Technical II Report – Electrical Systems

Kelly Chan
Consultant: Prof T. Dannerth, P.E.

Part A – Drawings

Drawings needed for single-line diagram

EE1.01 – title sheet (electrical drawings)

EE2.09 – penthouse/roof electrical plan

EE3.01 - typical core electrical plan

EE3.02 – main electrical room and details

EE4.01E – power riser diagram

EE4.05 – panel schedules

EE4.06 – panel schedules

Feeder Schedule

Please refer to page 2-3

Existing Riser Diagram

Please refer to page 4

Part B – Report

Executive Summary

The Ballenger East Building in Alexandria, Virginia, has an gross area of just above 60,000 SF in 4 floors above grade. VEPCO, the electric utility company provides power to the service entrance where two main switchboards "A" & "B" are located. Power is then distributed to various panelboards and equipments throughout the building in either 480/277,3Ph 4w system or 208/120, 3Ph 4w system through dry type, step-down transformers at corresponding electrical rooms.

There are different lighting loads in the building; linear and compact fluorescent lamps, HID lamps, cold cathode lighting, etc. Besides that, the major mechanical loads are electric heaters, exhaust and intake fans, and air-conditioning.

The over-current devices in switchboards and panelboards are typically fuse switches, main lugs and miniature circuit breakers. In case of any emergency, there is an emergency generator run by diesel stand-by on the roof level.

Electrical Power Distribution System

Power is distributed from the utility company, VEPCO, to the two main switchboards 'A' & 'B' in the main electrical room at parking level 1 through the utility transformer outside the building. Then the power is distributed to various equipments and panelboards at different levels. 480/277V power systems are used as well as 208/120V power systems with step-down transformers, depending on the equipment need.

480/277V power is mainly distributed to systems like: exterior lightings, lightings and equipments in parking floors, decorative lighting for retail tenants on 1st and 2nd floor. While the 208/120V power is mainly distributed to systems like: lightings in offices on 3rd and 4th floors, telephone and security systems, elevator lightings, fire alarm equipments, generator battery charger, etc.

Electric Utility Company

Company name: VEPCO (Virginia Electric and Power Company, early known as Dominion Resources Company)

Company address: 120 Tredegar St.
Richmond, VA 23219
United States

Company website: http://www.dom.com/

Utility rate schedule: http://www.dom.com/customer/pdf/va/vabgs2.pdf

Service entrance

The service entrance point is at the electric vault where the utility transformer and utility switches are located. The electric vault is at the northwest part of the building, at P1 parking level with the main electrical room right next to it. In the main electrical room, both the main switchboards 'A' & 'B' of 480/277V are there, as long as two dry-type transformers at 45KVA and 30KVA.

The power distribution system is fed directly from the electric utility company, VEPCO, and the utility company meters the electricity use through the meter at the pulling section, where it is in the electrical room at mezzanine level.

Service entrance size

The total gross floor area of the building is about 61642 SF in four levels, while the first two levels are retail spaces and the upper two levels are office spaces, and since each level has approximate the same area, therefore the building area is categorized into 2 parts:

(a) ~30800 SF for retail spaces (closest to arena)
(b) ~30800 SF for office spaces

METHOD 1 – CONCEPTUAL & SCHEMATIC PHASES				
Building type	VA/ft^2	floor area(SF)	kVA	Approximate size of 480 – volt service entrance (Amps)
Office	12	30800 SF	369.6	445 A
Arena	13	30800 SF	400.4	482 A
				Total = 927A

METHOD 2 – DESIGN DEVELOPMENT PHASE			
Load category	VA/ft^2	Corresponding floor area (SF)	Approximate size of 480 – volt service entrance (kVA)
Normal lighting	3.5	61600 SF	215.6 kVA
Receptacles	0.5	61600 SF	30.8 kVA
Exhaust Fan	2	61600 SF	123.2 kVA
Electric Heating	15	61600 SF	924 kVA
Cooling	12	61600 SF	739.2 kVA
Elevators	50kw ea.	--	200 kVA
			Total = 2232.8 kVA

METHOD 3 – WORKING DRAWINGS					
Panelboard	Connected lighting loads (kVA)	Connected receptacle loads (kVA)	Connected mechanical loads (kVA)	Connected equipment loads (kVA)	Connected transformer loads (kVA)
4H	0.7	--	91.1	--	3.7
4PA	--	2.5	1.2	--	--
3H	0.7	67.1	--	--	3.7
3PA	--	2.5	1.2	--	--
HPP1	13.6	56.4	--	--	3.7
LPP1	--	2.4	--	7.8	--
HHA	10.3	--	133.7	5.6	23.6
LHA	0.9	7.8	8.0	6.6	--
EHP1	12.3	--	13.9	24	29.0
ELP1	5.6	5.0	16.5	4.5	--
Demand factor	1.25	1.0	1.0	1.0	1.0
Total (kVA)	55.1	143.7	265.6	48.5	63.7
					Total = 576.6 kVA
					After addition of 20% spare capacity, total = 692 kVA

SUMMARY TABLE			
Phase	Load (kVA)	Voltage system	Load (Amps)
Conceptual/Schematic Design	770	480/277V	927
Design Development	2233	480/277V	2686
Working Drawings	577	480/277V	694
Service Entrance 1	889	480/277V	1600

Voltage systems

The voltage system in the main switchboards 'A' & 'B' are both 480Y/277V, 3Ph, 4W.
The different types of power systems operating in the buildings are:

a. 480Y/277V, 3Ph, 4W
   It is connected to higher power consuming appliances, like the fan powered VAV, transformers, various types of heaters , loading dock and parking garage door control, etc.
b. 208Y/120V, 3Ph, 4W
   The low voltage system is connected to tenant receptacles; office, corridor, garage, and also for telephone system, security system, fans, etc.
c. 277V, 1Ph, 3W
   Most of the lightings (interior and exterior) within the building are operating in this voltage system.
d. 120V 1Ph, 3W
   There are 3 types of luminaires operating in this voltage. The lighting in elevator vault and the cove mounted luminaire in the main lobby.

Emergency power systems

There is an emergency diesel generator powered in 275kw, with a configuration of 480Y/277V, 3Ph, 4W. It provides power to emergency lighting, fire alarm system, one parking elevator and one passenger elevator, various pumps, and A/C in machine room (indoor and outdoor)
The generator has a starting battery of 24 voltages DC and a 10 amp voltage regulated battery charger.

The operating mechanism of automatic transfer switches should be such that loads cannot remain simultaneously disconnected from both normal and alternate sources. Transfer sequence from normal to emergency power source should be initiated when normal voltage source drops to 85% or less of normal voltage or when frequency has attained 90% of rated value.

