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

1. Poletop Luminaire Assembly
2. Wire Harness
3. Galvanized Steel Pole
4. Electrical Components Enclosure
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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.

About These Instructions
These instructions give basic assembly procedures for the Light-Structure Green lighting system. 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 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.
### Installation Instructions: Light-Structure Green™ Lighting System

#### Before You Begin

**Standard Tools/Supplies Checklist**

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**Documents You Need**

- Musco Foundation And Pole Assembly drawings
- 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.
Installation Instructions: Light-Structure Green™ Lighting System

Before You Begin

Electrical System Requirements

While the majority of the Light-Structure Green lighting 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 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.

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.

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.

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
- Full load current for each circuit

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 designs.

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 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 inch hex key

Contractor Supplied

- Conduit for underground wiring
- Concrete backfill
- Water pump (as needed)

Installation Procedure

![Diagram of precast concrete base with various parts labeled]

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.

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

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

7. 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 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.

Diagram:
- Equipment grounding conductor
- Supply wiring
- Compacted fill unless backfill to grade with concrete
- Concrete
- To contactor
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 inch wrench
- Dishwashing liquid (original Dawn® or DIAO™ brand)

Contractor Supplied
- Two 1½ ton chain come-alongs

Assembly Procedure

1. 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.

2. Lay out all pole sections and poletop luminaire assembly in sequence. Ensure all weldmarks face same direction. Weldmarks represent field side of pole. Orient electrical components enclosure hub up.

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

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

5. 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 \( \frac{3}{16} \) inch wrench.

5. Remove protective cover from pole alignment device.

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

If pole has welded crossarms, skip **Bolt-on Crossarms** section. Proceed to **Electrical Components Enclosure** section.
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 inch drive 1⅛ inch socket
- ¼ inch drive breaker bar
- ¼ inch drive 4 inch extension
- 1½ inch wrench
- Spreader bars
- ½ inch fasteners (for spreader bars)
- ½ inch structural fasteners

Contractor Supplied:
- Black marker
- Torque wrench with 9/16 inch socket
- 9/16 inch wrench

Assembly Procedure
1. 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.

   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
Position fasteners. 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 breaker bar, 1⅛ inch socket, extension, and 1⅜ inch wrench, tighten each nut in sequence shown until a very small amount of orange extrusion shows in at least one place on each washer.

5
Using black marker, matchmark each nut and bolt. Make straight line across corner of nut, extending to plate. This allows you to see that step 6 has been completed.

6
Tighten each nut ½ turn, in sequence shown in step 4. Do not allow hardened flat washer to turn and grind against DTI bumps. If flat washer grinds during tightening, try holding nut while turning bolt head.

7
Repeat steps 1–6 for remaining crossarms.

8
Do not reuse structural fasteners. Discard if removed or loosened after tightening.

Note: Step 8 is for multiple crossarm configurations that are six luminaires wide or wider. If your project includes spreader bars, follow step 8. Spreader bars are bundled together and marked with the pole ID. 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.

Install spreader bars with ⅝ inch fasteners at the locations marked on each crossarm. Torque to 25 ft-lb (34 N·m).

Spreader bars may come in two sizes, 30 ½ in (775 mm) and 60 in (1524 mm). Always install longer bars to upper three crossarms.
**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 assure trouble-free connection to the poletop luminaire assembly via the wire harness.

**Tools/Materials Needed**

Musco Supplied
- 9/16 inch wrench
- 3/16 inch 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 150 lb (68 kg). Lift carefully with two people to avoid injury.
**Electrical Components Enclosure**


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

3. Only qualified personnel may perform wiring. Route wires as shown in step 3, but leave the final connections for your electrician. See section *Connecting to Underground Wiring*.

4. Route all power leads from bottom enclosure up. Match power lead to driver ID and connect.

5. Route equipment grounding conductor and enclosure harnesses down to bottom enclosure.

6. Repeat steps 1 – 3 for each stack.
Electrical Components Enclosure

6 Identify your electrical components enclosure configuration.

7 Route and connect communication cable in each electrical components enclosure to termination point in next sequential electrical components enclosure per illustrations.
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 inch hex key
- 9/16 inch wrench

Contractor Supplied
- Fish tape
- Electrician’s tape

Assembly Procedure
1. Verify pole ID on wire harness matches pole location on Field Aiming Diagram.
2. Remove handhole covers using 5/32 inch hex key.
   Remove polecap using 9/16 inch wrench.
3. 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.
4. Attach support grips at poletop and midpole (if present).
5. Mate quick-connectors at poletop and inside electrical components enclosure(s). Match driver/luminaire IDs.

Note: When installing bolt-on crossarms, each crossarm has at least one separate harness. There is one additional spade connector for pole alignment beam.

6. Replace handhole covers and polecap.
Luminaire Attachment

Overview
Luminares 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 inch ratcheting combination wrench

Assembly Procedure

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

2. Remove orange protective caps from luminaire knuckle and mounting plate; discard.

3. Note: Do not remove plastic wrap from luminaire until ready to set pole.

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

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

3. Tighten captive mounting bolts. Torque must not exceed 20 ft-lb (27 N-m). To avoid overtightening, use provided 7/16 inch combination wrench.

See Installation Instructions: Climbing Steps and Safety Cable, if your project includes these items.
Installation Instructions: **Light-Structure Green™ Lighting System**

**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
  - Safety cutter (for removal of luminaire bag)
  - Dishwashing liquid (original Dawn® 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**

1. **Verify pole ID matches precast concrete base and pole location on Field Aiming Diagram.**
2. **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.
3. **Lubricate concrete base with provided dishwashing liquid.**

4. **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 plastic wrap from luminaires using provided safety cutter. Do not use knife. Cutter is attached to one luminaire for each pole.

5. Turn on alignment beam and check. Device has toggle switch inside electrical components enclosure.

**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.

**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.
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

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 inch hex key (ground bar)
- 5/32 inch hex key (bonding terminal inside handhole)
- 5/32 inch 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
- 10 foot (3 meter) stepladder or small line truck

Installation Procedure

1. Route all power leads for lighting equipment to appropriate subpanel locations. Poles with multiple circuits have multiple disconnect switches, sometimes in separate enclosures. Route power leads through pole if necessary. Match luminaire IDs on wiring to subpanel.

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 inch hex key.
Connecting to Supply Wiring

3. Remove handhole cover using 3/32 inch hex key. Route supply wiring through access hub into electrical components enclosure.

4. Connect equipment grounding conductor (supply) to ground bar. Tighten lug using 3/16 inch hex key.

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

6. 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.

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

8. 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.
Musco Light-Structure Green™ product referenced or shown may be protected by one or more of the following patents. United States Patents: D593883, D695949, D695952, 6250596, 7956551, 7956556, 8163993, 8300219, 8508152, 8575866, 8742254, 8789967. China Patent for Design: ZL201330222107.7, ZL201330222318.0. U.S. and foreign patents pending. [Pat_056A]