

Wanco[®] X-Marker[™] L-893(L)

Temporary Runway Closure Marker



Owner's Manual
January 2025

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1 Introduction

1.1 Read before using

This is the owner's manual for the Wanco® X-Marker™ L-893(L) Runway Closure Marker. Models with custom options may require additional information that is not provided in this document.

For your safety and protection from injury, carefully read, understand, and observe all instructions in this manual. Always read all instructions before performing a procedure.

Keep this manual with the X-Marker trailer. Additional and replacement manuals are available from the factory (see Section 1.3, "Where to obtain service," page 2).

If you have questions regarding this product, please contact Wanco Customer Service using the information in Section 1.3.

1.2 About the X-Marker L-893(L)

The Wanco X-Marker L-893(L) Runway Closure Marker is a lighted visual aid for indicating to airplane pilots that an airport runway or taxiway is closed. It is certified for use at FAA regulated airports, and can be used in any application where an L-893(L) device is needed.

The flashing X-Marker lights can be seen both day and night from miles away, clearly discernible as a giant "X" and distinguishable from other lighted visual devices in use at an airport. The X-Marker trailer is easy to transport, offers tandem towing of two trailers by one vehicle*, and can be deployed by one person in less than five minutes.

System power is provided by batteries, which power the lights and the control system. The batteries are continuously charged while the engine is running or while the charger is plugged into an external power source, such as a portable generator or shore power.

On a full tank of fuel, the system can run continuously for up to a week without intervention or refueling. The batteries continue to power the lights up to 24 hours if the engine runs out of fuel.

A weather resistant enclosure houses the power system.

**Tandem tow available only with optional equipment and where allowed by local regulations.*

1.3 Where to obtain service

Before calling for service, please have the X-Marker model number and VIN ready. This information is displayed on the vehicle identification tag (see Figure 1-1).

Contact our customer service department using the following information:

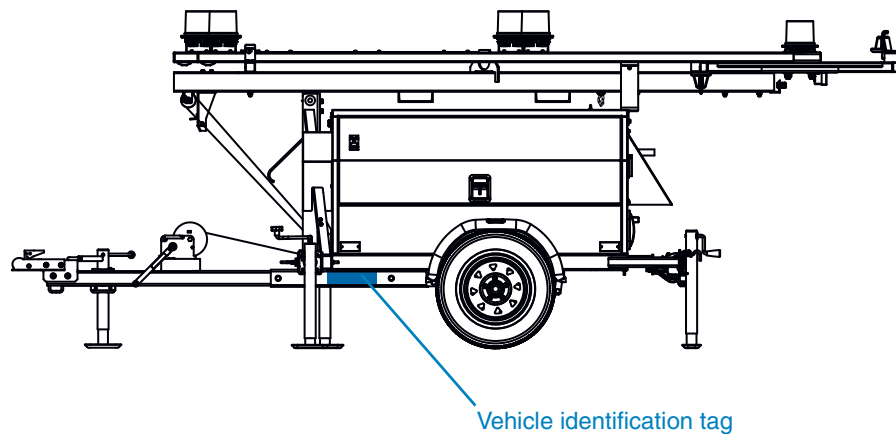
Wanco Inc.

5870 Tennyson Street
Arvada, Colorado 80003

303-427-5700
fax 303-427-5725

www.wanco.com
info@wanco.com

Figure 1-1. Vehicle identification tag location



2

Safety

2.1

Safety statements in this manual

This manual contains the following types of callouts, which must be followed to reduce the possibility of personal injury, damage to the equipment, or improper service. Each alert has a specific meaning, as described below:

 The safety alert symbol alerts you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

DANGER

Indicates an imminently hazardous situation which, if not avoided, WILL result in death or serious injury.

WARNING

Indicates an imminently hazardous situation which, if not avoided, COULD result in death or serious injury.

CAUTION

Indicates a potentially hazardous situation which, if not avoided, could result in minor or moderate injury.

CAUTION

Used without the safety alert symbol, indicates a potentially hazardous situation which, if not avoided, could result in property damage.

IMPORTANT!

Indicates information that is of particular importance when transporting, operating, or servicing the equipment.

2.2

General safety

DANGER



Electrocution hazard.

Contact with live electrical circuits will cause severe injury or death.

Use equipment only as instructed.

VA rating is
436.5
or higher

WARNING



Improper use of equipment could cause serious injury or death.

Before using this product, carefully read, understand, and observe all instructions in this manual and the engine manual.

CAUTION



Crush hazard.

When operating or working on equipment, keep hands and body parts clear of pinch points.

Your X-Marker L-893(L) Runway Closure Marker is a complex piece of machinery. You must have a reasonable level of familiarity with this equipment in order to use it safely. Using this equipment without proper understanding is potentially dangerous to you and others.

Do not transport, operate, or service the equipment before reading and understanding all the information provided in this manual and in the engine manual.

If you have questions or require additional information, contact Wanco Customer Service (see Section 1.3, "Where to obtain service," page 2).

2.3

Forklift and hoist safety



⚠ WARNING

Falling equipment can cause severe injury or death.

Follow all forklift and hoist requirements when moving the trailer.

Before using a forklift or hoist to move the trailer:

- Lower the mast and retract the giant “X” light arms (for instructions, see Section 4.3.5, page 36). Never move the trailer with the mast raised or the arms extended.
- Ensure equipment such as slings, chains, hooks, ramps, and jacks are secure and will bear the weight of the trailer. Refer to the gross vehicle weight rating (GVWR) listed on the vehicle identification tag (see Figure 1-1, page 2).
- Always ensure the safety of nearby people when moving the trailer.
- When using a forklift, ensure the forks fully engage and support the trailer. Use fork extenders if necessary.
- For forklift and hoist instructions, see Section 3.6, page 26.

2.4

Operating safety

2.4.1

Before using



⚠ DANGER

Electrocution hazard.

Contact with overhead electrical power lines will cause severe injury or death.

Do not position equipment under power lines.



⚠ WARNING

Falling equipment could cause serious injury or death.

Before using equipment, stabilize and level the trailer.

- The X-Marker mast and giant “X” light arms rise to over 20 feet (6.2 meters) in height. Ensure the area above the trailer is clear of obstructions.
- To reduce the risk of personal injury, ensure the surrounding area is in good order and free of debris.
- To reduce the risk of shifting, rolling, or overturning, locate the trailer on a firm, level surface, with enough space to deploy the trailer’s outriggers.

- For stability, always extend the outriggers and level the trailer before extending the giant “X” light arms and raising the mast.
- Do not allow water to accumulate around the base of the trailer.
- Ensure the trailer is in good operating condition. Never use any equipment that is damaged or in need of repair.

2.4.2

During operation



⚠ WARNING

Falling equipment could cause serious injury or death.

- Ensure the trailer outriggers are extended.
- When tilting the mast up or down, ensure the area around the trailer is clear of people.
- Ensure the vertical-lock pin is properly engaged when the trailer is in use.
- If the mast “hangs up” or the winch cable develops slack while tilting the mast, stop immediately, move away from the trailer, and contact a Wanco service representative.



⚠ WARNING

Unexpected equipment failure may result in severe injury or death.

Visually verify proper operation every two hours per FAA guidelines. FAA AC 150/5345-55A

- Ensure the trailer is well grounded, per all applicable regulations.
- Never collapse the outriggers or move the trailer while light arms are extended.
- Never raise, lower, or move the trailer while it is in use.
- When not in use, or in case of sustained high winds, lower the mast to the transport position (see Section 4.3.5, page 36). The X-Marker L-893(L) exceeds FAA requirements for minimum wind speed.
- Before leaving the unit running, ensure both gull-wing doors and the top panel are closed and properly latched.

2.5

2.5.1

Engine safety

Operator safety

DANGER



Explosion hazard.

- Keep engine, fuel, and other combustibles away from sparks, open flame, and burning objects.
- Do not smoke near engine.
- Stop engine before filling or draining fuel tank.
- Use only diesel fuel.
- Replace fuel tank cap after refueling.
- Do not use gasoline, other fuels, or flammable solvents to clean parts.

DANGER



Asphyxiation hazard.

- Operate the engine outdoors and keep away from engine exhaust.
- If operating in an enclosed area, vent exhaust fumes to outdoors and maintain adequate ventilation.
- Refill and drain fuel tank only in a well ventilated area.
- Perform maintenance in a well ventilated area.

WARNING



Fire hazard.

A hot muffler can ignite flammable materials.

Keep area around muffler free of debris such as leaves, paper, and cartons.

WARNING



Risk of severe burn.

- Do not touch the engine, exhaust pipes, or areas near the exhaust at rear of trailer.
- Do not remove radiator cap when engine is hot. Contents are hot and under pressure.

2.5.2

Spark arresters

IMPORTANT!

State and local safety codes specify that, in certain locations, internal combustion engines that use hydrocarbon fuels must be used with spark arresters.

A spark arrester is a device constructed of nonflammable materials specifically for the purpose of removing and retaining carbon and other flammable particles from the exhaust flow of an internal combustion engine.

Spark arresters are qualified and rated by the United States Forest Service. To comply with all applicable laws regarding spark arresters, consult your local Health and Safety Administrator.

2.6

Grounding

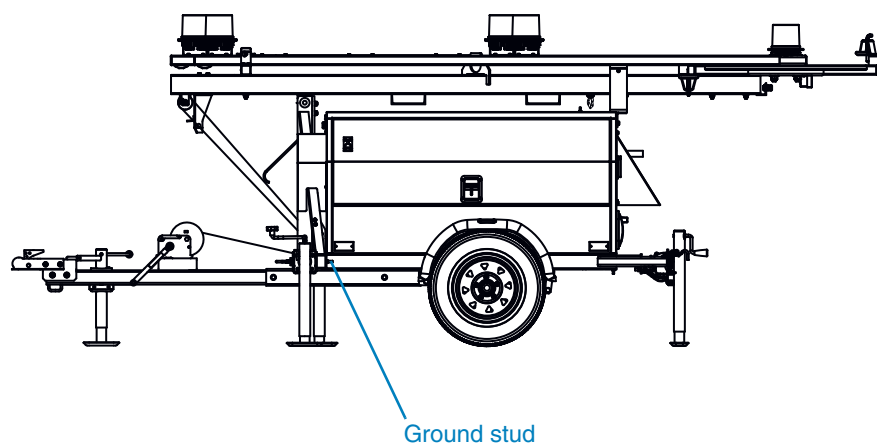
The X-Marker power system is a negative-ground system. The neutral of the generator stator winding is permanently connected (bonded) to the trailer frame.

The trailer includes a ground stud (see Figure 2-1) for electrically grounding the system when necessary to comply with the National Electrical Code (NEC) and other regulations.

For grounding and bonding requirements that apply to your deployment of the X-Marker trailer, consult a qualified electrician or refer to applicable regulations. Agencies and organizations that regulate electrical compliance may include, but are not limited to:

- Your local authority having jurisdiction (AHJ)
- National Fire Protection Association (NFPA), which publishes the NEC
- U.S. Occupational Safety and Health Administration (OSHA)

Figure 2-1. Ground stud



2.7

Service safety

2.7.1

Before servicing

DANGER



Electrocution hazard.

Contact with live electrical circuits will result in severe injury or death.

- Before servicing any component on the trailer, turn off power and then disconnect cable from the positive (+) battery terminal.
- Never allow positive wiring to short to ground.
- Only a qualified electrician should service the equipment's electrical system.

WARNING



Fire hazard.

When working with the batteries, never allow positive wiring to short to ground.

CAUTION



During servicing, adverse weather conditions can cause equipment damage and injury.

Whenever possible, perform maintenance indoors or in calm, dry weather.

- The engine is permanently grounded to the trailer. NEVER perform any service unless all electrical components are shut down:
 - ☐ Ensure all power circuits are shut off.
 - ☐ Turn the engine key to the OFF or vertical position.
 - ☐ Disconnect battery cables: first from the positive (+) battery terminal—because this is a negative-ground system—and then from the negative (–) terminal.
- If the surface under or around the trailer is damp or wet, move the trailer to a dry location and allow it to dry before servicing. Do not allow water to accumulate around the base of the trailer.
- Do not service the trailer if your clothing or skin is wet.
- Always take precautions to ensure the safety of service personnel. Whenever possible, perform maintenance indoors, out of the weather.
- Keep the equipment and all its components clean.

2.7.2

During servicing

WARNING



Moving parts can crush and cut.

- Keep hands, feet, hair, and loose clothing away from moving parts on engine and generator.
- Shut down engine before servicing.

WARNING



Rotating fan blades can cut.

- Keep hands, feet, hair, and loose clothing away from moving fan blades.
- Do not operate engine with fan guard removed.

- To prevent injury, keep hands, feet, hair, and loose clothing away from all moving parts.
- Keep labels legible. Replace damaged or missing labels. See Section 2.9.
- When hoisting or loading the trailer, read and follow all safety instructions in Section 2.3, page 5.
- For reliable performance, keep the equipment and all its components clean.

2.8

California Proposition 65

WARNING

Breathing diesel engine exhaust exposes you to chemicals known to the State of California to cause cancer and birth defects or other reproductive harm. Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

- Always start and operate the engine in a well-ventilated area.
- If in an enclosed area, vent the exhaust to the outside.
- Do not modify or tamper with the exhaust system.
- Do not idle the engine except as necessary.

For more information go to www.P65Warnings.ca.gov/diesel.

WARNING

Batteries and battery components can expose you to lead and lead compounds, which are known to the State of California to cause cancer and birth defects or other reproductive harm. For more information go to www.P65Warnings.ca.gov.

2.9 Labels

Labels provide instructions and information. They also warn of hazards. For convenience and safety, keep all labels in legible condition, replacing labels when damaged or missing. Replacement labels are available from the factory.

- Labels on the exterior of the trailer:
 - Figure 2-2 indicates label locations
 - Table 2-1 provides sample labels
- Labels on the interior of the equipment cabinet:
 - Figure 2-3 indicates label locations
 - Table 2-2 provides sample labels

Figure 2-2. Exterior label locations

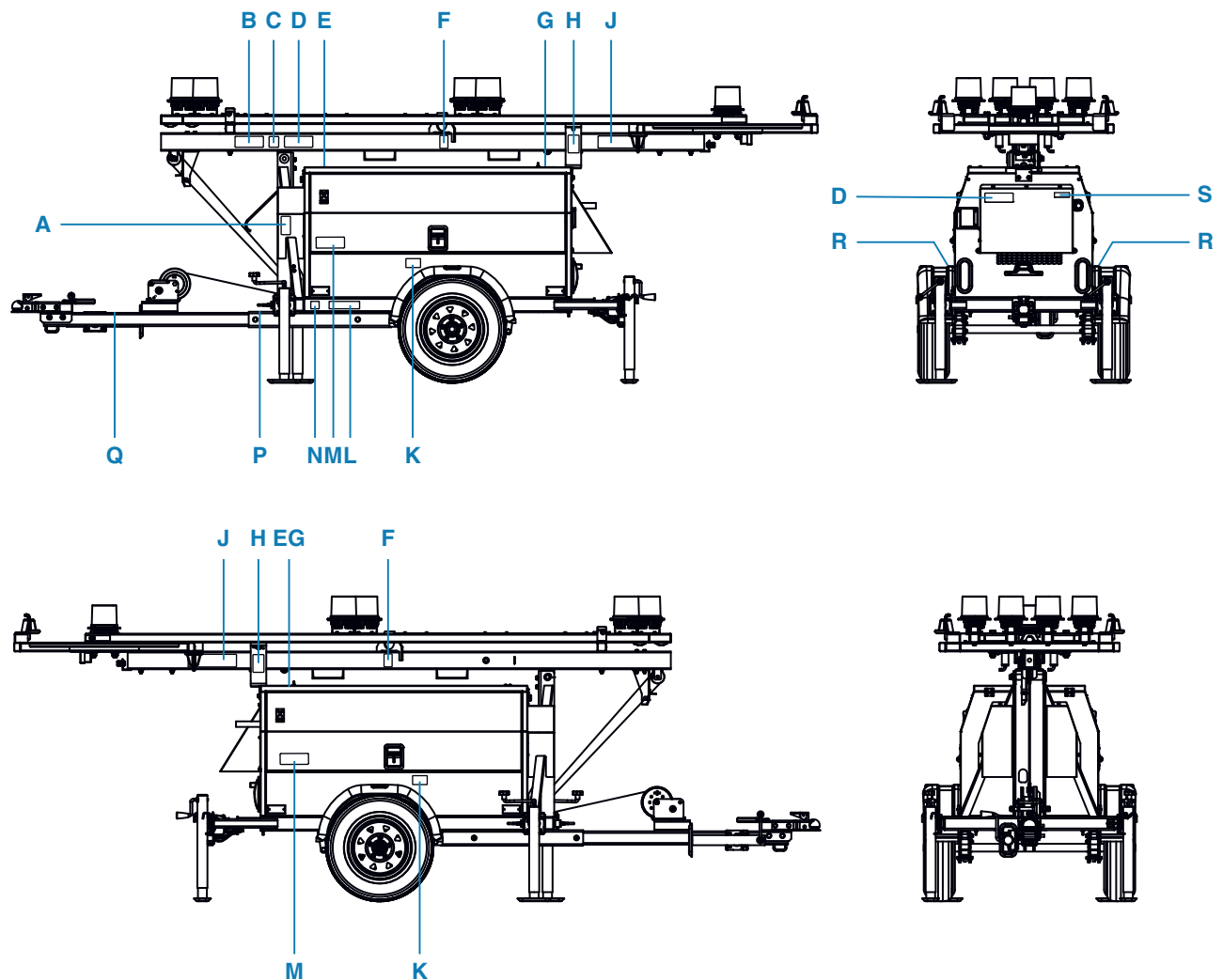
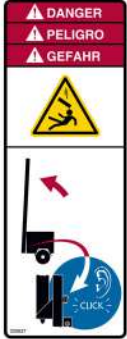
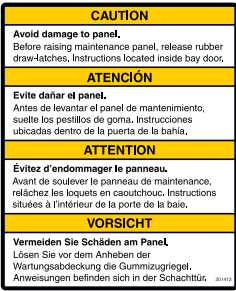
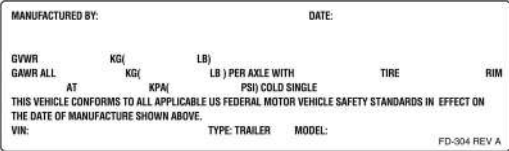
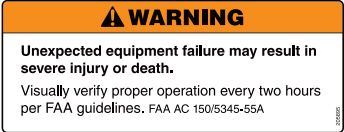
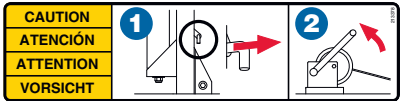


Table 2-1. Exterior label samples and descriptions

Ref.*	Label (not to scale)	Description
A		Danger: falling equipment
B		Danger: shock hazard
C		Warning: crush hazard
D		Danger: falling equipment
E		Caution: panel damage
F		Lifting point

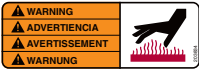
*Reference Figure 2-2 for label location.

Table 2-1. Exterior label samples and descriptions *continued*

Ref.*	Label (not to scale)	Description
G		Tandem tow adapter location (optional tandem tow package only)
H		Caution: secure with pin (optional tandem tow package only)
J		Warning: secure transport lock
K		Warning: California Prop. 65
L		Vehicle identification tag
M		Warning: equipment failure
N		Electrical ground
P		Caution: equipment damage

*Reference Figure 2-2 for label location.

Table 2-1. Exterior label samples and descriptions *continued*

Ref.*	Label (not to scale)	Description
Q		Warning: towing requirements
R		Tire pressure
S		Warning: hot surface

*Reference Figure 2-2 for label location.

Figure 2-3. Interior label locations

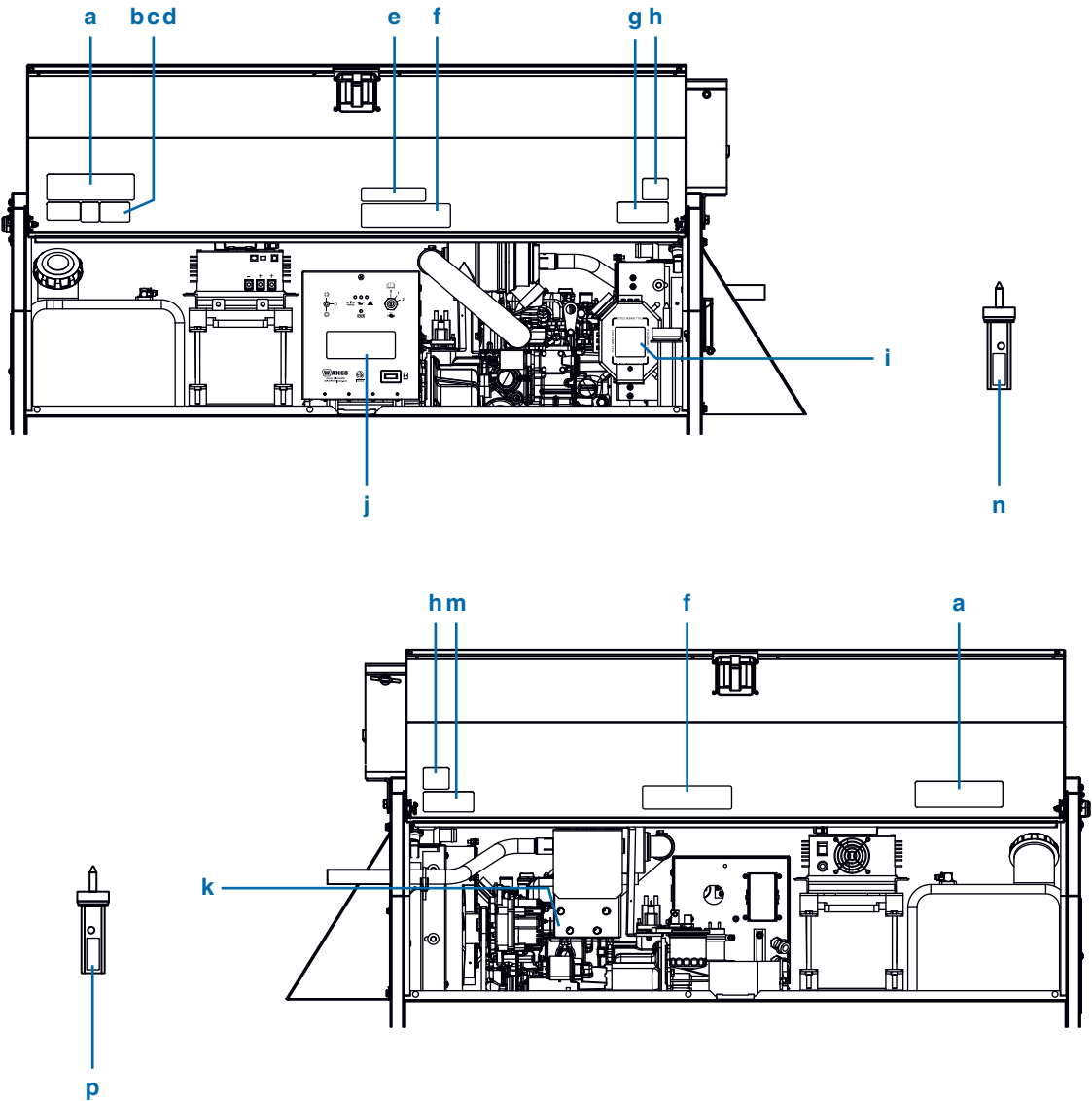
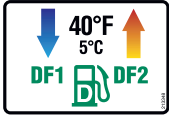
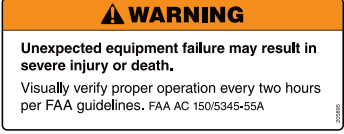
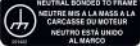


Table 2-2. Interior label samples and descriptions

Ref.*	Label (not to scale)	Description
a		Danger: explosion and fire hazards
b		Warning: California Prop. 65
c		Diesel fuel
d		Fuel type
e		Caution: equipment damage
f		Fluid containment: close doors (optional drip and spill protection package only)
g		Maintenance panel: release draw-latches
h		Warning: rotating fan blades
i		Do not fill
j		Warning: equipment failure
k		Neutral bond to frame

*Reference Figure 2-3 for label location.

Table 2-2. Interior label samples and descriptions *continued*

Ref.*	Label (not to scale)	Description
m		Maintenance panel: release draw-latches
n		Tandem tow adapter front, driver's side (optional tandem tow package only)
p		Tandem tow adapter front passenger's side (optional tandem tow package only)

*Reference Figure 2-3 for label location.

3 Transporting

3.1 Read before moving the trailer

You can move or transport the X-Marker trailer using any of the following methods. Before moving the trailer, read and follow all requirements for the method you choose:

- To tow a single X-Marker trailer, see Section 3.2.
- To tandem-tow a pair of X-Marker trailers, see Section 3.3, page 20.
- To lift and move the X-Marker trailer with a forklift or hoist, see Section 3.6, page 26.

IMPORTANT!

Before putting an X-Marker trailer into service, ensure the batteries are charged, the fuel tank is full, and the engine starts and runs properly.

3.2 Towing one trailer

3.2.1 Before towing

Before towing, refer to Figure 3-1 and prepare the trailer as follows:

1. Follow all safety instructions in Section 2, page 3.
2. Prepare the trailer for transport:



⚠ WARNING

Loose equipment will be damaged in transport, and could result in serious injury or death.

Before towing, set light arms in their cradles and secure with attached lock pins.

- a. Follow the instructions in Section 4.3.5, page 36, to lower the mast and light arms, and secure them in place.
- b. Verify the mast is secured in the transport cradle with the horizontal-lock pin.
- c. Verify the light arms are secured in their support cradles with their wire lock pins.
- d. Verify the maintenance panel is all the way down and secured in place with the two draw-latches inside the equipment cabinet (see Figure 3-2).
- e. Close and latch the side doors.
- f. If the trailer is connected to earth ground, disconnect it.
- g. If necessary, attach a red flag to the end of a light arm at the back of the trailer.

Figure 3-1. Trailer in travel position

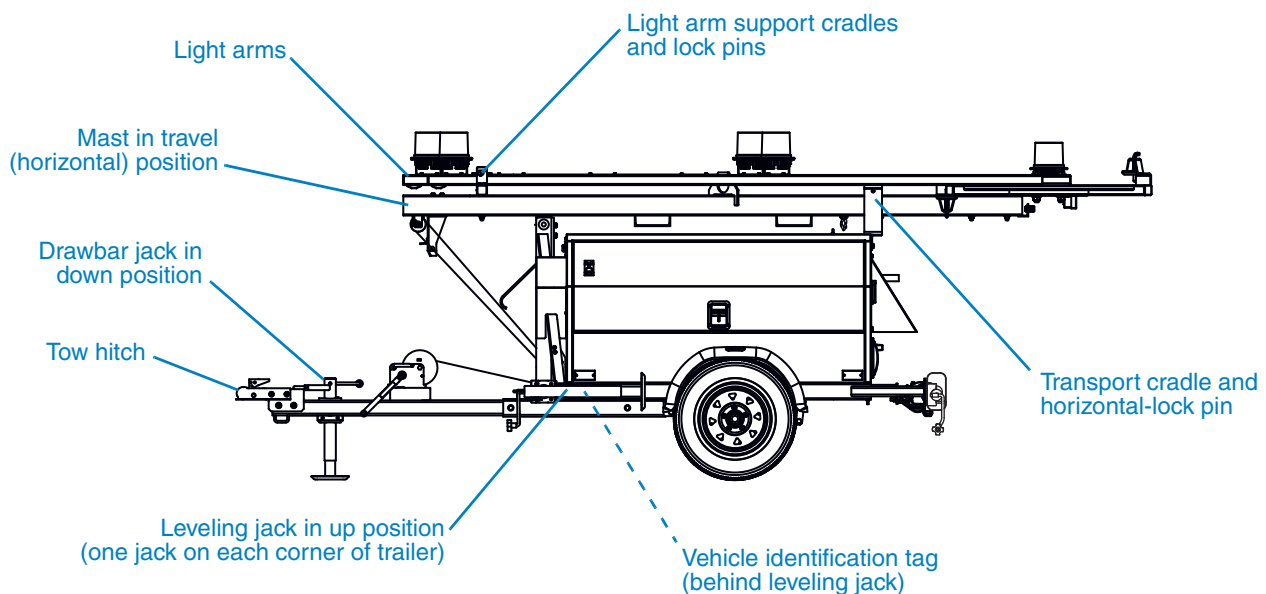
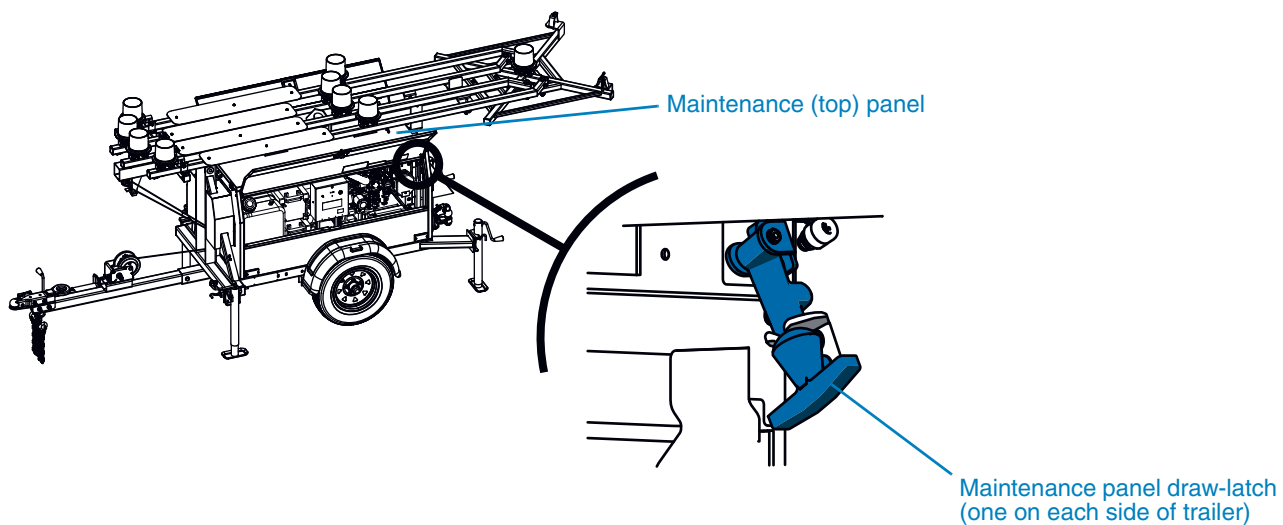


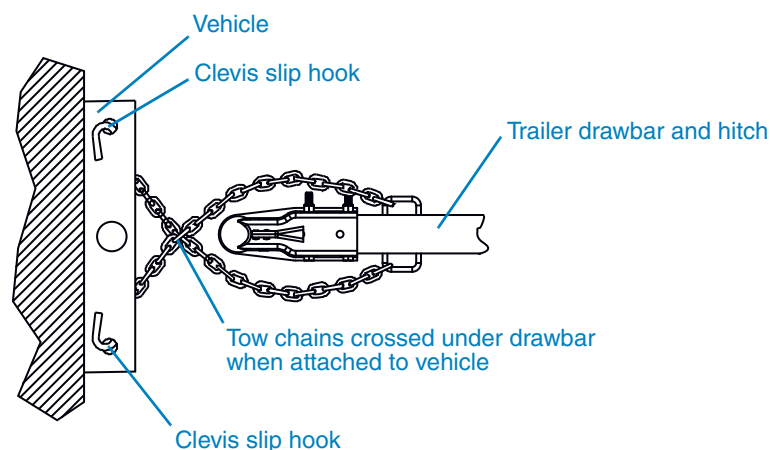
Figure 3-2. Maintenance panel and draw-latches



3. Check the tow hitch and safety chains:
 - a. Ensure the tow hitch on the tow vehicle is rated for weight equal to or greater than the trailer's gross vehicle weight rating (GVWR). The GVWR is displayed on the trailer vehicle identification tag.
 - b. Ensure the coupler and tow hitch on the trailer and the tow vehicle are compatible. The trailer has a combination ball coupler hitch and lunette ring. If it is necessary to reverse the hitch, refer to Section 3.5.1, page 25, for instructions.
 - c. Inspect the tow hitch and coupling for wear and damage. Replace or repair if necessary.
 - d. Ensure the drawbar jack is down with its foot on the ground.

