

**Lighting Mitigation Plan
 For**



Kerr McGee Oil & Gas Onshore LP

RAINBOW 24-9 HZ

Project Number: 21010-12

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1.0 EXECUTIVE SUMMARY

Kerr McGee Oil & Gas Onshore LP (KMOG) commissioned Samuel Engineering to develop a lighting mitigation plan for the Rainbow 24 - 9 HZ pad site. The purpose of this report is to demonstrate compliance with the various State and Local lighting regulations, predict lighting impacts for the different development phases, and to detail the various lighting mitigation techniques used to limit light pollution.

Specifically, the key points of the study are:

- Demonstrate compliance with Colorado Oil and Gas Conservation Commission (COGCC) Rule 424, Weld County Regulations, and the Greeley Municipal Code.
- Identify the light level impacts associated with each phase of the facility operations on surrounding buildings.
- Demonstrate compliance with the total lighting used based on site working surfaces.
- Demonstrate the various lighting mitigation techniques that were implemented.

Site specific three-dimensional lighting models were developed for each of the phases to determine their associated lighting impacts. The lighting fixtures used in the models were selected based on currently operated representative sites and research conducted into available vendor lighting systems.

The following Table 1.0 summarizes the calculated maximum values compared to the regulatory limits:

Calculated Lighting Values and Regulatory Limits Summary			
	Calculated Value	Regulatory Limit	Code Reference
Max. Light Impact on Surrounding Building	0.19 lux	≤ 4.0 lux	<i>COGCC 424.f</i>
Pre-Production – Drilling Phase (Lumens / Hardscape)	2.29 lm/ft ²	≤ 12 lm/ft ²	<i>Weld County Ordinance ORD2021-17 Table 405.B.1</i>
Pre-Production – Completions Phase (Lumens / Hardscape)	1.83 lm/ft ²	≤ 12 lm/ft ²	<i>Weld County Ordinance ORD2021-17 Table 405.B.1</i>
Production (Lumens / Hardscape)	0.08 lm/ft ²	≤ 1.25 lm/ft ²	<i>Weld County Sec 21-5-405 Table 405.C.1 for land use LZ-1 and COGCC Rule 424.d.(2) for Agricultural/Commercial</i>

Table 1.0 - Calculated Lighting Values and Regulatory Limits

All calculated values are within prescribed regulatory limits.

2.0 INTRODUCTION AND DEFINITION OF TECHNICAL TERMS

2.1 INTRODUCTION

Light mitigation plans seek to quantify and prescribe methods to address the negative effects of multiple forms of light pollution. Effective lighting mitigation plans address light pollution by limiting the impacts on the surrounding communities, preserving the overall night-sky aesthetics, and maintaining existing ecosystems, all while maintaining a safe work environment.

There are a number of standards, best practices, and regulations which are used as guidelines when developing lighting plans for reducing the negative effects of artificial lighting. The applicable regulations used for this report are COGCC Rule 424, Weld County Ordinance ORD2021-17, and Greeley Municipal Code Section 24-1102.

2.2 DEFINITION OF TECHNICAL TERMS

A number of technical terms are used throughout this report and, as an aid to the reader, are defined below.

Illuminance (lx)

Illuminance is defined as the amount of light falling on a surface area. It is measured in Lux (lx). One lux is equal to one lumen per square meter. As an example, the photo in Figure 2.2 shows the lux levels decreasing on the sidewalk, as the distance from the light source increases.

Illuminance is often associated with values for lighting levels for safe operation in various standard codes. In addition, photometric plans are used to predict the illuminance on surfaces of an area to provide minimum lighting levels and for mitigation of light trespass into adjoining properties or areas. Most lighting meter units used today are in lux and used to measure these values at a given distance. It should be noted that the measured value is dependent on angle, sensitivity, and optics.

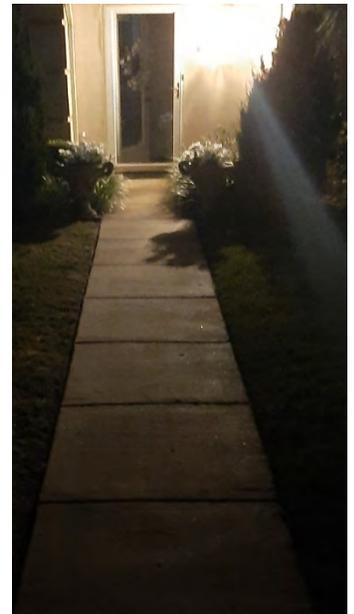


Figure 2.2—Illuminance (lx) level decreasing with distance from light source.

Table 2.2 below provides examples of typical Lux values.

Typical Lux Values	
Clear night, no moon:	0.002 lx
Clear night, full Moon:	0.27 to 1 lx
Family Living Room	50 lx
Sunrise/sunset	300-500 lx
Overcast day:	1000 lx
Daylight:	10,000-25,000 lx
Direct sunlight:	32,000-130,000 lx

Table 2.2 – Typical Lux Values

Luminous Flux(lm)

Luminous Flux is defined as the amount of light energy produced per unit time and is measured in Lumens (lm). It is a physical property of light and, in general terms, is a measurement of the total amount of light emanating from a source. It is important to note that the luminous flux value of a given source is independent of where a measurement is taken.

For example, a 60-watt light bulb produces approximately 800 lumens, regardless of if the measurement is taken at 1 foot, 10 miles, or 10,000 miles away from the source.

3.0 MODEL AND ANALYSIS DEVELOPMENT

Site-specific three-dimensional models were developed for each of the major project development phases. These phases being Pre-Production Drilling, Pre-Production Completions, and final Production. Elements incorporated into the models, among others, were the local site topographical information, major lighting obstructions (sound wall, large equipment, etc), individual luminaire lighting qualities, lighting mounting characteristics and surrounding building units.

The site geographical information was obtained using USGS topographical information to model the surrounding 1-mile landscape.

To determine the lighting impacts on local building units, 25-foot vertical walls were modeled at the units' locations, at the USGS identified elevations.

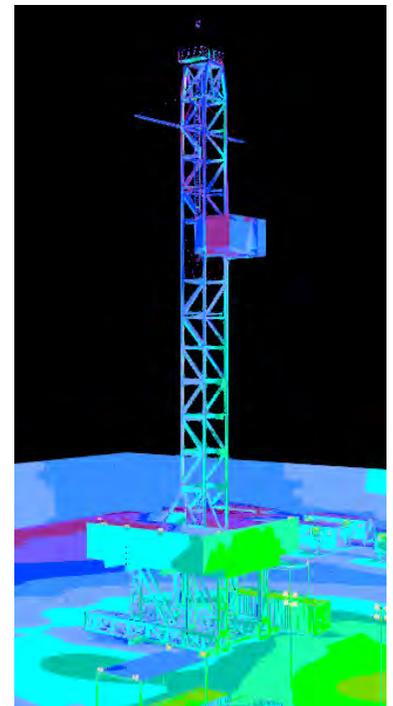


Figure 3.0–Screenshot from a representative 3-D model showing a false color rendering

Modeling of site-specific information (including large equipment, type of luminaire, and sound wall locations) were based on inspections of operational representative sites, provided vendor information, and research into various available lighting systems. The major pieces of equipment modeled included:

- Drilling: Drill rig floor, derrick, substructure, temporary lighting, sound barriers, backyard, and trailers.
- Completions: Temporary lighting, sound barriers, completion fleet equipment, and trailers.
- Production: LACT skids, separators, large tanks, and associated equipment.

Once site-specific topographical information and equipment were modeled, lighting characteristics were placed within the model. These characteristics were obtained from the various manufacturers and were specific to the make/model of the light to be used. The luminaires information included in the model were the type, quantity, mounting height, orientation, and tilt angle.

Models for each of the various project phases were developed in a similar manner and the resulting calculated lighting impacts were tabulated. An Excel spreadsheet was used to total the site lumens for each fixture and compared it to the site working pad surface (hardscape).

In the Pre-Production phases, temporary lighting fixtures were based on currently available rental units and on observations from representative sites. The temporary lighting system that will be used might vary based on rental availability at the time of procurement but is expected to be representative of the lumens values used in this analysis.

4.0 LIGHTING ANALYSIS RESULTS

4.1 CUMULATIVE LIGHTING IMPACTS

Applicable Code Reference: COGCC Rule 424.f:

“Operators will develop site lighting to reduce cumulative nighttime light intensity from all Oil and Gas Facilities to 4 lux at any Residential Building Unit or High Occupancy Building Unit within 1 mile of any Oil and Gas Facility, measured at 5.5 feet above grade in a direct line of sight to the brightest light fixture onsite.”

Due to the large number of buildings units located within the 1-mile radius of the site, buildings were grouped into clusters and a representative "wall" location was selected for analysis. These analyzed "wall" locations were selected to determine an upper cumulative light impact limit for that clustered group, considering the local topography, orientation, and distance to the site.

Figure 4.1 shows the building units that are located within a 1-mile radius of the Rainbow 24 - 9 HZ site.



Figure 4.1 – Building Units Within a 1-Mile Radius of Rainbow 24 - 9 HZ

Calculated Lighting Impact Results Building Units				
Location Unit No.	Pre-Production Drilling	Pre-Production Completions	Production	Regulatory Limit
1	< 0.1 lux	< 0.1 lux	< 0.1 lux	4 lux
2	0.1 lux	0.12 lux	< 0.1 lux	4 lux
3	0.11 lux	< 0.1 lux	< 0.1 lux	4 lux
4	< 0.1 lux	< 0.1 lux	< 0.1 lux	4 lux
5	< 0.1 lux	< 0.1 lux	< 0.1 lux	4 lux
6	< 0.1 lux	< 0.1 lux	< 0.1 lux	4 lux
7	< 0.1 lux	< 0.1 lux	< 0.1 lux	4 lux
8	0.19 lux	0.17 lux	< 0.1 lux	4 lux
9	< 0.1 lux	< 0.1 lux	< 0.1 lux	4 lux
10	< 0.1 lux	< 0.1 lux	< 0.1 lux	4 lux
11	< 0.1 lux	< 0.1 lux	< 0.1 lux	4 lux
12	< 0.1 lux	< 0.1 lux	< 0.1 lux	4 lux
13	< 0.1 lux	0.12 lux	< 0.1 lux	4 lux
14	< 0.1 lux	< 0.1 lux	< 0.1 lux	4 lux
15	< 0.1 lux	< 0.1 lux	< 0.1 lux	4 lux
16	< 0.1 lux	< 0.1 lux	< 0.1 lux	4 lux
17	< 0.1 lux	< 0.1 lux	< 0.1 lux	4 lux

Table 4.1 – Calculated Lighting Impact Results Building Units

Table 4.1 demonstrates compliance with COGCC Rule 424.f.

4.2 HARDSCAPE AND LUMEN LEVEL RESULTS

Applicable Code Reference: Weld County Ordinance ORD2021-17 Table 405 B.1 (B)
 Construction base allowance for lighting is stated as 12.0 lumens per square foot of hardscape.

Lumens per Hardscape calculations were performed based on the number of exterior fixtures light output (lumens) and the working pad surface (hardscape). These values were then compared to the regulatory allowed site lumens per square foot to demonstrate compliance.

4.2.1 PRE-PRODUCTION DRILLING LUMENS PER HARDSCAPE COMPLIANCE

Pre-Production Drilling Lighting Compliance		
	Calculated Value	Notes
Site Hardscape Area:	486,130 ft ²	Not to Exceed 12 Acres (ORD2021-17)
Site Hardscape Acres:	11.16 Acres	Not to Exceed 12 Acres (ORD2021-17)
Site Total Lumens:	1,113,558 lm	See Section 5.2
Site Allowance Initial Lumens Total:	5,833,555 lm	
Calculated Site (Lumens / ft ²):	2.29 lm/(ft ²)	Construction Site is Verified
Regulatory Allowed Limit:	12.0 lm/(ft ²)	Per Weld County Ordinance ORD2021-17 Table 405 B.1

Table 4.2.1 –Pre-Production Drilling Operation Compliance Calculation

Based on the calculation shown in Table 4.2.1, the estimated site lighting during the Pre-Production Drilling operation phase is less than the regulatory maximum value and is in compliance with Weld County Ordinance ORD2021-17.

4.2.2 PRE-PRODUCTION COMPLETIONS LUMENS PER HARDSCAPE COMPLIANCE

Pre-Production Completions Lighting Compliance		
	Calculated Value	Notes
Site Hardscape Area:	486,130 ft ²	Not to Exceed 12 Acres (ORD2021-17)
Site Hardscape Acres:	11.16 Acres	Not to Exceed 12 Acres (ORD2021-17)
Site Total Lumens:	1,113,558 lm	See Section 5.5
Site Allowance Initial Lumens Total:	5,833,555 lm	
Calculated Site (Lumens / ft ²):	1.83 lm/(ft ²)	Construction Site is Verified
Regulatory Allowed Limit:	12.0 lm/(ft ²)	Per Weld County Ordinance ORD2021-17 Table 405 B.1

Table 4.2.2 –Pre-Production Completions Operation Compliance Calculation

Based on the calculation shown in Table 4.2.2, the estimated site lighting during the Pre-Production Completions operation phase is less than the regulatory maximum value and is in compliance with Weld County Ordinance ORD2021-17.

4.2.3 PRODUCTION LUMENS PER HARDSCAPE COMPLIANCE

Production Lighting Compliance		
	Calculated Value	Notes
Site Hardscape Area:	182,516 ft ²	
Site Hardscape Acres:	4.19 Acres	
Site Total Lumens:	15,480 lm	See Section 5.6
Planning Zone for Weld County:	LZ-1	Near-Urban based on Weld County Appendix 21-B. Per Weld County Sec. 21-5-405.C.1.a, Planning Zone is directed to be LZ-1
Calculated Site Value:	0.08 lm/(ft ²)	Production Site is Verified
Regulatory Allowed Limit:	1.25 lm/(ft ²)	Weld County Sec. 21-5-405 Table 405.C.1 & COGCC Rule 424.d.(2)

Table 4.2.3 –Pre-Production / Construction Completions Operation Compliance Calculation

Based on the calculation shown in Table 4.2.3, the estimated site lighting during the Production operation phase is less than the regulatory maximum value and in compliance with Weld County Ordinance ORD2021-17 and COGCC Rule 424.d.(2) for Commercial/Agricultural.

5.0 SITE LIGHTING POSITIONS AND ORIENTATION

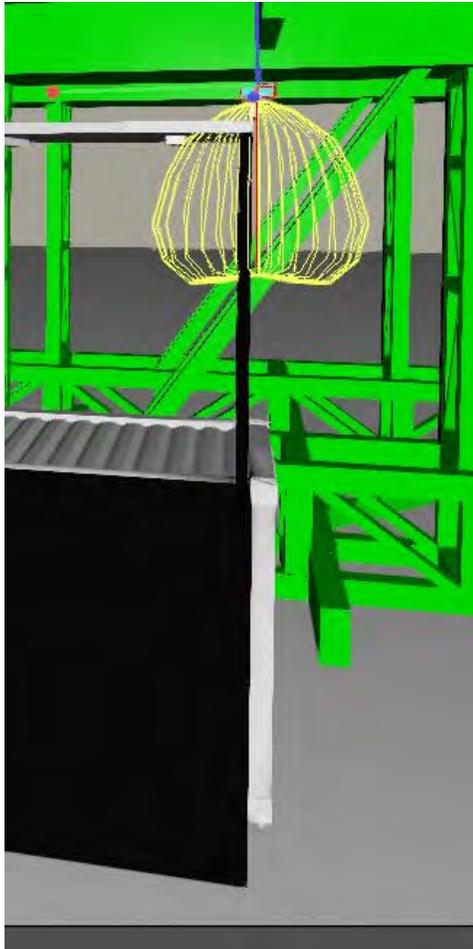
5.1 SITE LIGHTING NOTES

Applicable Code Reference: COGCC Rule 424(a)(2)(A)(ii)

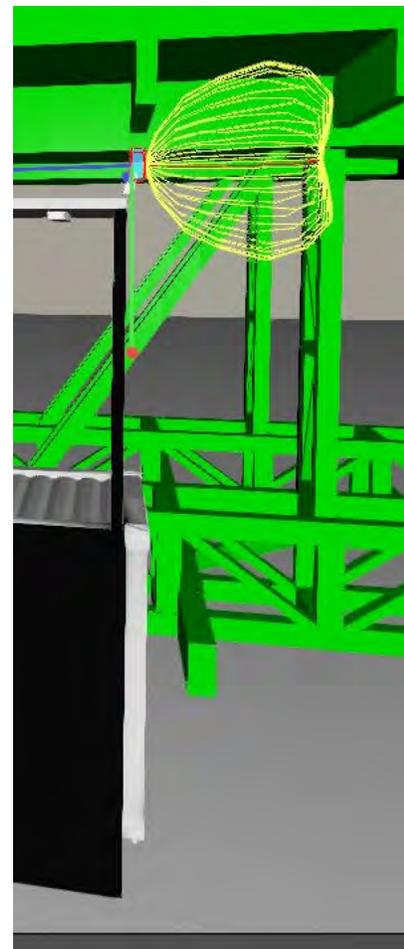
Pertaining to Pre-Production activities: *“The proposed anticipated location, mounting, height, and orientation of all outdoor lighting fixtures on the site during pre-production activities”*

The following figures and tables in this section show the lighting location, mounting, height, and orientations for the Pre-Production Drilling, Completions, and Production Operations, in accordance with COGCC Rule 424(a)(2)(A)(ii). The following notes apply:

- 1) Stated tilt at zero (0) degrees represents a luminaire facing directly downward.



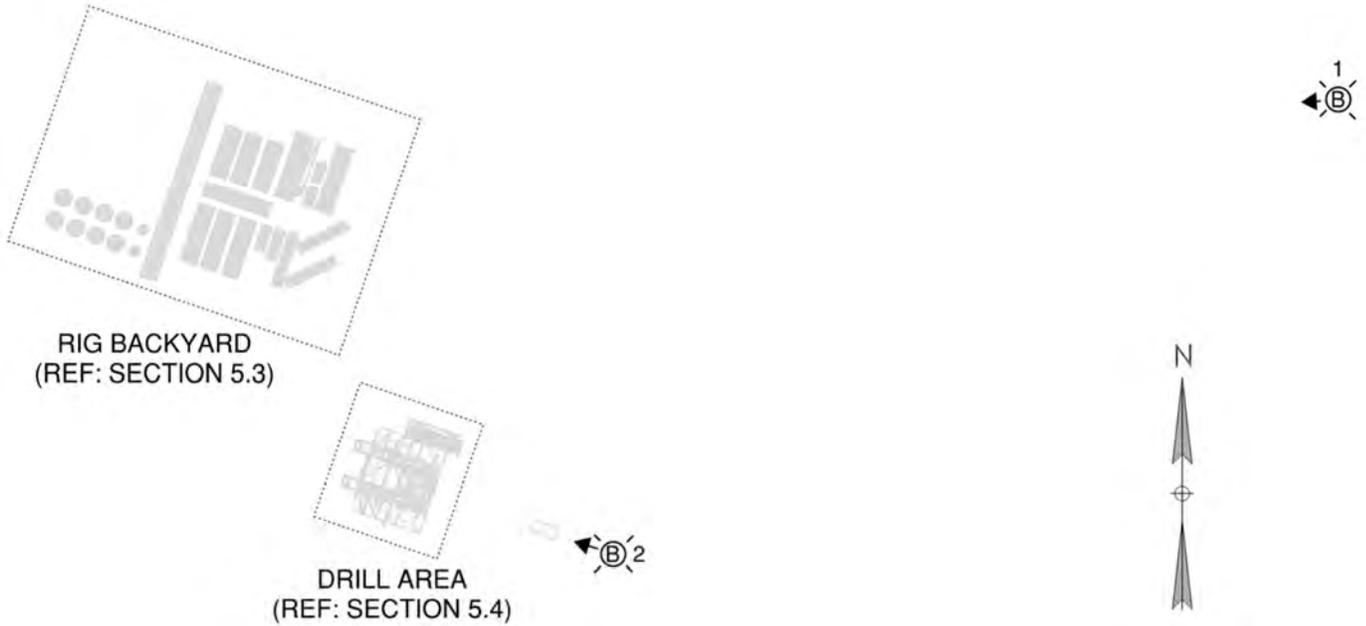
Example 0 degrees



Example 90 degrees

- 2) Intermittent sources of lights such as glow from on-site combustor and alarm lights are not included in this analysis.
- 3) Temporary lighting where necessary for safety reasons per COGCC 424.a.2.A.iii have not been modeled or accounted for in this analysis.
- 4) The quantity of lights and calculated values shown represents an estimated upper limit to the actual values that will be present on-site.
- 5) Refer to Attachment A for further lighting fixture information.

5.2 PRE-PRODUCTION - DRILLING SITE LAYOUT AND LUMINAIRE SCHEDULE

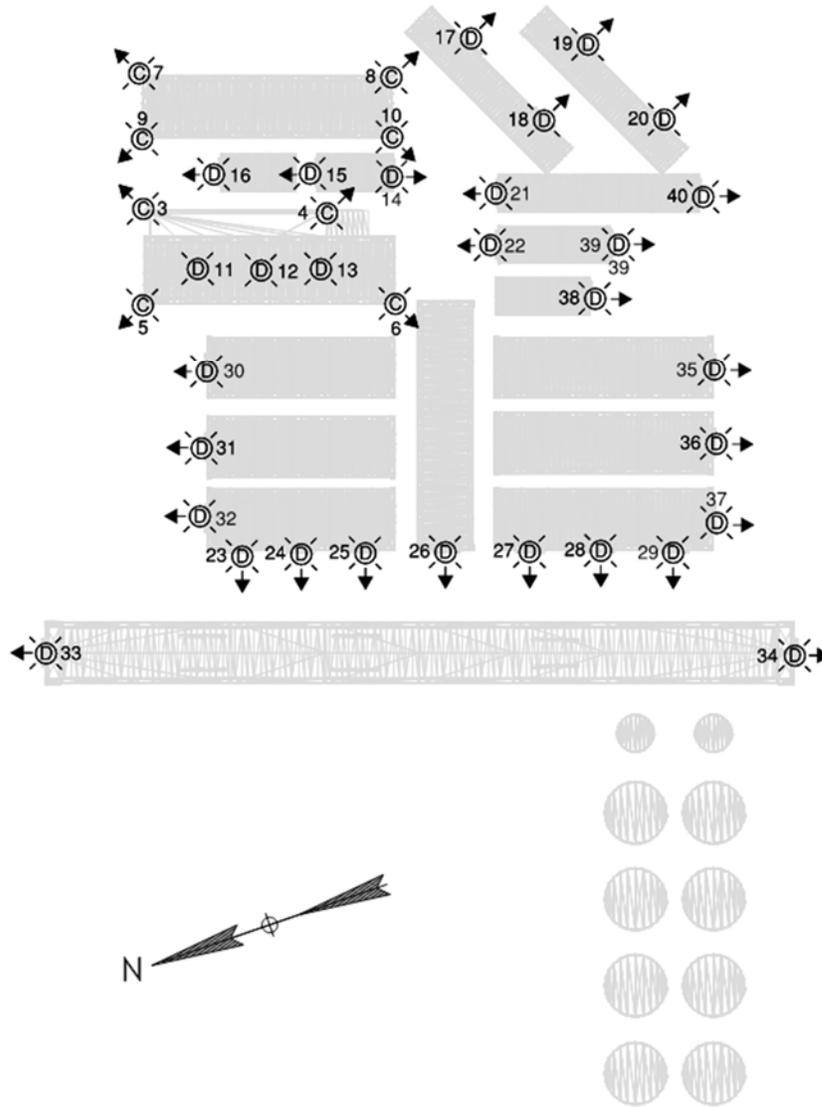


LUMINAIRE LAYOUT
 RAINBOW 24 - 9 HZ – OVERALL PRE-PRODUCTION
 DRILLING OPERATIONS

Luminaire Schedule					
Luminaire Type	Manufacturer	Model Number	Description	Power (Watts)	Luminous Flux (Φ)
B	HPWINNER	M8B-VCA-63	LED - TEMP. LIGHTING SYSTEM	960 W	121,920 lm

Luminaire Position and Tilt				
Luminaire No.	Mounting Height (ft)	Tilt (Degrees)	Luminaire Type	Luminous Flux (Φ)
1	30'	75°	B	121,920 lm
2	30'	75°	B	121,920 lm
Total Lumens Calculation				
Subtotal Area Calculation:				243,840 lm
Total Section 5.3 Lumens:				429,728 lm
Total Section 5.4 Lumens:				439,990 lm
Total Area Lumens:				1,113,558 lm

