

# E-242HD



## WARNING

This manual is for the exclusive use of dealers accredited by Motrec International Inc. and should not be considered an official document constituting any kind of guarantee for the end user. All information and data are subject to change without notice. All photos contained in this document are for illustrative purposes only and may include non-applicable options.

### PARTS:

It is recommended that part numbers be confirmed with Motrec International Inc. before ordering by providing the serial number of the vehicle requiring the part. In some cases, the part installed on the vehicle may differ from the manual depending on the options chosen.

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Publication date:

**July 1, 2015**

Edition for vehicles with  
a serial number higher than:

**1035393**

For additional information,  
please contact our customer service:

### MOTREC INTERNATIONAL INC.

200 Des PME Street  
Sherbrooke, Quebec J1C 0R2  
Canada  
1-866-846-3558

## AVERTISSEMENT

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### PIÈCES:

Il est recommandé de valider les numéros de pièces avec Motrec International Inc. avant de commander, en fournissant le numéro de série du véhicule pour lequel la pièce est requise. Dans certains cas, il est possible que la pièce installée sur le véhicule diffère du manuel en fonction des options choisies.

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Date de publication:

**1<sup>er</sup> juillet 2015**

Édition destinée aux véhicules ayant  
un numéro de série supérieur à:

**1035393**

Pour toutes informations additionnelles,  
contactez notre service à la clientèle:

### MOTREC INTERNATIONAL INC.

200, rue des PME  
Sherbrooke, Québec J1C 0R2  
Canada  
1-866-846-3558

# MOTREC



## E-242HD



**OPERATOR AND MAINTENANCE MANUAL  
SPARE PARTS LISTS INCLUDED**

SERIAL NUMBER : 1035396 & UP

Printed in Canada

# One Year Limited Warranty

Effective April 25, 2005, Motrec International Inc. (MOTREC) hereby warrants to the Original Retail Purchaser (Owner) that any of its vehicles shall be free from any defect in materials for a period of 90 DAYS while in the possession of such Original Retail Purchaser. This warranty IS NOT TRANSFERABLE to any subsequent Buyer.

The warranty period is extended to one year or one thousand (1,000) hours, which ever first occurs, on the electric motor, differential (parts that bathe in oil) and the electronic speed controller. MOTREC makes no warranty or representation with respect to the internal combustion engine, tires and batteries, since their respective manufacturers cover such parts. Accessories (light, gage, horn, etc), electrical contacts (switch, solenoid, contactor, relay), diodes & fuses, belts & pulleys, filters & spark plugs, lubricants, brake linings & shoes, brake drums & discs, seals, seats, trim and other items subject to wear are not included in this warranty; nor is any item that in MOTREC sole opinion, shows evidence of neglect, misuse, abuse, collision or alteration.

This warranty shall not apply to normal maintenance requirements as described in the User Manual, and to damages during shipment. The latter is the carrier's responsibility. No compensation will be allowed for delays.

To initiate warranty coverage on any MOTREC vehicle, the Dealer must complete and return the "Sales/Installation Report" to MOTREC within 30 days after delivery to the Original Retail Purchaser; or within 90 days after the delivery date to the Dealer, which ever occurs first. Failure to follow these procedures will result in considering the warranty coverage effective as of the shipment date from the factory.

The defective vehicle must be returned, at the Owner's expense, to an authorised MOTREC Dealer within 30 days after failure. The Owner will not be charged for parts and labour required for warranty repairs, which must be performed by an authorised MOTREC Dealer only. The vehicle will be returned at the owner's expense. The Warranty Claim Forms must be completed and returned with the defective part(s) to MOTREC within 30 days after repair was done. No compensation will be allowed for damages caused by vehicle downtime.

It is the responsibility of the owner of the vehicle to make sure that the driver is properly trained and instructed in the safety features and operation of the vehicle, including vehicle stability, as required by OSHA and ANSI-B56. Operators shall read, understand and follow the safety and operating instructions in MOTREC Manual before driving the vehicle. Operators shall not be permitted to drive the vehicle unless a complete and adequate training has been provided. Driving a vehicle constitutes a hazard. The driver is responsible for the control of the vehicle while driving and must always evaluate and care for all peculiar situations that he or she may meet while driving. The driver assumes the inherent hazards related to this activity. The vehicle is designed for off-road use only. MOTREC disclaims any liability for incidental or consequential damages, to include, but not be limited to, personal injury or property damage arising from vehicle misuse, lack of maintenance or any defect in the vehicle.

It is the responsibility of the Owner of the vehicle to make sure that the service technicians are properly trained as required by OSHA and ANSI-B56. Service technicians shall read, understand and follow instructions in the MOTREC manual before servicing the vehicle. Only qualified and authorized personnel shall be permitted to maintain, repair, adjust and inspect the vehicle.

MOTREC prohibits, and disclaims responsibility for, any vehicle modification altering the weight distribution and stability, increasing the speed or affecting the safety of the vehicle. Such modifications can cause serious personal injury or property damage for which MOTREC disclaims any responsibility.

For Owners that are located outside North America, the warranty period starts the date of shipment from the factory, and the defective parts must be returned at the Owner's expense to MOTREC prior to warranty repair.

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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 battery compartment to prevent battery explosion, acid splashing, severe damage to eyes or skin.
- Do not open motor compartment. Keep clear from moving, rotating(wheels, sheaves, etc) or lifting parts.
- Never carry more passengers than number allowed for this vehicle. Wait until all occupants are seated and holding on before moving. Always keep all body parts inside vehicle. Keep both hands on steering wheel.
- Do not exceed the vehicle cargo load capacity and gross trailing weight capacity, rated for flat hard even surface. Different operating conditions such as loose terrain or ramps reduce vehicle capacity.
- Avoid loose, unbalanced or top-heavy loads to keep a good stability and prevent overturn. Do not load cargo that can fall off the vehicle. Do not carry cargo that is longer, wider or higher than this vehicle.
- Always depress slowly the accelerator for smooth acceleration. Avoid stunt driving or horseplay.
- Avoid sharp turns, always slow down before turning, to prevent vehicle overturn or trailer jack knife. Vehicle is more sensitive to overturn and jack knife when traveling on inclines or when carrying a heavy load.
- Always drive straight up and down the face of an incline, never across the face, to prevent overturn and trailer jack knife. Drive slower and start applying brakes sooner on inclines to adjust for longer stopping distance.
- Use extra care and drive slowly in reverse, in congested areas or on wet or slippery ground.
- Keep to the right under normal conditions. Maintain a safe distance from all objects.
- Slow down and sound the horn when approaching a corner or other blind intersections.
- Before leaving the vehicle, park on a level ground flat surface, turn off all switches, set the forward/reverse switch to neutral, set the parking brake, remove the key. Do not park the vehicle on an incline.
- Before battery charging, park the vehicle in a well ventilated area set for. Do not operate it when charging. To interrupt a charging cycle, disconnect the AC plug; disconnecting the DC plug or a battery terminal, or operating the vehicle, could damage the charger and produce a spark, battery explosion and acid splashing.
- Use another driver to steer this vehicle while it is towed. Be sure the driver uses brakes when you slow or stop the towing vehicle. Do not exceed 5 MPH or carry any passenger while towing this vehicle.

## **OPERATING INSTRUCTIONS**

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

### **BEFORE TURNING ON KEYSWITCH**

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

### **AFTER TURNING ON KEYSWITCH**

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

### **BATTERIES**

Never open the battery compartment unless you have received proper training for battery maintenance.

Batteries emit explosive hydrogen gas that can be ignited by a spark or loose terminal. Battery acid causes severe damage to eyes or skin. Flush the contaminated area immediately with water. Park the vehicle in a well ventilated area for battery charging. Most battery chargers come with an electronic control that starts when the charger is plugged and stop when the battery is fully charged. To interrupt the charging cycle, disconnect the AC-plug, do not disconnect the DC plug.

### **BATTERY DISCHARGE INDICATOR**

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

### **EMERGENCY SAFETY DEVICE**

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

### **KEYSWITCH**

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

### **HORN**

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

### **F/R SWITCH**

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

### **ACCELERATOR PEDAL**

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

### **FOOT BRAKE PEDAL**

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

### **PARKING BRAKE**

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

**MAINTENANCE**



## **SAFETY WARNINGS FOR SERVICE TECHNICIANS**

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

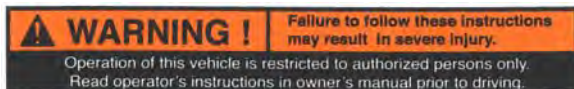
Check decals and labels, see "DECAL AND LABELS" page.

## DECALS AND LABELS

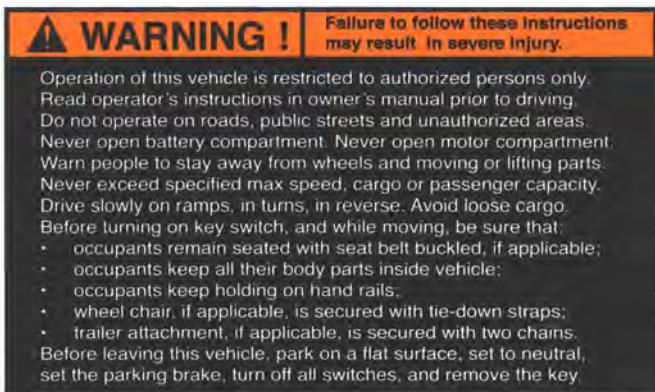
### ! CAUTION !

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

Dashboard security warning label:  
# 5100000002



General security warning label:  
# 5100000001



When an emergency push button is installed, this label is required (located under push button): # 3109800006



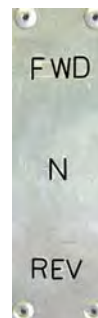
When a disconnect handle is installed, this label is required (located in front of handle):  
# 4800012J



Respectively, key switch markings, forward/reverse selector markings and light switch marking:



# 266211



# 2819321003



# 1269004

## **PERIODIC MAINTENANCE CHECKLIST**

REVISION 080206

**! WARNING !**

Maintenance operations must be made by properly trained service technicians.

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

CHECK/PERFORM	PERIOD HOURS	DAY	WEEK 20	MONTH 50	QUART. 200	YEAR 1000	2 YEARS 2000
MECHANICAL DAMAGE, OIL LEAKS		X					
REVERSE ALARM, DEADMAN SWITCH		X					
STATIC STRAP, min 2" contact with ground		X					
TIRE PRESSURE, pressure rating on tire			X				
CHECK/FILL BATTERIES, add distilled water to cover plates. Fill to recommended level after batteries have been fully charged.			X				
WARNING DECALS & MARKINGS				X			
EE-Rated CABLE PROTECTORS, SEALED MOTOR, SEALED CONTROL BOX, STATIC STRAP.				X			
MASTER CYLINDER FLUID (DOT 3)				X			
BRAKE PEDAL TRAVEL 2" (50 mm) maximum travel				X			
STEERING FOR PLAY				X			
PARKING BRAKE LEVER requires 75 lbs. (34 kg) force to apply				X			
BELTS AND PULLEYS -10 lbs (5kg). force for 1/8" (3mm) deflexion; -pulleys alignment, see procedure.					X		
CLEAN/TIGHTEN WIRE TERMINALS					X		
WASH BATTERY TOP WITH WATER					X		
MOTOR BRUSHES FOR WEAR -brushes must exceed holders					X		
ACCELERATOR 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.					X		
HYDR. BRAKE LINES FOR LEAK					X		
STEERING ASSEMBLY, as instructed					X		
BRAKE MECHANICAL LINKAGES for wear & play					X		
BRAKE LININGS FOR WEAR 1/16" (2 mm) minimum lining thickness. 6 mm minimum thickness for brake-pulley lining.					X		
LUBRICATE (GREASE EP-2) brake pedal pivots, steering column, ball joints and kingpins.					X		
OIL (SAE 30) LEVEL IN DIFFERENTIAL Before adding oil, check oil seals for leaks.					X		
FRONT WHEEL BEARINGS PLAY					X		
TIGHTEN NUTS/BOLTS, electric terminals; drive; steering; brakes; suspension; body.					X		
REPLACE DIFFERENTIAL OIL(SAE 30)						X	
CLEAN AND RE-PACK FRONT HUBS						X	
SERVICE DIFFERENTIAL, replace the three oil seals, wheel bearings, oil (SAE 30)							X

## **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.

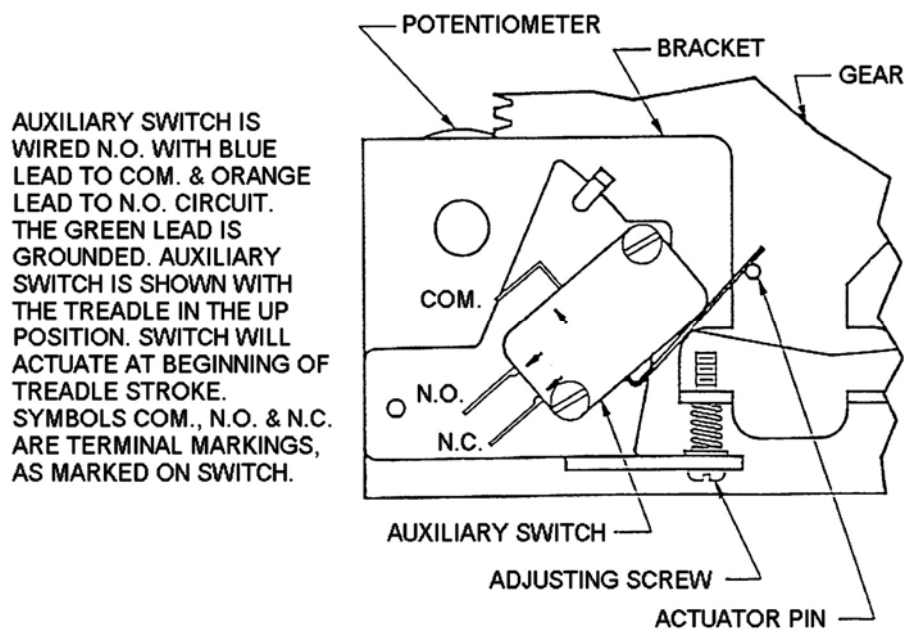
### **MICRO-SWITCH**

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).

