OPERATION & SERVICE MANUAL

Model: STT-18F
Electric Tow Tractor

09/2023 – Rev. 05

For Spare Parts, Operations & Service Manuals or Service Needs
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REVISION	DATE	TEXT AFFECTED
01	08/2022	Original release
02	01/2023	Modified 14.0 Braking System
03	03/2023	Modified 16.6 Seat
04	06/2023	Major revision
05	09/2023	Added 17.0 Cab Option

TABLE OF CONTENTS

PAGE

From everyone at Eagle Tugs, we would like to say thank you for purchasing an Eagle STT series tow tractor. We take a lot of pride in the quality of the products that we build, as well as, our continued customer service. Our goal is to build a long-term relationship with our customers. We want you, the customer, to be 100% satisfied with your Eagle experience. To us, this means that your Eagle STT series tractor is functionally superior to any other products you have used. This also means that your Eagle product is continually supported in a professional, timely manner.

WARNING!

Read this manual in its entirety before putting your Eagle tow tractor into service. This manual contains important safety instructions. Improper usage or a failure to follow the safety requirements listed in this manual could result in severe injury or death.

1.0 PRODUCT INFORMATION

1.1 DESCRIPTION

This manual is designed as a quick guide to familiarize you with the correct and safe operation of your Eagle tow tractor.

Your Eagle tractor was designed to do very specific tasks. For that reason, it will look, feel, drive and function differently than over-the-road trucks and automobiles, as well as various other types of vocational vehicles. It is the operator's responsibility to operate this equipment in a safe and prudent manner. Be alert; your safety and the safety of others is involved.

The descriptions and specifications contained in this manual were in effect at the time the manual was printed. Eagle Tugs reserves the right to discontinue models at any time and/or to change specifications, designs or components used without notice and without incurring obligations.

1.2 MODEL & SERIAL NUMBER

Reference nameplate on unit

1.3 MANUFACTURER

Eagle Tugs
1 Air Cargo Pkwy East
Swanton, Ohio 43558 USA

Telephone: (419) 866-6301 or 800-426-6301
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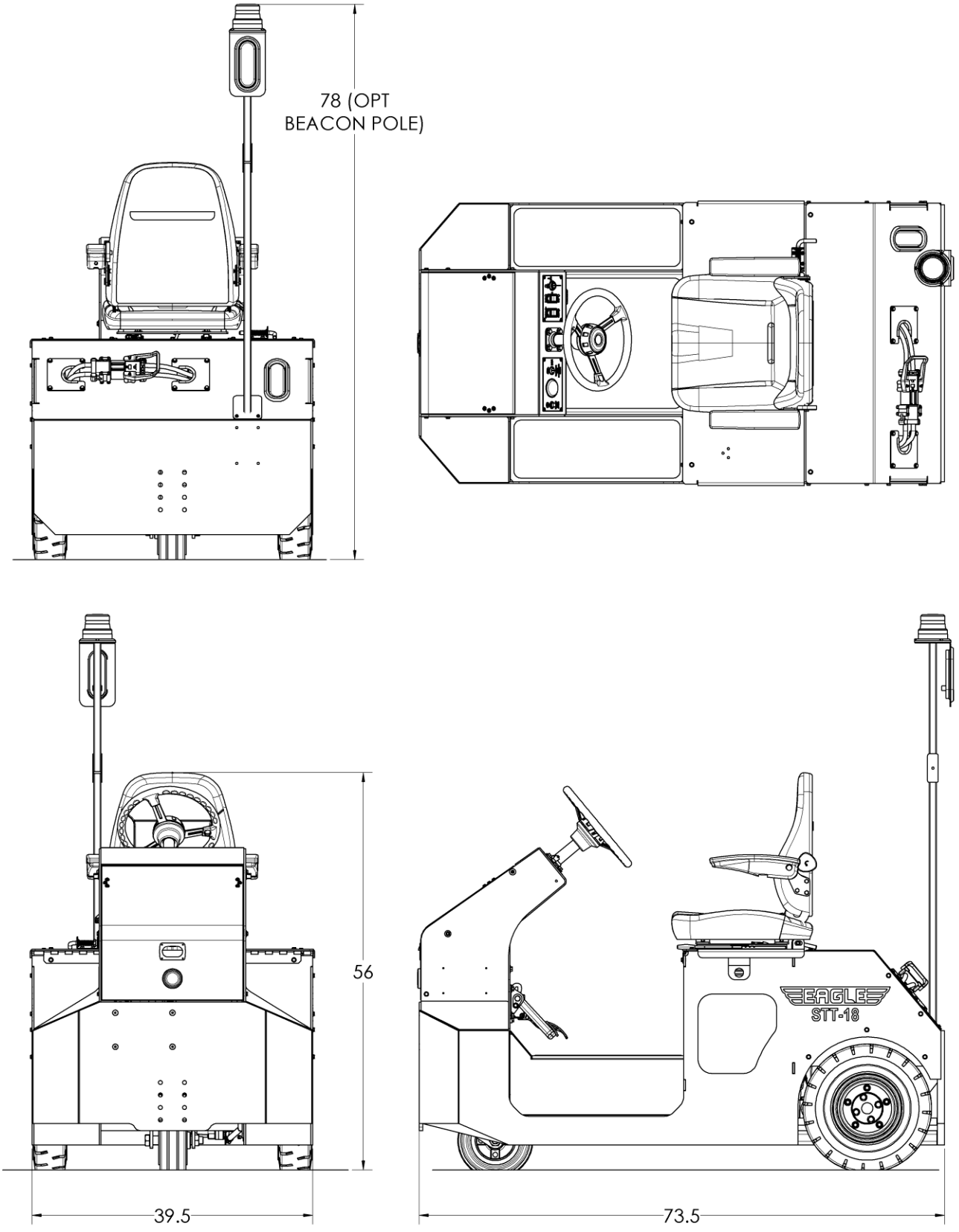
Please check www.eagletugs.com periodically for updates to this manual, operations manual, and service bulletins that affect your tractor

1.4 SPECIFICATIONS



Optional equipment shown; customer tractor may vary

1.4.1 Vehicle Specifications

Rated DBP	1,300 lbf (5.34 kN)
Towing Capacity	18,000 lbs (8,165 kg) Capacity applies to 0% grade, dry and clean surface condition

1.4.2 Chassis System

Length (Not Including Hitches)	73.5 in (1,866 mm)
Width	39.5 in (1,003 mm)
Height as Seat Back	56.0 in (1,422 mm)
Step-In Height	7.75 in (197 mm)
Ground Clearance	3.5 in (89 mm)
Wheelbase	52 in (1320 mm)

1.4.3 Gross Vehicle Weights

Without Battery	1,670 lbs (757 kg)
With Battery	3,100 lbs (1,406 kg)

1.4.4 Drive Motor

Model	Schabmueller TSA200-100-063
Type	AC Induction
Power	4.4 kW - S2 60 min
Environmental Rating	IP43
Voltage	32V 3-ph AC
Parking Brake	Electronic Spring-Applied

1.4.5 Drive Inverter

Model	Curtis 1234E
Power	275 A - 2 min
Power	140 A - S2 60 min
Environmental Rating	IP65
Nominal Voltage	48V DC
Cooling	Passive - Finned Heatsink

1.4.6 Front Axle

Model	Eagle Custom
Type	Steerable Caster
Suspension	Coil Spring
Steer Angle	50°
Steering Type	Ball Bearing Screw Gearbox
Turns (Lock-Lock)	4

1.4.7 Rear Axle

Model	PRM Marine 116RF
Type	Double-Reduction Parallel Motor Mount
Suspension	Rubber Compression Spring
Gear Ratio	18.36:1
Service Brakes	180x40 Leading/Trailing Drum Brakes
Track Width	40 in (1,016 mm)

1.4.8 Tires

Front	Solid 10.5x4-6
Rear	Solid 5.00x8-3

1.4.9 Electrical

Battery Voltage	48 Volt Floating Ground
Lighting Voltage	12 Volt Floating Ground
12V Converter Rating	5A

1.4.10 Battery

Battery Weight.....1400 – 1500 lbs (635 – 680 kg)
Nominal Voltage.....48V DC
Battery Compartment Length .....38.0 ± 0.13 in (965 ± 3 mm)
Battery Compartment Width.....14.9 ± 0.13 in (379 ± 3 mm)
Battery Compartment Height.....23.25 ± 0.13 in (590 ± 3 mm)

1.4.11 Performance

Standard Speed (High).....6 mph (9.7 kph)
Standard Speed (Low) .....3.5 mph (5.6 kph)
Drawbar Pull Rating .....1,300 lbf (5.34 kN)
Outside Turning Radius.....85 in (2,159 mm)

1.4.12 Fluid

Brake Fluid.....Dot 3 or Dot 4
Axle Oil.....SAE 85W-140

2.0 SAFETY INFORMATION

2.1 IMPORTANT SAVETY NOTICE

Appropriate service methods and proper repair procedures are essential for the safe and reliable operation of all industrial equipment as well as the personal safety of the individual performing the work. As such, all service should be performed by a qualified professional.

There are numerous variations in procedures, techniques, tools, and parts for servicing equipment, as well as in the skill of the individual doing the work. This manual cannot anticipate all such variations and provide advice or cautions as to each.

2.2 USAGE AND SAFETY INFORMATION

To insure safe operations please read the following statements and understand their meaning. Also refer to your equipment manufacturer's manual for other important safety information. This manual contains safety precautions which are explained below. Please read carefully.

WARNING!
Warning is used to indicate the presence of a hazard that can cause ***severe personal injury, death, and/or substantial property damage*** if the Warning Notice is ignored.

CAUTION!
Caution is used to indicate the presence of a hazard, which will or can cause ***minor personal injury or property damage*** if the Caution Notice is ignored.

2.3 GENERAL

The following list contains some general warnings that you should follow when you work on equipment:

- Always wear safety glasses for eye protection.
- Use safety stands whenever a procedure requires you to be under the equipment.
- Be sure that the battery is disconnected unless otherwise required by the procedure.
- Place wheel chocks on the tires to provide further restraint from inadvertent equipment movement.
- Keep yourself and your clothing away from moving parts when the tractor is moving.
- Do not smoke while working on the equipment.
- To avoid injury, always remove rings, watches, loose hanging jewelry, and loose clothing before beginning to work on the equipment. Tie long hair securely behind the head.

For more information regarding safety please refer to the operations manual provided with your tug. This manual can also be found on the Eagle Tugs website at www.eagletugs.com.

The following safety recommendations are not intended to cover all possible safety aspects of the STT series tow tractor. Please use common sense in addition to the safety recommendations that follow

WARNING!

Failure to comply with the following safety precautions can result in serious injury or death as well as equipment damage.

- Always do the Pre-Operation Inspection before using the tractor.
- If you have not operated this equipment previously, practice driving and operating it in a safe and clear (not congested) area until you are familiar with all aspects of its operation.
- Always operate the tractor at a speed appropriate for the environmental conditions and the towed load. Slow down in congested areas, when moving a large load, or when conditions reduce traction or visibility.
- Always take care when driving on a slope or uneven ground. Take turns in a controlled manner and with reduced speed.
- When working on or around the tractor, take care to keep well clear of any moving components, powered electrical components, and hot surfaces.
- The STT series tractor is intended to be operated on hard improved surfaces. Never drive on soft surfaces and avoid potholes and damaged pavement.
- The STT series tractor is intended for primarily indoor usage. Do not store the unit outside.
- Always turn the unit off when not in use. The electromagnetic parking brake will automatically actuate when the unit is turned off.

3.0 TRAINING

3.1 TRAINING REQUIREMENTS

The employer of the operator is responsible for providing a training program sufficient for the safe operation of the unit.

3.2 TRAINING PROGRAM

The employer provided operator training program should cover safety procedures concerning use of the unit in and around the intended aircraft at the intended aircraft servicing location.

3.3 OPERATOR TRAINING

The operator training should provide the required training for safe operation of the unit.

NOTE: Maintenance and Trouble Shooting are to be performed by a skilled and trained technician.

4.0 PUTTING INTO SERVICE

4.1 UNPACKING AND SETTING UP

The following directions specify the correct steps that should be taken once you receive delivery of your STT series tow tractor. These steps will ensure that the tow tractor will operate safely.

- During the unloading of your tractor, note any shipping damage and report it to Eagle Tugs and the shipping company. Verify that all components appear to be in order and undamaged
- Remove any shipped-loose components from the tractor
- Install shipped-loose components per the manual
- Read this manual in its entirety, paying close attention to all safety requirements
- Perform a full battery charge with equalization
- Check the following fluid levels:
  - Brake Fluid
  - Battery Electrolyte
  - Rear Axle Oil
- Familiarize yourself with the tractor operation and control

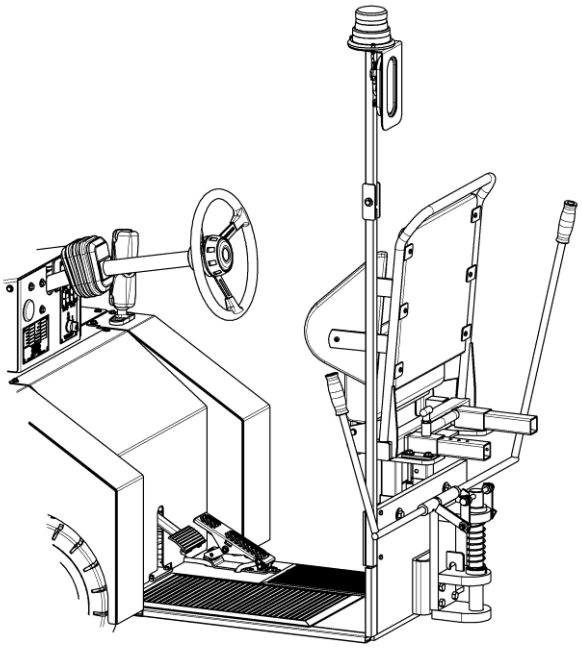
5.0 OPERATION

5.1 OPERATOR REQUIREMENTS

The STT series tow tractor is a piece of industrial equipment and has inherent safety risks. As such, the operator of the tow tractor is expected to have a fork truck or similar license, or be otherwise trained in the usage of material handling equipment.

The operator should read this manual in its entirety before operating the tow tractor.

The operator should be familiar with all aspects of the tow tractor before operating it



5.2 OPERATOR WORKSTATION

Your RTT/STT series tow tractor features an ergonomically designed operator's workstation. This is the only operator workstation on the tractor. Do not sit on or stand on the tractor outside of this area.

The operator should be standing (or seated when applicable) in the operator compartment when moving or operating the tractor.

Keep arms and legs within the perimeter of the tractor's frame to avoid injury.

Always place the tractor in Neutral before exiting the tractor.

5.3 PRE-OPERATION CHECKLIST

The following inspections should be conducted as stated below. Additional inspections may be required due to unusual operating conditions.

WARNING!

Any problems noted during inspection should be corrected as soon as possible. Failure to promptly attend to problems could compromise safety and/or the tractor's performance. Do not attempt to make repairs. Contact a qualified mechanic.

5.3.1 Daily Pre-Operation Checklist

Daily Pre-Operation Checklist	Satisfactory	Service Required	Not Applicable
Walk-Around Inspection			
Verify no evidence of leaks under and around the tractor			
Verify battery is securely connected to tractor			
Verify rims and tires free from damage including tire tread			
Verify tire tread is free from debris			
Verify lights, mirrors, and reflectors are clean (as applicable)			
Verify that hitches are in good shape and free from damage			
Verify that no wheel nuts are loose or missing			
Operational Checks			
Verify that horn is operational			
Verify that headlight is working properly			
Verify that brake light and beacon (if equipped) work properly			
Verify that steering is smootha nd free of excess play			
Operator Workstation			
Verify that seat is adjusted properly			
Verify that steering column is adjusted properly			
Verify hitches remote releases are functioning properly			
Verify that the digital display panel is free of errors and warnings			
Verify that battery level is in an acceptable range			
Verify that throttle pedal is in good condition			
Verify that the operator switchmat/pedal/seat switch is working properly			

5.4 STARTUP/SHUTDOWN AND SAFE TOWING

5.4.1 Starting the Unit

1. Enter the operator compartment. Adjust the seat and steering wheel to a comfortable position.
2. Sit in (or stand against) operator seat.
3. Stand on operator presence mat or press operator presence pedal down.
4. Select “N” (Neutral) using the direction switch.
5. Turn the ignition switch to the “ON” position.
6. Select High or Low speed using the dash-mounted switch.
7. Select “F” (Forward) or “R” (Reverse) using the direction switch.
8. Verify that the intended path of the tractor is clear of obstructions and personnel and then press the accelerator pedal.

5.4.2 Shutting Down the Unit

1. Bring the tractor to a complete stop.
2. Put the tractor in neutral using the direction switch.
3. Turn the tractor off by turning the ignition switch to the OFF position.

5.4.3 Load Towing and Pushing Safety

If towing or pushing a load, check to see that:

- The towed load is securely connected to the hitch of the tractor. Be sure hitch is locked/fastened into the closed position.
- The towbar must be parallel to the ground when connected to the tractor's hitch.
- Ensure the towed load clears all obstacles when towing.

5.5 CONTROLS AND INSTRUMENTATION

5.5.1 Ignition Switch

Your tractor is equipped with a keyed or keyless ignition switch. The switch provides power to the tractor.

When the ignition switch is off, the electromagnetic parking brake is automatically applied.

5.5.2 Slow/Fast Switch

Your tractor is equipped with a slow/fast switch to select between two pre-programmed speeds. The pre-programmed speeds may be adjusted by the Eagle factory based on customer requirements, but are standard at 3.5 mph in slow and 6 mph in fast.

The slow/fast switch can be switched on-the-fly while driving and the vehicle speed will automatically adjust to the new setting.

When traveling in reverse, the tractor will only move at the slow speed regardless of the position of the slow/fast switch

5.5.3 Forward / Neutral / Reverse Switch

The FNR switch allows the operator to select a travel direction. The F/N/R switch must be in neutral during key-on and whenever leaving the operator station for any length of time. If forward or reverse are selected at key-on of while away from the unit, the tractor will not respond to throttle requests unless the switch is first momentarily returned to neutral.

While neutral is selected, the electromagnetic parking brake is applied.

When traveling in reverse, the tractor will only move at the slow speed regardless of the position of the slow/fast switch

5.5.4 Foot Brake

The foot brake should be used when additional braking beyond that provided by the regenerative braking is required.

The foot brake is hydraulically powered and should be applied with a steady and firm downward pressure.

5.5.5 Parking Brake Applied Light

The electromagnetic (EM) parking brake provides necessary safety against unwanted movement. The EM brake is programmed to actuate automatically, which greatly simplifies operation of the tractor.

The parking brake applied light is illuminated when the tractor is powered up and the EM brake is applied.

The EM brake is applied automatically by the tractor controller in any of the following scenarios:

- The tractor direction switch is set to neutral.
- The operator presence seat switch (deadman switch) is open (STT only).
- The tractor is stationary and the throttle is at neutral.
- The tractor is turned off.

To prevent sudden and unsafe deceleration and/or possible damage to a towed load, the tractor will use regenerative braking to slow the tractor down (if necessary) before activating the EM brake.

5.5.6 Accelerator Pedal

The accelerator pedal allows smooth control over motor speed. The accelerator pedal contains redundant sensors to prevent any unwanted movement.

5.5.7 Operator Seat Switch (STT only)

The operator seat switch is used to detect the presence of the operator. The tractor will not allow throttle commands and will not release the EM brake if the seat switch is not activated.

In the event that the seat switch is released while the tractor is under movement, the regenerative braking will be activated after a short delay . Once the tractor has reached a slow enough speed, the EM brake will be engaged.

Note that the operator seat switch is tied to the LCD dash display backlight for a visual confirmation that seat switch is engaged. To test the seat switch operation, release pressure on the seat switch while monitoring the display. The backlight on the display will turn off when the pressure on the seat switch is removed.

5.5.8 EM Parking Brake Maintenance Release

The EM Parking Brake Maintenance Release key switch enables direct battery power override of the EM brake. Should the tractor ever become disabled, using this switch will allow short-term release of the EM parking brake for pushing/towing purposes.

When set to “Normal Operation”, the key switch does nothing. The tractor will operate normally.

When set to “EM Brake Override”, the key switch both disables normal functionality of the tractor, and also provides direct battery power to the EM brake coil to release the brake. This allows the tractor to be pushed or towed short distances. Once the push/tow operation is completed, the key switch should be returned to the “Normal Operation” setting.

Note: The EM Parking Brake Maintenance Release key switch is meant to be used for short durations only (less than 30 minutes). Long term usage of the “EM Brake Override” setting can result in overheating of the EM brake coil and/or possible damage to the tractor’s traction battery.

5.5.9 Dash Display

The dash display module provides important information about the tractor including:

- The battery charge state
- The cumulative tractor run hours
- The remaining hours on the preventive maintenance hours countdown
- Any error codes that are active

The display module also allows maintenance personnel to reset the preventive maintenance hours when maintenance is completed. See the Parts and Preventive Maintenance manual for details on the preventive maintenance reset.

5.5.10 Preventive Maintenance Hours

The STT series tractor includes a factory set preventive maintenance (PM) hour countdown. As the tractor is operated the PM hours will decrease from the factory set interval to zero. The factory set value is determined by Eagle engineering, tractor application, and customer requirements.

Once the PM hours reach zero, the tractor will display the error message P0 and enter a limp-mode that limits tractor speed to 1 mph. To restore full functionality, perform the preventive maintenance and then reset the hours per the instructions in the Parts and Preventive Maintenance manual.

5.5.11 Battery Protection Mode

When the battery state of charge percentage on the tractor reaches 20% or lower, the tractor will enter a limp-mode that limits tractor speed to 1 mph.

To restore full functionality, charge the battery

6.0 TROUBLE SHOOTING

6.1 ERROR CODES

The 3100R display module is capable of showing error codes should they occur. Below is a list of these error codes and possible causes **for** them. If you need assistance identifying an error or addressing an issue with your tractor, please contact:

Eagle Tugs
1 Air Cargo Pkwy East
Swanton, Ohio 43558 USA

Telephone: (419) 866-6301 or 800-426-6301
Fax: (419) 867-0634
E-mail: sales@tronair.com
Website: www.eagletugs.com

Er12: Controller Overcurrent
Effect: System shutdown of all drive components (motor, contactor, EM brake).
This error means that the electrical current to the motor has exceeded pre-set limits. Possible causes are:

- The U/V/W cables to the motor are shorted to the tractor frame or each other. Verify that the U/V/W cables are in good condition and not shorted. Replace the cables if necessary
- There is noise on the speed encoder signal. Verify that the speed encoder is working properly (that the tractor drives smoothly). If not, replace the speed encoder
- The controller is defective. If the motor cables and speed encoder are working correctly and the issue persists, replace the controller

Er13: Current Sensor Fault
Effect: System shutdown of all drive components (motor, contactor, EM brake).
This error means that the controller current sensor is unable to sense proper current. Possible causes are:

- The U/V/W cables are leaking current to the tractor frame. Verify that the U/V/W cables are in good condition and not contacting any of the tractor frame. Replace the cables if necessary
- The controller is defective. If the motor cables are working correctly and the issue persists, replace the controller

Er14: Pre-charge Failed
Effect: System shutdown of all drive components (motor, contactor, EM brake).
This error means that the drive was unable to charge its capacitor banks through the key switch input. Verify that there are no external loads on the B+ power terminal on the controller.

Er15: Controller Severe Undertemp
Effect: System shutdown of all drive components (motor, contactor, EM brake).
This error means that the controller heatsink is measuring a temperature below -40°C/F. Increase the heatsink temperature above -40°C/F and then power up.

Er16: Controller Severe Overtemp
Effect: System shutdown of all drive components (motor, contactor, EM brake).
This error means that the controller heatsink is measuring a temperature above 95°C / 203°F. Possible causes are:

- The tractor load is excessive and above the standard duty cycle. Let the tractor rest and cool down and then power up
- The tractor heatsink fins are obstructed by debris. Use compressed air to clean out the fins of any dust and dirt. Let the tractor cool down and then power up

Er17: Severe Undervoltage
Effect: Reduced drive torque.
This error means that the battery voltage has dropped below pre-set limits. Possible causes are:

- The battery is failing to provide the necessary power to the drive. Re-charge and/or repair the battery and return to service
- The B+ fuse is blown. Remove the fuse and check for damage. Replace if necessary
- The main contactor did not close. Verify that the main contactor is “clicking” when starting the tractor and driving
- A break in the battery connection while driving. Verify that all battery cables and connections are secure

6.1 ERROR CODES *(continued)*

Er18: Severe Overvoltage
Effect: System shutdown of all drive components (motor, contactor, EM brake).
This error means that the battery voltage has risen above pre-set limits. Possible causes are:

- The regenerative braking current is too high for the battery. Reduce braking behavior and/or battery charge state
- A loss of electrical continuity in the battery connection while braking. Verify that all battery cables and connections are secure

Er22: Controller Overtemp Cutback
Effect: Reduced drive and regenerative braking torque
This error means that the controller heatsink is measuring a temperature above 85°C / 203°F. Possible causes are:

- The tractor load is excessive and above the standard duty cycle. Let the tractor rest and cool down and then power up
- The tractor heatsink fins are obstructed by debris. Use compressed air to clean out the fins of any dust and dirt. Let the tractor cool down and then power up

Er23: Undervoltage Cutback
Effect: Reduced drive torque
This error means that the battery voltage has dropped below pre-set limits. Possible causes are:

- The battery is failing to provide the necessary power to the drive. Re-charge and/or repair the battery and return to service
- The B+ fuse is blown. Remove the fuse and check for damage. Replace if necessary
- The main contactor did not close. Verify that the main contactor is “clicking” when starting the tractor and driving
- A break in the battery connection while driving. Verify that all battery cables and connections are secure

Er24: Overvoltage Cutback
Effect: Reduced regenerative braking torque
This error means that the battery voltage has risen above pre-set limits. Possible causes are:

- The regen current is too high for the battery. Reduce braking behavior and/or battery charge state
- A break in the battery connection while braking. Verify that all battery cables and connections are secure

Er25: +5V Supply Failure
Effect: None
This error means that the internal +5V supply voltage is outside of acceptable range. Possible causes are:

- The throttle pedal wiring is shorted. Check the throttle pedal wiring for shorts or damaged wires and replace/repair as necessary
- The throttle pedal is faulty. Replace the throttle pedal

Er28: Motor Temp Hot Cutback
Effect: Reduced drive torque
This error means that the motor temperature has exceeded pre-set limits.

