

ROADQUAKE™ **RAPTOR™**

ROVER™

TPRS HANDLING MACHINE TRAILER

— OPERATORS MANUAL —

SCAN FOR
A DIGITAL
COPY OF THIS
MANUAL.



CONTACT:

Call 800.662.6338 to talk to a Customer Service Representative.

HOURS:

8 AM to 5 PM (E.T.)
Monday through Friday



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1.1 – ROVER INTRODUCTION

The introduction of RAPTOR™ Rumble Strip Handling Machine revolutionized the deployment, realignment, and retrieval of RoadQuake2F™ Temporary Portable Rumble Strips (TPRS). By keeping workers out of live traffic, the use of RoadQuake2F TPRS was easier and safer than ever before. To make RAPTOR more accessible, pss designed the dedicated transport RAPTOR trailer, the Rover™.

RAPTOR Rover is designed specifically for the transport of RAPTOR and mounts to the back of the operating vehicle rather than the front. Instead of requiring a 3,000 lb front-end capacity truck, RAPTOR Rover allows for a pickup truck (half ton or greater) to be used with RAPTOR through Rover. RAPTORs mounted on Rover use the same remote control and monitor feed functions as the original RAPTOR.

With RAPTOR Rover, more work vehicles are now compatible for automated TPRS use, protecting your crew and making their work more efficient. This manual will cover proper operations and maintenance of both RAPTOR and Rover trailer. Proper maintenance operations are required as preventative measures to preserve the reliability of RAPTOR.

1.2 – ROVER OPERATOR REQUIREMENTS

All ROVER operators shall:

- » Be trained in RAPTOR and Rover operations.
- » Ensure the regular maintenance of Rover.
- » Avoid all hazards that could cause injury or damage.

Please contact our technical support department with any further questions at 800-662-6338.

1.3 – ROVER TOWING REQUIREMENTS

Rover is an auxiliary device exclusively designed for RAPTOR to expand fleet compatibility. As opposed to vehicle requirements for a RAPTOR mounted directly to a vehicle, Rover requires a vehicle capable of towing 6,000 lbs, 650 lbs tongue weight, and 5,320 lbs axel weight.

1.4 – ROVER WARRANTY

Rover is equipped with one year warranty against defects in workmanship or material, excluding wear items such as tires, breaks, wheel bearings.



Sect. 02 ROVER PART IDENTIFICATION

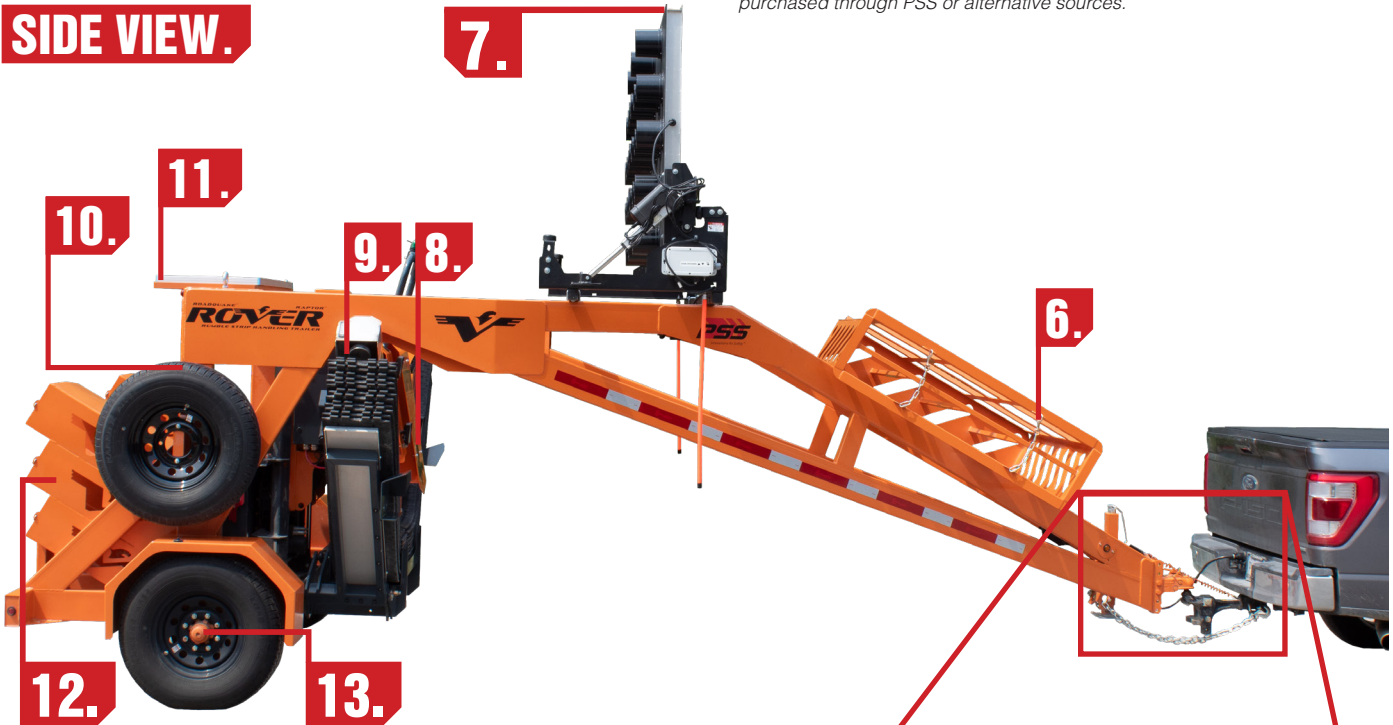
2.1 – ROVER PARTS OVERVIEW

Use this mode to transport RAPTOR to and from job sites.

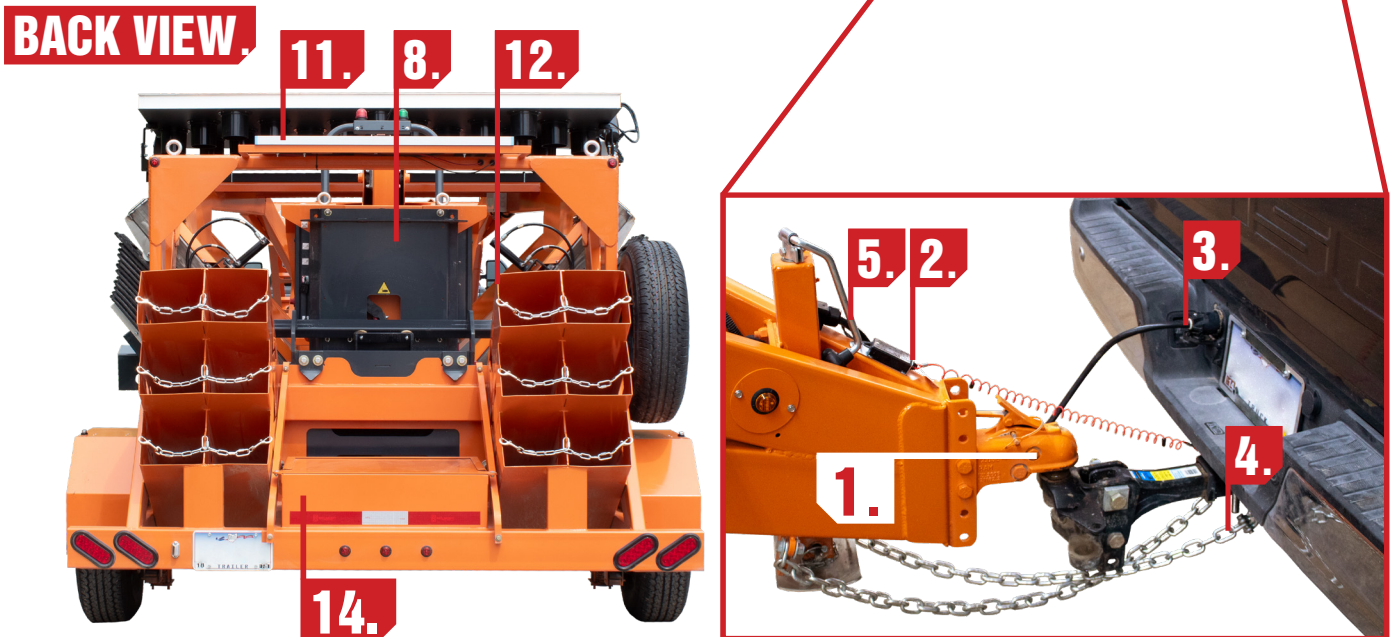
- 1. Ball Coupler
- 2. Trailer Emergency Brake
- 3. Trailer to Truck Electrical Connection
- 4. Safety Chains
- 5. Trailer Jack
- 6. Sign Storage
- 7. Arrow Board (if equipped)*
- 8. RAPTOR Rumble Strip Handling Machine
- 9. RoadQuake2F TPRS
- 10. Spare Tire
- 11. Solar Panel
- 12. Sign Stand Holder
- 13. Axle
- 14. Battery Box

*Arrow board and controls may be different depending if the arrow board was purchased through PSS or alternative sources.

SIDE VIEW.



BACK VIEW.



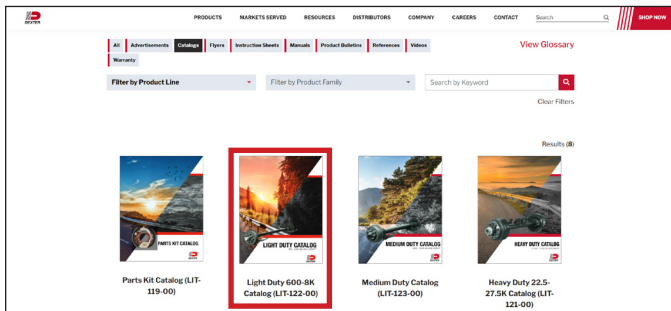
3.1 – PRE-TRIP SAFETY CHECKS

- » Verify Tire Pressure (80-95 psi).
- » Verify electric brakes are functioning.
- » Verify Trailer Emergency Brake is functioning by removing the tether from the receptacle. There is a separate battery for this function.
- » Verify trailer lighting is functioning.
- » Check / Re-Torque Lug Nuts (120-140 Ft/lb) at 25 / 50 / 500 miles.
- » Inspect the frame for any damage. If the frame's integrity is compromised, immediately stop using Rover and contact PSS.

▲ NOTICE NOTICE ▲
For pre-trip safety check, please repeat bullets 1-4 in the list above.

3.2 – AXLE / BREAK MAINTENANCE

Your Rover trailer is equipped with a Dexter® 7,000 Axle. Follow the manufacturer's maintenance recommendations - [LDSERVICEONLINE.PDF](https://www.dexteraxle.com) ([dexteraxle.com](https://www.dexteraxle.com)).

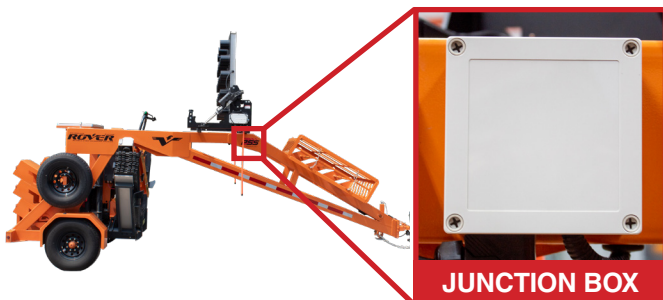


3.3 – MANUFACTURER OPTIONAL ARROW BOARD

All Rovers come pre-wired with 12 VDC power run to a junction box on the upper passengers side frame rail.

Arrow boards are an optional feature on Rover that can be purchased with Rover through PSS or user installed. All arrow boards purchased through PSS are manufactured by Vermac. If installing an aftermarket arrow board, please follow the manufacturer's installation instructions.

Rovers in a work zone without an arrowboard may need to be equipped with a strobe light kit. Consult your local DOT regulations prior to use.