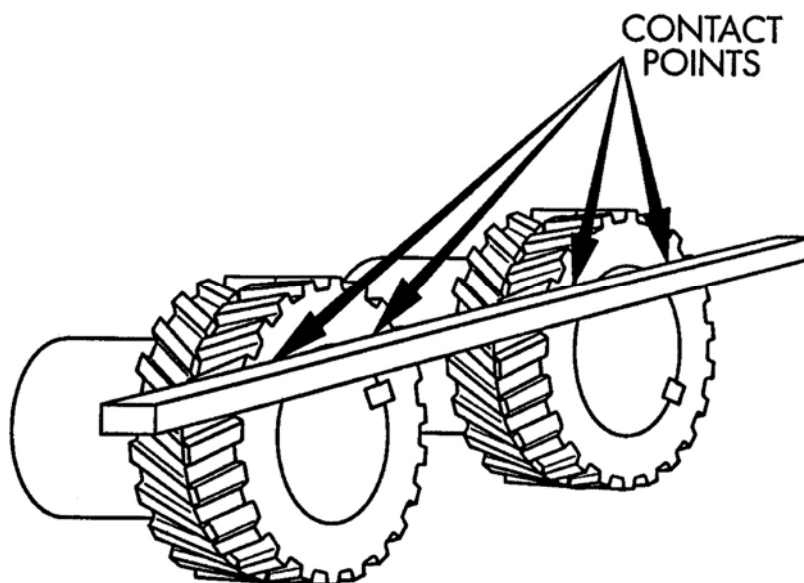
Proceed with the same verifications after the accelerator cover is on and then connect terminals 2 and 3.



## **BELT INSTALLATION AND TENSIONING**

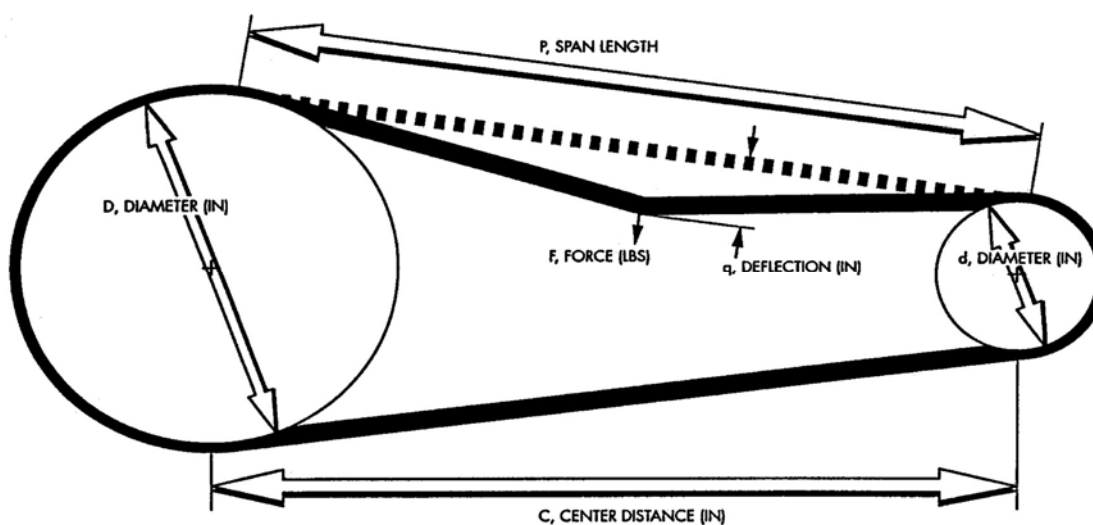
### **INSTALLATION**

Adjust the sprockets using a straight edge. Slide up the edge on the larger pulley until it contacts the smaller pulley. Properly adjusted pulleys will provide three points of contact. Properly aligned pulleys will provide four points of contact. Tighten setscrews and recheck alignment.



### **TENSIONING**

Check the force  $F$  required to provide a deflection of  $1/8$  in. If the measured force is less than 15 lbs then lengthen centre distance  $C$ .



## **MECHANICAL BRAKES**

**Revision 2008-02-06**

### **REPLACING THE BRAKE SHOES ON SELF ADJUSTING DRUM BRAKES:**

- raise the vehicle until the rear tires lift-off the floor and install two jack stands on rear;
- remove drums;
- replace brakes shoes and springs if linings are 1/16" (2mm) thick or less
- disassemble and clean the adjusting screw assembly;
- check brake lever and replace lever and pin if there is wear in the pivot;
- replace all spring parts;
- apply Hi-Temp grease on mechanisms and install the adjusting screw assembly;
- check pulling rods, make sure that they are of the same length;
- install drums and make sure that there is no contact with brake shoes;
- depress and release the brake pedal until the brakes are adjusted;
- drive the vehicle to check brakes.

### **ADDITIONAL INFORMATION FOR MANUALLY ADJUSTED DRUM BRAKES.**

Before any brake adjustment, check the brake levers on the inboard side of the backing plates. The levers must be equally pulled . Adjust pulling rods if necessary. The shoes are adjusted by turning the stud (17mm key) located on the inboard side of the backing plate. Turning the stud clockwise will reduce the drum to shoe clearance. Properly adjusted shoes will equally brake the rear wheels. Avoid Shoe contact with drum when the pedal is released.

### **PARKING BRAKE**

Replace cables and stoppers if cable play exceeds 1/8" (4mm).

To install new cables and stoppers:

- insert the new cable through the hand lever end;
- pull the cable out from the brake assembly or brake pedal 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 LbFt (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 75 Lbs or 34 kg is required on the handle to set the parking brake.

## **BATTERY MAINTENANCE**

### **! WARNING !**

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

### **BATTERY LEADS AND CONNECTORS**

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

### **BATTERY POST CORROSION**

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

### **ELECTROLYTE LEVEL**

Does not apply to sealed battery.

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



## **BATTERY MOUNTING**

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

## **BATTERY DISCHARGE LIMIT**

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

## **CHARGING AREA**

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

## **FREQUENCY OF CHARGE**

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

## **STORAGE**

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

## **DEFECTIVE BATTERY**

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

## **BATTERY CHARGER**

### **! WARNING !**

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

#### **CHARGER DOES NOT TURN ON:**

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

#### **RELAY CLOSSES AND TRANSFORMER HUMS BUT AMMETER DOES NOT REGISTER:**

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

#### **SINGLE CHARGER FUSE BLOWS:**

- Disconnect and check diodes;

#### **BOTH FUSE LINKS BLOW:**

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

#### **CHARGER OUTPUT IS LOW:**

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

#### **AMMETER READS 30 AMPS FOR MORE THAN 30 MINUTES:**

- Check the battery pack;

#### **CHARGER DOES NOT TURN OFF:**

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

#### **AC LINE FUSE OR CIRCUIT BREAKER BLOWS:**

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

## **ELECTRICAL TROUBLESHOOTING**

### **! WARNING !**

Maintenance work must be performed by trained service technicians only.

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

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

### **! WARNING !**

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

Always wear safety glasses.

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

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

## **PMC SELF DIAGNOSTIC**

If your PMC comes with a status led, use the flashing code to help troubleshooting.

## **BATTERY VOLTAGE**

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

## **ACCESSORIES NOT WORKING**

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

## **FORWARD ONLY**

On a SEPEX motor control, check the reverse signal input on the controller.

On a series wound motor control, a bad reverse contactor is the most probable cause of the problem.

Switch to reverse and check voltage on the reverse control wire. If not B+, replace the F/R switch. If B+, turn off the key switch, disconnect batteries, disconnect power terminals on the F/R contactors, check the resistance across N.C. power terminals of the reverse contactor. If not 0 ohm, change the reverse contactor. If 0 ohms, switch to forward and check the resistance across the forward N.O. power terminals. If not 0 ohms, change the forward contactor.

## REVERSE ONLY

On a SEPEX motor control, check the forward signal input on the controller.

On a series wound motor control, a bad forward contactor is the most probable cause of the problem. Switch to forward and check the voltage on the forward control wire. If not B+, replace the F/R switch. If B+, turn off the key switch, disconnect batteries, disconnect power terminals on the F/R contactors, check the resistance across N.C. power terminals of the forward contactor. If not 0 ohm, change the forward contactor. If 0 ohms, switch to reverse and check the resistance across the reverse N.O. power terminals. If not 0 ohms, change the reverse contactor.

## TRAVEL AT REDUCED SPEED

### *Check batteries.*

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

### *Check potentiometer.*

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

Other causes of lower speed:

- dragging brakes;
- cold temperature (higher differential oil viscosity).

## INTERMITTENT OPERATION

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

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

A bad F/R contactor is also a probable cause of the following:

- sudden stop after a bump or shock;
- would not start to move at times.

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 an 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 may also have an 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 circuit breaker has open to prevent motor overheating and will reset automatically after one minute. The PMC is also equipped with an internal thermal protection that cutback the current until the PMC has cooled down.

## **NO MOTION**

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

### *Check F/R switch*

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

### *Check switches and wiring*

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

### *Check potentiometer*

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

### *Check main contactor or solenoid*

Check voltage across power terminals; if not B+, check circuit breaker or replace the solenoid.

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

### *Check circuit breaker and SEPEX DIODE*

Before replacing the circuit breaker, check for shorts in the power circuit and check the SEPEX diode in the power circuit using a diode tester. If no such instrument is at hand, use an ohmmeter: the reading should be weak in one direction and strong in the other way.

Check the resistance across the circuit breaker. If not 0 ohms, replace the circuit breaker.

### *Check PMC*

First disconnect battery B+ and B-, then PMC B+ and M-. Check the internal diode between B+ and M- terminals using a diode tester. If no such instrument is at hand, use an ohmmeter: the reading should be weak in one direction and strong in the other way. If the internal diode is defective, the PMC must be replaced.

### *Check the Motor*

First disconnect battery B+ and B-, disconnect power terminals and check the motor armature and field for opens.

**CURTIS SPEED CONTROLLER**

# MANUAL

MODEL **1 2 4 3**  
**Generation 2**  
**MultiMode™**  
**MOTOR CONTROLLER**

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DESIGN OF CURTIS PMC 1200 SERIES  
CONTROLLERS PROTECTED BY U.S.  
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**CURTIS**

**CURTIS INSTRUMENTS, INC.**

200 Kisco Avenue  
Mount Kisco, NY 10509 USA  
Tel: 914-666-2971  
Fax: 914-666-2188  
[www.curtisinst.com](http://www.curtisinst.com)

1243GEN2 Manual, p/n 37044  
Rev. A: October 2002

## WIRING : STANDARD CONFIGURATION

2 — INSTALLATION & WIRING: Controller

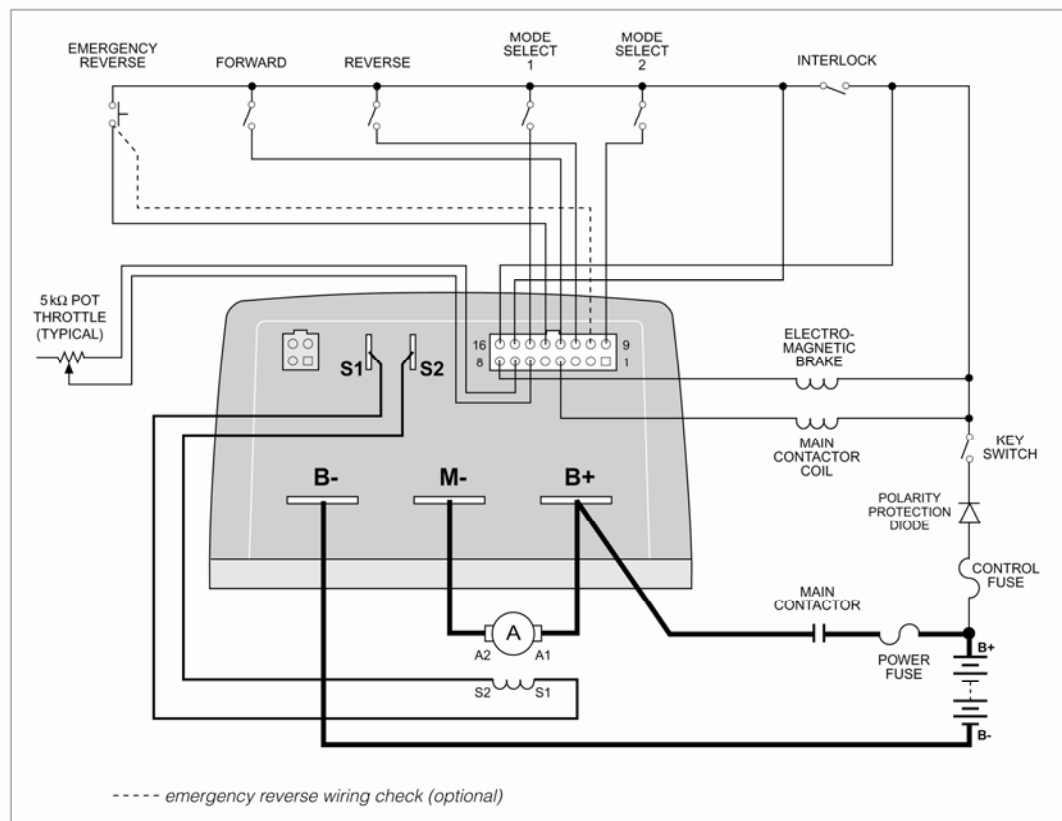
for the M8 bolts. The maximum bolt insertion depth below the surface of the bus bar is 1.3 cm (1/2"). Bolt shafts exceeding this length may damage the controller. The torque applied to the bolts should not exceed 16.3 N·m (12 ft-lbs).

Two 1/4" quick connect terminals (**S1** and **S2**) are provided for the connections to the motor field winding.

### WIRING: Standard Configuration

Figure 3 shows the typical wiring configuration for most applications. **For walkie applications** the interlock switch is typically activated by the tiller, and an emergency reverse switch on the tiller handle provides the emergency reverse signal.

**For rider applications** the interlock switch is typically a seat switch or a foot switch, and there is no emergency reverse.



**Fig. 3** Standard wiring configuration, Curtis 1243GEN2 controller.



## DIAGNOSTICS AND TROUBLESHOOTING

7 — DIAGNOSTICS & TROUBLESHOOTING

# 7

## DIAGNOSTICS AND TROUBLESHOOTING

The 1243GEN2 controller provides diagnostics information to assist technicians in troubleshooting drive system problems. The diagnostics information can be obtained by observing the appropriate display on the handheld programmer, the fault message displayed on the Spyglass gauge, the fault codes issued by the Status LED, or the fault display driven by the controller's fault outputs (Fault 1 and Fault 2). Refer to the troubleshooting chart (Table 7) for suggestions covering a wide range of possible faults.

