MC-480

OPERATOR AND MAINTENANCE MANUAL
SPARE PARTS LISTS INCLUDED

SERIAL NUMBER: 1184294 & UP

Printed in Canada

MOTREC INTERNATIONAL

LIMITED WARRANTY

EFFECTIVE ON ORDERS RECEIVED STARTING JANUARY1st.

3-YEAR LIMITED WARRANTY ON AC PRODUCTS, STOCK CHASER AND TRAILERS
2-YEAR LIMITED WARRANTY ON DC PRODUCTS AND OTHER MOTREC PRODUCTS

Motrec warrants to the original purchaser that its products are free from defects in parts and workmanship.

STARTING DATE OF WARRANTY. The present terms and conditions of the Motrec Limited Warranty apply to new Motrec products only and do not replace any pre-existing warranty. The warranty period is effective from the date the purchaser registers the product, provided it is registered within thirty (30) days of reception and in conformity with Motrec's registration process.

REGISTRATION. IMPORTANT: AS A PURCHASER OF A MOTREC PRODUCT, IT IS IMPORTANT THAT YOUR PRODUCT BE REGISTERED UNDER YOUR NAME AS REQUIRED BY MOTREC'S PRODUCT REGISTRATION PROCEDURE. PLEASE ASK YOUR MOTREC DEALER TO REGISTER YOUR PRODUCT. MOTREC'S LIMITED WARRANTY WILL BECOME EFFECTIVE AT THE TIME OF PRODUCT REGISTRATION. IF YOU FAIL TO REGISTER YOUR PRODUCT WITHIN THE THIRTY (30) DAYS, THE WARRANTY WILL NOT BE APPLICABLE. IF YOU PURCHASED THE PRODUCT DIRECTLY FROM MOTREC AND NOT FROM A MOTREC DEALER, YOU MUST REGISTER YOUR PRODUCT FOLLOWING THE INSTRUCTIONS BELOW (CLAUSE 3)

https://www.motrec.com/registration/

DEFECTS. Subject to the terms and conditions described below, parts, components or accessories installed on the product by Motrec which fail under normal usage within the warranty period, and that are proven to be defective, will be repaired or replaced without charge for parts or labor unless stated otherwise herein. This is Motrec's sole liability under this Warranty. The warranty excludes items described in (Clause 6). Motrec reserves the right to require that all parts or components claimed to be defective be returned for inspection and verification of defect. The purchaser is responsible for any and all shipping fees of any and all parts or components that it alleges to be defective. In the event the part is still under warranty and confirmed defective after inspection by Motrec, freight would be credited.

WARRANTY SERVICES. All warranty services must be rendered by authorized Motrec distributors and approved in writing by Motrec prior to initiating any repairs or adjustments. Motrec parts must also be used when performing the warranty otherwise the warranty will be voided. All approved warranty services will be paid for based on standard rates established by Motrec. Rather than replace or repair parts or components, Motrec may, at its discretion, replace the product or refund a prorated amount of its purchase price (based on service time, wear and tear) upon return of the defective product.

AUTHORIZATION PROCESS. No product shall be returned to Motrec without its prior authorization. All warranty claims must be disclosed to Motrec or its authorized distributor as soon as the purchaser is aware of a suspected defect or any event susceptible to give rise to a claim under the Motrec Limited Warranty. All claims must be processed through an authorized Motrec distributor using the warranty claim procedure approved by Motrec.

THE ABOVE TERMS AND CONDITIONS REPRESENT THE ONLY REPRESENTATIONS MADE BY MOTREC IN RELATION TO ITS PRODUCTS. MOTREC DOES NOT PROVIDE ANY OTHER PARTICULAR WARRANTY TO THE USER OF ITS PRODUCTS. MOTREC DOES NOT MAKE ANY EXPRESS OR IMPLIED WARRANTIES OR REPRESENTATION WITH RESPECT TO ANY RESULT, PERFORMANCE OR DURABILITY EXPECTED FROM THE USE OF ANY OF ITS PRODUCTS. MOTREC EXCLUDES AND DECLINES ANY OTHER WARRANTY OF SUITABILITY OR OF FITNESS FOR A PARTICULAR PURPOSE, WOULD THEY BE PROVIDED BY LAW, BY CONTRACT OR OTHERWISE.

PRODUCT MODIFICATIONS ARE PROHIBITED. Motrec prohibits and disclaims any and all liability for any modification made to the product, including but not limited to, modifications that are susceptible to alter the weight distribution and stability of the product, increase its speed or affect its safety. Such modifications can cause serious personal injury or property damage for which Motrec disclaims and excludes any and all responsibility. It is the purchaser's responsibility to ensure that any technicians servicing the product are properly trained as required by OSHA (Occupational Safety and Health Administration: https://www.osha.gov/) and ANSI-B56 (American National Standards Institute: https://webstore. ansi.org/default.aspx). Service technicians shall read, understand and follow the instructions in the Motrec Owner's Manual before servicing the product. Only qualified and authorized personnel shall be permitted to maintain, repair, adjust and inspect the product.

TRAINING. It is the purchaser's responsibility to ensure that the driver or any person operating, using, maintaining or handling the product (or its accessories) is properly trained and instructed on the product's safety features and operation, including its stability. Operators shall read, understand and follow the safety and operating instructions in the Motrec Owner's Manual before driving the vehicle. Operators shall not be permitted to operate the product unless a complete and adequate training has been provided by the purchaser. Driving an electrical vehicle constitutes a hazard. The driver is responsible for the control of the product while driving and must always evaluate all unusual or particular situations that he or she may encounter while driving. The driver assumes the inherent hazards related to this activity. Motrec products are designed for off-road use only.

EXCLUSION OF LIABILITY. Motrec disclaims any liability for incidental or consequential damages, including, but not limited to, personal injury or property damage arising from misuse of the product, lack of maintenance or any defect in the vehicle.

UNDER NO CIRCUMSTANCE WILL MOTREC BE LIABLE FOR ANY DAMAGE, WHETHER DIRECT, INDIRECT OR OTHERWISE, RESULTING FROM THE USE OF ITS PRODUCTS, EVEN IF MOTREC OR ONE OF ITS REPRESENTATIVES WAS AWARE OF THE POSSIBILITY OF SUCH DAMAGE. ANY LIABILITY FOR LATENT DEFECT IS LIMITED TO THE PRICE OF THE PRODUCT.

1. Definitions

"Product": the complete vehicle manufactured and/or assembled by Motrec, including its parts, components and accessories installed by Motrec. **"Purchaser"**: The party in whose name the product is originally registered at the time of purchase pursuant to the product registration procedure maintained by Motrec at that time, either: (a) the party to whom Motrec sold the product, if that party purchased the product for its own use, or (b) the customer of a Motrec dealer, who bought the product directly from such dealer.

2. Warranty Period

Your Motrec product using the AC technology is covered by the Motrec Limited Warranty for a period of three (3) years or 3,000 hours of use, whichever comes first. This period of three (3) years starts on the date the product is registered, as mentioned hereinabove. This coverage does not apply to wearable parts, normal use or abusive usage of the product.

Your Motrec stock chaser is covered by the Motrec Limited Warranty for a period of three (3) years or 3,000 hours of use, whichever comes first. This period of three (3) years starts on the date the product is registered, as mentioned hereinabove. This coverage does not apply to wearable parts, normal use or abusive usage of the product.

Your Motrec trailer is covered by the Motrec Limited Warranty for a period of three (3) years. This period of three (3) years starts on the date the product is registered, as mentioned hereinabove. This coverage does not apply to wearable parts, normal use or abusive usage of the product.

Your Motrec product using DC or other technology is covered by the Motrec Limited Warranty for a period of two (2) years or 2,000 hours of use, whichever comes first. This period of two (2) years starts on the date the product is registered, as mentioned hereinabove. This coverage does not apply to wearable parts, normal use or abusive usage of the product.

3. Warranty Registration

The warranty registration must be completed within thirty (30) days of purchase of the product. If registration is not completed within this time, the warranty will be voided. If you purchased the product from a Motrec dealer, please make sure the dealer has completed the registration. If you purchased the product directly from Motrec, please make sure to go to this link (https://www.motrec.com/registration/) and register your vehicle. In case of registration problems, please contact your Motrec representative.

4. Maintenance

Motrec requires that scheduled maintenance be performed at the times shown in the Owner's Manual (Refer to the "Preventive Maintenance Schedule"). If this scheduled maintenance is not done and the product fails as a result of a failure to properly maintain it, repairs will not be covered under any warranty.

5. Warranty will be void if:

- The product has been modified in any manner not approved in writing by Motrec
- The product has been overloaded beyond its rated capacity
- The product's maximum speed has been increased
- The product's motor controller parameters have been tampered without Motrec's authorization
- The product has been used abusively (including, but not limited to: improper use; twisted, bent, misaligned front or rear axles; any signs of abusive use)
- The product has been involved in an accident
- The product has been transferred to a second owner without Motrec's authorization
- The product has been used in extreme environments (including, but not limited to: freezers, excessive moisture areas, corrosive environments, etc.)
- The product has had its serial number modified or altered
- The product has been repaired with non-Motrec parts without Motrec's authorization
- The preventive maintenance schedule was not followed as specified in the Motrec Owner's Manual

6. The following items are not covered by the Motrec limited warranty:

- Batteries, charger, wheels (which are covered by warranties from manufacturers)
- Internal combustion engines (which are covered by warranties from manufacturers)
- Wearable parts (diodes & fuses, filters & spark plugs, lubricants, seals, switch, horn, tires, wheel bearings, seats, brake pads and shoes)
- Tear and wear resulting from normal use
- Adjustments, including field set-up
- Damage or defects caused by using non-Motrec parts, components or accessories
- Shipping damage caused by the freight carrier
- Shipping fees for warranty parts (if proven not admissible, refer to Defects section)
- Travel fees for technical support and repair

TABLE OF CONTENTS

INSTRUCTIONS

SAFETY WARNINGS FOR OPERATORS

- FAILURE TO OBEY THE FOLLOWING SAFETY RULES MAY RESULT IN SEVERE INJURY.
- It is the responsibility of the owner of this vehicle to train operators to ensure that they understand the operating characteristics of this vehicle, including training in vehicle stability, and obey the following safety rules and guidelines. Owner shall comply with OSHA and ANSI/ITSDF B56.8 & B56.9 Standards for vehicle use, safety rules, operator training and certification. Do not drive this vehicle unless you are a qualified operator.
- Do not drive this vehicle under the influence of drugs or alcohol.
- Do not drive this vehicle on public roads and highways. This vehicle is designed to be driven in buildings.
- The electrical system of this vehicle will make sparks which can ignite inflammable materials. Never use the vehicle in hazardous areas where there are inflammable materials, explosive dust or fumes in the air.
- Have your vehicle inspected regularly by trained personnel, and cease operation if a malfunction occurs.
- Do not open battery compartment to prevent battery explosion, acid splashing, severe damage to eyes or skin.
- Do not open motor compartment. Keep clear from moving, rotating(wheels, sheaves, etc) or lifting parts.
- Never carry more passengers than number allowed for this vehicle. Wait until all occupants are seated and holding on before moving. Always keep all body parts inside vehicle. Keep both hands on steering wheel.
- Do not exceed the vehicle cargo load capacity and gross trailing weight capacity, rated for flat hard even surface. Different operating conditions such as loose terrain or ramps reduce vehicle capacity.
- Avoid loose, unbalanced or top-heavy loads to keep a good stability and prevent overturn. Do not load cargo that can fall off the vehicle. Do not carry cargo that is longer, wider or higher than this vehicle.
- Always depress slowly the accelerator for smooth acceleration. Avoid stunt driving or horseplay.
- Avoid sharp turns, always slow down before turning, to prevent vehicle overturn or trailer jack knife. Vehicle is more sensitive to overturn and jack knife when traveling on inclines or when carrying a heavy load.
- Always drive straight up and down the face of an incline, never across the face, to prevent overturn and trailer jack knife. Drive slower and start applying brakes sooner on inclines to adjust for longer stopping distance.
- Use extra care and drive slowly in reverse, in congested areas or on wet or slippery ground.
- Keep to the right under normal conditions. Maintain a safe distance from all objects.
- Slow down and sound the horn when approaching a corner or other blind intersections.
- Before leaving the vehicle, park on a level ground flat surface, turn off all switches, set the forward/reverse switch to neutral, set the parking brake, remove the key. Do not park the vehicle on an incline.
- Before battery charging, park the vehicle in a well ventilated area set for. Do not operate it when charging. To interrupt a charging cycle, disconnect the AC plug; disconnecting the DC plug or a battery terminal, or operating the vehicle, could damage the charger and produce a spark, battery explosion and acid splashing.
- Use another driver to steer this vehicle while it is towed. Be sure the driver uses brakes when you slow or stop the towing vehicle. Do not exceed 5 MPH or carry any passenger while towing this vehicle.

OPERATING INSTRUCTIONS

It is the responsibility of the owner of this vehicle to ensure that the operator understands the operating characteristics of this vehicle, and obeys the safety instructions in this manual and ANSI/ITSDF B56.8 & 9 Standards. Do not drive this vehicle unless you are a certified operator as required by OSHA.

BEFORE TURNING ON KEYSWITCH

Set to neutral, set parking brake, check for visible damage, check brake pedal.

AFTER TURNING ON KEYSWITCH

Check safety devices: seat switch, reverse alarm, motion beeper, strobe light, and all other safety devices.

BATTERIES

Never open the battery compartment unless you have received proper training for battery maintenance.
Batteries emit explosive hydrogen gas that can be ignited by a spark or loose terminal. Battery acid causes severe damage to eyes or skin. Flush the contaminated area immediately with water. Park the vehicle in a well ventilated area for battery charging. Most battery chargers come with an electronic control that starts when the charger is plugged and stop when the battery is fully charged. To interrupt the charging cycle, disconnect the AC-plug, do not disconnect the DC plug.

BATTERY DISCHARGE INDICATOR

The green light moves from right to left as batteries are being discharged. When the green light is at the last position on the left the batteries must be recharged. A flashing light warns the operator that further discharge will damage batteries. See HOBBS indicator instructions.

EMERGENCY SAFETY DEVICE

The emergency push button or battery disconnect handle, when present, should only be used in case of emergency. Use the key switch for normal ON/OFF control.

KEYSWITCH

Depress brake pedal and turn the key switch clockwise for on position. Always turn off all switches, set the F/R selector to neutral, set the parking brake, remove the key before leaving the vehicle.

HORN

Depress the horn button on the steering column or handle bar.

F/R SWITCH

Three positions with neutral at center. Depress the front part of the rocker switch for forward direction. Depress the rear part of the rocker switch for reverse direction. Always set switch to neutral, turn off all switches, set the parking brake, remove the key before leaving the vehicle.

ACCELERATOR PEDAL

It is designed for right foot operation only, and controls the speed of the vehicle. Apply slowly.

FOOT BRAKE PEDAL

It is designed for right foot operation only. The brake force is proportional to the pressure on the pedal.

PARKING BRAKE

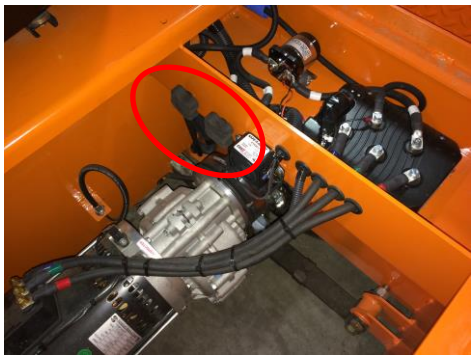
Pull handbrake lever to apply. Never park the vehicle on an incline. Always turn off all switches, set the F/R selector to neutral, set the parking brake, remove the key before leaving the vehicle.

ELECTROMAGNETIC BRAKE

This vehicle could be equipped with electromagnetic parking brake. This spring applied and electrically released brake keeps the vehicle stationary when it comes to a stop or power is cut. When the accelerator is depressed, the brake is released automatically.

If the vehicle is not powered and must be moved, the following steps must be done to avoid any damage to the vehicle:

1- Remove the knobs located outside the electrical components compartment.



2- Screw the knobs behind the electromagnetic brake to manually release the brake.

When the vehicle is ready to be used, the knobs must be removed from the electromagnetic brake and put back to their storage location.

MAINTENANCE

SAFETY WARNINGS FOR SERVICE TECHNICIANS

FAILURE TO OBEY THE FOLLOWING SAFETY RULES MAIN RESULT IN SEVERE INJURY.

Owner shall comply with OSHA and ANSI/ITSDF B56.8 & B56.9 Standards for vehicle maintenance.

Only qualified and authorized personnel shall be permitted to maintain, repair, adjust and inspect carriers, vehicles, tractors, and batteries.

Before any maintenance work, park the vehicle on flat level surface, turn off all switches, remove key, lift wheels off the ground and secure with jack stands of adequate capacity. Don't connect charger.

Keep clear from moving parts such as tires, sheaves and motor.

Follow the maintenance instructions applicable to the type of repair, maintenance, or service.

Always wear a face shield and gloves when working around batteries.

Before opening the battery compartment, disconnect the charger, turn off all switches and remove the key. Batteries emit highly explosive gases which greatly increase when charging; do not disturb connections or produce sparks around batteries to avoid a battery explosion and acid splashing. Battery acid causes severe damage to eyes or skin. Flush contaminated area immediately with water.

Use insulated tools to avoid sparks that can cause battery explosion and acid splashing.

Use two counteracting tools, double-wrench technique, when disconnecting or tightening terminals on the battery and the speed controller to avoid cracking the terminal or battery post welds.

Before cleaning or replacing a battery, charger, speed controller, contactor, relay, diode, or any other component in the power circuit, always disconnect the charger, turn off all switches, remove the key, wear a face shield and gloves, identify battery polarity and disconnect battery leads, discharge the capacitor in the controller with a 10 ohms, 25 W resistor for a few seconds across B+ and B-.

After cleaning, the power must not be reapplied until terminal areas are thoroughly dry.

On EE-Rated vehicles make sure that the control box is sealed, the static strap makes good contact with the ground, the motor is sealed by bands, the cable protectors are properly installed.

Keep cables and wires clear from mechanical and rubbing action. Make sure that cable insulation is free from cutting or visible damage. Make sure that EE-Rated cable protectors are properly installed.

Before replacing a fuse or circuit breaker, identify the cause of failure and repair.

Programmable controllers must be programmed using the parameter settings in this service manual, before connecting the motor, to avoid sudden vehicle movement and accident.

Do not try to increase motor speed by changing parameter settings in the speed controller; it can cause accident and severe damage to the motor.

SEPEX speed controls are protected by a diode in the power circuit to filter inductive loads in the event of a sudden power interrupt. Some speed controllers require a diode to filter inductive loads on the KSI input. Removing the diodes will cause the speed control failure.

Before resuming maintenance operations, inspect safety warnings stickers and replace any if damage is found and part of the text can't be read.

Check decals and labels, see "DECAL AND LABELS" page.

DECALS AND LABELS

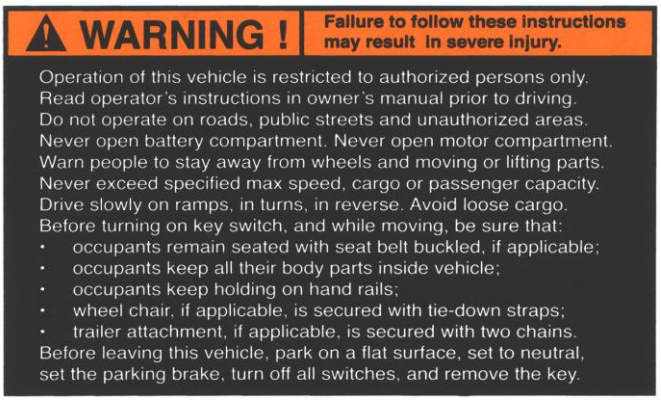
! CAUTION!

The images included in this section depict the decals/markings installed on the vehicle. It is of the utmost importance that theses decals/markings remain unaltered and readable. Else, the sticker or the part baring the marking must be replaced.

Dashboard security warning label:
5100000002

When an emergency push button is installed, this label is required
#3109000032 (ENGLISH VERSION)
#3109000033 (FRENCH VERSION)

General security warning label:
5100000001



When a disconnect handle is installed, this label is required (located in front of handle):
4800012J.

Respectively from left to right, pictogram shows
FORWARD / REVERSE SWITCH DPDT (3109923010),
HEADLIGHT DPST ROCKER SWITCH (3109922020),
HORN SWITCH (3109922130),
INCHING OR HITCH SWITCH DPDT (3109923111),
HEATER SWITCH DPDT (3109923032),
WIPER SWITCH DPST (3109922031),
ROCKER SWITCH ON/OFF (3109922020).

PREVENTIVE MAINTENANCE SCHEDULE

FOR MODELS WITH AC DIRECT DRIVE

! WARNING!

Maintenance operations must be made by properly trained service technicians.

- Keep clear from moving parts such as tires, sheaves and motor.
- Batteries contain Sulphur acid that can cause severe burns on skin or eyes.
- When working around batteries, wear acid proof protective equipment: face shield and gloves.
- Use electrically insulated tools to avoid sparks that can cause battery explosion.
- Before any maintenance work, park the vehicle on a flat level surface, turn off all switches, remove the key, lift the wheels off the ground and secure with jack stands of adequate capacity, identify and disconnect battery leads. Don't connect the charger.

	ESTIMATED TIME (MINUTES)				
DESCRIPTION PERIOD	**SHIFT**	**500H**	**1000 H**	**2000 H**	**CHECK**
Check for visible damage	**1**				
Examine floor around and beneath unit for signs of differential and brake fluid leaks.	**1**				
Turn steering, check for hard steering, excessive free play, or unusual sound when turning.	**1**				
Check accelerator for free & smooth movement.	**1**				
Check reverse alarm, horn, strobe light.	**1**				
Check brake pedal travel and parking brake for secure hold. Start slowly and check service brake.	**1**				
Check tire pressure, see pressure rating on tire	**1**				
Check deadman switch and static strap (min 2`` contact with the floor)	**1**				
Check warning decal & marking		**1**			
Clean battery with water		**1**			
Check master cylinder fluid level (DOT 3)		**1**			
Check brake pedal travel	**1**				
Turn front wheels straight, check steering play	**1**				
Check parking brake, requires 30-40 lbs. force to apply	**1**				
Check brake lines for leaks	**1**				
Check drive for leaks	**1**				
Inspect steering suspension linkages	**1**				
Inspect the frame for damage	**1**				
Check pedal & master cylinder linkages for wear	**1**				

	ESTIMATED TIME (MINUTES)				
DESCRIPTION PERIOD	**SHIFT**	**500H**	**1000 H**	**2000 H**	**CHECK**
Inspect rear wheel bearings for play		**3**			
Inspect front wheel bearings and kingpins for play		**3**			
Inspect rear brake lining for wear 1/16" (2 mm) minimum lining thickness.		**3**			
Check service brake linings and linkages for wear		**12**			
Check parking brake linings and linkages for wear		**5**			
Check power circuit connections		**5**			
Check motor brushes & commutator		**5**			
Check accelerator pot and switch adjustment -1/8" (3 mm) travel to activate micro-switch; -0 to 50 ohms when micro-switch activated; -4500 to 5500 ohms with pedal down.		**10**			
Lubricate the vehicle		**5**			
Change differential oil MOBILUBE 1 SHC 75W-90		**15**			
Check and tighten all electrical connections			**15**		
Lubricate motor spline using Monocal GP 1499 from Lubrication Engineers grease			**15**		
Tighten all nuts and bolts			**15**		
Clean & repack front Wheel Bearing			**15**		
Clean & repack Rear Wheel Bearing			**90**		
Flush the hydraulic brake system (DOT 3), if appl.				**60**	
Replace differential oil seals & wheel bearings.				**90**	
TOTAL TIME (MINUTES)	**16**	**69**	**150**	**150**	

Check & fill batteries (add distilled water to cover plates. Fill to recommended level after batteries have been fully charged.)	**According to the battery manufacturer and the battery maintenance section of this manual.**

Date: _____ Hour Meter Reading: _____

Inspected By: _____ Unit Number: _____

Any deficiencies found during inspection must be corrected before the unit is returned to service.

ACCELERATOR

GEAR

- Remove the cover.
- Backlash between gears must be reduced to a minimum by sliding holder; use locktite 262 to lock the three screws.
- When the plastic gear is fully depressed a small backlash must remain between the gears.
- When the plastic gear is released its rear portion must not exceed the pedal case.

MICRO-SWITCH

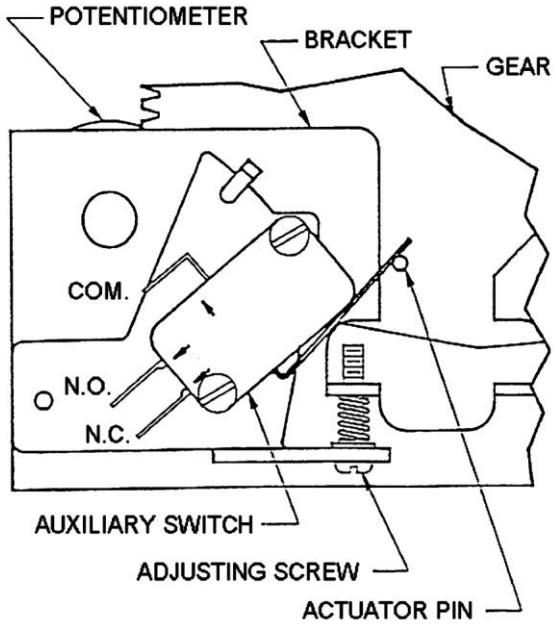
The micro-switch must deactivate the on/off solenoid when the accelerator is released; turn the adjusting screw (shown on figure below) to adjust the micro-switch height.

