HILLERS ELECTRICAL ENGINEERING, INC.
23257 STATE ROAD 7, SUITE 100
BOCA RATON, FLORIDA 33428
561.451.9165

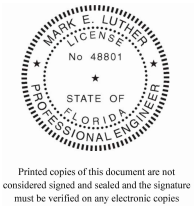
Technical Memorandum

Date: Septemeber 5, 2018

Prepared For: Shannon LaRocque, PE, Utility Director

Prepared By: Mark Luther, PE
Hillers Electrical Engineering, Inc.

Subject: WRF Lighting and Lightning Protection Study



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1.0 Executive Summary

1.1 The Village of Wellington (Village) operates a 6.5 MGD Water Reclamation Facility (plant) consisting of process, administration and maintenance buildings and structures on the plant site. Energy efficiency and power cost savings are equally important as process treatment efficiency and operational efficiency. Technology improvements related to exterior and interior lighting systems has resulted in improved watt/lumen ratios through the implementation of LED type luminaires and solid state drivers/controllers. Existing plant lighting systems generally consist of high pressure sodium, fluorescent and incandescent fixtures that are less energy efficient than LED type units. The Village desires to implement energy saving LED lighting fixtures to reduce purchased energy cost and improve overall efficacy of the plant interior and exterior lighting systems.

1.2 The plant also contains lightning protection systems on select structures and desires to evaluate the necessity to implement lightning protection systems on the remaining structures within the facility, where practicable. Approximately half of the existing plant structures have lightning protection systems installed in the form of air terminals and pathway conductors to the plant grounding system. A lightning risk assessment analysis is performed for plant structures that do not presently have lightning protection systems and are not modified under the ongoing plant upgrade project. The risk assessment is based upon NFPA 780-2017 Annex L for the simplified calculation analysis.

1.3 There is plant upgrade project, presently in design, that will modify existing plant structures, demolish other structures, and construct new structures. It is assumed that new LED lighting fixtures, and appropriate lightning protection systems, will be designed and specified for structures/buildings in the associated design documents and are therefore omitted from this study.

1.4 Field observations of existing lighting and lightning protection systems are performed to determine which structures contain lightning protection systems, which structures do not contain lightning protection systems, and what types of light fixtures are installed, and where, throughout the facility. Observations are made for both interior and exterior light fixtures where appropriate.

1.5 Lightning Protection System Analysis

A. Existing Pretreatment Structure: The risk analysis indicates that the annual threat of occurrence is higher than the tolerable lightning frequency and a lighting protection system is recommended. The following lightning protection system improvements are recommended for this structure:

1. Add air terminals to light poles on the top of the structure, or include with new light fixtures and poles recommended under the lighting section of this technical memorandum.
2. Add air terminals every twenty-five (25) feet around the perimeter of the structure.
3. Add horizontal aluminum bonding conductors, and vertical down-comer conductors, to bond air terminals, lighting fixtures, walkways, hand rails, stairways, process equipment and control panels on the top deck.
4. Connect vertical down-comer conductors to a new grounding counterpoise around the structure.

B. Existing Aeration Basins No.1 & No.2: The risk analysis indicates that the annual threat of occurrence is higher than the tolerable lightning frequency and a lighting protection system is recommended. The following lightning protection system improvements are recommended for this structure:

1. Add air terminals to light poles on the top of the structure, or include with new light fixtures and poles recommended under the lighting section of this technical memorandum.
2. Add air terminals every twenty-five (25) feet around the perimeter of the basins.
3. Add air terminals on top of exposed odor control piping every twenty-five (25) feet along the length of the pipe on top of the structure.

4. Add horizontal aluminum bonding conductors, and vertical down-comer conductors, to bond air terminals, lighting fixtures, walkways, hand rails, stairways and control panels on the top deck.
5. Connect vertical down-comer conductors to a new grounding counterpoise around the structure.

C. Existing Small Aerobic Digester: The risk analysis indicates that the annual threat of occurrence is higher than the tolerable lightning frequency and a lighting protection system is recommended. The following lightning protection system improvements are recommended for this structure:

1. Add air terminals to light poles on the top of the structure, or include with new light fixtures and poles recommended under the lighting section of this technical memorandum.
2. Add horizontal aluminum bonding conductors, and vertical down-comer conductors, to bond air terminals, walkways, lighting fixtures, hand rails, stairways and control panels on the top deck.
3. Connect vertical down-comer conductors to a new grounding counterpoise around the structure.

D. Existing Clarifier No.1: The risk analysis indicates that the annual threat of occurrence is higher than the tolerable lightning frequency and a lighting protection system is recommended. The following lightning protection system improvements are recommended for this structure:

1. Add air terminals to light poles on the top of the structure, or include with new light fixtures and poles recommended under the lighting section of this technical memorandum.
2. Add air terminals every twenty (20) feet of perimeter around the edge of the tank.
3. Add horizontal aluminum bonding conductors, and vertical down-comer conductors, to bond air terminals, walkways, lighting fixtures, hand rails, stairways and control panels on the top of the Clarifier.
4. Connect vertical down-comer conductors to a new grounding counterpoise around the structure.

E. Existing Clarifier No.2: The risk analysis indicates that the annual threat of occurrence is higher than the tolerable lightning frequency and a lighting protection system is recommended. The following lightning protection system improvements are recommended for this structure:

1. Add air terminals to light poles on the top of the structure, or include with new light fixtures and poles recommended under the lighting section of this technical memorandum.
2. Add air terminals every twenty (20) feet of perimeter around the edge of the tank.
3. Add horizontal aluminum bonding conductors, and vertical down-comer conductors, to bond air terminals, walkways, lighting fixtures, hand rails, stairways and control panels on the top of the Clarifier.
4. Connect vertical down-comer conductors to a new grounding counterpoise around the structure.

F. Existing Digester Splitter Structure: The risk analysis indicates that the annual threat of occurrence is higher than the tolerable lightning frequency and a lighting protection system is recommended. The following lightning protection system improvements are recommended for this structure:

1. Add air terminals to light poles on the top of the structure, or include with new light fixtures and poles recommended under the lighting section of this technical memorandum.
2. Add horizontal aluminum bonding conductors, and vertical down-comer conductors, to bond air terminals, walkways, lighting fixtures, hand rails, stairways and diverter gates on the top deck.
3. Connect vertical down-comer conductors to a new grounding counterpoise around the structure.

G. Existing Sludge Dewatering Facility: The risk analysis indicates that the annual threat of occurrence is higher than the tolerable lightning frequency and a lighting protection system is recommended. The following lightning protection system improvements are recommended for this structure:

1. Add air terminals every twenty (20) feet of perimeter around the edge of the structure roof.
2. Add horizontal aluminum bonding conductors, and vertical down-comer conductors, to bond air terminals, antenna mast, exhaust fans and access hatch on roof.
3. Connect vertical down-comer conductors to a new grounding counterpoise around the structure.

H. Existing Truck Loading Facility: The risk analysis indicates that the annual threat of occurrence is higher than the tolerable lightning frequency and a lighting protection system is recommended. The following lightning protection system improvements are recommended for this structure:

1. Add air terminals every twenty (20) feet of perimeter around the edge of the structure roof and on the exhaust fan housing on the top ridge of the roof.
2. Add horizontal aluminum bonding conductors, and vertical down-comer conductors, to bond roof air terminals.
3. Connect vertical down-comer conductors to a new grounding counterpoise around the structure.

I. Existing Filter Dosing Pump Station and Adjacent Fuel Storage Tank/Canopy: The risk analysis indicates that the annual threat of occurrence is higher than the tolerable lightning frequency and a lighting protection system is recommended. The adjacent fuel storage tank is located within a concrete containment structure with a metal pole barn canopy cover and no enclosing side panels. It is recommended to include a lightning protection system for this structure because it contained fuel. The risk analysis further supports this recommendation due to the flammability of the fuel. However, given that the entire pole barn structure is metallic, including the roof, it would likely act as protection for the tank, which is presently bonded to the plant grounding system. Recommendations for the adding a lightning protection system are included below, however, this location is not as critical as others in the plant for implementation.

The following lightning protection system improvements are recommended for Filter Dosing Pump Station structure:

1. Add air terminals every twenty (20) feet of perimeter around the edge of the structure roof.
2. Add horizontal aluminum bonding conductors, and vertical down-comer conductors, to bond air terminals, exhaust fans and access hatch on roof.
3. Connect vertical down-comer conductors to a new grounding counterpoise around the structure.

The following lightning protection system improvements are recommended for the adjacent Fuel Storage Tank/Canopy structure:

1. Add air terminals every twenty (20) feet of perimeter around the edge of the structure roof.
2. Add horizontal aluminum bonding conductors, and vertical down-comer conductors, to bond air terminals on roof.
3. Connect vertical down-comer conductors to a new grounding counterpoise around the structure.

J. Existing O&M Building: The risk analysis indicates that the annual threat of occurrence is higher than the tolerable lightning frequency and a lighting protection system is recommended. However the annual threat of occurrence is significantly low, (0.06 events per year) and the functionality/programming of the building, relative to the more critical process buildings on site, suggest that implementation of a lightning protection system on this structure is a low priority. If the Village elects to implement a lightning protection system for this structure, the following recommended:

1. Add air terminals every twenty (20) feet of perimeter around the edge of the structure roof and along the top ridge.
2. Add horizontal aluminum bonding conductors, and vertical down-comer conductors, to bond air terminals on roof.
3. Connect vertical down-comer conductors to a new grounding counterpoise around the structure or adjacent grounding counterpoise from a nearby process building.

K. Existing Aeration Basin No.3: This structure has an existing lightning protection system with air terminals on existing light poles. It was observed that the existing air terminals on the aluminum poles appear to be made of copper and there is concern with regards to long term galvanic action between the dissimilar metals causing corrosion of the junction where they meet an increase in impedance of the lightning protection system to ground for current if an event occurs. It is recommended that the air terminals on the existing light poles be changed to aluminum in conjunction with new lighting poles/fixtures recommended later in this technical memorandum.

L. Existing Aeration Basins No.1 and No.2 Odor Control Air Piping from Odor Control System to Basins: The existing odor control system has a lightning protection system installed, however it is not extended to the odor control ducts to Aeration Basins No.1 and No.2. The ductwork is somewhat exposed to possible events at its raised elevation between the odor control system and the basins. It is recommended to add lightning protection to Aeration Basins No.1 and No.2 and it is further recommended to extend the lightning protection system to include the odor control ducts and interconnecting to

the lightning protection system installed at the odor control system. The following lightning protection system improvements are recommended for the odor control ductwork:

1. Add air terminals every twenty (20) feet of linear ductwork and connect with horizontal aluminum bonding conductors and vertical down-comer conductors at each support structure.
2. Connect vertical down-comer conductors to existing grounding counterpoise around aeration basins and at the odor control system.
3. Connect the aluminum bonding conductors to the existing odor control system bonding conductors and

M. Existing Clarifier No.3: The Clarifier has a lightning protection system installed, however it is not extended to the north side of the tank. The existing system is primarily installed on the existing aluminum walkway and light fixtures and there is gap in coverage on the north side of the tank structure. It is recommended to install air terminals on twenty (20) foot spacing with horizontal aluminum bonding conductors along the north perimeter of the Clarifier wall, and connect to the existing system, to ensure the structure has full coverage.

1.6 Lightning Prediction System

A. Plant staff has expressed an interest in implementing a lightning prediction system to warn plant staff to seek shelter against the threat of a strike event. One system would suffice for the plant for both detection and notification. It is recommended that the system be implemented and that the sensor, horns and strobe be located on either the Dewatering Building, Sludge Drying Building, or Adjacent Aerobic Digester. This would allow for remote mounting of the control panel, possibly in the Dewatering Building Control Room or in/on the Sludge Drying Building PLC Control Panels.

1.7 Anticipated Lightning Protection System Cost: **$204,100.**

1.8 Lighting Systems Analysis

A. Recommendations put forth are for a direct one-for-one replacement of existing fixtures only. No design is undertaken to change the current layout and fixture distribution types and final number of LED light bars are to be determined in the design phase.

B. Existing Pretreatment Structure:

1. Recommend:
   a. Seven (7) new outdoor area lights (34W-4200 lumens) on new 8-foot poles and new mounting brackets.
   b. Six (6) new outdoor wall mounted fixtures (28W-2845 lumens) at same mounting elevation as existing.
   c. Five (5) vapor tight lights (24W-3334 lumens) in the dumpster room to better distribute the lighting in the space. Recommend wall mounting of the fixtures in lieu of ceiling mounting for maintenance purposes.
   d. Two (2) new 4-foot strip lights (30W-3343 lumens) in the electrical room.
   e. Overall power demand is expected to reduce from 1760W to 586W which is a 67% reduction in power for this structure.

C. Existing Aeration Basins No.1 & No.2:

1. Recommend:
   a. Eleven (11) new outdoor area lights (34W-4200 lumens) on new 8-foot poles and new mounting brackets.
   b. Overall power demand is expected to reduce from 1100W to 374W which is a 66% reduction in power for this structure.

D. Existing Aeration Basin No.3:

1. Recommend:
   a. Eleven (11) new outdoor area lights (34W-4200 lumens) on new 8-foot poles and new mounting brackets.
   b. Overall power demand is expected to reduce from 1100W to 374W which is a 66% reduction in power for this structure.

E. Existing Aeration Basins No.1, No.2 and No.3 Odor Control System:

1. Recommend:
   a. Eight (8) new outdoor area lights (34W-4200 lumens) on new 8-foot poles and new mounting brackets.
   b. Overall power demand is expected to reduce from 800W to 272W which is a 66% reduction in power for this structure.

F. Existing Small Aerobic Digester:

1. Recommend:
   a. Three (3) new outdoor area lights (34W-4200 lumens) on new 8-foot poles and new mounting brackets.
   b. Recommend installing two (2) additional new outdoor area lights (34W-4200 lumens) on new 8-foot poles and new mounting brackets to improve safety lighting at the east end of the basin near the access stairs.
   c. Overall power demand is expected to slightly increase from 300W to 340W due to the additional recommended fixtures, which is 10% increase in power for the structure, for additional light fixtures. If the additional fixtures are not implemented, the reduction in power will be from 300W to 102W or 66%.

G. Existing Large Aerobic Digester:

1. Recommend:
   a. Ten (10) new outdoor area lights (34W-4200 lumens) on new 8-foot poles and new mounting brackets.
   b. One (1) new outdoor area light (34W-4200 lumens) on new 8-foot pole by recirculation pumps.
   c. Overall power demand is expected to reduce from 1100W to 374W which is a 66% reduction in power for this structure.

H. Existing Aerobic Digesters Odor Control System:

1. Recommend:

a. Seven (7) new outdoor area lights (34W-4200 lumens) on new 8-foot poles and new mounting brackets.
b. Overall power demand is expected to reduce from 700W to 238W which is a 66% reduction in power for this structure.

I. Existing Maintenance Shop:

1. Recommend:
   a. Three (3) new wall pack fixtures (25W-1476 lumens) on north, east and west walls at approximately 6 foot mounting height.
   b. Eighteen (18) ceiling mounted strip fixtures (30W-3343 lumens) in shop area; mounting elevation as existing (approximately 10-12 feet from finished floor).
   c. The break room appears to have excessive lumens available in the existing fixture as compared to the size of the room. It was observed that not all of the lamps were functioning in the fixture which reduced the amount of lumens applied. The amount of light from two lamps operating in each fixture should be sufficient for the space and not cause visual discomfort. It is recommended that this be verified during the design phase. For the purposes of this memorandum, it is assumed that the equivalent lumens of two lamps in each fixture to be sufficient for the space and the equivalent LED output is recommended: (2) recessed troffers (25W-3204 lumens each).
   d. The office/library room analysis is similar to the break room and two (2) recessed troffers (25W-3204 lumens each) are recommended.
   e. Overall power demand is expected to reduce from 2262W to 715W which is a 68% reduction in power for this building.

J. Existing Clarifier Splitter Structure:

1. Recommend:
   a. Three (3) new outdoor area lights (34W-4200 lumens) on new 8-foot poles and new mounting brackets.
   b. Overall power demand is expected to reduce from 300W to 102W which is a 66% reduction in power for this structure.

K. Existing Clarifier No.1:

1. Recommend:
   a. Three (3) new outdoor area lights (34W-4200 lumens) on new 8-foot poles and new mounting brackets.
   b. Overall power demand is expected to reduce from 300W to 102W which is a 66% reduction in power for this structure.

L. Existing Clarifier No.2:

1. Recommend:
   a. Three (3) new outdoor area lights (34W-4200 lumens) on new 8-foot poles and new mounting brackets.
   b. Overall power demand is expected to reduce from 300W to 102W which is a 66% reduction in power for this structure.

M. Existing Clarifier No.4:

1. Recommend:
   a. Eleven (11) new outdoor area lights (34W-4200 lumens) on new 8-foot poles and new mounting brackets.
   b. Overall power demand is expected to reduce from 1100W to 374W which is a 66% reduction in power for this structure.

N. Existing Clarifier No.4 RAS/WAS Pump Station:

1. Recommend:
   a. Three (3) new outdoor area lights (34W-4200 lumens) on new 8-foot poles and new mounting brackets/bases.
   b. Overall power demand is expected to reduce from 300W to 102W which is a 66% reduction in power for this structure.

O. Existing Effluent Filters:

1. Recommend:
   a. Six (6) new outdoor area lights (34W-4200 lumens) on new 8-foot poles and new mounting brackets/bases.
   b. Four (4) new outdoor area lights (34W-4200 lumens) on new 8-foot poles and new mounting bases.
   c. Overall power demand is expected to reduce from 1000W to 340W which is a 66% reduction in power for this structure.

P. Existing Filter Backwash Basin:

1. Recommend:
   a. One (1) new outdoor area light (34W-4200 lumens) on new 8-foot poles and new mounting brackets for top of basin structure.
   b. One (1) new outdoor area light (34W-4200 lumens) on new 8-foot poles and new mounting bases at same location as existing by access stairway.
   c. Overall power demand is expected to reduce from 200W to 68W which is a 66% reduction in power for this structure.

Q. Existing Chlorine Contact Tank No.1:

1. Recommend:
   a. Three (3) new outdoor area light (34W-4200 lumens) on new 8-foot poles and new mounting brackets for top of tank structure.
   b. Three (3) new outdoor area light (226W-27746 lumens) on new 20-foot poles and new mounting bases around the tank. It is suggested to use a forward throw type T4FT fixture to maximize the light distribution. To make better use of the light distribution, fixture locations will likely require adjustment during the design phase.
   c. Overall power demand is expected to reduce from 1500W to 780W which is a 48% reduction in power for this structure.

R. Existing Chlorine Contact Tank No.2:

1. Recommend:
   a. Two (2) new outdoor area light (34W-4200 lumens) on new 8-foot poles and new mounting brackets for top of tank structure.
   b. Overall power demand is expected to reduce from 200W to 68W which is a 66% reduction in power for this structure.

S. Existing Sludge Dewatering Building:

1. Recommend:
   a. Five (5) new exterior wall mounted fixtures (48W-4768 lumens) on the exterior walls at approximately 16 foot mounting height off finished grade. The final mounting height shall be adjusted during the design phase as appropriate.
   b. For the belt press room; initial recommendation of Nine (9) vaportight 84W high/low bay fixtures (Polycarbonate lense-12,149 lumens) mounted to the wall in the same location as the existing 250W HPS fixtures and supplemented by enclosed vapor tight strip fixtures 51W (6490 lumens) at strategic locations where shadowing occurs. For the purposes of this memorandum, eight (8) vaportight strip fixtures are proposed.
   c. For the office/rest room: recommend four (4) new 51W (6490 lumens) vaportight strip fixtures ceiling mounted and spaced to maximize distribution.
   d. Overall power demand is expected to reduce from 3884W to 1608W which is a 59% reduction in power for this building.

T. Existing Sludge Drying Facility:

1. Recommend:
   a. Nine (9) new outdoor wall mounted fixtures (28W-2845 lumens) as same mounting elevation as existing (10’ above finished grade).
   b. Twenty (20) new industrial high bay fixtures 197W (24143 lumens) in same locations as the four (4) 400W units and general locations of the existing wall mounted units. Final locations to be verified during the design phase.
   c. Overall power demand is expected to reduce from 8900W to 4192W which is a 53% reduction in power for this building.

U. Existing Sludge Facilities Odor Control System:

1. Recommend:
   a. Five (5) new outdoor area lights (34W-4200 lumens) on new 8-foot poles and new mounting brackets.
   b. Overall power demand is expected to reduce from 500W to 170W which is a 66% reduction in power for this structure.

V. Existing MCC/Generator Building:

1. Recommend:
   a. Five (5) new outdoor wall mounted fixtures (28W-2845 lumens) on north, east and west walls at approximately 10 foot mounting height.

b. Nine (9) ceiling mounted vaportight LED (51W-6490 lumens) in storage area; mounting elevation as existing (approximately 16 feet from finished floor).
c. Twelve (12) architectural recessed LED troffers with higher output lumen package. For this location, the Lithonia 2ALL4 with LP850 lumen package is recommended (47W-5427 lumens). Troffers shall be mounted in the existing suspended ceiling and exact layout to be determined in the design phase.
d. Ten (10) ceiling mounted vaportight LED (51W-6490 lumens) in storage area; mounting elevation as existing (approximately 16 feet from finished floor).
e. Overall power demand is expected to reduce from 2740W to 1673W which is a 39% reduction in power for this building.

W. Existing Filter Dosing Pump Station Building:

1. Recommend:
   a. Five (5) new outdoor wall mounted fixtures (28W-2845 lumens) on north, south, east and west walls at approximately 10 foot mounting height.
   b. Ten (10) ceiling mounted vaportight LED (51W-6490 lumens) in pump room; mounting elevation as existing (approximately 12 feet from finished floor).
   c. Six (6) ceiling mounted strip fixtures (30W-3343 lumens) in electrical/MCC room; mounting elevation as existing (approximately 12 feet from finished floor).
   d. Overall power demand is expected to reduce from 1684W to 830W which is a 51% reduction in power for this building.

X. Existing General Site Lighting:

1. Recommend:
   a. Thirty-six (37) new outdoor area lights (34W-4200 lumens) on new 8-foot poles and new mounting brackets/foundations.
   b. Overall power demand is expected to reduce from 3700W to 1258W which is a 66% reduction in power for the site.

1.9 Lighting System Upgrade Energy Savings Summary

A. The following table summarizes the anticipated energy savings if the recommendations described above are implemented.

Anticipated Energy Savings

Location	Existing Lighting Power (W)	Modified Lighting Power (W)	Power Reduction (W)	Yearly kWH Reduction
Existing Pretreatment Structure**	1,760	586	1,174	5,999
Existing Aeration Basins No.1 & No.2**	1,100	374	726	3,710
Existing Aeration Basin No.3**	1,100	374	726	3,710
Existing Aeration Basins No1, No2 and No.3 Odor Control System**	800	272	528	2,698

Existing Small Aerobic Digester**	300	340	(40)	(204)
Existing Large Aerobic Digester**	1,100	374	726	3,710
Existing Aerobic Digesters Odor Control System**	700	238	462	2,361
Existing Maintenance Shop**	2,262	715	1,547	7,905
Existing Clarifier Splitter Structure**	300	102	198	996
Existing Clarifier No.1**	300	102	198	996
Existing Clarifier No.2**	300	102	198	996
Existing Clarifier No.4**	1,100	374	726	3,710
Existing Clarifier No.4 RAS/WAS Pump Station**	300	102	198	996
Existing Effluent Filters**	1,000	340	660	3,373
Existing Filter Backwash Basin**	200	68	132	675
Existing Chlorine Contact Tank No.1**	1,500	780	720	3,679
Existing Chlorine Contact Tank No.2**	200	68	132	675
Existing Sludge Dewatering Building*	3,884	1,608	2,276	19,938
Existing Sludge Drying Facility*	8,900	4,192	4,708	41,242
Existing Sludge Facilities Odor Control System**	500	170	330	1,686
Existing MCC/Generator Building*	2,740	1,673	1,067	9,345
Existing Filter Dosing Pump Station Building*	1,684	830	854	7,481
Existing General Site Lighting**	3,700	1,258	2,442	12,479
Totals:	35,730	15,042	20,688	138,156

* assumed to operate 24 hrs/day/365 days/year
** assumed to operate average of 14 hrs/day/365 days/year

1.10 Lighting System Improvements Budgetary Cost: **$734,730.**

2.0 PURPOSE

2.1 The Village of Wellington Utilities (Village) operates a 6.5 MGD Water Reclamation Facility (plant) consisting of process, administration and maintenance buildings and structures on the plant site. The Village desires to implement energy saving LED lighting fixtures to reduce energy cost and improve overall efficacy of the plant interior and exterior lighting systems. The plant also contains lightning protection systems on select structures and desires to evaluate the necessity to implement lightning protection systems on the remaining structures within the facility, where practicable. This technical memorandum evaluates the feasibility, and associated budgetary cost, to replace existing interior and exterior light fixtures with LED type units and implement lightning protection systems on existing structures that presently do not contain the system.

3.0 BACKGROUND

3.1 Approximately half of the existing plant structures have lightning protection systems installed in the form of air terminals and pathway conductors to the plant grounding system. These structures are:

1. Chlorine Contact Tanks No.1 & No.2
2. High Level Chlorine Contact Tank
3. Reuse High Level Chlorine Contact Tanks

4. Reuse Wetwells No.1 & No.2
5. Filter Backwash Waste Basin
6. Aeration Basin No.3
7. Hydropneumatic Tank
8. Aeration Basins Odor Control System
9. Clarifier No.4 RAS/WAS Pump Station
10. Clarifier No.4
11. Effluent Filters
12. Large Aerobic Digester
13. South MCC & Generator Electrical Building
14. South Diesel Fuel Storage Tank
15. Aerobic Digester Odor Control System

3.2 There is plant upgrade project, presently in design, that will modify existing plant structures, demolish other structures, and construct new structures. It is assumed that new LED lighting fixtures, and appropriate lightning protection systems, will be designed and specified for structures/buildings in the associated design documents and are therefore omitted from this study. Existing facilities included in the upgrade project, and not addressed in this study, are:

1. Existing Operations Building (renovation)
2. Existing Storage Building/Old Sodium Hypochlorite Pump Building (demolition)
3. Existing Clarifier No.3 (renovation)
4. Existing Sludge Stabilization Building (Old Lime Building) (renovation/re-purpose)
5. Existing Steel Frame Pole Barn (demolition)
6. Existing Steel Frame Storage Building (demolition)
7. Existing Reuse Building (reconstruction)
8. Existing Sodium Hypochlorite Storage (rehabilitation)
9. Existing Loading Building and Canopy (rehabilitation)
10. Existing Lime Silo (demolition)

3.3 Existing exterior lighting systems primarily are comprised of 100W high pressure sodium (HPS) light fixtures (9500 lumens) on eight (8) to ten (10) foot poles mounted on structure and on foundations at grade level. There are also 100W HPS wall pack type fixtures (1600 lumens) mounted to many structures supplementing pole mounted area lighting. Around the chlorine contact basin, there are 400W HPS fixtures (50,000 lumens) mounted on twenty (20) foot poles. Interior lighting is a mixture of fluorescent (T12-40W lamps-2650 lumens, T8-32W lamps-2850 lumens) in office/breakroom/electrical rooms, as well as, pump rooms. High pressure sodium (400W wall pack and high bay style-50,000 lumens) type fixtures are observed in the Sludge Drying and Sludge Dewatering Buildings. It is observed that much of the existing exterior lighting systems were installed in year 2010, or prior years, and likely do not meet the current wind loading requirements of the Florida Building Code.

4.0 METHODOLOGY

4.1 Field observations of existing lighting and lightning protection systems are performed to determine which structures contain lightning protection systems, which structures do not contain lightning protection systems, and what types of light fixtures are installed, and where, throughout the facility. Observations are made for both interior and exterior light fixtures where appropriate. Recommendations for replacement lights are on a direct one-for-one basis, particularly on process structures, as re-design of the existing lighting system is beyond the scope of this study. No measurements of existing lighting performance were taken. Field

observations for lightning protection systems were conducted with a representative from Bonded Lightning Protection for recommendations related to conceptual system configuration and budgetary costs.

4.2 It is unclear from field observations and record drawings that there are grounding counterpoise grids around the base of the structures recommended in this technical memorandum to receive lightning protection systems. For conservativism, new grounding counterpoises for these structures will be recommended and included in the budgetary estimates for the structure.

4.3 A lightning risk assessment analysis is performed for plant structures that do not presently have lightning protection systems and are not modified under the ongoing plant upgrade project. The risk assessment is based upon NFPA 780-2017 Annex L for the simplified calculation analysis. Assessments are performed by structure and are contained in Appendix B. The assessment is based upon specific criteria pertinent to the structure and its location relative to nearby structures, and geographic location in the United States. The analysis calculations take into account lightning threat parameters together with the following structure specific factors:

A. Building environment

B. Type of construction

C. Structure occupancy

D. Structure contents

E. Lightning strike consequences

Lightning threat parameters accounted for in the assessment calculations include:

A. *Lightning Flash Density:* The number of detected lightning flashes per square mile per year. This information is obtained from the National Lightning Detection Network and an illustrative color graphical map is published by Vaisala depicts the range of flashes per year observed in the area of the Water Reclamation Facility. The Village is located in a high flash density area of 20-28 observed flashes per square mile, per year.

B. *Structure Equivalent Collection Area:* The equivalent ground area having the equivalent lightning flash vulnerability as the structure; the area extends beyond the perimeter of structure itself for a distance equivalent of a line drawn from the top of the structure to the ground with a 3:1 slope for simple structures.

C. *Expected Annual Threat of Occurrence:* The annual (yearly) threat of lightning strike frequency to a structure. The threat is calculated using Lightning Flash Density, Structure Equivalent Collection Area, and environmental considerations of where the structure is constructed. Environmental considerations include other structures, and trees, located within a surrounding radius, around the structure in question, that is three (3) times the height of the structure. Higher impact factors are given to structures that are isolated on hills than those surrounded by other structures, or trees, taller than the structure under analysis.

D. *Tolerable Lightning Frequency to the Structure:* This value is a weighted calculation using the structure specific factors described above.

To determine whether a lightning protection system is recommended, the Expected Annual Threat of Occurrence must exceed the Tolerable Lightning Frequency to the Structure. If the Annual Threat of Occurrence does not exceed the Tolerable Lightning Frequency to the Structure, then a lightning protection system is optional.

4.4 A lightning risk assessment analysis is performed, and recommendations made, for the following plant structures:

1. Existing Pretreatment Structure
2. Existing Aeration Basins No.1 & No.2
3. Existing Small Aerobic Digester
4. Existing Clarifier No.1
5. Existing Clarifier No.2
6. Existing Clarifier Splitter Structure
7. Existing Sludge Dewatering Facility
8. Existing Truck Loading Building
9. Existing Filter Dosing Pump Station
10. Existing O&M Building

5.0 Lightning Protection System

5.1 Lightning Protection System Analysis

A. Existing Pretreatment Structure: This structure concrete construction with aluminum hand rails, light poles and fixtures and process equipment mounted on the top deck. There is an aluminum stairway attached to the structure for access to the top. Contained within the structure is an electrical room to power and control the process equipment and a dumpster to collect screenings removed from the incoming raw wastewater. Loss of this structure would hinder plant operations as there is a bypass pipe and valve that may be implemented to temporarily route incoming flows around the structure. The unscreened flows into the aeration basins would build up grit and debris over the long term and affect the aeration process. The risk analysis contained in Appendix B indicates that the annual threat of occurrence is higher than the tolerable lightning frequency and a lighting protection system is recommended. The following lightning protection system improvements are recommended for this structure:

5. Add air terminals to light poles on the top of the structure, or include with new light fixtures and poles recommended under the lighting section of this technical memorandum.
6. Add air terminals every twenty-five (25) feet around the perimeter of the structure.
7. Add horizontal aluminum bonding conductors, and vertical down-comer conductors, to bond air terminals, lighting fixtures, walkways, hand rails, stairways, process equipment and control panels on the top deck.
8. Connect vertical down-comer conductors to a new grounding counterpoise around the structure.

B. Existing Aeration Basins No.1 & No.2: This structure is the largest, and among the tallest, on site. The structure is primarily concrete construction with metal covers,

aluminum hand rails and lighting fixtures mounted to the top deck. The risk analysis contained in Appendix B indicates that the annual threat of occurrence is higher than the tolerable lightning frequency and a lighting protection system is recommended. The physical size of the structure combined with the calculated equivalent collection area significantly raises the threat of occurrence for the structure. Adding to the threat is the possibility of explosive gasses contained within the basin that could ignite of a direct lightning hit were to puncture the structure. Loss of this structure would hinder plant operations but not halt operations as there is a third Aeration Basin to continue the treatment process. The following lightning protection system improvements are recommended for this structure:

6. Add air terminals to light poles on the top of the structure, or include with new light fixtures and poles recommended under the lighting section of this technical memorandum.
7. Add air terminals every twenty-five (25) feet around the perimeter of the basins.
8. Add air terminals on top of exposed odor control piping every twenty-five (25) feet along the length of the pipe on top of the structure.
9. Add horizontal aluminum bonding conductors, and vertical down-comer conductors, to bond air terminals, lighting fixtures, walkways, hand rails, stairways and control panels on the top deck.
10. Connect vertical down-comer conductors to a new grounding counterpoise around the structure.