5.3 PRE-PRODUCTION - DRILLING –RIG BACKYARD- SITE LAYOUT AND LUMINAIRE SCHEDULE

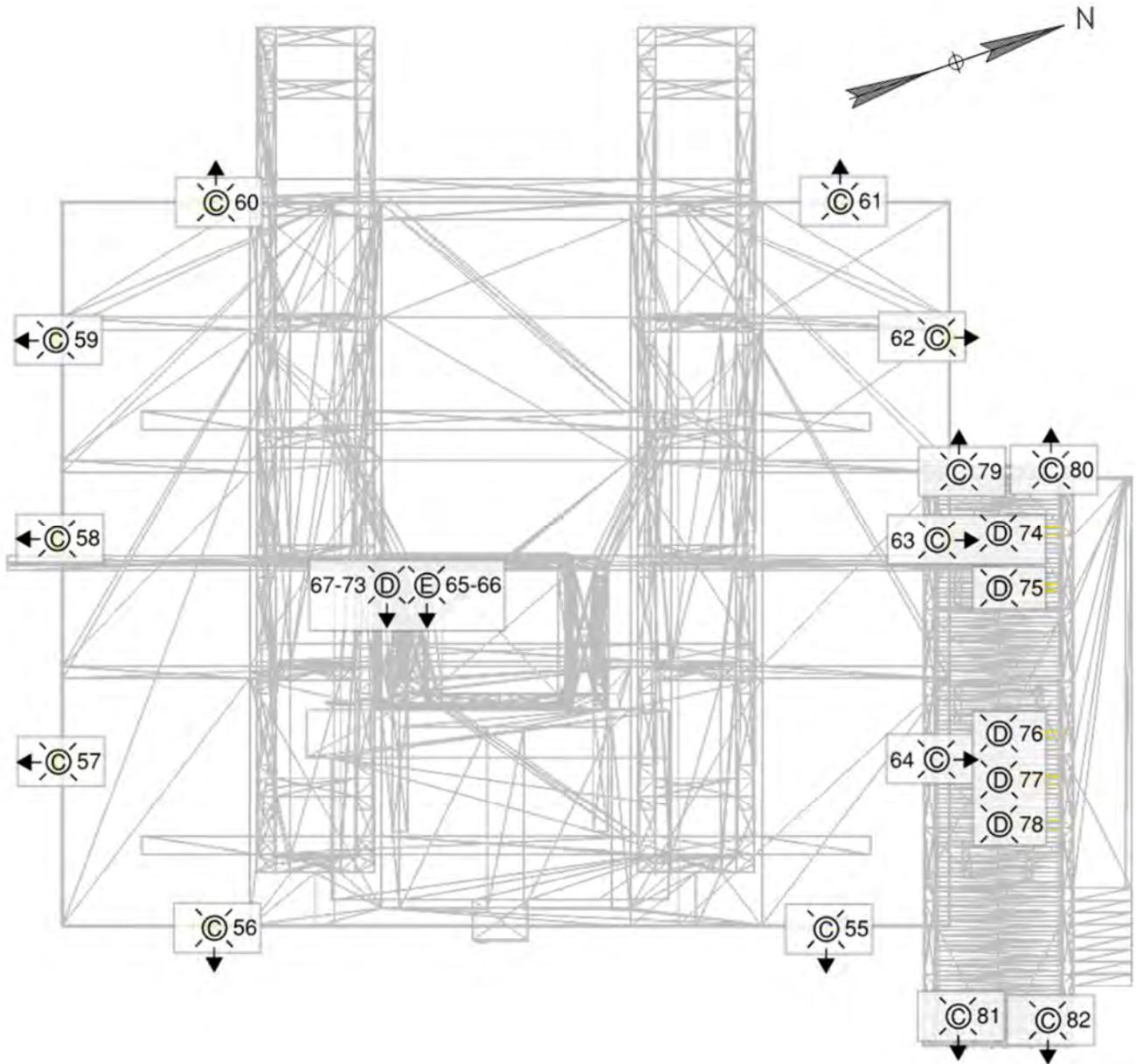


LUMINAIRE LAYOUT
 RAINBOW 24 - 9 HZ – RIG BACKYARD
 DRILLING OPERATIONS

Luminaire Schedule					
Luminaire Type	Manufacturer	Model Number	Description	Power (Watts)	Luminous Flux (Φ)
C	EATON – COOPER CROUSE HINDS	DFLMYM400	HID – HAZ. AREA CLEAR CLASS	400 W	24,091 lm
D	EATON – COOPER CROUSE HINDS	DLL4/UNV1S903D	LED – 4FT LINEAR POLYCARBONATE	63 W	7,900 lm

Luminaire Position and Tilt				
Luminaire No.	Mounting Height (ft)	Tilt (Degrees)	Luminaire Type	Luminous Flux (Φ)
3	21'	75°	C	24091 lm
4	21'	75°	C	24091 lm
5	21'	75°	C	24091 lm
6	21'	75°	C	24091 lm
7	21'	75°	C	24091 lm
8	21'	75°	C	24091 lm
9	21'	75°	C	24091 lm
10	21'	75°	C	24091 lm
11	20'	0°	D	7900 lm
12	20'	0°	D	7900 lm
13	20'	0°	D	7900 lm
14	9'	75°	D	7900 lm
15	9'	75°	D	7900 lm
16	9'	75°	D	7900 lm
17	9'	75°	D	7900 lm
18	9'	75°	D	7900 lm
19	9'	75°	D	7900 lm
20	9'	75°	D	7900 lm
21	9'	75°	D	7900 lm
22	9'	75°	D	7900 lm
23	9'	75°	D	7900 lm
24	9'	75°	D	7900 lm
25	9'	75°	D	7900 lm
26	9'	75°	D	7900 lm
27	9'	75°	D	7900 lm
28	9'	75°	D	7900 lm
29	9'	75°	D	7900 lm
30	9'	75°	D	7900 lm
31	9'	75°	D	7900 lm
32	9'	75°	D	7900 lm
33	9'	75°	D	7900 lm
34	9'	75°	D	7900 lm
35	9'	75°	D	7900 lm
36	9'	75°	D	7900 lm
37	9'	75°	D	7900 lm
38	9'	75°	D	7900 lm
39	9'	75°	D	7900 lm
40	9'	75°	D	7900 lm
Subtotal Lumens Calculation Section 5.3				
Subtotal Area Lumens:				429,728 lm

5.4 PRE-PRODUCTION - DRILLING –DRILL AREA - SITE LAYOUT AND LUMINAIRE SCHEDULE



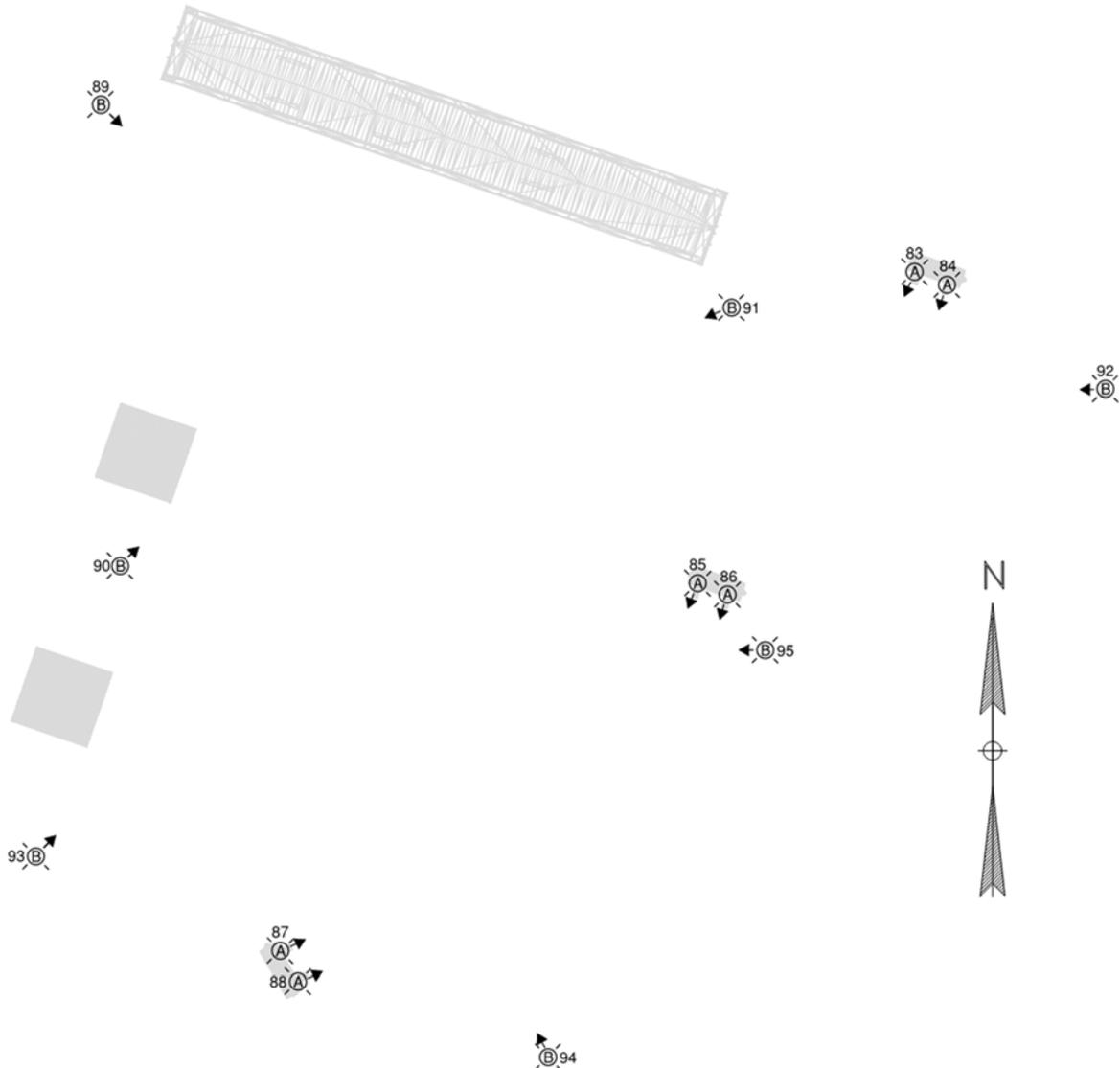
LUMINAIRE LAYOUT
RAINBOW 24 - 9 HZ – DRILL AREA
DRILLING OPERATIONS

Luminaire Schedule					
Luminaire Type	Manufacturer	Model Number	Description	Power (Watts)	Luminous Flux (Φ)
C	EATON – COOPER CROUSE HINDS	DFLMYM400	HID – HAZ. AREA CLEAR CLASS	400 W	24,091lm
D	EATON – COOPER CROUSE HINDS	DLL4/UNV1S903D	LED – 4FT LINEAR POLYCARBONATE	63 W	7,900 lm
E	EATON – COOPER CROUSE HINDS	DLL2/UNV1S903D	LED – 2FT LINEAR POLYCARBONATE	32 W	3,958 lm

Luminaire Position and Tilt				
Luminaire No.	Mounting Height (ft)	Tilt (Degrees)	Luminaire Type	Luminous Flux (Φ)
55	36'	75°	C	24091 lm
56	36'	75°	C	24091 lm
57	36'	75°	C	24091 lm
58	36'	75°	C	24091 lm
59	36'	75°	C	24091 lm
60	36'	75°	C	24091 lm
61	36'	75°	C	24091 lm
62	36'	75°	C	24091 lm
63	36'	75°	C	24091 lm
64	36'	75°	C	24091 lm
65	41'	90°	E	3958 lm
66	167'	90°	E	3958 lm
67	53'	90°	D	7900 lm
68	61'	90°	D	7900 lm
69	73'	90°	D	7900 lm
70	82'	90°	D	7900 lm
71	92'	90°	D	7900 lm
72	149'	90°	D	7900 lm
73	158'	90°	D	7900 lm
74	19'	0°	D	7900 lm
75	19'	0°	D	7900 lm
76	19'	0°	D	7900 lm
77	19'	0°	D	7900 lm
78	19'	0°	D	7900 lm
79	20'	75°	C	24091 lm

Luminaire Position and Tilt <i>Continued</i>				
Luminaire No.	Mounting		Luminaire Type	Luminous Flux (Φ)
	Height (ft)	Tilt (Degrees)		
80	20'	75°	C	24091 lm
81	20'	75°	C	24091 lm
82	20'	75°	C	24091 lm
Subtotal Lumens Calculation Section 5.4				
Subtotal Area Lumens:				439,990 lm

5.5 PRE-PRODUCTION - COMPLETIONS - SITE LAYOUT AND LUMINAIRE SCHEDULE

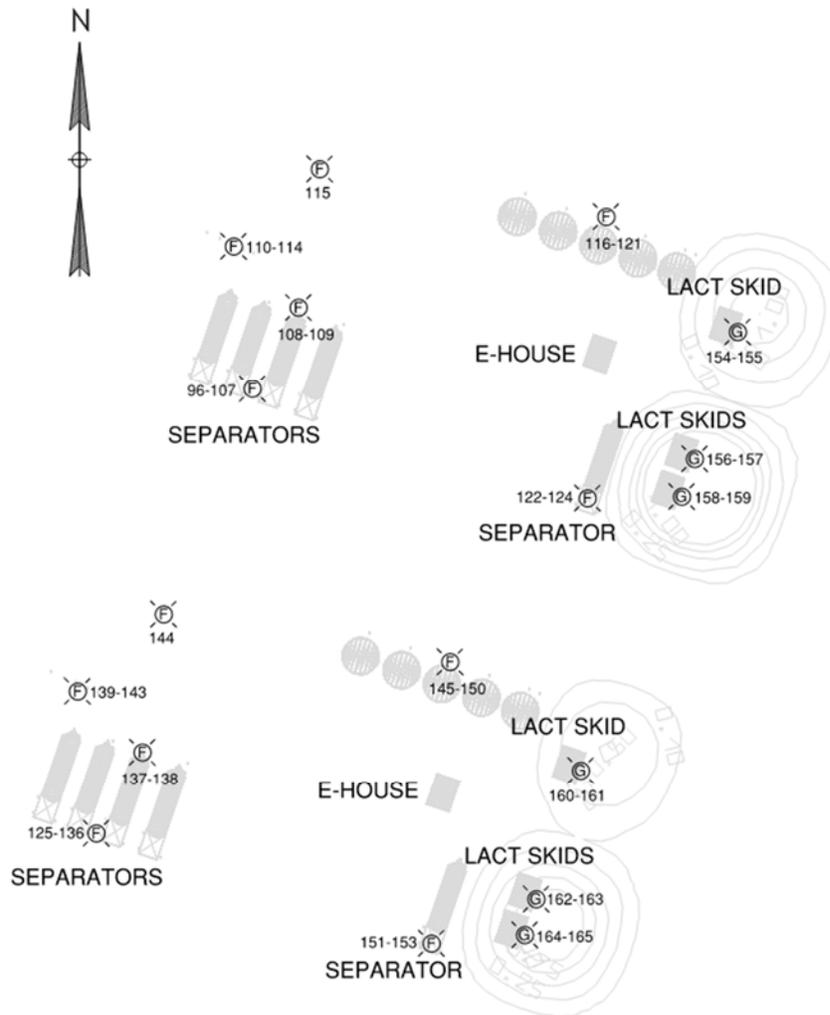


LUMINAIRE LAYOUT
 RAINBOW 24 - 9 HZ – COMPLETIONS AREA
 COMPLETIONS OPERATIONS

Luminaire Schedule					
Luminaire Type	Manufacturer	Model Number	Description	Power (Watts)	Luminous Flux (Φ)
A	STANPRO	WPS	LED –WALL PACK	40 W	5,800 lm
B	HPWINNER	M8B-VCA-63	LED - TEMP. LIGHTING SYSTEM	960 W	121,920 lm

Luminaire Position and Tilt				
Luminaire No.	Mounting		Luminaire Type	Luminous Flux (Φ)
	Height (ft)	Tilt (Degrees)		
83	11'	0°	A	5800 lm
84	11'	0°	A	5800 lm
85	11'	0°	A	5800 lm
86	11'	0°	A	5800 lm
87	11'	0°	A	5800 lm
88	11'	0°	A	5800 lm
89	30'	75°	B	121920 lm
90	30'	75°	B	121920 lm
91	30'	75°	B	121920 lm
92	30'	75°	B	121920 lm
93	30'	75°	B	121920 lm
94	30'	75°	B	121920 lm
95	30'	75°	B	121920 lm
Total Lumens Calculation				
Total Area Lumens:				888,240 lm

5.6 PRODUCTION - SITE LAYOUT, LUMINAIRE SCHEDULE, AND PHOTOMETRIC



NOTE: ISOMETRIC VALUES ARE IN FOOT-CANDLES (FC).

LUMINAIRE LAYOUT & PHOTOMETRIC
 RAINBOW 24 - 9 HZ – PRODUCTION AREA
 PRODUCTION OPERATIONS

Luminaire Schedule					
Luminaire Type	Manufacturer	Model Number	Description	Power (Watts)	Luminous Flux (Φ)
F	RAYCHEM	E-100	LED HEAT TRACE END SEAL KIT	2 W	60 lm
G	PHOENIX	CL-13LED-120-240	LED CUBE LIGHT	13 W	1000 lm

Luminaire Position and Tilt				
Luminaire No.	Mounting Height (ft)	Tilt (Degrees)	Luminaire Type	Luminous Flux (Φ)
96	5'	180°	F	60 lm
97	5'	180°	F	60 lm
98	5'	180°	F	60 lm
99	5'	180°	F	60 lm
100	5'	180°	F	60 lm
101	5'	180°	F	60 lm
102	5'	180°	F	60 lm
103	5'	180°	F	60 lm
104	5'	180°	F	60 lm
105	5'	180°	F	60 lm
106	5'	180°	F	60 lm
107	5'	180°	F	60 lm
108	5'	180°	F	60 lm
109	5'	180°	F	60 lm
110	5'	180°	F	60 lm
111	5'	180°	F	60 lm
112	5'	180°	F	60 lm
113	5'	180°	F	60 lm
114	5'	180°	F	60 lm
115	5'	180°	F	60 lm
116	5'	180°	F	60 lm
117	5'	180°	F	60 lm
118	5'	180°	F	60 lm
119	5'	180°	F	60 lm
120	5'	180°	F	60 lm
121	5'	180°	F	60 lm
122	5'	180°	F	60 lm
123	5'	180°	F	60 lm
124	5'	180°	F	60 lm
125	5'	180°	F	60 lm
126	5'	180°	F	60 lm
127	5'	180°	F	60 lm
128	5'	180°	F	60 lm
129	5'	180°	F	60 lm
130	5'	180°	F	60 lm
131	5'	180°	F	60 lm
132	5'	180°	F	60 lm
133	5'	180°	F	60 lm
134	5'	180°	F	60 lm
135	5'	180°	F	60 lm

Luminaire Position and Tilt				
Luminaire No.	Mounting Height (ft)	Tilt (Degrees)	Luminaire Type	Luminous Flux (Φ)
136	5'	180°	F	60 lm
137	5'	180°	F	60 lm
138	5'	180°	F	60 lm
139	5'	180°	F	60 lm
140	5'	180°	F	60 lm
141	5'	180°	F	60 lm
142	5'	180°	F	60 lm
143	5'	180°	F	60 lm
144	5'	180°	F	60 lm
145	5'	180°	F	60 lm
146	5'	180°	F	60 lm
147	5'	180°	F	60 lm
148	5'	180°	F	60 lm
149	5'	180°	F	60 lm
150	5'	180°	F	60 lm
151	5'	180°	F	60 lm
152	5'	180°	F	60 lm
153	5'	180°	F	60 lm
154	8'	0°	G	1000 lm
155	8'	0°	G	1000 lm
156	8'	0°	G	1000 lm
157	8'	0°	G	1000 lm
158	8'	0°	G	1000 lm
159	8'	0°	G	1000 lm
160	8'	0°	G	1000 lm
161	8'	0°	G	1000 lm
162	8'	0°	G	1000 lm
163	8'	0°	G	1000 lm
164	8'	0°	G	1000 lm
165	8'	0°	G	1000 lm
Total Lumens Calculation				
Total Area Lumens:				15,480 lm

6.0 SITE MITIGATION NOTES AND BEST MANAGEMENT PRACTICES

Construction Phase:

- KMOG will only conduct day light operation and there will be no nighttime operations that require lighting.

Drilling Phase:

- KMOG will utilize LED fixtures to reduce skyglow.
- KMOG will position all lights to point in a downward direction where vertical lighting is not required. Where it is required, lights are angled in a vertical direction to provide task lighting for safety and operations involving personnel.
- Derrick mast in Section 5.4 is facing horizontally to provide adequate lighting for safe operation.
- Lighting is angled away from surrounding off site buildings.
- Lighting within the Drilling area has been reduced to provide a minimum acceptable value for safe operation.
- Light masts are automatically switched off/on based on lighting sensors.
- Lights are switched off when not required.
- Low power (63 W) LED lights are used for the drill rig.
- In the event of a lightning complaint, KMOG will address the complaint and work with all parties involved to ensure the complaint is resolved.

Completions and Flowback Phases:

- KMOG will utilize LED fixtures to reduce skyglow.
- KMOG will position all lights to point in a downward direction where vertical lighting is not required. Where it is required, lights are angled in a vertical direction to provide task lighting for safety and operations involving personnel.
- Lighting is angled away from surrounding off site buildings.
- Lighting within the Completion and Flowback areas have been reduced to provide a minimum acceptable value for safe operation.
- Light masts are automatically switched off/on based on lighting sensors.
- Lights are switched off when not required.
- Lights are directed to task areas only.
- In the event of a lightning complaint, KMOG will address the complaint and work with all parties involved to ensure the complaint is resolved.

Production Phase:

- KMOG will utilize LED fixtures to reduce skyglow.
- KMOG will position all lights to point in a downward direction.
- Lighting within the Production areas have been reduced to provide a minimum acceptable value for safe operation.
- In the event of a lighting complaint, KMOG will address the complaint and work with all parties involved to ensure the complaint is resolved.

1) Lighting Cut Sheet Notes for Attachment A

1. Type A Fixtures (Pre-Production Phase)

- Type A fixtures are construction trailer lights. These units vary significantly depending on supplier, rental agency, inventory, and current market available

fixtures. Lights varied significantly during site inspections. A representative model was selected based on a lumen output for a trailer.

2. Type B Fixtures (Pre-Production Phase)
 - Type B fixtures are portable construction light towers with vertical masts. These units vary significantly depending on supplier, rental agency, inventory, and current market available fixtures. HP Winner M8B Model was selected for this analysis based on site inspections and current available units; however specific site units may vary based on time of construction. The model for these portable light towers consisted of a LED light source with 4 fixtures. Each of these fixtures were comprised of 4 LED modules mounted in a rectangular arrangement. The attached cut sheet for HP Winner represents 1 LED module. 16 total modules were modeled for each light mast.
 - The typical light pole center of fixtures is raised approximately 30 feet from grade and pointed downward toward work area.
 - The fixture mounting for portable light towers are articulated mountings which allows for both vertical and horizontal plane adjustments. For this analysis, the light mast fixtures were modeled at indicated angles.
3. Type C Fixtures (Pre-Production Phase) are representative of current fixtures used during drilling operations.
4. Type D Fixtures (Pre-Production Phase) are representative of current fixtures used during drilling operations.
5. Type E Fixtures (Pre-Production Phase) are representative of current fixtures used during drilling operations.
6. Type F Fixtures (Production Phase)
 - Type F Fixtures is an estimation of heat trace end kits. Photometric data from the manufacturer is not available. These lights are low power LED's mounted on the pipe where heat trace is installed. Mounting height, and location vary based on final design and installation.
7. Type G Fixtures (Production Phase) are representative of current fixtures used for LACT skids and mounted near the doors to the skids.

7.0 ATTACHMENT

Attachment A – 21010 Rainbow 24 - 9 HZ Lighting Fixture Cut Sheets Attachment

END OF REPORT

ATTACHMENT A
FIXTURE CUT SHEETS TYPES A,B,C,D,E,F,G
LIGHTING MITIGATION PLAN
FOR
KERR MCGEE OIL & GAS ONSHORE LP
RAINBOW 24-9 HZ
Project Number: 21010-12

Fixture Cut Sheet

Type A

Series Spec Sheet

WPS GEN 4

CLASSIC WALL PACK

Selectable color temperature (3 000 K / 4 000 K / 5 000 K)¹

Power selectable¹

Integrated photocell¹

Multi-Voltage (120-347 V)¹

This wall pack series is a classic and familiar design integrated with modern LED technology to promote better energy efficiency and long life. Certain configurations come with integrated photocell, selectable power and/or selectable color temperature. It is best suited for entrances, underpasses or anywhere controlled security lighting is required, the series luminaire is a great addition to any commercial or industrial outdoor wall mount application. The tough die cast aluminum housing is moisture and dustproof. ¹



FEATURES AND SPECIFICATIONS

• Construction

Housing

- This luminaire is made of aluminum die cast and comes standard in a bronze powder coat finish.
- The housing has four conduit entries of 1/2" on each sides and some of the configurations comes with a button type photocell that can be turned off by using the internal switch if needed.¹

Lens

Prismatic tempered glass lens is standard in this product series.

• Electrical

- The drivers allows an input voltage from 120-277 V or 120-347 V AC 50/60 Hz and are 0-10 V dimmable. They are coming with an onboard surge protection:
 - NS29: 2.5kV standard
 - NS40, NS60, NS80, PS40, PS100: 2kV standard
 - NS120: 4kV standard

- This wall pack series is suitable for ambient temperature range of -40°C to +50°C. Available in color temperatures of 4 000 K, 5 000 K or 3CCT selectable (3 000/4 000/5 000 K) with a lumen per watt ratio of 140 lm/W to 152 lm/W depending on the lumen package.
- The color temperature of the fixture is set by default at 4 000 K and can be changed on the field.

• Compliances

- Wet location
- IP65
- Meets requirements of ICES-005 issue 5 for class B products
- cULus
- IK06
- BC Hydro

OVERVIEW

Light source	LED
Watts (W)	25/30/40, 60/80/100 30, 40, 60, 80, 120
Lumens output (lm)	3 625 - 17 885
Efficiency (lm/W)	140 - 152
Color temperature (K)	3CCT (3 000/4 000/5 000) 4 000, 5 000
CRI	> 80

¹ Integrated photocell, multi-volt driver, CCT and Power selectable on some configurations. Consult Quick ship and technical specification table for more details.



quick ship



power selectable¹



wet location



ICES 005



IK06



Not all products are qualified on the DLC QPL. To view our DLC qualified products, please consult the DLC Qualified Products List at www.designlights.org/search.

