



STATE OF TENNESSEE
DEPARTMENT OF TRANSPORTATION
TRAFFIC OPERATIONS DIVISION
SUITE 1800, JAMES K. POLK BUILDING
505 DEADERICK STREET
NASHVILLE, TENNESSEE 37243-1402
(615) 253-1122

CLAY BRIGHT
COMMISSIONER

BILL LEE
GOVERNOR

TO: Will Reid, Assistant Chief Engineer of Operations

FROM: Brad Freeze, Director of Traffic Operations 21

SUBJECT: **Proprietary Item Request and Justification for Street Lighting**
City of Spring Hill

The City of Spring Hill is requesting that Holophane street light fixtures and Hapco street light poles be used in all signalization and lighting projects within the City over the next three years where Federal and/or State funding are used. The following items are included in this proprietary request and justification items for this request:

- Holophane High Mast Advance Optix (HMAO) LED III series lighting fixtures with Color Temperature of 4,000K and Field Adjustable Output (AO)
- Holophane Wallpack LED (W4GLED Wallpack IV Glass LED) with Color Temperature of 4,000K, T3M = Type III Medium, Voltage of MVOLT (120, 208, 240, 277), Control Options of P7 = NEMA Twist-lock 7-pin Receptacle – control not included, Surge protection SPD = 20kV/104kA (Standard), and Finish of GYSDP = Gray)
- Hapco 11-290-A4-D Pole with USSL-G-A02-U-T3-SA-BK-7030-10K-4N7 (150W LED) – Single Light with 30' Square Pole
- Hapco 11-290-A4-D Pole with USSL-G-A02-D-U-T3-SA-BK-7030-10K-4N7 (150W LED) – Double Light with 30' Square Pole

The City of Spring Hill has established the use of Holophane street light fixtures and Hapco street light poles as the street lighting standard for use in all Citywide projects (see attached documentation). The above street lighting fixtures and poles are standardized with the City of Spring Hill's jurisdiction and are approved maintenance street lighting fixtures and poles by the Middle Tennessee Electric Membership Corporation (MTEMC) lighting system. With these standardized lighting fixtures, MTEMC will continue to maintain the City's street lighting system in order to provide for the synchronization with existing and future facilities.

I, Brad Freeze, Director of the Traffic Operations Division of the Tennessee Department of Transportation, do hereby certify that in accordance with the requirements of 23 CFR 635.411(a) (2) that the patented or proprietary items listed above are essential for the synchronization of existing facilities.


Will Reid (Sep 24, 2020 08:50 CDT)

Assistant Chief Engineer of Operations

Sep 24, 2020

Date



August 17, 2020

Mr. Stephen K. Bryan, P.E. PTOE
Traffic Engineer Section Manager
Tennessee Department of Transportation Traffic Operations Division
James K. Polk Bldg., 12th Floor
505 Deaderick Street
Nashville, TN 37243

Re: Proprietary Item Request and Justification for Lighting for the I-65/Buckner Road Interchange Project (PIN 128576.00)

Dear Mr. Bryan,

The City of Spring Hill requests the specification of particular brands and models of lighting to be used for the I-65/Buckner Road Interchange project as well as roadway lighting projects within the City of Spring Hill over the next three years where Federal and/or State funding is used.

- Holophane High Mast Advance Optix (HMAO) LED III series lighting fixtures with Color Temperature of 4,000K and Field Adjustable Output (AO)
- Hapco 11-290-A4-D Pole with USSL-G-A02-U-T3-SA-BK-7030-10K-4N7 (150W LED) – Single Light with 30' Square Pole
- Hapco 11-290-A4-D Pole with USSL-G-A02-D-U-T3-SA-BK-7030-10K-4N7 (150W LED) – Double Light with 30' Square Pole
- Holophane Wallpack LED (W4GLED Wallpack IV Glass LED) with Color Temperature of 4,000K, T3M = Type III Medium, Voltage of MVOLT (120, 208,240, 277), Control Options of P7= NEMA Twist-lock 7-pin Receptacle – control not included, Surge protection SPD = 20kV/104kA (Standard), and Finish of GYSDP = Gray)

The City of Spring Hill will maintain all interstate lighting installed for the I65/Buckner Road Interchange project. The City of Spring Hill will either provide extensive training for the operation and maintenance of these fixtures or will contract with a properly licensed and bonded contractor, as well as MTEMC in the case of street light fixtures located within their utility

199 Town Center Parkway
P.O. Box 789
Spring Hill, TN 37174

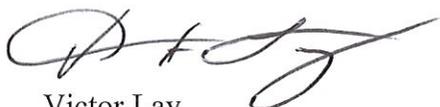
Phone 931.486.2252
Fax 931.486.0516
www.springhilltn.org

district. By standardizing these light fixtures, this O&M approach will reduce time required to maintain these lighting systems resulting in faster and less cost repairs at a cost savings to the City of Spring Hill.

For your reference, I have attached both a copy of the product brochure and specification sheets from the manufacturer.

Thank you in advance for your favorable consideration of our request. Please contact my office directly should you have questions concerning our request.

Sincerely,

A handwritten signature in black ink, appearing to read 'Victor Lay', written in a cursive style.

