Quote

Date: October 05, 2022
To: Wayne Thames, City of Escondido

Project: Francis Ryan Park Fields 6 and 7
Escondido, California
Ref: 167006

1 Government Procurement Alliance (1GPA)
Master Project: 189976 **Contract Number:** 18-23DP-01 Expiration: 09/17/2023
Commodity/Contract Title: Athletic Field/Court and Parking Lot Lighting

All purchase orders should note the following:
1 Government Procurement Alliance (1GPA) purchase – contract number 18-23DP-01

Quotation Price – Materials Only Delivered to Job Site

Fields 6 & 7 LED Lighting – Each Field 330' x 225' ***$256,800.***

Estimated Sales Tax, Based on 7.75%: ***$19,900.***

Project Total: ***$276,700.***

Sales tax is estimated. Bonding, labor/installation, and unloading of the equipment are not included.
Freight and Structural Engineering ARE included.
Pricing furnished is effective for 90 days and is considered confidential.

Light-Structure System™ with Total Light Control – TLC for LED™ Technology (New poles S17-S20)

Guaranteed Lighting Performance

- Guaranteed light levels of 20 footcandles and uniformity of 3.0:1

System Description – Light Structure

- (6) Pre-cast concrete bases with integrated lightning grounding – See Note Below
- (4) 80' Galvanized steel poles
- Factory wired and tested remote electrical component enclosures
- Pole length, factory assembled wire harnesses
- (4) Factory wired poletop luminaire assemblies
- (16) Factory aimed and assembled luminaires – ***Existing HID fixtures will be remounted towards Field 5***
- UL Listed assemblies

Light-Structure System™ retrofit with Total Light Control – TLC for LED™ technology (Existing Poles S15-S16)

System Description – Light Structure Retrofit

- (2) Factory wired poletop luminaire assemblies
- (16) Factory aimed and assembled luminaires
- Factory wired and tested remote electrical component enclosures
- Pole length, factory assembled wire harnesses
- Mounting hardware for poletop luminaire assemblies and electrical components enclosures
- UL Listed assemblies

Note: Due to the new building code and windspeed for the State of California, the existing S15-S16 poles will need to move. We will provide new concrete piers to relocate them to use a common pole between the fields. Larger, structurally adequate poles will be placed near the current locations. New concrete piers will be required.

Environmental Light Control

- Spill light minimized at Property Line to <.2 footcandles maximum horizontal, <.5 footcandles maximum vertical
- Off-site glare light minimized at Property Line to <13,000 maximum candela

Quote

ALSO INCLUDES:

Control Systems and Services

- Control-Link® Control and Monitoring system to provide remote on/off and dimming (high/medium/low) control and performance monitoring with 24/7 customer support

Operation and Warranty Services

- 25 Year Warranty that covers materials and onsite labor, eliminating 100% of your maintenance costs for 25 years
- Support from Musco's Lighting Services Team – over 170 Team members dedicated to operating and maintaining your lighting system – plus a network of 1800+ contractors

Payment Terms

To be coordinated with Musco's Credit Department.

Email a copy of the Purchase Order to Musco Sports Lighting, LLC:

Musco Sports Lighting, LLC
Attn: Karin Anderson
Email: Karin.anderson@musco.com

All purchase orders should note the following:
1 Government Procurement Alliance (1GPA) purchase – Contract Number: 18-23DP-01

Delivery Timing

6 - 8 weeks for delivery of materials to the job site from the time of order, submittal approval, and confirmation of order details including voltage, phase, and pole locations.

Due to the built-in custom light control per luminaire, pole locations need to be confirmed prior to production. Changes to pole locations after the product is sent to production could result in additional charges.

Notes

Quote is based on:

- Shipment of entire project together to one location.
- 480 Volt, 3 Phase electrical system requirement.
- Structural code and wind speed = 2019 IBC, 95 mi/h, Exposure C, Importance Factor 1.0.
- Owner is responsible for getting electrical power to the site, coordination with the utility, and any power company fees.
- Standard soil conditions – rock, bottomless, wet, or unsuitable soil may require additional engineering, special installation methods and additional cost.
- Confirmation of pole locations prior to production.

Thank you for considering Musco for your lighting needs. Please contact me with any questions or if you need additional details.

Karin Anderson
Sales Representative
Musco Sports Lighting, LLC
Phone: 858-232-1620
E-mail: karin.anderson@musco.com

Project Submittal: Bill of Materials

Equipment Description	
32	Light-Structure System™ Total Light Control™ TLC-LED-1200 luminaires
4	80 ft galvanized steel poles
6	Pre-cast concrete foundations (9,500 PSI) with integrated grounding
✓	Factory wired and assembled pole top luminaire assemblies
✓	Factory wired electrical component enclosures
✓	Factory built wire harnesses with plug-in connections
Controls	
1	24” x 72” Control and monitoring cabinet
✓	High/medium/low dimming
8	30-amp contactors
2	On-Off-Auto (OOA) switches
Warranty	
✓	Musco’s Constant 25™ product assurance and warranty program that eliminates 100% maintenance costs for 25 years, including labor, materials, monitoring and guaranteed light levels.

Francis Ryan Park Fields 6 And 7 LED

Escondido,CA

Lighting System

Pole / Fixture Summary

Pole ID	Pole Height	Mtg Height	Fixture Qty	Luminaire Type	Load	Circuit
S15-S16	80'	80'	4	TLC-LED-1200	4.68 kW	F
		80'	4	TLC-LED-1200	4.68 kW	G
S17-S18	80'	80'	6	TLC	9.60 kW	A
		80'	4	TLC-LED-1200	4.68 kW	F
S19-S20	80'	80'	4	FUTURE	4.68 kW	H
		80'	4	TLC-LED-1200	4.68 kW	G
6			***52***		***66.00 kW***	

Circuit Summary

Circuit	Description	Load	Fixture Qty
A	Soccer 1 (Existing)	19.2 kW	12
F	Soccer 6	18.72 kW	16
G	Soccer 7	18.72 kW	16
H	Soccer 8 (Future)	9.36 kW	8

Fixture Type Summary

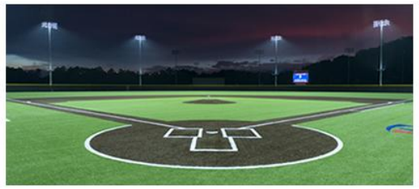
Type	Source	Wattage	Lumens	L90	L80	L70	Quantity
TLC-LED-1200	LED 5700K - 75 CRI	1170W	136,000	>120,000	>120,000	>120,000	32

Light Level Summary

Calculation Grid Summary

Grid Name	Calculation Metric	Illumination					Circuits	Fixture Qty
		Ave	Min	Max	Max/Min	Ave/Min		
Property Line Spill	Horizontal	0.04	0	0.19	0.00		F,G,H	40
Property Line Spill	Max Candela (by Fixture)	2304	0	12532	0.00		F,G,H	40
Property Line Spill	Max Vertical Illuminance Metric	0.09	0	0.44	0.00		F,G,H	40
Soccer 6	Horizontal Illuminance	21.6	17	28	1.69	1.27	F	16
Soccer 7	Horizontal Illuminance	21.4	17	28	1.70	1.26	G	16

From Hometown to Professional



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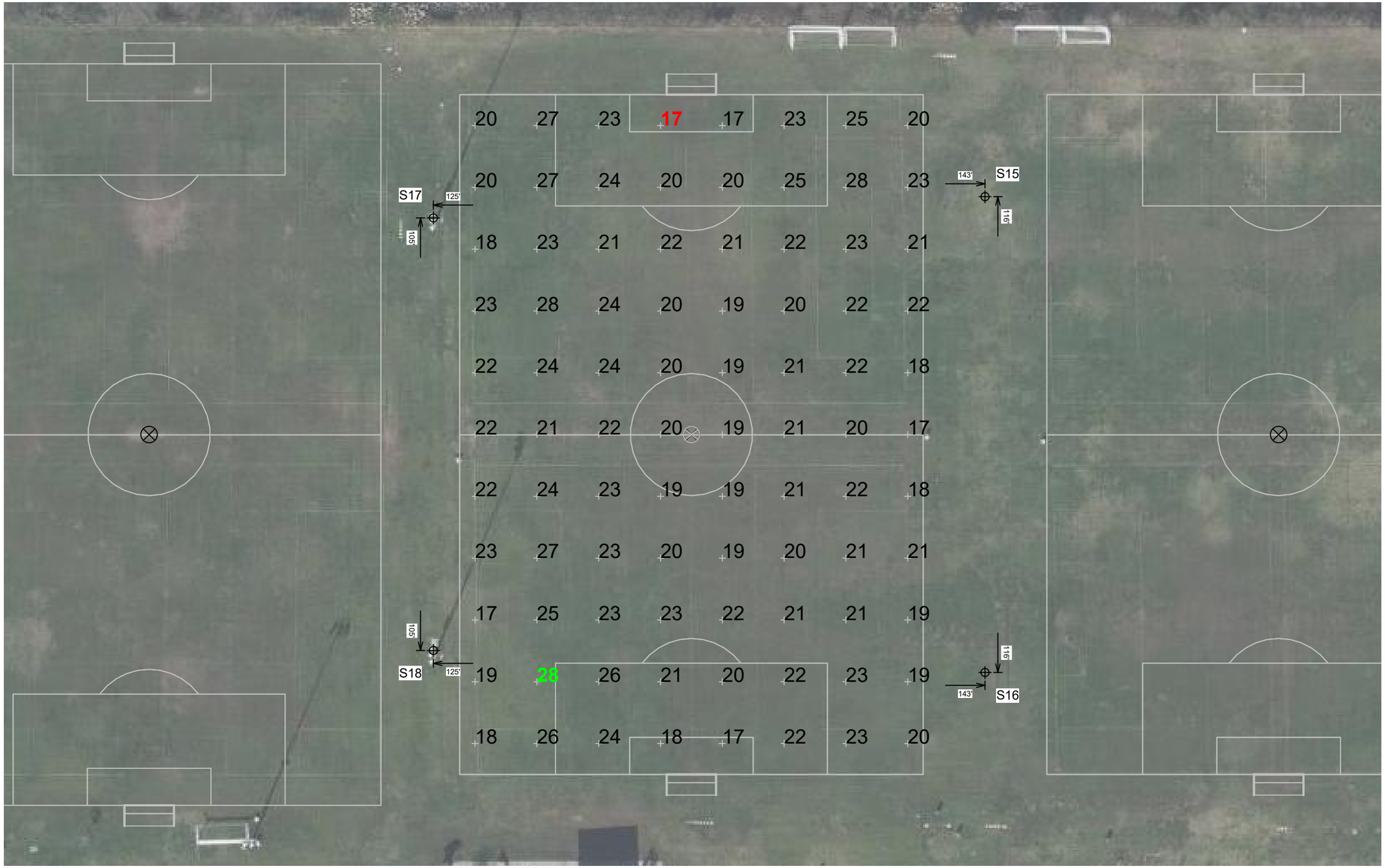
EQUIPMENT LIST FOR AREAS SHOWN

Pole				Luminaires				
QTY	LOCATION	SIZE	GRADE ELEVATION	MOUNTING HEIGHT	LUMINAIRE TYPE	QTY / POLE	THIS GRID	OTHER GRIDS
2	S15-S16	80'	-	80'	TLC-LED-1200	4/4*	4	4
2	S17-S18	80'	-	80'	TLC 1500W MZ 5	1*	0	1
				80'	TLC 1500W MZ 4	5*	0	5
				80'	TLC-LED-1200	4	4	0
4	TOTALS					36	16	20

* This structure utilizes a back-to-back mounting configuration



SCALE IN FEET 1 : 50
0' 50' 100'

Pole location(s) ⊕ dimensions are relative to 0,0 reference point(s) ⊗

ENGINEERED DESIGN By: H.Sabers · File #167006B · 22-Mar-22

GRID SUMMARY

Name:	**Soccer 6**
Size:	330' x 225'
Spacing:	30.0' x 30.0'
Height:	3.0' above grade

ILLUMINATION SUMMARY

MAINTAINED HORIZONTAL FOOTCANDLES

	Entire Grid
Guaranteed Average:	**20**
Scan Average:	21.57
Maximum:	28
Minimum:	17
Avg / Min:	1.29
Guaranteed Max / Min:	**3**
Max / Min:	1.69
UG (adjacent pts):	1.51
CU:	0.79
No. of Points:	88

LUMINAIRE INFORMATION

Applied Circuits:	F
No. of Luminaires:	**16**
Total Load:	18.72 kW

Guaranteed Performance: The ILLUMINATION described above is guaranteed per your Musco Warranty document and includes a 0.95 dirt depreciation factor.

Field Measurements: Individual field measurements may vary from computer-calculated predictions and should be taken in accordance with IESNA RP-6-15.

Electrical System Requirements: Refer to Amperage Draw Chart and/or the **"Musco Control System Summary"** for electrical sizing.

Installation Requirements: Results assume ± 3% nominal voltage at line side of the driver and structures located within 3 feet (1m) of design locations.

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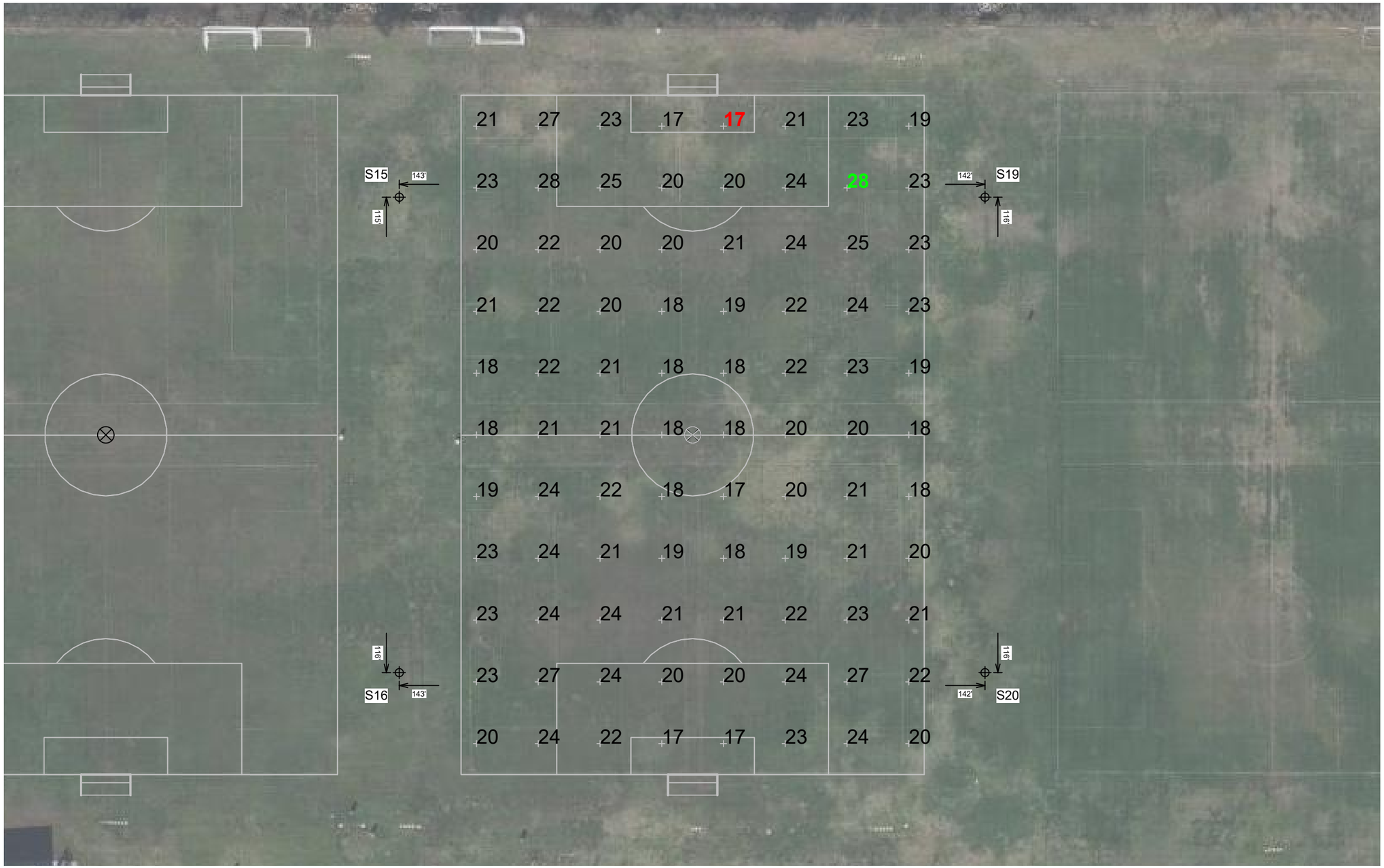
Francis Ryan Park Fields 6 And 7 LED
Escondido,CA

EQUIPMENT LIST FOR AREAS SHOWN

Pole				Luminaires				
QTY	LOCATION	SIZE	GRADE ELEVATION	MOUNTING HEIGHT	LUMINAIRE TYPE	QTY / POLE	THIS GRID	OTHER GRIDS
2	S15-S16	80'	-	80'	TLC-LED-1200	4/4*	4	4
2	S19-S20	80'	-	80'	TLC-LED-1200	4/4*	4	4
4	TOTALS					32	16	16

* This structure utilizes a back-to-back mounting configuration



SCALE IN FEET 1 : 50
0' 50' 100'

Pole location(s) ⊕ dimensions are relative to 0,0 reference point(s) ⊗

GRID SUMMARY

Name:	**Soccer 7**
Size:	330' x 225'
Spacing:	30.0' x 30.0'
Height:	3.0' above grade

ILLUMINATION SUMMARY

MAINTAINED HORIZONTAL FOOTCANDLES

	Entire Grid
Guaranteed Average:	**20**
Scan Average:	21.35
Maximum:	28
Minimum:	17
Avg / Min:	1.28
Guaranteed Max / Min:	**3**
Max / Min:	1.70
UG (adjacent pts):	1.39
CU:	0.79
No. of Points:	88

LUMINAIRE INFORMATION

Applied Circuits:	G
No. of Luminaires:	**16**
Total Load:	18.72 kW

Guaranteed Performance: The ILLUMINATION described above is guaranteed per your Musco Warranty document and includes a 0.95 dirt depreciation factor.

Field Measurements: Individual field measurements may vary from computer-calculated predictions and should be taken in accordance with IESNA RP-6-15.

Electrical System Requirements: Refer to Amperage Draw Chart and/or the **"Musco Control System Summary"** for electrical sizing.

Installation Requirements: Results assume ± 3% nominal voltage at line side of the driver and structures located within 3 feet (1m) of design locations.

ENGINEERED DESIGN By: H.Sabers · File #167006B · 22-Mar-22

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Escondido,CA

EQUIPMENT LIST FOR AREAS SHOWN

Pole				Luminaires				
QTY	LOCATION	SIZE	GRADE ELEVATION	MOUNTING HEIGHT	LUMINAIRE TYPE	QTY / POLE	THIS GRID	OTHER GRIDS
2	S15-S16	80'	-	80'	TLC-LED-1200	4/4*	8	0
2	S17-S18	80'	-	80'	TLC 1500W MZ 5	1*	0	1
				80'	TLC 1500W MZ 4	5*	0	5
				80'	TLC-LED-1200	4	4	0
2	S19-S20	80'	-	80'	TLC-LED-1200	4/4*	4	4
6	TOTALS					52	32	20

* This structure utilizes a back-to-back mounting configuration

SCALE IN FEET 1 : 150
0' 150' 300'

Pole location(s) ⊕ dimensions are relative to 0,0 reference point(s) ⊗

GRID SUMMARY

Name:	**Property Line Spill**
Spacing:	30.0'
Height:	3.0' above grade

ILLUMINATION SUMMARY

HORIZONTAL FOOTCANDLES

	Entire Grid
Scan Average:	0.0411
Maximum:	0.19
Minimum:	0.00
No. of Points:	61

LUMINAIRE INFORMATION

Applied Circuits:	F, G, H
No. of Luminaires:	**32**
Total Load:	37.44 kW

Guaranteed Performance: The ILLUMINATION described above is guaranteed per your Musco Warranty document.

Field Measurements: Individual field measurements may vary from computer-calculated predictions and should be taken in accordance with IESNA RP-6-15.

Electrical System Requirements: Refer to Amperage Draw Chart and/or the **"Musco Control System Summary"** for electrical sizing.

Installation Requirements: Results assume ± 3% nominal voltage at line side of the driver and structures located within 3 feet (1m) of design locations.

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Francis Ryan Park Fields 6 And 7 LED
Escondido,CA

EQUIPMENT LIST FOR AREAS SHOWN

Pole				Luminaires				
QTY	LOCATION	SIZE	GRADE ELEVATION	MOUNTING HEIGHT	LUMINAIRE TYPE	QTY / POLE	THIS GRID	OTHER GRIDS
2	S15-S16	80'	-	80'	TLC-LED-1200	4/4*	8	0
2	S17-S18	80'	-	80'	TLC 1500W MZ 5	1*	0	1
				80'	TLC 1500W MZ 4	5*	0	5
				80'	TLC-LED-1200	4	4	0
2	S19-S20	80'	-	80'	TLC-LED-1200	4/4*	4	4
6	TOTALS					52	32	20

* This structure utilizes a back-to-back mounting configuration

SCALE IN FEET 1 : 150

0' 150' 300'

Pole location(s) ⌖ dimensions are relative to 0,0 reference point(s) ⊗

GRID SUMMARY

Name:	**Property Line Spill**
Spacing:	30.0'
Height:	3.0' above grade

ILLUMINATION SUMMARY

MAX VERTICAL FOOTCANDLES	
	Entire Grid
Scan Average:	0.0949
Maximum:	0.44
Minimum:	0.00
No. of Points:	61
LUMINAIRE INFORMATION	
Applied Circuits:	F, G, H
No. of Luminaires:	**32**
Total Load:	37.44 kW

Guaranteed Performance: The ILLUMINATION described above is guaranteed per your Musco Warranty document.

Field Measurements: Individual field measurements may vary from computer-calculated predictions and should be taken in accordance with IESNA RP-6-15.

Electrical System Requirements: Refer to Amperage Draw Chart and/or the **"Musco Control System Summary"** for electrical sizing.

Installation Requirements: Results assume ± 3% nominal voltage at line side of the driver and structures located within 3 feet (1m) of design locations.

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Francis Ryan Park Fields 6 And 7 LED
Escondido,CA

EQUIPMENT LIST FOR AREAS SHOWN

Pole				Luminaires				
QTY	LOCATION	SIZE	GRADE ELEVATION	MOUNTING HEIGHT	LUMINAIRE TYPE	QTY / POLE	THIS GRID	OTHER GRIDS
2	S15-S16	80'	-	80'	TLC-LED-1200	4/4*	8	0
2	S17-S18	80'	-	80'	TLC 1500W MZ 5	1*	0	1
				80'	TLC 1500W MZ 4	5*	0	5
				80'	TLC-LED-1200	4	4	0
2	S19-S20	80'	-	80'	TLC-LED-1200	4/4*	4	4
6	TOTALS					52	32	20

* This structure utilizes a back-to-back mounting configuration

SCALE IN FEET 1 : 150
0' 150' 300'

Pole location(s) ⊕ dimensions are relative to 0,0 reference point(s) ⊗

GRID SUMMARY

Name:	**Property Line Spill**
Spacing:	30.0'
Height:	3.0' above grade

ILLUMINATION SUMMARY

CANDELA (PER FIXTURE)

	Entire Grid
Scan Average:	2304.4170
Maximum:	12532.42
Minimum:	0.00
No. of Points:	61

LUMINAIRE INFORMATION

Applied Circuits:	F, G, H
No. of Luminaires:	**32**
Total Load:	37.44 kW

Guaranteed Performance: The ILLUMINATION described above is guaranteed per your Musco Warranty document.

Field Measurements: Individual field measurements may vary from computer-calculated predictions and should be taken in accordance with IESNA RP-6-15.

Electrical System Requirements: Refer to Amperage Draw Chart and/or the **"Musco Control System Summary"** for electrical sizing.

Installation Requirements: Results assume ± 3% nominal voltage at line side of the driver and structures located within 3 feet (1m) of design locations.

ENGINEERED DESIGN By: H.Sabers · File #167006B · 22-Mar-22

Francis Ryan Park Fields 6 And 7 LED
Escondido,CA

EQUIPMENT LAYOUT

INCLUDES:
· Soccer 1
· Soccer 6
· Soccer 7

Electrical System Requirements: Refer to Amperage Draw Chart and/or the **"Musco Control System Summary"** for electrical sizing.

Installation Requirements: Results assume ± 3% nominal voltage at line side of the driver and structures located within 3 feet (1m) of design locations.

EQUIPMENT LIST FOR AREAS SHOWN

	Pole			Luminaires		
QTY	LOCATION	SIZE	GRADE ELEVATION	MOUNTING HEIGHT	LUMINAIRE TYPE	QTY / POLE
4	S15-S16 S19-S20	80'	-	80'	TLC-LED-1200	4/4*
2	S17-S18	80'	-	80' 80' 80'	TLC 1500W MZ 5 TLC 1500W MZ 4 TLC-LED-1200	1* 5* 4
6	TOTALS					52

* This structure utilizes a back-to-back mounting configuration

SINGLE LUMINAIRE AMPERAGE DRAW CHART

Ballast Specifications (.90 min power factor)	Line Amperage Per Luminaire (max draw)						
Single Phase Voltage	208 (60)	220 (60)	240 (60)	277 (60)	347 (60)	380 (60)	480 (60)
TLC-LED-1200	7.0	6.6	6.1	5.2	4.2	4.0	3.0
1500 watt MZ	8.1	7.7	7.1	6.1	4.8	4.4	3.5

SCALE IN FEET 1 : 150
0' 150' 300'

Pole location(s) ⊕ dimensions are relative to 0,0 reference point(s) ⊗

ENGINEERED DESIGN By: H.Sabers · File #167006B · 22-Mar-22

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Control System Summary

Project Specific Notes:

Project Information

Project #:	167006
Project Name:	Francis Ryan Park Fields 6 And 7 LED
Date:	03/22/22
Project Engineer:	Hunter Sabers
Sales Representative:	Karin Anderson
Control System Type:	Control-Link™ Control and Monitoring System
Communication Type:	PowerLine-ST
Scan:	167006B
Document ID:	167006P1V2-0322161437
Distribution Panel Location or ID:	Service #1
Total # of Distribution Panel Locations for Project:	1
Design Voltage/Hertz/Phase:	480/60/3
Control Voltage:	120

Equipment Listing

DESCRIPTION	APPROXIMATE SIZE
1.Control and Monitoring Cabinet	24 X 72

	QTY	SIZE (AMPS)
Total Contactors	8	30 AMP
Total Off/On/Auto Switches:	2	

Materials Checklist

Contractor/Customer Supplied:

- ❑ A dedicated control circuit must be supplied per distribution panel location
  - — If the control voltage is NOT available, a control transformer is required
- ❑ Electrical distribution panel to provide overcurrent protection for circuits
  - — HID rated or D-curve circuit breaker sized per full load amps on Circuit Summary by Zone Chart
- ❑ Wiring
  - — See chart on page 2 for wiring requirements
  - — Equipment grounding conductor and splices must be insulated (per circuit)
  - — Lightning ground protection (per pole), if not Musco supplied
- ❑ Electrical conduit wireway system
  - — Entrance hubs rated NEMA 4, must be die-cast zinc, PVC, or copper-free die-cast aluminum
- ❑ Mounting hardware for cabinets
- ❑ Breaker lock-on device to prevent unauthorized power interruption to control power and powerline connection (if present)
- ❑ Anti-corrosion compound to apply to ends of wire, if necessary

Call Control-Link Central™ operations center at 877/347-3319 to schedule activation of the control system upon completion of the installation.

Note: Activation may take up to 1 1/2 hours.

IMPORTANT NOTES

1. Please confirm that the design voltage listed above is accurate for this facility. Design voltage/phase is defined as the voltage/phase being connected and utilized at each lighting pole's electrical components enclosure disconnect. Inaccurate design voltage/phase can result in additional costs and delays. Contact your Musco sales representative to confirm this item.
2. In a 3 phase design, all 3 phases are to be run to each pole. When a 3 phase design is used Musco's single phase luminaires come pre-wired to utilize all 3 phases across the entire facility.
3. One contactor is required for each pole. When a pole has multiple circuits, one contactor is required for each circuit. All contactors are 100% rated for the published continuous load. All contactors are 3 pole.
4. If the lighting system will be fed from more than one distribution location, additional equipment may be required. Contact your Musco sales representative.
5. A single control circuit must be supplied per control system.
6. Size overcurrent devices using the full load amps column of the Circuit Summary By Zone chart- Minimum power factor is 0.9.

NOTE: Refer to Installation Instructions for more details on equipment information and the installation requirements.

