0	5	121	28,212	5	0	5	122
				TSVS	26,043	5	0	1	113	28,056	5	0	1	121	28,411	5	0	1	123
				TSS	25,824	4	0	2	112	27,819	5	0	2	120	28,172	5	0	2	122
				TSM	25,818	5	0	3	112	27,813	5	0	3	120	28,165	5	0	3	122
				TSW	25,586	5	0	4	111	27,563	5	0	4	119	27,912	5	0	4	121
				BLC	21,241	4	0	4	92	22,882	4	0	4	99	23,172	4	0	4	100
				LCCO	15,170	2	0	4	66	16,342	2	0	4	71	16,549	2	0	4	72
				RCCO	15,150	5	0	5	66	16,321	5	0	5	71	16,527	5	0	5	72

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.

1. See ordering tree for details.
2. A+ Certified Solutions for ROAM require the order of one ROAM node per luminaire. Sold Separately: [Link to Roam](#); [Link to DTL DLL](#)

FEATURES & SPECIFICATIONS

INTENDED USE

The sleek design of the D-Series Size 1 reflects the embedded high performance LED technology. It is ideal for many commercial and municipal applications, such as parking lots, plazas, campuses, and streetscapes.

CONSTRUCTION

Single-piece die-cast aluminum housing has integral heat sink fins to optimize thermal management through conductive and convective cooling. Modular design allows for ease of maintenance and future light engine upgrades. The LED drivers are mounted in direct contact with the casting to promote low operating temperature and long life. Housing is completely sealed against moisture and environmental contaminants (IP65). Low EPA (1.01 ft²) for optimized pole wind loading.

FINISH

Exterior parts are protected by a zinc-infused Super Durable TGIC thermoset powder coat finish that provides superior resistance to corrosion and weathering. A tightly controlled multi-stage process ensures a minimum 3 mils thickness for a finish that can withstand extreme climate changes without cracking or peeling. Available in both textured and non-textured finishes.

OPTICS

Precision-molded proprietary acrylic lenses are engineered for superior area lighting distribution, uniformity, and pole spacing. Light engines are available in standard 3000 K, 4000 K and 5000 K (70 CRI) configurations. The D-Series Size 1 has zero uplight and qualifies as a Nighttime Friendly™ product, meaning it is consistent with the LEED® and Green Globes™ criteria for eliminating wasteful uplight.

ELECTRICAL

Light engine configurations consist of high-efficacy LEDs mounted to metal-core circuit boards to maximize heat dissipation and promote long life (up to L85/100,000 hours at 25°C). Class 1 electronic drivers are designed to have a power factor >90%, THD <20%, and an expected life of 100,000 hours with <1% failure rate. Easily serviceable 10kV surge protection device meets a minimum Category C Low operation (per ANSI/IEEE C62.41.2).

STANDARD CONTROLS

The DSX1 LED area luminaire has a number of control options. Dusk to dawn controls can be utilized via optional NEMA twist-lock photocell receptacles. Integrated motion sensors with on-board photocells feature field-adjustable programming and are suitable for mounting heights up to 30 feet.

nLIGHT AIR CONTROLS

The DSX1 LED area luminaire is also available with nLight® AIR for the ultimate in wireless control. This powerful controls platform provides out-of-the-box basic motion sensing and photocontrol functionality and is suitable for mounting heights up to 40 feet. Once commissioned using a smartphone and the easy-to-use CLAIRITY app, nLight AIR equipped luminaires can be grouped, resulting in motion sensor and photocell group response without the need for additional equipment. Scheduled dimming with motion sensor over-ride can be achieved when used with the nLight Eclipse. Additional information about nLight Air can be found [here](#).

INSTALLATION

Included mounting block and integral arm facilitate quick and easy installation. Stainless steel bolts fasten the mounting block securely to poles and walls, enabling the D-Series Size 1 to withstand up to a 3.0 G vibration load rating per ANSI C136.31. The D-Series Size 1 utilizes the AERIS™ series pole drilling pattern (template #8). NEMA photocontrol receptacle are also available.

LISTINGS

UL Listed for wet locations. Light engines are IP66 rated; luminaire is IP65 rated. Rated for -40°C minimum ambient. U.S. Patent No. D672,492 S. International patent pending.

DesignLights Consortium® (DLC) Premium qualified product and DLC qualified product.

Not all versions of this product may be DLC Premium qualified or DLC qualified. Please check the DLC Qualified Products List at www.designlights.org/QPL to confirm which versions are qualified.

International Dark-Sky Association (IDA) Fixture Seal of Approval (FSA) is available for all products on this page utilizing 3000K color temperature only.

WARRANTY

5-year limited warranty. Complete warranty terms located at:

www.acuitybrands.com/support/customer-support/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.



COMMERCIAL OUTDOOR

One Lithonia Way • Conyers, Georgia 30012 • Phone: 1-800-705-SERV (7378) • www.lithonia.com
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DSX1-LED

Rev. 02/05/20

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APARTMENT MAIN FEEDER SIZING OPTIONAL CALCULATION

	Unit - A	Unit - B	Unit - C
AREA	0	0	0
GEN. LTG @ 3 WATTS/SQ.FT.	2400	780	1290
AMPS @ 120 VOLTS	7200	2340	3870
15/1 CKTS (12A) REQUIRED	60	19.5	32.25
	5.0	1.6	2.7
	0	0	0
	0	0	0
GENERAL LIGHTING (WATTS)	7200	2340	3870
SMALL APPLIANCE (WATTS)	3000	3000	3000
LAUNDRY (WATTS)	1500	1500	1500
T.C.L. (WATTS)	11700	6840	8370
	0	0	0
	0	0	0
1ST 3.0KW @ 100%	3000	3000	3000
NEXT 117.0KW @ 35%	3045	1344	1879.5
OVER 120.0KW @ 25%	0	0	0
TOTAL	6045	4344	4879.5
	0	0	0
WATER HEATER	4500	4500	0
DISHWASHER	1200	1200	1200
LARGER OF ELEC. HEAT OR A/C (VA)	600	600	600
RANGE (VA)	12000	12000	12000
DISPOSER (VA)	0	0	0
DRYER (VA)	5000	5000	5000
MICROWAVE (VA)	1500	1500	1500
E.M.D. (VA)			
E.M.D. AMPS @ 208			
T.C.L.	36500	31640	28670

	OPTIONAL CALCULATION			NUMBER OF UNITS
NUMBER OF UNITS	2	8	4	14
T.C.L.	73000	253120	114680	440800 TOTAL
				0.4 FROM NEC TABLE 220.84
				176320
THREE PHASE VOLTAGE	208			489.4 AMPS AT 208 V
				ADD HOUSE LOADS
				691.9 AMPS HOUSE LOAD SIZING
				TOTAL 1181.3

NFPA 780 SIMPLIFIED LIGHTNING RISK ASSESSMENT

LIGHTNING FLASH DENSITY	$N_G =$	0.3 FLASHES/KM ² /YEAR
EQUIVALENT COLLECTION AREA	$A_D =$	18,590 M ²
LOCATION FACTOR	$C_D =$	0.5
ANNUAL THREAT OF OCCURRENCE	$N_D =$	0.0023238 FLASHES/YEAR
$N_D = (N_G) (A_D) (C_D) (10^{-6})$		

TOLERABLE LIGHTNING FREQUENCY	$N_C =$	0.00075 FLASHES/YEAR
$N_C = (1.5 \times 10^{-3}) / C$		
COEFFICIENT	$C =$	2
$C = (C_2) (C_3) (C_4) (C_5)$		
CONSTRUCTION COEFFICIENT	$C_2 =$	2
STRUCTURE CONTENTS COEFFICIENT	$C_3 =$	1
STRUCTURE OCCUPANCY COEFFICIENT	$C_4 =$	1
LIGHTNING CONSEQUENCE COEFFICIENT	$C_5 =$	1

NOTES

IF THE ANNUAL THREAT OF OCCURRENCE (N_D) IS LESS THAN OR EQUAL TO THE TOLERABLE LIGHTNING FREQUENCY (N_C), A LIGHTNING PROTECTION SYSTEM CAN BE OPTIONAL.

IF THE ANNUAL THREAT OF OCCURRENCE (N_D) IS GREATER THAN THE TOLERABLE LIGHTNING FREQUENCY (N_C), IT IS RECOMMENDED THAT A LIGHTNING PROTECTION SYSTEM BE INSTALLED.

VARIABLES

N_G = LIGHTNING FLASH DENSITY, THE YEARLY NUMBER OF FLASHES TO GROUND PER SQUARE KILOMETER

A_D = THE EQUIVALENT GROUND AREA HAVING THE EQUIVALENT LIGHTNING FLASH VULNERABILITY AS THE STRUCTURE. IT IS AN AREA ADJUSTED FOR THE STRUCTURE THAT INCLUDES THE EFFECT OF THE HEIGHT AND LOCATION OF THE STRUCTURE.

C_D =	RELATIVE STRUCTURE LOCATION	
	STRUCTURE SURROUNDED BY TALLER STRUCTURES OR TREES WITHIN A DISTANCE OF 3H	0.25
	STRUCTURE SURROUNDED BY STRUCTURES OF EQUAL OR LESSER HEIGHT WITHIN A DISTANCE OF 3H	0.5
	ISOLATED STRUCTURE, WITH NO OTHER STRUCTURES LOCATED WITHIN A DISTANCE OF 3H	1.0
	ISOLATED STRUCTURE ON HILLTOP	2.0
	H = BUILDING HEIGHT	

N_D = THE YEARLY ANNUAL THREAT OF OCCURRENCE (LIGHTNING STRIKE FREQUENCY) TO A STRUCTURE

N_C = MEASURE OF THE RISK OF DAMAGE TO STRUCTURE, INCLUDING FACTORS AFFECTING RISKS TO THE STRUCTURE, TO THE CONTENTS, AND OF ENVIRONMENTAL LOSS.

C = THE PRODUCT OF STRUCTURAL COEFFICIENTS C_2 THROUGH C_5 .

