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# T-448HD

## 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.

Publication date:
**July 1, 2015**

Edition for vehicles with
a serial number higher than:
**1059506**

For additional information,
please contact our customer service:

**MOTREC INTERNATIONAL INC.**
200 Des PME Street
Sherbrooke, Quebec J1C 0R2
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1-866-846-3558

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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.

Date de publication:
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Édition destinée aux véhicules ayant
un numéro de série supérieur à:
**1059506**

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

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MOTREC

# T-448HD


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

SERIAL NUMBER: 1059506 & 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.

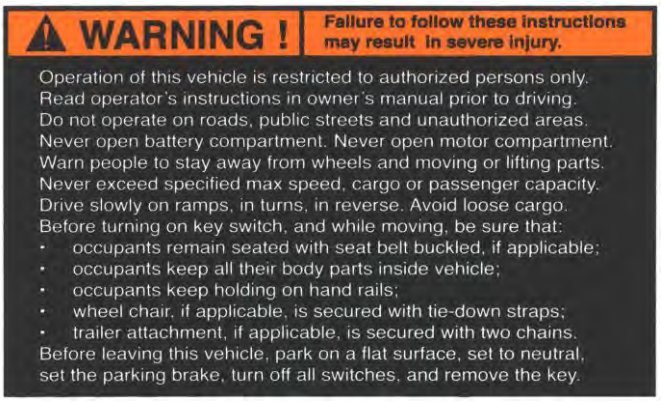
## DECALS AND LABELS

**! CAUTION !**

The images included in this section depict the decals/markings installed on the vehicle. It is of the utmost importance that theses decals/markings remain unaltered and readable. Else, the sticker or the part baring 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 120110**

**! 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<br>2" (50 mm) maximum travel | | | X | | | |
| STEERING FOR PLAY | | | X | | | |
| PARKING BRAKE LEVER<br>requires 65-75 lbs. (30-34 kg) force to apply | | | X | | | |
| BELTS AND PULLEYS<br>-10 lbs (5kg). force for 1/8" (3mm) deflexion;<br>-pulleys alignment, see procedure. | | | | X | | |
| CLEAN/TIGHTEN WIRE TERMINALS | | | | X | | |
| WASH BATTERY TOP WITH WATER | | | | X | | |
| MOTOR BRUSHES FOR WEAR<br>-brushes must exceed holders | | | | X | | |
| ACCELERATOR ADJUSTMENT<br>-1/8" (3 mm) travel to activate micro-switch;<br>-0 to 50 ohms when micro-switch activated;<br>-4500 to 5500 ohms with pedal down. | | | | X | | |
| HYDR. BRAKE LINES FOR LEAK | | | | X | | |
| STEERING ASSEMBLY, as instructed | | | | X | | |
| BRAKE MECHANICAL LINKAGES<br>for wear & play | | | | X | | |
| BRAKE LININGS FOR WEAR<br>1/16" (2 mm) minimum lining thickness.<br>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<br>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.

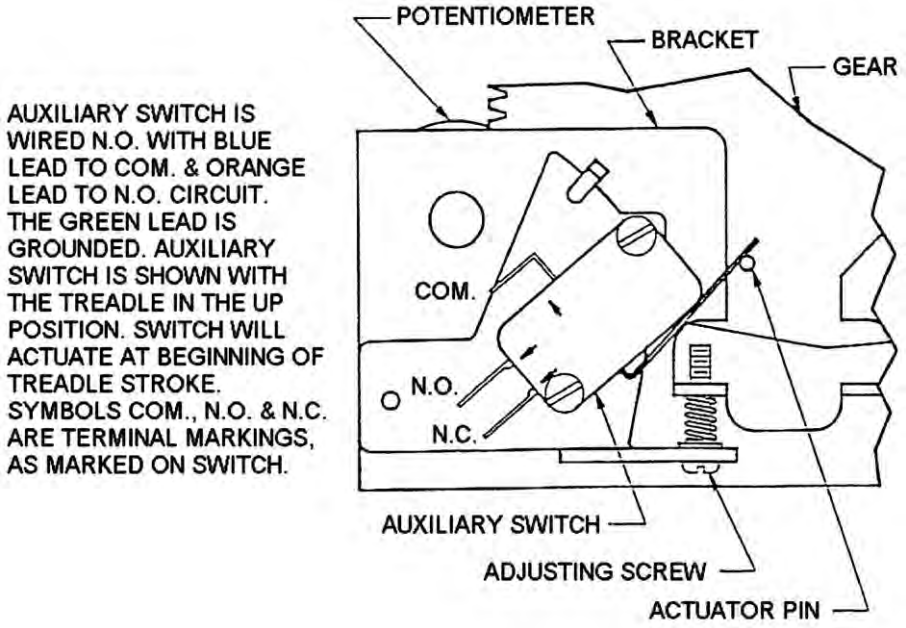
## MICRO-SWITCH

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.



## FOOT PEDAL FP-6 MAINTENANCE GUIDELINES

***FEATURES -***

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

***SPECIFICATIONS -***

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

***INSTALLATION PROCEDURE***

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

### 1. MICRO SWITCHES AND POT SETTING

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

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

***CHECK LIST / CAUTION***

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

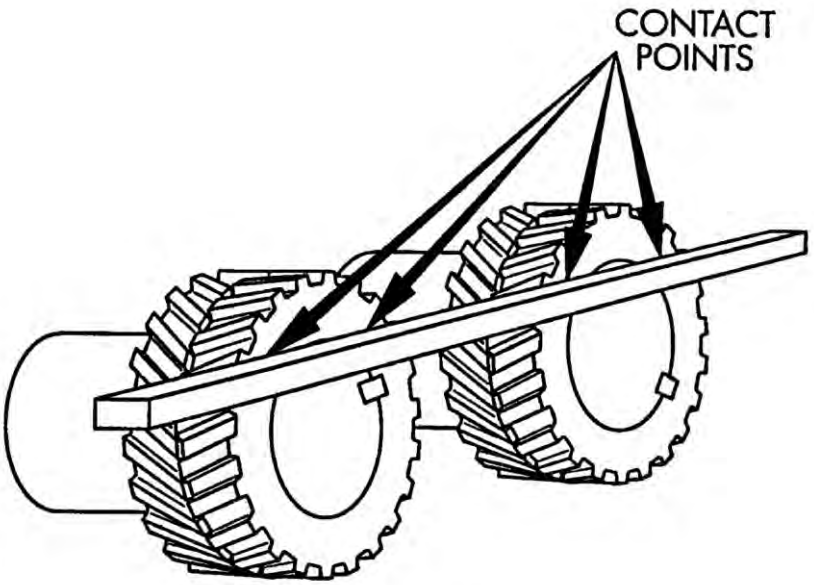
***YEARLY MAINTENANCE***

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

## BELT INSTALLATION AND TENSIONING

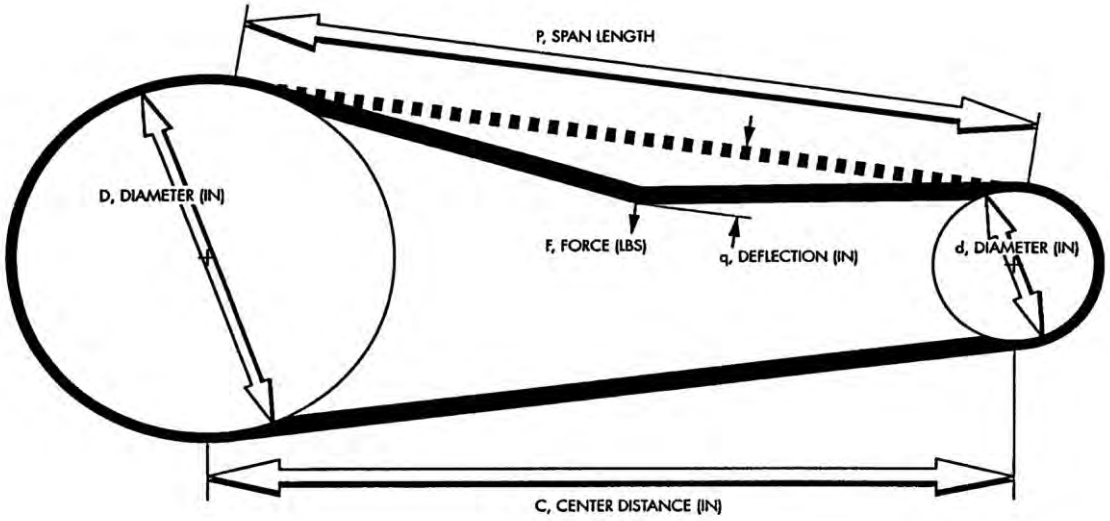
### INSTALLATION

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.



# HYDRAULIC & PARKING BRAKES

**Revision 2012-01-10**

## 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 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 65-75 Lbs or 30-34 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 callipers one at a time by having someone applying a steady pressure on the brake pedal, and close the bleeder before allowing the brake pedal to return to up position;
3. fill the master cylinder with brake fluid (DOT-3);
4. bleed rear wheel brakes one at a time, following the same procedure;
5. fill the master cylinder with brake fluid (DOT-3);
6. clean every fitting and line, remove traces of oil;
7. apply a continuous pressure on the brake pedal for about five minutes ;
8. Finally, inspect brake lines and fittings for leaks ;

# FRONT AXLE AND STEERING

**! CAUTION !**

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

## STEERING INSPECTION

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

## REPLACING & ADJUSTING THE STEERING GEAR

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

## TOE-IN ADJUSTEMENT

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

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

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

## ADJUSTING FRONT HUBS

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

# BATTERY MAINTENANCE

**! WARNING !**

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

## BATTERY LEADS AND CONNECTORS

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

## BATTERY POST CORROSION

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

## ELECTROLYTE LEVEL

Does not apply to sealed battery.

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

## BATTERY MOUNTING

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

## BATTERY DISCHARGE LIMIT

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

## CHARGING AREA

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

## FREQUENCY OF CHARGE

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

## STORAGE

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

## DEFECTIVE BATTERY

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

## BATTERY CHARGER

**! WARNING !**

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

**CHARGER DOES NOT TURN ON:**

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

**RELAY CLOSES AND TRANSFORMER HUMS BUT AMMETER DOES NOT REGISTER:**

- Check dc fuse links;
- Check the continuity of the dc output cord, ammeter, diodes and all connections in the dc circuit;
- Check diodes;
- Check capacitor(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 heavely discharged new or cold batteries;
- Replace electronic control.

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

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

# ELECTRICAL TROUBLESHOOTING

**! WARNING !**

Maintenance work must be performed by trained service technicians only.

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

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

**! WARNING !**

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

Always wear safety glasses.