- The tractor load is excessive and above the standard duty cycle. Let the tractor rest and cool down and then power up
- The motor temperature sensor is not connected properly. Verify motor temperature sensor wiring

Er29: Motor Temp Hot Cutback
Effect: Reduced motor speed
This error means that the motor temperature cannot be read from the controller. Possible causes are:

- The motor temperature sensor is not connected properly. Verify motor temperature sensor wiring

Er31: Main Open/Short
Effect: System shutdown of all drive components (motor, contactor, EM brake).
This error means that the main contactor coil is either not connected or the wiring is shorted. Possible causes are:

- The main contactor has a wiring connection issue. Verify main contactor wiring

6.1 ERROR CODES *(continued)*

Er32: EM Brake Open/Short
Effect: Shutdown EM brake, shutdown throttle
This error means that the electromagnetic brake coil is either not connected or the wiring is shorted. Possible causes are:

- The electromagnetic brake has a wiring connection issue. Verify electromagnetic brake coil wiring

Er33: Brake Relay Open/Short
Effect: Shutdown brake relay throttle
This error means that the brake relay coil is either not connected or the wiring is shorted. Possible causes are:

- The brake relay coil has a wiring connection issue. Verify brake relay coil wiring

Er34: EM Brake Light Relay Open/Short
Effect: Shutdown EM brake light relay
This error means that the EM brake light relay coil is either not connected or the wiring is shorted. Possible causes are:

- The EM brake light relay coil has a wiring connection issue. Verify EM brake light relay coil wiring

Er36: Encoder Fault
Effect: Shutdown EM brake, shutdown throttle
This error means that the motor speed encoder data cannot be read reliably by the controller. Possible causes are:

- The motor speed encoder has a wiring connection issue. Verify speed encoder connection and wiring
- The motor encoder is faulty. Replace the encoder

Er37: Motor Open
Effect: System shutdown of all drive components (motor, contactor, EM brake).
This error means that one of the U, V, or W wires are not connected properly. Possible causes are:

- One of the U, V, or W wires is loose. Verify motor U, V, and W connections are tight and secure
- One of the U, V, or W wires is faulty or improperly crimped. Verify that the U, V, and W wires are in good condition with good crimps. Replace as necessary

Er38: Main Contactor Welded
Effect: System shutdown of all drive components (motor, contactor, EM brake).
This means that the controller thinks that the main contactor is stuck in the closed position.

- The U, V, or W cables are loose. Verify motor U, V, and W connections are tight and secure
- The main contactor is faulty. Replace the main contactor

Er39: Main Contactor Did Not Close
Effect: System shutdown of all drive components (motor, contactor, EM brake).
This error means that the controller thinks that the main contactor is stuck in the open position. Possible causes are:

- The B+ fuse is blown. Remove the fuse and check for damage. Replace if necessary
- The main contactor did not close. Verify that the main contactor is “clicking” when starting the tractor and driving
- The main contactor has high resistance across the terminals. Replace the main contactor

Er41: Throttle Wiper High
Effect: Shutdown throttle.
This error means that the primary throttle wiper is out of range. Possible causes are:

- The throttle wiring is damaged or connected improperly. Verify the throttle pedal wiring
- The throttle pedal is faulty. Replace the throttle pedal

Er42: Throttle Wiper Low
Effect: Shutdown throttle.
This error means that the primary throttle wiper is out of range. Possible causes are:

- The throttle wiring is damaged or connected improperly. Verify the throttle pedal wiring
- The throttle pedal is faulty. Replace the throttle pedal

6.1 ERROR CODES *(continued)*

Er43: Pot2 Wiper High
Effect: Shutdown throttle.
This error means that the secondary throttle wiper is out of range. Possible causes are:
- The throttle wiring is damaged or connected improperly. Verify the throttle pedal wiring
- The throttle pedal is faulty. Replace the throttle pedal

Er44: Pot2 Wiper Low
Effect: Shutdown throttle.
This error means that the secondary throttle wiper is out of range. Possible causes are:
- The throttle wiring is damaged or connected improperly. Verify the throttle pedal wiring
- The throttle pedal is faulty. Replace the throttle pedal

Er45: Pot Low Overcurrent
Effect: Shutdown throttle.
This error means that the throttle wipers current is out of range. Possible causes are:
- The throttle wiring is damaged or connected improperly. Verify the throttle pedal wiring
- The throttle pedal is faulty. Replace the throttle pedal

Er46: EEPROM Failure
Effect: System shutdown of all drive components (motor, contactor, EM brake).
This error means the controller has suffered an internal memory error. Cycle key power to reset. If the issue persists, the controller is faulty. Replace the controller.

Er47: HPD/Sequencing Fault
Effect: **Shutdown throttle.**
This error means that the controller has detected an improper sequencing of the key switch, interlock, direction control, and throttle. Possible causes are:
- The control inputs were out of sequence. Re-apply controls in the correct order
- The control wiring is faulty. Verify wiring of the key switch, the operator presence mat, the directional switch, and the throttle pedal

Er49: Parameter Change Fault
Effect: **System shutdown of all drive components (motor, contactor, EM brake).**
This error means the system detected a parameter change and needs a key cycle to re-set. This should only happen during programming of a controller. Cycle key power to reset. If the problem persists, replace the controller.

Er68: VCL Run Time Error
Effect: **System shutdown of all drive components (motor, contactor, EM brake).**
This error means the Eagle-specific software ran into a run time error. Possible causes are:
- The software has an issue. Re-flash Eagle-specific software
- The controller is faulty. Replace the controller

Er69: External Supply Out of Range
Effect: **None**
This error means that the 5V and 12V controller output currents are out of range. Possible causes are:
- The throttle pedal connection is faulty. Verify throttle pedal wiring connection and repair any issues
- The motor speed encoder connection is faulty. Verify encoder wiring connection and repair any issues
- The throttle pedal is faulty. Replace the throttle pedal
- The motor speed encoder is faulty. Replace the motor speed encoder

Er71: OS General
Effect: **System shutdown of all drive components (motor, contactor, EM brake).**
This error means that the controller experienced an internal fault. Cycle key power to reset. If the error continues, replace the controller.

6.1 ERROR CODES *(continued)*

Er72: PDO Timeout
Effect: **Shutdown throttle.**
This error means that the CAN communication failed to transmit data properly. Possible causes are:

- Faulty CAN wiring. Verify the CAN communication wires between the controller and the display module and repair as necessary
- Missing CAN termination jumper. Verify the jumper wire connection between pins 21 and pins 34 on the controller
- Missing CAN termination resistor near the display. Verify the 120 ohm resistor between pins 3 and 4 on the display module

Er73: Stall Detected
Effect: **Shutdown throttle.**
This error means that the motor encoder showed no movement while the motor was being commanded to a speed above zero. Possible causes are:

- A mechanical issue is causing the motor to fail to rotate. Verify free movement of the motor and axle (with the EM brake released)
- The motor speed encoder has a wiring connection issue. Verify speed encoder connection and wiring

Er92: EM Brake Failed to Set
Effect: **Shutdown throttle, shutdown EM brake.**
This error means that vehicle movement was sensed after the EM brake was set. Possible causes are:

- EM brake failure to hold. Verify that the EM brake is properly adjusted and working correctly

Er93: Encoder LOS (Limited Operating Strategy)
Effect: Enter LOS control mode.
This error means that the motor speed encoder data cannot be read reliably by the controller and the controller has entered a limited operating mode to continue to work. Possible causes are:

- The motor speed encoder has a wiring connection issue. Verify speed encoder connection and wiring
- The motor encoder is faulty. Replace the encoder

ErP0: PM timer expired
Effect: Tractor limited to limp speed.
This error means that the built-in PM countdown timer has expired. Complete the relevant PM operation and use the display module to re-set the PM timer per the instructions contained in this section

6.2 RE-SETTING THE PREVENTIVE MAINTENANCE TIMER

The RTT and STT tractors feature a built-in PM timer. The PM timer counts down tractor hours from 2000. Once the PM timer reaches zero hours, the tractor enters a limp speed mode and displays ErP0.

You can use the right button to switch the display between tractor hours and remaining PM hours. Note that the remaining PM hours have a “P” prefix.

After performing the proper preventive maintenance activities (refer to the tractor PM schedule), the timer can be reset using the 3100R display panel following the below procedure

1. Hold both the left and right buttons for several seconds until the display shows 5 zeroes. The far right digit will be flashing.
2. Use the left hand button to increase the digit value. (The digit value will loop if you exceed 9.)
3. Once the digit has been set, use the right hand button to move to the next digit to the left.
4. Using the two buttons, set the code to 26111.
5. Once the correct code has been entered, the digits will all return to zero.
6. Power cycle the tractor to complete the PM hour reset. Normal speed functionality will be restored and the remaining PM hours will show 2000.

7.0 REPAIRS AND SERVICE

7.1 REPAIR AND SERVICE WORK

Refer to the Operation and Service Manual for details on the parts lists, diagrams, schematics, preventive maintenance schedule, and other helpful information.

Only a trained and qualified mechanic for this type of equipment should undertake repairs to this tractor. Before undertaking any repair, the mechanic must read the Operation and Service Manual. All safety recommendations and rules must be followed.

Only parts recommended or specified by the manufacturer (or of equal quality and performance) in the Operation and Service Manual should ever be used for repair or replacement. Using approved parts ensures that the tractor performs up to designed capacity, performance, and safety functions. Failure to use parts specified by the manufacturer may invalidate the warranty.

WARNING!

Modifications to this tractor are to be made only by the manufacturer or with the written approval of the manufacturer. Modifications made without this approval will void the warranty.

7.2 EMERGENCY TOWING

The preferred method of transporting a non-functional RTT or STT unit is to use an appropriately sized fork lift unit. When lifting, ensure that the tractor center of gravity is located between the forks. Refer to the specifications section for tractor GVW and center of gravity location.

8.0 MAINTENANCE

8.1 PREVENTIVE MAINTENANCE SCHEDULE

Any items found to be deficient during the preventive maintenance review should be repaired or replaced. All fluids found low should be topped off.

* See supplemental information in this section.

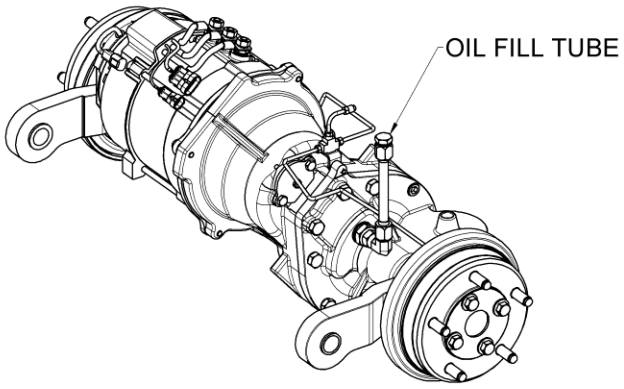
† Whichever time period is shorter.

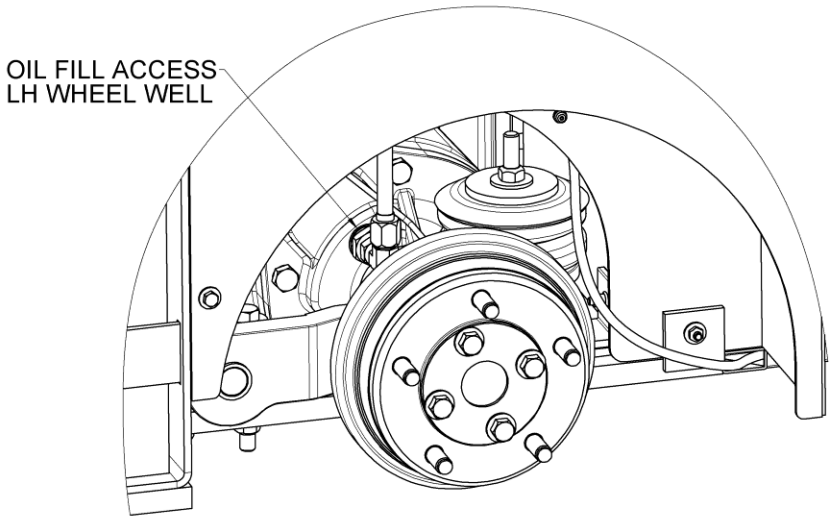
Preventive Maintenance Item	Daily				
Perform daily pre-operation checklist	X				
Equalize battery per manufacturer's recommendations		X			
Drain and replace rear axle gear oil*			X		
Clean all debris from the axle magnetic drain plug*			X		
Drain and replace rear axle gear oil*					X
Clean all debris from the axle magnetic drain plug*					X
Inspect rear axle bronze flange bushings and replace as necessary				X	
Inspect rear axle rubber compression springs, and replace as necessary				X	
Inspect rear axle tires and replace if excessively worn				X	
Inspect front wheel assembly including suspension springs				X	
Inspect front wheel polymer thrust washer, add grease if necessary				X	
Re-pack front wheel bearings with clean grease, replace if worn or damaged				X	
Inspect and grease front wheel flange bearing				X	
Inspect front tire and replace if excessively worn				X	
Oil front steered wheel suspension pivot with light oil applied through the lube hole				X	
Inspect and grease steering shaft U-joints				X	
Inspect steering U-joint set screw for loosening, correct as necessary				X	
Verify steering wheel horn button operation, repair as necessary				X	
Inspect and clean steering shaft horn brushes, replace as necessary				X	
Lubricate steering shaft horn brushes with dielectric grease				X	
Inspect all battery cables for signs of wear or chafing, replace as necessary				X	
Inspect battery cable Euro connectors for signs of damage, repair as necessary				X	
Inspect battery cable end connections for signs of looseness, repair as necessary				X	
Inspect inverter fuse for looseness, repair as necessary				X	
Inspect throttle pedal assembly for operation and condition, replace as necessary				X	
Inspect electronic parking brake rotor thickness, replace if out of spec*				X	
Inspect electronic parking brake air gap, adjust if out of spec*				X	
Verify parking brake operation				X	

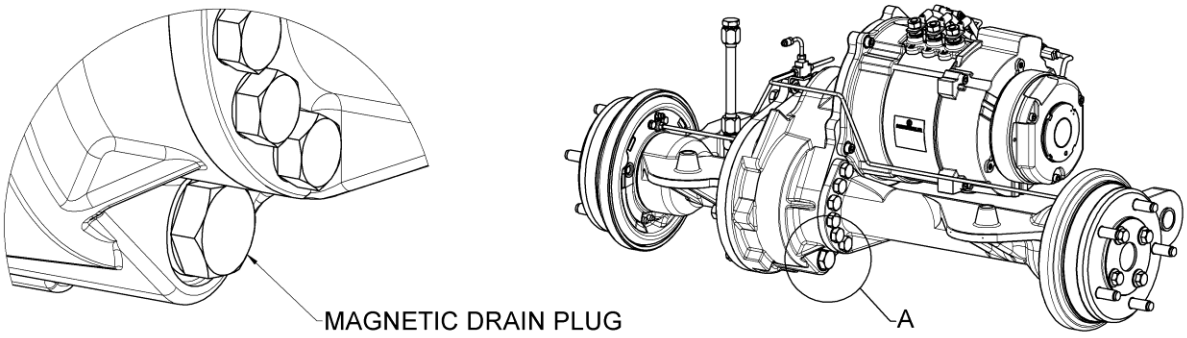
8.1 PREVENTIVE MAINTENANCE SCHEDULE *(continued)*

Preventive Maintenance Item	Daily	Weekly	First 1000 hours	2000 hours or annually †	10,000 hours
Drain and replace brake fluid				X	
Inspect master cylinder for leakage or rubber boot wear, repair or replace as necessary				X	
Verify brake pressure switch functionality, repair as necessary				X	
Verify brake relay function, repair or replace as necessary				X	
Inspect brake shoes for wear, replace as necessary				X	
Inspect brake cylinders for leakage, repair or replace as necessary				X	
Inspect brake pedal for smooth operation and looseness, repair as necessary				X	
Inspect brake pressure sensor electrical connection, tighten as necessary				X	
Verify operator switchmat and pedal operation, replace as necessary				X	
Verify proper function of dash panel lights and switches, repair or replace as necessary				X	
Verify ignition switch condition, replace as necessary				X	
Verify beacon, headlight, and taillight function, repair or replace as necessary				X	
Inspect all fuses in the fuse holder, repair or replace as necessary				X	
Inspect seat cushions for wear, replace as necessary				X	
Inspect “E”-hitch for pin wear and proper operation, repair or replace as necessary				X	

8.2 DRIVE AXLE ACCESS POINTS







DETAIL A

Fluid	**Recommendation**	**Specification**	**Total Volume** (approx.)
Axle Oil	SAE 85W-140	API-GL5	41 fl oz / 1.2 liters

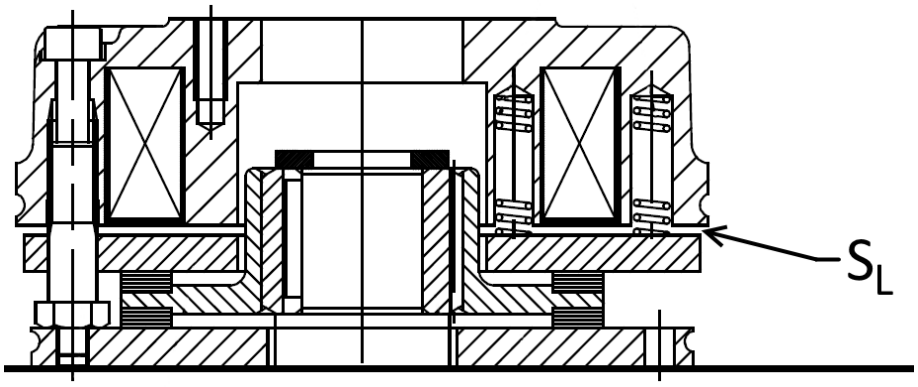
8.3 ELECTRONIC BRAKE MAINTENANCE AND ADJUSTMENT

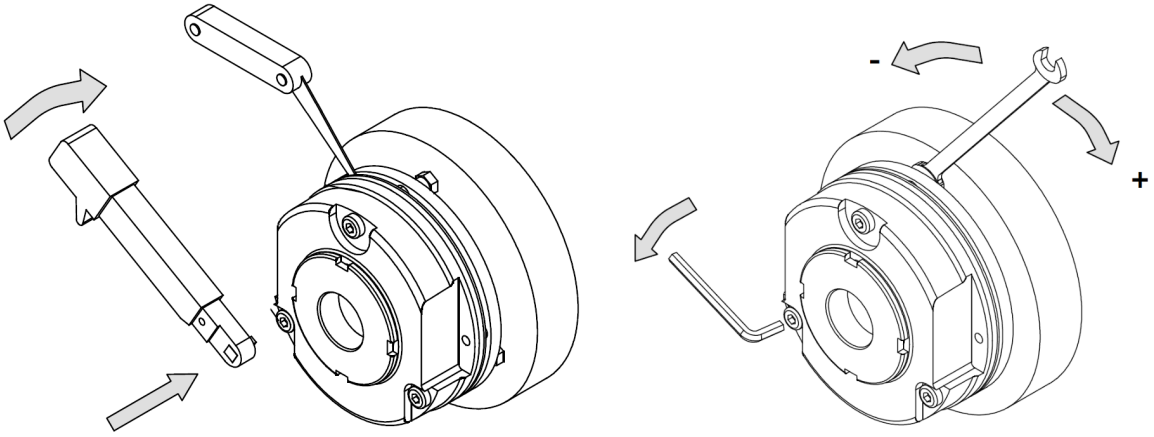
Checking the rotor thickness:

- Remove the cover ring from the brake assembl
- Loosen and remove the three stator screws and then remove the stator
- Remove the rotor and measure the rotor thickness with a set of calipers
- If the rotor thickness is less than .315” (8mm), replace the brake assembly
- Reinstall the stator and then proceed to checking the air gap per the below instructions

Checking the air gap:

- Remove the cover ring from the brake assembly
- Check the air gap SL (shown below) near the stator screws between the armature plate and stator using a feeler gage
- If the air gap exceeds .017” (.45mm), set the air gap to .012” (.3mm) using the following procedure
- Loosen the three stator screws on the outside of the brake module
- Adjust the threaded spacer sleeves using a combination wrench. Tightening/loosening by 1/6 of a turn reduces/increases the air gap approximately .006” (.15mm)
- Once the air gap is adjusted, tighten the stator screws to 88 in-lbs. (10 Nm) to lock the new position
- Re-check the air gap using a feeler gage to verify the correct gap distance





9.0 PROVISION OF SPARES

9.1 SOURCE OF SPARE PARTS

Spare parts may be obtained from the manufacturer:

Eagle Tugs
1 Air Cargo Pkwy East
Swanton, Ohio 43558 USA

Telephone: (419) 866-6301 or 800-426-6301
Fax: (419) 867-0634
E-mail: sales@tronair.com
Website: www.eagletugs.com

For Spare Parts, Operations & Service Manuals or Service Needs:
Scan the QR code or visit Tronair.com/aftermarket

9.2 ORDERING SPARE/SERVICE PARTS

Eagle inventories many of the spare/service parts found in its STT series tow tractors, and most of these parts can be shipped the day after the order is received. Non-stock parts orders will be shipped as soon as the parts are available.

10.0 IN SERVICE SUPPORT

Contact Eagle Tugs for technical services and information. See Section 1.3 – Manufacturer.

10.1 TECHNICAL ASSISTANCE

When addressing a repair procedure or operational problem, please remember that Eagle technical support is only a phone call away. Eagle technicians are available to assist you in vehicle diagnostics and recommended repair procedures. We encourage you to use this service to reduce machine down-time and to gain a better understanding of proper repair procedures.

11.0 GUARANTEES/LIMITATION OF LIABILITY - EAGLE 1-YEAR WARRANTY

Items added or modified by Eagle Tugs as shown in this manual are covered under Eagle's one-year standard warranty.

The Eagle Tugs (Eagle) Standard Warranty covers all NEW MTT, STT-series, RTT-series, and Transit Pro tow tractors, as well as all Eagle tow tractor models used in non-aviation/industrial applications. Eagle Tugs warrants that these tractors will be free from defects in material and workmanship for a period of 1 year or 2,000 operating hours, from date of delivery.

This warranty does not apply to any Eagle tow tractor, or component part(s) that have damage caused by: misuse of the vehicle, accidents, collision or objects striking the vehicle, vandalism, fire, explosion or water damage, using contaminated or improper fuel/fluids, customer-applied chemicals to painted surfaces, improper handling or application, maintenance neglect including lack of lubricants or fluids; nor does it extend to the Eagle tow tractor and/or parts which have been repaired or altered outside of Eagle's plant or the facility of an Authorized Service Representative without the permission of Eagle. Furthermore, any modification of the tow tractor's electrical system MUST be preapproved and documented in writing by Eagle. Failure to do so voids the unit's electrical component warranty.

This warranty does not apply to routine maintenance or wearable parts of the Eagle tow tractor such as: tires, brake pads or shoes, ball joints, kingpins, u-joints, wheel bearings, filters, seals, spark plugs, hoses, belts, light bulbs, batteries (Diesel & Gas tractors), fuses or similar items. Also snow plows and transit pro options are warranted directly to the user by their respective manufacturer and not by Eagle or an Authorized Service Representative. This warranty does not extend to the batteries and battery chargers as these are warranted directly to the user by their respective manufacturer and not by Eagle or an Authorized Service Representative.

This warranty does not cover or provide credit for the following: tractor rental or other substitute equipment; lodging; loss of time, income, sales or profits; loss of the use of tractor; telephone calls or communication expense; lift truck; storage fees; injury or death to persons or damage or destruction of property; or consequential, incidental or punitive damage.

Warranty Claim Procedure: When a warranty situation arises, it is essential that the customer contact Eagle's Warranty Department at +1 734-442-1000. The customer will need to provide Eagle with the tow tractor serial number and operating hours. A customer service representative will analyze the problem and determine the next steps. In many cases Eagle's technical support personnel will be able to analyze the problem and recommend a solution that will solve the problem and reduce down time. If further service is required, an Eagle customer service representative will work with customer personnel to arrange a service provider and/or will send parts to your facility for the repair as quickly as possible. The determination of a warrantable claim will be at the sole discretion of Eagle.

Notice of any claimed defect must be given to Eagle within the warranty period and within ten (10) days after such defect is discovered. Liability under this warranty is limited to either replacing or repairing, at Eagle's election, any part or parts deemed defective after examination by Eagle or an Authorized Service Representative. Eagle reserves the right to use remanufactured parts as replacements in warranty claims.