C_2 =	CONSTRUCTION COEFFICIENT		
	STRUCTURE	METAL ROOF	NONMETALLIC ROOF
	METAL	0.5	1.0
	NONMETALLIC	1.0	2.5
	COMBUSTIBLE	2.0	3.0

C_3 =	STRUCTURE CONTENTS	
	LOW VALUE AND NONCOMBUSTIBLE	0.5
	STANDARD VALUE AND NONCOMBUSTIBLE	1.0
	HIGH VALUE, MODERATE COMBUSTIBILITY	2.0
	EXCEPTIONAL VALUE, FLAMMABLE LIQUIDS, COMPUTER OR ELECTRONICS	3.0
	EXCEPTIONAL VALUE, IRREPLACABLE CULTURAL ITEMS	4.0

C_4 =	STRUCTURE OCCUPANCY	
	UNOCCUPIED	0.5
	NORMALLY OCCUPIED	1.0
	DIFFICULT TO EVACUATE OR RISK OF PANIC	3.0

C_5 =	LIGHTNING CONSEQUENCE	
	CONTINUITY OF FACILITY SERVICES NOT REQUIRED, NO ENVIRONMENTAL IMPACT	1
	CONTINUITY OF FACILITY SERVICES REQUIRED, NO ENVIRONMENTAL IMPACT	5.0
	CONSEQUENCES TO THE ENVIRONMENT	10.0



BLACKFEET COMMUNITY HOSPITAL

INDIAN HEALTH SERVICES

FE #191017

JANUARY 2020

COMMISSIONING PLAN

VERSION 1.1

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COMMISSIONING PLAN OVERVIEW

The purpose of the Commissioning Plan is to provide a clear and concise roadmap for the implementation of the commissioning process and to provide a record of the results of the process. Since the Commissioning Plan contains the results of the process, it can be considered a living document where the results are added throughout the process. Therefore, to simplify the upkeep of the document, the basic process and procedures to be followed throughout the project are detailed in the main body of the Commissioning Plan. The materials and information that is developed during the commissioning process are included in the appendices.

As detailed above, the structure of this Commissioning Plan is a main body and appendices. The specific sections include:

- Commissioning Process Description: This section provides an overview of the tasks to be accomplished during the commissioning process. The information is tailored for this project, focusing specifically on what must be accomplished during the design, construction, occupancy and operations phases of the project.
- Roles and Responsibilities: The roles and responsibilities of each commissioning team member are clearly defined in this section. The goal of this section is to have each individual understand what they must do and how they fit into the entire process.
- Communication Structures: The communication paths to be used by the commissioning team members are detailed in this section.
- Contact Information: Proper communication is critical for the success of any project. This section provides detailed contact information of those on the commissioning team for quick reference.
- Commissioned Systems and Equipment: The commissioned systems include those that are in the commissioning authority's contract. These systems were expanded using the drawings and specifications to develop a detailed listing of each type of equipment in each system to be commissioned.
- Commissioning Process Schedule: There are specific sequences of events that must occur during the commissioning process. These events are detailed in this section.
- Appendices: The appendices present the information developed during the commissioning process. As work is completed, the results are added to the proper appendix and the status and date of the document are inserted into the table on the next page.

COMMISSIONING PLAN VERSION HISTORY

The changes made to this Cx Plan document throughout the Design, Construction, and Occupancy and Operations Phases are summarized in the following table. Tracking of this information is critical in that it enables future operators and design professionals an understanding of the trade-offs made during the project and the resulting impact on the facility and achievements of the Cx Plan.

Table 1: Cx Plan Version History

Change #	Date Changed
Version 1.0	12/03/2019
Version 1.1	1/06/2020

COMMISSIONING PROCESS DESCRIPTION

The intent of this section is to provide an overview of the tasks to be accomplished as part of the commissioning effort for this project. The subsequent sections provide guidance on how these activities are to be accomplished for each phase of the project.

The general approach taken in implementing the commissioning process on this project is prescriptive and stepwise in nature to focus the commissioning efforts on verifying that the Owner's Project Requirements have been achieved. Details on the results of actually accomplishing the tasks are contained in the appendices.

The key phases and commissioning tasks that have been or will be accomplished for this project are detailed in the following sections.

DESIGN PHASE

The tasks to be accomplished the during design phase are:

- Develop Owner's Project Requirements
- Develop Commissioning Plan
- Develop Commissioning Requirements
- Record Commissioning Process Issues

DEVELOP OWNER'S PROJECT REQUIREMENTS

The Owner's Project Requirements (OPR) is a written document that details the functional requirements of a project and the expectations of how it will be used and operated. This includes project goals, measurable performance criteria, cost considerations, benchmarks, success criteria, and supporting information. The OPR document is a condensed collection of vital information about a construction project. The document is intended for a wide audience, including the owner, design team, construction team, operation and maintenance staff, future renovation teams, and anyone who needs access to the original project information. The OPR is not a substitute for traditional architectural programming. It does contain some programming information, such as space usage. The OPR can be considered a living document because it is updated during design, construction and occupancy. This document is provided to the building owner upon completion of the project, so that the information it contains is not lost over time.

DEVELOP COMMISSIONING PLAN

Development of the initial commissioning plan involves a decision on the format of the plan, inserting the initial information, documentation of communication structures for the project, documentation of the roles and responsibilities relative to the commissioning process, identification of the systems to be commissioned, and development of the initial commissioning schedule. The sections described below

are contained in the body of the commissioning plan following the description of the commissioning process (this section).

- Roles and Responsibilities: The roles and responsibilities of each commissioning team member are clearly defined in this section. The goal of this section is to have each individual understand what they must do and how they fit into the entire process.
- Communication Structures: The communication structures focus on how questions are answered, problems resolved, and how documentation should flow through the system, including the time required for turnaround or resolution. Specifically, the communication structures for requests for information (RFI), change orders, schedules, meeting minutes, and dispute resolution are defined for the project.
- Contact Information: The contact information is provided so that once the roles and responsibilities and communication structures are known, the project team members are able to contact each other.
- Commissioned Systems and Equipment: The commissioned systems include those that are in the commissioning authority's contract. Using the drawings and specifications, a detailed listing was developed of each type of equipment that is associated with the systems to be commissioned. Also included are the commissioning steps that will be accomplished for each type of equipment.
- Commissioning Process Schedule: The commissioning process schedule section details the items related to commissioning and how they fit into the overall project schedule.

The commissioning plan is a living document and requires updating as the project progresses. Additional details are added to show how the commissioning process will be implemented during construction and the specific roles and responsibilities of key team members refined. The structure of the commissioning plan is such that most of these changes will be through addition of material to the appendices.

DEVELOP COMMISSIONING REQUIREMENTS

There will be specific commissioning process requirements included in the contractor's specifications and project documents, such as specific equipment and component performance documentation and construction checklists with appropriate cross-references. These documents will include the format for which contractor and other submittals will be used, training requirements deemed necessary, construction checklists development and completion, commissioning process test development, and so on.

See Appendices for the commissioning process input into the project specifications.

RECORD COMMISSIONING PROCESS ISSUES

Throughout the commissioning process, the commissioning authority will identify and track the resolution of commissioning process issues, which are defined as a finding that does not meet the OPR.

The documentation of commissioning issues goes beyond the traditional description of the issue, who is responsible, and due date. The primary reason for this is that if the commissioning process works as it is supposed to, the owner, A/E, and contractor do not have problems at the end of construction.

The issues database also includes the cost to resolve each issue identified and the savings achieved as a result of resolving the issue. This cost information is meant to show the value that commissioning contributed to the project, i.e., costs the owner would have incurred if commissioning was not done, and should not be used for other purposes.

Each commissioning process issue is created in a three-step process:

1. Identify and Record Issues – The documentation of the issue will be accomplished using a Commissioning Issues/Benefits Log.
2. Calculate Avoided Costs – The commissioning authority will determine which issues are to be included in the cost analysis. Possible reasons for excluding a particular issue from a cost analysis could be lack of adequate cost information, negligible effects on the project outcome, or commissioning playing a minimal role in the issue. Costs will be determined based upon the commissioning authority's professional judgment and may include, but is not limited to, actual implementation costs (if a change order is required), industry reference materials such as standardized unit costs, and calculations of energy use or additional maintenance labor.
3. Evaluate Range of Avoided Costs – Typically there could be a wide range of avoided costs. For example, if during mock-up construction of a VAV box it was determined that they could not be maintained, there are two possible scenarios to the avoided cost. The first scenario (maximum avoided cost) is if the issue was never identified during construction and the owner has long-term costs in both energy and maintenance. The second scenario (minimum avoided cost) is if the issue was identified early in construction and was resolved through a redesign change order, with cost to the A/E to redesign and to the contractor to relocate the VAV boxes. By estimating the range of avoided cost, the entire project team is provided with feedback on the value of commissioning.

The commissioning authority will provide periodic updates via email to the owner, A/E, and the contractors on issues that are in the process of being resolved. Issues that have been resolved will be added to the issues log in the commissioning plan during the periodic updates of the commissioning plan.

Appendices will contain the commissioning process issues log.

CONSTRUCTION PHASE

During construction phase, the tasks to be accomplished include:

- Construction Checklists
- Commissioning Site Visit Reports
- Functional Performance Testing

CONSTRUCTION CHECKLISTS

The construction checklists are developed by the commissioning authority during the design phase and modified during construction mobilization, maintained by the general contractor, and used by the general contractor and subcontractors. They will be tracked utilizing a procedure acceptable to the owner. The intent of construction checklists is to convey pertinent information to the installers regarding the owner's concerns on long-term operation of the facility and systems.

The approach to the structure of the checklists is to keep it short and simple by focusing on key elements. When information is known (manufacturer, model, etc), this information is included on the checklist when it is provided by the commissioning authority. When multiple components are to be installed (lights, etc.) and information specific to each component is not required, then there shall be generic checklists that are not specific to a particular piece of equipment. The construction checklists are typically composed of three primary sections:

1. Delivery – information to be verified upon delivery to the site.
2. Pre-Installation Checks – items to verify prior to installation (may have been in storage for weeks or months).
3. Installation and Start-up Checks – items to verify during each installation step and at start-up.

The checklists span the duration from when the equipment is delivered to the job site until the point that the system/component is started up and is operational. This includes testing, adjusting, and balancing (TAB) and control system tuning.

The development of the construction checklists takes close coordination between the commissioning authority and contractors to maximize the benefits of the checklists and to tailor the checklists to the way the contractors will manage the project.

During each site visit the commissioning authority will randomly verify roughly 10% of the construction checklists completed since the commissioning authority's previous site visit. Both positive and negative items from this review are to be conveyed to the project team.

Appendices contains sample construction checklists.

COMMISSIONING SITE VISIT REPORTS

Following each site visit by the commissioning authority, a site visit report will be prepared and distributed via e-mail to the owner's representative, A/E, and contractors. If a commissioning meeting was also held during the site visit, the meeting minutes will be included in the site visit report.

Items which may be included in the site visit reports are construction issues, access and maintenance issues, energy efficiency issues, and other issues relating to the project requirements and overall success of the project. Site visit reports will be sent by e-mail within one week of the site visit. Disagreements with items in the reports should be brought to the commissioning authority's attention within one week of the report being sent.

FUNCTIONAL PERFORMANCE TESTING

The purpose of the commissioning process tests is to verify that the building systems as a whole meet the performance requirements stated in the OPR. Before this testing can be conducted, the individual components and systems must be verified for proper operation. This verification is accomplished as part of the construction checklist activity and typically includes the verification of individual control loops, point-to-point testing, and TAB (testing, adjusting, and balancing).

