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M E M O R A N D U M

DATE: November 13, 2015

TO: Specification Review Distribution List

FROM: Daniel Scheer, P.E., State Specifications Engineer

SUBJECT: Proposed Specification: **9920000 Highway Lighting Materials.**

In accordance with Specification Development Procedures, we are sending you a copy of a proposed specification change.

The changes are proposed by Chester Henson of the State Roadway Design Office to add requirements for LED luminaires and eliminate the portion of the specification concerning wooden poles.

Please share this proposal with others within your responsibility. Review comments are due within four weeks and should be sent to Mail Station 75 or online at http://www2.dot.state.fl.us/ProgramManagement/Development/IndustryReview.aspx . Comments received after **December 11, 2015,** may not be considered. Your input is encouraged.

DS/ot
Attachment

HIGHWAY LIGHTING MATERIALS.
(REV 11-~~2~~*4*-15)

SECTION 992 is deleted and the following substituted:

992-1 General.

992-1.1 Pole Design Criteria: The light poles and bracket arms shall be in accordance with the requirements of the AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals, the FDOT Structures Manual and with the specific requirements contained in this Section.

992-1.2 Luminaires*, Driver, etc.*: *All luminaries shall be one of the products listed in the Department's Approved Product List (APL). Manufacturers seeking evaluation of their product shall submit an application in accordance with Section 6.*

The light source for luminaries shall be either light emitting diodes (LED), magnetic induction or plazma induction.~~ Luminaires shall be one of the products listed on the Department's Approved Product List (APL). Manufacturers seeking evaluation of their product shall submit an application in accordance with Section 6.~~

The luminaire shall be constructed of precision cast aluminum with a corrosive resistant polyester powder coat finish. The standard color shall be gray. The optical portion of the housing shall be sealed to provide an IP 66 rating. The refractor and~~/or~~ lens shall consist of glass or an optical grade of polycarbonate. The manufacturer shall place a permanent tag in the luminaire housing imprinted with: the manufacturer name, luminaire voltage, lamp wattage, and provide a blank area for the Contractor to inscribe the installation date.

Luminaires shall *meet the following requirements:* ~~comply with~~ UL 1598 *listed* ~~and be listed~~ and labeled for installation in wet locations by an OSHA recognized "Nationally Recognized Testing Laboratory" (NRTL), *minimum Correlated Color Temperature (CCT) 4000° K meeting ANSI~~-~~ C78.377A (3985° K plus or minus 275° K), be capable of maintaining 94.1% intensity at 10,000 hours with an ambient temperature of 25° C (IES~~-~~ LM-80) and have IESNA light distribution curves (IES~~-~~ LM-79) by an EPA ~~R~~recognized ~~L~~laboratory*.

The driver shall be rated for 100,000~~-~~ hours and have a power factor greater than or equal to~~ or greater than~~ 90% at full load with a total harmonic distortion ~~equal to or~~ less than or equal to 20% at full load. The fixture shall accommodate a circuit voltage of 480 volts.

Luminaries shall be provided with a minimum 10kV/10kA internal surge suppression module meeting UL 1449/ANSI C62.41.2 Category C.

The manufacturer shall submit a five year non-prorated warranty to the Department. The warranty shall begin on the project acceptance date and include all components of luminaire.

992-1.3 Conductors: All conductors shall be color-coded stranded copper meeting the requirements of NEMA WC 70. *All conductors shall be tested and listed by a ~~Nationally Recognized Testing Laboratory (~~NRTL~~)~~.*

Service and circuit conductors shall be single-conductor cable Type THWN-2 and shall not be smaller than No. 6 AWG.

Bonding ground conductor shall have a green jacket and shall not be smaller than No. 6 AWG.

992-1.4 Conduit: ~~Conduit shall be used in accordance with the National Electrical Code and as specified in the Plans.~~ Conduit shall meet the requirements of Section 630.

992-1.5 Electrical Ground Rod: The electrical ground rods shall be 5/8 inch copper clad steel. Electrical ground rods shall be sectional type where length exceeds 10 feet.