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

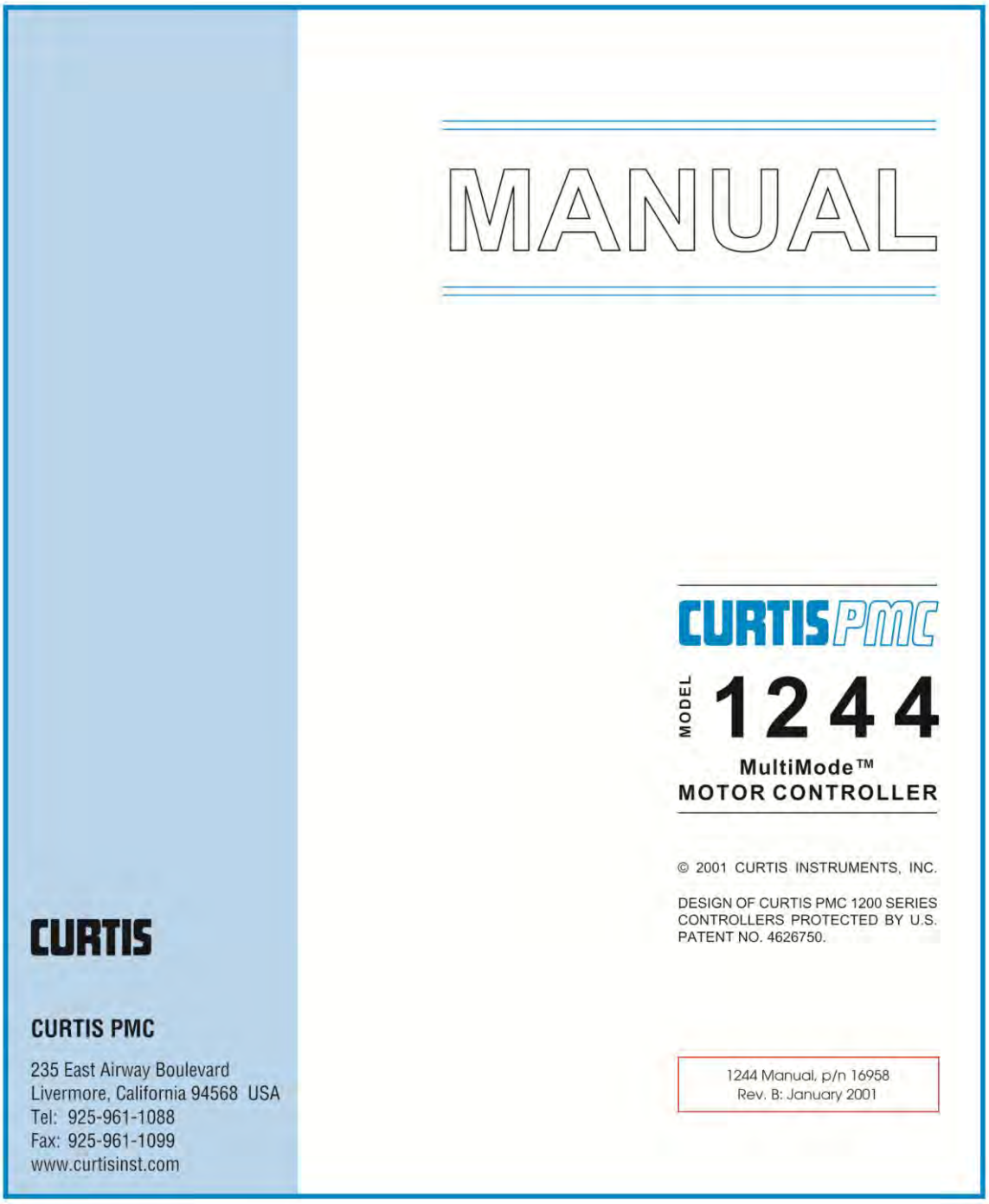
*Check PMC*

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 1244


MANUAL
CURTIS PMC
MODEL 1244
MultiMode™
MOTOR CONTROLLER
© 2001 CURTIS INSTRUMENTS, INC.
DESIGN OF CURTIS PMC 1200 SERIES CONTROLLERS PROTECTED BY U.S. PATENT NO. 4626750.
1244 Manual, p/n 16958
Rev. B: January 2001
CURTIS
CURTIS PMC
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1244 Manual
p/n 16958, Rev. B: January 2001

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# WIRING : STANDARD CONFIGURATION



## WIRING: Standard Configuration

Figure 3 shows the typical wiring configuration for most applications. The interlock switch is typically a seat switch, tiller switch, or foot switch.

### Standard Power Wiring

Motor armature winding is straightforward, with the armature's A1 connection going to the controller's B+ bus bar and the armature's A2 connection going to the controller's M- bus bar.

The motor's field connections (**F1** and **F2**) to the controller are less obvious. The direction of vehicle travel with the forward direction selected will depend on

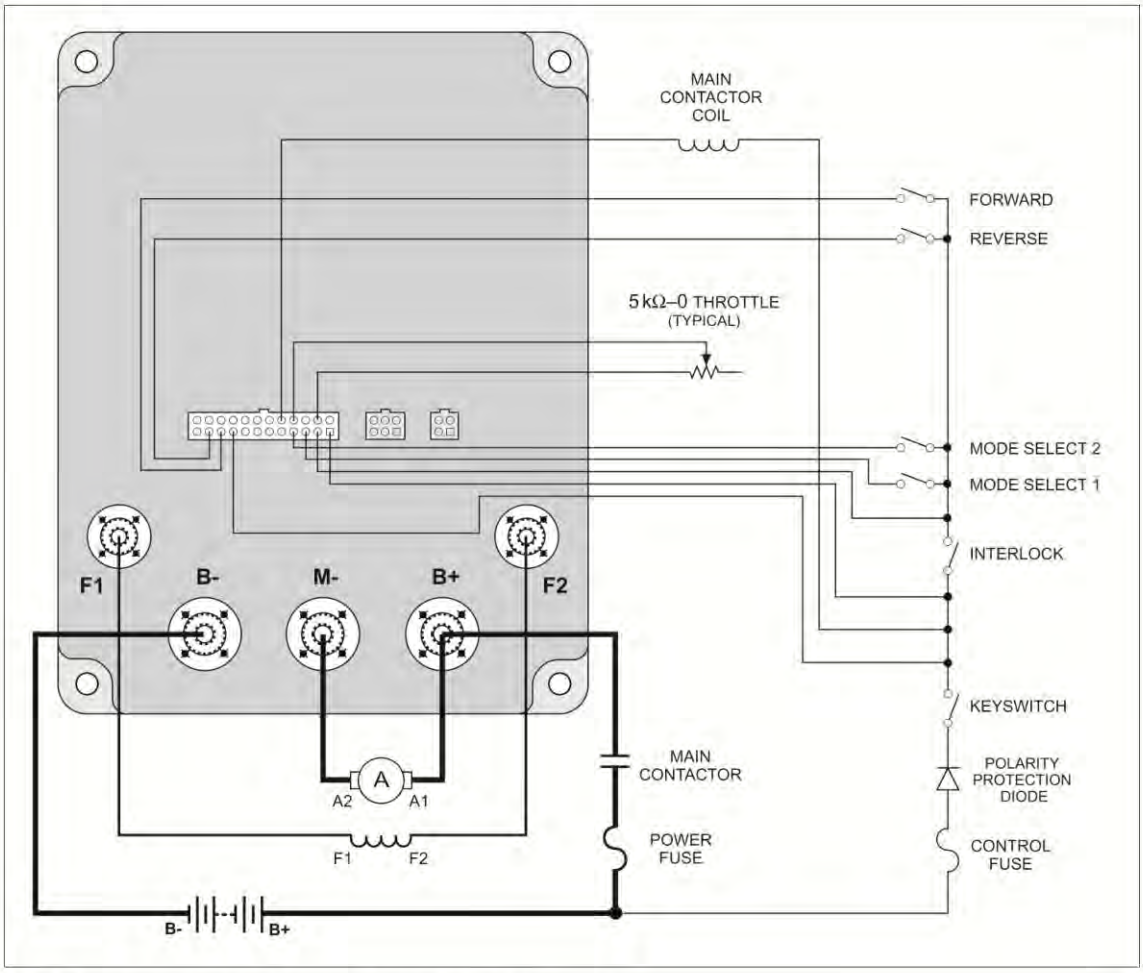



**Fig. 3** *Standard wiring configuration, Curtis PMC 1244 controller.*

# DIAGNOSTICS AND TROUBLESHOOTING



8

## DIAGNOSTICS AND TROUBLESHOOTING

The 1244 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 codes issued by the Status LED, or the fault display driven by the controller's Fault 1 and Fault 2 outputs. Refer to the troubleshooting chart (Table 5) for suggestions covering a wide range of possible faults.

### PROGRAMMER DIAGNOSTICS

The programmer presents complete diagnostic information in plain language. Faults are displayed in the Diagnostic Menu (see column 2 in the troubleshooting chart), and the status of the controller inputs/outputs is displayed in the Test Menu.

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

The following 4-step process is recommended for diagnosing and troubleshooting an inoperative vehicle: (1) visually inspect the vehicle for obvious problems; (2) diagnose the problem, using the programmer; (3) test the circuitry with the programmer; and (4) correct the problem. Repeat the last three steps as necessary until the vehicle is operational.

**Example:** A vehicle that does not operate in "forward" is brought in for repair.

STEP 1: Examine the vehicle and its wiring for any obvious problems, such as broken wires or loose connections.

STEP 2: Connect the programmer, select the Diagnostics Menu, and read the displayed fault information. In this example, the display shows "No Known Faults," indicating that the controller has not detected anything out of the norm.

STEP 3: Select the Test Menu, and observe the status of the inputs and outputs in the forward direction. In this example, the display shows that the forward switch did not close when "forward" was selected, which means the problem is either in the forward switch or the switch wiring.

STEP 4: Check or replace the forward switch and wiring and repeat the test. If the programmer shows the forward switch closing and the vehicle now drives normally, the problem has been corrected.

# TROUBLESHOOTING CHART



**Table 5 TROUBLESHOOTING CHART**

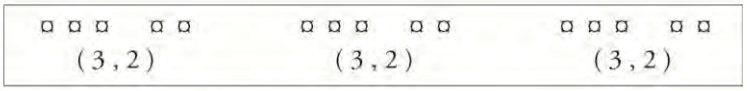
| LED CODE | PROGRAMMER LCD DISPLAY | FAULT CATEGORY | EXPLANATION | POSSIBLE CAUSE |
|---|---|---|---|---|
| 1,2 | HW FAILSAFE1-2-3 | 1 | self-test or watchdog fault | 1. Controller defective. |
| 1,3 | M- SHORTED | 1 | internal M- short to B- | 1. Controller defective. |
| | FIELD OPEN | 1 | field winding fault | 1. Motor field wiring loose.<br>2. Motor field winding open. |
| | ARM SENSOR | 1 | armature current sensor fault | 1. Controller defective. |
| | FLD SENSOR | 1 | field current sensor fault | 1. Controller defective. |
| 2,1 | THROTTLE FAULT 1 | 1 | wiper signal out of range | 1. Throttle input wire open.<br>2. Throttle input wire shorted to B+ or B-. |
| | THROTTLE FAULT 2 | 1 | pot low fault | 1. Throttle pot defective.<br>2. Wrong throttle type selected. |
| 2,2 | SRO | 3 | SRO fault | 1. Improper sequence of KSI, interlock, and direction inputs.<br>2. Wrong SRO type selected.<br>3. Interlock or direction switch circuit open.<br>4. Sequencing delay too short. |
| 2,3 | HPD | 3 | HPD fault | 1. Improper seq. of direction and throttle inputs.<br>2. Wrong HPD type selected.<br>3. Misadjusted throttle pot.<br>4. Sequencing delay too short. |
| 2,4 | BB WIRING CHECK | 1 | emergency reverse wiring fault | 1. Emergency reverse wire open.<br>2. Emergency reverse check wire open. |
| 3,1 | CONT DRVR OC | 1 | cont. driver output overcurrent | 1. Contactor coil shorted. |
| 3,2 | MAIN CONT WELDED | 1 | welded main contactor | 1. Main contactor stuck closed.<br>2. Main contactor driver shorted. |
| 3,3 | PRECHARGE FAULT | 1 | internal voltage too low at startup | 1. Controller defective.<br>2. External short, or leakage path to B- on external B+ connection. |
| 3,4 | MISSING CONTACTOR | 1 | missing contactor | 1. Any contactor coil open or not connected. |
| | MAIN CONT DNC | 1 | main contactor did not close | 1. Main contactor missing or wire to coil open. |
| 4,1 | LOW BATTERY VOLTAGE | 2 | low battery voltage | 1. Battery voltage <undervoltage cutback limit.<br>2. Corroded battery terminal.<br>3. Loose battery or controller terminal. |
| 4,2 | OVERVOLTAGE | 2 | overvoltage | 1. Battery voltage >overvoltage shutdown limit.<br>2. Vehicle operating with charger attached.<br>3. Battery disconnected during regen braking. |
| 4,3 | THERMAL CUTBACK | 2 | over-/under-temp. cutback | 1. Temperature >85°C or < -25°C.<br>2. Excessive load on vehicle.<br>3. Improper mounting of controller.<br>4. Operation in extreme environments. |
| 4,4 | ANTI-TIEDOWN | 3 | Mode 2 or Mode 4 selected at startup | 1. Mode switches shorted to B+.<br>2. Mode switches "tied down" to select Mode 2 or Mode 4 permanently. |

# LED DIAGNOSTICS



## LED DIAGNOSTICS

A Status LED is built into the 1244 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"—welded main contactor—appears as:




The codes are listed in Table 6.

**Table 6 STATUS LED FAULT CODES**

| LED CODES | | EXPLANATION |
|---|---|---|
| *LED off* | ▬▬▬ | no power or defective controller |
| *solid on* | ▭▭▭ | controller or microprocessor fault |
| 0,1 | ■ □ | controller operational; no faults |
| 1,1 | □ □ | [not used] |
| 1,2 | □ □□ | hardware failsafe fault |
| 1,3 | □ □□□ | M-, current sensor, or motor fault |
| 1,4 | □ □□□□ | [not used] |
| 2,1 | □□ □ | throttle fault |
| 2,2 | □□ □□ | static return to off (SRO) fault |
| 2,3 | □□ □□□ | high pedal disable (HPD) fault |
| 2,4 | □□ □□□□ | emergency reverse circuit check fault |
| 3,1 | □□□ □ | contactor driver overcurrent |
| 3,2 | □□□ □□ | welded main contactor |
| 3,3 | □□□ □□□ | precharge fault |
| 3,4 | □□□ □□□□ | missing contactor, or main cont. did not close |
| 4,1 | □□□□ □ | low battery voltage |
| 4,2 | □□□□ □□ | overvoltage |
| 4,3 | □□□□ □□□ | thermal cutback, due to over/under temp. |
| 4,4 | □□□□ □□□□ | anti-tiedown fault |

NOTE: Only one fault is indicated at a time, and faults are not queued up. Refer to the troubleshooting chart (Table 5) for suggestions about possible causes of the various faults.