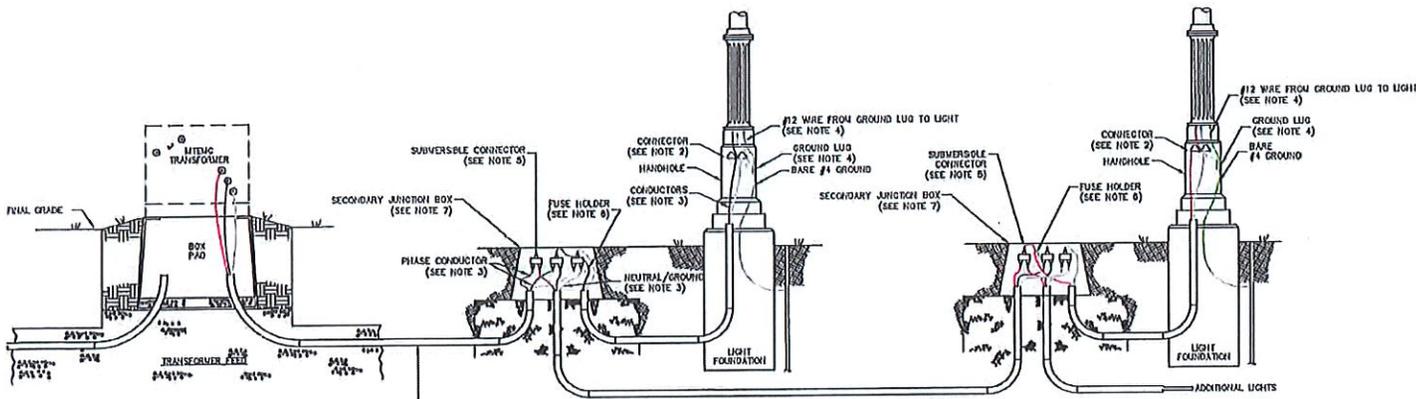
Victor Lay
City Administrator

ms/attachments



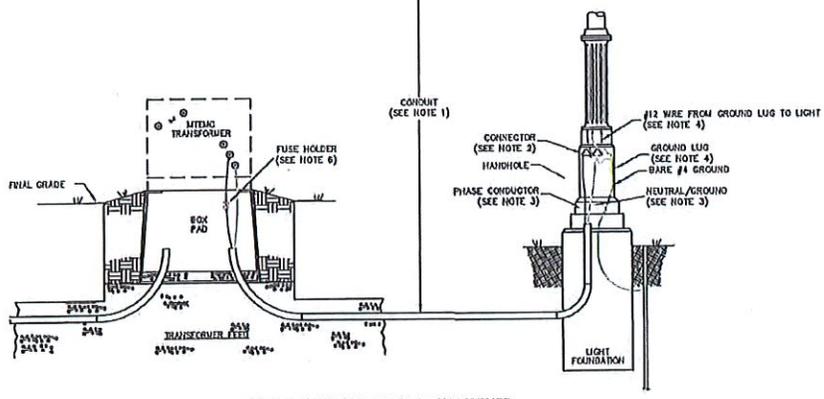
**Approved Decorative Street Lighting
Catalogue**

Revised 4-22-19

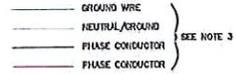


MULTIPLE LIGHTS FED FROM PULL BOXES

- NOTES:
1. Use schedule 40, PVC standard radius elbows and conduit. Minimum size of conduit shall be 2". All sizes of conduit shall conform to the NEC table 31, Chapter 9, "Maximum Number of Conductors in Trade Sizes of Conduit or Tubing."
 2. Connections must have between 6" and 12" of slack when extended from the hand-hole. When wire size permits, the use of appropriately sized wire-nuts is permissible. An insulated Multi-Cable Connector Block shall be used for other luminaires. In no case shall the use of split-bolts and lugs be used. When wire sizes prohibit the use of wire nuts, the approved connection for those above grade connectors is Home type CSB or CUG type HACC.
 3. A color coded system shall be applied to all straight(ish) wiring. All "hot" leads shall be colored or marked in their entirety within the junction box, pedestal, or transformer box pad as black, red, or blue. Raceways containing multiple "hot" leads shall be marked independently of each other and alternated between successive lights connected to the individual raceways. The neutral/ground conductor shall be colored or marked white in its entirety within the above mentioned enclosures.
 4. A grounding lug shall be used with the pole to bond the pole with the service entrance neutral/ground, the neutral of the light, and an 8" driven ground rod. A #12 ground wire shall be run from the ground lug to the ground terminal on all LED lights.
 5. For all below grade connections, a submersible connector shall be used. Acceptable connectors for below grade use are Home type RAB and CUG type SSCB. In no case shall the use of split-bolts and lugs be used.
 6. Initial fuse holder and fuse in series with source connection to the fixture. Fuses shall be located in the transformer for single light installations and in the pull boxes for multiple light installations. Approved fuse holder is Home SLM-M.
 7. For multiple lights connected to the same transformer feed, install a small secondary junction box near the base of each light. Approved junction boxes are listed in Appendix B of the Underground Installation Code.



SINGLE LIGHT FED FROM TRANSFORMER



MTEMC		
CONSTRUCTION DETAIL		
STREETLIGHT INSTALLATION		
SCALE: 3/8" = 1'-0"	APPROVED	DATE: 10-6-16
STANDARD BY:	DRAWING NO.	SHEET: 1
DRAWN BY: KRELLER	SLC-1	OF: 1 SHEETS
CHECKED BY: K.T.		

Single Light with 30' Square Pole



150 Watt LED

Catalogue Number	MTEMC Item Number	MTEMC Unit Number
USSL-G-A02-D-U-T3-SA-BK-7030-10K-4N7	6121L	M30-150-30S-LED

Pole

Catalogue Number	MTEMC Item Number	Foundation Drawing
Hapco 11-290-A4-D	6141B	SLF-1