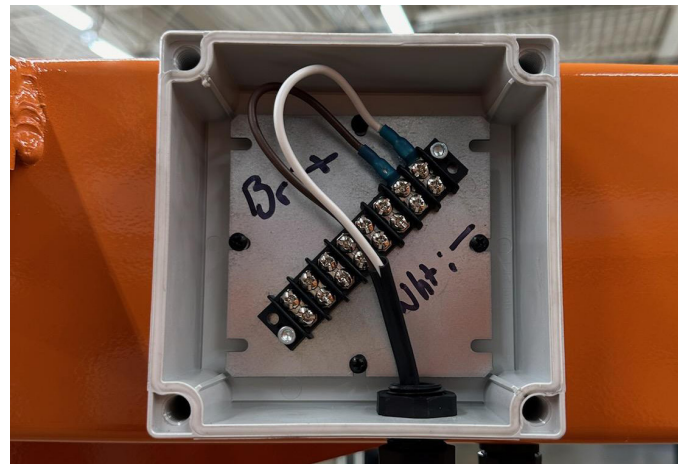
3.4 – AFTERMARKET ARROW BOARD MOUNTING

For aftermarket arrow board additions, follow the manufacturer mounting recommendations.



When mounting an aftermarket arrow board, verify it is mounted far enough forward in its lowered position to avoid colliding with the RAPTOR Arm as it extends during use.

Connect power at the junction box per manufactures recommendations.

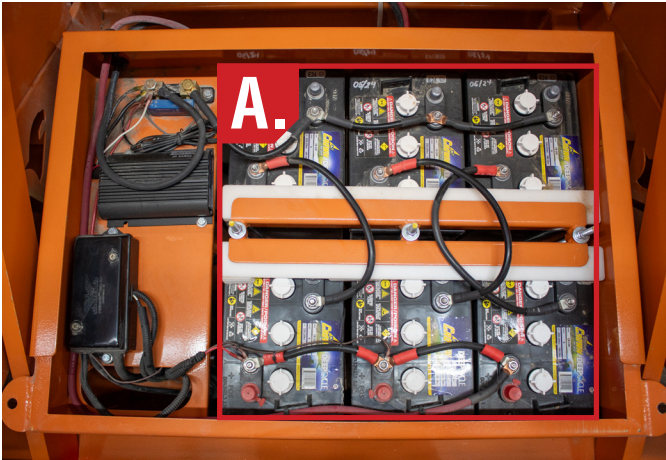


▲ NOTICE NOTICE ▲

RAPTOR wireless remote frequencies can interfere with the wireless arrow board remote. Move the arrow board up or down, then use RAPTOR. Only have one remote powered at a time.

Sect. 04 ROVER POWER INFORMATION

4.1 – ROVER POWER SUPPLY



The Rover Trailer comes equipped with six VDC batteries (A) to supply 12 VDC power to the RAPTOR and the Arrow Board.



All of the power runs through a Victron SmartShunt Battery Monitor (B). The SmartShunt monitors power going in and out of the battery system.

The Trailer comes equipped with a RedArc In-Vehicle BCDC Battery Charger (C). This RedArc device controls incoming voltage to the battery system. Prioritize solar power charging before putting a load on the tow vehicles charging system.

4.2 – VICTRONCONNECT APP

There is an app called VictronConnect which allows you to monitor power usage and charging. You may have to open the battery box for Bluetooth to successfully connect.



The Rover's batteries are charged from either the supplied 100-watt solar panel or direct from the tow vehicle's charging system.

Keep the surface of the solar panel clean for maximum solar efficiency.

The Rover's batteries require maintenance. Monitor the water level and maintain as required using distilled water.

5.1 – ROVER LOADING AND BALANCE

The Rover is designed exclusively to haul the RAPTOR Rumble Strip Handling Machine with 12 RoadQuake2F Rumble Strips and 12 signs and Sign Stands. Do not use these compartments for storage of any other materials.

5.2 – ROVER SIGN AND STAND STORAGE

Rover is equipped with onboard storage compartments at the front and back of the trailer for roll up signs and their accompanying stands (sometimes referred to as folding signs). These compartments are designed exclusively for sign and stand storage, do not use them for any other purpose.



The storage cubicles (A) mounted on the back of Rover are equipped to hold 12 sign stands. Do not attempt to over-fill these compartments or exceed 500 lbs behind the axle as this will disturb Rover's center of gravity and create instability.

The sign storage (B) mounted on the front of Rover are equipped to hold up to 250 lbs of assembled fabric sign. Do not attempt to over-fill these compartments or exceed 250 lbs behind the axle as this will disturb Rover's center of gravity and create instability.

When signs and stands are loaded in these compartments, ensure that all fastener chains are attached to hold materials safely in place during transport.

5.3 – HOST VEHICLE REQUIREMENTS

The Rover's host vehicle must have a towing capacity of 5,500 lbs or greater.

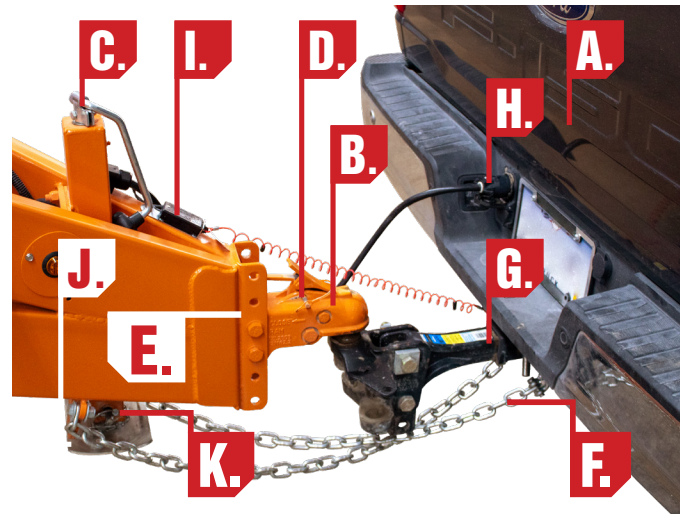
The tongue weight for Rover can reach up to 800 lbs and varies based on how much weight is in either sign storage compartment.

The weight behind the axle is dependant on sign stand quantity and weight. The weight in front of the axle is dependant on sign quantity, arrow board, and trailer lighting.

The Rover is equipped with the required DOT lighting. Before each use, verify lights are working properly.



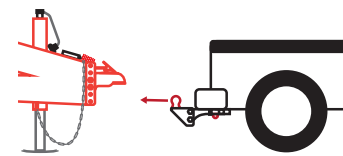
5.4 – ROVER HITCH IDENTIFICATION



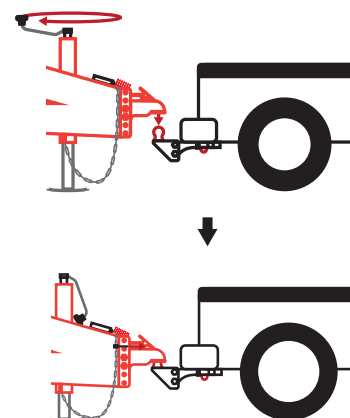
- A. Tow Vehicle using a 2 5/16" Ball
- B. Ball Coupler
- C. Rover Jack
- D. Coupler Locking Pin
- E. Rover Adjustable Coupler Height
- F. Safety Chains
- G. Truck's Receiver
- H. Standard Seven Blade Electrical Connector
- I. Emergency Brake Tether
- J. Jack Foot Plate
- K. Rover Jack Safety Pin

5.5 – HITCHING ROVER TO VEHICLE

1. Position the truck so that the Tow Vehicle using a 2 5/16" Ball (A) is under the receiving Ball Coupler (B).



2. Lower the trailer on the 2 5/16" Ball (A) using the Hand Crank (C). Latch the coupler and insert the Coupler Locking Pin (D).

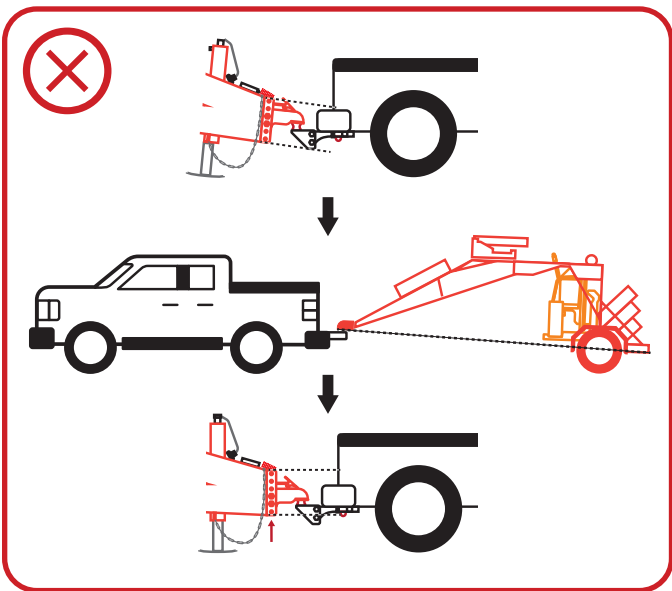
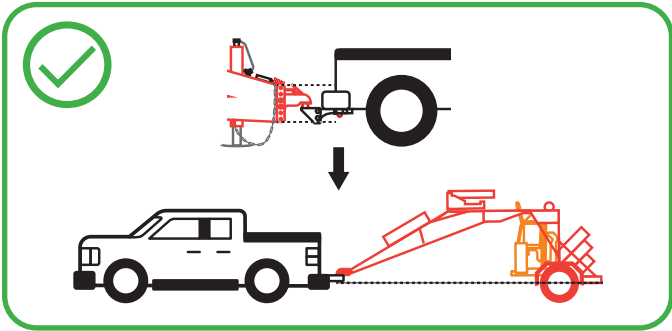


5.5 – HITCHING ROVER TO VEHICLE (CON'T)

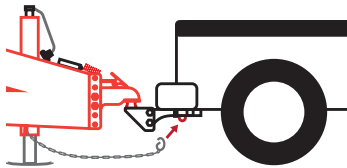
3. Verify that the Rover is riding level with the host vehicle. If Rover is not riding level, raise or lower the Rover Adjustable Couple Height (E).

⚠ WARNING WARNING ⚠

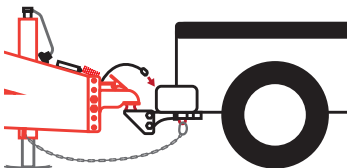
If the Rover is in a “Nose High” attitude – there is a risk that RAPTOR may not reach the ground to retrieve TPRS.



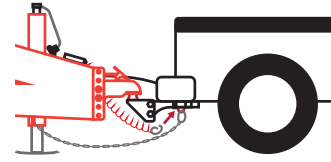
4. Connect the Safety Chains (F) to the Host Truck's Hitch (A).



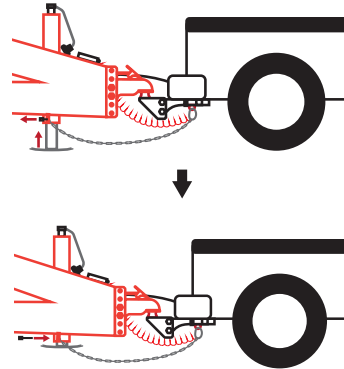
5. Connect the Standard Seven Blade Electrical Connector (H) to the Tow Vehicle (A).



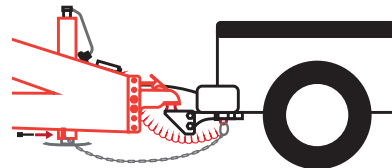
6. Connect the Emergency Brake Tether (I) to secured attachment point on the towing vehicle.



7. Pull the Safety Pin out of the Rover Jack (J). Pull the Rover Jack Foot up and put the Rover Jack Safety Pin (K) in to hold it in place.



8. Visually inspect that the Rover has been properly hitched following steps 2-7 above.



6.1 – MOUNTING RAPTOR WARNINGS

⚠ WARNING WARNING ⚠

A ceiling crane (minimum of 3 Tons) or mechanism to lift the Rover frame is required for this operation.