## PROGRAMMING PARAMETERS - E-500-80V & T-448HD

**! 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 | 7 |
| M1 DRIVE C/L | MODE 1 DRIVE CURRENT LIMIT, IN AMPS | 350 |
| M2 DRIVE C/L | MODE 2 DRIVE CURRENT LIMIT, IN AMPS | 350 |
| M3 DRIVE C/L | MODE 3 DRIVE CURRENT LIMIT, IN AMPS | 350 |
| M4 DRIVE C/L | MODE 4 DRIVE CURRENT LIMIT, IN AMPS | 350 |
| M1 BRAKE C/L | MODE 1 BRAKING CURRENT LIMIT, IN AMPS | 150 |
| M2 BRAKE C/L | MODE 2 BRAKING CURRENT LIMIT, IN AMPS | 150 |
| M3 BRAKE C/L | MODE 3 BRAKING CURRENT LIMIT, IN AMPS | 150 |
| M4 BRAKE C/L | MODE 4 BRAKING CURRENT LIMIT, IN AMPS | 150 |
| M1 THRT BRK % | MODE 1 THROT. BRAKING, AS % OF BRAKE C/L | 50 |
| M2 THRT BRK % | MODE 2 THROT. BRAKING, AS % OF BRAKE C/L | 50 |
| M3 THRT BRK % | MODE 3 THROT. BRAKING, AS % OF BRAKE C/L | 50 |
| M4 THRT BRK % | MODE 4 THROT. BRAKING, AS % OF BRAKE C/L | 50 |
| M1 ACCEL RATE | MODE 1 ACCELERATION RATE, IN SEC. | 4 |
| M2 ACCEL RATE | MODE 2 ACCELERATION RATE, IN SEC. | 4 |
| M3 ACCEL RATE | MODE 3 ACCELERATION RATE, IN SEC. | 4 |
| M4 ACCEL RATE | MODE 4 ACCELERATION RATE, IN SEC. | 4 |
| DECEL RATE | DECELERATION RATE, IN SEC. | 2.5 |
| M1 BRAKE RATE | MODE 1 BRAKING RATE, IN SEC. | 3 |
| M2 BRAKE RATE | MODE 2 BRAKING RATE, IN SEC. | 3 |
| M3 BRAKE RATE | MODE 3 BRAKING RATE, IN SEC. | 3 |
| M4 BRAKE RATE | MODE 4 BRAKING RATE, IN SEC. | 3 |
| QUICK START | QUICK START THROTTLE FACTOR | 1 |
| TAPER RATE | Regen brak. Decrease rate when apporch. 0spd, 1/32s | 32 |
| M1 MAX SPEED | MODE 1 MAX. SPEED, AS % PWM OUTPUT | 40 |
| M2 MAX SPEED | MODE 2 MAX. SPEED, AS % PWM OUTPUT | 100 |
| M3 MAX SPEED | MODE 3 MAX. SPEED, AS % PWM OUTPUT | 40 |
| M4 MAX SPEED | MODE 4 MAX. SPEED, AS % PWM OUTPUT | 40 |
| M1 CREEP SPEED | MODE 1 CREEP SPEED, AS % PWM OUTPUT | 0 |
| M2 CREEP SPEED | MODE 2 CREEP SPEED, AS % PWM OUTPUT | 0 |
| M3 CREEP SPEED | MODE 3 CREEP SPEED, AS % PWM OUTPUT | 0 |
| M4 CREEP SPEED | MODE 4 CREEP SPEED, AS % PWM OUTPUT | 0 |
| REGEN SPEED | Min. speed for regen braking, as % of vehicle speed | 25 |
| CTRL MODE | CONTROL MODE | 1 |
| THROTTLE TYPE | THROTTLE TYPE | 3 |

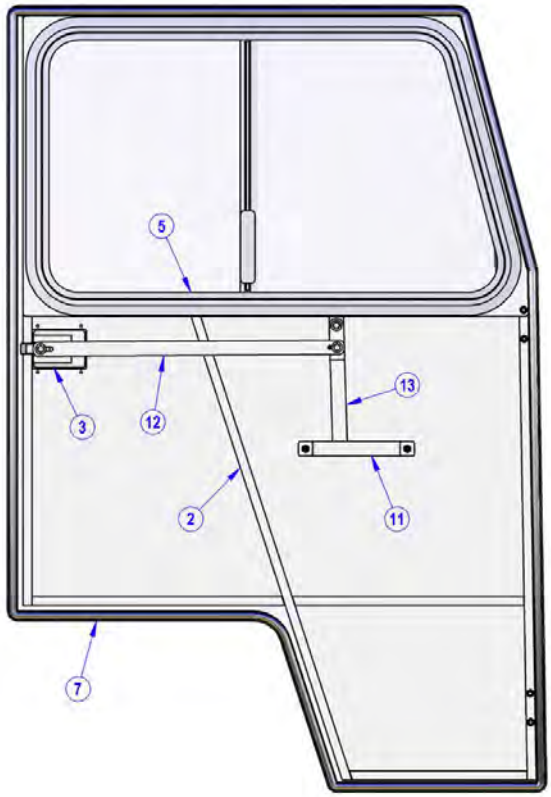
| | | |
|---|---|---|
| THRO. DEADBAND | Thr. Neutral deadband % of 5kohms pot | 6 |
| THROTTLE MAX | Thr. Input req`d for 100%PWM %5kohm pot | 90 |
| M1 THRTL MAP | MODE 1 THROTTLE MAP, AS % | 30 |
| M2 THRTL MAP | MODE 2 THROTTLE MAP, AS % | 30 |
| M3 THRTL MAP | MODE 3 THROTTLE MAP, AS % | 30 |
| M4 THRTL MAP | MODE 4 THROTTLE MAP, AS % | 30 |
| FIELD MIN | MIN. FIELD CURRENT, IN AMPS | 10 |
| FIELD MAX | MAX. FIELD CURRENT, IN AMPS | 50 |
| FIELD MAP START | Armature current at wich FIELD MAP takes effect, amps | 100 |
| FIELD MAP | Field Winding Current, as % of Armature Current | 50 |
| CURRENT RATIO | CURRENT RATIO:FACTOR OF 1, 2, 4 OR 8 | 1 |
| RESTRAINT | RAMP RESTRAINT: 1 TO 10 | 3 |
| LOAD COMP | LOAD COMPENSATION: 0 TO 25 | 0 |
| HPD | HIGH PEDAL DISABLE (HPD) TYPE | 1 |
| SRO | STATIC RETURN TO OFF (SRO) TYPE | 1 |
| SEQUENCING DLY | SEQUENCING DELAY, IN SEC. | 1 |
| MAIN CONT INTR | MAIN CONTACTOR INTERLOCK: ON OR OFF | ON |
| MAIN OPEN DELAY | MAIN CONTACTOR DROPOUT DELAY, IN SEC. | 1 |
| WELD CHECK | MAIN CONTACTOR WELD CHECK: ON OR OFF | ON |
| MAIN CHECK | MAIN COIL OPEN CHECK: ON OR OFF | ON |
| AUX ENABLE | AUXILIARY ENABLE: ON OR OFF | ON |
| EM BRAKE | ELECTROMAGNETIC BRAKE ON OR OFF | OFF |
| AUX DELAY | AUXILIARY DRIVER DROPOUT DELAY, IN SEC. | 4 |
| AUX CHECK | AUXILIARY COIL OPEN CHECK: ON OR OFF | ON |
| EM BRAKE DELAY | ELECTROMAGNETIC BRAKE DELAY, IN SEC. | 0 |
| EM BRAKE CHECK | ELECTROMAG. BRAKE OPEN CHECK: ON OR OFF | OFF |
| REV DRVR CHECK | REVERSE SIGNAL OPEN CHECK: ON OR OFF | OFF |
| CONT PULL IN | CONTACTOR COIL PULL-IN VOLTAGE, AS % | 50 |
| CONT HOLDING | CONTACTOR HOLDING VOLTAGE, AS % | 48 |
| EMR REV ENABLE | EMERGENCY REVERSE FUNCTION : ON OR OFF | OFF |
| EMR REV C/L | EMERGENCY REVERSE CURRENT LIMIT, IN AMPS | 50 |
| EMR REC CHECK | EMERGENCY REV. WIRING CHECK : ON OR OFF | OFF |
| ANTI-TIEDOWN | ANTI-TIEDOWN: ON OR OFF | OFF |
| FAULT CODE | ON OR OFF | ON |
| PEDAL INTERLOCK | THREADLE, PB-6, CHECK WIRING | OFF |
| PRECHARGE | ON OR OFF | ON |

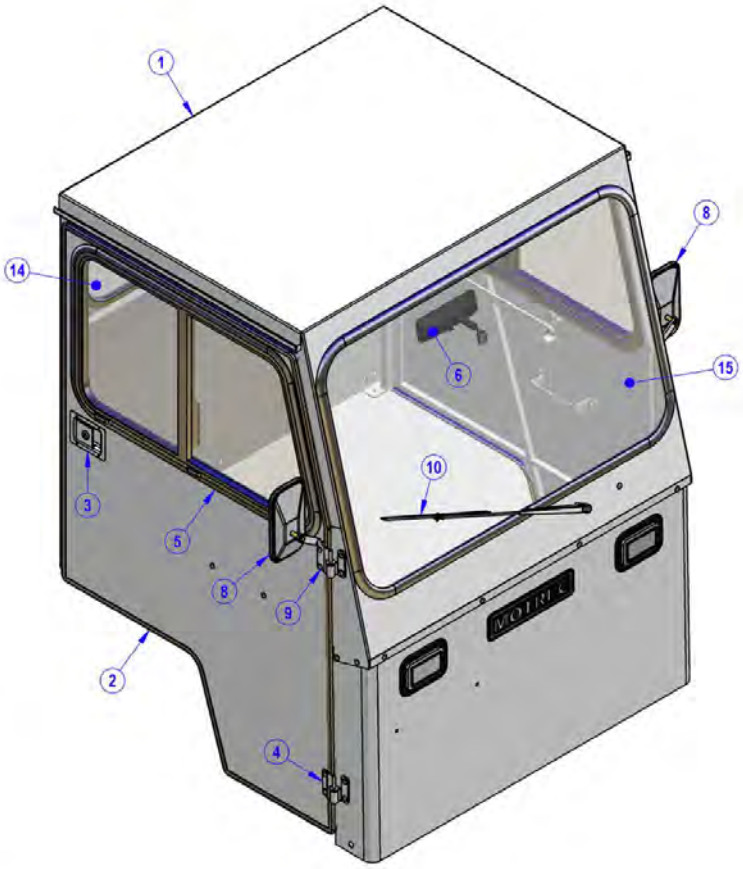
# SPARE PARTS

# BODY


| *REF.* | *PART NO* | *DESCRIPTION* |
|---|---|---|
| **1** | 2382320009 | SEAT BACK CUSHION |
| | 2383320004 | SEAT CUSHION |
| | 2385320003 | BUCKET SEAT ON SLIDE ADJUSTER *(Not illustrated)* |
| **2** | 2384300009 | BACKREST FRAME WITHOUT REAR LIGHT |
| | 2384448010 | LIGHT HOLDER FOR 2384448014 *(Not illustrated)* |
| | 2384448014 | BACKREST FRAME FOR REAR LIGHTS *(Not illustrated)* |
| **3** | 2331448012 | BATTERY COVER |
| **4** | 2330448004 | MOTOR COVER – HORIZONTAL |
| | 2330448006 | MOTOR COVER – INCLINED |
| **5** | 2339448004 | CONTROLS COVER |
| **6** | 2223360004 | 5.00 X 8 SOLID SOFT RUBBER WHEEL, RIB TREAD |
| | 2223360003 | 5.00 X 8 SOLID SOFT RUBBER WHEEL, LUG TREAD |
| **7** | 2314320001 | FRONT BUMPER |
| **8** | 120003 | TRIMMING |
| **9** | 2803300008 | RIGHT HANDLE |
| | 2803300009 | LEFT HANDLE |