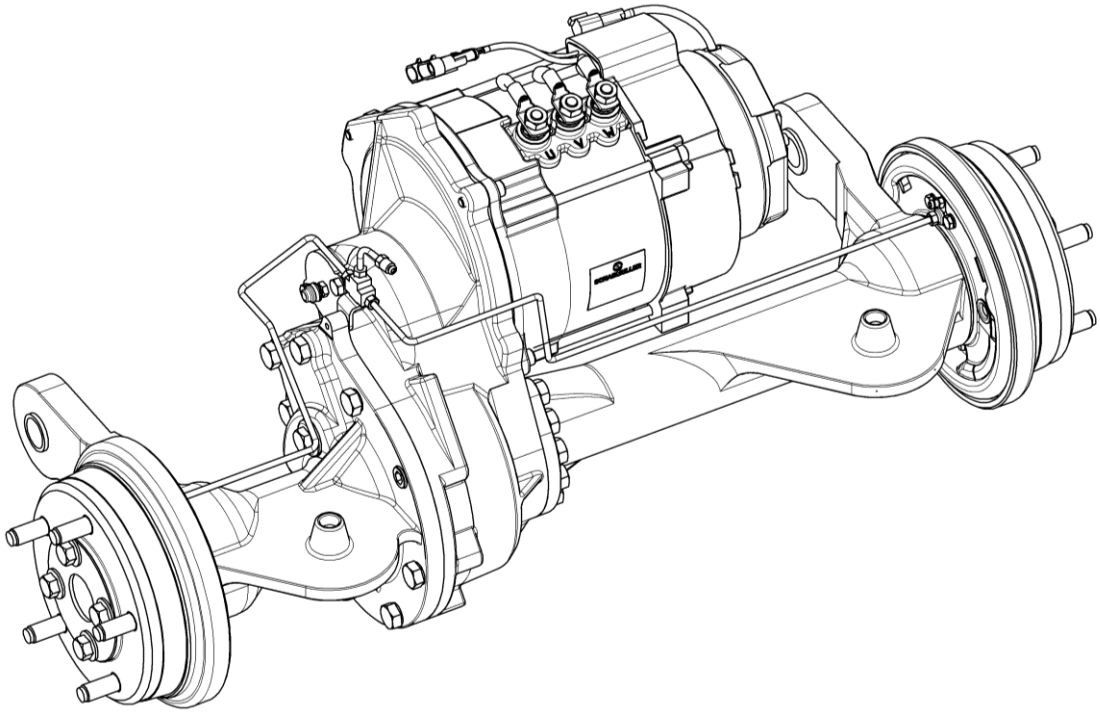
At Eagle's election, any part replaced under warranty as defective can be sent out for third party inspection. If the part is not found to be defective, or abuse was the cause for the failure, all associated costs related to the warranty claim may be charged to the customer. All parts returned to Eagle by a customer must be received without further damage. If returned items are not properly packaged for return shipping to Eagle or an Authorized Service Representative via prepaid transportation, the customer will be charged for the full value of the item that was Rev B, 11-Nov-2017 Standard Warranty 2 damaged upon return. This warranty does not extend beyond its original term for any Eagle tow tractor or part replaced or repaired under warranty. Any and all disputes or disagreements will be negotiated in good faith by both parties.

Labor Allowance: A labor allowance may be issued upon request at Eagle's discretion. Allowable labor hours and a per hour labor rate will be determined by Eagle according to reasonable automotive standards.

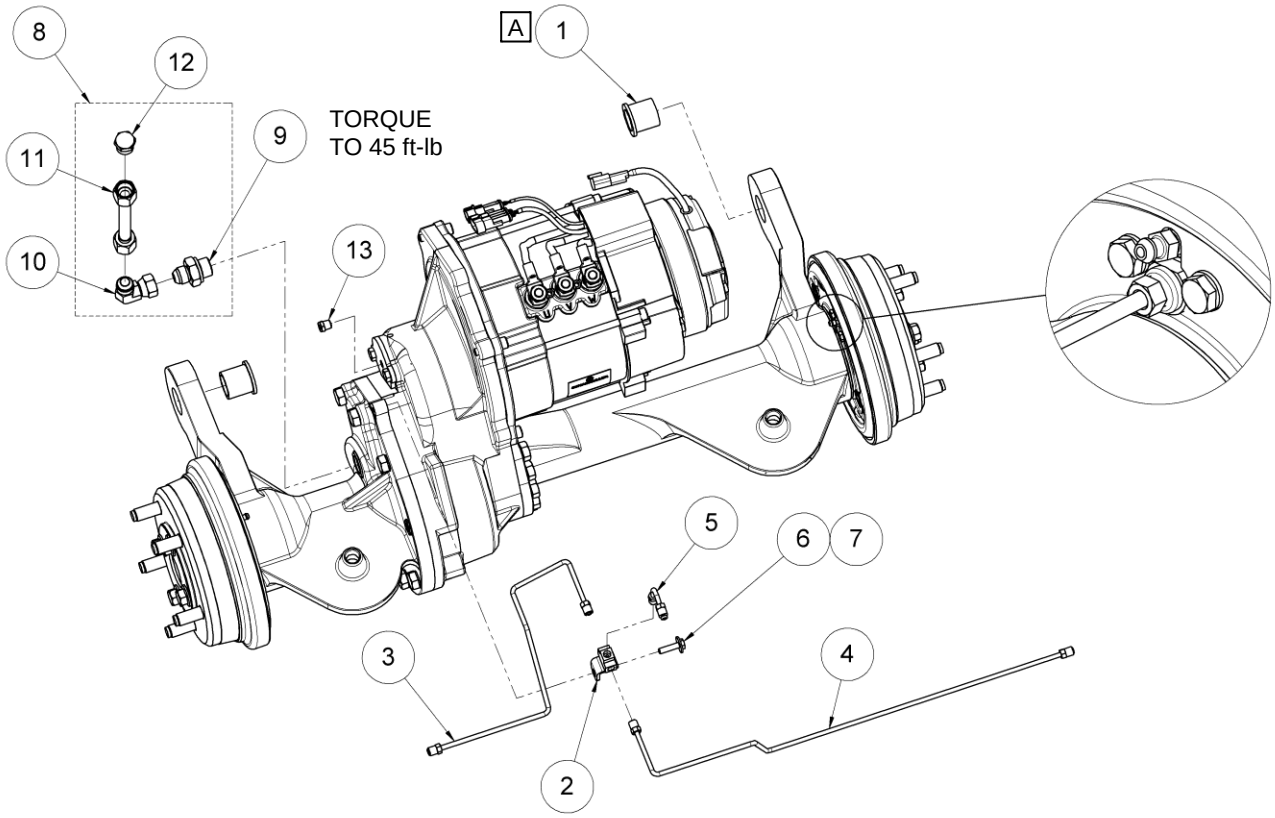
EXCEPT AS SET FORTH ABOVE, ALL WARRANTIES, CONDITIONS, REPRESENTATIONS, INDEMNITIES AND GUARANTEES, EXPRESS OR IMPLIED, WHETHER ARISING BY STATUTE, CUSTOM OF TRADE OR UNDER ORAL OR WRITTEN STATEMENTS MADE BY OR ON BEHALF OF EAGLE NEGOTIATIONS WITH CUSTOMER, DISTRIBUTOR, DEALER, OR ANY REPRESENTATIVE, ARE HEREBY OVERWRITTEN AND EXCLUDED, AND NO LIABILITY SHALL ATTACH TO EAGLE, EITHER IN CONTRACT OR IN TORT, OR STRICT LIABILITY IN TORT, FOR ANY DAMAGE TO PROPERTY, LOSS OF PROFITS, DAMAGES, COSTS, CHARGES, LIABILITY OR EXPENSES, WHETHER DIRECT OR INDIRECT, CONSEQUENTIAL OR OTHERWISE, WHICH ARISE OUT OF OR IN CONNECTION WITH THE SALE OR USE OF ANY EAGLE MACHINE OR THE SUPPLY OF SERVICES.

SUBJECT TO CHANGE WITHOUT NOTICE.

12.0 DRIVE AXLE SYSTEM



12.1 BRAKE LINES AND SLEEVE BEARINGS



Sleeves must be pressed in and then reamed to Ø1.00

A

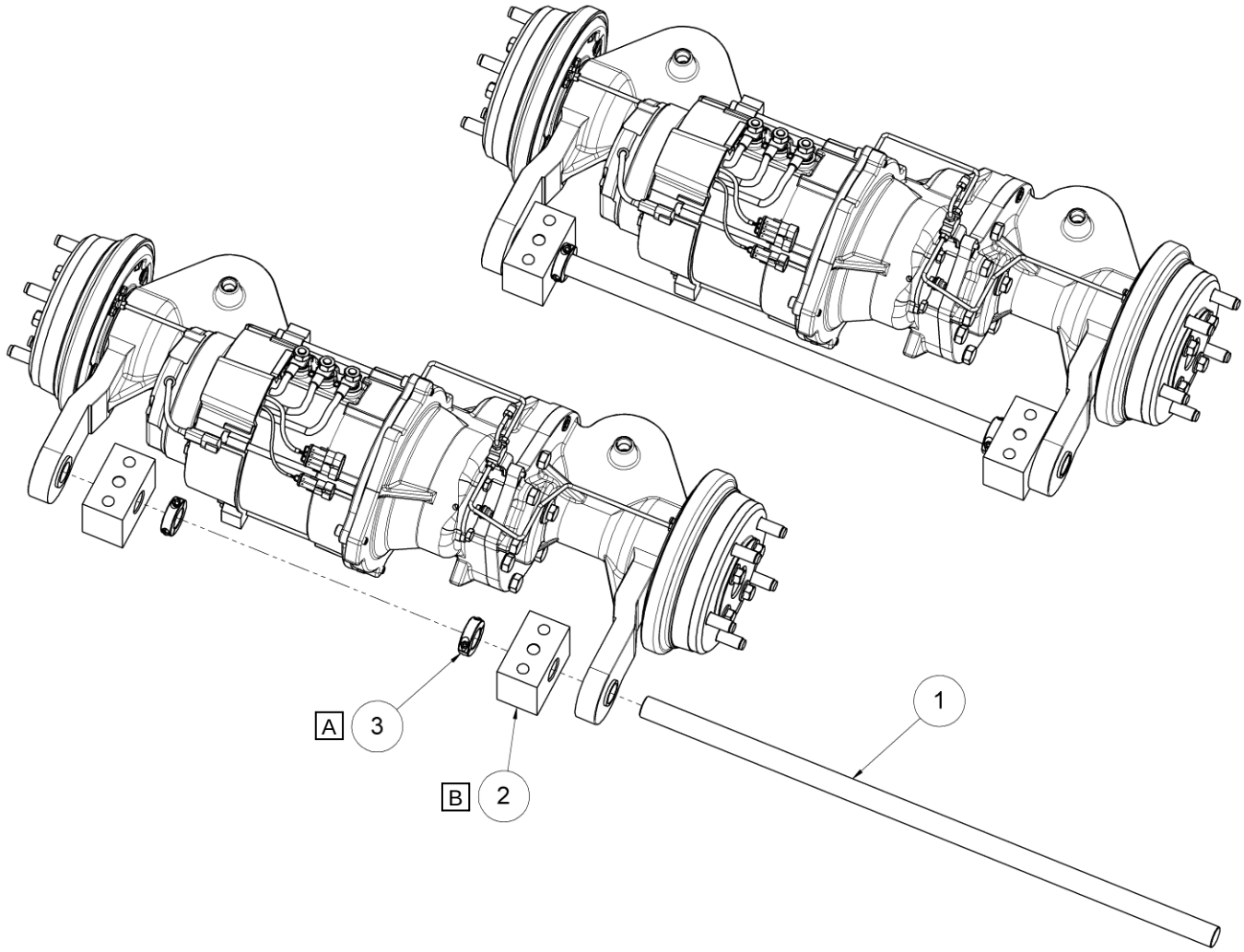
Parts List

When ordering replacement parts/kits, please specify model, serial number and color of your unit.

Item	Part Number	Description	Qty
1	RT00-04-004-CA	BRONZE SLEEVE BEARING	2
2	A-TT4-00168	CROSS TEE REAR	1
3	A-RTT12-00169	REAR LH BRAKE LINE	1
4	A-RTT12-00171	REAR RH BRAKE LINE	1
5	A-TT4-00167	BRAKE LINE - SHORT 90°	1
6	NPN	FLAT WASHER, M6	1
7	NPN	HCS, M6X1.0X20	1
8	RT00-04-007-AA	AXLE FILL TUBE ASSEMBLY	1
9	MB5315X8X8	ADAPTER, 8BSPP M - 8 JIC M	1
10	C5506X8	ELBOW 90°, 8 JIC M - 8 JIC F	1
11	RT00-04-008-SA	AXLE FILL TUBE	1
12	C5229X8	PLUG, 8 JIC M	1
13	RT00-04-009-CA	BREATHER VENT, 1/8 BSPT	1
N/S	DT04-2P	ELECTRICAL CONNECTOR	1
N/S	W2P	CONNECTOR LOCK	1
N/S	0460-215-16141	CONNECTOR PIN	2

EM Brake to be wired as shown below (polarity is not important)

12.2 PIVOT SHAVT AND MOUNTING BLOCKS



A Do not fully tighten collar until assembly is installed into the chassis

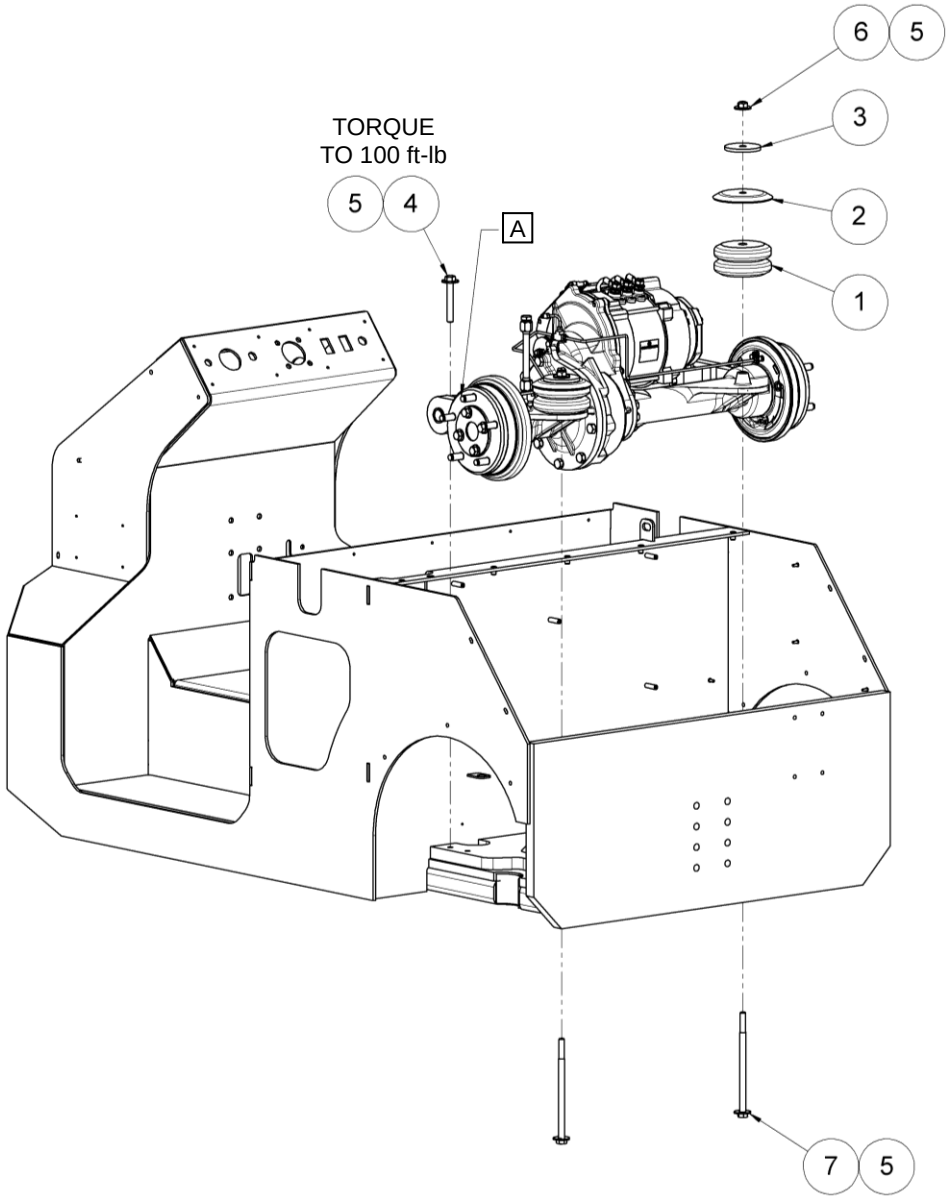
B Use Permatex® Anti-Seize Lubricant or equivalent on the interior surface of item 2

Parts List

When ordering replacement parts/kits, please specify model, serial number and color of your unit.

Item	Part Number	Description	Qty
1	A-RTT12-00110	Ø1 IN BEARING SHAFT	1
2	RT00-04-005-SA	AXLE SHAFT MOUNTING BLOCK	2
3	RT00-12-002-CA	Ø1 IN SHAFT COLLAR	3

12.3 AXLE INSTALL TO CHASSIS



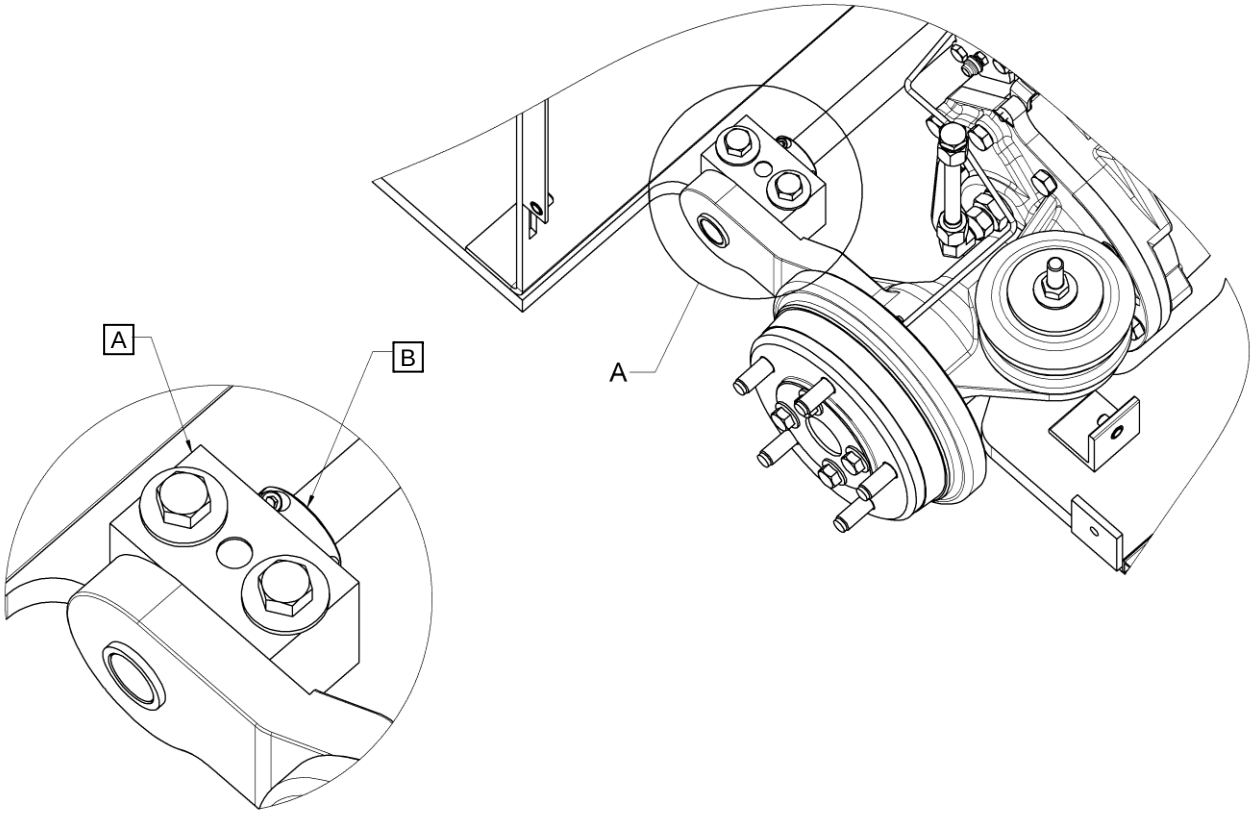
A Mount blocks must be installed with the center divot mark facing up

Parts List

When ordering replacement parts/kits, please specify model, serial number and color of your unit.

Item	Part Number	Description	Qty
1	A-RTT12-00116	RUBBER COMPRESSION SPRING	2
2	A-TN4-00115E	SUSPENSION CUP	2
3	ST00-04-001-CA	AXLE SUSPENSION WASHER	2
4	NPN	HCS, 1/2-13 UNC X 4.5, GR 8, ZN PL	4
5	NPN	FLAT WASHER, 1/2	8
6	NPN	LOCK NUT, 1/2-13 UNC, GR C	2
7	NPN	HCS, 1/2-13 UNC X 8.0 x 1.50 THREAD LENGTH, GR 8, ZN PL	2

12.4 REAR AXLE SHAFT COLLARS

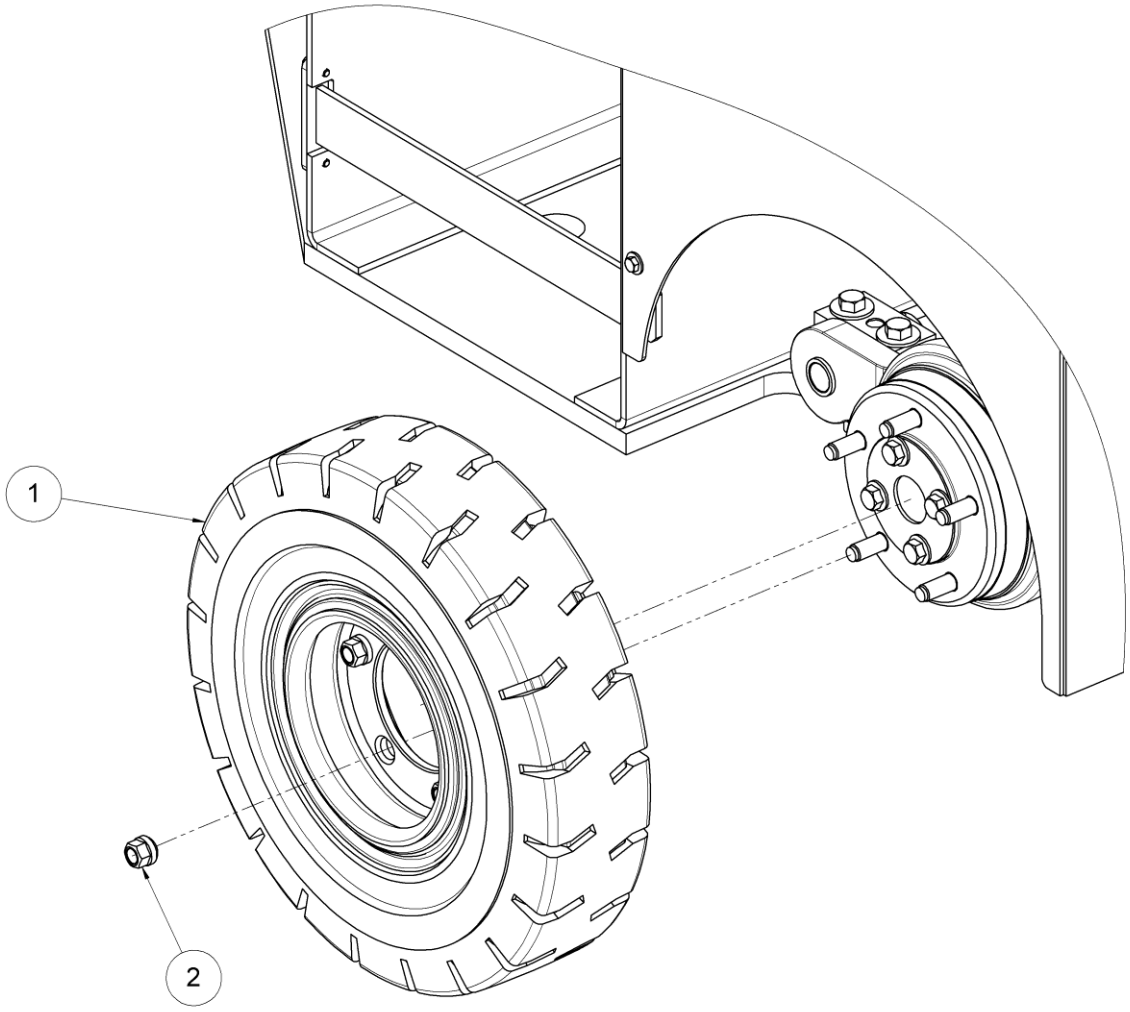


DETAIL A

A Note center divot mark facing up

B After axle assembly to chassis;
1. Verify that the pivot shaft is centered side-to-side in the tractor
2. Press the shaft collar up against the mount block (one on each side)
3. Tighten the shaft collar bolts to 14 ft-lb.

12.5 REAR WHEELS AND TIRES



TORQUE
TO 140 ft-lb

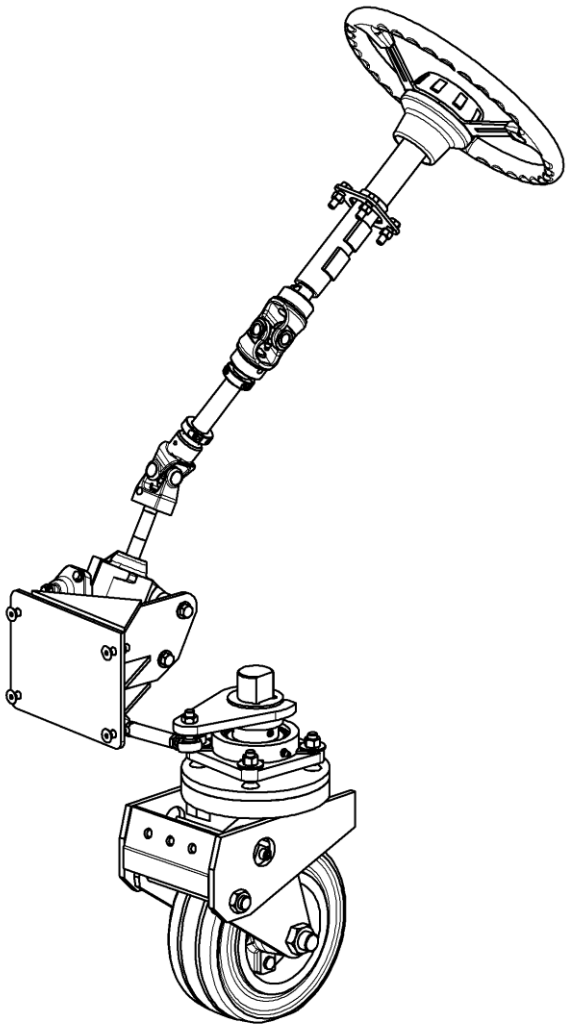
Non-marking tires available upon request. Tires sold individually must be mounted to the rim by the customer with special equipment/tooling (not provided by Eagle Tugs).

