TAYLOR-DUNN®

The Best Way
To Go
About Your
Business

Models Inlcuded:
P0-032-49 (P 2-49)
Equipped with the GT drive system

MANUAL MP-249-02

Operation, Troubleshooting and Replacement Parts Manual

Revision: A

Serial Number Starting: 165452

TAYLOR-DUNN SERVICE CENTER

For more information about this and other Taylor-Dunn® manuals, please write Taylor-Dunn®:

Taylor-Dunn® Mfg.
2114 W. Ball Road
Anaheim, CA 92804
(Attn: Technical Writer)

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

"PullMaster" Model P0-032-49

Operator and Service Manual Section Index

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.

TAYLOR - DUNN

Introduction

Table of Contents

ABOUT THIS MANUAL

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

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

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 withstake 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 equiped 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.

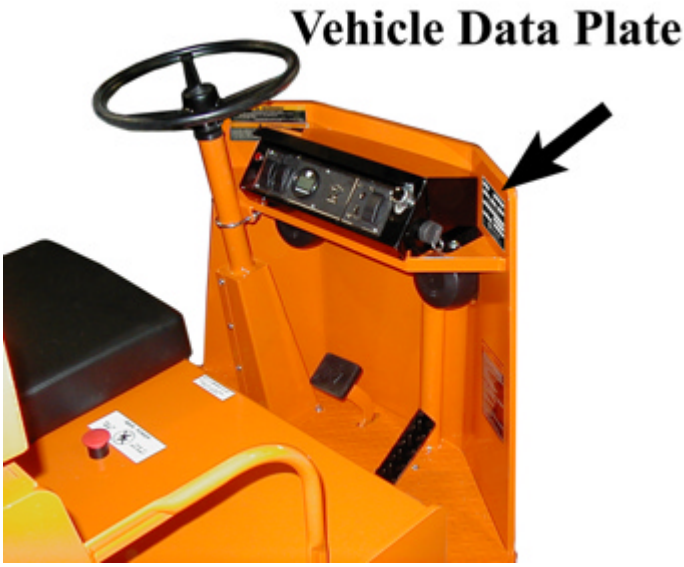
These vehicles are designed for driving on smooth surfaces in and around facilities such as industrial plants, nurseries, institutions, motels, mobile home parks, and resorts. They are not to be driven on public highways.

⚠WARNING

This vehicle is not designed to be driven on public roads or highways. It is available in maximum designed speed of 6 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.

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 Operator Controlled Industrial Tow Tractors (ANSI B56.9).

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



TAKING DELIVERY OF YOUR VEHICLE

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

TAYLOR - DUNN

Safety Rules and Operating Instructions

TABLE OF CONTENTS

STANDARD SPECIFICATIONS TOW TRACTOR

ITEM	SPECIFICATION
Occupancy	Driver only, no passengers
Dimensions	81L x 42W x 48H inches 207.7L x 106.6 W x 121.9H Centimeters
Turning Radius	190.5 Centimeters (75 inches)
Dry Weight (Without Battery)	948 kg (2,090 lbs)
Battery Compartment Dimensions	82.5L x 100.3W x 57.4 Centimeters 32.5L x 39.5W x 22.625H inches
Battery specifications:	
Max Battery Weight	1179 kg (2,600 lbs)
Voltage	36
Connector	SB 350 gray
Lead Length	91.4 Centimeters (36 inches)
Position	A
Cover	No
Maximum Towed Load	272 kg Draw Bar Pull @ 4.82 kph, 1,360 kg ultimate 600 lb. Draw Bar Pull @ 3 mph, 3,000 pound ultimate Tongue weight max. 22 kg (50 lbs)
Electrical System	Solid State Speed Control, 400 Amp
Transmission	Helical Gear, Oil Bath, Automotive Type Hypoid Differential.
Motor, DC Separately Excited Field	9.69 kW, (13 Horse Power) for 5 min
Brakes	Rear Wheel Hydraulic Drum, Front Wheel Hydraulic Disc Hand Operated Park Brake
Steering	Automotive Steering 24:1
Tires	Front: 16 x 4 x 12-1/8 Solid Cushion (smooth) Rear: 18 x 5 x 14 Solid Cushion
Instrumentation	Smart View Display (battery status, hour meter, fault code), Key Switch, Horn Button,Forward/Reverse Switch, Headlight Switch
Light Accessories	Dual Headlight, Tail/Brake Light

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 Operator Controlled Industrial Tow Tractors (ANSI B56.9).

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 while also obeying he following safety rules and guidelines (reference American National Standards Institute Operator Controlled Industrial Tow Tractors ANSI B56.9).

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 speed of 6 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 B56.9, 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.

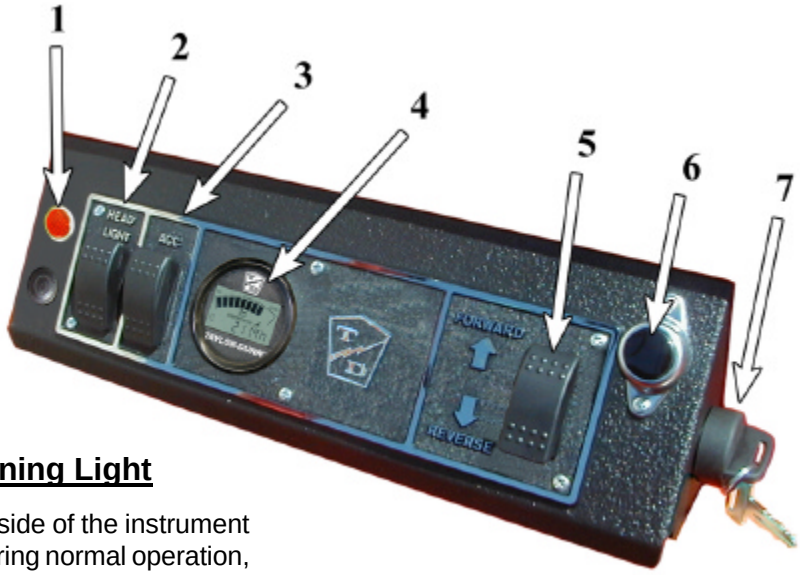
Driver Qualifications.

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) Motor Temperature Warning Light

A warning light located on the left side of the instrument panel is for motor temperature. During normal operation, the light will be "OFF." If the light comes "ON", the motor is overheated and the vehicle should be stopped in a safe area to allow the motor to cool.

⚠CAUTION

Continuing to operate the vehicle while the motor temperature warning light is "ON" may result in damage to the motor.

2) Headlight Switch

The headlight switch is located on the left side 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.

3) 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.

4) Smart View Display

The Smart View Display (SVD) functions as a Battery Status Indicator (BSI), Hour Meter (HM), speed controller status monitor, and as an optional maintenance monitor feature. The operation of each of these functions is listed at the end of this section.

5) 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.

6) 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.

7) Key-Switch

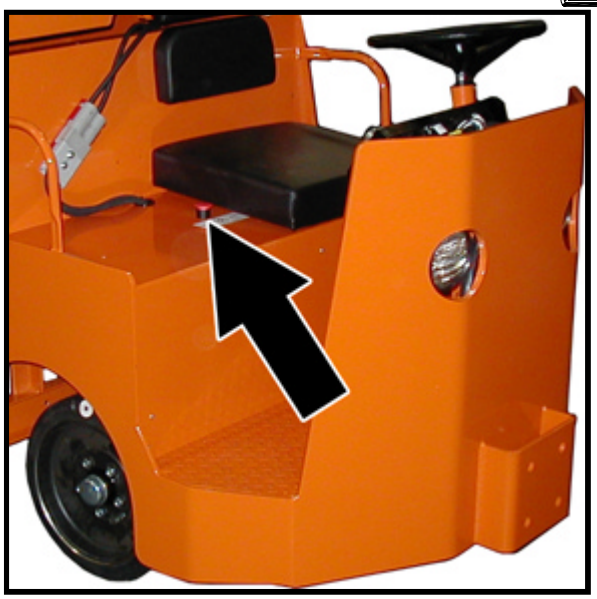
A key-switch, located on the right center side of the instrument panel, turns on the vehicle. Rotate the key clockwise to turn the vehicle power on, counterclockwise to turn the vehicle power off.

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.

Power Disconnect Switch

The Power Disconnect Switch is located to the right of the driver seat. To turn off main power for the system, push down on the knob. Pull up on the knob to turn main power back on.

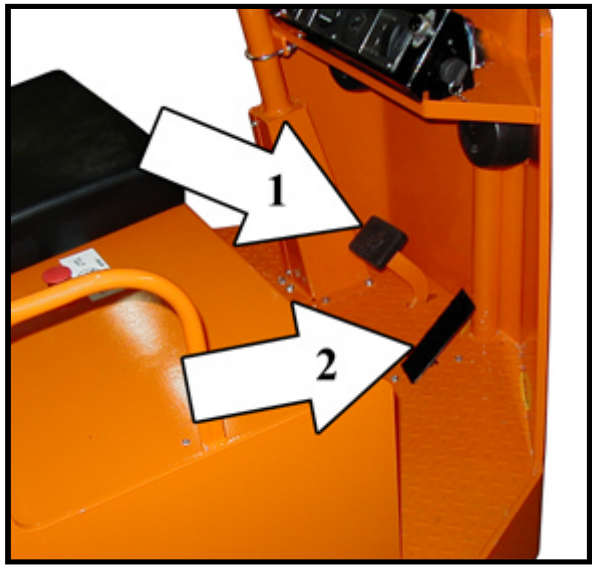


1) Foot Brake Pedal

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.

2) 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 park brake is automatically applied when the key switch is turned off or the batteries are disconnected. Refer to Towing This Vehicle for information on temporarily disabling the automatic park brake.

⚠ WARNING

The park brake should be disabled for servicing or towing procedures only. Do not operate the vehicle while the automatic park brake is disabled. Operating the vehicle with the automatic park brake disabled could lead to severe bodily injury and/or property damage.

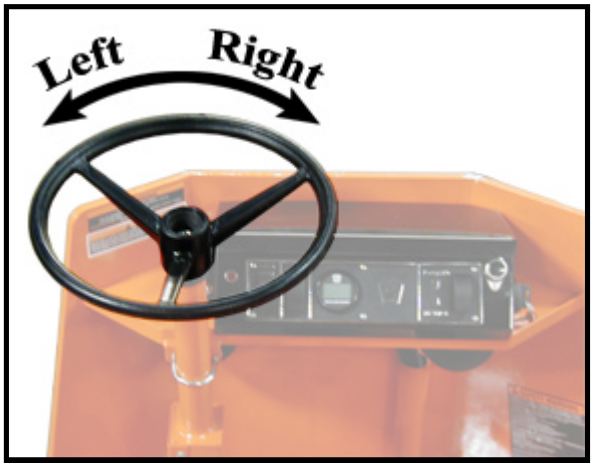
Seat Interlock Switch

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.

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.

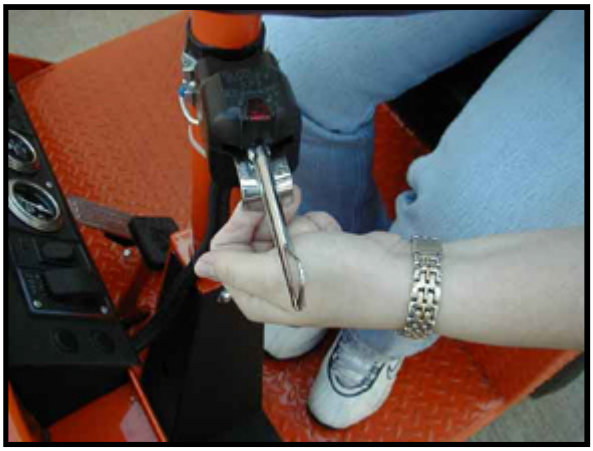


Directional Signals (Optional)

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.



Floorboard Mounted Horn Switch (optional)

If equipped with this option, the horn switch is located to the left of the steering column. Depress the switch with your left foot to sound the horn, release it to turn it off.

Trailer Hook Up Assist Panel

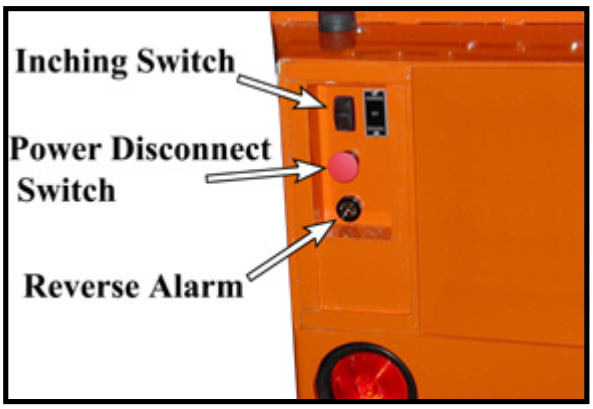
This panel contains an Inching Switch, Power Disconnect Switch and Motion Alarm.

NOTE: To operate the Inching Switch, the Key Switch must be "ON", The Forward/Reverse switch must be "OFF", and the driver seat be unoccupied.

The Inching Switch is used to move the vehicle a very short distance (forward or reverse) to assist in connecting a trailer to the vehicle. Push the top of the Inching Switch to move forward, the bottom of the switch to move backward. The vehicle will only move a short distance with each operation of the switch. It will not continue to run if the switch is held down. To "Inch" the vehicle again, release and then depress the switch as needed.

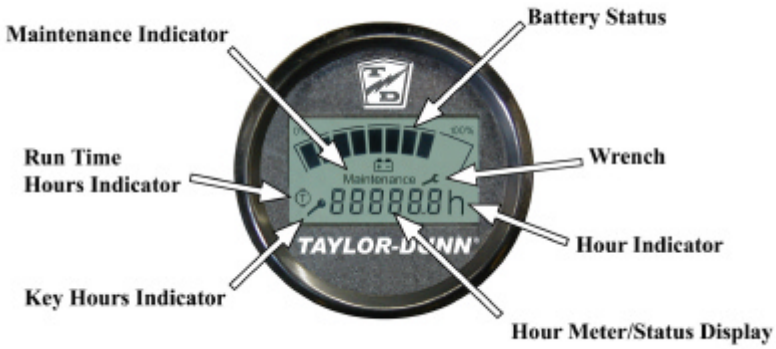
The Power Disconnect Switch below the Inching Switch is used to turn off main power for the system. Push the knob "IN" to disconnect main power and stop the vehicle. Pull the knob "OUT" to turn main power back on.

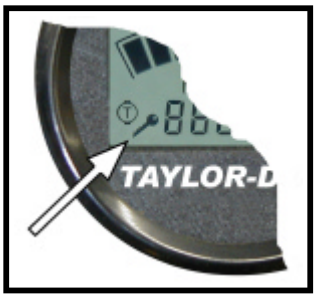
Note: If the Power Disconnect Switch is used, the Key Switch must be cycled "OFF" then "ON" again to operate the Inching Switch.



Panel located at the rear of the vehicle

Smart View Display





Key Hours icon

The Smart View Display (SVD) functions as a Battery Status Indicator (BSI), Hour Meter (HM), speed controller status monitor, and as an optional maintenance monitor feature. The operation of each of these functions is listed below.

BSI: A bar graph representing the current state of charge is located across the top of the display. When the batteries are fully charged, all segments of the bar graph will be on. As the batteries are used, segments will turn off in the order of right to left.

When the batteries are discharged to 75%, the last three segments will flash indicating that you are approaching the end of the battery cycle. At this time, the vehicle's batteries should be charged as soon as possible.

At 90%, all segments will flash and the vehicles speed will be reduced. At this time, the vehicle should be removed from service for charging. Discharging beyond 90% will result in damage to the batteries that will shorten the battery life-span.

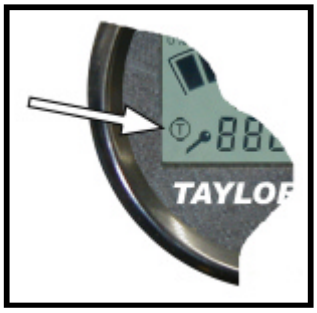
HM: There are two hour meter functions, Key Hours and Run Time Hours.

Key Hours is the accumulated length of time in hours that the key switch is in the "ON" position.

Run Time Hours is the accumulated length of time that the vehicles has been in operation. Time is accumulated when the FS-1 switch in the accelerator module is closed.

One of the Hours functions is being displayed whenever the either of the Hours Indicators are visible at the right side of the display.

Key Hours: When the display is turned on, the Key Hours will be displayed for approximately 5-seconds as indicated by the Key Hours Indicator located at the lower left of the display. The icon represents the silhouette of a key.

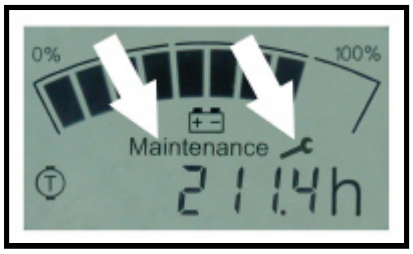


Run Time Hours icon

Run Time Hours: After the initial 5-seconds, the Run Time Hours will be displayed as indicated by the Run Time Hours Indicator located at the left of the display. The icon represents a motor symbol with a "T" in the center.

Speed controller status: The display will indicate a fault code whenever the control system logic detects a problem with the control system. A fault code is being displayed whenever the Fault Code Indicator (the letter 'F') is visible at the left of the numeric display. Refer to the table below for a list of fault codes and their descriptions.

Fault Code	Description	Corrective action
01004	Discharged battery or defective wiring.	Charge the battery. If the battery is good, check wiring to the controller.
01005	Speed control overheated.	Allow the controller to cool off. May be the result of an overloaded vehicle or an obstruction to the controller heat sink.
01008	Optional speed encoder or speed encoder wiring defective	Repair as required
02000	Start up switches not operated in the correct order or a defective switch.	Reset switches and start again.
02001	Defective wiring	Refer to troubleshooting
04003	Start up switches not operated in the correct order or a defective switch.	Reset switches and start again.
04004	Both the forward and reverse directions are selected at the same time	Check the forward/ switch and wiring for shorts.
04005	Start up switches not operated in the correct order or a defective switch.	Reset switches and start again.
04006	Accelerator pedal depressed before the seat interlock switch is closed	Recycle start up switches and try again. Possible defective seat switch.
04007	-	Defective wiring
04009	Discharged battery or defective wiring.	Charge the battery. If the battery is good, check wiring to the controller.
04010	Battery voltage too high	Incorrect battery installed.
04011	Personality fault	Reprogram the controller
04012	Personality fault	Reprogram the controller
04013	Defective wiring or batteries	Refer to troubleshooting
05000	Line contactor coil or wiring shorted	Replace contactor or repair wiring
05006	MOSFET shorted	Refer to troubleshooting
05008	Line contactor welded contacts or wiring shorted	Replace contactor or repair wiring
05009	MOSFET shorted	Refer to troubleshooting
05046	Line contactor contacts open or defective wiring	Replace contactor or repair wiring. Could also be result of open circuit breaker



Display showing Maintenance and Wrench icons

Maintenance monitor:

Operation: The SMD notifies the operator 10-hours (standard) before a scheduled maintenance is due. During this warning period, the meter will continue to alert the operator. This should allow sufficient time for the operator to schedule the maintenance that is due, with minimal down time. If the scheduled maintenance is not performed before the warning period elapses, then the vehicles maximum speed will be significantly reduced.

Warning period: The warning starts when the Maintenance Indicator is ON and the Wrench icon is flashing. The Wrench icon will continue to flash until the warning time has expired.

Maintenance Due: Once the warning has expired and the maintenance is due, the Wrench icon will stop flashing and remain ON. Additionally, the vehicles maximum speed will be significantly reduced until the maintenance is performed and the display is reset. The display should only be reset by an authorized technician. Refer to the ***Illustrated parts*** section for information regarding tools required to reset the Smart View Display.

VEHICLE OPERATIONAL GUIDELINES

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 emergencies 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 witch is in the center “OFF” position.
2. Set the parking brake.
3. Hold down the foot brake.
4. Rotate the ON-OFF switch to the “ON” position.
5. Wait 1-second then place the forward-off-reverse switch in the desired direction of travel.
6. Release the parking brake.
7. Release the foot brake.
8. 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.

Towing This Vehicle

This vehicle is equipped with an automatic electric park brake that is applied whenever the vehicle is stopped. A park brake bypass switch is provided to bypass the electric park brake and allow the vehicle to be towed or pushed. The brake is bypassed when the lever is "UP". The switch is located in the control panel compartment at the rear of the vehicle (see illustration). The compartment cover must be removed to access the switch.

When the switch is in the bypass position, power is being supplied to the electric park brake. Do not leave the switch in the bypass position for extended periods as this may result in damage to the electric brake or a severely discharged battery. The switch should be in the bypass position only while towing or pushing the vehicle. Return the switch to the normal position (down) after the vehicle has been towed or pushed to its final destination.

NOTE: The park brake bypass switch will not function if the battery is disconnected or severely discharged.

NOTE: The vehicle will not operate while the park brake bypass switch is in the bypass position (up).

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.

⚠CAUTION

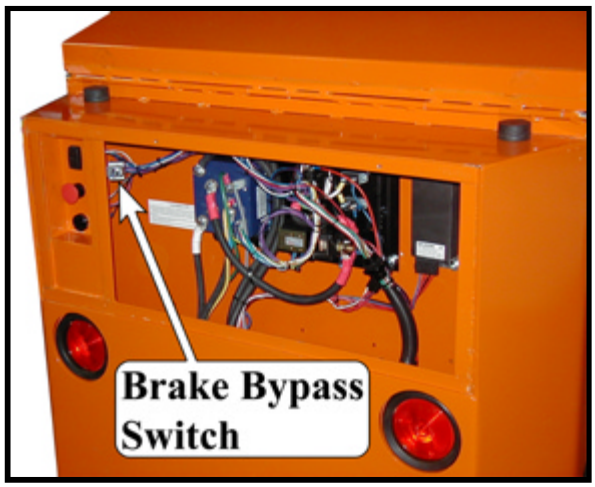
This vehicle is equipped with regenerative braking. Follow these steps before towing this vehicle.

1. To tow this vehicle the start switch must be in the "OFF" position.

2. Place the forward/reverse switch in the center "OFF" position.

3. Disable the park brake with the Brake Bypass Switch (see text).

Failure to follow these instructions may result in damage to the vehicle.



Parking

Before leaving the vehicle:

- Set the parking brake.
- Set the forward-off-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.

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.

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.

Charging time will vary depending on the model charger and battery installed in the vehicle. Refer to the documentation supplied with the battery and charger for more information or contact the manufacturer..

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.

STORING AND 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

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

- Check the battery's state of charge and charge if required.
- 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[2,3]	Weekly (20hrs)	Monthly (80hrs)	Quaterly (250hrs)	Semi - Annual (500hrs)	Annualy (1000hrs)
Check Condition of Tires and Tire Pressure	●				
Check All Lights, Horns, Beepers and Warning Devises	●				
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.

STANDARD PERIODIC MAINTENANCE SCHEDULE FOR THE SMART VIEW DISPLAY

NOTE: The maintenance function is optional. Your vehicle may be equipped with a customized maintenance schedule

PREVENTATIVE MAINTENANCE SCHEDULE		
MAINTENANCE LEVEL	HOUR INTERVAL[1]	MAINTENANCE TO BE PERFORMED[2,3]
1	500	Inspect the brake system including the park brake and mounting harware
		Inspect the steering system, tighten the steering shaft coupler on the steering gear input shaft
		Lubricate the vehicle, check for leaks
		Inspect safety interlocks
		Inspect front and rear wheel bearings
		Inspect and adjust fork collar bearings (3-wheel trucks only)
		Inspect and tighten all nuts and bolts. First 500 hours and then every 1000 hours.
2	1000	Inspect and tighten all nuts and bolts
		Clean and repack front wheel bearings
		Inspect and tighten all wire connections
		Inspect the motor brushes and commutator
		Inspect the king pin bushings
		Check front end alignment
3	2000	Change oil in the drive and rear axle
		Flush hydraulic brake system
		Inspect suspension bushings
		Replace brake pedal/treadle return spring
		Inspect frame for damage

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

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 devises 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.

General Maintenance

Table of Contents

Model C 4-25 Tow Tractor

Examples of other Taylor-Dunn Tow Tractors

Model E 4-55 Tow Tractor

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 <u>BEFORE</u> 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.

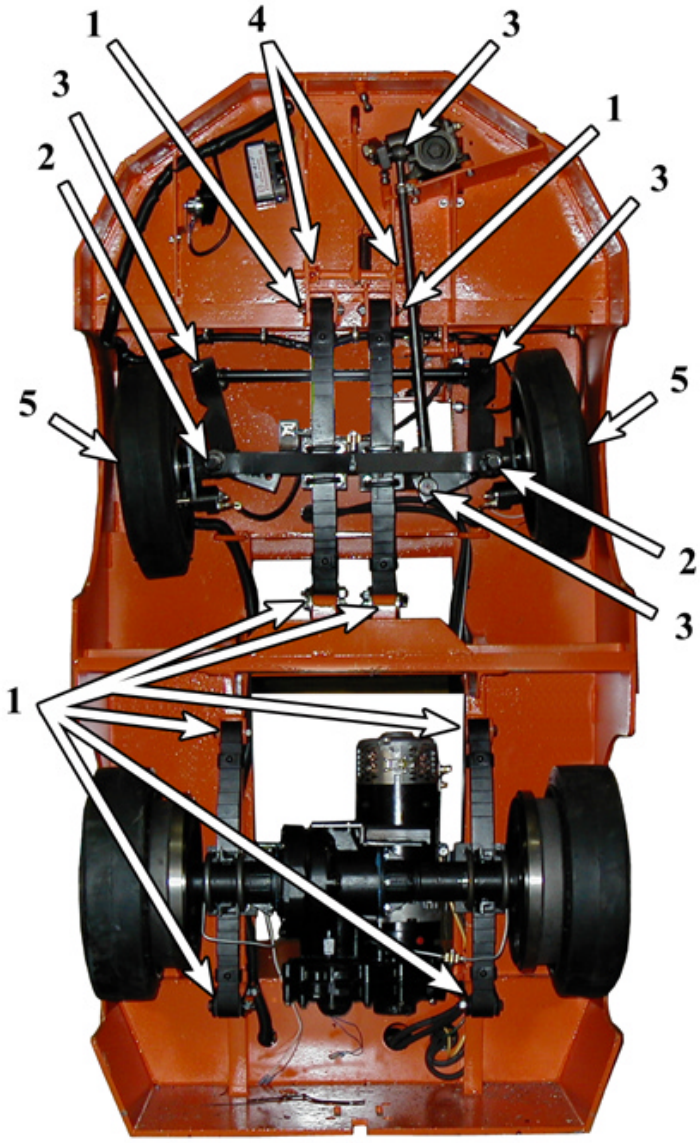
- Avoid fire hazards and have fire protection equipment present in the work area. Conduct vehicle performance checks in an authorized area where safe clearance exists.
- Before starting the vehicle, follow the recommended safety procedures in Section 2, "Safety Rules and Operational Information."
- Ventilate 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.

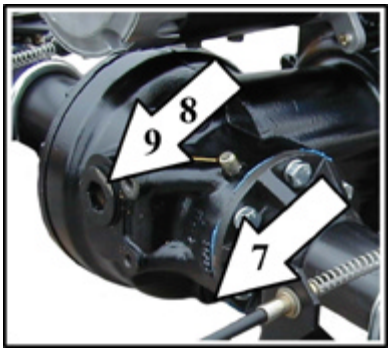
Troubleshooting Guide

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





Drive Axle

#	Description	Locations	Lubricant Type
1	Leaf Springs	12	General Purpose Grease
2	King Pin	2	General Purpose Grease
3	Ball Joints	4	General Purpose Grease
4	Pedal Linkages	2	
5	Front Wheel Bearings	2	High Temperature Wheel Bearing Grease
6	-	-	-
7	Drive Drain Plug	1	-
8	Drive Level Plug	1	-
9	Drive Fill Plug	1	SAE 80/90 Hypoid Gear Oil

Front Axle Service

TABLE OF CONTENTS

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.

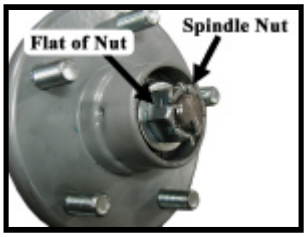
4. Place blocks under the front wheels to prevent vehicle movement.

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 brake body. Refer to the ***Brakes*** section for information regarding the removal of the brake body.
10. Remove the hub from the steering knuckle.
11. Thoroughly clean all grease from the inside of the hub and the bearings.
12. 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.