POT

- Remove the terminals 2 and 3 on PMC to measure resistance signal.
- When the micro-switch is activated the signal must be less than 50 ohms. When the front portion of the pedal is fully depressed the signal must be more than 4600 ohms.
- To modify the resistance, turn the adjusting screw to change the micro-switch height (see figure below).

Proceed with the same verifications after the accelerator cover is on and then connect terminals 2 and 3.

AUXILIARY SWITCH IS WIRED N.O. WITH BLUE LEAD TO COM. & ORANGE LEAD TO N.O. CIRCUIT. THE GREEN LEAD IS GROUNDED. AUXILIARY SWITCH IS SHOWN WITH THE TREADLE IN THE UP POSITION. SWITCH WILL ACTUATE AT BEGINNING OF TREADLE STROKE. SYMBOLS COM., N.O. & N.C. ARE TERMINAL MARKINGS, AS MARKED ON SWITCH.



FOOT PEDAL FP-6 MAINTENANCE GUIDELINES

FEATURES -

- FP 6 is designed for IP rating 64
  - It can work in dusty atmosphere.
  - It has sealing against splashing and spraying water from all side.
  - We do not recommend low pressure or high pressure washing.

SPECIFICATIONS -

- Pedal high point is pedal free condition
- 1st Microswitch Setting ;
  a) First micro switch should operate at 3º ± 1º (i.e. between 2º to 4º) from free condition
- Pot setting
  a) Operate pedal slowly; find reading at which first Microswitch operates.
  b) Pot resistance reading across pot low and wiper (i.e. black and white) must be within 100Ω to 400Ω.
- 2nd Micro switch setting
  a) 2nd micro switch should operate between 4600 Ω and *pot max* resistance, across *pot low and wiper* (i.e. black and white)

INSTALLATION PROCEDURE

Terminology - ***"Pot low", "wiper" and "pot high"*** are pot terminals. (Black, white and red cables respectively) "***Pot max resistance***" is the resistance value across pot low and pot high. (Black and Red cables)

1. MICRO SWITCHES AND POT SETTING

For Foot Pedal FP-6, use pot low and wiper (black and white) for setting micro switches.

- Set Pedal at free condition.
- Adjust pedal at 3° deflection. Set first micro switch to operate about set deflection.
- Adjust pot resistance from high valve to get (100 to 400Ω) across *pot low and wiper* (i.e. black and white).
- Set 2nd micro switch between 4600 Ω and *pot max* resistance.

CHECK LIST / CAUTION

- Pedal angle must be within 30 +/- 3 degree. Check freeness of pedal.
- Select 'resistance' measurement range in as per requirement on the Multi meter. Minimum resistance between pot low and wiper must be less than 10 ohms. Pot Max Resistance (between pot low and pot high) must be within 4500 to 5500 ohms.
- Confirm that micro switch settings are as per specifications.
- Measure the resistance between each of the seven wires and the housing of the Foot Pedal. It should measure "Infinity"
- Visually check the insulating sleeves are put around the soldered side of all seven cables, and that the sleeves are firmly in place.

YEARLY MAINTENANCE

- Remove cover of Pedal.
- Apply 3 to 5 drops oil on pedal return spring.
- Apply 2 drops oil in the slot of front bush.
- Do not apply oil on shaft from outside. It is of no use, due to sealing on the shaft.
    i. Oil Specification
    ii. 20W Motor Oil (Or 3 in one motor oil)
    iii. 20 stand for weight of motor oil.
    iv. W Stands for winter grade.

HYDRAULIC & PARKING BRAKES

FOR MODELS WITH TOWING CAPACITY UP TO 16,000 LB (7270 KG)

Revision 2012-01-23

DRUM BRAKES

Remove brake drums and check lining wear. Replace shoes and springs if the lining thickness is 1/16" (2mm) or less. Turn the brake adjustment to reduce the clearance between lining and drum. Wheels must turn free when the pedal is released.

DISC BRAKES

Check pad linings. Replace pads if lining thickness is 1/16" (2 mm) or less.

PARKING BRAKE

Replace cables and stoppers if cable play exceeds 1/8" (4mm).
Wheels and/or differential pinion must turn freely when the parking brake is released.
On pinion brake, use spacers at pad fixed ends to reduce space between pads and pulley to 1mm.
To install new cables and stoppers:
-insert the new cable through the hand lever end;
-pull the cable out from the brake assembly end;
-insert the stopper on the cable and leave a maximum play of 1mm;
-for a two-cable system, make sure that cable length is the same at hand lever end;
-tighten ¼-ncx3/4 grade-5 bolt in stopper at 8 Lb-Ft (11Nm) torque;
-cable must extend 1.5" (4cm) out of the cable stopper, cut cable excess.

Once cable play has been checked and/or adjusted, turn the knob on the brake lever until a force of 30-40 Lbs or 14-18 kg is required on the handle to set the parking brake. Tighten the locking screw.

BRAKE PEDAL

If the brake pedal becomes soft or spongy, air may have entered the hydraulic system and the brake system has to be bled:

1. fill the master cylinder with brake fluid (DOT-3);
2. bleed front calipers one at a time by having someone applying a steady pressure on the brake pedal, and close the bleeder before allowing the brake pedal to return to up position;
3. fill the master cylinder with brake fluid (DOT-3);
4. bleed rear wheel brakes one at a time, following the same procedure;
5. fill the master cylinder with brake fluid (DOT-3);
6. clean every fitting and line, remove traces of oil;
7. apply a continuous pressure on the brake pedal for about five minutes ;
8. Finally, inspect brake lines and fittings for leaks ;

FRONT AXLE AND STEERING

! CAUTION !

Before maintenance, turn off all switches, set to neutral, set parking brake, remove the key, and raise the front end of the vehicle supporting it with two jack stands of adequate capacity

STEERING INSPECTION

- Check tire inflation pressure, suspension components, tie rods straightness, tie rod ends play (wear), play (wear) in wheel bearings, kingpins and bushings.

REPLACING & ADJUSTING THE STEERING GEAR

- Remove the pitman arm;
- The steering box makes 6.5 turns, center the steering gear (3.25 turns from either side);
- Align the front wheel straight. Install the pitman arm.

TOE-IN ADJUSTEMENT

- With the wheels in straight forward direction, measure the inside (left to right) distance between the front tires, at the front and rear of the tires;
- Turn the rear tie rod until the distances are equal and tighten the two lock nuts on the tie rod.

REMOVING & GREASING OF FRONT HUBS, required once-a-year

- Remove dust cap and cutter pin, unscrew nut, remove hub;
- Inspect bearings and races for wear and replace worn bearings;
- Replace the seal;
- Pack the hub with wheel bearing grease and re-assemble.

ADJUSTING FRONT HUBS

- Tighten spindle nut to 30 ft-lb to seat the bearing and back off the nut to the next slot;
- Install a new cutter pin and the dust cap.

BATTERY MAINTENANCE

! WARNING !

- It is the responsibility of the owner of this vehicle to ensure that the service technicians are properly trained, read and obey the safety rules and guidelines in this manual (ANSI B56).
- Maintenance operations must be made by properly trained service technicians only.
- Before any maintenance work, park the vehicle on a flat level surface, turn off all the switches, set to neutral, remove the key, lift the wheels off the ground and secure with jack stands of adequate capacity.
- Keep charger disconnected while doing any maintenance work.
- Always wear a face shield and scarf when working around batteries.
- Battery emits highly explosive gases; do not produce sparks to avoid battery explosion and acid splashing. Battery acid causes severe damage to eyes or skin. Flush contaminated area immediately with water.
- Use insulated tools to avoid sparks that can cause battery explosion and acid splashing.
- Use two counteracting tools, double-wrench technique, when disconnecting or tightening battery posts.
- Before cleaning or replacing a battery, discharge the capacitor in the controller with a 10 ohms, 25 W resistor for a few seconds across B+ and B-, identify battery polarity and disconnect battery leads.
- After cleaning, the power must not be reapplied until terminal areas are thoroughly dry.

BATTERY LEADS AND CONNECTORS

Check for loose connections, damaged cables, acid spill, loose terminal posts, quarterly.

BATTERY POST CORROSION

If corrosion is present on battery posts, remove the cable connectors, use a wire brush to remove particles, and then clean them with a cloth that has been moistened with ammonia.

ELECTROLYTE LEVEL

Does not apply to sealed battery.

- Disconnect battery connectors on roll-out or lift-out installations.
- Make sure the battery roll-out tray is provided with stops before rolling out.
- Fill with distilled water.
- Daily charged batteries normally require watering once a week. Under watering leads to a shortened battery life. Over watering leads to battery corrosion. Be careful not to overfill any cell to avoid electrolyte to be forced out while charging.
- Fill each cell to plate level with distillated or de-ionized water, before battery charging. When the battery is charged, the fluid expands and can seep out if overfilled. Refill each cell after full charge, when the fluid has expanded to its maximum level.
- Reinstall battery caps before charging.

BATTERY MOUNTING

A loose battery increases damaging effects of vibrations and is more prone to short out.

BATTERY DISCHARGE LIMIT

Discharging below a 20% state of charge cuts down the battery life and the number of cycles available. At 20% state of charge, specific gravity of 6V battery should be 1180; and 1220 for industrial battery.

CHARGING AREA

- Always charge battery in a well ventilated area set for and approved for charging.
- Never leave a charger connected for more than 20 hours.

FREQUENCY OF CHARGE

- When a battery is discharged to its 20% state of charge, it is best to charge immediately.
- Batteries require a low current equalization charge (min 4 hours) at least every week, to equalize battery cells, improve battery performance and life in number of cycles.
- Never leave a charger connected for more than 20 hours.

STORAGE

- Keep the battery from getting cold, it would loose its capacity.
- Let the battery warm up before charging.
- Charge batteries in “stored” vehicles every month.

DEFECTIVE BATTERY

Check specific gravity of each cell; if a cell is shorted, voltage drop may occur only when there is current.

BATTERY CHARGER

! WARNING !

Always unplug the AC and DC electrical cords before attempting any repairs to the charger.

CHARGER DOES NOT TURN ON:

- Dc cord of portable chargers must be disconnected from batteries after every charge to restart.
- Check dc fuse links;
- Check battery voltage at the battery connector;
- Check ac outlet and cord set;
- Replace electronic control;

RELAY CLOSES AND TRANSFORMER HUMS BUT AMMETER DOES NOT REGISTER:

- Check dc fuse links;
- Check the continuity of the dc output cord, ammeter, diodes and all connections in the dc circuit;
- Check diodes;
- Check capacitor(rapidly increasing resistance);

SINGLE CHARGER FUSE BLOWS:

- Disconnect and check diodes;

BOTH FUSE LINKS BLOW:

- Check the battery pack and battery connector polarity;
- Disconnect and check diodes.

CHARGER OUTPUT IS LOW:

- Disconnect and check diodes;
- Can be caused by a transformer failure.

AMMETER READS 30 AMPS FOR MORE THAN 30 MINUTES:

- Check the battery pack;

CHARGER DOES NOT TURN OFF:

- Check specific gravity in each battery cell;
- As much as 16 hours may be required to properly charge heavely discharged new or cold batteries;
- Replace electronic control.

AC LINE FUSE OR CIRCUIT BREAKER BLOWS:

- Check ac cordset;
- Check ac line fuse rating;
- Replace electronic control;
- Can be caused by a transformer failure.

ELECTRICAL TROUBLESHOOTING

! WARNING !

Maintenance work must be performed by trained service technicians only.

It is the responsibility of the owner of this vehicle to ensure that the services technicians are properly trained, understand and obey the safety rules and guidelines (ANSI B56).

All service technicians must read and understand the maintenance warning section in this manual.

! WARNING !

Before any maintenance work, park the vehicle on a flat level surface, turn off all switches, remove the key, lift the wheels off the ground, secure with jack stands of adequate capacity, disconnect charger.

Always wear safety glasses.

Batteries emit highly explosive gases that can be ignited by a spark. Before disconnecting a high current terminal, turn off all switches, disconnect battery charger and disconnect batteries.

Keep clear from moving parts such as tires, sheaves and motor.

PMC SELF DIAGNOSTIC

If the vehicle has a display, it will give the error codes to help troubleshooting. The PMC also comes with a status LED, which gives a flashing code to help troubleshooting.

BATTERY VOLTAGE

Make sure batteries are securely connected. Measure voltage between + and - terminals. We will call this value B+ or full battery voltage.

ACCESSORIES NOT WORKING

- Check the fuses on the batteries and the DC/DC converter.
- Check voltage across + and – terminals on the battery gage; if not B+, check wiring.
- Turn the key switch ON, check voltage between output terminal on the key switch and the - terminal on the battery gage; if not B+, replace the key switch.
- Check voltage across DC/DC converter output terminals; if not 12-Volt, replace the converter.
- Depress the accessory switch, check voltage across accessory terminals. If not 12-Volt, replace the switch. If 12-Volt, replace the accessory.

FORWARD ONLY

Check the reverse signal input on the controller.
Switch to reverse and check voltage on the reverse control wire. If not B+, replace the F/R switch.

REVERSE ONLY

Check the forward signal input on the controller.

Switch to forward and check the voltage on the forward control wire. If not B+, replace the F/R switch.

TRAVEL AT REDUCED SPEED

Check batteries.

Turn off all switches and disconnect charger. Wear face shield and gloves. Do not disturb any battery connection to avoid sparks. Check the specific gravity of each cell. Cold batteries, highly discharged batteries or dead cells are the most frequent causes of reduced travel speed.

Check potentiometer.

Turn off the key switch, disconnect potentiometer terminals. Check the resistance between terminals.

Other causes of lower speed:

dragging brakes;

cold temperature (higher differential oil viscosity).

INTERMITTENT OPERATION

A bad potentiometer is the most probable cause of the following:

- acceleration is not constant;
- maximum speed is erratic;
- sudden stop after a bump or shock;
- erratic starts, requiring several pedal cycles.

Erratic starts could also be the cause of a misadjusted potentiometer or micro-switch; the pot signal must be less than 50 ohms when the micro-switch turns on.

PMC has a HPD safety feature that prevents the vehicle from moving if the accelerator pedal is depressed before the key switch is ON and seat switch is activated.

PMC also has a SRO safety feature that prevents the vehicle from moving if the F/R switch is activated before turning on the key switch and activating the seat switch.

The vehicle stops on a steep and long ramp or while towing a heavy load: the PMC monitors the temperature of the motor and is also equipped with an internal thermal protection that cutback the current until the PMC and/or motor has cooled down.

NO MOTION

Make sure that the PMC surface is clean and dry; check the terminal areas. Dust Particles or acid contamination, can create current leaks and cause a PMC malfunction.

Check F/R switch

Turn on the key switch and set to forward. Check voltage between the forward terminal and the B– post on the PMC, check voltage between the reverse terminal and the B– post on the PMC; if both B+, replace the F/R switch.

Check switches and wiring

Disconnect control terminals on the PMC and check all control signals. If a switch pin does not read B+, check wiring or replace the switch.

Check potentiometer

Turn the key switch to OFF, disconnect potentiometer terminals. Check the resistance across terminals: if not within the recommended limits, adjust or replace the potentiometer. Check for shorts between potentiometer wires and vehicle frame; resistance should read at least 1 megohm.

Check main contactor or solenoid

Check voltage on coil positive terminal; if not B+, check circuit breaker or replace the solenoid. Turn to on the key switch and activate the seat switch. Check voltage across the coil terminals; if not 24V, check wiring and interlock switches. Check resistance across power terminals; if not 0 ohms, replace the solenoid.

8 DIAGNOSTICS AND TROUBLESHOOTING

These controllers detect a wide variety of faults or error conditions. Faults can be detected by the operating system or by the VCL code. This section describes the faults detected by the operating system.

Faults detected by VCL code (faults 51–67 in Table 5) cannot be defined here as they will vary from application to application. Refer to the appropriate OEM documentation for information on these faults.

DIAGNOSTICS

Diagnostics information can be obtained in either of two ways: (1) by reading the display on a 1311 programmer or (2) by observing the fault codes issued by the Status LEDs. See Table 4 for a summary of LED display formats.

The 1311 programmer will display all faults that are currently set as well as a history of the faults that have been set since the history log was last cleared. The 1311 displays the faults by name.

The pair of LEDs built into the controller (one red, one yellow) produce flash codes displaying all the currently set faults in a repeating cycle. Each code consists of two digits. The red LED flashes once to indicate that the first digit of the code will follow; the yellow LED then flashes the appropriate number of times for the first digit. The red LED flashes twice to indicate that the second digit of the code will follow; the yellow LED flashes the appropriate number of times for the second digit.

Example: Battery Undervoltage (code 23).

In the Fault menu of the 1311 programmer, the words **Undervoltage Cutback** will be displayed; the real-time battery voltage is displayed in the Monitor menu ("Keyswitch Voltage").

The controller's two LEDs will display this repeating pattern:

RED	YELLOW	RED	YELLOW
*	* *	* *	* * *
(first digit)	(2)	(second digit)	(3)

The numerical codes used by the yellow LED are listed in the troubleshooting chart (Table 5), which also lists possible fault causes and describes the conditions that set and clear each fault.

Summary of LED display formats

The two LEDs have four different display modes, indicating the type of information they are providing.

Table 4 TYPES OF LED DISPLAY

DISPLAY	STATUS
Neither LED illuminated	Controller is not powered on; or vehicle has dead battery; or severe damage.
Yellow LED flashing	Controller is operating normally.
Yellow and red LEDs both on solid	Controller is in Flash program mode.
Red LED on solid	Watchdog failure or no software loaded. Cycle KSI to restart, and if necessary load software.
Red LED and yellow LED flashing alternately	Controller has detected a fault. 2-digit code flashed by yellow LED identifies the specific fault; one or two flashes by red LED indicate whether first or second code digit will follow.

TROUBLESHOOTING

The troubleshooting chart, Table 5, provides the following information on all the controller faults:

- fault code
- fault name as displayed on the programmer's LCD
- the effect of the fault
- possible causes of the fault
- fault *set* conditions
- fault *clear* conditions.

Whenever a fault is encountered and no wiring or vehicle fault can be found, shut off KSI and turn it back on to see if the fault clears. If it does not, shut off KSI and remove the 35-pin connector. Check the connector for corrosion or damage, clean it if necessary, and re-insert it.

Table 5 TROUBLESHOOTING CHART

CODE	PROGRAMMER LCD DISPLAY / *EFFECT OF FAULT*	POSSIBLE CAUSE	SET/CLEAR CONDITIONS
12	Controller Overcurrent *ShutdownMotor;* *ShutdownMainContactor;* *ShutdownEMBrake;* *ShutdownThrottle;* *FullBrake;* *ShutdownPump.*	1. External short of phase U,V, or W motor connections. 2. Motor parameters are mis-tuned. 3. Controller defective.	*Set:* Phase current exceeded the current measurement limit. *Clear:* Cycle KSI.
13	Current Sensor Fault *ShutdownMotor;* *ShutdownMainContactor;* *ShutdownEMBrake;* *ShutdownThrottle;* *FullBrake;* *ShutdownPump.*	1. Leakage to vehicle frame from phase U, V, or W (short in motor stator). 2. Controller defective.	*Set:* Controller current sensors have invalid offset reading. *Clear:* Cycle KSI.
14	Precharge Failed *ShutdownMotor;* *ShutdownMainContactor;* *ShutdownEMBrake;* *ShutdownThrottle;* *FullBrake;* *ShutdownPump.*	2. External load on capacitor bank (B+ connection terminal) that prevents the capacitor bank from charging. 1. See Monitor menu » Battery: Capacitor Voltage.	*Set:* Precharge failed to charge the capacitor bank to the KSI voltage. *Clear:* Cycle Interlock input or use VCL function *Precharge()*.
15	Controller Severe Undertemp *ShutdownMotor;* *ShutdownMainContactor;* *ShutdownEMBrake;* *ShutdownThrottle;* *FullBrake;* *ShutdownPump.*	1. See Monitor menu » Controller: Temperature. 2. Controller is operating in an extreme environment.	*Set:* Heatsink temperature below -40°C. *Clear:* Bring heatsink temperature above -40°C, and cycle interlock or KSI.
16	Controller Severe Overtemp *ShutdownMotor;* *ShutdownMainContactor;* *ShutdownEMBrake;* *ShutdownThrottle;* *FullBrake;* *ShutdownPump.*	1. See Monitor menu » Controller: Temperature. 2. Controller is operating in an extreme environment. 3. Excessive load on vehicle. 4. Improper mounting of controller.	*Set:* Heatsink temperature above +95°C. *Clear:* Bring heatsink temperature below +95°C, and cycle interlock or KSI.
17	Severe Undervoltage *Reduced drive torque.*	1. Battery Menu parameters are misadjusted. 2. Non-controller system drain on battery. 3. Battery resistance too high. 4. Battery disconnected while driving. 5. See Monitor menu » Battery: Capacitor Voltage. 6. Blown B+ fuse or main contactor did not close.	*Set:* Capacitor bank voltage dropped below the Severe Undervoltage limit (see page 55) with FET bridge enabled. *Clear:* Bring capacitor voltage above Severe Undervoltage limit.

Table 5 TROUBLESHOOTING CHART, continued

CODE	PROGRAMMER LCD DISPLAY *EFFECT OF FAULT*	POSSIBLE CAUSE	SET/CLEAR CONDITIONS
18	Severe Overvoltage *ShutdownMotor;* *ShutdownMainContactor;* *ShutdownEMBrake;* *ShutdownThrottle;* *FullBrake;* *ShutdownPump.*	1. See Monitor menu » Battery: Capacitor Voltage. 2. Battery menu parameters are misadjusted. 3. Battery resistance too high for given regen current. 4. Battery disconnected while regen braking.	*Set:* Capacitor bank voltage exceeded the Severe Overvoltage limit (see page 55) with FET bridge enabled. *Clear:* Bring capacitor voltage below Severe Overvoltage limit, and then cycle KSI.
22	Controller Overtemp Cutback *Reduced drive and brake torque.*	1. See Monitor menu » Controller: Temperature. 2. Controller is performance-limited at this temperature. 3. Controller is operating in an extreme environment. 4. Excessive load on vehicle. 5. Improper mounting of controller.	*Set:* Heatsink temperature exceeded 85°C. *Clear:* Bring heatsink temperature below 85°C.
23	Undervoltage Cutback *Reduced drive torque.*	1. Normal operation. Fault shows that the batteries need recharging. Controller is performance limited at this voltage. 2. Battery parameters are misadjusted. 3. Non-controller system drain on battery. 4. Battery resistance too high. 5. Battery disconnected while driving. 6. See Monitor menu » Battery: Capacitor Voltage. 7. Blown B+ fuse or main contactor did not close.	*Set:* Capacitor bank voltage dropped below the Undervoltage limit (see page 55) with the FET bridge enabled. *Clear:* Bring capacitor voltage above the Undervoltage limit.
24	Overvoltage Cutback *Reduced brake torque.*	1. Normal operation. Fault shows that regen braking currents elevated the battery voltage during regen braking. Controller is performance limited at this voltage. 2. Battery parameters are misadjusted. 3. Battery resistance too high for given regen current. 4. Battery disconnected while regen braking. 5. See Monitor menu » Battery: Capacitor Voltage.	*Set:* Capacitor bank voltage exceeded the Overvoltage limit (see page 55) with the FET bridge enabled. *Clear:* Bring capacitor voltage below the Overvoltage limit.
25	+5V Supply Failure *None, unless a fault action is programmed in VCL.*	1. External load impedance on the +5V supply (pin 26) is too low. 2. See Monitor menu » outputs: 5 Volts and Ext Supply Current.	*Set:* +5V supply (pin 26) outside the +5V±10% range. *Clear:* Bring voltage within range.
26	Digital Out 6 Overcurrent *Digital Output 6 driver will not turn on.*	1. External load impedance on Digital Output 6 driver (pin 19) is too low.	*Set:* Digital Output 6 (pin 19) current exceeded 15 mA. *Clear:* Remedy the overcurrent cause and use the VCL function *Set_DigOut()* to turn the driver on again.