Parts List

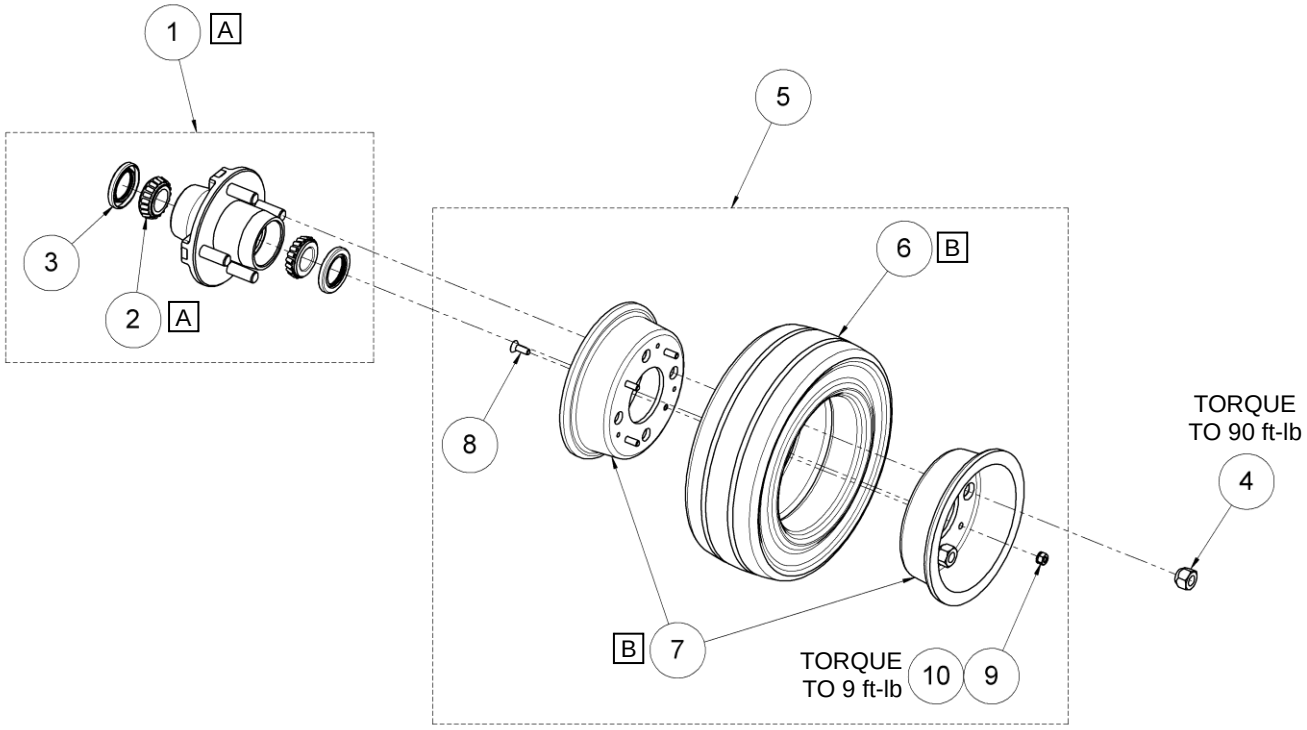
When ordering replacement parts/kits, please specify model, serial number and color of your unit.

Item	Part Number	Description	Qty
1	U-1205	3-PIECE WHEEL AND TIRE ASSEMBLY WITH NUTS	2
2	RT12-04-011-CA	WHEEL NUT, SPHERICAL, M14X1.5	10
3	RT12-04-010-CB	500 X 8-3 TIRE, NON-MARKING	-

13.0 STEERING AND FRONT WHEEL



13.1 FRONT WHEEL AND TIRE ASSEMBLY



A Hand or machine pack bearing with NLGI 2 grease, and fill hub with NLGI 2 grease before installation

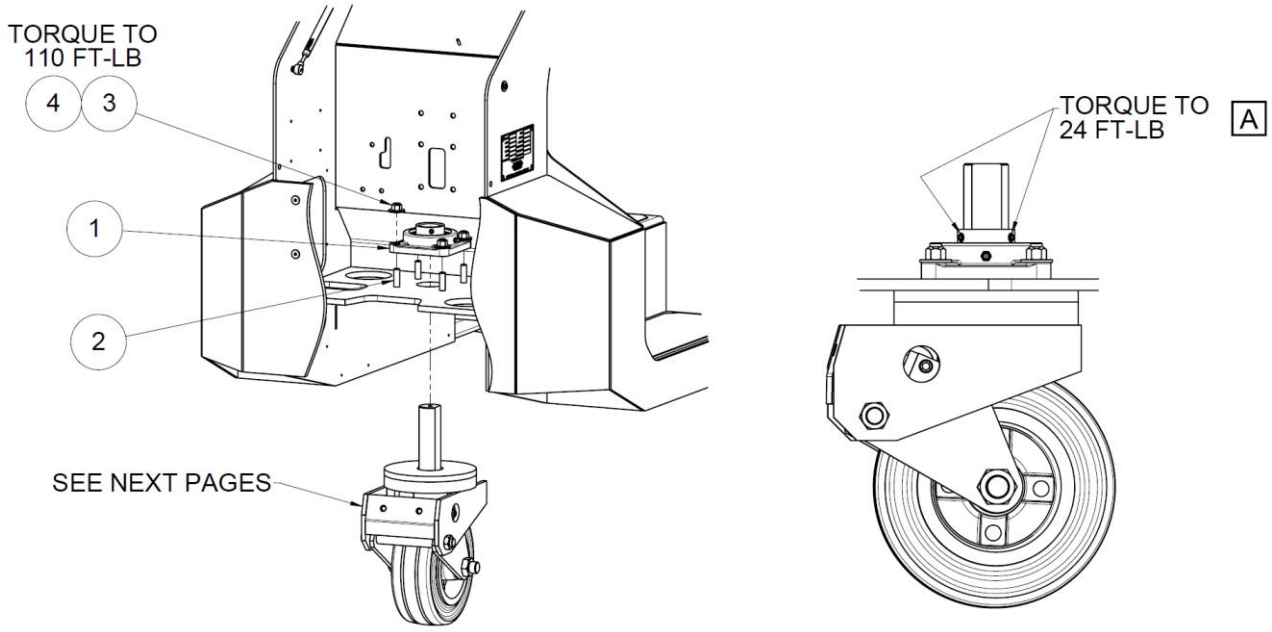
B When the tire or wheel are ordered separately it is the responsibility of the end customer to assemble the tire to the rim. Note that this assembly requires specialized equipment

Parts List

When ordering replacement parts/kits, please specify model, serial number and color of your unit.

Item	Part Number	Description	Qty
1	RT12-54-005-KA	WHEEL HUB KIT WITH BEARINGS AND SEALS, UNASSEMBLED	1
2	A-RTT12E-00049D	WHEEL BEARING OUTER RACE	2
3	A-RTT12E-00049G	WHEEL GREASE SEAL	2
4	NPN	WHEEL NUT, 1/2-20 UNF X 60 DEG	4
5	---	FRONT RIM AND TIRE, ASSEMBLED	1
6	RT12-04-0067-CA	FRONT TIRE - MONARCH	1
6	RT12-04-007-CB	FRONT TIRE – MONARCH NON MARKING (OPTIONAL)	N/A
7	RT12-54-006-KA	FRONT RIM ONLY	1
8	NPN	FHS, 1/4-20 UNC X .75	4
9	NPN	LOCK WASHER, 1/4	4
10	NPN	HEX NUT, 1/4-20 UNC	4

13.2 STEERABLE WHEEL



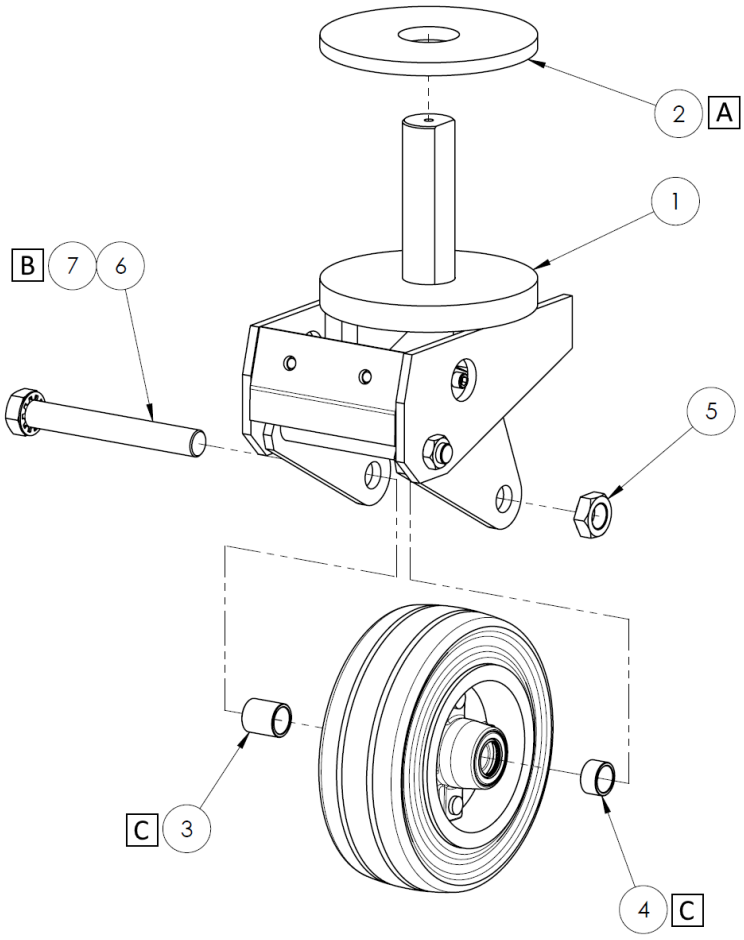
A Remove set screws, and apply Loctite® Threadlocker Red 271®thread retaining compound or comparable. Align set screws to straddle flat on shaft, and tighten the set screw to the specified torque. Ensure that the caster is fully seated against the chassis before tightening

Parts List

When ordering replacement parts/kits, please specify model, serial number and color of your unit.

Item	Part Number	Description	Qty
1	A-RTT12-00105	FLANGE BEARING	1
2	G-1152-109120	FLATHEAD CAP SCREW, 1/2-13 X 2	4
3	G-1250-1090W	FLATWASHER, 1/2	4
4	G-1727-1090	LOCKNUT, 1/2-13	4

13.2 STEERABLE WHEEL *(continued)*



A Liberally apply NLGI 2 grease to the top surface of items 1 and 2 before installation.

B Hand tighten item nut until there is zero play in the roller bearings and the wheel has a small amount of drag while spinning.

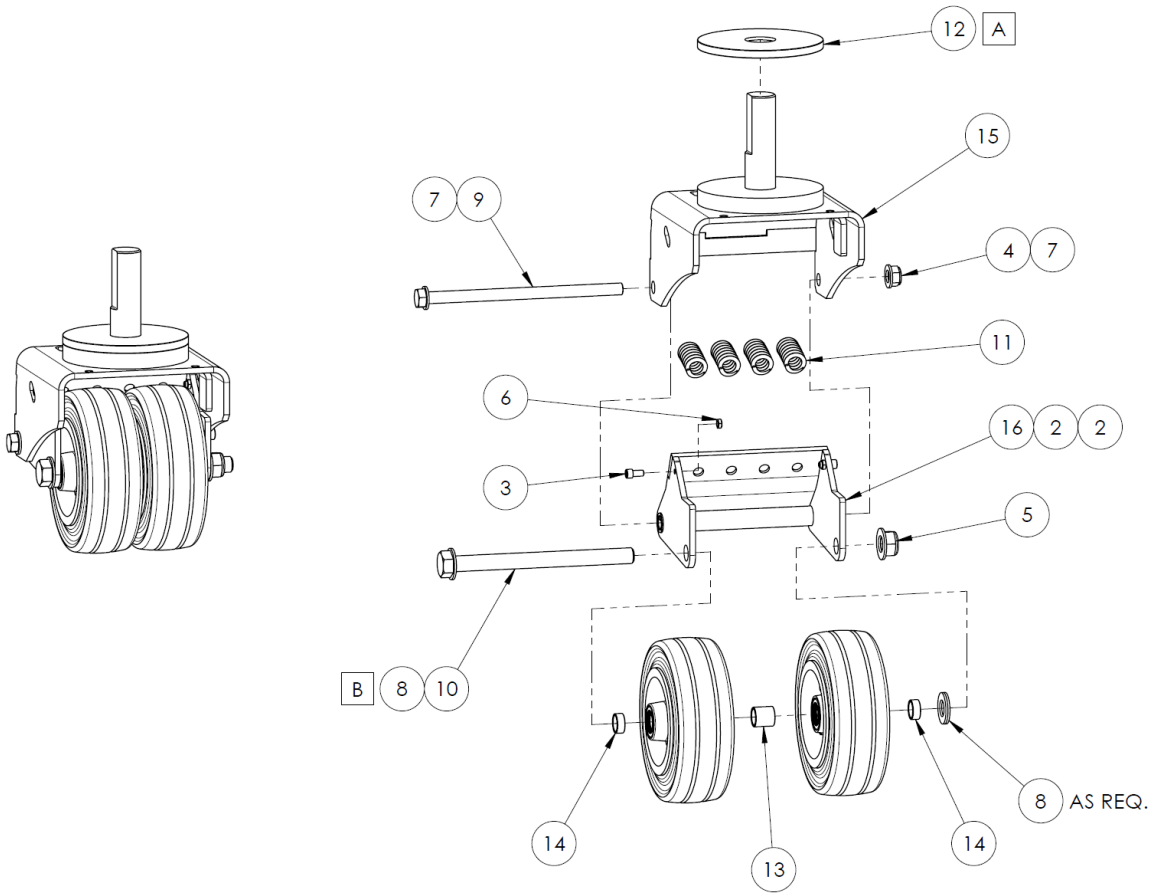
C Install spacers such that steered wheel is centered within item 1.

Parts List

When ordering replacement parts/kits, please specify model, serial number and color of your unit.

Item	Part Number	Description	Qty
1	RT12-04-006-SA	FRONT STEERABLE WHEEL - SINGLE (INCLUDES ALL ITEMS BELOW)	1
2	A-RTT12-00050-C	POLYMER WEAR DISC	1
3	A-RTT12E-00050-E	SPACER, Ø1.25 X Ø1 X 1.375	1
4	A-RTT12E-00050-D	SPACER, Ø1.25 X Ø1 X .6875	1
5	A-RTT12E-00050-B	LOCK NUT	1
6	A-RTT12E-00050-A	HEX CAP SCREW	1
7	A-RTT12E-00050-C	LOCK WASHER	1

13.2 STEERABLE WHEEL *(continued)*



A Liberally apply NLGI 2 grease to the top surface of items 1 and 2 before installation.

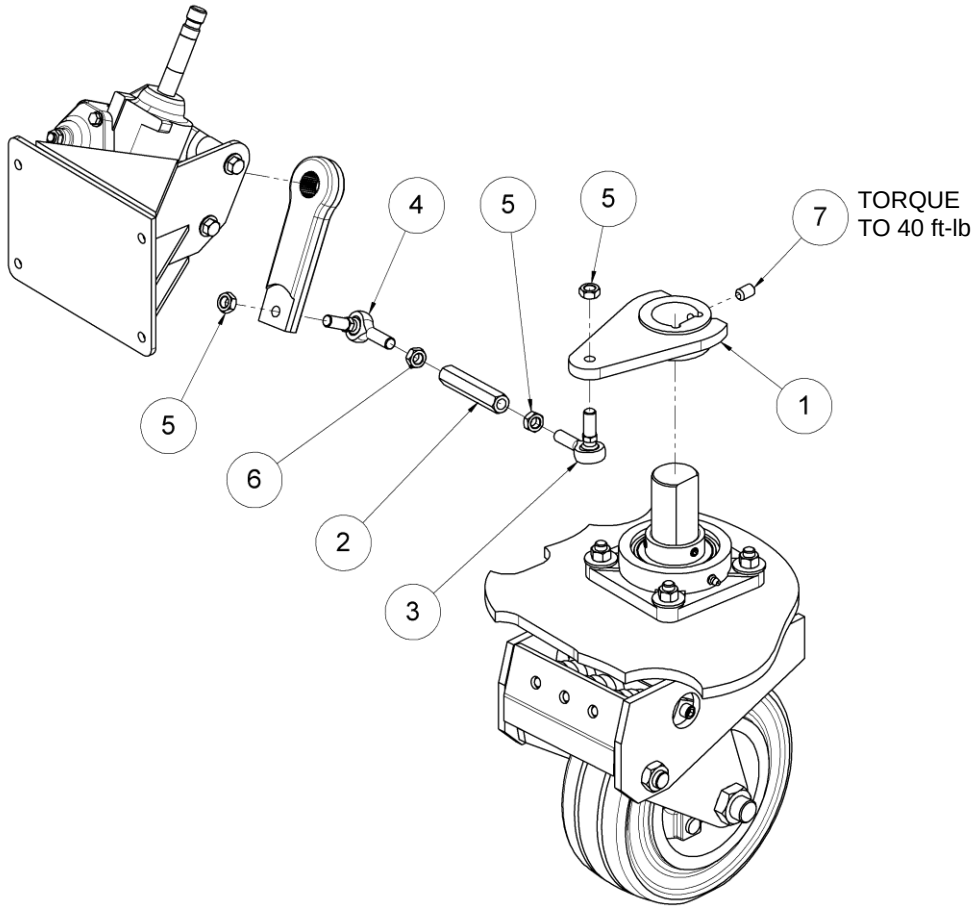
B Hand tighten item nut until there is zero play in the roller bearings and the wheel has a small amount of drag while spinning.

Parts List

When ordering replacement parts/kits, please specify model, serial number and color of your unit.

Item	Part Number	Description	Qty
1	A-RTT50-0328	GREASE ZERK	1
2	C-TT4-10188	NYLINER BEARING	2
3	G-1151-107206	SCREW, 3/8-16 X 3/4 HEX HD CAP GR 8	2
4	G-1202-1110	STOPNUT, 3/4-10 ELASTIC	1
5	G-1202-1120	STOPNUT, 1-8 ELASTIC	1
6	G-1203-1070	JAMNUT, 3/8-16 ELASTIC	2
7	G-1250-1110N	FLATWASHER, 3/4 NARROW	2
8	G-1250-1130N	FLATWASHER, 1 NARROW	4
9	G-1420-1110113	BOLT, 3/4-10 X 13" HEX HD GR 8	1
10	G-1420-1130112	BOLT, 1-8 X 12" HEX HD GR 8	1
11	H-5081	SPRING, SUSPENSION	4
12	H-5083	CASTER WEAR PLATE	1
13	TR-2808	CENTER SPACER	1
14	TR-2809	END SPACER	2
15	Z-12014-00	WLD, UPPER FRAME (P)	1
16	Z-12015-00	WLD, LOWER FRAME	1

13.3 STEERING LINKAGE

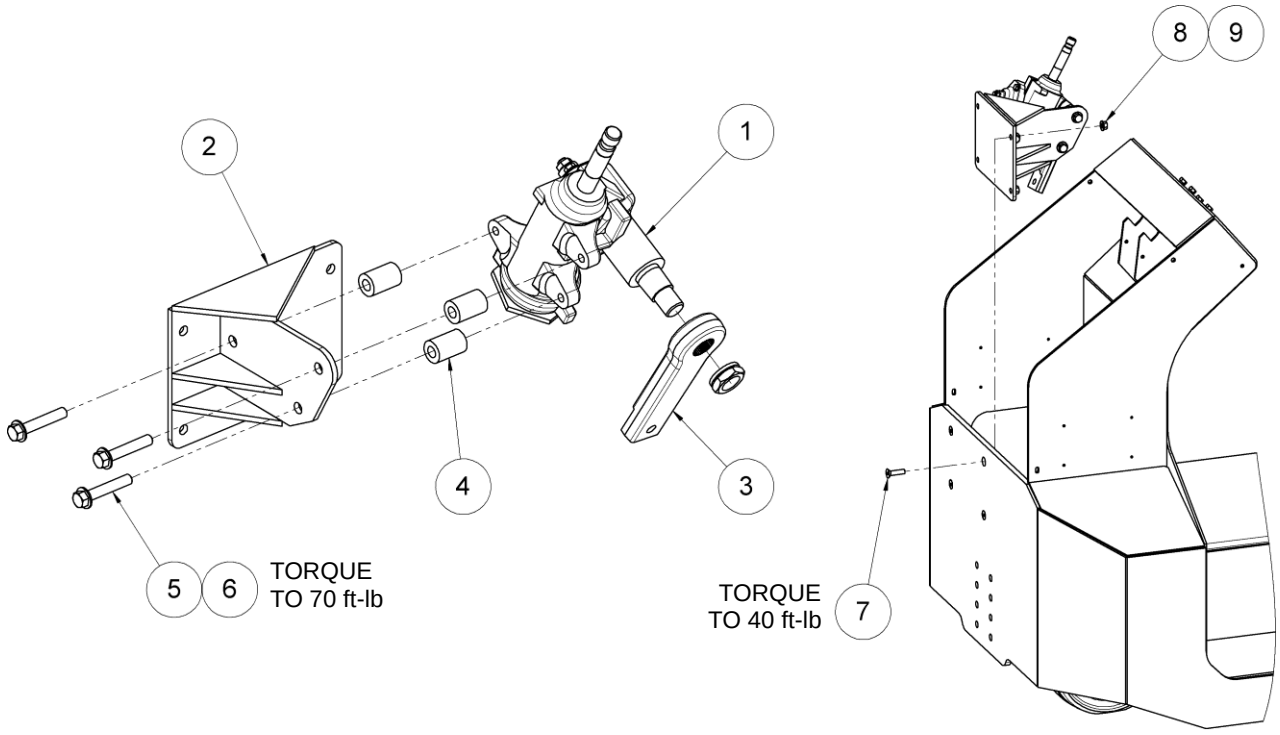


Parts List

When ordering replacement parts/kits, please specify model, serial number and color of your unit.

Item	Part Number	Description	Qty
1	ST00-12-002-SA	STEERING ARM CASTER	1
2	ST00-12-003-SA	STEERING DRAG LINK	1
3	ST00-12-008-CA	BALL JOINT	1
4	ST00-12-008-CB	BALL JOINT, LH THREAD	1
5	NVSP-21-009-CA	JAM NUT, 1/2-20 UNF	3
6	NVSP-21-009-CB	JAM NUT, 1/2-20 UNF, LH	1
7	NVSP-21-014-CA	CUP POINT SET SCREW, 1/2-20 UNF X .75	1

13.4 STEERING GEARBOX

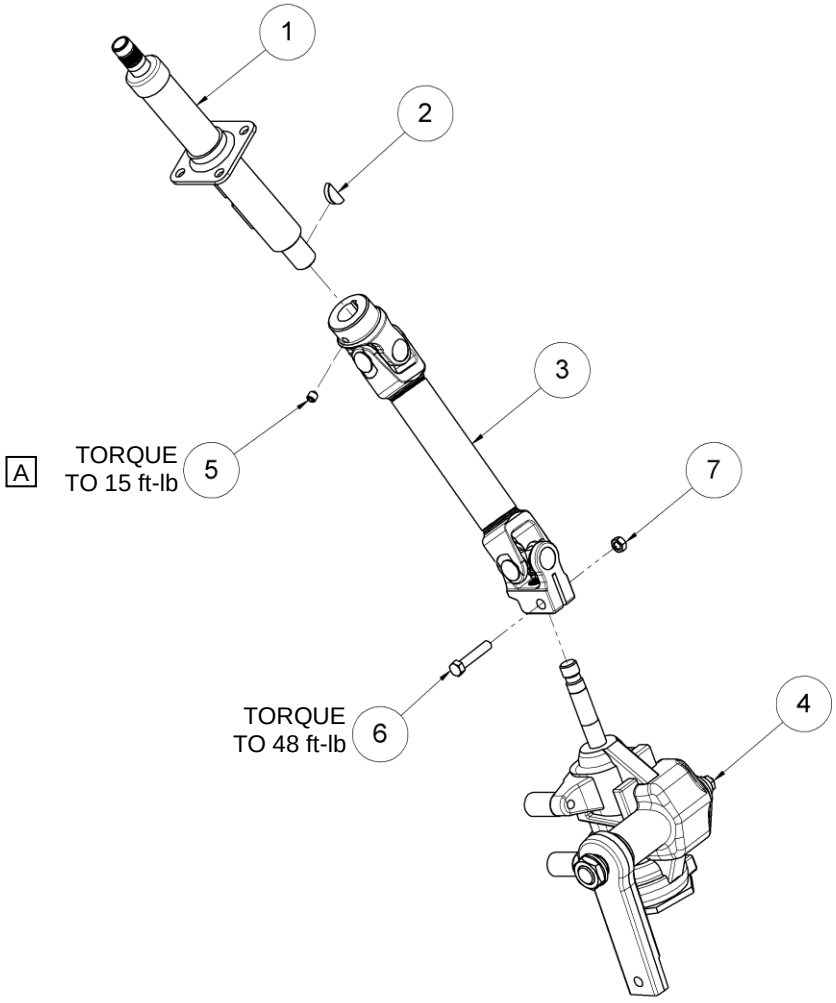


Parts List

When ordering replacement parts/kits, please specify model, serial number and color of your unit.