Control System Summary

Francis Ryan Park Fields 6 And 7 LED / 167006 - 167006B
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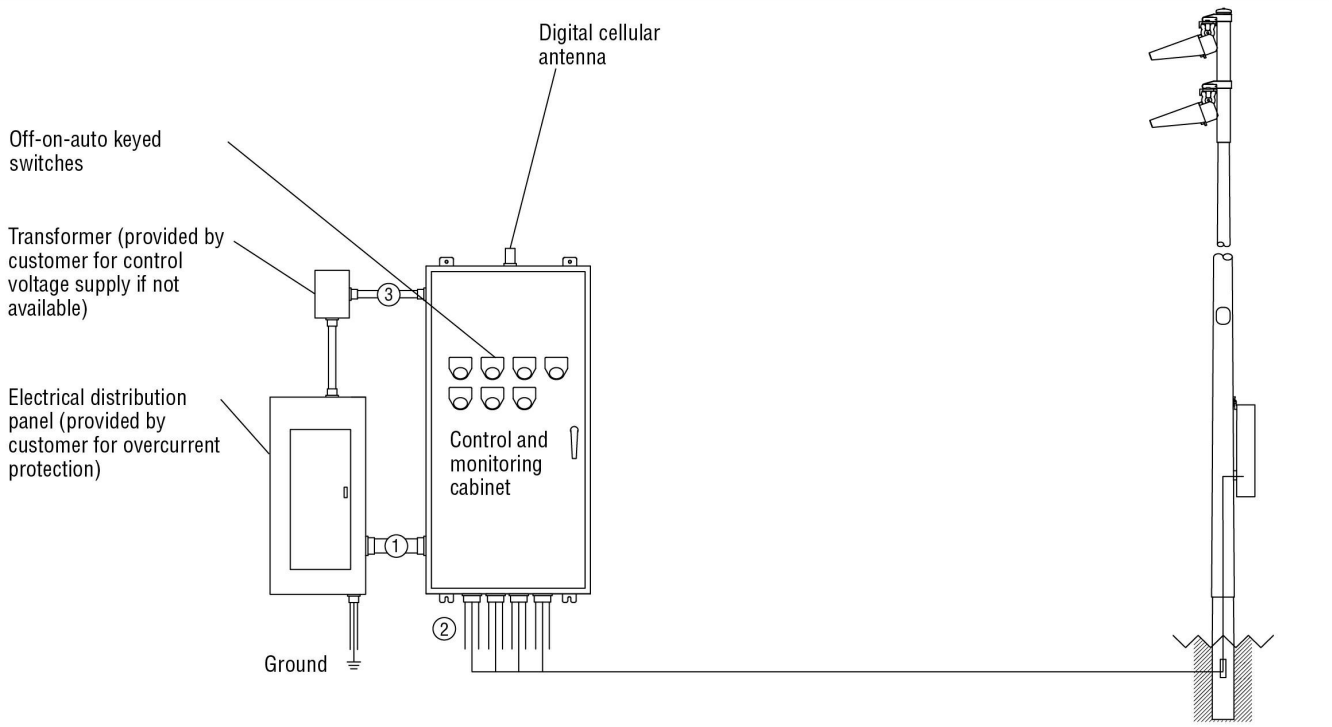
Control•Link® Control and Monitoring System



Conduit ID	Description	# of Wires	Wire (AWG)	Conduit (in)	Max. Wire Length (ft)	MUSCO Supplied	Notes
1	Line power to contactors, and equipment grounding conductor	*A	*B	*C	N/A	No	A-E
2	Load power to lighting circuits, and equipment grounding conductor	*A	*B	*C	N/A	No	A-E
3	Control power (dedicated, 20A)	3	12	*C	N/A	No	C,E

R60-100-00_B

* Notes:
A. See voltage and phasing per the notes on cover page.
B. Calculate per load and voltage drop.
C. All conduit diameters should be per code unless otherwise specified to allow for connector size.
D. Equipment grounding conductor and any splices must be insulated.
E. Refer to control and monitoring system installation instructions for more details on equipment information and the installation requirements.

IMPORTANT: Control wires (3) must be in separate conduit from line and load power wires (1, 2).

Control System Summary

Francis Ryan Park Fields 6 And 7 LED / 167006 - 167006B
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SWITCHING SCHEDULE

Field/Zone Description	Zones
Soccer 6	2
Soccer 7	3

CONTROL POWER CONSUMPTION	
120V Single Phase	
VA loading of Musco Supplied Equipment	INRUSH: 2533.0
	SEALED: 283.8

CIRCUIT SUMMARY BY ZONE

POLE	CIRCUIT DESCRIPTION	# OF FIXTURES	# OF DRIVERS	*FULL LOAD AMPS	CONTACTOR SIZE (AMPS)	CONTACTOR ID	ZONE
S15	Soccer 6	4	4	**7.9**	30	C1	2
S16	Soccer 6	4	4	**7.9**	30	C2	2
S17	Soccer 6	4	4	**7.9**	30	C3	2
S18	Soccer 6	4	4	**7.9**	30	C4	2
S15	Soccer 7	4	4	**7.9**	30	C5	3
S16	Soccer 7	4	4	**7.9**	30	C6	3
S19	Soccer 7	4	4	**7.9**	30	C7	3
S20	Soccer 7	4	4	**7.9**	30	C8	3

*Full Load Amps based on amps per driver.

Control System Summary

Francis Ryan Park Fields 6 And 7 LED / 167006 - 167006B
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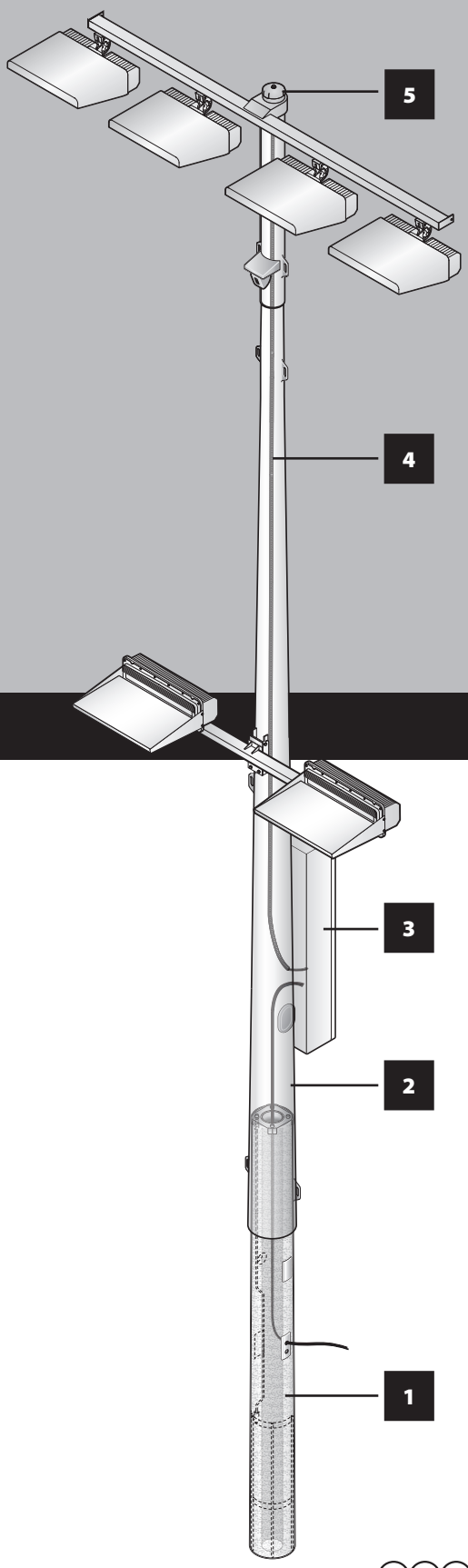
PANEL SUMMARY

CABINET #	CONTROL MODULE LOCATION	CONTACTOR ID	CIRCUIT DESCRIPTION	FULL LOAD AMPS	DISTRIBUTION PANEL ID (BY OTHERS)	CIRCUIT BREAKER POSITION (BY OTHERS)
1	1	C1	Pole S15	7.87		
1	1	C2	Pole S16	7.87		
1	1	C3	Pole S17	7.87		
1	1	C4	Pole S18	7.87		
1	1	C5	Pole S15	7.87		
1	1	C6	Pole S16	7.87		
1	1	C7	Pole S19	7.87		
1	1	C8	Pole S20	7.87		

ZONE SCHEDULE

			CIRCUIT DESCRIPTION	
ZONE	SELECTOR SWITCH	ZONE DESCRIPTION	POLE ID	CONTACTOR ID
Zone 2	1	Soccer 6	S15 S16 S17 S18	C1 C2 C3 C4
Zone 3	2	Soccer 7	S15 S16 S19 S20	C5 C6 C7 C8

Diode Light Source—LED



Installation Instructions: **Light-Structure System™**

Fast, trouble-free installation with 5 Easy Pieces™ approach to system design

5 **Poletop Luminaire Assembly**

4 **Wire Harness**

3 **Electrical Components Enclosure**

2 **Galvanized Steel Pole**

1 **Precast Concrete Base**

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Table of Contents

Before You Begin

Safety Information

Electrical Safety Guidelines

Use extreme caution near overhead power lines or underground utilities. Observe all safety precautions for high-voltage equipment. Only qualified personnel may perform wiring. Follow all applicable building and electrical codes.

General Safety Guidelines

Follow proper safety procedures during installation. Installers must wear the appropriate personal protective equipment including:

- Hard hat
- Steel-toed shoes
- Leather work gloves
- Eye protection

Locate all underground utilities prior to digging.

All tools and equipment supplied by Musco are designed for specific use as described in these instructions. Do not use them in any other manner. Do not alter structural members in any way, such as bend, weld, or drill, without prior authorization from Musco.

The luminaires should be positioned so that prolonged staring into the luminaire at a distance closer than 12–37 m (40–121 ft) is not expected, per IEC/TR 62778. See table.

Luminaire	Minimum Distance
TLC-LED-350	29 m (95 ft)
TLC-LED-400	24 m (79 ft)
TLC-LED-550	29 m (95 ft)
TLC-LED-550NR	29 m (95 ft)
TLC-BT-575	12 m (38 ft)
TLC-LED-600	24 m (79 ft)
TLC-LED-900	24 m (79 ft)
TLC-LED-900NB	no minimum
TLC-LED-1150	12 m (40 ft)
TLC-LED-1200	37 m (121 ft)
TLC-LED-1400NB	38 m (124 ft)
TLC-LED-1500	37 m (121 ft)
TLC-RGBW	15 m (49 ft)
TLC-RGB-U	12 m (38 ft)
TLC-BT-1500	37 m (121 ft)

Install luminaires outside arm's reach of unauthorized personnel.

About These Instructions

These instructions give basic assembly procedures for the Light-Structure System. They are not a comprehensive guide to all possible situations. Direct any questions to your local Musco representative.

Before You Begin

Throughout this manual note these important symbols:

The safety alert symbol alerts you of situations that require care and caution to avoid serious personal injury.

The stop and check symbol signals you to stop and verify conditions before proceeding.

The contact Musco symbol appears in special situations where you may need to contact Musco for further information.

The go-to arrow indicates a branch in a procedure for special situations. In the case of optional equipment, the instructions may be in another document.

The tip symbol points out advice that makes installation easier.

The recycle symbol identifies recyclable materials.

Before You Begin

Standard Tools/Supplies Checklist

Refer to supplemental instructions provided for additional tools required.

Contractor/installer supplied tools	Function	Page
Hammer, pry-bar, banding cutters	Unloading equipment	7
Water pump	Removing water from base holes (as needed)	9
Two 1½ ton chain-type come-alongs	Jacking pole sections together	11, 29
Large Phillips-head screwdriver	Tightening captive screws to seal enclosure to pole hub	17
Standard screwdriver	Tightening distribution lugs, 45 A disconnect switch	30, 31
Torque wrench with ⅜, 7⁄16 and 9⁄16 in sockets	Tightening luminaire retaining cable and spreader bar hardware	15, 24
Electrical fish tape, electrician's tape	Feeding wire harness through pole	21
Spray paint, chalk, or flags	Marking points to sight in aiming	25
Chalk or pencil	Making alignment marks	29
10 ft (3 m) stepladder or small line truck	Connecting supply wires to electrical enclosure	30, 31
Musco supplied tools	**Function**	**Page**
Wooden base wedges	Setting base	9
Level with shim for base taper	Plumbing base	9
Steel bar	Setting base, seating pole on base	9, 29
1 1⁄16 in socket, extension, breaker bar, and 1 1⁄16 in wrench	Tightening structural fasteners	14
5⁄32 in hex key	Attaching handhole covers on base and steel pole	8, 21, 30
9⁄16 in wrench	Tightening poletop set screw, pole cap fastener, enclosure hanger bolt, and spreader bar hardware	12, 15, 17
Dishwashing liquid (original Dawn®, ECOS® Pro, or DIAO™ brand)	Lubricating pole slip-fit connections	11, 25
Wooden shipping blocks	Elevating pole sections off ground during assembly	11
7⁄16 in ratcheting combination wrench	Tightening captive bolts to secure luminaire assembly	24
Pole rotator kit	Guiding pole onto base, pole alignment	25, 27, 28
Steel chain	Setting pole on base	29
5 mm hex key	Landing primary feed wires on 125 A disconnect switch	31
3⁄16 in hex key	Attaching grounding conductors inside electrical enclosure	30, 31
5⁄16 in hex key	Attaching grounding conductors inside pole at handhole	31
Machinery needed	**Function**	**Page**
Crane or forklift with nylon strapping and 8 ft (2.5 m) sling (sized to weight of base)	Unloading materials, setting bases	7, 9
Auger	Boring holes for bases	8
Load-rated crane, nylon slings, and shackles	Setting poles	26

Documents You Need

- ❑ Musco *Foundation And Pole Assembly Drawing*
- ❑ *Field Aiming Diagram*
- ❑ Alternate foundation design (when present)
- ❑ *Control System Summary*

If you do not have all of these documents, contact your local Musco representative.

Before You Begin

Electrical System Requirements

While the majority of the Light-Structure System™ can be assembled by non-professionals, a qualified electrician must handle the electrical supply installation and hook-up in accordance with national, state, and local codes. Your electrician should review this information before installation begins.

The electrician is generally required to provide these items:

- Service entrance
- Main power disconnect and distribution panel(s)
- Supply wiring and insulated equipment grounding conductors

Ensure supply wiring is rated for 90°C. Review the label inside the electrical components enclosure door and *Control System Summary* for voltage and phase requirements.

Luminaires generate up to 2.6 mA per driver on the equipment grounding conductor and are designed to meet leakage current requirements per IEC 61347-1.

Basic insulation provided between RS-485 control input and main power supply.

Inspect all wiring for damage prior to installation.

Always dispose of electronic waste in accordance with all applicable laws and regulations.

Other features that may affect the wiring supply requirements for this project include:

- Lighting contactor cabinets — refer to installation instructions provided with control equipment and the Musco *Control System Summary.*
- Control-Link® system — refer to installation instructions provided with control equipment and the Musco *Control System Summary*.
- Auxiliary bracket option — customer supplies all wiring for auxiliary components. Refer to *Installation Instructions: Auxiliary Bracket*.

Volunteer Installation

Have a qualified electrician review and complete the following:

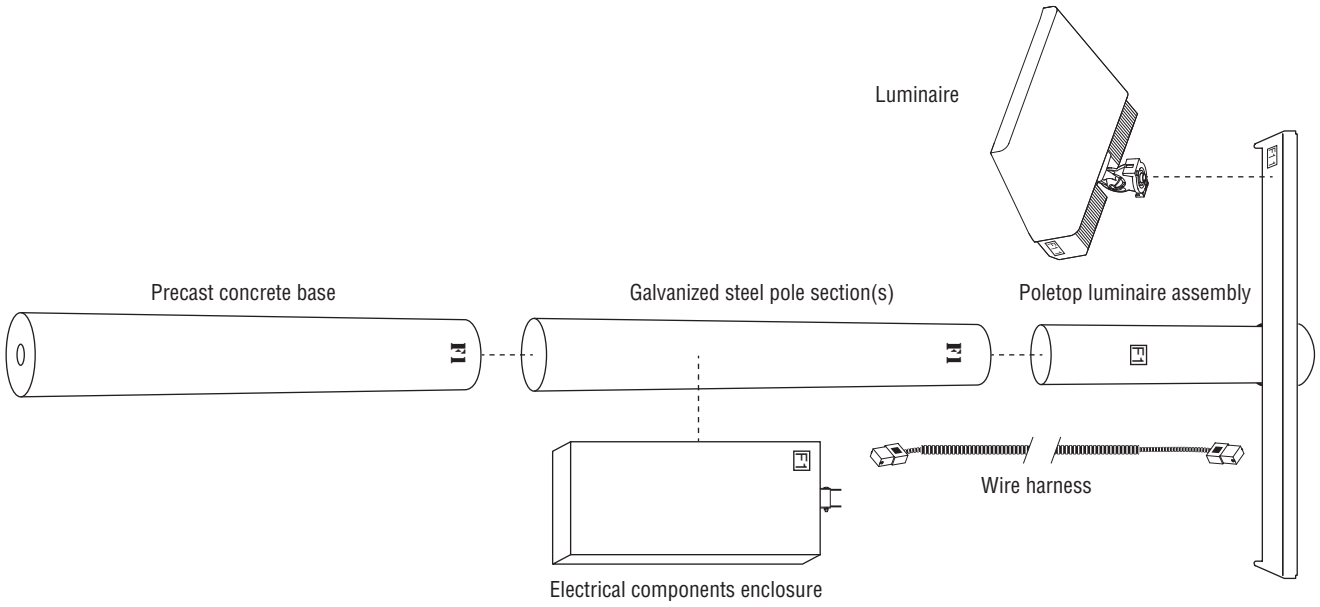
- Create electrical system design — prior to installation.
- Provide and install trenching, supply wiring, and conduit.
- Complete all steps from *Connecting to Supply Wiring* section.
- Test complete lighting system.

Before You Begin

Components Matching and Labeling

Pole locations are identified by a pole ID (A1, A2, B1, B2, etc.) on the *Field Aiming Diagram*. These IDs are also marked on the individual components:

- Poletop luminaire assemblies, bolt-on crossarms, and luminaire shipping cartons
- Wire harnesses
- Electrical components enclosures
- Galvanized steel pole sections
- Precast concrete bases



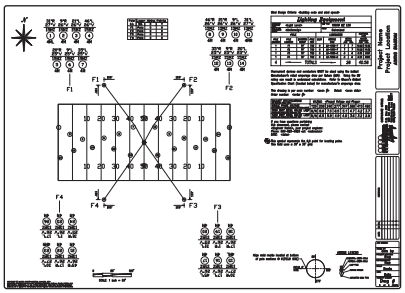
Before You Begin

Documents We Provide

Field Aiming Diagram

The *Field Aiming Diagram* is your map for locating all poles on your project. It gives this information:

- Pole IDs, locations, and heights
- Luminaire IDs
- Field origin for coordinate measuring
- Common aiming point for all poles, or individual aiming points for each pole
- Factory-set aiming information for each luminaire
- Full load current for each luminaire



Control System Summary

Projects with a control system include a *Control System Summary*. It gives this information:

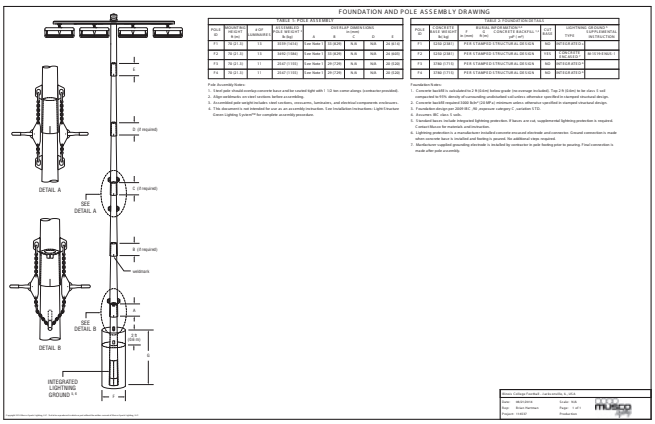
- Control system diagram and details
- Contactors and cabinets
- Lighting circuits
- Voltage, phase, and frequency information
- Full load current for each circuit

Musco Foundation and Pole Assembly Drawing

This drawing provides information related to the installation of the foundation and the galvanized steel pole.

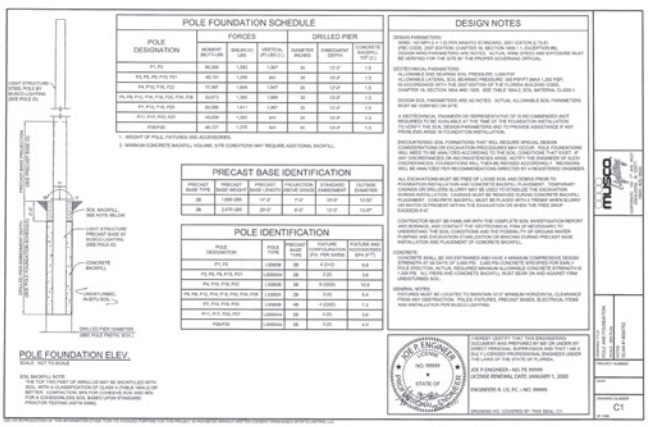
- Pole weight
- Precast concrete base weight
- Hole depth and diameter
- Concrete backfill quantities
- Pole section minimum overlaps

Note: Foundation details are omitted on projects with alternate foundation design.



Alternate Foundation Design

Some poles on a project may require an alternate foundation design. This stamped drawing provides construction details of the alternative design. This document supersedes all other foundation information.



Before You Begin

Unloading Instructions

A typical shipment includes precast concrete bases, galvanized steel poles, electrical components enclosures, wire harnesses, and poletop luminaire assemblies with luminaires.

For ease of installation, set all matched components by the proper pole location as noted on the *Field Aiming Diagram*.

Tools/Materials Needed

- ❑ Crane with nylon web sling or forklift (load rated)
- ❑ Hammer
- ❑ Pry bar
- ❑ Banding cutters

Warning
Crushing hazard. Product is heavy and may roll.

Do not cut shipping bands or remove blocking from concrete bases or poles until they are supported by unloading equipment.

Use proper pick-up procedures conforming with local regulations when lifting concrete bases and poles. Balance point may not be at midpoint of base or pole.

- Check bill of lading to verify you have all materials.
- Inspect all materials for shipping damage.
- Store electrical components enclosures and luminaires in a dry location or cover with tarp until ready to install.

Painted poles require special handling, see *Instructions: Painted Pole Special Requirements.*

If additional information is needed, contact your local Musco representative.

Save wooden shipping blocks to use during pole assembly.

Please recycle.
Luminaires, wire harnesses, and other components are shipped in recyclable cardboard packaging.

Precast Concrete Base

Overview

The precast concrete base is set directly into the ground, backfilled with concrete, and allowed to cure for 12 to 24 hours. The base is designed for easy slip-fit connection to the galvanized steel pole. The remaining components — steel pole, poletop luminaire assembly, electrical components enclosure, and wire harness — are assembled as a unit and set onto the base. The base includes an integrated lightning ground system.

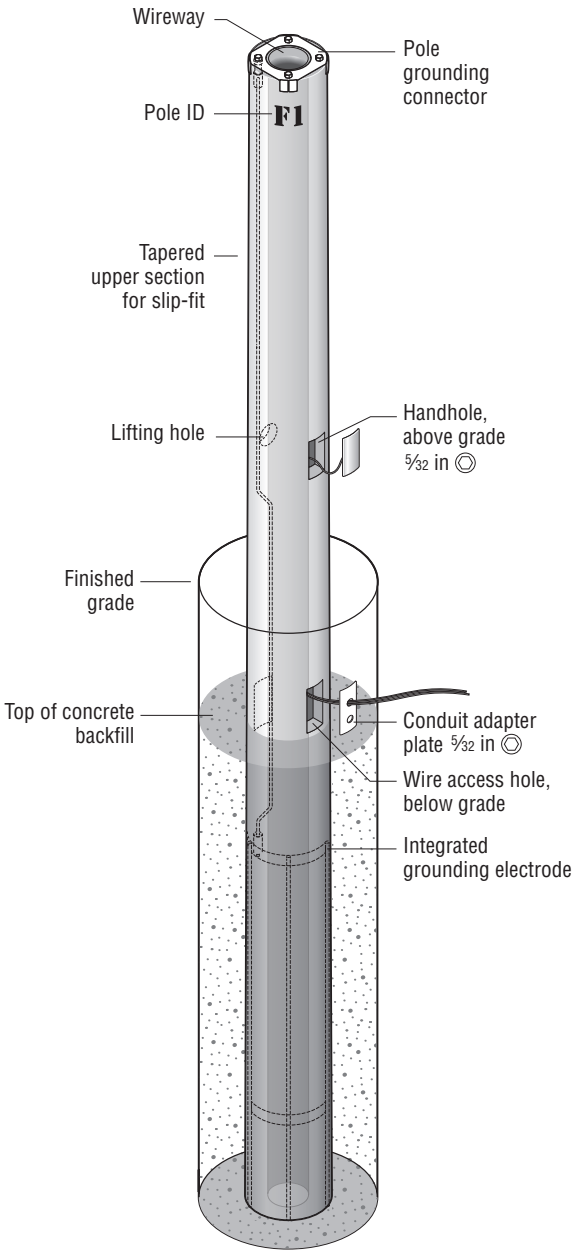
Tools/Materials Needed

Musco Supplied

- ❑ Field Aiming Diagram
- ❑ Musco Foundation and Pole Assembly Drawing or alternate foundation design
- ❑ Steel bar
- ❑ Wooden base wedges
- ❑ Level with shim for tapered base
- ❑ 5⁄32 in hex key

Contractor Supplied

- ❑ Crane or forklift with nylon strapping and 8 ft (2.5 m) sling sized to weight of base
- ❑ Conduit for underground wiring
- ❑ Concrete backfill
- ❑ Water pump (as needed)



Installation Procedure

Verify pole ID on concrete base matches pole location on *Field Aiming Diagram*.

For options on poor soil conditions, alternative installation methods, or if there are any issues with pole locations given, contact your local Musco representative. Your project engineer's name appears on *Field Aiming Diagram*.

Note: Use only project-specific foundation designs as detailed on Musco Foundation and Pole Assembly Drawing or alternate foundation design plan.

1 Mark pole locations per *Field Aiming Diagram*.

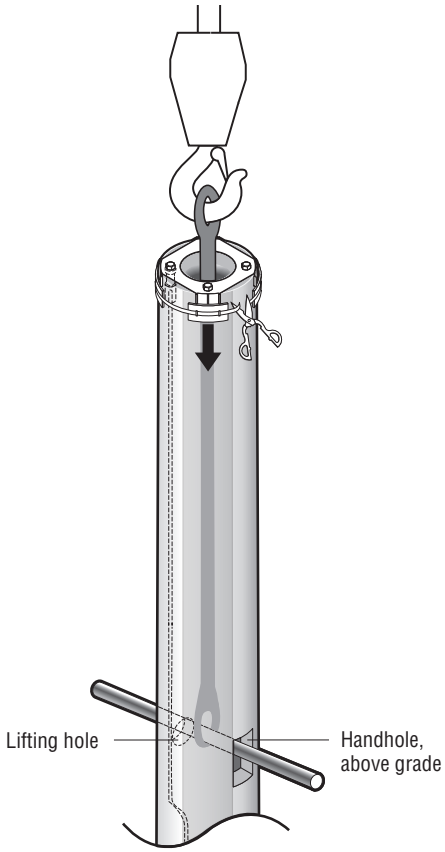
2 Excavate holes to size and depth given on Musco *Foundation and Pole Assembly Drawing* or alternate foundation design.

Warning
Fall hazard

Cover holes or install fencing for fall safety.

Precast Concrete Base

3 Sling and lower base into hole. Orient wire access hole to accommodate incoming supply wiring. Snip banding and remove tab protectors.

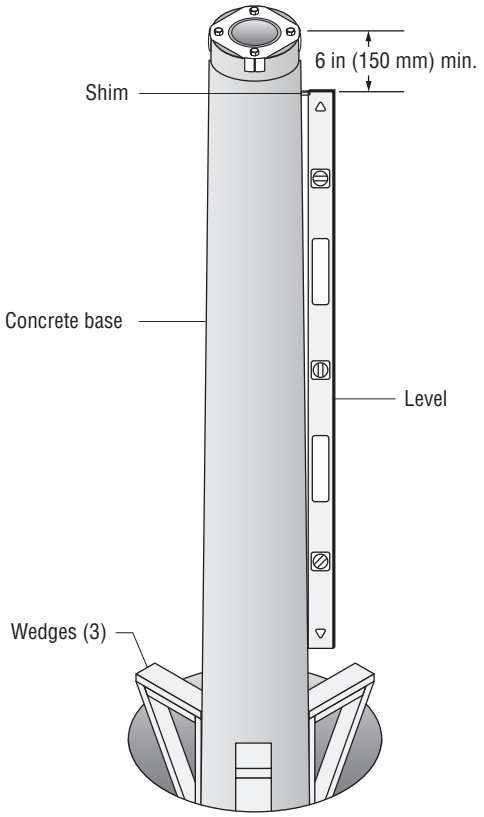


4 Plumb base and wedge into position. Use supplied level with shim on upper end against base. Shim accommodates taper of base. Top of base is beveled. Keep level at least 6 in (150 mm) from top when plumbing.

5 Remove any water from hole to avoid weakening foundation. Water in hole during concrete pour can also cause hollow center of base to fill with concrete.

If backfilling to finished grade with concrete instead of compacted fill, be sure to maintain wire access.

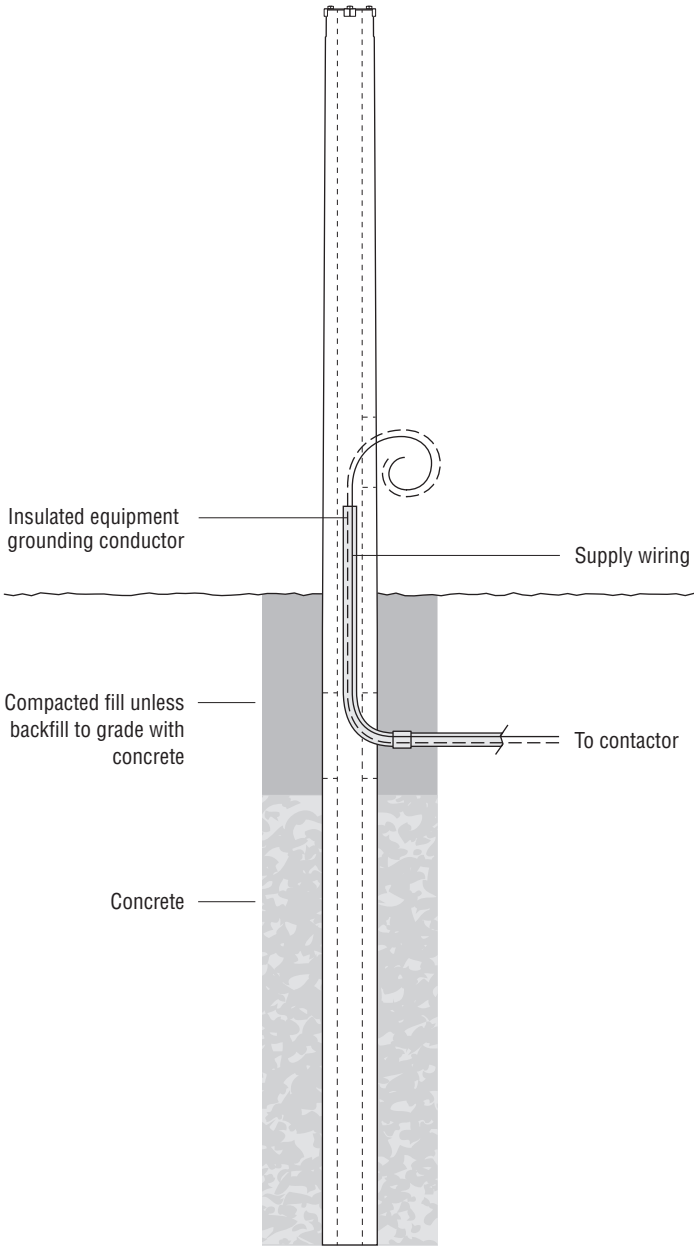
6 Backfill with concrete per Musco *Foundation and Pole Assembly Drawing* or alternate foundation design.



