Wanco® AFAD

Automated Flagger Assistance Device

Owner's Manual

February 2026

WANCO® The industry leader.

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1 Introduction

1.1 Read before using

This is the owner's manual for standard Wanco® Automated Flagger Assistance Devices (AFADs). Wanco AFADs that have 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 AFAD. 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 Service or Sales using the information in Section 1.3.

1.2 Applications

1.2.1 Overview

The Wanco AFAD is a portable flagging station. It removes the human flagger from the road by providing motorists with clear guidance through temporary traffic control (TTC) zones.

An operator controls the AFAD using a control unit while positioned off the road and out of the path of moving traffic. The AFAD restricts or allows traffic flow using a gate arm and red and yellow signal lights.

1.2.2 Common deployments

Common AFAD deployments pair human flaggers and AFADs as follows:

- **1 AFAD, 1 human flagger**

  Deploy one AFAD at one end of the TTC zone and station a human flagger at the other end. The flagger operates the machine, removing one flagger from the road.

- **2 AFADs, 1 human flagger**

  Deploy one AFAD at either end of the TTC zone, and employ one human flagger. The flagger operates both machines, removing two flaggers from the road.

- **2 AFADs, 2 human flaggers**

  Deploy AFADs at both ends of the TTC zone, each controlled by a nearby human flagger. Each flagger works a machine, removing two flaggers from the road.

1.2.3 DOT requirements

According to the U.S. Department of Transportation:*

- All AFAD applications must abide by the specific standards set forth in the MUTCD†, Section 6L.02.
- AFADs are typically used for short-term or intermediate-term lane or road closures such as bridge maintenance, haul road crossings, guardrail repair, and pavement patching. The MUTCD discourages their use for long-term closures.
- Most states permit the use of AFADs during daytime or nighttime operations; but, if used at night, the AFAD must be illuminated (in accordance with Section 6D.06 of the MUTCD).

For complete DOT requirements, consult your local authority having jurisdiction (AHJ).

1.3 Where to obtain service

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

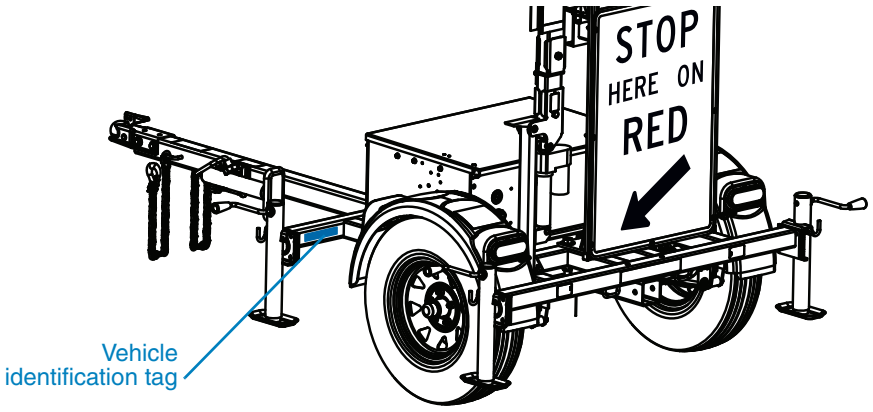
Contact our service department using the following information:

Wanco Inc.
5870 Tennyson Street
Arvada, Colorado 80003 USA

303-427-5700
fax 303-427-5725

www.wanco.com
info@wanco.com

Figure 1-1. Vehicle identification tag



**FHWA-HOP-17-042, Fall 2017.*
†The U.S. Department of Transportation's Manual on Uniform Traffic Control Devices *(MUTCD, 11th ed., December 2023), defines the standards for traffic control devices on all public streets and private roads open to public traffic.*

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

⚠ 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.
- Follow all regulatory guidelines.

⚠ CAUTION

Crush hazard.

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

2.3 Operating safety

2.3.1 Prior to use

- To reduce the risk of shifting, rolling, or overturning, locate the AFAD on a firm, level surface.

⚠ WARNING

Falling equipment could cause severe injury or death.

Before raising signal lights and sign tower, stabilize and level the trailer.

- Always stabilize and level the trailer before raising the signal lights and sign.
- Ensure the AFAD is in good operating condition. Never use any equipment that is damaged or in need of repair.
- To reduce the risk of personal injury, ensure the area surrounding the AFAD operator (human flagger) is in good order and free of debris.
- Before deploying the AFAD in a TTC zone, ensure the system has been tested for proper functioning (see Section 5.1, page 29).

2.3.2 During operation

- Never move the AFAD while the signal lights and sign are raised.
- Do not allow water to accumulate around the base of the trailer.
- When the signal lights and sign are raised, verify the height locking-pin is engaged.

2.4 Service safety

⚠ WARNING

Fire hazard.

When working with the AFAD 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.

CAUTION

Voltage surge could damage control circuits.

Before servicing electrical components, disconnect power.

- When working with batteries, never allow positive wiring to short to ground.
- Always take precautions to ensure the safety of service personnel. Whenever possible, perform maintenance indoors, out of weather and away from traffic.
- Never perform any service unless all electrical components are shut down. Ensure all AFAD power circuits are switched off.
- The solar charging system is always active when exposed to daylight. Before performing any service, always turn off all electrical loads and halt battery charging from both the solar panels and the external AC charger. For an overview of the AFAD power system, see Section 6.2, page 48.
- If disconnecting AFAD battery cables, always disconnect the positive (+) cable first.* Do not allow positive power cable to short to ground.
- If the ground 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 service the AFAD if your clothing or skin is wet.
- Always be aware of traffic when performing roadside maintenance.
- Keep the AFAD and all its components clean.

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

2.5 California Proposition 65

⚠ 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.

2.6 FCC statement

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

2.7 Labels

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

Label locations are indicated in Figure 2-1. Samples of labels and their descriptions are provided in Table 2-1.

Figure 2-1. Label locations

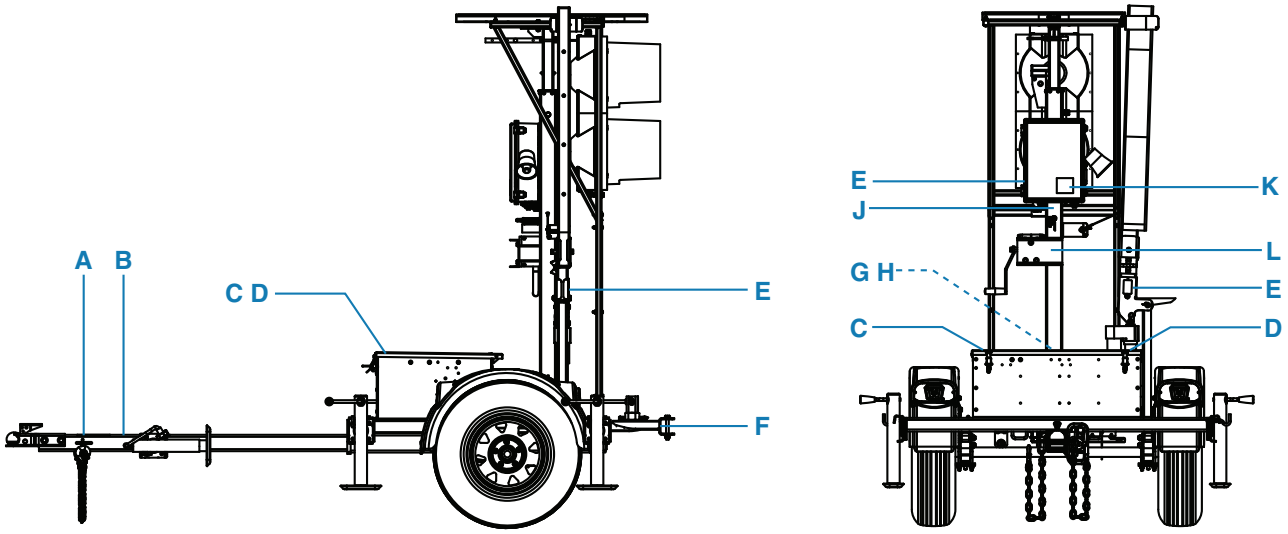
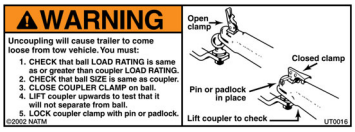
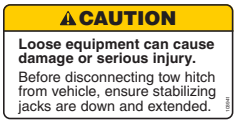
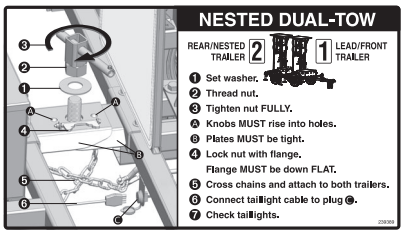
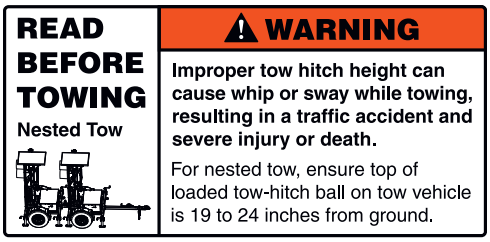
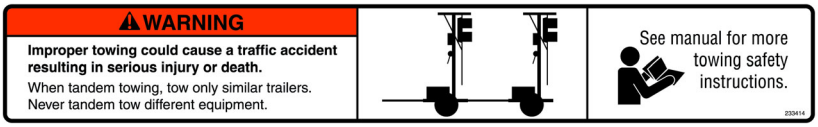
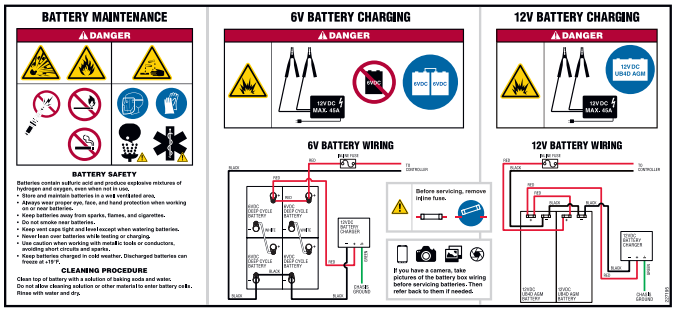
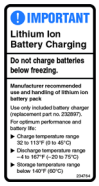


Table 2-1. Label samples and descriptions

Ref.*	Label (not to scale)	Description
A		Warning: towing connection
B		Caution: extend stabilizing jack
C**		Nested towing instructions
D**		Warning: nested towing
E		Caution: Lower gate arm

*Reference Figure 2-1 for label location. **EZ-Nest dual-tow kit only.

Table 2-1. Label samples and descriptions *continued*

Ref.*	Label (not to scale)	Description
F		Warning: tandem towing
G		Danger: battery hazards
H		Lithium ion battery charging
J		Release locking-pin
K		AFAD pair button
L**		Front/lead trailer number
L**		Rear/nested trailer number

*Reference Figure 2-1 for label location. **EZ-Nest dual-tow kit only.

3 Assembly

3.1 Drawbar

Before using your Wanco AFAD for the first time, it might be necessary to install the drawbar. The drawbar may be removed before shipment from the factory.

To install the drawbar, follow these steps:

1. The drawbar includes wiring for the trailer lights. Before installing the drawbar, ensure the wiring cable is hanging out of the drawbar, as indicated in Figure 3-1.
2. Refer to Figure 3-2 and install the drawbar and wiring:
   a. Locate the receiving sleeve, centered under the front of the trailer frame.
   b. Carefully insert the cable into the sleeve, followed by the drawbar.
   c. Align the holes in the sleeve and drawbar.
   d. Attach the drawbar to the trailer with two sets of bolts, washers, and nuts. Tighten the nuts fully.
   e. Connect the trailer plug to the receptacle under the trailer frame. Before towing, ensure the trailer brake lights, taillights, and directional/turn indicators are functioning properly.

Figure 3-1. Wiring cable and trailer plug

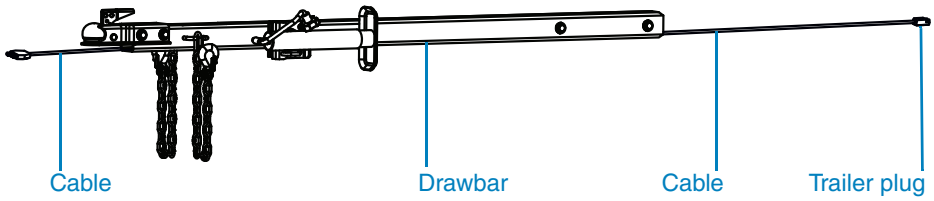
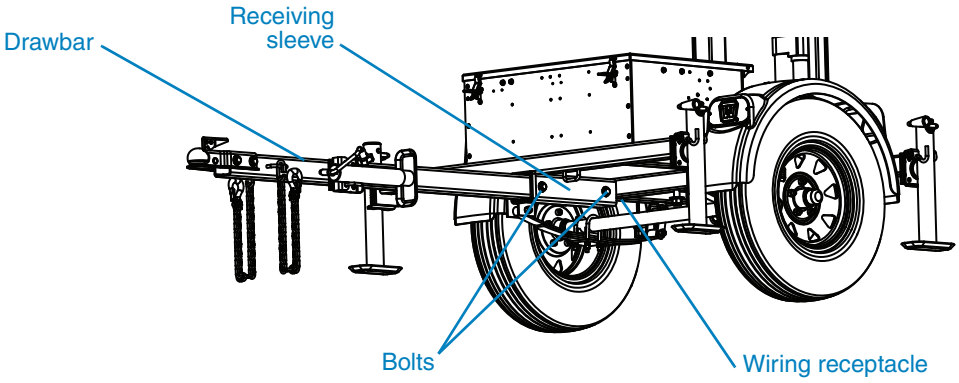


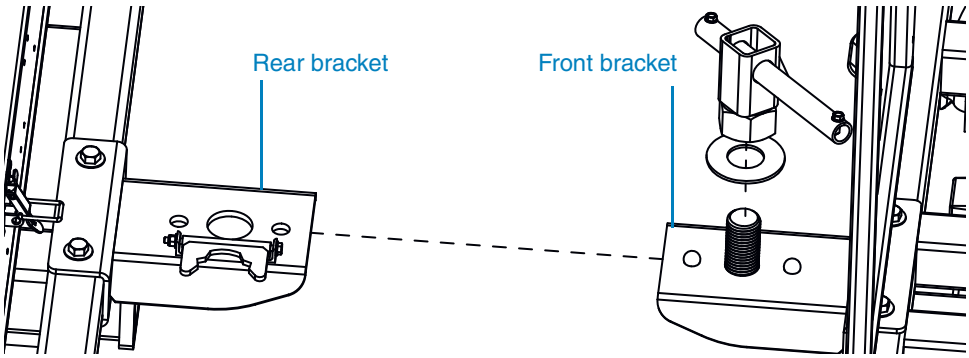
Figure 3-2. Drawbar installation



3.2 EZ-Nest dual-tow brackets

If the AFAD is equipped with optional EZ-Nest brackets for nested dual-towing, they may be installed at the factory, or stored in the battery box. EZ-Nest brackets are optional equipment that may not be included with your AFAD (see Figure 3-3).

Figure 3-3. EZ-Nest dual-tow brackets



Before dual-towing two trailers, follow these steps to install the brackets:

1. Remove the brackets and hardware from the battery box.
2. For each AFAD, find the number label that is on the back of the winch.
   - The AFAD with label "1" is the front trailer.
   - The AFAD with label "2" is the rear trailer.
3. If the rear AFAD has a drawbar installed, remove the drawbar:
   a. Unplug the drawbar cable from the trailer wiring.
   b. Loosen and remove the two bolts that attach the drawbar to the trailer, then remove the drawbar by sliding it forward.
   c. To prevent the nuts and bolts from being lost, insert the bolts into the holes in the drawbar and secure them and the washers in place with the nuts.
4. Identify the EZ-Nest bracket with the hinged locking flange and its hardware. This is the rear trailer bracket for the trailer labeled #2.
5. Place the bracket on the rear AFAD's front frame crossbar, aligning the holes in the bracket and the frame as shown in Figure 3-4.
6. Attach the bracket to the frame with the included bolts, washers, and nuts. Ensure the nuts are fully tightened.
7. If the front AFAD (the AFAD that will be hitched to the tow vehicle, labeled #1) has a tow coupler installed at the rear of the trailer, uninstall the coupler.
8. Place the remaining bracket on the front AFAD's rear frame crossbar, aligning the holes in the bracket and the frame as shown in Figure 3-5.
9. Attach the bracket to the frame with the included bolts, washers, and nuts. Ensure the nuts are fully tightened.

Figure 3-4. Dual-tow bracket installation: rear AFAD

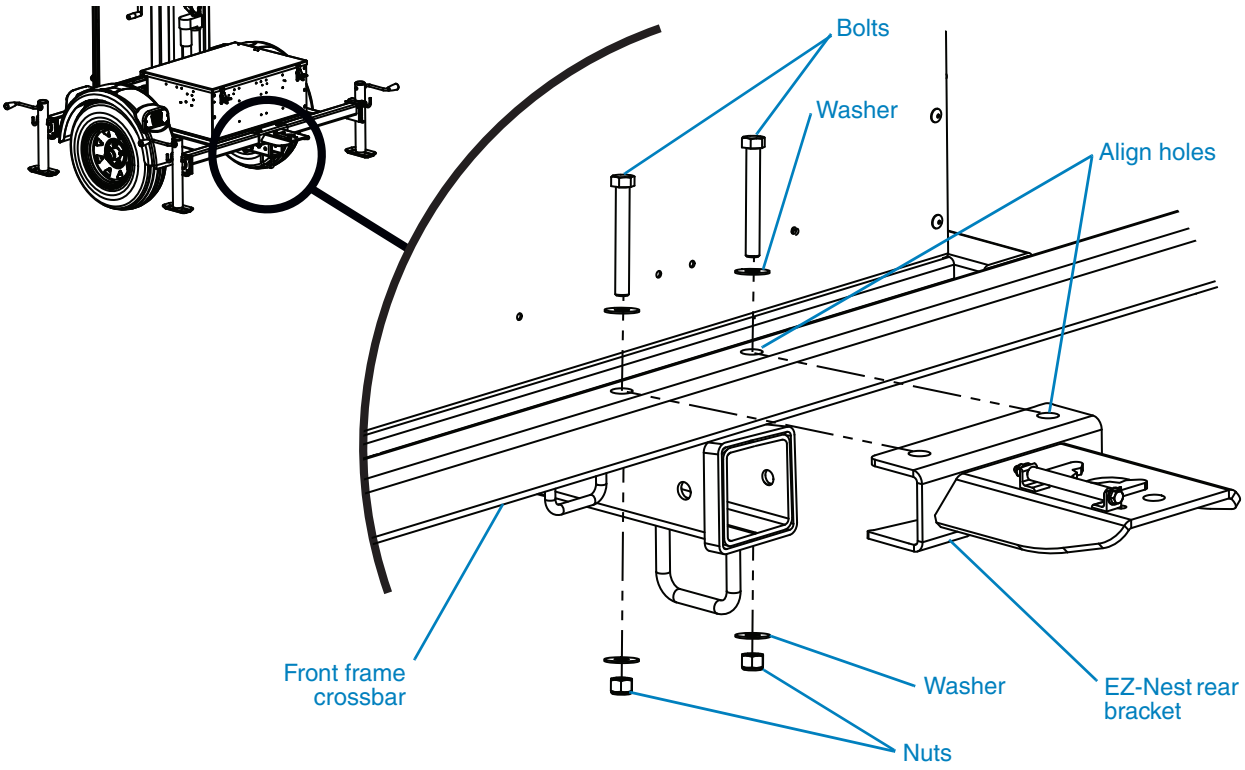
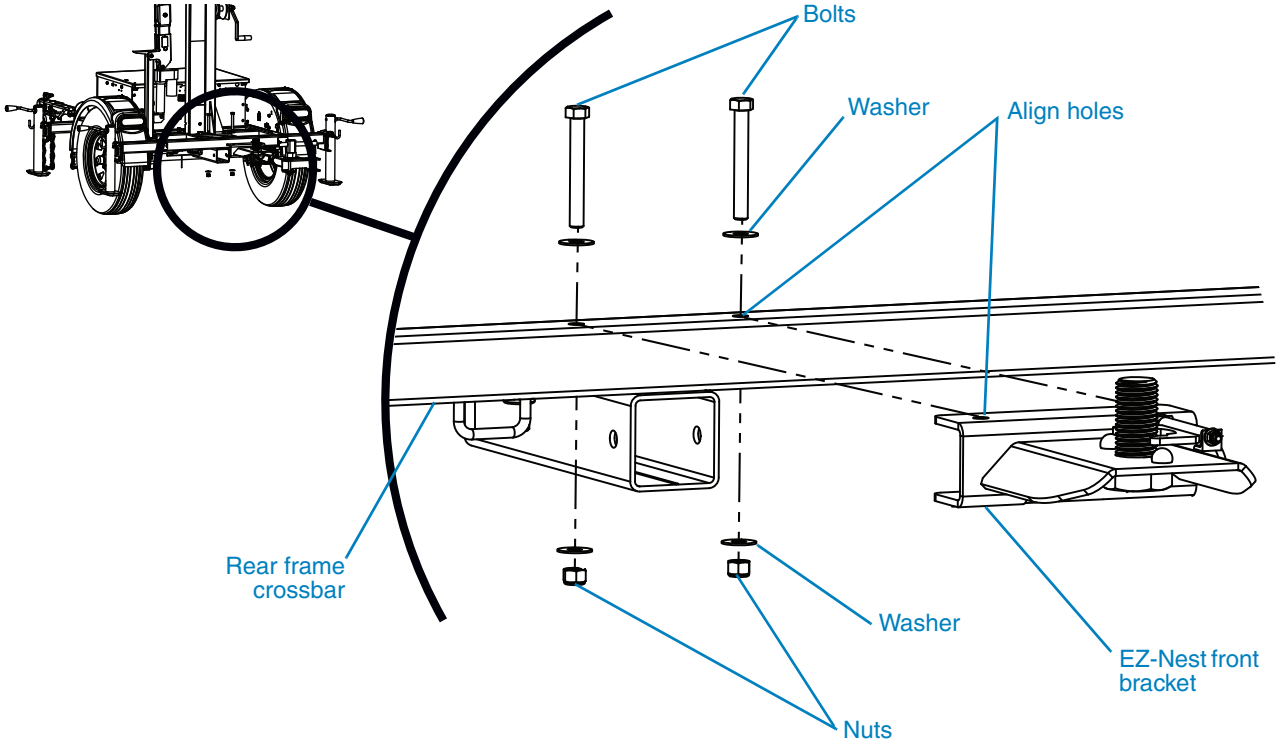


Figure 3-5. Dual-tow bracket installation: front AFAD



3.3 Gate arm

The AFAD gate arm has two main sections: the gate arm that is attached to the tilt bracket, and the gate arm extension.

The arm may also have an optional safety flag stored inside the gate arm extension (see Section 5.7.3, page 44).

When shipped from the factory, the extension is stored in a cradle next to the telescoping tower. For operation, the gate arm extension must be installed on the end of the gate arm. For transport, the extension may be removed.

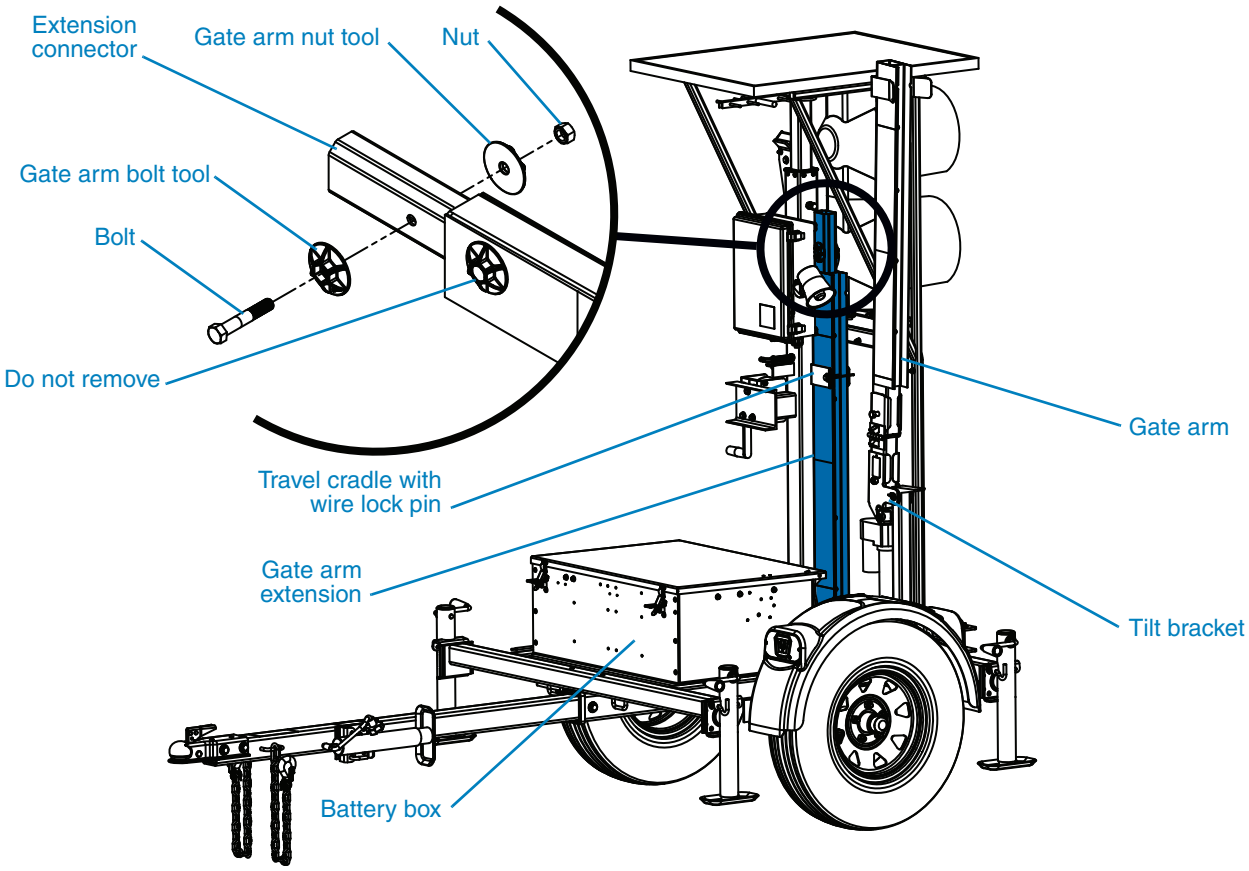
To install the gate arm extension, refer to Figure 3-6 and follow these steps:

1. Lower the gate arm using either the wireless controller or the cable-connected controller. Both controllers are stored in the battery box.
   - Instructions for using the wireless controller are provided in Section 5.5.2, page 34.
   - Instructions for using the cabled controller are provided in Section 5.5.3, page 40.
2. Remove the wire lock pin that holds the gate arm extension in the travel cradle, then lift the extension out of the cradle.
3. Attach the extension to the gate arm (see Figure 3-6, page 13):
   a. Remove the bolt and nut from the hole in the connector with their installed gate arm tools*. Do not remove the hardware that attaches the connector to the extension.
   b. Slide the connector into the end of the gate arm.
   c. Line up the holes in the connector and the gate arm, then insert the bolt through the holes.
   d. Tighten the nut on the bolt with the gate arm bolt tool until it is hand-tight. Do not over-tighten.
4. Reinstall the wire lock pin in the travel cradle.

   To remove the extension from the gate arm, reverse these steps.

*It is not necessary to use a wrench to tighten or loosen the hardware.

Figure 3-6. Gate arm extension



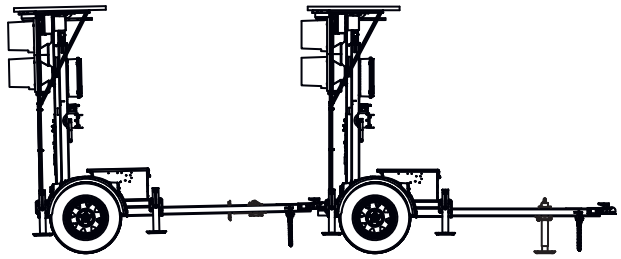
4 Towing

4.1 Towing two AFADs

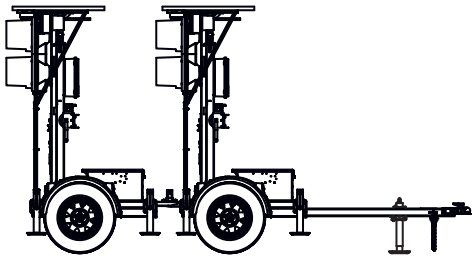
4.1.1 Overview

If desired, you can transport two Wanco AFAD trailers with one tow vehicle using either of two methods (see Figure 4-1, page 15):

Figure 4-1. Tandem and nested towing



Tandem tow—side view



Nested tow—side view

Tandem towing—Both AFAD trailers have full-length drawbars installed. Attaching one trailer behind the other is referred to as tandem towing. See Section 4.1.3, page 16.