### PROGRAMMER DIAGNOSTICS

The handheld programmer presents complete diagnostic information in plain language. Faults are displayed in the System Faults Menu, and the status of the controller inputs/outputs is displayed in the Monitor Menu.

Accessing the programmer's Fault History Menu provides a list of the faults that have occurred since the fault history file was last cleared. Checking (and clearing) the fault history file is recommended each time the vehicle is brought in for maintenance.

For information on 1311 programmer operation, see Appendix B. If you are using the older 1307 programmer, refer to existing documentation.

### SPYGLASS DIAGNOSTICS

The eight-character LCD on the Spyglass displays a continuous sequence of hourmeter, battery state-of-charge, and fault messages.

Fault messages are displayed using the same codes that are flashed by the LED (see Table 8). For example, the LED flashes 3,2 for a welded main contactor:

□□□ □□ ( 3 , 2 )	□□□ □□ ( 3 , 2 )	□□□ □□ ( 3 , 2 )
---------------------	---------------------	---------------------

and the corresponding Spyglass message is:

CODE 32
---------

When a fault message is being displayed, the red Fault LED (labeled with a wrench symbol) flashes to catch the operator's attention.

The LCD also displays a warning when either service timer expires. The service warning is not considered a fault and the red Fault LED does not flash. The word SERVICE is displayed for about 20 seconds on each key-on, after the hourmeter is displayed.

The Spyglass is available in 3-LED and 6-LED models; see Figure 21.

## TROUBLESHOOTING CHART

7 — DIAGNOSTICS &amp; TROUBLESHOOTING

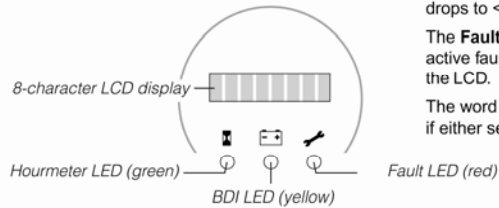
Table 7 TROUBLESHOOTING CHART

LED CODE	PROGRAMMER LCD DISPLAY	FAULT CATEGORY	POSSIBLE CAUSE	FAULT CLEARANCE
0,1	NO KNOWN FAULTS	0	n/a	n/a
1,1	CURRENT SHUNT FAULT	1	1. Abnormal vehicle operation causing high current spikes. 2. Current sensor out of range. 3. Controller failure.	Cycle KSI. If problem persists, replace controller.
1,2	HW FAILSAFE	1	1. Noisy environment. 2. Self-test or watchdog fault. 3. Controller failure.	Cycle KSI. If problem persists, replace controller.
1,3	M- SHORTED	1	1. Internal or external short of M- to B-. 2. Incorrect motor wiring. 3. Controller failure.	Check wiring; cycle KSI. If problem persists, replace controller.
1,4	SRO	3	1. Improper sequence of KSI, interlock, and direction inputs. 2. Interlock or direction switch circuit open. 3. Sequencing delay too short. 4. Wrong SRO or throttle type selected. 5. Misadjusted throttle pot.	Follow proper sequence; adjust throttle if necessary; adjust programmable parameters if necessary.
2,1	THROTTLE WIPER HI	1	1. Throttle input wire open or shorted to B+. 2. Defective throttle pot. 3. Wrong throttle type selected.	When Throttle Wiper High input returns to valid range.
2,2	EMR REV WIRING	1	1. Emergency reverse wire or check wire open.	Re-apply emergency reverse or cycle interlock.
2,3	HPD	3	1. Improper sequence of KSI, interlock, and throttle inputs. 2. Misadjusted throttle pot. 3. Sequencing delay too short. 3. Wrong HPD or throttle type selected. 5. Misadjusted throttle pot.	Follow proper sequence; adjust throttle if necessary; adjust programmable parameters if necessary.
	SRVC TOTAL	3	1. Total maintenance timer expired.	Reset with programmer.
	SRVC TRAC	3	1. Traction maintenance timer expired.	Reset with programmer.
	TOTAL DISABLED	3	1. Total disable timer expired.	Reset with programmer.
	TRAC DISABLED	3	1. Traction disable timer expired.	Reset with programmer.
2,4	THROTTLE WIPER LO	1	1. Throttle pot wire open or shorted to B+. 2. Wrong throttle type selected. 3. Defective throttle pot.	When Throttle Wiper Low input returns to valid range.
3,1	FIELD SHORT	1	1. Main contactor coil shorted. 2. Field winding shorted to B+ or B-. 3. Field resistance too low.	Check contactor coil and field winding; cycle KSI.
3,2	MAIN CONT WELDED	1	1. Main contactor stuck closed. 2. Main contactor driver shorted.	Check wiring and contactor; cycle KSI.
3,3	FIELD OPEN	1	1. Field winding connection open. 2. Field winding open.	Check wiring and cycle KSI.
3,4	MISSING CONTACTOR	1	1. Main contactor coil open. 2. Main contactor missing. 3. Wire to main contactor open.	Check wiring and cycle KSI.

Table 7 TROUBLESHOOTING CHART, <i>cont'd</i>				
LED CODE	PROGRAMMER LCD DISPLAY	FAULT CATEGORY	POSSIBLE CAUSE	FAULT CLEARANCE
4,1	LOW BATTERY VOLTAGE	2	1. Battery voltage < undervoltage cutback. 2. Corroded battery terminal. 3. Loose battery or controller terminal.	When voltage rises above undervoltage cutoff point.
4,2	OVERVOLTAGE	2	1. Battery voltage > overvoltage shutdown limit. 2. Vehicle operating with charger attached.	When voltage falls below overvoltage cutoff point.
4,3	THERMAL CUTBACK	2	1. Temperature >85°C or < -25°C. 2. Excessive load on vehicle. 3. Improper mounting of controller.	Clears when heatsink temperature returns to within acceptable range.
4,4	ANTI-TIEDOWN	3	1. Mode switches shorted to B+. 2. Mode Select 1 "tied down" to select Mode 2 or Mode 4 permanently.	Release Mode Select 1.
	MOTOR HOT	3	1. Field resistance > motor hot setpoint.	When resistance < setpoint.
	MOTOR WARM	3	1. Field resistance > motor warm setpoint.	When resistance < setpoint.

**Fig. 21** Curtis 840 Spyglass, 3-LED and 6-LED models.

#### 3-LED Spyglass



The **hourmeter LED** lights when the LCD is displaying hourmeter data.

The **BDI LED** lights when the LCD is displaying BDI%. It flashes when BDI% drops to <10%.

The **Fault LED** flashes to indicate an active fault, and the fault code appears on the LCD.

The word SERVICE is displayed at key-on if either service timer has expired.

#### 6-LED Spyglass

The three green **BDI LEDs** function as a bargraph showing BDI% between 52% and 100%.

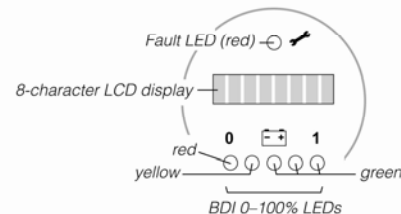
Yellow LED = 36% – 51% BDI.

Red LED steady = 20% – 35% BDI.

Red LED flashing = 0 – 19% BDI.

The **Fault LED** flashes to indicate an active fault, and the fault code appears on the LCD.

The word SERVICE is displayed at key-on if either service timer has expired.





## LED DIAGNOSTICS

### STATUS LED DIAGNOSTICS

A Status LED is built into the 1243GEN2 controller. It is visible through a window in the label on top of the controller. This Status LED displays fault codes when there is a problem with the controller or with the inputs to the controller. During normal operation, with no faults present, the Status LED flashes steadily on and off. If the controller detects a fault, a 2-digit fault identification code is flashed continuously until the fault is corrected. For example, code “3,2”—main contactor welded—appears as:

□□□ □□ ( 3 , 2 )	□□□ □□ ( 3 , 2 )	□□□ □□ ( 3 , 2 )
---------------------	---------------------	---------------------

The codes are listed in Table 8.

Table 8 STATUS LED FAULT CODES		
LED CODES		EXPLANATION
<i>LED off</i>		no power or defective controller
<i>solid on</i>		controller or microprocessor fault
0,1	■ □	controller operational; no faults
1,1	□ □	current sensor error
1,2	□ □□	hardware failsafe fault
1,3	□ □□□	M- fault or motor output short
1,4	□ □□□□	static return to off (SRO)
2,1	□□ □	throttle wiper high
2,2	□□ □□	emergency reverse circuit check fault
2,3	□□ □□□	high pedal disable (HPD), or expired timer
2,4	□□ □□□□	throttle wiper low
3,1	□□□ □	contactor driver overcurrent or field winding short
3,2	□□□ □□	main contactor welded
3,3	□□□ □□□	field winding open
3,4	□□□ □□□□	missing contactor
4,1	□□□□ □	low battery voltage
4,2	□□□□ □□	overvoltage
4,3	□□□□ □□□	thermal cutback, due to over/under temp
4,4	□□□□ □□□□	anti-tiedown fault, or overheated motor

Note: Only one fault is indicated at a time, and faults are not queued up. Refer to the troubleshooting chart (Table 7) for suggestions about possible causes of the various faults. Operational faults—such as a fault in SRO sequencing—are cleared by cycling the interlock switch or keyswitch.

**PROGRAMMING PARAMETERS – E-242, E-242HD, E-250****! WARNING !**

The owner of this vehicle shall ensure that the service technicians are qualified, properly trained and obey the safety rules and guidelines in OSHA and ANSI B56 regulations, and in this manual.

Before installing and/or programming the PMC, park the vehicle on a flat level surface, lift the wheels off the ground and secure with jack stands of adequate capacity. Don't connect charger.

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.

VOLTAGE	NOMINAL BATTERY VOLTAGE, IN VOLTS	2	HPD	HIGH PEDAL DISABLE (HPD) TYPE	1
M1 DRIVE C/L	MODE 1 DRIVE CURRENT LIMIT, IN AMPS	250	SRO	STATIC RETURN TO OFF (SRO) TYPE	1
M2 DRIVE C/L	MODE 2 DRIVE CURRENT LIMIT, IN AMPS	250	SEQUENCING DLY	SEQUENCING DELAY, IN SEC.	1
M3 DRIVE C/L	MODE 3 DRIVE CURRENT LIMIT, IN AMPS	250	MAIN CONT INTR	MAIN CONTACTOR INTERLOCK: ON OR OFF	ON
M4 DRIVE C/L	MODE 4 DRIVE CURRENT LIMIT, IN AMPS	250	MAIN OPEN DELAY	MAIN CONTACTOR DROPOUT DELAY, IN SEC.	1
M1 BRAKE C/L	MODE 1 BRAKING CURRENT LIMIT, IN AMPS	100	CONT DIAG	CONT DIAG, ON OR OFF	ON
M2 BRAKE C/L	MODE 2 BRAKING CURRENT LIMIT, IN AMPS	100	AUX TYPE	AUXILIARY TYPE, 0 TO 5	0
M3 BRAKE C/L	MODE 3 BRAKING CURRENT LIMIT, IN AMPS	100	AUX DELAY	AUXILIARY DRIVER DROPOUT DELAY, IN SEC.	0.0
M4 BRAKE C/L	MODE 4 BRAKING CURRENT LIMIT, IN AMPS	100	EMR REV C/L	EMERGENCY REVERSE CURRENT LIMIT, IN AMPS	50.0
M1 ACCEL RATE	MODE 1 ACCELERATION RATE, IN SEC.	3	EMR REV CHECK	EMERGENCY REV. WIRING CHECK : ON OR OFF	OFF
M2ACCEL RATE	MODE 2 ACCELERATION RATE, IN SEC.	3	EMR DIR INTR	EMR DIR INTR: ON OR OFF	OFF
M3 ACCEL RATE	MODE 3 ACCELERATION RATE, IN SEC.	3	VARIABLE BRAKE	VARIABLE BRAKE : ON OR OFF	OFF
M4 ACCEL RATE	MODE 4 ACCELERATION RATE, IN SEC.	3	ANTI-TIEDOWN	ANTI-TIEDOWN: ON OR OFF	OFF
M1 DECEL RATE	MODE 1 DECELERATION RATE, IN SEC.	3.4	POT LOW FAULT	POT LOW FAULT: ON OR OFF	ON
M2 DECEL RATE	MODE 2 DECELERATION RATE, IN SEC.	3.4	FULL VOLTS	FULL VOLTS: 174 TO 211	204
M3 DECEL RATE	MODE 3 DECELERATION RATE, IN SEC.	3.4	EMPTY VOLTS	EMPTY VOLTS : 0 TO 211	174
M4 DECEL RATE	MODE 4 DECELERATION RATE, IN SEC.	3.4	RESET VOLTS	RESET VOLTS: 174 TO 300	210
THROTTLE DECEL	THROTTLE DECEL, IN SEC.	0.3	BATTERY ADJUST	BATTERY ADJUST : 0.1 TO 20.0	20
M1 BRAKE RATE	MODE 1 BRAKING RATE, IN SEC.	2	BDI LOCKOUT	BDI LOCKOUT : ON OR OFF	OFF
M2 BRAKE RATE	MODE 2 BRAKING RATE, IN SEC.	2	BDI DISABLE	BDI DISABLE: ON OF OFF	OFF
M3 BRAKE RATE	MODE 3 BRAKING RATE, IN SEC.	2	ADJ HRS LOW	ADJ HRS LOW: 0 TO 99	0
M4 BRAKE RATE	MODE 4 BRAKING RATE, IN SEC.	2	ADJ HRS MID	ADJ HRS MID: 0 TO 99	0
INT BRAKE RATE	INT BRAKE RATE, IN SEC.	2	ADJ HRS HIGH	ADJ HRS HIGH: 0 TO 99	0
QUICK START	QUICK START THROTTLE FACTOR	1	SET TOTAL HRS	SET TOTAL HRS: ON OR OFF	OFF
TAPER RATE	Regen brak. Decrease rate when apporch. 0spd, 1/32s	20	SET TRAC HRS	SET TRAC HRS: ON OR OFF	OFF
M1 MAX FWD SPD	MODE 1 MAX. FWD SPEED, AS % PWM OUTPUT	40	HOURLMETER TYPE	HOURLMETER TYPE: ON OR OFF	OFF
M2 MAX FWD SPD	MODE 2 MAX. FWD SPEED, AS % PWM OUTPUT	72	SRVC TOTAL HRS	SRVC TOTAL HRS: 0.0 TO 50.0	0.0
M3 MAX FWD SPD	MODE 3 MAX. FWD SPEED, AS % PWM OUTPUT	86	SRVC TRAC HRS	SRVC TRAC HRS: 0.0 TO 50.0	0.0
M4 MAX FWD SPD	MODE 4 MAX. FWD SPEED, AS % PWM OUTPUT	100	SRVC TOTAL	SRVC TOTAL : ON OR OFF	OFF
M1 MAX REV SPD	MODE 1 MAX. REV SPEED, AS % PWM OUTPUT	40	SRVC TRAC	SRVC TRAC: ON OR OFF	OFF
M2MAX REV SPD	MODE 2 MAX. REV SPEED, AS % PWM OUTPUT	40	DIS TOTAL HRS	DIS TOTAL HRS: 0 TO 250	0
M3 MAX REV SPD	MODE 3 MAX. REV SPEED, AS % PWM OUTPUT	40	DIS TRAC HRS	DIS TRAC HRS: 0 TO 250	0
M4 MAX REV SPD	MODE 4 MAX. REV SPEED, AS % PWM OUTPUT	40	TRAC FAULT SPD	TRAC FAULT SPEED: 0 TO 100	100
CREEP SPEED	CREEP SPEED, AS % PWM OUTPUT	0	BDI LIMIT SPD	BDI LIMIT SPEED: 0 TO 100	100
THROTTLE TYPE	THROTTLE TYPE	3	WARM SPD	WARM SPEED : 0 TO 100	100
THRO. DEADBAND	Thr. Neutral deadband % of 5kohms pot	6	MOT WARM	MOT WARM X 10 m : 10 TO 250	250
THROTTLE MAX	Thr. Input req'd for 100%PWM %5kohm pot	90	MOT HOT	MOT HOT X 10 m : 10 TO 250	250
THRTL MAP	THROTTLE MAP, AS %	30	MOTOR COMP	MOTOR COMP: ON OR OFF	OFF
FIELD MIN	MIN. FIELD CURRENT, IN AMPS	6	MAX REV REGEN	MAX REV REGEN : 100 TO 300	100
FIELD MAX	MAX. FIELD CURRENT, IN AMPS	20	MAX FWD REGEN	MAX FWD REGEN: 100 TO 300	100
FIELD MAP START	Arm. current at wich FIELD MAP takes effect, amps	70	MIN REV REGEN	MIN REV REGEN: 100 TO 300	25
FIELD MAP	Field winding current, as % armature current	50	MIN FWD REGEN	MIN FWD REGEN: 100 TO 300	25
CURRENT RATIO	CURRENT RATIO:FACTOR OF 1, 2, 4 OR 8	1	MAX LOAD VOLTS	MAX LOAD VOLTS: 0.2 TO 5.5	0.2
M1 RESTRAINT	MODE 1 RAMP RESTRAINT: 1 TO 10	6	MIN LOAD VOLTS	MIN LOAD VOLTS: 0.2 TO 5.0	0.2
M2 RESTRAINT	MODE 2 RAMP RESTRAINT: 1 TO 10	6	INT BRAKE DLY	INT BRAKE DLY : 0.0 TO 8.0	0.0
M3 RESTRAINT	MODE 3 RAMP RESTRAINT: 1 TO 10	6	FAULT CODE	ON OR OFF	ON
M4 RESTRAINT	MODE 4 RAMP RESTRAINT: 1 TO 10	6	EMR BRAKE PWM	EMR BRAKE PWM : ON OR OFF	OFF
LOAD COMP	LOAD COMPENSATION: 0 TO 25	0	FIELD CHECK	FIELD CHECK: ON OR OFF	ON
			PUMP METER	PUMP METER : ON OR OFF	OFF