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

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

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

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

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 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.

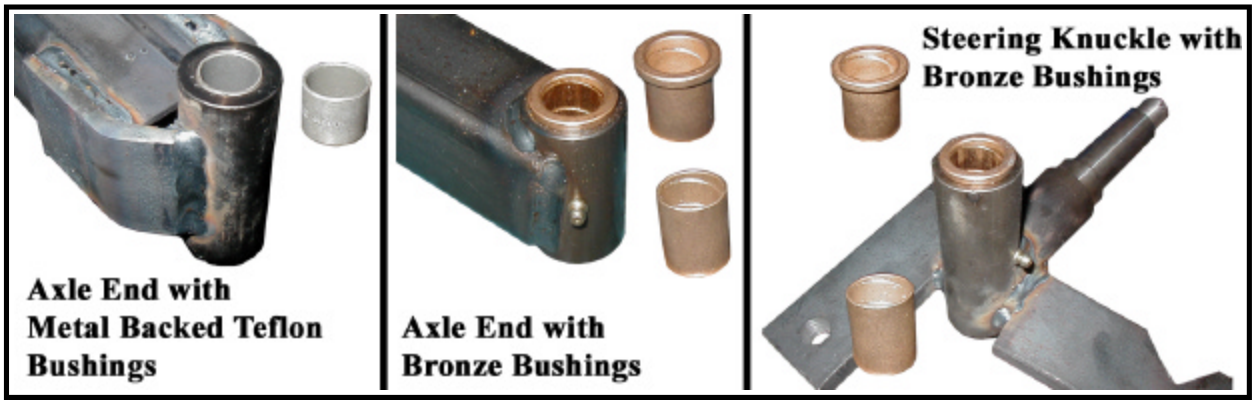
   a) Ream or broach bronze bushings to 0.880 inches.

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.

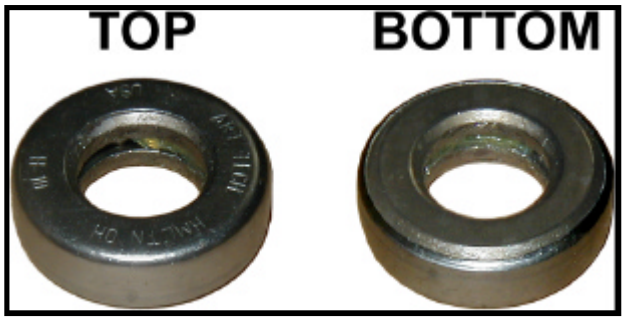
13. Assemble in reverse order. Refer to the illustratinon below for orientation of the thrust bearing.
14. Pack the thrust bearing with grease.
15. Tighten the king pin nut so that there is no verticle play between the knuckle and the axle.

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.



Orientation of thrust bearing

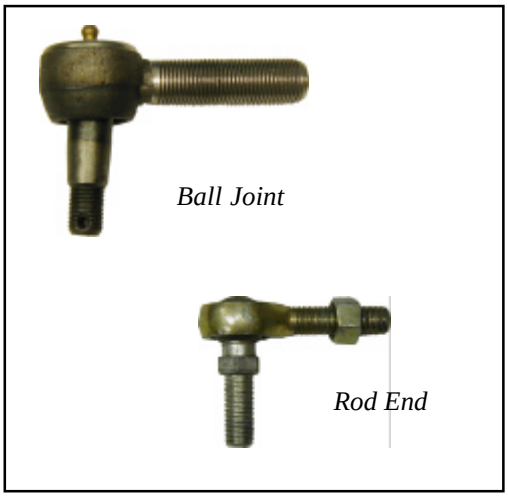
Steering Component Service

TABLE OF CONTENTS

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.

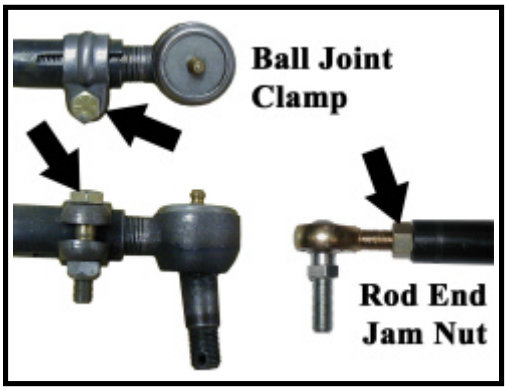
NOTE: Refer to **Replace the Ball Joints** *section for information regarding removing the ball joint or rod end from the drag link.*

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.

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.

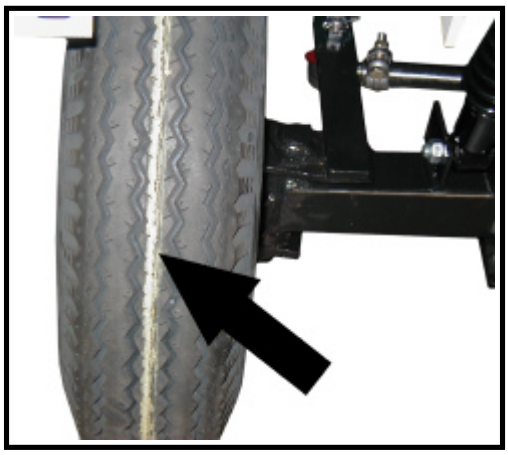
⚠WARNING

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.



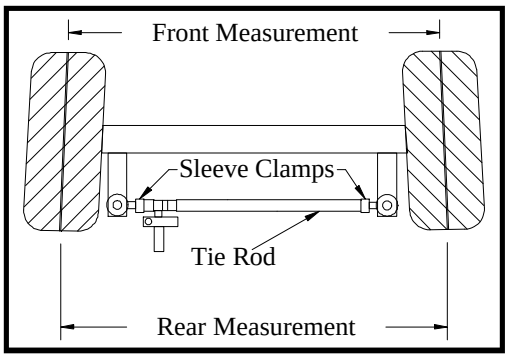
8. Using a piece of chalk, mark a line around the center of both front tires.

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.

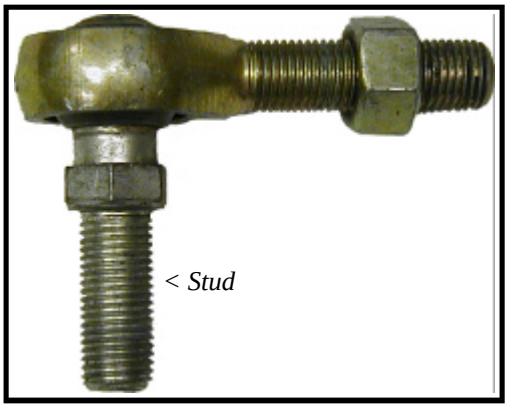
2. Place the forward-reverse switch in the center "OFF" position.

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

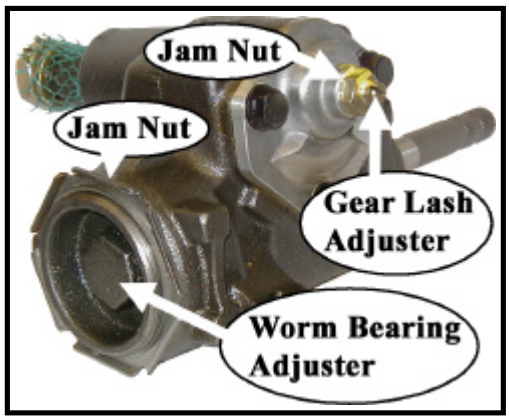
1. Make sure the key-switch is in the "OFF" position, then remove the key.

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.

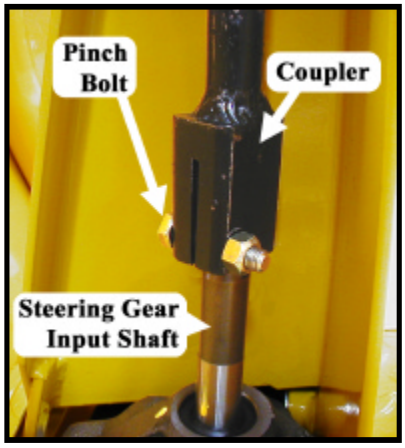
⚠WARNING

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.*

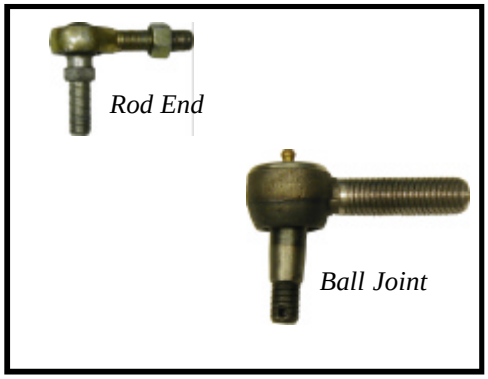
⚠WARNING

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.

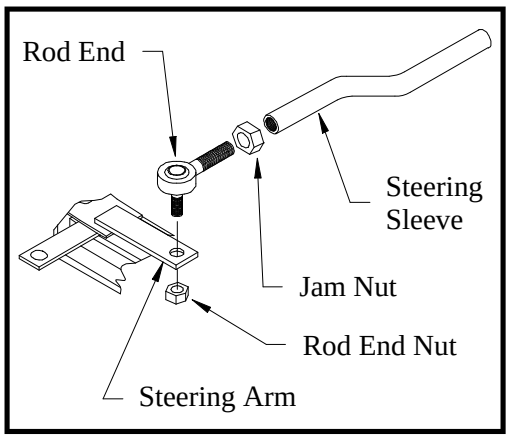
⚠WARNING

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.

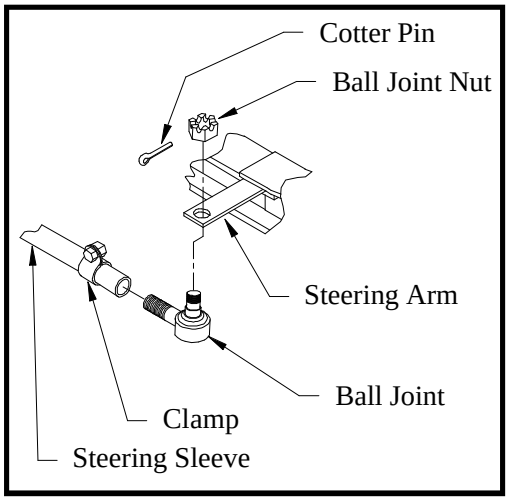
4. Place blocks under the front wheels to prevent vehicle movement.

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 appropriat section for details.

1. Remove the pitman arm or drag link.
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.

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.*

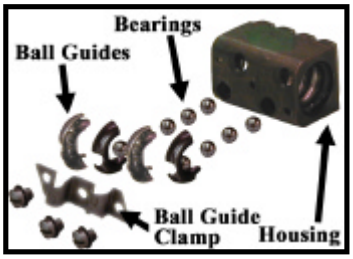
NOTE: The steering gear is packed with grease. Only perform maintenance on the steering gear in an area that will contain any grease that may spill out of the steering gear when it is disassembled.

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

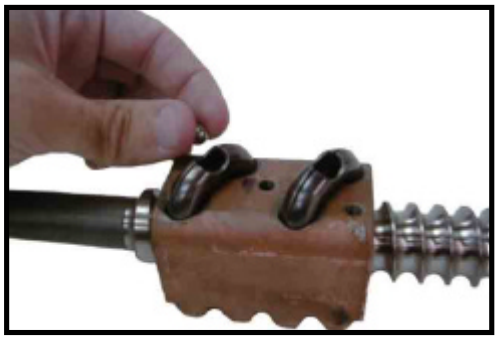
1. Lightly lubricate all parts before reassembly.
2. Install a new worm shaft seal and pitman shaft seal into the housing.
3. Install the upper worm bearing cup.
4. Divide the ball bearing into two equal groups.
5. Position the ball nut onto the worm as shaft as shown in the illustration.
6. Insert the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

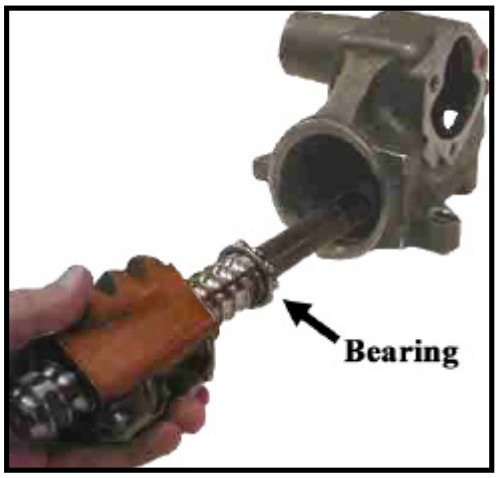
NOTE: Do not rotate the worm shaft while installing the bearings. This may cause one or more of the bearings to enter the crossover passage in the ball nut, causing improper operation.

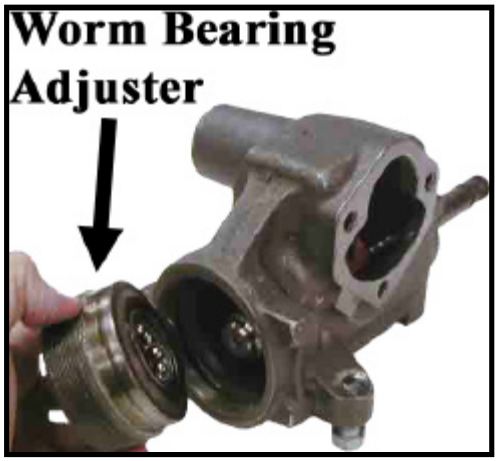
8. Install the ball guide clamp.
9. Place the upper worm bearing on the worm shaft and install the worm shaft/ball nut assembly into the housing being careful not to damage the worm shaft seal.
10. Install the assembled worm bearing adjuster into the housing and tighten just enough to remove all play 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.*

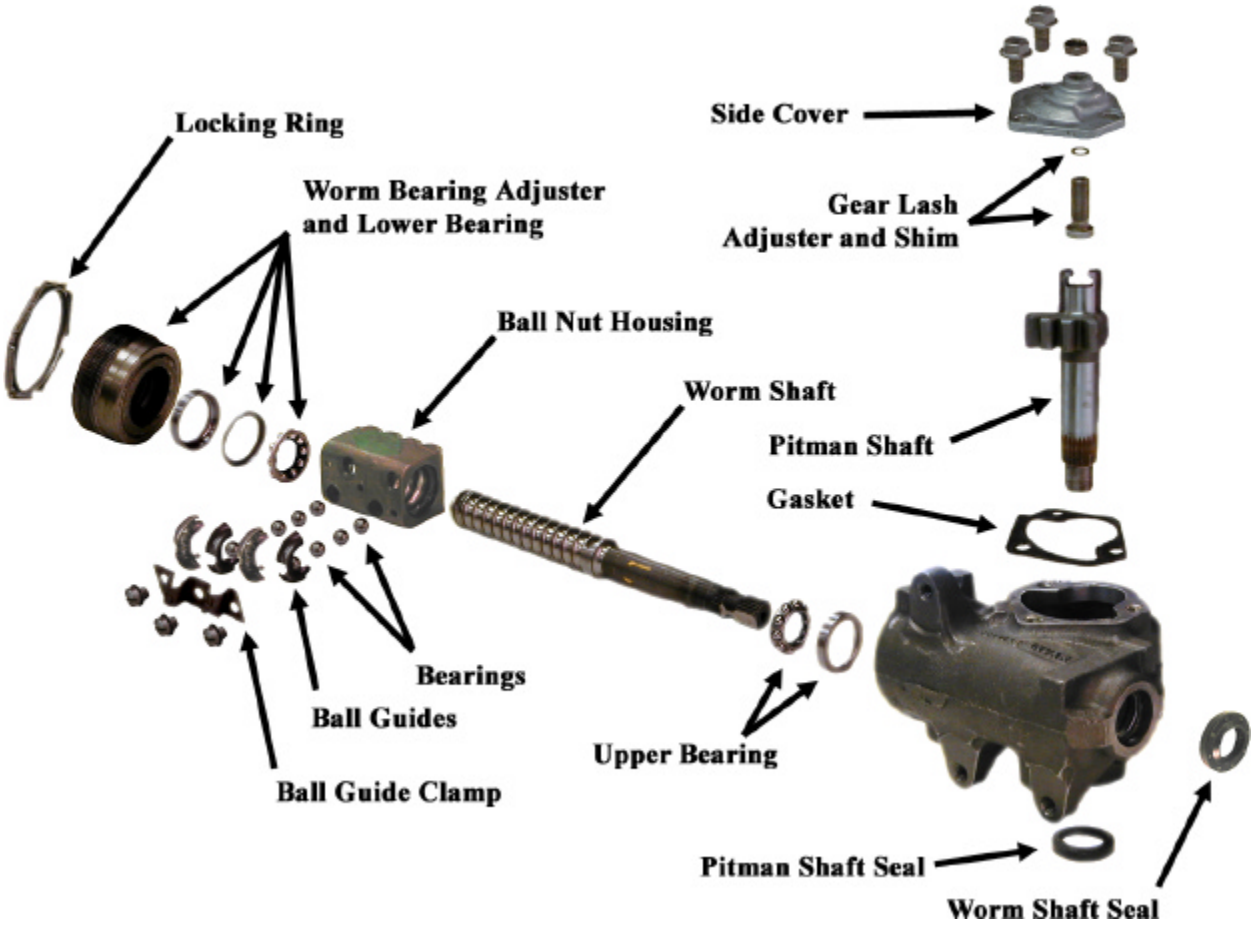
16. Once the adjustments are completed, make sure that the locking ring and jam nut are tight.







Exploded View of Steering Gear



Brake Service

TABLE OF CONTENTS

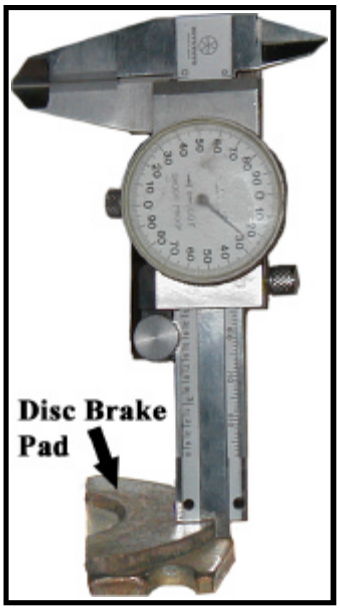
INSPECT THE SERVICE BRAKE

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.

Brake Shoes

⚠WARNING

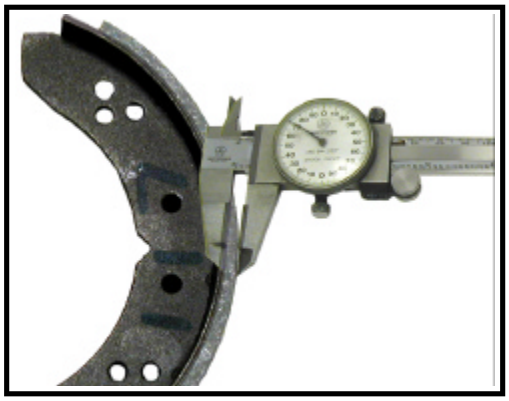
Current Taylor-Dunn® brakes are asbestos free. However, there is the possibility that the original brakes were replaced with aftermarket parts containing asbestos. Since this possibility exists, all brake parts should be handled as if they contain asbestos. Refer to Appendix C for recommended handling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

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

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

NOTE: If this is a riveted lining, then the measurement must be to the top of the rivets.

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



Brake Drum

⚠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.

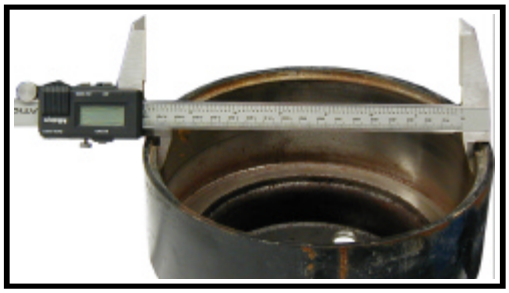
⚠WARNING

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

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

The service limit for the inside diameter of the brake drum is 12.060 inches (refer to brake drum casting).

If the brake drum is grooved or worn beyond the service limit then the brake drum must be replaced.



Measure the inside diameter of the brake drum in 3-places.

If the difference between any of the measurements exceeds 0.010-inches then the brake drum must be replaced.

INSPECT THE PARKING BRAKE

Electric Motor Brake

A variable power supply capable of supplying 0-volts to 24-volts DC at 2-Amps will be required to perform the testing.

The brake does not have to be removed from the transmission for this test.

⚠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. Disconnect the electric brake connector from the vehicles harness.
7. Adjust the power supply to zero volts.
8. Connect the power supply to the electric brake.
9. Slowly increase the voltage until you hear a 'click' from the brake. The 'click' is the brake releasing. The motor should now be free to rotate limited by the gear train and parking brake).
   a) If the brake does not release until the voltage exceeds 18-volts, then the friction plate has worn beyond its service limits and must be replaced.
   b) If the brake does not release at all, then the brake electromagnet has failed and must be replaced.
10. Reconnect the electric brake.
11. Reconnect the main positive and negative cables at the batteries.
12. Remove blocks from behind the wheels.
13. Release the parking brake and test drive the vehicle.

ADJUST THE SERVICE BRAKES

Rear Drum Brake Adjustments

NOTE: This vehicle is equipped with self-adjusting brakes. The need to adjust the brakes manually may be an indication that the auto-adjust mechanism is not functioning properly. Refer to **Inspecting the Auto-Adjust Brake Mechanism** *for information on the auto-adjust mechanism.*

⚠WARNING

1. Make sure the key-switch is in the "OFF" position, then remove the key.

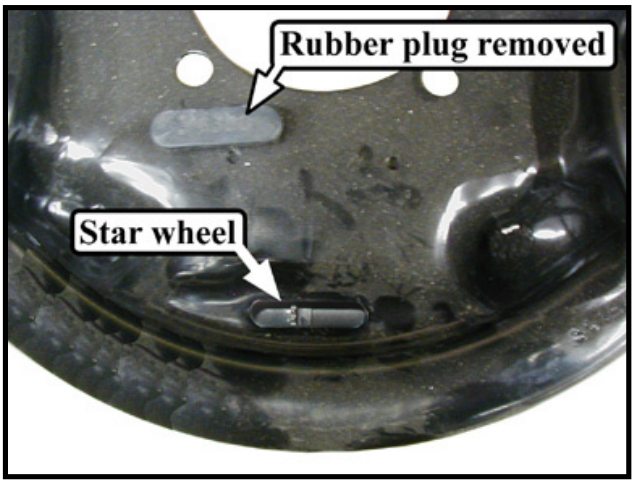
2. Place the forward-reverse switch in the center "OFF" position.

3. Confirm the electric park brake is set.

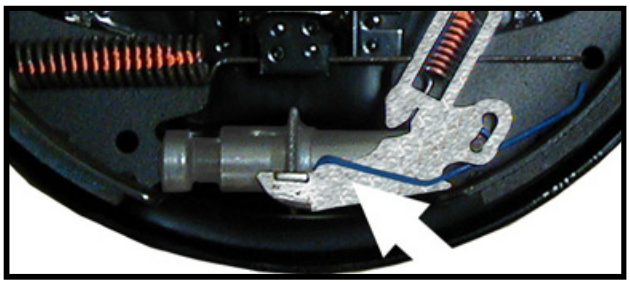
4. Place blocks under the front wheels to prevent vehicle movement.

5. Disconnect the main positive and negative cables at the batteries.

6. Raise the rear of the vehicle and support with jack stands.
7. Release the park brake.



8. To access the brake adjustor, remove the rubber plug located near the bottom of the brake backing plate.



Close up of adjuster with brake drum removed. Arrow depicts the indexing lever.

9. Turn the star wheel until the brakes lock the wheel then back off the star adjusting nut until the wheel spins freely with a minimum of drag.

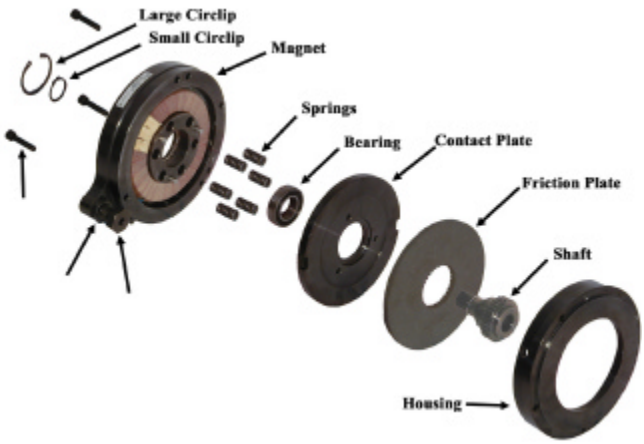
NOTE: Use a screwdriver inserted through the access hole to disengage the indexing lever from the star wheel.

10. Repeat steps 9 through 11 for the other side.
11. Lower the vehicle.
12. Reconnect the main positive and negative at the batteries.
13. Remove the blocks from behind the wheels
14. Test drive the vehicle.
    a. Inspect the park brake adjustment. If required, refer to ***Adjust the Parking Brake*** section for information regarding adjusting the parking brake.

ADJUST THE PARKING BRAKE

The parking brake is an automaticly applied electric disc brake on the motor shaft. There are no adjustments.

If the brake is not working properly, refer to Inspect the Parking Brake for more information.



CHECK MASTER CYLINDER FLUID

⚠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. **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.**

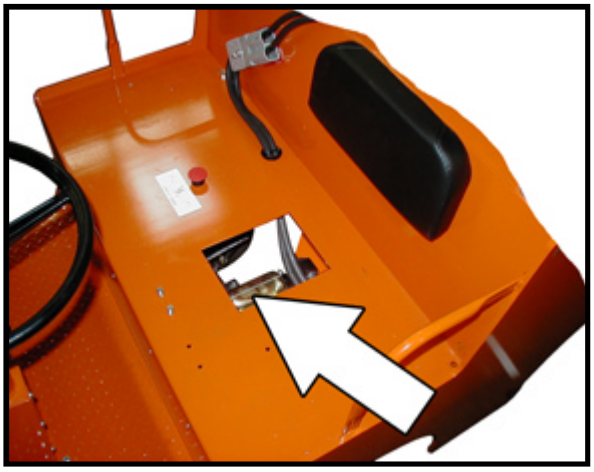
6. Thoroughly clean the area around the master cylinder cap.
7. Remove the master cylinder cap.
8. If the fluid in the master cylinder is contaminated then the entire brake system must be flushed. Refer to ***Bleed the Brakes*** for information regarding flushing the brake system.
9. Fill with brake 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

- **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

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.



Master Cylinder located under the driver seat

BLEED THE BRAKE SYSTEM

⚠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

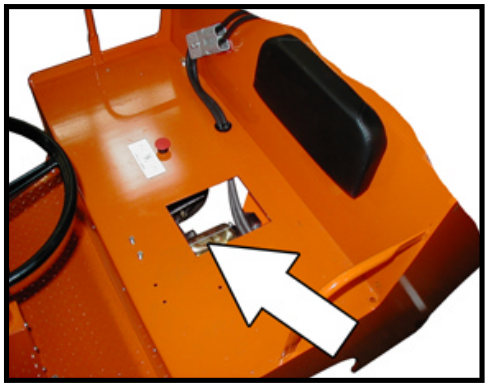
Get medical attention immediately.

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.**

6. Thoroughly clean the area around the master cylinder cap and remove the cap.



Master Cylinder located under the driver seat

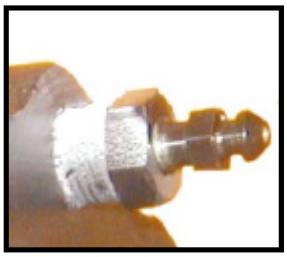
⚠WARNING

- **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

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.

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.



Typical bleeder valve

10. Pump the brake pedal a few times and then press and hold light pressure to the brake pedal.
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 and test drive the vehicle.

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.

