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Business**

Published: 3/27/2002  
Revision: D, 7/23/2013

**TAYLOR-DUNN<sup>®</sup>**



*Shown with optional steel  
cab and doors*

*Models Included:  
B0-012-10 ( B 2-10)*

## **MANUAL MB-210-08**

*Operation, Troubleshooting and  
Replacement Parts Manual*

Serial Number Starting: 151285



### **Taylor-Dunn Contact information**

Service, Parts, Sales:

Taylor-Dunn has a network of dealers distributed around the globe to support our vehicles. Information regarding vehicle sales, replacement parts, or service should be obtained through your local dealer. A dealer locator can be found on the Taylor-Dunn website at [www.taylor-dunn.com](http://www.taylor-dunn.com).

If you do not have access to the internet, you can call the factory direct at:  
01 (714) 956-4040

Feedback regarding this or any Taylor-Dunn vehicle manual can be sent to:  
Taylor-Dunn Manufacturing  
Attn: Tech Writer  
2114 West Ball Road  
Anaheim, CA 92804





*B2-48 With Stake Side Dump Bed Option*



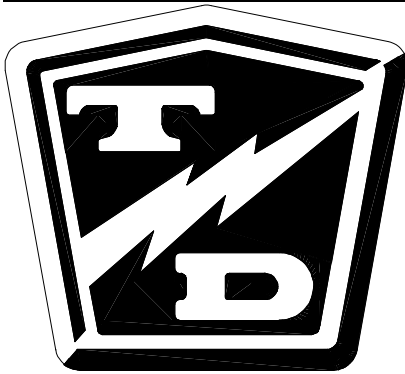
*SC1-00 Stock Chaser*



*E4-55 Sit Down Tow Tractor*



*C4-25 Sit Down Tow Tractor*



# Taylor-Dunn®

*Model B0-012-10*

*Operator and Service Manual Section Index*

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This quick reference section index guide will assist you in locating a desired topic or procedure.

Refer to each sectional Table of Contents for the page number location for specific topics or procedures.





*B2-48 With Dump Bed Option*



*B2-10 Ambulance*



*B2-48 with Steel Cab, Foldaway  
4-Passenger Seat and Stake Sides*



*P2-50 30,000 Pound Tow Tractor*



*ET 3000*

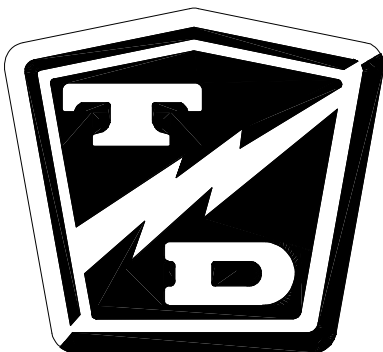


*ET1-50 Full Size Truck*

# Introduction

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## ***ABOUT THIS MANUAL***

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The purchase of this vehicle shows a belief in high quality products manufactured in the USA. Taylor-Dunn®, a leading manufacturer of electric burden and personnel carriers since 1949, wants to be sure this vehicle provides years of reliable service. Please continue to read this manual and enjoy this high quality Taylor-Dunn® vehicle.

This manual is to serve as a guide for the service, repair, and operation of Taylor-Dunn® vehicles and is not intended as a training guide. Taylor-Dunn® has made every effort to include as much information as possible about the operation and maintenance of this vehicle.

Included in this manual are:

- Vehicle Description
- Safety Rules and Guidelines
- Operational Information
- Operator Responsibilities
- Owner Responsibilities
- Control Operation and Location Information
- Maintenance and Troubleshooting Information
- Standard Parts List

Before servicing, operating, training or performing maintenance on this or any other Taylor-Dunn® vehicle, read the appropriate Taylor-Dunn® manual.

Each Taylor-Dunn® manual references the applicable models and serial numbers on the front cover.

Please, be aware of all cautions, warnings, instructions, and notes contained in this manual.

## ***WHO SHOULD READ THIS MANUAL***

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This manual is intended for use by anyone who is going to operate, own, perform maintenance on, service, or order parts for this Taylor-Dunn® vehicle. Each person should be familiar with the parts of this manual that apply to their use of this vehicle.

## ***RESPONSIBILITIES***

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### **Of the Owner...**

The owner of this or any Taylor-Dunn® vehicle is responsible for the overall maintenance and repairs of the vehicle, as well as the training of operators. Owners should keep a record of conducted training and maintenance performed on the vehicle. (OSHA Regulation, 29 CFR 1910.178 Powered Industrial Truck Operator Training).

### **Of the Operator...**

The operator is responsible for the safe operation of the vehicle, preoperational and operational checks on the vehicle, and the reporting of any problems to service and repair personnel.

### **Of the Service Personnel...**

The service personnel are responsible for the service and maintenance of the vehicle. At no time should a service person allow any untrained personnel to service or repair this or any Taylor-Dunn® vehicle. For the purposes of training, a qualified service person may oversee the repairs or services being made to a vehicle by an individual in training. At no time should an untrained individual be allowed to service or repair a vehicle without supervision. This manual is not a training guide.

### **Of the Passengers ...**

The passengers are responsible to remain fully seated, keeping their hands, arms, and legs inside the vehicle at all times. Each passenger should be fully aware of the vehicle's operation. All forms of recklessness are to be avoided. Do not engage in horseplay.



*Model B 2-10 shown with stake sides and steel cab with doors options*



## **HOW TO USE THIS MANUAL**

This manual is organized into five main sections:

### **INTRODUCTION**

This section describes how to use this service manual and how to identify your vehicle.

### **Safety Rules and Operating Instructions**

This section outlines the safety and operational issues, location and operation of controls, and the operational checks that are to be performed on this vehicle. It also includes various subjects that should be included in the operator and service training program.

### **Maintenance Service and Repair**

This section gives specific information on the servicing of the vehicle and a schedule for maintenance checks.

### **Electrical and Charger Troubleshooting**

This section identifies the troubleshooting procedures for testing the electrical system and battery charger.

### **Illustrated Parts**

This section provides an illustrated view of various assemblies. The illustrations are accompanied by tables identifying the parts.




*Model R 3-80 shown equipped with a cargo box and steel cab with doors options*


## **Conventions**

Symbols and/or words that are used to define warnings, cautions, instructions, or notes found throughout this manual. Refer to the examples below.


### **⚠ WARNING**

A shaded box with the word "Warning" and the symbol  above denotes a warning. A warning alerts the reader of a hazard that may result in injury to themselves or others. Be sure to follow any instructions contained within a warning and exercise extreme care while performing the task.

### **⚠ WARNING**

A shaded box with and the word "Warning" and the symbol  above denotes a warning. This warning alerts the reader of a high voltage hazard that may result in injury to themselves or others. Be sure to follow any instructions contained within a warning and exercise extreme care while performing the task.

### **⚠ CAUTION**

A box with the word "CAUTION" and the symbol  above denotes a caution and is used to inform the reader that property damage may occur. Be sure to exercise special care and follow any instructions contained with in a caution.

*Note: Alerts the reader to additional information about a subject.*



*Model B 2-48 equipped with the Dump Bed option*

## HOW TO IDENTIFY YOUR VEHICLE

This manual applies to vehicles with the same model and serial numbers listed on the front cover.

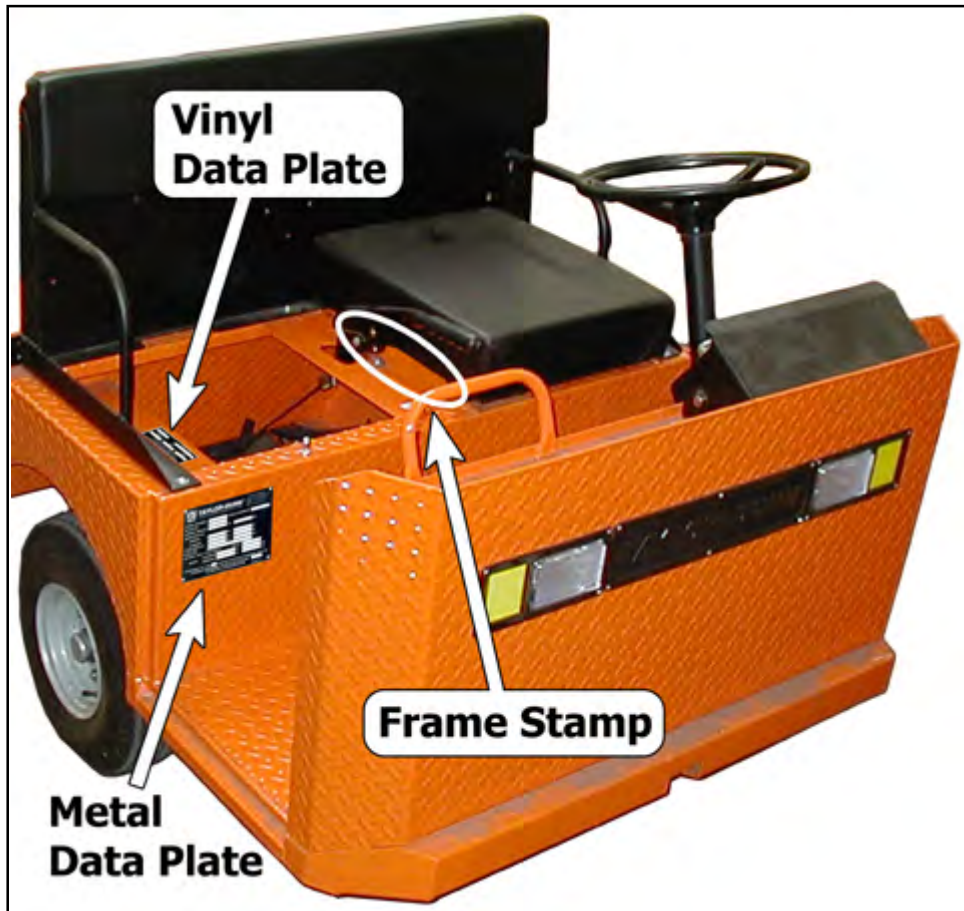
These vehicles are designed for driving on smooth surfaces in and around facilities such as industrial plants, nurseries, institutions, motels, mobile home parks, and resorts. They are not to be driven on public highways.

### **⚠ WARNING**

**This vehicle is not designed to be driven on public roads or highways. It is available in maximum designed speeds ranging from 7 to 16 mph. Do not exceed the maximum designed speed. Exceeding the maximum designed speed may result in steering difficulty, motor damage, and/or loss of control. Do not exceed locally imposed speed limits. Do not tow at more than 5 mph.**

This vehicle conforms to requirements for Type E vehicles as described in O.S.H.A. Standard Section 29 CFR 1910.178 (Powered Industrial Trucks) and with all applicable portions of the American National Standard for Personnel and Burden Carriers (ANSI B56.8).

The locations of the model and serial numbers are illustrated below:



## TAKING DELIVERY OF YOUR VEHICLE

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Inspect the vehicle immediately after delivery. Use the following guidelines to help identify any obvious problems:

- Examine the contents of all packages and accessories that may have come in separate packages with the vehicle.
- Make sure everything listed on the packing slip is there.
- Check that all wire connections, battery cables, and other electrical connections are secure.
- Check battery cells to be sure they are filled.
- Check the tire pressure, tightness of lug nuts, and for any signs of damage.

Check the operation of each of the following controls:

- Accelerator
- Brake
- Parking Brake
- Key-Switch
- Forward/Reverse Switch
- Reverse Beeper (if equipped)
- Front Headlight Switch
- Steering Wheel
- Horn

## What To Do If a Problem is Found

If there is a problem or damage as a result of shipping, note the damage or problem on the bill of lading and file a claim with the freight carrier. The claim must be filed within 48 hours of receiving the vehicle and its accessories. Also, notify your Taylor-Dunn® dealer of the claim.

If there is a problem with the operation of the vehicle, **DO NOT OPERATE THE VEHICLE**. Immediately contact your local Taylor-Dunn® distributor and report the problem. The report must be made within 24 hours of receiving the vehicle and its accessories.

The only personnel authorized to repair, modify, or adjust any part of this or any Taylor-Dunn® vehicle is a factory authorized service technician.

## **⚠ WARNING**

**The only personnel authorized to repair, modify, or adjust any part of this or any Taylor-Dunn® vehicle is a factory authorized service technician. Repairs made by unauthorized personnel may result in damage to the vehicles systems which could lead to an unsafe condition resulting in severe bodily injury and/or property damage. Unauthorized repairs may also void the vehicles warranty.**



*Model B 2-10 Ambulance*



*B2-48 With Stake Side Dump Bed Option*



*SC1-00 Stock Chaser*



*E4-55 Sit Down Tow Tractor*



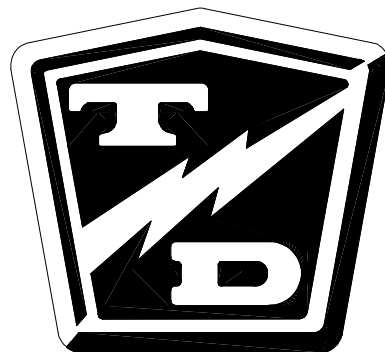
*C4-25 Sit Down Tow Tractor*

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# Safety Rules and Operating Instructions



# SAFETY RULES AND OPERATING INSTRUCTIONS

## STANDARD SPECIFICATIONS\*

ITEM	SPECIFICATION
Occupancy	Driver, 1-passenger
Dimensions	302L x 114W x 122H Centimeters 119L x 45W x 48H Inches
Turning Radius	317 Centimeters (125 Inches)
Dry Weight Without Batteries	301 kg (665 lbs)
Min/Max Battery Weights	158 kg to 194 kg (348 lbs to 428 lbs)
Maximum Load Deck dimensions	1088 kg (2,400 lbs) 113.6 W x 188 L Centimeters (44.75W x 74L Inches)
Electrical System	Six 217 Amp Hour, 6 Volt, Lead Acid Batteries, Solid State Speed Control, 400 Amp
Transmission	Helical Gear, Oil Bath, Automotive Type Hypoid Differential.
Motor, DC, Series Wound	4.47 kW, (6 Horse Power) @ 1,400 RPM
Brakes	Rear Wheel Hydraulic Disc, Hand Operated Park Brake, 4 Wheel Hydraulic Disc, Hand Operated Park Brake
Steering	Automotive Steering 24:1
Tires	5.70 x 8 Load Range B
Frame	Steel Unitized Body, Heavy Duty 16 Gauge Steel, Diamond Plate
Instrumentation	Battery Status Indicator, Key Switch, Horn Button, Forward/Reverse Switch, Headlight Switch
Light Accessories	Headlight, Dual Tail/Brake Lights
Charger	36v DC / 25A, 120v AC / 12A 60Hz

This vehicle conforms to requirements for Type E vehicles as described in O.S.H.A. Standard Section 1910.178 (Powered Industrial Trucks) and with all applicable portions of the American National Standard for Personnel and Burden Carriers (ANSI B56.8).

\* - Specifications are subject to change without notice.





## SAFETY RULES AND GUIDELINES

It is the responsibility of the owner of this vehicle to assure that the operator understands the various controls and operating characteristics of this vehicle (extracted from the American National Standards Institute Personnel and Burden Carriers ANSI B56.8). As well as, following the safety rules and guidelines outlined in ANSI B56.8 and listed below.

These vehicles are designed for driving on smooth surfaces in and around facilities such as industrial plants, nurseries, institutions, motels, mobile home parks, and resorts. They are not to be driven on public highways.

### **⚠ WARNING**

**These vehicles are not designed to be driven on public roads or highways. They are available in maximum designed speeds ranging from 7 to 16 mph. Do not exceed the maximum designed speed. Exceeding the maximum designed speed may result in steering difficulty, motor damage, and/or loss of control. Do not exceed locally imposed speed limits. Do not tow this vehicle at more than 5 mph.**

Refer to *Vehicle Operational Guidelines, Safety Guidelines* section for important safety information regarding operating this vehicle.

### **⚠ WARNING**

**Read and follow all of the guidelines listed below. Failure to follow these guidelines may result in severe bodily injury and/or property damage.**

### **⚠ WARNING**

**Before working on a vehicle:**

- 1. Make sure the key-switch is in the "OFF" position, then remove the key.**
- 2. Place the forward-reverse switch in the center "OFF" position.**
- 3. Set the park brake.**
- 4. Place blocks under the front wheels to prevent vehicle movement.**
- 5. Disconnect the main positive and negative cables at the batteries.**

## DRIVER TRAINING PROGRAM

According to ANSI B56.8, the owner of this vehicle shall conduct an Operator Training program for all those who will be operating this vehicle. The training program shall not be condensed for those claiming to have previous vehicle operation experience. Successful completion of the Operator Training program shall be required for all personnel who operate this vehicle.

The Operator Training program shall include the following:

- Operation of this vehicle under circumstances normally associated with your particular environment.
- Emphasis on the safety of cargo and personnel.
- All safety rules contained within this manual.
- Proper operation of all vehicle controls.
- A vehicle operation and driving test.

### Driver Qualifications.

Only those who have successfully completed the Operator Training program are authorized to drive this vehicle. Operators must possess the visual, auditory, physical, and mental ability to safely operate this vehicle as specified in the American National Standards Institute Controlled Personnel and Burden Carriers ANSI B56.8.

The following are minimum requirements necessary to qualify as an operator of this vehicle:

- Demonstrate a working knowledge of each control.
- Understand all safety rules and guidelines as presented in this manual.
- Know how to properly load and unload cargo.
- Know how to properly park this vehicle.
- Recognize an improperly maintained vehicle.
- Demonstrate ability to handle this vehicle in all conditions.



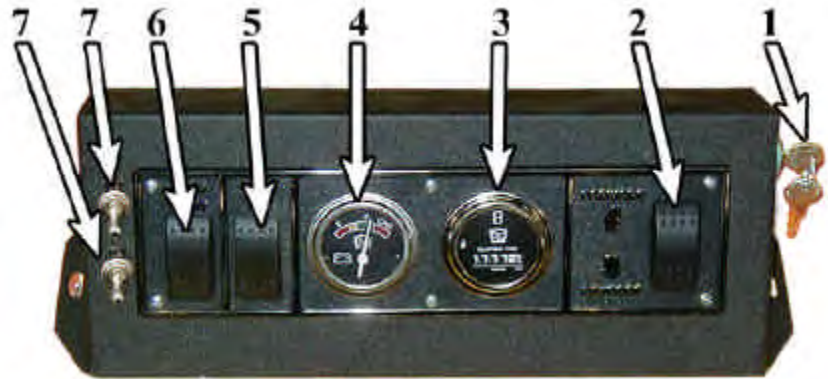
## VEHICLE CONTROLS

### 1) Key-Switch

A key-switch, located on the right center side of the instrument panel, turns on the vehicle. Rotate the key clockwise to turn the vehicle power on, counterclockwise to turn the vehicle power off.

The key-switch should be in the “OFF” position whenever the operator leaves the vehicle.

This switch is also designed to secure and disable the vehicle. The key can only be removed when the key-switch is in the “OFF” position.



### 2) Forward-Off-Reverse Switch

The forward-off-reverse switch, located on the right side of the instrument panel, determines the direction of travel of the vehicle. Push the top of the switch to engage the forward direction. Push the bottom of the switch to engage the reverse direction.

DO NOT SWITCH from forward to reverse or vice-versa while the vehicle is in motion. Make sure the vehicle is completely stopped before shifting.

The forward-off-reverse switch should be in the center “OFF” position, with the key-switch off and the park brake set whenever the operator leaves the vehicle.

### 3) Hour Meter (optional)

The hour meter is located to the right of the battery status indicator. It records the number of hours the vehicle has been in operation.

### 4) Battery Status Indicator, Analog

The battery status indicator is located to the left of the hour meter. The normal operating range is in the green zone. Park the vehicle for a few minutes for an accurate reading. The vehicle needs charging if it is in the yellow zone. During and immediately following charging, the needle will be in the red zone to the right. The needle will move through the green zone toward the yellow zone as the batteries discharge. Charge the batteries when the needle is in the yellow zone. If it is in the red zone to the left, the batteries are empty and the truck should be taken out of service and charged to avoid damaging the batteries.

### 5) Accessory Switch (Optional)

The accessory switch is located on the left side of the instrument panel and to the right of the headlight switch. Push the top of the switch to turn on the accessory. Push the bottom of switch to turn off the accessory. The accessory can be turned on with the key switch in the “OFF” position. If a vehicle is equipped with windshield wipers and one or more accessories, the windshield wipers are controlled from this switch. Other accessories are controlled from the auxiliary switch.

### 6) Headlight Switch

The headlight switch is located on the left of the instrument panel. Push the top of the switch to turn the lights on. Push the bottom of the switch to turn the lights off.

### 7) Auxiliary Switch (Optional)

Additional accessory switches may be located on the left side of the instrument panel. Toggle the switch up to turn on the accessory, down to turn off the accessory. The accessory can be turned on with the key switch in the “OFF” position.

### Horn Switch

The horn switch is located on the right side of the instrument panel. Depress the switch to sound the horn, release it to turn it off.



## Steering

The steering wheel and steering system are similar to an automobile. To turn right, turn the steering wheel clockwise. To turn left, turn the steering wheel counter-clockwise. If equipped with tilt steering, the release lever is located on the lower left of the steering column. Pull the lever up to reposition the steering wheel.

## Foot Brake Pedal

The foot brake pedal, is located to the right of the steering column, it is for operation with the right foot only. It works similar to the brake in an automobile. Applying pressure to the brake pedal slows the vehicle according to the amount of pressure applied. Relieving pressure from the pedal releases the braking action.



## Accelerator Pedal

The accelerator pedal is located to the right of the brake pedal. It controls the speed of the vehicle and operates similar to the accelerator pedal in an automobile. Depress the pedal to increase speed and release the pedal to decrease speed.

## Park Brake

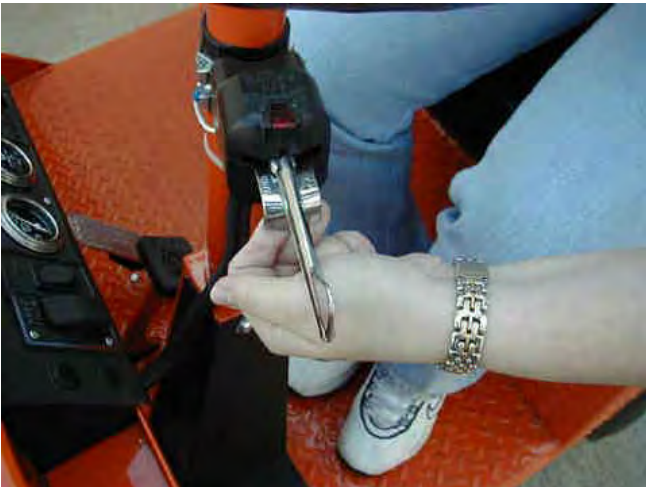
The parking brake is actuated with a hand lever, which is located to the right of the driver. To set the parking brake, push down on the brake pedal and pull the lever up until it locks. To release the park brake, depress the foot brake pedal, pull up on the park brake handle, push the release button, and lower the handle.





### **Directional Signals (Optional)**

The turn signal lever is located on the left side of the steering column. Push the lever forward to activate the right turn signal and pull the lever back to activate the left turn signal.



### **Hazard Light Switch (Optional)**

The hazard light switch is located on the left side of the steering column. The switch is a small tab. To activate the hazard lights, pull the tab out. To turn the hazard lights off, push forward or pull back the directional signal lever.

### **Charger Interlock**

The charger interlock is designed to disable the vehicle from being driven while the AC charger cord is plugged into a functioning power source.

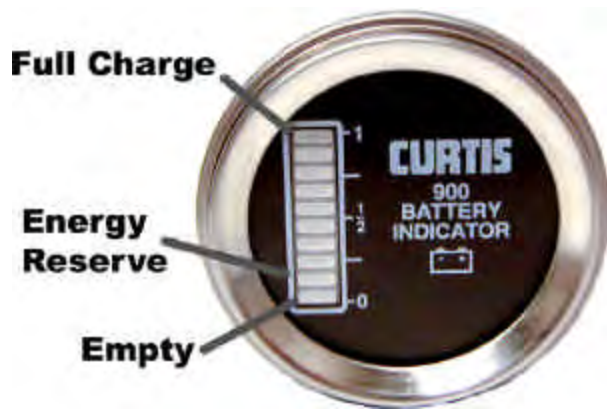
NOTE: The interlock shown is mounted external of the charger. Some vehicles may have the interlock built into the charger.

### **Seat Interlock Switch**

A switch located under the driver's seat disables the power to the vehicle when the driver leaves the seat. The driver must be seated for the vehicle to operate.

Whenever the driver leaves the vehicle, the driver should turn the key-switch off, place the forward-off-reverse switch in the center "OFF" position, and set the park brake.





## Battery Status Indicator, Digital Bargraph (optional)

The battery status indicator is located to the left of the hour meter. The battery status indicator has a LED bargraph that indicates the relative state of charge of the battery. The top LED will light only when connected to a fully charged battery or after completing a charging cycle. Successive lower LED's will light as the battery charge diminishes. When the second from the bottom LED flashes the battery energy status is in energy reserve and should be placed on charge as soon as possible. When the two bottom LED's are alternately flashing the batteries are empty and the truck should be taken out of service and charged to avoid damaging the batteries. The BSI will reset to fully charged only after a complete charge cycle is completed. A complete charge cycle is defined as battery voltage exceeding 2.35 volts per cell for a minimum of 6 minutes.



## VEHICLE OPERATIONAL GUIDELINES

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### Safety Guidelines

- Only qualified and trained operators may drive this vehicle.
- Drive only on level surfaces or on surfaces having an incline of no more than 10% (5.6 degrees).
- Drive slowly when making a turn, especially if the ground is wet or when driving on an incline.
- This vehicle may overturn easily if turned sharply or when driven at high speeds.
- Observe all traffic regulations and speed limits.
- Keep all body parts (head, arms, legs) inside this vehicle while it is moving.
- Keep the vehicle under control at all times.
- Yield right of way to pedestrians, ambulances, fire trucks, or other vehicles in emergencies.
- Do not overtake another vehicle at intersections, blind spots, or other dangerous locations.
- Do not drive over loose objects, holes, or bumps.
- Yield right of way to pedestrians and emergency vehicles.
- Stay in your driving lane under normal conditions, maintaining a safe distance from all objects.
- Keep a clear view ahead at all times.

### Starting:

Perform all necessary vehicle preparation steps, inspections, or maintenance before operating this vehicle.

1. Make sure the forward-off-reverse switch is in the center "OFF" position.
2. Set the parking brake.
3. Hold down the foot brake.
4. Rotate the start switch to the "ON" position.
5. Release the parking brake.
6. Release the foot brake.
7. Slowly depress the accelerator pedal.

### While driving:

- Slow down and sound the horn to warn pedestrians or when approaching a corner or other intersection.
- No reckless driving.
- Do not drive this vehicle on steep inclines or where prohibited.
- Immediately report any accidents or vehicle problems to a supervisor.

### Loading and Unloading

- Do not carry more than the maximum number of passengers allowed for this vehicle.
- Do not exceed the cargo load capacity.
- Do not load cargo that can fall off.
- Be careful when handling cargo that is longer, wider, or higher than this vehicle, be sure to properly secure all loads.

### Towing Loads:

- Do not exceed the towing capacity of the tractor.
- Do not exceed the load capacity of the trailer. Refer to documentation supplied with your trailer for information regarding load capacity of the trailer.
- Make sure all loads are securely tied down. Refer to documentation supplied with your trailer for information regarding attaching loads to the trailer.
- Do not back up when towing more than one trailer.
- Drive slowly when towing loads with a high center of gravity.
- When turning, be sure to allow for "corner cutting" of the trailer.
- Allow for longer stopping distances when towing heavy loads.
- Allow for longer stopping distances when driving down a grade.





## **Parking**

Before leaving the vehicle:

- Set the parking brake.
- Set the forward-of-reverse switch to the "OFF" position.
- Rotate the start switch to the "OFF" position.

In addition:

- If parking this vehicle on an incline, turn the wheels to the curb, or block the wheels.
- Do not block fire aisles, emergency equipment, stairways, or exits.

## **Towing This Vehicle**

To tow this vehicle, attach a tow strap to the front bumper tow-bar.

Use another driver to steer this vehicle while it is being towed. Be sure the driver uses the brakes when the towing vehicle slows or stops. Do not tow the vehicle faster than 5 m.p.h. or its maximum designed speed, whichever is lower.

If at all possible, this vehicle should be placed on a carrier, rather than towing.



# SAFETY RULES AND OPERATING INSTRUCTIONS

## CHARGING YOUR VEHICLE

### ⚠ WARNING

Explosive mixtures of Hydrogen gas are present within battery cells at all times. Do not work with or charge battery in an area where open flames (including gas furnace or water heater pilots), sparks, cigarettes, or any other sources of combustion are present. Always provide ample ventilation in rooms where batteries are being charged. Failure to do so may result in severe bodily injury and/or property damage.

### ⚠ WARNING

Battery electrolyte is poisonous and dangerous. It contains sulfuric acid. Avoid contact with skin eyes or clothing. Wear rubber gloves and safety glasses while servicing batteries. DO NOT INGEST! This may result in severe bodily injury.

### ⚠ CAUTION

The key switch must be in the "OFF" position when charging the batteries. Failure to turn the key switch "OFF" may result in damage to the vehicles electrical system.

### Signet® Charger Operation, Model HB Series

The Signet® HB series chargers use a semi-automatic charging system. The charger will turn itself ON when the AC power cord is connected to the AC power source and turn itself OFF when the batteries are fully charged. Refer to the data plate on the charger for the voltage and type power required for the charger.



Typical Signet® Built In

There is a series of LED's on the faceplate of the charger that serve two functions:

1. Status of charge. The LED's will display an approximate percent of charge during the charging cycle. Refer to the table below.
2. Error condition. All three LED's flashing is an indication of a charging problem (charger will also be beeping). Refer to the **Charger Troubleshooting** section for information on error codes.



Charging State	LED1	LED2	LED3
0 to 50%	Blinking	OFF	OFF
50% to 75%	ON	Blinking	OFF
75% to 100%	ON	ON	Blinking
Cycle complete	ON	ON	ON

### Signet Charger Operation, Model HBS series

The Signet® HBS series chargers are fully automatic. The charger will turn itself ON when the AC power cord is connected to the AC power source and turn itself OFF when the batteries are fully charged. Once the charge cycle is complete, the charger will continue to monitor the batteries. If the battery voltage drops during storage, the charger will start a new cycle to keep the batteries fully charged.



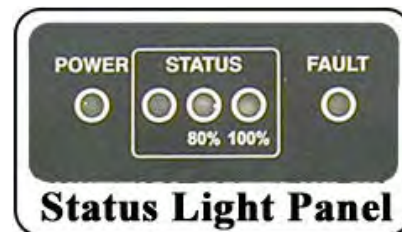
Typical Signet® HBS

*NOTE: If the charger restarts during a short time period of storage, then it would be an indication of faulty batteries.*

Refer to the data plate on the charger for the voltage and type power required for the charger.

There is a series of LED's on the faceplate of the charger that serve two functions:

1. Status of charge. The **STATUS** LED's will display an approximate percent of charge during the charging cycle. Refer to the table below.
2. Error condition. The **FAULT** LED flashing is an indication of a charging problem (charger may also be beeping). Refer to the **Charger Troubleshooting** section for information on error codes.





## Lestronic II® Charger Operation

The Lestronic II® charger is a semi-automatic charging system. The charger will turn itself ON when the AC power cord is connected to the AC power source and turn itself OFF when the batteries are fully charged. Refer to the data plate on the charger for the voltage and type power required for the charger. When plugged in, the charger assumes that the batteries require charging and will charge for a minimum of approximately 4-hours. This charger should not be plugged in until the batteries are discharged beyond 50% or the batteries may be overcharged..

## New Battery Break in

New batteries require a break in period of up to 40-cycles. The batteries will not have their full capacity during this break in period and may require longer charging times.

## To obtain the maximum battery life:

Charge the batteries only after they reach a normal discharge as indicated on the Battery Status Indicator (BSI). Failure to follow this guideline could result in the batteries entering an overcharge state, which will reduce the life of the batteries. If you find it necessary to charge the batteries before they are completely discharged we recommend waiting until they are discharged a minimum of 25% to reduce the possibility of overcharging. Refer to Vehicle Controls in this section for information on how to read the BSI.

Do not discharge the batteries beyond a normal discharge as indicated on the BSI. Refer to Vehicle Controls in this section for information on how to read the BSI.

Check the battery electrolyte once a week. Do not charge the batteries if the battery electrolyte is low. Charging when the electrolyte is low will damage the batteries and shorten their life-span. Only authorized personnel should perform battery maintenance including maintaining the battery electrolyte level. Refer to Section **Maintenance, Service and Repair** for battery maintenance information.

Do not interrupt the charging cycle. When the charger is plugged in, allow it to turn off before disconnecting. Interrupting the charging cycle could lead to overcharging or discharging the batteries too deep. Both circumstances will shorten the life of the batteries.

## Charging Time

Average charging time is 8 to 10-hours. The time required to fully charge your batteries will vary depending on:

- Capacity of the batteries, higher capacity requires longer charge time.
- Output of the charger, higher output requires less charge time.
- Depth of discharge, the deeper a battery is discharged, the longer it takes to charge.
- Temperature, low temperatures require longer charge time.

It is not unusual for charge times to exceed 15-hours, especially with new batteries.

Charging time is limited to 20-hours (HBS) or 18-hours (HB). A fault will occur if the charging time exceeds the 20-hour limit.

---

## **STORING / RETURNING TO SERVICE**

---

Both storing your vehicle and returning it to service should only be performed by authorized personnel.

### Storing Your Vehicle

- Clean the batteries, then fill and charge before putting the vehicle in storage. Do not store batteries in a discharged condition.
- Lube all grease fittings.
- Clean, dry, and check all exposed electrical connections.
- Inflate tires to proper pressure (if applicable).
- For extended storage, the vehicle should be elevated so that the tires do not touch the ground.

If stored for a prolonged period, the batteries should be charged as follows:

### Returning to Service

- Check the battery's state of charge and charge if required.

Storage Temperature (F)	Charging Interval (months)
Over 60	1
Between 40 and 60	2
Below 40	6

- Perform ALL maintenance checks in the periodic checklist.
- Remove any blocks from the vehicle and/or place the vehicle down on to the ground.
- Test drive before putting into normal service.



## PERIODIC MAINTENANCE CHECKLIST

Maintenance Item <sup>2,3</sup>	Weekly (20hrs)	Monthly (80hrs)	Quarterly (250hrs)	Semi - Annual (500hrs)	Annually (1000hrs)
Check Condition of Tires and Tire Pressure	●				
Check All Lights, Horns, BEEPERS and Warning Devices	●				
Check and Fill Batteries	●				
Check Brake System		●			
Check Steering System		●			
Check for Fluid Leaks		●			
Lubricate Vehicle			●		
Clean and Tighten All Wire Connections			●		
Wash and Service Batteries			●		
Check Park Brake				●	
Check Motor Brushes and Blow Out Motor				●	
Check Front Wheel Bearings				●	
Check Rear Axle Oil				●	
Change Rear Axle Oil					●
Check and Tighten all Nuts and Bolts					●
Clean and Repack Front Wheel Bearings					●

1, 2, 3 - See notes on following pages.

### **⚠ WARNING**

**Only properly trained and authorized technicians should perform maintenance or repairs to this vehicle. Repairs or maintenance by improperly trained or unauthorized personnel could cause improper operation of the vehicle or premature failure of components resulting in severe bodily injury and/or property damage.**



## Daily Visual inspection:

Tire condition and pressure.

External frame damage (body).

Operation of all lights and warning alarms and/or horns.

Smooth and proper operation of all controls such as but not limited to:

- Accelerator pedal, Brake pedal, Steering, Parking brake, etc.
- Proper operation of all locking devices such as but not limited to:
- Tool box, Removable battery trays, Cargo box, Cab doors, etc.
- Proper operation of all interlocking switches such as but not limited to:
- Key switch, Seat interlock switch, Charger interlock switch, etc.

Inspect for leaking fluids or grease.

---

## **MAINTENANCE GUIDELINES FOR SEVERE DUTY APPLICATIONS**

---

1. This maintenance checklist is based on the average application. If the vehicle is operated under “severe conditions”, service procedures should be conducted more frequently than specified. The frequency of service under severe conditions is determined by the use of the vehicle. The owner/operator must evaluate the operating environment to determine the increase in maintenance frequency.

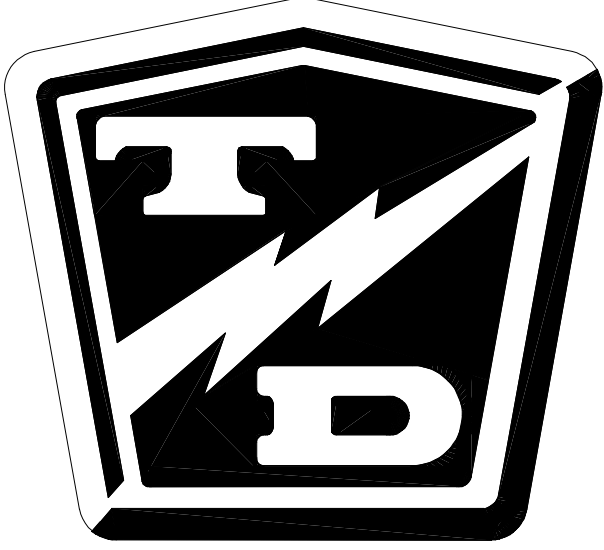
In addition, the whole vehicle should be inspected monthly for signs of damage. The damage must be repaired immediately.

The following list is meant as a guide and is not all-inclusive of a “severe duty” application.

- Extreme temperature.
  - Bumpy, dusty, or ill maintained roads.
  - Excessively wet areas.
  - Corrosive or contaminated areas.
  - Frequent loading of vehicle at/near capacity.
  - Use on multiple shifts.
2. Any deficiencies found during an inspection should corrected before the vehicle is returned to service.
  3. Battery water level should be inspected on a weekly schedule.



**TAYLOR - DUNN**





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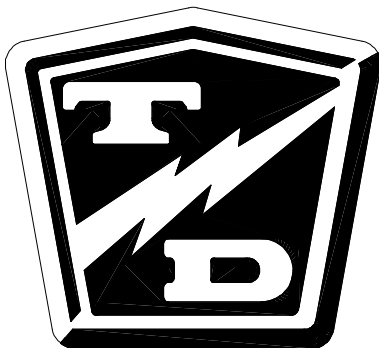


*Model C 4-25 Tow Tractor*

*Shown here are two of the many Taylor-Dunn tow tractors available. Contact your distributor for more information.*



*Model E 4-55 Tow Tractor*



# General Maintenance



## ***Maintenance Guidelines***

---

### **⚠ WARNING**

**Periodic maintenance and service must be performed on this vehicle. Failure to complete these scheduled maintenance and service procedures can result in severe bodily injury and/or property damage. It is the owner and/or operators responsibility to insure that proper service and maintenance is performed on the vehicle, described in this manual.**

### **⚠ WARNING**

**Before starting any repairs:**

- 1. Make sure the key-switch is in the "OFF" position, then remove the key.**
- 2. Place the forward-reverse switch in the center "OFF" position.**
- 3. Set the park brake.**
- 4. Place blocks under the front or rear wheels to prevent vehicle movement.**
- 5. Disconnect the main positive and negative cables at the batteries.**

### **⚠ CAUTION**

**Turn the Key switch OFF BEFORE disconnecting the batteries. Disconnecting the batteries with the key switch ON may corrupt the controller programming resulting in a fault code 1 (refer to the fault table in the troubleshooting section).**

### **⚠ WARNING**

**Read and follow all of the guidelines listed below. Failure to follow these guidelines may result in severe bodily injury and/or property damage.**

- Avoid fire hazards and have fire protection equipment present in the work area. Conduct vehicle performance checks in an authorized area where safe clearance exists.
- Before starting the vehicle, follow the recommended safety procedures in Section 2, "Safety Rules and Operational Information."
- Ventilate the work area properly.
- Regularly inspect and maintain in a safe working condition, brakes, steering mechanisms, speed and directional control mechanisms, warning devices, lights, governors, guards, and safety devices.
- Inspect and maintain battery limit switches, protective devices, electrical conductors, and connections in conformance with Taylor-Dunn's® recommended procedures.
- Keep the vehicle in clean condition to minimize fire hazards and facilitate detection of loose or defective parts.
- Do not use an open flame to check level or leakage of battery electrolyte.
- Do not use open pans of fuel or flammable fluids for cleaning parts.
- Only properly trained and authorized technicians should perform maintenance or repairs to this vehicle.

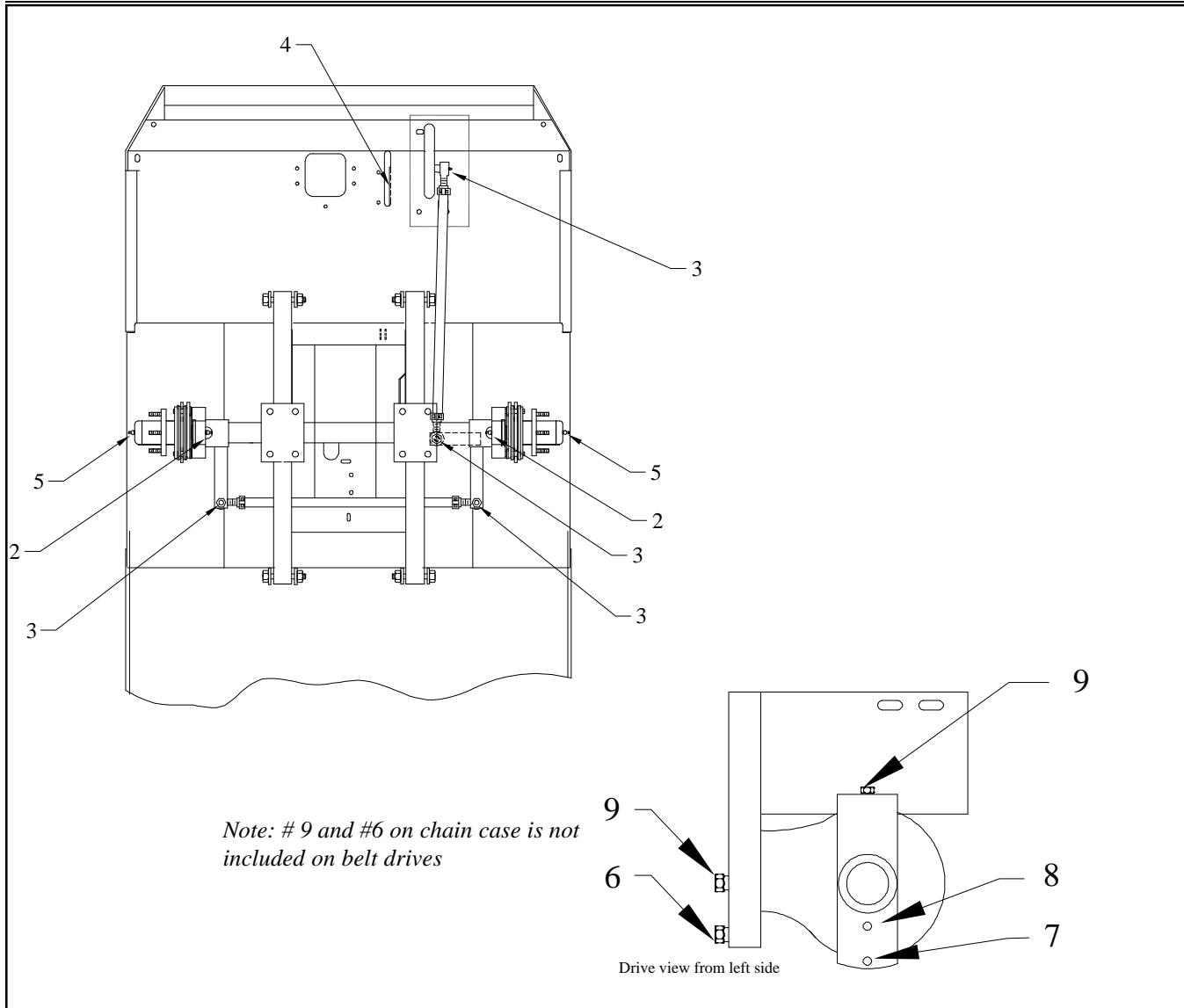
## Troubleshooting Guide

Symptom	Probable Cause
Steering Pulls in One Direction	Front End Out of Alignment
	Low Tire Pressure
Hard Steering	Dry Lube Points in Steering Linkage
	Damaged King Pin/Ball Joint
	Low Tire Pressure
Excessive Steering Play	Worn Ball Joints
	Mis-Adjusted or Worn Steering Gear
	Loose Steering Linkage
Lack of Power or Slow Operation	Brakes or Parking Brakes Dragging
	Batteries Discharged or Defective
	Worn Drive Gears
	Front End Out of Alignment
	Defective Speed Control
Abnormal Noise	Worn Drive Gears or Bearings
	Worn Front /Rear Axle Bearings
	Loose Lug Nuts
	Motor Bearings Worn
Oil Leak in Rear Bearing Area	Rear Wheel Bearing and/or Gasket Failed
	Drive Over Filled
Brake Pedal Soft or Spongy	Air in Brake Lines
Brake Pedal Low	Brake Worn (1/16" Wear Limit)
	Brake Fluid Low
	Brakes Out of Adjustment
Braking Power Low	Brake Worn (1/16" Wear Limit)
	Brake Pads Contaminated with Fluid
	Brake Pedal Linkage Binding
	Brakes Out of Adjustment
	Air in Brake Lines

*Note: This list is provided as a guide only. It is not all inclusive of causes that may result in a specific symptom.*



## Lubrication Chart



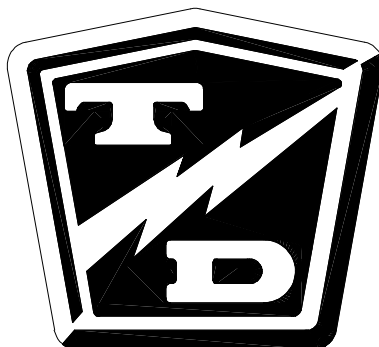
#	Description	Locations	Lubricant Type
1	-		General Purpose Grease
2	King Pin	2	General Purpose Grease
3	Ball Joints	4	General Purpose Grease
4	Pedal Linkages	1	General Purpose Grease
5	Front Wheel Bearings	2	High Temperature Wheel Bearing Grease
6	Chain Case Drain Plug	1	-
7	Drive Drain Plug	1	-
8	Drive Level Plug	1	-
9	Drive Fill Plug	1	SAE 140 API GL5 Hypoid Gear Oil
10	-		-

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# **Front Axle Service**



## INSPECT THE FRONT WHEEL BEARINGS AND KING PIN

### ⚠ WARNING

1. Make sure the key-switch is in the "OFF" position, then remove the key.
2. Place the forward-reverse switch in the center "OFF" position.
3. Confirm the electric park brake is set.
4. Place blocks under the front wheels to prevent vehicle movement.
5. Disconnect the main positive and negative cables at the batteries.

### ⚠ WARNING

Always use a lifting strap, hoist, and jack stands, of adequate capacity to lift and support the vehicle. Failure to use lifting and support devices of rated load capacity may result in severe bodily injury.

6. Raise the front of the vehicle and support with jack stands.
7. Grab the top and bottom of the tire/wheel assembly. Feel for any movement or play while pulling and pushing on the top and bottom of the tire. Any movement or play is an indication of loose wheel bearings or king pin.



*NOTE: Refer to the **Adjust Front Wheel Bearings** section for information regarding the adjustment of the wheel bearings.*

*NOTE: If the king pin is loose, then refer to **Replace the King Pins and Bushings** for information regarding replacing the king pin bushings. There are no adjustments for the king pin or bushings.*

8. Spin the wheel and listen for any grinding noise. Any grinding noise may be an indication of worn or damaged wheel bearings.

*NOTE: Refer to the **Replace Front Wheel Bearings** section for information regarding the replacement of the wheel bearings.*

9. Lower the vehicle.
10. Reconnect the main positive and negative cables at the batteries.
11. Remove the blocks from behind the wheels.
12. Release the park brake and test drive the vehicle.





## ADJUST FRONT WHEEL BEARINGS

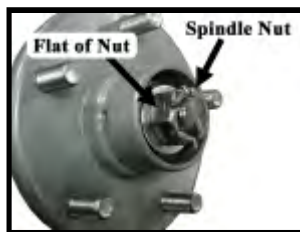
### ⚠ WARNING

1. Make sure the key-switch is in the "OFF" position, then remove the key.
2. Place the forward-reverse switch in the center "OFF" position.
3. Confirm the electric park brake is set.
4. Place blocks under the front wheels to prevent vehicle movement.
5. Disconnect the main positive and negative cables at the batteries.

### ⚠ WARNING

Always use a lifting strap, hoist, and jack stands, of adequate capacity to lift and support the vehicle. Failure to use lifting and support devices of rated load capacity may result in severe bodily injury.

6. Raise the front of the vehicle and support with jack stands.
7. Remove the hub dust cap and cotter pin.
8. While rotating the hub, tighten the spindle nut to 30 ft-lbs. This seats the bearings.
9. Back off the spindle nut one flat until the hub turns, but is not loose.
10. Spin the wheel and listen for any grinding noise. Any grinding noise may be an indication of worn or damaged wheel bearings.



*Hub with Dust Cap  
Removed*

**NOTE:** Refer to the **Replace Front Wheel Bearings** section for information regarding the replacement of the wheel bearings.

11. Install a new cotter pin.
12. Install the dust cap.
13. Lower the vehicle.
14. Reconnect the main positive and negative cables at the batteries.
15. Remove the blocks from behind the wheels.
16. Release the park brake and test drive the vehicle.



# FRONT AXLE REMOVAL AND INSTALLATION

## Removal

### ⚠ WARNING

1. Make sure the key-switch is in the "OFF" position, then remove the key.
2. Place the forward-reverse switch in the center "OFF" position.
3. Confirm the electric park brake is set.
4. Place blocks under the front wheels to prevent vehicle movement.
5. Disconnect the main positive and negative cables at the batteries.

### ⚠ WARNING

Always use a lifting strap, hoist, and jack stands, of adequate capacity to lift and support the vehicle. Failure to use lifting and support devices of rated load capacity may result in severe bodily injury.

6. Raise the front of the vehicle and support with jack stands.
7. Remove both front wheels. Refer to **Tires and Wheels** section for information regarding removing the front wheels.
8. Tie up or support the front axle so it can not fall out of the vehicle.
9. Disconnect the drag link ball joint or rod end from the steering knuckle or the steering gear pitman arm.

*NOTE: Refer to the **Replacing the Ball Joints** section for information regarding the removal of the ball joints or rod ends.*

10. If equipped with front brakes, disconnect the hydraulic brake lines from the brake bodies.
11. Disconnect the front axle beam from the front springs and remove the axle from the vehicle.

*NOTE: In some configurations the front springs and or shocks will have to be removed in order to remove the axle beam. Refer to section **Front Suspension** for information regarding removing the springs and shocks.*

## Installation

### ⚠ WARNING

1. Make sure the key-switch is in the "OFF" position, then remove the key.
2. Place the forward-reverse switch in the center "OFF" position.
3. Confirm the electric park brake is set.
4. Place blocks under the front wheels to prevent vehicle movement.
5. Disconnect the main positive and negative cables at the batteries.

### ⚠ WARNING

Always use a lifting strap, hoist, and jack stands, of adequate capacity to lift and support the vehicle. Failure to use lifting and support devices of rated load capacity may result in severe bodily injury.

6. Raise the front of the vehicle and support with jack stands.
7. Install the front axle in reverse order of removal.

*NOTE: Use all new cotter pins.*

*NOTE: Refer to the **Replacing the Ball Joints** section for information regarding the installing the ball joints or rod ends.*

*NOTE: Refer to **Tires and Wheels** section for information regarding removing the front wheels.*

8. Realign the front wheels. Refer to **Steering Component Service** section for information regarding realigning the front wheels.
9. If equipped with front brakes, bleed the brakes. Refer to **Brake Service** section for information regarding bleeding the brakes.
10. Lower the vehicle.
11. Reconnect the main positive and negative cables at the batteries.
12. Remove the blocks from behind the wheels.
13. Release the park brake and test drive the vehicle.



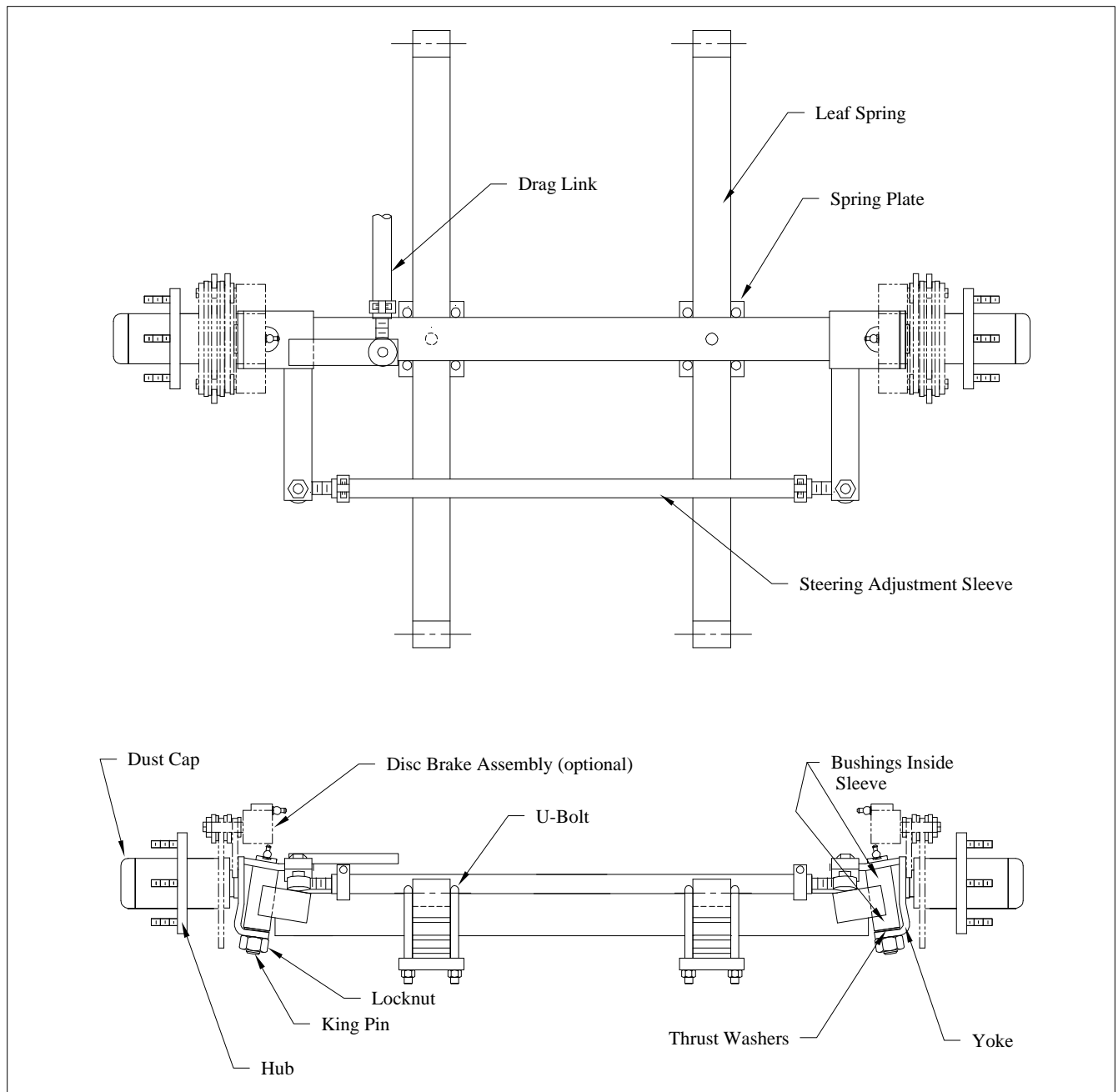
## FRONT AXLE DISASSEMBLY

Disassembling and reassembling involves removing and replacing the left and right steering knuckles and king pin bushings. Refer to the following sections for information regarding these procedures:

### Replace the Steering Knuckle

### Replace the King Pins and Bushings

**NOTE:** The front axle does not have to be removed unless the axle beam must be replaced. Refer to **Front Axle Removal and Installation** for information regarding removing the front axle.





### REPLACE FRONT WHEEL BEARINGS

#### ⚠ WARNING

1. Make sure the key-switch is in the "OFF" position, then remove the key.
2. Place the forward-reverse switch in the center "OFF" position.
3. Confirm the electric park brake is set.
4. Place blocks under the front wheels to prevent vehicle movement.
5. Disconnect the main positive and negative cables at the batteries.

#### ⚠ WARNING

Always use a lifting strap, hoist, and jack stands, of adequate capacity to lift and support the vehicle. Failure to use lifting and support devices of rated load capacity may result in severe bodily injury.

6. Raise the front of the vehicle and support with jack stands.
7. Remove the tire/wheel assembly from the hub. Refer to **Tires and Wheels** for information regarding removing the wheel assembly.
8. Remove the hub dust cap, cotter pin, and spindle nut.
9. Remove the hub from the steering knuckle.

*NOTE: For a front disc brake option you must remove the brake body before removing the hub. Refer to the **Brakes** section for information regarding the removal of the brake body.*

*NOTE: Catch the outer bearing as it falls out.*

10. Thoroughly clean all grease from the inside of the hub and the bearings.
11. Inspect and replace the races, bearings, and seals.

*NOTE: It is recommended to replace all four bearings and races in the left and right wheels as a set.*

12. Assemble in reverse order, using new grease seals.

*NOTE: Refer to **Adjust Wheel Bearings** for information regarding proper tightening of the spindle nut*

13. Install the hub dust cap.
14. Reinstall the brake body and the tire/wheel assembly.

*NOTE: Refer to the **Brakes** for information regarding the installation of the brake body.*

15. Lower the vehicle.
16. Reconnect the main positive and negative cables at the batteries.
17. Remove the blocks from behind the wheels.
18. Release the park brake and test drive the vehicle.



## REPLACE THE KING PINS AND BUSHINGS

There are different types of king pin bushings depending on the configuration of your vehicle.

- Bronze bushings in the axle beam.
- Bronze bushings in the steering knuckle.
- Metal backed teflon bushings in the axle beam or suspension arm.

*NOTE: Bronze bushings must be reamed or broached to the proper diameter after they are pressed into the axle beam or steering knuckle.*

Refer to the illustration below for the type of bushing in your vehicle.

### ⚠ WARNING

1. Make sure the key-switch is in the "OFF" position, then remove the key.
2. Place the forward-reverse switch in the center "OFF" position.
3. Confirm the electric park brake is set.
4. Place blocks under the front wheels to prevent vehicle movement.
5. Disconnect the main positive and negative cables at the batteries.

### ⚠ WARNING

**Always use a lifting strap, hoist, and jack stands, of adequate capacity to lift and support the vehicle. Failure to use lifting and support devices of rated load capacity may result in severe bodily injury.**

6. Raise the front of the vehicle and support with jack stands.

### ⚠ WARNING

**Failure to correctly broach or ream bronze bushings may result in steering difficulty and loss of control of the vehicle causing severe bodily injury and /or property damage.**

7. Remove the steering knuckle. Refer to **Replace the Steering Knuckle** for information regarding removing the steering knuckle.

*NOTE: It is not necessary to remove the tie rod or drag link for this procedure.*

8. Press the king pin bushings out from the axle, steering knuckle or suspension arm.
9. Press new bushings into the axle, steering knuckle or suspension arm.
10. Inspect the king pin for damage or wear. If any damage or wear is noted then the king pin must be replaced.
11. Reassemble in reverse order.

*NOTE: Refer to **Replace the Steering Knuckle** for information on installing the steering knuckle.*

*NOTE: It is recommended that the thrust washers or bearing be replaced whenever replacing the king pin bushings. Refer to the **Replacement Parts** section for the orientation of the bearing or washers in your vehicle.*

12. Grease the bushings (bronze only).
13. Lower the vehicle.
14. Reconnect the main positive and negative cables at the batteries.
15. Remove the blocks from behind the wheels.
16. Release the park brake and test drive the vehicle.





### REPLACE THE STEERING KNUCKLE

#### ⚠ WARNING

1. Make sure the key-switch is in the "OFF" position, then remove the key.
2. Place the forward-reverse switch in the center "OFF" position.
3. Confirm the electric park brake is set.
4. Place blocks under the front wheels to prevent vehicle movement.
5. Disconnect the main positive and negative cables at the batteries.

#### ⚠ WARNING

Always use a lifting strap, hoist, and jack stands, of adequate capacity to lift and support the vehicle. Failure to use lifting and support devices of rated load capacity may result in severe bodily injury.

6. Raise the front of the vehicle and support with jack stands.
7. Remove the tire/wheel assembly. Refer to **Tires and Wheels** section for information regarding removing the tire/wheel assembly.
8. Remove the hub bearing cap, cotter pin and nut, then remove the hub from the steering knuckle.

*NOTE: For a front disc brake option you must remove the brake body before removing the hub. Refer to the **Brakes** section for information regarding the removal of the brake body. Do not remove the hydraulic brake line from the brake body. If the brake line is removed then it will be necessary to bleed the brakes.*

*NOTE: Catch the outer bearing as it falls out.*

9. Remove the drag link and/or tie rod from the steering knuckle. Refer to **Replace the Ball Joints, Tie Rods, Drag Link** in this section for information regarding removal of the drag link or tie rod.
10. While supporting the knuckle, remove the king pin and thrust bearing.
11. Remove the knuckle from the axle.
12. Thoroughly clean and/or replace all bearings, nuts, washers, and bushings.

*NOTE: Both the left and right side bushings and thrust bearings should be replaced as a set.*

13. Assemble in reverse order. Refer to the illustration below for orientation of the thrust bearing.
14. Install the thrust washers so that the Teflon coated sides of the washers are together.
15. Install the king pin and tighten the king pin nut until it contacts the bottom of the knuckle. Do not tighten so much as to squeeze the legs of the knuckle together.

*NOTE: Refer to **Adjust Wheel Bearings** for information regarding proper tightening of the spindle nut*

16. Install new cotter pins.
17. Realign the wheels.

*NOTE: Refer to the **Steering** section for information regarding realignment of the front wheels.*

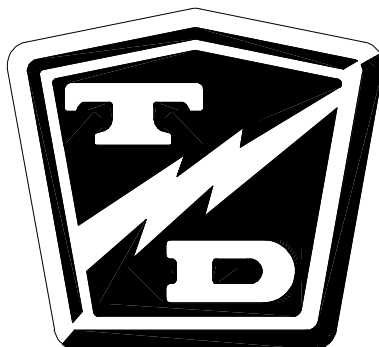
18. Lower the vehicle.
19. Reconnect the main positive and negative cables at the batteries.
20. Remove the blocks from behind the wheels.
21. Release the park brake and test drive the vehicle.

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# Steering Component Service



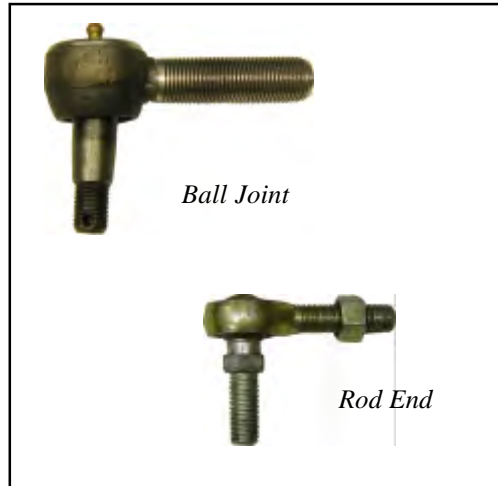
## FRONT END ALIGNMENT

This section will refer to two different types of ball joints. One type is has a grease fitting and a tapered shaft where it is fitted to the steering arm or pitman arm. The second type cannot be greased and has a straight shaft. See the illustrations to the right. Depending on the configuration of your truck, it may be equipped with one or both types of ball joints.

In this text:

The first type has a grease fitting and will be referred to as a "Ball Joint."

The second type has no grease fitting and will be referred to as a "Rod End."



### Center the Steering

#### ⚠ WARNING

1. Make sure the key-switch is in the "OFF" position, then remove the key.
2. Place the forward-reverse switch in the center "OFF" position.
3. Confirm the electric park brake is set.
4. Place blocks under the front wheels to prevent vehicle movement.
5. Disconnect the main positive and negative cables at the batteries.

#### ⚠ WARNING

**Always use a lifting strap, hoist, and jack stands, of adequate capacity to lift and support the vehicle. Failure to use lifting and support devices of rated load capacity may result in severe bodily injury.**

6. Raise the front of the vehicle and support with jack stands.

#### ⚠ WARNING

**Do not drive the vehicle while the steering wheel or front wheels are tied in position. Driving the vehicle while the steering wheel or front wheels tied in the position may cause loss of control of the vehicle resulting in severe bodily injury and/or property damage.**

7. Turn the front wheels so that they are in the straight ahead position and then tie off the wheels so that they cannot turn from the straight ahead position.
8. Disconnect the drag link from the pitman arm.

*NOTE: Refer to **Replace the Ball Joints** section for information regarding removing the ball joint or rod end from the drag link.*

9. Center the steering gear and tie off the steering wheel so that it cannot rotate.

*NOTE: Refer to **Center the Steering Gear** section for information regarding centering of the steering gear.*

10. At this point both the steering wheel **and** the front wheels should be tied up and held in position. If one or the other is not tied up then you must start from the beginning.
11. Loosen the ball joint clamps or the rod end jam nuts on the drag link.

*NOTE: Remember the position and orientation of the clamps.*





12. Adjust the drag link so that it can be easily inserted into the pitman arm.
13. Tighten the ball joint or rod end nut as specified below:  
 Ball joint - 40-45 ft-lbs.  
 Rod end - 20-25 ft-lbs.
14. If equipped with ball joints, position the ball joint clamps in their original location and orientation.
15. Tighten the ball joint clamps (28-32 ft. lbs.) or the rod end jam nuts on the drag link.
16. Untie the steering wheel and the front wheels.
17. Reconnect the main positive and negative cables at the batteries.

## **⚠ WARNING**

**If the clamps are positioned so that they contact other components, it may result in steering failure and loss of control of the vehicle causing property damage and/or severe bodily injury.**

18. Rotate the steering wheel from a full left turn to a full right turn and make sure that the ball joint clamps do not contact any other component.
19. Remove the blocks from behind the wheels.
20. Release the parking brake and test drive the vehicle.

## **⚠ WARNING**

**Rotate the steering wheel from a full left turn to a full right turn and make sure that the ball joint clamps do not contact any other component. Clamps positioned so that they contact other components may result in steering failure and loss of control of the vehicle causing severe bodily injury and/or property damage.**



# Maintenance, Service, and Repair

## Front wheel alignment

*NOTE: It is recommended to center the steering before aligning the front wheels. Refer to the **Center the Steering** section for information.*

### ⚠ WARNING

1. Make sure the key-switch is in the "OFF" position, then remove the key.
2. Place the forward-reverse switch in the center "OFF" position.
3. Confirm the electric park brake is set.
4. Place blocks under the rear wheels to prevent vehicle movement.
5. Disconnect the main positive and negative cables at the batteries.

### ⚠ WARNING

Always use a lifting strap, hoist, and jack stands, of adequate capacity to lift and support the vehicle. Failure to use lifting and support devices of rated load capacity may result in severe bodily injury.

6. Raise the front of the vehicle and support with jack stands.

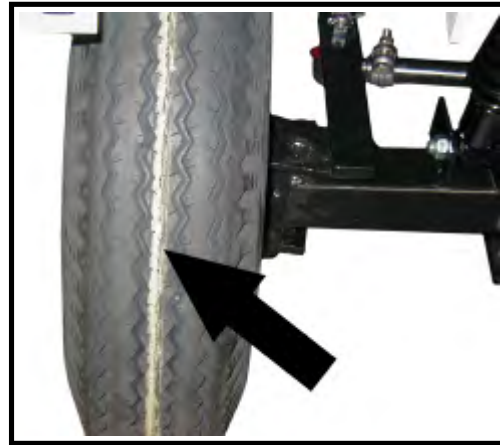
### ⚠ WARNING

Do not drive the vehicle while the steering wheel or front wheels are tied in position. Driving the vehicle while the steering wheel or front wheels tied in the position may cause loss of control of the vehicle resulting in severe bodily injury and/or property damage.

7. Turn the front wheels so that they are in the straight ahead position and tie off the steering wheel so that it cannot rotate.

### ⚠ WARNING

Rotate the steering wheel from a full left turn to a full right turn and make sure that the ball joint clamps do not contact any other component. Clamps positioned so that they contact other components may result in steering failure and loss of control of the vehicle causing severe bodily injury and/or property damage.



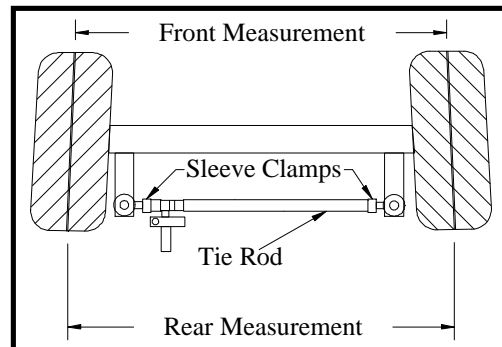
8. Using a piece of chalk, mark a line around the center of both front tires.

*HINT: Hold the chalk on the center of the tire and rotate the tire to mark the line.*

9. Loosen the ball joint clamps or the rod end jam nuts on the tie rod.

*NOTE: Remember the position and orientation of the ball joint clamps.*

10. Lower the front wheels to the ground and push the vehicle back and forth a few feet to settle the suspension.



11. Measure the distance between the lines at the front of the tires.
12. Measure the distance between the lines at the rear of the tires.
13. Adjust the tie rod so that the distance at the front and rear of the tires is the same.
14. If equipped with ball joints, position the ball joint clamps in their original location and orientation.
15. Tighten the ball joint clamps (28-32 ft. lbs.) or the rod end jam nuts.
16. Untie the steering wheel.
17. Reconnect the main positive and negative cables at the batteries.
18. Remove the blocks from behind the wheels.
19. Release the parking brake and test drive the vehicle.



## INSPECT BALL JOINTS

NOTE: A set of ball joints and/or rod ends will wear at the same rate. If a ball joint and or rod end is worn out, then all should be replaced as a set.

### ⚠ WARNING

1. Make sure the key-switch is in the "OFF" position, then remove the key.
2. Place the forward-reverse switch in the center "OFF" position.
3. Confirm the electric park brake is set.
4. Place blocks under the rear wheels to prevent vehicle movement.
5. Disconnect the main positive and negative cables at the batteries.

### ⚠ WARNING

Always use a lifting strap, hoist, and jack stands, of adequate capacity to lift and support the vehicle. Failure to use lifting and support devices of rated load capacity may result in severe bodily injury.

6. Raise the front of the vehicle and support with jack stands.
7. Tie off the front wheels so that they cannot turn.
8. While watching the ball joints, rapidly rotate the steering wheel to the left and right.
9. If the ball joint housing moves up or down then the ball joint is worn out and should be replaced. Refer to section **Replacing a Ball Joint** for information regarding replacing ball joints.
10. Untie the front wheels.
11. Reconnect the main positive and negative cables at the batteries.
12. Remove the blocks from behind the wheels.
13. Release the parking brake and test drive the vehicle.

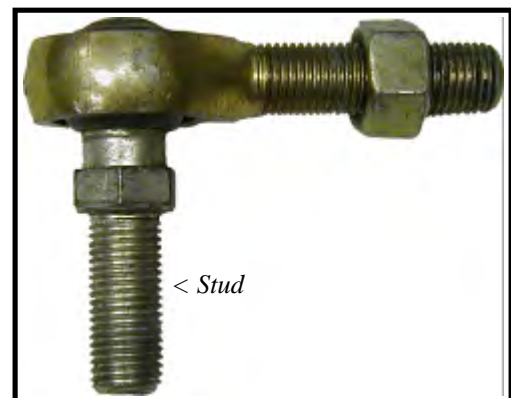
## INSPECT ROD ENDS

NOTE: A set of ball joints and/or rod ends will wear at the same rate. If a ball joint and or rod end is worn out, then all should be replaced as a set.