992-1.6 Fittings and Bends: Fittings, bends and miscellaneous hardware shall be in accordance with the National Electrical Code (NEC~~)~~ and shall be compatible with the adjacent conduit and materials.

992-1.7 Conductor Splices: Unless otherwise shown in the Design Standards or authorized by the Engineer, splices shall be made with compression sleeves or split bolt connectors. The connector shall be sealed in silicone gel that easily peels away leaving a clean connection. The gel ~~will~~ *shall* be contained in a *UV, impact, and abrasion resistant* closure that when snapped around the split bolt will provide a waterproof connection without the use of tools or taping. ~~This closure will be UV resistant, impact resistant and abrasion resistant.~~

992-1.8 Pull Boxes: Pull boxes shall meet the requirements of Section 635.

992-1.9 Distribution Service Point Equipment: All electrical equipment shall be provided with 75°C terminal lug connectors.

992-1.9.1 Service Main: Two pole 480 ~~V~~*volt*, 35,000 min. AIC, solid neutral, NEMA 4X stainless steel, enclosed circuit breaker rated for service entrance.

992-1.9.2 Control Panel Enclosure: NEMA 4X stainless steel enclosure ground mounted per Design Standards, Index No. 17736. Dimensions shall be as necessary for equipment inside.

992-1.9.3 Control Panel Main Disconnect: Two Pole, ~~480V~~*480 volt*, 35,000 AIC with solid neutral in NEMA 1 enclosure. Number and rating of branch circuit breakers shall be as indicated in Plans.

992-1.9.4 Lighting Contactor: Two pole, ~~480V~~ *480 volt* electrical contactor in NEMA 1 enclosure w/HOA on cover, 120V coil and fused control power transformer.

992-1.9.5 Electrical Panel: Single Phase (~~Two~~ *two* pole), ~~480V~~*480 volt*, with solid neutral in NEMA 1 enclosure.

992-1.9.6 Surge Protection Device: ~~Surge protective device shall be~~ Type 1, UL or NRTL listed to 1449, Third Edition. Surge current rating on per phase basis shall equal or exceed ~~50KA~~*50 kA*. I-nominal rating shall be ~~10KA~~ *10 kA* or ~~20KA~~*20 kA*. ~~480V~~ *480 volt* true single phase system modes of protection shall include L-G and N-G having UL 1449-3 Voltage Protection Ratings of ~~2000V~~ *2000 volt* or lower. 240/~~480V~~ *480 volt* split phase systems deriving ~~480V~~ *480 volt* across two energized conductor's modes of protection shall include L-G and N-G having UL 1449-3 Voltage Protection Ratings of ~~1200V~~ *1200 volt* or lower.

992-2 Conventional Lighting.

992-2.1 Poles: Poles for conventional lighting shall be aluminum unless otherwise shown in the Plans.

992-2.1.1 Aluminum Poles: Aluminum ~~light~~ poles shall be round, one piece, continuous-tapered high-strength aluminum, and of an approved alloy meeting the requirements of the Design Standards. The poles shall be of such length as to provide the approximate luminaire mounting height shown in the Plans. Poles installed on bridges, walls and concrete median barriers shall be equipped with internal vibration damping devices.

992-2.1.~~1~~ *2* Concrete Poles: Concrete poles may be used only when specified in the Plans. When specified, concrete poles shall meet the requirements of Section 641 and Design Standards, Index No. 17725 for a Type P-III pole.

992-2.2 Bases: Aluminum poles shall be installed on transformer bases with the exception of lights installed on bridge pilasters or on top of median barrier. Transformer base

poles shall have a grounding lug in the transformer base. The base shall be arranged for anchoring to a transformer base with four 1 inch anchor bolts (minimum size).

992-2.3 Bracket Arms: Bracket arms shall be aluminum, truss-type construction, consisting of upper and lower members with vertical struts, and shall have the luminaire end formed to accommodate a 2 inch pipe slipfitter. The bracket arms shall meet the design requirements of 992-1.~~1~~*2*. Bracket arms shall be attached to aluminum poles, with machine bolts and pole adapters, unless approved otherwise.

