Simple, Efficient, Low Maintenance Lighting for Hazardous Locations

Appleton™ Linmaster™ LED Series Luminaires

Technology and Application Guide.

EMERSON™

See the Future of Nonmetallic Linear Lighting in Hazardous Locations.

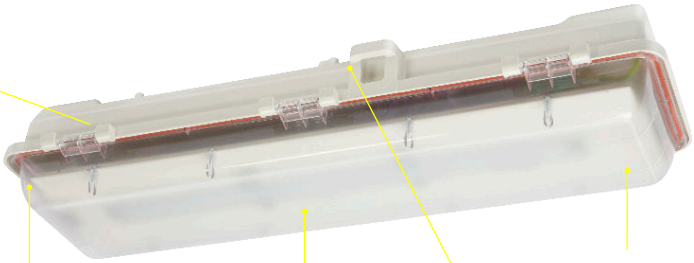
The luminaires you choose today will make the difference in plant safety, worker comfort and maintenance costs for years to come. Emerson™ lights your way forward with the Linmaster™ LED Series of linear luminaires for rugged Zone 1, 2, 21 and 22 applications.

Certified for use in IECEx and ATEX installations, these nonmetallic luminaires equal or exceed the lighting output, quality and distribution of our FE and FN Series fluorescent luminaires and FELED & FNLED linear non metallic luminaires, already the proven industry standard. Using the same footprint and mounting hardware as the FE and FN Series, with a wide range of lumen outputs that allow for an easy retrofit of any fluorescent installation, the Linmaster™ Series low profile design and functional simplicity suit practically any task or general purpose application requirement and mounting height.

For best-in-class corrosion resistance, durability and performance, look to the brand you trust. Appleton™ Linmaster™ Series luminaires, only from Emerson™.

The Simple Way To Light Your Way Forward

Linmaster™ Luminaires make it easy to replace existing fluorescent fixtures because they feature the same mounting dimensions and mounting accessories as original FE and FN fluorescent luminaires. Luminaires are available in light output from 2,500 to 7,000 lumens. In the rare event maintenance is needed, the cover can be quickly removed to access the internal components, while the specially designed hinged cover speeds up the process of replacing drivers, or other components.



Central lock opening with unique patented release system to prevent damage

Instant on, even in temperatures down to -40°C

Fiberglass reinforced polyester body lightweight, corrosion and impact resistant (IK10, the highest rating), IP66

Easy to retrofit with same mounting dimensions and mounting accessories as conventional fluorescent luminaires

Replaceable LED drivers extend luminaire life

Optional Emergency Exit Sign

Emergency version available for all models, 90min or 180min battery time field selection.

Diffused lens for even illumination, glare reduction and photobiological requirements

Central hex key opening with unique patented release system to prevent damage

Optional stainless steel safety cable can be attached through the cast secondary retention points in the housing for added safety

Easy To Specify

Linmaster™ LED luminaires are available in a wide range of lumen outputs to suit a variety of Zone 1, 21 and 22 task and general purpose lighting requirements. Compared to fluorescent luminaires, they deliver increased energy efficiency, lower maintenance costs and greater operational uptime. With the emergency option, the Linmaster™ Series provides assurance that your hazardous locations will be safely illuminated.

Easy To Install

For sites that already have non-metallic linear Zone 1, 2, 21 & 22 fluorescent installations, the Linmaster™ Series retrofits into the existing mounting hardware. Luminaires can be mounted vertically or horizontally, using pole, wall, ceiling, hinged or chain mount options. The terminal block provides ample working room, with screw type terminals for simple, secure wiring.

Easy To Maintain

Maintenance access requires only a hex key and straight blade screwdriver. The patented release mechanism and hinged cover are designed to ensure hassle-free maintenance and installation. The optional positive safety switch disconnects power to LED's and driver upon unlocking the cover to allow maintenance in hazardous locations. Our LEDs are rated for 102,000 hours of operation at +65 °C (+149 °F). Field-replaceable parts are available to extend performance even further.

