

MC-480 LITHIUM POWERED



<p>OPERATOR AND MAINTENANCE MANUAL SPARE PARTS LISTS INCLUDED</p>
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SERIAL NUMBER: 1228959 & 1228962

Printed in Canada



**3-YEAR LIMITED WARRANTY ON AC-POWERED PRODUCTS, STOCK CHASERS AND TRAILERS
2-YEAR LIMITED WARRANTY ON DC-POWERED 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, the part return 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, 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, high 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, chargers, charging system components, wheels (which may be covered by warranties from manufacturers)
- Internal combustion engines (which may be covered by warranties from manufacturers)
- Wearable parts (lights, bulbs, diodes & fuses, filters & spark plugs, lubricants, tires, wheel bearings, seats, brake pads and shoes)
- Wear and tear resulting from normal use
- Adjustments, including field set-up
- Damage or defects caused by using non-Motrec parts, components or accessories
- Shipping damage, be it caused during travel or loading / unloading procedures
- Shipping, customs and/or brokerage fees for warranty parts
- Towing fees, travel fees for technical support and repair, delays or time spent accessing a customer's facility, for locating a vehicle, for loading/unloading or for vehicle movement to a work area or to the dealership
- Damages that are the result of an impact, improper or excessive forces applied or improper use of the vehicle

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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 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.
- 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.

LITHIUM POWERED VEHICLE UTILISATION AND DRIVING

Lithium powered vehicle utilization and driving is the same as lead-acid powered vehicle. Regenerative braking efficiency will be reduced when battery SOC is 100 %. Continuous fault display on the vehicle screen is not normal. MOTREC technical support should be contacted when this occurs.

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 handlebar.

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.

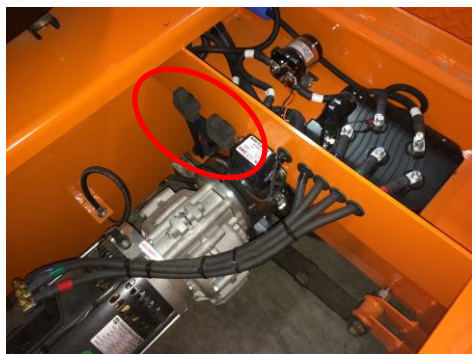
ELECTROMAGNETIC BRAKE

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.

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

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.

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.

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.

! CAUTION!

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

Dashboard security warning label:
5100000002



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

BATTERY DISCONNECT

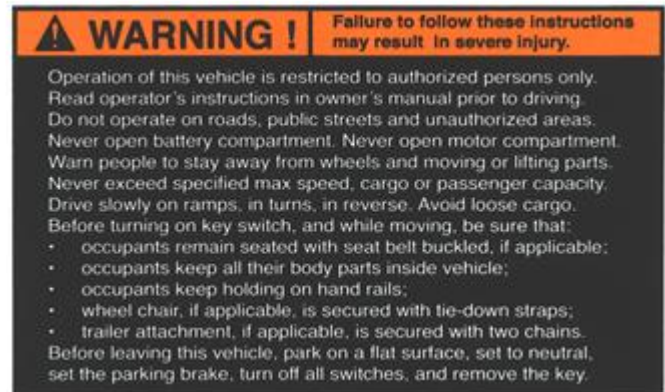
PULL 

7248

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



General security warning label:
5100000001



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 AND LITHIUM BATTERY**

! WARNING!

Maintenance operations must be made by properly trained service technicians.

- Keep clear from moving parts such as tires, sheaves and motor.
- 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. Don't connect the charger.

DESCRIPTION	PERIOD	ESTIMATED TIME (MINUTES)				CHECK
		SHIFT	500 h	1000 h	2000 h	
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 s contact with the floor)		1				
Check warning decal & marking			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				

DESCRIPTION	PERIOD	ESTIMATED TIME (MINUTES)				CHECK
		SHIFT	500 h	1000 h	2000 h	
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	

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.

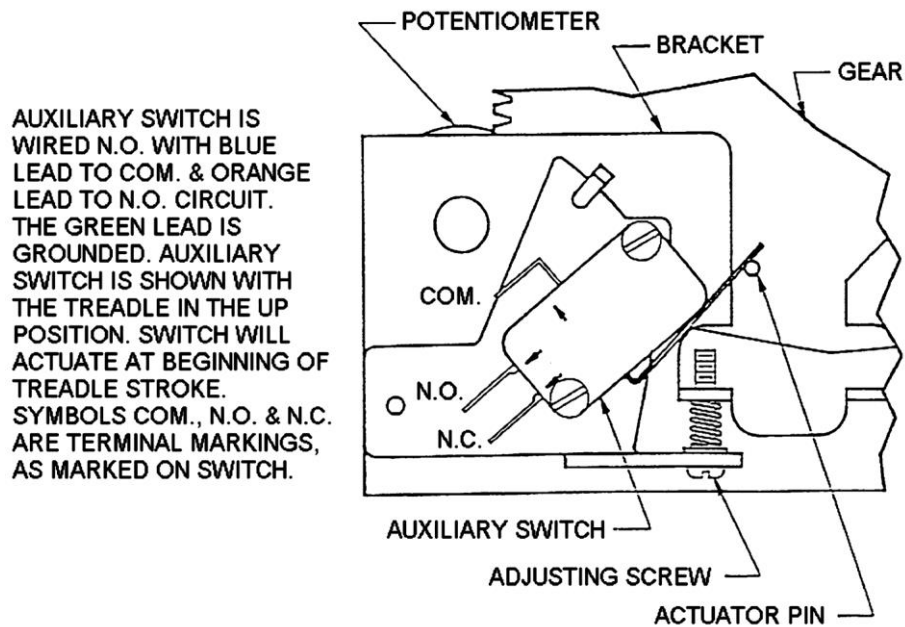
MICRO-SWITCH

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.



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 $3^\circ \pm 1^\circ$ (i.e. between 2° to 4°) 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 1/4-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

- The vehicle is powered by lithium type batteries (Nickel Cobalt Manganese cell chemistry).
- Lithium batteries are maintenance free.
- Final user and reseller shall not attempt to monitor battery voltage and current with external device.
- Final user and reseller shall not attempt to open or modify the battery enclosure.

BATTERY CHARGER

! WARNING!

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

Lithium batteries charging:

- The batteries charging should be made with the supplied charging station (MOTREC # 3102000013).
- The vehicle is using a SAE J1772 (J plug) for charging the batteries.
- Charging should be monitored by the display on the charging station
- Battery charging is occurring when the charging station display is showing a current value higher than zero.
- The battery charging process begin approximately 30 s after the charging connector is plug in- to the vehicle charging port.
- The vehicle display screen also shows the charging indicator light during battery charging.

Charging station installation:

- The supplied charging station (MOTREC # 3102000013) shall be installed as showed by Global Industries user guide. See EV ONE user guide.
- The charging station use a NEMA 14-50P plug type.
- The charging station shall be powered with 240 VAC.
- Rated current is 40 A.

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.

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.

ACCESSORIES NOT WORKING

- Check the fuses on the batteries and the DC/DC converter.
- Check voltage across DC/DC converter output terminals; if not 12 V, replace the converter.
- Depress the accessory switch, check voltage across accessory terminals. If not 12 V, replace the switch. If 12 V, replace the accessory.

FORWARD ONLY

Check the reverse signal input on the controller.

REVERSE ONLY

Check the forward signal input on the controller.

TRAVEL AT REDUCED 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 can create current leaks and cause a PMC malfunction.

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.

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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 <i>ShutdownMotor;</i> <i>ShutdownMainContactor;</i> <i>ShutdownEMBrake;</i> <i>ShutdownThrottle;</i> <i>FullBrake;</i> <i>ShutdownPump.</i>	<ol style="list-style-type: none"> 1. External short of phase U,V, or W motor connections. 2. Motor parameters are mis-tuned. 3. Controller defective. 	<i>Set:</i> Phase current exceeded the current measurement limit. <i>Clear:</i> Cycle KSI.
13	Current Sensor Fault <i>ShutdownMotor;</i> <i>ShutdownMainContactor;</i> <i>ShutdownEMBrake;</i> <i>ShutdownThrottle;</i> <i>FullBrake;</i> <i>ShutdownPump.</i>	<ol style="list-style-type: none"> 1. Leakage to vehicle frame from phase U, V, or W (short in motor stator). 2. Controller defective. 	<i>Set:</i> Controller current sensors have invalid offset reading. <i>Clear:</i> Cycle KSI.
14	Precharge Failed <i>ShutdownMotor;</i> <i>ShutdownMainContactor;</i> <i>ShutdownEMBrake;</i> <i>ShutdownThrottle;</i> <i>FullBrake;</i> <i>ShutdownPump.</i>	<ol style="list-style-type: none"> 2. External load on capacitor bank (B+ connection terminal) that prevents the capacitor bank from charging. 1. See Monitor menu » Battery: Capacitor Voltage. 	<i>Set:</i> Precharge failed to charge the capacitor bank to the KSI voltage. <i>Clear:</i> Cycle Interlock input or use VCL function <i>Precharge()</i> .
15	Controller Severe Undertemp <i>ShutdownMotor;</i> <i>ShutdownMainContactor;</i> <i>ShutdownEMBrake;</i> <i>ShutdownThrottle;</i> <i>FullBrake;</i> <i>ShutdownPump.</i>	<ol style="list-style-type: none"> 1. See Monitor menu » Controller: Temperature. 2. Controller is operating in an extreme environment. 	<i>Set:</i> Heatsink temperature below -40°C. <i>Clear:</i> Bring heatsink temperature above -40°C, and cycle interlock or KSI.
16	Controller Severe Overtemp <i>ShutdownMotor;</i> <i>ShutdownMainContactor;</i> <i>ShutdownEMBrake;</i> <i>ShutdownThrottle;</i> <i>FullBrake;</i> <i>ShutdownPump.</i>	<ol style="list-style-type: none"> 1. See Monitor menu » Controller: Temperature. 2. Controller is operating in an extreme environment. 3. Excessive load on vehicle. 4. Improper mounting of controller. 	<i>Set:</i> Heatsink temperature above +95°C. <i>Clear:</i> Bring heatsink temperature below +95°C, and cycle interlock or KSI.
17	Severe Undervoltage <i>Reduced drive torque.</i>	<ol style="list-style-type: none"> 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. 	<i>Set:</i> Capacitor bank voltage dropped below the Severe Undervoltage limit (see page 55) with FET bridge enabled. <i>Clear:</i> 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 <i>ShutdownMotor; ShutdownMainContactor; ShutdownEMBrake; ShutdownThrottle; FullBrake; ShutdownPump.</i>	<ol style="list-style-type: none"> 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. 	<p><i>Set:</i> Capacitor bank voltage exceeded the Severe Overvoltage limit (see page 55) with FET bridge enabled.</p> <p><i>Clear:</i> Bring capacitor voltage below Severe Overvoltage limit, and then cycle KSI.</p>
22	Controller Overtemp Cutback <i>Reduced drive and brake torque.</i>	<ol style="list-style-type: none"> 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. 	<p><i>Set:</i> Heatsink temperature exceeded 85°C.</p> <p><i>Clear:</i> Bring heatsink temperature below 85°C.</p>
23	Undervoltage Cutback <i>Reduced drive torque.</i>	<ol style="list-style-type: none"> 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. 	<p><i>Set:</i> Capacitor bank voltage dropped below the Undervoltage limit (see page 55) with the FET bridge enabled.</p> <p><i>Clear:</i> Bring capacitor voltage above the Undervoltage limit.</p>
24	Overvoltage Cutback <i>Reduced brake torque.</i>	<ol style="list-style-type: none"> 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. 	<p><i>Set:</i> Capacitor bank voltage exceeded the Overvoltage limit (see page 55) with the FET bridge enabled.</p> <p><i>Clear:</i> Bring capacitor voltage below the Overvoltage limit.</p>
25	+5V Supply Failure <i>None, unless a fault action is programmed in VCL.</i>	<ol style="list-style-type: none"> 1. External load impedance on the +5V supply (pin 26) is too low. 2. See Monitor menu » outputs: 5 Volts and Ext Supply Current. 	<p><i>Set:</i> +5V supply (pin 26) outside the +5V±10% range.</p> <p><i>Clear:</i> Bring voltage within range.</p>
26	Digital Out 6 Overcurrent <i>Digital Output 6 driver will not turn on.</i>	<ol style="list-style-type: none"> 1. External load impedance on Digital Output 6 driver (pin 19) is too low. 	<p><i>Set:</i> Digital Output 6 (pin 19) current exceeded 15 mA.</p> <p><i>Clear:</i> Remedy the overcurrent cause and use the VCL function <i>Set_DigOut()</i> to turn the driver on again.</p>