Random sampling will be used to conduct the commissioning process tests. The tasks included for developing and utilizing the tests include:

- Review OPR and identify testing criteria.
- Review submittals for equipment restrictions and testing procedures.
- Develop testing schedule.
- Develop draft test procedures.
- Obtain contractor and owner input.
- Finalize test procedures.
- Oversee accomplishment of testing by the contractors.
- Complete test data records.
- Verify results of tests.
- Retest if necessary.
- Document results, conclusions, and any recommendations.

OCCUPANCY AND OPERATIONS PHASE

The tasks to be completed in the occupancy and operations phase include:

- Final Commissioning Process Report

FINAL COMMISSIONING PROCESS REPORT

The final commissioning process report will essentially be the filling in of the commissioning plan. This will minimize the potential for excess paperwork and rework. An executive summary and a summary of the project will be added along with all the documented issues. Included in the executive summary will be the commissioning authority's evaluation of achievement of the OPR and recommendations on resolving any issues related to not achieving the OPR. The whole report will be scrutinized for completeness and accuracy.

ROLES AND RESPONSIBILITIES

OWNER

The owner has the following responsibilities during the commissioning process:

- Work with the project architect, engineer, and commissioning authority to develop the Owner's Project Requirements during the design portion of the project.
- Owner's representative will be available to respond to questions and assist the commissioning authority in the development of the commissioning plan.
- Review and approve any scope of work changes in the Owner's Project Requirements and the Construction Documents.
- Review and comment on the commissioning authority's system verification reports.
- Review and comment or accept the commissioning authority's final project acceptance recommendation.

COMMISSIONING AUTHORITY

The commissioning authority has the following responsibilities during the commissioning process:

- Prepare and document a Commissioning Plan incorporating the Owner's Project Requirements.
- Plan, organize and document the commissioning process for the project.
- Revise the commissioning plan as required during construction.
- Assist in coordination of commissioning activities among contractors and suppliers and assist in integrating the commissioning process into the contractor's project schedule.
- Organize and assist in documentation of results of equipment/system readiness checks.
- Observe or verify all functional performance verification of equipment/systems.

- Recommend final acceptance of the equipment/systems to the owner.

DESIGN PROFESSIONALS (ARCHITECT AND ENGINEER)

The design professionals have the following responsibilities during the commissioning process:

- Prepare contract documents incorporating Owner's Project Requirements into the design.
- Review and comment on commissioning authority's periodic and final recommendations and reports.
- Participate in scheduled construction meetings as necessary.

CONTRACTOR AND ALL SUB-CONTRACTORS AND THEIR SUPPLIERS

The contractor and all sub-contractors and their suppliers have the following responsibilities during the commissioning process:

- Provide equipment installation and systems testing and start-up as required by the contract documents.
- Operate equipment and systems as required for functional performance verification.
- Complete the Equipment/Systems checklists for each system and/or piece of equipment as the work is accomplished. Provide completed checklists to the commissioning authority.
- Attend construction meetings and respond to action items arising from them as required for the commissioning process to proceed as scheduled.
- Demonstrate equipment/systems operation and performance as required by the contract documents.
- Promptly remedy deficiencies identified by the commissioning team during verification of installation and/or functional performance testing.

COMMUNICATION STRUCTURES

Clear and concise communication structures are needed for this project to ensure consistent and efficient information flow. These communication structures have been developed by the Commissioning Authority based upon the specifications for the project, and include RFI's, change orders, project schedules, submittals, and commissioning process issues.

Some general notes on communication:

- The Commissioning Authority cannot direct the contractors in any of their work.
- All communication between the Commissioning Authority and subcontractors will be through the general contractor. In cases where correspondence is sent to a subcontractor, the general contractor will be copied.
- The owner will be copied on all direct communication from the Commissioning Authority to the contractors or the architect/engineer.
- The owner, A/E, and contractors should provide responses to the Commissioning Authority's review comments and proposed checklists and procedures in a timely manner.
- The CxA should incorporate comments on proposed checklists and procedures in a timely manner.
- Whenever possible, communication from the Commissioning Authority will be done electronically via email.

The communication structures for this project are shown below.