Item	Part Number	Description	Qty
1	A-RTT12-00381	STEERING GEARBOX	1
2	ST00-12-005-SA	STEERING GEAR BRACKET	1
3	ST00-12-001-SA	STEERING ARM	1
4	H-4900-081414	STEERING GEAR SPACER, 1.50 LONG	3
5	NPN	HCS, 7/16-14 UNC X 2.5, GR 8, ZN PLATED	3
6	NPN	FLAT WASHER, 7/16, HARDENED	3
7	NPN	FHS, 3/8-16 UNC X 1.5, GR 8	4
8	NPN	FLAT WASHER, 3/8	4
9	NPN	LOCK NUT, 3/8-16 UNC	4

13.5 STEERING SHAFT



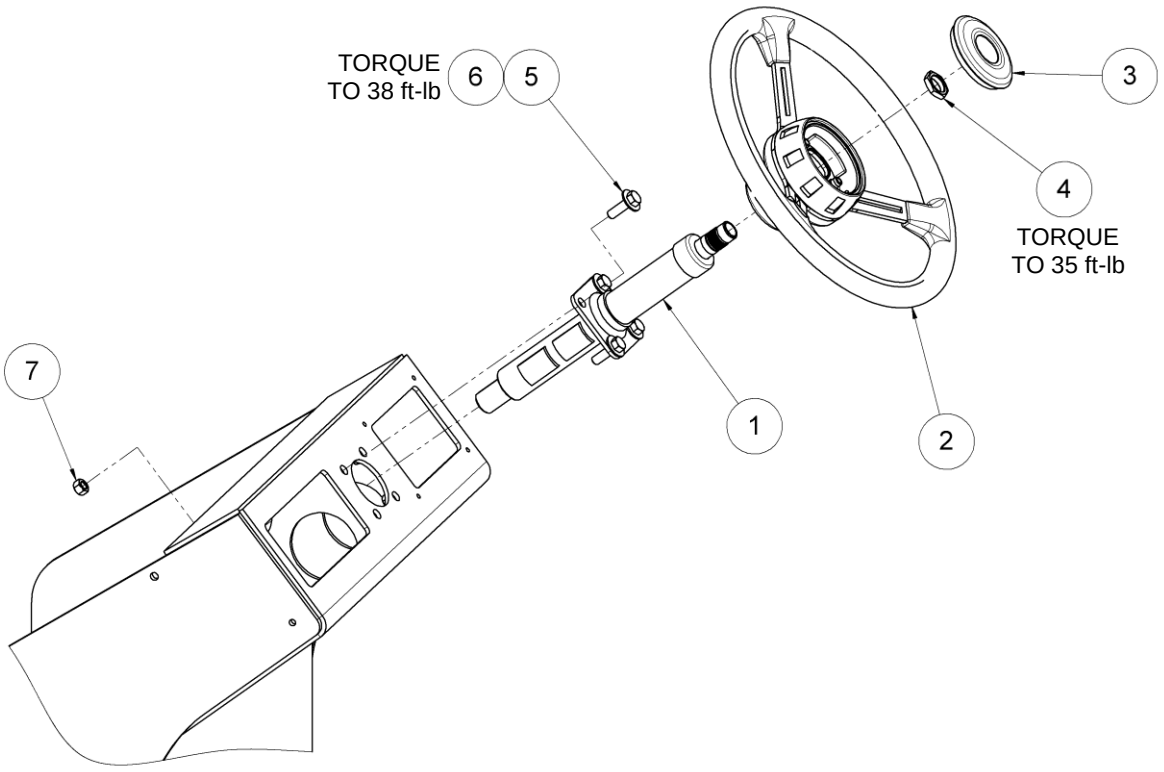
A Install specified components using Loctite® Threadlocker Blue 242®thread retaining compound or comparable

Parts List

When ordering replacement parts/kits, please specify model, serial number and color of your unit.

Item	Part Number	Description	Qty
1	ST00-12-007-SA	STEERING COLUMN	1
2	N/A	WOODRUFF KEY, #18 (INCLUDED WITH ITEM 1)	1
3	ST00-12-011-SA	STEERING SHAFT (INCLUDES ITEMS 6-7)	1
4	A-RTT12-00381	STEERING BOX	1
5	NPN	SET SCREW, CUP POINT, 3/8-16 UNC X .375	1
6	NPN	HCS, 3/8-24 UNC X 2 (INCLUDED WITH ITEM 3)	1
7	NPN	LOCK NUT, 3/8-24 UNF (INCLUDED WITH ITEM 3)	1

13.6 STEERING COLUMN

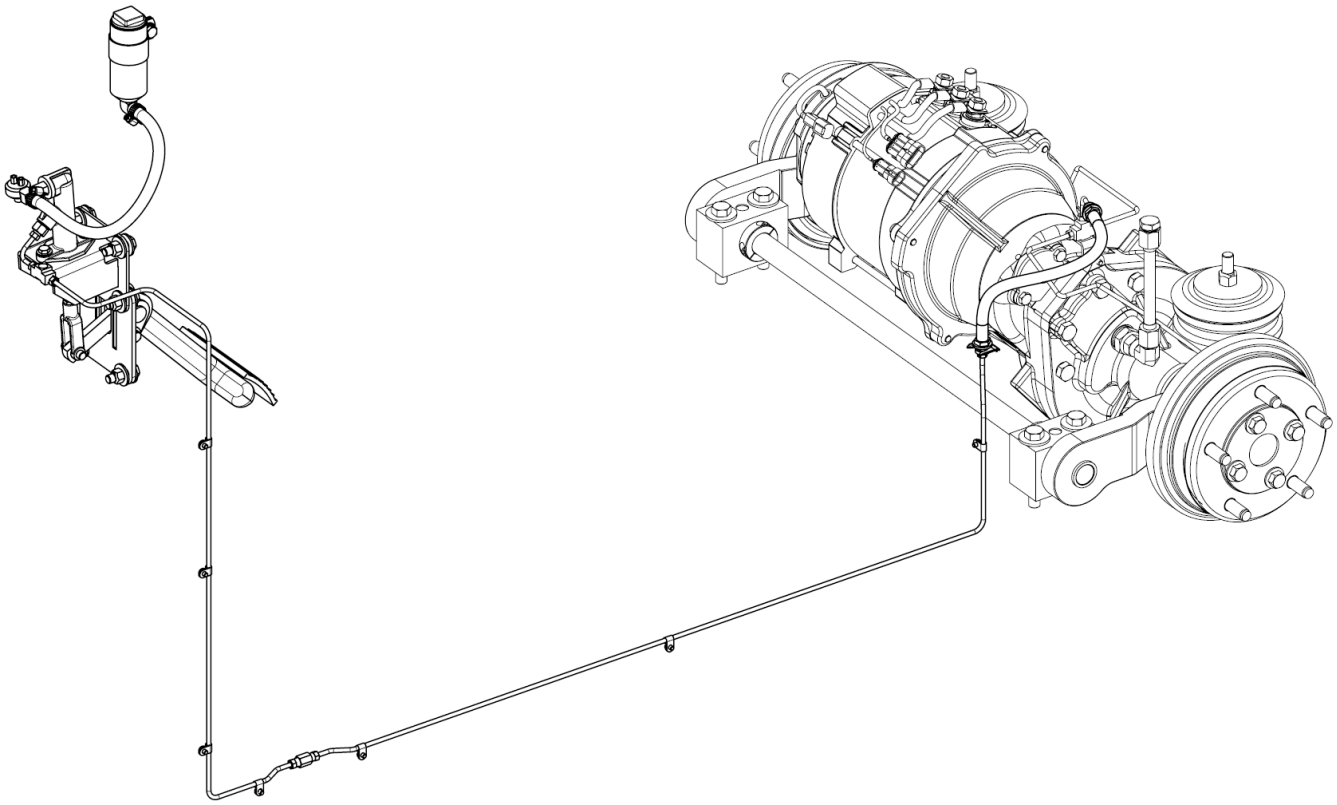


Parts List

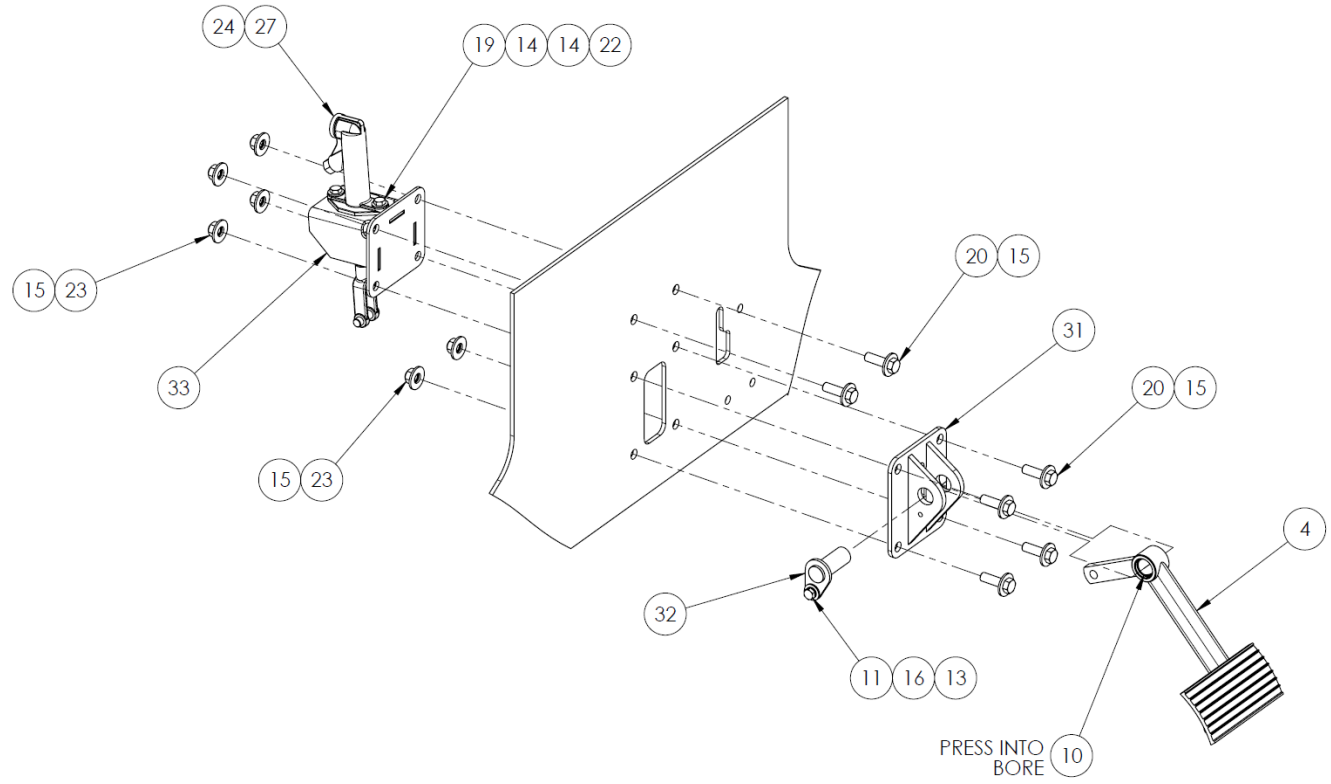
When ordering replacement parts/kits, please specify model, serial number and color of your unit.

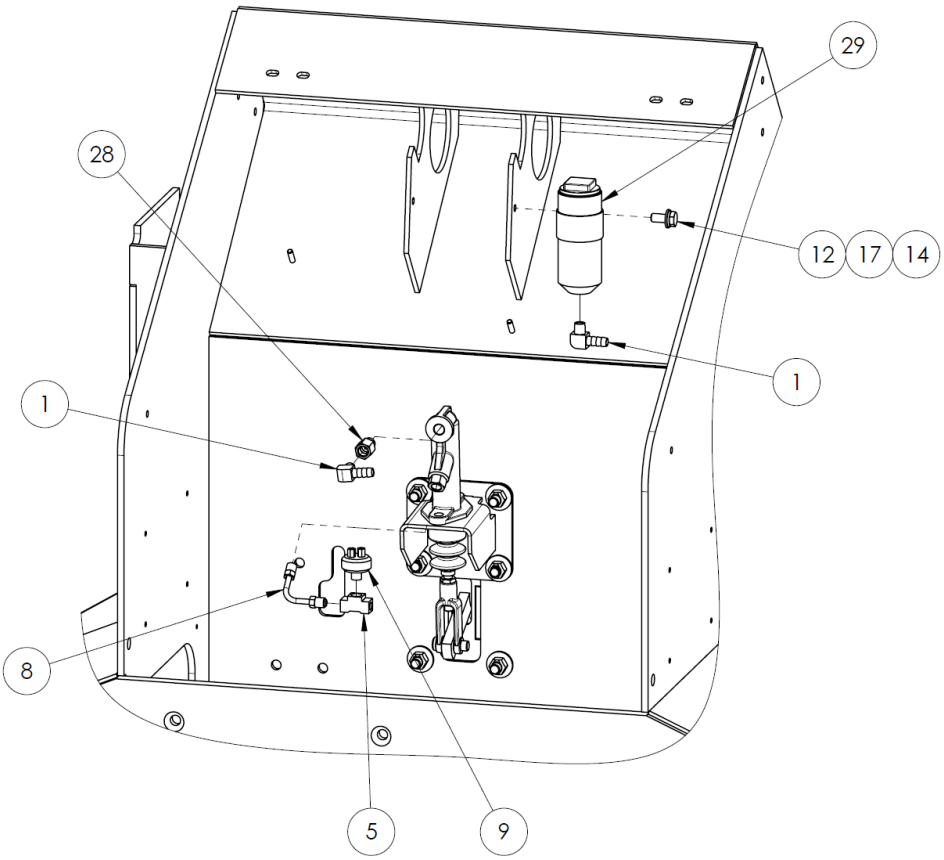
Item	Part Number	Description	Qty
1	ST00-12-007-SA	STEERING COLUMN	1
2	A-TN4-00809E	STEERING WHEEL, ELECTRIC	1
3	A-TT10-00811	HORN BUTTON	1
4	A-TT10-00813	HEX JAM NUT, 13/16-20 UNEF	1
5	NPN	HCS, 3/8-16 UNC X 1.25	4
6	NPN	FLAT WASHER, 3/8	4
7	NPN	LOCK NUT, 3/8-16 UNC	4

14.0 BRAKE SYSTEM

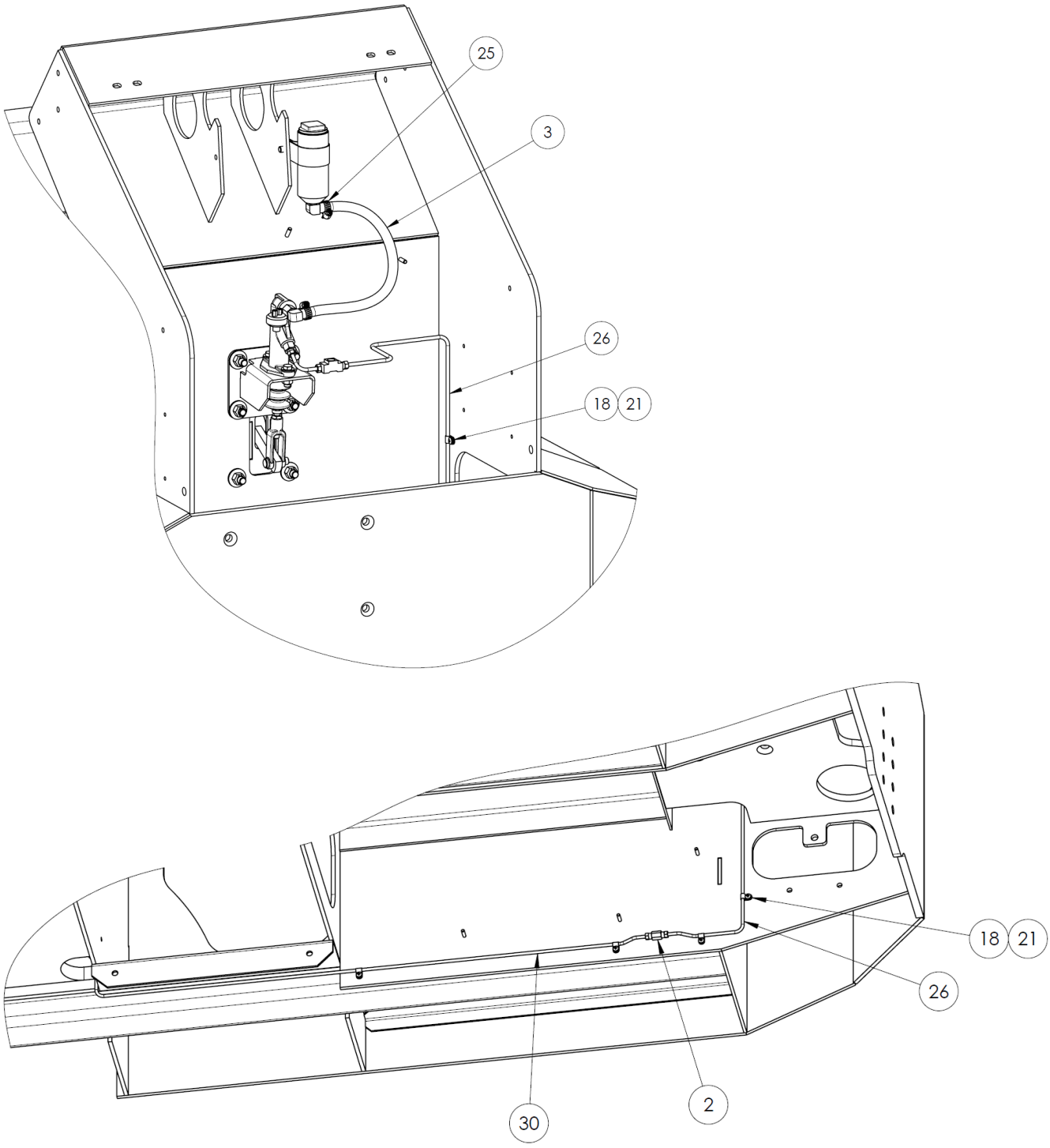


14.1 BRAKE PEDAL

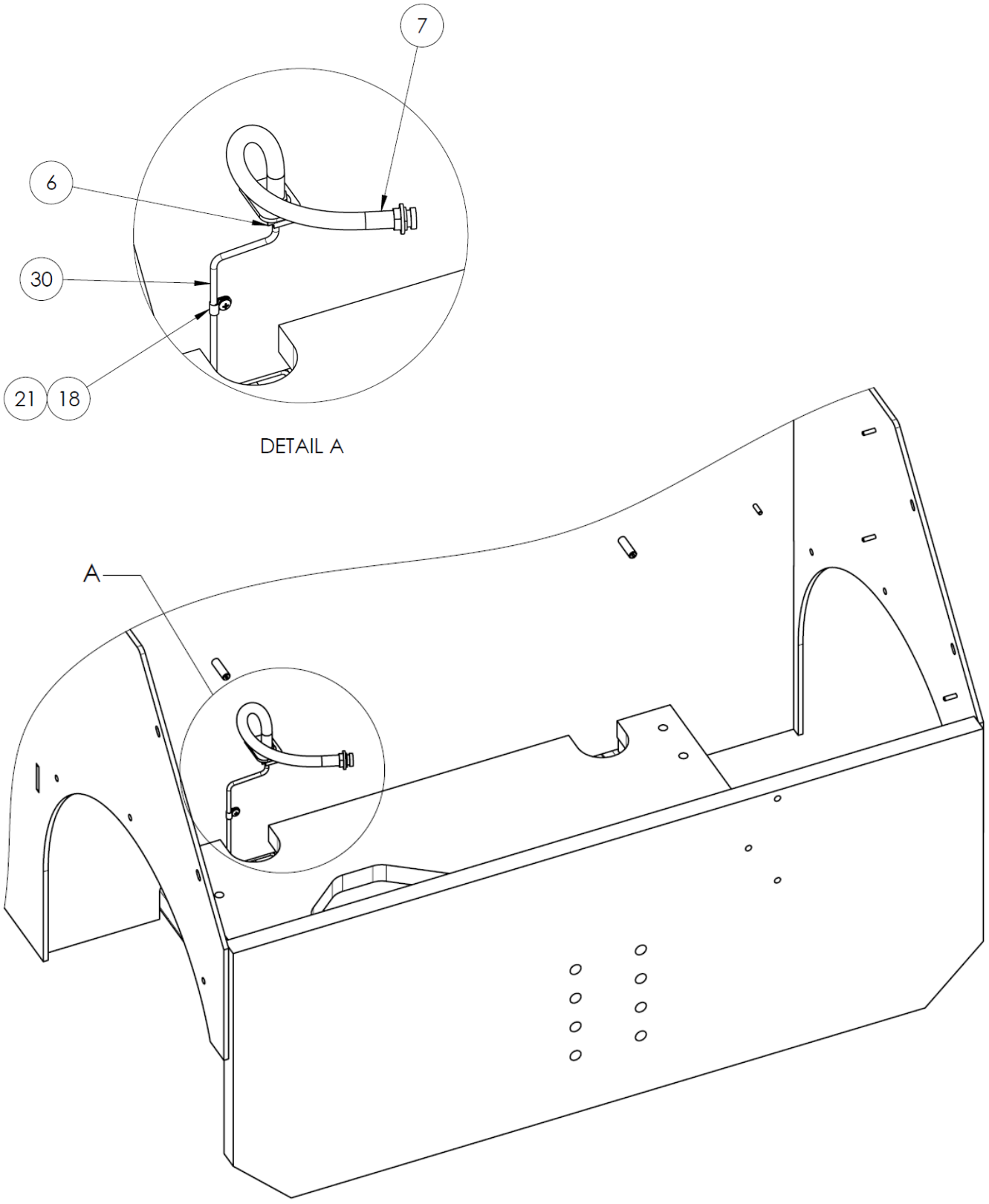




14.1 BRAKE PEDAL *(continued)*



14.1 BRAKE PEDAL *(continued)*



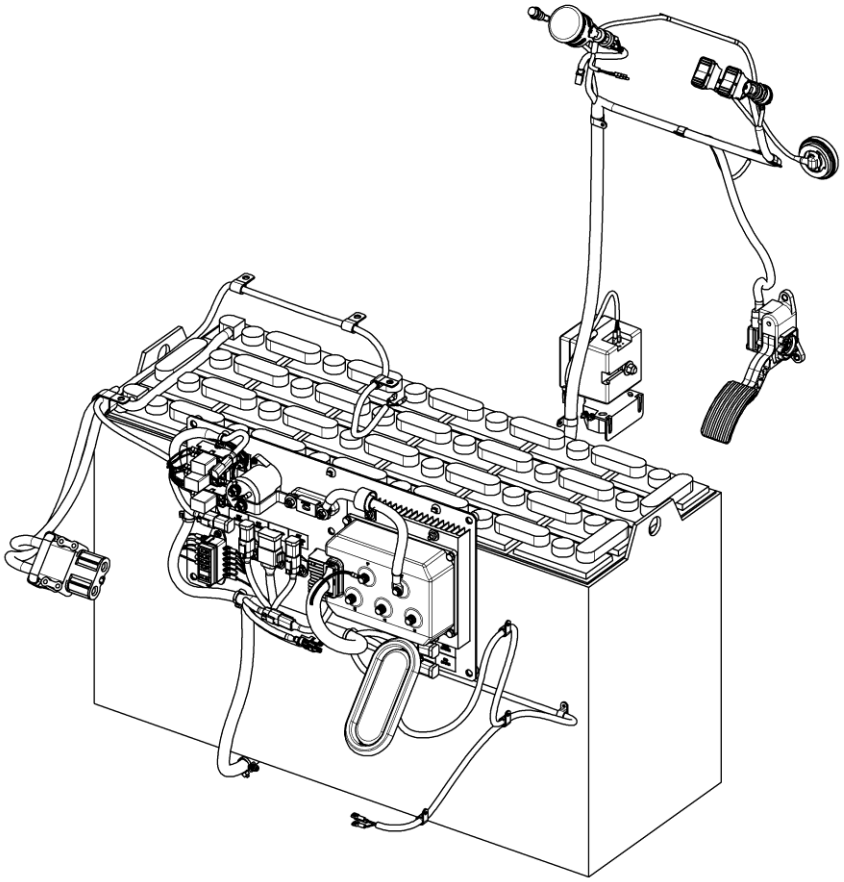
14.1 BRAKE PEDAL *(continued)*

Parts List

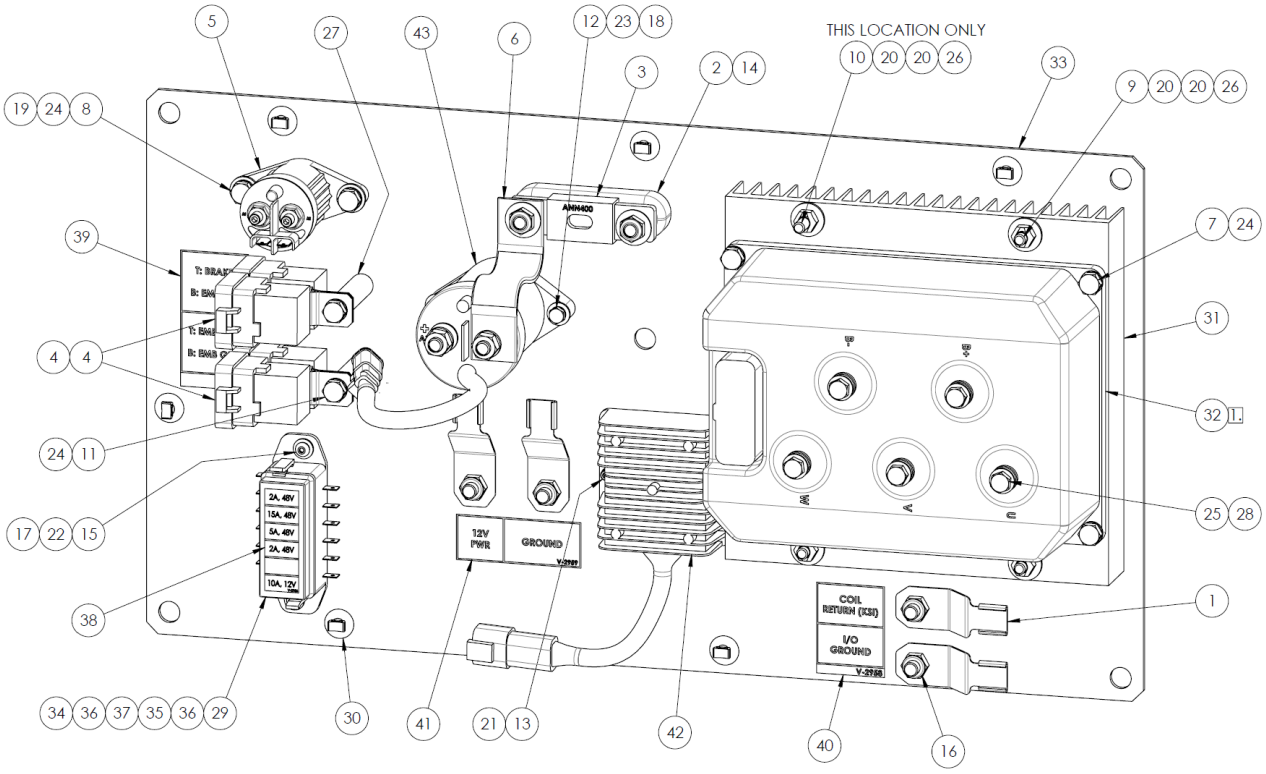
When ordering replacement parts/kits, please specify model, serial number and color of your unit.