C. Existing Small Aerobic Digester: This structure has aluminum hand rails and lighting fixtures on the top deck; and an aluminum stairway connected to the structure for access. The structure is near similar height structures (larger aeration basin and odor control system towers) that help mitigate some of the annual threat of occurrence. Similar to Aeration Basins 1 & 2 there is a threat of ignition of explosive gasses, contained within the structure, if a lightning strike were to puncture the structure envelope. Loss of this structure would hinder plant operations but not halt operations as there is a second Aerobic Digester. In the plant expansion project, a third digester will be constructed to add further redundancy. The risk analysis contained in Appendix B indicates that the annual threat of occurrence is higher than the tolerable lightning frequency and a lighting protection system is recommended. The following lightning protection system improvements are recommended for this structure:

4. Add air terminals to light poles on the top of the structure, or include with new light fixtures and poles recommended under the lighting section of this technical memorandum.
5. Add horizontal aluminum bonding conductors, and vertical down-comer conductors, to bond air terminals, walkways, lighting fixtures, hand rails, stairways and control panels on the top deck.
6. Connect vertical down-comer conductors to a new grounding counterpoise around the structure.

D. Existing Clarifier No.1: This structure is an open top tank with walkways, light fixtures and electrical panels on the top. The tank itself is concrete construction, however the highest elements of the clarifier are all metallic. The existing handrails are aluminum; lighting fixtures are on aluminum eight (8) foot poles; an aluminum stairway is connected to the structure for access. The structure is near taller structures (large and small Aerobic Digesters) and similar height structures (Clarifier No.2) that help

mitigate some of the annual threat of occurrence. Loss of this structure would somewhat hinder plant operations but there are two additional clarifiers to continue the treatment process. The risk analysis contained in Appendix B indicates that the annual threat of occurrence is higher than the tolerable lightning frequency and a lighting protection system is recommended. Existing Clarifier No.3 has a lightning protection system installed and it will be used as a guide for the recommendations for Clarifier No.1. The following lightning protection system improvements are recommended for this structure:

5. Add air terminals to light poles on the top of the structure, or include with new light fixtures and poles recommended under the lighting section of this technical memorandum.
6. Add air terminals every twenty (20) feet of perimeter around the edge of the tank.
7. Add horizontal aluminum bonding conductors, and vertical down-comer conductors, to bond air terminals, walkways, lighting fixtures, hand rails, stairways and control panels on the top of the Clarifier.
8. Connect vertical down-comer conductors to a new grounding counterpoise around the structure.

E. Existing Clarifier No.2: This structure is an open top tank with walkways, light fixtures and electrical panels on the top. The tank itself is concrete construction, however the highest elements of the clarifier are all metallic. The existing handrails are aluminum; lighting fixtures are on aluminum eight (8) foot poles; an aluminum stairway is connected to the structure for access. The structure is near taller structures (Clarifier Splitter Box) and similar height structures (Clarifier No.1) that help mitigate some of the annual threat of occurrence. Loss of this structure would somewhat hinder plant operations but there are two additional clarifiers to continue the treatment process. The risk analysis contained in Appendix B indicates that the annual threat of occurrence is higher than the tolerable lightning frequency and a lighting protection system is recommended. Existing Clarifier No.3 has a lightning protection system installed and it will be used as a guide for the recommendations for Clarifier No.2. The following lightning protection system improvements are recommended for this structure:

5. Add air terminals to light poles on the top of the structure, or include with new light fixtures and poles recommended under the lighting section of this technical memorandum.
6. Add air terminals every twenty (20) feet of perimeter around the edge of the tank.
7. Add horizontal aluminum bonding conductors, and vertical down-comer conductors, to bond air terminals, walkways, lighting fixtures, hand rails, stairways and control panels on the top of the Clarifier.
8. Connect vertical down-comer conductors to a new grounding counterpoise around the structure.

F. Existing Digester Splitter Structure: This structure has aluminum hand rails and lighting fixtures on the top deck; and an aluminum stairway connected to the structure for access. The structure is near similar height structures (larger aeration basin and odor control system towers) that help mitigate some of the annual threat of occurrence. Loss of this structure would hinder plant operations as flow diversion from the Aeration Basins to the Clarifiers could be interrupted. The risk analysis contained in Appendix B indicates that the annual threat of occurrence is higher than the tolerable lightning

frequency and a lighting protection system is recommended. The following lightning protection system improvements are recommended for this structure:

4. Add air terminals to light poles on the top of the structure, or include with new light fixtures and poles recommended under the lighting section of this technical memorandum.
5. Add horizontal aluminum bonding conductors, and vertical down-comer conductors, to bond air terminals, walkways, lighting fixtures, hand rails, stairways and diverter gates on the top deck.
6. Connect vertical down-comer conductors to a new grounding counterpoise around the structure.

G. Existing Sludge Dewatering Facility: This structure is a concrete CMU building that is near similar height structures (Truck Loading Facility, Large Aerobic Digester) that help mitigate some of the annual threat of occurrence. Loss of this structure would hinder plant operations as dewatering of digested sludge could not take place resulting in the inability to use the drying facility and excess sludge hauling trips. The risk analysis contained in Appendix B indicates that the annual threat of occurrence is higher than the tolerable lightning frequency and a lighting protection system is recommended. The following lightning protection system improvements are recommended for this structure:

4. Add air terminals every twenty (20) feet of perimeter around the edge of the structure roof.
5. Add horizontal aluminum bonding conductors, and vertical down-comer conductors, to bond air terminals, antenna mast, exhaust fans and access hatch on roof.
6. Connect vertical down-comer conductors to a new grounding counterpoise around the structure.

H. Existing Truck Loading Facility: This structure is a metal frame/metal siding building that is near similar height structures (Sludge Drying Facility, Sludge Dewatering Facility) that help mitigate some of the annual threat of occurrence. Loss of this structure would hinder plant operations as offloading of dried sludge could not take place resulting in the inability to use the drying facility. Alternate means of sludge hauling truck loading would be required during repair/recovery of the facility. The risk analysis contained in Appendix B indicates that the annual threat of occurrence is higher than the tolerable lightning frequency and a lighting protection system is recommended. The following lightning protection system improvements are recommended for this structure:

4. Add air terminals every twenty (20) feet of perimeter around the edge of the structure roof and on the exhaust fan housing on the top ridge of the roof.
5. Add horizontal aluminum bonding conductors, and vertical down-comer conductors, to bond roof air terminals.
6. Connect vertical down-comer conductors to a new grounding counterpoise around the structure.

I. Existing Filter Dosing Pump Station and Adjacent Fuel Storage Tank/Canopy: The Filter Dosing Pump Station structure is a concrete CMU building that is not near any similar height, or taller, structures to help mitigate threats. The pump station contains

filter dosing pumps and associated electrical equipment (including variable frequency drives) that move the treated secondary effluent through the effluent filters and high level disinfection process for treatment and pumping off-site or down the existing injection well for disposal. Loss of this structure would hinder plant operations to treat secondary effluent for compliant disposal, however, secondary effluent can flow by gravity to the on-site ponds temporarily while the facility is repaired. The risk analysis contained in Appendix B indicates that the annual threat of occurrence is higher than the tolerable lightning frequency and a lighting protection system is recommended. The adjacent fuel storage tank is located within a concrete containment structure with a metal pole barn canopy cover and no enclosing side panels. In performing the site observations with Bonded Lightning Protection, it was recommended to include a lightning protection system for this structure because it contained fuel. The risk analysis in Appendix B further supports this recommendation due to the flammability of the fuel. However, given that the entire pole barn structure is metallic, including the roof, it would likely act as protection for the tank, which is presently bonded to the plant grounding system. Recommendations for the adding a lightning protection system are included below, however, this location is not as critical as others in the plant for implementation.

The following lightning protection system improvements are recommended for Filter Dosing Pump Station structure:

4. Add air terminals every twenty (20) feet of perimeter around the edge of the structure roof.
5. Add horizontal aluminum bonding conductors, and vertical down-comer conductors, to bond air terminals, exhaust fans and access hatch on roof.
6. Connect vertical down-comer conductors to a new grounding counterpoise around the structure.

The following lightning protection system improvements are recommended for the adjacent Fuel Storage Tank/Canopy structure:

4. Add air terminals every twenty (20) feet of perimeter around the edge of the structure roof.
5. Add horizontal aluminum bonding conductors, and vertical down-comer conductors, to bond air terminals on roof.
6. Connect vertical down-comer conductors to a new grounding counterpoise around the structure.

J. Existing O&M Building: The facility is constructed of CMU walls with a conventional truss roof with shingles and houses a machine shop, office/library and break room/bathroom areas for the O&M staff. The roof peak is higher than the nearby Sodium Hypochlorite Bulk Storage Tanks and Blower/Generator Building to the north; however it is lower than the large Aerobic Digester immediately to the east that has an existing lightning protection system. There is also a flag pole immediately west of the structure that would likely experience lightning strike events before the O&M Building does. This structure, while not critical to plant operations, would hinder the maintenance of the plant if a lightning strike event were to occur. The risk analysis contained in Appendix B indicates that the annual threat of occurrence is higher than the tolerable lightning frequency and a lighting protection system is recommended. However the annual threat of occurrence is significantly low, (0.06 events per year) and

the functionality/programming of the building, relative to the more critical process buildings on site, suggest that implementation of a lightning protection system on this structure is a low priority. If the Village elects to implement a lightning protection system for this structure, the following recommended:

4. Add air terminals every twenty (20) feet of perimeter around the edge of the structure roof and along the top ridge.
5. Add horizontal aluminum bonding conductors, and vertical down-comer conductors, to bond air terminals on roof.
6. Connect vertical down-comer conductors to a new grounding counterpoise around the structure or adjacent grounding counterpoise from a nearby process building.

K. Existing Aeration Basin No.3: This structure has an existing lightning protection system with air terminals on existing light poles. It was observed that the existing air terminals on the aluminum poles appear to be made of copper and there is concern with regards to long term galvanic action between the dissimilar metals causing corrosion of the junction where they meet an increase in impedance of the lightning protection system to ground for current if an event occurs. It is recommended that the air terminals on the existing light poles be changed to aluminum in conjunction with new lighting poles/fixtures recommended later in this technical memorandum.

L. Existing Aeration Basins No.1 and No.2 Odor Control Air Piping from Odor Control System to Basins: The existing odor control system has a lightning protection system installed, however it is not extended to the odor control ducts to Aeration Basins No.1 and No.2. The ductwork is somewhat exposed to possible events at its raised elevation between the odor control system and the basins. Paragraph 4.1.B recommends adding a lightning protection system to Aeration Basins No.1 and No.2 and it is further recommended to extend the lightning protection system to include the odor control ducts and interconnecting to the lightning protection system installed at the odor control system. The following lightning protection system improvements are recommended for the odor control ductwork:

4. Add air terminals every twenty (20) feet of linear ductwork and connect with horizontal aluminum bonding conductors and vertical down-comer conductors at each support structure.
5. Connect vertical down-comer conductors to existing grounding counterpoise around aeration basins and at the odor control system.
6. Connect the aluminum bonding conductors to the existing odor control system bonding conductors and

M. Existing Clarifier No.3: The Clarifier has a lightning protection system installed, however it is not extended to the north side of the tank. The existing system is primarily installed on the existing aluminum walkway and light fixtures and there is gap in coverage on the north side of the tank structure. It is recommended to install air terminals on twenty (20) foot spacing with horizontal aluminum bonding conductors along the north perimeter of the Clarifier wall, and connect to the existing system, to ensure the structure has full coverage.

5.2 Lightning Prediction System

A. Plant staff has expressed an interest in implementing a lightning prediction system, similar to one deployed in the Village Park complex adjacent to the facility to warn plant staff to seek shelter against the threat of a strike event. The prediction system consists of a sensor, flashing strobe and air horns; it monitors and evaluates the threat of lightning in an approximate two mile radius area from the sensor. Appendix C contains a vendor data sheet for a Thorguardian Lightning Prediction System that is manufactured locally in Sunrise, Florida. The air horns have an audibility range of approximately 700 yards in a 360 degree pattern from the point of installation. One system would suffice for the plant for both detection and notification. It is recommended that the system be implemented and that the sensor, horns and strobe be located on either the Dewatering Building, Sludge Drying Building, or Adjacent Aerobic Digester. This would allow for remote mounting of the control panel, possibly in the Dewatering Building Control Room or in/on the Sludge Drying Building PLC Control Panels.

6.0 Lighting Systems

6.1 Lighting Systems Analysis

A. The recommendations put forth are for a direct one-for-one replacement of existing fixtures only. No design is undertaken to change the current layout and fixture distribution types and final number of LED light bars are to be determined in the design phase. Vendor data of proposed fixtures is located in Appendix D. The following fixture type definitions, relating to the vendor data in Appendix D, are used in the lighting systems discussion:

1. Outdoor area light: Eaton Galleon LED fixture on new aluminum pole with foundation/mounting bracket and hardware as appropriate. (600ma drive current for 34W fixtures and 600mA drive current for 226W fixtures)
2. Outdoor wall pack: Lithonia TWP LED wall luminaire. For lower wattage applications: Lithonia TWS LED wall luminaire.
3. Vapor tight light: Eaton Metalux Vaportight LED, surface/suspended as appropriate.
4. Strip light: Mercury Lighting LSA series LED, surface/suspended as appropriate.
5. Recessed light (troffer): Eaton Metalux 24FP LED 2’x4’ thin recessed fixture for ceiling grid mounting. Alternately, Lithonia Lighting 2ALL 2’x4’ recessed architectural troffer.
6. Industrial vaportight high/low bay fixture: Eaton Metalux VT4S LED surface/suspended as appropriate.
7. Industrial highbay fixture: Lithonia JHBL 45000LM Package.

B. <u>Existing Pretreatment Structure</u>:

2. Observe:
   a. Seven (7) 100W HPS pole mounted fixtures on the top deck; Fixture mounting height: 8 feet from top of deck.
   b. Six (6) 100W HPS wall packs on exterior walls; mounting height approximately 8-10 feet from finished grade.
   c. Three (3) 100W HPS fixtures in the dumpster room; mounting height approximately 12 feet from finished floor. This area appeared dimly lit and could benefit from an increase in lumens for safety purposes.

d. Two (2) 2-40W T-12 (80W) fluorescent strip fixtures in electrical room; mounting height approximately 12 feet from finished floor.

3. Recommend:
   a. Seven (7) new outdoor area lights (34W-4200 lumens) on new 8-foot poles and new mounting brackets.
   b. Six (6) new outdoor wall mounted fixtures (28W-2845 lumens) at same mounting elevation as existing.
   c. Five (5) vapor tight lights (24W-3334 lumens) in the dumpster room to better distribute the lighting in the space. Recommend wall mounting of the fixtures in lieu of ceiling mounting for maintenance purposes.
   d. Two (2) new 4-foot strip lights (30W-3343 lumens) in the electrical room.
   e. Overall power demand is expected to reduce from 1760W to 586W which is a 67% reduction in power for this structure.

C. Existing Aeration Basins No.1 & No.2:

2. Observe:
   a. Eleven (11) 100W HPS pole mounted fixtures on the top deck; Fixture mounting height: 8 feet from top of deck.
3. Recommend:
   c. Eleven (11) new outdoor area lights (34W-4200 lumens) on new 8-foot poles and new mounting brackets.
   d. Overall power demand is expected to reduce from 1100W to 374W which is a 66% reduction in power for this structure.

D. Existing Aeration Basin No.3:

2. Observe:
   a. Eleven (11) 100W HPS pole mounted fixtures on the top deck; Fixture mounting height: 8 feet from top of deck.
3. Recommend:
   c. Eleven (11) new outdoor area lights (34W-4200 lumens) on new 8-foot poles and new mounting brackets.
   d. Overall power demand is expected to reduce from 1100W to 374W which is a 66% reduction in power for this structure.

E. Existing Aeration Basins No.1, No.2 and No.3 Odor Control System:

2. Observe:
   a. Eight (8) 100W HPS pole mounted fixtures around odor control equipment; Fixture mounting height: 8 feet from top finished grade.
3. Recommend:
   c. Eight (8) new outdoor area lights (34W-4200 lumens) on new 8-foot poles and new mounting brackets.
   d. Overall power demand is expected to reduce from 800W to 272W which is a 66% reduction in power for this structure.

F. Existing Small Aerobic Digester:

2. Observe:

a. Three (3) 100W HPS pole mounted fixtures on the top deck; Fixture mounting height: 8 feet from top of deck.

3. Recommend:

d. Three (3) new outdoor area lights (34W-4200 lumens) on new 8-foot poles and new mounting brackets.

e. Recommend installing two (2) additional new outdoor area lights (34W-4200 lumens) on new 8-foot poles and new mounting brackets to improve safety lighting at the east end of the basin near the access stairs.

f. Overall power demand is expected to slightly increase from 300W to 340W due to the additional recommended fixtures, which is 10% increase in power for the structure, for additional light fixtures. If the additional fixtures are not implemented, the reduction in power will be from 300W to 102W or 66%.

G. Existing Large Aerobic Digester:

2. Observe:

a. Ten (10) 100W HPS pole mounted fixtures on the top deck; Fixture mounting height: 8 feet from top of deck.

b. One (1) 100W HPS pole mounted fixture by recirculation pumps. Fixture mounting height: 8 feet from finished grade.

3. Recommend:

d. Ten (10) new outdoor area lights (34W-4200 lumens) on new 8-foot poles and new mounting brackets.

e. One (1) new outdoor area light (34W-4200 lumens) on new 8-foot pole by recirculation pumps.

f. Overall power demand is expected to reduce from 1100W to 374W which is a 66% reduction in power for this structure.

H. Existing Aerobic Digesters Odor Control System:

2. Observe:

a. Seven (7) 100W HPS pole mounted fixtures around odor control equipment; Fixture mounting height: 8 feet from finished grade.

3. Recommend:

c. Seven (7) new outdoor area lights (34W-4200 lumens) on new 8-foot poles and new mounting brackets.

d. Overall power demand is expected to reduce from 700W to 238W which is a 66% reduction in power for this structure.

I. Existing Maintenance Shop:

2. Observe:

a. Three (3) 50W HPS wall pack fixtures (4000 lumens each) on north, east and west exterior walls; mounting height approximately 6 feet from finished grade.

b. Twenty (20) 2-40W T-12 fluorescent strip fixture in shop area; mounting height approximately 10-12 feet from finished floor.

c. Two (2) 4-32W T-8 (128W) fluorescent lay-in troffer fixtures in break room; mounting height approximately 8 feet off finished floor.

d. Two (2) 4-32W T-8 (128W) fluorescent lay-in troffer fixtures in office/ library room; mounting height approximately 8 feet off finished floor.

3. Recommend:
    f. Three (3) new wall pack fixtures (25W-1476 lumens) on north, east and west walls at approximately 6 foot mounting height.
    g. Eighteen (18) ceiling mounted strip fixtures (30W-3343 lumens) in shop area; mounting elevation as existing (approximately 10-12 feet from finished floor).
    h. The break room appears to have excessive lumens available in the existing fixture as compared to the size of the room. It was observed that not all of the lamps were functioning in the fixture which reduced the amount of lumens applied. The amount of light from two lamps operating in each fixture should be sufficient for the space and not cause visual discomfort. It is recommended that this be verified during the design phase. For the purposes of this memorandum, it is assumed that the equivalent lumens of two lamps in each fixture to be sufficient for the space and the equivalent LED output is recommended: (2) recessed troffers (25W-3204 lumens each).
    i. The office/library room analysis is similar to the break room and two (2) recessed troffers (25W-3204 lumens each) are recommended.
    j. Overall power demand is expected to reduce from 2262W to 715W which is a 68% reduction in power for this building.

J. Existing Clarifier Splitter Structure:

2. Observe:
    a. Three (3) 100W HPS pole mounted fixtures on the top deck; Fixture mounting height: 8 feet from top of deck.
3. Recommend:
    c. Three (3) new outdoor area lights (34W-4200 lumens) on new 8-foot poles and new mounting brackets.
    d. Overall power demand is expected to reduce from 300W to 102W which is a 66% reduction in power for this structure.

K. Existing Clarifier No.1:

2. Observe:
    a. Three (3) 100W HPS pole mounted fixtures on the top deck; Fixture mounting height: 8 feet from top of deck.
3. Recommend:
    c. Three (3) new outdoor area lights (34W-4200 lumens) on new 8-foot poles and new mounting brackets.
    d. Overall power demand is expected to reduce from 300W to 102W which is a 66% reduction in power for this structure.

L. Existing Clarifier No.2:

2. Observe:
    a. Three (3) 100W HPS pole mounted fixtures on the top deck; Fixture mounting height: 8 feet from top of deck.
3. Recommend:
    c. Three (3) new outdoor area lights (34W-4200 lumens) on new 8-foot poles and new mounting brackets.

d. Overall power demand is expected to reduce from 300W to 102W which is a 66% reduction in power for this structure.

M. Existing Clarifier No.4:

2. Observe:
   a. Eleven (11) 100W HPS pole mounted fixtures on the top deck; Fixture mounting height: 8 feet from top of deck.
3. Recommend:
   c. Eleven (11) new outdoor area lights (34W-4200 lumens) on new 8-foot poles and new mounting brackets.
   d. Overall power demand is expected to reduce from 1100W to 374W which is a 66% reduction in power for this structure.

N. Existing Clarifier No.4 RAS/WAS Pump Station:

2. Observe:
   a. Three (3) 100W HPS pole mounted fixtures around pump pad; Fixture mounting height: 8 feet from top of pad.
3. Recommend:
   c. Three (3) new outdoor area lights (34W-4200 lumens) on new 8-foot poles and new mounting brackets/bases.
   d. Overall power demand is expected to reduce from 300W to 102W which is a 66% reduction in power for this structure.

O. Existing Effluent Filters:

2. Observe:
   a. Six (6) 100W HPS pole mounted fixtures on top of filter structure; fixture mounting height: 8 feet from top of grating.
   b. Four (4) 100W HPS pole mounted fixtures around north and west side of the structure at grade; fixture mounting height: 8 feet from finished grade.
3. Recommend:
   d. Six (6) new outdoor area lights (34W-4200 lumens) on new 8-foot poles and new mounting brackets/bases.
   e. Four (4) new outdoor area lights (34W-4200 lumens) on new 8-foot poles and new mounting bases.
   f. Overall power demand is expected to reduce from 1000W to 340W which is a 66% reduction in power for this structure.

P. Existing Filter Backwash Basin:

2. Observe:
   a. One (1) 100W HPS pole mounted fixture on top of backwash basin structure; fixture mounting height: 8 feet from top of grating.
   b. One (1) 100W HPS pole mounted fixture at grade by access stairway; fixture mounting height: 8 feet from finished grade.
3. Recommend:
   d. One (1) new outdoor area light (34W-4200 lumens) on new 8-foot poles and new mounting brackets for top of basin structure.

e. One (1) new outdoor area light (34W-4200 lumens) on new 8-foot poles and new mounting bases at same location as existing by access stairway.
f. Overall power demand is expected to reduce from 200W to 68W which is a 66% reduction in power for this structure.

Q. Existing Chlorine Contact Tank No.1:

2. Observe:
   a. Three (3) 100W HPS pole mounted fixtures on top of tank structure; fixture mounting height: 8 feet from top of grating.
   b. Three (3) 400W HPS pole mounted fixture at grade by access stairway; fixture mounting height: 20 feet from finished grade.
3. Recommend:
   d. Three (3) new outdoor area light (34W-4200 lumens) on new 8-foot poles and new mounting brackets for top of tank structure.
   e. Three (3) new outdoor area light (226W-27746 lumens) on new 20-foot poles and new mounting bases around the tank. It is suggested to use a forward throw type T4FT fixture to maximize the light distribution. To make better use of the light distribution, fixture locations will likely require adjustment during the design phase.
   f. Overall power demand is expected to reduce from 1500W to 780W which is a 48% reduction in power for this structure.

R. Existing Chlorine Contact Tank No.2:

2. Observe:
   a. Two (2) 100W HPS pole mounted fixtures on top of tank structure at the southern end; fixture mounting height: 8 feet from top of grating.
3. Recommend:
   c. Two (2) new outdoor area light (34W-4200 lumens) on new 8-foot poles and new mounting brackets for top of tank structure.
   d. Overall power demand is expected to reduce from 200W to 68W which is a 66% reduction in power for this structure.

S. Existing Sludge Dewatering Building:

2. Observe:
   a. Five (5) 250W HPS wall pack fixtures (27,000 lumens each) on all four exterior walls; mounting height approximately 16 feet from finished grade.
   b. Nine (9) 250W HPS wall mounted fixtures in the belt press room; mounting height approximately 16 feet from finished floor. Lighting appears to be dim as the belt presses occupy much of the space and create many shadows around the equipment. It is suggested in the design phase to re-evaluate the location and quantity of fixtures to improve overall distribution of the lighting.
   c. Six (6) (2) 2-32W T-8 (64W) enclosed fluorescent strip fixtures in control/restroom; mounting height approximately 8 feet off finished floor.
3. Recommend:
   e. Five (5) new exterior wall mounted fixtures (48W-4768 lumens) on the exterior walls at approximately 16 foot mounting height off finished grade.

The final mounting height shall be adjusted during the design phase as appropriate.

f. For the belt press room; initial recommendation of Nine (9) vaportight 84W high/low bay fixtures (Polycarbonate lense-12,149 lumens) mounted to the wall in the same location as the existing 250W HPS fixtures and supplemented by enclosed vapor tight strip fixtures 51W (6490 lumens) at strategic locations where shadowing occurs. For the purposes of this memorandum, eight (8) vaportight strip fixtures are proposed.

g. For the office/rest room: recommend four (4) new 51W (6490 lumens) vaportight strip fixtures ceiling mounted and spaced to maximize distribution.

h. Overall power demand is expected to reduce from 3884W to 1608W which is a 59% reduction in power for this building.

T. Existing Sludge Drying Facility:

2. Observe:
   a. Nine (9) 100W HPS wall pack fixtures on all four exterior walls; mounting height approximately 10 feet from finished grade.
   b. Sixteen (16) 400W HPS wall mounted fixtures in the thermal dryer room; mounting height approximately 16 feet from finished floor.
   c. Four (4) 400W high bay HPS fixtures in center of space around the thermal dying skid; mounting height approximately 16 feet off finished floor.
3. Recommend:
   d. Nine (9) new outdoor wall mounted fixtures (28W-2845 lumens) as same mounting elevation as existing (10’ above finished grade).
   e. Twenty (20) new industrial high bay fixtures 197W (24143 lumens) in same locations as the four (4) 400W units and general locations of the existing wall mounted units. Final locations to be verified during the design phase.
   f. Overall power demand is expected to reduce from 8900W to 4192W which is a 53% reduction in power for this building.

U. Existing Sludge Facilities Odor Control System:

2. Observe:
   a. Five (5) 100W HPS pole mounted fixtures around odor control equipment; Fixture mounting height: 8 feet from finished grade.
3. Recommend:
   c. Five (5) new outdoor area lights (34W-4200 lumens) on new 8-foot poles and new mounting brackets.
   d. Overall power demand is expected to reduce from 500W to 170W which is a 66% reduction in power for this structure.

V. Existing MCC/Generator Building:

2. Observe:
   a. Five (5) 100W HPS wall pack fixtures on north, east and west exterior walls; mounting height approximately 10 feet from finished grade.
   b. Nine (9) 2-32W T-8 fluorescent enclosed strip fixtures in storage room; ceiling mounted approximately 16 feet from finished floor.

c. Eight (8) 4-32W T-8 (128W) fluorescent lay-in troffer fixtures in electrical/mcc room; mounting height approximately 12 feet off finished floor.
d. Ten (10) 2-32W T-8 fluorescent enclosed strip fixtures in generator room; ceiling mounted approximately 16 feet from finished floor.

3. Recommend:
f. Five (5) new outdoor wall mounted fixtures (28W-2845 lumens) on north, east and west walls at approximately 10 foot mounting height.
g. Nine (9) ceiling mounted vaportight LED (51W-6490 lumens) in storage area; mounting elevation as existing (approximately 16 feet from finished floor).
h. Twelve (12) architectural recessed LED troffers with higher output lumen package. For this location, the Lithonia 2ALL4 with LP850 lumen package is recommended (47W-5427 lumens). Troffers shall be mounted in the existing suspended ceiling and exact layout to be determined in the design phase.
i. Ten (10) ceiling mounted vaportight LED (51W-6490 lumens) in storage area; mounting elevation as existing (approximately 16 feet from finished floor).
j. Overall power demand is expected to reduce from 2740W to 1673W which is a 39% reduction in power for this building.

W. Existing Filter Dosing Pump Station Building:

2. Observe:
a. Three (3) 100W HPS wall pack fixtures on north, west and south exterior walls; mounting height approximately 10 feet from finished grade.
b. Two (2) 100W incandescent fixtures on the east exterior by access doors.
c. Ten (10) 2-40W T-12 fluorescent enclosed strip fixtures in pump room; ceiling mounted approximately 12 feet from finished floor.
d. Six (6) 2-32W T-8 (64W) fluorescent strip fixtures in electrical/MCC room; mounting height approximately 12 feet off finished floor.

3. Recommend:
e. Five (5) new outdoor wall mounted fixtures (28W-2845 lumens) on north, south, east and west walls at approximately 10 foot mounting height.
f. Ten (10) ceiling mounted vaportight LED (51W-6490 lumens) in pump room; mounting elevation as existing (approximately 12 feet from finished floor).
g. Six (6) ceiling mounted strip fixtures (30W-3343 lumens) in electrical/MCC room; mounting elevation as existing (approximately 12 feet from finished floor).
h. Overall power demand is expected to reduce from 1684W to 830W which is a 51% reduction in power for this building.

X. Existing General Site Lighting:

2. Observe:
a. Thirty-six (37) 100W HPS pole mounted fixtures; Fixture mounting height: 8 feet from finished grade.

3. Recommend:
c. Thirty-six (37) new outdoor area lights (34W-4200 lumens) on new 8-foot poles and new mounting brackets/foundations.

d. Overall power demand is expected to reduce from 3700W to 1258W which is a 66% reduction in power for the site.

6.2 Lighting System Upgrade Energy Savings Summary

A. Table 6.2 summarizes the anticipated energy savings if the recommendations described in section 6.1 A-X are implemented.

Table 6.2 Anticipated Energy Savings

Location	Existing Lighting Power (W)	Modified Lighting Power (W)	Power Reduction (W)	Yearly kWH Reduction
Existing Pretreatment Structure**	1,760	586	1,174	5,999
Existing Aeration Basins No.1 & No.2**	1,100	374	726	3,710
Existing Aeration Basin No.3**	1,100	374	726	3,710
Existing Aeration Basins No1, No2 and No.3 Odor Control System**	800	272	528	2,698
Existing Small Aerobic Digester**	300	340	(40)	(204)
Existing Large Aerobic Digester**	1,100	374	726	3,710
Existing Aerobic Digesters Odor Control System**	700	238	462	2,361
Existing Maintenance Shop**	2,262	715	1,547	7,905
Existing Clarifier Splitter Structure**	300	102	198	996
Existing Clarifier No.1**	300	102	198	996
Existing Clarifier No.2**	300	102	198	996
Existing Clarifier No.4**	1,100	374	726	3,710
Existing Clarifier No.4 RAS/WAS Pump Station**	300	102	198	996
Existing Effluent Filters**	1,000	340	660	3,373
Existing Filter Backwash Basin**	200	68	132	675
Existing Chlorine Contact Tank No.1**	1,500	780	720	3,679
Existing Chlorine Contact Tank No.2**	200	68	132	675
Existing Sludge Dewatering Building*	3,884	1,608	2,276	19,938
Existing Sludge Drying Facility*	8,900	4,192	4,708	41,242
Existing Sludge Facilities Odor Control System**	500	170	330	1,686
Existing MCC/Generator Building*	2,740	1,673	1,067	9,345
Existing Filter Dosing Pump Station Building*	1,684	830	854	7,481
Existing General Site Lighting**	3,700	1,258	2,442	12,479
Totals:	35,730	15,042	20,688	138,156

* assumed to operate 24 hrs/day/365 days/year
** assumed to operate average of 14 hrs/day/365 days/year

B. Energy cost savings is calculated from the yearly reduction in power consumed (yearly kWH reduction in Table 6.2) multiplied by the rate of power cost charge by FPL and the reduction in monthly demand due to the reduction in instantaneous power demand. In technical memorandum "Solar Power Feasibility Study for the WRF" dated September 27, 2017 by HEE, it was determined that the power cost per kWH (not

including demand charge) is $0.0486/kWH with a demand cost of $12.56/kWD/month. Yearly energy cost savings is calculated as follows:

1. (138,156 kWH/year x $0.0486/kWH) + (20.688 kWD x $12.56/kWD/month x 12 months) = $9,832/year savings.