- e. Verify the rear and side leveling jacks are in the up position, the outriggers are retracted, and all are secured with their locking pins:
 - To raise jacks, turn the jack handle until the jack foot is off the ground, then pull the jack locking pin and rotate the jack upward until its locking pin snaps into position with an audible “click.”
 - To retract outriggers, pull the outrigger locking pin (not the jack locking pin) and push the outrigger in, toward the trailer, until its locking pin snaps into position with an audible “click.”
 - f. Use the drawbar jack to raise the front of the trailer and set the drawbar hitch on the tow vehicle hitch. Ensure the coupling is properly engaged and locked.
 - g. Ensure the drawbar is within five degrees ($\pm 5^\circ$) of parallel with the ground. A greater angle will change the tongue weight and may cause the trailer to whip or sway while towing.
 - h. Raise, rotate, and lock the drawbar jack in the up position.
 - i. Verify approved safety chains are attached properly to both the trailer and tow vehicle, as illustrated in Figure 3-3. The chains should cross underneath the tow hitch.
4. Check tires, wheels, and axle lock:
 - a. Check tires for wear. Replace worn tires.
 - b. Verify tires are fully inflated to the proper pressure.
 - c. Verify that all wheel lugs are in place and tightened. Do not tow the trailer if a wheel lug is missing.
 - d. Remove the axle lock bar, if installed.
 5. Ensure the trailer brake lights, taillights, and directional (turn) indicators are hooked up and functioning properly.
 6. Remove blocks or chocks from wheels, if present.
 7. Follow the towing requirements in Section 3.2.2, page 20.

Figure 3-3. Tow chain hook-up



3.2.2

During towing

- Do not tow the trailer with any people, parts, supplies, or additional equipment attached to it or loaded onto it.
- Do not tow additional trailers or other equipment in tandem with the trailer. (For tandem-towing two X-Marker trailers, see Section 3.3.)
- The recommended maximum speed for highway towing is 65 mph (105 km/h). For off-road towing, the recommended maximum speed is 15 mph (25 km/h) or less, depending on terrain.
- Adhere to applicable regulatory requirements when towing the trailer.
- If whipping or swaying occurs, do not attempt to correct it by turning the steering wheel, do not apply the brakes, and DO NOT speed up. Instead, release the gas pedal and hold the steering wheel in a straight-ahead position until the whipping or swaying stops. Whipping and swaying can be caused by excessive speed, crosswinds, and many other conditions.

3.3

Towing two trailers in tandem

3.3.1

Before tandem towing

One vehicle can tow two X-Marker trailers in tandem under the following conditions:

WARNING

Tandem towing poses risks that can damage equipment and could cause serious injury or death.

- Read and follow all tandem towing requirements in this document before towing.
- Adhere to all regulatory requirements when tandem towing.
- Tandem towing requires optional equipment that may not be included with your X-Marker trailer (for details, see Section 4.5.2, page 47). Without these components, you cannot tandem tow the trailers:
 - ☐ Each trailer must have its own tandem-tow prop (see Figure 3-4).
 - ☐ At least one trailer must have a rear tandem-tow hitch (see Figure 3-5).
- Transportation regulations for tandem towing on public streets and highways vary by region. Adhere to applicable regulatory requirements for tandem towing.
- The tow hitch on the tow vehicle must be rated for weight equal to or greater than the total gross vehicle weight rating (GVWR) of two X-Marker trailers. The trailer GVWR is listed on its vehicle identification tag (see Figure 3-1, page 18).
- The recommended maximum speed for tandem towing on paved roads is 25 mph (40 km/h). Tandem towing is not recommended on rough terrain or unpaved roads.

Figure 3-4. Tandem-tow prop

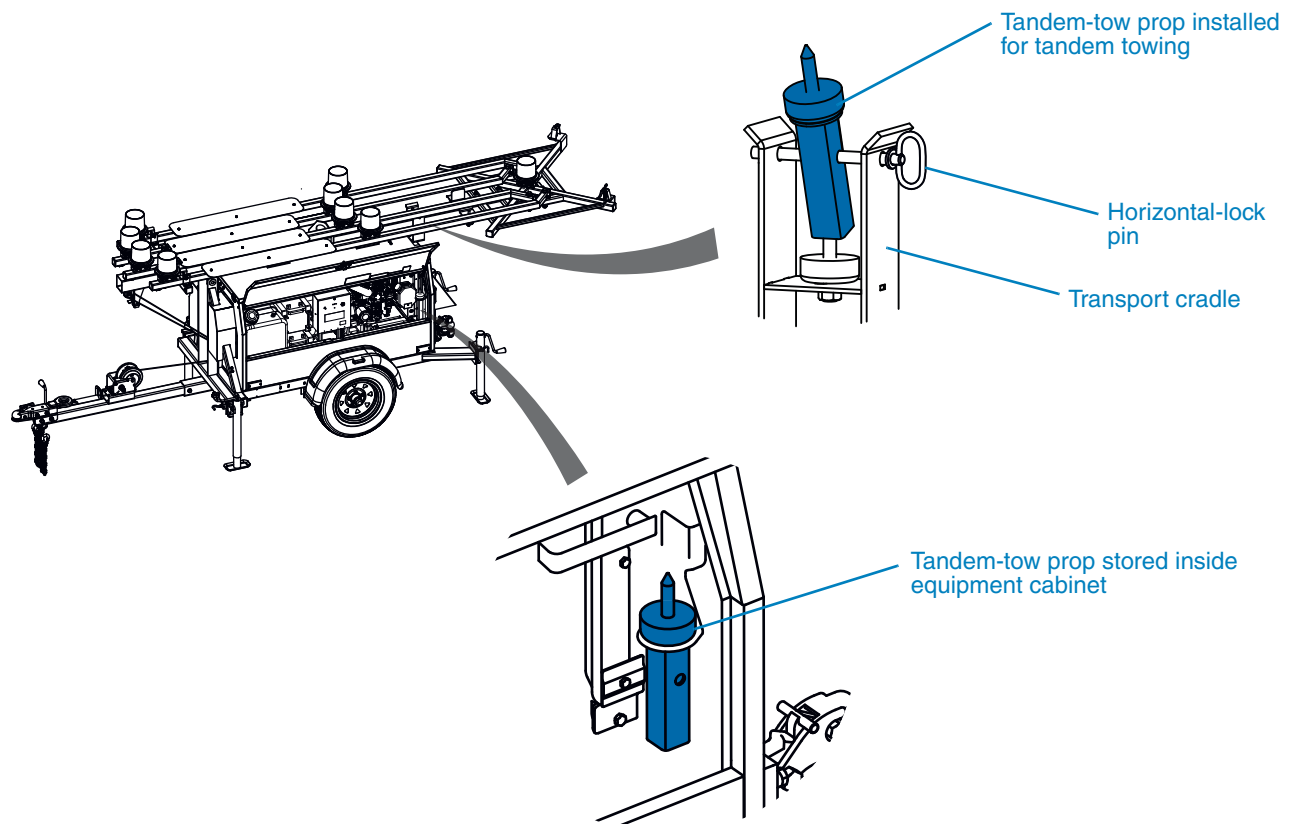
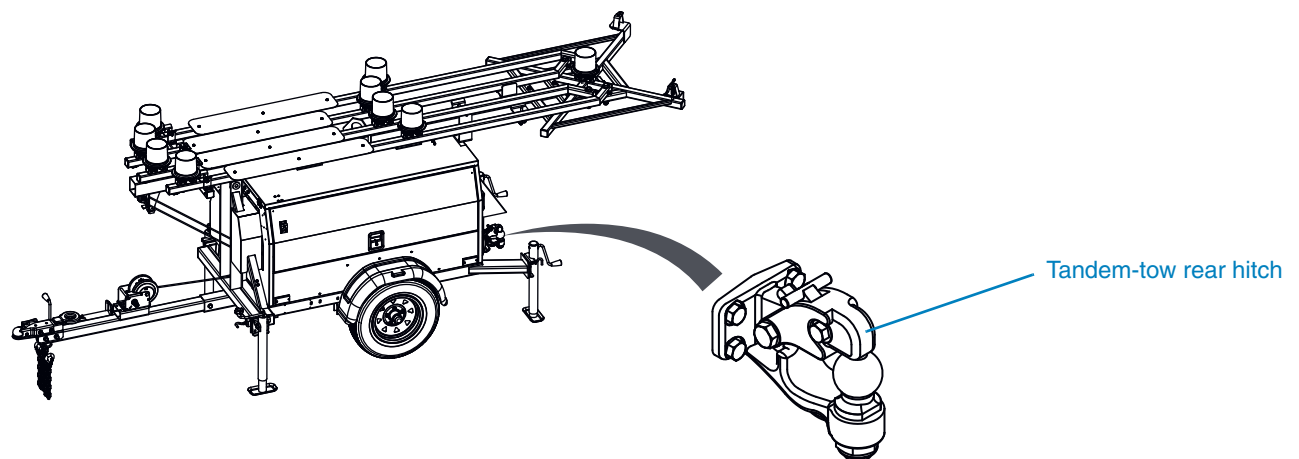


Figure 3-5. Tandem-tow hitch



3.3.2

Preparing for tandem towing

1. Follow the instructions in Section 3.2, page 17, to tow the first trailer to the location of the second trailer, if needed.

IMPORTANT!

If only one of the two trailers has a rear tow hitch (Figure 3-5), your towing experience will be easier if you tow that trailer first, towing it to the location of the trailer that does not have a rear tow hitch.

2. Meet the requirements for tandem towing in Section 3.3.1.
3. Refer to Figure 3-1, page 18, and prepare the second trailer for transport:

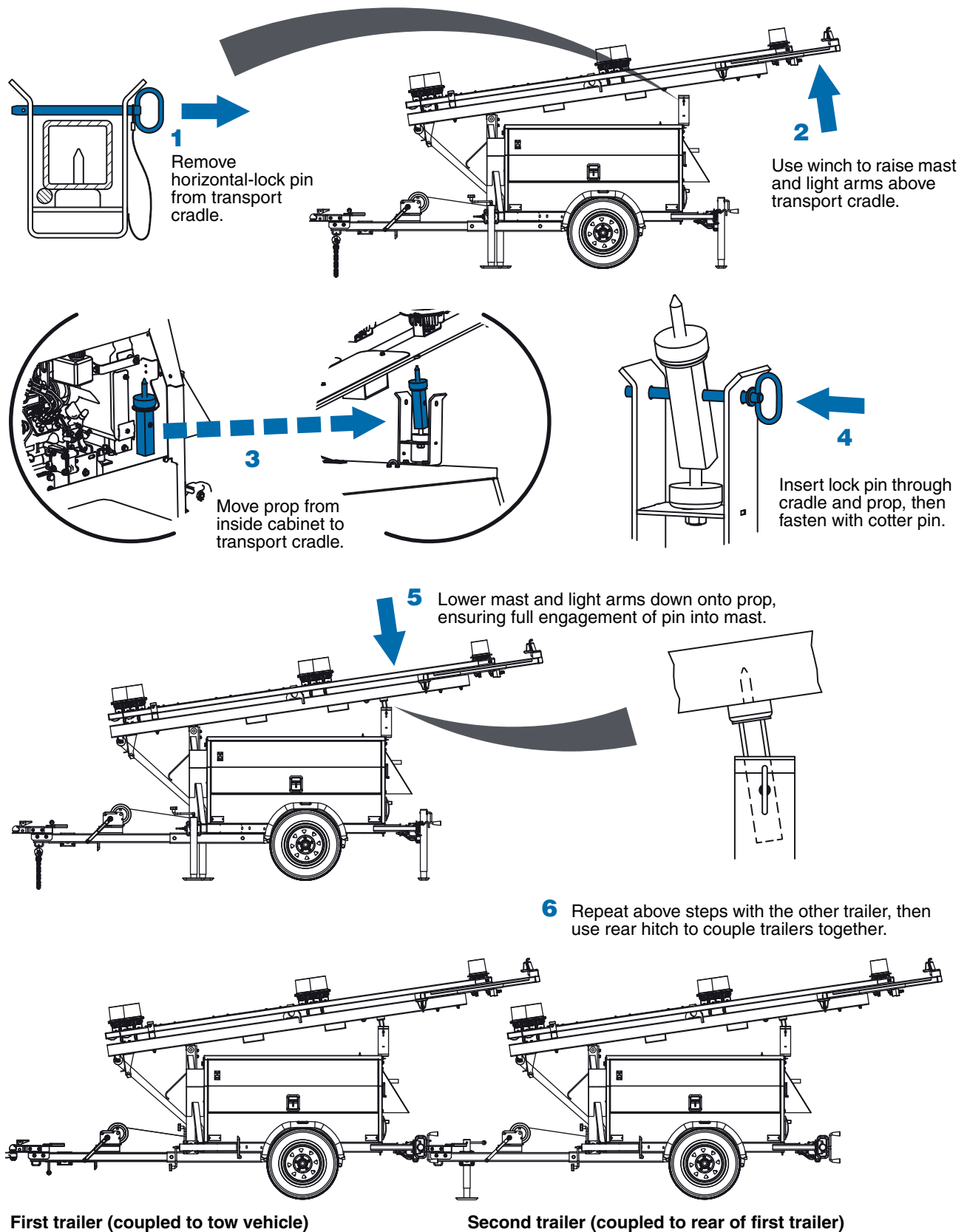


⚠ WARNING

Loose equipment will be damaged in transport, and could result in serious injury or death.

Before towing, set light arms in their cradles and secure with attached lock pins.

- a. Follow the instructions in Section 4.3.5, page 36, to lower the mast and light arms and secure them in place.
 - b. Verify the maintenance panel is all the way down and secured in place with the two draw-latches inside the equipment cabinet (Figure 3-2, page 18).
 - c. Verify the light arms are secured in their support cradles with their wire lock pins.
 - d. If the trailer is connected to earth ground, disconnect it.
 - e. If necessary, attach a red flag to the end of a light arm at the back of the trailer.
4. Refer to Figure 3-6 and prepare the trailer for tandem towing:
 - a. If the horizontal-lock pin is installed through the transport cradle (1), remove it from the cradle.
 - b. Use the winch to tilt the mast and light arms up, until they are a few inches above the cradle (2).
 - c. Open the driver's side gull-wing door to access the tandem-tow prop. Remove the prop from inside the trailer, set it over the vertical pin in the transport cradle. Ensure the arrows on the prop point toward the front of the trailer (3).
 - d. Secure the prop in place by inserting the horizontal-lock pin through the holes in the cradle and the prop, and then inserting the attached cotter pin through the horizontal-lock pin (4).
 - e. Use the winch to lower the mast and light arms down onto the prop. Ensure the pin protruding from the top of the prop goes inside the hole in the mast. The mast should rest snugly on the prop (5).
 5. Repeat Step 4 for the remaining trailer.
 6. Close and latch the side doors on both trailers.

Figure 3-6. Tandem towing

7. Check the tow hitch:
 - a. Inspect the tow hitch and coupling for wear and damage. Inspect both the rear tow hitch on the first trailer and the front coupling on the second trailer. Replace or repair if necessary.
 - b. Ensure the drawbar jack is down with its foot resting on the ground.
 - c. Verify the rear and side leveling jacks on the second trailer are in the up position, the outriggers are retracted, and all are secured with their locking pins.
 - d. Use the drawbar jack on the second trailer to raise the front of the trailer and set its drawbar hitch on the rear tow hitch of the first trailer. Ensure the coupling is properly engaged and locked.
 - e. On the second trailer, raise, rotate, and lock the drawbar jack in the up position.
8. Check tires, wheels, and axle lock:
 - a. Check tires for wear. Replace worn tires.
 - b. Verify tires are fully inflated to the proper pressure.
 - c. Verify that all wheel lugs are in place and tightened. Do not tow the trailer if a wheel lug is missing.
 - d. Remove the axle lock bar, if installed.
9. Ensure the trailer brake lights, taillights, and directional (turn) indicators are hooked up and functioning properly.
10. Remove blocks or chocks from wheels, if present.
11. Follow the towing requirements in Section 3.3.3.

3.3.3

During tandem towing

- Do not tow the trailers with any people, parts, supplies, or additional equipment attached to them or loaded onto them.
- Do not tow more than two X-Marker trailers in tandem. Do not tow additional trailers or other equipment in tandem with X-Marker trailers.
- If whipping or swaying occurs, do not attempt to correct it by turning the steering wheel, do not apply the brakes, and DO NOT speed up. Instead, release the gas pedal and hold the steering wheel in a straight-ahead position until the whipping or swaying stops.
- Do not exceed 25 mph (40 km/h) while tandem towing. Do not tandem tow on rough terrain or unpaved roads.

3.4

After towing

After towing, unhook trailers, tow chains, and taillight plugs. Use the drawbar-mounted jacks to raise the trailer drawbars and release the tow couplings. When ready, pull the tow vehicle and front trailer away from rear trailer, and pull the vehicle away from the remaining trailer.

3.5

Tow hitches

3.5.1

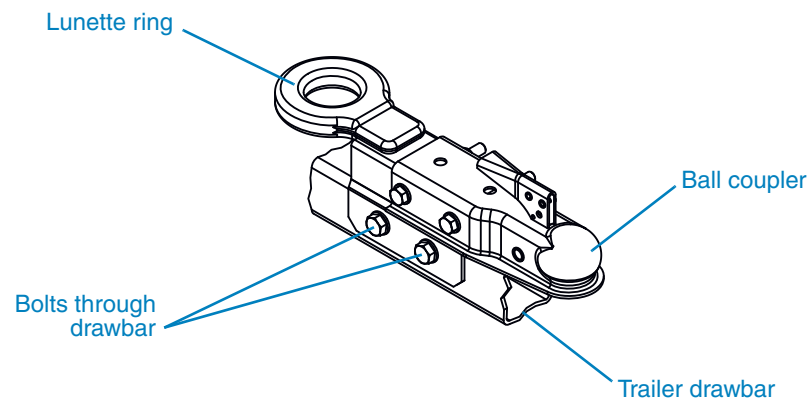
Drawbar tow hitch

The standard tow bar includes a combination hitch coupler for a 2-inch ball and 2½-inch pintle hook.

To reverse the coupler and ring, refer to Figure 3-7 and follow these steps:

1. Remove the lower two bolts that hold the combination hitch to the drawbar.
2. Lift the combination hitch off the drawbar and rotate the hitch end-to-end.
3. Using care not to pinch your fingers, return the hitch to the drawbar and align the bolt holes.
4. Reinstall the bolts and tighten the nuts fully.

Figure 3-7. Combination tow hitch



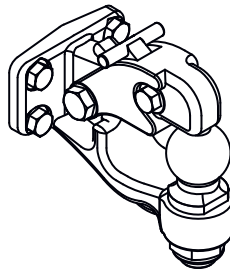
3.5.2

Tandem tow hitch

The tandem-tow hitch (Figure 3-8) is a combination hitch that allows two trailers to be towed in tandem. This hitch accommodates ball couplers and pintle hooks.

Before tandem towing, ensure the hitch is properly installed.

Figure 3-8. Tandem-tow hitch



3.6 Forking and hoisting

The trailer can be transported using a forklift or hoisted by means of the hoist ring on the mast. Before using a forklift or hoist to move the trailer:



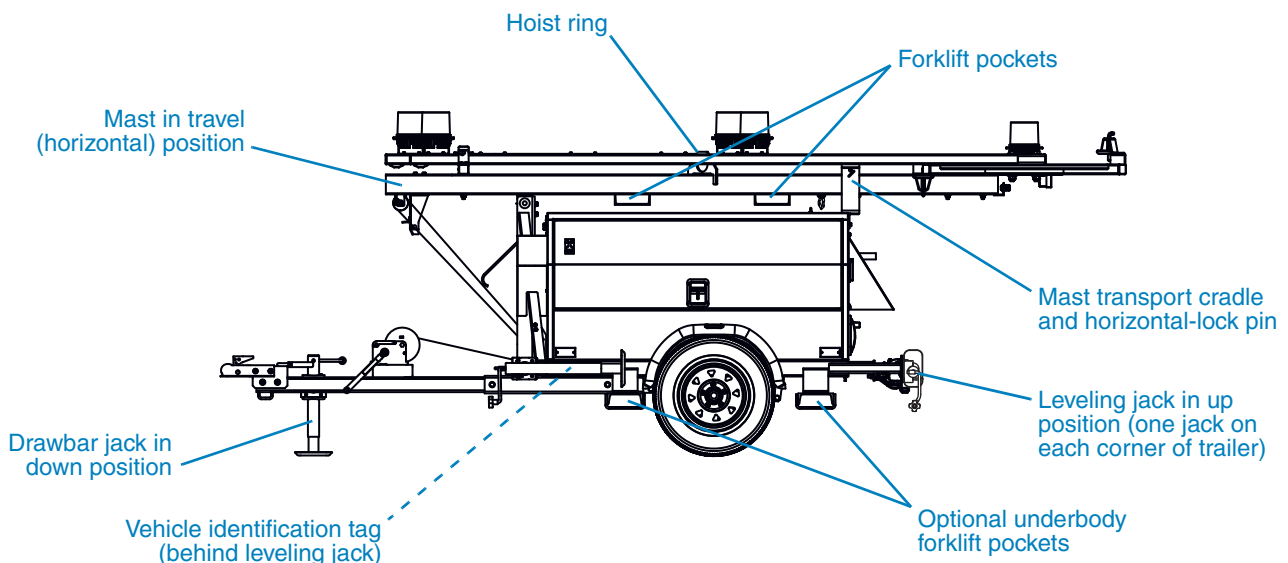
WARNING

Falling equipment can cause severe injury or death.

Follow all forklift and hoist requirements when moving the trailer.

- Follow all safety instructions in Section 2, page 3.
- Lower the mast and retract the giant “X” light arms (for instructions, see Section 4.3.5, page 36). Never move the trailer with the mast raised or the arms extended.
- Verify the mast and light arms are secured in place with their lock pins.
- Ensure both gull-wing doors and the top panel are closed and properly latched.
- Ensure the drawbar jack is down. Return the corner leveling jacks and outriggers to the transport position, and ensure they are all secured in place with their locking pins.
- Ensure equipment such as slings, chains, hooks, ramps, and jacks are secure and will bear the weight of the trailer. The trailer’s gross vehicle weight rating (GVWR) is displayed on the X-Marker vehicle identification tag (see Figure 3-9).
- Be aware and cautious of people’s proximity to the trailer. Always ensure the safety of nearby people when moving the trailer.
- When using a forklift, ensure the forks fully engage and support the trailer. Use fork extenders if necessary. Underbody forklift pockets (Figure 3-9) are optional and may not be included on your trailer.

Figure 3-9. Forklift pockets and horizontal-lock pin



4

Operation

4.1

Read before using

4.1.1

Safety



⚠ WARNING

Improper use of equipment could cause serious injury or death.

Before using this product:

- Carefully read, understand, and observe all instructions in this manual and in the engine manual.
- Read and follow all safety instructions. See Section 2, page 3.
- Follow all regulatory guidelines.

4.1.2

System checks

IMPORTANT!

Before putting the X-Marker L-893(L) into service, ensure its batteries are charged, the fuel tank is full, and the engine starts and runs properly.

If your X-Marker system is equipped with drip and spill protection:

- Before using the X-Marker system, ensure the drip pan is empty. To drain the pan, see Section 5.6.2, page 53.
- Before leaving the X-Marker system running, ensure both gull-wing doors and the top panel are closed and properly latched.

Drip and spill projection is optional and may not be included with your trailer.

4.2

Overview

A typical deployment of the Wanco X-Marker L-893(L) includes the following steps:

1. Transporting the trailer (Section 3, page 17)
2. Deploying the trailer (Section 4.3):
 - a. Locating and positioning the trailer (Section 4.3.1)
 - b. Leveling the trailer (Section 4.3.2)
 - c. Determining grounding requirements (Section 4.3.3, page 30)
 - d. Extending the arms and raising the mast (Section 4.3.4, page 31)
3. Operating the system (Section 4.4, page 40)

4.3

Deployment

4.3.1

Locating and positioning the trailer



⚠ DANGER
Electrocution hazard.
Contact with overhead electrical power lines will cause serious injury or death.

Do not position trailer under power lines.

- The trailer mast and giant “X” light arms rise to over 20 feet (6.2 meters) in height. Ensure the area above the trailer is clear of obstructions.
- To reduce the risk of shifting, rolling, or overturning, locate the trailer on a firm, level surface, with enough space to deploy the trailer’s outriggers.
- To reduce the risk of personal injury, ensure the surrounding area is in good order and free of debris.
- Ensure convenient access to earth ground (see Section 4.3.3, page 30).
- To achieve the best possible visibility:
 - ☐ Locate the trailer in the center of the runway.
 - ☐ Point the front of the trailer toward the glide path of incoming aircraft.
 - ☐ Ensure the giant “X” is visible from the glide path.

4.3.2

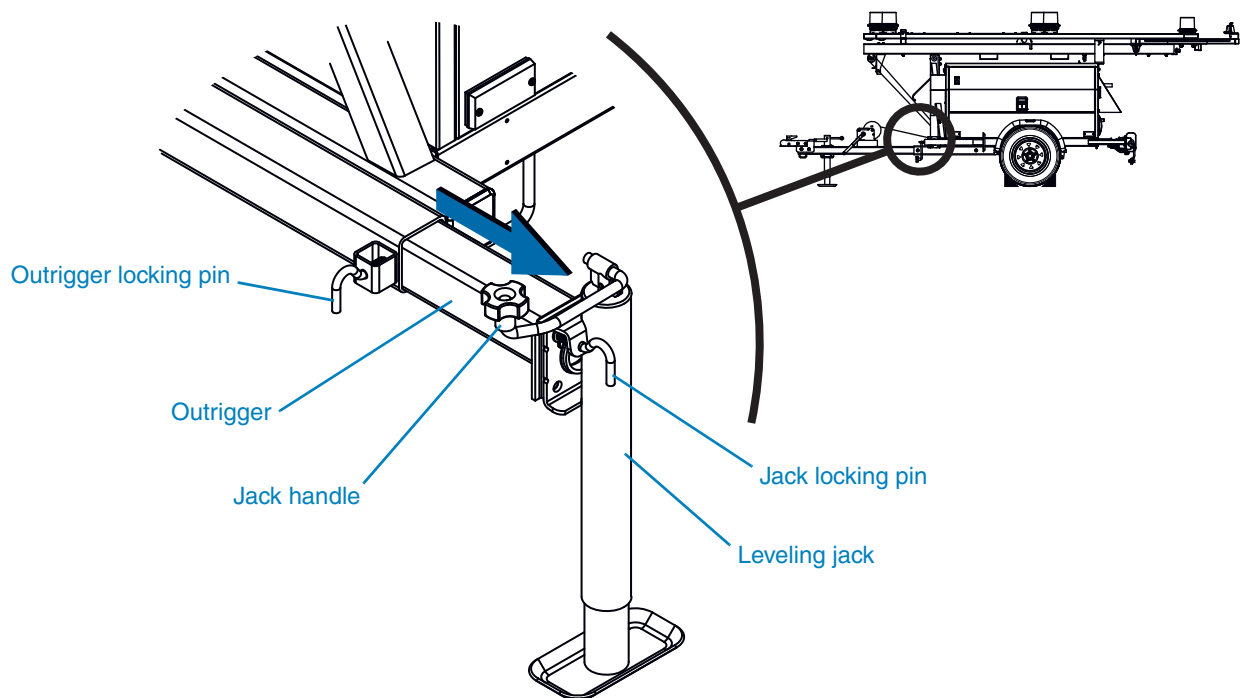
Leveling the trailer

Prior to extending the light arms and raising the mast, the trailer must be level and the outriggers extended for increased stability.

To level the trailer, refer to Figure 4-1 and follow these steps:

1. Ensure the area around and above the trailer are clear from obstructions.
2. Block or chock the trailer wheels.
3. Locate the outrigger on either side of the trailer. Pull the outrigger locking pin (not the jack locking pin) and pull the outrigger outward, away from the trailer, as far as it will go. When fully extended, the locking pin snaps into position with an audible “click.”
4. Pull the jack locking pin and rotate the jack downward until the locking pin engages. Do not lower the jack foot yet.
5. Repeat the previous two steps for the other outrigger, then locate and set the two jacks at the rear corners of the trailer.
6. Determine which corner of the trailer is highest, and extend the jack foot on that side downward until it rests firmly on the ground. Then level the trailer with the remaining three jacks.
7. Lower the drawbar jack for added stability.

Figure 4-1. Outriggers and jacks



4.3.3

Grounding the trailer

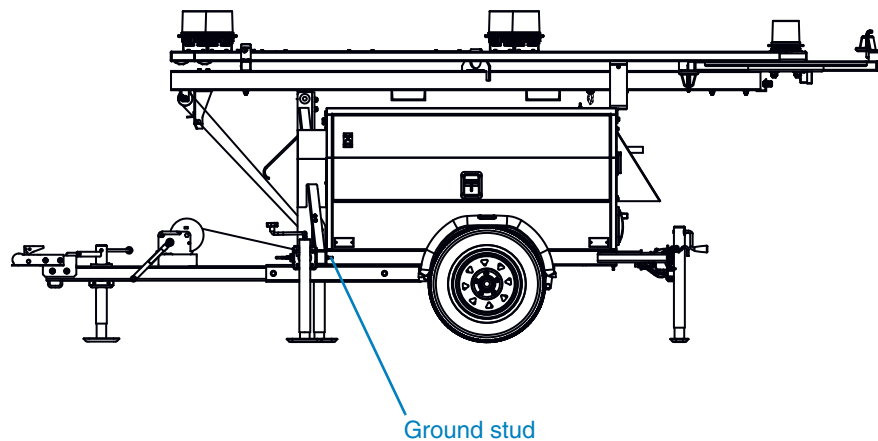
The X-Marker power system is a negative-ground system. The neutral of the generator stator winding is permanently connected (bonded) to the trailer frame.