Construct a support stand to hold RAPTOR approximately 20" off of the ground. A wheeled cart is preferred, with castering wheels.

**⚠ WARNING WARNING ⚠**

Never have TPRS in the RAPTOR while installing or removing RAPTOR From Rover.

⚠ WARNING WARNING ⚠

Never Lift RAPTOR by the lifting eyes on its shoulders. Only lift RAPTOR with a forklift on the forklift support.

**⚠ WARNING WARNING ⚠**

Do not lift the trailer frame while the trailer jack is on the ground – the trailer jack will not withstand the side loading. Have the trailer hitched to a truck - the truck may need to be in neutral to allow it to roll as the trailer frame is lifted.



6.2 – POST-PURCHASE RAPTOR MODIFICATIONS

Rover is reverse compatible with wall RAPTOR models. Customers should consult with PSS to confirm if the remote of the RAPTOR being mounted needs to be updated to function with Rover. Please call PSS as 800-662-6338.

Any RAPTORS that were not sold pre-mounted to a Rover will need the following modifications:

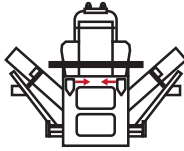
- » The wireless Remote control will need to be returned to PSS to be reprogrammed to transmit with more power.
- » Lateral movement stops will need to be added to limit the lateral movement of RAPTOR.
- » The headlights and guide markers on the wings of RAPTOR will need to be removed.

6.3 – MOUNTING RAPTOR ONTO EMPTY ROVER

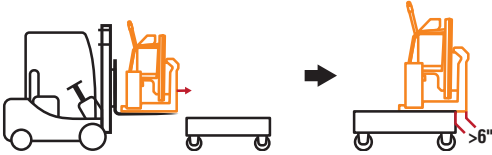
RAPTOR

ROVER

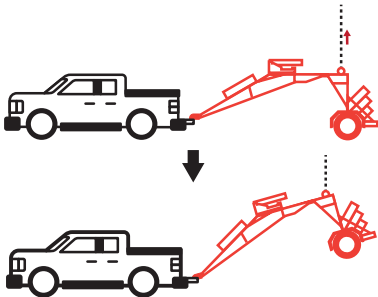
1. Adjust the RAPTORS Mounting Hooks to the farthest inboard position in the mounting slots. This will allow the RAPTOR to “center” on the DIN Plate mounted to the Trailer Frame.



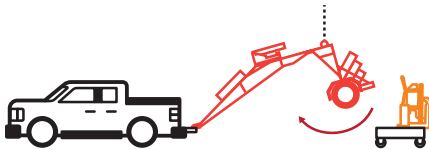
2. Position RAPTOR on the wheeled cart – with the back side of RAPTOR over hanging the cart at least 6” to clear the trailers axle. Caution – RAPTOR may be unstable in this position.



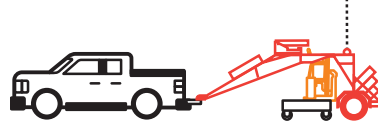
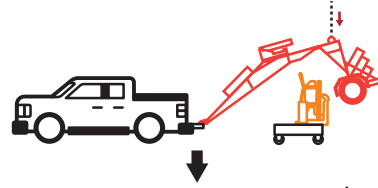
3. Using the ceiling crane, lift the Trailer Frame using the Lifting eyes on the rear of the upper frame rails.



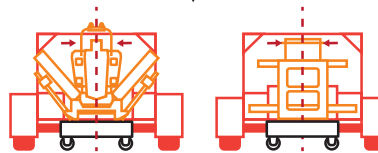
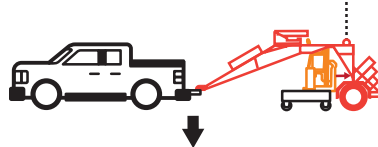
4. Lift the trailer frame high enough to roll RAPTOR (on the cart) under the frame rails of the trailer.



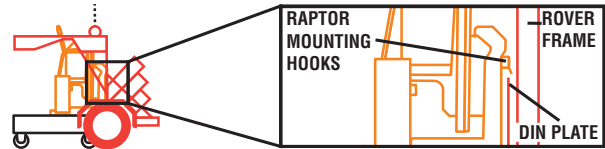
5. Lower the trailer frame to the ground. Being careful not to hit the RAPTOR.



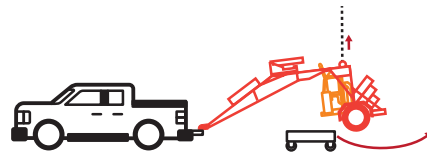
6. Using the wheeled cart – Center RAPTOR on the DIN Plate. Use caution – there isn't much room in-between the trailer frame and the RAPTORS Lateral Movement guide rail.



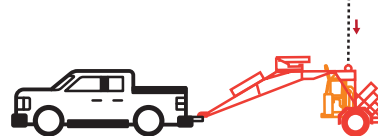
7. Push The RAPTORS Frame up against the trailers DIN Plate. The RAPTORS Mounting Hooks should be overhanging the DIN Plate.



8. Lift the Trailer Frame – making sure RAPTOR remains centered $\pm 1/4$ ” until the trailer frame picks up the RAPTOR off of the wheeled cart. Remove the cart.

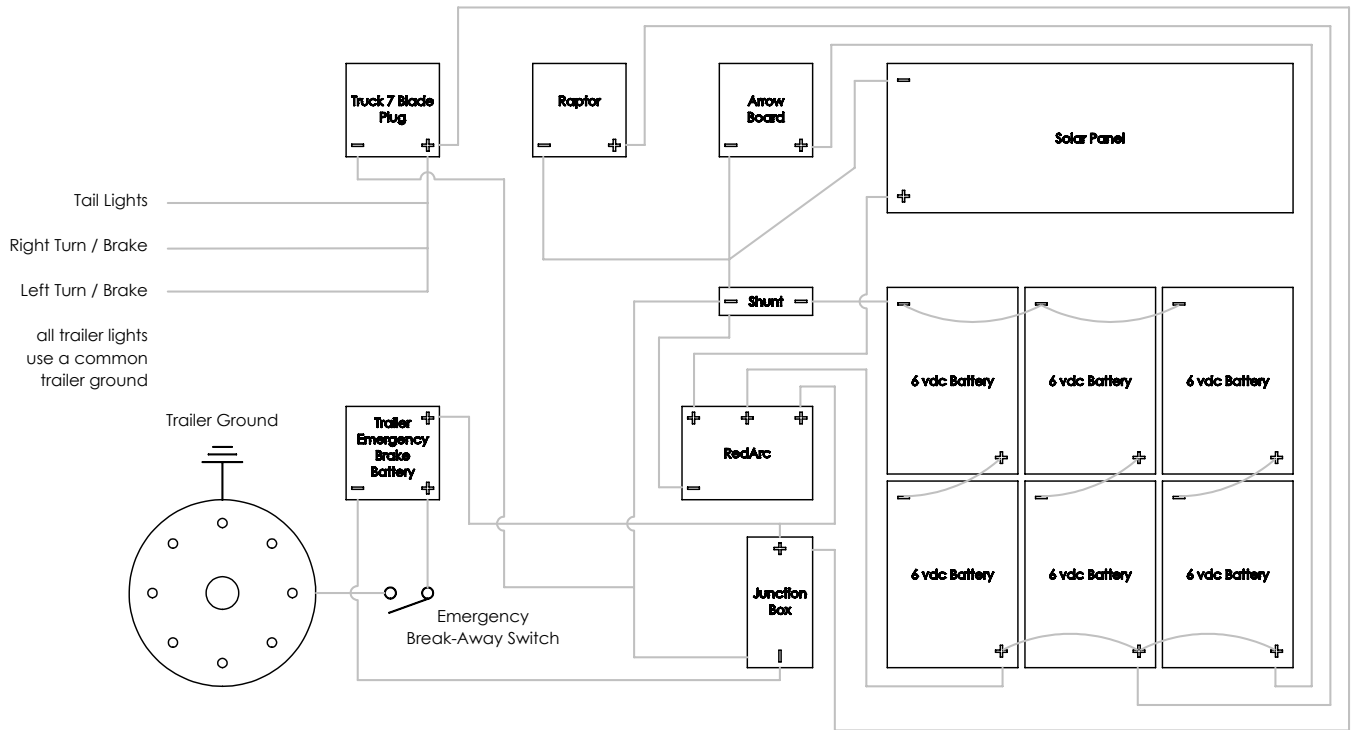


9. Lower the trailer frame to the ground.



10. Rotate the RAPTORS Swivel Bolts through the Slots in the DIN Plate and tighten the nuts. Connect the 12 VDC power to RAPTOR.

7.1 – ELECTRICAL SCHEMATIC



8.1 – SAFETY INSTRUCTIONS & HAZARD WARNINGS**DANGER****DANGER****DANGER**

Severe injury or death may result if instructions are not followed.

**WARNING****WARNING**

Follow instructions carefully. Serious damage to equipment may result if instructions are not followed properly.

INSTRUCTIONS

Follow these instructions to work safely and effectively. Keep these instructions available with RAPTOR™. These instructions must be followed.

8.2 – ADDITIONAL SAFETY INSTRUCTIONS, TRANSPORT AND HANDLING

- » When not attached to a truck, move RAPTOR with a forklift. Do not attempt to move RAPTOR manually.
- » Place forklift forks under RAPTOR's frame, as indicated with "Lift Here" stickers.
- » Set the machine on a firm, level and stable surface only.

INSTALLATION

- » Only trained operators should install RAPTOR onto the user's truck.
- » Only trained operators should load RoadQuake™ 2F Temporary Portable Rumble Strip (TPRS)* onto RAPTOR once operators have installed RAPTOR onto truck.

GETTING STARTED

- » Inspect RAPTOR for damaged parts before every use. Conduct a test of all functions before every use.
- » Use only if RAPTOR's safety and protective systems are in good working order.
- » Report any damage or malfunctions to the proper personnel.
- » After work, secure RAPTOR against any unintended or unauthorized use.
- » Use RAPTOR only for its intended purpose.

STORAGE

- » Clean and store RAPTOR in a dry area, free of debris.
- » If storing RAPTOR for long periods of time: RAPTOR's wings may open partially, especially if the tray contains RoadQuake2F. Store RAPTOR in a location in which the wings can freely open, without obstruction. Or, use restraints on the upper ends of the wings to maintain RAPTOR in Transport Mode.

*Some states may use other acronyms, like PRS, PTRS, or RS, to identify RoadQuake™ Temporary Portable Rumble Strips.

Picture courtesy of Pennsylvania Department of Transportation

**1.3 – MECHANICAL HAZARDS****DANGER****DANGER****DANGER****MECHANICAL HAZARD****DANGER! INJURIES MAY RESULT FROM**

- » Moving parts.
- » Pinch points.
- » High pressure hydraulics.
- » Maintain distance from moving parts.
- » Do not perform work on a moving machine.

8.3.1 – ELECTRICAL HAZARDS

Only trained personnel should perform work on RAPTOR's electrical components.

DANGER**DANGER****DANGER****ELECTRICAL HAZARD****INJURIES: DANGER! ELECTROCUTION, ELECTRICAL SHOCK OR BURNS CAUSED BY**

- » Direct contact.
- » Defective insulation.
- » Faulty maintenance or repairs.

CAUSES

- » Contact with uninsulated or live wires.
- » Use of uninsulated tools.
- » Inadequate inspection after maintenance work.
- » Circuit breaker failure.

SAFETY ADVISORY

- » Before performing any maintenance, ensure RAPTOR is completely powered off.
- » Inspect electrical equipment at regular intervals.
- » Replace damaged cables immediately.
- » Always replace blown fuses.
- » Avoid contact with energized components.
- » Use only insulated tools.