Double Light with 30' Square Pole

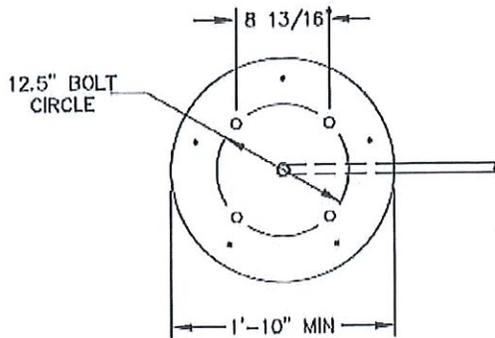


150 Watt LED

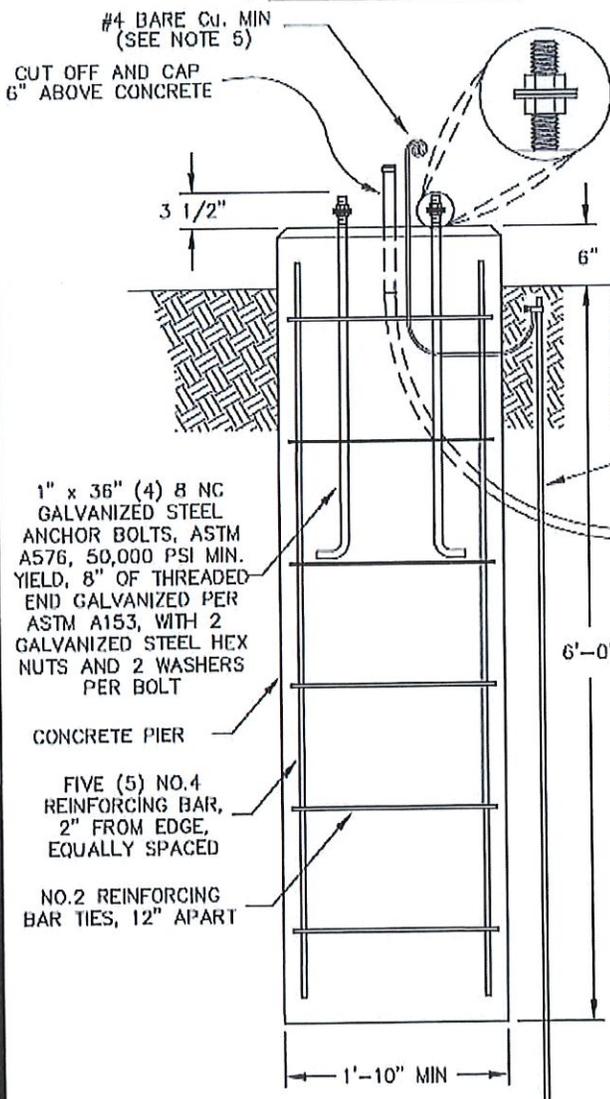
Catalogue Number	MTEMC Item Number	MTEMC Unit Number
USSL-G-A02-D-U-T3-SA-BK-7030-10K-4N7	6121L	M30-150-30D-LED

Pole

Catalogue Number	MTEMC Item Number	Foundation Drawing
Hapco 11-290-A4-D	6141B	SLF-1



PLAN VIEW



ELEVATION VIEW

NOTES:

1. DEVELOPER SHALL CHECK WITH M.T.E.M.C. REGARDING CONDUIT SIZE, TRANSFORMER LOCATIONS, AND POSSIBLE BOXES REQUIRED.
2. ALL MATERIALS AND LABOR TO BE FURNISHED BY DEVELOPER.
3. ALIGN ANCHOR BOLTS TO BE PARALLEL TO STREET.
4. MTEMC DITCH INSPECTOR TO APPROVE BEFORE CONCRETE POUR AND AT COMPLETION.
5. EXTEND Cu. GROUND WIRE 18" (MIN) FROM CENTER OF FORM & BOND TO LIGHT & POLE.
6. FINISH SHALL BE SMOOTH & FREE OF VOIDS.

1" x 36" (4) 8 NC GALVANIZED STEEL ANCHOR BOLTS, ASTM A576, 50,000 PSI MIN. YIELD, 8" OF THREADED END GALVANIZED PER ASTM A153, WITH 2 GALVANIZED STEEL HEX NUTS AND 2 WASHERS PER BOLT

CONCRETE PIER

FIVE (5) NO.4 REINFORCING BAR, 2" FROM EDGE, EQUALLY SPACED

NO.2 REINFORCING BAR TIES, 12" APART

8' DRIVEN GROUND ROD

2" PVC SCHEDULE 40 CONDUIT, 24" BELOW GRADE

TO BOX, TRANSFORMER, OR NEXT LIGHT (SEE M.T.E.M.C. SPECS.)

DATE	REVISION	BY
2-24-14	ADDED "MIN" TO DIAMETER DIM.	KDO
8-03-09	CHANGED BOLT DIA. TO 12.5"	KDO
8-21-02	REVERSED HOOKS ON ANCHOR RODS	KKK
5-25-00	EDITED NOTES, ADDED GROUND ROD	WHD
11-3-98	EDITED NOTES AND ADDED DETAIL	WHD
11-13-90	CHANGED ANCHOR BOLT THREADS	-RKW-
10-5-90	CHANGED TITLE	-RKW-

MTEMC

30' SQUARE STREET LIGHT POLE FOUNDATION DETAIL

SCALE: 3/4"=1'-0"	APPROVED	DATE
PREPARED BY: CTG	DRAWING NO.	AUG. 25, 1989
DRAWN BY: -RKW-	SLF-1	SHEET 1
CHECKED BY: CTG		OF 1 SHEETS

Single Davit Style Streetlight with 30' Pole



150 Watt LED

Catalogue Number	MTEMC Item Number	MTEMC Unit Number
Cooper ARCH-M-AF48-140-D-U-T3-7030-4N7-10K-BK GE ERL2019C330ABLCKRX	6114G	M31-150-30S-LED

Arm

Catalogue Number	MTEMC Item Number
Hapco 48268-002	6144A

Pole

Catalogue Number	MTEMC Item Number	Foundation Drawing
Hapco 41-158LA/271-002	6144	SLF-3

Double Davit Style Streetlight with 30' Pole



150 Watt LED

Catalogue Number	MTEMC Item Number	MTEMC Unit Number
Cooper ARCH-M-AF48-140-D-U-T3-7030-4N7-10K-BK GE ERL2019C330ABLCKRX	6114G	M31-150-30S-LED

Double Arm

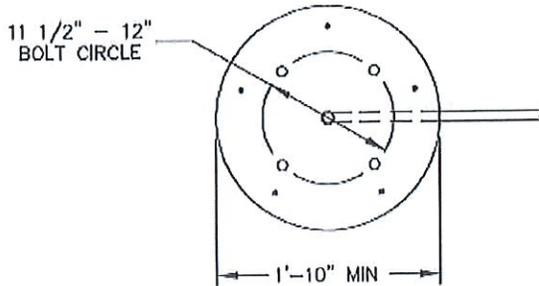
Catalogue Number	MTEMC Item Number
Hapco 49255-002	6144B

