

**The Best Way
To Go
About Your
Business**

TAYLOR-DUNN®



*Models Included:
E0-455-24 (E 4-55GT)*



Standard Equipped with the GT Drive System

MANUAL ME-455-01

*Operation, Troubleshooting and
Replacement Parts Manual*

**Published: 3/7/2003
Revision: G, 1/31/2011**

Serial number Range: 151716 through 182562

Taylor-Dunn Contact information

Service, Parts, Sales:

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

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

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





B2-48 With Dump Bed Option



B2-10 Ambulance



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



P2-50 30,000 Pound Tow Tractor



ET 3000



ET1-50 Full Size Truck

Contents

Introduction	1	General Maintenance	1
About this manual	2	Maintenance Guidelines	2
Who Should Read This Manual	3	Maintenance Guidelines for Vehicles	
Responsibilities	3	Used in Severe Conditions	3
How To Use This Manual	4	Troubleshooting Guide	4
Conventions	5	Lubrication Chart	5
How to Identify Your Vehicle	6		
Taking Delivery of Your Vehicle	7		
Safety Rules and		Front Axle Service	1
Operating Instructions	1	Inspect the Front Wheel Bearings	2
Standard Specifications	2	Adjust Front Wheel Bearings	3
Safety Rules and Guidelines	3	Front Axle Removal and Installation	4
Driver Training Program	4	Removal	4
Driver Qualifications	4	Installation	4
Vehicle Controls	5	Replace Front Wheel Bearings	5
Key-Switch	5		
Forward-Off-Reverse Switch	5	Steering Component Service	1
Accelerator Pedal	5	Front End Alignment	
Steering	5	Serial numbers up to 155559	2
Foot Brake Pedal	6	Front End Alignment	
Park Brake	6	Serial numbers after 155559	3
Horn Switch	6	Inspect the Steering Components	4
Seat Interlock Switch	6	Pillow Bearings (E 4-55)	4
Headlight Switch	7	Ball Joints	4
Hour Meter (Optional)	7	Spherical Rod Ends	5
Battery Status Indicator, Analog	7	Fork Bearings	5
Battery Status Indicator, Digital Bargraph	8	Adjust the Steering Gear	6
Reverse or Motion Alarm (Optional)	8	Replace the Steering Shaft	8
Electrolyte Alarm (Optional)	8	Replace the Steering Gear	9
Directional Signals (Optional)	8	Center the Steering Gear	10
Hazard Light Switch (Optional)	9	Pitman Arm Alignment	10
Accessory Switch (Optional)	9	Replace the Front Fork	11
Smart View Display	10	Replace the Ball Joints, Tie Rods, and	
Vehicle Operational Guidelines	13	Drag Link	12
Safety Guidelines	13	Replacing the Drag Link	14
Starting	13	Replacing the Tie Rod	15
While driving:	14	Repair the Steering Gear	16
Loading and Unloading	13	Exploded View of Steering Gear	19
Towing Loads	13		
Parking	14	Brake Service	1
Draw bar Pull, Definition	14	Inspect the Service Brake	2
Towing this Vehicle	14	Disc Brake Pads	2
Charging your vehicle	15	Disc Brake Rotor	3
Operation of the Charger	15	Inspect the Parking brake	4
New Battery Break in	15	Wheel Park Brake (hydraulic disc)	4
Storing and Returning to Service	16	Adjust the Service Brakes	5
Storing your Vehicle	16	Two or Four Wheel Hydraulic Disc Brakes	5
Returning To Service	17	Adjust the Parking Brake	
Periodic Maintenance Checklist	18	S/N up to 155559	6
Standard Periodic Maintenance		Wheel Park Brake (hydraulic disc)	6
Schedule for the Smart View Display	19	Adjust the Parking Brake	
Daily Visual Inspection	20	After S/N 155559	8
Maintenance Guidelines for		Wheel Park Brake (hydraulic disc)	8
Severe Duty Applications	20	Check Master Cylinder Fluid	10
		Bleed the Brakes	11
		Flush the Brake System	13



Table of Contents

Replace Rear Brake Pads or Shoes	14
Hydraulic Disc	14
Replace the Wheel Cylinder	16
Disc Brake Body Assembly	16
Repair the Brake Body	18
Replace the Master Cylinder	20
Repair the Master Cylinder	22
Motor Service	1
Inspecting the Motor Brushes	2
Motors with internal cooling fans	2
Motor Removal and Installation	3
Motor Inspection	3
Replacing the Brushes or	
Armature Bearing	7
Repairing the Commutator	8
Service Limits	10
Transmission	1
Check Oil Level	2
Change Oil	3
Motor Removal and Installation	4
Rear Hub or Rotor	5
Removing and Installing the Rear Axles ..	6
Transmission Assembly	8
Remove and Install	8
Disassembly and Reassembly of the	
Primary Reduction Gear Case	10
Disassembling the 3rd Member	13
Assembling the 3rd Member	16
Pinion Bearing Preload	19
Pinion Gear Shimming Instructions	20
Setting the Pinion Gear Depth	20
Suspension	1
Replace the Rear Springs	2
Rubber Springs (bushings)	2
Tire Inflation	2
Tire Inspection	2
Replace the Front Tire/Wheel Assembly ..	3
Replace the Rear Tire/Wheel Assembly ..	3
Repair the Tire	4
Replace the Tire (pneumatic)	5
Battery Service	1
Cleaning	2
Testing	3
Watering	5
Charging	6
Replacing (6-volt batteries only)	7
Moist Charge Batteries	9
Storage and Returning to Service	10
Storage	10
Returning to Service	11

Sevcon Control System	
Troubleshooting	1
Test Equipment Required:	2
Important Notes and Instructions	2
Definitions:	2
Terminology used:	2
Identifying your Controller	3
Start Troubleshooting Here	4
Test 8. Anti-Rolloff Fault	17
Test 9. Electric Motor Brake	18
Sevcon Logic Voltage Reference Table	20
Status LED Code Table	21
Smart View Fault Codes	22

Charger Troubleshooting	1
--------------------------------------	----------

Wire Diagrams	1
Chassis	2
Control Panel	3
Accelerator Module Detail	4

Illustrated Parts	1
Front Axle and Fork	2
Steering Linkage	4
Steering Column (standard)	6
Steering Column (tilt)	8
Steering Gear Assembly	10
Transmission Primary Gear Case	12
Transmission Differential Case	14
Rear Axle	14
Rear Brakes	16
Rear Suspension	18
Motor	20
Master Cylinder	22
Hydraulic Brake Lines	24
Park Brake linkage up to S/N 155559	26
Park Brake linkage After S/N 155559	26
Wheels and Tires (rear)	28
Instrument Panel (dash)	30
Speed Control Panel	32
Miscellaneous Electrical and Wiring	34
Lights and Horn	36
Battery Compartment	38
Driver Seat	40
Miscellaneous Frame Components	42
Hitches	42
Decals	44
Mirrors	46
Strobe Light Option	48
Electric Motor Brake	60

APPENDIX A-Special Tools	A-1
---------------------------------------	------------

APPENDIX B-Torque Values	B-1
---------------------------------------	------------

Appendix C	1
Brake Lining Handling Precautions	2



Introduction

Contents

About this manual 2

Who Should Read This Manual 2

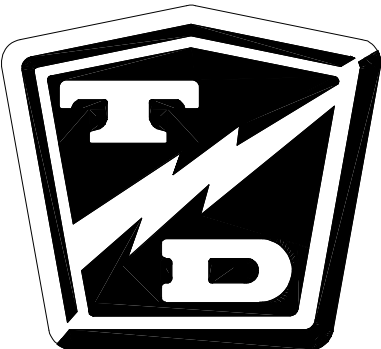
Responsibilities 3

How To Use This Manual 4

 Conventions 4

How to Identify Your Vehicle 6

Taking Delivery of Your Vehicle 7





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.



INTRODUCTION

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.

Conventions

Symbols and/or words that are used to define warnings, cautions, instructions, or notes found throughout this manual:

 WARNING

or,

 WARNING

A shaded box with the word “Warning” on its left 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.

 CAUTION

The symbol at the left and the bold text contained within a box 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 within a caution.

NOTE: Alerts the reader to additional information about a subject.



INTRODUCTION

HOW TO IDENTIFY YOUR VEHICLE

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

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

⚠ WARNING

This vehicle is not designed to be driven on public roads or highways. It is available in maximum designed speeds ranging from 5 to 8 mph. Do not exceed the maximum designed speed. Exceeding the maximum designed speed may result in steering difficulty, motor damage, and/or loss of control. Do not exceed locally imposed speed limits. Do not tow at more than 5 mph.

This vehicle conforms to requirements for Type E vehicles as described in O.S.H.A. Standard Section 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.