The trailer includes a ground stud (see Figure 4-2) for electrically grounding the system when necessary to comply with the National Electrical Code (NEC) and other regulations.

For grounding and bonding requirements that apply to your deployment of the X-Marker trailer, consult a qualified electrician or refer to applicable regulations. Agencies and organizations that regulate electrical compliance may include, but are not limited to:

- Your local authority having jurisdiction (AHJ)
- National Fire Protection Association (NFPA), which publishes the NEC
- U.S. Occupational Safety and Health Administration (OSHA)

Figure 4-2. Ground stud



4.3.4

Raising the mast and light arms

**⚠ WARNING****Falling equipment could cause serious injury or death.**

- Before extending the light arms, ensure the trailer outriggers are extended.
- For safe operation, outriggers must remain extended while the mast and light arms are deployed.
- When tilting the mast up, ensure people are clear of the area around the trailer.
- Ensure the vertical-lock pin is properly engaged when the mast and light arms are tilted up.

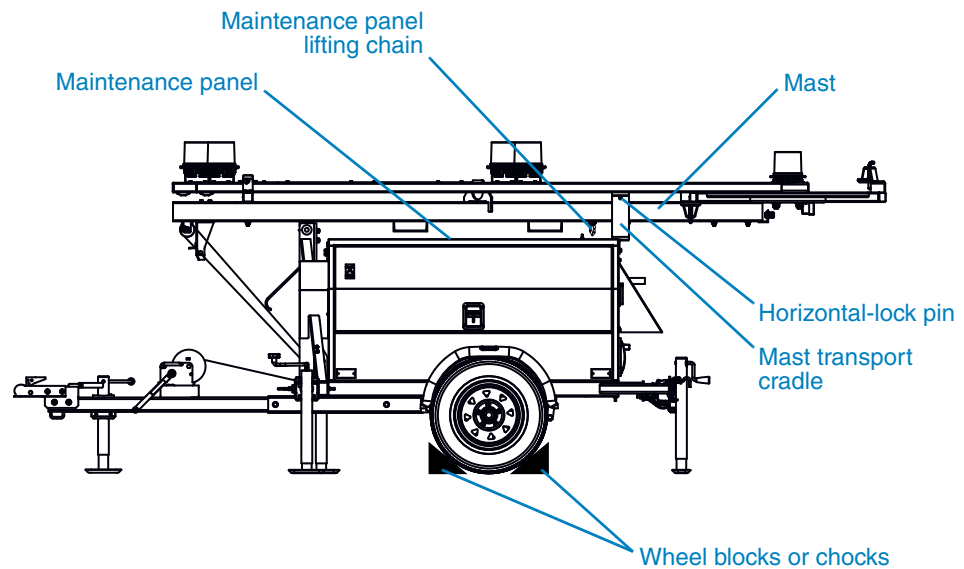
**⚠ CAUTION****Crush hazard.**

When extending the light arms and when raising the mast, keep clear of moving parts.

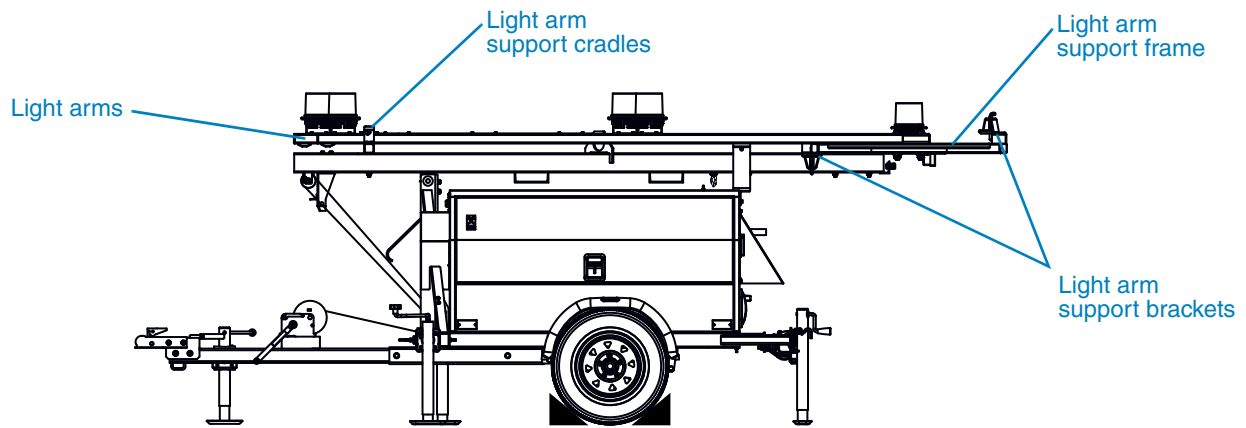
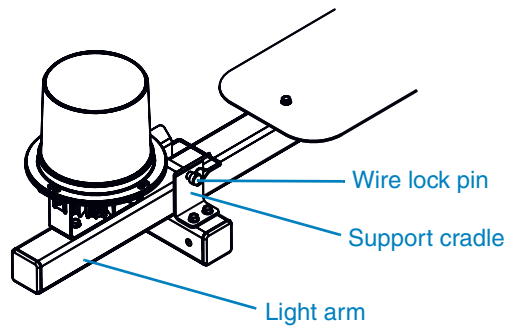
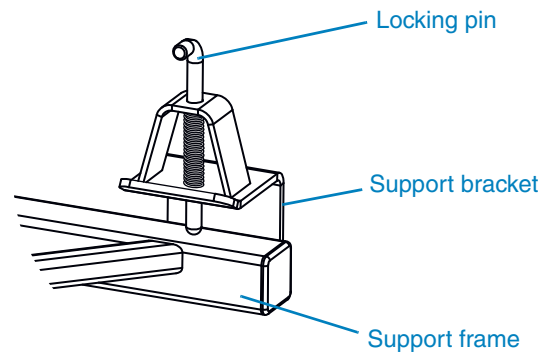
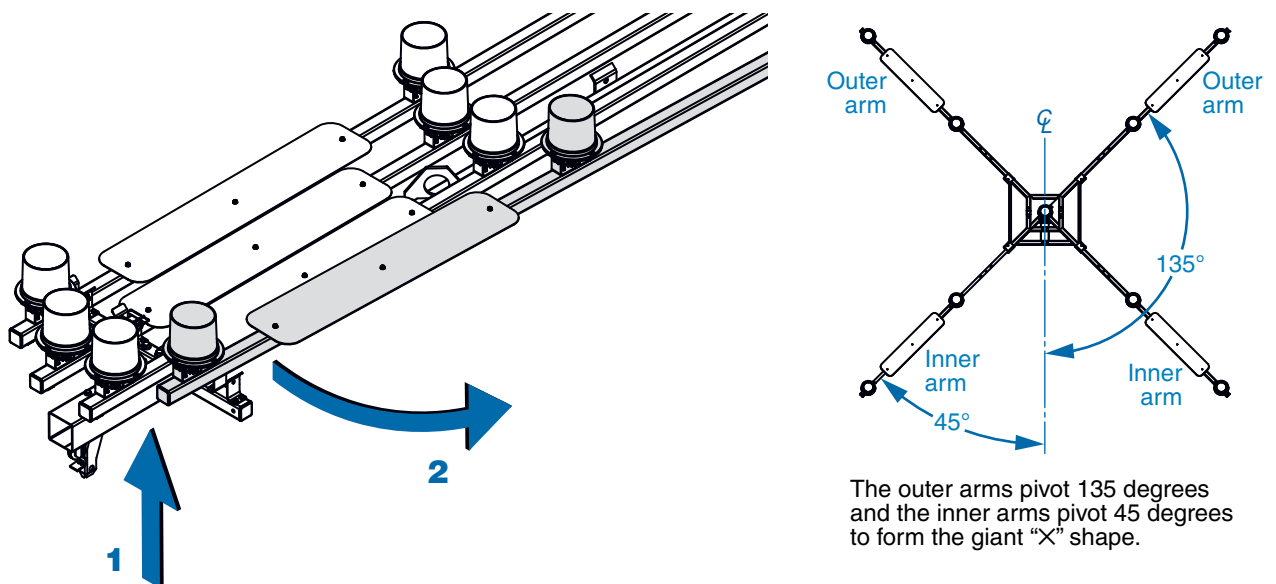
After locating the trailer (Section 4.3.1) and leveling the trailer (Section 4.3.2), extend the light arms and raise the mast using the following procedure.

1. Follow all safety instructions in Section 2, page 3.
2. Take the weather into account. Sustained high winds and other weather conditions may affect operation. For example, you should not deploy the trailer in an electrical storm. The trailer exceeds the FAA standard for wind load.
3. Ensure the area above the trailer is clear from obstructions.
4. Refer to Figure 4-3 and prepare for deployment:
 - a. Ensure the trailer wheels are blocked or chocked.
 - b. Ensure the outriggers are extended (see Section 4.3.2, page 29).
 - c. Connect the trailer ground stud to earth ground if required (see Section 4.3.3).
 - d. Ensure both ends of the maintenance panel lifting chain are attached to the mast. The chain should not be attached to the maintenance panel during operation.
 - e. Remove the horizontal-lock pin from the mast transport cradle.

Figure 4-3. Wheel chocks, mast, and lifting chain



5. Refer to Figure 4-4 and extend the light arms:
 - a. Ensure the area around the trailer is clear of obstructions. Be aware of people in the area around the trailer.
 - b. Remove the four wire lock pins from the light arm support cradles.
 - c. Choose one of the outer arms to extend. Lift the arm up, out of its support cradle, and pivot it sideways, out past the side of the trailer and toward the back of the trailer (see Figure 4-5). Continue lifting the arm slightly while moving it, to avoid dragging the arm across the support frame.
 - d. When the arm is next to its support bracket, pull up on the spring-loaded locking pin in the bracket. While holding the pin, move the arm into the support bracket, then release the pin to secure the arm in place. The pin should slide down in front of the arm.
 - e. Repeat the previous steps to extend the other outer arm and secure it in its support bracket.
 - f. Choose one of the inner arms to extend. Lift it and pivot it as with the outer arms. When its support bracket is next to the support frame, pull down on the spring-loaded locking pin in its bracket. While holding the pin, move the arm until the bracket engages the support frame, then release the pin to secure the arm. The pin should pop up in front of the frame. Repeat for the remaining arm.

Figure 4-4. Light arms**Detail view: Light arm support cradle****Detail view: Light arm support bracket****Figure 4-5. Extending the light arms**

6. Raise the mast and light arms by referring to Figure 4-6 and following these steps:



⚠ DANGER



Electrocution hazard.

Contact with overhead electrical power lines will cause serious injury or death.

Do not raise the mast and light arms when the trailer is near or under overhead power lines.

- a. Ensure the area above the trailer is clear of all obstructions.
- b. Ensure people are clear of the area around the trailer.
- c. Use the winch to tilt the mast from horizontal to vertical. Stand next to the drawbar while raising the mast and light arms.



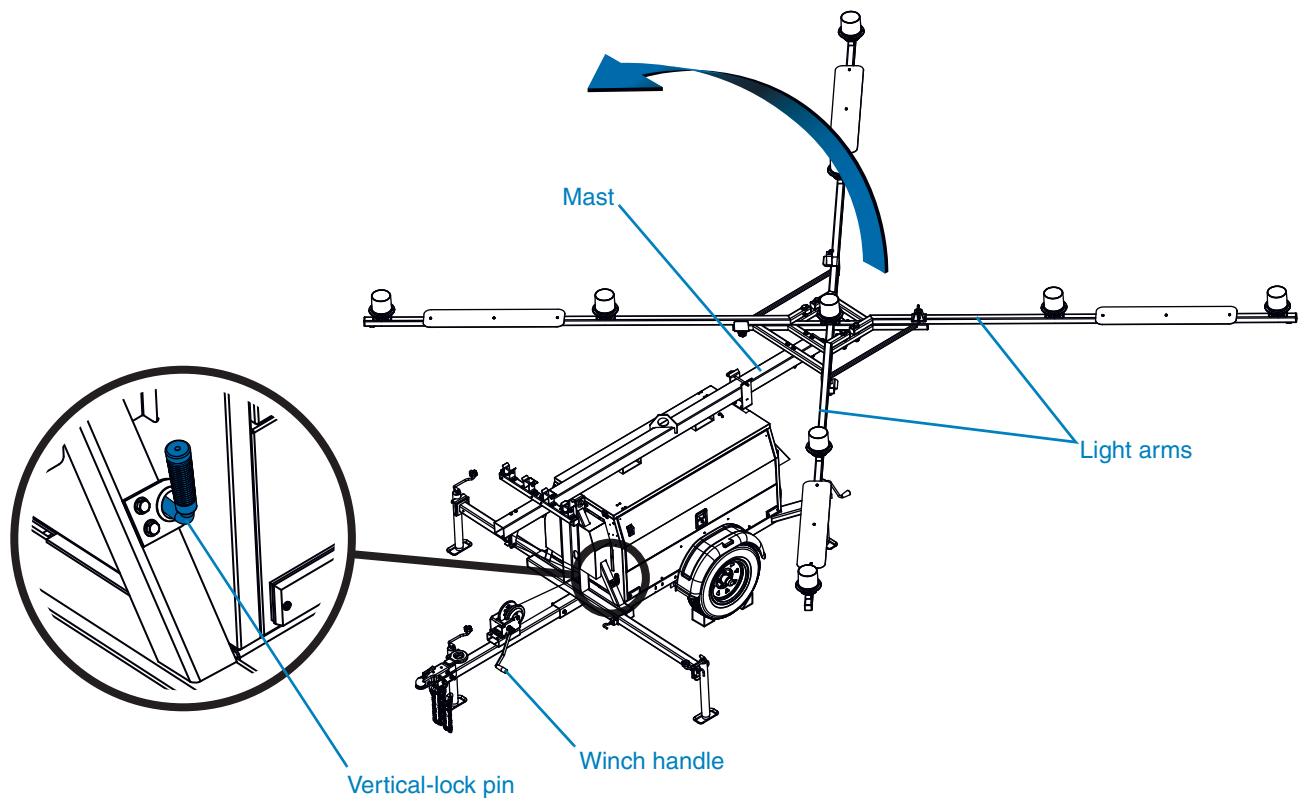
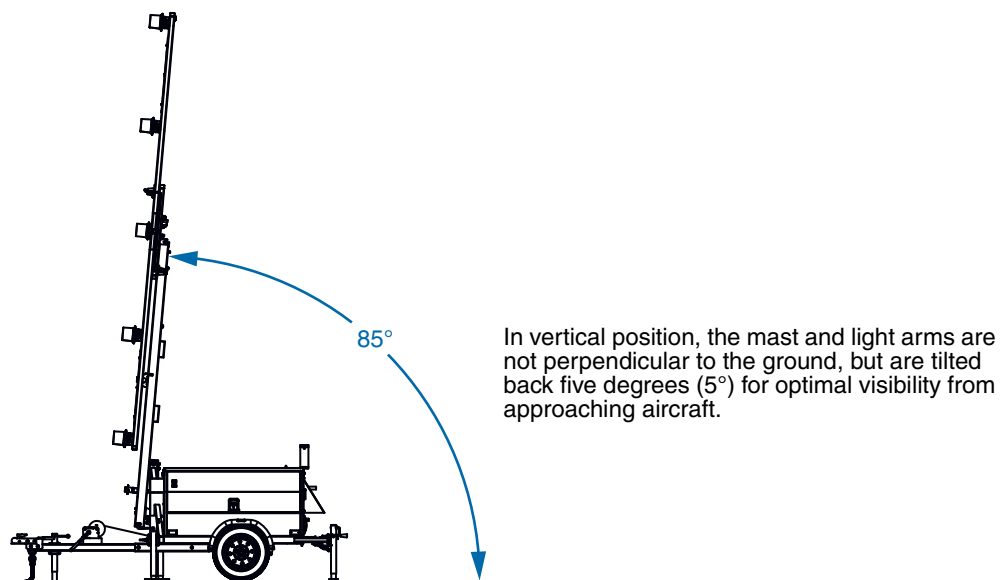
⚠ WARNING



Falling equipment could cause serious injury or death.

- When raising the mast and light arms to vertical, ensure the vertical-lock pin engages with an audible “click.”
- If the mast “hangs up” or the winch cable develops slack while raising the mast, stop immediately, move away from the trailer, and contact a Wanco service representative (see Section 1.3, “Where to obtain service,” page 2).

- Rotate the winch handle to tighten the cable and tilt the mast up.
 - The mast will stop five degrees (5°) from vertical (see Figure 4-7).
 - Operate the winch until the mast stops moving and the spring-loaded vertical-lock pin automatically snaps into place to secure the mast in the upright position. The pin engages the mast with an audible “click.”
- d. Ensure the vertical-lock pin is secure and has locked the mast in place. To test whether the pin is fully engaged, use the winch to start lowering the mast. If the mast stays in place, the pin is engaged. Use the winch to tighten the cable before moving to the next step.
7. To start the engine and turn on the lights, see Section 4.4, page 40.
 8. Visually verify proper operation per FAA guidelines.

Figure 4-6. Raising the mast and light arms**Figure 4-7. Mast and light arms in vertical position**

4.3.5

Lowering the mast and light arms

**⚠ WARNING**

Falling equipment could cause serious injury or death.

- Before lowering the mast, ensure the trailer outriggers are extended and all leveling jacks are down.
- When lowering the mast, ensure people are clear of the area around the trailer.

**⚠ CAUTION**

Crush hazard.

When lowering the mast and when stowing the light arms, keep hands and body parts clear of moving parts.

Before moving, transporting, or storing the trailer, lower the mast and retract the light arms using the following procedure.

1. Follow all safety instructions in Section 2, page 3.
2. Follow the instructions in Section 4.4, page 40, to turn off the lights and the engine.
3. Refer to Figure 4-8 and lower the mast and light arms as follows:
 - a. Ensure the horizontal-lock pin is not engaged through the mast transport cradle, but is hanging loose next to the cradle.
 - b. Ensure people are clear of the area around the trailer. Stand next to the drawbar when lowering the mast.
 - c. Release the spring-loaded vertical-lock pin by pulling it outward, away from the mast. If the pin resists, ensure the mast is fully vertical by using the winch to tighten the cable.
 - d. While pulling on the pin, use the winch to loosen the cable and tilt the mast downward. After the mast begins to tilt, release the pin.

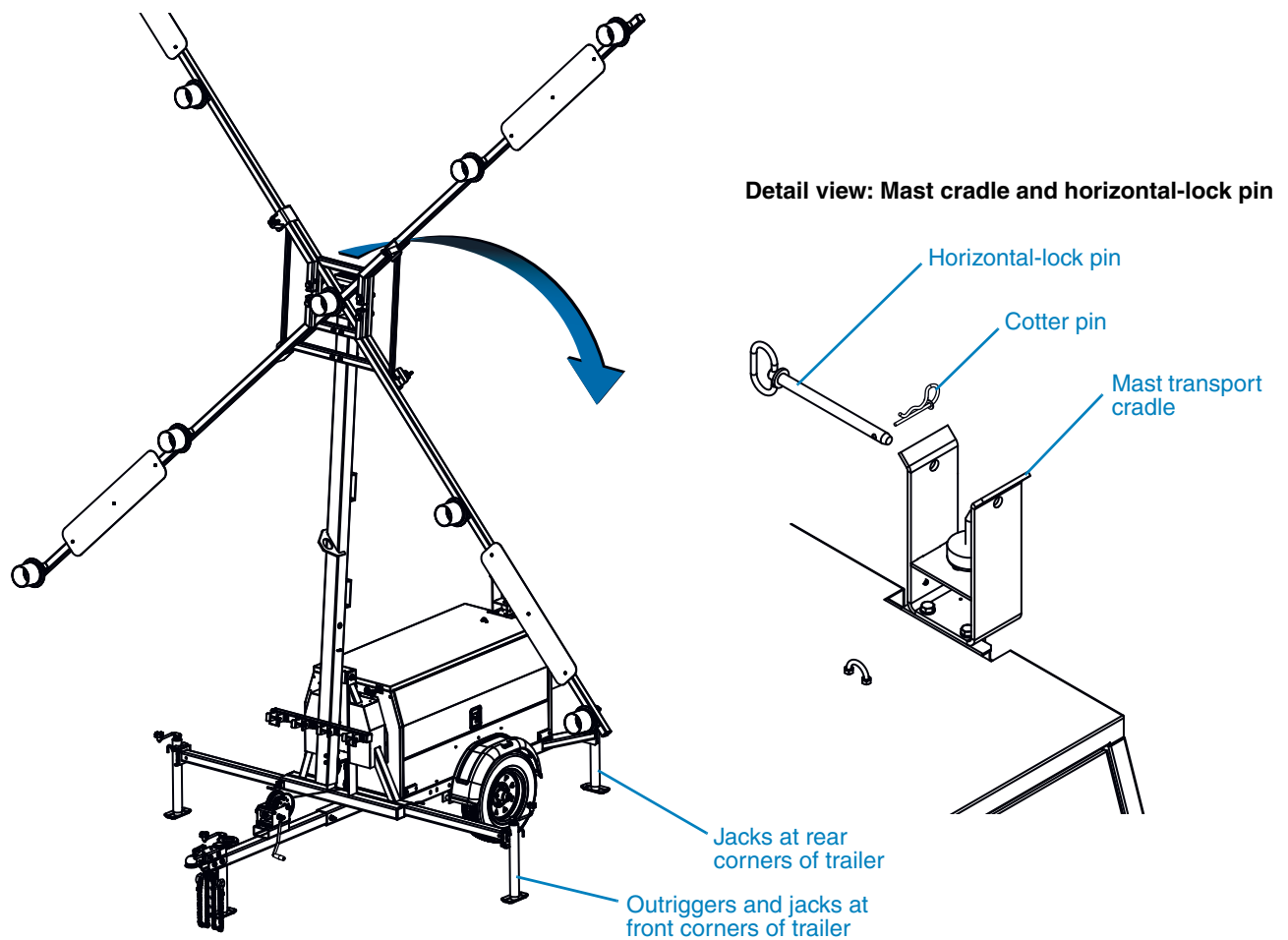
**⚠ WARNING**

Falling equipment could cause serious injury or death.

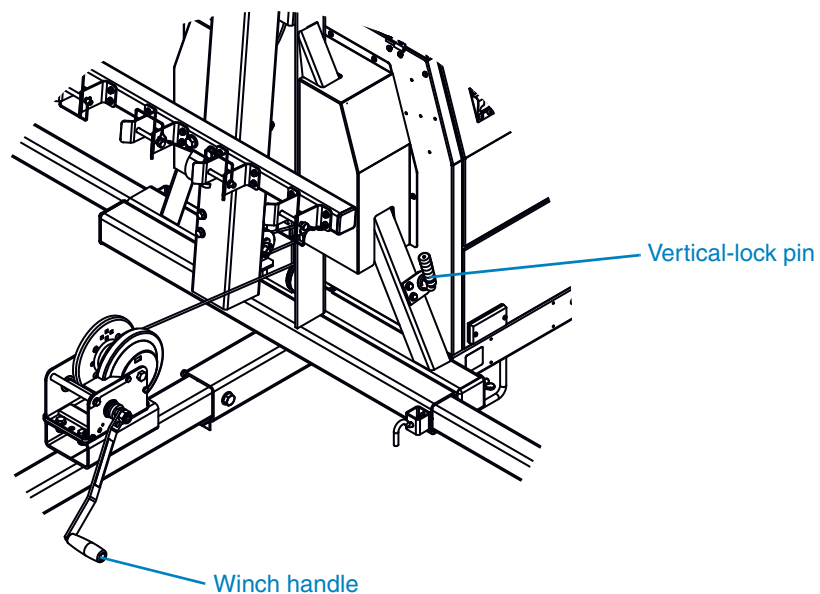
If the mast “hangs up” or the winch cable develops slack while tilting the mast, stop immediately, move away from the trailer, and contact a Wanco service representative (see Section 1.3, “Where to obtain service,” page 2).

- e. Continue rotating the winch handle to tilt the mast down to the horizontal position.
4. With the mast in the horizontal position, resting in the transport cradle, insert the horizontal-lock pin through both holes in the cradle, and then secure it with the attached cotter pin.

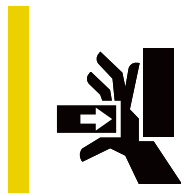
Figure 4-8. Lowering the mast and light arms



Detail view: Winch and vertical-lock pin



5. Refer to Figure 4-9 and retract the light arms:



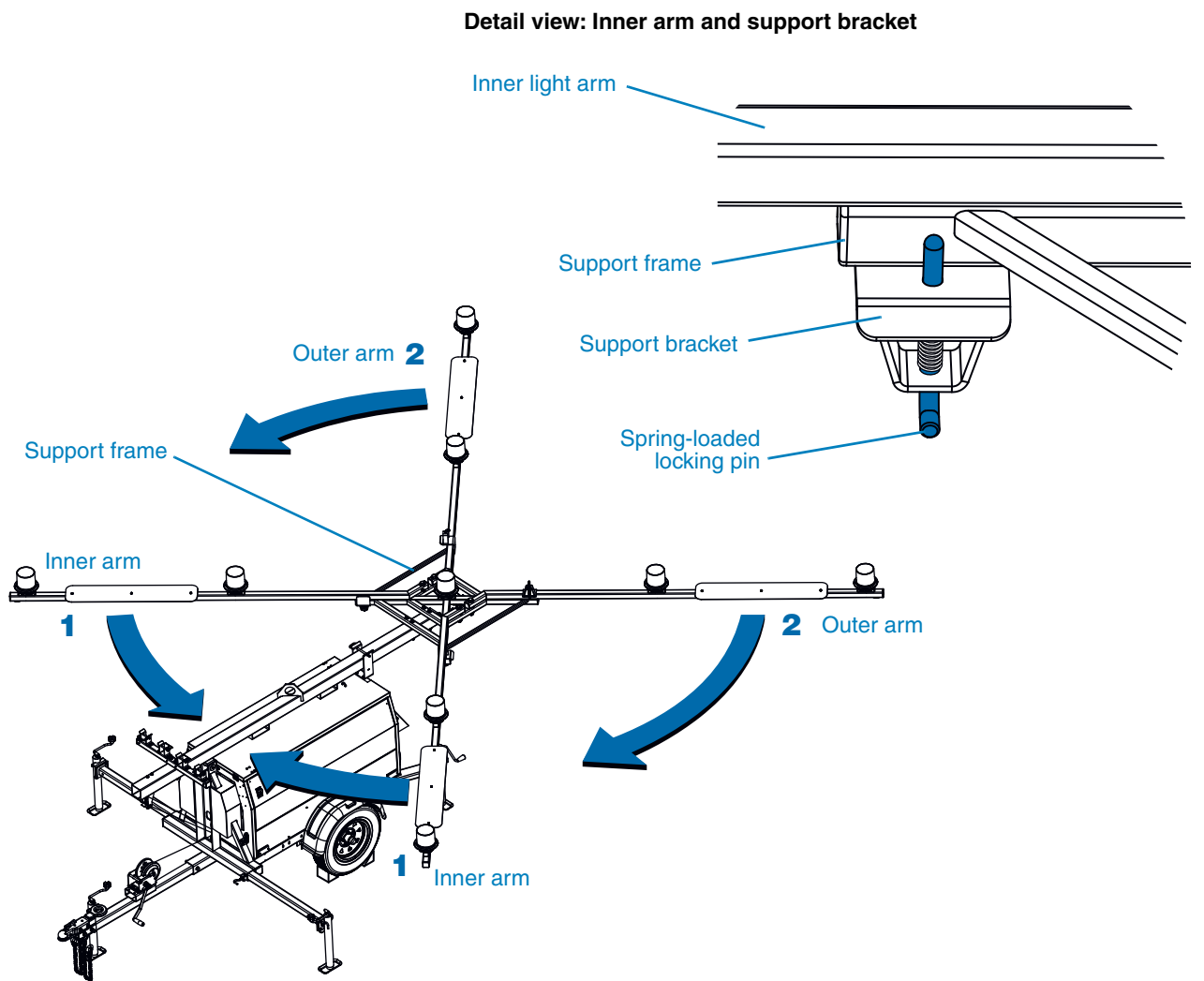
⚠ CAUTION

Crush hazard.

When moving the light arms, keep hands and body parts clear of pinch points.

- a. Ensure the four wire-lock pins are not engaged through the light arm support cradles, but are hanging loose next to the cradles.
- b. Ensure the area around the trailer is clear of obstructions. Be aware of people in the area around the trailer.
- c. Choose one of the inner arms to retract, and access its support bracket and spring-loaded locking pin at the support frame.
- d. Pull down on the spring-loaded locking pin. While holding the pin, move the arm until the bracket is clear of the support frame, then release the pin.
- e. Lift the arm slightly while pivoting it inward to its support cradle. Lift the arm the entire time you are moving it, to avoid dragging it across the support frame.
- f. Lift the end of the arm over the cradles and set it down in the appropriate cradle. The two inner cradles are for the inner light arms, while the outer cradles are for the outer arms.
- g. With the arm resting in its support cradle, insert the wire lock pin through the cradle and secure it in place.
- h. Repeat these steps to retract the other inner arm and secure it in its support cradle.
- i. Choose one of the outer arms to retract, and access its support bracket and spring-loaded locking pin at the support frame.
- j. Pull up on the spring-loaded locking pin. While holding the pin, move the arm until it clears the bracket, then release the pin.
- k. Lift the arm slightly while pivoting it inward to its support cradle. Lift the arm the entire time you are moving it, to avoid dragging it across the support frame.
- l. Lift the end of the arm over its support cradle and set it down in the cradle.
- m. With the arm resting in its support cradle, insert the wire lock pin through the cradle and secure it in place.
- n. Repeat these steps to retract the remaining arm and secure it in its support cradle.

Figure 4-9. Retracting the light arms



4.4 Operating the system

4.4.1 Safety



⚠ DANGER
Electrocution hazard.
Contact with live electrical circuits will result in severe injury or death.
 Use equipment only as instructed.

VA rating is
436.5
 or higher

Before operating the X-Marker system, read and follow all safety instructions. See Section 2, page 3.