7.0 BUDGETARY COSTS

7.1 Table 6.1 summarizes budgetary costs for the lightning protection system modifications described in Section 4.0:

Table 6.1 Lightning Protection System Budgetary Cost Summary

Facility/Building	**Budgetary Cost**
Pretreatment Structure	$10,000
Aeration Basins No.1 and No.2	$25,000
Small Aerobic Digester	$10,000
Clarifier No.1	$12,000
Clarifier No.2	$12,000
Digester Splitter Structure	$8,000
Sludge Dewatering Facility	$15,000
Truck Loading Facility	$10,000
Filter Dosing Pump Station/Adjacent Fuel Storage Tank/Canopy	$10,000
O&M Building	$8,000
Aeration Basin No.3	$5,000
Aeration Basins No.1, No.2 and No.3 Odor Control Piping	$8,000
Clarifier No.3	$12,000
Lightning Prediction System	$12,000
Subtotal:	$157,000
Contingency (30%)	$47,100
Total	**$204,100**

6.2 Table 7.2 summarizes budgetary costs for the lighting system modifications described in Section 5.0:

Table 7.2 Lighting System Budgetary Cost Summary

Facility/Building	**Budgetary Cost**
Pretreatment Structure	$24,870
Aeration Basins No.1 and No.2	$27,910
Aeration Basin No.3	$25,140
Aeration Basin No.1, No.2 and No. Odor Control System	$22,620
Small Aerobic Digester	$15,300
Large Aerobic Digester	$26,415
Aerobic Digesters Odor Control System	$20,680
Maintenance Shop	$17,905
Clarifier Splitter Structure	$12,920
Clarifier No.1	$12,020
Clarifier No.2	$12,020
Clarifier No.4	$27,690

Facility/Building	Budgetary Cost
Clarifier No.4 RAS/WAS Pump Station	$12,920
Effluent Filters	$24,775
Filter Backwash Basin	$10,160
Chlorine Contact Tank No.1	$20,390
Chlorine Contact Tank No.2	$10,380
Sludge Dewatering Building	$24,185
Sludge Drying Facility	$51,195
Sludge Facilities Odor Control System	$16,800
MCC/Generator Building	$27,725
Filter Dosing Pump Station	$18,765
General Site Lighting	$102,390
Subtotal:	$565,177
Contingency (30%)	$169,553
Total	**$734,730**

Appendix A

Excerpts from NFPA 780-2017

Simplified Risk Analysis Calculation Procedure

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IEC 62305-4, *Protection Against Lightning — Part 4: Electrical and Electronic Systems Within Structures,* also provides tables (Table G.1 and G.2) where the I_{imp} and I_n ratings of these surge protective devices are provided depending on the number of lightning protection down conductors installed.

K.5 Isolated Lightning Protection Components. IEC/TS 62561-8, Lightning Protection System Components (LPSC) — Part 8: Requirements for Components for Isolated LPS, provides information on the means of reducing the separation distance through the use of isolated lightning protection components on PV installations.

Annex L Lightning Risk Assessment

This annex is not a part of the requirements of this NFPA document but is included for informational purposes only.

L.1 General. This lightning risk assessment methodology is provided to assist the building owner, safety professional, or architect/engineer in determining the risk of damage or injury due to lightning. This annex provides a simplified, quick-look assessment (Section L.5) and a more detailed assessment for those requiring a more detailed analysis (Section L.6). Once the level of risk has been determined, the development of appropriate lightning protection measures can begin.

L.1.1 There are some cases where the need for protection should be given serious consideration regardless of the outcome of the risk assessment. Examples are those applications where the following are factors:

(1) Large crowds
(2) Continuity of critical services
(3) High lightning flash frequency
(4) Tall isolated structure
(5) Building containing explosive or flammable materials
(6) Building containing irreplaceable cultural heritage

L.1.1.1 Statutory, regulatory, and insurance requirements for the installation of a lightning protection system should take precedence over the results of a risk assessment.

L.1.1.2 When required, a lightning protection system should be installed in accordance with the requirements contained in this standard.

L.1.2 The vulnerability of a structure or object to lightning involves evaluation of the equivalent collection area of the structure or object and the flash density for the area in which the structure is located.

L.1.3 This risk assessment method is a guide that takes into account the lightning threat parameters and the following factors:

(1) Building environment
(2) Type of construction
(3) Structure occupancy
(4) Structure contents
(5) Lightning stroke consequences

L.1.4 Lightning risk for a structure is the product of the lightning frequency, exposure vulnerability, and the consequence of the strike to the structure or object.

L.2 Lightning Flash Density (N_G). Lightning flash density, the yearly number of flashes to ground per square kilometer, can be found in Figure L.2. A color version of this map with resolution of 2 km can be found at http://www.vaisala.com/VaisalaImages/Lightning/avg_fd_2005-2014_CONUS_2km_grid.png.

L.3 Annual Threat of Occurrence (N_D). The yearly annual threat of occurrence (lightning strike frequency) (N_D) to a structure is determined by the following equation:

$$N_D = (N_G)(A_D)(C_D)(10^{-6}) = \text{potential events/year} \quad \text{[L.3]}$$

where:
N_D = yearly lightning strike frequency to the structure or object
N_G = lightning ground flash density in flashes/km^2/year
A_D = the equivalent collection area of the structure (m^2)
C_D = environmental coefficient

L.4 Equivalent Collection Area (A_D). A_D refers to 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.

L.4.1 The equivalent ground collection area of a structure is the area obtained by extending a line with a slope of 1 to 3 from the top of the structure to ground completely around the structure. The equivalent collection area can be developed either numerically or by graphical methods.

L.4.1.1 The equivalent collection area of a rectangular structure with length L, width W, and height H *(see Figure L.4.1.1)* is as follows:

$$A_D = LW + 6H(L+W) + \pi 9H^2 \quad \text{[L.4.1.1]}$$

L.4.1.2 The equivalent collection area of complex structures can be developed by numerical or graphical methods. *[See Figure L.4.1.2(a) and Figure L.4.1.2(b) for examples of complex structures.]*

L.4.2 The location factor accounts for the topography of the site of the structure and any objects located within the distance $3H$ from the structure that can affect the collection area. Location factors are given in Table L.4.2.

L.4.3 Where the equivalent collection area of one structure or object totally encompasses another structure, the covered structure is disregarded.

L.4.4 Where the collection areas of several structures overlap, the corresponding common collection area is considered as a single collection area.

L.5 Simplified Risk Assessment.

L.5.1 General.

L.5.1.1 A simplified risk assessment calculates the tolerable lightning frequency (N_C) and compares it to the annual threat of occurrence (N_D) calculated according to Section L.3. The tolerable lightning frequency (N_C) is a measure of the risk of damage to the structure, including factors affecting risks to the structure, to the contents, and of environmental loss. It is calculated by dividing the acceptable frequency of property losses by

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various coefficients relating to the structure, the contents, and the consequence of damage.

The tolerable lightning frequency is expressed by the following formula:

[L.5.1.1]

$$N_C = \frac{1.5 \times 10^{-3}}{C} \text{ events/year}$$

where:
$C = (C_2)(C_3)(C_4)(C_5)$

The default value of tolerable frequency of property losses is 1.5×10^{-3}.

L.5.1.2 The coefficient (C) is the product of structural coefficients C_2 through C_5. The structural coefficients are obtained from Table L.5.1.2(a) through Table L.5.1.2(d).

L.5.2 Risk Calculation.

L.5.2.1 The tolerable lightning frequency (N_C) is compared with the annual threat occurrence (N_D). The result of this comparison is used to decide if a lightning protection system is needed. If $N_D \leq N_C$, a lightning protection system can be optional. If $N_D > N_C$, it is recommended that a lightning protection system be installed.

L.5.2.2 Table L.5.2.2 provides a simple method of calculating and using the assessment methods described in Section L.5.

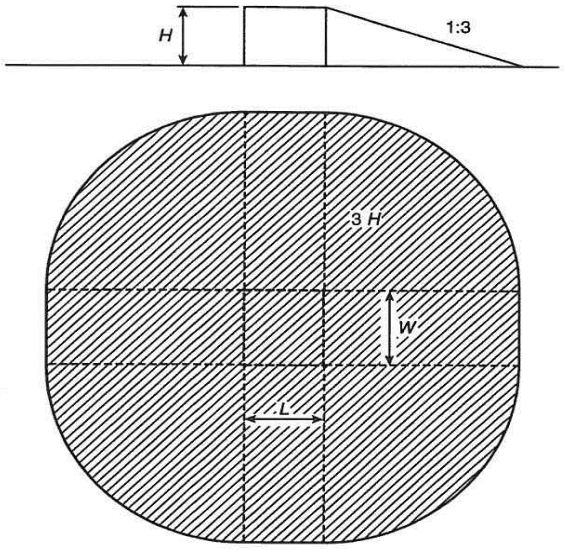

FIGURE L.4.1.1 Calculation of the Equivalent Ground Collection Area for a Rectangular Structure.

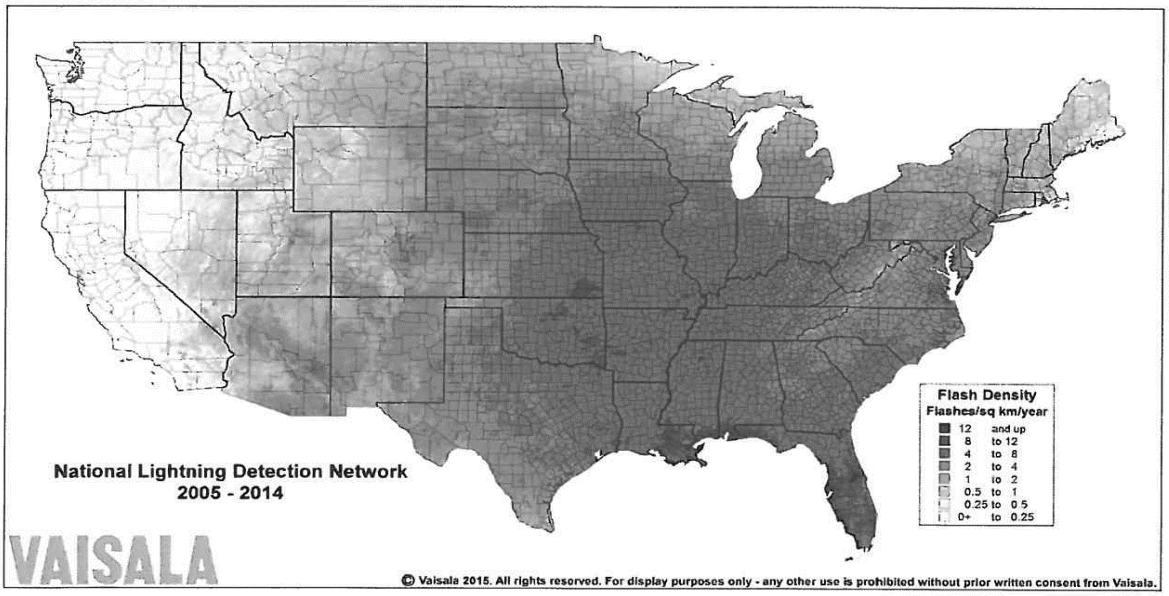

FIGURE L.2 2005–2014 Average U.S. Lightning Flash Density Map (Flashes per Square Kilometer per Year). *(Courtesy Vaisala, Inc.)*

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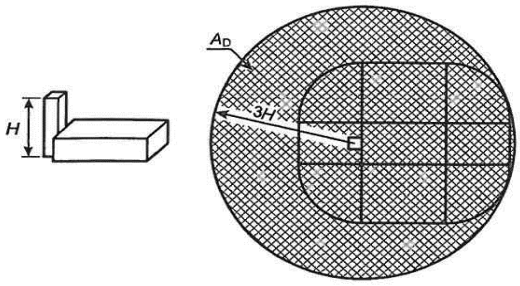


Note: For a structure where a prominent part encompasses all portions of the lower part, $A_D = \pi 9H^2$.

FIGURE L.4.1.2(a) Calculation of the Equivalent Collection Area for a Complex Shape Structure Where a Prominent Part Encompasses All Portions of the Lower Part.

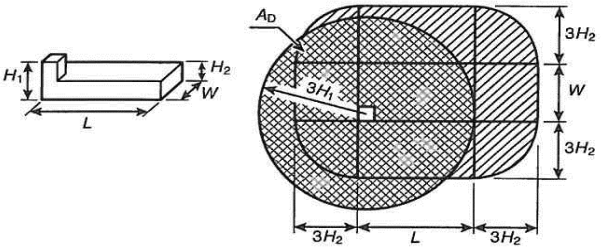


FIGURE L.4.1.2(b) Graphical Solution of the Equivalent Collection Area for a Structure Where a Prominent Part Encompasses Part of the Lower Structure.

Table L.4.2 Location Factor, C_D

Relative Structure Location	C_D
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
Isolated structure on hilltop	2

Table L.5.1.2(a) Determination of Construction Coefficient, C_2

	Construction Coefficient — C_2		
Structure	Metal Roof	Nonmetallic Roof	Combustible Roof
Metal	0.5	1.0	2.0
Nonmetallic	1.0	1.0	2.5
Combustible	2.0	2.5	3.0

Table L.5.1.2(b) Determination of Structure Contents Coefficient, C_3

Structure Contents	C_3
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, irreplaceable cultural items	4.0

Table L.5.1.2(c) Determination of Structure Occupancy Coefficient, C_4

Structure Occupancy	C_4
Unoccupied	0.5
Normally occupied	1.0
Difficult to evacuate or risk of panic	3.0

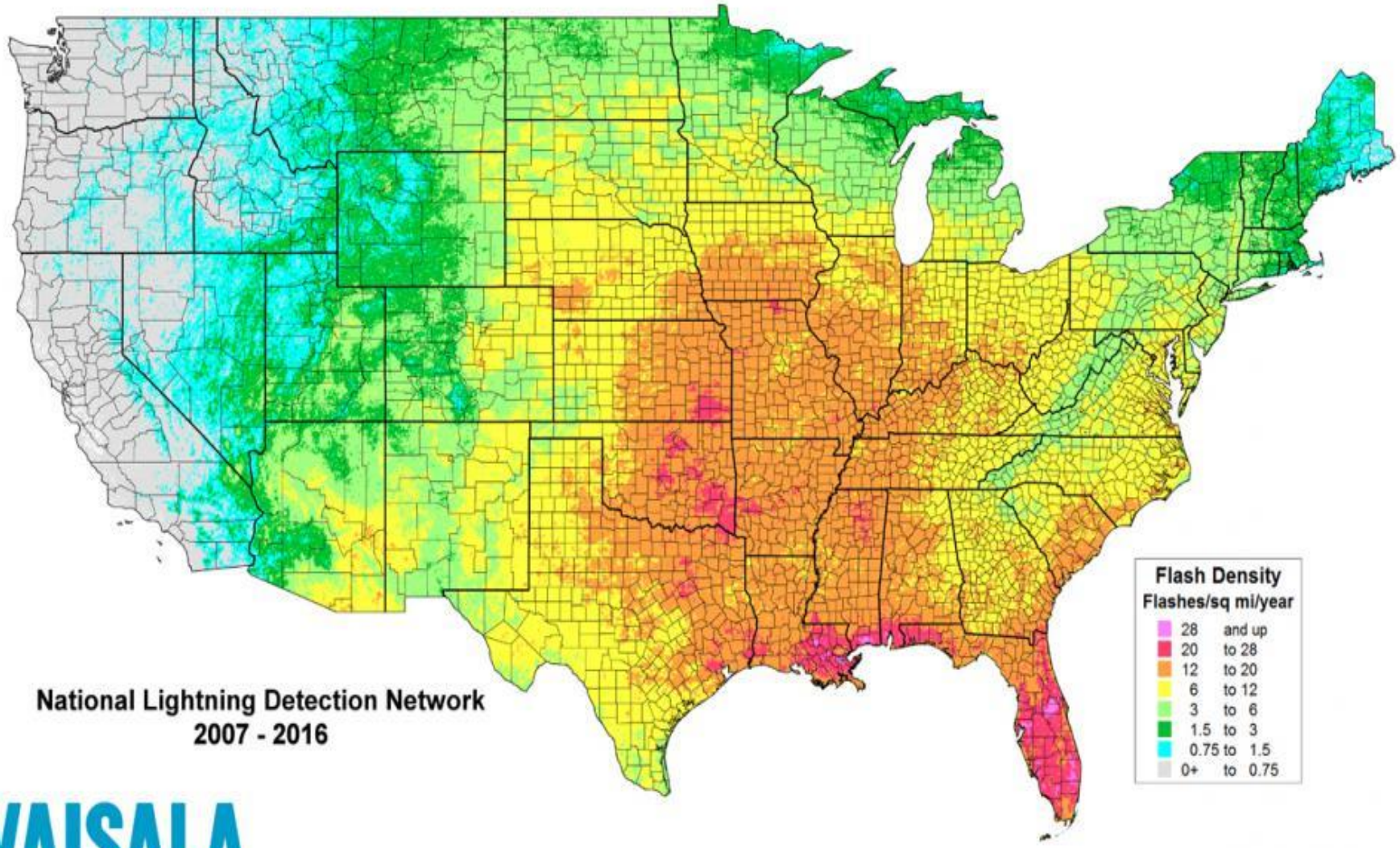
Table L.5.1.2(d) Determination of Lightning Consequence Coefficient, C_5

Lightning Consequence	C_5
Continuity of facility services not required, no environmental impact	1.0
Continuity of facility services required, no environmental impact	5.0
Consequences to the environment	10.0

Table L.5.2.2 Simplified Risk Calculation

Data Input Equations	Computation	Result
Equivalent collection area: $A_D = LW + 6H(L + W) + \pi 9H^2$*	$L =$ $W =$ $H =$ $H^2 =$	$A_D =$
Expected annual threat occurrence: $N_D = (N_G)(A_D)(C_D)(10^{-6})$	$N_D =$ $A_D =$ $C_D =$	$N_D =$
Tolerable lightning frequency to the structure: $N_C = (1.5 \times 10^{-3})/C$, where $C = (C_2)(C_3)(C_4)(C_5)$ If $N_D \leq N_C$, an LPS could be optional. If $N_D > N_C$, an LPS is recommended.	$C_2 =$ $C_3 =$ $C_4 =$ $C_5 =$ $C =$	$N_C =$

*Use the appropriate collection area calculation as defined in L.4.1.1.



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Appendix B

Simplified Risk Analysis Calculations

Simplified Lightning Risk Assessment
Based Upon NFPA 780-2017 Annex L.5

	Structure Name:	**Aeration Basin No.1 & No.2**	
	Structure Dimensions:		
	Length	243	
	Width:	171	
	Height:	18	
NFPA 780 Annex			Notes
L.2	Lightning Flash Density (N_G):	28	From lightning flash density map.
L.3	Annual Threat of Occurrence (N_D):	1.3360	Formula: $N_D=(N_G)(A_D)(C_D)(10^{-6})$ potential events per year.
L.4	Equivalent Collection Area (A_D):	95,425.9	Formula: $A_D=LW+6H(L+W)+\pi 9H^2$ (ft^2)
Table L.4.2	Location Factor (C_D):	0.5	Structure surrounded by structures of equal or lesser height within a distance of 3H.
L.5.1.1	Tolerable Lightning Frequency (N_C):	0.0003	Formula: $N_C= (1.5x10^{-3})/C$ events per year. $C=(C_2)(C_3)(C_4)(C_5)$
Table L.5.1.2(a)	Construction Coefficient C_2:	1.0	Non-metallic structure (concrete); metal roof (covers/handrails)
Table L.5.1.2(b)	Structure Contents Coefficient C_3:	2.0	Moderate combustibility
Table L.5.1.2(c)	Structure Occupancy Coefficient C_4:	0.5	Unoccupied
Table L.5.1.2(d)	Lightning Consequence Coefficient C_5:	5.0	Continuity of service required; no environmental impact.(third aeration basin)
	Is LPS Required?	**Recommended**	if $N_D \leq N_C$ then LPS is optional; if $N_D > N_C$ then LPS is recommended

Simplified Lightning Risk Assessment
Based Upon NFPA 780-2017 Annex L.5

	Structure Name:	**Pretreatment Building**	
	Structure Dimensions:		
	Length	60	
	Width:	20	
	Height:	18	
NFPA 780 Annex			Notes
L.2	Lightning Flash Density (N_G):	28	From lightning flash density map.
L.3	Annual Threat of Occurrence (N_D):	0.2660	Formula: $N_D=(N_G)(A_D)(C_D)(10^{-6})$ potential events per year.
L.4	Equivalent Collection Area (A_D):	19,000.9	Formula: $A_D=LW+6H(L+W)+\pi 9H^2$ (ft^2)
Table L.4.2	Location Factor (C_D):	0.5	Structure surrounded by structures of equal or lesser height within a distance of 3H.
L.5.1.1	Tolerable Lightning Frequency (N_C):	0.00015	Formula: $N_C= (1.5x10^{-3})/C$ events per year. $C=(C_2)(C_3)(C_4)(C_5)$
Table L.5.1.2(a)	Construction Coefficient C_2:	1.0	Non-metallic structure (concrete); metal roof (covers/handrails)
Table L.5.1.2(b)	Structure Contents Coefficient C_3:	2.0	Moderate combustibility
Table L.5.1.2(c)	Structure Occupancy Coefficient C_4:	0.5	Unoccupied
Table L.5.1.2(d)	Lightning Consequence Coefficient C_5:	10.0	Continuity of service required; Environmental impact.
	Is LPS Required?	**Recommended**	if $N_D \leq N_C$ then LPS is optional; if $N_D > N_C$ then LPS is recommended

Simplified Lightning Risk Assessment
Based Upon NFPA 780-2017 Annex L.5

	Structure Name:	**Small Aerobic Digester**	
	Structure Dimensions:		
	Length	77	
	Width:	33	
	Height:	18	
NFPA 780 Annex			Notes
L.2	Lightning Flash Density (N_G):	28	From lightning flash density map.
L.3	Annual Threat of Occurrence (N_D):	0.3301	Formula: $N_D=(N_G)(A_D)(C_D)(10^{-6})$ potential events per year.
L.4	Equivalent Collection Area (A_D):	23,581.9	Formula: $A_D=LW+6H(L+W)+\pi 9H^2$ (ft^2)
Table L.4.2	Location Factor (C_D):	0.5	Structure surrounded by structures of equal or lesser height within a distance of 3H.
L.5.1.1	Tolerable Lightning Frequency (N_C):	0.0003	Formula: $N_C=(1.5x10^{-3})/C$ events per year. $C=(C_2)(C_3)(C_4)(C_5)$
Table L.5.1.2(a)	Construction Coefficient C_2:	1.0	Non-metallic structure (concrete); metal roof (covers/handrails)
Table L.5.1.2(b)	Structure Contents Coefficient C_3:	2.0	Moderate combustibility
Table L.5.1.2(c)	Structure Occupancy Coefficient C_4:	0.5	Unoccupied
Table L.5.1.2(d)	Lightning Consequence Coefficient C_5:	5.0	Continuity of service required; no environmental impact.(Large Aerobic Digester)
	Is LPS Required?	**Recommended**	if $N_D \leq N_C$ then LPS is optional; if $N_D > N_C$ then LPS is recommended

Simplified Lightning Risk Assessment
Based Upon NFPA 780-2017 Annex L.5

	Structure Name:	**Clarifier No.1**	
	Structure Dimensions:		
	Length	65	
	Width:	65	
	Height:	15	

NFPA 780 Annex			Notes
L.2	Lightning Flash Density (N_G):	28	From lightning flash density map.
L.3	Annual Threat of Occurrence (N_D):	0.3120	Formula: $N_D=(N_G)(A_D)(C_D)(10^{-6})$ potential events per year.
L.4	Equivalent Collection Area (A_D):	22,286.7	Formula: $A_D=LW+6H(L+W)+\pi 9H^2$ (ft^2)
Table L.4.2	Location Factor (C_D):	0.5	Structure surrounded by structures of equal or lesser height within a distance of 3H.
L.5.1.1	Tolerable Lightning Frequency (N_C):	0.0006	Formula: $N_C=(1.5x10^{-3})/C$ events per year. $C=(C_2)(C_3)(C_4)(C_5)$
Table L.5.1.2(a)	Construction Coefficient C_2:	1.0	Non-metallic structure (concrete); non-metallic roof
Table L.5.1.2(b)	Structure Contents Coefficient C_3:	1.0	Standard Value and non-combustible.
Table L.5.1.2(c)	Structure Occupancy Coefficient C_4:	0.5	Unoccupied
Table L.5.1.2(d)	Lightning Consequence Coefficient C_5:	5.0	Continuity of service required; no environmental impact.(additional clarifiers)
	Is LPS Required?	**Recommended**	if $N_D \leq N_C$ then LPS is optional; if $N_D > N_C$ then LPS is recommended

Simplified Lightning Risk Assessment
Based Upon NFPA 780-2017 Annex L.5

	Structure Name:	**Clarifier No.2**	
	Structure Dimensions:		
	Length	72	
	Width:	72	
	Height:	15	

NFPA 780 Annex			Notes
L.2	Lightning Flash Density (N_G):	28	From lightning flash density map.
L.3	Annual Threat of Occurrence (N_D):	0.3431	Formula: $N_D=(N_G)(A_D)(C_D)(10^{-6})$ potential events per year.
L.4	Equivalent Collection Area (A_D):	24,505.7	Formula: $A_D=LW+6H(L+W)+\pi 9H^2$ (ft^2)
Table L.4.2	Location Factor (C_D):	0.5	Structure surrounded by structures of equal or lesser height within a distance of 3H.
L.5.1.1	Tolerable Lightning Frequency (N_C):	0.0006	Formula: $N_C=(1.5x10^{-3})/C$ events per year. $C=(C_2)(C_3)(C_4)(C_5)$
Table L.5.1.2(a)	Construction Coefficient C_2:	1.0	Non-metallic structure (concrete); non-metallic roof
Table L.5.1.2(b)	Structure Contents Coefficient C_3:	1.0	Standard Value and non-combustible.
Table L.5.1.2(c)	Structure Occupancy Coefficient C_4:	0.5	Unoccupied
Table L.5.1.2(d)	Lightning Consequence Coefficient C_5:	5.0	Continuity of service required; no environmental impact.(additional clarifiers)
	Is LPS Required?	**Recommended**	if $N_D \leq N_C$ then LPS is optional; if $N_D > N_C$ then LPS is recommended

Simplified Lightning Risk Assessment
Based Upon NFPA 780-2017 Annex L.5

	Structure Name:	**Clarifier Splitter Structure**	
	Structure Dimensions:		
	Length	48	
	Width:	12	
	Height:	15	
NFPA 780 Annex			Notes
L.2	Lightning Flash Density (N_G):	28	From lightning flash density map.
L.3	Annual Threat of Occurrence (N_D):	0.1727	Formula: $N_D = (N_G)(A_D)(C_D)(10^{-6})$ potential events per year.
L.4	Equivalent Collection Area (A_D):	12,337.7	Formula: $A_D = LW+6H(L+W)+\pi 9H^2$ (ft^2)
Table L.4.2	Location Factor (C_D):	0.5	Structure surrounded by structures of equal or lesser height within a distance of 3H.
L.5.1.1	Tolerable Lightning Frequency (N_C):	0.0003	Formula: $N_C = (1.5x10^{-3})/C$ events per year. $C=(C_2)(C_3)(C_4)(C_5)$
Table L.5.1.2(a)	Construction Coefficient C_2:	1.0	Non-metallic structure (concrete); non-metallic roof
Table L.5.1.2(b)	Structure Contents Coefficient C_3:	1.0	Standard Value and non-combustible.
Table L.5.1.2(c)	Structure Occupancy Coefficient C_4:	0.5	Unoccupied
Table L.5.1.2(d)	Lightning Consequence Coefficient C_5:	10.0	Continuity of service required; environmental impact.
	Is LPS Required?	**Recommended**	if $N_D \leq N_C$ then LPS is optional; if $N_D > N_C$ then LPS is recommended

Simplified Lightning Risk Assessment
Based Upon NFPA 780-2017 Annex L.5

	Structure Name:		**Sludge Dewatering Facility**
	Structure Dimensions:		
		Length	47
		Width:	47
		Height:	24

NFPA 780 Annex			Notes
L.2	Lightning Flash Density (N_G):	28	From lightning flash density map.
L.3	Annual Threat of Occurrence (N_D):	0.4484	Formula: $N_D = (N_G)(A_D)(C_D)(10^{-6})$ potential events per year.
L.4	Equivalent Collection Area (A_D):	32,031.0	Formula: $A_D = LW+6H(L+W)+\pi 9H^2$ (ft^2)
Table L.4.2	Location Factor (C_D):	0.5	Structure surrounded by structures of equal or lesser height within a distance of 3H.
L.5.1.1	Tolerable Lightning Frequency (N_C):	0.000075	Formula: $N_C=(1.5x10^{-3})/C$ events per year. $C=(C_2)(C_3)(C_4)(C_5)$
Table L.5.1.2(a)	Construction Coefficient C_2:	1.0	Non-metallic structure and roof.
Table L.5.1.2(b)	Structure Contents Coefficient C_3:	2.0	High Value.
Table L.5.1.2(c)	Structure Occupancy Coefficient C_4:	1.0	Occupied
Table L.5.1.2(d)	Lightning Consequence Coefficient C_5:	10.0	Consequences to the Environment
	Is LPS Required?	**Recommended**	if $N_D \leq N_C$ then LPS is optional; if $N_D > N_C$ then LPS is recommended

Simplified Lightning Risk Assessment
Based Upon NFPA 780-2017 Annex L.5

	Structure Name:	**Truck Loading Building**	
	Structure Dimensions:		
	Length	52	
	Width:	24	
	Height:	24	
NFPA 780 Annex			Notes
L.2	Lightning Flash Density (N_G):	28	From lightning flash density map.
L.3	Annual Threat of Occurrence (N_D):	0.3987	Formula: $N_D=(N_G)(A_D)(C_D)(10^{-6})$ potential events per year.
L.4	Equivalent Collection Area (A_D):	28,478.0	Formula: $A_D=LW+6H(L+W)+\pi 9H^2$ (ft^2)
Table L.4.2	Location Factor (C_D):	0.5	Structure surrounded by structures of equal or lesser height within a distance of 3H.
L.5.1.1	Tolerable Lightning Frequency (N_C):	0.0006	Formula: $N_C= (1.5x10^{-3})/C$ events per year. $C=(C_2)(C_3)(C_4)(C_5)$
Table L.5.1.2(a)	Construction Coefficient C_2:	0.5	Metal Structure and Roof
Table L.5.1.2(b)	Structure Contents Coefficient C_3:	1.0	Standard Value and non-combustible.
Table L.5.1.2(c)	Structure Occupancy Coefficient C_4:	0.5	Unoccupied
Table L.5.1.2(d)	Lightning Consequence Coefficient C_5:	10.0	Consequences to the Environment
	Is LPS Required?	**Recommended**	if $N_D \leq N_C$ then LPS is optional; if $N_D > N_C$ then LPS is recommended

Simplified Lightning Risk Assessment
Based Upon NFPA 780-2017 Annex L.5

	Structure Name:	**Filter Dosing Pump Station**	
	Structure Dimensions:		
	Length	42	
	Width:	28	
	Height:	10	
NFPA 780 Annex			Notes
L.2	Lightning Flash Density (N_G):	28	From lightning flash density map.
L.3	Annual Threat of Occurrence (N_D):	0.2297	Formula: $N_D=(N_G)(A_D)(C_D)(10^{-6})$ potential events per year.
L.4	Equivalent Collection Area (A_D):	8,203.4	Formula: $A_D=LW+6H(L+W)+\pi 9H^2$ (ft^2)
Table L.4.2	Location Factor (C_D):	1	Isolated structure, not other structures located within a distance of 3H.
L.5.1.1	Tolerable Lightning Frequency (N_C):	0.0003	Formula: $N_C=(1.5x10^{-3})/C$ events per year. $C=(C_2)(C_3)(C_4)(C_5)$
Table L.5.1.2(a)	Construction Coefficient C_2:	1.0	Non-metallic structure with non-metal roof.
Table L.5.1.2(b)	Structure Contents Coefficient C_3:	2.0	High Value, moderate combustibility
Table L.5.1.2(c)	Structure Occupancy Coefficient C_4:	0.5	Unoccupied
Table L.5.1.2(d)	Lightning Consequence Coefficient C_5:	5.0	Continuity of facility services required; no environmental impact.
	Is LPS Required?	**Recommended**	if $N_D \leq N_C$ then LPS is optional; if $N_D > N_C$ then LPS is recommended

Simplified Lightning Risk Assessment
Based Upon NFPA 780-2017 Annex L.5

	Structure Name:	**Covered Fuel Storage Tank**	
	Structure Dimensions:		
	Length	30	
	Width:	15	
	Height:	10	
NFPA 780 Annex			Notes
L.2	Lightning Flash Density (N_G):	28	From lightning flash density map.
L.3	Annual Threat of Occurrence (N_D):	0.1674	Formula: $N_D = (N_G)(A_D)(C_D)(10^{-6})$ potential events per year.
L.4	Equivalent Collection Area (A_D):	5,977.4	Formula: $A_D = LW+6H(L+W)+\pi 9H^2$ (ft^2)
Table L.4.2	Location Factor (C_D):	1	Isolated structure, not other structures located within a distance of 3H.
L.5.1.1	Tolerable Lightning Frequency (N_C):	0.002	Formula: $N_C = (1.5x10^{-3})/C$ events per year. $C=(C_2)(C_3)(C_4)(C_5)$
Table L.5.1.2(a)	Construction Coefficient C_2:	0.5	Metal; Metal Roof
Table L.5.1.2(b)	Structure Contents Coefficient C_3:	3.0	Exceptional Value, Combustible Liquids
Table L.5.1.2(c)	Structure Occupancy Coefficient C_4:	0.5	Unoccupied
Table L.5.1.2(d)	Lightning Consequence Coefficient C_5:	1.0	Continuity of facility services not required (second fuel storage tank).
	Is LPS Required?	**Recommended**	if $N_D \leq N_C$ then LPS is optional; if $N_D > N_C$ then LPS is recommended

Simplified Lightning Risk Assessment
Based Upon NFPA 780-2017 Annex L.5

	Structure Name:	**O&M Building**	
	Structure Dimensions:		
	Length	48	
	Width:	25	
	Height:	10	

NFPA 780 Annex			Notes
L.2	Lightning Flash Density (N_G):	28	From lightning flash density map.
L.3	Annual Threat of Occurrence (N_D):	0.0589	Formula: $N_D=(N_G)(A_D)(C_D)(10^{-6})$ potential events per year.
L.4	Equivalent Collection Area (A_D):	8,407.4	Formula: $A_D=LW+6H(L+W)+\pi 9H^2$ (ft^2)
Table L.4.2	Location Factor (C_D):	0.25	Structure surrounded by taller structures of trees within a distance of 3H.
L.5.1.1	Tolerable Lightning Frequency (N_C):	0.0015	Formula: $N_C=(1.5x10^{-3})/C$ events per year. $C=(C_2)(C_3)(C_4)(C_5)$
Table L.5.1.2(a)	Construction Coefficient C_2:	1.0	Non-metallic structure with metal roof.
Table L.5.1.2(b)	Structure Contents Coefficient C_3:	1.0	Standard value and non-combustible.
Table L.5.1.2(c)	Structure Occupancy Coefficient C_4:	1.0	Normally occupied.
Table L.5.1.2(d)	Lightning Consequence Coefficient C_5:	1.0	Continuity of facility services not required; no environmental impact.
	Is LPS Required?	**Recommended**	if $N_D \leq N_C$ then LPS is optional; if $N_D > N_C$ then LPS is recommended

Appendix C

Lightning Prediction System Vendor Data

THORGUARDIAN
LIGHTNING PREDICTION SYSTEM

The THORGUARDIAN is the first, totally integrated advance warning system for lightning. The sensor continuously monitors the atmosphere's electrostatic energy as far away as 15 miles and evaluates the potential for lightning within an area approximately 2 miles in radius. When the system determines a hazardous condition, the air-horns and strobe light provide necessary alerts.