B2-48 With Dump Bed Option



B2-10 Ambulance



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



P2-50 30,000 Pound Tow Tractor



ET 3000

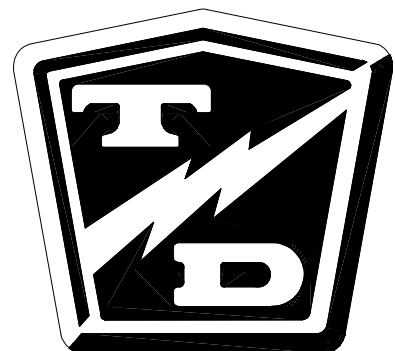


ET1-50 Full Size Truck

Safety Rules and Operating Instructions

TABLE OF CONTENTS

Standard Specifications	2	Vehicle Operational Guidelines	13
Safety Rules and Guidelines	3	Safety Guidelines	13
Driver Training Program	4	Starting:	13
Driver Qualifications	4	While driving:	13
Vehicle Controls	5	Loading and Unloading	13
Key-Switch	5	Towing Loads:	13
Forward-Off-Reverse Switch	5	Parking	14
Accelerator Pedal	5	Draw Bar Pull (DBP), definition	14
Steering	5	Towing this Vehicle	14
Foot Brake Pedal	6	Charging your vehicle	15
Park Brake	6	Operation of the Charger	15
Horn Switch	6	New Battery Break in	15
Seat Interlock Switch	6	Storing and Returning to Service	16
Headlight Switch	7	Storing your Vehicle	16
Hour Meter (Optional)	7	Returning To Service	17
Battery Status Indicator, Analog	7	Periodic Maintenance Checklist	18
Battery Status Indicator, Digital Bargraph	8	Standard Periodic Maintenance Schedule	
Reverse or Motion Alarm (Optional)	8	for the Smart View Display	19
Electrolyte Alarm (Optional)	8	Daily Visual inspection:	20
Directional Signals (Optional)	8	Maintenance Guidelines for	
Hazard Light Switch (Optional)	9	Severe Duty Applications	20
Accessory Switch (Optional)	9		
Smart View Display	10		





SAFETY RULES AND OPERATING INSTRUCTIONS

STANDARD SPECIFICATIONS

ITEM	SPECIFICATION
Occupancy	Driver only, no passengers
Dimensions	1962L X 889W X 1099H Millimeters 77.25L X 35W X 43.25H Inches
Turning Radius	2286 Millimeters (90 inches)
Dry Weight (Without Battery)	812 kg (1790 lbs)
Battery Compartment Dimensions	844L x 355W x 635H Millimeters 33.25L x 14.W x 25H inches
Battery specifications: Min/Max Battery Weight Voltage Connector Lead Length Position Cover	454 kg to 635 kg (1000 lbs to 1400 lbs) 24 SB 175 grey 762 millimeters (30 inches) B Yes
Maximum Towed Load	79 kg Draw Bar Pull @ 9.7 kph 175 lb. Draw Bar Pull @ 6 mph
Electrical System	Solid State Speed Control, 400 Amp
Transmission	Helical Gear, Oil Bath, Automotive Type Hypoid Differential.
Motor, DC Separately Excited Field	4.25 kW, (5.7 Horse Power) for 5 min
Maximum Recommended Speed	12.9 kph (8 mph)
Brakes	Rear Wheel Hydraulic Disc, Hand Operated Park Brake
Steering	Automotive Steering 24:1
Tires	Two 4.00 X 8 Soft Solid Zero Pressure (rear) Two 9.75 x 4 Solid (front)
Instrumentation	Battery Discharge Indicator, Key Switch, Horn Button, Forward/Reverse Switch, Headlight Switch Hour Meter
Light Accessories	Headlight, Tail/Brake Light



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 the 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

This vehicle is not designed to be driven on public roads or highways. It is available in maximum designed speeds ranging from 7 to 15 mph. Do not exceed the maximum designed speed. Exceeding the maximum designed speed may result in steering difficulty, motor damage, and/or loss of control. Do not exceed locally imposed speed limits. Do not tow at more than 5 mph.

⚠ 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.

- Do not drive this vehicle unless you are a qualified and trained operator.
- Keep all body parts (head, arms', legs') inside the vehicle while it is moving.
- Drive slowly when making a turn especially if the ground is wet, slippery or when driving on an incline.
- This vehicle may overturn easily if turned sharply, driven at high speeds, or when on an incline.
- Drive only on level surfaces or on surfaces having an incline of no more than 10% (5.6 degrees).
- Do not drive over loose objects, holes, or bumps.
- Observe all traffic regulations and speed limits (see speed warning above).
- Keep to the right under normal conditions.
- Maintain a safe distance from all objects.
- 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.
- Keep a clear view ahead at all times.

⚠ 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 Operator Controlled Industrial Tow Tractors ANSI B56.9.

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

Key-Switch



A key-switch, located on the lower left 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.

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 SHIFT 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 key-switch off and the park brake set whenever the operator leaves the vehicle.

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.

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.



SAFETY RULES AND OPERATING INSTRUCTIONS

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.

Park Brake



The parking brake is actuated with a hand lever, which is located to the right of the driver seat. To set the parking brake, depress the foot brake while pulling up on the park brake handle. To release the parking brake, pull up on the handle, depress the button on the end of the handle, then release the handle.

Horn Switch



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

Seat Interlock Switch



A switch located to the rear of 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, they should turn the key-switch Off, place the forward-off-reverse switch in the center "OFF" position, and set the park brake.

⚠ WARNING

The seat interlock switch is only one part of the vehicle safety system. The interlock switch should not be relied upon as the only safety feature used to disable or disengage this vehicle. Doing so could result in unexpected movement of the vehicle causing severe bodily injury and/or property damage.



Headlight Switch



The headlight switch is located on the far 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.

Hour Meter (Optional)



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

Battery Status Indicator, Analog

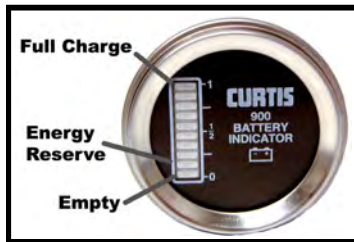


The battery status indicator is located to the left of the hour meter. The normal operating range is in the green zone. Park the vehicle for a few minutes for an accurate reading. The vehicle needs charging if it is in the yellow zone. During and immediately following charging, the needle will be in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



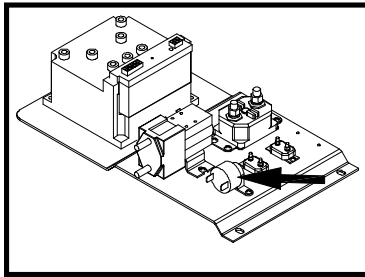
SAFETY RULES AND OPERATING INSTRUCTIONS

Battery Status Indicator, Digital Bargraph



The battery status indicator is located to the left of the hour meter. The battery status indicator has a LED bar graph that indicates the relative state of charge of the battery. The top LED will light only when connected to a fully charged battery or after completing a charging cycle. Successive lower LED's will light as the battery charge diminishes. When the second from the bottom LED flashes the battery energy status is in energy reserve and should be placed on charge as soon as possible. When the two bottom LED's are alternately flashing the batteries are empty and the truck should be taken out of service and charged to avoid damaging the batteries.

Reverse or Motion Alarm (Optional)



The reverse or motion alarm is located in the electronics compartment mounted on the speed control panel or on the rear panel of the vehicle.

The reverse alarm is activated when the key switch is in the "ON" position and the Forward-off-Reverse switch is in the reverse position. The alarm makes a repeated audible sound.

The motion alarm is activated when the key switch is in the "ON" position and the Forward-off-Reverse switch is in the forward or reverse position. The alarm makes a repeated audible sound.

Electrolyte Alarm (Optional)



The Electrolyte Alarm is located in the battery area, in the 4th battery cell from the main battery positive cable. The Electrolyte alarm is activated when the battery cell fluid level falls below the level of the probe. The alarm is an audible continuous sound along with a bi-color indicator lamp. Inspect the fluid level in all battery cells when the alarm sounds or the bi-color lamp turns from its green color to red. The vehicle batteries should then be filled and/or charged. With the fluid level at a normal operating level and/or the batteries charged the alarm and light will reset.

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.

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 an 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.



SAFETY RULES AND OPERATING INSTRUCTIONS

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 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.

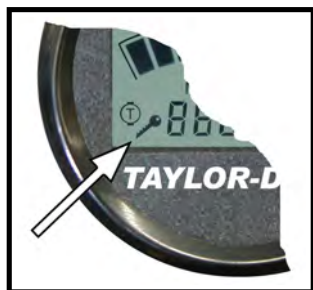
At 90%, all segments will flash and the vehicles speed will be reduced. At this time, the vehicle should be removed from service for charging. Discharging beyond 90% will result in damage to the batteries that will shorten the battery life-span.

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.

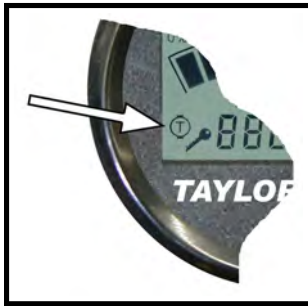
Run Time Hours is the accumulated length of time that the vehicles has been in operation. Time is accumulated when the FS-1 switch in the accelerator module is closed.

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 icon

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



SAFETY RULES AND OPERATING INSTRUCTIONS

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.



Display showing Maintenance and Wrench icons

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.

NOTE: The vehicle is equipped with a seat or foot interlock switch. This switch must be closed BEFORE the throttle is depressed.