Precast Concrete Base

7 Have your electrician install all underground conduit and wiring, including insulated equipment grounding conductor. Route wires up through base to handhole. Conduit adapter plates with knockouts are provided. You may also install wiring after standing pole.

8 Backfill with compacted soil to finished grade unless alternate foundation design requires concrete to finished grade.



Galvanized Steel Pole and Poletop Luminaire Assembly

Overview

The galvanized steel pole and poletop luminaire assembly are designed to slip-fit together. Jacking ears on each pole section provide attachment points to pull pole sections together. The Musco *Foundation and Pole Assembly Drawing* gives minimum overlap specifications for each pole section.

Tools/Materials Needed

Musco Supplied
- ❑ Wooden shipping blocks
- ❑ Musco Foundation and Pole Assembly Drawing
- ❑ 9/16 in wrench
- ❑ Dishwashing liquid (original Dawn®, ECOS® Pro, or DIAO™ brand)

Contractor Supplied
- ❑ Two 1½ ton chain come-alongs

Assembly Procedure

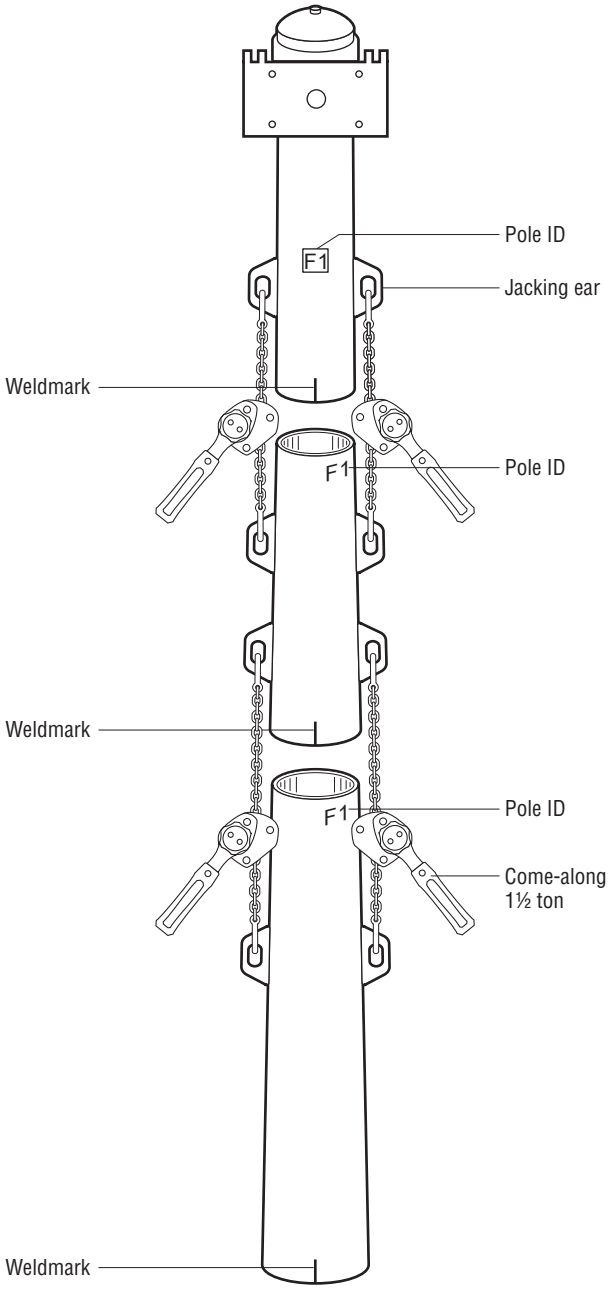
Verify pole ID on each steel pole section matches pole location on *Field Aiming Diagram*. Pole ID is stenciled on inside bottom end and outside top end of each section.

1 Lay out all pole sections and poletop luminaire assembly in sequence. Ensure all weldmarks face same direction. Weldmarks represent field side of pole.

Use shipping blocks as necessary to support pole sections during assembly.

2 Lubricate top of each steel pole section with supplied dishwashing liquid.

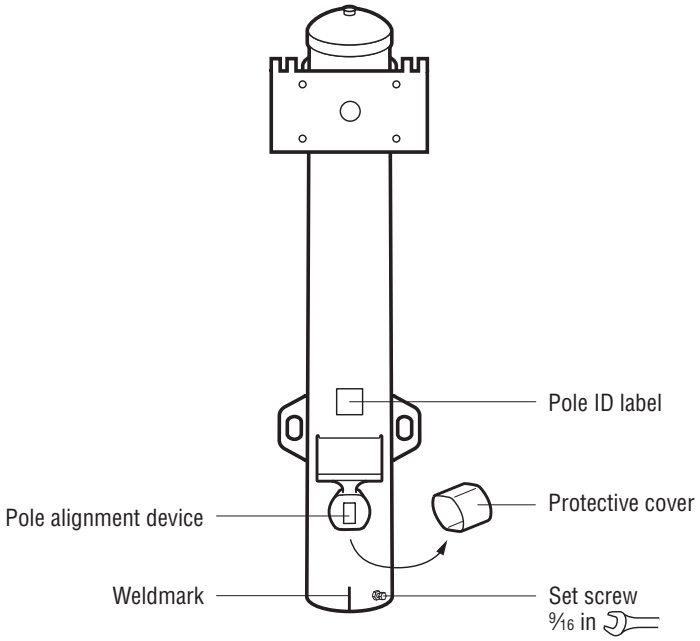
3 Align jacking ears. Using two 1½ ton come-alongs, pull sections together evenly until tight. Ensure minimum overlap per Musco *Foundation and Pole Assembly Drawing*. Repeat for all sections.



Galvanized Steel Pole and Poletop Luminaire Assembly

4 Tighten set screw using 9⁄16 in wrench.

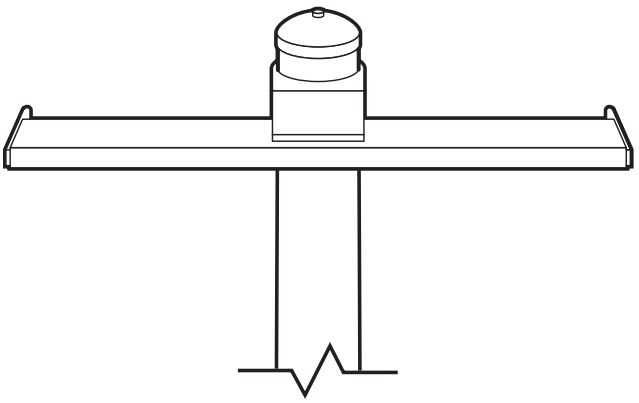
5 Remove protective cover from pole alignment device.



Bolt-on crossarm configuration

If pole has welded crossarms, skip *Bolt-on Crossarms* section. Proceed to *Electrical Components Enclosure section*.

See *Installation Instructions: Platform, Climbing Steps, and Safety Cable,* if your project includes these items.



Welded crossarm configuration

(reference)

Bolt-on Crossarms

Overview

Due to shipping restrictions, it is sometimes necessary to ship crossarms separate from the poletop section. For these situations, the crossarms are designed to easily attach to the poletop.

Tools/Materials Needed

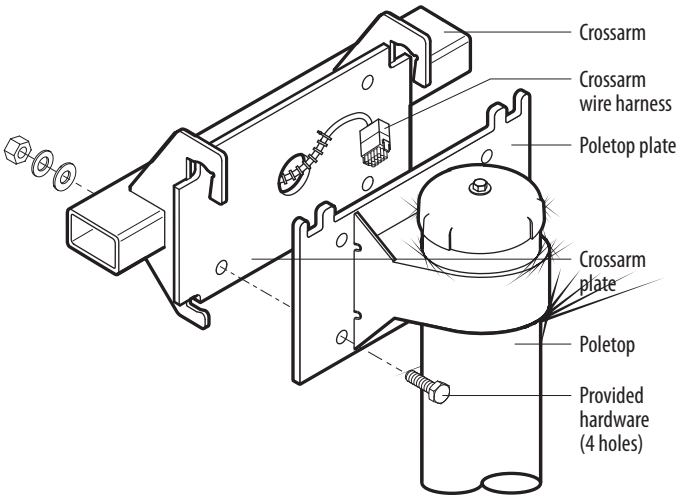
Musco Supplied:

- ❑ ¾ in drive 1⅛ in socket
- ❑ ¾ in drive breaker bar
- ❑ ¾ in drive 4 in extension
- ❑ 1⅛ in wrench
- ❑ Spreader bars
- ❑ ⅜ in fasteners (for spreader bars)
- ❑ ⅝ in structural fasteners
- ❑ ⅝ in wrench

Contractor Supplied:

- ❑ Torque wrench with ⅞ and ⅝ in socket

Assembly Procedure



✓ Verify pole ID on crossarm matches ID of pole.

Note: Each crossarm is factory assembled for a specific position on poletop section to ensure correct aiming. Top side of crossarm is labeled with crossarm's position number. Example: Position 1 is installed on first position from top of poletop section.

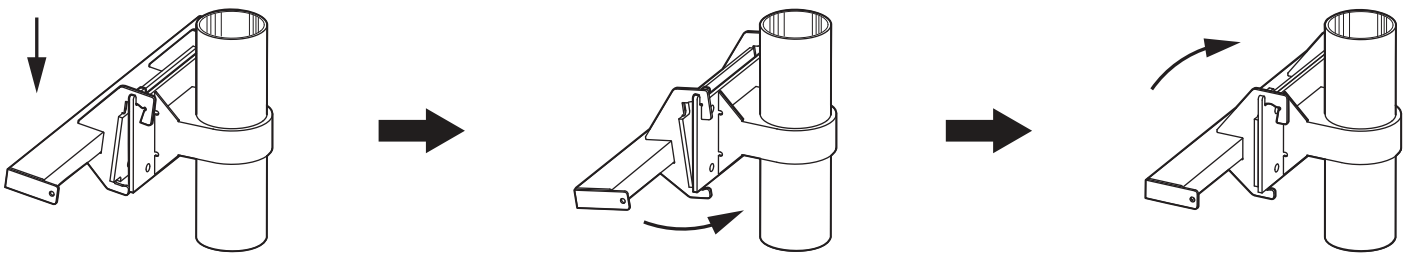
1 Position crossarm near poletop, and feed crossarm wire harness through hole in center of poletop plate.

Route wire harness for crossarms 1–3 to top of pole.

Route wire harness for crossarms 4–7 to handhole below crossarm position 5.

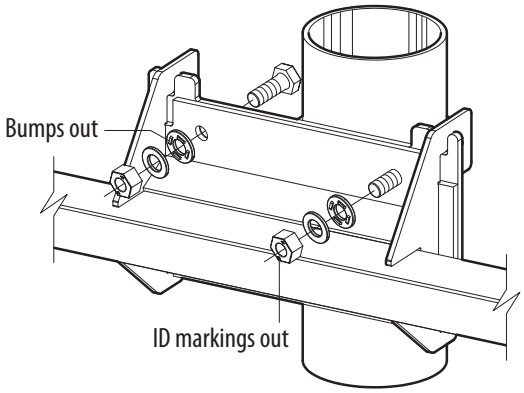
2 Position crossarm as shown below.

✓ Ensure crossarm wire harness is not pinched between mating plates.

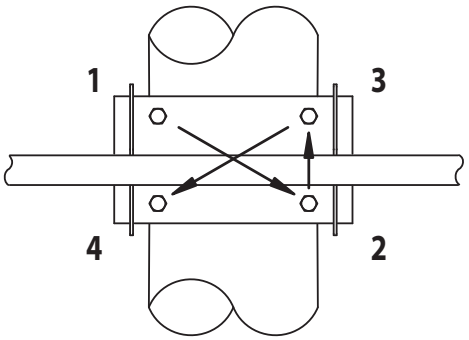


Bolt-on Crossarms

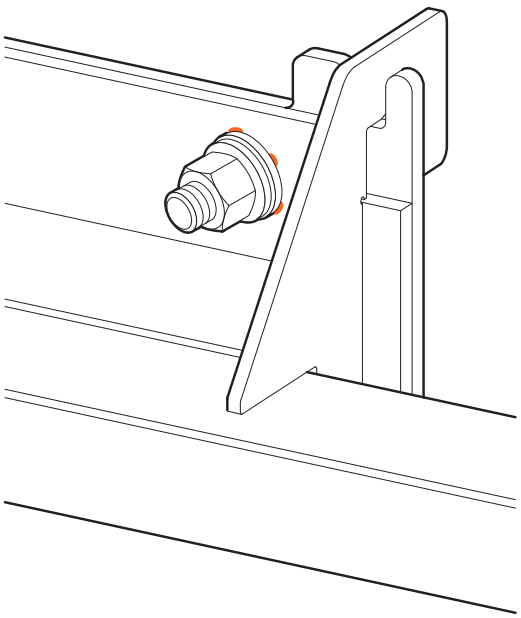
3 Install bolts through plates with threads away from pole. Place direct tension indicating (DTI) washer next, with flat surface (orange material) against plate, and bumps facing out toward nut. Place flat washer next, followed by nut. Small ID markings on nut must face out to allow proper identification of nut.



4 Snug all nuts. Using supplied 1 1/16 in wrench, tighten each nut until plates are in firm contact. Follow tightening sequence shown.



5 Using supplied breaker bar, 1 1/16 in socket, extension, and wrench, tighten each nut until orange extrusion appears from at least three bumps.



Bolt-on Crossarms

6 Repeat steps 1–5 for remaining crossarms.

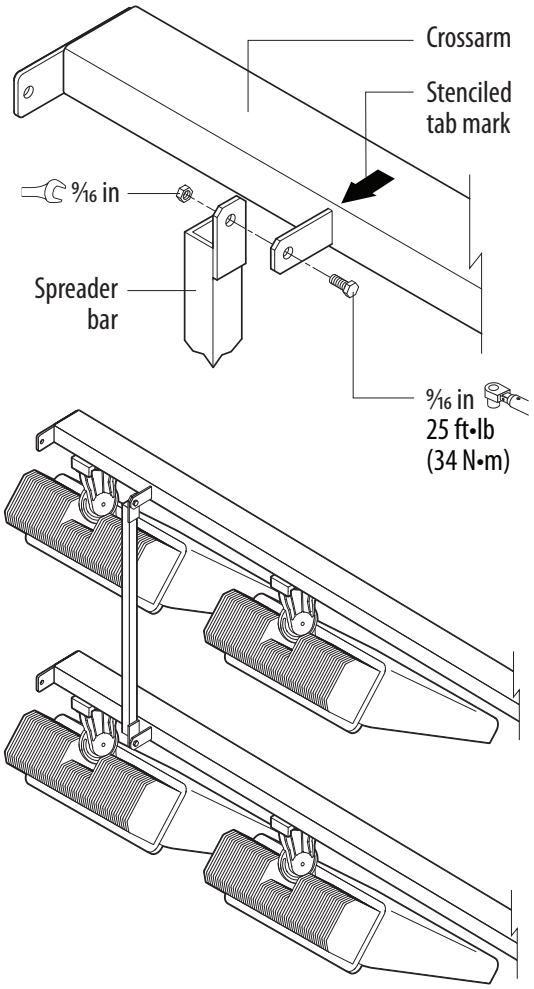
Do not reuse structural fasteners. Discard if removed or loosened after tightening.

Refer to the *Field Aiming Diagram* to determine if a pole requires spreader bars. If so, spreader bars are bundled together and marked with the pole ID. Additionally, the pole crossarms are stenciled indicating which tabs to use. Crossarms are joined in groups of two or three with the greatest grouping on top; do not form other groupings.

7 Install spreader bars with ⅜ in fasteners at the locations marked on each crossarm. Torque to 25 ft•lb (34 N•m).

Spreader bars may come in two sizes, 30½ in (775 mm) and 60 in (1524 mm). Always install longer bars to upper three crossarms.

See *Installation Instructions: Platform, Climbing Steps, and Safety Cable,* if your project includes these items.



Electrical Components Enclosure

Overview

The electrical components enclosure is factory-wired and tested. Built-in hardware allows for easy attachment to the galvanized steel pole. Quick-connect plug-ins ensure trouble-free connection to the poletop luminaire assembly via the wire harness.

Tools/Materials Needed

Musco Supplied

- ❑ 9⁄16 in wrench
- ❑ 3⁄16 in hex key

Contractor Supplied

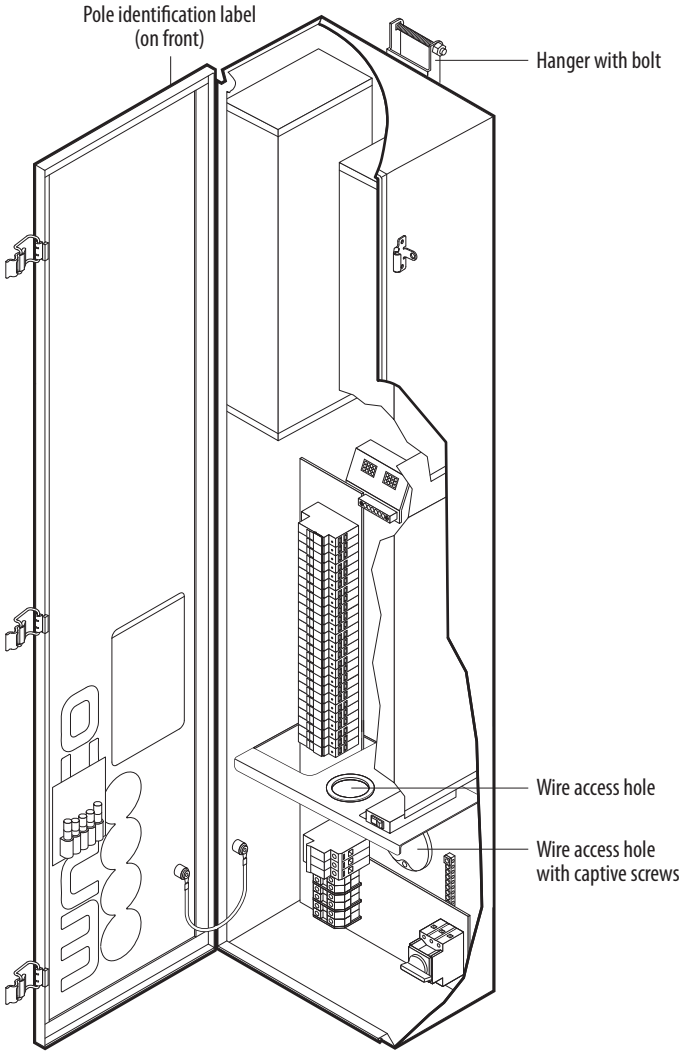
- ❑ Phillips-head screwdriver
- ❑ Standard screwdriver

Assembly Procedure

Verify pole ID on electrical components enclosure matches pole location on *Field Aiming Diagram*.

Caution
Electrical components enclosures are heavy.

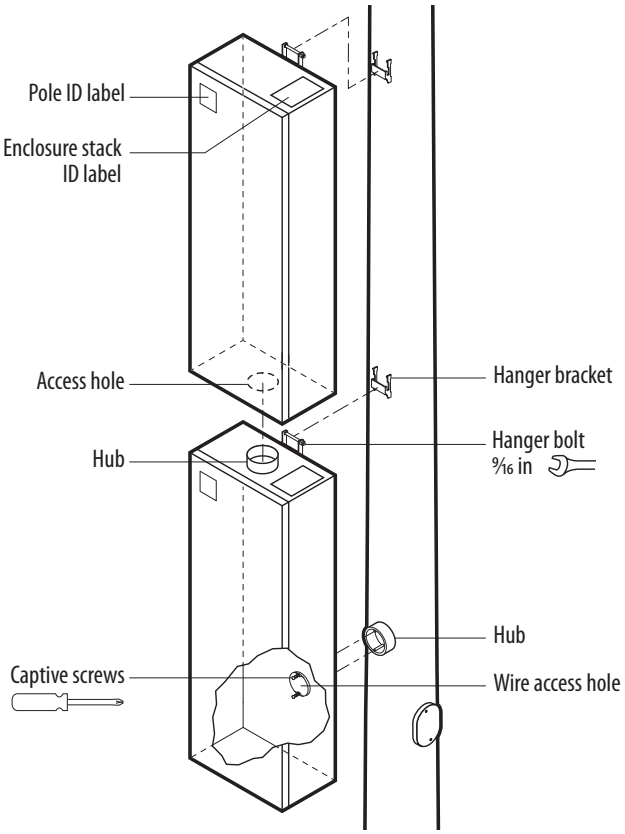
Electrical components enclosure may weigh up to 65 lb (30 kg). Lift carefully with two people to avoid injury.



Electrical Components Enclosure

1 Mount bottom enclosure on pole. Align wire access hole with hub. Tighten captive screws using Phillips-head screwdriver. Tighten hanger bolt with 9⁄16 in wrench.

2 Mount middle and/or top enclosures. Align access hole with hub and slide box onto hanger bracket. Tighten hanger bolt with 9⁄16 in wrench.

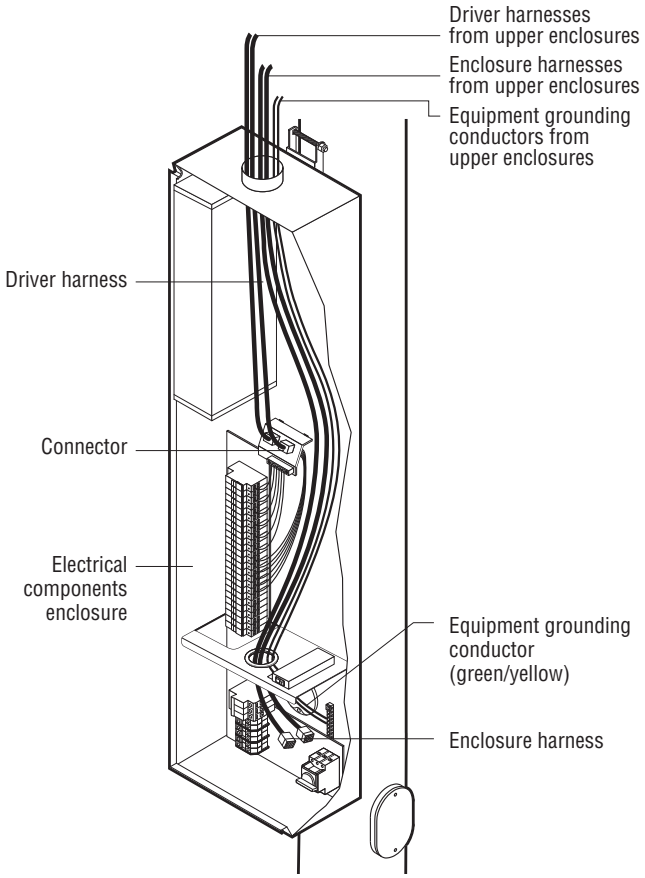


Only qualified personnel may perform wiring. Route wires as shown, but leave the final connections for your electrician. See section *Connecting to Supply Wiring*.

3 Route driver harnesses from top and middle enclosures to bottom enclosure and plug into connector mounted in bracket.

4 Route equipment grounding conductor and enclosure harnesses from top and middle enclosures to bottom enclosure.

5 Repeat steps 1 – 4 for each stack.



Warning

Pole rotation may be required to assemble all components onto the pole. Do not stand under pole when lifting. Steady pole with two people holding crossarms. Allow for pole to safely rotate around when it is high enough for crossarms and electrical components enclosures to clear the ground.

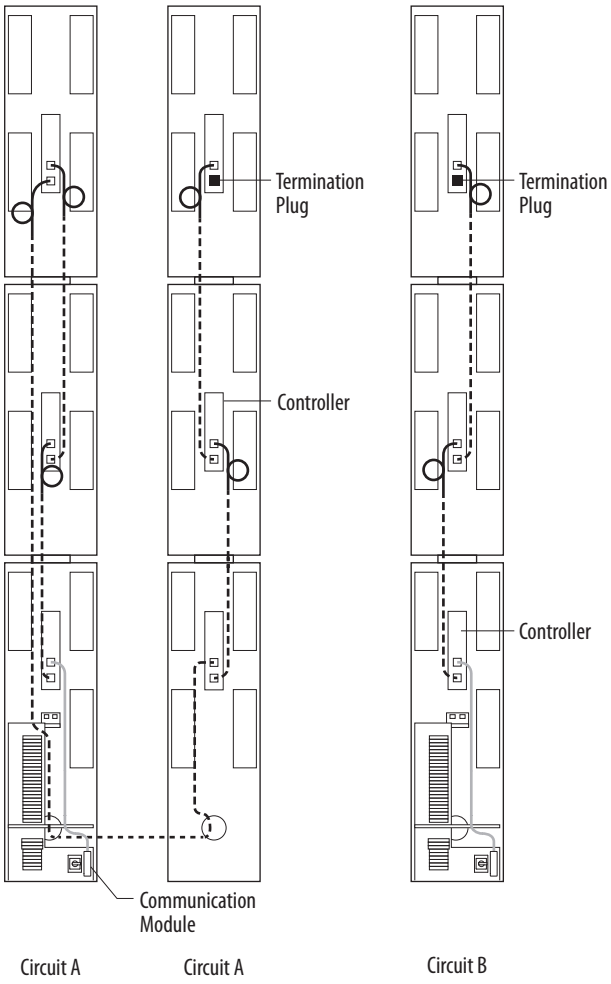
Caution - Equipment Damage

Properly support pole to ensure components do not get damaged. Do not attach components to pole without the pole being properly supported.

Electrical Components Enclosure

Note: Skip steps 6–7 if controller not present.

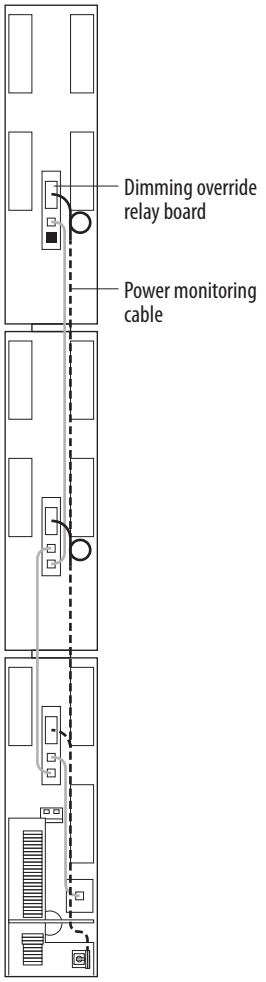
6 Pull communication cables down from top and middle boxes and plug into controller in enclosure below as shown.



Electrical Components Enclosure

Note: Skip step 7 if emergency egress lighting dimming override relay board is not present.

7 Pull power monitoring cable from dimming override relay board in top and middle enclosures down to bottom enclosure and land black wire on terminal block M1 and blue/white wire on terminal block M2.

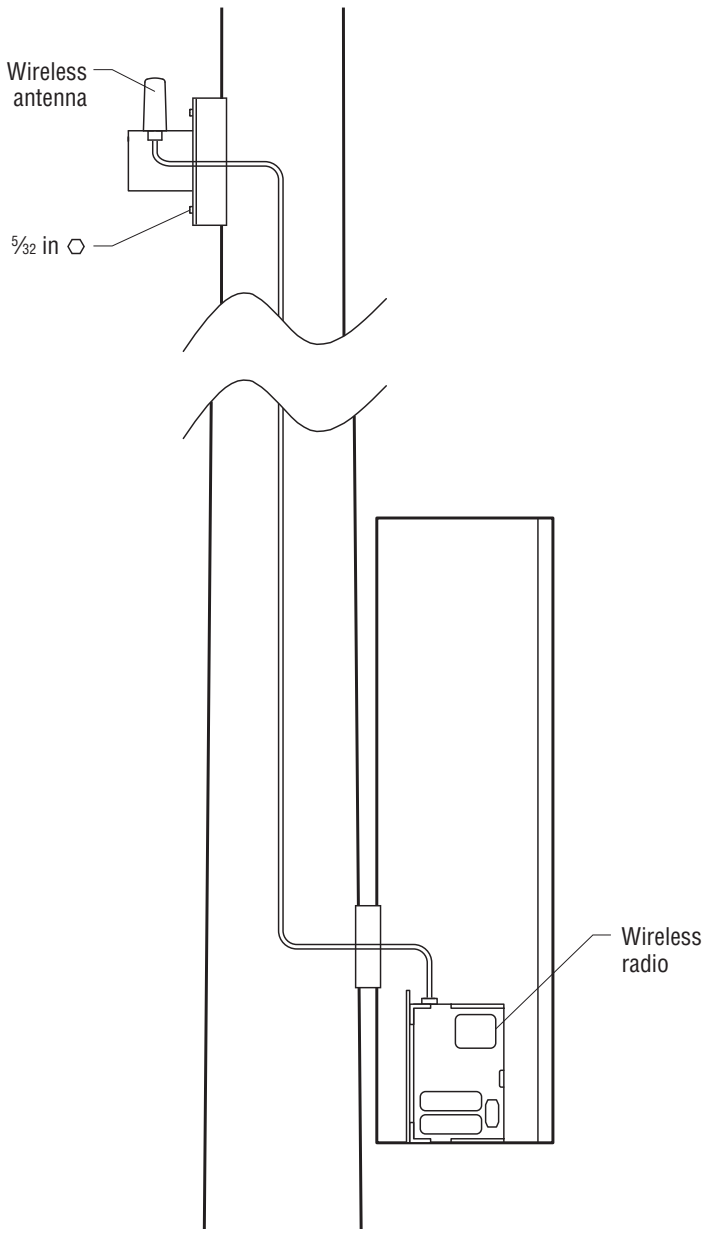


Electrical Components Enclosure

Note: Skip steps 8-9 if wireless antenna not present.

8 Using a 5⁄32 in hex wrench mount the wireless antenna on the handhole provided. Route the coaxial cable down the pole into bottom electrical components enclosure.

9 Install the coaxial cable on the wireless radio located in the electrical components enclosure.



Wire Harness

Overview

The factory-built wire harness connects the electrical components enclosure to the poletop luminaire assembly.