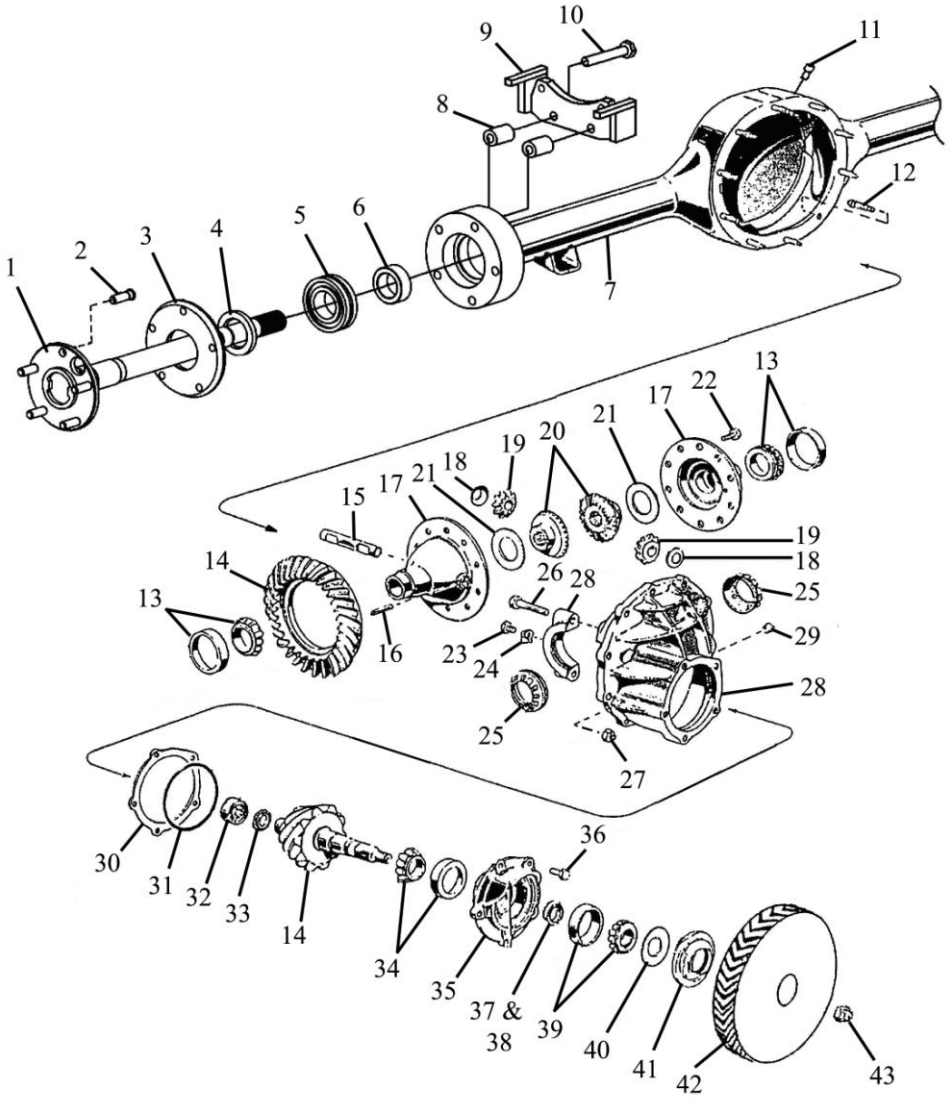
# CAB

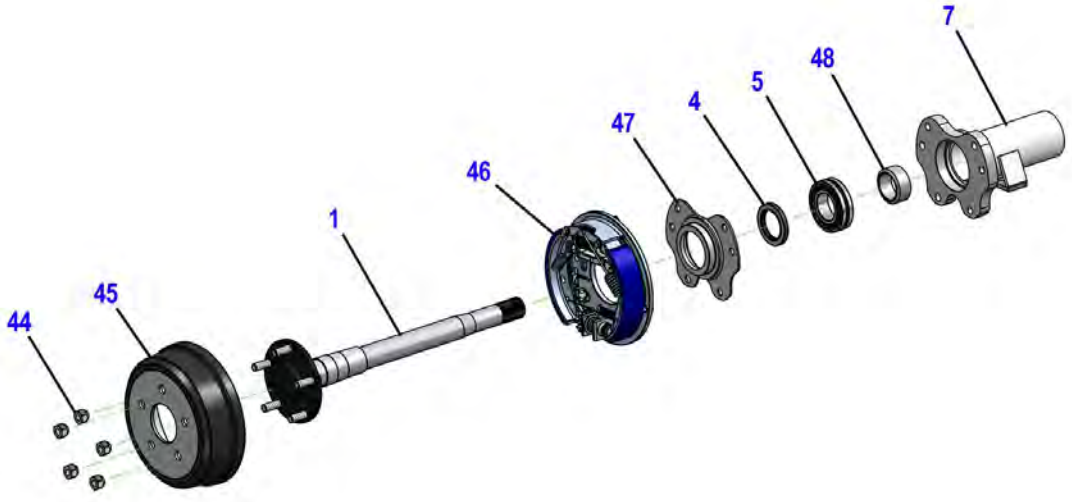



| *REF* | *PART NO* | *DESCRIPTION* |
|---|---|---|
| **1** | 2360448009 | STEEL CAB |
| | 2382320009 | SEATBACK CAB |
| **2** | 2360320014 | RIGHT DOOR |
| | 2360320015 | LEFT DOOR |
| **3** | 2803000003 | PADDLE LATCH |
| | 2366320015 | DOOR LATCH |
| **4** | 2365000001 | RIGHT HINGES KIT |
| | 2365000002 | LEFT HINGES KIT |
| **5** | 2367320002 | RIGHT DOOR GLASS |
| | 2367320001 | LEFT DOOR GLASS |
| **6** | 2801000002 | REAR VIEW MIRROR |
| **7** | 2802000001 | TRIM DOOR |
| **8** | 2801000001 | SIDE MIRROR |
| **9** | 2399000014 | SIDE MIRROR BRACKET |
| **10** | 3113000001 | WIPER MOTOR |
| | 2800000002 | WIPER |
| | 2800000001 | ARM |
| **11** | 2366320001 | DOOR HANDLE |
| **12** | 2366320002 | DOOR HANDLE BAR |
| **13** | 2366320003 | DOOR LEVER |
| **14** | 2367300001 | REAR GLASS |
| **15** | 2367300002 | WINDSHIELD |