[Note: please refer to Emergency Generator Schedule on pg. 7]

EMERGENCY GENERATOR SCHEDULE			
275kW, 480/277V, 3Ph, 4W Diesel Generator		Max. SkW Required: 291kW Max. SkVA Required: 1028kVA Max. Starting Voltage DIP: 14%	
Step	**Load served**	**HP**	**kW**
1	Emergency Lighting	--	20.0
1	Fire Alarm System	--	10.0
1	F-13 (stairwell press.)	2.0	2.2
1	F-14	3.0	2.3
1	F-17	--	0.9
1	A/C -1	--	3.3
1	A/C -1	--	2.2
1	A/C -2	--	3.3
1	A/C -2	--	2.2
1	A/C -4	--	4.9
1	A/C -4	--	1.6
1	Miscellaneous Equipment	--	15.0
1	Jockey Jump	1.0	1.5
1	Duplex Sump Pump	7.5	9.1
1	Booster Pump	5.0	6.3
1	Parking Elevator	50.0	54
1	Passenger Elevator	30.0	33.2
1	Fire Pump	60.0	63.1
			Total Connected kW: 235.1

Location of switchgear

There are two main switchboards 'A' and 'B'. Both of them are located in the main electrical room in the P1 parking level, where two transformers are at the room as well. There is a pulling section along with a transformer in the electrical room, M114, on the mezzanine level. There are panelboards in the electrical room on corresponding floor levels P1, mezzanine, 3rd and 4th. On the roof, there is a emergency generator and a roof-top unit.

Major equipments location

Tag	Type of equipment	Location Floor level	Room number Room name
1	Dry-type transformer 30 KVA, 480 primary – 208 secondary, 3Ph	Mezzanine floor	M114 Electrical room
2	Dry-type transformer 45 KVA, 480V primary – 208V secondary, 3Ph	P1 parking	P102 Electrical room
3	Dry-type transformer 75 KVA, 480V primary – 208V secondary, 3Ph	3rd and 4th floor	307, 407 Electrical room
9	Standby diesel generator 275 KW, 460/265 V, 3Ph, 4W, 400 AMP MCB	Roof	--
10	Fused safety switch 3/400/400	Roof	--
11	Fused safety switch 3/100/100	Roof	--
12	Fused safety switch 3/200/200	Mezzanine floor	M114 Electrical room
13	Automatic transfer switch	--	--
14	Automatic transfer switch	--	--
--	Switchboard 'A'	P1 parking	P102 Electrical room
--	Switchboard 'B'	P1 parking	P102 Electrical room
G	Emergency generator	Roof	--
RTU	Roof-top Unit	Roof	--

Panelboards location				
Tag	**Voltage system**	**Main size**	**Corresponding level**	**Room number Room name**
HHA	480Y/277V 3Ph, 4W	400A	P1 Parking	P102 Electrical room
HHB	480Y/277V 3Ph, 4W	400A	P1 Parking	P102 Electrical room
LHA	208Y/120V 3Ph, 4W	150A	P1 Parking	P102 Electrical room
ELP1	208Y/120V 3Ph, 4W	225A	P1 Parking	P102 Electrical room
ELP2	208Y/120V 3Ph, 4W	225A	P1 Parking	P102 Electrical room
EHP1	480Y/277V 3Ph, 4W	400A	P1 Parking	P102 Electrical room
EHP2	480Y/277V 3Ph, 4W	400A	P1 Parking	P102 Electrical room
HPP1	480Y/277V 3Ph, 4W	225A	Mezzanine	M114 Electrical room
LPP1	208Y/120V 3Ph, 4W	100A	Mezzanine	M114 Electrical room
3H	480Y/277V 3Ph, 4W	400A	3rd floor	307 Electrical room
3PA	208Y/120V 3Ph, 4W	225A	3rd floor	307 Electrical room
3PB	208Y/120V 3Ph, 4W	225A	3rd floor	307 Electrical room
4H	480Y/277V 3Ph, 4W	400A	4th floor	407 Electrical room
4PA	208Y/120V 3Ph, 4W	225A	4th floor	407 Electrical room
4PB	208Y/120V 3Ph, 4W	225A	4th floor	407 Electrical room

Over-current devices

The main switchboard 'A' has a 1600A bus amp size with an AIC rating of 100,000. Except the 1600 fuse switch for the distribution section main BPS with GFP, all the other branches have 400 amp frame and trip circuit breaker in the main switchboard 'A'.
The main switchboard 'B' also has an AIC rating of 100,000, but it has a 2000A bus amp size instead. There is also a distribution section main BPS with GFP, with a 2000 amp fuse switch.

The distribution panelboards usually have a bus amp size of 400A, 225A, 150A, or 100A, depending on the loads connected. The main over-current devices are usually main lugs only, 225A miniature circuit breaker, 150A or 100A miniature circuit breaker.

Transformers

5 indoor transformers are used. All of them are step-down transformers.

TRANSFORMER SCHEDULE								
Tag	Primary volt	Secondary volt	Size	Type	Temp. rise	Taps	Mounting	remarks
UT	--	--	--	--	--	--	--	Utility Transformer
T-1a	480V 3Ph, 3W	208Y/120V 3Ph, 4W	30KVA	Dry type	150 C	(6) 2.5%	Pad-mounted	--
T-1b	480V 3Ph, 3W	208Y/120V 3Ph, 4W	30KVA	Dry type	150 C	(6) 2.5%	Pad-mounted	--
2	480V 3Ph, 3W	208Y/120V 3Ph, 4W	45KVA	Dry type	150 C	(6) 2.5%	Pad-mounted	--
T-3a	480V 3Ph, 3W	208Y/120V 3Ph, 4W	75KVA	Dry type	150 C	(6) 2.5%	Pad-mounted	K-4 rated
T-3b	480V 3Ph, 3W	208Y/120V 3Ph, 4W	75KVA	Dry type	150 C	(6) 2.5%	Pad-mounted	K-4 rated

Special Equipments

There is no sign of any of the special equipment either in the drawings or mentioned in the specifications, therefore an assumption of no such equipments is made.

Lighting Loads

There are about 35 luminaire types used throughout the building. The variety of luminaire type is quite wide-spread. Linear fluorescent, compact fluorescent, metal halides, cold cathode lighting, LED. The majority would be the fluorescent lightings which probably provide the most sufficient illumination efficiently, watts-usage wise.

Automatic lighting shutoff is not provided according to exception from 9.4.1.1 in ASHRAE 90.1, because it would endanger the safety or security of the room or building occupants.