Tools/Materials Needed

Musco Supplied

- ❑ 5⁄32 in hex key
- ❑ 9⁄16 in wrench

Contractor Supplied

- ❑ Fish tape
- ❑ Electrician's tape

Assembly Procedure

Verify pole ID on wire harness matches pole location on *Field Aiming Diagram.*

1 Remove handhole covers using 5⁄32 in hex key. Remove polecap using 9⁄16 in wrench.

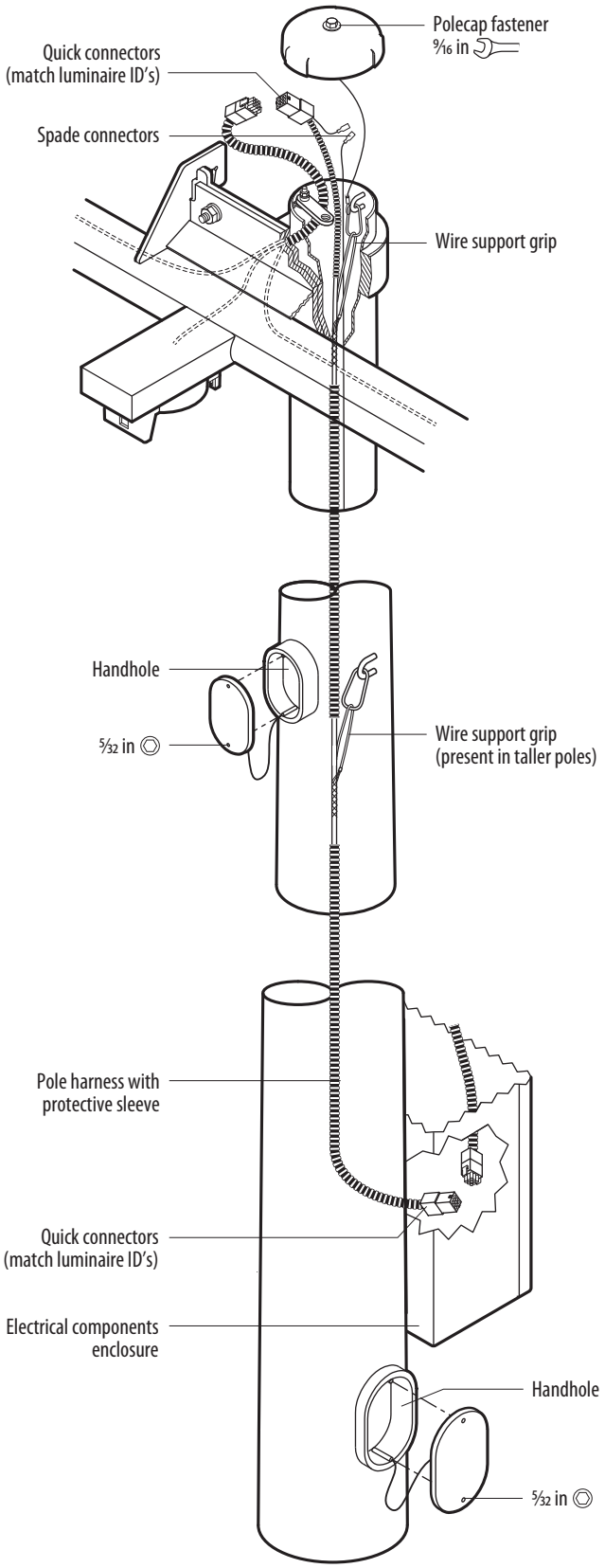
2 Fish all pole wire harnesses between poletop and appropriate electrical components enclosure(s). Use lower handhole to access enclosure hubs. Ensure protective sleeve extends through access hub and tuck harnesses behind subpanel.

3 Attach support grips at poletop and midpole (if present).

4 Mate quick-connectors at poletop and inside electrical components enclosure(s). Match driver/luminaire IDs.

Note: Each bolt-on crossarm has at least one separate harness. There is one additional spade connector for pole alignment beam.

5 Replace handhole covers and polecap.



Luminaire Attachment

Overview

Luminaires are factory built and shipped in individual cartons. They are aimed in the factory and ready for installation. Do not disassemble knuckle.

Tools/Materials Needed

Musco Supplied
- ❑ 7⁄16 in ratcheting combination wrench

Note: Leave luminaires in box until ready to assemble. Keep protective cover on luminaire until ready to set pole. Do not leave luminaires unassembled from crossarm in wet conditions.

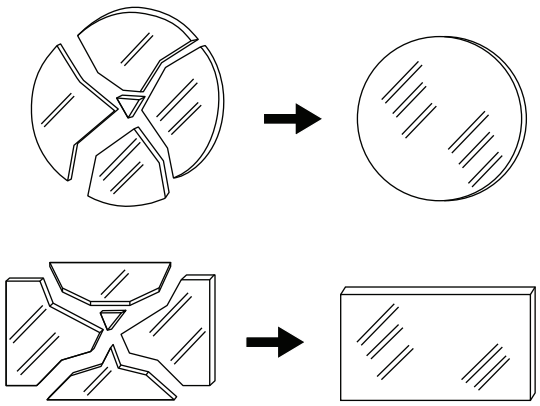
Contractor Supplied:
- ❑ Torque wrench with 7⁄16 in socket

Caution
No User Serviceable Parts

If protective lens glass is cracked or broken, luminaire must be replaced.

Luminaire light source is not replaceable; when light source reaches end of life entire luminaire must be replaced.

Contact your local Musco representative for maintenance or replacement.



Luminaire Attachment

Assembly Procedure

Verify pole ID on luminaire cartons matches pole and location on *Field Aiming Diagram*.

1 Remove and discard orange protective caps from luminaire knuckle and mounting plate that cover electrical connections. Do not remove orange tag around captive bolts.

Note: The luminaire style may vary from what is shown.

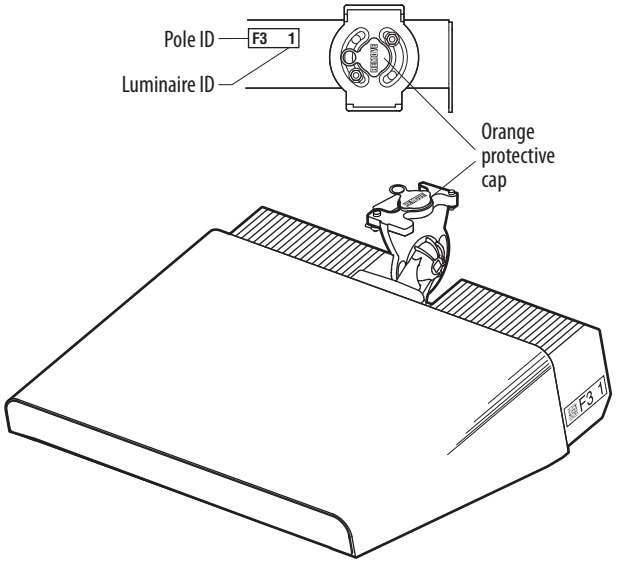
Warning

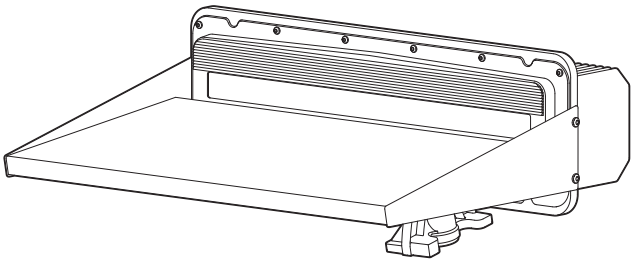
Pole rotation may be required to assemble all components onto the pole. Do not stand under pole when lifting. Steady pole with two people holding crossarms. Allow for pole to safely rotate around when it is high enough for crossarms and electrical components enclosures to clear the ground.

Caution - Equipment Damage

Properly support pole to ensure components do not get damaged. Do not attach components to pole without the pole being properly supported.

Some luminaires may attach to auxiliary brackets, refer to *Installation Instructions: Auxiliary Bracket*.





Luminaire Attachment

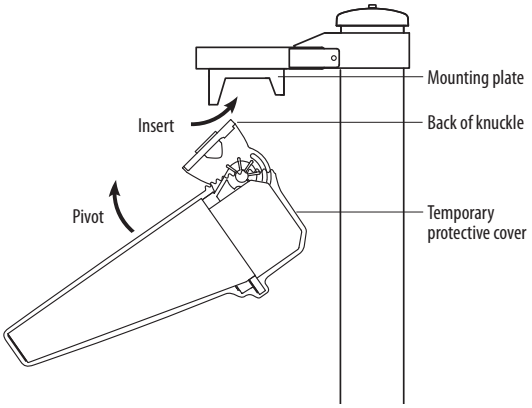
2 Match luminaire ID to crossarm and install luminaire onto mounting plate. Insert back of knuckle into mounting plate and pivot into position.

Note: The luminaire style may vary from what is shown.

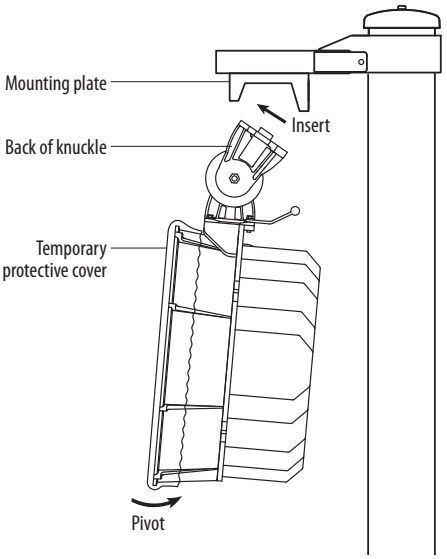
Luminaire	Weight
TLC-LED-350	25 lb (11 kg)
TLC-LED-400	40 lb (18 kg)
TLC-LED-550	25 lb (11 kg)
TLC-LED-550NR	38 lb (17 kg)
TLC-BT-575	34 lb (15 kg)
TLC-LED-600	40 lb (18 kg)
TLC-LED-900	40 lb (18 kg)
TLC-LED-900NB	114 lb (52 kg)
TLC-LED-1150	80 lb (36 kg)
TLC-LED-1200	45 lb (20 kg)
TLC-LED-1400NB	106 lb (48 kg)
TLC-LED-1500	67 lb (30 kg)
TLC-RGB-U	20 lb (9 kg)
TLC-RGBW	40 lb (18 kg)
TLC-TW	40 lb (18 kg)
TLC-LED-550NR	38 lb (17 kg)

Caution

Luminaire may be heavy. Lift carefully with two people to avoid injury.



Or



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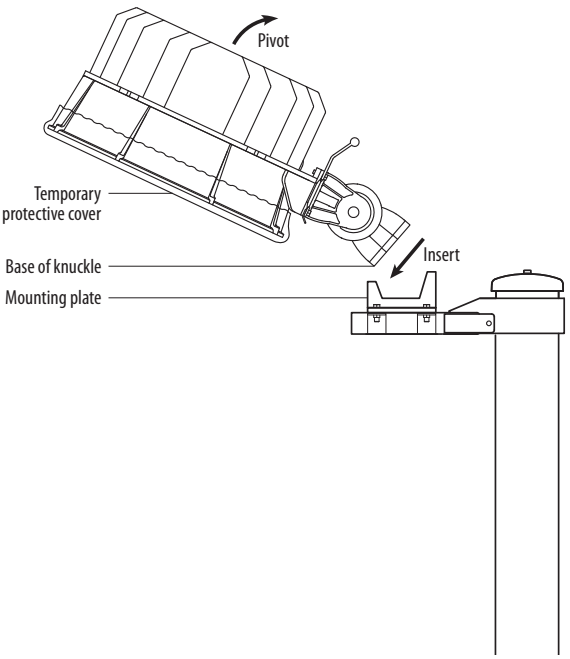
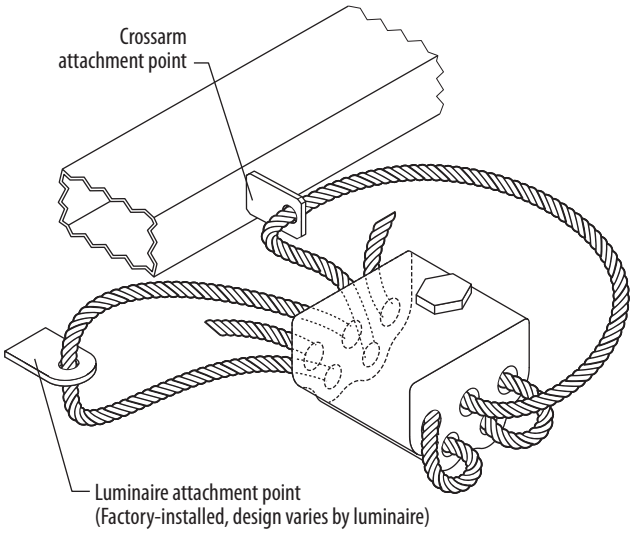


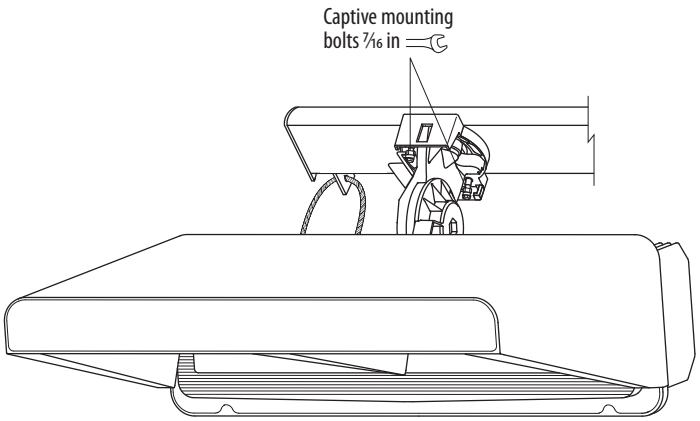
Luminaire Attachment

3 Attach luminaire retaining cable (if present). Route luminaire cable through crossarm anchor point, through luminaire block, and back through the block under the set screw. Luminaire attachment point will vary per luminaire design.

4 Using 7⁄16 in socket and torque wrench, tighten cable set screw to 60 in•lb (6.8 N•m)



5 Tighten captive mounting bolts. Orange tag will break loose before all bolts are fully tight - continue tightening. Torque must not exceed 20 ft•lb (27 N•m). To avoid overtightening, use provided 7⁄16 in combination wrench.



Warning
Luminaire may fall if bolts are not tight.

Do not remove tag before tightening bolts.

See *Installation Instructions: Climbing Steps and Safety Cable,* if your project includes these items.

Warning

Pole rotation may be required to assemble all components onto the pole. Do not stand under pole when lifting. Steady pole with two people holding crossarms. Allow for pole to safely rotate around when it is high enough for crossarms and electrical components enclosures to clear the ground.

Caution - Equipment Damage

Properly support pole to ensure components do not get damaged. Do not attach components to pole without the pole being properly supported.

If pole has auxiliary equipment, refer to *Installation Instructions: Auxiliary Bracket*.

Note: Attaching auxiliary brackets before setting pole may interfere with slings. Attaching auxiliary brackets after pole is set may be preferable depending on height of auxiliary bracket.

Pole Setting and Alignment

Overview

All luminaires are factory aimed to their exact position on the field. To ensure the proper pole orientation, a simple-to-use pole alignment beam completes the precision field aiming. The pole alignment beam is attached in the factory to each pole.

Tools/Materials Needed

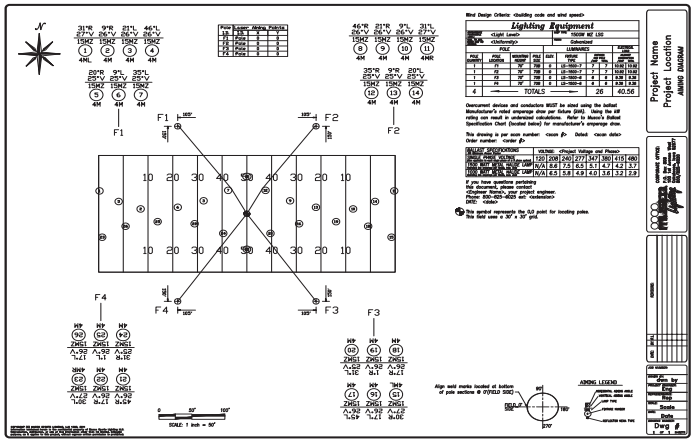
Musco Supplied

- ❑ Field Aiming Diagram
- ❑ Steel chain
- ❑ Steel bar
- ❑ Pole rotator kit
- ❑ Dishwashing liquid (original Dawn®, ECOS® Pro, or DIAO™ brand)
- ❑ Level

Contractor Supplied

- ❑ Chalk or pencil
- ❑ Load-rated shackles as required
- ❑ Load-rated nylon slings as required
- ❑ Spray paint, chalk, or flags (to mark aiming points on field)
- ❑ Two 1½ ton chain come-alongs

Installation Procedure

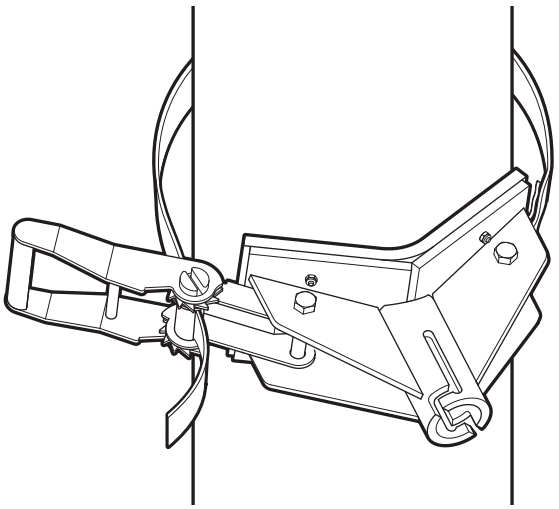


✓ Verify pole ID matches precast concrete base and pole location on *Field Aiming Diagram*.

1 Mark aiming point(s) on field using *Field Aiming Diagram*. Poles may have individual aiming points or may all be aimed to a common point.

2 Lubricate concrete base with provided dishwashing liquid.

3 Attach pole rotator clamp approximately 12 in (300 mm) above bottom of pole. Wrap strap around pole and cinch tightly.

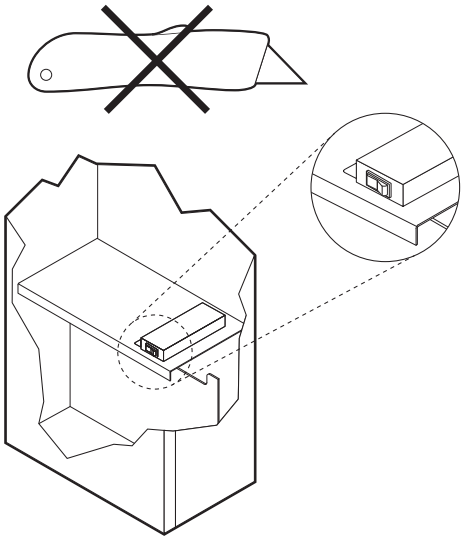


⚠ **Caution**
Risk of injury or property damage.

Rotator bar can swing with force as pole is lifted. Do not install until you are ready to lower pole onto base (step 8).

Pole Setting and Alignment

4 Remove temporary protective cover from luminaires (if present). Do not use knife.



Warning
Laser radiation hazard

Pole alignment beam is safe for viewing at a distance of three feet (one meter) or more. Do not look into beam from closer than three feet (one meter).

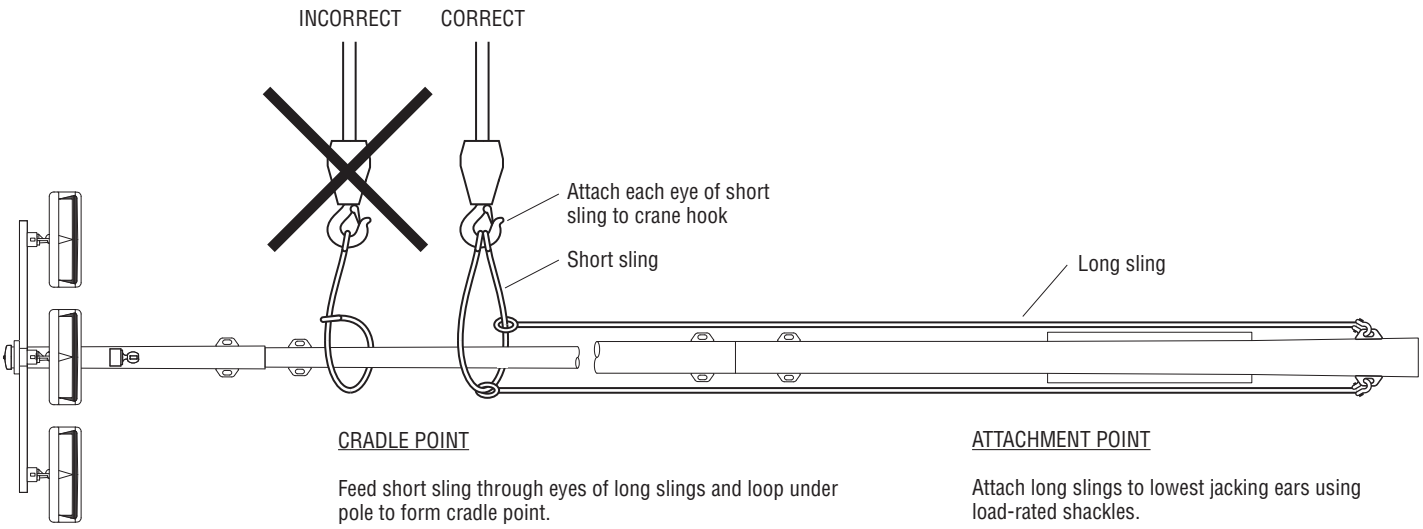
5 Turn on alignment beam and check. Device has toggle switch inside electrical components enclosure. For poles with platforms, alignment beam device has a rotary switch located on the back of the alignment device.

Warning
Improper rigging can cause pole sections to separate and fall.

Follow these instructions carefully. Do not choke pole or lift from crossarms.

6 Sling pole using this recommended method (see illustration). You must lift pole from lowest section. Friction between assembled sections will not hold pole together when lifting. To keep pole upright when lifting, ensure cradle point is above pole center of gravity. Ensure cradle point is free and will not cinch around pole or snag on hardware or components during lifting.

Warning



CRADLE POINT

Feed short sling through eyes of long slings and loop under pole to form cradle point.

Ensure cradle point is free and will not cinch around pole or snag on hardware or components during lifting.

Cradle point must be above pole assembly center of gravity.

ATTACHMENT POINT

Attach long slings to lowest jacking ears using load-rated shackles.

Lowest jacking ears carry entire weight of pole.

All slings must be rated for complete pole weight. Refer to Musco *Foundation and Pole Assembly Drawing*.

Pole Setting and Alignment

Warning
Crushing hazard

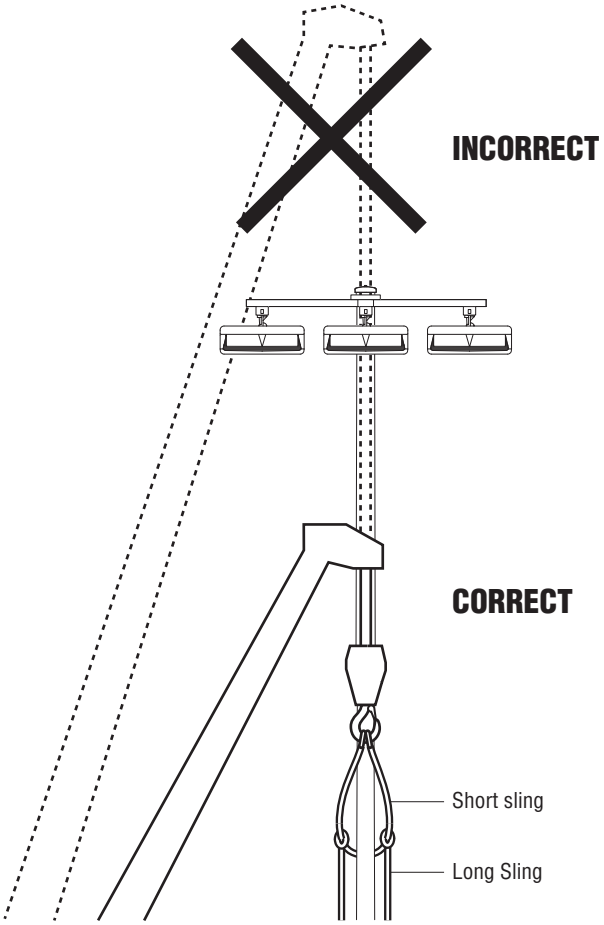
Pole can rotate with force, causing injury.

Do not stand under pole when lifting. Steady pole with two people holding crossarms. Allow pole to safely rotate around when it is high enough for crossarms and electrical components enclosures to clear the ground.

7 Lift pole. Use care to avoid dragging bottom of pole. Keep crane head below crossarms.

Watch for these signs to ensure you are lifting pole properly:

- Short sling slides freely up the pole and long slings tighten.
- Top of pole rises first.
- Short sling does not choke or snag on pole.
- Lowest jacking ears carry entire weight of pole.



8 When pole is suspended, insert rotator bar to clamp and turn to lock in place. Guide pole into position over base using rotator bar and lower onto base. Do not allow pole to seat on base until it is properly aimed (step 9). Pole should rotate with reasonable force applied to bar, but not freely.

Warning
Pinching hazard

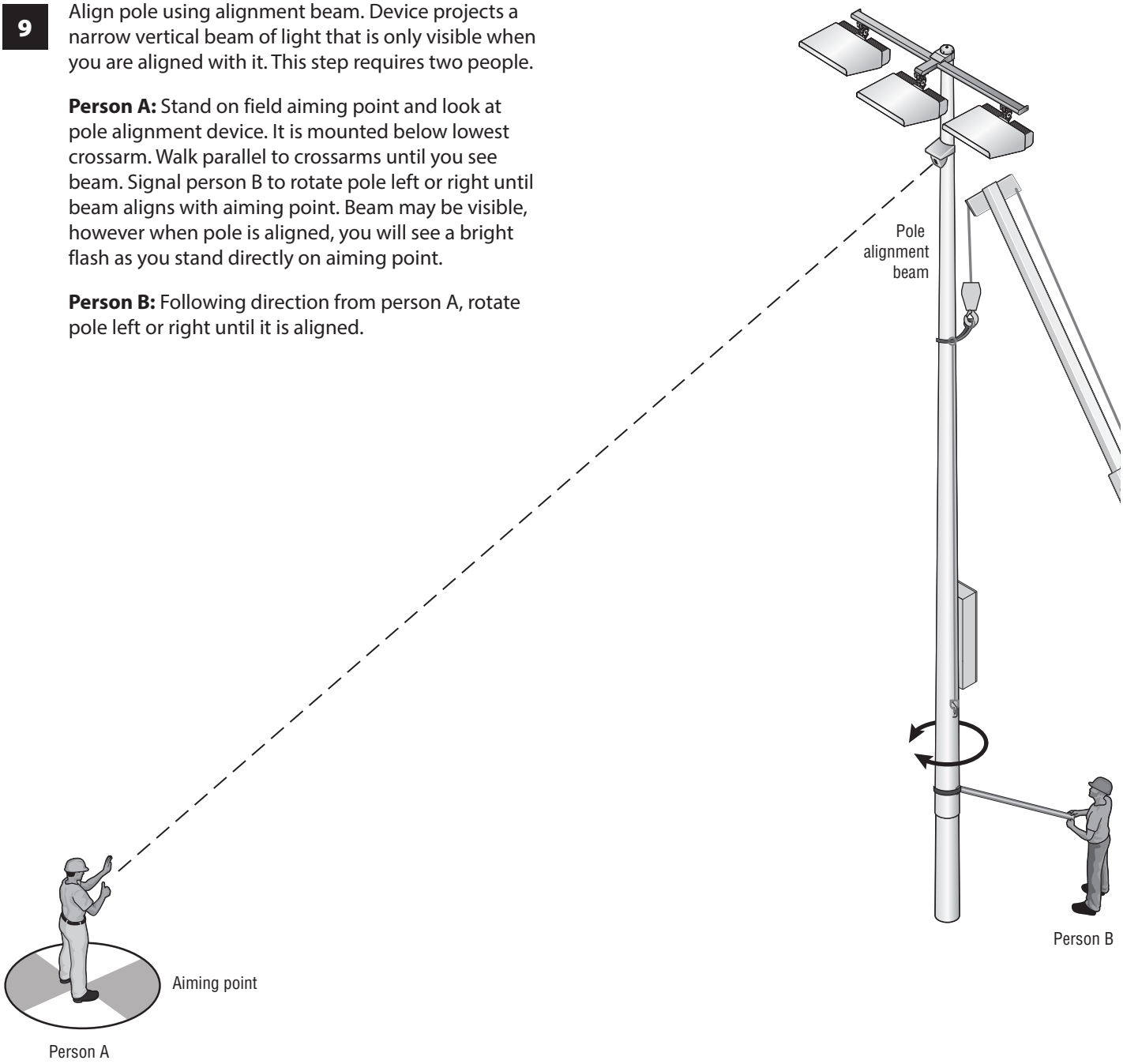
Keep hands clear when setting pole on concrete base.

Pole Setting and Alignment

9 Align pole using alignment beam. Device projects a narrow vertical beam of light that is only visible when you are aligned with it. This step requires two people.

Person A: Stand on field aiming point and look at pole alignment device. It is mounted below lowest crossarm. Walk parallel to crossarms until you see beam. Signal person B to rotate pole left or right until beam aligns with aiming point. Beam may be visible, however when pole is aligned, you will see a bright flash as you stand directly on aiming point.

Person B: Following direction from person A, rotate pole left or right until it is aligned.



Warning
Laser radiation hazard

Pole alignment beam is safe for viewing at a distance of three feet (one meter) or more. Do not look into beam from closer than three feet (one meter). Do not use binoculars, camera, or telescope to view beam from any distance. Locator beam is a class 2M laser device. Wavelength: 635-660 nm, laser power for classification: <1 mW continuous, divergence: <1.5 mrad x 1 rad. Using alignment beam in a manner other than as described here may result in hazardous exposure. Do not modify, dismantle, or attempt to repair.

Pole Setting and Alignment

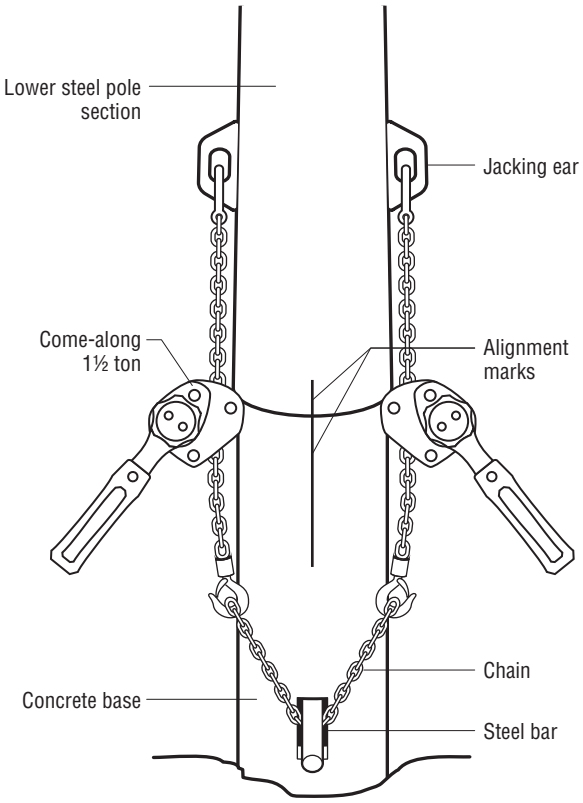
10 Once pole is aligned, use level to draw a thin vertical alignment mark on pole and concrete base. Use mark to verify alignment is maintained while lowering pole (step 11) and jacking onto base (step 12).