As a leader in lightning prediction, THOR GUARD has advanced its state of the art lightning prediction technology by the development of its propriety L125 prediction computer.

The entire system can be easily installed outdoors as a single unit, or the control box can be located separately. Under normal conditions, the air horns have a range of approximately 700 yards, in a 360' pattern. An external status LED indicates THORGUARDIAN is operational.

FEATURES

- THOR GUARD L125 lightning prediction computer.
- LCD provides immediate lightning / system status.
- Sensor, Strobe, Air-horns, Mtg. Bar & Tripod included.
- User - hours of operation, selectable by day.
- 12 selectable ranges permits desired sensitivity.
- Designed for continuous unattended operation.
- Automatic system status ensures timer opetation.
- Automatic notification, both visual and audible, of "RED - ALERT" and "ALL - CLEAR" conditions.
- Strobe light that remains on during "RED ALERT".
- AC Power (120V) or Optional Solar Power.
- RS232 port (DB9) allows interface to users computer providing data for THOR GUARD's ThorPCX (Optional) visual display and storm storage software.
- Audible notification for low battery or test failure.
- High performance long life rechargeable battery

SELECTED SPECIFICATIONS

Model: THORGUARDIAN L125

Power Requirements:
Voltage: 120-240 volts AC, 50-60 Hz, Single Phase
Power: .25A, 30 Watts

>> Optional Solar Power Using 40 Watt Panel

Power Supply:
100-240 volts AC 50-60 Hz 0.6A
Dimensions: 1.96" W x 1.5" D x 2.8" H
Safety Requirements: UL, CSA
Power Cord: 5 ft. Weight: 5.22oz.

Enclosure Control Box:
Dimensions: 13" W x 6 ½" D x 15 ¼" H
Safety Requirements: UL, CSA, Type 4X
Material: Sealed Gray Fiberglass Enclosure
Weight: 26 Lbs.

Thorguardian Enclosure

THOR GUARD L125:
Dimensions: 7.325" W x 6.0" D x 1.5" H
Power: 12V DC (Supplied by System Battery)
Safety Requirements: FCC Part, 15 Class B

D-ASA Sensor:
Dimensions: 12" L x 6"W x 14"H
Weight: 2 Lbs. (Excludes Cable)


Lightning Prediction Sensor
(Maintenance-free)

Sensor Cable:
West Penn 5992 (Optional Plenum Cable)
3/8" Dia. Doubled Shielded Triaxial with Teflon Core
Standard Lengths: 12ft., 40ft.

VOT Air Horn Cluster:
Manufacture: THOR GUARD
Material: ASA; Dome & Horn Mounting Plate
Weight: 8Lbs. (Excludes Cable)
Cable: General Cable 234600 12 AWG (UL) Type TC-ER
Sound Output: 113db @ 10ft., 700 Yard Radius, Typical Coverage


VOT Horn

Strobe Light:
Manufacture: Whelen 51 Series (UL) Listed
Dimensions: 3.90" H x 5.2" Dia. Weight 1Lb.
Light Output: LED High Intensity Multi-Flash, Amber
Cable: West Penn AQ224, 18 AWG 2-Conductor
Length: Standard 12ft., 40ft. (Additional Lengths Available)


LED Strobe Light

(Specifications & Features subject to change without notice)

THOR GUARD, Inc. 1193 Sawgrass Corporate Parkway, Sunrise, FL 33323
Tel (954) 835-0900 (888) 571-1212 Fax(954) 835-0808 Email: Sales@thorguard.com

www.thorguard.com

REV 17.1

THOR GUARD Model L75

LIGHTNING PREDICTION SYSTEM

THOR GUARD leads the world in the manufacture of lightning prediction and lightning warning systems. Since 1972, THOR GUARD has utilized our proprietary atmospheric electrostatic analysis to produce a variety of lightning prediction systems to meet the technical and budgetary demands of various customer groups.

THOR GUARD's Model L75 is our first upgradeable base prediction and warning system control center. Customers can now have an entry level system, automatic or manual, capable of providing audible and visual warning for a single site. The L75 is fully upgradeable, so that at any time in the future, you can provide warning for remote locations up to 1 1/4 miles away.

FEATURES

- Easy to Read Large Blue Vacuum Fluorescent Display.
- 40 segment "Energy Level" LED Display to show instantaneous energy migrations.
- "Field Collapse Count" indicator shows lightning discharges during storm activity.
- Unique "Activity Detector" displaying projected time until resumption of safe operations.
- Instant Lightning Hazard Level (LHL) and Dynamic Index (DI) continuously displayed.
- All Clear, Caution, Warning, Red Alert, each distinct warning level clearly displayed.
- Multiple range options available for different geographic areas and user applications.
- User adjustable Red Alert level for increased storm notification time.
- Programmable sensor self-test every 24 hours at user selected time.
- Separate Test key provided to manually verify sensor operation.
- Connects to THOR GUARD's ThorPCX visual display and storm storage software.
- Two (DB9) RS232 ports and 1 USB port to run THOR GUARD'S ThorPCX (Optional)
- Two hazard levels of local audio alarm with user adjustable volume control.
- Option provided for user to mute local audio during storms.
- Auto / Manual mode manages alarms for monitored or unmonitored operations.
- Option to manually sound **All Clear** or **Red Alert** alarm horns by user.
- Self-powerd Internal Storm Buffer maintains recent storm times and hazard levels.
- User-selectable hours of alarm operation or 24-hour continuous operation.
- System diagnostics to facilitate and maintain correct operations.
- Compact design and robust construction, sealed tactile feedback membrane panel.
- Access to **All Clear** & **Red Alert** signal using dry closure contacts relay.
- Wall or table mounting.
- Interfaces with **THOR GUARD WEATHER** (Optional).
- Optional software for use at Airport locations.
- Can be upgraded to the THOR GUARD GUARDIAN EMERGENCY NOTIFICATION SYSTEM.

SELECTED SPECIFICATIONS

Models:	L75T, L75B, L75I, L75R
Model Specifications:	L75T ..... Local Hazard Output, +12 Volt DC L75B ..... Local THOR GUARD VOT Base Horn L75I ..... Dry Contact Closure Relays (x2), rated 30V DC/4Amax L75R ..... Local THOR GUARD VOT Base Horn & Remote Horns
Safety Specification:	TÜV (NTRL), CE
Power Requirement:	Voltage: 120-240 volts AC, 50-60 Hz, Single Phase Power: .25A, 30 Watts
Power Supply:	100-240 volts AC 50-60 HZ 0.6A Dimensions: 1.96″ W x 1.5″ D x 2.8″ H Safety Requirements: UL, CSA Power Cord: 5 ft. Weight: 5.22 oz.
Console:	Dimensions: 7.25″ L x 8.75″ W x 1.75″ H Weight: 2 Lbs.
Lightning Prediction Sensor: (Maintenance-free)	Dimensions: 12″ L x 6″ W x 14″ H Weight: 2 Lbs. (Excludes Cable) Mounting: 1″ Diameter Threaded Pipe
Sensor Cable:	West Penn 5992 (Optional Plenum Cable) 3/8″ Dia. Double Shielded Triaxial with Teflon Core Standard Lengths Available 75ft., 125ft., 150 ft. (200 ft. Max. Length)
Vot Comm-Link Cable:	West Penn ACQ 3186 UL Listed Nec Type CL3 (Optional Plenum Cable) 5/16″ Dia. Shielded 6 Conductor PVC Jacket. Standard Lengths Available 75 ft., 125 ft., 150 ft. (200 ft. Max. Length)
VOT Air Horn Cluster:	Manufacture: THOR GUARD Material: ASA; Dome & Horn Mounting Plate Weight: 8 Lbs. (Excludes Cable) Cable: General Cable 234600 12AWG (UL) Type TC-ER Sound Output: 113db @ 10ft., 700 Yard Radius, Typical Coverage
Strobe Light:	Manufacture: Whelen 51 Series (UL) Listed Dimensions: 3.90″H x 5.2″ Dia. Weight: 1 Lb. Light Output: LED High Intensity Multi-Flash, Amber Cable: West Penn AQ224, 18AWG 2-Conductor Length: Standard 12 ft., 40 ft. (Additional Lengths Available)
RF Specifications:	West Penn RG58/U Coaxial 50 Ohm - 1 Conductor 20 AWG 19x32 Tinned Copper, 95% Tinned copper braid and an overall PVC Jacket. NEC RATING: CM Approvals :(UL) C(UL)Listed

Lightning Prediction Sensor
(Maintenance-free)

VOT BD
or
VOT RC

VOT Horn

LED Strobe Light

(Specifications & features subject to change without notice)

THOR GUARD, Inc. 1193 Sawgrass Corporate Parkway, Sunrise, FL 33323
Tel (954) 835-0900 (888) 571-1212 Fax (954) 835-0808 E-mail: sales@thorguard.com
www.thorguard.com

REV 16.1

Appendix D

Lighting Fixture Vendor Data

McGraw-Edison

DESCRIPTION

The Galleon™ LED luminaire delivers exceptional performance in a highly scalable, low-profile design. Patented, high-efficiency AccuLED Optics™ system provides uniform and energy conscious illumination to walkways, parking lots, roadways, building areas and security lighting applications. IP66 rated and UL/cUL Listed for wet locations.

Catalog #		Type
Project		
Comments		Date
Prepared by		

SPECIFICATION FEATURES

Construction
Extruded aluminum driver enclosure thermally isolated from Light Squares for optimal thermal performance. Heavy-wall, die-cast aluminum end caps enclose housing and die-cast aluminum heat sinks. A unique, patent pending interlocking housing and heat sink provides scalability with superior structural rigidity. 3G vibration tested and rated. Optional tool-less hardware available for ease of entry into electrical chamber. Housing is IP66 rated.

Optics
Patented, high-efficiency injection-molded AccuLED Optics technology. Optics are precisely designed to shape the distribution maximizing efficiency and application spacing. AccuLED Optics create consistent distributions with the scalability to meet customized application requirements. Offered standard in 4000K (+/- 275K) CCT 70 CRI. Optional 3000K, 5000K and 6000K CCT.

Electrical
LED drivers are mounted to removable tray assembly for ease of maintenance. 120-277V 50/60Hz, 347V 60Hz or 480V 60Hz operation. 480V is compatible for use with 480V Wye systems only. Standard with 0-10V dimming. Shipped standard with Eaton proprietary circuit module designed to withstand 10kV of transient line surge. The Galleon LED luminaire is suitable for operation in -40°C to 40°C ambient environments. For applications with ambient temperatures exceeding 40°C, specify the HA (High Ambient) option. Light Squares are IP66 rated. Greater than 90% lumen maintenance expected at 60,000 hours. Available in standard 1A drive current and optional 600mA, 800mA and 1200mA drive currents (nominal).

Mounting
STANDARD ARM MOUNT: Extruded aluminum arm includes internal bolt guides allowing for easy positioning of fixture during mounting. When mounting two or more luminaires at 90° and 120° apart, the EA extended arm may be required. Refer to the arm mounting requirement table. Round pole adapter included. For wall mounting, specify wall mount bracket option. QUICK MOUNT ARM: Adapter is bolted directly to the pole. Quick mount arm slide into place on the adapter and is secured via two screws, facilitating quick and easy installation. The versatile, patent pending, quick mount arm accommodates multiple drill patterns ranging from 1-1/2" to 4-7/8". Removal of the door on the quick mount arm enables wiring of the fixture without having to access the driver compartment. A knock-out enables round pole mounting.

Finish
Housing finished in super durable TGIC polyester powder coat paint, 2.5 mil nominal thickness for superior protection against fade and wear. Heat sink is powder coated black. Standard housing colors include black, bronze, grey, white, dark platinum and graphite metallic. RAL and custom color matches available.

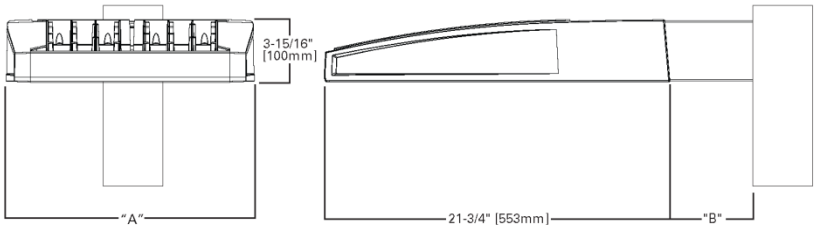
Warranty
Five-year warranty.

GLEON
GALLEON LED

1-10 Light Squares
Solid State LED

AREA/SITE LUMINAIRE

DIMENSIONS



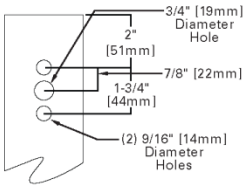
DIMENSION DATA

Number of Light Squares	"A" Width	"B" Standard Arm Length	"B" Optional Arm Length [1]	Weight with Arm (lbs.)	EPA with Arm [2] (Sq. Ft.)
1-4	15-1/2" (394mm)	7" (178mm)	10" (254mm)	33 (15.0 kgs.)	0.96
5-6	21-5/8" (549mm)	7" (178mm)	10" (254mm)	44 (20.0 kgs.)	1.00
7-8	27-5/8" (702mm)	7" (178mm)	13" (330mm)	54 (24.5 kgs.)	1.07
9-10	33-3/4" (857mm)	7" (178mm)	16" (406mm)	63 (28.6 kgs.)	1.12

NOTES: 1. Optional arm length to be used when mounting two fixtures at 90° on a single pole. **2.** EPA calculated with optional arm length.

DRILLING PATTERN

TYPE "N"



CERTIFICATION DATA

UL/cUL Wet Location Listed
ISO 9001
LM79 / LM80 Compliant
3G Vibration Rated
IP66 Rated
DesignLights Consortium® Qualified*

ENERGY DATA

Electronic LED Driver
>0.9 Power Factor
<20% Total Harmonic Distortion
120V-277V 50/60Hz
347V & 480V 60Hz
-40°C Min. Temperature
40°C Max. Temperature
50°C Max. Temperature (HA Option)

Powering Business Worldwide

*www.designlights.org

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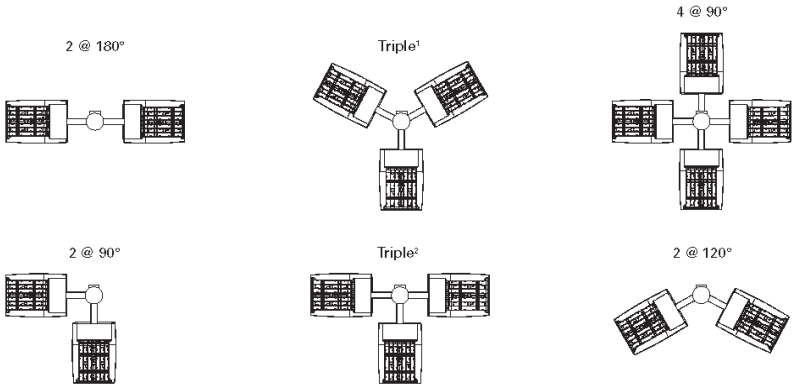
March 12, 2018 4:50 PM

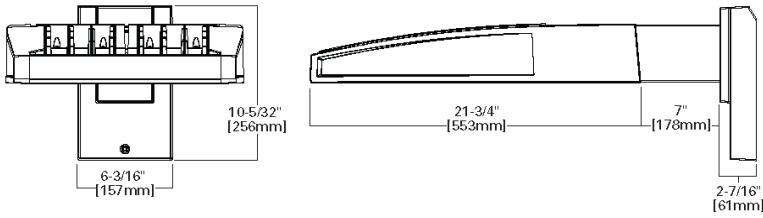
ARM MOUNTING REQUIREMENTS

Configuration	90° Apart	120° Apart
GLEON-AF-01	7" Arm (Standard)	7" Arm (Standard)
GLEON-AF-02	7" Arm (Standard)	7" Arm (Standard)
GLEON-AF-03	7" Arm (Standard)	7" Arm (Standard)
GLEON-AF-04	7" Arm (Standard)	7" Arm (Standard)
GLEON-AF-05	10" Extended Arm (Required)	7" Arm (Standard)
GLEON-AF-06	10" Extended Arm (Required)	7" Arm (Standard)
GLEON-AF-07	13" Extended Arm (Required)	13" Extended Arm (Required)
GLEON-AF-08	13" Extended Arm (Required)	13" Extended Arm (Required)
GLEON-AF-09	16" Extended Arm (Required)	16" Extended Arm (Required)
GLEON-AF-10	16" Extended Arm (Required)	16" Extended Arm (Required)

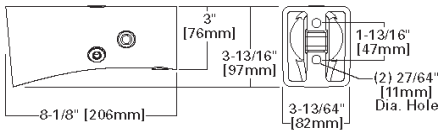


NOTES: 1 Round poles are 3 @ 120°. Square poles are 3 @ 90°. **2** Round poles are 3 @ 90°.

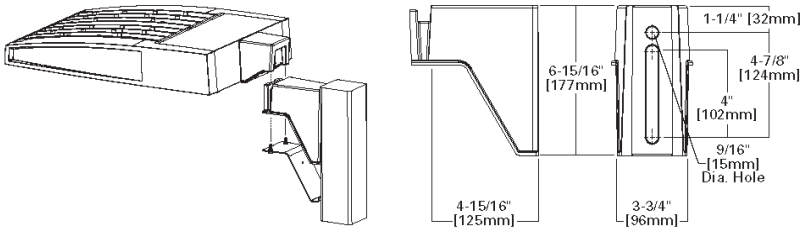
STANDARD WALL MOUNT



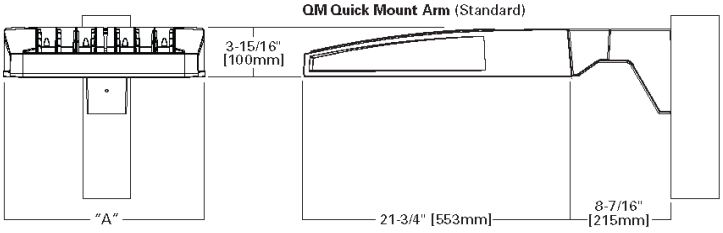
MAST ARM MOUNT



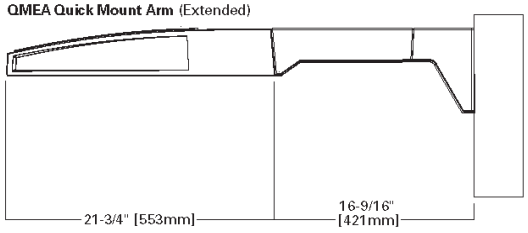
QUICK MOUNT ARM (INCLUDES FIXTURE ADAPTER)



QM Quick Mount Arm (Standard)



QMEA Quick Mount Arm (Extended)



QUICK MOUNT ARM DATA

Number of Light Squares [1,2]	**"A" Width**	**Weight with QM Arm** (lbs.)	**Weight with QMEA Arm** (lbs.)	**EPA** (Sq. Ft.)
1-4	15-1/2" (394mm)	35 (15.91 kgs.)	38 (17.27 kgs.)	1.11
5-6 [3]	21-5/8" (549mm)	46 (20.91 kgs.)	49 (22.27 kgs.)	
7-8	27-5/8" (702mm)	56 (25.45 kgs.)	59 (26.82 kgs.)	

NOTES: 1 QM option available with 1-8 light square configurations. **2** QMEA option available with 1-6 light square configurations. **3** QMEA arm to be used when mounting two fixtures at 90° on a single pole.

Eaton
1121 Highway 74 South
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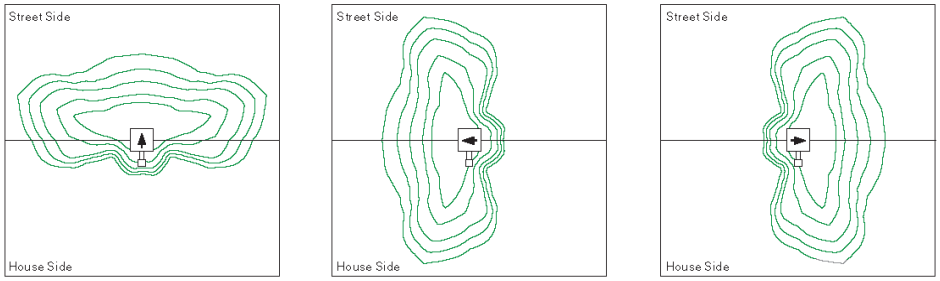
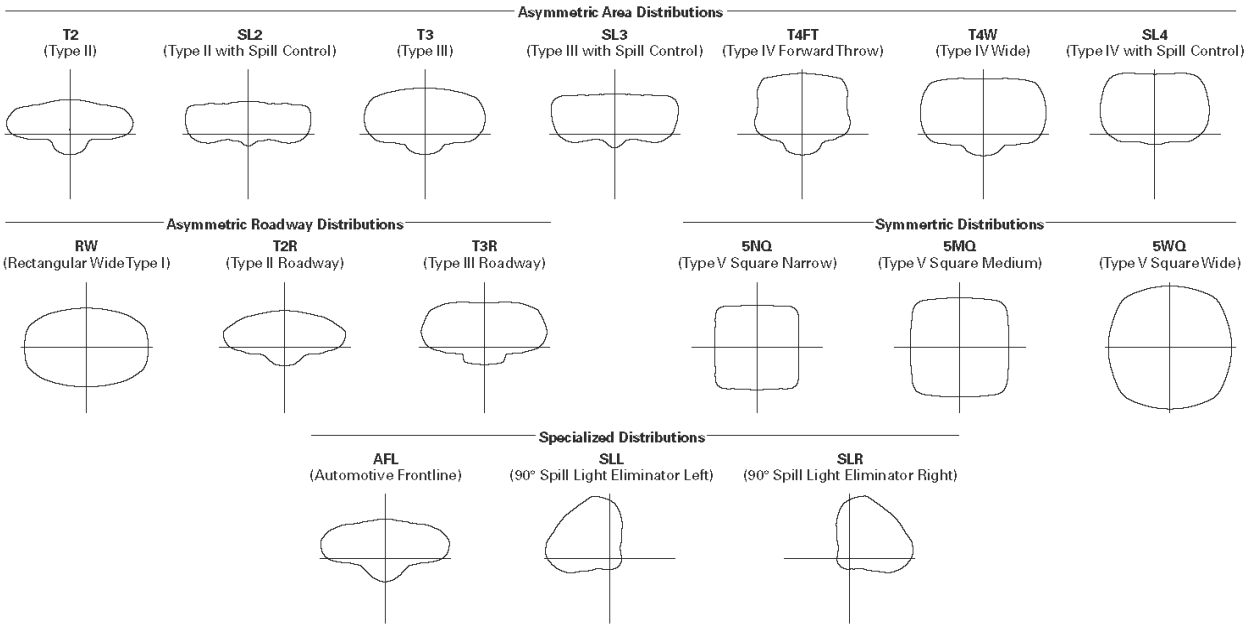
OPTIC ORIENTATION



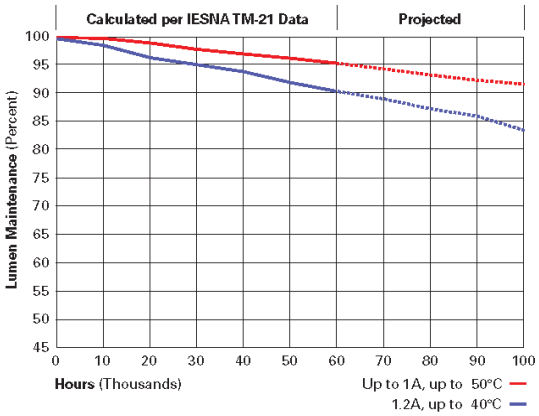
Standard | **Optics Rotated Left @ 90°** [L90] | **Optics Rotated Right @ 90°** [R90]

OPTICAL DISTRIBUTIONS



LUMEN MAINTENANCE

Drive Current	Ambient Temperature	TM-21 Lumen Maintenance (60,000 Hours)	Projected L70 (Hours)
Up to 1A	Up to 50°C	> 95%	416,000
1.2A	Up to 40°C	> 90%	205,000



LUMEN MULTIPLIER

Ambient Temperature	Lumen Multiplier
0°C	1.02
10°C	1.01
25°C	1.00
40°C	0.99
50°C	0.97

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NOMINAL POWER LUMENS (1.2A)

Number of Light Squares		1	2	3	4	5	6	7	8	9	10
Nominal Power (Watts)		67	129	191	258	320	382	448	511	575	640
Input Current @ 120V (A)		0.58	1.16	1.78	2.31	2.94	3.56	4.09	4.71	5.34	5.87
Input Current @ 208V (A)		0.33	0.63	0.93	1.27	1.57	1.87	2.22	2.52	2.8	3.14
Input Current @ 240V (A)		0.29	0.55	0.80	1.10	1.35	1.61	1.93	2.18	2.41	2.71
Input Current @ 277V (A)		0.25	0.48	0.70	0.96	1.18	1.39	1.69	1.90	2.09	2.36
Input Current @ 347V (A)		0.20	0.39	0.57	0.78	0.96	1.15	1.36	1.54	1.72	1.92
Input Current @ 480V (A)		0.15	0.30	0.43	0.60	0.73	0.85	1.03	1.16	1.28	1.45
Optics											
T2	4000K/5000K Lumens	6,709	13,111	19,562	25,848	32,026	38,325	45,324	51,355	57,286	63,424
	3000K Lumens	5,939	11,606	17,316	22,881	28,349	33,925	40,121	45,459	50,710	56,143
	BUG Rating	B1-U0-G2	B2-U0-G2	B3-U0-G3	B3-U0-G4	B3-U0-G4	B3-U0-G5	B4-U0-G5	B4-U0-G5	B4-U0-G5	B4-U0-G5
T2R	4000K/5000K Lumens	7,122	13,919	20,769	27,442	34,000	40,687	48,117	54,519	60,816	67,333
	3000K Lumens	5,939	11,606	17,316	22,881	28,349	33,925	40,121	45,459	50,710	56,143
	BUG Rating	B1-U0-G1	B2-U0-G2	B2-U0-G3	B3-U0-G3	B3-U0-G4	B3-U0-G4	B3-U0-G5	B3-U0-G5	B4-U0-G5	B4-U0-G5
T3	4000K/5000K Lumens	6,838	13,363	19,939	26,346	32,642	39,062	46,196	52,343	58,388	64,646
	3000K Lumens	6,053	11,829	17,650	23,321	28,895	34,578	40,893	46,334	51,685	57,225
	BUG Rating	B1-U0-G2	B2-U0-G2	B3-U0-G3	B3-U0-G4	B3-U0-G4	B3-U0-G5	B4-U0-G5	B4-U0-G5	B4-U0-G5	B4-U0-G5
T3R	4000K/5000K Lumens	6,990	13,660	20,382	26,931	33,368	39,930	47,223	53,506	59,686	66,081
	3000K Lumens	6,188	12,092	18,042	23,839	29,537	35,346	41,802	47,364	52,834	58,495
	BUG Rating	B1-U0-G2	B2-U0-G3	B2-U0-G3	B3-U0-G4	B3-U0-G5	B3-U0-G5	B3-U0-G5	B3-U0-G5	B4-U0-G5	B4-U0-G5
T4FT	4000K/5000K Lumens	6,878	13,440	20,055	26,499	32,832	39,289	46,464	52,646	58,726	65,020
	3000K Lumens	6,088	11,897	17,753	23,457	29,063	34,779	41,130	46,602	51,984	57,556
	BUG Rating	B1-U0-G2	B2-U0-G3	B2-U0-G4	B3-U0-G4	B3-U0-G5	B3-U0-G5	B3-U0-G5	B4-U0-G5	B4-U0-G5	B4-U0-G5
T4W	4000K/5000K Lumens	6,789	13,267	19,795	26,156	32,408	38,781	45,864	51,967	57,968	64,180
	3000K Lumens	6,010	11,744	17,523	23,153	28,688	34,329	40,599	46,001	51,313	56,812
	BUG Rating	B1-U0-G2	B2-U0-G3	B3-U0-G4	B3-U0-G4	B3-U0-G5	B3-U0-G5	B4-U0-G5	B4-U0-G5	B4-U0-G5	B4-U0-G5
SL2	4000K/5000K Lumens	6,697	13,088	19,529	25,804	31,970	38,259	45,245	51,267	57,186	63,315
	3000K Lumens	5,928	11,585	17,287	22,842	28,300	33,867	40,051	45,382	50,621	56,046
	BUG Rating	B1-U0-G2	B2-U0-G3	B3-U0-G3	B3-U0-G4	B3-U0-G4	B3-U0-G5	B4-U0-G5	B4-U0-G5	B4-U0-G5	B4-U0-G5
SL3	4000K/5000K Lumens	6,837	13,361	19,936	26,342	32,639	39,057	46,189	52,336	58,380	64,636
	3000K Lumens	6,052	11,827	17,647	23,318	28,892	34,573	40,887	46,328	51,678	57,216
	BUG Rating	B1-U0-G2	B2-U0-G3	B2-U0-G4	B3-U0-G4	B3-U0-G5	B3-U0-G5	B3-U0-G5	B4-U0-G5	B4-U0-G5	B4-U0-G5
SL4	4000K/5000K Lumens	6,496	12,695	18,943	25,029	31,011	37,110	43,886	49,727	55,470	61,414
	3000K Lumens	5,750	11,238	16,768	22,156	27,451	32,850	38,848	44,018	49,102	54,364
	BUG Rating	B1-U0-G2	B1-U0-G3	B2-U0-G4	B2-U0-G4	B2-U0-G5	B3-U0-G5	B3-U0-G5	B3-U0-G5	B3-U0-G5	B3-U0-G5
5NQ	4000K/5000K Lumens	7,052	13,781	20,564	27,171	33,664	40,285	47,641	53,981	60,215	66,669
	3000K Lumens	6,242	12,199	18,203	24,052	29,799	35,660	42,172	47,784	53,302	59,015
	BUG Rating	B3-U0-G1	B3-U0-G2	B4-U0-G2	B4-U0-G2	B5-U0-G2	B5-U0-G3	B5-U0-G3	B5-U0-G4	B5-U0-G4	B5-U0-G4
5MQ	4000K/5000K Lumens	7,182	14,034	20,942	27,671	34,284	41,027	48,518	54,975	61,323	67,896
	3000K Lumens	6,358	12,423	18,538	24,494	30,348	36,317	42,948	48,664	54,283	60,102
	BUG Rating	B3-U0-G1	B4-U0-G2	B4-U0-G2	B5-U0-G3	B5-U0-G4	B5-U0-G4	B5-U0-G4	B5-U0-G5	B5-U0-G5	B5-U0-G5
5WQ	4000K/5000K Lumens	7,201	14,073	20,998	27,744	34,375	41,136	48,648	55,121	61,487	68,077
	3000K Lumens	6,374	12,457	18,587	24,559	30,429	36,414	43,063	48,793	54,428	60,262
	BUG Rating	B3-U0-G2	B4-U0-G2	B5-U0-G3	B5-U0-G4	B5-U0-G4	B5-U0-G4	B5-U0-G5	B5-U0-G5	B5-U0-G5	B5-U0-G5
SLL/SLR	4000K/5000K Lumens	6,009	11,741	17,519	23,148	28,681	34,321	40,589	45,990	51,301	56,798
	3000K Lumens	5,319	10,393	15,508	20,491	25,388	30,381	35,929	40,710	45,412	50,278
	BUG Rating	B1-U0-G2	B2-U0-G3	B2-U0-G3	B3-U0-G4	B3-U0-G4	B3-U0-G5	B3-U0-G5	B3-U0-G5	B3-U0-G5	B4-U0-G5
RW	4000K/5000K Lumens	6,989	13,657	20,378	26,925	33,360	39,921	47,211	53,494	59,672	66,066
	3000K Lumens	6,187	12,089	18,039	23,834	29,530	35,338	41,791	47,353	52,822	58,482
	BUG Rating	B3-U0-G1	B3-U0-G2	B4-U0-G2	B4-U0-G2	B5-U0-G3	B5-U0-G3	B5-U0-G4	B5-U0-G4	B5-U0-G4	B5-U0-G4
AFL	4000K/5000K Lumens	7,014	13,706	20,452	27,023	33,481	40,066	47,383	53,688	59,888	66,306
	3000K Lumens	6,209	12,133	18,104	23,921	29,637	35,466	41,943	47,525	53,013	58,694
	BUG Rating	B1-U0-G1	B2-U0-G2	B2-U0-G2	B3-U0-G3	B3-U0-G3	B3-U0-G3	B3-U0-G3	B3-U0-G4	B4-U0-G4	B4-U0-G4

* Nominal data for 70 CRI.