QUICK SHIP AND TECHNICAL SPECIFICATION TABLE  1

Order code	Model number	DLC unique ID	Watts (W)	Volts (V)	Color temp. (K) ²	Lumen output (lm) ³	Efficiency (lm/W)	Photo-cell ⁶	CRI	Life L70 (hrs) ⁵	Tested hours LM-80 (hrs) ⁵	Calculated TM21 (hrs) ⁵	Finish	Dimming	B.U.G.	LED current (mA)	Power factor	THD (%)	Case qty (master)
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Power Select, CCT Select and Integrated Photocell⁶

68314	WPS-PS40-Q-3C	PLW61NEJG50K	25/30/40	120-347	3000/4000/5000	3875/4500/5800 ⁴	141	Yes	>80	54 000	9 000	173 600	Bronze	Yes	B1U3G4	850	≥0.9	≤20	1
68315	WPS-PS100-Q-3C	PLE7PYF9LCSH	60/80/100	120-347	3000/4000/5000	9300/12000/14500 ⁴	137	Yes	>80	54 000	9 000	173 600	Bronze	Yes	B1U3G4	2 100	≥0.9	≤20	1

Single Power, Single CCT and Integrated Photocell⁶

68524	WPS-NS30-W-40K/P127		29	120-277	4 000	4 200	150	Yes	>80	54 000	9 000	173 600	Bronze	Yes	B1U3G5	230	≥0.9	≤20	1
68525	WPS-NS30-W-50K/P127		29	120-277	5 000	4 300	148	Yes	>80	54 000	9 000	173 600	Bronze	Yes	B1U3G5	230	≥0.9	≤20	1

Single Power and Single CCT

68490	WPS-NS40-W-40K	PLVM09BUX07G	40	120-277	4 000	6 004	142	No	>80	54 000	9 000	173 600	Bronze	Yes	B1U3G4	354	≥0.9	≤20	1
68491	WPS-NS40-W-50K	PL3ULW7TEV5H	40	120-277	5 000	6 034	144	No	>80	54 000	9 000	173 600	Bronze	Yes	B1U3G4	354	≥0.9	≤20	1
68492	WPS-NS60-W-40K	PL6EFOU7BPWB	60	120-277	4 000	8 458	146	No	>80	54 000	9 000	173 600	Bronze	Yes	B1U3G5	486	≥0.9	≤20	1
68493	WPS-NS60-W-50K	PL01JETYSQ80	60	120-277	5 000	8 611	147	No	>80	54 000	9 000	173 600	Bronze	Yes	B1U3G5	486	≥0.9	≤20	1
68497	WPS-NS80-W-40K	PLVXL8TOP2UF	80	120-277	4 000	11 242	146	No	>80	54 000	9 000	173 600	Bronze	Yes	B1U4G5	645	≥0.9	≤20	1
68498	WPS-NS80-W-50K	PL2AZJG3LDRQ	80	120-277	5 000	11 446	148	No	>80	54 000	9 000	173 600	Bronze	Yes	B1U4G5	645	≥0.9	≤20	1

Single Power, CCT Select and Integrated Photocell⁶

68316	WPS-NS120-Q-3C	PLYRMZY3SAV3	120	120-347	3000/4000/5000	16 943	137	Yes	>80	54 000	9 000	173 600	Bronze	Yes	B2U4G5	2 600	≥0.9	≤20	1
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¹ **QUICK SHIP:** Product availability is subject to change without notice. Please contact your Stanpro customer service representative to confirm inventory levels at time of order.

² Typical color temperature range: +/- 5 %.

³ Lumen values are derived from photometric testing. Initial lumens range: +/- 10 %.

⁴ Lumen values are based on 4 000 K default settings. Please refer to Quick ship Technical Specification Table for more details on other color temperatures.

⁵ Life hours are derived from IESNA LM-80-08 testing report and projected per IESNA TM-21-11 extrapolations.

⁶ Integrated ON/OFF photocell that can be easily disabled.

ACCESSORIES (order separately)

Order code	Description
68370	18" Bronze metal backplate
68371	Bronze glare shield
68372	Stainless Steel wireguard



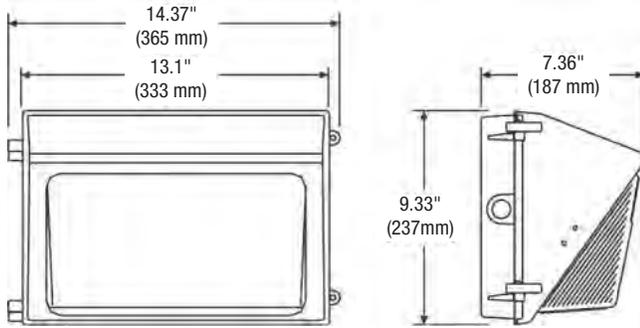
ORDERING GUIDE

Series	Lumen package (W)	Volts (V)	Color temp. (K)	Casting color	Options
WPS	PS40 - 25/30/40 PS100 - 60/80/100 NS120 - 120	Q - 120-347	3C - 3 000/4 000/5 000	BR - Bronze (standard) BK - Black WH - White	KV - 10 kV surge Protection PC - Polycarbonate lens
	NS30 ¹ - 29 NS40 - 40 NS60 - 60 NS80 - 80	W - 120-277	40K - 4 000 50K - 5 000	SP - Special color	KV - 10 kV surge Protection P127 ¹ - Button type photocell 120-277 V PC - Polycarbonate lens

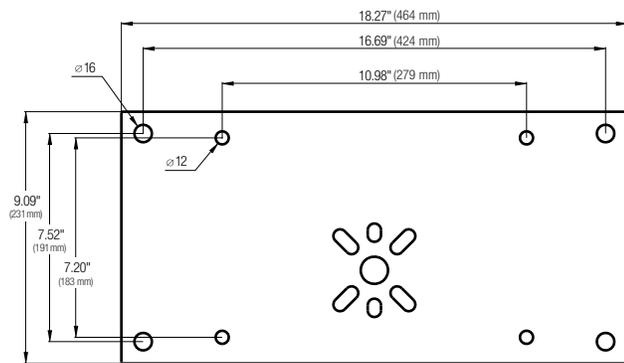
¹ Button type photocell 120-277 V comes standard with the "NS30" lumen package.

Data is based upon tests performed in a controlled environment. Actual performance can vary depending on operating conditions. All products are subject to change or may be discontinued any time without notice.

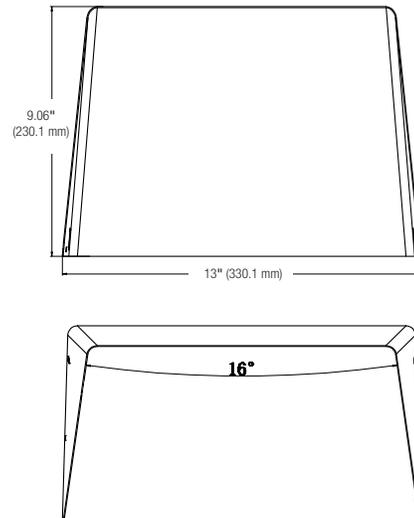
DIMENSIONS



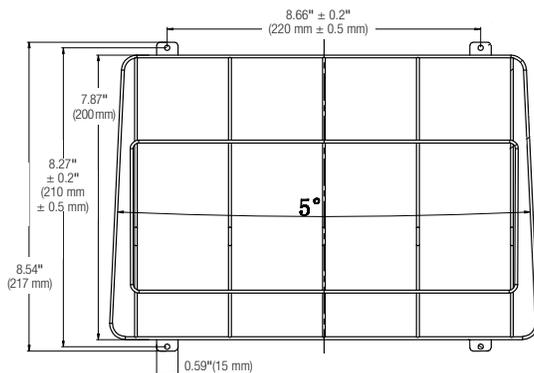
BACKPLATE



GLARESHIELD

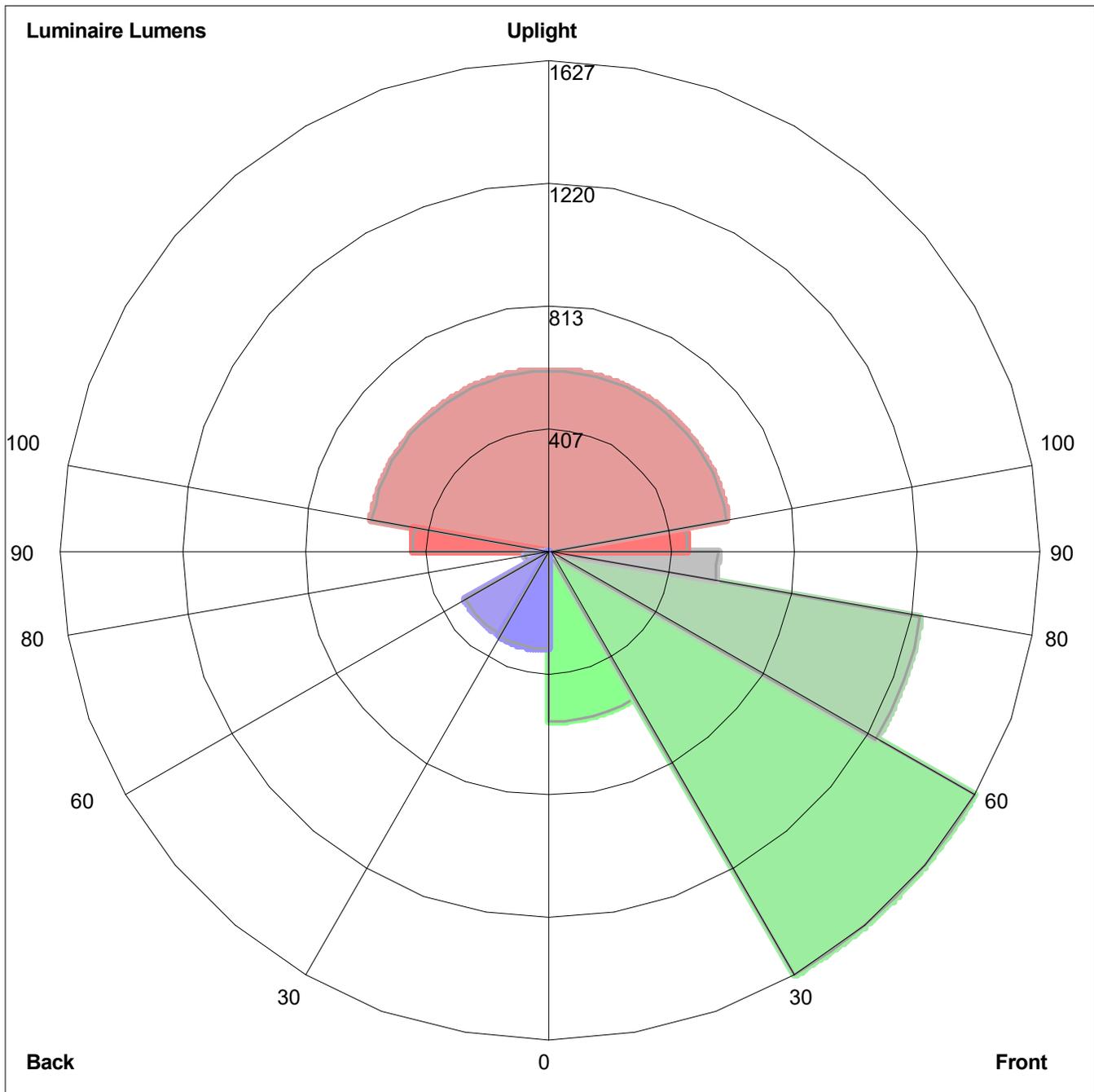


WIREGUARD



Data is based upon tests performed in a controlled environment. Actual performance can vary depending on operating conditions. All products are subject to change or may be discontinued any time without notice.

LUMINAIRE CLASSIFICATION SYSTEM (LCS) GRAPH



Luminaire Lumens:
 Front: Low=566.0, Medium=1626.5, High=1251.8, Very High=558.0
 Back: Low=327.7, Medium=323.2, High=79.4, Very High=11.6
 Uplight: Low=456.3, High=599.7

BUG Rating : B1-U4-G4

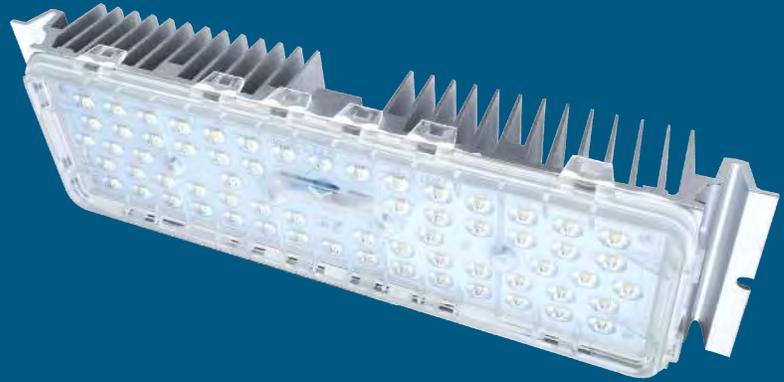
Fixture Cut Sheet

Type B

Example Used



LED Module M8B Series



Specification

Working Environment: -40°C~+50°C

Storage Temperature: -40°C~+50°C

Relative humidity: 10%~90%RH

Typical value of pad temperature^[1]: 70°C

IP Rating of LED Light Engine: IP68

Impact Protection Level: IK09

Color Temperature (CCT)^[2]: 3000K, 4000K, 5000K, 5700K

Main Material: Aluminum 6063

Module N.W.: 0.67±0.04 kg

Note :

[1] Typical values of pad temperature is obtained based on 60W with a ambient temperature of 25°C.

[2] Efficacy of 3000K is 5% lower than other CCTs.

Features

- Lumileds Luxeon 3030;
- Super long lifetime(Lumen maintenance);
- Multiple lighting distributions available;
- Wide applicability for complex situations;
- High versatility apply for all sorts of lamps retrofit.

Application

- Street lighting retrofit and application;
- Factory lighting retrofit and application;
- Tunnel lighting retrofit and application;
- Sports lighting retrofit and application.

Ordering Information

For example: M8B-VCA-63 -1321-7040-LU

Module Model	Interface	Dimension of LEDS	Wire Material	LED Qty	Lens Model	Ra & CCT	LED Brand	
M8B	V: V-shape Groove	C: 3030	A: CCC+VDE C: PSE H: UL X: Others	49 49PCS	1324 Type II Short	1325 25 DEG	7030: Ra≥70, 3000K	LU: Lumileds
				63 63PCS	2322 Type II Short (V)	2360 60 DEG	8040: Ra≥80, 4000K	SN: Sanan
					5321 Type II Short	5340 40 DEG	...	XX: Others
					2321 Type II Short	5390 90 DEG		
					1321 Type III Medium	1310 Lambert Type		
					1390 Tunnel Lighting			

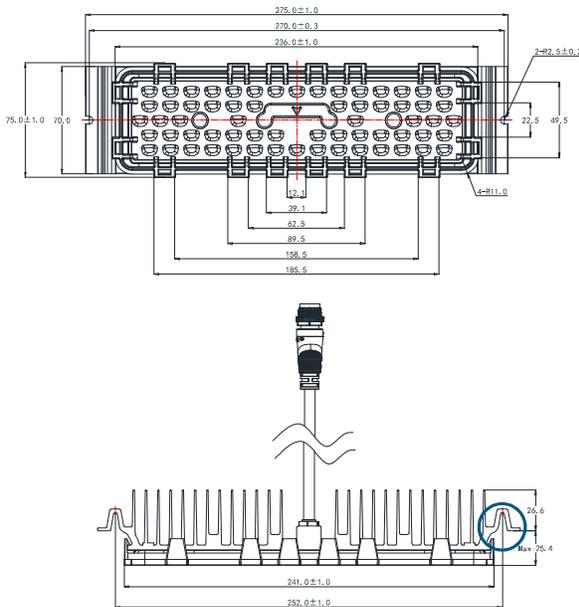
Performance

Model	Power (W)	Driving current (mA)	Input voltage (Vdc)	Efficacy (lm/W)	Lumens (lm)
M8B-VCA-63	40	700	48~61	140	5600
M8B-VCA-49	50	1050	38~48	127	6350
M8B-VCA-63	50	860	48~61	135	6750
M8B-VCA-63	60	1050	48~61	127	7620

Note : Values shown are subject to ±5%~±8% tolerance; Cable default A type;

Efficacy above is based on calculated @92% power efficiency ; Light efficacy of 3000K is 5% lower than other CCTs.

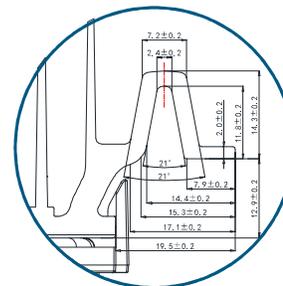
Dimensions



L (mm)	W (mm)	H (mm)
275	75	Max52

The height of the module is the maximum value.

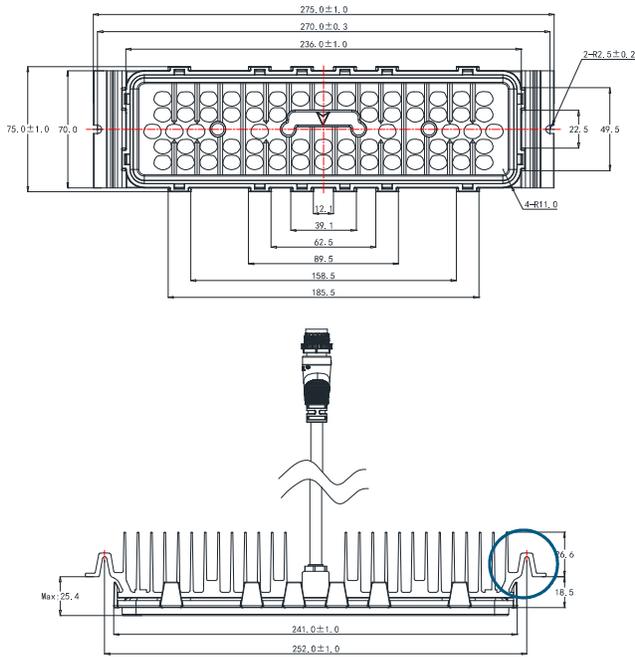
Tolerance: ±0.5mm



Available Lens Model

1321	1324	1390
1232	2322	5321

Dimensions

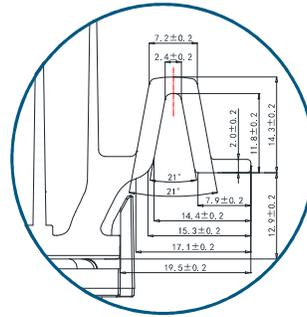


L (mm)	W (mm)	H (mm)
--------	--------	--------

275 75 Max52

The height of the module is the maximum value.

Tolerance: ± 0.5 mm



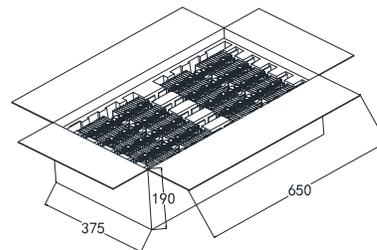
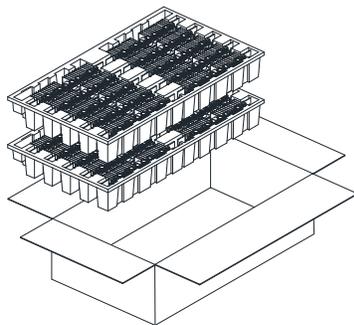
Available Lens Model

1310	1325	5340	2360
5390			

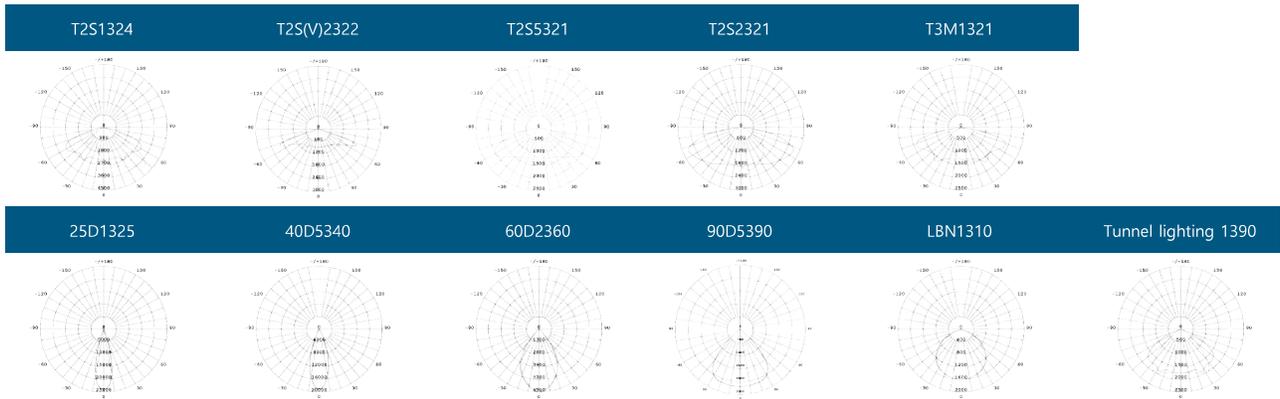
Package Information

L (mm)	W (mm)	H (mm)	Module pcs/carton (PCS)	Package weight (kg)
650	375	190	20	14.9

Values shown are subject to $\pm 5\%$ tolerance.



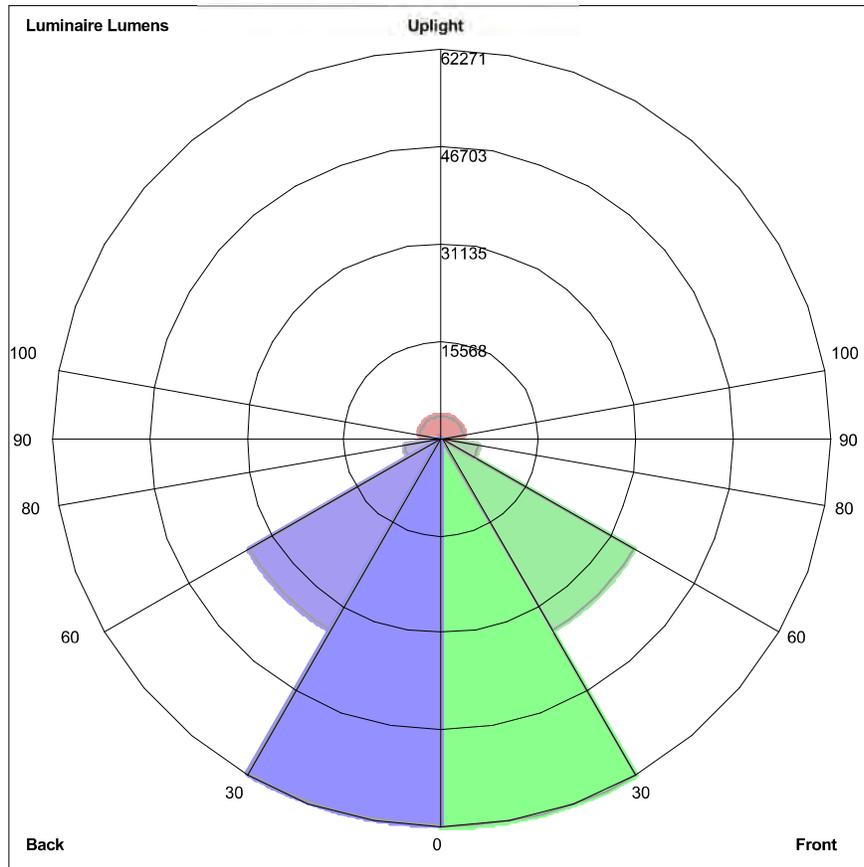
Lighting distributions



Version History

Change Date	Version	Description of Change		
		Item	From	To
20190905	Ver2.0	Data sheets release (new version) Update of luminous efficacy Optimized G.W of Module package	16.2kgs	14.9kgs

LUMINAIRE CLASSIFICATION SYSTEM (LCS) GRAPH



Luminaire Lumens:
Front: Low=62270.6, Medium=35421.7, High=5946.3, Very High= 1328.0
Back: Low= 61920.0, Medium=35466.8, High=5958.8, Very High=1320.7
Uplight: Low=493.0, High=3564.5

BUG Rating : B5-U5-G5

Fixture Cut Sheet

Type C

Pauluhn DFL HID hazardous area floodlights

Cl. I, Div. 2, Groups A, B, C, D
Cl. I, Zone 2, AEx nR II
Cl. II, Div. 1, Groups F, G (250W
max.)
Ex nR II

Marine & Wet Locations
NEMA 4X
IP66

6L

Applications:

- Onshore drilling and exploration
- Pipeline compressor and storage
- Corrosive environments
- Façade security lighting

Features:

- 150-400W high pressure sodium or 175-400W metal halide
- AEx nR, Ex nR restricted breathing rating is standard – restricted breathing offers cooler T-numbers for increased hazardous locations suitability
- NEMA 7x6 butterfly beam floodlight pattern – wide, uniform and far reaching to provide excellent efficiency and more light where you need it
- NEMA Type 4X and IP66 heavy duty, die cast copper-free aluminum construction is designed for use indoors and outdoors in marine and wet locations with stainless steel external hardware suitable for saltwater and corrosive applications
- 40°C, 55°C and 65°C ambient suitability – addresses high ambient common at industrial facilities
- Low ambient capability to -40°C – perfect for colder climates
- Hinged door frame assembly – has captive cover screws for ease of relamping
- Yoke mount design – standard construction provides the greatest mounting flexibility; can be mounted vertically (wall), horizontally (rooftop or floor) or any angle in between
- 3-axis resonance withstand and UL844 vibration compliant – can stand up to the tough jobs
- Precision formed aluminum reflector – superior beam control, distribution and efficiency
- High light output with a low cost of operation – cost-effectiveness in a high wattage floodlight
- Slipfitter adapter for pole mounting and wall mounting bracket available

Certifications and compliances:

- Class I, Division 2, Groups A, B, C, D
- Class I, Zone 2, AEx nR II
- Class II, Division 1, Groups F, G (250W maximum)
- Ex nR II
- UL/cUL844 – Hazardous Locations
- UL/cUL1598 – Luminaires
- UL/cUL1598A – Supplemental Requirements for Luminaires for Installation on Marine Vessels
- 60079-15
- NEMA Type 4X
- IP66
- Marine and wet locations
- ABS



Standard materials and finishes:

- Housing and lens frame – heavy duty die cast copper-free aluminum with Corro-free epoxy powder coat finish
- Lens – heat- and impact-resistant tempered glass
- Gasket – one-piece silicone
- Mounting brackets – aluminum with Corro-free epoxy powder coat finish
- Reflector – precision formed aluminum
- Lamp holder – porcelain
- Hardware – stainless steel

Technical specifications:

- Entries – one 3/4" AEx/Ex gland
- Wind rating – EPA: 2.90 at vertical
- Lamp type – high pressure sodium; probe start metal halide^A; pulse start metal halide (lamps not provided)
- Lamp holder – mogul base
- Ballast – multi-tap 120/208/240/277V, 60 Hz (standard); 220-240V, 50 Hz (optional); tri-tap 120/277/347V (optional); 480V (optional)

Mounting option:

- Yoke mount

Photometrics:

- Complete photometrics can be found at www.crouse-hinds.com/photometrics

^A Not available in the U.S.