11 Lower pole into position. Hold pole rotator bar to maintain alignment until pole seats on base. Remove rotator bar and clamp.

12 Insert provided steel bar through base. Wrap provided chain around base below steel bar. Attach two 1½ ton come-alongs to jacking ears. To avoid twisting, attach come-alongs to provided chain directly below jacking ears. If ears align parallel with steel bar, do not use chain. Pull pole down onto base, keeping marks aligned. Ensure minimum overlap per Musco *Foundation and Pole Assembly Drawing*.

If pole seats out of alignment, contact Musco to request separating tools. See *Installation Instructions: Separating Steel Pole from Concrete Base*.

If pole has climbing steps and safety cable, see *Installation Instructions: Climbing Steps and Safety Cable* for cable tensioning instructions.



Connecting to Supply Wiring

Overview

The final step of installation is connecting the supply wiring at the subpanel. Terminals for phase wires and neutral (if used), disconnect switch with lockout, and equipment ground bar are provided on the subpanel in the electrical components enclosure. If there are multiple circuits on the pole, a disconnect is provided for each circuit. This may be on a separate subpanel in another enclosure. The lighting system uses an integrated lightning ground embedded in the precast concrete base. Depending on foundation design and/or soil conditions, a supplemental grounding electrode may be required.

Tools/Materials Needed

Musco Supplied

- ❑ 3⁄16 in hex key (ground bar)
- ❑ 5⁄16 in hex key (bonding terminal inside handhole)
- ❑ 5⁄32 in hex key (handhole covers)
- ❑ 5 mm hex key (125 A disconnect terminals)
- ❑ Equipment bonding jumper

Contractor Supplied

- ❑ Underground wiring and conduit
- ❑ Main power disconnect and distribution panel(s)
- ❑ Standard screwdriver
- ❑ 3 m (10 ft) stepladder or small line truck

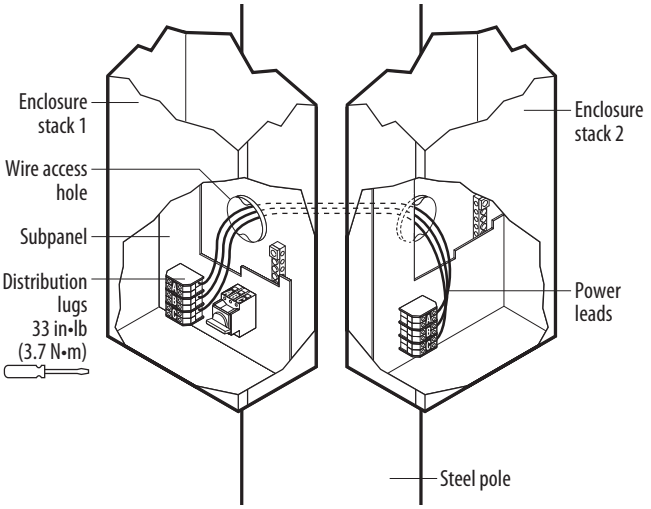
Installation Procedure

Musco *Control System Summary* or *Field Aiming Diagram* provides electrical loading information needed to size wire and switchgear.

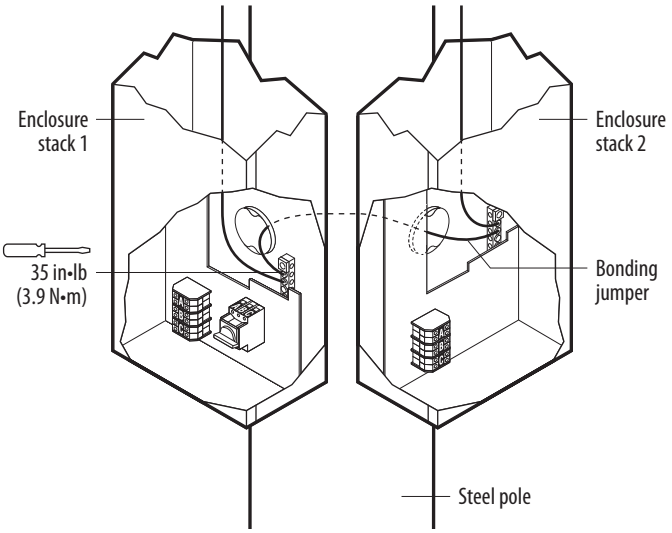
Musco provides instructions for installing Control-Link™ control system or lighting contactor cabinet when these items are part of your project.

1 If pole has multiple stacks on the same electrical circuit, route lower loads from second stack to distribution lugs on main subpanel.

Route all power leads for lighting equipment to appropriate subpanel locations.



2 Connect equipment grounding conductors (green/yellow) from each upper enclosure to equipment ground bar in bottom enclosure. If pole has multiple stacks, connect bonding jumper from stack one. Tighten lugs using 3⁄16 in hex key.



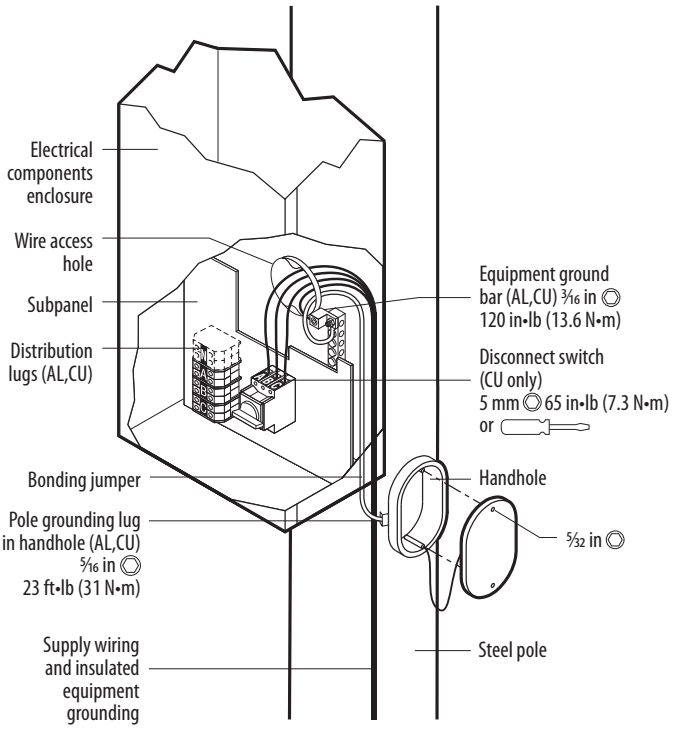
Connecting to Supply Wiring

3 Remove handhole cover using 5⁄32 in hex key. Rout supply wiring through access hub into electrical components enclosure.

4 Connect insulated equipment grounding conductor (supply) to ground bar. Tighten lug using 3⁄16 in hex key.

Disconnect is rated for copper wire only. Contact Musco for adaptor or use UL Listed adaptor for aluminum supply wire.

5 Connect phase wires (supply) to disconnect switch. Tighten lugs using standard screwdriver (45 A disconnect) or 5 mm hex key (125 A disconnect). Connect neutral wire (if used) to distribution lug. Tighten lug using standard screwdriver.



Disconnect Wiring Information

Disconnect Rating	Terminal	Wire Size Range	Strip Length	Torque
45 A	L	12 – 3 AWG (4 – 25 mm²)*	0.63 in (16 mm)	25 in•lb (2.8 N•m)
	N	16 – 4 AWG (1.5 – 25 mm²)*	0.56 in (14 mm)	27 in•lb (3.1 N•m)
	G	14 – 2/0 AWG (2.5 – 50 mm²)**	NA	120 in•lb (13.6 N•m)
125 A	L	10 – 2 AWG (6 – 35 mm²)*	0.63 in (16 mm)	50 in•lb (5.6 N•m)
		1 – 2/0 AWG (40 – 50 mm²)*	0.63 in (16 mm)	65 in•lb (7.3 N•m)
	N	16 – 1/0 AWG (1.5 – 50 mm²)*	0.71 in (18 mm)	33 in•lb (3.7 N•m)
	G	14 – 2/0 AWG (2.5 – 50 mm²)**	NA	120 in•lb (13.6 N•m)

*Stranded cable, single conductor, copper only

**Stranded cable, single conductor, copper or aluminum

Connecting to Supply Wiring

6 Route provided equipment bonding jumper (green/yellow) through access hub to pole grounding lug inside handhole. Tighten lug using 5/16 in hex key.

7 Ensure all handhole covers are installed and electrical components enclosure is closed and latched.

If your project includes a supplemental grounding electrode kit, follow instructions in kit for installing electrode.

Warning
Risk of electric shock.

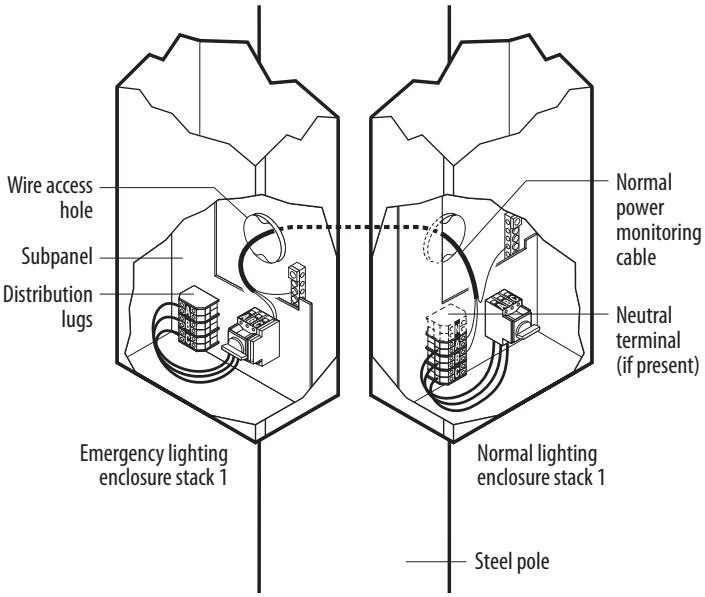
Terminate equipment grounding conductor at equipment ground bar in electrical components enclosure.

Warning
Lightning hazard.

For poles located near metal fences, metal bleachers, or other metal structures, bond structures to pole ground to maintain equal electrical potential.

Note: Skip step 8 if no emergency egress lighting is present.

8 Route cable for normal power to adjacent enclosure stack. Connect black wire and blue/white wire to any two active terminals A, B, C, or neutral, if present, and green wire to ground bar.



Musco Light-Structure System™ product referenced or shown may be protected by one or more of the following patents. United States Patent(s): D593883, D794244, D841854, D841855, D841856, D872350, D872351, D872927, D872928, D872929, D873462, D874050, D880035, D882141, D882850, D882860, D892375, D892376, 8163993, 8300219, 8742254, 8789967, 9435517, 9781780, 9951929, 10267491, 10330284, 10344948, 10549384. Benelux: 87546-01, 87547-01, 87548-01, 87990-01, 87991-01, 87992-01, 87994-01, 87995-01. 88535-01, 88536-01. Canada Patent(s): 2912148. China Patent for Invention 中国发明专利: ZL201280036994.1, ZL201380077801.1, ZL201610187066.5. China Patents for Design 中国外观设计专利: ZL201830262493.5, ZL201830262495.4, ZL201830262588.7, ZL201930116087.2. European Patent(s): 2715222, 2999920. Germany Patents: 402018100450-0001, 402018100451-0001, 402018100452-0001, 402019100343, 402019100344, 402019100345, 402019100346, 402019100347, 402019100348. Mexico Patent(s): 346527. Republic of Korea Patent(s): 10-1577571, 10-1661263, 10-1881998, 30-1014229, 30-1014230, 30-1014231, 30-1037776, 30-1037783-0001-0004, 30-1037788-0001-0004, 30-1037795, 30-1037796-0001 – 0004, 30-1037802-0001 – 0004. Russia Patent: 2616559. United Kingdom Patent(s): 6032011, 6032022, 6032023, 6056943, 6056944, 6056945, 6056946, 6056947, 6056948. U.S. and foreign patents pending. [Pat_057R]

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Instructions: **Separating Steel Pole Sections**

Overview

Pole sections must be properly aligned and installed correctly on the precast concrete base for lighting to meet design specifications. If misassembly occurs, you may separate using separating tools along with two five-ton bottle jacks or ram sets.

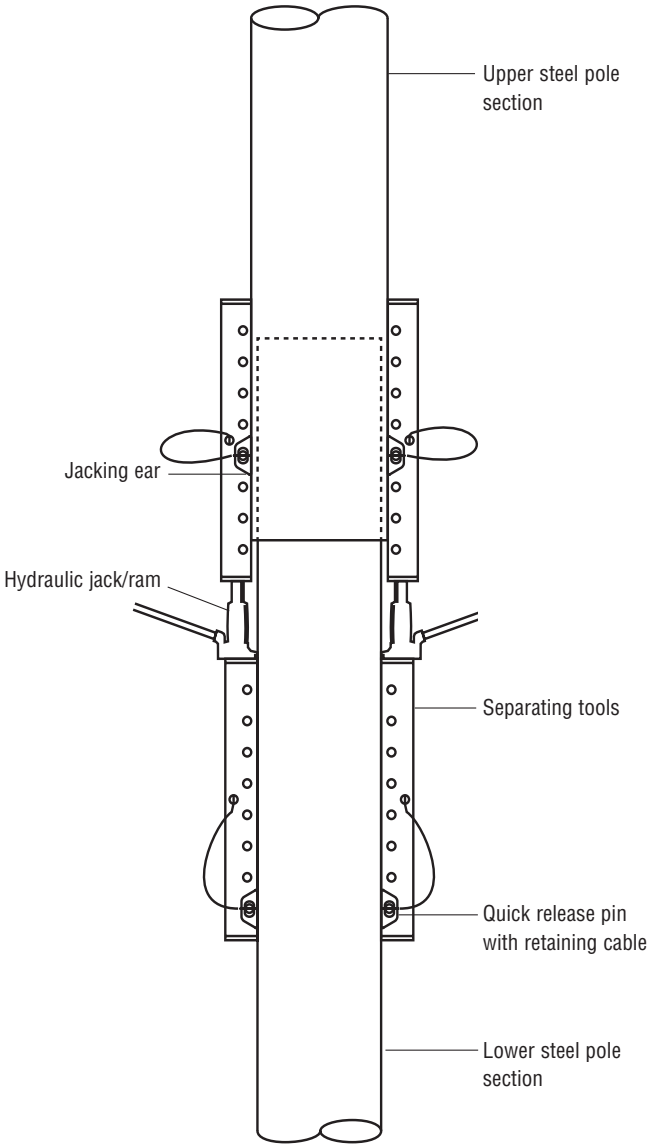
Tools/Materials Needed

Musco Supplied

- ❑ Four separating tools with pins

Contractor Supplied

- ❑ Crane and slings to support pole sections
- ❑ Dead blow hammer
- ❑ Two hydraulic bottle jacks or ram sets with five-ton capacity (Ensure bottle jacks can operate in horizontal position if pole is on the ground.)



Separation Procedure

1 Use crane to sling and support upper pole sections. Attach sling above separation point. Do not use crane to provide separating force. Ensure crane pick point is above load center of gravity. See *Light-Structure Green™ Installation Instructions* for proper pick points.

Caution
Using higher capacity jacks can damage pole. If sections do not separate using tools and methods described, call your Musco project engineer or local representative.

2 Position four separating tools on jacking ears, as shown. Position as close together as possible, allowing space for collapsed jacks/rams.

3 Attach tools to jacking ears using pins provided.

4 Place the jacks/rams on each side of pole between separating tools. Ensure jacks/rams are placed securely and cannot move during separation.

⚠ **Warning**
Separating force is high. Keep hands clear of apparatus when jacking.

5 Jack sections apart applying even pressure to each side of pole.

6 Tap on upper pole section using dead blow hammer. This vibration helps sections separate.

Instructions: **Separating Steel Pole from Concrete Base**

See *Overview*, previous page.

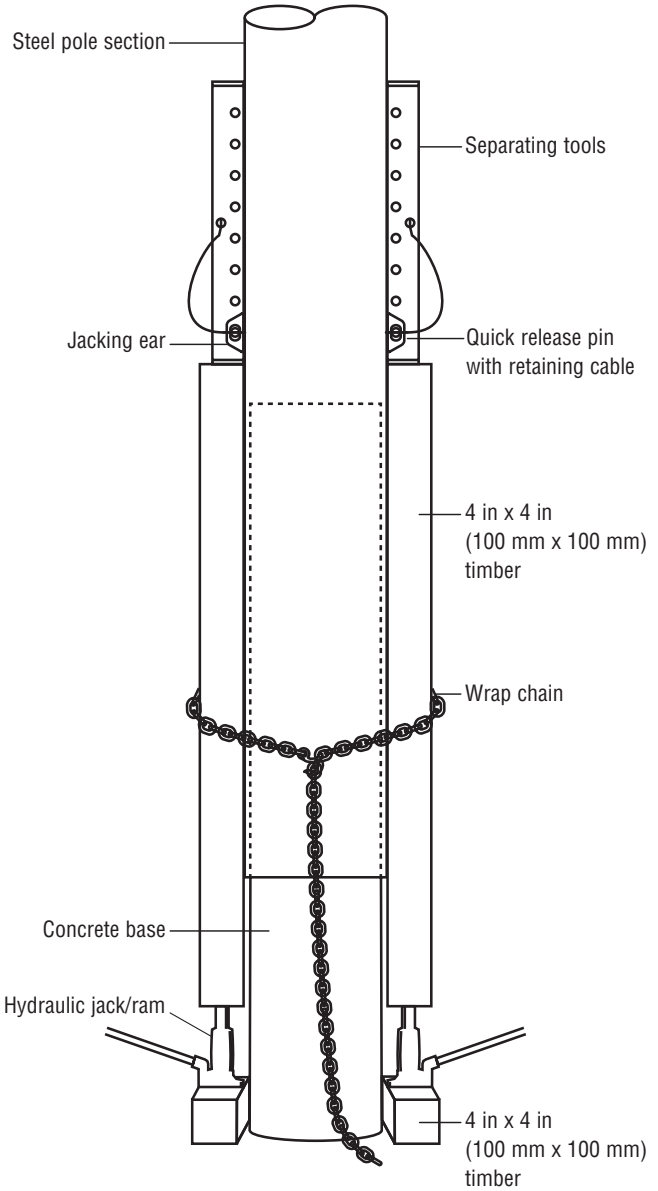
Tools/Materials Needed

Musco Supplied

- ❑ Two separating tools with pins

Contractor Supplied

- ❑ Crane and slings to support pole sections
- ❑ Dead blow hammer
- ❑ Two hydraulic bottle jacks or ram sets with five-ton capacity
- ❑ Chain/strapping to constrain jacking apparatus
- ❑ Soap and water solution for lubrication
- ❑ 4 in x 4 in (100 mm x 100 mm) timber to support jacks/rams at ground level and to form vertical extensions



Separation Procedure

1 Use crane to sling and support pole sections. Attach sling above separation point. Do not use crane to provide separating force. Ensure crane pick point is above load center of gravity. See *Light-Structure Green™ Installation Instructions* for proper pick points.

Caution
Using higher capacity jacks can damage pole. If sections do not separate using tools and methods described, call your Musco project engineer or local representative.

2 Position two separating tools on jacking ears of lowest steel pole section, as shown.

3 Attach tools to jacking ears using pins provided.

4 Create solid base at ground level to support jacks/rams using 4 in x 4 in (100 mm x 100 mm) timber. Timber should prevent jacks/rams from sinking into ground during separation.

5 Place jacks/rams on each side of pole directly under separating tools. Ensure jacks/rams are placed securely and cannot move during separation.

6 Form extensions from 4 in x 4 in (100 mm x 100 mm) timber and place one on each side of pole between jacks/rams and separating tools.

7 Wrap chain or strapping around jacking extensions and pole to secure them during separation.

8 Remove handhole cover and lubricate interior of pole using soap and water solution.

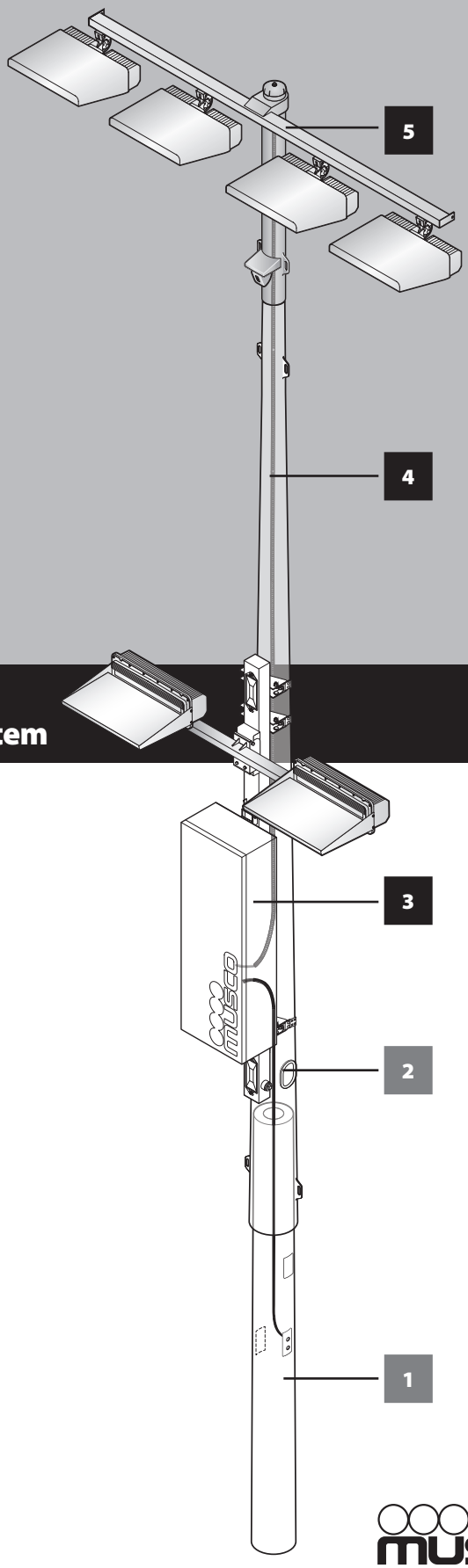
Warning
Separating force is high. Keep hands clear of apparatus when jacking.

9 Jack pole section from concrete base applying even pressure to each side of pole.

10 Tap on pole section using dead blow hammer. This vibration helps pole section separate from concrete base.

If base is equipped with integral ground, contact Musco for a replacement grounding tip. +1-800-825-6020

Once the pole and base are separated, refer to *Light-Structure Green Installation Instructions* to reset the pole.



Installation Instructions:
Light-Structure System™ Retrofit Lighting System

Upgrade to TLC for LED® with 5 Easy Pieces™ approach to system design

5 **Poletop Luminaire Assembly**

4 **Wire Harness**

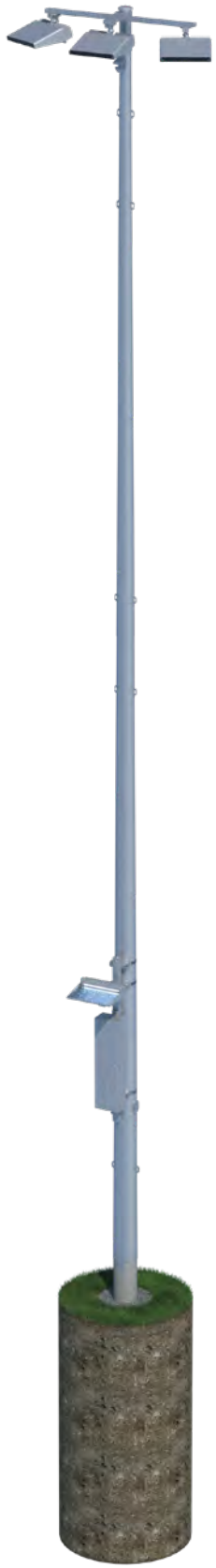
3 **Electrical Components Enclosure**

2 **Existing Galvanized Steel Pole**

1 **Existing Precast Concrete Base**

musco Lighting
We Make It Happen.

Table of Contents



Before You Begin

Safety Information

Electrical Safety Guidelines

Use extreme caution near overhead power lines or underground utilities. Observe all safety precautions for high-voltage equipment. Only qualified personnel may perform wiring. Follow all applicable building and electrical codes.

General Safety Guidelines

Follow proper safety procedures during installation. Installers must wear the appropriate personal protective equipment including:

- Hard hat
- Steel-toed shoes
- Leather work gloves
- Eye protection

Locate all underground utilities prior to digging.

All tools and equipment supplied by Musco are designed for specific use as described in these instructions. Do not use them in any other manner. Do not alter structural members in any way, such as bend, weld, or drill, without prior authorization from Musco.

Luminaires generate up to 2.6 mA per driver on the equipment grounding conductor and are designed to meet leakage current requirements per IEC 61347-1.

The luminaires should be positioned so that prolonged staring into the luminaire at a distance closer than 12–37 m (40–121 ft) is not expected, per IEC/TR 62778. See table.

Luminaire	Distance
TLC-LED-400	24 m (79 ft)
TLC-LED-550	24 m (79 ft)
TLC-BT-575	20 m (65 ft)
TLC-LED-600	24 m (79 ft)
TLC-LED-900	24 m (79 ft)
TLC-LED-1200	37 m (121 ft)
TLC-LED-1500	37 m (121 ft)

About These Instructions

These instructions give basic assembly procedures for the Light-Structure System retrofit. They are not a comprehensive guide to all possible situations. Direct any questions to your local Musco representative.

Throughout this manual note these important symbols:

The safety alert symbol alerts you of situations that require care and caution to avoid serious personal injury.

The tip symbol points out advice that makes installation easier.

The stop and check symbol signals you to stop and verify conditions before proceeding.

The recycle symbol identifies recyclable materials.

The contact Musco symbol appears in special situations where you may need to contact Musco for further information.

The go-to arrow indicates a branch in a procedure for special situations. In the case of optional equipment, the instructions may be in another document.

Before You Begin

Standard Tools/Supplies Checklist

Refer to supplemental instructions provided for additional tools required.

Contractor/installer supplied tools	Function	Page
Hammer, pry-bar, banding cutters	Unloading equipment	7
Ground resistance meter	Verifying existing lightning ground system	8
Angle grinder	Removal of poletop luminaire assembly	12
Dead blow mallet	Removal of poletop luminaire assembly	12
Two 1½ ton chain-type come-alongs	Jacking pole sections together	27
Large Phillips-head screwdriver	Tightening captive screws to seal enclosure to pole hub	11, 16
Standard screwdriver	Tightening distribution lugs, 45 A disconnect switch	10, 35
Torque wrench with ⅜, 7⁄16 and 9⁄16 in sockets	Tightening luminaire retaining cable and spreader bar hardware. Must cover a range of torque from 5 ft•lb to 40 ft•lb (6 N•m to 55 N•m)	17, 32
Torque wrench to cover the following ranges: 60 in•lb (6.8 N•m) to 120 in•lb (13.6 N•m) 16 ft•lb (21.7 N•m) to 40 ft•lb (54.2 N•m)	Proper torquing of fasteners	17 – 32
Electrical fish tape, electrician's tape	Feeding wire harness through pole	17
Spray paint, chalk, or flags	Marking points to sight in aiming	28
10 ft (3 m) stepladder or small line truck	Connecting supply wires to electrical enclosure	34, 35
Musco supplied tools	**Function**	**Page**
9⁄16 in wrench	Tightening poletop set screw, pole cap fastener, enclosure hanger bolt, and spreader bar hardware	11 – 32
1 1⁄16 in socket, extension, breaker bar, and 1 1⁄16 in wrench	Tightening structural fasteners	13, 31
7⁄16 in ratcheting combination wrench	Tightening captive bolts to secure luminaire assembly	26
5⁄32 in hex key	Attaching handhole covers on base and steel pole	33, 35
3⁄16 in hex key	Attaching grounding conductors inside electrical enclosure	35
5⁄16 in hex key	Attaching grounding conductors inside pole at handhole	35
5 mm hex key	Landing primary feed wires on 125 A disconnect switch	35
Dishwashing liquid (original Dawn®, ECOS® Pro, or DIAO™ brand)	Lubricating pole slip-fit connections	27
Machinery needed	**Function**	**Page**
Crane or forklift with nylon strapping and 8 ft (2.5 m) sling (sized to weight of poletop luminaire assembly)	Unloading materials, poletop assembly	7, 11 – 13, 21, 27
Manlift or bucket truck	Poletop setting and removal, enclosure setting and removal	7, 11 – 13, 21, 27
Load-rated crane, nylon slings, and shackles	Setting poletops	9 – 13, 21 – 23, 25 – 35

Documents You Need

- ❑ Musco *Pole Assembly Drawing*
- ❑ *Field Aiming Diagram*
- ❑ *Control System Summary*

If you do not have all of these documents, contact your local Musco representative.

Before You Begin

Electrical System Requirements

A qualified electrician must handle the electrical supply installation and hook-up in accordance with national, state, and local codes. Your electrician should review this information before installation begins.