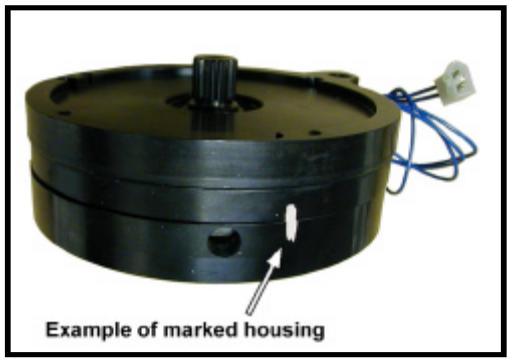
6. Raise the rear wheels off of the ground and support with jack stands.
7. If equipped with front brakes, raise the front wheels off of the ground and support with jack stands.
8. Release the park brake.
9. Remove both rear wheels and, if equipped with front brakes, the front wheels. Refer to ***Tires 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

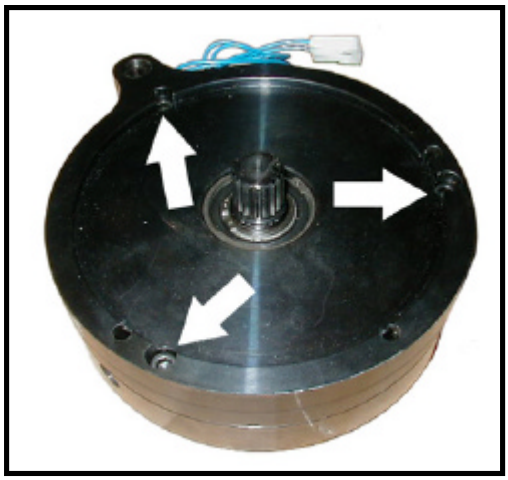
⚠WARNING

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.

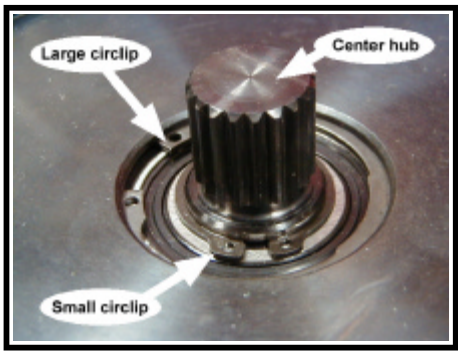
1. Remove the electric brake assembly from the drive. Refer to ***Motor Removal and Installation*** in the ***Transmission*** section for information regarding removing the brake.
2. Place the brake assembly on flat surface with the shaft pointing up.
3. Mark the orientation of the outer housing and magnet. This mark will be used to correctly align the housing during reassembly



4. Remove the three Allen head socket screws evenly so that the internal spring pressure is reduced gradually. Turn each screw no more than two turns at a time.



5. Remove the outer housing and friction plate.
6. Mark the orientation of the inner contact plate in relation to the magnet.
7. Remove the smaller bearing circlip.
8. Using a soft hammer, drive out the center hub and remove the inner contact plate and six springs.
9. If required, remove the larger bearing circlip and press out the bearing. If the bearing is removed it must be replaced.



10. Thoroughly clean all parts.
11. Inspect all parts for damage or wear.
12. Reassemble in reverse order.

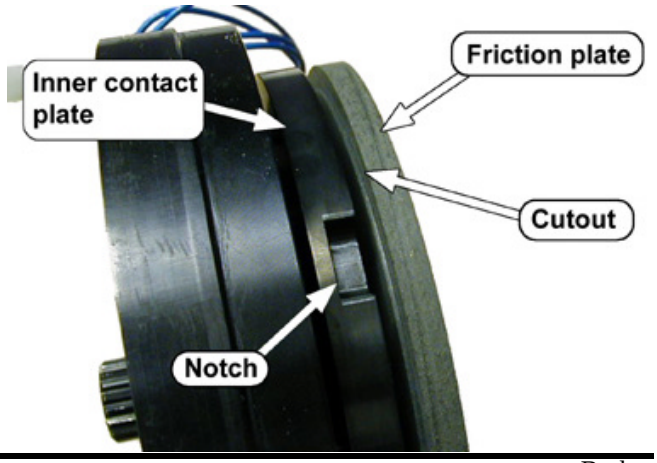
Reassembly Notes

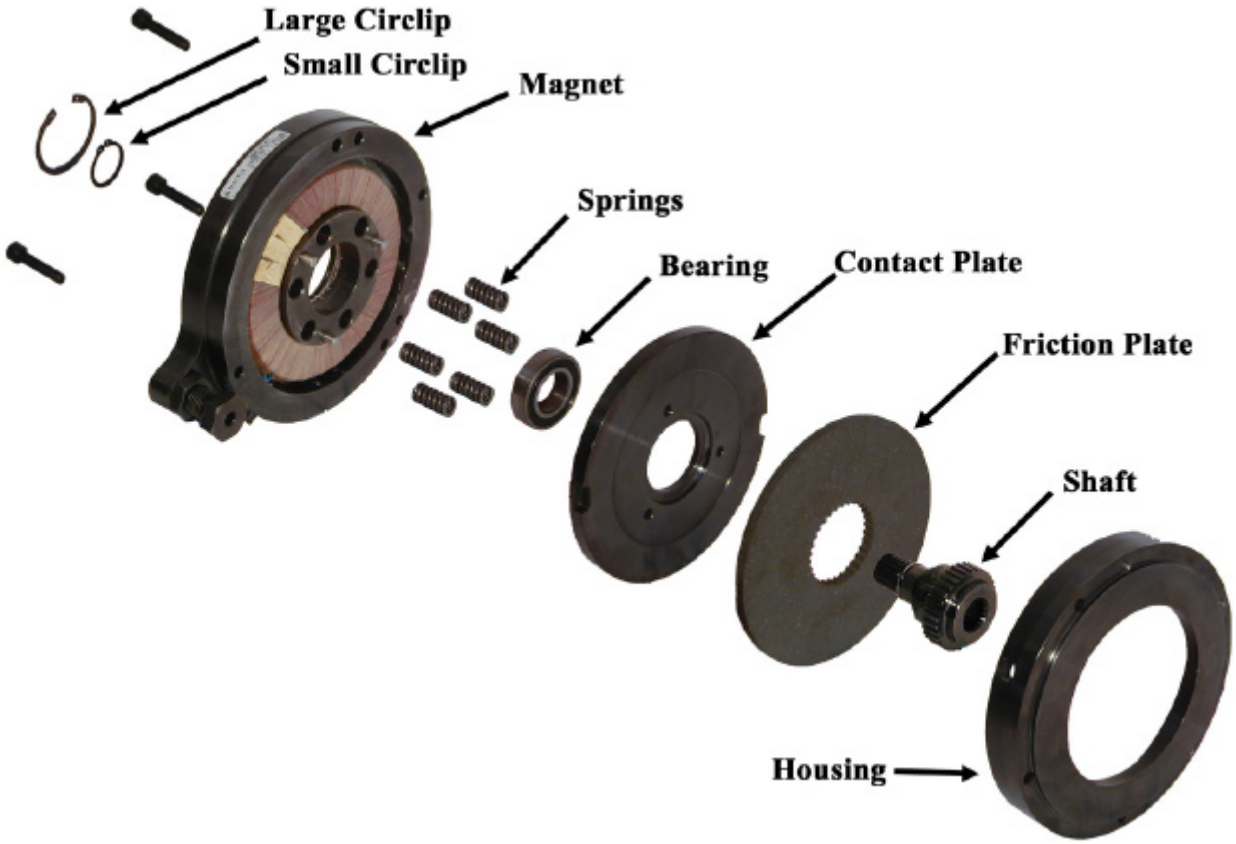
a. Orientate the inner contact plate lining up the marks made when removed and so that the notches face away from the magnet (see illustration below).

b. Orientate the friction plate so that the cutout faces the inner contact plate.

c. Orientate the outer housing lining up the marks made when it was removed.

d. Tighten the three Allen head socket screws in a cross pattern evenly so that the internal spring pressure is increased gradually. Turn each screw no more than two turns at a time. Final torque-10 ft-lbs.



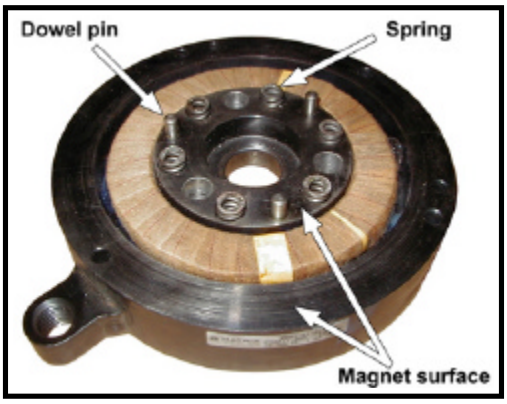


Electric motor brake exploded

Inspection:

Note: There are no repairable parts in this assembly. The parts must be replaced if any damage or wear is found.

1. Measure the free length of the five springs. Minimum length =0.713”
2. Inspect the splines on the hub and the friction plate for damage.
3. Inspect the inner contact plate and the outer housing where they come into contact with the friction plate for wear or damage.
4. Inspect the three dowel pins and their corresponding holes in the inner contact plate. The dowel pins should be straight and the holes should be round.
5. Inspect the bearing for excessive play or roughness when rotated.
6. Inspect the contact surfaces of the magnet and inner contact plate for damage and flatness.



REPLACE FRONT 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: 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.

6. Thoroughly clean the area around the master cylinder cap.
7. Remove fluid from the master cylinder until it is 1/2 full.

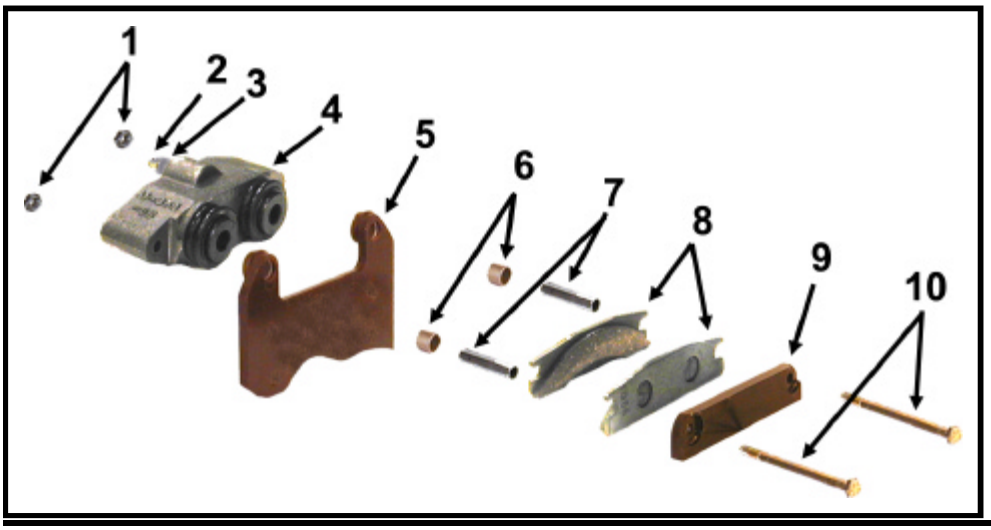
⚠WARNING

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.

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.

NOTE: Refer to the illustration below 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 SHOES

⚠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

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 of the vehicle and support with jack stands.
7. Remove the brake drum. Refer to ***Transmission*** section for information regarding removing the brake drum.
8. Disconnect the auto-adjust lever from the brake shoe (figure 1).
9. Remove the upper and lower return springs and brake shoe retaining springs (figure 2).

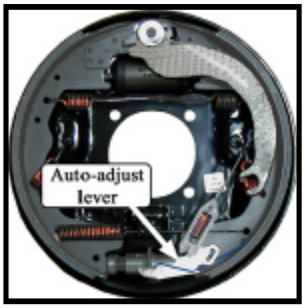


Figure 1

⚠WARNING

Do not allow grease to contact any of the braking surfaces. If any braking surface is contaminated with grease, it may cause the brakes to fail resulting in property damage and/or severe bodily injury.

10. Remove the brake shoes.
11. Remove and thoroughly clean the adjustor assembly.
12. Lightly lubricate the adjustor screw threads with high temperature grease (figure 3) and install the adjustor screw all of the way into the adjustor nut.

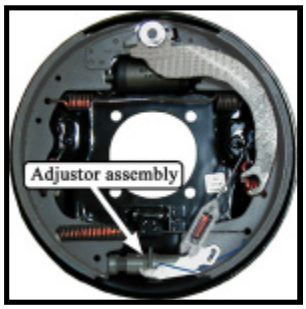


Figure 3

13. Install in reverse order.
    a. Before installing the brake drum, inspect the auto-adjust mechanism for proper operation.
    b. Inspect the brake drum. Refer to ***Inspect the Service Brake*** section for information regarding inspecting the brake drum.
14. Adjust the brakes. Refer to ***Rear Brake Drum Adjustments*** section for information regarding adjusting the brakes.
15. Lower the vehicle.
16. Reconnect the main positive and negative at the batteries.
17. Remove the blocks from behind the wheels and test drive the vehicle.

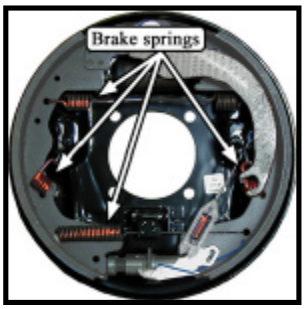


Figure 2

REPLACE THE WHEEL CYLINDER

Disc Brake Body Assembly (front)

⚠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. **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

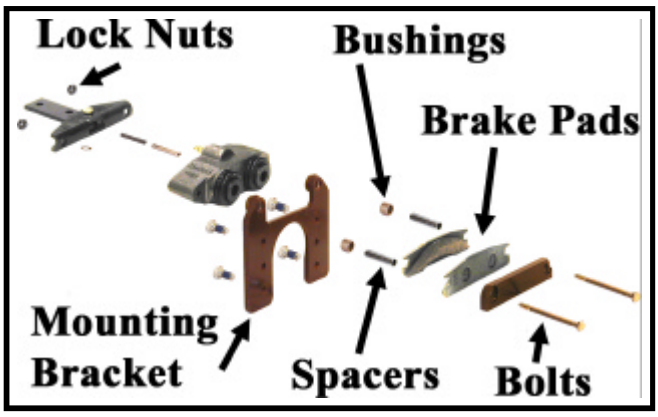
Always use a lifting strap, hoist, and jack stands, of adequate capacity to lift and support the vehicle. Failure to use lifting and support devices of rated load capacity may result in severe bodily injury.

6. Release the park brake.
7. Raise the wheel off of the ground and support with jack stands.

⚠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.

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.
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.



REPAIR THE BRAKE BODY

⚠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 contaminates 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. **Confirm the electric park brake is applied.**
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

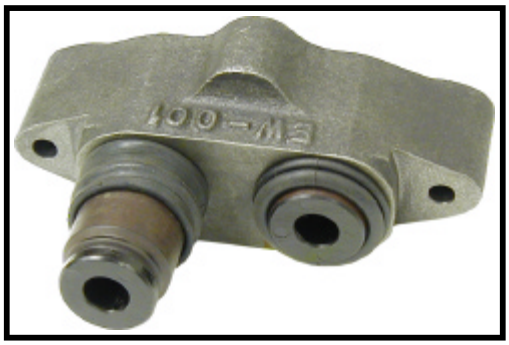
The pistons are very fragile. If the piston is damaged it must be replaced. Failure to replace a damaged piston could lead to brake failure and result in property damage and/or severe bodily injury.

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 contaminates from entering the brake body.

REPLACE THE MASTER CYLINDER

⚠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.

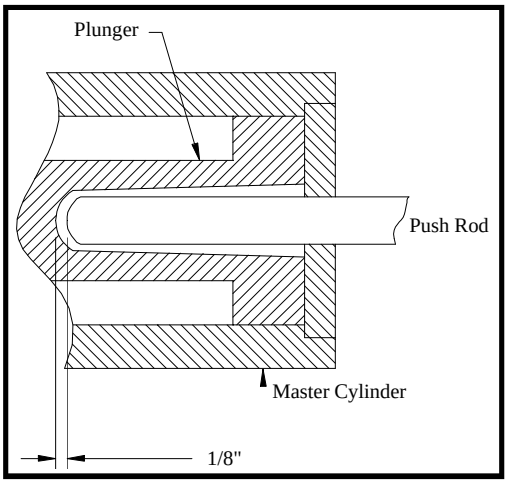
⚠WARNING

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. **Confirm the electric park brake is applied.**
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 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.



Cutaway of typical master cylinder showing the push rod clearance

12. Fill the master cylinder with brake fluid from a sealed container.
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. Lower the vehicle 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. 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.**

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.

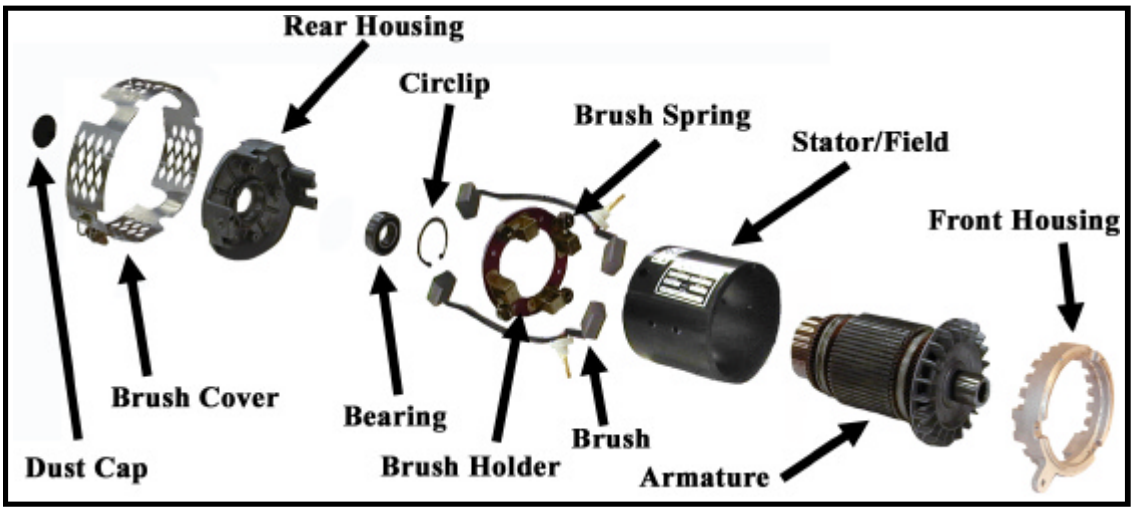
Reassemble in reverse order.

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

TAYLOR - DUNN

Motor Service

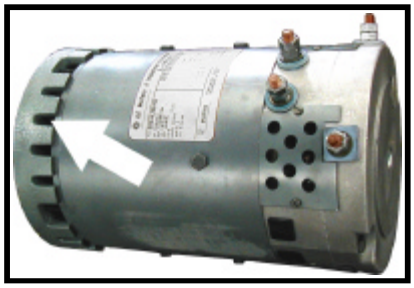
TABLE OF CONTENTS



Typical Motor

INSPECTING THE MOTOR BRUSHES

Motors with internal cooling fans



Typical motor with cooling fan indicated by the arrow

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.

MOTOR REMOVAL AND INSTALLATION

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

MOTOR INSPECTION

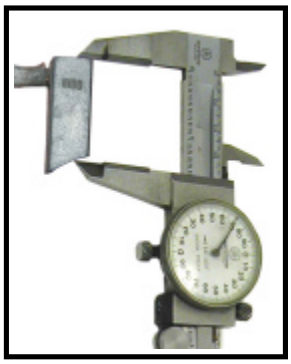
Disassembly

1. Remove the motor from the vehicle. See the ***Transmission*** section for information on removing the motor.
2. Remove the brush cover and pull the brushes out away from the commutator.
3. Remove the dust cap from the rear motor housing.
4. Place the motor in a press, and press the armature out of the rear bearing.

NOTE: Removing the armature will damage the motor bearing. The motor bearing should be replaced whenever the armature is removed.

5. Remove the housing screws from the rear motor housing and remove the housing from the motor.
6. Remove the nuts from the armature studs and remove the two brush assemblies.
7. Remove the bearing circlip and press the motor bearing out of the housing and discard.

Inspection



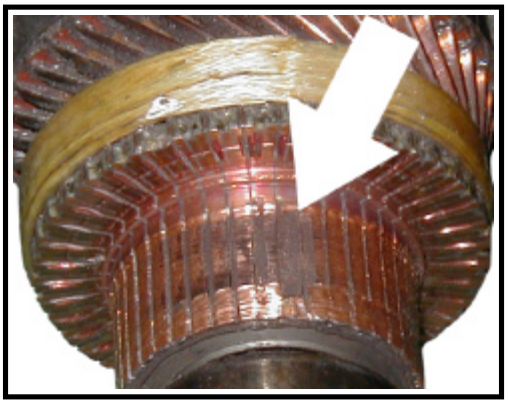
1. Measure the length of each motor brush.
   - If any one brush is less than or equal to the service limit specified in section ***Service Limits***, then all four brushes should be replaced. Refer to ***Replacing the Brushes*** section for information regarding replacing the motor brushes.
2. Measure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

4. Inspect the commutator for groves.
   - 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.
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.
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. Measure the armature and field resistance (refer to ***Service Limits*** table at end of this section). If the armature of field resistance is not within specification then the motor must be repaired or replaced.

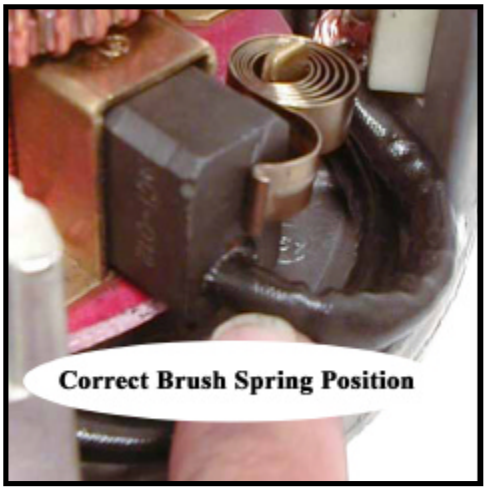


Typical burn mark on a shorted armature

Assembly

1. Press a new bearing into the motor housing and install the circlip.
2. Install the two brush assemblies so that the brushes are 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.

3. Install the rear motor housing to the stator housing.
4. Lightly grease the inside diameter of the armature bearing.
5. Carefully insert the armature through the stator housing and onto the motor bearing in the rear housing.
6. While supporting the inner race of the bearing, press the armature into the bearing.
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.
8. Install the brush cover.



REPLACING THE BRUSHES OR ARMATURE BEARING

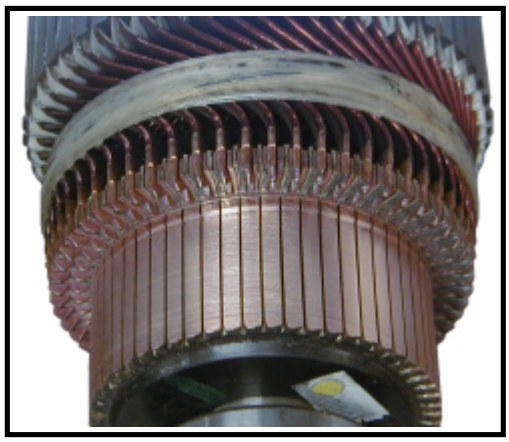
NOTE: It is recommended that all four brushes be replaced as a set.

NOTE: The motor must be disassembled to replace the brushes or the bearing. Refer to **Motor Inspection-Disassembly** *section for information on taking the motor apart.*

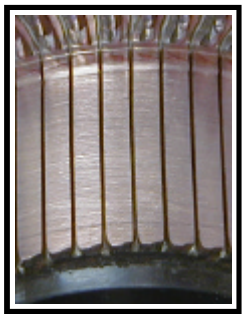
NOTE: The motor must be removed from the vehicle for this procedure. Refer to **Transmission Service** *section for information on removing the motor.*

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



Example of freshly cut commutator

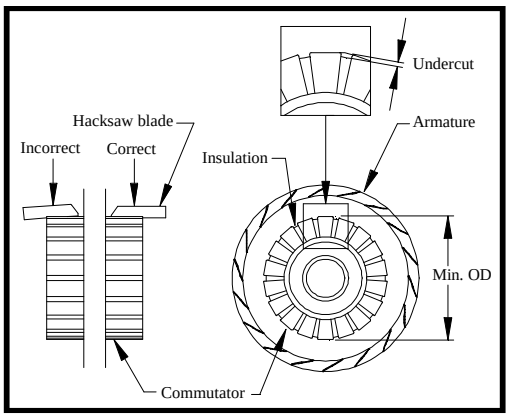


Properly undercut and cleaned commutator segments

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.

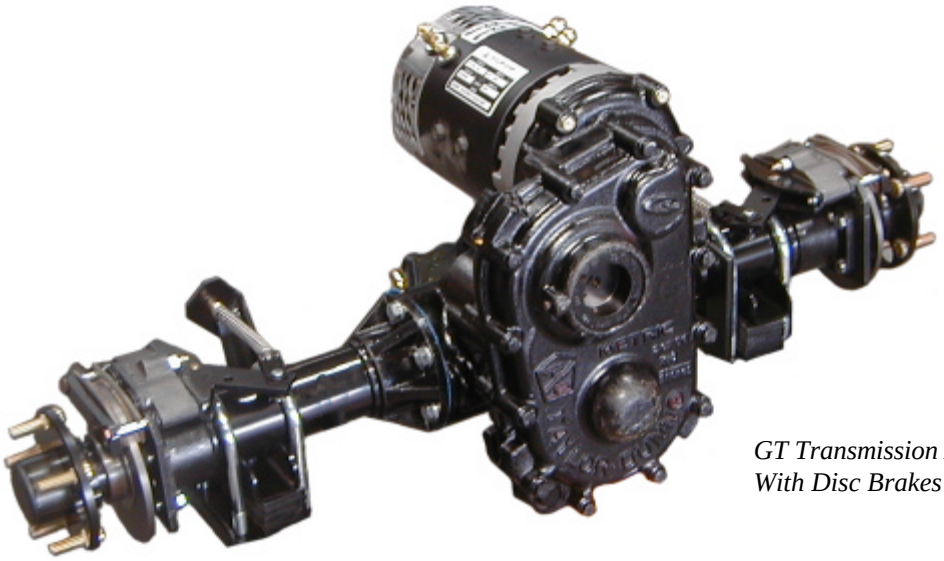


SERVICE LIMITS

Motor Specification Number	Undercut Depth		Commutator Diameter (min)		Brush Length (min)		Resistance (Ohms@75º F)	
	mm	inches	mm	inches	mm	inches	Armature	Field
70-054-40 (XP-1672 or DV1-4002)	0.635	0.025	69.85	2.75	15.87	0.625	.0116	1.20
70-054-41 (XP-1789 or DY2-4001)	0.635	0.025	69.85	2.75	15.87	0.625	0.011	0.43
70-057-40 (XP-1673 or DV1-4003)	0.635	0.025	69.85	2.75	15.87	0.625	0.008	0.58
70-052-40 (XP 1876 or DD3-4004)	0.635	0.025	69.85	2.75	15.87	0.625	0.011	0.73
70-072-41 (XP 1820A)	0.635	0.025	69.85	2.75	15.2	0.6	0.0052	0.79
70-061-40 (XP-1765A)	0.889	0.035	69.85	2.75	15.87	0.625	0.011	0.71
* - Not available at time of printing								

Transmission

TABLE OF CONTENTS



GT Transmission Assembly With Disc Brakes

CHECK OIL LEVEL

The oil flows freely between the main gear case (3rd member) and the primary reduction gear case. It is only necessary to check the oil level of the 3rd member.

Park the vehicle on a level surface.

⚠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 underneath the 3rd member.
7. Remove the fill/level plug.
8. The oil level should be very close to the bottom of the level plug opening.
   a. If the oil level is below the bottom of the opening, add oil as required until level with the bottom of the opening. Refer to the ***Lube Chart*** section for information regarding type of oil.
   b. If oil comes out of the opening, allow to drain until level with the bottom of the opening.
9. Replace the fill/level plug.
10. Reconnect the main positive and negative cables at the batteries.
11. Remove the blocks from the wheels.
12. Release the park brake and test drive the vehicle.

CHANGE OIL

⚠WARNING

1. Make sure the key-switch is in the "OFF" position, then remove the key.

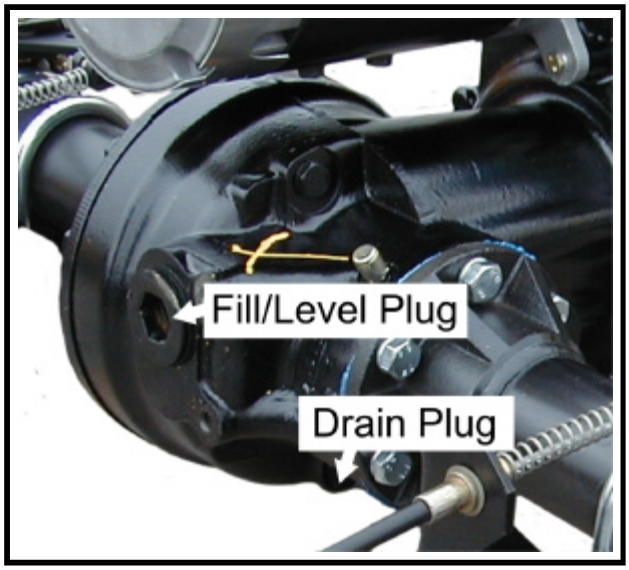
2. Place the forward-reverse switch in the center "OFF" position.