992-2.4 Luminaires,~~ Ballasts, etc~~: *The luminaries shall meet the requirements shown in the Plans.*

The luminaire mounting assembly shall be a slipfitter type designed to accommodate a nominal 2 inch pipe size (2-3/8- inch O.D.) arm or a pole top mounting assembly designed to accommodate a 2-3/8- inch pole top tenon.

For APL qualification, the manufacturer must have a fixture with an IESNA light distribution curve (IES- LM-79) by an EPA recognized laboratory, meeting a minimum pole spacing of 215- feet using the AGi32 lighting optimization tool with the following settings:

Setting	*Requirement*
Roadway Standard	*IES- RP-8-200*
R-Table	*R3 (Q0=0.07)*
Roadway Layout	*Two Rows Opposite, With Median, 2R OPP w/M*
Roadway Width	*40- feet*
Median Width	*22- feet*
Number of Lanes in Direction of Travel	*3*
Driver's Side of Roadway	*Right*
Calculation Area	*Bottom*
Mounting Height	*As per Manufacturer's recommendation*
Setback	*12- feet*
Tilt	*0°*
Optimization Criteria	*Avg. Illuminance = 1.5- fc Avg./Min. Ratio = 4 Max./Min. Ratio= 10 Lv Max./L Avg. Ratio= 0.3*
Arm Length	*Pole top fixtures – as provided by the IES file Arm mounted fixtures – 12 feet*

~~Luminaires shall consist of a precision-cast aluminum housing and reflector holder, a high-pressure sodium lamp, and a heat resistant, high-transmission glass refractor. Luminaire housing shall have a refractor-holder latch on the street side, and a hinge with a safety catch on the house side of the luminaire and a slipfitter suitable for attaching to a 2 inch mounting bracket. Pole top mounted luminaires which shall have a 2 inch tenon. Housing shall be IP 66 rated.~~

~~High-pressure sodium lamps shall meet the following requirements: NEMA C78.42, CRI 21(Min.), CCT 2100 K and average rated life of 24,000 hours minimum.~~

~~Luminaires shall have internal ballasts of the regulated output (constant wattage) type, suitable for operating on the circuits shown in the Plans. The ballasts shall be pre-wired to the lamp socket and terminal board, requiring only connection of the power-supply leads to the ballast primary terminals. The ballast shall have a power factor of at least 90%. The ballast shall~~

~~provide for regulation within plus or minus 6% variation in lamp watts at a primary voltage variation of plus or minus 10% for lamps of 400w or less.~~

~~The luminaires shall meet the requirements shown in the Plans.~~

992-2.5 Luminaire Cable: Pole and bracket cable shall be multi-conductor Type XHHW-2 XLP TC with three No. 10 AWG.

992-2.6 In Line Fuse Holders: In line fuse holders shall provide a breakaway connection and be UL recognized per Guide IZLT2 and rated for ~~600V~~*600 volt*. The wire connections in the fuse holders shall be of the copper setscrew type. Fused connections shall utilize and ATQ or FNQ 10 amp time delay fuse rated for ~~500V~~*500 volt*. Fuses shall be UL listed to Standard 248-14. The rating for the fuse holders shall be water resistant or submersible rated.

992-2.7 Surge Protection Devices *for Circuit Protection at Poles*: The metal oxide varistor (MOV) based SPD shall be potted in a manner to be waterproof. UL listing is not required. SPD's per mode surge current rating shall be ~~20KA~~ *20 kA* for 480 *volt*~~V~~ to ground and ~~40~~ *20* ~~K~~*k*A for neutral to ground. Maximum continuous operation voltage (MCOV) shall be not less than 550Vrms and not greater than 600Vrms. All wires and internal spacings shall be insulated for 600Vrms.

992-2.8 Pole Cable Distribution System.

992-2.8.1 General: These requirements are applicable for all systems rated up to and including 600 ~~V~~*volts*. The installed system shall be in compliance with the Design Standards, Index No. 17500. Systems installed as alternates to the Design Standards shall be one of the products listed on the Department's Approved Product List (APL). Manufacturers seeking evaluation of their product shall submit an application in accordance with Section 6.