Pauluhn DFL HID hazardous area floodlights

Cl. I, Div. 2, Groups A, B, C, D
Cl. I, Zone 2, AEx nR II
Cl. II, Div. 1, Groups F, G (250W max.)
Ex nR II

Marine & Wet Locations
NEMA 4X
IP66

6L

Options:

Description	Suffix
• Lamps included	L ⓐ
• 480V.....	480
<i>Replace /MT in catalog number with /480</i>	
• 230V.....	230
<i>Replace /220 ONLY in catalog number with /230</i>	

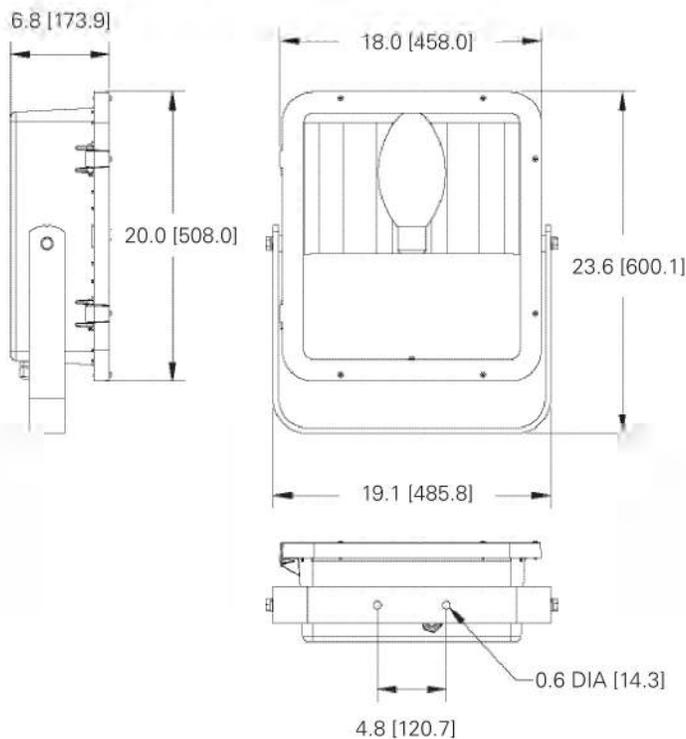
Accessories (ordered separately):

Description	Cat. #
• Pole mount slipfitter adapter	SFA6
• Wall mount bracket adapter	SWB6
• Bull horn, 2 tenon, gray	BLHN2
• Bull horn, 3 tenon, gray	BLHN3

Ordering information:

Cat. #	Lamp type	Watts	Weight (lbs.)	ANSI lamp type	Zone T-code	Division T-code	Ambient temperature °C	Supply wire °C
DFLMY250/MT 76 S828	Pulse start metal halide	250	42.0	M153	T3	T1	40/55/65	90/90/105
DFLMY400/MT 76 S828	Pulse start metal halide	400	44.0	M155	T3	T1	40/55	105/105
DFLMY320/MT 76 S828	Pulse start metal halide	320	44.0	M154	T3	T1	40/55	105/105
DFLMY250/TT 76 ⓐ	Probe start metal halide	250	42.0	M58 ⓐ	T3	T1	40/55/65	90/90/105
DFLMY400/TT 76 ⓐ	Probe start metal halide	400	44.0	M59 ⓐ	T3	T1	40/55	90/105
DFLMY250/220 50 76 ⓐ	Probe start metal halide	250	42.0	M58 ⓐ	T3	T1	40/55/65	90/90/105
DFLMY400/220 50 76 ⓐ	Probe start metal halide	400	44.0	M59 ⓐ	T3	T1	40/55	90/105
DFLSY250/MT 76	High pressure sodium	250	40.0	S50	T3	T1	40/55/65	90/90/105
DFLSY400/MT 76	High pressure sodium	400	44.0	S51	T3	T1	40/55	90/105
DFLSY250/TT 76	High pressure sodium	250	40.0	S50	T3	T1	40/55/65	90/90/105
DFLSY400/TT 76	High pressure sodium	400	44.0	S51	T3	T1	40/55	90/105
DFLSY250/220 50 76	High pressure sodium	250	40.0	S50	T3	T1	40/55/65	90/90/105
DFLSY400/220 50 76	High pressure sodium	400	44.0	S51	T3	T1	40/55	90/105

Dimensions (in inches):



Bull horns – provided with 2 3/8" pole tenon

ⓐ Lamp is not included unless option 'L' is selected.
ⓐ Not available in the U.S.

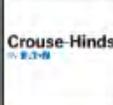
6L

Pauluhn DFL HID hazardous area floodlight

The image below was obtained from the manufacturer's IES file of the fixture. It is included to show the lumen value of the fixture, which is not included in the manufacturer catalog cutsheet.

Active luminaire

CAST ALUMINUM HOUSING, FORMED SPECULAR HAMMERTONE REFLECTOR, CLEAR GLASS ENCSLOURE.
DFLMYM400



0.813 x 1.240 x 0.328ft

Luminaire type index

Designation in DWG plan

Select

Properties

Name

Positioning

Position ft

Rotation °

Mounting type

Mounting type

Light centre height ft

Mounting height ft

Photometric data

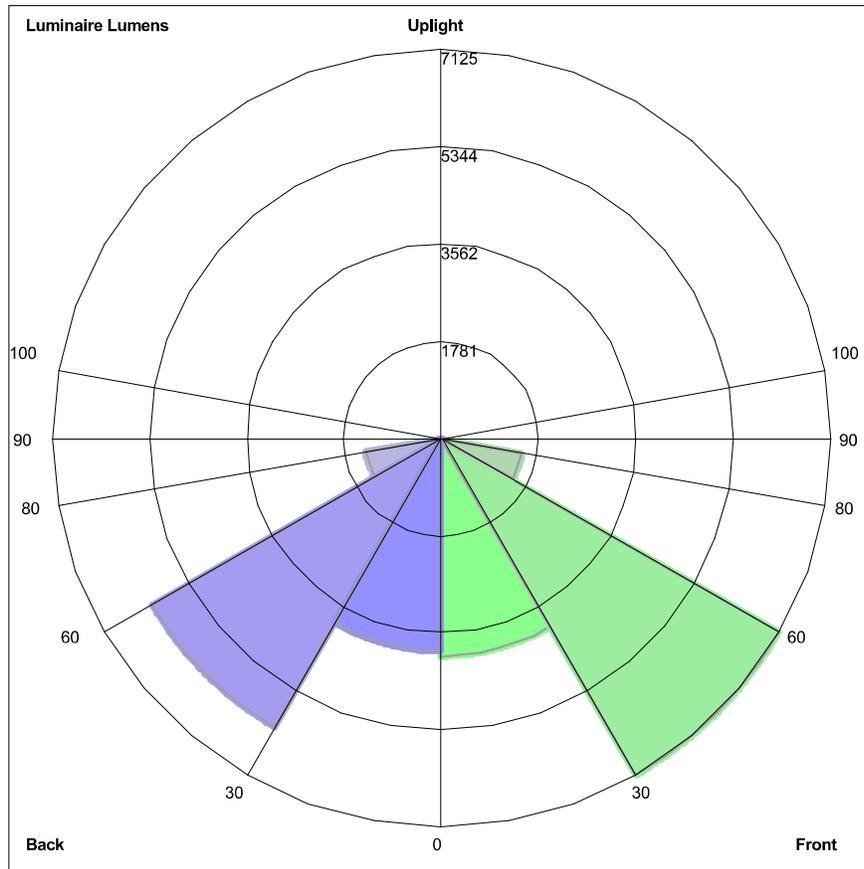
Luminaire luminous flux lm

Light output ratio %

Connected load W

Luminous efficacy lm / W

LUMINAIRE CLASSIFICATION SYSTEM (LCS) GRAPH



Luminaire Lumens:
Front: Low=3985.6, Medium= 7125.0, High=1500.3, Very High=28.6
Back: Low=3894.8, Medium=6102.1, High=1404.5, Very High=40.2
Uplight: Low=0.0, High=0.0

BUG Rating : B4-U0-G3

Fixture Cut Sheet Type D

Pauluhn DLL LED Luminaires

For land-based drilling

Cl. I, Div. 2, Groups A, B, C, D
Cl. I, Zone 2
Cl. II, Div. 2, Groups F, G
Cl. III

UL Listed
CSA Certified
Marine & Wet Locations
NEMA 4X; IP66

2L

2L

The Pauluhn™ DLL linear LED is specifically designed to replace fluorescent T12, T8 and T5HO lighting on land-based and offshore drilling platforms. The rugged and durable design features the industry's most versatile and flexible mounting options. The Pauluhn DLL is the ideal solution for high vibration, impact and hose down in drilling applications.

Model	Typical lumens	Watts	Lumens per watt	Equivalent HID luminaire	Typical energy savings / lifetime
DLL2	3,958	32	124	T12HO	Up to 63%
				T8HO	Up to 59%
				T5HO	Up to 47%
				T12	Up to 36%
				T8	Up to 25%
DLL4	7,900	63	130	T5	Up to 9%
				T12HO	Up to 58%
				T8HO	Up to 54%
				T5HO	Up to 43%
				T12	Up to 37%
DLL4	7,900	63	130	T8	Up to 22%
				T5	Up to 10%

Applications:

- Land-based and offshore rigs; areas include: derrick, mast, SCR house, top drive, operator's house, power and pump stations

Features:

- High efficacy: up to 120 LPW
- 40°C to +65°C ambient operating temperature (standard model)
- Low profile (<3" height)
- Versatile ceiling/swivel, wall, flush, pole and pendant mounting options
- Wide and narrow optics for uniform illumination in control room and drill mast
- Four points of secondary retention
- 2,000 PSI high pressure hose rated
- High vibration resistance
- Emergency battery back-up (90 minutes) and surge protection options (up to 10 kV)Ⓐ
- DesignLights Consortium® Qualified (some models are not DLC qualified)Ⓑ
- 5 year fixture warranty

Standard materials:

- Housing – copper-free aluminum; Corro-free epoxy powder coat (optional)
- Lens – clear polycarbonate; diffused polycarbonate

Photometrics:

- Complete photometrics can be found at www.crouse-hinds.com/photometrics

Temperature performance data:

Ambient temp. °C	Min. temp. supply wire °C	Simultaneous rating		
		Class I, Div. 2	Class II, Div. 2	Class I, Div. 2; Class II, Div. 2
40	60	T6	T6	T6
55	75	T5	T5	T5
65	90	T5	T5	T5



Mounting (ordered separately):

Versatile mounting options:

- Flush back mount
- Swivel/ceiling back mount
- Offset ceiling mount
- Offset wall mount
- Pole mount
- Pendant mount

Easily retrofit to:

- Existing Pauluhn DuraPro and MagnaPro fluorescent light fixtures
- Rig-A-Lite and Snelson C1D2 fluorescent lighting fixtures

Certifications and compliances:

NEC:

- Class I, Division 2, Groups A, B, C, D
- Class I, Zone 2
- Class II, Division 2, Groups F, G
- Class III
- NEMA 4X, IP66
- Marine and wet locations

UL standards:

- UL844 – Electrical Fixture Hangers for Hazardous Locations
- UL1598 – Luminaire
- UL1598A – Luminaire for Installation on Marine Vessels
- UL924 – Emergency Lighting

CSA standard:

- C22.2 No. 137

Additional certifications:

- ABS design assessed

Electrical ratings:

	DLL2	DLL4
Lumen output	3,958	7,900
Frequency	50/60 Hz	50/60 Hz
Voltage	100-277 VAC, 108-250 VDC; 347-480 VAC	

Model	Voltage	Current (A)	Watts	Power factor	THD
DLL2/UNV1	100	0.33	32.5	0.92	<20%
DLL2/UNV1	277	0.13	34.3	0.92	<20%
DLL2/UNV34	347	0.10	32.2	0.92	<20%
DLL2/UNV34	480	0.07	34.5	0.92	<20%
DLL4/UNV1	100	0.63	63.4	0.92	<20%
DLL4/UNV1	277	0.23	62.5	0.92	<20%
DLL4/UNV34	347	0.18	61.4	0.92	<20%
DLL4/UNV34	480	0.13	63.9	0.92	<20%

Weights:

Model	Lbs.	Kg.
DLL2	12.50	5.70
DLL4	22.50	10.20

Ⓐ One year warranty.

Ⓑ Refer to www.designlights.org Qualified Products List under Family Models for full listing details. Not all models are approved for all application categories.

Pauluhn DLL LED luminaires

For land-based drilling

Cl. I, Div. 2, Groups A, B, C, D
Cl. I, Zone 2
Cl. II, Div. 2, Groups F, G
Cl. III

UL Listed
CSA Certified
Marine & Wet Locations
NEMA 4X; IP66

2L

Designed for drilling. Pauluhn DLL linear LED luminaires are engineered to handle demanding conditions faced on land-based drilling rigs. The DLL stands up to high vibration, hose down, shock and impact, while delivering long life and high lumen performance for up to 20 years.

Custom optics:

- Standard wide (120°) beam spread for control room and indoor application maximizes illumination on wall panels
- Narrow (80°) beam spread option for high mast/derrick application avoids spillage and light loss

Comprehensive certification:

- Single model certified for use in Class I, Division 2 and Class II, Division 2 harsh and hazardous applications

Quick & easy installation:

- Easy access to drivers and wiring
- No custom brackets or hardware needed
- Seven mounting options available
- Easily retrofit to Pauluhn DuraPro and MagnaPro, Rig-A-Lite and Snelson



Slim profile:

- 2.7" fixture height (excluding mounting brackets)
- Perfect for mounting in confined or low height areas

Built to last:

- Ingress protection from hose down water or diesel fuel in harsh operational conditions – passed 2,000 PSI high pressure test
- Vibration-, impact- and shock-resistant – passed 5G, 3-axis vibration test
- 60,000 hour lifetime at 55°C ambient



Pauluhn DLL LED luminaires

For land-based drilling

Cl. I, Div. 2, Groups A, B, C, D
Cl. I, Zone 2
Cl. II, Div. 2, Groups F, G
Cl. III

UL Listed
CSA Certified
Marine & Wet Locations
NEMA 4X; IP66

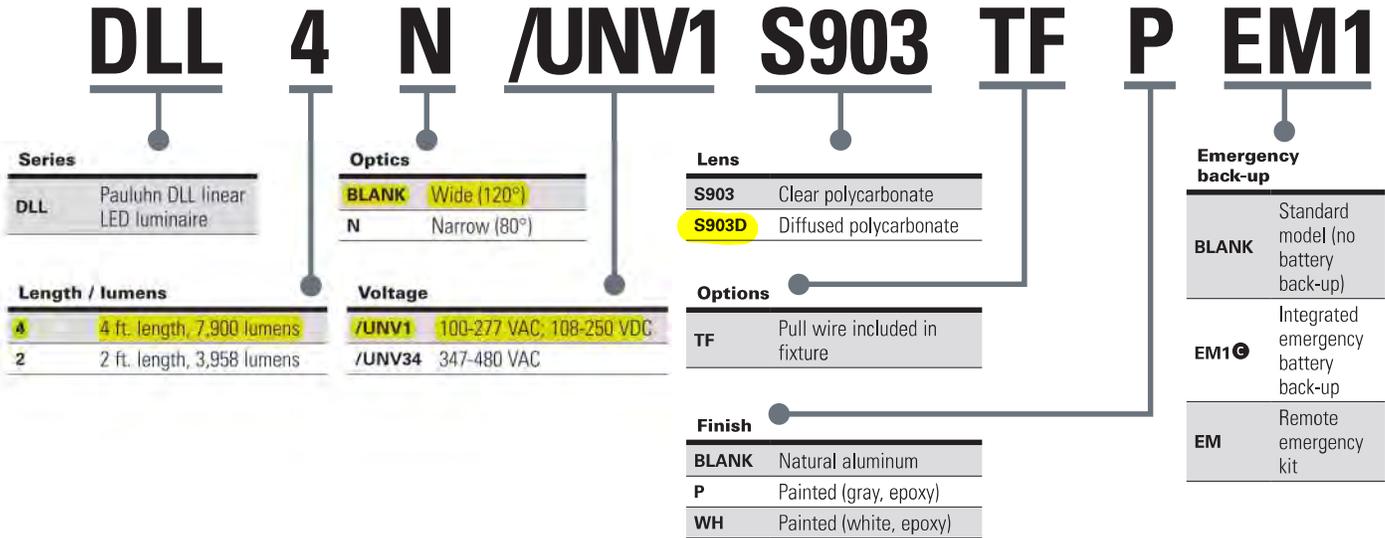
2L

2L

Ordering information:

Part number example

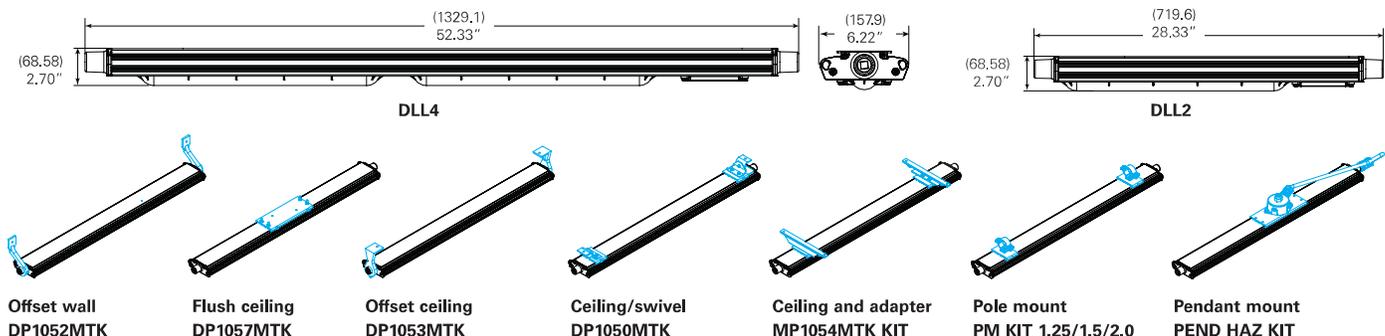
DLL4N/UNV1 S903 TF P EM1



Accessories (ordered separately):

Description	Cat. #	Description	Cat. #
• Flush/back mount back plate.....	DP1057MTK <i>Compatible with DuraPro</i>	• Pendant mount kit.....	PEND HAZ KIT
• Ceiling/swivel mount.....	DP1050MTK <i>Compatible with DuraPro</i>	• Safety chain kit.....	SS KIT
• Ceiling/wall mount offset.....	DP1053MTK <i>Compatible with DuraPro</i>	• 1 amp driver replacement kit, 100-277 VAC for 4 ft. linear.....	VMVL/UNV1 80W 1A KIT
• Ceiling mount bracket and adapter kit.....	MP1054MTK KIT <i>Compatible with MagnaPro</i>	• 1 amp driver replacement kit, 347-480 VAC for 4 ft. linear.....	VMVL/UNV34 80W 1A KIT
• Offset wall mount.....	DP1052MTK <i>Compatible with DuraPro</i>	• 0.5 amp driver replacement kit, 100-277 VAC for 2 ft. linear.....	VMVL/UNV1 80W 0.5A KIT
• Pole mount kit, 1.25" conduit.....	PM KIT 1.25	• 0.5 amp driver replacement kit, 347-480 VAC for 2 ft. linear.....	VMVL/UNV34 80W 0.5A KIT
• Pole mount kit, 1.50" conduit.....	PM KIT 1.5		
• Pole mount kit, 2.00" conduit.....	PM KIT 2.0		

Dimensions and mounting options:



One year warranty. Remote EM kit also available, 120-277 VAC only. Available with 4 ft. model only.

Pauluhn DLL LED Luminaires

For land-based drilling

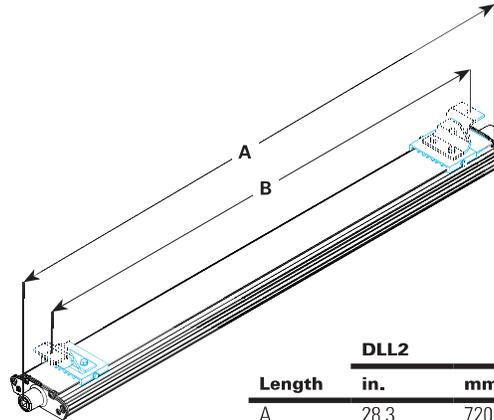
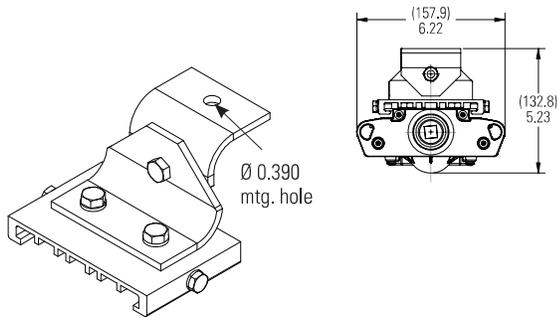
Cl. I, Div. 2, Groups A, B, C, D
Cl. I, Zone 2
Cl. II, Div. 2, Groups F, G
Cl. III

UL Listed
CSA Certified
Marine & Wet Locations
NEMA 4X; IP66

2L

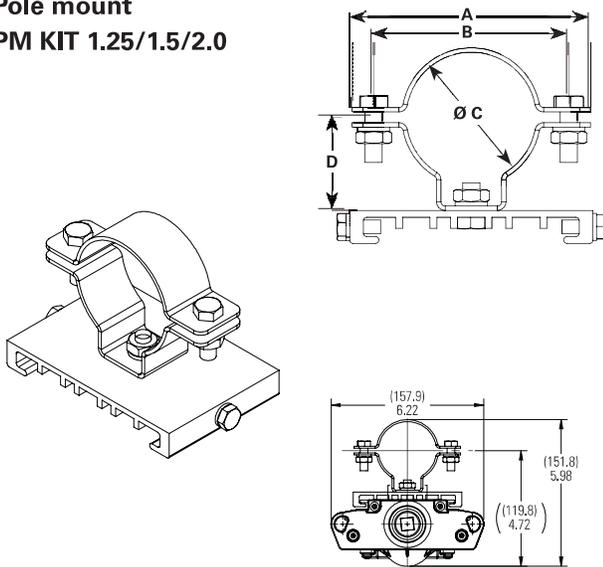
Mounting options:

Ceiling/swivel mount DP1050MTK

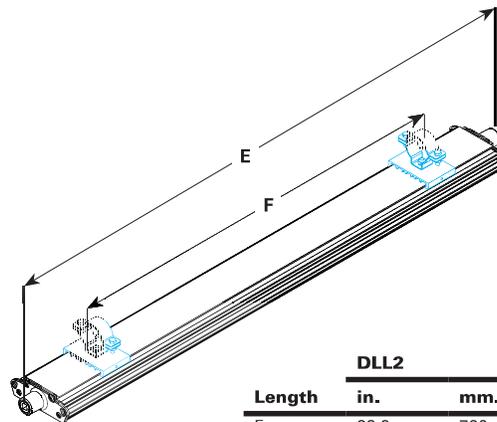


Length	DLL2		DLL4	
	in.	mm.	in.	mm.
A	28.3	720	52.3	1329
B	9-27	222-681	9-51	222-1289

Pole mount PM KIT 1.25/1.5/2.0

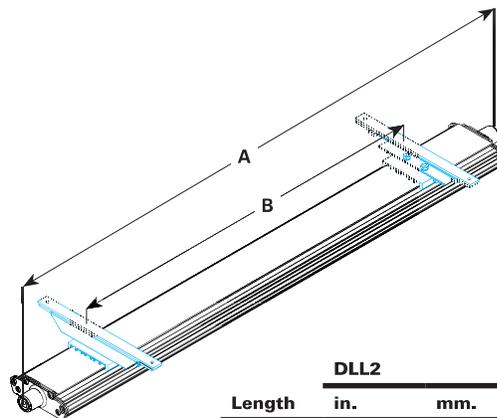
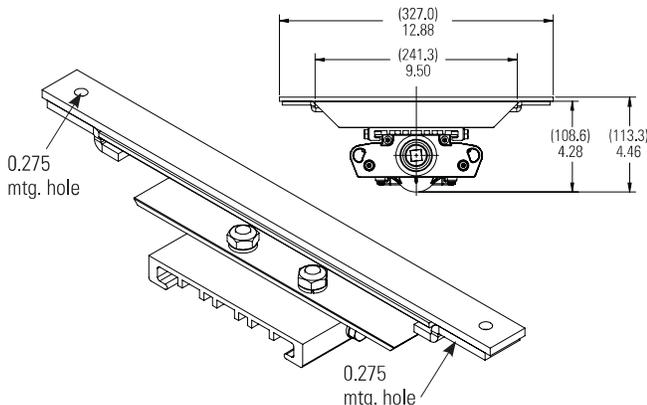


Configuration	ALL MEASUREMENTS IN INCHES			
	A	B	C	D
PM KIT 1.25	4.331	3.543	1.680	1.693
PM KIT 1.5	3.740	2.953	2.000	1.535
PM KIT 2.0	3.386	2.598	2.360	1.378



Length	DLL2		DLL4	
	in.	mm.	in.	mm.
E	28.3	720	52.3	1329
F	12-21	305-533	24-45	610-1143

MagnaPro mount MP1054MTK KIT



Length	DLL2		DLL4	
	in.	mm.	in.	mm.
A	28.3	720	52.3	1329
B	12-22	305-559	24-46	610-1168

Pauluhn DLL LED luminaires

For land-based drilling

Cl. I, Div. 2, Groups A, B, C, D
Cl. I, Zone 2
Cl. II, Div. 2, Groups F, G
Cl. III