Pole

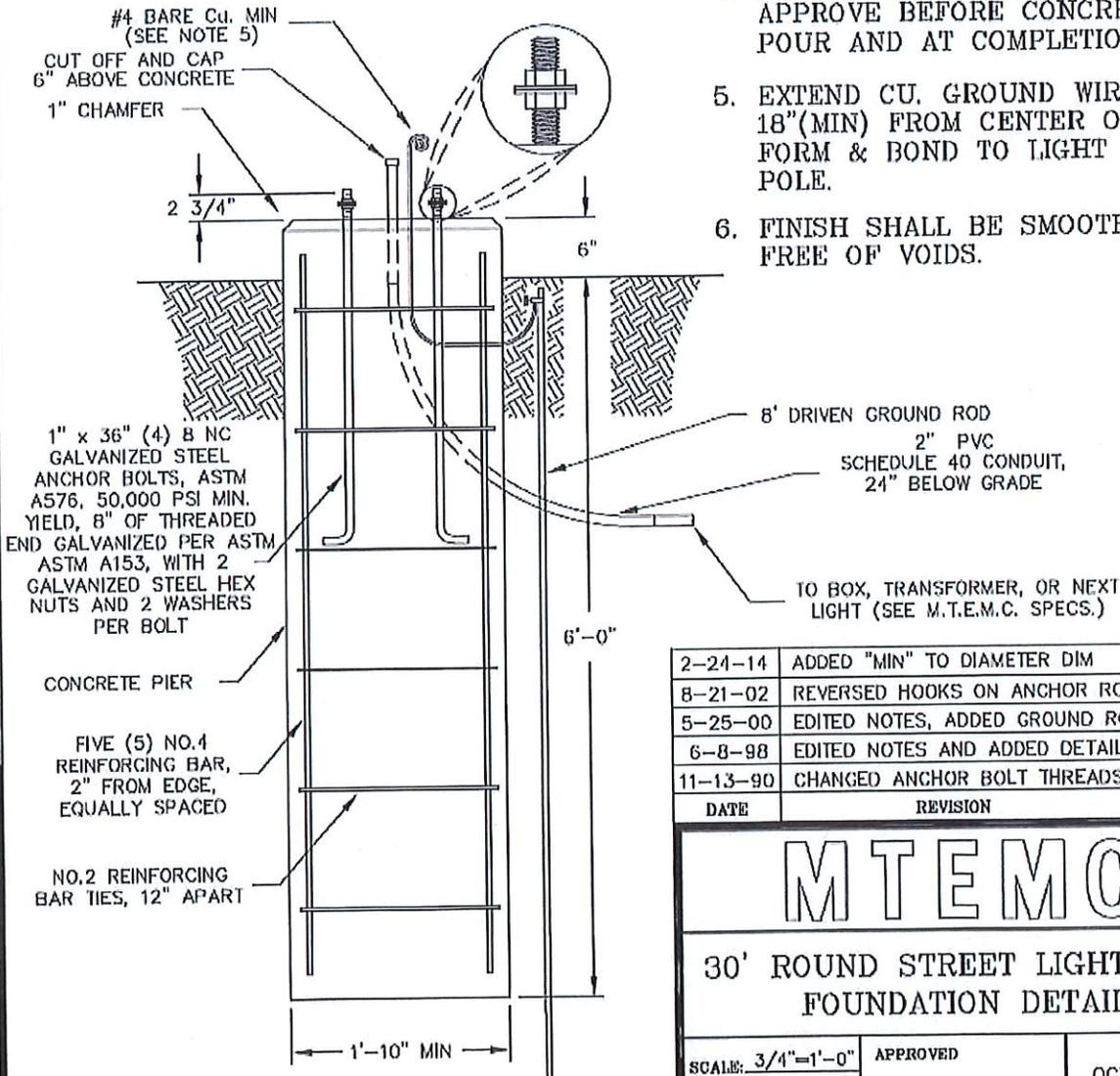
Catalogue Number	MTEMC Item Number	Foundation Drawing
Hapco 41-158LA/271-002	6144	SLF-3

NOTES:

1. DEVELOPER SHALL CHECK WITH M.T.E.M.C. REGARDING CONDUIT SIZE, TRANSFORMER LOCATIONS, AND POSSIBLE BOXES REQUIRED.
2. ALL MATERIALS AND LABOR TO BE FURNISHED BY DEVELOPER.
3. ALIGN ANCHOR BOLTS TO BE PARALLEL TO STREET.
4. MTEM C DITCH INSPECTOR TO APPROVE BEFORE CONCRETE POUR AND AT COMPLETION.
5. EXTEND CU. GROUND WIRE 18"(MIN) FROM CENTER OF FORM & BOND TO LIGHT & POLE.
6. FINISH SHALL BE SMOOTH & FREE OF VOIDS.



PLAN VIEW



ELEVATION VIEW

DATE	REVISION	BY
2-24-14	ADDED "MIN" TO DIAMETER DIM	KDO
8-21-02	REVERSED HOOKS ON ANCHOR RODS	KKK
5-25-00	EDITED NOTES, ADDED GROUND ROD	WHID
6-8-98	EDITED NOTES AND ADDED DETAIL	WHID
11-13-90	CHANGED ANCHOR BOLT THREADS	-RKW-

MTEMC

30' ROUND STREET LIGHT POLE FOUNDATION DETAIL

SCALE: 3/4"=1'-0"	APPROVED	DATE OCT. 5, 1990
PREPARED BY: CTG	DRAWING NO.	SHEET 1
DRAWN BY: -RKW-	SLF-3	OF 1 SHEETS
CHECKED BY: CTG		