The Illumination You Need, The Quality You Expect

Retrofitting Made Easy

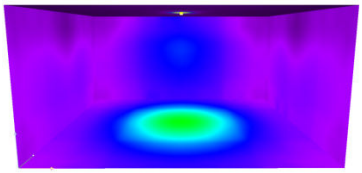
The Linmaster™ Series includes models that provide illuminance and lighting distribution comparable to our FE Series fluorescent luminaires, with additional models that offer even more application possibilities. Choose the diffused cover option for the greatest uniformity, least amount of glare, best vertical illumination and safest photobiological rating.

Light Distribution Comparison

The lighting simulation below compares three luminaires, each mounted at 4.5 m (15 ft) in a room with the dimensions 10m (32.8 ft) x 10m (32.8 ft) x 4.5m (15 ft).The photometric simulated color rendered images below demonstrate the seamless transition with either luminaire.

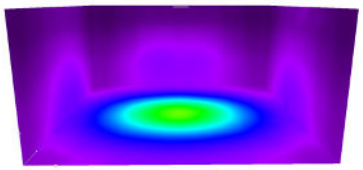
Fluorescent

FEB236BUSA

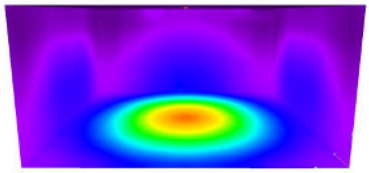


LED

LELED4CBUSAD



LELED5CBUSAD



The Linmaster™ Zone 1 Series Luminaires saves energy while maintaining equivalent required illuminance levels and uniformity to the FE Series Fluorescent Luminaires.

Lighting Performance

Luminaire	Size (Meters)	Size (Feet)	Power Consumption (Watts)	Light Output (Lumens)	Eav (Lux) Floor	Emin (Lux) Floor	Emax (Lux) Floor	Emin / Emax	Uniformity (u0) Emin/Eavg
FEB236BUSA	1.39	4.56	72	4423	25	12	50	0.24	0.48
LELED4CBUSAD	0.7	2.3	30	3710	25	9	55	0.16	0.36
LELED5CBUSAD	1.3	4.26	44	5398	36	14	79	0.17	0.39

The table below provides a cross reference between the FE Series Fluorescent Luminaires and the FELED Series Luminaires.

Fluorescent to LED Retrofit Guide

FE Series Fluorescent	Lamp Used	Lamp Output (Lumens)	System Efficiency	System Output (Lumens)	Effective LED Output Required for Replacement (Lumens)	Normalized Output (Lumens)	Linmaster™ Zone 1 Series	Linmaster™ Zone 1 Series (Lumens)
FEB218BUSA	2X 18 W	2400	85%	2040	1836	1800	LELED3CBUSAD	3219
FEB318BUSA	3X 18 W	3600	68%	2448	2203	2200	LELED3CBUSAD	3219
FEB136BUSA	1 X 36 W	2750	89%	2448	2203	2200	LELED3CBUSAD	3219
FEB236BUSA	2 X 36 W	5500	80%	4400	3960	4000	LELED4CBUSAD/ LELED5CBUSAD	3710/5398
FEB158BUSA	1 X 58 W	4325	87%	3763	3386	3300	LELED3CBUSAD/ LELED5CBUSAD	3219 /5398
FEB258BUSA	2 X 58 W	8650	77%	6661	5994	6000	LELED6CBUSAD	6097
FEB358BUSA	3 X 58 W	12975	66%	8564	7707	7500	LELED7CBUSAD	6961

Fluorescent To LED: The Smart Upgrade

Energy Savings
LED luminaires provide far greater lighting efficacy compared to traditional lighting sources, including fluorescent luminaires, the previous efficiency leader.

Maintenance Savings
Fluorescent lamps last an average of 13,000 hours, or 1.48 years, in continuous use. By contrast, LED luminaires are rated for >102,000 hours.

Safety
LED luminaires provide instant-on and cold-start capabilities without end-of-life degradation or premature failures due to frequent cycling, with a photobiological safety rating of RG0.