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 rear of the vehicle and support with jack stands.
7. Place a four quart drain pan under the drive assembly.
8. Remove the drain plugs from the differential case and gear case.
9. Once the oil has drained, replace the drain plugs and lower the vehicle to the ground.
10. Remove the fill/level plug and fill the differential up to the bottom of the level plug opening. Refer to the ***Lube Chart*** section for information regarding type of oil.
11. Replace the fill plug.
12. Reconnect the main positive and negative cables at the batteries.
13. Remove the blocks from the wheels.
14. Release the park brake and test drive the vehicle.



MOTOR REMOVAL AND INSTALLATION

Some vehicles are equipped with an automatic electric brake. The automatic electric brake is sandwiched between the drive motor and the gear case. The electric brake is retained by the drive motor mounting screws. Once the motor is removed the electric brake will no longer be retained by any hardware.

⚠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 wires from the motor.

NOTE: Label the motor wires with the number of the motor terminal before they are removed from the motor.

7. If equipped, remove the motor support bracket u-bolt (only used on larger motors).

Support bracket u-bolt

8. Remove the motor mounting bolts and slide the motor off of the input shaft.
9. Install the motor in reverse order.

NOTE: Apply a light coating of grease to the splines on the transmission input shaft only.

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.

REAR HUB OR ROTOR

NOTE: The torque specification for the axle hub bolt is 275 ft-lbs. An impact wrench will be required to remove the bolt.

NOTE: The axle hub bolt has a special thread locking compound applied to the threads. If this bolt is removed, it must be replaced.

⚠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 wheel off of the ground.
7. Remove the tire/wheel assembly, Refer to ***Tires and Wheels*** section for information regarding removing the tire/wheel assembly.
8. Remove the axle hub bolt and washer and remove the hub from the axle.

9. Remove the outer brake pad. Refer to section ***Brake Service*** for information regarding removing the brake pads.
10. Remove the rotor.

⚠WARNING

The axle retaining plate bolts have a pre-applied thread locking compound. They are intended for one time use only. If removed they must be replaced. Reusing the original bolts could cause loss of brakes resulting in severe bodily injury and/or property damage.

Refer to section Rear Brakes in Illustrated Parts for the part number of the bolt.

11. Install in reverse order.
    a. Lightly grease the axle splines.
    b. Refer to section ***Brake Service*** for information regarding installing the brake pads.
    c. Thoroughly clean the threads in the axle shaft.
    d. Using a new bolt, torque the axle hub bolt to 275 ft-lbs.
    e. Refer to ***Tires and Wheels*** section for information regarding installing the tire/wheel assembly.
12. Lower the wheel to the ground.

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 the vehicle.

REMOVING AND INSTALLING THE REAR AXLES AND BRAKE DRUM

The oil level in the housing is above the bottom of the axle flange. To minimize oil spills, raise the side of the vehicle high enough so that the oil level is below the bottom of the axle flange. If both axles are to be removed, you must drain all of the oil from the housing.

NOTE: This procedure does not require that the rear end or drive assembly be removed from the 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. If required, drain the oil from the 3rd member.

7. Raise the rear of the vehicle and support with jack stands.

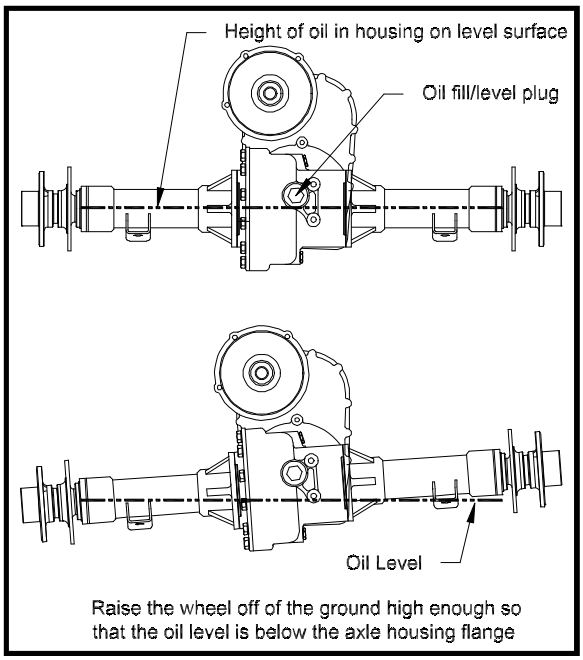
8. Release the park brake.

9. If removing the brake drum, remove the tire and wheel assembly. Refer to section ***Tires and Wheels*** for information regarding removing the tire and wheel assembly.

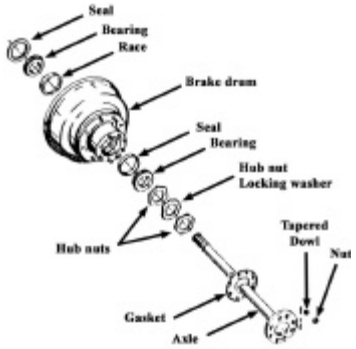
10. Remove the 8 axle retaining nuts and remove the axle.

NOTE: A small quantity of oil may be left in the hub that will come out when the axle is removed.

11. Straighten the locking tab on the locking washer under the brake drum/hub nut and remove the outer nut and washer. Discard the washer.



12. Remove inner nut and outer bearing, then remove the brake drum/hub from the axle tube.
13. Remove the gasket from the axle or hub and discard. Clean any remaining gasket material from the hub and axle flange.
14. Install the hub and axle in reverse order.
    a. Use a new axle gasket and hub nut locking washer.
    b. While rotating the brake drum, tighten the inner hub nut to approximatly 30 ft-lbs and then loosen until the brake drum spins with moderate resistance.
    c. Install a new locking washer and tighten the outer hub nut to 60-70 ft-lbs.
    d. Bend the locking washer up against one of the flats on the outer nut.
15. Lower the vehicle.
16. Set the park brake.
17. Reconnect the main positive and negative cables at the batteries.
18. Remove the blocks from behind the wheels.
19. Release the park brake and test drive the vehicle.



DISASSEMBLY AND REASSEMBLY OF THE PRIMARY REDUCTION GEAR 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.

⚠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. Place a drain pan under gear case that is capable holding four quarts of oil and drain the oil from the front gear case.
8. If required, remove the drive assembly from the vehicle
9. Remove the motor only if the entire drive is to be disassembled.

Oil Drain Plug

NOTE: Refer to **Motor Removal and Installation** *for information on removing the motor.*

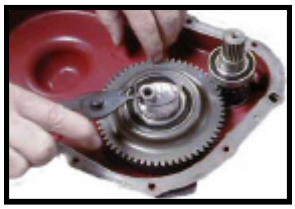
10. Remove the cover retaining bolts.

⚠CAUTION

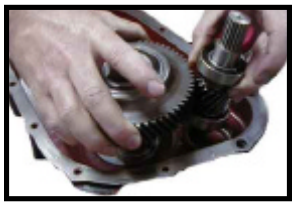
Be careful not to damage the sealing surfaces on the housings. Damage to the sealing surface may lead to an oil leak resulting in damage to the internal parts of the drive.

11. Remove the cover plate from the differential and let the remaining oil drain from the housing.

12. Remove the circlip from the idler gear.



13. Remove the input shaft/bearing assembly and idler gear/bearing assembly from the gear case cover at the same time.



14. Remove the pinion nut from the output gear and remove the output gear from the pinion shaft.

NOTE: If necessary, remove the seal from the input shaft bore at this time.

15. Mark the gear case position in relation to the 3rd member housing so that it will be reassembled in the same position.
16. Remove the six retaining bolts holding the gear case to the 3rd member housing.

NOTE: Make note of the angle of the gear case.

17. Remove the gear case housing from the 3rd member housing.
18. Inspect all parts for signs of wear or damage.

⚠CAUTION

Lubricate all parts with gear oil before installation. Failure to pre-lube the parts may result in premature failure.

19. Assemble the gear case in reverse order.

NOTE: Torque the drain plug to 21-25 foot-pounds.

NOTE: Torque the gear case to 3rd member retaining bolts to 18-20 foot-pounds.

NOTE: Torque the pinion nut to 154-169 foot-pounds.

NOTE: Apply gasket sealer (#94-430-05) to the front flange on the 3rd member and gear case cover.

NOTE: Pack the motor seal with non-acetic based grease.

20. Fill the differential with oil.

NOTE: Refer to **Changing the Differential Oil** *for information on filling the drive with oil.*

21. Lower the vehicle.
22. Reconnect the main positive and negative cables at the batteries.
23. Remove the blocks from behind the wheels.
24. Test drive the vehicle.

DISASSEMBLING THE 3RD MEMBER

⚠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.

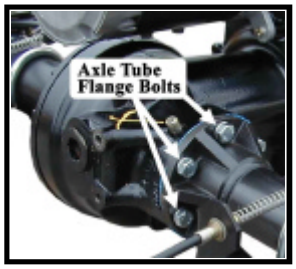
4. Place blocks under the front wheels to prevent vehicle movement.

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. Remove the complete drive from the vehicle.
8. Place a drain pan under the gear case that is capable of holding four quarts of oil and drain the oil from the front gear case and 3rd member.
9. Place the 3rd member on an appropriate stand.
10. Remove the axle shafts and tubes as an assembly from the 3rd member by removing the six axle tube flange bolts on each axle tube.



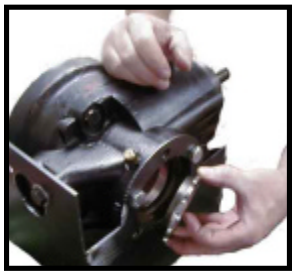
11. Remove the primary reduction gear case. Refer to ***Disassembly and reassembly of the Primary Reduction Gear Case*** for information on removing the gear case.
12. Remove the 12 side plate bolts, then remove the side plate.

13. Remove the carrier bearing adjusting nut roll pin and adjusting nut from the side plate.

14. Turn the side plate over and remove the carrier bearing race from the side plate.

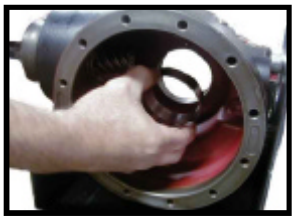
15. Remove the differential assembly from the 3rd member housing.

16. Remove the carrier bearing adjusting nut roll pin from the 3rd member housing, then remove the carrier adjusting nut.



Roll Pin

17. Remove the carrier bearing race from the 3rd member housing.



18. Remove the front bearing from the input shaft.

NOTE: The input shaft may have to be driven out to perform this procedure.

19. Remove the input shaft's shims and spacer.

20. Remove the pinion shaft from the 3rd member.

21. Remove the front and rear pinion bearing races.
22. Inspect all parts for signs of wear or damage.
23. Thoroughly clean all parts.

ASSEMBLING THE 3RD MEMBER

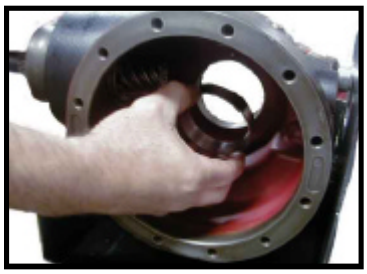
1. Temporarily install the pinion gear (hand tighten only).
2. Install the carrier bearing race ring nuts into the housing and cover.

Cover

Housing

3. Install the carrier bearing races into the housing and cover.

Cover



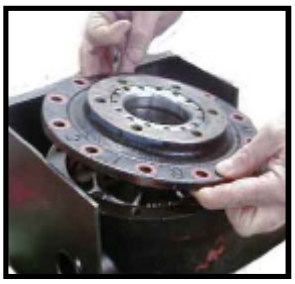
Housing

4. Place the differential assembly into the housing.
5. Tighten the housing carrier bearing race ring nut so that the ring gear is not in binding against the pinion gear.
6. Remove the differential assembly.

NOTE: Do not allow the ring nut to rotate.

7. Remove the pinion gear and then reinstall the differential assembly.
8. Install the cover onto the housing using 4-bolts in a cross pattern and torque to 45-50 ft-lbs.

9. Pre set the carrier bearing preload by tightening the housing carrier bearing race ring nut until it requires 1.5 to 3.3 ft-lbs to rotate the differential assembly.



NOTE: Rotate the carrier assembly whenever adjusting the ring nuts.

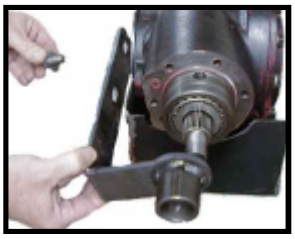
10. Mark the position of each carrier bearing ring nut in relation to the drive housing and cover and then remove the differential assembly, do not allow the ring nuts to rotate.

11. Install the pinion gear. Re-shim if required.

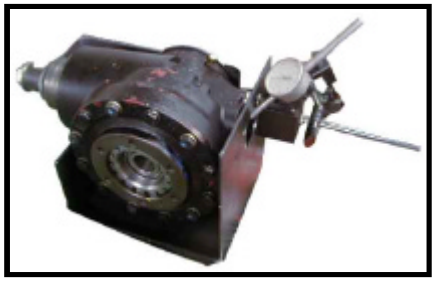
⚠CAUTION

If the ring and pinion gears or bearings are replaced then the pinion gear must be re-shimmed. Improper pinion gear shims will result in drive noise and premature failure. Refer to Pinion Gear Shimming Instructions.

12. Install the pinion gear holding tool (96-500-42) and tighten the pinion nut enough to keep the pinion gear from rotating.



13. Install the differential assembly.
14. Install the cover and all of the cover bolts. Torque to 45-50 ft-lbs.
15. Check the gear lash between the ring and pinion gears. The gear lash should be .005 to .007 inches.



16. Adjust the gear lash if needed by tightening or loosening the carrier bearing race ring nuts. The two ring nuts must be turned equally in opposite directions.

NOTE: To move the ring gear closer to the pinion: Loosen the housing carrier bearing race ring nuts and tighten the cover carrier bearing race ring nut equally.

NOTE: To move the ring gear away from the pinion: Loosen the cover carrier bearing race ring nut and tighten the housing carrier race ring nut equally.

⚠CAUTION

The two ring nuts must be turned the same amount in opposite directions. This allows the carrier assembly to be positioned with the proper gear lash without upsetting the bearing preload. If the ring nuts are not turned the same amount, then the bearing preload will no longer be correct and will result in drive noise and premature failure.

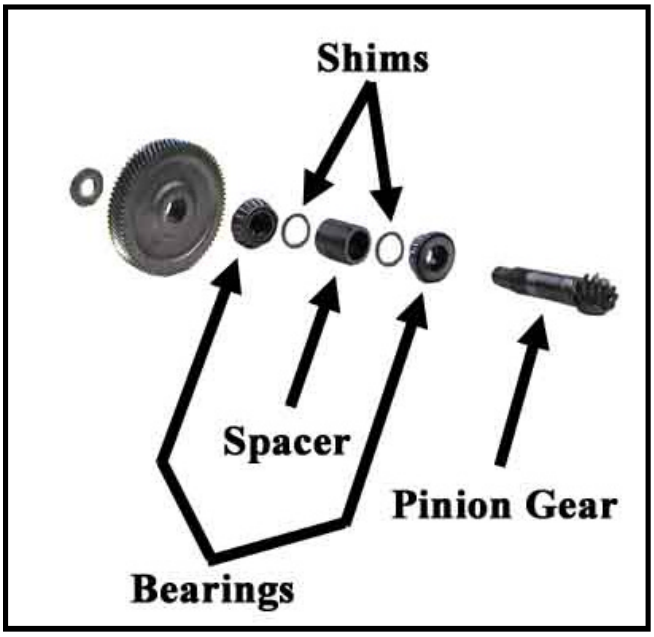
17. Install the locking roll pins into the housing and cover to lock the ring nuts in place.
18. Remove the pinion gear holding tool.
19. Install the primary reduction gear case, axles and housings, motor, and install the complete drive onto the vehicle.
20. Fill the drive with oil. Refer to the ***Lube Chart*** section for information regarding type of oil. Refer to ***Change Oil*** section for information regarding the proper oil level..
21. Lower the vehicle.
22. Reconnect the main positive and negative cables at the batteries.
23. Remove the blocks from behind the wheels.
24. Test drive the vehicle.

Pinion Bearing Preload

NOTE: The pinion gear depth must be set before the preload. Refer to **Setting the Pinion Gear Depth**.

1. Install the pinion gear, spacer, and shims into the housing.
2. Install the outer pinion bearing.
3. Install the main gear onto the pinion shaft and torque the pinion nut to 154-169 ft lbs.
4. Measure the torque required to rotate the pinion shaft in the housing.
5. The torque required to rotate the pinion shaft should be between 1.1 and 2.9 ft-lbs. If the torque is not within specifications then add or subtract from the total shim thickness and repeat this procedure until the proper preload is obtained.

NOTE: Add shims to decrease torque.



PINION GEAR SHIMMING INSTRUCTIONS

NOTE: This procedure is required only when replacing the front or rear pinion bearings and races or the ring and pinion gears.

NOTE: To perform this procedure, all parts must be clean and the bearings lightly lubricated.

Refer to the illustrations on the following pages.

Setting the Pinion Gear Depth

This formula is used to calculate the amount of shims that are required:

C - B - A + (DV) = Pinion Shim (mm) where,

DV = The number on the face of the pinion gear (Figure 1).

A = The distance in millimeters from the face of the pinion gear to the top of the inner pinion bearing race (Figuer 2).

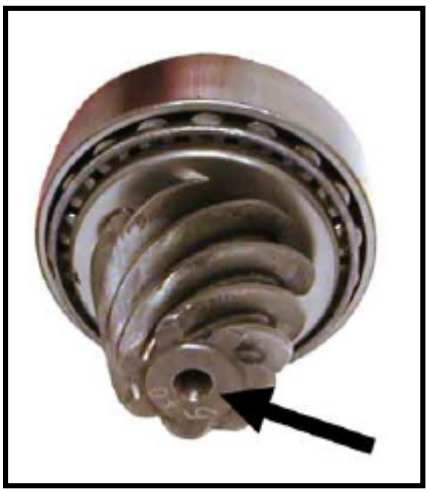
B = 54.

C = The number on the edge of the differential side plate closest to the input shaft (Figure 3).

D = The number on the edge of the differential side plate farthest from the input shaft (Figure 3).

E = The distance in millimeters from the rear of the drive housing to the face of the pinion gear (Figure 4).

Once a shim has been selected and the pinion gear is installed, confirm that: **E - D = B + (DV)**



Figreu 1a

Figreu 1b

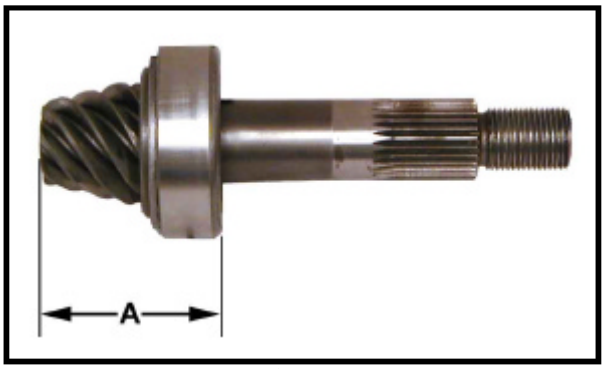


Figure 2

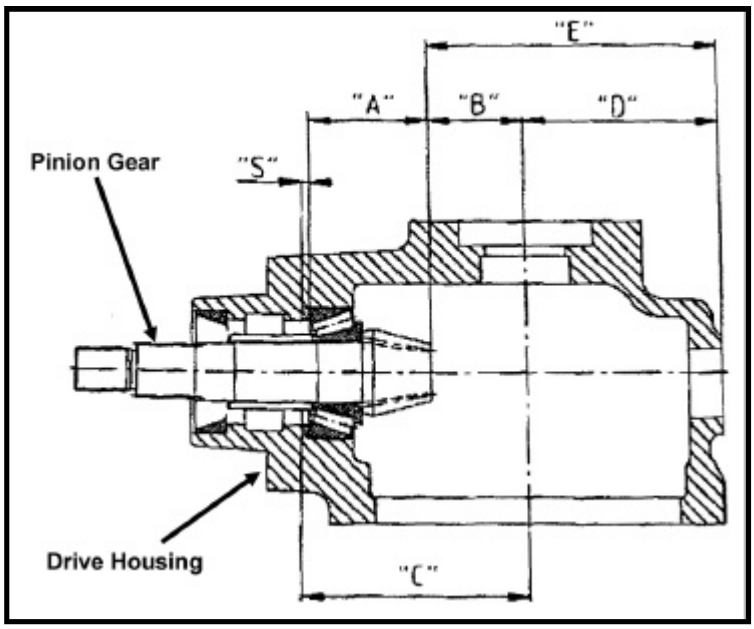


Figure 4

NOTE: Values shown are for reference only

Figure 3

Suspension

TABLE OF CONTENTS

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

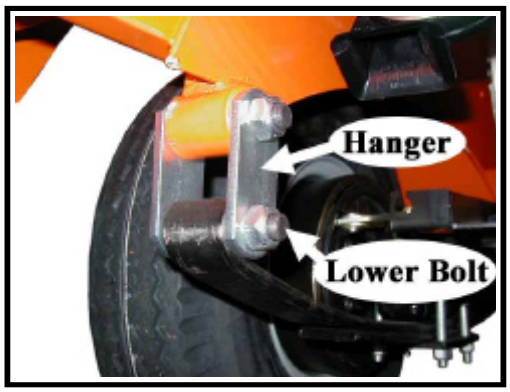
Always use a lifting strap, hoist, and jack stands, of adequate capacity to lift and support the vehicle. Failure to use lifting and support devices of rated load capacity may result in severe bodily injury.

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.
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. 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.

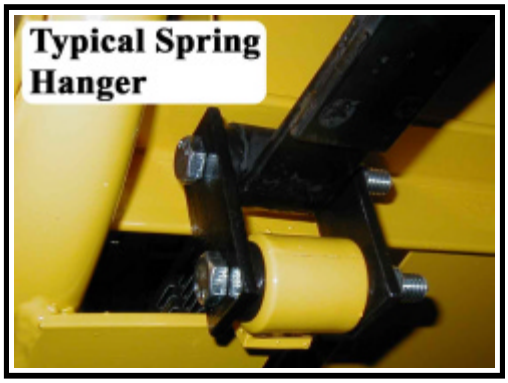
5. Disconnect the main positive and negative cables at the batteries.

⚠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.

Tires and Wheels

TABLE OF CONTENTS

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.

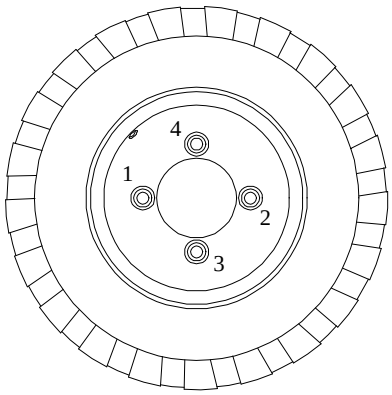
4. Place blocks under the front wheels to prevent vehicle movement.

5. Disconnect the main positive and negative cables at the batteries.

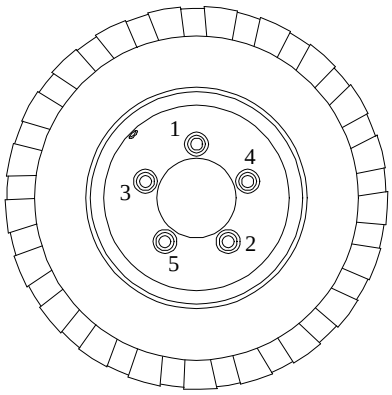
6. Raise the wheel to be replaced off of the ground and support with jack stands.
7. Remove the wheel nuts and remove the wheel.
8. Install in reverse order.
9. Following the pattern shown below, cross tighten the wheel nuts in two stages as follows:

   1st stage to approximately 20 ft-lbs.

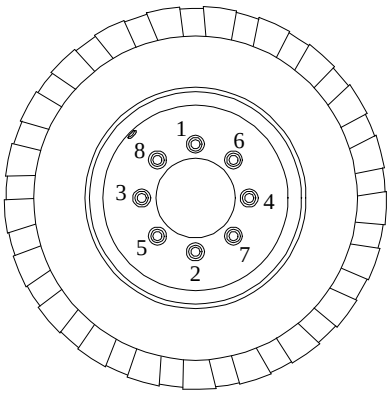
   2nd stage to 80-90 ft-lbs.
10. Reconnect the main positive and negative cables at the batteries.
11. Lower the wheel to the ground.
12. Remove the blocks from behind the wheels.
13. Release the parking brake and test drive the vehicle.



4-Bolt Pattern



5-Bolt Pattern



8-Bolt Pattern

⚠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.

Battery Service

TABLE OF CONTENTS

⚠ 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.**
- **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.**
- **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.**

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.**

· **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.**

· **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.

CHARGING

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

⚠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 applied.**
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 battery indicates battery acid. Using a nonmetallic brush with flexible bristles, wash the battery 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 battery, 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.**
- **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.**
- **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.

Specific Gravity

⚠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 applied.**
4. **Place blocks under the front wheels to prevent vehicle movement.**
5. **Disconnect the main positive and negative cables at the batteries.**

NOTE: The battery 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 cell will read 1100. Ideally, all cells in a battery will have the same reading. Any cells in a battery that vary by more than 30-points may be an indication of a bad cell.

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

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

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 battery is no longer accepting a charge and should be replaced.

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

Typical Hydrometer Float

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: Individual cells in some industrial batteries can be replaced. Contact the battery manufacturer for more information.

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

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.**

· **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.**

· **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

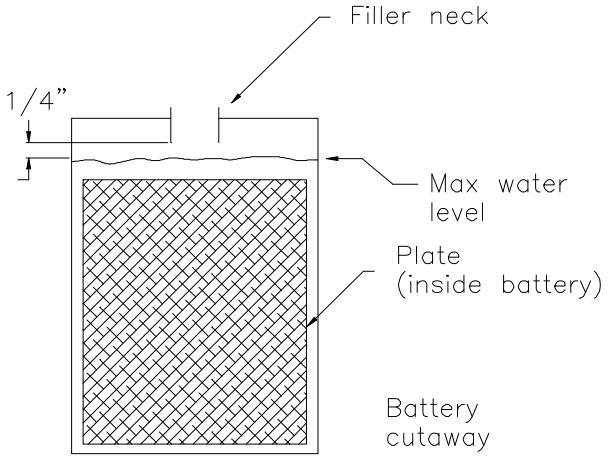
Do not overfill the batteries. Over filling the batteries may cause the batteries to boil over and result in severe bodily injury or property damage.

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 battery 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.

⚠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 applied.**
4. **Place blocks under the front wheels to prevent vehicle movement.**
5. **Disconnect the main positive and negative cables at the batteries.**

6. Clean the battery. Refer to ***Cleaning*** section for information on cleaning the battery.
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 battery, remove the blocks from the wheels and test drive.



REMOVING

⚠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.**

· **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.**

· **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

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 applied.**
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 battery and battery compartment. Refer to ***Cleaning*** in this section for information regarding cleaning the batteries.
7. Using a hoist or forklift equipped with a proper battery lifting device (see next page), slowly raise the battery out of the vehicle.
8. Inspect the battery compartment for signs of corrosion.

⚠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.

9. If minimal signs of corrosion are seen, then the damaged paint should be stripped off and the entire battery compartment cleaned and repainted.
10. 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.
11. Inspect the battery cables and terminals. If any of the cables or terminals show signs of corrosion, then they must be repaired or replaced.
12. Install the battery in reverse order.
13. Remove the blocks from the wheels and test drive.

Typical battery lifting beam

Typical forklift attachment to use with the lifting beam

STORAGE AND RETURNING TO SERVICE

⚠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.

⚠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

- **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.**
- **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.**
- **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.**

Storage

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

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

Store the vehicle or battery (if removed) in a cool, dry, well ventilated area.

If storing for more than one month, the battery should be charged per the table ar right:

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. **Confirm the electric park brake is applied.**
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 battery and battery compartment. Refer to ***Cleaning*** in this section for information regarding cleaning the battery.
7. Check the electrolyte level and charge the battery. Refer to ***Watering*** in this section for information regarding checking the electrolyte level.
8. Test the battery. Refer to ***Testing*** section for information on testing the battery.
9. The battery is now ready to be put back into service.