Table 5 TROUBLESHOOTING CHART, continued

CODE	PROGRAMMER LCD DISPLAY / *EFFECT OF FAULT*	POSSIBLE CAUSE	SET/CLEAR CONDITIONS
27	Digital Out 7 Overcurrent *Digital Output 7 driver will not turn on.*	1. External load impedance on Digital Output 7 driver (pin 20) is too low.	*Set:* Digital Output 7 (pin 20) current exceeded 15 mA. *Clear:* Remedy the overcurrent cause and use the VCL function *Set_DigOut()* to turn the driver on again.
28	Motor Temp Hot Cutback *Reduced drive torque.*	1. Motor temperature is at or above the programmed Temperature Hot setting, and the requested current is being cut back. 2. Motor Temperature Control Menu parameters are mis-tuned. 3. See Monitor menu » Motor: Temperature and » Inputs: Analog2. 4. If the application doesn't use a motor thermistor, Temp Compensation and Temp Cutback should be programmed Off.	*Set:* Motor temperature is at or above the Temperature Hot parameter setting. *Clear:* Bring the motor temperature within range.
29	Motor Temp Sensor Fault *MaxSpeed reduced (LOS, Limited Operating Strategy), and motor temperature cutback disabled.*	1. Motor thermistor is not connected properly. 2. If the application doesn't use a motor thermistor, Motor Temp Sensor Enable should be programmed Off. 3. See Monitor menu » Motor: Temperature and » Inputs: Analog2.	*Set:* Motor thermistor input (pin 8) is at the voltage rail (0 or 10V). *Clear:* Bring the motor thermistor input voltage within range.
31	Coil1 Driver Open/Short *ShutdownDriver1.*	1. Open or short on driver load. 2. Dirty connector pins. 3. Bad crimps or faulty wiring.	*Set:* Driver 1 (pin 6) is either open or shorted. This fault can be set only when Main Enable = Off. *Clear:* Correct open or short, and cycle driver.
31	Main Open/Short *ShutdownMotor; ShutdownMainContactor; ShutdownEMBrake; ShutdownThrottle; FullBrake; ShutdownPump.*	1. Open or short on driver load. 2. Dirty connector pins. 3. Bad crimps or faulty wiring.	*Set:* Main contactor driver (pin 6) is either open or shorted. This fault can be set only when Main Enable = On. *Clear:* Correct open or short, and cycle driver
32	Coil2 Driver Open/Short *ShutdownDriver2.*	1. Open or short on driver load. 2. Dirty connector pins. 3. Bad crimps or faulty wiring.	*Set:* Driver 2 (pin 5) is either open or shorted. This fault can be set only when EM Brake Type = 0. *Clear:* Correct open or short, and cycle driver.
32	EMBrake Open/Short *ShutdownEMBrake; ShutdownThrottle; FullBrake.*	1. Open or short on driver load. 2. Dirty connector pins. 3. Bad crimps or faulty wiring.	*Set:* Electromagnetic brake driver (pin 5) is either open or shorted. This fault can be set only when EM Brake Type >0. *Clear:* Correct open or short, and cycle driver.
33	Coil3 Driver Open/Short *ShutdownDriver3.*	1. Open or short on driver load. 2. Dirty connector pins. 3. Bad crimps or faulty wiring.	*Set:* Driver 3 (pin 4) is either open or shorted. *Clear:* Correct open or short, and cycle driver.
34	Coil4 Driver Open/Short *ShutdownDriver4.*	1. Open or short on driver load. 2. Dirty connector pins. 3. Bad crimps or faulty wiring.	*Set:* Driver 4 (pin 3) is either open or shorted. *Clear:* Correct open or short, and cycle driver.

Table 5 TROUBLESHOOTING CHART, continued

CODE	PROGRAMMER LCD DISPLAY / *EFFECT OF FAULT*	POSSIBLE CAUSE	SET/CLEAR CONDITIONS
35	**PD Open/Short** *ShutdownPD.*	1. Open or short on driver load. 2. Dirty connector pins. 3. Bad crimps or faulty wiring.	*Set:* Proportional driver (pin 2) is either open or shorted. *Clear:* Correct open or short, and cycle driver.
36	**Encoder Fault** *ShutdownEMBrake.*	1. Motor encoder failure. 2. Bad crimps or faulty wiring. 3. See Monitor menu » Motor: Motor RPM.	*Set:* Motor encoder phase failure detected. *Clear:* Cycle KSI.
37	**Motor Open** *ShutdownMotor;* *ShutdownMainContactor;* *ShutdownEMBrake;* *ShutdownThrottle;* *FullBrake;* *ShutdownPump.*	1. Motor phase is open. 2. Bad crimps or faulty wiring.	*Set:* Motor phase U, V, or W detected open. *Clear:* Cycle KSI.
38	**Main Contactor Welded** *ShutdownMotor;* *ShutdownMainContactor;* *ShutdownEMBrake;* *ShutdownThrottle;* *FullBrake;* *ShutdownPump.*	1. Main contactor tips are welded closed. 2. Motor phase U or V is disconnected or open. 3. An alternate voltage path (such as an external precharge resistor) is providing a current to the capacitor bank (B+ connection terminal).	*Set:* Just prior to the main contactor closing, the capacitor bank voltage (B+ connection terminal) was loaded for a short time and the voltage did not discharge. *Clear:* Cycle KSI
39	**Main Contactor Did Not Close** *ShutdownMotor;* *ShutdownMainContactor;* *ShutdownEMBrake;* *ShutdownThrottle;* *FullBrake;* *ShutdownPump.*	1. Main contactor did not close. 2. Main contactor tips are oxidized, burned, or not making good contact. 3. External load on capacitor bank (B+ connection terminal) that prevents capacitor bank from charging. 4. Blown B+ fuse.	*Set:* With the main contactor commanded closed, the capacitor bank voltage (B+ connection terminal) did not charge to B+. *Clear:* Cycle KSI.
41	**Throttle Wiper High** *ShutdownThrottle.*	1. See Monitor menu » Inputs: Throttle Pot. 2. Throttle pot wiper voltage too high.	*Set:* Throttle pot wiper (pin 16) voltage is higher than the high fault threshold (can be changed with the VCL function *Setup_Pot_Faults()*). *Clear:* Bring throttle pot wiper voltage below the fault threshold.
42	**Throttle Wiper Low** *ShutdownThrottle.*	1. See Monitor menu » Inputs: Throttle Pot. 2. Throttle pot wiper voltage too low.	*Set:* Throttle pot wiper (pin 16) voltage is lower than the low fault threshold (can be changed with the VCL function *Setup_Pot_Faults()*). *Clear:* Bring throttle pot wiper voltage above the fault threshold.
43	**Pot2 Wiper High** *FullBrake.*	1. See Monitor menu » Inputs: Pot2 Raw. 2. Pot2 wiper voltage too high.	*Set:* Pot2 wiper (pin 17) voltage is higher than the high fault threshold (can be changed with the VCL function *Setup_Pot_Faults()*). *Clear:* Bring Pot2 wiper voltage below the fault threshold.

Table 5 TROUBLESHOOTING CHART, continued

CODE	PROGRAMMER LCD DISPLAY / *EFFECT OF FAULT*	POSSIBLE CAUSE	SET/CLEAR CONDITIONS
44	Pot2 Wiper Low *FullBrake.*	1. See Monitor menu » Inputs: Pot2 Raw. 2. Pot2 wiper voltage too low.	*Set:* Pot2 wiper (pin 17) voltage is lower than the low fault threshold (can be changed with the VCL function *Setup_Pot_Faults()*). *Clear:* Bring Pot2 wiper voltage above the fault threshold.
45	Pot Low Overcurrent *ShutdownThrottle;* *FullBrake.*	1. See Monitor menu » Outputs: Pot Low. 2. Combined pot resistance connected to pot low is too low.	*Set:* Pot low (pin 18) current exceeds 10mA. *Clear:* Clear pot low overcurrent condition and cycle KSI.
46	EEPROM Failure *ShutdownMotor;* *ShutdownMainContactor;* *ShutdownEMBrake;* *ShutdownThrottle;* *ShutdownInterlock;* *ShutdownDriver1;* *ShutdownDriver2;* *ShutdownDriver3;* *ShutdownDriver4;* *ShutdownPD;* *FullBrake;* *ShutdownPump.*	1. Failure to write to EEPROM memory. This can be caused by EEPROM memory writes initiated by VCL, by the CAN bus, by adjusting parameters with the programmer, or by loading new software into the controller.	*Set:* Controller operating system tried to write to EEPROM memory and failed. *Clear:* Download the correct software (OS) and matching parameter default settings into the controller and cycle KSI.
47	HPD/Sequencing Fault *ShutdownThrottle.*	1. KSI, interlock, direction, and throttle inputs applied in incorrect sequence. 2. Faulty wiring, crimps, or switches at KSI, interlock, direction, or throttle inputs. 3. See Monitor menu » Inputs.	*Set:* HPD (High Pedal Disable) or sequencing fault caused by incorrect sequence of KSI, interlock, direction, and throttle inputs. *Clear:* Reapply inputs in correct sequence.
47	Emer Rev HPD *ShutdownThrottle;* *ShutdownEMBrake.*	1. Emergency Reverse operation has concluded, but the throttle, forward and reverse inputs, and interlock have not been returned to neutral.	*Set:* At the conclusion of Emergency Reverse, the fault was set because various inputs were not returned to neutral. *Clear:* If EMR_Interlock = On, clear the interlock, throttle, and direction inputs. If EMR_Interlock = Off, clear the throttle and direction inputs.
49	Parameter Change Fault *ShutdownMotor;* *ShutdownMainContactor;* *ShutdownEMBrake;* *ShutdownThrottle;* *FullBrake;* *ShutdownPump.*	1. This is a safety fault caused by a change in certain parameter settings so that the vehicle will not operate until KSI is cycled. For example, if a user changes the Throttle Type this fault will appear and require cycling KSI before the vehicle can operate.	*Set:* Adjustment of a parameter setting that requires cycling of KSI. *Clear:* Cycle KSI.
51–67	OEM Faults *(See OEM documentation.)*	1. These faults can be defined by the OEM and are implemented in the application-specific VCL code. See OEM documentation.	*Set:* See OEM documentation. *Clear:* See OEM documentation.

Table 5 TROUBLESHOOTING CHART, continued

CODE	PROGRAMMER LCD DISPLAY / *EFFECT OF FAULT*	POSSIBLE CAUSE	SET/CLEAR CONDITIONS
68	VCL Run Time Error *ShutdownMotor; ShutdownMainContactor; ShutdownEMBrake; ShutdownThrottle; ShutdownInterlock; ShutdownDriver1; ShutdownDriver2; ShutdownDriver3; ShutdownDriver4; ShutdownPD; FullBrake; ShutdownPump.*	1. VCL code encountered a runtime VCL error. 2. See Monitor menu » Controller: VCL Error Module and VCL Error. This error can then be compared to the runtime VCL module ID and error code definitions found in the specific OS system information file.	*Set:* Runtime VCL code error condition. *Clear:* Edit VCL application software to fix this error condition; flash the new compiled software and matching parameter defaults; cycle KSI.
69	External Supply Out of Range *None, unless a fault action is programmed in VCL.*	1. External load on the 5V and 12V supplies draws either too much or too little current. 2. Fault Checking Menu parameters Ext Supply Max and Ext Supply Min are mis-tuned. 3. See Monitor menu » Outputs: Ext Supply Current.	*Set:* The external supply current (combined current used by the 5V supply [pin 26] and 12V supply [pin 25]) is either greater than the upper current threshold or lower than the lower current threshold. The two thresholds are defined by the External Supply Max and External Supply Min parameter settings (page 52). *Clear:* Bring the external supply current within range.
71	OS General *ShutdownMotor; ShutdownMainContactor; ShutdownEMBrake; ShutdownThrottle; ShutdownInterlock; ShutdownDriver1; ShutdownDriver2; ShutdownDriver3; ShutdownDriver4; ShutdownPD; FullBrake; ShutdownPump.*	1. Internal controller fault.	*Set:* Internal controller fault detected. *Clear:* Cycle KSI.
72	PDO Timeout *ShutdownInterlock; CAN NMT State set to Pre-operational.*	1. Time between CAN PDO messages received exceeded the PDO Timeout Period.	*Set:* Time between CAN PDO messages received exceeded the PDO Timeout Period. *Clear:* Cycle KSI or receive CAN NMT message.
73	Stall Detected *ShutdownEMBrake; Control Mode changed to LOS (Limited Operating Strategy).*	1. Stalled motor. 2. Motor encoder failure. 3. Bad crimps or faulty wiring. 4. Problems with power supply for the motor encoder. 5. See Monitor menu » Motor: Motor RPM.	*Set:* No motor encoder movement detected. *Clear:* Either cycle KSI, or detect valid motor encoder signals while operating in LOS mode and return Throttle Command = 0 and Motor RPM = 0.

Table 5 TROUBLESHOOTING CHART, continued

CODE	PROGRAMMER LCD DISPLAY / *EFFECT OF FAULT*	POSSIBLE CAUSE	SET/CLEAR CONDITIONS
94	Emer Rev Timeout *ShutdownEMBrake;* *ShutdownThrottle.*	1. Emergency Reverse was activated and concluded because the EMR Timeout timer has expired. 2. The emergency reverse input is stuck On.	*Set:* Emergency Reverse was activated and ran until the EMR Timeout timer expired. *Clear:* Turn the emergency reverse input Off.
98	Illegal Model Number *ShutdownMotor;* *ShutdownMainContactor;* *ShutdownEMBrake;* *ShutdownThrottle;* *FullBrake;* *ShutdownPump.*	1. Model_Number variable contains illegal value (not 1234, 1236, 1238, or 1298). 2. Software and hardware do not match. 3. Controller defective.	*Set:* Illegal Model_Number variable; when KSI cycles, a check is made to confirm a legal Model_Number, and a fault is issued if one is not found. *Clear:* Download appropriate software for your controller model.

Table 5 TROUBLESHOOTING CHART, continued

CODE	PROGRAMMER LCD DISPLAY / *EFFECT OF FAULT*	POSSIBLE CAUSE	SET/CLEAR CONDITIONS
87	Motor Characterization Fault *ShutdownMotor;* *ShutdownMainContactor;* *ShutdownEMBrake;* *ShutdownThrottle;* *FullBrake;* *ShutdownPump.*	1. Motor characterization failed during characterization process. See Monitor menu » Controller: Motor Characterization Error for cause: 0=none 1=encoder signal seen, but step size not determined; set Encoder Step Size manually 2=motor temp sensor fault 3=motor temp hot cutback fault 4= controller overtemp cutback fault 5=controller undertemp cutback fault 6=undervoltage cutback fault 7=severe overvoltage fault 8=encoder signal not seen, or one or both channels missing 9=motor parameters out of characterization range.	*Set:* Motor characterization failed during the motor characterization process. *Clear:* Correct fault; cycle KSI.
89	Motor Type Fault *ShutdownMotor;* *ShutdownMainContactor;* *ShutdownEMBrake;* *ShutdownThrottle;* *FullBrake;* *ShutdownPump.*	1. The Motor_Type parameter value is out of range.	*Set:* Motor_Type parameter is set to an illegal value. *Clear:* Set Motor_Type to correct value and cycle KSI.
91	VCL/OS Mismatch *ShutdownMotor;* *ShutdownMainContactor;* *ShutdownEMBrake;* *ShutdownThrottle;* *ShutdownInterlock;* *ShutdownDriver1;* *ShutdownDriver2;* *ShutdownDriver3;* *ShutdownDriver4;* *ShutdownPD;* *FullBrake;* *ShutdownPump.*	1. The VCL software in the controller does not match the OS software in the controller.	*Set:* VCL and OS software do not match; when KSI cycles, a check is made to verify that they match and a fault is issued when they do not. *Clear:* Download the correct VCL and OS software into the controller.
92	EM Brake Failed to Set *ShutdownEMBrake;* *ShutdownThrottle.*	1. Vehicle movement sensed after the EM Brake has been commanded to set. 2. EM Brake will not hold the motor from rotating.	*Set:* After the EM Brake was commanded to set and time has elapsed to allow the brake to fully engage, vehicle movement has been sensed. *Clear:* Activate the throttle.
93	Encoder LOS (Limited Operating Strategy) *Enter LOS control mode.*	1. Limited Operating Strategy (LOS) control mode has been activated, as a result of either an Encoder Fault (Code 36) or a Stall Detect Fault (Code 73). 2. Motor encoder failure. 3. Bad crimps or faulty wiring. 4. Vehicle is stalled.	*Set:* Encoder Fault (Code 36) or Stall Detect Fault (Code 73) was activated, and Brake or Interlock has been applied to activate LOS control mode, allowing limited motor control. *Clear:* Cycle KSI, **or** if LOS mode was activated by the Stall Fault, clear by ensuring encoder senses proper operation, Motor RPM = 0, and Throttle Command = 0.

9 MAINTENANCE

There are no user serviceable parts in Curtis 1234/36/38 controllers. **No attempt should be made to open, repair, or otherwise modify the controller.** Doing so may damage the controller and will void the warranty.

It is recommended that the controller and connections be kept clean and dry and that the controller's fault history file be checked and cleared periodically.

CLEANING

Periodically cleaning the controller exterior will help protect it against corrosion and possible electrical control problems created by dirt, grime, and chemicals that are part of the operating environment and that normally exist in battery powered systems.

CAUTION

When working around any battery powered system, proper safety precautions should be taken. These include, but are not limited to: proper training, wearing eye protection, and avoiding loose clothing and jewelry.

Use the following cleaning procedure for routine maintenance. Never use a high pressure washer to clean the controller.

1. Remove power by disconnecting the battery.
2. Discharge the capacitors in the controller by connecting a load (such as a contactor coil) across the controller's **B+** and **B-** terminals.
3. Remove any dirt or corrosion from the power and signal connector areas. The controller should be wiped clean with a moist rag. Dry it before reconnecting the battery.
4. Make sure the connections are tight. Refer to Section 2, page 5, for maximum tightening torque specifications for the battery and motor connections.

FAULT HISTORY

The 1311 programmer can be used to access the controller's fault history file. The programmer will read out all the faults the controller has experienced since the last time the fault history file was cleared. Faults such as contactor faults may be the result of loose wires; contactor wiring should be carefully checked. Faults such as overtemperature may be caused by operator habits or by overloading.

After a problem has been diagnosed and corrected, it is a good idea to clear the fault history file. This allows the controller to accumulate a new file of faults. By checking the new fault history file at a later date, you can readily determine whether the problem was indeed fixed.

OEM CODE :

CODE 51 Can initialization : Check PIN 23 and PIN 35 (twisted wire green and yellow)

CODE 52 Can operational : Check PIN 23 and PIN 35 (twisted wire green and yellow)

CODE 53 Throttle Wiper : Check PIN 18

CODE 54 Maintenance is required

CODE 55 Throttle active before foward

CODE 56 Throttle active before reverse

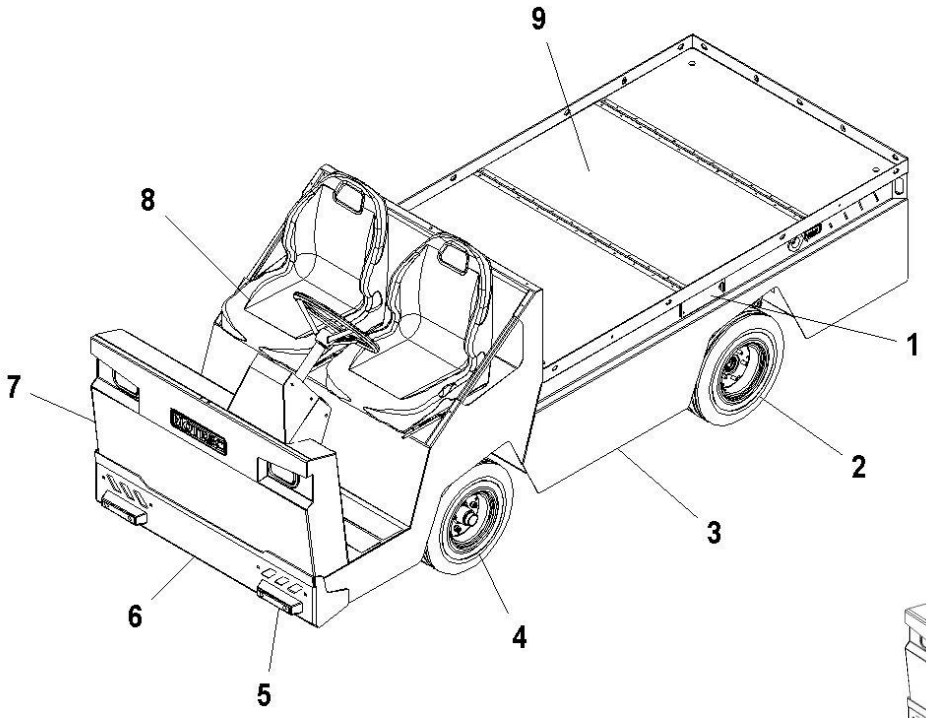
CODE 57 FWD and REV active : Bad switch FWD/REV

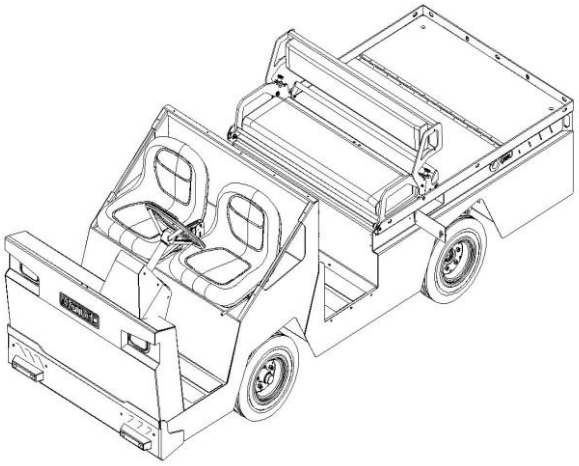
CODE 58 Driver voltage exceeded : Max voltage for driver is 24V

SPARE PARTS

BODY

2 PASSAGERS / 4PASSAGERS

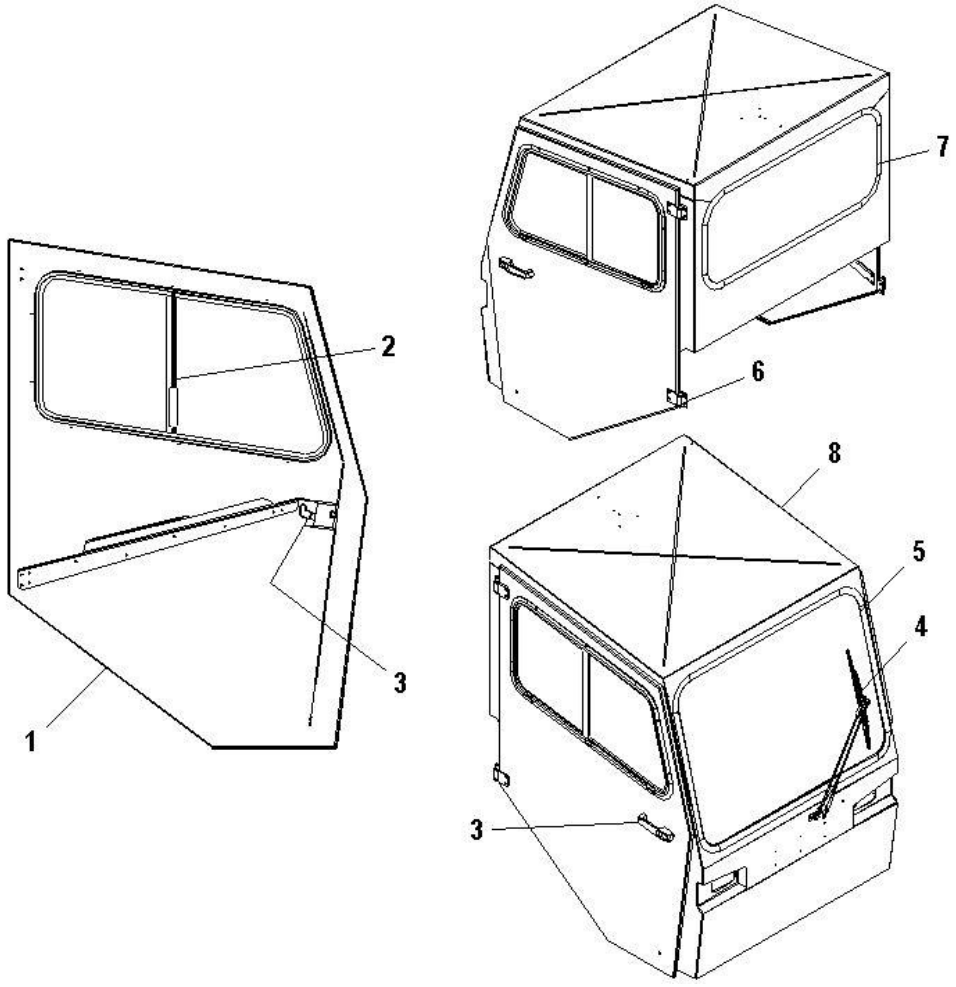




REF.	*PART NO*	*DESCRIPTION*
1	2819480010	CABLE COMP. DOOR
	2803000019	HANDLE CAM LATCH
2	-	REAR WHEEL ASSY
	2223360025	N.M TYRE,570X8 LRC, RIM 5-H
	2223360034	TUBE TYRE,570X8LRD, SPLIT 5-H
	2223360035	N.M LUG TYRE,3.75X8, SPLIT 5-H
	2223360033	LUG TYRE, 500X8, SPLIT 5-H
	2223360036	LUG TYRE, 5.7X8LRD, SPLIT 5-H
3	6104480031	BODY 2PASSAGERS
	6104480032	BODY 4PASSAGERS
	6104480041	BODY 2P./ROLL-OUT
	6104480046	BODY /REAR CHARGING CABLE
	6104480047	BODY / REVERSE 6 PASSAGERS

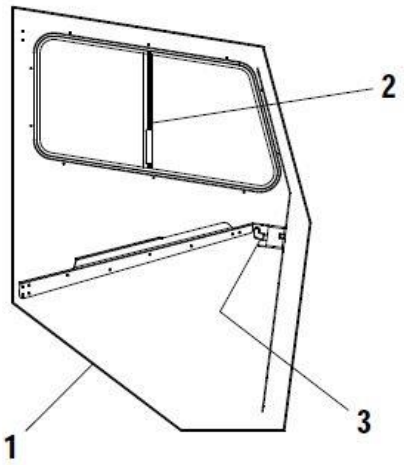
REF.	*PART NO*	*DESCRIPTION*
4	-	FRONT WHEEL
	2223360013	500X8 SOLID TYRE ,4.5X5, SPLIT 5-H
	2223360016	5.7X8 LRD, RIM 5-H
	2223360018	RIB TYRE N.M. SOLID, SPLIT 5-H
5	2314480007	RUBBER BUMPER
6	2314480006	FRONT STEEL BUMPER
7	2370360055	FRONT COWL
8	2385000009	BUCKET SEAT WT RAILS
9	-	PLYWOOD ASSEMBLY
	2332480085	DECK PLYWOOD 44X57 *(4P)
	2332480109	DECK PLYWOOD 44X76 *(2P)
	2332480115	DECK PLYWOOD 44X95
	2332480125	DECK PLYWOOD 44X58
	2332480132	DECK PLYWOOD 44X48
	2332480144	DECK PLYWOOD 44X40 *(6P)