Figure 1: RFI Communication Structure

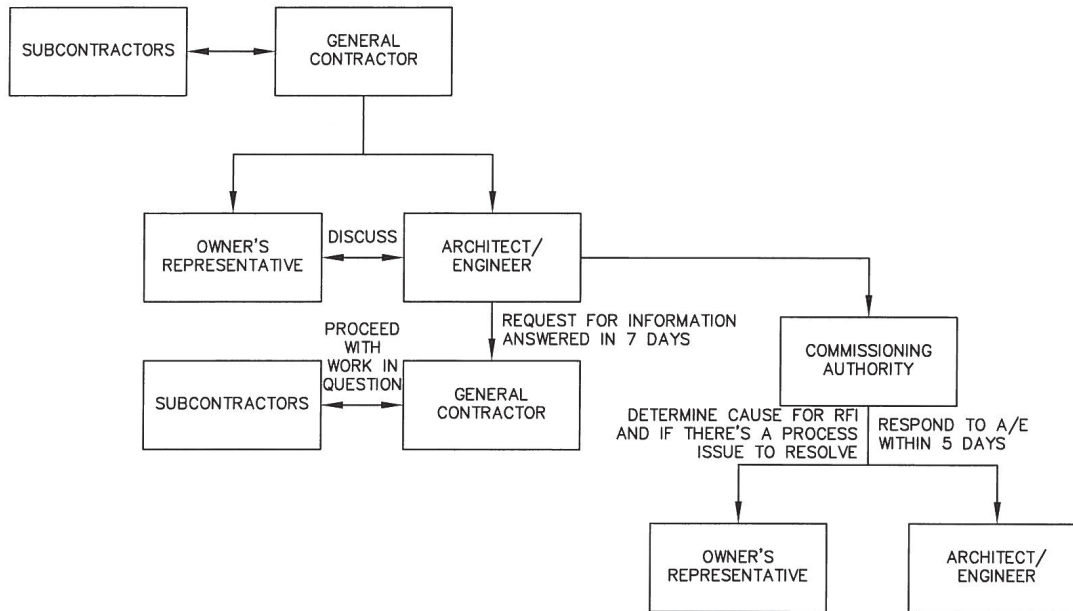


Figure 2: Change Order Communication Structure

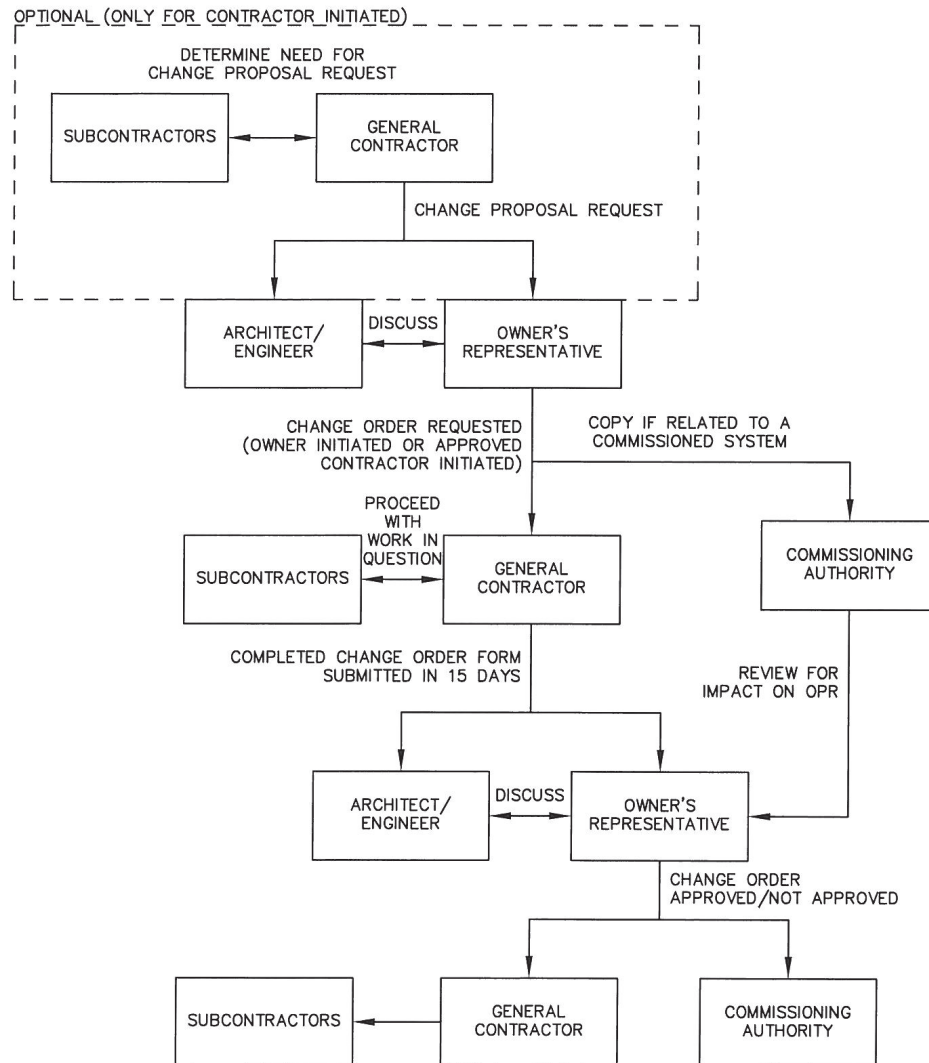


Figure 3: Project Schedule Communication Structure

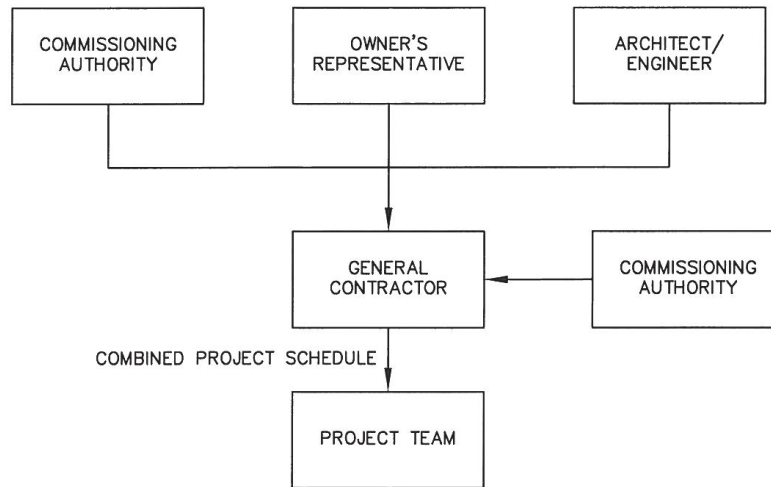


Figure 4: Submittal Communication Structure

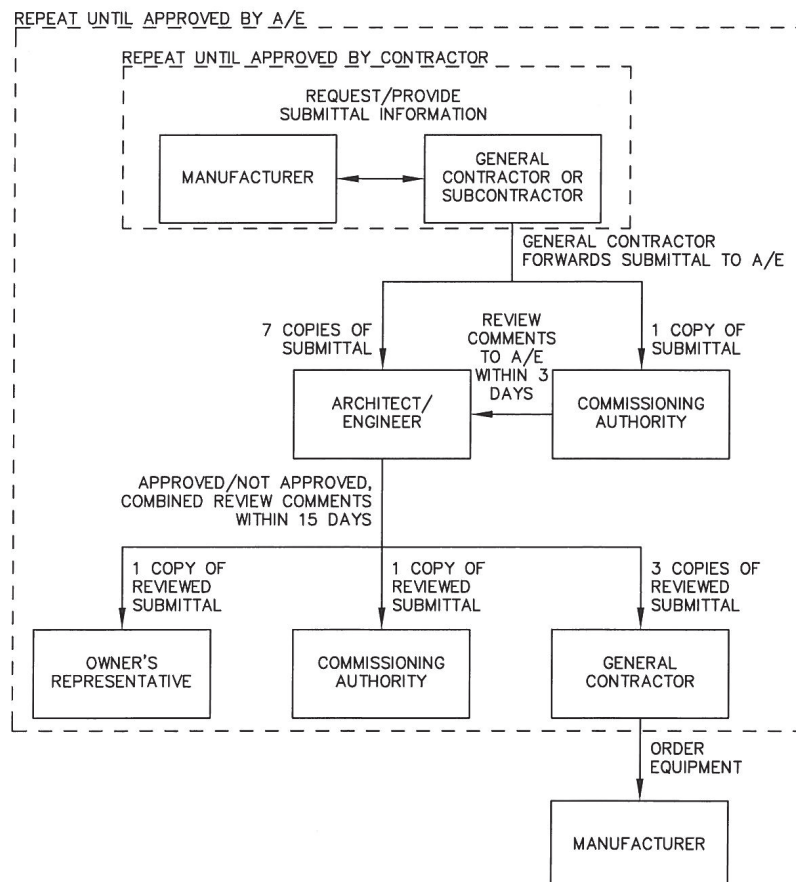
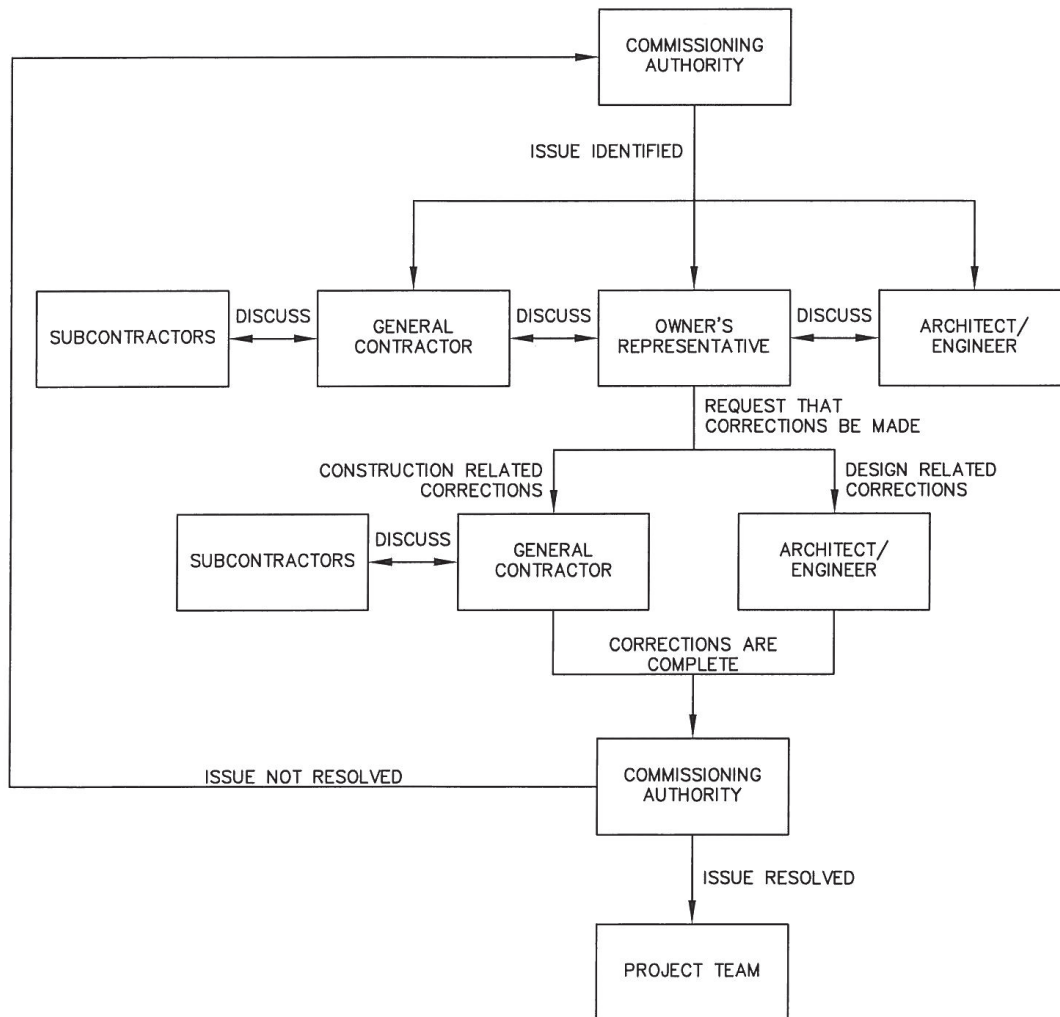


Figure 5: Commissioning Process Issue Communication Structure



CONTACT INFORMATION

Table 2: Contact Information

Role	Person	Company	Phone/Fax	E-mail
Commissioning Authority	Danny VanDoren	Farris Engineering	573.202.9766	dvandoren@farris-usa.com
Project Manager	Andrew Rutenbeck	HFG	816.249.1500	andrewr@hfgarchitecture.com
Project Architect	Jennifer Unrein	HFG	816.249.1500	jenniferu@hfgarchitecture.com
Mechanical Engineer	Ben Schmitt	Farris Engineering	308.203.2222	bschmitt@farris-usa.com
Electrical Engineer	Ericka Nienhueser	Farris Engineering	402.330.5900	enienhueser@farris-usa.com
General Contractor				
Mechanical Contractor				
Electrical Contractor				
Controls Contractor				
TAB Contractor				

COMMISSIONED SYSTEMS AND EQUIPMENT

The equipment and systems to be commissioning are the following:

- HVAC System
- Plumbing System
- Emergency Power
- Elevator

HVAC SYSTEM (AND ALL INTEGRAL EQUIPMENT CONTROLS)

- Heat Pumps
- Fan Coil Units
- Boilers
- Cooling Tower
- Chiller
- Chilled/Hot Water Pumps
- Controls Sequences
- Review Test and Balance Report
- Building automation system (controlled devices, control loops and system integration)

PLUMBING SYSTEM

- Domestic Water Heating, Pumps, and Accessories

ELECTRICAL SYSTEM

- Emergency Generator
- Transfer Switches

COMMISSIONING PROCESS SCHEDULE

The following are key commissioning tasks for the project and their anticipated date (if known) or order in the construction process (if a specific date is not known).

Table 3: Commissioning Process Schedule

Phase	Task	Status
Design	OPR	Completed
	Cx Plan	Completed
	Develop Cx Specifications	Completed
	Cx Plan (periodic updates)	Ongoing
Construction	CxA develops checklists	
	CxA to develop FPT procedures	
	Cx site visit	
	Cx Process Issues Report	
	Functional Performance Testing.	
	CxA to submit FPT report	
	Owner occupancy of building	

[Table will be filled in as project schedule is developed.]



APPENDIX A – OWNER’S PROJECT REQUIREMENTS/BASIS OF DESIGN

11.1(6) OPR/BOD

PART 1 - GENERAL

1.1 CODES, STANDARDS, AND GUIDELINES

- A. International Building Code (2018)
- B. International Residential Code (2018)
- C. International Energy Conservation Code (2018)
- D. 10 CFR Part 435
ASHRAE 62.2-2016
- E. ASHRAE 111-2008 (RA 2017)
- F. ASHRAE 188-2018
- G. IEEE Standards
- H. UL Standards
- I. TIA/ETA Standards
- J. NFPA Codes

1.2 DESIGN CONDITIONS

- A. Elevation: 4,380'
- B. Latitude/Longitude: 48°33'25"N 113°0'52"W
- C. Temperatures (Outdoor):
 - 1. Winter (Heating): -18 deg F (99.6%)
 - 2. Summer (Cooling): 89 deg F db, 60 deg F wb (0.4%)
- D. Temperatures (Indoor):
 - 1. Winter (Heating): 72 deg F, 30% RH
 - 2. Summer (Cooling): 75 deg F, 50% RH

PART 2 – HEATING, VENTILATION, AND AIR CONDITIONG (HVAC) SYSTEMS

2.1 CENTRAL UTILITY PLANT

- A. Provide a 4-pipe hydronic fan coil system. The system shall include distribution pumps, boilers, and an air-cooled chiller.
- B. The boiler system will consist of (2) high efficiency condensing boilers configured in a lead/lag control strategy. Each boiler will have a capacity of approximately 1,000,000 Btu/hr input with a rated efficiency of approximately 92% and a turndown ratio of 7:1.
- C. The chiller system will consist of a single air-cooled chiller with a remote evaporator plate and frame heat exchanger located in the mechanical room with a capacity of approximately 60 tons to provide cooling for the facility. The chilled water pumps will be rated for approximately 145 gpm.
- D. The hydronic solution for both the heating and cooling loops will be 100% water. Glycol will not be required.
- E. All heating and chilled water piping shall be insulated.

2.2 AIR HANDLING SYSTEMS

- A. Provide 4-pipe hydronic fan coil units. Each living unit shall have a dedicated unit for proper zone temperature control. Fan coil units shall be vertical style and located in mechanical rooms or mechanical closets. Above ceiling units are not acceptable.
- B. A small air-to-air energy recovery ventilator (ERV) shall be included for each fan coil unit to pre-condition ventilation air. The ERV shall have a static plate heat exchanger.
- C. All supply and return air ductwork for the fan coil units shall have internal acoustical liner.

2.3 TEMPERATURE CONTROL SYSTEMS

- A. Provide a direct digital control (DDC) building management system (BMS). The system should be Johnson Controls and shall connect to and integrate with the hospital's existing front-end control system.

PART 3 - ELECTRICAL SYSTEMS

3.1 MATERIALS

- A. Nonmetallic Sheathed Cable (Romex) will be the primary raceway type used within the facility. PVC 40 will be used for underground installations. Rigid Galvanized Steel (RGS) will be used for exposed exterior work and where conduits are subject to damage.
- B. Wiring devices will be white, specification grade, 15-amp minimum and have plastic cover plates. Exterior receptacles will be ground fault type and provided with weatherproof in-use covers.