Mechanical Loads

Please refer to the mechanical load table on page.

Environmental stewardship design

There is no sign of any environmental electrical systems in either drawings or the specifications; therefore an assumption of no such design equipments is made.

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Design issues

Voltage drop would be an issue due to the power to 1st floor and 2nd floor is distributed from the panelboard 2 floors beneath, which may lead to a voltage drop problem. This voltage drop problem also extends to 3rd and 4th floors because the panelboard locations are not always in the closest distance as possible to the appliances.

Communication systems

The telephone and data system come from the outside of building and get to the base building Telephone Room, M109, on the mezzanine floor. This telephone and data system is then run throughout the entire building through telephone closets on all floor levels.

The main fire alarm enunciator panel is located in the main lobby on the 1st floor. The system is composed of manual pull station, smoke and duct detectors, main fire service and sprinklers flow switch, etc. These devices are located throughout the building.

The fire alarm system also includes an integrated fire alarm and detection system that conforming NFPA 72. The primary power for the fire alarm control panel is obtained from the power panel board while the secondary power supply is from sealed gelled electrolyte batteries.

Appendix

Please refer to the Manufacturer catalog cut-sheets on page 19 - 26

[Luminaire type "9"]

ADVANCE™

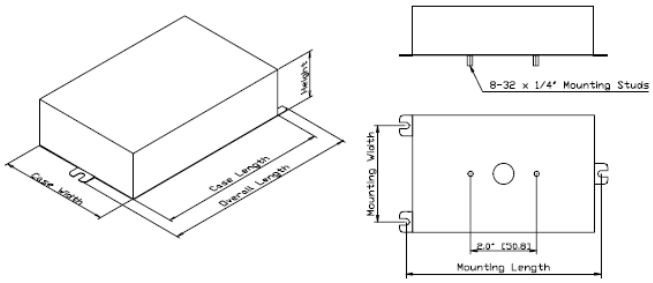
e-Vision® Electronic Ballast for Metal Halide Lamps

Catalog Number IMH-150-H
For 150W Metal Halide Lamps
ANSI M142, M102
120-277V 50/60Hz Electronic
Status: Released

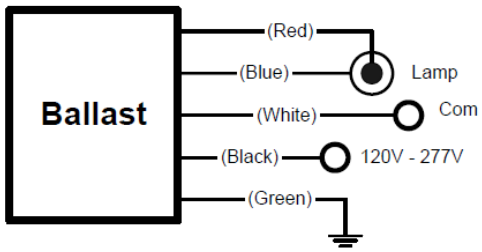
DIMENSIONS AND DATA

Lamp Data		Input Volts	Catalog Number*	Line Current (Amps)	Input Power (W)	Ballast Factor	Max THD (%)	Min Power Factor	Wiring Dia	Figure	Weight (lb)	Max Distance to Lamp (ft)
Number	Watts											
150W Watt Lamp, ANSI Code M142, M102 Minimum Starting Temp -30°C/-20°F												
1	150	120	IMH-150-H-xxx	1.38	165	1.0	10%	0.90	3	H	1.9	5
		277		0.69	161							

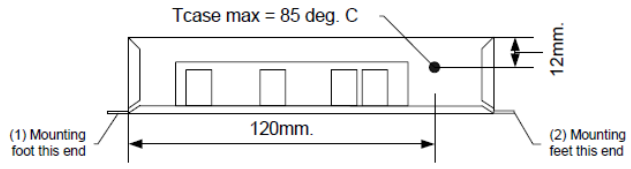
Figure H



CASE LENGTH = 5.67" [144mm]
MOUNTING LENGTH = 6.0" [152mm]
MOUNTING WIDTH = 2.87" [73mm]
OVERALL LENGTH = 6.34" [161mm]
CASE WIDTH = 3.62" [92mm]
HEIGHT = 1.5" [38mm]



Wiring Diagram 3



Case Temperature Measurement Location

INSTALLATION & APPLICATION NOTES:

1. Maximum allowable case temperature is 85°C. See figure above for measurement location
2. Ignition pulse is 4 kV max
3. All leads are 12 inches long
4. Ballast output will shutdown after 20 minutes if lamp fails to ignite
5. Power must be cycled off – then on, after replacing lamp
6. Connect the red lead to the center terminal of the lamp when using screw base lamps

***Ordering Information**

Order Suffix	Description
-LF	Ballast with side exit leads and mounting feet
-BLS	Ballast with bottom exit leads and mounting studs

Data is based on tests performed by Advance transformer in a controlled environment and representative of relative performance. Actual performance can vary depending on operating conditions. Specifications are subject to change without notice. All specifications are nominal unless otherwise noted.

Advance • 10275 West Higgins Road • Rosemont, Illinois 60018-5603 • (847) 390-5000 • fax: 847-390-5109 • www.advancetransformer.com

A DIVISION OF PHILIPS ELECTRONICS NORTH AMERICA CORPORATION

Revised 9/22/06

[Luminaire type "10"]

ADVANCE™

e-Vision® Electronic Ballast for Metal Halide Lamps

Catalog Number IMH-100-A
For (1) 100W Metal Halide Lamp
ANSI M90, M140
120-277V 50/60Hz Electronic
Status: Active

DIMENSIONS AND DATA

Lamp Data		Input Volts	Catalog Number*	Line Current (Amps)	Input Power (W)	Ballast Factor	Max THD (%)	Min Power Factor	Wiring Dia	Figure	Weight (lb)	Max Distance to Lamp (ft)
Number	Watts											
100 Watt Lamp, ANSI Code M90 or M140 Minimum Starting Temp -30°C/-20°F												
1	100	120	IMH-100-A-xxx	0.93	112	1.0	15	0.9	2	D	1.5	5
		277		0.40	110							

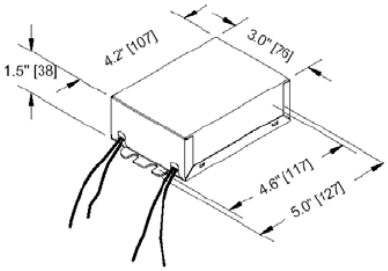
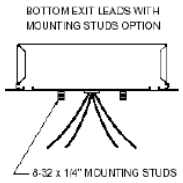
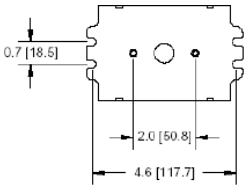
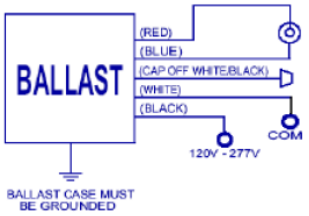