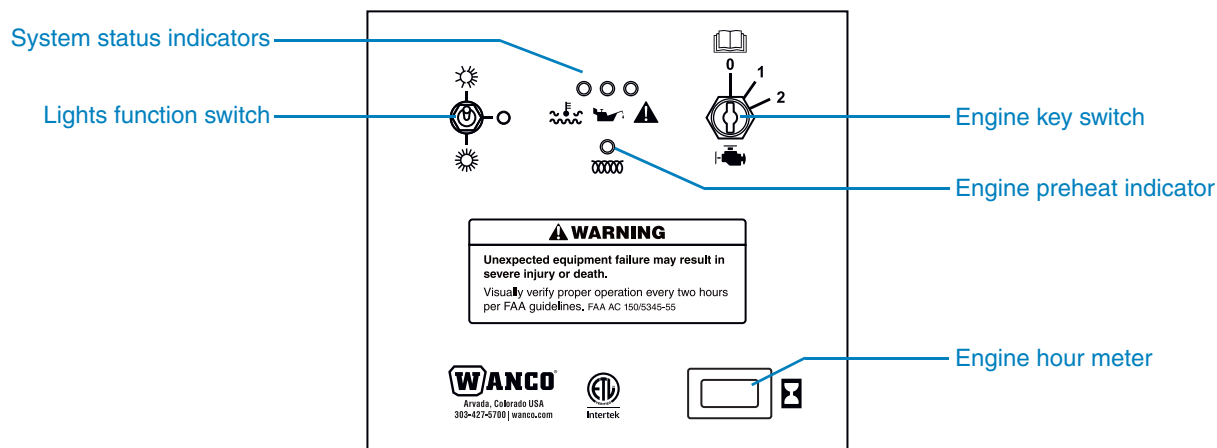
4.4.2 Control panel

The X-Marker control panel (Figure 4-10) gives you control of the engine and lights. The control panel is located inside the equipment cabinet on the driver's side of the trailer.

The control panel includes:

- A switch for controlling the lights (see Section 4.4.3)
- System status indicators (see Section 4.4.4, page 43)
- A key switch for starting and stopping the engine, with an engine preheat indicator for the engine's start coil (see Section 4.4.5, page 44)
- An hour meter that tracks engine use

Figure 4-10. Control panel



4.4.3

Lights

Switching the lights on and off

To switch the lights on and off:

1. Allow the engine to warm up before turning on the lights. For engine starting instructions, see Section 4.4.5, page 44.
2. Toggle the lights function switch to the desired setting:



Auto-brightness

Turns the lights on. The system uses a photocell to automatically adjust brightness in response to ambient light level: dim at night and fully bright during the day.



Full brightness

Turns the lights on. Sets the lights to the brightest illumination for daytime use.



Off

Turns the lights off.

3. Visually verify proper operation per FAA guidelines.

Ice-melt mode

In ice-melt mode, maximum continuous high power is applied to the lights, increasing their temperature for melting snow and ice accumulation on the light fixtures. Normal operation resumes automatically after one hour.

IMPORTANT!

In ice-melt mode, the temperature of the lights increases from normal but depends on environmental conditions. The desired effect of ice-melt mode on ice and snow melt is not guaranteed. You may run ice-melt mode more than once if needed.

Always visually verify proper operation per FAA guidelines.

- For ice-melt mode and auto-brightness:

Start with the lights function switch in the off (●) position. Rapidly toggle the switch up, then back to off, then up again. The lights will stay on continuously and then resume flashing at automatic brightness after one hour.

- For ice-melt mode and full brightness:

Start with the lights function switch in the off (●) position. Rapidly toggle the switch down, then back to off, then down again. The lights will stay on continuously and then resume flashing at full brightness after one hour.

Fail-safe mode

The X-Marker control system features a fail-safe operating mode that ensures the lights continue to operate in the event of a system failure.

- If the control system fails, the lights remain on continuously. See Section 4.4.4.
- If an engine shutdown occurs (see “Automatic engine shutdown” on page 45) or shore power is interrupted (see Section 4.4.6, page 46), the lights continue to flash as long as the batteries remain charged. Depending on environmental and other conditions, the batteries can power the lights for up to 24 hours.
- If the batteries are fully charged when an engine shutdown occurs or shore power is interrupted, the lights continue to flash normally for 18 hours, then remain on continuously for another 6 hours to indicate the battery charge is low.

Lights that will not turn on

If the lights are not lit while the system is powered, follow these steps:

1. Check the lights function switch to ensure it is not in the off (●) position. If the switch is set to auto-brightness or full brightness and the lights are not lit, proceed to Step 2.
2. Toggle the lights function switch to the off (●) position.
3. Stop the engine (see “Stopping the engine” on page 45) or, if connected to shore power, shut off the AC power source.
4. Identify the battery charger, located on top of the battery stack, behind the control box.
5. Ensure the battery charger power cord is plugged into the side of the control box for engine power or an extension cable for shore power. If it is plugged in, proceed to Step 6.
6. Lower the mast and light arms to the horizontal position (see Section 4.3.5, page 36), but leave the light arms extended outward.
7. With the lights switched off, the engine stopped and shore power shut off, ensure the quick-connect plug on the back of each light fixture is fully engaged.
8. If connections are secure, contact Wanco Customer Service (see Section 1.3, “Where to obtain service,” page 2).

Lights that remain on continuously

If the lights are on but not flashing, see “Fail-safe mode” above. One of the following conditions may have occurred:

- Low battery charge
- Automatic engine shutdown
- System error

4.4.4

Status indicators

Status indicators on the control panel (Figure 4-11) will light when the following conditions occur:

- High temperature—If the engine overheats, the engine shuts down automatically and the high temperature indicator is lit.
- Low oil pressure—If the oil pressure drops below a predetermined setpoint, the engine shuts down automatically and the low oil indicator is lit.
- System error—Various system errors can cause the system error indicator to light. Some system errors also cause automatic engine shutdown.

To troubleshoot status indicators, see Table 4-1. If troubleshooting does not resolve the issue, contact Wanco Customer Service (see Section 1.3, “Where to obtain service,” page 2).

Figure 4-11. Status indicators on control panel

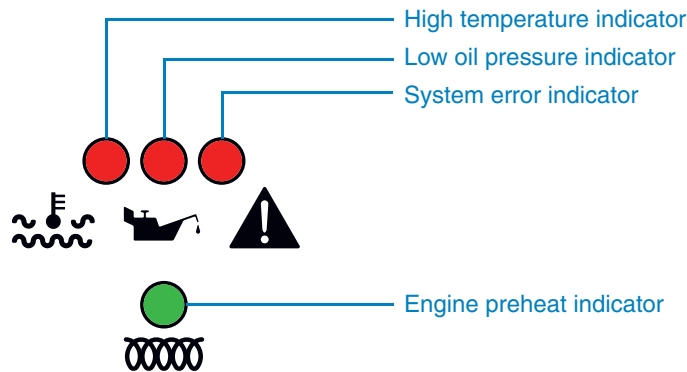


Table 4-1. Troubleshooting status indicators

Status indicator	Possible cause	Solution
High temperature	Low coolant level	Wait for engine to cool, then check coolant level at radiator; refill if necessary
Low oil pressure	Low oil level	Wait for engine to cool, then check oil level; refill if necessary
	Insufficient fuel	1. Check fuel level; refuel if necessary (see “Fuel type” on page 45)
		2. Check fuel filter; clean or replace if necessary (see engine manual)
		3. Check fuel supply line for leaks and obstructions; repair, clear, or replace if necessary
System error	System failure	Contact the factory for assistance (see Section 1.3, page 2)

4.4.5

Engine

Starting the engine

1. Follow all engine safety requirements in Section 2.5, page 7, and in the engine manual.
2. Perform system checks before starting the engine:
 - a. Check battery charge, fluid level, and wiring connections. Ensure batteries are not frozen. See Section 5.8, page 57, for battery safety and maintenance instructions.
 - b. From the driver's side of the trailer, access the battery charger inside the equipment cabinet. The charger is located on top of the battery stack, behind the control box.
 - c. Ensure the battery charger power cord is plugged into the side of the control box.
 - d. Check engine fuel, oil, and coolant levels. Use the proper diesel fuel (see "Fuel type" on page 45).
 - e. If the fuel tank was drained or run dry, it might be necessary to prime the fuel lines. Refer to the engine manual for instructions.
 - f. Ensure the lights function switch on the control panel is set to off (○).
3. To start the engine:
 - a. Insert the engine key into the key slot on the control panel and turn the key to the number 1 position. The engine preheat indicator (Figure 4-11, page 43) will light and remain lit for 30 seconds. Do not proceed while this indicator is lit.
 - b. When the engine preheat indicator light goes out, immediately turn and hold the key at the number 2 position. Release the key as soon as the engine starts or after 10 seconds.

CAUTION

Over cranking may damage the starter system.

Do not hold the engine key at position 2 longer than 10 seconds, regardless of whether the engine starts.

- c. If the engine does not start after 10 seconds, return the key to position 0 and wait 15 to 30 seconds, allowing the starter to cool before attempting to start the engine again.

4. After starting the engine, or attempting to start it:
 - If the engine starts, but does not gain sufficient oil pressure within 30 seconds of starting, the automatic shutdown system will engage (see below). Before attempting to restart the engine, return the key to position 0 to reset the internal 30-second timer.
 - If the engine does not start, return the key to position 0 before trying to start the engine again. If the engine key is left in position 1 and the engine is not started, all indicator lights (Figure 4-11) will blink continuously until the key is turned to position 0.
 - After the engine has started, turn on the lights (see Section 4.4.3, page 41). Visually verify proper operation per FAA guidelines.
 - Before leaving the X-Marker trailer, ensure both gull-wing doors and the top panel are closed and properly latched.

Stopping the engine

To manually stop the engine:

1. Toggle the lights function switch to the off (●) position.
2. Turn the engine key to the number 0 position.

Automatic engine shutdown

The control system is equipped with an automatic shutdown feature that prevents damage by shutting down the engine when any of the following conditions occur:

- Engine temperature is too high
- Oil pressure is too low
- System error

The engine also shuts down when it runs out of fuel.

For fail-safe operation in the event of engine shutdown, see page 42.

Fuel type

Use only diesel fuel for the engine. The recommended fuel type varies with ambient temperature. Typically:

- When the ambient temperature is 40°F (5°C) or above, use diesel fuel #2 (DF2).
- When the ambient temperature is below 40°F (5°C), use diesel fuel #1 (DF1).
- For very cold climates, use the appropriate winter-blended diesel fuel.

For more information about fuel type, read the engine manual.

4.4.6

Shore power

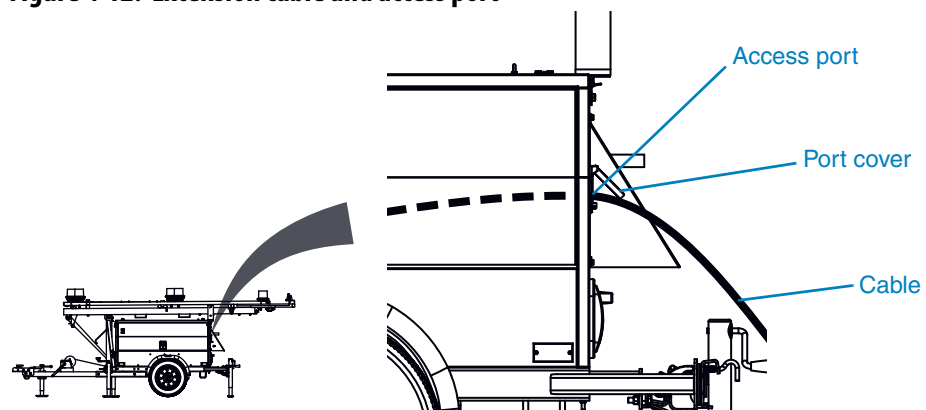
When necessary, the X-Marker system can be connected to shore power as an alternative to running the engine. An industrial grade extension cable is required and must be user supplied.

To operate the system on shore power:

1. Check battery charge, fluid level, and wiring connections. Ensure batteries are not frozen. See Section 5.8, page 57, for battery safety and maintenance instructions.
2. To ensure the system can operate with all its doors closed, the extension cable **MUST** enter the equipment cabinet through the access port on the rear of the cabinet (see Figure 4-12, page 46). Route the extension cable into the cabinet through the port.
3. From the driver's side of the trailer, access the battery charger inside the equipment cabinet. The charger is located on top of the battery stack, behind the control box.
4. Unplug the battery charger from the side of the control box and plug it into the extension cable inside the cabinet.
5. Plug the free end of the extension cable into an appropriately rated external power source.
6. Turn on the lights as needed (see Section 4.4.3, page 41).

If the system is not working, first check the fuse on the charger, and then check the line voltage from the power source. Contact Wanco Customer Service if necessary (see Section 1.3, "Where to obtain service," page 2).

Figure 4-12. Extension cable and access port



4.5

Optional equipment

4.5.1

Cold weather package

The cold weather package adds equipment that aids in starting the engine when temperatures are very low. Equipment includes an electric oil-pan heater, an in-line electric block heater, a battery blanket, and a dedicated GFCI receptacle with power cable.

To use the electric heaters, plug the power cable into a user supplied extension cable connected to shore power, such as a portable generator or grid power.

IMPORTANT!

DO NOT use the X-Marker engine to power the heaters. Plug the extension cable into an external AC power source. Additionally, the extension cable **MUST** enter the equipment cabinet through the access port on the rear of the cabinet.

Ensure both gull-wing doors and the top panel are closed and properly latched while using the heaters.

The cold weather package is an option that might not be included with your X-Marker system.

4.5.2

Tandem-tow package

The tandem-tow package allows a single vehicle to tow a pair of X-Marker trailers, under certain conditions, for simplified deployment. The package adds a rear tow hitch for towing a second trailer, and a tandem-tow prop to support the mast and light arms during transport.

The tandem-tow prop is stored inside the equipment cabinet on the driver's side of the trailer. The rear tow hitch is installed at the back of the trailer.

For tandem-towing instructions, see Section 3.3, page 20.

The tandem-tow package is an option that might not be included with your X-Marker trailer.

4.5.3

Protective cover

A protective cover for the X-Marker trailer, light arms, and lights provides protection when the system is not in use, eliminates the accumulation of snow and ice, and protects from dust and dirt when the trailer is in storage.

The cover is optional equipment that might not be included with your X-Marker system.

5 Maintenance

5.1 Safety



⚠ DANGER

Electrocution hazard.

Contact with live electrical circuits will result in serious injury or death.

- Before servicing any component on the trailer, turn off power, then disconnect cables from batteries.
- Never allow positive wiring to short to ground.
- Only a qualified electrician should service the electrical system.

**VA rating is
436.5
or higher**

- Before performing any type of service or maintenance, read and follow all safety instructions. See Section 2, page 3.
- The engine is permanently grounded to the trailer. NEVER perform any service unless all electrical components are shut down:
 - ☐ Ensure all power circuits are shut off.
 - ☐ Turn the engine key to the OFF or vertical position.
 - ☐ Disconnect battery cables: first from the positive (+) battery terminal,* then from the negative (–) terminal.



⚠ CAUTION

During maintenance, adverse weather conditions can cause equipment damage and injury.

Whenever possible, perform maintenance indoors.

**Removing the positive cable first is a requirement for negative-ground systems.*

5.2 Routine inspection

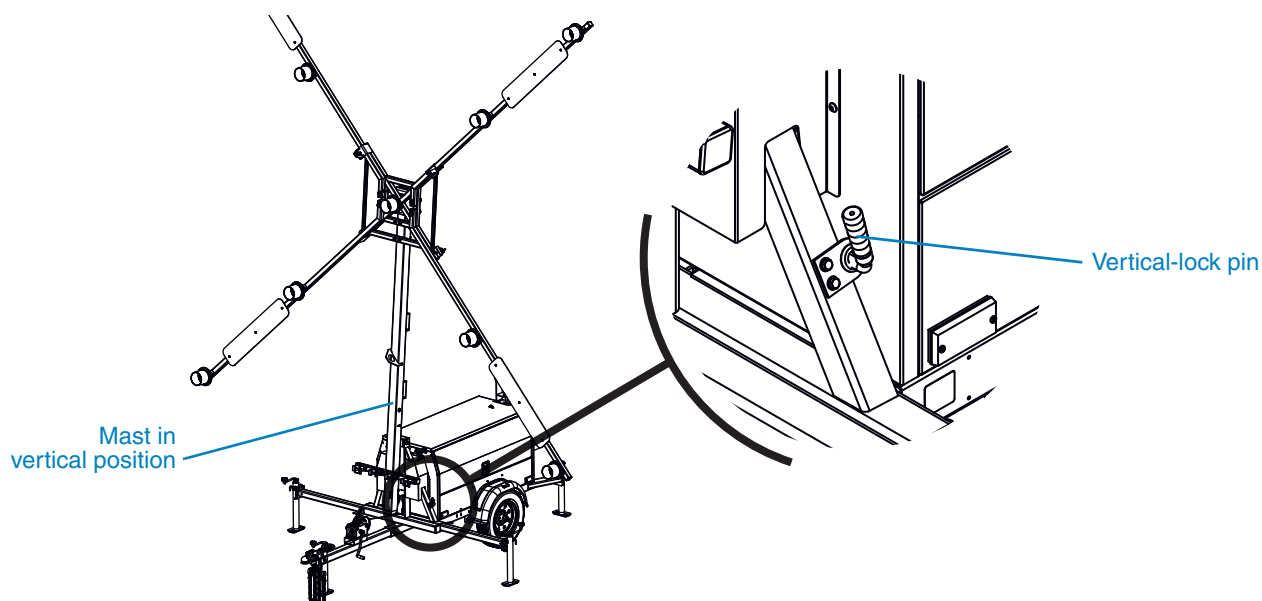
Before performing any type of service or maintenance, read and follow all safety instructions. See Section 2, page 3.

Repair or replace worn and damaged components immediately. Never use any equipment that is damaged or in need of repair.

When the system is in regular use, you should routinely perform the following maintenance checks:

- Check fluid levels and look for leaks. Refill fluids if necessary. Repair leaks before using the system.
- If the system includes optional drip and spill protection, check the drip pan for fluid. The drip pan is located under the engine inside the equipment cabinet. If fluid is present, drain the pan before using the system. See Section 5.6.2, page 53.
- To drain engine oil, see Section 5.6.2, page 53.
- Check battery charge, fluid level, and wiring connections. See Section 5.8, page 57.
- Inspect all exposed wiring for damage, worn insulation, and cuts. Repair or replace if necessary.
- Inspect winch cable for wear and damage. Repair or replace if necessary.
- If the mast and light arms are vertical, verify the vertical-lock pin is engaged and secure. (see Figure 5-1). To test whether the pin is fully engaged, use the winch to start lowering the mast. If the mast stays in place, the pin is engaged. Use the winch to tighten the cable.

Figure 5-1. Vertical-lock pin



5.3 Fuses and relays

Before performing any type of service or maintenance, read and follow all safety instructions. See Section 2, page 3.

Check and replace fuses when necessary.

The fuse box is located on the back of the control box and is accessed either from the right (passenger) side of the trailer or the top of the equipment cabinet with the maintenance panel raised (see Section 5.5).

5.4 Cleaning the control panel

Before performing any type of service or maintenance, read and follow all safety instructions. See Section 2, page 3.

CAUTION

Pressure wash could damage control panel and electronics.

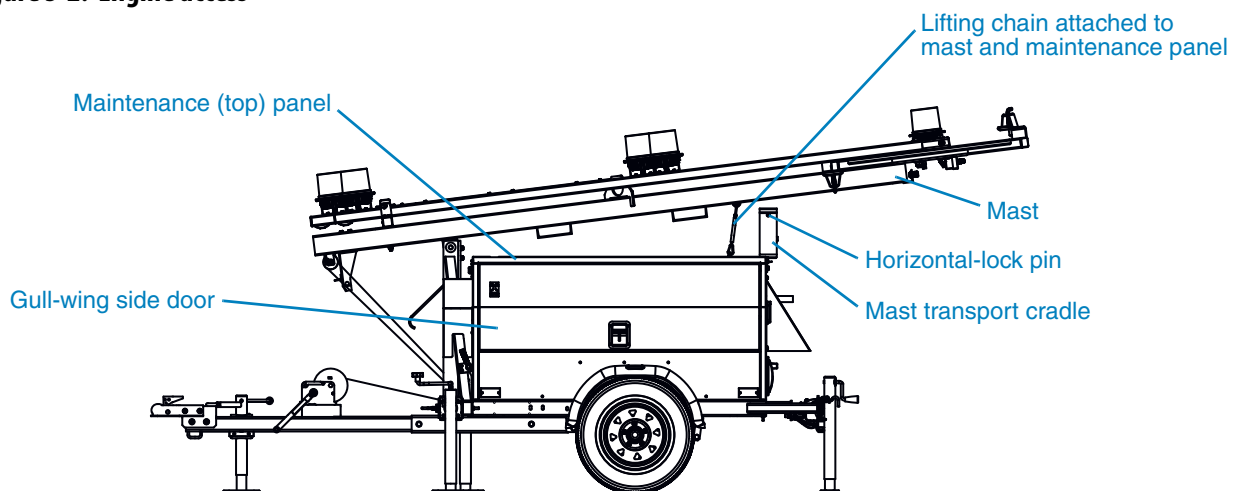
Use a slightly damp, soft cloth to clean control panel when necessary.

5.5 Using the maintenance panel

Before performing any type of service or maintenance, read and follow all safety instructions. See Section 2, page 3.

Figure 5-2 calls out the components necessary for accessing the engine for routine maintenance and repairs. Access the engine using the two gull-wing side doors and the maintenance panel.

Figure 5-2. Engine access



Raising the panel

To raise the maintenance panel using the lifting chain:

1. Follow the instructions in Section 4.3.5, page 36, to lower the mast and light arms, and secure the light arms in place.
2. Remove the horizontal-lock pin from the mast transport cradle.
3. Detach one end of the lifting chain from the mast and connect it to the maintenance panel.
4. Release the two rubber draw-latches located inside the engine cabinet (see Figure 5-3), one on either side of the trailer.
5. Close both side doors.

CAUTION

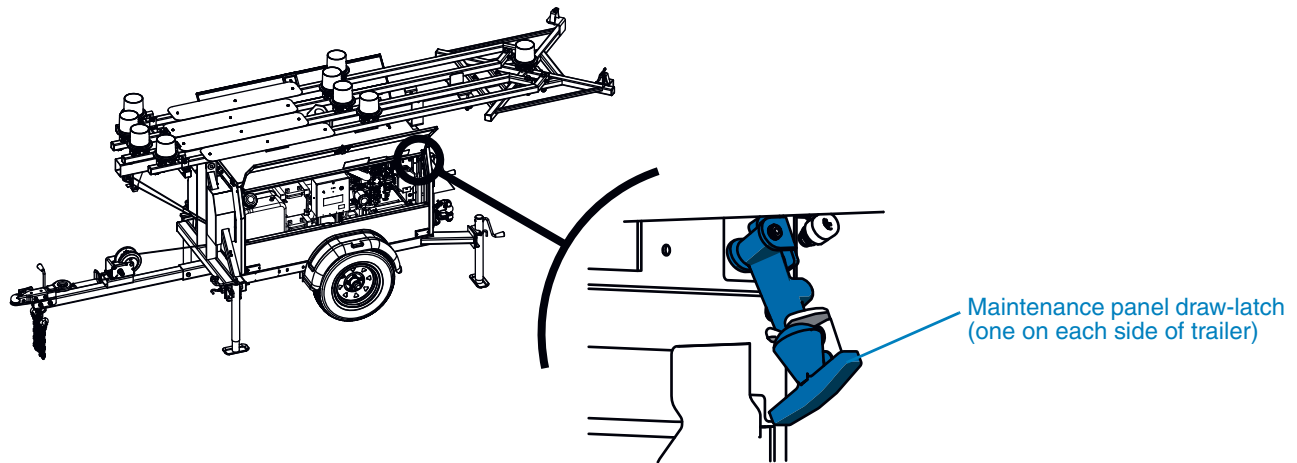
Improperly raising the maintenance panel could damage equipment.

- Before raising the maintenance panel, release its two rubber draw-latches and close both side doors.
 - Raise the panel fully by raising the mast to vertical.
6. Raise the mast, light arms, and the attached panel using the winch. Raise the panel fully, bringing the mast to vertical so that the vertical-lock pin engages (see Figure 5-1, page 50).

Securing the panel

When maintenance is complete:

1. Lower the mast, light arms, and maintenance panel all the way down using the winch.
2. Detach the lifting chain from the maintenance panel and attach the loose end to the ring on the mast.
3. Reattach the two rubber draw-latches to the brackets inside the cabinet (Figure 5-3), one on either side of the trailer.
4. Close both side doors.

Figure 5-3. Maintenance panel draw-latches

5.6 Servicing the engine

5.6.1 Before servicing

Before performing any type of service or maintenance, read and follow all safety instructions. See Section 2, page 3.

- For engine maintenance and servicing, see the engine instruction manual.
- To drain engine oil and coolant, see Section 5.6.2.
- To check and refill coolant, see Section 5.6.3.

5.6.2 Draining engine fluids

Before performing any type of service or maintenance, read and follow all safety instructions. See Section 2, page 3.

Standard trailers

To drain the engine oil and coolant, see the engine instruction manual.

Trailers with drip and spill protection

If the trailer includes optional drip and spill protection, a drip pan under the engine requires the following steps:

1. Locate the drip pan inside the equipment cabinet, under the engine. Ensure there is no fluid in the pan. If fluid is present, it will flow through the drain hole when the plug is removed in Step 3. Be prepared to capture the fluid and prevent it from spilling onto the ground.
2. Start the engine and allow it to warm up. Do not turn on the lights. After it has warmed up, stop the engine. For engine operating instructions, see Section 4.4.5, page 44.
3. Locate and remove the drip pan drain plug. The plug is located under the trailer, near the rear frame (see Figure 5-4).
4. If the trailer includes an oil drain hose, it is connected to the bottom of the engine block inside the equipment cabinet. The other end of the hose is loose and lying in the drip pan. The loose end of the hose has a plug inserted into it, while the end connected to the engine has a valve (see Figure 5-5). Locate the hose, if equipped.
5. Route the drain hose through the drain hole in the bottom of the drip pan.
6. Put the end of the hose in an oil drain pan, a bucket, or other container to capture the engine oil when the plug is removed. Before removing the plug from the loose end of the drain hose under the trailer, be aware the hose might be full of fluid.
7. Remove the plug from the end of the drain hose and let the contents of the hose drain into your container.
8. Open the drain valve at the engine end of the drain hose using the valve lever. The lever moves in two directions, as indicated in Figure 5-5. When the valve is opened, the oil will drain from the engine through the hose into your container.
9. When the engine oil has finished draining:
 - a. Close the drain valve.
 - b. Reinstall the plug at the loose end of the drain hose.
 - c. Pull the hose from the drip pan drain hole and lay it in the pan.
 - d. Reinstall the drip pan drain plug.

5.6.3

Coolant overflow

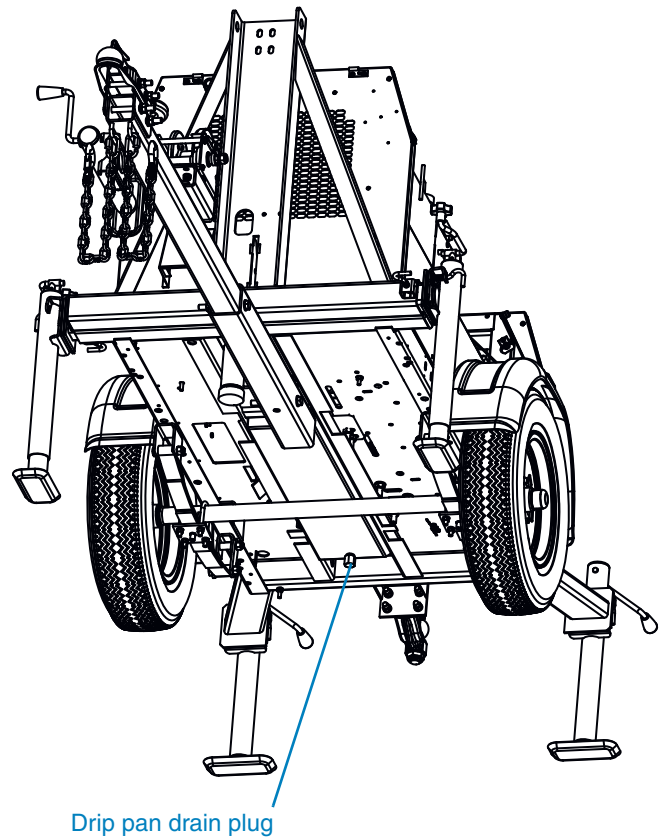
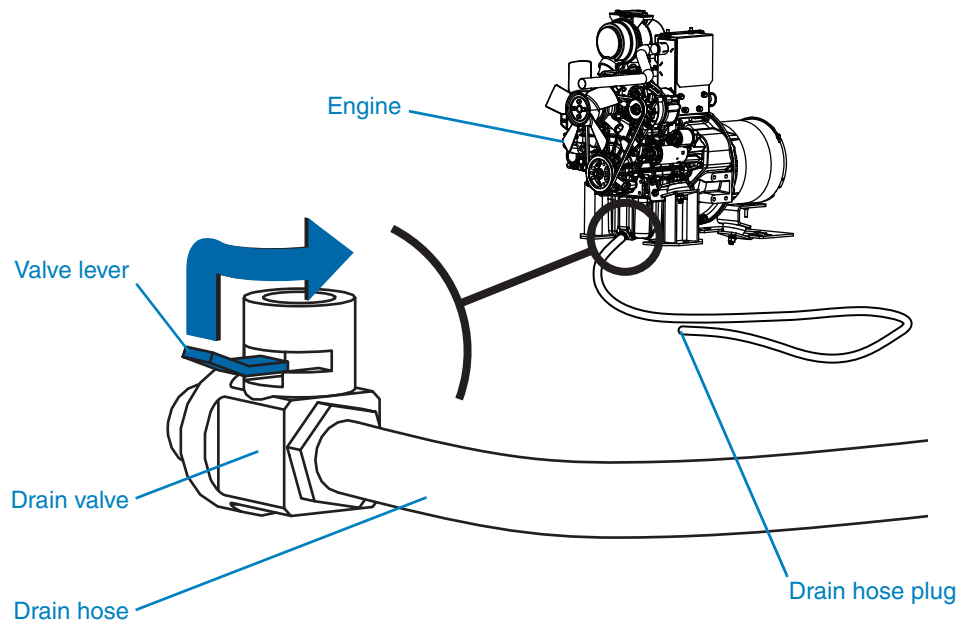
Before performing any type of service or maintenance, read and follow all safety instructions. See Section 2, page 3.

The engine is equipped with a coolant overflow bottle. When the engine is hot, the overflow bottle may have coolant in it, and may become full. When the engine is cool, the bottle may be empty or nearly empty. This is normal.

- Do not add coolant to the system using the overflow bottle. Add coolant only at the radiator, and only when needed.
- Empty the overflow bottle when it contains fluid.
- Check the coolant level at the radiator.

Figure 5-4. Drip pan drain plug

Drip and spill protection is an option that may not be included with your X-Marker system.

**Figure 5-5. Engine oil drain valve**

5.7 Photocell adjustment

Before performing any type of service or maintenance, read and follow all safety instructions. See Section 2, page 3.