3.2 ELECTRICAL SERVICE

- A. Electrical service will be provided by Glacier Electric Cooperative. The building will likely be served with a 208V, 3 phase, 4 wire electrical service. A single meter with integral surge suppression to main distribution panel will serve the entire facility. The individual apartments will not be metered separately.
- B. Calculations will be performed to determine the maximum available fault current and voltage drop throughout the building system. All electrical equipment will be fully rated based on the fault current available at that location. Refer to riser diagram within appendix for preliminary available fault current values and voltage drop analysis.
- C. Preliminary building load analysis yields an estimated 25 Watts/ft² total with the following breakdown, refer to calculations within appendix for a detailed breakdown:
 - a. Lighting – 1.9 Watts/ft²
 - b. Receptacles – 5.5 Watts/ft²
 - c. HVAC – 7.0 Watts/ft²
 - d. Miscellaneous – 10.6 Watts/ft²

3.3 EMERGENCY POWER SYSTEM

- A. A natural gas generator will be located on grade adjacent to the building. Dedicated automatic transfer switches, panels, and branch circuit wiring will be provided for life safety and standby loads.
- B. Natural gas generator will be required to meet EPA standards outlined in Clean Air Act, 40 CFR Part 60, 1065, 1068, and 60. But this generator will not need to comply with one through four emission standards for non-road Diesel Engines.
- B. Summary of emergency power requirements:
 - 1. Life Safety Branch:
 - i. Emergency lighting (building and exterior)
 - ii. Fire alarm
 - iii. ADA doors
 - 2. Standby Branch:
 - i. Security/card access control panel
 - ii. Communication systems
 - iii. HVAC heating components (boilers, pumps, temperature control system, heat pumps, fan coil units, etc.)
 - iv. Miscellaneous duplex receptacles in the Common Area and Fitness Area
 - v. Single duplex receptacle in each corridor area of apartment units

3.4 POWER DISTRIBUTION

- A. There will be an electrical panel within each apartment. A “house” panel will be located in the mechanical/electrical room to handle the common area loads on each floor.
- B. Power will be provided as required to all mechanical equipment.
- C. Pedestal mounted receptacles will be provided for all parking lot stalls for vehicle block heaters.
- D. Emergency power system and normal power systems are located within dedicated electrical room on first floor as allowed per NFPA 110.

3.5 GROUNDING

- A. Grounding for the facility will be achieved by a single-point grounding system. The main ground bus at the meter center will be connected to the water service and a concrete encased electrode.

3.6 LIGHTING

- A. The lighting throughout the building will generally be residential grade, using luminaires with LED lamps. The ceiling/attic insulation will be at ceiling level, so all luminaires should be surface mounted or IC rated. Refer to luminaire cutsheets within appendix for preliminary selections.

- B. Exterior site lighting for entry plaza, parking lots and pathways to the hospital will be provided. All luminaires will be LED and full cutoff type.
- C. Lighting levels shall comply with IESNA recommended illuminance levels for the following general spaces
 - a. Corridors – 10 fc
 - b. Kitchen – 20 fc
 - c. Living Room – 3 fc
 - d. Bathroom – 10 fc
 - e. Equipment Room – 20 fc
 - f. Fitness Room – 15 fc
 - g. Parking Lot – 1 fc
 - h. Building Entries – 5 fc

3.7 EMERGENCY LIGHTING

- A. Exit lights will be surface mounted thermoplastic fixtures with LED lamps. All exit lights will be red in color. Emergency and exit lighting will be connected to the emergency generator system. Exterior emergency lighting will be provided at all building exits.

3.8 FIRE ALARM SYSTEM

- A. The facility will be equipped with a Johnson Controls (or equivalent) intelligent microprocessor based addressable fire alarm system. Notification and annunciation devices will be provided per applicable codes. The panel covers common spaces and sprinkler riser system.
- B. Horn/strobe devices tied to the main panel will be located in apartment units. Apartment units will also have 120V detectors located per code and interconnected with adjacent units.
- C. An LCD remote annunciator panel will be mounted at the main fire department entrance to the building. Audible/visual evacuation signals will be provided at all points along the path of egress and other areas required by code.

3.9 SECURITY SYSTEMS

- A. Security system will be provided for a card access system at entrances/exits to the building and each apartment unit.
- B. Security system will also include surveillance cameras at corridors, common areas, entrances/exits, and parking lots.

3.10 TELECOMMUNICATION SYSTEMS

- A. Telephone and data capability will be provided to the building with empty conduits to the property line or location as directed by the utility provider. Telephone and data provider is 3 Rivers Communications.
- B. Main telecommunication room will be located such that no data cable exceeds the maximum 90 meter cable length. Other telecommunication rooms will be provided as necessary to not exceed maximum cable lengths.
- C. Horizontal cabling, patch panels, data racks, and conduits will be provided to provide telecommunication systems throughout. Telephone and data ports will be provided in each apartment unit and common areas as necessary.
- D. Horizontal cabling will be provided to support wireless access points in each apartment unit, corridors, and common areas to facilitate Public network access for occupants and guests throughout the building.

3.11 AV SYSTEMS

- A. Sound system will be provided for public systems in the indoor and outdoor common areas. Sound system will not include the exercise space.
- B. Coaxial connections will be provided in apartment units and common areas for satellite television systems. Satellite television system equipment and hardware will be located in the main telecommunication room.

3.12 LIGHTNING PROTECTION

- A. Simplified Lightning Risk Assessment conducted in accordance with NFPA 780 has yielded that the annual threat of occurrence is greater than the tolerable lightning frequency of the building. As a result, NFPA 780 recommends that a lightning protection system be installed. Refer to calculations within appendix for more detailed information.

PART 4 - PLUMBING SYSTEMS

4.1 SERVICES

- A. A single 3" domestic water service and meter will serve the facility. The service is provided by Two Medicine Water Company. A domestic water booster pump will be required due to low incoming water pressure.
- B. A 1" stub out will be provided downstream of the water meter to serve site irrigation.
- C. Natural gas will serve the facility with a single meter. The service is provided by Northwestern Energy.
- D. The 6" sanitary sewer service will leave the building at a single location.
- E. Storm drainage will discharge on grade via gutter and downspouts.

4.2 TREATMENT SYSTEMS

- A. A water softener is required to treat the domestic hot water and HVAC makeup water systems. The domestic cold water will not be treated.

4.3 HOT WATER GENERATION SYSTEM

- A. A series of three (3) natural gas fired tank style water heaters will be provided to serve the facility. Each water heater shall have a capacity of approximately 100 gallons of storage and an input of 250,000 Btu/hr.

4.4 DISTRIBUTION SYSTEMS

- A. The main cold water and hot water piping throughout the facility will be insulated copper piping.
- B. A hot water circulation system will be provided to minimize hot water delivery delays.

4.5 FIXTURES

- A. Plumbing fixtures will be typical commercial style to ensure quality. However, all faucets and water closets will be manually operated. Water closets will be tank style in lieu of flush valve.
- B. Wall hydrants will be recessed with covers and have keyed operation.
- C. A natural gas fireplace, fire pit, and barbeque will be provided for the building.

PART 5 - FIRE PROTECTION SYSTEMS

5.1 GENERAL

- A. An automatic wet pipe fire sprinkler system designed in accordance with NFPA 13R will be required for all residential areas of this facility. All public spaces and common mechanical rooms shall be designed in accordance with NFPA 13. To date, a current hydrant flow test at the site has not yet been accomplished. Existing domestic data has been researched; however, not all piping has been located and pipe sizes have not all been confirmed. Based on existing hydrant data provided, it is assumed that the fire hydrant closest to the site is served from a dead-end run of piping. The existing data provided indicates water supply is deficient in both flow. It has not yet been determined if any effort will be made as part of this project to loop this piping such that better water supply is available to the project site. At this point, the design team is currently working under the assumption that a fire pump will be required.
- B. As primarily a residential (13R) system, all sprinklers installed within the individual apartment units shall be residential style. All common area, public spaces, and mechanical spaces will be designed in compliance with NFPA 13. Sprinklers in these areas shall be quick response style. All areas of the building will be protected with the exception of the following:
 - 1. Restrooms that do not exceed 55 SF located within the dwelling units, provided that walls and ceilings, including the walls and ceilings behind a shower enclosure or tub, are of noncombustible or limited combustible materials with a 15-minute thermal barrier rating.
 - 2. Closets used for clothing, linen and pantries located within the dwelling units that are less than or equal to 24 SF where the least dimension is 3'0" and smaller with non-combustible or limited-combustible materials used for the walls and ceiling, provided the closet does not contain heating or air conditioning equipment, washers, dryers, or water heaters.
 - 3. Combustible attic spaces, penthouse equipment rooms, elevator machine rooms, concealed spaces dedicated exclusively to and containing only dwelling unit ventilation equipment, crawl spaces, floor/ceiling spaces, elevator shafts where the elevator installation complies with ANSI

- A17.1, and other concealed spaces that are not intended for living purposes or storage and do not contain fuel-fired equipment.
4. Sprinkler protection shall be provided for exterior balconies, decks, and ground floor patios of dwelling units and sleeping units where the building is of Class V Construction facilities; otherwise, they may be omitted.
 5. Sprinklers shall not be required in closets on exterior balconies and exterior breezeway/corridors, regardless of size, as long as the closet does not have doors or unprotected penetrations directly into the dwelling unit.
- C. All piping for the facility shall be routed in the ceiling plenum space where ceilings have been provided and shall be routed exposed where construction is exposed.
- D. A 6" fire main will be provided to serve the new fire sprinkler system. The main will be equipped with a supervised backflow prevention which will be located withing the fire pump house. A post indicator valve shall be installed on the 6" main at a minimum distance of 40' from the building. This valve shall be equipped with a tamper switch that is monitored by the building's fire alarm system.
- E. The fire sprinkler system shall be equipped with a fire department connection (FDC) that shall be flush wall mounted on the street/address side of the building and shall be equipped with threads that are compatible with the local responding fire department hose threads. Connections and a separate shut-off valve will be provided to allow the FDC to be used to conduct a full forward flow test of the backflow preventer.
- F. A system riser will be provided that includes a main shut-off valve and a riser manifold assembly that includes a flow switch and a combination main drain and inspector's test valve. The drain line shall route to the building exterior at an elevation that is six inches above external grade. A threaded outlet will be provided to allow the drain to be extended away from the building during testing of the system. A concrete splash block shall be installed beneath the outlet. An outside bell/strobe/sign device shall be provided that is connected to the riser pressure switch and is mounted with the device centered above the FDC at an elevation of 9'-0" above final exterior grade. All valves shall be equipped with tamper switches. All flow and tamper switches shall be monitored by the building's fire alarm system.