1. Make sure the forward-off-reverse switch is in the "OFF" position.
2. Set the parking brake.
3. Hold down the foot brake.
4. Insert the key and turn it to the "ON" position.
5. Wait 1-second then place the forward-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 DBP towing capacity of the tractor. See vehicle specifications and DBP definition.
- 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.



SAFETY RULES AND OPERATING INSTRUCTIONS

Parking

Before leaving the vehicle:

- Set the parking brake.
- Set the forward-off-reverse switch to the center "OFF" position.
- Turn the key switch to the "OFF" position and remove the key.

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.

Draw Bar Pull (DBP), definition

DBP is a measure of pulling force required to move a load. The load may be a trailing load or a pushed load. It is normally expressed in pounds or Newtons.

The DBP of a tow tractor is the horizontal force exerted on a load at its coupler while towing or pushing a load. To measure the DBP, a scale would be connected in line with the tractor coupler and the load. The scale will directly read the DBP as the tractor tows the load.

Tow tractor DBP specifications, definition:

Normal DBP: Highest DBP that can be sustained for a given duty cycle.

Ultimate DBP: Also referred to a Maximum DBP. Highest DBP achieved while travelling at a minimum speed of approximately 0.5 mph (0.8 kph) for a minimum of 30 seconds. This specification is used in calculations for getting a load moving.

Notes:

Tow tractor DBP specifications are based on:

- Road surface consisting of level dry clean asphalt, brushed concrete or equivalent.
- Maximum battery weight installed per tow tractor battery specification.

Towing a load up any grade will significantly affect the DBP required.

Most paved roads and parking lots have a drainage grade to allow water to run off. When operating a tow tractor at or near its maximum capacity, this drainage grade will greatly affect DBP required to pull the load and may exceed the tractor specifications.

⚠ 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.

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

⚠ 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.

Towing this Vehicle

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

NOTE: If the vehicle is equipped with an automatic electric brake, do not tow the vehicle with the drive wheels on the ground.

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 it.



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.

Operation of the Charger

The charger supplied with this vehicle is either specified by or provided by the end user. Refer to the operating instruction supplied with your charger or contact the charger manufacturer for more information.

New Battery Break in

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

To obtain the maximum battery life:

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

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

Check the battery electrolyte once a week. Do not charge the batteries if the battery electrolyte is low.



SAFETY RULES AND OPERATING INSTRUCTIONS

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 **General Maintenance** section 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:

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



Returning To Service

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

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

WARNING

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



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 hardware
		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.



SAFETY RULES AND OPERATING INSTRUCTIONS

Daily Visual inspection:

Tire condition and pressure.

External frame damage (body).

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

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

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

Inspect for leaking fluids or grease.

MAINTENANCE GUIDELINES FOR SEVERE DUTY APPLICATIONS

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

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

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

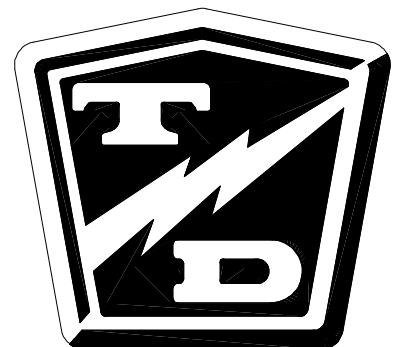
- Extreme temperature.
 - Bumpy, dusty, or ill maintained roads.
 - Excessively wet areas.
 - Corrosive or contaminated areas.
 - Frequent loading of vehicle at/near capacity.
 - Use on multiple shifts.
2. Any deficiencies found during an inspection should corrected before the vehicle is returned to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



General Maintenance

TABLE OF CONTENTS

Maintenance Guidelines	2
Maintenance Guidelines for Vehicles Used in Severe Conditions	3
Troubleshooting Guide	4
Lubrication Chart	5





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 wheels to prevent vehicle movement.
5. Disconnect the main positive and negative cables at the batteries.

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.



MAINTENANCE GUIDELINES FOR VEHICLES USED IN SEVERE CONDITIONS

If this vehicle is operated in severe conditions all maintenance items listed in the Periodic Maintenance Table should be carried out twice as often as stated. In addition, the entire vehicle should be inspected monthly for signs of damage. If any damage is found, the vehicle should be immediately removed from service and repaired.

The following list is meant as a guide and is not all inclusive:

SEVERE CONDITIONS refer to operation:

- In extreme temperatures
- On bumpy, dusty, or poorly maintained roads
- In excessively wet areas
- In corrosive or contaminated areas
- At or near maximum capacity for more than 50% of the operating time
- On multiple shifts

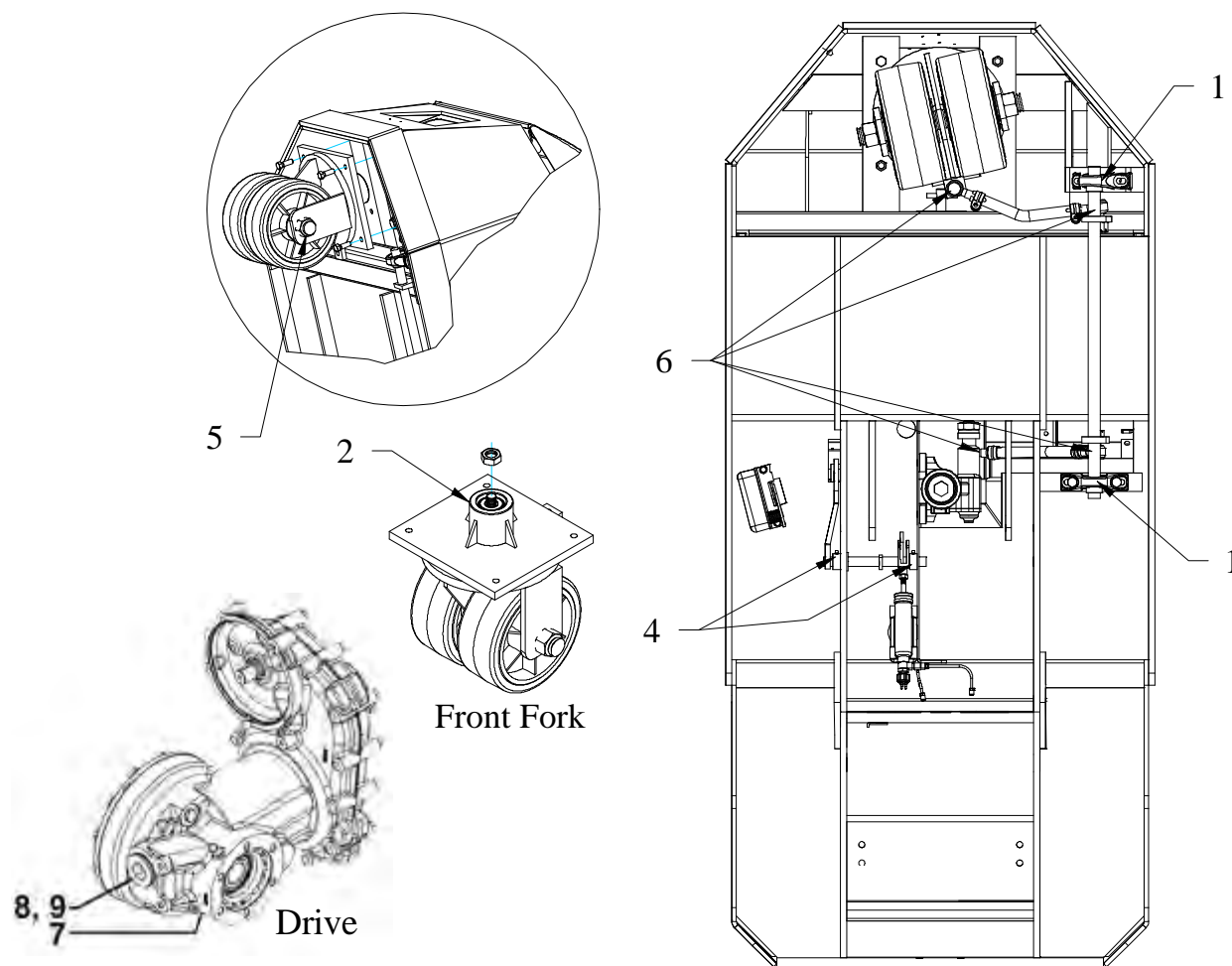


TROUBLESHOOTING GUIDE

Symptom	Probable Cause
Steering Pulls in One Direction	Front Fork or Frame Damaged
	Low Tire Pressure
Hard Steering	Dry Lube Points in Steering Linkage
	Damaged Fork Spindle
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
	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