Item	Part Number	Description	Qty
1	129HB-5-2	HOSE BARB, 1/8 M NPT X 5/16 BARB, 90°	2
2	302X3	UNION, 3/16 INVERTER FLARE	1
3	A-RTT12-00164	BRAKE HOSE	13"
4	A-RTT12-00181-P	RTT BRAKE PEDAL (P)	1
5	A-TT4-00163	BRAKE SWITCH TEE	1
6	A-TT4-00165	BRAKE HOSE CLIP	1
7	A-TT4-00166	JOUNCE HOSE	1
8	A-TT4-00167	BRAKE LINE SHORT ELBOW	1
9	A-TT4-00173	BRAKE PRESSURE SWITCH	1
10	C-TT4-10188	NYLINER BEARING	1
11	G-1100-105006	BOLT, 1/4-20 X 3/4" LG HEX HD GR 5	1
12	G-1100-106006	BOLT, 5/16-18 X 3/4" LG. HEX HD GR 5	1
13	G-1250-1050W	FLATWASHER, 1/4 WIDE	1
14	G-1250-1060N	FLATWASHER, 5/16 NARROW	5
15	G-1250-1070W	FLATWASHER, 3/8 WIDE	12
16	G-1251-1050R	LOCKWASHER, 1/4 REGULAR	1
17	G-1251-1060R	LOCKWASHER, 5/16 REGULAR	1
18	G-1417-02	CLAMP, CABLE Ø.188	7
19	G-1420-106010	BOLT, 5/16-18 X 1.0" LG. HEX HD GR 8	2
20	G-1420-107012	BOLT, 3/8-16 X 1.25" HEX HD GR 8	6
21	G-1497-103102	SCREW, #10-24 X 1/4" LG. SST PAN HD CROSS RECESS	7
22	G-1727-1060	NUT, 5/16-18 TOP LOCK ZINC	2
23	G-1727-1070	NUT, 3/8-16 TOP LOCK ZINC	6
24	G-1873	YOKE END, 5/16-24 X Ø.375	1
25	H-1426-01	HOSE CLAMP - .38" - .87"	2
26	H-5063	BRAKE LINE, FRONT	1
27	HC-2985	MASTER CYLINDER	1
28	N-2202-26-S-B	ADAPTER, FEMALE PIPE, STRAIGHT THD	1
29	RT00-13-002-CA	BRAKE RESERVOIR	1
30	ST18-13-001-SA	REAR BRAKE LINE	1
31	ST00-13-008-SA	BRAKE PEDAL BRACKET (WP)	1
32	ST00-13-010-SA	BRAKE PEDAL RETAINER (WP)	1
33	Z-11959-00	WLD, MASTER CYLINDER BRACKET (P)	1

15.0 ELECTRICAL SYSTEM



15.1 ELECTRICAL PANEL SUBASSEMBLY



A Apply a thin uninterrupted layer of thermal interface compound such as Loctite TC4 or equivalent to bottom of drive before mounting.

Parts List

When ordering replacement parts/kits, please specify model, serial number and color of your unit.

Item	Part Number	Description	Qty
1	1027-003-1200	DEUTSCH RETAINER CLIP	4
2	A-MTT5-0225	ANN FUSE HOLDER	1
3	A-RTT12-00417	ANN FUSE, 400A	1
4	EC-3540	RELAY, SEALED 48V	4
5	EC-3541	CONTACTOR, 48V	1
6	ET00-05-007-SA	FLEXIBLE POWER CABLE	1
7	G-1100-105006	BOLT, 1/4-20 X 3/4" LG HEX HD GR 5	4
8	G-1100-105010	BOLT, 1/4-20 X 1.0" LG HEX HD GR 5	2
9	G-1100-105020	BOLT, 1/4-20 X 2.0" LG HEX HD GR 5	3
10	G-1100-105022	BOLT, 1/4-20 X 2-1/4" LG HEX HD GR 5	1
11	G-1100-105026	BOLT, 1/4-20 X 2-3/4" LG HEX HD GR 5	2
12	G-1150-103510	SCREW, #10-32 X 1.0" LG HEX HD MACHINE	2
13	G-1151-101704	SCR, SOC HD CAP #6-32 X 1/2 ZINC PLATED	2
14	G-1152-103510	SCREW, #10-32 X 1.0" LG SOCKET FLAT HD CAP	2
15	G-1154-102204	SCREW, #8-32 X .50" LG. SOC BUTT. HD CAP	2
16	G-1202-1060	STOPNUT, 5/16-18 ELASTIC	4
17	G-1250-1020N	FLATWASHER, #8 NARROW	2

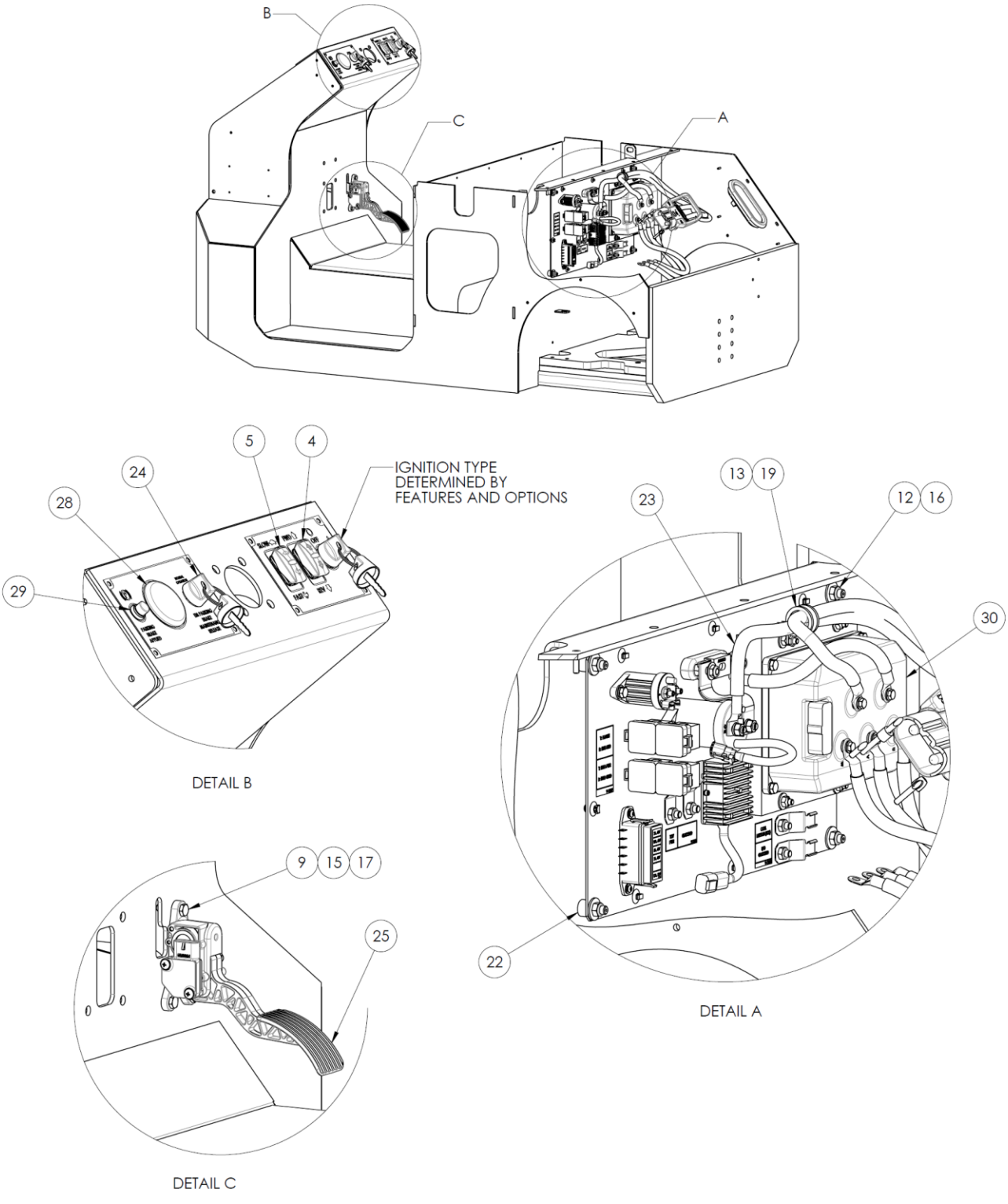
15.1 ELECTRICAL PANEL SUBASSEMBLY *(continued)*

Parts List

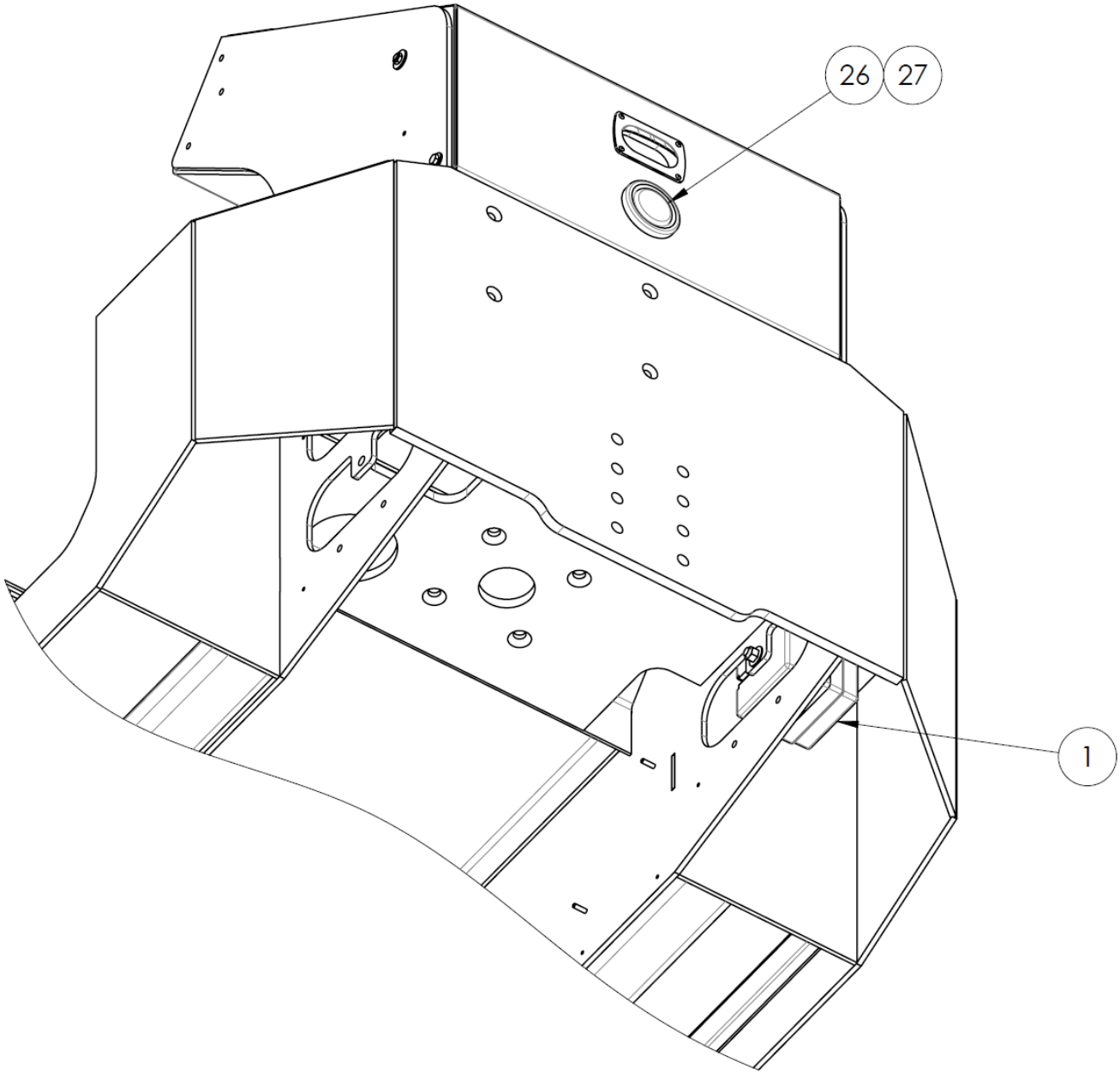
When ordering replacement parts/kits, please specify model, serial number and color of your unit.

Item	Part Number	Description	Qty
18	G-1250-1030N	FLATWASHER, #10 NARROW	2
19	G-1250-1050N	FLATWASHER, 1/4 NARROW	2
20	G-1250-1050W	FLATWASHER, 1/4 WIDE	8
21	G-1251-1010R	LOCKWASHER, #6 REGULAR	2
22	G-1251-1020R	LOCKWASHER, #8 REGULAR	2
23	G-1251-1030R	LOCKWASHER, #10 REGULAR	2
24	G-1251-1050R	LOCKWASHER, 1/4 REGULAR	8
25	G-1533-060020	BOLT, METRIC 10.9 M6X1X20	5
26	G-1727-1050	NUT, 1/4-20 TOP LOCK ZINC	4
27	H-4900-050820	SPACER, 1/4 ID X 1/2 OD X 2.0 LG	2
28	NSVP-21-016-CA	M6 BELLEVILLE SPRING LOCK WASHER	5
29	NVSP-05-009-CA	ATO FUSE BLOCK - 6 POS	1
30	NVSP-24-022-CA	CABLE TIE ANCHOR STD (Ø.375 X .27 THK)	6
31	RT12-08-002-CA	HEATSINK, MACHINED	1
32	RT12-10-001-CA	48V TRACTION DRIVE	1
33	S-4470-00	PANEL, ELECTRICAL (P)	1
34	TAC-10	10A ATO FUSE, 58V RATED	1
35	TAC-15	15A ATO FUSE, 58V RATED	1
36	TAC-2	2A ATO FUSE, 58V RATED	2
37	TAC-5	5A ATO FUSE, 58V RATED	1
38	V-2956	DECAL, FUSE COVER	1
39	V-2957	DECAL, RELAYS	1
40	V-2958	DECAL, BUSSES	1
41	V-2959	LABEL, BUSSES	1
42	Z-11594	ASY, DC-DC WITH CONN	1
43	Z-11613	ASY, CONTACTOR AND CONN	1