Alternate Systems shall meet the following requirements:

~~1.~~ A modular color coded cable system consisting of rubber cords with integrally molded watertight submersible connectors, inline fuses, submersible surge arrestor and breakaway connectors shall be installed. The cables shall extend from an underground pull box near the base of the pole to the luminaires at the top of the pole. A cable system shall be required at each pole.

The cable system shall consist of the following described components:

1. Distribution Block: The red molded body shall contain a three wire female outlet integrally molded to a 24 inch length of 10/3 SOOW cable with an end molded to the body and the other end shall be spliced in the field to the distribution cable that feeds through the underground pull box near the base of the pole. The block shall be watertight and submersible when the integrally fused plug on the power cable is engaged and fully seated. Dimensions shall be approximately 2 inches by 3 inches by 3 inches. The size is important because of limited space.

2. Surge Arrestor Cable: Provide a 12 inch length of 10/2 SOOW cable with a red male plug to match the red female connector cable extending from the fused plug on the power cable. The other end of the surge arrestor cable shall be integrally molded to a MOV waterproof surge arrestor. The red male plug shall make a submersible connection when mated to the red female connector on the power cable. A separate 12 inch length of No. 10 THWN green ground wire shall be provided from the surge arrestor to attach to the ground system in the pull box.

3. Power Cable: This cable feeds the luminaire cable and the surge arrestor cable from the load side of its integrally fused red male plug end. The red fused plug

shall contain 10 amp 500 volt fuses (13/32 inch by 1-1/2 inch) or equal. A solid copper slug shall be installed on neutral side for line to neutral service. Both lines shall be fused for line to line service. The section that feeds the luminaire cable shall be a 10 foot section of 10/3 SOOW cable with an orange female connector molded to the end extending up into the base of the pole. This female connector shall pass easily through a standard size 1-1/4 inch PVC elbow and make a submersible connection when mated with the orange male plug on the luminaire cable. The section that feeds the surge arrestor cable shall be 12 inches in length of 10/2 SOOW cable with a red female connector on the end. The red female connector shall make a submersible connection when mated to the red male plug on the surge arrestor cable.

4. Luminaire Cable: This cable is Type XHHW-2 XLP-TC with three No. 10AWG an orange male molded plug molded to match the orange female end of the power cable. The connector shall require 25 pounds of force to mate or disengage from the female end. When engaged the connection shall be watertight and submersible. The cable strain relief shall extend approximately 2 inches from the connector.

The distribution block and each connector shall be made of thermosetting synthetic polymer which is non-flame supporting and which remains flexible over a temperature range of minus40°F to plus 190°F. Hardness of the molded rubber shall be 65 durometer.

992-2.8.2 Testing and Performance Criteria: The system shall pass the following performance criteria in accordance with NEC 110 2.

1. Dielectric Test: No breakdown shall occur with a test potential of 1,960 volts applied between the primary conductors (tied together) and the protective ground for a period of one-minute.

2. Leakage Current Test: Leakage current shall be measured on the mated connectors between the primary conductors and the protective ground conductor. When tested at the rated operating voltage, the leakage current shall not exceed 0.5 mA. The mated connectors shall then be wrapped in aluminum foil and the leakage current measured between the primary conductors and the foil wrap. When tested at the rated operation voltage the leakage current shall not exceed 0.5 mA.

3. Flame Retardant Test: Flammability tests shall be conducted on the cable, the molded body of the connectors, and the molded protective caps. These materials shall be subjected to five flame application, on for 15 seconds and off for 15 seconds. The materials shall self-extinguish within one minute upon removal of the flame and not burn through.

4. Internal Temperature Test: The internal temperature rise of the contact area of the mated connectors shall not exceed a temperature rise of 54°F referenced to 73°F ambient temperature when operated at the maximum current rating.

5. External Temperature Test: The external temperature rise of the mated connectors and the cable shall not be greater than 54°F referenced to 73°F ambient temperature when operated an the maximum current rating.

6. Fault Test: The mated connectors shall be fault tested by applying a test current of 1,000 amperes, 60 HZ for a minimum of 3 cycles (50 ms). The mated connectors shall then satisfactorily pass the dielectric test.