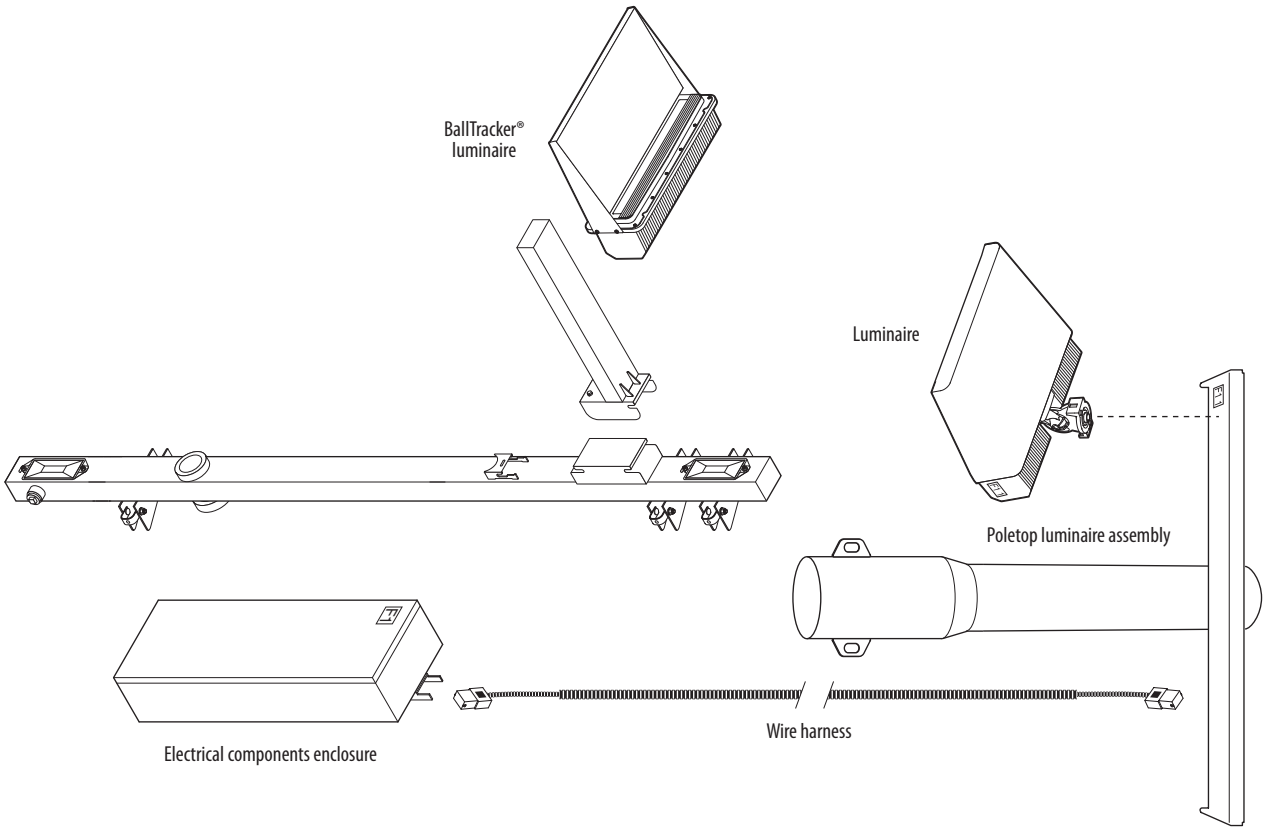
Ensure supply wiring is rated for 90°C. Review the label inside the electrical components enclosure door and *Control System Summary* for voltage and phase requirements.

Always dispose of electronic waste in accordance with all applicable laws and regulations.

Components Matching and Labeling

Pole locations are identified by a pole ID (A1, A2, B1, B2, etc.) on the *Field Aiming Diagram*. These IDs are also marked on the individual components:

- Poletop luminaire assemblies, bolt-on crossarms, and luminaire shipping cartons
- Wire harnesses
- Electrical components enclosures



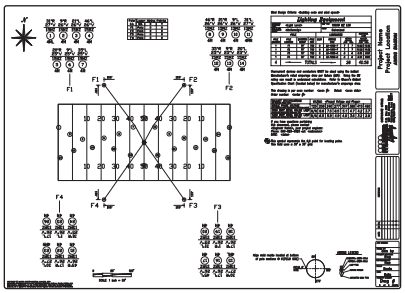
Before You Begin

Documents We Provide

Field Aiming Diagram

The *Field Aiming Diagram* is your map for locating all poles on your project. It gives this information:

- Pole IDs, locations, and heights
- Luminaire IDs
- Common aiming point for all poles, or individual aiming points for each pole
- Full load current for each luminaire



Control System Summary

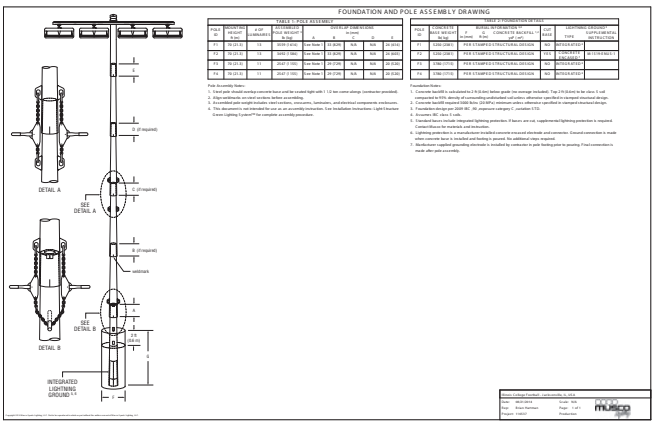
Projects with a control system include a *Control System Summary*. It gives this information:

- Control system diagram and details
- Contactors and cabinets
- Lighting circuits
- Voltage, phase, and frequency
- Full load current for each circuit

Musco Pole Assembly Drawing

This drawing provides information related to the installation of the poletop luminaire assembly.

- Poletop or crossarm weight
- Poletop luminaire assembly minimum overlaps



Before You Begin

Unloading Instructions

A typical shipment includes electrical components enclosures, wire harnesses, and poletop luminaire assemblies with luminaires.

For ease of installation, set all matched components by the proper pole location as noted on the *Field Aiming Diagram*.

Tools/Materials Needed

- ❑ Crane with nylon web sling or forklift (load rated)
- ❑ Hammer
- ❑ Pry bar
- ❑ Banding cutters

Warning
Crushing hazard.

Do not cut shipping bands or remove blocking from equipment until it is supported by unloading equipment.

- Check bill of lading to verify you have all materials.
- Inspect all materials for shipping damage.
- Store electrical components enclosures and luminaires in a dry location or cover with tarp until ready to install.

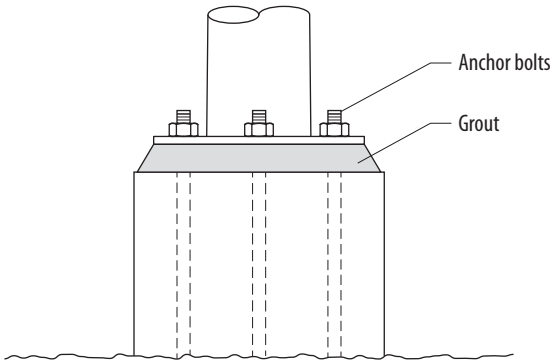
If additional information is needed, contact your local Musco representative.

Please recycle.
Luminaires, wire harnesses, and other components are shipped in recyclable cardboard packaging.

Before You Begin

Inspections

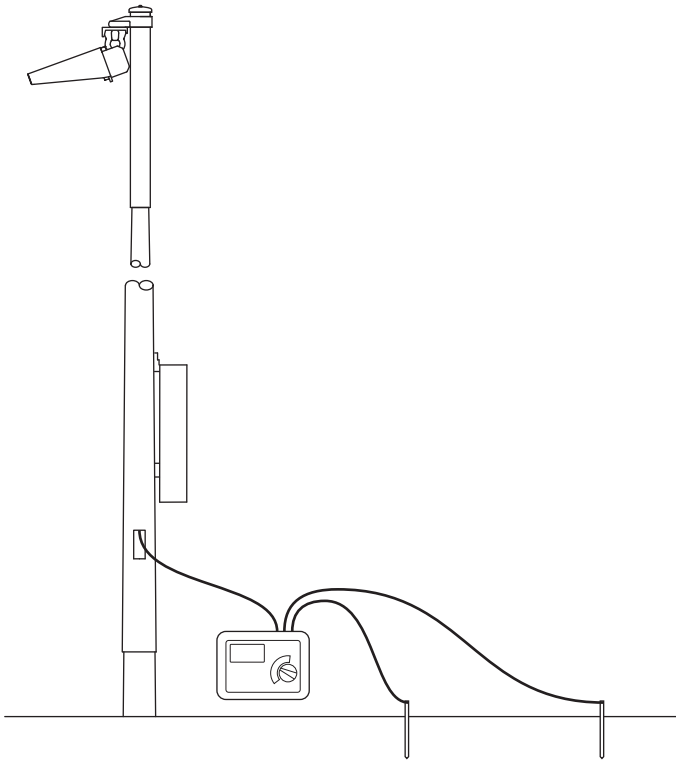
1 A qualified inspector must examine the base and pole sections for damage or prior field modifications.



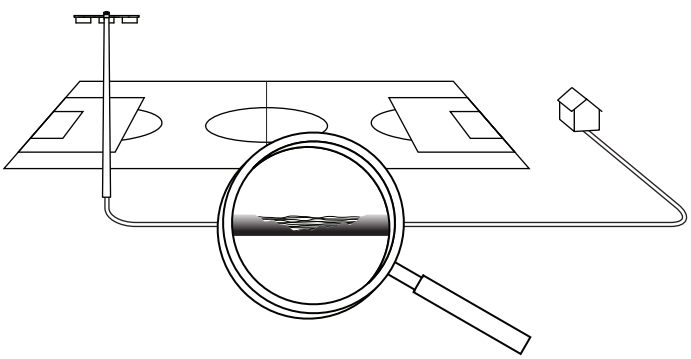
2 Repair grout on baseplate poles (if necessary).

3 If pole is equipped with an external ground rod, test earth ground connection of pole. If greater than 25 ohms, install additional ground rod and retest.

Repeat until < 25 ohms.



4 To the extent possible, inspect power supply wiring for good condition. Leakage current should not exceed 20 mA.



Notify your local Musco representative if concerns are identified with any of these items.

Disassembly

Overview

Remove the existing equipment to be replaced: electrical components enclosures, wire harness, and poletop luminaire assembly (or bolt-on crossarms).

Tools/Materials Needed

Musco Supplied (For bolt-on crossarms.)

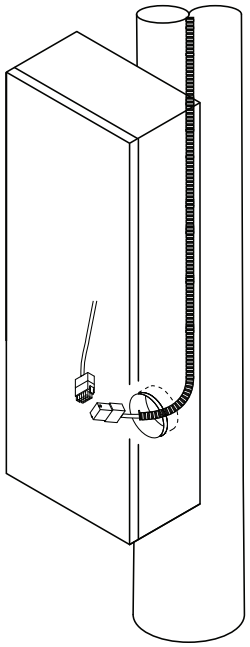
- ❑ 1 1/16 in socket, ¾ in drive
- ❑ Breaker bar, ¾ in drive
- ❑ 4 in extension, ¾ in drive
- ❑ 1 1/16 in wrench

Contractor Supplied

- ❑ 9/16 in wrench, 9/16 in socket and ratchet
- ❑ Angle grinder with metal cutting wheel
- ❑ Crane and slings to support poletop luminaire assembly
- ❑ Dead blow hammer
- ❑ Ratchet, ¾ in drive

Disassembly

1 In electrical components enclosure, disconnect pole harness from enclosure harness. Feed end of pole harness into pole interior. Cut off connector if necessary.

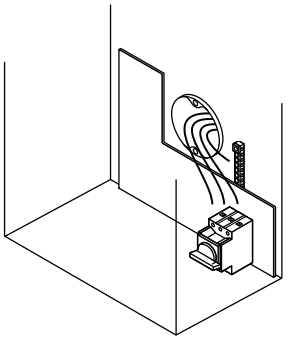


Warning

Risk of electrical shock

Ensure all circuits are disconnected before proceeding

2 Disconnect electrical supply wiring and equipment grounding conductor.



3 Remove wire harnesses between top, middle, and bottom boxes.

4 Remove wiring between stacks.

Disassembly

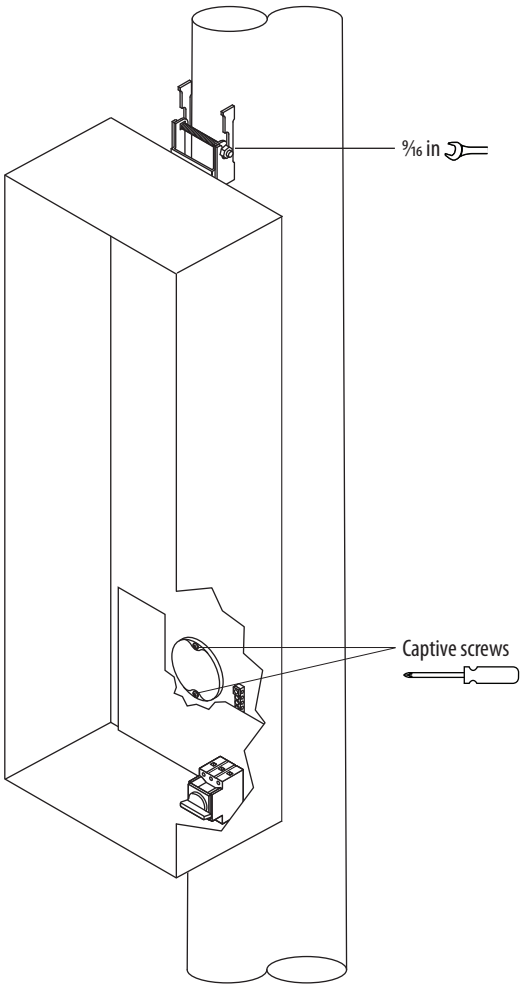
5 Using 9⁄16 in wrench and Phillips screwdriver, loosen enclosure hanger bolts, and captive hub screws.

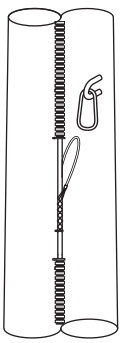
6 Using a crane and sling, remove enclosures from the stack, starting at the top.

Caution

Electrical components enclosures are heavy.

Enclosures may weigh up to 225 lb (102 kg). Lift with caution.





7 Disconnect middle wire support grip on poles greater than 80 ft (24.5 m).

Leave the pole harness connected to the poletop luminaire assembly. It will pull out as the poletop is removed.

Disassembly

8 Determine if entire poletop luminaire assembly (welded crossarms) or crossarms only (bolted crossarms) will be replaced.

If replacing bolt-on crossarms, skip to *Bolt-on Crossarm Removal*.

9 Using 9⁄16 in wrench, loosen set screw.

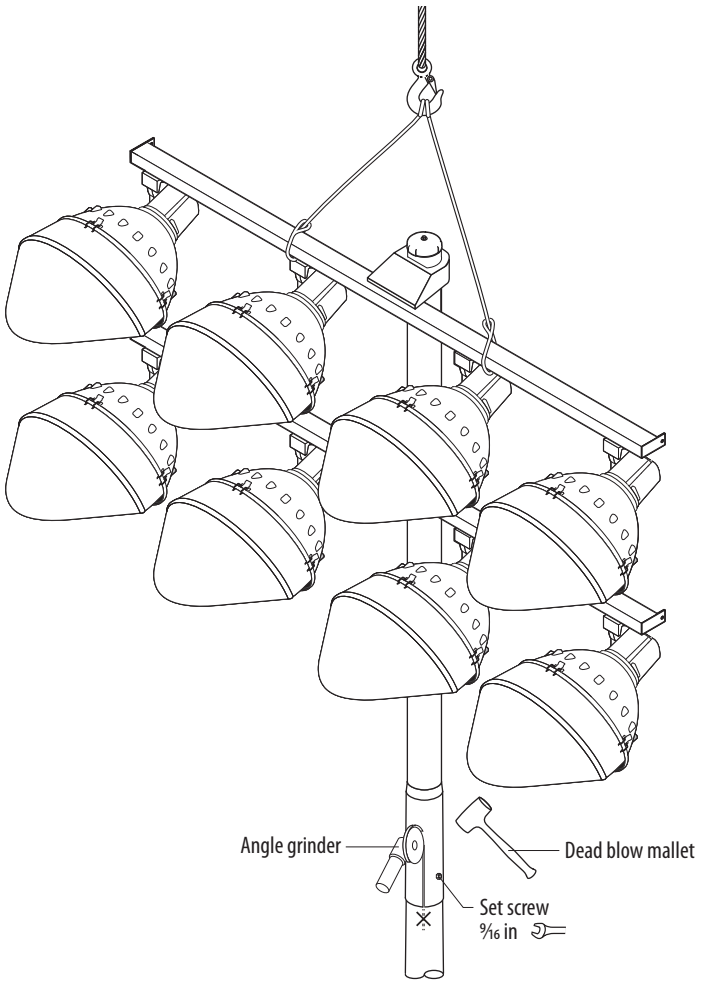
10 Use crane to sling around the top crossarm and provide a slight separating force to the poletop.

Warning
Crushing hazard.

Do not attempt to "pop off" the poletop using the crane only as the high separating forces can cause an uncontrolled separation and potential injury.

11 Use an angle grinder to make a relief cut in the overlap area of the poletop luminaire assembly. Do not damage the pole section underneath the poletop.

12 Tap on the poletop with a dead blow mallet until it begins to move and separate.

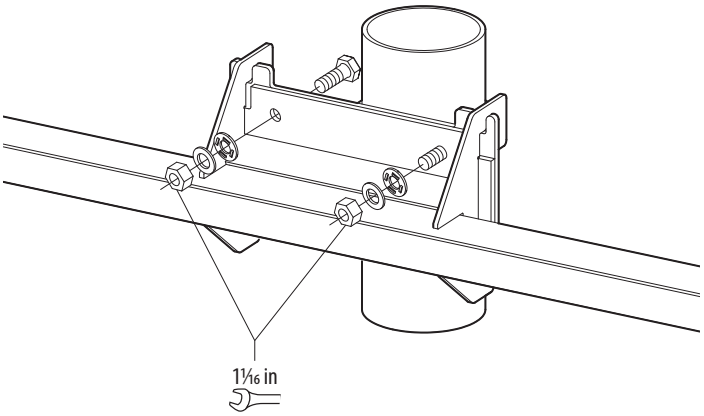


Disassembly

Bolt-On Crossarm Removal

1 Use crane and sling to support crossarm.

2 Use supplied breaker bar, 1 1/16 in socket, extension, and wrench to remove crossarm retaining bolts.



Electrical Components Enclosure and BallTracker® Luminaire

Overview

The electrical components enclosure is factory-wired and tested. It contains essential electrical components of the lighting system in an accessible location.

Tools/Materials Needed

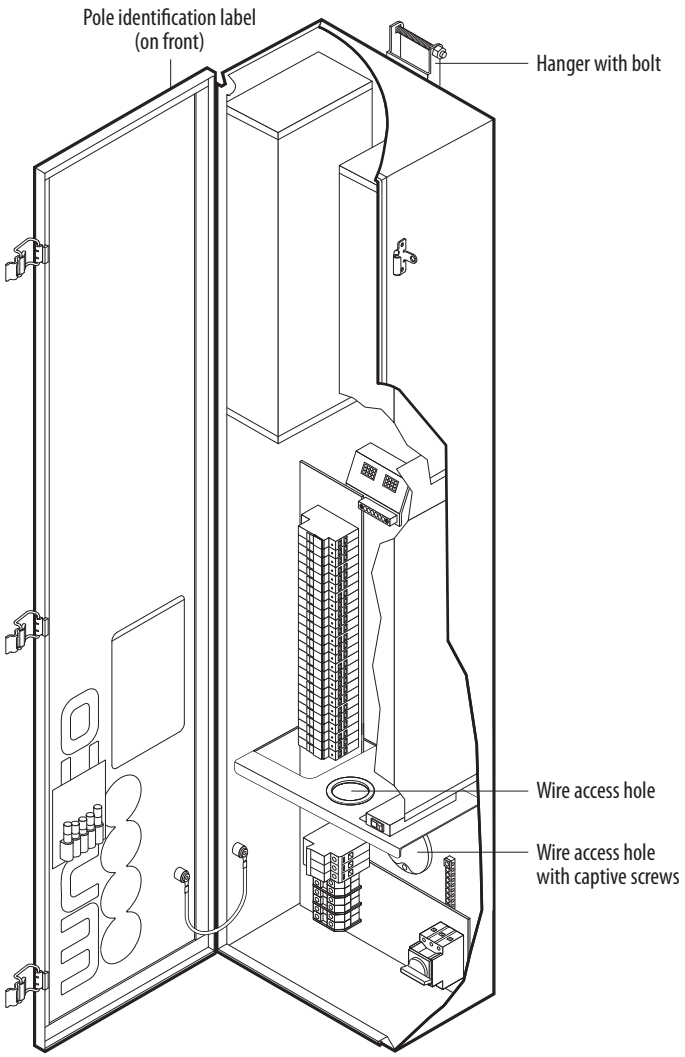
Musco Supplied

- ❑ ½ and 9⁄16 in offset combination wrenches
- ❑ Snips
- ❑ *Field Aiming Diagram*

Contractor Supplied

- ❑ Torque wrench with ½ and 9⁄16 in sockets
- ❑ Large Phillips-head screwdriver
- ❑ Measuring tape
- ❑ Marker
- ❑ 10 ft (3 m) stepladder or small line truck

Consult project documents to determine if your enclosures will mount on existing hangers or if new mounting bracket has been provided.



Electrical Components Enclosure and BallTracker® Luminaire

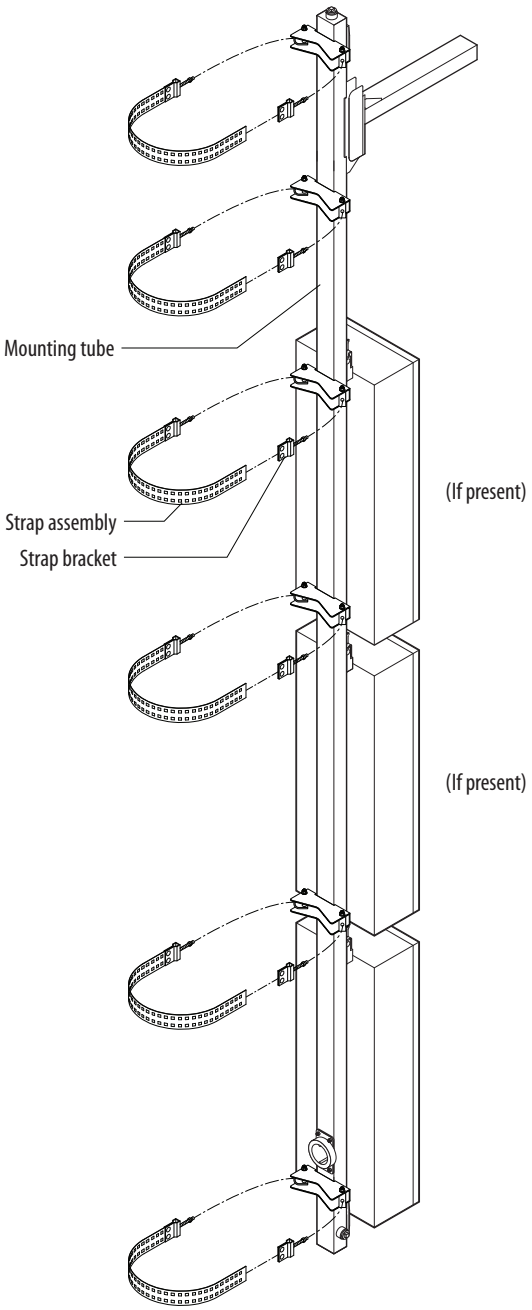
Round Pole Strap Selection

Diameter	Round Pole Strap Length
0 – 17 in (0 – 432 mm)	45 in (1143 mm)
17.01 – 22 in (432 – 559 mm)	60 in (1524 mm)
22.01 – 28 in (559 – 711 mm)	78 in (1981 mm)
28.01 – 34 in (711 – 864 mm)	96 in (2438 mm)
34.01 – 40 in (864 – 1016 mm)	114 in (2896 mm)
40.01 – 46 in (1016 – 1168 mm)	132 in (3353 mm)

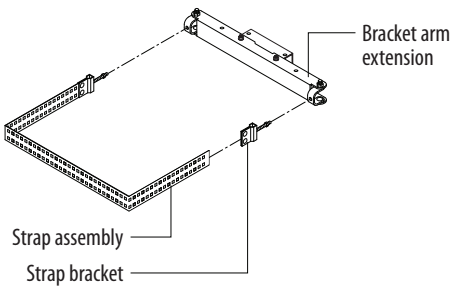
Square Pole Strap and Bracket Selection

Width	Strap Length	Bracket Arm Extension Width
0 – 12 in (0 – 304 mm)	45 in (1143 mm)	14 in (356 mm)
12.01 – 16 in (304 – 406 mm)	60 in (1524 mm)	18.5 in (470 mm)
16.01 – 20 in (406 – 508 mm)	78 in (1981 mm)	22.5 in (572 mm)
20.01 – 24 in (508 – 610 mm)	96 in (2438 mm)	26.5 in (673 mm)
24.01 – 28 in (610 – 711 mm)	114 in (2896 mm)	30.5 in (775 mm)

Mounting tubes are marked with pole ID. One strap assembly and one strap bracket required per mounting arm (as shown).



Round pole option (shown)



Option for square pole

Electrical Components Enclosure and BallTracker® Luminaire

Verify pole ID on electrical components enclosure matches pole location on *Field Aiming Diagram*.

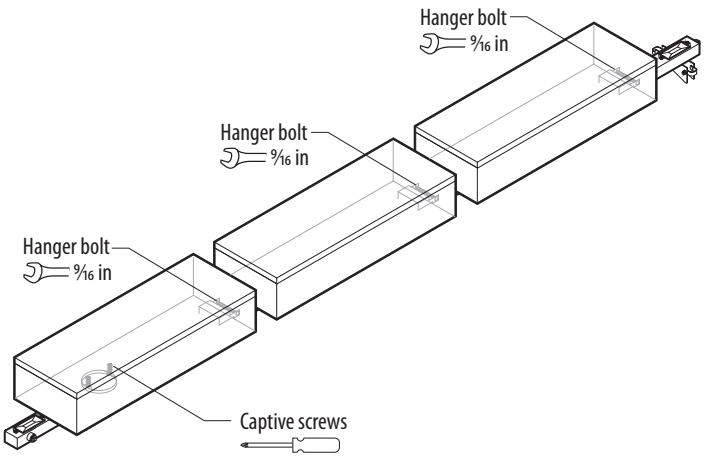
Assembly Procedure

Caution
Electrical components enclosures are heavy.

Electrical components enclosure may weigh up to 65 lb (30 kg). Lift carefully with two people to avoid injury.

1 Mount bottom enclosure on tube. Align wire access hole with hub. Tighten captive screw using Phillips-head screwdriver. Tighten hanger bolt with 9⁄16 in wrench.

2 Mount middle and/or top enclosures. Align access hole with hub and slide box onto hanger bracket. Tighten hanger bolt with 9⁄16 in wrench.



Electrical Components Enclosure and BallTracker® Luminaire

3 If pole includes a BallTracker® luminaire, attach bracket using ¾ in socket and torque wrench. Tighten captive bolts to 40 ft•lb (54 N•m).

4 Position crossarm near poletop, and feed crossarm wire harness through hole in center of poletop plate.

Route crossarm wire harness to upper handhole for connection to pole harness.

Ensure crossarm wire harness is not pinched between mating plates.

5 Attach luminaire using 7⁄16 in wrench. Tighten captive screws until fully tight. Do not exceed 20 ft•lb (27 N•m).

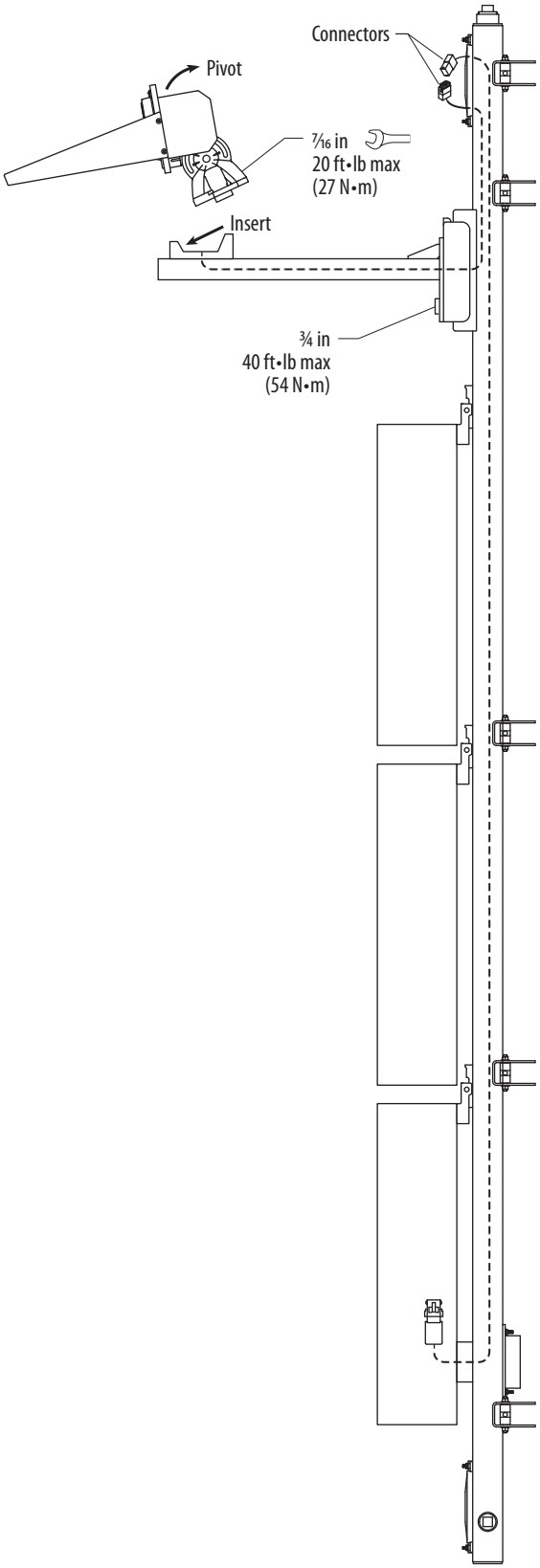
6 Pull BallTracker® wire harness through tube.

Feed bottom of harness into enclosure hub.

7 Fish all pole wire harnesses between poletop and appropriate electrical components enclosure(s). Use handholes to access tube and aid in routing pole harness. Ensure protective sleeve extends through access hub and tuck harnesses behind subpanel.