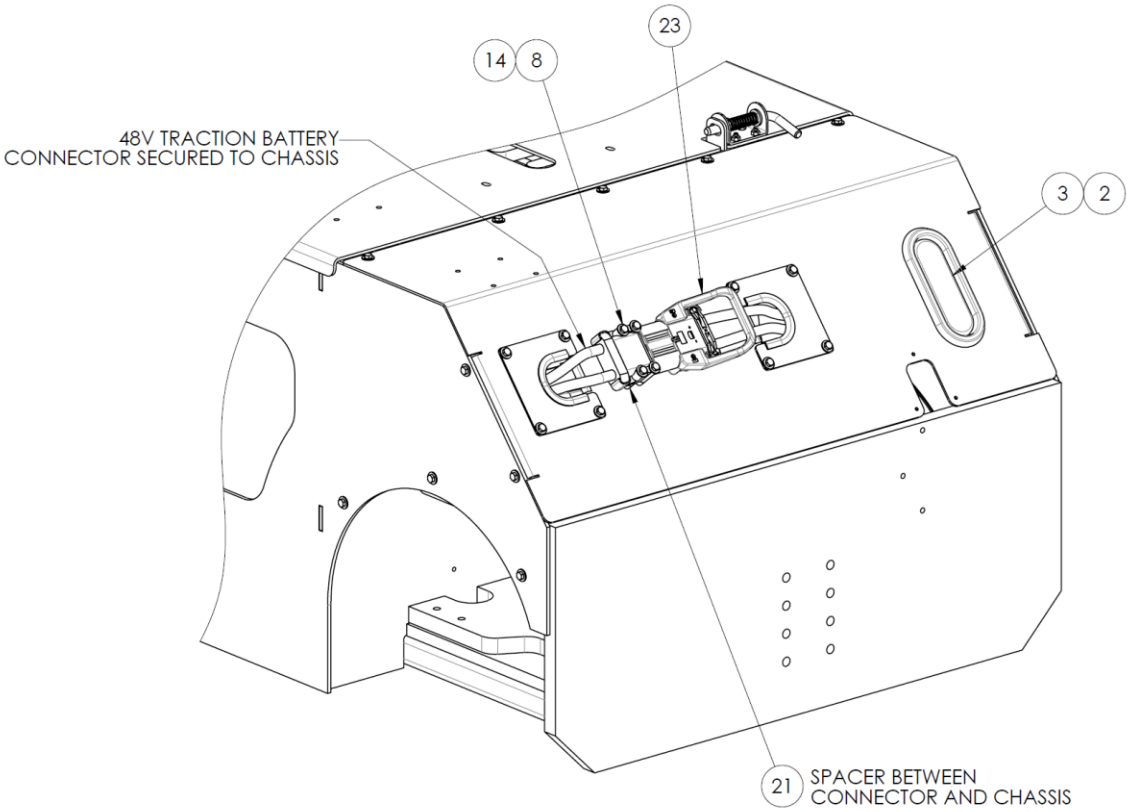
15.2 ELECTRICAL PANEL COMPONENT WIRING

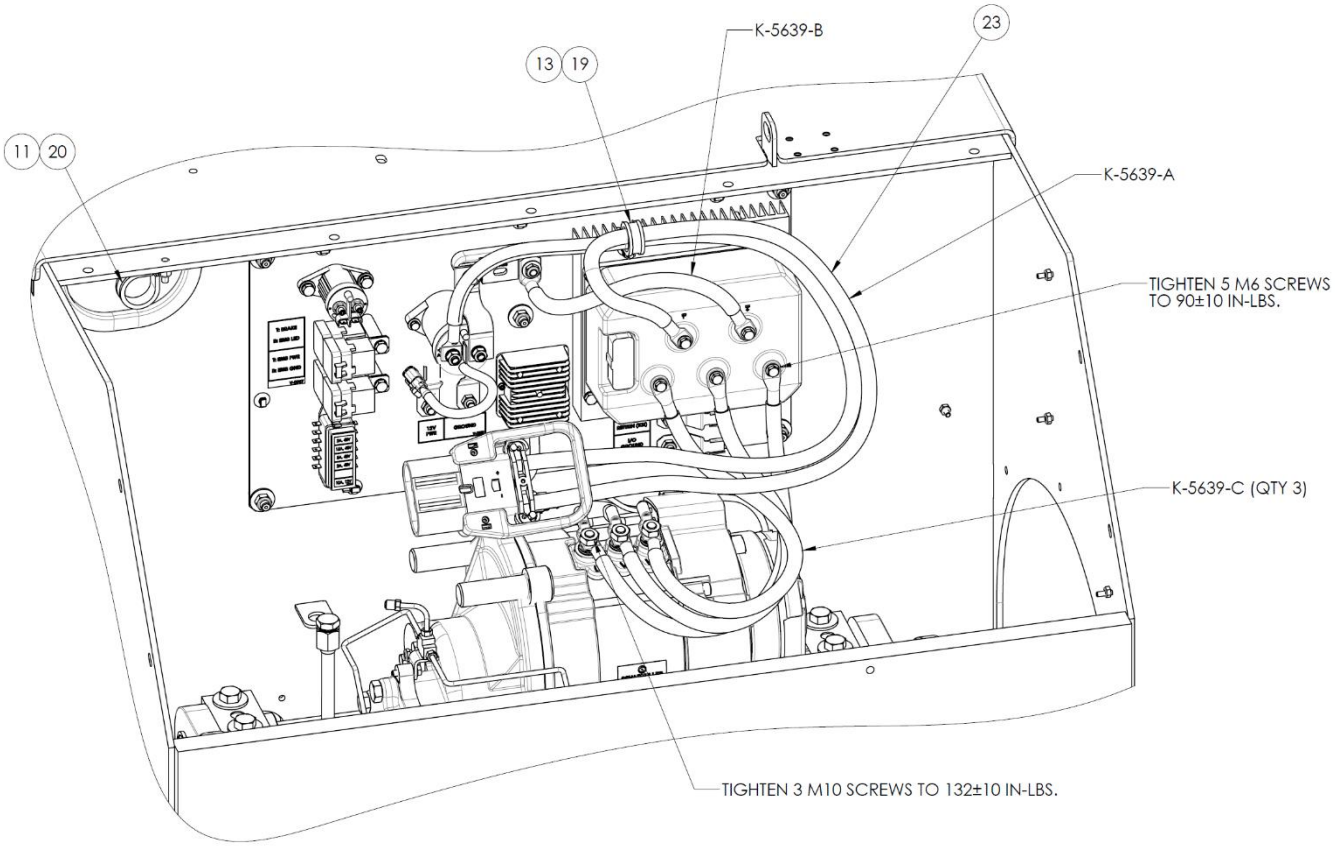


15.2 ELECTRICAL PANEL COMPONENT WIRING *(continued)*

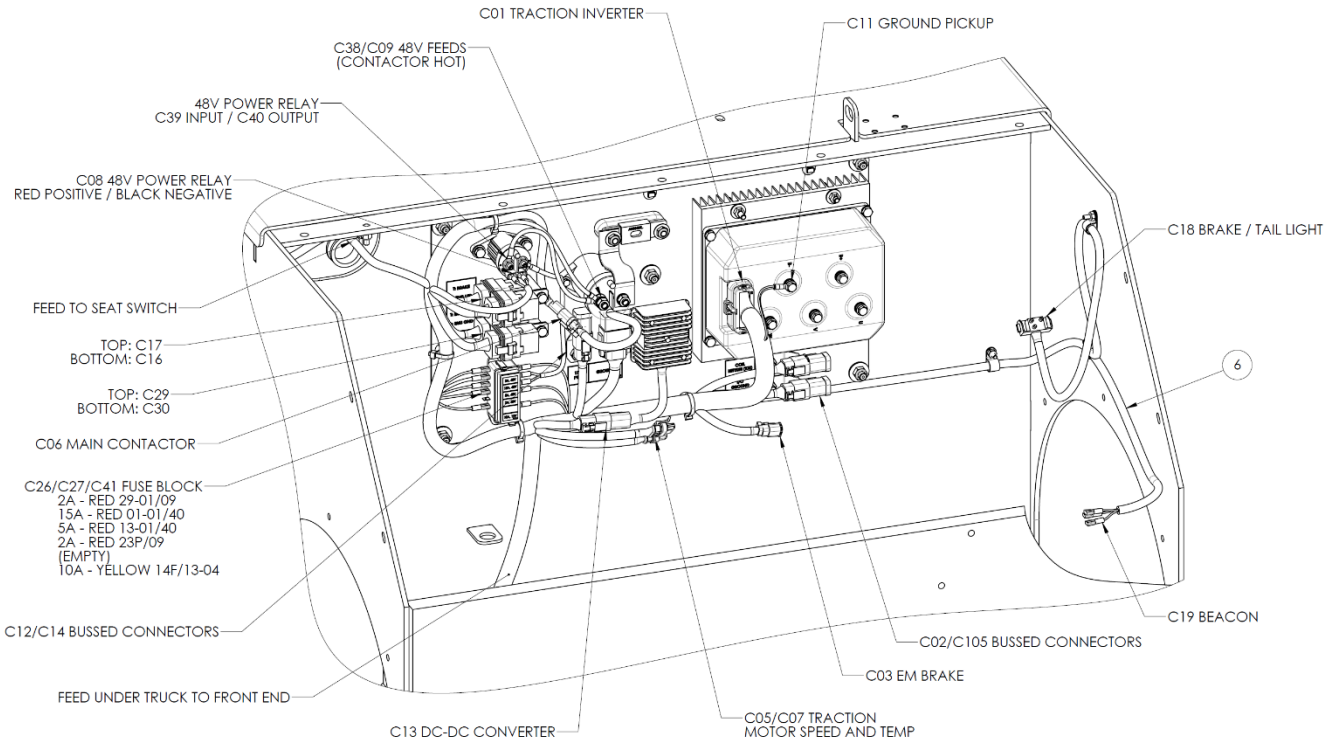


15.2 ELECTRICAL PANEL COMPONENT WIRING *(continued)*

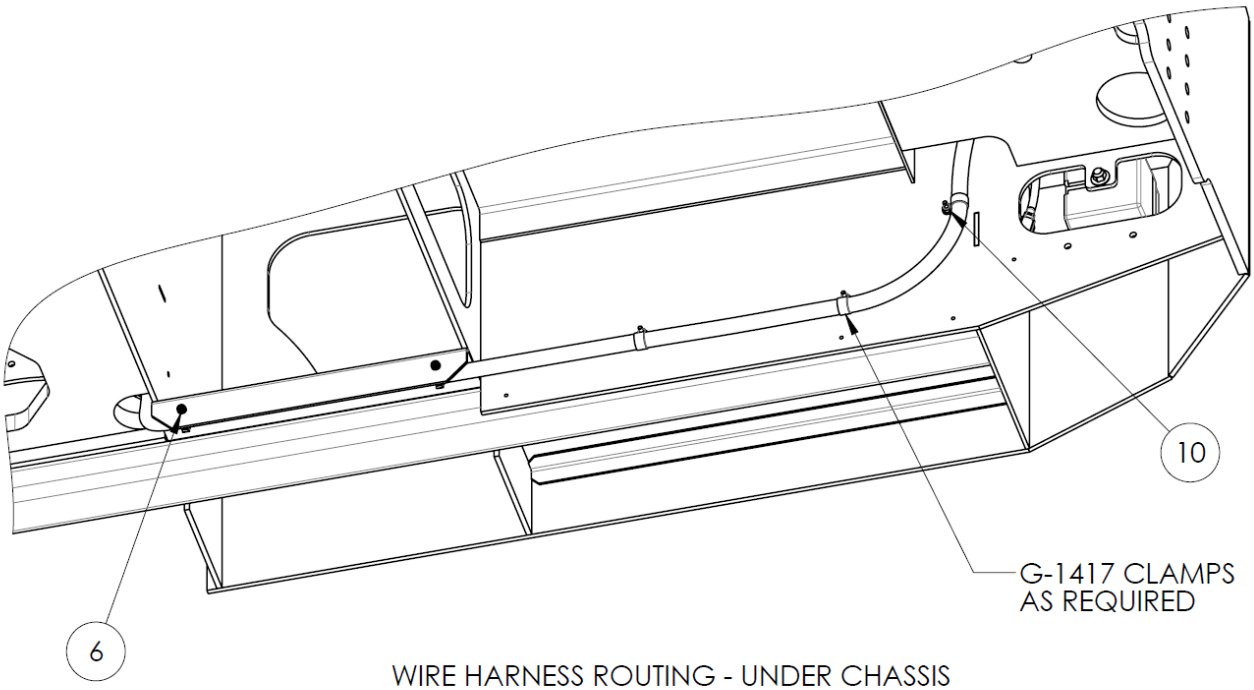




15.2 ELECTRICAL PANEL COMPONENT WIRING *(continued)*

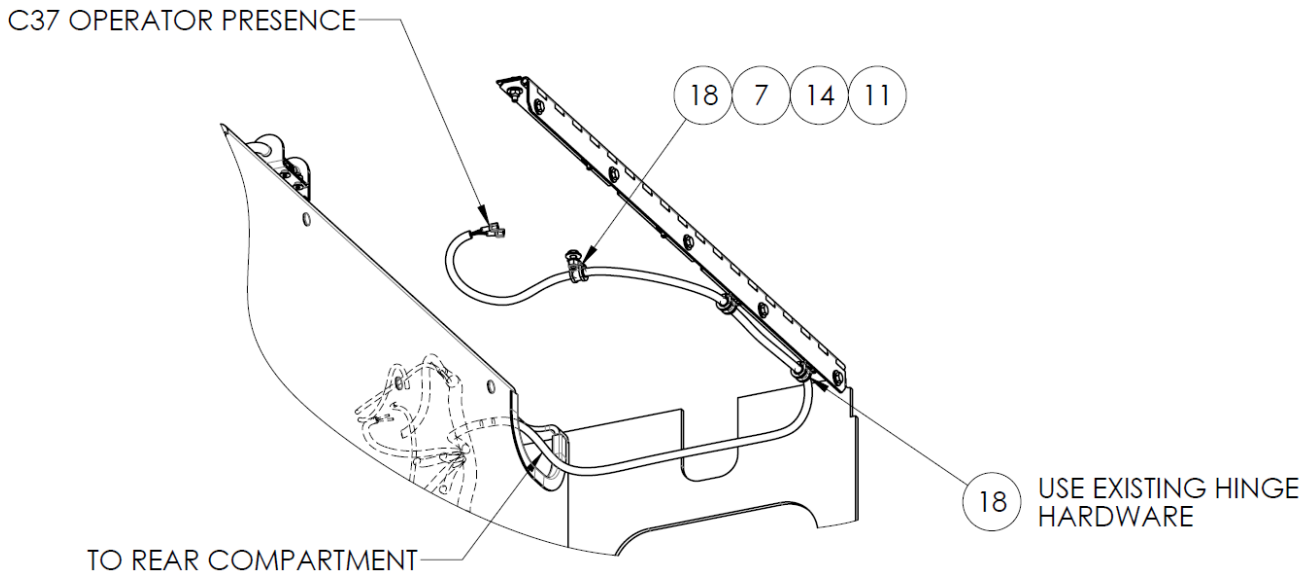


WIRE HARNESS ROUTING - REAR COMPARTMENT

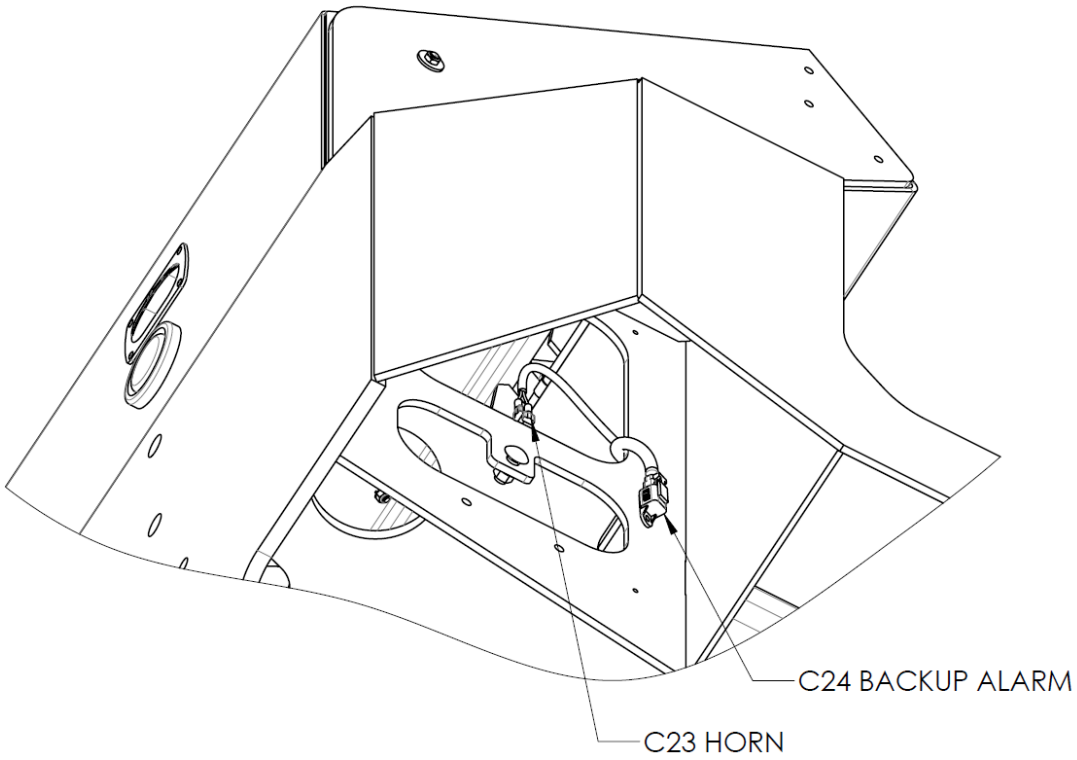


WIRE HARNESS ROUTING - UNDER CHASSIS

15.2 ELECTRICAL PANEL COMPONENT WIRING *(continued)*

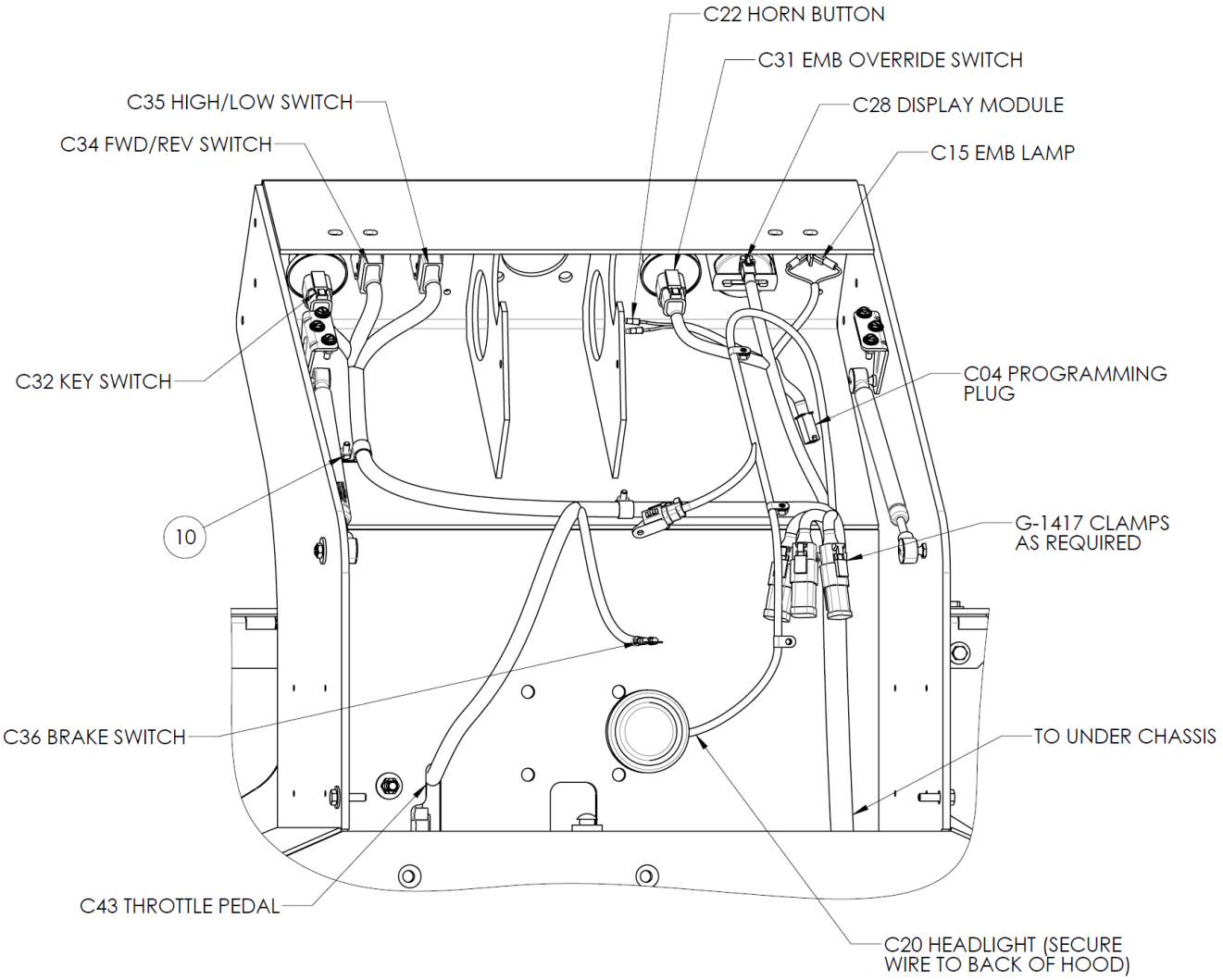


WIRE HARNESS ROUTING - UNDER SEAT PAN
(SOME SHEETMETAL HIDDEN FOR CLARITY)



WIRE HARNESS ROUTING - FRONT LH FENDER

15.2 ELECTRICAL PANEL COMPONENT WIRING *(continued)*



WIRE HARNESS ROUTING - FRONT LH FENDER

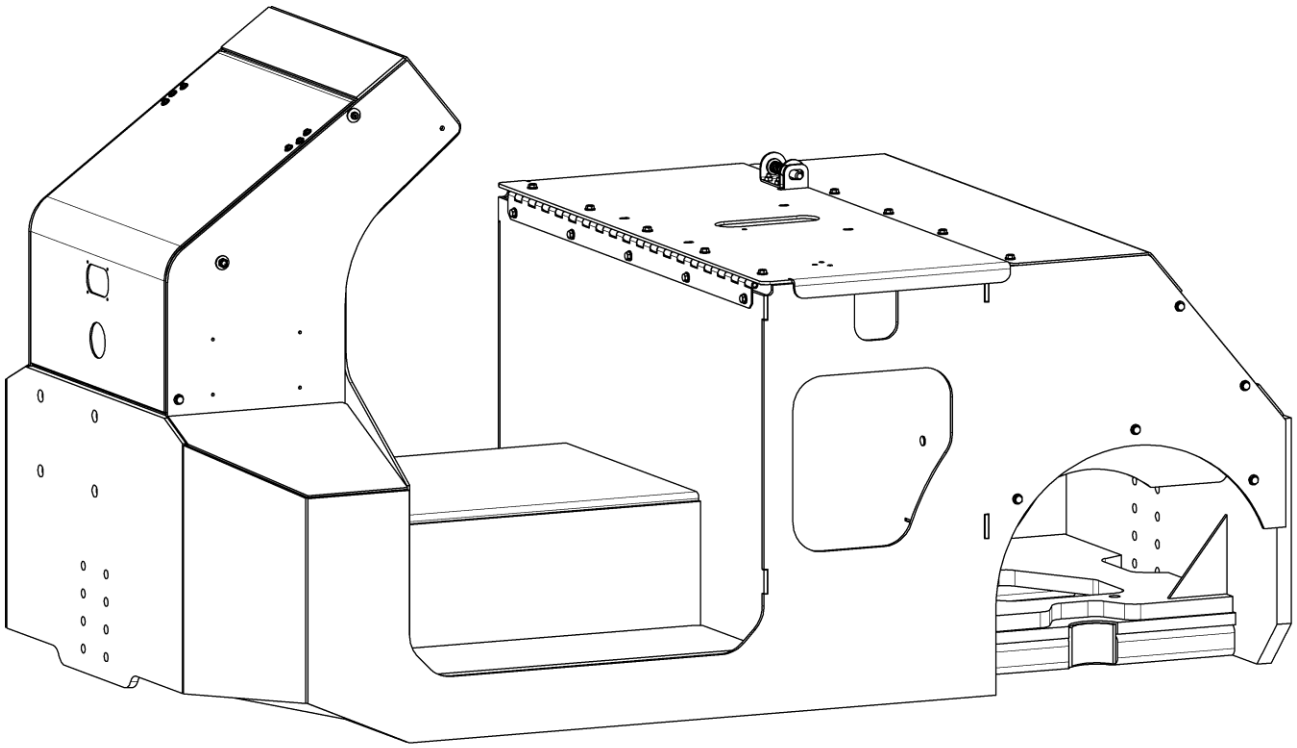
15.2 ELECTRICAL PANEL COMPONENT WIRING *(continued)*

Parts List

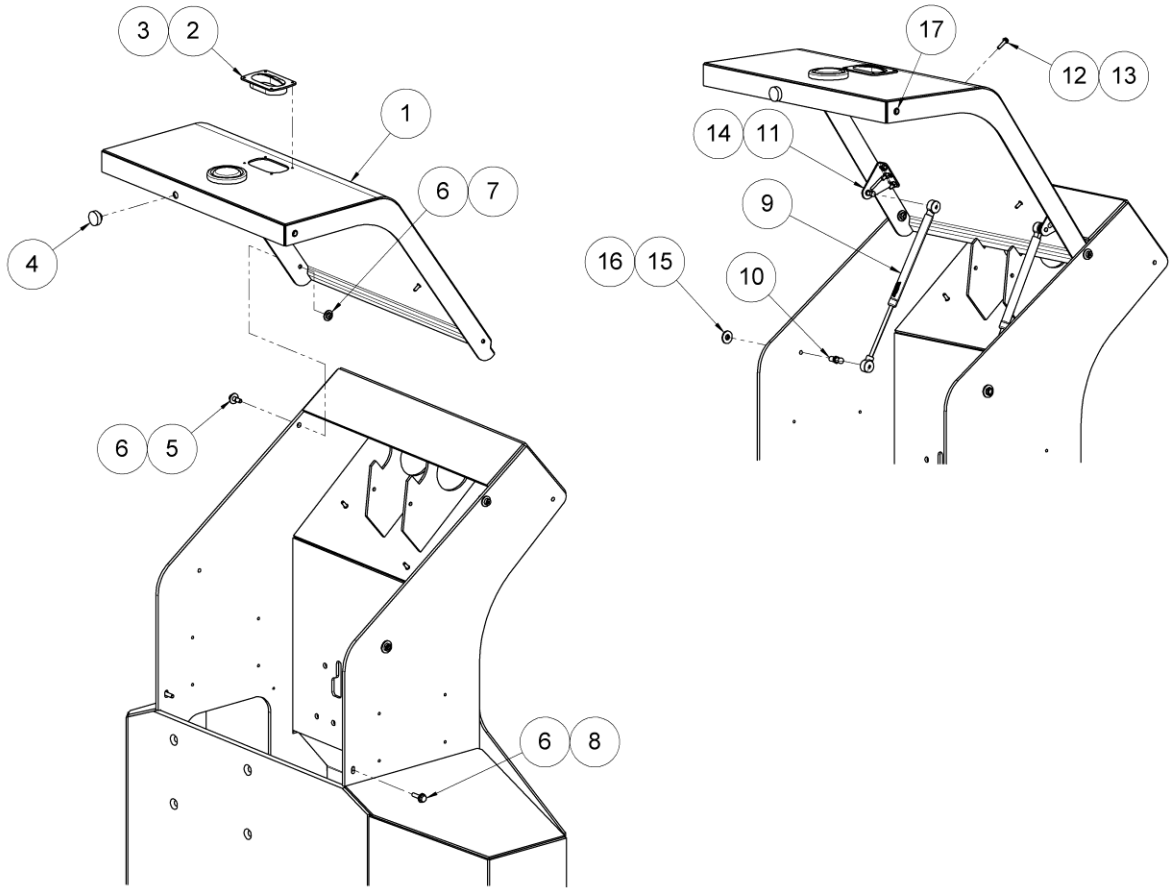
When ordering replacement parts/kits, please specify model, serial number and color of your unit.

Item	Part Number	Description	Qty
1	A-RTT12-00052	ELECTRONIC HORN	1
2	A-RTT12E-00287	TAIL LIGHT GROMMET	1
3	A-RTT12E-00292	STOP LAMP	1
4	EC-3450-03	FNR SWITCH	1
5	EC-3450-07	HIGH/LOW SWITCH RTT-STT	1
6	EC-3539	WIRE HARNESS	1
7	G-1100-105006	BOLT, 1/4-20 X 3/4" LG HEX HD GR 5	1
8	G-1100-105032	BOLT, 1/4-20 X 3-1/4" LG HEX HD GR 5	4
9	G-1100-106512	BOLT, 5/16-24 X 1-1/4" LG. HEX HD GR 5	3
10	G-1202-1035	STOPNUT, #10-32 ELASTIC	13
11	G-1202-1050	STOPNUT, 1/4-20 ELASTIC	2
12	G-1202-1070	STOPNUT, 3/8-16 ELASTIC	5
13	G-1203-1050	JAMNUT, 1/4-20 ELASTIC	1
14	G-1250-1050W	FLATWASHER, 1/4 WIDE	5
15	G-1250-1060W	FLATWASHER, 5/16 WIDE	3
16	G-1250-1070W	FLATWASHER, 3/8 WIDE	5
17	G-1727-1060	NUT, 5/16-18 TOP LOCK ZINC	3
18	H-3521-03	CLAMP, CUSHIONED LOOP 1/2"	3
19	H-3521-11	CLAMP, CUSHIONED LOOP 1"	1
20	H-3521-15	CLAMP, CUSHIONED LOOP 1 1/4"	1
21	H-4900-050804	SPACER, 1/4 SCR X 1/2 OD X 1/2 LG	4
22	H-4900-071204	SPACER, 3/8 SCR X 3/4 OD X 1/2 LG	5
23	K-5639	BATTERY CABLE KIT	1
24	NVSP-05-005-CA	IGNITION SWITCH, 3-POS, KEYED	1
25	NVSP-14-028-CA	THROTTLE PEDAL, DUAL ANALOG	1
26	NVSP-34-008-CA	UTILITY LIGHT, WHITE LED	1
27	NVSP-34-009-CA	2 IN MARKER LIGHT GROMMET	1
28	RT12-10-002-CA	BATTERY CHARGE AND SYSTEM MESSAGE GAGE	1
29	RT00-05-002-CA	LED INDICATOR LIGHT	1
30	-	ASY, ELECTRICAL PANEL	1

16.0 CHASSIS SYSTEM



16.1 FRONT COVER

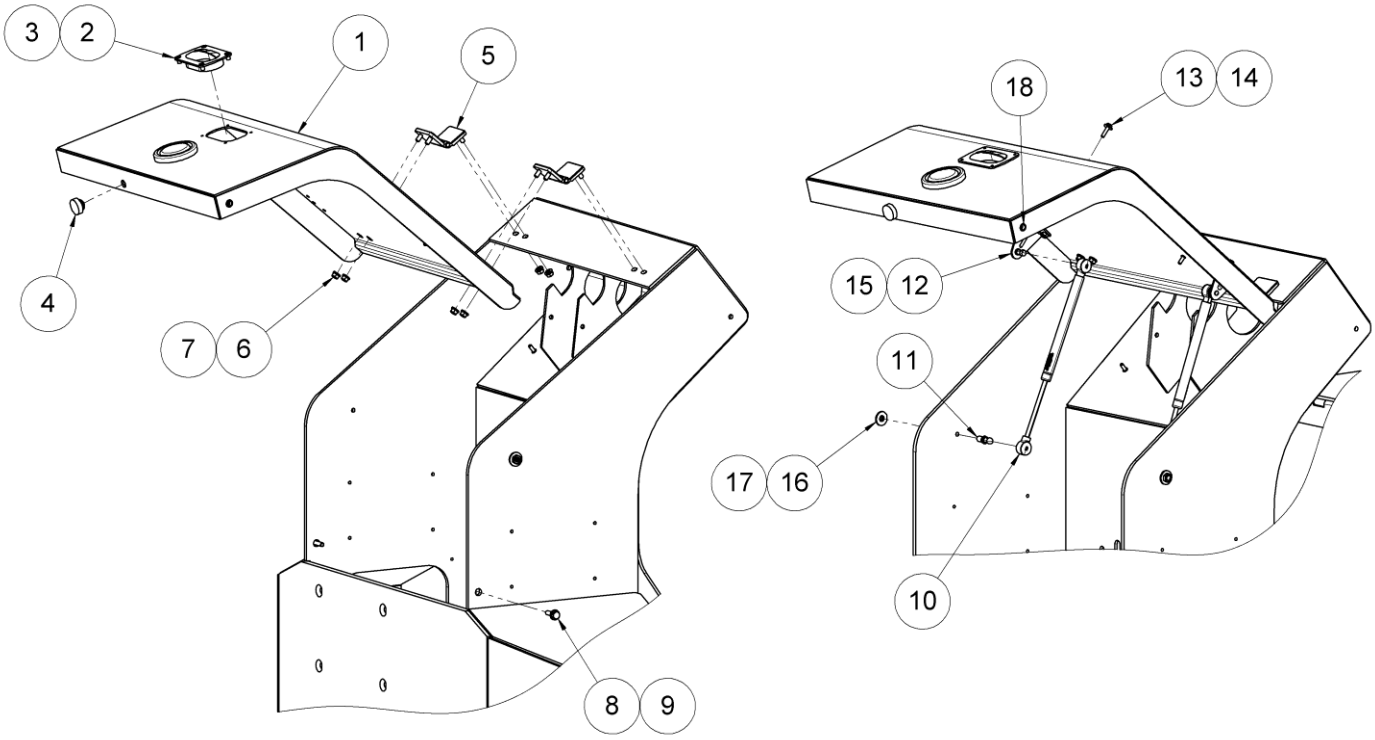


Parts List

When ordering replacement parts/kits, please specify model, serial number and color of your unit.