APPENDIX B – COMMISSIONING SPECIFICATIONS

SECTION 23 08 00 - GENERAL COMMISSIONING REQUIREMENTS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- (A) Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.
- (B) OPR, BOD and Commissioning Plan documentation are included by reference for information only.
- (C) ASHRAE Guideline 0.

1.02 SUMMARY

- (A) Section includes general requirements that apply to implementation of commissioning without regard to specific systems, assemblies, or components.

1.03 DESCRIPTION

- (A) The owner has elected to use the Commissioning Process as part of their quality process to design, construct and operate this project. As with any quality process, Commissioning provides tools to enable everyone involved in the construction of a building to ensure that the final building meets the original intent of the Owner. A primary tool used is the completion of construction checklists by individual workers. The checklists are simple to fill out and easily track the current state of work by providing the key criteria in the specifications that the Owner has defined as important for the successful installation and long-term operation of systems and equipment.

1.04 INCLUDED SYSTEMS

- (A) The following systems, at a minimum, and their components are the focus of the Commissioning Process due to their complexity and the need to have coordination among the various subcontractors:

- 1. HVAC System (and all integral equipment controls)

- A. Heat Pumps
- B. Fan Coil Units
- C. Boilers
- D. Cooling Tower
- E. Chiller
- F. Chilled/Hot Water Pumps
- G. Controls Sequences
- H. Review Test and Balance Report

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GENERAL COMMISSIONING REQUIREMENTS

PROJECT NO. H IH BLAC 19100

- I. Building automation system (controlled devices, control loops and system integration)
 - 2. Plumbing System
 - A. Domestic Water Heating, Pumps, and Accessories
 - 3. Electrical System
 - A. Emergency Generator
 - B. Transfer Switches
 - 4. Elevator
- 1.05 DEFINITIONS
- (A) BoD: Basis of Design. A document that records concepts, calculations, decisions, and product selections used to meet the OPR and to satisfy applicable regulatory requirements, standards, and guidelines. The document includes both narrative descriptions and lists of individual items that support the design process.
 - (B) Commissioning Plan: A document that outlines the organization, schedule, allocation of resources, and documentation requirements of the commissioning process.
 - (C) CxA: Commissioning Authority.
 - (D) OPR: Owner's Project Requirements. A document that details the functional requirements of a project and the expectations of how it will be used and operated. These include Project goals, measurable performance criteria, cost considerations, benchmarks, success criteria, and supporting information.
 - (E) TAB: Testing, Adjusting and Balancing
 - (F) Systems, Subsystems, Equipment, and Components: Where these terms are used together or separately, they shall mean "as-built" systems, subsystems, equipment, and components.
- 1.06 COMMISSIONING TEAM
- (A) Members Appointed by Contractor(s): Individuals, each having the authority to act on behalf of the entity he or she represents, explicitly organized to implement the commissioning process through coordinated action. The commissioning team shall consist of, but not be limited to, representatives of Contractor, including Project superintendent and subcontractors, installers, suppliers, and specialists deemed appropriate by the CxA.
 - (B) Members Appointed by Owner:
 - 1. CxA: The designated person, company, or entity that plans, schedules, and coordinates the commissioning team to implement the commissioning process.
 - 2. Representatives of the facility user and operation and maintenance personnel.
 - 3. Architect and engineering design professionals.

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1.07 OWNER'S RESPONSIBILITIES

- (A) Provide the OPR documentation to the CxA and Contractor for information and use.
- (B) Assign operation and maintenance personnel and schedule them to participate in commissioning team activities.
- (C) Provide the BoD documentation, prepared by Architect/Engineer and approved by Owner, to the CxA and Contractor for use in developing the commissioning plan, systems manual, and operation and maintenance training plan.

1.08 CONTRACTOR'S RESPONSIBILITIES

- (A) Contractor shall assign representatives with expertise and authority to act on its behalf and shall schedule them to participate in and perform commissioning process activities including, but not limited to, the following:
 - 1. Evaluate performance deficiencies identified in test reports and, in collaboration with entity responsible for system and equipment installation, recommend corrective action.
 - 2. Cooperate with the CxA for resolution of issues recorded in the Issues Log.
 - 3. Attend commissioning team meetings held on an as needed basis.
 - 4. Integrate and coordinate commissioning process activities with construction schedule.
 - 5. Review and accept construction checklists provided by the CxA.
 - 6. Complete paper construction checklists as Work is completed and provide to the Commissioning Authority as requested.
 - 7. Review and accept commissioning process test procedures provided by the Commissioning Authority.
 - 8. Complete commissioning process test procedures.

1.09 CxA'S RESPONSIBILITIES

- (A) Organize and lead the commissioning team.
- (B) Provide commissioning plan.
- (C) Convene commissioning team meetings.
- (D) Provide Project-specific construction checklists and commissioning process test procedures.
- (E) Verify the execution of commissioning process activities using random sampling. The sampling rate may vary from 1 to 100 percent. Verification will include, but is not limited to, equipment submittals, construction checklists, training, operating and maintenance data, tests, and test reports to verify compliance with the OPR. When a random sample does not meet the requirement, the CxA will report the failure in the Issues Log.
- (F) Prepare and maintain the Issues Log.
- (G) Verify proper owner training.

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(H) Verify proper testing and balancing.

(I) Witness functional performance testing.

PART 2 - PRODUCTS

2.01 SCHEDULE

(A) The CxA shall provide the Contractor with a schedule of commissioning activities. Commissioning activities will not be critical path activities.

(B) The Contractor shall incorporate the commissioning activities into the overall project schedule.

2.02 CONSTRUCTION CHECKLIST OVERVIEW

(A) The intent of the construction checklist is to provide a formalized means to easily track construction progress and to provide individual workers the key criteria for a successful installation.

(B) Construction checklists for all pieces of equipment typically follow the same format, yet are tailored to the specific equipment being installed.

(C) Construction checklists are developed for each individual piece of equipment to track and verify equipment from when they are delivered, installed, and started up. The contractor will be provided with all checklists developed for each piece of equipment or system with the following sections:

1. Pre-Installation Checks: Includes several yes/no or short answer questions to document the condition of the equipment prior to installation and several blank columns to compare delivery items such as manufacturer, model, serial no., etc. to the corresponding submitted/approved items.

2. Installation and Startup: Includes several yes/no or short answer questions to document that the equipment is installed, electrically wired, controlled and started up and balanced according to the specified requirements. A Negative Response section is included at the end of the checklist to document the reasons for any “no” responses or discrepancies in the various sections. A space is included to document the actions taken to correct the problems resulting in “no” responses.

(D) The checklist shall be completed by the individual actually completing the work. Prior to any work, the checklist shall be reviewed by the individual contractor for pertinent information. Any negative responses on the checklist shall be explained and documented at the end of the checklist.

(E) The checklists shall not be filled out by a supervisor or other individual who did not work on the equipment.

(F) The completion of the checklist does not eliminate the contractor’s responsibility for meeting other requirements in the specifications and drawings.

(G) The CxA will periodically verify the accuracy and completeness of the checklists. If consistent errors are found, the responsible contractor shall re-validate 100% of the checklists for the problem equipment or system type.

(H) The Checklists are designed to detect and eliminate delivery, installation and startup problems, and problems with miscommunication. This process also serves as a convenient way to document the progress of the work.

2.03 CONTROL SYSTEM VERIFICATION

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- (A) Particular emphasis will be placed on the automatic control system performance.
- (B) Included in this work will be sample-based verification of instrument calibration, access to components, labeling of devices, clear sequences and shop drawings.
- (C) The verification of the control system will be accomplished as an on-going task during construction to identify and resolve systemic issues early in the project.
- (D) The control system operation must be sufficiently operational prior to the TAB of the system. It is understood that a portion of the final control system startup occurs in conjunction with the TAB work. The intent of this requirement is for the TAB work to be productive and not be hampered by a control system that is not sufficiently functional.
- (E) The control system testing will utilize the controls system instrumentation for testing. Therefore, the first portion of the control system testing will be verification of the sensors, inputs and outputs.
- (F) Point-to-Point Verification: All wiring shall be checked out by the Control Contractor from end to end, point to point, from field to computer screen to ensure correct connection and a system free from wiring defects.
- (G) CxA verification of sensors will be made using the sampling method; an exhaustive retest of the control system inputs and outputs will not be conducted by the CxA. Prior to CxA verification, the Control Contractor shall be responsible for complete input/output checkout quality assurance.

1. Sensor and Actuator Calibration, General:

- A. This section is included to emphasize the importance of the Control Contractor calibrating the instrumentation and to make clear the requirement for same; and that "factory calibration" or "calibration by exception" is not acceptable.
- B. All field-installed temperature, relative humidity, CO, CO₂ and pressure sensors and gages, and all actuators (dampers and valves) on all equipment shall be calibrated using the methods described below. Alternate methods may be used, if approved by the Owner beforehand. All test instruments shall have had a certified calibration within the last 12 months. Sensors installed in the unit at the factory with calibration certification provided need not be field calibrated.
- C. All procedures used shall be fully documented and clearly reference the procedures followed and include written documentation of initial, intermediate and final results.

2.04 FUNCTIONAL PERFORMANCE TESTING

- (A) The systems in the building will be operated in their different modes of operation to ensure the facility operates properly as a whole. This testing provides both Owner and the General and subcontractors with documentation that the building was operating properly at turnover.
- (B) Each subcontractor will be responsible, as required, to put the system in various modes of operation and fixing minor problems found during the test.
- (C) If major problems are discovered during the test, the responsible subcontractors and General Contractor will fix the problem and the test shall be redone. If more than two functional performance tests are required, the responsible subcontractor will be back-charged for the CxA's time and expenses.

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- (D) The CxA will provide all commissioning team members, and others as required, the functional performance test plan prior to scheduled testing.
- (E) The CxA shall schedule and direct the testing once all construction checklists have been completed and accepted by the CxA.
- (F) Control system setup, calibration and operation shall be completed and verified prior to system functional performance testing. System functional performance testing shall not be completed until the Adjusting and Balancing report has been verified and accepted by the CxA.
- (G) Skilled technicians shall be provided by the appropriate Contractor familiar with the system and building to execute the functional performance testing of the control system and perform functional performance testing of equipment.

2.05 TRAINING VERIFICATION

- (A) The lead subcontractor for the respective system is responsible for the development of the training material for the system. Any coordination of training between different subcontractors is the responsibility of the lead subcontractor.
- (B) The training material shall be submitted to the CxA 60 days prior to the originally scheduled system training for review and acceptance.
- (C) All training shall be videotaped using professional-grade equipment.
- (D) All training sessions shall be scheduled and coordinated by the General Contractor through Owner.
- (E) Major component training shall be completed and accepted by Owner prior to substantial completion and occupancy.

2.06 COMMISSIONING PLAN

- (A) A detailed commissioning plan containing the Owner's Project Requirements, designer's Basis of Design, and a compilation of all test forms will be provided and reviewed with the subcontractors.
- (B) The commissioning plan is intended only as a guide for commissioning activities on the project. The specifications are the contract requirements and shall be considered the extent of the subcontractor's responsibilities.