8 Attach support grips at top handhole.

9 Mate quick-connectors at poletop and inside electrical components enclosure(s). Match driver/luminaire IDs.

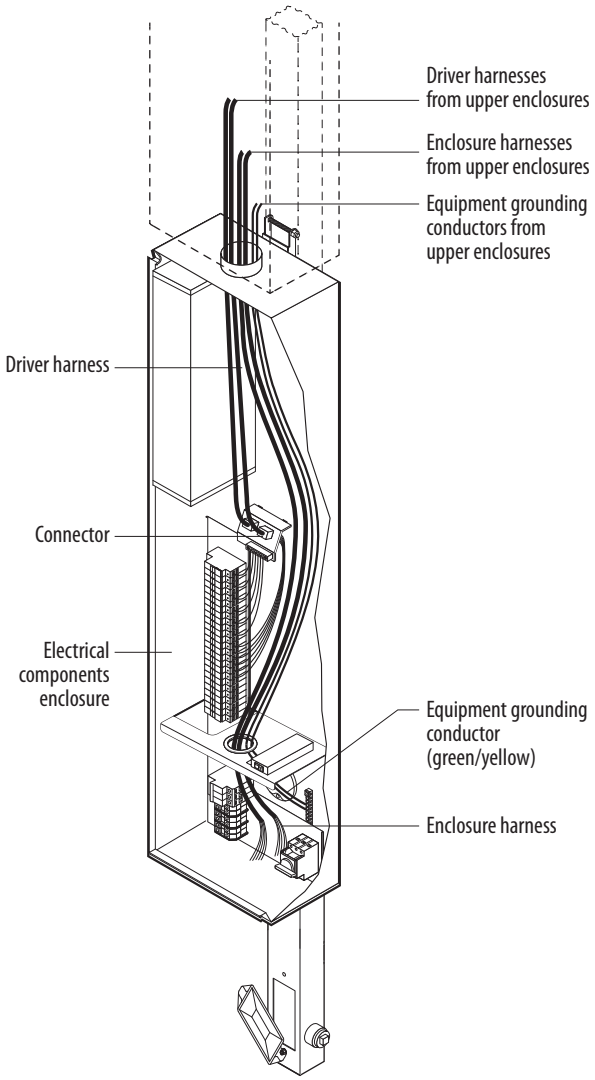


Electrical Components Enclosure and BallTracker® Luminaire

Only qualified personnel may perform wiring. Route wires as shown, but leave the final connections for your electrician.

10 Route driver harnesses from top and middle enclosures to bottom enclosure and plug into connector mounted in bracket.

11 Route equipment grounding conductor and enclosure harnesses from top and middle enclosures to bottom enclosure.

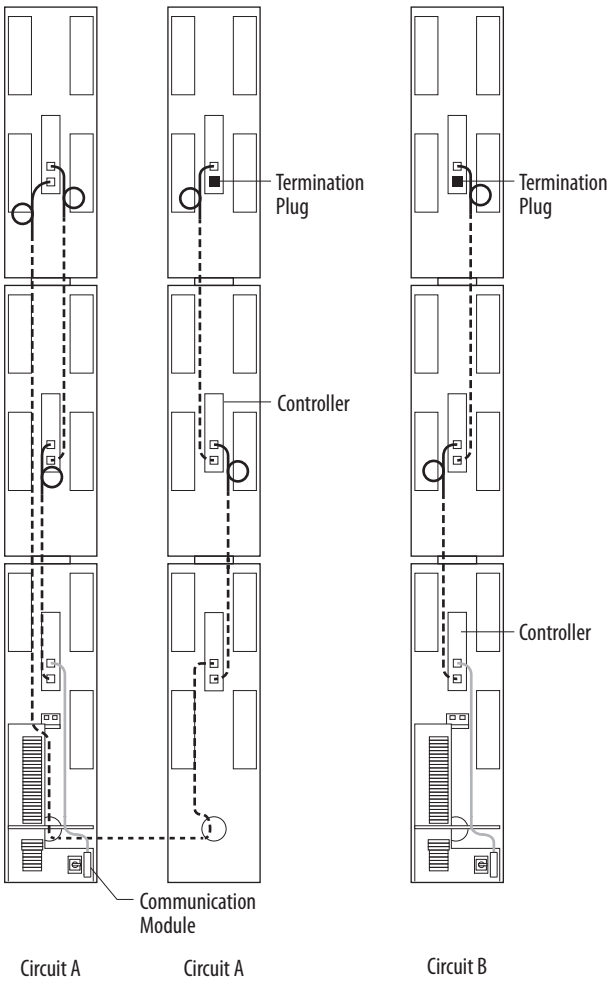


Electrical Components Enclosure and BallTracker® Luminaire

Skip Step 9–10 if controller not present

12 Pull communication cables down from top and middle boxes and plug into controller in enclosure below as shown.

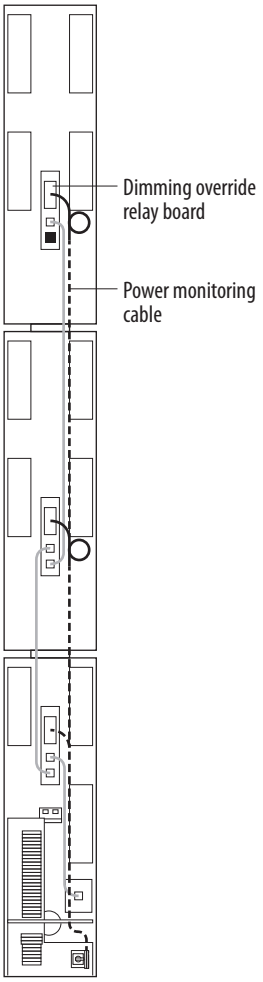
Connections between stacks must be done after stacks are mounted on the pole.



Electrical Components Enclosure and BallTracker® Luminaire

Skip Step 10 if emergency egress lighting dimming override relay board is not present.

13 Pull power monitoring cable from dimming override relay board in top and middle enclosures down to bottom enclosure and land black wire on terminal block M1 and blue/white wire on terminal block M2.



Emergency Circuit

Electrical Components Enclosure and BallTracker® Luminaire

Installation Procedure

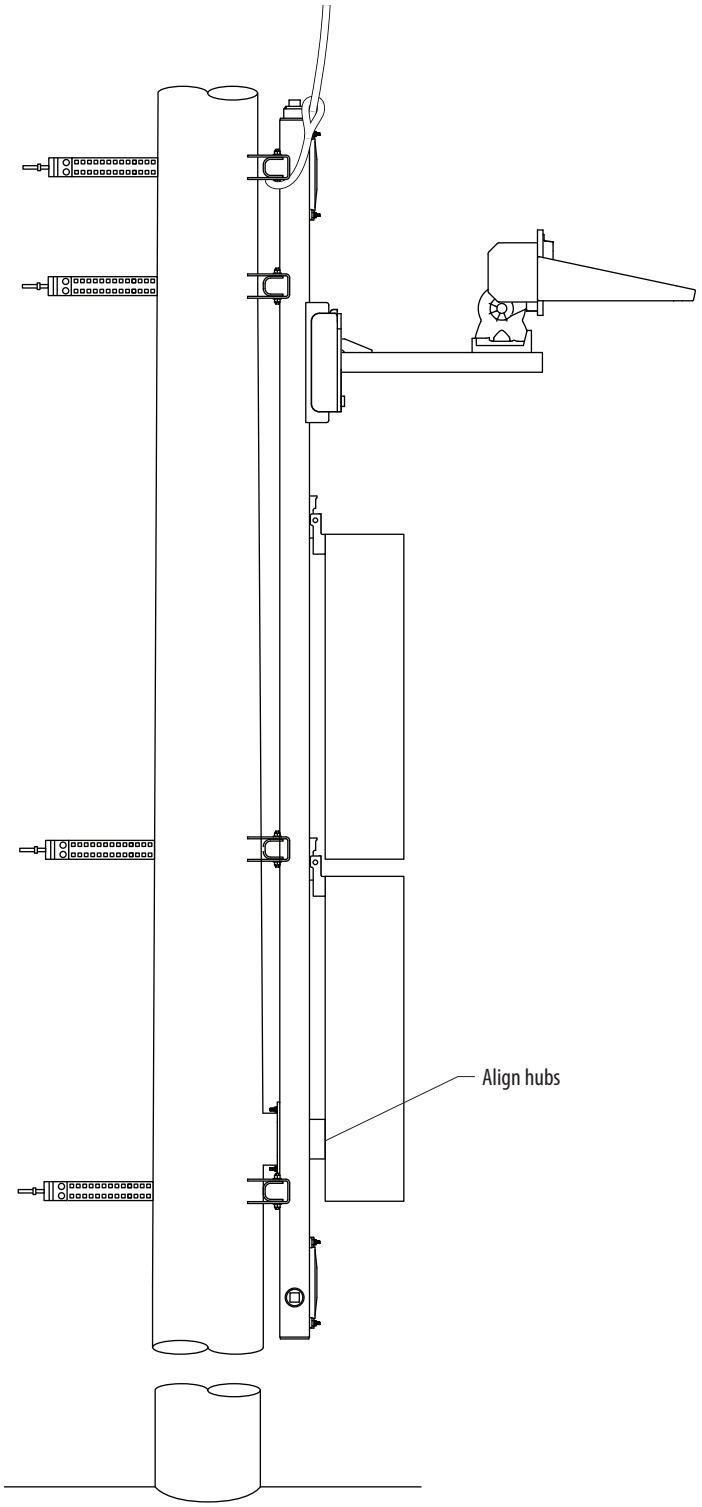
- ☑ Verify pole ID on electrical components enclosure matches pole location on *Field Aiming Diagram*.

1. Sling enclosure stack under the welded arm for strapping connections (not under the BallTracker luminaire crossarm) and lift enclosure stack.

2. Align hub on tube with pole hub.

- ☑ Enclosure stacks that are not mounted on a pole hub will include cover plates for tube opening. Ensure these plates are installed.

- ☑ BallTracker® luminaires should face the field. If pole hub does not face the field, contact your Project Engineer or local Musco representative.



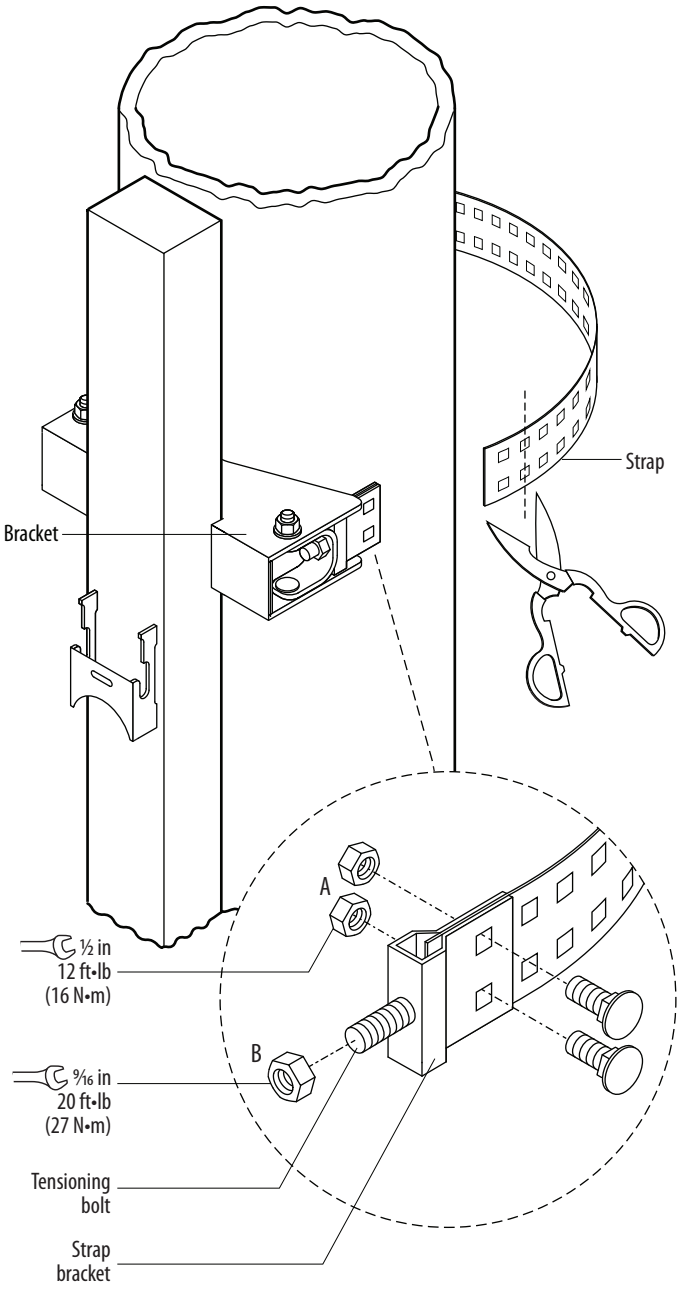
Electrical Components Enclosure and BallTracker® Luminaire

3 Cut straps to required length. Pull tight around pole and trim excess within 1 in (25 mm) of strap bracket. Cut across square holes, not between them.

4 Attach brackets to pole. Torque 5⁄16 in strap bracket hardware A to 12 ft•lb (16 N•m) using ½ in socket and torque wrench. Torque all ⅜ in tensioning nuts B to 20 ft•lb (27 N•m) using 9⁄16 in socket and torque wrench.

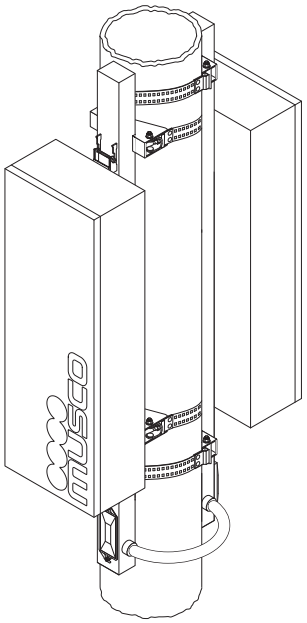
Caution
Falling equipment hazard
Ensure you meet torque values specified on all tensioning hardware.

If tensioning bolt is fully seated and strap is not yet tight, trim strap at next set of holes and repeat step 4.



Electrical Components Enclosure and BallTracker® Luminaire

5 Repeat steps 3 and 4 for back-to-back or multiple stacks.



6 Use 1¼ in hubs provided to run flex conduit between electrical component enclosure stacks.

Luminaire Attachment

Overview

Luminaires are factory built and shipped in individual cartons. They are aimed in the factory and ready for installation. Do not disassemble knuckle.

Tools/Materials Needed

Musco Supplied
- ❑ 7⁄16 in ratcheting combination wrench

Contractor Supplied:
- ❑ Torque wrench with 7⁄16 in socket

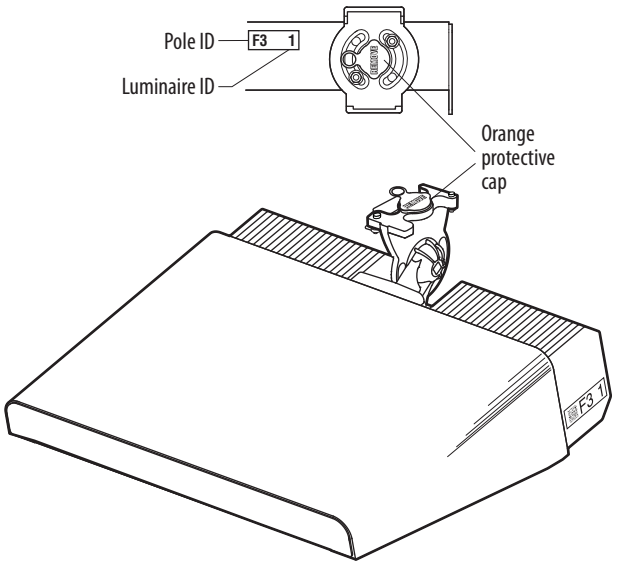
Leave luminaires in box until ready to assemble. Keep protective cover on luminaire until ready to set pole. Do not leave luminaires unassembled from crossarm in wet conditions.

Assembly Procedure

Verify pole ID on luminaire cartons matches pole and location on *Field Aiming Diagram*.

1 Remove and discard orange protective caps from luminaire knuckle and mounting plate that cover electrical connections. Do not remove orange tag around captive bolts.

Note: The luminaire style may vary from what is shown.



Warning

Rotation may be required to assemble all luminaires onto the poletop luminaire assembly. Do not stand under poletop when lifting. Steady with two people holding crossarms. Allow for poletop to safely rotate around when it is high enough for crossarms to clear the ground.

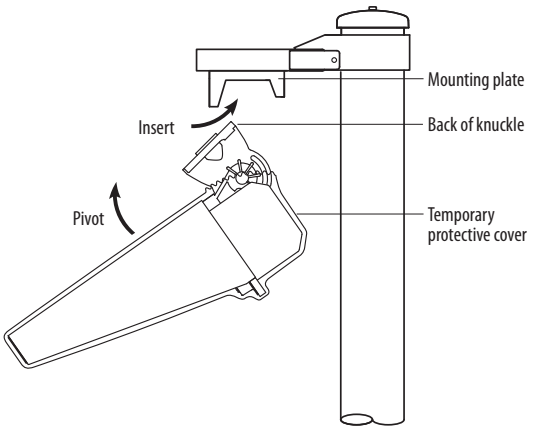
Caution

Equipment Damage

Properly support poletop to ensure luminaires do not get damaged.

Luminaire Attachment

2 Match luminaire ID to crossarm and install luminaire onto mounting plate. Insert back of knuckle into mounting plate and pivot into position.



Note: The luminaire style may vary from what is shown.

Luminaire	Weight
TLC-LED-400	40 lb (18 kg)
TLC-LED-550	25 lb (11 kg)
TLC-BT-575	34 lb (15 kg)
TLC-LED-600	40 lb (18 kg)
TLC-LED-900	40 lb (18 kg)
TLC-LED-1200	45 lb (20 kg)
TLC-LED-1500	67 lb (30 kg)
TLC-RGB-U	20 lb (9 kg)
TLC-RGBW	40 lb (18 kg)

Caution

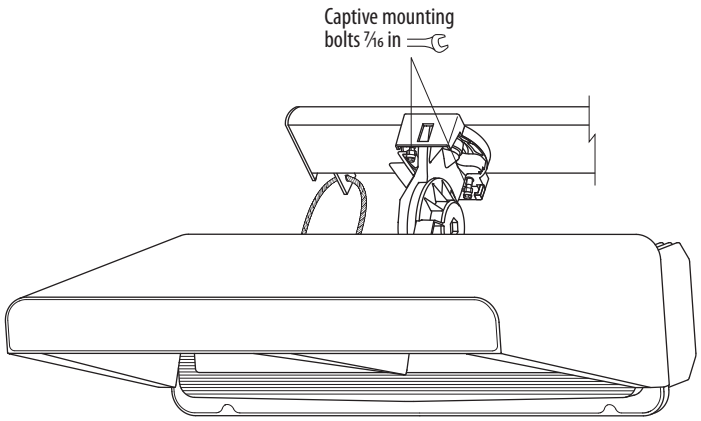
Luminaire may be heavy. Lift carefully with two people to avoid injury.

Luminaire Attachment

3 Tighten captive mounting bolts. Orange tag will break loose before all bolts are fully tight - continue tightening. Torque must not exceed 20 ft•lb (27 N•m). To avoid overtightening, use provided 7⁄16 in combination wrench.

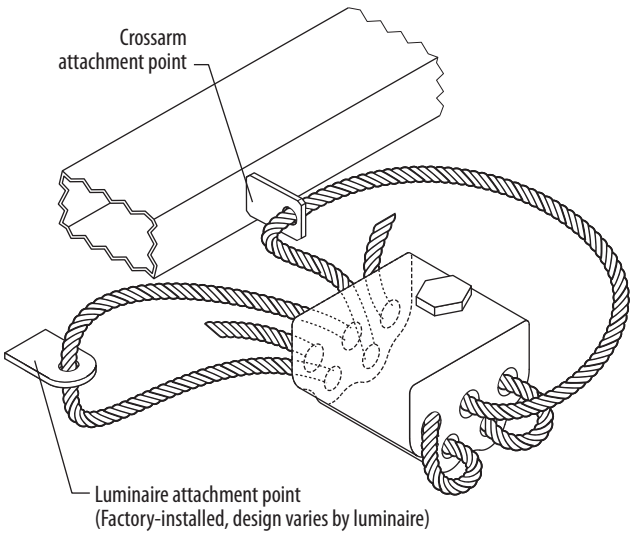
Warning
Luminaire may fall if bolts are not tight.

Do not remove tag before tightening bolts.



4 Attach luminaire retaining cable (if present). Route luminaire cable through crossarm anchor point, through luminaire block, and back through the block under the set screw. Luminaire attachment point will vary per luminaire design.

5 Using 7⁄16 in socket and torque wrench, tighten cable set screw to 60 in•lb (6.8 N•m).



Poletop Luminaire Assembly

Overview

The galvanized steel pole and poletop luminaire assembly are designed to slip-fit together. Jacking ears on pole section and poletop assembly provide attachment points to pull sections together. The Musco *Pole Assembly Drawing* gives minimum overlap specifications for each poletop luminaire assembly.

Tools/Materials Needed

Musco Supplied
- ❑ Musco *Pole Assembly Drawing*
- ❑ 9/16 in wrench
- ❑ Dishwashing liquid (original Dawn®, ECOS® Pro, or DIAO™ brand)

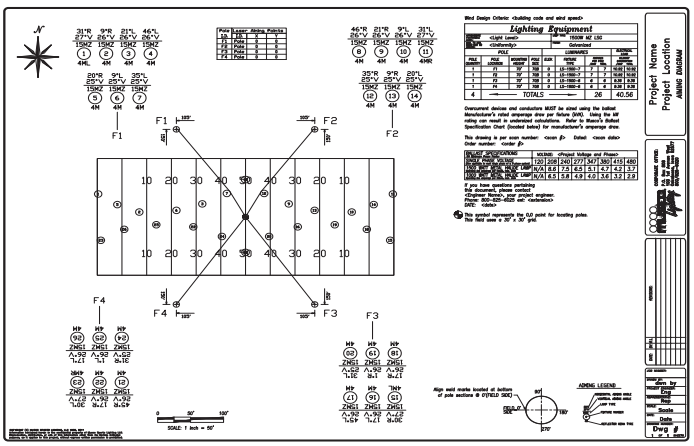
Contractor Supplied
- ❑ Two 1½ ton chain come-alongs

If pole utilizes bolt-on bars, skip to next section. See Musco *Pole Assembly Drawing*.

Assembly Procedure

Verify pole ID on each poletop luminaire assembly matches pole location on *Field Aiming Diagram*. Pole ID is labeled on crossarm.

1 Plot and mark aiming point(s) on field. Refer to *Field Aiming Diagram*.



Poletop Luminaire Assembly

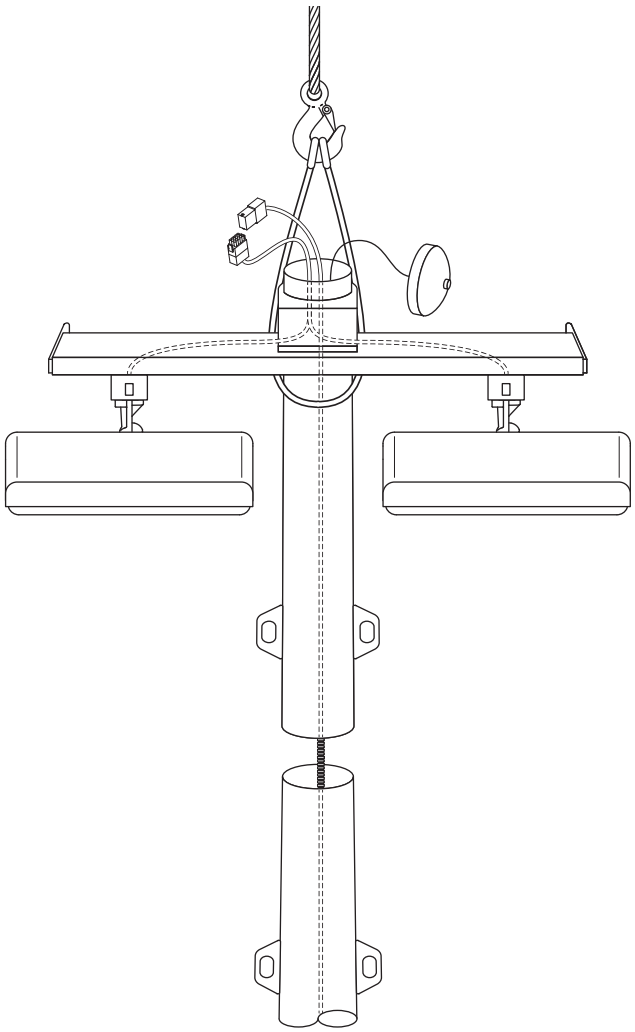
2 Turn on pole alignment beam.

3 Hook pole harness wire support grip to the poletop luminaire assembly u-hook and bundle the pole harness to the bottom crossarm.

4 Lubricate top of steel pole section with supplied dishwashing liquid.

5 Sling and lift poletop luminaire assembly into place.

6 Carefully lower the pole harness(es) down into the pole. The attached cable support hook will prevent the pole harness from dropping.

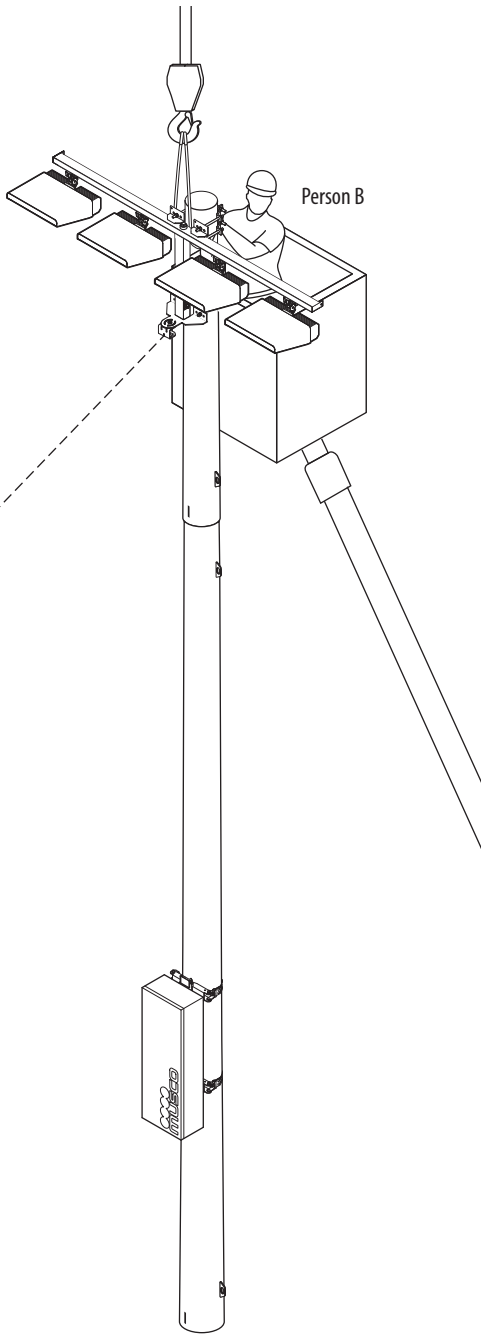


Poletop Luminaire Assembly

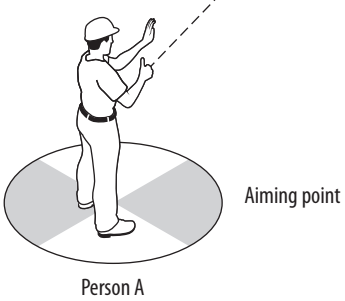
7 Aim luminaire assembly using alignment beam. Device projects a narrow vertical beam of light that is only visible when you are aligned with it. This step requires two people.

Person A: Stand on field aiming point and look at pole alignment device. It is attached to a luminaire. Walk parallel to crossarms until you see beam. Signal person B to rotate luminaire assembly left or right until beam aligns with aiming point. Beam may be visible, however when pole is aligned, you will see a bright flash as you stand directly on aiming point.

Person B: Following direction from person A, rotate luminaire assembly left or right until it is aligned.



Warning
Falling material hazard
If erecting pole with luminaire assembly attached, do not attach rigging to luminaire assembly. Follow pole supplier instructions for lifting.



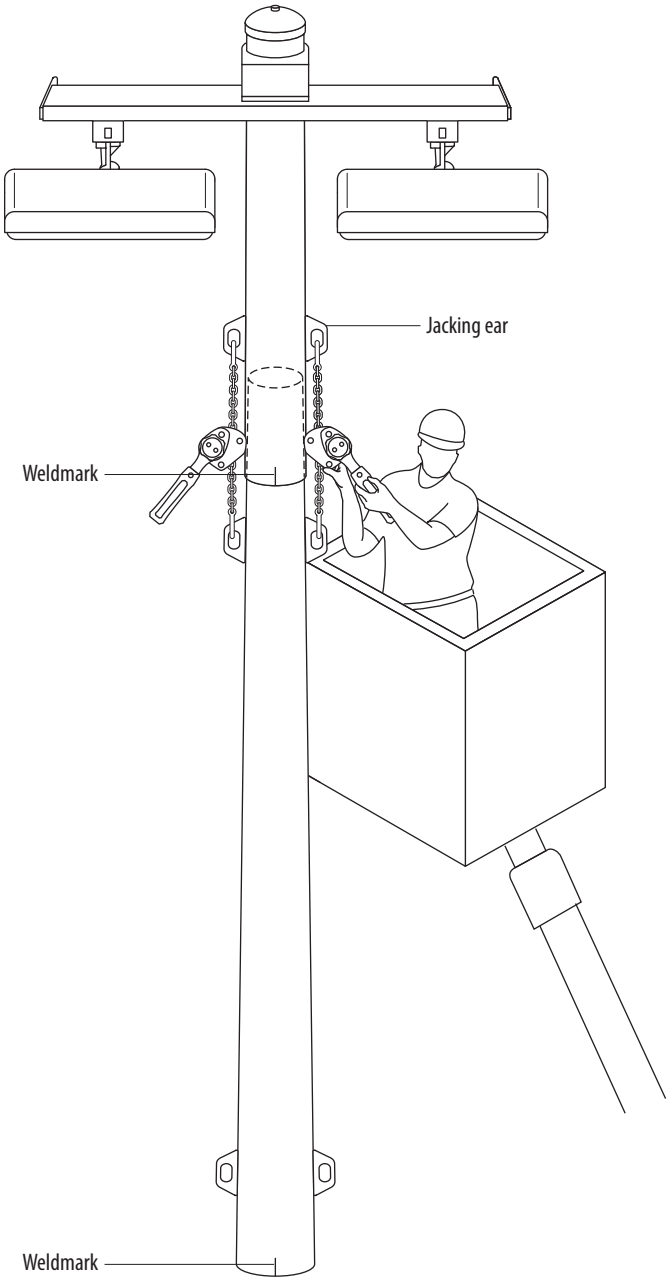
Warning
Laser radiation hazard
Pole alignment beam is safe for viewing at a distance of three feet (one meter) or more. Do not look into beam from closer than three feet (one meter). Do not use binoculars, camera, or telescope to view beam from any distance. Locator beam is a class 2M laser device. Wavelength: 635-660 nm, Laser power for classification: <1 mW continuous, divergence: <1.5 mrad x 1 rad. Using alignment beam in a manner other than as described here may result in hazardous exposure. Do not modify, dismantle, or attempt to repair.