**6 MPH MAX : disconnect wire MODE-2-B (PIN 9)**

**8 MPH MAX : disconnect wire MODE-1-A (PIN 14)**

**CURTIS PMC MOTOR CONTROLLER**

# MANUAL

**CURTIS**PMC

MODEL **1204/5**  
MOTOR CONTROLLERS

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DESIGN OF CURTIS 1200 SERIES  
CONTROLLERS PROTECTED BY U.S.  
PATENT NO. 4626750.

**CURTIS**

**CURTIS PMC**

235 East Airway Boulevard  
Livermore, California 94568 USA  
Tel: 925-961-1088  
Fax: 925-961-1099  
[www.curtisinst.com](http://www.curtisinst.com)

1204 / 1205 Manual  
p/n 98690, Rev. B: May 1999

## WIRING : STANDARD CONFIGURATION

WIRING

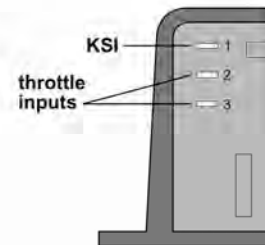
3

### WIRING

#### CONNECTIONS: Low Current

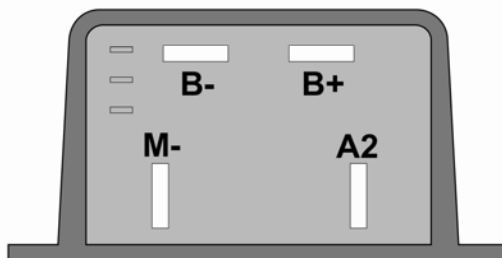
Three 1/4" push-on terminals are provided for the low current connections to the KSI and throttle inputs.

For the control wiring, 0.75 mm<sup>2</sup> (#18 AWG) vinyl insulated stranded wire is recommended.



#### CONNECTIONS: High Current

Four tin-plated solid copper bus bars are provided for the high current connections to the battery and motor:

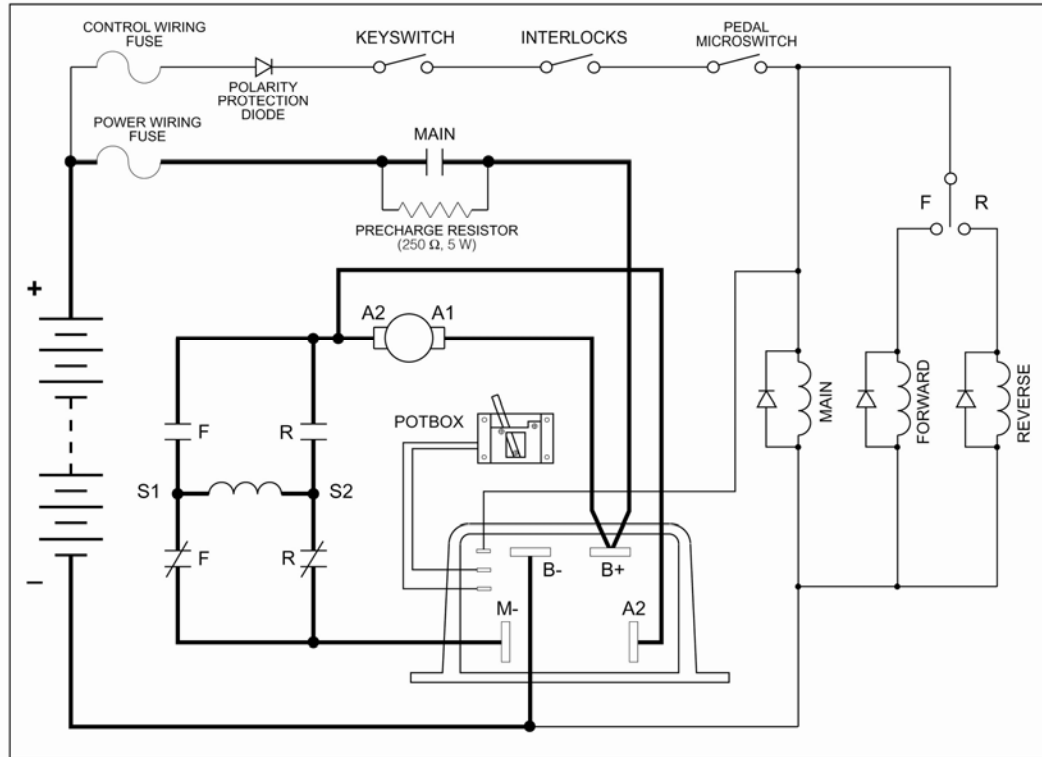


- M-** output to motor field
- B-** negative connection to battery
- B+** positive connection to battery and to motor armature
- A2** plug diode to motor armature

The cables used for the battery and motor connections must be heavy enough to carry the high current required. A minimum size of 25 mm<sup>2</sup> (#4 AWG) is recommended. Rubber insulated welding cable is convenient to work with because of its flexibility.

Connections to the controller bus bars should be made with lugs suitable for the cable used, fastened by M8 (5/16") bolts and nuts. **When tightening the bolts, two opposing wrenches should be used.** Failure to use the double-wrench technique could cause undue strain to be placed on the internal connections, and could also result in cracked seals around the bus bars.





**Fig. 6** Basic wiring configuration,  
Curtis PMC 1204/1205 controller.

### WIRING: SERIES MOTORS

Figure 6 is a schematic of the configuration shown in Figure 5. Wired this way, the vehicle will plug brake if the direction is changed with the vehicle moving and the throttle applied. Reversing is accomplished via two single-pole, double-throw (2×SPDT) contactors. Coil suppression diodes should be used on the main and forward/reverse contactors.

#### KSI Wiring

The keyswitch input (KSI) circuit includes input from the keyswitch and from the various interlocks. The controller KSI is used to turn the controller on and off. KSI is turned on by connecting it to battery B+. Any positive voltage greater than about 8 volts will turn on the controller, but usually the full vehicle battery voltage is used. KSI draws only a very small current (a few mA).

In its simplest form, KSI is operated by a keyswitch that turns the vehicle off and prevents unauthorized use. The keyswitch should also

## MAINTENANCE AND ADJUSTMENT

### MAINTENANCE & ADJUSTMENT

# 4

## MAINTENANCE & ADJUSTMENT

Curtis 1204/1205 controllers and potboxes require only minimal maintenance if properly installed. **NOTE:** The controllers are sealed and thus are not field serviceable.

### CONTROLLER

#### Maintenance



It is recommended that the following two steps be performed occasionally. **First remove power by disconnecting the battery, and discharge the capacitors in the controller** (with a light bulb or a 2–10  $\Omega$ , 25 W resistor connected for a few seconds across B+, B-). Follow good safety practices: get the vehicle drive wheels off the ground, wear safety glasses, and use insulated tools (*see page 2*).

1. Make sure the electrical connections to the controller (and to the motor, contactors, etc.) are tight. When checking the controller bus bar connections for tightness, use two opposing wrenches. This double-wrench technique will help avoid putting stress on the bus bars, which could crack the seals. **Always use insulated wrenches.**
2. Inspect all seals at the front and back of the controller. If necessary, use a moist rag to wipe these areas clean enough so that you can see the seals. Look for cracks and other signs of seal damage.

If the seals are intact, clean the controller thoroughly either by washing it off or by wiping it clean with a moist rag. **Power must not be reapplied until the controller terminal area is completely dry.**

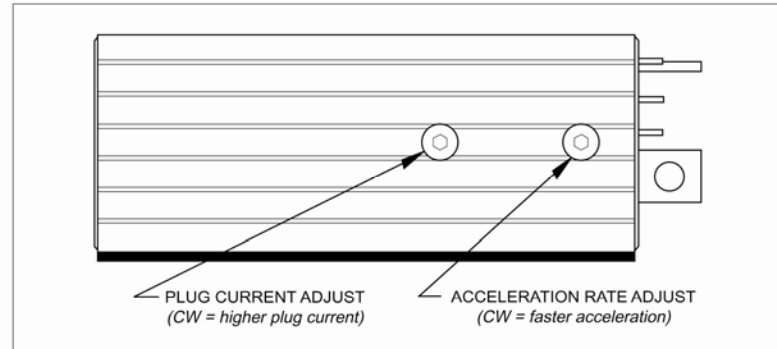
If the seals have been damaged, there are several possible causes. Perhaps the double-wrench technique was not used when the cables were installed. Perhaps the vehicle's environment requires that the controller be better protected: either by mounting it in a different location, or by installing a protective cover.

**Damaged seals can lead to faulty operation.** We strongly recommend replacing controllers that have faulty seals.

### Adjustment

On some models, the plug braking current and acceleration rate settings are adjustable. On these adjustable controllers, the adjustment pots are located as shown in Figure 18.

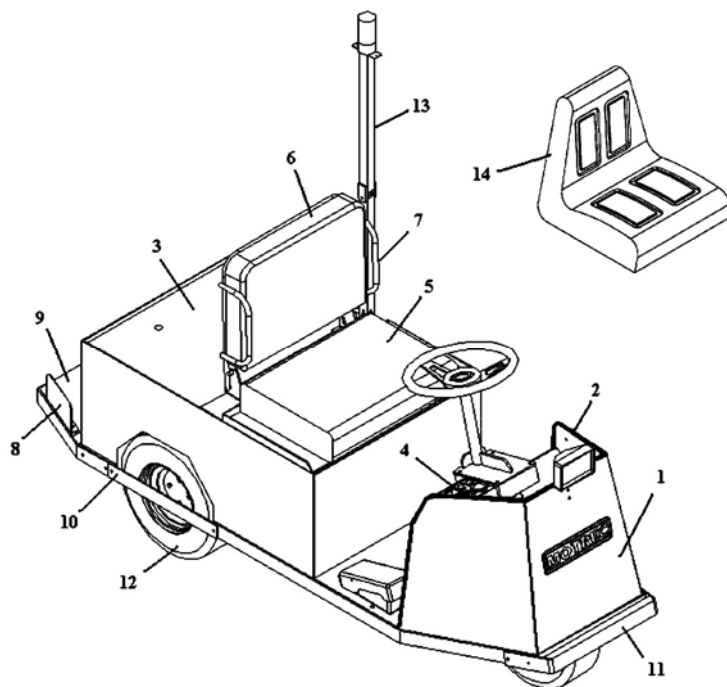
**Fig. 18** Adjustment pots.