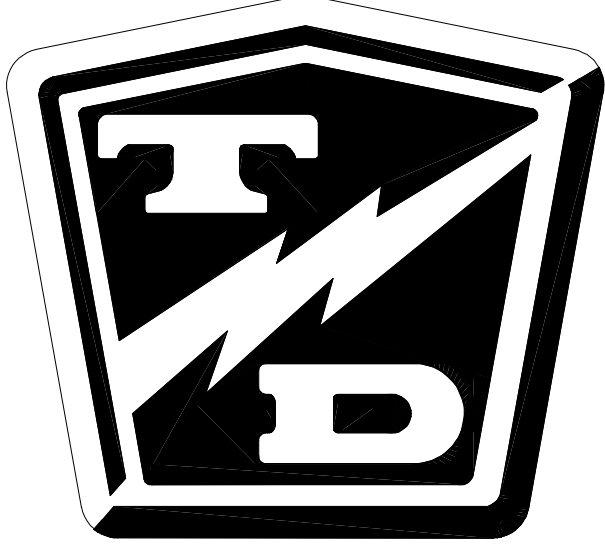


LUBRICATION CHART



#	Description	Locations	Lubricant Type
1	Pillow Bearings	2	General Purpose Grease
2	Fork collar	1	General Purpose Grease
3	-	-	-
4	Pedal Linkages	2	General Purpose Grease
5	Front Wheel Bearings	2	High Temperature Wheel Bearing Grease
6	Ball Joints	4	General Purpose Grease
7	Drive Drain Plug	1	SAE 80W90 Hypoid Gear Oil
8	Drive Level Plug	1	SAE 80W90 Hypoid Gear Oil
9	Drive Fill Plug	1	SAE 80W90 Hypoid Gear Oil

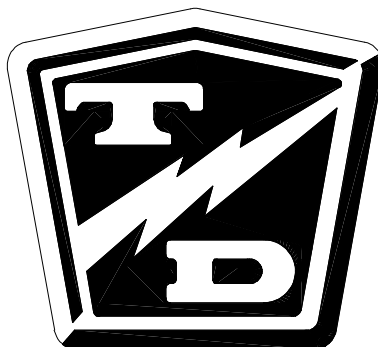
TAYLOR - DUNN



Front Axle Service

TABLE OF CONTENTS

Inspect the Front Wheel Bearings	2
Adjust Front Wheel Bearings	3
Front Axle Removal and Installation	4
Removal	4
Installation	4
Replace Front Wheel Bearings	5





INSPECT THE 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. Set the park brake.
4. Place blocks under the rear wheels to prevent vehicle movement.
5. Disconnect the main positive and negative cables at the batteries.

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

⚠ 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.

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 indication of loose wheel bearings or king pin.
8. Spin the front wheel(s) by hand. The wheel should stop spinning in no more than 2-revolutions. A wheel that continues to spin freely is an indication of a loose wheel bearing.

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

9. Spin the wheel(s) and listen for any grinding noise. Any 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.*

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.





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. Set the park brake.
4. Place blocks under the rear wheels to prevent vehicle movement.
5. Disconnect the main positive and negative cables at the batteries.

6. Raise the front wheel(s) off of the ground and support with jack stands.

⚠ 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.

7. Tighten the front axle until the wheel(s) do not spin freely. To test, spin the front wheel by hand. The wheel should stop spinning in no more than 2-revolutions. If the wheel continues to spin, tighten the axle nut and repeat the test.
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.





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. Set the park brake.
4. Place blocks under the rear wheels to prevent vehicle movement.
5. Disconnect the main positive and negative cables at the batteries.

6. Remove the front axle nut.
7. Slowly raise the front of the vehicle until the axle can slide freely out of the fork. The front wheel(s) should still be resting on the ground.
8. Remove the front axle from the fork and support the vehicle with jack stands.

⚠ WARNING

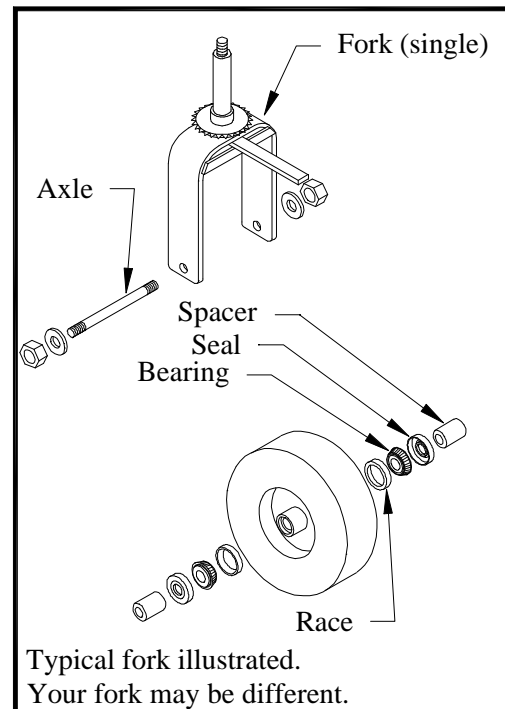
Always use a lifting strap, hoist, and jack stands, of adequate capacity to lift and support the vehicle. Failure to use lifting and support devices of rated load capacity may result in severe bodily injury.

Installation

1. Raise the front of the vehicle so that the hole for the axle is the same height as the front wheel hub.
2. Assemble the bearing spacers into the front wheel hub and place the front wheel(s) into the fork.
3. Insert the axle into the front fork.
4. Install the axle nut(s). Refer to **Adjust Front Wheel Bearings** section for information regarding tightening the front axle.

NOTE: If your vehicle is equipped with two axle nuts, the nuts should be tightened equally so that the same number of axle threads are visible on both ends.

5. Lower the vehicle.
6. Reconnect the main positive and negative cables at the batteries.
7. Remove the blocks from behind the wheels.
8. Release the park brake and test drive the vehicle.



REPLACE FRONT WHEEL BEARINGS

** -Serial number range 183560 through 183613 were assembled with alternate front wheel assemblies. Replacement bearings, races, seals, and spacers are not available for these wheel assemblies. The wheel must be replaced as an assembly. The standard wheel assembly is a direct replacement for the alternate wheels but both wheels must be replaced as a set along with the spacers.

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 rear wheels to prevent vehicle movement.
5. Disconnect the main positive and negative cables at the batteries.

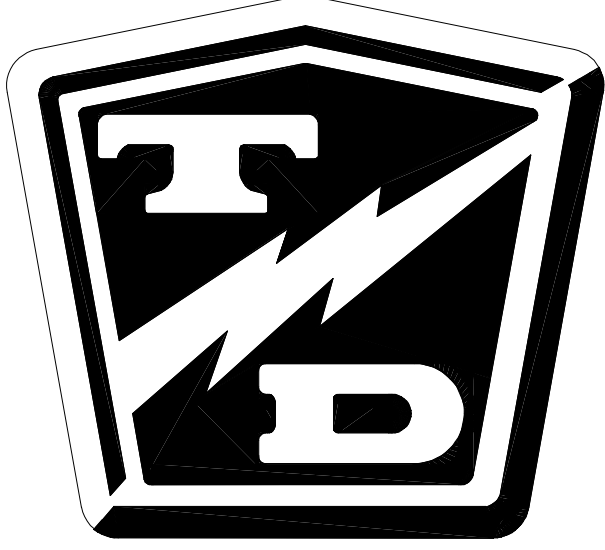
6. Remove the front axle and wheel(s). Refer to **Front Axle Removal and Installation** section for information regarding removing the axle.

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.

7. Remove the spacers, seals and bearings from the hub
8. Thoroughly clean all grease from the inside of the hub and the bearings.
9. Drive the races out from the hub.
10. Press new races into the hub.
11. Assemble in reverse order, using new grease seals.
 - a. Pack bearings with grease.
 - b. Refer to **Front Axle Removal and Installation** section for information regarding installing the axle.
12. Lower the vehicle.
13. Reconnect the main positive and negative cables at the batteries.
14. Remove the blocks from behind the wheels.
15. Release the park brake and test drive the vehicle.

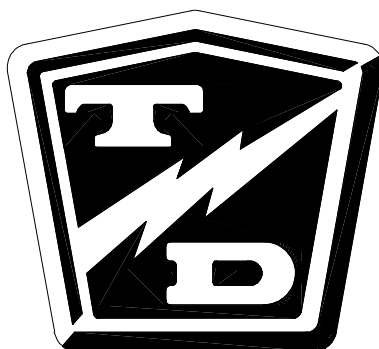
TAYLOR - DUNN



Steering Component Service

TABLE OF CONTENTS

Front End Alignment	
Serial numbers up to 155559	2
Front End Alignment	
Serial numbers After 155559	3
Inspect the Steering Components	4
Pillow Bearings (E 4-55)	4
Ball Joints	4
Spherical Rod Ends	5
Fork Bearings	5
Adjust the Steering Gear	6
Replace the Steering Shaft	8
Replace the Steering Gear	9
Center the Steering Gear	10
Pitman Arm Alignment	10
Replace the Front Fork	11
Replace the Ball Joints, Tie Rods, and Drag	
 Link	12
Replacing the Drag Link	14
Replacing the Tie Rod	15
Repair the Steering Gear	16
Exploded View of Steering Gear	19





FRONT END ALIGNMENT SERIAL NUMBERS UP TO 155559

⚠ WARNING

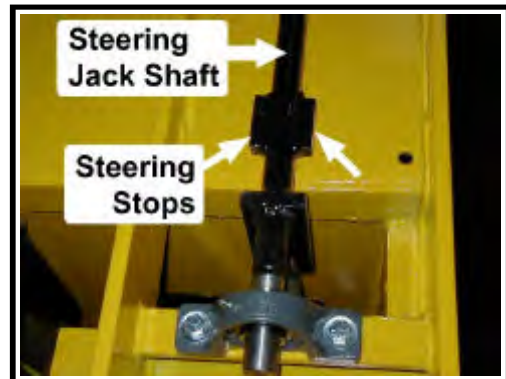
1. Make sure the key-switch is in the "OFF" position, then remove the key.
2. Place the forward-reverse switch in the center "OFF" position.
3. Set the park brake.
4. Place blocks under the rear wheels to prevent vehicle movement.
5. Disconnect the main positive and negative cables at the batteries.