NOMINAL POWER LUMENS (1A)

Number of Light Squares		1	2	3	4	5	6	7	8	9	10
Nominal Power (Watts)		59	113	166	225	279	333	391	445	501	558
Input Current @ 120V (A)		0.51	1.02	1.53	2.03	2.55	3.06	3.56	4.08	4.6	5.07
Input Current @ 208V (A)		0.29	0.56	0.82	1.11	1.37	1.64	1.93	2.19	2.46	2.75
Input Current @ 240V (A)		0.26	0.48	0.71	0.96	1.19	1.41	1.67	1.89	2.12	2.39
Input Current @ 277V (A)		0.23	0.42	0.61	0.83	1.03	1.23	1.45	1.65	1.84	2.09
Input Current @ 347V (A)		0.17	0.32	0.50	0.64	0.82	1.00	1.14	1.32	1.50	1.68
Input Current @ 480V (A)		0.14	0.24	0.37	0.48	0.61	0.75	0.91	0.99	1.12	1.28
Optics											
T2	4000K/5000K Lumens	6,116	11,951	17,833	23,563	29,195	34,937	41,317	46,814	52,221	57,817
	3000K Lumens	5,414	10,579	15,786	20,858	25,843	30,926	36,574	41,440	46,226	51,180
	BUG Rating	B1-U0-G2	B2-U0-G2	B3-U0-G3	B3-U0-G3	B3-U0-G4	B3-U0-G4	B4-U0-G5	B4-U0-G5	B4-U0-G5	B4-U0-G5
T2R	4000K/5000K Lumens	6,493	12,688	18,932	25,015	30,994	37,090	43,863	49,699	55,439	61,380
	3000K Lumens	5,748	11,231	16,759	22,143	27,436	32,832	38,828	43,994	49,075	54,334
	BUG Rating	B1-U0-G1	B2-U0-G2	B2-U0-G2	B3-U0-G3	B3-U0-G4	B3-U0-G4	B3-U0-G4	B3-U0-G5	B4-U0-G5	B4-U0-G5
T3	4000K/5000K Lumens	6,234	12,181	18,176	24,017	29,756	35,609	42,111	47,715	53,225	58,930
	3000K Lumens	5,518	10,783	16,089	21,260	26,340	31,521	37,277	42,237	47,115	52,165
	BUG Rating	B1-U0-G2	B2-U0-G2	B3-U0-G3	B3-U0-G4	B3-U0-G4	B3-U0-G5	B4-U0-G5	B4-U0-G5	B4-U0-G5	B4-U0-G5
T3R	4000K/5000K Lumens	6,372	12,453	18,580	24,550	30,418	36,400	43,048	48,776	54,409	60,239
	3000K Lumens	5,640	11,023	16,447	21,732	26,926	32,221	38,106	43,177	48,163	53,324
	BUG Rating	B1-U0-G2	B2-U0-G2	B2-U0-G3	B3-U0-G4	B3-U0-G4	B3-U0-G5	B3-U0-G5	B3-U0-G5	B3-U0-G5	B4-U0-G5
T4FT	4000K/5000K Lumens	6,270	12,252	18,282	24,156	29,929	35,815	42,356	47,992	53,534	59,271
	3000K Lumens	5,550	10,845	16,183	21,383	26,493	31,703	37,494	42,483	47,388	52,467
	BUG Rating	B1-U0-G2	B2-U0-G2	B2-U0-G3	B3-U0-G4	B3-U0-G5	B3-U0-G5	B3-U0-G5	B3-U0-G5	B4-U0-G5	B4-U0-G5
T4W	4000K/5000K Lumens	6,189	12,094	18,045	23,844	29,543	35,352	41,809	47,372	52,843	58,506
	3000K Lumens	5,479	10,706	15,973	21,107	26,151	31,294	37,009	41,934	46,777	51,790
	BUG Rating	B1-U0-G2	B2-U0-G2	B3-U0-G3	B3-U0-G4	B3-U0-G5	B3-U0-G5	B4-U0-G5	B4-U0-G5	B4-U0-G5	B4-U0-G5
SL2	4000K/5000K Lumens	6,105	11,931	17,803	23,522	29,144	34,877	41,245	46,734	52,130	57,717
	3000K Lumens	5,404	10,561	15,759	20,822	25,798	30,873	36,510	41,369	46,145	51,091
	BUG Rating	B1-U0-G2	B2-U0-G3	B3-U0-G3	B3-U0-G4	B3-U0-G4	B3-U0-G5	B4-U0-G5	B4-U0-G5	B4-U0-G5	B4-U0-G5
SL3	4000K/5000K Lumens	6,233	12,180	18,174	24,013	29,753	35,604	42,106	47,708	53,218	58,921
	3000K Lumens	5,517	10,782	16,088	21,256	26,337	31,517	37,272	42,231	47,109	52,157
	BUG Rating	B1-U0-G2	B2-U0-G3	B2-U0-G3	B3-U0-G4	B3-U0-G4	B3-U0-G5	B3-U0-G5	B3-U0-G5	B4-U0-G5	B4-U0-G5
SL4	4000K/5000K Lumens	5,922	11,572	17,268	22,816	28,269	33,829	40,006	45,330	50,566	55,984
	3000K Lumens	5,242	10,244	15,286	20,197	25,024	29,945	35,413	40,126	44,761	49,557
	BUG Rating	B1-U0-G2	B1-U0-G3	B2-U0-G3	B2-U0-G4	B2-U0-G5	B3-U0-G5	B3-U0-G5	B3-U0-G5	B3-U0-G5	B3-U0-G5
5NQ	4000K/5000K Lumens	6,429	12,563	18,746	24,768	30,688	36,723	43,429	49,208	54,891	60,775
	3000K Lumens	5,691	11,121	16,594	21,925	27,165	32,507	38,443	43,559	48,590	53,798
	BUG Rating	B2-U0-G1	B3-U0-G2	B4-U0-G2	B4-U0-G2	B5-U0-G2	B5-U0-G3	B5-U0-G3	B5-U0-G3	B5-U0-G4	B5-U0-G4
5MQ	4000K/5000K Lumens	6,547	12,794	19,090	25,224	31,253	37,400	44,228	50,114	55,902	61,893
	3000K Lumens	5,795	11,325	16,898	22,328	27,665	33,106	39,151	44,361	49,484	54,788
	BUG Rating	B3-U0-G1	B4-U0-G2	B4-U0-G2	B5-U0-G3	B5-U0-G3	B5-U0-G4	B5-U0-G4	B5-U0-G4	B5-U0-G5	B5-U0-G5
5WQ	4000K/5000K Lumens	6,564	12,828	19,141	25,291	31,336	37,499	44,347	50,248	56,051	62,058
	3000K Lumens	5,810	11,355	16,944	22,388	27,739	33,194	39,256	44,480	49,616	54,934
	BUG Rating	B3-U0-G2	B4-U0-G2	B5-U0-G3	B5-U0-G3	B5-U0-G4	B5-U0-G4	B5-U0-G5	B5-U0-G5	B5-U0-G5	B5-U0-G5
SLL/SLR	4000K/5000K Lumens	5,478	10,703	15,970	21,102	26,145	31,286	37,001	41,924	46,765	51,777
	3000K Lumens	4,849	9,474	14,137	18,679	23,144	27,694	32,753	37,111	41,396	45,833
	BUG Rating	B1-U0-G2	B1-U0-G3	B2-U0-G3	B2-U0-G4	B3-U0-G4	B3-U0-G5	B3-U0-G5	B3-U0-G5	B3-U0-G5	B3-U0-G5
RW	4000K/5000K Lumens	6,371	12,449	18,576	24,544	30,411	36,392	43,037	48,764	54,396	60,225
	3000K Lumens	5,640	11,020	16,443	21,726	26,920	32,214	38,096	43,166	48,151	53,311
	BUG Rating	B3-U0-G1	B3-U0-G2	B4-U0-G2	B4-U0-G2	B5-U0-G3	B5-U0-G3	B5-U0-G3	B5-U0-G4	B5-U0-G4	B5-U0-G4
AFL	4000K/5000K Lumens	6,394	12,494	18,644	24,634	30,521	36,524	43,194	48,942	54,593	60,444
	3000K Lumens	5,660	11,060	16,504	21,806	27,017	32,331	38,235	43,323	48,326	53,505
	BUG Rating	B1-U0-G1	B2-U0-G2	B2-U0-G2	B3-U0-G2	B3-U0-G3	B3-U0-G3	B3-U0-G3	B3-U0-G3	B4-U0-G4	B4-U0-G4

* Nominal data for 70 CRI.

NOMINAL POWER LUMENS (800MA)

Number of Light Squares		1	2	3	4	5	6	7	8	9	10
Nominal Power (Watts)		44	85	124	171	210	249	295	334	374	419
Input Current @ 120V (A)		0.39	0.77	1.13	1.54	1.90	2.26	2.67	3.03	3.39	3.80
Input Current @ 208V (A)		0.22	0.44	0.62	0.88	1.06	1.24	1.50	1.68	1.87	2.12
Input Current @ 240V (A)		0.19	0.38	0.54	0.76	0.92	1.08	1.30	1.46	1.62	1.84
Input Current @ 277V (A)		0.17	0.36	0.47	0.72	0.83	0.95	1.19	1.31	1.42	1.67
Input Current @ 347V (A)		0.15	0.24	0.38	0.49	0.63	0.77	0.87	1.01	1.15	1.52
Input Current @ 480V (A)		0.11	0.18	0.29	0.37	0.48	0.59	0.66	0.77	0.88	0.96
Optics											
T2	4000K/5000K Lumens	4,941	9,656	14,408	19,038	23,588	28,227	33,382	37,823	42,191	46,713
	3000K Lumens	4,374	8,547	12,754	16,852	20,880	24,987	29,550	33,481	37,347	41,350
	BUG Rating	B1-U0-G1	B2-U0-G2	B2-U0-G2	B3-U0-G3	B3-U0-G3	B3-U0-G4	B3-U0-G4	B3-U0-G4	B4-U0-G5	B4-U0-G5
T2R	4000K/5000K Lumens	5,246	10,251	15,296	20,211	25,041	29,966	35,439	40,154	44,791	49,592
	3000K Lumens	4,644	9,074	13,540	17,891	22,166	26,526	31,371	35,544	39,649	43,899
	BUG Rating	B1-U0-G1	B1-U0-G2	B2-U0-G2	B2-U0-G3	B3-U0-G3	B3-U0-G4	B3-U0-G4	B3-U0-G4	B3-U0-G4	B3-U0-G5
T3	4000K/5000K Lumens	5,037	9,842	14,685	19,404	24,041	28,770	34,024	38,551	43,003	47,612
	3000K Lumens	4,459	8,712	12,999	17,176	21,281	25,467	30,118	34,125	38,066	42,146
	BUG Rating	B1-U0-G1	B2-U0-G2	B2-U0-G3	B3-U0-G3	B3-U0-G4	B3-U0-G4	B3-U0-G4	B3-U0-G5	B4-U0-G5	B4-U0-G5
T3R	4000K/5000K Lumens	5,148	10,061	15,011	19,835	24,576	29,409	34,780	39,408	43,959	48,669
	3000K Lumens	4,557	8,906	13,288	17,558	21,755	26,033	30,787	34,884	38,913	43,082
	BUG Rating	B1-U0-G2	B1-U0-G2	B2-U0-G3	B2-U0-G3	B3-U0-G4	B3-U0-G4	B3-U0-G5	B3-U0-G5	B3-U0-G5	B3-U0-G5
T4FT	4000K/5000K Lumens	5,066	9,899	14,770	19,516	24,181	28,936	34,221	38,774	43,252	47,888
	3000K Lumens	4,484	8,763	13,074	17,276	21,405	25,614	30,292	34,323	38,287	42,390
	BUG Rating	B1-U0-G2	B1-U0-G2	B2-U0-G3	B2-U0-G4	B3-U0-G4	B3-U0-G4	B3-U0-G5	B3-U0-G5	B3-U0-G5	B3-U0-G5
T4W	4000K/5000K Lumens	5,000	9,771	14,579	19,264	23,869	28,562	33,779	38,274	42,694	47,269
	3000K Lumens	4,426	8,649	12,905	17,052	21,129	25,283	29,901	33,880	37,793	41,843
	BUG Rating	B1-U0-G2	B2-U0-G2	B2-U0-G3	B3-U0-G4	B3-U0-G4	B3-U0-G4	B3-U0-G5	B3-U0-G5	B4-U0-G5	B4-U0-G5
SL2	4000K/5000K Lumens	4,933	9,639	14,383	19,005	23,547	28,178	33,324	37,758	42,118	46,632
	3000K Lumens	4,367	8,532	12,732	16,823	20,844	24,943	29,498	33,423	37,283	41,279
	BUG Rating	B1-U0-G2	B2-U0-G2	B2-U0-G3	B3-U0-G3	B3-U0-G4	B3-U0-G4	B3-U0-G4	B3-U0-G5	B4-U0-G5	B4-U0-G5
SL3	4000K/5000K Lumens	5,036	9,841	14,683	19,401	24,039	28,766	34,019	38,546	42,997	47,605
	3000K Lumens	4,458	8,711	12,997	17,174	21,279	25,464	30,114	34,121	38,061	42,140
	BUG Rating	B1-U0-G2	B1-U0-G2	B2-U0-G3	B2-U0-G3	B3-U0-G4	B3-U0-G4	B3-U0-G5	B3-U0-G5	B3-U0-G5	B3-U0-G5
SL4	4000K/5000K Lumens	4,784	9,350	13,951	18,434	22,840	27,332	32,323	36,624	40,854	45,232
	3000K Lumens	4,235	8,277	12,349	16,318	20,218	24,194	28,612	32,420	36,164	40,039
	BUG Rating	B1-U0-G2	B1-U0-G3	B1-U0-G3	B2-U0-G4	B2-U0-G4	B2-U0-G5	B2-U0-G5	B3-U0-G5	B3-U0-G5	B3-U0-G5
5NQ	4000K/5000K Lumens	5,194	10,150	15,145	20,011	24,794	29,670	35,088	39,757	44,349	49,102
	3000K Lumens	4,598	8,985	13,406	17,714	21,948	26,264	31,060	35,193	39,258	43,465
	BUG Rating	B2-U0-G1	B3-U0-G1	B3-U0-G2	B4-U0-G2	B4-U0-G2	B5-U0-G2	B5-U0-G3	B5-U0-G3	B5-U0-G3	B5-U0-G3
5MQ	4000K/5000K Lumens	5,290	10,337	15,424	20,380	25,250	30,217	35,734	40,489	45,165	50,006
	3000K Lumens	4,683	9,150	13,653	18,040	22,351	26,748	31,632	35,841	39,980	44,265
	BUG Rating	B3-U0-G1	B3-U0-G2	B4-U0-G2	B4-U0-G2	B5-U0-G3	B5-U0-G3	B5-U0-G4	B5-U0-G4	B5-U0-G4	B5-U0-G4
5WQ	4000K/5000K Lumens	5,304	10,365	15,465	20,434	25,318	30,297	35,830	40,597	45,286	50,139
	3000K Lumens	4,695	9,175	13,690	18,088	22,411	26,819	31,717	35,936	40,087	44,383
	BUG Rating	B3-U0-G1	B4-U0-G2	B4-U0-G2	B5-U0-G3	B5-U0-G3	B5-U0-G4	B5-U0-G4	B5-U0-G4	B5-U0-G5	B5-U0-G5
SLL/SLR	4000K/5000K Lumens	4,426	8,648	12,903	17,049	21,124	25,278	29,894	33,872	37,784	41,832
	3000K Lumens	3,918	7,655	11,422	15,092	18,699	22,376	26,462	29,983	33,446	37,030
	BUG Rating	B1-U0-G2	B1-U0-G2	B2-U0-G3	B2-U0-G3	B2-U0-G4	B3-U0-G4	B3-U0-G5	B3-U0-G5	B3-U0-G5	B3-U0-G5
RW	4000K/5000K Lumens	5,147	10,058	15,009	19,830	24,570	29,402	34,771	39,399	43,949	48,658
	3000K Lumens	4,556	8,903	13,286	17,554	21,749	26,027	30,779	34,876	38,904	43,072
	BUG Rating	B2-U0-G1	B3-U0-G1	B3-U0-G2	B4-U0-G2	B4-U0-G2	B4-U0-G2	B5-U0-G3	B5-U0-G3	B5-U0-G3	B5-U0-G4
AFL	4000K/5000K Lumens	5,166	10,095	15,063	19,903	24,659	29,509	34,898	39,542	44,108	48,835
	3000K Lumens	4,573	8,936	13,334	17,618	21,828	26,121	30,892	35,003	39,044	43,229
	BUG Rating	B1-U0-G1	B1-U0-G1	B2-U0-G2	B2-U0-G2	B3-U0-G2	B3-U0-G3	B3-U0-G3	B3-U0-G3	B3-U0-G3	B3-U0-G3

* Nominal data for 70 CRI.

NOMINAL POWER LUMENS (600MA)

Number of Light Squares		1	2	3	4	5	6	7	8	9	10
Nominal Power (Watts)		34	66	96	129	162	193	226	257	290	323
Input Current @ 120V (A)		0.30	0.58	0.86	1.16	1.44	1.73	2.03	2.33	2.59	2.89
Input Current @ 208V (A)		0.17	0.34	0.49	0.65	0.84	0.99	1.14	1.30	1.48	1.63
Input Current @ 240V (A)		0.15	0.30	0.43	0.56	0.74	0.87	1.00	1.13	1.30	1.43
Input Current @ 277V (A)		0.14	0.28	0.41	0.52	0.69	0.81	0.93	1.04	1.22	1.33
Input Current @ 347V (A)		0.11	0.19	0.30	0.39	0.49	0.60	0.69	0.77	0.90	0.99
Input Current @ 480V (A)		0.08	0.15	0.24	0.30	0.38	0.48	0.53	0.59	0.71	0.77
Optics											
T2	4000K/5000K Lumens	4,029	7,874	11,749	15,525	19,235	23,019	27,222	30,844	34,406	38,093
	3000K Lumens	3,566	6,970	10,400	13,743	17,027	20,376	24,097	27,303	30,456	33,720
	BUG Rating	B1-U0-G1	B1-U0-G2	B2-U0-G2	B2-U0-G2	B3-U0-G3	B3-U0-G3	B3-U0-G4	B3-U0-G4	B3-U0-G4	B3-U0-G4
T2R	4000K/5000K Lumens	4,278	8,360	12,474	16,482	20,421	24,437	28,900	32,745	36,527	40,441
	3000K Lumens	3,787	7,400	11,042	14,590	18,077	21,632	25,582	28,986	32,334	35,798
	BUG Rating	B1-U0-G1	B1-U0-G2	B2-U0-G2	B2-U0-G2	B2-U0-G3	B3-U0-G3	B3-U0-G3	B3-U0-G4	B3-U0-G4	B3-U0-G4
T3	4000K/5000K Lumens	4,107	8,026	11,976	15,824	19,605	23,461	27,746	31,438	35,068	38,827
	3000K Lumens	3,636	7,105	10,601	14,007	17,354	20,768	24,561	27,829	31,042	34,370
	BUG Rating	B1-U0-G1	B1-U0-G2	B2-U0-G2	B2-U0-G3	B3-U0-G3	B3-U0-G4	B3-U0-G4	B3-U0-G4	B3-U0-G5	B3-U0-G5
T3R	4000K/5000K Lumens	4,198	8,205	12,242	16,175	20,041	23,982	28,363	32,137	35,848	39,689
	3000K Lumens	3,716	7,263	10,837	14,318	17,740	21,229	25,107	28,448	31,733	35,133
	BUG Rating	B1-U0-G1	B1-U0-G2	B2-U0-G2	B2-U0-G3	B2-U0-G3	B3-U0-G4	B3-U0-G4	B3-U0-G4	B3-U0-G5	B3-U0-G5
T4FT	4000K/5000K Lumens	4,131	8,072	12,045	15,915	19,719	23,597	27,907	31,620	35,272	39,052
	3000K Lumens	3,657	7,145	10,662	14,088	17,455	20,888	24,703	27,990	31,223	34,569
	BUG Rating	B1-U0-G1	B1-U0-G2	B2-U0-G2	B2-U0-G3	B2-U0-G4	B3-U0-G4	B3-U0-G4	B3-U0-G5	B3-U0-G5	B3-U0-G5
T4W	4000K/5000K Lumens	4,077	7,968	11,889	15,710	19,465	23,292	27,546	31,212	34,816	38,547
	3000K Lumens	3,609	7,053	10,524	13,906	17,230	20,618	24,384	27,629	30,819	34,122
	BUG Rating	B1-U0-G1	B1-U0-G2	B2-U0-G2	B2-U0-G3	B3-U0-G4	B3-U0-G4	B3-U0-G4	B3-U0-G5	B3-U0-G5	B3-U0-G5
SL2	4000K/5000K Lumens	4,022	7,861	11,729	15,498	19,202	22,979	27,175	30,791	34,347	38,028
	3000K Lumens	3,560	6,959	10,383	13,719	16,998	20,341	24,055	27,256	30,404	33,662
	BUG Rating	B1-U0-G1	B1-U0-G2	B2-U0-G3	B2-U0-G3	B3-U0-G3	B3-U0-G4	B3-U0-G4	B3-U0-G4	B3-U0-G5	B3-U0-G5
SL3	4000K/5000K Lumens	4,106	8,025	11,974	15,821	19,603	23,458	27,742	31,433	35,064	38,821
	3000K Lumens	3,635	7,104	10,599	14,005	17,353	20,765	24,557	27,824	31,039	34,364
	BUG Rating	B1-U0-G1	B1-U0-G2	B2-U0-G3	B2-U0-G3	B2-U0-G3	B3-U0-G4	B3-U0-G4	B3-U0-G4	B3-U0-G5	B3-U0-G5
SL4	4000K/5000K Lumens	3,902	7,624	11,377	15,033	18,626	22,289	26,359	29,867	33,316	36,886
	3000K Lumens	3,454	6,749	10,071	13,307	16,488	19,730	23,333	26,438	29,491	32,651
	BUG Rating	B1-U0-G2	B1-U0-G2	B1-U0-G3	B1-U0-G3	B2-U0-G4	B2-U0-G4	B2-U0-G4	B2-U0-G5	B3-U0-G5	B3-U0-G5
5NQ	4000K/5000K Lumens	4,236	8,277	12,351	16,319	20,219	24,196	28,614	32,422	36,166	40,042
	3000K Lumens	3,750	7,327	10,933	14,446	17,898	21,418	25,329	28,700	32,014	35,445
	BUG Rating	B2-U0-G1	B3-U0-G1	B3-U0-G2	B3-U0-G2	B4-U0-G2	B4-U0-G2	B4-U0-G2	B5-U0-G2	B5-U0-G3	B5-U0-G3
5MQ	4000K/5000K Lumens	4,314	8,429	12,578	16,619	20,591	24,641	29,141	33,019	36,832	40,779
	3000K Lumens	3,819	7,461	11,134	14,711	18,227	21,812	25,796	29,228	32,604	36,098
	BUG Rating	B3-U0-G1	B3-U0-G2	B4-U0-G2	B4-U0-G2	B4-U0-G2	B5-U0-G3	B5-U0-G3	B5-U0-G4	B5-U0-G4	B5-U0-G4
5WQ	4000K/5000K Lumens	4,325	8,452	12,611	16,664	20,646	24,707	29,219	33,106	36,930	40,888
	3000K Lumens	3,828	7,482	11,163	14,751	18,276	21,871	25,865	29,305	32,690	36,194
	BUG Rating	B3-U0-G1	B3-U0-G2	B4-U0-G2	B4-U0-G2	B5-U0-G3	B5-U0-G3	B5-U0-G4	B5-U0-G4	B5-U0-G4	B5-U0-G4
SLL/SLR	4000K/5000K Lumens	3,609	7,052	10,522	13,903	17,226	20,613	24,378	27,622	30,812	34,114
	3000K Lumens	3,195	6,242	9,314	12,307	15,248	18,247	21,579	24,451	27,275	30,198
	BUG Rating	B1-U0-G1	B1-U0-G2	B1-U0-G3	B2-U0-G3	B2-U0-G3	B2-U0-G4	B3-U0-G4	B3-U0-G4	B3-U0-G5	B3-U0-G5
RW	4000K/5000K Lumens	4,197	8,202	12,239	16,171	20,036	23,977	28,356	32,129	35,839	39,680
	3000K Lumens	3,715	7,260	10,834	14,315	17,736	21,224	25,101	28,441	31,725	35,125
	BUG Rating	B2-U0-G1	B3-U0-G1	B3-U0-G2	B4-U0-G2	B4-U0-G2	B4-U0-G2	B4-U0-G2	B5-U0-G3	B5-U0-G3	B5-U0-G3
AFL	4000K/5000K Lumens	4,213	8,232	12,284	16,230	20,109	24,064	28,459	32,246	35,969	39,824
	3000K Lumens	3,729	7,287	10,874	14,367	17,800	21,301	25,192	28,544	31,840	35,252
	BUG Rating	B1-U0-G1	B1-U0-G1	B2-U0-G2	B2-U0-G2	B2-U0-G2	B3-U0-G2	B3-U0-G3	B3-U0-G3	B3-U0-G3	B3-U0-G3

* Nominal data for 70 CRI.

CONTROL OPTIONS

0-10V (DIM)
This fixture is offered standard with 0-10V dimming driver(s). The DIM option provides 0-10V dimming wire leads for use with a lighting control panel or other control method.

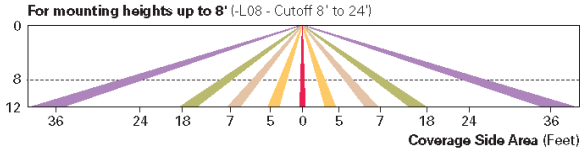
Photocontrol (P, R and PER7)
Optional button-type photocontrol (P) and photocontrol receptacles (R and PER7) provide a flexible solution to enable "dusk-to-dawn" lighting by sensing light levels. Advanced control systems compatible with NEMA 7-pin standards can be utilized with the PER7 receptacle.

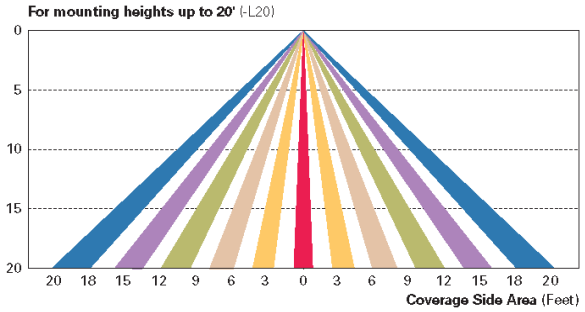
After Hours Dim (AHD)
This feature allows photocontrol-enabled luminaires to achieve additional energy savings by dimming during scheduled portions of the night. The dimming profile will automatically take effect after a "dusk-to-dawn" period has been calculated from the photocontrol input. Specify the desired dimming profile for a simple, factory-shipped dimming solution requiring no external control wiring. Reference the After Hours Dim supplemental guide for additional information.

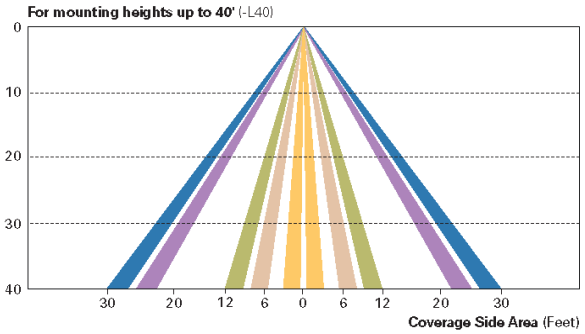
Dimming Occupancy Sensor (MS/DIM-LXX, MS/X-LXX and MS-LXX)
These sensors are factory installed in the luminaire housing. When the MS/DIM-LXX sensor option is selected, the occupancy sensor is connected to a dimming driver and the entire luminaire dims when there is no activity detected. When activity is detected, the luminaire returns to full light output. The MS/DIM sensor is factory preset to dim down to approximately 50 percent power with a time delay of five minutes. The MS-LXX sensor is factory preset to turn the luminaire off after five minutes of no activity. The MS/X-LXX is also preset for five minutes and only controls the specified number of light engines to maintain steady output from the remaining light engines.

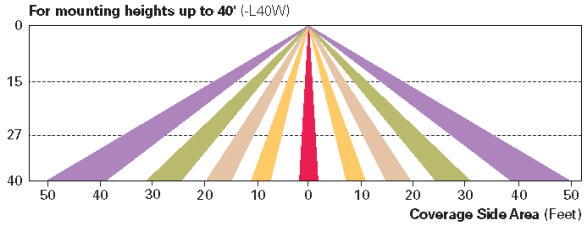
These occupancy sensors includes an integral photocell that can be activated with the FSIR-100 accessory for "dusk-to-dawn" control or daylight harvesting - the factory preset is OFF. The FSIR-100 is a wireless tool utilized for changing the dimming level, time delay, sensitivity and other parameters.

A variety of sensor lens are available to optimize the coverage pattern for mounting heights from 8'-40'.



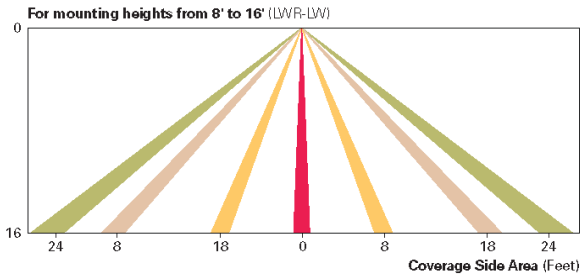


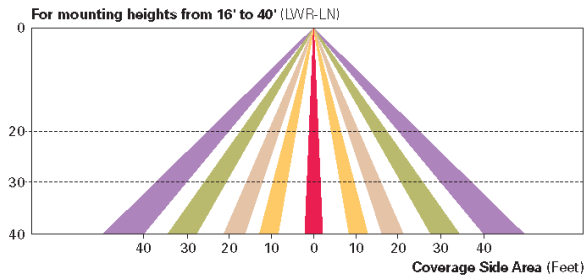




LumaWatt Pro Wireless Control and Monitoring System (LWR-LW and LWR-LN)
The LumaWatt Pro system is a peer-to-peer wireless network of luminaire-integral sensors for any sized project. Each sensor is capable of motion and photo sensing, metering power consumption and wireless communication. The end-user can securely create and manage sensor profiles with browser-based management software. The software will automatically broadcast to the sensors via wireless gateways for zone-based and individual luminaire control. The LumaWatt Pro software provides smart building solutions by utilizing the sensor to provide easy-to-use dashboard and analytic capabilities such as improved energy savings, traffic flow analysis, building management software integration and more.

For additional details, refer to the LumaWatt Pro product guides.