7. Drop Test: The connectors shall not break, crack or suffer other damage when subjected to eight consecutive drop tests from 3 feet above the concrete floor with the connectors having been rotated 45 degrees between each drop.

8. Crushing Test: No breakage of deformation shall result when the mated and unmated connectors are subjected to a crushing force of 500 pounds for one minute. Following the crush test, the dielectric test shall be satisfactorily passed.

9. Impact Test: No breakage or deformation shall result when the connectors are subjected to an impact caused by dropping a cylindrical 10 pound weight having a flat face 2 inches in diameter from a height of 18 inches.

10. Flex Test: No detachment or loosening shall result when each connector is subjected to a 5,000 cycle flex test at the cable/bond area back and forth in a plane through an angle of 180 degrees. Following the flex test the dielectric test shall be satisfactorily passed.

11. No Load Endurance Test: No excessive wear shall result when the male and female connectors and protective cap and female connector were subjected to 2,000 cycles of complete insertion and withdrawal.

12. Rain Test: The mated and capped connectors shall be subjected to a continuous water spray (simulating worst case outdoor rain down pour) for at least one hour at a rate of at least 18 inches per hour at an operating pressure of 5 psi. The dielectric and leakage current tests shall be satisfactorily passed. The connectors shall be unmated and caps removed. Inspection shall indicate that water had been successfully prevented from reaching the contact areas of the connectors.

13. Watertight (Immersion) Test: The mated and capped connectors shall be immersed in water for one hour in which the highest point of the test samples in as least 3 feet below the water level. Immediately following the immersion, a satisfactory dielectric and leakage current tests shall be performed. The connectors shall be unmated and caps removed. Inspection shall indicate that water had been successfully prevented from reaching the contact areas of the connectors.

14. Exposure to Deteriorating Liquids: The cable and connectors shall be dried at 212°F for one hour. The samples shall then be immersed in ASTM Reference Oil No. l and ASTM Reference Fuel C liquids for one hour. The samples shall show no evidence of bubbling, cracking or corrosion. Within one hour after being removed from the fluids, the test samples shall satisfactorily pass the flammability test.

992-3 High Mast Lighting.

992-3.1 Poles: Poles for high mast lighting shall be galvanized steel unless otherwise shown in the Plans. Steel high mast poles shall be continuous-tapered, round or minimum of 12 sided poles and meet the requirements of the Design Standards.

Each pole shall include a galvanized steel wench plate of sufficient size to mount the winch, portable drive unit mounting tube, circuit breaker panel and surge arrestor.

992-3.2 Luminaires~~ and Ballasts~~: *The luminaire mounting assembly shall be a slip fitter type designed to accommodate a nominal 2 inch pipe size (2-3/8- inch O.D.) connection. For qualification, the manufacturer must have a fixture with a Type- V IESNA light distribution curve (IES- LM-79) by an EPA ~~-~~ ~~R~~recognized ~~L~~laboratory, capable of providing photometrics similar to a 1000- W HPS fixture when mounted on 80 to 120- foot poles.*~~The reflector with its aluminum cover shall be firmly attached to a cast ring. This ring shall have keyhole slots in its upper surface such that the reflector/refractor assembly may be readily attached to, or detached from, the luminaire bracket entry and lamp support assembly without completely removing the support bolts.~~

~~High pressure sodium lamps shall meet the following requirements: NEMA C78.42, CRI 21(min), CCT 2100 K and average rated life of 24,000 hours (min).~~

~~Each luminaire shall contain an integral auto-regulator type ballast. The luminaire ballast shall be enclosed within an aluminum housing which integrally attaches to the luminaire bracket entry and lamp support assembly. It shall be readily removable without removing the luminaire from the bracket arm. The ballasts shall be pre-wired to the lamp socket and terminal board, requiring only connection of the power supply leads to the ballast primary terminals. The ballast shall have a power factor of at least 90%. The ballast shall provide for regulation within plus or minus 6% variation in lamp watts at a primary voltage variation of plus or minus 13% for lamps of 750w or greater.~~

~~The luminaire shall be attached to the bracket arm by means of a bracket entry and lamp support assembly. The assembly shall include a side entry slipfitter designed for 2 inch pipe with provision for 3 adjustments for leveling the luminaire. An enclosed terminal block shall be included such that all electrical connections shall be protected from exposure to weather.~~