### ⚠ WARNING

1. Make sure the key-switch is in the "OFF" position, then remove the key.
2. Place the forward-reverse switch in the center "OFF" position.
3. Confirm the electric park brake is set.
4. Place blocks under the rear wheels to prevent vehicle movement.
5. Disconnect the main positive and negative cables at the batteries.

6. Visually inspect each rod end for any signs of play between the ball and the nylon or brass bushing in the housing.
7. If any play is evident, then the rod end is worn out and should be replaced. Refer to section **Replace the Ball Joints, Tie Rods, and Drag Link** for information regarding replacing ball joints.
8. Reconnect the main positive and negative cables at the batteries.
9. Remove the blocks from behind the wheels.
10. Release the parking brake and test drive the vehicle.



Typical rod end. Studded rod end shown, your vehicle may be equipped with spherical rod ends that do not have a stud.



### ADJUST THE STEERING GEAR

**NOTE:** In some vehicle configurations it may be necessary to remove the steering gear to perform this procedure. Refer to **Replace the Steering Gear** for information regarding removing the steering gear.

#### ⚠ WARNING

1. Make sure the key-switch is in the "OFF" position, then remove the key.
2. Place the forward-reverse switch in the center "OFF" position.
3. Confirm the electric park brake is set.
4. Place blocks under the front wheels to prevent vehicle movement.
5. Disconnect the main positive and negative cables at the batteries.



#### ⚠ WARNING

Always use a lifting strap, hoist, and jack stands, of adequate capacity to lift and support the vehicle. Failure to use lifting and support devices of rated load capacity may result in severe bodily injury.

6. Raise the front of the vehicle and support with jack stands.
  7. Disconnect the drag link from the pitman arm.
- NOTE:** Refer to **Replace the Ball Joints** section for information regarding removing the ball joint from the drag link.
8. Loosen the gear lash jam nut and the worm bearing adjuster jam nut.
  9. Unscrew the gear lash adjuster all of the way to the stop.
  10. Loosen the worm bearing adjuster and then tighten just enough to remove all end play from the input shaft and then an additional 1/8 turn more.
  11. While holding the worm bearing adjuster so that it cannot turn, tighten the worm bearing adjuster jam nut.
  12. Find the center position of the steering shaft:
    - A. Turn the steering shaft all of the way in one direction.
    - B. While counting the rotations, turn the steering shaft all of the way in the opposite direction.
    - C. Turn the steering shaft 1/2 the number of turns in the original direction.
  13. While rotating the input shaft back and forth through its centered position, adjust the gear lash adjusting screw so that there is a slight drag as the steering gear is rotated through its centered position.
  14. While holding the gear lash adjusting screw so that it cannot turn, tighten the gear lash adjusting screw jam nut.
  15. Reconnect the main positive and negative cables at the batteries.
  16. Remove the blocks from behind the wheels.
  17. Release the parking brake and test drive the vehicle.



## REPLACE THE STEERING SHAFT

### ⚠ WARNING

1. Make sure the key-switch is in the "OFF" position, then remove the key.
2. Place the forward-reverse switch in the center "OFF" position.
3. Confirm the electric park brake is set.
4. Place blocks under the front wheels to prevent vehicle movement.
5. Disconnect the main positive and negative cables at the batteries.

### ⚠ WARNING

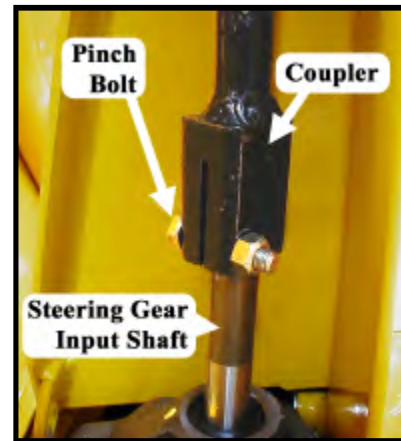
Always use a lifting strap, hoist, and jack stands, of adequate capacity to lift and support the vehicle. Failure to use lifting and support devices of rated load capacity may result in severe bodily injury.

6. If equipped with a horn switch in the steering wheel, remove the switch, disconnect the wires from the switch and cut the terminals off of the wires.
7. Remove the steering wheel.

*NOTE: Refer to **Replace the Steering Wheel** section for information regarding removing the steering wheel.*



8. Remove the upper steering shaft bushing or bearing from the steering column.
9. Remove the steering gear access cover from the steering column (if equipped).
10. Remove and discard the pinch bolt and nut from the steering shaft coupler.



*NOTE Most vehicle configurations will now allow the steering shaft to slide off of the steering gear input shaft and then back down out of the steering column. If there is not enough clearance for this procedure then the steering gear must be removed. Refer to **Replace the Steering Gear** for information regarding removing the steering gear.*

11. Remove the steering shaft from the vehicle.
12. Lightly grease the input shaft splines, steering wheel splines and the upper steering shaft bushing.

### ⚠ WARNING

**Do not use the original pinch bolt and nut. Failure to replace the pinch bolt and nut may result in failure of the steering causing loss of control of the vehicle. This could lead to property damage and/or severe bodily injury.**

13. Install the steering shaft in reverse order using a new pinch bolt. Orientate the shaft so that the pinch bolt is opposite the flat in the steering gear shaft.
14. Tighten the pinch bolt to 24-26 ft-lbs.
15. Reconnect the main positive and negative cables at the batteries.
16. Remove the blocks from behind the wheels.
17. Test drive the vehicle.

### ⚠ WARNING

**Make sure that the pinch bolt is not aligned with the flat on the steering shaft. Aligning the bolt with the flat could result in failure of the steering and loss of control of the vehicle. This could lead to property damage and/or severe bodily injury.**





### REPLACE THE STEERING WHEEL

#### ⚠ WARNING

1. Make sure the key-switch is in the "OFF" position, then remove the key.
2. Place the forward-reverse switch in the center "OFF" position.
3. Confirm the electric park brake is set.
4. Place blocks under the front wheels to prevent vehicle movement.
5. Disconnect the main positive and negative cables at the batteries.

6. If equipped with a horn switch in the steering wheel, remove the switch and disconnect the wires from the switch.
7. Remove the steering wheel nut.
8. Using a steering wheel puller, remove the steering wheel.
9. Position the front wheels in the straight ahead position (see below).
10. Lightly grease the steering wheel splines and install the replacement steering wheel orientated as shown in the illustration to the right.
11. Tighten the steering wheel nut to 28-32 ft lbs.
12. Reinstall the horn switch (if equipped).
13. Reconnect the main positive and negative cables at the batteries.
14. Remove the blocks from behind the wheels.
15. Release the parking brake and test drive the vehicle.



### REPLACE THE STEERING GEAR

#### ⚠ WARNING

1. Make sure the key-switch is in the "OFF" position, then remove the key.
2. Place the forward-reverse switch in the center "OFF" position.
3. Confirm the electric park brake is set.
4. Place blocks under the front wheels to prevent vehicle movement.
5. Disconnect the main positive and negative cables at the batteries.

6. Remove the steering wheel. Refer to **Replace the Steering Wheel** section for information regarding removing the steering wheel.
7. Remove the steering shaft. Refer to **Replace the Steering Shaft** section for information regarding removing the steering shaft.
8. Remove the pitman arm using a pickle fork.

*NOTE: On some vehicle configurations it may be required to remove the drag link from the pitman arm. Refer to **Replace the Ball Joints** section for information regarding removing the ball joint from the pitman arm.*

#### ⚠ WARNING

**Failure to support the steering gear will result in the steering gear falling out of the vehicle and could cause property damage and/or severe bodily injury.**

9. Support the steering gear so that it cannot fall out of the vehicle.
10. Remove the bolts holding the steering gear to the vehicle frame and remove the steering gear from the vehicle.
11. Center the steering gear. Refer to **Center the Steering Gear** section for information regarding centering the steering gear.
12. Install in reverse order. Torque the pitman arm nut to 75-100 ft-lbs.
13. Reconnect the main positive and negative cables at the batteries.
14. Remove the blocks from behind the wheels.
15. Release the parking brake and test drive the vehicle.



## REPLACE THE BALL JOINTS, TIE RODS, AND DRAG LINK

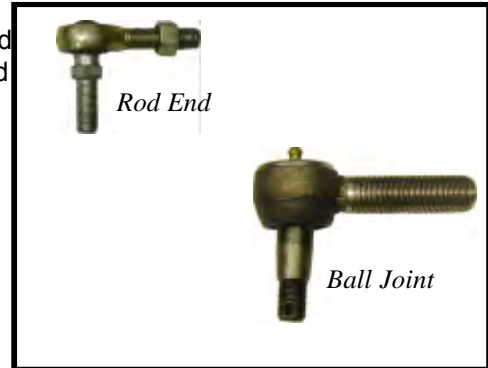
This section will refer to two different types of ball joints. One type is has a grease fitting and a tapered shaft where it is installed on the steering arm or pitman arm. The second cannot be greased and has a straight shaft. See the illustrations to the right. Depending on the configuration of your vehicle, it may be equipped one or both types of ball joints.

In this text:

The first type will be referred to as a "Ball Joint."

The second type will be referred to as a "Rod End."

*NOTE: If a rod end or ball joint is worn out, we recommend replacing all of the ball joints and/or rod ends as a set.*



### Replacing a Rod End

#### ⚠ WARNING

1. Make sure the key-switch is in the "OFF" position, then remove the key.
2. Place the forward-reverse switch in the center "OFF" position.
3. Confirm the electric park brake is set.
4. Place blocks under the front wheels to prevent vehicle movement.
5. Disconnect the main positive and negative cables at the batteries.

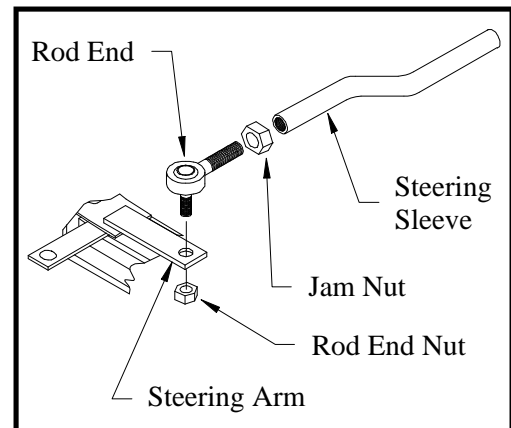
#### ⚠ WARNING

**Always use a lifting strap, hoist, and jack stands, of adequate capacity to lift and support the vehicle. Failure to use lifting and support devices of rated load capacity may result in severe bodily injury.**

6. Raise the front of the vehicle and support with jack stands.
7. Loosen the rod end jam nut or clamp on the steering sleeve.
8. Remove the rod end nut.
9. Remove the rod end from the steering arm.

*HINT: Count the number of turns required to remove the rod end from the steering sleeve. This will make it easier to realign the wheels.*

10. Install the new rod end into the steering sleeve. Screw it into the sleeve the same number of turns counted in the previous step. Do not tighten the rod end clamp or jam nut at this time.



11. Install the rod end into the steering arm. Tighten the rod end nut to 20-25 ft-lbs.
12. Realign the front wheels.

*NOTE: Refer to the **Steering** section for information regarding realignment of the front wheels.*

13. Lower the vehicle.
14. Reconnect the main positive and negative cables at the batteries.
15. Remove the blocks from behind the wheels.
16. Release the park brake and test drive the vehicle.

### Replacing a Ball Joint

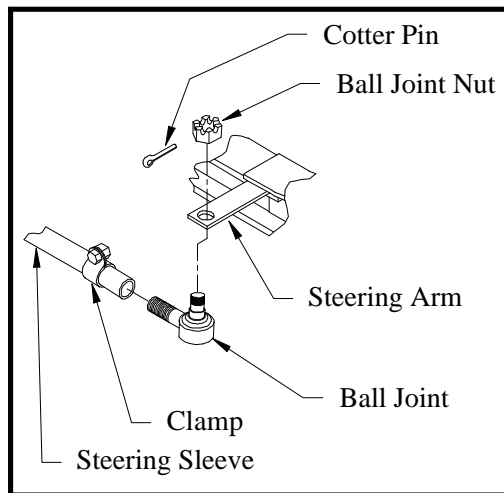
#### **⚠ WARNING**

1. Make sure the key-switch is in the "OFF" position, then remove the key.
2. Place the forward-reverse switch in the center "OFF" position.
3. Confirm the electric park brake is set.
4. Place blocks under the front wheels to prevent vehicle movement.
5. Disconnect the main positive and negative cables at the batteries.

#### **⚠ WARNING**

Always use a lifting strap, hoist, and jack stands, of adequate capacity to lift and support the vehicle. Failure to use lifting and support devices of rated load capacity may result in severe bodily injury.

6. Raise the front of the vehicle and support with jack stands.



7. Loosen the ball joint clamp on the steering sleeve.
8. Remove the cotter pin and ball joint nut.
9. Using a pickle fork, remove the ball joint from the steering arm.
10. Remove the ball joint from the steering sleeve.

**HINT:** Count the number of turns required to remove the ball joint from the sleeve. This will make it easier to realign the wheels.

11. Install the new ball joint into the steering sleeve. Screw it into the sleeve the same number of turns counted in the previous step. Do not tighten the ball joint clamp at this time.
12. Install the ball joint into the steering arm. Tighten the ball joint nut to 40-45 ft-lbs. and install a new cotter pin.
13. Realign the front wheels.

**NOTE:** Refer to the **Steering** section for information regarding realignment of the front wheels.

14. Lower the vehicle.
15. Reconnect the main positive and negative cables at the batteries.
16. Remove the blocks from behind the wheels.
17. Release the park brake and test drive the vehicle.

### Replacing the Drag Link

The Drag Link is the linkage that connects the steering gear pitman arm to the steering knuckle. Refer to the illustration on the following page.

#### **⚠ WARNING**

1. Make sure the key-switch is in the "OFF" position, then remove the key.
2. Place the forward-reverse switch in the center "OFF" position.
3. Confirm the electric park brake is set.
4. Place blocks under the front wheels to prevent vehicle movement.
5. Disconnect the main positive and negative cables at the batteries.

#### **⚠ WARNING**

Always use a lifting strap, hoist, and jack stands, of adequate capacity to lift and support the vehicle. Failure to use lifting and support devices of rated load capacity may result in severe bodily injury.

6. Raise the front of the vehicle and support with jack stands.
7. Remove the ball joints or rod ends from the steering knuckle and pitman arm.

**NOTE:** Refer to the **Replacing the Ball Joints** section for information regarding the removal of the ball joints or rod ends.

8. Remove the drag link as an assembly.





9. Install in reverse order.
10. Realign the front wheels.

*NOTE: Refer to the **Steering** section for information regarding realignment of the front wheels.*

11. Lower the vehicle.
12. Reconnect the main positive and negative cables at the batteries.
13. Remove the blocks from behind the wheels.
14. Release the park brake and test drive the vehicle.

## **Replacing the Tie Rod**

The Tie Rod is the linkage that connects the two steering knuckles together. Refer to the illustration below..

### **⚠ WARNING**

1. Make sure the key-switch is in the "OFF" position, then remove the key.
2. Place the forward-reverse switch in the center "OFF" position.
3. Confirm the electric park brake is set.
4. Place blocks under the front wheels to prevent vehicle movement.
5. Disconnect the main positive and negative cables at the batteries.

### **⚠ WARNING**

**Always use a lifting strap, hoist, and jack stands, of adequate capacity to lift and support the vehicle. Failure to use lifting and support devices of rated load capacity may result in severe bodily injury.**

6. Raise the front of the vehicle and support with jack stands.
7. Remove the ball joints or rod ends from the steering knuckles.

*NOTE: Refer to the **Replacing the Ball Joints** section for information regarding the removal of the ball joints or rod ends.*

8. Remove the tie rod as an assembly.
9. Install in reverse order.
10. Realign the front wheels.

*NOTE: Refer to the **Steering** section for information regarding realignment of the front wheels.*

11. Lower the vehicle.
12. Reconnect the main positive and negative cables at the batteries.
13. Remove the blocks from behind the wheels.
14. Release the park brake and test drive the vehicle.

## **CENTER THE STEERING GEAR**

*NOTE: The drag link must be disconnected from the pitman arm or the pitman arm removed from the steering gear to perform this procedure. Refer to the appropriate section for details.*

1. Remove the pitman arm.
2. Rotate the input shaft clockwise until it stops.
3. While counting the rotations, rotate the input shaft counter clockwise until it stops.
4. Rotate the input shaft clockwise 1/2 the rotations counted in the previous step.
5. Mark the input and pitman shaft in relation to the housing.



### **PITMAN SHAFT ALIGNMENT**

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#### **⚠ WARNING**

- 1. Make sure the key-switch is in the "OFF" position, then remove the key.**
- 2. Place the forward-reverse switch in the center "OFF" position.**
- 3. Confirm the electric park brake is set.**
- 4. Place blocks under the front wheels to prevent vehicle movement.**
- 5. Disconnect the main positive and negative cables at the batteries.**

#### **⚠ WARNING**

**Do not drive the vehicle while the steering wheel or front wheels are tied in position. Driving the vehicle while the steering wheel or front wheels tied in the position may cause loss of control of the vehicle resulting in severe bodily injury and/or property damage.**

6. Center the steering gear. Refer to Center the Steering Gear section for information regarding centering the steering gear.
7. Tie the steering wheel in position so that it cannot rotate.
8. Install the pitman shaft on the steering gear so that it is as close as possible to centered between the steering stops. Torque the pitman arm nut to 75-100 ft-lbs.
9. Adjust the drag link as required to position the front wheels to the straight ahead position.
10. Untie the steering wheel.
11. If required, remove and reposition the steering wheel. Refer to Replace the Steering Wheel section for information regarding repositioning the steering wheel.
12. Reconnect the main positive and negative cables at the batteries.
13. Remove the blocks from behind the wheels.
14. Release the parking brake and test drive the vehicle.



## REPAIR THE STEERING GEAR

### Disassembly

*NOTE: The steering gear must be removed from the vehicle for this procedure. Refer to **Replace the Steering Gear** section for information regarding removing the steering gear.*

*NOTE: The steering gear is packed with grease. Only perform maintenance on the steering gear in an area that will contain any grease that may spill out of the steering gear when it is disassembled.*

Refer to the illustration at the end of this section for a blown up view of the steering gear assembly.

1. Center the steering gear.
  - A. Turn the steering shaft all of the way in one direction.
  - B. While counting the rotation, turn the steering shaft all of the way in the opposite direction.
  - C. Turn the steering shaft 1/2 the number of turns in the original direction.
2. Remove the worm bearing adjuster locking ring and the worm bearing adjuster.
3. Remove the side cover/pitman shaft assembly by removing the three side cover bolts and then pulling the assembly out of the housing.



*NOTE: The side cover/pitman shaft assembly normally does not have to be disassembled.*

4. Remove the worm shaft and ball nut assembly from the bottom of the housing.
5. Remove the worm shaft seal.
6. Remove the pitman shaft seal.
7. Remove the upper worm bearing and bearing cup from the housing.
8. The ball nut assembly consists of two sets of ball bearings that recirculate in two channels in the ball nut housing. The bearings may fall out once the bearing guides are removed. Be careful not to lose any of the bearings.
9. Remove the ball guide clamps, ball guides and all of the ball bearings.
10. Remove the ball nut from the worm shaft.
11. Thoroughly clean and inspect all parts for signs of corrosion, damage or wear and replace as required.





### Reassembly

1. Lightly lubricate all parts before reassembly.
2. Install a new worm shaft seal and pitman shaft seal into the housing.
3. Install the upper worm bearing cup.
4. Divide the ball bearing into two equal groups.
5. Position the ball nut onto the worm as shaft as shown in the illustration.
6. Insert the ball guides into the ball nut.
7. Insert each group of bearings into the ball guides.



*NOTE: Do not rotate the worm shaft while installing the bearings. This may cause one or more of the bearings to enter the crossover passage in the ball nut, causing improper operation.*

8. Install the ball guide clamp.
9. Place the upper worm bearing on the worm shaft and install the worm shaft/ball nut assembly into the housing being careful not to damage the worm shaft seal.
10. Install the assembled worm bearing adjuster into the housing and tighten just enough to remove all play in the worm shaft.
11. Install, but do not tighten the worm bearing adjuster lock nut.
12. Rotate the worm shaft to center the ball nut in the housing.
13. Place a new gasket onto the housing and install the assembled pitman shaft/side cover onto the housing using two of the three mounting bolts.
14. Pack the steering gear with grease through the open side cover bolt hole and then install the bolt.
15. Adjust the steering gear.



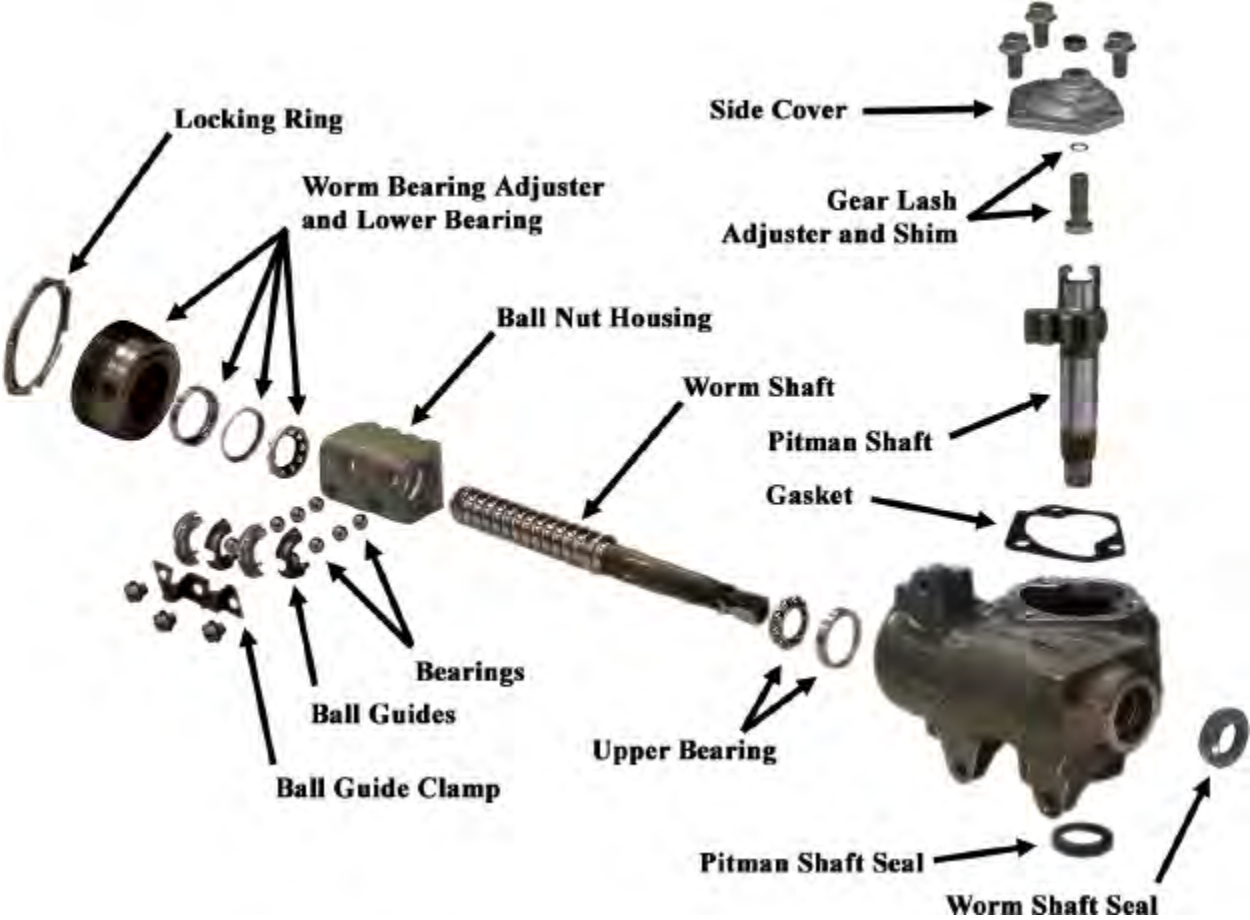
*NOTE: Refer to **Adjust the Steering gear** section for information regarding adjusting the steering gear.*

16. Once the adjustments are completed, make sure that the locking ring and jam nut are tight.

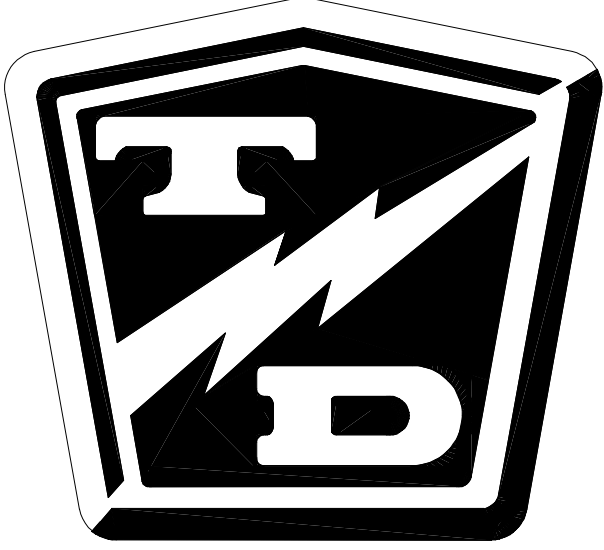




Exploded View of Steering Gear



**TAYLOR - DUNN**



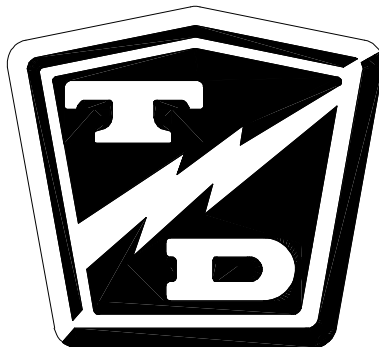
# Brake Service

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## **INSPECT THE SERVICE BRAKE**

### **Disc Brake Pads**

#### **⚠ WARNING**

**Current Taylor-Dunn® brakes are asbestos free. However, there is the possibility that the original brakes were replaced with aftermarket parts containing asbestos. Since this possibility exists, all brake parts should be handled as if they contain asbestos. Refer to Appendix C for recommended handling precautions.**

*NOTE: The brake pad must be removed to accurately measure the lining thickness. Refer to **Replace the Front or Rear Brake Pads** section for information on removing the brake pads.*

Measure the brake pad lining at the thinnest point on the pad. If the brake pad lining is 1/16-inch or less then the brake pad must be replaced.

It is recommended to replace the left and right side brake pads as a set.



### **Disc Brake Rotor**

*NOTE: The front brake rotor is an integral part of the front hub. If the brake rotor is worn beyond its service limits, then the front hub must be replaced. Refer to **Front Axle Service** for information on replacing the front hub.*

*NOTE: Depending on the rear axle configuration, the rear brake rotor may be an integral part of the rear axle. If the brake rotor is worn beyond its service limits, then the rear axle must be replaced. Refer to **Transmission** section for information regarding replacing the rear axle*

*NOTE: The wheel must be removed to accurately measure the rotor thickness. Refer to **Tires and Wheels** section for information on removing the wheel.*

1. Measure the run out of the rotor at its maximum diameter. If the run out exceeds 0.005, then the rotor must be machined. Do not machine the rotor beyond its service limits.

*NOTE: A bent axle or damaged rear axle could cause excessive brake rotor run out.*

2. Measure the thickness of the brake rotor in 3 places. If the brake rotor thickness is less than 0.20-inches, then the rotor must be replaced.

#### **⚠ WARNING**

**Do not use a rotor that is worn beyond its service limits. A rotor worn beyond its service limits could fail and cause loss of brakes resulting in severe bodily injury and/or property damage.**



## INSPECT THE PARKING BRAKE

*NOTE: The parking brake is actuated through a pin in the center of the rear left and right brake body on the rear axles.*

### **⚠ WARNING**

1. Make sure the key-switch is in the "OFF" position, then remove the key.
2. Place the forward-reverse switch in the center "OFF" position.
3. Confirm the electric park brake is set.
4. Place blocks under the front wheels to prevent vehicle movement.
5. Disconnect the main positive and negative cables at the batteries.

6. Release the park brake.
7. Inspect the brake pads. Refer to *Inspect the Service Brake* section to inspect the brake pads.
8. Inspect the park brake pin and bushing for any signs of damage or corrosion.



*NOTE: The park brake pin is inside of the brake body. Refer to **Repair the Brake Body** for information on removing the park brake pin.*

9. Inspect all brake cables and linkages for any signs of damage, wear, or missing cotter pins.
10. Inspect the brake handle locking mechanism for any signs of damage.

*NOTE: Refer to **Adjust the Parking Brake** section for information regarding adjusting the parking brake.*



## ADJUST THE SERVICE BRAKES

### Two or Four Wheel Hydraulic Disc Brakes

The hydraulic disc brake system is automatically adjusted. A low brake pedal or lack of braking power could be caused by:

- Brake fluid level low in the master cylinder. See *Check the Master Cylinder Fluid* section.
- Air in the brake lines. See *Bleed the Brakes* section.
- Worn brake pads. See *Inspect the Service Brake* section.
- Worn brake rotor. See *Inspect the Service Brake* section.
- Binding brake pedal linkage.

If you are experiencing a low brake pedal or lack of braking power, the entire brake system should be inspected.



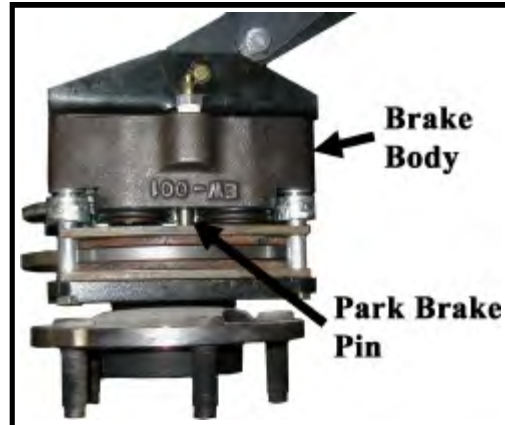
# ADJUST THE PARKING BRAKE

### Wheel Park Brake

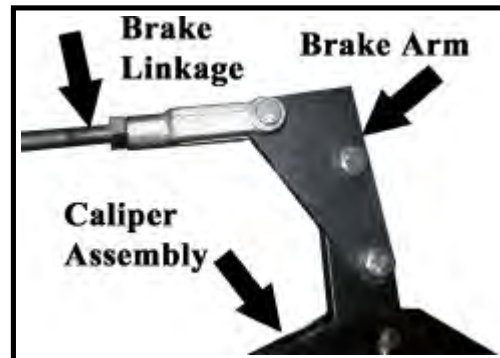
The parking brake is actuated through a pin in the center of the rear left and right brake body on the rear axles.

### **⚠ WARNING**

1. Make sure the key-switch is in the "OFF" position, then remove the key.
2. Place the forward-reverse switch in the center "OFF" position.
3. Confirm the electric park brake is set.
4. Place blocks under the front wheels to prevent vehicle movement.
5. Disconnect the main positive and negative cables at the batteries.



6. Release the park brake.
7. Loosen the jam nuts on the park brake linkage that is connected to the brake arm on the caliper assembly.
8. Tighten the brake linkage until it is difficult to rotate the brake arm clevis pin and then loosen the linkage 1-turn.
9. Tighten the jam nuts on the park brake linkage.
10. Repeat this procedure for both rear wheels.
11. Set the park brake.
12. Reconnect the main positive and negative cables at the batteries.
13. Remove blocks from behind the wheels.
14. Release the park brake and test drive the vehicle.





## CHECK MASTER CYLINDER FLUID

### ⚠ WARNING

1. Make sure the key-switch is in the "OFF" position, then remove the key.
2. Place the forward-reverse switch in the center "OFF" position.
3. Confirm the electric park brake is set.
4. Place blocks under the front wheels to prevent vehicle movement.
5. Disconnect the main positive and negative cables at the batteries.

6. Thoroughly clean the area around the master cylinder cap.
7. Remove the master cylinder cap.
8. If the fluid in the master cylinder is contaminated then the entire brake system must be flushed. Refer to ***Bleed the Brakes*** for information regarding flushing the brake system.
9. Fill with brake fluid from a new sealed container to within 1/4-inch of the top of the master cylinder chamber and reinstall the cap.
10. Reconnect the main positive and negative cables at the batteries.
11. Remove blocks from behind the wheels.
12. Release the parking brake and test drive the vehicle.

### ⚠ WARNING

Do not ingest brake fluid or allow contact with skin or eyes. Always wear protective clothing and a face shield when working with or around brake fluid.

#### SKIN CONTACT

Flush area immediately with water for several minutes. If a rash or skin irritation develops, get medical attention immediately.

#### EYE CONTACT

Immediately flush the eye with water for 15 minutes and call physician.

#### INGESTION

Get medical attention immediately.

### ⚠ WARNING

- Only use DOT 3 brake fluid from a new sealed container.
- DOT 3 brake fluid is corrosive and will damage paint finishes.
- Dispose of brake fluid in accordance with local state and federal regulations.
- Read and follow all warnings on the brake fluid container.



## BLEED THE BRAKE SYSTEM

*NOTE: Start this procedure at the wheel furthest from the master cylinder, then work toward the wheel closest to the master cylinder.*

### ⚠ WARNING

1. Make sure the key-switch is in the "OFF" position, then remove the key.
2. Place the forward-reverse switch in the center "OFF" position.
3. Confirm the electric park brake is set.
4. Place blocks under the front wheels to prevent vehicle movement.
5. Disconnect the main positive and negative cables at the batteries.

### ⚠ WARNING

**Always use a lifting strap, hoist, and jack stands, of adequate capacity to lift and support the vehicle. Failure to use lifting and support devices of rated load capacity may result in severe bodily injury.**

6. Thoroughly clean the area around the master cylinder cap and remove the cap.
7. Add brake fluid from a new sealed container to the master cylinder. Fill to 1/4" from the top of the master cylinder chamber.
8. The master cylinder fluid level will drop as the brakes are bled. Periodically check and fill the master cylinder during this procedure. Do not allow the fluid level in the master cylinder to drop too low as this will allow air into the brake lines.
9. Attach a clear hose to the bleeder valve on the brake cylinder that is to be bled. Route the hose into a clear container for waste brake fluid.
10. Pump the brake pedal a few times and then press and hold light pressure to the brake pedal.

### ⚠ WARNING

**Always use brake fluid from a new sealed container. Never reuse any brake fluid that has been removed from the brake system. Use of contaminated brake fluid will degrade the braking performance and may cause property damage or severe bodily injury.**

11. Open the bleeder valve on the hydraulic brake body.
12. Depress the foot pedal to the floor and then close the bleeder valve. Do not release pressure on the brake pedal until the bleeder valve is closed.
13. Slowly release the foot pedal, allowing it to return to its released position.

*NOTE: Check and fill the master cylinder frequently during the bleeding process. Do not allow the fluid level in the master cylinder to drop low enough to allow air to enter the brake lines. If air enters the brake lines during the bleeding process, then you will have to start again from the beginning.*

14. Repeat the above steps until you are sure that all of the air is expelled from the brake line. Any air bubbles that can be seen in the clear hose attached to the bleeder is an indication that there is still air in the brake lines.
15. Repeat this process with each of the other wheels.

*NOTE: When finished, top off the master cylinder with fluid. See **Check Master Cylinder Fluid** for information on filling the master cylinder.*

16. Reconnect the main positive and negative cables at the batteries.
17. Remove the blocks from behind the wheels.
18. Release the park brake and test drive the vehicle.

### ⚠ WARNING

- Only use DOT 3 brake fluid from a new sealed container.
- DOT 3 brake fluid is corrosive and will damage paint finishes.
- Dispose of brake fluid in accordance with local state and federal regulations.
- Read and follow all warnings on the brake fluid container.



## FLUSH THE BRAKE SYSTEM

### ⚠ WARNING

1. Make sure the key-switch is in the "OFF" position, then remove the key.
2. Place the forward-reverse switch in the center "OFF" position.
3. Confirm the electric park brake is set.
4. Place blocks under the front wheels to prevent vehicle movement.
5. Disconnect the main positive and negative cables at the batteries.

### ⚠ WARNING

Always use a lifting strap, hoist, and jack stands, of adequate capacity to lift and support the vehicle. Failure to use lifting and support devices of rated load capacity may result in severe bodily injury.

6. Raise the rear wheels off of the ground and support with jack stands.
7. If equipped with front brakes, raise the front wheels off of the ground and support with jack stands.
8. Release the park brake.
9. Remove both rear wheels and, if equipped with front brakes, the front wheels. Refer to *Tires and Wheels* section for information regarding removing the wheels.
10. Remove the wheel cylinders from each axle. Refer to *Replace the Wheel Cylinder* section for information regarding removing the wheel cylinder.
11. Attach a clear hose to the bleeder valve on each of the wheel cylinders and route the hoses into a container for waste brake fluid.
12. Position the wheel cylinders so that the bleeder screw is pointing to the ground and open all bleeder screws.
13. Pump the master cylinder until all fluid has been pumped from the brake lines and all wheel cylinders.
14. Close all bleeder screws.
15. Fill the master cylinder with fluid.
16. Open one of the bleeder screws and pump the master cylinder until all fluid has been pumped from the master cylinder and close the bleeder screw.

17. Repeat the above two steps for each wheel cylinder.
18. Reinstall the wheel cylinders and bleed the brakes. Refer to *Bleed the Brakes* for information regarding bleeding the brakes.
19. Set the park brake.
20. Install the wheels and lower the vehicle to the ground.
21. Reconnect the main positive and negative cables at the batteries.
22. Release the park brake and test drive the vehicle.

## REPLACE THE PARKING BRAKE LINING

### ⚠ WARNING

Current Taylor-Dunn® brakes are asbestos free. However, there is the possibility that the original brakes were replaced with aftermarket parts containing asbestos. Since this possibility exists, all brake parts should be handled as if they contain asbestos. Refer to Appendix C for recommended handling precautions.

### Wheel Park Brake

The parking brake is the same as the rear service brake. See *Replace Rear Brake Pads or Shoes* section for information on replacing the park brake lining.

## REPLACE FRONT DISC BRAKE PADS

NOTE: It is recommended that both the left and right brake pads be replaced as a set.

NOTE: Installing new brake pads will raise the brake fluid level in the master cylinder.

### ⚠ WARNING

1. Make sure the key-switch is in the "OFF" position, then remove the key.
2. Place the forward-reverse switch in the center "OFF" position.
3. Confirm the electric park brake is set.
4. Place blocks under the front wheels to prevent vehicle movement.
5. Disconnect the main positive and negative cables at the batteries.

### ⚠ WARNING

Always use a lifting strap, hoist, and jack stands, of adequate capacity to lift and support the vehicle. Failure to use lifting and support devices of rated load capacity may result in severe bodily injury.

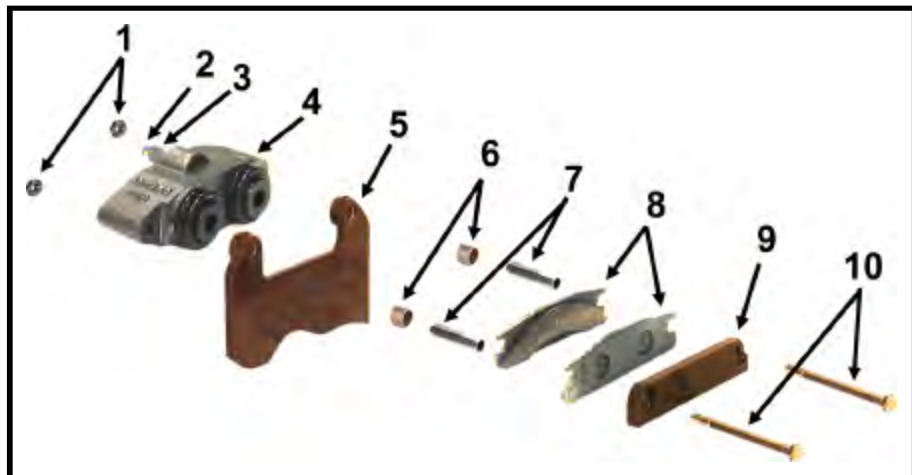
6. Thoroughly clean the area around the master cylinder cap.
7. Remove fluid from the master cylinder until it is 1/2 full.
8. Raise the front of the vehicle and support with jack stands.
9. Remove the tire/wheel assembly. Refer to **Tires and Wheels** section for information on removing the tire and wheel assembly.

### ⚠ WARNING

Current Taylor-Dunn® brakes are asbestos free. However, there is the possibility that the original brakes were replaced with aftermarket parts containing asbestos. Since this possibility exists, all brake parts should be handled as if they contain asbestos. Refer to Appendix C for recommended handling precautions.

NOTE: Refer to the illustration for the following steps.

10. Remove the brake body bolts (10) and discard the lock nuts (1) and brake pads (8).
11. Remove the spacer bushings (6) from the mounting bracket (5) and discard the bushings.
12. Inspect the brake rotor. See **Inspect the Service Brakes** section for information regarding inspecting the brake rotor.
13. Inspect the spacers (7) and replace if any wear or damage is found.
14. Install new spacer bushings in the mounting bracket.
15. Install new brake pads in reverse order. Torque the mounting bolts to 11 ft-lbs.
16. Repeat this procedure for the other wheel.
17. Install the tire/wheel assembly and lower the vehicle to the ground.
18. Fill the master cylinder to the proper level. Refer to **Check Master Cylinder Fluid** section for information on the proper master cylinder fluid level.
19. Reconnect the main positive and negative cables at the batteries.
20. Remove the blocks from behind the wheels.
21. Release the park brake and test drive the vehicle.







## REPLACE REAR BRAKE PADS OR SHOES

NOTE: It is recommended that both the left and right brake pads be replaced as a set.

NOTE: Installing new brake pads will raise the brake fluid level in the master cylinder.

### ⚠ WARNING

1. Make sure the key-switch is in the "OFF" position, then remove the key.
2. Place the forward-reverse switch in the center "OFF" position.
3. Confirm the electric park brake is set.
4. Place blocks under the front wheels to prevent vehicle movement.
5. Disconnect the main positive and negative cables at the batteries.

### ⚠ WARNING

Always use a lifting strap, hoist, and jack stands, of adequate capacity to lift and support the vehicle. Failure to use lifting and support devices of rated load capacity may result in severe bodily injury.

6. Thoroughly clean the area around the master cylinder cap.
7. Remove fluid from the master cylinder until it is 1/2 full.
8. Raise the rear of the vehicle and support with jack stands.
9. Remove the tire/wheel assembly.

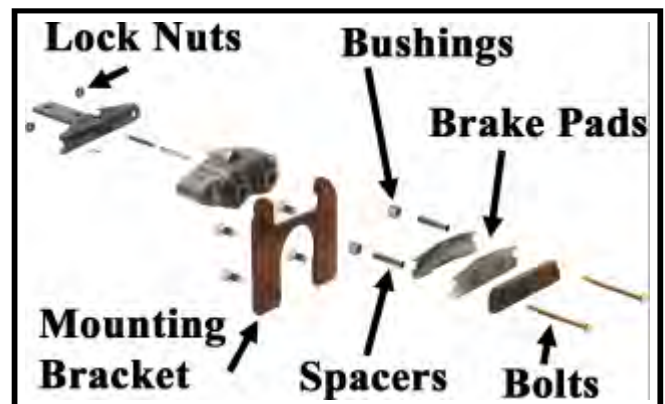
NOTE: Refer to **Tires and Wheels** section for information on removing the tire and wheel assembly.

10. Release the park brake (wheel brake only).
11. Remove the brake body bolts and discard the lock nuts and brake pads.
12. Remove the spacer bushings from the mounting bracket and discard.
13. Inspect the brake rotor. Refer to **Inspect the Service Brake** section for information regarding inspecting the brake rotor.

### ⚠ WARNING

Current Taylor-Dunn® brakes are asbestos free. However, there is the possibility that the original brakes were replaced with aftermarket parts containing asbestos. Since this possibility exists, all brake parts should be handled as if they contain asbestos. Refer to Appendix C for recommended handling precautions.

14. Inspect the spacers and replace if any wear or damage is found.
15. Install new spacer bushings in the mounting bracket.
16. Back off the parking brake adjustment (wheel park brake only).
17. Install new brake pads in reverse order. Torque the mounting bolts to 11 ft-lbs.
18. Repeat this procedure for the other wheel.
19. Install the tire/wheel assembly and lower the vehicle to the ground.
20. Fill the master cylinder to the proper level. Refer to **Check Master Cylinder Fluid** section for information regarding the correct master cylinder fluid level.
21. Adjust the parking brake (wheel park brake only). Refer to **Adjust the Parking Brake** section.
22. Set the park brake.
23. Reconnect the main positive and negative cables at the batteries.
24. Remove the blocks from behind the wheels.
25. Release the park brake and test drive the vehicle.



## **REPLACE THE WHEEL CYLINDER**

### **Disc Brake Body Assembly (front or rear)**

#### **⚠ WARNING**

1. Make sure the key-switch is in the "OFF" position, then remove the key.
2. Place the forward-reverse switch in the center "OFF" position.
3. Confirm the electric park brake is set.
4. Place blocks under the front wheels to prevent vehicle movement.
5. Disconnect the main positive and negative cables at the batteries.

#### **⚠ WARNING**

**Always use a lifting strap, hoist, and jack stands, of adequate capacity to lift and support the vehicle. Failure to use lifting and support devices of rated load capacity may result in severe bodily injury.**

6. Release the park brake.
7. Raise the wheel off of the ground and support with jack stands.
8. Remove the tire/wheel assembly. Refer to **Tires and Wheels** section for information on removing the tire and wheel assembly.
9. Thoroughly clean the area around the brake body.
10. Remove the brake body bolts and discard the lock nuts.
11. Inspect the brake rotor. Refer to **Inspect the Service Brake** section for information regarding inspecting the brake rotor.
12. Disconnect the brake hose from the brake body.
13. Install the new brake body assembly in reverse order.
  - Use teflon tape thread sealant on the brake hose fitting.
  - Torque the brake body bolts to 11 ft-lbs.
14. Bleed the brakes. Refer to **Bleed the Brakes** section for information regarding bleeding the brakes.

#### **⚠ WARNING**

Current Taylor-Dunn® brakes are asbestos free. However, there is the possibility that the original brakes were replaced with aftermarket parts containing asbestos. Since this possibility exists, all brake parts should be handled as if they contain asbestos. Refer to Appendix C for recommended handling precautions.

#### **⚠ WARNING**

Do not ingest brake fluid or allow contact with skin or eyes. Always wear protective clothing and a face shield when working with or around brake fluid.

##### **SKIN CONTACT**

Flush area immediately with water for several minutes. If a rash or skin irritation develops, get medical attention immediately.

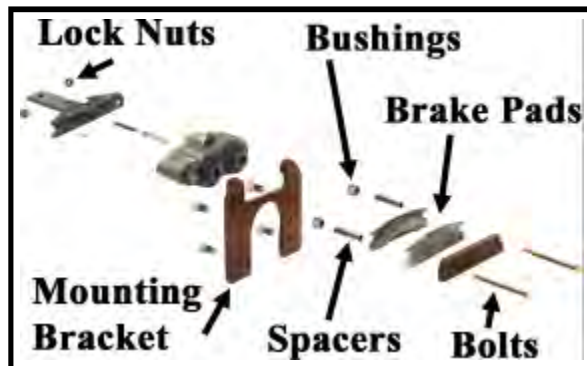
##### **EYE CONTACT**

Immediately flush the eye with water for 15 minutes and call physician.

##### **INGESTION**

**Get medical attention immediately.**

15. Set the park brake.
16. Reconnect the main positive and negative cables at the batteries.
17. Lower the wheel to the ground.
18. Remove the blocks from behind the wheels.
19. Release the park brake and test drive the vehicle.





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## REPAIR THE BRAKE BODY

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### ⚠ WARNING

Hydraulic brake system components must be kept clean. Make sure your work area is free from dirt and debris and will contain any brake fluid spills. Any debris or contaminants left in the brake system could lead to brake failure and result in property damage and/or severe bodily injury.

### ⚠ WARNING

Do not ingest brake fluid or allow contact with skin or eyes. Always wear protective clothing and a face shield when working with or around brake fluid.

#### SKIN CONTACT

Flush area immediately with water for several minutes. If a rash or skin irritation develops, get medical attention immediately.

#### EYE CONTACT

Immediately flush the eye with water for 15 minutes and call physician.

#### INGESTION

Get medical attention immediately.

### ⚠ WARNING

1. Make sure the key-switch is in the "OFF" position, then remove the key.
2. Place the forward-reverse switch in the center "OFF" position.
3. Set the park brake.
4. Place blocks under the front wheels to prevent vehicle movement.
5. Disconnect the main positive and negative cables at the batteries.

6. Remove the brake body from the vehicle.

*NOTE: Refer to **Replace the Brake Body Assembly (front or rear)** section for information on removing the brake body.*

### ⚠ WARNING

The pistons are very fragile. If the piston is damaged it must be replaced. Failure to replace a damaged piston could lead to brake failure and result in property damage and/or severe bodily injury.

7. Pull the pistons out of the brake body.
8. Remove the piston rubber boot.
9. Remove the piston o-ring from inside of the brake body.
10. Inspect and replace parts as required.
11. Lubricate the brake parts with clean brake fluid from a sealed container.



12. Install the o-rings into the brake body. Make sure that the o-rings are installed into the second groove and that they are not twisted.



13. Using tool #41-350-13, slide the rubber boots onto the pistons as shown. The boot should be hanging off of the end of the piston.



14. Insert the rubber boot/piston into the brake body making sure that the boot is properly seated in the groove.



15. Press the pistons all the way down into the brake body making sure that the boot seats properly into the upper groove on the piston.
16. Install any fittings or plugs that were removed from the brake body using teflon tape thread sealant.
17. If the brake body assembly is not to be immediately installed onto a vehicle, plug the brake hose fitting hole to prevent any contaminants from entering the brake body.





## REPLACE THE MASTER CYLINDER

*NOTE: Most vehicle configurations do not require lifting the vehicle to remove the master cylinder. Lifting the vehicle may not be required.*

### ⚠ WARNING

1. Make sure the key-switch is in the "OFF" position, then remove the key.
2. Place the forward-reverse switch in the center "OFF" position.
3. Confirm the electric park brake is set.
4. Place blocks under the front wheels to prevent vehicle movement.
5. Disconnect the main positive and negative cables at the batteries.

### ⚠ WARNING

**Always use a lifting strap, hoist, and jack stands, of adequate capacity to lift and support the vehicle. Failure to use lifting and support devices of rated load capacity may result in severe bodily injury.**

6. If required, raise the vehicle and support with jack stands.
7. Place a drain pan under the master cylinder.
8. Disconnect the brake line(s) to the master cylinder and pump out the fluid in the master cylinder by depressing the pedal several times.
9. Remove the master cylinder bolts and remove the master cylinder from the vehicle.
10. Install in reverse order.
11. Adjust the master cylinder push rod so that it is approximately 1/8 inch away from the master cylinder plunger when the brake pedal is up.
12. Fill the master cylinder with brake fluid from a sealed container.

### ⚠ WARNING

- Only use DOT 3 brake fluid from a new sealed container.
- DOT 3 brake fluid is corrosive and will damage paint finishes.
- Dispose of brake fluid in accordance with local state and federal regulations.
- Read and follow all warnings on the brake fluid container.

### ⚠ WARNING

**Do not ingest brake fluid or allow contact with skin or eyes. Always wear protective clothing and a face shield when working with or around brake fluid.**

#### SKIN CONTACT

**Flush area immediately with water for several minutes. If a rash or skin irritation develops, get medical attention immediately.**

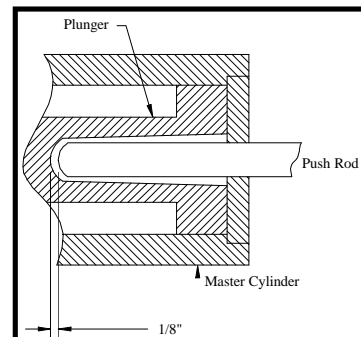
#### EYE CONTACT

**Immediately flush the eye with water for 15 minutes and call physician.**

#### INGESTION

**Get medical attention immediately.**

13. Pump the brake pedal a short distance of one to two inches until no bubbles are seen coming from the inlet ports inside of the master cylinder chamber.
14. If the vehicle was raised, lower it to the ground.
15. Bleed the brakes. refer to **Bleed the Brakes** section for information regarding bleeding the brakes.
16. Reconnect the main positive and negative cables at the batteries.
17. Remove the blocks from behind the wheels.
18. Release the park brake and test drive the vehicle.



*Cutaway of typical master cylinder showing the push rod*



### **REPAIR THE MASTER CYLINDER**

---

*NOTE: Hydraulic brake system components must be kept clean. Make sure your work area is free from dirt and debris and will contain any brake fluid spills.*

Remove the master cylinder from the vehicle. See **Replace the Master Cylinder** section .

Drain all fluid from the master cylinder and discard.

Remove the rubber boot.

Depress the plunger and remove the plunger spring clip retainer.

Pull the plunger and all seals out of the master cylinder bore.

Thoroughly clean, inspect and replace parts as required.

If any damage is found in the bore of the master cylinder then it must be replaced.

Lubricate all parts with clean brake fluid from a sealed container.

Reassemble in reverse order.

If the master cylinder is not to be immediately installed onto a vehicle, plug the brake line fitting hole to prevent any contaminants from entering the master cylinder.

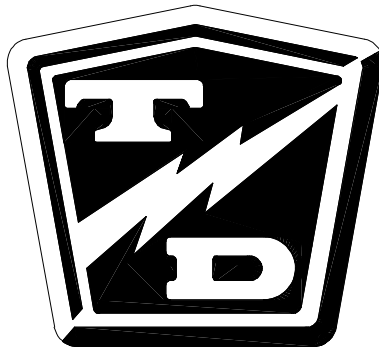
# Throttle Linkage

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## **THROTTLE LINKAGE ADJUSTMENTS**

### **Magnetic Sensor Module**

#### **⚠ WARNING**

**The standard magnetic throttle module should not be used in areas that contain large magnetic fields. Large magnetic fields may effect the operation of the module resulting in unexpected movement of the vehicle.**

*NOTE: The magnetic sensor module and pot box module are not interchangeable.*

The throttle pedal is attached directly to the throttle module. There are no adjustments to the throttle linkage. There are no serviceable components in the throttle module.

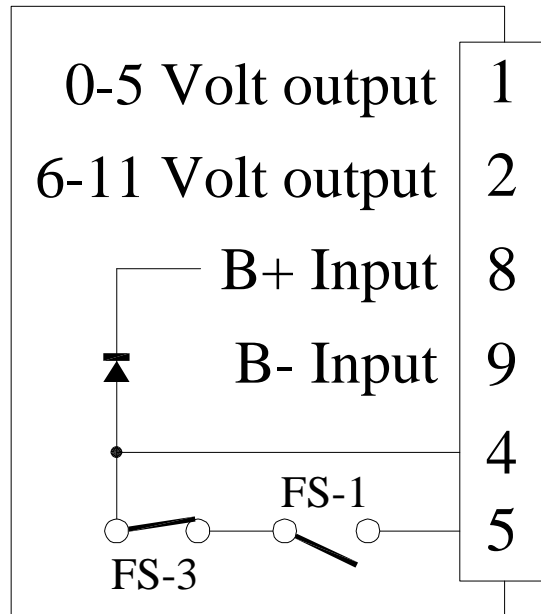
The standard throttle module consists of two micro switches and a magnetic sensor that detects the position of the throttle pedal.

Switch FS-3 is a normally open switch that is held closed by the throttle pedal return spring. The vehicle will be disabled if the throttle return spring breaks.

Switch FS-1 closes just as the throttle pedal is depressed.

Depending on the control system in the vehicle, the throttle position output is obtained from pin #1 (0-5v) or pin #2 (6-11v).

The start signal output is either a positive or a negative signal from pin #5. The polarity of the signal depends on the type of control system in the vehicle and will be the same as the voltage into pin #4.



*Throttle Module Internal Wiring*



*Throttle Module*



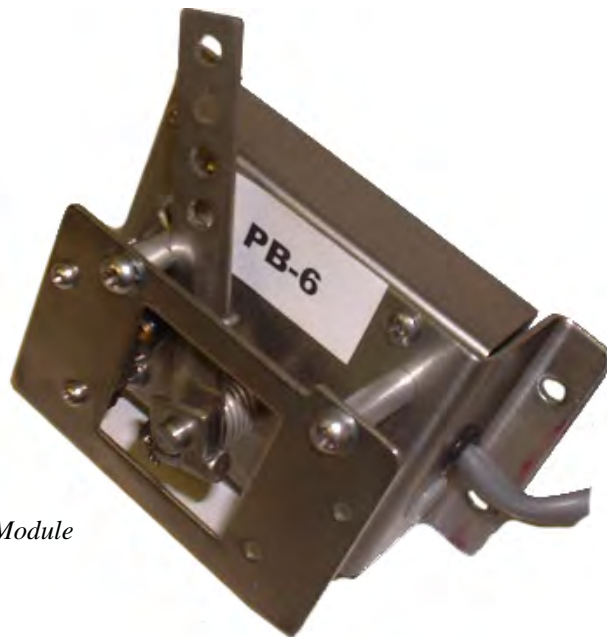
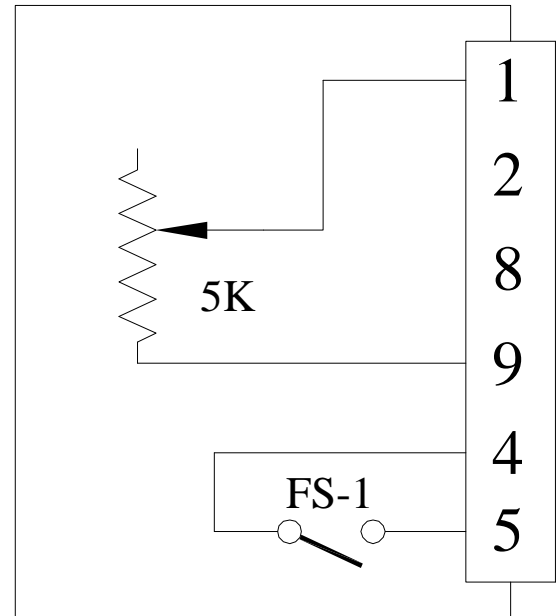


## Pot Box module

The pot box module is used on vehicles that are to be operated in areas with large magnetic fields.

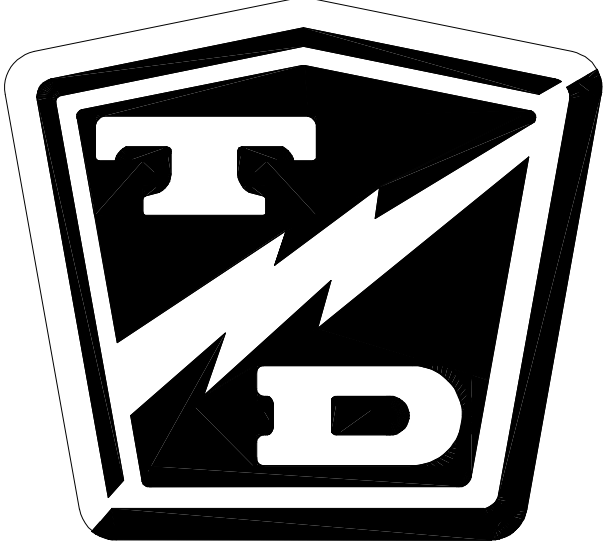
The linkage to the pot box should be adjusted so that the FS-1 switch closes just as the pedal is depressed and the output is at 5K with the pedal fully depressed.

*NOTE: The magnetic sensor module and pot box module are not interchangeable.*



*Pot Box Module*

**TAYLOR - DUNN**



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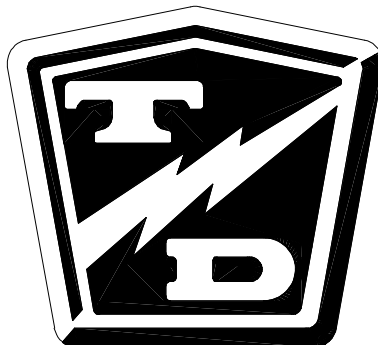
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*Typical Transmission Assembly*



# F2/F3 Transmission Service

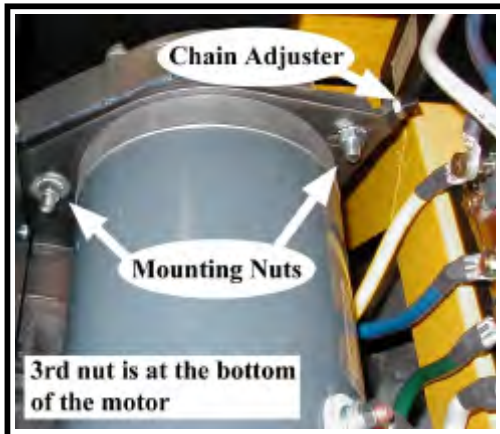
## ADJUST THE DRIVE CHAIN

*NOTE: A small amount of oil may come out when the drive motor mounting bolts are loosened.*

### **⚠ WARNING**

1. Make sure the key-switch is in the "OFF" position, then remove the key.
2. Place the forward-reverse switch in the center "OFF" position.
3. Set the park brake.
4. Place blocks under the front wheels to prevent vehicle movement.
5. Disconnect the main positive and negative cables at the batteries.

6. Place a small oil drain pan under the chain case.
7. Loosen but do not remove the three drive motor mounting nuts.
8. Loosen the chain adjuster jam nut.



### **⚠ WARNING**

**Always use a lifting strap, hoist, and jack stands, of adequate capacity to lift and support the vehicle. Failure to use lifting and support devices of rated load capacity may result in severe bodily injury.**

9. Raise the drive wheels off of the ground.

### **⚠ WARNING**

**Tie the vehicle to an immovable object to prevent the vehicle from moving in forward or reverse. Failure to securely tie the vehicle may result in unexpected vehicle movement resulting in severe bodily injury or property damage.**

10. Tie the vehicle in place so that it cannot move.
11. Reconnect the batteries.

### **⚠ WARNING**

**Rotating parts, keep hands and loose clothing clear of all moving parts. Failure to keep clear of moving parts may result in severe bodily injury and/or property damage.**

12. Close all safety interlock switches, turn the key On, place the forward-off-reverse switch in forward and fully depress the accelerator pedal.
13. Tighten or loosen the adjustment screw to obtain the minimum noise level.

*NOTE: If there is less than 1/16" of threads left on the adjustment screw (see illustration) then the drive chain has stretched beyond service limits and should be replaced. Refer to section **Chain Case** for information regarding replacing the drive chain.*



14. Release the accelerator pedal, place the forward-off-reverse switch in off, turn the key off and disconnect the batteries.
15. Untie the vehicle.
16. Tighten the adjustment screw jam nut and motor mounting nuts.
17. Wipe off any oil that may have come from behind the motor.
18. Lower the drive wheels to the ground.
19. Reconnect the main positive and negative at the batteries, remove the blocks from the wheels, and test drive.

## CHECK THE OIL LEVEL

*NOTE: The oil level in the chain case is maintained by the transmission. Oil is pumped from the 3rd member into the chain case housing. It is not necessary to check the oil level in the chain case.*

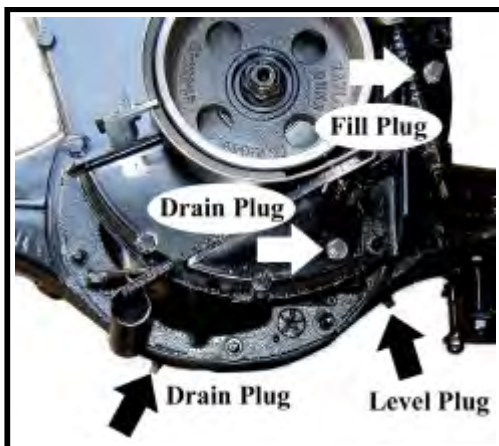
### ⚠ WARNING

1. Make sure the key-switch is in the "OFF" position, then remove the key.
2. Place the forward-reverse switch in the center "OFF" position.
3. Set the park brake.
4. Place blocks under the front wheels to prevent vehicle movement.
5. Disconnect the main positive and negative cables at the batteries.

6. Park the vehicle on a level surface.
7. Place a small oil drain pan under the drive housing.
8. Remove the drive housing level plug.
9. A small amount of oil should come out. This indicates the correct oil level.

*NOTE: If a large amount of oil comes out, then let it drain to the proper level and replace the level plug.*

*If no oil comes out, then fill the drive to the proper level and replace the level plug.*



*Typical location of oil plugs. The actual location of the level plug will vary depending on your vehicles configuration.*

## CHANGE THE OIL

### ⚠ WARNING

**Wear protective gloves when working with petroleum lubricants. Repeated contact with petroleum lubricants can result in skin disorders.**

### ⚠ WARNING

1. Make sure the key-switch is in the "OFF" position, then remove the key.
2. Place the forward-reverse switch in the center "OFF" position.
3. Set the park brake.
4. Place blocks under the front wheels to prevent vehicle movement.
5. Disconnect the main positive and negative cables at the batteries.

6. Place a large drain pan under the chain housing.
7. Remove the chain case drain plug and allow all of the oil to drain from the housing and then reinstall the drain plug
8. Place the drain pan under the drive housing.
9. Remove the drive housing drain plug and allow all of the oil to drain from the housing and then reinstall the drain plug
10. Remove the chain case fill plug and add 1-pint of oil.
11. Remove the drive housing fill plug and add 2-quarts of oil.

*NOTE: Refer to the Lubrication Chart for information regarding the type of oil.*

12. Replace all fill plugs.

*NOTE: Dispose of waste oil in accordance with your local regulations.*

13. Reconnect the main positive and negative at the batteries, remove the blocks from the wheels, and test drive.



### DRIVE MOTOR

#### Remove

*NOTE: In most cases it is not necessary to disassemble the chain case to remove the motor. If you find it necessary to disassemble the chain case, refer to **Transmission** section for information regarding disassembly of the chain case.*

#### ⚠ WARNING

1. Make sure the key-switch is in the "OFF" position, then remove the key.
2. Place the forward-reverse switch in the center "OFF" position.
3. Set the park brake.
4. Place blocks under the front wheels to prevent vehicle movement.
5. Disconnect the main positive and negative cables at the batteries.

6. Remove the four motor wires.
7. Loosen the drive chain adjusting screw.
8. Remove the hardware holding the motor to the chain case backing plate.
9. Lift the rear of the motor and rotate the motor so that the motor mounting plate clears the two threaded studs on the chain case backing plate and remove the motor from the drive.

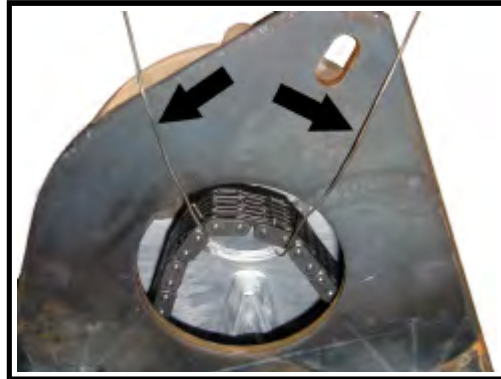
#### Install

#### ⚠ CAUTION

**Do not allow the wheels to rotate after the motor has been removed. Allowing the wheels to rotate may result in the drive chain getting bound up with the drive sprocket, locking up the transmission. Should this happen, the chain may have to**

1. Tie the chain up in position with mechanics wire as shown.
2. Slip the motor sprocket under the chain and rotate the motor so that the mounting plate goes into the threaded studs and remove wire(s) holding the chain.

3. Install the motor mounting hardware but do not tighten until the chain adjustment is complete.
4. Adjust the drive chain. Refer to **Adjust the Drive Chain** for information regarding adjusting the drive chain.
5. Connect the motor wires.
6. Reconnect the main positive and negative at the batteries, remove the blocks from the wheels, and test drive.



*Chain tied with mechanics wire*





## REAR AXLE

### Remove and Install

#### ⚠ WARNING

1. Make sure the key-switch is in the "OFF" position, then remove the key.
2. Place the forward-reverse switch in the center "OFF" position.
3. Set the park brake.
4. Place blocks under the front wheels to prevent vehicle movement.
5. Disconnect the main positive and negative cables at the batteries.

#### ⚠ WARNING

Always use a lifting strap, hoist, and jack stands, of adequate capacity to lift and support the vehicle. Failure to use lifting and support devices of rated load capacity may result in severe bodily injury.

6. Raise the drive wheel off of the ground.
7. Remove the wheel assembly.
8. Place a small oil drain pan under the end of the axle housing.
9. Remove the four axle retaining bolts. Secure the brake body assembly, do not let it hang by the brake hose.
10. Using a slide hammer, remove the axle from the axle housing.
11. Remove the bearing gasket and axle seal from the housing.
12. Install the axle in reverse order using a new gasket and seal.
13. Reconnect the main positive and negative at the batteries, remove the blocks from the wheels, and test drive.

### Replace the Axle Bearing

*NOTE:* The axle must be removed from the vehicle to replace the axle bearing. Refer to section **Rear Axle: Remove and Install** for information regarding removing the axle.

*NOTE:* A 10-ton press is required to replace the axle bearing.

*NOTE:* The axle bearing will be damaged when it is removed.

#### ⚠ WARNING

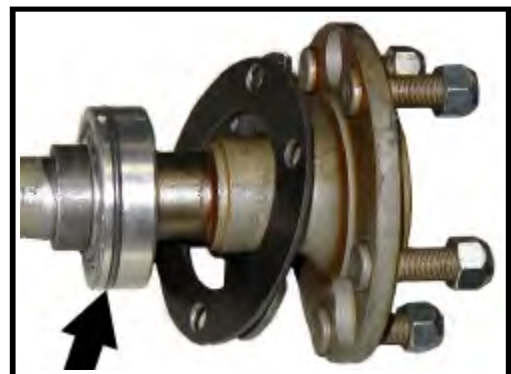
The axle bearing retainer will be damaged when it is removed. Do not reuse the axle bearing retainer. Reinstalling the original bearing retainer may result in the axle falling out of the transmission resulting in severe bodily injury or property damage.

#### ⚠ WARNING

Old axle bearings may explode while being removed. Place a cage around the axle bearing that will contain all debris if the bearing explodes. Failure to place a cage around the axle bearing could result in severe bodily injury or property damage.

1. Place the axle in a press and remove the bearing and bearing retainer.
2. Lightly lubricate the axle shaft.
3. Install a new bearing and bearing retainer and press into place.

*NOTE:* Some axle configurations have an o-ring around the axle bearing. The bearing should be orientated so that the o-ring is farthest away from the axle hub. See the illustration below.





## TRANSMISSION ASSEMBLY

---

### Remove and Install

#### **⚠ WARNING**

1. Make sure the key-switch is in the "OFF" position, then remove the key.
2. Place the forward-reverse switch in the center "OFF" position.
3. Set the park brake.
4. Place blocks under the front wheels to prevent vehicle movement.
5. Disconnect the main positive and negative cables at the batteries.

6. Remove the motor wires.
7. Disconnect the left and right parking brake linkage from the brake arms.
8. Disconnect the brake lines from the rear brake calipers.
9. Remove the 8-bolts holding the transmission assembly to the rear springs.
10. Remove the nuts from the rear spring hangers. Do not remove the bolts at this time.

#### **⚠ WARNING**

**Always use a lifting strap, hoist, and jack stands, of adequate capacity to lift and support the vehicle. Failure to use lifting and support devices of rated load capacity may result in severe bodily injury.**

11. Lift the rear of the vehicle just enough to allow the removal of the rear spring hanger bolts and remove the bolts.
12. Raise the rear of the vehicle high enough to roll the transmission out from under the vehicle and support with jack stands.
13. Install in reverse order.
14. Bleed the brake system. Refer to **Bleed the Brakes** in the **Brake Service** section for information regarding bleeding the brake system.
15. Check brake adjustment and adjust as needed. Refer to **Adjust the Brakes** in the **Brake Service** section for information regarding adjusting the brakes.
16. Reconnect the main positive and negative at the batteries, remove the blocks from the wheels, and test drive.