Nested towing—The front AFAD trailer has a full-length drawbar installed. The two trailers are fastened together with the EZ-Nest kit and towed as though they were a single unit. This method is referred to as nested dual-towing. See Section 4.1.4, page 16.

4.1.2 Towing instructions

- If towing a single AFAD, follow the procedure in Section 4.2, page 20.
- If towing two AFADs, and they are not fastened together:
  a. Follow the procedure in Section 4.2, page 20, for the first AFAD.
  b. Then tow it to the second AFAD's location before fastening the two AFADs together (see Section 4.1.3 or Section 4.1.4).
  c. Once they are fastened together, follow the procedure in Section 4.2, page 20 for both AFADs.
- If the two AFADs are already fastened together, follow the procedure in Section 4.2 for both AFADs.

4.1.3 Tandem towing

⚠ WARNING

Tandem towing poses risks that could cause a traffic accident resulting in severe injury or death.

- When tandem towing, tow only similar trailers. Never tandem tow different equipment.
- Read and follow all tandem towing requirements before towing.
- Adhere to all regulatory requirements when tandem towing.

- At least one AFAD trailer must have the included tow hitch installed at the back of the trailer for hooking up and tandem towing the second trailer.
- Each AFAD trailer uses a full-length drawbar. The rear trailer's drawbar must have a coupler that is compatible with the tow hitch at the back of the front AFAD, and the front AFAD's drawbar must have a coupler that is compatible with the tow hitch on the tow vehicle.
- Once the trailers are hooked up, ensure that both drawbars are within five degrees (±5°) of parallel with the ground. A greater angle will change the tongue weight and may cause the trailer to whip or sway while towing.
- Tandem tow only where allowed by local regulations.
- Follow the procedure in Section 4.2, page 20, for both trailers.

4.1.4 Nested towing

⚠ WARNING

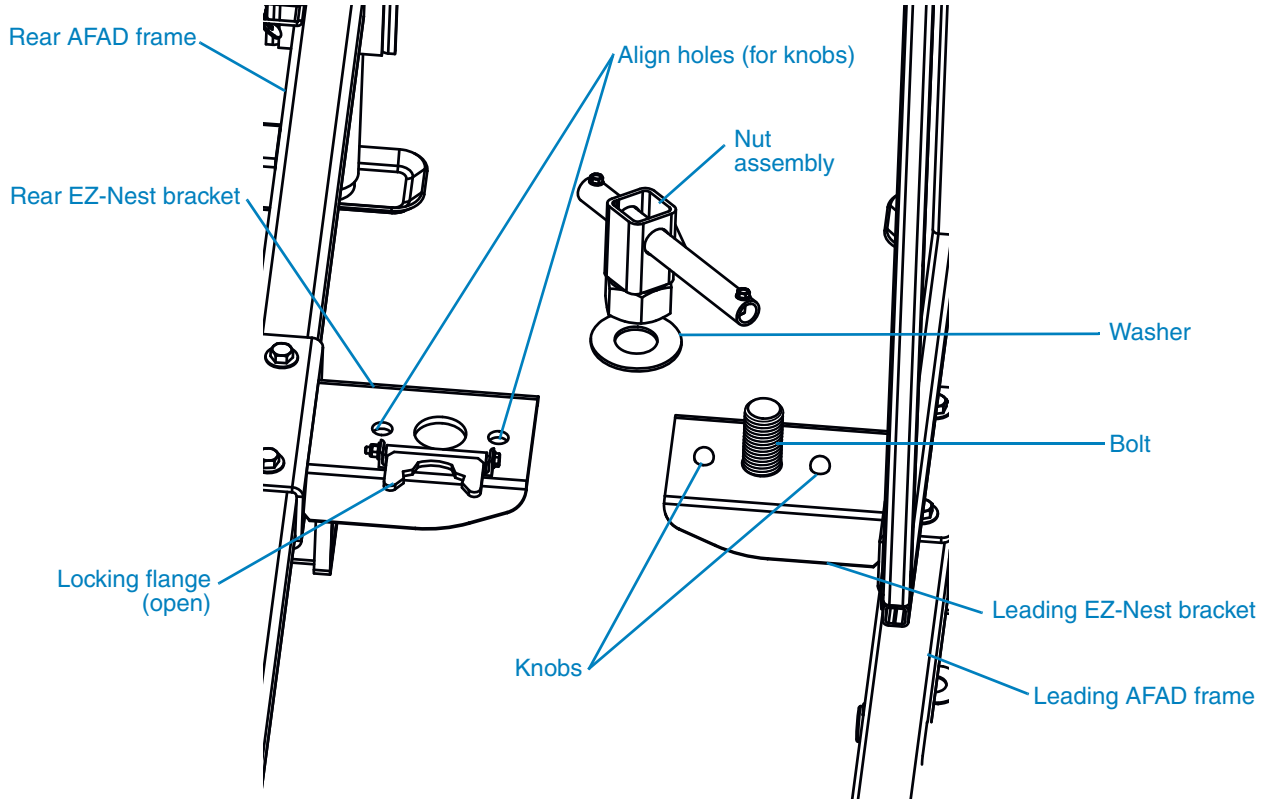
Improper tow hitch height can cause whip or sway while towing, resulting in a traffic accident and severe injury or death.

Ensure top of loaded tow-hitch ball on tow vehicle is 19 to 24 inches from ground.

This method of towing two AFADs nests the trailers together using a mated pair of brackets to join them. When the brackets are nested, the two trailers can be towed as though they are a single four-wheel trailer. The dual-tow brackets are optional equipment that may not be included with your AFADs.

- One bracket is installed on the rear frame of the front, or leading trailer. The other bracket is installed in place of the drawbar on the rear trailer (see Figure 4-2).
- The leading trailer must have a full-length drawbar installed. The drawbar requires a coupler that is compatible with the tow hitch on the tow vehicle.
- For bracket installation instructions, see Section 3.2, page 10.

Figure 4-2. EZ-Nest bracket parts



To prepare the trailers for nested towing, refer to Figure 4-3, and follow these steps:

1. Move the rear trailer behind the leading trailer, with the dual-tow brackets nearly touching.
2. Using the front corner leveling jacks on the rear trailer, raise the front of the trailer so the leading trailer's bracket can slide under the rear trailer's bracket.
3. Use the leading trailer's drawbar to move its bracket under the rear trailer's bracket so the holes line up.
4. Use the rear trailer's front corner leveling jacks to lower its bracket over the leading trailer's bracket. so the large bolt goes through the large hole. Ensure the knobs line up with the small align holes on the rear bracket.
5. Move the locking flange to the open position, and thread the washer over the large bolt.
6. With the locking flange still in the open position, thread the nut onto the large bolt and tighten it FULLY.

7. Close and engage the locking flange so that it holds the nut in place. Adjust and align the nut so the locking flange lies flat.

⚠ WARNING

Loose equipment could cause a traffic accident resulting in severe injury or death.

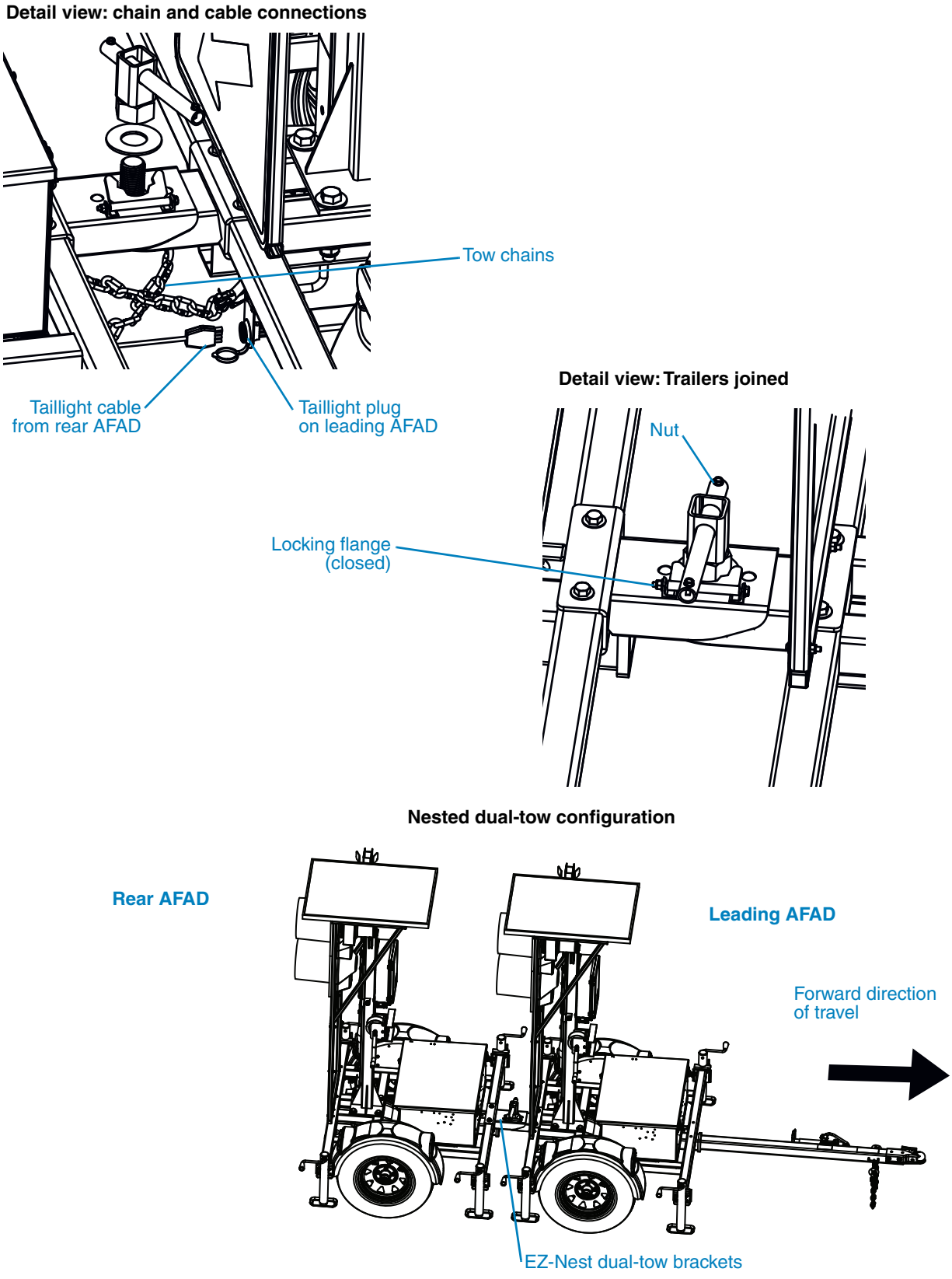
Ensure the locking flange is flat and tight around the nut.

8. Locate the leading trailer's taillight plug and plug in the taillight cable from the rear trailer. Before towing, ensure the rear trailer brake lights, taillights, and directional (turn) indicators are connected and functioning properly.
9. Check the height of the tow vehicle's loaded tow hitch from the ground and ensure that it is 19 to 24 inches high. Otherwise, the trailers could whip or sway while being towed and cause a traffic accident.
10. Follow the procedure in Section 4.2, page 20, for both trailers.

    The EZ-Nest brackets need to be removed for tandem or separate trailer towing. Remove the brackets before:

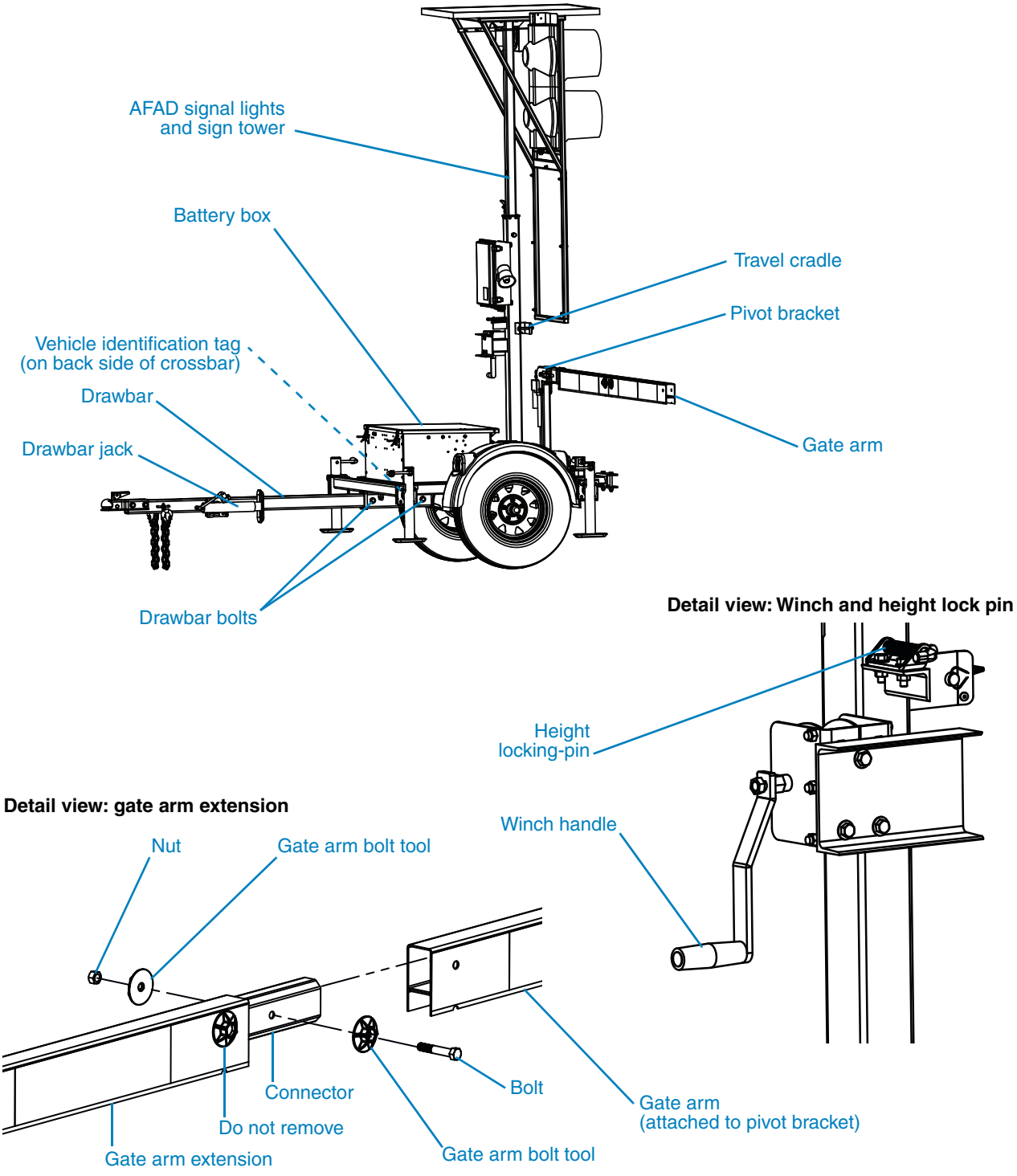
    - Installing a rear hitch on the leading trailer
    - Installing a drawbar on the rear trailer

Figure 4-3. Nested dual-tow



4.2 Before towing

Figure 4-4. Before towing



Refer to Figure 4-4 and follow these steps to prepare the AFAD for towing:

1. If towing two AFADs, follow the instructions in Section 4.1, page 15, before continuing with this procedure.
2. Using the wireless controller, lower the AFAD gate arm all the way down. If the controller is paired with two AFADs, lower both gates. The controller is stored inside the battery box. Instructions for using the controller are provided in Section 5.5.2, page 34.
3. Lower the signal lights and regulatory sign tower into the travel position:
   a. Pull and hold the height locking-pin to release the tower so that it can be lowered.

⚠ WARNING

Falling equipment could cause severe injury or death.

If height locking-pin is stuck, removing the pin may cause the signal lights and sign tower to fall.

- Do not force pin.
- Contact factory for assistance.

   b. While holding the pin, use the hand-operated winch to start lowering the tower.
   c. Release the pin and continue lowering the tower.
   d. When lowered all the way down, the height locking-pin snaps into place with an audible "click," locking the tower, signal lights, and sign in the down (travel) position.
4. When the gate arm is raised, it will extend to over 11 feet (3.4 meters) in height unless the gate arm extension is removed before towing. To remove the extension:
   a. If installed, remove the optional safety flag from the end of the extension arm (see Section 5.7.3, page 44).
   b. Locate and remove the bolt that attaches the extension to the gate arm. Use its gate arm bolt tool to loosen the bolt.* Do not remove the bolt that attaches the extension to the connector.
   c. Slide the connector and extension out of and away from the gate arm.
   d. Insert the bolt through the hole in the connector and tighten the nut on the bolt with its gate arm bolt tool until it is hand-tight. Do not over-tighten.
   e. Remove the wire lock pin from the travel cradle.
   f. With the extension held vertically and the connector at the top, set the bottom of the extension on the trailer frame, then rest the extension in the cradle.
   g. Reinstall the wire lock pin through the cradle to secure the extension in place.

*It is not necessary to use a wrench to tighten or loosen the hardware.

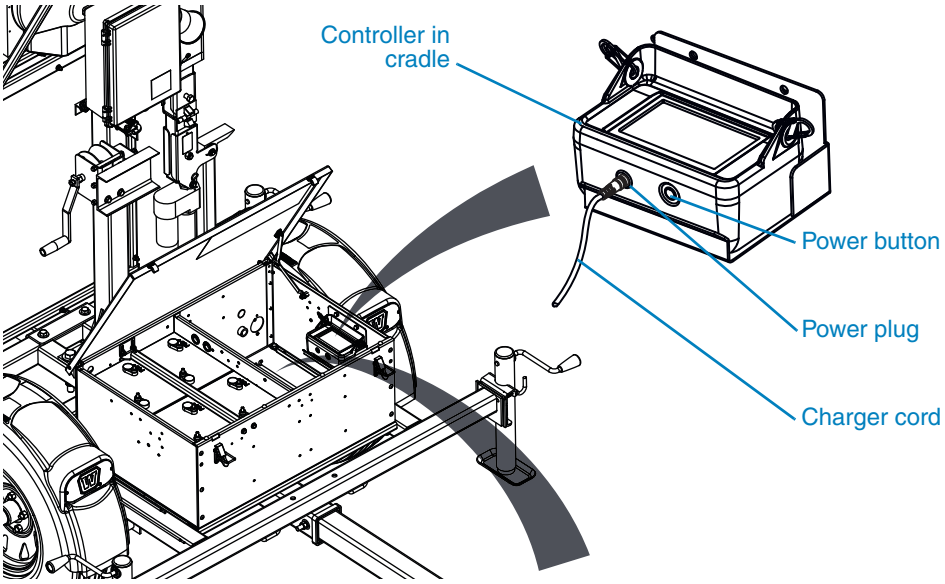
5. Using the wireless controller, turn off the signal lights and raise the gate arm all the way up:
   a. Access the Settings screen by pressing the ⚙ button on the Main screen.
   b. Press the **GATE UP, SIGNAL OFF** button. If the controller is paired with two AFADs, the button is labeled **GATES UP, SIGNALS OFF**.
   c. Press **BACK** when done to go back to the Main screen.
6. If the AFAD is equipped with a camera, it should be turned off before transport:
   a. With the wireless controller, access the Settings screen by pressing the blue **AUX DEVICE POWER** button on the Main screen.
   b. Press the **OFF** button under "Aux 1 Pwr." A green checkmark appears.
   c. Press **BACK** when done or switch the controller off.
7. Refer to Figure 4-5 and follow these steps to stow the controller inside the battery box.

   IMPORTANT!

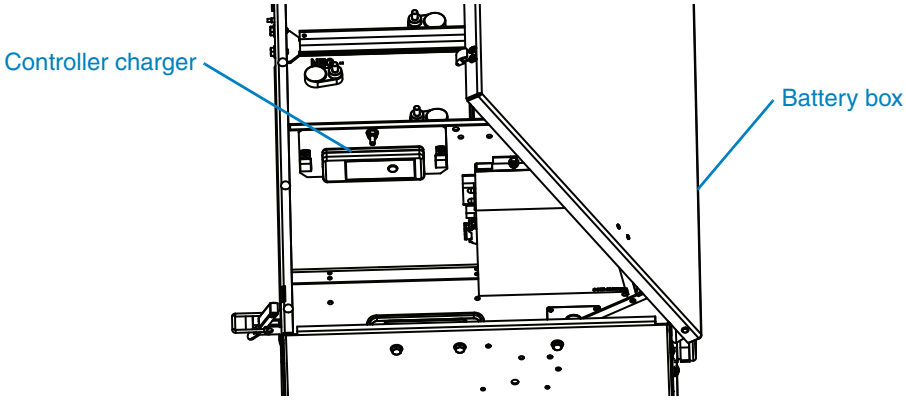
   Do not charge the controller batteries when the temperature is below freezing.

   a. Access the charging cord in the battery box and insert the loose end into the charging port on the bottom of the controller.
   b. Ensure the cord is secured to the controller by fully tightening the locking collar, and attaching the retaining clip, if present.
   c. Place the controller in its cradle inside the battery box. Ensure the controller is fully seated so it will not come loose during transport.
8. Close and latch the battery box cover. Lock the battery box if desired.
9. Check tires and wheels:
   a. Check tires for wear. Replace worn tires.
   b. Ensure tires are inflated to the proper pressure.
   c. Verify all wheel lugs are in place and tightened. Do not tow the trailer if a wheel lug is missing.

Figure 4-5. Controller, cradle, and charger



Controller charger location



10. Check the drawbar, tow hitch, and safety chains:

    a. Ensure the tow hitch on the tow vehicle is rated for weight equal to or greater than the AFAD's gross vehicle weight rating (GVWR). The GVWR is listed on the vehicle identification tag.

       If towing two AFADs with one tow vehicle, ensure the tow hitch on the tow vehicle is rated for weight equal to or greater than double the AFAD's gross vehicle weight rating (GVWR).

    b. Ensure the tow hitch on the tow vehicle and the drawbar hitch on the AFAD trailer are compatible.

    c. Inspect the tow hitch and drawbar hitch for wear and damage. Replace or repair if necessary.

    d. Ensure the trailer's removable drawbar is attached securely to the trailer frame with two sets of bolts, washers, and nuts. The bolts should engage the drawbar and the nuts should be tight. (For drawbar installation instructions, see Section 3.1, page 9.)

    e. Lower the drawbar jack into the down position by pulling the jack locking-pin and rotating the jack downward. Release the pin and continue rotating the jack until it is vertical. When the jack is properly set, the locking-pin snaps into position with an audible "click." Use the hand-crank on the jack to lower it to the ground.

    f. Verify the trailer's four corner leveling jacks are in the up position and secured with their locking-pins. To raise the leveling jacks, use the hand-crank on each jack to raise the jack foot off the ground, then pull the jack locking-pin and rotate the jack upward. Release the pin and continue rotating the jack until it is horizontal and the pin re-engages with an audible "click."

    g. 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.

    h. Check the tow hitch height and drawbar angle. Improper tow hitch height will change the tongue weight and may cause the trailer to whip or sway while towing. ALWAYS check the tow hitch height before towing.

⚠ WARNING

Improper tow hitch height can cause a traffic accident, resulting in severe injury or death.

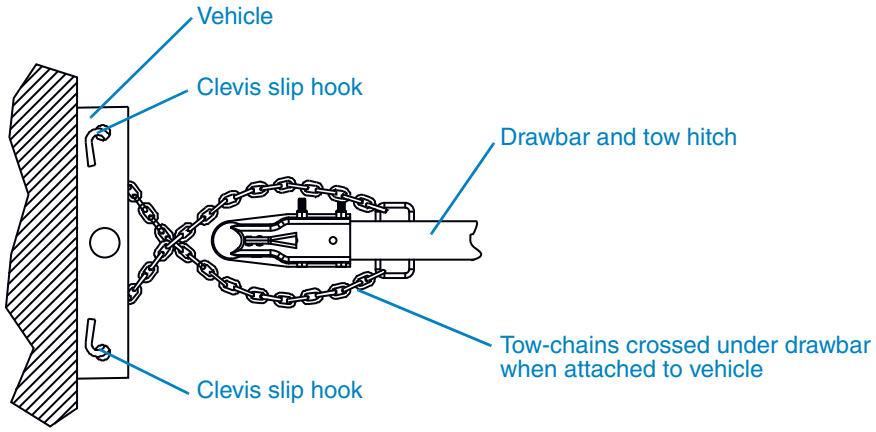
- For single or tandem tow, ensure the drawbar is within five degrees (±5°) of parallel with the ground.
- For nested dual-tow, ensure the top of the loaded tow-hitch ball on tow vehicle is 19 to 24 inches from the ground.

    i. Raise, rotate, and lock the drawbar jack in the up or horizontal position.

    j. Verify approved safety chains are attached properly to both the trailer and tow vehicle, as shown in Figure 4-6. The chains should cross underneath the tow hitch.

If towing two AFADs, also use chains between the trailers. Verify they are attached properly to both trailers, and are crossed under the tow hitch or dual-tow bracket.

Figure 4-6. Tow-chain hook-up



11. Ensure the trailer brake lights, taillights, and directional (turn) indicators are connected and functioning properly.
12. Remove blocks or chocks from wheels.
13. Follow the towing requirements in Section 4.3.

4.3 During towing

- Do not tow the trailer with any people, parts, supplies, or additional equipment attached to the trailer or loaded onto it.
- Do not tow additional trailers or other equipment in tandem with the trailer. For towing two AFAD trailers, see Section 4.1, page 15.
- 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 transportation department regulations when towing.
- 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.

4.4 After towing

4.4.1 After towing one AFAD

- If you will be towing two AFADs and you have finished towing the first AFAD to the location of the second one, see Section 4.1, page 15, for hooking up the two AFADs.
- If you have finished towing one AFAD and you have reached its destination, follow these steps:

1. Unhook the tow chains and unplug the taillight plug from the tow vehicle, then use the drawbar-mounted jack to raise the AFAD drawbar and release the drawbar hitch from the tow vehicle. Pull the vehicle away from the trailer when ready.
2. If desired, the drawbar may be removed from the trailer:
   a. Before removing the drawbar, locate and level the trailer as instructed in Section 5.4, page 31.
   b. To remove the drawbar, disconnect the trailer taillight plug from underneath the trailer, loosen and remove the two bolts that connect the drawbar to the trailer, then remove the drawbar by sliding it forward.
   c. To prevent the nuts and bolts from being lost, insert the bolts into the holes on the drawbar and secure them and the washers in place with the nuts.
3. If deploying the AFAD in a TTC zone, test the system as described in Section 5.3, page 30.

4.4.2 After towing two AFADs with one tow vehicle…

…to the destination for *only one AFAD*

1. On the rear AFAD, rotate the two front leveling jacks to vertical with the jack feet toward the ground, then lower both jacks until they touch the ground.

⚠ WARNING

Falling equipment could cause severe injury or death.

To prevent the AFAD from tipping and falling, always lower the rear trailer's front leveling jacks to the ground before disconnecting the rear trailer.

2. Unplug the rear AFAD taillights cable from the receptacle between the AFAD trailers. (The receptacle is under the rear cross-frame of the front AFAD trailer.)
3. For the tow chains between the two trailers, unhook the tow chains from the front AFAD. Leave the chains attached to the rear trailer drawbar or rear trailer frame.

4. Separate the two AFAD trailers:

   - For two trailers tandem towed using the full-length drawbar, use the drawbar-mounted jack to raise the rear AFAD drawbar and release the drawbar hitch from the front AFAD. Pull the vehicle and front AFAD away from the rear AFAD when ready.
   - For two trailers dual-towed using the optional dual-tow brackets between the two trailers (see Figure 4-7), lift the locking flange to the open position and unscrew the nut from the bolt. Pull the vehicle and front AFAD away from the rear AFAD when ready.

5. If two AFADs will be operated by two people, proceed to Step 6. If two AFADs will be operated by one person, then you might want to test the system for proper functioning before towing the front AFAD to its destination.

   In order for one person to operate two AFADs, the wireless controller must first be paired with both AFADs. Pairing requires pushing a button on each AFAD's control box. For this reason you may want to pair and test both AFADs while they are still located near each other. To test the system, see Section 5.3, page 30.

6. When ready, deploy the rear AFAD as described in Section 5.4, page 31.

7. Tow the front AFAD to its destination, then see Section 4.4.1, "After towing one AFAD," page 26.

…to the destination for *both AFADs*

The two AFADs can be stored together or they may be separated.