8.3.2 – NEODYMIUM MAGNET HAZARDS

PACEMAKERS

- » Magnets may interfere with pacemakers and implanted cardiac defibrillators.

MAGNETIC FIELDS

- » May damage devices such as cellular phones, laptops, disk drives, payment cards, data storage devices, watches, hearing aids, and speakers.



8.3.3 – NOISE LEVEL

Because the noise level of the machine is well below 70 decibels (dB), no hearing protection is required.

8.4 – PROPER USE

RAPTOR is designed exclusively for the transport, deployment, and retrieval of RoadQuake™ Temporary Portable Rumble Strips (TPRS); improper use is prohibited.

EXAMPLES OF IMPROPER USE INCLUDE:

- » Deployment / removal of other objects.
- » Carrying objects other than RoadQuake™ TPRS.

8.5 – DUTY CYCLE

⚠ WARNING WARNING ⚠

RAPTOR is rated up to 24 continuous cycles. A cycle is one deployment or retrieval of RQ TPRS. RAPTOR must have a 30 minute rest interval to allow the hydraulic pump to cool down

8.6 – PROPER LIFTING OF RAPTOR

Use a forklift to attach or remove RAPTOR from the the host vehicle. Set forklifts at the center and bottom of RAPTOR, where designated by "Lift Here" labels. (See page 16 for location.)

DO NOT:

- » Set forklifts in any other place on RAPTOR.
- » Deploy any other lifting device.
- » Use eyelet bolts, located on top of mast of RAPTOR, to lift RAPTOR.

8.7 – WARRANTY

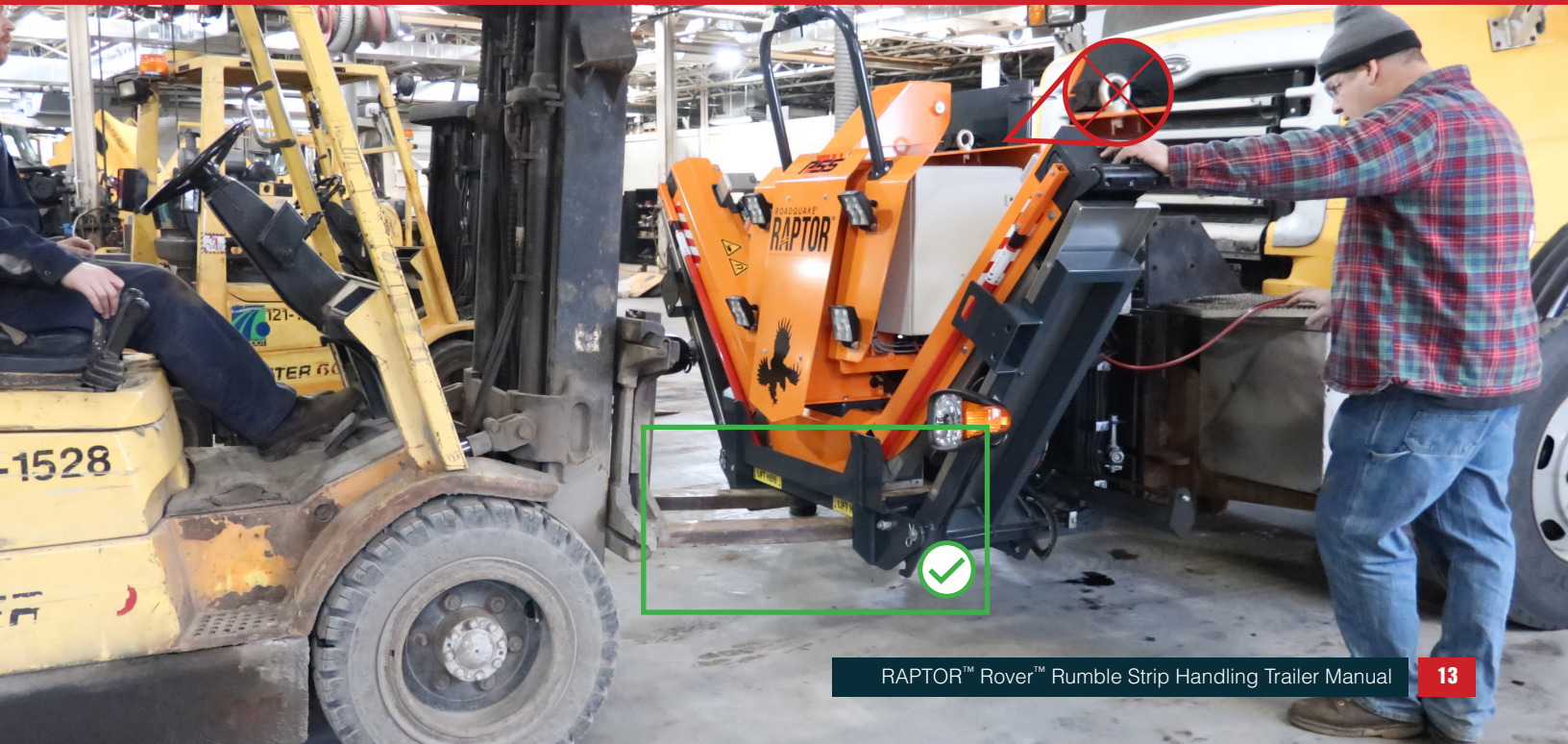
RAPTOR RSHMs sold by PSS are warranted by PSS to be free from defects in material and workmanship for one (1) years from the date of shipment. PSS's warranty does not cover, and PSS makes no warranty with respect to, any defect, failure, or deficiency that is:

1. Not reported to PSS in the applicable warranty period.
2. Due to misapplication, modification, disassembly, abuse, isuse, improper maintenance or abnormal conditions.
3. Due to operation either intentional or otherwise, above rated capacities or in an otherwise improper manner. Please refer to this Manual for further guidance.

For more information, please contact PSS at 800-662-6338.

*Picture courtesy of Pennsylvania Department of Transportation

DO NOT LIFT RAPTOR BY THE EYELETS. ALWAYS USE A FORKLIFT TO LIFT RAPTOR.



Sect. 09 RAPTOR INTRODUCTION

9.1 – INTRODUCTION

Welcome to the PSS instruction manual for RoadQuake™ RAPTOR™ Rumble Strip Handling Machine.

In this manual, we will discuss RAPTOR's basic features and functions, how it works, and how to troubleshoot and maintain the device. We have also included all necessary parts lists and schematic drawings.

9.2 – TO RAPTOR OPERATORS

All RAPTOR operators shall:

- » Be trained in RAPTOR operations.
- » Ensure the regular maintenance of RAPTOR.
- » Avoid all hazards that could cause injury or damage.

Please contact our technical support department with any further questions at 800-662-6338.

9.3 – FUNCTIONS OF RAPTOR

In the images to the right, RAPTOR simulates deployment of RQ TPRS:

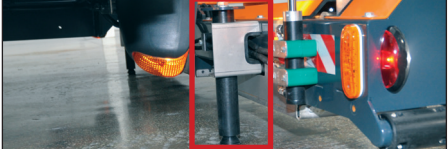



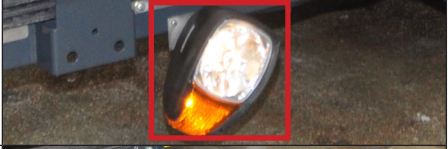



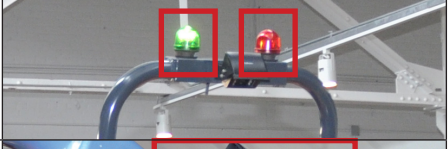


1. Magnet bar lifts one RQ TRPS from TPRS tray to deploy on road surface.
2. RAPTOR arm extends out from TPRS tray.
3. Arm lowers to deployment location of RQ TPRS.
4. Magnet bar releases RQ TPRS at installation location.

To deploy more strips, return RAPTOR arm to TPRS tray. Lift another strip for installation, repeat until installation is complete.

To retrieve TPRS strips from the roadway, repeat these steps in reverse order.



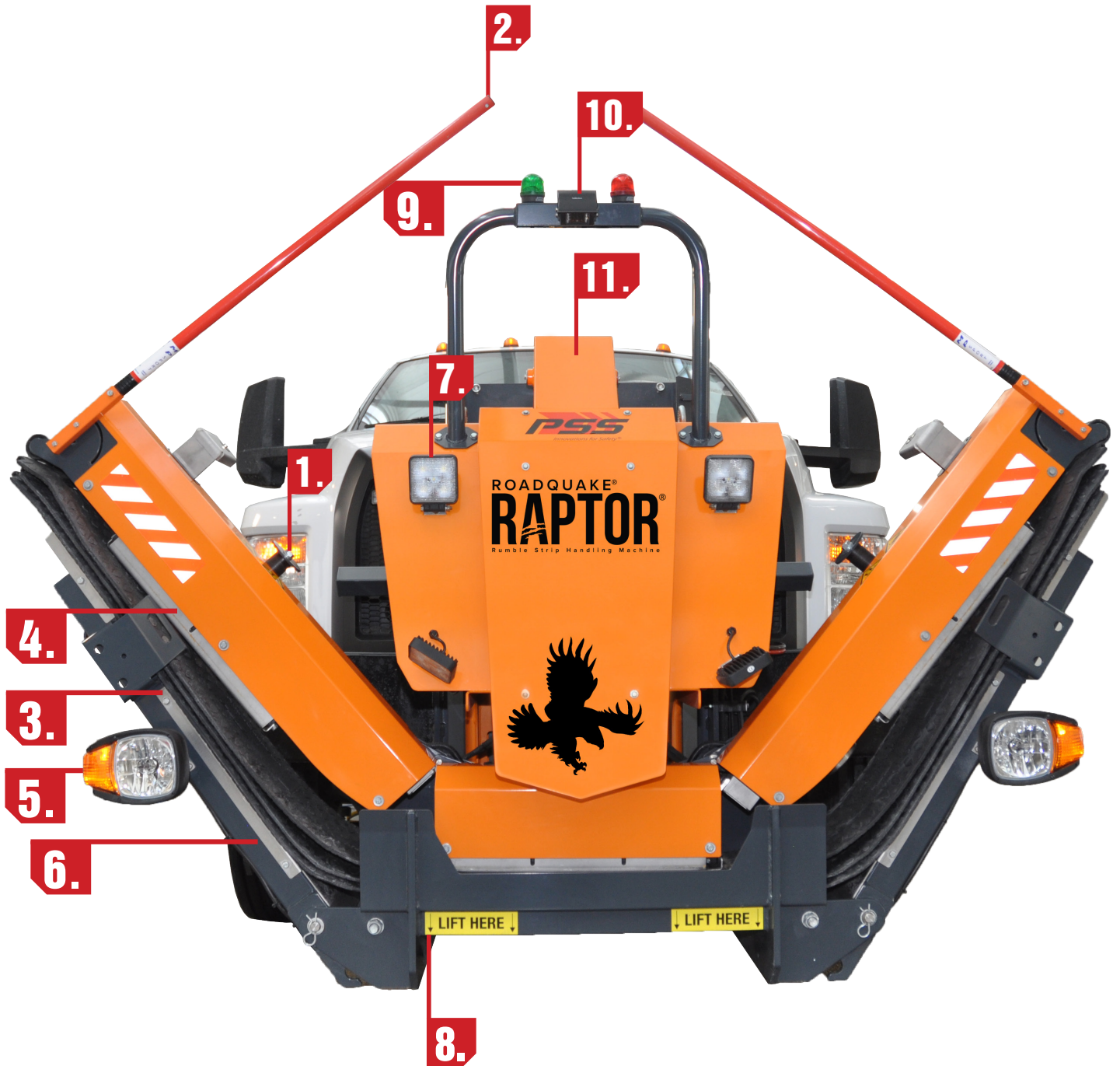
10.1 – RAPTOR KEY COMPONENTS

NUM	PIECE NAME	DESCRIPTION	IMAGE
1	Alignment Rod	Component on each wing allows for the realignment of RQ TPRS.	
2	Guide Markers	Component on each wing showing the user the width of RAPTOR	
3	TPRS Tray	Housing location of RQ TPRS within RAPTOR.	
4	Magnet Bar	Component that allows for deployment or retrieval of RQ TPRS and is comprised of eight neodymium magnets.	
5	Auxiliary Headlights	Component on each wing allows for headlight functionality when host vehicle's headlights are obstructed by RAPTOR.	
6	RoadQuake Temporary Portable Rumble Strips	RAPTOR allows for the deployment, realignment, and retrieval RQ TPRS.	
7	Work Lights	Provides additional lighting while working in low light conditions and is comprised of four lights on the mast.	
8	Forklift Support	Structural support designed for lifting with a forklift.	
9	Indicator Lights (Red and Green)	Two components mounted to the forward-facing camera loop indicating functionality. For more information, see page 25.	
10	Forward-Facing Camera	Component shows the approach to deployment area or an array previously deployed.	
11	Downward-Facing Camera	Component shows the realignment or retrieval of an RQ TPRS.	