ORDERING INFORMATION

Sample Number: GLEON-AF-04-LED-E1-T3-GM-QM

Product Family [1, 2]	Light Engine	Number of Light Squares [3]	Lamp Type	Voltage	Distribution	Color	Mounting
GLEON=Galleon	**AF**=1A Drive Current	**01**=1 **02**=2 **03**=3 **04**=4 **05**=5 [4] **06**=6 **07**=7 [5] **08**=8 [5] **09**=9 [6] **10**=10 [6]	**LED**=Solid State Light Emitting Diodes	**E1**=120-277V **347**=347V [7] **480**=480V [7, 8]	**T2**=Type II **T2R**=Type II Roadway **T3**=Type III **T3R**=Type III Roadway **T4FT**=Type IV Forward Throw **T4W**=Type IV Wide **5NQ**=Type V Narrow **5MQ**=Type V Square Medium **5WQ**=Type V Square Wide **SL2**=Type II w/Spill Control **SL3**=Type III w/Spill Control **SL4**=Type IV w/Spill Control **SLL**=90° Spill Light Eliminator Left **SLR**=90° Spill Light Eliminator Right **RW**=Rectangular Wide Type I **AFL**=Automotive Frontline	**AP**=Grey **BZ**=Bronze **BK**=Black **DP**=Dark Platinum **GM**=Graphite Metallic **WH**=White	**[Blank]**=Arm for Round or Square Pole **EA**=Extended Arm [9] **MA**=Mast Arm Adapter [10] **WM**=Wall Mount **QM**=Quick Mount Arm (Standard Length) [11] **QMEA**=Quick Mount Arm (Extended Length) [12]

Options (Add as Suffix)

7030=70 CRI 3000K [13]
8030=80 CRI 3000K [14]
7050=70 CRI 5000K [13]
7060=70 CRI 6000K [13]
600=Drive Current Factory Set to Nominal 600mA [15]
800=Drive Current Factory Set to Nominal 800mA [15]
1200=Drive Current Factory Set to Nominal 1200mA [15, 16]
F=Single Fuse (120, 277 or 347V. Must Specify Voltage)
FF=Double Fuse (208, 240 or 480V. Must Specify Voltage)
2L=Two Circuits [17, 18]
DIM=External 0-10V Dimming Leads [18, 20]
P=Button Type Photocontrol (120, 208, 240 or 277V. Must Specify Volatage) [21]
PER7=NEMA 7-PIN Twistlock Photocontrol Receptacle [21]
R=NEMA Twistlock Photocontrol Receptacle [21]
AHD145=After Hours Dim, 5 Hours [22]
AHD245=After Hours Dim, 6 Hours [22]
AHD255=After Hours Dim, 7 Hours [22]
AHD355=After Hours Dim, 8 Hours [22]
HA=50°C High Ambient [23]
MS/DIM-L08=Motion Sensor for Dimming Operation, Maximum 8' Mounting Height [24, 25]
MS/DIM-L20=Motion Sensor for Dimming Operation, 9' - 20' Mounting Height [24, 26]
MS/DIM-L40=Motion Sensor for Dimming Operation, 21' - 40' Mounting Height [22, 25]
MS/DIM-L40W=Motion Sensor for Dimming Operation, 21' - 40' Mounting Height (Wide Range) [24, 28]
MS/X-L08=Bi-Level Motion Sensor, Maximum 8' Mounting Height [24, 25, 29]
MS/X-L20=Bi-Level Motion Sensor, 9' - 20' Mounting Height [24, 26, 29]
MS/X-L40=Bi-Level Motion Sensor, 21' - 40' Mounting Height [22, 27, 29]
MS/X-L40W=Bi-Level Motion Sensor, 21' - 40' Mounting Height (Wide Range) [24, 28, 29]
MS-L08=Motion Sensor for ON/OFF Operation, Maximum 8' Mounting Height [24, 25]
MS-L20=Motion Sensor for ON/OFF Operation, 9' - 20' Mounting Height [24, 26]
MS-L40=Motion Sensor for ON/OFF Operation, 21' - 40' Mounting Height [24, 27]
MS-L40W=Motion Sensor for ON/OFF Operation, 21' - 40' Mounting Height (Wide Range) [24, 28]
LWR-LW=LumaWatt Pro Wireless Sensor, Wide Lens for 8' - 16' Mounting Height [30]
LWR-LN=LumaWatt Pro Wireless Sensor, Narrow Lens for 16' - 40' Mounting Height [30]
L90=Optics Rotated 90° Left
R90=Optics Rotated 90° Right
MT=Factory Installed Mesh Top
TH=Tool-less Door Hardware
LCF=Light Square Trim Plate Painted to Match Housing [31]
HSS=Factory Installed House Side Shield [32]
CE=CE Marking [33]

Accessories (Order Separately)

OA/RA1016=NEMA Photocontrol Multi-Tap - 105-285V
OA/RA1027=NEMA Photocontrol - 480V
OA/RA1201=NEMA Photocontrol - 347V
OA/RA1013=Photocontrol Shorting Cap
OA/RA1014=120V Photocontrol
MA1252=10kV Surge Module Replacement
MA1036-XX=Single Tenon Adapter for 2-3/8" O.D. Tenon
MA1037-XX=2@180° Tenon Adapter for 2-3/8" O.D. Tenon
MA1197-XX=3@120° Tenon Adapter for 2-3/8" O.D. Tenon
MA1188-XX=4@90° Tenon Adapter for 2-3/8" O.D. Tenon
MA1189-XX=2@90° Tenon Adapter for 2-3/8" O.D. Tenon
MA1190-XX=3@90° Tenon Adapter for 2-3/8" O.D. Tenon
MA1191-XX=2@120° Tenon Adapter for 2-3/8" O.D. Tenon
MA1038-XX=Single Tenon Adapter for 3-1/2" O.D. Tenon
MA1039-XX=2@180° Tenon Adapter for 3-1/2" O.D. Tenon
MA1192-XX=3@120° Tenon Adapter for 3-1/2" O.D. Tenon
MA1193-XX=4@90° Tenon Adapter for 3-1/2" O.D. Tenon
MA1194-XX=2@90° Tenon Adapter for 3-1/2" O.D. Tenon
MA1195-XX=3@90° Tenon Adapter for 3-1/2" O.D. Tenon
FSIR-100=Wireless Configuration Tool for Occupancy Sensor [24]
GLEON-MT1=Field Installed Mesh Top for 1-4 Light Squares
GLEON-MT2=Field Installed Mesh Top for 5-6 Light Squares
GLEON-MT3=Field Installed Mesh Top for 7-8 Light Squares
GLEON-MT4=Field Installed Mesh Top for 9-10 Light Squares
GLEON-QM=Quick Mount Arm Kit [10]
GLEON-QMEA=Quick Mount Extended Arm Kit [11]
LS/HSS=Field Installed House Side Shield [32, 34]

NOTES:
1. Customer is responsible for engineering analysis to confirm pole and fixture compatibility for all applications. Refer to our white paper WP513001EN for additional support information.
2. DesignLights Consortium® Qualified. Refer to www.designlights.org Qualified Products List under Family Models for details.
3. Standard 4000K CCT and minimum 70 CRI.
4. Not compatible with MS/4-LXX or MS/1-LXX sensors.
5. Not compatible with extended quick mount arm (QMEA).
6. Not compatible with standard quick mount arm (QM) or extended quick mount arm (QMEA).
7. Requires the use of an internal step down transformer when combined with sensor options. Not available with sensor at 1200mA. Not available in combination with the HA high ambient and sensor options at 1A.
8. Only for use with 480V Wye systems. Per NEC, not for use with ungrounded systems, impedance grounded systems or corner grounded systems (commonly known as Three Phase Three Wire Delta, Three Phase High Leg Delta and Three Phase Corner Grounded Delta systems).
9. May be required when two or more luminaires are oriented on a 90° or 120° drilling pattern. Refer to arm mounting requirement table.
10. Factory installed.
11. Maximum 8 light squares.
12. Maximum 6 light squares.
13. Extended lead times apply. Use dedicated IES files for 3000K, 5000K and 6000K when performing layouts. These files are published on the Galleon luminaire product page on the website.
14. Extended lead times apply. Use dedicated IES files for 3000K, 5000K and 6000K when performing layouts. These files are published on the Galleon luminaire product page on the website.
15. 1 Amp standard. Use dedicated IES files for 600mA, 800mA and 1200mA when performing layouts. These files are published on the Galleon luminaire product page on the website.
16. Not available with HA option.
17. 2L is not available with MS, MS/X or MS/DIM at 347V or 480V. 2L in AF-02 through AF-04 requires a larger housing, normally used for AF-05 or AF-06. Extended arm option may be required when mounting two or more fixtures per pole at 90° or 120°. Refer to arm mounting requirement table.
18. Not available with LumaWatt Pro wireless sensors.
19. Cannot be used with other control options.
20. Low voltage control lead brought out 18" outside fixture.
21. Not available if any "MS" sensor is selected. Motion sensor has an integral photocell.
22. Requires the use of P photocontrol or the PER7 or R photocontrol receptacle with photocontrol accessory. See After Hours Dim supplemental guide for additional information.
23. 50°C lumen maintenance data applies to 600mA, 800mA and 1A drive currents.
24. The FSIR-100 configuration tool is required to adjust parameters including high and low modes, sensitivity, time delay, cutoff and more. Consult your lighting representative at Eaton for more information.
25. Approximately 22' detection diameter at 8' mounting height.
26. Approximately 40' detection diameter at 20' mounting height.
27. Approximately 60' detection diameter at 40' mounting height.
28. Approximately 100' detection diameter at 40' mounting height.
29. Replace X with number of Light Squares operating in low output mode.
30. LumaWatt Pro wireless sensors are factory installed only requiring network components LWP-EM-1, LWP-GW-1 and LWP-PoE8 in appropriate quantities. See www.eaton.com/lighting for LumaWatt Pro application information.
31. Not available with house side shield (HSS).
32. Only for use with SL2, SL3, SL4 and AFL distributions. The Light Square trim plate is painted black when the HSS option is selected.
33. CE is not available with the LWR, MS, MS/X, MS/DIM, P, R or PER7 options. Available in 120-277V only.
34. One required for each Light Square.

Eaton
1121 Highway 74 South
Peachtree City, GA 30269
P: 770-486-4800
www.eaton.com/lighting

Specifications and dimensions subject to change without notice.

TD500020EN
March 12, 2018 4:50 PM

TWP LED
LED Wall Luminaire

Catalog Number

Notes

Type

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

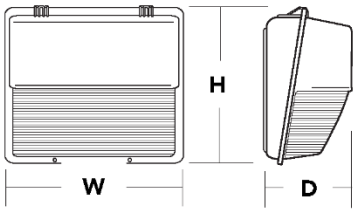
Specifications

Width: 16-1/8" (41.0 cm)

Height: 15-1/2" (39.4 cm)

Depth: 7-3/4" (19.7 cm)

Weight: 15 lbs (6.8kg)



Introduction

The TWP LED offers a classic appearance and is powered by advanced LEDs. A one-piece polycarbonate cover delivers enhanced durability and is vandal resistant, making the TWP LED ideal for lower mounting heights or high-traffic areas. The new TWP LED luminaire is powerful yet energy efficient, capable of replacing up to a 250W metal halide luminaire while saving up to 83% in energy costs.

The new TWP LED features an Adjustable Light Output (ALO), that allows the contractor to set the light output, during installation, to a level perfectly suited for the job site. The feature allows one luminaire to replace anywhere from 70W to all the way up to 250W metal halide luminaire.

Ordering Information

EXAMPLE: TWP LED ALO 50K T3M MVOLT DDBXD

TWP LED							
Series	**Power Package**	**Color temperature**	**Distribution**	**Voltage**	**Control Options**	**Other Options**	**Finish** *(required)*
TWP LED	ALO	30K 40K 50K	T3M Type III Medium	MVOLT [1] 120 208 240 277 347 480	**Shipped installed** PE Photoelectric cell, button type	**Shipped installed** SF Single fuse (120, 277, 347V) [2] DF Double fuse (208, 240, 480V) [2] TP Tamper proof screws SPD Separate surge protection **Shipped separately** WG Wire guard [3]	DDBXD Dark bronze DBLXD Black DWHXD White DDBTXD Textured dark bronze DBLBXD Textured black DWHGXD Textured white

Stock configurations are offered for shorter lead times:

Standard Part Number	Stock Part Number	CI Codes
TWP LED ALO 40K T3M MVOLT DDBXD	TWP LED ALO 40K	*265A1W
TWP LED ALO 50K T3M MVOLT DDBXD	TWP LED ALO 50K	*265A23

Accessories

Ordered and shipped separately.

TWPWGU Wire guard accessory [3]

NOTES

1. MVOLT driver operates on any line voltage from 120-277V (50/60 Hz).
2. Single fuse (SF) requires 120, 277 or 347 voltage option. Double fuse (DF) requires 208, 240 or 480 voltage option.
3. Not available with 10C option.
4. Requires field modification (only when ordered as a separate accessory).

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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.

FAO Setting	System Watts	30K (3000K, 70 CRI)		40K / 50K (4000K / 5000K, 70 CRI)		Replaces (Metal Halide)
		Lumens	LPW	Lumens	LPW	
Step 8 (default)	48	4,768	100	5,174	108	250W
Step 7	45	4,504	100	4,888	109	
Step 6	39	3,963	101	4,301	110	175W
Step 5	34	3,410	102	3,701	111	
Step 4	28	2,845	103	3,087	111	150W
Step 3	22	2,267	103	2,460	112	100W
Step 2	16	1,677	104	1,820	112	70W
Step 1	11	1,074	103	1,166	112	CFL

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	1.05
10°C	50°F	1.03
20°C	68°F	1.01
25°C	**77°F**	**1.00**
30°C	86°F	0.99
40°C	104°F	0.97

Projected LED Lumen Maintenance

Data references the extrapolated performance projections for the **TWP LED ALO (default setting)** platform 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	0	25,000	50,000	100,000
Lumen Maintenance Factor	1.00	1.00	0.98	0.93

Electrical Load

LEDs	System Watts	Current (A)					
		120	208	240	277	347	480
ALO (default setting)	48W	0.41	0.27	0.24	0.19	0.14	0.11

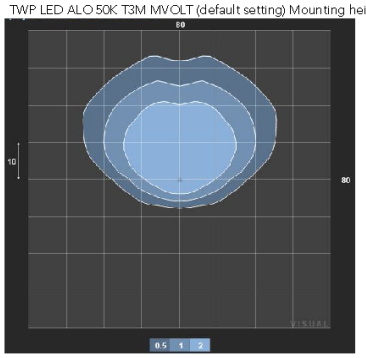
Photometric Diagrams

To see complete photometric reports or download .ies files for this product, visit Lithonia Lighting's TWP LED homepage.
Tested in accordance with IESNA LM-79 and LM-80 standards

LEGEND

- 0.5 fc
- 1.0 fc
- 2.0 fc

TWP LED ALO 50K T3M MVOLT (default setting) Mounting height - 10'



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FEATURES & SPECIFICATIONS

INTENDED USE
The energy savings, long life and easy-to-install design of the TWP LED make it the smart choice for building-mounted doorway and pathway illumination for nearly any facility.

CONSTRUCTION
Die-cast aluminum rear housing has an impact-resistant, UV-stabilized polycarbonate front housing and refractor that is fully gasketed. Modular design allows for ease of maintenance. The LED driver is mounted to the front casting to thermally isolate it from the light engine for low operating temperature and long life. Housing is completely sealed against moisture and environmental contaminants.

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 textured and non-textured finishes.

OPTICS
Protective glass lens covers the light engine's precision-molded proprietary acrylic lenses. Light engines are available in 3000K, 4000K and 5000K configurations.

ELECTRICAL
Light engine(s) consist of 72 high-efficacy LEDs mounted to a metal-core circuit board and integral aluminum heat sink to maximize heat dissipation and promote long life (L93/100,000 hrs at 25ºC). The electronic driver has a power factor of >90%, THD <20%, and a minimum 6 KV surge rating. When ordering the SPD option, a separate surge protection device is installed within the luminaire which meets a minimum Category C low operation (per ANSI/IEEE C62.41.2).

INSTALLATION
Top 3/4" threaded wiring access. Back access through removable 3/4" knockout. Feed-thru wiring can be achieved by using a condulet tee. Mount on any flat, vertical surface.

LISTINGS
UL listed for use in the US and Canada. Suitable for use in wet locations. Rated for -40ºC minimum operating temperature.

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.

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TWS LED
LED Wall Luminaire

Catalog Number

Notes

Type

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

Introduction

The popular TWS luminaire is now available with long-lasting, energy-efficient LED technology. Featuring a classic dayform, the TWS LED offers a traditional appearance and is powered by advanced LEDs.

The TWS LED luminaire is powerful yet energy efficient, capable of replacing up to a 70W HPS or 100W MH wall pack while saving up to 80% in energy costs. With long-life LEDs, the TWS LED eliminates frequent lamp and ballast replacements associated with traditional technologies.

Specifications

Width: 6-3/4" *(17.2 cm)*

Height: 10-7/8" *(27.7 cm)*

Depth: 5-5/16" *(13.5 cm)*

Weight: 3.19 lbs *(1.45 kg)*

Ordering Information

EXAMPLE: TWS LED P1 50K 120 PE

TWS LED											
Series	**Performance Package**		**Color Temperature**		**Voltage**		**Control Options**		**Finish**	
TWS LED	P1	1476 lumens	50K	5000K [1]	120	120V [2]	PE	Photoelectric cell, button type	(blank)	Dark bronze

Accessories

Ordered and shipped separately.

TWSWG Wire Guard

NOTES

1. Corrected color temperature (CCT) shown is nominal per ANSI C78, 377-2008.
2. 120V driver operates on 120V.

FEATURES & SPECIFICATIONS

INTENDED USE
The TWS LED combines traditional wall pack design with high-output LEDs to provide an energy-efficient, low maintenance LED wall pack suitable for replacing up to 70W HPS or 100W MH fixtures. The traditional shape helps maintain building aesthetics when replacing only a portion of your building's wall packs. TWS LED is for outdoor applications such as personnel doors, loading areas, driveways and parking areas.

CONSTRUCTION
Back plate is die-cast aluminum. Front cover is impact-resistant polycarbonate which is fully gasketed. All electronics are protected in the upper housing. Housing is sealed against moisture and environmental contaminants.

FINISH
UV stabilized polycarbonate front cover has dark bronze color which provides superior resistance to corrosion and weathering and that can withstand extreme climate changes without cracking or peeling.

OPTICS
Protective polycarbonate lens covers the LEDs. Prismatic front cover and precision-molded reflector for superior uniformity and fixture spacing. Light engine is available in 5000K (70 min. CRI).

ELECTRICAL
Light engine consists of two high-powered, long-life, high-efficacy LEDs mounted on an internal aluminum heat sink to maximize heat dissipation and promote long life (L95/100,000 hours at 40°C). Driver and integral photocell operate at 120V and are fully enclosed in the upper housing. There are no user serviceable parts.

INSTALLATION
Back housing easily mounts to any recessed junction box. With all electronics in upper housing the open lower section makes wiring easy. Mount on any vertical surface. Not recommended in applications where a sprayed stream of water can come in direct contact with polycarbonate lens.

LISTINGS
UL Certified to US and Canadian safety standards for wet-location mounting higher than 4 feet off the ground.

Rated for -40°C to 40°C ambient temperature.

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 are subject to change without notice.

LITHONIA LIGHTING.
One Lithonia Way • Conyers, Georgia 30012 • Phone: 800.279.8041 • www.lithonia.com
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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. Actual performance may differ as a result of end-user environment and application.

Performance Package	CCT	System Watts	50K (5000K, 67 CRI)				
			Lumens	B	U	G	LPW
P1	5000K	25W	1,476	1	3	1	60

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	1.03
10°C	50°F	1.02
20°C	68°F	1.01
25°C	**77°F**	**1.00**
30°C	86°F	0.99
40°C	104°F	0.98

Electrical Load

LED Package	System Watts	Current (A)
		120
P1	25W	0.26

Projected LED Lumen Maintenance

Data references the extrapolated performance projections in a **40°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	0	25,000	50,000	55,000	100,000
Lumen Maintenance Factor	1.0	0.98	0.97	0.97	0.95

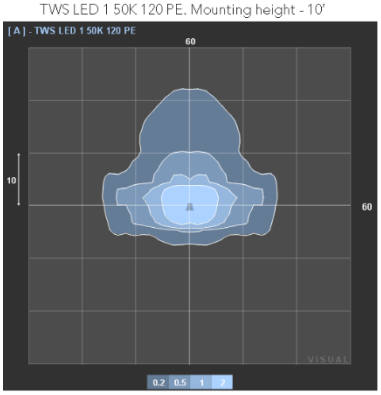
Photometric Diagrams

To see complete photometric reports or download .ies files for this product, visit the Lithonia Lighting TWS LED homepage. Tested in accordance with IESNA LM-79 and LM-80 standards

TWS LED 1 50K 120 PE. Mounting height - 10'

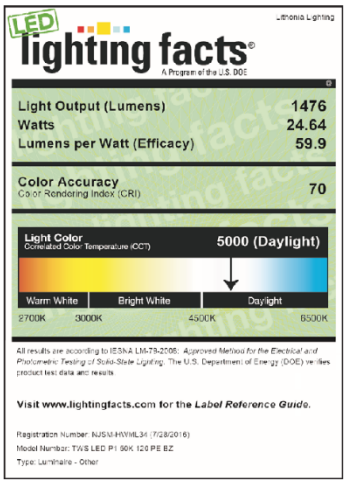
LEGEND

- 0.2 fc
- 0.5 fc
- 1.0 fc
- 2.0 fc



Test No. LTL22672S tested in accordance with IESNA LM-79-08.

Lighting Facts Labels



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DESCRIPTION

The Vaportite LED Series is an energy efficient industrial Vaportite fixture that features rugged and durable construction. The Vaportite LED incorporates a full metal fixture liner inside a reinforced fiberglass housing with a high impact diffuser. This Vaportite series is suitable for interior and exterior applications and can be surface or chain mounted.

The Vaportite LED Series has been designed for maximum operation in commercial institutional and industrial environments and can operate in a wide range of temperatures (-40°C to 55°C) and is ideal for cold storage environments.

Catalog #		Type
Project		
Comments		Date
Prepared by		

VAPORTITE LED

2' AND 4' INDUSTRIAL LED

Vaportite Industrial

SPECIFICATION FEATURES

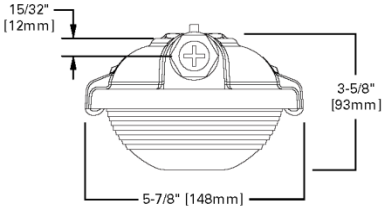
Construction
Compression molded self-extinguishing fiberglass reinforced polyester compound with UL 5V flame rating (ASTM D635-74). Standard housings available with one 7/8" conduit entry point on both ends. Polyurethane gasketing is formed in the housing providing a continuous seamless seal for the diffuser. Durable cam latches clamp diffuser tightly for a positive seal between housing, gasketing and diffuser. Electrical components and fixtures are UL/ cUL listed for Wet Locations. -40°C to 55°C ambient ratings.

Electrical
Long-Life LED system coupled with electrical driver to deliver optimal performance. LED's available in 3500, 4000 and 5000K with a CRI ≥ 80. Projected life is 60,000 hours at 91% lumen output. cULus listed. Electronic drivers are available for 120-277V applications. A 0-10V dimming control is available (standard).

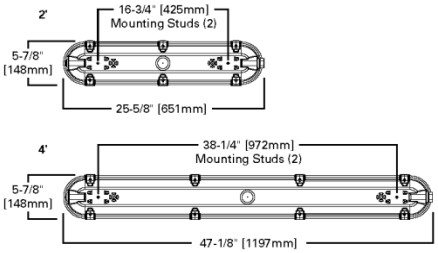
Lens
Thermoformed low profile, high impact 50% DR acrylic lens. General distribution offered with smooth frosted lens. Wide distribution offered with frosted prismatic lens. Parking garage distribution offered in clear prismatic lens.

Warranty
Vaportite LED features a five year limited warranty.

Compliance
UL/cUL listed for Wet location. RoHS compliant, and LED modules comply with IESNA LM-79 and LM-80 standards. IP65, IP66 and IP67 rated (see installation instructions for requirements). NSF International certified for NSF/ANSI Standard 2 – Food Equipment

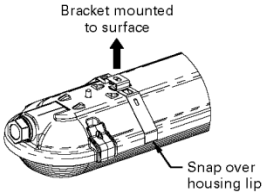


MOUNTING DATA

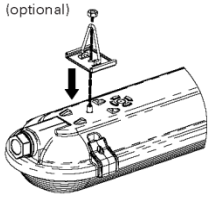


INSTALLATION DATA

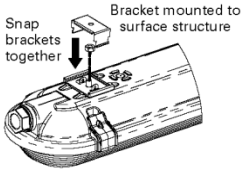
STANDARD



V-HANGER
(optional)



SURFACE BRACKET
(optional)



ENERGY DATA

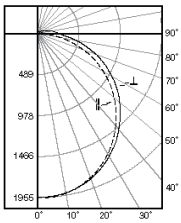
Input Watts:
4VT3LD5-4 (4,000 lumens)=31W
4VT3-LD5-6 (6,000 lumens)=49W
4VT3-LD5-8 (8,000 lumens)=69W

LINEAR DISCONNECT
Safe and convenient means of disconnecting power

Powering Business Worldwide

PS507020EN
May 7, 2018 2:08 PM

PHOTOMETRICS



4VT3-LD5-6-G-UNV-L840-CD1-U
Electronic Driver
Linear LED 4000K
Spacing criterion: (II) 1.24 x mounting height, (⊥) 1.26 x mounting height
Lumens: 6033
Input Watts: 51.1W
Efficacy: 118.1 lm/W
Test Report: 4VT3-LD5-6-G-UNV-L840-CD1-U.IES

Candlepower

Angle	Along II	45°	Across ⊥
0	1948	1948	1948
5	1950	1930	1939
10	1919	1904	1916
15	1869	1859	1872
20	1800	1799	1816
25	1715	1722	1741
30	1618	1633	1653
35	1508	1532	1558
40	1388	1416	1447
45	1262	1297	1334
50	1121	1168	1218
55	981	1033	1091
60	828	893	953
65	676	752	821
70	515	610	679
75	352	460	538
80	198	324	397
85	72	207	280
90	16	138	211

Coefficients of Utilization

Effective floor cavity reflectance 20%

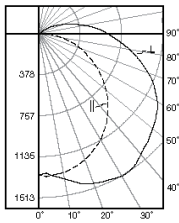
rc	80%				70%				50%			30%			10%			0%
rw	70	50	30	10	70	50	30	10	50	30	10	50	30	10	50	30	10	0
RCR																		
0	118	118	118	118	115	115	115	115	109	109	109	104	104	104	99	99	99	97
1	107	102	97	93	104	99	95	91	94	91	88	90	87	84	86	83	81	79
2	97	88	81	75	94	86	79	74	82	76	72	78	73	69	75	71	67	65
3	88	77	69	62	85	75	67	61	72	65	60	69	63	58	66	61	57	54
4	81	68	59	52	78	67	58	52	64	56	51	61	55	49	58	53	48	46
5	74	61	52	45	72	59	51	44	57	49	44	55	48	43	52	47	42	40
6	68	55	46	39	66	54	45	39	51	44	38	49	43	37	47	42	37	35
7	63	49	41	34	61	49	40	34	47	39	34	45	38	33	43	37	33	31
8	59	45	36	31	57	44	36	30	43	35	30	41	34	30	40	34	29	27
9	55	41	33	27	53	41	33	27	39	32	27	38	31	27	37	31	26	24
10	52	38	30	25	50	38	30	25	36	29	24	35	29	24	34	28	24	22

Zonal Lumen Summary

Zone	Lumens	% Fixture
0-30	1507	25.0
0-40	2466	40.9
0-60	4393	72.8
0-90	5838	96.8
0-180	6033	100.0

Luminance Data

Angle in Deg	Average 0-Deg cd/sm	Average 45-Deg cd/sm	Average 90-Deg cd/sm
45	9145	4014	3481
55	8048	3072	2687
65	6626	2216	1972
75	4452	1386	1299
85	1338	657	702



4VT3-LD5-6-W-UNV-L840-CD1-U
Electronic Driver
Linear LED 4000K
Spacing criterion: (II) 1.27 x mounting height, (⊥) 1.67 x mounting height
Lumens: 6655
Input Watts: 49.3W
Efficacy: 135 lm/W
Test Report: 4VT3-LD5-6-W-UNV-L840-CD1-U.IES

Candlepower

Angle	Along II	45°	Across ⊥
0	1303	1303	1303
5	1310	1306	1315
10	1300	1331	1364
15	1268	1354	1429
20	1227	1373	1467
25	1174	1376	1487
30	1119	1355	1513
35	1045	1331	1496
40	967	1290	1441
45	879	1231	1399
50	780	1164	1348
55	681	1093	1298
60	582	1027	1238
65	479	961	1152
70	388	880	1047
75	284	792	938
80	189	684	826
85	97	584	714
90	25	478	615

Coefficients of Utilization

Effective floor cavity reflectance 20%

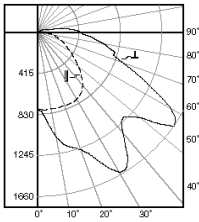
rc	80%				70%				50%			30%			10%			0%
rw	70	50	30	10	70	50	30	10	50	30	10	50	30	10	50	30	10	0
RCR																		
0	117	117	117	117	113	113	113	113	105	105	105	99	99	99	93	93	93	90
1	103	96	91	86	99	93	88	83	87	83	79	81	78	74	76	73	70	67
2	92	82	74	67	88	79	72	65	74	67	62	69	64	59	64	60	56	53
3	83	71	61	54	79	68	60	53	64	56	50	59	53	48	55	50	46	43
4	75	62	52	44	72	60	51	44	56	48	42	52	46	40	49	43	38	36
5	69	55	45	38	66	53	44	37	50	42	35	46	40	34	43	38	33	30
6	63	49	39	32	61	47	38	32	44	36	31	42	35	29	39	33	28	26
7	58	44	35	28	56	43	34	28	40	32	27	38	31	26	36	29	25	23
8	54	40	31	25	52	39	30	24	37	29	24	34	28	23	33	26	22	20
9	51	36	28	22	49	35	27	22	33	26	21	32	25	20	30	24	20	18
10	47	33	25	20	45	33	25	19	31	24	19	29	23	18	28	22	18	16

Zonal Lumen Summary

Zone	Lumens	% Fixture
0-30	1135	17.1
0-40	1950	29.3
0-60	3801	57.1
0-90	5973	89.8
0-180	6655	100.0

Luminance Data

Angle in Deg	Average 0-Deg cd/sm	Average 45-Deg cd/sm	Average 90-Deg cd/sm
45	7709	8566	9130
55	7240	8509	9303
65	6720	8794	9476
75	6135	9130	9386
85	4854	9468	9490



4VT3-LD5-6-P-UNV-L840-CD1-U
Electronic Driver
Linear LED 4000K
Spacing criterion: (II) 1.45 x mounting height, (⊥) 2.17 x mounting height
Lumens: 6050
Input Watts: 49.3W
Efficacy: 122.7 lm/W
Test Report: 4VT3-LD5-6-P-UNV-L840-CD1-U.IES

Candlepower

Angle	Along II	45°	Across ⊥
0	783	783	783
5	790	829	883
10	786	965	1091
15	789	1080	1200
20	787	1114	1268
25	785	1130	1440
30	775	1199	1637
35	751	1277	1564
40	691	1242	1311
45	603	1161	1206
50	510	1110	1344
55	426	1090	1660
60	354	1188	1524
65	291	1299	1178
70	236	1218	893
75	188	991	793
80	142	761	661
85	77	553	522
90	22	372	426

Coefficients of Utilization

Effective floor cavity reflectance 20%

rc	80%				70%				50%			30%			10%			0%
rw	70	50	30	10	70	50	30	10	50	30	10	50	30	10	50	30	10	0
RCR																		
0	118	118	118	118	114	114	114	114	108	108	108	102	102	102	96	96	96	94
1	103	96	90	85	99	93	88	83	88	83	79	82	79	75	78	75	72	69
2	91	81	72	65	88	78	70	64	74	67	61	69	64	59	65	60	56	54
3	82	69	59	52	79	67	58	51	63	55	49	59	53	47	56	50	45	43
4	74	60	50	42	71	58	49	41	55	47	40	52	44	39	49	42	37	35
5	68	53	43	35	65	51	42	35	48	40	34	46	38	33	43	37	32	29
6	62	47	37	30	60	46	36	29	43	35	29	41	33	28	39	32	27	25
7	57	42	33	26	55	41	32	25	39	31	25	37	30	24	35	28	23	21
8	53	38	29	23	51	37	28	22	35	27	22	33	26	21	32	25	21	18
9	49	35	26	20	48	34	25	20	32	25	19	31	24	19	29	23	18	16
10	46	32	23	18	44	31	23	18	30	22	17	28	22	17	27	21	16	14

Zonal Lumen Summary

Zone	Lumens	% Fixture
0-30	907	15.0
0-40	1657	27.4
0-60	3398	56.2
0-90	5657	93.5
0-180	6050	100.0

Luminance Data

Angle in Deg	Average 0-Deg cd/sm	Average 45-Deg cd/sm	Average 90-Deg cd/sm
45	5285	8077	7869
55	4530	8487	11893
65	4075	11885	9687
75	4053	11417	7942
85	3880	8971	6938

ENERGY AND PERFORMANCE DATA BY CATALOG NUMBER

Catalog Number	Description	Delivered Lumens	Watts	Efficacy (lm/W)
General				
2VT3-LD5-2-G-UNV-L850-CD1-U	2ft Vaportight, 2K Lumen, General Dist, 120-277V, 5000K, Dim	2203	16	138
2VT3-LD5-3-G-UNV-L850-CD1-U	2ft Vaportight, 3K Lumen, General Dist, 120-277V, 5000K, Dim	3334	24	139
2VT3-LD5-4-G-UNV-L850-CD1-U	2ft Vaportight, 4K Lumen, General Dist, 120-277V, 5000K, Dim	4366	32	136
4VT3-LD5-4-G-UNV-L850-CD1-U	4ft Vaportight, 4K Lumen, General Dist, 120-277V, 5000K, Dim	4428	32	138
4VT3-LD5-6-G-UNV-L850-CD1-U	4ft Vaportight, 6K Lumen, General Dist, 120-277V, 5000K, Dim	6490	51	127
4VT3-LD5-8-G-UNV-L850-CD1-U	4ft Vaportight, 8K Lumen, General Dist, 120-277V, 5000K, Dim	8694	67	130
Wide				
2VT3-LD5-2-W-UNV-L850-CD1-U	2ft Vaportight, 2K Lumen, Wide Dist, 120-277V, 5000K, Dim	2445	17	144
2VT3-LD5-3-W-UNV-L850-CD1-U	2ft Vaportight, 3K Lumen, Wide Dist, 120-277V, 5000K, Dim	3547	25	142
2VT3-LD5-4-W-UNV-L850-CD1-U	2ft Vaportight, 4K Lumen, Wide Dist, 120-277V, 5000K, Dim	4700	34	138
4VT3-LD5-4-W-UNV-L850-CD1-U	4ft Vaportight, 4K Lumen, Wide Dist, 120-277V, 5000K, Dim	4767	31	154
4VT3-LD5-6-W-UNV-L850-CD1-U	4ft Vaportight, 6K Lumen, Wide Dist, 120-277V, 5000K, Dim	7159	49	146
4VT3-LD5-8-W-UNV-L850-CD1-U	4ft Vaportight, 8K Lumen, Wide Dist, 120-277V, 5000K, Dim	9552	70	136
Parking				
2VT3-LD5-2-P-UNV-L850-CD1-U	2ft Vaportight, 2K Lumen, Parking Garage, 120-277V, 5000K, Dim	2228	17	131
2VT3-LD5-3-P-UNV-L850-CD1-U	2ft Vaportight, 3K Lumen, Parking Garage, 120-277V, 5000K, Dim	3231	25	129
2VT3-LD5-4-P-UNV-L850-CD1-U	2ft Vaportight, 4K Lumen, Parking Garage, 120-277V, 5000K, Dim	4271	34	126
4VT3-LD5-4-P-UNV-L850-CD1-U	4ft Vaportight, 4K Lumen, Parking Garage, 120-277V, 5000K, Dim	4338	31	140
4VT3-LD5-6-P-UNV-L850-CD1-U	4ft Vaportight, 6K Lumen, Parking Garage, 120-277V, 5000K, Dim	6509	49	133
4VT3-LD5-8-P-UNV-L850-CD1-U	4ft Vaportight, 8K Lumen, Parking Garage, 120-277V, 5000K, Dim	8671	69	126

LUMEN MAINTENANCE

Ambient Temperature	TM-21 Lumen Maintenance (60,000 hours)	Theoretical L70 (Hours)
25°C	> 91%	> 247,000

AMBIENT RATINGS

2ft. Lumen Package	Ambient Rating
2VT3-LD5-2	55°C
2VT3-LD5-3	50°C
2VT3-LD5-4	50°C

4ft. Lumen Package	Ambient Rating
4VT3-LD5-4	55°C
4VT3-LD5-6	50°C
4VT3-LD5-8	45°C

ORDERING INFORMATION

SAMPLE NUMBER: 4VT3-LD5-6-G-UNV-L840-CD1-U

Series
2VT3=2' Vaportite
4VT3=4' Vaportite

Lamp Type
LD5=LED 5.0

LED Lumens Output

2 ft.	4 ft.
2=2000 Lumens	**4**=4000 Lumens
3=3000 Lumens	**6**=6000 Lumens
4=4000 Lumens	**8**=8000 Lumens

Distribution [7]
G=General Distribution
W=Wide Distribution
P=Parking Garage Distribution

Voltage
120V=120 Volt
277V=277 Volt
347V=347 Volt
480V=480 Volt
UNV=Universal Voltage 120-277 Volt
UNC=Universal Voltage 347-480 Volt

EL10W=10-watt, 120-277V emergency battery pack installed [1], [2], [5]
VT-REM-EL10W=Remote mounted 10-watt, 120-277V emergency battery pack [1], [6]

Lamps
L835=3500K, LED
L840=4000K, LED
L850=5000K, LED

Driver Type
CD1=1 Dimming Driver
5LTD1=Fifth Light DALI

Options
SSL=Stainless Steel Latches
MSWL20=Wet Listed Motion Sensor 360°

Packaging
U=Unit Pack

ACCESSORIES

(Order Separately)
VT3-SS-VBK=Stainless Steel V-Bracket (2 per kit)
VT3-SS-SBK=Stainless Steel Surface Bracket (2 per kit)

NOTES: [1] EL and REM-EL options not available with UNC, 347V and 480V configurations. [2] EL10W available in 4ft 4000 and 6000 lumen packages only. [5] IP ratings require fixtures be mounted horizontally. [6] Specify voltage when ordering sensor option. [5] EL10W option rated for max. 35°C ambient. [6] VT-REM-EL10W option rated for max. 45°C ambient. [7] General distribution provided with smooth frosted lens, Wide distribution provided with frosted prismatic lens, and Parking Garage distribution provided with clear prismatic lens.