Poletop Luminaire Assembly

8 Using two 1½ ton come-alongs, pull poletop luminaire assembly onto pole evenly until tight. Ensure minimum overlap per Musco *Pole Assembly Drawing*.

Ensure alignment is maintained while tightening.

9 Tighten set screw using 9⁄16 in wrench.



Bolt-on Crossarms

Overview

Bolt-on bar style may vary from what is shown. Replacement procedure is identical.

Tools/Materials Needed

Musco Supplied:

- ❑ ¾ in drive 1⅛ in socket
- ❑ ¾ in drive breaker bar
- ❑ ¾ in drive 4 in extension
- ❑ 1⅛ in wrench
- ❑ Spreader bars
- ❑ ⅜ in fasteners (for spreader bars)
- ❑ ⅝ in structural fasteners
- ❑ ⅝ in wrench

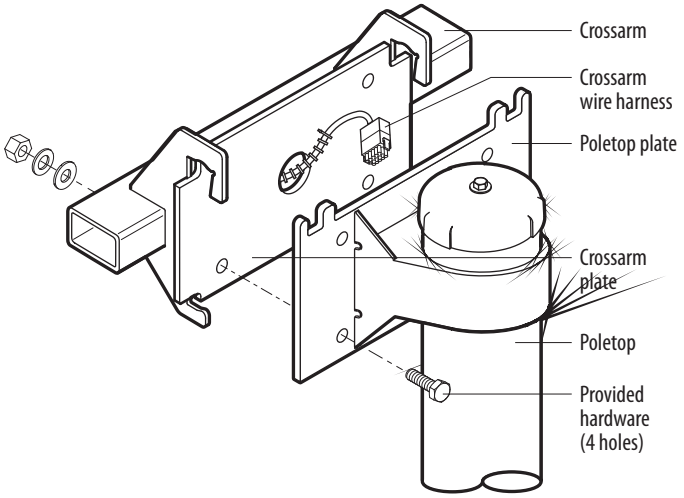
Contractor Supplied:

- ❑ Torque wrench with ⅝ in socket

Assembly Procedure

Verify pole ID on crossarm matches ID of pole.

Note: Each crossarm is factory assembled for a specific position on poletop section to ensure correct aiming. Top side of crossarm is labeled with crossarm's position number. Example: Position 1 is installed on first position from top of poletop section.



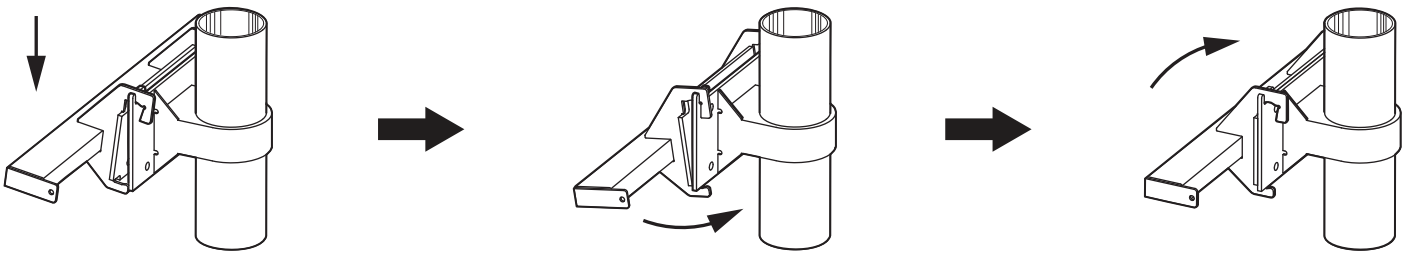
1 Position crossarm near poletop, and feed crossarm wire harness through hole in center of poletop plate.

Route wire harness for crossarms 1–3 to top of pole.

Route wire harness for crossarms 4–7 to handhole below crossarm position 5.

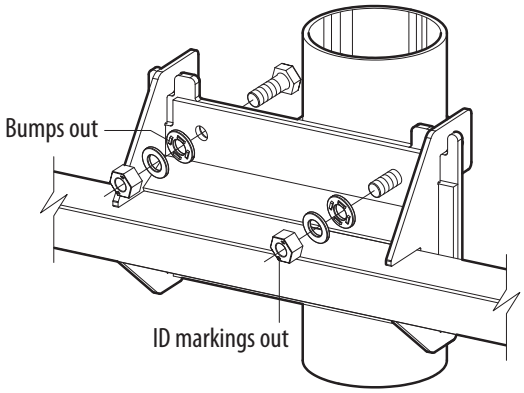
2 Position crossarm as shown below.

Ensure crossarm wire harness is not pinched between mating plates.

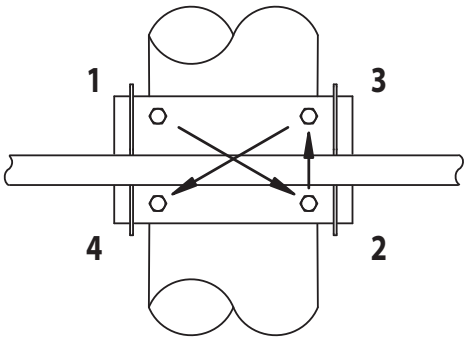


Bolt-on Crossarms

3 Install bolts through plates with threads away from pole. Place direct tension indicating (DTI) washer next, with flat surface (orange material) against plate, and bumps facing out toward nut. Place flat washer next, followed by nut. Small ID markings on nut must face out to allow proper identification of nut.



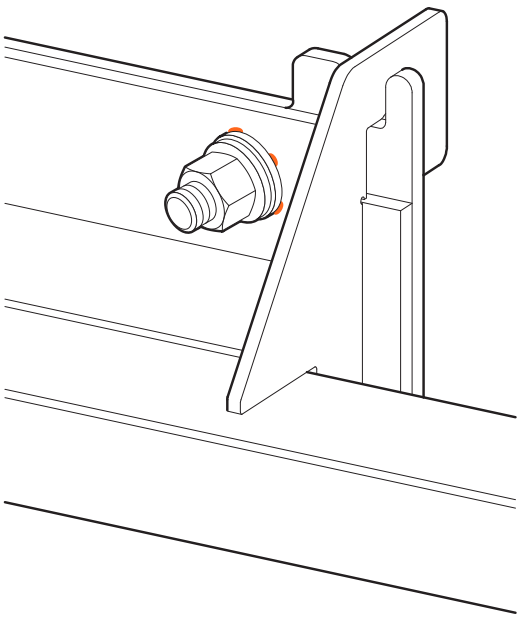
4 Snug all nuts. Using supplied 1 1/16 in wrench, tighten each nut until plates are in firm contact. Follow tightening sequence shown.



5 Using supplied breaker bar, 1 1/16 in socket, extension, and wrench, tighten each nut until orange extrusion appears from at least three bumps.

6 Repeat steps 1–5 for remaining crossarms.

Do not reuse structural fasteners. Discard if removed or loosened after tightening.

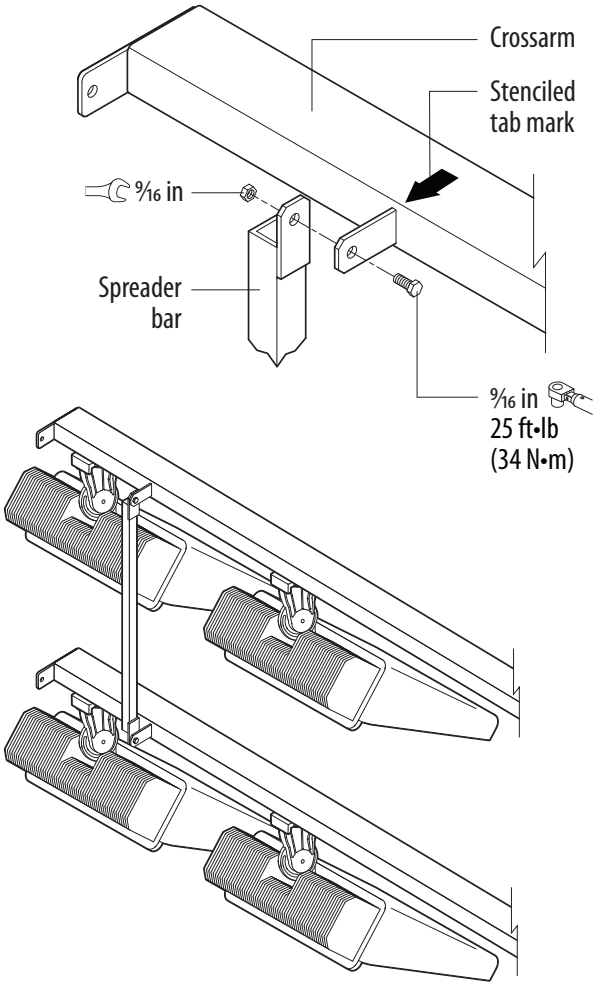


Bolt-on Crossarms

Refer to the Musco *Field Aiming Diagram* to determine if a pole requires spreader bars. If so, spreader bars are bundled together and marked with the pole ID. Additionally, the pole crossarms are stenciled indicating which tabs to use. Crossarms are joined in groups of two or three with the greatest grouping on top; do not form other groupings.

7 Install spreader bars with ⅜ in fasteners at the locations marked on each crossarm. Torque to 25 ft•lb (34 N•m).

Spreader bars may come in two sizes, 30½ in (775 mm) and 60 in (1524 mm). Always install longer bars to upper three crossarms.



Wire Harness

Overview

Tools/Materials Needed

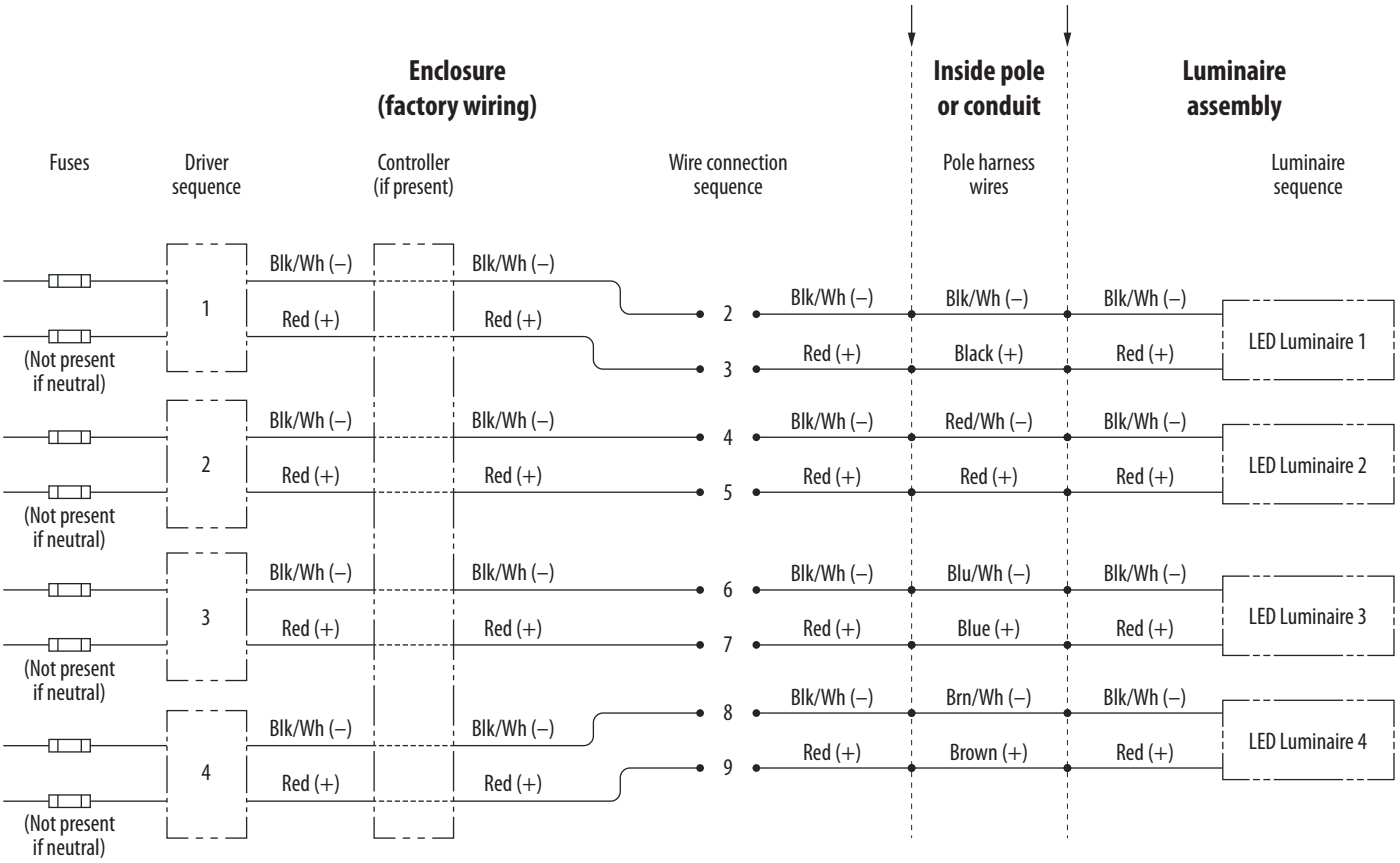
Musco Supplied

- ❑ 5⁄32 in hex key
- ❑ 9⁄16 in wrench

Contractor Supplied

- ❑ Fish tape
- ❑ Electrician's tape

The factory-built wire harness connects the electrical components enclosure to the poletop luminaire assembly.



Notes:

1. Pole harness wire color indicated if provided by Musco.
2. Enclosure factory wiring may be different than shown above. One pair of wires per luminaire is required in pole harness.

Wire Harness

Assembly Procedure

Verify pole ID on wire harness matches pole location on *Field Aiming Diagram*.

1 Remove handhole covers using 5⁄32 in hex key. Remove polecap using 9⁄16 in wrench.

2 Fish all pole wire harnesses between poletop and appropriate electrical components enclosure(s). Use lower handhole to access enclosure hubs. Ensure protective sleeve extends through access hub and tuck harnesses behind subpanel.

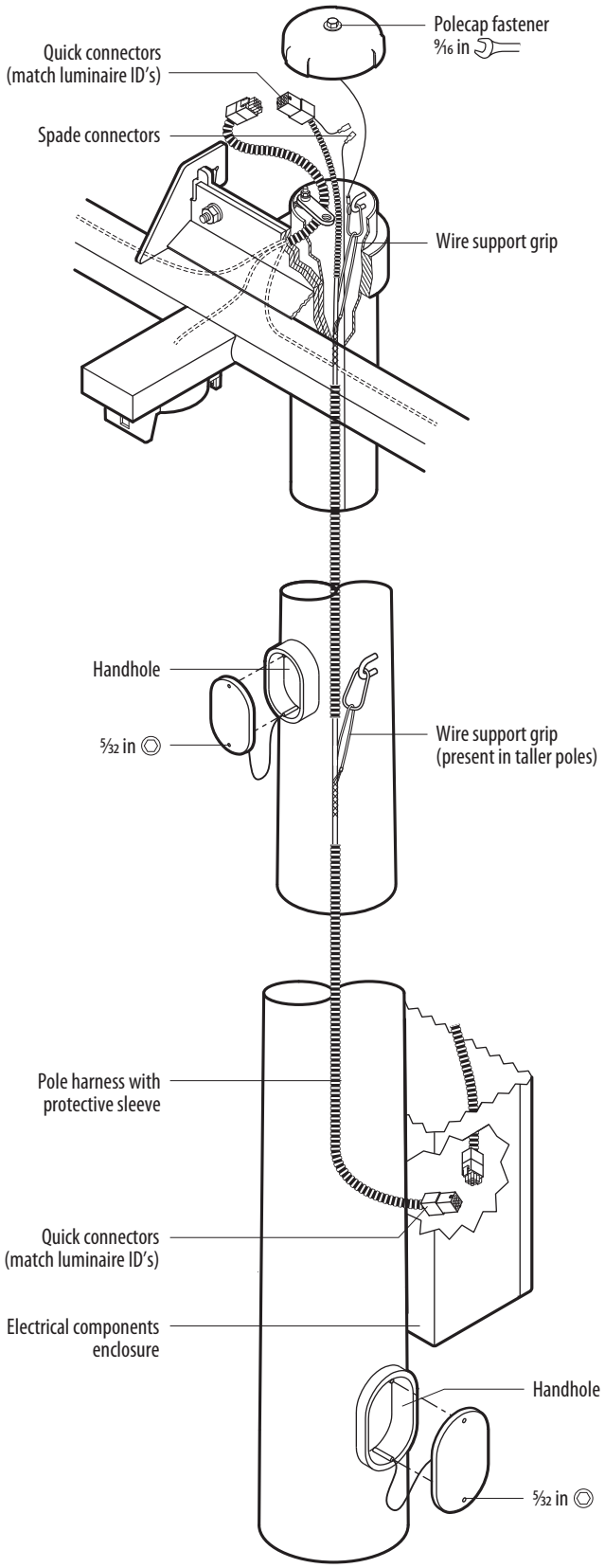
3 Attach support grips at midpole (if present).

4 Mate quick connectors at poletop and inside first stack of electrical components enclosures. Match driver/ luminaire IDs.

For additional stacks of enclosures, connect pole harnesses using the Musco-provided LEVER-NUTS wire connectors. Match luminaire ID and wire polarity per each wire label.

Use electrical tape to ensure LEVER-NUTS® levers stay secure and don't snag on surrounding wires.

5 Replace handhole covers and polecap.



Connecting to Supply Wiring

Overview

The final step of installation is connecting the supply wiring at the subpanel. Terminals for phase wires and neutral (if used), disconnect switch with lockout, and equipment ground bar are provided on the subpanel in the electrical components enclosure. If there are multiple circuits on the pole, a disconnect is provided for each circuit. This may be on a separate subpanel in another enclosure. Depending on foundation design and/or soil conditions, a supplemental grounding electrode may be required.

Tools/Materials Needed

Musco Supplied

- ❑ 3⁄16 in hex key (ground bar)
- ❑ 5⁄16 in hex key (bonding terminal inside handhole)
- ❑ 5⁄32 in hex key (handhole covers)
- ❑ 5 mm hex key (125 A disconnect terminals)
- ❑ Equipment bonding jumper

Contractor Supplied

- ❑ Standard screwdriver
- ❑ 3 m (10 ft) stepladder or small line truck

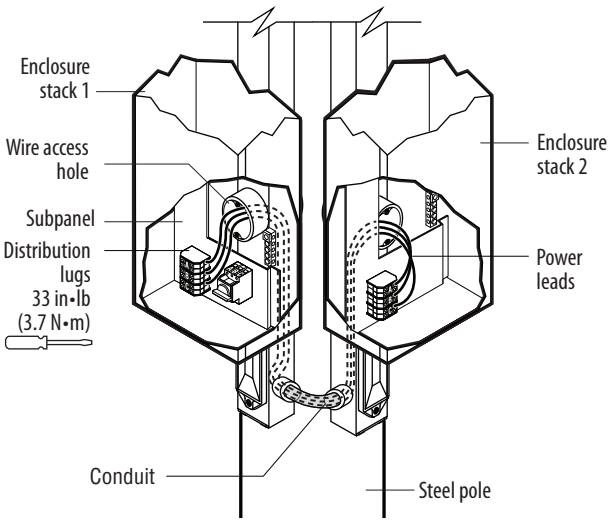
Installation Procedure

Musco *Control System Summary* or *Field Aiming Diagram* provides electrical loading information needed to size wire and switchgear.

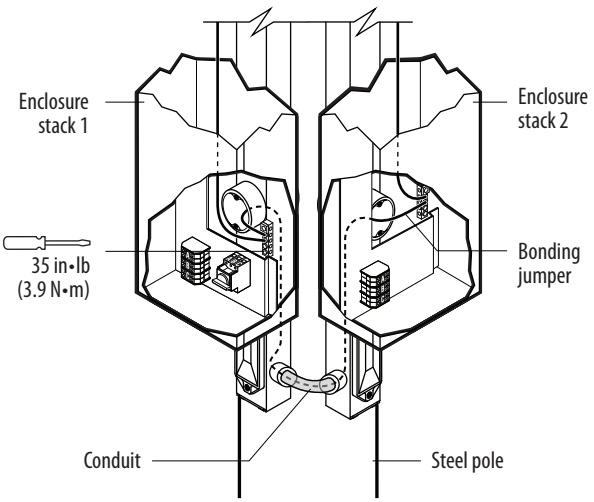
Musco provides instructions for installing Control-Link™ control system or lighting contactor cabinet when these items are part of your project.

1 If pole has multiple stacks on the same electrical circuit then route lower loads from second stack to distribution lugs on main subpanel.

Route all power leads for lighting equipment to appropriate subpanel locations.



2 Connect equipment grounding conductors (green/yellow) from each upper enclosure to equipment ground bar in bottom enclosure. If pole has multiple stacks, connect bonding jumper from stack one. Tighten lugs using 3⁄16 in hex key.



Connecting to Supply Wiring

3 Remove handhole cover using 5⁄32 in hex key. Rout supply wiring through access hub into electrical components enclosure.

4 Connect insulated equipment grounding conductor (supply) to ground bar. Tighten lug using 3⁄16 in hex key.

Disconnect is rated for copper wire only. Contact Musco for adaptor or use UL Listed adaptor for aluminum supply wire.

5 Connect phase wires (supply) to disconnect switch. Tighten lugs using standard screwdriver (45 A disconnect) or 5 mm hex key (125 A disconnect). Connect neutral wire (if used) to distribution lug. Tighten lug using standard screwdriver.

6 Route provided equipment bonding jumper (green/yellow) through access hub to pole grounding lug inside handhole. Tighten lug using 5⁄16 in hex key.

7 Ensure all handhole covers are installed and electrical components enclosure is closed and latched.

If your project includes a supplemental grounding electrode kit, follow instructions in kit for installing electrode.

Warning
Risk of electric shock.

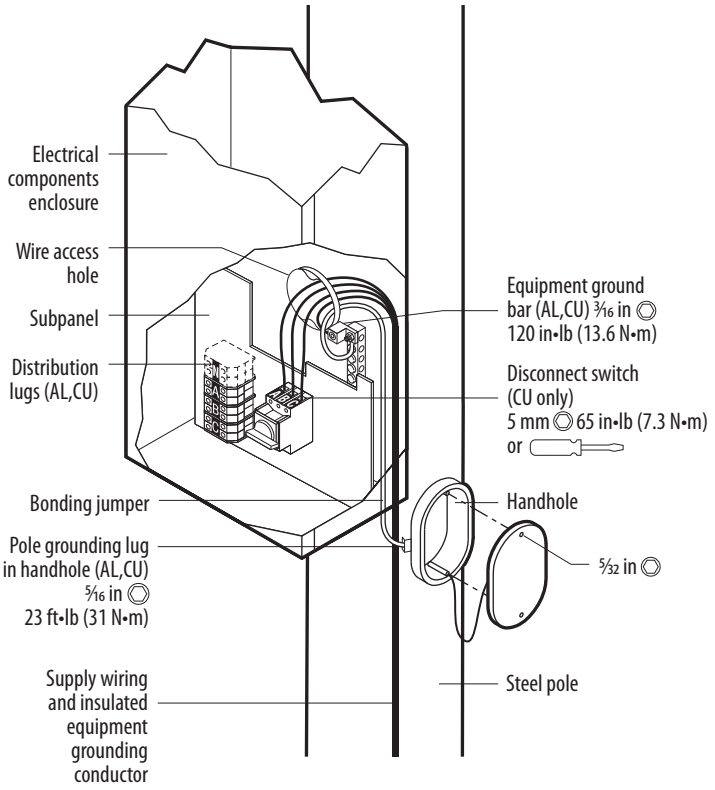
Terminate equipment grounding conductor at equipment ground bar in electrical components enclosure.

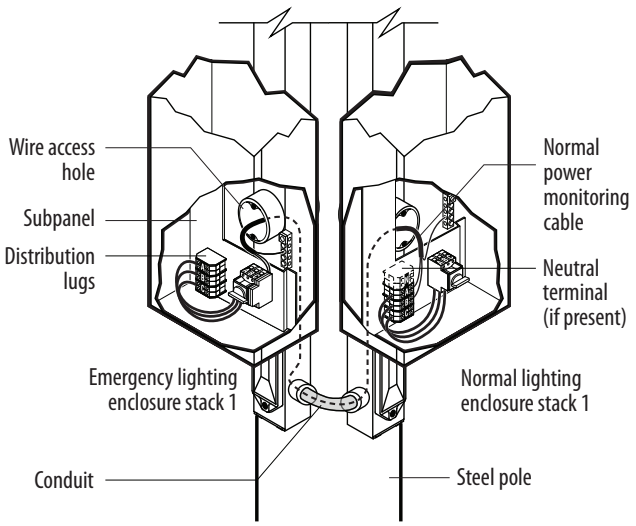
Warning
Lightning hazard.

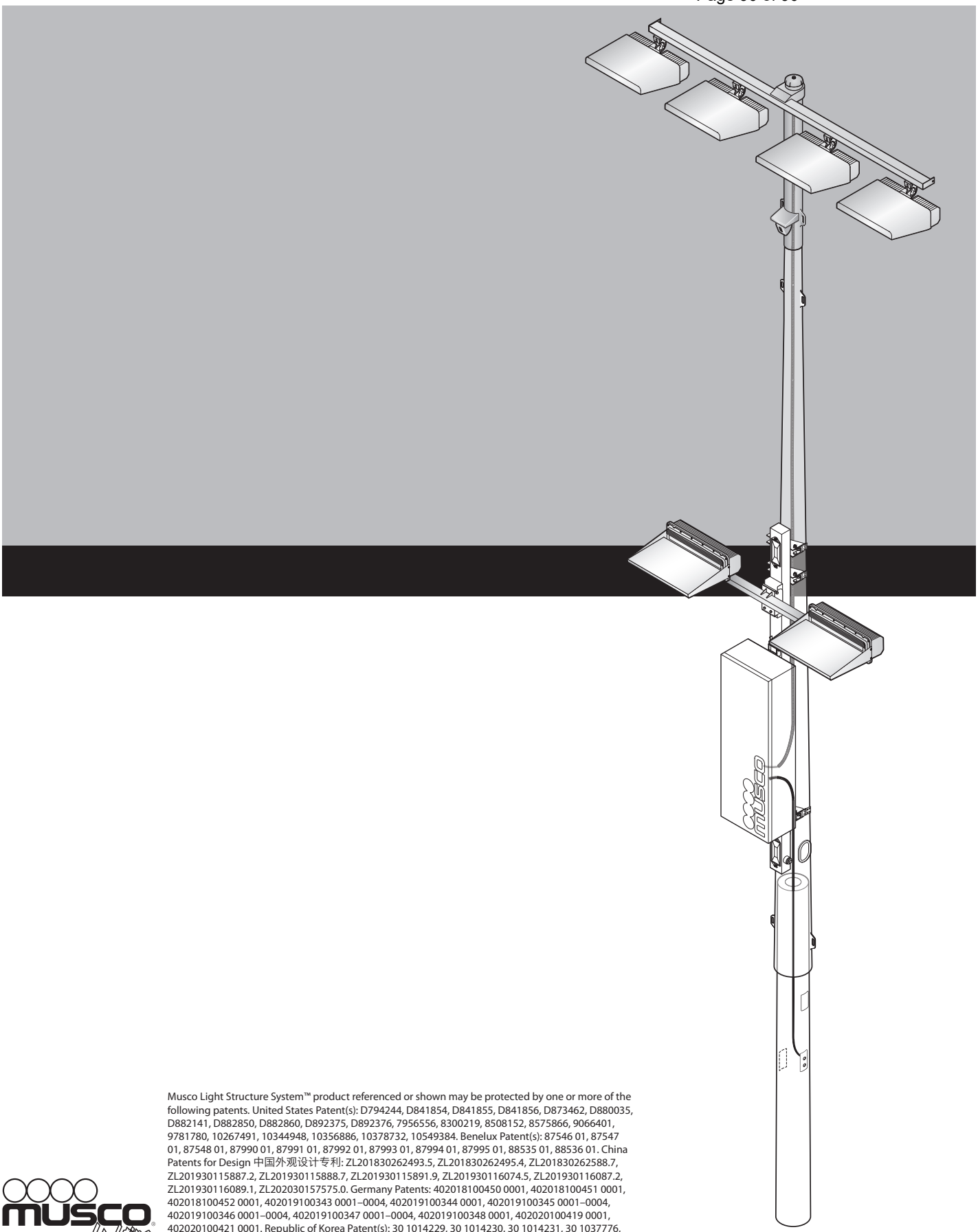
For poles located near metal fences, metal bleachers, or other metal structures, bond structures to pole ground to maintain equal electrical potential.

Skip step 8 if no emergency egress lighting is present.

8 Route cable for normal power to adjacent enclosure stack. Connect black wire and blue/white wire to any two active terminals A, B, C, or neutral, if present, and green wire to ground bar.







Musco Light Structure System™ product referenced or shown may be protected by one or more of the following patents. United States Patent(s): D794244, D841854, D841855, D841856, D873462, D880035, D882141, D882850, D882860, D892375, D892376, 7956556, 8300219, 8508152, 8575866, 9066401, 9781780, 10267491, 10344948, 10356886, 10378732, 10549384. Benelux Patent(s): 87546 01, 87547 01, 87548 01, 87990 01, 87991 01, 87992 01, 87993 01, 87994 01, 87995 01, 88535 01, 88536 01. China Patents for Design 中国外观设计专利: ZL201830262493.5, ZL201830262495.4, ZL201830262588.7, ZL201930115887.2, ZL201930115888.7, ZL201930115891.9, ZL201930116074.5, ZL201930116087.2, ZL201930116089.1, ZL202030157575.0. Germany Patents: 402018100450 0001, 402018100451 0001, 402018100452 0001, 402019100343 0001–0004, 402019100344 0001, 402019100345 0001–0004, 402019100346 0001–0004, 402019100347 0001–0004, 402019100348 0001, 402020100419 0001, 402020100421 0001. Republic of Korea Patent(s): 30 1014229, 30 1014230, 30 1014231, 30 1037776, 30 1037783 0001–0004, 30 1037788 0001–0004, 30 1037795, 30 1037796 0001–0004, 30 1037802 0001–0004, 30 1110351, 30 1110358, 30 1110362. United Arab Emirates Patent(s): 5678, 5679, 5680, 5984, 5985, 5986, 5987, 5988, 5989. United Kingdom Patent(s): 6032011, 6032022, 6032023. 6056943, 6056944, 6056945, 6056946, 6056947, 6056948, 6088584, 6088586, 6088587. U.S. and foreign patents pending. [Pat_085A]

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