10.2 – RAPTOR IN TRANSPORT MODE (WINGS UP)

Use this mode to transport RAPTOR to and from job sites.

1. Alignment Rod
2. Guide Markers
3. TPRS Tray
4. Magnet Bar
5. Auxiliary Headlights
6. RoadQuake™ Temporary Portable Rumble Strips (TPRS)
7. Work Lights
8. Forklift Support
9. Indicator Lights
10. Forward-Facing Camera
11. Downward-Facing Camera (inside of the arm)



10.3 – OPERATIONAL MODE (WINGS DOWN)

In Operational Mode, RAPTOR deploys, retrieves and realigns RQ TPRS.

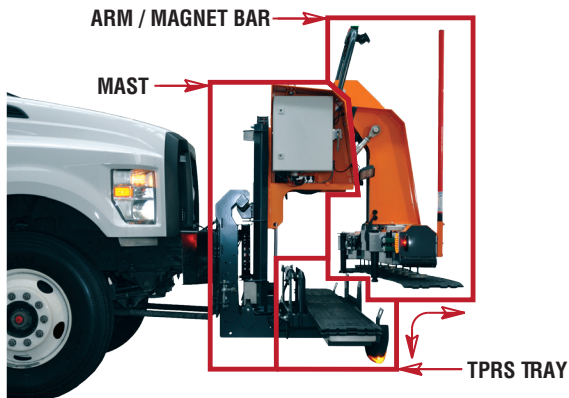
RAPTOR wings contain the magnet bar, TPRS tray and guide markers.



10.4 – OPERATIONAL MODE, SIDE VIEW

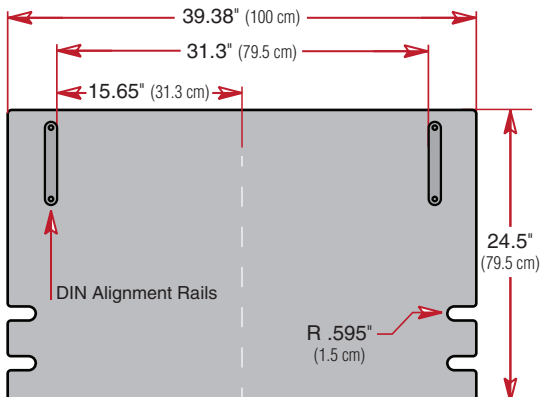
RAPTOR mast contains RAPTOR arm, which extends from the mast to deploy and retrieve RQ TPRS.

The arm features a magnet bar, comprised of eight powerful magnets that move RQ TPRS into position.



10.5 – DIN PLATE, FRONT VIEW

DIN Plate is to be made of 1/2 - 5/8" (1.3 - 1.6 cm) Hot Rolled Steel (HRS). Securely Mount to frame of host vehicle. CAD data available upon request.



10.6 – RAPTOR SPECIFICATIONS

RAPTOR SPECIFICATIONS

Brand Name	RoadQuake RAPTOR
Category	Rumble Strip Handling Machine
Function	Transports, deploys, realigns, retrieves RoadQuake 2F TPRS
Capacity	12 RoadQuake TPRS
Operating System	Electric / Self-Contained Hydraulic
Recommended Mounting Height from Road	8-12" (20-25 cm)

VEHICLE REQUIREMENTS (Provided by user)

Front Axle Load Capacity	3,000 lbs. (1,360 kg)
Power	12 VDC / 140 peak Amp
Mounting	DIN Plate

WEIGHTS

RAPTOR Weight (Empty)	1,530 lbs. (694 kg)
TPRS Individual Weight	105 lbs (48 kg)
Total Weight (TPRS & RAPTOR)	2,790 lbs. (1,266 kg)

OTHER FEATURES

Lights	2 Each Aux. Headlights 4 Each Work Lights
Guide Markers	2 each 48" L (122 cm)
Cameras	1 Forward-Facing 1 Downward-Facing
Remote Control	1 Push-Button Remote

ACCESSORIES

TPRS Spacing Measurement Device	Distance Measuring Equipment (DME not provided by PSS)
---------------------------------	--

Sect. 11 RAPTOR AND HOST VEHICLE

11.1 – SHIPMENT FROM PSS

RAPTOR ships via freight carrier, wrapped and banded to a custom pallet.

Inspect RAPTOR upon arrival. Contact PSS immediately if you discover any damage: PSS Technical Support at 800-662-6338.



11.2 – VEHICLE REQUIREMENTS & DIN PLATE

RAPTOR requires a vehicle with a minimum 3,000 lbs (1,361 km) front axle capacity.

To mount RAPTOR to a vehicle:

- » Attach a DIN* plate to the front frame rails of the vehicle. A front frame rail extension will make the DIN plate attachment easier.
- » The top of the DIN plate should be 38 in (96.5 cm) - 40 in (102 cm) above the ground when an empty RAPTOR is attached.
- » Preferably, vehicles selected for RAPTOR feature a stationary grille. The vehicle hood can then open around RAPTOR, providing access for any vehicle maintenance work, without removing RAPTOR.

For DIN Plate Dimensions, see drawing on previous page.

*DIN is an acronym for "Deutsches Institut für Normung", which means "German Institute for Standardization."

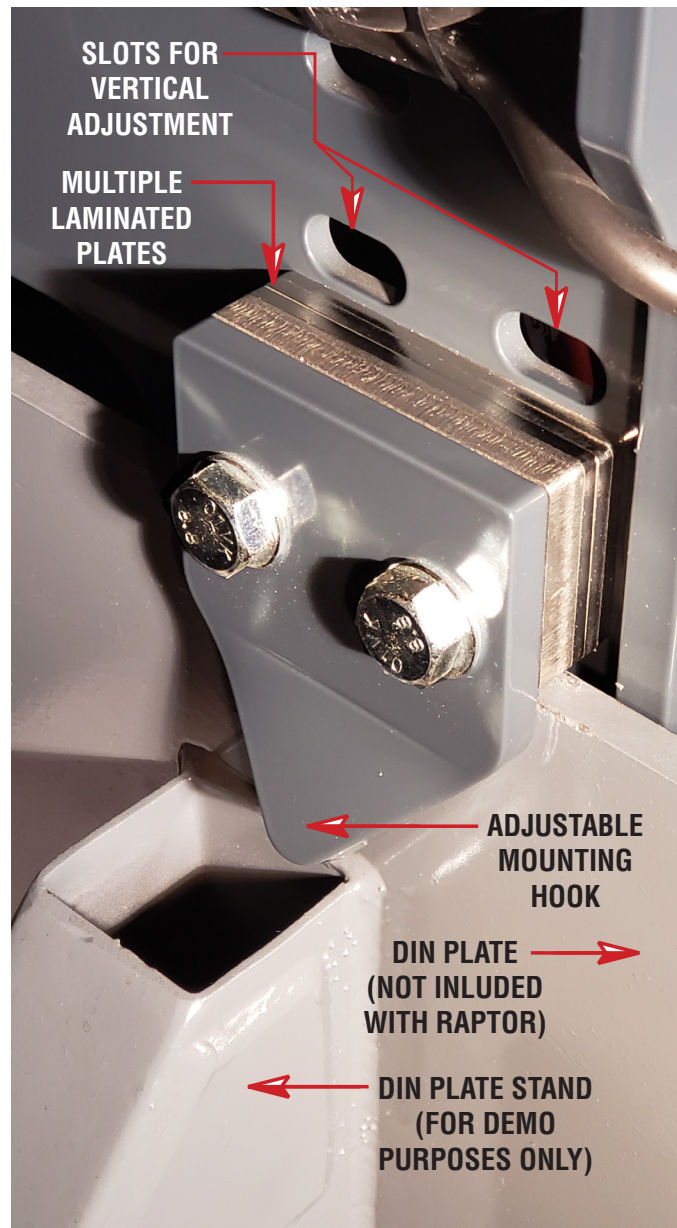
DIN Standards provide specifications for products, procedures and services worldwide.



11.3 – ADJUSTABLE MOUNTING HOOKS

Once the DIN plate is attached to the host vehicle:

- » Mount RAPTOR to top of DIN plate by the adjustable mounting hooks, located on each side on the back of RAPTOR's frame. The adjustable mounting hooks contain multiple-laminated plates to accommodate various thicknesses of DIN plates.
- » The adjustable mounting hook spacing must equal DIN plate thickness + 0.015 in to 0.032 in (0.038 cm to 0.081 cm). Use mounting hook spacers (a set of spacers is included with RAPTOR) to adjust the mounting hooks to the appropriate thickness. Use brass shims between plates if needed to achieve clearance. (Shims not supplied by PSS.)
- » Securely tighten mounting hook fasteners before attaching RAPTOR to the DIN plate. Once mounted, tighten all the connections. Routinely check connections for tightness.



11.3.1 – MOUNT RAPTOR TO DIN PLATE

Use a forklift to lift RAPTOR. Place forks where designated. For instructions, see Section 8.6.

- » Mount RAPTOR to top of DIN plate, as shown in picture on previous page. Use adjustable mounting hooks, as shown on the previous page, to achieve the correct ground clearance as shown in 10.3.2.
- » Place swivel bolts through slots on DIN plate sides to secure RAPTOR to DIN plate.
- » Once RAPTOR is mounted, tighten all connections.
- » Check connections routinely; tighten as necessary.



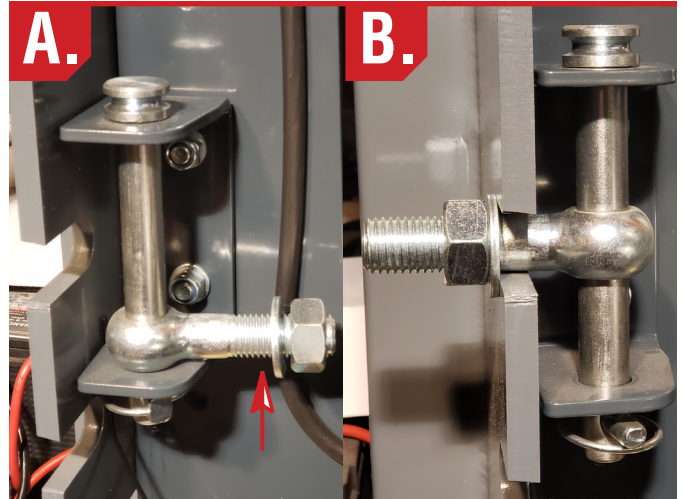
11.3.2 – APPROPRIATE MOUNTING HEIGHT

For proper use, an empty-loaded RAPTOR must maintain ground clearance between 8 in (20.32 cm) to 12 in (30.48 cm). Clearance that exceeds the maximum may prevent RAPTOR from retrieving RQ TPRS from the road surface.