Use the following adjustment procedure. **The keyswitch should be off during adjustment.**

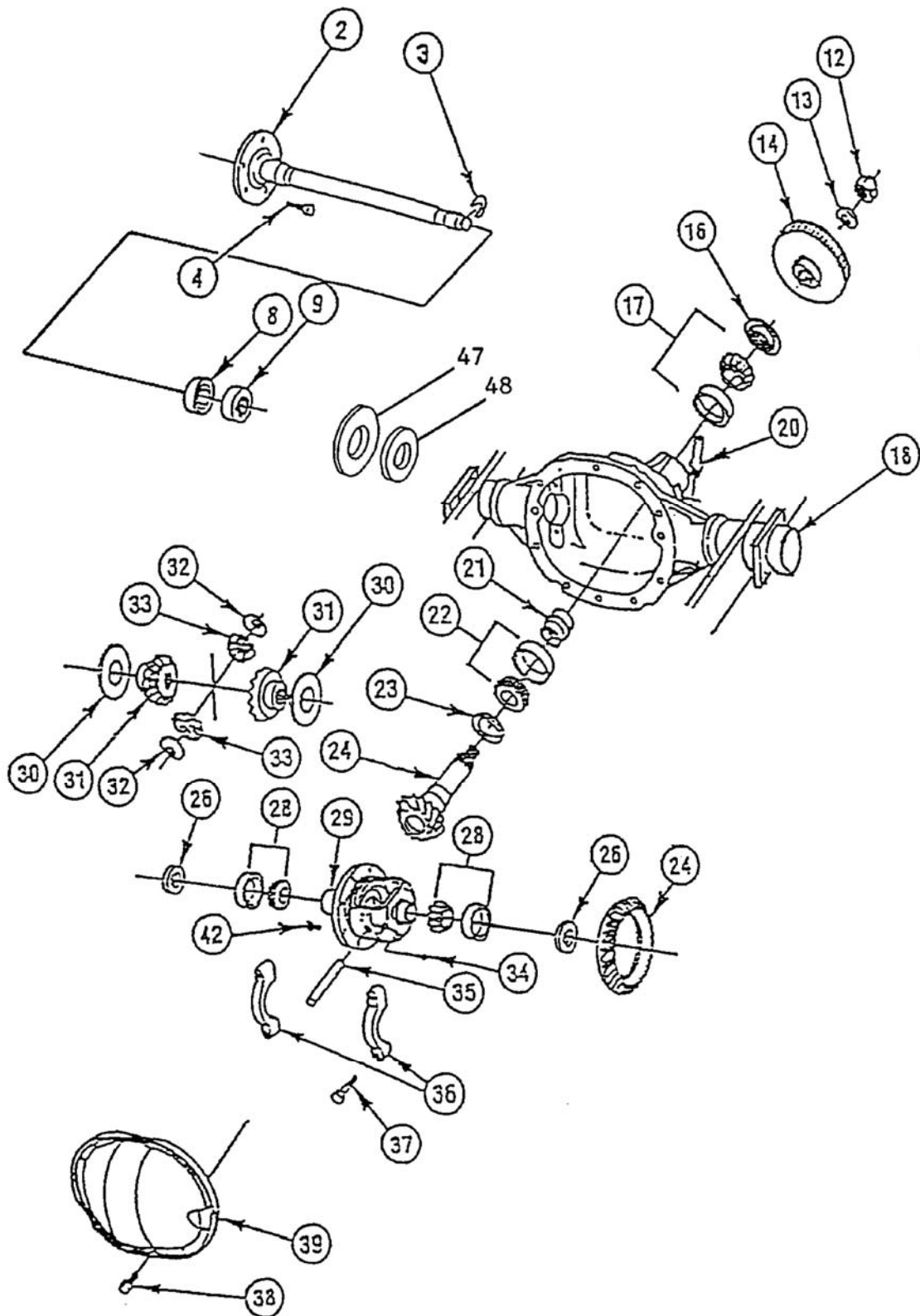
1. Remove the socket head screw (1/8" Allen) for the adjustment you want to make.
2. Adjust the internal potentiometer using a small **insulated** screwdriver (*available from Curtis*).
3. Replace the socket head screw and nylon seal washer. To prevent stripping, do not over-tighten.

**SPARE PARTS**

**BODY**

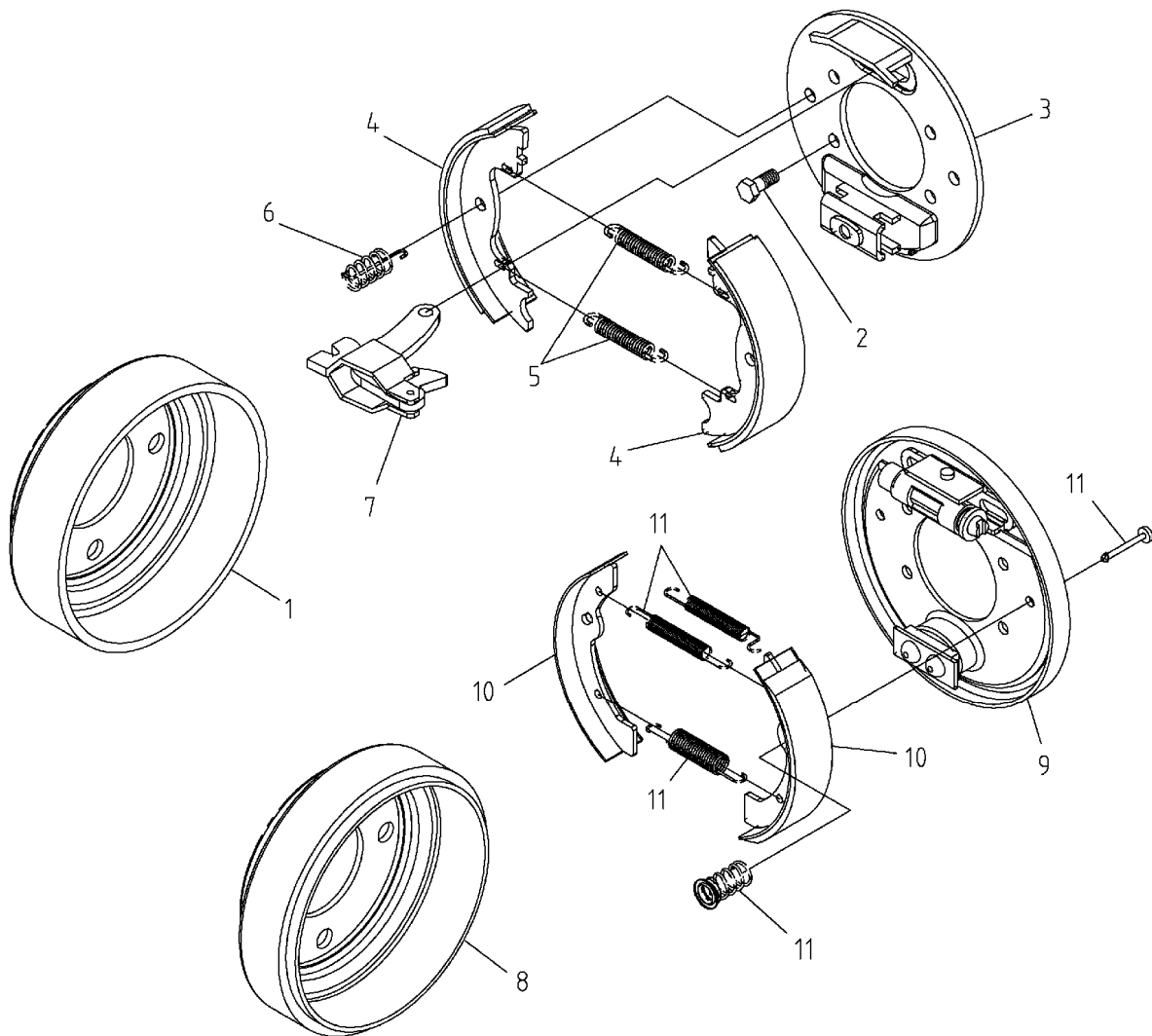
<i>REF.</i>	<i>PART NO</i>	<i>DESCRIPTION</i>
<b>1</b>	240001	BODY
<b>2</b>	120003	TRIM
<b>3</b>	240003	CARGO DECK
<b>4</b>	2400050	INSTRUMENT PANEL
<b>5</b>	240501	SEAT CUSHION
<b>6</b>	240502	BACKREST CUSHION
<b>7</b>	240503	FRAME
<b>8</b>	2401017	GARD
<b>9</b>	240101	7" REAR FOOTSTEP
	240107	12" REAR FOOTSTEP
	2401004	12" REAR FOOTSTEP WITH CLEVIS
	2401005	12" REAR FOOTSTEP, CLEVIS & SPRING
<b>10</b>	240105	BAR
<b>11</b>	240106	FRONT BUMPER
<b>12</b>	243001	4.80 X 8 PNEUMATIC WHEEL, 4 BOLT
	283001	4.80 X 8 PNEUMATIC WHEEL, 5 BOLT
	243002	4.80 X 8 FOAMFILLED WHEEL, 4 BOLT
	283002	4.80 X 8 FOAMFILLED WHEEL, 5 BOLT
	2407011	16" O.D. N.M. SOFT WHEEL, 4 BOLT
	2807001	16" O.D. N.M. SOFT WHEEL, 5 BOLT
<b>13</b>	2800006	FOLDING LIGHT POLE
<b>14</b>	1005003	BUCKET SEAT WITH SLIDE ADJUSTERS

## DIFFERENTIAL



<b>REF.</b>	<b>PART NO</b>	<b>DESCRIPTION</b>
<b>2</b>		SHAFT
	242052	BEFORE SERIAL # 0611210, 0611204 AND 0611207
	2420014	BETWEEN SERIAL # 0611210, 1013902
	2173240001	SERIAL # 1013902 & UP
<b>3</b>	2420021	LOCK
<b>4</b>	242054	BOLT
<b>8</b>		OIL SEAL
	242056	BEFORE SERIAL # 0611210
	2420011	SERIAL # 0611210 & UP
<b>9</b>		BEARING
	242057	BEFORE SERIAL # 0611210
	2420010	SERIAL # 0611210 & UP
<b>12</b>	242058	NUT
<b>13</b>	242059	WASHER
<b>14</b>	262081	PULLEY 12" O.D.
<b>16</b>	242060	OIL SEAL
<b>17</b>	242061	TAPER BEARING
<b>18</b>	Contact manuf.	HOUSING
<b>20</b>	242063	BREATHER
<b>21</b>	242064	SPACER
<b>22</b>	242065	TAPER BEARING
<b>23</b>	242066	SHIM
<b>24</b>	Contact manuf.	GEAR KIT
<b>26</b>	242068	SHIM
<b>28</b>	242070	TAPER BEARING
<b>29</b>	242071	CASE
<b>30</b>	242072	WASHER
<b>31</b>	242073	GEAR KIT
<b>32</b>	242074	WASHER
<b>33</b>	242075	GEAR KIT
<b>34</b>	242076	SCREW
<b>35</b>	242077	SHAFT
<b>36</b>	242078	CAP
<b>37</b>		BOLT
<b>38</b>	242079	PLUG
<b>39</b>	242080	COVER
<b>42</b>	2420019	BOLT
<b>47</b>	2420012	SLEEVE ( BEARING SIDE )
		FOR SERIAL # 0611204, 06112207 AND 0611280
<b>48</b>	2420013	SLEEVE ( OIL SEAL SIDE )
		FOR SERIAL # 0611204, 06112207 AND 0611280