- To separate the two AFADs, follow steps 1 through 4 above, then follow the steps below.
- To keep the two AFADs joined together, or if they are already separated, follow these steps:

1. Unhook the tow chains and unplug the trailer taillight plug from the tow vehicle.
2. Use the drawbar-mounted jack to raise the AFAD drawbar and release the drawbar hitch from the tow vehicle. Pull the vehicle away from the trailer when ready.
3. If desired, the drawbar may be removed from the trailer:

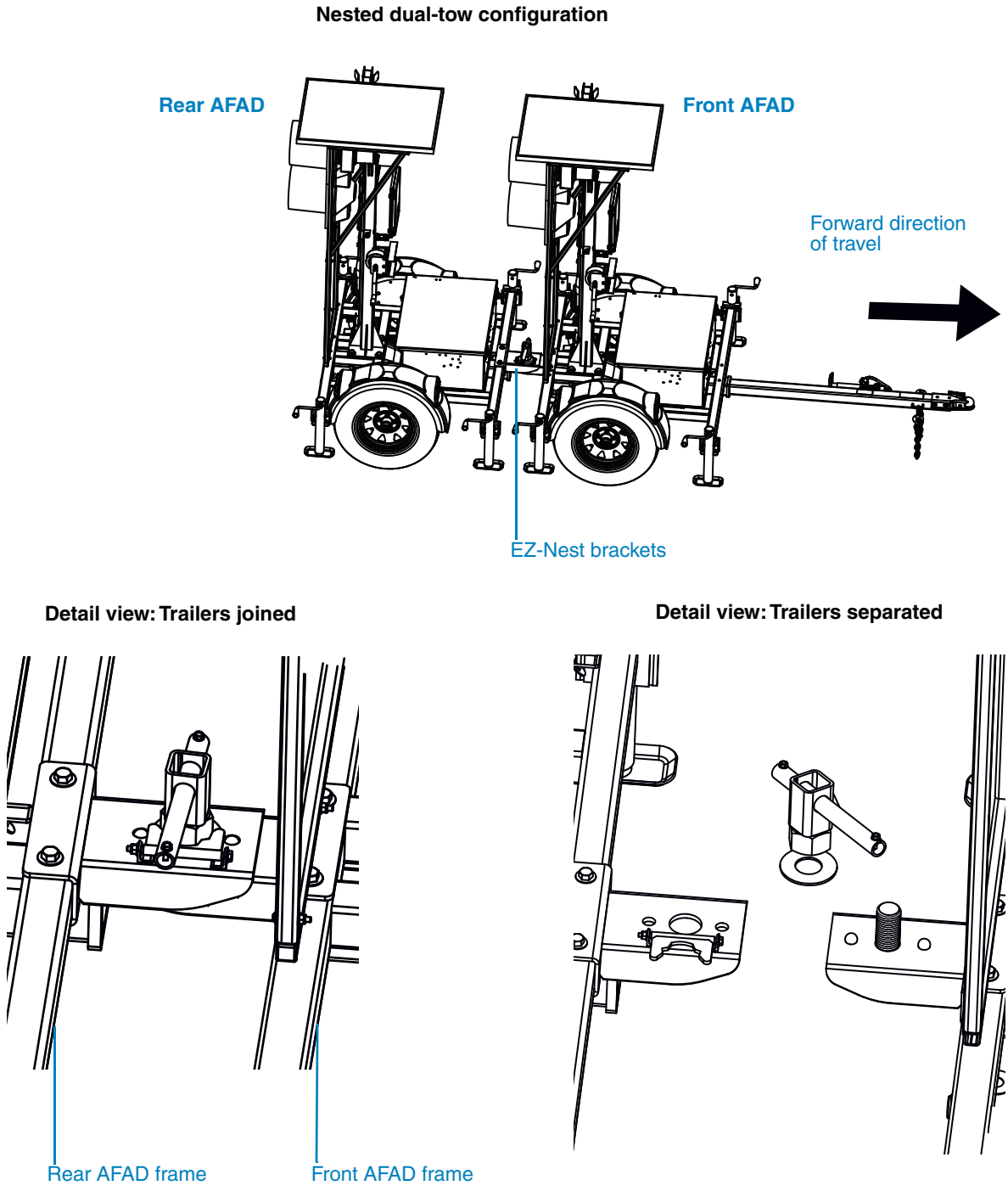
   a. If the two AFADs are separated, then before you remove the drawbar, level the front AFAD as instructed in Section 5.4.2, page 31.

   b. To remove the drawbar, disconnect the trailer taillight plug from underneath the trailer, loosen and remove the two bolts that connect the drawbar to the trailer, then remove the drawbar by sliding it forward.

   c. To prevent the nuts and bolts from being lost, insert the bolts into the holes on the drawbar and secure them and the washers in place with the nuts.

4. If deploying the AFADs in a TTC zone, test the system as described in Section 5.3, page 30.

Figure 4-7. Separating the trailers



5 Operation

5.1 Before using the AFAD

⚠ 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.
- Read and follow all safety instructions.
- Follow all regulatory guidelines.

- Read and follow all safety instructions (see Section 2, page 3).
- Ensure the AFAD batteries are fully charged (see Section 6.2.3, page 48).
- Ensure the AFAD wireless controller is fully charged (see Section 5.5, page 34).
- Ensure the AFAD operator is a flagger who has been trained to operate the AFAD.
- Ensure the AFAD system has been tested for proper functioning before being deployed in the TTC zone. See Section 5.3, page 30.
- Follow all regulatory guidelines.

5.2 Overview

A typical deployment of the Wanco AFAD includes the following steps:

1. Towing the trailer to its destination (Section 4, page 15)
2. Testing the system (Section 5.3, page 30)
3. Deploying the AFAD:
   a. Locating and positioning the trailer (Section 5.4.1, page 31)
   b. Leveling the trailer (Section 5.4.2, page 31)
   c. Setting the gate arm and raising the tower (Section 5.4.3, page 33)
4. Operating the AFAD (Section 5.5, page 34)

5.3 Testing the system

Your Wanco AFAD is equipped with two controller choices:

- A wireless touchscreen controller that provides access to all AFAD functions
- A cable-connected push-button controller that operates the AFAD gate arm

If you will be using the wireless controller, it is recommended to test the system for proper functioning before deploying the AFAD in the TTC zone. Otherwise, if you will be using the cabled controller, this testing is not necessary and you may proceed to Section 5.4 for deploying the system.

The wireless controller is stored inside the battery box. Depending on your system deployment, you can use one controller for operating one AFAD, one controller for operating two AFADs, or two controllers for operating two AFADs.

For basic system testing, use the wireless controller to operate the AFAD and ensure proper functioning as described below. For additional operating information, refer to the wireless controller user's manual.

1. Access the wireless controller inside the battery box and turn it on.

IMPORTANT!

When removing the power plug from the controller, first remove the retaining clip, if present. Then unscrew the locking collar, grasp the plug firmly, and pull it from the port on the bottom of the controller.

DO NOT pull on the cord. Pulling on the power cord will damage it.

2. Pair the controller and the AFAD if they are not already paired (see "Pairing" on page 36).
3. While using the controller to open and close the gate arm, watch the AFAD and ensure it responds as follows:

   Press Close… Yellow signal is on steady for 5 seconds and the gate remains open… After 5 seconds, the red signal is on steady and the gate closes.

   Press Open… Red signal is on steady while the gate opens… After the gate opens, the yellow signal flashes.

   If the gate and signal do not respond as described, then either the controller is not paired with the AFAD or the AFAD is not functioning properly.
4. If applicable, repeat the process for the second AFAD.
   - Use the same controller if both AFADs will be controlled by one flagger/operator.
   - Use a second controller if a second flagger/operator will control the second AFAD.
5. If the system test is successful, deploy the AFADs in the TTC zone when ready. For deployment instructions, see Section 5.4.

5.4 Deployment

5.4.1 Locating and positioning the trailer

⚠ DANGER

Electric shock hazard.

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

Do not position AFAD under power lines.

- During operation, the AFAD gate arm extends the height of the AFAD to over 11 feet (3.4 meters) when the arm is raised, or more than 15 feet (4.6 meters) with the optional arm extension and safety flag installed. When choosing a location, ensure the area above the trailer is clear of overhead wires and other obstructions.
- To reduce the risk of shifting, rolling, or overturning, locate the AFAD on a firm, level surface.
- For the AFAD's solar charging system to function properly, locate the AFAD where it will be exposed to full sunlight during daylight hours.
  - ☐ The solar panel charging capacity is significantly affected by shadows. Avoid locating the AFAD where the sun will be obstructed, such as under a tree or in the shadow of a building.
  - ☐ Ensure the solar panel is clean (see Section 6.2.2, page 48).
- Position the AFAD next to the traffic lane being controlled:
  - ☐ To meet MUTCD requirements, the end of the gate arm must reach at least to the center of the lane.*
  - ☐ Local requirements may apply. Consult your local authority having jurisdiction (AHJ).
- Position the AFAD so the rear of the trailer faces oncoming traffic.

5.4.2 Leveling the trailer

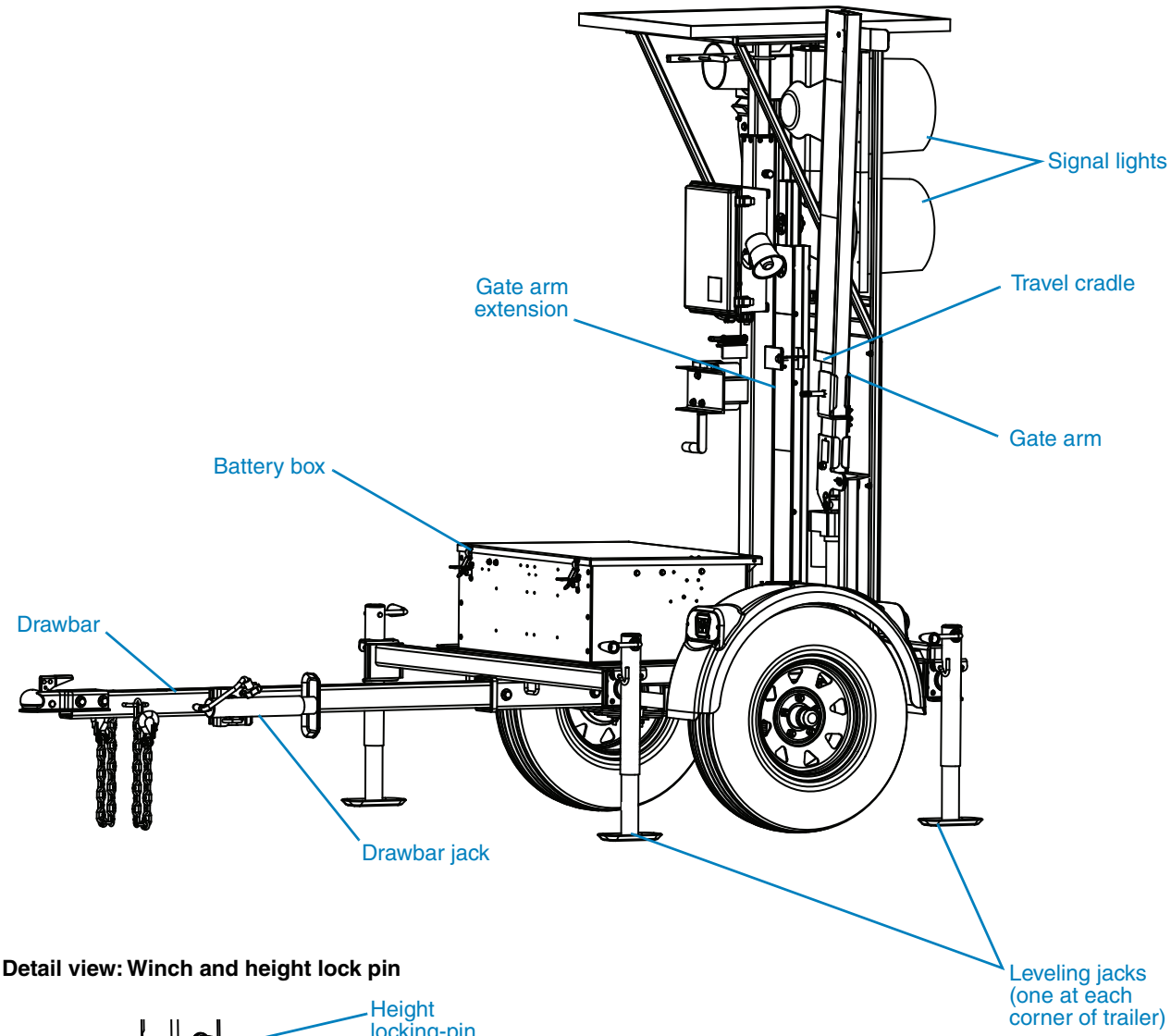
Prior to raising the AFAD signal lights and sign tower, the trailer must be level.

To level the trailer, refer to Figure 5-1, page 32, and follow these steps:

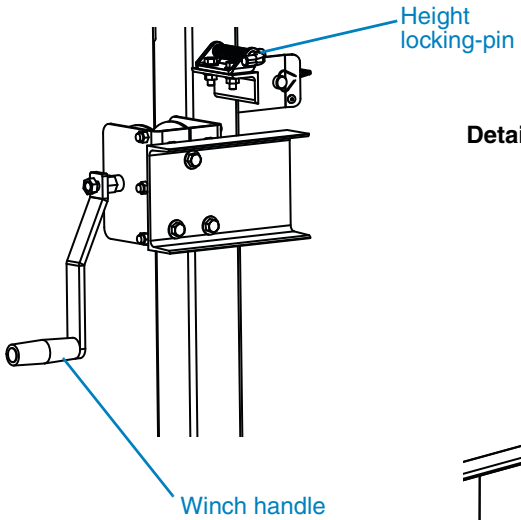
1. Block or chock the trailer wheels.
2. For each of the four leveling jacks at the corners of the trailer, pull the jack locking-pin and rotate the jack downward. Release the pin and continue rotating the jack until it is vertical. When the jack is properly set, the pin snaps into place with an audible "click."
3. Determine which corner of the trailer is highest, and extend the jack foot on that corner downward until it rests firmly on the ground. Then, level the trailer with the remaining three corner jacks.

**MUTCD, 11th ed., December 2023, §6L.04, ¶04.B*

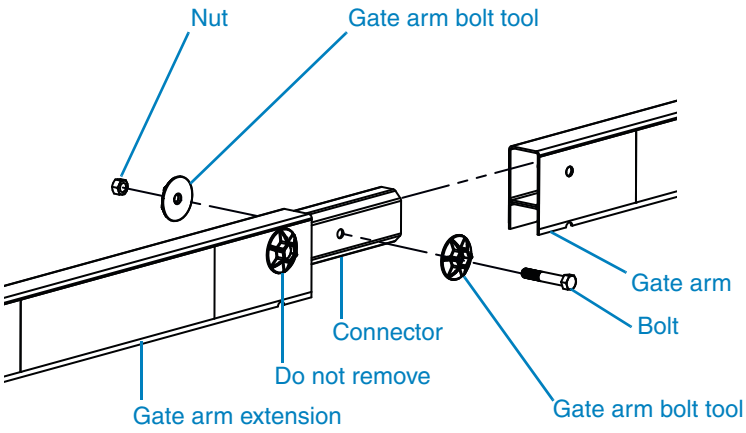
Figure 5-1. Deploying the AFAD



Detail view: Winch and height lock pin



Detail view: gate arm extension



5.4.3 Gate arm and signal lights

After positioning the trailer (Section 5.4.1) and leveling the trailer (Section 5.4.2), assemble the gate arm and raise the signal lights and sign tower by referring to Figure 5-1 and using the following procedure.

⚠ WARNING

Falling equipment could cause severe injury or death.

Before raising tower, stabilize and level the AFAD trailer.

1. Observe safety precautions (see Section 2, page 3).
2. If the gate arm extension is already attached to the gate arm, skip to Step 3. Otherwise, attach the gate arm extension as follows:
   a. Lower the gate arm all the way down using either the wireless controller or the cable-connected controller (see Section 5.5, page 34).
   b. Remove the wire lock pin that holds the gate arm extension in the travel cradle, then remove the gate arm extension from the cradle.
   c. Loosen and remove the nut and bolt from the hole in the connector with their gate arm bolt tools*. Do not remove the hardware that attaches the connector to the extension.
   d. Slide the connector into the end of the gate arm.
   e. Line up the holes in the connector and the gate arm, then insert the bolt through the holes.
   f. Tighten the nut on the bolt with its gate arm bolt tool until it is hand-tight. Do not over-tighten.
   g. Reinstall the wire lock pin in the travel cradle.
3. Raise the signal lights and sign into the deployed position:
   a. Pull and hold the height locking-pin to release the tower so that it can be raised.
   b. While holding the pin, use the hand-operated winch to start raising the tower. As the tower begins to rise, release the pin.
   c. Continue raising the tower all the way up. When raised to its full height, the height locking-pin snaps into place with an audible "click," locking the tower, signal lights, and sign in the up position.

*It is not necessary to use a wrench to tighten or loosen the hardware.

5.5 Controlling the system

5.5.1 Controller choices

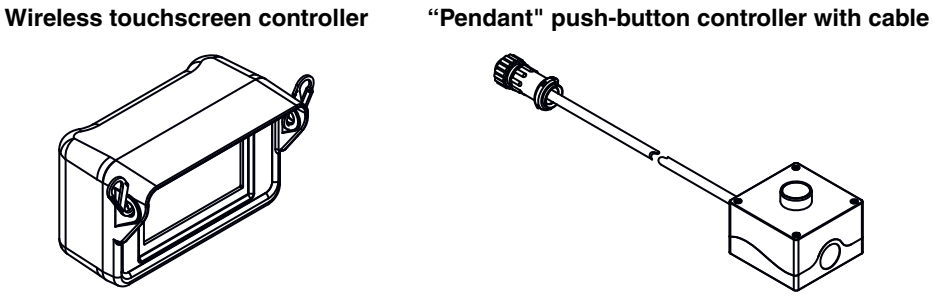
Your Wanco AFAD is equipped with two choices for operating the AFAD (Figure 5-2):

- A wireless touchscreen controller that provides access to all AFAD functions including operating the gate arm (see Section 5.5.2)
- A cable-connected push-button controller, or "pendant," that only operates the gate arm (see Section 5.5.3, page 40)

Both controllers are stored inside the battery box.

When you connect the pendant cable to the control box, the wireless controller loses its wireless connection with the AFAD. The connection is restored within seconds of disconnecting the cable from the control box if the wireless controller remains paired.

Figure 5-2. AFAD controllers



5.5.2 Wireless touchscreen controller

Overview

The wireless touchscreen controller provides access to all AFAD functions.

Basic instructions are included below. For additional information and complete instructions, refer to the wireless controller user's manual.

On/off behavior

The controller touchscreen display remains active and ready to use while you are using the controller.

After 15 minutes of inactivity, the screen goes blank and the controller enters standby mode. To reactivate the controller, press the screen or press and release the power button on the bottom of the controller.

After 60 minutes of inactivity, the controller automatically shuts itself off. To turn the controller on, press and release the power button.

If the display does not turn on after you press the power button, the controller batteries need to be charged. See "Lithium ion batteries" and "Charging" on page 35.

Lithium ion batteries

The manufacturer of the controller batteries recommends the following use and handling of the lithium ion battery pack:

- Do not charge the batteries when the temperature is below freezing.
- Use only the included battery charger.
- For optimum performance and battery life, see Table 5-1.

Table 5-1. Lithium ion battery temperature ranges

Operating condition	Temperature range
Charging	32 to 113°F (0 to 45°C)
Discharging	–4 to 167°F (–20 to 75°C)
Storage	below 140°F (60°C)

Charging

To ensure continuous operation, the wireless controller battery pack must be charged.

IMPORTANT!

Do not charge the controller batteries when the temperature is below freezing. See "Lithium ion batteries" above.

The controller and charger are located inside the battery box (see Figure 5-3, page 36).

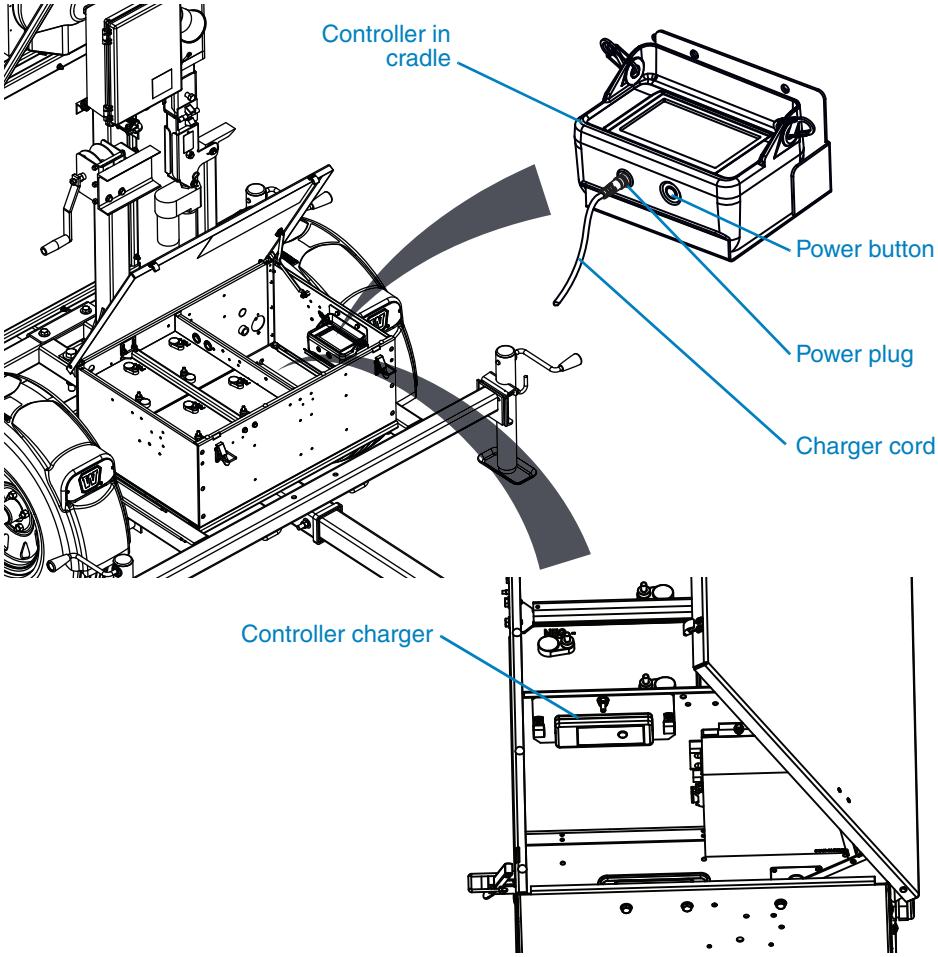
- When the controller is in use, leave the power cord loose inside the battery box.
- Whenever the controller is not being used, plug in its charger cord and set it in the travel cradle. Ensure the power plug is secured to the controller by fully tightening its locking collar and attaching the retaining clip, if present.

  The fully charged controller can operate approximately 60 hours before recharging is necessary. If the controller battery pack is fully discharged, you can expect to charge the controller for up to 4 hours for a full charge.

Pairing

Before the controller will work with the AFAD, the two must be "paired." Until they are paired, the AFAD will not respond to commands from the controller. To pair the controller and AFAD, see Figure 5-3 and follow these steps:

Figure 5-3. Controller, cradle, and charger



1. Access the controller and turn it on:

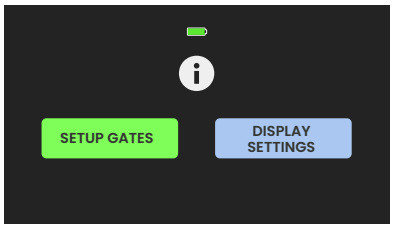
   a. Remove the controller from its cradle and unplug the power plug from the bottom of the controller.

> **IMPORTANT!**
>
> When removing the power plug from the controller, first remove the retaining clip, if present. Then unscrew the locking collar, grasp the plug firmly, and pull it from the port on the bottom of the controller.
>
> DO NOT pull on the cord. Pulling on the power cord will damage it.

   b. Turn on the controller by pressing the screen or pressing the power button on the bottom of the controller.

2. When the controller first turns on, if you see any screen other than the one shown in Figure 5-4, the controller and AFAD may already be paired.

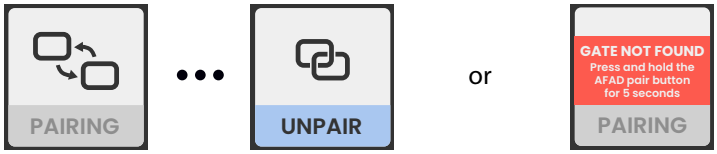
Figure 5-4. Main screen, not paired



With no AFADs paired, press the **SETUP GATES** button to get started.

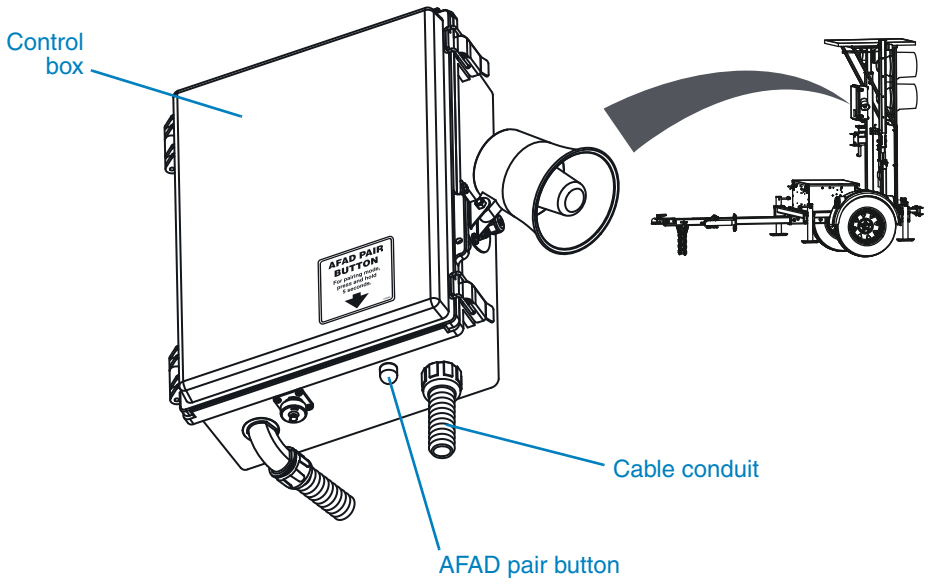
- If you see a green **SETUP GATES** button, press it to access the Pairing screen, then skip to Step 5.
- If you see a green **OPEN** button or yellow **CLOSE** button, the controller and AFAD may already be paired. Press the button.
  - ☐ If the AFAD gate opens or closes, then pairing is complete. Press the **BACK** button, skip the steps below, and see "AFAD controls" on page 38.
  - ☐ If the gate does not open or close, go to Step 3.

3. Access the Settings screen by pressing the ⚙ button, then press the blue **MANAGE PAIRING** button to access the Pairing screen.
4. Press any **UNPAIR** button as needed for resetting the controller's previous pairings.
5. Locate the AFAD pair button on the bottom of the AFAD control box (see Figure 5-5).
6. Activate pairing mode by pressing and holding the AFAD pair button for 5 to 7 seconds. Both the red and yellow signal lights on the AFAD flash to indicate paring mode is active.
7. On the controller, press either of the green **PAIR** buttons.
8. The resulting screen will show pairing in process, and then show that pairing was successful. If an error occurs, repeat Step 5.



9. To pair a second AFAD, repeat the procedure, starting with Step 5, using the pair button on the second AFAD control box.
10. When pairing is complete, press the **BACK** button on the touchscreen.
11. Test the system as described in Section 5.3, page 30.

Figure 5-5. AFAD pair button



AFAD controls

Operating screens (Figure 5-6) let you control the gate arms on one or two paired AFADs, and give you access to system status, alerts, and settings. For complete operating instructions, see the wireless controller user's manual.