Figure D

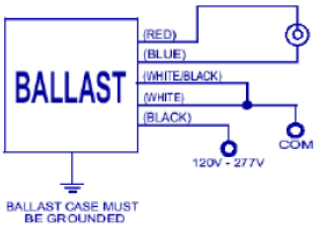
(side exit leads shown – see diagram at right for bottom leads with mounting studs detail)



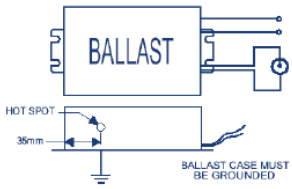




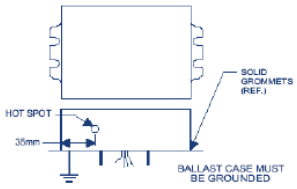
Wiring Diagram 1



Wiring Diagram 2



SIDE EXIT LEADS



BOTTOM EXIT LEADS

Case Temperature Measurement Location

INSTALLATION & APPLICATION NOTES:

1. Maximum allowable case temperature is 85°C. See figure above for measurement location
2. Ignition pulse is 4 kV max
3. All leads are 12 inches long
4. Ballast output will shutdown after 20 minutes if lamp fails to ignite
5. Power must be cycled off – then on, after replacing lamp

***Ordering Information**

Order Suffix	Description
-LF	Ballast with side exit leads and mounting feet
-BLS	Ballast with bottom exit leads and mounting studs

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1/26/05

[Luminaire type "11"]

ADVANCE™

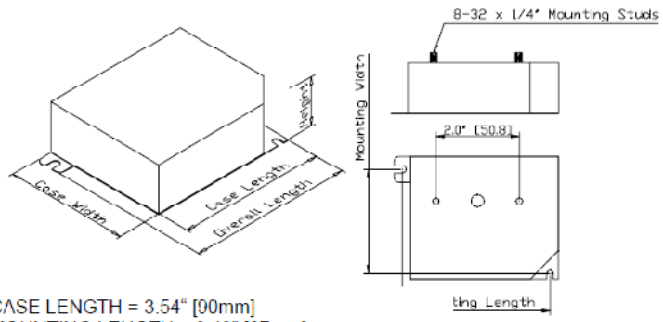
e-Vision® Electronic Ballast for Metal Halide Lamps

Catalog Number IMH-39-G
For 39W Metal Halide Lamps
ANSI M130
120-277V 50/60Hz Electronic
Status: Preliminary

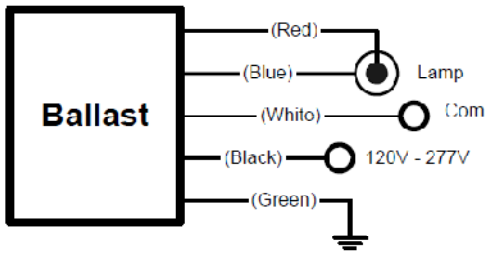
DIMENSIONS AND DATA

Lamp Data		Input Volts	Catalog Number*	Line Current (Amps)	Input Power (W)	Ballast Factor	Max THD (%)	Min Power Factor	Wiring Dia	Figure	Weight (lb)	Max Distance to Lamp (ft)
Number	Watts											
39W Watt Lamp, ANSI Code M130 Minimum Starting Temp -30°C/-20°F												
1	39	120	IMH-39-G-xxx	0.39	46	1.0	15%	0.95	3	G	0.9	5
		277		0.18	45							

Figure G

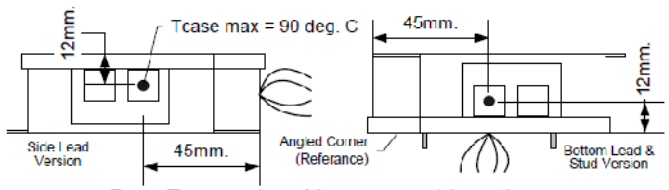


CASE LENGTH = 3.54" [90mm]
MOUNTING LENGTH = 3.43" [87mm]
MOUNTING WIDTH – 2.64" [67mm]
OVERALL LENGTH = 3.82" [97mm]
CASE WIDTH = 3.03" [77mm]
HEIGHT = 1.18" [30mm]



Ballast Case must be Grounded

Wiring Diagram 3



Case Temperature Measurement Location

INSTALLATION & APPLICATION NOTES

1. Maximum allowable case temperature is 90°C. See figure above for measurement location
2. Ignition pulse is 4 kV max
3. All leads are 9 inches long
4. Ballast output will shutdown after 20 minutes if lamp fails to ignite
5. Power must be cycled off – then on, after replacing lamp
6. Connect the red leads to the center terminals of the lamp when using screw base lamps

*Ordering Information

Order Suffix	Description
-LF	Ballast with side exit leads and mounting feet
-BLS	Ballast with bottom exit leads and mounting studs

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Revised 1/16/06

[Luminaire type "12"]

ADVANCE

e-Vision® Electronic Ballast for Metal Halide Lamps

Catalog Number IMH-70-D
For (1) 70W Metal Halide Lamp
ANSI M98, M139, M143
120-277V 50/60Hz Electronic
Status: Active

DIMENSIONS AND DATA

Lamp Data		Input Volts	Catalog Number*	Line Current (Amps)	Input Power (W)	Ballast Factor	Max THD (%)	Min Power Factor	Wiring Dia	Figure	Weight (lb)	Max Distance to Lamp (ft)
Number	Watts											
70 Watt Lamp, ANSI Code M98, M139 or M143 Minimum Starting Temp -30°C/-20°F												
1	70	120	IMH-70-D-xxx	0.67	80	1.0	15	0.9	3	D	1.6	5
		277		0.29	79							

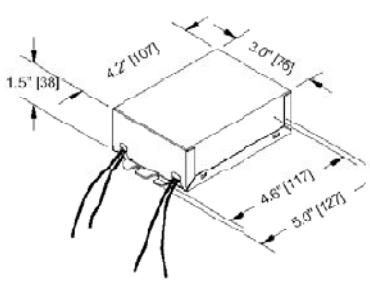
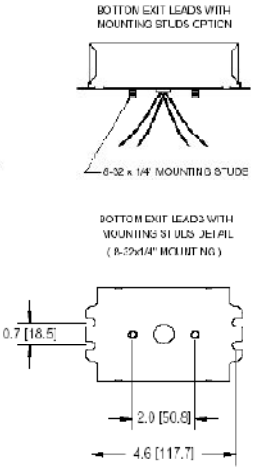
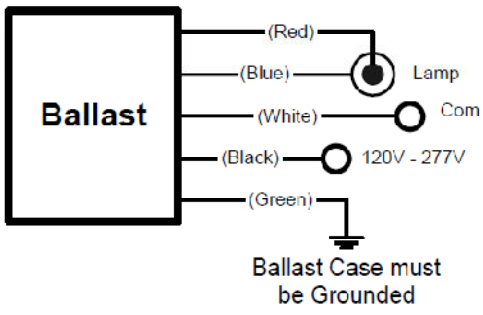