## MECHANICAL DRUM BRAKES



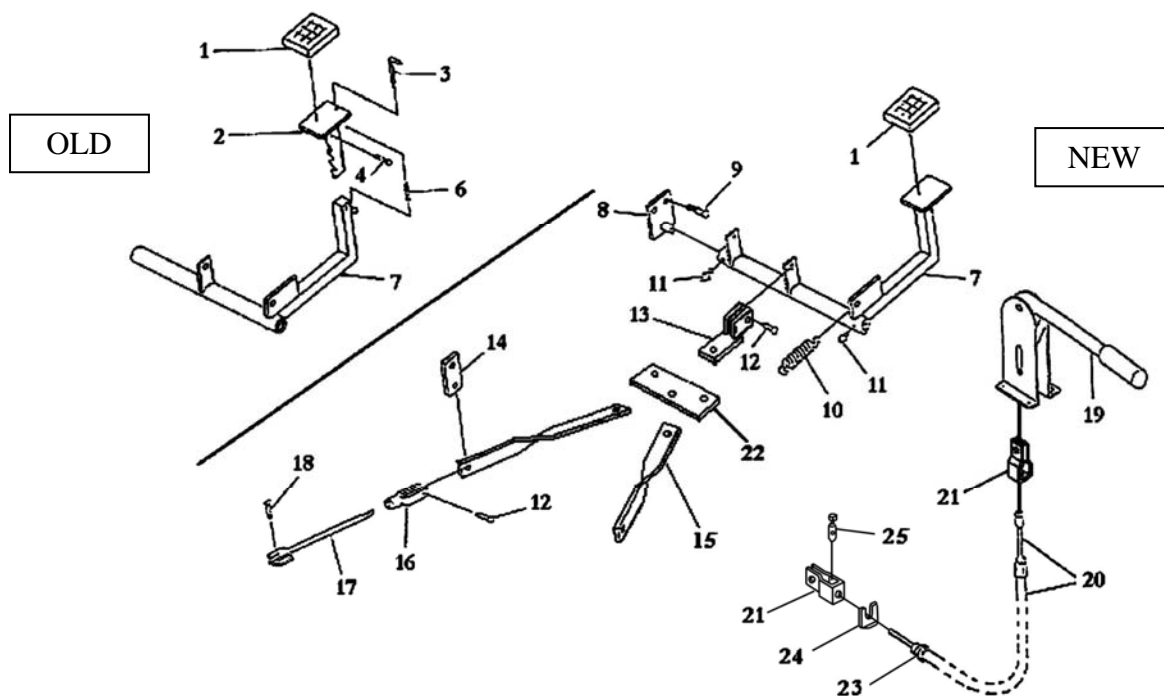
MANUAL ADJUSTMENT, OLD

SELF ADJUSTMENT, NEW SERIAL NUMBER  
0707070 & +

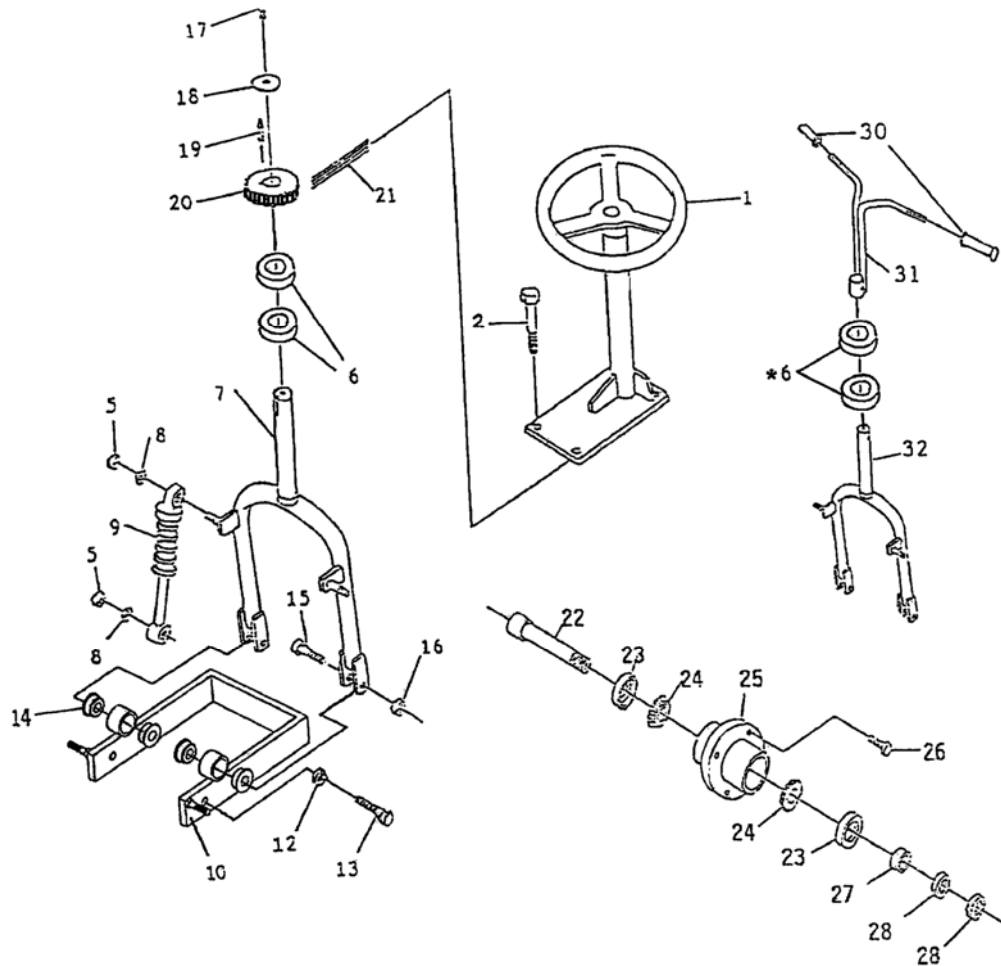
REF.	PART NO	DESCRIPTION
1	242051	DRUM
2		BOLT, 5/16-NC X 3/4
3	242841	BACK PLATE
4	242842	BRAKE SHOE
5	242844	EXT. SPRING
6	242845	HOLD SPRING
7	242846	LEVER

REF.	PART NO	DESCRIPTION
8	2123242001	DRUM 4-BOLT
	2123240001	DRUM 5-BOLT
9	2413002	BACKING PLATE LH
	2413010	BACKING PLATE RH
10	2413003	BRAKE SHOE
11	2413004	SPRING KIT (5)



**BRAKE CONTROLS**

REF.	PART NO	DESCRIPTION
1	242801	PEDAL RUBBER
2	242802	PARKING BRAKE CONTROL
3	242803	COTTER PIN
4		PIN 1/4 X 2
6	242806	SPRING
7	242830	OLD BRAKE LEVER
	2416006	NEW BRAKE LEVER
8	242831	PIVOT
9		BOLT 3/8-NC X 3
10	242816	SPRING
11	242817	LUBRICATION FITTING
12		PIN 3/8 X 1
13	2416017	PIVOT, DRAWBAR
14	242836	BAR
15	2416016	DRAWBAR
16	122813	YOKE
17	242837	ROD
18		PIN 5/16 X 3/4
19	3616013	8 IN. HAND BRAKE LEVER
20	362831	CABLE & CONDUIT
21	2416009	YOKE
22	2416018	BAR
23	2416012	END BUSHING,CABLE W/O CLIP
24	2129000001	CLIP
25	2921000001	CABLE STOP

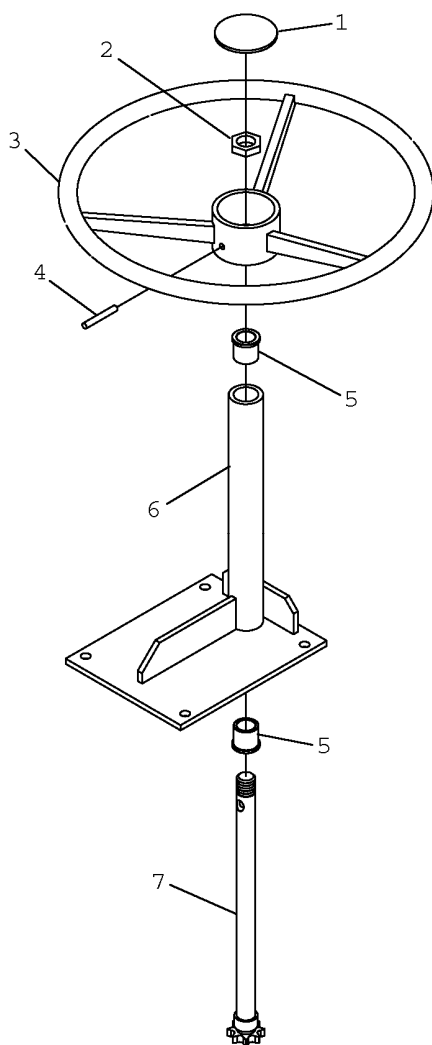
**STEERING ASSEMBLY****REF. PART NO DESCRIPTION**

<b>1</b>	241430	STEERING WHEEL ASS.
<b>2</b>		BOLT 3/8-NC X 3
<b>5</b>		LOCKNUT 7/16-NC
<b>6</b>	241406	BALL BEARING (2.44 O.D.)
	281406	BALL BEARING (3.31 O.D.)
<b>7</b>	241427	FORK (2.44 BEARING O.D.)
	281427	FORK (3.31 BEARING O.D.)
<b>9</b>	281409	SHOCK ABSORBER
<b>10</b>	281410	SUSPENSION ARM
<b>12</b>		LOCK WASHER ½
<b>13</b>		BOLT ½-NF X 1 ½
<b>14</b>	2440007	NYL-OIL ½ BUSHING, SET FOR 4
<b>15</b>		BOLT 5/8-NC X 3
<b>16</b>		LOCKNUT 5/8-NC
<b>17</b>		BOLT ¼-NC X ¾
<b>18</b>	261405	FLAT WASHER
<b>19</b>		KEY ¼

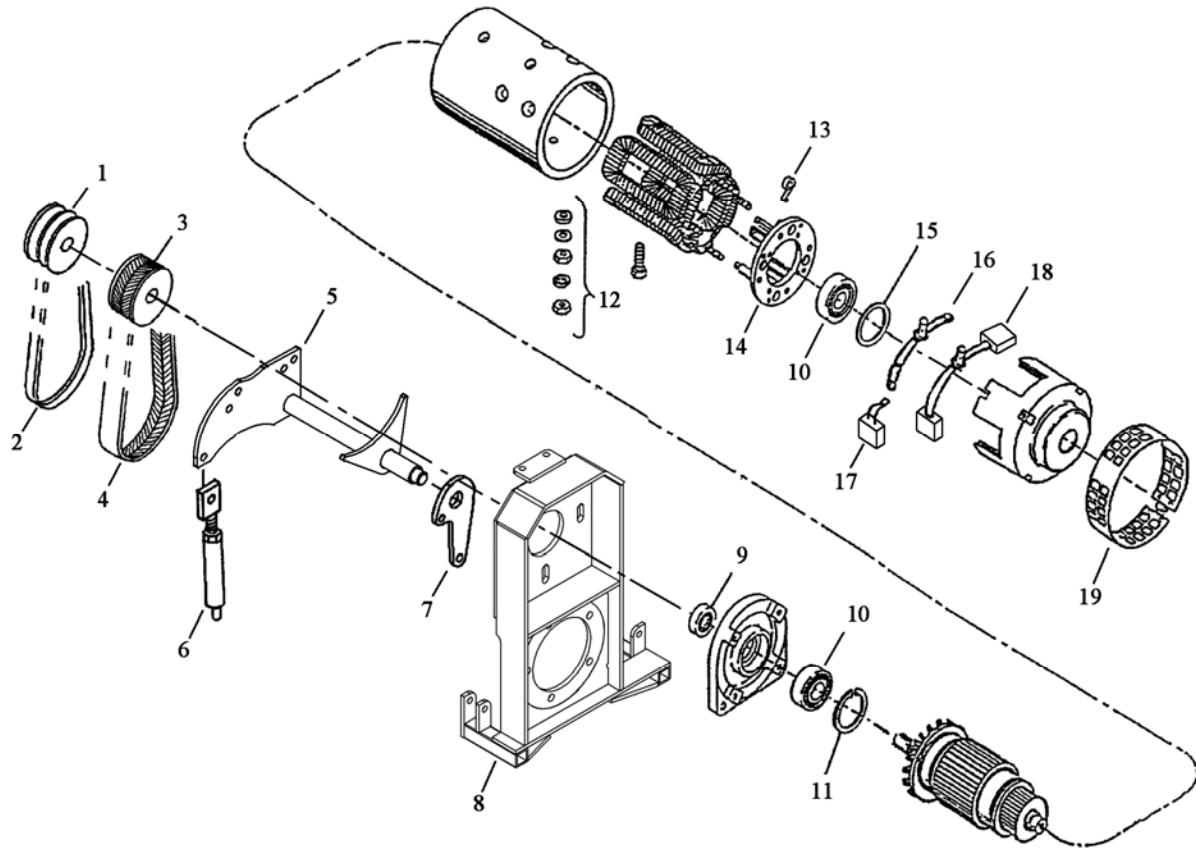
**REF. PART NO DESCRIPTION**

<b>20</b>	241431	SPROCKET
<b>21</b>	2430010	CHAIN
<b>22</b>	241001	AXLE
<b>23</b>	241002	SEAL
<b>24</b>	241003	TAPER BEARING
<b>25</b>	241004	HUB, 4 BOLT
	281004	HUB, 5 BOLT
<b>26</b>	241005	WHEEL BOLT
<b>27</b>	241006	BUSHING
<b>28</b>		JAM NUT 1-14-NF
<b>30</b>	241402	HANDGRIPS, RIGHT & LEFT
<b>31</b>	241401	HANDLE BAR
<b>32</b>	241407	FORK (2.44 BEARING O.D.)
	281407	FORK (3.31 BEARING O.D.)
<b>33</b>		BOLT 3/8-NC X ¾

## **STEERING WHEEL**



<b>REF.</b>	<b>PART NO</b>	<b>DESCRIPTION</b>
	241430	STEERING WHEEL ASS.
<b>1</b>	481453	COVER
<b>2</b>	481452	NUT
<b>3</b>	481451	STEERING WHEEL
<b>4</b>	481454	SPRING PIN
<b>5</b>	481437	BUSHING
<b>6</b>	2830011	SUPPORT
<b>7</b>	2830004	SHAFT

**MOTOR AND DRIVE****COMMON PARTS**

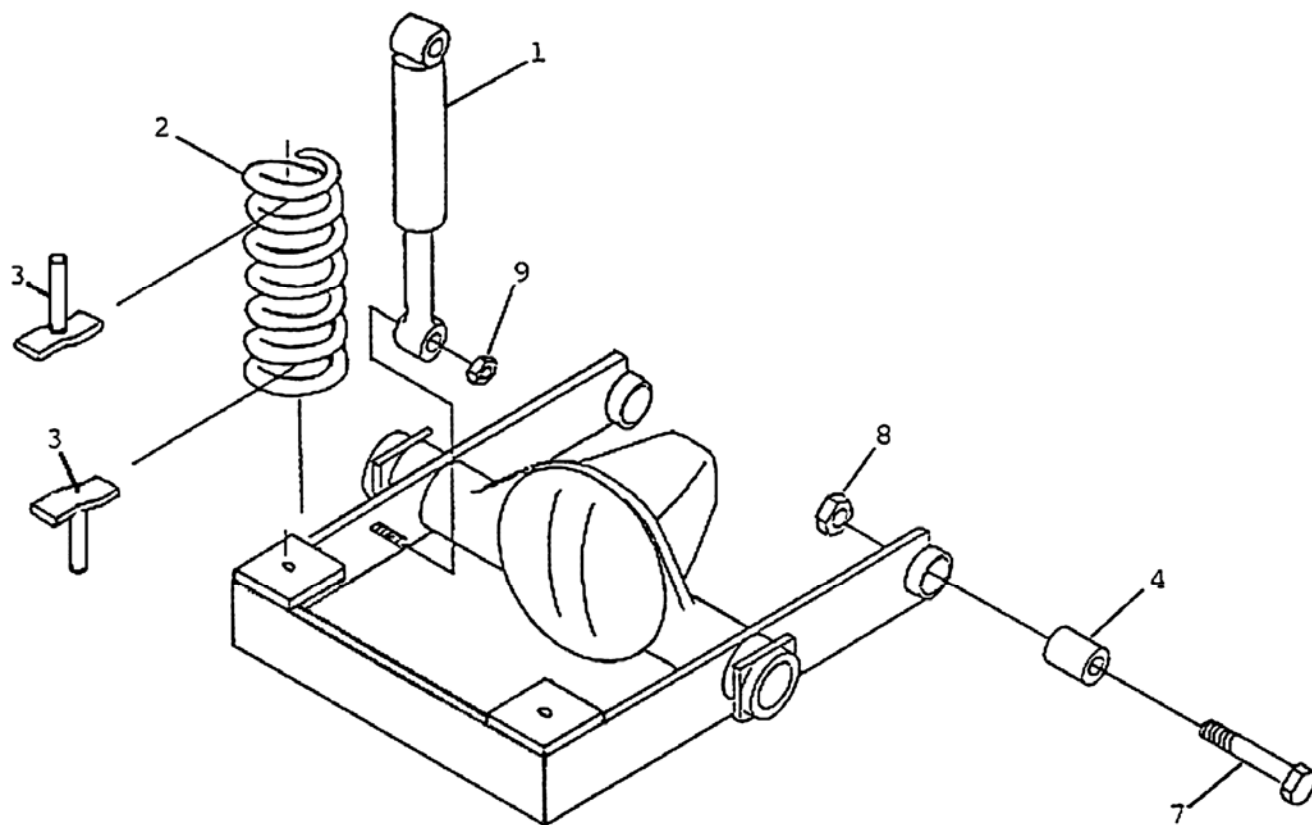
REF	DESCRIPTION	PART #	REF	DESCRIPTION	PART #
1	PULLEY	262424	8	MOTOR BASE, FORD	Contact manuf.
2	V BELT	242431		BELT TENSIONER	2152002
3	PULLEY	3651001	9	SEAL	484001
4	BELT, EAGLE	3651002	10	BEARING	484003
5	MOTOR BASE, GM	Contact manuf.	11	SNAP RING	484004
6	BELT TENSIONER, LONG	2452005	12	NUT WASHER PACK	484006
7	BELT TENSIONER, SHORT	2452003	15	WAVY WASHER	484013
	PIVOT	2452002	19	HEADBAND	484015
				EE HEADBAND KIT	A91-107A