## CHAIN CASE

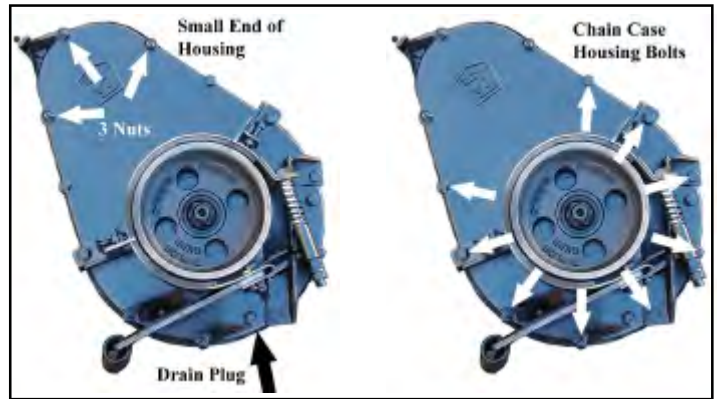
**NOTE:** Some vehicle configurations may require that the transmission be removed to disassemble the chain case. Refer to section **Transmission Assembly** for information on removing the transmission.

### Disassemble

#### **⚠ WARNING**

1. Make sure the key-switch is in the "OFF" position, then remove the key.
2. Place the forward-reverse switch in the center "OFF" position.
3. Set the park brake.
4. Place blocks under the front wheels to prevent vehicle movement.
5. Disconnect the main positive and negative cables at the batteries.

6. Place an oil drain pan under the chain case.
7. Remove the chain case drain plug and allow all of the oil to drain from the housing and then reinstall the drain plug
8. Remove the brake drum. Refer to section **Brakes: Replace the Brake Drum** for information regarding removing the brake drum.
9. Remove the nuts from the three threaded studs at the small end of the chain case housing.
10. Remove the chain case housing bolts, brake assembly, and alignment brackets.
11. Remove the chain case housing from the backing plate.
12. Remove the pinion seal from the chain case housing.
13. Loosen the motor mounting bolts.
14. Loosen the chain adjuster.
15. Remove the drive chain, motor nut and sprocket and the drive sprocket.
16. If the backing plate must be removed from the 3rd member, first remove the motor from the backing plate then remove the backing plate from the 3rd member.



*Typical Chain Case*

### Assemble

1. Thoroughly clean all gasket surfaces.
2. Apply a 1/8" bead of 94-430-03 gasket sealer to the face of the 3rd member.

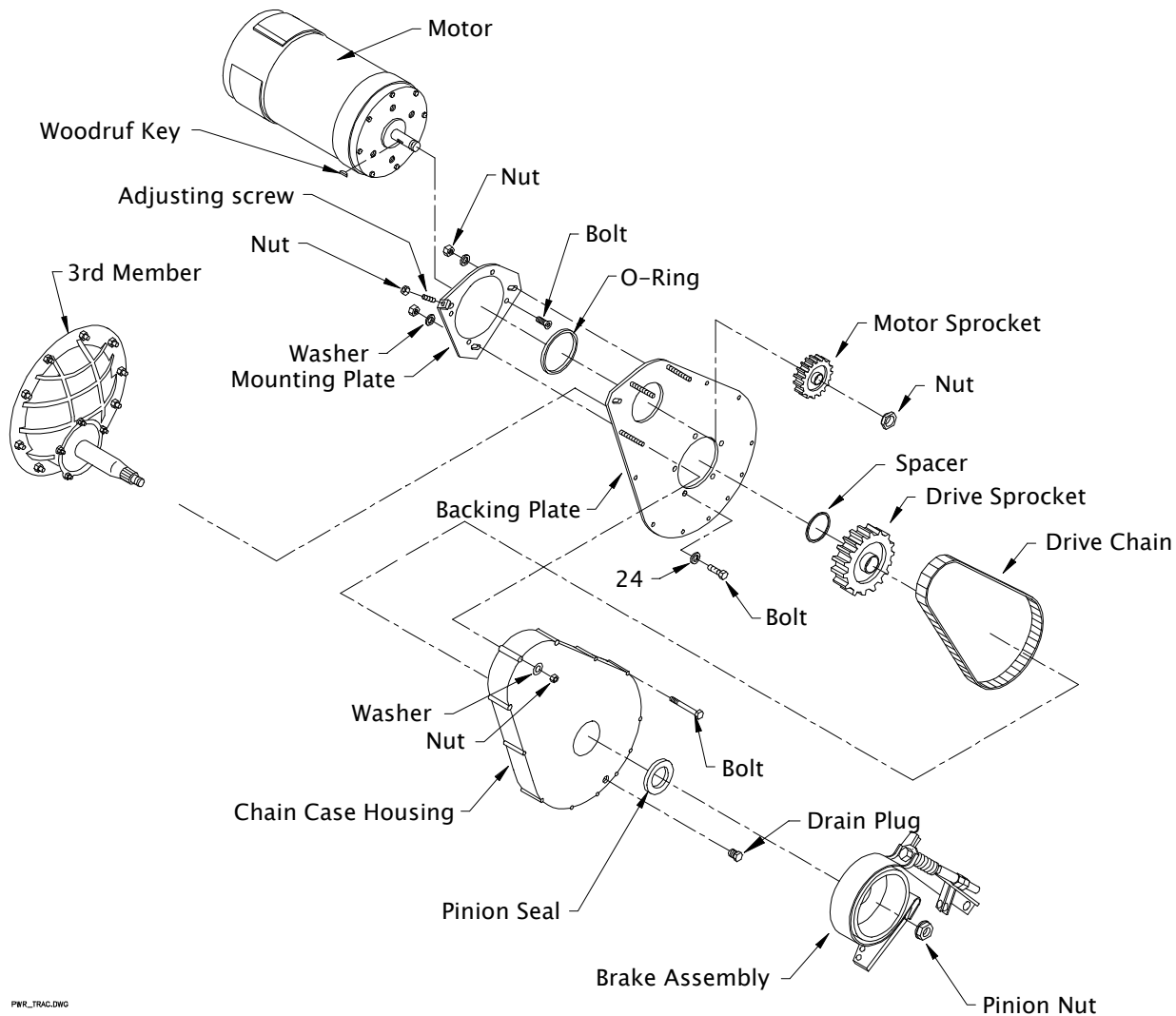


3. Install the backing plate to the 3rd member. Torque to 30-45 ft-lbs.
4. Install the motor to the backing plate. Do not fully tighten the motor mounting hardware at this time.
5. Install the motor sprocket, drive sprocket and chain. Do not adjust the chain tension at this time.
6. Apply a 1/8" bead of 94-430-03 gasket sealer to the chain case housing.



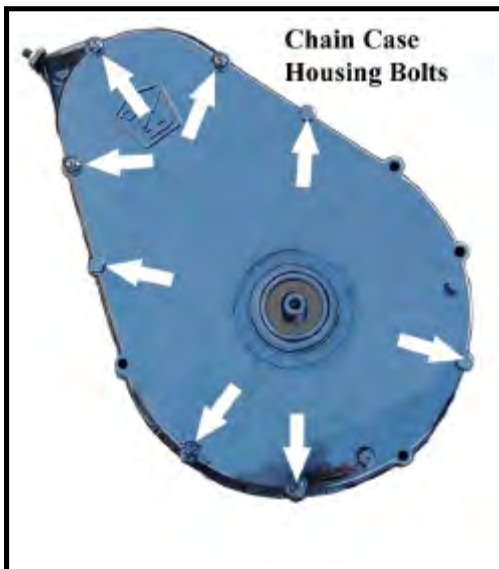
*Apply sealer around the ID of the holes*

7. Install the chain case centering tool (refer to Appendix A) into the pinion seal bore in the chain case housing.



PWR\_TRAC.DWG

8. Install the chain case housing onto the pinion shaft and tighten the pinion nut to 75 ft-lbs.
9. Install and tighten the three nuts and washers to the threaded studs and the housing bolts that are not used for the brake mounting bracket or alignment brackets.
10. Remove the centering tool and install a new pinion seal. Lightly lubricate the pinion seal lip.
11. Install the brake assembly and the brake band alignment bracket(s). Do not tighten the bolts at this time.
12. Install the brake drum. Torque to 175 ft-lbs.
13. Tighten the brake adjusting bolt to 25 ft-lbs.
14. Tighten the brake assembly mounting bolts.
15. Adjust the brake. Refer to section **Brake Service: Adjust the Brakes** for information regarding adjusting the brakes.
16. Adjust the drive chain. Refer to section **Adjust the Drive Chain** for information regarding adjusting the drive chain.

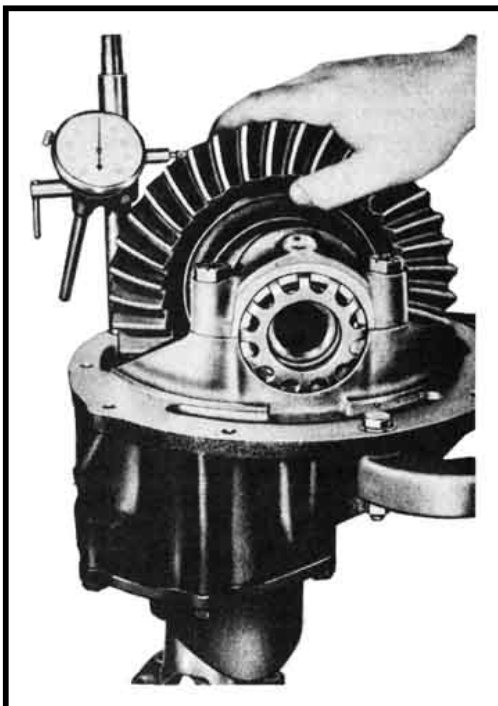


## DIFFERENTIAL ASSEMBLY (3<sup>RD</sup> MEMBER)

### Disassemble

*NOTE: Bearings and races must be replaced as a set. If any one bearing or race is worn, its mate must also be replaced. It is recommended to replace all bearings and races in the 3rd member as a set.*

1. Drain the oil from the differential housing and chain case. Refer to section **Change the Oil** for information regarding draining the oil.
2. Remove the transmission assembly from the vehicle. Refer to **Transmission Assembly: Remove and Install** for information regarding removing the transmission.
3. Remove both rear axle assemblies. Refer to section **Rear Axle: Remove and Install** for information regarding removing the axles.
4. Remove the chain case and backing plate from the 3rd member. Refer to section **Chain Case: Disassemble** for information regarding removing the chain case.
5. Remove the nuts holding the 3rd member to the axle housing and remove the 3rd member from the housing.
6. Install a spacer on the pinion shaft so that the pinion nut can be installed and tightened.



Measuring backlash

7. While rotating the pinion shaft, tighten the pinion nut to 100 ft-lbs.
8. Measure and record the ring and pinion gear backlash. This setting will be used during reassembly.
9. Remove the pinion housing and pinion gear from the 3rd member.

*NOTE: Do not lose the spacers and shims in the pinion housing or the pinion housing shim(s).*

10. If required, remove the rear tapered bearing from the pinion shaft and discard.

*NOTE: Do not remove the bearing unless it requires replacement. Removing the rear bearing will damage the bearing. Replacing this bearing will require re-shimming of the pinion shaft.*

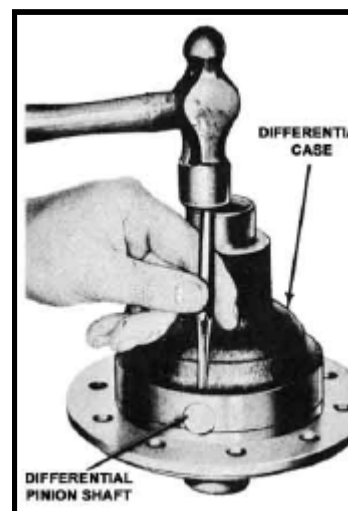
11. If required, remove the bearing races from the pinion housing.
12. Mark the differential bearing caps and 3rd member housing so that they can be reassembled in their original location. Refer to illustration at end of section.

*NOTE: The caps cannot be interchanged or replaced. If the caps are lost or damaged then the entire 3rd member assembly must be replaced.*

13. Remove the differential bearing caps, bearing adjusting nuts and races.
14. Remove the differential assembly from the 3rd member.
15. Mark the ring gear and differential housing so that the ring gear can be reinstalled in the same orientation.
16. Remove the bearings from the differential housing and discard.

*NOTE: Removing the bearings will damage the bearings. Do not remove the bearings unless they require replacement.*

17. Remove the ring gear from the differential housing.
18. Remove the differential shaft locking roll pin.
19. Split the 2-piece differential housing.
20. Drive the differential pinion shaft out of the housing with a brass drift punch.
21. Remove the differential gears, axle gears, and thrust washers.





### Assemble

**NOTE:** Thoroughly clean and inspect all parts before reassembly. Apply a small amount of differential oil to all gears and bearings before reassembly.

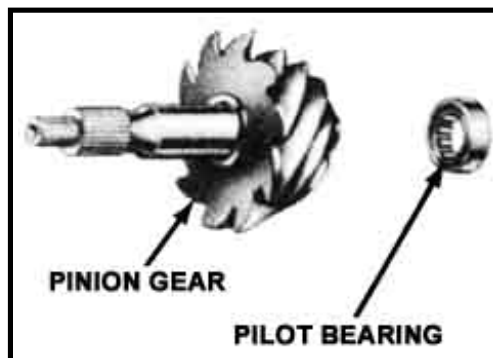
**NOTE:** Depending on your vehicle configuration, the rear pinion pilot bearing is not required and may not be installed.

**NOTE:** If the ring and pinion gear set is to be replaced then the shims for the pinion housing may have to be adjusted. Refer to section **Selecting the Pinion Housing Shim** for information on adjusting the shim.

**NOTE:** Most of our gear sets are non-hunting or semi-hunting gears. With this type of gear the pinion and ring gears must be aligned correctly. There will be two teeth marked on the ring gear and one tooth marked on the pinion gear. The one tooth on the pinion gear must be installed so that it is between the two teeth on the ring gear. The gear ratios are; 2.50, 2.70, 2.75, 3.25 and 3.00.

### Pinion housing

1. If the rear pinion bearing was removed, install a new bearing.
2. Install the bearing races into the pinion housing.
3. Place the pinion gear into the 3rd member.
4. Install the pinion housing onto the 3rd member.
5. Install the pinion bearing spacers, shims and front bearing.
6. Install a spacer on the pinion shaft so that the pinion nut can be installed and tightened.
7. While rotating the pinion shaft, tighten the pinion nut to 100 ft-lbs.
8. Check the torque required to rotate the shaft. If the torque is not between 6 -10 in-lbs. then the bearings must be re-shimmed. Add or subtract shims as required until the torque is within specifications.



### Differential Assembly

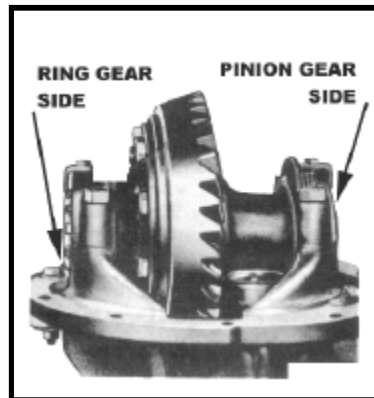
9. Reassemble the differential housing in reverse order.
10. Place the ring gear onto the differential housing matching the mark made during disassembly.
11. Install two of the ring gear bolts finger tight to align the gear.
12. Press the ring gear onto the differential housing.
13. Install the ring gear bolts and cross tighten to 65-80 ft-lbs.
14. If the differential bearings were removed, install new bearings.
15. Place races onto the differential bearings and place the differential assembly onto the 3rd member. Position the assembly so that it is just touching the pinion gear.
16. Install the bearing adjusting nuts making sure that the nuts are not cross threaded. Position the nuts so they are in contact with the bearing races.

## ⚠ CAUTION

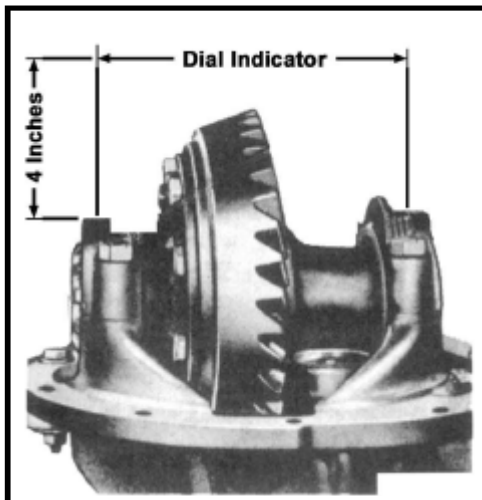
**Cross threading the nuts will damage the 3rd member housing and bearing caps. If the housing and/or nuts are damaged, the entire 3rd member assembly may have to be replaced.**

17. Install the bearing caps in their original locations and torque the bolts to 12-15 ft-lbs. making sure that the adjusting nuts still turn freely.

*NOTE: In the following procedure, "Left adjusting nut" refers to the nut on the ring gear side of the differential assembly. "Right adjusting nut" refers to the nut on the pinion gear side of the differential assembly.*



The differential bearing preload is set by measuring the case spread of the 3rd member housing. As the bearing adjusting nuts are tightened, the two differential bearing caps will be pushed (spread) away from each other. A dial indicator must be used to measure the case spread as the nuts are tightened. Mount the dial indicator so that it is 4 inches above the top of the bearing caps and parallel to the center line of the carrier bearings.



*NOTE: Be sure to continually rotate the ring gear while adjusting the bearings. This makes sure that the bearings and races remain seated correctly.*

*NOTE: One hole on adjusting nut = approximately 0.003" change in backlash. Left and right nuts MUST be turned the same amount AND in the same direction. The final direction of rotation MUST be in the tightening direction, to loosen a nut 1-hole, back off 2-holes and then tighten 1 hole. The ring gear should be rotated any time the nuts are being adjusted.*

18. Loosen the right side nut.

19. Tighten the left nut until all backlash is removed from the ring and pinion gear.

20. Tighten the right nut until a case spread of 0.010" is indicated on the dial indicator.

*NOTE: If new ring and pinion gears are used, refer to the recommended backlash that is supplied with the gear set*

21. Measure the backlash. If the backlash is not within 0.002" of the original measurement taken on disassembly or the recommended setting for new gears, then readjust the bearings as follows:

*To increase backlash, loosen the left spanner nut and then tighten the right spanner nut the same amount.*

*To decrease backlash, loosen the right spanner nut and then tighten the left spanner nut the same amount.*

22. Apply gear marking compound on both sides of 7 to 10 teeth on the ring gear.

23. While applying resistance to the pinion shaft, rotate the ring gear back and forth (not full revolutions) until a clear contact pattern is shown. Compare the contact pattern to the illustration on the following page and reshim the pinion housing or adjust the backlash as indicated on the illustration. If the pinion housing is reshimed the backlash must be reset. Go back and repeat ALL procedures in setting the backlash.

24. Tighten the bearing cap bolts to 70-85 ft/lbs (F2 drive), 55-70 ft/lbs (F3 drive) and install the spanner nut locks. Tighten the spanner nut lock bolts to 12-25 ft/lbs.

*NOTE: Final pinion nut torque on completely assembled drive, 175 ft/lbs.*



## RE-SHIMMING THE PINION HOUSING

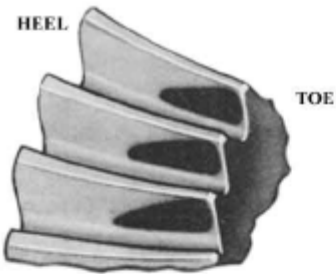
The pinion housing shim may require replacement if the ring and pinion gear or pinion housing is replaced.

Pinion housing shims are available from 0.005" to 0.021" in increments of 0.001". Locate the number printed on the flat surface of the pilot bearing shaft of the pinion gear. It should be a number ranging from -5 to +5. This is the amount in 0.001" increments to add to the "standard" shim. For example, if the number on the shaft is '-3' then the standard shim (0.015) plus '-3' equals 0.012. The correct shim would be 0.012".

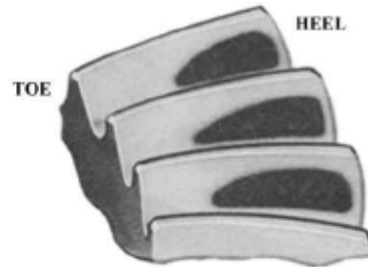
If you cannot locate the number on the shaft, start with the standard shim and adjust as required per the contact pattern chart below.



**Ideal contact pattern  
Correct shim  
Correct backlash**



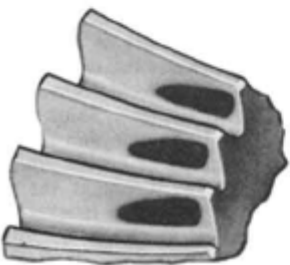
**Backlash is correct  
Add 0.004" shim**



**Backlash is correct  
Subtract 0.004" shim**



**Shim is correct  
Decrease backlash 0.004"**

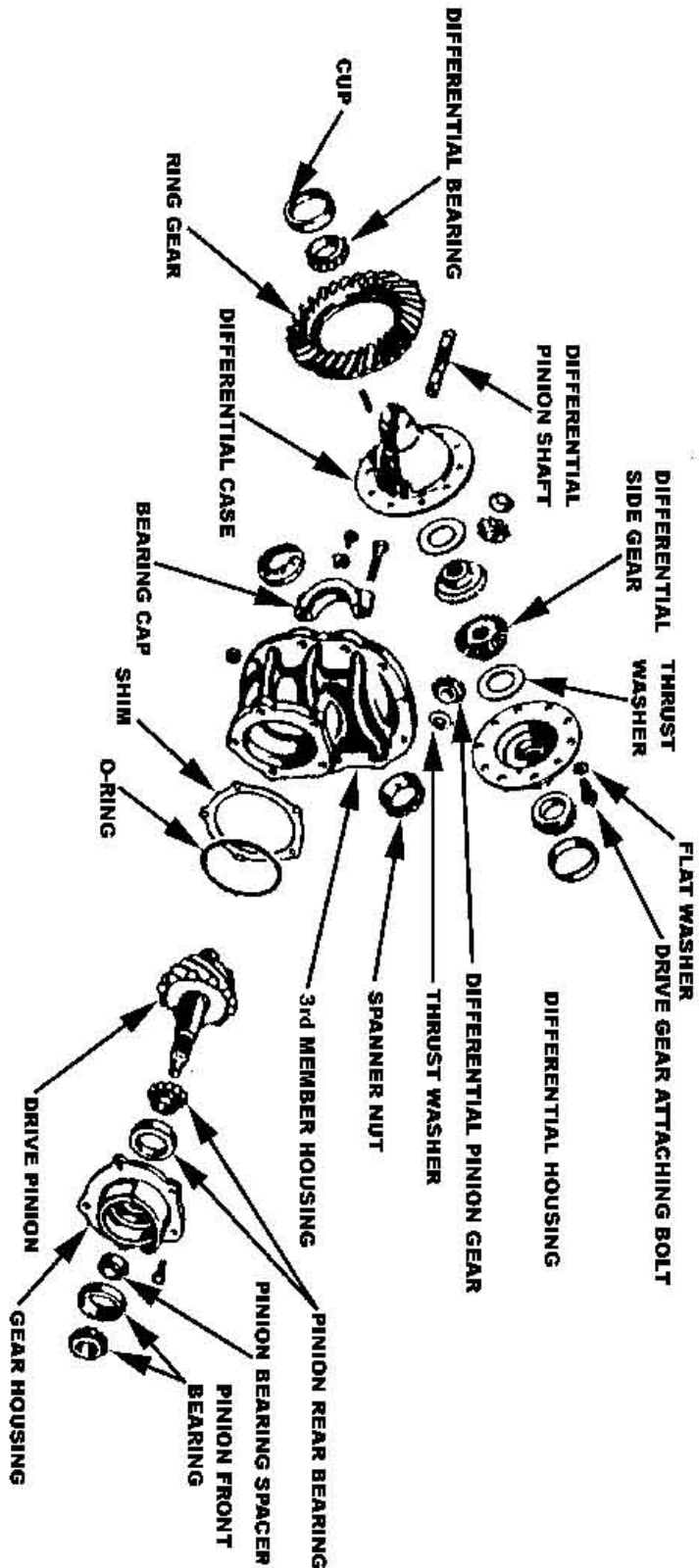


**Shim is correct  
Increase backlash 0.004"**

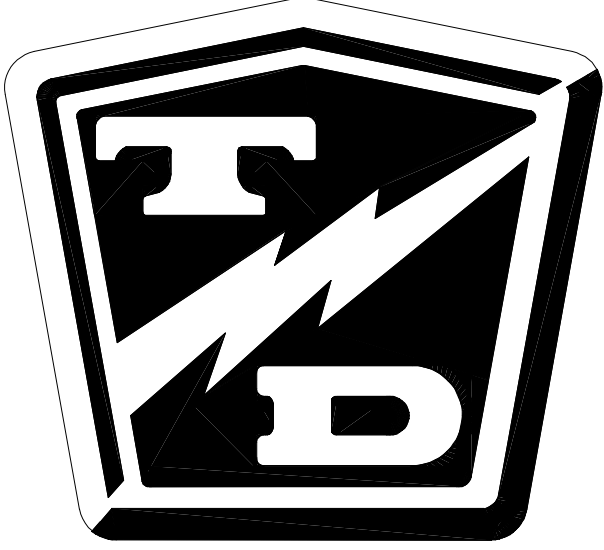




**EXPLODED VIEW**



**TAYLOR - DUNN**





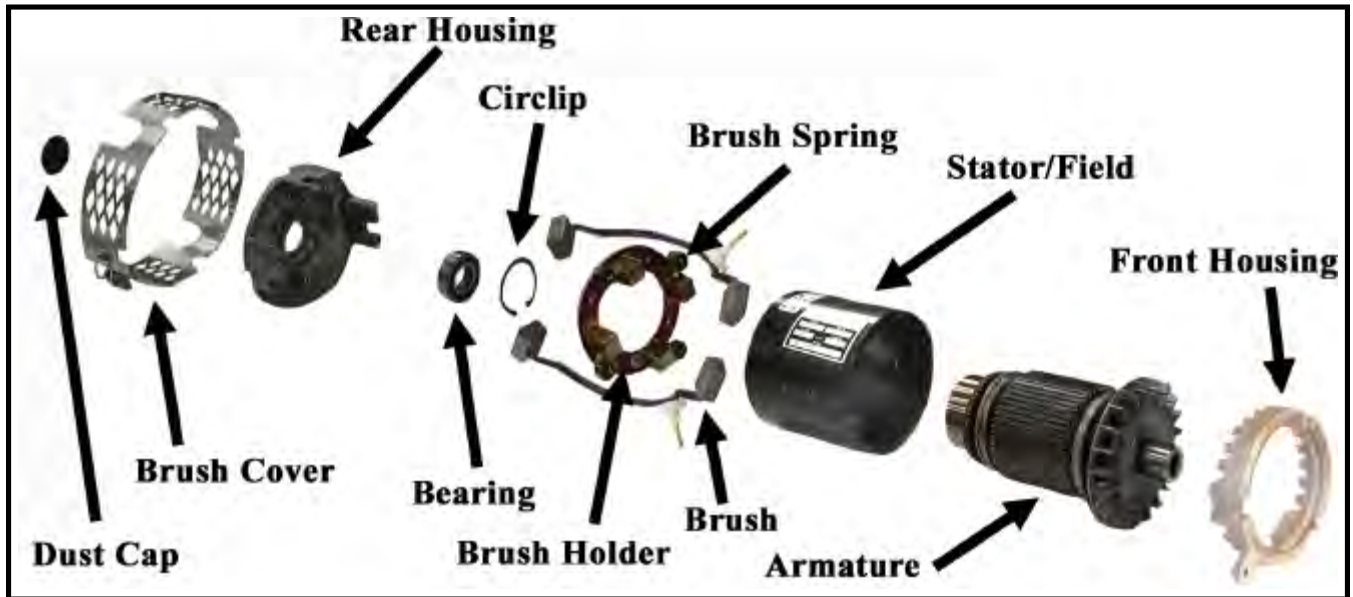
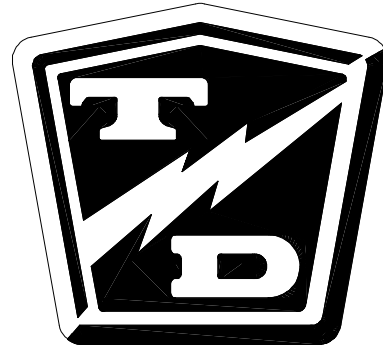
# Motor Service

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*Typical Exploded Motor*

## ***INSPECTING THE MOTOR BRUSHES***



*Typical motor with cooling fan indicated by the arrow*



*Typical brush and brush holder*

### **Enclosed Motors (GE, no cooling fan)**

### **Motors with internal cooling fans**

*NOTE: There are four brushes in the motor. The brushes will not wear at the same rate. It is recommended that all four brushes are inspected at the same time.*

*NOTE: In some vehicle configurations it may not be possible to inspect all four brushes while the motor is in the vehicle. Refer to **Transmission Service** section for information on removing the motor.*

### **⚠ WARNING**

- 1. Make sure the key-switch is in the "OFF" position, then remove the key.**
- 2. Place the forward-reverse switch in the center "OFF" position.**
- 3. Set the park brake.**
- 4. Place blocks under the front wheels to prevent vehicle movement.**
- 5. Disconnect the main positive and negative cables at the batteries.**

6. Look through the brush cover and compare the top of the brush to the top of the brush holder. If it is even with or below the top of the brush holder then the brushes should be removed and measured. Refer to **Replacing the Brushes** section for information regarding removing the motor brushes.
7. If any one brush is less than or equal to the service limit specified in **Service Limits**, then all four brushes should be replaced.
8. Reconnect the main positive and negative cables at the batteries.
9. Remove the blocks from behind the wheels, release the park brake and test drive.

### **General Electric Motors**

### **⚠ WARNING**

- 1. Make sure the key-switch is in the "OFF" position, then remove the key.**
- 2. Place the forward-reverse switch in the center "OFF" position.**
- 3. Set the park brake.**
- 4. Place blocks under the front wheels to prevent vehicle movement.**
- 5. Disconnect the main positive and negative cables at the batteries.**

*NOTE: Some motors may not have the brush inspection holes. In this case, the motor must be disassembled to inspect the brushes. For future inspections, holes may be drilled into the motor housing after it has been disassembled.*

6. Insert a 0.035" diameter wire through the brush inspection hole above each brush until it contacts the top of the brush.
7. Mark the wire to indicate how far it was inserted into the motor housing.
8. Remove the wire and measure how far into the motor the wire was inserted.
9. If any one wire insertion length exceeds the length specified in **Service Limits**, then all four brushes should be replaced. Refer to **Replacing the Brushes** section for information regarding replacing the motor brushes.
10. Reconnect the main positive and negative cables at the batteries.
11. Remove the blocks from behind the wheels, release the park brake and test drive.

**Advanced DC Motors**

The enclosed Advanced DC motors must be disassembled to inspect the motor brushes. Refer to **Motor Inspection** for information regarding disassembling the motor.

**MOTOR REMOVAL AND INSTALLATION**

See the **Transmission** section for information on removing or installing the motor.

**MOTOR INSPECTION**

**Disassembly**

1. Remove the motor from the vehicle. See the **Transmission** section for information on removing the motor.
2. Remove the housing screws from the rear and/or front of the motor.
3. Remove the armature retaining screws from the rear housing (if equipped).



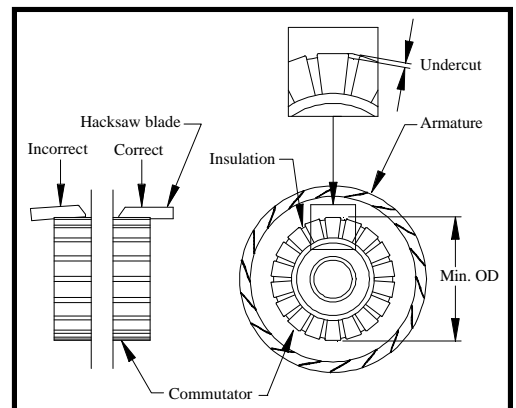
4. If this is an enclosed motor, remove the front housing end.
5. Pull the armature out of the front end of the motor housing.
6. Remove the nuts off of all of the terminals in the rear motor housing.
7. Remove the rear motor housing being careful not to damage the field coil wires.

**Inspection**

1. Measure the length of each motor brush.
  - If any one brush is less than or equal to the service limit specified in section **Service Limits**, then all four brushes should be replaced. Refer to **Replacing the Brushes** section for information regarding replacing the motor brushes.
2. Measure the diameter of the commutator.
  - If the commutator is less than the minimum diameter specified in section **Service Limits**, then the motor must be replaced.



3. Measure the commutator undercut depth in 5-places around the commutator.
  - If any one of the measurements is less than the minimum undercut depth specified in **Service Limits** above, then the commutator must be undercut. Refer to **Repair Commutator** section for information regarding undercutting the commutator.

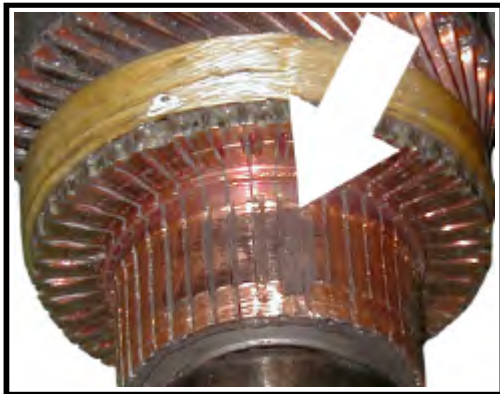


4. Inspect the commutator for grooves.
  - If the commutator is grooved then it must be machined on a lathe. Do not machine the commutator past the minimum diameter specified in **Service Limits** section. Refer to **Repair Commutator** section for information regarding machining the commutator.



## Motor Service

5. Inspect the commutator for burn marks.
  - Burn marks and/or raised commutator segments 90 or 180 degrees apart is evidence of a shorted armature. A tool called a growler is required to reliably test for a shorted armature.



*Typical burn mark on a shorted armature*

6. Inspect the commutator for raised segments. Raised segments could be a result of a stalled motor or shorted armature. A tool called a growler is required to reliably test for a shorted armature.
    - If the armature is not shorted then the raised segments can be removed by machining the commutator. Do not machine the commutator past the minimum diameter specified in **Service Limits** section. Refer to **Repair Commutator** section for information regarding machining the commutator.
  7. Visually inspect the armature windings for burnt insulation. Burnt insulation is a direct result of motor overheating and could lead to a shorted armature.
    - If the insulation is cracked or burnt, then it is recommend that the armature or motor be replaced.
- NOTE:** *If the armature has been burnt then there is a good possibility that the field windings may also be burnt. Symptoms indicating a shorted field include high motor current, lack of power and possibly excessive speed.*
8. Using a growler, test the armature for shorts.
    - If the armature is shorted, then we recommend that the armature or motor be replaced.
  9. Using the continuity function of digital multi meter, check the continuity around the entire commutator by placing one test lead against one of the commutator segments and the other test lead against all of the other segments one at a time. There should be continuity around the entire commutator. If any segment indicates an open circuit, then the motor must be replaced.
  10. Using the continuity function of digital multi meter, check the continuity from any one of the

commutator segments and the armature frame. If it is not an open circuit, then the armature is shorted and the motor must be replaced.

11. Rotate the motor bearing(s) by hand.
  - The bearing should not 'freewheel' but should come to a smooth stop when rapidly spun by hand. If the bearing freewheels, then grease is no longer present in the bearing and it must be replaced. Refer to **Replacing the Bearings** section for information regarding replacing the armature bearings.
  - Feel for any roughness when the bearing is rotated. If any roughness or grinding is noticed then the bearing must be replaced. Refer to **Replacing the Bearings** section for information regarding replacing the armature bearings.

### **Assembly**

**NOTE:** *If this is an enclosed motor on a vehicle with a Power Traction primary reduction, then it is recommended to replace the armature shaft seal any time the motor is disassembled.*

1. Push the motor brushes just far enough out of the brush holder so that the brush springs hold them in place away from the commutator. See the illustration to the right.
2. Install the rear motor housing to the stator housing.
3. Lightly grease the outside diameter of the armature bearings.
4. Insert the armature through the stator housing and seat the bearing into the rear housing.
5. If equipped with armature retaining screws, install and tighten them at this time.
6. If this is an enclosed motor, lightly grease the armature shaft seal and install the front motor housing.

**NOTE:** *If the vehicle is equipped with a belt type primary reduction then the spring on the motor seal should be removed. Failure to remove the spring may result in a high pitched squeal from the seal.*

7. Push the motor brushes into the brush holder until the brush spring snaps into place. Be certain that the spring does not rest up against the brush wire. See the illustrations below.





*Brush Spring Orientation*

## **REPLACING THE BRUSHES**

*NOTE: It is recommended that all four brushes be replaced as a set.*

*NOTE: Motors without removable brush covers must be disassembled to replace the brushes. Refer to **Motor Inspection-Disassembly** section for information on taking the motor apart.*

*NOTE: Some motors are equipped with brush pairs. These motors must be disassembled to replace the brushes. Refer to **Motor Inspection-Disassembly** section for information on taking the motor apart. Refer to the **Motor Parts List** for your vehicles brush configuration.*

*NOTE: Some motors have brush leads that are routed through or behind the brush holder assembly. In this case, the brush holder assembly must be removed to replace the brushes.*

*NOTE: The motor must be removed from the vehicle for this procedure. Refer to **Transmission Service** section for information on removing the motor.*

### **Motors with brush covers and brushes with termination screws**

1. Remove the brush covers.
2. Loosen the brush wire retaining screw and remove the brush from the brush holder. Be careful with the brush spring and do not let it slip off of the spring mount. If the spring comes off, then the motor must be disassembled. Refer to **Motor Inspection-Disassembly** section for information on taking the motor apart.

3. Install the new brushes in reverse order.
4. Be certain that the brush springs do not rest up against the brush wires. Refer to illustrations in **Motor Inspection-Assembly** for proper brush spring position.

### **Motors with brush pairs or not equipped with brush covers**

1. Disassemble the motor. Refer to **Motor Inspection-Disassembly** section for information on taking the motor apart.

2. Remove the brush holder.

*Note: Remember the position and routing of the brush crossover leads. They must be reinstalled in the same position.*

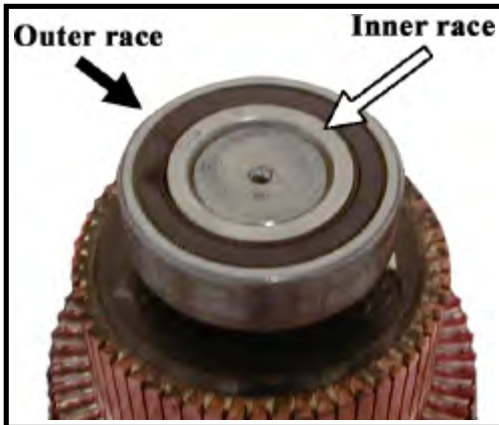
3. Remove the brush termination screws or the armature studs and remove the brushes from the brush holder.
4. Install the new brushes in reverse order.
5. Reassemble the motor. Refer to **Motor Inspection-Assembly** for information regarding reassembling the motor.

## **REPLACING THE BEARINGS**

1. The motor must be removed from the vehicle for this procedure. Refer to **Transmission Service** section for information on removing the motor.
2. Remove the armature. Refer to **Motor Inspection-Disassembly** section for information on taking the motor apart.
3. Press the armature bearing(s) off of the armature shaft.

### **CAUTION**

**Do not press against the outer race of the bearing. Pressing against the outer race will damage the bearing and may result in premature failure of the bearing. See the illustration below**



4. Press new bearing(s) onto the shaft.
5. Reassemble the motor.

## **REPAIRING THE COMMUTATOR**

1. The motor must be removed from the vehicle for this procedure. Refer to **Transmission Service** section for information on removing the motor.
2. The armature must be removed from the motor for this procedure. Refer to **Motor Inspection-Disassembly** section for information on taking the motor apart.
3. Using a lathe, cut the armature just enough to remove all grooves, depressions or ridges.
4. Measure the diameter of the commutator. If the commutator is less than the minimum diameter specified in **Service Limits**, then the motor must be replaced.
5. Thoroughly clean all copper debris from between the commutator segments.

6. Measure the commutator undercut depth in 5-places around the commutator. If any one of the measurements is less than the minimum undercut depth specified in **Service Limits**, then the commutator must be undercut.



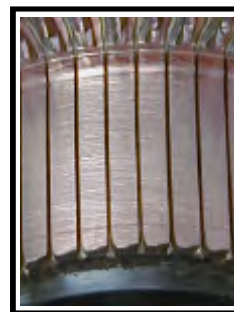
*Example of freshly cut commutator*

7. While still in the lathe, smooth the commutator with fine emery cloth.

### **Undercutting the commutator**

1. Using a small straight cut saw blade, cut the commutator insulation to the proper depth. Refer to undercut depth in **Service Limits**.
2. Once all segments have been properly undercut, mount the armature in a lathe and smooth the commutator with fine emery cloth.
3. Inspect the armature for shorts. Refer to **Motor Inspection** section for information on testing the armature.

**NOTE:** Copper debris in the undercut area can give a reading of a shorted armature.

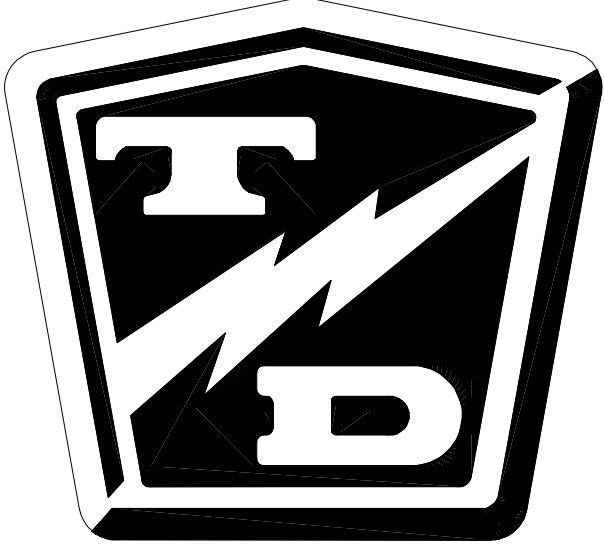


*Properly undercut and cleaned commutator segments*

**SERVICE LIMITS**

Motor Specification Number	Undercut Depth		Commutator Diameter (min)		Brush Length (min)		Wire Depth (max)	
	mm	inches	mm	inches	mm	inches	mm	inches
5BC58JBS6129A	0.635	0.025	66.75	2.625	19.05	0.75	38.1	1.5
5BC58JBS6129B	0.635	0.025	66.75	2.625	19.05	0.75	38.1	1.5
5BC58JBS6129C	0.635	0.025	66.75	2.625	19.05	0.75	38.1	1.5
5BC49JB399C	0.635	0.025	78.97	3.109	19.05	0.75	-	-
5BC58JBS6110C	0.635	0.025	78.97	3.109	19.05	0.75	38.1	1.5
A02-4011	1.0	.04	69.9	2.75	16	0.62	-	-
ER5-4001 XP-2023	1.0	.04	69.9	2.75	16	0.62	-	-
ER5-4002	1.0	.04	69.9	2.75	16	0.62	-	-
BP5-4002	1.0	.04	69.9	2.75	16	0.62	-	-

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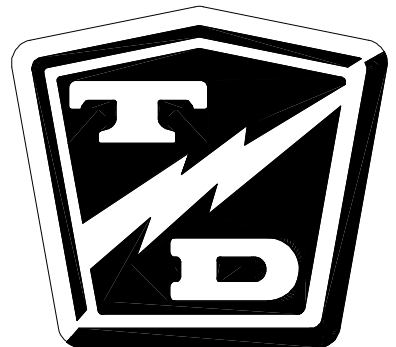


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# **Suspension**



### REPLACE THE REAR SPRINGS

If a spring has failed or is fatigued, then it is recommended that both rear springs are replaced as a set.

*HINT : In most vehicles it will be easier if the springs are replaced one at a time.*

#### **⚠ WARNING**

1. Make sure the key-switch is in the "OFF" position, then remove the key.
2. Place the forward-reverse switch in the center "OFF" position.
3. Set the park brake.
4. Place blocks under the front wheels to prevent vehicle movement.
5. Disconnect the main positive and negative cables at the batteries.

#### **⚠ WARNING**

**Always use a lifting strap, hoist, and jack stands, of adequate capacity to lift and support the vehicle. Failure to use lifting and support devices of rated load capacity may result in severe bodily injury.**

6. Raise the rear of the vehicle and support with jack stands.
7. Tie up or support the rear axle so it cannot fall out of the vehicle.
8. Remove the nuts from the u-bolts holding the spring to the axle tube.
9. Support the spring so that it cannot fall out of the vehicle.
10. Remove the lower bolt from the spring hanger.
11. Remove the spring bolt from the other end of the spring and remove the spring from the vehicle.

#### **⚠ WARNING**

**Damaged or worn spring bolts or hangers could result in sudden failure of the suspension causing severe bodily injury or property damage.**

12. Inspect the spring bolts and spring hangers for signs of wear or damage. If any wear or damage is found, then they must be replaced.

13. Install the new spring in reverse order.
14. If the spring hanger bolts do not have a grease fitting, lube the spring bushings before installing the spring.
15. Torque the spring hanger bolts to 20 ft-lbs.
16. Lower the vehicle.
17. Reconnect the main positive and negative cables at the batteries.
18. Remove the blocks from behind the wheels.
19. Release the parking brake and test drive the vehicle



*Typical Spring hanger*



## REPLACE THE FRONT SPRINGS



If a spring has failed or is fatigued, then it is recommended that both front springs are replaced as a set.

*HINT : In most vehicles it will be easier if the springs are replaced one at a time.*

### ⚠ WARNING

1. Make sure the key-switch is in the "OFF" position, then remove the key.
2. Place the forward-reverse switch in the center "OFF" position.
3. Set the park brake.
4. Place blocks under the front wheels to prevent vehicle movement.
5. Disconnect the main positive and negative cables at the batteries.

### ⚠ WARNING

**Always use a lifting strap, hoist, and jack stands, of adequate capacity to lift and support the vehicle. Failure to use lifting and support devices of rated load capacity may result in severe bodily injury.**

6. Raise the front of the vehicle and support with jack stands.
7. Tie up or support the front axle so it cannot fall out of the vehicle.
8. Unbolt the spring from the front axle beam.
9. Support the spring so that it cannot fall out of the vehicle.

### ⚠ WARNING

**Damaged or worn spring bolts or hangers could result in sudden failure of the suspension causing severe bodily injury or property damage.**

10. Remove the lower bolt from the spring hanger.
11. Remove the spring bolt from the other end of the spring and remove the spring from the vehicle.
12. Inspect the spring bolts and spring hangers for signs of wear or damage. If any wear or damage is found, then they must be replaced.
13. Install the new spring in reverse order.
14. If the spring hanger bolts do not have a grease fitting, lube the spring bushings before installing the spring.
15. Torque the spring hanger bolts to 20 ft-lbs.
16. If the spring bolts are equipped with grease fittings, lube them at this time.
17. Lower the vehicle.
18. Reconnect the main positive and negative cables at the batteries.
19. Remove the blocks from behind the wheels.
20. Release the parking brake and test drive the vehicle.

## **REPLACE THE SPRING BUSHINGS**



It is recommended that all front spring bushings are replaced as a set.

Your vehicle will be equipped with one of two types of spring bushings, internal and external (see illustration to the right):

- The internal bushing is a plastic insert that is pressed into the spring eye. There are one of these bushings for each spring eye.
- The external bushing consists of two plastic bushings on each end of the spring eye.
- Refer to the parts list to identify the bushings used in your vehicle.

### **⚠ WARNING**

- 1. Make sure the key-switch is in the "OFF" position, then remove the key.**
- 2. Place the forward-reverse switch in the center "OFF" position.**
- 3. Set the park brake.**
- 4. Place blocks under the front wheels to prevent vehicle movement.**
- 5. Disconnect the main positive and negative cables at the batteries.**

### **⚠ WARNING**

**Always use a lifting strap, hoist, and jack stands, of adequate capacity to lift and support the vehicle. Failure to use lifting and support devices of rated load capacity may result in severe bodily injury.**

6. Raise the front or rear of the vehicle depending on which spring is to be removed and support with jack stands.

7. Remove the spring from the vehicle.

*NOTE: Refer to **Replace the Front Springs** section for information regarding removing the front springs.*



8. If the vehicle is equipped with spring hangers, remove the spring hanger bolt from the vehicles frame.
9. Remove the spring bushing(s):
  - For internal bushing, press the spring bushings out of the two spring eyes and from the mounting eye on the vehicles frame.
  - For external bushing, Remove the bushings from the spring eye.
10. Install the new bushings in reverse order.

*HINT: Apply a light coating of grease to the bushing before pressing into the spring eye.*

11. Install the spring onto the vehicle.

*NOTE: Refer to **Replace the Front Springs** section for information regarding installing the front springs.*

12. Repeat for the other spring.
13. Lower the vehicle.
14. Reconnect the main positive and negative cables at the batteries.
15. Remove the blocks from behind the wheels.
16. Release the parking brake and test drive the vehicle.



## REPLACE THE SHOCKS



### Front

It is recommended to replace both front shocks as a set.

**NOTE:** On some vehicles it may be required to remove the front wheel to gain access to the shock mounting bolts. Refer to **Tires and Wheels** section for information regarding removing the front wheels.

### ⚠ WARNING

1. Make sure the key-switch is in the "OFF" position, then remove the key.
2. Place the forward-reverse switch in the center "OFF" position.
3. Set the park brake.
4. Place blocks under the front wheels to prevent vehicle movement.
5. Disconnect the main positive and negative cables at the batteries.

### ⚠ WARNING

Always use a lifting strap, hoist, and jack stands, of adequate capacity to lift and support the vehicle. Failure to use lifting and support devices of rated load capacity may result in severe bodily injury.

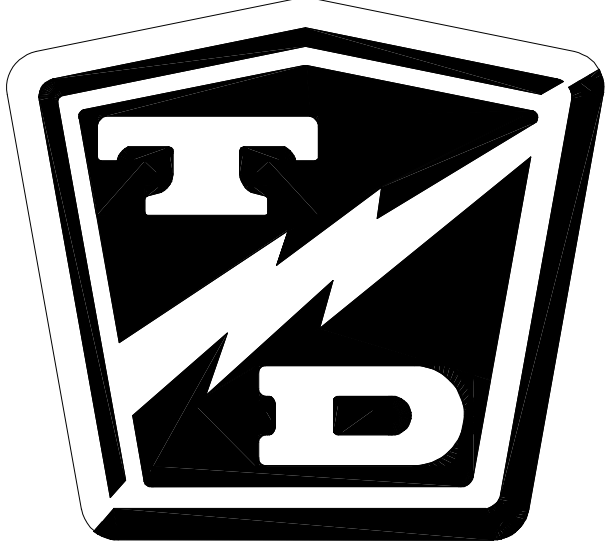
6. Some vehicles may require that the wheels be lifted off of the ground and supported with jack stands to replace the shocks.

7. Remove the upper and lower shock bolts.
8. Remove the shock from the vehicle.

**NOTE:** If the shock that was removed is to be reinstalled:

- A. Inspect the shaft where it enters the shock body for any signs of leakage. If any sign of leakage is seen, then the shock must be replaced.
  - B. Inspect the upper and lower shock bushings. If any signs of damage or wear are seen, then the shock must be replaced.
9. Install the shock in reverse order.
  10. Lower the vehicle.
  11. Reconnect the main positive and negative cables at the batteries.
  12. Remove the blocks from behind the wheels.
  13. Release the parking brake and test drive the vehicle.

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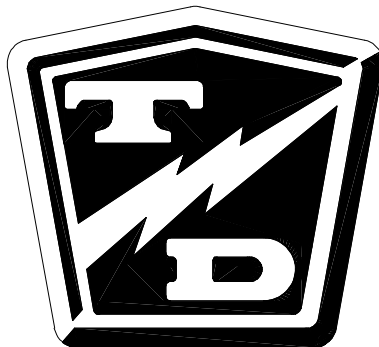


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# Tires and wheels

## TIRE INFLATION

### **⚠ WARNING**

1. **Make sure the key-switch is in the "OFF" position, then remove the key.**
2. **Place the forward-reverse switch in the center "OFF" position.**
3. **Set the park brake.**
4. **Place blocks under the front wheels to prevent vehicle movement.**
5. **Disconnect the main positive and negative cables at the batteries.**

There are many tire options available with varying tire pressures. Refer to the side wall of your tire for information regarding the tire pressure for your tires.

The illustration to the right is an example of the side wall information on a tire.

Tire pressures must be checked when the tire is cold.



## TIRE INSPECTION

6. Check the tire pressure. Refer to **Tire Inflation** section for information on checking the tire pressure.
7. Inspect the tire tread depth. Minimum recommended tread depth is 1/16-inch. There are a series of tread depth wear indicators around the circumference of the tire. They will appear as 1/2-inch bands across the tread as the tire approaches its wear limit (see illustration below). Replace the tire if any tread depth indicator can be seen or any part of the tread depth is 1/16-inch or less. Refer to **Replace the Tire** section for information regarding replacing the tire.



8. Inspect for uneven tire wear on the front tires. Uneven tire wear could be a result of an improperly inflated tire or a misaligned or damaged front end.

**NOTE:** Refer to **Tire Inflation** section or **Steering Component Service** section for information on proper tire inflation or front end wheel alignment.

9. Inspect the inner and outer side walls for cracks. If any cracks are seen, then the tire should be replaced. Refer to **Replace the Tire** section for information regarding replacing the tire.
10. Inspect the valve stem for cracks. If any cracks are seen, then the valve stem should be replaced. It is also recommended that the valve stem be replaced whenever the tire is replaced.

**NOTE:** Refer to **Replace the Tire** section for information regarding replacing the valve stem.

11. Inspect the tread and side walls for debris in the rubber that could lead to a puncture. If any debris is found it should be removed and the tire inspected for a leak.



## REPLACE THE TIRE/WHEEL

### **⚠ WARNING**

- 1. Make sure the key-switch is in the "OFF" position, then remove the key.**
- 2. Place the forward-reverse switch in the center "OFF" position.**
- 3. Set the park brake.**
- 4. Place blocks under the front wheels to prevent vehicle movement.**
- 5. Disconnect the main positive and negative cables at the batteries.**

6. Raise the wheel to be replaced off of the ground and support with jack stands.
7. Remove the 4 or 5 wheel nuts and remove the wheel.
8. Install in reverse order.
9. Following the pattern shown on the following page, cross tighten the wheel nuts in two stages as follows:
  - 1st stage to approximately 20 ft-lbs.
  - 2nd stage to 80-90 ft-lbs.
10. Reconnect the main positive and negative cables at the batteries.
11. Lower the wheel to the ground.
12. Remove the blocks from behind the wheels.
13. Release the parking brake and test drive the vehicle.

## REPLACE THE TIRE (PNEUMATIC)

*NOTE; To replace the tire, the tire/wheel assembly must be removed from the vehicle. Refer to **Replace the Tire/Wheel** section for information on removing the tire/wheel assembly.*

Tire replacement should only be performed by personnel trained in tire replacement.

The tire replacement procedure will be unique to the type of replacement equipment being used. Refer to the instructions provided with your equipment.

Always use a new valve stem when replacing a tire.

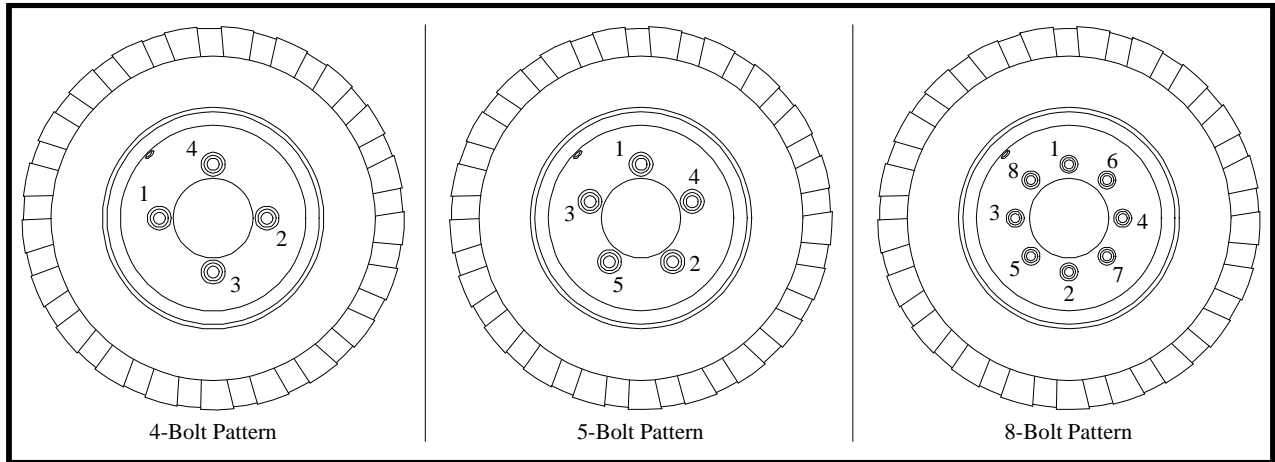
### **⚠ WARNING**

**Explosion Hazard. Fully deflate the tire before attempting to remove the tire from the wheel. Do not over inflate the tire when seating the bead. Failure to deflate the tire or over inflating the tire to seat the bead may cause explosive failure of the tire resulting in severe bodily injury or death.**

1. Remove the tire from the wheel.
2. Cut the old valve stem off of the wheel.
3. Remove the valve stem cap from the new valve stem.
4. Lubricate the valve stem with liquid soap.
5. Install a new valve stem using a valve stem tool.

*NOTE: The valve stem tool is available at most auto repair shops.*

6. Install the tire onto the wheel following the instructions provided with your tire replacement equipment.
7. Inflate the tire to the proper pressure and check for leaks.
8. Install the valve stem cap.



*Pattern for tightening the wheel nuts*

## **⚠ WARNING**

Re-torque all wheel nuts to their final value after 1-week (20-hours) of operation. Failure to re-torque the wheel nuts may result in the wheel coming off of the vehicle causing severe bodily injury and/or property damage.

## **REPAIR THE TIRE (PNEUMATIC)**

## **⚠ WARNING**

Do not attempt to repair a tire with a damaged side wall or a slice in the tread. This type of repair could fail prematurely resulting in severe bodily injury and/or property damage.

*NOTE: To properly repair a puncture, the tire must be removed from the wheel. Refer to **Replace the Tire** section for information on removing the tire from the wheel.*

It is recommended to repair a tire with a combination vulcanized plug and internal patch.

Tire repairs should only be performed by personnel trained in tire repair.

The tire repair procedure will be unique to the type of repair equipment or repair components used. Refer to the instructions provided with your equipment or repair components.



## REPLACE THE TIRE (PNEUMATIC)

*NOTE: To replace the tire, the tire/wheel assembly must be removed from the vehicle. Refer to **Replace the Tire/Wheel** section for information on removing the tire/wheel assembly.*

### **⚠ WARNING**

**Explosion Hazard. Fully deflate the tire before attempting to remove the tire from the wheel. Do not over inflate the tire when seating the bead. Failure to deflate the tire or over inflating the tire to seat the bead may cause explosive failure of the tire resulting in severe bodily injury or death.**

Tire replacement should only be performed by personnel trained in tire replacement.

The tire replacement procedure will be unique to the type of replacement equipment being used. Refer to the instructions provided with your equipment.

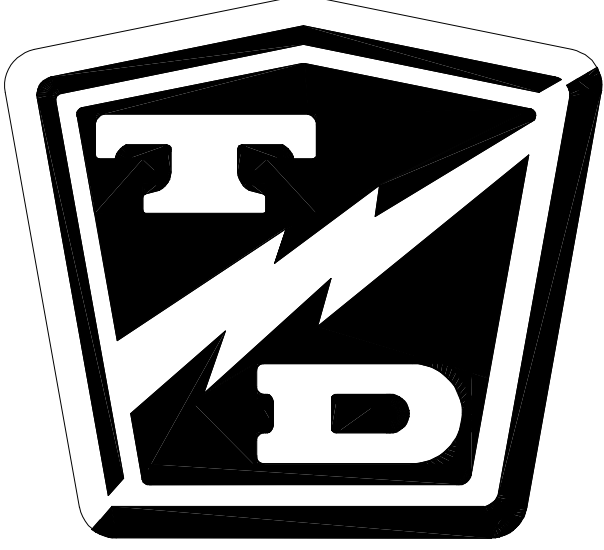
Always use a new valve stem when replacing a tire.

1. Remove the tire from the wheel.
2. Cut the old valve stem off of the wheel.
3. Remove the valve stem cap from the new valve stem.
4. Lubricate the valve stem with liquid soap.
5. Install a new valve stem using a valve stem tool.

*NOTE: The valve stem tool is available at most auto repair shops.*

6. Install the tire onto the wheel following the instructions provided with your tire replacement equipment.
7. Inflate the tire to the proper pressure and check for leaks.
8. Install the valve stem cap.

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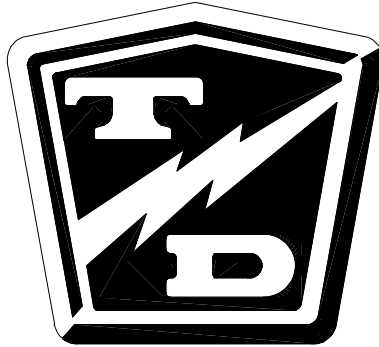


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# Battery Service



## CLEANING

### **⚠ WARNING**

Explosive mixtures of Hydrogen gas are present within battery cells at all times. Do not work with or charge battery in an area where open flames (including gas furnace or water heater pilots), sparks, cigarettes, or any other sources of combustion are present. Always provide ample ventilation in rooms where batteries are being charged. Failure to do so may result in severe bodily injury and/or property damage.

### **⚠ WARNING**

Battery electrolyte is poisonous and dangerous. It contains sulfuric acid. Avoid contact with skin eyes or clothing. Wear rubber gloves and safety glasses while servicing batteries. **DO NOT INGEST!** This may result in severe bodily injury.

### **⚠ WARNING**

A battery is a live electrical source. It cannot be disconnected or neutralized. Do not drop any tool or conductive object onto the battery. A conductive object that comes in contact with the battery terminals will initiate a short circuit of the battery. This could cause the battery to explode resulting in severe bodily injury and/or property damage.

### **⚠ CAUTION**

Battery electrolyte will stain and corrode most surfaces. Immediately and thoroughly clean any surface outside of the battery that the battery electrolyte comes in contact with. Failure to clean may result in property damage.

### **⚠ WARNING**

1. Make sure the key-switch is in the "OFF" position, then remove the key.
2. Place the forward-reverse switch in the center "OFF" position.
3. Set the park brake.
4. Place blocks under the front wheels to prevent vehicle movement.
5. Disconnect the main positive and negative cables at the batteries.

6. Dry dirt can be readily blown off with low-pressure air or brushed off.
7. Wetness or wet dirt on the batteries indicates battery acid. Using a nonmetallic brush with flexible bristles, wash the batteries off with a strong solution of baking soda and hot water (1 lb. of soda to a gallon of water). Continue until all fizzing stops, which indicates that the acid has been neutralized. Then rinse thoroughly with clear water. **DO NOT** get any of the solution into the battery cells.
8. Reconnect the batteries, remove the blocks from the wheels and test drive.



## TESTING

### ⚠ WARNING

Explosive mixtures of Hydrogen gas are present within battery cells at all times. Do not work with or charge battery in an area where open flames (including gas furnace or water heater pilots), sparks, cigarettes, or any other sources of combustion are present. Always provide ample ventilation in rooms where batteries are being charged. Failure to do so may result in severe bodily injury and/or property damage.

### ⚠ WARNING

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Battery electrolyte will stain and corrode most surfaces. Immediately and thoroughly clean any surface outside of the battery that the battery electrolyte comes in contact with. Failure to clean may result in property damage.

### ⚠ WARNING

1. Make sure the key-switch is in the "OFF" position, then remove the key.
2. Place the forward-reverse switch in the center "OFF" position.
3. Set the park brake.
4. Place blocks under the front wheels to prevent vehicle movement.
5. Disconnect the main positive and negative cables at the batteries.

*NOTE: A combination of the Load Test and Specific Gravity Test should be used to accurately determine the condition of the batteries.*

### Load Test (6-volt batteries only)

*NOTE: The batteries must be fully charged before performing this test.*

1. Clean the batteries. Refer to **Cleaning the Batteries** section for information on cleaning the batteries.
2. Load test each battery using a battery load test meter (available at most auto parts distributors). Follow the instructions provided with the test meter.
  - If any battery fails the load test, then it should be replaced.

*NOTE: If the batteries are over one year old, it is recommended to replace them as a set.*

- If all batteries fail the test you should check the charging system before replacing the batteries. Refer to **Charger Troubleshooting** section for information on checking the charging system.

### Specific Gravity Test

*NOTE: The batteries must be fully charged before performing this test.*

The specific gravity of a cell is an indication of the actual state of charge of the cell. A fully charged cell should have a reading of 1275 to 1300 (see the illustration to the right). A discharged battery will read 1100. Ideally, all cells in a battery pack will have the same reading. Any cells in a battery pack that vary by more than 30-points may be an indication of a bad cell.



## Maintenance, Service, and Repair

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Clean the batteries. Refer to ***Cleaning the Batteries*** section for information on cleaning the batteries.

Using part number **77-200-00** hydrometer, check and record the specific gravity of each cell in the battery pack.

If, after charging, none of the cells exceed a hydrometer reading of 1250 then there may be a fault in the charging system. If the charging system checks OK then the batteries are no longer accepting a charge and should be replaced.

*NOTE: Refer to **Charger Troubleshooting** for information on checking the charging system.*

The highest reading will be the cell that is accepting the most charge. This reading will be used to gauge all other cells.

Compare the specific gravity readings to the highest reading, if the difference between any of the cells is more than 30-points, then that battery should be replaced.

*NOTE: If the batteries are over one year old, it is recommended to replace them as a set.*

Reconnect the batteries, remove the blocks from the wheels and test drive.



*Typical Hydrometer Float*

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## CHARGING

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Refer to ***Charging Your Vehicle*** in section **Safety Rules and Operating Instructions**.



## WATERING

### ⚠ WARNING

Explosive mixtures of Hydrogen gas are present within battery cells at all times. Do not work with or charge battery in an area where open flames (including gas furnace or water heater pilots), sparks, cigarettes, or any other sources of combustion are present. Always provide ample ventilation in rooms where batteries are being charged. Failure to do so may result in severe bodily injury and/or property damage.

### ⚠ WARNING

Battery electrolyte is poisonous and dangerous. It contains sulfuric acid. Avoid contact with skin eyes or clothing. Wear rubber gloves and safety glasses while servicing batteries. **DO NOT INGEST!** This may result in severe bodily injury.

### ⚠ CAUTION

Battery electrolyte will stain and corrode most surfaces. Immediately and thoroughly clean any surface outside of the battery that the battery electrolyte comes in contact with. Failure to clean may result in property damage.

### ⚠ WARNING

A battery is a live electrical source. It cannot be disconnected or neutralized. Do not drop any tool or conductive object onto the battery. A conductive object that comes in contact with the battery terminals will initiate a short circuit of the battery. This could cause the battery to explode resulting in severe bodily injury and/or property damage.

### ⚠ WARNING

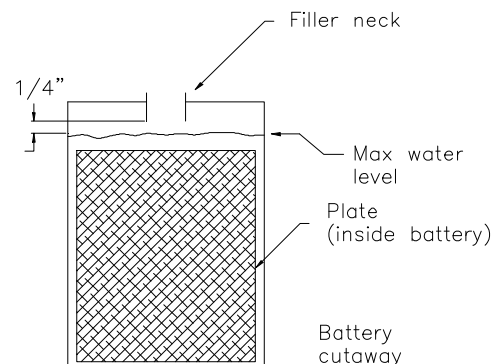
Do not overfill the batteries. Over filling the batteries may cause the battery electrolyte to boil out of the battery and result in severe bodily injury or property damage.

### ⚠ WARNING

1. Make sure the key-switch is in the "OFF" position, then remove the key.
2. Place the forward-reverse switch in the center "OFF" position.
3. Set the park brake.
4. Place blocks under the front wheels to prevent vehicle movement.
5. Disconnect the main positive and negative cables at the batteries.

*NOTE: The electrolyte level in a battery rises while charging and will be close to its highest level after the end of a charging cycle. It is recommended to fill the batteries at the end of a charging cycle. If the electrolyte is below the top of the battery plates then fill just enough to cover the plates and then top off when the charging cycle is complete.*

6. Clean the batteries. Refer to **Cleaning the Batteries** section for information on cleaning the batteries.
7. Check the electrolyte level in all battery cells. If low, fill to the correct level with distilled water using part number **77-201-00** battery filler, never add additional battery electrolyte to the batteries.
8. Reconnect the batteries, remove the blocks from the wheels and test drive.





### REPLACING (6-VOLT BATTERIES ONLY)

#### ⚠ WARNING

Explosive mixtures of Hydrogen gas are present within battery cells at all times. Do not work with or charge battery in an area where open flames (including gas furnace or water heater pilots), sparks, cigarettes, or any other sources of combustion are present. Always provide ample ventilation in rooms where batteries are being charged. Failure to do so may result in severe bodily injury and/or property damage.

#### ⚠ WARNING

Battery electrolyte is poisonous and dangerous. It contains sulfuric acid. Avoid contact with skin eyes or clothing. Wear rubber gloves and safety glasses while servicing batteries. **DO NOT INGEST!** This may result in severe bodily injury.

#### ⚠ CAUTION

Battery electrolyte will stain and corrode most surfaces. Immediately and thoroughly clean any surface outside of the battery that the battery electrolyte comes in contact with. Failure to clean may result in property damage.

#### ⚠ WARNING

A battery is a live electrical source. It cannot be disconnected or neutralized. Do not drop any tool or conductive object onto the battery. A conductive object that comes in contact with the battery terminals will initiate a short circuit of the battery. This could cause the battery to explode resulting in severe bodily injury and/or property damage.

*NOTE: If the batteries are over one year old, it is recommended to replace them as a set.*

#### ⚠ WARNING

1. Make sure the key-switch is in the "OFF" position, then remove the key.
2. Place the forward-reverse switch in the center "OFF" position.
3. Set the park brake.
4. Place blocks under the front wheels to prevent vehicle movement.
5. Disconnect the main positive and negative cables at the batteries.

6. Thoroughly clean the batteries and battery compartment. Refer to **Cleaning** in this section for information regarding cleaning the batteries.
7. Remove the battery hold downs.
8. Inspect the battery hold downs for corrosion. If any signs of corrosion are seen then the battery hold downs should be replaced.

#### ⚠ WARNING

**Do not leave cables on batteries that have been removed from the vehicle. Cables left on batteries could cause a short circuit resulting in battery explosion, severe bodily injury and/or property damage.**

9. Remove all battery jumpers from both posts of the battery or batteries being replaced.

*NOTE: It is recommended to replace the battery jumpers when replacing the batteries.*

10. Remove the batteries from the vehicle.
11. Inspect the battery compartment for signs of corrosion.
12. If minimal signs of corrosion are seen, then the damaged paint should be stripped off and the entire battery compartment prepped and repainted.
13. If there are excessive signs of corrosion, then it may be necessary to replace some of the frame members or completely rebuild the battery compartment.
14. Inspect the main positive and negative cables and terminals, charger cables and terminals and 12-volt tap wiring. If any of the terminals or wires show signs of corrosion, then they must be repaired or replaced.



15. Install the batteries in reverse order. Refer to the *Illustrated Parts List* for battery cable routing.
16. It is recommended to replace the battery terminal hardware when replacing the batteries.