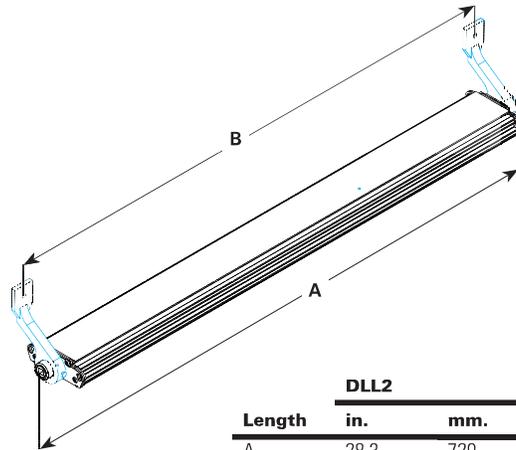
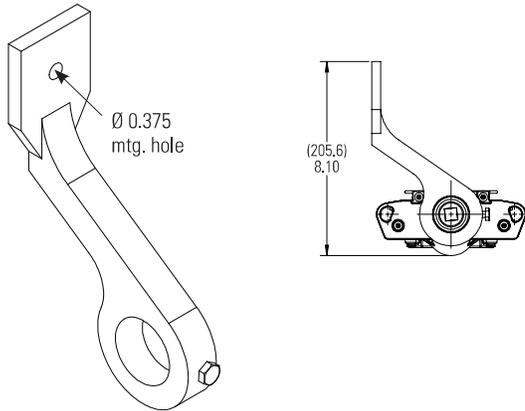
UL Listed
CSA Certified
Marine & Wet Locations
NEMA 4X; IP66

2L

2L

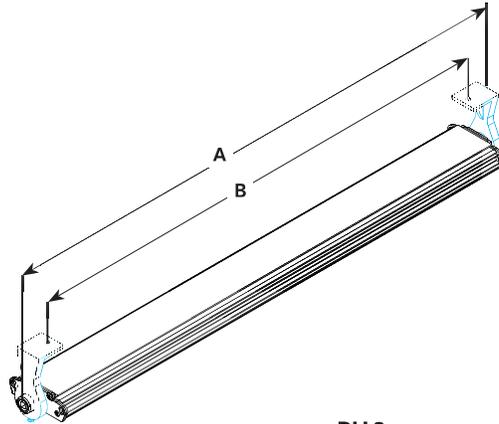
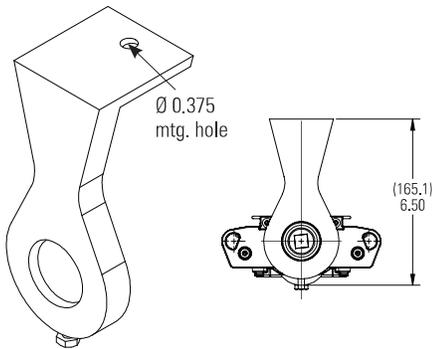
Mounting options (continued):

Offset wall DP1052MTK



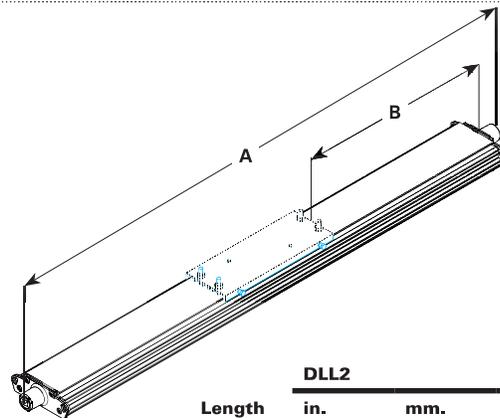
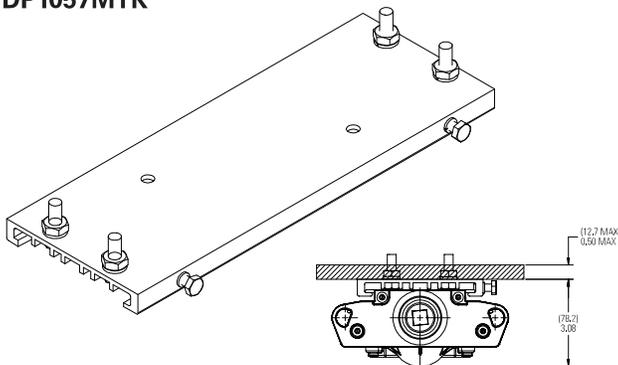
Length	DLL2		DLL4	
	in.	mm.	in.	mm.
A	28.3	720	52.3	1329
B	26.3	669	50.3	1278

Offset ceiling/wall mount DP1053MTK



Length	DLL2		DLL4	
	in.	mm.	in.	mm.
A	28.3	720	52.3	1329
B	26.3	584	47.0	1194

Flush ceiling DP1057MTK



Length	DLL2		DLL4	
	in.	mm.	in.	mm.
A	28.3	720.0	52.3	1329.0
B	6.2	157.5	18.2	462.0

Pauluhn DLL LED luminaires

For land-based drilling

Cl. I, Div. 2, Groups A, B, C, D
Cl. I, Zone 2
Cl. II, Div. 2, Groups F, G
Cl. III

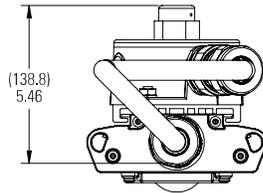
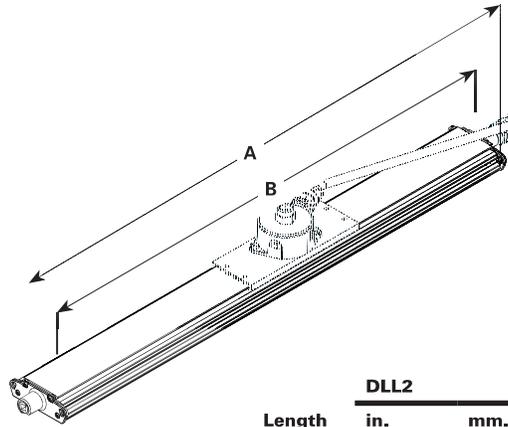
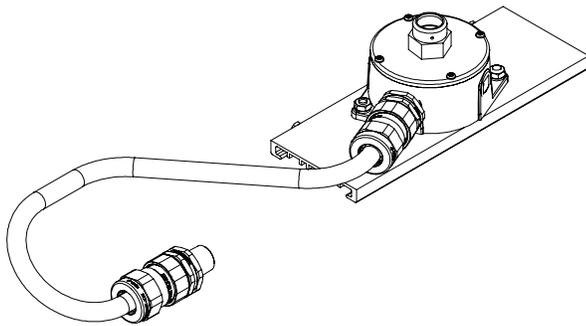
UL Listed
CSA Certified
Marine & Wet Locations
NEMA 4X; IP66

2L

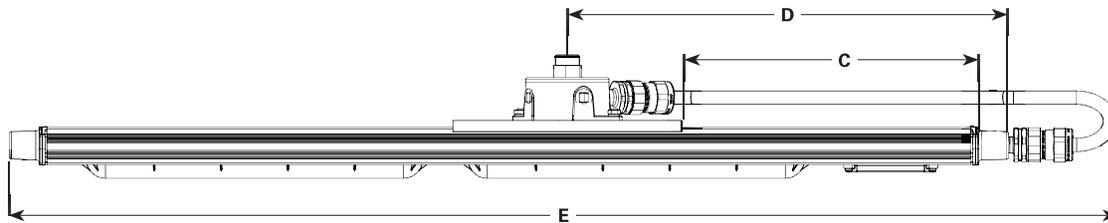
2L

Mounting options (continued):

Pendant mount – Class I, Division 2 only
PEND HAZ KIT



Length	DLL2		DLL4	
	in.	mm.	in.	mm.
A	31.7	805	55.8	1418
B	28.3	720	52.3	1329
C	4.2	108	16.0	406
D	12.2	310	24.0	610
E	34.9	886	58.9	1495



Pauluhn DLL LED luminaires

Integral battery back-up

Cl. I, Div. 2, Groups A, B, C, D
Cl. II, Div. 2, Groups F, G

UL Listed
CSA Certified
Wet Locations
Type 4X; IP66

2L

2L

Pauluhn DLL linear LED luminaires are available with an integral battery back-up module. Virtually the same size as the standard 4 foot model and 90 minutes of emergency lighting to keep your facility and personnel safe.



Model	EM output	Normal output
DLL4/UNV1 S903 EM1	1,400 lumens (100-277V)	6,720 lumens (100-277V)

Applications:

- Egress and emergency lighting for areas requiring uninterrupted lighting during power failure
- Hazardous rated indoor and outdoor emergency lighting in manufacturing plants, heavy industrial, chemical and petrochemical facilities, platforms, loading docks and parking areas

Features:

- Operating ambient: 0°C to +40°C
- 90-minute run time in emergency mode
- 6,720 lumen output for normal operation; 1,400 lumen output in emergency mode
- 50,000 hours rated life at 40°C
- IP66 rated enclosure
- LED indicator to check battery operation
- Nickel cadmium battery
- 1 year warranty

Certifications and compliances:

NEC/CEC:

- Class I, Division 2, Groups A, B, C, D
- Class II, Division 2, Groups F, G
- Wet locations, Type 4X, IP66

UL standards:

- UL844 – Hazardous (Classified)
- UL1598 – Luminaires
- UL1598A – Marine
- UL924 – Emergency Lighting

CSA standard:

- CSA C22.2 Nos. 137, 141

Electrical ratings:

	EM output	Normal output
Voltage	120	277
Amperage at 120 VAC	0.480	0.212
Wattage at 120 VAC	57.8	57.7
Lumen output	1,400	6,720
Frequency	50/60 Hz	50/60 Hz
Power factor at 100 VAC	>0.90	>0.90
THD	6.58	11.70

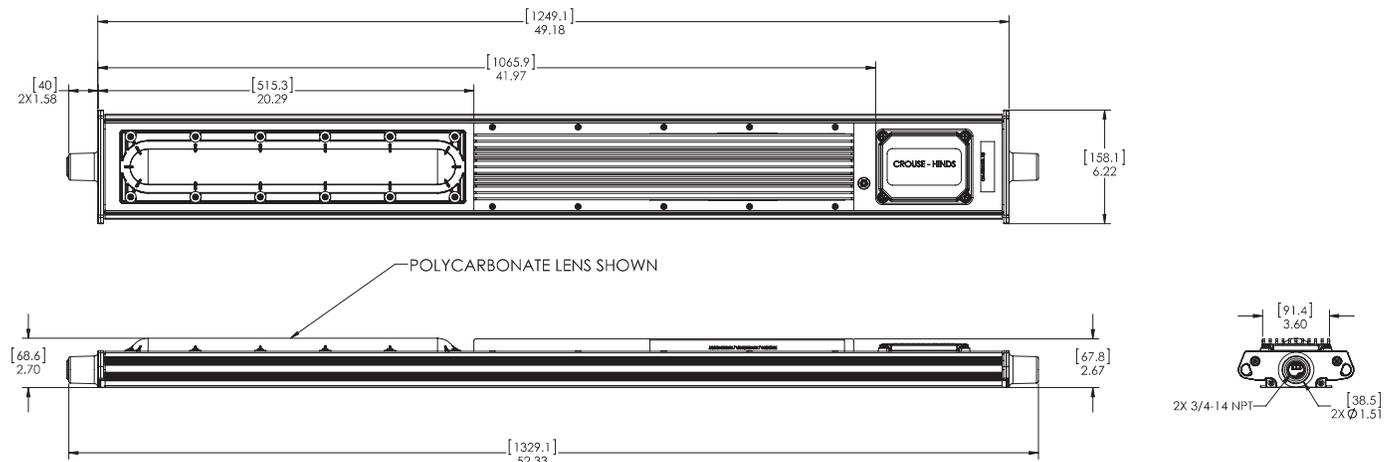
Temperature performance data:

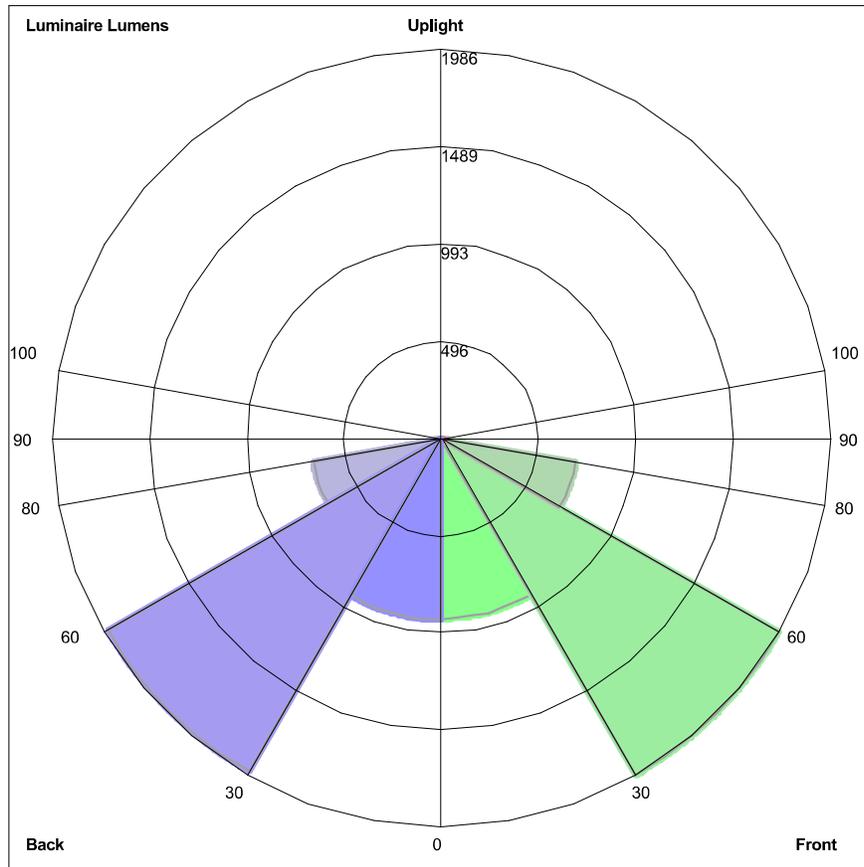
Ambient temp. °C	Min. temp. supply wire °C	Simultaneous rating		
		Class I, Div. 2	Class II, Div. 2	Class I, Div. 2; Class II, Div. 2
40	60	T5	T6	T5

Photometrics:

- Complete photometrics can be found at www.crouse-hinds.com/photometrics

Dimensions:





Luminaire Lumens:
 Front: Low=921.0, Medium=1985.6, High=698.7, Very High=29.2
 Back: Low=925.1, Medium=1963.4, High=664.7, Very High=26.5
 Uplight: Low=4.7, High=1.2

BUG Rating : B2-U1-G1

Fixture Cut Sheet

Type E

Pauluhn DLL LED luminaires

For land-based drilling

Cl. I, Div. 2, Groups A, B, C, D
Cl. I, Zone 2
Cl. II, Div. 2, Groups F, G
Cl. III

UL Listed
CSA Certified
Marine & Wet Locations
NEMA 4X; IP66

2L

2L

The Pauluhn™ DLL linear LED is specifically designed to replace fluorescent T12, T8 and T5HO lighting on land-based and offshore drilling platforms. The rugged and durable design features the industry's most versatile and flexible mounting options. The Pauluhn DLL is the ideal solution for high vibration, impact and hose down in drilling applications.

Model	Typical lumens	Watts	Lumens per watt	Equivalent HID luminaire	Typical energy savings / lifetime
DLL2	3,958	32	124	T12HO	Up to 63%
				T8HO	Up to 59%
				T5HO	Up to 47%
				T12	Up to 36%
				T8	Up to 25%
DLL4	7,900	63	130	T5	Up to 9%
				T12HO	Up to 58%
				T8HO	Up to 54%
				T5HO	Up to 43%
				T12	Up to 37%
				T8	Up to 22%
				T5	Up to 10%

Applications:

- Land-based and offshore rigs; areas include: derrick, mast, SCR house, top drive, operator's house, power and pump stations

Features:

- High efficacy: up to 120 LPW
- 40°C to +65°C ambient operating temperature (standard model)
- Low profile (<3" height)
- Versatile ceiling/swivel, wall, flush, pole and pendant mounting options
- Wide and narrow optics for uniform illumination in control room and drill mast
- Four points of secondary retention
- 2,000 PSI high pressure hose rated
- High vibration resistance
- Emergency battery back-up (90 minutes) and surge protection options (up to 10 kV)^A
- DesignLights Consortium® Qualified (some models are not DLC qualified)^B
- 5 year fixture warranty

Standard materials:

- Housing – copper-free aluminum; Corro-free epoxy powder coat (optional)
- Lens – clear polycarbonate; diffused polycarbonate

Photometrics:

- Complete photometrics can be found at www.crouse-hinds.com/photometrics

Temperature performance data:

Ambient temp. °C	Min. temp. supply wire °C	Simultaneous rating		
		Class I, Div. 2	Class II, Div. 2	Class I, Div. 2; Class II, Div. 2
40	60	T6	T6	T6
55	75	T5	T5	T5
65	90	T5	T5	T5



Mounting (ordered separately):

Versatile mounting options:

- Flush back mount
- Swivel/ceiling back mount
- Offset ceiling mount
- Offset wall mount
- Pole mount
- Pendant mount

Easily retrofit to:

- Existing Pauluhn DuraPro and MagnaPro fluorescent light fixtures
- Rig-A-Lite and Snelson C1D2 fluorescent lighting fixtures

Certifications and compliances:

NEC:

- Class I, Division 2, Groups A, B, C, D
- Class I, Zone 2
- Class II, Division 2, Groups F, G
- Class III
- NEMA 4X, IP66
- Marine and wet locations

UL standards:

- UL844 – Electrical Fixture Hangers for Hazardous Locations
- UL1598 – Luminaire
- UL1598A – Luminaire for Installation on Marine Vessels
- UL924 – Emergency Lighting

CSA standard:

- C22.2 No. 137

Additional certifications:

- ABS design assessed

Electrical ratings:

	DLL2	DLL4
Lumen output	3,958	7,900
Frequency	50/60 Hz	50/60 Hz
Voltage	100-277 VAC, 108-250 VDC; 347-480 VAC	

Model	Voltage	Current (A)	Watts	Power factor	THD
DLL2/UNV1	100	0.33	32.5	0.92	<20%
DLL2/UNV1	277	0.13	34.3	0.92	<20%
DLL2/UNV34	347	0.10	32.2	0.92	<20%
DLL2/UNV34	480	0.07	34.5	0.92	<20%
DLL4/UNV1	100	0.63	63.4	0.92	<20%
DLL4/UNV1	277	0.23	62.5	0.92	<20%
DLL4/UNV34	347	0.18	61.4	0.92	<20%
DLL4/UNV34	480	0.13	63.9	0.92	<20%

Weights:

Model	Lbs.	Kg.
DLL2	12.50	5.70
DLL4	22.50	10.20

^AOne year warranty.

^BRefer to www.designlights.org Qualified Products List under Family Models for full listing details. Not all models are approved for all application categories.

Pauluhn DLL LED luminaires

For land-based drilling

Cl. I, Div. 2, Groups A, B, C, D
Cl. I, Zone 2
Cl. II, Div. 2, Groups F, G
Cl. III

UL Listed
CSA Certified
Marine & Wet Locations
NEMA 4X; IP66

2L

2L

Designed for drilling. Pauluhn DLL linear LED luminaires are engineered to handle demanding conditions faced on land-based drilling rigs. The DLL stands up to high vibration, hose down, shock and impact, while delivering long life and high lumen performance for up to 20 years.

Custom optics:

- Standard wide (120°) beam spread for control room and indoor application maximizes illumination on wall panels
- Narrow (80°) beam spread option for high mast/derrick application avoids spillage and light loss

Comprehensive certification:

- Single model certified for use in Class I, Division 2 and Class II, Division 2 harsh and hazardous applications

Quick & easy installation:

- Easy access to drivers and wiring
- No custom brackets or hardware needed
- Seven mounting options available
- Easily retrofit to Pauluhn DuraPro and MagnaPro, Rig-A-Lite and Snelson



Slim profile:

- 2.7" fixture height (excluding mounting brackets)
- Perfect for mounting in confined or low height areas

Built to last:

- Ingress protection from hose down water or diesel fuel in harsh operational conditions – passed 2,000 PSI high pressure test
- Vibration-, impact- and shock-resistant – passed 5G, 3-axis vibration test
- 60,000 hour lifetime at 55°C ambient



Pauluhn DLL LED luminaires

For land-based drilling

Cl. I, Div. 2, Groups A, B, C, D
Cl. I, Zone 2
Cl. II, Div. 2, Groups F, G
Cl. III

UL Listed
CSA Certified
Marine & Wet Locations
NEMA 4X; IP66

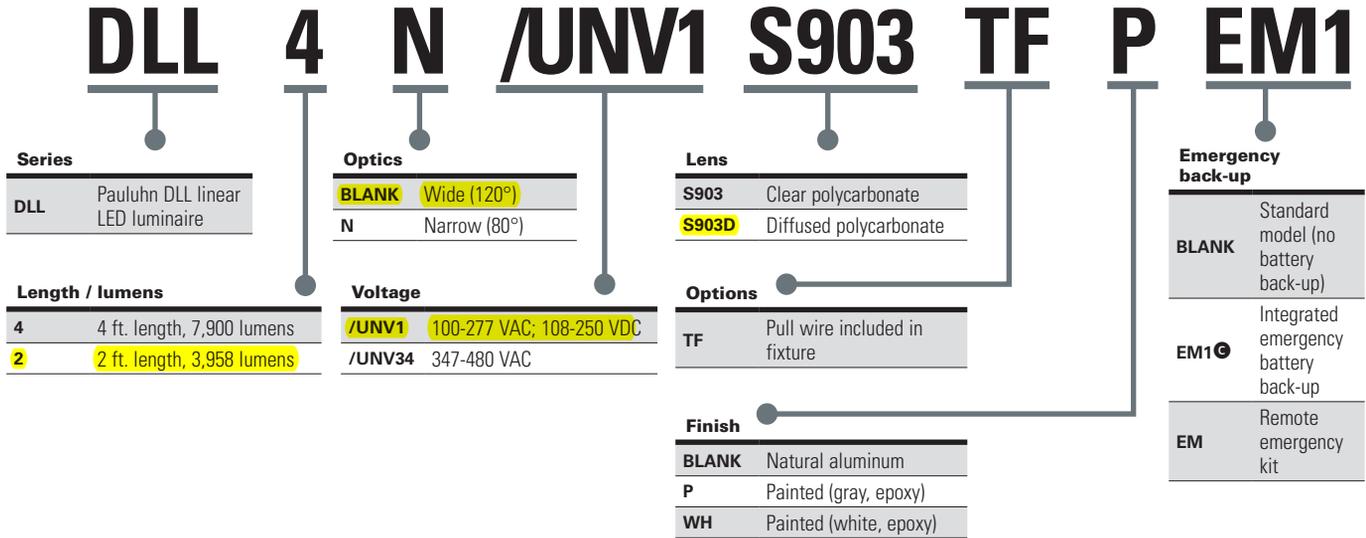
2L

2L

Ordering information:

Part number example

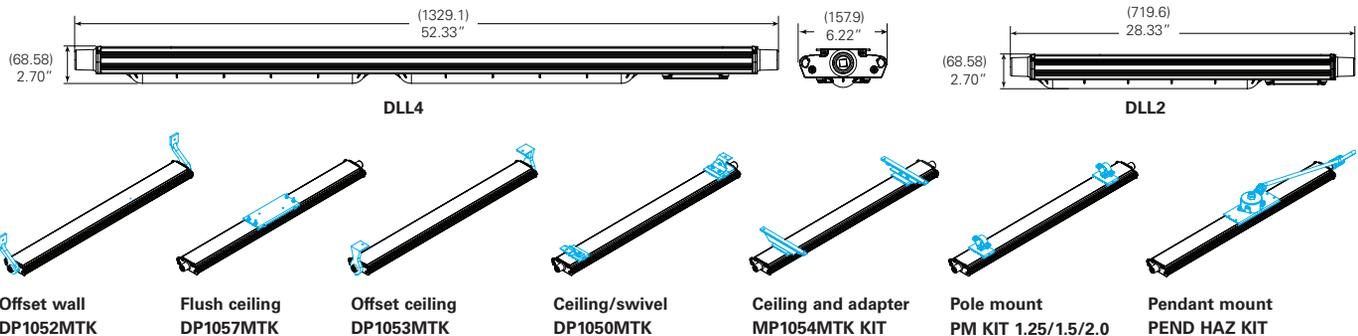
DLL4N/UNV1 S903 TF P EM1



Accessories (ordered separately):

Description	Cat. #	Description	Cat. #
• Flush/back mount back plate.....	DP1057MTK <i>Compatible with DuraPro</i>	• Pendant mount kit.....	PEND HAZ KIT
• Ceiling/swivel mount.....	DP1050MTK <i>Compatible with DuraPro</i>	• Safety chain kit.....	SS KIT
• Ceiling/wall mount offset.....	DP1053MTK <i>Compatible with DuraPro</i>	• 1 amp driver replacement kit, 100-277 VAC for 4 ft. linear.....	VMVL/UNV1 80W 1A KIT
• Ceiling mount bracket and adapter kit.....	MP1054MTK KIT <i>Compatible with MagnaPro</i>	• 1 amp driver replacement kit, 347-480 VAC for 4 ft. linear.....	VMVL/UNV34 80W 1A KIT
• Offset wall mount.....	DP1052MTK <i>Compatible with DuraPro</i>	• 0.5 amp driver replacement kit, 100-277 VAC for 2 ft. linear.....	VMVL/UNV1 80W 0.5A KIT
• Pole mount kit, 1.25" conduit.....	PM KIT 1.25	• 0.5 amp driver replacement kit, 347-480 VAC for 2 ft. linear.....	VMVL/UNV34 80W 0.5A KIT
• Pole mount kit, 1.50" conduit.....	PM KIT 1.5		
• Pole mount kit, 2.00" conduit.....	PM KIT 2.0		

Dimensions and mounting options:



One year warranty. Remote EM kit also available, 120-277 VAC only. Available with 4 ft. model only.