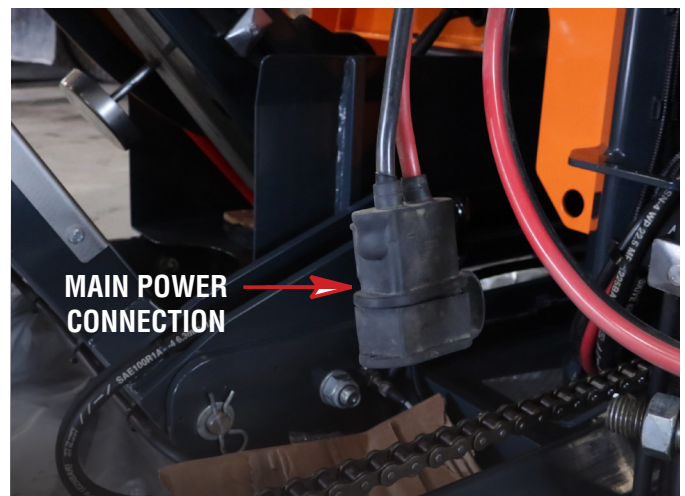
11.3.3 – ADJUSTABLE SWIVEL BOLTS

Adjust swivel bolts as necessary, by sliding the bolt up or down the pin (A.). Rotate the bolt into the slot on the DIN plate and tighten the nut (B.). If more movement is required, move the swivel bolt mounting bracket up or down on RAPTOR's frame.



11.4 – ELECTRICAL CONNECTIONS

RAPTOR operates on 12V DC power, and so requires a 12V DC electrical connection to the vehicle. RAPTOR is supplied with #2 gauge wires to accommodate the 140 peak Amps required to run the machine. Use the proper-size electrical cable to minimize voltage drop. PSS recommends a power-pole type connector. (Not included with RAPTOR.) When driving the vehicle without RAPTOR attached, operators should not allow any electrical cables to drag from the vehicle.



11.5 – DETACH RAPTOR FROM VEHICLE

To detach RAPTOR, reverse the steps in Section 10.3.1. Unplug and loosen all power connectors. Loosen and pivot the swivel bolts out of the way. Lastly, use a forklift to lift RAPTOR off the DIN plate. Place RAPTOR in short or long-term storage.



DME

RAPTOR OPERATIONS ARE DRIVEN BY A SYSTEM OF REMOTE CONTROL, CAMERA AND MONITOR SYSTEM, AND DISTANCE MEASURING EQUIPMENT (OPTIONAL).

12.1 – CAMERA SYSTEM

For ease of operation, and safety, RAPTOR features a camera system, comprised of:

- » 2 wireless cameras
- » 1 monitor

Cameras are used primarily to retrieve RQ TPRS from the road surface:

- » Forward-facing camera shows the approach of RAPTOR to the TPRS array.
- » Downward-facing camera displays strip location for magnet bar alignment.

For installation of camera receivers and monitor, please refer manufacturer's instructions.



12.2 – CAMERA SYSTEM MONITOR

Install the monitor in the RAPTOR host vehicle.

- » Wire the monitor harness to a 12V DC connection.
- » Ensure ignition is on and engine is running prior to turning on the monitor.

In split-screen display, the monitor shows:

- » The forward-facing camera broadcast, and the vehicle's approach to the array.
- » The downward-facing camera broadcast, used to retrieve and align RQ TPRS.

12.3 – DISTANCE MEASURING EQUIPMENT (DME)

To measure distances between strips while deploying them, PSS recommends that operators install an (optional) Distance Measuring Equipment (DME) device in the RAPTOR vehicle.



12.4 – FUNCTIONS OF REMOTE CONTROL

RAPTOR operates with a wireless remote control transmitter that features eight multi-functional buttons. The battery status light, located in the middle of the top row, is the only battery status light programmed at this time.

The battery status light flashes green when not in use, steady-green when any buttons are depressed, and turns red to indicate low battery status.

The wireless remote will function for approximately 100 hours on a set of three AAA alkaline batteries batteries.

MULTI-FUNCTIONAL BUTTONS:

Button 1: Arrow Down (↓)

Unfolds wings from Transport to Operational Mode to initiate strip deployment.

Button 2: Arrow Up (↑)

Unfolds wings from Transport to Operational Mode to initiate strip retrieval.

Button 3: Arrow Left (←)

Unfolds wings and moves arm laterally toward driver's side.

Button 4: Arrow Right (→)

Unfolds wings and moves arm laterally toward passenger side.

Button 5: R

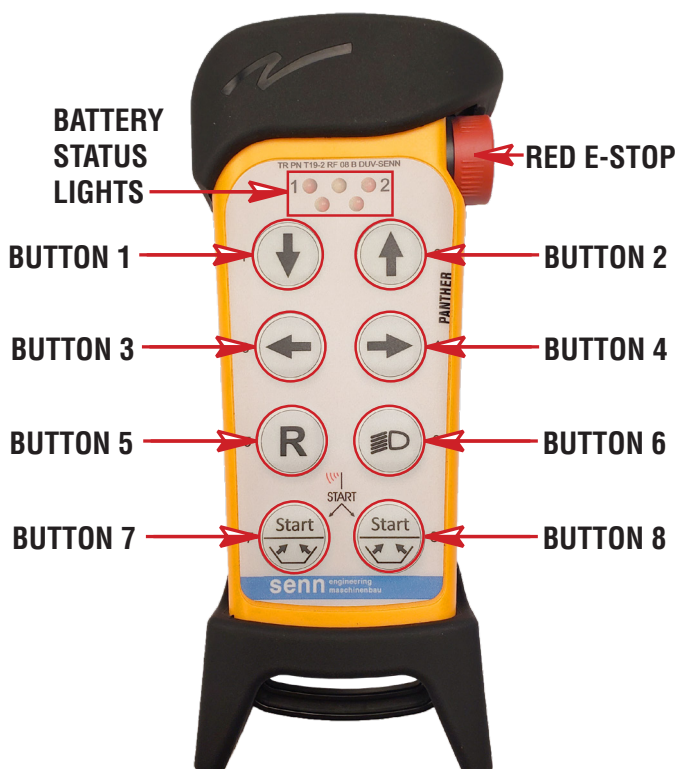
Reset. Used only for troubleshooting. See Section 17 on page 27.

Button 6: Light icon

Turns work lights on and off.

Buttons 7 & 8: Start button

Folds wings from Operational Mode to Transport Mode.



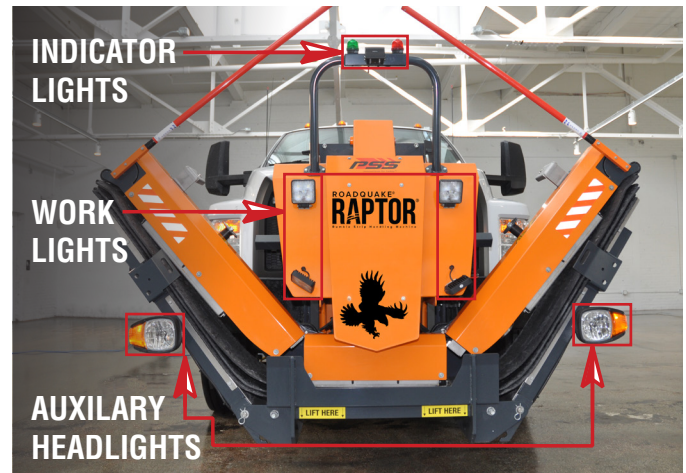
12.5 – USE OF REMOTE

- » To turn the remote on, release the red E-Stop button, turn clockwise ¼ turn, as shown on its side. See previous for location.
- » Depress the two START buttons (buttons 7 & 8) simultaneously, hold them for approximately one second, then release. The remote and RAPTOR are now synced. There may be a 15 second delay for RAPTOR's PLC (programmable logic controller) to turn on. The marker lights and strobe lights of the magnet bar will turn on when RAPTOR is on.
- » Always maintain visual contact with RAPTOR when using the remote control.

12.6 – AUXILIARY HEADLIGHTS

When RAPTOR is loaded to capacity with 12 RQ TPRS, and the wings are folded for transport, the wings cover the headlights on most vehicles.

RAPTOR features auxiliary headlights mounted to the wings on the TPRS tray. Each auxiliary headlight has an electrical cable exiting the machine, which contains wires for high beams, low beams, turn signals and parking lamps. The user is responsible for wiring these into the host vehicle.



12.7 – WORK LIGHTS

RAPTOR features work lights, which are located on the right and left sides of the mast. Press button 6 to turn lights on and off.

12.8 – INDICATOR LIGHTS

RAPTOR features two indicator lights, located at the top of the forward-facing camera bar:

- » Steady-green indicates RAPTOR status is ready for use.
- » Flashing green indicates RAPTOR is mid-function.
- » Flashing red indicates an error message.

⚠ NOTICE NOTICE ⚠

If using a Rover-mounted RAPTOR with optional arrow board, RAPTOR remote frequencies will interfere with the arrow board remote. Deploy the arrow board before using RAPTOR to reduce interference. Have one remote powered at all times.

Sect. 13 PRIOR TO USE IN A WORK ZONE

13.1 – NEW, NEVER-DEPLOYED RQ TPRS

The polymers in a brand-new RQ TPRS may cause them to temporarily stick together in the TPRS tray. Strips may temporarily stick together so that the magnets in RAPTOR cannot deploy a strip.

Operators should drive over brand-new strips several times prior to use in RAPTOR. Once driven over, individual strips should no longer stick together.

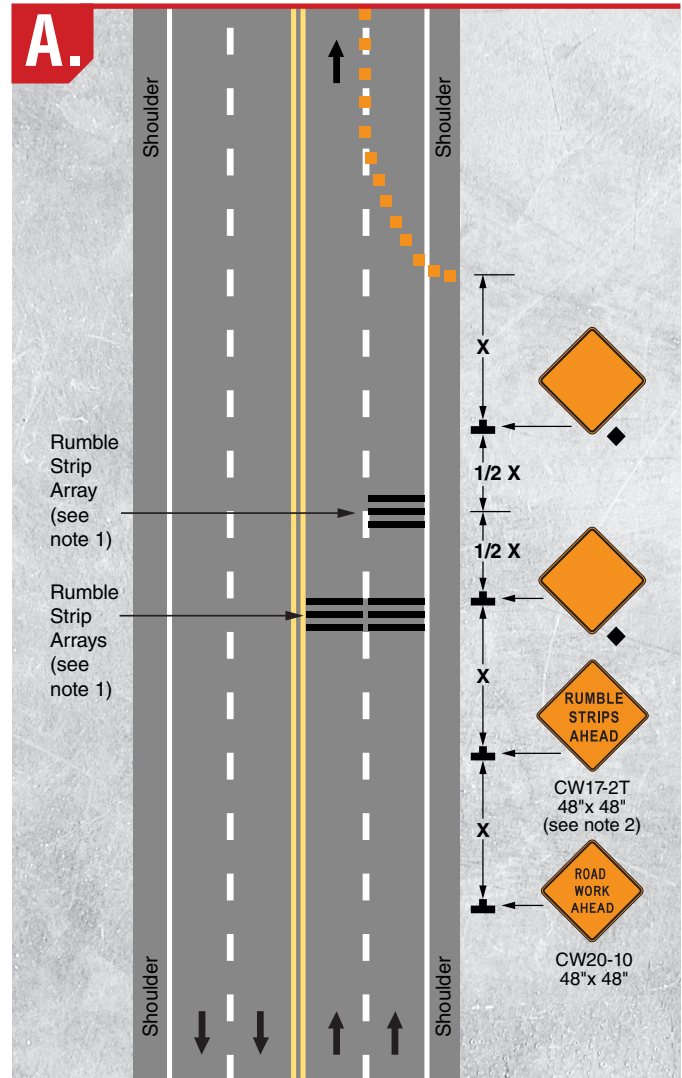
13.2 – DETERMINING YOUR TRAFFIC CONTROL PLAN

Review the specific traffic control plan for use of RQ TPRS in work zones. If no TTC plan exists, use the PSS "RoadQuake: Best Practices for Optimal Use" guide book to determine distances between strips.

See figure A to the right for an example.