Energy Comparison

Compared to the FE Series fluorescent luminaires, the Linmaster™ Series saves energy costs per the below table:

FE Series Fluorescent to Linmaster™ Series Energy Comparison

FE Series Fluorescent	Lamp Used	Power Consumption (Watts)	Linmaster™ Series	Power Consumption (Watts)	% Energy Savings
FEB218BUSA	2 x 18 W	36	LELED3CBUSAD	26	30.56%
FEB318BUSA	3 x 18 W	54	LELED3CBUSAD	26	53.7%
FEB136BUSA	1 x 36 W	36	LELED3CBUSAD	26	30.56%
FEB236BUSA	2 x 36 W	72	LELED5CBUSAD	42	41.67%
FEB158BUSA	1 x 58 W	58	LELED5CBUSAD	42	27.60%
FEB258BUSA	2 x 58 W	116	LELED6CBUSAD	51	56.9%
FEB358BUSA	3 x 58 W	174	LELED7CBUSAD	57	68.4%

Dramatically Reduce Your Lighting Costs

When retrofitting a 2 lamp FEB236BUSA, you can achieve break even on your investment in approximately 8 months. When evaluating lighting systems, consider both the total system power consumption and the expected luminaire life, in order to evaluate energy and maintenance costs and savings.

5 Year Cumulative

Luminaire	Power Consumption (Watts)	Light Output (Lumens)	Yearly Energy Costs	Lamp Life (Hours)	Yearly Maintenance Costs	Yearly Total Costs	Yearly LED Savings	Yearly Savings Percentage
FEB236BUSA	72 W	4423	42 €	13,000	30 €	72 €	—	—
LELED5CBUSAD	44 W	5398	25 €	100,000	0 €	25 €	48 €	67%

Energy Costs =
Watts x 24 (hr / day) x 365 (days / yr) / 1000 (kWh / yr) x 0.2890 (Euro / kWh)
Maintenance Costs =
[{2 (fluorescent lamps) x 8 (euro each)} + 30 (euro for installation cost for one worker)] x 3 (replacements in 5 years) / 5 (years)
Labor cost =
50 euro / hour/worker

Walkways: Ensure Optimal and Uniform Light Dispersion

Use Appleton™ Linmaster™ in any application where you would have specified flameproof or increased safety linear fluorescent lighting in the past.

Walkway lighting is a common application in almost every industry. These heavily trafficked areas must be illuminated evenly and sufficiently to ensure safe passage, especially with regard to changes of direction, level, stairs or any obstructions that may be present. Vertical illumination is an important consideration in process areas that require monitoring of instrumentation. Walkway lighting must also be designed with adequate overhead clearance for safe passage of people and equipment. In the event of a power disruption, an emergency backup system provides for safe egress. Linmaster™ Series luminaires provide:

- A wide range of lumen outputs, meeting or exceeding the output of FE Series fluorescent luminaires
- Various mounting options to suit any walkway configuration and luminaire height
- A low profile design to maximize headroom even in confined spaces
- Rugged, corrosion resistant durability to withstand harsh onshore and offshore environments
- The emergency version is available for all models.