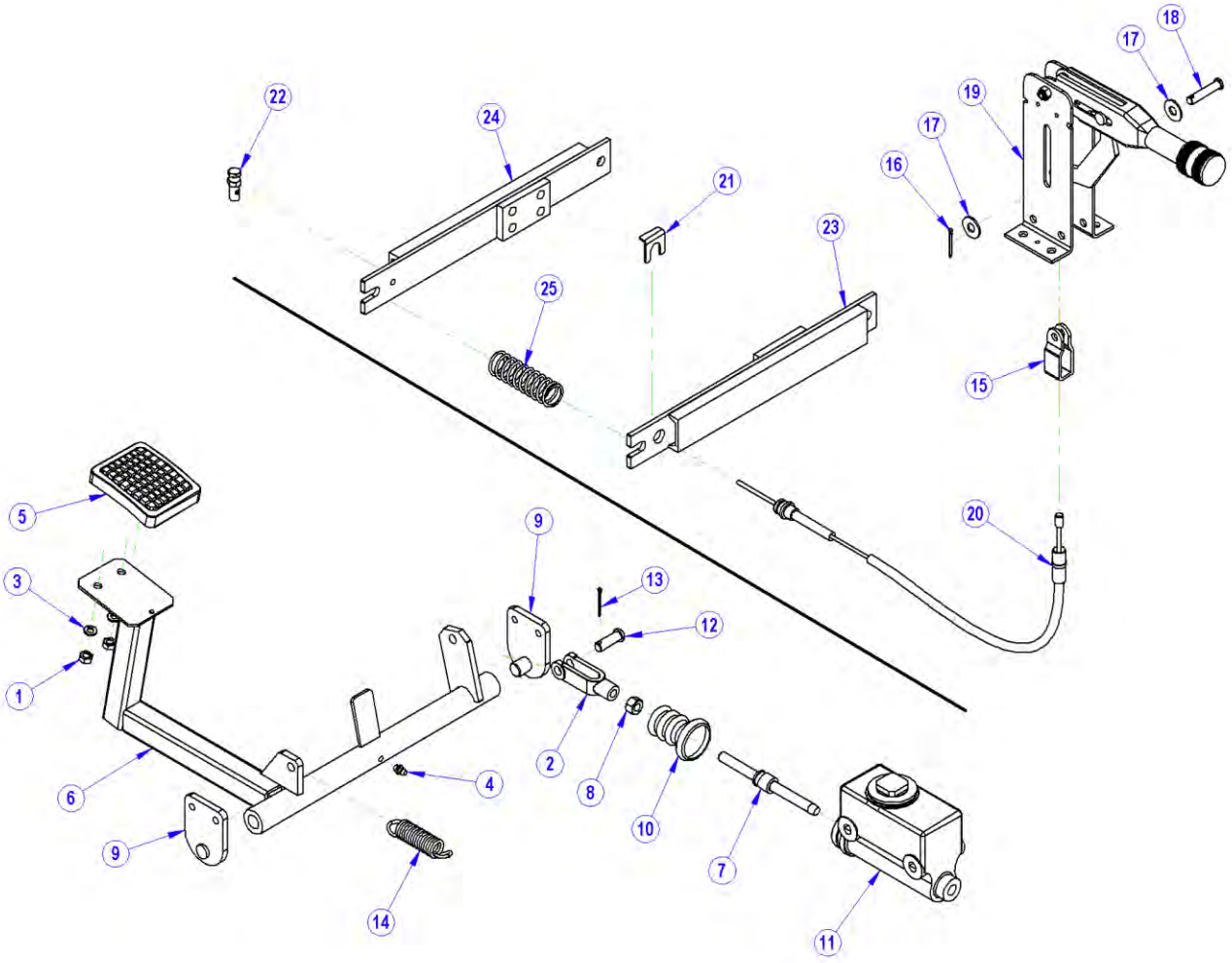
## FORD F-150 DIFFERENTIAL



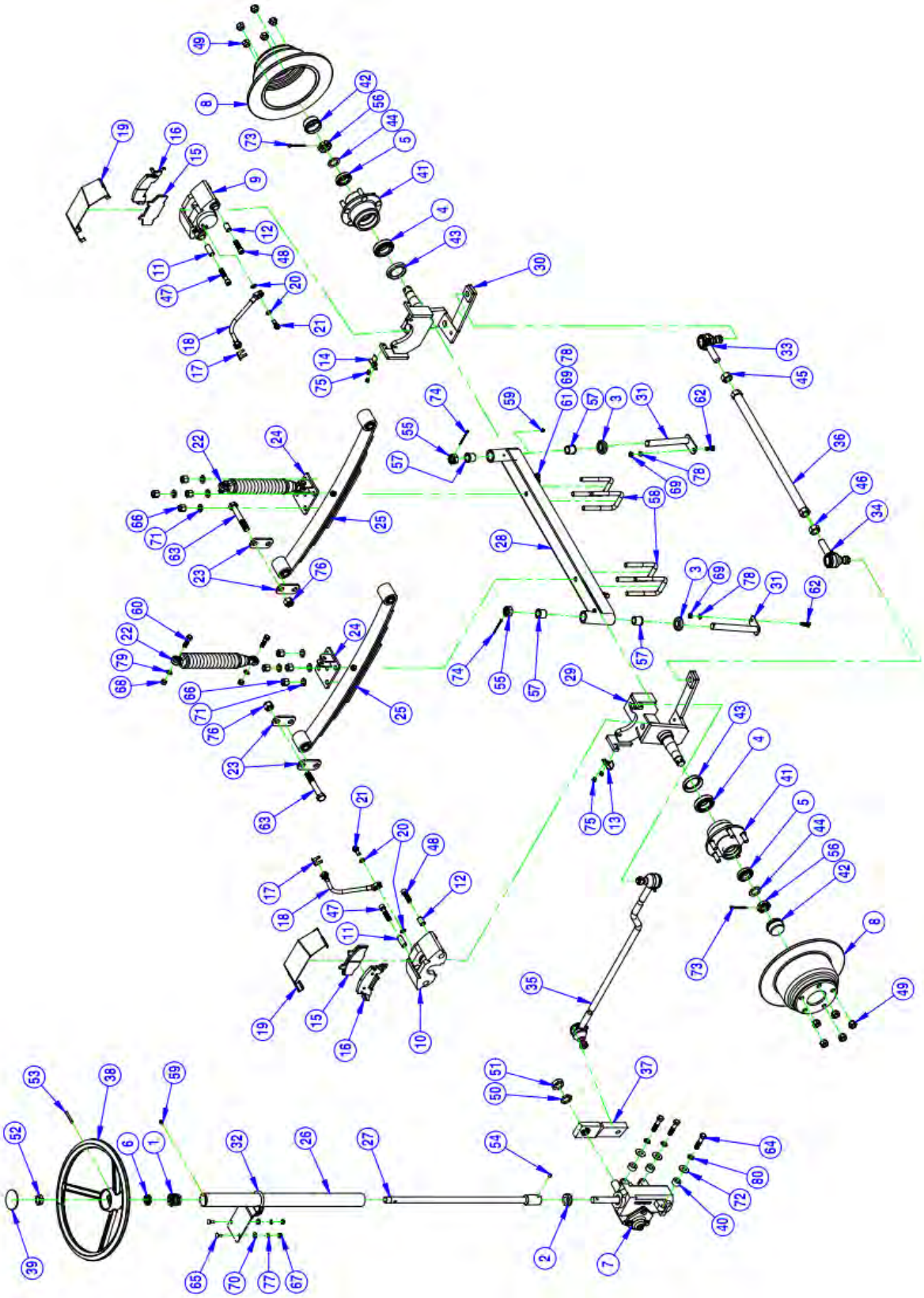
| *REF* | *DESCRIPTION* | *QTY.* | *PART NO.* |
|---|---|---|---|
| **1** | Shaft, Axle | 2 | Contact manufat. |
| **2** | Wheel stud | 10 | 2910000001 |
| | Wheel nut | 10 | 2910000019 |
| **3** | Retainer plate | 2 | 2179000011 |
| **4** | Oil seal | 2 | 2104448001 |
| **5** | Spherical bearing | 2 | 2103448001 |
| **6** | Retaining ring | 2 | 2179000012 |
| **7** | Housing | 1 | Contact manufat. |
| **8** | Spacer, calliper support | 4 | 2122236003 |
| **9** | Mounting plate, caliper | 2 | 2122236001 |
| **10** | Bolt 1/2-nf x 5", grade 5 | | |
| | Bolt 1/2-nf x 2 1/2", grade 5 | | |
| | Lock washer 1/2" | 10 | |
| **11** | Breather | 1 | 2179000033 |
| **12** | Housing stud | 10 | 2179000016 |
| **13** | Bearing Cone & cup – 2.89" O.D. | 2 | 2103000021 |
| | Bearing Cone & cup – 3.06" O.D. | 2 | 2103000001 |
| **14** | Ring & pinion gear kit | 1 | Contact manufat. |
| **15** | Shaft | 1 | 2179000001 |
| **16** | Spring pin | 1 | 2179000061 |
| **17** | Open carrier case, kit (included item 15 to 21) | 1 | 2179000020 |
| **18** | Washer for small spider gear | 2 | 2179000062 |
| **19** | Small spider gear | 2 | 2116000011 |
| **20** | Big spider gear | 2 | 2116000002 |
| **21** | Washer for big spider gear | 2 | 2179000014 |
| **22** | Bolt 7/16-NF x 1", grade 8 | 10 | |
| | Flat washer 7/16" | 10 | |
| **23** | Button socket cap screw 5/16-NC x 3/8" | 2 | 2179000057 |
| **24** | Lock | 2 | 2179000058 |
| **25** | Shim (differential bearing adjustment), 80mm O.D. | 2 | 2179000059 |
| | Shim (differential bearing adjustment), 2.97" O.D. | 2 | 2179000060 |
| **26** | Bolt 1/2-NC x 2", grade 8 | 4 | |
| **27** | Nylon-Insert Hex Locknut 3/8-NF | 10 | |
| **28** | Gear case | 1 | 2179000018 |
| **29** | Plug, 1/2" NPT | 1 | |
| **30** | Pinion depth shim, 0.005" | | 2179000023 |
| | Pinion depth shim, 0.010" | | 2179000024 |
| | Pinion depth shim, 0.013" | | 2179000025 |
| **31** | O-ring, pinion support | 1 | 2179000055 |
| **32** | Pocket bearing | 1 | 2103448008 |
| **33** | Retainer, pocket bearing | 1 | 2179000056 |
| **34** | Bearing Cone & cup – 2.39" O.D. | 1 | 2103000004 |
| | Bearing Cone & cup – 3.00" O.D. | 1 | 2103000019 |
| **35** | Pinion support | 1 | 2179000019 |
| **36** | Bolt 3/8-NC x 1 1/2" | | |
| | Bolt 3/8-NC x 2" | | |
| | Lock washer 3/8" | | |
| **37** | Solid spacer, pinion | 1 | 2179000022 |
| **38** | Pinion pre-load shim, 0.002" | | 2179000026 |
| | Pinion pre-load shim, 0.005" | | 2179000027 |
| | Pinion pre-load shim, 0.010" | | 2179000028 |
| **39** | Bearing Cone & cup | 1 | 2103000004 |
| **40** | Shielding disc for seal | 1 | 2179000063 |
| **41** | Oil seal, pinion – 2.75" O.D. | 1 | 2104448003 |
| | Oil seal, pinion – 3.00" O.D. | 1 | 2104448002 |
| **42** | Pulley W80, 8.00" O.D. | 1 | 2113000003 |
| | Pulley W90, 9.00" O.D. | 1 | 2113000004 |
| **43** | Machined nut, pinion | 1 | 2179000013 |
| **44** | Wheel nut | 10 | 2910000019 |
| **45** | Drum | 2 | 2123480003 |
| **46** | Brake assembly, left hand | 1 | 2124480003 |
| | Brake assembly, right hand | 1 | 2124480004 |
| **47** | Retainer plate | 2 | 2179489001 |
| **48** | Retainer ring | 2 | 2179489002 |
| **n/a** | Drain Plug, magntic | 1 | 2179000015 |

# BRAKE CONTROLS




| *REF* | *PART NO* | *DESCRIPTION* | *QTY* | *REF* | *PART NO* | *DESCRIPTION* | *QTY* |
|---|---|---|---|---|---|---|---|
| 1 | | Nut 1/4-20UNC | 1 | 14 | 2190000003 | Spring ( Extention ) | 1 |
| 2 | 2910000015 | Yoke | 1 | 15 | 2910000013 | Yoke | 1 |
| 3 | | Lock washer ¼ | 1 | 16 | | Cotter pin 3/32 x 1 | 1 |
| 4 | 2930000012 | Lubrication fitting | 1 | 17 | | Flat washer 5/16 | 2 |
| 5 | 2131100002 | Rubber pad | 1 | 18 | | Clevis pin 5/16 x 1-1/2 | 1 |
| 6 | 2131448001 | Lever | 1 | 19 | 2139240002 | Handbrake lever | 1 |
| 7 | 2133280001 | Push rod-Master cylinder | 1 | 20 | 2129000003 | Handbrake cable | 1 |
| 8 | | Nut 3/8-16UNF | 1 | 21 | 2129000001 | Clip | 1 |
| 9 | 2132448001 | Pivot | 2 | 22 | 2921000001 | Cable stop | 1 |
| 10 | | Boot, included with #2125000001 | 1 | 23 | 2127000006 | Handbrake band (side cable) | 1 |
| 11 | 2125000001 | Master cylinder | 1 | 24 | 2127000001 | Handbrake band | 1 |
| 12 | 2910000028 | Clevis pin 3/8 x 1-3/32 | 1 | 25 | 2191240002 | Spring ( compression ) | 1 |
| 13 | | Cotter pin 3/32 x 1 | 1 | | | | |

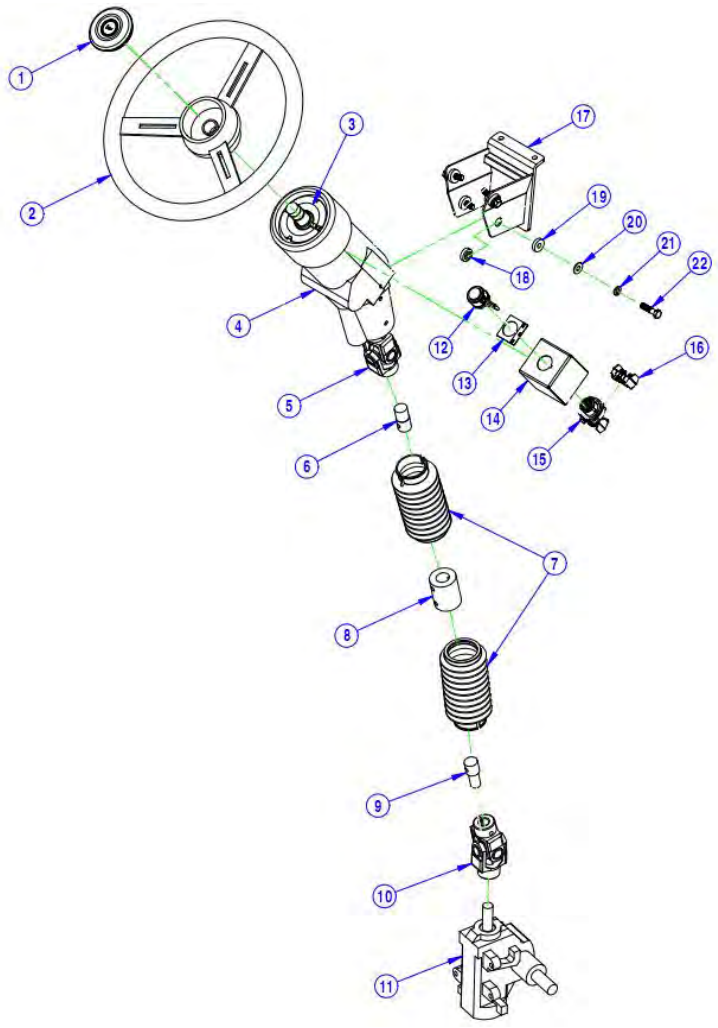
## FRONT AXLE, SUSPENSION, STEERING, DISC BRAKES



| *REF* | *PART NO* | *DESCRIPTION* |
|---|---|---|
| **1** | 2100300002* | BUSHING |
| | 2100300001* | BUSHING WITH OIL SEAL |
| **2** | 2100300003* | BUSHING |
| **3** | 2103250001 | THRUST BEARING |
| **4** | 2103300001 | TAPER BEARING |
| **5** | 2103300002 | TAPER BEARING |
| **6** | 2104300004* | OIL SEAL |
| **7** | 2117250001* | GEAR |
| **8** | 2120236001 | DISC |
| **9** | 481431K | RIGHT CALIPER |
| **10** | 481430K | LEFT CALIPER |
| **11** | 2121000005 | BUSHING, LONG |
| **12** | 2121000006 | BUSHING, SHORT |
| **13** | 2122300001 | LEFT CALIPER SUPPORT |
| **14** | 2122300002 | RIGHT CALIPER SUPPORT |
| **15** | 2128280001 | PADS |
| **16** | 2128280001 | PADS |
| **17** | 2129000001 | CLIP |
| **18** | 2134000001 | FLEXIBLE HOSE |
| **19** | 2139000001 | CALIPER PROTECTOR |
| **20** | 2139000002 | WASHER |
| **21** | 2139000003 | BOLT |
| **22** | 2180240001 | SHOCK ABSORBER |
| **23** | 2182320001 | SHACKLE LINK |
| **24** | 2184448001 | PLATE |
| **25** | 2192280001 | LEAF SPRINGS |
| **26** | 2200300002* | TUBE |
| **27** | 2200300003* | SHAFT |
| **28** | 2201320001 | AXLE BEAM |
| | 2201448009 | AXLE BEAM, PWR STEERING |
| **29** | 2201360001 | LEFT SPINDLE, BRAKES |
| | 2201662003 | LEFT SPINDLE, PWR STEERING |
| **30** | 2201360002 | RIGHT SPINDLE, BRAKES |
| | 2201662002 | RIGHT SPINDLE, PWR STEERING |
| **31** | 2205250001 | KING PIN |
| **32** | 2206300003 | STEERING SUPPORT, |
| **33** | 2207000001 | ROD END, LEFT HAND |
| **34** | 2207000002 | ROD END, RIGHT HAND |
| **35** | 2207320001* | FRONT TIE ROD |
| **36** | 2207300006 | REAR TIE ROD |
| **37** | 2207320009* | ARM |
| **38** | 2208240001* | STEERING WHEEL |
| **39** | 2208240002* | COVER |
| **40** | 2219250001* | SPACER |
| **41** | 2224300002 | HUB |
| | 2910300003 | WHEEL BOLT |
| **42** | 2229300001 | DUST CAP |
| **43** | 2229300002 | OIL SEAL |
| **44** | 2229300003 | SPINDLE WASHER |
| **45** | 2910000005 | NUT, LEFT HAND |
| **46** | 2910000006 | NUT, RIGHT HAND |
| **47** | 2910000017 | BOLT, LONG |
| **48** | 2910000018 | BOLT, SHORT |
| **49** | 2910000019 | WHEEL NUT |
| **50** | 2910000020* | LOCK WASHER 7/8 |
| **51** | 2910000021* | JAM NUT 7/8-NF |
| **52** | 2910000022* | JAM NUT 3/4-NF |
| **53** | 2910000023* | SPRING PIN ¼ X 1 3/4 |
| **54** | 2910000024* | SET SCREW 5/16-NC |
| **55** | 2910300001 | CASTELLATED NUT 3/4-NF |
| **56** | 2910300002 | CASTELLATED NUT 1-UNEF |
| **57** | 2914364001 | BUSHING |
| **58** | 2916000001 | U-BOLT |
| **59** | 2930000012 | GREASE FITTING |
| **60** | | BOLT 3/8-NC X 1 1/2 |
| **61** | | BOLT 5/16-NC X 1 1/4 |
| **62** | | BOLT 5/16-NC X 1 |
| **63** | | BOLT 5/8-NC X 4 |
| **64** | | BOLT 7/16-NC X 2 |
| **65** | | CARRIAGE BOLT 1/4-NC X 3/4 |
| **66** | 2910000041 | HEAVY NUT 1/2-NF |
| **67** | | NUT 1/4-NC |
| **68** | | NUT 3/8-NC |
| **69** | | NUT 5/16-NC |
| **70** | | FLAT WASHER 1/4 |
| **71** | 2910000042 | FLAT WASHER 12mm |
| **72** | | FLAT WASHER 7/16 |
| **73** | | COTTER PIN 3/16 X 2 |
| **74** | | COTTER PIN 7/64 X 2 |
| **75** | | MACHINE SCREW 1/4-NC X 3/8 |
| **76** | | NYLON NUT 5/8-NC |
| **77** | | LOCK WASHER 1/4 |
| **78** | | LOCK WASHER 5/16 |
| **79** | | LOCK WASHER 3/8 |
| **80** | | LOCK WASHER 7/16 |