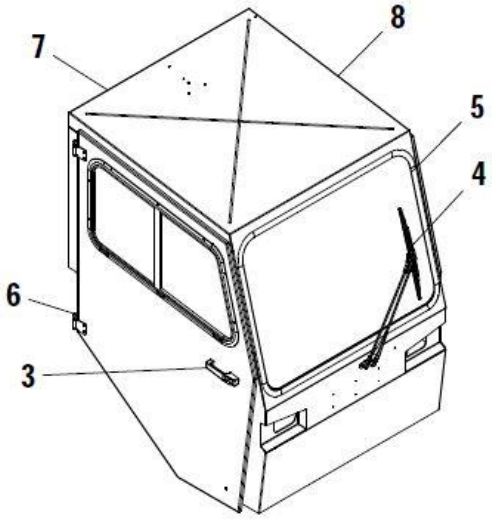
2 PASS. CABIN

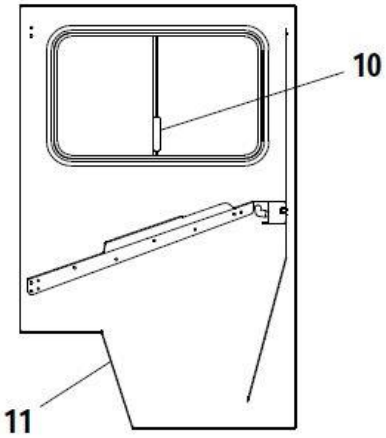


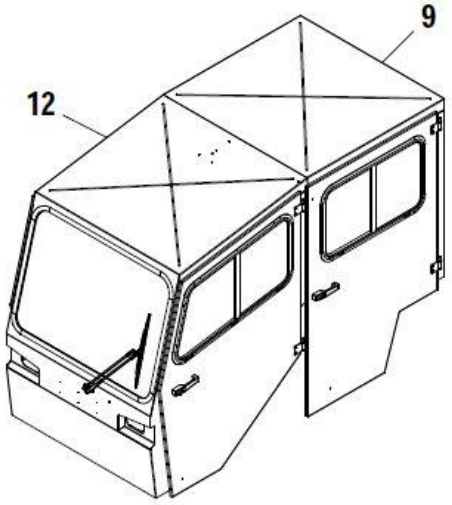
REF	*PART NO.*	*DESCRIPTION*
1	2362480040	RIGHT DOOR
	2362480030	LEFT DOOR
2	2803000003	RIGHT WINDOW
	2803000002	LEFT WINDOW
3	2366480000	LOCKING HANDLE
4	2800000009	WIPER (LINKAGE)
	2800000007	WIPER (BLADE)
5	2367480004	WINDSHIELD
6	2365480001	HINGE KIT
7	2367480005	REAR BACK GLASS
8	2361480010	WELDED CAB

2 & 4 PASS. CABIN



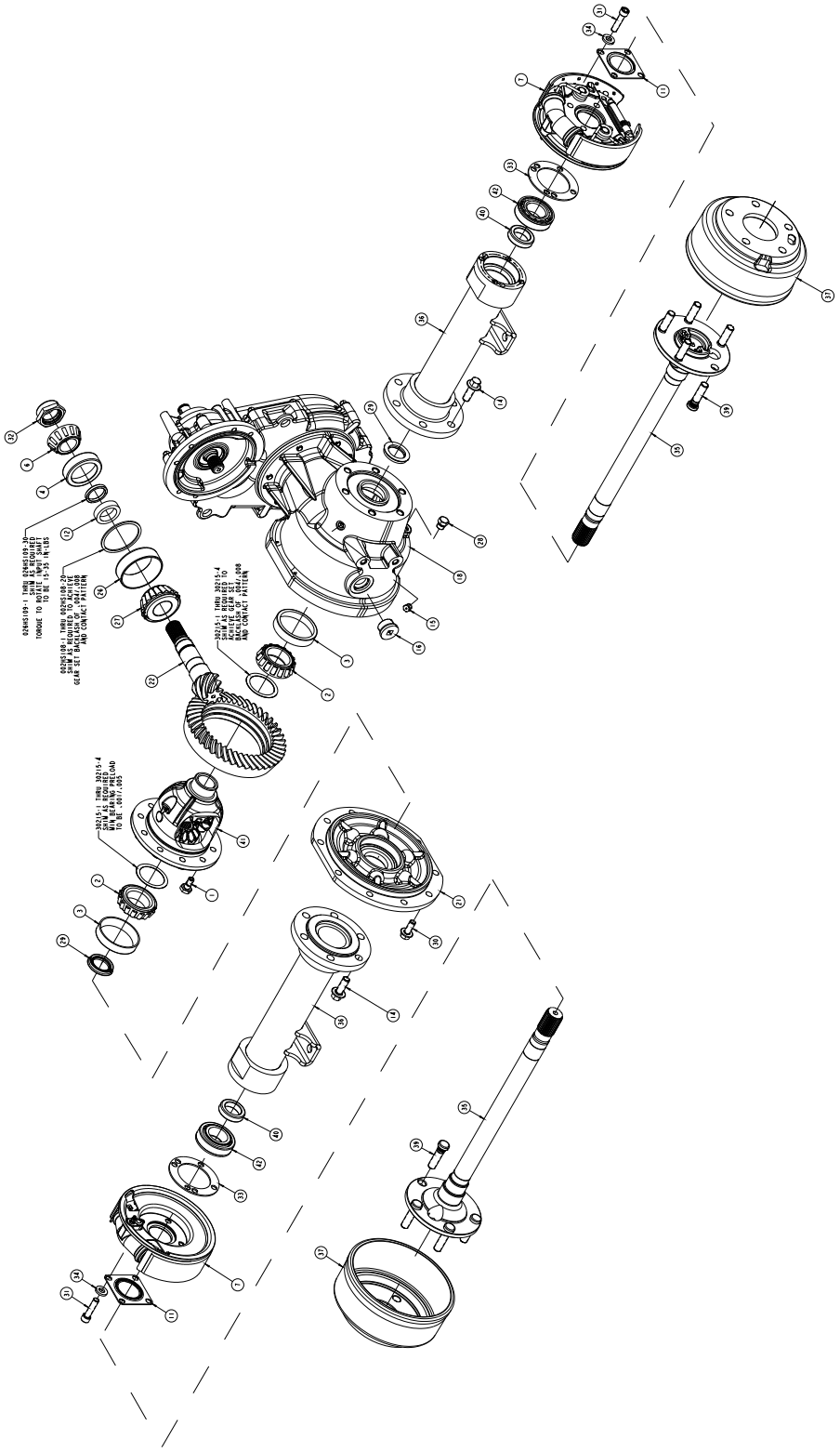


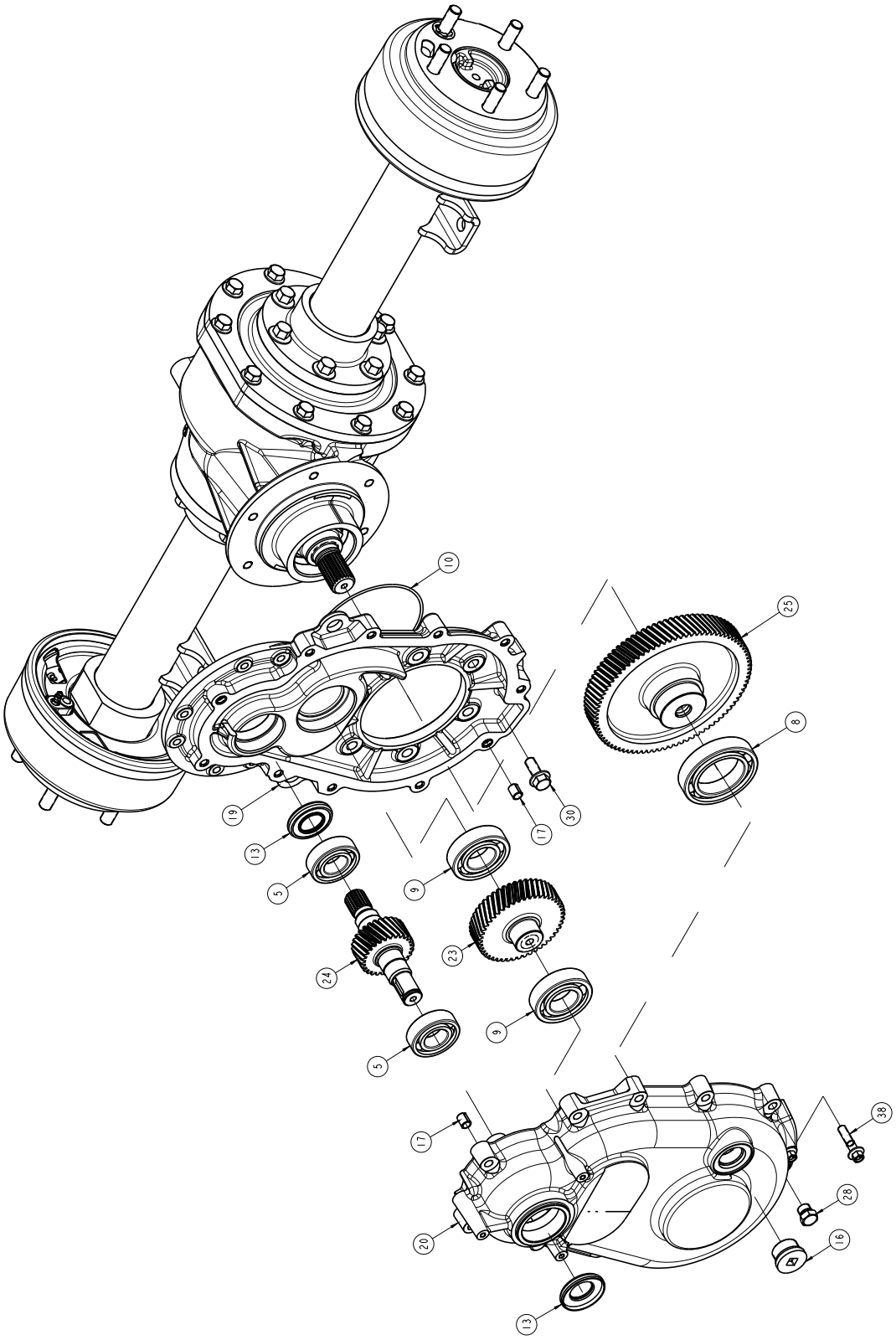




REF	*PART NO.*	*DESCRIPTION*
1	2362480040	RIGHT DOOR
	2362480030	LEFT DOOR
2	2803000003	RIGHT WINDOW
	2803000002	LEFT WINDOW
3	2366480000	LOCKING HANDLE (KIT)
4	2800000009	WIPER (LINKAGE)
	2800000007	WIPER (BLADE)
5	2367480004	WINDSHIELD
6	2365480001	HINGE KIT
7	2367480005	REAR BACK GLASS
8	2361480010	WELDED CABIN (2P)
9	2367480005	REAR BACK GLASS
10	2367320007	REAR LEFT SIDE GLASS
	2367320008	REAR RIGHT SIDE GLASS
11	2362480036	REAR LEFT DOOR (4P)
	2362480047	REAR RIGHT DOOR (4P)
12	2361480021	WELDED CABIN (4P)

DIFFERENTIAL 19 : 1
PART NUMBER : 2170480319

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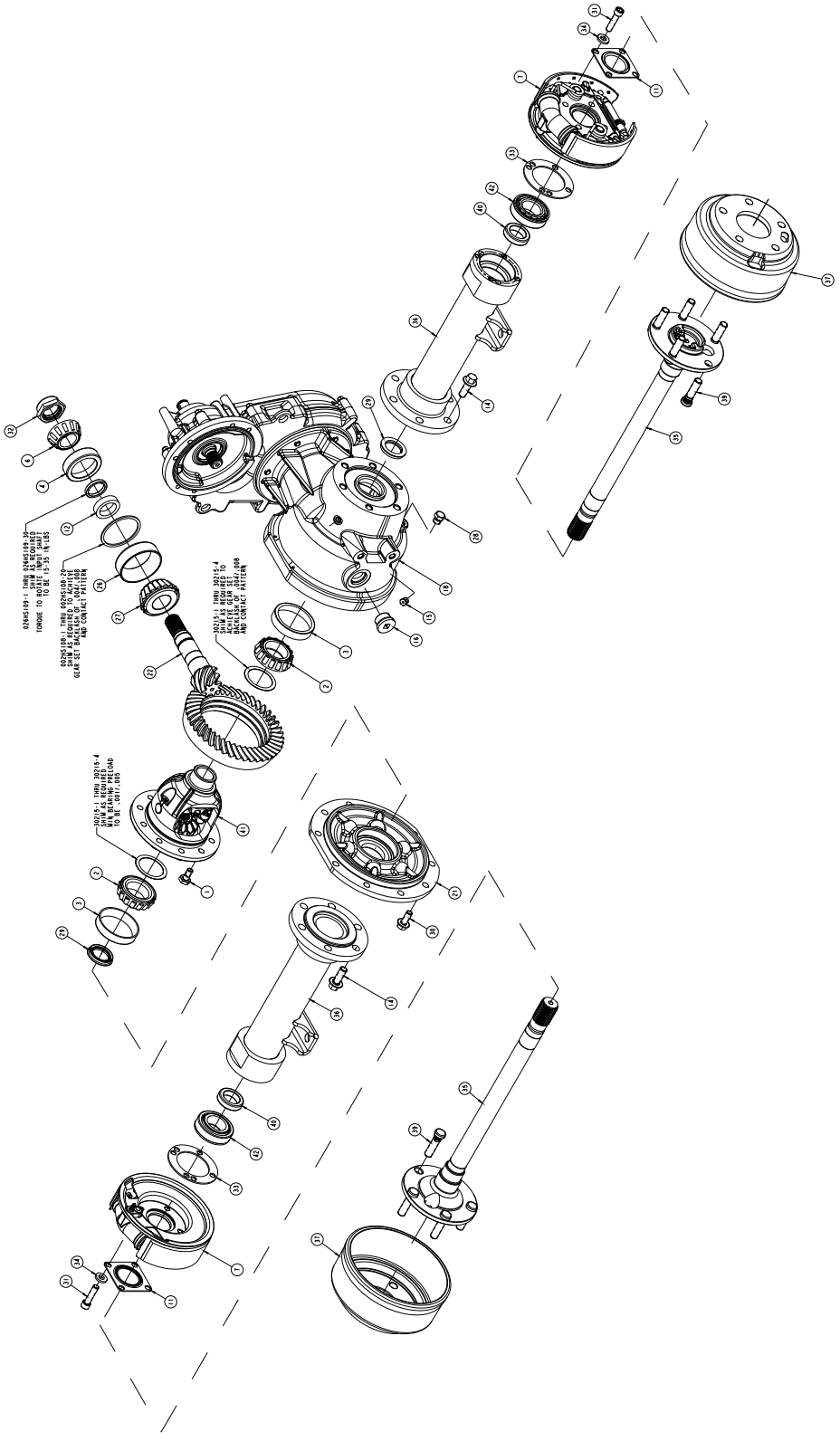
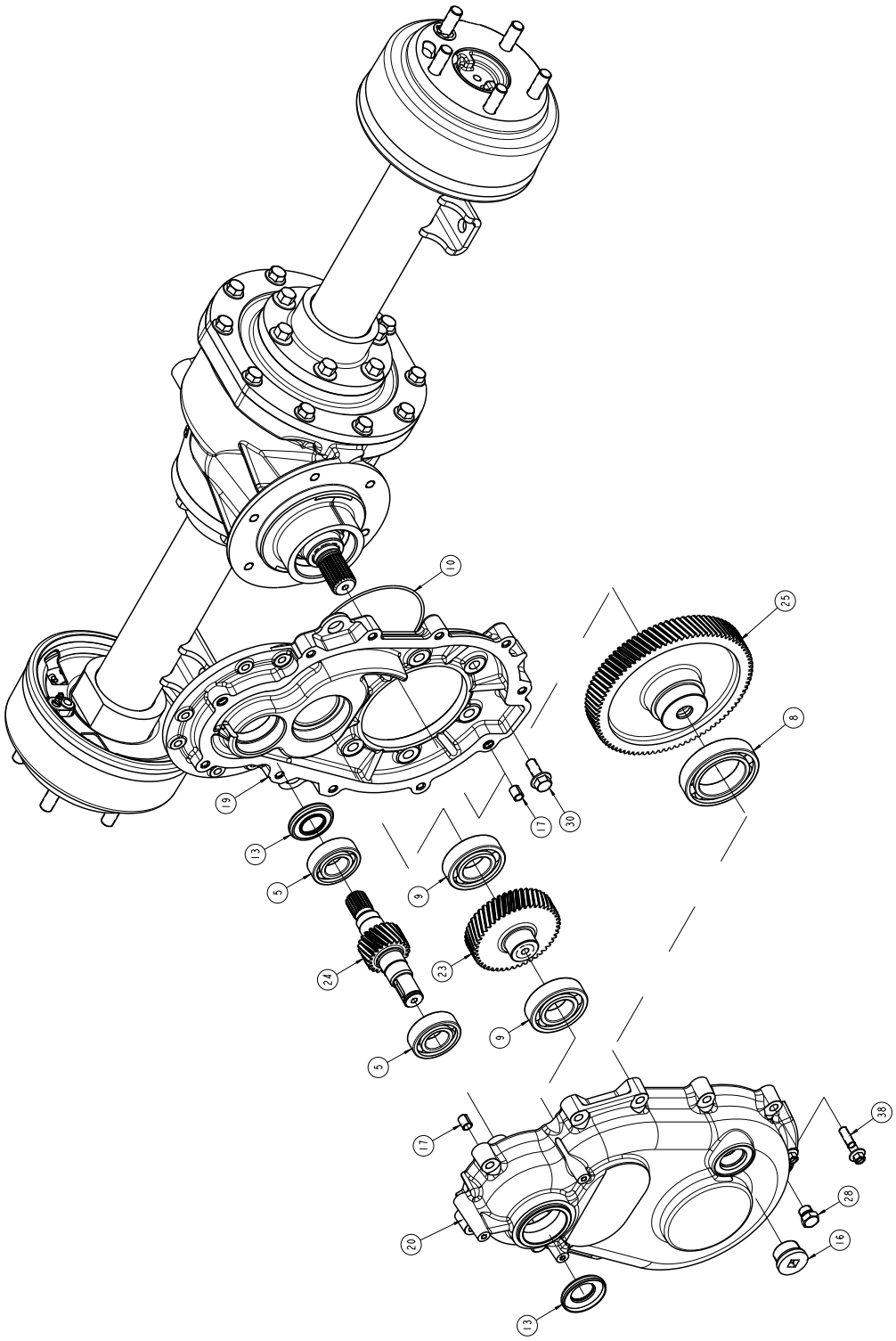
REF.	*PART NO.*	*DESCRIPTION*	*QTY.*
	2170480319	Kit assembly, differential ratio 19 : 1	*1*
1	2179480301	SCREW DRIVE GEAR	10
2	2179480302	CONE, BEARING, TAPERED ROLLER, 1.625 SHAFT	2
3	585911	CUP, BEARING, TAPERED ROLLER, 2.892 BORE	2
4	585938	CUP, BEARING, TAPERED ROLLER, 2.532 BORE	1
5	484003	BEARING, BALL, SINGLE ROW, 6205	2
6	2108000002	CONE, BEARING, TAPERED ROLLER, 1.188 SHAFT	1
7	2179480003	ASSEMBLY, BRAKE, 7 X 1.75, HYDRAULIC	2
8	2179000077	BEARING, BALL, SINGLE ROW, 6010	1
9	2179000078	BEARING, BALL, SINGLE ROW, 6206	2
10	002HH108	O-RING, 4.487 X .103	1
11	2179480311	SEAL, GREASE	2
12	002HS109-1	SPACER, 1.205 X 1.700 X .895	1
13	2104000011	SEAL, OIL, .948 SHAFT, 1.850 BORE	2
14	012HM124	SCREW, FLANGE HEAD, M12-1.75 X 32 MM	12
15	012HN140	VENT, 1/8 NPTF	1
16	026HG100	FILL PLUG, SQUARE SOCKET, 3/4 PORT	2
17	026HP105	BUSHING, DOWEL, .313 X .500	2
18	030CH133	HOUSING, CARRIER	1
19	030CH134-3	HOUSING, GEARBOX	1
20	030CH136-3	COVER, GEARBOX	1
21	030CV101	COVER, CARRIER, FINSH	1
22	030GA102X	ASSEMBLY, GEAR AND PINION, 6.143 RATIO	1
23	030GS110	GEAR, HELICAL, INTERMEDIATE, 47T	1
24	030GS114	SHAFT, INPUT, 28T	1
25	030GS116	GEAR, HELICAL, OUTPUT, 87T	1
26	030HA100	CUP, BEARING, TAPERED ROLLER, 3.000 BORE	1
27	030HB100	CONE, BEARING, TAPERED ROLLER, 1.375 SHAFT	1
28	030HG101	DRAIN PLUG, MAGNETIC, O-RING, 1/2-20	2
29	030HH109	SEAL, OIL, 1.173 SHAFT, 1.687 BORE	2
30	030HM106	SCREW, FLANGE HEAD, M10 X 1.5	16
31	2179480002	SCREW, CAP, SOCKET HEAD	8
32	030HN101	NUT, PINION, M30-1.5	1
33	2179480334	RETAINER, BEARING, WHEEL	2
34	2179480001	WASHER	8
35	2173480003	SHAFT, AXLE, FLANGED, FINISH	2
36	030TA124-1X	ASSEMBLY, TUBE, FINISH	2
37	2179480338	DRUM, BRAKE, FINISH	2
38	070HM251-3	SCREW, FLANGE HEAD, M8-1.25 X 35MM	11
39	2179300010	BOLT, WHEEL, 1/2-20 X 1.875	10
40	2179000009	RING, RETAINING, WHEEL BEARING	2
41	A20DA101X	ASSEMBLY, CASE, DIFFERENTIAL	1
42	2179480343	BEARING, ROLLER, TAPERED	2

TORQUE CHART

PART NO	*DESCRIPTION*	*TORQUE VALUE*
2179480301	SCREW DRIVE GEAR	70-80 FT-LBS
012HM124	SCREW, FLANGE HEAD, M12-1.75 X 32 MM	70-80 FT-LBS
026HG100	FILL PLUG, SQUARE SOCKET, 3/4 PORT	40-50 FT-LBS
030HG101	DRAIN PLUG, MAGNETIC, O-RING, 1/2-20	9-14 FT-LBS
030HM106	SCREW, FLANGE HEAD, M10 X 1.5	45-55 FT-LBS
2179480002	SCREW, CAP, SOCKET HEAD	55-60 FT-LBS
030HN101	NUT, PINION, M30-1.5	275-300 FT-LBS
070HM251-3	SCREW, FLANGE HEAD, M8-1.25 X 35MM	23-27 FT-LBS