6. Position the front fork so that the wheels are straight ahead and tie it off so that it cannot rotate.
7. Loosen the four ball joint clamps on the front and rear steering links.



Rear steering link

8. Adjust the front steering link so that the steering stops on the jack shaft are equal distance from the frame.
9. Adjust the rear steering link to center the steering wheel.
10. Tighten the four ball joint clamps on the front and rear steering links.
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.



⚠ 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.

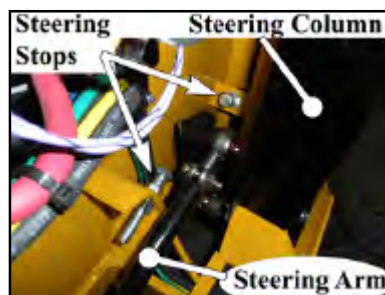
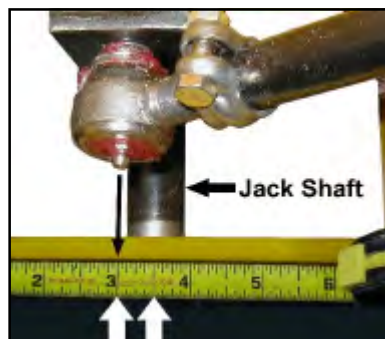


FRONT END ALIGNMENT SERIAL NUMBERS AFTER 155559

⚠ 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 rear wheels to prevent vehicle movement.
5. Disconnect the main positive and negative cables at the batteries.

6. Rotate the steering wheel until the pitman arm is vertical, then tie off the steering wheel so that it cannot rotate.
7. Loosen the four ball joint clamps on the front and rear steering links.
8. Adjust the rear steering link so that the ball joint is 1/2" to the left of the center of the jack shaft.
9. Adjust the front steering link to position the front wheels in the straight ahead position.
10. Tighten the four ball joint clamps on the front and rear steering links.
11. Adjust the pitman arm steering stops so that the front fork rotates approximately 45° to the left and right.
12. Reconnect the main positive and negative cables at the batteries.
13. Remove the blocks from behind the wheels.
14. Release the parking brake and test drive the vehicle.



⚠ 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.



INSPECT THE STEERING COMPONENTS

Pillow Bearings (E 4-55)

NOTE: All pillow bearings will wear at the same rate. If one bearing is worn out, then both bearings should be replaced as a set.

The pillow bearings must be removed from the vehicle for inspection.

Remove the bearing and inspect for play. Any play is an indication of a worn bearing and it should be replaced.

Rotate the bearing by hand. Any grinding or noise is an indication of a worn bearing and it should be replaced.



Front pillow bearing

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

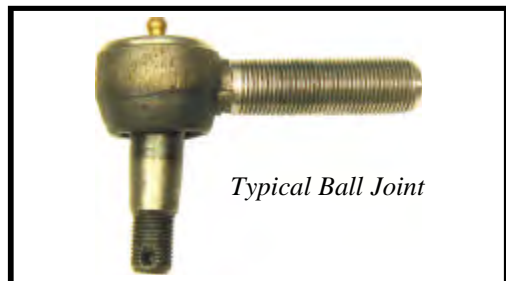
1. Make sure the key-switch is in the "OFF" position, then remove the key.
2. Place the forward-reverse switch in the center "OFF" position.
3. Set the park brake.
4. Place blocks under the rear wheels to prevent vehicle movement.
5. Disconnect the main positive and negative cables at the batteries.

6. Tie off the front fork so that it cannot turn.

⚠ 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. While watching the ball joints, rapidly rotate the steering wheel to the left and right.
8. 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.
9. Untie the front fork.
10. Reconnect the main positive and negative cables at the batteries.
11. Remove the blocks from behind the wheels.
12. Release the parking brake and test drive the vehicle.



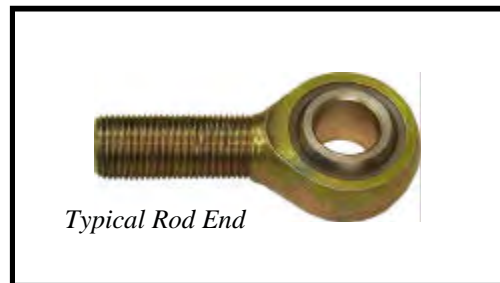
Typical Ball Joint



Spherical Rod Ends

NOTE: Ball joints and rod ends will wear at the same rate. If one is worn out, then all should be replaced as a set.

Use the same inspection procedure as in the **Ball Joints** section with the exception that you are inspecting for any play in the spherical bearing in the rod end. Any play in the rod end indicates that the rod end is worn out and should be replaced.



Fork 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. Set the park brake.
4. Place blocks under the rear wheels to prevent vehicle movement.
5. Disconnect the main positive and negative cables at the batteries.

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

⚠ 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.

7. Inspect for lateral play by attempting to move the fork to the left and right (not rotating), There should be no noticable play.
8. If there is any play in the fork bearings, refer to section **Replace the Front Fork** for information regarding adjusting the fork bearings.
9. Lower the front end to the ground.
10. Reconnect the main positive and negative cables at the batteries.
11. Remove the blocks from behind the wheels.
12. Release the parking brake and test drive the vehicle.



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. Set the park brake.
4. Place blocks under the rear wheels to prevent vehicle movement.
5. Disconnect the main positive and negative cables at the batteries.

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

⚠ 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 serious bodily injury.

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. 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 steering wheel cap.
7. Remove the three screws holding the steering wheel to the steering shaft.
8. Remove the steering column access cover.
9. There are two allen head set screws holding the steering shaft to the universal joint. Only one of the screws must be removed, the other only needs to be loosened. Refer to the illustration. Loosen the jam nuts and and remove/loosen the screws.
10. Once the screws have been removed and loosened, the steering shaft can be pulled up and out of the steering column.
11. Install the shaft in reverse order.
12. Reconnect the main positive and negative cables at the batteries.
13. Remove the blocks from behind the wheels.
14. Release the parking brake and test drive the vehicle.



U-joint removed from shaft

NOTE: Lightly lubricate the upper and lower steering column bushings.



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. Set the park brake.
4. Place blocks under the rear wheels to prevent vehicle movement.
5. Disconnect the main positive and negative cables at the batteries.

6. Remove the steering wheel.

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

7. Remove the steering shaft.

*NOTE: Refer to **Replace the Steering Shaft** section for information regarding removing the steering shaft.*

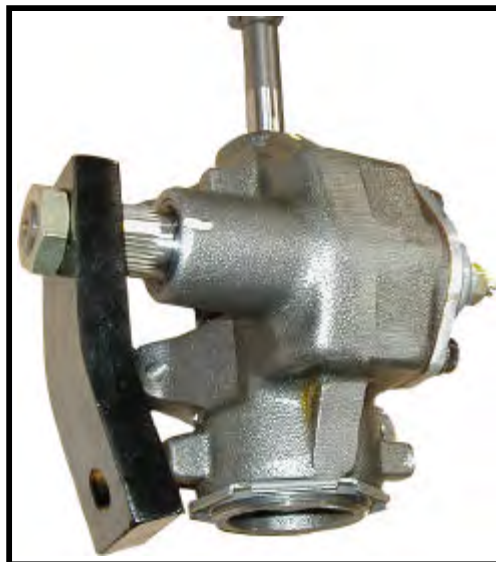
8. Remove the pitman arm using a pickle fork.

*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.*

9. Support the steering gear so that it cannot fall out of the vehicle.

⚠ WARNING

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



Steering Gear with Pitman Arm (typical)

10. Remove the bolts holding the steering gear to the vehicle frame and remove the steering gear from the vehicle.

11. Install in reverse order. Torque the pitman arm nut to 75-100 ft-lbs.

*NOTE: Refer to section **Pitman Arm Alignment** for information regarding the correct position of the pitman arm*

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



CENTER THE STEERING GEAR

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

PITMAN ARM ALIGNMENT

Center the steering gear. Refer to section ***Center The Steering Gear*** for information on centering the steering gear.

Install the pitman arm so that it is parallel with the input shaft.

Torque the pitman arm nut to 75-100 ft-lbs.



Pitman arm shown parallel with the steering shaft.