Pauluhn DLL LED luminaires

For land-based drilling

Cl. I, Div. 2, Groups A, B, C, D
Cl. I, Zone 2
Cl. II, Div. 2, Groups F, G
Cl. III

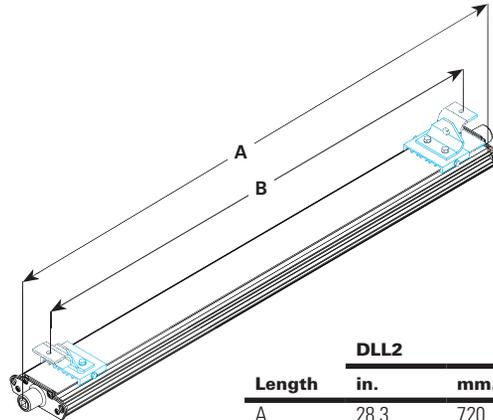
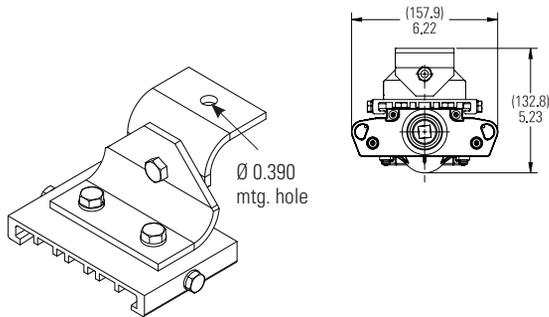
UL Listed
CSA Certified
Marine & Wet Locations
NEMA 4X; IP66

2L

2L

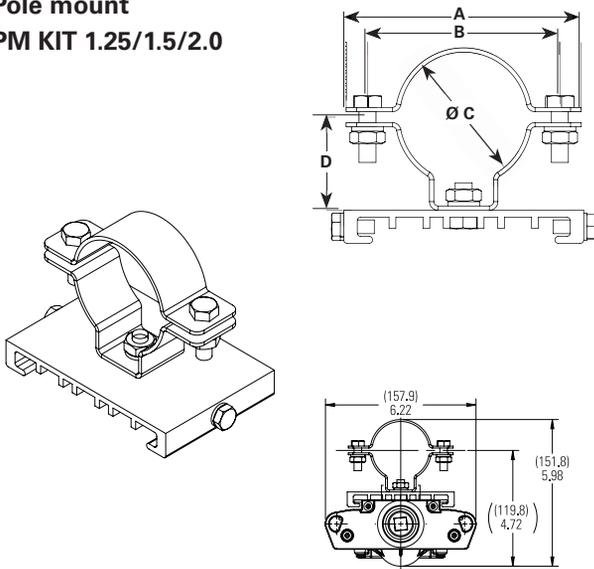
Mounting options:

Ceiling/swivel mount DP1050MTK

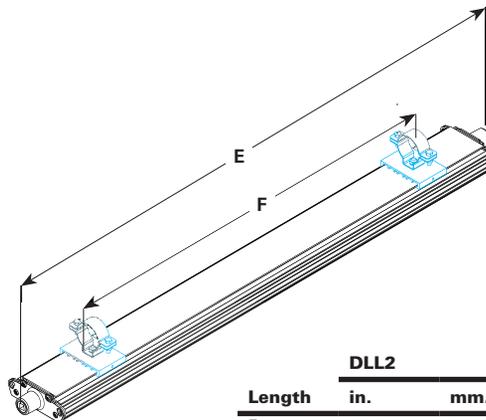


Length	DLL2		DLL4	
	in.	mm.	in.	mm.
A	28.3	720	52.3	1329
B	9-27	222-681	9-51	222-1289

Pole mount PM KIT 1.25/1.5/2.0

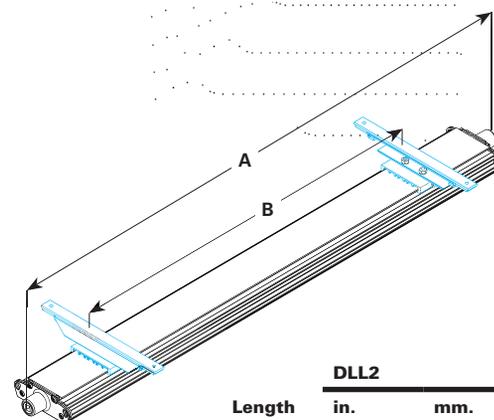
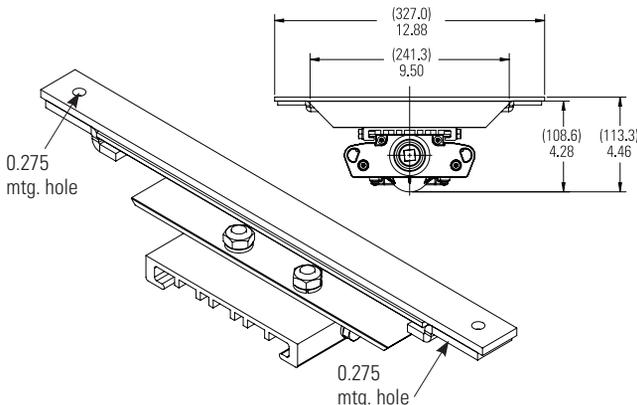


Configuration	ALL MEASUREMENTS IN INCHES			
	A	B	C	D
PM KIT 1.25	4.331	3.543	1.680	1.693
PM KIT 1.5	3.740	2.953	2.000	1.535
PM KIT 2.0	3.386	2.598	2.360	1.378



Length	DLL2		DLL4	
	in.	mm.	in.	mm.
E	28.3	720	52.3	1329
F	12-21	305-533	24-45	610-1143

MagnaPro mount MP1054MTK KIT



Length	DLL2		DLL4	
	in.	mm.	in.	mm.
A	28.3	720	52.3	1329
B	12-22	305-559	24-46	610-1168

Pauluhn DLL LED Luminaires

For land-based drilling

Cl. I, Div. 2, Groups A, B, C, D
Cl. I, Zone 2
Cl. II, Div. 2, Groups F, G
Cl. III

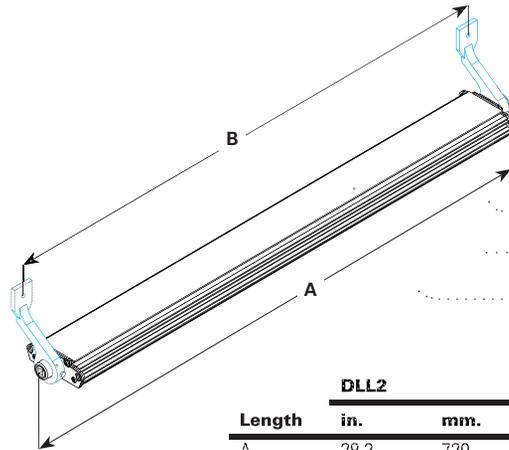
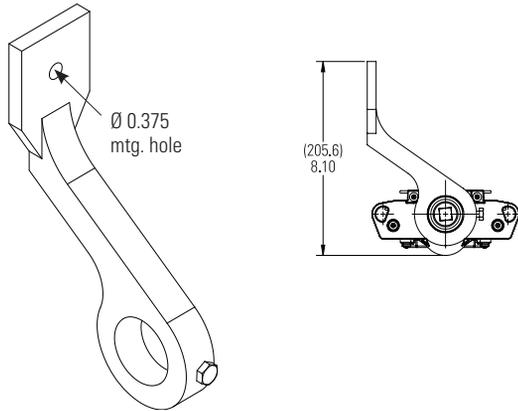
UL Listed
CSA Certified
Marine & Wet Locations
NEMA 4X; IP66

2L

2L

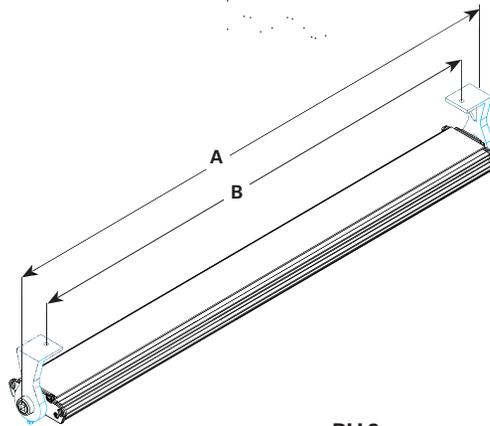
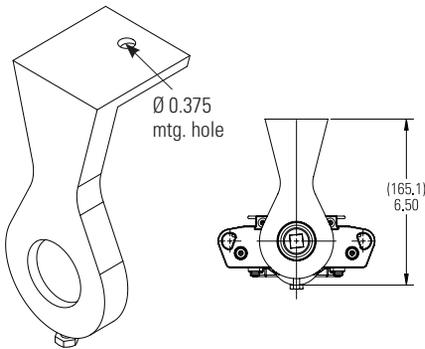
Mounting options (continued):

Offset wall DP1052MTK



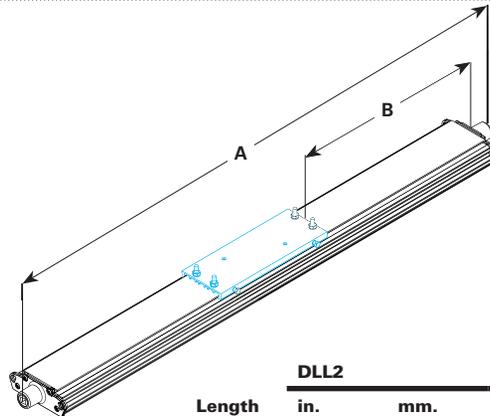
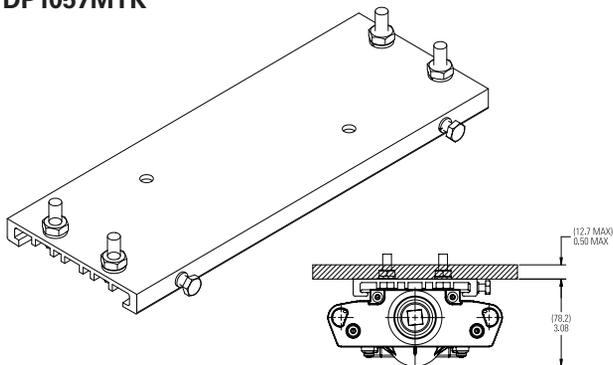
Length	DLL2		DLL4	
	in.	mm.	in.	mm.
A	28.3	720	52.3	1329
B	26.3	669	50.3	1278

Offset ceiling/wall mount DP1053MTK



Length	DLL2		DLL4	
	in.	mm.	in.	mm.
A	28.3	720	52.3	1329
B	26.3	584	47.0	1194

Flush ceiling DP1057MTK



Length	DLL2		DLL4	
	in.	mm.	in.	mm.
A	28.3	720.0	52.3	1329.0
B	6.2	157.5	18.2	462.0

Pauluhn DLL LED luminaires

For land-based drilling

Cl. I, Div. 2, Groups A, B, C, D
Cl. I, Zone 2
Cl. II, Div. 2, Groups F, G
Cl. III

UL Listed
CSA Certified
Marine & Wet Locations
NEMA 4X; IP66

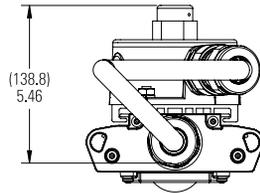
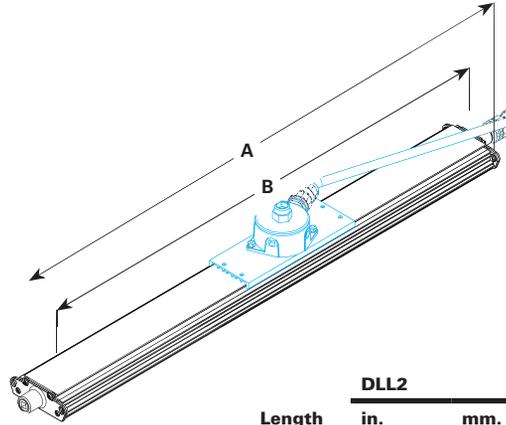
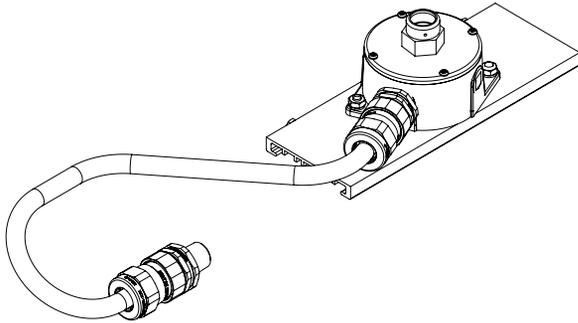
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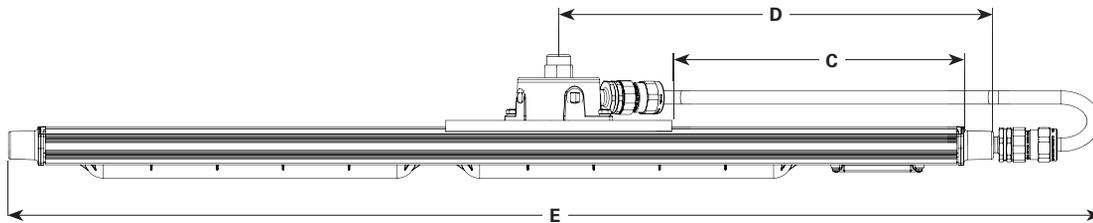
Mounting options (continued):

Pendant mount – Class I, Division 2 only

PEND HAZ KIT



Length	DLL2		DLL4	
	in.	mm.	in.	mm.
A	31.7	805	55.8	1418
B	28.3	720	52.3	1329
C	4.2	108	16.0	406
D	12.2	310	24.0	610
E	34.9	886	58.9	1495



Pauluhn DLL LED luminaires

Integral battery back-up

Cl. I, Div. 2, Groups A, B, C, D
Cl. II, Div. 2, Groups F, G

UL Listed
CSA Certified
Wet Locations
Type 4X; IP66

2L

2L

Pauluhn DLL linear LED luminaires are available with an integral battery back-up module. Virtually the same size as the standard 4 foot model and 90 minutes of emergency lighting to keep your facility and personnel safe.

Model	EM output	Normal output
DLL4/UNV1 S903 EM1	1,400 lumens (100-277V)	6,720 lumens (100-277V)

Applications:

- Egress and emergency lighting for areas requiring uninterrupted lighting during power failure
- Hazardous rated indoor and outdoor emergency lighting in manufacturing plants, heavy industrial, chemical and petrochemical facilities, platforms, loading docks and parking areas

Features:

- Operating ambient: 0°C to +40°C
- 90-minute run time in emergency mode
- 6,720 lumen output for normal operation; 1,400 lumen output in emergency mode
- 50,000 hours rated life at 40°C
- IP66 rated enclosure
- LED indicator to check battery operation
- Nickel cadmium battery
- 1 year warranty

Certifications and compliances:

NEC/CEC:

- Class I, Division 2, Groups A, B, C, D
- Class II, Division 2, Groups F, G
- Wet locations, Type 4X, IP66

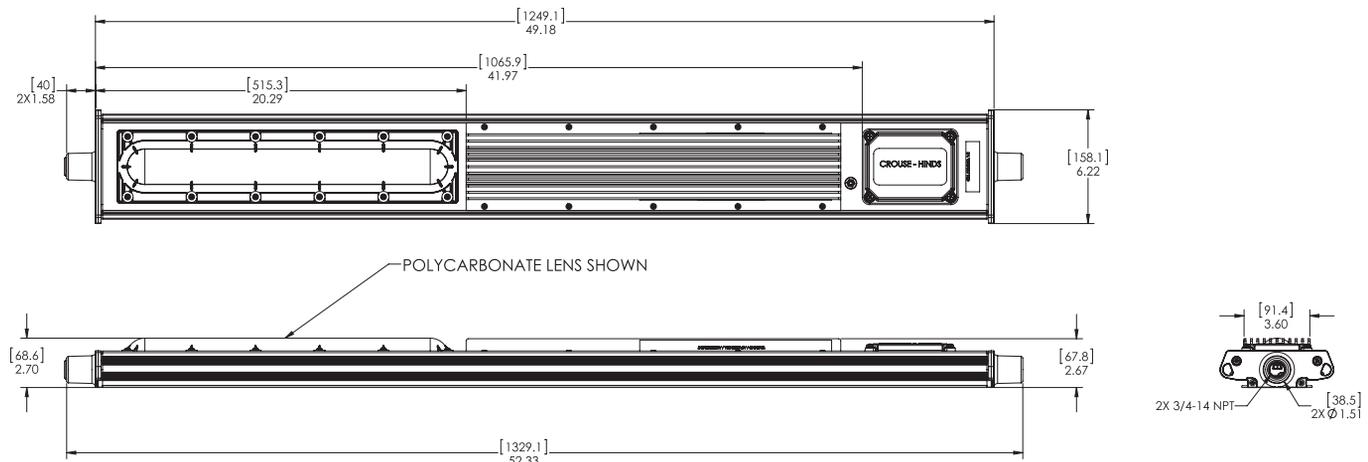
UL standards:

- UL844 – Hazardous (Classified)
- UL1598 – Luminaires
- UL1598A – Marine
- UL924 – Emergency Lighting

CSA standard:

- CSA C22.2 Nos. 137, 141

Dimensions:



Electrical ratings:

	EM output	Normal output
Voltage	120	277
Amperage at 120 VAC	0.480	0.212
Wattage at 120 VAC	57.8	57.7
Lumen output	1,400	6,720
Frequency	50/60 Hz	50/60 Hz
Power factor at 100 VAC	>0.90	>0.90
THD	6.58	11.70

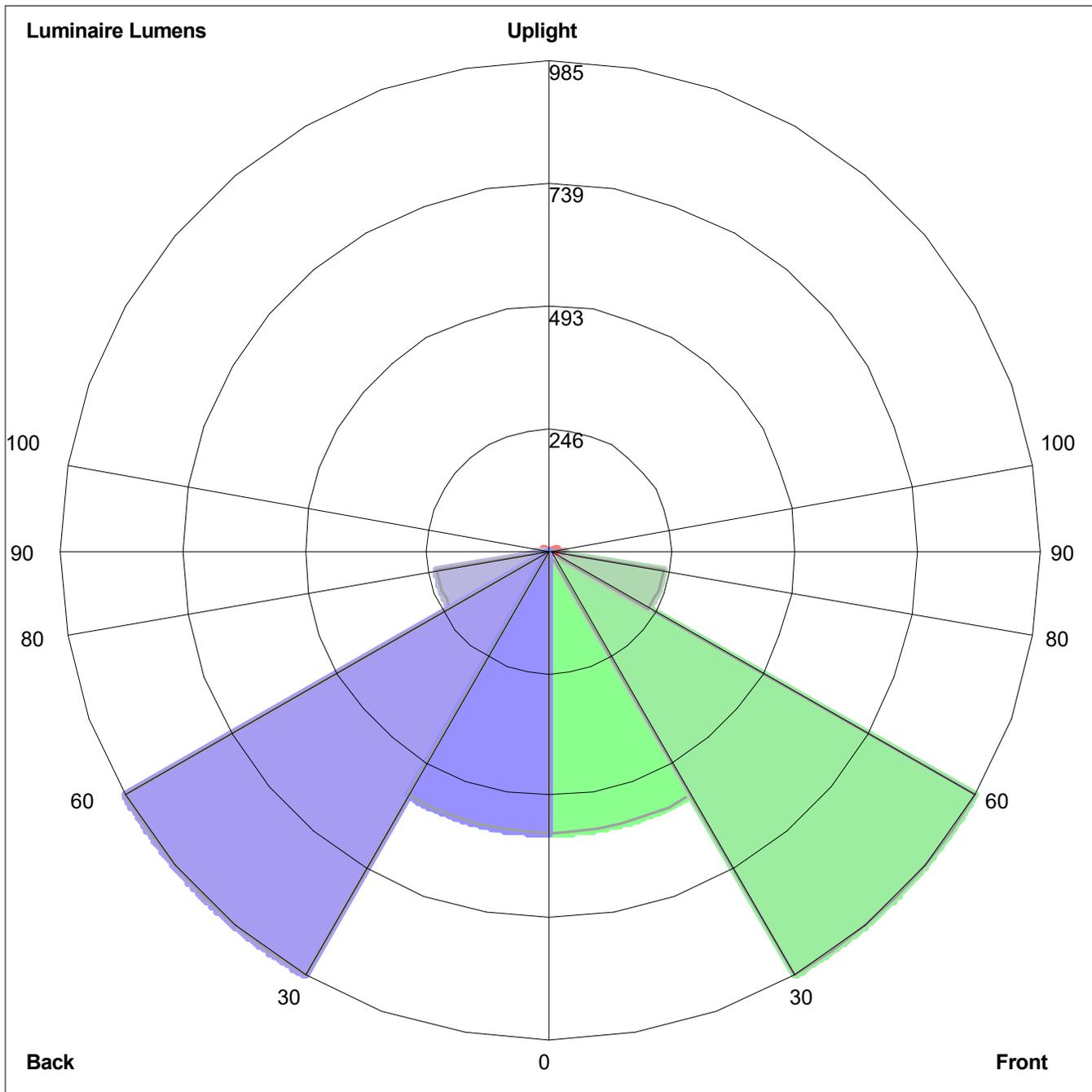
Temperature performance data:

Ambient temp. °C	Min. temp. supply wire °C	Simultaneous rating		
		Class I, Div. 2	Class II, Div. 2	Class I, Div. 2; Class II, Div. 2
40	60	T5	T6	T5

Photometrics:

- Complete photometrics can be found at www.crouse-hinds.com/photometrics

LUMINAIRE CLASSIFICATION SYSTEM (LCS) GRAPH



Luminaire Lumens:
 Front: Low=568.6, Medium=985.4, High=230.6, Very High=28.4
 Back: Low=568.6, Medium=985.4, High=230.6, Very High=28.4
 Uplight: Low=12.8, High=0.3

BUG Rating : B2-U2-G1

Fixture Cut Sheet

Type F



Mounting: Vertical Green LED Heat Trace End Seal Kit

Mounting Height: Piping Height Varies.