DIFFERENTIAL 24 : 1
PART NUMBER : 2170480324

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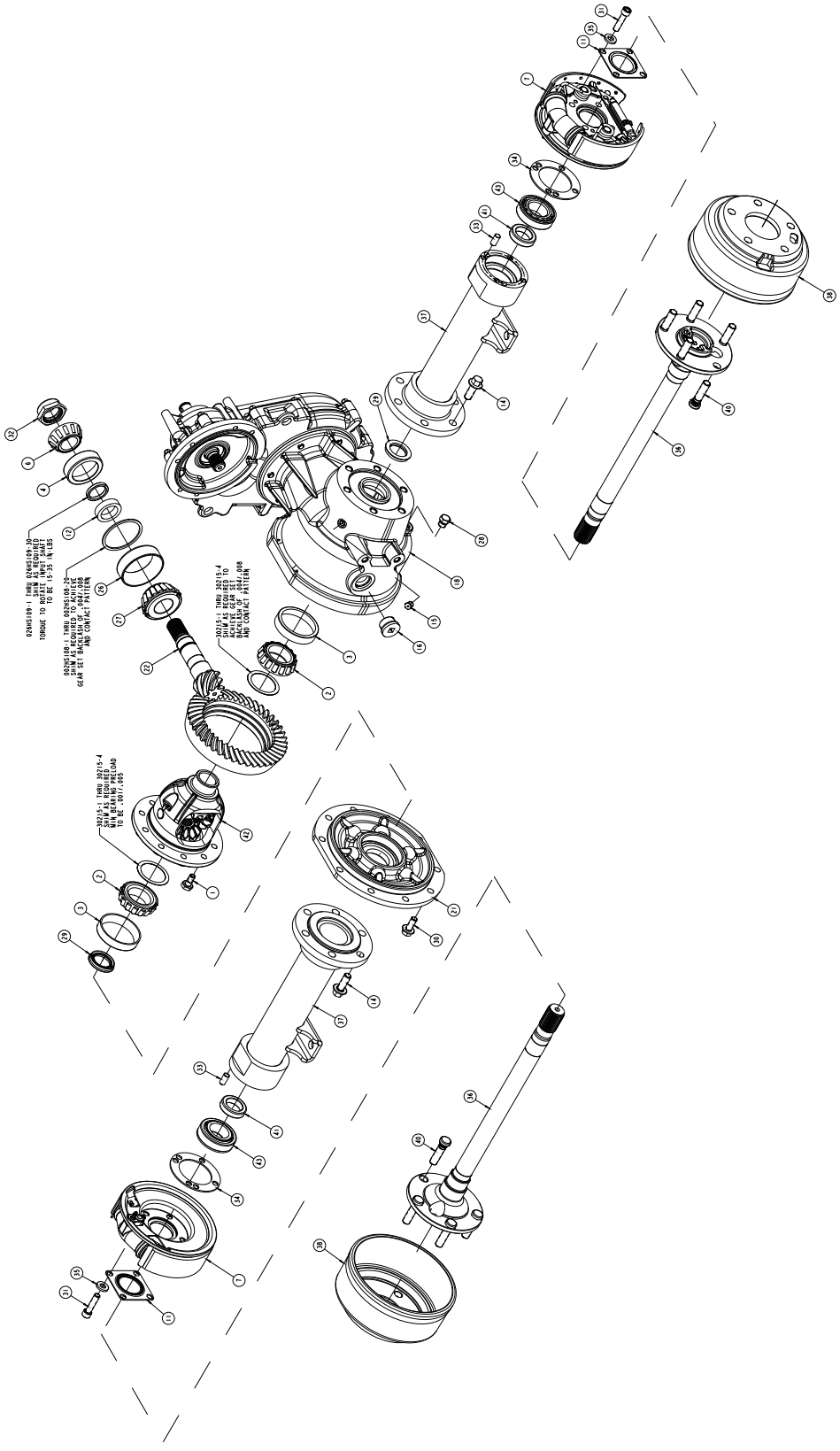
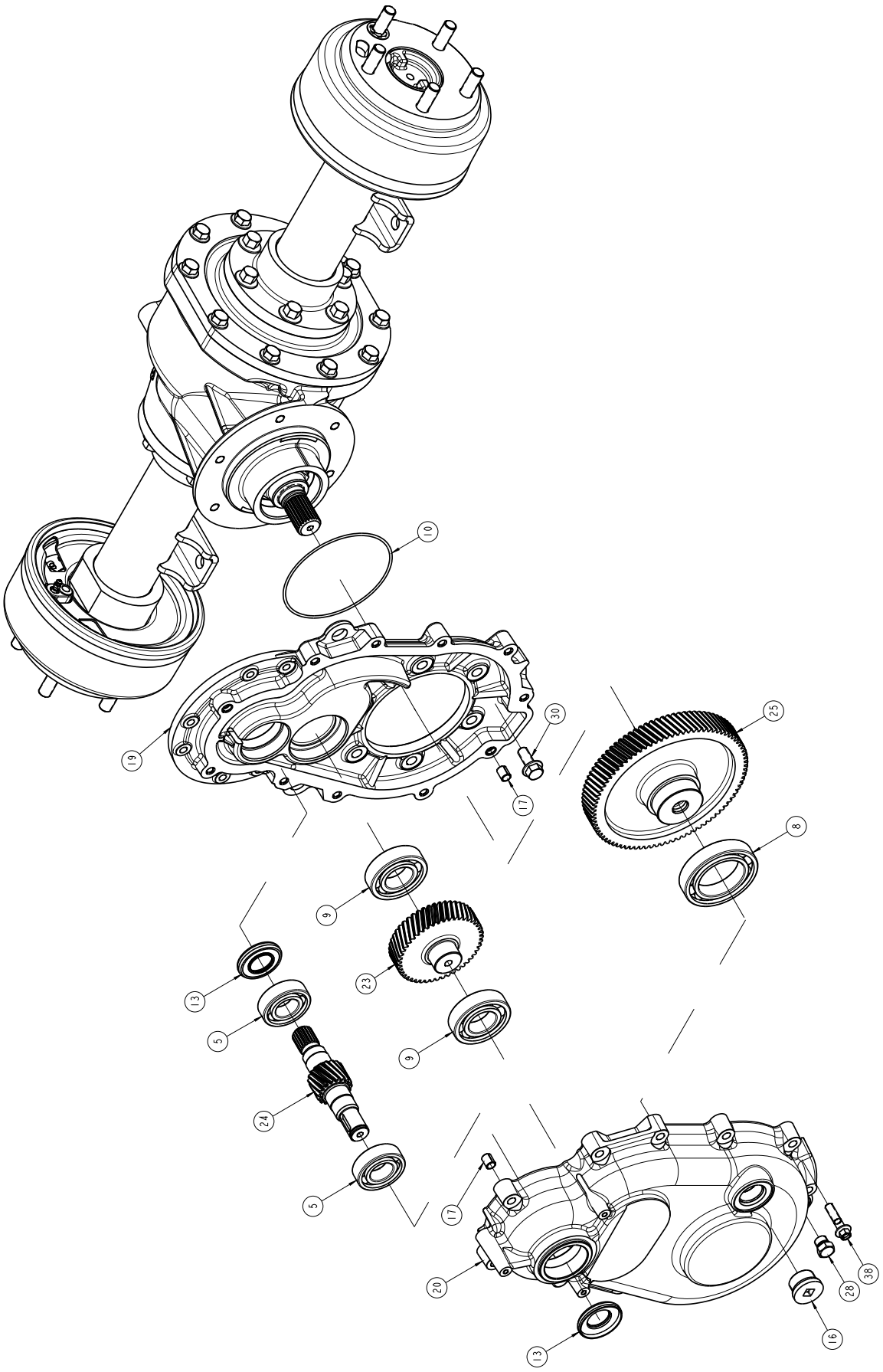
REF.	*PART NO.*	*DESCRIPTION*	*QTY.*
	2170480324	Kit assembly, differential ratio 24 : 1	*1*
1	2179480301	SCREW DRIVE GEAR	10
2	2179480302	CONE, BEARING, TAPERED ROLLER, 1.625 SHAFT	2
3	585911	CUP, BEARING, TAPERED ROLLER, 2.892 BORE	2
4	585938	CUP, BEARING, TAPERED ROLLER, 2.532 BORE	1
5	484003	BEARING, BALL, SINGLE ROW, 6205	2
6	2108000002	CONE, BEARING, TAPERED ROLLER, 1.188 SHAFT	1
7	2179480003	ASSEMBLY, BRAKE, 7 X 1.75, HYDRAULIC	2
8	2179000077	BEARING, BALL, SINGLE ROW, 6010	1
9	2179000078	BEARING, BALL, SINGLE ROW, 6206	2
10	002HH108	O-RING, 4.487 X .103	1
11	2179480311	SEAL, GREASE	2
12	002HS109-1	SPACER, 1.205 X 1.700 X .895	1
13	2104000011	SEAL, OIL, .948 SHAFT, 1.850 BORE	2
14	012HM124	SCREW, FLANGE HEAD, M12-1.75 X 32 MM	12
15	012HN140	VENT, 1/8 NPTF	1
16	026HG100	FILL PLUG, SQUARE SOCKET, 3/4 PORT	2
17	026HP105	BUSHING, DOWEL, .313 X .500	2
18	030CH133	HOUSING, CARRIER	1
19	030CH134-2	HOUSING, GEARBOX	1
20	030CH136-2	COVER, GEARBOX	1
21	030CV101	COVER, CARRIER, FINSH	1
22	030GA102X	ASSEMBLY, GEAR AND PINION, 6.143 RATIO	1
23	030GS110	GEAR, HELICAL, INTERMEDIATE, 47T	1
24	030GS113	SHAFT, INPUT, 22T	1
25	030GS116	GEAR, HELICAL, OUTPUT, 87T	1
26	030HA100	CUP, BEARING, TAPERED ROLLER, 3.000 BORE	1
27	030HB100	CONE, BEARING, TAPERED ROLLER, 1.375 SHAFT	1
28	030HG101	DRAIN PLUG, MAGNETIC, O-RING, 1/2-20	2
29	030HH109	SEAL, OIL, 1.173 SHAFT, 1.687 BORE	2
30	030HM106	SCREW, FLANGE HEAD, M10 X 1.5	16
31	2179480002	SCREW, CAP, SOCKET HEAD	8
32	030HN101	NUT, PINION, M30-1.5	1
33	2179480334	RETAINER, BEARING, WHEEL	2
34	2179480001	WASHER	8
35	2173480003	SHAFT, AXLE, FLANGED, FINISH	2
36	030TA124-1X	ASSEMBLY, TUBE, FINISH	2
37	2179480338	DRUM, BRAKE, FINISH	2
38	070HM251-3	SCREW, FLANGE HEAD, M8-1.25 X 35MM	11
39	2179300010	BOLT, WHEEL, 1/2-20 X 1.875	10
40	2179000009	RING, RETAINING, WHEEL BEARING	2
41	A20DA101X	ASSEMBLY, CASE, DIFFERENTIAL	1
42	2179480343	BEARING, ROLLER, TAPERED	2

TORQUE CHART

PART NO	*DESCRIPTION*	*TORQUE VALUE*
2179480301	SCREW DRIVE GEAR	70-80 FT-LBS
012HM124	SCREW, FLANGE HEAD, M12-1.75 X 32 MM	70-80 FT-LBS
026HG100	FILL PLUG, SQUARE SOCKET, 3/4 PORT	40-50 FT-LBS
030HG101	DRAIN PLUG, MAGNETIC, O-RING, 1/2-20	9-14 FT-LBS
030HM106	SCREW, FLANGE HEAD, M10 X 1.5	45-55 FT-LBS
2179480002	SCREW, CAP, SOCKET HEAD	55-60 FT-LBS
030HN101	NUT, PINION, M30-1.5	275-300 FT-LBS
070HM251-3	SCREW, FLANGE HEAD, M8-1.25 X 35MM	23-27 FT-LBS

DIFFERENTIAL 30 : 1
PART NUMBER : 2170480330

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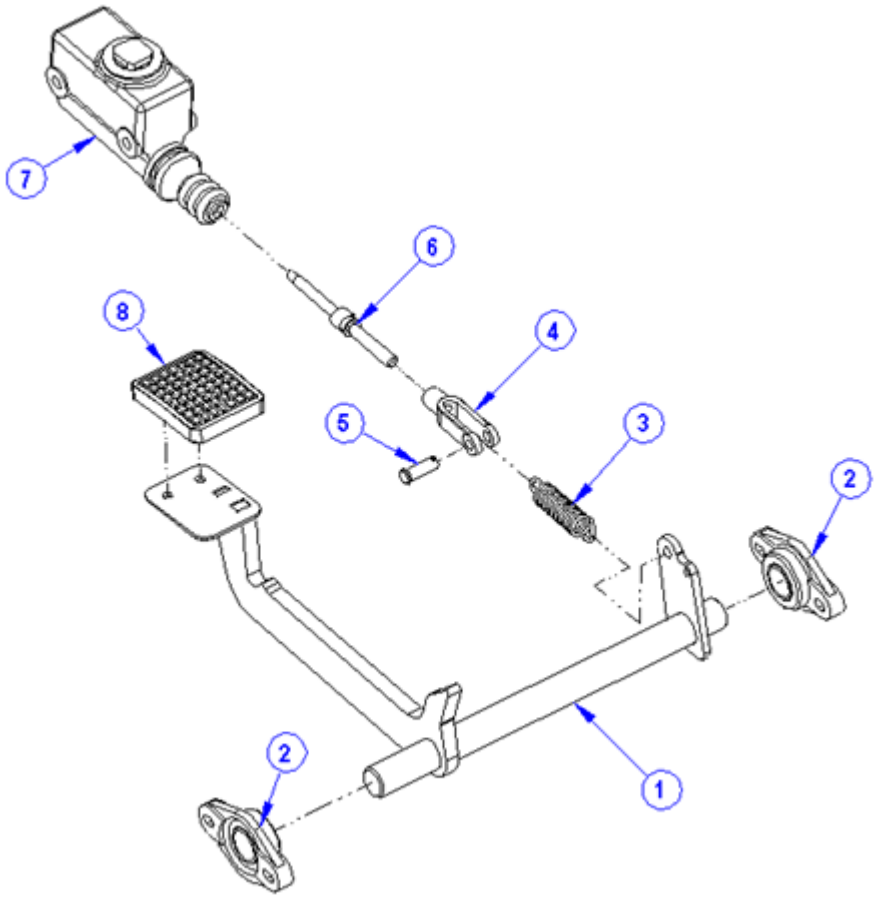
REF.	*PART NO.*	*DESCRIPTION*	*QTY.*
	2170480330	Kit assembly, differential ratio 30 : 1	*1*
1	2179480301	SCREW DRIVE GEAR	10
2	2179480302	CONE, BEARING, TAPERED ROLLER, 1.625 SHAFT	2
3	585911	CUP, BEARING, TAPERED ROLLER, 2.892 BORE	2
4	585938	CUP, BEARING, TAPERED ROLLER, 2.532 BORE	1
5	484003	BEARING, BALL, SINGLE ROW, 6205	2
6	2108000002	CONE, BEARING, TAPERED ROLLER, 1.188 SHAFT	1
7	2179480307	ASSEMBLY, BRAKE, 7 X 1.75, HYDRAULIC	2
8	2179000077	BEARING, BALL, SINGLE ROW, 6010	1
9	2179000078	BEARING, BALL, SINGLE ROW, 6206	2
10	002HH108	O-RING, 4.487 X .103	1
11	2179480311	SEAL, GREASE	2
12	002HS109-1	SPACER, 1.205 X 1.700 X .895	1
13	2104000011	SEAL, OIL, .948 SHAFT, 1.850 BORE	2
14	012HM124	SCREW, FLANGE HEAD, M12-1.75 X 32 MM	12
15	012HN140	VENT, 1/8 NPTF	1
16	026HG100	FILL PLUG, SQUARE SOCKET, 3/4 PORT	2
17	026HP105	BUSHING, DOWEL, .313 X .500	2
18	030CH133	HOUSING, CARRIER	1
19	030CH134-1	HOUSING, GEARBOX	1
20	030CH136-1	COVER, GEARBOX	1
21	030CV101	COVER, CARRIER, FINSH	1
22	030GA102X	ASSEMBLY, GEAR AND PINION, 6.143 RATIO	1
23	030GS110	GEAR, HELICAL, INTERMEDIATE, 47T	1
24	030GS112	SHAFT, INPUT, 18T	1
25	030GS116	GEAR, HELICAL, OUTPUT, 87T	1
26	030HA100	CUP, BEARING, TAPERED ROLLER, 3.000 BORE	1
27	030HB100	CONE, BEARING, TAPERED ROLLER, 1.375 SHAFT	1
28	030HG101	DRAIN PLUG, MAGNETIC, O-RING, 1/2-20	2
29	030HH109	SEAL, OIL, 1.173 SHAFT, 1.687 BORE	2
30	030HM106	SCREW, FLANGE HEAD, M10 X 1.5	16
31	2179480002	SCREW, CAP, SOCKET HEAD	8
32	030HN101	NUT, PINION, M30-1.5	1
33	030HP100	PIN, DOWEL	4
34	2179480334	RETAINER, BEARING, WHEEL	2
35	2179480001	WASHER	8
36	2173480003	SHAFT, AXLE, FLANGED, FINISH	2
37	030TA124-1X	ASSEMBLY, TUBE, FINISH	2
38	2179480338	DRUM, BRAKE, FINISH	2
39	070HM251-3	SCREW, FLANGE HEAD, M8-1.25 X 35MM	11
40	2179300010	BOLT, WHEEL, 1/2-20 X 1.875	10
41	2179000009	RING, RETAINING, WHEEL BEARING	2
42	A20DA101X	ASSEMBLY, CASE, DIFFERENTIAL	1
43	2179480343	BEARING, ROLLER, TAPERED	2

TORQUE CHART

PART NO	*DESCRIPTION*	*TORQUE VALUE*
2179480301	SCREW DRIVE GEAR	70-80 FT-LBS
012HM124	SCREW, FLANGE HEAD, M12-1.75 X 32 MM	70-80 FT-LBS
026HG100	FILL PLUG, SQUARE SOCKET, 3/4 PORT	40-50 FT-LBS
030HG101	DRAIN PLUG, MAGNETIC, O-RING, 1/2-20	9-14 FT-LBS
030HM106	SCREW, FLANGE HEAD, M10 X 1.5	45-55 FT-LBS
2179480002	SCREW, CAP, SOCKET HEAD	55-60 FT-LBS
030HN101	NUT, PINION, M30-1.5	275-300 FT-LBS
070HM251-3	SCREW, FLANGE HEAD, M8-1.25 X 35MM	23-27 FT-LBS

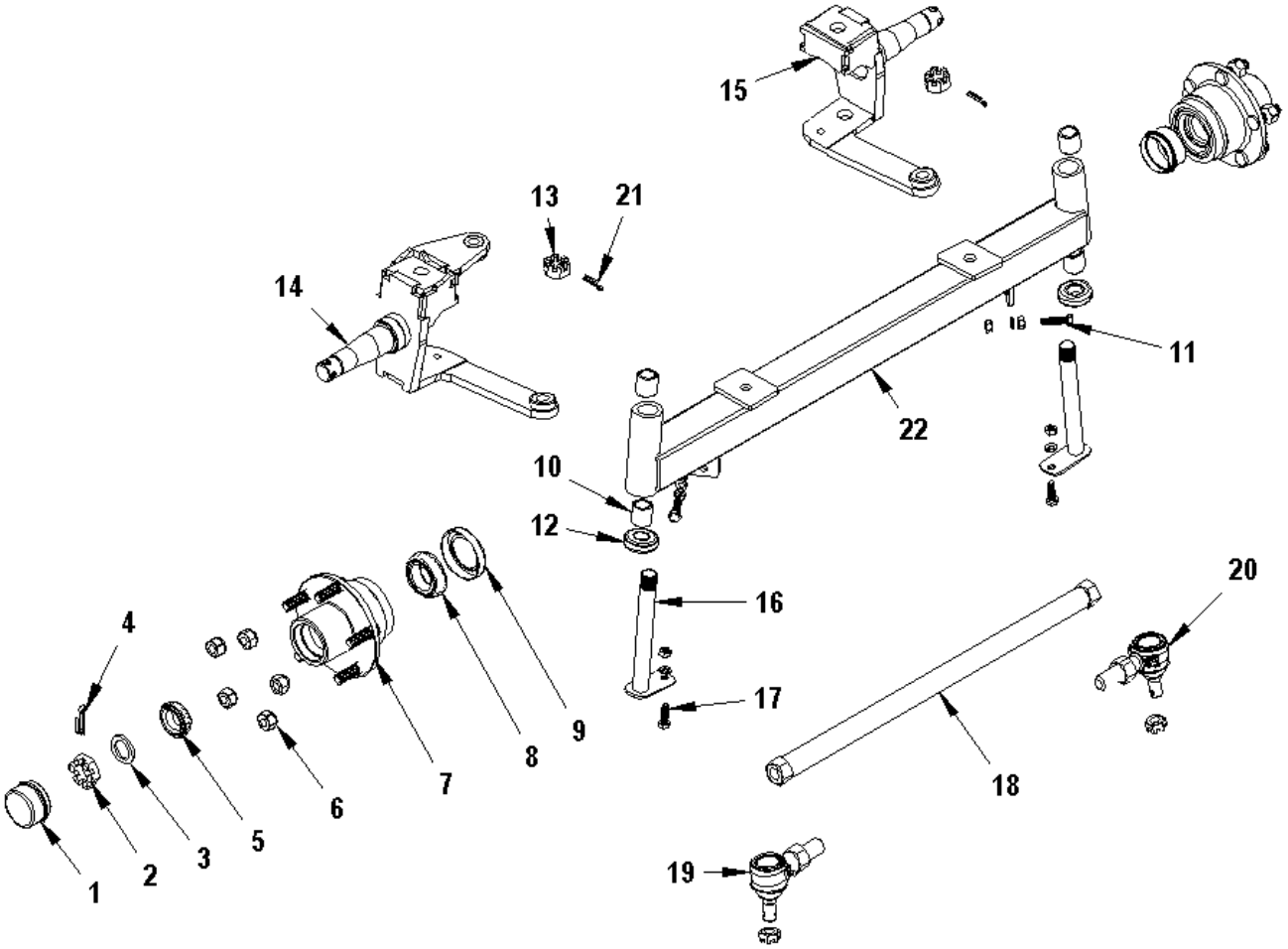
BRAKE CONTROLS



REF.	*PART NO*	*DESCRIPTION*
1	2131480004	BRAKE PEDAL
2	2106016001	FLANGE BEARING, 1 DIA
3	2190000003	SPRING
4	2910000015	CLEVIS YOKE 3/8 NF
5	2910000028	CLEVIS PIN 3/8 X 1-3/32
6	2133280001	PUSH ROD, MASTER CYLINDRE
7	2125000001	MASTER CYLINDER
8	2131100002	RUBBER FOR BRAKE PEDAL

FRONT AXLE

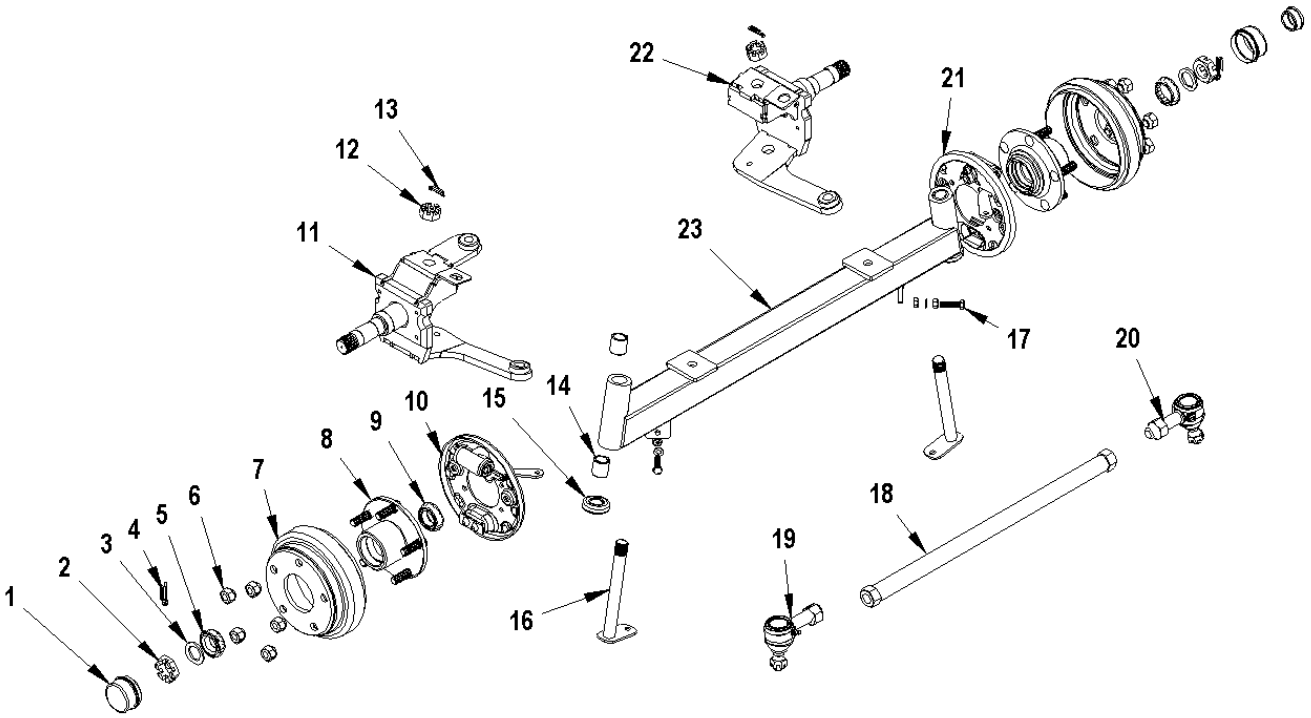
(WITHOUT BRAKES)



REF.	*PART NO.*	*DESCRIPTION*	*REF.*	*PART NO.*	*DESCRIPTION*
1	2229300001	DUST SEAL CAP	**13**	2910300001	CASTELLATED NUT
2	2910300002	CASTELLATED NUT	**14**	2201320008	LEFT SPINDLE
3	2229300003	SPINDLE WASHER	**15**	2201320009	RIGHT SPINDLE
4	-	CUTTER PIN 3/16 X 2LG.	**16**	2205250001	KING PIN
5	2103300005	TAPER BEARING	**17**	-	BOLT 5/16 NC X 1
6	2910000019	WHEEL NUT		-	LOCK WASHER 5/16
7	2224300002	HUB		-	NUT 5/16 NC
8	2103300003	TAPER BEARING	**18**	2207300006	WELDED DIRECTION ROD
9	2229300002	DUST SEAL	**19**	2207000002	TIE ROD END JOINT (LEFT SIDE)
10	2100121616-Q2S	PLASTIC BUSHING D.I ¾ X1 ½ LG.	-	2910000006	3/4-UNF RIGHT-HAND NUT
11	-	BOLT 5/16 NC X1 ¼	**20**	2207000001	TIE ROD END JOINT (RIGHT SIDE)
	-	NUT 5/16 NC	-	2910000005	3/4-UNF LEFT-HAND NUT
	-	LOCK WASHER 5/16	**21**	-	CUTTER PIN 7/64" x 2" LG
12	2103250001	THRUST ROLLER BEARING	**22**	2201320010	STRUCTURE CENTRALE