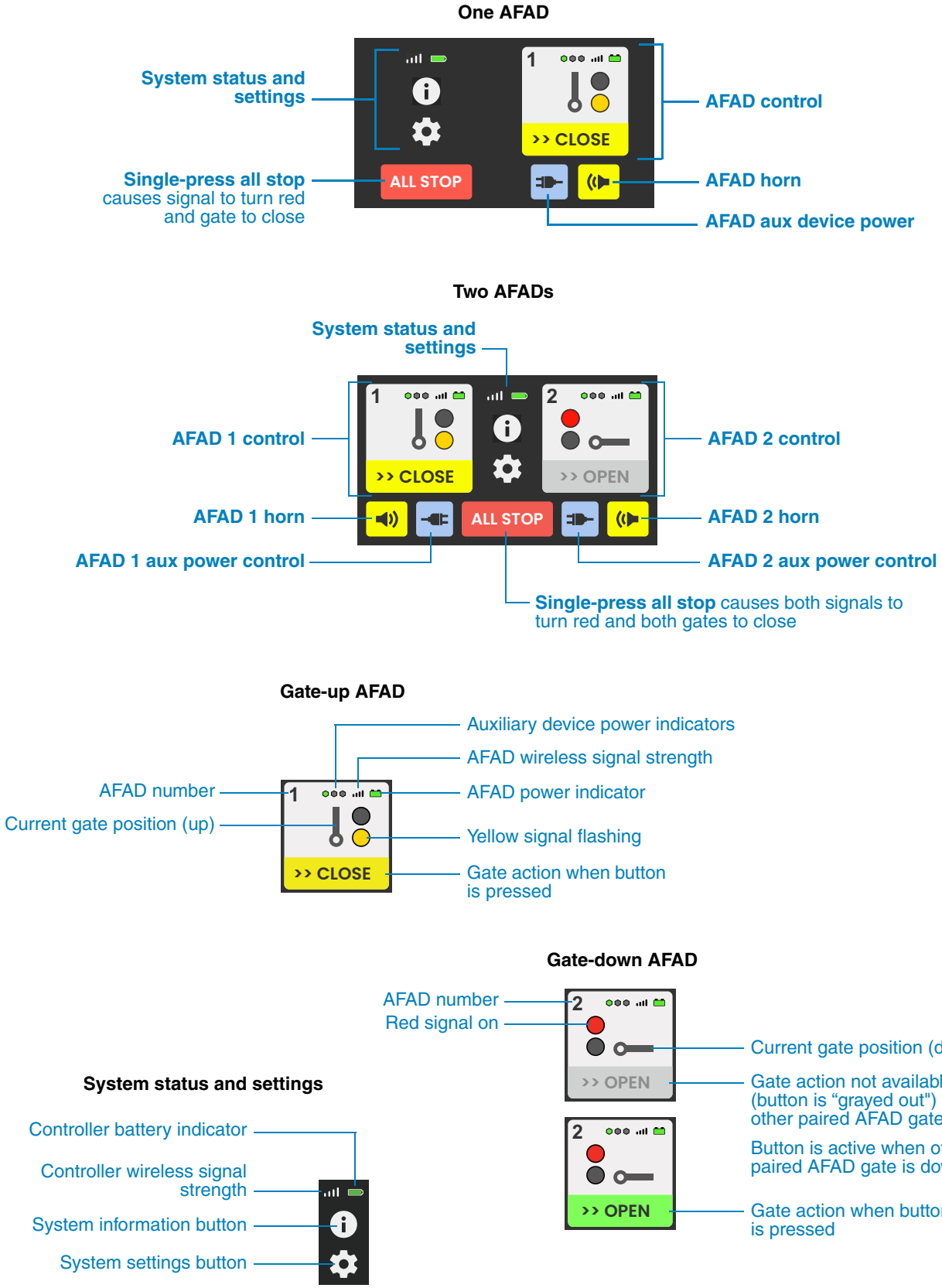
Starting the camera

If the AFAD is equipped with a camera, it should be turned on before deployment:

1. Access the Aux Power screen by pressing the blue **AUX DEVICE POWER** button on the Main screen. If the button is not shown, see Section A.3, page 94, to enable it.
2. Press the **ON** button under the "Aux 1 Pwr" heading. A green check mark appears.
3. Press **BACK** when done to go back to the Main screen.

The camera is optional, auxiliary equipment that may not be included with your AFAD. For more information, see Section 5.7.1, page 42.

Figure 5-6. Operating screens



5.5.3 Cable-connected push-button controller

The cable-connected push-button controller, or "pendant," provides operation of the AFAD gate arm only. No other AFAD functions are available using the cabled controller.

When you connect the pendant cable to the control box, the wireless controller loses its connection with the AFAD. The connection is restored within seconds of disconnecting the cable from the control box if the wireless controller remains paired with the AFAD.

Power to the pendant is provided by the AFAD power system. The pendant has no batteries and charging it is not required.

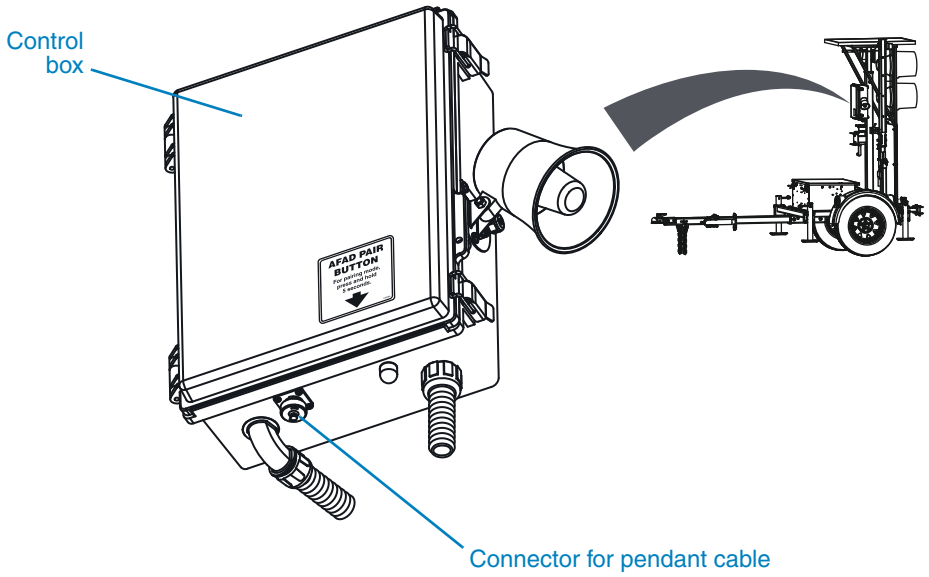
To use the pendant to control the AFAD:

1. Remove the pendant controller and its cable from the battery box.
2. Attach the pendant cable to the control box:
   a. Remove the dust cap from the connector on the bottom of the control box by unscrewing it a quarter-turn (see Figure 5-7).
   b. Insert the loose end of the cable into the connector.

      When inserting the end of the cable, ensure the pins in the connector are aligned with the holes in the end of the cable. The connection should be snug.
   c. Hand-tighten the collar on the end of the cable onto the connector, using care not to over-tighten.
3. Operate the AFAD gate by pressing the button on the pendant.

When done with the pendant, reverse the procedure to detach the pendant cable from the control box and stow the pendant and its cable in the battery box.

Figure 5-7. Cable connection to control box



5.5.4 Shutting off system power

While the AFAD signal lights are on, the system is consuming battery power. For an overview of the AFAD power system, see Section 6.2.1, page 48.

To reduce power consumption when the system is not in use, ensure the gate arm is up and the lights are off:

1. Using the wireless touchscreen controller, access the Settings screen by pressing the ⚙ button.
2. Turn off the signals and raise the gate by pressing the **GATE UP, SIGNAL OFF** button. If the controller is paired with two AFADs, pressing the **GATES UP, SIGNALS OFF** button opens both AFAD gates and turns off the signal lights on both AFADs.
   - For additional information, refer to the wireless controller user's manual.
   - You cannot turn off the signal lights using the cabled controller.
3. If the AFAD is equipped with a camera, it should also be turned off:
   a. Access the Settings screen by pressing the blue **AUX DEVICE POWER** button on the Main screen.
   b. Press the **OFF** button under "Aux 1 Pwr." A green checkmark appears.
   c. Press **BACK** when done or switch the controller off.

5.6 Batteries

To ensure the health of the AFAD batteries, follow these requirements:

- Do not allow batteries to fully discharge.
- Ensure batteries are fully charged before using the AFAD.
- Charge batteries after each period of use, and before putting the AFAD into temporary storage.
- To lengthen battery life and prevent freezing, always keep batteries fully charged.
- For an overview of the AFAD power system, see Section 6.2.1, page 48.
- For battery charging information, see Section 6.2.3, page 48.
- Before putting the AFAD into long-term storage, see Section 6.4, page 59.

5.7 Optional equipment

Your AFAD trailer may come with optional equipment, which can include the following:

- Camera (see Section 5.7.1)
- Breakaway gate arm (see Section 5.7.2)
- Safety warning flag (see Section 5.7.3, page 44)
- EZ-Nest dual–tow system (see Section 5.7.4, page 45)

5.7.1 Camera

The fixed-position, day/night, IR dome camera records traffic passing the gate arm, and documents with time-and-date-marked video any incidents that occur there.

The camera's field of view is the AFAD gate arm and approach lane of traffic. This view is preset at the factory and cannot be changed in the field.

Video is recorded continuously while power is applied, and video files are stored on a local memory card.

- The memory card must be user-supplied.
- When the memory card is full, the oldest video file is overwritten by the newest file.
- Capacity of a 128 GB memory card is typically about 7 days before overwriting begins.
- Follow the camera's instruction manual, included with the AFAD, to insert a memory card.

The camera does not provide live view, remote view, or remote control. Its purpose is to record and document incidents at the gate arm, such as incursion into the TTC zone by an errant vehicle.

Best practice suggests the camera should be powered on and recording whenever the AFAD is in use. To prevent the AFAD batteries from being drained, the camera should be switched off whenever the AFAD is not in use.

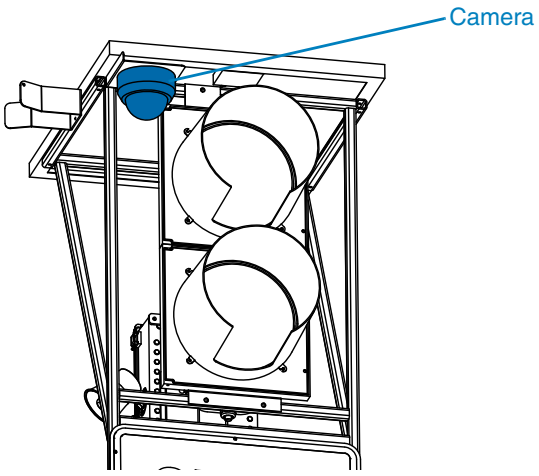
For camera operating instructions, see Appendix A, page 91:

- To turn the camera on or off, see Section A.2, page 92.
- To enable camera power controls, see Section A.3, page 94.
- To download video from the camera, see Section A.4, page 96.

The camera is optional, auxiliary equipment that may not be included with your AFAD.

If you want to add a camera to your AFAD, it can be installed in the field. Contact Wanco customer service for details (see Section 1.3, page 2).

Figure 5-8. Camera location



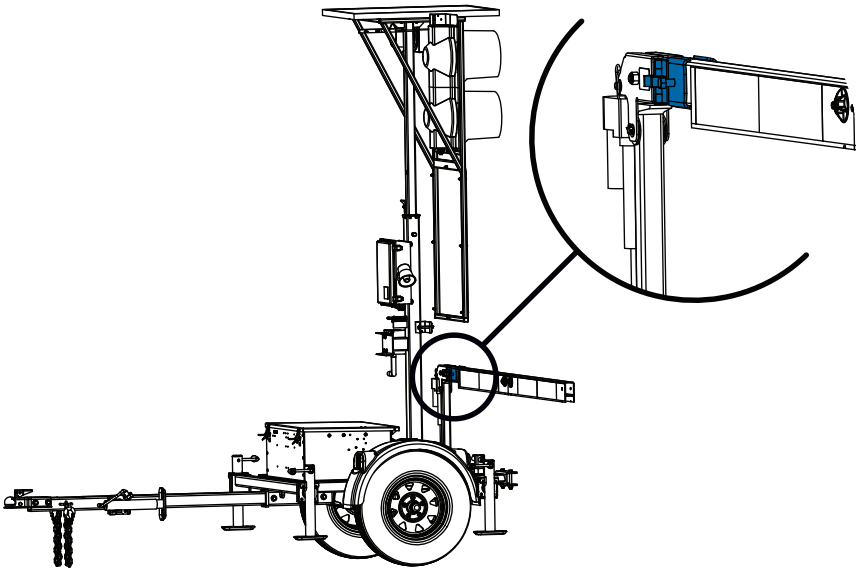
5.7.2 Breakaway gate arm

The breakaway gate arm attachment allows the gate to swing out of the way when struck by a passing vehicle, reducing the chance of damage to the arm and AFAD. A spring-tensioned mechanism returns the arm to its default position after the vehicle passes (see Figure 5-9).

The breakaway arm attachment is optional, auxiliary equipment that might not be included with your AFAD.

If you want to add the breakaway arm attachment to your AFAD, it can be installed in the field. Contact Wanco customer service for details (see Section 1.3, page 2).

Figure 5-9. Breakaway gate arm



5.7.3 Safety warning flag

The fluorescent orange safety flag hangs from the free end of the gate arm extension, effectively lengthening the gate arm and improving its visibility.

When shipped from the factory the flag is stored inside the gate arm extension. A bracket inside the extension holds the flag pole in place.

To use the flag, refer to Figure 5-10 and follow these steps:

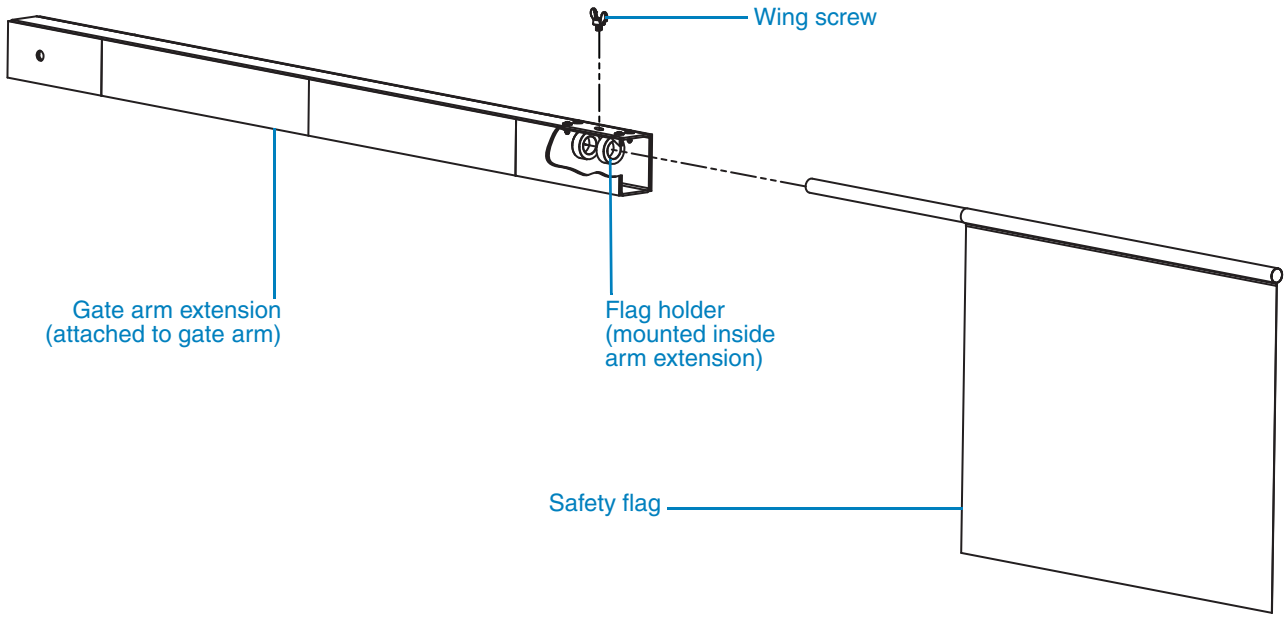
1. Loosen the wing screw.
2. Slide the flag out of the extension arm and turn it so that the flagpole faces the flag holder bracket.
3. Slide the flagpole into the bracket that is mounted inside the end of the extension arm.
4. Tighten the wing screw to hold the flagpole in place.

To remove the flag and store it in the arm extension, reverse these steps.

The safety flag is optional, auxiliary equipment that may not be included with your AFAD.

If you want to add a safety flag to your AFAD, it can be added in the field. Contact Wanco customer service for details (see Section 1.3, page 2).

Figure 5-10. Safety flag installation



5.7.4 EZ-Nest dual-tow kit

The EZ-Nest dual-tow kit connects two AFAD trailers together to be towed as though they were a single four-wheel trailer (see Figure 5-11).

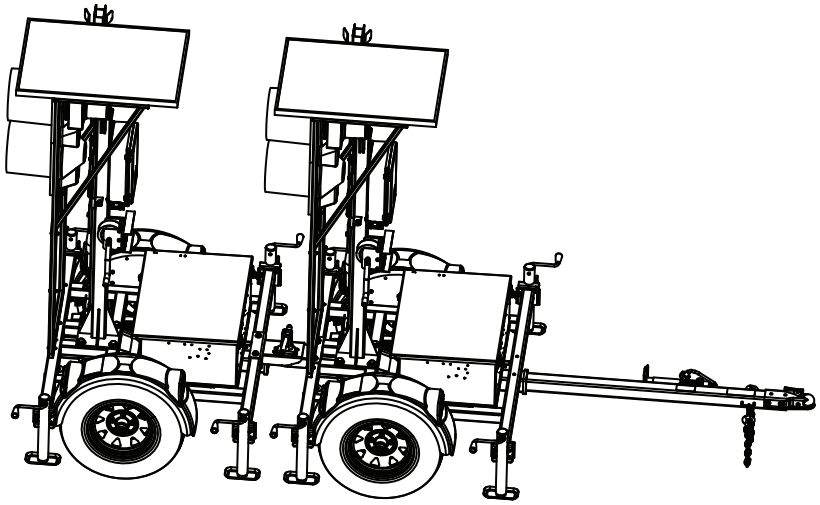
The kit includes two mating brackets, one installed on each trailer. When the trailers are brought together, with the brackets nested and locked, the trailers tow as one unit.

- For installation instructions, see Section 3.2, page 10.
- For towing instructions, see Section 4.1.4, page 16.

The EZ-Nest dual-tow kit is optional, auxiliary equipment that may not be included with your AFADs.

If you want to add the EZ-Nest dual-tow kit to your AFAD, it can be installed in the field. Contact Wanco customer service for details (see Section 1.3, page 2).

Figure 5-11. Nested AFAD trailers



6 Maintenance

6.1 Periodic maintenance

When performing any maintenance on the system, follow the safety requirements in Section 2, page 3.

⚠ CAUTION

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

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

CAUTION

Voltage surge could damage control circuits.

Before servicing electrical components, disconnect power.

- The solar charging system is always active when exposed to daylight. Before performing any service, always turn off all electrical loads and halt battery charging from both the solar panels and the external AC charger. For an overview of the AFAD power system, see Section 6.2.
- Repair or replace worn and damaged components immediately. Never use any equipment that is damaged or in need of repair.
- All components in the battery box will operate more efficiently and have a longer lifespan if they are free of dirt and dust. Keep the interior of the battery box and components inside the battery box clean. Observe battery safety requirements when working on or around batteries. See “Safety” on page 49.
- When necessary, clean the solar panel with a squeegee, soft cloth, or sponge and a cleaning solution of mild detergent and warm water. See Section 6.2.2, page 48.

6.2 Power system

6.2.1 Overview

The AFAD is powered by batteries, which are charged using a solar panel and an automated charging system. The default system uses four 6-volt batteries wired in series and parallel for a 12-volt power supply. Other battery configurations are also available.

The solar charging system runs continuously, keeping the batteries charged. The system automatically detects when the batteries are fully charged and will not overcharge them.

Under optimal conditions, the batteries will remain charged and the AFAD can be used without needing to charge the batteries using the on-board AC-powered charger. If you use the AFAD continuously and the solar panel is not exposed to full sunlight all day, the solar charging system may not keep the batteries charged sufficiently.

If there is not enough sunlight to keep the batteries fully charged, you will need to charge the batteries using the on-board AC-powered charger, which is located inside the battery box (see "Charging" on page 50).

The low-voltage-disconnect circuit detects when the battery charge falls below 11.2 volts DC, and shuts down power to the AFAD. If a shutdown occurs, the AFAD will not function and the batteries must be fully charged.

6.2.2 Solar panel

For the solar charging system to function properly, the solar panel must be exposed to full sunlight during daylight hours. If the location where the AFAD will be used is not a sunny location, the batteries must be charged using the on-board AC-powered charger, which is located inside the battery box (see "Charging" on page 50).

- Clean the solar panel with a squeegee, soft cloth, or sponge and a cleaning solution of mild detergent and warm water. The panel can be left to air dry or wiped with a soft cloth or chamois.
- If a shadow or any obstruction blocks even a portion of the solar panel, charging will be negatively affected and a significantly longer charge time will be necessary.

6.2.3 Batteries

Although the automated charging system helps maintain battery health by keeping the batteries fully charged when there is sun, and by shutting down power before full discharge, regular maintenance is necessary for the batteries to function properly and for long battery life.

- When working on or around the batteries, always observe battery safety precautions (see "Safety" below).
- Routinely inspect batteries and cables, clean surfaces and terminals, and check battery charge.

See the following pages for battery safety and care instructions.

Safety

⚠ 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 AFAD 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.
- When working with the AFAD batteries, never allow positive wiring to short to ground.
- 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.
- Before disconnecting battery cables, turn off all electrical loads and halt battery charging from the solar panels and external AC charger.

- If disconnecting AFAD battery cables, always disconnect positive (+) cables first.* Do not allow a 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 to prevent corrosion. Keep battery hold-downs 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 leaking. Always replace damaged batteries immediately. Dispose of old batteries in accordance with local regulatory codes.
- Keep the battery box lid closed and latched unless you are performing maintenance or charging the batteries.

Charging

Battery voltage should be checked once a week to ensure the charging system is keeping the batteries charged. In northern locales during winter, when sunlight is less intense, battery voltage should be checked more often. For an overview of the charging system, see Section 6.2.1, page 48.

If the battery voltage is low because the charging system is not able to fully charge the batteries, use the on-board AC-powered charger when the batteries need charging (see "On-board AC-powered charger" on page 54).

After charging flooded (non-sealed) batteries, check battery fluid levels (see "Watering flooded batteries" on page 55).

To determine charge requirements, perform a specific-gravity or voltage test as described below.

- For flooded batteries, follow the procedure below for testing specific-gravity, or go to page 52 to perform a voltage test.
- For sealed (AGM) batteries, go to page 52 to perform a voltage test.

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

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 52).

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 "Safety" on page 49).
2. Turn off all electrical loads and halt battery charging from the on-board AC-powered charger, (see Section 6.3, page 58).
3. Open the battery vent cap and inspect 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).

    Refer to Table 6-1, to determine the battery charge requirements based on the corrected specific gravity.

Table 6-1. Specific gravity charging time

Charge level, %	Specific gravity @ 80°F (27°C)	Open-circuit voltage, volts		Approx. required charge time, hrs.	
		6V batt.	12V batt.	15A	45A
100	1.277	6.37	12.73	0	0
95	1.268	6.34	12.68	1	1
90	1.258	6.31	12.62	2	1
85	1.248	6.28	12.56	3	1
80	1.238	6.25	12.50	4	2
75	1.227	6.22	12.44	5	2
70	1.217	6.19	12.37	6	2
65	1.206	6.16	12.31	7	2
60	1.195	6.12	12.24	8	3
55	1.184	6.09	12.17	9	3
50	1.172	6.05	12.10	10	3
45	1.277	6.37	12.03	11	4
40	1.268	6.34	11.96	12	4
35	1.137	5.95	11.89	13	4
30	1.124	5.91	11.81	14	5
25	1.111	5.87	11.74	15	5
20	1.098	5.83	11.66	16	5
15	1.087	5.79	11.59	17	6
10	1.079	5.75	11.51	18	6
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.

The AFAD is equipped with a 15A AC-powered battery charger (standard) or a 45A charger (optional).

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 (see page 51). For sealed batteries, the voltage test is the only testing method.

1. Observe battery safety precautions (see “Safety” on page 49).
2. Unplug the power charger cord from the touchscreen controller (located inside the battery box) by grasping the plug firmly and pulling it from the port on the bottom of the controller. DO NOT pull on the cord. Pulling on the power cord will damage it.

3. Turn off all electrical loads and halt battery charging from the on-board AC-powered charger, (see Section 6.3, page 58).
4. If you have a smartphone or camera, take pictures of the battery wiring before disconnecting the cables. This can help when reattaching the cables later in this procedure.
5. Disconnect AFAD battery cables by removing the positive (+) cables first.* Do not allow a positive power cable to short to ground.
6. Disconnect the black cables from the negative battery terminals, which isolates each battery. Ensure battery cables are disconnected and terminals are clean.
7. For accurate voltage readings, wait at least one hour to allow the battery voltage to stabilize.
8. For each battery, use a DC voltmeter or multimeter to measure the DC voltage across the positive and negative terminals. Record the voltage, making note of which battery it belongs to. Repeat the procedure until you have recorded the voltages for all batteries in the battery bank.
9. 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.
10. 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 6-volt battery has three 2-volt cells.

    Refer to Table 6-2, to determine the battery charge requirements based on the corrected voltage.

Table 6-2. Battery charging requirements

Voltage, VDC	**Charge level,%**	**Charging requirement**
13.00	100	No charge required
12.75	90	
12.50	80	
12.30	70	
12.15	60	Charge required
12.05	50	
11.95	40	
11.81	30	
11.66	20	
11.51	10	Replace battery
10.50	0	

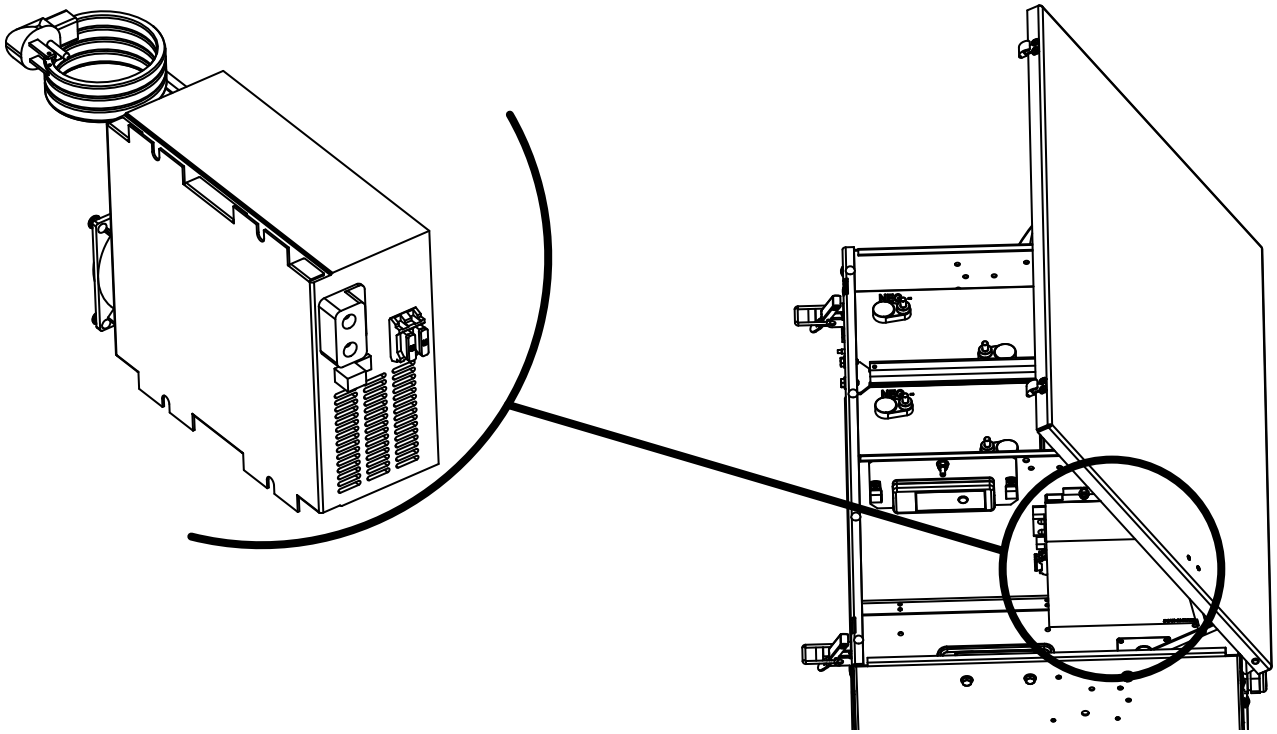
**Removing the positive cable first is a requirement for negative-ground systems.*

On-board AC-powered charger

To charge the batteries with the on-board AC-powered charger, located inside the battery box (see Figure 6-1, page 54):

1. Observe battery safety precautions (see "Safety" on page 49).
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 AFAD shutting down unexpectedly.
3. Ensure battery cables are properly connected.
4. Connect the charger to a standard 120-volt or 240-volt commercial power outlet.
   - If the charger appears not to be working, the fuse on the charger may be blown, or the power outlet may not be switched on.
   - The charger will not overcharge the batteries, even if left unattended for an extended period.
5. Charge the batteries until they reach 12.65 volts DC.
6. After charging is complete, disconnect the charger from the power outlet and stow the power cord inside the battery box.
7. Close and latch the battery box.

Figure 6-1. External AC charger



Watering flooded batteries

This section applies only to flooded (non-sealed) batteries. If your AFAD uses sealed batteries, you do not need to water the batteries.

CAUTION

Low battery acid can damage batteries.

Periodically check fluid level in each battery cell.

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

- Observe battery safety precautions (see "Safety" on page 49).
- 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.
- Battery maintenance instructions are shown on a label attached to the inside of the battery box lid.

Cleaning

- Observe battery safety precautions. See "Safety" on page 49.
- Keep batteries clean to avoid accumulation of dust, dirt, and grime.
- To clean batteries, use a solution of 50% baking soda and 50% water.
- Clean battery terminals, particularly if they are warm, hot, or corroded. Scour the terminals and the inside of the cable clamps until they have a bright metallic shine. Use a battery post cleaner, clamp cleaner, or wire brush.
- After cleaning, rinse batteries with clean water and allow to dry thoroughly.
- At least once a year, visually inspect terminals and cables for signs of corrosion, especially in hot temperatures.

Replacing

When replacing batteries, always replace the old battery with a new battery of the same type.