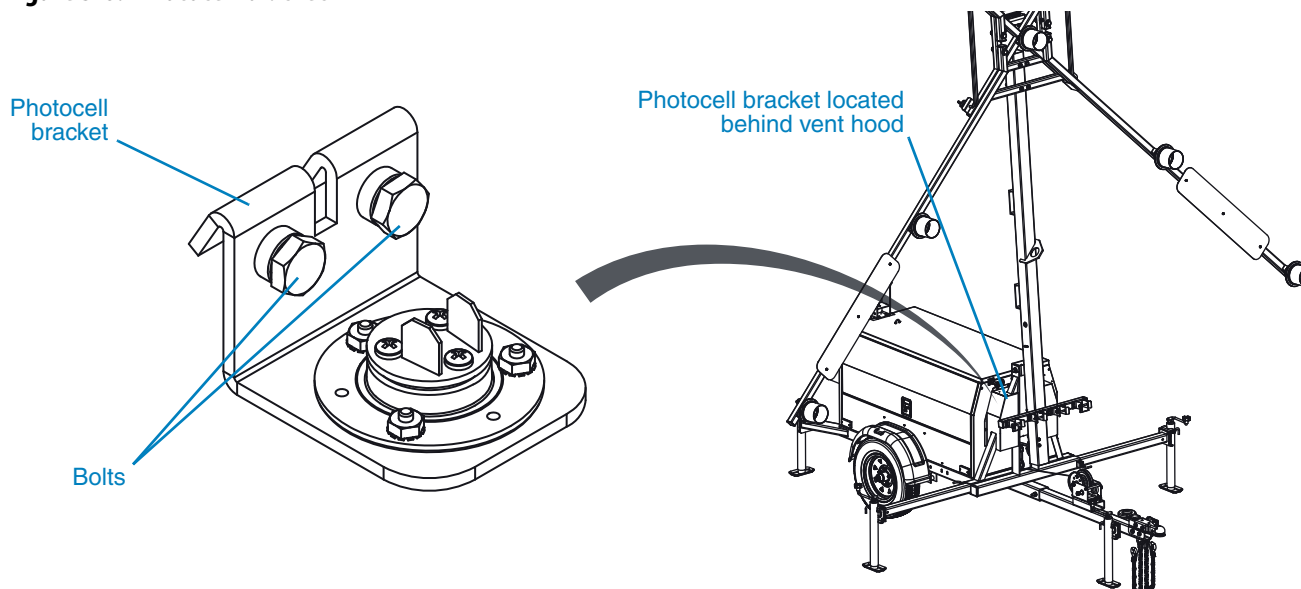
The system uses a photocell sensor to detect ambient light levels and adjust the brightness of the X-Marker lights. In auto-brightness mode, the lights automatically dim at night and brighten to full intensity in daylight.

The photocell response to ambient light can be adjusted if necessary by changing its position, which determines how much light reaches it.

To change the photocell position, refer to Figure 5-6 and follow these steps:

1. Facing the front of the trailer, identify and remove the vent hood to the left of the mast.
2. Loosen the two bolts that hold the photocell bracket in place.
3. Using care not to affect the photocell wiring connections, slide the bracket up, out of its vent slot, and move it up or down, inserting it into another slot:
 - Moving the bracket higher causes the photocell to receive less ambient light. As a result, the auto-dimming function will dim the X-Marker lights earlier in the evening and go to full brightness later in the morning.
 - Moving the bracket lower causes the photocell to receive more ambient light. As a result, the auto-dimming function will dim the X-Marker lights later in the evening and go to full brightness earlier in the morning.
4. Tighten the bolts to secure the bracket in place.
5. Reinstall the vent hood.

Figure 5-6. Photocell bracket



5.8

Batteries

Before performing any type of service or maintenance, read and follow all safety instructions. See Section 2, page 3.

Regular maintenance is necessary for the batteries to function properly and for long battery life. The system includes three batteries: a 12-volt engine start battery and a pair of 12-volt batteries for system power. The paired batteries are wired in series for a 24-volt system.

- When working on or around batteries, ALWAYS observe battery safety precautions.
- Routinely inspect batteries and cables, clean surfaces and terminals, and check fluid levels and battery charge.

See below and the following pages for battery safety and care instructions.

To access the paired batteries, see Section 5.8.3, page 59.

5.8.1

Safety



⚠ DANGER

Electrocution hazard.

Contact with live electrical circuits will result in serious injury or death.

- Before servicing any component on the trailer, turn off power, then disconnect cables from battery.
- Never allow positive wiring to short to ground.
- Only a qualified electrician should service the electrical system.

**VA rating is
436.5
or higher**



⚠ DANGER

Explosive gases can cause blindness and severe injury.

When working on or near batteries:

- Wear eye protection
- Prevent sparks and open flames
- No smoking anywhere in the vicinity
- Keep children clear of the area

DANGER



Sulfuric acid can cause blindness and severe burns.

- Use caution when working on or near batteries
- Avoid contact with skin, face, and eyes
- Upon contact, seek medical help immediately
- Keep out of reach of children

WARNING



Fire hazard.

When working with the X-Marker batteries, never allow positive wiring to short to ground.

- Even when the batteries are not in operation, self-discharge generates hydrogen gas that can explode. Always store and work on batteries in a well ventilated area.
- Always wear proper eye, face, and hand protection when working on or near batteries.
- Keep all sparks, flames, and cigarettes away from batteries at all times.
- Never lean over batteries when testing or charging.
- Keep battery vent caps tight and level, except when watering batteries.
- To prevent short circuits and sparks, exercise caution when working with metallic tools or conductors near batteries.
- To reduce the risk of sparks, ensure connectors make good contact with battery terminals.
- Replace cables that you suspect might be worn or damaged. Replace cables that have visible fraying, cracks, or bare wires.
- If disconnecting X-Marker battery cables, always disconnect positive (+) cable first.* Do not allow the positive power cable to short to ground.
- At least once a month, coat cable connections with a protective spray, non-metallic grease, or petroleum jelly (such as Vaseline® brand) to prevent corrosion. Keep battery hold-down brackets painted.
- To lengthen battery life and prevent freezing, always keep batteries fully charged and keep cable connections clean and tight.
- Visually inspect batteries for physical damage, including cracks and leaks. Always replace damaged batteries immediately. Dispose of old batteries in accordance with local regulatory codes.
- Keep equipment cabinet doors and top panel closed and latched unless you are performing maintenance or using the controls.

**Removing the positive cable first is a requirement for negative-ground systems.*

5.8.2

Determining paired batteries type

The standard batteries are flooded (non-sealed) and require regular maintenance to ensure proper function and long battery life. The optional AGM batteries require little maintenance.

To determine whether the paired batteries are flooded or AGM type:

1. Observe battery safety precautions (see Section 5.8.1, page 57).
2. Open either of the equipment cabinet doors to view the batteries.
3. Determine the battery type:
 - If the batteries have removable caps on top, for refilling battery fluid, then they are flooded and require maintenance. See the following pages for care instructions.
 - If the batteries have no removable caps on top, then they are AGM batteries that require no maintenance other than keeping them clean and ensuring good cable connections. See the following pages for care instructions.

5.8.3

Accessing the paired batteries

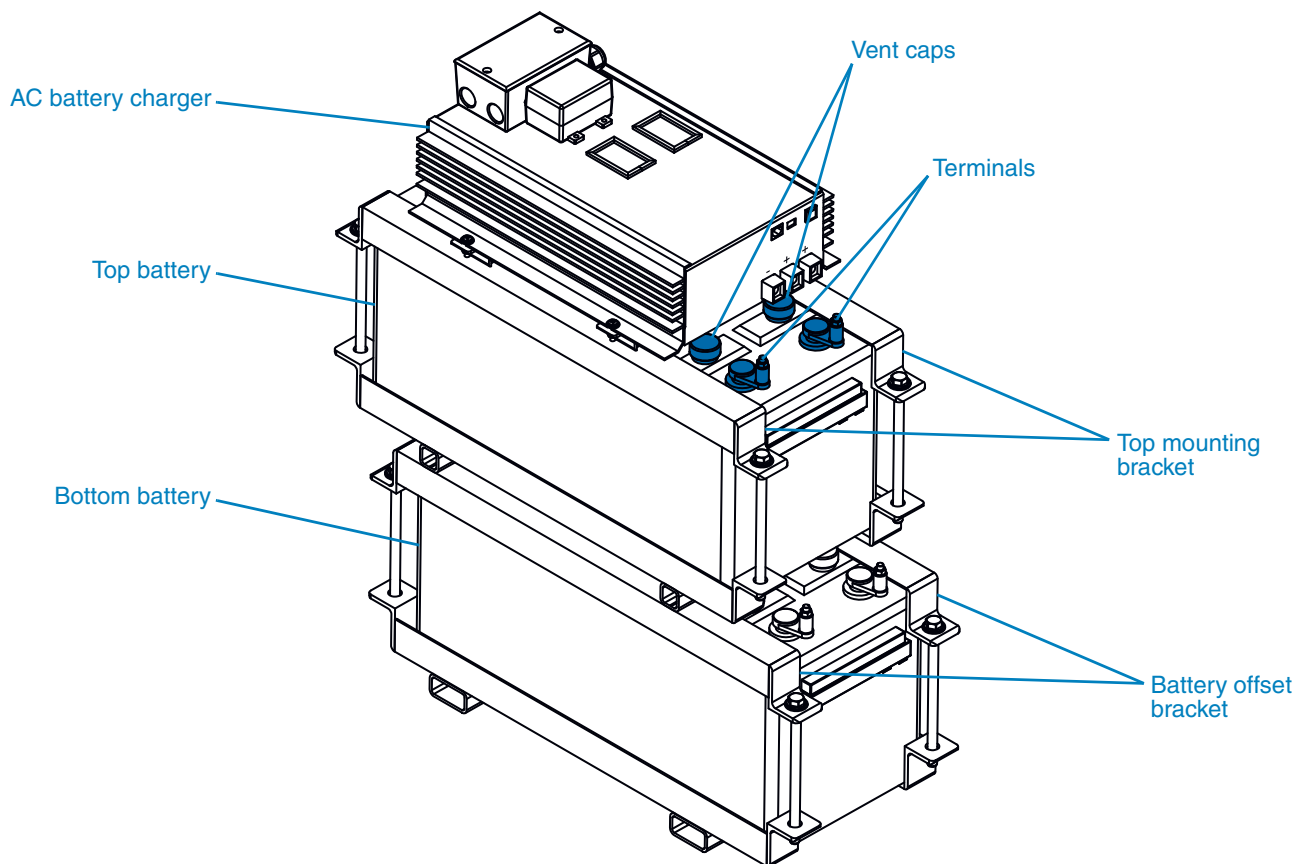
Before performing any type of service or maintenance, read and follow all safety instructions. See Section 2, page 3.

The batteries are located inside the equipment cabinet between the engine and fuel tank. To access the batteries, refer to Figure 5-7, page 60, and follow these steps (note that, for a voltage test on sealed batteries, this procedure is not necessary):

1. Observe battery safety precautions (see Section 5.8.1, page 57).
2. Open the maintenance panel (see Section 5.5, page 51).
3. If you have a camera, take pictures of the battery and charger wiring before servicing the batteries, then refer back to the pictures if needed for rewiring.
4. Unplug the battery charger power cord, then disconnect wiring connections at the charger.
5. The charger assembly is secured to the top mounting bracket with four screws.
 - If you are accessing only the top battery, remove the screws, then remove the charger and set it aside along with the screws, washers, and nuts.
 - If you are accessing both batteries, you do not need to remove the charger from the top mounting bracket.
6. Before servicing the batteries, disconnect wiring from battery terminals:
 - a. Disconnect the positive (+) cables from the top battery.* Do not allow the positive power cable to short to ground.
 - b. Disconnect the negative (–) cables from the bottom battery.
 - c. Identify the jumper cable that connects the batteries to each other (typically the white wire), and disconnect it from the top battery.

**Removing the positive cable first is a requirement for negative-ground systems.*

Figure 5-7. Batteries and charger



7. For the top battery:
 - a. If you are accessing only the top battery and do not need to remove it, skip to Step 9; otherwise, loosen and remove the four bolts that secure the top mounting bracket in place, then remove the charger and bracket together and set them aside with the bolts.
 - b. Taking care to prevent injury, lift the top battery out of the cabinet and set it nearby for testing, charging, or replacement. The battery is heavy, and you may need assistance to lift it.
8. For the bottom battery:
 - a. If you are servicing the bottom battery and do not need to remove it, then skip to Step 9; otherwise, loosen and remove the four bolts that secure the battery offset bracket in place, then remove the bracket and set it aside with the bolts.
 - b. Again taking care to prevent injury, lift the bottom battery out of the cabinet and set it nearby for servicing or replacement.
9. See below and the following pages for instructions to test the battery voltage and charge the batteries, and for watering, cleaning, and replacing batteries
10. When you are finished servicing the batteries, reverse these steps to reinstall the batteries and battery charger, and to reconnect wiring.

5.8.4

Charging

To ensure good battery health, test the battery voltage and charge the batteries if necessary before putting the X-Marker system into service. If any battery will not hold a charge, then replace it.

Always replace both paired batteries as a pair. To access the paired batteries, see Section 5.8.3, page 59.

The lights are powered by batteries that are charged by the smart charger while the engine is running or while the charger is plugged into a live external power source, such as a portable power generator or other shore power. The smart charger prevents overcharging.

When power is applied, the charger should charge the batteries to full capacity. If it does not, one or both batteries may be faulty or have reached their end of life.

IMPORTANT!

To keep the batteries fully charged, the smart charger (located on top of the battery stack, see Figure 5-7) must be plugged into either the control box, for charging by the engine, or an external AC power source.

Because the charger can be unplugged, ensure the charger is always plugged in so the batteries remain charged.

- After charging flooded (non-sealed) batteries, check battery fluid levels (see Section 5.8.5, page 65).
- To determine charge requirements, perform a specific-gravity or voltage test as described below and on the following pages.

Specific-gravity testing procedure

A specific-gravity test is the preferred testing method for flooded (non-sealed) batteries, because it is possible for batteries to exhibit a valid voltage (surface charge) yet have no capacity to drive a load. (For AGM batteries, the voltage test is the only testing method; see "Voltage testing procedure" on page 62.)

For regular maintenance, perform specific-gravity testing on two or more cells on different batteries. Normal readings should be between 1.250 and 1.280. If readings are low, check all other cells and batteries to determine whether batteries are near the end of their operating life.

1. Observe battery safety precautions (see Section 5.8.1, page 57).
2. Turn off all electrical loads and halt battery charging from both the engine and shore power.
3. Open a battery vent cap and inspect the fluid level.
4. Add distilled water until the plates are covered.
5. Fill a battery hydrometer and then drain it back into the battery cell. Repeat two to four times.

6. Using the hydrometer, pull out a sample. There should be enough sample fluid (electrolyte) to support the float.
7. Record the hydrometer reading.
8. Drain the hydrometer back into the battery cell.
9. Close and tighten the battery vent cap.
10. Repeat for the other cells of the battery.
11. Clean any spilled electrolyte.
12. Correct the hydrometer readings to 80°F (27°C) using ambient air temperature:
 - Add 0.004 for every 10°F above 80°F (5.6°C above 27°C).
 - Subtract 0.004 for every 10°F below 80°F (5.6°C below 27°C).
13. Refer to Table 5-1 to determine the battery charge requirements based on the corrected specific gravity.

Voltage testing procedure

Before performing a voltage test on flooded (non-sealed) batteries, consider a specific-gravity test (a more accurate indicator of battery charge) instead. For AGM batteries, the voltage test is the only testing method.

1. Observe battery safety precautions (see Section 5.8.1, page 57).
2. Turn off all electrical loads and halt battery charging from both the engine and shore power.
3. If testing a paired battery, identify the jumper cable that connects the batteries to each other (typically the white wire), and disconnect it from the top battery.
4. Ensure the battery terminals are clean.
5. For accurate voltage readings, wait at least one hour to allow the battery voltage to stabilize.
6. Using a DC voltmeter or multimeter, measure and record the DC voltage across the positive and negative terminals of each battery.
7. If the voltage varies between batteries, recharge the batteries and perform the test again, or obtain appropriate test equipment from the battery manufacturer and follow the manufacturer's instructions.
8. Correct the voltage readings to 80°F (27°C). Using ambient air temperature:
 - Add 28 mV (0.028 volts) per cell for every 10°F above 80°F (5.6°C above 27°C).
 - Subtract 28 mV (0.028 volts) per cell for every 10°F below 80°F (5.6°C below 27°C).
 - Each 12-volt battery has six 2-volt cells.
9. Refer to Table 5-1 to determine the battery charge requirements based on the corrected voltage.
10. For paired batteries, reconnect the jumper cable to the top battery.

Table 5-1. Battery charge requirements

Charge level, %	Specific gravity @ 80°F (27°C)	Open circuit voltage, volts	Approx. required charge time, hrs.		
		12V battery	5A	10A	20A
100	1.277	12.73	0	0	0
95	1.268	12.68	3	1	1
90	1.258	12.62	5	2	1
85	1.248	12.56	8	4	2
80	1.238	12.50	10	5	3
75	1.227	12.44	13	6	3
70	1.217	12.37	16	8	4
65	1.206	12.31	18	9	4
60	1.195	12.24	21	10	5
55	1.184	12.17	23	12	6
50	1.172	12.10	26	13	6
45	1.277	12.03	28	14	7
40	1.268	11.96	31	16	8
35	1.137	11.89	34	17	8
30	1.124	11.81	36	18	9
25	1.111	11.74	39	19	10
20	1.098	11.66	41	21	10
15	1.087	11.59	44	22	11
10	1.079	11.51	47	23	12
5	1.037	—	—	—	—
0	1.000	—	—	—	—

Notes

Determine the battery charge level from the specific-gravity or voltage test readings.

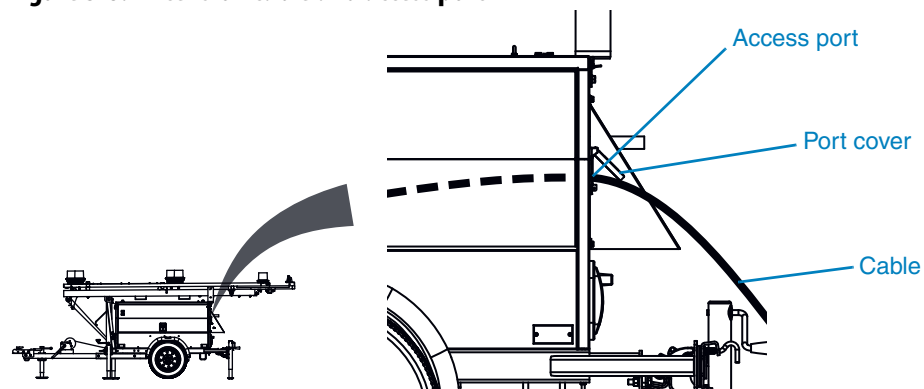
If charge level is above 70%, no charging is required. If charge level is below 10%, the battery may need replacing. Otherwise, determine the required charge time from the table.

External AC charging

You can charge the batteries using an external AC power source, such as a portable generator or other shore power. An industrial grade extension cable is required and must be user supplied.

1. Observe battery safety precautions (see Section 5.8.1, page 57).
2. Observe the following charging requirements:
 - Avoid charging batteries at temperatures above 120°F (49°C).
 - Never charge a frozen battery. Thaw batteries completely before charging.
 - Always charge batteries fully. Undercharging causes stratification and may result in the power system shutting down unexpectedly.
3. Ensure battery cables are properly connected.
4. Route the extension cable into the equipment cabinet through the access port on the rear of the cabinet (see Figure 5-8).
5. From the driver's side of the trailer, access the battery charger inside the equipment cabinet. The charger is located on the battery stack behind the control box.
6. Unplug the battery charger power cord from the control box and plug it into the extension cable inside the cabinet.
7. Plug the extension cable into an appropriately rated external power source.
 - The charger will not overcharge the batteries, even if left unattended for an extended period.
 - If the charger appears not to be working, first check the fuse on the charger, and then check the line voltage from the power source. Contact Wanco Customer Service if necessary (see Section 1.3, "Where to obtain service," page 2).
8. Close and latch the side doors and top panel.
9. Charge the batteries until they reach 12.65 volts DC each. Charge paired batteries to 25.3 volts total.
10. After charging is complete, disconnect the charger from the extension cable and plug it into the side of the control box.

Figure 5-8. Extension cable and access port



5.8.5

Watering flooded batteries

This section applies only to flooded (non-sealed) batteries. If your X-Marker system uses AGM batteries, you do not need to water the batteries (see Section 5.8.2, page 59).

CAUTION

Low battery acid can damage batteries.

Periodically check fluid level in each battery cell.

For proper and optimal functioning of the X-Marker system, battery fluid levels must be maintained. Check fluid levels regularly and refill when necessary using the following guidelines:

- Observe battery safety precautions (see Section 5.8.1, page 57).
- Use only distilled or deionized water. Water with mineral content can cause the plates to corrode. Never add acid or additives to batteries.
- Open battery vent caps and inspect the fluid well for each cell. If necessary, add just enough distilled water to cover the plates. More water may be required after charging.
- Do not overfill batteries. Overfilling will result in overflowing of battery acid during use.
- Watering guns and automatic watering systems are acceptable for watering batteries. Do not use a common garden hose for watering.
- When finished, ensure all vent caps are tight and level.
- Charge batteries after refilling, then check again for proper fluid levels.
- When checking battery fluid levels, overfull batteries can be an indication of overcharging, operation at high temperature, or the battery nearing its end of life.

5.8.6

Cleaning

- Observe battery safety precautions (see Section 5.8.1, page 57).
- Keep batteries clean to avoid accumulation of dust, dirt, and grime.
- To clean batteries, use a solution of 50% baking soda and 50% water. Do not allow cleaning solution or other material to enter battery cells. After cleaning, rinse batteries with clean water and allow to dry thoroughly.
- Clean battery terminals, particularly if they are warm, hot, or corroded. Scour the terminals and the inside of the cable clamps using a battery post or clamp cleaner, or a wire brush, until they have a bright metallic shine.
- At least once a year, visually inspect terminals and cables for signs of corrosion, especially in hot temperatures.

5.8.7

Replacing

Always replace both paired batteries as a pair.

To replace any battery, follow these steps:

1. Observe battery safety precautions (see Section 5.8.1, page 57).
2. Open the maintenance panel (see Section 5.5, page 51).
3. If you have a camera, take pictures of the battery and charger wiring before replacing the batteries, then refer back to the pictures if needed for rewiring.
4. To replace the engine start battery:
 - a. Disconnect the positive (+) cable from the battery.* Do not allow the positive power cable to short to ground.
 - b. Disconnect the negative (–) cable from the battery.
 - c. Remove the hold-down brackets that keep the battery in place.
5. To replace the paired batteries, access and remove both batteries using the procedure in Section 5.8.3, page 59.
6. Inspect the battery cradle for corrosion and other damage. Clean it and any other components that need cleaning.
7. Inspect the battery cables for corrosion and damage. Clean or replace the cables as necessary for ensuring good connections.
8. Install the new batteries and secure them in place. Always replace batteries with new batteries of the same type.
9. Reconnect wiring, taking care not to over-tighten the cable clamps.
 - For the paired battery wiring diagram, see Figure 5-12, page 74.
 - Connect the negative (–) cables first, and then connect the positive (+) cables, in the reverse order you disconnected them.

**Removing the positive cable, or removing it first, is a requirement for negative-ground systems.*

5.8.8

Storing

- Observe battery safety precautions (see Section 5.8.1, page 57).
- Before storing the X-Marker trailer or batteries:
 - ☐ Disconnect the cables from the positive (+) battery terminals.* Do not allow the positive power cable to short to ground.
 - ☐ Check fluid levels as described in Section 5.8.5, page 65.
 - ☐ Clean the batteries as described in Section 5.8.6, page 65.
 - ☐ To prevent freezing, ensure batteries are fully charged (see Section 5.8.4, page 61).
- Store batteries in a cool, dry, well ventilated location. The storage temperature should remain as low as possible without dropping below 32°F (0°C), and should not exceed 80°F (27°C).
- Store batteries safely out of reach of children and pets.
- Check fluid levels and state of charge every week.
- Charge stored batteries every 30 days.

5.9

Wiring

Before performing any type of service or maintenance, read and observe all service safety instructions. See Section 2, page 3.

For wiring diagrams, see Table 5-2.

Table 5-2. Wiring diagrams

Description	See page...
Trailer wiring	page 69
Fuse and relay block	page 70
Power system	page 72
Battery stack	page 74
Control box and signal lights	page 76

**Removing the positive cable, or removing it first, is a requirement for negative-ground systems.*

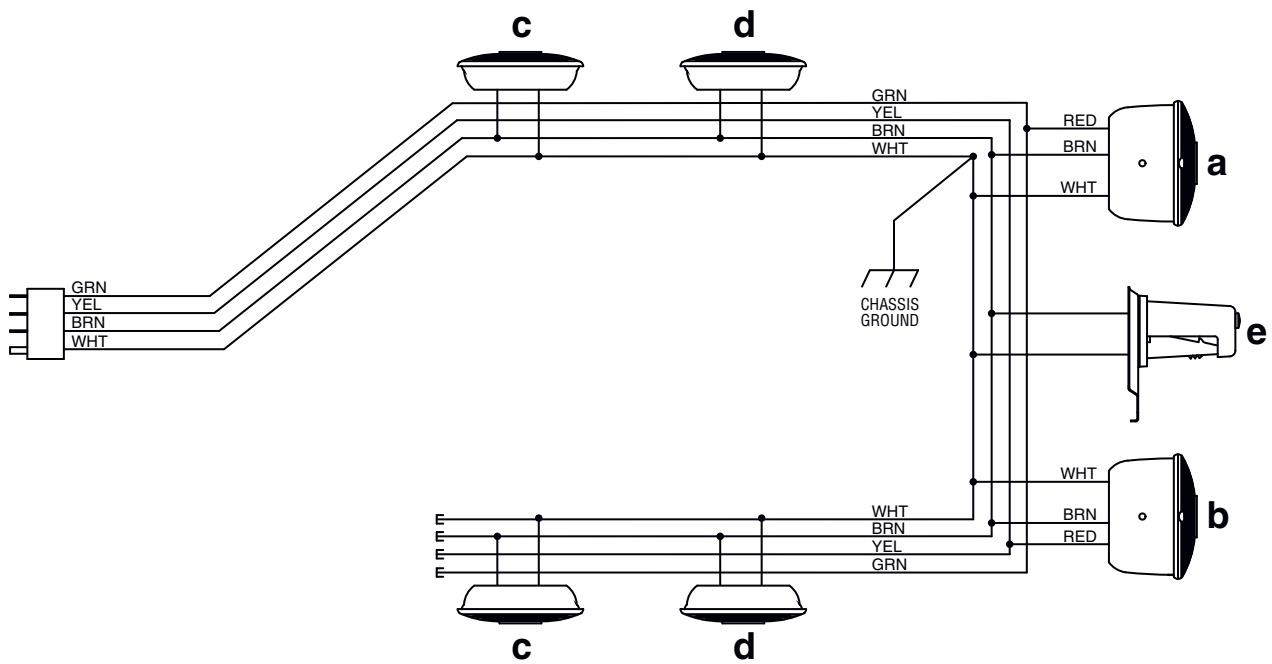
5.10 Replacement parts

Before performing any type of service or maintenance, read and observe all service safety instructions. See Section 2, page 3.

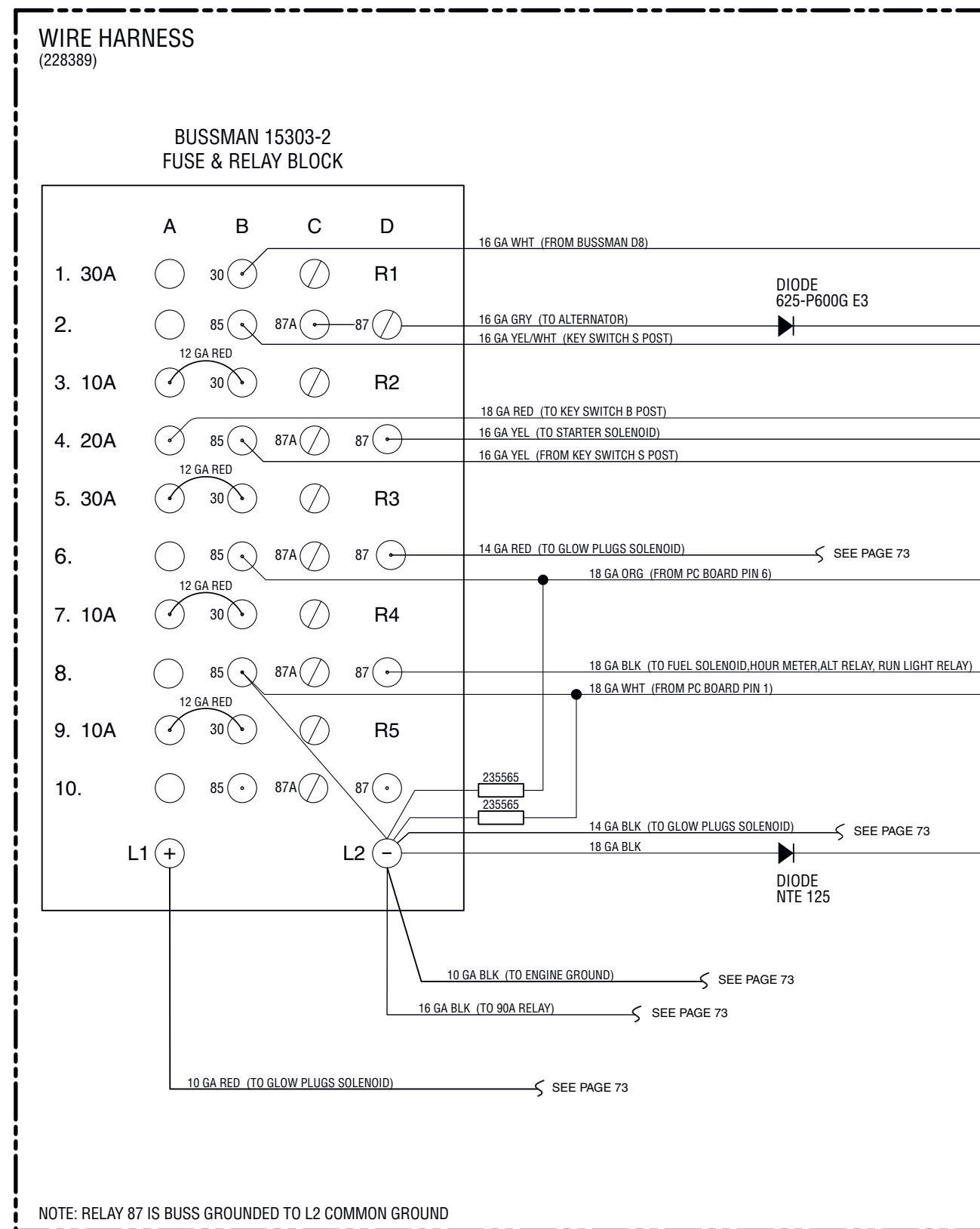
For replacement parts, see Table 5-3 or contact the Wanco Service Department (see Section 1.3, “Where to obtain service,” page 2).