Table 5 TROUBLESHOOTING CHART, continued

CODE	PROGRAMMER LCD DISPLAY EFFECT OF FAULT	POSSIBLE CAUSE	SET/CLEAR CONDITIONS
27	Digital Out 7 Overcurrent <i>Digital Output 7 driver will not turn on.</i>	1. External load impedance on Digital Output 7 driver (pin 20) is too low.	<i>Set:</i> Digital Output 7 (pin 20) current exceeded 15 mA. <i>Clear:</i> Remedy the overcurrent cause and use the VCL function <i>Set_DigOut()</i> to turn the driver on again.
28	Motor Temp Hot Cutback <i>Reduced drive torque.</i>	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.	<i>Set:</i> Motor temperature is at or above the Temperature Hot parameter setting. <i>Clear:</i> Bring the motor temperature within range.
29	Motor Temp Sensor Fault <i>MaxSpeed reduced (LOS, Limited Operating Strategy), and motor temperature cutback disabled.</i>	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.	<i>Set:</i> Motor thermistor input (pin 8) is at the voltage rail (0 or 10V). <i>Clear:</i> Bring the motor thermistor input voltage within range.
31	Coil1 Driver Open/Short <i>ShutdownDriver1.</i>	1. Open or short on driver load. 2. Dirty connector pins. 3. Bad crimps or faulty wiring.	<i>Set:</i> Driver 1 (pin 6) is either open or shorted. This fault can be set only when Main Enable = Off. <i>Clear:</i> Correct open or short, and cycle driver.
31	Main Open/Short <i>ShutdownMotor; ShutdownMainContactor; ShutdownEMBrake; ShutdownThrottle; FullBrake; ShutdownPump.</i>	1. Open or short on driver load. 2. Dirty connector pins. 3. Bad crimps or faulty wiring.	<i>Set:</i> Main contactor driver (pin 6) is either open or shorted. This fault can be set only when Main Enable = On. <i>Clear:</i> Correct open or short, and cycle driver.
32	Coil2 Driver Open/Short <i>ShutdownDriver2.</i>	1. Open or short on driver load. 2. Dirty connector pins. 3. Bad crimps or faulty wiring.	<i>Set:</i> Driver 2 (pin 5) is either open or shorted. This fault can be set only when EM Brake Type = 0. <i>Clear:</i> Correct open or short, and cycle driver.
32	EMBrake Open/Short <i>ShutdownEMBrake; ShutdownThrottle; FullBrake.</i>	1. Open or short on driver load. 2. Dirty connector pins. 3. Bad crimps or faulty wiring.	<i>Set:</i> Electromagnetic brake driver (pin 5) is either open or shorted. This fault can be set only when EM Brake Type >0. <i>Clear:</i> Correct open or short, and cycle driver.
33	Coil3 Driver Open/Short <i>ShutdownDriver3.</i>	1. Open or short on driver load. 2. Dirty connector pins. 3. Bad crimps or faulty wiring.	<i>Set:</i> Driver 3 (pin 4) is either open or shorted. <i>Clear:</i> Correct open or short, and cycle driver.
34	Coil4 Driver Open/Short <i>ShutdownDriver4.</i>	1. Open or short on driver load. 2. Dirty connector pins. 3. Bad crimps or faulty wiring.	<i>Set:</i> Driver 4 (pin 3) is either open or shorted. <i>Clear:</i> 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 <i>ShutdownPD.</i>	<ol style="list-style-type: none"> 1. Open or short on driver load. 2. Dirty connector pins. 3. Bad crimps or faulty wiring. 	<i>Set:</i> Proportional driver (pin 2) is either open or shorted. <i>Clear:</i> Correct open or short, and cycle driver.
36	Encoder Fault <i>ShutdownEMBrake.</i>	<ol style="list-style-type: none"> 1. Motor encoder failure. 2. Bad crimps or faulty wiring. 3. See Monitor menu » Motor: Motor RPM. 	<i>Set:</i> Motor encoder phase failure detected. <i>Clear:</i> Cycle KSI.
37	Motor Open <i>ShutdownMotor;</i> <i>ShutdownMainContactor;</i> <i>ShutdownEMBrake;</i> <i>ShutdownThrottle;</i> <i>FullBrake;</i> <i>ShutdownPump.</i>	<ol style="list-style-type: none"> 1. Motor phase is open. 2. Bad crimps or faulty wiring. 	<i>Set:</i> Motor phase U, V, or W detected open. <i>Clear:</i> Cycle KSI.
38	Main Contactor Welded <i>ShutdownMotor;</i> <i>ShutdownMainContactor;</i> <i>ShutdownEMBrake;</i> <i>ShutdownThrottle;</i> <i>FullBrake;</i> <i>ShutdownPump.</i>	<ol style="list-style-type: none"> 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). 	<i>Set:</i> 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. <i>Clear:</i> Cycle KSI
39	Main Contactor Did Not Close <i>ShutdownMotor;</i> <i>ShutdownMainContactor;</i> <i>ShutdownEMBrake;</i> <i>ShutdownThrottle;</i> <i>FullBrake;</i> <i>ShutdownPump.</i>	<ol style="list-style-type: none"> 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. 	<i>Set:</i> With the main contactor commanded closed, the capacitor bank voltage (B+ connection terminal) did not charge to B+. <i>Clear:</i> Cycle KSI.
41	Throttle Wiper High <i>ShutdownThrottle.</i>	<ol style="list-style-type: none"> 1. See Monitor menu » Inputs: Throttle Pot. 2. Throttle pot wiper voltage too high. 	<i>Set:</i> Throttle pot wiper (pin 16) voltage is higher than the high fault threshold (can be changed with the VCL function <i>Setup_Pot_Faults()</i>). <i>Clear:</i> Bring throttle pot wiper voltage below the fault threshold.
42	Throttle Wiper Low <i>ShutdownThrottle.</i>	<ol style="list-style-type: none"> 1. See Monitor menu » Inputs: Throttle Pot. 2. Throttle pot wiper voltage too low. 	<i>Set:</i> Throttle pot wiper (pin 16) voltage is lower than the low fault threshold (can be changed with the VCL function <i>Setup_Pot_Faults()</i>). <i>Clear:</i> Bring throttle pot wiper voltage above the fault threshold.
43	Pot2 Wiper High <i>FullBrake.</i>	<ol style="list-style-type: none"> 1. See Monitor menu » Inputs: Pot2 Raw. 2. Pot2 wiper voltage too high. 	<i>Set:</i> Pot2 wiper (pin 17) voltage is higher than the high fault threshold (can be changed with the VCL function <i>Setup_Pot_Faults()</i>). <i>Clear:</i> 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 <i>FullBrake.</i>	1. See Monitor menu » Inputs: Pot2 Raw. 2. Pot2 wiper voltage too low.	<i>Set:</i> Pot2 wiper (pin 17) voltage is lower than the low fault threshold (can be changed with the VCL function <i>Setup_Pot_Faults()</i>). <i>Clear:</i> Bring Pot2 wiper voltage above the fault threshold.
45	Pot Low Overcurrent <i>ShutdownThrottle;</i> <i>FullBrake.</i>	1. See Monitor menu » Outputs: Pot Low. 2. Combined pot resistance connected to pot low is too low.	<i>Set:</i> Pot low (pin 18) current exceeds 10mA. <i>Clear:</i> Clear pot low overcurrent condition and cycle KSI.
46	EEPROM Failure <i>ShutdownMotor;</i> <i>ShutdownMainContactor;</i> <i>ShutdownEMBrake;</i> <i>ShutdownThrottle;</i> <i>ShutdownInterlock;</i> <i>ShutdownDriver1;</i> <i>ShutdownDriver2;</i> <i>ShutdownDriver3;</i> <i>ShutdownDriver4;</i> <i>ShutdownPD;</i> <i>FullBrake;</i> <i>ShutdownPump.</i>	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.	<i>Set:</i> Controller operating system tried to write to EEPROM memory and failed. <i>Clear:</i> Download the correct software (OS) and matching parameter default settings into the controller and cycle KSI.
47	HPD/Sequencing Fault <i>ShutdownThrottle.</i>	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.	<i>Set:</i> HPD (High Pedal Disable) or sequencing fault caused by incorrect sequence of KSI, interlock, direction, and throttle inputs. <i>Clear:</i> Reapply inputs in correct sequence.
47	Emer Rev HPD <i>ShutdownThrottle;</i> <i>ShutdownEMBrake.</i>	1. Emergency Reverse operation has concluded, but the throttle, forward and reverse inputs, and interlock have not been returned to neutral.	<i>Set:</i> At the conclusion of Emergency Reverse, the fault was set because various inputs were not returned to neutral. <i>Clear:</i> 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 <i>ShutdownMotor;</i> <i>ShutdownMainContactor;</i> <i>ShutdownEMBrake;</i> <i>ShutdownThrottle;</i> <i>FullBrake;</i> <i>ShutdownPump.</i>	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.	<i>Set:</i> Adjustment of a parameter setting that requires cycling of KSI. <i>Clear:</i> 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.	<i>Set:</i> See OEM documentation. <i>Clear:</i> 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 <i>ShutdownMotor; ShutdownMainContactor; ShutdownEMBrake; ShutdownThrottle; ShutdownInterlock; ShutdownDriver1; ShutdownDriver2; ShutdownDriver3; ShutdownDriver4; ShutdownPD; FullBrake; ShutdownPump.</i>	<ol style="list-style-type: none"> 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. 	<p><i>Set:</i> Runtime VCL code error condition.</p> <p><i>Clear:</i> Edit VCL application software to fix this error condition; flash the new compiled software and matching parameter defaults; cycle KSI.</p>
69	External Supply Out of Range <i>None, unless a fault action is programmed in VCL.</i>	<ol style="list-style-type: none"> 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. 	<p><i>Set:</i> 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).</p> <p><i>Clear:</i> Bring the external supply current within range.</p>
71	OS General <i>ShutdownMotor; ShutdownMainContactor; ShutdownEMBrake; ShutdownThrottle; ShutdownInterlock; ShutdownDriver1; ShutdownDriver2; ShutdownDriver3; ShutdownDriver4; ShutdownPD; FullBrake; ShutdownPump.</i>	<ol style="list-style-type: none"> 1. Internal controller fault. 	<p><i>Set:</i> Internal controller fault detected.</p> <p><i>Clear:</i> Cycle KSI.</p>
72	PDO Timeout <i>ShutdownInterlock; CAN NMT State set to Pre-operational.</i>	<ol style="list-style-type: none"> 1. Time between CAN PDO messages received exceeded the PDO Timeout Period. 	<p><i>Set:</i> Time between CAN PDO messages received exceeded the PDO Timeout Period.</p> <p><i>Clear:</i> Cycle KSI or receive CAN NMT message.</p>
73	Stall Detected <i>ShutdownEMBrake; Control Mode changed to LOS (Limited Operating Strategy).</i>	<ol style="list-style-type: none"> 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. 	<p><i>Set:</i> No motor encoder movement detected.</p> <p><i>Clear:</i> Either cycle KSI, or detect valid motor encoder signals while operating in LOS mode and return Throttle Command = 0 and Motor RPM = 0.</p>

Table 5 TROUBLESHOOTING CHART, continued

CODE	PROGRAMMER LCD DISPLAY EFFECT OF FAULT	POSSIBLE CAUSE	SET/CLEAR CONDITIONS
94	Emer Rev Timeout <i>ShutdownEMBrake;</i> <i>ShutdownThrottle.</i>	<ol style="list-style-type: none"> 1. Emergency Reverse was activated and concluded because the EMR Timeout timer has expired. 2. The emergency reverse input is stuck On. 	<i>Set:</i> Emergency Reverse was activated and ran until the EMR Timeout timer expired. <i>Clear:</i> Turn the emergency reverse input Off.
98	Illegal Model Number <i>ShutdownMotor;</i> <i>ShutdownMainContactor;</i> <i>ShutdownEMBrake;</i> <i>ShutdownThrottle;</i> <i>FullBrake;</i> <i>ShutdownPump.</i>	<ol style="list-style-type: none"> 1. Model_Number variable contains illegal value (not 1234, 1236, 1238, or 1298). 2. Software and hardware do not match. 3. Controller defective. 	<i>Set:</i> 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. <i>Clear:</i> 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 <i>ShutdownMotor;</i> <i>ShutdownMainContactor;</i> <i>ShutdownEMBrake;</i> <i>ShutdownThrottle;</i> <i>FullBrake;</i> <i>ShutdownPump.</i>	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.	<i>Set:</i> Motor characterization failed during the motor characterization process. <i>Clear:</i> Correct fault; cycle KSI.
89	Motor Type Fault <i>ShutdownMotor;</i> <i>ShutdownMainContactor;</i> <i>ShutdownEMBrake;</i> <i>ShutdownThrottle;</i> <i>FullBrake;</i> <i>ShutdownPump.</i>	1. The Motor_Type parameter value is out of range.	<i>Set:</i> Motor_Type parameter is set to an illegal value. <i>Clear:</i> Set Motor_Type to correct value and cycle KSI.
91	VCL/OS Mismatch <i>ShutdownMotor;</i> <i>ShutdownMainContactor;</i> <i>ShutdownEMBrake;</i> <i>ShutdownThrottle;</i> <i>ShutdownInterlock;</i> <i>ShutdownDriver1;</i> <i>ShutdownDriver2;</i> <i>ShutdownDriver3;</i> <i>ShutdownDriver4;</i> <i>ShutdownPD;</i> <i>FullBrake;</i> <i>ShutdownPump.</i>	1. The VCL software in the controller does not match the OS software in the controller.	<i>Set:</i> 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. <i>Clear:</i> Download the correct VCL and OS software into the controller.
92	EM Brake Failed to Set <i>ShutdownEMBrake;</i> <i>ShutdownThrottle.</i>	1. Vehicle movement sensed after the EM Brake has been commanded to set. 2. EM Brake will not hold the motor from rotating.	<i>Set:</i> After the EM Brake was commanded to set and time has elapsed to allow the brake to fully engage, vehicle movement has been sensed. <i>Clear:</i> Activate the throttle.
93	Encoder LOS (Limited Operating Strategy) <i>Enter LOS control mode.</i>	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.	<i>Set:</i> 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. <i>Clear:</i> 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.