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

Sevcon Control System Troubleshooting

TABLE OF CONTENTS

⚠CAUTION

Turn the Key switch OFF <u>BEFORE</u> 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

This troubleshooting guide is written in sequential order. All tests must be performed in the order that they are written. Starting in the middle or skipping sections when not instructed to do so may lead to invalid test results.

Rev K

Test Equipment Required:

- Digital multimeter (DMM) with diode test function, FLUKE 79 model shown.
- Test harness, Taylor-Dunn #75-089-00

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 you are not familiar with these types of tests then refer testing to a qualified technician.
- These tests are not intended to locate a problem on an incorrectly wired vehicle.
- Make sure the batteries are in good condition and fully charged before performing any tests.
- If the vehicle exhibits intermittent problems, it must be in the failed mode for troubleshooting. If it is running normally when the testing is done then the problem will not be identified.
- Some tests refer to a High/Low switch. The High/Low switch is optional and the vehicle may not be equipped with this option. If the vehicle is without this option, there is a jumper bypass installed in place of the switch in the dash.
- All voltage tests are done referenced to battery negative, unless otherwise specified.
- At the start of each test sequence you will be instructed on how to place the control switches. While testing, do not change the position of any switches unless instructed to do so.

Definitions:

- Battery volts = full voltage available at the batteries at the time of test.
- High: Greater than +4.5 volts
- Low: Less than +1.8 volts

Terminology used:

- The “HOT” side of a switch is the terminal that the power is connected to.
- The “COLD” side of a switch is the terminal that the power is switched to.
- FS-1 = Micro-switch in the accelerator module.

DURING ALL TESTS

- After any repairs are made, completely retest vehicle before lowering the drive wheels to the ground.

⚠CAUTION

Turn the Key switch OFF <u>BEFORE</u> 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).

⚠WARNING

Turn the Key switch OFF then 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.

⚠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 property damage and/or serious bodily injury.

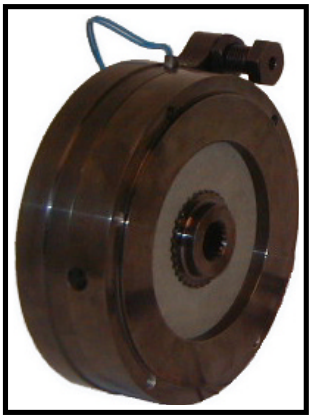
START TROUBLESHOOTING HERE

⚠CAUTION

This troubleshooting guide is written in sequential order. All tests must be performed in the order that they are written. Starting in the middle or skipping sections when not instructed to do so may lead to invalid test results.

⚠CAUTION

If your vehicles is equipped with an electric motor brake, the motor brake system must be checked to be sure it is working properly before continuing with this troubleshooting. Operating the speed control when the motor brake has not disengaged may result in damage to the motor or speed control system. Refer to Test 9: Electric Motor Brake for information regarding testing the motor brake system.



Electric motor brake

The electric motor brake is mounted between the drive motor and the primary reduction gear case. An illustration of the motor brake is shown to the left.

If the Battery Status Indicator does not show a charged battery, check the following:

- The batteries
- The wiring from the battery status indicator to the batteries for open circuits
- The battery status indicator
- The positive and negative circuit breaker
- The main circuit breaker for open circuits

Do not continue unless the indicator shows a charged battery.

If the vehicle runs in one direction only, then skip ahead to test #3.

If the vehicle runs slow in forward, but otherwise runs normal, then skip ahead to test #1.3.

Test 1. CHECKING THE CONTROL LOGIC INPUTS

Close the seat switch. Place the high/low switch in the HIGH position.

Connect a voltmeter across the ISO solenoid coil terminals and carefully monitor the voltage as the key switch is turned on.

Turn the key switch ON and wait 1-second until the Isolator contactor closes.

Perform the following tests:

TEST 1.1

The coil voltage should start at approximately 24 volts when the key is turned ON, then drop to approximately 15 volts after about 0.5 seconds.

If the test is good, then skip ahead to test # 1.2.
If the voltage starts high, drops to 15 volts, and then drops to 0 volts, then it indicates an open circuit to the main battery positive. Check the continuity of the ISO solenoid contacts, the main circuit breaker, and the wiring to the main battery positive post.
If the voltage is starts at 24 volts but the solenoid does not pick up, then skip ahead to section #5.
If the voltage does not start at 24 volts, then go to section #4.

TEST 1.2:

Test the voltage from B+ to B- on the Controller.

If the voltage equals battery volts, then go to test #1.3.
If the voltage does not equal battery volts, then:

- Check the main positive wire to the circuit breaker for open circuits.
- Check the wire from the circuit breaker to battery positive.
- Check the wire from the contactor to B+ on the controller for open circuits.
- Check the wire from B- to battery negative on the controller for open circuits.

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.

⚠CAUTION

This troubleshooting guide is written in sequential order. All tests must be performed in the order that they are written. Starting in the middle or skipping sections when not instructed to do so may lead to invalid test results.

⚠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 injury or property damage.

TEST 1.3:

Test the voltage at pin #6 on the 12-pin logic card connector.

If the voltage is low, then skip ahead to test #1.4. If the voltage is high, then check the wire to the High/Low switch and the High/Low switch for open circuits.

NOTE: The High/Low switch is optional and the vehicle may not have this option. If the vehicle is not equipped with option then there is a jumper bypass installed in place of the switch in the dash. Check the jumper to be sure it is still connected.

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.

TEST 1.4:

Test the voltage at pin #5 on the 12-pin logic card connector.

If the voltage is low, then skip ahead to test #1.5. If the voltage is high, then:

- Check the seat switch for open contacts.
- Check that the seat switch is engaging the seat correctly.
- Check the wire from the pin 5 to the seat switch for open circuits.
- Check the wire from the seat switch to B- for open circuits.

If all of the above is in working order, then the logic card may have 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. Reaching this point indicates a failure in the Sevcon power unit or an error was made during testing. Confirm all previous tests were performed correctly before replacing the Sevcon power unit.

TEST 1.5:

Test the voltage at pin #4 on the 12-pin logic card connector.

If the voltage is high, then skip ahead to test #1.6.
If the voltage is low, then skip ahead to Test #6.

TEST 1.6:

Test the voltage at pin #7 on the 12-pin logic card connector.

NOTE: Pin #7 is for a parking brake interlock switch. This switch is not available for all vehicles and may not be used.

If the voltage is high, then skip ahead to test #1.7.
If the voltage is low, then:

- Check the park brake switch for shorted contacts.
- Check the wire to the park brake switch for short circuits to B-.

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.

⚠CAUTION

This troubleshooting guide is written in sequential order. All tests must be performed in the order that they are written. Starting in the middle or skipping sections when not instructed to do so may lead to invalid test results.

⚠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 injury or property damage.

TEST 1.7:

Depress the accelerator pedal to engage FS-1 only (creep speed).

Perform the following tests:

Test the voltage at pin #10 on the 12-pin logic card connector.

If the voltage is below 0.3 volts, then skip ahead to test #1.8.
If the voltage is above 0.3 volts, then skip ahead to Test #6.

TEST 1.8:

Test the voltage at pin #4 on the 12-pin logic card connector.

If the voltage is low, then skip ahead to test #1.9.
If the voltage is high, then skip ahead to Test #6.

TEST 1.9:

Depress the accelerator pedal fully.

Test the voltage at pin #10 on the 12-pin logic card connector.

If the voltage is between 4.8 and 5.1 volts, then skip ahead to Test #2.
If the voltage is *not* between 4.8 and 5.1 volts, then skip ahead to Test #6.

Test 2. TESTING 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.**

⚠WARNING

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

TEST 2.1:

Check the motor field resistance from the motor F1 to the motor F2 terminals.

If the resistance is within the values given in the motor specification table, then skip ahead to test #2.2. (The motor specification table can be found in the "Motor Service" section).
If the resistance is not within specification, then repair or replace the motor.

Test continuity from F1 to the frame of the motor.

Any reading other than an open circuit indicates a short in the motor.
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.

TEST 2.2:

Check the resistance from the motor A1 to the A2 terminals.

If the resistance is less than 1 Ohm, then go to test #2.3.
If the resistance is greater than 1 Ohm , then the armature circuit is out of specification.
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.

TEST 2.3:

Test the continuity from the motor A1 terminal to the frame on the motor and from F1 to A1 for open circuits.

Any reading other than an open circuit indicate a short in the motor. If there is a short in the motor, stop here and repair or replace the motor.

TEST 2.4:

Reaching this point indicates an open circuit in the motor wiring. Check the continuity of all wires from the controller to the motor.

Repair any open wires then test drive the vehicle.

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.

⚠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 injury or property damage.

⚠CAUTION

This troubleshooting guide is written in sequential order. All tests must be performed in the order that they are written. Starting in the middle or skipping sections when not instructed to do so may lead to invalid test results.

Test 3. THE VEHICLE RUNS IN ONE DIRECTION ONLY

Test 3.1:

Close the seat switch, turn the key switch ON and wait 1-second until the Isolator contactor closes.

If the vehicle runs in reverse only then skip ahead to test #3.3.

Place the forward and reverse switch in the FORWARD direction.

Test the voltage at pin #2 on the 12 pin logic card connector.

If the voltage is low, then skip ahead to test #3.2.
If the voltage is high, then skip ahead to Test #7.

TEST 3.2:

Test the voltage at pin #3 on the 12 pin logic card connector.

If the voltage is high, then skip ahead to test #3.3.
If the voltage is low, then skip ahead to Test #7.

⚠CAUTION

This troubleshooting guide is written in sequential order. All tests must be performed in the order that they are written. Starting in the middle or skipping sections when not instructed to do so may lead to invalid test results.

TEST 3.3:

Place the forward and reverse switch in the REVERSE direction.

Test the voltage at pin #3 on the 12 pin logic card connector.

If the voltage is low, then skip ahead to test #3.4.
If the voltage is high, then skip ahead to Test #7.

TEST 3.4:

Test the voltage at pin #2 on the 12 pin logic card connector.

If the voltage is high, then refer to note at bottom of page.
If the voltage is low, then skip ahead to Test #7.

TEST 3.5

Disconnect the batteries and remove wires from the B-, F1, and F2 terminals on the controller.

Using the diode test function on your meter, connect the positive lead to the B- terminal on the controller. Connect the negative lead to the F1 terminal on the controller.

The test should show the presence of a diode (approx 0.5v).
If the test is good, then skip ahead to test #3.6.
If the test is open or shorted then one or both directional FET's are shorted and the controller must be replaced.

TEST 3.6

Disconnect the batteries and remove wires from the B-, F1, and F2 terminals on the controller.

Using the diode test function on your meter, connect the positive lead to the B- terminal on the controller.
Connect the negative lead to the F2 terminal on the controller.

The test should show the presence of a diode (approx 0.5v). If the test is open or shorted then one or both directional FET's are shorted and the controller must be replaced.

⚠CAUTION

This troubleshooting guide is written in sequential order. All tests must be performed in the order that they are written. Starting in the middle or skipping sections when not instructed to do so may lead to invalid test results.

STOP

Stop, do not continue. Reaching this point indicates an unanticipated failure or an error was made during testing. Confirm all previous tests were performed correctly and contact your Taylor-Dunn® represetative for assistatnce.

⚠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 injury or property damage.

Test 4. KEY FAULT

TEST 4.1:

Turn the key switch ON and place the forward and reverse switch in the center OFF position

Perform the following tests:

Test the voltage at pin #1 on the 12 pin logic card connector.

If the voltage equals battery volts, then skip ahead to Test #5.

Test the voltage on both terminals of the battery voltage positive circuit breaker.

If the voltage on both terminals equals battery volts, then skip ahead to test #4.2.
If the voltage on both terminals does not equal battery volts, then check the circuit breaker and wiring to the main circuit breaker and to the batteries for open circuits.

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.

Circuit Breaker

TEST 4.2:

Test the voltage at the hot terminal (red wire) on the key switch.

If the voltage equals battery volts, then skip ahead to test #4.3.
If the voltage does not equal battery volts, then check the wiring from the key switch to the battery voltage positive 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.

⚠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 injury or property damage.

TEST 4.3:

Test the voltage at the cold side (violet/black wire) of the key switch.

If the voltage equals battery volts, then skip ahead to test #4.4.
If the voltage does not equal battery volts, then replace the key switch.

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.

TEST 4.4:

Check the wire from the cold side of the key switch to pin #1 on the 12 pin logic card connector for open circuits.

NOTE: Your vehicle may be equipped with a charger interlock relay. The charger interlock relay disables the control system when the charger is connected to its power source. The interlock relay contacts are in series with the wire from the cold side of the key switch to pin #1 on the 12 pin logic card connector. The relay is located in the charger cabinet.

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. Reaching this point indicates a failure in the Sevcon power unit or an error was made during testing. Confirm all previous tests were performed correctly before replacing the Sevcon power unit.

⚠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 injury or property damage.

⚠CAUTION

This troubleshooting guide is written in sequential order. All tests must be performed in the order that they are written. Starting in the middle or skipping sections when not instructed to do so may lead to invalid test results.

Test 5. CONTACTOR COIL FAULT

Disconnect the 12-pin logic card connector from the Sevcon power unit.

Turn the key switch ON and perform the following tests:

TEST 5.1:

Check the voltage on the positive coil terminal of the ISO solenoid (violet wire).

If the voltage is within approximately 1-volt of the battery voltage, then skip ahead to test #5.2.
If the voltage is not within approximately 1-volt of the battery voltage, then check the diode in the positive wire to the ISO solenoid.

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.

TEST 5.2:

Check the voltage on the negative coil terminal of the contactor coil.

If the voltage is not within 1-volt of battery voltage, then the contactor is bad and must be replaced.

NOTE: An open contactor coil should be accompanied by a 4-flash code from the logic LED.

If the voltage is within 1-volt, then one of the four following faults may have occurred:

<u>Broken Wire</u>: Check the wire from pin #8 in the 12-pin logic card connector to the contactor coil negative terminal for open circuits.

<u>Welded Solenoid Contacts</u>: Test the solenoid for welded contact tips. There are two methods for checking the contacts:

1. **Disconnect the batteries and test the continuity across the contacts. If there is continuity then the contact tips are welded.**
2. **With the key switch OFF, check the voltage at the B+ terminal on the Sevcon control (see illustration on following page). If the voltage at the B+ terminal is at full battery voltage then the contact tips are welded.**

NOTE: Welded tips should be accompanied by a 4-flash code from the logic LED.

B+ Terminal on the Sevcon controller

<u>Shorted Solenoid Coil</u>: Disconnect the logic card connector and measure the resistance across the solenoid coil. Depending on the solenoid or contactor you vehicle is equipped with, the resistance should be 25 ohms or higher (nominal). A reading less than 25 ohms may indicate a shorted coil.
<u>The control logic may have failed</u>.

STOP

Stop, do not continue. Reaching this point indicates a failure in the Sevcon power unit or an error was made during testing. Confirm all previous tests were performed correctly before replacing the Sevcon power unit.

⚠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 injury or property damage.

⚠CAUTION

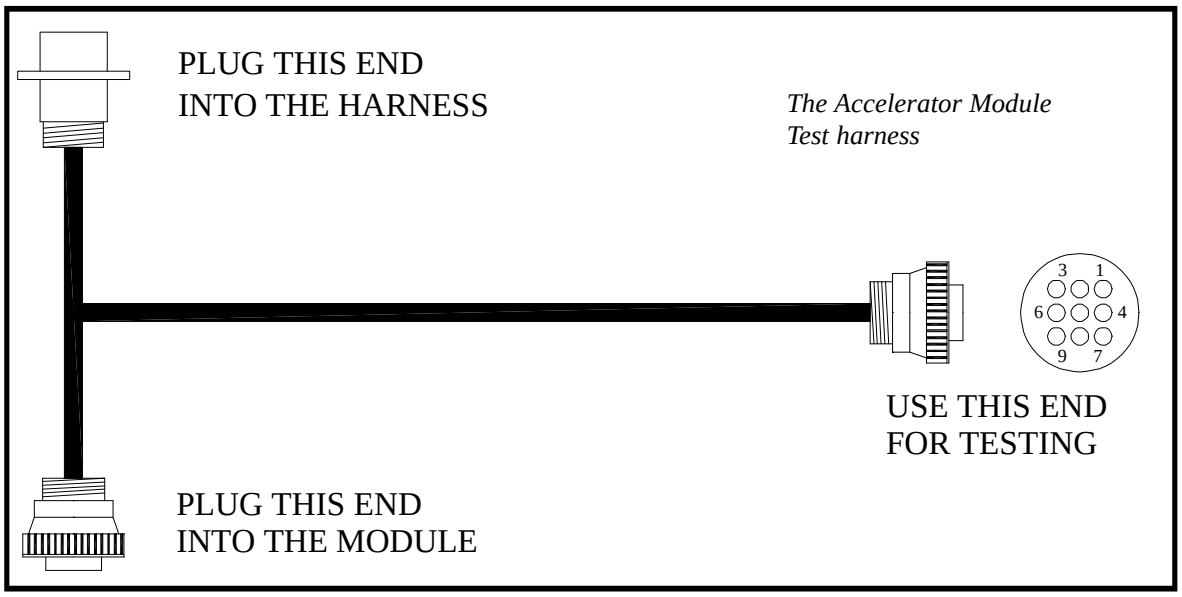
This troubleshooting guide is written in sequential order. All tests must be performed in the order that they are written. Starting in the middle or skipping sections when not instructed to do so may lead to invalid test results.

Test 6. ACCELERATOR MODULE FAULT

Disconnect the truck harness from the accelerator module. Connect the plug on the short end of the 75-089-00 test harness to the accelerator module. Connect the receptacle on the short end of the test harness to the vehicles control harness. The long end of the harness will be used for testing. Refer to the illustration below.

This testing cannot be completed without the 75-089-00 test harness.

Unless specified otherwise, all references to a pin # is referring the connector on the long end of the test harness. Refer to the illustration for the pin locations in the connector. The pin numbers are cast into the connector as shown in the illustration.



All tests in this section (6) with the Key switch in the ON position.

Accelerator pedal depressed meas to depress the accelerator pedal fully (full speed).

Accelerator pedal released means to completely release the accelerator pedal (off).

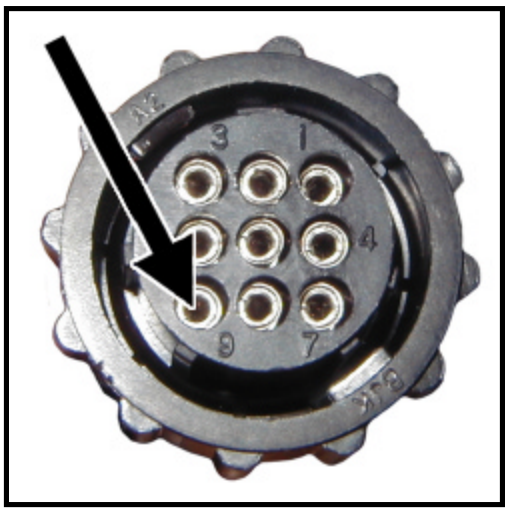
TEST 6.1:

Accelerator pedal released.

Test the voltage from pin #9 to battery positive.

If the voltage equals battery volts ,then skip ahead to test #6.2.
If the voltage does not equal battery volts, then check the wire from pin #9 to the battery voltage 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.



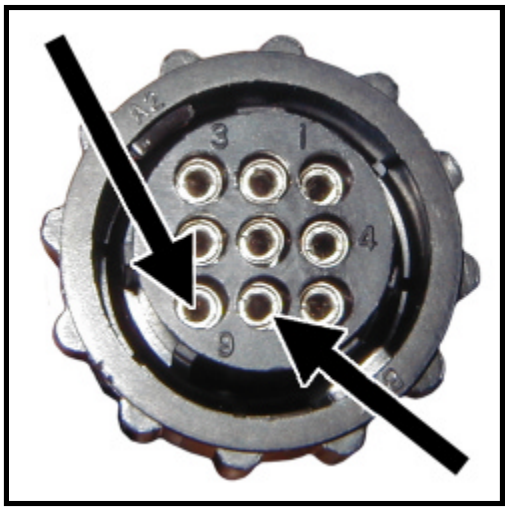
TEST 6.2:

Accelerator pedal released.

Test the voltage from pin #9 to pin #8.

If the voltage equals battery volts, then skip ahead to test #6.3.
If the voltage does not equal battery volts, then check the wire from pin #8 to the key switch.

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.



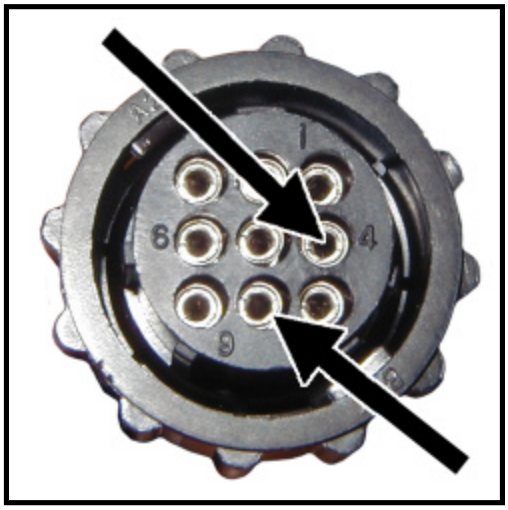
TEST 6.3:

Accelerator pedal released.

Test the voltage from pin #8 to pin #4.

If the voltage equals battery volts, then skip ahead to test #6.4.
If the voltage does not equal battery volts, then check the wire from pin #4 to the battery voltage 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.



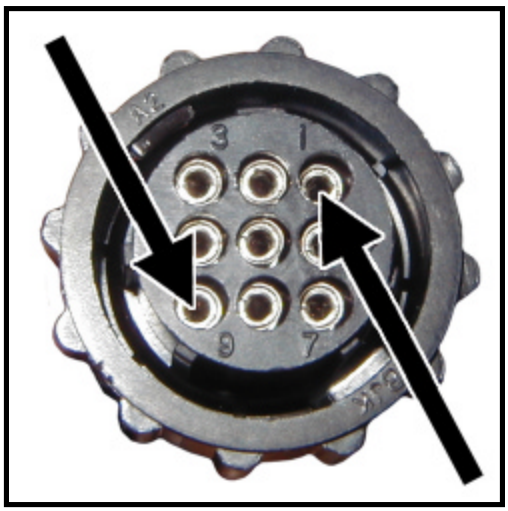
TEST 6.4:

Accelerator pedal released.

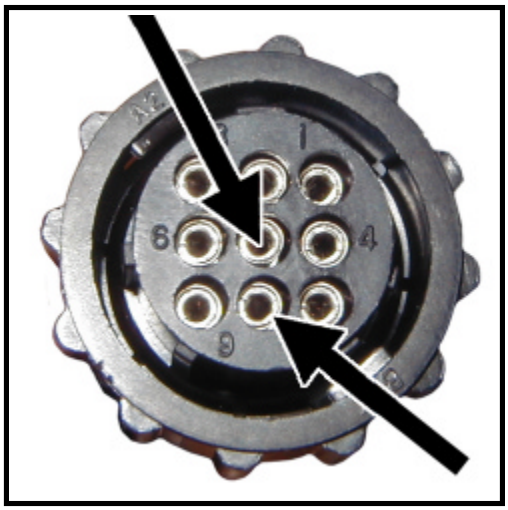
Test the voltage from pin #9 to pin #1.

If the voltage is below 0.3 volts, then skip ahead to test #6.5.
If the voltage is above 0.3 volts, then the module has failed 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.



TEST 6.5a:



Test the voltage from pin #5 to pin #8.

Accelerator pedal released.

If the voltage is low then skip ahead to test 6.5b.
If the voltage is high then then the module 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.

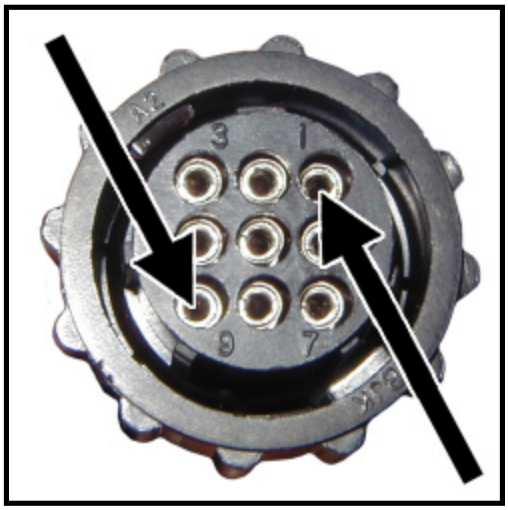
TEST 6.5b:

Accelerator pedal depressed.

If the voltage equals battery volts, then skip ahead to test #6.6.
If the voltage does not equal battery volts, then the module has failed or the accelerator pedal return spring on the module is broken.

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.

TEST 6.6:



Accelerator pedal depressed.

Test the voltage from pin #9 to pin #1.

If the voltage is between 4.8 and 5.1 volts, then skip ahead to test #6.7.
If the voltage is not between 4.8 and 5.1 volts, then the module has failed 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.

TEST 6.7:

If the test at pin #4 on the 12-pin logic card connector failed, but the test at pin #5 at the accelerator module was good (#6.5), then check the wire from pin #5 (module) to pin #4 (logic card).
If the test at pin #10 on the 12-pin logic card connector failed, but the test at pin #1 at the accelerator module was good (#6.6), then check the wire from pin #1 (module) to pin #10 (logic card).

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.

Test 7. FORWARD AND REVERSE SWITCH FAULT

Turn the key switch ON, place the forward and reverse switch in the center OFF position and perform the following tests:

TEST 7.1:

Referencing battery positive, test the voltage on the center terminal of the F&R switch (Black wire).

If the voltage equals battery volts, then skip ahead to test #7.2.
If the voltage does not equal battery volts, then check the wire from the F&R switch to the battery voltage 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.

NOTE: The wires are disconnected for reference only. The test must be done with the wires connected to the switch.

TEST 7.2:

If the vehicle does not travel in reverse, skip ahead to test #7.3.
Place the forward and reverse switch in the FORWARD position.

Referencing battery positive, test the voltage at the Blue/ Black wire on the F&R switch.

If the voltage equals battery volts, skip ahead to test #7.4.
If the voltage does not equal 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.

NOTE: The wires are disconnected for reference only. The test must be done with the wires connected to the switch.

TEST 7.3:

If the vehicle does not travel in forward, skip ahead to test #7.4.
Place the forward and reverse switch in the REVERSE position.

Referencing battery positive, test the voltage at the White/ Black wire on the F&R switch.

If the voltage equals battery volts, skip ahead to test #7.4.
If the voltage does not equal 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.

NOTE: The wires are disconnected for reference only. The test must be done with the wires connected to the switch.

TEST 7.4:

Check the wires from the F&R switch to the logic card connector for continuity.

STOP

Stop, do not continue. Reaching this point indicates a failure in the Sevcon power unit or an error was made during testing. Confirm all previous tests were performed correctly before replacing the Sevcon power unit.

⚠CAUTION

This troubleshooting guide is written in sequential order. All tests must be performed in the order that they are written. Starting in the middle or skipping sections when not instructed to do so may lead to invalid test results.

Test 8. ANTI-ROLLOFF FAULT

The Sevcon Controller is equipped with a feature called Anti-Rolloff. Anti-Rolloff will automatically slow the vehicle if it starts to roll. Anti-Rolloff is active when the key switch has been left in the “ON” position and the accelerator pedal is not depressed. Anti-Rolloff is deactivated when the key switch is in the “OFF” position When the key switch is in the “ON” position and the truck is stationary, the controller supplies a small current to the field. This current is used to sense if the armature is rotating. As the armature begins to rotate, the controller senses a fault condition and then supplies current to the field opposing the armature rotation, slowing the vehicle.

Refer to Motor Specifications Table for information on the maximum allowable field current when the Anti-Rolloff feature is active.

To test the Anti-rolloff feature:

Park the vehicle on a flat level surface, turn the key switch OFF and apply the parking brake.

Connect an analog Ammeter in series with the motor field windings or a clamp on Ammeter on one of the field wires that is capable of reading up to 25-Amps.

Place the forward and reverse switch in the center OFF position and turn the key switch ON

TEST #8.1

Read the motor field current on the Ammeter.

If the field current is greater than specified in the Motor Specification table (see Motor Service section for specifications), then the Anti-Rolloff feature has failed. Check the status of the Anti-Rolloff feature using the hand held calibrator (62-027-61).