Streetlight with 6' mast on 25' Pole



125 Watt LED

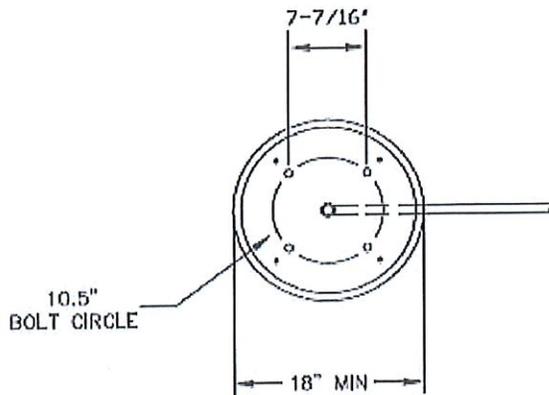
Catalogue Number	MTEMC Item Number	MTEMC Unit Number
GE ERL2016B330AGRAYRX Cooper ARCH-M-AF48-120-D-U-T3-7030-4N7-10K-AP	6114C	M31-125-22M-LED

Arm

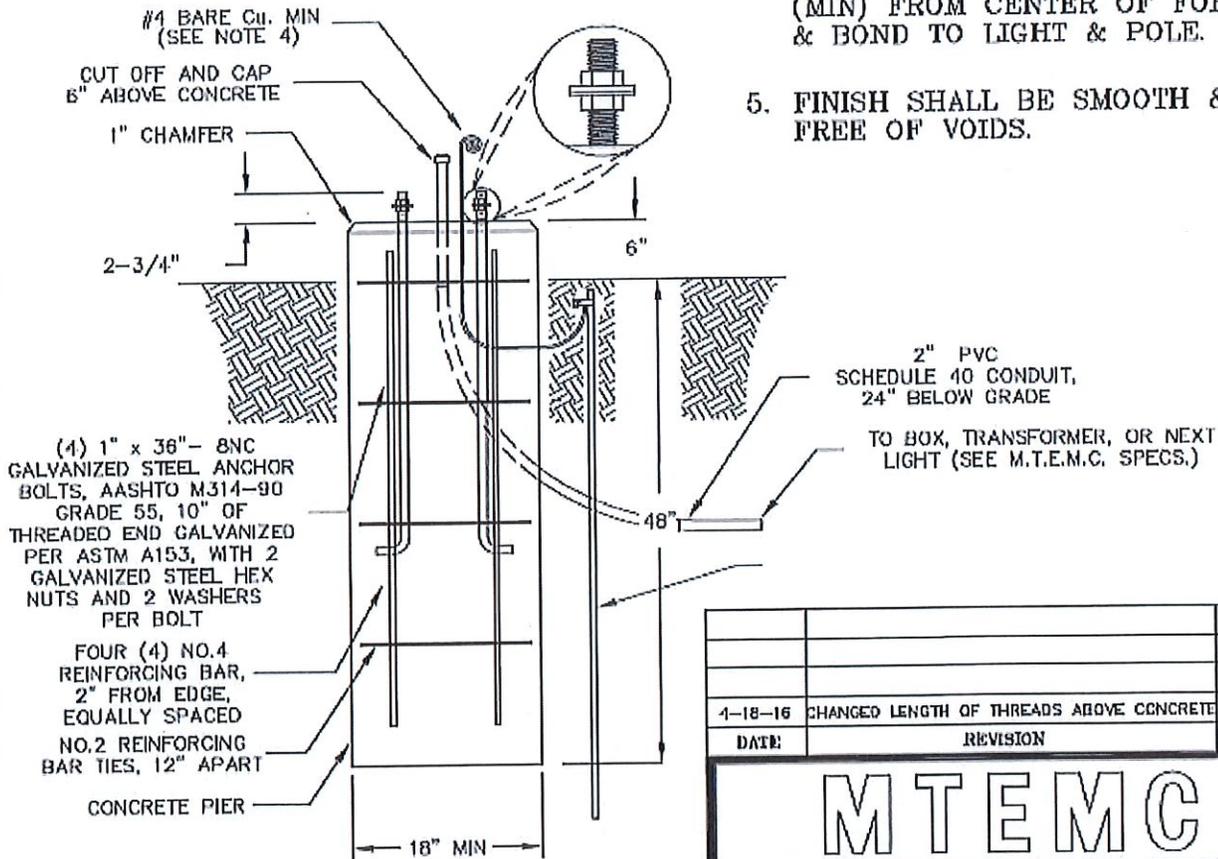
Catalogue Number	MTEMC Item Number
Hapco 47005-005	6138N

Pole

Catalogue Number	MTEMC Item Number	Foundation Drawing
Hapco RTA206D7B4-01	6138M	SLF-14



PLAN VIEW



ELEVATION VIEW

NOTES:

1. DEVELOPER SHALL CHECK WITH M.T.E.M.C. REGARDING TRANSFORMER LOCATION AND POSSIBLE BOX LOCATION.
2. ALL MATERIALS AND LABOR TO BE FURNISHED BY DEVELOPER.
3. MTEMC DITCH INSPECTOR TO APPROVE BEFORE CONCRETE POUR AND AT COMPLETION
4. EXTEND Cu. GROUND WIRE 18" (MIN) FROM CENTER OF FORM & BOND TO LIGHT & POLE.
5. FINISH SHALL BE SMOOTH & FREE OF VOIDS.