To replace a battery, follow these steps:

1. Observe battery safety precautions (see "Safety" on page 49).
2. Turn off all electrical loads and halt battery charging from the on-board AC-powered charger, (see Section 6.3, page 58).
3. Unplug the power cord from the touchscreen controller by removing the retainer clip, if present, then unscrewing the collar on the cord that is plugged into the bottom of the controller. Grasp the plug firmly and pull it from the port. DO NOT pull on the cord. Pulling on the power cord will damage it.
4. If you have a smartphone or camera, take pictures of the battery wiring before disconnecting the cables. This can help when reattaching the cables later in this procedure.
5. Disconnect AFAD battery cables by removing the positive (+) cable first.* Do not allow the positive power cable to short to ground.
6. Disconnect the negative (–) cable from the battery.
7. Remove the hold-down brackets that keep the battery in place.
8. Taking care to prevent injury, lift the battery out of the battery box. A battery is heavy, and you may need assistance to lift it.
9. Inspect the bottom of the battery box for corrosion and other damage. Clean the bottom of the battery box and any other components in the battery box that need cleaning.
10. Inspect the battery cables for corrosion and damage. Clean or replace the cables as necessary for ensuring a good connection.
11. Install the new battery and secure it with the hold-down brackets.
12. Reconnect wiring (see Figure 6-4, page 62), taking care not to over-tighten the cable clamps:
    a. Connect the negative (–) cable to the replacement battery.
    b. Connect the positive (+) cable to the replacement battery.

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

Storing

- Observe battery safety precautions (see "Safety" on page 49).
- Before storing the AFAD or batteries:
  - ☐ Clean the batteries as described in "Cleaning" on page 55.
  - ☐ Check fluid levels as described in "Watering flooded batteries" on page 55.
  - ☐ To prevent freezing, ensure all batteries are fully charged (see "Charging" on page 50).
- 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.
- For flooded (non-sealed) batteries:
  - ☐ Check fluid levels and state of charge every week.
  - ☐ Charge stored batteries every 30 days.
- If storing the AFAD, see Section 6.4, page 59.

6.3 Accessing system electronics

Electronics for the AFAD are located inside the control box. If necessary, you can access the electronics as follows:

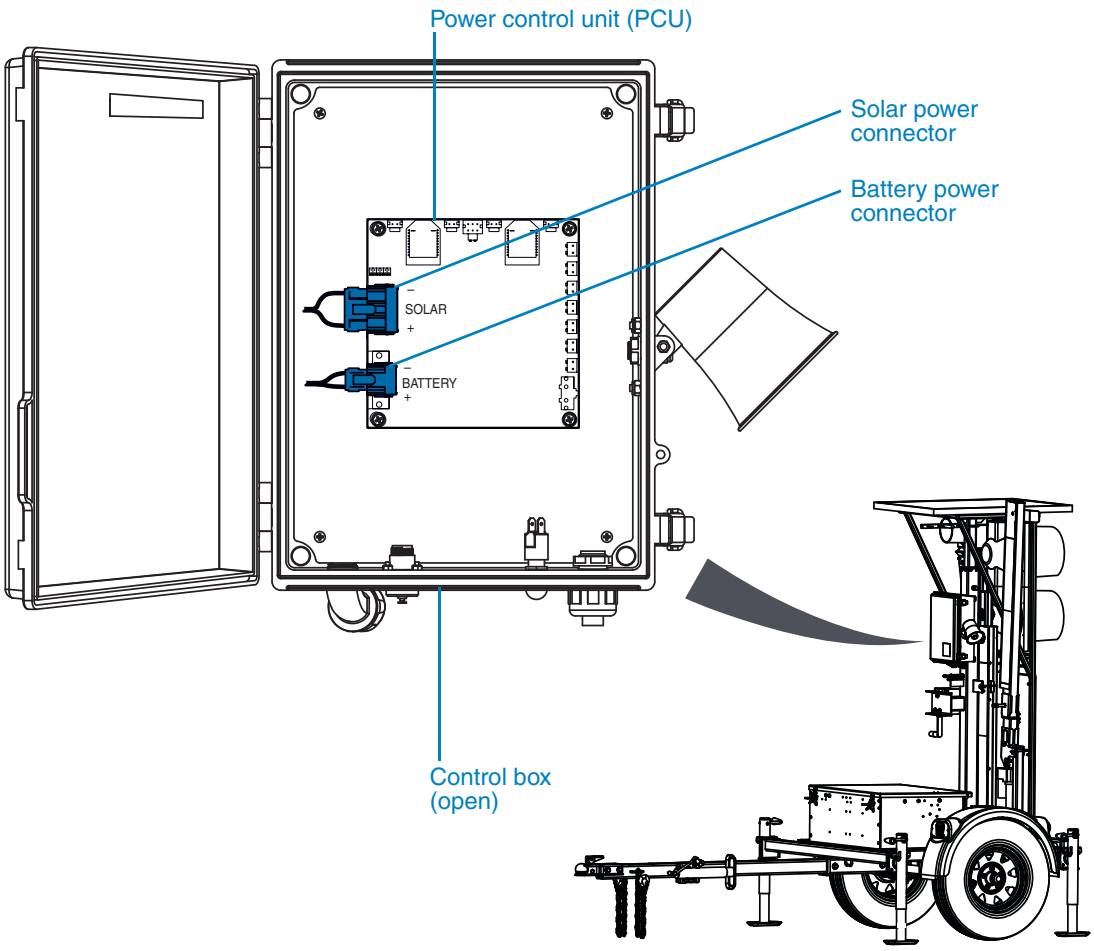
CAUTION

Static electricity can damage electrical components.

Before touching electronic components, touch grounded metal to discharge static electricity.

1. Open the control box on the AFAD's mast and identify the solar and battery connectors (see Figure 6-2).
2. Release the solar power connector by pressing the tab on the cable side of the connector, and while pressing the tab, slide the cable side of the connector to the left to disconnect it from the PCU.
3. Repeat the above procedure for the battery power connector.

Figure 6-2. Power connections on power control unit (PCU)



6.4 Storing the AFAD

Before storing the AFAD trailer, take the following steps to prevent damage to electrical components:

1. Unplug the power cord from the touchscreen controller by removing the retainer clip, if present, then unscrewing the collar on the cord that is plugged into the bottom of the controller. Grasp the plug firmly and pull it from the port. DO NOT pull on the cord. Pulling on the power cord will damage it.
2. Remove the touchscreen controller from the battery box and store it indoors.
3. If the AFAD is equipped with a camera, turn off power to the camera and all other auxiliary devices before storing:
    a. Turn on the wireless controller.
    b. Access the Settings screen by pressing the blue **AUX DEVICE POWER** button on the Main screen.
    c. Press the **OFF** button under "Aux 1 Pwr." A green checkmark appears.
    d. Press **BACK** when done or switch the controller off.
4. Observe battery storage requirements to ensure battery health and longevity. See "Storing" on page 57.

6.5 Wiring

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

For wiring, see the following diagrams:

- Trailer wiring, Figure 6-3, page 61
- System wiring, Figure 6-4, page 62

6.6 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 6-3 or contact the Wanco Service Department (see Section 1.3, "Where to obtain service," page 2).

Table 6-3. Replacement parts

Trailer, tower, and gate	
AFAD assembly	page 64
Trailer assembly	page 66
Battery box assembly	page 68
Tower and mounting frame	page 70
Tower assembly	page 72
Signal assembly	page 74
Gate assembly	page 76
Gate arm components	page 78
Drawbar assembly	page 80
Control system	
Control box assembly	page 81
Touchscreen controller assembly	page 82
Touchscreen controller charger	page 83
Optional equipment	
Optional rear beacon	page 84
Optional camera assembly	page 86
Optional AGM batteries	page 87
Optional EZ-Nest dual-tow kit	page 88
Rear-tow combo hitch	page 89

Figure 6-3. Trailer wiring

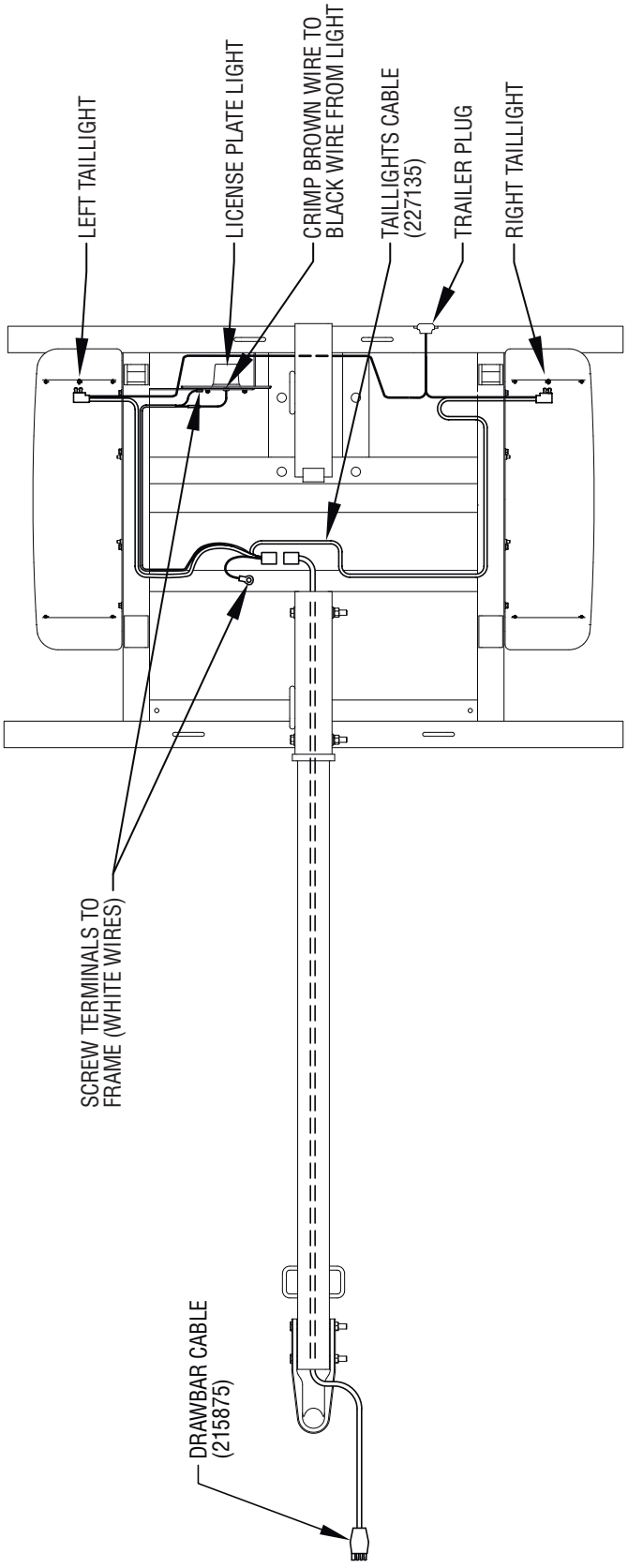
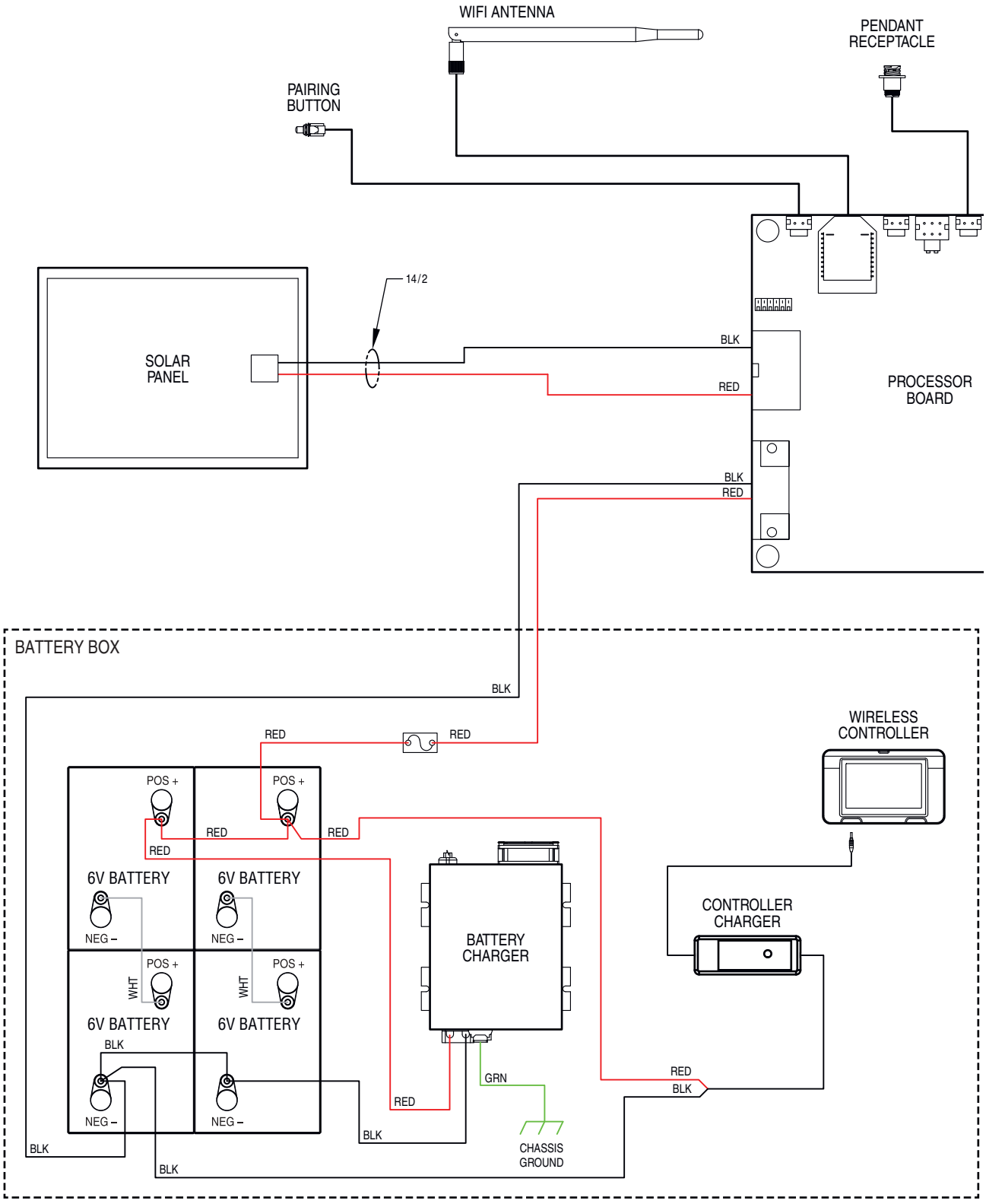


Figure 6-4. System wiring



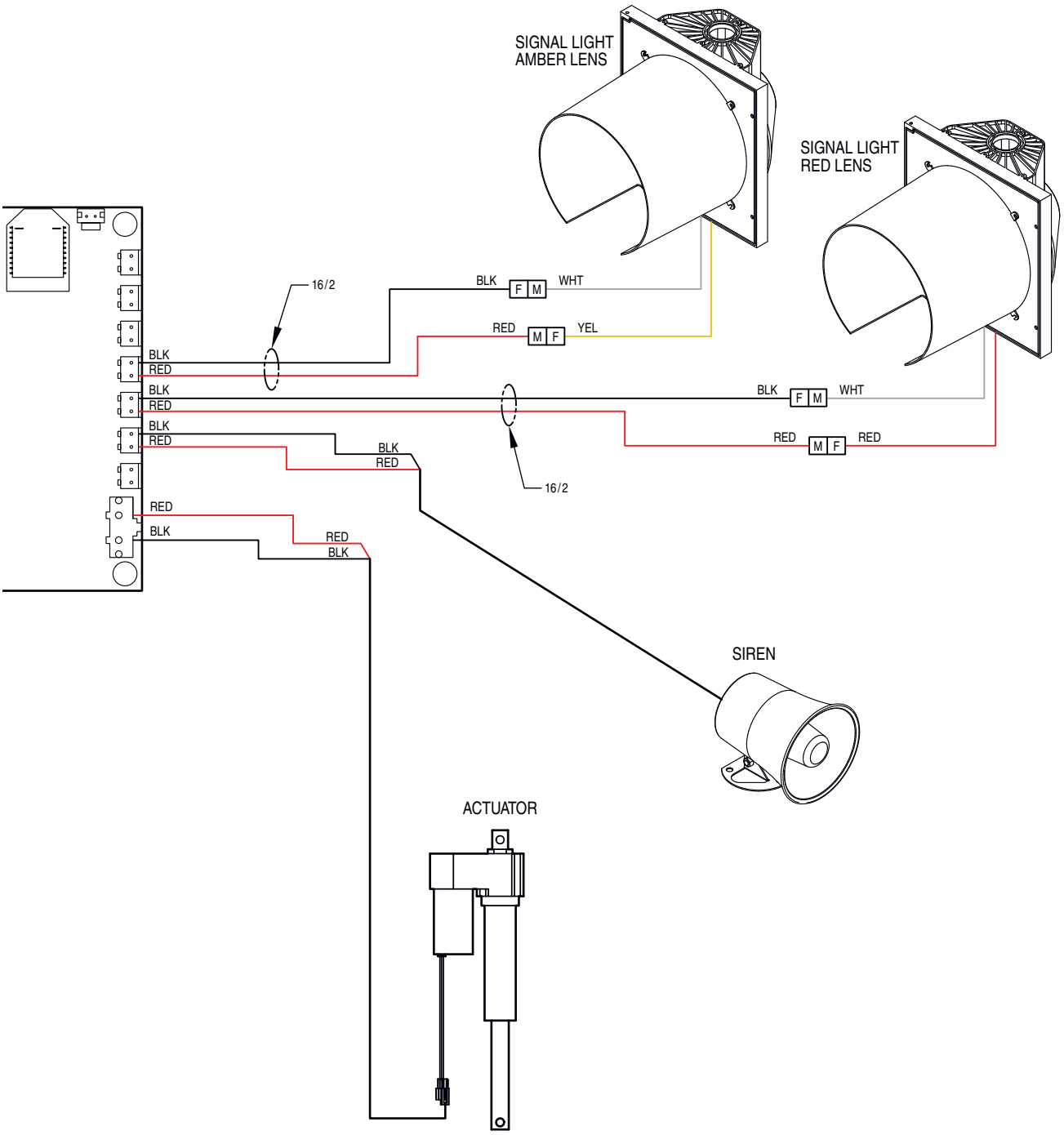

SIGNAL LIGHT
AMBER LENS
SIGNAL LIGHT
RED LENS
16/2
BLK
WHT
F
M
RED
YEL
BLK
RED
BLK
RED
BLK
RED
BLK
WHT
RED
RED
BLK
RED
16/2
RED
BLK
RED
BLK
SIREN
ACTUATOR

Figure 6-5. Replacement parts: AFAD assembly

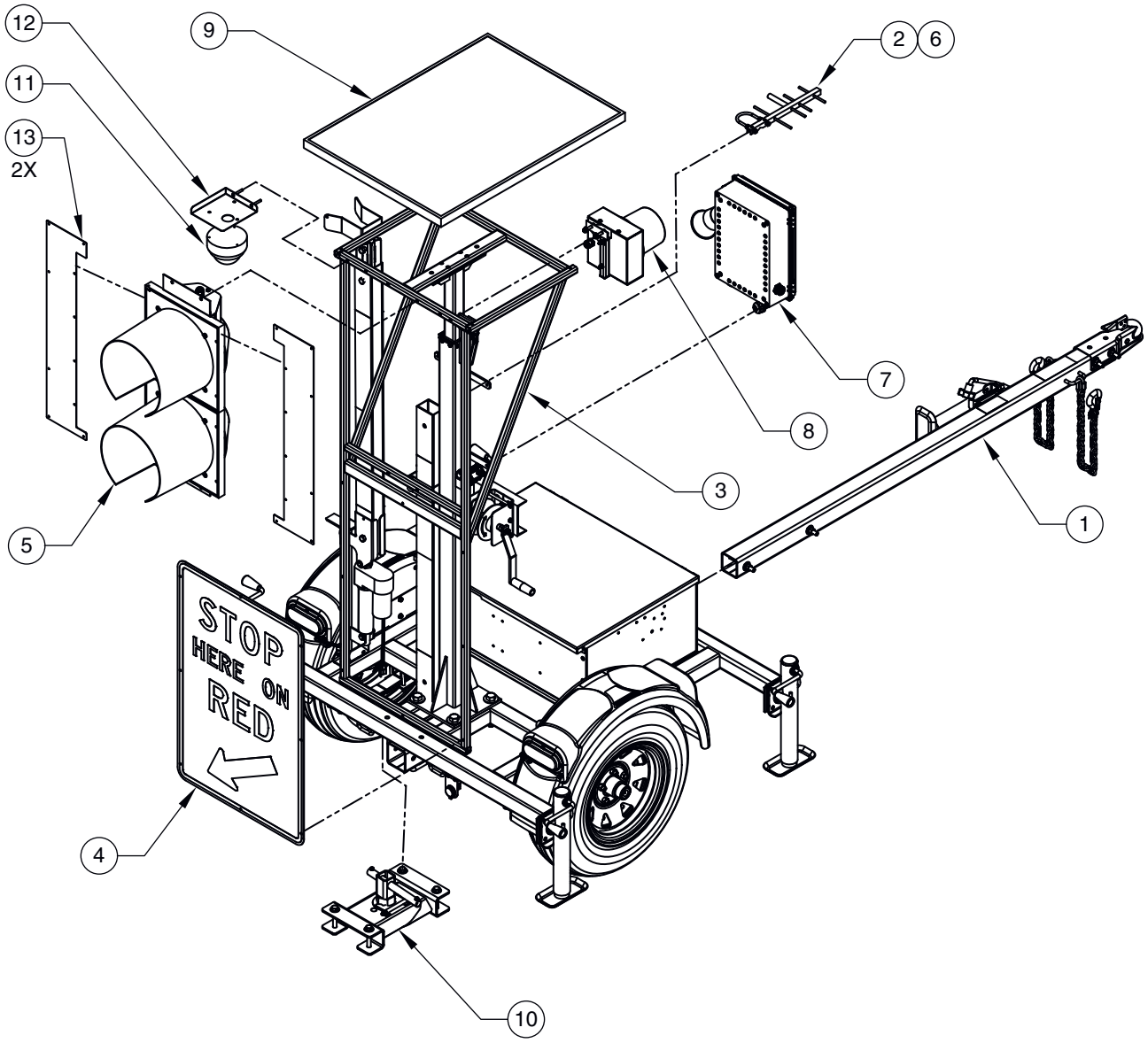


Table 6-4. Parts list: AFAD assembly

Item No.	Part No.	Description	Qty.
1	108797-	Drawbar assembly, 2" Ball w/ pad-foot jack, see Figure 6-13, page 80	1
	200842-	Drawbar assembly, 2" Ball w/ caster-wheel jack (optional, not shown)	
2	228588	Antenna cable with connector (not shown)	1
3	228813-	Mounting frame for signals and sign	1
4	228814	“Stop Here on Red" sign, 24" × 36"	1
5	233071-	Signal stack assembly, see Figure 6-10, page 74	1
6	233164	Antenna, 900MHz 8dBi	1
7	233177	Control box assembly, see Figure 6-14, page 81	1
8	234656-	Rear beacon kit (optional), see Figure 6-17, page 84	1
9	234331	Solar panel assembly, 100 watt	1
10*	241438-	—Kit, EZ-Nest kit, see Figure 6-20, page 88	1
11*	237625	—Camera, 2MP Hanwha QNV-6082R1, see Figure 6-18, page 86	1
12*	237976-	—Camera mounting plate	1
13*	234655-	—Signal light backplate	1

**Optional component might not be included on your AFAD*

Figure 6-6. Replacement parts: Trailer assembly

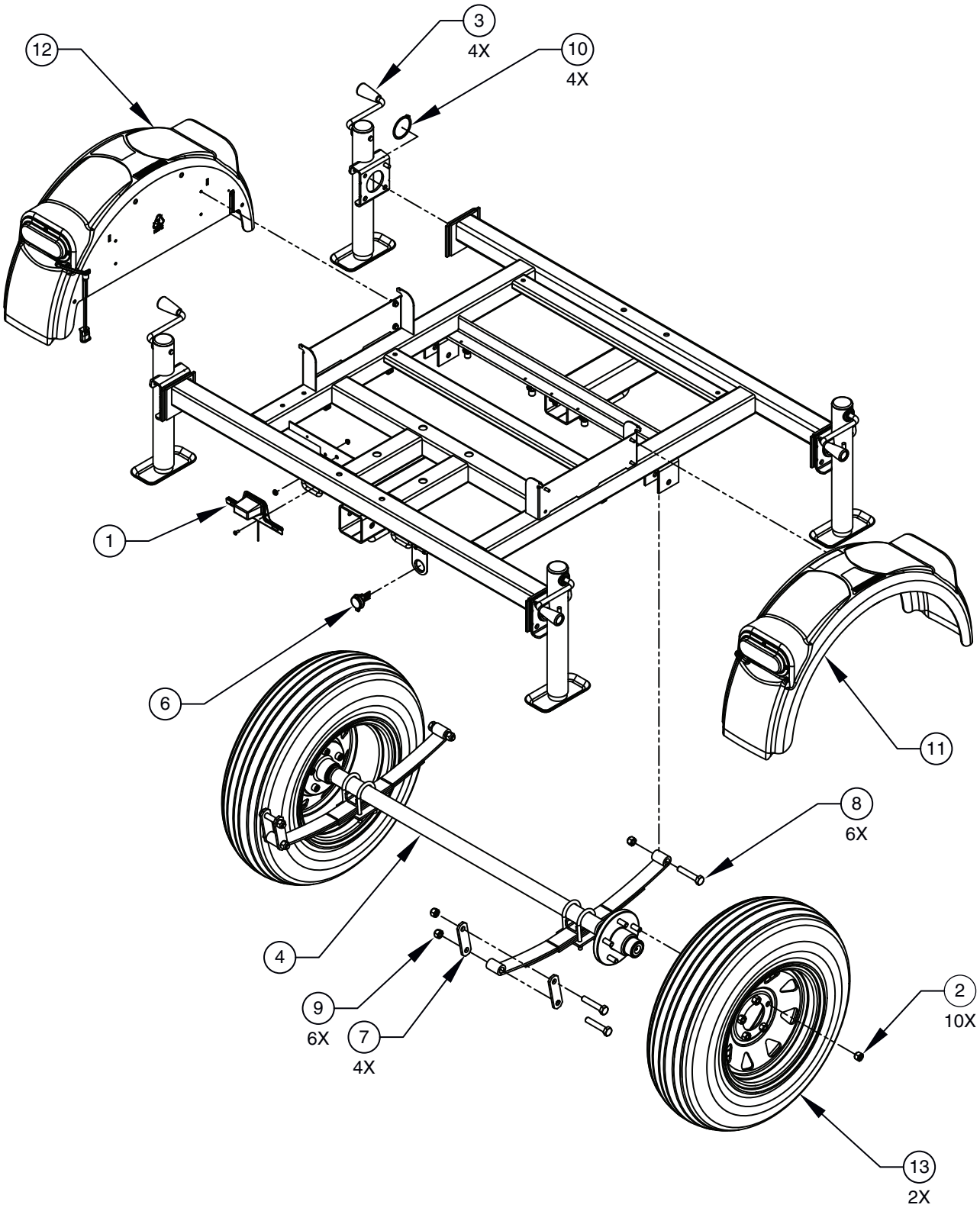


Table 6-5. Parts list: Trailer assembly

Item No.	Part No.	Description	Qty.
1	100783	License plate holder with light	1
2	101323	Hex nut, 1/2"-20 × 60° cone	10
3	101933	Side-wind swivel jack with pad-foot	4
4	104261	Axle assembly, leaf spring 1200 lb cap	1
5	105198	Flat washer, 1/4"	7
6	106964	Tow plug, female	1
7	200108	Axle shackle link	4
8	200109	Axle shackle bolt, 9/16"-18 × 3"	6
9	200110	Stover lock nut, 9/16"-18	6
10	215874	Swivel jack snap ring, 2 1/2"	4
11	227132-	Fender assembly, passenger (right) side	1
12	227133-	Fender assembly, driver (left) side	1
13	238158	Tire and wheel assembly, 15" radial	2