## ⚠ CAUTION

**When torquing battery hardware, use a backup wrench on the battery bolt and tighten the nut. Failure to use a backup wrench may damage the battery post.**

17. Torque the terminal hardware to 7-8 ft.-lbs.
18. Tighten the hold downs so that the batteries are secure but not so tight as to deform the batteries.
19. Remove the blocks from the wheels and test drive.

## Moist Charge Batteries

Moist charged batteries are shipped without battery electrolyte. This allows for a much greater shelf life of the battery. Moist charged batteries must be filled with electrolyte and charged before putting into service. Battery electrolyte is a solution of acid and water that is formulated to be used in wet lead acid batteries and is available at most automotive parts distributors that carry batteries.

## ⚠ CAUTION

**Do not operate or charge a vehicle equipped with moist charged batteries until the batteries have been filled with electrolyte and charged. Operating or charging moist charged batteries before filling and charging will damage the batteries resulting in premature failure of the batteries.**

## ⚠ CAUTION

**Battery electrolyte will stain and corrode most surfaces. Immediately and thoroughly clean any surface outside of the battery that the battery electrolyte comes in contact with. Failure to clean may result in property damage.**

## ⚠ WARNING

**Battery electrolyte is poisonous and dangerous. It contains sulfuric acid. Avoid contact with skin eyes or clothing. Wear rubber gloves and safety glasses while servicing batteries. DO NOT INGEST! This may result in severe bodily injury.**

## ⚠ WARNING

**A battery is a live electrical source. It cannot be disconnected or neutralized. Do not drop any tool or conductive object onto the battery. A conductive object that comes in contact with the battery terminals will initiate a short circuit of the battery. This could cause the battery to explode resulting in severe bodily injury and/or property damage.**

## ⚠ WARNING

1. Make sure the key-switch is in the "OFF" position, then remove the key.
2. Place the forward-reverse switch in the center "OFF" position.
3. Set the park brake.
4. Place blocks under the front wheels to prevent vehicle movement.
5. Disconnect the main positive and negative cables at the batteries.

6. Fill all battery cells with electrolyte to the proper level.
7. Thoroughly clean any spilled electrolyte from the batteries or the ground. Refer to *Cleaning the Batteries* for information on cleaning the batteries.
8. Reconnect the battery cables, connect the batteries to the charger and allow the charger to complete one charging cycle.
9. Remove the blocks from the wheels and test drive. The batteries are now ready to be put into service.

## **STORAGE AND RETURNING TO SERVICE**

### **⚠ WARNING**

Explosive mixtures of Hydrogen gas are present within battery cells at all times. Do not work with or charge battery in an area where open flames (including gas furnace or water heater pilots), sparks, cigarettes, or any other sources of combustion are present. Always provide ample ventilation in rooms where batteries are being charged. Failure to do so may result in severe bodily injury and/or property damage.

### **⚠ WARNING**

1. Make sure the key-switch is in the "OFF" position, then remove the key.
2. Place the forward-reverse switch in the center "OFF" position.
3. Set the park brake.
4. Place blocks under the front wheels to prevent vehicle movement.
5. Disconnect the main positive and negative cables at the batteries.

### **⚠ WARNING**

Battery electrolyte is poisonous and dangerous. It contains sulfuric acid. Avoid contact with skin eyes or clothing. Wear rubber gloves and safety glasses while servicing batteries. **DO NOT INGEST!** This may result in severe bodily injury.

### **⚠ CAUTION**

If the batteries are removed from the vehicle, do not place them directly on the ground, concrete or solid metal surface. It is recommended to store them on a wooden pallet or equivalent. Storing on the ground, concrete or solid metal surface will cause the batteries to discharge and may result in premature failure of the batteries.

### **⚠ WARNING**

A battery is a live electrical source. It cannot be disconnected or neutralized. Do not drop any tool or conductive object onto the battery. A conductive object that comes in contact with the battery terminals will initiate a short circuit of the battery. This could cause the battery to explode resulting in severe bodily injury and/or property damage.

### **Storage**

Thoroughly clean the batteries and battery compartment. Refer to **Cleaning** in this section for information regarding cleaning the batteries.

Check the electrolyte level and charge the batteries. Refer to **Watering** in this section for information regarding checking the electrolyte level.

Store the vehicle or batteries in a cool, dry, well ventilated area.

If storing for more than one month, the batteries should be charged as follows:

### **⚠ CAUTION**

Battery electrolyte will stain and corrode most surfaces. Immediately and thoroughly clean any surface outside of the battery that the battery electrolyte comes in contact with. Failure to clean may result in property damage.

Storage Temperature (F)	Charging Interval (months)
Over 60	1
Between 40 and 60	2
Below 40	6

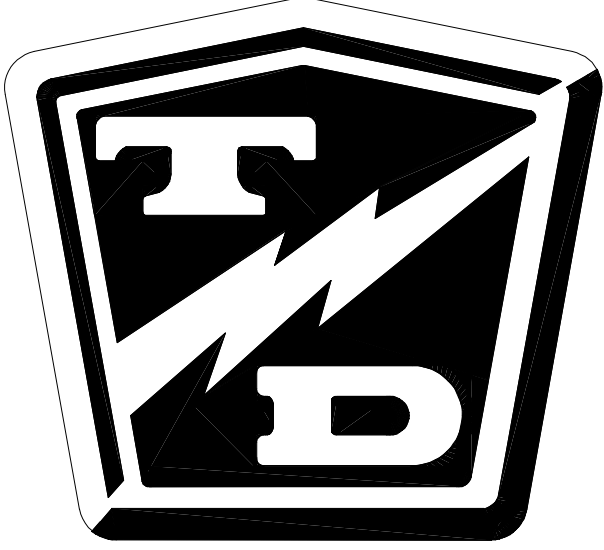


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**Returning to Service****⚠ WARNING**

- 1. Make sure the key-switch is in the "OFF" position, then remove the key.**
  - 2. Place the forward-reverse switch in the center "OFF" position.**
  - 3. Set the park brake.**
  - 4. Place blocks under the front wheels to prevent vehicle movement.**
  - 5. Disconnect the main positive and negative cables at the batteries.**
- 
6. Thoroughly clean the batteries and battery compartment. Refer to ***Cleaning*** in this section for information regarding cleaning the batteries.
  7. Check the electrolyte level and charge the batteries. Refer to ***Watering*** in this section for information regarding checking the electrolyte level.
  8. Test the batteries. Refer to ***Testing*** section for information on testing the batteries.
  9. The batteries are now ready to be put back into service.

**TAYLOR - DUNN**



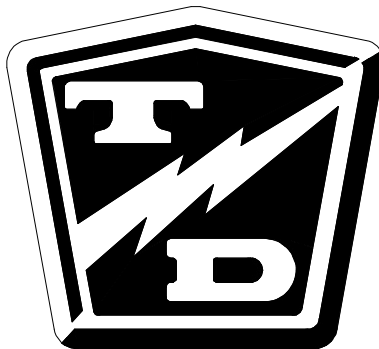
# Electrical Troubleshooting

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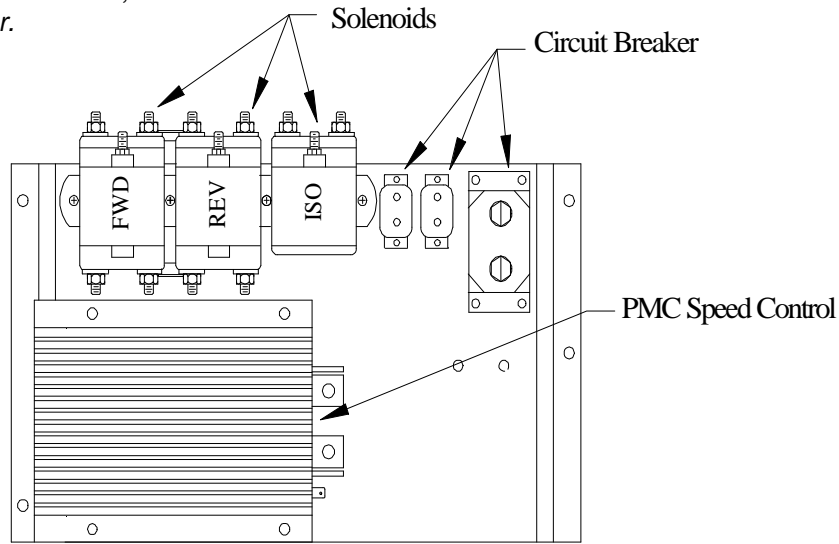
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Note: Vehicles with Dana H12 transmission,  
Forward solenoid is in the center.



Typical Control Panel

## **SYMPTOMS:**

If your vehicle exhibits any of the following symptoms then skip the main troubleshooting sequence and proceed to **Symptom Troubleshooting** later in this section.

- Runs slow in both directions plus high armature and field current in both directions. NOTE: Armature and field current should be equal.
- Runs slow in both directions plus high armature current in both directions. NOTE: Field current will be very low.
- Runs normal in one direction only plus runs slow or lacks power in the opposite direction with high armature current in the opposite direction or;
- Accelerates slowly and exceeds normal speed in the opposite direction with high armature current only. NOTE: Field current will be very low in the opposite direction.
- Accelerates slowly and exceeds normal speed in both directions plus high armature current. NOTE: Field current will be very low.
- Full speed only.
- Does not run in either direction plus there is noise from motor (hum or whine) with high field current and low armature current.
- Jumps into high speed when direction is selected after depressing the accelerator pedal. Excessive spark when connecting battery
- Does not run or runs very slow with low motor current and high battery current.
- Jumps into high speed when direction is selected after depressing the accelerator pedal.

If your vehicle does not exhibit any of the above symptoms then continue with the main troubleshooting sequence on the following pages.



## **READ THIS FIRST**

### **Test Equipment Required:**

- Digital multimeter (DMM) with diode test function, FLUKE 79 model used in illustrations.
- Shunt or clamp-on DC Ammeter to measure up to 400 amps.
- Test light with a rated voltage equal to or exceeds maximum battery voltage or Taylor-Dunn test light part number #62-027-00 for systems up to 48 volts.
- Throttle Module Analyzer, Taylor-Dunn #62-027-32.
- These tools are available through your local Taylor-Dunn parts distributor.

### **IMPORTANT NOTES and INSTRUCTIONS**

- This troubleshooting guide assumes that the vehicle is wired correctly. It is not intended to diagnose a vehicle that is not wired correctly.
- This troubleshooting guide is not written to be able to locate a problem if there are multiple component failures.
- This troubleshooting guide assumes the batteries are good. Charge and test the batteries before troubleshooting the control system.
- **DO NOT** start in the middle of this troubleshooting guide. Start at the beginning and complete each test in the order that they are written **DO NOT** skip any test unless instructed to do so. Once a problem is found, stop testing and repair the indicated problem. When the repair is completed it is recommended that the control system be retested before lowering the drive wheels to the ground.
- This troubleshooting guide requires the use of a test light rated at the battery voltage of the truck and the Taylor-Dunn Throttle Module Analyzer. **Troubleshooting CANNOT be completed without these tools.**

## **⚠ CAUTION**

**These test procedures must be performed in the order they were written. If the test result is good, then proceed to the next test or go to the next section. Failure to do so may result in incorrect test results.**



## Definitions:

- “MS-1” = The first switch in the accelerator module.
- “Battery volts” = The voltage at the batteries at the time the test is completed.
- “Pick up” = Energizing a solenoid or contactor.
- “F&R” = Forward and Reverse.
- “ISO” = Isolator.
- “Battery negative” = Main negative battery post.
- “Battery positive” = Main positive battery post.
- “PMC” = Speed control module (black box).
- “HOT terminal” = The side of a switch or solenoid that is connect to the power source.
- “COLD terminal” = The side of a switch or solenoid that power is switched to.

## DURING ALL TESTS

### **⚠ WARNING**

**After any repairs are made, completely retest the vehicle before lowering the drive wheels to the ground. Failure to retest the vehicle could result in unexpected movement of the vehicle resulting in severe bodily injury and/or property damage.**

### **⚠ WARNING**

**The rear drive wheels may rotate during some of the following tests. Block the front wheels, raise the rear drive wheels off the ground, and support the vehicle with jack stands. Failure to do so may cause the vehicle to move and cause severe bodily injury and/or property damage.**

### **⚠ WARNING**

**Rotating rear drive wheels are a potential hazard. Keep hands, arms, legs and loose clothing away from the rear drive wheels while conducting tests. Failure to do so may cause serious bodily injury.**

### **⚠ WARNING**

**Disconnect both of the battery leads during any maintenance or before disconnecting any electrical component or wire. Failure to do so may cause severe bodily injury and/or property damage.**

## START:

Read all warnings above before continuing.

If the vehicle runs normal in one direction but does not run in the opposite direction then go to the ***Solenoids*** sequence.

If none of the three solenoids pick up (click) when the accelerator pedal is depressed then go to the ***Forward & Reverse Switch*** sequence.

**Power Output Test**

**⚠ WARNING**

The rear drive wheels may rotate during some of the following tests. Block the front wheels, raise the rear drive wheels off the ground, and support the vehicle with jack stands. Failure to do so may cause the vehicle to move and cause severe bodily injury and/or property damage.

Rotating rear drive wheels are a potential hazard. Keep hands, arms, legs and loose clothing away from the rear drive wheels while conducting tests. Failure to do so may cause serious bodily injury.

**⚠ WARNING**

1. Make sure the key-switch is in the "OFF" position, then remove the key.
2. Place the forward-reverse switch in the center "OFF" position.
3. Set the park brake.
4. Place blocks under the front wheels to prevent vehicle movement.

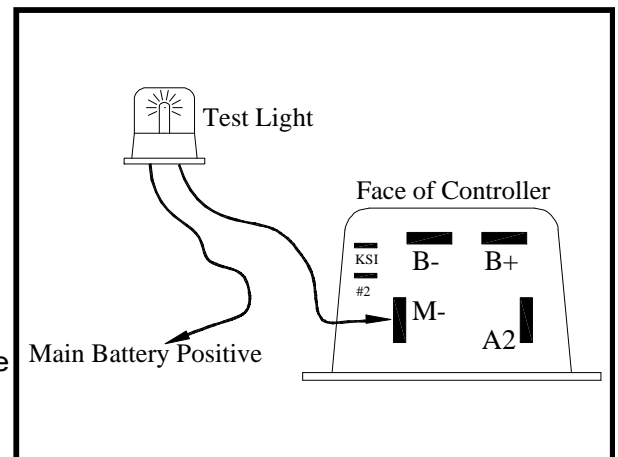
Set the test light voltage to the same voltage as the battery volts.

Connect the test light from the PMC 'M-' Terminal to battery positive.

Close all interlock switches, turn the Key Switch ON, and place the F&R Switch in Forward.

**Depress the accelerator pedal fully.**

- If the light comes ON then go to the Motor sequence.
- If the light does not come ON then continue with the next test.



**Control Wire Inputs**

**⚠ WARNING**

The rear drive wheels may rotate during some of the following tests. Block the front wheels, raise the rear drive wheels off the ground, and support the vehicle with jack stands. Failure to do so may cause the vehicle to move and cause severe bodily injury and/or property damage.

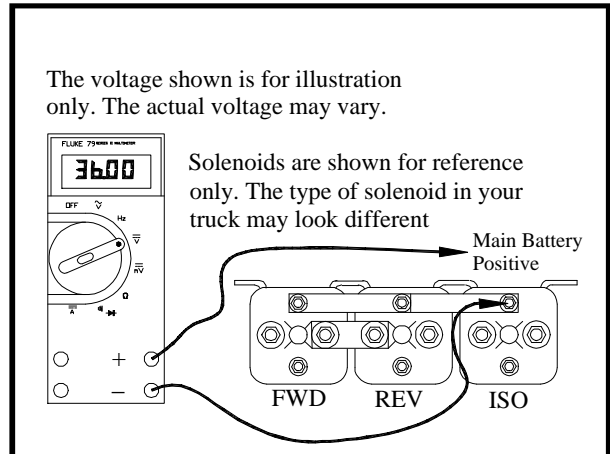
Rotating rear drive wheels are a potential hazard. Keep hands, arms, legs and loose clothing away from the rear drive wheels while conducting tests. Failure to do so may cause serious bodily injury.

**⚠ WARNING**

1. Make sure the key-switch is in the "OFF" position, then remove the key.
2. Place the forward-reverse switch in the center "OFF" position.
3. Set the park brake.
4. Place blocks under the front wheels to prevent vehicle movement.

Connect a voltmeter across the Solenoid Negative Buss Bar and battery positive.

- If the voltage is not at battery volts then check the wiring to battery negative and the negative circuit breaker. Stop trouble shooting here and repair the problem. When the repair is completed, completely retest the vehicle before lowering the drive wheels to the ground.

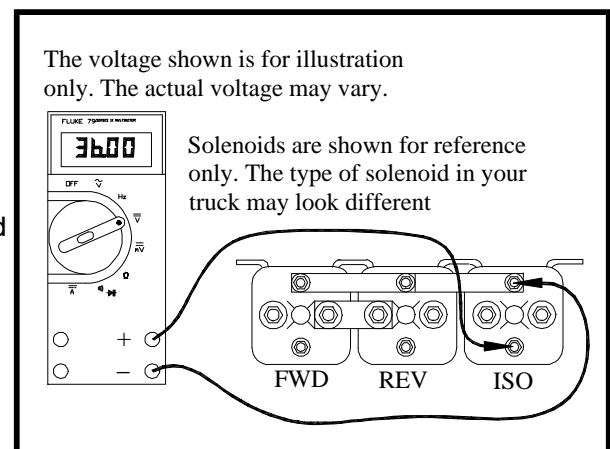


Connect a voltmeter across the ISO solenoid coil terminals.

**Close all interlock switches and turn the Key Switch ON.**

**Depress the accelerator pedal to engage MS-1 only.**

- If the voltage is not at battery volts then go to the **Key Switch** sequence.
- If the voltage is at battery volts and the ISO solenoid does not pick up (click) then the ISO solenoid has failed. Stop trouble shooting here and repair the problem. When the repair is completed, completely retest the vehicle before lowering the drive wheels to the ground.



*Note: Vehicles with Dana H12 transmission, Forward solenoid is in the center.*

Connect a voltmeter across the PMC #2 terminal and battery negative.

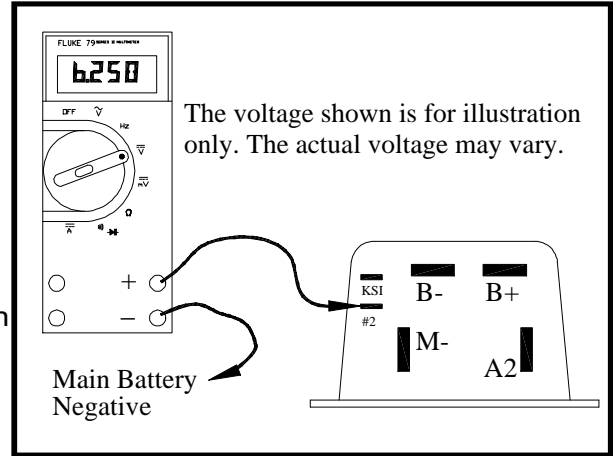
Close all interlock switches, turn the Key Switch ON, and place the F&R Switch in Forward.

**Depress the accelerator pedal to engage MS-1 only.**

- If the voltage is not between 6.0 and 6.5 volts then go to the **Accelerator** sequence.

**Depress the pedal fully.**

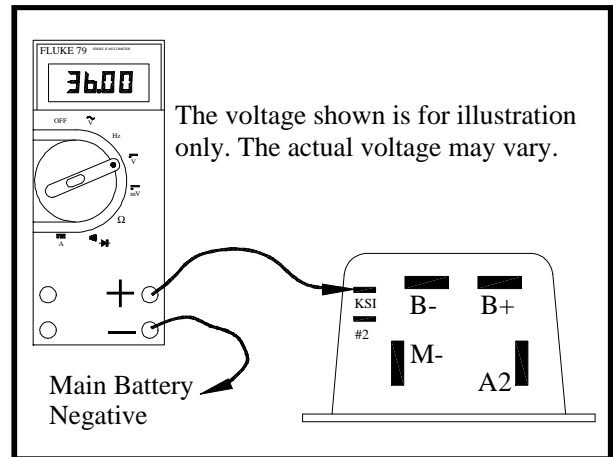
- If the voltage is not between 11.0 and 11.5 volts then go to the **Accelerator** sequence.



Connect voltmeter across the PMC KSI terminal and battery negative.

**With the pedal still fully depressed:**

- If the voltage is not at battery volts then go to the **Key Switch** sequence.
- If the voltage is at battery volts then continue with the next test.



**Power Wire Inputs**

**⚠ WARNING**

The rear drive wheels may rotate during some of the following tests. Block the front wheels, raise the rear drive wheels off the ground, and support the vehicle with jack stands. Failure to do so may cause the vehicle to move and cause severe bodily injury and/or property damage.

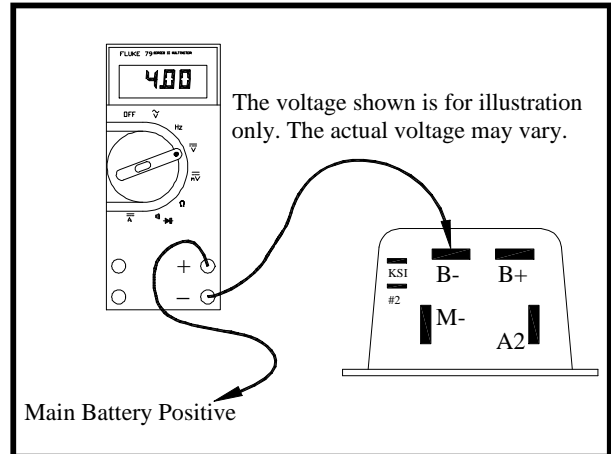
Rotating rear drive wheels are a potential hazard. Keep hands, arms, legs and loose clothing away from the rear drive wheels while conducting tests. Failure to do so may cause serious bodily injury.

**⚠ WARNING**

1. Make sure the key-switch is in the "OFF" position, then remove the key.
2. Place the forward-reverse switch in the center "OFF" position.
3. Set the park brake.
4. Place blocks under the front wheels to prevent vehicle movement.

Connect a voltmeter to the PMC 'B-' terminal and battery positive.

- If the voltage is not the same as battery volts then there is an open circuit in the wire from 'B-' to the battery. Stop troubleshooting here and repair the problem. When the repair is completed, completely retest the vehicle before lowering the drive wheels to the ground.

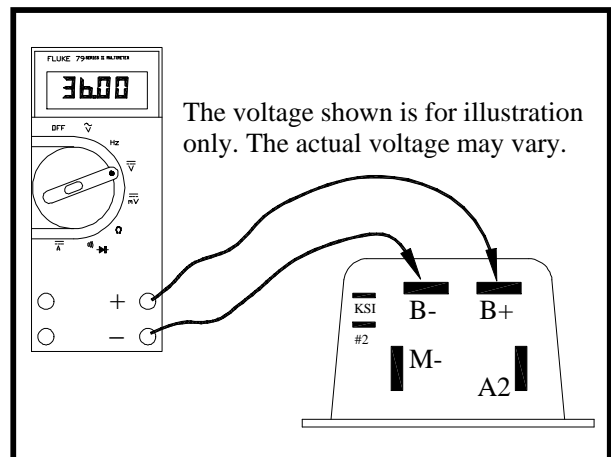


Connect a voltmeter across the PMC 'B-' terminal and the PMC 'B+' terminal.

**Close all interlock switches, turn the Key Switch ON, and place the F&R Switch in Forward.**

**Depress the accelerator pedal to engage MS-1 only.**

- If the voltage is not the same as battery volts then go to the **Solenoids** sequence.
- If the voltage is the same as battery volts then the PMC controller has failed. Stop trouble shooting here and repair the problem. When the repair is completed, completely retest the vehicle before lowering the drive wheels to the ground.



**Motor**

**⚠ WARNING**

The rear drive wheels may rotate during some of the following tests. Block the front wheels, raise the rear drive wheels off the ground, and support the vehicle with jack stands. Failure to do so may cause the vehicle to move and cause severe bodily injury and/or property damage.

Rotating rear drive wheels are a potential hazard. Keep hands, arms, legs and loose clothing away from the rear drive wheels while conducting tests. Failure to do so may cause serious bodily injury.

**⚠ WARNING**

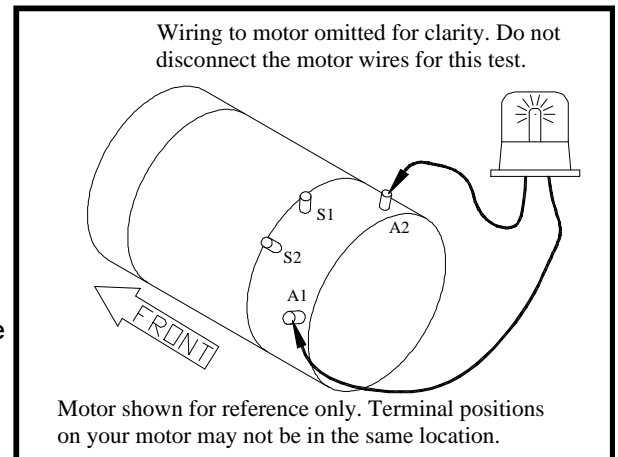
1. Make sure the key-switch is in the "OFF" position, then remove the key.
2. Place the forward-reverse switch in the center "OFF" position.
3. Set the park brake.
4. Place blocks under the front wheels to prevent vehicle movement.

Set the test light voltage to the same voltage as the battery volts.

Connect the test light across the motor 'A1' and 'A2' terminals.

**Close all interlock switches, turn the Key Switch ON, and place the F&R Switch in Forward. Depress the accelerator fully.**

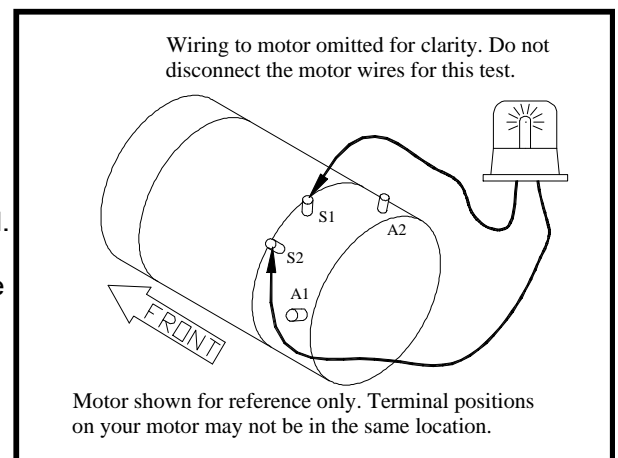
- If the light comes on then the motor armature windings are open and the motor must be repaired or replaced. Stop trouble shooting here and repair the problem. When the repair is completed, completely test the vehicle before lowering the drive wheels to the ground.



Connect the test light across the motor 'S1' and 'S2' terminals.

**Close all interlock switches, turn the Key Switch ON, and place the F&R Switch in Forward. Depress the accelerator fully.**

- If the light comes on then the motor field windings are open and the motor must be repaired or replaced. Stop trouble shooting here and repair the problem. When the repair is completed, completely retest the vehicle before lowering the drive wheels to the ground.
- If the test light did not come on during either test then go to the **F/R Switch** sequence.





**Accelerator**

**⚠ WARNING**

The rear drive wheels may rotate during some of the following tests. Block the front wheels, raise the rear drive wheels off the ground, and support the vehicle with jack stands. Failure to do so may cause the vehicle to move and cause severe bodily injury and/or property damage.

Rotating rear drive wheels are a potential hazard. Keep hands, arms, legs and loose clothing away from the rear drive wheels while conducting tests. Failure to do so may cause serious bodily injury.

**⚠ WARNING**

1. Make sure the key-switch is in the "OFF" position, then remove the key.
2. Place the forward-reverse switch in the center "OFF" position.
3. Set the park brake.
4. Place blocks under the front wheels to prevent vehicle movement.

With the power switch OFF, connect a throttle module to the analyzer.

Position the power switch to the 6-11 volt range.

All but the power lamp should be OFF. If the FS-1, FS-3 or OV lamp (Over Voltage) are ON, then the module is faulty.

Depress the lever on the module. The FS-1 lamp should be ON with no more that a few degrees of rotation. If the FS-1 lamp does not come on, then the module is faulty (see note2 below).

The voltage on the digital display should vary with the position of the module arm, starting at approximately 6-volts and ending at approximately 11-volts.

If the module is equipped with the FS-3 switch, the FS-3 lamp should come ON when the module arm is rotated to the full speed position. If the lamp does not come ON then the module is faulty.

*Note1: Current versions of the throttle module do not have additional switched output (FS-3 fully depressed). additional switched output was only used on PT-II cc systems and Power-Tron 240, 350, or 480 systems that equipped with the Power Plus module.*

If the OV lamp comes ON at any time, then the module is faulty.

If the Low battery lamp is ON, then the analyzer battery should be replaced.

Additional information regarding the analyzer can be found in the instructions provided with the analyzer (D0-110-53)

If the module functions correctly with the analyzer but not on the vehicle it is likely that there is a fault in the vehicle wiring.



**NOTE2:** Failures of the FS-1 circuit indicate a possible vehicle wiring fault that has resulted in a short circuit across FS-1. **BEFORE REPLACING THE MODULE:** Confirm that there are no shorts in the vehicle wiring or components. Installing a replacement module in a vehicle with faulty wiring will burn out the new module.

**Key Switch**

**⚠ WARNING**

The rear drive wheels may rotate during some of the following tests. Block the front wheels, raise the rear drive wheels off the ground, and support the vehicle with jack stands. Failure to do so may cause the vehicle to move and cause severe bodily injury and/or property damage.

Rotating rear drive wheels are a potential hazard. Keep hands, arms, legs and loose clothing away from the rear drive wheels while conducting tests. Failure to do so may cause serious bodily injury.

**⚠ WARNING**

1. Make sure the key-switch is in the "OFF" position, then remove the key.
2. Place the forward-reverse switch in the center "OFF" position.
3. Set the park brake.
4. Place blocks under the front wheels to prevent vehicle movement.

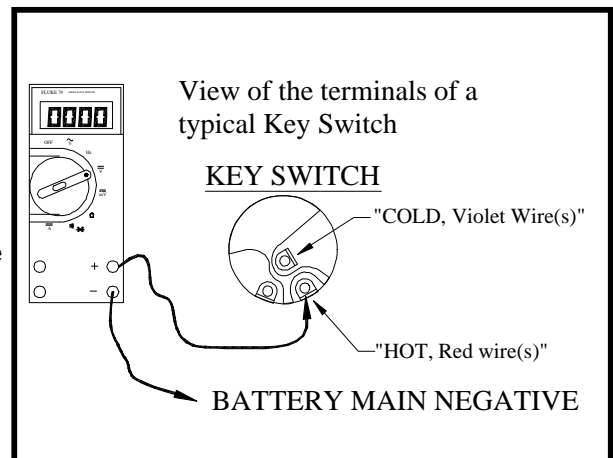
Test all interlock switches and/or interlock relays (if equipped) for continuity. Depending on the model of your vehicle, it may have a seat interlock, Foot interlock, Charger interlock, special order interlock or any combination of the above. Refer to the wire diagram at the end of this section for location of the interlocks.

*NOTE: Due to the many different configurations possible for special order interlocks, they will not be included in this text. Refer to the option list for your truck or contact your Taylor-Dunn® Representative for more information.*

If you do not know how to test for continuity, refer test to a qualified technician.

Connect a voltmeter across the HOT terminal of the key switch and battery negative.

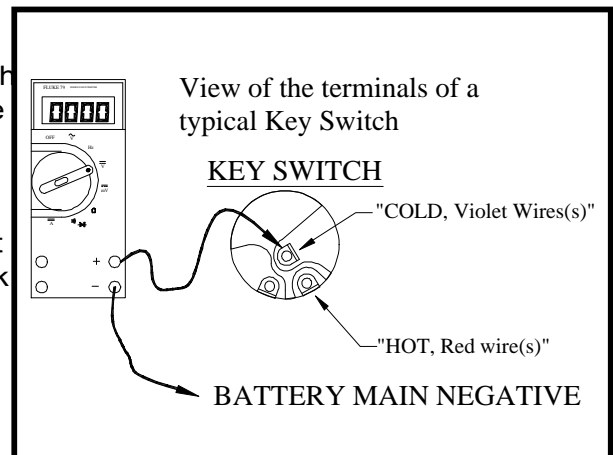
- If the voltage is not at battery volts then check the wire between the key switch and battery positive. Stop trouble shooting here and repair the problem. When the repair is completed, completely retest the vehicle before lowering the drive wheels to the ground.



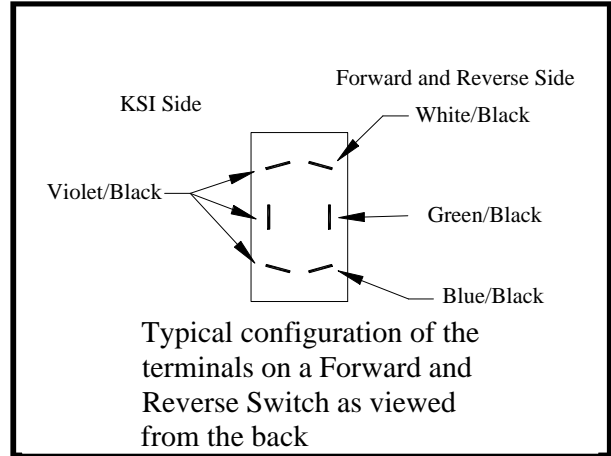
Connect a voltmeter across the COLD terminal of the key switch and battery negative.

**Turn the key switch ON.**

- If the voltage is not at battery volts then the key switch has failed. Stop trouble shooting here and repair the problem. When the repair is completed, completely retest the vehicle before lowering the drive wheels to the ground.
- If the voltage is at battery volts but the previous test at pin #4 in the Accelerator section failed then check the wire from the key switch to pin #4 at the accelerator module. Stop trouble shooting here and repair the problem. When the repair is completed, completely retest the vehicle before lowering the drive wheels to the ground.



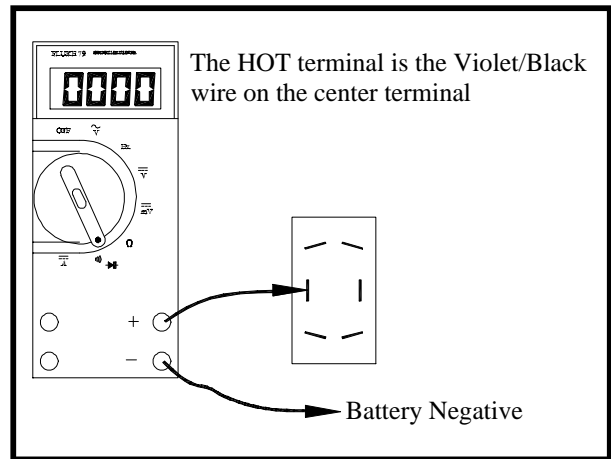
For your reference, shown at the right are the Forward and Reverse switch wire connections for a typical control system.



Connect a voltmeter across the HOT terminal of the KSI side of the F&R switch and battery negative.

**Turn the key switch ON.**

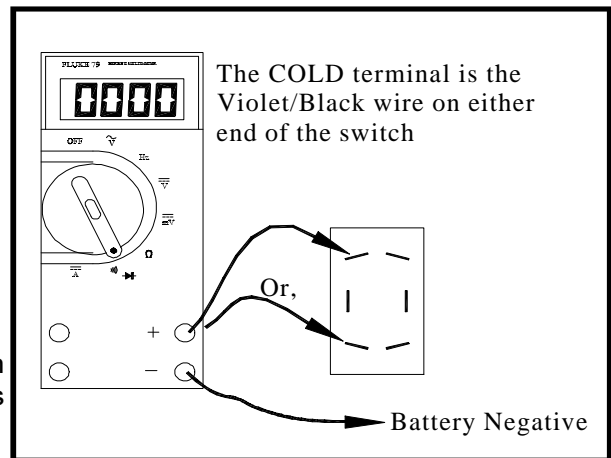
- If the voltage is not at battery volts then go to the Accelerator sequence.



Connect a voltmeter across one of the COLD terminals of the KSI side of the F&R switch and battery negative.

**Close all interlock switches, turn the Key Switch ON, and place the F&R Switch in Forward.**

- If the voltage is not at battery volts then the F&R switch has failed. Stop trouble shooting here and repair the problem. When the repair is completed, completely retest the vehicle before lowering the drive wheels to the ground.
- If the voltage is at battery volts and the test at the PMC KSI terminal in the Control Wire Inputs section failed then check the wiring between COLD terminals of the KSI side of the F&R switch and the PMC KSI terminal. Stop trouble shooting here and repair the problem. When the repair is completed, completely retest the vehicle before lowering the drive wheels to the ground.



**F/R switch**

**⚠ WARNING**

The rear drive wheels may rotate during some of the following tests. Block the front wheels, raise the rear drive wheels off the ground, and support the vehicle with jack stands. Failure to do so may cause the vehicle to move and cause severe bodily injury and/or property damage.

Rotating rear drive wheels are a potential hazard. Keep hands, arms, legs and loose clothing away from the rear drive wheels while conducting tests. Failure to do so may cause serious bodily injury.

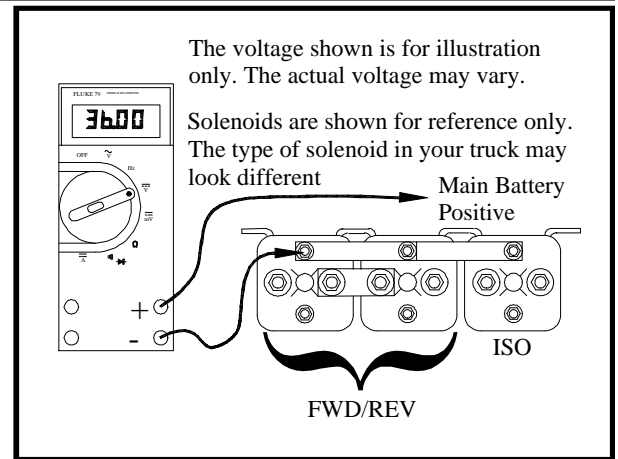
**⚠ WARNING**

1. Make sure the key-switch is in the "OFF" position, then remove the key.
2. Place the forward-reverse switch in the center "OFF" position.
3. Set the park brake.
4. Place blocks under the front wheels to prevent vehicle movement.

Connect a voltmeter across the Solenoid Negative Buss Bar and battery positive.

NOTE: You may skip this test if it was completed in a previous section

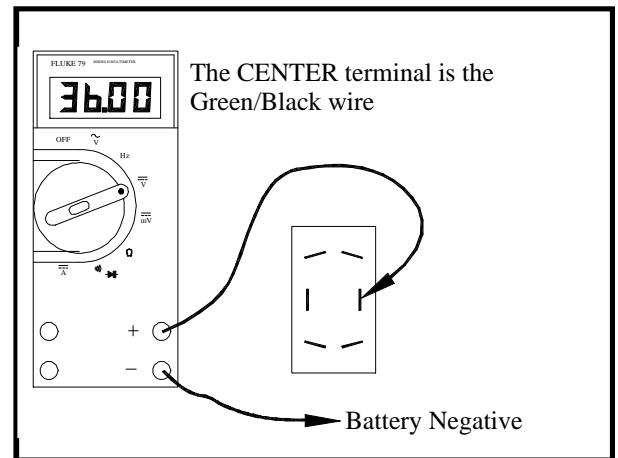
- If the voltage is not at battery volts then check the wiring to battery negative and the negative circuit breaker. Stop trouble shooting here and repair the problem. When the repair is completed, completely retest the vehicle before lowering the drive wheels to the ground.



Connect a voltmeter across the center terminal of the forward and reverse side of the F&R switch and battery negative.

**Close all interlock switches, turn the Key Switch ON, and place the F&R Switch in Forward. Depress the accelerator pedal fully.**

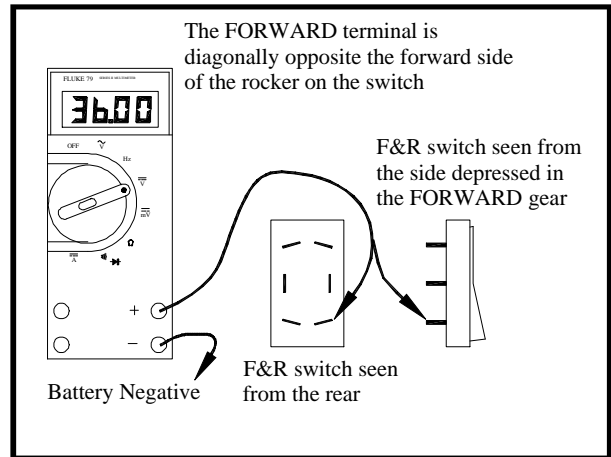
- If the voltage is not at battery volts then go to the Accelerator sequence.



Connect a voltmeter across the forward terminal of the forward and reverse side of the F&R switch and battery negative.

**Close all interlock switches, turn the Key Switch ON, and place the F&R Switch in forward. Depress the accelerator pedal fully.**

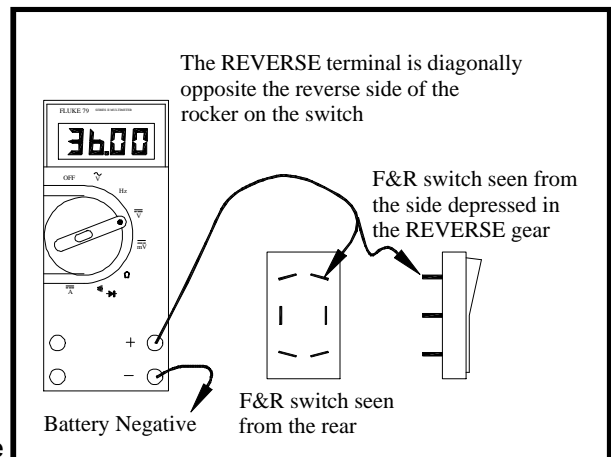
- If the voltage is not at battery volts then the F&R switch has failed. Stop trouble shooting here and repair the problem. When the repair is completed, completely retest the vehicle before lowering the drive wheels to the ground.



Connect a voltmeter across the reverse terminal of the forward and reverse side of the F&R switch and battery negative.

**Close all interlock switches, turn the Key Switch ON, and place the F&R Switch in reverse. Depress the accelerator pedal fully.**

- If the voltage is not at battery volts then the F&R switch has failed. Stop trouble shooting here and repair the problem. When the repair is completed, completely retest the vehicle before lowering the drive wheels to the ground.
- If all tests in this section were good then check the wiring from the F&R switch to the Forward and Reverse solenoids and both the forward and reverse solenoid coils. Stop trouble shooting here and repair the problem. When the repair is completed, completely retest the vehicle before lowering the drive wheels to the ground.



**Solenoids**

**⚠ WARNING**

The rear drive wheels may rotate during some of the following tests. Block the front wheels, raise the rear drive wheels off the ground, and support the vehicle with jack stands. Failure to do so may cause the vehicle to move and cause severe bodily injury and/or property damage.

Rotating rear drive wheels are a potential hazard. Keep hands, arms, legs and loose clothing away from the rear drive wheels while conducting tests. Failure to do so may cause serious bodily injury.

**⚠ WARNING**

1. Make sure the key-switch is in the "OFF" position, then remove the key.
2. Place the forward-reverse switch in the center "OFF" position.
3. Set the park brake.
4. Place blocks under the front wheels to prevent vehicle movement.

If the vehicle runs in forward only then skip ahead to the test sequence:

**Forward (does not run in reverse)**.

If the vehicle runs in reverse only then skip ahead to the test sequence:

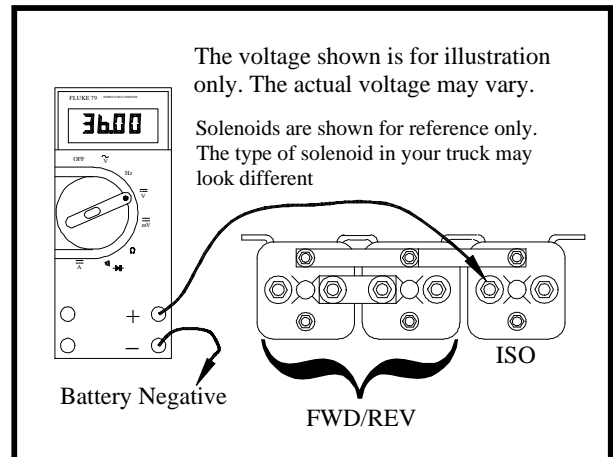
**Reverse (does not run in forward)**.

Connect a voltmeter across the ISO solenoid COLD terminal and battery negative.

**Close all interlock switches and turn the Key Switch ON.**

**Depress the accelerator pedal fully.**

- If the voltage is at battery volts then the wire from the ISO solenoid to the PMC is bad. Stop trouble shooting here and repair the problem. When the repair is completed, completely retest the vehicle before lowering the drive wheels to the ground.

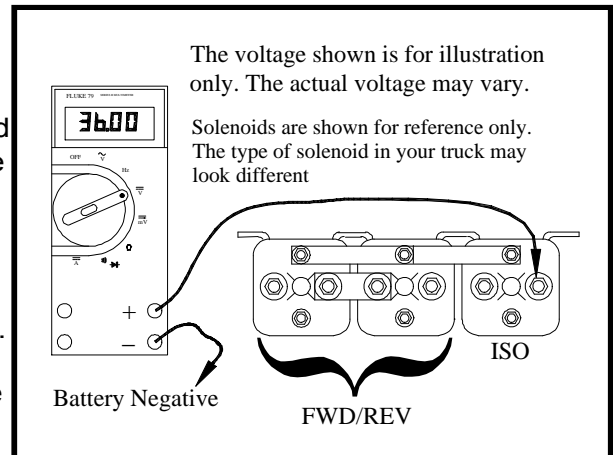


Connect a voltmeter across the ISO solenoid HOT terminal and battery negative.

**Close all interlock switches and turn the Key Switch ON.**

**Depress the accelerator pedal fully.**

- If the voltage is at battery volts then the ISO solenoid has failed. Stop trouble shooting here and repair the problem. When the repair is completed, completely retest the vehicle before lowering the drive wheels to the ground.
- If the voltage is not at battery volts then check the wiring to battery positive and the main circuit breaker. Stop trouble shooting here and repair the problem. When the repair is completed, completely retest the vehicle before lowering the drive wheels to the ground.

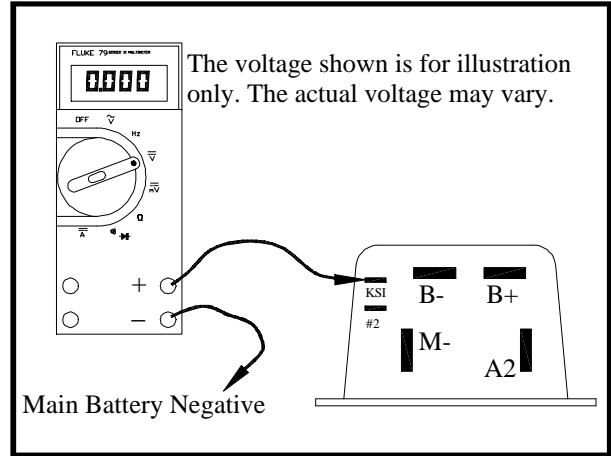


**Forward (does not run in reverse)**

Connect a voltmeter across the PMC KSI terminal and battery negative.

**Close all interlock switches, turn the Key Switch ON, and place the F&R Switch in reverse.**

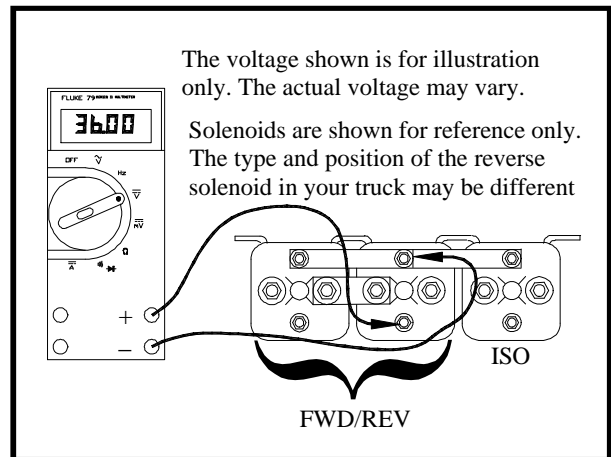
- If the voltage is not at battery volts then go to the **Key Switch** sequence.



Connect a voltmeter across the Reverse Solenoid coil terminals. Refer to your vehicles wiring diagram to identify the position of the reverse solenoid.

**Close all interlock switches, turn the Key Switch ON, and place the F&R Switch in reverse. Depress the accelerator pedal fully.**

- If the voltage is not at battery volts then go to the **F/R Switch** sequence.

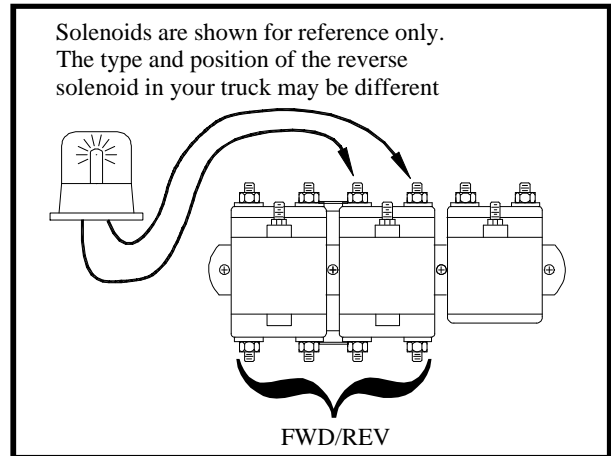


Set the test light voltage to the same voltage as the battery volts.

Connect the test light across the normally open contacts of the reverse solenoid. Refer to your vehicles wiring diagram to identify the position of the reverse solenoid.

**Close all interlock switches, turn the Key Switch ON, and place the F&R Switch in reverse. Depress the accelerator pedal fully.**

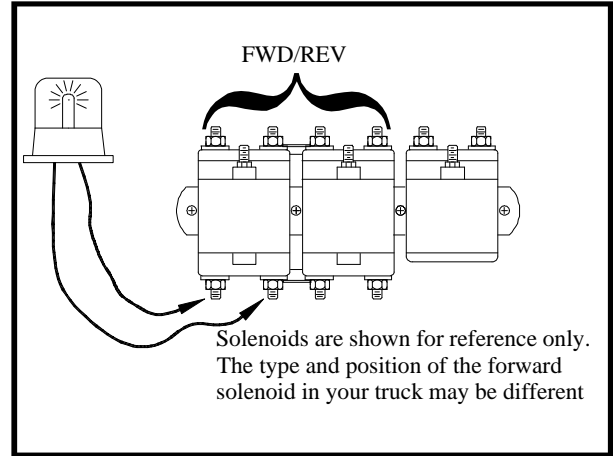
- If the light comes on then the Reverse solenoid has failed. Stop trouble shooting here and repair the problem. When the repair is completed, completely retest the vehicle before lowering the drive wheels to the ground.



Connect the test light across the Normally Closed contacts of the Forward solenoid. Refer to your vehicles wiring diagram to identify the position of the forward solenoid.

**Close all interlock switches, turn the Key Switch ON, and place the F&R Switch in Reverse.**  
**Depress the accelerator pedal fully.**

- If the light comes on then the Forward solenoid has failed. Stop trouble shooting here and repair the problem. When the repair is completed, completely retest the vehicle before lowering the drive wheels to the ground.



## STOP

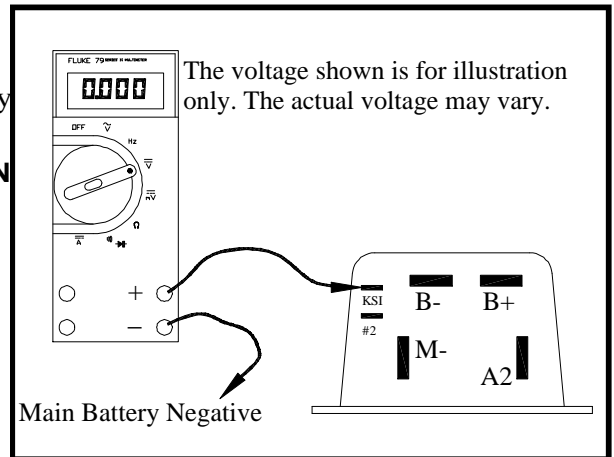
Stop, do not continue. If you reached this point without a solution, then you may have an unanticipated problem or have made an error during testing. It is important to review the trouble shooting steps that have led to this point. The tests may need to be repeated.

### Reverse (does not run in forward)

Connect a voltmeter across the PMC KSI terminal and battery negative.

**Close all interlock switches, turn the Key Switch ON and place the F&R Switch in forward.**

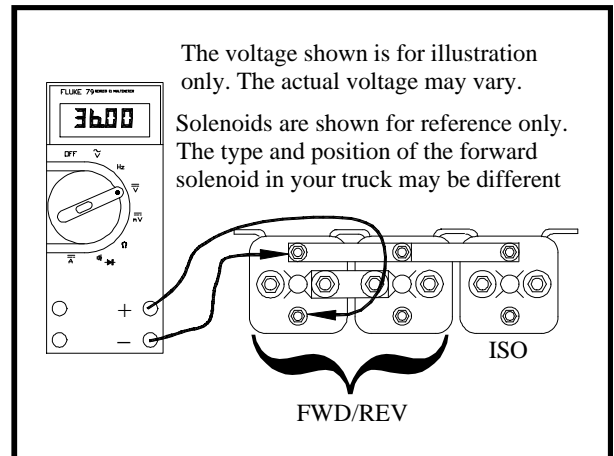
- If the voltage is not at battery volts then go to the **Key Switch** sequence.



Connect a voltmeter across the Forward Solenoid coil terminals. Refer to your vehicles wiring diagram to identify the position of the forward solenoid.

**Close all interlock switches, turn the Key Switch ON, and place the F&R Switch in forward.**  
**Depress the accelerator pedal fully.**

- If the voltage is not at battery volts then go to the **F/R Switch** sequence.





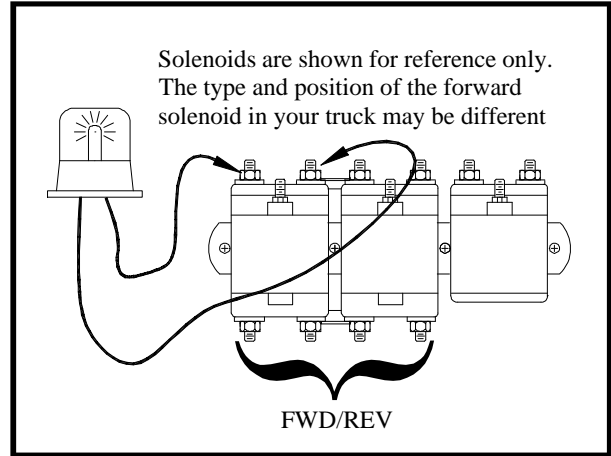
Set the test light voltage to the same voltage as the battery volts.

Connect the test light across the Normally Open contacts of the Forward solenoid. Refer to your vehicles wiring diagram to identify the position of the forward solenoid.

**Close all interlock switches, turn the Key Switch ON, and place the F&R Switch in forward.**

**Depress the accelerator pedal fully.**

- If the light comes on then the Forward solenoid has failed. Stop trouble shooting here and repair the problem. When the repair is completed, completely retest the vehicle before lowering the drive wheels to the ground.



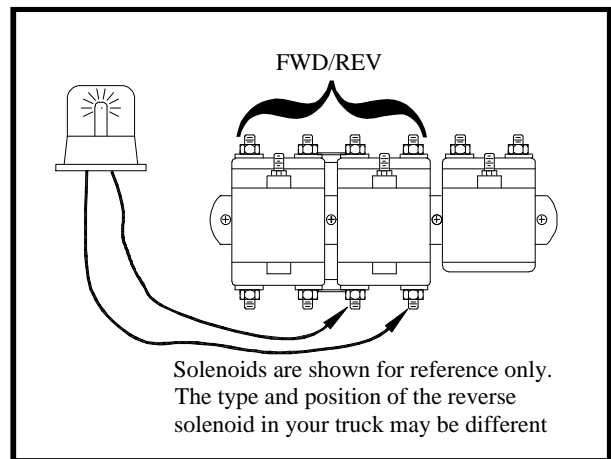
Set the test light voltage to the same voltage as the battery volts.

Connect the test light across the Normally Closed contacts of the Reverse solenoid. Refer to your vehicles wiring diagram to identify the position of the Reverse solenoid.

**Close all interlock switches, turn the Key Switch ON, and place the F&R Switch in Forward.**

**Depress the accelerator pedal fully.**

- If the light comes on then the Reverse solenoid has failed. Stop trouble shooting here and repair the problem. When the repair is completed, completely retest the vehicle before lowering the drive wheels to the ground.



## STOP

Stop, do not continue. If you reached this point without a solution, then you may have an unanticipated problem or have made an error during testing. It is important to review the trouble shooting steps that have led to this point. The tests may need to be repeated.

## **SYMPTOM TROUBLESHOOTING GUIDE**

This section is specific to the symptoms listed below. Each troubleshooting sequence assumes that all listed symptoms are present. Do not use this section unless the truck has all listed symptoms.

<b>SYMPTOMS</b>		<b>GO TO</b>
➤	Runs slow in both directions plus high armature and field current in both directions. NOTE: Armature and field current should be equal.	MOTOR
➤	Runs slow in both directions plus high armature current in both directions. NOTE: Field current will be very low.	SOLENOIDS
➤	Runs normal in one direction only plus runs slow or lacks power in the opposite direction with high armature current in the opposite direction or;  Accelerates slowly and exceeds normal speed in the opposite direction with high armature current only. NOTE: Field current will be very low in the opposite direction.	SOLENOIDS
➤	Accelerates slowly and exceeds normal speed in both directions plus high armature current. NOTE: Field current will be very low.	SOLENOIDS
➤	Full speed only.	PMC CONTROL
➤	Does not run in either direction plus there is noise from motor (hum or whine) with high field current and low armature current.	PLUGGING DIODE
➤	Excessive spark when connecting battery	ISO
➤	Does not run or runs very slow with low motor current and high battery current.	FREEWHEEL DIODE
➤	Jumps into high speed when direction is selected after depressing the accelerator pedal.	HPD

### **Special Troubleshooting Table of Contents**

PMC CONTROL .....	22
PLUGGING DIODE .....	25
FREEWHEEL DIODE .....	26
ISO .....	27
SOLENOIDS .....	29
MOTOR .....	32

**PMC CONTROL**

**⚠ WARNING**

1. Make sure the key-switch is in the "OFF" position, then remove the key.
2. Place the forward-reverse switch in the center "OFF" position.
3. Set the park brake.
4. Place blocks under the front wheels to prevent vehicle movement.
5. Disconnect the main positive and negative cables at the batteries.

**⚠ WARNING**

The rear drive wheels may rotate during some of the following tests. Block the front wheels, raise the rear drive wheels off the ground, and support the vehicle with jack stands. Failure to do so may cause the vehicle to move and cause severe bodily injury and/or property damage.

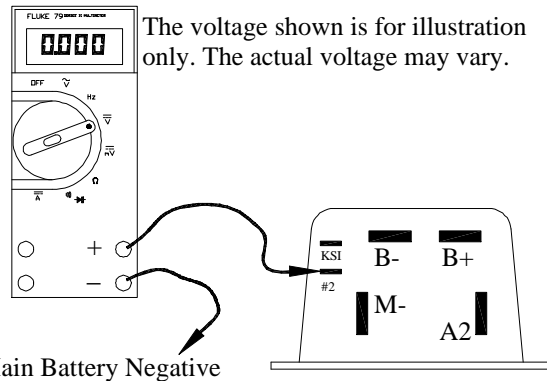
**⚠ WARNING**

Rotating rear drive wheels are a potential hazard. Keep hands, arms, legs and loose clothing away from the rear drive wheels while conducting tests. Failure to do so may cause serious bodily injury.

Disconnect the wire from the 'M-' terminal on the PMC control and tape it off to prevent electrical contact. Connect a volt meter across the PMC #2 terminal and battery negative.

Turn the key-switch on, close all interlock switches (if equipped), depress the accelerator pedal to engage the first micro switch only (creep speed), then perform the following tests:

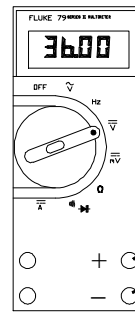
- The meter reading should be between 6 and 6.5 volts.
- If the voltage at pin #2 is not 6 to 6.5 volts, then go to the **ACCELERATOR** sequence in the Main Troubleshooting Sequence, otherwise continue with the next test.



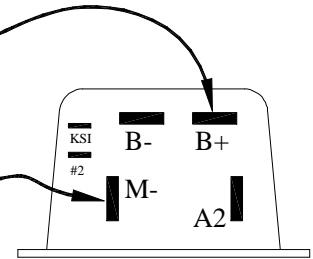
Connect a volt meter across the PMC B+ and PMC M- terminals.

**Turn the key-switch on, close all interlock switches (if equipped), depress the accelerator pedal to engage the first micro switch only (creep speed), then perform the following tests:**

- The meter reading should not be equal to the battery voltage.
- If you have full battery voltage then the PMC control is shorted and must be replaced. Stop trouble shooting here and repair the problem. When the repair is completed, completely retest the vehicle before lowering the drive wheels to the ground, otherwise continue with the next test.



The voltage shown is for illustration only. The actual voltage may vary.



If the voltage at pin #2 is correct and the voltage at 'M-' is correct, then there is a short in the harness between the wire connected to the PMC 'M-' and main battery negative. Stop trouble shooting here and repair the problem. When the repair is completed, completely retest the vehicle before lowering the drive wheels to the ground.

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**STOP**

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Stop, do not continue. If you reached this point without a solution, then you may have an unanticipated problem or have made an error during testing. It is important to review the trouble shooting steps that have led to this point. The tests may need to be repeated.

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**PLUGGING DIODE**

**⚠ WARNING**

1. Make sure the key-switch is in the "OFF" position, then remove the key.
2. Place the forward-reverse switch in the center "OFF" position.
3. Set the park brake.
4. Place blocks under the front wheels to prevent vehicle movement.
5. Disconnect the main positive and negative cables at the batteries.

**⚠ WARNING**

The rear drive wheels may rotate during some of the following tests. Block the front wheels, raise the rear drive wheels off the ground, and support the vehicle with jack stands. Failure to do so may cause the vehicle to move and cause severe bodily injury and/or property damage.

**⚠ WARNING**

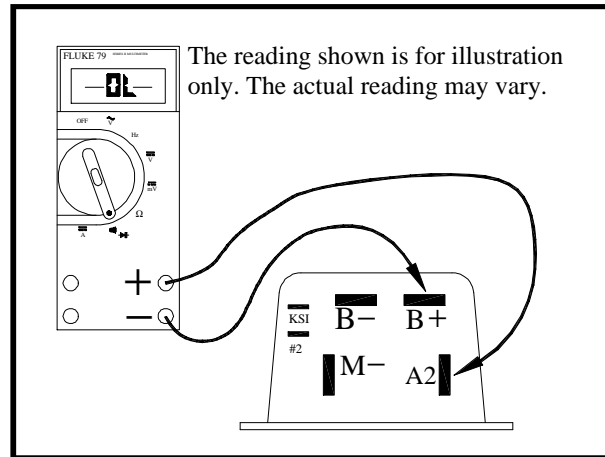
Rotating rear drive wheels are a potential hazard. Keep hands, arms, legs and loose clothing away from the rear drive wheels while conducting tests. Failure to do so may cause serious bodily injury.

Remove the wires from the 'B+' and 'A2' terminals on the PMC control and perform the following test:

Using the diode test function on the DMM check for the presence of a diode across 'B+' and 'A2' on the PMC control..

If you do not know how to test for a diode, refer test to a qualified technician.

- If the diode is open or shorted, then the PMC control must be replaced. Stop trouble shooting here and repair the problem. When the repair is completed, completely retest the vehicle before lowering the drive wheels to the ground.



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**STOP**

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Stop, do not continue. If you reached this point without a solution, then you may have an unanticipated problem or have made an error during testing. It is important to review the trouble shooting steps that have led to this point. The tests may need to be repeated.

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**FREEWHEEL DIODE**

**⚠ WARNING**

1. Make sure the key-switch is in the "OFF" position, then remove the key.
2. Place the forward-reverse switch in the center "OFF" position.
3. Set the park brake.
4. Place blocks under the front wheels to prevent vehicle movement.
5. Disconnect the main positive and negative cables at the batteries.

**⚠ WARNING**

The rear drive wheels may rotate during some of the following tests. Block the front wheels, raise the rear drive wheels off the ground, and support the vehicle with jack stands. Failure to do so may cause the vehicle to move and cause severe bodily injury and/or property damage.

**⚠ WARNING**

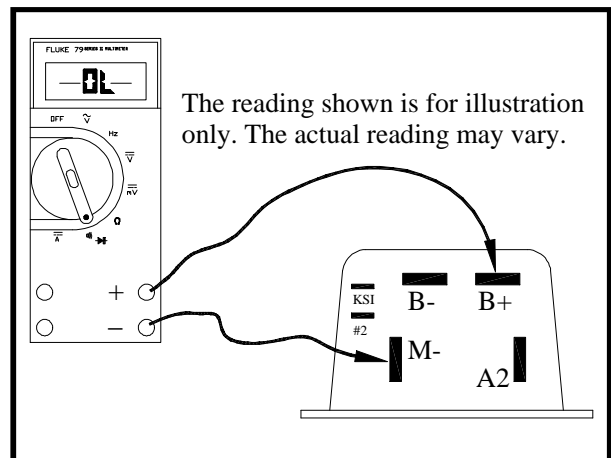
Rotating rear drive wheels are a potential hazard. Keep hands, arms, legs and loose clothing away from the rear drive wheels while conducting tests. Failure to do so may cause serious bodily injury.

Remove the wires from the 'B+' and 'M-' terminals on the PMC control and perform the following test:

Using the diode test function on the DMM check for the presence of a diode across 'B+' and 'M-' on the PMC control. Refer to Diode Figure 2.

If you do not know how to test for a diode, refer test to a qualified technician.

- If the diode is open or shorted, then the PMC control must be replaced. Stop trouble shooting here and repair the problem. When the repair is completed, completely retest the vehicle before lowering the drive wheels to the ground.



**STOP**

Stop, do not continue. If you reached this point without a solution, then you may have an unanticipated problem or have made an error during testing. It is important to review the trouble shooting steps that have led to this point. The tests may need to be repeated.

ISO

**⚠ WARNING**

1. Make sure the key-switch is in the "OFF" position, then remove the key.
2. Place the forward-reverse switch in the center "OFF" position.
3. Set the park brake.
4. Place blocks under the front wheels to prevent vehicle movement.
5. Disconnect the main positive and negative cables at the batteries.

**⚠ WARNING**

The rear drive wheels may rotate during some of the following tests. Block the front wheels, raise the rear drive wheels off the ground, and support the vehicle with jack stands. Failure to do so may cause the vehicle to move and cause severe bodily injury and/or property damage.

**⚠ WARNING**

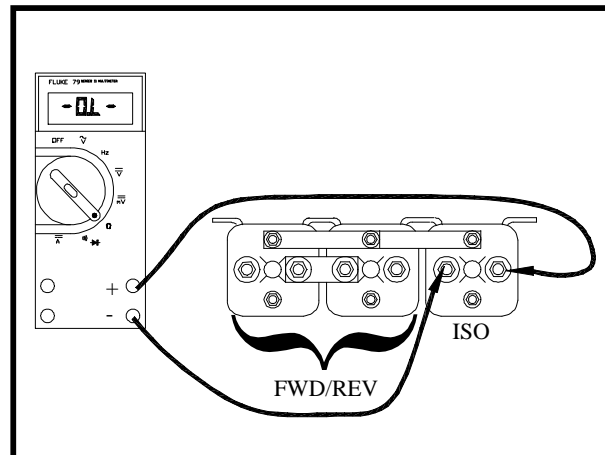
Rotating rear drive wheels are a potential hazard. Keep hands, arms, legs and loose clothing away from the rear drive wheels while conducting tests. Failure to do so may cause serious bodily injury.

Remove the wires and the resistor from the ISO solenoid and perform the following tests:

Test continuity across the ISO power contacts.

If you do not know how to test for continuity, refer test to a qualified technician.

- This should be an open circuit. If it is not an open circuit then the contactor should be replaced. Stop trouble shooting here and repair the problem. When the repair is completed, completely retest the vehicle before lowering the drive wheels to the ground, other wise continue to the next test.

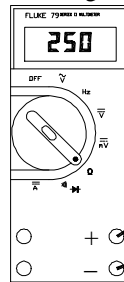




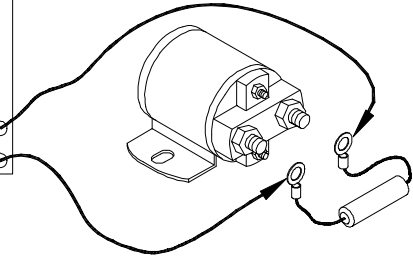
Connect the meter to each end of the resistor that was removed from the ISO solenoid and measure its resistance.

- The meter reading should be 250 Ohms (+/-10%). If it is not 250 ohms (+/-10%), then replace the resistor. Stop trouble shooting here and repair the problem. When the repair is completed, completely retest the vehicle before lowering the drive wheels to the ground.

Reading is plus or minus 10%



ISO solenoid is shown for reference only. The type of solenoid in your truck may look different



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## STOP

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Stop, do not continue. If you reached this point without a solution, then you may have an unanticipated problem or have made an error during testing. It is important to review the trouble shooting steps that have led to this point. The tests may need to be repeated.

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**SOLENOIDS**

There is a very slight possibility that a failure in the motor could cause these symptoms. Perform the tests covered in the MOTOR section first. If the motor is OK, continue with the following tests.

**⚠ WARNING**

1. Make sure the key-switch is in the "OFF" position, then remove the key.
2. Place the forward-reverse switch in the center "OFF" position.
3. Set the park brake.
4. Place blocks under the front wheels to prevent vehicle movement.
5. Disconnect the main positive and negative cables at the batteries.

**⚠ WARNING**

The rear drive wheels may rotate during some of the following tests. Block the front wheels, raise the rear drive wheels off the ground, and support the vehicle with jack stands. Failure to do so may cause the vehicle to move and cause severe bodily injury and/or property damage.

**⚠ WARNING**

Rotating rear drive wheels are a potential hazard. Keep hands, arms, legs and loose clothing away from the rear drive wheels while conducting tests. Failure to do so may cause serious bodily injury.

Remove the wires from the 'S1' and 'S2' terminals on the motor. Remove the wire from the 'M-' terminal on the PMC control. Make sure none of these wires can come into electrical contact with the frame or any other wire.

Reconnect the batteries.

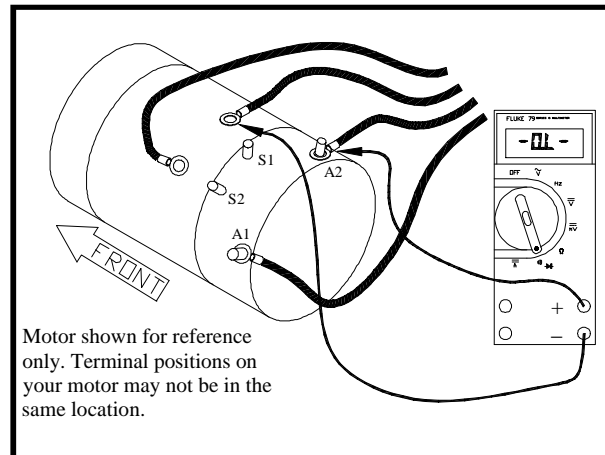
**With the key-switch on and the forward and reverse switch in neutral, perform the following tests:**

- Check continuity from the motor 'A2' terminal to the wire that was connected to the motor 'S1' terminal. DO NOT make this test to the 'S1' terminal, just the wire. Refer to Solenoid Figure 1.