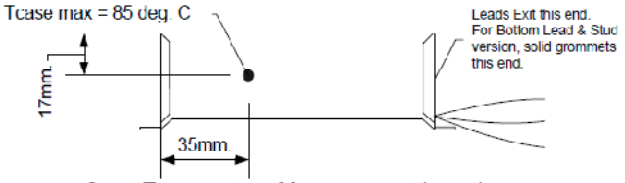
Figure D

(Side exit leads shown – see diagram at right for bottom leads with mounting studs detail)





Wiring Diagram 3



Case Temperature Measurement Location

INSTALLATION & APPLICATION NOTES.

1. Maximum allowable case temperature is 85°C. See figure above for measurement location
2. Ignition pulse is 4 kV max
3. All leads are 12 inches long
4. Ballast output will shutdown after 20 minutes if lamp fails to ignite
5. Power must be cycled off – then on, after replacing lamp

*Ordering Information

Order Suffix	Description
-LF	Ballast with side exit leads and mounting foot
-BLS	Ballast with bottom exit leads and mounting studs

Data is based on tests performed by Advance transformer in a controlled environment and representative of relative performance. Actual performance can vary depending on operating conditions. Specifications are subject to change without notice. All specifications are nominal unless otherwise noted.

Advance Transformer Co. • 10275 West Higgins Road • Rosemont, Illinois 60018-5603 • (847) 390-5000 • fax: 847-390-5109 • www.advancetransformer.com

A DIVISION OF PHILIPS ELECTRONICS NORTH AMERICA CORPORATION

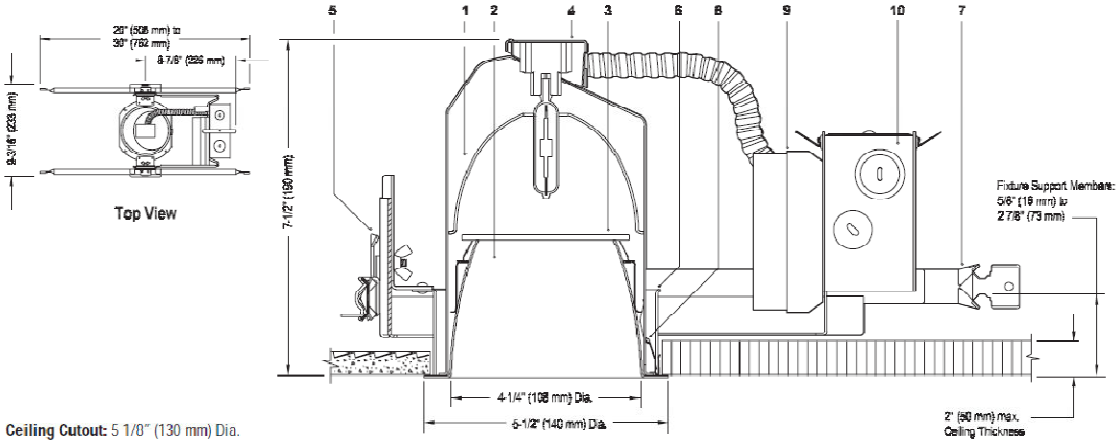
Revised 1/13/06

[Luminaire type "M", "M1", "AB"]

Calculite® HID Downlight C4T4VM

Page 1 of 2

4 1/2" Aperture, 2pc Vertical, T4.5 Medium Beam



Ceiling Cutout: 5 1/8" (130 mm) Dia.

Reflector Trim		
C4T4VM	CLW	Specular Clear, White Painted Flange.
	CLP	Specular Clear, Matching Flange.
	CCDW	Comfort Clear Diffuse, White Painted Flange.
	CCDP	Comfort Clear Diffuse, Matching Flange.
	CCZW	Champagne Bronze, White Painted Flange.
	CCZP	Champagne Bronze, Matching Flange.

Frame-In Kit			
C420T4E1	Electronic 120V	20W T4.5	Ceramic Metal Halide
C420T4E2	Electronic 277V	20W T4.5	Ceramic Metal Halide
C439T4E1	Electronic 120V	39W T4.5	Ceramic Metal Halide
C439T4E2	Electronic 277V	39W T4.5	Ceramic Metal Halide
C470T4E1	Electronic 120V	70W T4.5	Ceramic Metal Halide
C470T4E2	Electronic 277V	70W T4.5	Ceramic Metal Halide

Features

1. **Upper Reflector**: Clear anodized aluminum, 0.040" (16-ga.). Provides medium beam optics ideal for general lighting. Also available in narrow and wide beam, see C4T4VN and C4T4VW specification sheets.
2. **Aperture Cone:** Provides 50° visual cut-off to lamp and lamp image; self-flange in painted white or aperture-matching polished flange. Consult factory for other finishes.
3. **Lamp Shield:** High-temperature glass as required by code, captive during re-lamping. Light diffusion provides exceptionally smooth beam.
4. **Socket Housing:** Galvanized steel, pre-wired with G8.5 pulse rated socket. Snaps onto upper reflector for secure attachment without tools; unitized construction assures proper lamp alignment to optics for consistent performance.
5. **Mounting Frame:** 0.048" (18-ga.) galvanized steel. Vertical adjustment mechanism accommodates mounting to virtually any ceiling system using mounting bars (provided, or 1/2" EMT tubing (by others). Single locking feature secures all adjustments. Alignment holes and markings allow fixture to be preset prior to installation.
6. **Mounting Ring:** 0.048"(18-ga.) galvanized steel. Designed for vertical adjustment from above or below for ceilings from 0" to 2" thick. Center-line notches allow consistent alignment of multiple fixtures.
7. **Mounting Bars:** 0.048" (18-ga.) pre-installed, telescoping bars extend to 30" long and lock securely into position. Built-in locking tabs provide positive attachment to common T-bar systems. Self-centering feature simplifies installation in 24" O.C. grid systems. Attaches to steel or wood joists without accessories.
8. **Trim Retention Springs:** Rust resistant springs secure reflector/housing for quick, tool-less installation.
9. **Ballast /Socket Housing/Cover Assembly:** Snaps onto junction box without tools for inspection and ballast replacement, accessible from below.
10. **Junction Box:** 0.048" (18-ga.) galvanized steel. UL listed for 8 No. 12 AWG, 90°C through branch circuit conductors. Allows inspection from below.
11. **Thermal Protector:** (Not Shown) Meets NEC and UL requirements. Do not install insulation above nor within 3" (76mm) of any part of the luminaire.