13.3 – TRUCK MOUNTED ATTENUATOR

We recommend to deploy a Truck Mounted Attenuator (TMA) with RAPTOR. RAPTOR vehicle (1.) can accommodate a TMA attached to its back. Or, deploy a "shadow" TMA vehicle (2.) to follow RAPTOR. Always follow the controlling agency's requirements for the use of a TMA in active work zones. See figure B for an example.





14.1 – POWER RAPTOR ON

To start RAPTOR, the operator must leave the cab, or, from the cab, direct a co-worker outside the vehicle to perform the following steps:

- » On the driver side of the vehicle, locate the rotary switch on the electrical cabinet.
- » Turn the switch clockwise to the ON position.

14.2 – TRANSPORT AND OPERATIONAL MODES

To drive RAPTOR and the host vehicle to and from workzones, set RAPTOR to Transport Mode with wings in the folded-up position.

For TPRS deployment, retrieval, and realignment, set RAPTOR in Operational Mode with wings in the horizontal position. See Remote functions on page 20 for instructions.

In the images on the right, RAPTOR is shown in operational mode demonstrating the steps of RQ TPRS deployment:

1. Magnet bar pulls one RQ TRPS from TPRS tray to deploy on road surface.
2. RAPTOR arm moves out from and in front of TPRS tray
3. The arm moves down to deployment location of RQ TPRS.
4. Magnet bar releases RQ TPRS at installation location.

To deploy more strips, return RAPTOR arm and magnet bar to TPRS tray. Repeat until installation is complete.



15.1 – DEPLOYING RQ TPRS

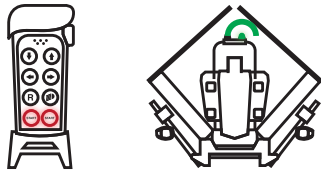
An individual RoadQuake Rumble Strip measures 11 ft (31 cm) long, and covers an entire lane of traffic. Before deploying a strip, position the vehicle so that it is centered in the lane.

With RAPTOR at a full stop, at the location of the TPRS deployment:

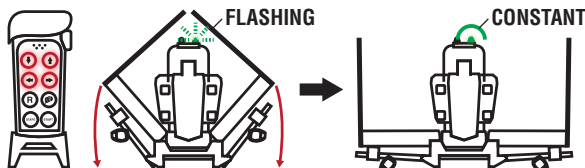
⚠ WARNING WARNING ⚠

Bring RAPTOR vehicle to a full stop before deploying or retrieving each RQ TPRS.

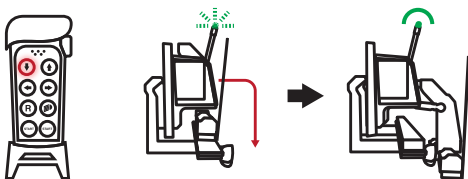
1. Synchronize your remote and RAPTOR by pressing buttons 7 and 8 simultaneously. There will be an approximately 15-second wait for RAPTOR's PLC to turn on. The marker lights and strobe lights of the magnet bar will turn on when RAPTOR is on. The green indicator light will be constantly on.



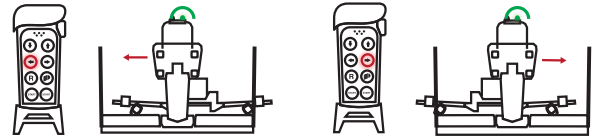
2. Engage RAPTOR in Operational Mode by pressing and holding any individual directional button (1 (↓), 2 (↑), 3 (←), or 4 (→)) until the wings are fully lowered. The green indicator light will begin flashing. Once the wings are fully down, wait for the green indicator light to be constantly on, then release the button.



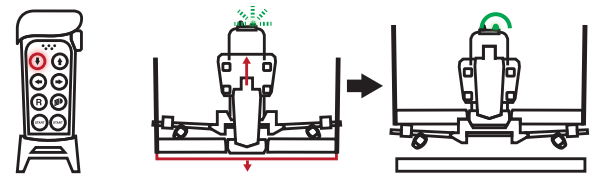
3. To raise the arm and the first RQ TPRS up and out of the tray, press and hold button 1 (↓) to start the cycle of deploying RQ TPRS. The green indicator light will begin flashing. When the arm is fully extended and stops moving, wait for the green indicator light to burn constantly, then release button 1 (↓).



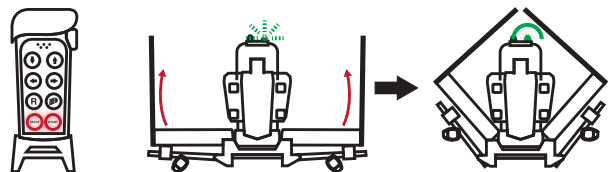
4. If your RAPTOR is not centered in the deployment area, press and hold buttons 3 (←) or 4 (→) to laterally move the arm left or right. **NOTE: Lateral movement functions (buttons 3 (←) or 4 (→)) will only work when RAPTOR arm is fully extended in front of TPRS tray during deployment, and in float position during retrieval. Direction of Lateral Movement is oriented towards the machine and will be reversed when inside the cab of the RAPTOR host vehicle.**



5. Once the RAPTOR is in the correct deployment position, press and hold button 1 (↓) to retract the magnets and release the TPRS in front of RAPTOR. The green indicator light will begin flashing. With button 1 (↓) still depressed after the TPRS is released, the arm will return to the TPRS tray centered. Once the green indicator light changes from flashing to constantly on, release button 1 (↓).



6. To deploy additional TPRS, move your vehicle to the appropriate distance established by the state specification. To measure distance between strips, reset DME (optional) to zero after deployment of each strip. Drive forward slowly until the required distance is reached.
7. Stop the vehicle and repeat steps 3-6 for the rest of your TPRS array.
8. Once you have completed the deployment of your array and the arm of RAPTOR has been returned to the TPRS tray, press and hold button 7 or 8. The green indicator light will be flashing. The wings will raise to return to transport mode. Release button 7 or 8 once the guide markers are centered in the middle for RAPTOR. **NOTE: RAPTOR and remote will turn off functionality after three minutes of no input from the remote.**



15.2 – AFTER DEPLOYMENT

To power RAPTOR off: Drive to a safe location so that the operator may exit the vehicle. The On/Off switch is located on the driver-side electrical cabinet. Rotate the switch counter-clockwise to power RAPTOR off. Return guide markers to the transport position. Or, perform these functions upon returning to the yard.

16.1 – BEFORE RETRIEVING RQ TPRS

PSS recommends the removal of all RQ TPRS from the roadway when work concludes each day. Do not leave RQ TPRS arrays on the roadway of an inactive work zone.

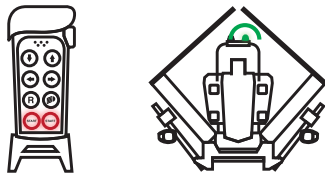
16.2 – RETRIEVING RQ TPRS

⚠ WARNING WARNING ⚠

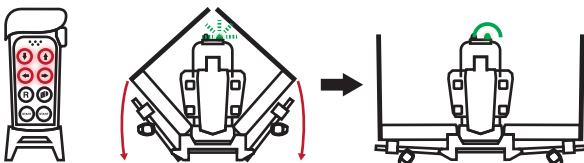
Bring RAPTOR vehicle to a full stop before deploying and retrieving each RQ TPRS.

To retrieve a strip:

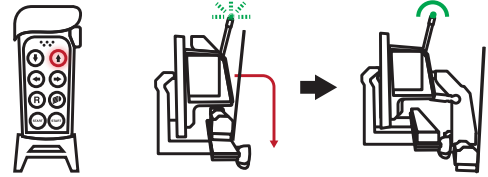
- Approach RQ TPRS array. Use the split-screen camera monitor to center the vehicle with the strip. Once the strip disappears under the line-of-sight of the vehicle, stop the vehicle. Synchronize your remote and RAPTOR by pressing buttons 7 and 8 simultaneously. There will be an approximately 15-second wait for RAPTOR's PLC to turn on. The marker lights and strobe lights of the magnet bar will turn on when RAPTOR is on. The green indicator light will burn constant. RAPTOR's forward-facing camera will show the location of the magnet bar in relation to the strip or road surface.



- Put RAPTOR in Operational Mode by pressing and holding any directional button (1 (↓), 2 (↑), 3 (←), or 4 (→)) until the wings are fully lowered. The green indicator light will begin flashing. Once the wings are fully down and the green indicator light is burning constant, release the button.



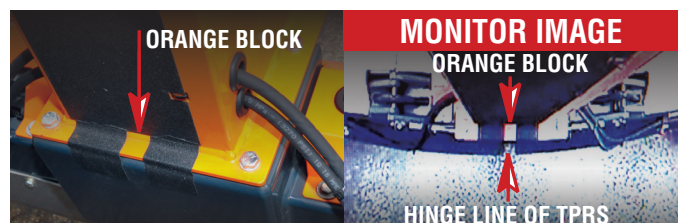
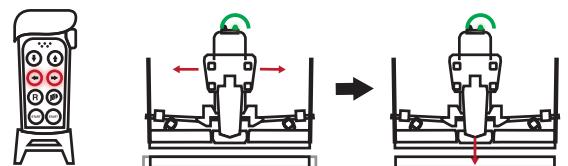
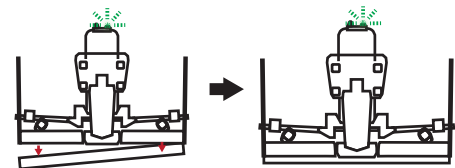
- Press and hold button 2 (↑) to raise the arm up and out of the tray. The green indicator light will begin flashing. When the arm is fully extended and stops moving, the green indicator light will burn constant, release button 2 (↑). RAPTOR is now in float position.



FLOAT POSITION

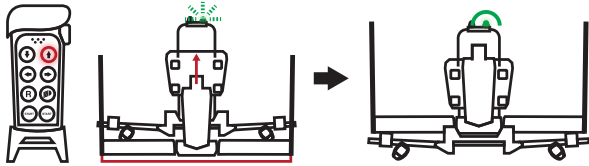


- Slowly drive forward until both alignment rods touch the TPRS. If the TPRS is skewed, continue driving forward until the RQ TPRS makes contact with both alignment rods. If your RAPTOR is not centered on the TPRS being retrieved, press and hold buttons 3 (←) or 4 (→) to laterally move the arm left or right to align the magnet bar to the strip. Use the "orange block", shown on the downward-facing monitor, on the back of the magnet bar to center the hinge location at the center of RQ TPRS. Center the magnet bar to the strip to 1 in / 2.5 cm (+, -). **NOTE:** Lateral movement functions (buttons 3 (←) or 4 (→)) will only work when RAPTOR arm is fully extended in front of TPRS tray during deployment, and in float position during retrieval.

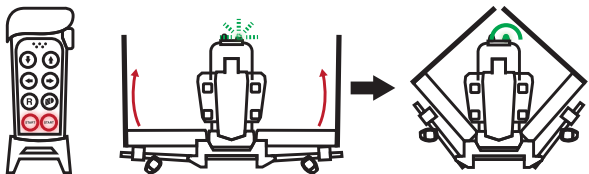


16.2 – RETRIEVING RQ TPRS (CON'T)

- With the magnet bar centered over RQ TPRS, press and hold button 2 (↑) of remote to begin the cycle to retrieve a RQ TPRS from the roadway. The green indicator light will begin flashing. The RAPTOR arm will descend from Float Position to the top side of the strip. The arm will then deploy the magnet bar, raise the strip off the roadway, and return it to the TPRS tray centered. Once the arm has returned to the TPRS tray, wait for the the green indicator light will bburn constant, release button 2 (↑).