TEST #8.2

While monitoring the motor field current, release the park brake, and push the vehicle.

⚠WARNING

The surface must be level for this test. Do not attempt to test the Anti-Rolloff by pushing up or down an incline. Testing by pushing up or down an incline could result in injury or property damage.

Within approximately 10-feet, the field current should rise dramatically and the vehicle should become difficult to push. Now stop pushing the vehicle and allow it to come to a complete stop.

The field current should drop down below the value specified in the Motor Specification table. This indicates that the Anti-Rolloff feature is operating normally.

If the current does not rise, then the Anti-Rolloff feature has failed or has been turned off.

The status of the Anti-Rolloff feature can be checked with the hand held calibrator.

If the Anti-Rolloff feature is on and the field current did not rise, then the controller has failed and must be replaced.
If the Anti-Rolloff feature is off then the controller logic must be reprogrammed. Contact your dealer.

Test 9. ELECTRIC MOTOR BRAKE

Description:

The electric motor brake is a 24-volt electromagnetic disc brake mounted between the drive motor and the primary reduction gear case. The brake is controlled by the speed controller logic. At what times the brake is applied or released is dependent on the controller programing and will vary depending on the model vehicle.

Operation:

B+ is supplied to the brake when the key switch is turned on. When the control logic determines that it is time to start, it provides B- at 24-volts through pin #9 on the logic card connector.

Testing:

Place the forward and reverse switch in the OFF position, turn the key switch OFF.

Rotate the drive wheels to confirm the brake is engaged.

If the brake is engaged then skip ahead to 9.1.
If the brake is not engaged then:

Disconnect the electric brake harness connector and repeat the test.

If the brake is still not engaged then:

- Remove the brake and repair or replace the brake as required. 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 brake engaged after the harness was disconnected then:

Inspect the harness for shorts.

Stop troubleshooting here and repair the problem. When the repair is completed, completely retest the vehicle before lowering the drive wheels to the ground.

Test 9.1

Close the seat switch, turn the key switch ON, place the forward and reverse switch in the FORWARD position, depress the accelerator pedal to engage FS-1 only (creep speed).

Rotate the drive wheels to confirm the brake has released.

If the brake released, then the brake system is working and no further testing of the brake is required.

If the brake did not release, then perform the following tests:

Connect a volt meter from battery negative to the Violet/Black wire at the electric brake harness plug.

If the voltage is less than battery volts then:

- Check wiring to the key switch and continue troubleshooting at test #4.2.

If the voltage equals battery volts then:

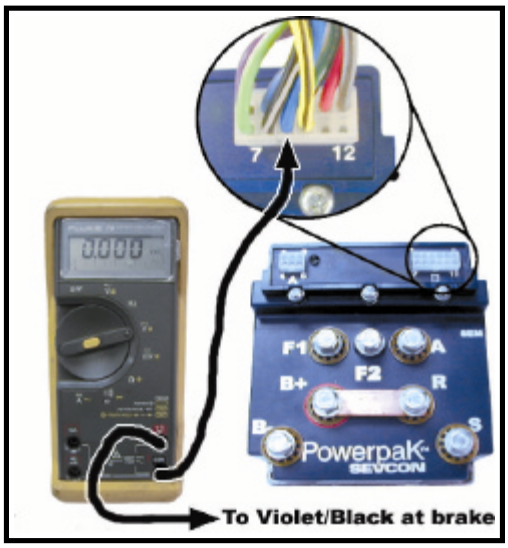
Connect a volt meter across the Violet/Black wire and the Blue wire at the electric brake harness plug. The voltage should start at approximately 24 volts, then drop to approximately 15 volts after about 0.5 seconds.

If the test is good then:

- The pigtail harness to the electric brake is broken or the electric brake has failed. Remove the brake and repair or replace as required.

If the test is bad then:

Connect a volt meter across the Violet/Black wire at the electric brake harness plug and Pin #9 at the logic card connector. The voltage should start at approximately 24 volts, then drop to approximately 15 volts after about 0.5 seconds.



If the test is good then:

- The blue wire from the electric brake harness plug to pin #9 on the logic card connector is broken. 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 is bad then:

- The logic card is not releasing the brake. This could be a result of:
  - -Improper operation of the vehicle.
  - - fault in the vehicles wiring or switches.
  - -A fault in the speed controller.
  - -Incorrect programming.
  - -A failed speed controller.

Disconnect the electric brake harness connector and connect the electric brake to a 24-volt source. This should release the brake and allow you to troubleshoot the vehicles control system. Return to the beginning of the troubleshooting section and continue.

If the brake does not release then:

- The electric brake has failed. Remove the brake and repair or replace the brake as required. 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.

⚠WARNING

The electric brake is part of the vehicle braking system. Do not operate a vehicle with the electric brake bypassed or disabled unless the system is being tested for faults. Operating a vehicle with the brake bypassed or disabled may result in severe personal injury or property damage.

Sevcon Logic Voltage Reference Table

Pin#	Condition	Volts*
1	Key switch off	0.0 volts
	Key switch on	Battery volts
2	F&R in forward	Low
	F&R in neutral	High
	F&R in reverse	
3	F&R in reverse	Low
	F&R in neutral	High
	F&R in forward	
4	Accelerator pedal up	High
	Accelerator pedal down	Low
5	Seat switch closed (depressed)	Low
	Seat switch open	High
6	High/low switch in high	Low
	High/low Switch in low	High
7	Hand brake switch closed	Low
	Hand brake switch open	High
8	Key switch on (ref battery positive)	**
	Key switch off (ref battery positive)	Battery volts
9	System off (ref battery positive)	0 volts
	System on (ref battery positive)	**
10	Accelerator pedal up	0.0–0.3 volts
	Accelerator pedal down	4.8–5.0 volts
11	Not used	–
12	Not used	–

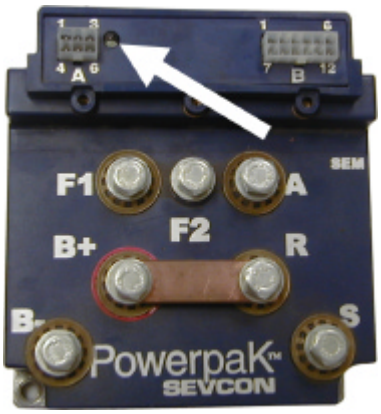
* - All voltages made referencing main negative unless specified otherwise

** - The voltage should start at approximately 24 volts, then drop to approximately 15 volts after about 0.5 seconds.

Status LED Code Table

The status LED on the Sevcon power unit logic card can be used to give you an idea of where the problem may be. It is recommended that you complete the troubleshooting procedure to confirm failure of any component.

Number of Flashes	Fault Description	Possible Cause	Actions
1	Personality fault	See dealer	-
2	Sequence fault	Startup switches not operated in the correct order	Reset the switches and start over (Refer to Vehicle Operating Instuctions))
3	MOSFET or motor short	Burned Motor	Repair as required
4	Contactor fault or open motor	Contactor Failure Open Circuit	Check contactor and motor
5	Not used	-	-
6	Accelerator module fault	FS-1 Micro Switch Failure Faulty Wiring Accelerator Failure	Check accelerator module inputs
7	Discharged battery	Discharged battery or loose connections	Check battery and connections to controller
8	Controller overheated	Overloaded truck	Wait for controller to cool
9	ISO coil shorted	ISO Coil Short Circuit	Check coil continuity and replace as required
12	Can Buss Fault	Fault in the Wiring to the dash display or a faulty Dash Display NOTE: The Dash Display is Optional	Check wiring. If vehicle is not equipped with a dash display, check for debris in the 6-pin connector on the logic card



LED Status Light

Charger Troubleshooting

The charger supplied with this vehicle is either specified or provided by the end user.

Refer to the documentation supplied with the charger or contact the charger manufacturer for more information.

⚠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).

Wire Diagrams

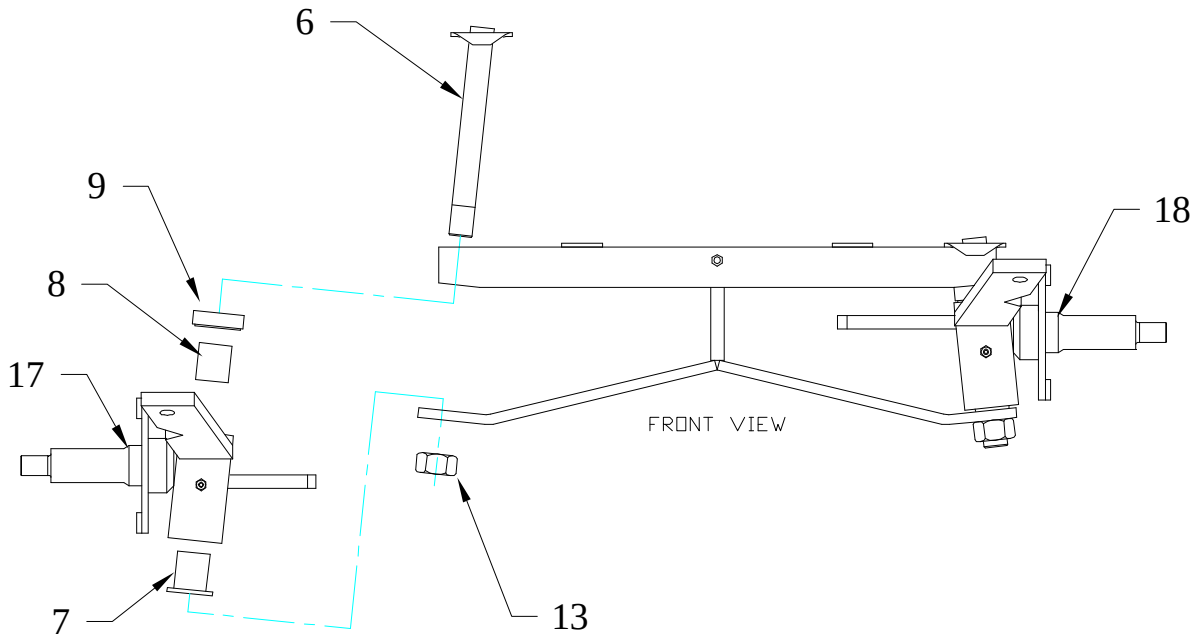
The vehicle wiring diaram is too large to be legible when printed at this size. A full size diagram (22 x 16) is inculded on the CD in PDF format. You can access the diagram from a button on the CD menu.

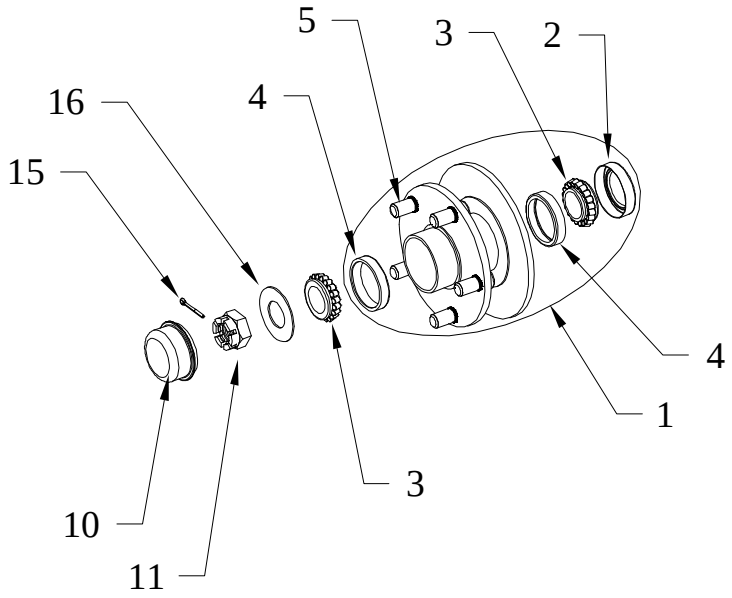
The diagram # is SCH-00006

Illustrated Parts

TABLE OF CONTENTS

Front Axle

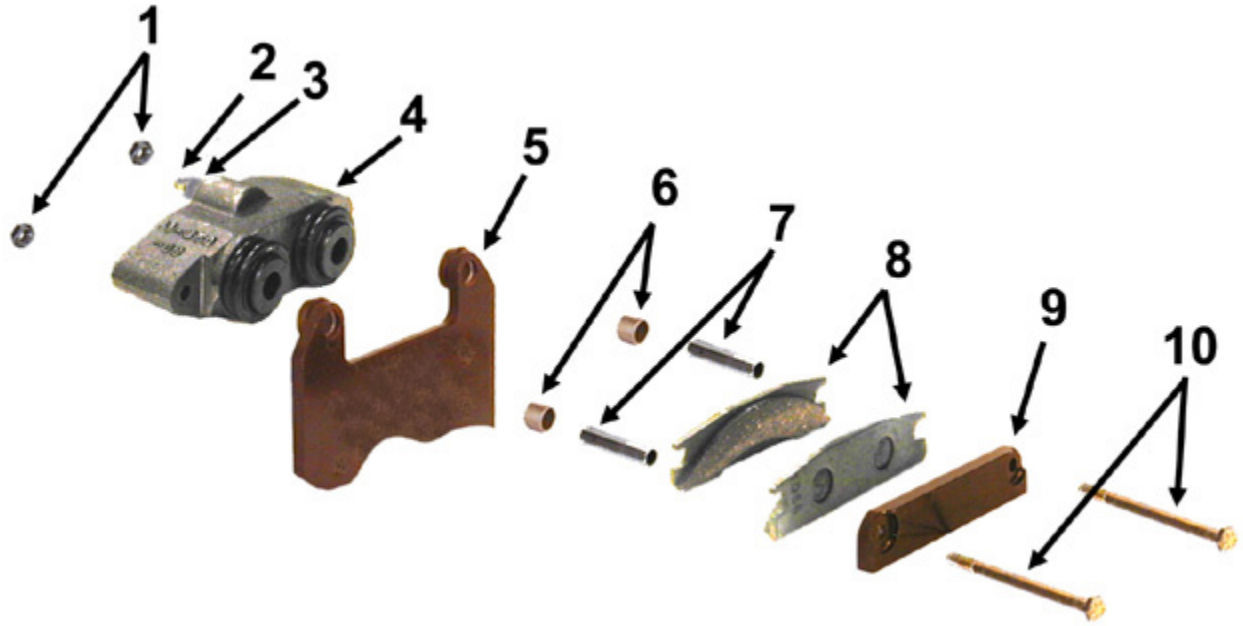




Front Axle

Item #	Part #	Description	Qty
	15-067-30	Axle assembly (includes all listed parts, brakes and springs)	1
1	12-115-10	Wheel Hub	2
2	45-304-00	Grease seal for wheel hub	2
3	80-011-00	Wheel bearing	4
4	80-102-00	Bearing race	4
5	96-329-00	Wheel stud	1
6	21-015-00	King pin	2
7	32-200-00	King pin bushing (lower)	2
8	32-204-00	King pin bushing (upper0	2
9	80-309-00	Thrust bearing (king pin)	2
10	92-105-00	Dust cap (wheel hub)	2
11	88-239-85	3/4 NF HEX SLOTTED NUT (spindle)	2
12	-	-	-
13	88-279-81	7/8 NF HEX HD LOCK NUT (king pin)	2
14	-	-	-
15	88-527-14	1/8 X 1-1/2 STEEL COTTER PIN (spindle)	2
16	88-228-60	3/4 CUT WASHER (spindle)	2
17	14-250-98	Steering knuckle, right	1
18	14-250-99	Steering knuckle, left	1

Front Brakes



Brake Body (#4 above)

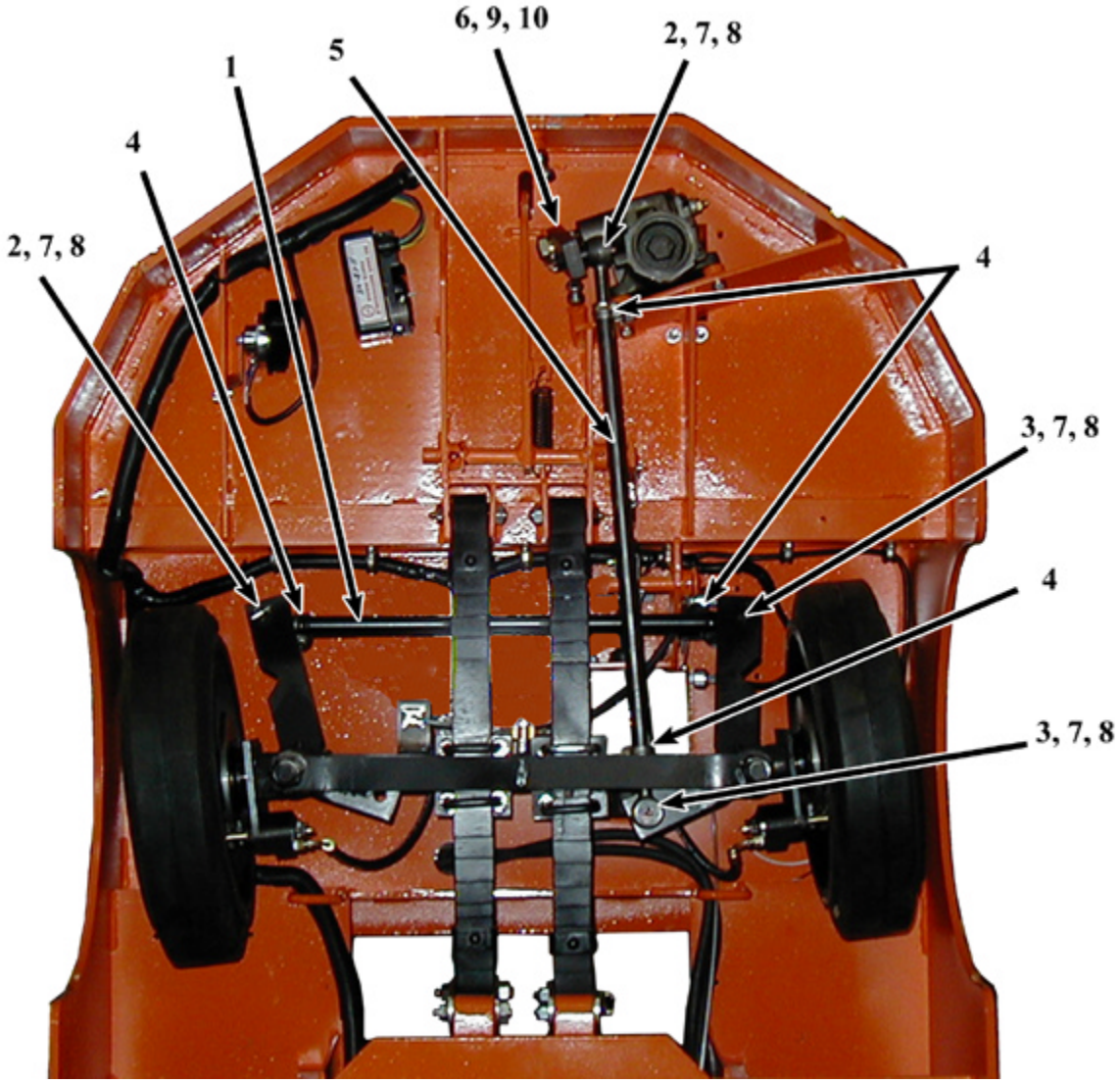
Front Brakes

Item #	Part #	Description	Qty
1	88-069-82	1/4 NC HEX LOCKNUT,GR 8	4
2	99-588-00	Bleeder	2
3	99-588-01	Bleeder Adaptor	2
4	41-350-30	Brake body assembly (see below for breaddown)	2
5	-	Mounting bracket (part of knuckle)	
6	32-240-41	Bushing	4
7	41-348-57	Spacer	4
8	41-348-70	Brake pad	4
9	41-350-51	Secondary plate	2
10	88-067-21	1/4NC X 3.75 HEX BOLT, GR 8	2
Not shown	41-886-00	PLUG, 1/8 PIPE, HEX SOCKET	2

Brake Body

Item #	Part #	Description	Qty
1	See above	Bleeder	
2	See above	Adaptor	
3	41-350-45	Brake body	2
4	80-713-00	O-ring	4
5	41-350-09	Boot	4
6	41-350-10	Piston	4

Steering Linkage

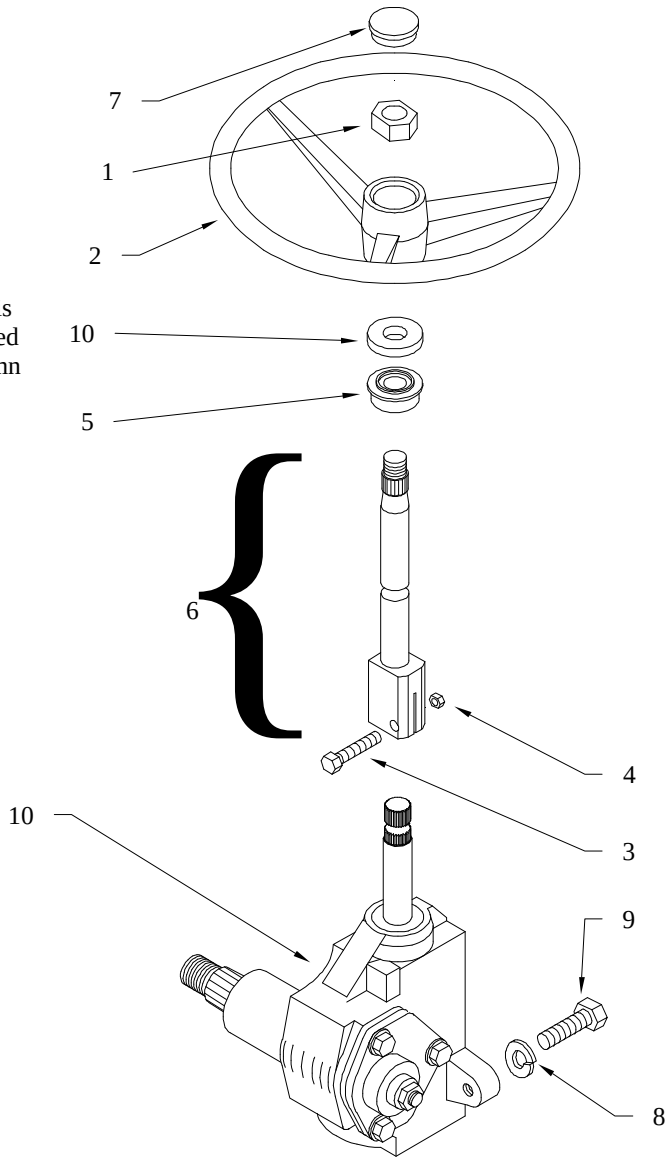


Steering Linkage

Item #	Part #	Description	Qty
1	18-053-50	Tie rod	1
2	86-501-99	Ball joint, right thread	2
3	86-501-98	Ball joint, left thread	2
4	86-510-00	Ball joint clamp	4
5	18-041-05	Drag link	1
6	18-107-00	Pitman arm	1
7	88-159-85	Castle nut, 1/2NF	4
8	88-527-11	1/8 X 1 STEEL COTTER PIN (ball joint)	4
9	See Steering Gear	Nut, pitman arm	1
10	See Steering Gear	Split lock washer, pitman arm	1

Steering Column

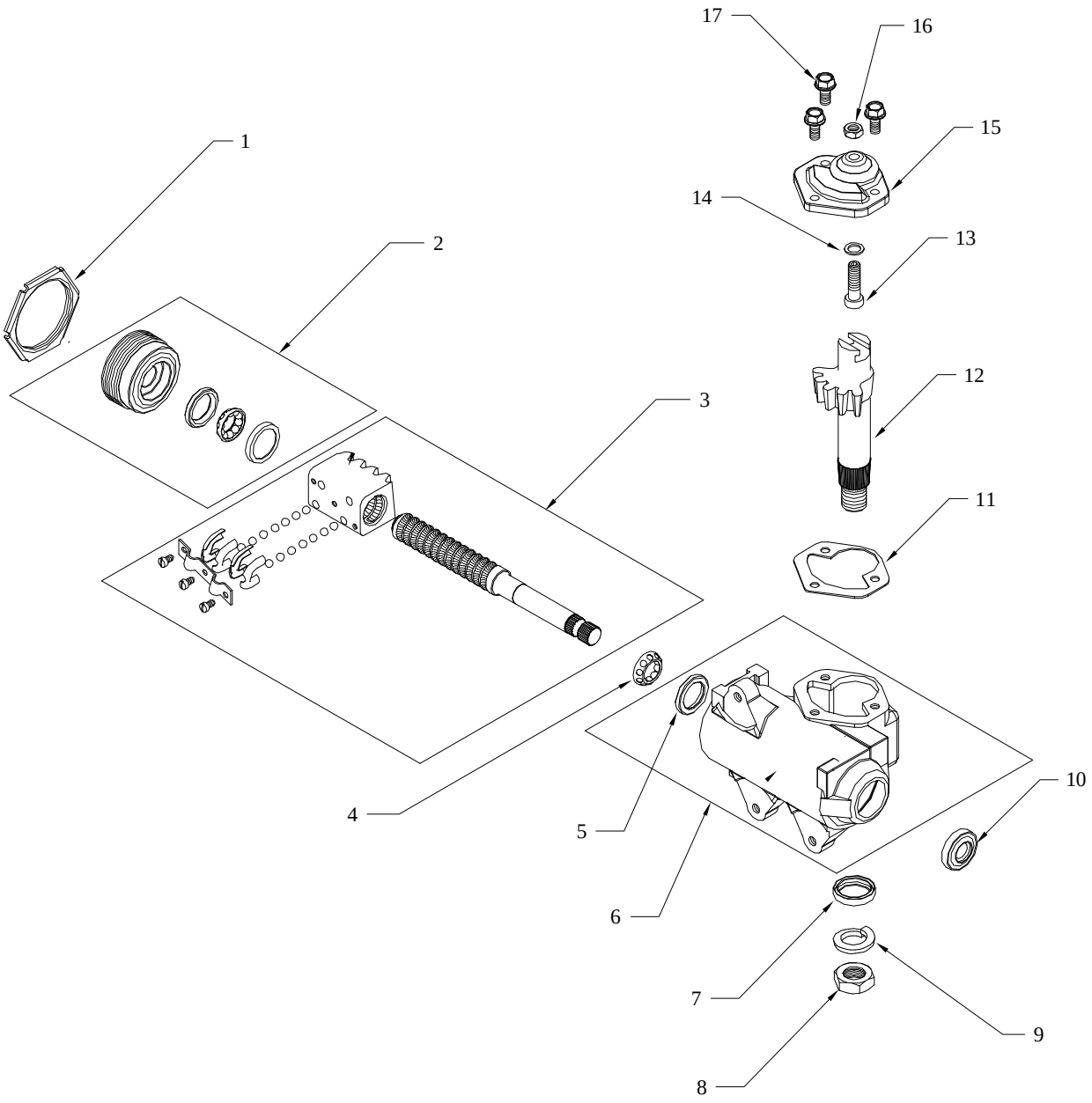
The steering column is an integral part of the frame and is not shown. Part ID# 5 is located in the top of the steering column tube.