Figure 6-7. Replacement parts: Battery box assembly

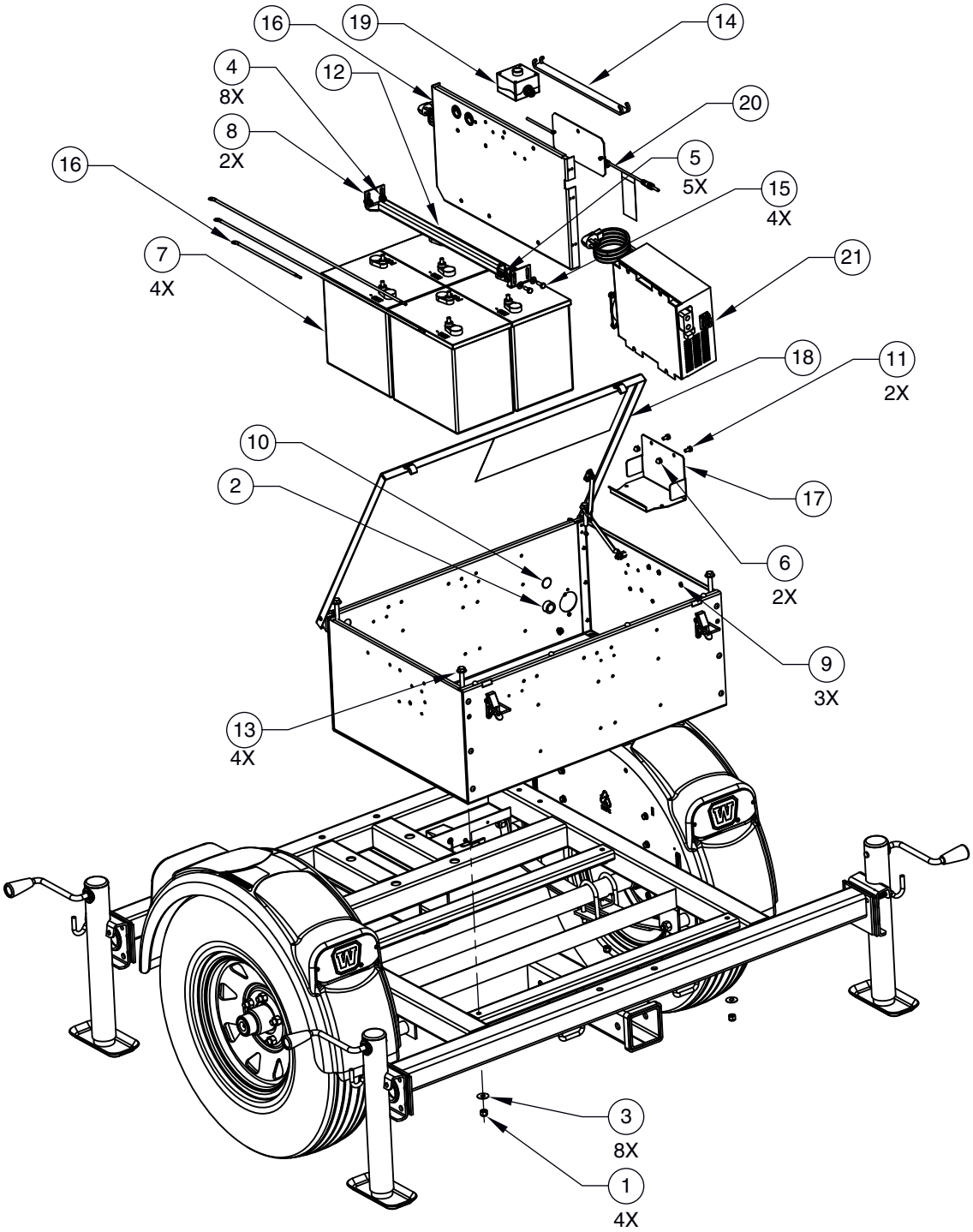


Table 6-6. Parts list: Battery box assembly

Item No.	Part No.	Description	Qty.
1	100073	Hex nut, nylon insert lock 3/8"-16	4
2	100135	Cord grip, 3/4" NPT	1
3	100234	Flat washer, 3/8"	8
4	100236	Flat washer, 1/4" × 5/8"	8
5	100238	Hex nut, nylon insert lock 1/4"-20	5
6	102470	Hex nut, acorn 1/4"-20	2
7	104131	Battery, 6 volt deep cycle 215Ah	4
8	104577-	Bracket, hold down battery box	2
9	105198	Flat washer, 1/4"	3
10	106029	Plug, black plastic 1 3/32" dia.	1
11	106253	Hex screw, 1/4"-20 × 1/2"	2
12	200912-	Battery hold–down bar	1
13	203702	Hex screw, 3/8"-16 × 2" × 1"	4
14	205882	Handle battery removal tool	1
15	216260	Hex screw, 1/4"-20 × 3/4"	4
16	228799	Partition assembly	1
17	232177-	Wireless controller cradle	1
18	232868	Battery box	1
19	233184	Push-button pendant assembly	1
20	235136	Wireless controller charger assembly	1
21	210268	Battery charger, 15A	1

Figure 6-8. Replacement parts: Tower and mounting frame

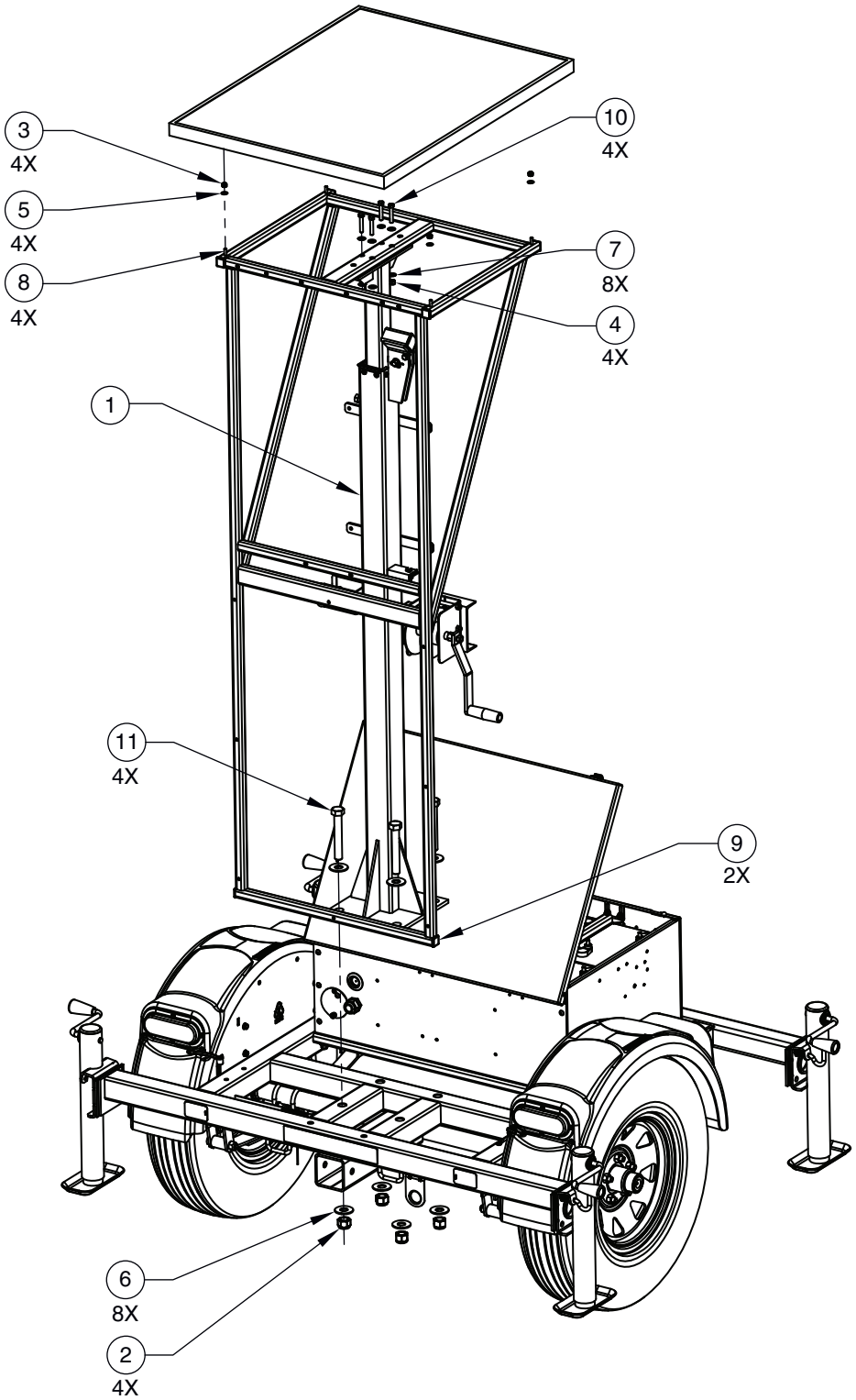


Table 6-7. Parts list: Tower and mounting frame

Item No.	Part No.	Description	Qty.
1	229409	Tower assembly	1
2	100214	Hex nut, nylon insert lock 3/4"-10	4
3	100238	Hex nut, nylon insert lock 1/4"-20	4
4	100239	Hex nut, nylon insert lock 5/16"-18	4
5	105198	Flat washer, 1/4"	4
6	106258	Flat washer, 3/4"	8
7	108374	Flat washer, 5/16" × 3/4" × 3/64"	8
8	203023	Button-head screw, 1/4"-20 × 1 3/4"	4
9	203156	Square tube plug, 1"	2
10	203704	Hex screw, 5/16"-18 × 1 3/4" × 1"	4
11	217773	Hex screw, 3/4"-10 × 5" × 1"	4

Figure 6-9. Replacement parts: Tower assembly

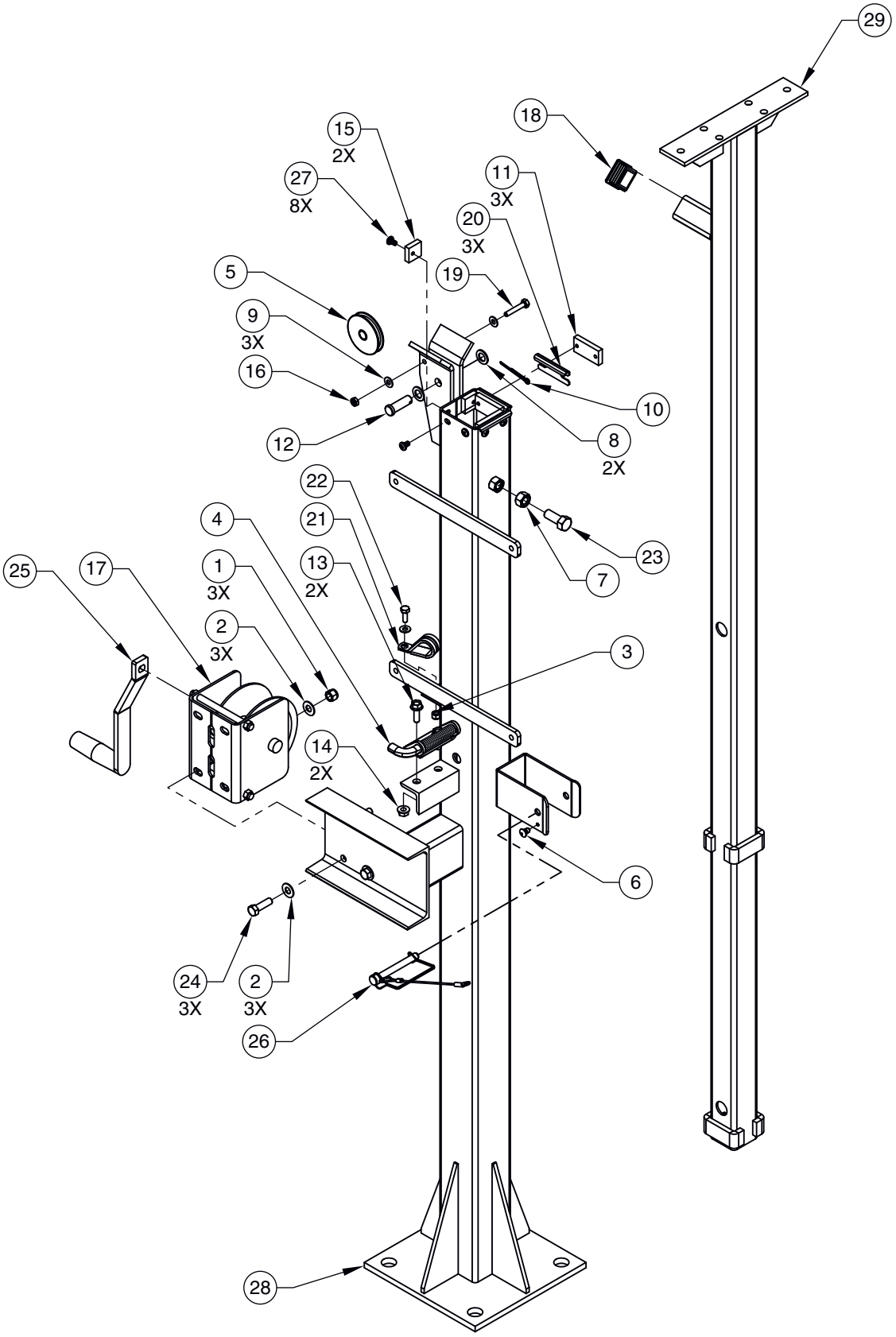


Table 6-8. Parts list: Tower assembly

Item No.	Part No.	Description	Qty.
1	100073	Hex nut, nylon insert lock 3/8"-16	3
2	100234	Flat washer, 3/8"	6
3	100238	Hex nut, nylon insert lock 1/4"-20	1
4	100394	Spring-latch	1
5	100757	Single-groove pulley, 2 1/2"	1
6	101493	Button-head rivet, 3/16" × 1/8"-1/4"	1
7	102665	Hex nut, 1/2"-13	1
8	104856	Flat washer, 1/2"	2
9	105198	Flat washer, 1/4"	3
10	105418	Cotter pin, 5/32" dia. × 1"	1
11	105812	Nylon guide block, 2" × 1"	3
12	105830	Clevis pin, 1/2" × 1 1/2"	1
13	106010	Machine bolt, M8-1.25 × 25mm	2
14	106011	Hex lock nut, serrated flange M8-1.25	2
15	106015	Nylon guide block, 1" × 1"	2
16	106549	Hex jam nut, nylon insert lock 1/4"-20	1
17	203062	Hand-operated winch, 200 lb cap.	1
18	203155	Square tube plug, 1 1/2"	1
19	203696	Hex screw, 1/4"-20 × 1 1/2"	1
20	208213	Spacer bracket	3
21	215780	P-clamp, 7/8" dia.	1
22	216260	Hex screw, 1/4"-20 × 3/4"	1
23	217662	Hex screw, 1/2"-13 × 1 1/4"	1
24	217816	Hex screw, 3/8"-16 × 1 1/4"	3
25	218061	Winch handle, 8"	1
26	221649	Wire-pin lock, 3/8" × 2 7/8" with steel lanyard	1
27	223696	Pan–head screw, M6-1.0 × 10mm	8
28	229406-	Tower base	1
29	229408-	Tower	1
30	233063	Winch cable (not shown)	1

Figure 6-10. Replacement parts: Signal assembly

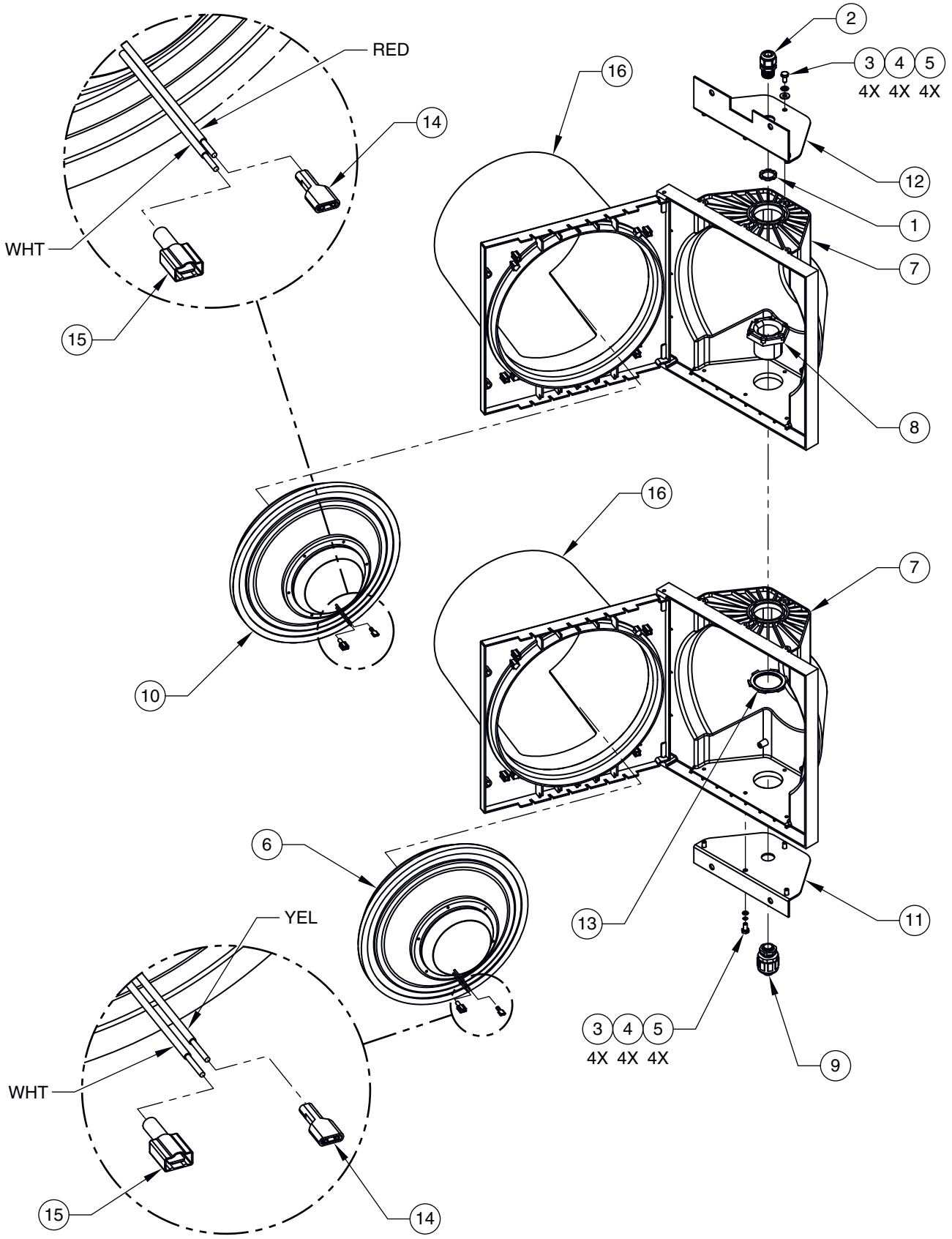


Table 6-9. Parts list: Signal assembly

Item No.	Part No.	Description	Qty.
1	100133	Conduit nut, 1/2"-14 NPT	1
2	100137	Cord grip, 1/2" NPT	1
3	100207	Hex screw, 1/4"-20 × 1/2"	8
4	100208	Split lock washer, 1/4" ID × 1/2" OD	8
5	100236	Flat washer, 1/4" × 5/8"	8
6	103687	12–inch amber LED module	1
7	103984	Beacon housing, 12"	2
8	103986-005	Cast nipple	1
9	106300	Conduit fitting, 1/2"	1
10	217885	12" red LED module	1
11	228240-	Lower mounting bracket	1
12	229627-	Upper mounting bracket	1
13	232632	Conduit nut, 1 1/2"	1
14	102533	Quick-disconnect terminal, female 14–16GA	2
15	103260	Quick-disconnect coupler, male 14–16GA	2
16	101333	12" visor	2

Figure 6-11. Replacement parts: Gate assembly

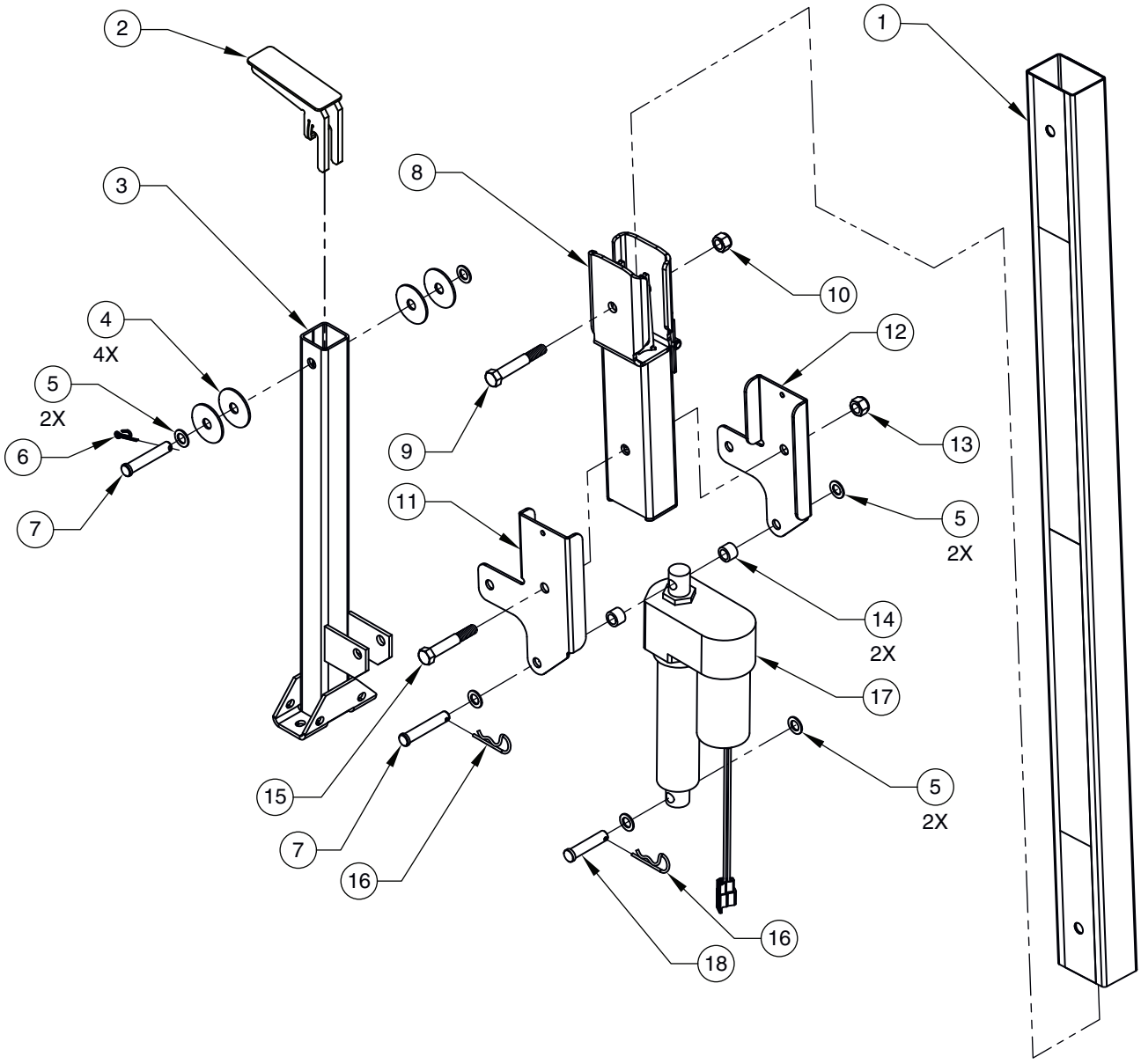


Table 6-10. Parts list: Gate assembly

Item No.	Part No.	Description	Qty.
1	232885	Gate arm/extension 48" × 3", vertical stripes	1
	234055	— Gate arm 48" × 4 1/2", vertical stripes (optional)	
	234445	— Gate arm 48" × 3", diagonal stripes (optional)	
2	242156	Drop-in arm limiter	1
3	242157-	Cylinder and gate-arm mount for large actuator	1
4	105462	Fender washer, 1/2"	4
5	104856	Flat washer, 1/2"	6
6	205128	Cotter pin, 5/32" dia. × 1"	1
7	209724	Clevis pin, 1/2" × 2 1/2"	2
8*	234304-	— Breakaway gate arm cartridge (optional)	1
9*	217669	— Hex bolt, 1/2"-13 × 3 1/4" (optional)	1
10*	100217	— Hex nut, nylon insert lock 1/2"-13 (optional)	1
11	234452-	Large mounting plate, left	1
12	234451-	Large mounting plate, right	1
13	100217	Hex nut, nylon insert lock 1/2"-13	1
14	234208	Tube spacer	2
15	217668	Hex screw, 1/2"-13 × 3"	1
16	104050	Hairpin cotter pin, 1/2" to 5/8"	2
17	234109	Electric actuator (black), 12Vdc 6" stroke 250 lb cap.	1
18	233159	Clevis pin, 1/2" × 2 1/4"	1

**Optional component might not be included on your AFAD*

Figure 6-12. Replacement parts: Gate arm components

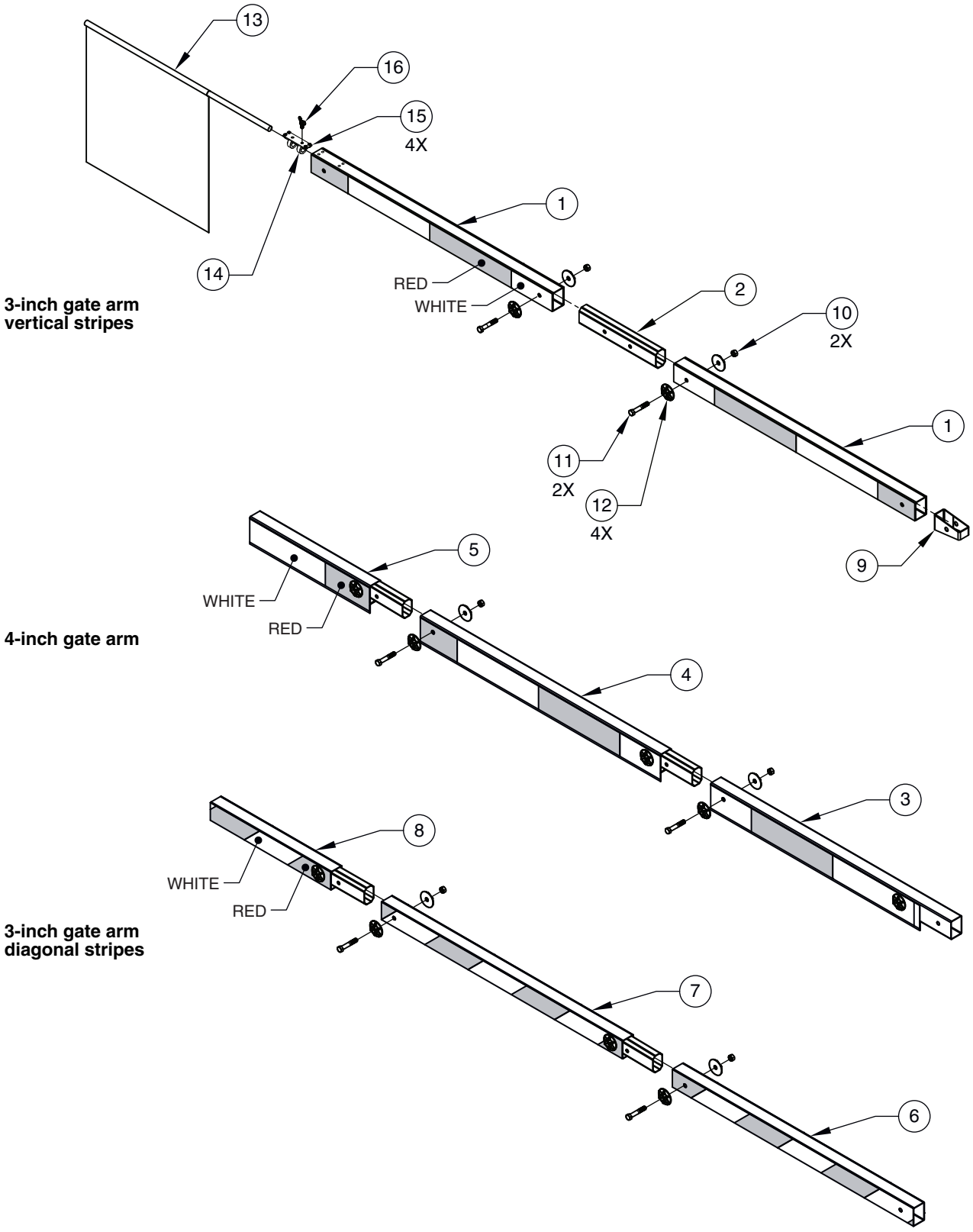


Table 6-11. Parts list: Gate arm components

Item No.	Part No.	Description	Qty.
1	232885	Gate arm/extension 48" × 3", vertical stripes	1
2	239295	Gate arm extension connector	1 or 2
3*	234055	— Gate arm 48" × 4 1/2", vertical stripes (optional)	1
4*	234053	— Gate arm extension 48" × 4 1/2" with connector, vertical stripes	1
5*	234106	— Gate arm extension 24" × 4 1/2" with connector, vertical stripes	1
6*	234445	— Gate arm 48" × 3", diagonal stripes (optional)	1
7*	234444	— Gate arm extension 48" × 3" with connector, diagonal stripes	1
8*	235018	— Gate arm extension 24" × 3" with connector, diagonal stripes	1
9	238561-	Gate arm tube brace	1
10	233064	Hex nut, 1/2"-13 nylon	2 or 4
11	233065	Hex screw, 1/2"-13 × 3" × 1 1/4"	2 or 4
12	235023	Gate arm nut tool	4 or 8
13*	234118	— Safety flag and pole, 24" × 24" florescent orange	1
14*	234205-	— Flag holder	1
15*	102273	— Rivet, 3/16" × 1/16" to 1/4"	4
16*	234203	— Wing screw, 5/16"-18 × 3/4"	1