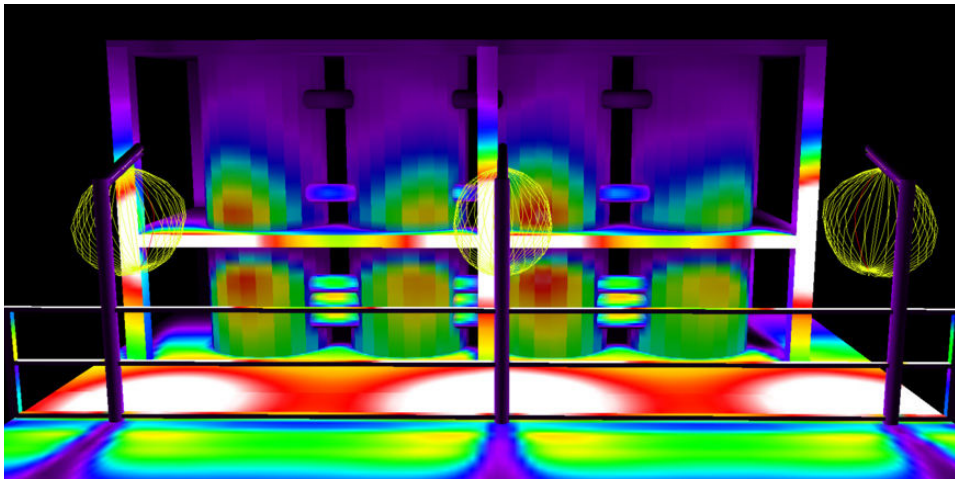
Walkway Application Simulation

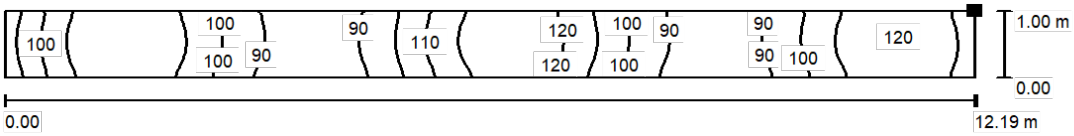
Linmaster™ Series luminaires provide similar or higher lumen output and greater lighting uniformity compared to FE Series fluorescent luminaires. In walkway applications, they offer the potential to achieve illumination targets with fewer luminaires, higher mounting heights or reduced wattage luminaires.

In the application simulation below, three LELED5CBUSAD luminaires provide sufficient illumination for the walkway with good uniformity and vertical illumination.

Single Linmaster™ Zone 1 Luminaire

Sample Application	Luminaire Height	Type Of Mount	Luminaire Spacing	Targeted Illumination
Walkway 1 m (3 ft) Wide	3 m (10 ft)	15° Pole Mount	5 m (16 ft)	50-75 Lux





Lighting Performance

Luminaire	Size (Meters)	Size (Feet)	Power Consumption (Watts)	Light Output (Lumens)	Eav (Lux) Floor	Emin (Lux) Floor	Emax (Lux) Floor	Emin / Emax
FEB236BUSA	1.39	4.56	72	4423	70	51	82	0.62
LELED5CBUSAD	1.3	4.26	44	5398	104	83	128	0.65

Optical Radiation and Photobiological Safety Requirements in Lighting

Photobiology is the study of the interaction of optical radiation with living organisms. Optical radiation, anotherterm for light, can be visible and invisible and is comprised of UV, IR and blue light emissions. It is strongly absorbedin tissue, with the skin and eyes of the human body most at risk of exposure. All visible light
(380 nm to 780 nm) can,in principle, only damage the eye by thermal or photochemical effects.

The purpose of photobiological safety standards is to protect users from the harmful effects caused by opticalradiations emitted by lighting devices. Within the European Union, the standards in the field of photobiologicalsafety are IEC / EN 62471 and the more recent Technical Report IEC / TR 62778. The American standard in the fieldof photobiological safety is ANSI IESNA RP 27. These standards define values for levels of risk ranging from RiskGroup Exempt (RG0) (lamp / LED does not pose any photobiological hazard) to Group 3 (high risk) (lamp / LED) may pose a hazard even for momentary or brief exposure). Appleton™ Linmaster™ diffused luminaires are rated RG0, Risk Group Exempt..

Area Illumination: Safe, Efficient Lighting

For proper illumination in extreme conditions, you need a lighting manufacturer who engineers their luminaires to ensure optimal light dispersion, creating more usable light.

Upgrading from our fluorescent to LED is seamless with a one-to-one installation retrofit.
Effective lighting is critical for worker safety and productivity; particularly when flammable gases, vapors and dusts are present. Midstream natural gas compressor stations are a prime example. Appleton™ Linmaster™ Series luminaires provide:

- Certification for use in Zone 1, 2, 21, and 21 hazardous locations
- Easy retrofitting to the FE fluorescent mounting hardware and footprint already in extensive use in these facilities
- A lumen output range suitable for everything from task, tunnel and walkway lighting to expansive spaces and higher mounting requirements
- A low profile that provides clearance in confined spaces and withstands high winds and jets of water in weather-exposed installations
- 100,000+ hours of operation with no lamps to change, minimizing maintenance costs and maximizing operational uptime

Compressor Room Application Simulation

Oil and gas facilities incorporate both expansive areas and confined spaces, requiring a wide range of lumen outputs and mounting options to provide optimum lighting in every workspace. Linmaster™ Series achieves these goals with a single luminaire that is easy to retrofit into the existing fluorescent footprint.