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

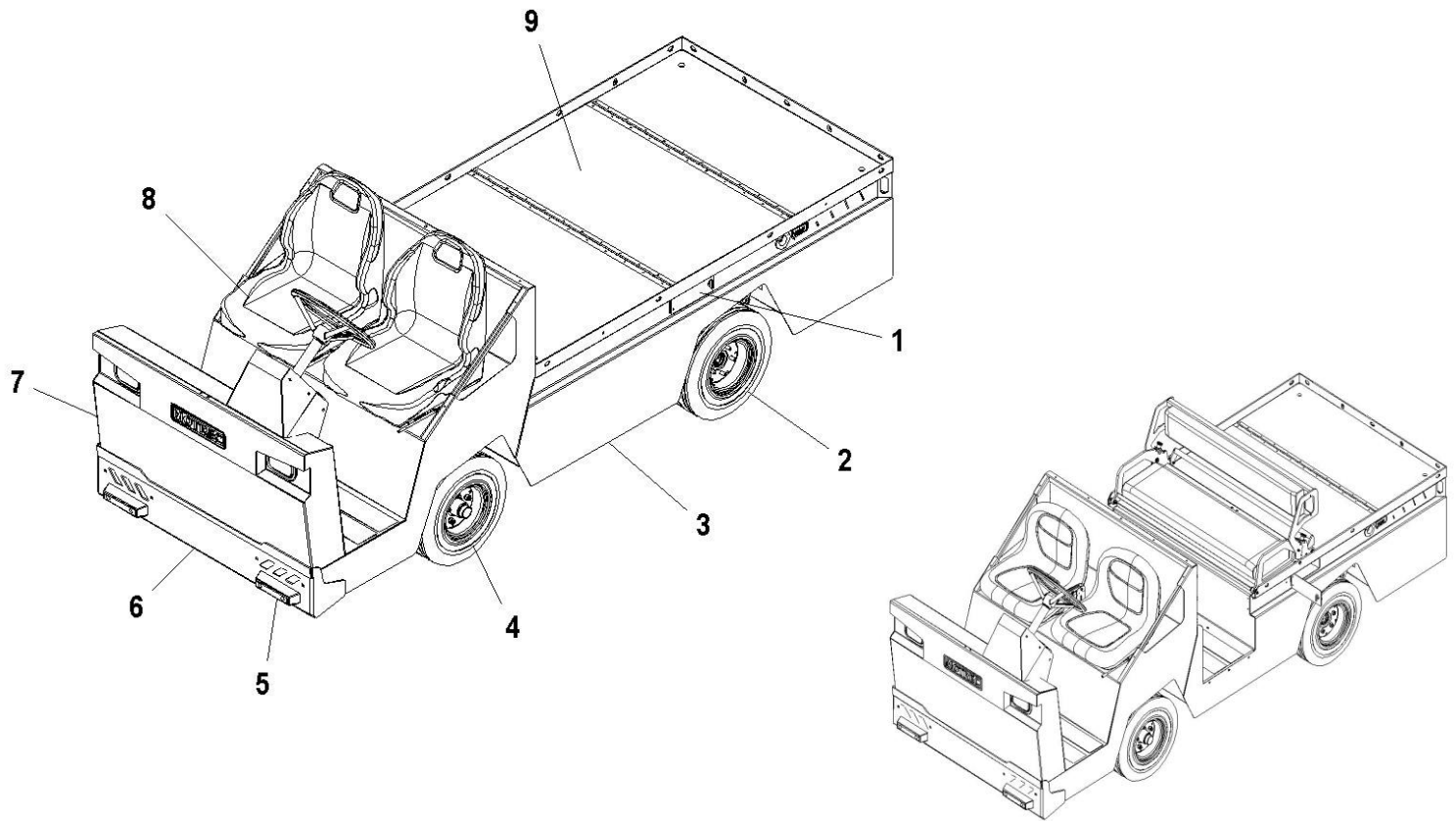
CODE 55 Throttle active before foward

CODE 56 Throttle active before reverse

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

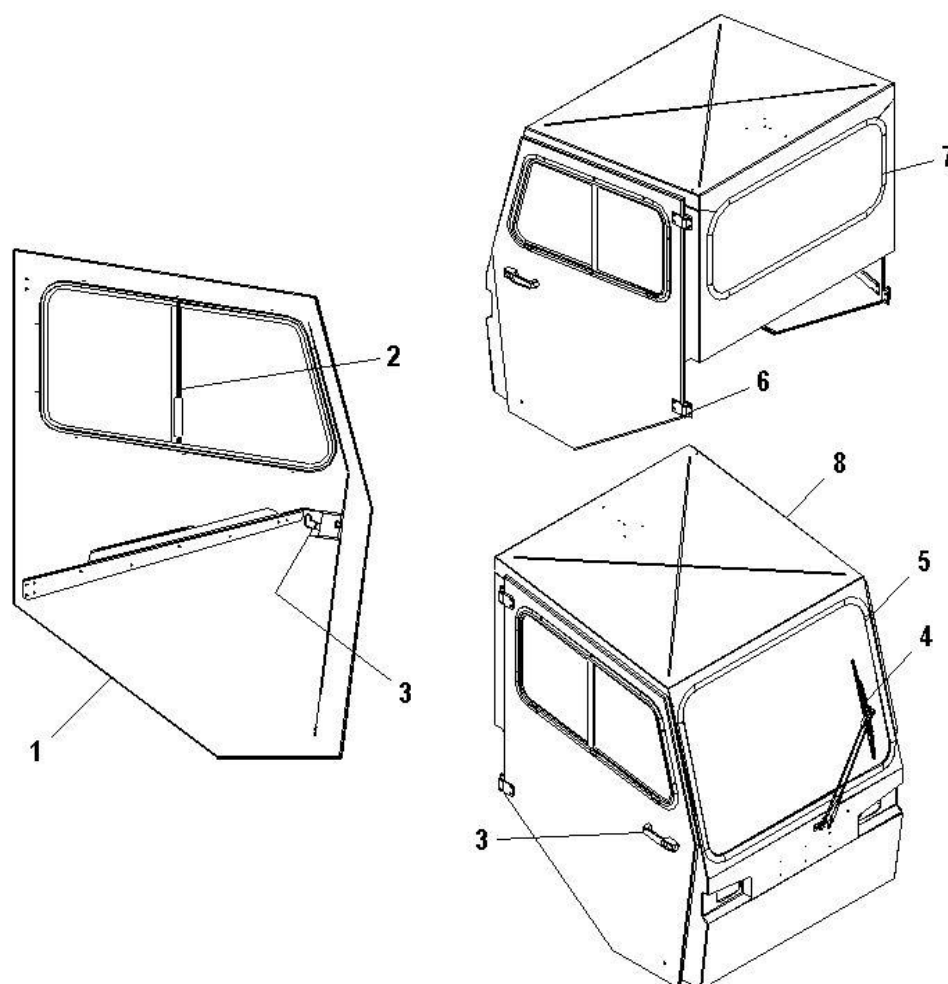
CODE 58 Driver voltage exceeded : Max voltage for driver is 24V

SPARE PARTS

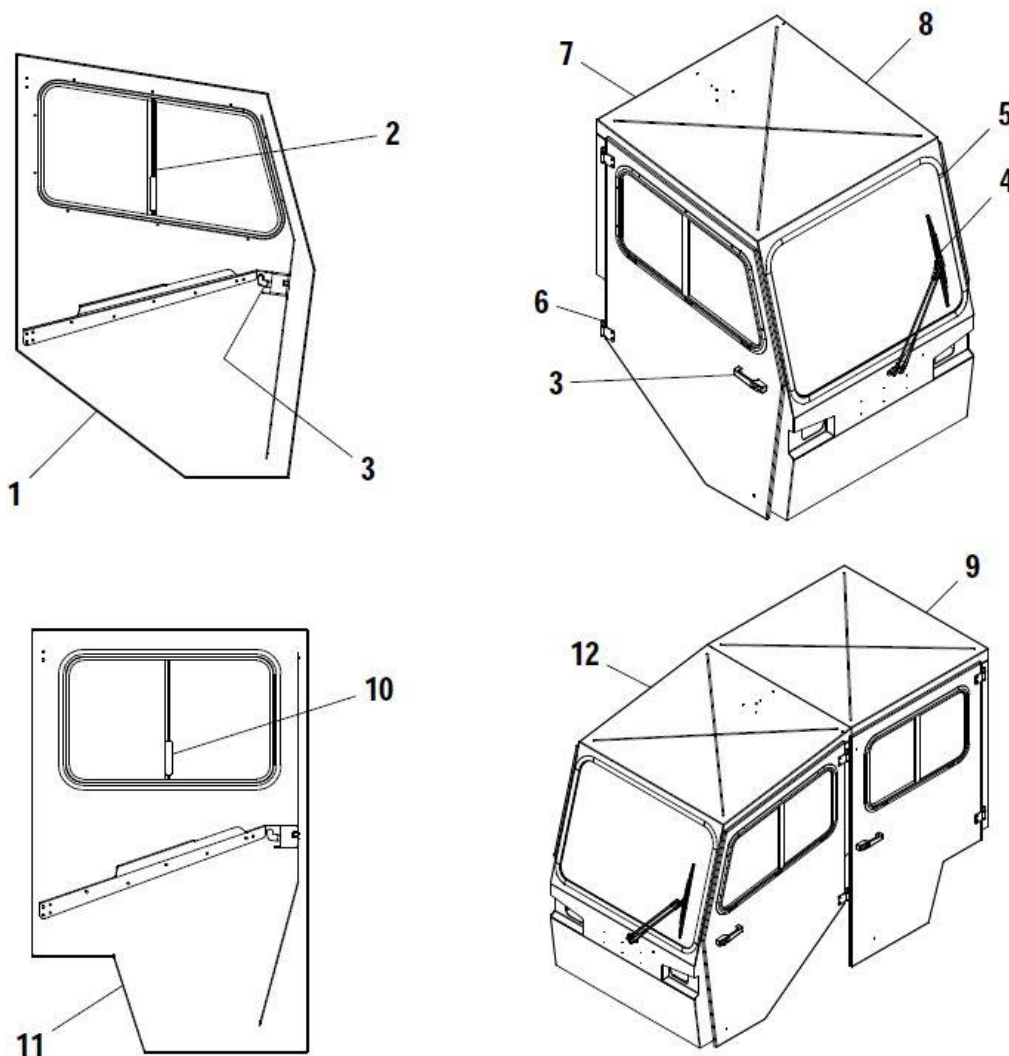
BODY**2 PASSAGERS / 4PASSAGERS**

REF.	PART NO	DESCRIPTION	REF.	PART NO	DESCRIPTION
1	2819480010	CABLE COMP. DOOR	4	-	<u>FRONT WHEEL</u>
	2803000019	HANDLE CAM LATCH		2223360013	500X8 SOLID TYRE ,4.5X5, SPLIT 5-H
2	-	<u>REAR WHEEL ASSY</u>		2223360016	5.7X8 LRD, RIM 5-H
	2223360025	N.M TYRE,570X8 LRC, RIM 5-H		2223360018	RIB TYRE N.M. SOLID, SPLIT 5-H
	2223360034	TUBE TYRE,570X8LRD, SPLIT 5-H	5	2314480007	RUBBER BUMPER
	2223360035	N.M LUG TYRE,3.75X8, SPLIT 5-H	6	2314480006	FRONT STEEL BUMPER
	2223360033	LUG TYRE, 500X8, SPLIT 5-H	7	2370360055	FRONT COWL
	2223360036	LUG TYRE, 5.7X8LRD, SPLIT 5-H	8	2385000009	BUCKET SEAT WT RAILS
3	6104480031	BODY 2PASSAGERS	9	-	<u>PLYWOOD ASSEMBLY</u>
	6104480032	BODY 4PASSAGERS		2332480085	DECK PLYWOOD 44X57 *(4P)
	6104480041	BODY 2P./ROLL-OUT		2332480109	DECK PLYWOOD 44X76 *(2P)
	6104480046	BODY /REAR CHARGING CABLE		2332480115	DECK PLYWOOD 44X95
	6104480047	BODY / REVERSE 6 PASSAGERS		2332480125	DECK PLYWOOD 44X58
				2332480132	DECK PLYWOOD 44X48
				2332480144	DECK PLYWOOD 44X40 *(6P)

2 PASS. CABIN



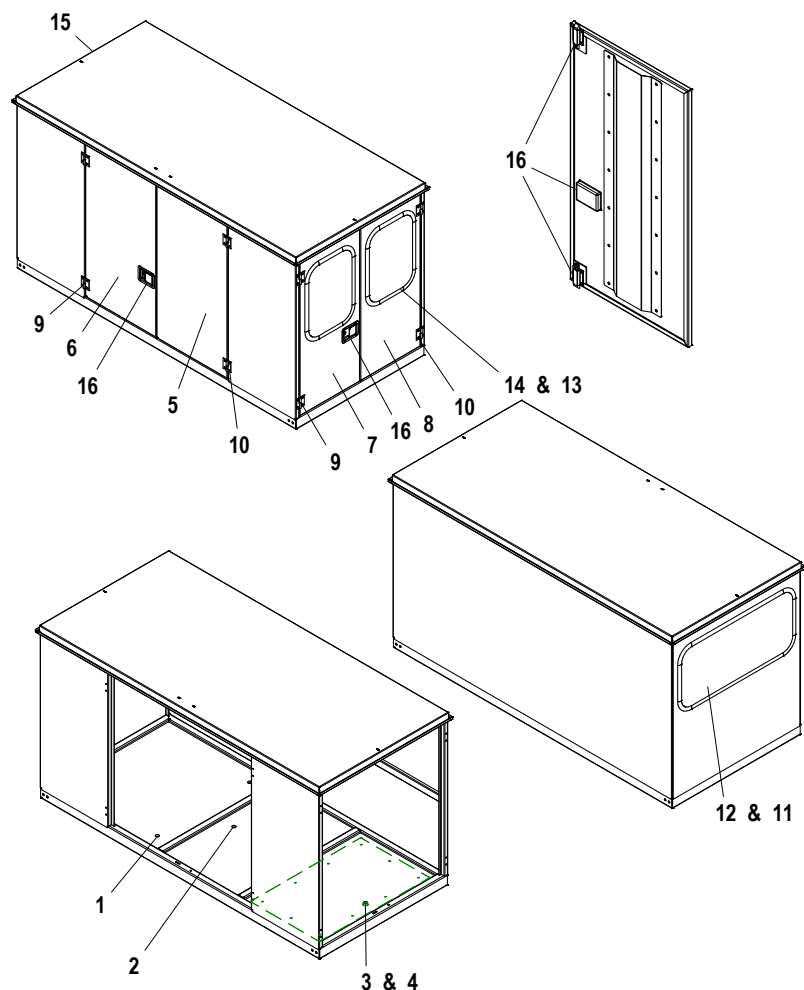
REF	PART NO.	DESCRIPTION
1	2362480040	RIGHT DOOR
	2362480030	LEFT DOOR
2	2803000003	RIGHT WINDOW
	2803000002	LEFT WINDOW
3	2366480000	LOCKING HANDLE
4	2800000009	WIPER (LINKAGE)
	2800000007	WIPER (BLADE)
5	2367480004	WINDSHIELD
6	2365480001	HINGE KIT
7	2367480005	REAR BACK GLASS
8	2361480010	WELDED CAB