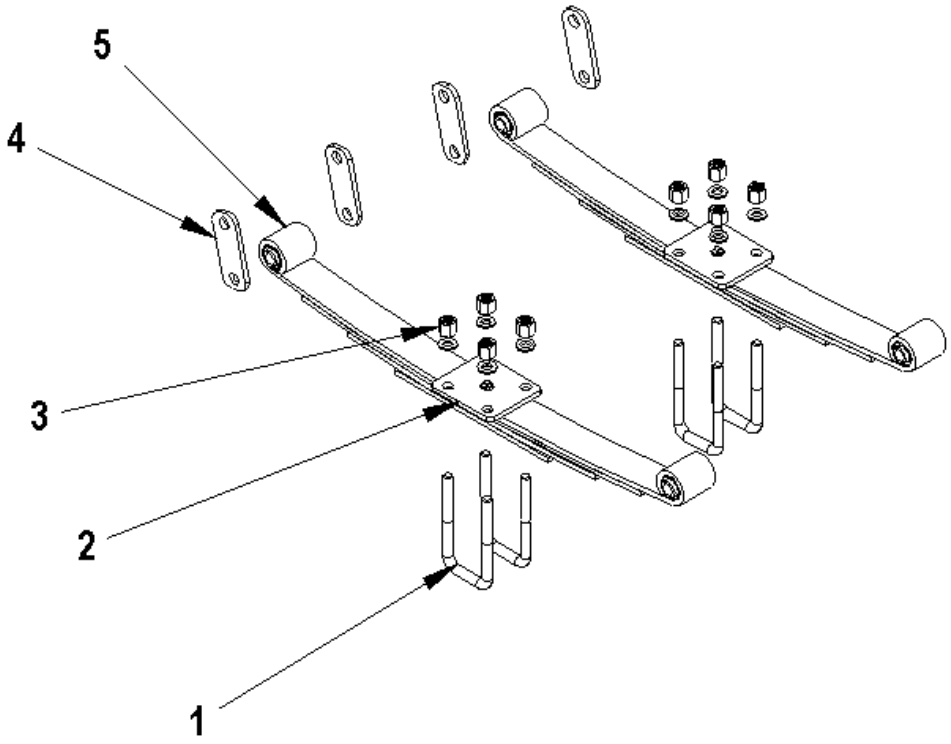
FRONT AXLE

(DRUM BRAKES MODEL)



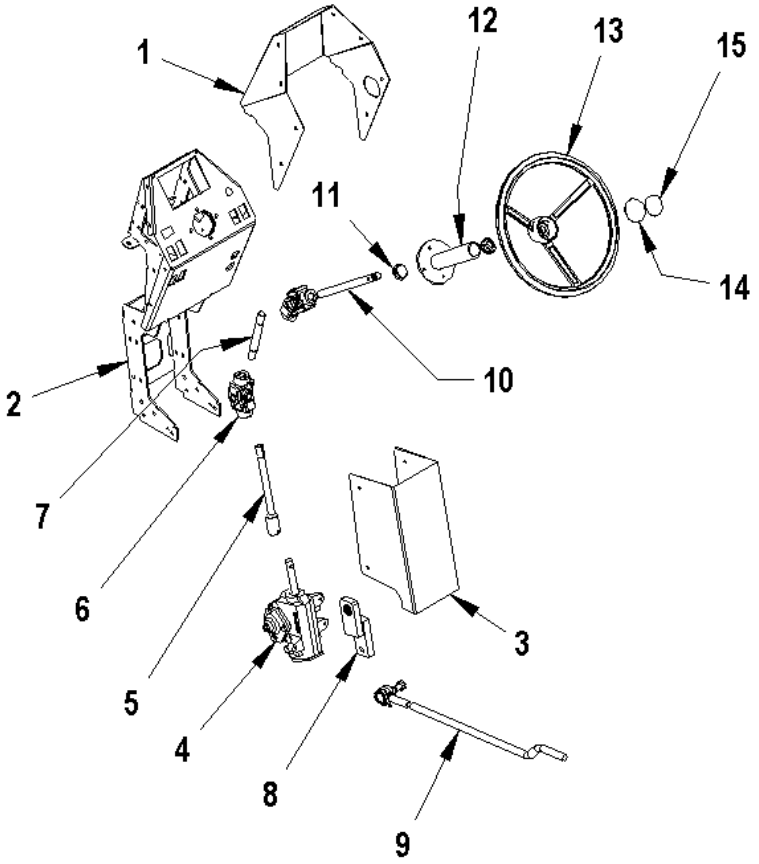
REF.	*PART NO.*	*DESCRIPTION*	*REF.*	*PART NO.*	*DESCRIPTION*
1	2229300001	DUST SEAL CAP	**14**	2100121616-Q2S	PLASTIC BUSHING D.I ¾ X1 ½ LG.
2	2910300002	CASTELLATED NUT	**15**	2103250001	THRUST ROLLER BEARING
3	2229300003	SPINDLE WASHER	**16**	2205250001	KING PIN
4	-	CUTTER PIN 3/16 X 2LG.	**17**	-	BOLT 5/16 NC X 1
5	2103300005	TAPER BEARING		-	LOCK WASHER 5/16
6	2910000019	WHEEL NUT		-	NUT 5/16 NC
7	2123240001	DRUM BRAKE	**18**	2207300003	WELDED DIRECTION ROD
8	2224300003	HUB	**19**	2207000002	TIE ROD END JOINT (LEFT SIDE)
9	2103300005	TAPER BEARING	-	2910000006	3/4-UNF RIGHT-HAND NUT
10	2124280001	BRAKE ASSY, LEFT SIDE	**20**	2207000001	TIE ROD END JOINT (RIGHT SIDE)
11	2201360028	LEFT SPINDLE	-	2910000005	3/4-UNF LEFT-HAND NUT
12	2910300001	CASTELLATED NUT	**21**	2124280002	BRAKE ASSY, RIGHT SIDE
13	-	CUTTER PIN 7/64” x 2” LG	**22**	2201360032	RIGHT SPINDLE
			23	2201360043	AXLE BEAM

FRONT SUSPENSION



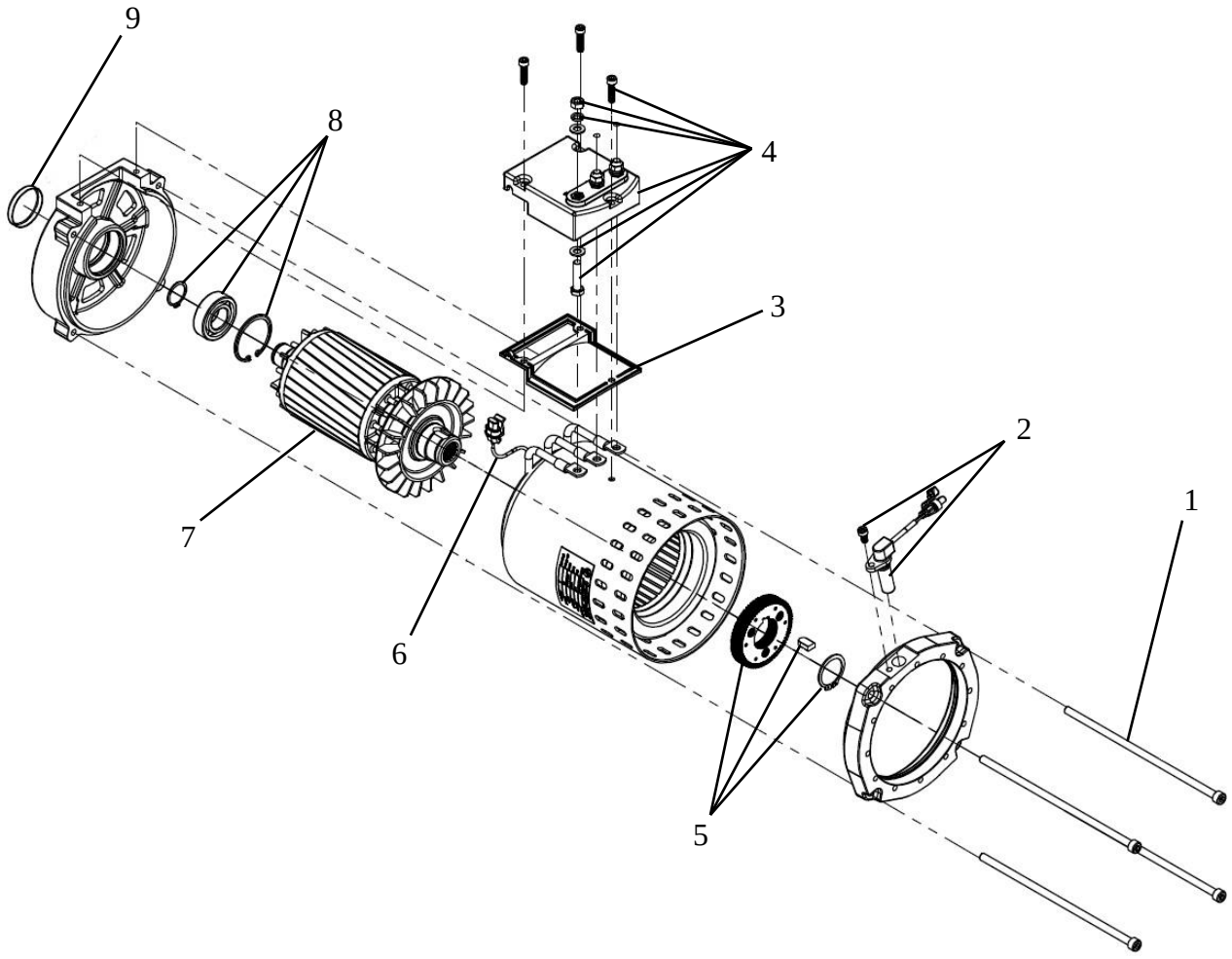
REF.	*PART NO.*	*DESCRIPTION*
1	2916000001	SQUARE "U" BOLT
2	2185320001	PLATE, FRONT LEAF SPRING
3	-	NUT ½ NF
	-	LOCK WASHER ½
4	2182320002	SHACKLE LINK
5	2192280001	4-LEAF SPRING

STEERING COLUMN ASSEMBLY



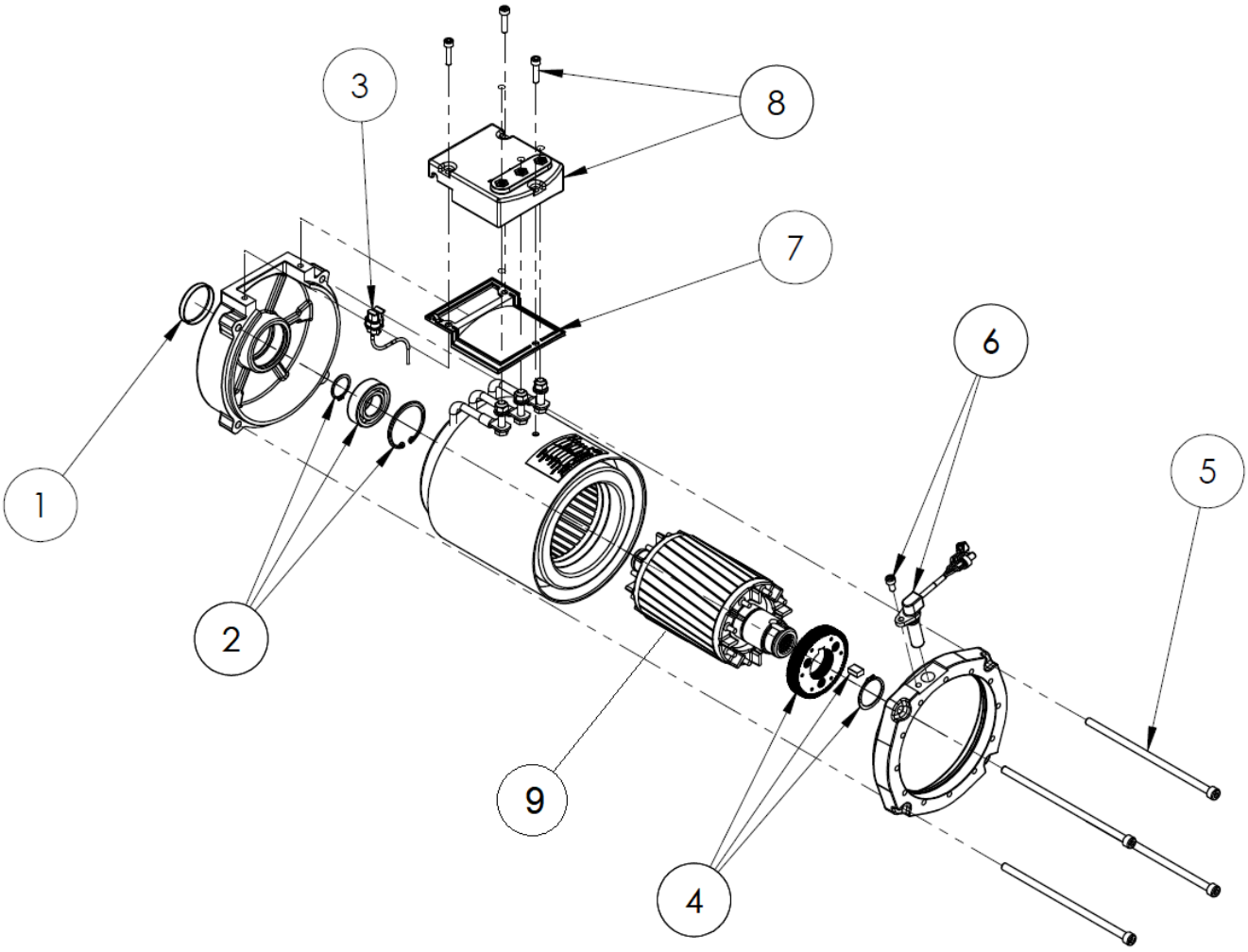
REF.	*No. PIÈCE*	*DESCRIPTION*	*REF.*	*No. PIÈCE*	*DESCRIPTION*
1	2206360016	DASHBOARD COVER	**10**	2209320008	STEERING SHAFT (UP)
2	2206360010	STEERING COLUMN	**11**	2109012001	PLASTIC BEARING
3	2806360020	KICK PANEL	**12**	2206360010	STEERING SUPPORT
4	2117250001	STEERING GEARBOX	**13**	2208240001	STEERING WHEEL
5	2200360002	STEERING SHAFT (BOTTOM)	-	2910000021	JAM NUT 7/8-NF
-	2910000024	SET SCREW 5/16-NC	-	2910000023	SPRING PIN 1/4 X 1 ¾
6	2104250004	UNIVERSAL JOINT	**14**	2208240002	STEERING COVER
	2104250005	CROSS, U-JOINT	**15**	5100250009	"MOTREC" STICKER
7	2209320007	STEERING SHAFT (MIDDLE)	-	2930000059	SNAP RING
8	2207320022	PITMAN ARM	-	2930000060	SQUARE KEY – ROUNDED
9	2207320027	TIE ROD			

AC MOTOR FAN COOLED



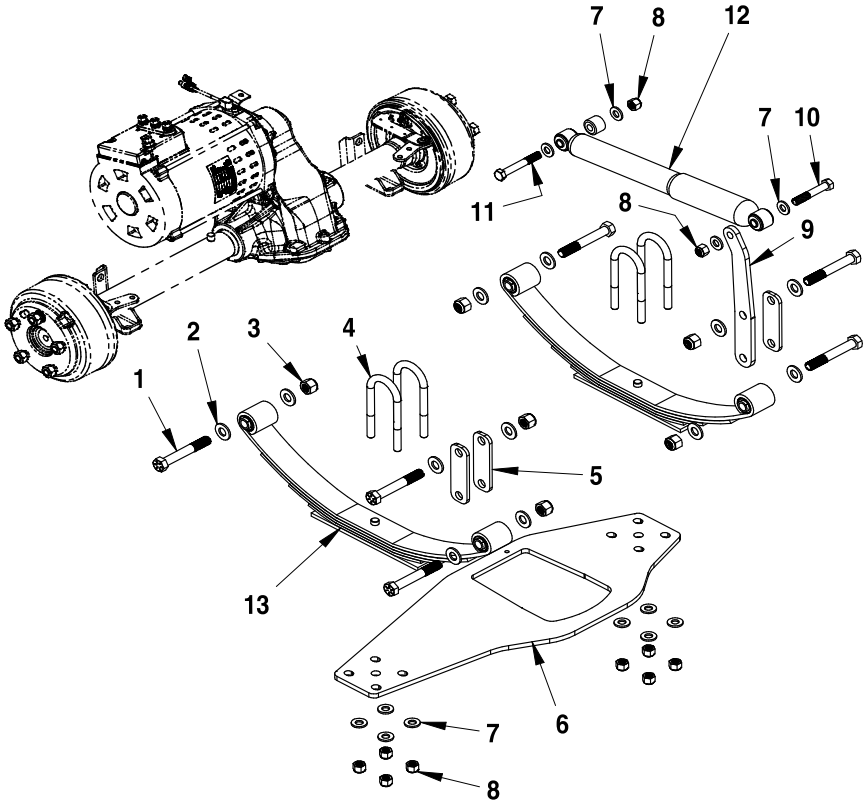
REF.	*PART NO.*	**DESCRIPTION**
1	8SD.909.020S	BOLT SERVICE KIT
2	3113248002	SPEED SENSOR SERVICE KIT
3	8SD.371.226	TERMINAL GASKET
4	3112248005SP	TERMINAL BLOCK SERVICE KIT
5	5SD.676.502S	PULSE WHEEL SERVICE KIT
6	H-303S	THERMAL SENSOR SERVICE KIT
7	3112248008	ROTOR
8	100218AS	REAR BEARING SERVICE KIT
9	8SD.310.310	REAR END SHAFT COVER

AC MOTOR ENCLOSED



REF.	*PART NO.*	**DESCRIPTION**
1	8SD.310.310	REAR END SHAFT COVER
2	100218AS	REAR BEARING SERVICE KIT
3	H-303S	THERMAL SENSOR SERVICE KIT
4	5SD.676.502S	PULSE WHEEL SERVICE KIT
5	8SD.909.020S	BOLT SERVICE KIT
6	3113248002	SPEED SENSOR SERVICE KIT
7	8SD.371.226	TERMINAL GASKET
8	3112248005SP	TERMINAL BLOCK SERVICE KIT
9	5SD.674.3396	ROTOR

REAR SUSPENSION
(NOMINAL CAPACITY 2000 LB)

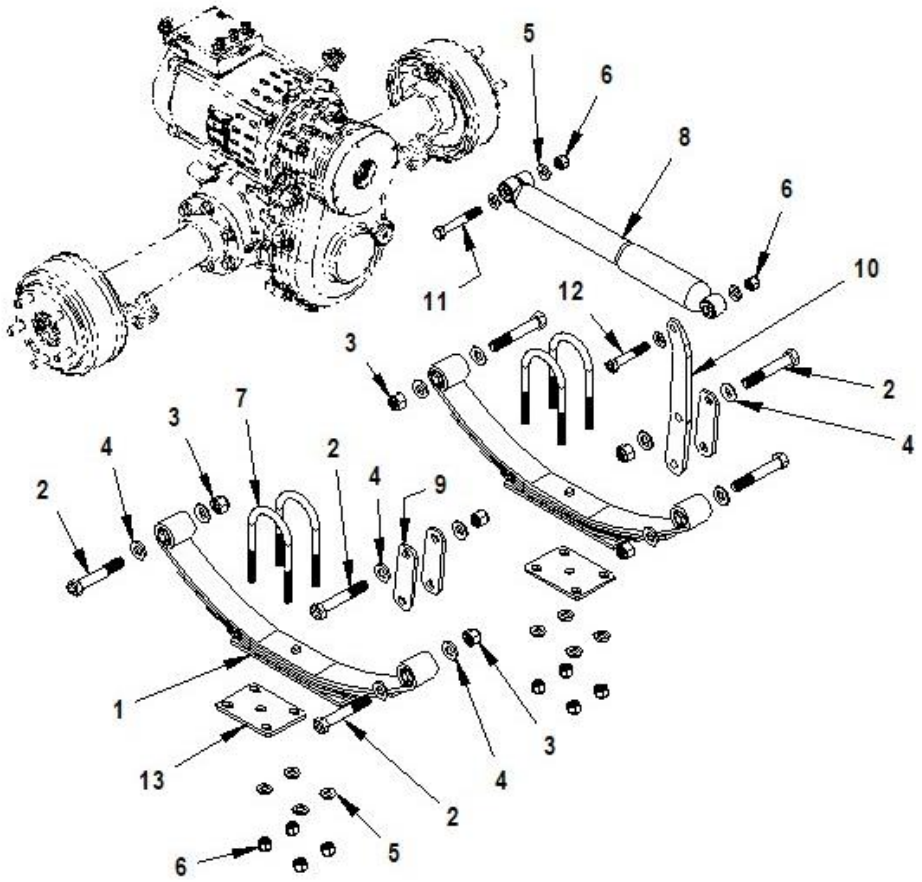


REF.	*PART NO.*	*DESCRIPTION*
1	70011810040	HEX BOLT 5/8"-11, 4" LG, GR.8
2	75001810000	WASHER 5/8”
3	73111810000	JAMNUT 5/8"-11
4	2916000002	“U” BOLT 1/2"-13
5	2182322001	SHACKLE LINKS
6	2185300005	PROCTECTION PLATE
7	750018080	WASHER 1/2"
8	731218080	JAMNUT 1/2"-13**
9	218248000	SHACKLE LINKS FOR SHOCK**
10	700118080	HEX BOLT 1/2"-13, 3" LG, GR.8**
11	700118080	HEX BOLT 1/2"-13, 3 1/2" LG, GR.8**
12	218024000	SHOCK ABSORBER**
13	2192320003	5 – LEAF SPRINGS, 22” C/C

** SHOCK ABSORBER (KIT) OPTION ONLY

REAR SUSPENSION

(NOMINAL CAPACITY 3500 & 5000 LB)



REF.	*NUMBER*	*DESCRIPTION*
1	2192320003	LEAF SPING (WITH DRUM BRAKES) *
	2192320004	LEAF SPING (WITH DISC BRAKES) **
2	700118100400	HEX BOLT 5/8"-11, 4" LG, GR.8
3	731118100000	JAMNUT 5/8"-11
4	750018100000	WASHER 5/8”
5	750018080000	WASHER 1/2"
6	731218080000	JAMNUT 1/2"-13
7	2916000002	“U” BOLT 1/2"-13 (WITH DRUM BRAKES) *
	2916320001	“U” BOLT 1/2"-13 (WITH DISC BRAKES) **
8	2180240002	SHOCK ABSORBER***
9	2182322001	SHACKLE LINKS
10	2182480003	SHACKLE LINKS FOR SHOCK***
11	700118080308	HEX BOLT 1/2"-13, 3 1/2" LG, GR.8***
12	700118080300	HEX BOLT 1/2"-13, 3" LG, GR.8***
13	2185320002	TIE PLATE
	2185300009	TIE PLATE (WITH DIFF. 012AJ549) **

*

NOMINAL CAPACITY 3500 LBS (1588 KG) ONLY

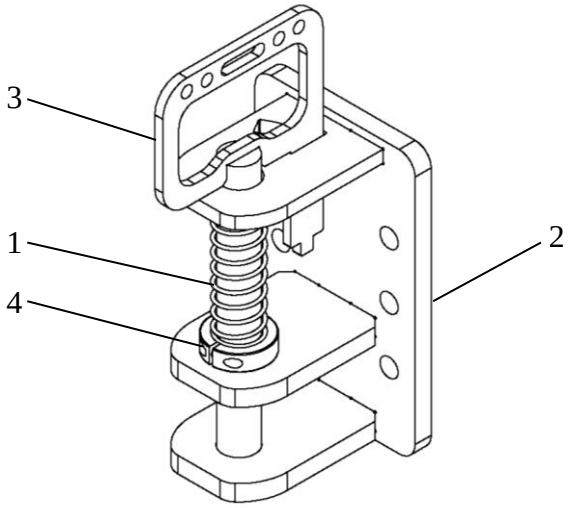
** DIFFERENTIEL CAP. NOMINALE 5000 LBS (2268 KG) ONLY

*** SHOCK ABSORBER (KIT) OPTION ONLY

HITCH

1" CLEVIS HITCH WITH SPRING

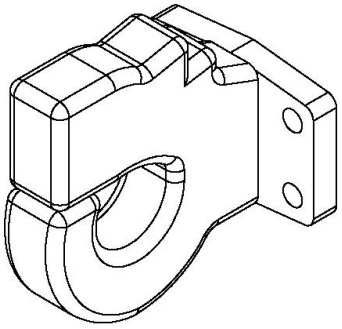
30,000 lbs Towing Capacity



REF.	*PART NO.*	*DESCRIPTION*
1	2191000003	SPRING
2	2321000016	HITCH PLATE
3	2329448007	CLEVIS 1” WITH LOCK ASSEMBLY
	2329448009	CLEVIS 1” WITHOUT LOCK ASSEMBLY
4	2915016001	ONE PIECE CLAMP-ON COLLAR

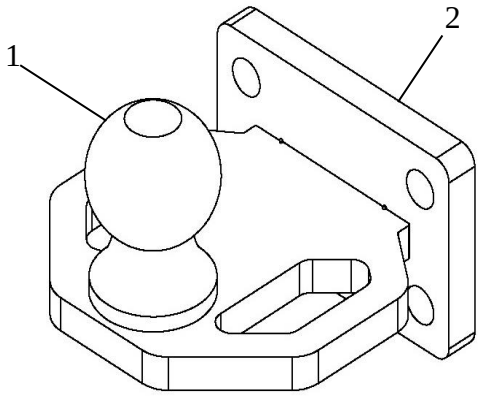
PINTLE HITCH

(260006)
10,000 lbs Towing Capacity
(2320448002)
30,000 lbs Towing Capacity



BALL HITCH 1 7/8”