Compressor Room Comparison

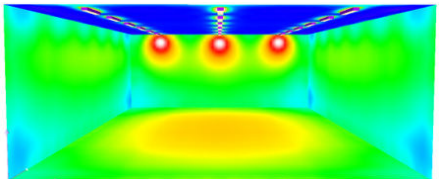
In the application simulation below, 18 symmetrically spaced luminaires were ceiling mounted at 3.5 meters (12 feet). The targeted illumination is 300 lux with maximum uniformity and minimum glare.

FE Fluorescent and Linmaster™ Zone 1, Single Luminaire

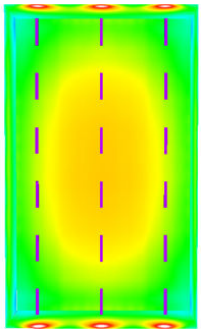
Sample Application	Luminaire Height	Type Of Mount	Luminaire Spacing	Targeted Illumination
15m x 9 m (50 ft x 30 ft)	3.5 m (12 ft)	Ceiling	18 Luminaires Symmetrically Spaced	300 Lux

Fluorescent

FEB236 Fluorescent



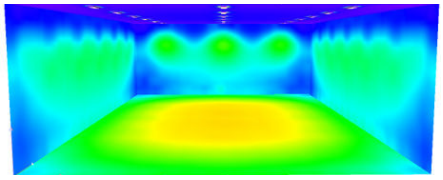
Side view



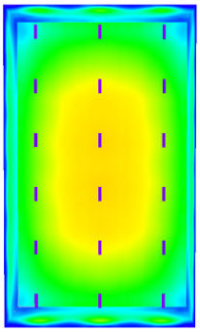
Top down view

LED

LELED4 (Diffused)

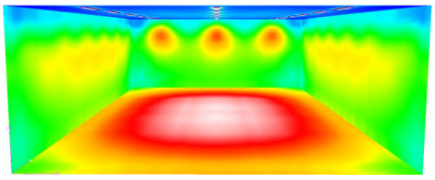


Side view

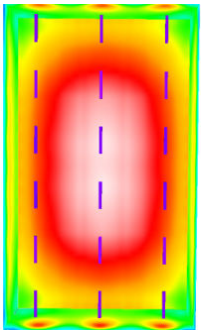


Top down view

LELED5 (Diffused)



Side view



Top down view

This simulation shows that the LELED4 diffused and LELED5 diffused provides a very similar light output, spread and uniformity to the FE Series fluorescent luminaires. In addition, glare was reduced with the diffused LED solutions. This provides two options depending on luminaire length requirements.

Lighting Performance

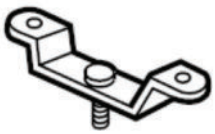
Luminaire	Size (Meters)	Size (Feet)	Power Consumption (Watts)	Light Output (Lumens)	Eav (Lux) Floor	Emin (Lux) Floor	Emax (Lux) Floor	Emin / Emax
FEB236BUSA	1.2	3.94	72	4431	327	236	388	0.72
LELED4CBUSAD	0.7	2.3	30	3710	308	210	365	0.68
LELED5CBUSAD	1.3	4.26	44	5398	446	298	536	0.67

Mounting Options

Easy To Retrofit

Appleton™ Linmaster™ Zone 1 Series luminaires use the same footprint and mounting accessories as our FE Series fluorescent luminaires. Mounting accessories are available in gray painted aluminum, zinc plated steel, galvanized steel and 316 stainless steel.