**Optional component might not be included on your AFAD*

Figure 6-13. Replacement parts: Drawbar assembly

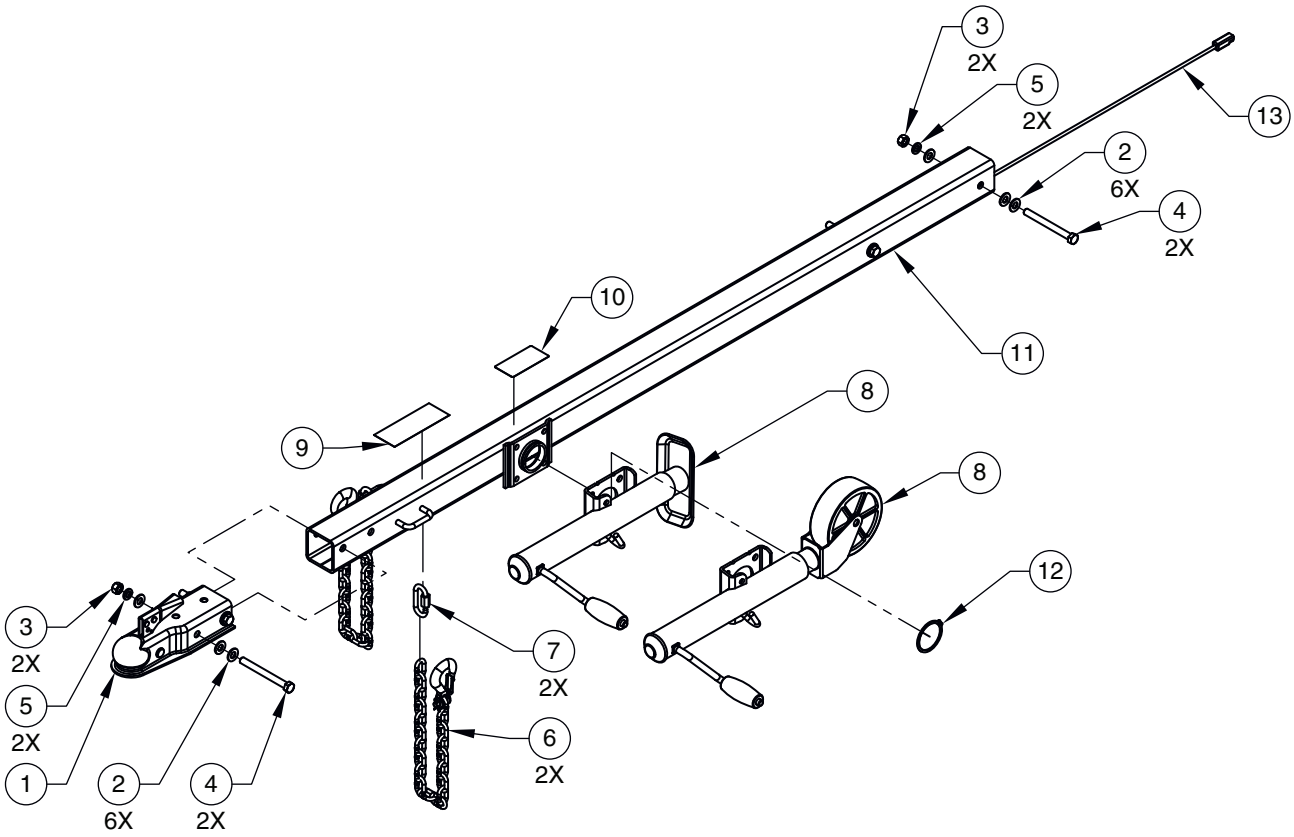


Table 6-12. Parts list: Drawbar assembly

Item No.	Part No.	Description	Qty.
1	101677	Tow hitch, 2" ball 2000 lb cap.	1
2	100233	Flat washer, 1/2"	12
3	100652	Hex nut, 1/2"-13	4
4	217814	Hex screw, 1/2"-13 × 5"	4
5	100713	Split–lock washer, 1/2"	4
6	104859	Tow chain with clevis slip hook	2
7	201432	Quick-link for tow chain, 1540 lb cap.	2
8	101933	Swivel jack with pad-foot	1
	218076	— Swivel jack with caster wheel (optional)	
9	103939	Decal, safe towing instructions	1
10	103941	Decal, caution tow-hitch connection	1
11	103409-	AFAD drawbar	1
12	215874	Swivel jack snap ring, 2 1/2"	1
13	215875	Trailer lights cable with flat-four plug	1

Figure 6-14. Replacement parts: Control box assembly

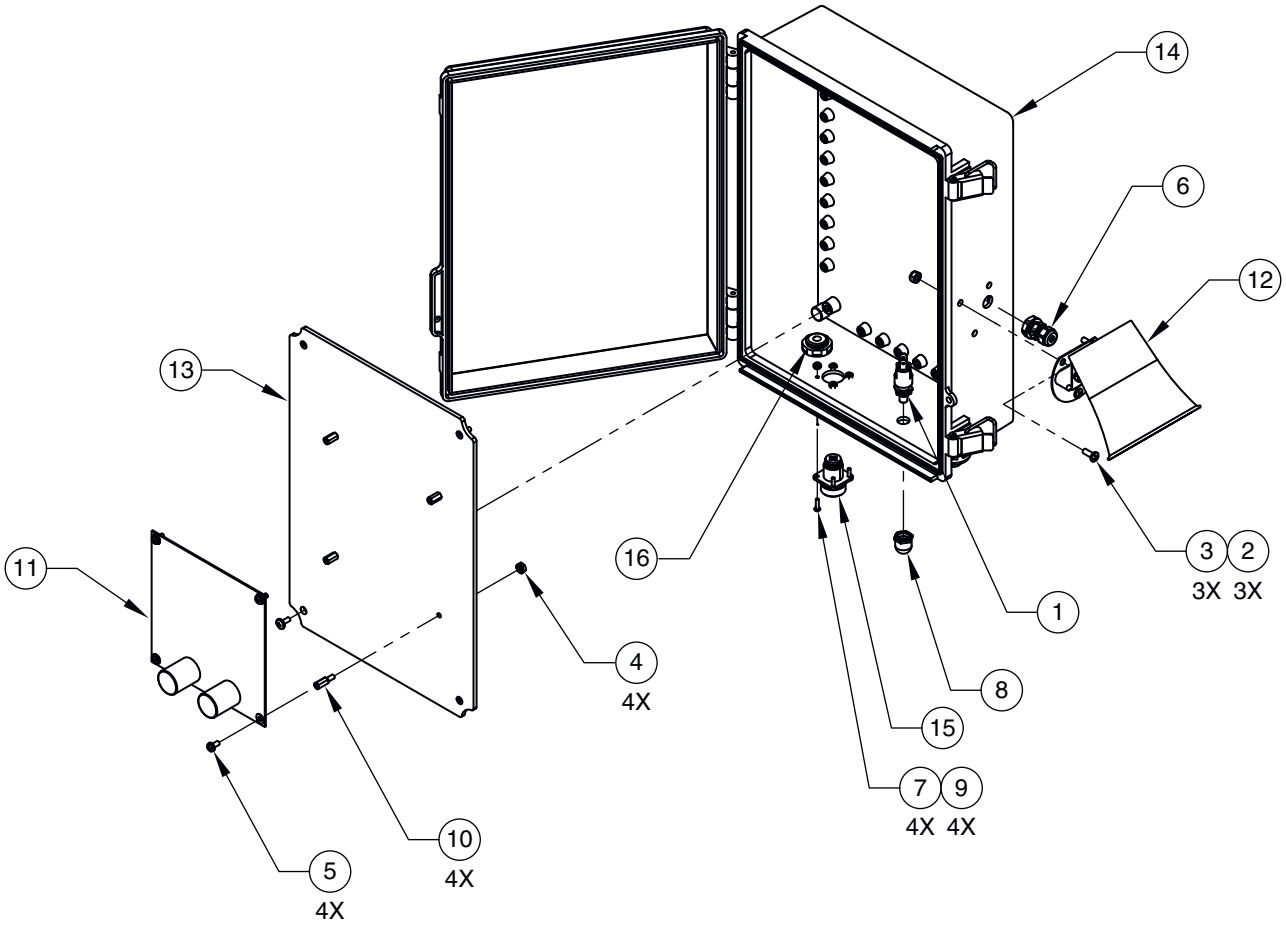


Table 6-13. Parts list: Control box assembly

Item No.	Part No.	Description	Qty.
1	100846	Push-button switch (pairing button)	1
2	101489	Hex nut, nylon insert lock #10-24	3
3	101805	Pan-head screw, #10-32 × 1/2"	3
4	103534	K-lock nut, #8-32	4
5	105688	Pan-head machine screw w/ tooth washer, #8-32 × 3/8"	4
6	108431	Cord grip, PG-7 thread for 0.114 to 0.250 cable diameter	1
7	203237	Pan–head machine screw, #4-40 × 7/16"	4
8	207781	Boot for push-button switch	1
9	226154	Hex nut, nylon insert lock #4-40	4
10	227570	Standoff, #8-32 × 1/2"	4
11	234808	Control board with RF module	1
12	232620	Siren, 12V 15W 110 dB	1
13	233174	Control box backplane	1
14	233176	Control box enclosure	1
15	233183	Connector and harness for push-button controller	1
16	106298	Connector, 90-degree 1/2" liquid tight	1

Figure 6-15. Replacement parts: Touchscreen controller assembly

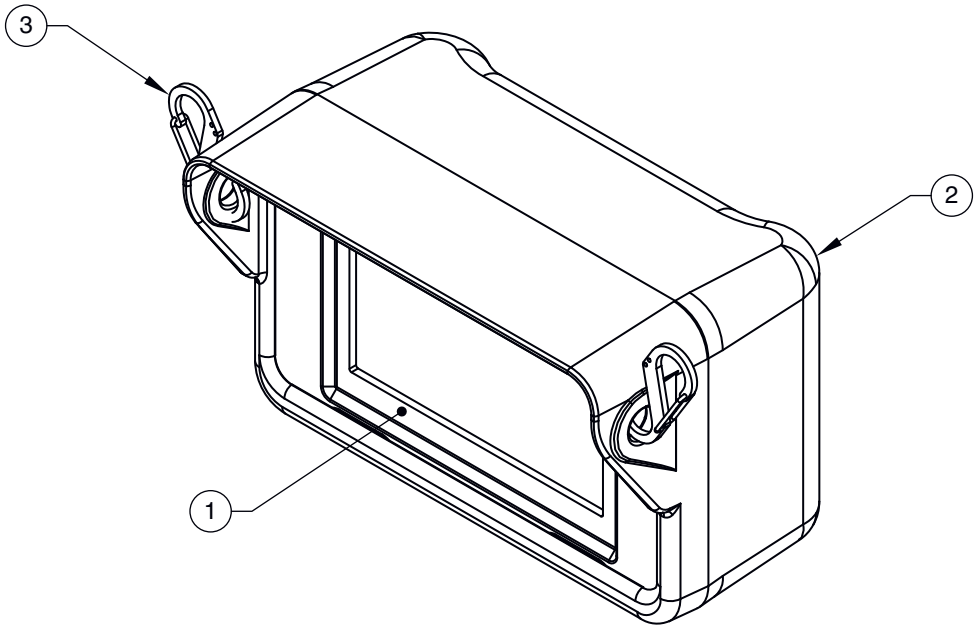


Table 6-14. Parts list: Touchscreen controller assembly

Item No.	Part No.	Description	Qty.
1	233344	Touchscreen controller	1
2	233341	Rubber boot	1
3	232898	Double-gate clip, set of 2	1
4	232896	Battery pack (not shown)	1
5	232901	Carry strap (not shown)	1

Figure 6-16. Replacement parts: Touchscreen controller charger

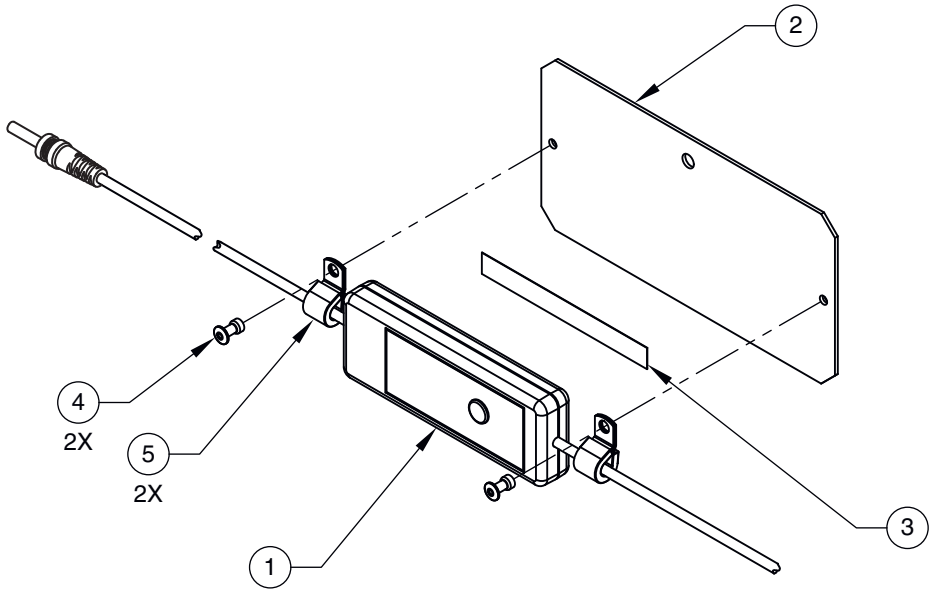


Table 6-15. Parts list: Touchscreen controller charger

Item No.	Part No.	Description	Qty.
1	235135	Wireless controller charger assembly	1
2	235134-	Mounting plate	1
3	223572	Double-sided foam tape, 3M™ VHB™ 4611	4.5"
4	104463	Button-head rivet, 3/16" × 1/16"	2
5	101583	Loom clamp, #4 (1/4")	2
6	233319	Retention clip for power cord without screw collar (optional, not shown)	1

Figure 6-17. Replacement parts: Optional rear beacon

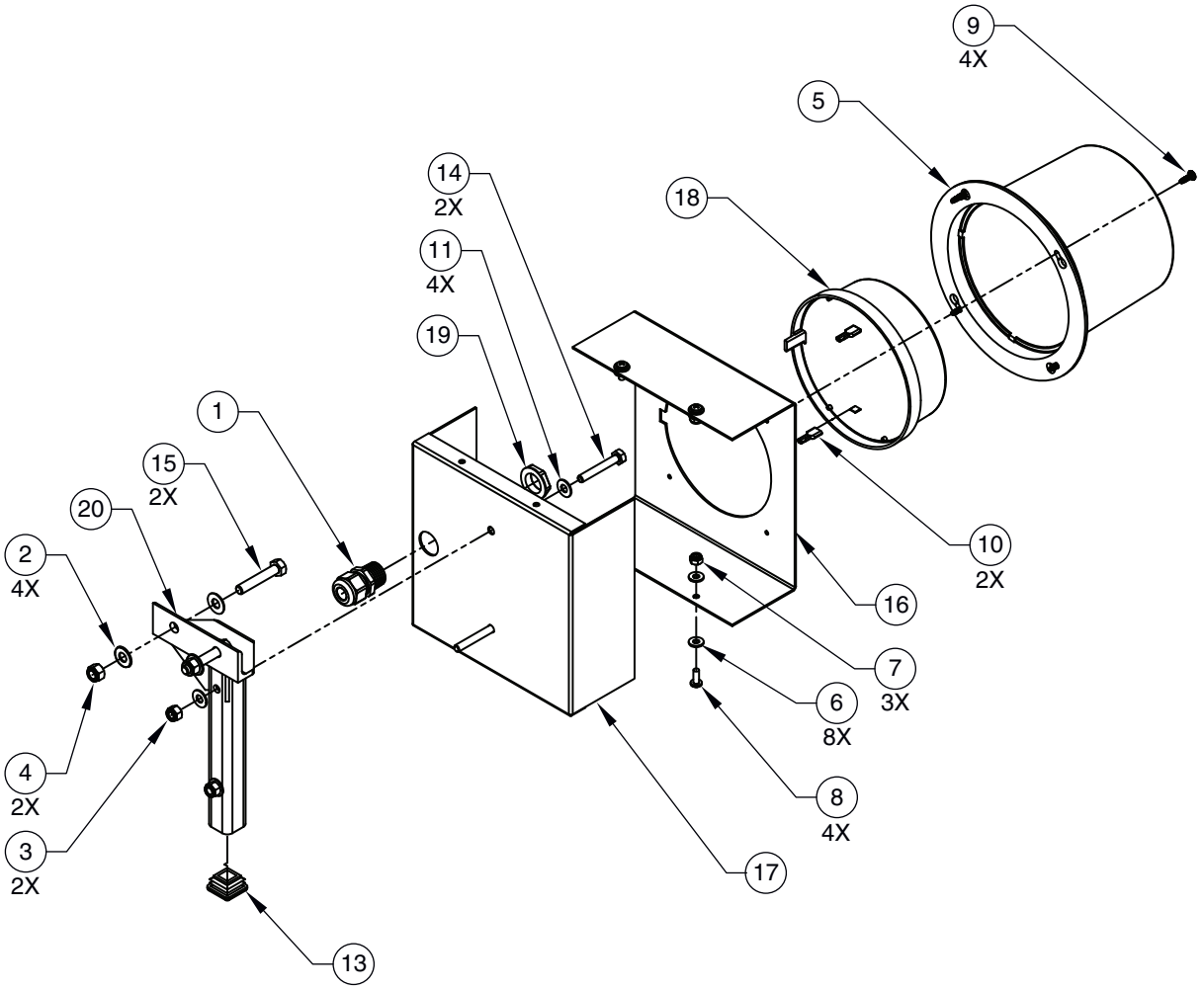


Table 6-16. Parts list: Optional rear beacon

Item No.	Part No.	Description	Qty.
1	100137	Cord grip, 1/2"	1
2	100237	Flat washer, 11/32" ID × 3/4" OD	4
3	100238	Hex nut, nylon insert lock 1/4"-20	2
4	100239	Hex nut, nylon insert lock 5/16"-18	2
5	100342	Visor, PAR 46	1
6	101526	Flat washer, 7/32" ID × 1/2" OD	8
7	101721	Hex nut, nylon insert lock #10-32	3
8	101805	Pan-head screw, #10-32 × 1/2"	4
9	102516	Thread-cutting pan-head screw, #8-32 × 1/2"	4
10	102533	Quick-disconnect terminal, female crimp 14–16GA	2
11	105198	Flat washer, 1/4"	4
12	202584	2-conductor cable, 14AWG red/black (not shown)	36"
13	203156	Square tube plug, 1" 10–14GA	1
14	203699	Hex screw, 1/4"-20 × 1 3/4"	2
15	203704	Hex screw, 5/16"-18 × 1 3/4"	2
16	238289-	Lamp housing, top panel	1
17	204807-	Lamp housing, bottom panel	1
18	207265	PAR 46 light, amber LED	1
19	218057	Nylon lock nut, 1/2" NPT	1
20	234651-	Beacon mounting bracket, PAR 46	1

Figure 6-18. Replacement parts: Optional camera assembly

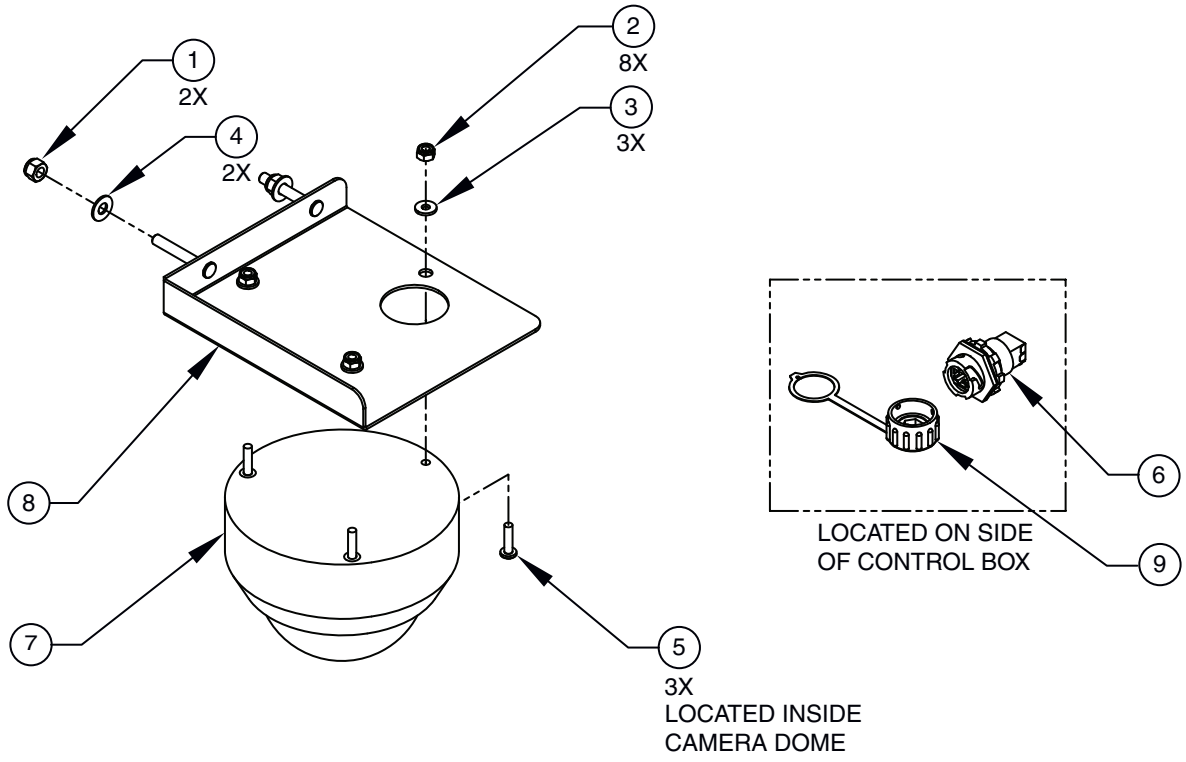


Table 6-17. Parts list: Optional camera assembly

Item No.	Part No.	Description	Qty.
1	100238	Hex nut, nylon insert lock 1/4"-20	2
2	101721	Hex nut, nylon insert lock 10-32	3
3	104855	Flat washer, #10	3
4	105198	Flat washer, SAE 1/4"	2
5	203685	Machine screw, #10-32 × 3/4"	3
6	217318	Cable connector, RJ45	1
7	237625	Hanwha camera, model QNV-6082R1	1
8	237976-	Camera mounting plate	1
9	239646	Dust cap, RJ45 connector	1

Figure 6-19. Replacement parts: Optional AGM batteries

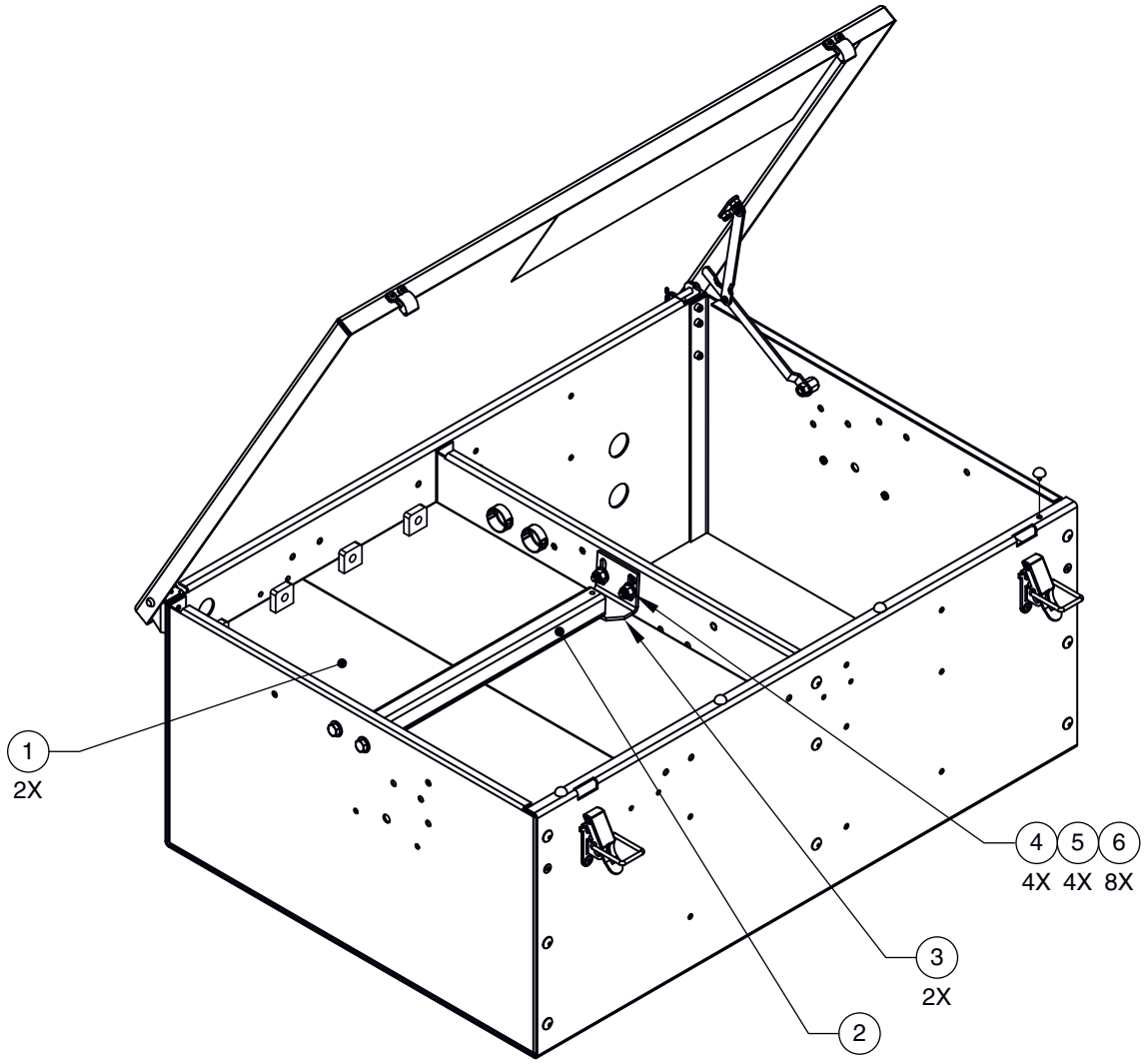


Table 6-18. Parts list: Optional AGM batteries

Item No.	Part No.	Description	Qty.
1	205016	Battery, 12-volt AGM UB4D	2
2	205019	Battery hold-down bar	1
3	104577-	Bracket for hold-down bar	2
4	216260	Hex screw, 1/4"-20 × 3/4"	4
5	100238	Hex nut, nylon insert lock 1/4"-20	4
6	100236	Flat washer, 1/4"× 5/8"	8