Part Number: E-100-L-A

Manufacturer: Raychem

Wattage: 2 watts at 60 Lumens/watt LED. 120 Lumens per end seal

APPROVALS

E-100-E	E-100-L-E
PTB 09 ATEX 1060 U Ⓜ II 2G Ex e II II 2D Ex tD A21 IP66 IECEx PTB 09.0038U Ex e II Ex tD A21 IP66 Ⓜ Ex e II T*	Sira 14ATEX3015X Ⓜ II 2GD Ex e mb IIC T* Gb Ex tb IIIC T***°C Db Ta = -40°C to +40°C IECEx SIR 14.0007X Ex e mb IIC T* Gb Ex tb IIIC T***°C Db Ta = -40°C to +40°C FM CLI, ZN1, AEx e mb IIC T* Gb (1) ZN21 AEx tb IIIC T* Ⓜ Ex e mb IIC T* Gb Ⓜ Ex tb IIIC T***°C Db
DNV Certificate No. E-11564 and E-11565 *For T-rating, see heating cable or design documentation (1) Except VPL	
EAC Ex TC RU C-BE.MI062.B.00054/18 Ex e IIC Gb U Ex tb IIIC Db U Ex e mb IIC Gb U Ex tb mb IIIC Db U Ta -55°C...+56°C IP66 000 "ТехИмпорт"	EAC Ex TC RU C-BE.MI062.B.00054/18 Ex e IIC Gb U Ex tb IIIC Db U Ex e mb IIC Gb U Ex tb mb IIIC Db U Ta -55°C...+56°C IP66 000 "ТехИмпорт"

PRODUCT SPECIFICATIONS

	E-100-E	E-100-L-E
Max. pipe temperature	Refer to heating cable specification (absolute maximum is 260°C)	
Max. operating voltage	480 V*	277 V
	*Extra conditions for safe use apply for voltages above 277 V. Please refer to the certificate or installation instructions for full details.	
Ambient temperature range	-50°C to +56°C*	-40°C to +40°C
	*Extra conditions for safe use apply for ambient temperatures above +40°C. Please refer to the summary the certificate or installation instructions for full details.	
Min. installation temperature	-50°C	-40°C
Overall height	171 mm	197 mm
Outer diameter	46 mm Usable with up to 100 mm thermal insulation	66 mm
Ingress protection	IP66, Type 4X	IP66, Type 4X
Impact resistance	EN 60079-30-1, ≥ 7 joules	EN 60079-30-1, ≥ 7 joules
UV stability	No degradation after > 1000 h	No degradation after > 1000 h
Solvent resistance	Excellent	Excellent
Strain relief	> 250 N	> 250 N

LIGHT SOURCE

Type	Green LEDs
Voltage rating range	110-277 Vac, 50/60 Hz
Power consumption	< 2 W
Electromagnetic immunity/emissions	Complies with IEC61000-6 and IEC61000-4

INSTALLATION DATA

Tools required	Cable knife, wire cutters, screwdriver	Cable knife, wire cutters, screwdriver, crimp tool (Panduit-CT-100), long nose pliers
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ORDERING DETAILS

End seal

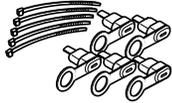
Part description	E-100-E	E-100-L-E
PN (Weight)	101255-000 (0.22 kg) Requires one pipe strap (not supplied)	P000001583 (0.63 kg) Requires one pipe strap (not supplied) PTB, DNV and EAC approved product

ACCESSORIES

Small pipe adaptor JBS- SPA, required for pipes $\leq 1"$ (DN 25), E 90515-000 (bag of 5 adaptors)

SPARE PART

Boot pack for E-100-E



Part description	E-100-BOOT-5-PACK
PN (Weight)	281053-000 (140 g)
Pack size	5 sealant filled boots and 5 cable ties

Replacement indicator light for E-100-L

Part description:	E-100-LR-E
PN	P000001586

North America

Tel +1.800.545.6258
Fax +1.800.527.5703
thermal.info@nVent.com

Europe, Middle East, Africa

Tel +32.16.213.502
Fax +32.16.213.604
thermal.info@nVent.com

Asia Pacific

Tel +86.21.2412.1688
Fax +86.21.5426.3167
cn.thermal.info@nVent.com

Latin America

Tel +1.713.868.4800
Fax +1.713.868.2333
thermal.info@nVent.com



Our powerful portfolio of brands:

nVent.com

CADDY

ERICO

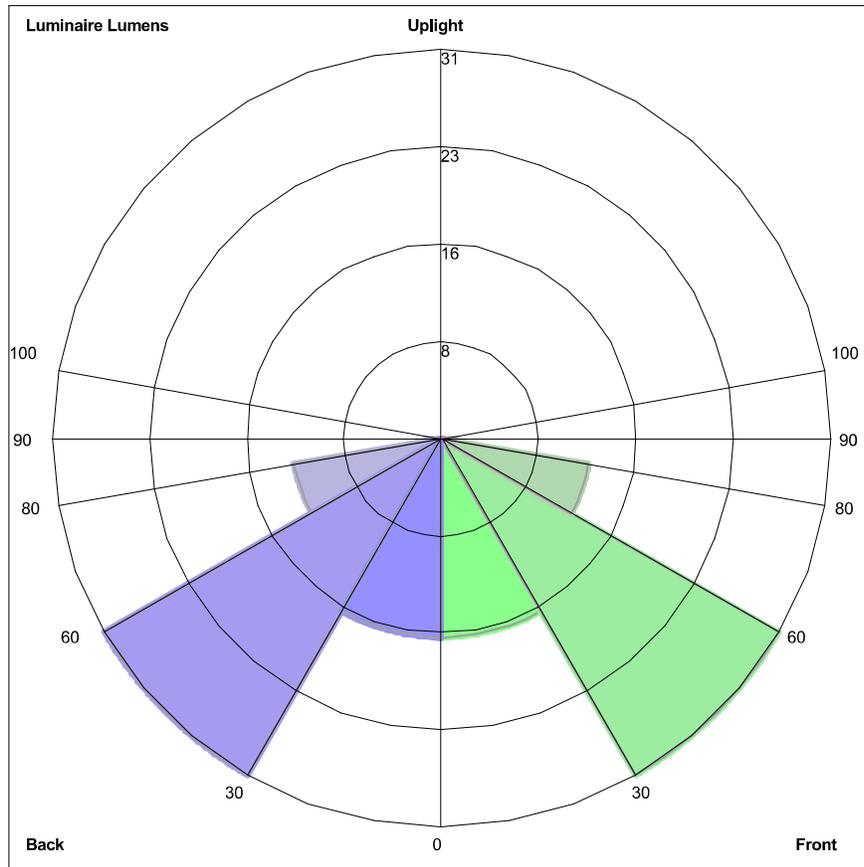
HOFFMAN

RAYCHEM

SCHROFF

TRACER

LUMINAIRE CLASSIFICATION SYSTEM (LCS) GRAPH



Luminaire Lumens:
Front: Low=16.0, Medium=31.2, High=12.0, Very High=1.2
Back: Low=16.0, Medium=31.2, High=12.0, Very High=1.2
Uplight: Low=0.0, High=0.0

BUG Rating : B0-U0-G0

Fixture Cut Sheet

Type G



PHOENIX[®]
DURABILITY X DESIGN™



Cube-Light

Compact LED Area Light

Australian Design No. 359170
US Patent No. D762,321 S

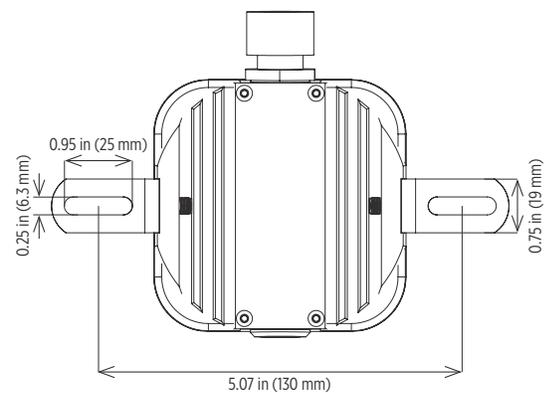
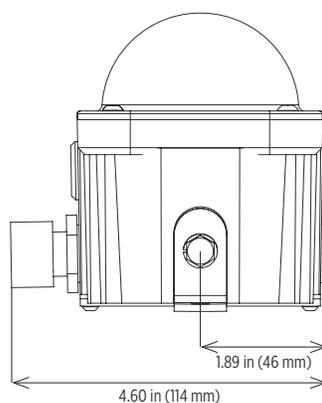
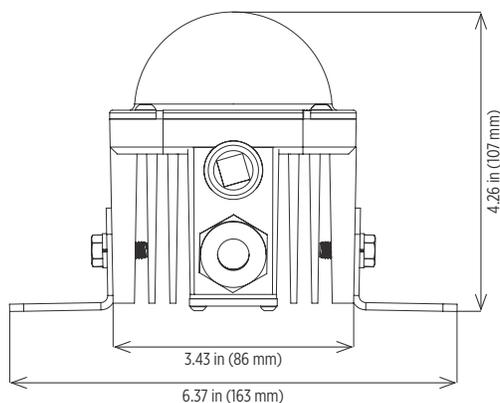
Delivers up to 1000 lumens to doorways, walkways, cabins or other small areas

Competitive pricing with short lead times

Various mounting options for maximum versatility

LED technology increases efficiency, eliminates maintenance and supports green initiatives

Dimensions



Cube-Light

Compact LED Area Light

Specifications

Construction	Cast aluminum housing
Finish	White thermoset powder coat
Hardware	Marine grade (316) stainless steel
Lens	Impact-resistant, diffuse polycarbonate Diffuse red, green, blue and amber lens accessories available (AMB-CL, BLU-CL, GRN-CL, RED-CL)
Light source	13W, up to 1000 lumens Conformal coated CRI ≥ 70 CCT 5000K 50,000 hour rated life
Power source	120-240V, 50/60Hz 240V, 50/60Hz 13-27V DC
Wiring	Stranded wires Cord not included - standard 72.00 inch (1829 mm) cord with pigtail option (CD) NEMA 5-15 plug (120V only) sold separately (PLG-515)
Through wiring	Continuous row mounting option (TW)
Ambient operating temperature	-30°C to +50°C
Mounting	Flush mount brackets - standard Harp mount available Rail mount available - 2.00 inch overall diameter Fixture can be mounted in any orientation
Weight	2.0 lb (0.9 kg)
Warranty	3 years

For IES files, see website or contact factory

Compliances

ETL/cETL Listed to:

- UL 1598 Suitable for Wet Locations
- UL 1598A Marine Outside Type (Saltwater)
- CSA C22.2 No. 250.0

CE

ABS

IP66 rated

LM79 and LM80 reports available



The Cube-Light on an STS crane



Ordering Information

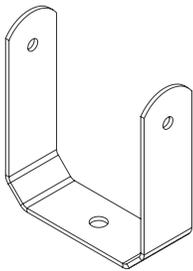
Example: CL-13LED-120-240

Fixture	Wattage/Type	Voltage	Options
CL	13LED	120-240 ^{1,2} 240 ² DC ³	CD TW

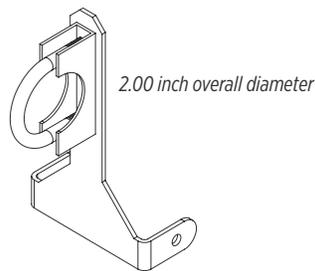
Wattage/Type	Voltage	Options	Notes
13LED 13W, up to 1000 lumens	120-240 ^{1,2} 120-240V, 50/60Hz 240 ² 240V, 50/60Hz DC ³ 13-27V DC	CD 72.00 inch (1829 mm) cord with pigtail option TW Continuous row mounting	1 ETL/cETL listed 2 CE 3 No certifications

Special Projects: We may be able to accommodate your special projects, so please don't hesitate to ask about additional options. Minimum order quantities and/or extended lead times will apply. Contact your Phoenix representative with specific inquiries.

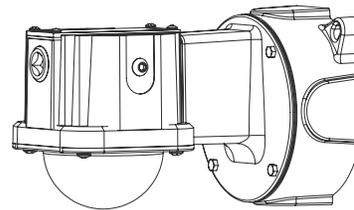
Mounting (order separately)



Harp Mount
HRP-CL



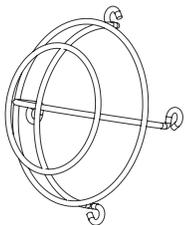
Rail Mount
RLMT-CL
Contact factory



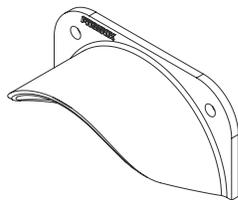
Wall Mount
Complete fixture sold separately
Refer to Cube-Light Wall Mount spec sheet

Flush mount comes standard with fixture

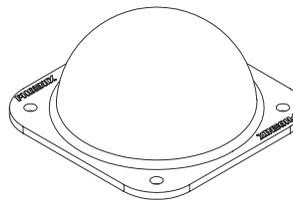
Accessories (order separately)



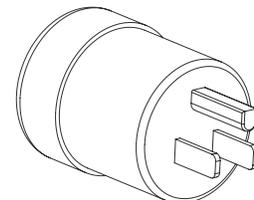
Wire Guard Kit
WG-CL



Visor Kit
VSR-CL



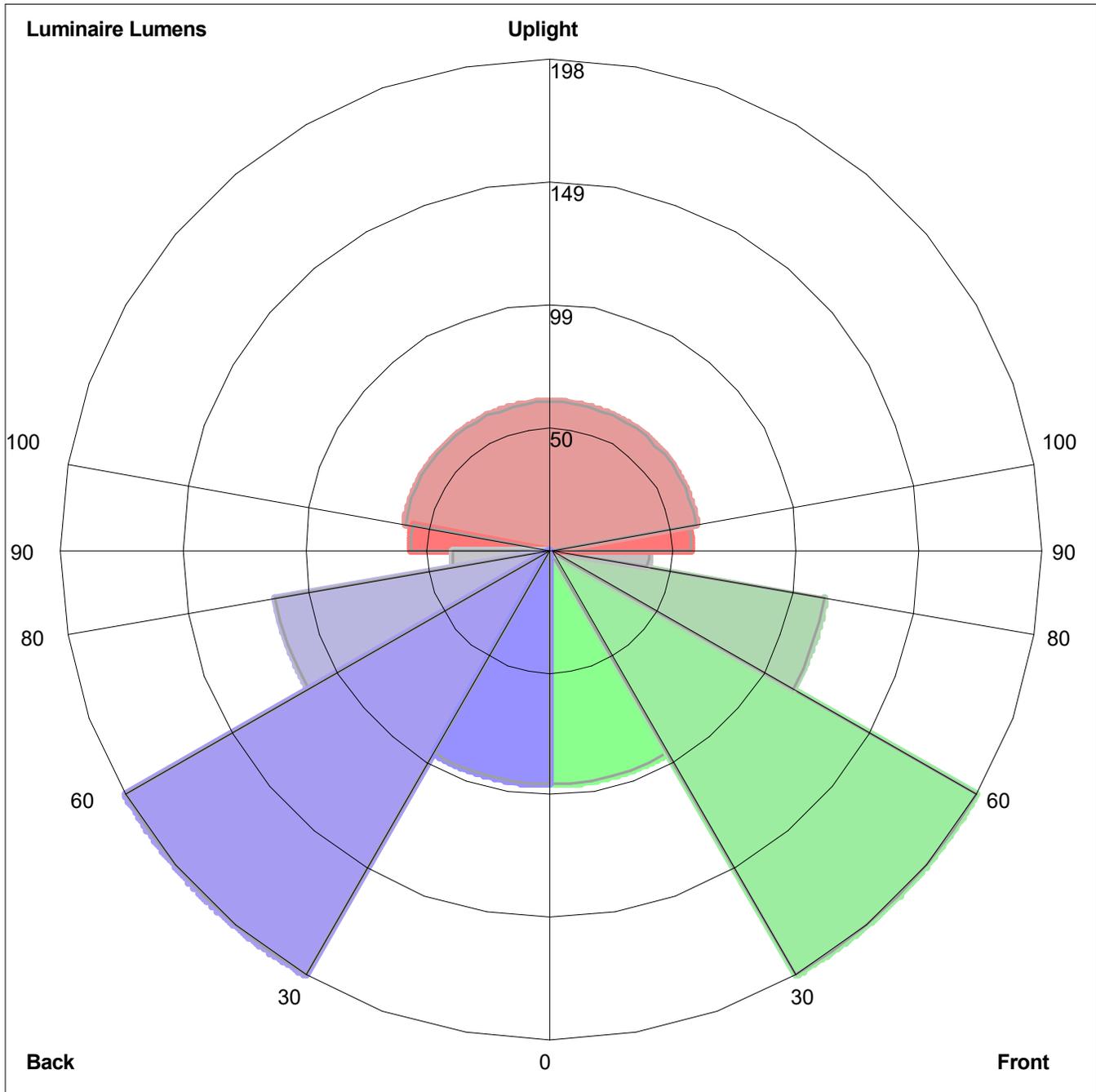
Color Lens Kits
AMB-CL amber lens kit
BLU-CL blue lens kit
GRN-CL green lens kit
RED-CL red lens kit



NEMA 5-15 plug (120V only)
PLG-515

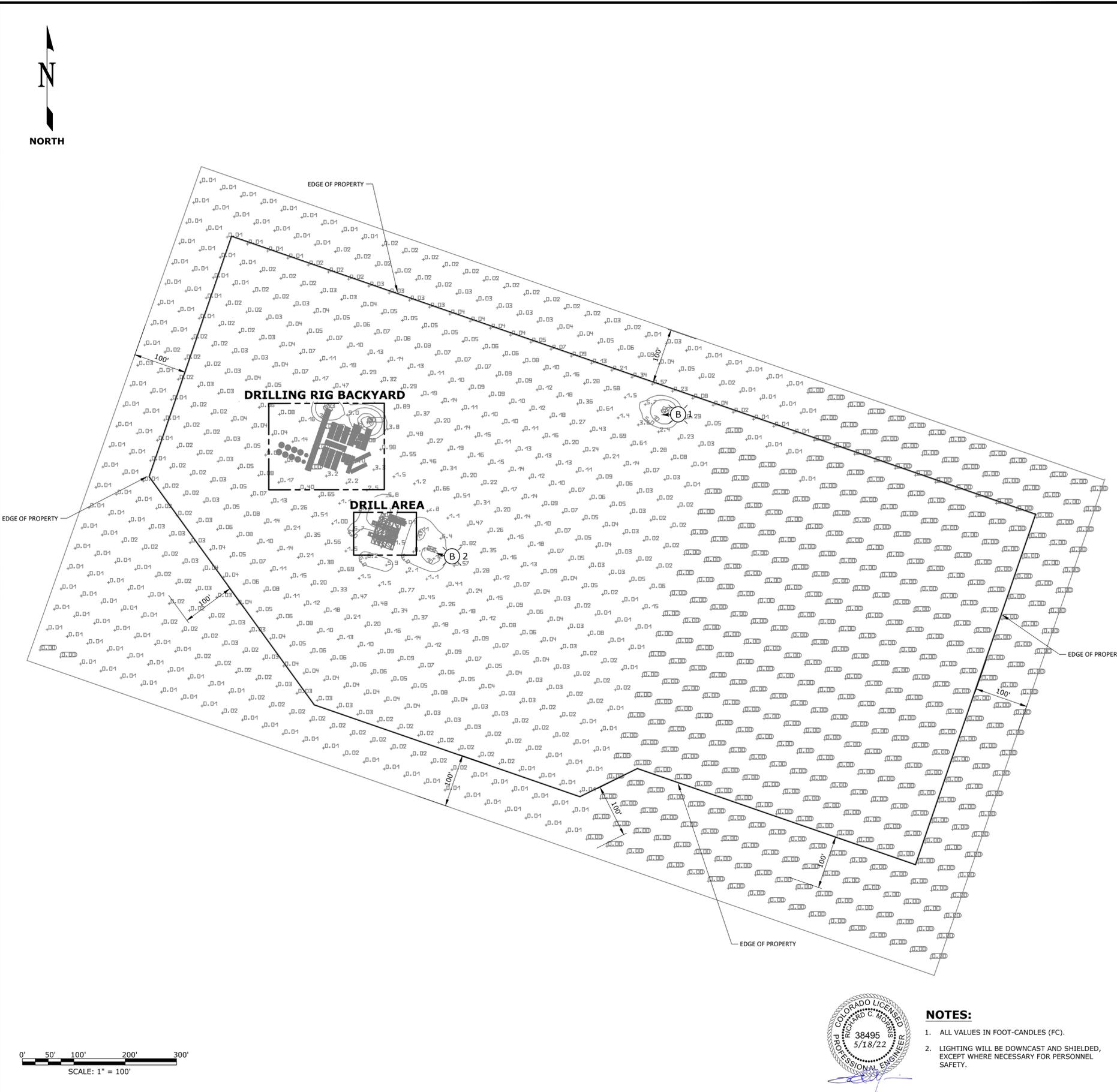
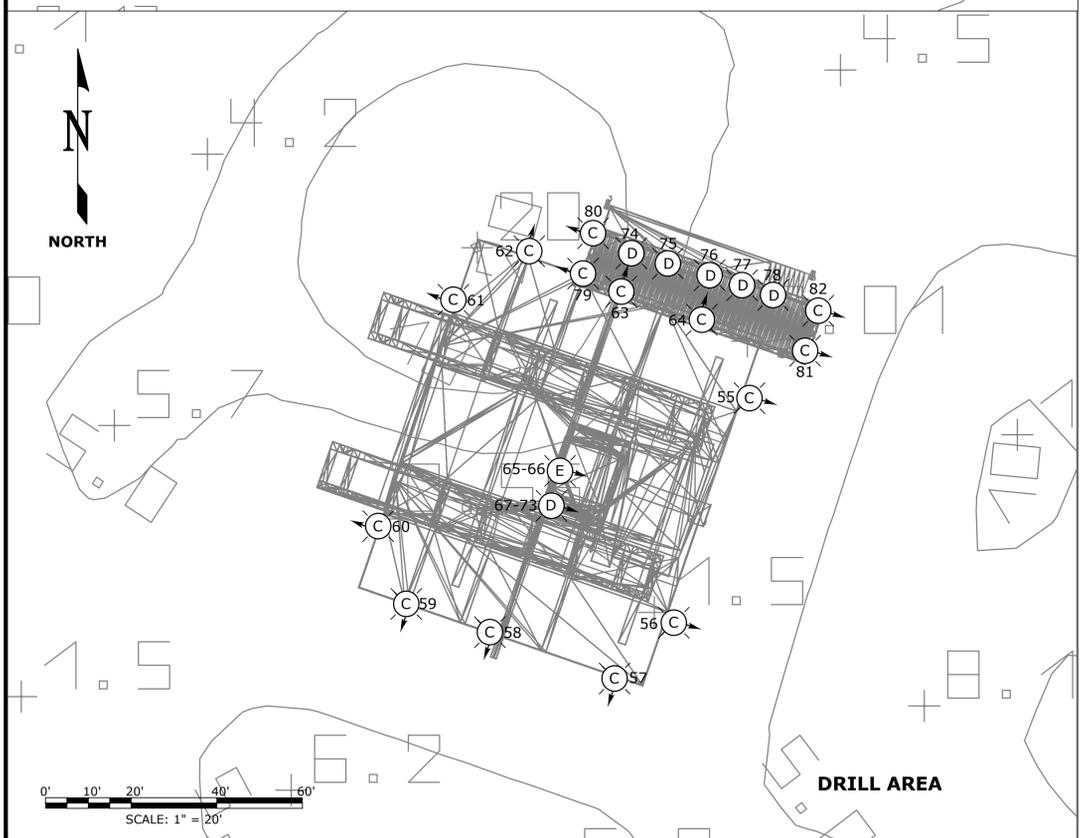
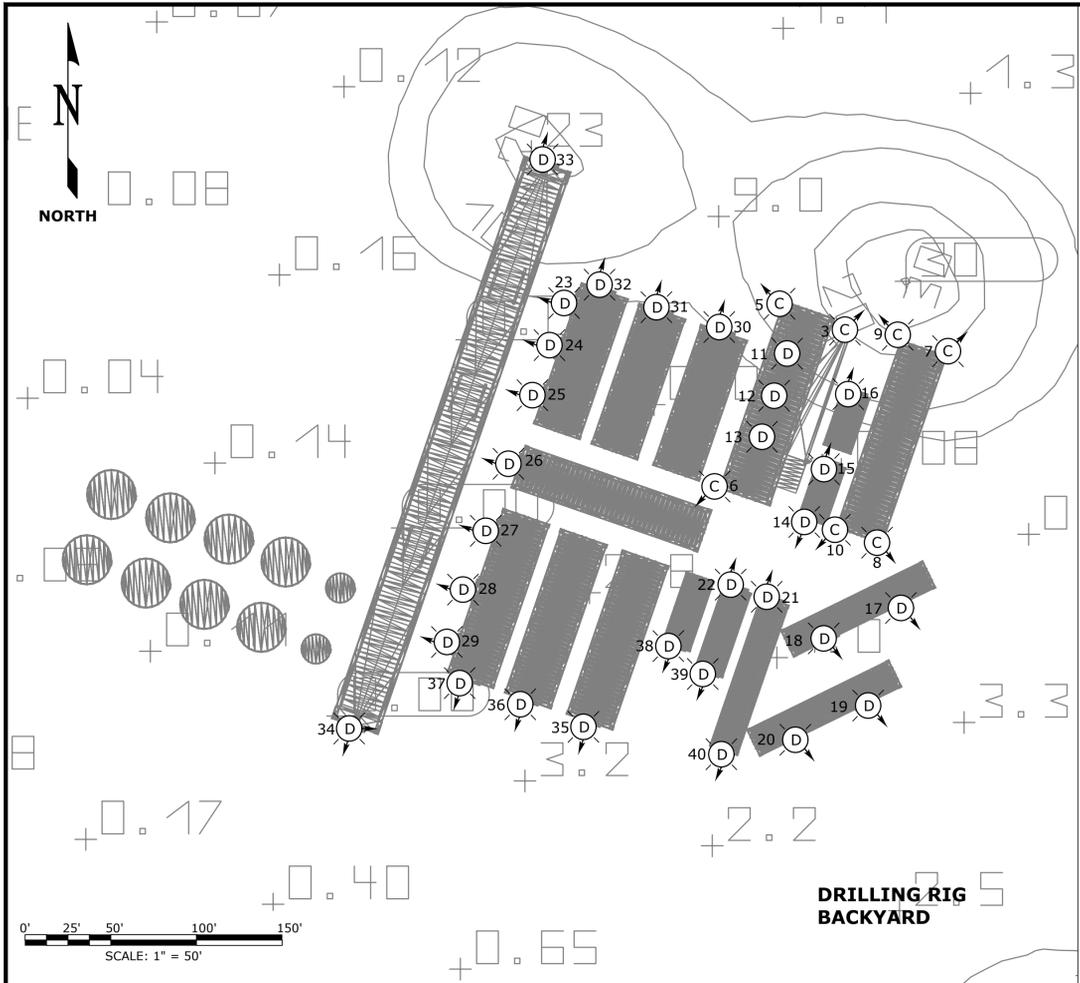


LUMINAIRE CLASSIFICATION SYSTEM (LCS) GRAPH



Luminaire Lumens:
 Front: Low=94.7, Medium=198.1, High=112.5, Very High=39.7
 Back: Low=94.7, Medium=198.1, High=112.5, Very High=39.7
 Uplight: Low=56.4, High=59.7

BUG Rating : B1-U3-G1



- NOTES:**
1. ALL VALUES IN FOOT-CANDLES (FC).
 2. LIGHTING WILL BE DOWNCAST AND SHIELDED, EXCEPT WHERE NECESSARY FOR PERSONNEL SAFETY.