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)
	2367480004	WINDSHIELD

REF PART NO. DESCRIPTION

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)

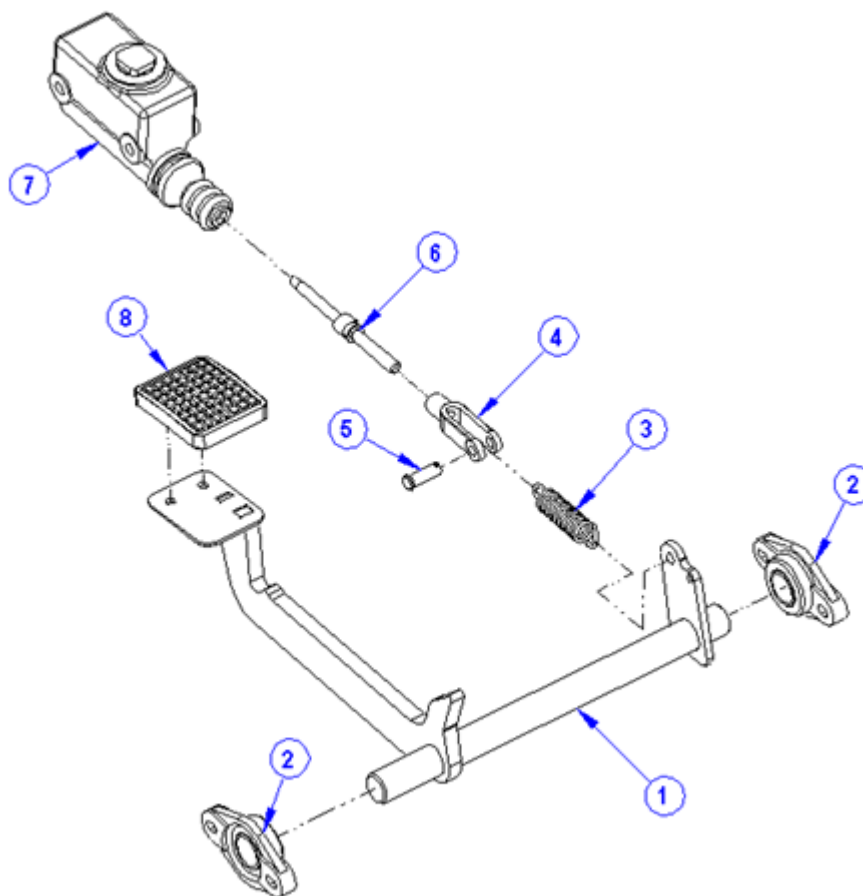
PANNEL BOX***REF PART NO. DESCRIPTION***

1	2332360045	HEXA NOIR 12 MM 35 7/16" X 39 1/4"
2	2332360046	HEXA NOIR 12 MM X 24 7/8" X 39 1/4"
3	2332360047	HEXA NOIR 12 MM X 25 5/16" X 39 1/4 "
4	2339480024	TOLE 22G GALV. 23 3/8" X 37 3/8"
5	2362360126	PORTE DE CÔTÉ, DROITE - COFFRE 45" HT
6	2362360129	PORTE DE CÔTÉ, GAUCHE- COFFRE 45" HT
7	2362360131	PORTE ARRIÈRE, GAUCHE - COFFRE 44 X 96 X 45 HT
8	2362360133	PORTE ARRIÈRE, DROITE - COFFRE 45" HT
9	2365000013	PENTURE - CÔTÉ GAUCHE
10	2365000014	PENTURE - CÔTÉ GAUCHE
11	2367360010	GASKET DE VITRE AVANT

REF PART NO. DESCRIPTION

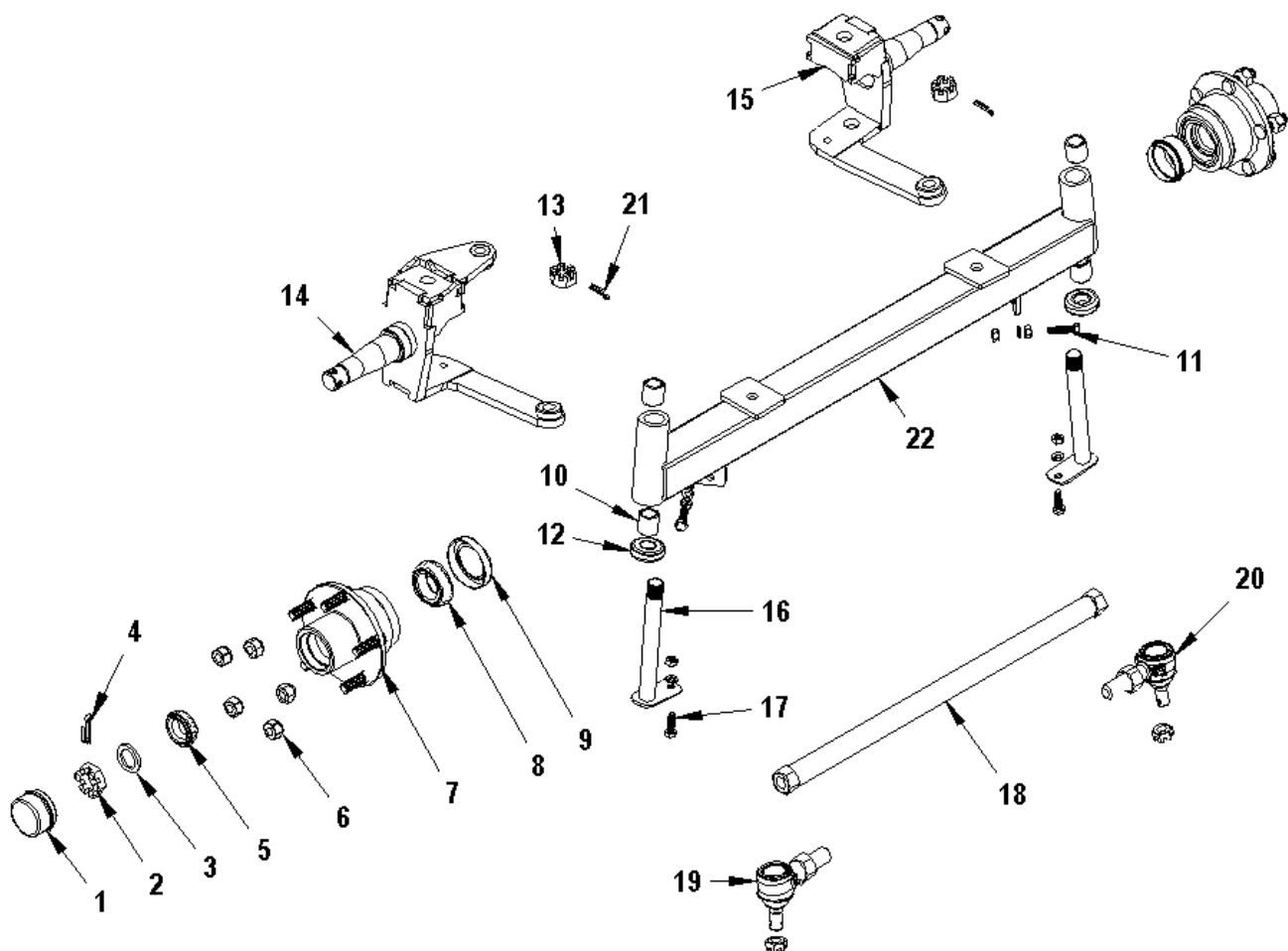
12	2367360010	VITRE 1/4 X 18 X 38 3/8
13	2367360011	GASKET DE VITRE ARRIÈRE
14	2367360011	VITRE 15 3/8" X 21 3/8"
15	2368360142	COFFRE ARRIÈRE (ASSY SOUDÉE)
16	2803000004	POIGNÉE VERTICALE, À PALETTE

BRAKE CONTROLS



<i>REF.</i>	<i>PART NO</i>	<i>DESCRIPTION</i>
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

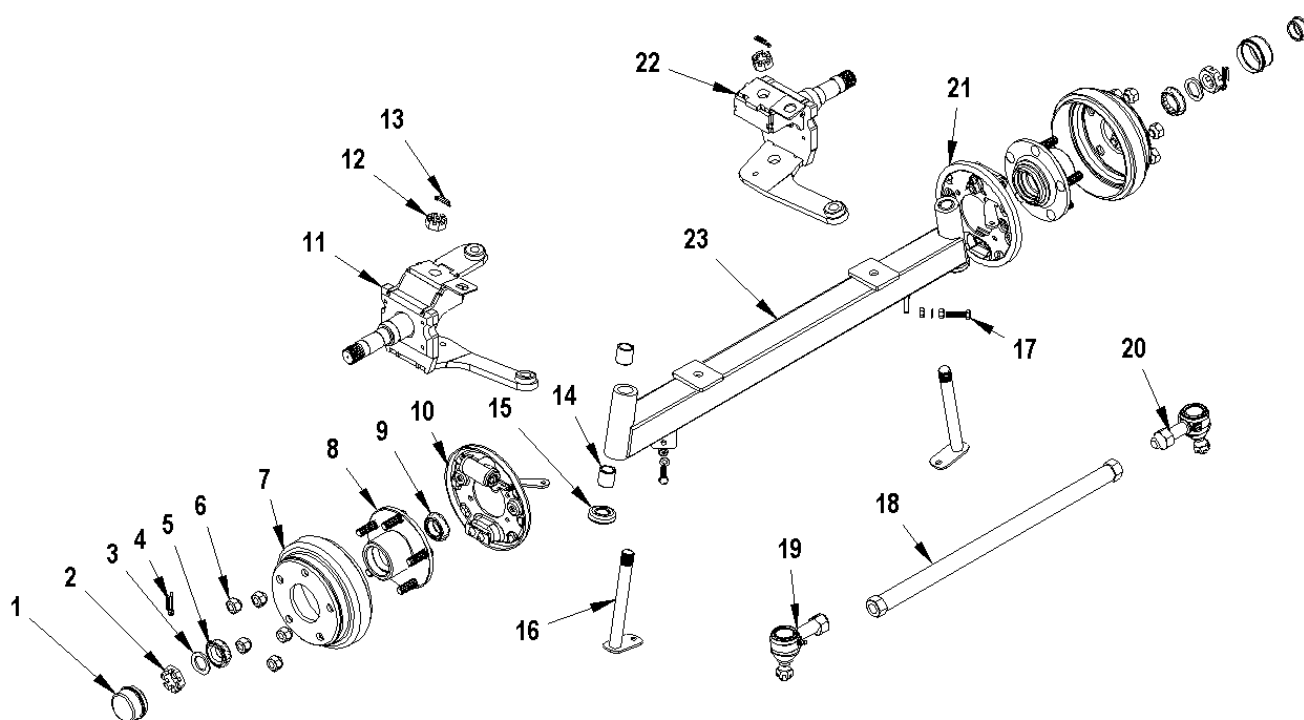
FRONT AXLE (WITHOUT BRAKES)



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 X 1 ½ LG.	-	2910000006	3/4-UNF RIGHT-HAND NUT
11	-	BOLT 5/16 NC X 1 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

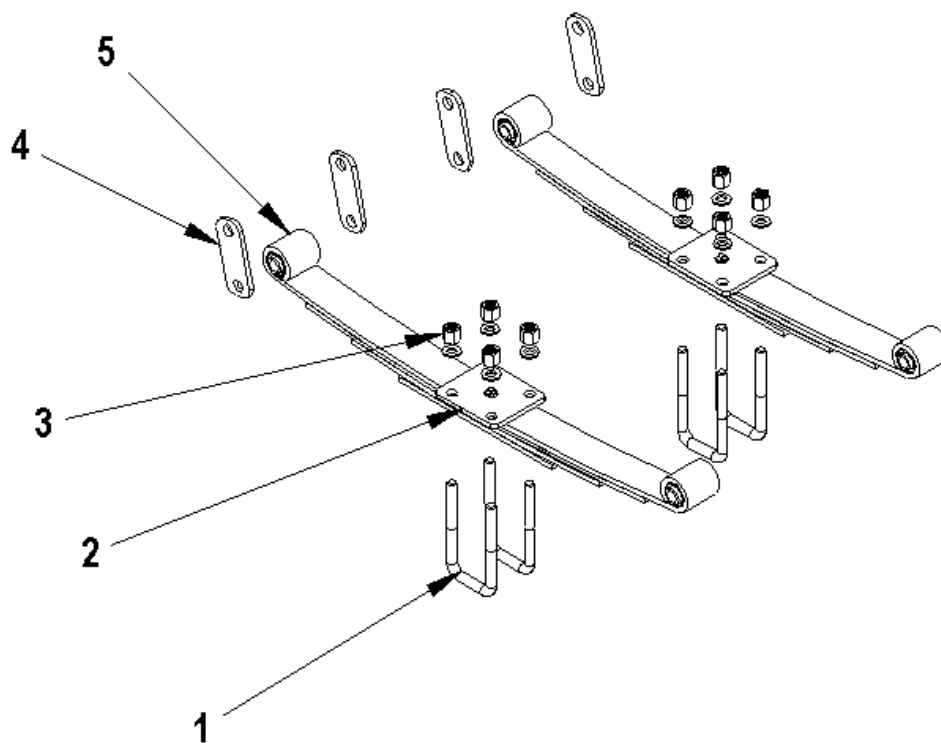
FRONT AXLE

(DRUM BRAKES MODEL)