Electrical

Electronic Ballast: 120 or 277V, 50/60 Hz., encased, high power factor, T.H.D. <15%, thermally and transient protected, RMI/RFI complies with FCC Part 18 non-consumer limits, shut-down circuit at end of lamp life, sound rating "A", -5°F minimum starting temperature, Type 1 Outdoor rating.

Ballast	ANSI Code	Voltage	Max. Amps	Input Watts
20W MH	M156	120/277	0.21/0.10	23
39W MH	M130	120/277	0.39/0.17	44
70W MH	M139	120/277	0.67/0.29	78

Options and Accessories

Slope Ceiling Adapters: See Specification Sheet SCA.
Chicago Plenum: Consult Factory..

Labels

UL (Suitable for Damp Locations), CSA, I.B.E.W.
For 70W, install fixtures with minimum spacing between:
1. Center-to center of adjacent luminaries: 2 feet.
2. Top of luminaire to overhead building member: 1/2 inch.
3. Luminaire center to side building member: 1 foot.

Job Information **Type:**

Job Name:

Cat. No.:

Lamp(s):

Notes:

Lightolier a Genlyte Thomas Company www.lightolier.com
631 Airport Road, Fall River, MA 02720 • (508) 679-8131 • Fax (508) 674-4710

LIGHTOLIER®

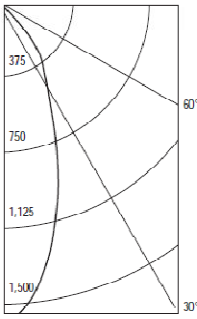
Calculite® HID Downlight C4T4VM

Page 2 of 2

4 1/2" Aperture, 2pc Vertical, T4.5 Medium Beam

20W T4 GE CMH LAMP, LUMEN RATING = 1700 LMS, AROMAT 20W ELECTRONIC BALLAST CL FINISH TRIM

CANDLEPOWER DISTRIBUTION



ANGLE	MEAN CP	LUMENS
0	1595	
5	1524	143
10	1345	
15	1109	314
20	867	
25	649	308
30	493	
35	396	248
40	294	
45	125	107
50	10	
55	0	2
60	0	
65	0	0
70	0	
75	0	0
80	0	
85	0	0
90	0	

LUMINANCE SUMMARY CD. / SQ. M.

ANGLE	MEAN CD/SQ M
45	17255
55	39
65	0
75	0
85	0

ZONAL LUMENS AND PERCENTAGES

ZONE	LUMENS	% LAMP	%LUMINAIRE
0-30	764	44.96	68.13
0-40	1012	59.56	90.25
0-60	1121	66	100
0-90	1121	66	100
40-90	109	6.43	9.75
60-90	0	0	0
90-180	0	0	0
0-180	1121	66	100

Coefficients of Utilization

CEILING	80%				70%		50%		30%		
WALL	70	50	30	10	50	10	50	10	50	10	0
RCR	Zonal Cavity Method - Effective Floor Cavity Reflectance = 20%										
0	.79	.79	.79	.79	.77	.77	.74	.74	.71	.71	.66
1	.76	.74	.73	.72	.73	.71	.70	.68	.68	.66	.63
2	.73	.70	.68	.66	.69	.65	.67	.64	.65	.63	.60
3	.70	.66	.64	.61	.65	.61	.64	.60	.62	.59	.57
4	.67	.63	.60	.58	.62	.57	.61	.57	.60	.56	.54
5	.64	.60	.56	.54	.59	.54	.58	.53	.57	.53	.51
6	.62	.57	.53	.51	.56	.51	.55	.50	.54	.50	.49
7	.59	.53	.50	.48	.53	.47	.52	.47	.51	.47	.46
8	.56	.51	.47	.45	.50	.45	.49	.44	.49	.44	.43
9	.53	.48	.44	.42	.47	.42	.47	.42	.46	.42	.41
10	.51	.45	.42	.39	.45	.39	.44	.39	.44	.39	.38

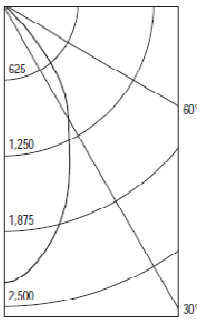
LUMINAIRE INPUT WATTS = 23

** EFFICIENCY = 66.0% **
SC = .7

CERTIFIED TEST REPORT NO. 2322FR, DATE: OCT 04, 2003
COMPUTED BY LSI PROGRAM **TEST-LITE**

39W T4 PHILIPS CMH LAMP, LUMEN RATING = 3300 LMS, AROMAT 39W ELECTRONIC BALLAST, CL FINISH TRIM

CANDLEPOWER DISTRIBUTION



ANGLE	MEAN CP	LUMENS
0	2306	
5	2232	211
10	2064	
15	1856	523
20	1601	
25	1313	616
30	1095	
35	902	551
40	609	
45	243	216
50	20	
55	3	6
60	0	
65	0	0
70	0	
75	0	0
80	0	
85	0	0
90	0	

LUMINANCE SUMMARY CD. / SQ. M.

ANGLE	MEAN CD/SQ M
45	33651
55	466
65	0
75	0
85	0

ZONAL LUMENS AND PERCENTAGES

ZONE	LUMENS	% LAMP	%LUMINAIRE
0-30	1349	40.9	63.6
0-40	1900	57.59	89.56
0-60	2121	64.3	100
0-90	2121	64.3	100
40-90	221	6.72	10.44
60-90	0	0	0
90-180	0	0	0
0-180	2121	64.3	100