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NUMBER	TITLE

NO.	DESCRIPTION	DATE	BY

NO.	DESCRIPTION	DATE	BY
0	ISSUED FOR ATTACHMENT TO PERMIT	05/18/22	DM

SCALE:	DATE
AS NOTED	05/10/22
DESIGNED: D.MILLER	05/10/22
DRAWN: D.MILLER	05/10/22
CHECKED: L.OHL	05/18/22
PE APPROVED: R.MORRIS	05/18/22
PM APPROVED: B.PRIMEAUX	05/18/22

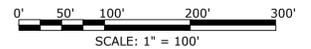
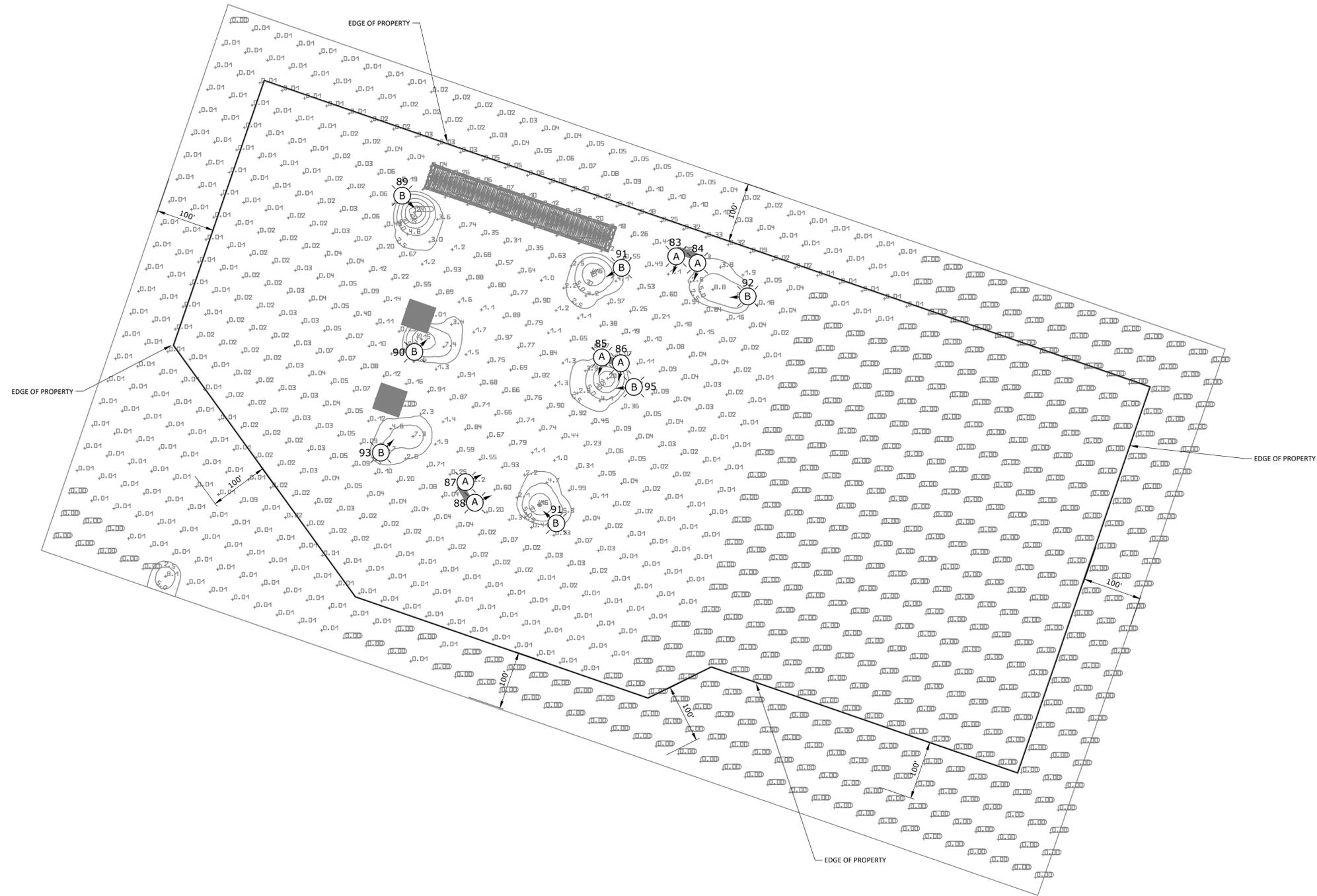
CLIENT: KERR MCGEE
PROJECT LOCATION: GREELEY, CO

8450 E. Crescent Parkway, Suite 200
Greenwood Village, CO 80111
Phone: 303.714.4840
Fax: 303.714.4800
Web: samuelengineering.com

TITLE	PROJECT NUMBER
LIGHTING STUDY GREELEY, CO ELECTRICAL RAINBOW 24-9 HZ - DRILLING PHOTOMETRIC LIGHTING PLAN	21010

DRAWING NUMBER	REV.
21010-EE-321	0

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Plot Date: Monday, May 23, 2022 9:10:54 AM
Plotted By: David Miller
CTB Used: SE_Scd_B&W_Full_size.ctb



- NOTES:**
1. ALL VALUES IN FOOT-CANDLES (FC).
 2. LIGHTING WILL BE DOWNCAST AND SHIELDED, EXCEPT WHERE NECESSARY FOR PERSONNEL SAFETY.

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NUMBER	TITLE	CLIENT	PROJECT NUMBER	PROJECT BUSINESS	CHECK

NO.	DESCRIPTION	DATE	BY

NO.	DESCRIPTION	DATE	BY
0	ISSUED FOR ATTACHMENT TO PERMIT	05/18/22	DM

SCALE:	AS NOTED	DATE
DESIGNED:	D.MILLER	05/10/22
DRAWN:	D.MILLER	05/10/22
CHECKED:	L.OHL	05/18/22
PE APPROVED:	R.MORRIS	05/18/22
PM APPROVED:	B.PRIMEAUX	05/18/22

CLIENT: KERR MCGEE
PROJECT LOCATION: GREELEY, CO

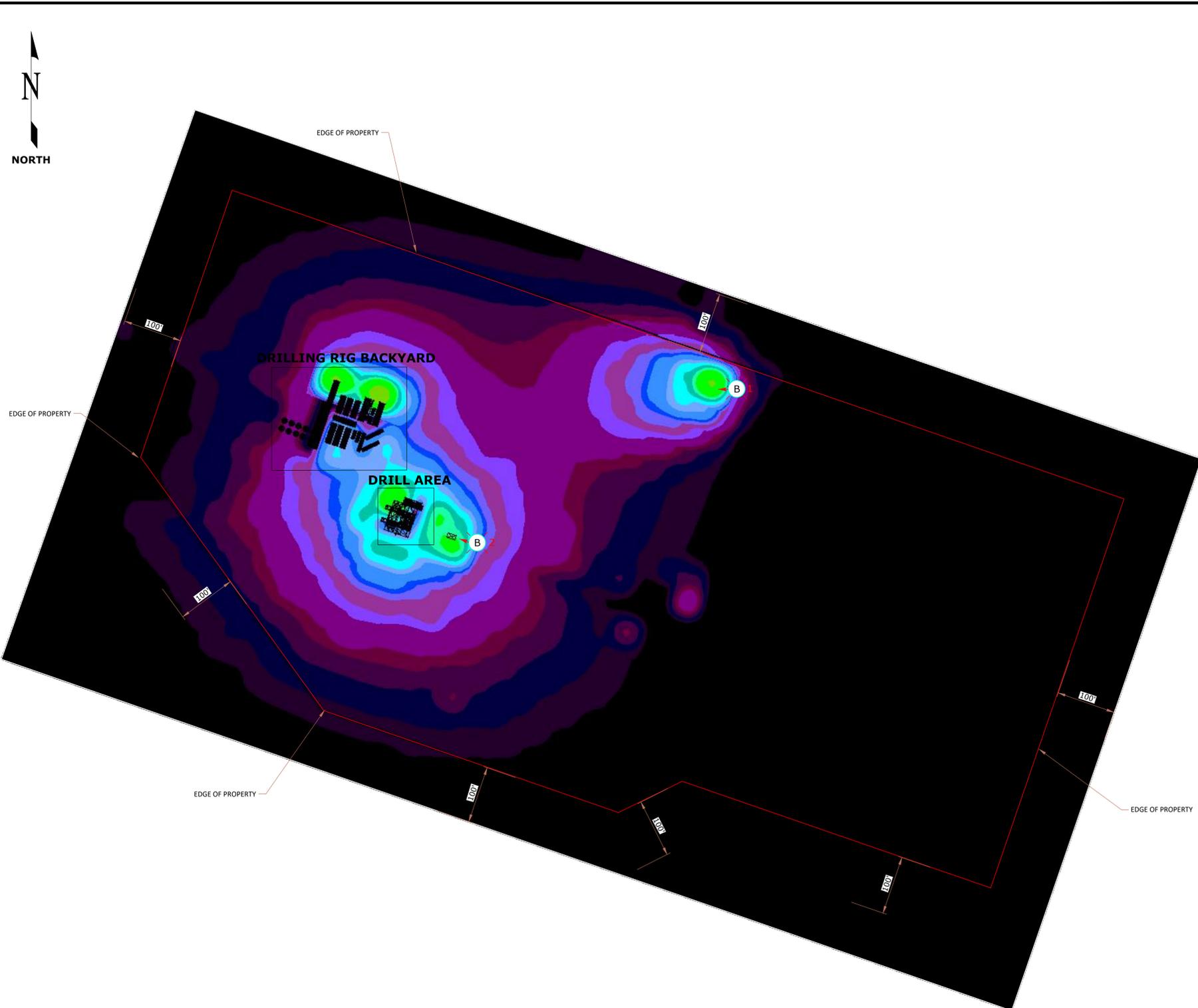
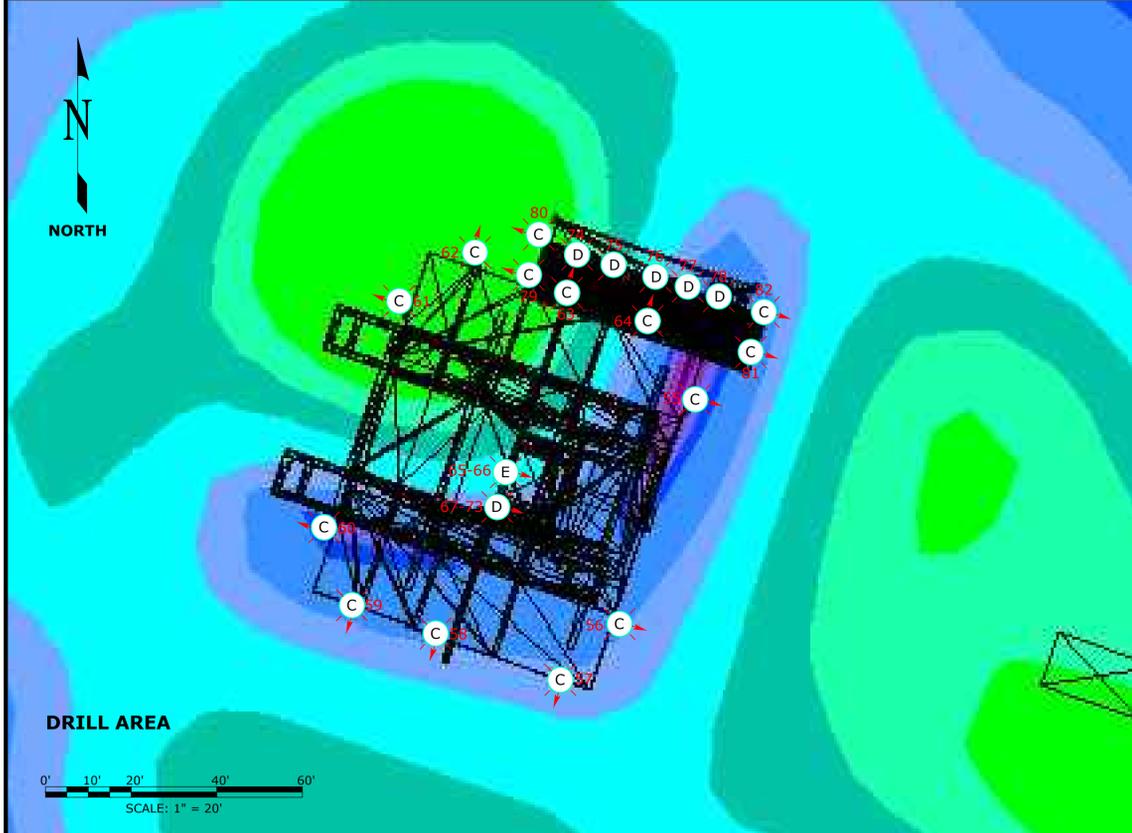
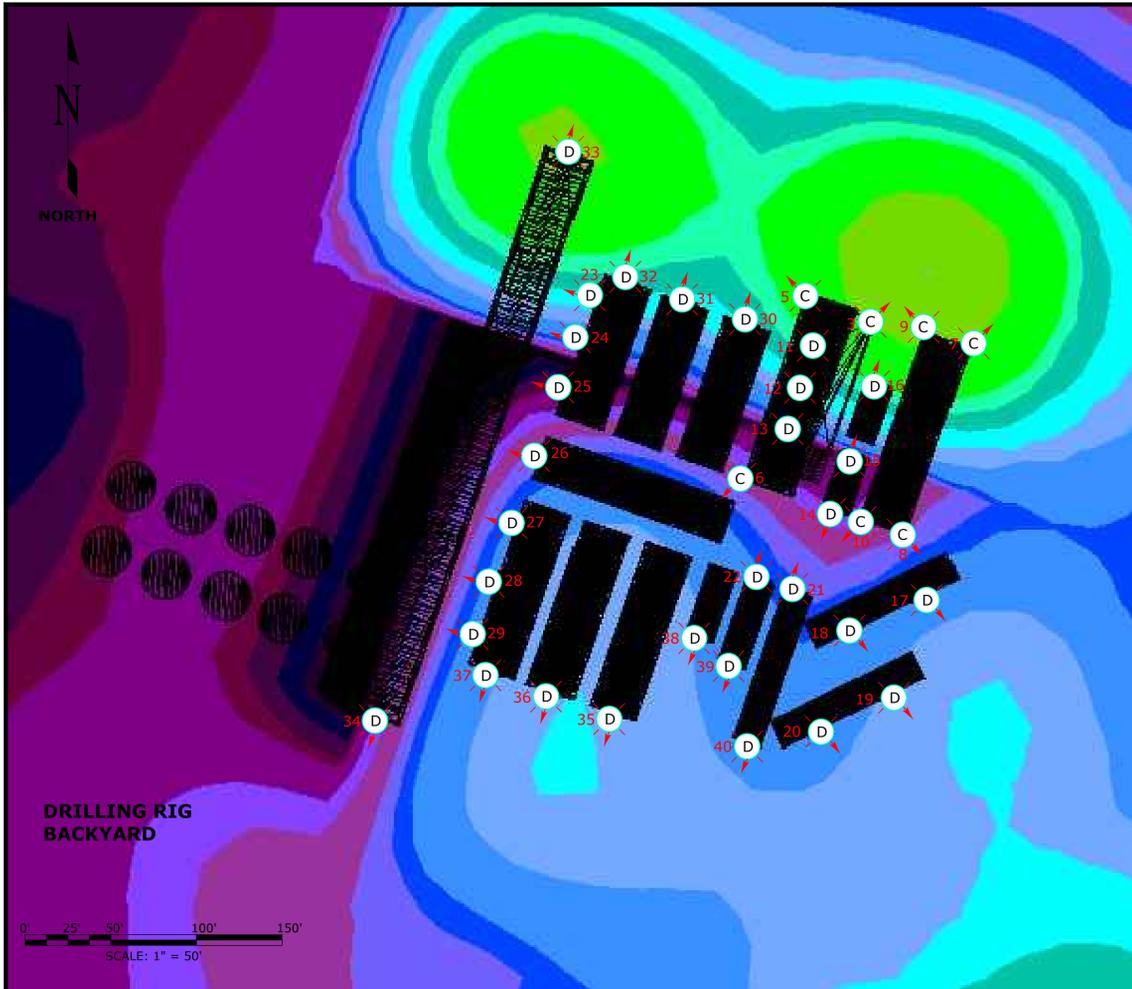
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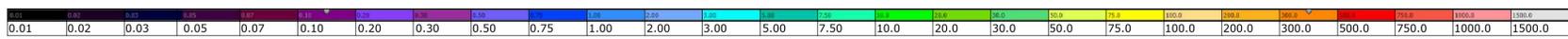
TITLE	PROJECT NUMBER
LIGHTING STUDY GREELEY, CO ELECTRICAL RAINBOW 24-9 HZ - COMPLETIONS PHOTOMETRIC LIGHTING PLAN	21010
	DRAWING NUMBER
	21010-EE-322

REV.	REV.
	0

CAD File: S:\Projects\21010_Oxy_Lighting_Studies\CAD\Electrical\Drawings\Physical Plans\21010-EE-322.dwg
Plot Date: Monday, May 23, 2022 9:11:36 AM
Plotted By: David Miller
CTB Used: SE_Scd_B&W_Full_size.ctb



LEGEND



- NOTES:**
1. ALL VALUES IN FOOT-CANDLES (FC).
 2. LIGHTING WILL BE DOWNCAST AND SHIELDED, EXCEPT WHERE NECESSARY FOR PERSONNEL SAFETY.

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NUMBER	TITLE	CLIENT	PROJECT MANAGER	PROJECT ENGINEER	CHECK

NO.	DESCRIPTION	DATE	BY

NO.	DESCRIPTION	DATE	BY
0	ISSUED FOR ATTACHMENT TO PERMIT	05/18/22	DM

SCALE:	DATE
AS NOTED	05/10/22
DESIGNED: D.MILLER	05/10/22
DRAWN: D.MILLER	05/18/22
CHECKED: L.OHL	05/18/22
PE APPROVED: R.MORRIS	05/18/22
PM APPROVED: B.PRIMEAUX	05/18/22

CLIENT: KERR MCGEE
PROJECT LOCATION: GREELEY, CO

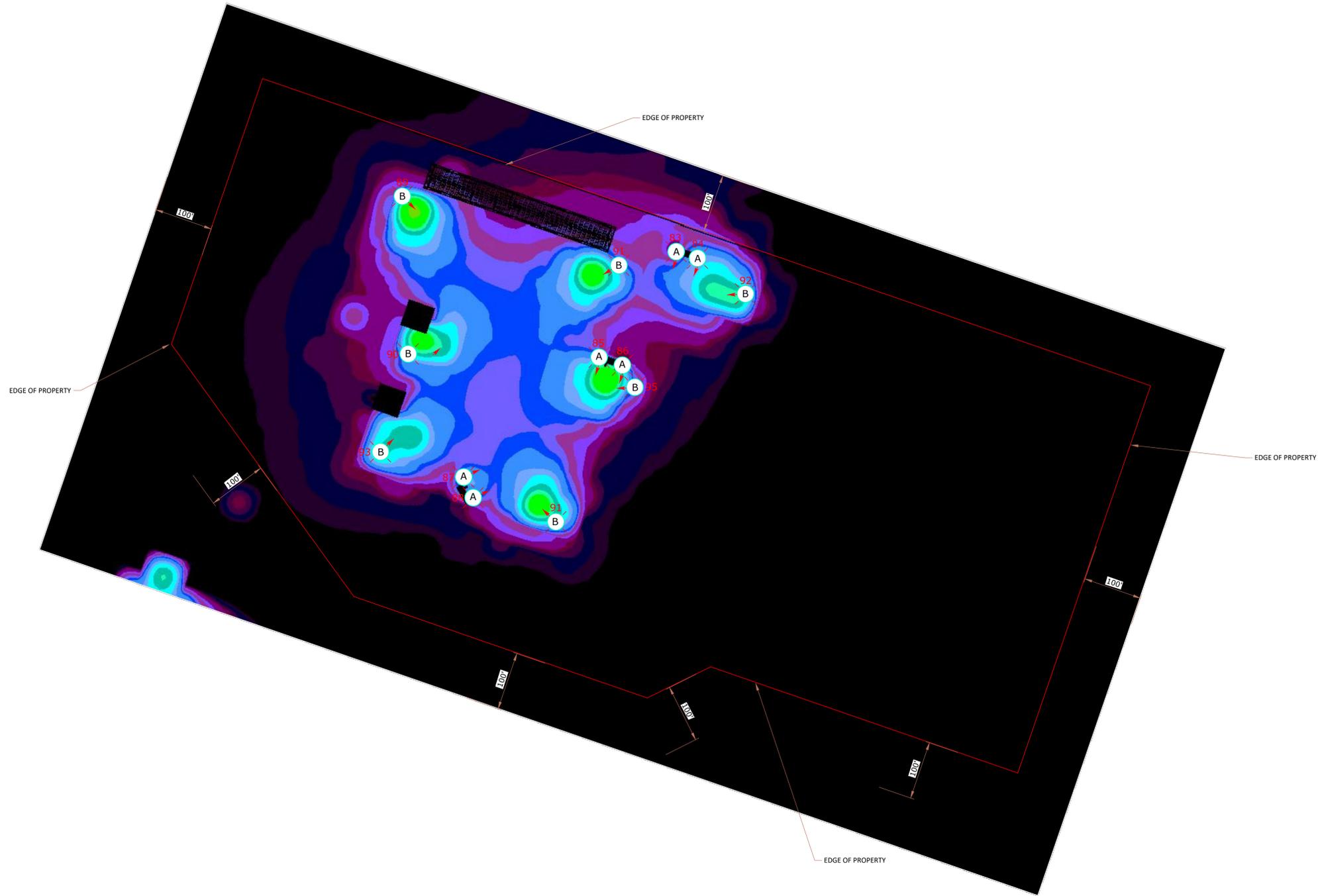
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8450 E. Crescent Parkway, Suite 200
Greenwood Village, CO 80111
Phone: 303.714.4840
Fax: 303.714.4800
Web: samuelengineering.com

TITLE
LIGHTING STUDY GREELEY, CO ELECTRICAL RAINBOW 24-9 HZ - DRILLING PHOTOMETRIC LIGHTING PLAN

PROJECT NUMBER
21010
DRAWING NUMBER
21010-EE-323
REV.
0

CAD File: S:\Projects\21010_Oxy_Lighting_Studies\CAD\Electrical\Drawings\Physical Plans\21010-EE-323.dwg
Plot Date: Monday, May 23, 2022 9:12:35 AM
Plotted By: David Miller
Plot Used: SE_Sld_Color_Full_Size.ctb



- NOTES:**
1. ALL VALUES IN FOOT-CANDLES (FC).
 2. LIGHTING WILL BE DOWNCAST AND SHIELDED, EXCEPT WHERE NECESSARY FOR PERSONNEL SAFETY.

LEGEND



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NUMBER	TITLE
	REFERENCE DRAWINGS

NO.	DESCRIPTION	DATE	BY
	REVISIONS		

NO.	DESCRIPTION	DATE	BY
0	ISSUED FOR ATTACHMENT TO PERMIT	05/18/22	DM
	REVISIONS		

SCALE:	AS NOTED	DATE:	05/10/22
DESIGNED:	D.MILLER	DATE:	05/10/22
DRAWN:	D.MILLER	DATE:	05/10/22
CHECKED:	L.OHL	DATE:	05/18/22
PE APPROVED:	R.MORRIS	DATE:	05/18/22
PM APPROVED:	B.PRIMEAUX	DATE:	05/18/22

CLIENT: KERR MCGEE
PROJECT LOCATION: GREELEY, CO

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8450 E. Crescent Parkway, Suite 200
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Web: samuelengineering.com

TITLE	PROJECT NUMBER
LIGHTING STUDY GREELEY, CO ELECTRICAL RAINBOW 24-9 HZ - COMPLETIONS PHOTOMETRIC LIGHTING PLAN	21010
	DRAWING NUMBER
	21010-EE-324

REV.	0
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CAD File: S:\Projects\21010_Oxy_Lighting_Studies\CAD\Electrical\Drawings\Physical Plans\21010-EE-324.dwg
Plot Date: Monday, May 23, 2022 9:14:43 AM Plotted By: David Miller
CTB Used: SE_Std_Color_Full_Size.ctb

LIGHTING FIXTURE SCHEDULE

FIXTURE TYPE	DESCRIPTION	CLASSIFICATION	MOUNTING TYPE	MANUFACTURER CATALOG No. (See Note 2)	VOLTAGE	LUMEN OUTPUT	WATTS (See Note 1)	REMARKS
A	STANPRO WPS GEN 4	CLASS I, DIV II GROUPS A-D	WALL MOUNT	WPS-PS40-Q-3C	120-347	5,800	40W	INCLUDES GLARESHEILD (#68371) TO MITIGATE UPLIGHT
B	HPWINNER M8B	CLASS I, DIV II GROUPS A-D	POLE MOUNT - PORTABLE	M8B-VCA-63	48 - 61 Vdc	121,920	960W	EACH FIXTURE CONSISTS OF 16 MODULES, VALUES SHOWN ARE TOTAL PER FIXTURE
C	PAULUHN DFL HID	CLASS I, DIV II GROUPS A-D	WALL MOUNT	DFLMY400/TT 76	100-277	24,091	400W	
D	PAULUHN DLL LED	CLASS I, DIV II GROUPS A-D	WALL MOUNT	DLL4/UNV1S903D	100-277	7,900	63W	INCLUDED DIFFUSED POLYCARBONATE LENS
E	PAULUHN DLL LED	CLASS I, DIV II GROUPS A-D	WALL MOUNT	DLL2/UNV1S903D	100-277	3,958	32W	INCLUDED DIFFUSED POLYCARBONATE LENS
F	RAYCHEM LIGHTED END SEAL	CLASS I, DIV II GROUPS A-D	VERTICAL END SEAL	E-100-L-A	110-277	60	2W	FIXTURE IS AN ESTIMATE OF TYPICAL END-SEAL KIT LIGHTS
G	PHOENIX AREA LED	CLASS I, DIV II GROUPS A-D	WALL MOUNT	CL-13LED-120-240	120-240	1,000	13W	INCLUDE VISOR KIT (#VSR-CL) TO MITIGATE UPLIGHT

NOTES:

1. WATTS SHOWN INDICATES APPROXIMATE INPUT WATTAGE AS IS USED MAINLY FOR CALCULATING LOADS.
2. ALL FIXTURES SHALL BE PURCHASED AS INDICATED BY CATALOG # OR APPROVED EQUAL.
3. SEE PLAN DRAWINGS AND ELECTRICAL SYMBOL DRAWING FOR SYMBOLOGY.
4. CONTRACTOR TO VERIFY FIXTURE AND MATERIAL COUNT WITH PLAN DRAWINGS.
5. LIGHTING WILL BE DOWNCAST AND SHIELDED, EXCEPT WHERE NECESSARY FOR PERSONNEL SAFETY.



CAD File: S:\Projects\21010_Oxy_Lighting_Studies\CAD\Electrical\Drawings\Schedules\21010-EE-325.dwg
 Plot Date: Monday, May 23, 2022 9:17:22 AM Plotted By: David Miller
 CTB Used: SE_Sch_B&W_Full_size.ctb

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NUMBER	TITLE

NO.	DESCRIPTION	DATE	BY

NO.	DESCRIPTION	DATE	BY
0	ISSUED FOR ATTACHMENT TO PERMIT	5/18/22	DM

SCALE:	AS NOTED	DATE
DESIGNED:	D.MILLER	5/10/22
DRAWN:	D.MILLER	5/10/22
CHECKED:	L.OHL	05/18/22
PE APPROVED:	R.MORRIS	05/18/22
PM APPROVED:	B.PRIMEAUX	05/18/22

CLIENT: KERR MCGEE
 PROJECT LOCATION: GREELEY, CO

TITLE
LIGHTING STUDY
 GREELEY, CO
 ELECTRICAL
 RAINBOW 24-9 HZ
 LIGHTING FIXTURE SCHEDULE

PROJECT NUMBER	REV.
21010	
DRAWING NUMBER	
21010-EE-325	0