1-18-16	CHANGED LENGTH OF THREADS ABOVE CONCRETE	KDO
DATE	REVISION	BY

MTEMC

22' 6" POLE WITH 6' MAST ARM
POLE FOUNDATION DETAIL

SCALE: 3/4"=1'-0"	APPROVED	DATE
PREPARED BY: KDO	DRAWING NO.	FEB. 23, 2016
DRAWN BY: KDO	SLF-14	SHEET 1
CHECKED BY:		OF 1 SHEETS

Distributors	Product Line
Stuart C. Irby Company PO Box 110628 Nashville, TN 37222 Phone: 833-2484 Fax: 834-9255	American Electric Lighting Cooper Lighting Holophane Lighting Hapco Poles
Harris Electric Supply PO Box 24707 Nashville, TN 37202 Phone: 255-4161 Fax: 242-5683	American Electric Lighting Cooper Lighting Hapco Poles Holophane Lighting
WESCO PO Box 22769 Nashville, TN 37202 Phone: 242-7301 Fax: 242-1323	Cooper Lighting Holophane Lighting Hapco Poles
HD Supply PO Box 24460 Nashville, TN 37202 Phone: 833-0001 Fax: 256-3466	American Electric Lighting Hapco Poles
Hermitage Lighting 531 Lafayette Street Nashville, TN 37203 Phone: 843-3327 Fax: 843-3352 Email: jzigelsky@hermitagelighting.com	Hapco Poles Holophane Lighting

Distributors	Product Line
Braid Electric 299 Cowan Street Nashville, TN 37213 Phone: 242-6511 Fax: 254-2350 Email: popek@braidelectric.com	Holophane Lighting
H&H Supply 85 Athens Dr Mt Juliet, TN 37122 Phone: 615-758-9411 Fax: 615-773-7892 Cell: 615-573-1516 Email: DustinH@HandHSupply.net	Hapco Poles Cooper Lighting
Mayer Electric Supply 2924 Sidco Drive Nashville, TN 37204-3783 Phone: 615-242-1100 Cell: 615-351-9209 Fax: 615-242-9340 Email: RGoolsby@mayerelectric.com	Cooper Lighting Holophane Lighting Hapco Poles

Catalog Number	W4GLED 20C1000 40K T3M MVOLT SPD P7 GYSDP
Notes	Type 303450000

Wallpack[®] LED



LVG - Vandal guard



LWG - Wire guard

FEATURES & SPECIFICATIONS

Description

Perimeter and security lighting requires excellent control and uniformity while minimizing light trespass and glare. The W4GLED/W4PLED Wallpack LED luminaires excel at this, requiring fewer luminaires to achieve required light levels in Infrastructure, Industrial and municipal applications. With energy cost reductions up to 77% and expected service life of over 20 years, Wallpack LED provides the latest lighting technology from the company that introduced the very first Wallpack to the market.

Optics

The W4G uses a tempered glass lens and the W4P uses a protective polycarbonate lens that covers the light engine's precision-molded proprietary acrylic lenses.

- Type 3 medium
- Type 3 short (IP66 rated light engine)

Mechanical

- The housing is constructed of die-cast aluminum and is fully gasketed for ease of maintenance
- The LED driver is mounted to the front casing to thermally isolate it from the light engine for low operating temperature and long life
- Housing is completely sealed against moisture and environmental contaminants, IP55
- Exterior parts are protected by a zinc-infused Super Durable TGIC thermoset powder coat finish that provides superior resistance to corrosion and weathering.
- A tightly controlled multi-stage process ensures a minimum 3 mils thickness for a finish that can withstand extreme climate changes without cracking or peeling.

Electrical

- Light engine(s) consist of 10-30 high-efficacy LEDs mounted to a metal-core circuit board and integral aluminum heat sink to maximize heat dissipation and promote long life
- The dimmable electronic driver has a power factor of >90%, THD <20%
- SPD: 20kV/10kA standard
- CCT: 3000K, 4000K, 5000K
- CRI: 70CRI

Installation

- Top 3/4" threaded wiring access
- Back access through removable 3/4" knockout
- Feed-thru wiring can be achieved by using a conduit tee

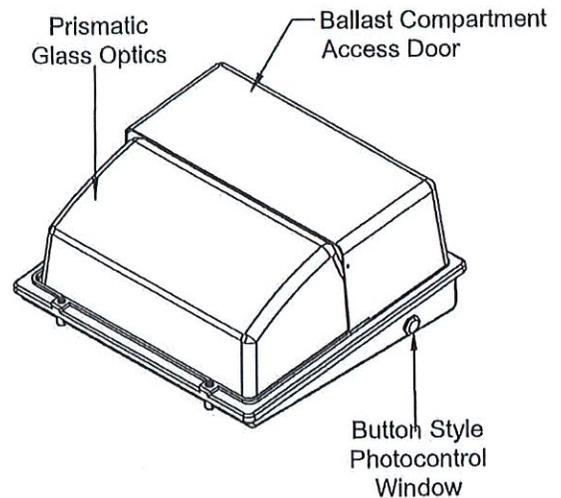
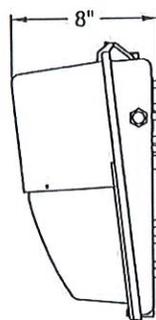
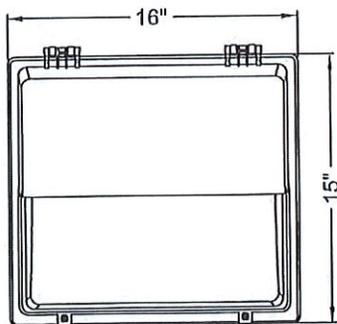
Certification and Standards

- UL listed for wet locations. Rated for -40°C minimum ambient
- DesignLights Consortium[®] (DLC) qualified product. Not all versions of this product may be DLC qualified. Please check the DLC Qualified Products List at www.designlights.org/QPL to confirm which versions are qualified.
- LM-79 compliant
- The projected LED Lumen Maintenance shall be based only on IES LM-80-08 and TM-21