~~All electrical connections shall be made waterproof or be made inside a weather resistant enclosure. All luminaires shall be ANSI/IES light distribution as indicated in the Plans. Each luminaire shall be labeled with a permanent label which states the type of lamp, voltage input, power input, power factor, ballast type, socket position, ANSI/IES light distribution, and such other catalog information that a complete replacement can be readily ordered.~~

992-3.3 Surge Protective Devices *for Surge Protection at Poles*: Surge protective devices (SPD) shall be Type 1 or Type 2. UL or NRTL listed to UL 1449 Third Edition. Surge current rating on a per phase basis shall be equal or exceed ~~50KA~~*50 kA*. I-nominal rating shall be ~~10KA~~ *10 kA* or 20 ~~K~~*k*A. Modes of protection shall include L-G and N-G having UL 1449-3 Voltage Protection Ratings (VPR's) of ~~2000V~~ *2000 volt* or lower.

992-3.4 Lowering System: The lowering system may be either a top latch or bottom latch system. The lowering system shall consist of the following.

992-3.4.1 Head frame and Covers: The head frame unit shall rigidly mate the top of the pole to the head frame platform. The platform with its associated sheaves shall be covered to prevent water from entering the top of the pole. The head frame structure shall be stainless steel and attach to the pole by stainless steel bolts or by means of a galvanized steel slipfitter. The head frame shall utilize two stainless steel cable sheaves for each lowering cable. The cable sheaves shall be a minimum of 5 inches in diameter and grooved to the exact cable diameter, for 180 cable bearing surface. The power cord shall travel on sheaves or a combination of rollers providing a radius for the cord of 6 inches or larger. Each end of the sheaves or rollers shall have a keeper to prevent the cable from jumping out of the roller track or sheave cover that will act as a keeper. Bearings shall have permanent lubrication. For top latch systems the head frame shall include latch mechanisms which support the luminaire ring in the latched position and prevent the luminaire ring from rotation. For bottom latch systems the head frame shall include centering guides which center the luminaire ring and prevent the ring from rotation.

992-3.4.2 Luminaire Ring: The luminaire ring assembly shall consist of the luminaire ring, hoisting cable terminator tubes, and weather proof junction box. The luminaire ring and the junction box shall be fabricated of stainless steel. The ring shall be supplied with bolt on 2 inch stainless steel pipe tenons for the required number of luminaires. Two of the stainless steel tenons shall have a 1 inch half coupling welded to the tenon for the possible installation of FAA approved obstruction lights. The inner portion of the ring shall be equipped with a PVC shock absorbing tubes or shall utilize roller contact spring-loaded centering arms

which center the luminaire ring and protect the pole and luminaire ring during raising or lowering operations. A 600 volt terminal block, completely prewired shall be included in the junction box. The luminaire ring shall be prewired with distribution wiring suitable for proper application and operation of the luminaires. A male flanged receptacle shall be mounted on the luminaire ring to allow testing of the luminaire while in the lowered position. The receptacle shall face away from the pole for easy access.

992-3.4.3 Lowering Cables: For bottom latch lowering systems, a minimum of two cables shall be used to lower the luminaire ring. Lowering cables for bottom latch systems shall be stainless steel aircraft cables of 1/4 inch or greater diameter. Where the wire cables bend over sheaves or the winch drum, the maximum working stress in the outer fibers of wire cable shall not exceed 20% of the cable manufacture's rated ultimate stress. The hoisting cable shall manually latch at the base of the pole and shall remove the load from the winch system. Each latch point shall be capable of supporting the entire weight of the luminaire ring assembly including luminaires. All moving parts of the latch mechanism shall be within reach from the ground level.

For top latch lowering systems, three stainless steel aircraft cables of 3/16 inches or greater diameter shall be provided. The transition yoke, hardware connecting the lowering cables to the transition yoke and hardware connecting the winch cable to the transition yoke shall be stainless steel. Where the wire cables bend over sheaves or the winch drum, the maximum working stress in the outer fibers of wire cable shall not exceed 20% of the cable manufacturer's rated ultimate stress. All latching systems shall remove the load from the winch system. Each latch point shall be capable of supporting the entire weight of the luminaire ring assembly including luminaires.