If you do not know how to test for continuity, refer test to a qualified technician.

- This should be an open circuit, if it reads as a short, then one of the following has occurred:

- A) The reverse solenoid is shorted.
- B) The wire connected to the motor 'S1' terminal is shorted to the wire connected to the motor 'A2' terminal.
- C) The wire connected to the motor 'S1' terminal is shorted to the wire connected to the PMC 'A2' terminal.



Stop trouble shooting here and repair the problem. When the repair is completed, completely retest the vehicle before lowering the drive wheels to the ground, otherwise continue with the next test.

- Check continuity from the motor 'A2' terminal to the wire that was connected to the motor 'S2' terminal. **DO NOT** make this test to the 'S2' terminal, just the wire.

If you do not know how to test for continuity, refer test to a qualified technician.

- This should read as an open circuit. If it reads as a short then one of the following has occurred:

- The forward solenoid is shorted.
- The wire connected to the motor 'S2' terminal is shorted to the wire connected to the motor 'A2' terminal.
- The wire connected to the motor 'S2' terminal is shorted to the wire connected to the PMC 'A2' terminal.

Stop trouble shooting here and repair the problem. When the repair is completed, completely retest the vehicle before lowering the drive wheels to the ground, otherwise continue with the next test.

**With the key-switch on and the F&R switch in forward, depress the accelerator pedal and perform the following tests:**

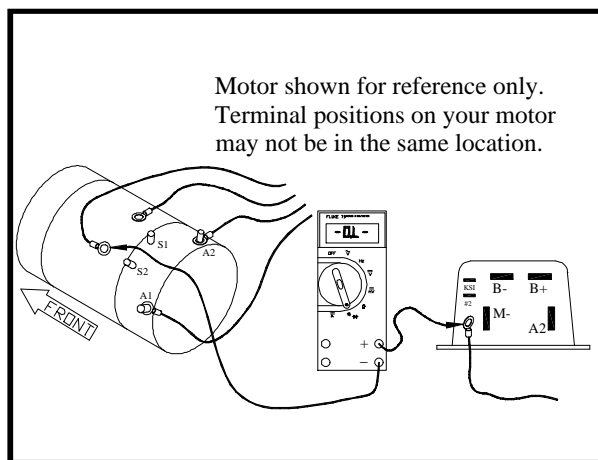
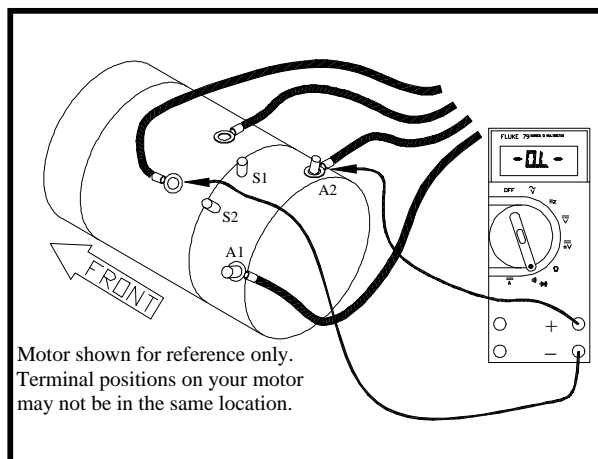
- Check continuity from the wire that was connected to the PMC 'M-' terminal to the wire that was connected to the motor 'S2' terminal.

If you do not know how to test for continuity, refer test to a qualified technician.

- This should read as an open circuit. If it reads as a short, then one of the following has occurred:

- The forward solenoid is shorted.
- The wire connected to the PMC 'M-' terminal is shorted to the wire connected to the motor 'S2' terminal.

Stop trouble shooting here and repair the problem. When the repair is completed, completely retest the vehicle before lowering the drive wheels to the ground, otherwise continue with the next test.



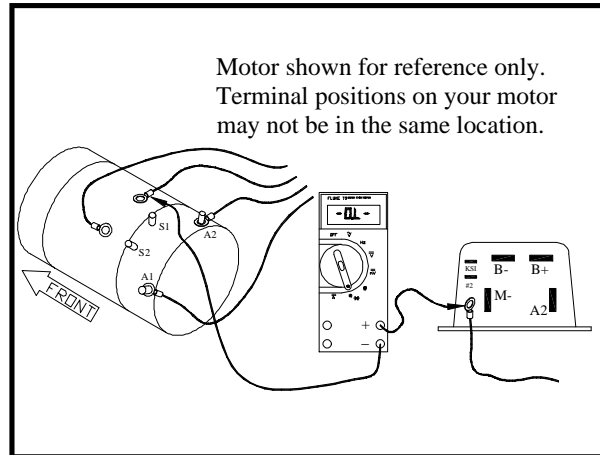
**With the key-switch on and the F&R switch in reverse, depress the accelerator pedal and perform the following tests:**

- Check continuity from the wire that was connected to the PMC 'M-' terminal to the wire that was connected to the motor 'S1' terminal.

If you do not know how to test for continuity, refer test to a qualified technician.

- This should read as an open circuit. If it reads as a short, then one of the following has occurred:  
A) The reverse solenoid is shorted.  
B) The wire connected to the PMC 'M-' terminal is shorted to the wire connected to the motor 'S1' terminal.

Stop trouble shooting here and repair the problem. When the repair is completed, completely retest the vehicle before lowering the drive wheels to the ground



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## STOP

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Stop, do not continue. If you reached this point without a solution, then you may have an unanticipated problem or have made an error during testing. It is important to review the trouble shooting steps that have led to this point. The tests may need to be repeated.

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## MOTOR

High motor current in both the field and the armature, accompanied with a lack of power, would indicate a shorted armature and/or field.

Another symptom that may exist is jumping or stuttering at low speeds and/or the motor will not run unless the armature is manually rotated. If this symptom exists, it indicates that there may be open segments in the armature. Visually inspect the brushes, if they are OK, continue with the testing below.

### ⚠ WARNING

1. Make sure the key-switch is in the "OFF" position, then remove the key.
2. Place the forward-reverse switch in the center "OFF" position.
3. Set the park brake.
4. Place blocks under the front wheels to prevent vehicle movement.
5. Disconnect the main positive and negative cables at the batteries.

### ⚠ WARNING

The rear drive wheels may rotate during some of the following tests. Block the front wheels, raise the rear drive wheels off the ground, and support the vehicle with jack stands. Failure to do so may cause the vehicle to move and cause severe bodily injury and/or property damage.

### ⚠ WARNING

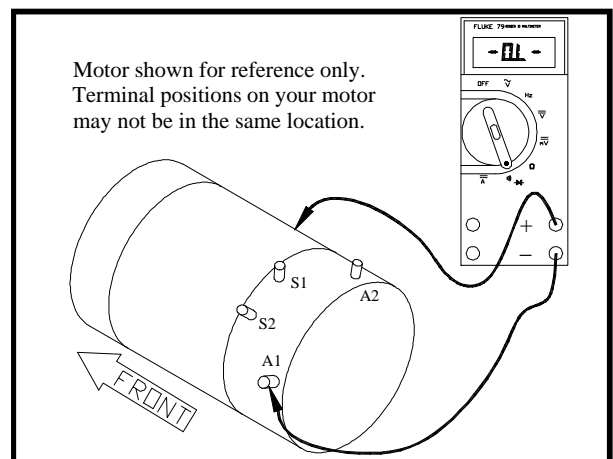
Rotating rear drive wheels are a potential hazard. Keep hands, arms, legs and loose clothing away from the rear drive wheels while conducting tests. Failure to do so may cause serious bodily injury.

Disconnect the four motor wires and perform the following tests:

Check continuity from 'A1' to the frame of the motor..

If you do not know how to test for continuity, refer test to a qualified technician.

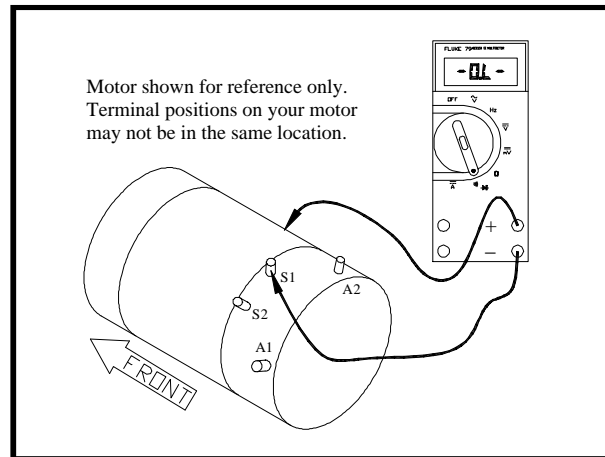
- This should be an open circuit. If there is continuity from 'A1' to the frame of the motor, then the motor armature or armature circuit (brushes) are shorted. Stop trouble shooting here and repair the problem. When the repair is completed, completely retest the vehicle before lowering the drive wheels to the ground, otherwise continue with the next test.



Check continuity from 'S1' to the frame of the motor.

If you do not know how to test for continuity, refer test to a qualified technician.

This should be an open circuit. If there is continuity from 'S1' to the frame of the motor, then the motor field is shorted. Stop trouble shooting here and repair the problem. When the repair is completed, completely retest the vehicle before lowering the drive wheels to the ground, otherwise continue to Motor Inspection.

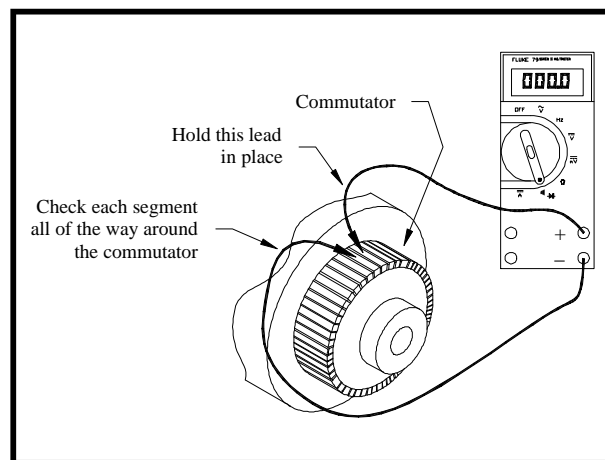


### Motor Inspection

1. Remove and disassemble the motor.
2. Visually inspect the inside of the brush end housing. If there are any silver specs of metal around the inside of the housing, it indicates that the armature has overheated and melted the solder around the commutator. The armature is bad and the motor must be replaced. Stop here and repair the problem, otherwise continue with the next test.
3. Visually inspect the armature wires where they loop around at the shaft end of the armature. The insulation should be a light to medium reddish brown color. If the insulation is dark brown to black or the insulation is cracked and peeling, then the armature has been overheated and burnt. The motor must be replaced. Stop here and repair the problem, otherwise continue with the next test.
4. Perform a continuity test around the armature commutator. Place one of the test leads on a single commutator segment. While holding the first test lead on the segment, check the continuity to the other segments around the commutator.

If you do not know how to test for continuity, refer test to a qualified technician.

- There should be continuity on each commutator segment. If an open segment is found, the armature is bad and the motor must be replaced. Stop trouble shooting here and repair the problem. When the repair is completed, completely retest the vehicle before lowering the drive wheels to the ground.



## STOP

Stop, do not continue. If you reached this point without a solution, then you may have an unanticipated problem or have made an error during testing. It is important to review the trouble shooting steps that have led to this point. The tests may need to be repeated.

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### ⚠ CAUTION

Turn the Key switch **OFF** **BEFORE** disconnecting the batteries. Disconnecting the batteries with the key switch **ON** may corrupt the controller programming resulting in a fault code 1 (refer to fault table).



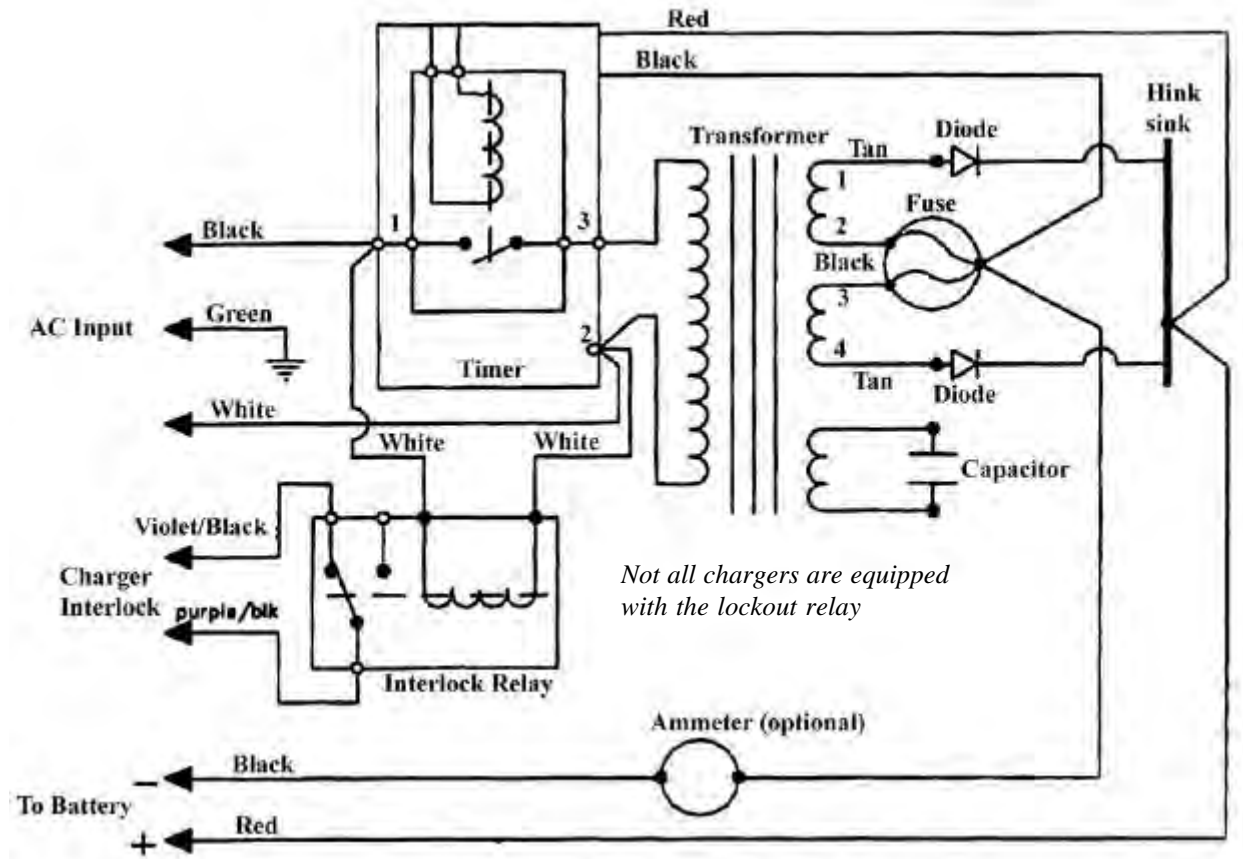
# Lestronic II<sup>®</sup> Charger Troubleshooting

## OPERATING INSTRUCTIONS AND THEORY OF OPERATION

The Lestronic II® chargers are designed as semiautomatic chargers. The Lestronic II charger turns itself on when the “built-in” charger is plugged into the wall outlet, or when the “portable” charger is plugged into the batteries. As the battery charges, the battery voltage rises. The charger periodically checks the battery voltage and compares it to the previous reading. When the battery voltage stops rising a predetermined amount, then the batteries are no longer accepting a charge and the charger shuts off. The charger will not start again unless the AC cord on a “built-in” charger is disconnected from the wall outlet, or the DC plug on a portable charger is disconnected from the batteries.

The charger does not check the current state of charge when it is plugged in, it assumes that the batteries require charging when it is connected. For this reason, it is recommended to discharge the batteries approximately 50% (1175-1200 as indicated on a hydrometer) before connecting the charger. If the charger is connected before the batteries are discharged 50%, the batteries may enter an overcharge state before the charger can sense that the batteries are no longer accepting a charge. This could result in overcharging and damaging the batteries.

The relay that operates the charger is powered by the batteries being charged. If the voltage on the batteries to be charged is less than approximately 65% of the rated charger DC voltage, the relay will not pick up and the charger will not turn on. In this situation, a manual charger would have to be used to bring the battery voltage up so that the Lestronic® charger can sense that they are connected and turn itself on.



*Typical Charger Internal Wire Diagram*

## ***TESTING THE CHARGING CYCLE***

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In typical installations, the charger will remain on for up to 12 hours depending on the state of charge of the battery when the charge cycle was started.

A charger could remain on for longer than 12 hours if:

- The charging cycle is interrupted at any time during the charging cycle.
- Defective batteries causing a fluctuating DC voltage that confuses the charger.
- A brownout (drop in AC line voltage) during the charging cycle.
- An electrically noisy charging environment.

A charger could turn off in less than 12 hours, but still show symptoms of overcharging if:

- The batteries were not discharged to 50% before connecting the charger.
- The electrolyte in the batteries is too high (boil over).
- The electrolyte in the batteries is too low (excessive gassing or sulfur smell).

To test the charger to see if it is turning off correctly, monitor the battery voltage and the electrolyte specific gravity during the charging cycle as indicated below.

### ***Specific Gravity***

Using a hydrometer take the specific gravity reading of several cells, at 1 hour intervals while charging. If the specific gravity of the electrolyte does not rise for three consecutive readings and the charger does not shut off, then the charger is running too long.

### ***Battery Voltage***

Using an accurate 5-1/2 digit digital voltmeter, monitor the battery voltage during the charging cycle. Take readings every 30 minutes. If the battery voltage does not increase 0.012 volts in two consecutive readings, then the charger is running too long.



## **TEST EQUIPMENT REQUIRED FOR TROUBLESHOOTING**

Digital Multi Meter (DMM) with diode and capacitor test function, FLUKE 79 model shown at right and in the troubleshooting illustrations.



### **Important Notes and Instructions**

- This troubleshooting guide assumes a familiarity with the use of a digital multimeter including, voltage tests, continuity tests and diode testing. If not familiar with any part of these tests, refer testing to a qualified technician.
- Make sure that the AC electrical socket the charger is plugged into is in good working condition.
- Make sure that the AC voltage at the electrical socket is the same as the AC voltage on the charger nameplate.
- Make sure the batteries are in good condition and no less than 80% discharged as per hydrometer reading.
- The battery voltage must be above approximately 65% of the chargers rated DC voltage. If the batteries are below approximately 65% of the chargers rated DC voltage, the charger will not turn on.
- If the charger exhibits intermittent problems, it must be in the failed mode for troubleshooting.
- Battery volts = Full voltage available at the batteries at the time of the test being performed.
- This test procedure must be performed in the order it was written. If starting in the middle or skipping sections when not instructed to do so, the proper results will not occur. If the test result is good, then proceed to the next test or go to the next section if instructed to do so.

### **During All Tests**

#### **WARNING**

**The charger cabinet must remain electrically grounded. Disconnect both of the battery leads and unplug the charger from the AC source before disconnecting any electrical component or wire. Failure to do so may result in serious bodily injury.**

## TROUBLESHOOTING FOR BUILT-IN CHARGER

### WARNING

1. Make sure the key-switch is in the "OFF" position, then remove the key.
2. Place the forward-reverse switch in the center "OFF" position.
3. Set the park brake.
4. Place blocks under the front wheels to prevent vehicle movement.

5. Disconnect the charger from the AC source.

Locate the charger harness connectors where the charger harness is connected to the vehicle's control harness. There will be two 10 gauge and two 14 gauge wires.

Slide the insulators off the connectors on the two 10 gauge wires and perform the following tests:

### CAUTION

**Make sure that these two wires do not come into electrical contact with any other object.**

6. Test the voltage from the red wire to the main battery negative. This voltage should be equal to the battery voltage. If the voltage is less than the battery voltage, then this wire is broken or has a bad connection. **Stop here and repair the problem.**
7. Test the voltage from the red 10 gauge wire (+) to the other 10 gauge wire (white or black depending on model). This voltage should be equal to the battery voltage. If the voltage is less than the battery voltage, then the white (or black) wire is broken or has a bad connection. **Stop here and repair the problem.**

Slide the insulators back onto the connectors on the two 10 gauge wires.

Slide the insulators off the connectors on the two 14 gauge wires.

### WARNING

**High Voltage. Do not touch the 14-gauge wires and make sure these two wires do not come into electrical contact with any other object. Failure to do so may result in serious bodily injury.**

Re-Connect the charger to the AC source.

8. Test the voltage across the two 14 gauge wires. This voltage should be the same as the voltage at the AC receptacle (rated voltage of the charger). If the voltage is less than the rated AC voltage of the charger then the 14 gauge white or black wire(s) is broken or has a bad connection between the charger connectors and the AC plug. **Stop here and repair the problem.**

- Disconnect the charger from the AC source.
- Disconnect the batteries.
- Disconnect the charger from the vehicle's harness.
- Remove the charger from the vehicle.

## WARNING

**HIGH VOLTAGE** may be stored in the capacitor. Discharge the capacitor before continuing. Connect a 2k ohm resistor across the capacitor terminals for 10 seconds. Do not touch the capacitor terminals with your hands. The resistor should be held with a pair of insulated pliers. Failure to do so may cause serious bodily injury

### Remove the charger cover and perform the following tests:

1. Inspect the internal wiring of the charger and repair as required.
2. Check the continuity of both fuse links and replace if bad.
3. Disconnect one transformer lead from the capacitor. Test the capacitor using the capacitor test function of the meter. It is a 6 microfarad capacitor. If the capacitor is bad, it must be replaced. **Stop here and repair the problem.**



4. Reconnect the transformer lead to the capacitor and disconnect one transformer lead from one of the diodes. Test each of the diodes using the diode test function of your meter. If either one of the diodes are bad, replace the diode assembly. **Stop here and repair the problem.**
5. Reconnect the lead to the diode.
6. Reconnect the charger to the vehicle's harness and slide the wiring insulators back into place. Connect the charger to the AC source and perform the following tests:



## WARNING

**High Voltage** inside the charger. Do not touch any internal components while the charger is plugged in. Failure to do so may result in serious bodily injury.

- Test the voltage from the fuse assembly (-) to the diode block (+). This voltage should be equal to the battery voltage. If the voltage is less than the battery voltage, then the wires from the harness connectors to the charger are bad. **Stop here and repair the problem.**



- Test the voltage across the white and black wires that are connected to the timer board. This voltage should be the same as the rated AC voltage of the charger. If the voltage is less than the rated AC voltage of the charger, then the wires from the harness connectors to the charger are bad. **Stop here and repair the problem.**
- If the timer relay does not pickup (click) when the AC source is connected, then the timer control circuit or the relay is bad (refer to Timer Relay Test). **Stop here and repair the problem.**
- Test the AC voltage across the transformer primary circuit. The transformer primary consists of the two solid wires with the brown fiber insulator that are connected to the timer board. This voltage should be the same as the rated AC voltage of the charger. If the voltage is less than the rated AC voltage of the charger, then the timer relay is bad. **Stop here and repair the problem.**
- Test the AC voltage across the transformer low voltage secondary circuit. The transformer low voltage secondary circuit can be tested at the two solid wires with the brown fiber insulator that are connected to the anodes on the two diodes. The voltage here will vary depending on the state of charge in the batteries. The voltage should be between 208% and 250% of the rated DC voltage of the charger. If the voltage is not between 208% and 250% of the rated DC voltage of the charger, the transformer is bad and must be replaced. **Stop here and repair the problem.**



## ***TROUBLESHOOTING FOR PORTABLE CHARGER***

Disconnect the charger from the AC outlet and the batteries.

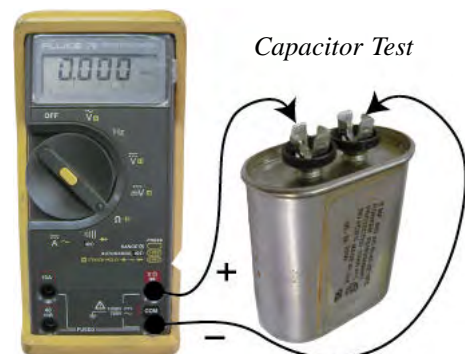
1. Test the voltage from the positive terminal on the vehicles DC receptacle to main battery negative. This voltage should be equal to the battery voltage. If the voltage is less than the battery voltage then this wire is broken or has a bad connection. **Stop here and repair the problem.**
2. Test the voltage from the positive terminal on the DC receptacle to the negative terminal on the DC receptacle. This voltage should be equal to the battery voltage. If the voltage is less than the battery voltage, then the wire on the negative terminal of the DC receptacle is broken or has a bad connection. **Stop here and repair the problem.**

Remove the charger cover and perform the following tests:

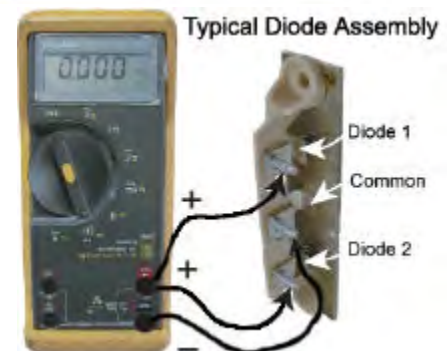
### **WARNING**

**HIGH VOLTAGE may be stored in the capacitor. Discharge the capacitor before continuing. Connect a 2k ohm resistor across the capacitor terminals for 10 seconds. Do not touch the capacitor terminals with your hands. The resistor should be held with a pair of insulated pliers. Failure to do so may cause serious bodily injury**

1. Inspect the internal wiring of the charger and repair as required.
2. Check the continuity of both fuse links and replace if bad.
3. Disconnect one lead from the capacitor. Test the capacitor using the capacitor test function on the meter. If the capacitor is bad, it must be replaced. **Stop here and repair the problem.**



4. Reconnect the lead to the capacitor and disconnect one transformer lead from one of the diodes. Test each of the diodes using the diode test function on the meter. If either one of the diodes are bad, replace the diode assembly. **Stop here and repair the problem.**



5. Reconnect the lead to the diode.
6. Connect the charger to the AC source. Insert the DC charger plug into the DC receptacle and perform the following tests:

## **WARNING**

**High Voltage inside the charger. Do not touch any internal components while the charger is plugged in. Failure to do so may result in serious bodily injury.**

- Test the voltage from the fuse assembly (-) to the diode block (+). This voltage should be equal to the battery voltage. If the voltage is less than the battery voltage, then the DC cord is bad. **Stop here and repair the problem.**
- Test the voltage across the white and black wires that are connected to the timer board. This voltage should be the same as the rated AC voltage of the charger. If the voltage is less than the rated AC voltage of the charger then the AC cord is bad. **Stop here and repair the problem.**
- If the timer relay does not pickup (click) within 5 seconds of connecting the DC charger plug, then the timer control circuit or the relay is bad (refer to Timer Relay Test). **Stop here and repair the problem.**
- Test the AC voltage across the transformer primary circuit. This voltage should be the same as the rated AC voltage of the charger. If it is less than the rated AC voltage of the charger, then the timer relay is bad. **Stop here and repair the problem.**



*Transformer Secondary Circuit*

- Test the AC voltage across the transformer secondary circuit. The voltage here will vary depending on the state of charge in the batteries. The voltage should be between 208% and 250% of the rated DC voltage of the charger. If the voltage is not between 208% and 250% of the charge's rated DC voltage, the transformer is bad and must be replaced. **Stop here and repair the problem.**

## ***TESTING THE TIMER RELAY***

### **Test 1:**

1. Connect the batteries to the charger.
  2. Plug the charger into the AC source.
  3. Wait 5 seconds, then test the voltage at the timer relay coil terminals.  
NOTE: This voltage should be close to the battery volts.
- If the voltage is close to the battery volts, then skip to test 2.
  - If the voltage is not close to the battery volts, then the timer control circuit has failed and the timer must be replaced.

### **Test 2:**

1. Disconnect the batteries.
2. Unplug the charger from the AC source.
3. Discharge the capacitor (see warning on previous page).



4. Disconnect the wires from the contact terminals on the timer relay .
  5. Reconnect the batteries.
  6. Wait 5 seconds, then test the continuity across the timer relay contact terminals.
- If this is a closed circuit, then the timer start up circuit is functioning normally.
  - If there is an open circuit, then the timer relay has failed and the relay must be replaced.

## ***TESTING THE INTERLOCK RELAY***

### **Operation**

The Interlock Relay disables the vehicle from running whenever the charger is connected to a working AC power source. When the charger is plugged in, the relay contacts open and break the Key Switch connection to the speed controller. The Interlock Relay is available for built-in chargers only. Not all built-in chargers are equipped with this relay. To identify chargers that are equipped with the Interlock Relay:

Inspect the charger wire harness where it enters the charger cabinet for two Violet/Black wires. If these wires are present then the charger is equipped with the Interlock Relay.

### **Testing**

## **⚠ WARNING**

- 1. Make sure the key-switch is in the "OFF" position, then remove the key.**
- 2. Place the forward-reverse switch in the center "OFF" position.**
- 3. Set the park brake.**
- 4. Place blocks under the front wheels to prevent vehicle movement.**
- 5. Disconnect the main positive and negative cables at the batteries.**

6. Disconnect the charger from the AC power source.
  7. Disconnect the two Violet/Black wires at the charger harness knife connectors.
  8. Set the DMM to check for continuity and connect the DMM leads to the wires going into the charger.
    - The DMM should indicate a closed circuit. If the DMM indicates an open circuit, then the relay or the wires to the relay have failed. **Stop here and repair the problem.**
  9. Connect the charger to a working AC power source.
    - The charger should turn on. If the charger does not turn on then there may be a problem with the AC power source or the AC wiring to the charger. Refer to the beginning of this section for charger troubleshooting. **DO NOT** continue until you have confirmed that the AC power source is working.
    - The DMM should indicate an open circuit. If it still indicates a closed circuit, then the relay or the wires to the relay have failed. **Stop here and repair the problem.**
- If the DMM indicates an open circuit then the interlock relay is functioning normally.



# Signet® Charger Troubleshooting

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## Charger Models:

*HBS 600*

*HBS 1000*

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#### ⚠ CAUTION

Turn the Key switch **OFF** **BEFORE** disconnecting the batteries. Disconnecting the batteries with the key switch **ON** may corrupt the controller programming resulting in a fault code 1 (refer to fault table).

#### ⚠ CAUTION

GEL batteries must be charged with a charger configured for GEL batteries. Use of any other charger will result in damage to the batteries and premature failure of the batteries.







## DEFINITIONS:

Volts Per Cell = Voltage for each cell in a battery pack. for example, one 6-volt battery has 3-cells.

Term	Value	Condition
V1:	See Chart 2.383 Volts Per Cell	Flooded batteries Gel Batteries
V2:	2.08 Volts Per Cell	All batteries
A1:	2 to 4 Amps	All batteries

V1: Voltages are temperature compensated relative to the temperature of the charger at the time the charge cycle is started.

Starting Temperature (C)	V1 Volts Per Cell
Less than -4	2.64
-4 to 2	2.61
2 to 8	2.59
8 to 14	2.56
14 to 21	2.54

All voltages are nominal.

### **⚠ CAUTION**

**This charger is rated for 115 VAC or 230 VAC operation (nominal). When switching from one input voltage to the other, wait until all LED's are off. Switching voltage when any of the LED's are on will result in damage to the charger.**

### **⚠ CAUTION**

**GEL batteries must be charged with a charger configured for GEL batteries. Use of any other charger will result in damage to the batteries and premature failure of the batteries.**

## TEST EQUIPMENT REQUIRED FOR TROUBLESHOOTING

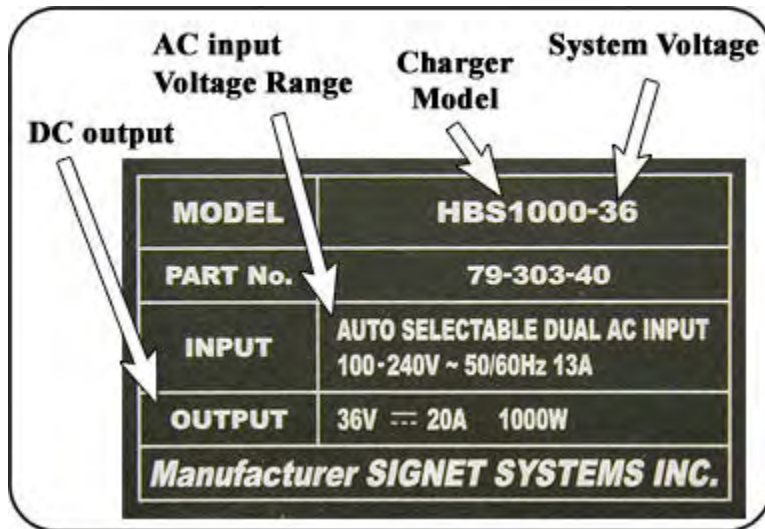
Digital Multi Meter (DMM), calibrated and accurate down to 0.00001 volts.

Clamp on DC ammeter to measure up to 20-Amps.

### **Important Notes and Instructions**

- This troubleshooting guide assumes a familiarity with the use of a digital multimeter including, voltage tests, continuity tests and diode testing. If not familiar with any part of these tests, refer testing to a qualified technician.
- Make sure that the AC electrical socket the charger is plugged into is in good working condition.
- Make sure that the AC voltage at the electrical socket is the same as the AC voltage on the charger nameplate.
- Make sure the batteries are in good condition.
- If the charger exhibits intermittent problems, it must be in the failed mode for troubleshooting.
- There are no internally serviceable components in the charger. If the charger has failed then it must be replaced.

**OPERATING INSTRUCTIONS AND THEORY OF OPERATION**



*Typical specification plate  
(reference only, specifications will vary for different chargers)*

The model HBS 600W<sup>®</sup> and HBS 1000W<sup>®</sup> chargers are designed as automatic chargers. The charger turns itself on when it is plugged into the wall outlet and turns off when the batteries are fully charged. Once the charging cycle is complete, the charger will monitor the battery voltage. If the battery voltage drops below a specific value (V2), the charger will turn on again for a short cycle.

Both the HBS 600W<sup>®</sup> and HBS 1000W<sup>®</sup> are two stage chargers. The first stage is a constant current mode. It maintains a constant current until the battery reaches a terminal voltage (V1) and then switches to the second stage, constant voltage. At the second stage the charger decreases the charger current while holding the batteries at the terminal voltage until the charging cycle is complete. The charging cycle is complete when the current is down to A1

On the charger face plate, there is a status light panel that displays the current status of the charger.

The first light (**POWER**) should be ON when the AC cord is connected to a proper AC power source.

The three **STATUS** lights will indicate the current charging condition as follows:

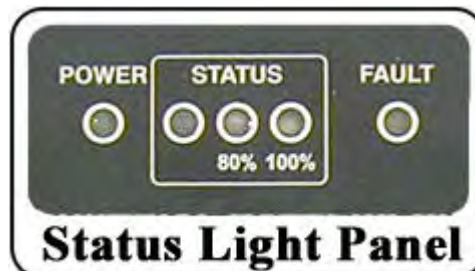
**Left:** Charge cycle is ON and is in constant current mode.

**Left & Middle (80%):** Charge cycle is ON and is in constant voltage mode.

**Right (100%):** Charge cycle completed.

The **FAULT** light will turn ON and flash a fault code only when an abnormal charging condition has occurred. Refer to the fault code table for more information.

NOTE: Critical faults will be accompanied with an audible beeping.



## ***TESTING THE CHARGING CYCLE***

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In typical installations, The charge cycle will be completed in 8 to 12 hours depending on the state of charge of the batteries when the charge cycle was started.

NOTE: The charge cycle time is limited to 20-hours (max). A fault will occur if charging time exceeds the time limit. Refer to the fault code table for more information.

A charger could remain on for longer than 12 hours if:

- The vehicle is equipped with batteries larger than 220 Amp hour capacity.
- The charging cycle is interrupted at any time during the charging cycle.
- Defective batteries causing a fluctuating DC voltage that confuses the charger.
- One or more defective cells in the battery pack.
- A brownout (drop in AC line voltage) during the charging cycle.
- An electrically noisy charging environment.

NOTE: This charger has a maintenance mode that will restart the charger if the battery voltage drops below a threshold after the charge cycle is complete. In some cases, it may appear that the charger is not turning off due to that the charger has restarted. Fully test the battery pack before assuming that the charger is not turning off or running too long.

A charger could turn off in less than 12 hours, but still show symptoms of overcharging if:

- The electrolyte in the batteries is too high (boil over).
- The electrolyte in the batteries is too low (excessive gassing or sulfur smell).

To test the charger to see if it is turning off correctly, monitor the battery voltage and charging current during the charging cycle as indicated below.

Using a digital voltmeter and clamp on DC ammeter, monitor the battery voltage and current during the charging cycle. The charging current should remain within 10% of the DC output current (see previous page) until the battery voltage reaches V1. When the voltage reaches V1, the charging current will drop significantly and slowly taper off (voltage will remain constant). The charger should turn off within 2 to 4 hours after entering the second stage when the charging current is down to A1.

## **▲ CAUTION**

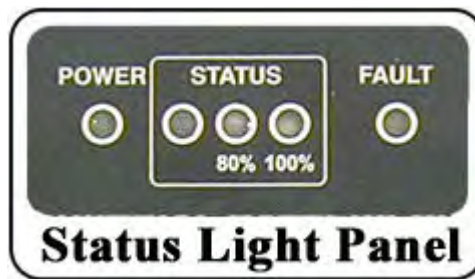
**GEL batteries must be charged with a charger configured for GEL batteries. Use of any other charger will result in damage to the batteries and premature failure of the batteries.**



## STATUS LIGHT ERROR CODE TABLE

If the Fault light is ON or flashing, it indicates a problem has occurred during the charging cycle. If the light is flashing, it will flash from 2 to 6 times before a pause. This is the fault code.

Refer to the table below.



Fault Code	Description	Action Required
1 (no flash)	Time out	Charge cycle time exceeded the time limit. Test batteries for possible defective cells.
2*	Open circuit or reverse polarity to battery	Check battery wiring.
3*	Battery voltage too high	Wrong voltage charger or batteries installed. 24v charger: Battery voltage must be less than 33.7v 36v charger: Battery voltage must be less than 43.2v 48v charger: Battery voltage must be less than 57.6v
4	Overheated	Inspect for dirt or debris on the charger cooling fins and clean as required.
5*	AC line voltage too high or too low	Check the input voltage. It must be within 85-137VAC or 170-264VAC
6	Low battery voltage	Extremely discharged battery, defective battery, miswired battery. When this fault occurs, the charger will operate in a low current mode until the battery voltage is built up. This fault will reset once the battery voltage is normal. If the battery voltage does not come up: > Test the batteries > Check battery wiring
*	These faults will be accompanied by an audible beep and indicates that the charge cycle was terminated before completion.	

## **TROUBLESHOOTING**

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NOTE: There are no internally serviceable components in the charger.

To test charger operation:

Connect a DC volt meter to the main battery positive and negative terminals.

Attach a clamp on DC Ammeter to one of the charger DC output wires.

Plug the charger into an AC outlet.

Wait for charger to start (up to 15 seconds), the ammeter should display the DC Amp rating of the charger (plus or minus 10%) indicating that the charger is on (constant current mode).

The ammeter should continue to display the DC Amp rating of the charger until the battery voltage equals V1. When the battery voltage equals V1 the charger will switch to the constant voltage mode. At this point, the charging current will be reduced and will taper off until the batteries are fully charged. The batteries are fully charged when the charging current is down to A1.

If the charger does not turn on, there are no faults, and the POWER light is ON, then the charger has failed and must be replaced.

If the POWER light is OFF, then check the AC power source, AC power cable and connections. If the source, cable and connections are good, then the charger has failed and must be replaced.

The charger comes equipped with a long fully insulated AC cord that can be cut to length as needed for the vehicle application. Do not cut the AC cord and splice to the existing AC cord in the vehicle. **Cutting and splicing the AC cord will void the charger warranty**

### **⚠ CAUTION**

**GEL batteries must be charged with a charger configured for GEL batteries. Use of any other charger will result in damage to the batteries and premature failure of the batteries.**



# signet® Charger Troubleshooting

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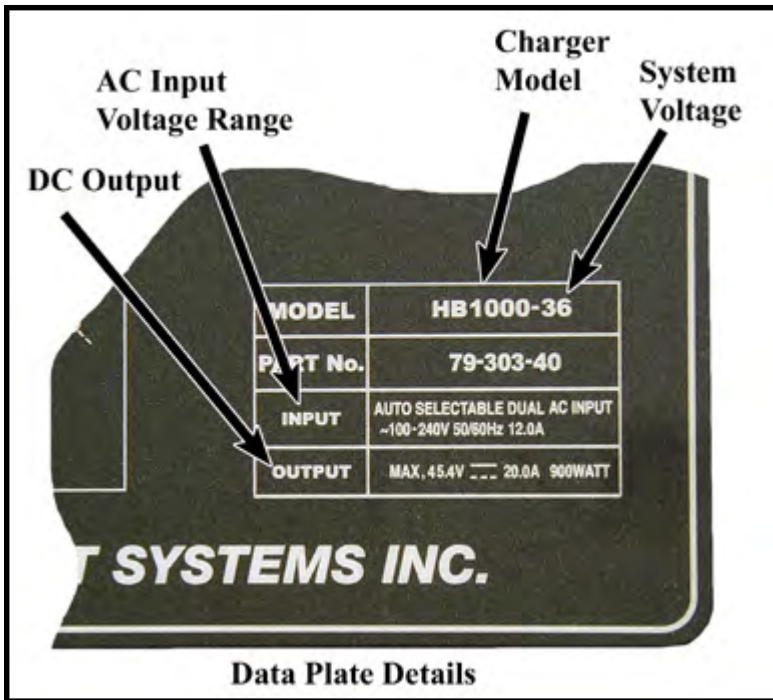
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### ⚠ CAUTION

Turn the Key switch OFF **BEFORE** disconnecting the batteries. Disconnecting the batteries with the key switch ON may corrupt the controller programming resulting in a fault code 1 (refer to fault table).



## OPERATING INSTRUCTIONS AND THEORY OF OPERATION

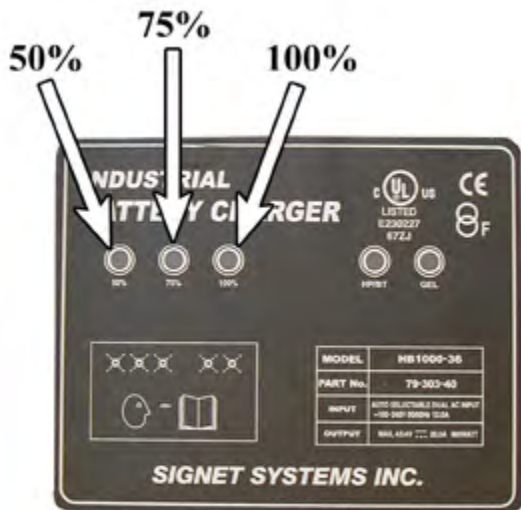


The model HB600W<sup>®</sup> and HB1000W<sup>®</sup> chargers are designed as semiautomatic chargers. The charger turns itself on when it is plugged into the wall outlet and turns off when the batteries are fully charged.

Both the HB600W<sup>®</sup> and HB1000W<sup>®</sup> are two stage chargers. The first stage is a constant current mode. It Maintains a constant current until the battery reaches a terminal voltage and then switches to the second stage, constant voltage. At the second stage the charger decreases the charger current while holding the batteries at the terminal voltage until the charging cycle is complete.

The charger faceplate has three status LED's that monitor the charging status. Refer to the chart and illustration below for the function of these LED's.

If an error occurs during charging, the charger will beep, and display an error code by flashing the status LED's. Refer to the Status LED error code table later in this section.



**Typical Charger Data Plate**  
(your data plate may vary)

Charging Status	Left (50%)	Middle (75%)	Right (100%)
0-50%	<b>FLASHING</b>	OFF	OFF
50% - 75%	ON	<b>FLASHING</b>	OFF
75% - 100%	ON	ON	<b>FLASHING</b>
Charging Cycle complete	ON	ON	ON
Error, refer to troubleshooting	<b>FLASHING</b>	<b>FLASHING</b>	<b>FLASHING</b>
Charger Time Out	OFF	OFF	<b>FLASHING</b>

## HB/PT AND GEL INDICATOR LAMPS

NOTE: Your charger may not be equipped with these lamps.

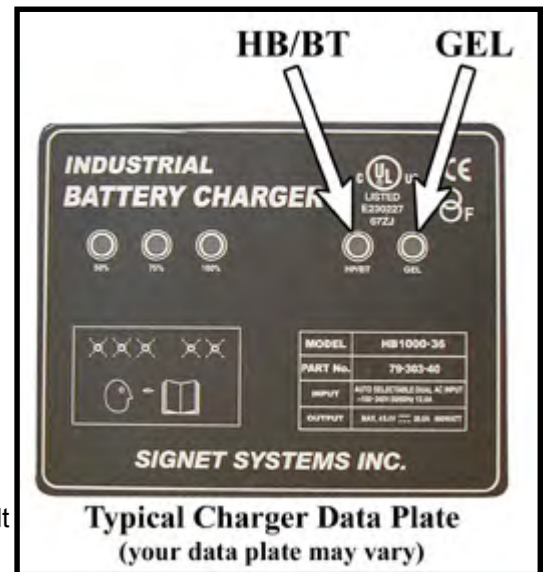
### HB/PT Lamp

If the HB/PT lamp is “ON”, then the charger has overheated and has entered a proportionally reduced output. The charging cycle will terminate if the temperature continues to rise. If the charging cycle is terminated, the charger will automatically restart once it has cooled.

The charging cycle is limited to 18-hours. If the HB/PT lamp is flashing, then the charging time has exceeded 18-hours (time is limited to 18-hours). If any of the status lamps are flashing, then the charge cycle did not complete.

### GEL lamp

This LED will only be “ON” if the charger is configured for GEL batteries. Using a GEL charger with non-GEL batteries may result in an incomplete charge or long charge times.



## **CAUTION**

**GEL batteries must be charged with a charger configured for GEL batteries. Use of any other charger will result in damage to the batteries and premature failure of the batteries.**

## TESTING THE CHARGING CYCLE

In typical installations, the charger will remain on for up to 12 hours depending on the state of charge of the batteries when the charge cycle was started.

NOTE: Charging time is limited to 18-hours (max). An error occurs if charging time exceeds 18-hours. See table on previous page.

A charger could remain on for longer than 12 hours if:

- The vehicle is equipped with batteries larger than 220Amp hour capacity.
- The charging cycle is interrupted at any time during the charging cycle.
- Defective batteries causing a fluctuating DC voltage that confuses the charge
- One or more defective cells in the battery pack.
- A brownout (drop in AC line voltage) during the charging cycle.
- An electrically noisy charging environment.

A charger could turn off in less than 12 hours, but still show symptoms of overcharging if:

- The electrolyte in the batteries is too high (boil over).
- The electrolyte in the batteries is too low (excessive gassing or sulfur smell).

To test the charger to see if it is turning off correctly, monitor the battery voltage and charging current during the charging cycle as indicated below.

Using a digit digital voltmeter and clamp on DC ammeter, monitor the battery voltage and current during the charging cycle. The charging current should remain within 10% of the DC output current (see previous page) until the battery voltage reaches 2.55 volts per cell. When the voltage reaches 2.55 volts per cell, the charging current will drop significantly and slowly taper off (voltage will remain constant). The charger should turn off within 2 to 4 hours after entering the second stage.



## ***TEST EQUIPMENT REQUIRED FOR TROUBLESHOOTING***

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Digital Multi Meter (DMM), FLUKE 79<sup>®</sup> model shown at right and in the troubleshooting illustrations.

Clamp on DC ammeter to measure up to 20-Amps.



### **Important Notes and Instructions**

- This troubleshooting guide assumes a familiarity with the use of a digital multimeter including, voltage tests, continuity tests and diode testing. If not familiar with any part of these tests, refer testing to a qualified technician.
- Make sure that the AC electrical socket the charger is plugged into is in good working condition.
- Make sure that the AC voltage at the electrical socket is the same as the AC voltage on the charger nameplate.
- Make sure the batteries are in good condition.
- If the charger exhibits intermittent problems, it must be in the failed mode for troubleshooting.
- Battery volts = Full voltage available at the batteries at the time of the test being performed.
- There are no internally serviceable components in the charge. If the charger has failed then it must be replaced.

### **⚠ CAUTION**

**This charger is rated for 115 VAC or 230 VAC operation. When switching from one input voltage to the other, wait until all three status LED's are off. Switching voltage when any of the LED's are on will result in damage to the charger.**



## STATUS LED ERROR CODE TABLE

There are three status lights (LED's) on the charger name plate. These LED's normally indicate the current operating state of the charger. If all three LED's are flashing, it indicates an error has occurred in the charging cycle. See the table below for an explanation of the error codes:

Note: If only the 100% LED is flashing and all others are OFF then the charger has exceeded its maximum charging time and shut off before the batteries were fully charged.

This could be a result of:

- Defective battery or batteries
- Excessively discharged batteries
- Oversize batteries

Error Code	Description	Action Required
1*	Reverse polarity or open circuit to the batteries	Check wiring for corrosion, loose connections, broken wires and proper connection to the batteries
2	AC line voltage too high or too low	Check the input voltage. It must be within 96-132VAC or 196-266VAC
3	Charger overheated	Wait for charger to cool, the charger will automatically restart. Inspect for dirt or debris on the charger cooling fins and clean as required.
4	Input or Output over current	Charger will automatically correct for this condition and restart

\* - In many cases fault 1 will only be displayed for a short amount of time and then the charger will attempt to restart. Typically, the fault will repeat 8-times and then the charger will start the boot up process with the 50% light on. If the charger cannot restart then the fault loop will start again, repeating the fault 1.

This fault could be a result of an open connection between the charger and batteries, an open connection on one or more of the battery cables, or an open connection internal of the charger.

Before replacing the charger, confirm all battery wiring is good.



**Typical Charger Data Plate**  
(your data plate may vary)

## TROUBLESHOOTING

To test charger operation:

Connect a DC volt meter to the main battery positive and negative terminals.

Attach a clamp on DC Ammeter to one of the charger DC output wires.

Plug the charger into an AC outlet.

Wait for charger to start (up to 15 seconds), the ammeter should display the DC amp rating of the charger (plus or minus 10%) indicating that the charger is on (constant current mode).

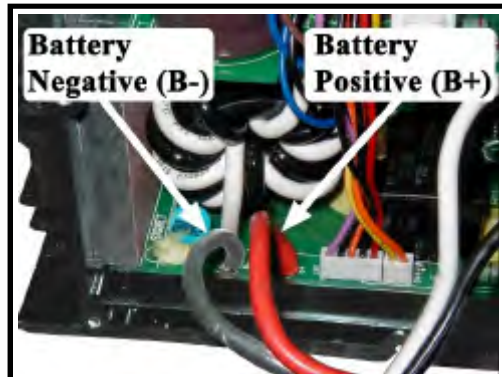
The ammeter should continue to display the DC amp rating of the charger until the battery voltage equals 2.55 VPC. When the battery voltage equals 2.55 VPC the charger will switch to the constant voltage mode. At this point the charging current will be reduced and will taper off until the batteries are fully charged.

Perform the following if the charger does not turn on:

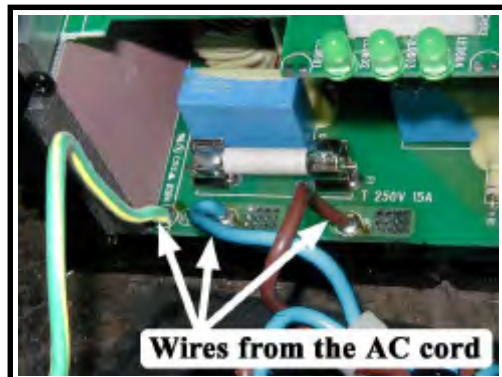
### **WARNING**

1. **Make sure the key-switch is in the "OFF" position, then remove the key.**
2. **Place the forward-reverse switch in the center "OFF" position.**
3. **Set the park brake.**
4. **Place blocks under the front wheels to prevent vehicle movement.**

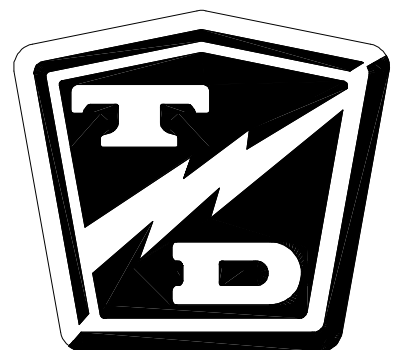
5. Disconnect the charger from the AC source.
6. Remove the charger end cap where the DC wires enter.
7. Test the voltage across the Battery Positive (red) and Battery Negative (black) wires at the lower left of the charger circuit board. This voltage should be equal to the battery voltage. If the voltage is less than the battery voltage, then the wires to the batteries have been damaged. **Stop here and repair the problem.**
8. Reinstall the charger end cap where the DC wires enter.



9. Remove the charger end cap where the AC wires enter.
10. Test the continuity of all three AC wires from the circuit board to the AC plug. If you find an open circuit in any one of the three wires then the AC cord or plug has been damaged. **Stop here and repair the problem.**
11. Install the charger end cap where the AC wires enter.



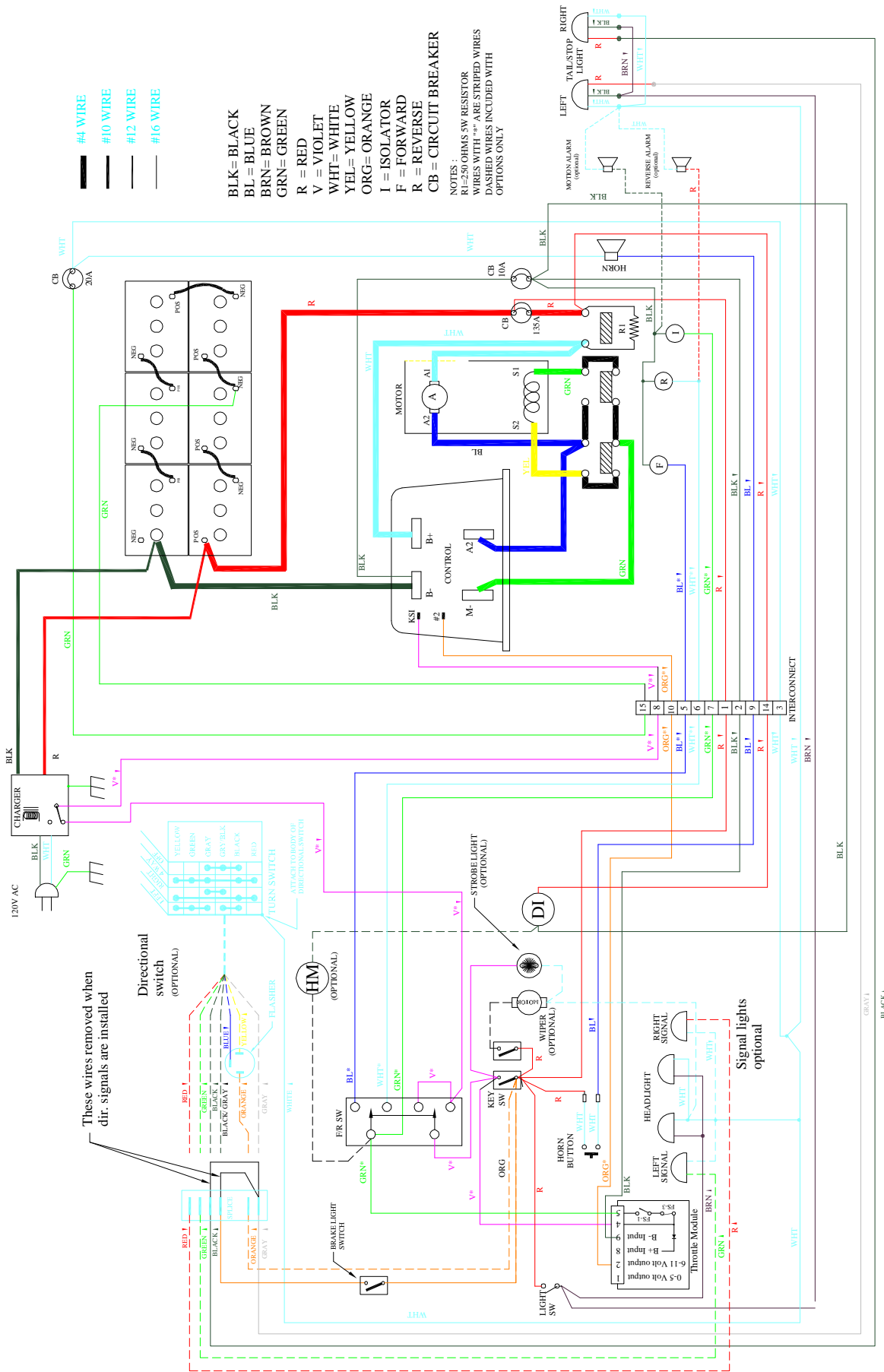
If both the AC and DC tests are good then the charger has failed. There are no internally serviceable components in the charger. If the charger has failed then it must be replaced.



# Wire Diagrams

The vehicle wiring diagram is too large to be legible when printed at this size. A full size diagram (22 x 16) is included on the CD in PDF format. You can access the diagram from a button on the CD menu.

The diagram # is SCH-00017

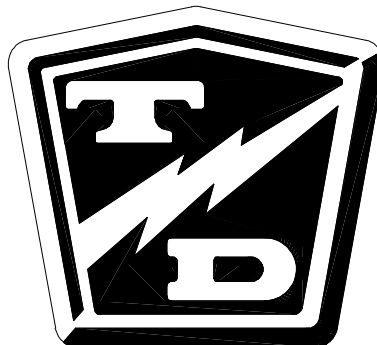


# Model B0-012-10, TYPICAL

# Illustrated Parts

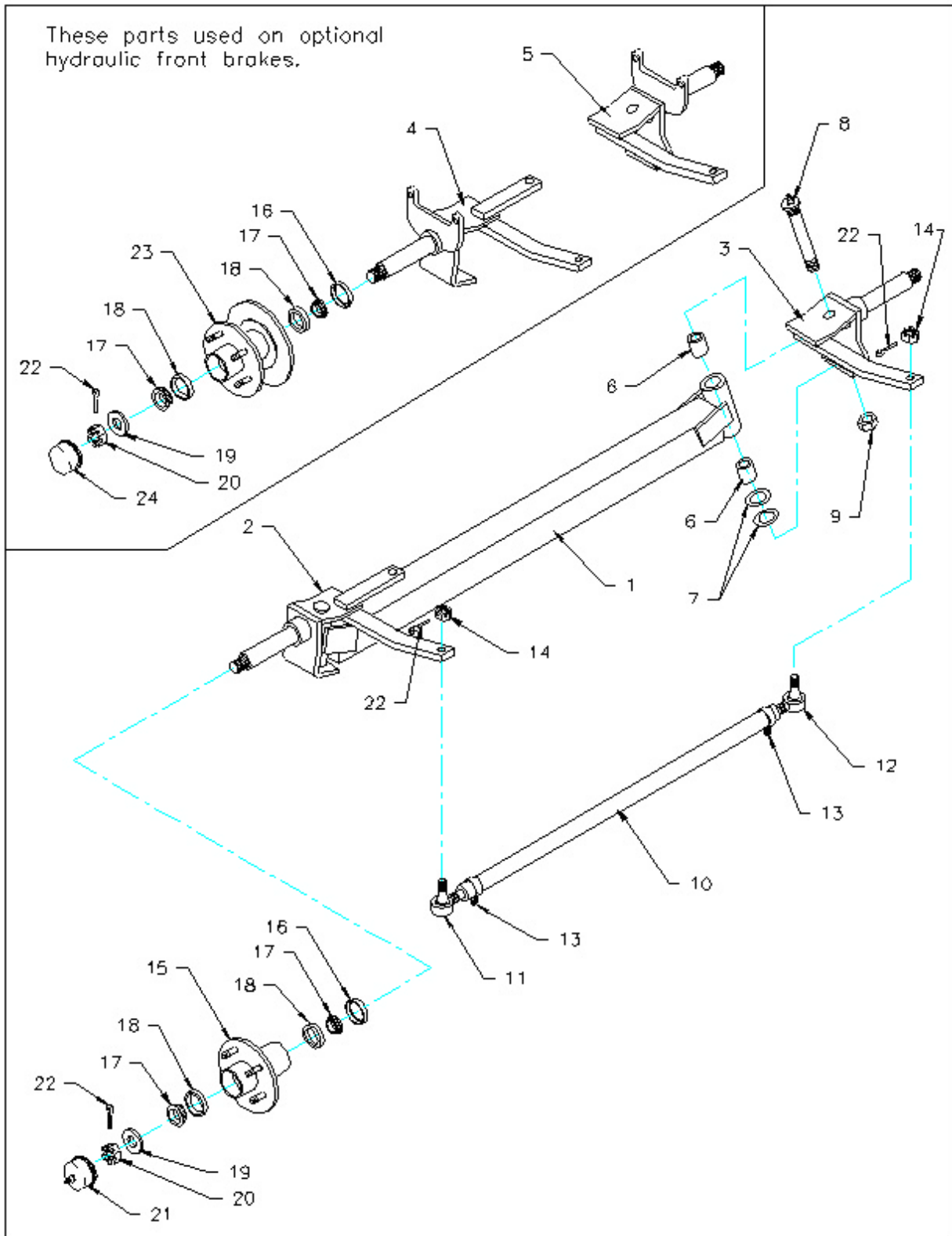
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# Front Axle

These parts used on optional hydraulic front brakes.