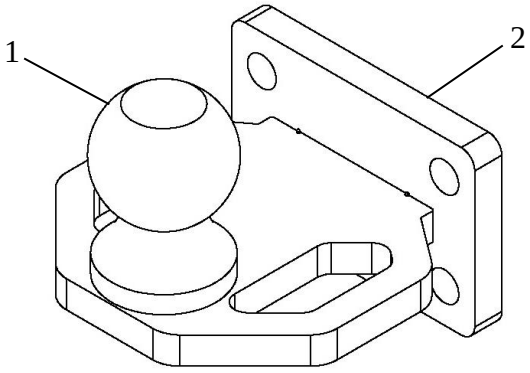
2,000 lbs Towing Capacity



REF.	*PART NO.*	*DESCRIPTION*
1	2321000006	BALL 1 7/8”
2	2321501005	BALL HITCH SUPPORT

BALL HITCH 2”

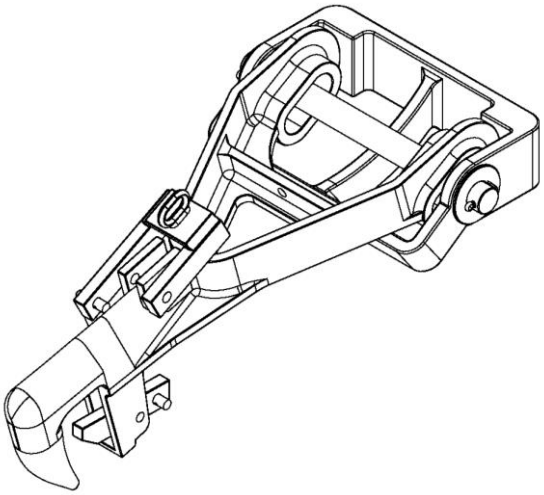
3,500 lbs Towing Capacity



REF.	*PART NO.*	*DESCRIPTION*
1	2321000010	BALL 2”
2	2321501005	BALL HITCH SUPPORT

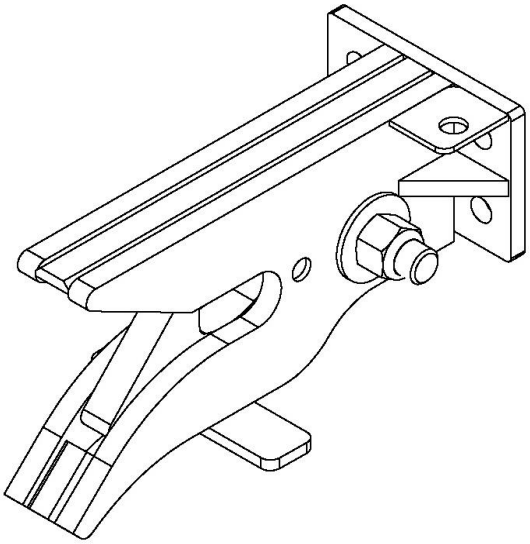
ROSE HITCH

(2320000009)
30,000 lbs Towing Capacity



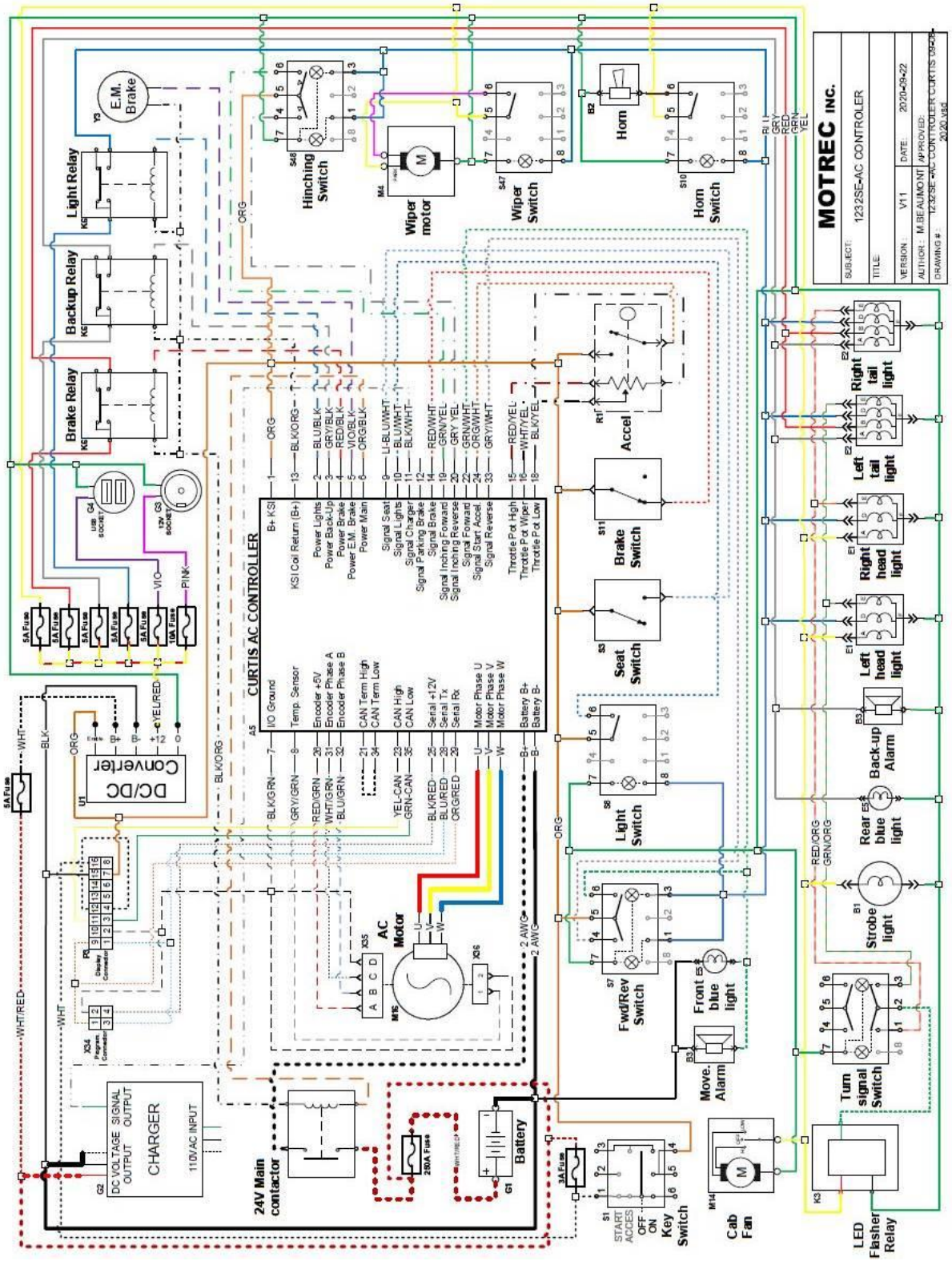
AUTOMATIC HITCH

(2320210001)
10,000 lbs Towing Capacity



ELECTRICAL DIAGRAM – MAIN CIRCUIT

CURTIS 1232SE



AC CABLES

WIRE	LINE	WIRE # ON CONNECTOR	USAGE	GROUP
WHITE		36	Power B+ (24, 36, 48 ou 80V) (live fused)	High power
WHITE		36	Power B+ (24, 36, 48 ou 80V) (live fused)	High power
WHITE		36	Power B+ (24, 36, 48 ou 80V) (live fused)	High power
WHITE		36	Power B+ (24, 36, 48 ou 80V) (live fused)	High power
WHITE		36	Power B+ (24, 36, 48 ou 80V) (live fused)	High power
BLACK		37	Power B- (24, 36, 48 ou 80V)	High power
BLACK		37	Power B- (24, 36, 48 ou 80V)	High power
BLACK		37	Power B- (24, 36, 48 ou 80V)	High power
BLACK		37	Power B- (24, 36, 48 ou 80V)	High power
WHITE	RED	38	Power B+ (24, 36, 48 ou 80V) (live no fuse)	High power
BROWN		39	Horn	Power 12V
WHITE	BLUE	40	Spare cable	
YELLOW		41	DC/DC converter +12V	Power 12V
YELLOW		41	DC/DC converter +12V	Power 12V
YELLOW		41	DC/DC converter +12V	Power 12V
GREEN		42	DC/DC converter -	Power 12V
GREEN		42	DC/DC converter -	Power 12V
GREEN		42	DC/DC converter -	Power 12V
GREEN		42	DC/DC converter -	Power 12V
BLUE		43	Power lights (+12V)	Power 12V
BLUE		43	Power lights (+12V)	Power 12V
GRAY		44	Power reverse alarm & light (+12V)	Power 12V
RED		45	Power brake light (+12V)	Power 12V
VIOLET		46	USB socket	Power 12V
PINK		47	12V socket	Power 12V
YELLOW	RED	48	Right turn signal	Power 12V
YELLOW	GREEN	49	Left turn signal	Power 12V
ORANGE		1	Power B+ (24, 36 48 ou 80V) (key switch)	Low power
ORANGE		1	Power B+ (24, 36 48 ou 80V) (key switch)	Low power
ORANGE		1	Power B+ (24, 36 48 ou 80V) (key switch)	Low power
BLUE	BLACK	2	Power lights relay (negative 24V PWM)	Low power
GRIS	BLACK	3	Power reverse alarm and light relay (negative 24V PWM)	Low power
RED	BLACK	4	Power brake light relay (negative 24V PWM)	Low power
VIOLET	BLACK	5	Power E.M. brake (- battery)	Low power
ORANGE	BLACK	6	Power main contactor (- battery)	Low power
BLACK	GREEN	7	I/O ground	Sensors
GRAY	GREEN	8	Temperature sensor	Sensors
PALE BLUE	WHITE	9	Signal seat switch (+ voltage battery)	Signal
BLUE	WHITE	10	Signal lights (+ voltage battery)	Signal
BLACK	WHITE	11	Charger signal	Signal
YELLOW	WHITE	12	Signal parking brake (+ voltage battery)	Signal
BLACK	ORANGE	13	Power KSI coil return (+ battery PWM)	Low power
RED	WHITE	14	Signal brake (+ voltage battery)	Signal
WHITE	YELLOW	15	Throttle pot high	Throttle
BLACK	YELLOW	16	Throttle pot wiper	Throttle
RED	YELLOW	18	Throttle and brake pot low	Throttle
GREEN	YELLOW	19	Inching forward	Signal
GRAY	YELLOW	20	Inching reverse	Signal
WHITE	BLACK	21	CAN term high (21) and low (34) + display CAN term	Signal
GREEN	WHITE	22	Signal forward (+ voltage battery)	Signal
ORANGE	WHITE	24	Signal start accel (+ voltage battery)	Signal
BLACK	RED	25	Serial +12V	Communicatior
RED	GREEN	26	Encoder +5V	Sensors
BLUE	RED	28	Serial TX	Communicatior
ORANGE	RED	29	Serial RX	Communicatior
WHITE	GREEN	31	Encoder phase A	Sensors
BLUE	GREEN	32	Encoder phase B	Sensors
GRAY	WHITE	33	Signal reverse (+ voltage battery)	Signal

FAULT CODES SHOWN ON DISPLAY

MOST COMMON ERROR CODES

17	Severe Undervoltage *Reduced drive torque.*	1. Battery Menu parameters are misadjusted. 2. Non-controller system drain on battery. 3. Battery resistance too high. 4. Battery disconnected while driving. 5. See Monitor menu » Battery: Capacitor Voltage. 6. Blown B+ fuse or main contactor did not close.	Low voltage on battery (recharge and erase code) 36V battery in a 48V vehicle Bad connector Parameter has been changed
18	Severe Overvoltage *ShutdownMotor;* *ShutdownMainContactor;* *ShutdownEMBrake;* *ShutdownThrottle;* *FullBrake;* *ShutdownPump.*	1. See Monitor menu » Battery: Capacitor Voltage. 2. Battery menu parameters are misadjusted. 3. Battery resistance too high for given regen current. 4. Battery disconnected while regen braking.	Battery is fully charged and too much regenerative braking . 48V in 36V vehicle.
23	Undervoltage Cutback *Reduced drive torque.*	1. Normal operation. Fault shows that the batteries need recharging. Controller is performance limited at this voltage. 2. Battery parameters are misadjusted. 3. Non-controller system drain on battery. 4. Battery resistance too high. 5. Battery disconnected while driving. 6. See Monitor menu » Battery: Capacitor Voltage. 7. Blown B+ fuse or main contactor did not close.	*Low voltage on battery (recharge and erase code)* *36V battery in a 48V vehicle* *Bad connector* *Parameter has been changed*
24	Overvoltage Cutback *Reduced brake torque.*	1. Normal operation. Fault shows that regen braking currents elevated the battery voltage during regen braking. Controller is performance limited at this voltage. 2. Battery parameters are misadjusted. 3. Battery resistance too high for given regen current. 4. Battery disconnected while regen braking. 5. See Monitor menu » Battery: Capacitor Voltage.	Battery is fully charged and too much regenerative braking. 48V in 36V vehicle.

MOST COMMON ERROR CODES

28	Motor Temp Hot Cutback *Reduced drive torque.*	1. Motor temperature is at or above the programmed Temperature Hot setting, and the requested current is being cut back. 2. Motor Temperature Control Menu parameters are mis-tuned. 3. See Monitor menu » Motor: Temperature and » Inputs: Analog2. 4. If the application doesn't use a motor thermistor, Temp Compensation and Temp Cutback should be programmed Off.	+145 C This is the temperature limit of the motor . +160 C The vehicle will stop. Bring temp back to normal *whithin range.*
29	Motor Temp Sensor Fault *MaxSpeed reduced (LOS, Limited Operating Strategy), and motor temperature cutback disabled.*	1. Motor thermistor is not connected properly. 2. If the application doesn't use a motor thermistor, Motor Temp Sensor Enable should be programmed Off. 3. See Monitor menu » Motor: Temperature and » Inputs: Analog2.	Bad contact must check PIN 7 or PIN 8 on controller. Check connector sensor.
31	Coil1 Driver Open/Short *ShutdownDriver1.*	1. Open or short on driver load. 2. Dirty connector pins. 3. Bad crimps or faulty wiring.	See Main Open/Short
31	Main Open/Short *ShutdownMotor; ShutdownMainContactor; ShutdownEMBrake; ShutdownThrottle; FullBrake; ShutdownPump.*	1. Open or short on driver load. 2. Dirty connector pins. 3. Bad crimps or faulty wiring.	*Emergency button is activated.* *Wire is disconnected on* *emergency button .* *Bad contact on PIN13 or PIN 6.*
32	Coil2 Driver Open/Short *ShutdownDriver2.*	1. Open or short on driver load. 2. Dirty connector pins. 3. Bad crimps or faulty wiring.	Only when Em Brake is in fault. See below.
32	EMBrake Open/Short *ShutdownEMBrake; ShutdownThrottle; FullBrake.*	1. Open or short on driver load. 2. Dirty connector pins. 3. Bad crimps or faulty wiring.	Wire disconnect on Em Brake . Bad contact on PIN 13 or PIN 5.
33	Coil3 Driver Open/Short *ShutdownDriver3.*	1. Open or short on driver load. 2. Dirty connector pins. 3. Bad crimps or faulty wiring.	Brake light relay defect or disconnect. Check PIN 4 (wire Red/Black)
34	Coil4 Driver Open/Short *ShutdownDriver4.*	1. Open or short on driver load. 2. Dirty connector pins. 3. Bad crimps or faulty wiring.	Back-up light relay defect or disconect. Check Pin 3 (wire gray/black)

MOST COMMON ERROR CODES

35	PD Open/Short *ShutdownPD.*	1. Open or short on driver load. 2. Dirty connector pins. 3. Bad crimps or faulty wiring.	Light Relay defect or disconnect . Check PIN 2 (wire blue/black)
36	Encoder Fault *ShutdownEMBrake.*	1. Motor encoder failure. 2. Bad crimps or faulty wiring. 3. See Monitor menu » Motor: Motor RPM.	Check 4 wire on the encoder. PIN 7 - 26- 31- 32
37	Motor Open *ShutdownMotor;* *ShutdownMainContactor;* *ShutdownEMBrake;* *ShutdownThrottle;* *FullBrake;* *ShutdownPump.*	1. Motor phase is open. 2. Bad crimps or faulty wiring.	Check loose wire on the motor and on the controller.
39	Main Contactor Did Not Close *ShutdownMotor;* *ShutdownMainContactor;* *ShutdownEMBrake;* *ShutdownThrottle;* *FullBrake;* *ShutdownPump.*	1. Main contactor did not close. 2. Main contactor tips are oxidized, burned, or not making good contact. 3. External load on capacitor bank (B+ connection terminal) that prevents capacitor bank from charging. 4. Blown B+ fuse.	The main contactor commanded is closed.
41	Throttle Wiper High *ShutdownThrottle.*	1. See Monitor menu » Inputs: Throttle Pot. 2. Throttle pot wiper voltage too high.	Bad conctact or installation on accelerator pedal (wire white/yellow) Bad contact on PIN 15 or PIN 16.
42	Throttle Wiper Low *ShutdownThrottle.*	1. See Monitor menu » Inputs: Throttle Pot. 2. Throttle pot wiper voltage too low.	Bad conctact or installation on accelerator pedal (wire red/yellow) Bad contact on PIN 16 or PIN 18.
45	Pot Low Overcurrent *ShutdownThrottle;* *FullBrake.*	1. See Monitor menu » Outputs: Pot Low. 2. Combined pot resistance connected to pot low is too low.	Bad contact with PIN 18 or wire
47	HPD/Sequencing Fault *ShutdownThrottle.*	1. KSI, interlock, direction, and throttle inputs applied in incorrect sequence. 2. Faulty wiring, crimps, or switches at KSI, interlock, direction, or throttle inputs. 3. See Monitor menu » Inputs.	Bad start sequence (seat/ neutral /do not touch accelerator)
49	Parameter Change Fault *ShutdownMotor;* *ShutdownMainContactor;* *ShutdownEMBrake;* *ShutdownThrottle;* *FullBrake;* *ShutdownPump.*	1. This is a safety fault caused by a change in certain parameter settings so that the vehicle will not operate until KSI is cycled. For example, if a user changes the Throttle Type this fault will appear and require cycling KSI before the vehicle can operate.	Parameter has been change
51–67	OEM Faults *(See OEM documentation.)*	1. These faults can be defined by the OEM and are implemented in the application-specific VCL code. See OEM documentation.	See last page for more detail .

MOST COMMON ERROR CODES

73	Stall Detected *ShutdownEMBrake; Control Mode changed to LOS (Limited Operating Strategy).*	1. Stalled motor. 2. Motor encoder failure. 3. Bad crimps or faulty wiring. 4. Problems with power supply for the motor encoder. 5. See Monitor menu » Motor: Motor RPM.	No movement, motor reach 350A and stall after 5 seconds.

92	EM Brake Failed to Set *ShutdownEMBrake; ShutdownThrottle.*	1. Vehicle movement sensed after the EM Brake has been commanded to set. 2. EM Brake will not hold the motor from rotating.	Knobs are screw into the motor, remove and clear code.

OEM CODE :

CODE 51 Can initialization : Check PIN 23 and PIN 35 (twisted wire green and yellow)

CODE 52 Can operational : Check PIN 23 and PIN 35 (twisted wire green and yellow)

CODE 53 Throttle Wiper : Check PIN 18

CODE 54 Maintenance is required

CODE 55 Throttle active before foward

CODE 56 Throttle active before reverse

CODE 57 FWD and REV active : Bad switch FWD/REV

CODE 58 Driver voltage exceeded : Max voltage for driver is 24V

PARTS LIST AC

NO	DESIGNATION	REF
A5	CURTIS AC CONTROL. 36-48V, 350A - 1234	3105236001
	CURTIS AC CONTROL. 36-48V, 350A – 1232SE	3105236008
	CURTIS AC CONTROL. CONNECTOR	3105800001-C
	CURTIS AC CONTROL. CONNECTOR PINS	3105800001-P
B1	STROBELIGHT	*
B2	HORN	*
B3	REVERSE / MOTION ALARM	*
E1	HEADLIGHT	*
E2	TAIL / BRAKE / TURN / BACKUP LIGHT	*
E5	SAFETY BLUE LIGHT	3111000063
F14	FUSE, ANN 250A	3118224001
	FUSE HOLDER BUSS 4164	3118224002
G1	BATTERY	CALL FACTORY
G2	BATTERY CHARGER	**
G3	USB CHARGER SOCKET	3119000083
G4	12V, 10A MAX SOCKET	3119000082
K3	FLASHER RELAY	3127000002
K6	RELAY 24VDC SPST 280 STYLE, FOR BRIC	3127024001
M4	WIPER MOTOR	*
M7	CAB HEATER	*
M14	CAB FAN	*
M16	AC MOTOR 36-48VAC FAN COOLED	3112248005
	AC MOTOR 36-48VAC ENCLOSED (EE)	3112248003
P3	LCD DISPLAY CURTIS	3108000006
	DISPLAY CONNECTOR	3119000062
	DISPLAY CONNECTOR PINS	3130000019
R1	ACCELERATOR, VERTICAL MOUNT	3062001C
S1	SEALED KEY SWITCH 2 POSITION	3109000046
	SEALED IGNITION SWITCH WITHOUT KEY 2 POS	3109000047
	KEY ONLY FOR SEALED KEY SWITCH	3109000046K
	AUTOMOTIVE CONNECTOR 6 PIN PLUD WEDGE	ASCAW6S
	AUTOMOTIVE CONNECTOR PLUG 6 WAYS	AT06-6S
	AUTOMOTIVE CONNECTOR TERMINAL 16-18	AT62-16-0122-L
S3	SEAT SWITCH, KIT	2392240003
	SEAT SWITCH, MICRO-SWITCH	3109100002
	SEAT SWITCH, SEAT MOUNTED (MICHIGAN)	3109000003
	CONNECTOR	3109000004
	SEAT SWITCH, SEAT MOUNTED (GRAMMER)	2205002SW
S6	FOOT SWITCH	1269003
S7	FOWARD/REVERSE SELECTOR, ROCKER TYPE	*
S8	LIGHT SWITCH, ROCKER TYPE	*
S10	HORN BUTTON	*
S11	BRAKE SWITCH	*
	HYDRAULIC BRAKE LIGHT SWITCH	2374001
S13	TURN SIGNAL SWITCH	*
S15	EMERGENCY PUSH BUTTON	3109800012
	EMERGENCY PUSH BUTTON, LABEL	3109800006
S16	UP/DOWN SWITCH	*
S25	WIPER SWITCH	*
S26	HEATER SWITCH	*
S44	MAGNETIC SWITCH FOR PARKING BRAKE LEVER	3109000037

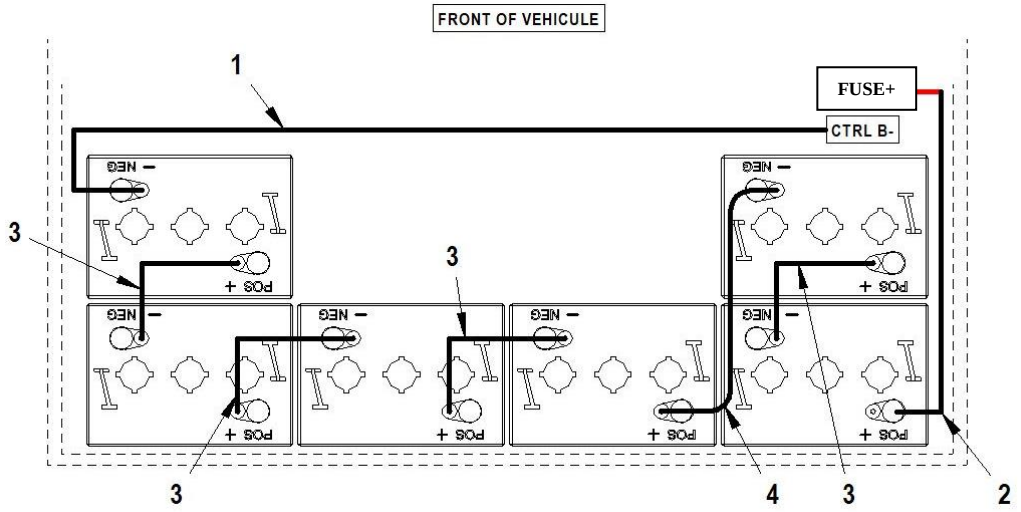
S45	COMBINED MAIN CONTACTOR AND MANUAL DISCONNECT SWITCH	3104224001
S46	INCHING SWITCH	*
U1	DC-DC CONVERTER	*
X34	PROGRAMMATION CONNECTOR	3119000063
	PROGRAMMATION CONNECTOR PINS	3130800001
X35	ENCODER CONNECTOR – VEHICLE PART	3119000048
	ENCODER CONNECTOR PINS – VEHICLE PART	3119000052
	ENCODER CONNECTOR – MOTOR PART	3119000049
	ENCODER CONNECTOR PINS – MOTOR PART	3119000053
	ENCODER CONNECTOR SEAL	3119000051
	ENCODER CONNECTOR LOCK	3119000050
X36	THERMAL SENSOR CONNECTOR – VEHICLE PART	3119000045
	THERMAL SENSOR CONNECTOR PINS – VEHICLE PART	3119000052
	THERMAL SENSOR CONNECTOR – MOTOR PART	3119000049
	THERMAL SENSOR CONNECTOR PINS – MOTOR PART	3119000053
	THERMAL SENSOR CONNECTOR SEAL	3119000051
	THERMAL SENSOR CONNECTOR LOCK	3119000047
Y3	ELECTROMAGNETIC BRAKE	3129000023