Figure 6-20. Replacement parts: Optional EZ-Nest dual-tow kit

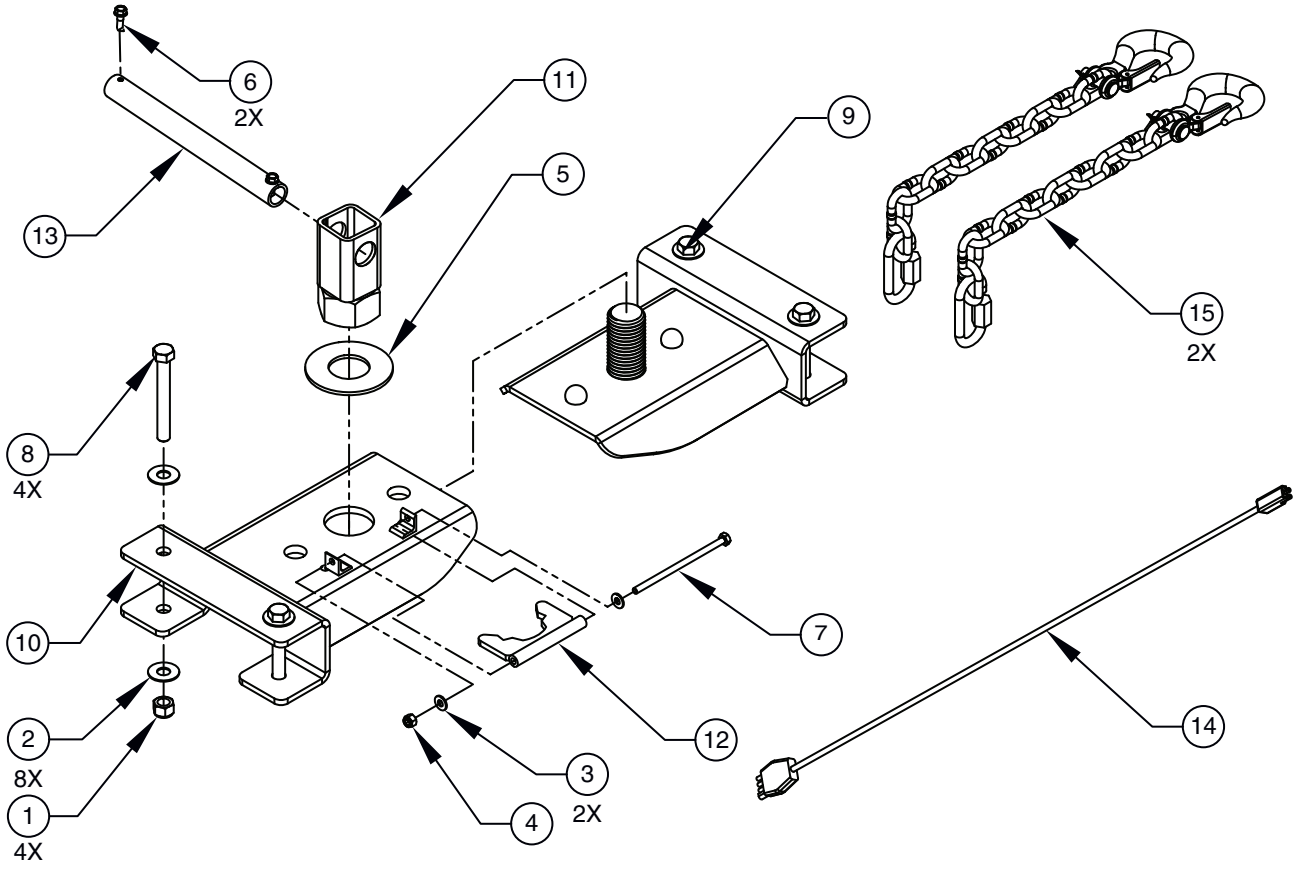


Table 6-19. Parts list: Optional EZ-Nest dual-tow kit

Item No.	Part No.	Description	Qty.
1	100217	Hex nut, nylon insert lock 1/2"-13	4
2	100233	Flat washer, 17/32" ID × 1 1/4" OD	8
3	100236	Flat washer, 9/32" ID × 5/8" OD	2
4	100238	Hex nut, nylon insert lock 1/4"-20	1
5	101508	Fender washer, 1 1/2" × 3 1/2" × 0.203"	1
6	205122	Hex washer head self-drilling screw, 1/4"-14 × 3/4"	2
7	217659	Hex bolt, 1/4"-20 × 5" × 1"	1
8	217672	Hex bolt, 1/2"-13 × 4" × 1"	4
9	241432-	EZ-Nest bottom bracket	1
10	241435-	EZ-Nest top bracket	1
11	237413-	EZ-Nest nut, handle-ready	1
12	237816-	EZ-Nest rotation lock plate	1
13	237825-	EZ-Nest tube handle	1
14	239382	EZ-Nest taillight harness, 36"	1
15	239384	EZ-Nest tow chain for rear AFAD	2

Figure 6-21. Replacement parts: Optional rear-tow combo hitch

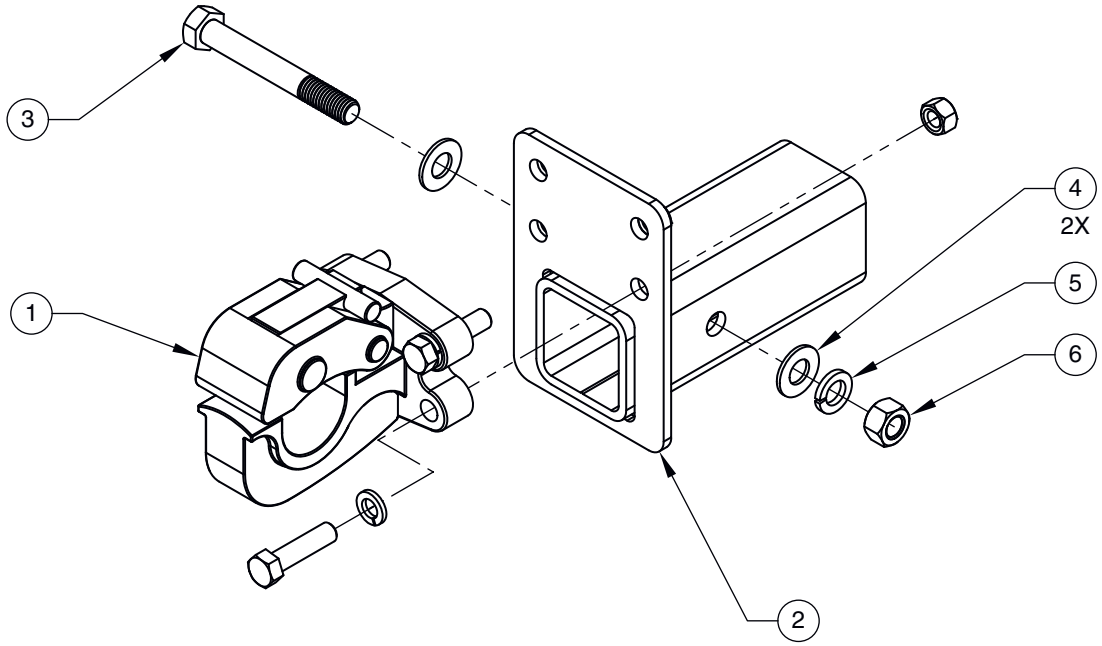


Table 6-20. Parts list: Optional rear-tow combo hitch

Item No.	Part No.	Description	Qty.
1	234755	Pintle coupler with mounting hardware	1
2	234752-	Rear-mount adapter	1
3	229093	Hex bolt, 5/8"-11 × 4 3/4"	1
4	108371	Flat washer, 5/8"	2
5	108170	Split lock washer, 5/8"	1
6	202455	Hex nut, 5/8"-11	1

APPENDIX
A AFAD camera

A.1 Introduction

The optional AFAD camera (Figure A-1, page 91) continuously records video of the AFAD gate arm and approach lane of traffic.

Recorded video is saved to an internal Micro–SD memory card. Video is time-and-date marked, providing essential documentation when an incident occurs. Best practice suggests the camera should be powered on and recording whenever the AFAD is in use. To prevent the AFAD batteries from being drained, the camera should be switched off whenever the AFAD is not in use.

The camera does not provide live view or remote access. To view and save videos, the files must be downloaded from the camera and saved to an external device, such as a computer or cloud storage.

Because the camera is always recording when powered, it overwrites the oldest video files when the memory card is filled. Typical capacity of a 128 GB Micro SD card is about 7 days before overwriting.

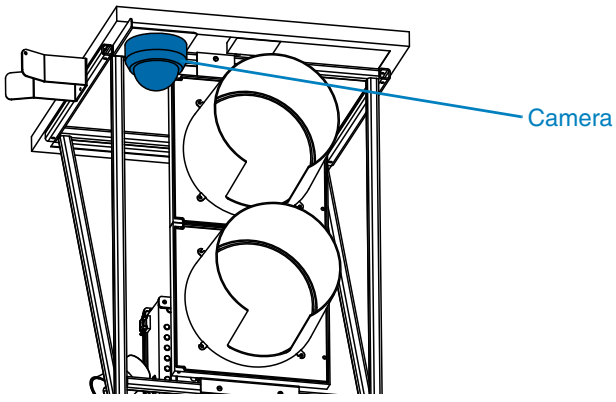
When the camera records an event that needs to be saved (e.g., incursion into the TTC zone by an errant vehicle), the video should be downloaded before it is overwritten.

This section of the manual demonstrates three important procedures for using the camera:

- To switch power to the camera on and off, see Section A.2, page 92.
- To enable and disable auxiliary power controls, see Section A.3, page 94.
- To download video files for viewing or saving, see Section A.4, page 96.

For additional camera instructions, refer to the camera's user manual.

Figure A-1. AFAD camera



A.2 Turning the camera on and off

The camera is always recording when powered. Best practice suggests the camera should be powered and recording whenever the AFAD is in use. Additionally, to prevent the AFAD batteries from being drained, the camera should also be switched off whenever the AFAD is not in use.

The AFAD ships from the factory with the camera installed but turned off.

To view or toggle camera power, follow these steps:

1. On the controller Main screen, view the aux power indicators (see Figure A-2).
   - If the left indicator is green, power to the camera is on.
   - If the left indicator is gray, power to the camera is off.
   - If the indicators are not shown, see Section A.3, page 94, to enable them.
2. Toggle camera power using the Aux Power screen. Press the blue **AUX POWER** button.
3. The Aux Power screen (Figure A-3) indicates the power status for three auxiliary power circuits with the ☑ symbol. The camera is Aux 1.
   - Press the blue Aux 1 **ON** button to toggle the camera power on.
   - Press the blue Aux 1 **OFF** button to toggle the camera power off.
4. When finished, press the **BACK** button to return to the Main screen.

Figure A-2. "Show aux power" enabled

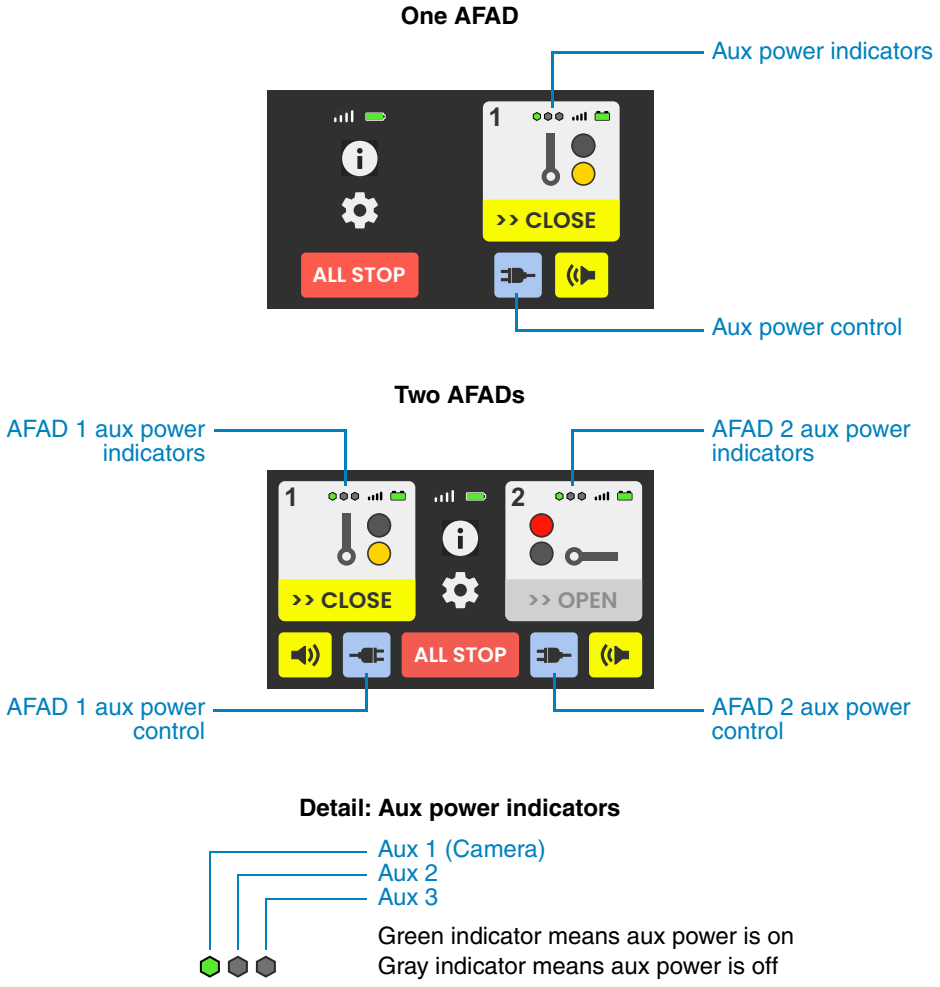
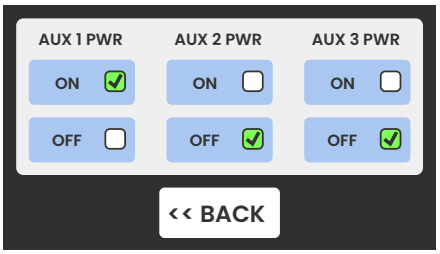


Figure A-3. Aux power screen

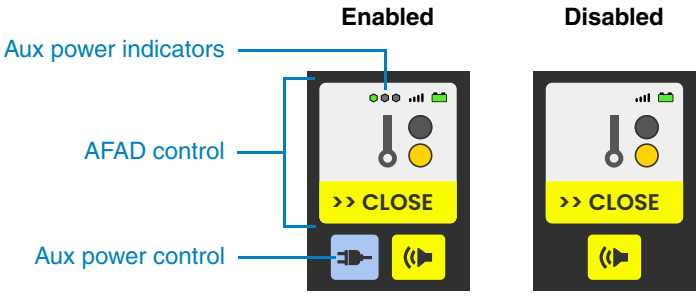


A.3 Enabling aux power control

To determine whether aux power control is enabled, view the Main screen on the wireless controller and compare with Figure A-4:

- If enabled, the display includes a blue **AUX POWER** button and aux power indicators.
- If disabled, the button and indicators are not shown.

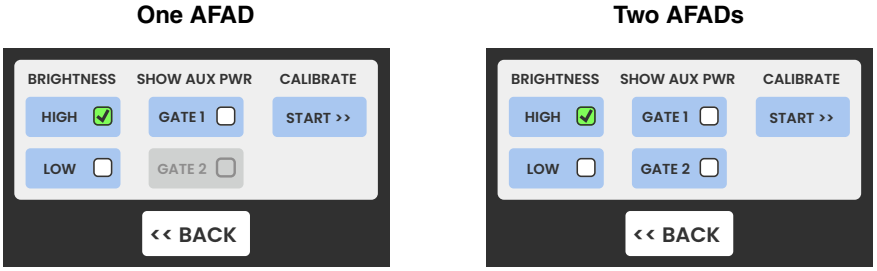
Figure A-4. Aux power controls



To enable aux power controls:

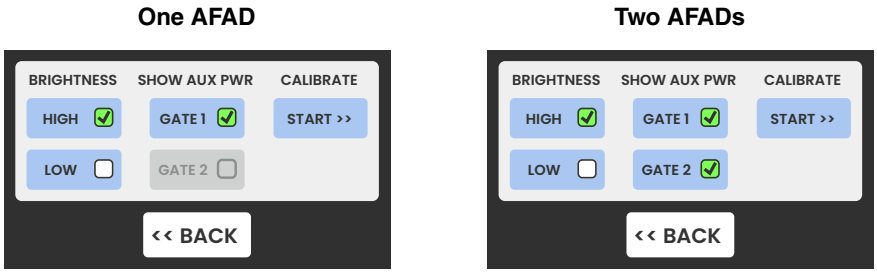
1. On the controller, press the ⚙ button, then press the blue **DISPLAY SETTINGS** button to access the Display Settings screen (Figure A-5).

Figure A-5. Display Settings screen, aux power disabled



2. Enabled power control is indicated by the ☑ symbol (see Figure A-6). To enable it:
   - For a single paired AFAD, press the **GATE 1** button.
   - For two paired AFADs, press the **GATE 1** button and the **GATE 2** button.

Figure A-6. Display Settings screen, aux power enabled



3. When finished, press the **BACK** button to return to the Settings screen, then press the **BACK** button again to return to the Main screen.

   To toggle aux power on and off, see Section A.2, page 92.

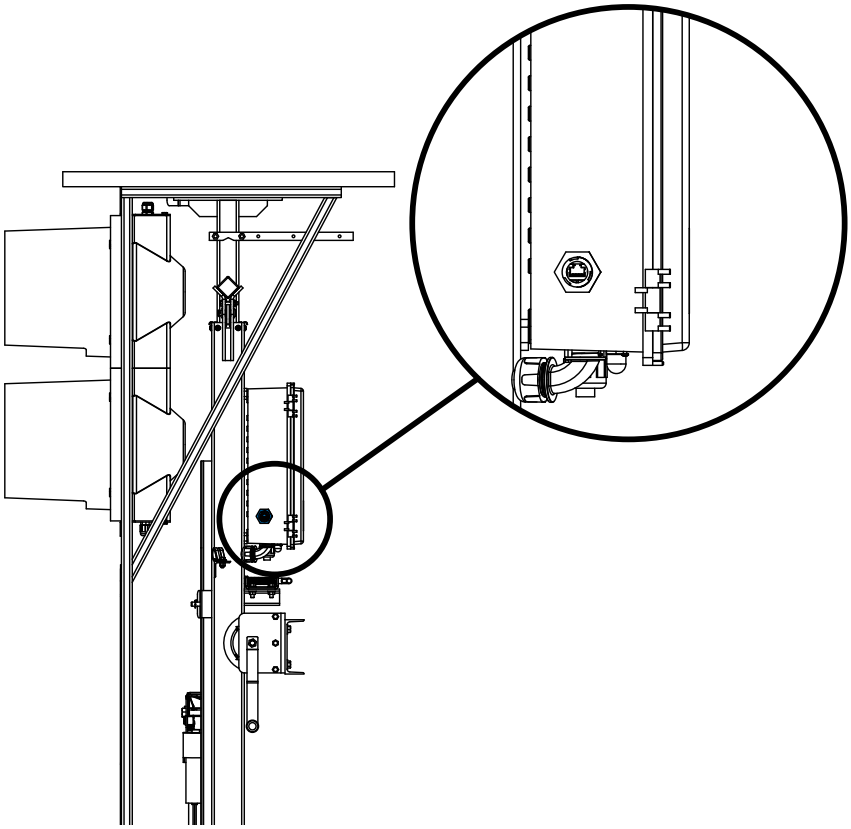
A.4 Downloading video

Downloading video files from the camera requires a direct connection from the AFAD to a Windows®–based laptop or desktop computer. It also requires the use of a standard CAT-5 or CAT-6 Ethernet cable.

The camera must be powered on for this procedure (see Section A.2, page 92). Once the camera is on, follow these steps:

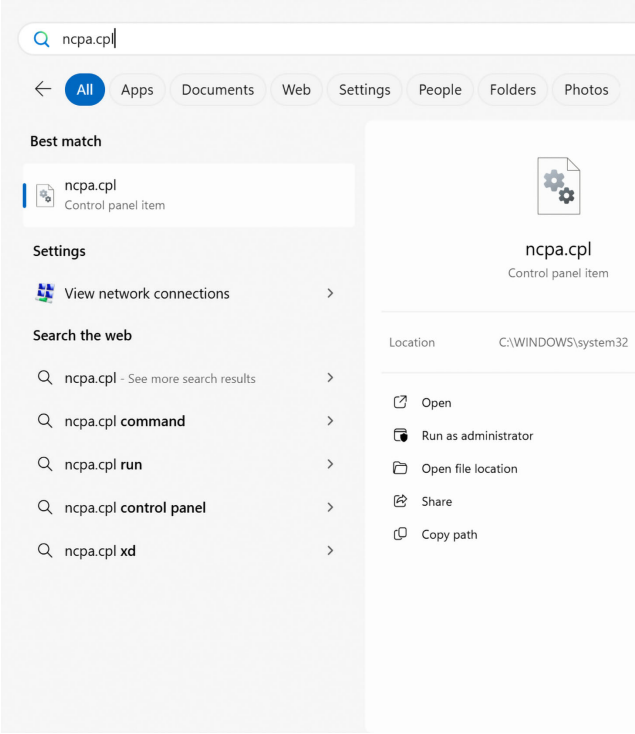
1. Locate the RJ45 (Ethernet) port on the side of the AFAD control box (see Figure A-7).

Figure A-7. Ethernet port location - control box



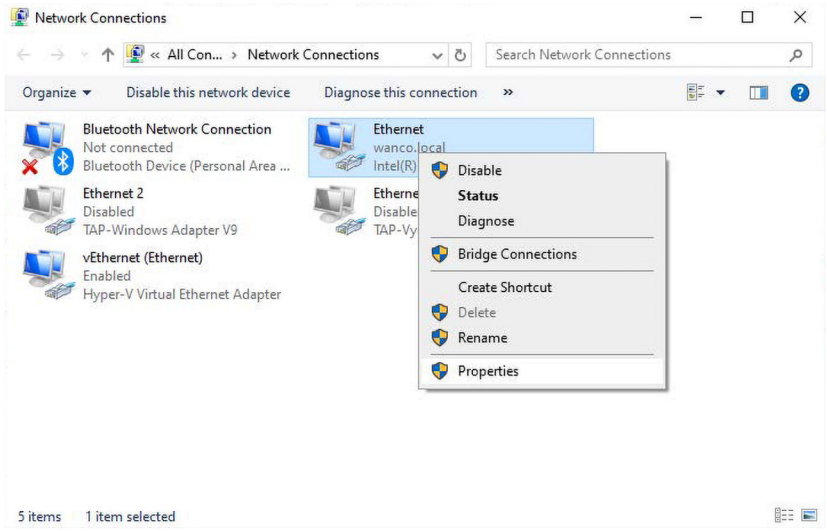
2. Remove the dust cap from the port to expose the RJ45 jack.
3. Plug a standard CAT-5 or CAT-6 Ethernet cable into the jack, and plug the other end into the RJ45 jack of a Windows-based computer.
4. On the computer, open the Windows menu, and type “ncpa.cpl” into the search bar, and press **ENTER**. See Figure A-8.

Figure A-8. Windows® search results



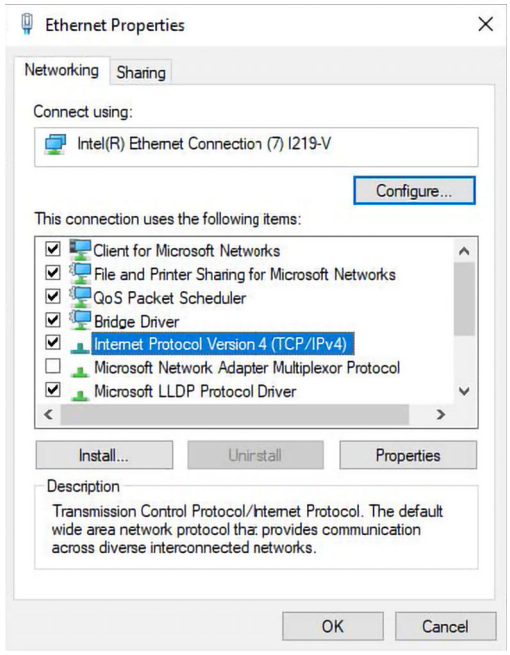
5. In the Network Connections window (Figure A-9), locate the network adapter that the Ethernet cable is plugged into, right-click it, and then click to open Properties.

Figure A-9. Network Connections



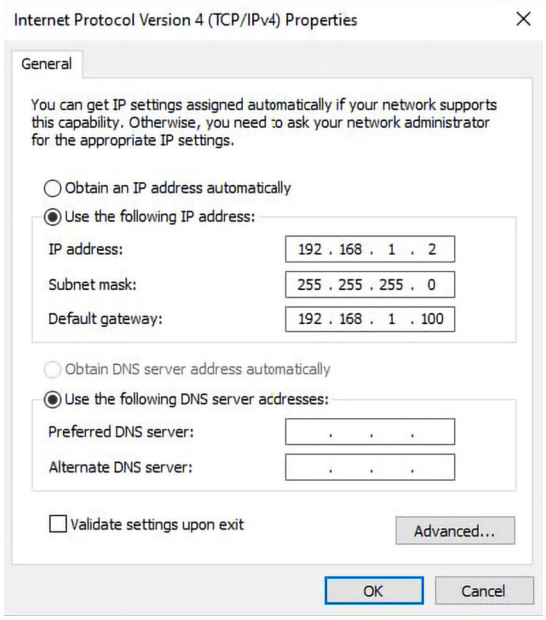
6. In the Ethernet Properties window, click "Internet Protocol Version 4 (TCP/IPv4)" to select it, and then click the **PROPERTIES** button. See Figure A-10.

Figure A-10. Ethernet Properties



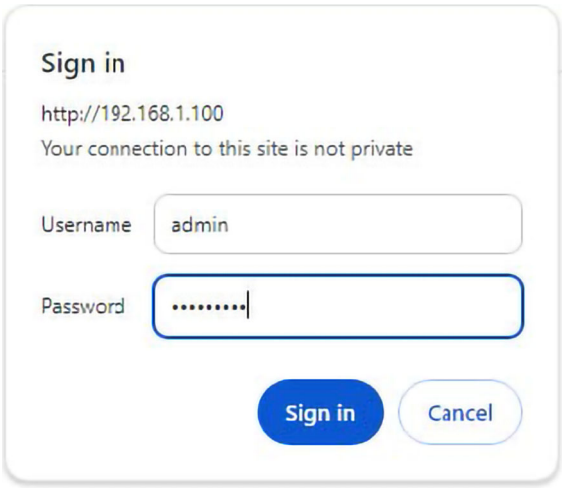
7. When the TCP/IPv4 properties window appears (see Figure A-11), record the information shown. You will need all of it later in this procedure. Write the information down or, to ensure accuracy, take a screenshot or photo of the screen.
8. Select "Use the following IP address" and enter the following information (see Figure A-11):
   - IP address: 192.168.1.2
   - Subnet mask: 255.255.255.0
   - Default gateway: 192.168.1.100

Figure A-11. TCP/IPv4 properties



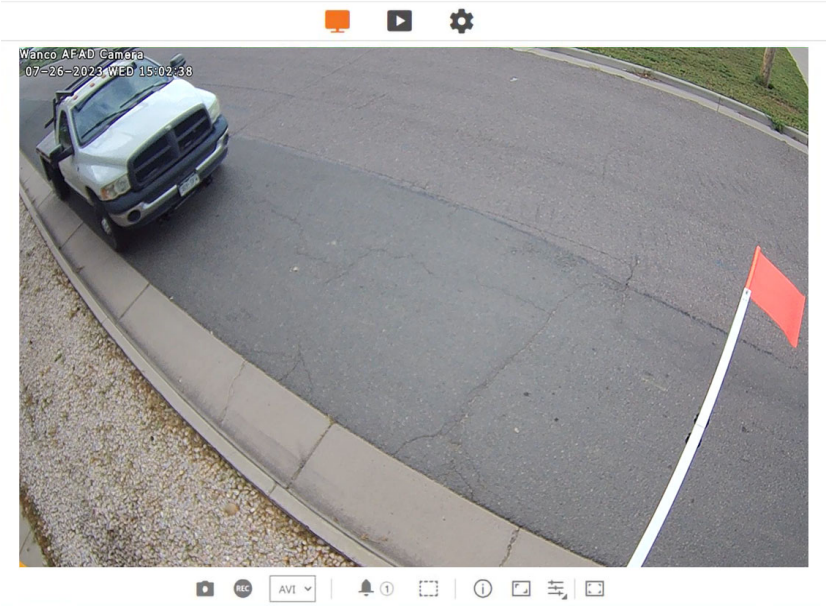
9. Click **OK**, then click **CLOSE**.
10. Open a web browser, type "192.168.1.100" into the address bar, and press **ENTER**.
11. The camera login screen appears (see Figure A-12, page 100).

Figure A-12. Camera login screen



12. Type the username as “admin”, enter the password*, then click **SIGN IN**.
13. The main camera screen appears (see Figure A-13).

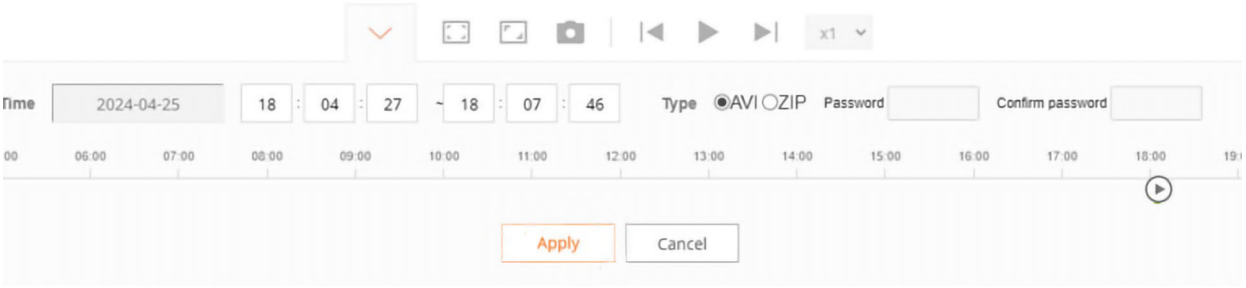
Figure A-13. Main camera screen



14. Click the button to go to the Playback screen.
15. Click the **EXPORT** button to open the Export menu (see Figure A-14).

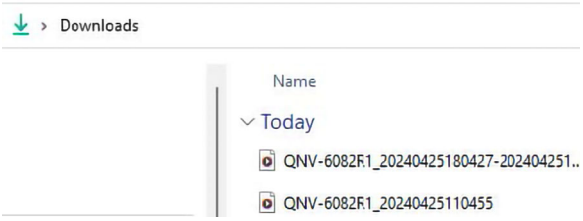
*To help ensure security, the admin password is not included in this document. Contact your supervisor or the AFAD owner for the correct password, or consult the factory for the initial, factory-set password.

Figure A-14. Export menu



16. Click the **APPLY** button to download all video files to your computer's Downloads folder (see Figure A-15).

Figure A-15. Downloaded files



17. Repeat Steps 4 through 6 to access the TCP/IPv4 properties.
18. Change the TCP/IPv4 information back to the way it was, using the information you copied in Step 7.
19. Click **OK**, then click **CLOSE**.
20. Remove the CAT-5 Ethernet cable from the AFAD control box and reinstall the dust cap to protect the RJ45 jack.

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