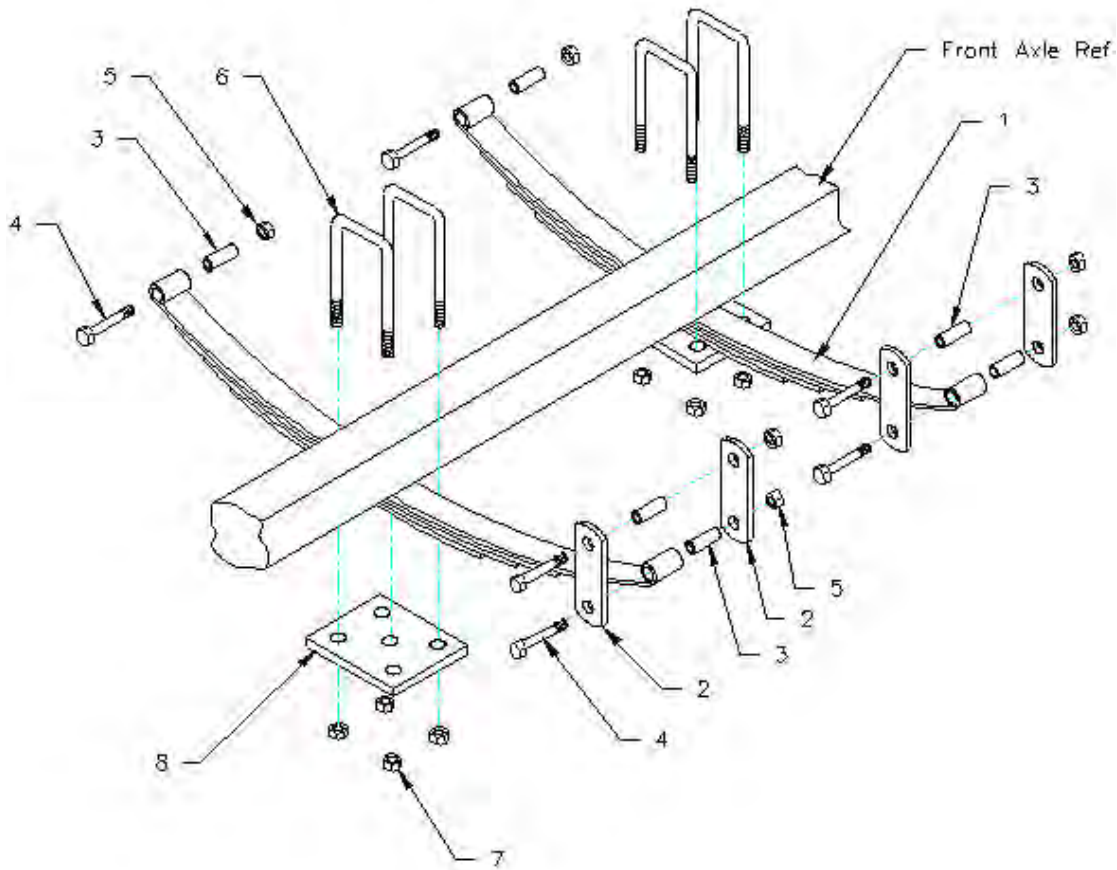


**FRONT AXLE**

Item No.	Part No.	Description	Qty
1	15-210-00	Front Axle	1
2	14-210-98	Axle Yoke, Left	1
3	14-210-99	Axle Yoke, Right	1
4	14-210-88	Axle Yoke, Hydraulic Disc, Left (optional)	1
5	14-210-89	Axle Yoke, Hydraulic Disc, Right (optional)	1
6	32-240-55	Bushing, Metal Backed Teflon, 5/8"	4
7	97-180-55	Thrust Washer, Metal Backed Teflon, 5/8"	4
8	21-020-15	King Pin, 5/8" x 1-1/4", w/fitting	2
9	88-189-81	Locknut, 5/8NC	2
10	18-041-00	Steering Sleeve, 22-1/2"	1
11	86-501-98	Ball Joint, Left	1
12	86-501-99	Ball Joint, Right	1
13	86-510-00	Ball Joint Clamp	2
14	88-159-85	Nut, Slotted, 1/2NF	2
15	12-124-00	Hub, 5 Stud, 1" Bearing (includes #16,17,18)	2
16	45-338-00	Seal, 1-1/4" ID	2
17	80-017-00	Bearing, Tapered, 1" ID	2
18	80-103-00	Race, Tapered Bearing	2
19	88-228-61	Washer, 3/4" SAE	2
20	88-239-85	Nut, Slotted, 3/4NF	2
21	92-104-00	Dust Cap, w/fitting	2
22	88-527-11	Cotter Pin, 1/8" x 1"	4
23	12-158-10	Hub, 5 Stud, 1" Bearing, w/Disc (includes #16,17,18)	2
24	92-104-01	Dust Cap	2



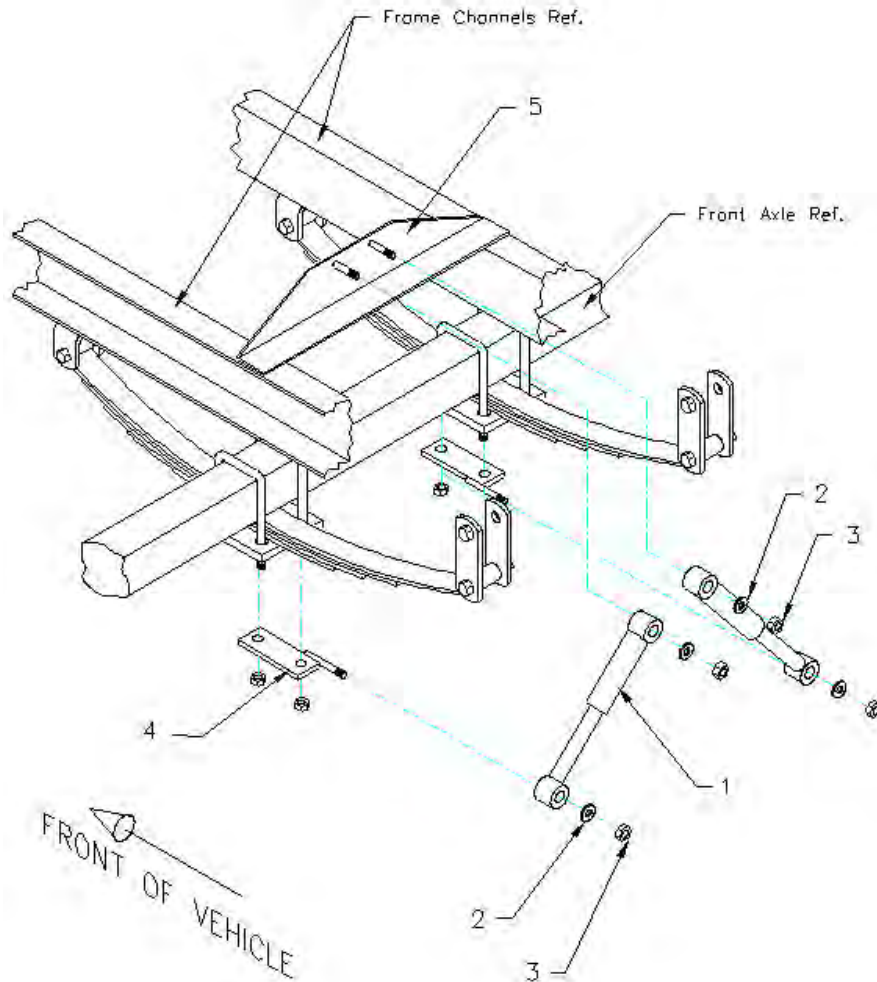
## Front Suspension



### FRONT SUSPENSION

Item No.	Part No.	Description	Qty
1	85-512-10	Leaf Spring, 1-3/4" x 27-3/8"	2
2	16-870-10	Spring Link	4
3	32-213-00	Bushing, 3/4" OD x 1.656" Long	6
4	96-248-00	Bolt, 9/16NF x 3"	12
5	88-169-82	Locknut, 9/16NF, Grade C	12
6	96-123-00	U-Bolt, 3/8NC x 2"	4
7	88-109-81	Locknut, 3/8NC	8
8	16-865-02	Spring Plate	2

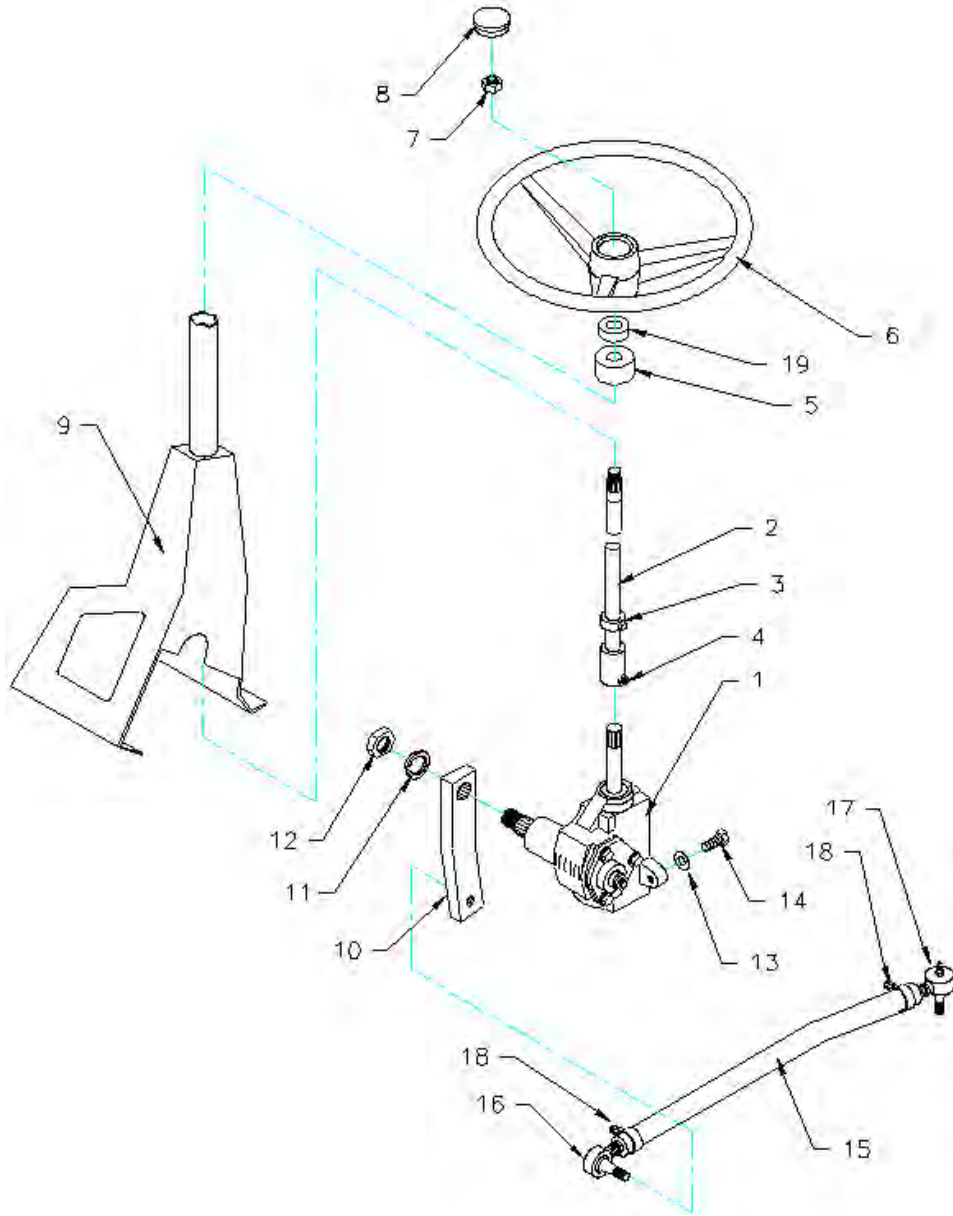
## FRONT SHOCKS (optional)



### FRONT SHOCKS (optional)

Item No.	Part No.	Description	Qty
1	86-602-00	Shock Absorber	2
2	88-128-60	Washer, 7/16	4
3	88-129-81	Locknut, 7/16NC	4
4	86-602-13	Lower Shock Mount	2
5	86-602-25	Upper Shock Mount (bolt on)	1
	86-602-61	Kit, Front Shocks (includes #1,2,3,4,5)	1

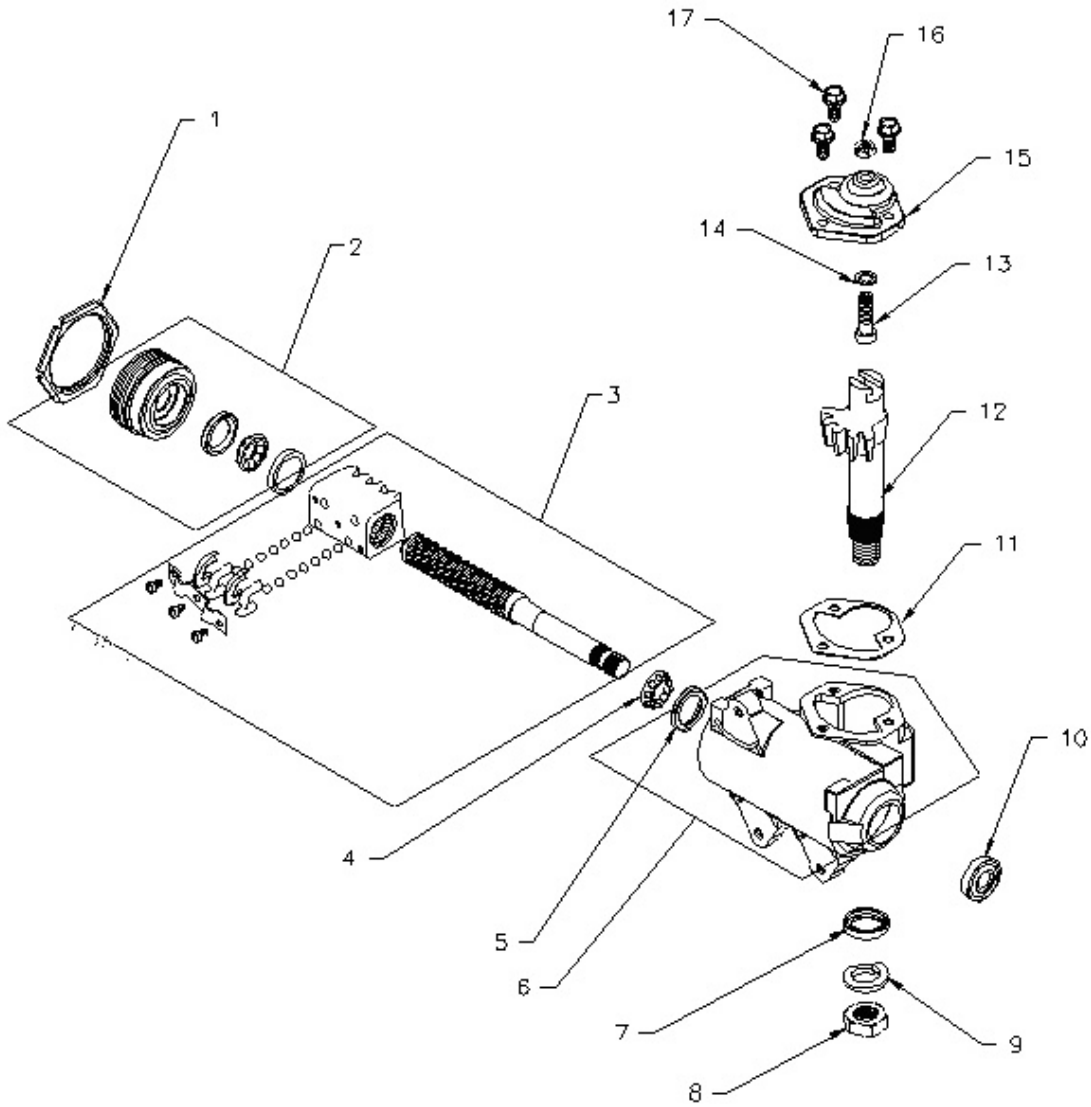
# STEERING



**STEERING**

Item No.	Part No.	Description	Qty
1	18-308-21	Steering Gear	1
2	21-031-13	Steering Shaft, 17.938" Long	1
3	17-110-00	Collar, 3/4" Shaft	1
4	88-080-04	Bolt, 5/16NC x 3/8" Hex Hd	1
5	80-400-10	Sealed Bearing, 3/4" (up to 4/1/2002)	1
	32-248-10	Bushing, plastic (after 4/1/2002)	1
6	19-011-20	Steering Wheel	1
7	88-199-82	Jam Nut, 5/8NF	1
8	19-011-25	Cover, Steering Wheel	1
9	00-210-17	Steering Column Weldment	1
10	18-111-30	Pitman Arm	1
11	88-268-62	Lock Washer, 7/8"	1
12	88-279-82	Jam Nut, 7/8NF	1
13	88-128-62	Lock Washer, 7/16"	3
14	88-120-15	Bolt, 7/16NC x 1" Hex Hd	3
15	18-057-11	Sleeve, Drag Link	1
16	86-501-98	Ball Joint, Left	1
17	86-501-99	Ball Joint, Right	1
18	86-510-00	Clamp, Ball Joint	2
19	97-200-00	Dust Washer	1

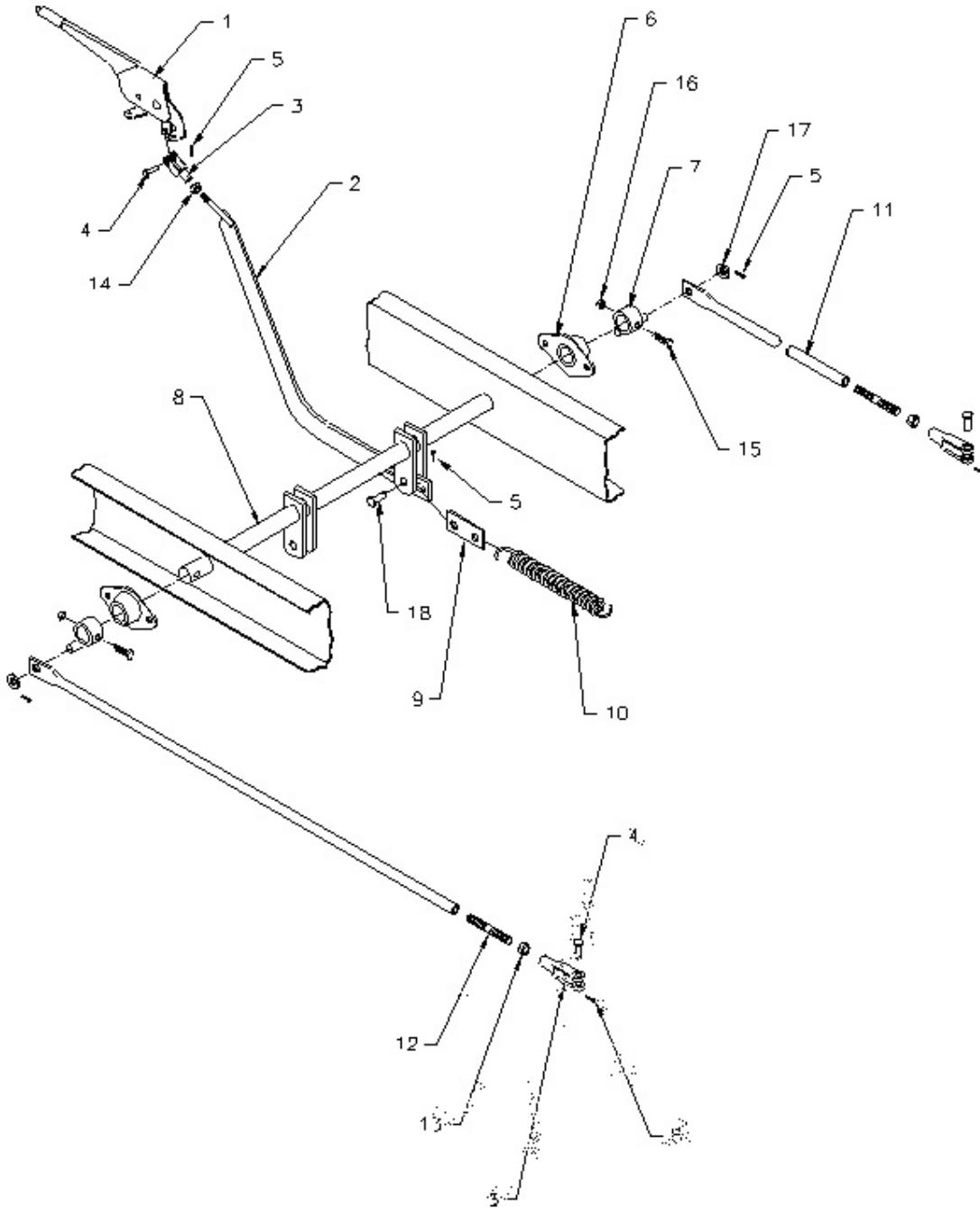
# STEERING GEAR



**STEERING GEAR (18-308-21)**

Item No.	Part No.	Description	Qty
1	18-308-70	Locknut, Worm Bearing Adjuster	1
2	18-308-71	Adjuster Assembly	1
3	18-308-72	Worm Assembly	1
4	18-308-23	Upper Worm Bearing	1
5	18-308-22	Upper Worm Bearing Race	1
6	18-308-77	Housing, Steering Gear	1
7	18-308-78	Seal, Pitman Shaft	1
8	18-308-80	Nut, Pitman Shaft	1
9	18-308-81	Lock Washer, Pitman Shaft	1
10	18-308-79	Seal, Worm Shaft	1
11	18-308-82	Gasket, Side Cover	1
12	18-308-76	Pitman Shaft	1
13	18-308-75	Lash Adjuster	1
14	18-308-85	Shim Kit	1
15	18-308-84	Side Cover	1
16	18-308-86	Nut, Lash Adjuster	1
17	18-308-83	Bolt, Side Cover	3

# PARK BRAKE

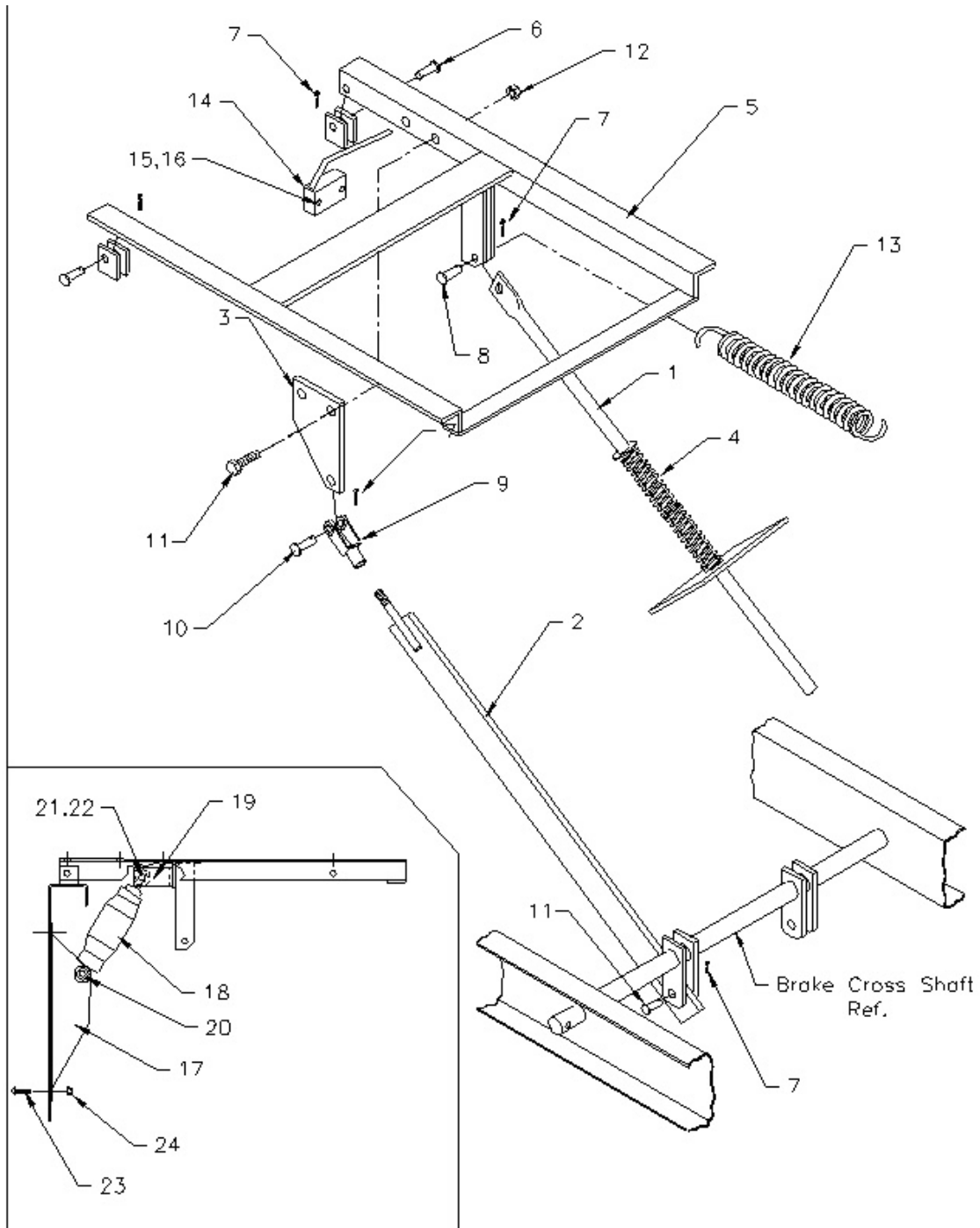


**PARK BRAKE**

Item No.	Part No.	Description	Qty
1	51-344-10	Lever, Park Brake, w/Tab	1
2	05-210-86	Hand Brake Bar	1
3	96-763-00	Clevis, 5/16"	3
4	96-773-00	Clevis Pin, 5/16" x 1" Long	3
5	88-517-09	Cotter Pin, 3/32" x 3/4" Long	6
6	80-410-20	Bearing, Brake Shaft	2
7	00-210-05	Rotor, Brake Rod	2
8	06-210-11	Brake Cross Shaft	1
9	02-210-72	Spring Link	1
10	85-295-00	Spring, Extension	1
11	02-210-01	Park Brake Rod	2
12	96-343-00	Screw, Brake Adjusting	2
13	88-099-80	Nut, 5/16NF	2
14	88-089-80	Nut, 5/16NC	1
15	88-060-14	Bolt, 1/4NC x 1-1/2" Hex Hd	2
16	88-069-81	Nut, 1/4NC	2
17	88-108-60	Washer, 3/8" Cut	2
18	96-772-00	Clevis Pin, 3/8" x 1" Long	1



## DEADMAN SEAT BRAKE (optional)



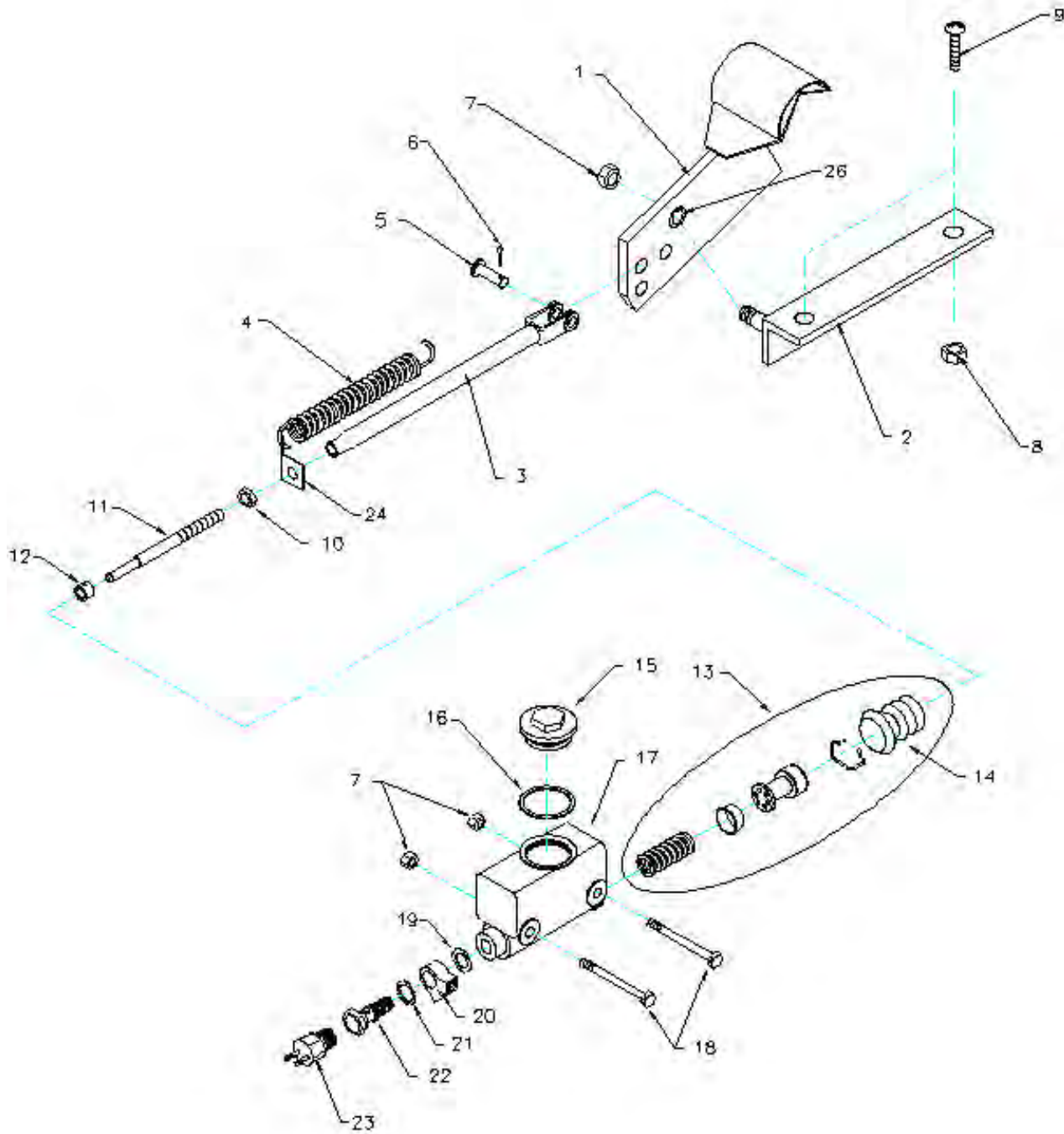
**DEADMAN SEAT BRAKE**

Item No.	Part No.	Description	Qty
1	00-210-24	Brake Push Rod	1
2	02-210-50	Seat Brake Link	1
3	02-210-60	Seat Link Arm	1
4	85-123-00	Spring, Deadman Seat	1
5	00-210-03	Seat Frame	1
6	96-773-00	Clevis Pin, 5/16" x 1" Long	2
7	88-517-09	Cotter Pin, 3/32" x 3/4" Long	5
8	96-773-10	Clevis Pin, 5/16" x 1-1/8" Long	1
9	96-762-00	Clevis, 3/8"	1
10	96-772-00	Clevis Pin, 3/8" x 1-1/8" Long	1
11	88-100-09	Bolt, 3/8NC x 3/4" Hex Hd.	2
12	88-109-81	Locknut, 3/8NC	2
13	85-234-00*	Spring, Extension, 1" OD x 5-1/2"	1
14	71-135-01**	Seat Switch	1
15	88-014-13**	Screw, 6-32 x 1-1/4" Round Hd.	2
16	88-019-86**	Locknut, 6-32	2
17	00-210-31	Mount, Seat Shock	1
18	86-007-00	Shock Absorber	1
19	02-210-91	U-Mount, Seat Shock	1
20	32-207-10	Bushing, Rubber, 3/8" x 5/8" x 1" Long	2
21	88-080-15	Bolt, 5/16NC x 1-3/4" Hex Hd	2
22	88-089-81	Locknut, 5/16NC	2
23	88-065-09	Screw, 1/4NC x 3/4 Phillips Truss Hd	2
24	88-069-87	Nut, 1/4NC Keps	2
Not Shown	98-756-00	Bushing, seat frame	2

\* This part is used on the standard B2-10 without the deadman seat option.

\*\* These parts are standard on all B2-10s.

# MASTER CYLINDER & BRAKE LINKAGE

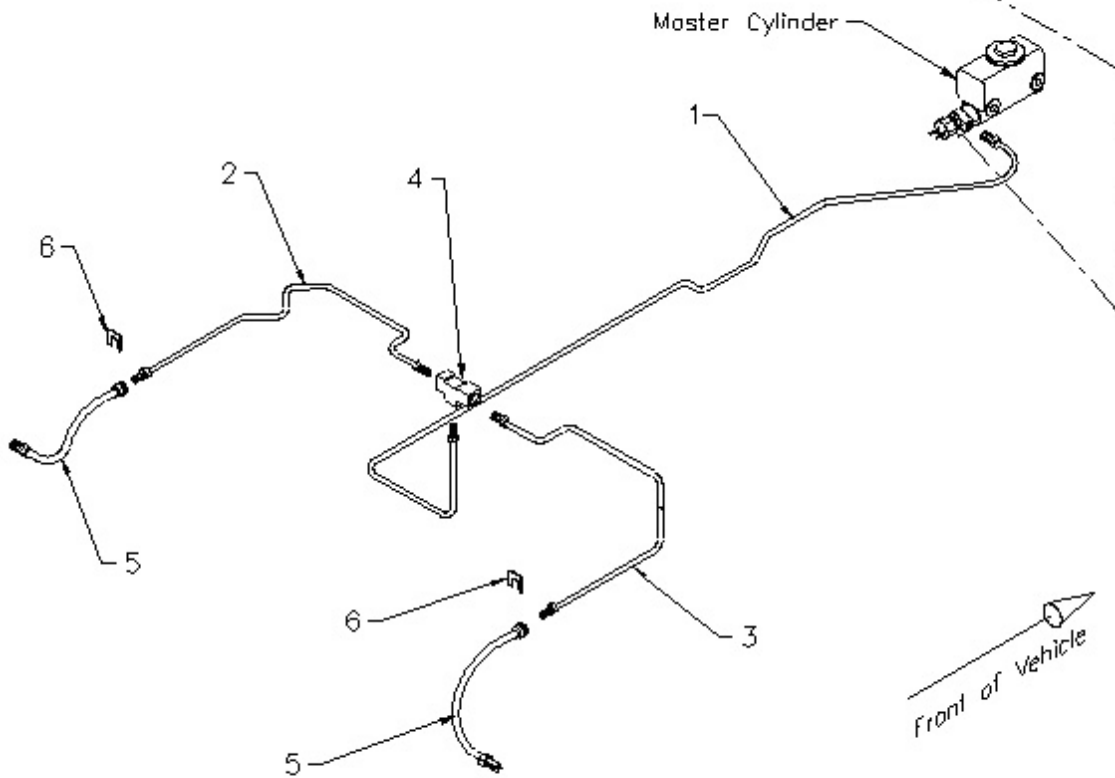
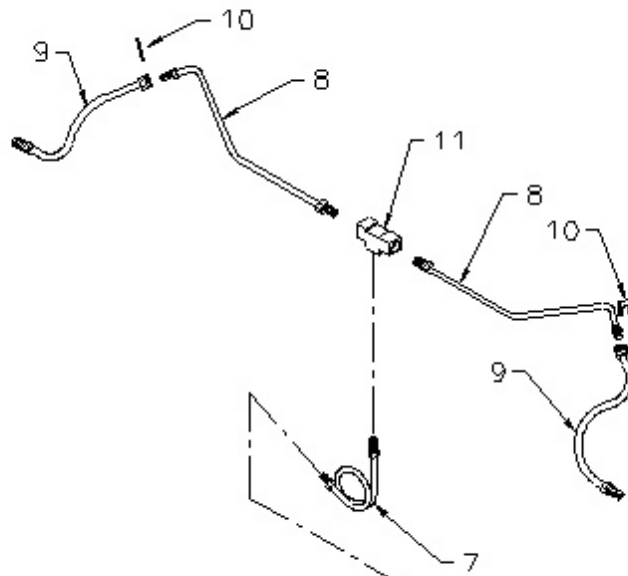


**MASTER CYLINDER & BRAKE LINKAGE**

Item No.	Part No.	Description	Qty
1	05-210-97	Brake Pedal	1
2	00-210-21	Mount, Brake Pedal	1
3	00-210-08	Rod, Hydraulic Brake	1
4	85-233-00	Spring, Extension, 1" OD x 5-1/2"	1
5	96-772-00	Clevis Pin, 3/8" x 1"	1
6	88-527-11	Cotter Pin, 1/8" x 1"	1
7	88-109-81	Locknut, 3/8NC	1
8	88-069-81	Locknut, 1/4NC	2
9	88-065-09	Bolt, 1/4NC x 3/4" Phillips Truss Hd	2
10	88-119-80	Nut, 3/8NF	1
11	50-009-00	Rod, Master Cylinder Push	1
12	17-104-00	Collar, 3/8" ID	1
13	99-510-61	Master Cylinder Rebuild Kit	1
14	99-510-51	Rubber Boot	1
15	99-510-52	Cap, Master Cylinder	1
16	99-510-53	Gasket, Master Cylinder Cap	1
17	99-510-02	Master Cylinder (includes: 13, 15, 16)	1
18	88-101-20	Bolt, 3/8NC x 3" Hex Hd, Grade 5	2
19	99-572-00	Washer, Small Dia.	1
20	99-565-00	Y-Fitting	1
21	99-571-00	Washer, Large Dia.	1
22	99-578-00	Bolt, Stop Light	1
23	71-110-00	Switch, Hydraulic Brake Light	1
24	06-210-03	Clip, Spring Anchor	1
26	32-240-40	Bearing, 3/8", Metal Backed Teflon	1
	94-410-00	Brake Fluid, Hydraulic, Dot 5, 12 oz. (up to S/N 151284)	1
	N/A	Brake Fluid DOT 3 (After S/N 151284)	

# HYDRAULIC BRAKE LINES

Used With Optional Front Brakes



## HYDRAULIC BRAKE LINES

Rear

Item No.	Part No.	Description	Qty
1	99-607-51	Brake Line, 51 Long	1
2	99-605-55	Brake Line, Left	1
3	99-605-56	Brake Line, Right	1
4	99-564-00	T-Fitting	1
5	99-580-20	Brake Hose	2
6	99-576-00	Clip, Brake Hose	2

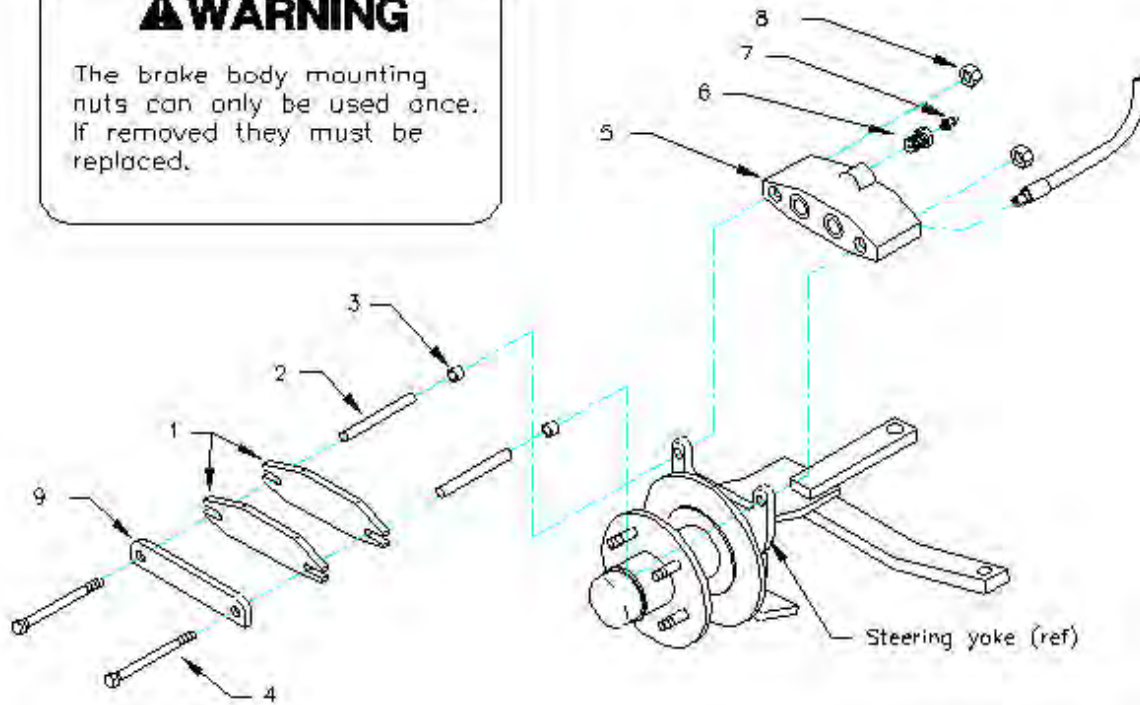
Front (optional)

7	99-607-51	Brake Line, 51 Long	1
8	99-603-53	Brake Line, Front	2
9	99-580-20	Brake Hose	2
10	99-576-00	Clip, Brake Hose	2
11	99-564-00	T-Fitting	1

## FRONT BRAKES (optional)

### **⚠ WARNING**

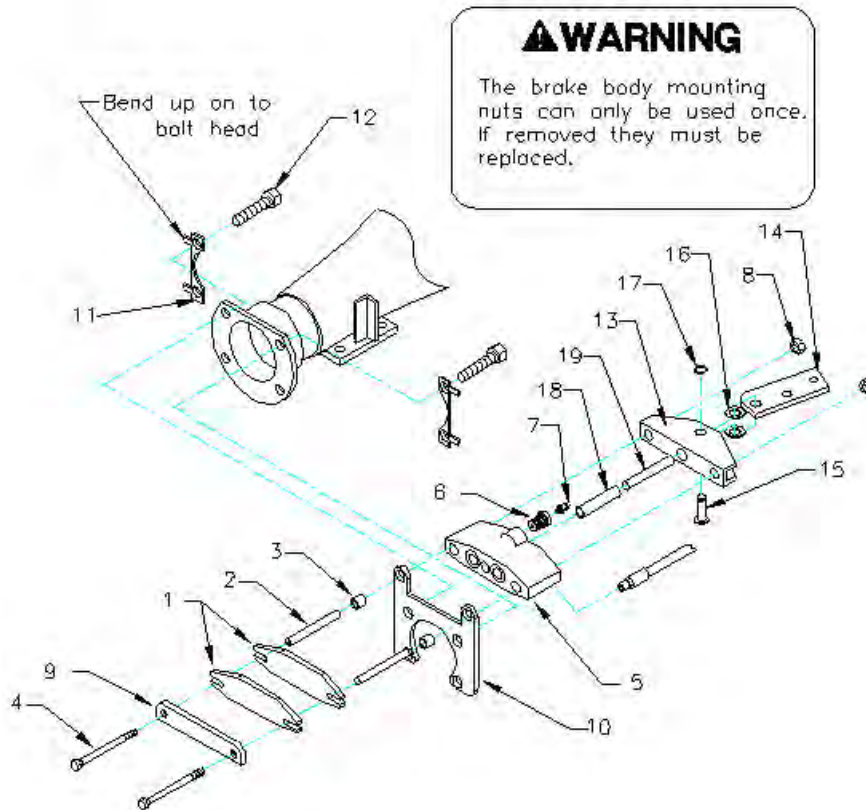
The brake body mounting nuts can only be used once. If removed they must be replaced.



## REAR BRAKES

### **⚠ WARNING**

The brake body mounting nuts can only be used once. If removed they must be replaced.



**FRONT BRAKES (optional)**

Item No.	Part No.	Description	Qty*
1	41-348-70	Pad, Disc Brake	2
2	41-348-52	Spacer, Disc Brake	2
3	32-240-40	Bushing, Mounting Bracket	2
4	88-067-21	Brake Body Bolt	2
5	41-350-70	Hydraulic Brake Body, Lt or Rt	1
6	99-588-01	Bleeder Fitting	1
7	99-588-00	Bleeder Valve	1
8	88-069-82	Locknut, 1/4NC, Grade 8; DO NOT REUSE!	2
9	41-350-51	Secondary Plate	1

\* Quantities are for one brake assembly only. The left brake assembly is shown in the illustration.

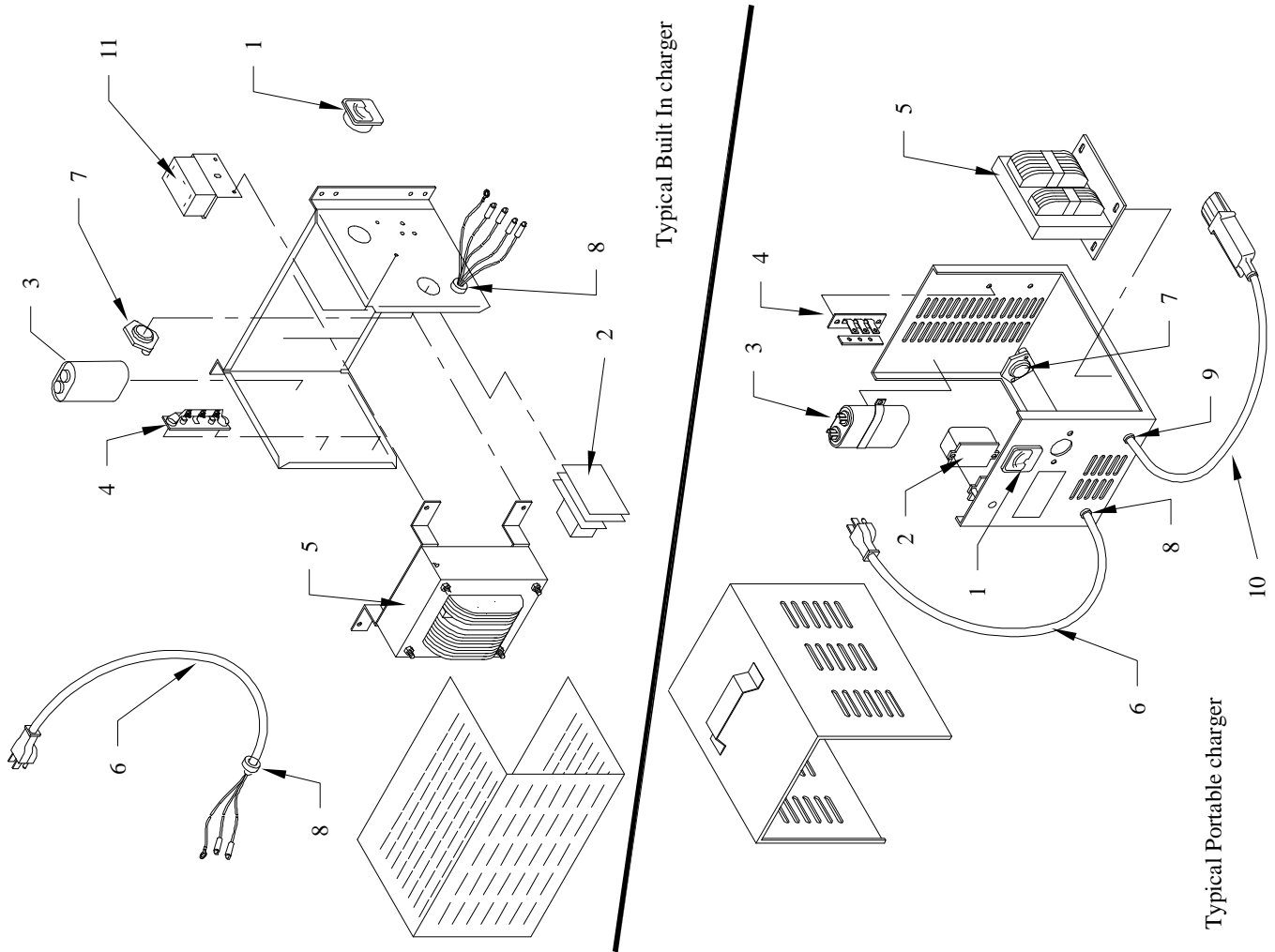
**REAR BRAKES**

Item No.	Part No.	Description	Qty*
	41-350-86	Hydraulic Brake Assembly, Left	1
	41-350-87	Hydraulic Brake Assembly, Right	1
1	41-348-70	Pad, Disc Brake	2
2	41-348-57	Spacer, Disc Brake	2
3	32-240-40	Bushing, Mounting Bracket	2
4	88-067-21	Brake Body Bolt	2
5	41-350-70	Hydraulic Brake Body, Lt or Rt	1
6	99-588-01	Bleeder Fitting	1
7	99-588-00	Bleeder Valve	1
8	88-069-82	Locknut, 1/4NC, Grade 8; DO NOT REUSE!	2
9	41-350-51	Secondary Plate	1
10	41-350-08	Bracket, Hydraulic Disc Brake	1
11	41-350-05	Clip, Bolt Locking	2
12	96-328-00	Bolt, 3/8NC x 5/8", Grade 5	4
13	41-350-12	Bracket, Park Brake	1
14	41-350-53	Arm, Park Brake	1
15	41-350-52	Clevis Pin, Hydraulic Disc Brake	1
16	88-100-00	Washer, .341" ID x .105" Thick	2
17	88-840-11	Retaining Ring, 5/16"	1
18	32-220-03	Bushing, 3/8" OD x 5/16" ID x 1-3/4"	1
19	41-350-56	Pin, Park Brake	1

\* Quantities are for one brake assembly only. The left brake assembly is shown in the illustration.



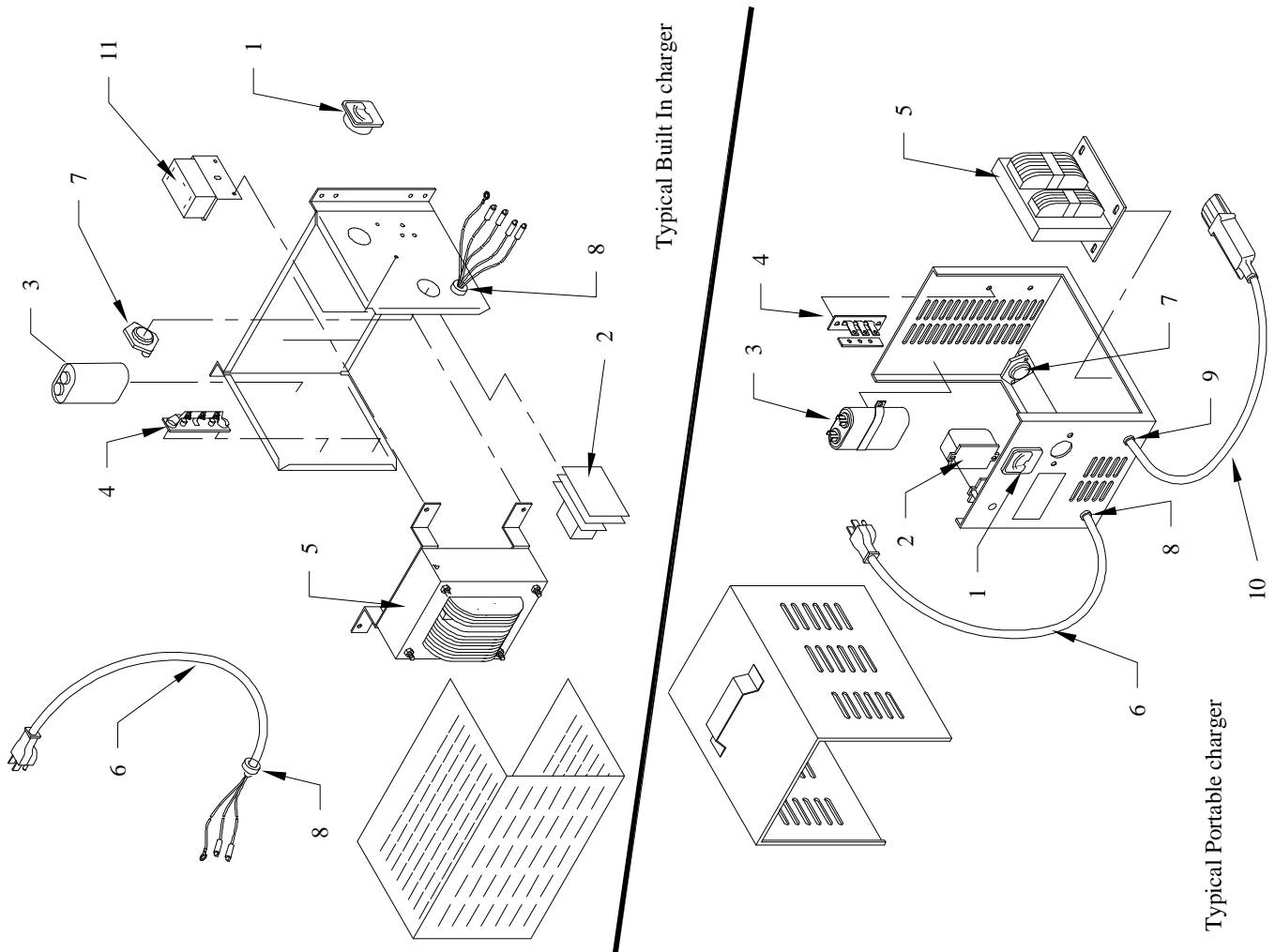
# Chargers, Lestronic (P1)



**CHARGERS**

ITEM #	DESCRIPTION	Charger Model # Charger Part #											
		22740 79-303-15	7710-32 79-305-20	11860 79-304-65E	22640 79-303-20	9695 79-309-00	9475-31 79-306-21	16910 79-309-10	22620 79-303-25	16920 79-309-20	36LC25-8ET	48LC25-8ET	
	Charger Type	36LC25-8ET	36LC25-8ET	36LC25-8ET	36LC40-8ET	48LC25-8ET	36LC40-8ET	48LC25-8ET	48LC25-8ET	36LC40-8ET	48LC25-8ET	48LC25-8ET	48LC25-8ET
	AC Voltage/Amps	115/60/12	115/60/12	230/50/na	150/60/16	115/60/15	150/60/16	115/60/15	115/60/15	115/60/17	115/60/15	115/60/15	230/50/na
	DC Voltage/Amps	36/25	36/25	36/25	36/40	48/25	36/40	48/25	48/25	36/40	48/25	48/25	48/25
	Style	Built-In	Portable	Built-In	Built-In	Portable	Built-In	Portable	Built-In	Portable	Built-In	Built-In	Built-In
1	Ammeter	-	79-851-10	79-851-10	79-852-00	79-851-10	79-852-00	79-851-10	79-852-00	79-852-00	-	-	-
2	Timer Assembly	79-805-67	79-805-69	79-805-72	79-805-67	79-805-65	79-805-67	79-805-65	79-805-68	79-805-67	79-805-68	79-805-68	S/O
	Relay for #2	79-808-00	79-808-00	79-808-00	79-808-00	79-808-20	79-808-00	79-808-20	79-808-20	79-808-00	79-808-20	79-808-20	79-808-20
3	Capacitor	79-902-00	79-902-00	79-902-00	79-902-00	79-902-00	79-902-00	79-902-00	79-902-00	79-902-00	79-902-00	79-902-00	79-902-00
4	Diode Assembly	79-749-13	79-749-13	79-749-11	79-749-10	79-749-13	79-749-10	79-749-13	79-749-13	79-749-10	79-749-13	79-749-13	79-749-13
5	Transformer	79-644-31	S/O	S/O	S/O	S/O	S/O	S/O	S/O	S/O	S/O	79-603-10	S/O
6	AC Cord	-	S/O	-	-	79-575-10	-	79-575-10	-	79-575-10	-	-	N/A
7	Fuse Assembly	79-831-00	79-831-00	79-831-00	79-831-10	79-831-00	79-831-10	79-831-00	79-831-00	79-831-00	79-831-00	79-831-00	79-831-00
8	Strain Relief	79-530-00	79-531-00	79-530-00	79-530-00	79-730-00	79-530-00	79-730-00	79-530-00	79-530-00	79-530-00	79-530-00	79-530-00
9	Strain Relief	-	79-530-00	-	-	79-730-00	-	79-730-00	-	79-531-00	-	-	-
10	DC Cord	-	79-566-10	-	-	79-566-10	-	79-566-10	-	S/O	-	-	-
11	Interlock Relay Assy.	79-809-60	-	79-306-23	79-809-50	-	79-809-50	-	-	-	-	79-809-50	-
-	Replacement AC Plug	76-200-00	76-200-00	-	76-200-00	76-200-00	76-200-00	76-200-00	76-200-00	76-200-00	76-200-00	76-200-00	N/A

# Chargers, Lestronic (P2)



**CHARGERS**

ITEM #	DESCRIPTION	Charger Model # Charger Part #												
		14400-31 79-302-50	7105-01 79-300-50	12750 79-300-55E	13110 79-301-10	9513-31 79-302-10	13760 79-302-15	22730 79-303-05	7030 79-304-60	12315 79-306-90				
	Charger Type	24LC40-8ET	24LC25-8ET	24LC25-8ET	24LC25-8ET	24LC40-8ET	24LC40-8ET	24LC25-8ET	24LC40-8ET	24LC25-8ET	24LC25-8ET	36LC25-8ET	36LC40-8ET	
	AC Voltage/Hz/Amps	230/50/7	230/50/4	230/50/4	115/60/9	115/60/13	115/60/13	115/60/8	230/50/7	230/50/8				
	DC Voltage/Amps	24/40	24/25	24/25	24/25	24/40	24/40	24/25	36/25	36/40				
	Style	Portable	Portable	Built-In	Portable	Portable	Built-In	Built-In	Portable	Portable				
1	Ammeter	79-852-00	79-851-10	-	79-851-10	79-852-00	-	-	79-851-10	79-852-00				
2	Timer Assembly	S/O	79-805-64	79-805-70	79-805-64	79-805-64	79-805-66	79-805-66	K4-071-87	K4-071-87				
	Relay for #2	79-808-10	79-808-10	79-808-10	79-808-10	79-808-10	79-808-10	79-808-10	79-808-00	79-808-00				
3	Capacitor	79-902-00	79-902-00	79-902-00	79-902-00	79-902-00	79-902-00	79-902-00	79-902-00	79-902-00				
4	Diode Assembly	S/O	79-749-13	79-749-13	S/O	79-749-13	79-749-13	79-749-13	79-749-13	79-749-13				
5	Transformer	S/O	S/O	79-644-08	S/O	S/O	S/O	S/O	S/O	S/O				
6	AC Cord	S/O	S/O	-	S/O	79-575-10	-	-	S/O	S/O				
7	Fuse Assembly	79-831-10	79-831-00	79-831-00	79-831-00	79-831-10	79-831-10	79-831-10	79-831-00	79-831-00				
8	Strain Relief	S/O	79-532-00	79-530-00	79-532-00	79-531-00	79-531-00	79-531-00	79-532-00	79-532-00				
9	Strain Relief	S/O	79-530-00	-	79-530-00	79-530-00	-	-	79-530-00	79-530-00				
10	DC Cord	79-567-10	79-566-10	-	79-566-10	S/O	-	-	S/O	S/O				
11	Interlock Relay Assy.	-	-	79-306-23	-	-	-	79-809-60	-	-				
-	Replacement AC Plug	-	-	-	76-200-00	76-200-00	76-200-00	76-200-00	76-200-00	76-200-00				

## Chargers, Signet



*Model HBS series charger shown*

Model HBS for Flooded Batteries	
PART #	DESCRIPTION
*	24 volt Charger Assembly (see note)
79-303-41	36 volt Charger assembly (see note)
79-309-42	48 volt charger assembly (see note)

Model HB for Flooded Batteries	
PART #	DESCRIPTION
79-302-20	24 volt Charger Assembly (see note)
79-303-40	36 volt Charger assembly (see note)
79-309-40	48 volt charger assembly (see note)

Model HBS for GEL Batteries	
PART #	DESCRIPTION
*	24 volt Charger Assembly (see note)
*	36 volt Charger assembly (see note)
*	48 volt charger assembly (see note)

Model HB for GEL Batteries	
PART #	DESCRIPTION
*	24 volt Charger Assembly (see note)
K4G-CH-003	36 volt Charger assembly (see note)
79-309-41	48 volt charger assembly (see note)

\* - Not available at time of printing

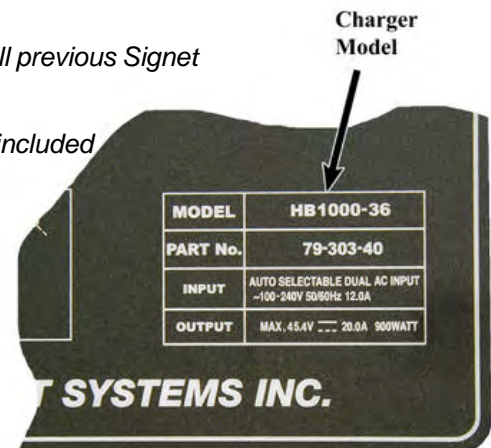
*NOTE: There are no user serviceable components inside the charger*

*NOTE: The charger AC cord is an intergal part of the charger. When replacing the charger, do not cut and splice the AC cord. **Cutting the AC cord will void the charger warranty.***

*NOTE: The Signet model HBS series charger replaces all previous Signet models.*

*NOTE: The harness connectors and AC plug are not included with the charger.*

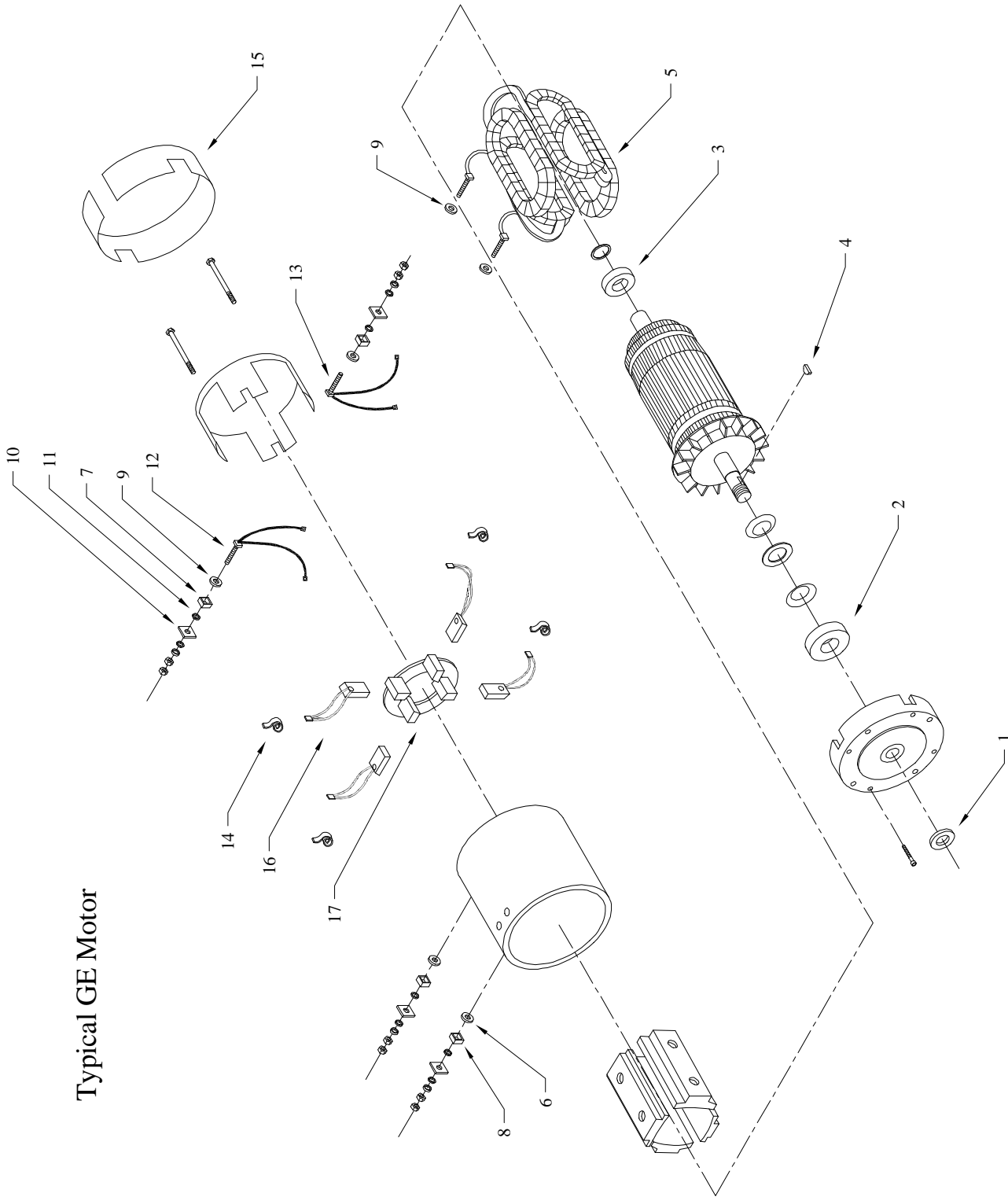
QTY	PART #	DESCRIPTION
2	75-318-20	Butt splice
2	75-320-51	Knife connector
1	76-200-00	AC plug, 115v domestic



**Typical Data Plate (your data plate may be different)**

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# Motors (P1)



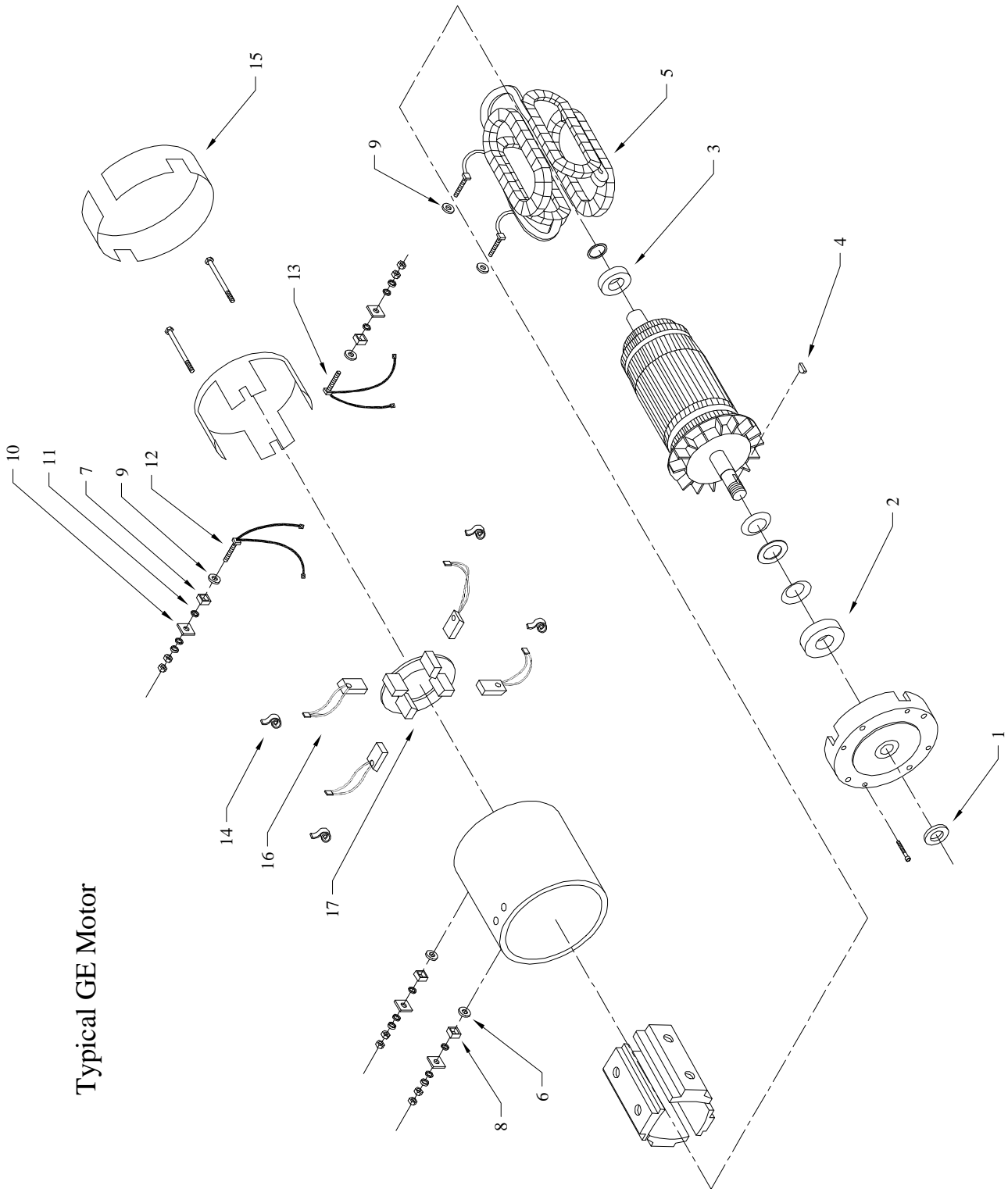
Typical GE Motor

**Motors, Series Wound Field**

ITEM #	DESCRIPTION	Motor Spec # Motor Part #																			
		5BC58JBS6110C 70-049-00	5BC58JBS6129B 70-049-05	5BC49JB399C 70-054-00	XPI706A 70-054-05	5BT1326B262A 70-055-00	5BC49JB249A 70-057-10	9475-31 70-057-20	5BC49JB3043B 70-061-00	5BT1344B185 70-072-00	L94-4006 70-074-00										
1	Oil seal	45-506-00	-	45-508-00	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
2	Front bearing	80-504-00	-	80-504-00	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
3	Rear bearing	80-209-00	80-209-00	80-200-00	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
4	Woodruff key	97-100-00	-	97-100-00	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
5	Field winding	70-201-15	70-201-15	70-203-10	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
6	Insulator	70-210-51	70-210-51	-	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
7	Bushing	-	70-049-06	98-622-00	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
8	Bushing	-	-	98-623-00	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
9	Insulator	-	70-210-51	97-178-00	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
10	Insulator	70-210-50	-	97-179-00	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
11	Insulator	-	-	-	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
-	Insulator/Bushing kit	N/A	-	70-210-62	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
12	Crossover	-	-	70-195-10	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
13	Crossover	-	-	70-195-10	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
14	Brush spring	85-412-00	85-412-00	80-412-00	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
15	Brush cover	-	-	30-802-00	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
16	Brush	70-104-00	70-104-15	70-105-00	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
17	Brush holder	70-172-00	70-172-15	70-104-10	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
18	Bearing Retainer	-	32-508-15	-	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
19	5/16NC Jam nut	N/A	88-089-91	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
20	5/16 SAE Flat washer	N/A	88-088-61	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A



# Motors (P2)

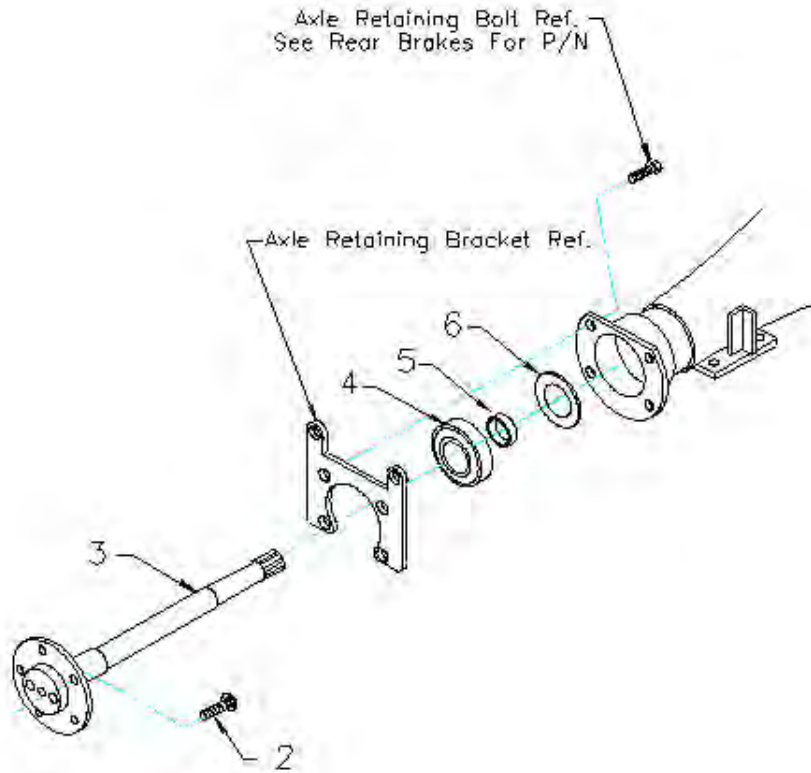


Typical GE Motor

**Motors, Series Wound Field**

ITEM #	DESCRIPTION	Motor Spec # Motor Part #																		
		5BC49JB430 70-054-20	ER5-4001 70-049-05	A02-4011 70-049-40	BPS-4002 70-054-00															
1	Oil seal	N/A	-	-	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2	Front bearing	N/A	-	-	80-212-00	80-212-00	80-212-00	80-212-00	80-212-00	80-212-00	80-212-00	80-212-00	80-212-00	80-212-00	80-212-00	80-212-00	80-212-00	80-212-00	80-212-00	80-212-00
3	Rear bearing	N/A	80-212-00	80-212-00	80-212-00	80-212-00	80-212-00	80-212-00	80-212-00	80-212-00	80-212-00	80-212-00	80-212-00	80-212-00	80-212-00	80-212-00	80-212-00	80-212-00	80-212-00	80-212-00
4	Woodruff key	N/A	-	-	97-100-00	97-100-00	97-100-00	97-100-00	97-100-00	97-100-00	97-100-00	97-100-00	97-100-00	97-100-00	97-100-00	97-100-00	97-100-00	97-100-00	97-100-00	97-100-00
5	Field winding	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
6	Insulator	N/A	-	-	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
7	Bushing	N/A	-	-	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
8	Bushing	N/A	-	-	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
9	Insulator	N/A	-	-	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
10	Insulator	N/A	-	-	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
11	Insulator	N/A	-	-	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
-	Insulator/Bushing Kit	N/A	-	-	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
12	Crossover	N/A	-	-	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
13	Crossover	N/A	-	-	70-170-30	70-170-30	70-170-30	70-170-30	70-170-30	70-170-30	70-170-30	70-170-30	70-170-30	70-170-30	70-170-30	70-170-30	70-170-30	70-170-30	70-170-30	70-170-30
14	Brush spring	N/A	70-412-20	70-412-20	70-412-20	70-412-20	70-412-20	70-412-20	70-412-20	70-412-20	70-412-20	70-412-20	70-412-20	70-412-20	70-412-20	70-412-20	70-412-20	70-412-20	70-412-20	70-412-20
15	Brush cover	N/A	N/A	N/A	70-421-00	70-421-00	70-421-00	70-421-00	70-421-00	70-421-00	70-421-00	70-421-00	70-421-00	70-421-00	70-421-00	70-421-00	70-421-00	70-421-00	70-421-00	70-421-00
16	Brush	N/A	70-109-00	70-109-00	70-170-10	70-170-10	70-170-10	70-170-10	70-170-10	70-170-10	70-170-10	70-170-10	70-170-10	70-170-10	70-170-10	70-170-10	70-170-10	70-170-10	70-170-10	70-170-10
17	Brush holder	N/A	70-180-00	70-180-00	70-180-01	70-180-01	70-180-01	70-180-01	70-180-01	70-180-01	70-180-01	70-180-01	70-180-01	70-180-01	70-180-01	70-180-01	70-180-01	70-180-01	70-180-01	70-180-01
18	Bearing Retainer	N/A	70-417-00	70-417-00	70-417-00	70-417-00	70-417-00	70-417-00	70-417-00	70-417-00	70-417-00	70-417-00	70-417-00	70-417-00	70-417-00	70-417-00	70-417-00	70-417-00	70-417-00	70-417-00
19	5/16NC Jam nut	N/A	88-089-91	88-089-91	88-089-91	88-089-91	88-089-91	88-089-91	88-089-91	88-089-91	88-089-91	88-089-91	88-089-91	88-089-91	88-089-91	88-089-91	88-089-91	88-089-91	88-089-91	88-089-91
20	5/16 SAE Flat washer	N/A	88-088-61	88-088-61	88-088-61	88-088-61	88-088-61	88-088-61	88-088-61	88-088-61	88-088-61	88-088-61	88-088-61	88-088-61	88-088-61	88-088-61	88-088-61	88-088-61	88-088-61	88-088-61

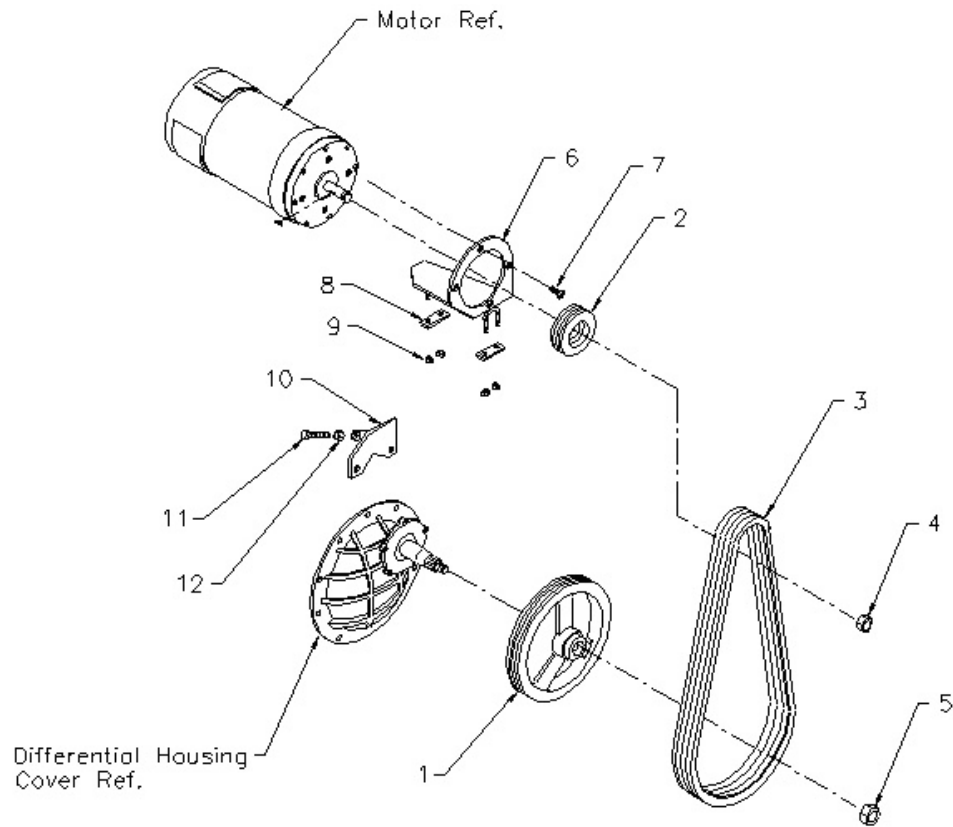
## REAR AXLE



### REAR AXLE

Item No.	Part No.	Description	Qty
1	97-236-00	Wheel Lug Nut	10
2		Wheel Bolt	10
3	41-152-00	Axle (includes #2)	2
4	80-503-00	Axle Bearing, Ball Type	2
5	32-515-00	Bearing Retainer	2
6	45-301-00	Seal, Rear Axle	2

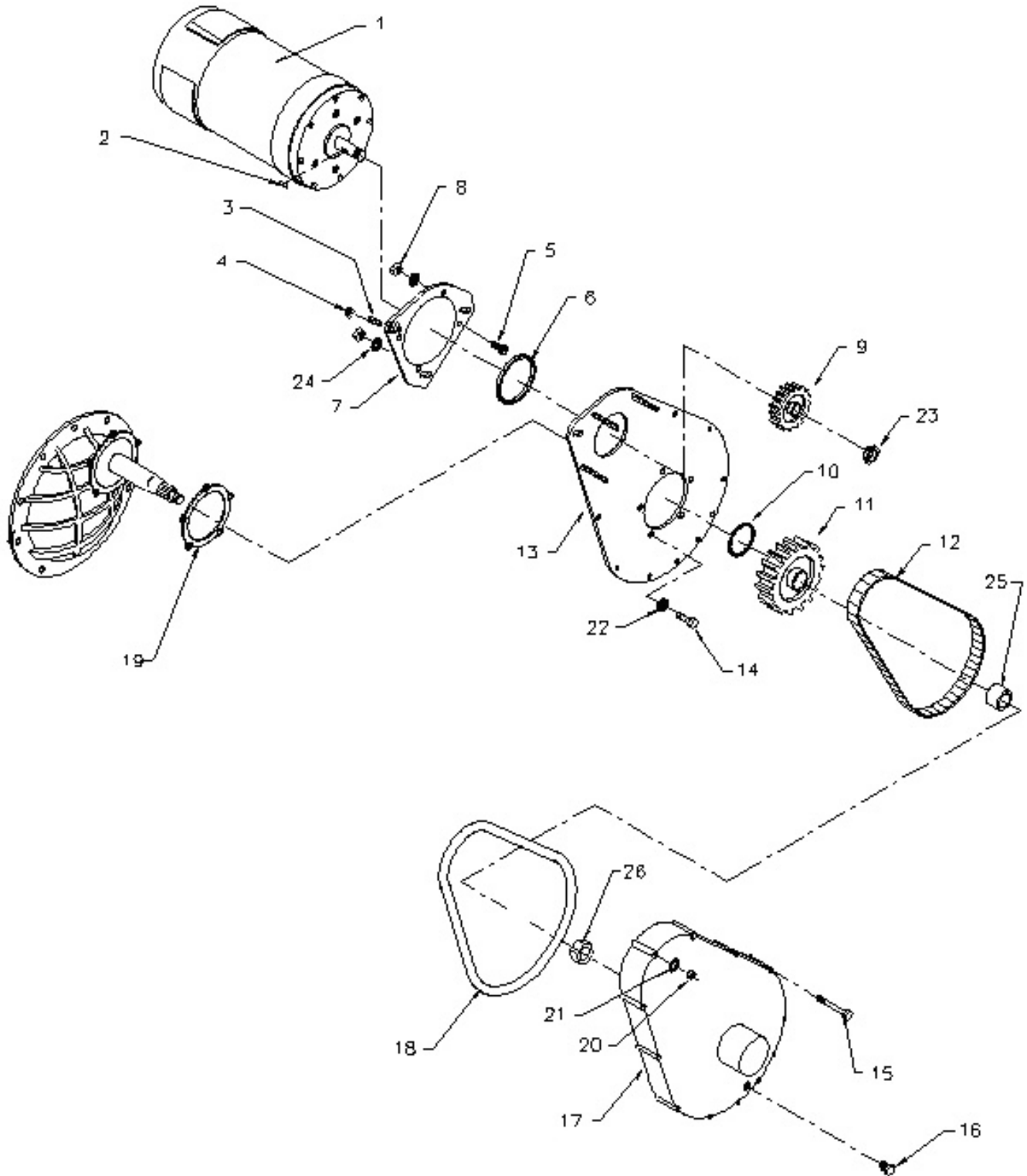
## BELT DRIVE



### BELT DRIVE

Item No.	Part No.	Description	Qty
1	30-121-10	Pulley, 4 Belt, 10.6" OD	1
2	30-158-00	Pulley, 4 Belt, 2.43" OD (used on 10.5 mph drive)	1
2a	30-159-00	Pulley, 4 Belt, 3.00" OD (used on 12.0 mph drive)	1
3	30-620-00	Belt, 3V x 400, R-Edge	4
4	88-239-82	Nut, Motor, 3/4NF Jam	1
5	97-250-00	Nut, Pinion, 3/4NF	1
6	00-380-96	Motor Mount	1
7	88-100-11	Bolt, 3/8NC x 1" Hex Hd	4
8	70-422-00	Strap, Motor Mount	2
9	88-109-87	Nut, Keps, 3/8NC	4
10	41-381-10	Motor Adjuster	1
11	96-316-00	Bolt, All Thread, 1/2NC x 3	1
12	88-149-80	Nut, 1/2NC	1

# POWER TRACTION DRIVE



**POWER TRACTION DRIVE**

Item No.	Part No.	Description	Qty
1	70-049-00	Motor, DC, 4.5/6.0 hp	1
1a	70-054-00	Motor, DC, 6.7/10.0 hp	1
1b	70-054-20	Motor, DC, 6.7/10.0 hp	1
2	97-100-00	Woodruff Key	1
3	88-087-11	Chain Adjusting Screw	1
4	88-069-80	Nut, 5/16NC	1
5	88-103-09	Motor Mounting Screw	4
6	80-703-00	O-Ring	1
7	70-454-00	Motor Mounting Plate	1
8	88-109-80	Nut, 3/8NC	3
9	30-081-00	Motor Sprocket, 14 Tooth	1
10	16-415-00	Spacer	1
11	30-093-00	Pinion Sprocket, 81 Tooth	1
12	30-508-20	Drive Chain, SSG	1
13	44-352-53	Backing Plate	1
14	88-101-13	Bolt, 3/8NC x 1-1/4" Hex Hd	5
15	88-080-19	Bolt, 5/16NC x 2-3/4" Hex Hd	9
16	41-989-00	Drain and Fill Plugs	2
17	43-201-30	Chain Cover	1
18	45-002-00	Chain Case Gasket	1
19	45-021-00	Backing Plate Gasket	1
20	88-089-81	Locknut, 5/16NC	12
21	88-088-61	Washer, 5/16 SAE	3
22	88-108-63	Lockwasher, Internal Tooth	5
23	88-239-82	Motor Nut	1
24	88-108-62	Lockwasher, 3/8"	3
25	16-423-00	Spacer, Sprocket	1
26	97-250-00	Pinion Nut	1



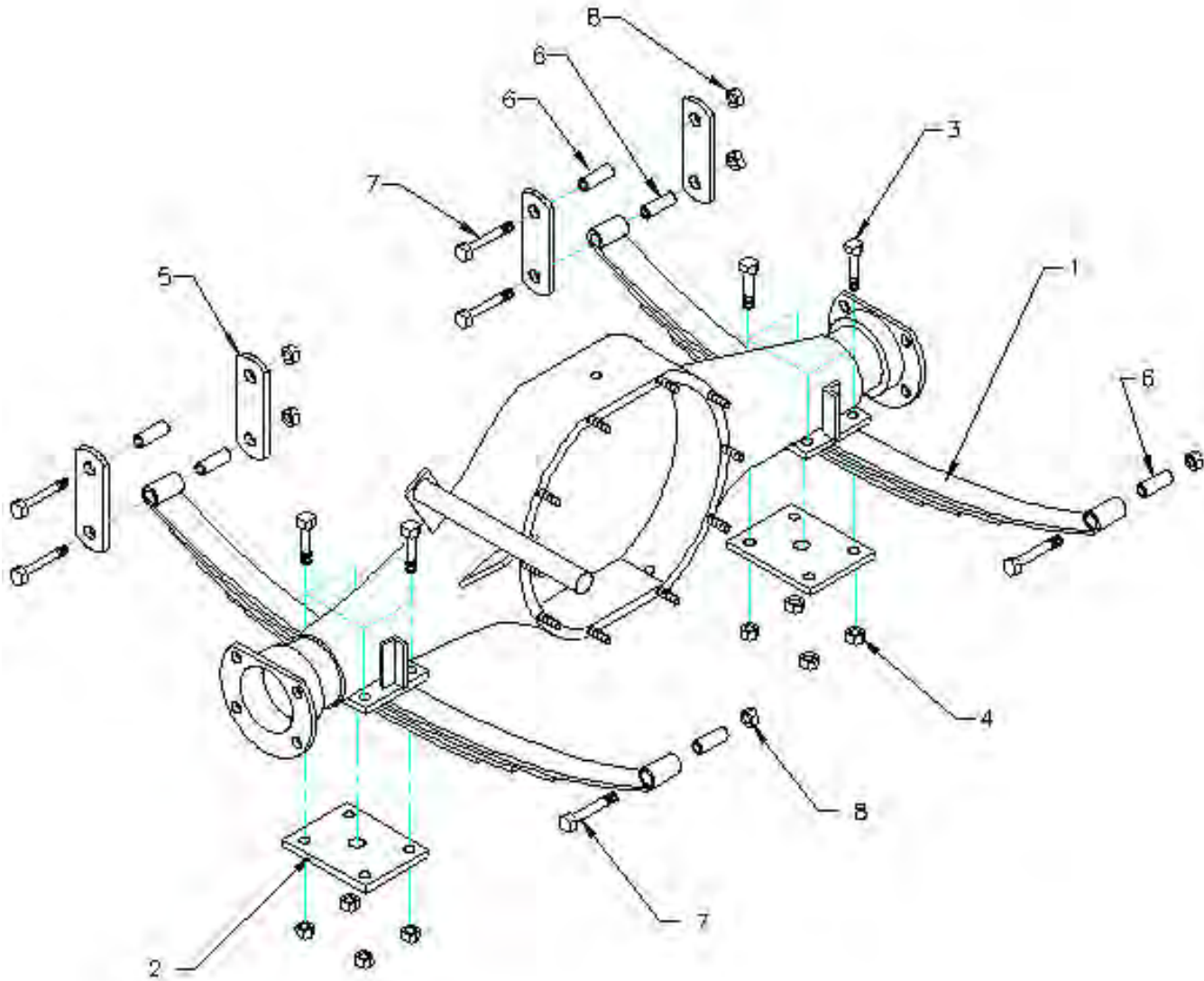
**REAR DIFFERENTIAL**

Item No.	Part No.	Description	Qty
	44-340-10	3rd Member-Complete, 2.69/2.70/2.75 Ratio	1
	44-340-12	3rd Member-Complete, 3.00 Ratio	1
1	41-709-00	3rd Member Housing (small carrier bearing, 1.628"ID)	1
1a	41-710-00	3rd Member Housing (large carrier bearing, 1.784"ID)	1
2	88-119-80	Nut, 3/8NF	14
3	41-712-00	Carrier Assembly (small bearing)	1
3a	41-713-00	Carrier Assembly (large bearing)	1
4	80-127-00	Carrier Bearing Race (80-511-00 bearing)	2
4a	80-128-00	Carrier Bearing Race (80-512-00 bearing)	2
4b	80-129-00	Carrier Bearing Race (80-513-00 bearing)	2
5	80-511-00	Carrier Bearing, 1.628"ID (small)	2
5a	80-512-00	Carrier Bearing, 1.784"ID (large)	2
5b	80-513-00	Carrier Bearing, 1.7812"ID	2
6	31-235-00	Ring and Pinion Gear Set (2.75)	1
6a	31-234-00	Ring and Pinion Gear Set (3.00)	1
7	41-997-00	Oil Plugs	2
8	41-291-51	Differential Housing	1
9	80-555-00*	Rear Pinion Bearing	1
10	80-554-00	Front Pinion Bearings	2
11	41-711-00	Pinion Housing Shim	1
12	80-702-00	O-Ring	1
13	44-340-90	Pinion Housing, w/Races	1
14	16-419-00	Shim, .002	as req'd
14a	16-420-00	Shim, .010	as req'd
14b	16-411-00	Shim, .005	as req'd
15	16-415-00	Spacer	1
16	80-125-00	Pinion Bearing Race	2
17	41-714-00*	Pinion Bearing Retainer	1
18	41-707-00	Bearing Adjusting Nut (80-511-00 bearing)	2
18a	41-707-50	Bearing Adjusting Nut (80-512-00 bearing)	2
18b	41-708-50	Bearing Adjusting Nut (80-513-00 bearing)	2
19	88-080-04	Bolt, 5/16NC x 3/8" Hex Hd	2
20	88-140-16	Bolt, 1/2NC x 2" Hex Hd	2
21	96-243-00	Bolt, 7/16NC x 7/8" Hex Hd (locking)	10
22	96-316-00	Bolt, 1/2NC x 3" All Thread	4
23	88-148-62	Washer, 1/2"	4
24	88-149-80	Nut, 1/2NC	4

\* These parts will become obsolete and do not need to be replaced. They will not be included in newer vehicles.