**SPECIFIC**

REF	DESCRIPTION	A89	B98	A00	D00 SEPEX	DC3 SEPEX	DANA DRIVE
	MOTOR ASS'Y	484000	204050	2450002*	2450003*	3112210001*	3112230001
13	BRUSH SPRING	484010	484010	2450006	2450006	2450006	2450006
14	BRUSH PLATE	484011	484011	2450007	2450007	2450007	2450007
16	LEAD ASSY.	484017	484017	N/A	N/A	N/A	N/A
17	BRUSH	484009	484009	N/A	N/A	N/A	N/A
18	LEAD AND BRUSH ASSY.	N/A	N/A	2450008	2450008	3112210004	2450008

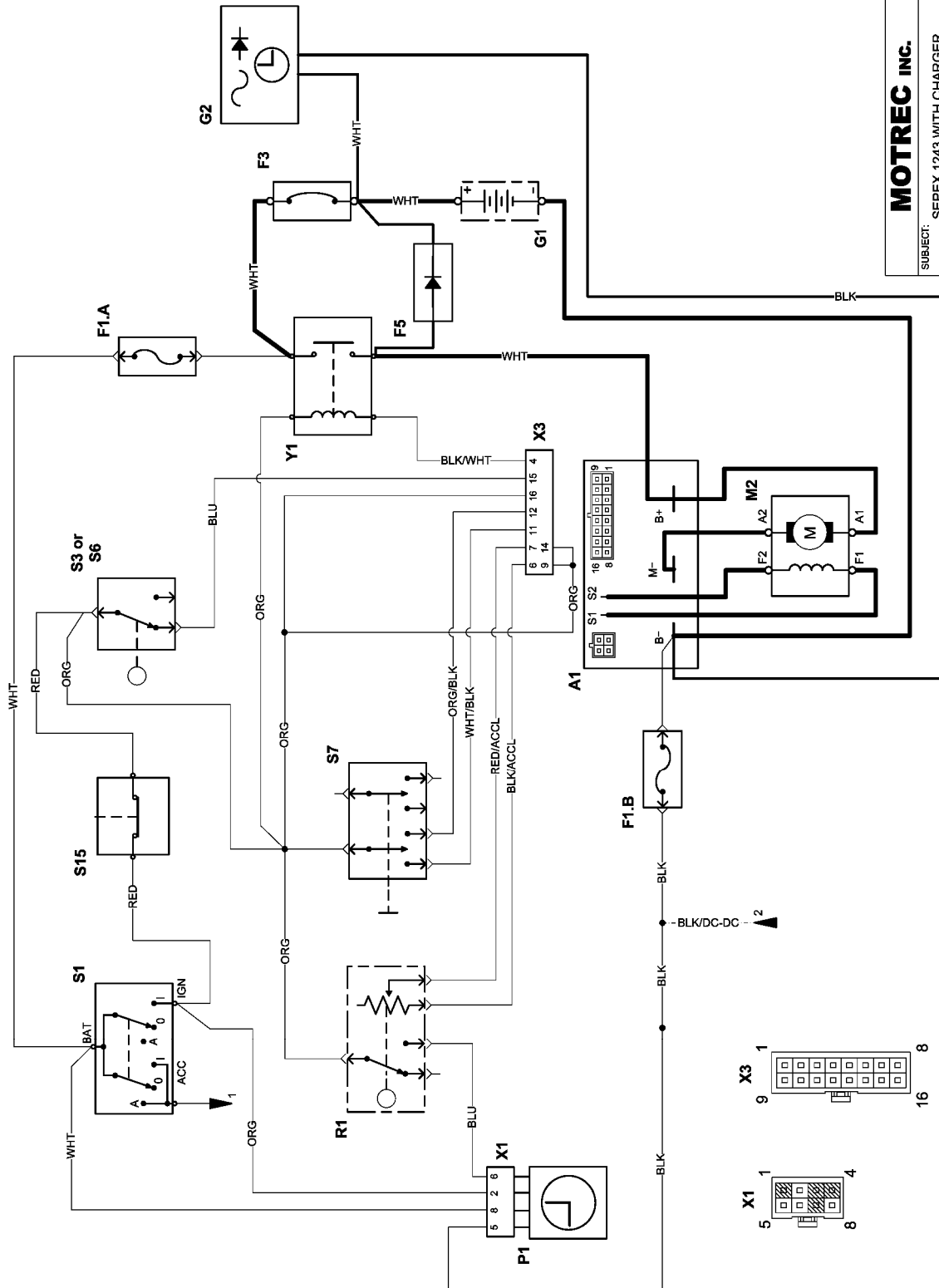
\* WHEN EQUIPPED WITH ELECTROMAGNETIC BRAKE, PLEASE CONTACT THE MANUFACTURER

## REAR AXLE FRAME



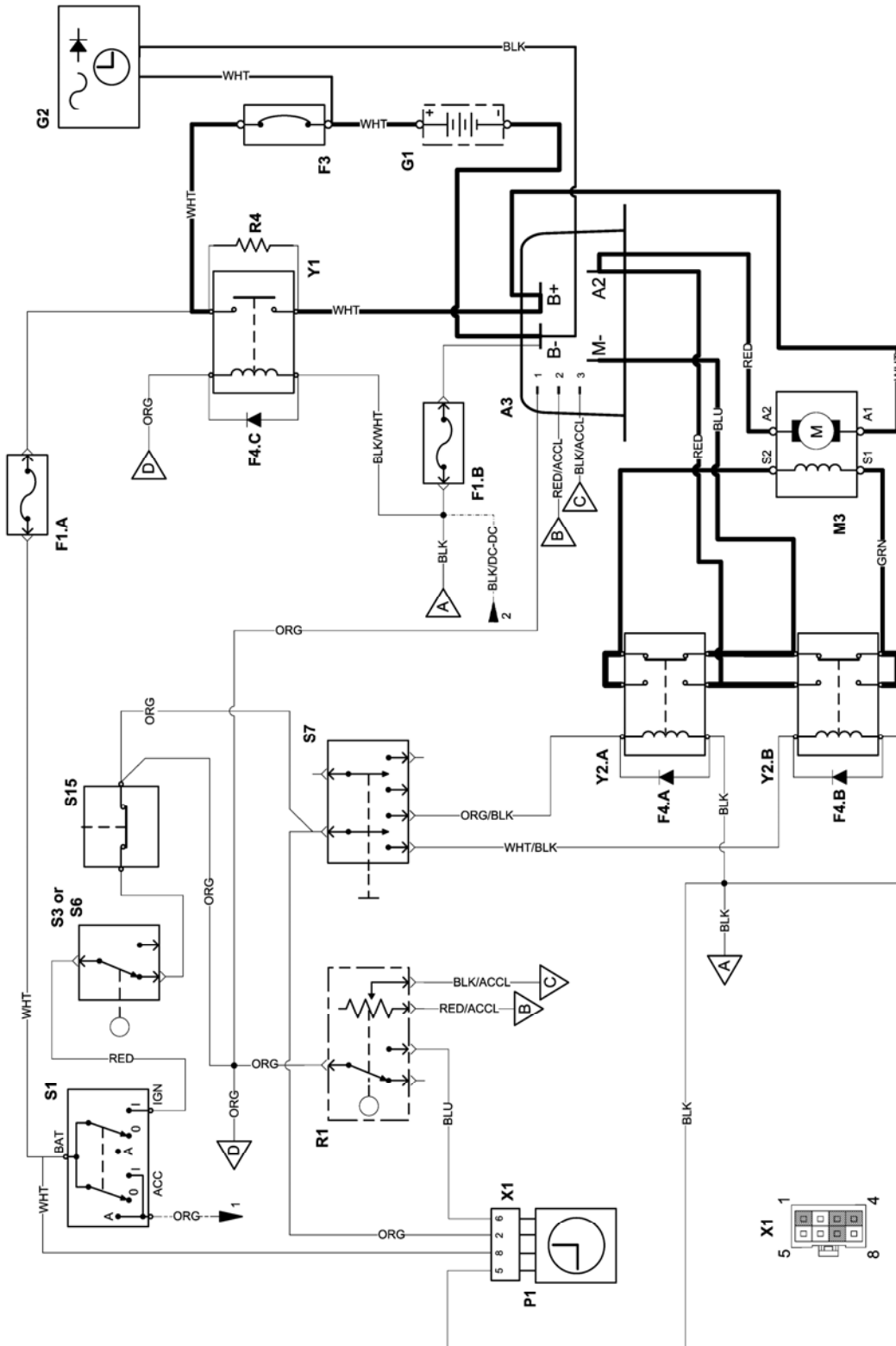
REF.	PART NO	DESCRIPTION
1	242621	SHOCK ABSORBER
2	242622	COIL SPRING
3		SPRING RETAINER
	242623	BEFORE SERIAL # 1012672 & UP
	2440008	SERIAL # 1012672 & UP
4	242602	BUSHING
7		BOLT 5/8-NC X 4
8		LOCK NUT 5/8-NC
9		LOCK NUT 1/2-NC

# **ELECTRICAL DIAGRAM – SEPEX MAIN CIRCUIT** **DIAGRAMME ÉLECTRIQUE – CIRCUIT PRINCIPAL SEPEX**



<b>MOTREC INC.</b>	
SUBJECT:	SEPEX 1243 WITH CHARGER
TITLE:	MAIN CIRCUIT SEPEX
VERSION:	01
DATE:	2008-07-10
AUTHOR:	J. GAGNON
APPROVED:	
DRAWING #:	SEPEX 1243 - CHARGER.VSD

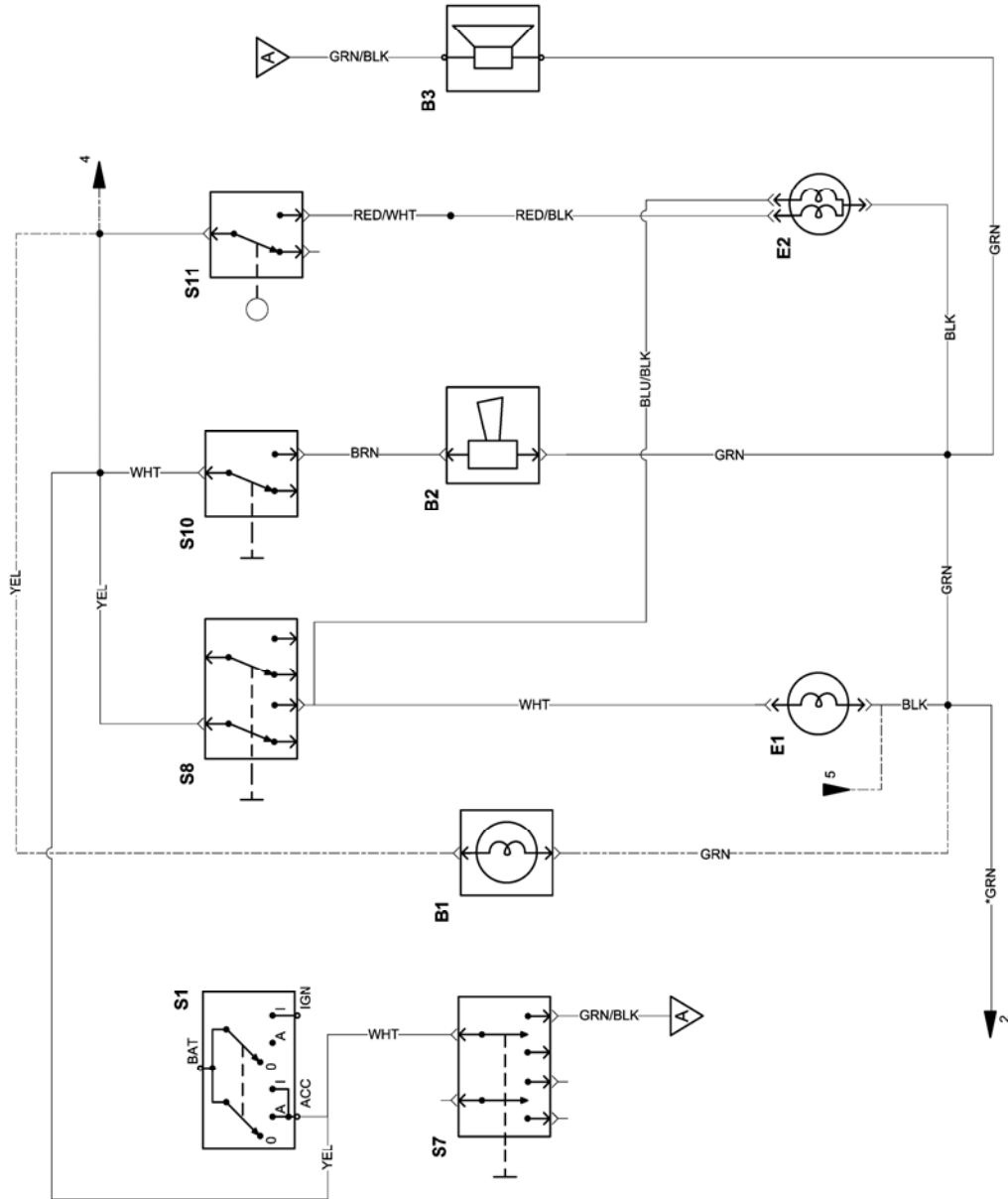
## ELECTRICAL DIAGRAM – SERIES MAIN CIRCUIT DIAGRAMME ÉLECTRIQUE – CIRCUIT PRINCIPAL SÉRIES