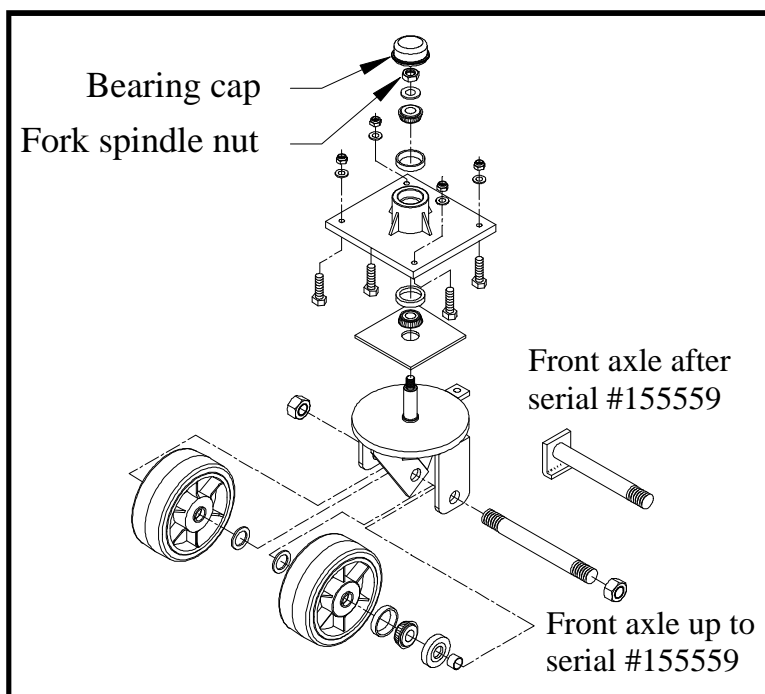


REPLACE THE FRONT FORK

⚠ 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 front axle. Refer to section **Front Axle Removal and Installation** in **Front Axle Service** for information regarding removing the front axle.
7. Remove the ball joint from the fork.
8. While supporting the front fork so that it cannot fall out of the vehicle, remove the fork spindle nut and remove the fork from the vehicle.
9. Thoroughly clean all parts and install in reverse order.
 - Tighten the fork spindle nut to remove all play in the fork bearings and then an additional 1/4 turn.
 - Refer to section **Front Axle Removal and Installation** in **Front Axle Service** for information regarding installing the front axle.
 - If the fork was replaced with a new fork the front end should be realigned. Refer to section **Front End Alignment** for information regarding aligning the front end.
10. Lower the wheels to the ground.
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.





REPLACE THE BALL JOINTS, TIE RODS, AND DRAG LINK

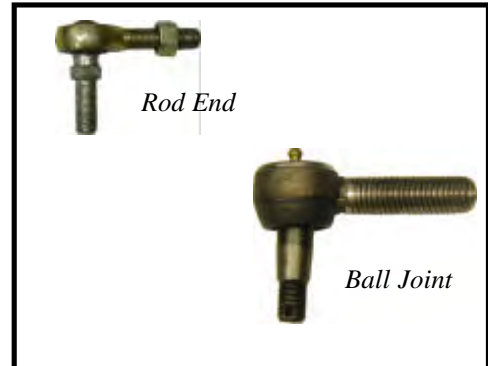
This section will refer to two different types of ball joints. One type has a grease fitting and a tapered shaft where it is installed on the steering arm or pitman arm. The second cannot be greased and has a straight shaft. See the illustrations to the right. Depending on the configuration of your vehicle,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

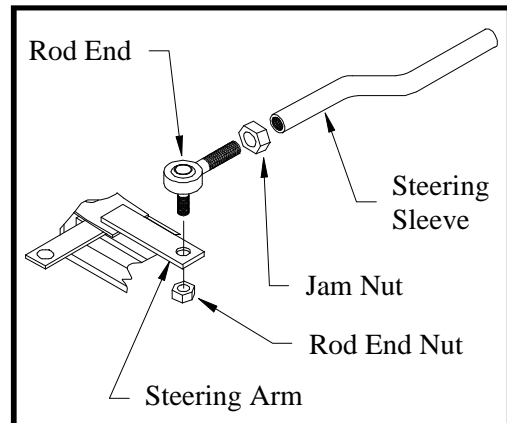
6. Raise the front of the vehicle and support with jack stands.

⚠ 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.

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. 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 front of the vehicle and support with jack stands.

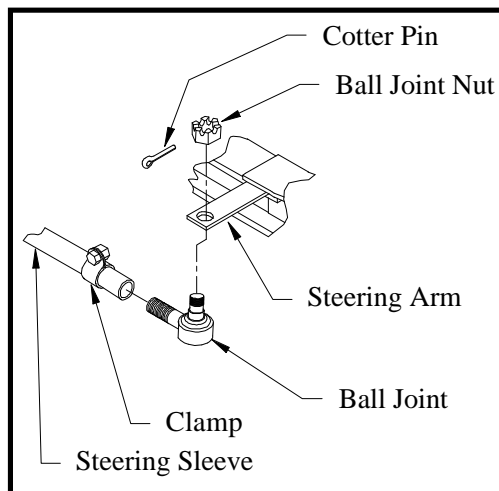
⚠ WARNING

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.

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.





Maintenance, Service, and Repair

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. 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 front of the vehicle and support with jack stands.

⚠ 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.

7. Remove the ball joints or rod ends from the steering knuckle and pitman arm.

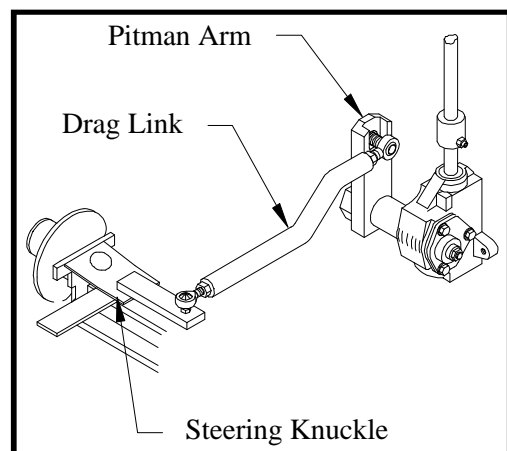
*NOTE: Refer to the **Replacing the Ball Joints** section for information regarding the removal of the ball joints or rod ends.*

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.*



Typical Drag Link



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 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. 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 front of the vehicle and support with jack stands.

⚠ WARNING

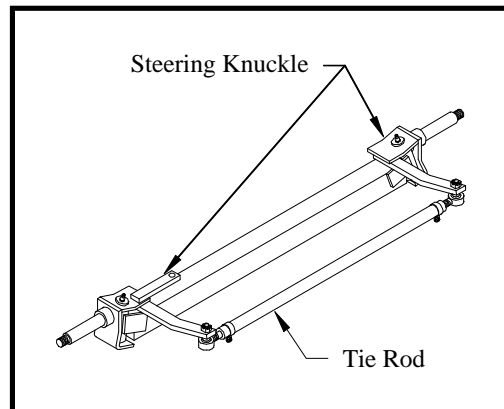
Always use a lifting strap, hoist, and jack stands, of adequate capacity to lift and support the vehicle. Failure to use lifting and support devices of rated load capacity may result in severe bodily injury.

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.*



Typical Front Axle Assembly

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.



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.

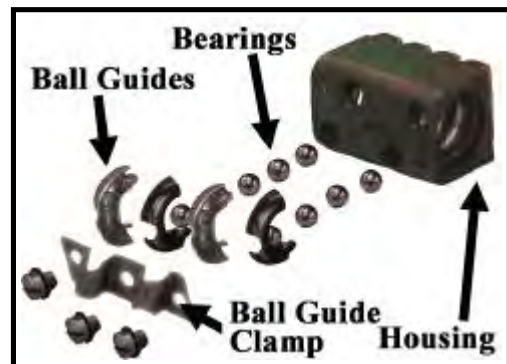




4. Remove the worm shaft and ball nut assembly from the bottom of the housing.
5. Remove the worm shaft seal.
6. Remove the pitman shaft seal.
7. Remove the upper worm bearing and bearing cup from the housing.



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.





Maintenance, Service, and Repair

9. Place the upper worm bearing on the worm shaft and install the worm shaft/ball nut assembly into the housing being careful not to damage the worm shaft seal.