* APPLICABLE ON VEHICLE WITHOUT POWER STEERING.

# TILT STEERING WHEEL



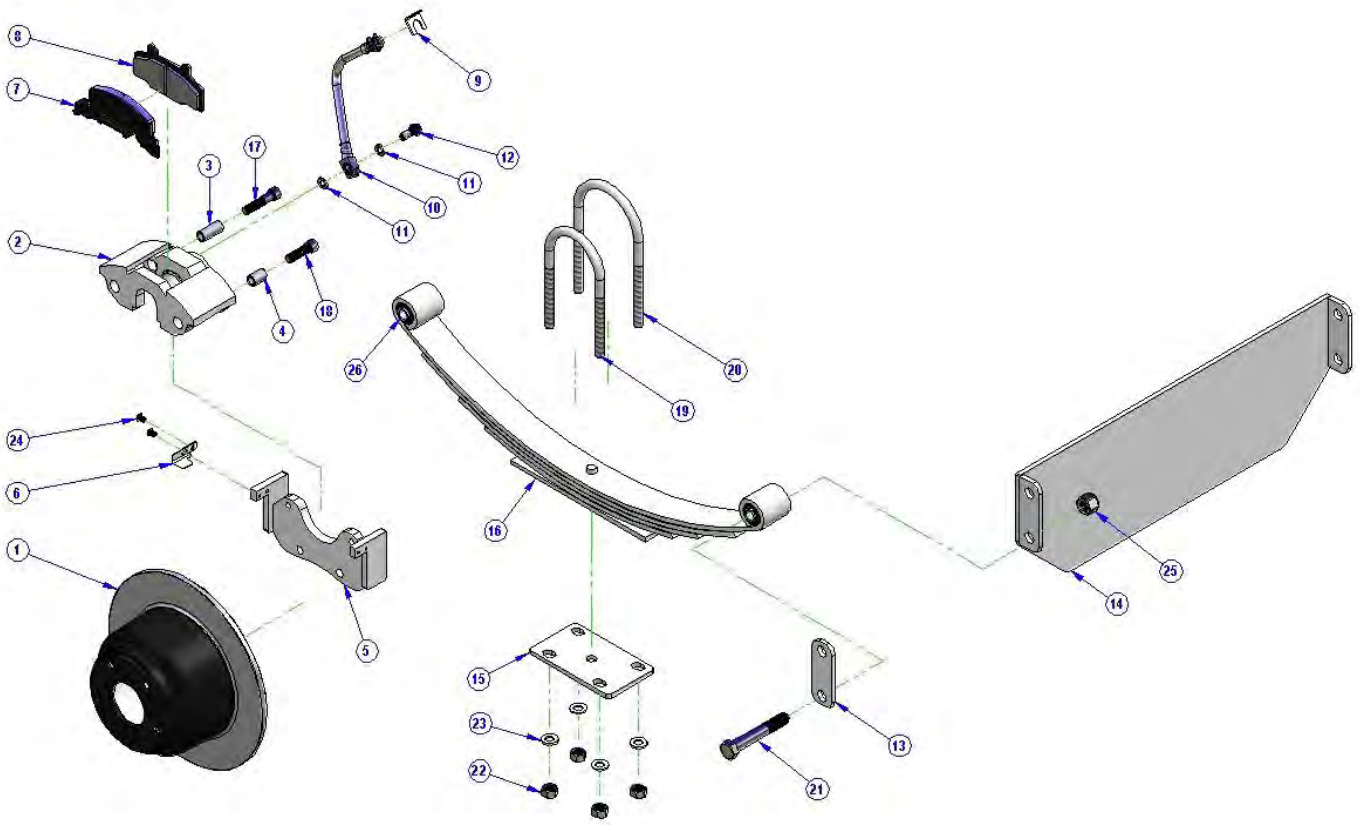

| *REF* | *PART NO* | *DESCRIPTION* | *REF* | *PART NO* | *DESCRIPTION* |
|---|---|---|---|---|---|
| 1 | 2208224002 | HORN BUTTON | **12** | 3109210001 | GREY HANDLE |
| **2** | 2208224001 | STEERING WHEEL | **13** | 3109210004 | NAMEPLATE F/R |
| **3** | 2219224002 | HORN BRUSH KIT | **14** | 2392224001 | CASE F/R |
| **4** | 2200224004 | TILT / TEL COLOMN | **15** | 3109210002 | SWITCH |
| **5** | 2330015 | UNIVERSAL JOINT | **16** | 3109210003 | CONTACT BLOCK |
| **6** | 2200224003 | SHAFT | **17** | 2206448001 | COLOMN SUPPORT – *before serial #1117032* |
| **7** | 2809000001 | RUBBER BOOTS | | 2206320003 | COLOMN SUPPORT – *serial #1117032 & after* |
| **8** | 2200224001* | NYLON COUPLER – *2 1/2"* | **18** | 2200224007 | BUSHING |
| | 2200248002* | NYLON COUPLER – *3 1/4"* | **19** | 2200224006 | WASHER |
| **9** | 2200224002 | SHAFT | **20** | | FLAT WASHER 5/16 |
| **10** | 2104000001 | UNIVERSAL JOINT | **21** | | LOCK WASHER 3/8 |
| **11** | 2117448001 | GEAR | **22** | | HEAVY BOLT 3/8-NC X 1 1/2 |

* SELECT APPROPRIATE LENGTH OR CONTACT MANUFACTURER.

# MOTOR AND DRIVE

| *REF.* | *PART NO* | *DESCRIPTION* |
|---|---|---|
| **1** | 3112720001 | MOTOR ASSEMBLY |
| **2** | 3112720002 | FRAME AND FIELD COIL |
| **3** | 3112720003 | ARMATURE ASSEMBLY |
| **4** | 3112720004 | BRUSH |
| **5** | 2154448001 | FRONT MOUNT, MOTOR |
| **6** | 2160448001 | REAR MOUNT, MOTOR |
| **7** | 2113000018 | PINION PULLEY |
| **8** | 2113000004 | MOTOR PULLEY |
| **9** | 4851001 | BELT |