Mounting Hardware Available

Fixing Bracket for Surface Mounting	Brackets for Surface Mounting	M8 Ring Bolts	Half Clamp Brackets for Pole Mounting	Hinged Brackets for Adjusting the Luminaire
				
FEFBZ (Zinc Plated Steel)	FESBS (316 Stainless Steel)	FERBM8Z (Zinc Plated Steel)	FEHC49Z (42 mm - 49 mm; Zinc Plated Steel) FEHC49S (42 mm - 49 mm; 316 Stainless Steel) FEHC60Z (60 mm; Zinc Plated Steel) FEHC60S (60 mm; 316 Stainless Steel)	FEHBA (Aluminum) FEHBS (316 Stainless Steel)

Mounting Heights, Lumen Outputs and Lux ①

Luminaire	Lens	Mounting Height (Meters)	Max Lux on Ground	Vertical Throw in Meters (along length of luminaire)					Horizontal Throw in Meters (along width of luminaire)				
				2 Lux	5 Lux	10 Lux	25 Lux	50 Lux	2 Lux	5 Lux	10 Lux	25 Lux	50 Lux
LELED3CBUXXD	Diffused	10	10.0	11.5	7.5	-	-	-	10.0	5.5	-	-	-
LELED4CBUXXD			11.5	12.5	9.0	-	-	-	11.0	6.0	-	-	-
LELED5CBUXXD			16.5	14.0	10.0	5.0	-	-	12.5	8.0	5.0	-	-
LELED6CBUXXD			18.5	14.0	10.0	6.0	-	-	12.5	9.0	5.0	-	-
LELED7CBUXXD			21.0	15.0	11.0	8.0	-	-	14.0	10.0	6.0	-	-
LELED3CBUXXD	Diffused	5	40.0	8.0	6.5	4.5	2.0	-	7.5	6.0	5.0	2.5	-
LELED4CBUXXD			46.0	8.5	7.0	5.5	3.0	-	8.0	6.0	5.0	2.5	-
LELED5CBUXXD			66.0	9.5	7.5	6.0	4.0	2.0	9.5	7.5	6.0	3.0	2.0
LELED6CBUXXD			74.5	10.0	8.0	6.5	4.5	2.5	10.0	7.5	6.0	3.5	2.0
LELED7CBUXXD			85.0	11.0	8.0	7.0	5.0	3.0	11.0	8.0	6.5	4.0	2.5
LELED3CBUXXD	Diffused	3	110.5	7.0	5.0	4.5	3.5	2.0	6.5	5.0	4.0	3.0	2.0
LELED4CBUXXD			127.0	7.0	5.0	4.5	3.5	2.5	7.0	5.5	4.5	3.0	2.0
LELED5CBUXXD			183.0	7.5	6.0	5.0	4.0	3.0	7.5	6.0	4.5	3.5	2.5
LELED6CBUXXD			207.0	8.0	6.0	5.0	4.0	3.0	7.5	6.0	5.0	4.0	3.0
LELED7CBUXXD			237.0	8.5	6.5	5.5	4.5	3.5	8.0	6.5	5.5	4.5	3.0
LELED3CBUXXD	Diffused	2	249.0	5.5	4.5	3.5	3.0	2.5	5.5	4.5	3.5	2.5	2.0
LELED4CBUXXD			287.0	5.5	4.5	3.5	3.0	2.5	5.5	4.5	3.5	2.5	2.0
LELED5CBUXXD			413.0	6.0	5.0	4.0	3.0	2.5	6.0	5.0	4.0	3.0	2.5
LELED6CBUXXD			466.0	6.5	5.0	4.0	3.5	3.0	6.5	5.0	4.0	3.5	2.5
LELED7CBUXXD			532.0	7.0	5.5	4.5	3.5	3.0	6.5	6.5	4.5	3.5	3.0

① All values displayed reflect 5000K CCT.