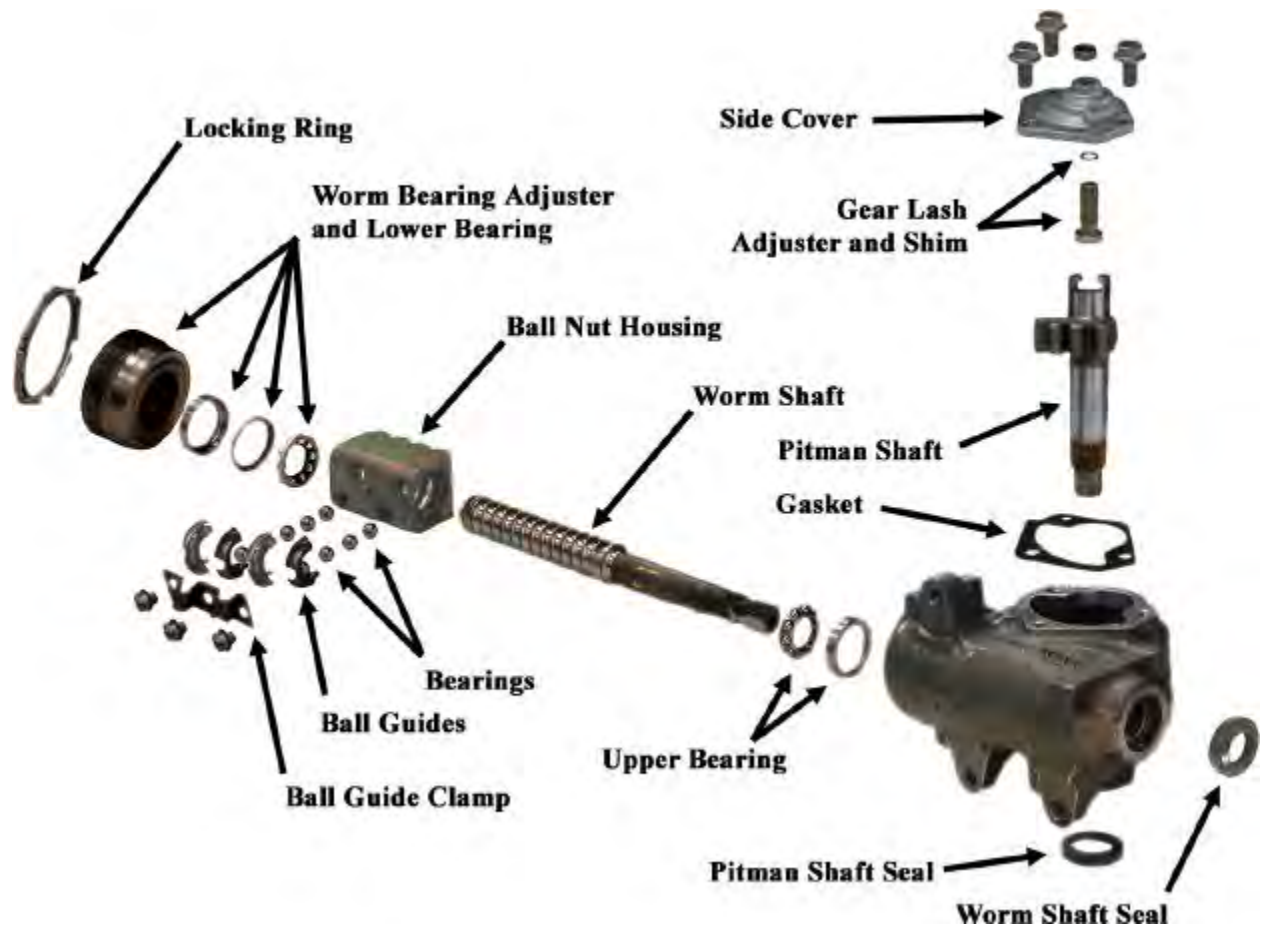
10. Install the assembled worm bearing adjuster into the housing and tighten just enough to remove all play in the worm shaft.
11. Install, but do not tighten the worm bearing adjuster lock nut.
12. Rotate the worm shaft to center the ball nut in the housing.
13. Place a new gasket onto the housing and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



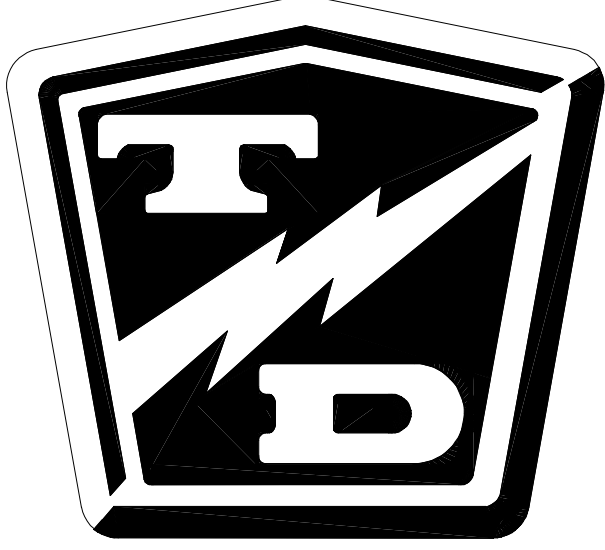
*NOTE: Refer to **Adjust the Steering gear** section for information regarding adjusting the steering gear.*

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

Exploded View of Steering Gear



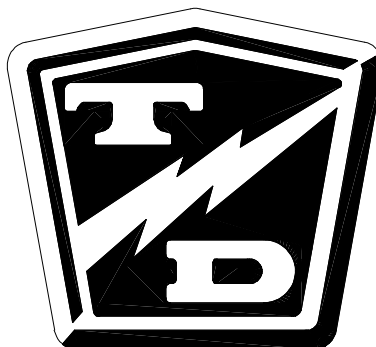
TAYLOR - DUNN



Brake Service

TABLE OF CONTENTS

Inspect the Service Brake	2
Disc Brake Pads	2
Disc Brake Rotor	3
Inspect the Parking brake	4
Wheel Park Brake (hydraulic disc)	4
Adjust the Service Brakes	5
Two or Four Wheel Hydraulic Disc Brakes	5
Adjust the Parking Brake	
Serial # up to 155559	6
Wheel Park Brake (hydraulic disc)	6
Adjust the Parking Brake	
Serial # after 155559	8
Wheel Park Brake (hydraulic disc)	8
Check Master Cylinder Fluid	10
Bleed the Brakes	11
Flush the Brake System	13
Replace Rear Brake Pads or Shoes	14
Hydraulic Disc	14
Replace the Wheel Cylinder	16
Disc Brake Body Assembly	16
Repair the Brake Body	18
Replace the Master Cylinder	20
Repair the Master Cylinder	22





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

⚠ 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 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-inches, 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.



Rotor removed for clarity. The rotor does not have to be removed for this procedure.



INSPECT THE PARKING BRAKE

Wheel Park Brake (hydraulic disc)

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

⚠ WARNING

1. Make sure the key-switch is in the "OFF" position, then remove the key.
2. Place the forward-reverse switch in the center "OFF" position.
3. 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.

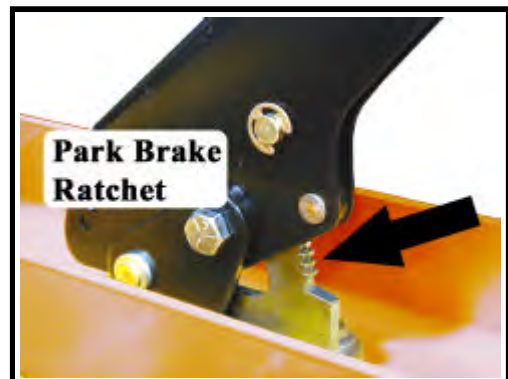
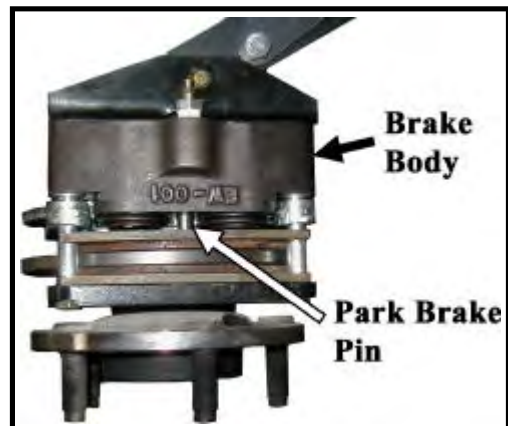
6. Release the park brake.
7. Inspect the brake pads. Refer to **Inspect the Service Brake** section to inspect the brake pads.
8. Inspect the park brake pin and bushing for any signs of damage or corrosion.

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

9. Inspect all brake cables and linkages for any signs of damage, wear, or missing cotter pins.

10. Inspect the brake handle locking mechanism for any signs of damage.

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



⚠ WARNING

If any sign of damage or wear is found on the locking mechanism, cables, or linkages then they must be repaired or replaced immediately. Failure to repair or replace any damaged component could result in failure of the park brake causing severe bodily injury and/or property damage.



ADJUST THE SERVICE BRAKES

Two or Four Wheel Hydraulic Disc Brakes

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

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

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

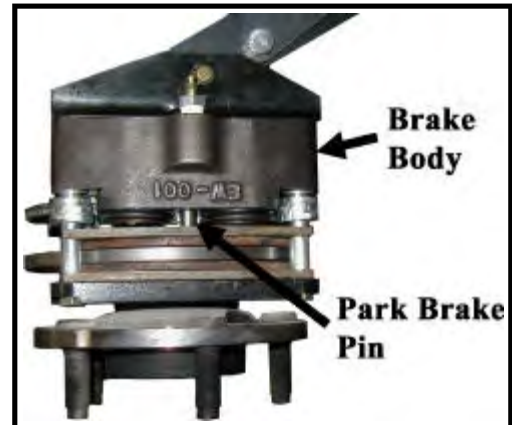




ADJUST THE PARKING BRAKE SERIAL # UP TO 155559

Wheel Park Brake (hydraulic disc)

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

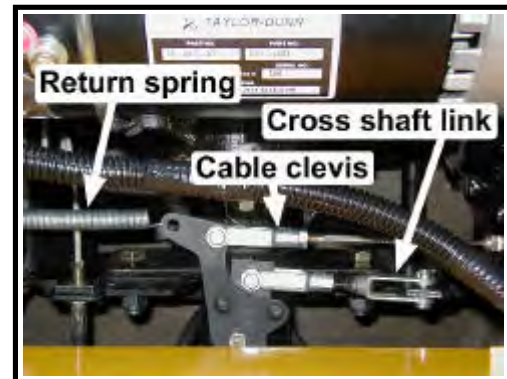


⚠ WARNING

1. Make sure the key-switch is in the "OFF" position, then remove the key.
2. Place the forward-reverse switch in the center "OFF" position.
3. 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. Release the park brake.
7. Disconnect the return spring.
8. Disconnect both links to the park brake cross shaft.
9. Tighten the park brake cable clevis to remove all play in the brake cable.