Coefficients of Utilization

CEILING	80%				70%		50%		30%		
WALL	70	50	30	10	50	10	50	10	50	10	0
RCR	Zonal Cavity Method - Effective Floor Cavity Reflectance = 20%										
0	.77	.77	.77	.77	.75	.75	.72	.72	.69	.69	.65
1	.74	.72	.71	.70	.71	.68	.68	.66	.66	.64	.61
2	.71	.68	.66	.64	.67	.63	.65	.62	.63	.60	.58
3	.68	.64	.61	.59	.63	.59	.62	.58	.60	.57	.55
4	.65	.60	.57	.55	.60	.54	.58	.54	.57	.53	.52
5	.62	.57	.53	.51	.56	.51	.55	.50	.54	.50	.49
6	.59	.54	.50	.48	.53	.48	.52	.47	.51	.47	.46
7	.56	.51	.47	.45	.50	.44	.49	.44	.48	.44	.43
8	.53	.47	.44	.42	.47	.41	.46	.41	.46	.41	.40
9	.50	.45	.41	.39	.44	.39	.44	.38	.43	.38	.37
10	.48	.42	.38	.36	.42	.36	.41	.36	.41	.36	.35

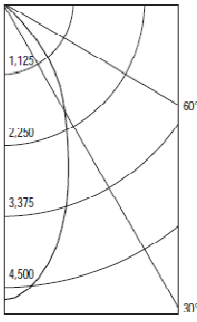
LUMINAIRE INPUT WATTS = 44

** EFFICIENCY = 64.3% **
SC = .8

CERTIFIED TEST REPORT NO. 2321FR, DATE: OCT 01, 2003
COMPUTED BY LSI PROGRAM **TEST LITE**

70W T4 PHILIPS CMH LAMP, LUMEN RATING = 6400 LMS, AROMAT 70W ELECTRONIC BALLAST, CL FINISH TRIM

CANDLEPOWER DISTRIBUTION



ANGLE	MEAN CP	LUMEN
0	4707	
5	4560	430
10	4188	
15	3667	1032
20	3046	
25	2445	1148
30	1987	
35	1587	982
40	1090	
45	444	390
50	38	
55	3	10
60	0	
65	0	0
70	0	
75	0	0
80	0	
85	0	0
90	0	

LUMINANCE SUMMARY CD. / SQ. M.

ANGLE	MEAN CD/SQ M
45	61418
55	584
65	0
75	0
85	0

ZONAL LUMENS AND PERCENTAGES

ZONE	LUMENS	% LAMP	%LUMINAIRE
0-30	2610	40.79	65.39
0-40	3592	56.13	89.97
0-60	3992	62.38	100
0-90	3992	62.38	100
40-90	400	6.26	10.03
60-90	0	0	0
90-180	0	0	0
0-180	3992	62.38	100

Coefficients of Utilization

CEILING	80%				70%		50%		30%		
WALL	70	50	30	10	50	10	50	10	50	10	0
RCR	Zonal Cavity Method - Effective Floor Cavity Reflectance = 20%										
0	.74	.74	.74	.74	.73	.73	.70	.70	.67	.67	.63
1	.71	.70	.69	.67	.69	.66	.66	.64	.64	.62	.59
2	.68	.66	.64	.62	.65	.61	.63	.60	.61	.59	.56
3	.66	.62	.59	.57	.61	.57	.60	.56	.58	.55	.53
4	.63	.59	.56	.54	.58	.53	.57	.53	.56	.52	.51
5	.60	.56	.52	.50	.55	.50	.54	.49	.53	.49	.48
6	.57	.53	.49	.47	.52	.47	.51	.46	.50	.46	.45
7	.55	.49	.46	.44	.49	.44	.48	.43	.47	.43	.42
8	.52	.47	.43	.41	.46	.41	.46	.41	.45	.40	.39
9	.49	.44	.41	.38	.44	.38	.43	.38	.42	.38	.37
10	.47	.41	.38	.36	.41	.36	.41	.36	.40	.35	.34

LUMINAIRE INPUT WATTS = 78

** EFFICIENCY = 62.4% **
SC = .8

CERTIFIED TEST REPORT NO. 2320FR, DATE: OCT 01, 2003
COMPUTED BY LSI PROGRAM **TEST-LITE**

Job Information **Type:**

Lightolier a Genlyte Thomas Company www.lightolier.com
631 Airport Road, Fall River, MA 02720 • (508) 679-8131 • Fax (508) 674-4710

LIGHTOLIER®

[Luminaire type "OD"]

Catalog Number Logic

Material	Series	Source	Housing	Lamp	Finish	Lens	Shielding	Cap Style	Base Height	Remote Option	Ballast
B	AR	ES20	RM	276	MIT	9	11	C	3	WM	-RM/H20E/MT

Material
Blank - Aluminum
B - Brass

Series
AR - ArtiStar™

Source
ES20 - ES16 Metal Halide (20W)

Housing
RM - Requires Remote Ballast

Lamp
0 - By Others
276 - (20W) 12° Spot
277 - (20W) 25° N. Flood
279 - (20W) 40° Flood

Finish

Aluminum & Brass Finishes

Powder Coat Color	Satin	Wrinkle
Bronze	BZP	BZW
Black	BLP	BLW
White (Gloss)	WHP	WHW
Aluminum	SAP	--
Verde	--	VER

Brass

Machined	MAC
Polished	POL
Mitique™	MIT

See Pages 19-21 for additional finish choices

Lens
9 - Clear Lens (Standard)
10 - Spread Lens
12 - Soft Focus Lens
13 - Rectilinear Lens

Shielding
11 - Honeycomb Baffle

Cap Style
A - 45°
B - 90°
C - Flush
D - 45° less weephole (for Interior Use Only)
E - 90° less weephole (for Interior Use Only)
F - 90° cutoff with flush lens

Base Height
3 - 3" with Anchor Base (Standard)
6 - 6" with Anchor Base
12 - 12" with Anchor Base
18 - 18" with Anchor Base
24 - 24" with Anchor Base

Option
PP - Power Pipe option with 18" Stake
WM - Wall or Ceiling Mount with 5" dia. canopy*
**Base height limited to 8" max. with brass fixtures.*

Remote Ballast
PM2RM-H20E-120 or 277 - 20 Watt UPM
RM-H20E-120 or 277 - 20 Watt Remote Wall Mount

For lamp information, see page 25.

Specifications

Body
Fully machined from solid, copper-free aluminum. Also available in solid machined brass. Unibody design provides enclosed, water-proof wireway and heat sink to maximize lamp life. Integral knuckle for maximum mechanical strength. High temperature, silicone 'O' Ring provides water-tight seal.

Knuckle
Aim and Lock, and 360HD™ Technology allows vertical to horizontal aiming and rotational aiming with positive 'aim-and-lock' technology and provides integral, water-tight wireway.

Cap
Machined from copper-free aluminum. Also available in machined brass. Accommodates up to [2] lens or louver media. Choose from 45° cutoff ('A' or 'D'), 1" deep bezel with 90° cutoff ('B' or 'E'), flush lens ('C'), or 90° cutoff with flush lens ('F') cap styles. 'A' and 'B' caps include weep-hole for water and debris drainage. 'D' and 'E' caps exclude weep-hole and are for interior use only.