<b>MOTREC INC.</b>			
SUBJECT:	SERIES - CHARGER		
TITLE:	MAIN CIRCUIT - SERIES		
VERSION :	01	DATE :	2006-04-11
AUTHOR :	J. GAGNON	APPROVED:	
DRAWING # :	SERIES - CHARGER VSD		

## ACCESSORIES – NO DC/DC CONVERTER

## ACCESSOIRES – SANS CONVERTISSEUR DC/DC



<b>MOTREC INC.</b>			
SUBJECT:	ACCESSORIES - 1HL1TL1SL		
TITLE:	ACCESSORIES		
VERSION:	01	DATE:	2006-04-11
AUTHOR:	J. GAGNON	APPROVED:	
DRAWING #:	ACC - NO DC-DC - 1HL1TL1SLVSD		

\* Accessories ground is connected at an intermediate post relative to vehicle battery set positive post when DC-DC converter option is not taken.  
The relative voltage is either 12V or 24V depending on accessories



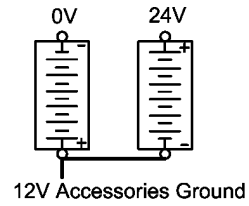
**PARTS LIST**

<b>NO</b>	<b>DESIGNATION</b>	<b>REF</b>	<b>QTY</b>
A1	SEPEX SPEED CONTROL	1243-4320	1
A3	SERIES SPEED CONTROL, 275A	367010	1
B1	STROBELIGHT	*	1
B2	HORN	*	1
B3	REVERSE ALARM	*	1
E1	HEADLIGHT, SQUARE	*	1
E2	TAIL/BRAKE LIGHT	*	1
F1.A,B	FUSE	246108K	2
F3	CIRCUIT BREAKER, 150A	3107000002	1
F4.A,B,C	DIODE	367012	3
F5	DIODE BRIDGE	3669027	1
G1	BATTERY		
G2	BATTERY CHARGER		
M2	SEPEX MOTOR		
M3	SERIES MOTOR		
P1	HOUR METER, BATTERY GAUGE	*	
	ANALOG METER	*	
R1	ACCELERATOR	2142100001	1
	MICROSWITCH	367002	1
	POTENTIOMETER	367003	1
	PLASTIC GEAR	367015	1
	SPRING	2462008	1
R4	RESISTANCE, 250 OHMS	367014	1
S1	KEY SWITCH	246205	1
S3	SEAT SWITCH, MICRO-SWITCH	3109100002	1
	SEAT SWITCH, SEAT MOUNTED	3109000003	1
	CONNECTOR	3109000004	1
S7	FOWARD/REVERSE SELECTOR	266211	1
S8	LIGHT SWITCH	1269004	1
S10	HORN BUTTON, COLUMN MOUNT	*	1
S12	BRAKE LIGHT SWITCH	246207	1
S15	EMERGENCY PUSH BUTTON	3109800001	1
	EMERGENCY PUSH BUTTON LABEL	3109800006	1
X1	HOUR METER CONNECTOR		1
X3	SPEED CONTROL CONNECTOR		1
Y1	MAIN CONTACTOR	246111	1
Y2.A,B	F/R CONTACTOR	246230	2
	F/R BUSSBARS	2469003	1
	STATIC STRAP	2450001	1

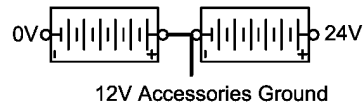
\* Consult Motrec Illustrated parts

## BATTERY CONFIGURATIONS - 24V CONFIGURATIONS DES BATTERIES – 24V

E-12



E-100

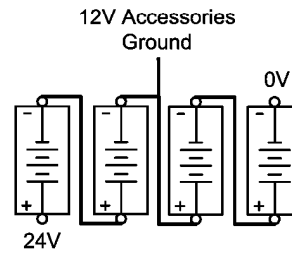


E-260

E-262

E-270

E-272



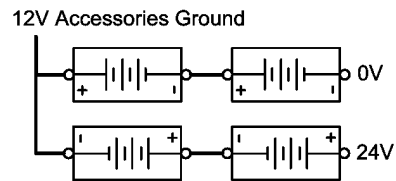
E-240

E-242

E-242 HD

E-250

E-250HD



## DELTA-Q HF CHARGER



<i>NO</i>	<i>PART NO</i>	<i>DESCRIPTION</i>
1	3102240002	24V CHARGER ( U.S. BATTERY )
	3102240003	24V CHARGER ( LIFELINE BATTERY )
	3102240004	24V CHARGER ( GEL 180AH BATTERY )
	3102240005	24V CHARGER ( 27TM BATTERY )
	3102302001	36V CHARGER ( U.S. BATTERY )
	3102302002	36V CHARGER ( LIFELINE BATTERY )
	3102302003	36V CHARGER ( GEL 180AH BATTERY )
	3102480002	48V CHARGER ( U.S. BATTERY )
	3102480003	48V CHARGER ( LIFELINE BATTERY )
	3102480004	48V CHARGER ( GEL 180AH BATTERY )
	3102720001	72V CHARGER (U.S. BATTERY)
2	3119000011	CONNECTOR C13
*	3120000001	PORTABLE CHARGER AC CORD
*	3120000002	BUILT-IN CHARGER AC CORD

\* NOT ILLUSTRATED



HFIPFC Battery Charger

## Product Manual for:

QuiQ 912-24xx | 36xx | 48xx | 72xx



Unit 3 – 5250 Grimmer St.  
Burnaby, BC, Canada V5H 2H2  
Tel: 604.327.8244 Fax: 604.327.8246  
www.delta-q.com

## SAVE THESE IMPORTANT SAFETY INSTRUCTIONS



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

### Battery Safety Information

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

### Electrical Safety Information

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

## INFORMATIONS IMPORTANTES DE SÉCURITÉ

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

### Information de Sécurité de la Batterie

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

### Information de Sécurité Électrique

**Danger:** Risque de chocs électriques. Ne pas toucher les parties non isolées du connecteur de sortie ou les bornes non isolées de la batterie. Toujours connecter le chargeur à une prise de courant mise à la terre. Ne pas ouvrir ni désassembler le chargeur – référer toute réparation aux personnes qualifiées. Pas à l'usage des enfants.

## Operating Instructions

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

## Maintenance Instructions

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

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



## Specifications

### DC Output – see Operating Instructions

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

### AC Input

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

### Operation

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

## Installation Instructions




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

### 1) Determine Mounting Location:

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

### 2) Mounting Procedure:

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

### 3) DC Battery Connection Procedure:

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

### Mechanical

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

### Regulatory

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

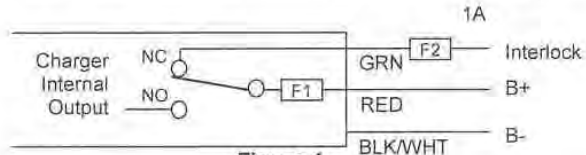


Figure 1

### 4) Check / Change Charging Algorithm:

The charger comes pre-loaded with algorithms for batteries as detailed in Table 1. If your specific battery model is not listed, please contact Delta-Q.

Each time AC power is applied with the battery pack NOT connected, the charger enters an algorithm select/display mode for approximately 11 seconds. During this time, the current Algorithm # is indicated on the '80%' LED (Models 912-xx0x) or on the single LED (Models 912-xx1x). A single digit Algorithm # is indicated by the number of blinks separated by a pause. A two digit Algorithm # is indicated by the number of blinks for the first digit followed by a short pause, then the number of blinks for the second digit followed by a longer pause.

To check / change the charging algorithm:

- Disconnect the charger positive connector from battery pack. Apply AC power and after the LED test, the Algorithm # will display for 11 seconds.
- To change algorithm, touch positive connector during the 11 second display period to the battery pack's positive terminal for 3 seconds and then remove – the Algorithm # will advance after 3 seconds. Repeat until desired Algorithm # is displayed. A 30 second timeout is extended for every increment. Incrementing beyond the last Algorithm moves back to the first Algorithm. After desired Algorithm # is displayed, touch the charger connector to the battery positive until the output relay is heard to click (~10 seconds) – algorithm is now in permanent memory.
- Remove AC power from the charger and reconnect the charger positive connector to the battery pack. It is highly recommended to check a newly changed algorithm by repeating step 4) above.

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

Table 1.

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

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

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**MOTREC ILLUSTRATED ACCESSORIES**

 <p>Strobelight, polemount Amber 12-80V: 3116000001 Red 12-80V: 2469001 Blue 12-80V: 3690008</p>	 <p>Red Tail/Brake light ** Model EE ** Assembly: 3111000030 Housing: 3111000027 Plug: 3111000029 12V : 3111000028</p>	 <p>Headlight Left: 3111480003 Right: 3111480004 Bulb H/L: 3111480006 Bulb Turn: 3111480008 Bulb Mark: 3111480007</p>	 <p>Red Tail/Brake light 12V: 386002</p>
 <p>Strobelight, cab mount Amber 12-48V: 3116250001 Red 12-48V: 3069026 Blue 12-48V: 3069014 Amber 72-80V: 3116720001 Red 72-80V: 3116720002 Blue 72-80V: 3116720003</p>	 <p>Red Tail/Brake light Housing: 3069012R Bulb 12V: 3117240001</p>	 <p>Headlight Left: 3111480003 Right: 3111480004 Bulb H/L: 3117480001 Bulb Turn: 3117480003 Bulb Mark: 3117480002</p>	 <p>Horn button VIP 2208224002</p>
 <p>Amber turn lamp 12V: 3111000022 Bulb 12V: 3069021 Multi-LED amber turn lamp Round Light: 3111000010 Grommet: 3111000008 Plug: 3111000009</p>	 <p>Back-up lamp Grommet: 3269001 12V: 3669012 24V: 3669012A</p>	 <p>Turn signal switch 246050</p>	 <p>Horn button, column mount 3109000011</p>
 <p>Red Tail/Brake light Grommet: 3269001 Plug: 246012A 12V : 2469021 24V : 2469022</p>	 <p>Clear lamp 12V: 3069012 Bulb 12V: 1269008</p>	 <p>Multi-LED Red Tail/Brake Light: 3111000006 Grommet: 3111000008 Plug: 3119000009</p>	 <p>Horn button, dash mount 266210</p>
	 <p>Pedestral head lamp 12V: 3111240001 Bulb 12V: 2569001B Bulb 24V: 2169001B</p>	 <p>Multi-LED Back-up Light: 3111000007 Strobe light: 3111000013 Grommet: 3111000008 Plug: 3119000009</p>	 <p>Horn button 3109250001</p>  <p>Horn 12V: 246003 24V: 246013</p>

 <p>Analog Voltmeter 12V : 3069007 24V : 2469002 36-48V : 3669002</p>	 <p>Wiper motor 12V: 3113000001 24V: 486211</p>	 <p>Cab heater 12V: 3103300001 36V: 3669008 48V: 4869020</p>	 <p>Headlamp 12V:3111250007</p>
 <p>HOBBS Gauge 24V: 2469026 36V: 3069038 48V: 4869037</p>	 <p>Wiper arm 2800000001</p>	 <p>12V Dome light 3669006</p>	 <p>Headlamp 12V: 3111300001 Bulb 12V: 3111300002</p>
 <p>DC-DC converter, 10A 12-48V: 3069019</p>	 <p>Wiper blade 14" Blade: 2800000002 18" Blade: 2800000003</p>	 <p>12V Fan 3669013</p>	 <p>Red Pilot light 12V: 246212 Bulb 12V: 246212B</p>
 <p>DC-DC Converter, 25A 12-48V: 3124000002 72-80V: 3124880001</p>	 <p>Pantograph wiper arm 246233A</p>	 <p>Limit switch 3109000029</p>	 <p>Back-up alarm or Motion beeper 12-48V : 3100000001 72-80V : 3105720001</p>
 <p>DC-DC Converter, 300W 24V: 3124224001 36-48V: 3124280001 72-80V: 3124880001</p>	 <p>Pantograph wiper blade 246233</p>		 <p>12-24V Adjustable ECCO: 3100000002</p>
 <p>CONNECTOR:3124280002</p>			 <p>12-48V Adjustable PRECO: 3100000004</p>

## BATTERY DISCHARGE INDICATOR (HOBBS)

This indicator monitors :

- the residual capacity of batteries;
- operating hours;
- status of service down counter.

The residual capacity of the battery is monitored via an 8-LED bar display. When the left red LED lights, the batteries must be charged to avoid damage. The LED display starts flashing as a pre-warning signal. The lower voltage limit is adjustable via potentiometer “M” on the rear.

A	B	C	D	E	F	G	H	I	J	K
1,57	1,63	1,68	1,73	1,78	1,82	1,84	1,86	1,89	1,91	1,93

In order to activate a new adjustment, the unit has to be reset :

- 2.35V/cell reset voltage with battery remaining in vehicle;
- 2,09V/cell reset voltage after battery has been disconnected.

To maintain a good battery performance, it is recommended to limit the discharging to 80% of the battery capacity. The recommended setting for 6V batteries is F and the recommended setting for an industrial battery is K.

An internal relay can prevent overdischarging and damaging the batteries. The relay can be wired to cut off the reverse direction, or energize an N.C. relay and alarm.

Turning off and on the vehicle will override the protection for 30 sec.

The current status (remaining operating hours before maintenance) of the service down counter is indicated for a period of 5 seconds after the key switch is turned on. When it is down to 0, the display flashes. After the maintenance, reset the counter: depress the button “R” on the rear. The service counter is factory programmable only.

24V UNIT #: 2469026

36V UNIT #: 3069038

48V UNIT #: 4869037

2- Orange, key switch

3- Relay +

4- Relay -

5- Black, battery –

6- Blue, hour counter

8- White, battery +