Warranty

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

DIMENSIONAL DATA



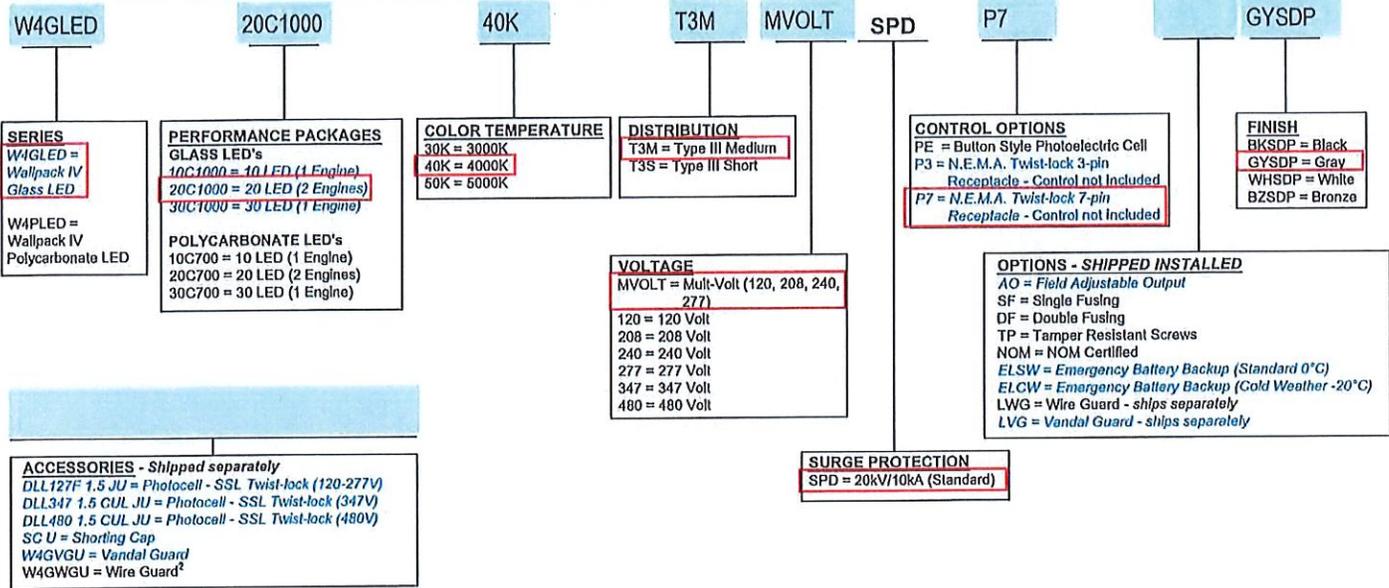
Wallpack® LED



ORDERING INFORMATION

Italicized BLUE options are ONLY available on W4GLED Series

Ex. W4GLED 30C1000 40K T3S MVOLT SPD P7 BZSDP



OPTIONS MATRIX

Parameters		SELECTED OPTION											
		AO	PE	P3	P7	SF	DF	TP	NOM	ELSW	ELCW	LWG	LVG
LED Package	10Cxxxx	N	Y	W4G	W4G	Y	Y	Y	T3M	W4G	W4G	Y	W4G
	20Cxxxx	Y	Y	W4G	W4G	Y	Y	Y	T3M	W4G	W4G	Y	W4G
	30Cxxxx	Y	Y	W4G	W4G	Y	Y	Y	T3M	N	N	Y	W4G
Voltage	AS	Y	Y	W4G	W4G	Y	Y	Y	T3M	W4G	W4G	Y	W4G
	120	Y	Y	W4G	W4G	Y	Y	Y	T3M	W4G	W4G	Y	W4G
	208	Y	Y	W4G	W4G	Y	Y	Y	T3M	W4G	W4G	Y	W4G
	240	Y	Y	W4G	W4G	Y	Y	Y	T3M	W4G	W4G	Y	W4G
	277	Y	Y	W4G	W4G	Y	Y	Y	T3M	W4G	W4G	Y	W4G
	347	Y	Y	W4G	W4G	Y	Y	Y	T3M	N	N	Y	W4G
Optic	480	Y	N	W4G	W4G	Y	Y	Y	T3M	N	N	Y	W4G
	T3M	Y	Y	W4G	W4G	Y	Y	Y	T3M	W4G	W4G	Y	W4G
Controls	T3S	W4G	Y	W4G	W4G	Y	Y	Y	N	N	N	Y	W4G
	AO	Y	Y	W4G	W4G	Y	Y	Y	T3M	W4G	W4G	Y	W4G
	PE	Y	N	N	N	Y	Y	Y	T3M	N	N	Y	W4G
	P3	W4G	N	N	N	W4G	W4G	W4G	W4GM	N	N	W4G	W4G
Options	P7	W4G	N	N	N	W4G	W4G	W4G	W4GM	N	N	W4G	W4G
	SF	Y	Y	W4G	W4G	N	N	Y	T3M	W4G	W4G	Y	W4G
	DF	Y	Y	W4G	W4G	N	N	Y	T3M	W4G	W4G	Y	W4G
	TP	Y	Y	W4G	W4G	Y	Y	Y	T3M	W4G	W4G	Y	W4G
	NOM	Y	W4G	W4G	W4G	Y	Y	Y	N	W4G	W4G	Y	W4G
	ELSW	Y	N	N	N	W4G	W4G	W4G	T3M	N	N	W4G	W4G
	ELCW	Y	N	N	N	W4G	W4G	W4G	T3M	N	N	W4G	W4G
	LWG	Y	Y	Y	Y	Y	Y	Y	T3M	W4G	W4G	N	N
	LVG	W4G	W4G	W4G	W4G	W4G	W4G	W4G	W4GM	W4G	W4G	N	N

LEGEND:

N = Not available with either W4GLED or W4PLED
 Y = Valid combination with either W4GLED or W4PLED

T3M = Only available on W4GLED & W4PLED with T3M distribution
 W4G = Only available on W4GLED
 W4GM = Only available on W4GLED with T3M distribution