Specifications

Product Specifications

Series Lumen Output	LELED3	LELED4	LELED5	LELED6	LELED7
Input Power (W, @230 V)	26	30	42	51	57
Equivalencies (W, Fluorescent)	3x18W	2x36W	3x36W	2x58W	3x58W
Nominal Lumens ❶	3219	3710	5398	6097	6961
Efficacy (up to, lm/W) ❶	124	124	129	120	122
Color Temperature (CCT) (K)	5000 / 4000 / 3000 / 2200				
Color Rendering Index (CRI)	≥80 CRI				
Voltage	100-277 Vac, 50/60 Hz; 125-300 Vdc; 24-48 Vdc as an option				
Surge Protection	6 kV Standard | 4 kV Emergency				
L70 Lifetime (hrs, reported)	> 102,000 hours at +25 °C (+77 °F)				
Ambient Temperature ❷	-40 °C to +60 °C or +65 °C (-40 °F to +140 °F or +149 °F)				
Temperature Code ❷	T4, T5, or T6				
Fixture Weight - kg (lbs)	5 (11)	5 (11)	7.6 (16.7)	7.6 (16.7)	7.6 (16.7)
Replaceable Parts	Drivers, Replacement Covers, Battery Pack, and Fuse Assembly				

❶ *Based on Type V optics, 5000K CCT, with diffused cover. Refer to catalog pages for detailed performance.*
❷ *Refer to catalog pages for detailed temperature tables/operating temperature based on lumen output/certification.*

ATEX and IECEx Certifications

- Certification Type: LELED
  - — Gas: Zones 1 and 2
  - – Conforming to ATEX 2014/34/EU: II 2 G
  - – Type of Protection: Ex eb mb IIC Gb
  - – Temperature Class: T4
  - — Dust: Zones 21 and 22
  - – Conforming to ATEX 2014/34/EU: II 2 D
  - – Type of Protection: Ex tb IIIC Db
  - —Standard Luminaire Ambient Temperature: -40 °C up to +65 °C (-40 °F up to +149 °F), refer to temperature codes table.
  - —Emergency Luminaire Ambient Temperature: -20 °C up to +60 °C (-4 °F up to +140 °F)
  - —ATEX Certificate: INERIS 24ATEX0001X
  - —IECEx Certificate: IIECEx INE 24.0001X)
- Standard and Emergency:
  - —Index of Protection according EN/IEC 60529: IP66 / 67 / 68.
  - —Impact Resistance (shock): IK10
  - —Photobiological Safety, IEC 62778 and IEC 62471: RG0

Catalog Numbering Guide

Series Prefix | Lumen Output | Color Temperature | Voltage | Mounting Version | Cable Entry | Optic | Emergency | Battery Pack | Cuttoff Switch

LELED			BU						

SERIES PREFIX:	
LELED	Zone 1, 2, 21, 22 ATEX/IECEx

LUMEN OUTPUT: ①	
3	3K
4	4K
5	5K
6	6K
7	7K

COLOR TEMPERATURE:	
C	5000K (Cool)
N	4000K (Neutral)
W	3000K (Warm)
H	2200K
V	Green (Safety Showers)

VOLTAGE:	
BU	120-277 Vac, 50/60 Hz; 125-300 Vdc
B2	24-48 Vdc ②

MOUNTING VERSION:	
S	Surface/Suspension Mount Standard Wiring (single phase)
L	Surface/Suspension Mount Dual Loop In/Out Through Wiring (single phase)

CABLE ENTRY:	
A	Armored M20 ③
U	Unarmored M20 ④
N	Unarmored M25 ④
R	Armored M25 ③

OPTIC:	
Blank	Clear
D	Diffused

EMERGENCY:	
Blank	No Emergency
R	90 minutes (non-maintained)
H	90 minutes (maintained)
E	180 minutes (maintained)

BATTERY PACK:	
Blank	Emergency Luminaire with Battery Pack
W	Emergency Luminaire without Battery Pack

CUTTOFF SWITCH:	
Blank	No Switch
F	Cutoff Switch ⑤

① *All lumen values are typical (tolerance +/- 10%).*
② *DC voltages can only be used with IECEx certified standard luminaires. Not available with ATEX certification.*
③ *Must order armored cable glands separately.*
④ *Cable glands provided in luminaires with unarmored hub entries.*
⑤ *Select to have cutoff switch with standard or emergency model.*

Maximize usable light enabling you to comfortably and safely work in harsh or hazardous environments.

APPLETON™

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