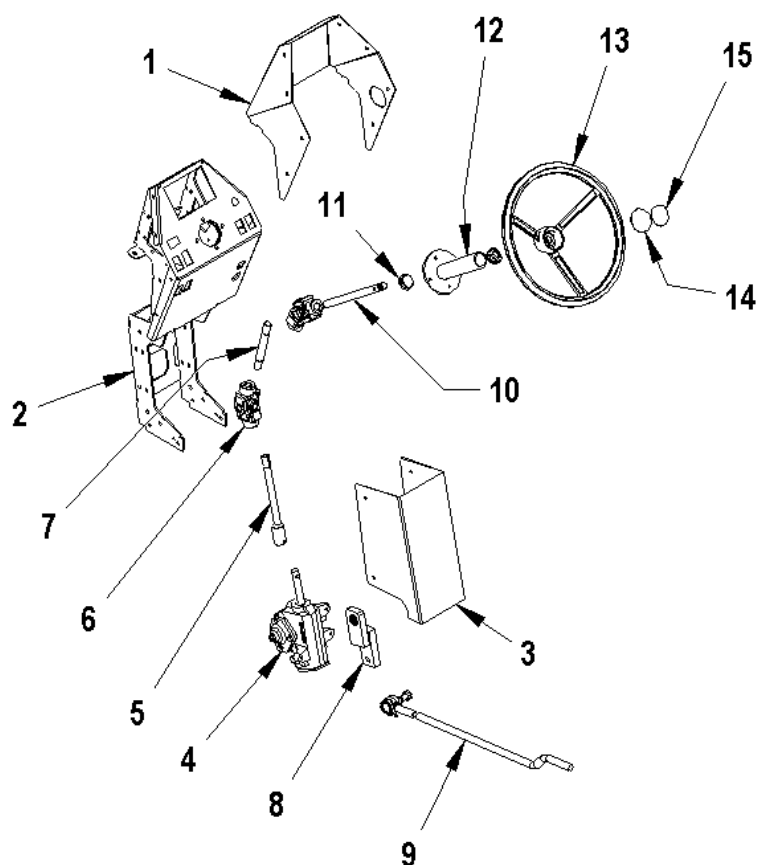
REF.	PART NO.	DESCRIPTION	REF.	PART NO.	DESCRIPTION
1	2229300001	DUST SEAL CAP	14	2100121616-Q2S	PLASTIC BUSHING D.1 ¼ X1 ½ LG.
2	2910300002	CASTELLATED NUT	15	2103250001	THRUST ROLLER BEARING
3	2229300003	SPINDLE WASHER	16	2205250001	KING PIN
4	-	CUTTER PIN 3/16 X 2LG.	17	-	BOLT 5/16 NC X 1
5	2103300005	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



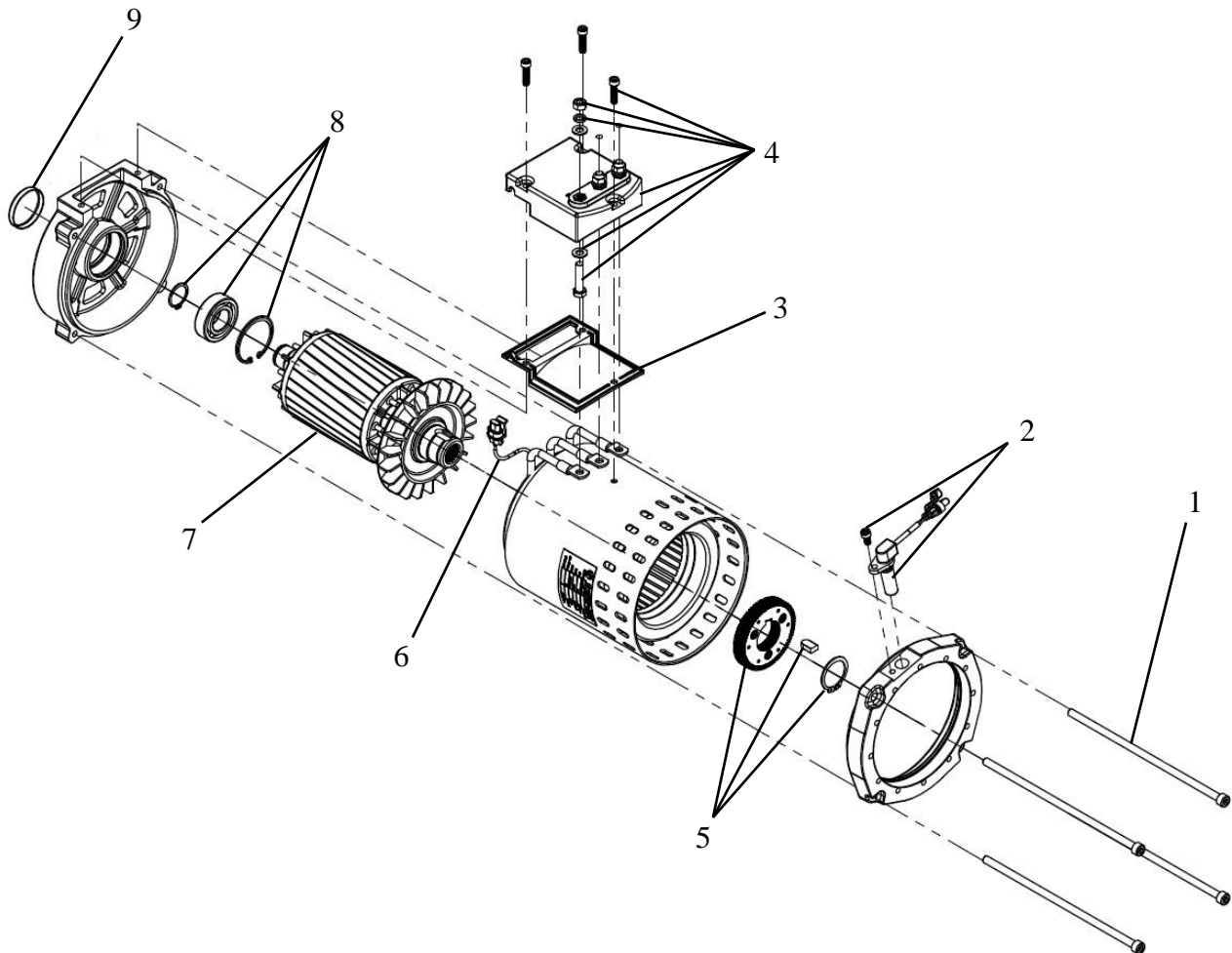
<i>REF.</i>	<i>PART NO.</i>	<i>DESCRIPTION</i>
1	2916000001	SQUARE "U" BOLT
2	2185320001	PLATE, FRONT LEAF SPRING
3	-	NUT ½ NF
	-	LOCK WASHER ½
4	2182320002	SHACKLE LINK
5	2192280001	4-LEAF SPRING

STEERING COLUMN ASSEMBLY



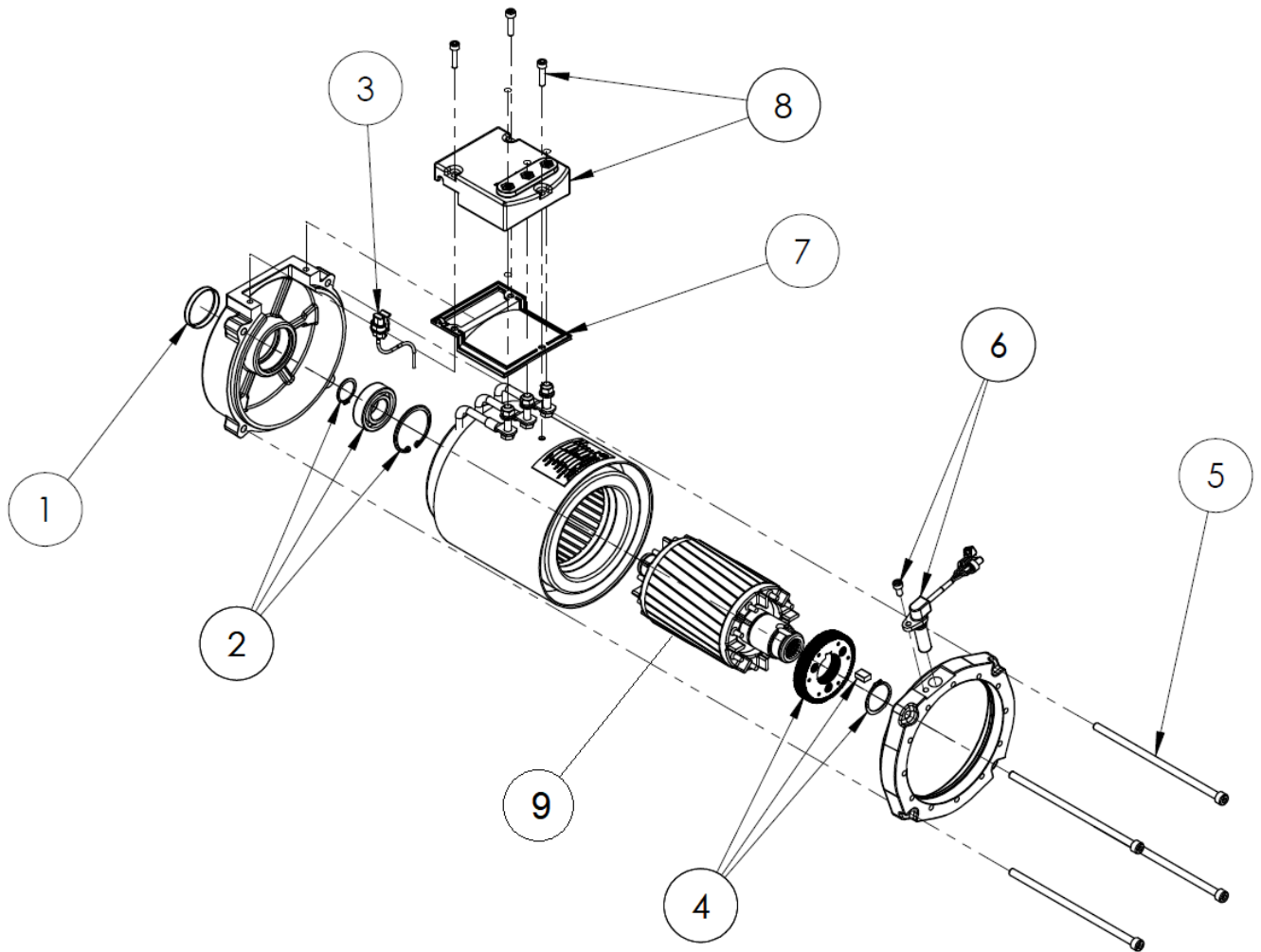
REF.	No. PIÈCE	DESCRIPTION	REF.	No. PIÈCE	DESCRIPTION
1	2206360016	DASHBOARD COVER	10	2209320008	STEERING SHAFT (UP)
2	2206360010	STEERING COLUMN	11	2109012001	PLASTIC BEARING
3	2806360020	KICK PANEL	12	2206360010	STEERING SUPPORT
4	2117250001	STEERING GEARBOX	13	2208240001	STEERING WHEEL
5	2200360002	STEERING SHAFT (BOTTOM)	-	2910000021	JAM NUT 7/8-NF
-	2910000024	SET SCREW 5/16-NC	-	2910000023	SPRING PIN 1/4 X 1 3/4
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



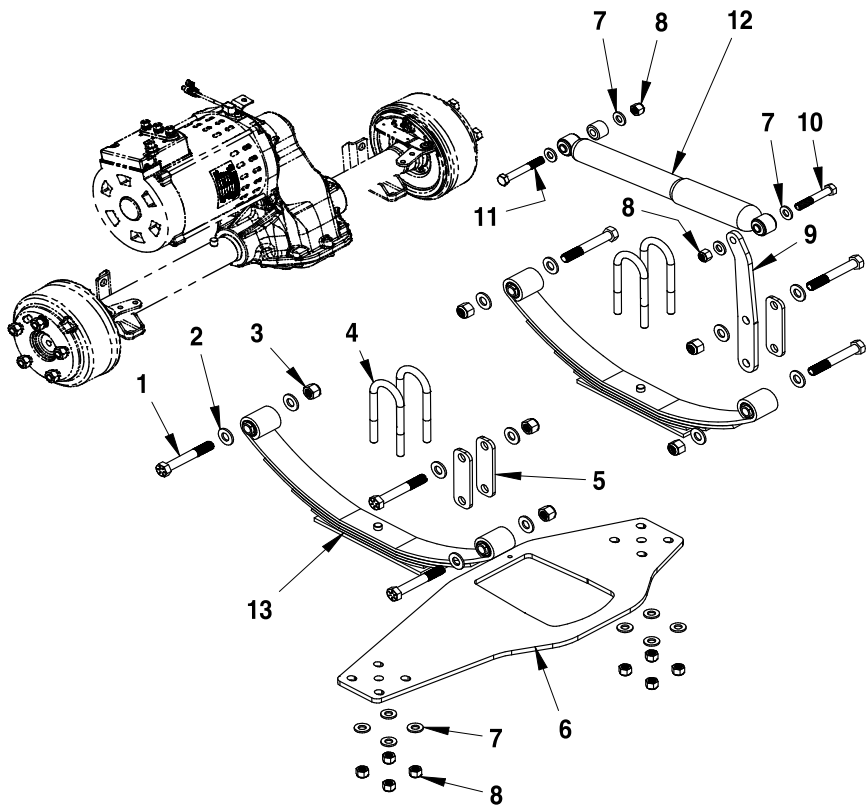
REF.	PART NO.	DESCRIPTION
1	8SD.909.020S	BOLT SERVICE KIT
2	3113248002	SPEED SENSOR SERVICE KIT
3	8SD.371.226	TERMINAL GASKET
4	3112248005SP	TERMINAL BLOCK SERVICE KIT
5	5SD.676.502S	PULSE WHEEL SERVICE KIT
6	H-303S	THERMAL SENSOR SERVICE KIT
7	3112248008	ROTOR
8	100218AS	REAR BEARING SERVICE KIT
9	8SD.310.310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