Wallpack[®] LED

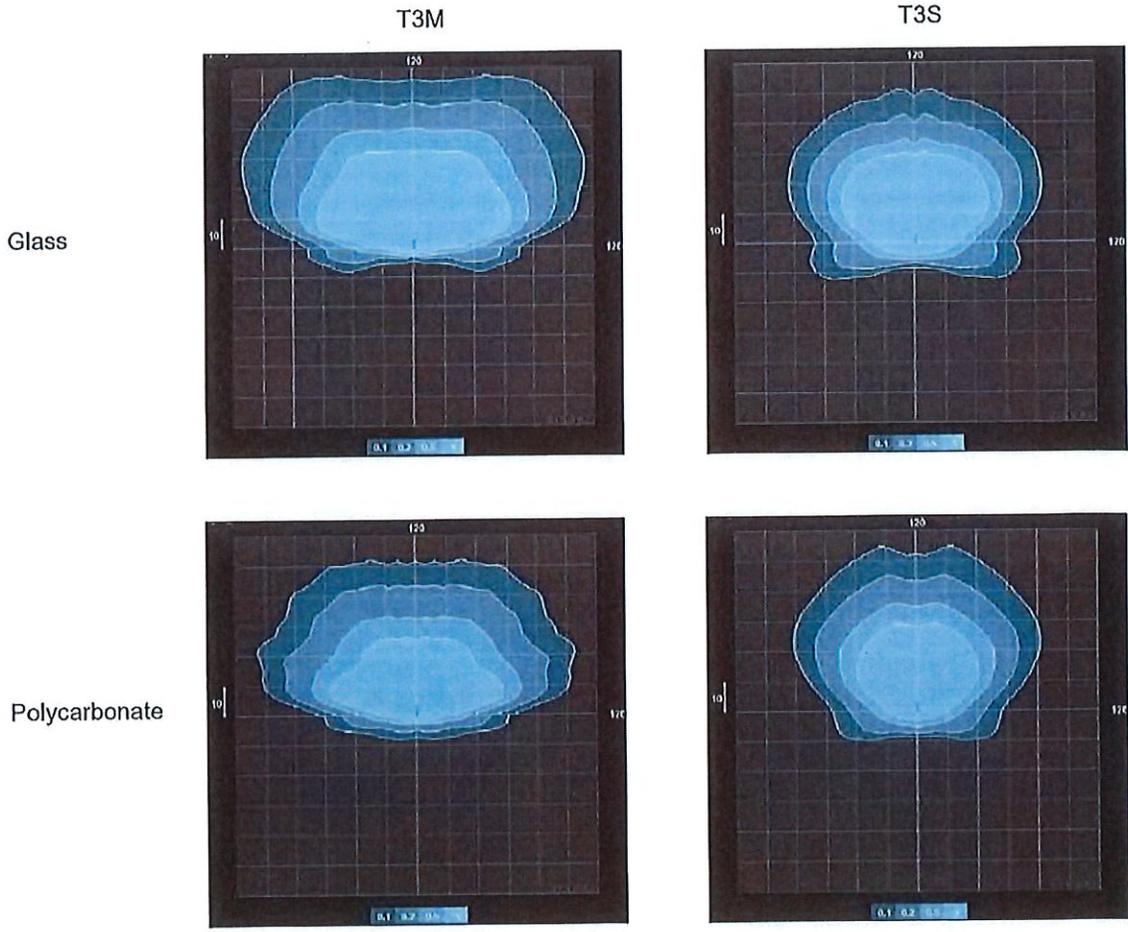


OPERATIONAL DATA

Operating Characteristics

Series	LED Package	System Watts	Distribution Type	30K (3000K, 70 CRI)					40K (4000K, 70 CRI)					50K (5000K, 70 CRI)					
				Lumens	LPW	B	U	G	Lumens	LPW	B	U	G	Lumens	LPW	B	U	G	
W4G	10C1000	39	T3M	3140	81	0	3	3	3377	87	0	3	3	3398	87	0	3	3	
	20C1000	72		6495	90	1	3	4	6983	97	1	3	4	7027	98	1	3	4	
	30C1000	104		7789	75	1	3	4	8375	81	1	3	5	8427	81	1	3	5	
W4P	10C700	26		2030	78	0	3	2	2183	84	0	3	2	2197	85	0	3	2	
	20C700	45		3912	87	0	3	3	4207	93	1	3	3	4233	94	1	3	3	
	30C700	67		4813	72	1	3	3	5176	77	1	3	4	5208	78	1	3	4	
W4G	10C1000	28		T3S	3206	115	0	3	2	3485	124	0	3	2	3485	124	0	3	2
	20C1000	57			6507	114	1	3	2	7073	124	1	3	3	7073	124	1	3	3
	30C1000	77			8477	110	1	3	3	9214	120	1	3	3	9214	120	1	3	3
W4P	10C700	27	2709		100	0	3	2	2944	109	0	3	3	2944	109	0	3	3	
	20C700	38	3299		87	0	3	3	4017	106	1	3	3	4017	106	1	3	3	
	30C700	49	4203		86	1	3	3	5173	106	1	3	3	5173	106	1	3	3	

Photometric Distributions



Wallpack[®] LED



OPERATIONAL DATA

Lumen Maintenance

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

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

Maintenance Factor with T3M Optic Option

Operating Hours	0	25,000	50,000	<i>100,000</i>
Glass Lumen Maintenance Factor	1.00	0.969	0.935	<i>0.870</i>
Polycarbonate Lumen Maintenance Factor	1.00	0.998	0.993	<i>0.982</i>

The *italicized data* is extrapolated beyond the TM-21 standard.

Maintenance Factor with T3S Optic Option

Operating Hours	0	25,000	50,000	<i>100,000</i>
Glass Lumen Maintenance Factor	1.00	1.00	0.977	<i>0.925</i>
Polycarbonate Lumen Maintenance Factor	1.00	1.00	0.977	<i>0.925</i>

The *italicized data* is extrapolated beyond the TM-21 standard.

$$E = (LM) \times (CU) \times (LAT) \times (LLD)$$

LM and CU are obtained from published photometry.

Lumen Ambient Temperature (LAT) Multipliers

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

Ambient		Lumen Temperature	
		LEDs with T3M	LEDs with T3S
0° C	32° F	1.02	1.05
10° C	50° F	1.01	1.03
20° C	68° F	1.00	1.01
25° C	77° F	1.00	1.00
30° C	86° F	1.00	0.99
40° C	104° F	0.98	0.97