* Consult Motrec Illustrated parts

** Consult Motrec chargers

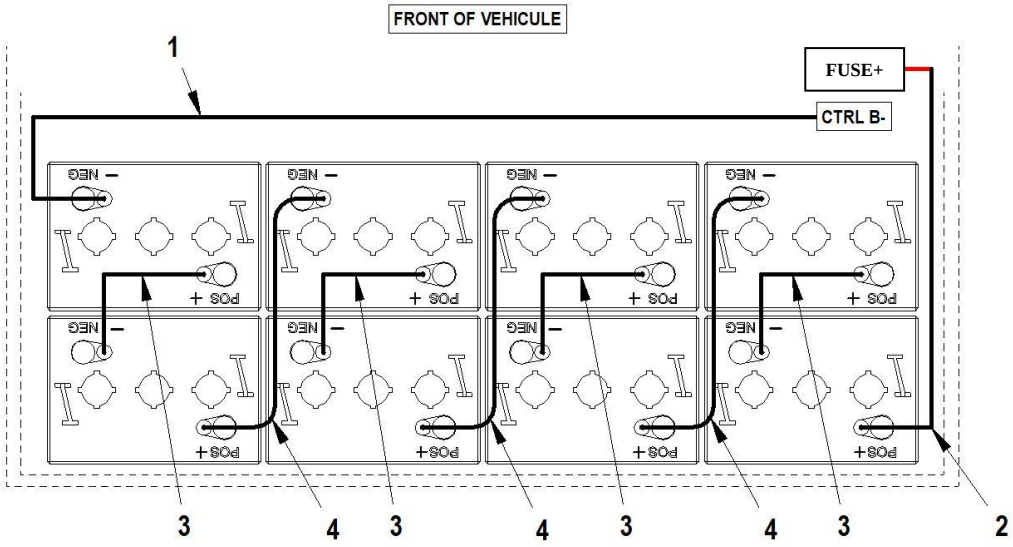
BATTERY CONFIGURATIONS

36V TROJAN T105-STANDARD BODY



REF.		
1	3132002070-BB	70” BLACK- POWER CABLE, 2 AWG, 5/16’’ RING TERMINAL
2	3132202025-BB	25” RED- POWER CABLE, 2 AWG, 5/16’’ RING TERMINAL
3	3132002005-BB	5” BLACK- POWER CABLE, 2 AWG, 5/16’’ RING TERMINAL
4	3132002015-BB	15” BLACK- POWER CABLE, 2 AWG, 5/16’’ RING TERMINAL

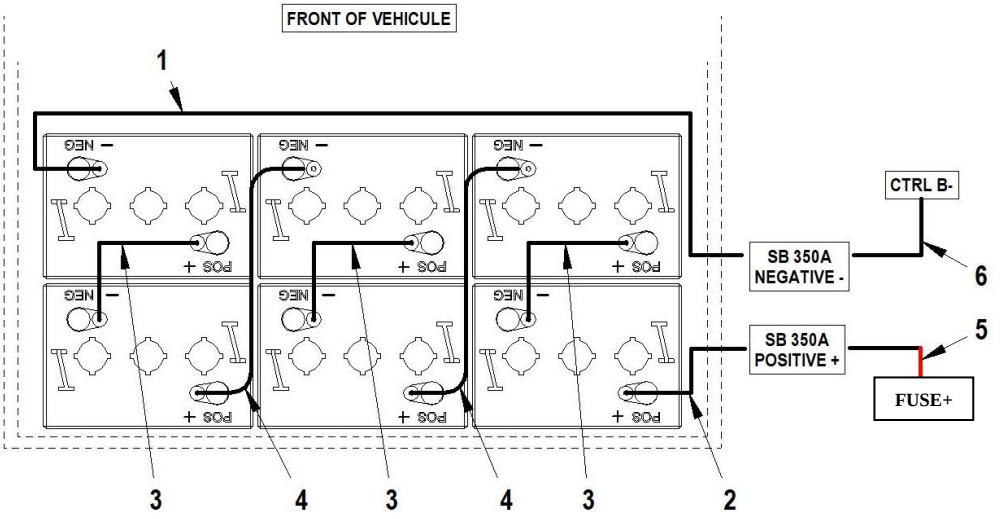
48V TROJAN T105-STANDARD BODY



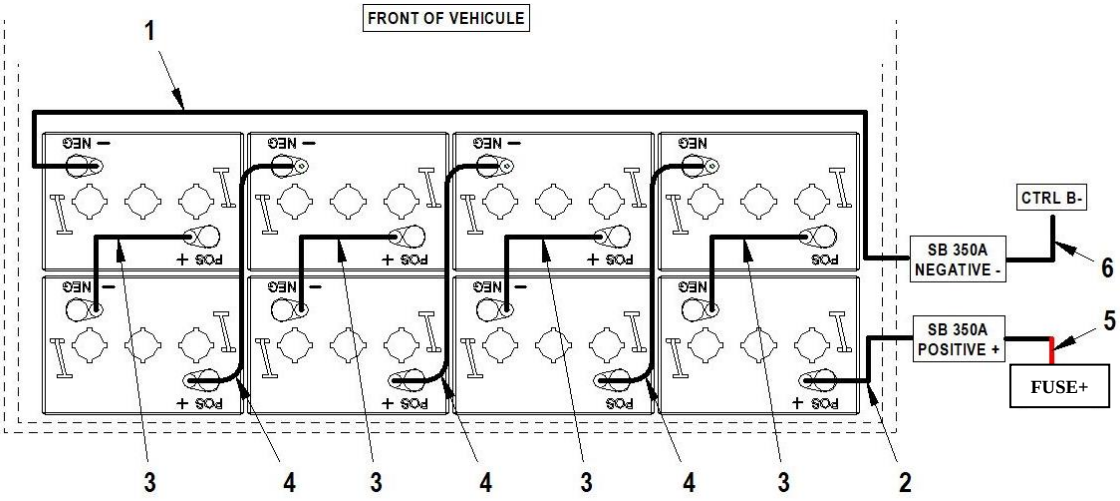
REF.	*PART NO.*	*DESCRIPTION*
1	3132002070-BB	70” BLACK- POWER CABLE, 2 AWG, 5/16’’ RING TERMINAL
2	3132202025-BB	25” RED- POWER CABLE, 2 AWG, 5/16’’ RING TERMINAL
3	3132002005-BB	5” BLACK- POWER CABLE, 2 AWG, 5/16’’ RING TERMINAL
4	3132002015-BB	15” BLACK- POWER CABLE, 2 AWG, 5/16’’ RING TERMINAL

BATTERY CONFIGURATIONS

36V TROJAN T105-ROLL-OUT OPTION



REF.	*PART NO.*	*DESCRIPTION*
1	3132002060-BG	60” BLACK- POWER CABLE, 2 AWG, 5/16’’ RING/ SB350 TERMINAL
2	3132202025-BG	25” RED- POWER CABLE, 2 AWG, 5/16’’ RING/ SB350 TERMINAL
3	3132002005-BB	5” BLACK- POWER CABLE, 2 AWG, 5/16’’ RING TERMINAL
4	3132002015-BB	15” BLACK- POWER CABLE, 2 AWG, 5/16’’ RING TERMINAL
5	3132202010-BG	10” RED- POWER CABLE, 2 AWG, 5/16’’ RING/ SB350 TERMINAL
6	3132002020-BG	20” BLACK- POWER CABLE, 2 AWG, 5/16’’ RING/ SB350 TERMINAL



REF.	*PART NO.*	*DESCRIPTION*
1	3132002060-BG	60” BLACK- POWER CABLE, 2 AWG, 5/16’’ RING/ SB350 TERMINAL
2	3132202025-BG	25” RED- POWER CABLE, 2 AWG, 5/16’’ RING/ SB350 TERMINAL
3	3132002005-BB	5” BLACK- POWER CABLE, 2 AWG, 5/16’’ RING TERMINAL
4	3132002015-BB	15” BLACK- POWER CABLE, 2 AWG, 5/16’’ RING TERMINAL
5	3132202010-BG	10” RED- POWER CABLE, 2 AWG, 5/16’’ RING/ SB350 TERMINAL
6	3132002020-BG	20” BLACK- POWER CABLE, 2 AWG, 5/16’’ RING/ SB350 TERMINAL

DELTA-Q HF CHARGER

1

4

2

3

5

* NOT ILLUSTRATED

NO	*DESCRIPTION*	*PART NO*		
		BUILT-IN	PORTABLE WITH SB-50	PORTABLE WITH SB-350
1	24V CHARGER (U.S. BATTERY)	3102240002	3102240009	3102240013
	24V CHARGER (LIFELINE BATTERY)	3102240003	3102240010	3102240014
	24V CHARGER (GEL 180AH BATTERY)	3102240004	3102240011	3102240015
	24V CHARGER (27TM BATTERY)	3102240005	3102240012	3102240016
	36V CHARGER (U.S. BATTERY)	3102302010	-	3102302007
	36V CHARGER (LIFELINE BATTERY)	3102302002	3102302005	3102302008
	36V CHARGER (GEL 180AH BATTRY)	3102302003	3102302006	3102302009
	48V CHARGER (U.S. BATTERY)	3102480011	-	3102480008
	48V CHARGER (LIFELINE BATTERY)	3102480003	3102480006	3102480009
	48V CHARGER (GEL 180AH BATTERY)	3102480004	3102480007	3102480010
	72V CHARGER (U.S. BATTERY)	3102720001		
2	CONNECTOR C13	3119000011		
*	PORTABLE CHARGER AC CORD		3120000001	3120000001
*	BUILT-IN CHARGER AC CORD	3120000002		
*	CORDSET, YELLOW PLUG & SB-50G		3120000003	
3	SOCKET 120VAC MALE FLANGE MOUNT	3119700001		
4	36V CHARGER (TPPL BATTERY)	3102360002	-	
	48V CHARGER (TPPL BATTERY)	3102480012		
5	CORD (12in) NEMA 5-15P TO IEC C13	3131314012		

QuiQ™ HF/PFC Battery Charger

Product Manual for:
QuiQ 912-24xx / 36xx / 48xx / 72xx

delta-q TECHNOLOGIES
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Burnaby, BC, Canada V5H 2H2
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www.delta-q.com

SAVE THESE IMPORTANT SAFETY INSTRUCTIONS

This manual contains important safety, operating, and installation instructions – read before using charger.

Battery Safety Information

Warning: Use charger only on battery systems with an algorithm selected that is appropriate to the specific battery type. Other usage may cause personal injury and damage. Lead acid batteries may generate explosive hydrogen gas during normal operation. Keep sparks, flames, and smoking materials away from batteries. Provide adequate ventilation during charging. Never charge a frozen battery. Study all battery manufacturers' specific precautions such as recommended rates of charge and removing or not removing cell caps while charging.

Electrical Safety Information

Danger: Risk of electric shock. Connect charger power cord to an outlet that has been properly installed and grounded in accordance with all local codes and ordinances. A grounded outlet is required to reduce risk of electric shock – do not use ground adapters or modify plug. Do not touch uninsulated portion of output connector or uninsulated battery terminal. Disconnect the AC supply before making or breaking the connections to the battery while charging. Do not open or disassemble charger. Do not operate charger if the AC supply cord is damaged or if the charger has received a sharp blow, been dropped, or otherwise damaged in any way – refer all repair work to qualified personnel. Not for use by children.

INFORMATIONS IMPORTANTES DE SÉCURITÉ

Conserver ces instructions. Ce manuel contient des instructions importantes concernant la sécurité et le fonctionnement.

Information de Sécurité de la Batterie

Attention: Utiliser seulement sur les batteries 72V avec un algorithme approprié au type spécifique de batterie – voire le manuel. D´autres types de batteries pourraient éclater et causer des blessures ou dommages. Les batteries peuvent produire des gaz explosives en service normal. Ne jamais fumer près de la batterie et éviter toute étincelle ou flame nue à proximité de ces derniers. Fournisser la bonne ventilation lors du chargement. Ne jamais charger une batterie gelée. Prendre connaissance des mesures de précaution spécifiées par le fabricant de la batterie, p. ex., vérifier s´il faut enlever les bouchons des cellules lors du chargement de la batterie, et les taux de chargement recommandés.

Information de Sécurité Électrique

Danger: Risque de chocs électriques. Ne pas toucher les parties non isolées du connecteur de sortie ou les bornes non isolées de la batterie. Toujours connecter le chargeur à une prise de courant mise à la terre. Ne pas ouvrir ni desassembler le chargeur – referer toute reparations aux personnes qualifiés. Pas à l´usage des enfants.

Operating Instructions

1. Always use a grounded outlet. When using an extension cord, avoid excessive voltage drops by using a grounded 3-wire 12 AWG cord.
2. The charger will automatically turn on and go through a short LED indicator self-test (Models 912-xx0x will flash all LED's in an up-down sequence and Models 912-xx1x will alternatively flash its LED RED-GREEN) for two seconds. If the charger is connected to battery pack, a trickle current will be applied until a minimum voltage is reached. If the charger is used in an off-board application and the charger is waiting to be plugged into a battery pack, the charging algorithm number will be displayed for 11 seconds (see "Check / Change Charging Algorithm") before ultimately displaying an under-voltage fault (fault disappears when plugged into battery pack).
3. Once a minimum battery voltage is detected, the charger will enter the bulk charging constant-current stage. Models 912-xx0x will display the current to the battery on the bargraph and Model 912-xx1x will flash its LED GREEN off more than on to indicate <80% charge status. The length of charge time will vary by how large and how depleted the battery pack is, the input voltage (the higher, the better), and ambient temperatures (the lower, the better). If the input AC voltage is low (below 104VAC), then the charging power will be reduced to avoid high input currents (Models 912-xx0x 'AC' LED and Models 912-xx1x single LED both flash YELLOW). If the ambient temperature is too high, then the charging power will also be reduced to maintain a maximum internal temperature (Models 912-xx0x bargraph flashes and Models 912-xx1x single LED flashes YELLOW).
4. When the battery is at approximately 80% state of charge, the bulk stage has completed and an >80% charge indication is given (Models 912-xx0x turn on the '80%' LED and Models 912-xx1x will flash its LED GREEN on more than off). In the next phase known as the absorption or constant-voltage phase, the last 20% of charge is then returned to the battery. The charging could be terminated at this point if the vehicle requires immediate usage, however, it is highly recommended to wait until 100% charge indication is given to ensure maximum battery capacity and life.
5. A low current "finish-charge" phase is next applied to return and maintain maximum battery capacity (Models 912-xx0x will flash the '100%' LED).
6. When Models 912-xx0x '100%' LED or Models 912-xx1x single LED is continuously GREEN, the batteries are completely charged. The charger may now be unplugged from AC power (always pull on plug and not cord to reduce risk of damage to the cord). If left plugged in, the charger will automatically restart a complete charge cycle if the battery pack voltage drops below a minimum voltage or 30 days has elapsed.
7. If a fault occurred anytime during charging, a fault indication is given by flashing RED with a code corresponding to the error. There are several possible conditions that generate errors. Some errors are serious and require human intervention to first resolve the problem and then to reset the charger by interrupting AC power for at least 15 seconds. Others may be simply transient and will automatically recover when the fault condition is eliminated. To indicate which error occurred, a fault indication will flash RED a number of times, pause, and then repeat.
   [1 FLASH] Battery Voltage High: auto-recover
   [2 FLASH] Battery Voltage Low: auto-recover
   [3 FLASH] Charge Timeout: the charge did not complete in the allowed time. This may indicate a problem with the battery pack (voltage not attaining the required level), or that the charger output was reduced due to high ambient temperatures.
   [4 FLASH] Check Battery: the battery pack could not be trickle charged up to the minimum level required for the charge to be started. This may indicate that one or more cells in the battery pack are shorted or damaged.
   [5 FLASH] Over-Temperature: auto-recover. Charger has shutdown due to high internal temperature which typically indicates there is not sufficient airflow for cooling – see Installation Instructions 1). Charger will restart and charge to completion if temperature comes within accepted limits.
   [6 FLASH] QuiQ Fault: an internal fault has been detected. If Fault 6 is again displayed after interrupting AC power for at least 15 seconds, the charger must be brought to a qualified service depot.

Maintenance Instructions

1. For flooded lead-acid batteries, regularly check water levels of each battery cell after charging and add distilled water as required to level specified by battery manufacturer. Follow the maintenance and safety instructions recommended by the battery manufacturer.
2. Make sure charger connections to battery terminals are tight and clean.
3. Do not expose charger to oil, dirt, mud or to direct heavy water spraying when cleaning vehicle.

See flip side for **Product Specifications** and **Installation Instructions** for qualified personnel.

Specifications

DC Output – see Operating Instructions

QuiQ Model: 912-	24xx	36xx	48xx	72xx
Voltage-nom (V)	24	36	48	72
Voltage-max (V)	33.6	50.4	67.2	100
Current-max (A)	25	21	18	12
Battery Type	Specific to selected algorithm			
Reverse Polarity	Electronic protection – auto-reset			
Short Circuit	Electronic current limit			

AC Input

All models	
Voltage-max (Vrms)	85 – 265
Frequency (Hz)	45 - 65
Current-max (Arms)	12A @ 104VAC (reduced 20%<104V)
Current – nominal (Arms)	10A @ 120VAC / 5A @ 230VAC
AC Power Factor	>0.98 at nominal input current

Operation

Charger Model: 912-	xx0x (10 LED)	xx1x (1 LED)
AC ON	Solid YELLOW	LED Active
AC LOW	Flash YELLOW	Flash YELLOW
Thermal Cutback	Flash Bargraph	Flash YELLOW
<80% Charge Indicator	-	Short Flash GREEN
>80% Charge Indicator	Solid YELLOW	Long Flash GREEN
100% Charge Indicator	Solid GREEN	Solid GREEN
Fault Indicator	Flash RED	Flash RED
DC Ammeter	LED Bargraph	-
Bat Temp Compensation	Automatic	Optional
Maintenance Mode	Auto-restart if V<2.1Vpc or 30 days elapse	

Mechanical

All models	
Dimensions	28.0 x 24.5 x 11.0 cm (11 x 9.7 x 4.3")
Weight	<5 kg (<11 lbs) w/ standard output cord
Environmental	Enclosure: IP46
Operating Temperature	-30°C to +50°C (-22°F to 122°F), derated above 30°C, below 0°C
Storage Temperature	-40°C to +70°C (-40°F to 158°F)
AC input connector	IEC320/C14 (require ≥1.8m localized cord)
DC output connector	OEM specific w/ 12AWG wire

Regulatory

Safety	
EN 60335-1/2-29	Safety of Appliances/ Battery Chargers
UL2202	EV Charging System Equipment
UL1564 2nd Edition	Industrial Battery Charger
CSA-C22.2 No. 107.2	Battery Chargers- Industrial
Emissions	
FCC Part 15/ICES 003	Unintentional Radiators Class A
EN 55011	Radio disturbance characteristics (Class A)
EN 61000-3-2	Limits for harmonic current emissions
EN 61000-3-3	Limits of voltage fluctuations and flicker
Immunity	
EN 61000-4-2	Electrostatic discharge immunity
EN 61000-4-3	Radiated, radio-frequency, EMF immunity
EN 61000-4-4	Electrical fast transient/burst immunity
EN 61000-4-5	Surge immunity
EN 61000-4-6	Conducted Immunity
EN 61000-4-11	Voltage variations immunity

Installation Instructions

WARNING: The output of chargers with greater than 48V may pose an energy and/or shock hazard under normal use. These units must be installed in the host equipment in such a manner that the output cable and battery connections are only accessible with the use of a tool by qualified personnel.

1) Determine Mounting Location:
While its sealed nature allows the charger to be mounted virtually anywhere, the choice of mounting location and orientation is extremely important. For optimum performance and shortest charge times, mount the charger in an area with adequate ventilation. The charger should also be mounted in an area that will be relatively free of oil, dirt, mud, or dust since accumulations within the fins of the charger will reduce their heat-dissipating qualities. Optimal cooling also occurs when the charger is mounted on a horizontal surface with the fins vertical. More airflow from below the charger will help cool the fins, so mounting above open areas or areas with cut-outs for airflow is desirable. Contact Delta-Q for information on other mounting orientations. As the charger may get hot in operation, the charger must be installed such that risk of contact by people is reduced. The charger's AC plug must be located at least 18" above the floor/ ground surface and the status display must be visible to the user.

2) Mounting Procedure:
Mount the charger by the mounting plate using appropriate fasteners (i.e. 1/4" or M6 with locking hardware). For UL2202 compliance, a 12AWG green bonding wire with ring terminals must be attached from the bonding stud located on the front of the charger (identified by ⏚) to the vehicle frame. The vehicle connection must be made using corrosion resistant hardware (e.g., a #10 stainless steel machine screw with at least two threads of engagement and, if required, a paint piercing washer).

3) DC Battery Connection Procedure:
a) The green wire outputs battery voltage when the charger is not plugged into AC to provide an interlock function – see Fig. 1. **If used, a user-supplied 1A fast-blow external fuse must be installed inline to prevent damage. Shorting or drawing more than 1A may damage charger and void the warranty.**
b) Securely fasten the black ring terminal from the charger to the negative terminal ("-", "NEG", NEGATIVE") of the battery pack.
c) Check that the correct charge algorithm is being used – refer to section 4). Securely fasten the red ring terminal to the positive terminal ("+", "POS", "POSITIVE") of the battery pack.

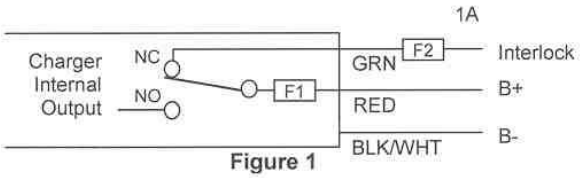

Figure 1

4) Check / Change Charging Algorithm:
The charger comes pre-loaded with algorithms for batteries as detailed in Table 1. If your specific battery model is not listed, please contact Delta-Q.
Each time AC power is applied with the battery pack NOT connected, the charger enters an algorithm select/display mode for approximately 11 seconds. During this time, the current Algorithm # is indicated on the '80%' LED (Models 912-xx0x) or on the single LED (Models 912-xx1x). A single digit Algorithm # is indicated by the number of blinks separated by a pause. A two digit Algorithm # is indicated by the number of blinks for the first digit followed by a short pause, then the number of blinks for the second digit followed by a longer pause.
To check / change the charging algorithm:
a) Disconnect the charger positive connector from battery pack. Apply AC power and after the LED test, the Algorithm # will display for 11 seconds.
b) To change algorithm, touch positive connector during the 11 second display period to the battery pack's positive terminal for 3 seconds and then remove – the Algorithm # will advance after 3 seconds. Repeat until desired Algorithm # is displayed. A 30 second timeout is extended for every increment. Incrementing beyond the last Algorithm moves back to the first Algorithm. After desired Algorithm # is displayed, touch the charger connector to the battery positive until the output relay is heard to click (~10 seconds) – algorithm is now in permanent memory.
c) Remove AC power from the charger and reconnect the charger positive connector to the battery pack. It is highly recommended to check a newly changed algorithm by repeating step 4) above.

Alg #	Battery Type
35	Concorde 2xxAh AGM
27	Crown CR325 dv/dt
26	Deka 8GGC2 Gel
11	generic flooded CP dv/dt
8	Concorde 1xxAh AGM
7	Trojan J305 dV/dt
6	DEKA 8G31 Gel
5	Trojan 30XHS
4	US Battery US2200
1	Trojan T-105

Table 1.

Product warranty is two years - please contact dealer of original equipment for warranty service.

Note: This is a Class A product. In a domestic environment this product may cause radio interference, in which case the user may be required to take adequate measures.

MOTREC ILLUSTRATED ACCESSORIES – AC VEHICLES

Strobe light, pole mount
Amber 12-80V: 3116000002
Red 12-80V: 2469001
Blue 12-80V: 3690008

Strobe light, cab mount
Amber 12-48V: 3116250001
Red 12-48V: 3069026
Blue 12-48V: 3069014

LED Amber turn lamp
12V: 3111000022

Amber turn lamp 2" LED
white background
12V : 3111330003

DC-DC Converter, 300W
24-80V: 3124000005
Connector : 3119000074
3119000075

Turn signal switch: 246050

12V Fan 3113000018

Tail/Brake/Turn/Back up light LED:
3111000055
Kit Connector:
3119000071K

Pedestal lamp – 9W LED
12-24V: 3111000045
Support: 2392000009

Front Headlight/Turn signal LED 12/48V :
3111000061
Connector : 3119000071K
Rear light/Turn signal/Back up LED 12/48V:
3111000062
Connector: 3119000071K

Dome light LED:
3111000066

Wiper arm 2800000001
14" Blade: 2800000002
18" Blade: 2800000003

Pantograph arm: 246233A
Pantograph blade: 246233

Horn button VIP:
2208224002

Horn
12V: 246003
24V: 246013

Back-up alarm or
Motion beeper
12-48V : 3100000001
72-80V : 3105720001

12-48V Adjustable PRECO:
3100000004

Brake switch : 3109000043

Cab heater
12V: 3103300001
36V: 3669008
48V: 4869020

Wiper motor
12V: 3113000001
24V: 486211

Rocker switch Headlight:
3109922020
Replace 1269004

Rocker switch Dome light:
3109922022

Rocker switch Wiper:
3109922031

Rocker switch On/Off:
3109922040

Rocker switch Horn:
3109922130

Rocker switch Forward/Reverse:
3109923010
Replace 266211

Rocker switch Heater:
3109923032

Rocker switch Inching:
3109923111