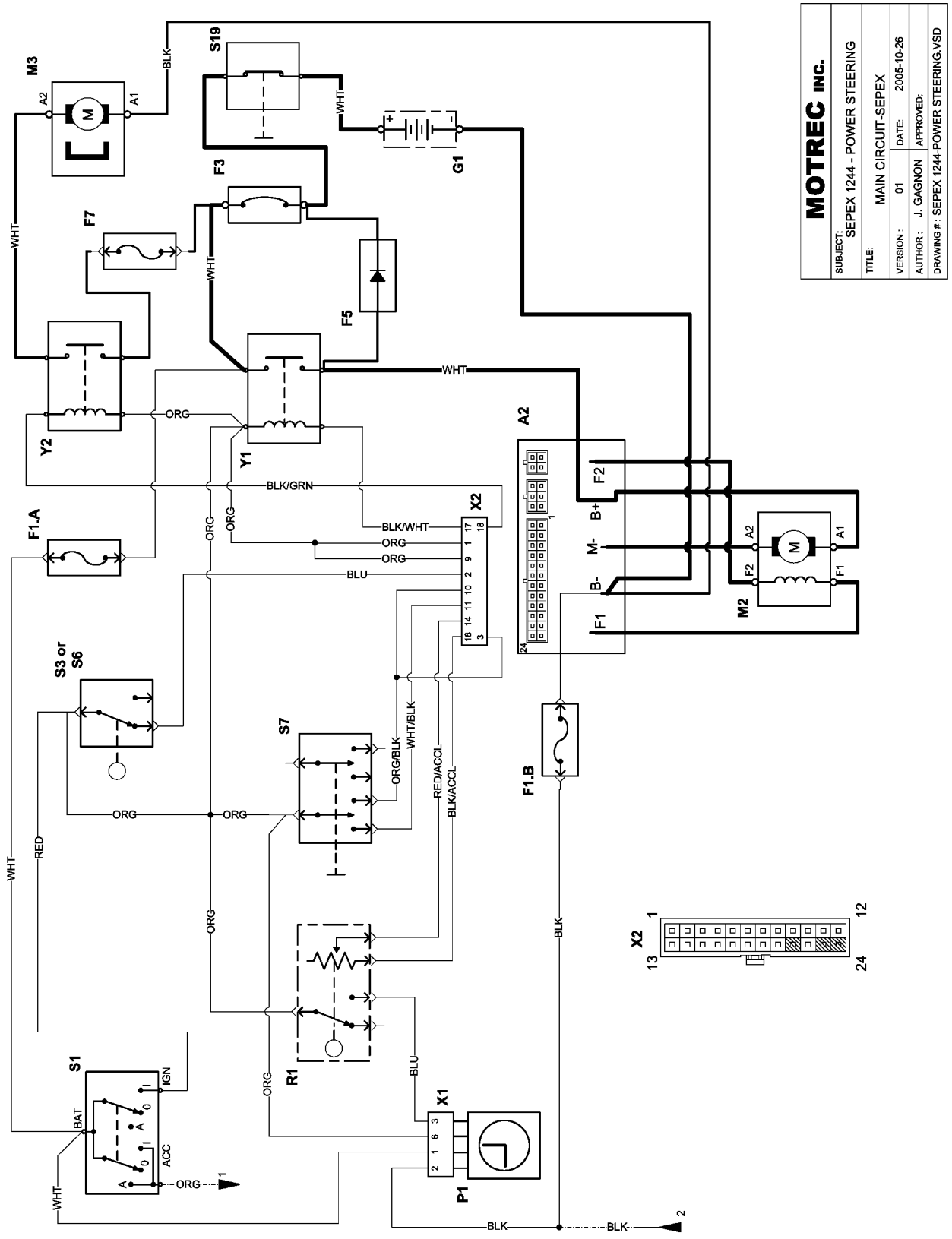
# REAR SUSPENSION AND BRAKE



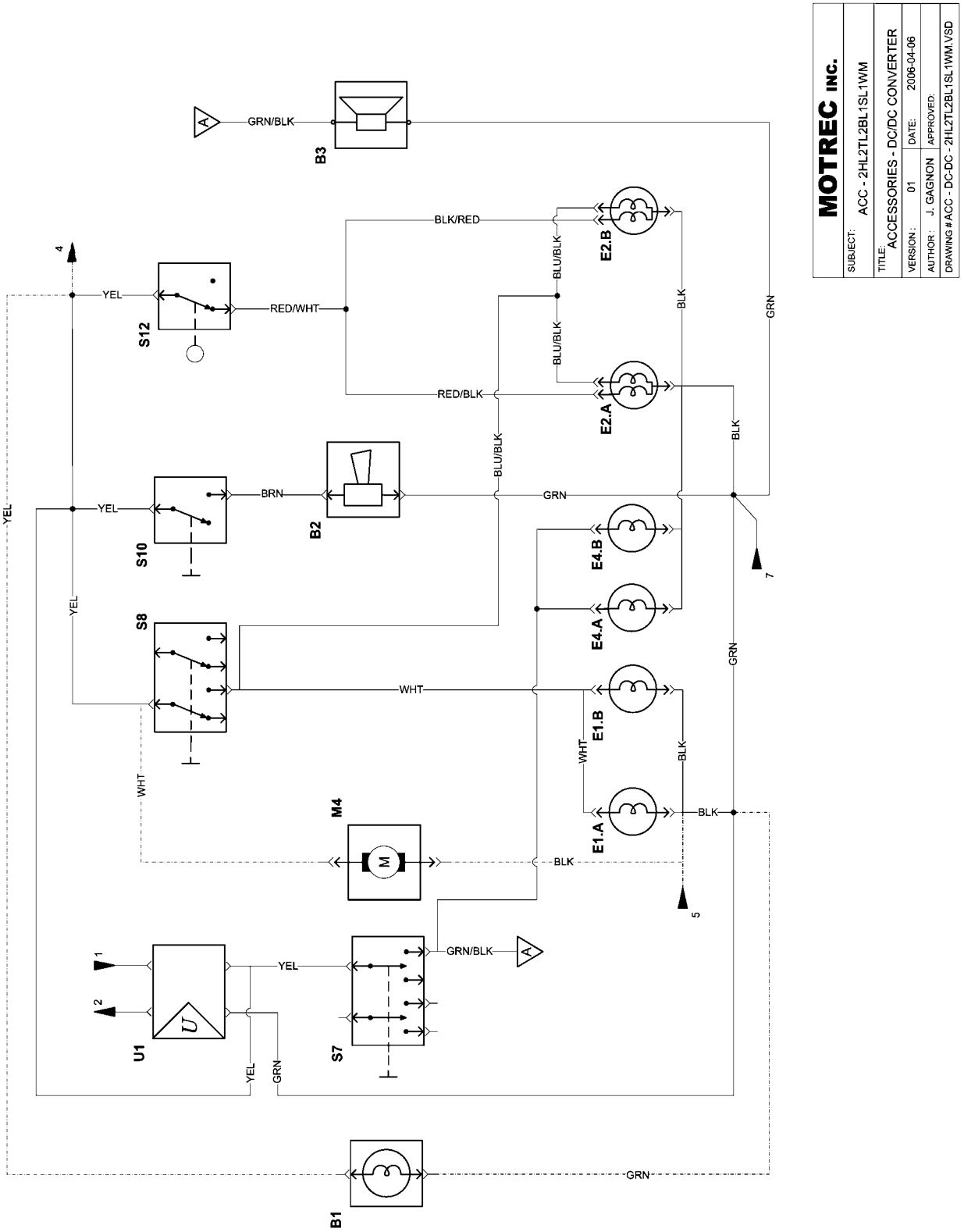

| *REF* | *PART NO* | *DESCRIPTION* | *REF* | *PART NO* | *DESCRIPTION* |
|---|---|---|---|---|---|
| 1 | 2120236001 | DISC | **15** | 2185280001 | FORD PLATE or |
| **2** | 481431K | RIGHT CALIPER | | 2185280002* | GM PLATE |
| | 481430K | LEFT CALIPER | **16** | 2192320001 | 5 - LEAF SPRINGS |
| **3** | 2121000005 | BUSHING, LONG | **17** | 2910000017 | BOLT, LONG |
| **4** | 2121000006 | BUSHING, SHORT | **18** | 2910000018 | BOLT,SHORT |
| **5** | 2122236001 | MOUNTING PLATE, CALIPER | **19** | 2916280002 | U-BOLT 1/2-NF X 3 1/4" I.D. or |
| **6** | 2122300001 | LEFT CALIPER SUPPORT | | 2916280002* | U-BOLT 1/2-NF X 3 1/4" I.D. (short) |
| | 2122300002 | RIGHT CALIPER SUPPORT | **20** | 2916480002 | U-BOLT 1/2-NF X 4" I.D. or |
| **7** | 2128280001 | PADS | | 2916280002* | U-BOLT 1/2-NF X 3 1/4" I.D. (long) |
| **8** | 2128280001 | PADS | **21** | | BOLT 5/8-NC X 4 |
| **9** | 2129000001 | CLIPS | **22** | 2910000041 | HEAVY NUT 1/2-NF |
| **10** | 2134000001 | FLEX. HOSE | **23** | 2910000042 | FLAT WASHER 12mm |
| **11** | 2139000002 | WASHER | **24** | | MACHINE SCREW 1/4-NC X 3/8 |
| **12** | 2139000003 | BOLT | **25** | | NYLON NUT 5/8-NC |
| **13** | 2182320002 | SHACKLE LINK | **26** | 2183240002 | BUSHING |
| **14** | 2182448004 | REAR SUSPENSION PLATE - *BEFORE SERIAL #1081327* | | | |

** NEW FORD HOUSING (SERIAL #1071613 AND UP):*
*NEED THE LEAF SPRING PLATE 2185320002 AND U-BOLT 1/2-NF x 3 1/4" I.D. 2916280003.*

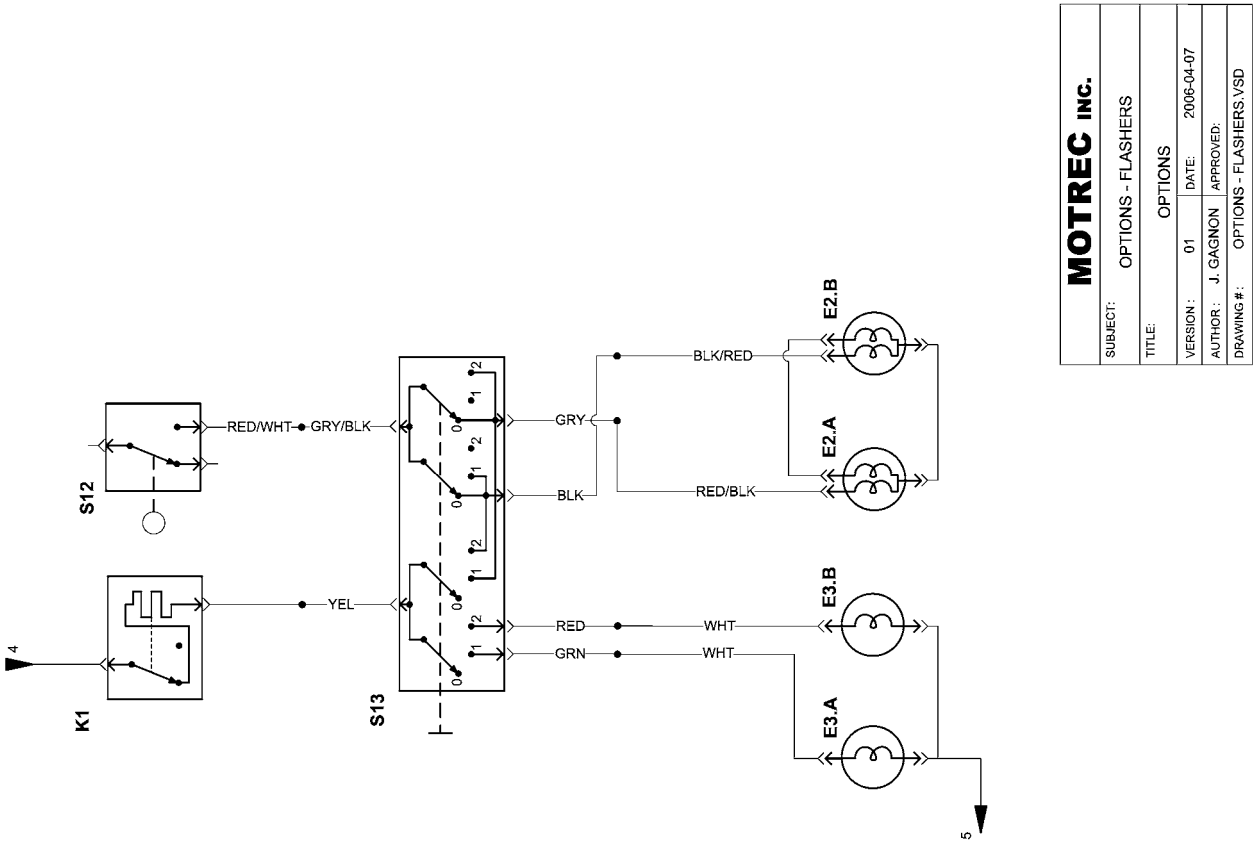
# ELECTRICAL DIAGRAM – SEPEX MAIN CIRCUIT
# DIAGRAMME ÉLECTRIQUE – CIRCUIT PRINCIPAL SEPEX



# ACCESSORIES – DC-DC CONVERTER
# ACCESSOIRES – CONVERTISSEUR DC-DC



# OPTIONS

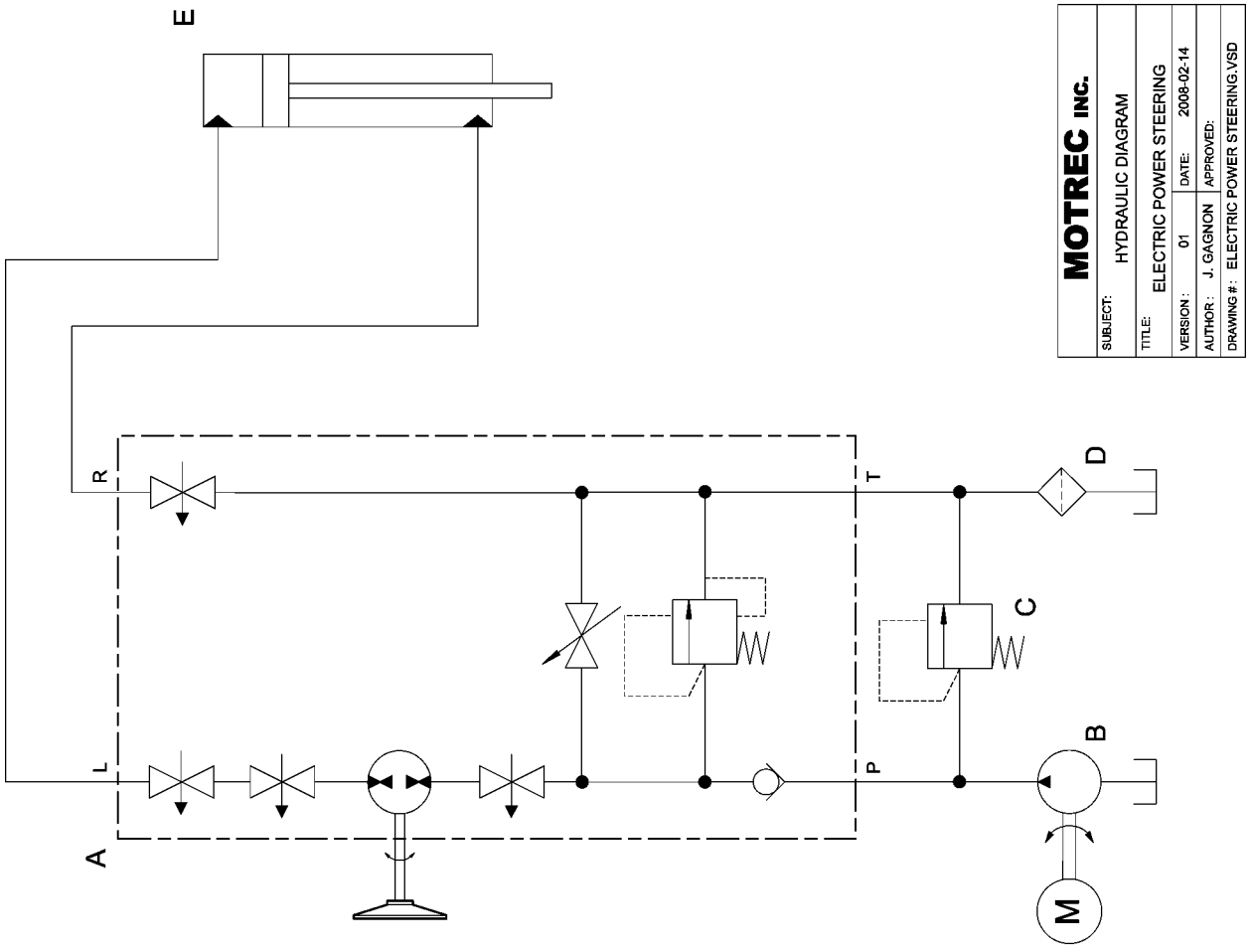

MOTREC INC.
SUBJECT: OPTIONS - FLASHERS
TITLE: OPTIONS
VERSION: 01
DATE: 2006-04-07
AUTHOR: J. GAGNON
APPROVED:
DRAWING # : OPTIONS - FLASHERS.VSD
K1
S12
S13
E2.B
E2.A
E3.B
E3.A
4
5
RED/WHT
GRY/BLK
YEL
GRY
BLK
RED
GRN
BLK/RED
RED/BLK
WHT
WHT