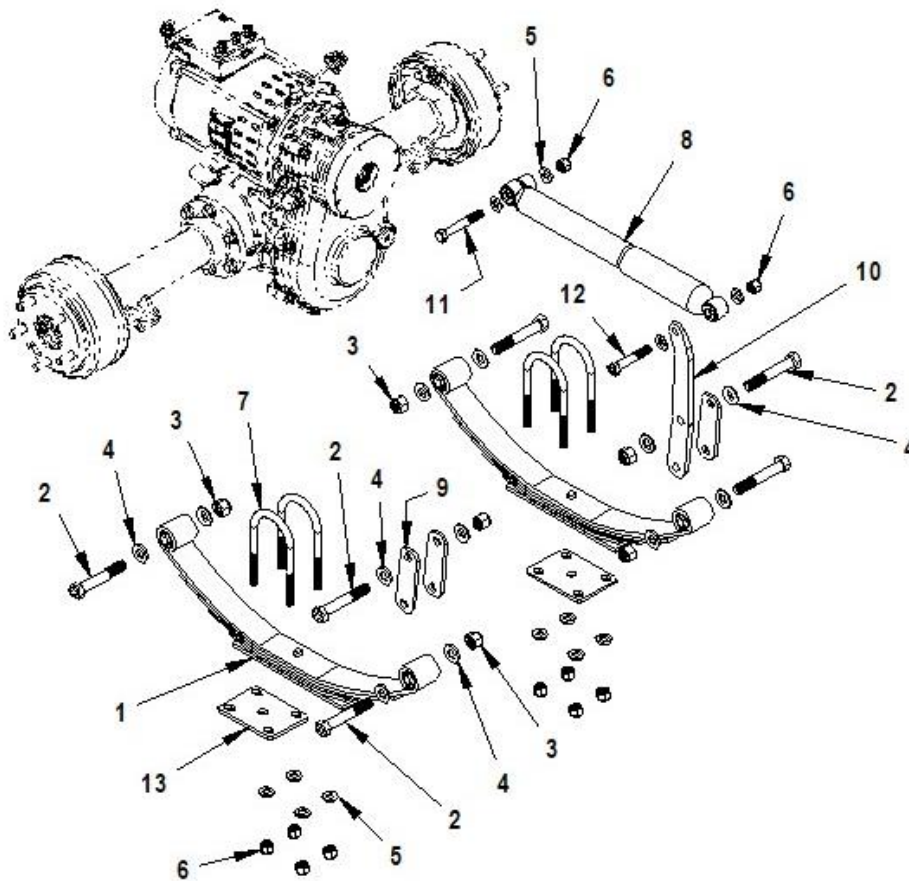
REAR SUSPENSION
(NOMINAL CAPACITY 2000 LB)



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	PROTECTION 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

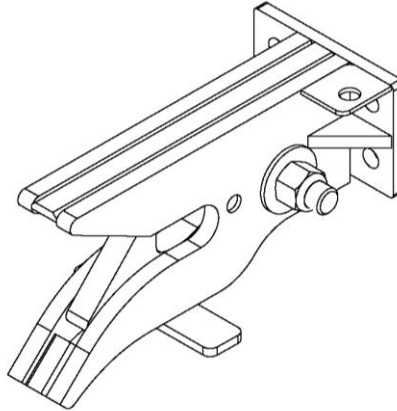
** DIFFERENTIAL CAP. NOMINALE 5000 LBS (2268 KG) ONLY

*** SHOCK ABSORBER (KIT) OPTION ONLY

AUTOMATIC HITCH

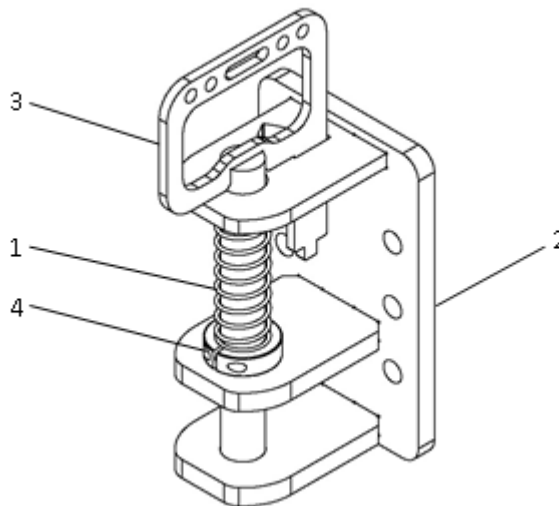
(2320210001)

10,000 lbs Towing Capacity



1" CLEVIS HITCH WITH SPRING

30,000 lbs Towing Capacity

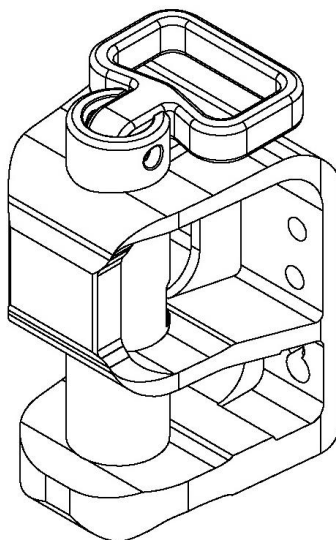


<i>REF.</i>	<i>PART NO.</i>	<i>DESCRIPTION</i>
1	2191000003	SPRING
2	2321000016	HITCH PLATE
3	2329448007	CLEVIS 1" WITH LOCK ASSEMBLY
	2329448009	CLEVIS 1" WITHOUT LOCK ASSEMBLY
4	2915016001	ONE PIECE CLAMP-ON COLLAR

2" CLEVIS HITCH WITH SPRING

(2320280001)

30,000 lbs Towing Capacity



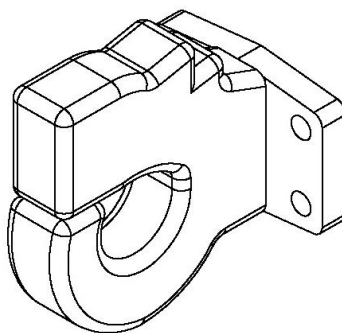
PINTLE HITCH

(260006)

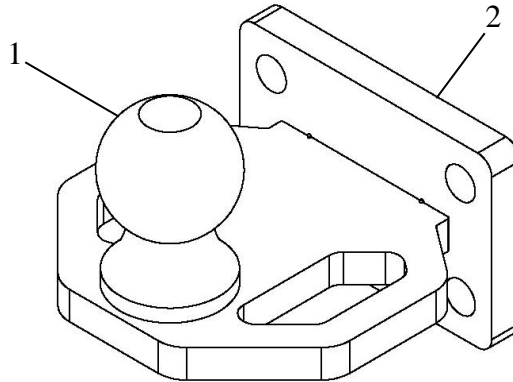
12,000 lbs Towing Capacity

(2320448002)

30,000 lbs Towing Capacity

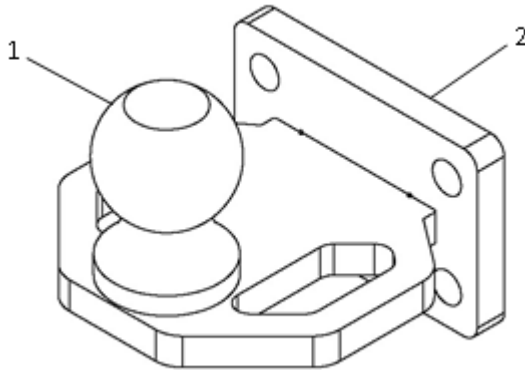


BALL HITCH 1 7/8"
2,000 lbs Towing Capacity



<i>REF.</i>	<i>PART NO.</i>	<i>DESCRIPTION</i>
1	2321000006	BALL 1 7/8"
2	2321501005	BALL HITCH SUPPORT

BALL HITCH 2"
3,500 lbs Towing Capacity

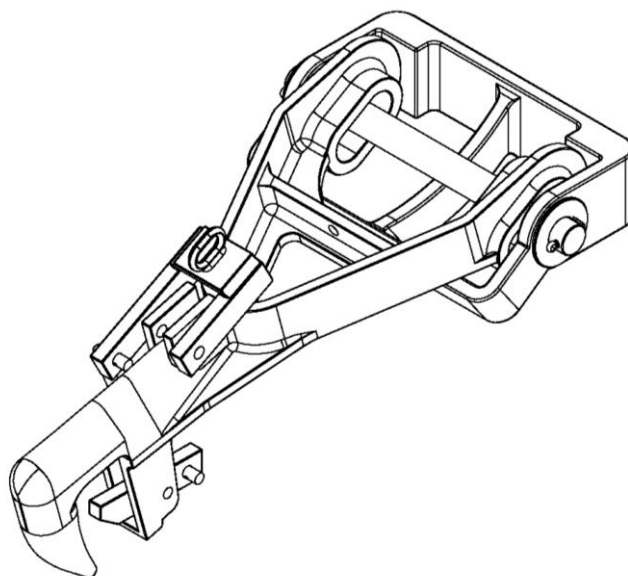


<i>REF.</i>	<i>PART NO.</i>	<i>DESCRIPTION</i>
1	2321000010	BALL 2"
2	2321501005	BALL HITCH SUPPORT

ROSE HITCH

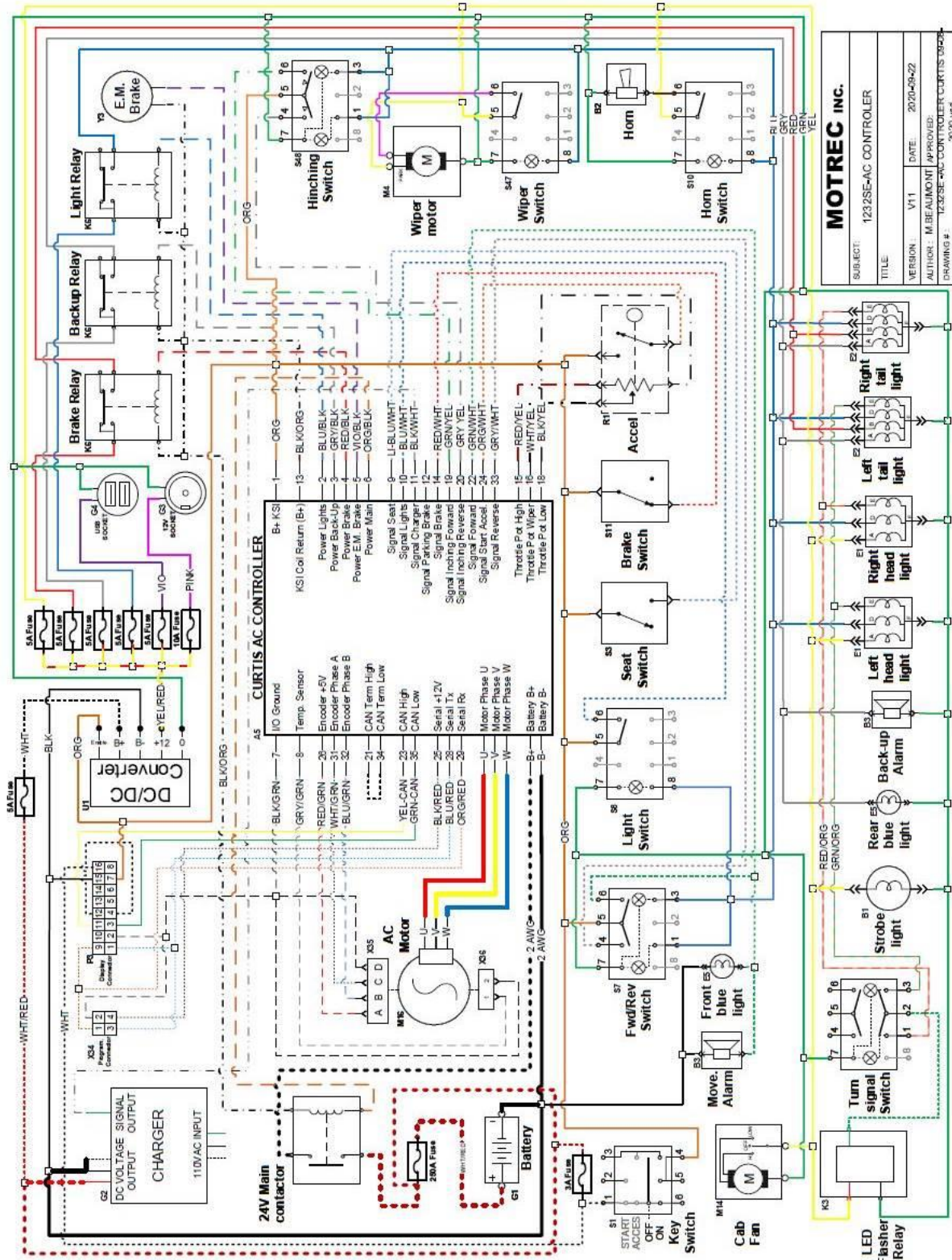
(2320000009)

30,000 lbs Towing Capacity



ELECTRICAL DIAGRAM – MAIN CIRCUIT

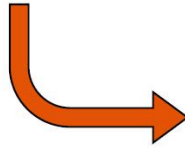
CURTIS 1232SE



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	Communication
RED	GREEN	26	Encoder +5V	Sensors
BLUE	RED	28	Serial TX	Communication
ORANGE	RED	29	Serial RX	Communication
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 <i>Reduced drive torque.</i>	<ol style="list-style-type: none"> 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. 	<p>Low voltage on battery (recharge and erase code)</p> <p>36V battery in a 48V vehicle</p> <p>Bad connector</p> <p>Parameter has been changed</p>
18	Severe Overvoltage <i>ShutdownMotor; ShutdownMainContactor; ShutdownEMBrake; ShutdownThrottle; FullBrake; ShutdownPump.</i>	<ol style="list-style-type: none"> 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. 	<p>Battery is fully charged and too much regenerative braking .</p> <p>48V in 36V vehicle.</p>
23	Undervoltage Cutback <i>Reduced drive torque.</i>	<ol style="list-style-type: none"> 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. 	<p>Low voltage on battery (recharge and erase code)</p> <p>36V battery in a 48V vehicle</p> <p>Bad connector</p> <p>Parameter has been changed</p>
24	Overvoltage Cutback <i>Reduced brake torque.</i>	<ol style="list-style-type: none"> 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. 	<p>Battery is fully charged and too much regenerative braking.</p> <p>48V in 36V vehicle.</p>