992-3.4.4 Modular Power Cable System: The modular cable system shall consist of cables with weathertight connectors. All portions of the cable system shall be rated up to and including 600 ~~V~~*volt*. The plugs and connectors shall be UL or NRTL listed to UL 498 twist-lock type devices with a NEMA L16-30R configuration for ~~480V~~ *480 volt* line to neutral systems or for ~~480V~~ *480 volt* line to line systems. The X designated prong shall be the hot leg for 480V line to neutral systems. The X and Z designated prongs shall be the hot legs for ~~480V~~ *480 volt* line to line systems. The Z designated prong shall always be treated as a neutral leg. The plugs and connectors shall be equipped with watertight safety shrouds meeting UL 4X enclosure rating. Plugs and connectors when used on cord sets shall be equipped with IP 55 rated waterproof boots.

The power cable shall be a minimum of 10/3 SOOW cable that is wired from distribution cable in the pull box near the base of the pole to the line side of the circuit breaker panel.

The circuit breaker cable shall be an 8 foot length of 10/3 SOOW (minimum) cable that is connected to the load side of the circuit breaker panel and a female receptacle on the other end. This female receptacle shall mate with the male plug on the pole cable, the male flanged receptacle on the luminaire ring and the male plug on the portable step-down transformer.

The pole cable shall be the length of the mounting height of the pole plus 6 feet. The cable shall be a minimum of 10/3 SOOW with a male plug on one end that mates with the female receptacle on the circuit breaker cable. The other end fits under the lugs in the junction box on the luminaire ring. The power cable shall be attached to the luminaire ring with a stainless steel strain relief Kellem's grip capable of withstanding the pull of the weight of the

cable. All power cables should be attached to the stainless steel weathertight wiring chamber with weathertight cable connectors

992-3.4.5 Winch Drum: The drum shall be constructed of stainless steel and be designed to provide a level wind of wire cable. The winch shall be a reversible worm gear self locking type with an integral friction drag brake to prevent free spooling. Raising speed of the luminaire ring shall be a minimum of 12 feet per minute. Stainless steel 7 x 19 aircraft cables of 1/4 inch or greater diameter shall be supplied on the winch. The winch drums shall be designed to provide smooth winding of the winch cables on the drum and to prevent cable slippage on the drum.

992-3.4.6 External Portable Winch Motor (One per Project): The winch shall be designed for hand operation or for operation by means of a 1/2 inch heavy duty reversing electric drill motor or a portable reversible AC motor with a magnetic brake. Both portable power units shall be mounted to the winch by a stainless steel mounting bracket and shall be remote controlled to enable the operator to stand 25 feet from the pole. One portable drill motor or portable motor power unit shall be provided for each project.

992-3.4.7 Portable Step-Down Transformer (One per Project): A portable 1.5 KVA dry type transformer shall be provided for each project. The transformer shall step-down the high mast distribution voltage to 120/240 volts. The transformer shall be mounted in a NEMA 3R enclosure and have a male plug or receptacle which mates to circuit power cable. The transformer shall also have a 120 volt grounded receptacle for use by electric drill motor or portable motor power unit.

992-4 Sign Lighting.

992-4.1 Luminaires~~ and Ballasts~~: ~~The luminaire shall consist of a precision cast aluminum housing with a corrosive resistant polyester powder coat finish. The standard color shall be gray. The cover shall be attached to the housing utilizing stainless steel hardware, and the housing shall be sealed to provide an IP 55 rating or greater.~~ The *luminaire* mounting assembly for a sign *luminaire* ~~light~~ shall be a slipfitter type *designed* to accommodate a 1-1/2 inch, Schedule 40 steel pipe *arm* connection. The luminaire manufacturer shall place a permanent tag on the luminaire housing on which the following is imprinted: the luminaire voltage, lamp wattage and a blank area for the Contractor to inscribe the installation date. The refractor shall be tempered clear or microprismatic glass.