Table 5-3. Replacement parts

Description	See page...
Trailer assembly	page 78
Light arms assembly	page 80
Light and base frame assemblies	page 82
Cabinet assembly	page 83
Mast travel cradle assembly	page 84
Drawbar and winch assemblies	page 85
Control box assembly	page 86
Engine assembly	page 88
Radiator assembly	page 90
Fuel tank assembly	page 92
Fuel tank and hold-down assembly	page 93
Battery stack assembly, flooded batteries	page 94
Battery stack assembly, optional AGM batteries	page 95
Optional drip and spill protection components	page 96
Optional cold weather kit	page 97
Optional tandem tow components	page 98

Figure 5-9. Wiring diagram: Trailer

Ref.	Description
a	Right stop, turn, and taillights
b	Left stop, turn, and taillights
c	Side light, amber
d	Side light, red
e	License plate light

Figure 5-10. Wiring diagram: Fuse and relay block to control panel

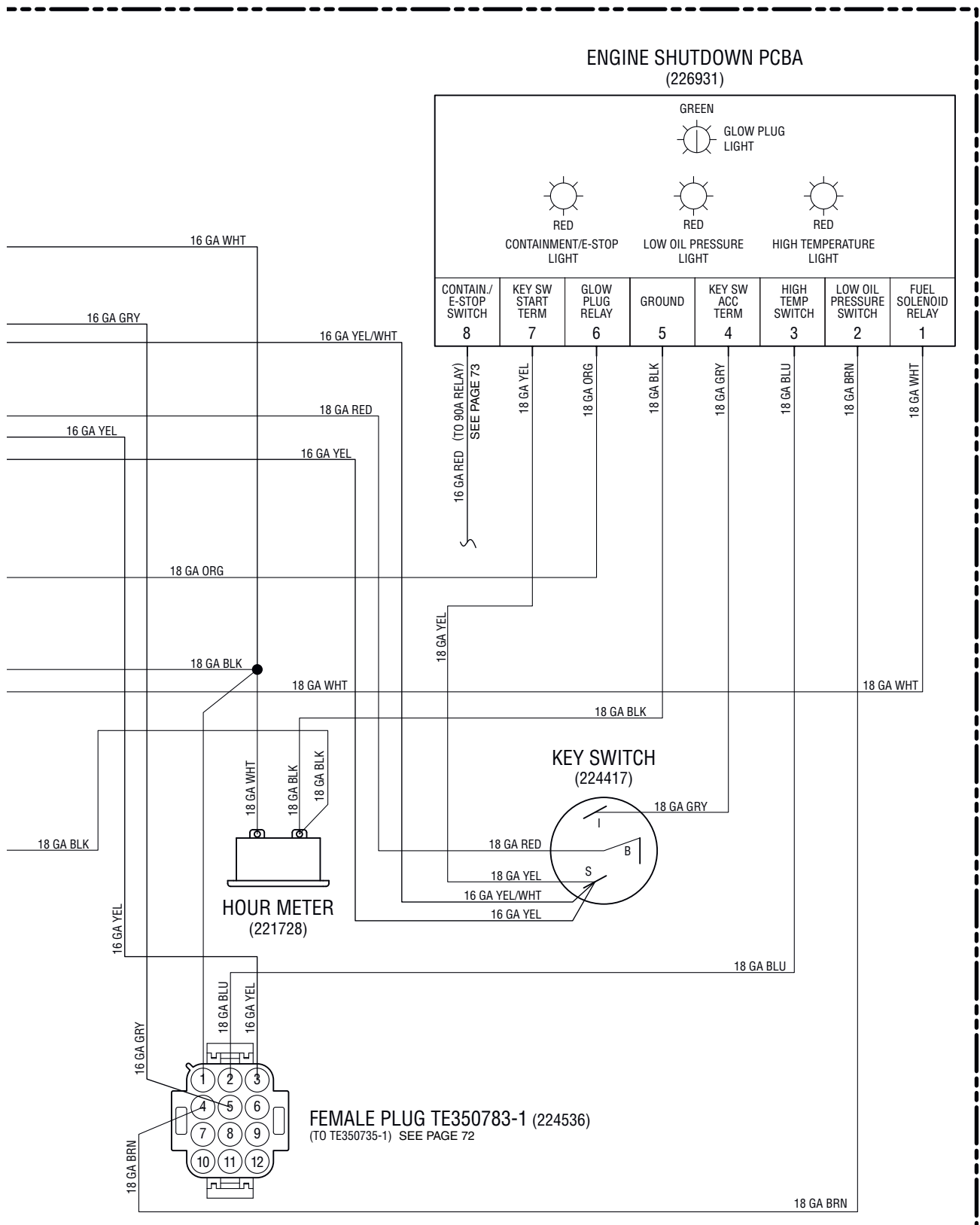
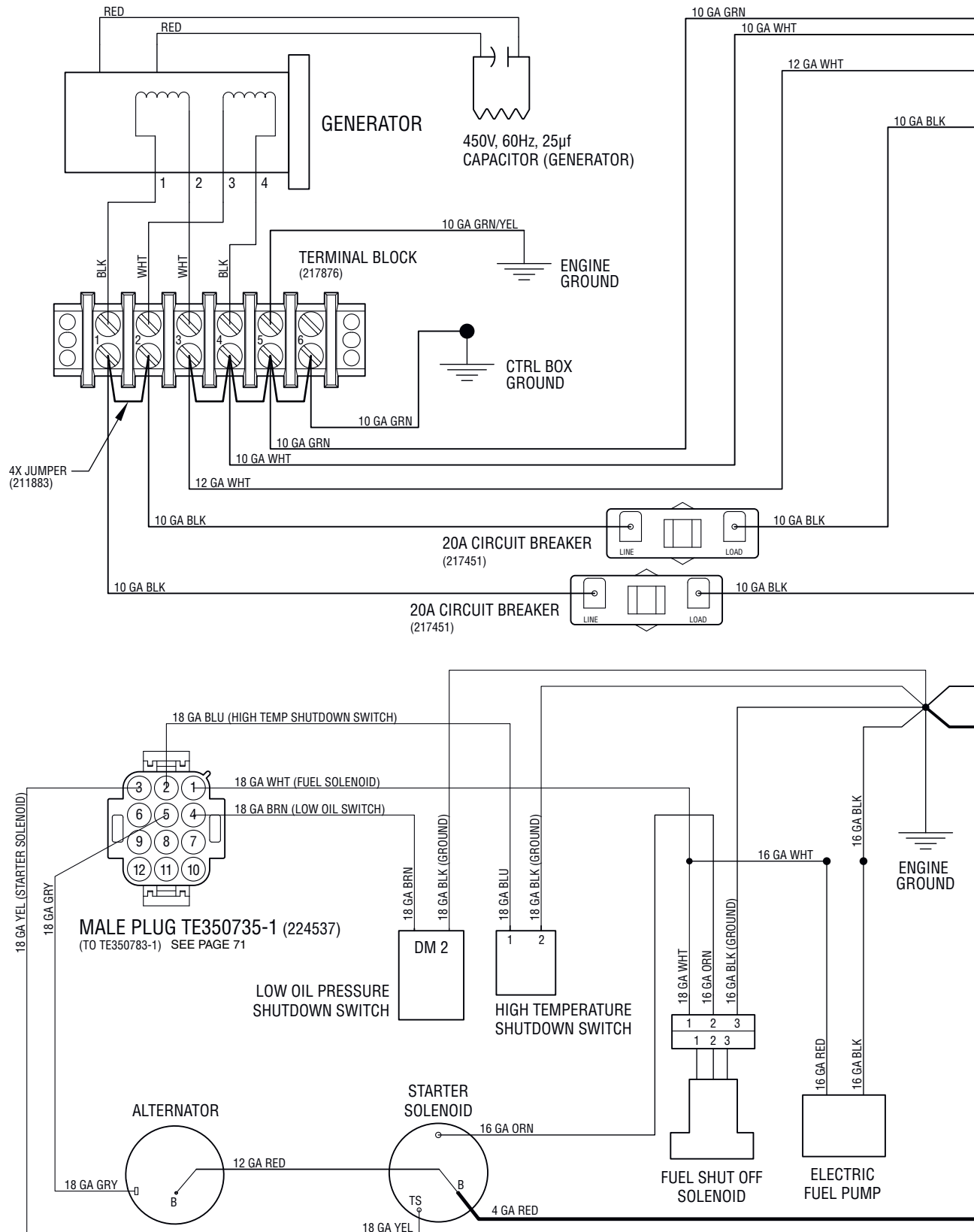


Figure 5-11. Wiring diagram: Power system

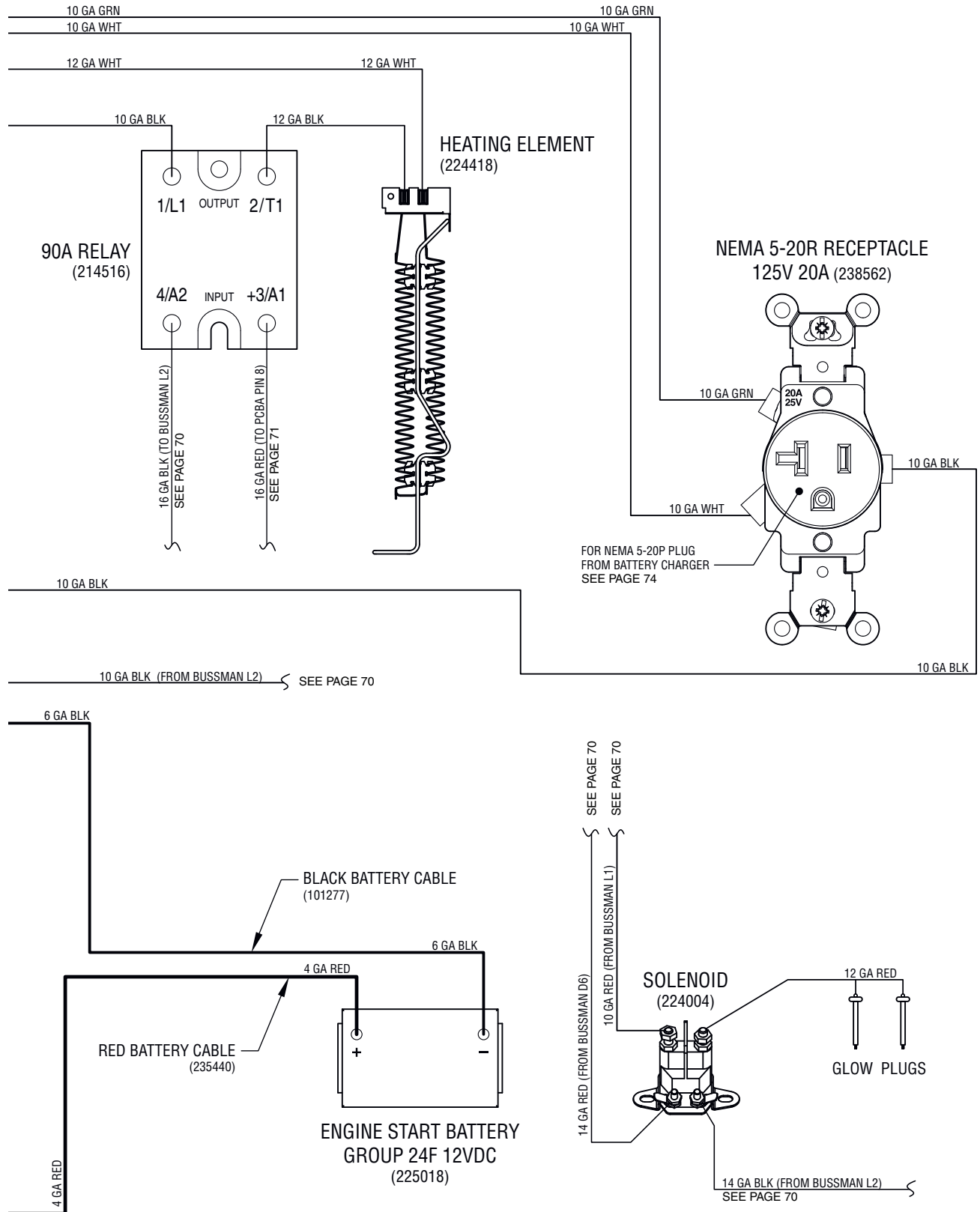
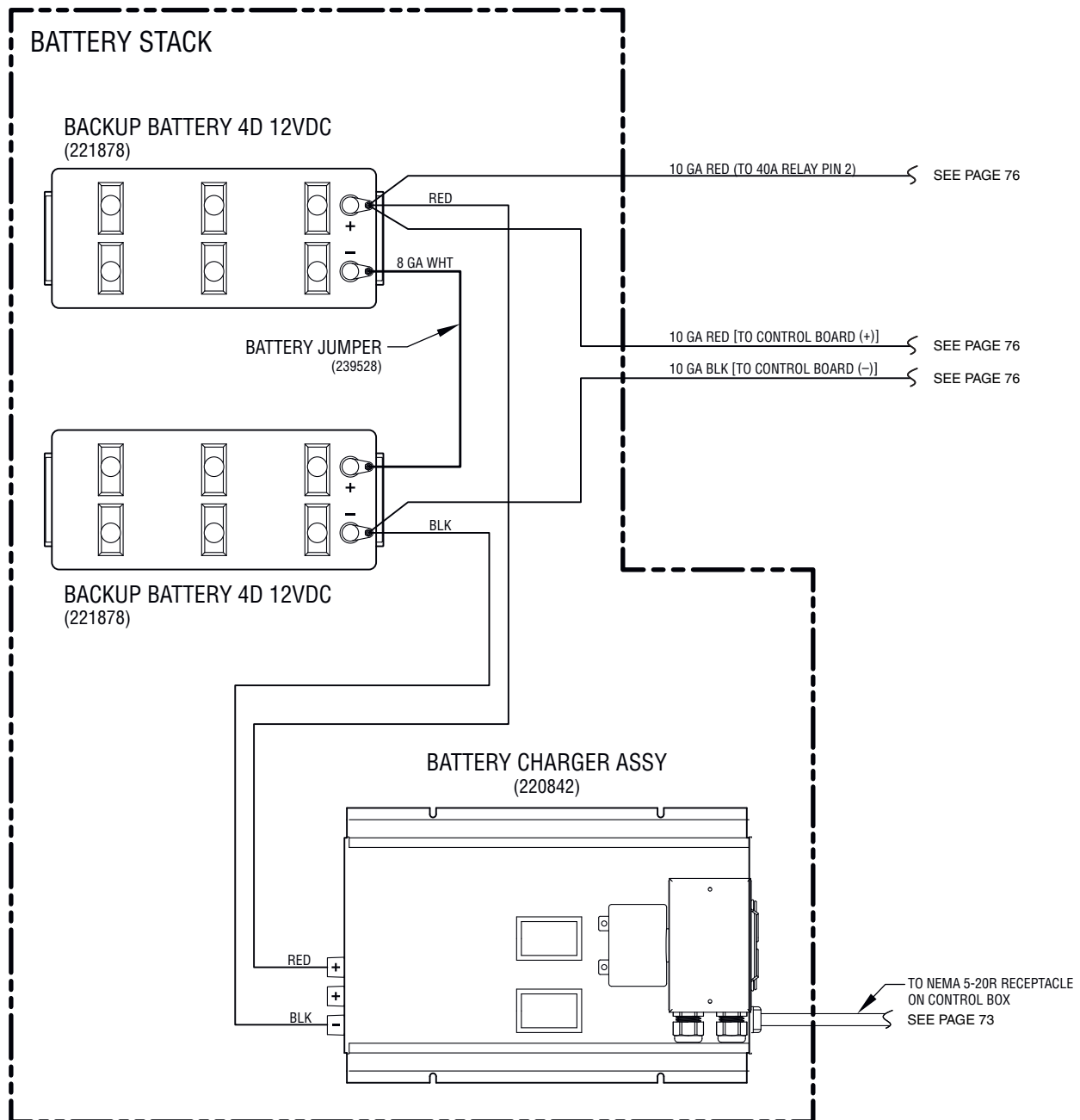
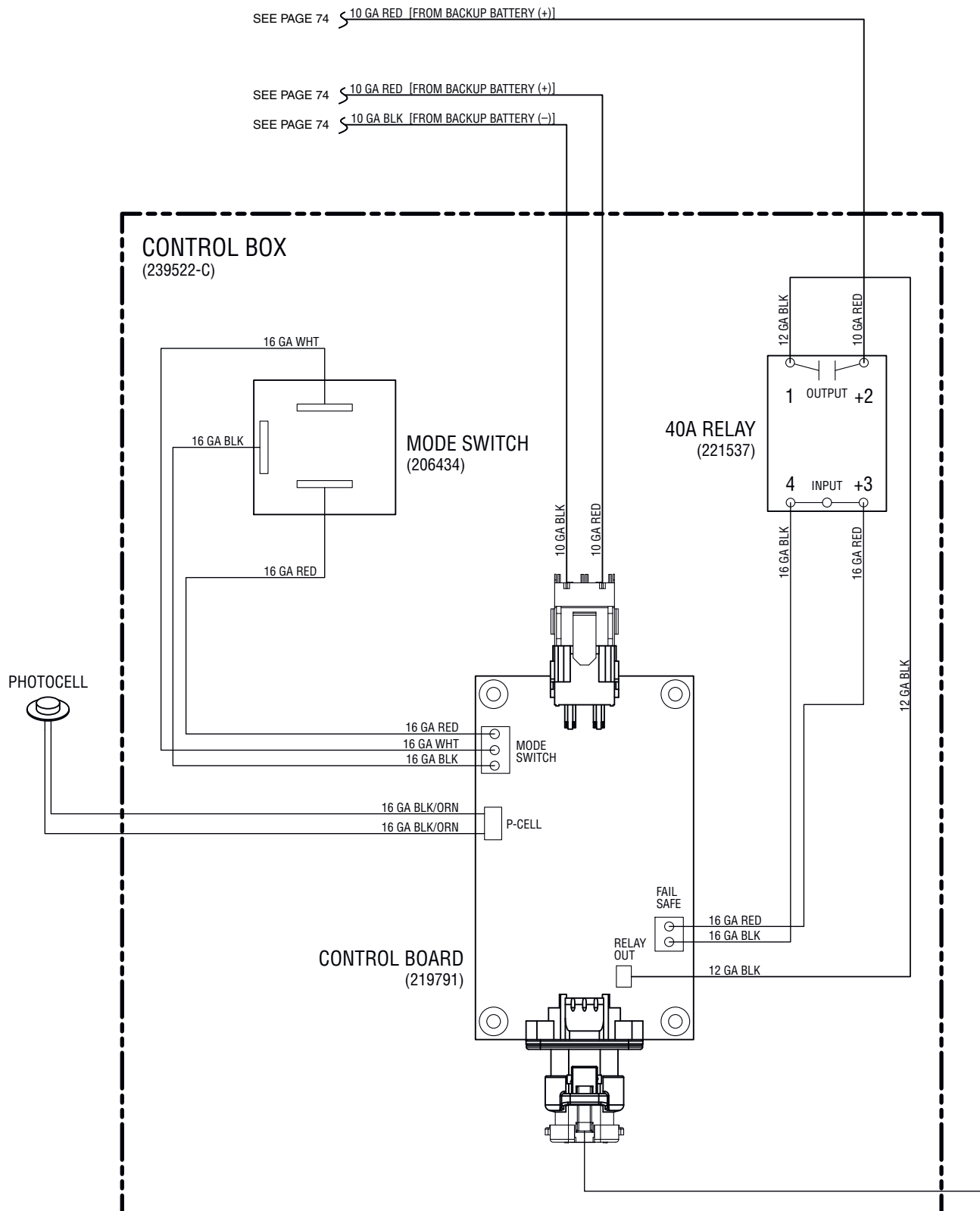


Figure 5-12. Wiring diagram: Battery stack



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Figure 5-13. Wiring diagram: Control box and signal lights



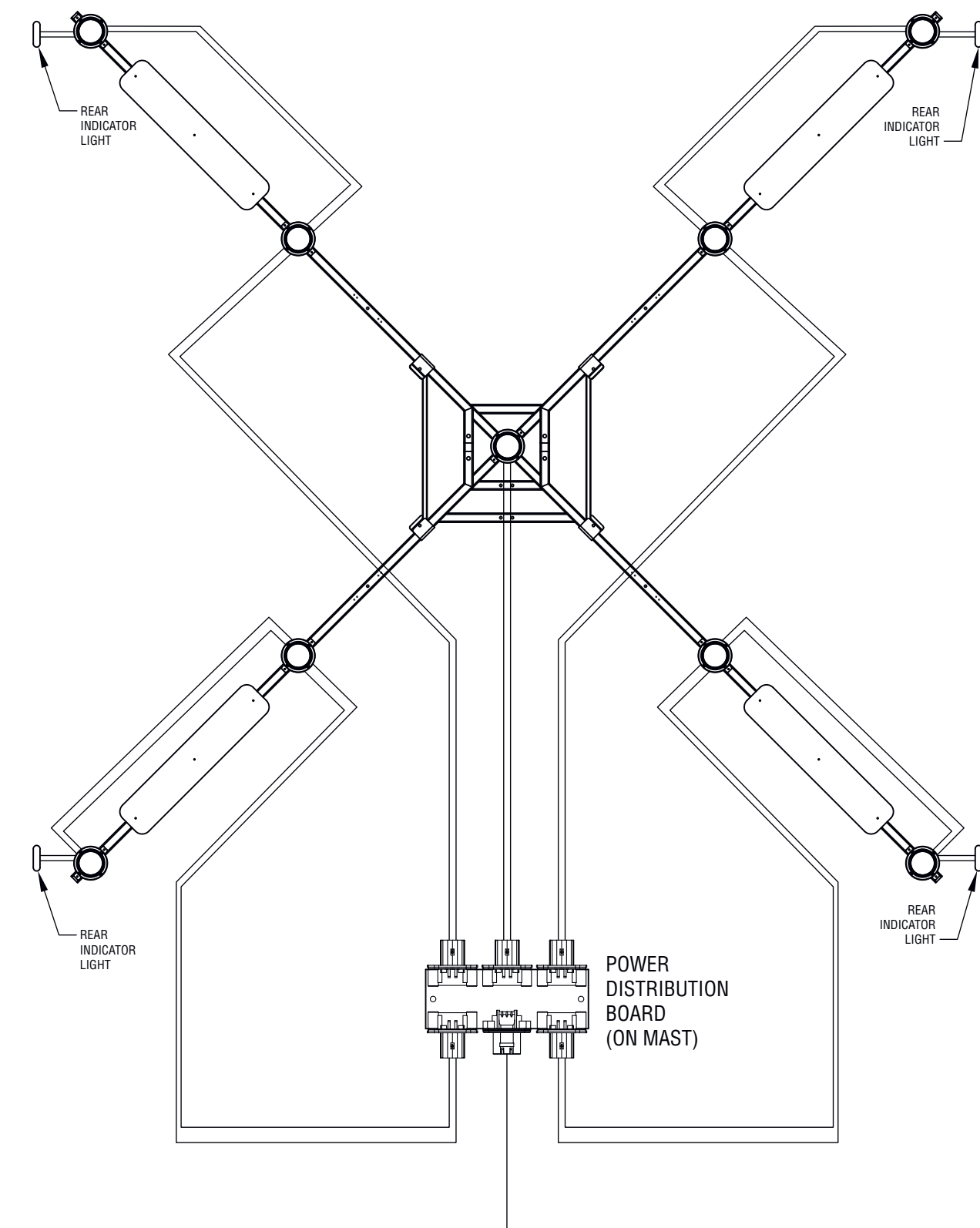


Figure 5-14. Replacement parts: Trailer assembly

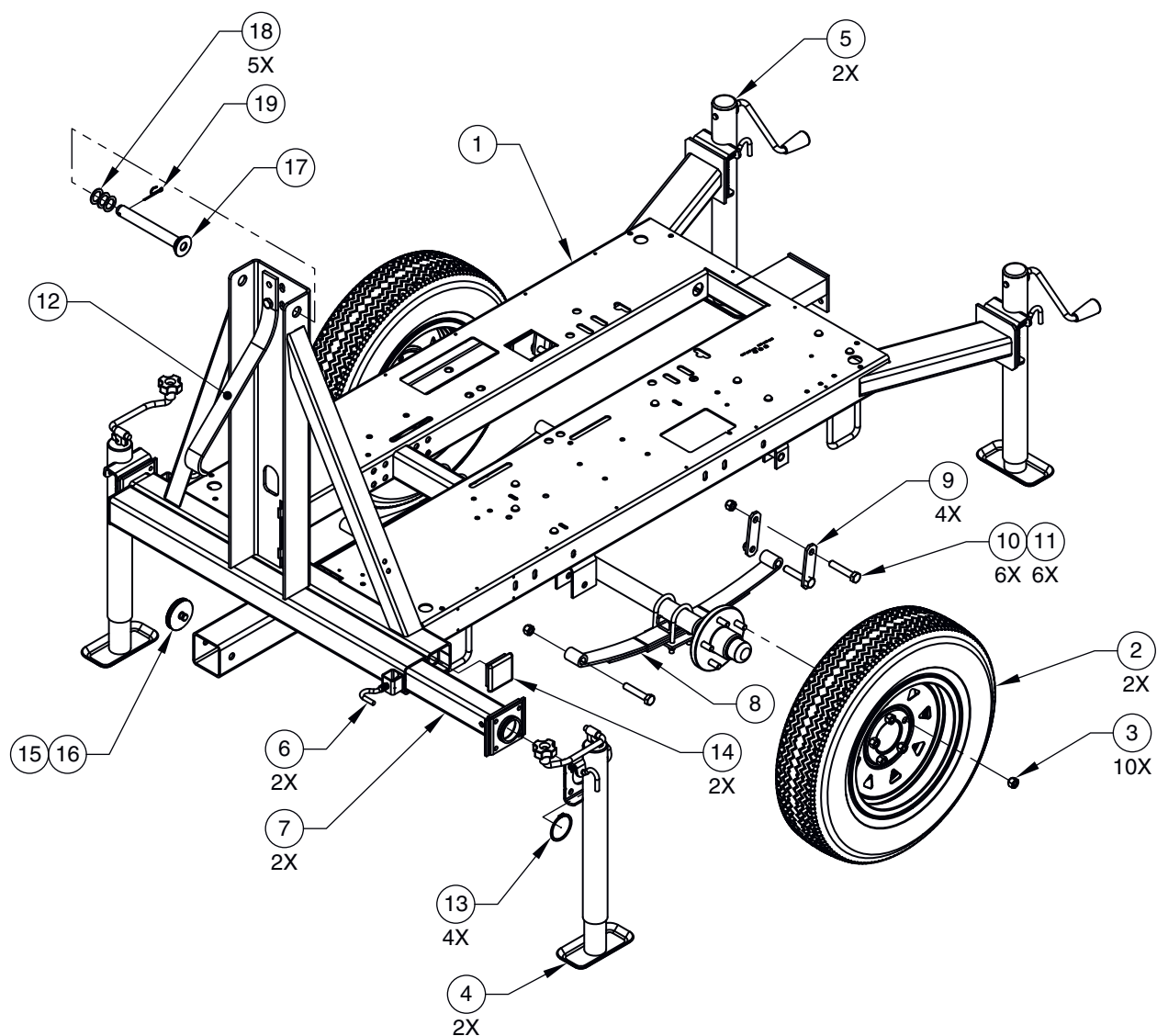


Table 5-4. Parts list: Trailer assembly

Item No.	Part No.	Description	Qty.
1	238212-	Trailer frame	1
2	236036	Tire and wheel assembly, 13" load range C	2
3	101323	Lug nut, 1/2"-20 × 60° cone	10
4	100143	Top-wind swivel jack, 2000-lb. cap.	2
5	101932	Side-wind swivel jack, 2000-lb. cap.	2
6	101990	Outrigger spring plunger assembly	2
7	105694-	Outrigger	2
8	200100	Axle assembly, 2200 lb cap. 41" hub face	1
9	200108	Axle shackle link strap	4
10	200109	Axle shackle bolt, 9/16"-18 × 3"	6
11	200110	Stover lock nut, 9/16"-18	6
12	205600	Mast/tower tilt spring	1
13	215874	Swivel jack snap ring, 2 1/2"	4
14	104736	Plastic plug	2
15	217093	Single-groove pulley, 3"	1
16	105830	Clevis pin, 1/2" dia. × 1 1/2"	1
17	221646-	Mast/tower tilt pin	1
18	100177	Bushing, 1" × 1.5" × 14 ga.	5
19	217874	Cotter pin, 5/32" × 1 1/2"	1
20	225018	Engine start battery, 12V Group 24F (not shown)	1