END OF SECTION 23 08 00 – GENERAL COMMISSIONING REQUIREMENTS



APPENDIX C – COMMISSIONING PROCESS ISSUES



Commissioning Issues/Benefits Log

Update: 12/4/19

Issue	Open Date	Closed Date	Associated Equip/Area	Issue Summary	Responsible Party	Status
1	-	-	-	-	-	-
2	-	-	-	-	-	-
3	-	-	-	-	-	-
4	-	-	-	-	-	-
5	-	-	-	-	-	-
6	-	-	-	-	-	-
7	-	-	-	-	-	-
8	-	-	-	-	-	-
9	-	-	-	-	-	-

Issue 1: OPEN

Item Name:

Location:

Open Date:

Closed Date:

Observed By:

Responsible Party:

Issue Description:

Proposed Resolution:

Potential Benefits:



APPENDIX D – PREFUNCTIONAL CHECKLISTS

COOLING TOWER CHECKLIST

TAG ID: CT-1A/B

Fill in blanks with check, specific information, or circle "yes" or "no". For any negative responses, complete Section 4. All information on this checklist may be reviewed at anytime by the Commissioning Authority (CxA).

1. Cooling Tower Model Verification

	Specified	Submitted	Installed
Manufacturer	BAC		
Model Number	XES3E-1424		
Serial Number			
Capacity (tons)	1833		
Chilled Fluid Flow Rate (gpm)	3500		
Fan Power (HP)	40		
Motor Voltage / Phase (V / -)	480 / 3		

2. Pre-Installation Checks

The following must be completed upon delivery of equipment to the work site.

		Contractor	Initial	CxA
2.1	Physical Checks	Mechanical		
A	Unit is free of physical damage	Yes / No		
B	Openings are sealed with plastic	Yes / No		
C	All components present	Yes / No		
E	Electrical disconnect is provided	Yes / No		
F	Installation and startup manual provided	Yes / No		
G	Unit tags affixed	Yes / No		

3. Installation and Start-up

The following items need to be verified during installation.

		Contractor	Initial	CxA
3.1	Installation of Cooling Tower	Mechanical		
A	Unit is secured as required by manufacturer and specifications	Yes / No		
B	General appearance good, no apparent damage	Yes / No		
C	Tower foundation is installed per structural drawings	Yes / No		
D	Ladders and Handrails installed per OSHA	Yes / No		
E	Manufacturer's required maintenance clearance provided	Yes / No		
F	Tower fill installed per manufacturers instructions	Yes / No		
G	Spray nozzles clean	Yes / No		
H	Distribution headers balanced	Yes / No		
I	Outlet screens clean	Yes / No		
J	Basin clean and clear of any debris	Yes / No		
K	Condenser Water system fill complete	Yes / No		
L	Condenser Water filtration system installed and functional	Yes / No		
M	Condenser Water makeup water piping installed and functional	Yes / No		
N	Vibration isolation installed if applicable	Yes / No		
O	All components are accessible for maintenance	Yes / No		
P	Unit labeled and is easy to see	Yes / No		
3.2	Piping	Mechanical		

A	Tower piping installation checked against the drawings and all devices gages and appurtenances are in place	Yes / No		
B	Piping supported independently of the tower	Yes / No		
C	Piping type and flow direction labeled on piping	Yes / No		
D	Isolation valves and piping specialties installed	Yes / No		
3.3	Fan	Mechanical		
A	Fan lubricated	Yes / No		
B	Fan drive properly aligned	Yes / No		
C	Fan turns freely, fan wheel is balanced	Yes / No		
D	Fan guard or shield is properly installed	Yes / No		
E	Vibration isolation devices installed and functional	Yes / No		
F	Vibration sensor is installed and wired if applicable	Yes / No		
3.4	Electrical	Electrical		
A	Lugs tightened by chiller startup technician	Yes / No		
B	Safety disconnect switch installed in an accessible location	Yes / No		
C	Lug sizing matches wire size requirement	Yes / No		
D	All electric connections tight	Yes / No		
E	Grounding installed for components and unit	Yes / No		
F	All control devices and wiring complete	Yes / No		
G	Control system interlocks connected and functional	Yes / No		
H	HOA Switch installed per manufacturer's instructions	Yes / No		
I	Operation of HOA switch checked in all positions	Yes / No		
J	Proper safeties in control when HOA switch in Hand position	Yes / No		
K	VFD Installed	Yes / No		
3.5	Controls - Installation	Controls		
A	Control panel accessible and labeled properly	Yes / No		
B	All sensors are installed and calibrated	Yes / No		
C	Safety items installed and verified	Yes / No		
3.6	Controls – Startup	Controls		
A	Unit voltage and amps verified	Yes / No		
B	Remote start and stop signal verified	Yes / No		
C	Unit “run” sequences verified	Yes / No		
D	Unit “alarm” sequences verified	Yes / No		
3.7	Mechanical – Startup	Mechanical		
A	Manufacturer's startup checklist completed and attached	Yes / No		
B	Associated safety controls are operational and have been verified	Yes / No		
C	Full load test to verify load limiting	Yes / No		
D	System starts and runs without any unusual noise or vibration	Yes / No		
3.8	Testing, Adjusting & Balancing	TAB		
A	Installation of system and balancing devices allowed balancing to be completed following specified NEBB or AABC procedures and contract documents	Yes / No		
B	Evaporator pressure drop (ft)	Yes / No		
C	Condenser water flow (gpm)	Yes / No		

4. Negative Responses (attach sheets as necessary).

Item	Reason for negative response	Resolution

***** Return completed checklist to the Commissioning Authority *****

END OF CHECKLIST



CONDENSER WATER PIPING CHECKLIST

TAG ID: N/A

Fill in blanks with check, specific information, or circle "yes" or "no". For any negative responses, complete Section 4. All information on this checklist may be reviewed at anytime by the Commissioning Authority (CxA).

1. Installation Checks

The following items need to be verified during installation.

		Contractor	Initial	CxA
1.1	Piping	Mechanical		
A	Pipe fittings complete and pipes properly supported	Yes / No		
B	Pipes properly labeled	Yes / No		
C	Pipes properly insulated	Yes / No		
D	Strainers in place and clean	Yes / No		
E	Isolation valves and balancing valves installed	Yes / No		
F	Test ports (P/T) installed near all control sensors and as per spec	Yes / No		
G	Piping system properly flushed and cleaned and temporary piping removed	Yes / No		
H	No leaking apparent around fittings	Yes / No		
1.2	Valves	Mechanical		
A	Valve labels permanently affixed	Yes / No		
B	Valves installed in proper direction	Yes / No		
	Valves stroke fully and easily and spars			
	Valves that require a positive shut-off are verified to not be leaking when closed at normal operating pressure			
C	No leaks	Yes / No		
1.3	Sensors and Gauges	Controls		
A	Temperature, pressure and flow gages and sensors installed	Yes / No		
B	Piping gages, BAS and chiller panel temperature and pressure readouts match	Yes / No		
1.4	TAB	TAB		
A	Installation of system and balancing devices allowed balancing to be completed following specified NEBB or AABC procedures and contract documents	Yes / No		

2. Negative Responses (attach sheets as necessary).

Item	Reason for negative response	Resolution

*** Return completed checklist to the Commissioning Authority ***

END OF CHECKLIST



CONTROLS CHECKLIST

TAG ID: N/A

Fill in blanks with check, specific information, or circle "yes" or "no". For any negative responses, complete Section 4. All information on this checklist may be reviewed at anytime by the Commissioning Authority (CxA).

1. Installation Checks

The following items need to be verified during installation.

		Contractor	Initial	CxA
1.1	Controls	Controls		
A	General appearance good, no apparent damage	Yes / No		
B	Equipment labels affixed	Yes / No		
C	Layout and location of control panels matches drawings	Yes / No		
D	Areas or equipment panels serve clear in control drawings	Yes / No		
E	Wiring labeled inside panels	Yes / No		
F	Shielded wiring used on electric sensors	Yes / No		
G	Battery backup in place and operable	Yes / No		
H	Panels properly grounded	Yes / No		
I	Architecture of control panels matches	Yes / No		
J	Environmental conditions in accordance	Yes / No		
K	Spare point capacity meets specified r	Yes / No		
L	Communications established between user interface and controller	Yes / No		

2. Negative Responses (attach sheets as necessary).

Item	Reason for negative response	Resolution

*** Return completed checklist to the Commissioning Authority ***

END OF CHECKLIST



VARIABLE FREQUENCY DRIVE (VFD) CHECKLIST

TAG ID: VFD-CT2B

Fill in blanks with check, specific information, or circle "yes" or "no". For any negative responses, complete Section 4. All information on this checklist may be reviewed at anytime by the Commissioning Authority (CxA).

1. VFD Model Verification

	Specified	Submitted	Installed
Manufacturer	Yaskawa		
Model Number	Z1000		
Serial Number			

2. Pre-Installation Checks

The following must be completed upon delivery of equipment to the work site.

		Contractor	Initial	CxA
2.1	Physical Checks	Mechanical		
A	Unit is free of physical damage	Yes / No		
B	All components present	Yes / No		
C	Installation and startup manual provided	Yes / No		
D	Wiring schematics (electrical & controls) for this application attached	Yes / No		
E	Units tags affixed	Yes / No		
F	Manufacturer's ratings readable/accurate	Yes / No		

3. Installation and Start-up

The following items need to be verified during installation.