Induction or LED fixtures shall meet the following requirements: Correlated Color Temperature of CCT 4500 K (plus or minus 500K), maintain 94.1% intensity at 6,000 hours (IES LM-80) and have IESNA light distribution curves (IES LM-79) by an EPA recognized laboratory. The driver/ballast may be internal or external to the fixture. The driver/ballast shall have a power factor greater than or equal to 90% at full load and a total harmonic distortion less than or equal to 20% at full load. The fixture shall accommodate a circuit voltage of 480 volts. If the fixture is not compatible with the circuit voltage, step-down transformers or other equivalent circuitry shall be provided by the fixture manufacturer to provide for a complete installation.

The fixture shall have an internal surge protective device. The surge protection must meet 10kV/5kA meeting ANSI/IEEEC 62.41.

The fixture shall be rated for a minimum lamp efficiency of 60% lumen output at 75,000 hours at 25°C. The manufacturer shall provide a five year non-prorated warranty to the Department. The warranty shall begin on the installation date.

992-5 Underdeck Lighting.

992-5.1 Luminaires ~~and Ballasts~~: ~~Luminaires shall consist of a die-cast aluminum housing and reflector holder and a heat-resistant, high-transmission glass prismatic refractor. Housing shall have gasketing between the reflector and the refractor and the socket entry. Luminaires shall be high pressure sodium vapor unless otherwise indicated in the Plans.~~

~~High pressure sodium lamps shall meet the following requirements: NEMA C78.42, Color Rendering Index of CRI 21 (Min), CCT 2100 K and average rated life of 24,000 hours (min).~~

Underdeck fixtures ~~may~~ *shall* be wall mounted ~~or pendant mounted~~ fixtures. ~~Pendant mounted fixtures shall be vibration tested in accordance with NEMA C136.31.~~

992-5.2 Conductors: Underdeck structure lighting conductors shall be Type RHW or THW and shall not be smaller than No. 10 AWG.

~~**992-6 Wooden Service Poles.**~~

~~**992-6.1 General:** Wooden service poles shall meet the requirements of ANSI (ASA) and shall be at least 35 feet in length. The pole shall be Class 5 unless otherwise specified in the Plans or in the Specifications.~~

~~**992-6.2 Treatment:** Poles shall be treated in accordance with ASTM D1760, Pressure Treatment of Timber Products, with the exceptions and additions as specified herein. Pressure treatment shall be with creosote oil, pentachlorophenol solution, or salt preservative meeting the requirements of 955-4 with the restriction that poles treated with pentachlorophenol solution shall not be used in a salt water nor brackish water environment.~~

~~**992-6.3 Retention of Preservative:**~~

~~**992-6.3.1 Creosote Oil:** Retention shall be at least 9 pounds per cubic foot of wood.~~

~~**992-6.3.2 Pentachlorophenol Solution:** Minimum retention shall be 0.45 pound of dry pentachlorophenol chemicals per cubic foot of wood.~~

~~**992-6.3.3 Salt Preservative (Chromated Copper Arsenate):** Minimum retention shall be 0.60 pounds of CCA oxide per cubic foot of wood.~~

~~**992-6.3.4 Measuring Retention:** With all preservatives, retention shall be by assay of sample from the 0.50 to 2.00 inch zone, performed and certified to by the treating company.~~

~~**992-6.4 Penetration of Preservative:**~~

~~**992-6.4.1 Determination:** Penetration shall be determined as specified in 955-6.4.~~

~~**992-6.4.2 Sapwood Penetration:** Sapwood penetration shall be as specified in 955-6.2.~~

~~**992-6.5 Retreatment:** Retreatment, when necessary, shall be as specified in 955-6.3.~~

~~**992-6.6 Mounting Height:** Mounting height of all equipment and lines shall meet the requirements of the latest edition of the National Safety Code, the local ordinances, and the specifications of the connecting utility.~~

992-~~7~~ *6* Protection of Light Poles.

Each metal pole shall be appropriately and adequately protected by “tire wrapping” with heavy paper, or by some other effective means, so that no chipping, gouging, or other significant surface damage will be incurred during transit or installation. The poles, when installed, shall be clean and uniformly free from dark streaks and discoloration.