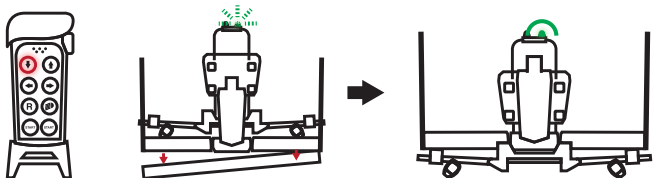
- Repeat steps 3-5 for the rest of your TPRS array.
- Once you have completed the retrieval of your array and the arm of RAPTOR has been returned to the TPRS tray, press and hold button 7 or 8. The green indicator light will be flashing. The wings will raise to return to transport mode. Release button 7 or 8 once the guidemarkers are centered on RAPTOR. **NOTE:** RAPTOR and remote will turn off functionality after three minute of no input from the remote.



16.3 – REALIGNING RQ TPRS

RQ TPRS may skew during use in an active work zone. **See PSS Best Practices Guide for acceptable movement.**

Operators can realign skewed strips during the day. If required, follow the steps in Section 15.2 up to step 4. Once the TPRS is realigned, press and hold button 1 (↓) to return the arm back to the TPRS tray. The green indicator light will begin flashing. Once the arm has returned to the TPRS tray, release button 1 (↓). The green indicator light will burn constant. Repeat for all skewed strips.



16.4 – AFTER RETRIEVAL OR REALIGNMENT

Power RAPTOR Off: Drive to a location safe enough for the operator to exit the cab. The On/Off switch is located on the driver-side electrical cabinet on the mast. Rotate the switch counter-clockwise to power RAPTOR off and return guide markers to down position.



17.1 – MANUALLY RESTORE RAPTOR TO TRANSPORT MODE

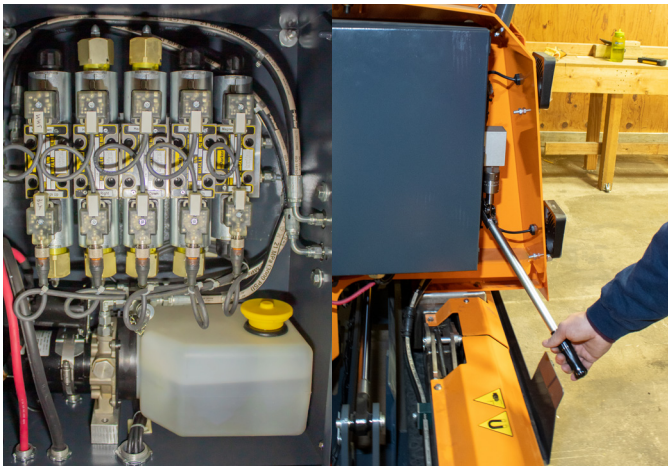
⚠ WARNING WARNING ⚠

During restoration, once valve operator is depressed, mast will lower by gravity.

In the unlikely event that RAPTOR's hydraulic pump or electronics fail, leaving RAPTOR without power, operators can manually return RAPTOR to Transport Mode for transportation to a repair facility. Operator must safely exit the cab to restore RAPTOR manually. Examine the hydraulic hoses, to ensure they are undamaged. The following instructions will not work with a broken hose or leaking hydraulic system.

To manually restore RAPTOR to transport:

- » One function can be manually restored at a time
- » Open the hydraulic cabinet on the passenger side of RAPTOR to access the hydraulic valves
- » Each hydraulic valve needed for this process is labeled accordingly. Determine which function requires restoration. Depress and turn the valve operator to lock it open
- » Remove the handle extension, located inside the cabinet, on the left side. Attach the handle extension to the pump, located outside the cabinet, on its right
- » To operate the pump, move the handle up and down, and fully extend it in both directions
- » Once the function is achieved, restore the valve operator to its unlocked position. Repeat for any other function.



HANDLE FOR HAND PUMP STORES IN PASSENGER SIDE HYDRAULIC CABINET

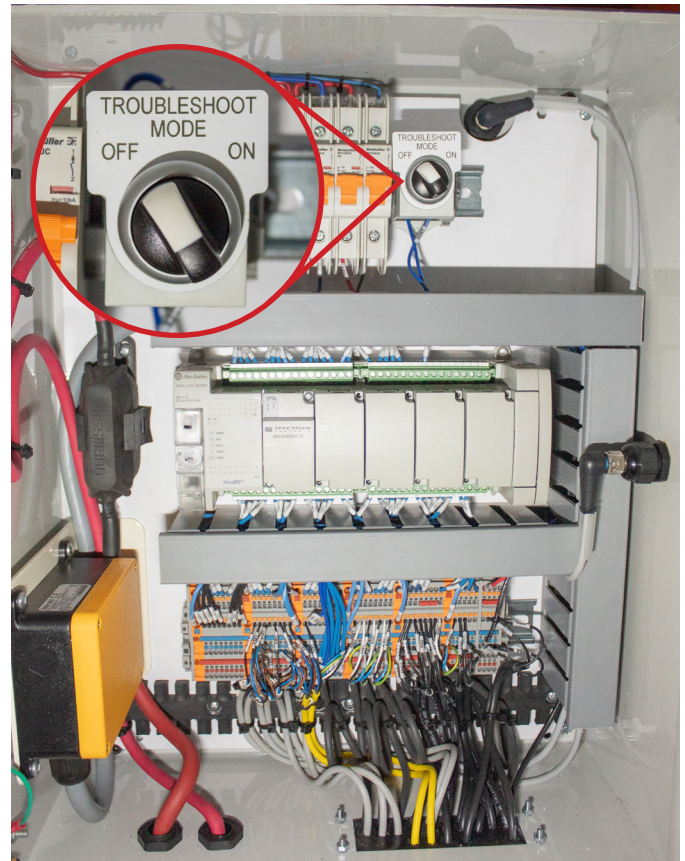
17.2 – ELECTRICAL TROUBLESHOOTING MODE

RAPTOR features a Troubleshooting Mode, which allows operators to test every hydraulic function.

⚠ DANGER DANGER DANGER

This mode bypasses the programming of RAPTOR. The Operator is responsible for moving the machine in a sequence that will not damage RAPTOR.

To activate the Troubleshooting Mode, open the electrical cabinet on the driver side of RAPTOR while RAPTOR is on. Locate the troubleshoot switch, on the top of the PLC. See picture below.



Indicator lights will flash red and green. To test a specific hydraulic function, press and hold the appropriate button for approximately two seconds:

- » Button 3 - Head up and down
- » Button 4 - Arm in and out
- » Button 6 - Magnets in and out
- » Button 7 - Move mast left and right
- » Button 8 - Wings up and down

Then press button 1 or 2 to test movement of that function.

To exit a function, press button 5, the reset button. You can select a new function at this point.

To exit Troubleshooting Mode, exit the function you are testing by pressing button 5, then turn the Troubleshoot Mode switch counterclockwise to the off position.

18.1 – GENERAL MAINTENANCE AND REPAIR

Repair RAPTOR malfunctions immediately as they can affect operations as well as safety.

⚠ WARNING	WARNING	⚠
<p>The RAPTOR must be serviced only by qualified personnel.</p>		

User shall not alter, add or modify RAPTOR without the manufacturer's prior approval.

The manufacturer will not be held liable for any unauthorized structural modifications in the event of an accident.

WARRANTY APPLIES ONLY TO ORIGINAL EQUIPMENT MANUFACTURER (OEM) PARTS, OR PRE-APPROVED SUBSTITUTES IN EXTENUATING CIRCUMSTANCES.

Moreover, PSS expressly states that Non-OEM parts and accessories have not been tested.

18.2 – GENERAL INFORMATION

Proper maintenance operations are required as preventative measures to preserve the reliability of the RAPTOR.

Failure to follow maintenance routines may lead to reduced performance and damage.

Perform maintenance operations according to instructions, at specified intervals. **See section 18.3.**

When servicing RAPTOR, follow all general accident prevention rules, special safety rules, and hazard prevention guidelines. All maintenance work must include visual inspection and cleaning.

Maintenance work is performed in addition to functional checks. During functional checks, all fasteners and cable clamps must be intact. Cables must be inspected for wear, abrasion and cracks in insulation. Grease fittings and points must be greased.

18.3 – MAINTENANCE

Perform the following operations at regular intervals:

Weekly:

- » Check remote control – Change batteries as required
- » Check alignment rods – Inspect to ensure the rods engage the road surface. Replace as required. PSS recommends operators carry a spare set in the RAPTOR vehicle.
- » Inspect electrical cabinet for accumulated moisture

Monthly:

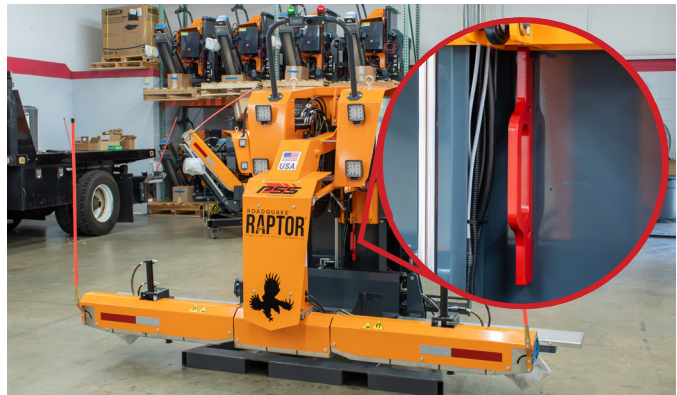
- » Check fasteners – tighten as needed
- » Grease the Zerk fitting at the arm pivot points
- » Use a spray grease on the horizontal and vertical slides
- » Apply a chain lube to the lateral movement chain
- » Inspect hydraulic system – Check oil level and leaks

Annually:

- » Check hydraulic hoses for abrasions or leaks

For additional maintenance concerns, contact PSS for a qualified repair technician.

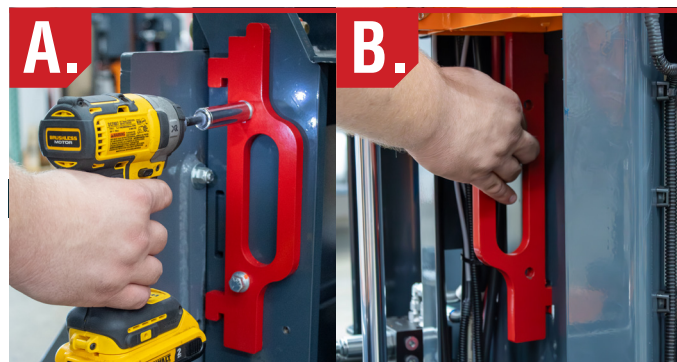
18.4 – SAFETY HANDLE



RAPTORs produced after S/N RPT-029 now include an integrated Safety Handle to secure the position of the Mast when maintenance is performed. Please continue to use Cribbing to secure the Mast on any RAPTORs that do not feature the Safety Handle.

To secure the Mast in a raised position for any maintenance to the Mast, Arm or Tray:

- » Remove the Red Safety Handle from the passenger's side of the Mast Frame (See Figure A)
- » Raise the Mast to the top of its vertical stroke by manual pumping or utilizing Trouble Shoot Mode
- » Insert the Safety Handle into the exposed slots (to the right of the lift cylinder) in the Mast frame. **NOTE:** The Safety Handle can only be inserted in the slots of the Mast Frame with the notched end pointing up
- » Lower the Safety Handle to engage the Slots in the handle, engaging the thickness of the Mast Frame.
- » Lower the Mast until it makes contact with the top of the Safety Handle. (See Figure B)



To remove the Mast:

- » Raise the Mast to the upper limit of its vertical travel
- » Lift the Safety Handle to disengage the slots in the handle from the Mast frame and remove
- » Reinstall the Safety Handle on the Passenger's side of the RAPTOR frame.

18.5 – ORDERING PARTS

- » To order spare or replacement parts, contact PSS at 800.662.6338.



SCAN FOR
THE RAPTOR
MANUAL.



SCAN FOR THE
ROADQUAKE
BEST PRACTICES.



CONTACT:

Call 800.662.6338 to talk to a Customer Service Representative.

HOURS:

8 AM to 5 PM (E.T.)
Monday through Friday

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