MOST COMMON ERROR CODES

28	Motor Temp Hot Cutback <i>Reduced drive torque.</i>	<ol style="list-style-type: none"> 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. 	<p>+145 C This is the temperature limit of the motor .</p> <p>+160 C The vehicle will stop.</p> <p>Bring temp back to normal <i>within range.</i></p>
29	Motor Temp Sensor Fault <i>MaxSpeed reduced (LOS, Limited Operating Strategy), and motor temperature cutback disabled.</i>	<ol style="list-style-type: none"> 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. 	<p>Bad contact must check PIN 7 or PIN 8 on controller.</p> <p>Check connector sensor.</p>
31	Coil1 Driver Open/Short <i>ShutdownDriver1.</i>	<ol style="list-style-type: none"> 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 <i>ShutdownMotor; ShutdownMainContactor; ShutdownEMBrake; ShutdownThrottle; FullBrake; ShutdownPump.</i>	<ol style="list-style-type: none"> 1. Open or short on driver load. 2. Dirty connector pins. 3. Bad crimps or faulty wiring. 	<p><i>Emergency button is activated.</i></p> <p><i>Wire is disconnected on emergency button .</i></p> <p><i>Bad contact on PIN13 or PIN 6.</i></p>
32	Coil2 Driver Open/Short <i>ShutdownDriver2.</i>	<ol style="list-style-type: none"> 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 <i>ShutdownEMBrake; ShutdownThrottle; FullBrake.</i>	<ol style="list-style-type: none"> 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 <i>ShutdownDriver3.</i>	<ol style="list-style-type: none"> 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 <i>ShutdownDriver4.</i>	<ol style="list-style-type: none"> 1. Open or short on driver load. 2. Dirty connector pins. 3. Bad crimps or faulty wiring. 	Back-up light relay defect or disconnect. Check Pin 3 (wire gray/black)

MOST COMMON ERROR CODES

35	PD Open/Short <i>ShutdownPD.</i>	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 <i>ShutdownEMBrake.</i>	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 <i>ShutdownMotor; ShutdownMainContactor; ShutdownEMBrake; ShutdownThrottle; FullBrake; ShutdownPump.</i>	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 <i>ShutdownMotor; ShutdownMainContactor; ShutdownEMBrake; ShutdownThrottle; FullBrake; ShutdownPump.</i>	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 <i>ShutdownThrottle.</i>	1. See Monitor menu » Inputs: Throttle Pot. 2. Throttle pot wiper voltage too high.	Bad contact or installation on accelerator pedal (wire white/yellow) Bad contact on PIN 15 or PIN 16.
42	Throttle Wiper Low <i>ShutdownThrottle.</i>	1. See Monitor menu » Inputs: Throttle Pot. 2. Throttle pot wiper voltage too low.	Bad contact or installation on accelerator pedal (wire red/yellow) Bad contact on PIN 16 or PIN 18.
45	Pot Low Overcurrent <i>ShutdownThrottle; FullBrake.</i>	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 <i>ShutdownThrottle.</i>	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 <i>ShutdownMotor; ShutdownMainContactor; ShutdownEMBrake; ShutdownThrottle; FullBrake; ShutdownPump.</i>	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 <i>(See OEM documentation.)</i>	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 <i>ShutdownEMBrake; Control Mode changed to LOS (Limited Operating Strategy).</i>	<ol style="list-style-type: none"> 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 <i>ShutdownEMBrake; ShutdownThrottle.</i>	<ol style="list-style-type: none"> 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 forward

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

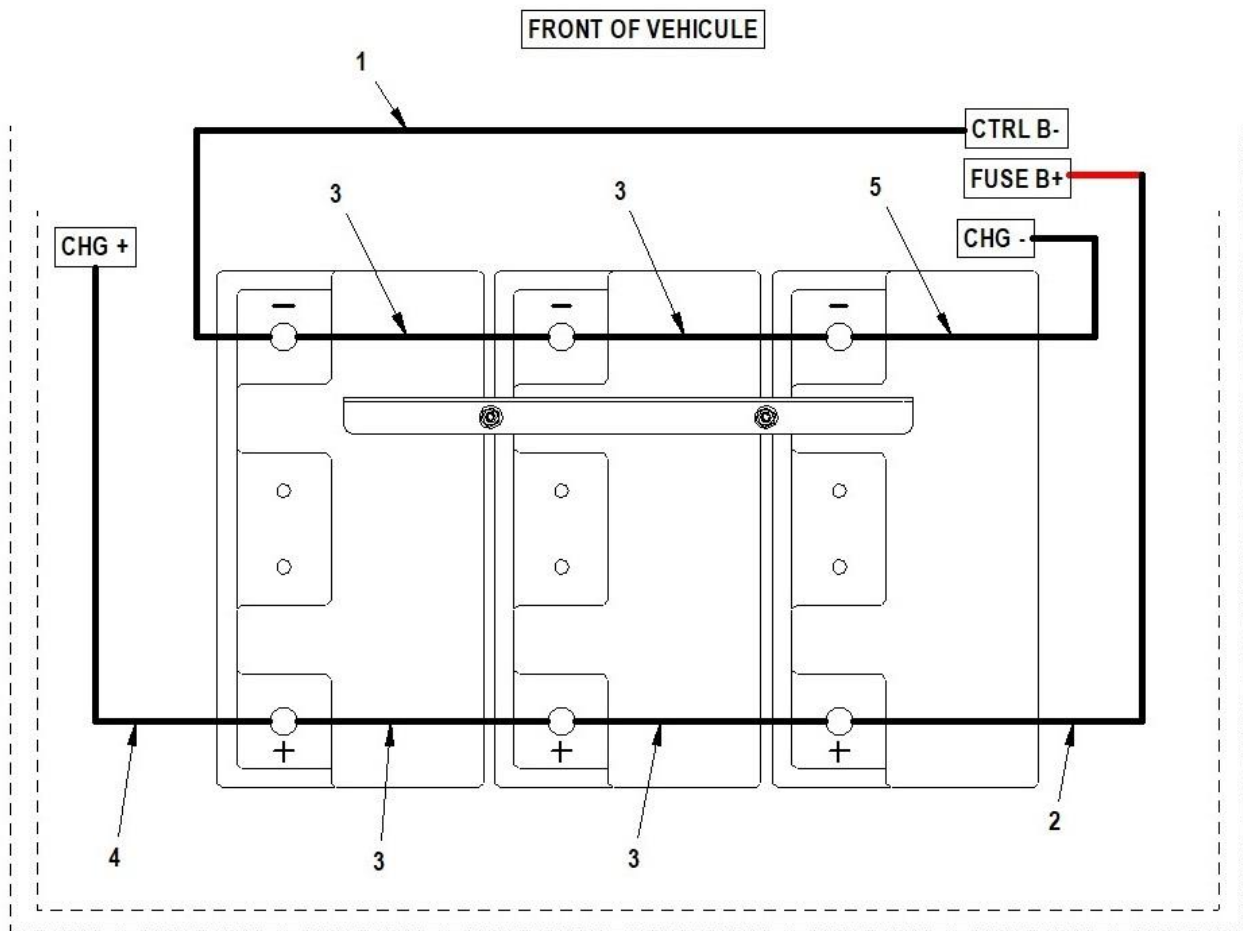
PARTS LIST AC

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	FORWARD/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 DIS-CONNECT 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 CONFIGURATION*Inventus M-48V60-TRX*

REF.	PART NO.	DESCRIPTION
1	TBD	POWER CABLE, 2 AWG, 5/16" RING TERMINAL, LENGTH TBD
2	TBD	POWER CABLE, 2 AWG, 5/16" RING TERMINAL, LENGTH TBD
3	TBD	POWER CABLE, 2 AWG, 5/16" RING TERMINAL, LENGTH TBD
4	TBD	POWER CABLE, 2 AWG, 5/16" RING TERMINAL, LENGTH TBD
5	TBD	POWER CABLE, 2 AWG, 5/16" RING TERMINAL, LENGTH TBD

Contact MOTREC for part number.

MOTREC ILLUSTRATED ACCESSORIES – AC VEHICLES

 <p>Strobe light, pole mount Amber 12-80V: 3116000002 Red 12-80V: 2469001 Blue 12-80V: 3690008</p>	 <p>Tail/Brake/Turn/Back up light LED: 3111000055 Kit Connector: 3119000071K</p>	 <p>Horn button VIP: 2208224002</p>	 <p>Rocker switch Headlight: 3109922020 *Replace 1269004*</p>
 <p>Strobe light, cab mount Amber 12-48V: 3116250001 Red 12-48V: 3069026 Blue 12-48V: 3069014</p>	 <p>Pedestal lamp – 9W LED 12-24V: 3111000045 Support: 2392000009</p>	 <p>Horn 12V: 246003 24V: 246013</p>	 <p>Rocker switch Dome light: 3109922022</p>
 <p>LED Amber turn lamp 12V: 3111000022</p>	 <p>Front Headlight/Turn signal LED 12/48V : 3111000061 Connector: 3119000071K Rear light/Turn signal/Back up LED 12/48V: 3111000062 Connector: 3119000071K</p>	 <p>Back-up alarm or Motion beeper 12-48V : 3100000001 72-80V : 3105720001</p>	 <p>Rocker switch Wiper: 3109922031</p>
 <p>Amber turn lamp 2" LED white background 12V : 3111330003</p>	 <p>Dome light LED: 3111000066</p>	 <p>12-48V Adjustable PRECO: 3100000004</p>	 <p>Rocker switch On/Off: 3109922040</p>
 <p>DC-DC Converter, 300W 24-80V: 3124000005 Connector : 3119000074 3119000075</p>	 <p>Wiper arm 2800000001 14" Blade: 2800000002 18" Blade: 2800000003</p>	 <p>Brake switch : 3109000043</p>	 <p>Rocker switch Horn: 3109922130</p>
 <p>Turn signal switch: 246050</p>	 <p>Pantograph arm: 246233A Pantograph blade: 246233</p>	 <p>Cab heater 12V: 3103300001 36V: 3669008 48V: 4869020</p>	 <p>Rocker switch Forward/Reverse: 3109923010 *Replace 266211*</p>
 <p>12V Fan 3113000018</p>		 <p>Wiper motor 12V: 3113000001 24V: 486211</p>	 <p>Rocker switch Heater: 3109923032</p>  <p>Rocker switch Inching: 3109923111</p>

EV ONE USER GUIDE



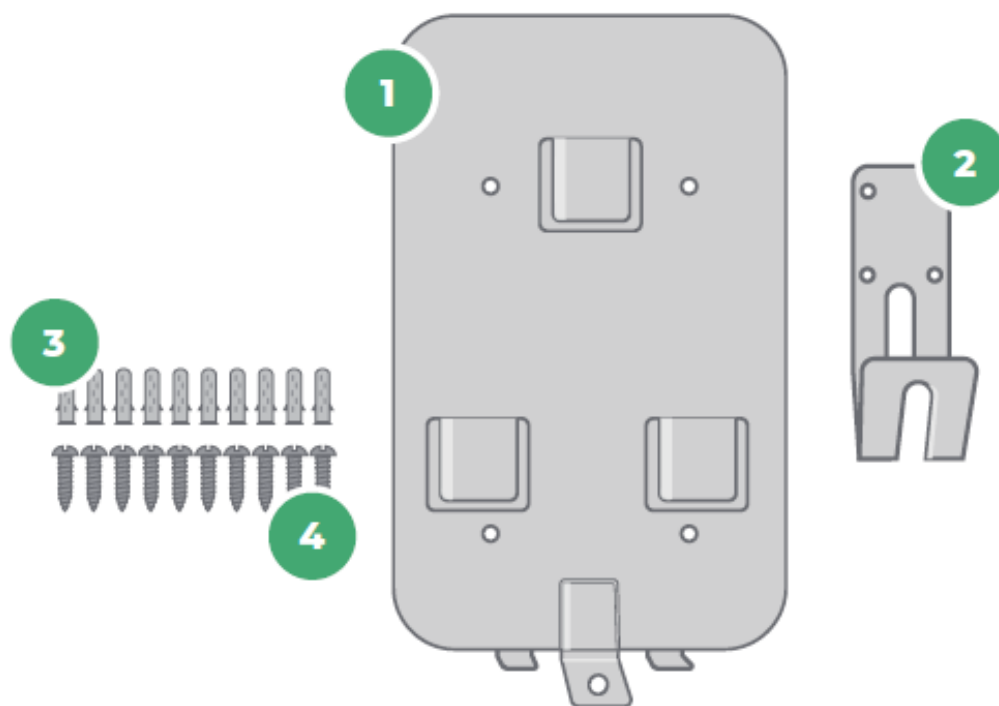
USER GUIDE



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03	Accessories included with the charging station.
04	Overview of the charging station
05	Technical specifications
06	Installation
07	Error messages
08	Changing the charge level

Accessories



1
1x Wall plate

2
1x Hook

3
10x Plastic bolts

4
10x Screws

Overview



Spécifications techniques

Installation method Wall / Pole

Charging port SAE J1772

Certificate TUV, CE, C CSA US

IP Degree IP66

Rated Voltage 240 VAC

Rated Current 32A or 40A

Single phase mode (32A) 7.7Kw
(Requires double 40A circuit breaker)

Single phase mode (40A) 9.6Kw
(Requires double 50A circuit breaker)