Item	Part Number	Description	Qty
1	ST18-02-001-SA	FRONT COVER	1
2	ST00-14-018-CA	RECESSED HANDLE	1
3	NPN	RIVET, 1/8	4
4	NVSP-21-004-CA	RUBBER PRESS-IN BUMPER	1
5	NVSP-21-010-CA	SHOULDER SCREW, 5/16 SHOULDER X 1 X 1/4-20 UNC	2
6	NPN	FLAT WASHER, 1/4	6
7	NPN	LOCK NUT, 1/4-20 UNC	2
8	NPN	HCS, 1/4-20 UNC X 1	2
9	SATS-14-005-CA	GAS SHOCK – 40 LB – 12 X3.5 STROKE	2
10	NVSP-24-020-CA	BALL STUD MOUNT	2
11	NVSP-24-021-CA	90º ANCHOR BRACKET	2
12	NPN	HCS, #10-32 UNC X .75	6
13	NPN	FLAT WASHER, 1/2	6
14	NPN	LOCK NUT, #10-32 UNF	6
15	NPN	FLAT WASHER, 5/16	2
16	NPN	LOCK NUT, 5/16-18 UNC	2
17	NPN	RIVNUT, 1/4-20 UNC	2

16.1 FRONT COVER *(continued)*

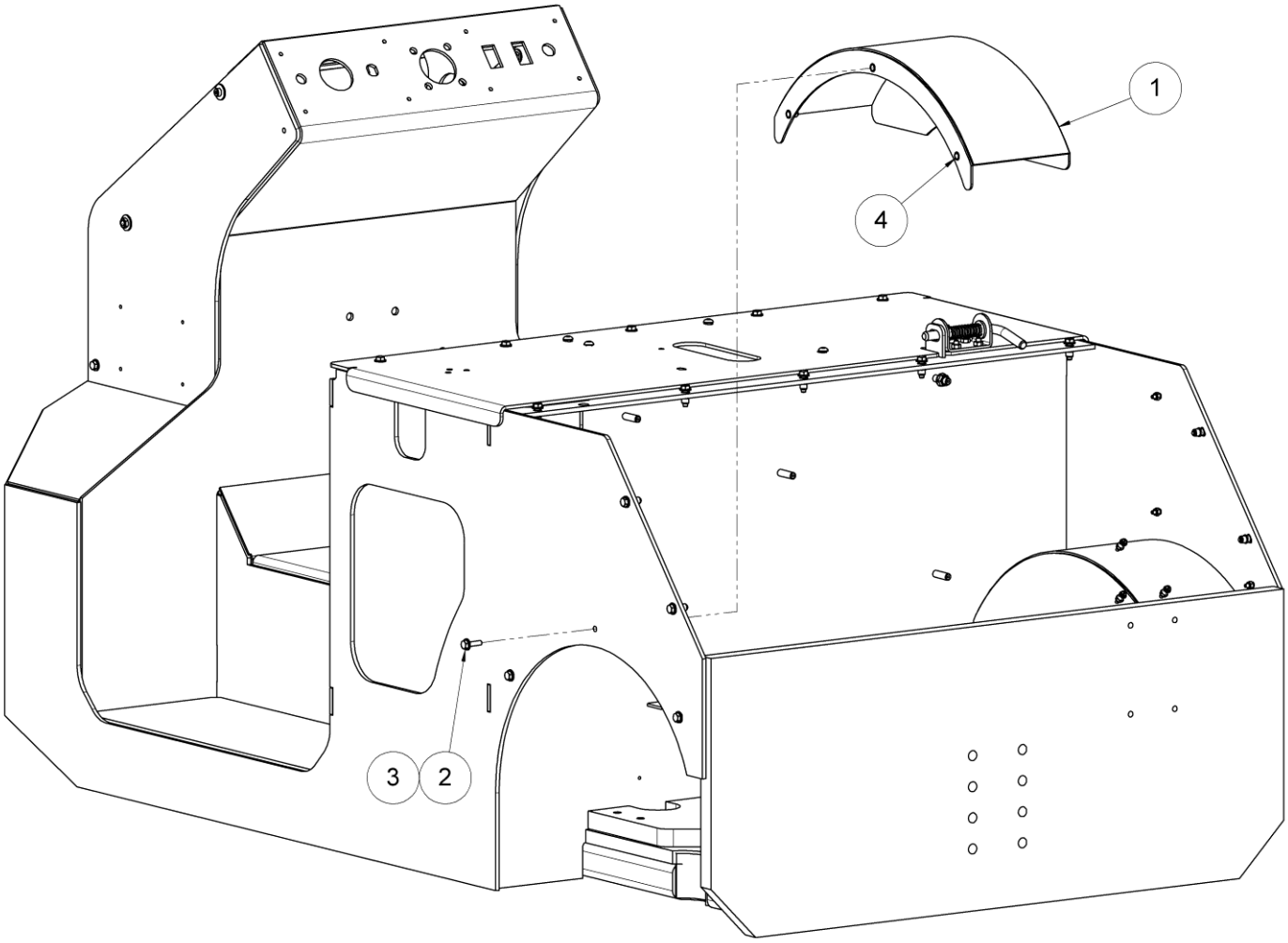


Parts List

When ordering replacement parts/kits, please specify model, serial number and color of your unit.

Item	Part Number	Description	Qty
1	ST18-02-001-SA	FRONT COVER	1
2	ST00-14-018-CA	RECESSED HANDLE	1
3	NPN	RIVET, 1/8	4
4	NVSP-21-004-CA	RUBBER PRESS-IN BUMPER	1
5	NVSP-24-039-CA	HINGE, CONCEALED HARDWARE	2
6	NPN	FLAT WASHER, M6 (INCLUDED WITH ITEM 5)	8
7	NPN	HEX NUT, M6 (INCLUDED WITH ITEM 5)	8
8	NPN	HCS, 1/4-20 UNC X 1	2
9	NPN	FLAT WASHER, 1/4	2
10	SATS-14-005-CA	GAS SHOCK – 40 LB – 12 X3.5 STROKE	2
11	NVSP-24-020-CA	BALL STUD MOUNT	2
12	NVSP-24-021-CA	90º ANCHOR BRACKET	2
13	NPN	HCS, #10-32 UNC X .75	6
14	NPN	FLAT WASHER, #10	6
15	NPN	LOCK NUT, #10-32 UNF	6
16	NPN	FLAT WASHER, 5/16	2
17	NPN	LOCK NUT, 5/16-18 UNC	2
18		RIVNUT, 1/4-20 UNC	2

16.2 TIRE WELLS

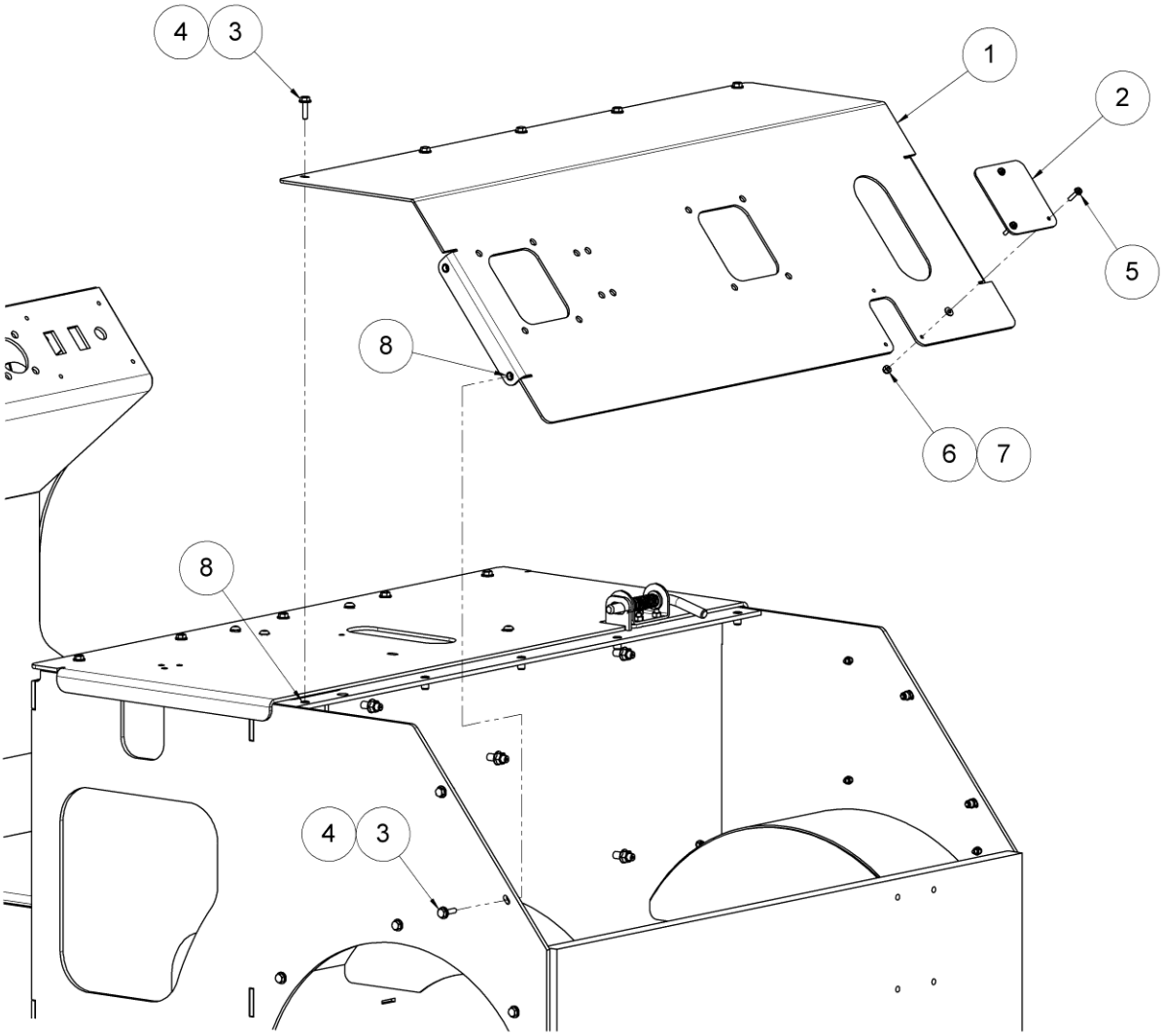


Parts List

When ordering replacement parts/kits, please specify model, serial number and color of your unit.

Item	Part Number	Description	Qty
1	ST20-02-007-SA	TIRE WELL	2
2	NPN	HCS, 1/4-20 UNC X 1	6
3	NPN	FLAT WASHER, 1/4	6
4	NPN	RIVNUT, 1/4-20 UNC	6

16.3 REAR PANEL

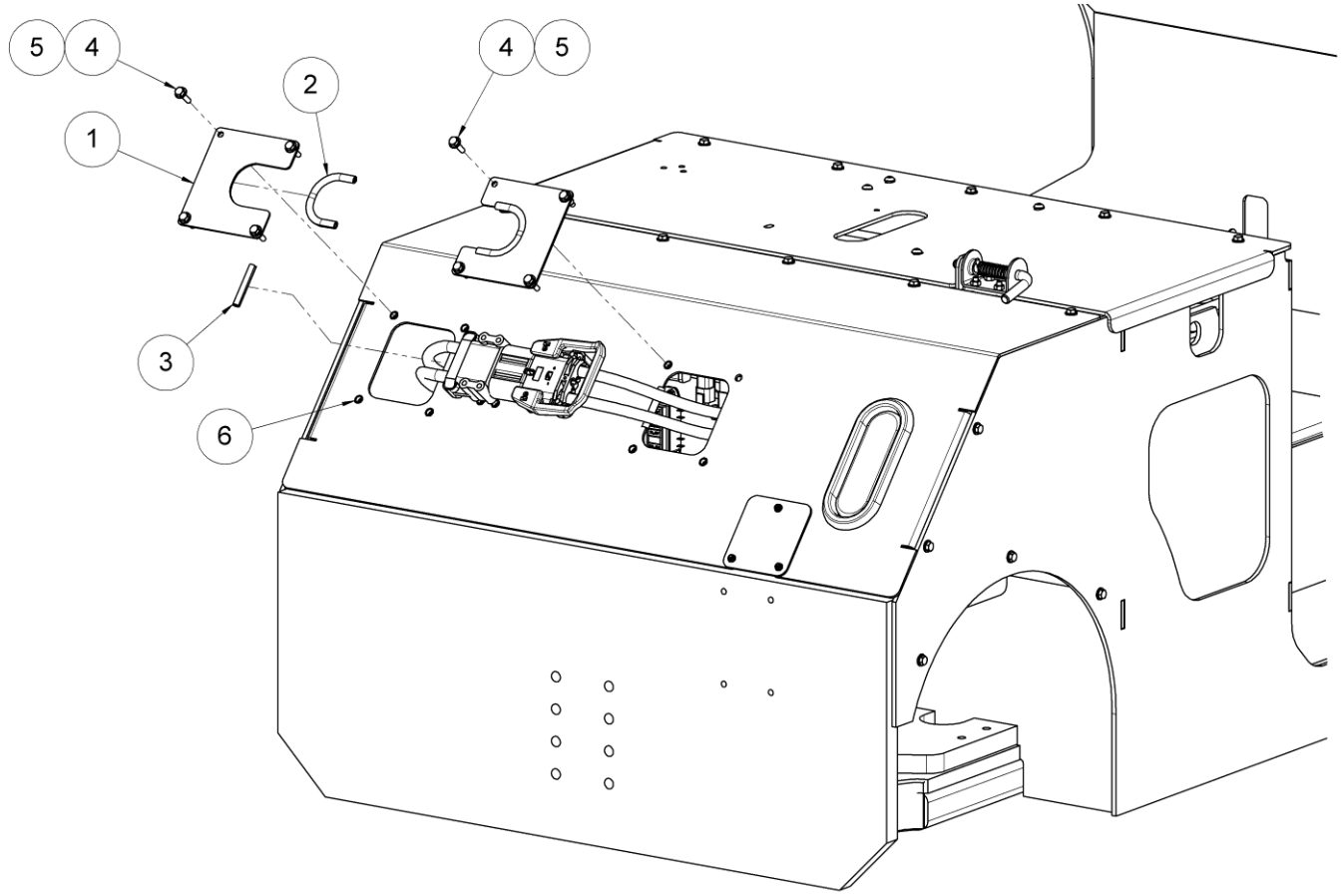


Parts List

When ordering replacement parts/kits, please specify model, serial number and color of your unit.

Item	Part Number	Description	Qty
1	ST18-02-002-SA	REAR PANEL	1
2	ST20-02-008-SA	BEACON POLE COVER PLATE	1
3	NPN	HCS, 1/4-20 UNC X 1	9
4	NPN	FLAT WASHER, 1/4	9
5	NPN	HCS, #10-32 UNC X .75	3
6	NPN	LOCK NUT, #10	3
7	NPN	LOCK NUT, #10-32 UNF	3
8	NPN	RIVNUT, 1/4-20 UNC	9

16.3 REAR PANEL *(continued)*

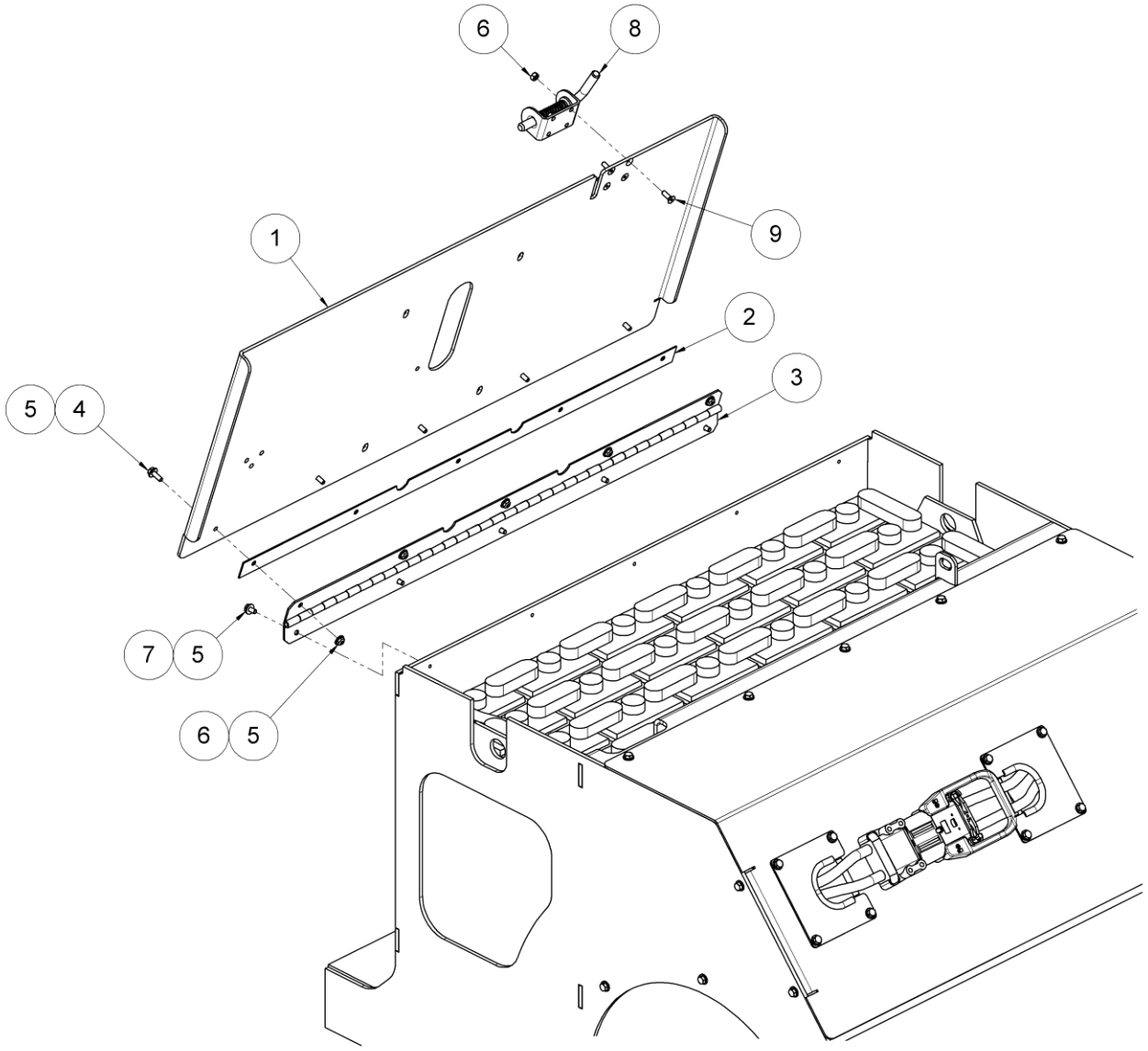


Parts List

When ordering replacement parts/kits, please specify model, serial number and color of your unit.

Item	Part Number	Description	Qty
1	ST20-02-004-SA	BATTERY CONNECTOR COVER PLATE	2
2	ST00-14-004-CA	BATTERY CABLE EDGE TRIM SMAL, 5.5 LONG	2
3	ST00-14-004-CA	BATTERY CABLE EDGE TRIM SMAL, 2.38 LONG	2
4	NPN	HCS, 1/4-20 UNC X 1	8
5	NPN	FLAT WASHER, 1/4	8
6	NPN	RIVNUT, 1/4-20 UNC	8

16.4 SEAT PANEL

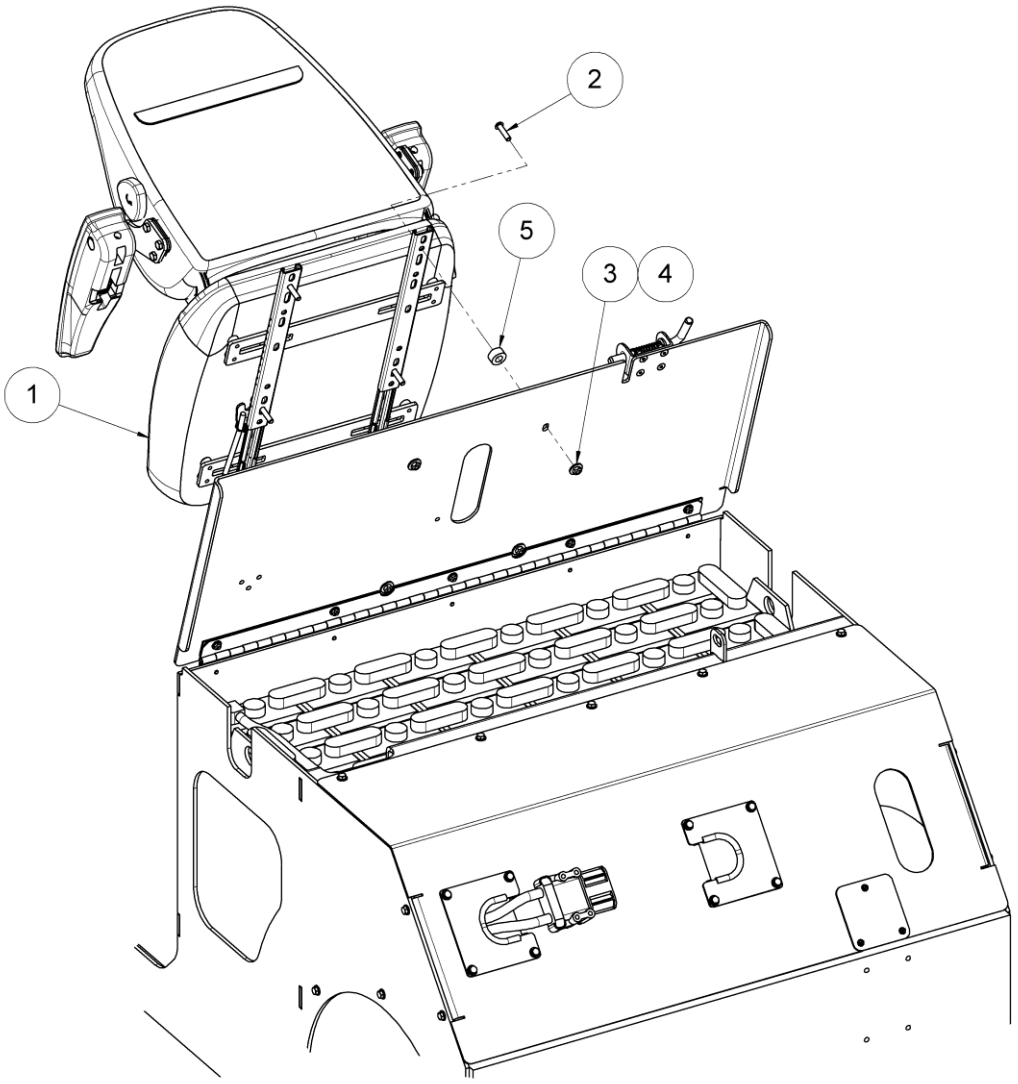


Parts List

When ordering replacement parts/kits, please specify model, serial number and color of your unit.

Item	Part Number	Description	Qty
1	ST18-02-003-SA	SEAT PANEL	1
2	ST20-02-011-SA	SHIM	1
3	ST20-02-006-SA	PIANO HINGE, .25 X .09 X 3 X 36	1
4	NPN	HCS, 1/4-20 UNC X .75	5
5	NPN	FLAT WASHER, 1/4	15
6	NPN	LOCK NUT, 1/4-20	9
7	NPN	HCS, 1/4-20 X .5	5
8	NVSP-24-019-CA	SPRING LATCH PIN	1
9	NPN	FHS, 1/4-20 UNC X .75	4

16.5 SEAT

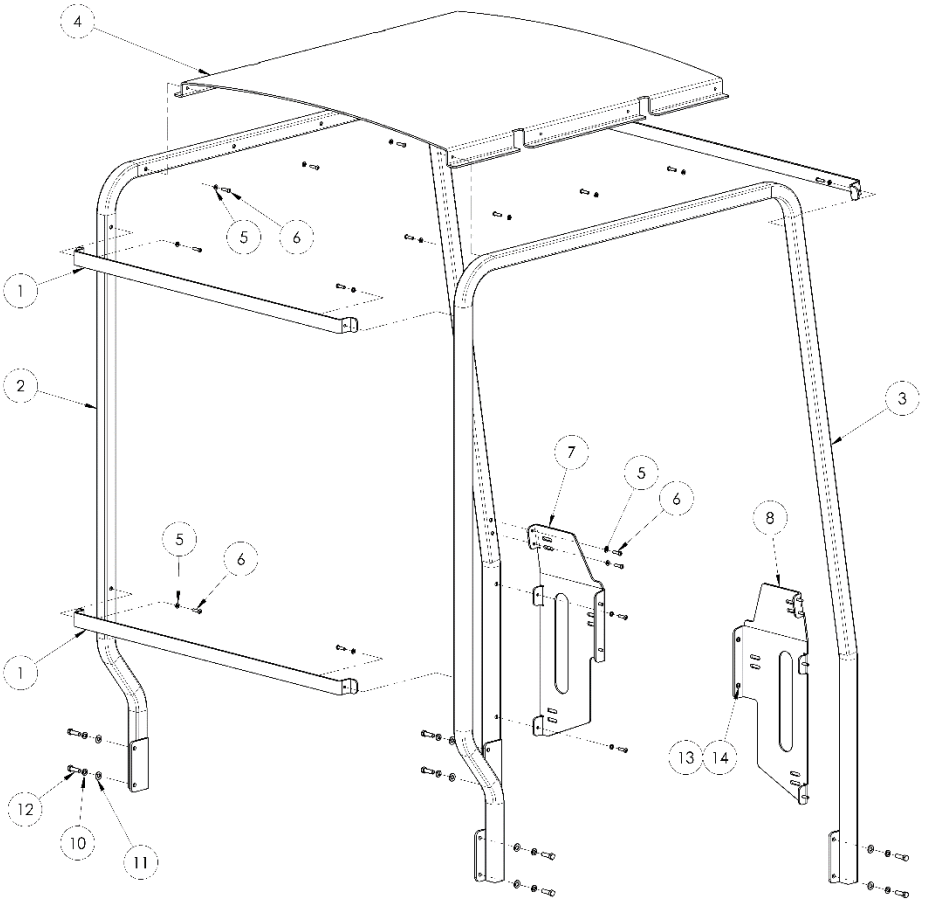


Parts List

When ordering replacement parts/kits, please specify model, serial number and color of your unit.

Item	Part Number	Description	Qty
1	H-5068	SEAT W/SEAT BELT	1
2	GR1020	SEAT SWITCH	1
3	NPN	FLAT WASHER, 5/19	4
4	NPN	LOCK NUT, 5/16-18 UNC	4
5	H-4900-061204	SPACER	4
N/S	H-5073	REPLACEMENT SEAT BELT	N/A

17.0 CAB OPTION



Parts List

When ordering replacement parts/kits, please specify model, serial number and color of your unit.

Item	Part Number	Description	Qty
1	J-8406-00	PLATE, FRAME CONNECTOR	3
2	Z-12017-00	WLD, FRAME SIDE, LH	1
3	Z-12018-00	WLD, FRAME SIDE, RH	1
4	J-8606-00	PLATE, TOP COVER	1
5	G-1251-1050R	LOCKWASHER, 1/4 REGULAR	22
6	G-1154-105210	SCREW, 1/4-20 X 1" LG. SOC BUTT. HD CAP	22
7	J-8490-00	PLATE, FRONT MOUNT, LH (P)	1
8	J-8491-00	PLATE, FRONT MOUNT, RH	1
9	H-5125	CANOPY, STT SOFT CAB (NOT SHOWN)	1
10	G-1251-1070R	LOCKWASHER, 3/8 REGULAR	8
11	G-1250-1070N	FLATWASHER, 3/8 NARROW	8
12	G-1100-107012	BOLT, 3/8-16 X 1-1/4" HEX HD GR 5	8
13	G-1251-1050R	LOCKWASHER, 1/4 REGULAR	4
14	G-1154-105206	SCREW, 1/4-20 X 3/4" LG. SOC BUTT. HD CAP	4