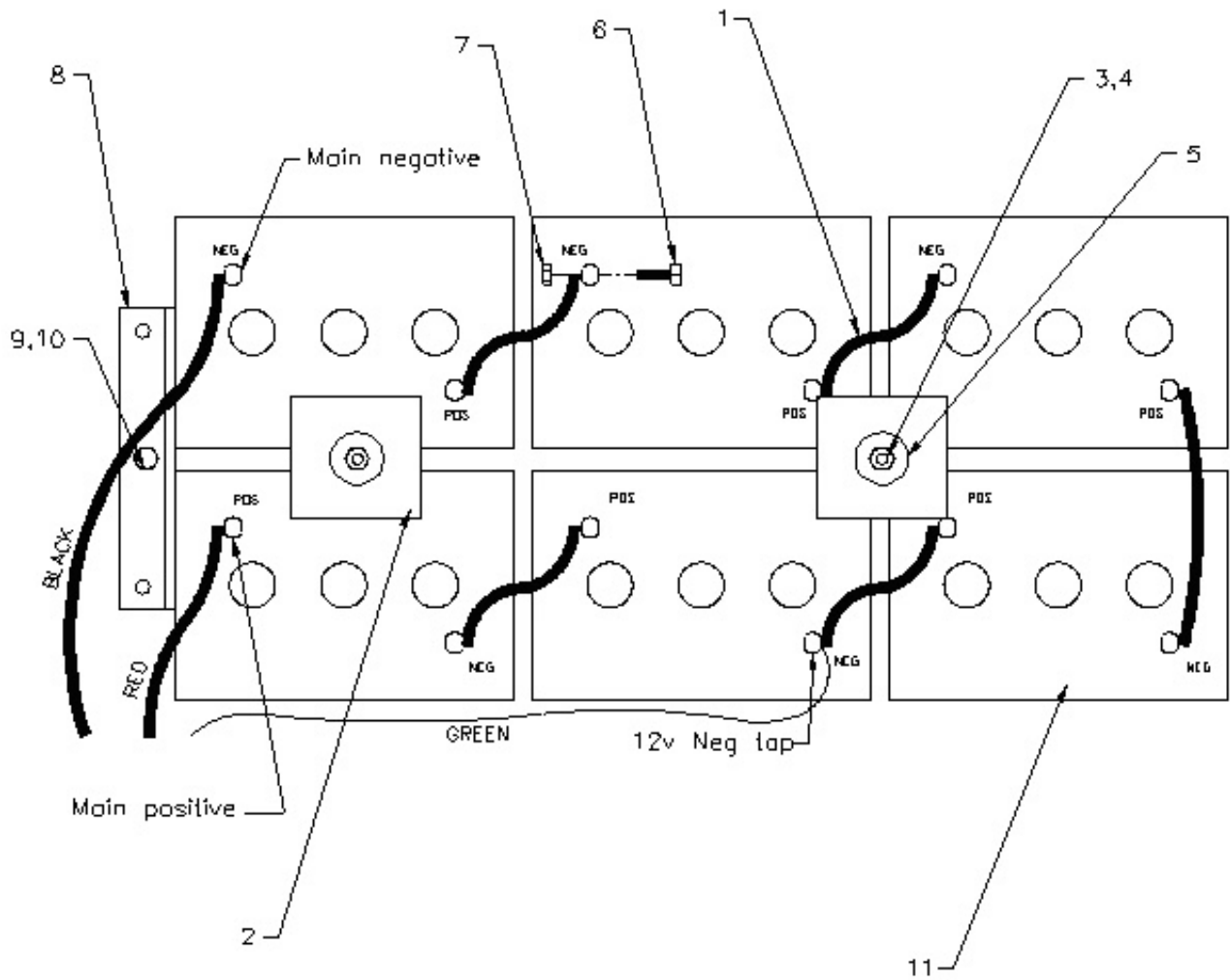
## REAR SUSPENSION



### REAR SUSPENSION

Item No.	Part No.	Description	Qty
1	85-513-10	Leaf Spring	2
2	16-861-00	Spring Pad	2
3	88-101-18	Bolt, 3/8NC x 2-1/2" Hex Hd, Grade 5	8
4	88-109-81	Locknut, 3/8NC	8
5	16-870-10	Spring Link	4
6	32-213-00	Bushing, 3/4" OD x 1.656" Long	6
7	96-248-00	Bolt, 9/16NF x 3"	6
8	88-169-82	Locknut, 9/16NF, Grade C	6

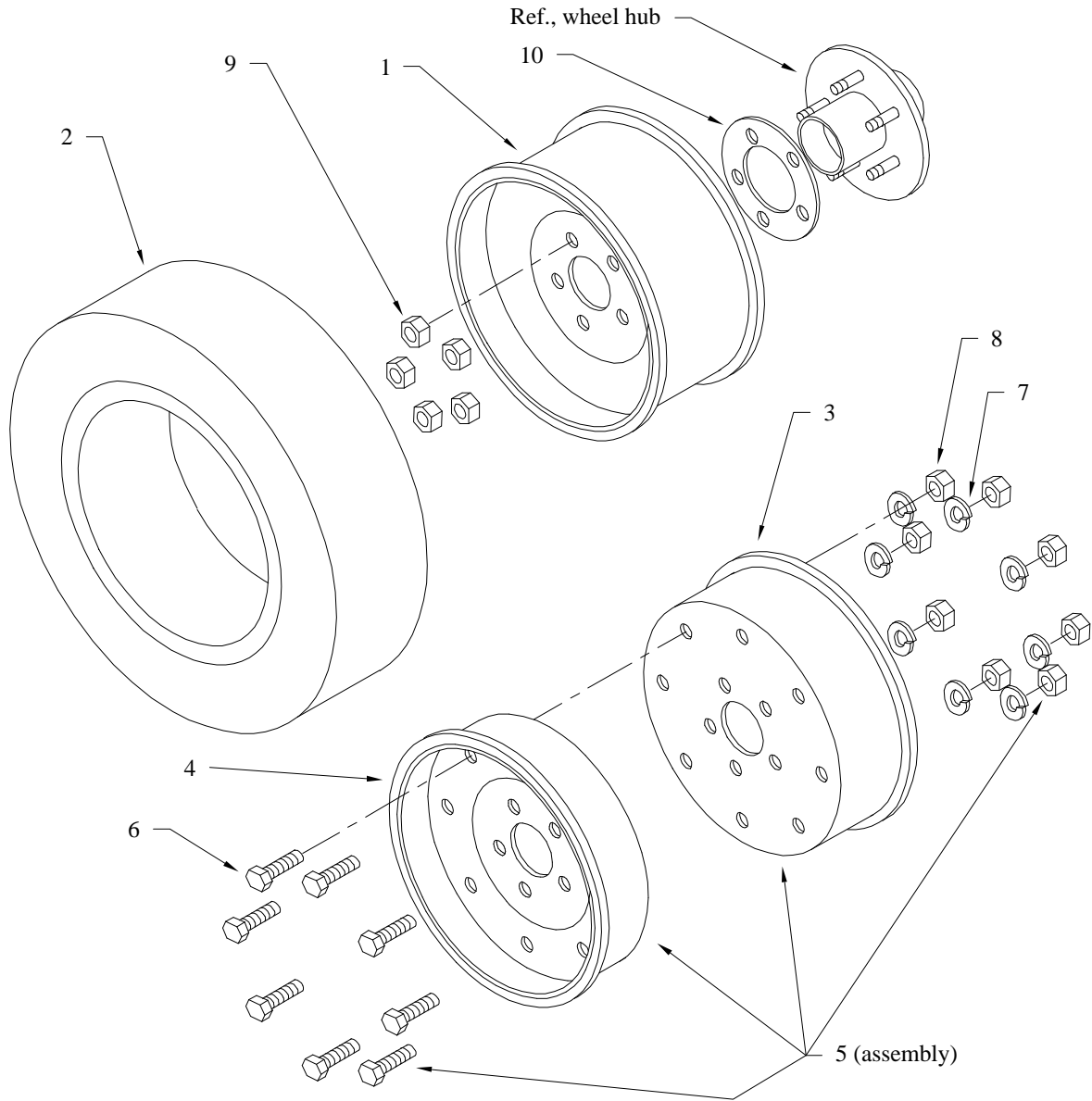
# BATTERIES



## BATTERIES

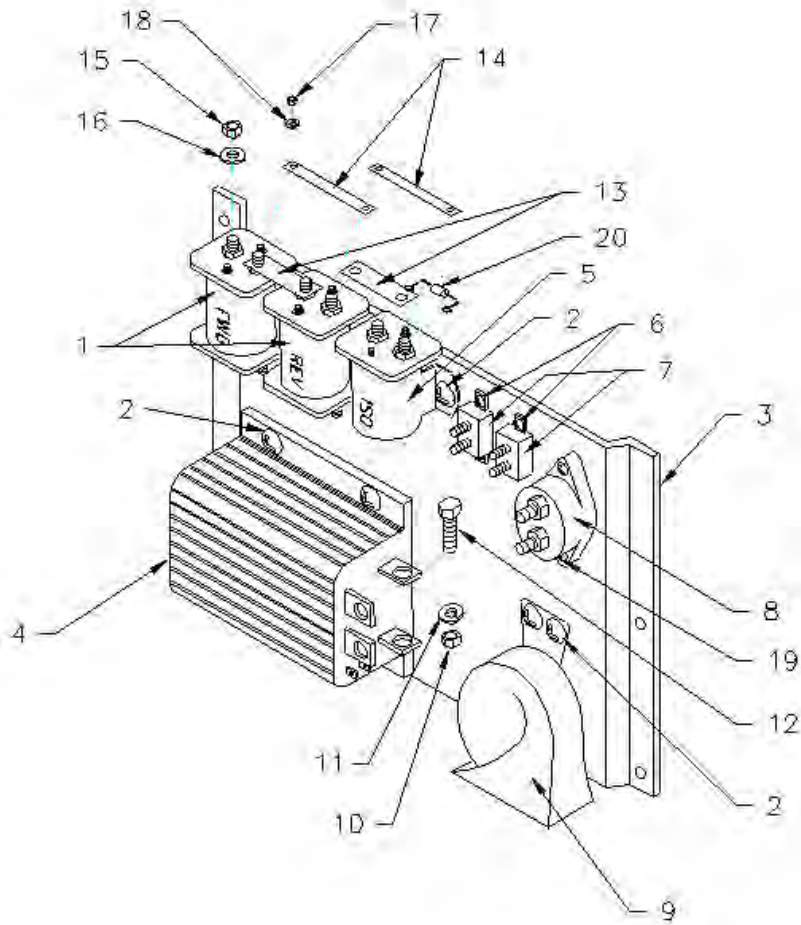
Item No.	Part No.	Description	Qty
1	75-231-00	Jumper, Battery, 10-1/4" long	5
2	50-250-00	Clamp, Battery Hold Down	2
3	50-243-10	Battery Rod	2
4	88-069-81	Locknut, 1/4NC	2
5	88-088-60	Washer, 5/16" Cut	2
6	88-081-12	Bolt, 5/16NC Square Hd, Tin-Lead	12
7	88-089-80	Nut, 5/16NC, Tin-Lead	12
8	01-534-43	Battery Box Angle	1
9	88-060-09	Bolt, 1/4NC x 3/4" Hex Hd	1
10	88-069-87	Nut, 1/4NC Keps	1
11	77-042-00	Battery, 6 Volt, 217 amp hour (standard)	6
11	77-044-00	Battery, 6 Volt, 230 amp hour (optional)	6
11	77-047-00	Battery, 6 Volt, 244 amp hour (optional)	6
11	77-042-80	Battery, 6 Volt, 217 amp hour (optional)	6
11	77-047-80	Battery, 6 Volt, 244 amp hour (optional)	6

# Tires/Wheels



Wheels and Tires		
ITEM #	PART #	DESCRIPTION
1	Wheels	
	12-012-00	5 x 8" Tubeless
	12-020-00	8.5 x 8 Tubeless
2	Tires	
	10-081-00	5.70 x 8 LR B Pneumatic
	10-082-00	5.70 x 8 Extra Grip
	10-083-00	5.70 x 8 LR C
	10-093-00	8.50 x 8 LR B
	10-091-10	8.50 x 8 Knobby
	10-092-00	8.50 x 8 LR C
	10-086-00	5.00 x 8 Man-Toterswith lugs (soft solid)
	10-250-00	16 x 4 x 12 Solid rubber
	Split Rim Wheels	
3	12-041-12	Inner Wheel (2.5 bead)
4	12-041-13	Outer Wheel (2.5 bead)
5	12-041-00	Wheel Assembly, 2.5 bead width (includes #3, #4, #6, #7, #8)
3a	12-042-12	Inner Wheel (12-bolt)
4a	12-042-13	Outer Wheel (12-bolt)
5a	12-042-00	Wheel Assembly, 3.75 bead width (includes #3a, #4a, #6, #7, #8)
6	88-110-09	3/8 x 3/4-NF Hex Bolt, grade 5
7	88-109-62	3/8 Split Lock Washer
8	88-119-80	3/8-NF Hex Nut
9	97-236-00	Wheel Nut
Not Shown	13-989-00	Valve stem, tubless tire only
Not Shown	11-041-00	8.50 x 8 Tube
Not Shown	11-040-00	5.70 x 8 Tube
	Tire and Wheel Assemblies	
	13-952-10	16 x 4 x 12 Solid Rubber, Cast Iron Wheel
	13-742-00	5.70 x 8 LR B Pneumatic
	13-742-40	5.70 x 8 Man-Toter
	13-742-11	5.70 x 8 Split Rim
	13-746-10	8.50 x 8 Pneumatic

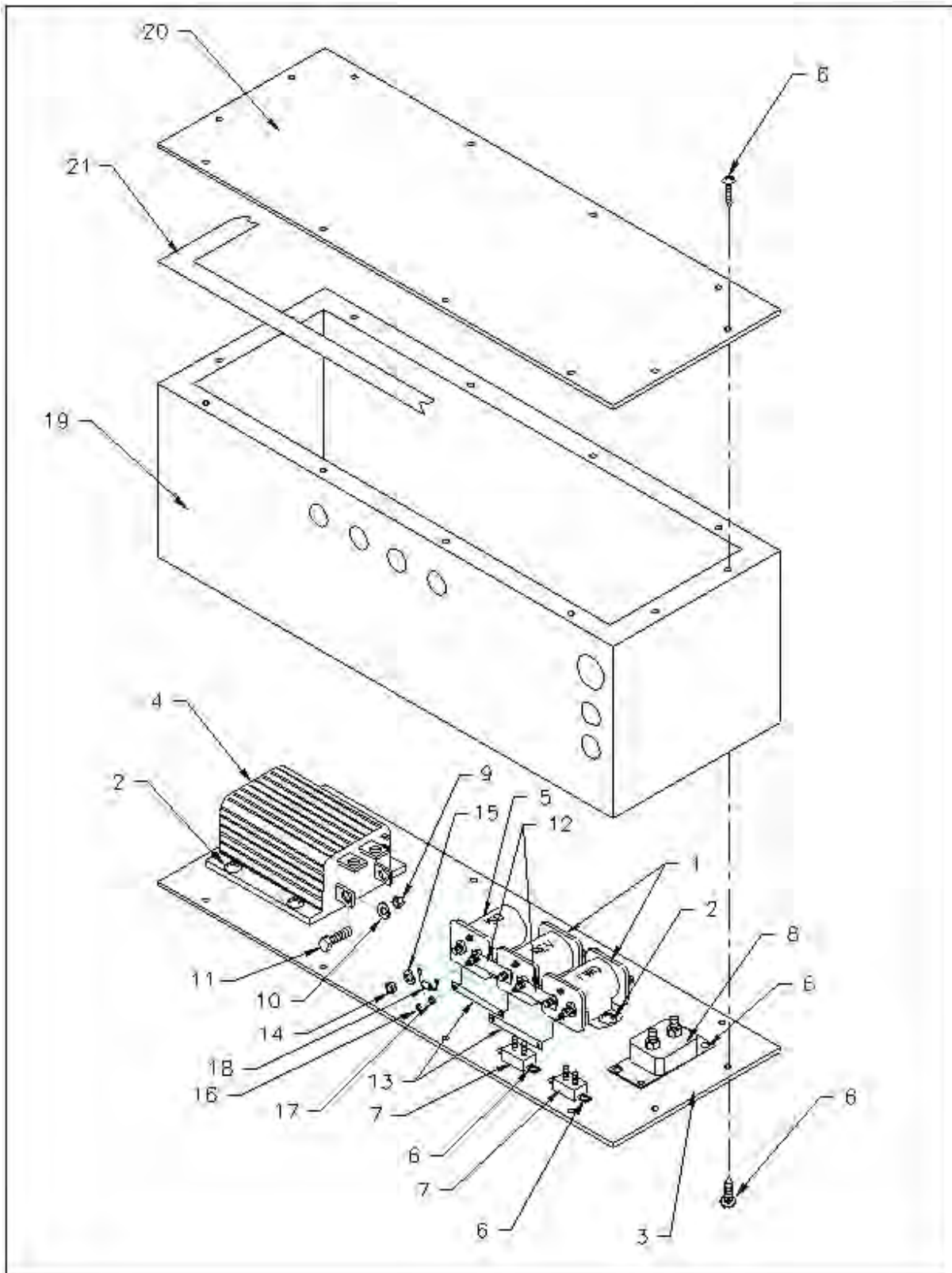
# CONTROL PANEL



**CONTROL PANEL**

Item No.	Part No.	Description	Qty
1	72-501-39	Forward or Reverse Solenoid	2
2	88-838-06	Sheet Metal Screw, #14 x 1/2"	10
3	01-534-80	Panel, Control Mounting	1
4	62-204-40	Speed Controller, 275 Plus 400	1
4a	62-205-00	Speed Controller, 400A, 24/36V (optional)	1
5	72-501-38	ISO Solenoid	1
6	88-818-06	Sheet Metal Screw, #8 x 1/2"	4
7	79-840-00	Circuit Breaker, 10 amp	2
8	79-844-00	Circuit Breaker, 135 amp	1
8	79-844-20	Circuit Breaker, 200 amp (optional, used w/#4a)	1
9	73-004-20	Horn, 12 V	1
10	88-089-80	Nut, 5/16NC	4
11	88-088-62	Lockwasher, 5/16	4
12	88-080-11	Bolt, 5/16NC x 1" Hex Hd	4
13	61-838-41	Bus Bar, 5/8" x 1-1/2" Hole Centers	2
14	61-838-42	Bus Bar, 3/8" x 2-5/8" Hole Centers	2
15	88-099-91	Nut, 5/16NF Thin Pattern	10
16	88-088-63	Lockwasher, 5/16" Internal Tooth	10
17	88-049-80	Nut, #10-32	6
18	88-048-62	Lockwasher, #10	6
19	88-817-09	Sheet Metal Screw, #8 x 3/4"	2
20	78-302-50	Resistor, 250 ohm, 5 watt	1
Not	75-148-25	Harness, Control Panel	1
Shown	75-149-78	Harness, Power, Control Panel	1
	75-148-78	Harness, Control, Vehicle	1

# CONTROL PANEL-EE

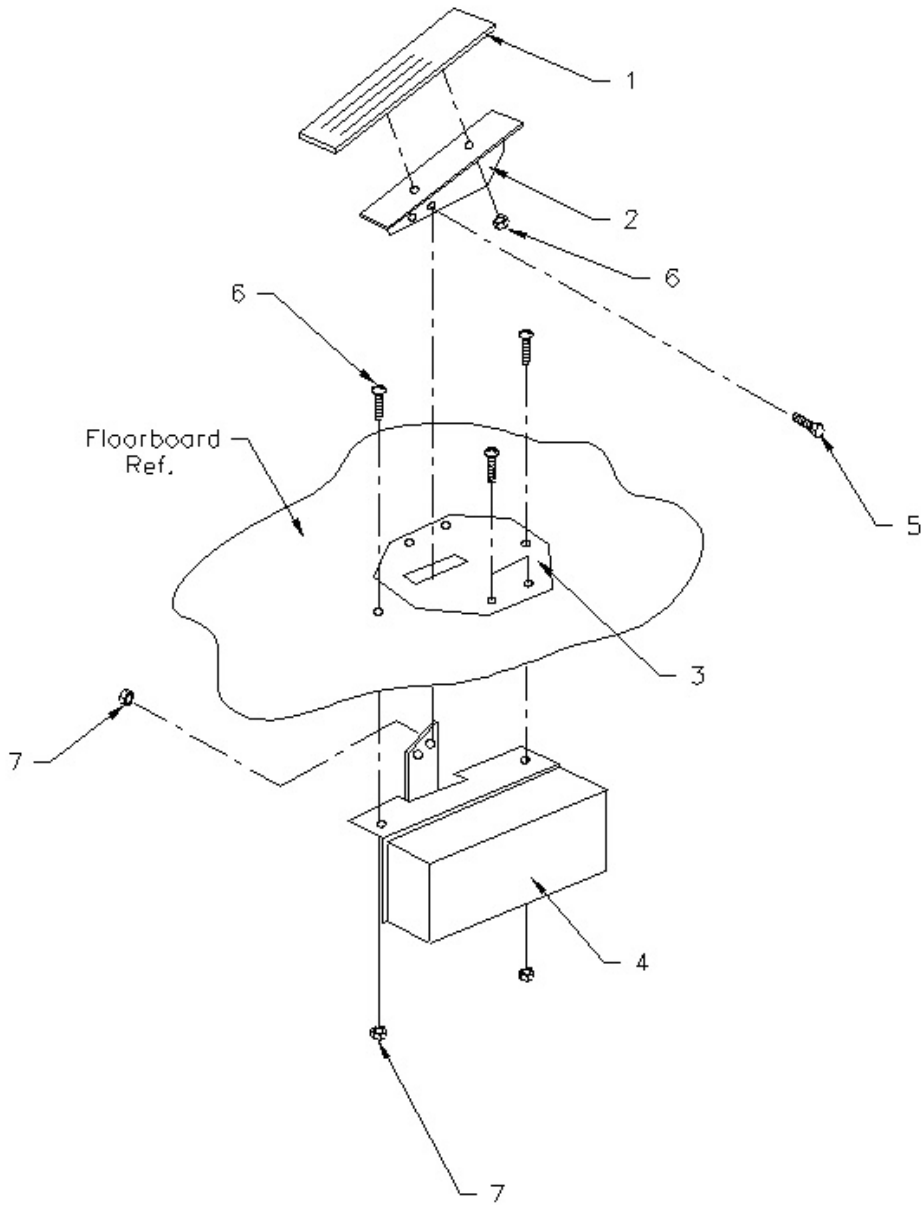


**CONTROL PANEL-EE**

Item No.	Part No.	Description	Qty
1	72-501-39	Forward or Reverse Solenoid	2
2	88-838-06	Sheet Metal Screw, #14 x 1/2"	8
3	04-210-20	Panel, Control Box Floor	1
4	62-205-00	Speed Controller, 400 amp	1
5	72-501-38	ISO Solenoid	1
6	88-818-06	Sheet Metal Screw, #8 x 1/2"	30
7	79-840-00	Circuit Breaker, 10 amp	2
8	79-844-20	Circuit Breaker, 200 amp	1
9	88-089-80	Nut, 5/16NC	4
10	88-088-62	Lockwasher, 5/16	4
11	88-080-11	Bolt, 5/16NC x 1" Hex Hd	4
12	61-838-41	Bus Bar, 5/8" x 1-1/2" Hole Centers	2
13	61-838-42	Bus Bar, 3/8" x 2-5/8" Hole Centers	2
14	88-099-91	Nut, 5/16NF Thin Pattern	10
15	88-088-63	Lockwasher, 5/16" Internal Tooth	10
16	88-049-80	Nut, #10-32	6
17	88-048-62	Lockwasher, #10	6
18	78-302-50	Resistor, 250 ohm, 5 watt	1
19	00-210-02	Control Box	1
20	04-210-23	Lid, Control Box	1
21	98-451-20	Foam Tape, 1/8" x 1/2" Wide	8ft
Not Shown	75-146-71	Harness, Control Box	1
	75-149-60	Harness, Power	1
	75-146-70	Harness, Control, Vehicle	1
	00-210-41	PAN,SPLASH,FWD	1
	00-210-42	PAN,SPLASH,CENTER,FWD	1
	00-210-43	PAN,SPLASH,CENTER,REAR	1
	00-210-44	PAN,SPLASH,REAR	1
	00-210-70	ANGLE,GUARD,WIRE,FWD	1
	00-210-71	ANGLE,GUARD,WIRE,CENTER	1
	00-210-72	ANGLE,GUARD,WIRE,REAR	1
	00-210-73	BAR,GUARD,VENT,BATTERY	2
	78-321-10	STRAP,STATIC GROUND,15 IN LONG	2
	94-201-20	DECAL, EE	2
	94-320-21	DECAL,CHARGING WARNING, EE	1
	94-373-14	DECAL,VEH ID,EE CARRIER	1



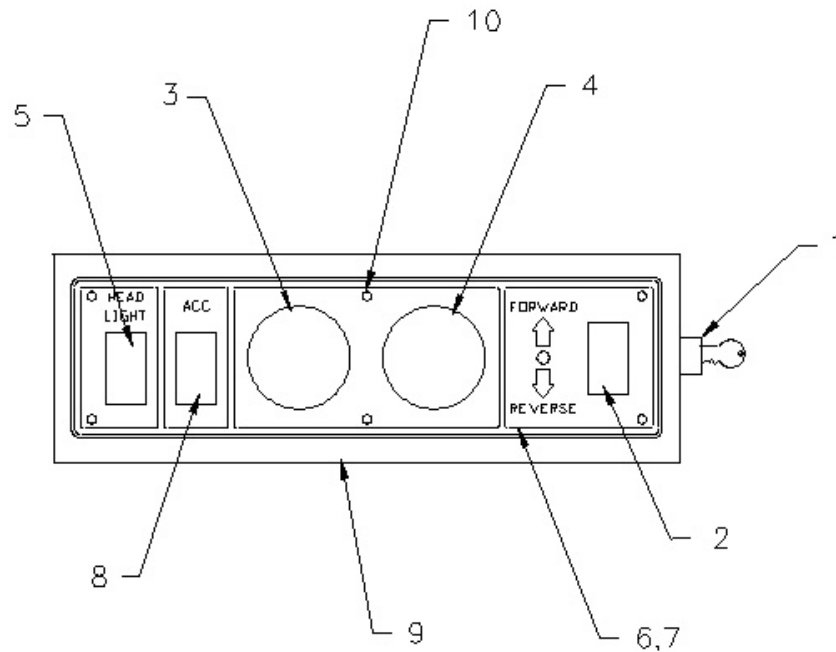
# ACCELERATOR MODULE



## ACCELERATOR MODULE

Item No.	Part No.	Description	Qty
1	98-254-00	Accelerator Pedal, Aluminum	1
2	98-254-25	Mount, Accelerator Pedal	1
3	03-210-96	Mounting Plate, Accelerator	1
4	62-033-00	Accelerator Module	1
5	88-060-09	Bolt, 1/4NC x 3/4" Hex Hd.	2
6	88-065-08	Screw, 1/4NC x 5/8" Truss Hd.	6
7	88-069-81	Locknut, 1/4NC	10

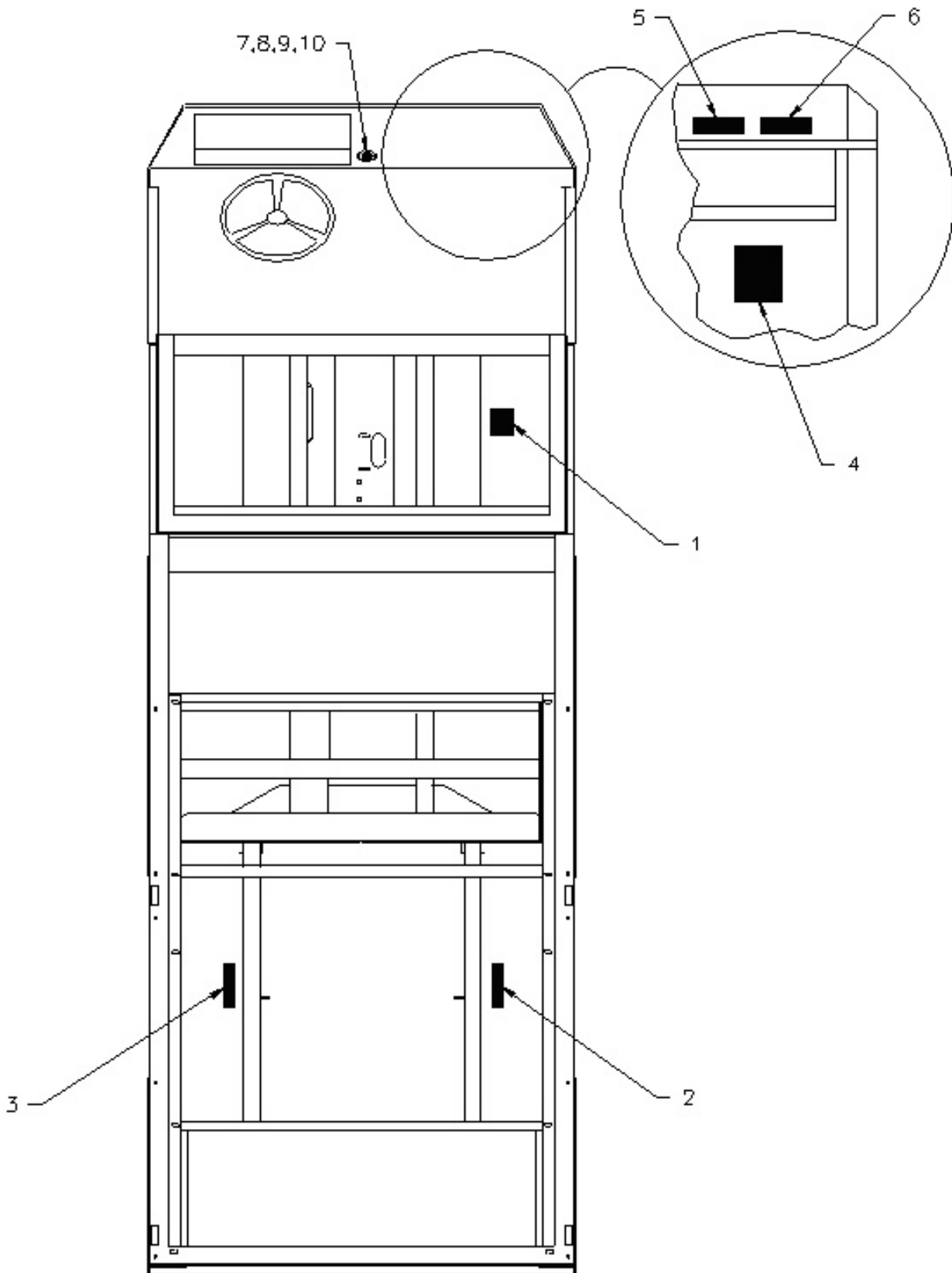
# INSTRUMENTATION



## INSTRUMENTATION

Item No.	Part No.	Description	Qty
1	71-120-00	Ignition Switch, Keyed Alike	1
1a	71-121-00	Ignition Switch, Keyed Unalike (optional)	1
2	71-039-00	Switch, Forward/Reverse	1
3	74-009-00	Battery Status Indicator	1
4	74-000-00	Hourmeter (optional)	1
5	71-039-10	Headlight Switch	1
6	94-304-10	Instrument Panel	1
7	88-817-07	Screw, #8 x 1/2" Tapping	6
8	71-039-20	Plug, Rocker Switch Hole	1
8a	71-039-10	Rocker Switch, On-Off (optional)	1
9	00-610-01	Instrument Console (painted black)	1
10	88-817-07	Screw, #8 x 1/2" Self Tapping	6

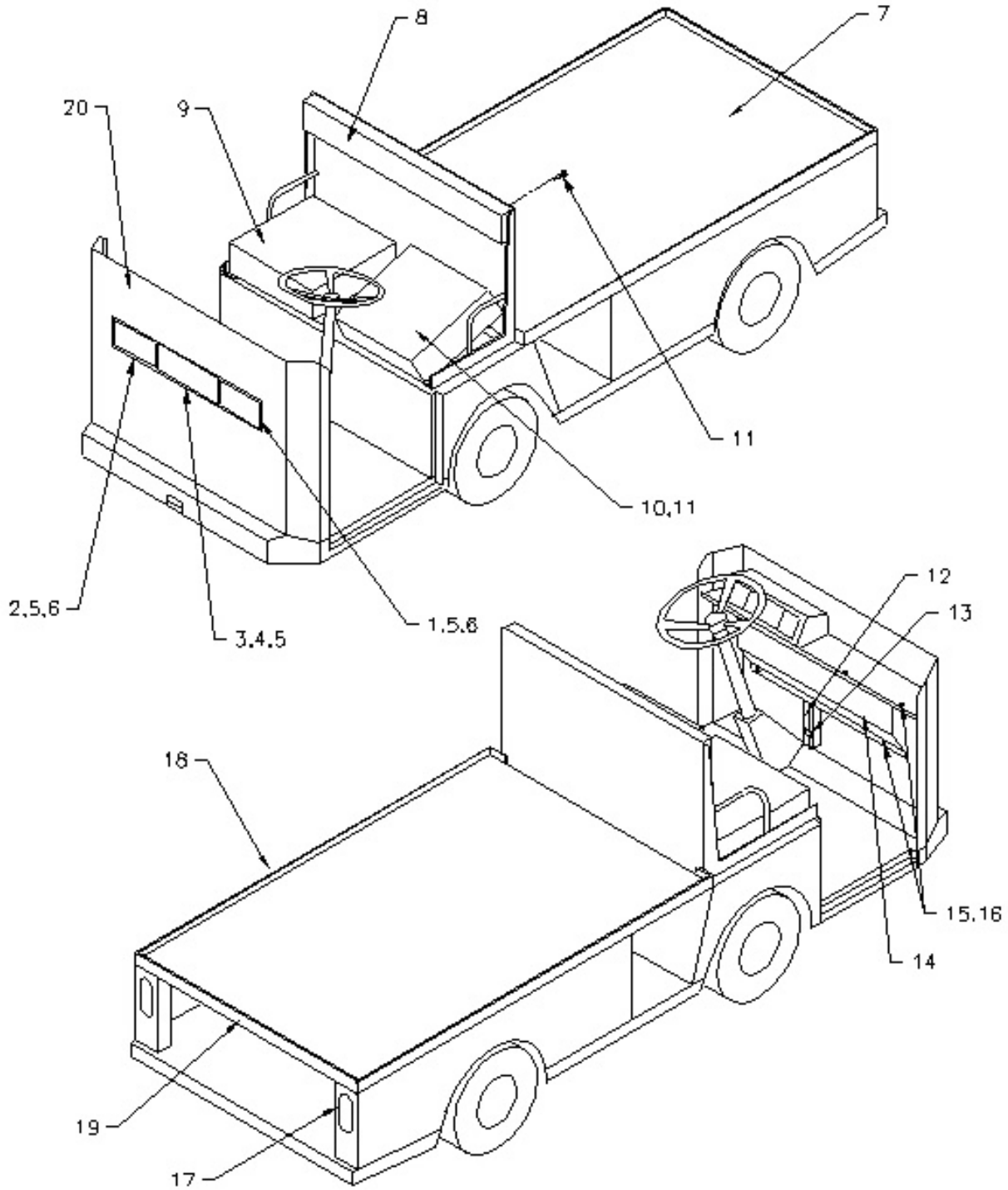
# DECALS & MISCELLANEOUS STANDARD PARTS



**DECALS & MISCELLANEOUS STANDARD PARTS**

Item No.	Part No.	Description	Qty
1	94-373-10	Decal, Vehicle Data	1
2	94-319-00	Decal, Battery Disconnect	1
3	94-313-00	Decal, Battery Warning	1
4	94-313-20	Decal, Safety Warning	1
5	94-309-00	Decal, Brake Warning	1
6	94-384-01	Decal, Not Motor Vehicle	1
7	71-501-00	Horn Button	1
8	88-025-06	Screw, 8-32 x 1/2" Truss Hd	2
9	88-028-62	Lockwasher, #8	2
10	88-029-80	Nut, 8-32	2

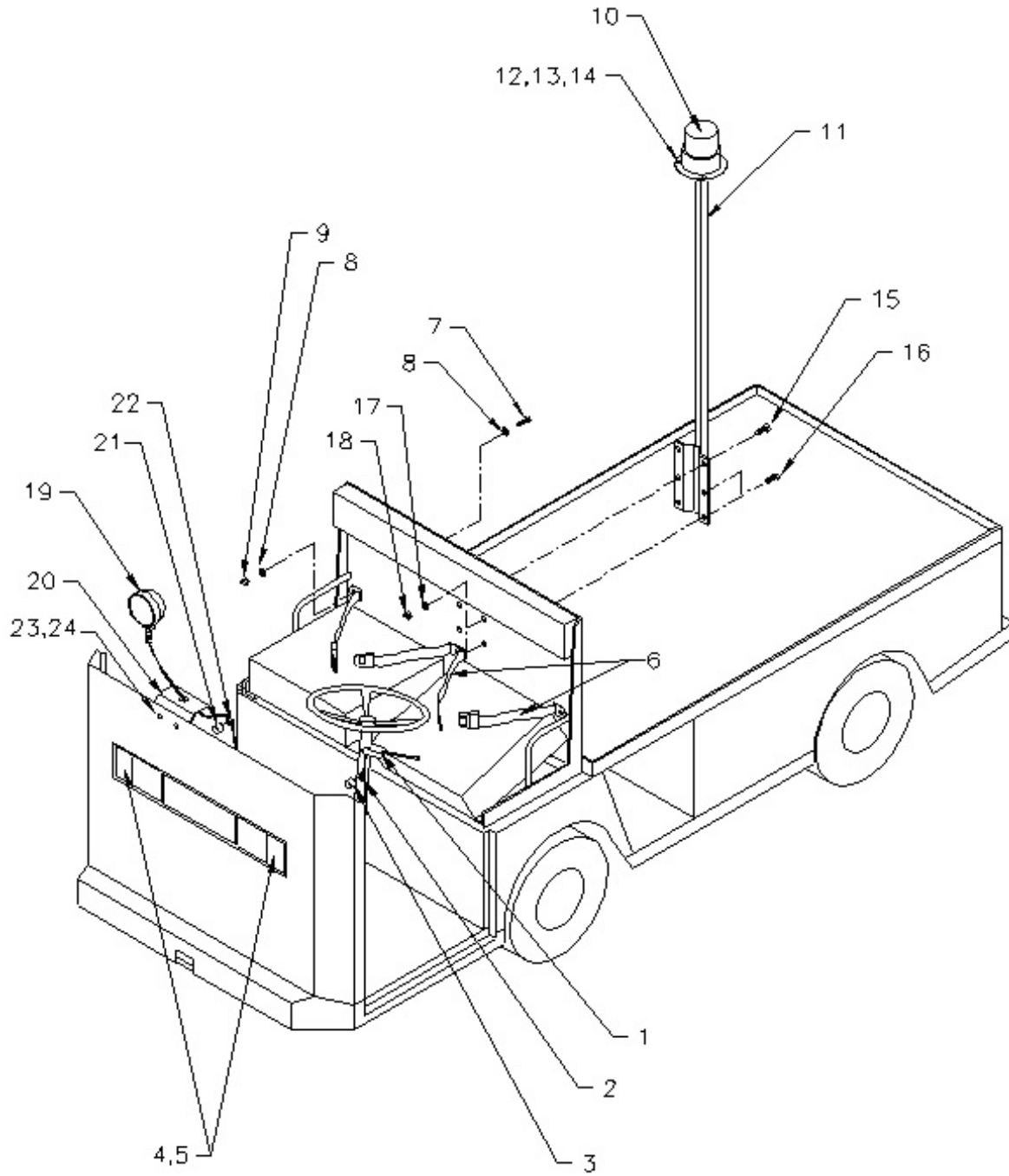
# MISCELLANEOUS STANDARD PARTS-Cont'd



**MISCELLANEOUS STANDARD PARTS-Cont'd**

Item No.	Part No.	Description	Qty
1	94-050-10	Headlight, Left	1
2	94-050-11	Headlight, Right	1
	72-082-01	Bulb, Headlight	2
3	94-201-10	Taylor-Dunnâ Name Plate	1
4	94-201-11	Fastener Strip, Plastic	2
5	88-817-07	Screw, #8 x 1/2" Self Tapping	14
6	94-050-04	Retainer, Headlight	4
7	90-444-00	Deckboard, 75-1/4" x 41"	1
8	90-179-00	Backrest	1
9	90-174-00	Seat Cushion, 17" x 19-1/2"	1
10	90-173-00	Seat Cushion, 17" x 18"	1
11	88-837-09	Screw, Sheet Metal, #14 x 3/4" Phillips Truss Hd	12
12	02-210-25	Angle, Wire Cover	1
13	91-513-00	S-Clip	2
14	00-210-22	Light Guard	1
15	88-065-06	Screw, 1/4NC x 1/2" Phillips Truss Hd	6
16	88-069-81	Locknut, 1/4NC	6
17	72-025-00	Light, Stop, Turn, & Tail	2
18	00-210-12	Side Rail (unpainted)	2
19	00-210-15	End Rail (unpainted)	1
20	00-610-00	Front Cowl (unpainted)	1

# Options



**Directional Signals**

Item No.	Part No.	Description	Qty
1	75-141-20	Turn Signal Switch	1
2	76-352-00	Flasher Receptacle	1
3	71-900-05	Flasher, 12V	1
4	72-082-10	Turn Signal Bulb, 12V	2
5	72-082-20	Socket, Turn Signal	2

**Seat Belts**

6	90-199-10	Seat Belt, Black	1
7	88-151-13	Bolt, 1/2NC x 1-1/4" Hex Hd, Grade 5	3
8	88-148-61	Washer, 1/2"	6
9	88-159-84	Locknut, 1/2NC	3

**Pole Mounted Strobe Light**

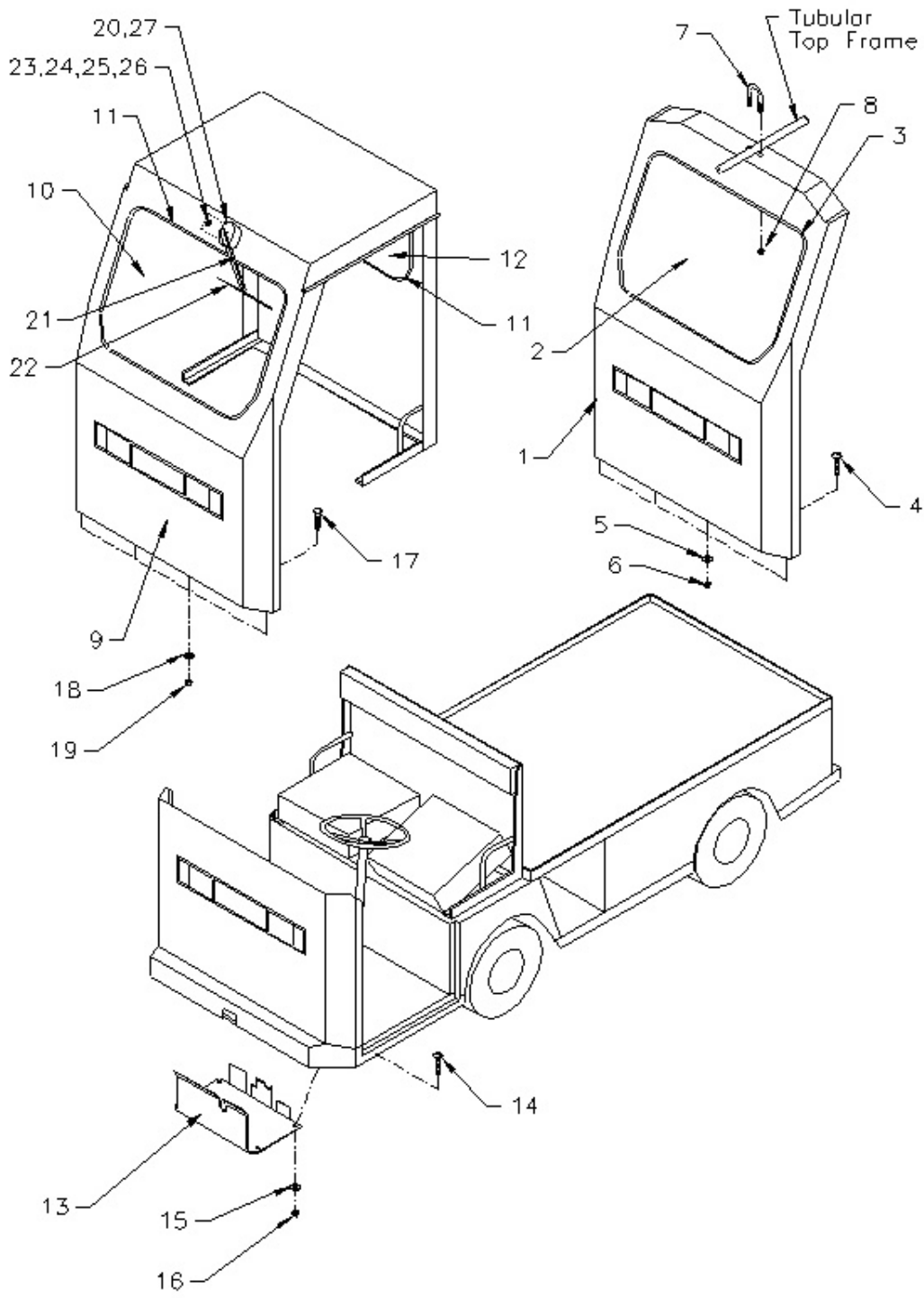
10	72-023-20	Strobe Light, Amber	1
11	72-023-25	Pole Mount, Strobe Light	1
12	88-025-06	Screw, #8-32 x 1/2" Truss Hd	3
13	88-028-62	Lockwasher, #8	3
14	88-029-80	Nut, #8-32	3
15	88-817-09	Screw, Sheet Metal, #8 x 3/4" Phillips Hd	2
16	88-065-08	Screw, 1/4NC x 5/8" Phillips Truss Hd	4
17	88-068-62	Lockwasher, 1/4"	4
18	88-069-83	Acorn Nut, 1/4NC	4
*	71-100-00	Toggle Switch	1
*	75-106-10	Harness, Strobe On Pole	1

**Cowl Mounted Emergency Light**

19	72-023-15	Light, Emergency, Red	1
20	72-411-10	Bracket, Light Mounting	1
21	71-900-05	Flasher, 12V	1
22	76-352-00	Flasher Receptacle	1
23	88-065-08	Screw, 1/4NC x 5/8" Phillips Truss Hd	2
24	88-069-87	Nut, 1/4NC Keps	2
*	71-100-00	Toggle Switch	1
*	75-105-10	Harness, Cowl Mounted Light or Siren	1

\* Not shown in illustration.





**Cowl w/Windshield**

Item No.	Part No.	Description	Qty
	91-013-64	Kit, Windshield, Orange (requires fiberglass or surrey top cover)	1
	91-013-65	Kit, Windshield, Specify Color (requires fiberglass or surrey top cover)	
1			
1	91-010-77	Cowl w/Windshield (unpainted)	1
2	90-852-30	Windshield	1
3	98-310-00	Window Channel, Rubber	12 ft
4	88-102-13	Bolt, 3/8NC x 1-1/4" Carriage	4
5	88-108-60	Washer, 3/8"	4
6	88-109-87	Nut, 3/8NC Keps	4
7	96-124-00	U-Bolt, 1/4NC x 1-3/4"	1
8	88-069-83	Acorn Nut, 1/4NC	2

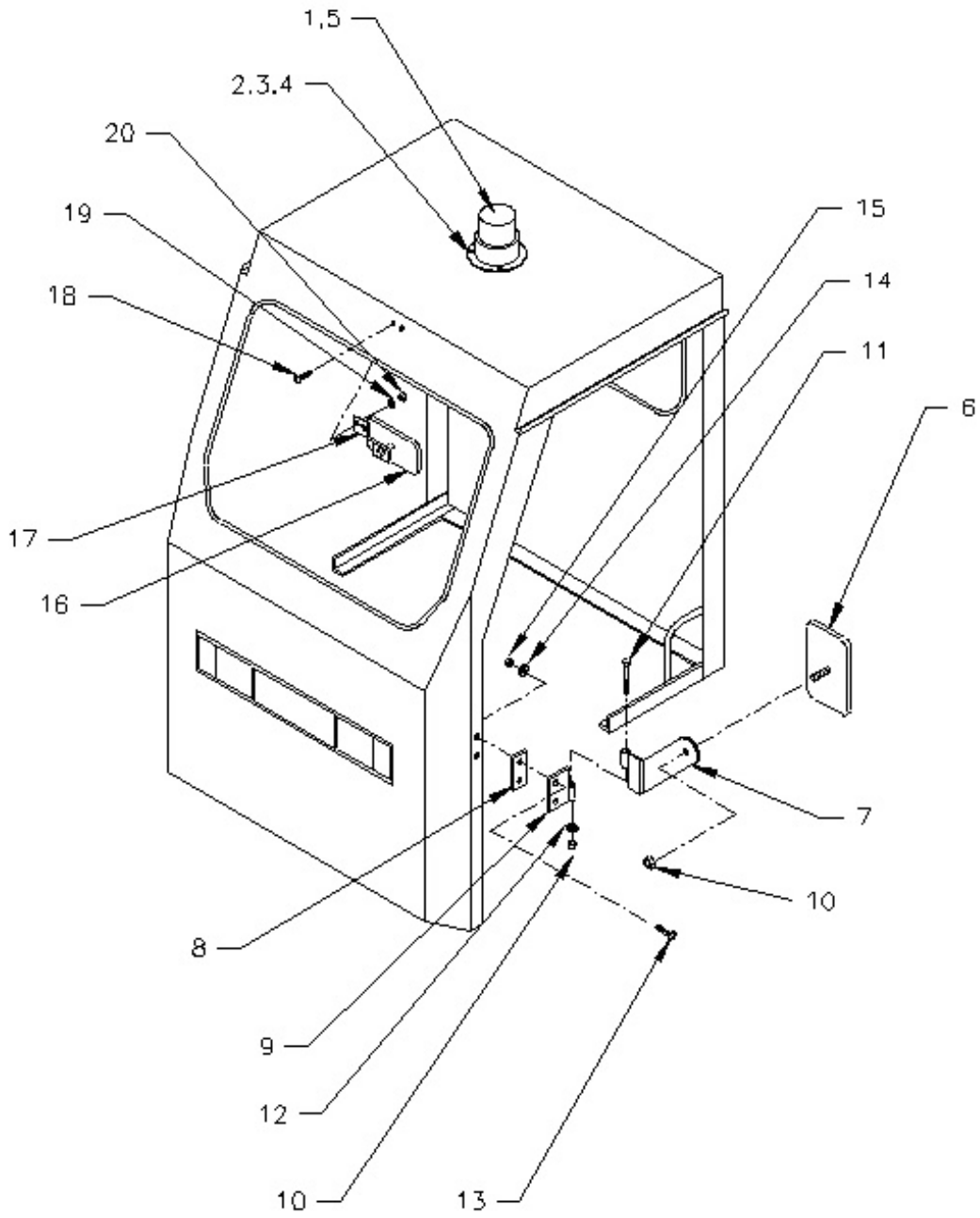
**Cab**

	91-012-62	Kit, Cab, Orange	1
	91-012-63	Kit, Cab, Specify Color	1
9	91-012-00	Cab (unpainted)	1
10	90-852-30	Windshield	1
11	98-310-00	Window Channel, Rubber	20 ft
12	90-850-10	Rear Window	1
13	05-210-87	Floor Pan	1
14	88-065-09	Screw, 1/4NC x 3/4" Phillips Truss Hd	4
15	88-068-61	Washer, 1/4" SAE	4
16	88-069-81	Locknut, 1/4NC	4
17	88-102-13	Bolt, 3/8NC x 1-1/4" Carriage	4
18	88-108-60	Washer, 3/8"	4
19	88-109-87	Nut, 3/8NC Keps	4

**Windshield Wipers**

20	74-050-00	Windshield Wiper Motor	1
21	74-051-00	Arm, Windshield Wiper	1
22	74-052-00	Blade, Windshield Wiper	1
23	88-065-11	Screw, 1/4NC x 1" Phillips Truss Hd	1
24	88-068-61	Washer, 1/4" SAE	2
25	88-069-83	Acorn Nut, 1/4NC	1
26	98-603-00	Grommet, 3/8" ID	1
27	98-618-00	Grommet, 3/4" ID	1
*	75-114-15	Harness, Wiper & Light	1
*	71-039-10	Switch, Wiper (located in accessory slot on instrument panel)	1

\* Not shown in illustration.



**Strobe Light On Cab**

Item No.	Part No.	Description	Qty
1	72-023-20	Strobe Light, Amber	1
2	88-025-06	Screw, #8-32 x 1/2" Truss Hd	3
3	88-028-62	Lockwasher, #8	3
4	88-029-80	Nut, #8-32	3
5	98-606-00	Grommet, 3/16" ID	1
*	75-114-15	Harness, Wiper & Light	1
*	71-100-00	Toggle Switch	1

**Mirrors, Cowl, Cab, or Door Mounted**

6	92-201-00	Mirror, 4-1/2" x 8-1/2"	1 or 2
7	92-202-12	Mirror Mounting Bracket, Left	1
7a	92-202-13	Mirror Mounting Bracket, Right	1
8	92-202-15	Spacer, Mirror Bracket	1 or 2
9	91-814-16	Hinge, Female, Left	1
9a	91-814-17	Hinge, Female, Right	1
10	88-069-81	Locknut, 1/4NC	2
11	88-060-22	Bolt, 1/4NC x 3-1/2" Hex Hd	1
12	88-068-61	Washer, 1/4" SAE	1
13	88-065-09	Screw, 1/4NC x 3/4" Phillips Truss Hd	2 or 4
14	88-068-62	Lockwasher, 1/4"	2 or 4
15	88-069-83	Acorn Nut, 1/4NC	2 or 4

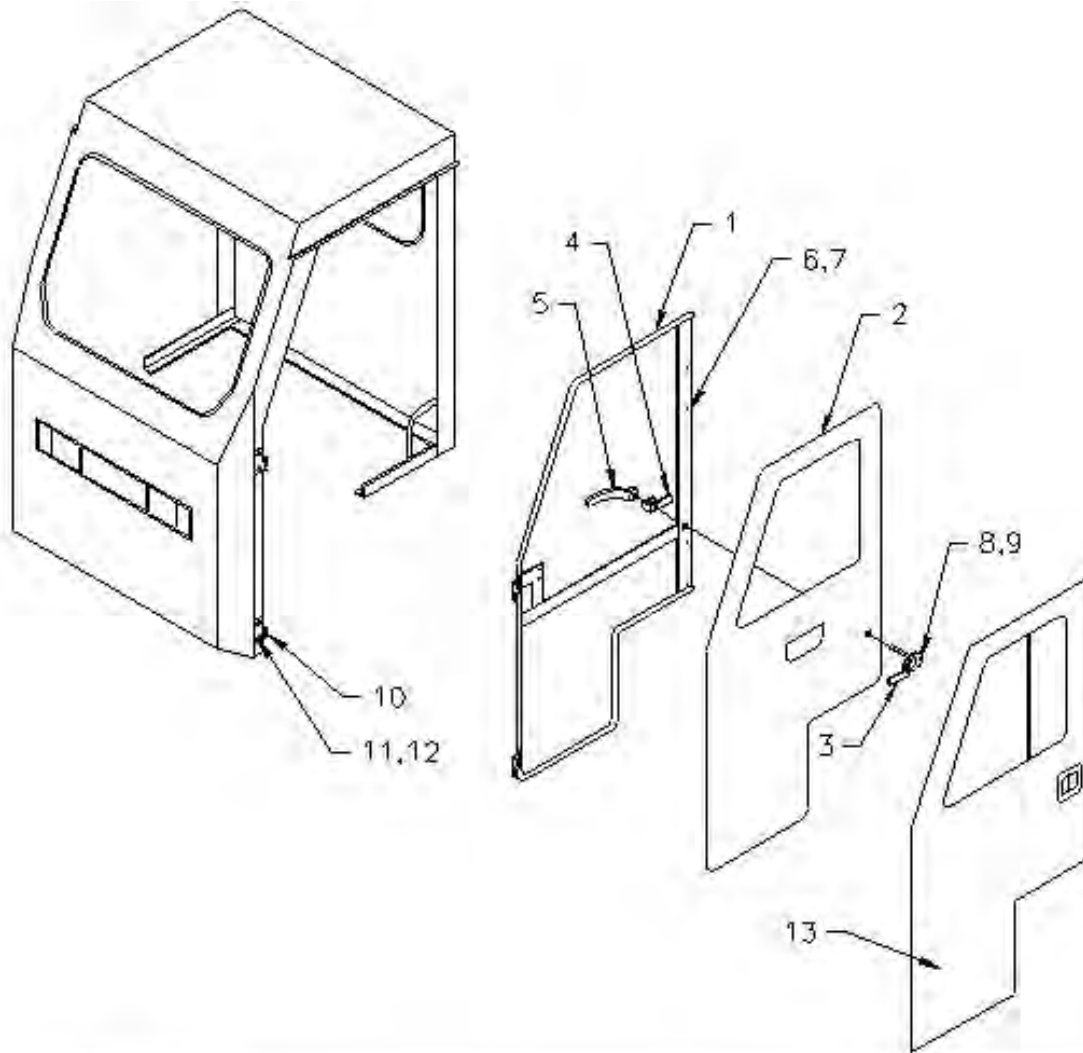
**Mirror, Inside Cab**

16	92-206-00	Mirror, Inside	1
17	02-210-70	Bracket, Inside Mirror	1
18	88-065-09	Screw, 1/4NC x 3/4" Phillips Truss Hd	2
19	88-068-67	Lockwasher, Internal Tooth, 1/4"	2
20	88-069-80	Nut, 1/4NC	2

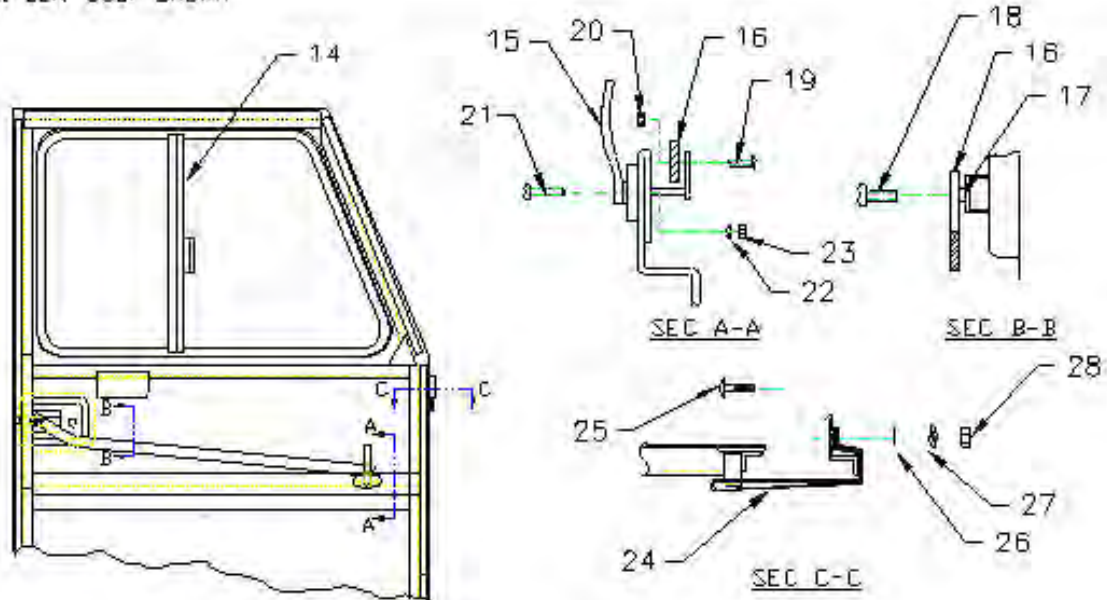
**Mirror, Winks, Inside Cab**

*	91-810-00	Door Hinge	2
*	92-207-00	Mirror, 5 Panel	1

\* Not shown in illustration.