Not compatible with GFCI circuit breaker

NEMA 14-50P or 6-50P

Operating temperature -40°C to +40°C

Box size 295mm*195mm*70mm

Box weight 7Kg

Case materials ABS+PC alloy

Starting mode Button

Current Adjustable Optional

APP Function Optional

Security protection

Warning and display functions

Open circuit protection

Output overcurrent protection

Input under voltage protection

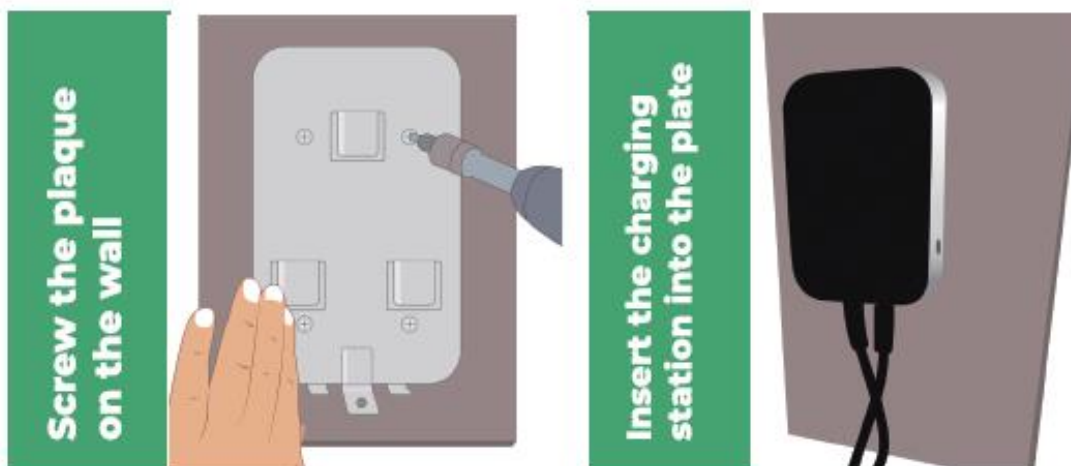
Over temperature protection

Ground protection

input overvoltage protection

Charge status détection

Installation



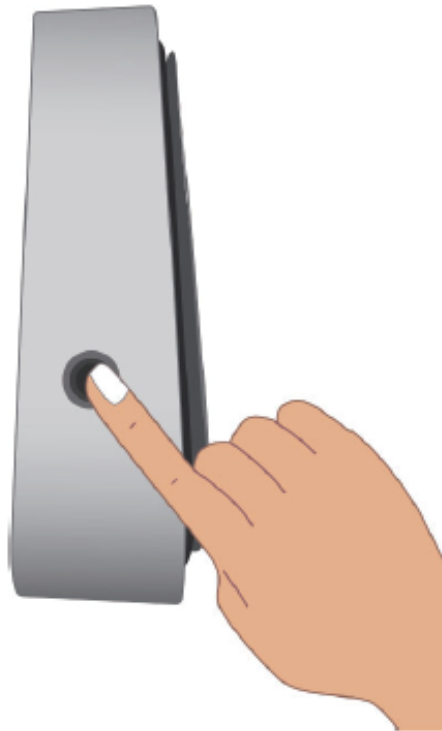
Important

The charging station must be installed at more than 4 feet from the ground

Error messages

Message	Description	Solution Suggestion
CP Error	<i>The Control Pilot (CP) connection is not reliable</i>	Check that your Control Pilot(CP) signal pin isn't shorted. Contact the Ev One provider if this problem persists.
Low voltage	<i>System voltage is lower than workable range</i>	Consult your electrician to ensure appropriate voltage on the circuit breaker that services the Ev One.
Over voltage	<i>System voltage is higher than workable range</i>	Consult your electrician to ensure appropriate voltage on the circuit breaker that services the Ev One.
Ungrounded	<i>The earth ground connection is not reliable</i>	Check if your circuit ground connection is established. If uncertain, consult your electrician to ensure proper grounding at your circuit breaker or power distribution box and that appropriate connections are made to the Ev One.
Over Current	<i>The output current is dangerously increasing</i>	Reduce the vehicle's charge current setting. If the problem persists, contact Ev One provider.
Short Current	<i>An excessive amount of current flowing into the circuit in a short time</i>	Possible causes include short circuits, excessive load, or a ground fault(see Ungrounded error). Check wiring or wiring connections, or contact Ev One provider.
Leakage protection	<i>A dangerous voltage is detected</i>	Consult your electrician
Over temperature	<i>The temperature is higher than workable range</i>	Make sure the connector is fully inserted into the charge inlet in the vehicle, and is not covered by anything, and no heat source is nearby. If the problem persists in normal ambient temperatures(under 50°C or 122°F), contact provider
Emergency stop	<i>The charger doesn't work immediately</i>	Stop using the Ev One and contact the Ev One provider

Changing the charge level



- 1** **Press the button for 5 seconds**
After 5 seconds release the button and the charge level options should appear. If nothing is displayed, you have not pressed long enough.
- 2** **Press the button to select the new charge level**
At each click the charge level changes.
- 3** **When you have selected the correct level of charge do not touch the button and the selection will be made at the next connection to the vehicle.**

Any questions?



www.global.industries
info@global.industries
1 855 531-0095

Returns & Warranty

Refund Policy

No Refunds. Exchanges only. Our product is guaranteed for 3 years for all its components when operated for normal use. In the event that a use is deemed improper resulting in breakage, Global Industries discharges itself from the said warranty. Global Industries undertakes to repair or exchange products that show malfunction or breakage, in accordance with the above statement. For any exceptional situation, we invite you to contact our customer service, which will work to find a solution that is beneficial for everyone.

<https://globalevq.com/en/documentation/returns-warranty/>

DELTA-Q USER MANUAL



ICL SERIES BATTERY CHARGERS USER MANUAL



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ORIGINAL SAFETY AND OPERATING INSTRUCTIONS

This manual is for the Delta-Q Technologies ICL Series (900, 1200, & 1500) Industrial Battery Chargers. Read and comprehend this document fully before handling or working with any ICL Series battery chargers. Important safety, operating, and installation instructions are included. As well, this manual includes a link to a list of fault codes and error codes that help engineers take steps quickly to resolve issues.

Read this information in its entirety before using your Delta-Q Technologies charger. Save these instructions.

For technical support, contact the manufacturer or distributor of your vehicle or machine, as their version of this charger may require unique operating instructions. For additional product documentation, see www.delta-q.com/resources.



Warning

Use the charger only with a charging algorithm that is appropriate to the specific battery type and capacity. Other usage may cause personal injury and damage. Lead acid batteries may generate explosive hydrogen gas during normal charging. Keep sparks, flames, and smoking materials away from batteries. If this charger is used with lithium-ion type batteries, an integrated battery management system (BMS) must be used. The BMS must ensure that, in all operating modes, the battery cells are protected from inappropriate levels of voltage, current, temperature, and state of charge. Do not operate the charger in a closed-in area or restrict ventilation. Never charge a frozen or non-rechargeable battery. Observe all battery manufacturers' precautions (e.g., maximum charge rates and if cell caps should be removed while charging).



Danger

Risk of electric shock. Connect charger power cord to an AC outlet that has been properly installed and grounded in accordance with all local codes and ordinances. A grounded AC outlet is required to reduce the risk of electric shock—do not use ground adapters or modify the plug. Do not touch uninsulated portions of the output connector or uninsulated battery terminals. Disconnect the AC supply before making or breaking the connections to the battery. Do not open or disassemble the charger. Do not operate this charger if the AC supply cord or DC output cord is damaged or if the charger has received a sharp blow, been dropped, or is damaged in any way. Refer all repair work to the manufacturer or qualified personnel. This charger is not intended for use by persons (including children) with reduced physical, sensory or mental capabilities, or lack of experience and knowledge on electrical systems and battery charging, unless they have been given supervision or instruction concerning use of the charger by a person responsible for their safety. Children should be supervised to ensure they do not play with the charger.



Instructions importantes concernant la sécurité

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

Attention



Utiliser le chargeur seulement avec un algorithme approprié au type et capacité spécifique de batterie. D'autres types de batteries pourraient éclater et causer des blessures ou dommages. Les batteries au plomb peuvent produire des gaz explosifs en service normal. Ne jamais fumer près de la batterie et éviter toute étincelle ou flamme nue à proximité des batteries. Si ce chargeur est utilisé avec des batteries au lithium-ion, un système de gestion des batteries intégrés doit être utilisé. Le système de gestion des batteries doit assurer que dans tous les modes de fonctionnement, les cellules de la batterie sont protégées contre les niveaux inappropriés de tension, de courant, de température et d'état de charge. Fournissez une ventilation adéquate du chargement. Ne chargez jamais une batterie gelée ou non rechargeable. 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, et les taux de chargement.



Danger

Risque de décharge électrique. 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. Déconnectez la source CA avant de faire ou défaire les connections à la batterie en chargement. Ne pas utiliser le chargeur si le cordon d'alimentation CA est endommagé ou si le chargeur est abîmé suite à une chute ou autre incident. Ne pas ouvrir ni désassembler le chargeur – référer toute réparation aux personnes qualifiées. Cet appareil n'est pas destiné à un usage par des personnes (dont les enfants) avec des facultés motrices, sensorielles ou mentales réduites, ou ayant une expérience et des connaissances insuffisantes, à moins qu'elles sont sous la supervision ou reçoivent les instructions sur l'utilisation de l'appareil d'un répondant garant de leur sécurité. Les enfants devraient être surveillés afin qu'il ne jouent en aucun temps avec l'appareil.



SAFE OPERATING INSTRUCTIONS

- The charger contains up to 25 selectable charging algorithms stored in its internal memory to charge batteries. These algorithms are specific to each manufacturer and model of battery. Your equipment supplier or charger distributor is responsible for ensuring the active charge algorithm matches the battery pack charging requirements. Contact them with any questions about which algorithm to select for each battery pack.
- The charger may become hot during charging. Use hand protection to safely handle the charger when charging.
- To maintain safe operations, the unit automatically reduces its output power if the temperature rises above set thresholds, or if the AC input voltage is too low.
- If power is interrupted, and then returns, the charger restarts and continues to operate without hazard to the user, or damage to the batteries.
- Unplug the charger from both AC and DC sources when cleaning, moving, or conducting any maintenance or repair on the charger. No user serviceable parts are inside. Do not remove the cover due to the risk of electrical shock.
- Do not expose the charger to oil, dirt, mud, or direct heavy water spray when cleaning the vehicle or machine.
- All connectors between the battery charger and the battery should be regularly inspected for corrosion and contamination as these can cause overheating and can be a fire hazard.
- If the detachable AC input power cord set or DC output cord is damaged, do not use the charger until they are replaced with cord sets appropriate to your region and application.
- When mated with a Delta-Q Technologies sealed AC cord, the charger meets IP66 specifications, making it dust-tight and protected against powerful water jets. If a cord set with an unsealed connector is used, the plug and connector must be periodically inspected to ensure the contacts are clean and dry.
 - If this charger is provided with an AC cord set and the power plug does not match the power outlet, contact the equipment manufacturer, distributor, or Delta-Q Technologies for the correct AC cord set terminating with a 3-prong plug suitable for your region's grounded power outlet.
 - In North America (and other 120V AC regions), the AC cord must be a 3-conductor ULL listed/ CSA approved detachable cord set at least 1.8m in length (≥ 6 feet), minimum 16 AWG and rated SJT; rated 105°C min, and terminated with 125V, 13A, or greater connector.
 - In Japan, the AC cord must be a 3-conductor PSE approved detachable AC cord set, rated 105°C, and terminated with 100V, 15A, or greater connector.
 - In 220-240VAC regions, the AC cord must be a 3-conductor safety-approved cord set, with 1.5mm² conductors (min.), rated appropriately for industrial use. The cord must be terminated on one end with a grounding type input plug appropriate for use in the country of destination; both plug and connector should be rated 250V, 10A, or greater.
- Extension cords must be 3-wire cords no longer than 30m (100') at 10 AWG or 7.5m (25') at 16 AWG, per UL guidelines.





EMC DECLARATION

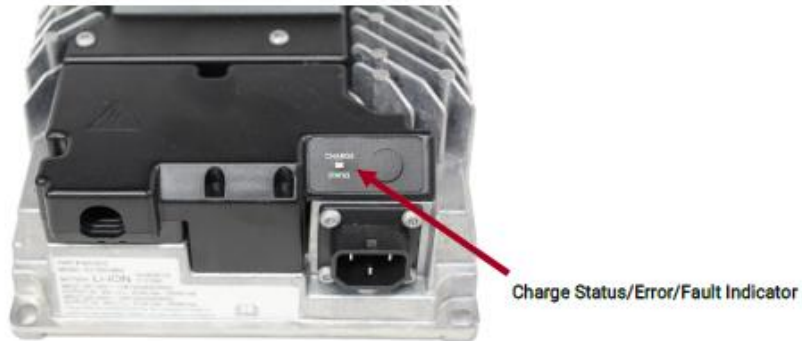
The ICL Series 900, 1200, and 1500 models have been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules for the United States and the ICES Regulations for Canada. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.



CHARGER INTERFACE

Not all ICL Series chargers have the same user interface (UI). The following is an example:



The Charge Status/Error/Fault Indicator behavior is described as follows:

Status	LED Operation
No AC	OFF
Charging: battery at low state of charge	Slow GREEN breathing
Charging: battery at high state of charge	Fast GREEN breathing
Charge Complete	Solid GREEN
Error	Rapid AMBER flashing
Fault	Solid RED



CHARGING ALGORITHMS

Almost every model of battery has different charging requirements and each application may add to those requirements. Delta-Q Technologies has established over 200 charge algorithms for the most common motive deep cycle batteries. These algorithms are designed to get the longest battery life and meet a variety of application environments.

All ICL chargers have charging algorithms even if the charger does not have a UI. The algorithms are specific to each manufacturer and model of battery. Your equipment supplier or charger distributor is responsible for ensuring the active charge algorithm matches the battery pack charging requirements. Contact them for information on selecting and/or changing the charging algorithm or any questions regarding the default algorithm, the other algorithms on the charger, and which algorithm to select for each battery pack.

FAULT AND ERROR CODES

Visit the Delta-Q Technologies support website at <https://support.delta-q.com> and search for fault and error codes to review recommended actions.

IDENTIFYING THE CHARGER SERIAL NUMBER

The serial number is printed on the front of the charger. Use this number when requesting technical support.





ACRONYMS

The following table provides acronym definitions used within this guide.

Term	Definition
AC	Alternating Current
AWG	American Wire Gauge
BMS	Battery Management System
CFM	Cubic Feet Per Minute
DC	Direct Current
EMC	Electromagnetic Compliance
FCC	Federal Communications Commission
HV	High Voltage
HW	Hardware
ICES	Interference-Causing Equipment Standard
ID	Identification
kW	Kilowatt
LED	Light Emitting Diode
LIN	Local Interconnect Network
LV	Low Voltage
MB	Megabyte
MCU	Microcontroller - also abbreviated uC or μ C
NMT	Network Management
SJTW	Hard Service Cord
SW	Software
TBD	To Be Determined
UL	Underwriters Laboratories
USB	Universal Serial Bus
V	Volt
VAC	Volts Alternating Current



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