Specifications & dimensions subject to change without notice. Consult your Eaton Representative for availability and ordering information.

SHIPPING DATA

Catalog No.	Wt.
4VT3-LD5	12 lbs.

Eaton
1121 Highway 74 South
Peachtree City, GA 30269
P: 770-486-4800
www.eaton.com/lighting

Specifications and dimensions subject to change without notice.

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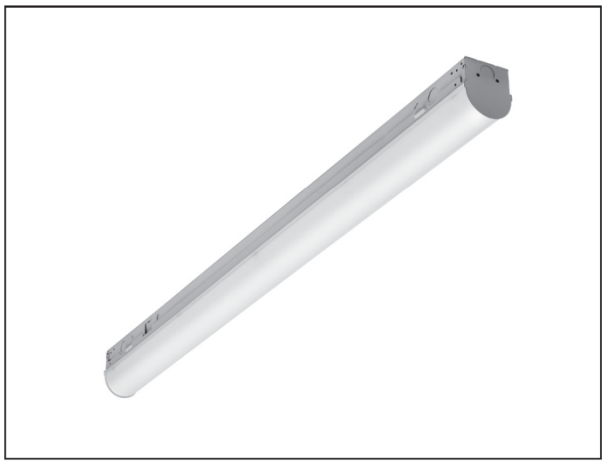


LSA SERIES

Diffuser Enclosed Linear LED Luminaire

Fixture Type: _____

Job Information: _____

_____

_____

SPECIFICATIONS:

LED MODULES:

- High performance linear configured LED module boards.
- Each board consists of multiple mid-power, high efficacy LEDs in a precise layout eliminating the need for supplemental heat sinking.
- The boards produce an even and diffuse light which maximizes optical efficiency.
- Compatible with the dimming performance of the LED driver.
- Color temperatures available: 3000K, 3500K, 4000K and 5000K.

LED DRIVERS:

- Factory programmable constant current LED power supply.
- Multiple standard drive current outputs (factory set by Mercury) are cataloged with their corresponding lumen package offerings. Upon request, custom drive current outputs and lumen packages are available.
- Note: Certain cataloged lumen packages may be provided with a non-programmable constant current LED power supply at Mercury's discretion. Contact factory if critical.
- Universal voltage input, 120V-277V, 50HZ-60HZ.
- Specification grade dimming down to 10% on 0-10V dimming controls.

LED LUMEN PACKAGES:

- Cataloged standard lumen packages. See attached chart for full details.
- Custom lumen packages pre-set are optional with programmable drivers only. Contact factory for details.

HOUSING:

- Fabricated from code grade cold rolled steel with a white polyester finish for long lasting durability.
- Sufficient electrical knockouts are provided on the housing back and ends.

DIFFUSER:

- Small-scale rounded profile design.
- Extruded from frosted acrylic material.
- Linear ribbing for high LED performance.
- One-piece diffuser runs the entire luminaire length. No joiners used.

STANDBY LIGHTING OPTION:

- Self-contained module, 7W, 10W or 12W as specified. Battery backup upon loss of power. Available 4Ft. and 8Ft. modules only.

INSTALLATIONS:

- May be installed in any direction, individually or in continuous run applications.
- May be surface mounted or suspended.
- End knockouts for surface conduit entry.

CERTIFICATE OF SAFETY COMPLIANCE AND LISTINGS:

- Luminaire: UL and CUL listed 1598 and bears their label. Suitable for damp locations.

WARRANTY:

- 5-year limited warranty. Complete LED warranty terms available at www.mercltg.com.
- Actual performance may differ as a result of end-user environment and application.

FEATURES:

- Shallow form linear ambient LED luminaire.
- Module lengths of 24", 46" and 92".
- Small-scale rounded profile acrylic diffuser evenly surrounds the LED light source.
- One-piece diffuser runs the entire luminaire length. No joiners used.
- Custom formulated high diffusion frosted acrylic material allows for maximum light transmission while eliminating pixilation and hot spots.
- Compact design complies with all ADA requirements for public areas.
- Digital LED technology provides high efficacy and energy efficiency.
- Lumen maintenance; Reported L80 (hours) > 50,000.
- CRI greater than 80.
- Fixture lumens per watt ratios up to 125.
- Optional wire guard for diffuser protection.
- American Made.

DELIVERING UP TO 125 LUMENS PER WATT

LED MERCURY LIGHTING PRODUCTS CO. INC.

20 Audrey Place • Fairfield, NJ 07004 • Tel: 800.637.2584 • Fax: 973.244.9522
www.mercltg.com

LSA SERIES

Fixture Type: _____ **Job Information:** _____

ORDERING DATA: Fill in boxes below with corresponding bold options.

Example: LSA-4-5800-35K-HTA-___-UNI

LSA				HTA	___	UNI	
SERIES	NOMINAL LENGTH (FT)	NOMINAL LUMENS	COLOR TEMP	DIFFUSER	DRIVER*	VOLTAGE	OPTIONS
LSA	**2** 24" Length **4** 46"L Length **8** 92"L Length	**24" L** 2300 2900 **46"L** 3300 4000 5800 **92"L** 6000 8000 11700	30K 35K 40K 50K	**HTA** High Transmission Acrylic	Factory Selected Driver.	UNI	**Standby Modules**** EM7 EM10 EM10 BSL310 (Philips) EM12

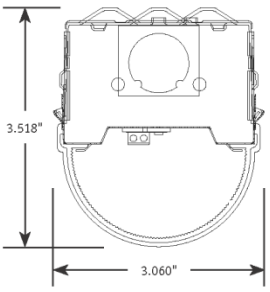
* Certain cataloged lumen packages may be provided with a non-programmable constant current LED power supply at Mercury's discretion. Contact factory if critical.

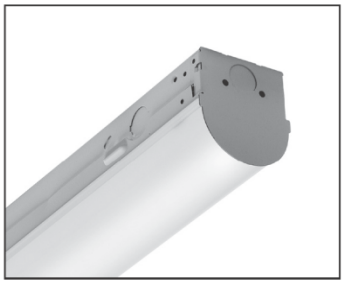
** Available on 4ft. and 8Ft. Modules Only.

PHOTOMETRICS:

All photometric reports are available at www.mercltg.com.

CROSS SECTIONS:





Detail

LUMEN PACKAGE

SERIES	NOMINAL LENGTH (FT)	Nominal Lumen Package	Color	Fixture Power (W)	Delivered Lumens	Fixture LPW	Standby EM
LSA	2						
		2300	3000K	20	2209	112	–
		2300	3500K	20	2246	113	–
		2300	4000K	20	2320	117	–
		2300	5000K	20	2390	121	–
		2900	3000K	26	2785	105	–
		2900	3500K	26	2381	107	–
		2900	4000K	26	2925	110	–
		2900	5000K	26	3013	114	–

SERIES	NOMINAL LENGTH (FT)	Nominal Lumen Package	Color	Fixture Power (W)	Delivered Lumens	Fixture LPW	Standby EM
LSA	4						
		3300	3000K	30	3182	105	✔
		3300	3500K	30	3236	107	✔
		3300	4000K	30	3343	110	✔
		3300	5000K	30	3443	114	✔
		4000	3000K	34	3867	115	✔
		4000	3500K	34	3932	117	✔
		4000	4000K	34	4062	121	✔
		4000	5000K	34	4183	124	✔
		5800	3000K	53	5569	105	✔
		5800	3500K	53	5663	107	✔
		5800	4000K	53	5850	110	✔
		5800	5000K	53	6026	114	✔

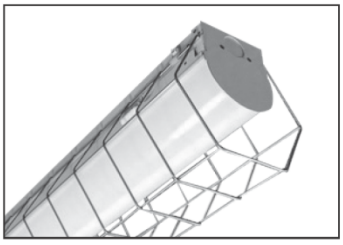
SERIES	NOMINAL LENGTH (FT)	Nominal Lumen Package	Color	Fixture Power (W)	Delivered Lumens	Fixture LPW	Standby EM
LSA	8						
		6000	3000K	53	5739	108	✔
		6000	3500K	53	5835	110	✔
		6000	4000K	53	6028	114	✔
		6000	5000K	53	6209	117	✔
		8000	3000K	66	7642	115	✔
		8000	3500K	66	7770	117	✔
		8000	4000K	66	8027	121	✔
		8000	5000K	66	8268	125	✔
		11,700	3000K	106	11,139	105	✔
		11,700	3500K	106	11,326	107	✔
		11,700	4000K	106	11,700	110	✔
		11,700	5000K	106	12,051	114	✔

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

HANGING ACCESSORIES/LUMINAIRE ACCESSORIES

PART #	DESCRIPTION
HWPFCS5/2T	Cable Hanger-Grid Ceiling/5" J-Box Feed Canopy, 2" Non-Feed Grid Canopy
HWNPFCS2	Cable Hanger-Grid Ceiling/2" Non-Feed Grid Canopy
HWPFCS5J	Cable Hanger-J-Box/5" J-Box Feed Canopy
HWNPFCS5J	Cable Hanger-J-Box/5" J-Box Non-Feed Canopy

PART #	DESCRIPTION
ACXX	Aircraft Cable/ XX= 48"L, 96"L, 150"L
	**Other lengths available.
VH-XX	"V" Hanger w/XX= 48"L or 72"L Chain & "S" Hook
	** Other lengths available.
CPYS-1	S-1 Single Stem 5" Dia. Canopy
STMXX	XX= 12"L, 24"L, 48"L Stem/ 3/8" IPS-5/8" OD
	** Other lengths available.
WG-LSA-4	46" Wire Guard



Wire Guard

MERCURY LIGHTING PRODUCTS CO. INC.

20 Audrey Place • Fairfield, NJ 07004 • Tel: 800.637.2584 • Fax: 973.244.9522
www.mercltg.com

SPECIFICATIONS SUBJECT TO CHANGE, CONSULT FACTORY WHEN CRITICAL. 11/17

DESCRIPTION

FPanel LED panel series provide premium performance and pleasing aesthetics. It is optimized for shallow plenum grid ceilings or surface mounting. Developed with Eaton's latest generation of solid state components and electronic driver technologies, these panels are ideal for new construction and to replace fluorescent troffers. Its refined visual optics and integrated grid retention clips provide the features needed for speed and installation flexibility. LED FPanels are an excellent lighting solution for commercial office spaces, schools, healthcare and retail merchandising areas.

Catalog #		Type
Project		
Comments		Date
Prepared by		

SPECIFICATION FEATURES

Construction/Mounting
Narrow aluminum bezel is tightly held to code gauge steel back plate to protect the LEDs and optical area. Corners are seamless with a narrow flange to provide a refined finish and maximize the light emitting surface. Integral grid locking clips and separate suspension clips are included on the panel to ensure installation flexibility in ceiling systems and to meet code when additional retention is required. Junction box is constructed of code gage galvanized steel with an easy access hinged door for high voltage and low voltage wiring access and includes trade size knockouts. The luminaire is less than 2 inches in depth making it an ideal choice for shallow plenums and low ceilings. May also be surface mounted using the optional kit.

Controls
The FPanel is standard with a 0-10V continuous dimming driver which dims to 10% and works with most standard 0-10V control/dimmers. Combine with energy-saving products like wall dimmers, Room Controller, occupancy and daylight sensors, and lighting relay panels. Or, go wireless with optional field installed controls for either WaveLinx or LumaWatt Pro.

Electrical
Long-Life LED system coupled with electrical driver to deliver optimal performance. LED's available in 3500K, 4000K and 5000K with a minimum of 80 CRI and a 90 CRI option that is 3000K. Projected lumen maintenance based on TM21 is L73 > 60,000 hours. Electronic drivers are cULus recognized and available for 120-277V. Emergency battery pack options are available in 7 watts and 14 watts. These emergency battery packs meet critical life-safety lighting requirements and are sold separately for field installation and remote mounting.

Optical Shielding
Light guide is constructed of acrylic with specialized features to optimize light extraction providing excellent efficiency. White frost lens with smooth pattern provides uniform illumination as well as scratch and impact resistance.

Compliance
Constructed of UL recognized components these indoor luminaires are cULus listed for 25°C ambient environments, IC rated for direct insulation contact, RoHS compliant, damp location listed, and comply with IESNA LM-79 and LM-80 standards. NEMA 410 Compliant. DesignLights Consortium® Qualified and classified for DLC Standard, refer to www.designlights.org for details.

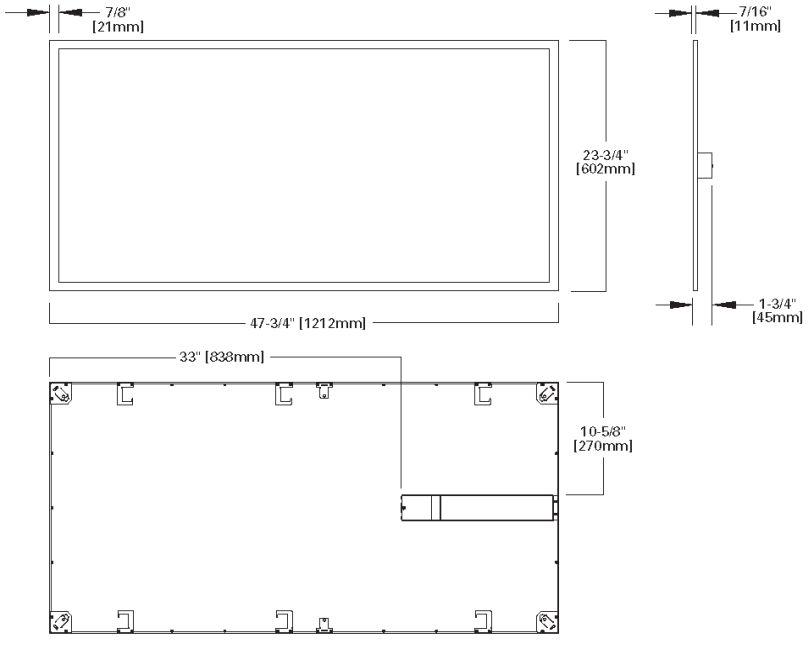
Warranty
Five year warranty.

24FP LED

2' X 4' LED PANEL

General LED Panel. Recessed in Insulated Ceilings or Surface Mount

DIMENSIONS



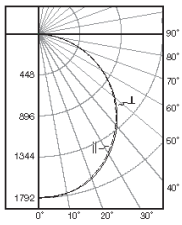
LOAD DATA

Thd	13%
Power Factor	0.96
Weight	18.5
Low Temp. Start	-20°C

Powering Business Worldwide

PS519169EN
9-26-2017

PHOTOMETRICS



24FP4735C
Electronic Driver
Linear LED 3500K
Spacing criterion: (II) 1.24 x mounting height, (⊥) 1.26 x mounting height
Lumens: 5073
Input Watts: 40W
Efficacy: 126 lm/W
Test Report: 24FP4735C.IES

Candlepower

Angle	Along II	45°	Across ⊥
0	1785	1785	1785
5	1786	1774	1785
10	1761	1751	1764
15	1718	1711	1726
20	1657	1655	1670
25	1582	1582	1598
30	1495	1497	1516
35	1396	1400	1418
40	1284	1290	1311
45	1167	1173	1191
50	1040	1046	1060
55	906	912	926
60	768	772	784
65	626	628	637
70	481	483	491
75	340	340	348
80	206	206	212
85	92	90	94
90	0	0	0

Coefficients of Utilization

Effective floor cavity reflectance 20%

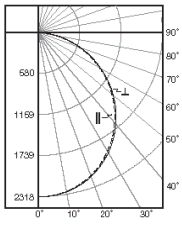
rc	80%				70%				50%			30%			10%			0%
rw	70	50	30	10	70	50	30	10	50	30	10	50	30	10	50	30	10	0
RCR																		
0	119	119	119	119	116	116	116	116	111	111	111	106	106	106	102	102	102	100
1	109	104	99	96	106	101	98	94	97	94	91	93	91	88	90	88	86	83
2	99	90	83	78	96	88	82	77	85	80	75	82	77	73	79	75	72	69
3	90	79	71	64	87	78	70	64	75	68	63	72	66	62	69	65	61	58
4	82	70	61	55	80	69	61	54	66	59	53	64	58	53	62	56	52	50
5	76	63	54	47	74	62	53	47	59	52	46	57	51	46	56	50	45	43
6	70	56	47	41	68	55	47	41	54	46	40	52	45	40	50	44	40	38
7	65	51	42	36	63	50	42	36	49	41	36	47	41	35	46	40	35	33
8	60	47	38	32	59	46	38	32	45	37	32	43	37	32	42	36	31	30
9	56	43	35	29	55	42	34	29	41	34	29	40	33	29	39	33	28	27
10	53	39	32	26	51	39	31	26	38	31	26	37	31	26	36	30	26	24

Zonal Lumen Summary

Zone	Lumens	% Fixture
0-30	1384	27.3
0-40	2261	44.6
0-60	3983	78.5
0-90	5073	100.0
0-180	5073	100.0

Luminance Data

Angle in Deg	Average 0-Deg cd/sm	Average 45-Deg cd/sm	Average 90-Deg cd/sm
45	2221	2232	2266
55	2125	2139	2172
65	1993	1999	2028
75	1768	1768	1809
85	1420	1389	1451



24FP6440C
Electronic Driver
Linear LED 4000K
Spacing criterion: (II) 1.25 x mounting height, (⊥) 1.26 x mounting height
Lumens: 6611.3
Input Watts: 59.4W
Efficacy: 111.3 lm/W
Test Report: 24FP6440C.IES

Candlepower

Angle	Along II	45°	Across ⊥
0	2316	2316	2316
5	2312	2309	2308
10	2279	2279	2282
15	2225	2229	2233
20	2150	2156	2163
25	2056	2062	2072
30	1939	1951	1963
35	1814	1824	1838
40	1668	1683	1698
45	1516	1530	1544
50	1351	1364	1376
55	1182	1191	1202
60	998	1007	1014
65	812	820	827
70	622	629	642
75	438	445	456
80	266	274	282
85	116	121	126
90	0	0	0

Coefficients of Utilization

Effective floor cavity reflectance 20%

rc	80%				70%				50%			30%			10%			0%
rw	70	50	30	10	70	50	30	10	50	30	10	50	30	10	50	30	10	0
RCR																		
0	119	119	119	119	116	116	116	116	111	111	111	106	106	106	102	102	102	100
1	109	104	99	95	106	101	97	94	97	94	91	93	91	88	90	88	86	83
2	99	90	83	78	96	88	82	77	85	79	75	82	77	73	78	75	71	69
3	90	79	71	64	87	78	70	64	75	68	63	72	66	62	69	65	60	58
4	82	70	61	54	80	69	60	54	66	59	53	64	58	53	62	56	52	50
5	76	63	54	47	73	61	53	47	59	52	46	57	51	46	56	50	45	43
6	70	56	47	41	68	55	47	41	54	46	40	52	45	40	50	44	40	37
7	65	51	42	36	63	50	42	36	49	41	36	47	40	35	46	40	35	33
8	60	47	38	32	59	46	38	32	45	37	32	43	37	32	42	36	31	30
9	56	43	35	29	55	42	34	29	41	34	29	40	33	29	39	33	28	27
10	53	39	32	26	51	39	31	26	38	31	26	37	30	26	36	30	26	24

Zonal Lumen Summary

Zone	Lumens	% Fixture
0-30	1798.9	27.2
0-40	2940.9	44.5
0-60	5186.4	78.4
0-90	6611.3	100.0
0-180	6611.3	100.0

Luminance Data

Angle in Deg	Average 0-Deg cd/sm	Average 45-Deg cd/sm	Average 90-Deg cd/sm
45	2885	2911	2938
55	2773	2794	2820
65	2585	2611	2633
75	2277	2313	2371
85	1791	1868	1945

ORDERING INFORMATION/PERFORMANCE

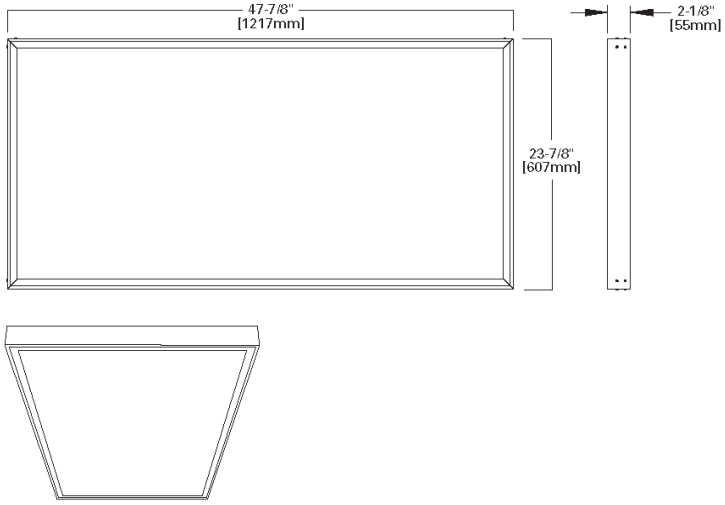
Catalog	UPC	CCT	CRI (Min)	Delivered Nominal Lumens	Watts	Efficacy (lm/W)	Input Current (A)	
							120V	277V
24FP4735C	080083801466	3500K	80	4990	40.4	124	.36	.15
24FP4740C	080083801480	4000K	80	4858	40.3	121		
24FP4750C	080083801503	5000K	80	5005	40.3	124		
24FP6435C	080083801527	3500K	80	6602	58.8	112	.51	.22
24FP6440C	080083801541	4000K	80	6611	59.4	111		
24FP6450C**	080083800704	5000K	80	6746	59.4	114		
24FP3830C9*	080083801909	3000K	90	3886	40.3	96	.36	.15
24FP5830C9*	080083801923	3000K	90	5282	58.2	91	.51	.22

*May have extended lead-times.
**Stock available October/November 2017. Check FLASH for availability.

ACCESSORIES/ORDERING INFORMATION

SURFACE MOUNT KIT**

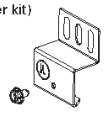
Catalog	UPC
FPSURF24	080083802746



CEILING RETENTION**

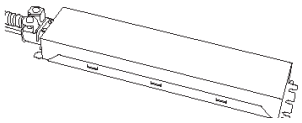
Catalog	UPC
FPEQ	080083802685

Required by some local codes
Order one set for each fixture
(Four clips per kit)



EMERGENCY BATTERY

Catalog	UPC	Watts
EBPLED7W	080083832265	7
EBPLED14W	080083832272	14



DRYWALL FRAME KIT

Catalog	UPC
DF-24W-U	662401232970

SHIPPING DATA

Size	Wt.	Pallet (30" x 56")
2' x 4'	22 lbs.	17

Eaton
1121 Highway 74 South
Peachtree City, GA 30269
P: 770-486-4800
www.eaton.com/lighting

Specifications and dimensions subject to change without notice.

PS519169EN
9-26-2017

LITHONIA LIGHTING®

Catalog Number	
Notes	
Type	

AL SERIES

2ALL

2' X 4'
LED

C.E.C. TITLE 20 COMPLIANT · A+ CAPABLE · eldoLED · DLC PREMIUM · nLIGHT

Patent No.: US D680,254 S

FEATURES & SPECIFICATIONS

INTENDED USE — The AL combines clean, fine lines with a unique design that complements any space. The completely luminous optical system provides a concave visual appearance while providing high fixture performance and even illumination. AL is also available with a number of control options thus providing the ability to dim or control the lighting providing the ability to save energy and operate with multiple control systems including daylight or occupancy sensors.

CONSTRUCTION — Rugged, one-piece cold-rolled steel reflector assembly with embossed steel for increased structural integrity and strength. Polyester powder-paint after fabrication.

Hinged doorframe assembly retains optical assembly and easy access to electrical components. End plates include integral T-bar clips.

OPTICS — Luminous optical system consists of a unique blend of high performance transmittance diffuser coupled with a concave, clear, ribbed refractor for and unique multi-step appearance. To improve fixture performance and eliminate pixilation the diffuser uses a unique blend of high molecular weight polymer beads with unrelated refractive index.

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).

nLight® embedded controls make each luminaire addressable - allowing it to digitally communicate with other nLight enabled controls such as dimmers, switches, occupancy sensors and photocontrols. Simply connect all the nLight enabled control devices and the AL luminaires using standard Cat-5 cabling. Unique plug-and-play convenience as devices and luminaires automatically discover each other and self-commission.

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 the energy waste created by the traditional practice of over-lighting.

Step-level dimming option allows system to be switched to 50% power for compliance with common energy codes while maintaining fixture appearance.

eldoLED driver options deliver choice of dimming range, and choices 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.

INSTALLATION — Lightweight and easy to install in any standard T-Bar system.

Maintenance: LED boards include plug-in connectors for easy replacement or servicing.

Suitable for damp locations.

LISTINGS — CSA Certified to meet U.S. and Canadian standards. IC rated.

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

Tested to LM80 standards.

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.

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® control networks when ordered with drivers marked by a shaded background*
- This luminaire is part of an A+ Certified solution for nLight control networks, providing advanced control functionality at the luminaire level, when selection includes driver and control options marked by a shaded background*

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

*See ordering tree for details

2ALL4 Architectural Lighting 2'x4'

A+ Capable options indicated by this color background.

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

Example: 2ALL4 48L EZ1 LP835 N100

2ALL4							
Series		**Lumens** [1]		**Voltage**		**Driver**	
2ALL4	Recessed LED 2x4	30L	3000 lumens	(blank)	MVOLT (120-277V)	EZ1	eldoLED dims to 1% (0-10 volt dimming)
		40L	4000 lumens	347	347V [2]	EZB	eldoLED dims to dark (0-10 volt dimming)
		48L	4800 lumens			GZ1	Dims to 1% (0-10V dimming) [3]
		60L	6000 lumens			GZ10	Dims to 10% (0-10V dimming) [3]
		72L	7200 lumens			EDB	eldoLED DALI [3]
						EXB	eldoLED DMX/RDM [3]
						EXA1	Dims to 1%, XPoint wireless enabled [3,4]
						EXAB	Dims to dark, XPoint wireless enabled [3,4]
						SLD	Step-level dimming [3]

Color temperature		**Control**		**Options**	
LP830	3000 K	(blank)	No controls	EL7L	700 nominal lumen battery pack (non-CEC compliant)
LP835	3500 K	N80	nLight with 80% (L80) lumen management	EL14L	1400 nominal lumen battery pack (non-CEC compliant)
LP840	4000 K	N80EMG	nLight with 80% (L80) lumen management for use with generator supply EM power	E10WLCP	EM Self-Diagnostic battery pack, 10W Constant Power, CEC compliant
LP850	5000 K	N100	nLight without lumen management	CP	Chicago plenum
		N100EMG	nLight without lumen management for use with generator supply EM power		

nLight® Control Accessories:
Order as separate catalog number. Visit www.sensorswitch.com/nLight for complete listing of nLight controls.

WallPod stations	**Model number**	**Occupancy sensors**	**Model number**
On/Off	nPODM [color]	Standard range 360°, ceiling (PIR / dual tech)	nCM 9 / nCM PDT 9
On/Off & Raise/Lower	nPODM DX [color]	Extended range 360°, ceiling (PIR / dual tech)	nCM 10 / nCM PDT 10
Graphic Touchscreen	nPOD GFX	Wide view (PIR / dual tech)	nWV 16 / nWV PDT 16
Photocell controls	**Model number**	**Cat-5 cable bundles (plenum rated)**	**Model number**
Continuous dimming	nCM ADC	10', CAT5 10FT	CAT5 10FT J1
On/Off & Dimming	nCM PC ADC	15', CAT5 15FT	CAT5 15FT J1

Accessories: *Order as separate catalog number.*

DGA24	Drywall ceiling adaptor , unit installation

Notes
1 Approximate lumen output.
2 Not available with EL7L or EL14L battery packs or SLD driver.
3 GZ1, GZ10 not available with any Controls options.
4 Not available with N80, N80EMG, N100, or N100EMG.
5 Gateway not included. Requires on-site commissioning. Visit www.lightingcontrols.com/XPointWireless for more information.

LED: One Lithonia Way Conyers, GA 30012 Phone: 800-858-7763 Fax: 770-929-8789 www.lithonia.com
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Performance Data				
Lumen	**Package**	**Lumens**	**Input Watts**	**LPW**
30L	LP830	3,010.3	25	120.4
30L	LP835	3,074.8	25	123.0
30L	LP840	3,096.4	25	123.9
30L	LP850	3,204.0	25	128.2
40L	LP830	3,828.2	32	119.6
40L	LP835	3,911.2	32	122.2
40L	LP840	3,938.9	32	123.1
40L	LP850	4,077.2	32	127.4
48L	LP830	4,722.9	40	118.1
48L	LP835	4,824.4	40	120.6
48L	LP840	4,858.2	40	121.5
48L	LP850	5,027.3	40	125.7
60L	LP830	5,427.1	47	115.5
60L	LP835	5,543.9	47	118.0
60L	LP840	5,583.9	47	118.8
60L	LP850	5,780.7	47	123.0
72L	LP830	7,490.3	68	110.2
72L	LP835	7,653.2	68	112.5
72L	LP840	7,705.5	68	113.3
72L	LP850	7,976.1	68	117.3

DIMENSIONS

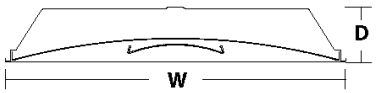
All dimensions are inches (centimeters) unless otherwise specified.

Specifications

Length: 48 (121.9)

Width: 24 (61.0)

Depth: 3-3/4 (9.5)



How to Estimate Delivered Lumens in Emergency Mode

Use the formula below to estimate the delivered lumens in emergency mode

Delivered Lumens = 1.25 x P x LPW

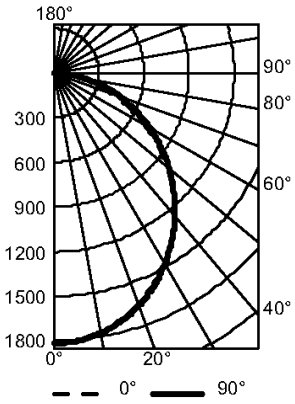
P = Ouput power of emergency driver. P = 10W for E10WLCP option.

LPW = Lumen per watt rating of the luminaire. This information is available on the ABL luminaire spec sheet.

LPW = Lumen per watt rating of the luminaire. LPW information available in Performance Data section.

PHOTOMETRICS

2ALL4 48L EZ1 LP840, 4858.2 delivered lumens, test no. LTL26939P10, tested in accordance to IESNA LM-79.