Note: Left Door Shown



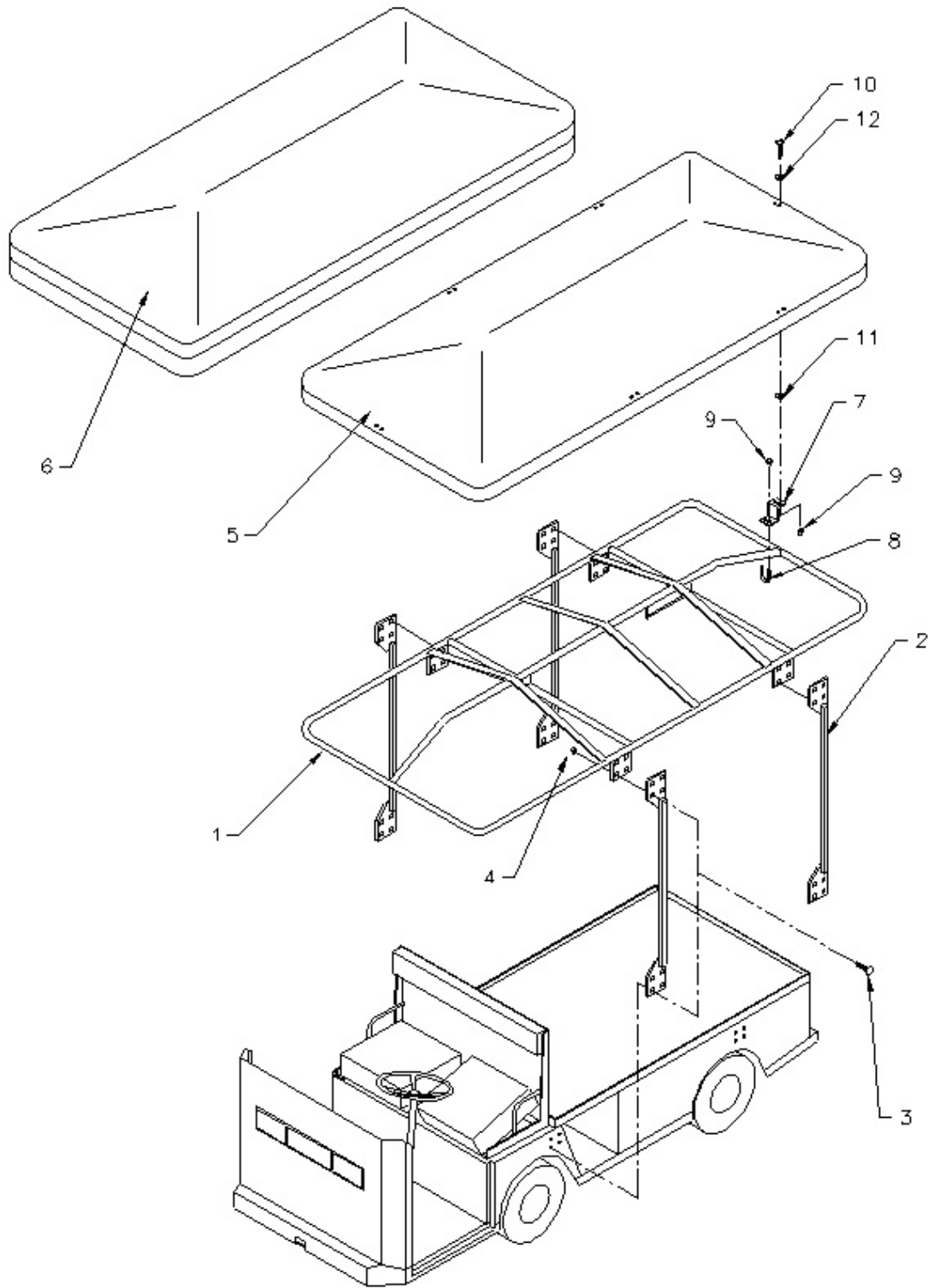
**Cab Doors, Naugahyde**

Item No.	Part No.	Description	Qty
	90-924-60	Kit, Naugahyde Door, Left	1
	90-924-61	Kit, Naugahyde Door, Right	1
1	90-923-98	Door Frame, Left	1
**	90-923-99	Door Frame, Right	1
2	90-924-98	Side Curtain, Left	1
**	90-924-99	Side Curtain, Right	1
3	97-315-53	Handle Assembly, Outer	1*
4	97-315-51	Door Latch	1*
5	97-315-54	Handle, Inner	1*
6	97-303-03	Snap Fastener, Female	7*
7	88-727-06	Rivit, 5/32" x 1/2"	7*
8	88-025-08	Screw, #8-32 x 5/8" Truss Hd	2*
9	88-029-86	Locknut, #8-32	2*
10	91-814-10	Hinge, Female, Left	2
**	91-814-11	Hinge, Female, Right	2
11	88-082-09	Bolt, 5/16NC x 5/8" Carriage	4*
12	88-089-81	Locknut, 5/16NC	4*

**Cab Doors, Metal**

13	91-011-66	Kit, Cab Door, Left, Specify Color (includes #10,11,12)	1
13	91-011-68	Kit, Cab Door, Left, Orange (includes #10,11,12)	1
**	91-011-67	Kit, Cab Door, Right, Specify Color (includes #10,11,12)	1
**	91-011-69	Kit, Cab Door, Right, Orange (includes #10,11,12)	1
14	90-853-10	Window, Left	1
**	90-853-11	Window, Right	1
15	97-315-58	Door Handle, Inner	1*
16	91-012-12	Connecting Bar	1*
17	16-510-00	Spacer	1*
18	88-065-06	Screw, 1/4NC x 1/2" Phillips Truss Hd	1*
19	88-045-08	Screw, #10-32 x 5/8" Truss Hd	1*
20	88-049-86	Locknut, #10-32	1*
21	88-045-11	Screw, #10-32 x 1" Truss Hd	2*
22	88-048-62	Lockwasher, #10	2*
23	88-049-80	Nut, #10-32	2*
24	91-012-45	Strap, Door Restraint	1*
25	88-082-11	Bolt, 5/16NC x 1" Carriage	1*
26	88-088-60	Washer, 5/16" Cut	1*
27	88-088-62	Lockwasher, 5/16"	1*
28	88-089-83	Acorn Nut, 5/16NC	1*
29	91-011-31	Door Weldment, Left (unpainted)	1
**	91-011-32	Door Weldment, Right (unpainted)	1

\*\* Not shown in illustration. \* Quantities are for one door only.



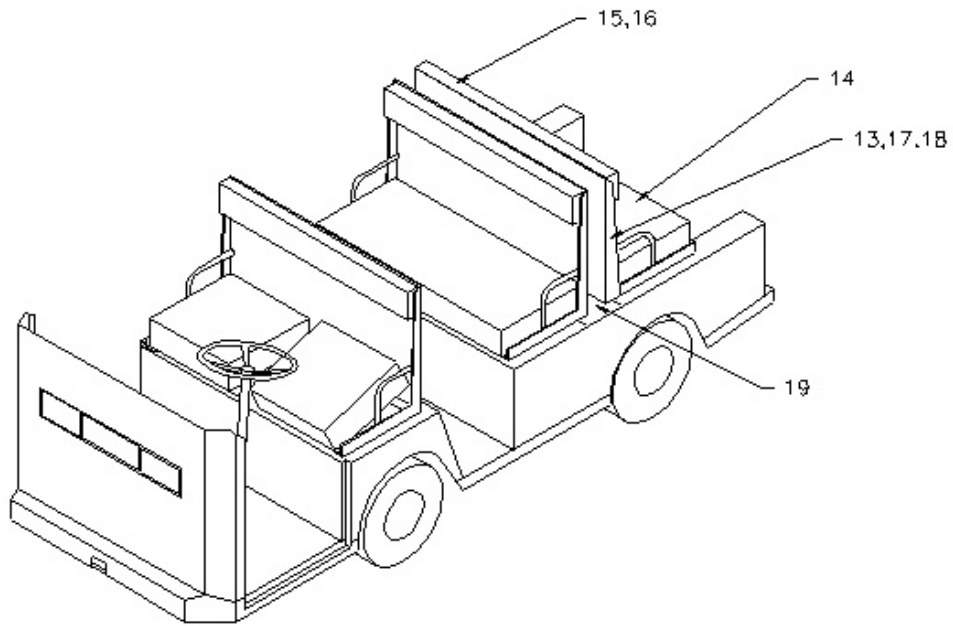
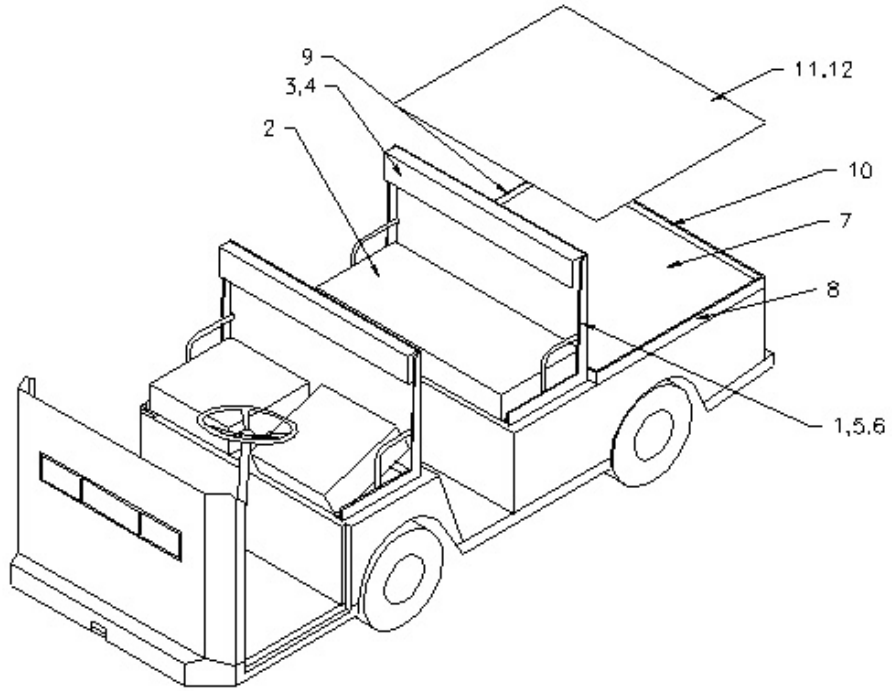
**Surrey Top Cover**

Item No.	Part No.	Description	Qty
	91-101-61	Kit, Surrey Top Cover	1
1	91-028-20	Tubular Top Frame	1
2	91-028-24	Post, Top Frame	4
3	88-102-11	Bolt, 3/8NC x 1" Carriage	32
4	88-109-81	Locknut, 3/8NC	32
6	91-101-00	Surrey Top, White	1

**Fiberglass Top Cover**

	91-151-61	Kit, Fiberglass Top Cover	1
1	91-028-20	Tubular Top Frame	1
2	91-028-24	Post, Top Frame	4
3	88-102-11	Bolt, 3/8NC x 1" Carriage	32
4	88-109-81	Locknut, 3/8NC	32
5	91-151-00	Fiberglass Top, White	1
7	91-028-25	Z-Bracket	6
8	96-124-00	U-Bolt, 1/4NC x 1-3/4"	6
9	88-069-81	Locknut, 1/4NC	24
10	88-065-09	Screw, 1/4NC x 3/4" Phillips Truss Hd	12
11	97-176-00	Washer, Neoprene	12
12	88-068-60	Washer, 1/4 Cut	12
27	88-088-62	Lockwasher, 5/16"	1*
28	88-089-83	Acorn Nut, 5/16NC	1*





**Fixed 2nd Seat**

Item No.	Part No.	Description	Qty
	90-010-61	Kit, 2nd Seat, Orange	1
	90-010-64	Kit, 2nd Seat, Specify Color	1
1	00-210-01	Seat Bulkhead (unpainted)	1
2	90-175-00	Seat Cushion, Black	1
3	90-179-00	Seatback, Black	1
4	88-837-09	Screw, #14 x 3/4" Phillips Sheet Metal	8
5	88-065-09	Screw, 1/4NC x 3/4" Phillips Truss Hd	5
6	88-069-87	Nut, 1/4NC Keps	5

**Deck, Fixed 2nd Seat**

7	90-444-20	Deckboard, 41" x 38-1/2" x 5/8" Thick, Black	1
8	00-210-19	Side Rail, Left, Fixed 2nd Seat (unpainted)	1
9	00-210-20	Side Rail, Right, Fixed 2nd Seat (unpainted)	1
10	00-210-15	Rear Deck Rail (unpainted)	1
***	00-210-23	Deck Support	1
***	88-065-08*	Screw, 1/4NC x 5/8" Phillips Truss Hd	11
***	88-065-09*	Screw, 1/4NC x 3/4" Phillips Truss Hd	8
***	88-068-61*	Washer, 1/4 SAE	16
***	88-069-87*	Nut, 1/4NC Keps	19

**Deck Cover, Diamond Plate, Fixed 2nd Seat**

11	90-440-46	Deck Cover, Diamond Plate, Black	1
12	88-607-09	Rivet, 1/4" x 1/2" Starpin	8

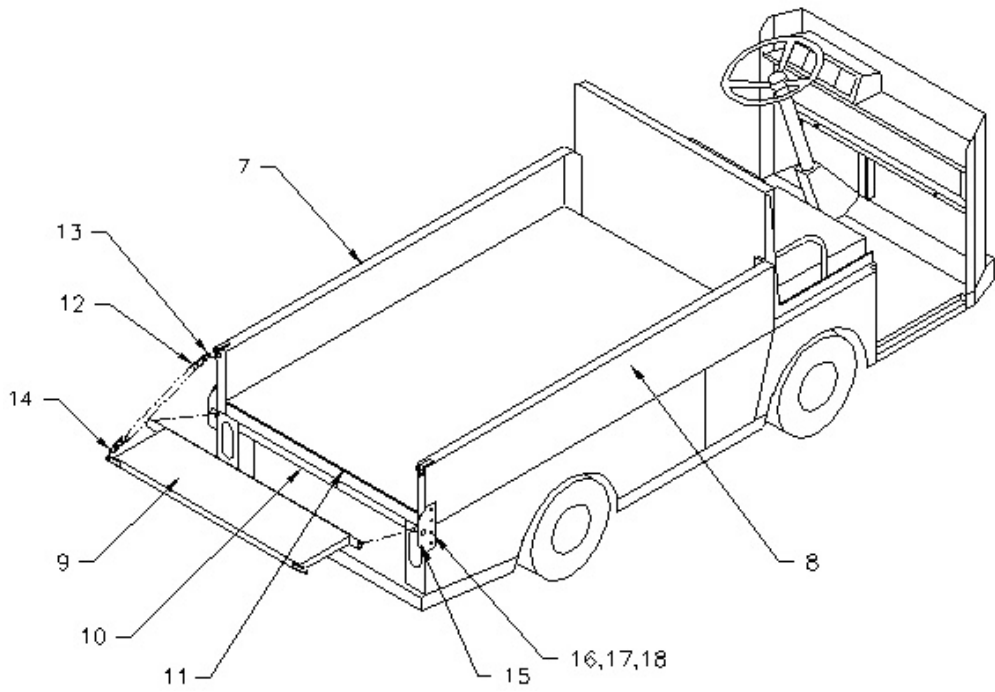
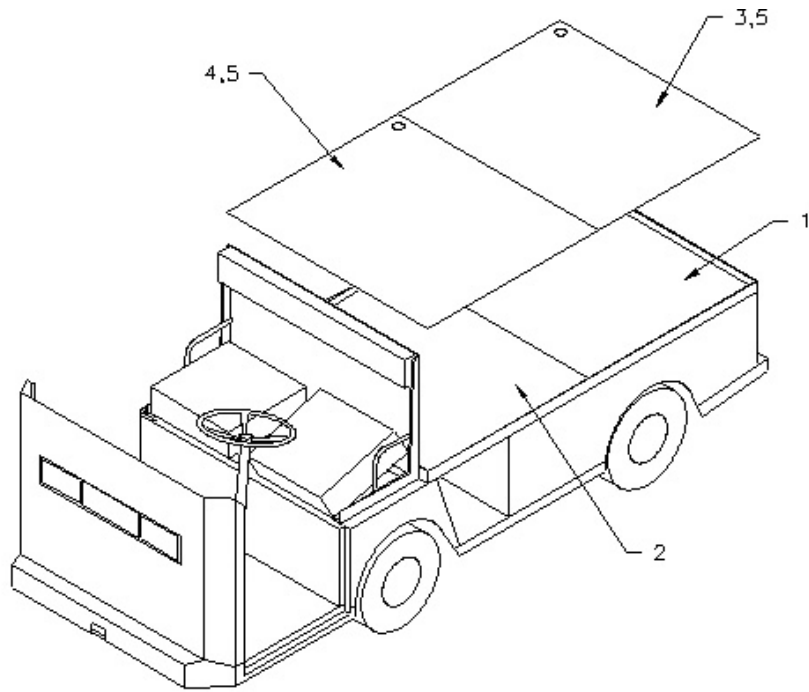
**Fixed 3rd Seat**

	90-010-62	Kit, 2nd & 3rd Seat, Orange	1
	90-010-65	Kit, 2nd & 3rd Seat, Specify Color	1
13	00-210-01	Seat Bulkhead (unpainted)	1**
14	90-175-00	Seat Cushion, Black	1**
15	90-179-00	Seatback, Black	1**
16	88-837-09	Screw, #14 x 3/4" Phillips Sheet Metal	8**
17	88-065-09	Screw, 1/4NC x 3/4" Phillips Truss Hd	5**
18	88-069-87	Nut, 1/4NC Keps	5**
19	02-210-32	Deck, 2nd & 3rd Seat	1**

\* Hardware used to mount the side rails and rear rail to the frame, the rails to the seatback, and the deck support (located behind the seatback) to the frame.

\*\* Quantities are for the 3rd seat only. The kit contains hardware for both 2nd & 3rd seats.

\*\*\* Not shown in illustration.



**Deck Cover, Diamond Plate, 2 Pc., Std. Bed**

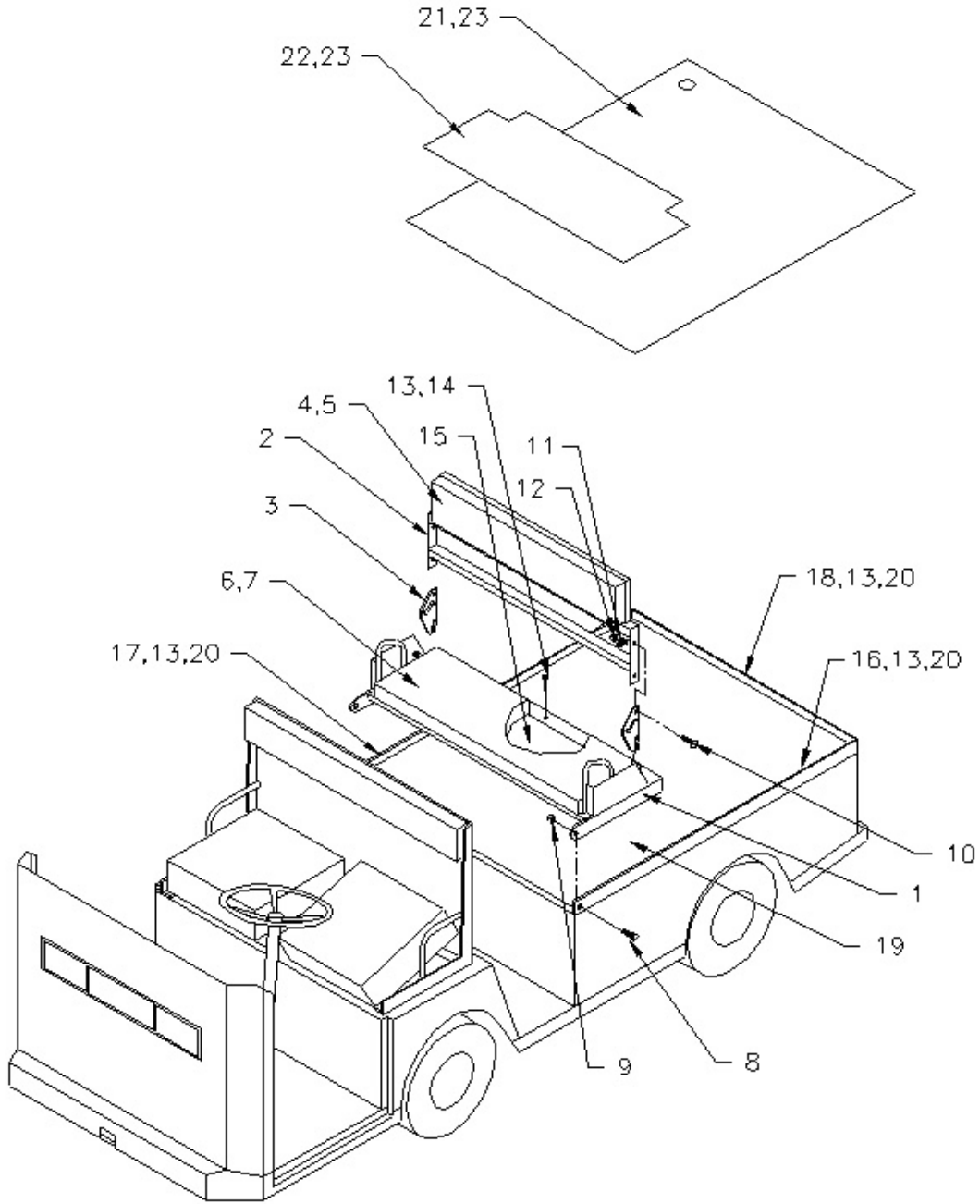
Item No.	Part No.	Description	Qty
	90-440-45	Kit, Diamond Cover, Std Bed, Black (does not include #1 & 2)	1
1	90-444-20	Deckboard, 41" x 38-1/2" x 5/8"	1
2	90-444-30	Deckboard, 41" x 36-5/8" x 5/8"	1
3	90-440-46	Deck Cover, Diamond Plate, Rear	1
4	90-440-47	Deck Cover, Diamond Plate, Front	1
5	88-607-09	Rivet, 1/4" x 1/2" Starpin	16
*	00-210-23	Deck Support	1
*	88-065-08	Screw, 1/4NC x 5/8" Phillips Truss Hd	3
*	88-069-87	Nut, 1/4NC Keps	3

**Side Panels, 12"**

	90-545-63	Kit, 12" Side Panels & Tailgate, Orange	1
	90-545-64	Kit, 12" Side Panels & Tailgate, Specify Color	1
7	00-210-38	Side Panel, Left, 12" (unpainted)	1
8	00-210-37	Side Panel, Right, 12" (unpainted)	1
9	00-210-58	Tailgate, 12" (unpainted)	1
10	00-210-78	Deck Angle, Lower Rear (unpainted)	1
11	00-210-77	Deck Angle, Top Rear (unpainted)	1
12	30-550-55	Chain, 12-1/4" Long	2
13	30-551-00	S-Hook	2
14	30-551-10	Hook, Tailgate Chain	2
15	00-210-39	Tailgate Pivot	2
16	88-082-11	Bolt, 5/16NC x 1" Carriage	8
17	88-088-60	Washer, 5/16" Cut	8
18	88-089-81	Locknut, 5/16NC	8
*	88-065-08**	Screw, 1/4NC x 5/8" Phillips Truss Hd	23
*	88-069-81**	Locknut, 1/4NC	23

\* Not shown in illustration.

\*\* Hardware used to mount the left and right side panels to the frame and to the seat back. Also, to mount the two rear deck angles.



**Foldaway 2nd Seat**

Item No.	Part No.	Description	Qty
	90-010-59	Kit, Foldaway 2nd Seat, Specify Color	1
	90-010-60	Kit, Foldaway 2nd Seat, Black	1
1	00-210-92	Seat Base Frame	1
2	00-210-93	Seat Back Frame	1
3	00-210-91	Seat Pivot Plate	2
4	90-179-00	Backrest, Black	1
5	88-837-11	Screw, #14 x 1" Phillips Sheet Metal	8
6	90-178-00	Seat Cushion, 12" x 40", Black	1
7	88-837-14	Screw, #14 x 1-1/2" Phillips Sheet Metal	6
8	88-100-11	Bolt, 3/8NC x 1" Hex Hd	2
9	88-109-81	Locknut, 3/8NC	2
10	88-082-11	Bolt, 5/16NC x 1" Carriage	4
11	88-088-82	Lockwasher, 5/16"	4
12	88-089-80	Nut, 5/16NC	4

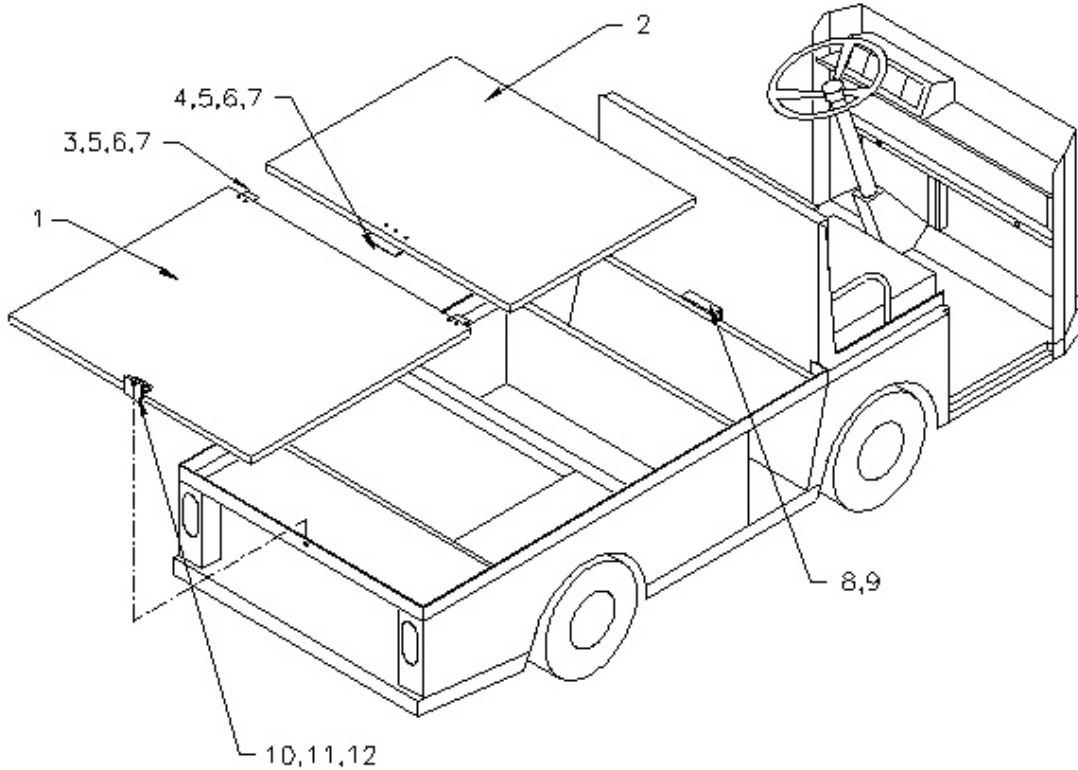
**Deckboard, Foldaway 2nd Seat**

13	88-065-09	Screw, 1/4NC x 3/4" Phillips Truss Hd	17
14	88-069-88	T-Nut, 1/4NC x 5/16", 4 Prong	3
15	90-440-36	Deckboard, Foldaway 2nd Seat	1
16	03-210-21	Side Rail, Left (unpainted)	1
17	03-210-20	Side Rail, Right (unpainted)	1
18	00-210-15	Rear Rail (unpainted)	1
19	90-440-37	Deckboard, Foldaway Seat, 58" x 41"	1
20	88-069-87	Nut, 1/4NC Keps	14

**Deck Cover, Diamond Plate, Foldaway 2nd Seat**

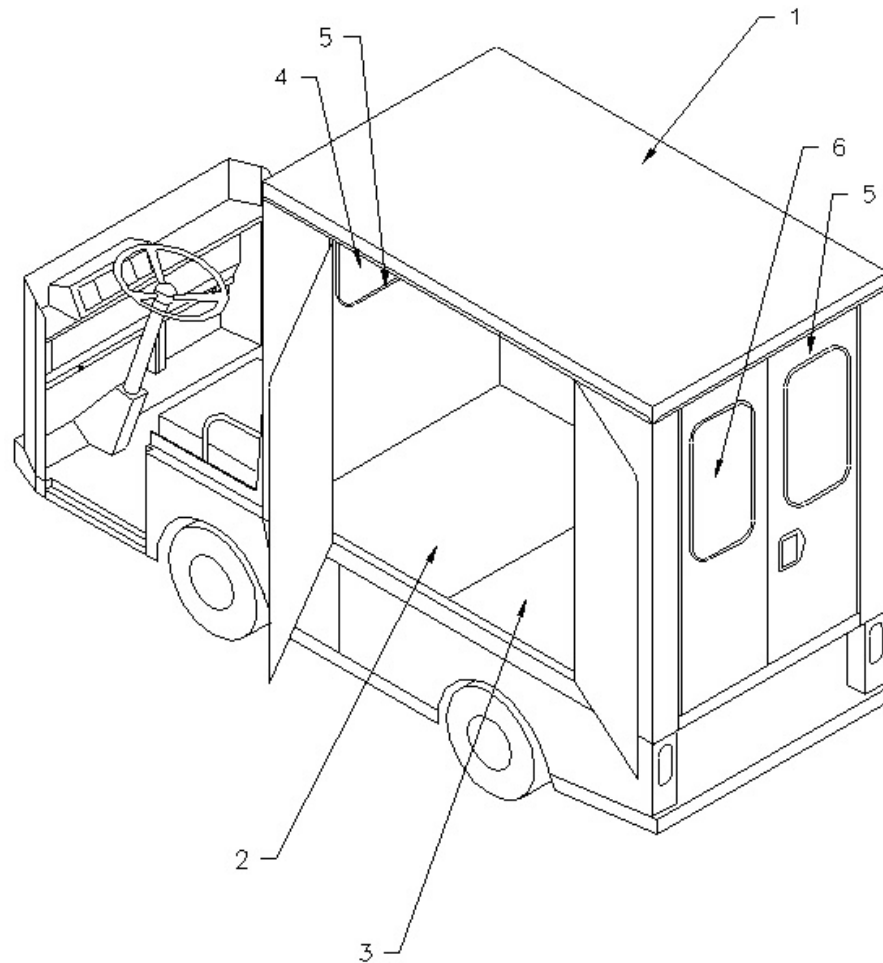
	90-440-61	Kit, Diamond Plate Deck Cover, Foldaway Seat	1
21	90-440-48	Deck Cover, 41" x 16-3/8", Black	1
22	90-440-49	Deck Cover, 41" x 58", Black	1
23	88-607-09	Rivet, 1/4" x 1/2" Starpin	13

\*\* Not shown in illustration.



**Deckboard, Lockable, 2 Piece**

Item No.	Part No.	Description	Qty
1	90-444-20	Deckboard, 41" x 38-1/2", Black	1
2	90-444-30	Deckboard, 41" x 36-5/8", Black	1
3	03-210-25	Plate, Deck Side Lock	2
4	03-210-24	Plate, Deck Center Lock	1
5	88-082-13	Bolt, 5/16NC x 1-1/4" Carriage	7
6	88-088-62	Lockwasher, 5/16"	7
7	88-089-80	Nut, 5/16NC	7
8	03-210-23	Angle, Forward Deck Lock	1
9	88-737-08	Rivet, 3/16" x 5/8"	3
10	03-210-28	Deck Lock, Rear	1
11	88-065-08	Screw, 1/4NC x 5/8" Phillips Truss Hd	2
12	88-069-88	T-Nut, 1/4NC x 5/16", 4 Prong	2



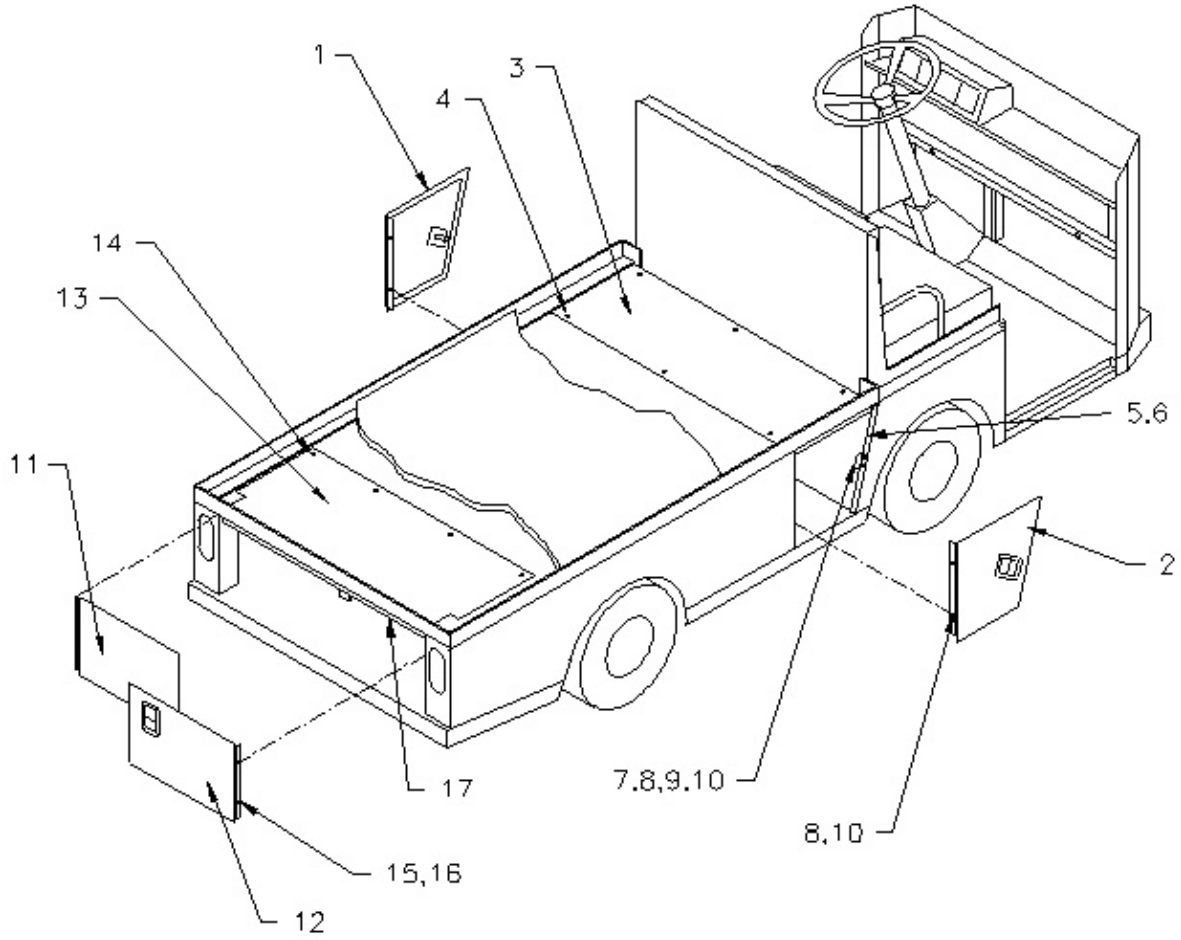
**Box, Double Doors, Side & Rear Windows**

Item No.	Part No.	Description	
	91-333-60	Kit, Box, Doors Lt & Rr, w/Glass, Orange	1
	91-333-61	Kit, Box, Doors Lt & Rr, w/Glass, Specify Color	1
1	90-333-02	Box, Doors Left & Rear, Glass Front & Rear (unpainted)	1
2	90-471-00	Deckboard, Front, 40" x 35-1/2"	1
3	90-472-00	Deckboard, Rear, 40" x 38-3/4"	1
4	90-850-10	Window, 13-7/8" x 31-7/8"	1
5	98-310-00	Window Channel, Rubber	19 ft
6	90-851-00	Window, Rear, 12" x 18"	2
**	88-080-11*	Bolt, 5/16NC x 1" Hex Hd	6
**	88-088-62*	Lockwasher, 5/16"	6
**	88-089-80*	Nut, 5/16NC	6
**	00-210-23	Angle, Deck Support	1
**	88-065-08	Screw, 1/4NC x 5/8" Phillips Truss Hd	3
**	88-069-87	Nut, 1/4NC Keps	3

\* Hardware used to mount box to vehicle frame.

\*\* Not shown in illustration.





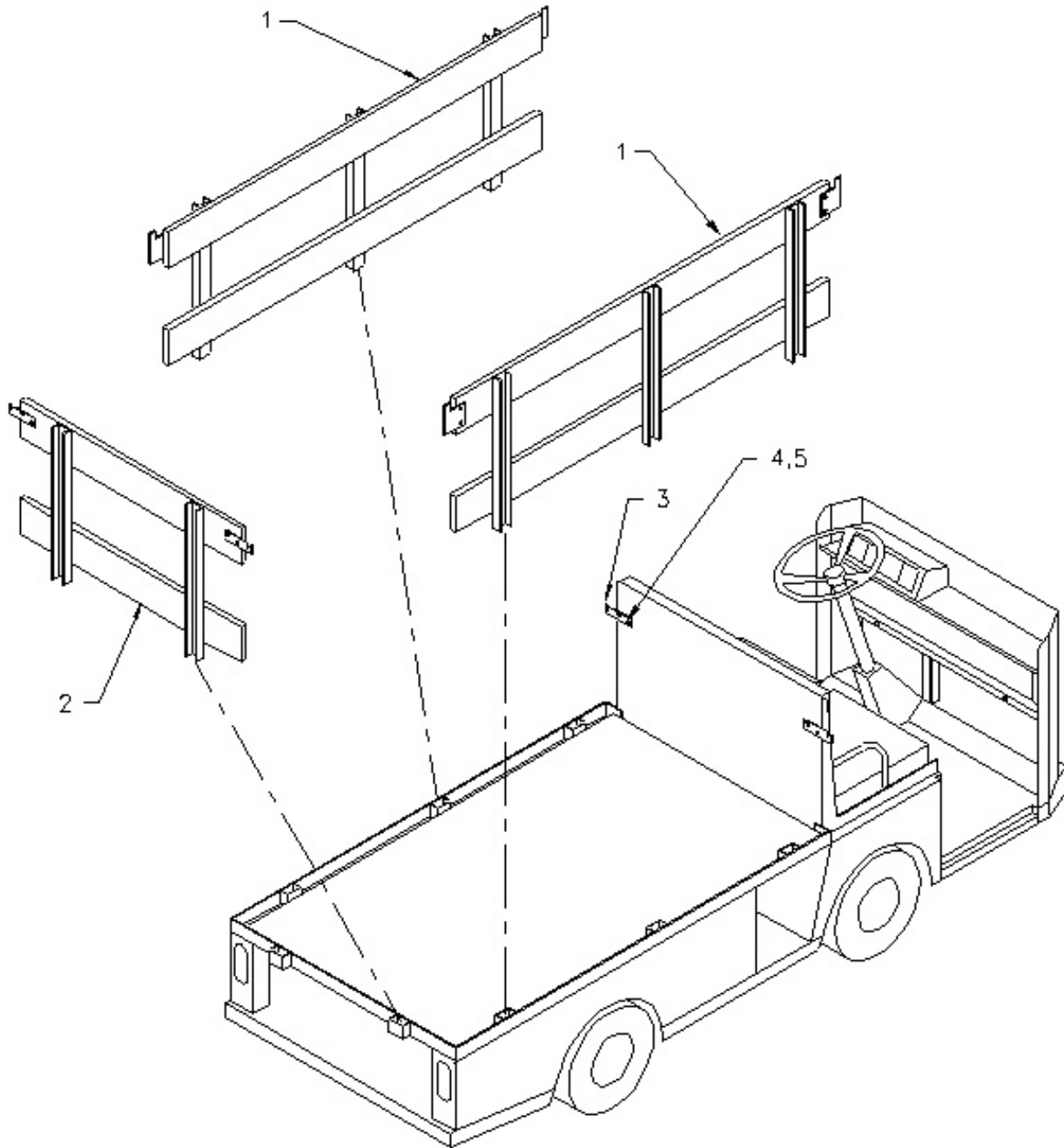
**Tools Box Doors, Side**

Item No.	Part No.	Description	
	91-340-62	Kit, Side Tool Box Doors, Orange	1
	91-340-64	Kit, Side Tool Box Doors, Specify Color	1
1	02-210-12	Tool Box Door, Left (unpainted)	1
2	02-210-13	Tool Box Door, Right (unpainted)	1
3	02-210-15	Tool Box Top, Black	1
4	88-737-08	Rivet, 3/16" x 5/8"	6
5	02-210-14	Door Stop, Tool Box Door	2
6	88-837-09	Screw, #14 x 3/4" Phillips Sheet Metal	6
7	02-210-16	Catch, Door Latch	2
8	88-065-08	Screw, 1/4NC x 5/8" Phillips Truss Hd	8
9	88-068-61	Washer, 1/4" SAE	2
10	88-069-87	Nut, 1/4NC Keps	8
**	98-451-10	Tape, Weather Strip, 3/4" x 9/16"	5 ft

**Tools Box Doors, Rear**

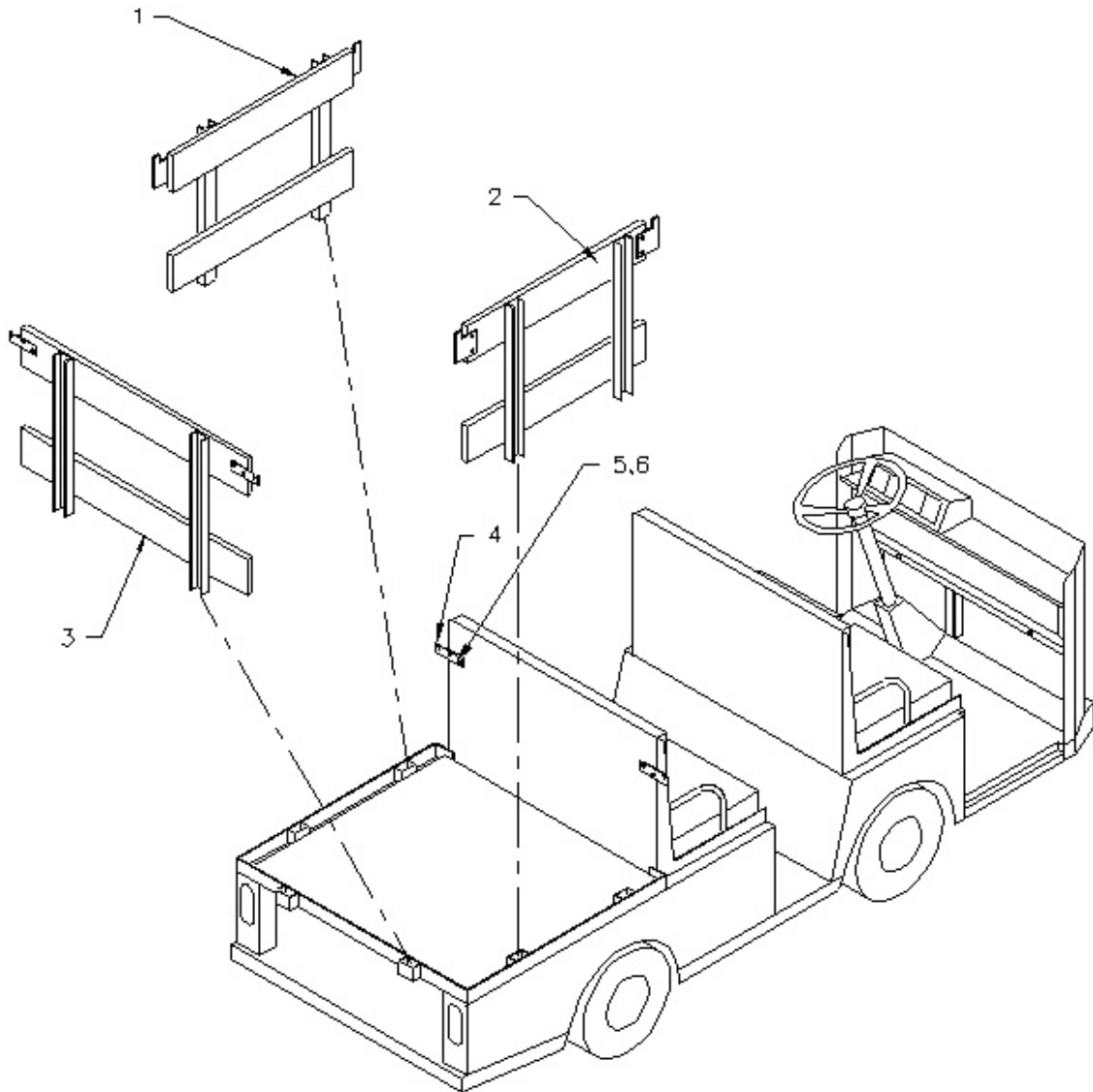
	91-340-61	Kit, Tool Box Doors, Rear, Orange	1
	91-340-65	Kit, Tool Box Doors, Rear, Specify Color	1
11	02-210-21	Tool Box Door, Rear Left (unpainted)	1
12	02-210-64	Tool Box Door, Rear Right (unpainted)	1
13	02-210-62	Rear Tool Box Top, Black	1
14	88-737-08	Rivet, 3/16" x 5/8"	4
15	88-065-09	Screw, 1/4NC x 3/4" Phillips Truss Hd	4
16	88-069-87	Nut, 1/4NC Keps	4
**	98-451-11	Tape, Seal, 1" x 3/8"	3 ft

\*\* Not shown in illustration.



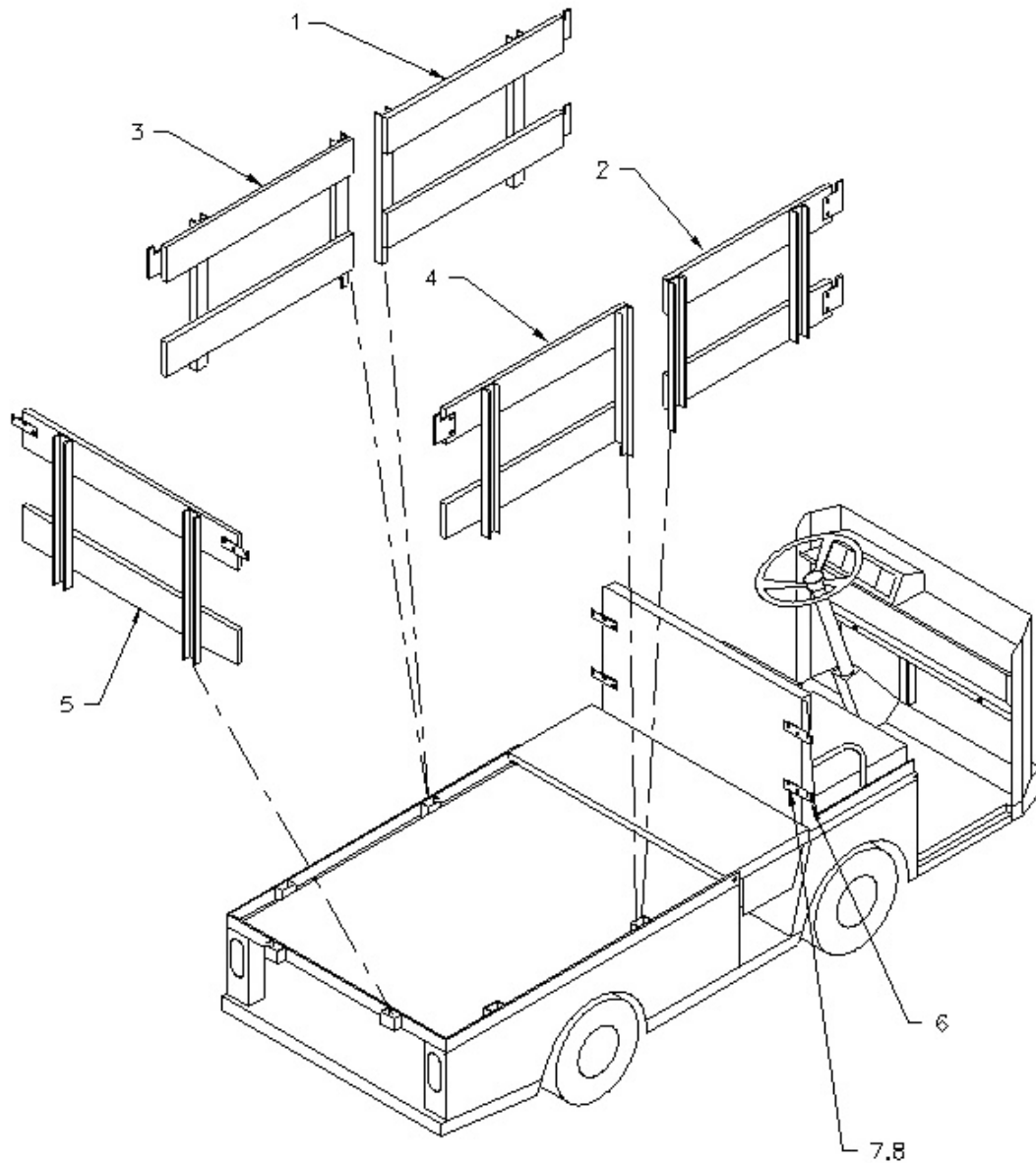
**Stake Sides, Standard Bed**

Item No.	Part No.	Description	
	90-545-61	Kit, Stake Sides, 2 Passenger, Std Bed	1
1	90-545-02	Side Gate, Black	1
2	90-545-01	End Gate, Black	1
3	90-540-00	Gate Hook	2
4	88-065-08	Screw, 1/4NC x 5/8" Phillips Truss Hd	4
5	88-069-87	Nut, 1/4NC Keps	4



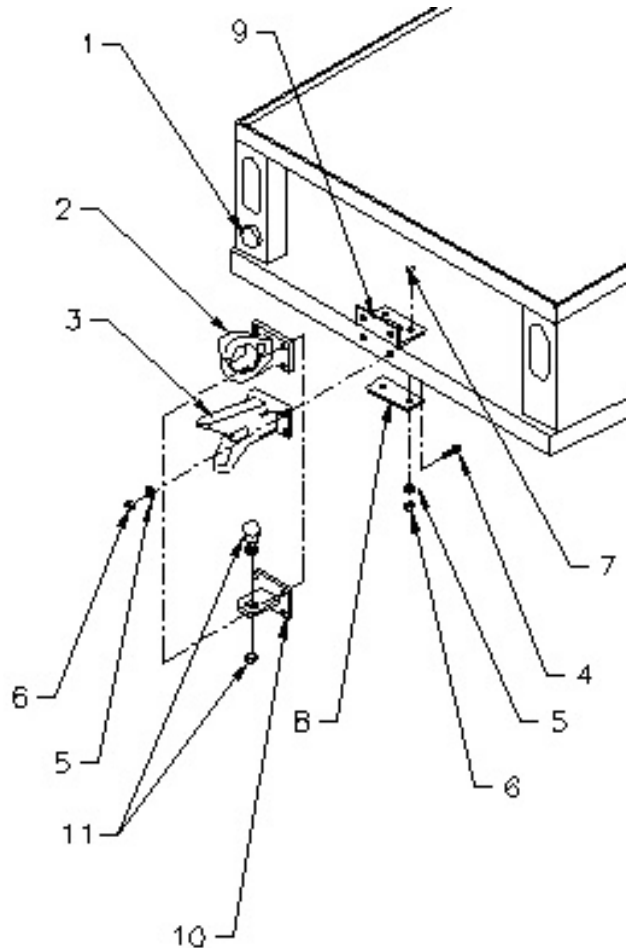
**Stake Sides, Fixed 2nd Seat**

Item No.	Part No.	Description	
	90-545-62	Kit, Stake Sides, 4 Passenger	1
1	90-545-03	Side Gate, Left, Black	1
2	90-545-04	Side Gate, Right, Black	1
3	90-545-01	End Gate, Black	1
4	90-540-00	Gate Hook	2
5	88-065-08	Screw, 1/4NC x 5/8" Phillips Truss Hd	4
6	88-069-87	Nut, 1/4NC Keps	4



**Stake Sides, Foldaway 2nd Seat**

Item No.	Part No.	Description	
1	90-545-12	Side Gate, Front Left, Black	1
2	90-545-13	Side Gate, Front Right, Black	1
3	90-545-14	Side Gate, Rear Left, Black	1
4	90-545-15	Side Gate, Rear Right, Black	1
5	90-545-01	End Gate, Black	1
6	90-540-00	Gate Hook	4
7	88-065-08	Screw, 1/4NC x 5/8" Phillips Truss Hd	8
8	88-069-87	Nut, 1/4NC Keps	8

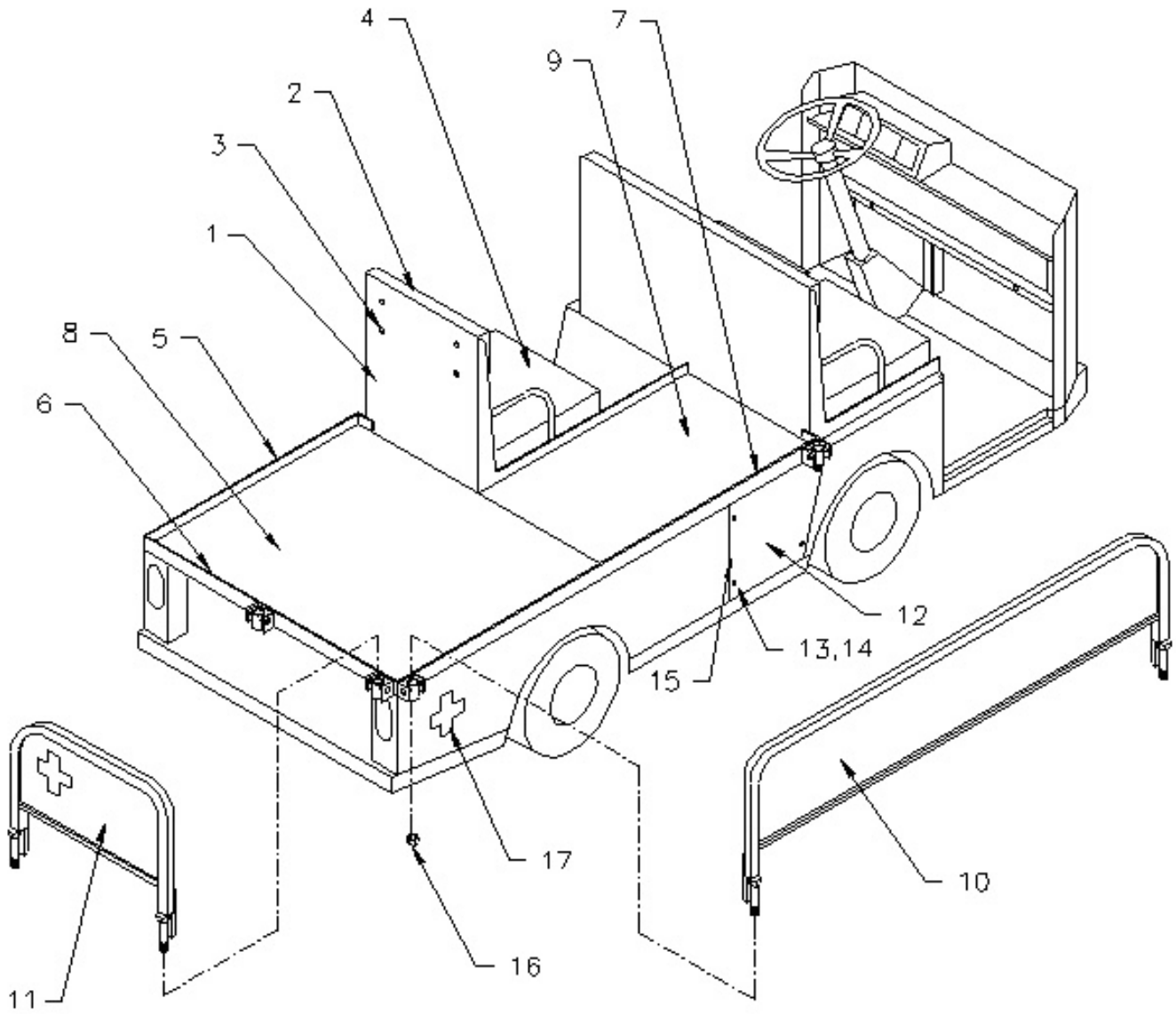


**Reverse Warning/Motion Beeper**

Item No.	Part No.	Description	Qty
1	73-005-05	Alarm, Pulsating	1

**Hitches**

2	97-804-01	Hitch, Pintle Type	1
3	97-808-00	Hitch, Automatic Coupling	1
4	88-140-14	Bolt, 1/2NC x 1-1/2" Hex Hd	4
5	88-148-62	Lockwasher, 1/2"	6
6	88-149-80	Nut, 1/2NC	6
7	88-140-11	Bolt, 1/2NC x 1" Hex Hd	2
8	97-835-10	Plate, Hitch Mounting	1
9	97-835-00	Angle, Hitch Mounting	1
10	97-805-00	Bracket, Ball Hitch Mounting, 1-7/8"	1
10a	97-807-00	Bracket, Ball Hitch Mounting, 2"	1
11	97-811-00	Hitch, 1-7/8" Ball	1
11a	97-821-00	Hitch, 2" Ball	1



**Nurse's Seat, Black Cushions**

Item No.	Part No.	Description	
1	00-210-51	Nurse's Seat Frame (unpainted)	1
2	90-000-00	Backrest, 6-1/8" x 16-3/4", Black	1
3	88-837-13	Screw, #14 x 1-1/4" Phillips Sheet Metal	4
4	90-191-00	Seat Cushion, 17" x 18", Black	1
***	88-065-08*	Screw, 1/4NC x 5/8" Phillips Truss Hd	4
***	88-069-87*	Nut, 1/4NC Keps	4

**Deck, Galvanized, Ambulance**

5	00-610-07	Deck Rail, Left (unpainted)	1
6	00-610-06	Deck Rail, Rear (unpainted)	1
7	00-610-05	Deck Rail, Right (unpainted)	1
8	90-440-72	Deckboard, Galvanized, Rear	1
9	90-440-70	Deckboard, Galvanized, Front	1
***	88-065-08**	Screw, 1/4NC x 5/8" Phillips Truss Hd	13
***	88-065-09**	Screw, 1/4NC x 3/4" Phillips Truss Hd	4
***	88-069-87**	Nut, 1/4NC Keps	17

**Ambulance Safety Panels**

10	00-201-77	Safety Panel, Right (unpainted)	1
11	00-201-78	Safety Panel, Rear (unpainted)	1
12	00-210-53	Panel, Right Side	1
13	88-065-08	Screw, 1/4NC x 5/8" Phillips Truss Hd	4
14	88-069-87	Nut, 1/4NC Keps	4
15	98-451-20	Tape, Foam, 1/8" x 1/2"	3 ft
16	88-149-81	Locknut, 1/2NC	4
17	94-324-00	Decal, Cross Emblem, Red	4

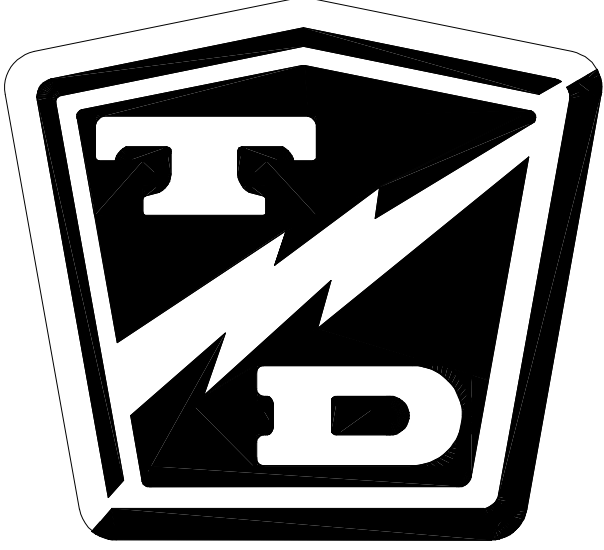
\* Hardware used to mount the nurse's seat to the vehicle frame.

\*\* Hardware used to mount the deck rails to the vehicle frame.

\*\*\* Not shown in illustration.



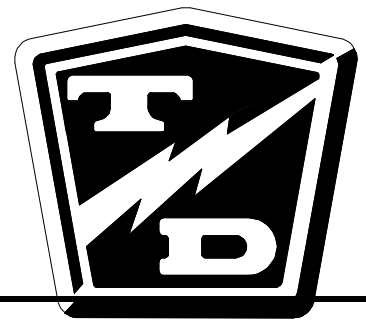
**TAYLOR - DUNN**



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# Appendixes





## APPENDIX A: SPECIAL TOOLS

DESCRIPTION	PURPOSE	PART NUMBER
Pinion Seal Installation Tool	Used to install the pinion seal on all chain drive trucks with the band style brake or the speed sensor on the chain case cover.	43-201-50
Chain Case Centering Tool	Used to center the chain case on the pinion shaft on all chain drive trucks with the band style brake or the speed sensor on the chain case cover. Includes instructions.	41-532-50
Test Light	Used for testing electrical circuits. Powered by the truck batteries, switchable for 12, 24, 36, and 48 volts.	62-027-00
Accelerator Test Harness	Used to test the solid state accelerator module part number series 62-033-XX.	62-027-31
PMC Test Kit	Includes 62-027-00, 62-027-31, and supplementary troubleshooting manual M3-001-06. For controllers equipped with pins labeled KSI and #2 only.	62-027-60
Curtis® PMC Handheld Programmer	Used to test and program the 62-215-00 PMC speed control used on early model C4-25 Huskey.	62-027-10
GE® EV1 Analyzer	Used to test the GE® EV1 speed control.	62-027-20
PMT/C Meter Reset Module	Used to reset the PMT/C maintenance meter after a maintenance is completed.	96-500-43
Sevcon® Handset Analyzer (read only)	Used to test the Sevcon® control systems and reset the Smart View display (includes instructions).	62-027-61
Sevcon® Handset Analyzer with Speed Adjust Capability	Same as 62-027-61 (above) plus allows a limited range of speed adjustment.	62-027-62
Disc Brake Boot Installation Tool	Used to install the rubber boot on all disc brake bodies.	41-350-13
Pin Removing Tool	Used to remove pins and sockets from AMP connectors.	75-440-55
Pin Removing Tool	Used to remove pins and sockets from MOLEX connectors.	75-442-55
Hydrometer	Used to check the specific gravity of battery electrolyte.	77-200-00
Battery Filler	Used to safely add water to batteries.	77-201-00
Retaining Plate Depressor	Used to hold down the retaining plate when disassembling the steering gear on trucks equipped with the tilt steering.	96-500-39
Fork Collar Weld Jig	Used when replacing the fork collar on models MX-600 and S55-36.	96-500-40
Secondary Sheave Holder	Used to hold the secondary sheave (pulley) from turning on models R6-80 and B6-10 with the Yamaha drive.	96-500-14
Solder Kit For Field Stud	Used to solder the aluminum field wire to the field stud. For use on motors with soldered connections only.	70-210-63
Pinion Gear Holding Tool	Used to align the Pinion Gear and Case during assembly and disassembly.	96-500-42

## APPENDIX B: SUGGESTED TORQUE LIMITS FOR STANDARD HARDWARE

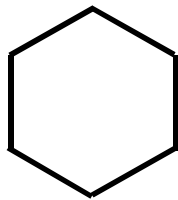
### HARDWARE IDENTIFICATION

#### Standard Head Markings

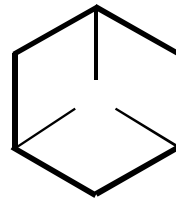
NOTE: Torque value used should be for lowest grade of hardware used. If a grade 2 nut is used on a grade 8 bolt, use grade 2 torque value.

NOTE: Toque values specified are for clean dry threads.

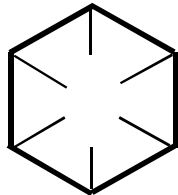
#### Hex Bolts



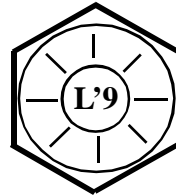
S.A.E. Grade 2



S.A.E. Grade 5



S.A.E. Grade 8



L'9

#### Other Bolts



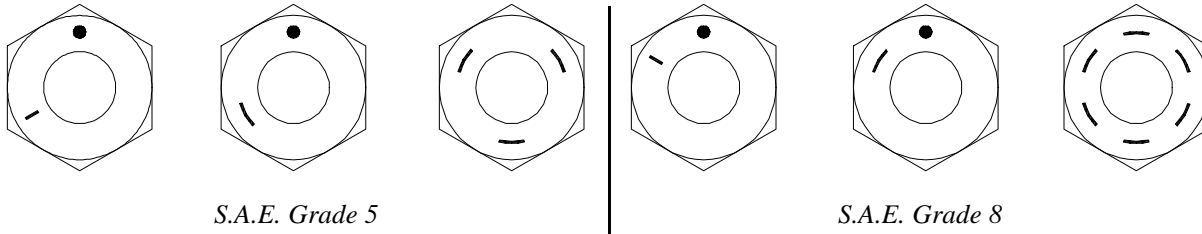
Truss Head, grade 2



Carriage Bolt, grade 2  
(unless marked as above)

**Hex Nuts**

*Nuts with no markings are to be treated as S.A.E. Grade 2*



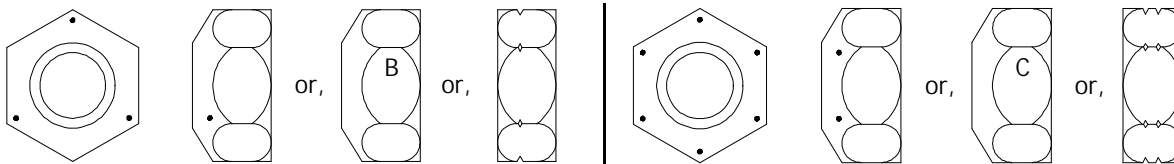
*S.A.E. Grade 5*

*S.A.E. Grade 8*

**Hex Lock Nuts (stover)**

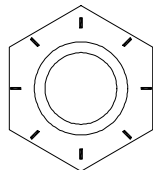
Lock nuts use a letter to indicate the grade of the nut. Grade 'A' locknuts would be the equivalent of Grade '2' hex nuts, Grade 'B' as Grade '5' and Grade 'C' as Grade '8'.

*NOTE: Nuts with no markings are to be treated as S.A.E. Grade A*



*S.A.E. Grade B*

*S.A.E. Grade C*



*Grade L'9*

**Other Nuts**

*Other nuts used by Taylor-Dunn® should be treated as S.A.E. grade A*

**Suggested Torque Values (non-critical hardware)**

Diameter and TPI	Grade 2 Tightening Torque (ft-lb)	Grade 5 Tightening Torque (ft-lb)	Grade 8 Tightening Torque (ft-lb)	L'9 Tightening Torque (ft-lb)
1/4-20	4-7	7-10	10-14	11
1/4-28	5-8	8-12	11-16	12
5/16-18	9-14	14-21	20-29	22
5/16-24	10-15	15-23	22-33	25
3/8-16	16-24	25-37	35-52	40
3/8-24	18-27	28-42	40-59	45
7/16-14	26-38	40-59	56-84	65
7/16-20	29-43	44-66	62-93	70
1/2-13	39-59	60-90	85-128	95
1/2-20	44-66	68-102	96-144	110
9/16-12	56-84	87-131	123-184	140
9/16-18	63-94	97-146	137-206	160
5/8-11	78-117	120-180	170-254	195
5/8-18	88-132	136-204	192-288	225
3/4-10	138-207	213-319	301-451	350
3/4-16	154-231	238-357	336-504	390
7/8-9	222-334	344-515	485-728	565
7/8-14	245-367	379-568	534-802	625
1-8	333-500	515-773	727-1091	850
1-14	373-560	577-866	815-1222	930
1.125-7	472-708	635-953	1030-1545	1700
1.125-12	530-794	713-1069	1156-1733	1850
1.25-7	666-999	896-1344	1454-2180	2950
1.25-12	738-1107	993-1489	1610-2414	3330



## Suggested Torque Values (critical hardware)

### *Torque Table*

<i>Group</i>	<i>Description</i>	<i>Ft-Lbs</i>	<i>Torque Range</i>	
			<i>In-Lbs</i>	<i>Nm</i>
<i>Brakes</i> - - - - -				
	Brake bolt (disc brake body)	11 - 11	132 - 132	15 - 15
	Brake line tube nut fittings	12 - 13	144 - 156	16.3 - 17.7
	Brake spider bolts (Dana 160mm hyd brakes)	25 - 35	300 - 420	34 - 47.6
	Brake spider bolts (Dana 160mm mech brakes)	15 - 19	180 - 228	20.4 - 25.8
	Brake spider bolts (Dana 7x1-3/4 brakes)	16 - 20	192 - 240	21.8 - 27.2
<i>Electrical</i> - - - - -				
	Battery terminals	8 - 9	96 - 108	10.9 - 12.2
<i>Front Axle</i> - - - - -				
	Front spindle nut	-	-	-
	<i>Note: Refer to maintenance section in the service manual</i>			
	King pin	-	-	-
	<i>Note: Refer to maintenance section in the service manual</i>			
<i>Rear Axle/Transmission</i> - - - - -				
	3rd member Gear case cover (GT drive)	45 - 50	540 - 600	61.2 - 68
	Axle bolt (GT drive)	275 - 275	3300 - 3300	374 - 374
	Axle hub nut (Dana)	95 - 115	1140 - 1380	129.2 - 156.4
	Axle tube to center section (Dana F-N-R)	25 - 35	300 - 420	34 - 47.6
	Carrier cap bolts (Dana)	100 - 120	1200 - 1440	136 - 163.2
	Differential Cover plate (Dana H12)	18 - 25	216 - 300	24.5 - 34
	Drain plug (Dana H12)	25 - 40	300 - 480	34 - 54.4
	Drain plug (GT drive)	21 - 25	252 - 300	28.6 - 34
	Gear case to 3rd member (GT drive)	18 - 20	216 - 240	24.5 - 27.2
	Motor mounting (GT/Dana)	6.5 - 7	78 - 84	8.8 - 9.5
	Pinion nut (F2/F3)	175 - 175	2100 - 2100	238 - 238
	Pinion nut (GT drive)	154 - 169	1848 - 2028	209.4 - 229.8
	Ring gear (Dana)	35 - 45	420 - 540	47.6 - 61.2
	Wheel lug nut	75 - 90	900 - 1080	102 - 122.4
<i>Steering</i> - - - - -				
	Ball joint clamp	28 - 32	336 - 384	38.1 - 43.5
	Ball joint nut	40 - 45	480 - 540	54.4 - 61.2
	Pitman nut (18-308-21 steering gear)	75 - 100	900 - 1200	102 - 136
	Pitman nut (18-308-25 steering gear)	181 - 217	2172 - 2604	246.2 - 295.1
	Rod end nut	20 - 25	240 - 300	27.2 - 34
	Steering shaft pinch bolt	24 - 26	288 - 312	32.6 - 35.4
	Steering wheel nut (18-308-21 steering gear)	28 - 32	336 - 384	38.1 - 43.5
	Steering wheel nut (18-308-25 steering gear)	72 - 86	864 - 1032	97.9 - 117
<i>Suspension</i> - - - - -				
	Leaf spring hangers	-	-	-
	<i>Note: Refer to maintenance section in the service manual</i>			

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## **APPENDIX C: BRAKE LINING HANDLING PRECAUTIONS**

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### **⚠ WARNING**

Taylor-Dunn does not currently supply asbestos fiber-brake pads/shoes with any vehicle. However, there is the possibility that the original brake pads/shoes were replaced with aftermarket pads/shoes containing asbestos. Since this possibility does exist, the brake pads/shoes should be handled as if they do contain asbestos.

Never use compressed air or dry brush to clean the brake assemblies. Use an OSHA approved vacuum cleaner or any alternate method approved by OSHA to minimize the hazard caused by airborne asbestos fibers and brake dust.

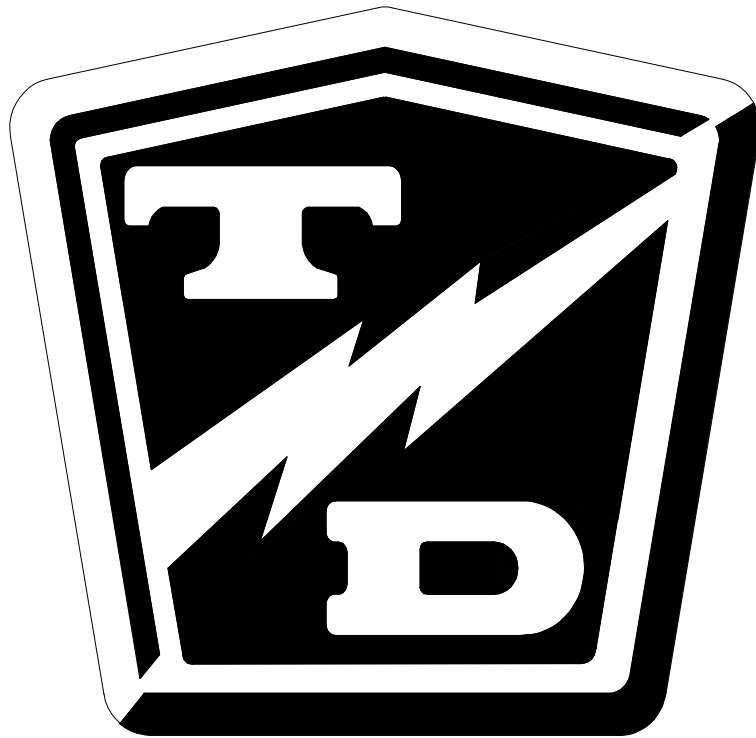
Do not grind, sand, break, or chisel the brake pads/shoes, as this will cause unnecessary dust, possibly releasing asbestos fibers in the air.

Always wear protective clothing and a respirator when working on the brake pads/shoes or their associated components.

Inhaled asbestos fibers have been found to cause cancer and respiratory diseases.

Do not drive the vehicle if any worn or broken part is detected in any part of the brake system. The cause of the damage must be repaired immediately.





Taylor-Dunn® Mfg.  
2114 W. Ball Rd.  
Anaheim, CA 92804  
(800)-688-8680  
(714) 956-4040  
(FAX) (714) 956-0504

Visit our Website:  
[www.taylor-dunn.com](http://www.taylor-dunn.com)