## PARTS LIST

| NO | DESIGNATION | REF | QTY |
|---|---|---|---|
| A2 | SEPEX SPEED CONTROL | 1244-6661 | 1 |
| A3 | I.D. PMC | | |
| B1 | STROBELIGHT | * | 1 |
| B2 | HORN | * | 1 |
| B3 | REVERSE ALARM | * | 1 |
| B4 | HANDBRAKE ALARM | 3100000005 | |
| E1.A,B | HEADLIGHT | * | 2 |
| E2.A,B | TAIL/BRAKE LIGHT | * | 2 |
| E3.A,B | AMBER FRONT LIGHT | * | 2 |
| E4.A,B | BACKUP LIGHT | * | 2 |
| F1.A,B | FUSE, 15A | 246108K | 2 |
| F3 | CIRCUIT BREAKER, 150A | 3107000002 | 1 |
| F4 | DIODE | 367012 | |
| F5 | DIODE BRIDGE | 3669027 | 1 |
| F7 | MAXI BLADE FUSE, 30A | 3118501005 | 1 |
| | MAXI FUSE HOLDER | 3118501006 | 1 |
| | DUST CAP | 3118501007 | 1 |
| F8.A,B | FUSE, 5A | | |
| G1 | BATTERY | | |
| G3 | BATTERY – AA TYPE | 14602 | |
| | BATTERY HOLDER | 3101000008 | |
| K1 | FLASHER RELAY | 3069004 | 1 |
| K2 | RELAY | 3127248002 | |
| M2 | SEPEX MOTOR | | 1 |
| M3 | POWER STEERING MOTOR | 3112800002 | 1 |
| M4 | WIPER MOTOR | * | 1 |
| P1 | INDICATOR (BDI), HOUR METER | 3108448001 | 1 |
| R1 | ACCELERATOR | 2142100001 | 1 |
| | MICROSWITCH | 3109100001 | 1 |
| | POTENTIOMETER | 367003 | 1 |
| | PLASTIC GEAR | 367015 | 1 |
| | SPRING | 2462008 | 1 |
| S1 | KEY SWITCH | 246205 | 1 |
| S3 | SEAT SWITCH, MICRO-SWITCH | 3109100002 | 1 |
| S7 | FOWARD/REVERSE SELECTOR | 266211 | 1 |
| S8 | LIGHT SWITCH, ROCKER TYPE | 1269004 | 1 |
| | LIGHT SWITCH, PUSH/PULL | 486002 | 1 |
| S10 | HORN BUTTON | * | 1 |
| S12 | BRAKE LIGHT SWITCH | 246207 | 1 |
| | HYDRAULIC BRAKE LIGHT SWITCH | 3669004 | 1 |
| S13 | FLASHER SWITCH | * | 1 |
| S15 | EMERGENCY PUSH BUTTON | 3109800001 | |
| | EMERGENCY PUSH BUTTON, LABEL | 3109800006 | |
| S19 | EMERGENCY PUSH BUTTON | 3109000005 | 1 |
| | EMERGENCY STOP LABEL | 3109800006 | 1 |
| S20 | HANDBRAKE SWITCH | 3109100002 | 1 |
| U1 | DC-DC CONVERTER | 3124880001 | 1 |
| X1 | HOUR METER CONNECTOR | | 1 |
| X2 | SPEED CONTROL CONNECTOR | | 1 |
| X3 | I.D. PMC CONNECTOR | | |
| Y1 | MAIN CONTACTOR | 486222 | 1 |
| Y2 | AUX CONTACTOR | 486222 | 1 |
| Y10 | HEATER SOLENOID | 246101 | 1 |
| | STATIC STRAP | 2450001 | 1 |

* Consult Motrec Illustrated parts

# HYDRAULIC DIAGRAM



## PARTS LIST

| NO | DESCRIPTION | REF | QTÉ |
|---|---|---|---|
| A | HYDRAULIC UNIT – STEERING | 4190448001 | 1 |
| B | POWER STEERING PUMP | * | 1 |
| C | RELIEF VALVE | * | 1 |
| D | FILTER | * | 1 |
| E | STEERING CYLINDER | 4130448001 | 1 |

* Contact manufacturer

# MOTREC ILLUSTRATED ACCESSORIES

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

Strobe light, cab mount
Amber 12-48V: 3116250001
Red 12-48V: 3069026
Blue 12-48V: 3069014
Amber 72-80V:3116720001
Red 72-80V: 3116720002
Blue 72-80V: 3116720003

Amber turn lamp
12V: 3111000022
Bulb 12V: 3069021
Multi-LED amber turn lamp
Round Light: 3111000010
Grommet: 3111000008
Plug: 3111000009

Amber turn lamp 2”
12V : 3111330002

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

Red Tail/Turn/Rev light
12V: 3111000002

Red Tail/Brake light
Grommet: 3269001
Plug: 246012A
12V : 2469021
24V : 2469022

Red Tail/Brake light
** Model EE **
Assembly: 3111000030
Housing: 3111000027
Plug: 3111000029
12V : 3111000028

Red Tail/Brake light
Housing: 3111000041
Red Tail/Brake light
Housing LED: 3111000044
Bulb 12V: 3117240001
Bulb 12V LED: 3117000010

Multi-LED Red Tail/Brake
Light: 3111000006
Grommet: 3111000008
Plug: 3119000009

Red Tail/Brake light
12V: 386002

Red Tail/Turn LED light
12-24V: 3111000037

Red Tail/Turn LED light
12-24V: 3111000037

Clear lamp Incandescent
12V: 3111000039
Clear lamp LED 12V:
3111000042
Bulb incandescent 12V :
1269008
Bulb 12V LED:
3117000001

Oval lamp
12V: 3111330001

LED Headlight
12V: 3111000036

Headlight
Left: 3111480003
Right: 3111480004
Bulb H/L: 3111480006
Bulb Turn: 3111480008
Bulb Mark: 3111480007

Headlight
Left: 3111480003
Right: 3111480004
Bulb H/L: 3117480001
Bulb Turn: 3117480003
Bulb Mark: 3117480002

Multi-LED Back-up
Light: 3111000007
Strobe light: 3111000013
Grommet: 3111000008
Plug: 3119000009

Back-up lamp
Grommet: 3269001
12V: 3669012
24V: 3669012A

Pedestal head lamp
12V: 3111240001
Bulb 12V: 2569001B
Bulb 24V: 2169001B

Pedestal head lamp - LED
12-48V: 3111000034

Headlamp 12V:3111250007

Headlamp
12V: 3111300001
Bulb 12V: 3111300002

Analog Voltmeter
12V : 3069007
24V : 2469002
36-48V : 3669002

HOBBS Gauge
24V: 2469026
36V: 3069038
48V: 4869037

DC-DC converter, 10A
12-48V: 3069019

DC-DC Converter, 25A
12-48V: 3124000002
72-80V: 3124880001

DC-DC Converter, 300W
24V: 3124224001
36-48V: 3124280001
72-80V: 3124880001

CONNECTOR:3124280002

Wiper motor
12V: 3113000001
24V: 486211

Wiper arm 2800000001

Wiper blade
14" Blade: 2800000002
18" Blade: 2800000003

Pantograph wiper arm
246233A

Pantograph wiper blade
246233

Limit switch 3109000029

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

12V Dome light 3669006

12V Fan 3669013

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

12-24V Adjustable ECCO:
3100000002

12-48V Adjustable PRECO:
3100000004

Red Pilot light
12V: 246212
Bulb 12V: 246212B

Horn
12V: 246003
24V: 246013

Horn button VIP
2208224002

Horn button, column mount
3109000011

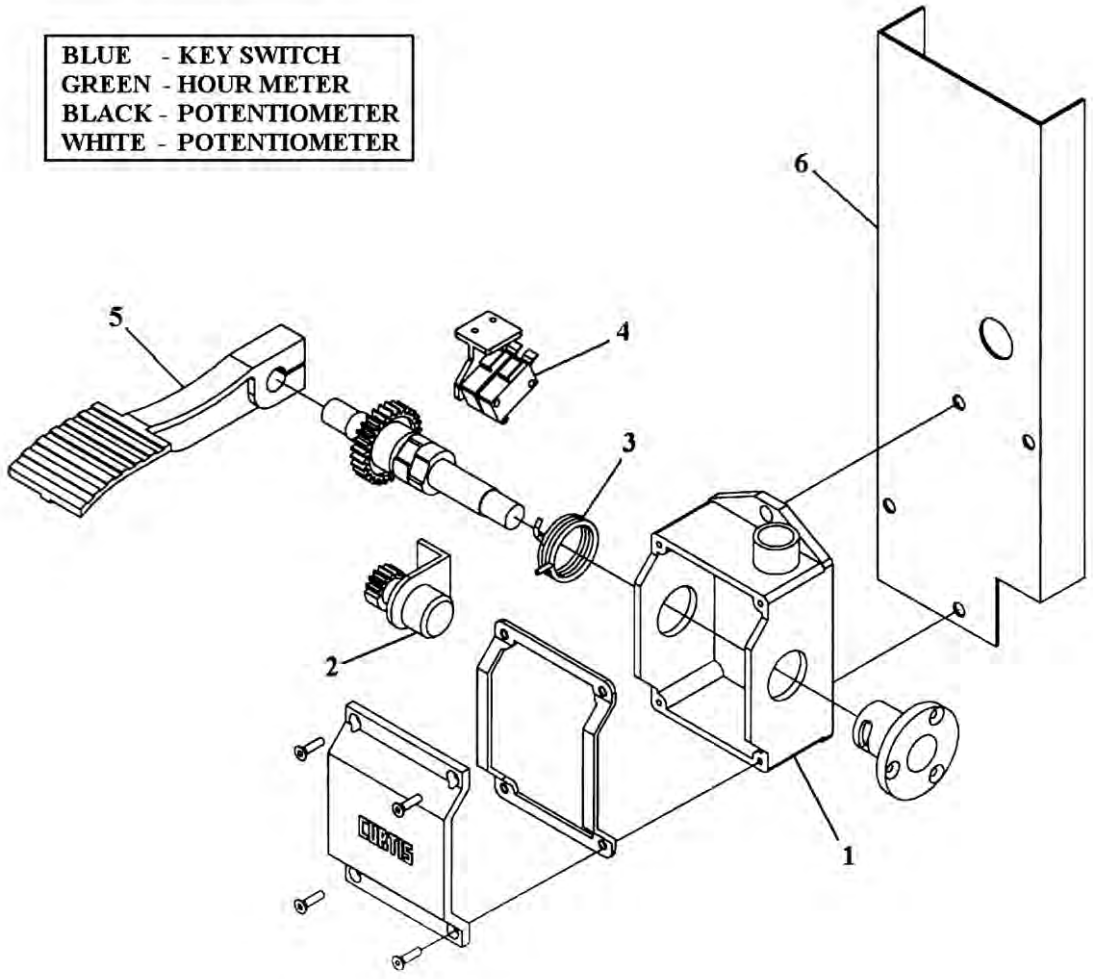
Horn button, dash mount
266210

Horn button 3109250001

Turn signal switch 246050

# ADDENDUM

## CURTIS FOOT PEDAL




| *REF.* | *PART. NO* | *DESCRIPTION* |
|---|---|---|
| ***1*** | ***3062001C*** | ***ACCELERATOR CURTIS*** |
| ***2*** | ***367008*** | ***POTENTIOMETER*** |
| ***3*** | ***2262004C*** | ***SPRING*** |
| ***4*** | ***2262001C*** | ***MICRO-SWITCH*** |
| ***5*** | ***2262003C*** | ***LEVER*** |
| ***6*** | ***3662002*** | ***CABLE PROTECTOR*** |

| | |
|---|---|
| *RESP :* ***CLAUDE L*** | MODEL(E) : **E-320/360/480/500** |
| *NO :* ***321A320001*** | *SER :* ***1018799*** *TO/À :* ***1019973*** |