CP Summary

	0°	90
0°	1815	1815
5°	1808	1808
15°	1733	1725
25°	1588	1575
35°	1375	1371
45°	1123	1131
55°	844	871
65°	550	600
75°	281	337
85°	71	82
90	0	0

Coefficients of Utilization

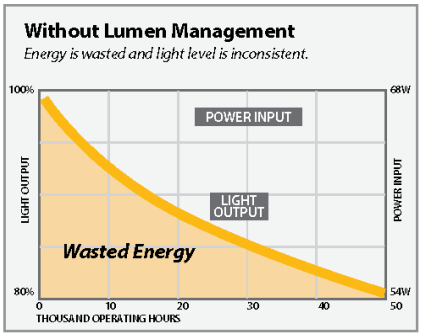
	pf	80%			70%			50%		
	pc	70%	50%	30%	50%	30%	10%	50%	30%	10%
	pw									
RCR	0	119	119	119	116	116	116	111	111	111
	1	109	104	100	102	98	94	98	94	91
	2	99	91	84	89	83	77	85	80	76
	3	90	80	72	78	71	65	75	69	64
	4	83	71	62	70	61	55	67	60	54
	5	76	63	54	62	54	48	60	53	47
	6	70	57	48	56	48	42	54	47	41
	7	65	52	43	51	43	37	50	42	37
	8	61	47	39	47	39	33	45	38	33
	9	57	44	35	43	35	30	42	35	30
	10	53	40	32	40	32	27	39	32	27

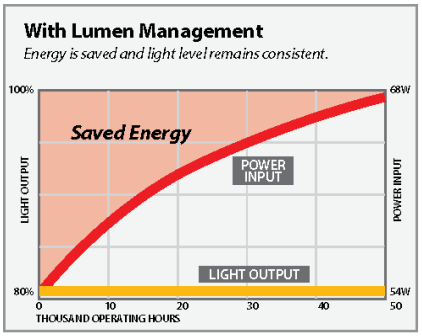
Zonal Lumen Summary

Zone	Lumens	% Lamp	% Fixture
0° - 30°	1383	28.5	28.5
0° - 40°	2238	46.1	46.1
0° - 60°	3868	79.6	79.6
0° - 90°	4858	100.0	100.0
90° - 120°	0	0.0	0.0
90° - 130°	0	0.0	0.0
90° - 150°	0	0.0	0.0
90° - 180°	0	0.0	0.0
0° - 180°	4858	100.0	100.0

Constant Lumen Management

Enabled by the embedded nLight control, the ALL actively tracks its run-time and manages its light source such that constant lumen output is maintained over the system life. Referred to as lumen management, this feature eliminates the energy waste created by the traditional practice of over-lighting.





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DESCRIPTION

The VT4S Series is an energy efficient industrial Vaportite fixture that features rugged and durable construction. The VT4S incorporates a full metal tray and heat sink inside a reinforced fiberglass housing with a high impact diffuser. This Vaportite series is suitable for interior and exterior applications and can be surface, chain, cable or monopoint mounted.

The VT4S Series has been designed for maximum operation in commercial institutional and industrial environments including cold storage, canopy, and general high bay lighting, where weathering, high temperature, humidity and dust are present.

Catalog #		Type
Project		
Comments		Date
Prepared by		

VT4S
LED

2' INDUSTRIAL

Vaportite LED Industrial

SPECIFICATION FEATURES

Construction
Fiberglass housing with high impact diffuser and metal gear tray secured by internal latches for easy driver access. Electrical components and fixtures are UL/cUL listed for Wet Locations. IP65, IP66, IP67 and IP69 ratings.[8] NEMA 4X, up to 1500 PSI Hosedown. NSF certified. -40°C to 40°C ambient rating on suspended luminaires. Stainless-steel latch option also available.

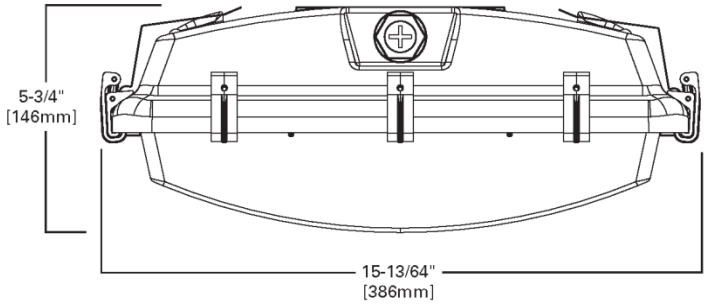
Electrical
Long-Life LED system coupled with electrical driver to deliver optimal performance. LED's available in 3500K, 4000K or 5000K with a CRI ≥ 80. Projected life is 60,000 hours at 70% lumen output. Electronic drivers are available for 120-277V, 347V and 480V applications. A 0-10V dimming driver is available.

Shielding
High impact clear or frosted acrylic, or 100% polycarbonate lens diffuser options.

Mounting
Suspended mount using two stainless steel V-hooks. Optional Surface mount bracket or monopoint available. Mounting hardware must be ordered separately.

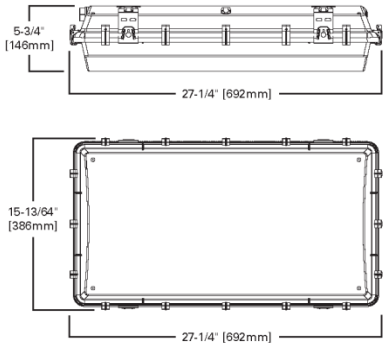
Compliance
UL/cUL listed. RoHS compliant, and LED modules comply with IESNA LM-79 and LM-80 standards.

Warranty
Five-year limited warranty.

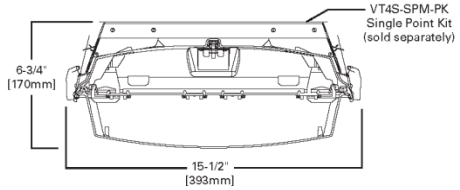


NOTES: [8] IP ratings based on fixture being mounted in horizontal position with light facing down,

MOUNTING DATA



INSTALLATION DATA



RATINGS
NSF
NEMA

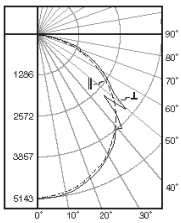
ENERGY DATA
Input Watts:
VT4S-9=62W
VT4S-12=84W
VT4S-15=108W
VT4S-18=138W

LINEAR DISCONNECT
Safe and convenient means of disconnecting power

Powering Business Worldwide

PS507022EN
4-13-2018

PHOTOMETRICS



VT4S-15-DR-UNV-L840-CD2-U

Electronic Driver

Linear LED 4000K

Spacing criterion: (II) 1.27 x mounting height, (⊥) 1.28 x mounting height

Lumens: 15098

Input Watts: 108.3W

Efficacy: 139.4 lm/W

Test Report: VT4S-15-DR-UNV-L840-CD2-U.IES

Candlepower

Angle	Along II	45°	Across ⊥
0	5113	5113	5113
5	5069	5110	5132
10	5011	5041	5063
15	4907	4938	4954
20	4756	4794	4814
25	4581	4610	4624
30	4363	4373	4408
35	4112	4092	4173
40	3823	3820	3857
45	3503	3535	3414
50	3130	3163	3600
55	2723	2609	2818
60	2277	2550	2399
65	1821	1939	1946
70	1340	1455	1342
75	904	1019	1012
80	525	575	606
85	249	232	207
90	40	64	61

Coefficients of Utilization

Effective floor cavity reflectance 20%

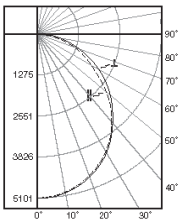
rc	80%				70%				50%			30%			10%			0%
rw	70	50	30	10	70	50	30	10	50	30	10	50	30	10	50	30	10	0
RCR																		
0	119	119	119	119	116	116	116	116	111	111	111	106	106	106	101	101	101	99
1	108	104	99	95	106	101	97	94	97	94	91	93	90	88	89	87	85	83
2	99	90	83	78	96	88	82	76	84	79	75	81	77	73	78	74	71	69
3	90	79	71	64	87	77	70	64	74	68	62	71	66	61	69	64	60	58
4	82	70	61	54	80	69	60	54	66	59	53	63	57	52	61	56	51	49
5	75	62	53	47	73	61	53	46	59	51	46	57	50	45	55	49	45	42
6	70	56	47	41	68	55	47	40	53	46	40	51	45	39	50	44	39	37
7	64	51	42	36	63	50	42	36	48	41	35	47	40	35	45	39	35	33
8	60	46	38	32	58	46	37	32	44	37	31	43	36	31	42	35	31	29
9	56	42	34	29	54	42	34	29	41	33	28	39	33	28	38	32	28	26
10	52	39	31	26	51	39	31	26	38	30	26	37	30	25	36	30	25	24

Zonal Lumen Summary

Zone	Lumens	% Fixture
0-30	4001	26.5
0-40	6584	43.6
0-60	11752	77.8
0-90	14946	99.0
0-180	15098	100.0

Luminance Data

Angle in Deg	Average 0-Deg cd/sm	Average 45-Deg cd/sm	Average 90-Deg cd/sm
45	21095	19104	18709
55	19329	16019	17623
65	16944	14284	14690
75	11505	9751	10019
85	5745	3310	3114



VT4S-15-DRF-UNV-L840-CD2-U

Electronic Driver

Linear LED 4000K

Spacing criterion: (II) 1.24 x mounting height, (⊥) 1.26 x mounting height

Lumens: 14822

Input Watts: 107.5W

Efficacy: 137.9 lm/W

Test Report: VT4S-15-DRF-UNV-L840-CD2-U.IES

Candlepower

Angle	Along II	45°	Across ⊥
0	5083	5083	5083
5	5041	5066	5085
10	4974	4997	5017
15	4865	4885	4906
20	4702	4727	4743
25	4495	4526	4540
30	4253	4278	4299
35	3957	3994	4014
40	3616	3671	3703
45	3254	3309	3338
50	2843	2929	2992
55	2418	2513	2619
60	2001	2117	2237
65	1605	1734	1811
70	1232	1356	1421
75	891	1001	1068
80	578	689	747
85	304	428	465
90	160	248	269

Coefficients of Utilization

Effective floor cavity reflectance 20%

rc	80%				70%				50%			30%			10%			0%
rw	70	50	30	10	70	50	30	10	50	30	10	50	30	10	50	30	10	0
RCR																		
0	118	118	118	118	115	115	115	115	110	110	110	105	105	105	100	100	100	98
1	108	103	98	94	105	100	96	92	95	92	89	91	88	86	87	85	83	81
2	98	89	82	77	95	87	81	75	83	78	73	80	75	71	76	73	69	67
3	89	78	70	64	86	77	69	63	73	67	61	70	65	60	67	63	59	56
4	82	69	61	54	79	68	60	53	65	58	52	63	56	51	60	55	50	48
5	75	62	53	46	73	61	52	46	58	51	45	56	50	45	54	48	44	42
6	69	56	47	40	67	55	46	40	53	45	40	51	44	39	49	43	39	36
7	64	51	42	36	62	50	41	36	48	41	35	46	40	35	45	39	34	32
8	60	46	38	32	58	45	37	32	44	37	31	43	36	31	41	35	31	29
9	56	42	34	29	54	42	34	29	40	33	28	39	33	28	38	32	28	26
10	52	39	31	26	51	39	31	26	37	30	26	36	30	25	35	29	25	23

Zonal Lumen Summary

Zone	Lumens	% Fixture
0-30	3943	26.6
0-40	6438	43.4
0-60	11244	75.9
0-90	14475	97.7
0-180	14822	100.0

Luminance Data

Angle in Deg	Average 0-Deg cd/sm	Average 45-Deg cd/sm	Average 90-Deg cd/sm
45	19596	17883	18293
55	17164	15430	16379
65	14405	12774	13671
75	11340	9579	10574
85	7014	6107	6995

LUMEN MAINTENANCE

Ambient Temperature	TM-21 Lumen Maintenance (60,000 hours)	Theoretical L70 (Hours)
25°C	> 91%	> 247,000

ENERGY AND PERFORMANCE DATA BY CATALOG NUMBER

Catalog Number	Description	Delivered Lumens				Watts	Efficacy			
		Lensing					Lensing			
		DR	DRF	PC	PCF		DR	DRF	PC	PCF
VT4S-9-XX-UNV-L835-CD1	2ft, Vaportight, 9000 lumens UNV, 3500K	9286	9116	9224	8266	62	151	148	150	134
VT4S-9-XX-UNV-L840-CD1	2ft, Vaportight, 9000 lumens UNV, 4000K	9394	9222	9331	8362	62	153	150	152	136
VT4S-9-XX-UNV-L850-CD1	2ft, Vaportight, 9000 lumens UNV, 5000K	10146	9959	10077	9031	62	165	162	164	147
VT4S-12-XX-UNV-L835-CD2	2ft, Vaportight, 12000 lumens UNV, 3500K	12092	11870	12010	10763	84	144	141	143	128
VT4S-12-XX-UNV-L840-CD2	2ft, Vaportight, 12000 lumens UNV, 4000K	12232	12008	12149	10888	84	146	143	145	130
VT4S-12-XX-UNV-L850-CD2	2ft, Vaportight, 12000 lumens UNV, 5000K	13211	12968	13121	11759	84	157	155	156	140
VT4S-15-XX-UNV-L835-CD2	2ft, Vaportight, 15000 lumens UNV, 3500K	14925	14651	14824	13285	108	138	135	137	123
VT4S-15-XX-UNV-L840-CD2	2ft, Vaportight, 15000 lumens UNV, 4000K	15098	14821	14996	13439	108	139	137	138	124
VT4S-15-XX-UNV-L850-CD2	2ft, Vaportight, 15000 lumens UNV, 5000K	16306	16007	16196	14514	108	151	148	150	134
VT4S-18-XX-UNV-L835-CD2	2ft, Vaportight, 18000 lumens UNV, 3500K	17780	17454	17660	15826	138	129	127	128	115
VT4S-18-XX-UNV-L840-CD2	2ft, Vaportight, 18000 lumens UNV, 4000K	17986	17656	17864	16010	138	131	128	130	116
VT4S-18-XX-UNV-L850-CD2	2ft, Vaportight, 18000 lumens UNV, 5000K	19425	19068	19294	17290	138	141	139	140	126

ORDERING INFORMATION

SAMPLE NUMBER: VT4S-18-DR-UNV-L850-CD2-WL-U

Series
VT4S=2' Vaportite
VT4SP=Pendant Mount [2], [6]

LED Lumen Output
9=9,000 Luamens
12=12,000 Lumens
15=15,000 Lumens
18=18,000 Lumens

Lens
DR=Clear Acrylic High Impact
DRF=Frosted Acrylic High Impact
PC=Clear Poly Carbonate
PCF=Frosted Poly Carbonate

Voltage [1]
120V=120 Volt
277V=277 Volt
347V=347 Volt
480V=480 Volt
UNV=Universal 120-277 Volt
UNC=Universal 347-480 Volt

CCT
L835=3500K
L840=4000K
L850=5000K

Options
Emergency
EL10W=10-watt, 120-277V emergency battery pack installed (9,000 lumen fixture only) [4]
VT-REM-EL10W=Remote Mounted, 10 Watt, 120-277V, Emergency Battery Pack [7]

Driver Type
CD=0-10V Dimming Driver

Number of Drivers
1=1 Driver (9,000 lumens)
2=2 Drivers (12,000, 15,000 and 18,000 lumen)

WL=Wet Label

Options
Blank=Plastic Latches and(2) End Watertite Hubs (all Watertite Hubs have 1/2" Conduit Entry)
C3=3' Power Cord
C6=6' Power Cord
PC3-=3' Power Cord & Plug (Specify Voltage)
PC6-=6' Power Cord & Plug (Specify Voltage)
VRS=Vandal Resistant Screws for Latches
MS=Damp listed Motion Sensor [1]
SSL=Stainless Steel Latches
MSWL20=Wet Location Motion Sensor [3], [5]
MSWL40=Wet Location Motion Sensor [3], [5]

Packaging
U=Unit Pack

ACCESSORIES

VT4S-MBK-PK=Mounting Bracket Kit (2 per kit)
VT4S-SPM-PK=Single Point Mounting Kit (1 per kit)

NOTES: [1] When ordering MS option, specify as UNV (for 120 or 277V), 347 or 480V. [2] Pendant mount option offers up to IP66 rating. [3] When ordering MSWL sensor, specify voltage (120V, 277V or 347V). 480V not available [4] EL10W option is rated for 0C to 35C ambient. [5] MSWL Sensor is rated up to IP65. [6] Rigid mount not for use in gymnasiums. [7] Remote mount battery rated up to IP66.

Specifications & dimensions subject to change without notice. Consult your Eaton Representative for availability and ordering information.

SHIPPING DATA

Catalog No.	Wt.
VT4S-9	12 lbs.
VT4S-12	12 lbs.
VT4S-15	12 lbs.
VT4S-18	12 lbs.

Eaton
1121 Highway 74 South
Peachtree City, GA 30269
P: 770-486-4800
www.eaton.com/lighting

Specifications and dimensions subject to change without notice.

PS507022EN
4-13-2018

LITHONIA LIGHTING®

Catalog Number	
Notes	
Type	

LED IP Rated High Bay

JHBL

12000LM, 18000LM, 24000LM, 30000LM, 35000LM, 40000LM, 45000LM

FEATURES & SPECIFICATIONS

INTENDED USE — The JHBL is constructed to withstand moisture, dust, and chemical contact. Common applications for JHBL include demanding environments such as manufacturing, foundries, natatoriums, gymnasiums, automotive manufacturing, packaging, and cold storage. Ideal one-for-one replacement of conventional HID and fluorescent high bay systems. **Certain airborne contaminants can diminish the integrity of acrylic and/or polycarbonate.** Click here for Acrylic-Polycarbonate Compatibility table for suitable uses.

CONSTRUCTION — Electrical housing is off-set from the optical assembly for maximum heat dissipation. Rugged die-cast aluminum housing and corrosion resistance. Housing utilizes die cut rubber gasketing to seal the optical and electrical compartments from dust and moisture. Wire guard attachment points are precast in optical housing. Housing and optics maintain IP65 rating with all internal components including optional integrated sensor.

OPTICS — One piece precision molded .375" thick borosilicate glass that is silicone rubber gasketed. Optional non-silicone gasket available and recommended for automotive applications.

ELECTRICAL — Non-class 2 drivers standard for maximum life at high temperatures. Less than 10% THD and PF >90. 6kV/3kA level of surge protection is standard. Multiple voltages available including HVOLT and 250VDC. Lumen maintenance is 90% at 60,000 hours. L70 greater than 100,000 hours. 0-10V dimming standard for a dimming range of 100% to 10% - dimming source current is 150 microA

INSTALLATION — 3/4 inch NPS threaded hub standard that is suitable for pendant, hook or loop mounting with appropriate mounting accessories. See accessories for available options.

LISTINGS — CSA certified to US and Canadian safety standards. Wet location listed. IP65 rated. Suitable for use in ambient temperatures from -40°F (-40°C) to 131°F (55°C). High ambient (HA option) up to 65°C available for MVOLT, HVOLT and 250VDC drivers. Patent pending. Covered ceiling not required to maintain wet location listing or IP ratings.

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.

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.

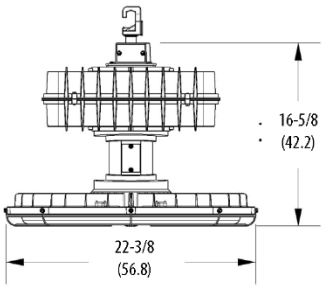
- All configurations of this luminaire meet the Acuity Brands' specification for chromatic consistency
- This luminaire is part of an A+ Certified solution for nLight® or XPoint™ Wireless control networks marked by a shaded background*

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

*See ordering tree for details

DIMENSIONS

All dimensions are in inches (centimeters) unless otherwise indicated.
Dimensions may vary with options or accessories.

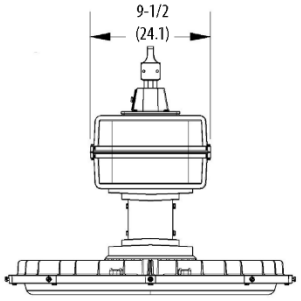


45000LM and under

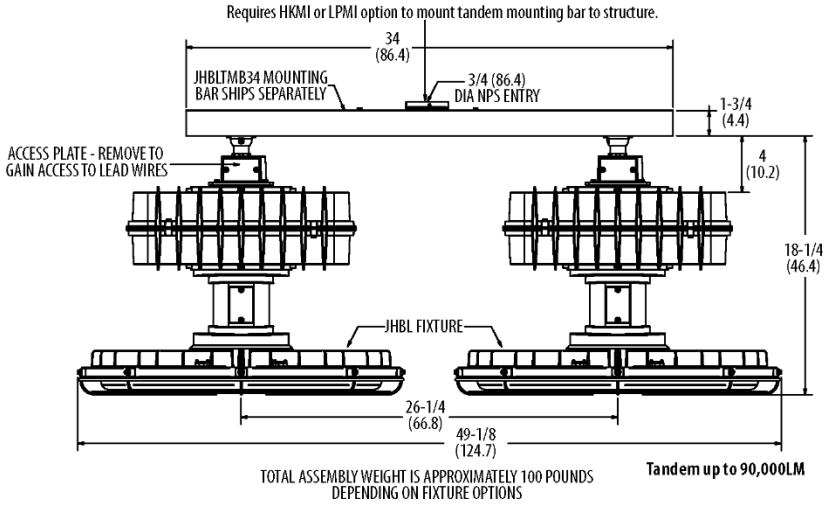
Typical weight:

A cartoned luminaire weighs 50 lbs.;
unboxed it weighs 43 lbs.

Shown with HKM(G) mounting accessory.
See accessory options on page 2.



45000LM and under



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JHBL LED IP Rated High Bay

A+ Capable options indicated by this color background.

ORDERING INFORMATION Lead times will vary depending on options selected. Consult with your sales representative. **Example**: JHBL 18000LM GL WD MVOLT GZ10 50K 70CRI CS89 DWHXD

JHBL		GL				GZ10		
Series	**Lumens-(single unit)**	**Lens**	**Distribution**	**Voltage**	**Driver**	**Color temperature**	**Color rendering index**
JHBL	12000LM 12,000 lumens 18000LM 18,000 lumens 24000LM 24,000 lumens 30000LM 30,000 lumens [1] 35000LM 35,000 lumens [1] 40000LM 40,000 lumens [1,2] 45000LM 45,000 lumens [1,2]	GL Glass ACL Clear Acrylic PCL Clear Polycarbonate	WD Wide ND Narrow	MVOLT 120-277V HVOLT 347-480V 120 120V 277 277V 347 347V 480 480V 250DC 250VDC [3]	GZ10 0-10V dimming	35K 3500 K 40K 4000 K 50K 5000 K	70CRI 70 CRI 80CRI 80 CRI 90CRI 90 CRI

Options

SF	Single fusing [4,5]
DF	Double fusing [4,6]
BSL722	Bodine® emergency LED battery pack for 0°C and up [4,7,8]
BSL722C	Bodine® emergency LED battery pack for -20°C and up [4,7,8]
WGX	Standard wire guard, installed
NSG	Non-silicone gasket
HA	Up to 65°C ambient operation [9]
Cord sets:	
CS88	6' Brad Harrison 16/3 cord and straight blade plug set, wet location [4]
CS88L12	12' Brad Harrison 16/3 cord and straight blade plug set, wet location [4]
CS89	6' white cord, 16/3, no plug, wet location [10]
CS89L12	12' white cord, 16/3, no plug, wet location [10]
CS6G16ST0W5D	6' white cord, 16/5, no plug, wet location, includes low voltage dimming wires
HC3PC3RWT	Wet location, hook, 3' cord, plug and receptacle [4,11]

Controls: [12]	
MSE6NWL	Embedded high mount 360° motion sensor, wet location, On/Off operation [4,7]
MSE62L3VWL	Embedded high mount 360° motion sensor, wet location, High/Low operation (2-level) [3,7]
MSE6NWL DSCNWL	Embedded high mount 360° motion sensor, wet location, On/Off operation from motion sensing, Override Off due to daylight [4,7]
MSE10NWL	Embedded low mount 360° motion sensor, wet location, On/Off operation [4,7]
MSE102L3VWL	Embedded low mount 360° motion sensor, wet location, High/Low operation (2-level) [4,7]
MSE10NWL DSCNWL	Embedded low mount 360° motion sensor, wet location, On/Off operation from motion sensing, Override Off due to daylight [4,7]
MSE6XAWL	XPoint™ wireless high mount 360° motion sensor embedded, on/off, wet location [4,7,13]
MSE6XAWL924	XPoint™ wireless high mount 360° motion sensor with emergency relay embedded, on/off, wet location
MSE10XAWL	XPoint™ wireless low mount 360° motion sensor embedded, on/off, wet location [4,7,13]
MSE10XAWL924	XPoint™ wireless low mount 360° motion sensor with emergency relay embedded, on/off, wet location
XAD	XPoint™ wireless 0-10V module (requires DL option) [4,13]
XAD924	XPoint™ wireless 0-10V with emergency relay (requires DL option) [4,13]
NPP16D	nLight® switching/dimming module
NPP16DER	nLight® switching/dimming module with emergency relay [5]

Color [14]

Super durable finishes

DWHXD	White
DNAXD	Natural aluminum
DWHGXD	Textured white
DNATXD	Textured natural aluminum

Options (Fixtures utilizing the below options will bear a damp location label.)

DL	Damp location [15]
HCX	Hook, cord, no plug [16,17]
HCXP	Hook, cord, 15A NEMA twist-lock plug [4,16,17]
LCXP	Loop, cord, 15A NEMA twist-lock plug [4,16,17]
LCPP	Loop, cord, non-NEMA 14A twist-lock plug [4,18]
HOCS	Hook, 5' RELOC® OCS [4,17]
LOCS	Loop, 5' RELOC® OCS [4,17]
OCS	5' RELOC® OCS [4]

Accessories: *Order as separate catalog number.*

Wet location	
WGJHBL	Wire guard
HKMG	Grommeted aluminum fixture hook male [17]
LPMG	Grommeted aluminum fixture loop male [17]
JHBLSCK120	10' safety cable
JHBLSCK84	7' safety cable

Damp location	
HKM	Aluminum fixture hook male [17]
LPM	Aluminum fixture loop male [17]
HKMI	Iron fixture hook male
LPMI	Iron fixture loop male

Damp location	
TPH	Through-wire power hook [17,19]
PPH	Pendant power hook [17,19]
JHBLTMB34 DWH	34" tandem mounting bar (standard white) [14,20]

See foot notes for above on next page.

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Notes

1 Tandem available in 30000LM, 35000LM, 40000LM, 45000LM (to order double the lumens - ex: 30000LM order as 60000LM)
2 Not available with 250VDC.
3 Not available with 40,000LM, 45,000LM, or control options.
4 Must specify voltage.
5 Available with 120, 277 or 347V.
6 Available with 208, 240 or 480V.
7 Not available with HA option.
8 Factory installed only. Must specify voltage. Not available with 347V, 480V, MVOLT, HVOLT, HA or XPoint option. For use in ambient temperatures up to 35°C. Four conductor cords ship when a cord is ordered with the BSL722 options.
9 Not available with controls, battery packs, or XPoint. See operational data table for correct ambient temp based on fixture.
10 Fixtures ship with black 4-conductor cords when BSL722 options are ordered.
11 Total cord length 6' (3' on plug side and 3' on receptacle side). Other lengths available in odd increments. Ex: 5',7', 9', etc.
12 Not available with HA option. For use in ambient temperatures up to 50°C. Not field installable; must be factory installed.
13 Available with 120, 277, 347, and 480. 480V utilizes a step transformer.
14 Lithonia standard and architectural colors also available. Consult sales representative.
15 Required for fixtures utilizing damp location options. Ex: HKM, LPM, etc.
16 X denotes length of cord. Cords are available in odd increments. Ex: 3', 5', 7', etc.
17 Not available with JHBLTMB34.
18 Requires TPH or PPH accessory.
19 Fixture must have LCPP option.
20 Not recommended for wet locations. Requires (1) HKMI or (1) LPMI to mount tandem bar to structure.

OPERATIONAL DATA

Lumen package	Ambient rating (120V - 277V)	Ambient rating (347V / 480V)	Distribution	Delivered Lumens									LPW*	Input watage
				3500K			4000K			5000K				
				70CRI	80CRI	90CRI	70CRI	80CRI	90CRI	70CRI	80CRI	90CRI		
12000LM	-40°F to 149°F (-40°C to 65°C)	-40°F to 149°F (-40°C to 65°C)	ND	11662	10671	7500	12195	10747	7829	12271	10671	8232	123	100
			WD	11724	10728	7540	12261	108050	7871	12337	10728	8276	123	
18000LM	-40°F to 149°F (-40°C to 65°C)	--40°F to 149°F (-40°C to 65°C))	ND	17874	16355	11495	18692	16472	12000	18808	16355	12617	123	153
			WD	17970	16443	11557	18792	16560	12064	18909	16443	12685	124	
24000LM	-40°F to 149°F (-40°C to 65°C)	--40°F to 149°F (-40°C to 65°C)	ND	22963	21012	14768	24014	21162	15417	24164	21012	16209	123	197
			WD	20386	21125	14848	24143	21276	15500	24293	21125	16296	123	
30000LM	--40°F to 140°F (-40°C to 60°C))	-40°F to 140°F (-40°C to 60°C)	ND	28958	26497	18624	30283	26687	19442	30472	26497	20441	122	251
			WD	29114	26640	18724	30446	26830	19546	30636	26640	20551	122	
35000LM	--40°F to 140°F (-40°C to 60°C)	-40°F to 140°F (-40°C to 60°C)	ND	32883	30089	21148	34387	30304	22077	34602	30089	23212	121	285
			WD	33060	30251	21262	34572	30467	22195	34788	30251	23336	122	
40000LM	-40°F to 140°F (-40°C to 60°C)	-40°F to 140°F (-40°C to 60°C)	ND	38657	35373	24862	40426	35625	25954	40679	35373	27288	118	344
			WD	38865	35563	24996	40643	35817	26093	40897	35563	27434	119	
45000LM	-40°F to 140°F (-40°C to 60°C)	-40°F to 140°F (-40°C to 60°C))	ND	44289	40526	28484	46315	40815	29734	46605	39448	30431	117	397
			WD	43342	39660	27875	45325	39943	29099	45609	39660	30595	115	

CHARACTERISTICS

Lumen package	Weight	Comparable light source
12000LM	43 lbs (19.5 kg)	4-lamp T8, 250W HID
18000LM	43 lbs (19.5 kg)	4-lamp T5HO, 6-lamp T8, 320W HID
24000LM	43 lbs (19.5 kg)	6-lamp T5HO, 8-lamp T8, 400W HID
30000LM	43 lbs (19.5 kg)	6-lamp T5HO, 8-lamp T8, 400W HID
35000LM	43 lbs (19.5 kg)	8-lamp T5HO, 750W HID
40000LM	43 lbs (19.5 kg)	10-lamp T5HO, 750W HID
45000LM	43 lbs (19.5 kg)	12-lamp T5HO, 1000W HID

PROJECTED LUMEN MAINTENANCE

Operating hours	0	10,000	20,000	25,000	35,000	50,000	60,000	100,000
Lumen maintenance factor	1	0.96	0.94	0.93	0.92	0.91	0.90	0.86

EMERGENCY LUMENS (5000K 70CRI)

	12000LM	18000LM	24000LM	30000LM	35000LM	40000LM	45000LM
Narrow distribution	3101	2820	2820	2820	2820	2820	2820
Wide Distribtuion	3117	2835	2835	2835	2835	2835	2835

INDUSTRIAL: One Lithonia Way, Conyers, GA 30012 Phone: 800-315-4963 www.lithonia.com

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PHOTOMETRICS

See www.lithonia.com.

SBGR – EMBEDDED Motion Sensor (see www.acuitycontrols.com for additional information)

- 360° coverage
- On/Off dim
- Photocell optional
- IP65 rated
- Photocell and 0-10VDC dimming options.
- Maximum ambient temperature 50°C

Lithonia nomenclature	Sensor Switch® nomenclature
For shortest lead times use one of the following SBGR configurations.	
MSE6NWL	SBGR 6 WH
MSE62L3VWL	SBGR 6 D WH 3V
MSE6NWL DSCNWL	SBGR 6 P WH
MSE10NWL	SBGR 10 WH
MSE102L3VWL	SBGR 10 D WH 3V
MSE10NWL DSCNWL	SBGR 10 P WH

MOTION SENSOR

ORDERING INFORMATION Lead times will vary depending on options selected. Consult with your sales representative. **Example:** MSE6NWL

Series	Lens option	Dimming	Environmental factors	Time delay
MSE Passive infrared embedded occupancy sensor	6 High mount, 360° 10 Low mount, 360°	N On/off 2LXX Bi level range [1] XA XPoint™ wireless signal to external system	WL Wet location	(blank) 10 minutes 5M 5 minutes 15M 15 minutes

Notes

1 XX denotes "Low" level on 0-10V output.

PHOTOCELL

ORDERING INFORMATION Lead times will vary depending on options selected. Consult with your sales representative. **Example:** DSCNWL

Series	Dimming	Environmental factors
DSC Closed loop (see external and fixture light)	N On/off CXX Continuous dimming and override off [1] XA XPoint™ wireless signal to external system	WL Wet location

Notes

1 Available with low mount only.

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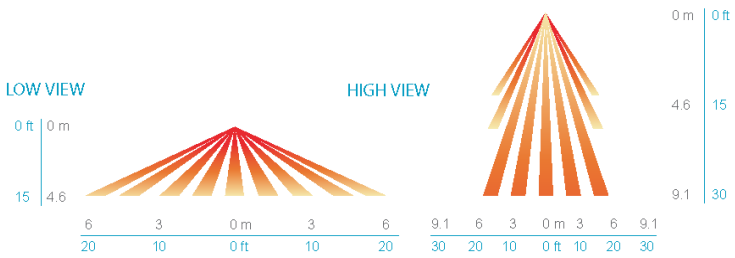
COVERAGE PATTERNS

SITE & AREA LIGHTING / HIGH MOUNT APPLICATIONS

The **SBGR 6 ODP** is intended for higher applications, between 15-30 ft, and provides a coverage area radius for walking motion of 15-20 ft.



Coverage Pattern of High Mount Lens Option (SBGR6 ODP)

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