Figure 5-15. Replacement parts: Light arms assembly

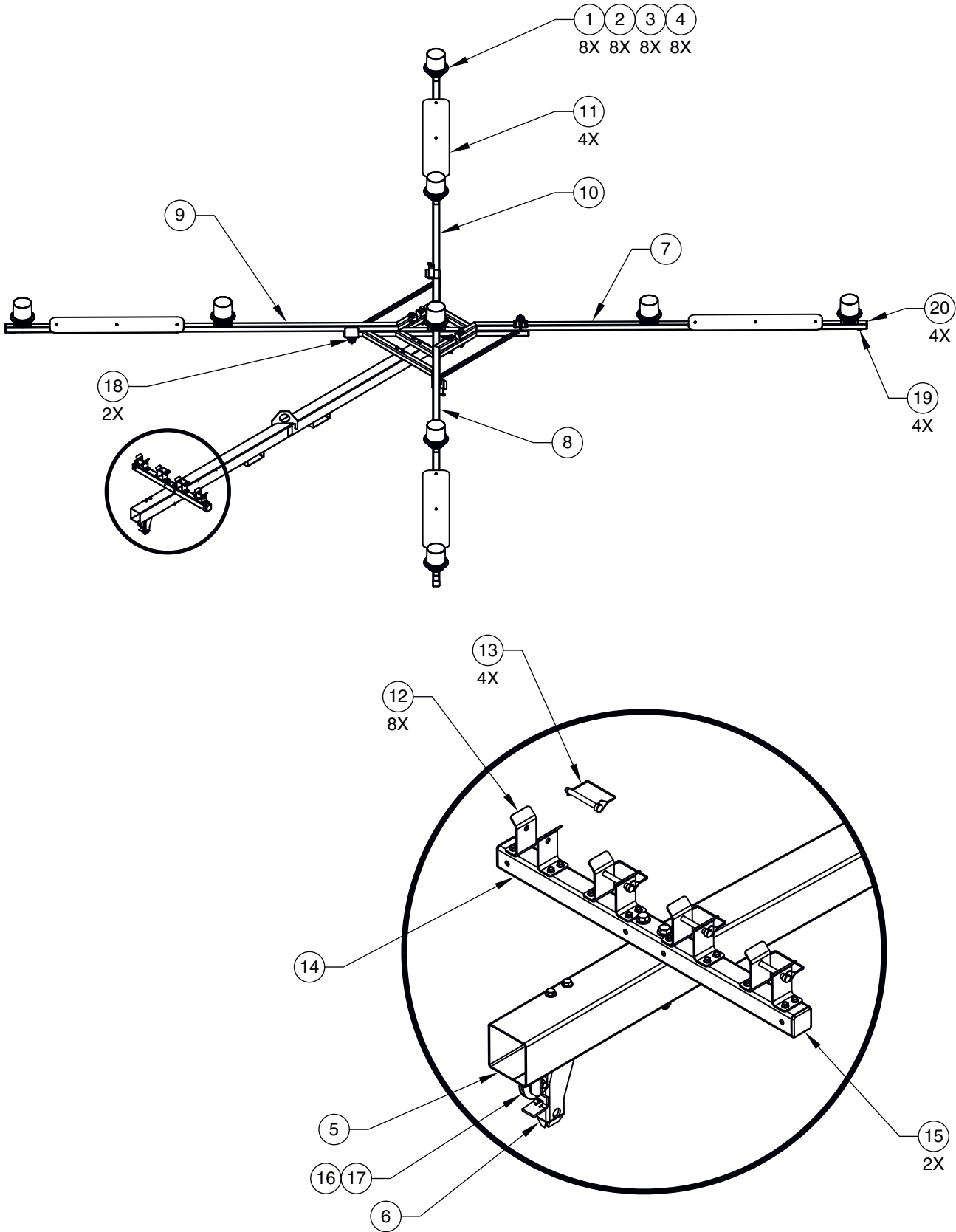
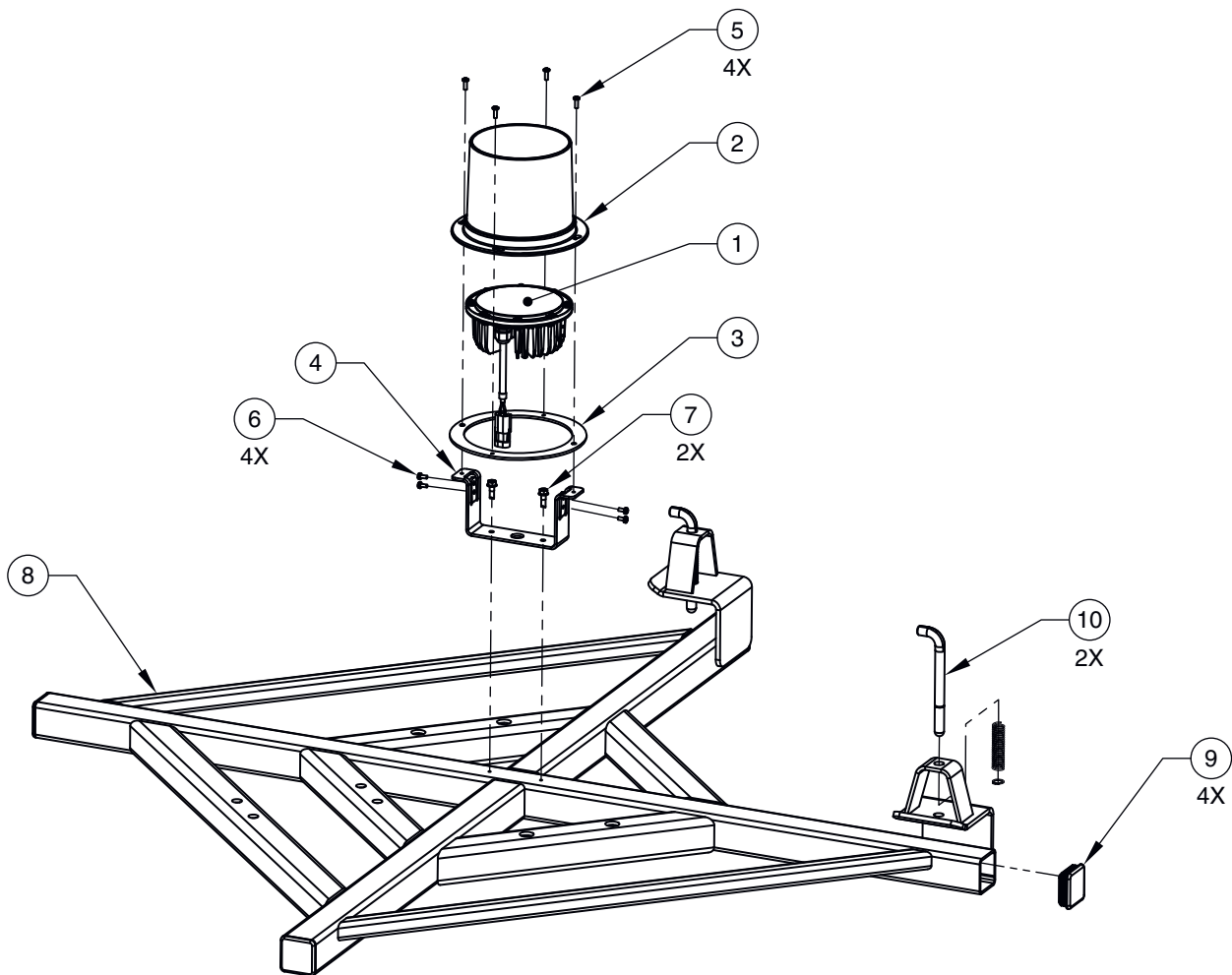
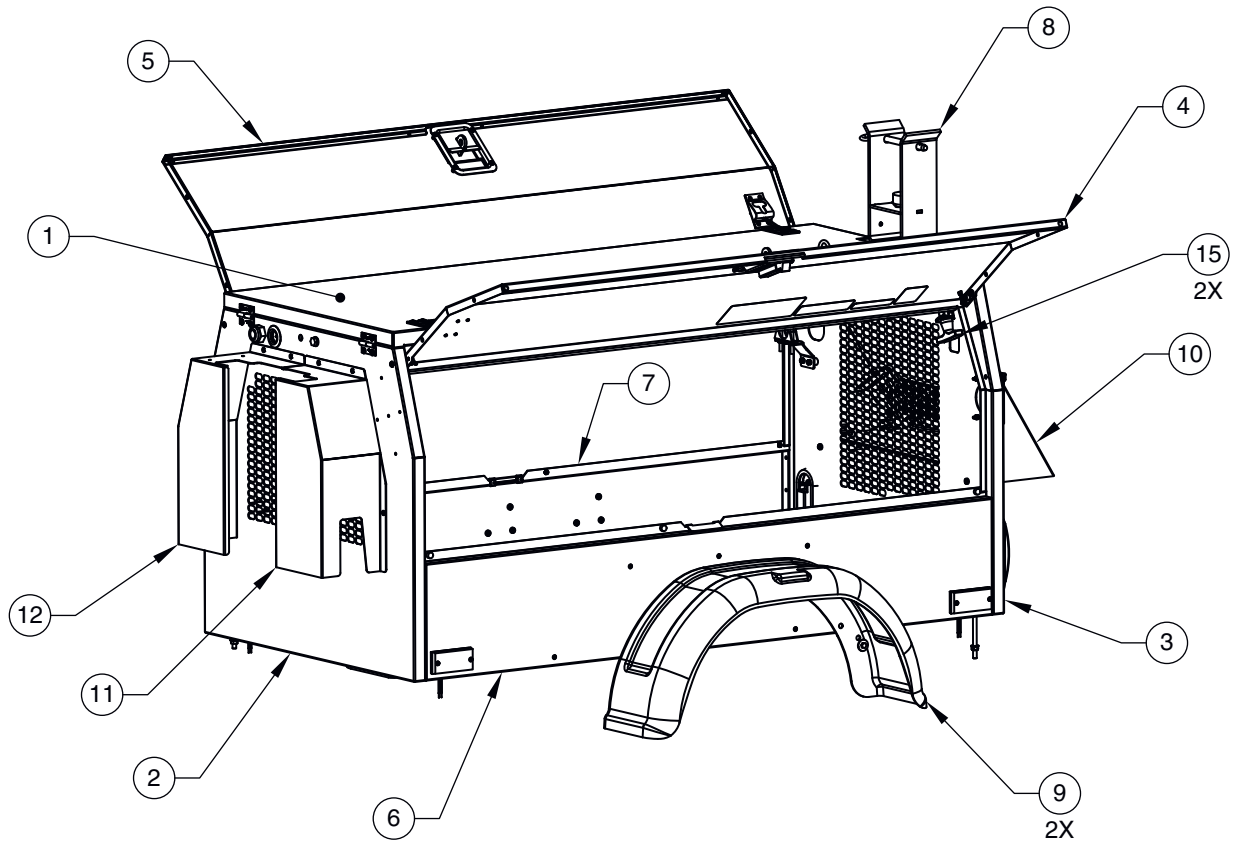


Table 5-5. Parts list: Light arms assembly

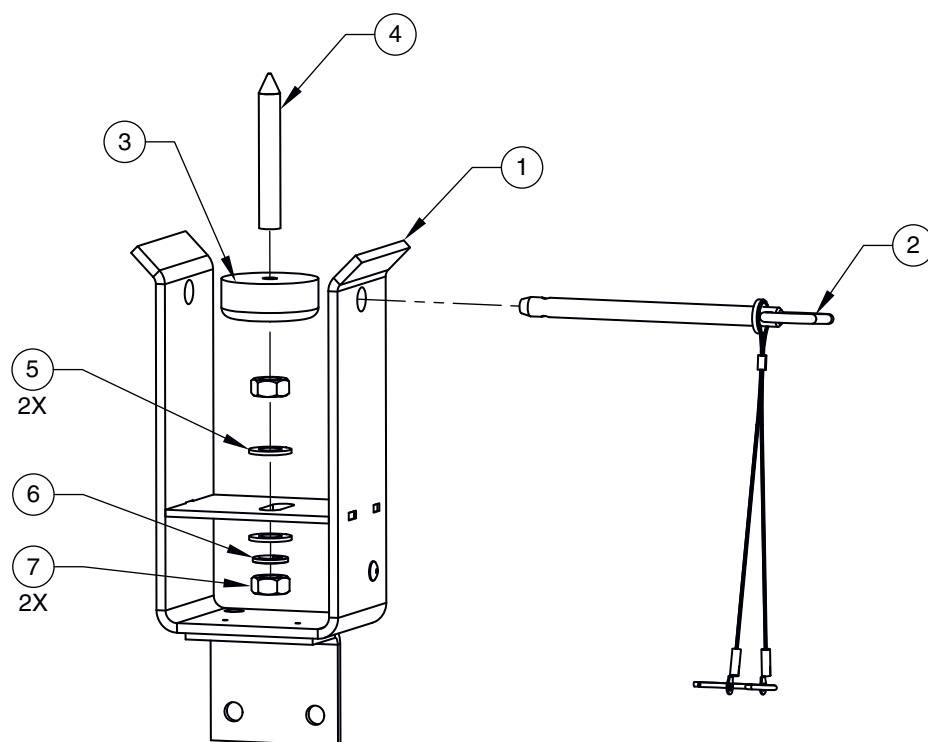
Item No.	Part No.	Description	Qty.
1	218206	LED light fixture	8
2	102516	Visor	8
3	220007-	Ring plate	8
4	219990-	Mounting bracket for light fixture	8
5	220358-	Mast/tower	1
6	220311	Latch-pin catch bracket	1
7	221637-	Upper arm, 1:30 position	1
8	221638-	Lower arm, 4:30 position	1
9	221639-	Lower arm, 7:30 position	1
10	221640-	Upper arm, 10:30 position	1
11	219941-	Conspicuity panel	4
12	219940-	Support bracket	8
13	221649	Wire lock pin	4
14	219956-	Transport retainer	1
15	104311	Plastic plug, 2" × 2" 10-14 gauge wall	2
16	217093	Single-groove pulley, 3"	1
17	205132	Clevis pin, 1/2" dia. × 1 1/4"	1
18	100394	Spring latch assembly	2
19	220199	Amber clearance light	4
20	209390	Plastic plug, 2" × 2" 4-8 gauge wall	4

Figure 5-16. Replacement parts: Light and base frame assemblies**Table 5-6. Parts list: Light and base frame assemblies**

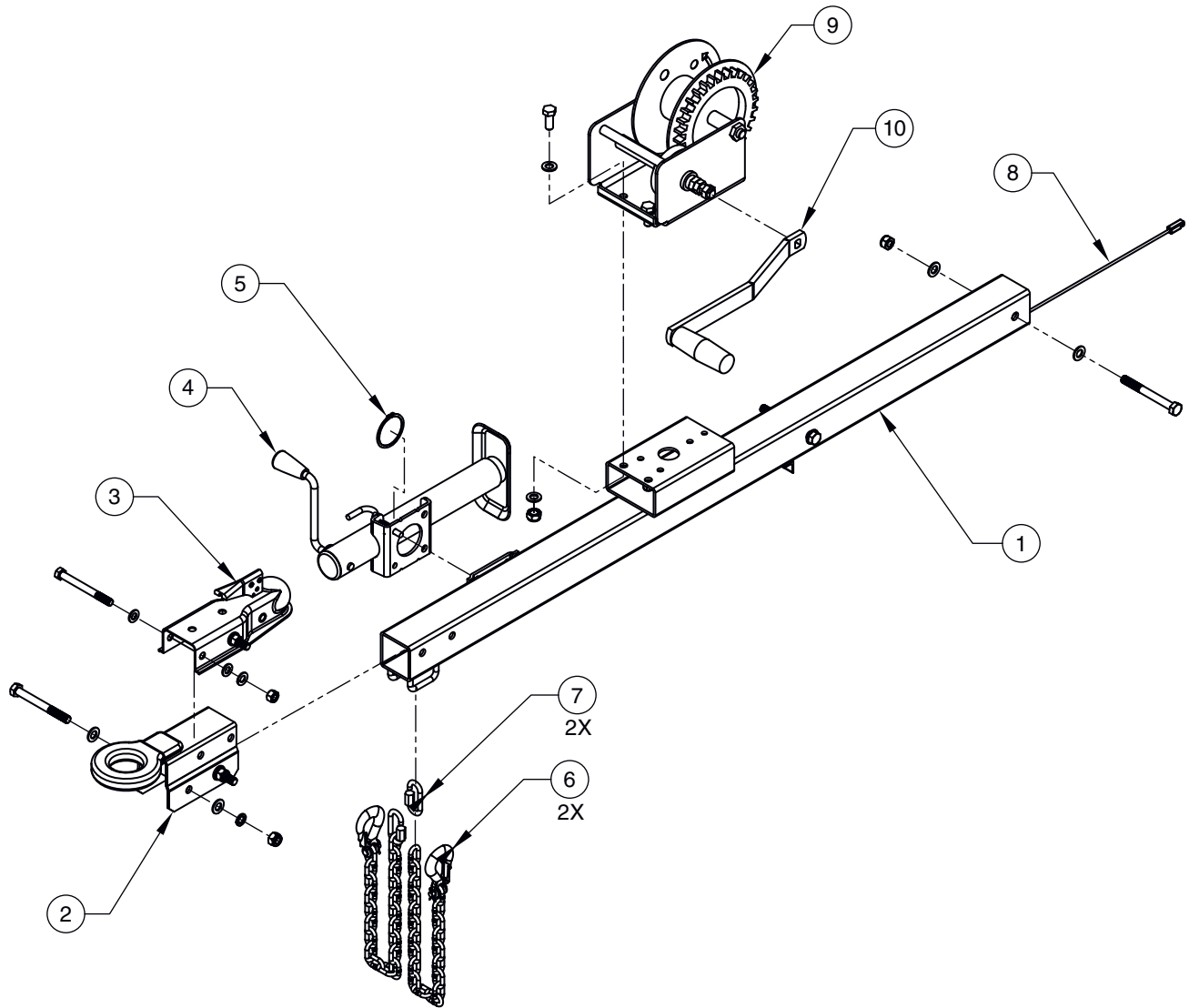
Item No.	Part No.	Description	Qty.
1	218206	LED light fixture	1
2	102516	Visor	1
3	220007-	Ring plate	1
4	219990-	Mounting bracket	1
5	102516	Thread cutting pan-head screw, #8-32 × 1/2"	4
6	218463	Pan-head machine screw, M4-0.7 × 10mm with spring tension washer	4
7	107154	Hex screw, #14-16 × 3/4"	4
8	220246-	Base frame	1
9	104311	Plastic plug, 2" × 2" 10-14 gauge wall	4
10	100394	Spring latch assembly	2
11	227373-C	Junction box assembly (not shown)	1

Figure 5-17. Replacement parts: Cabinet assembly**Table 5-7. Parts list: Cabinet assembly**

Item No.	Part No.	Description	Qty.
1	238967-C	Top panel	1
2	238211-C	Front panel	1
3	238209-C	Rear panel	1
4	236646-C	Door assembly, left (driver side)	1
5	236647-C	Door assembly, right (passenger side)	1
6	233084-C	Side panel assembly, left (driver side)	1
7	233085-C	Side panel assembly, right (passenger side)	1
8	221644-C	Transport cradle assembly	1
9	222113	Fender	2
10	238641-C	Heating element shroud	1
11	211383-	Air intake shroud, right	1
12	211433-	Air intake shroud, left	1
13	211560	Receptacle cover (not shown)	1
14	212913	Receptacle cover gasket (not shown)	1
15	105421	Rubber draw-latch	2

Figure 5-18. Replacement parts: Mast travel cradle assembly**Table 5-8. Parts list: Mast travel cradle assembly**

Item No.	Part No.	Description	Qty.
1	220831-	Transport cradle	1
2	103830	Horizontal lock-pin assembly	1
3	102004	Rubber bumper	1
4	105621	Pin, M14 × 100mm	1
5	106006	Flat washer, M14	2
6	106103	Split washer, M14	1
7	218990	Hex nut, M14-2.00	2

Figure 5-19. Replacement parts: Drawbar and winch assemblies**Table 5-9. Parts list: Drawbar and winch assemblies**

Item No.	Part No.	Description	Qty.
1	211136-	X-Marker drawbar	1
2	105740-	Combo-hitch bracket with ring for 2 1/2" pintle hook	1
3	101677	Tow hitch, 2" ball 2000 lb cap.	1
4	101933	Short side-wind swivel jack with pad foot, 2000 lb cap.	1
5	215874	Swivel jack snap ring, 2 1/2"	1
6	104859	Tow chain with clevis slip hook	2
7	201432	Quick-link for tow chain, 1540 lb cap.	2
8	215875	Trailer lights cable with flat-four plug	1
9	101007	Hand-operated winch, 1500 lb cap.	1
10	215906	Winch handle, 11"	1

Figure 5-20. Replacement parts: Control box assembly

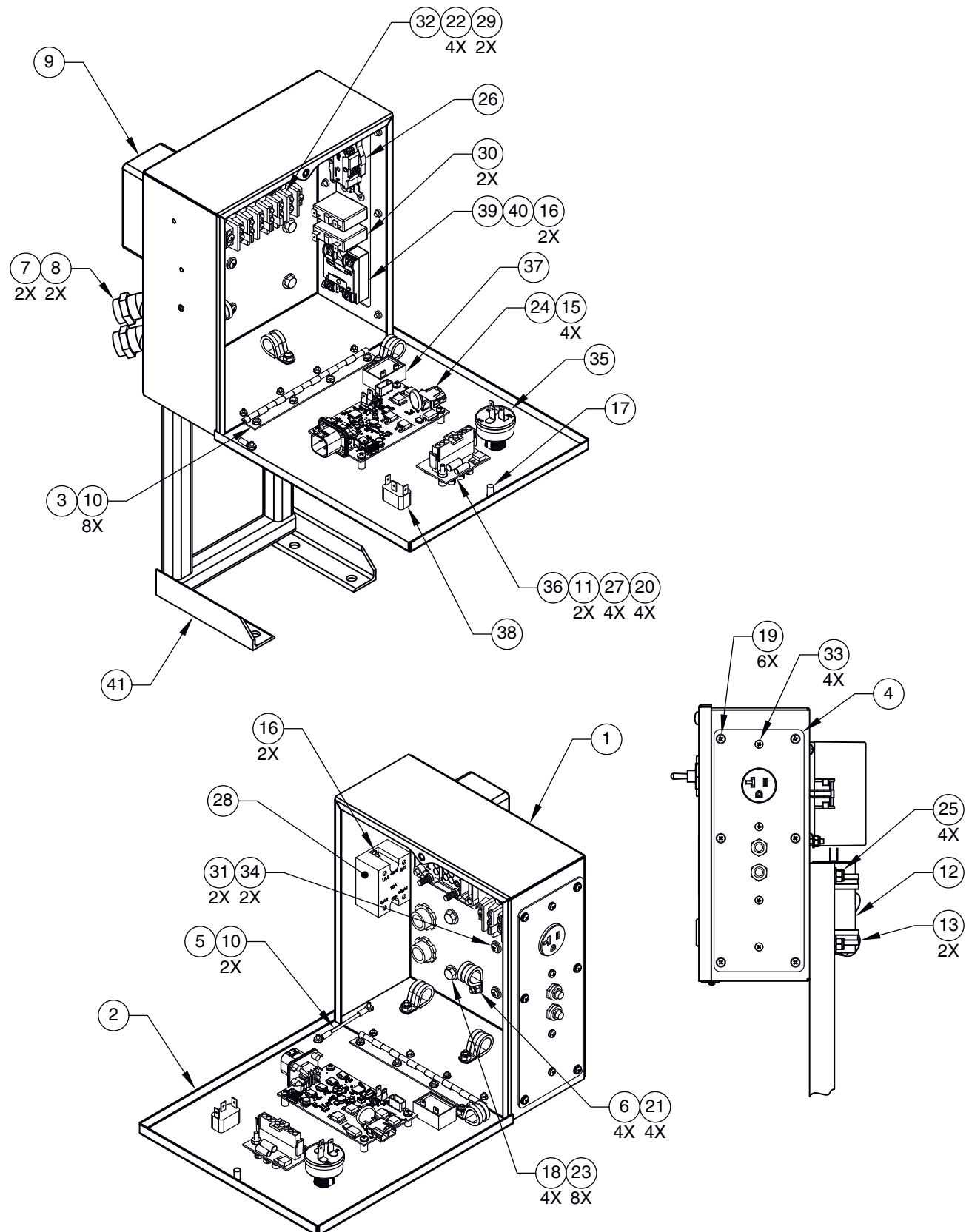


Table 5-10. Parts list: Control box assembly

Item No.	Part No.	Description	Qty.
1	239523-	Control box housing	1
2	219966-S	Control panel	1
3	220634-	Hinge	1
4	229120-	Receptacle/breakers mounting plate, NEMA 5-20R	1
5	211743	Ground wire assembly	1
6	104488	P-clamp, 3/4" #10 screw	4
7	212293	Cord grip, 1/2" NPT	2
8	100133	Conduit nut, 1/2"-14 NPT	2
9	228389	Bussman/relay block and wire harness	1
10	103124	Keps hex nut, #6-32	10
11	103534	Keps hex nut, #8-32	2
12	220147	Capacitor, 20 μ F 500V	1
13	212506	P-clamp, 1.875"	2
14	104738	Edge guard (not shown)	7"
15	105688	Pan-head machine screw with external tooth washer, #8-32 $\times$ 3/8"	4
16	106555	Keps hex nut, M4-0.7mm	4
17	203684	Pan-head machine screw, 1/4"-20 $\times$ 1/2"	1
18	203696	Hex screw, 1/4"-20 $\times$ 1 1/2"	4
19	205242	Pan-head machine screw with spring tension washer, #8-32 $\times$ 3/8"	6
20	211526	Window plug, 5/16" dia.	4
21	101721	Hex nut, nylon insert lock #10-32	4
22	211883	Terminal jumper, 0.562"	4
23	100236	Flat washer, 9/32"	8
24	219791	PCBA, control board	1
25	100238	Hex nut, nylon insert lock 1/4"-20	4
26	238562	Receptacle, 20A 125V NEMA 5-20R	1
27	213843	Nylon standoff, 0.166 ID $\times$ 0.313 OD $\times$ 0.188 L	4
28	214516	Relay, 90A 12Vdc	1
29	216271	Pan-head screw, #10-32 $\times$ 1"	2
30	217451	Circuit breaker, 20A 250V	2
31	217786	Pan-head screw, #10-32 $\times$ 3/4"	2
32	217876	Terminal block, 6-position #8 screws	1
33	218463	Pan-head machine screw with spring tension washer, M4-0.7mm $\times$ 10mm	4
34	101526	Flat washer, #10	2
35	224417	Key switch, 3-position	1
36	226931	PCBA, engine shutdown	1
37	221728	Digital hour meter, 12Vdc	1
38	206434	Toggle switch, 3-position	1
39	221537	Relay, 40A 100Vdc	1
40	221727	Thermal pad	1
41	229114-	Control box mounting bracket	1

Figure 5-21. Replacement parts: Mitsubishi engine assembly

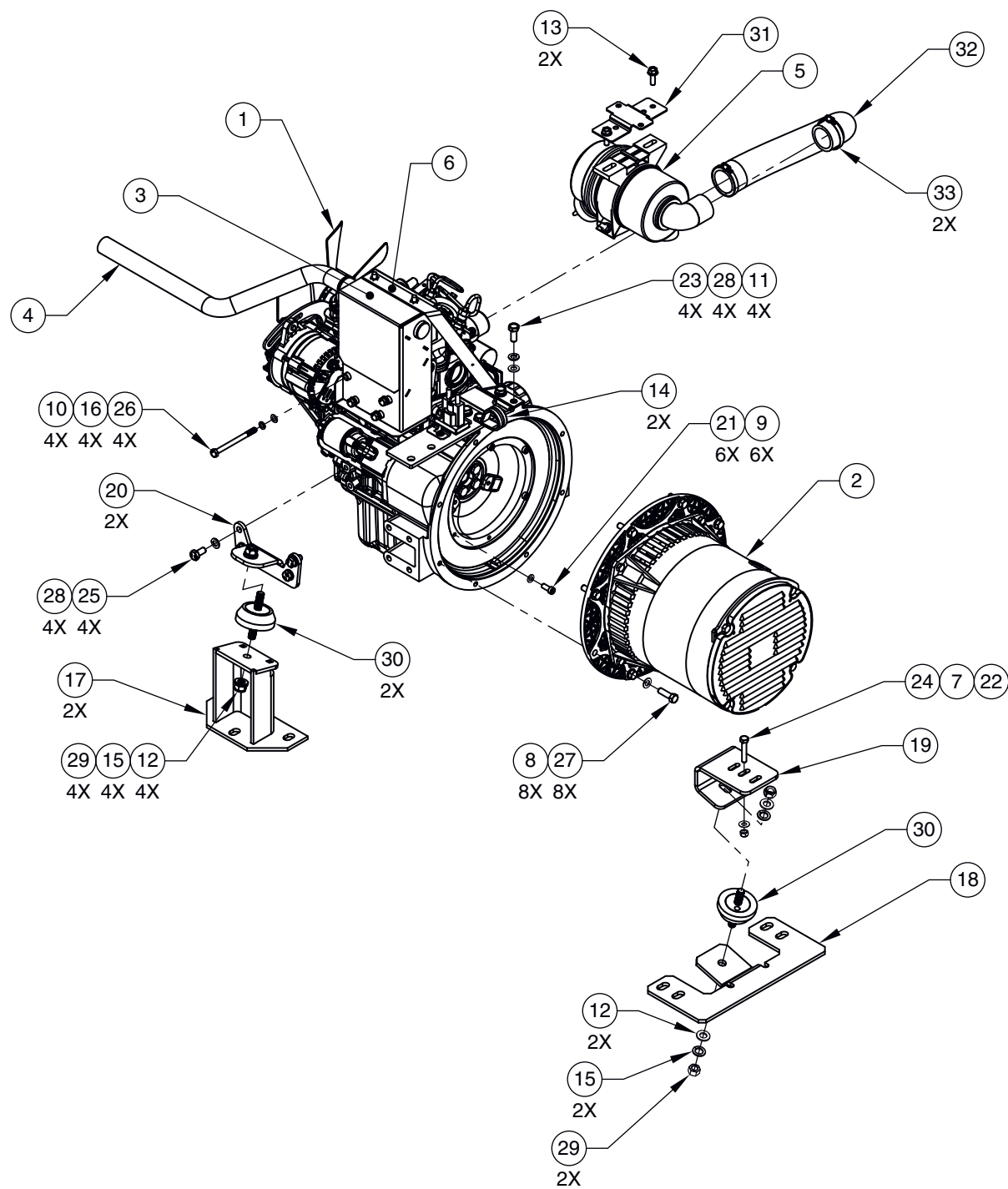


Table 5-11. Parts list: Mitsubishi engine assembly

Item No.	Part No.	Description	Qty.
1	234022	Mitsubishi engine	1
2	223739	Generator, 6.0kW 120V 60Hz	1
3	237020	Muffler assembly	1
4	224968-	Tailpipe	1
5	225537	Air filter housing	1
6	237200-	Muffler brace	1
7	100237	Flat washer, 5/16"	1
8	100723	Split lock washer, 3/8"	8
9	100724	Split lock washer, 5/16"	6
10	106003	Flat washer, M8	4
11	106004	Flat washer, M10	4
12	106005	Flat washer, M12	6
13	106010	Machine bolt, M8-1.25 × 25mm	2
14	104489	P-clamp, 1 1/4"	2
15	106104	Split lock washer, M12	6
16	106105	Split lock washer, M8	4
17	219584-	Vibration isolator mount	2
18	224132-	Vibration isolator mount	1
19	222862-	Generator shock mount	1
20	226315-	Engine shock mount	2
21	203810	Socket screw, 5/16"-18 × 3/4"	6
22	205163	Hex nut, nylon insert lock M8-1.25	1
23	200489	Hex screw, M10-1.25 × 25mm	4
24	207776	Hex screw, M8-1.25 × 45mm	1
25	213174	Hex screw, M10-1.25 × 20mm	8
26	225857	Hex screw, M8-1.25 × 100mm	4
27	215908	Hex screw, 3/8"-16 × 1 1/4"	8
28	203372	Split lock washer, M10	12
29	218989	Hex nut, M12-1.50mm	6
30	237193	Vibration isolator, M12 × 1.50 orange	3
31	224141-	Air cleaner bracket	1
32	223605	Air cleaner hose	1
33	213335	Hose clamp, #28	2