		Contractor	Initial	CxA
3.1	Installation of VFD	Mechanical		
A	Unit is secured as required by manufacturer and specifications	Yes / No		
B	Adequate clearance around unit for service	Yes / No		
C	All components accessible for maintenance	Yes / No		
D	Unit can be removed from the building	Yes / No		
E	Unit labeled and is easy to see	Yes / No		
F	Wiring schematic inside enclosure and includes bypass section	Yes / No		
3.2	Electrical	Electrical		
A	Drive to motor leads are in grounded metal conduit	Yes / No		
B	All electrical connections are tight	Yes / No		
C	All electrical components are grounded	Yes / No		
3.3	Controls - Installation	Controls		
A	Control panel accessible and labeled properly	Yes / No		
B	Low voltage control signals are shielded and in own conduit	Yes / No		
C	Auxiliary safeties (F/A shutdown, freezestat, etc.) are installed and operational	Yes / No		
3.4	Electrical – Pre-Startup Checks	Electrical		
A	Motor full load amps less than max rating, design / actual	/		
B	Input voltage, design / actual (within 10% of rating)	/		
C	All grounds verified	Yes / No		
D	All fuses verified	Yes / No		

3.5	Electrical - Startup	Electrical		
A	VFD properly powers up	Yes / No		
B	Stop button works	Yes / No		
C	Motor rotation is in the proper direction	Yes / No		
D	Minimum and maximum speeds reached using remote command	Yes / No		
E	"Accel" and "Decel" adjustments are made within the drive and do not depend on ramping signal from the DDC controls	Yes / No		
F	VFD restarts automatically	Yes / No		
G	No disconnect on load side of VFD	Yes / No		
H	Critical frequencies have been programmed out of VFD (if applicable)	Yes / No		
I	Motor runs in bypass mode while servicing or removing unit	Yes / No		
J	Motor overload protection and phase loss protection provided during bypass mode	Yes / No		
K	System starts and runs without any unusual noise or vibration	Yes / No		
L	Manufacturer's startup checklist completed and attached	Yes / No		

4. Negative Responses (attach sheets as necessary).

Item	Reason for negative response	Resolution

SAMPLE

***** Return completed checklist to the Commissioning Authority *****

END OF CHECKLIST



APPENDIX E –FUNCTIONAL PERFORMANCE TESTS



COOLING TOWER (CT-1A/B)

FUNCTIONAL PERFORMANCE TEST

1. Participants

Name	Company	Role

Date: _____

Completed By: _____

2. Test Prerequisites

	Item	Status
1	Construction Checklists are complete.	Yes / No
2	The control system is finalized and accepted by the Owners Representative.	Yes / No
3	Factory Start up is Complete.	Yes / No
4	Testing and Balancing is complete and accepted by the Owners Representative.	Yes / No

SAMPLE

3. DDC Point Review/Check

#	Point Description	Type	Value	Notes	Pass
1	Cooling tower enable	BO			
2	Cooling tower fan speed	AO			
3	Cooling tower sump temperature	AI			
4	Cooling tower sump water level	BI			
5	Outside air dry-bulb temperature	AI			
6	Outside air wet-bulb temperature	AI			
7	Outside air relative humidity	AI			
8	Cooling Tower Supply Temperature	AI			
9	Cooling Tower Return Temperature	AI			
10	Basin Temperature	AI			
11	Low Water Level	BI			
12	High Water Level	BI			
13	Drain Solenoid Valve	BO			

BI – Binary Input BO – Binary Output AI – Analog Input AO – Analog Output S – Software

4. Functional Testing Record

System Condition	Expected Response	Pass	Notes
If the cooling tower is enabled and the isolation control valves (CV-1A/B/C/D) are proven open and the	Cooling tower fan shall start	Yes/No	



CONTROL VALVE (TV-3522)

FUNCTIONAL PERFORMANCE TEST

1. Participants

Name	Company	Role

Date: _____

Completed By: _____

2. Test Prerequisites

	Item	Status
1	Construction Checklists are complete.	Yes / No
2	The control system is finalized and accepted by the Owners Representative.	Yes / No
3	Factory Start up is Complete.	Yes / No
4	Testing and Balancing is complete and accepted by the Owners Representative.	Yes / No

3. DDC Point Review/Check

#	Point Description	Test	Notes	Pass
1	Control valve actuator position	A		

BI – Binary Input BO – Binary Output AI – Analog Input AO – Analog Output

SAMPLE

4. Functional Testing Record

System Condition	Expected Response	Pass	Notes
When cooling system is enabled	Control valve actuator shall modulate to maintain cooling supply water temperature setpoint. This is listed to be 76.0F on the sequence of operations. Discussions have talked about that the existing setpoint may have been as high as 84.0°F. Verify what setpoint has been decided upon.	Yes/No	

5. Notes

Item	Reason for negative response	Resolution

END OF CHECKLIST

calculated flow is above the minimum			
If cooling tower fan is started	Fan speed shall modulate to maintain cooling tower supply temperature setpoint of 76.0°F as measured by TS1.2	Yes/No	
If lead tower fails	Lag tower shall become lead tower, appropriate control valves shall respond.	Yes/No	(What is the delay time?)
If either fan of lead tower fails	Lag tower shall become lead tower	Yes/No	
If both cells are operating and fan speed falls to the minimum (20%) speed for at least 15 minutes and the cooling tower water supply temp continues to drop at least 4°F below the setpoint	The fans shall cycle between off and the minimum speed to maintain the cooling tower water supply temperature between 0°F and 4°F below the setpoint	Yes/No	
If the OA temp is less than 10°F	Fan shall run backwards for the following conditions: OA=10°F: 5 min of every 30 min OA=-40°F: 20 min of every 30 min	Yes/No	(What is the reverse fan speed?)
Lead-Lag is switched	New lead cooling tower isolation valves shall open while new lag cooling tower return isolation valves close. When new lag cooling tower isolation valves are verified to be closed the new lead cooling tower fans shall be brought up to the same speed that the new lag cooling tower fans were at. Once new lag cooling tower is operating for 15 minutes, the new lead cooling tower fans shall be brought up to the same speed that the new lag cooling tower fans were at. Once new lag cooling tower water level in both tower basins is above low level, the new lag cooling tower supply isolation valves shall close	Yes/No	(Record timing of lead/lag switchover)
Water level in basin signals low level	PLC shall open makeup water valve CV-7A	Yes/No	
Water level in basin signals high level	(not in sequence – verify response)	Yes/No	
When return isolation valve CV-1A/B close	Associated drain valve CV-1E/F shall open	Yes/No	
Verify vibration alarm for fan, put vibration sensor into alarm	Fan shall be disabled	Yes/No	
CT fan is manually shut off	Fan shall alarm, CT shall be disabled, and lag CT shall be enabled	Yes/No	
If calculated flowrate is less than 1750 GPM per operating cell for at least 15	PLC shall generate an alarm and notify maintenance personnel	Yes/No	

consecutive minutes or 30 total minutes in any hour			
Min. flow calculated per the following:			
FCT = COOLING TOWER FLOW RATE			
F2 = COOLING WATER FLOW RATE MEASURED BY FLOW METER, FM-2			
T3.1 = WATER TEMPERATURE MEASURED BY TEMPERATURE SENSOR, TS-3.1			
T3.2 = WATER TEMPERATURE MEASURED BY TEMPERATURE SENSOR, TS-3.2			
T3.3 = WATER TEMPERATURE MEASURED BY TEMPERATURE SENSOR, TS-3.3			
FCT = $F2 \times (T3.2 - T3.3) / (T3.1 - T3.3)$			
If the lead cooling tower is running but has not been meeting the cooling tower supply water setpoint for more than 30 minutes	Lag cooling tower shall enable the primary cell. Associated control valves shall open and fan shall ramp to match lead cooling tower fan speed (at 100%). Once setpoint has been met, all fans shall modulate speed to maintain setpoint.	Yes/No	
In lead/lag operation, if 3 cells fans are below 40% for at least 15 minutes and the cooling tower supply water temperature is at least 4°F below setpoint	The lag cooling tower shall disable and the associated control valves shall close.	Yes/No	
In lead/lag operation, if 3 cells are operating but the cooling tower supply water temperature has been above setpoint for more than 30 minutes.	The second cell of the lag cooling tower shall be enabled. The control valves shall open and fan shall ramp to match other fans' speeds.	Yes/No	
In lead/lag operation, if 4 cells fans are below 40% for at least 15 minutes and the cooling tower supply water temperature is at least 4°F below setpoint	The lag cooling tower shall disable the second cell and the associated control valves shall close.	Yes/No	
If cooling tower is operating in lag mode	Verify that cooling tower fans are modulating to maintain cooling tower supply water temperature setpoint as measured by TS-1.2	Yes/No	
If cooling tower is operating in lag mode	Verify that cooling tower fans are modulating to maintain cooling tower supply water temperature setpoint as measured by TS-1.2	Yes/No	
		Yes/No	
		Yes/No	

5. Additional Testing

	Item	Status
1	Verify that cooling tower fan is rotating in the correct direction	Yes / No
2	Verify vibration alarm for cooling tower fan is operational	Yes / No
3	Verify that piping system has been completed per plans	Yes / No
4	Determine EWT, LWT, GPM, WB/DB values and verify that calculated tower performance matches design	
5	Verify that CT fan status is working properly	Yes / No
6	Are clearances around unit being met	Yes / No
7	Is there a minimum temperature for tower operation	Yes / No
8	Is the disconnect within site of the equipment, and labelled	Yes / No
9	Verify that float valve is operating correctly (if possible)	Yes / No
10	Is heat trace installed per drawings, how is it controlled	Yes / No
11	Are equalizer valves in their correct position	Yes / No
12	How often does routine lead/lag switchover occur	
13	Fan guard/shield is properly installed	Yes / No
14	How does the basic heater work, when does it kick on, is it integrated into the BAS/PLC	Yes / No
15	Does makeup water flow meter appear	Yes / No
16	If all pumps go into alarm, how does	
17	If flow meter shows no flow, how does the CT react	
18	If any of the associated control valve statuses go into alarm, how does the CT react	
19	If cooling tower fans go into alarm (and CT disables) do the associated control valves close	Yes / No
20	Verify that the fans for each cell of the cooling tower operate at the same speed	Yes / No
21	Check that discharge plumes do not entrain in intakes or enter building envelope openings	Yes / No
22	Spot check distribution pan/nozzles to ensure even flow	Yes / No
23	Visually check (if possible) that no air is entrained into the return water that may cause pump cavitation	Yes / No
24	Check cooling tower overflow for proper discharge	Yes / No
25	General appearance of cooling tower is good, no apparent damage	Yes / No
26	Is solenoid for basin draining operational	Yes / No
27	Verify that CT-1A is always the primary cell, under lead/lag operation	Yes / No
28		Yes / No
29		Yes / No

6. Notes

Item	Reason for negative response	Resolution



SOLIDS SEPARATOR (SS-1)

FUNCTIONAL PERFORMANCE TEST

1. Participants

Name	Company	Role

Date: _____

Completed By: _____

2. Test Prerequisites

	Item	Status
1	Construction Checklists are complete.	Yes / No
2	The control system is finalized and accepted by the Owners Representative.	Yes / No
3	Factory Start up is Complete.	Yes / No
4	Testing and Balancing is complete and accepted by the Owners Representative.	Yes / No

3. DDC Point Review/Check

SAMPLE

#	Point Description	Type	Value	Notes	Pass
1	Solids separator start/stop	BO			
2	Solids separator status	BI			
3	Solids separator alarm	BI			

BI – Binary Input BO – Binary Output AI – Analog Input AO – Analog Output S – Software

4. Functional Testing Record

System Condition	Expected Response	Pass	Notes
When associated cooling tower is enabled and water level in basin is not in alarm	Solid separator shall be enabled	Yes/No	(verify proper control of associated valves)
If SS-1 is enabled and CV-1G/CV-1H are proven open	Solid separator shall start operation	Yes/No	
If SS-1 does not operate properly	Alarm shall be reported to PLC	Yes/No	

5. Additional Testing

	Item	Status
1	Verify that suction line is installed with continual rise toward the pump	Yes / No
2		Yes / No
3		Yes / No