Base
Machined from copper-free aluminum. Also available in machined brass. Available in 6" standard increments to facilitate fixture elevation above grade. Mounts to anchor base (standard) or to optional Power Pipe™ or canopy for wall or ceiling installation.

Installation
Machined copper-free aluminum mounting base with 7/8" dia. slip conduit hole and [3] 3/16" dia. anchor bolt holes (hardware by others).

Optional 18" Power Pipe™. Heavy duty Schedule 80 PVC stake for direct burial into soil or concrete.

Optional 5" dia., machined aluminum canopy permits mounting to junction box (gasket by others). Also available in machined brass. 6" maximum base height for brass products when mounted to canopy.

Lens
Shock resistant, tempered, clear glass lens is factory adhered to fixture cap and provides hermetically sealed optical compartment.

Lamp
For use with 20 watt maximum, GX10 base, ES16 metal halide lamps.

Ballast
For use with remote, electronic metal halide ballast. (see page 30 ballast data).

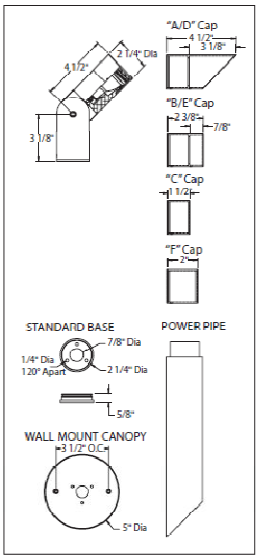
Wiring
Teflon® coated wire, 18AWG, 600V, 250° C rated and certified to UL 1659 standard.

Hardware
Tamper-resistant, stainless steel hardware. Knuckle adjustment screws are additionally black oxided.

Finish
StarGuard® (Pat. Pend.), a 15 stage chromate-free process cleans and conversion coats aluminum components prior to application of Class 'A' TGIC polyester powder coating. Brass components are available in powder coat or handcrafted metal finish.

Warranty
5 year limited warranty.

Listings
ARL and CSA, wet location listed.



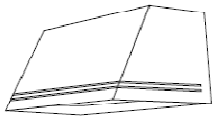
B-K LIGHTING

17

[Luminaire type "OE1"]

Notes: Job:
Type:

110 LINE
111 MINI SCONCE



GENERAL DESCRIPTION: The 110 Line combines high output and full cutoff performance with design and construction worthy of landmark architecture. The 111 Mini Sconce mirrors the renowned Gardco 100 Line, with classic styling, intelligent engineering and integrity of construction. Most importantly, this compact luminaire provides full cutoff performance without the high angle brightness associated with refractor type products, making them an attractive choice for controlled illumination at points of entry. Add to this seamless material transitions, flawless finishes and engineering considerate of installation, service and long term operation and one immediately appreciates that size need not compromise quality.

CUTOFF PERFORMANCE: 111 luminaires installed in the normal downlight position, with a flat glass lens, provide full cutoff performance.

ORDERING

PREFIX	DISTRIBUTION	WATTAGE	VOLTAGE	FINISH	OPTIONS

Enter the order code into the appropriate box above. Note: Gardco reserves the right to refuse a configuration. Not all combinations and configurations are valid. Refer to notes below for exclusions and limitations. For questions or concerns, please consult the factory.

PREFIX

111	Trapezoidal Wedge	*Refer to configuration chart below for available combinations.*
111EM	Emergency Sconce	
111EMC	Emergency Sconce Cold Temperature	
111EMR	Remote Emergency Sconce	

DISTRIBUTION

FT	Forward Throw	*T6 MH and CMHE types only.*
WT	Wide Throw	*T6 MH and CMHE types only.*
MT	Medium Throw	*Fluorescent and E-17 lamp only.*

WATTAGE AND VOLTAGE

LAMP / VOLTAGE CHART - 111

MT DISTRIBUTION	Voltage					
E17 - HID	120	208	240	277	347	480
50MH	●			●		
70MH	●	●	●	●	●	
35HPS	●					
50HPS	●			●		
70HPS	●	●	●	●	●	
Fluorescent						
26QF[1]	UNIV				●	
32TRF[1]	UNIV				●	
42TRF[1]	UNIV				●	
Incandescent						
INC	●					

Combinations marked with a dot or shown with "UNIV" are available for ordering.

MH Metal Halide
CMHE Ceramic Metal Halide with Electronic Ballast
HPS High Pressure Sodium
QF Quad Tube Fluorescent
TRF Triple Tube Fluorescent

LAMP / VOLTAGE CHART - 111

FT / WT DISTRIBUTION	Voltage					
T Lamps	120	208	240	277	347	480
(T6 Lamps Supplied by Gardco.)						
T39MH	●			●		
T70MH	●	●	●	●	●	
T39CMHE[1]	UNIV					
T70CMHE[1]	UNIV					

1. Fluorescent and CMHE luminaires feature electronic ballasts that accept 120V through 277V, 50hz to 60hz, input. Specify "UNIV" voltage for 120V through 277V.
2. Not Available in 111EM or 111EMC.

CONFIGURATION CHART - 111EM, 111EMC, OR 111EMR

	Distribution			Voltage					
Fluorescent	FT	WT	MT	120	208	240	277	347	480
26QF			●	●			●		
32TRF			●	●			●		
42TRF[2]			●	●			●		

FINISH

BRP	Bronze Paint
BLP	Black Paint
WP	White Paint
NP	Natural Aluminum Paint
BGP	Beige Paint
OC	Optional Color Paint *Specify Optional Color or RAL ex: OC-LGP or OC-RAL7024.*
SC	Special Color Paint *Specify. Must supply color chip.*

OPTIONS

F	Fusing *120V through 277V only. N/A with Incandescent.*
PCB	Button Type Photocontrol *Not available with 111EM.*
SL	Solite® Diffusing Lens
WLU	Wet Location Door for Inverted Mounting *Not available with WG option.*
WG	Wire Guard *Not available with WLU option.*
WS	Wall Mounted Box for Surface Conduit *Rear entry permitted.*

EMR Luminaires Only:

B84CG	Bodine Emergency Battery Pack *Emergency Battery Packs for EMR types MUST be ordered with luminaires and supplied by Gardco.*

Gardco Lighting 1611 Clovis Barker Road San Marcos, TX 78666 (800) 227-0758 (512) 753-1000 FAX: (512) 753-7855 www.sitelighting.com

Gardco Lighting is a Philips group brand

PHILIPS