Figure 5-22. Replacement parts: Radiator assembly

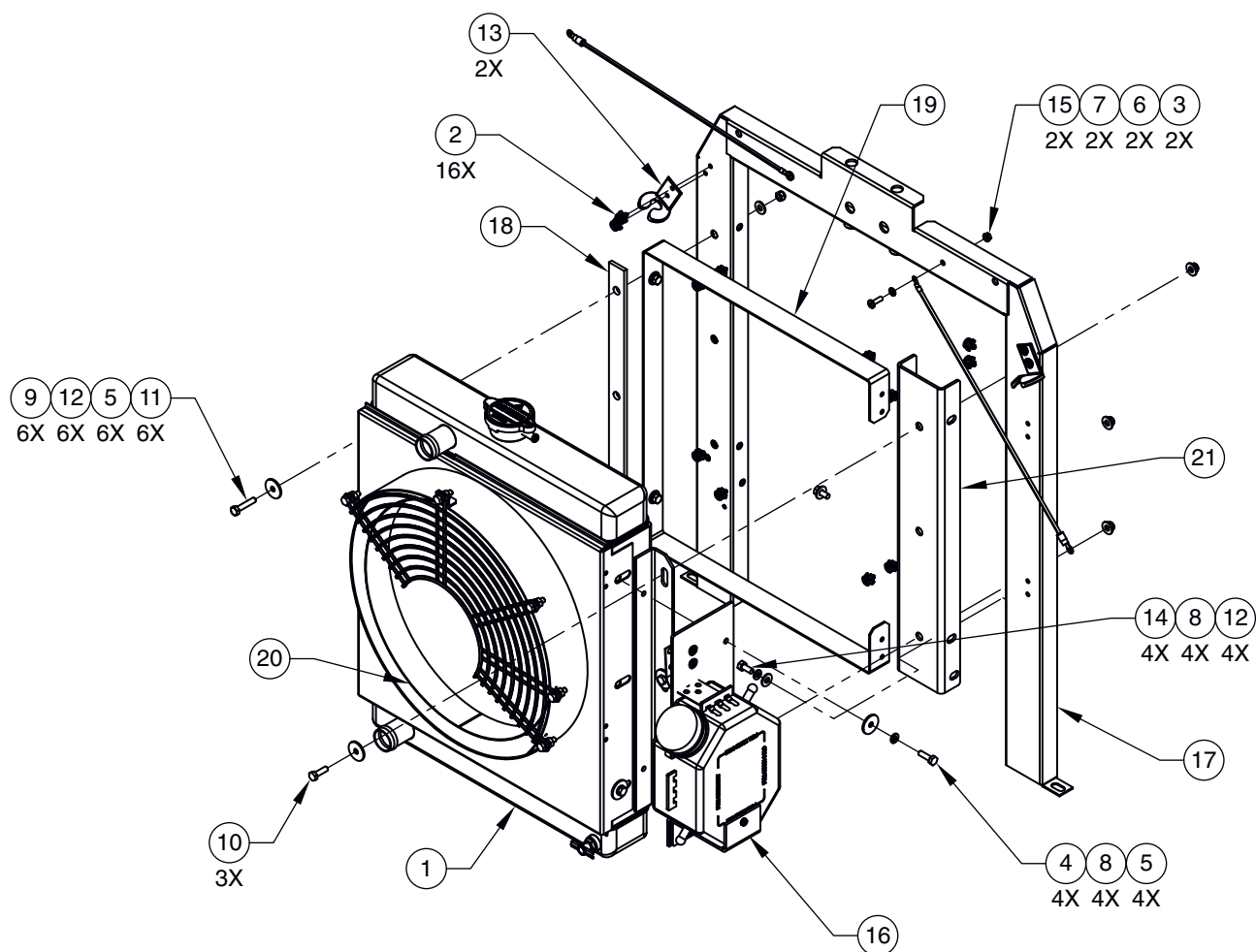
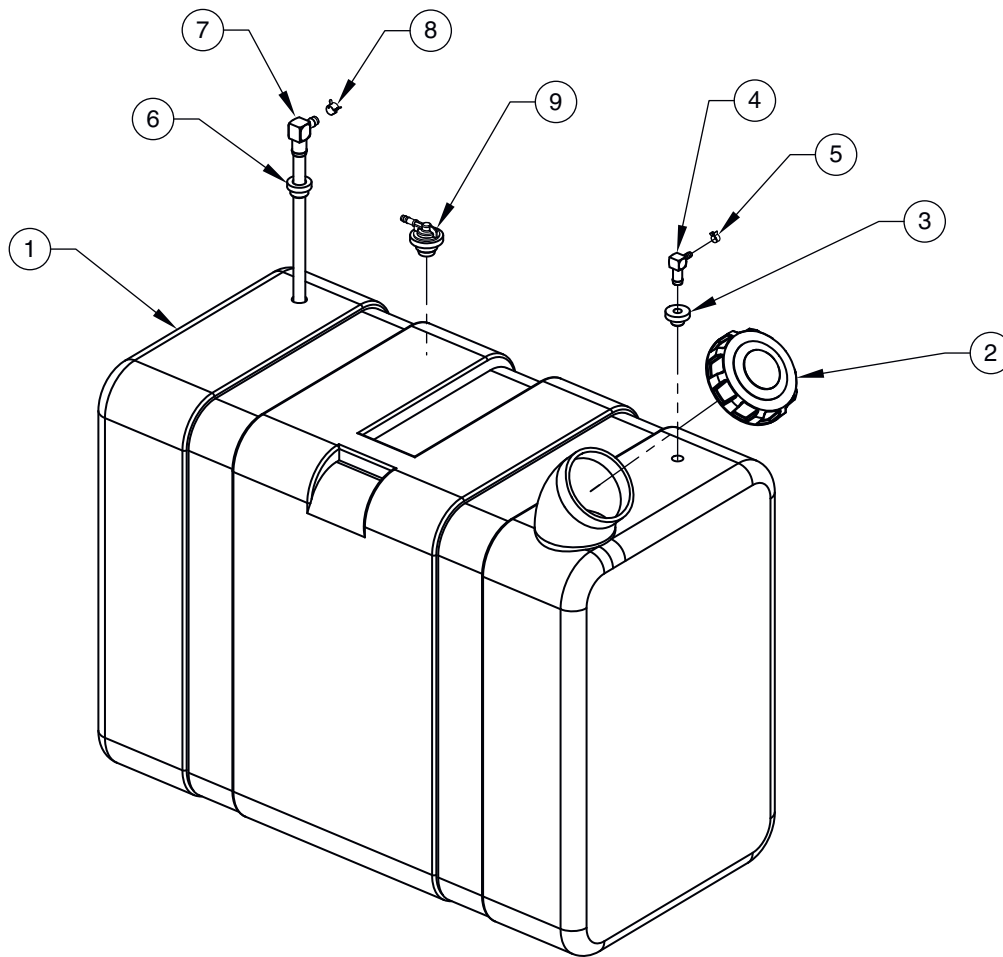
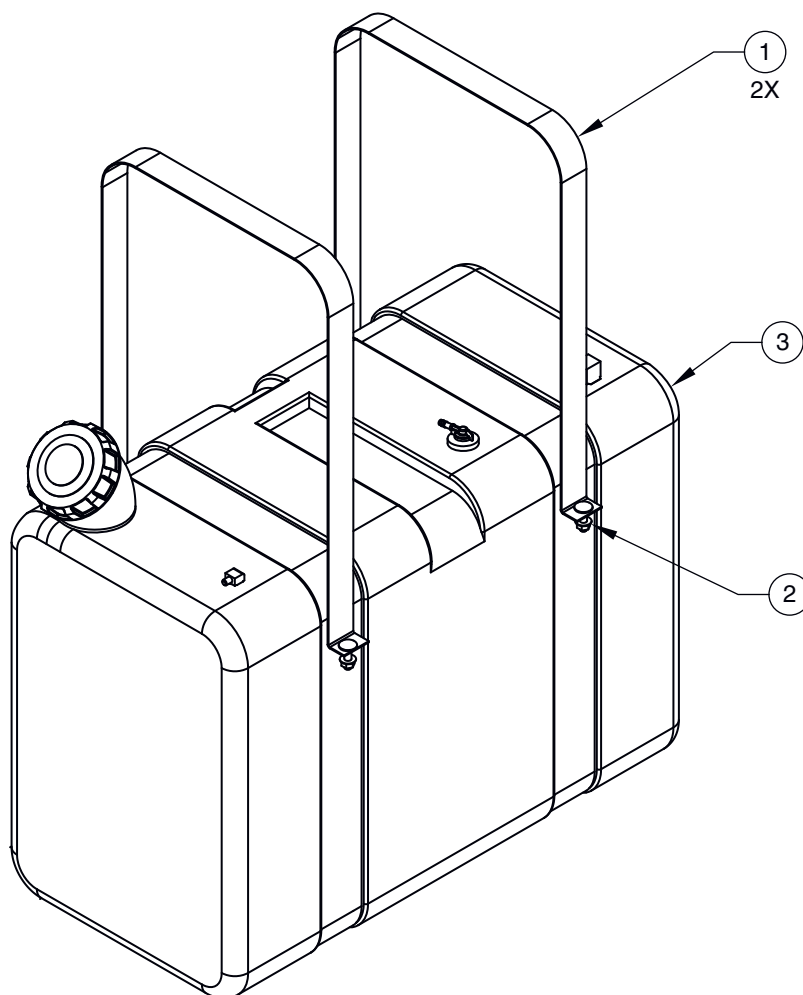


Table 5-12. Parts list: Radiator assembly

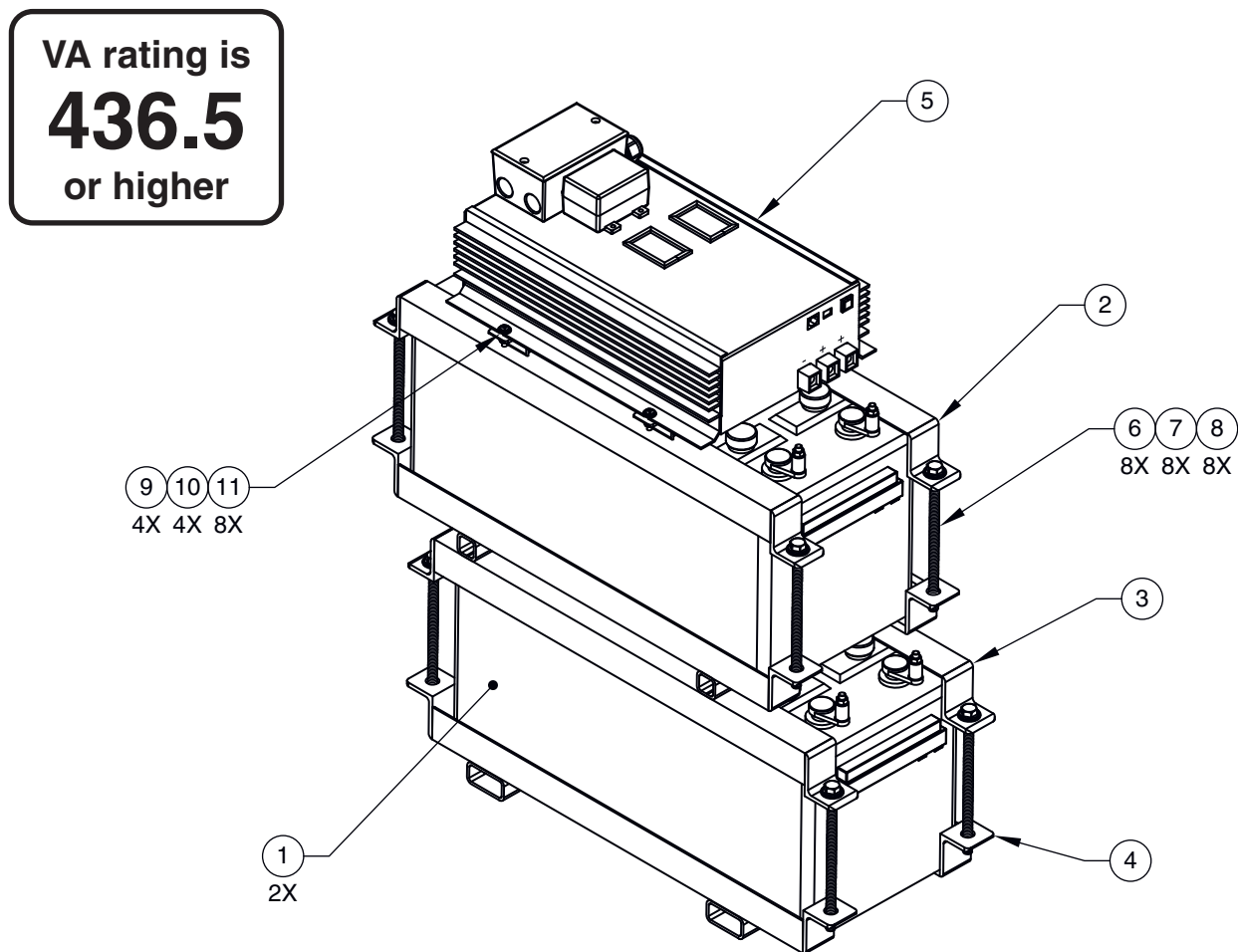
Item No.	Part No.	Description	Qty.
1	210097	Radiator assembly	1
2	102273	Rivet, 3/16" × 1/16" to 1/4" grip	16
3	105796	Pan-head machine screw, M5 × 16	2
4	105797	Hex screw, M6-1 × 20	4
5	106012	Fender washer, M6	10
6	106101	Internal-tooth lock washer, M5	2
7	107484	Ground wire assembly	2
8	108588	Split lock washer, M6	8
9	205137	Hex nut, nylon insert lock M6-1	6
10	205157	Hex screw, M6-1 × 20	3
11	205374	Hex screw, M6-1 × 30 × 18	6
12	100236	Flat washer, 9/32"	10
13	218461	Draw-latch bracket	2
14	218468	Hex screw, M6-1 × 14	4
15	218984	Keps hex nut, M5-0.8	2
16	237553-C	Coolant bottle assembly	1
17	238205-	Support frame	1
18	238975-	Spacer bar	1
19	239534-	Airflow seal strap	1
20	239535-	Fan shroud	1
21	239539-	Channel bracket	1

Figure 5-23. Replacement parts: Fuel tank assembly**Table 5-13. Parts list: Fuel tank assembly**

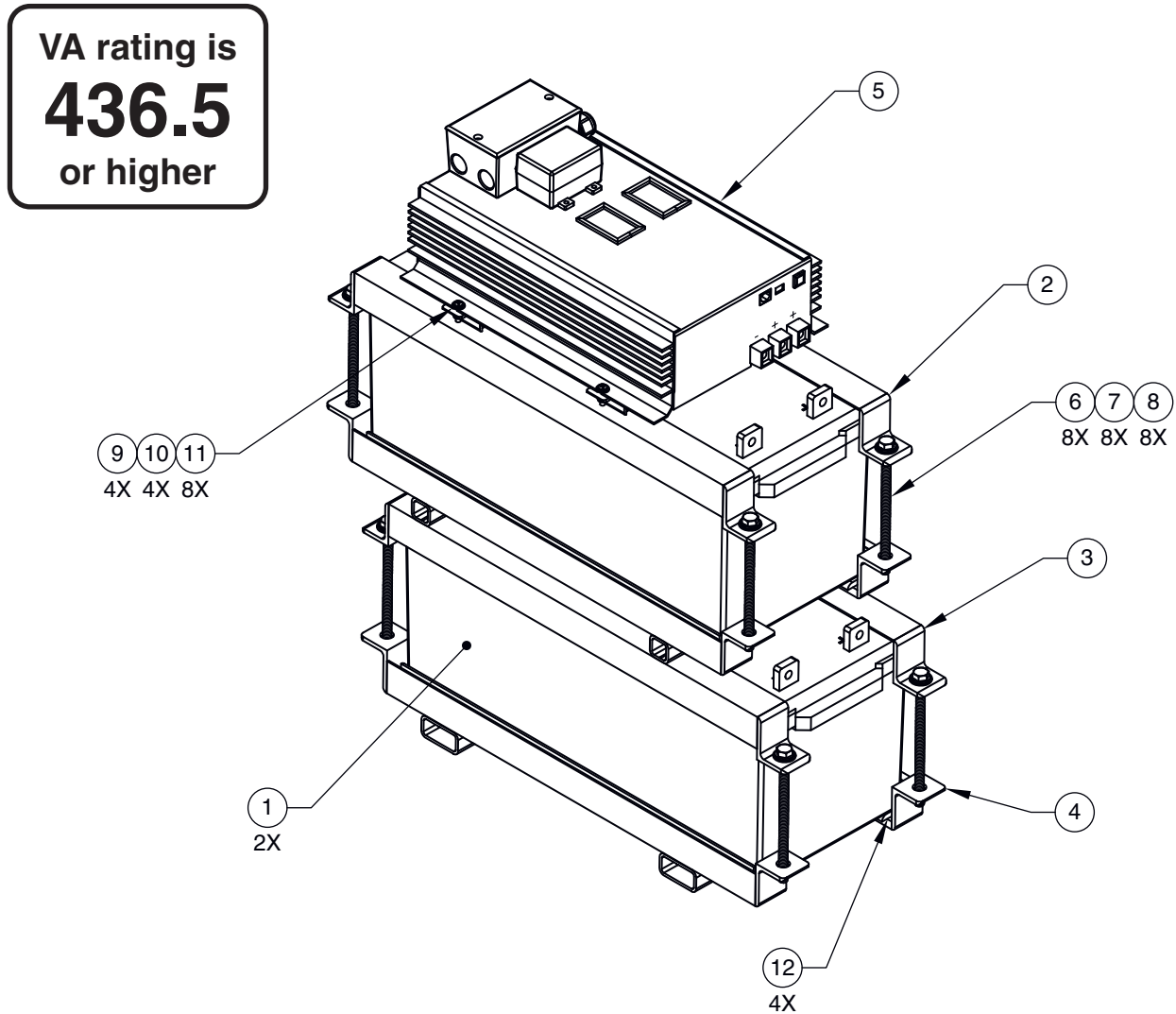
Item No.	Part No.	Description	Qty.
1	232131	Fuel tank	1
2	105406	Fuel cap	1
3	223744	Flanged grommet, 0.362" ID 0.560" OD	1
4	223749	Elbow fitting	1
5	209645	Hose clamp, 5/16"	1
6	223745	Flanged grommet, 0.540" ID 0.780" OD	1
7	223746	Fuel take-up tube assembly, 26"	1
8	228337	Hose clamp, 7/16"	1
9	236842	Vent valve with grommet, 0.8"	1

Figure 5-24. Replacement parts: Fuel tank and hold-down assembly**Table 5-14. Parts list: Fuel tank and hold-down assembly**

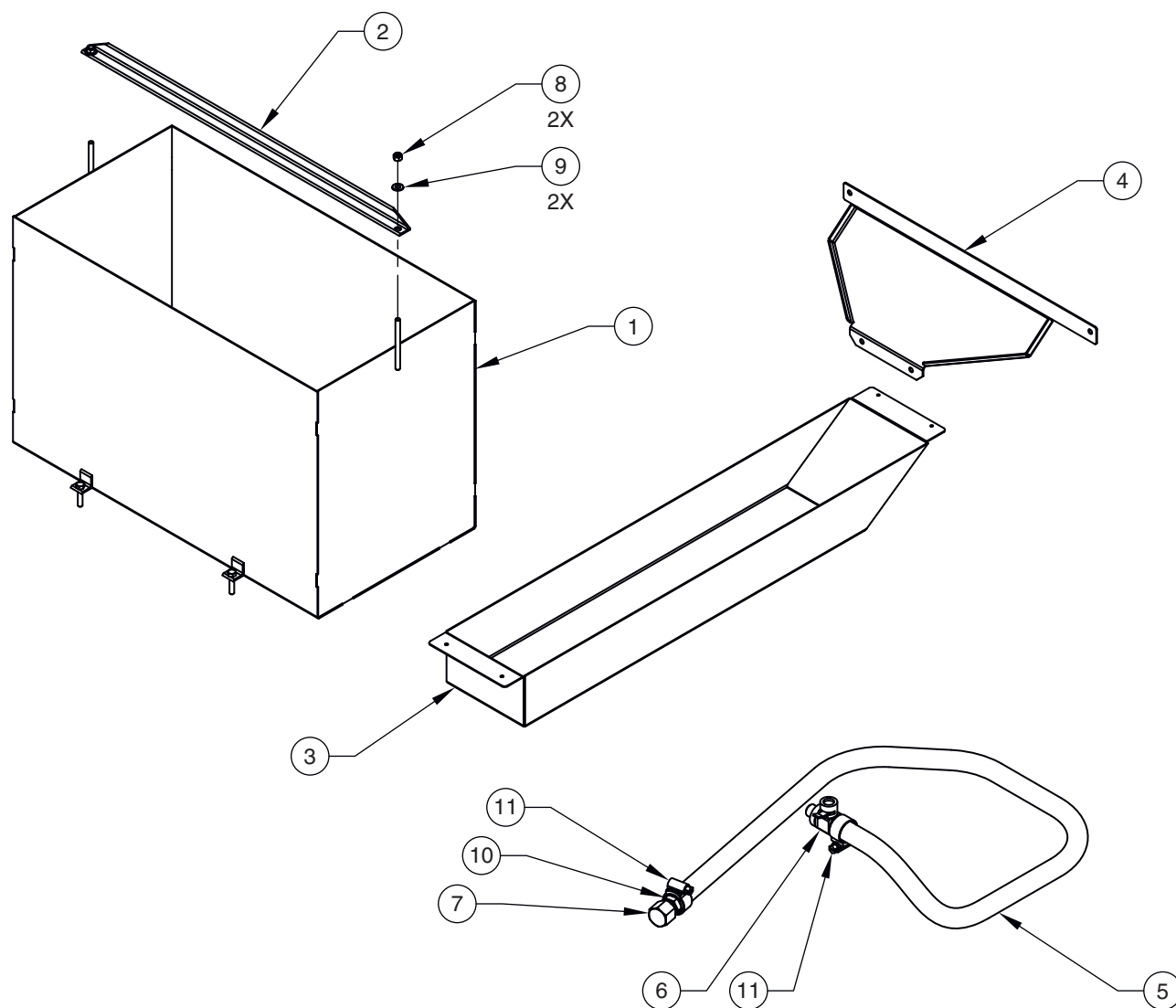
Item No.	Part No.	Description	Qty.
1	200497	Hold-down strap	2
2	201371	Hardware pack	1
3	232132	Fuel tank assembly	1

Figure 5-25. Replacement parts: Battery stack assembly, flooded batteries**Table 5-15. Parts list: Battery stack assembly, flooded batteries**

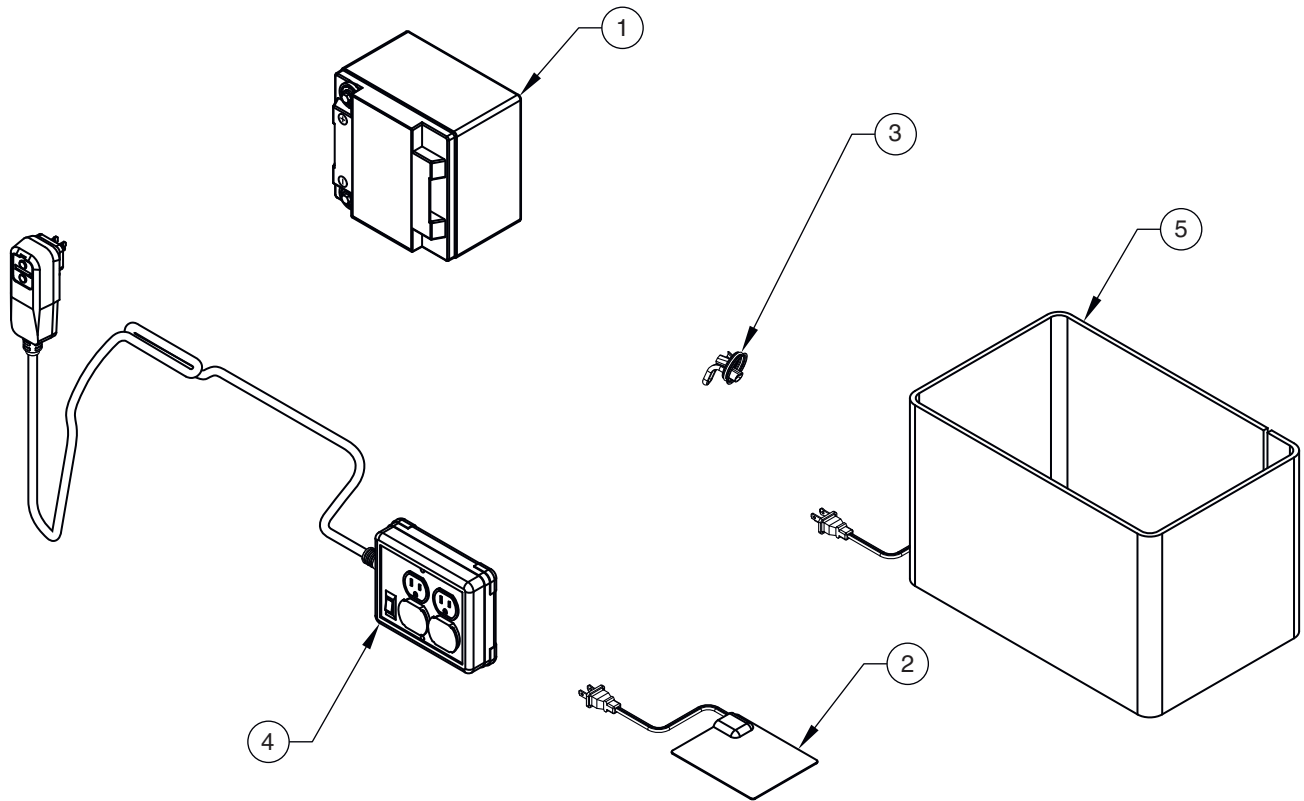
Item No.	Part No.	Description	Qty.
1	221878	Battery, 12V deep-cycle 4D	2
2	222932-	Top mounting bracket	1
3	222931-	Middle mounting bracket	1
4	222930-	Bottom mounting bracket	1
5	220842	Battery charger assembly	1
6	217654	Hex bolt, 3/8"-16 × 6 1/2"	8
7	100723	Split lock washer, 3/8"	8
8	100234	Flat washer, 3/8"	8
9	203685	Pan-head machine screw, #10-32 × 3/4"	4
10	101721	Hex nut, nylon insert lock #10-32	4
11	101526	Flat washer, #10	8

Figure 5-26. Replacement parts: Battery stack assembly, optional AGM batteries**Table 5-16. Parts list: Battery stack assembly, optional AGM batteries**

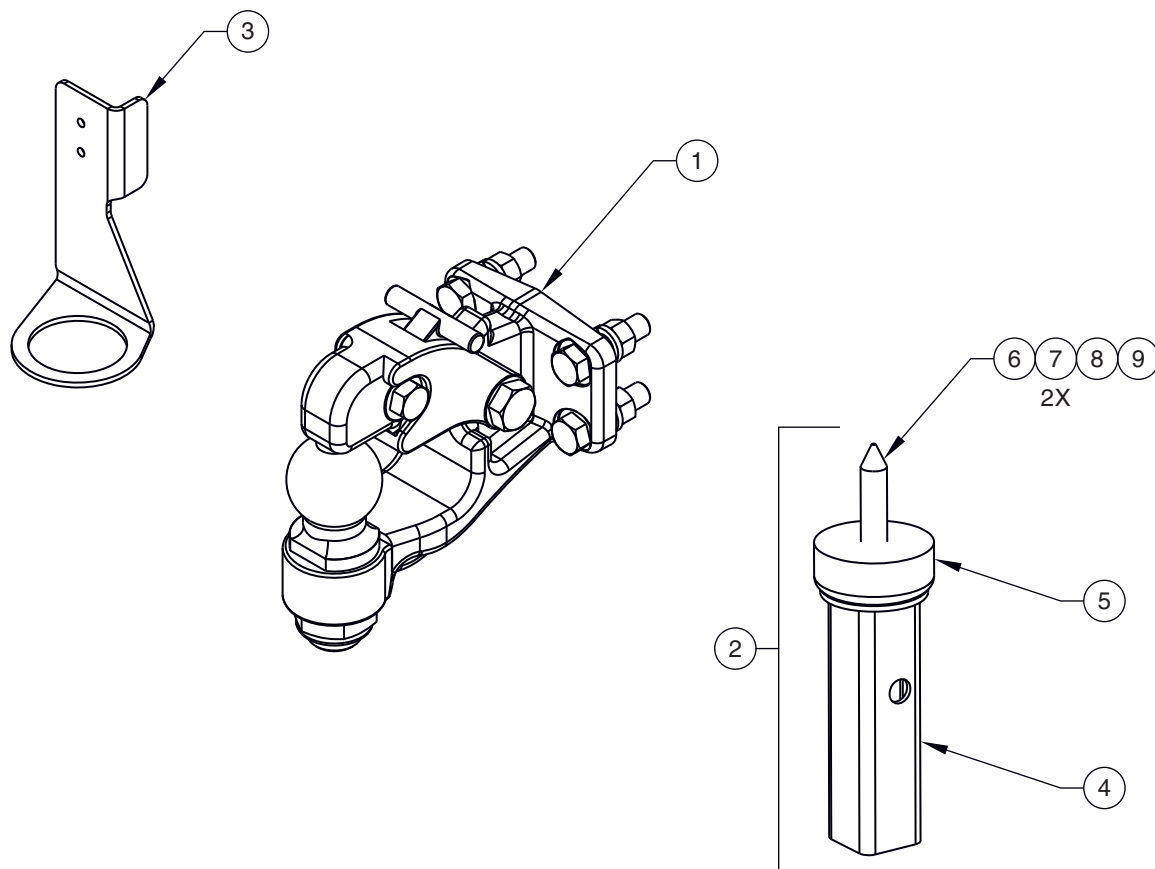
Item No.	Part No.	Description	Qty.
1	205016	Battery, 12V AGM UB4D	2
2	222932-	Top mounting bracket	1
3	222931-	Middle mounting bracket	1
4	222930-	Bottom mounting bracket	1
5	220842	Battery charger assembly	1
6	223569	Hex bolt, 3/8"-16 × 6"	8
7	100723	Split lock washer, 3/8"	8
8	100234	Flat washer, 3/8"	8
9	203685	Pan-head machine screw, #10-32 × 3/4"	4
10	101721	Hex nut, nylon insert lock #10-32	4
11	101526	Flat washer, #10	8
12	223566-	Angle spacer	4

Figure 5-27. Replacement parts: Optional drip and spill protection components**Table 5-17. Parts list: Optional drip and spill protection components**

Item No.	Part No.	Description	Qty.
1	229526-	Fuel containment tank, 30-gallon	1
2	239655-	Hold-down for fuel containment tank	1
3	232614-	Engine fluids drip pan	1
4	239652-	Radiator fluid diverter	1
5	212760	Oil drain hose	1
6	212289	Oil drain valve, M12-1.25	1
7	212759	Hose cap, 3/8" NPT	1
8	100239	Hex nut, nylon insert lock 5/16"-18	2
9	108374	Flat washer, 5/16"	2
10	106716	Barb fitting, 3/8" NPT	1
11	103006	Hose clamp	2

Figure 5-28. Replacement parts: Optional cold weather kit**Table 5-18. Parts list: Optional cold weather kit**

Item No.	Part No.	Description	Qty.
1	211940	AGM engine start battery, 12V	1
2	212557	Oil pan heater pad	1
3	224691	Block heater (cord not shown)	1
4	212661	GFCI receptacle assembly	1
5	212926	Battery heater	1

Figure 5-29. Replacement parts: Optional tandem tow components**Table 5-19. Parts list: Optional tandem tow components**

Item No.	Part No.	Description	Qty.
1	223564	Combination tow hitch, 2-ton cap.	1
2	223579-C1	Tandem-tow prop assembly	1
3	223583-P2	Prop holder	1
4	223578-P2	Prop shaft only	1
5	102004	Rubber bumper only	1
6	105621	Steel pin only	1
7	218990	Hex nut, M14-2	2
8	106006	Flat washer, M14	1
9	106103	Split lock washer, M14	1



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