Steering Column

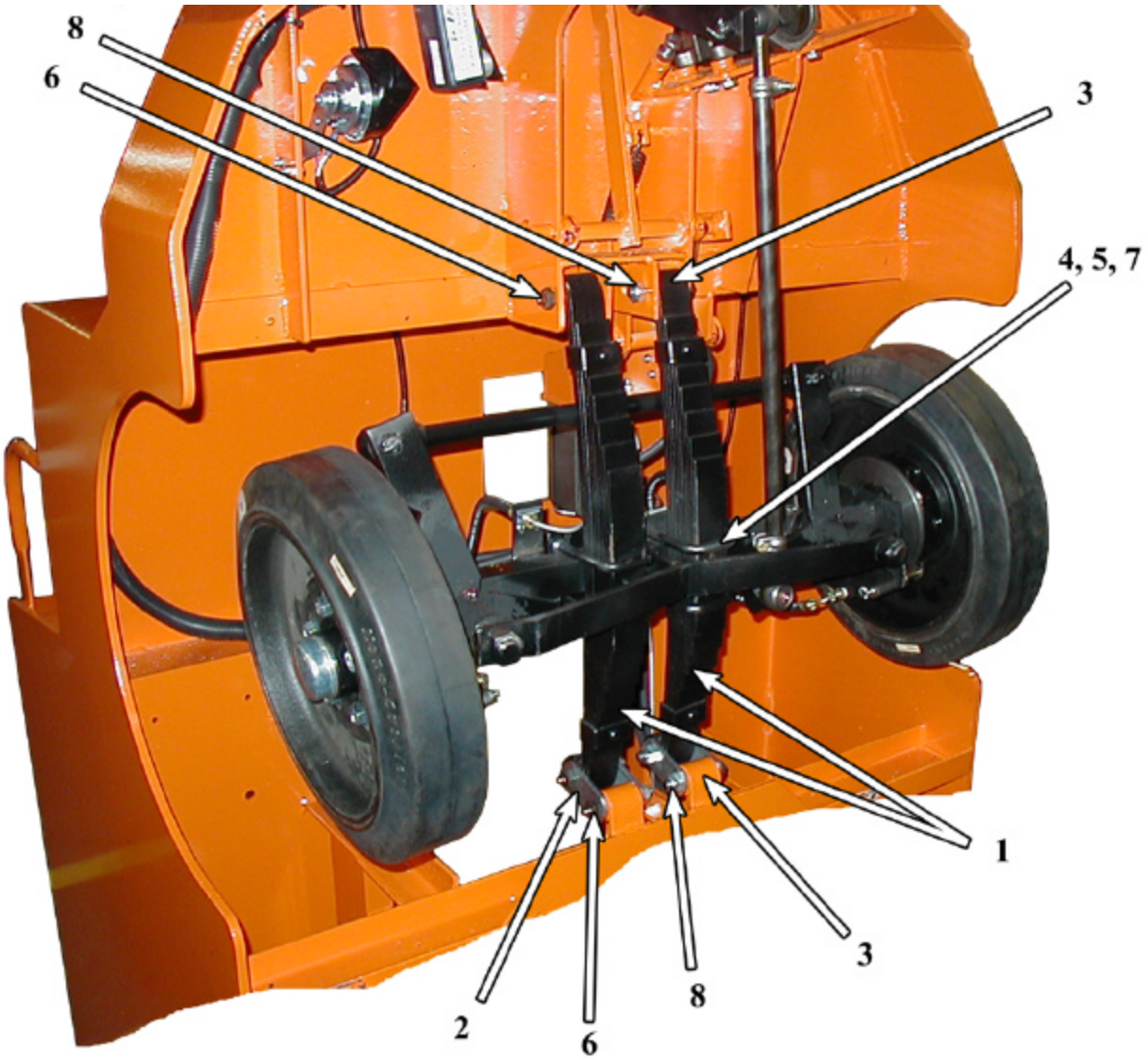
Item #	Part #	Description	Qty
1	88-199-82	Nut, Steering wheel	1
2	19-011-20	Steering wheel	1
3	88-081-14	Pinch bolt	1
4	88-089-84	Nut for pinch bolt	1
5	32-248-10	Bushing, upper column	1
6	20-031-65	Steering shaft kit, includes pinch bolt and nut	1
7	19-011-25	Steering wheel cap	1
8	88-128-62	7/16 Split lock washer	3
9	88-120-15	7/16NC x 1 Hex bolt	3
10	18-308-21	Steering gear	1
Not Shown			
00-202-12		Steering column cover	1

Steering Gear



Steering Gear			
ITEM #	PART #	DESCRIPTION	QTY
1	18-308-70	Locknut	1
2	18-308-71	Adjuster assembly	1
3	18-308-72	Worm assenbly	1
4	18-308-23	Upper worm bearing	1
5	18-308-22	Upper worm bearing race	1
6	18-308-77	Housing	1
7	18-308-78	Seal, pitman shaft	1
8	18-308-80	Nut, pitman shaft	1
9	18-308-81	Lock washer	1
10	18-308-79	Seal, input shaft	1
11	18-308-82	Gasket	1
12	18-308-76	Pitman shaft	1
13	18-308-75	Gear lash adjuster	1
14	18-308-85	Shim kit	1
15	18-308-84	Side cover	1
16	18-308-86	Jam nut	1
17	18-308-83	Bolt, side cover	3

Front Suspension

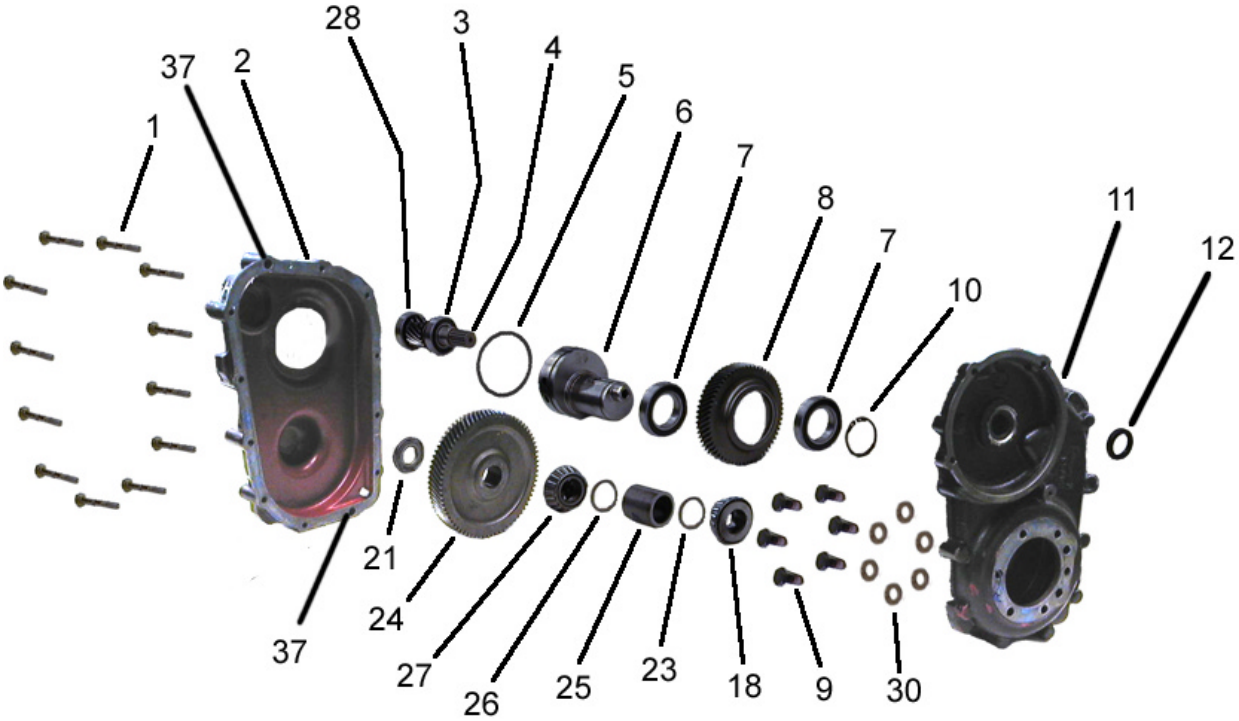


NOTE: Item # 3 is located inside of the spring eye's and frame mounting eye's.

Front Suspension

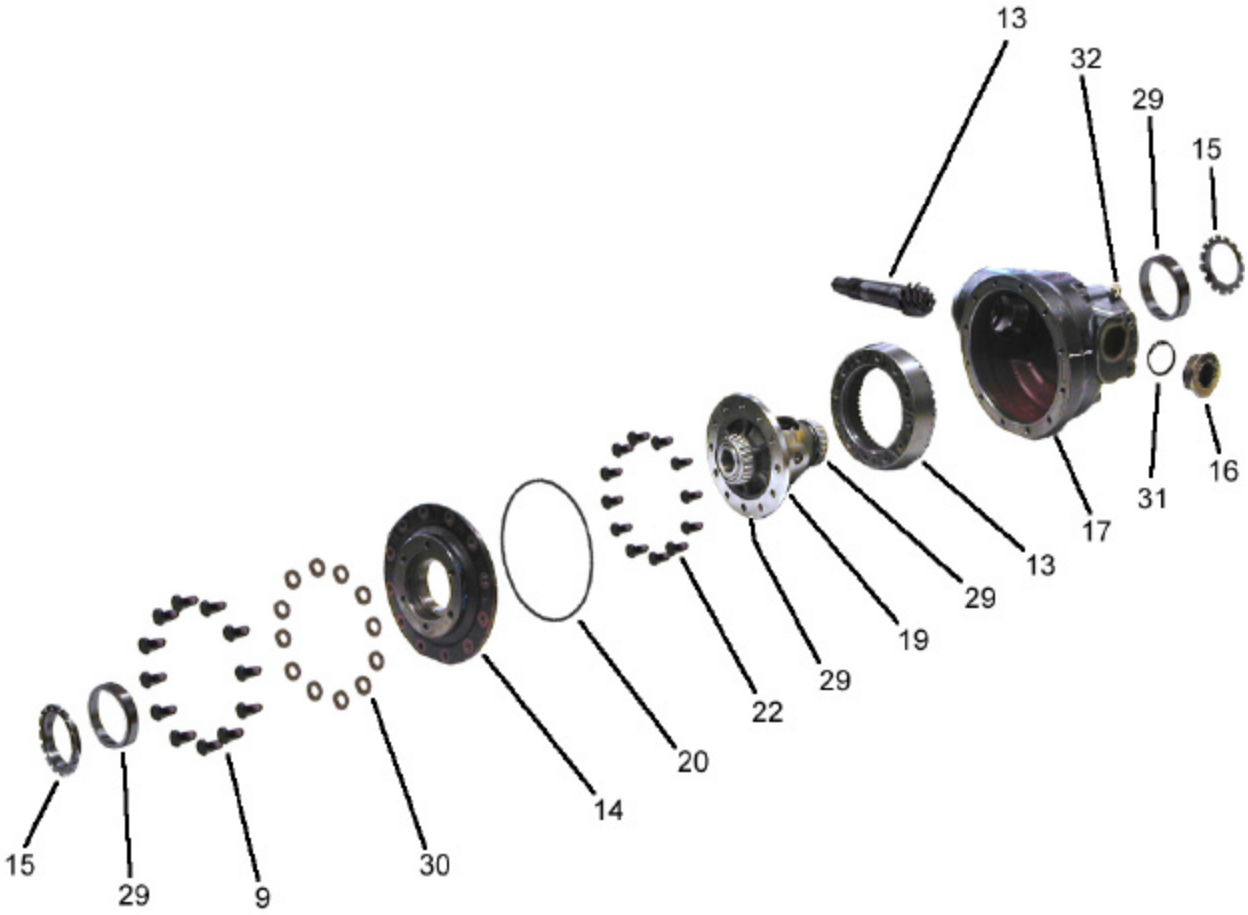
Item #	Part #	Description	Qty
1	85-503-00	Spring	2
2	16-870-10	Spring hanger	4
3	32-213-00	Spring eye bushing	6
4	96-121-00	U-bolt	2
5	16-865-00	Spring plate	2
6	96-244-00	Spring eye bolt	6
7	88-149-81	Nut, u-bolt	8
8	88-169-81	Nut, Spring eye bolt	6

Transmission Gear Case



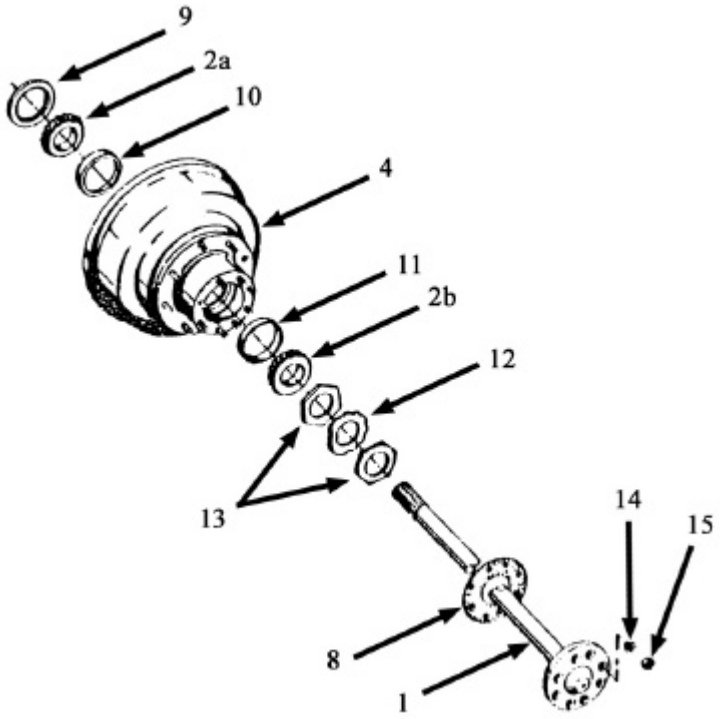
Transmission Gear Case			
ITEM #	PART #	DESCRIPTION	QTY
1	GT-71682	M8 x 60 bolt	12
2	GT-3287563	Gear case cover	1
3	GT-71259	Bearing	1
4	GT-3287513	Input shaft, 30:1	1
5	GT-71982	O-ring	1
6	GT-3287503	Eccentric shaft	1
7	GT-72005	Bearing	2
8	GT-3287493	Idler gear	1
9	GT-70302	M10 x 30 Bolt	6
10	GT-71715	Snap ring	1
11	GT-3287553	Gear case housing	1
12	GT-72019	Seal	1
18	GT-71979	Bearing	1
21	GT-3273633	Pinion nut	1
23	See Note 1, previous page	Spacer	1
24	GT-3287453	Output gear, 30:1	1
25	GT-328	Spacer, 46.100mm	1
	GT-328	Spacer, 46.100mm	0 or 1
	GT-328	Spacer, 46.125mm	0 or 1
	GT-328	Spacer, 46.150mm	0 or 1
	GT-328	Spacer, 46.175mm	0 or 1
26	GT-3287903	Shim, 0.100mm	0 or 1
	GT-3287883	Shim, 0.400mm	0 or 1
	GT-3287893	Shim, 0.500mm	0 or 1
	GT-3287853	Shim, 0.600mm	0 or 1
	GT-3287863	Shim, 0.700mm	0 or 1
	GT-3287873	Shim, 0.800mm	0 or 1
27	GT-71068	Bearing	1
28	GT-72022	Bearing	1
30	GT-70299	10mm Washer	6
37	GT-3252633	Dowel pin	2
Not shown	GT-71804	Drain plug	1
	GT-71755	Drain plug gasket	1

Transmission Differential Case



Transmission Differential Case			
ITEM #	PART #	DESCRIPTION	QTY
9	GT-70302	M10 x 30 Bolt	12
13	GT-3287183	Ring and pinion gear set	1
14	GT-3297193	Differential case cover	1
15	GT-3287133	Adjusting ring	2
16	GT-70417	Fill/Level plug	1
17	GT-3287113	Differential housing	1
19	GT-3287143	Differential case	1
20	GT-72013	O-ring	1
22	GT-71896	M10 x 25 Bolt	12
29	GT-71978	Bearing and race	2
30	GT-70299	10mm Washer	12
31	GT-71881	Seal	1
32	GT-70052	Vent	1

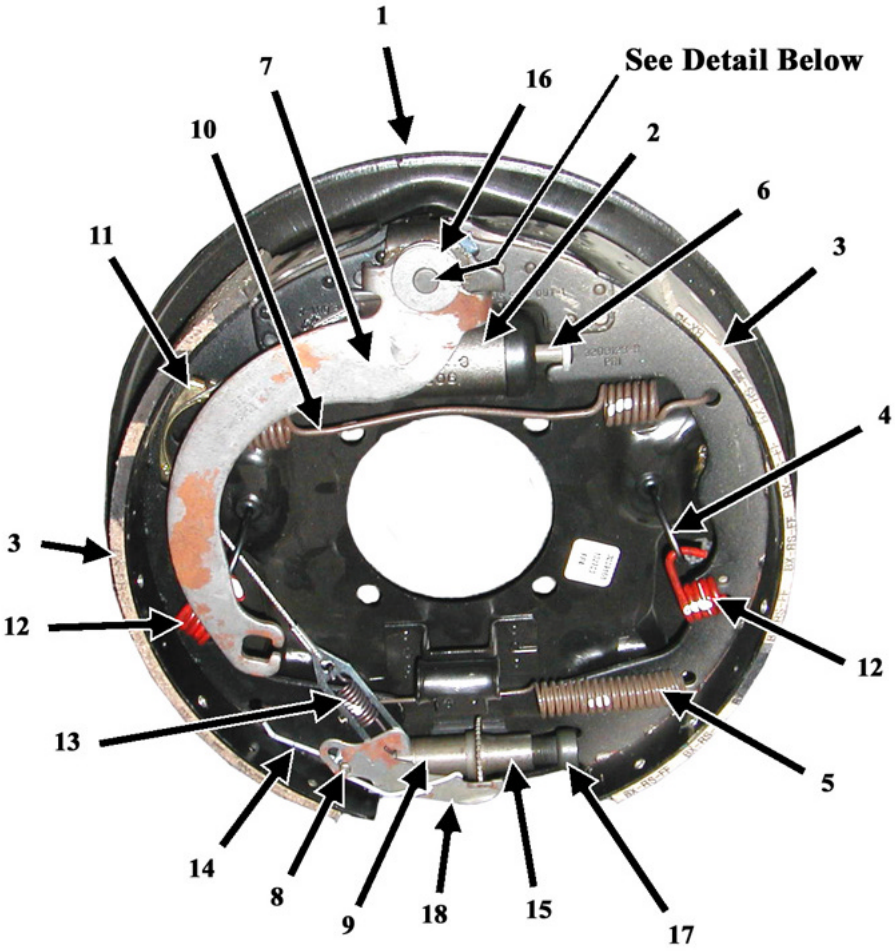
Rear Axle

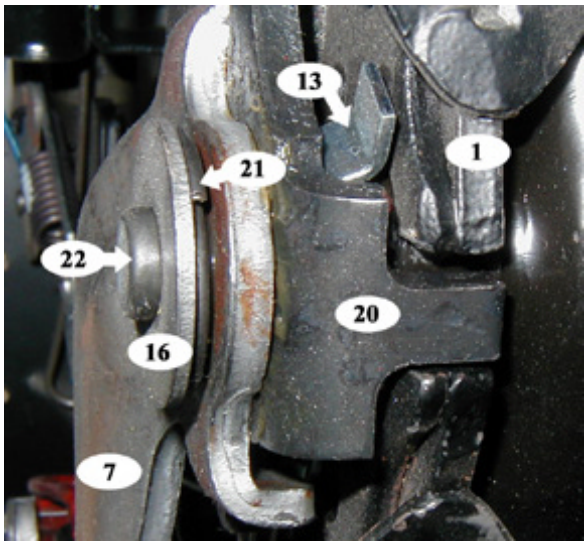


Rear Axle

Item #	Part #	Description	Qty
1	41-150-60	Axle shaft, left	1
	41-150-61	Axle shaft, right	1
2a	80-530-00	Hub bearing, inner	2
2b	80-529-00	Hub bearing, outer	2
3	-	-	-
4	12-225-10	Brake drum and hub	2
5	-	-	-
6	-	-	-
7	-	-	-
8	45-043-00	Axle gasket	2
9	45-337-01	Oil seal	2
10	80-135-00	Race, inner	2
11	80-134-00	Race, outer	2
12	41-871-00	Lock washer	2
13	41-870-00	Hub nuts	4
14	95-450-00	Tapered dowel	16
15	88-130-86	Axle nut	16
Not shown	K49-700-10	Axle housing, left	1
	K49-700-11	Axle housing, right	1
	89-113-30	M12 x 1.75 x 30mm Hex bolt, axle housing to center section	12
	89-113-60	M12 Split lock washer	12

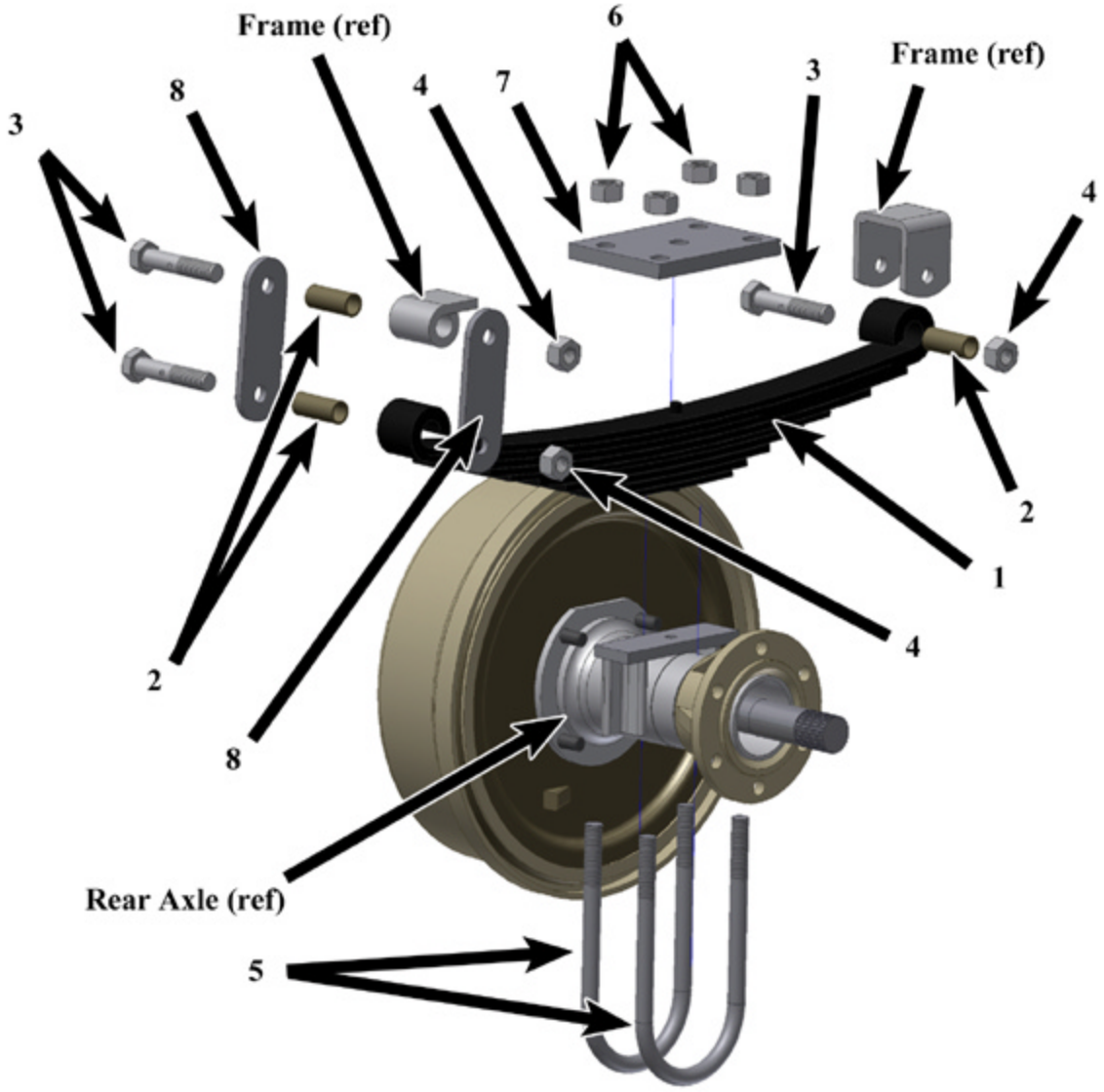
Rear Brakes


1
7
16
See Detail Below
10
2
6
11
3
4
3
12
12
13
5
14
8
9
18
15
17


13
1
21
22
20
16
7

REAR BRAKES			
ITEM #	PART #	DESCRIPTION	QTY
1	41-351-99	Backing Plate (R)	1
1	41-351-98	Backing Plate (L)	1
2	99-502-99	Wheel Cylinder (R)	1
2	99-502-98	Wheel Cylinder (L)	1
3	42-352-60	Brake shoe kit (left and right, 4 shoes)	1
4	41-352-10	Pin, Brake Shoe Hold Down	4
5	85-209-10	Spring	2
6	41-683-10	Wheel Cylinder Push Rod	4
7	51-352-99	Park Brake Lever (R)	1
7	51-352-98	Park Brake Lever (L)	1
8	41-352-00	Pin, Brake Adjuster	2
9	41-678-10	Socket, Brake aAjuster	2
10	85-211-10	Spring	2
11	27-352-00	Cable Guide	2
12	85-352-30	Spring	4
13	96-828-00	Cable	2
14	85-352-00	Spring (blk)	1
14	85-352-10	Spring (yel)	1
15	97-352-99	Nut, Brake adjuster (R)	1
15	97-352-98	Nut, Brake adjuster (L)	1
16	97-352-10	Washer	2
17	96-352-99	Screw, Brake Adjuster (R)	1
17	96-352-98	Screw, Brake Adjuster (L)	1
18	51-352-00	Lever, Brake adjuster	1
20	42-351-99	Cam, Park Brake (R)	1
20	42-351-98	Cam, Park Brake (L)	1
21	85-352-20	Compression Spring	2
22	96-000-10	Brake Anchor Bolt	2
Not Shown	88-079-85	1/4-NF Hex Nut (for #22)	2
	96-827-14	Sheathed Cable	1
	96-826-13	Brake Cable	2
	96-754-00	Clevis, 5/16-Pin x 2-516 Long	2
	96-826-09	Clevis Lock	2
	96-762-00	3/8 Clevis	1
	96-771-00	3/8 x 3/4 Clevis Pin	1

Rear Suspension



Rear Suspension

Item #	Part #	Description	Qty
1	85-503-05	Spring	2
2	32-213-00	Sprijng eye bushing	6
3	96-244-00	Spring eye bolt	6
4	88-169-81	Nut, spring eye bolt	6
5	96-111-00	Spring U-bolt	4
6	88-169-81	U-bolt nut	8
7	16-867-00	Spring plate	2
8	16-871-02	Spring hanger	4

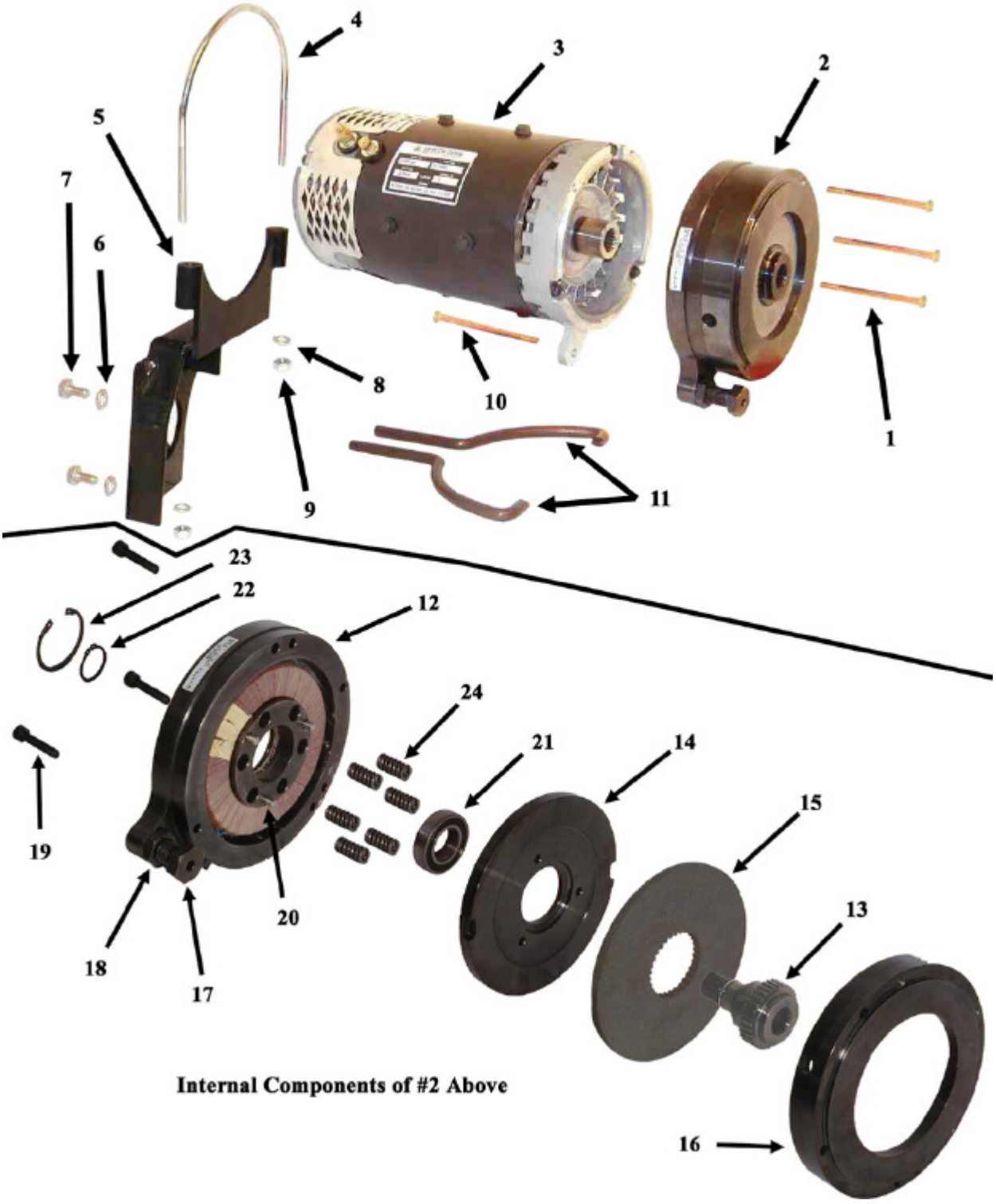
Motor

Illustration not available

Motor Part # 70-061-40 (Spec #XP-1765A)

Item #	Part #	Description	Qty
	70-170-10	Brush	8
	70-417-00	Retaining ring, bearing	1
	80-212-00	Bearing	1
	70-421-00	Adaptor ring	1
	70-173-00	Brush holder	1
	70-170-30	Brush lead kit	
	70-421-30	Commutoator end head	1

Electric Motor Brake and Motor Mount



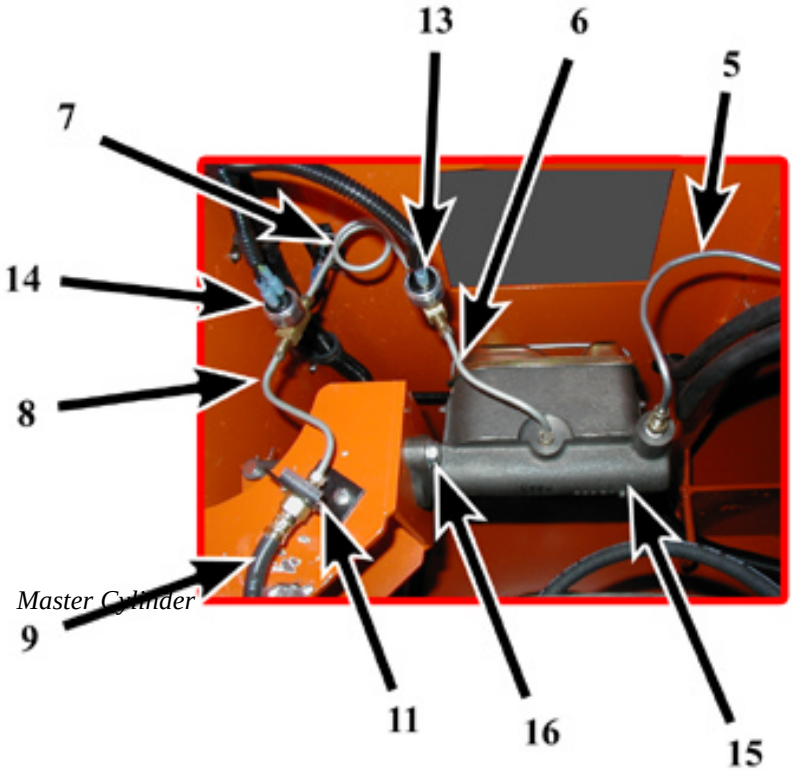
Internal Components of #2 Above

ELECTRIC MOTOR BRAKE AND MOTOR MOUNT

ITEM #	*PART #*	*DESCRIPTION*	*QTY*
1	88-067-22	Bolt,1/4 X 2" NC, Grade (no brake option)	3
2	41-355-00	Automatic Electric Brake Unit	1
3	See Motor	Motor (Typical)	1
4	96-114-10	U-Bolt, 5/16" NF, Motor Support	1
5	41-883-36	Motor, Support Bracket (45º)	1
6	88-128-62	Lockwasher, 7/16"	2
7	89-111-27	Bolt, 10m X 1.5 X 20 Hex Head	2
8	88-088-62	Lockwasher, 5/16"	2
9	88-099-80	Nut, 5/16" NF	2
10	88-067-17	Bolt, 1/4 X 1-1/8" NC, Grade 8 (no brake option)	
	88-067-29	Bolt, 1/4 X 4-1/4" NC, Grade 8 (brake option only)	1
11	96-500-04	Tool, Electric Brake, Manual Release	2
12	*	Magnet and Coil Sub Assembly	1
13	*	Hub	1
14	*	Armature	1
15	*	Friction Plate	1
16	*	Mounting Plate	1
17	*	Hex Head Bolt Spacer	1
18	*	Locknut	1
19	*	Screw, Socket Head Cap	3
20	*	Dowel Pin	3
21	*	Ball Bearing, Deep Groove	1
22	*	External Circlip	1
23	*	Internal Circlip	1
24	*	Coil Compression Spring	6
Not Shown	*	Wiring Harness	1

* - Part number not available at time of printing

Brake Lines & Linkage



Brake lines & Linkage

Item #	Part #	Description	Qty
5	K49-700-27	Brake line, master cylinder to Rear axle	1
6	99-600-56	Brake line, master cylinder to brake light switch	1
7	99-603-54	Brake line, brake light switch to interlock switch	1
8	99-600-58	Brake line, brake light switch to front axle	1
9	99-580-00	Brake hose, front (axle)	1
11	99-576-00	Clip, brake hose	4
13	71-110-00	Brake light switch	1
14	71-110-00	Brake regen switch	1
15	99-511-50	Master cylinder	1
16	88-101-13 88-109-80	Bolt, master cylinder mounting Nut, master cylinder mounting	
	K49-700-50	Brake line, front axle right	1
	K49-700-50	Brake line, front axle left	1
	K49-700-31	Brake line, rear axle left	1
	K49-700-30	Brake line, rear axle right	1
	99-580-10	Brake hose, front (wheel)	2
	99-580-10	Brake hose, rear	1
	50-009-05	Push rod, master cylinder	1
	17-104-00	Collar, push rod	1
	96-762-00	Clevis, master cylinder	1
	96-772-00	Clevis pin, master cylinder	1
	88-527-11	Cotter pin, master cylinder	1
	99-511-51	Boot, master cylinder	1
	96-762-00	Clevis, pedal linkage	2
	50-026-00	Pedal linkage (3/8 threaded rod)	1
	88-119-80	Jam nut, pedal linkage	1
	96-772-00	Clevis pin, pedal linkage	2
	88-527-11	Cotter pin, pedal linkage	2
	99-563-00	T-Fitting, Front axle	1
	99-574-00	Spacer (inside T-Fitting)	1
	99-563-00	T-Fitting, rear axle	1
	99-574-00	Spacer (inside T-Fitting)	1

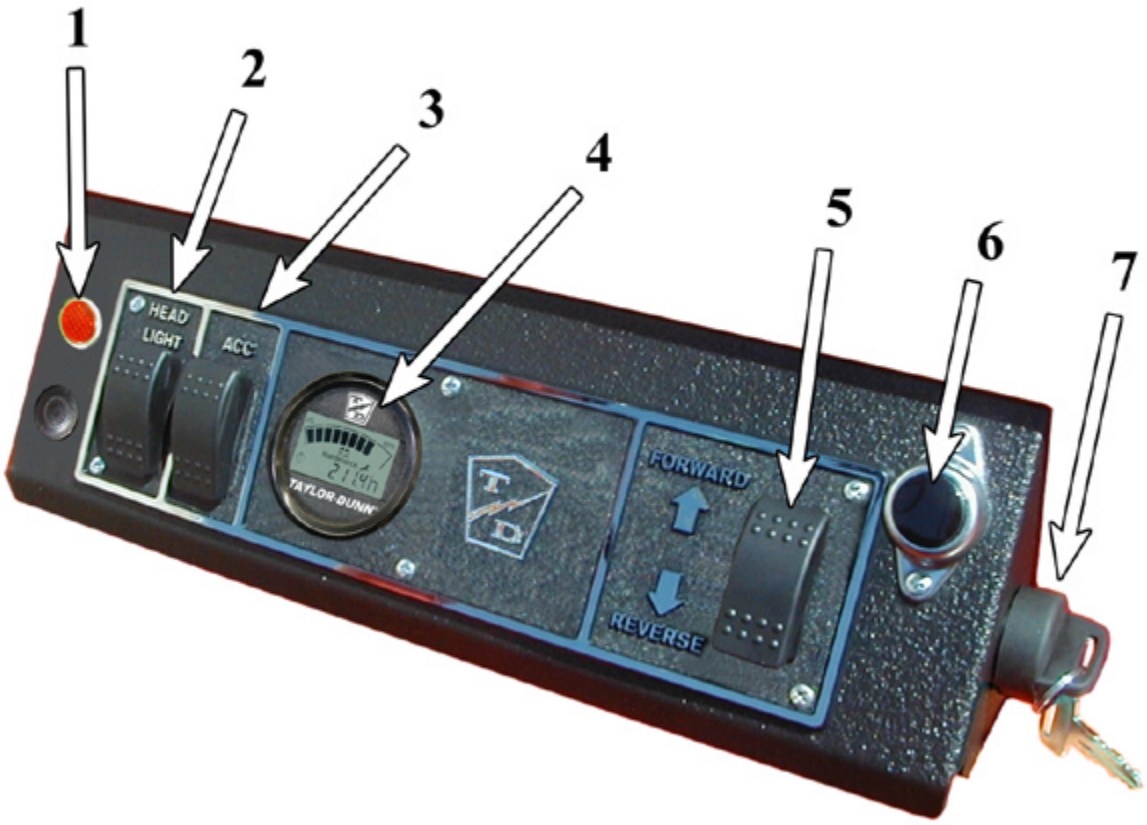
Wheels and Tires

Illustration not available

Wheels and Tires

Item #	Part #	Description	Qty
	13-957-10	REAR TIRE ASSEMBLY, 18X5X14, 8 HOLES	2
	10-262-00	TIRE, 18 X 5 X 14 SMOOTH	2
	12-055-00	WHEEL, CAST IRON, 8 HOLE, 14 OD	2
	13-952-10	FRONT TIRE ASSEMBLY, 16 X 4 X 12-1/8, 5 HOLE	2
	10-250-00	TIRE, 16 X 4 X 12 1/8 SMOTH	2
	12-050-00	WHEEL, IRON 5-HOLE, 12-1/8 OD	2
	97-236-00	Wheek nut	26

Instrument Panel (dash)



Instrument Panel

Item #	Part #	Description	Qty
1	72-018-23	Motor temperature warning light	1
2	71-039-11	SPST switch	1
3	71-039-11	SPST switch	1
4	74-010-00	Smart view display	1
5	71-039-02	F&R switch	1
6	71-501-00	Horn switch	1
7	71-120-10	Key switch	1
	71-120-90	Spare key	1
	01-200-09	Instrument panel housing	1
	K49-700-26	Instrument panel housing cover	1
	94-304-11	Instrument panel face plate, 1-hole	1
	88-817-07	Screw, face plate mouning	6
Not shown	71-119-99	Key switch spacer	1
	75-152-83	Harness	1

NOTE: If your vehicle was not originally equipped with the Smart View display, then the Sevcon speed control must be reprogrammed before the display will function.

If you have the Smart View display and wish to have the maintenance feature turned on, then the Sevcon speed control must be reprogrammed.

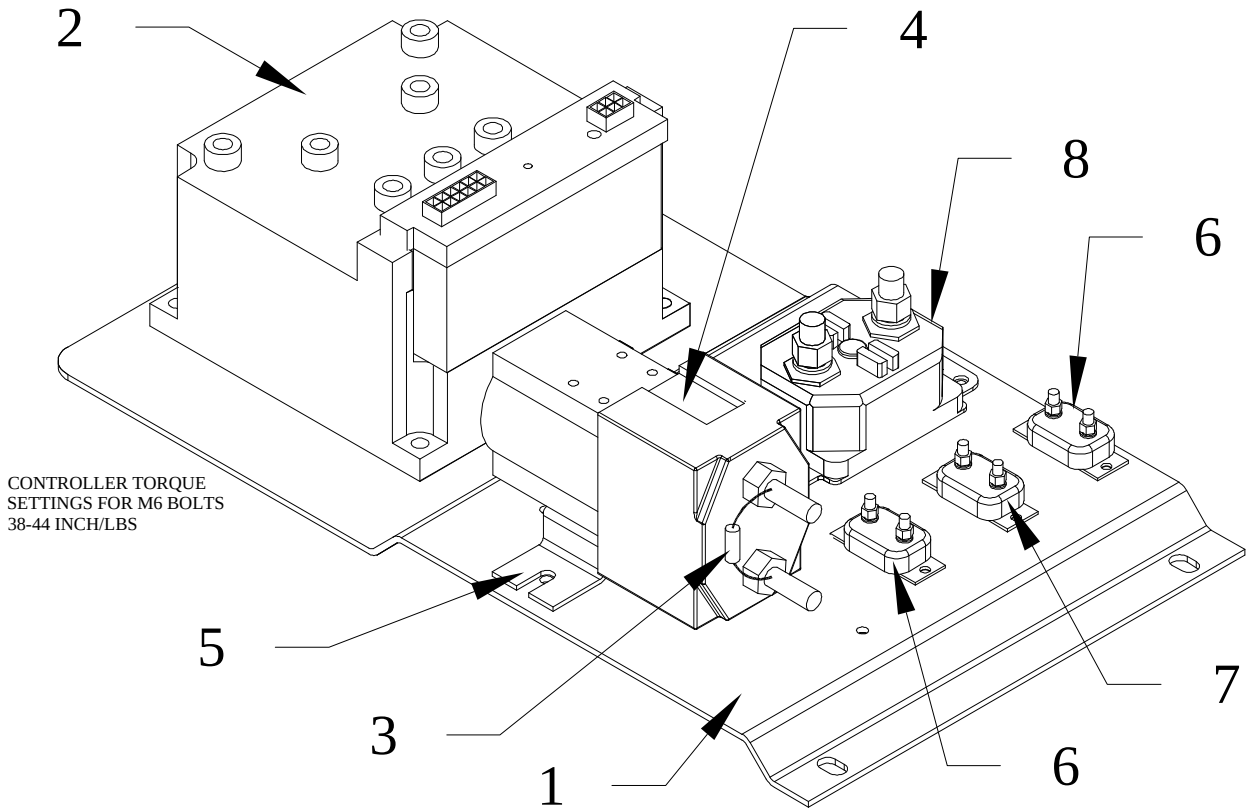
To reprogram the Sevcon speed control, the speed control must be returned to the factory. Contact your local Taylor-Dunn® distributor for more information.

The Smart View Display will only work with the Sevcon control system.

Resetting the Smart View Display

The meter should only be reset after the preventative maintenance has been performed. Taylor-Dunn® part number 62-027-40 Hand set (available with instructions as part number 62-027-61) must be used to reset the meter. Refer to the handset instructions (D0-100-08) for information on the procedure to reset the display.

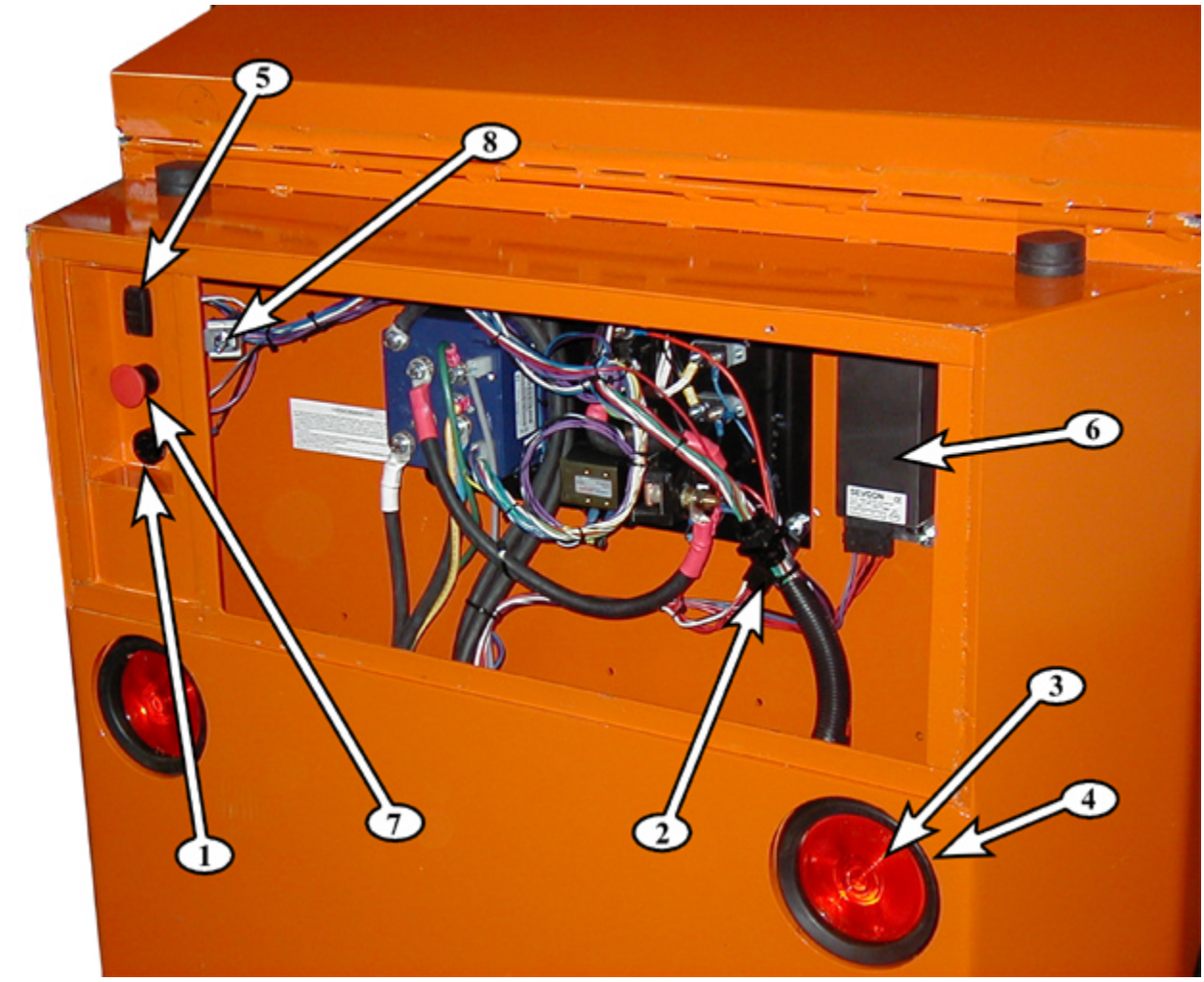
Speed Control Panel



Speed Control panel

Item #	Part #	Description	Qty
1	01-200-05	Mounting plate	1
2	62-400-10	Motor speed control	1
	88-067-15	1/4NC X 1.75 OVAL PHLP HD SCR	4
	88-068-61	1/4 SAE WASHER	4
	88-069-81	1/4NC NYL INS LOCKNUT,PLTD	4
	94-422-21	Heat sink paste (13.5 oz tube.)	
3	69-068-60	Resistor (ISO)	1
4	71-210-13	ISO contactor	1
5	71-210-11	Mount, contactor	1
	88-838-06	#14X1/2 PAN HD SCR TYPE D THD	2
6	79-840-00	Circuit breaker, 10A	2
	88-818-06	#8 X 1/2 PAN HD SCR TYPE B THD	4
7	79-840-20	Circuit breaker, 20A	1
	88-818-06	#8 X 1/2 PAN HD SCR TYPE B THD	2
8	79-844-20	Circuit breaker, 200A	1
	88-818-06	#8 X 1/2 PAN HD SCR TYPE B THD	2
	K49-300-01	Harness, control wires	1
	K49-300-02	Harness, power wires	1

Miscellaneous Electrical



Miscellaneous Electrical

Item #	Part #	Description	Qty
1	73-005-05	Alarm reverse/motion	1
2	71-303-01	Relay, DC converter output	1
3	72-022-00	Tail light	2
4	72-022-51	Mounting ring, tail light	2
5	K4G-SW-001	Switch, inching	1
6	73-012-30	DC-DC converter	1
7	71-124-20	Switch, battery disconnect	1
	71-124-21	Switch contact, battery disconnect	2
8	71-120-30	Inching switch	1
	62-033-48	Throttle module	1
	71-102-10	Switch, Seat interlock	1
	85-030-00	Spring, seat interlock	2
	02-610-18	Mount, seat interlock	1
	96-773-00	Clevis pin, seat interlock	2
	73-004-20	Horn	1
	K49-300-00	Harness, main control	1
	72-005-00	Head light assembly	2
	72-072-00	Head light bulb	2
	94-312-05	Label, inching switch	1

Miscellaneous Frame and Body

Frame and Body

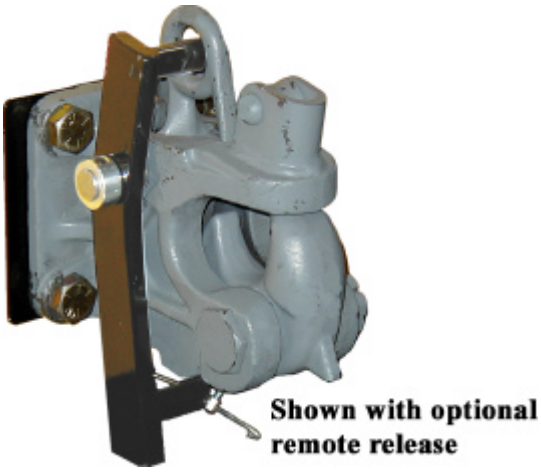
Item #	Part #	Description	Qty
1	76-020-11	Battery connector	1
	K4G-CO-002	CONN,SB350,MAN RELEASE,HANDLE	1
	K4G-CO-001	CONN,SB350,MAN RELEASE,MOUNT	1
2	98-753-05	Bump stop (front and rear)	4
3	K49-700-21	Battery lid	1
4	90-000-00	Seat back (lower)	1
5	90-000-00	Seat back (upper)	1
6	95-510-00	Handle	2
7	97-308-00	latch	2
	97-308-10	latch bracket	2
8	*	Battery lid latch	
9	90-197-20	Seat cushion	1
10	96-102-00	U-bolt	1
11	00-202-12	Column cover	1
12	98-200-00	Brake pedal pad, rubber	1
13	01-110-20	Accelerator pedal	1
	K49-700-25	Master cylinder cover (unders seat)	1
	K49-700-20	Electronics cover (at rear of frame)	1
	K49-700-22	Plywood deck under battery cover	1
	50-114-00	HINGE ROD FOR BATT BOX LID	1
	77-853-00	Battery locator	2
*	Not available at time of printing		1

Decals

Decals

Item #	Part #	Description	Qty	
1	94-313-00	DECAL, BATTERY WARNING	1	...
2	94-320-05	DECAL NO RIDERS	2	
3	94-328-16	DECAL 600 LB DBP	3	
4	94-301-09	TAYLOR-DUNN	2	
5	94-384-01	DECAL,NOT MOTOR VEHICLE	1	
6	94-384-14	DECAL,WARNING,WHEN LEAVING VEHICLE	1	
7	94-384-21	DECAL, NOTICE,AUTO PARK BRAKE	1	
8	94-373-10	Dala plate	1	
9	94-313-20	DECAL, SAFETY WARN	1	...
10	94-319-00	DECAL,BATTERY DISCONNECT	1	
11	94-301-41	Brake Fluid	1	
12	94-301-43	Arms and Legs	1	
	K25-300-23	DECAL, INSTR, E.BRAKE BYPASS located in electrical box	1	
	94-319-00	DECAL,BATTERY DISCONNECT (rear panel)	1	...

Hiches



Auto-Coupling pintle
30,000 lbs MAX

Auto-Coupling
15,000 lbs MAX

Pintle
15,000 lbs MAX

Hitches

Item #	Part #	Description	Qty
	97-814-00	Auto-Coupling pintle, 30,000 lbs	
	88-220-18	3/4 X 2-1/2 NC HH CAP SCR, GR8	4
	88-220-83	3/4 NC HEX HEAD NUT, GR 8	4
	88-229-62	3/4 LOCKWASHER	4
	97-808-00	Auto-Coupling, 15,000 lbs	
	88-140-14	1/2 X 1 1/2 NC HD SCREW	4
	88-149--80	1/2 NC HEX HD NUT	4
	88-148-62	1/2 IN. LOCK WASHER	4
	97-804-01	Pintle, 15,000 lbs	
	88-140-14	1/2 X 1 1/2 NC HD SCREW	4
	88-149--80	1/2 NC HEX HD NUT	4
	88-148-62	1/2 IN. LOCK WASHER	4 ...

TAYLOR - DUNN

Appendixes

Contents

APPENDIX A: SPECIAL TOOLS

DESCRIPTION	PURPOSE	PART NUMBER
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 accellerator module part number series 62-033-XX.	62-027-31
Sevcon® Handset Analyzer (read only)	Used to test the Sevcon® control systems and reset the Smart View display maintenance meter (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

APPENDIX B: SUGGESTED TORQUE LIMITS FOR STANDARD HARDWARE

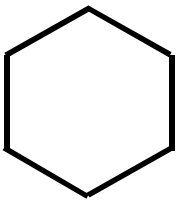
HARDWARE IDENTIFICATION

Standard Head Markings

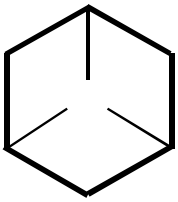
NOTE: Torque value used should be for lowest grade of hardware used. If a grade 2 nut is used on a grade 8 bolt, use grade 2 torque value.

NOTE: Toque values specified are for clean dry threads.

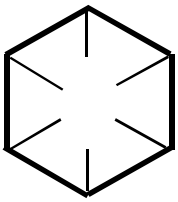
Hex Bolts



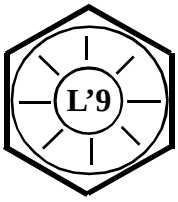
S.A.E. Grade 2



S.A.E. Grade 5



S.A.E. Grade 8



L'9

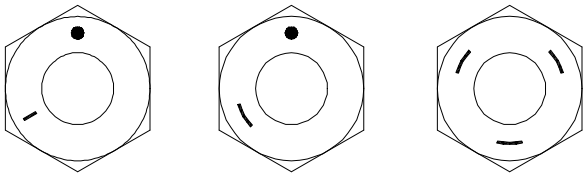
Other Bolts

Truss Head, grade 2

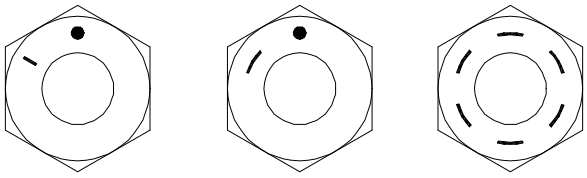
Carriage Bolt, grade 2
(unless marked as above)

Hex Nuts

Nuts with no markings are to be treated as S.A.E. Grade 2



S.A.E. Grade 5

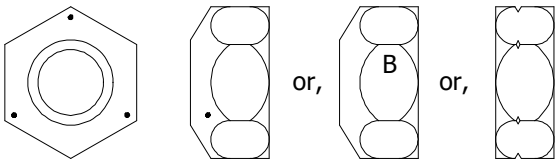


S.A.E. Grade 8

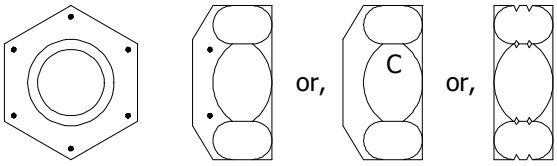
Hex Lock Nuts (stover)

Lock nuts use a letter to indicate the grade of the nut. Grade A' locknuts would be the equivelent of Grade '2' hex nuts, Grade 'B' as Grade '5' and Grade 'C' as Grade '8'.

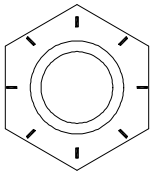
NOTE: Nuts with no markings are to be treated as S.A.E. Grade A



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

Group	Description	Torque Range Ft-Lbs	In-Lbs	Nm
Brakes				
	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
Electrical				
	Battery terminals	8 - 9	96 - 108	10.9 - 12.2
Front Axle				
	Front spindle nut	-	-	-
	Note: Refer to maintenance section in the service manual			
	King pin	-	-	-
	Note: Refer to maintenance section in the service manual			
Rear Axle/Transmission				
	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
Steering				
	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
Suspension				
	Leaf spring hangers	-	-	-
	Note: Refer to maintenance section in the service manual			

APPENDIX C: BRAKE LINING HANDLING PRECAUTIONS

⚠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

Mailing Address:
P.O. Box 4240
Anaheim, California 92803

Visit our Website:
www.taylor-dunn.com