NOTE: The clevis pin in the brake cable clevis should still be able to spin freely with the brake released.



Left side linkage shown

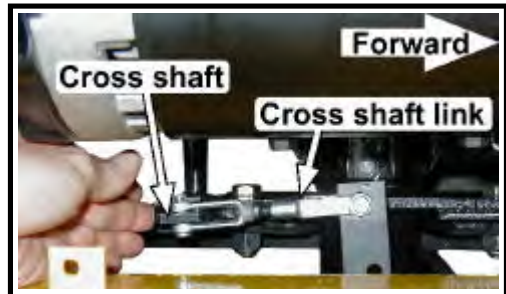


10. Set the length of the left park brake link to 4-7/8 inches and reconnect it to the cross shaft. Do not install the cotter pin at this time.
11. Reconnect the return spring.



12. Push the cross shaft forward and adjust the length of the right park brake link so that it is as short as possible and the clevis pin can be easily inserted into the cross shaft. Do not install the cotter pin at this time.

NOTE: The clevis pin in the brake arm clevis should still be able to spin freely with the brake released.



13. Disconnect the return spring.
14. While checking the free play in the cable clevis and right side cross shaft link, slowly pull up on the park brake lever. All play in the links should be gone at the same time.
15. While checking the free play in the cross shaft brake links, slowly pull up on the park brake lever. All play in the links should be gone at the same time.
 - a. If there is play in the right cross shaft link when there is no play in the cable clevis, then repeat the procedure.
 - b. If there is play in both the cable clevis and right cross shaft link when the park brake handle has reached the third tooth (click), then the cable is too loose. Repeat the procedure.
 - c. When the play in both the cable clevis and the cross shaft link is gone at the same time and there is no play when the park brake handle has reached the third tooth (click), then the adjustment is complete.
16. Reconnect the return spring.
17. Install new cotter pins in all clevis pins that were removed.
18. Set the park brake.
19. Reconnect the main positive and negative cables at the batteries.
20. Remove blocks from behind the wheels.
21. Release the park brake and test drive the vehicle.

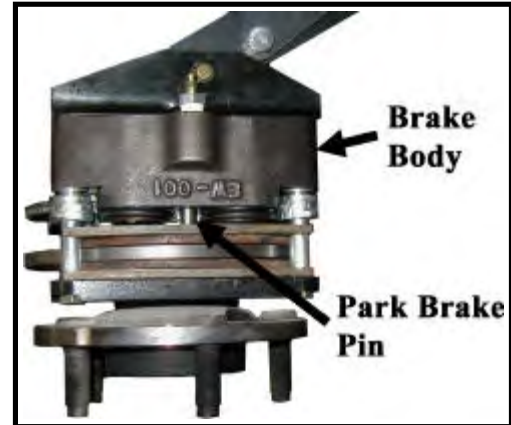




ADJUST THE PARKING BRAKE SERIAL # AFTER 155559

Wheel Park Brake (hydraulic disc)

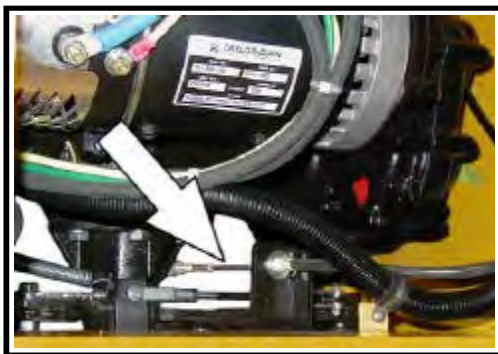
The parking brake is actuated through a pin in the center of the rear left and right brake body on the rear axles.



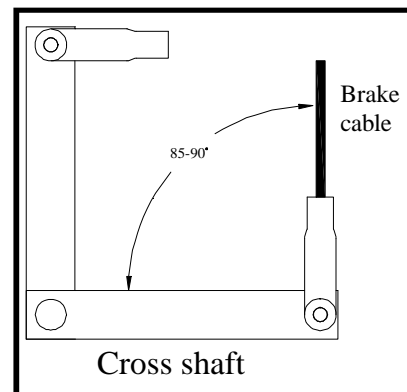
⚠ WARNING

1. Make sure the key-switch is in the "OFF" position, then remove the key.
2. Place the forward-reverse switch in the center "OFF" position.
3. 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. Check the angle of the brake cable to brake arm on the cross shaft. It should be between 85° and 90°. Adjust the cable if it is not within tolerance.



Brake cable



NOTE: The return spring must be connected to check the angle of the brake arm.



7. Disconnect the return spring and loosen both left and right cross shaft link jam nuts.



Return spring



Cross shaft link (left side shown)

8. Pull the parking brake handle until it stops on the second click.
9. Adjust the left side link until the clevis pin is difficult to rotate.
10. Adjust the right side link until the clevis pin is difficult to rotate.
11. Return the park brake handle to its fully released position.
12. Inspect to be sure that the clevis pins in both cross shaft links are free to rotate. Repeat the procedure if any one pin is binding.
13. Reconnect the return spring and tighten all jam nuts.
14. Install new cotter pins in all clevis pins that were removed.
15. Release the park brake and check for brake drag. Adjust the cross shaft links as required to eliminate any drag.
16. Set the park brake.
17. Reconnect the main positive and negative cables at the batteries.
18. Remove blocks from behind the wheels.
19. Release the park brake and test drive the vehicle.





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. Set the park brake.
4. Place blocks under the front wheels to prevent vehicle movement.
5. Disconnect the main positive and negative cables at the batteries.

6. Thoroughly clean the 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.



BLEED THE BRAKES

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

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





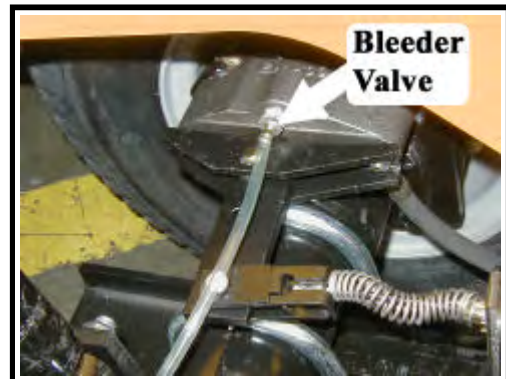
Maintenance, Service, and Repair

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.

⚠ 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.**

8. The master cylinder fluid level will drop as the brakes are bled. Periodically check and fill the master cylinder during this procedure. Do not allow the fluid level in the master cylinder to drop too low as this will allow air into the brake lines.
9. Attach a clear hose to the bleeder valve on the brake cylinder that is to be bled. Route the hose into a clear container for waste brake fluid.
10. Pump the brake pedal a few times and then press and hold light pressure to the brake pedal.
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.



Bleeder valve with hose attached

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.

⚠ 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 severe bodily injury and/or property damage.

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

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

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



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. 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 wheels off of the ground and support with jack stands.

⚠ 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.

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 REAR BRAKE PADS OR SHOES

Hydraulic Disc

⚠ 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.

⚠ WARNING

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

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

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



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

⚠ WARNING

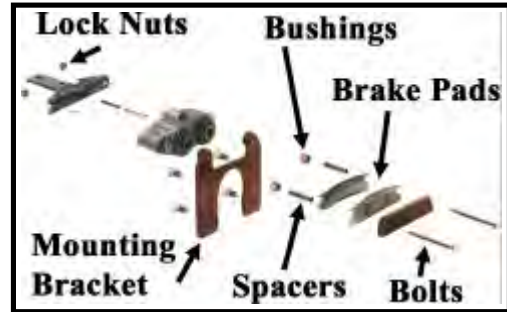
Always use a lifting strap, hoist, and jack stands, of adequate capacity to lift and support the vehicle. Failure to use lifting and support devices of rated load capacity may result in severe bodily injury.



9. Remove the tire/wheel assembly.

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

10. Release the park brake (wheel brake only).
11. Remove the brake body bolts and discard the lock nuts and brake pads.
12. Remove the spacer bushings from the mounting bracket and discard.
13. Inspect the brake rotor. Refer to **Inspect the Service Brake** section for information regarding inspecting the brake rotor.
14. Inspect the spacers and replace if any wear or damage is found.
15. Install new spacer bushings in the mounting bracket.
16. Back off the parking brake adjustment (wheel park brake only).



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





REPLACE THE WHEEL CYLINDER

Disc Brake Body Assembly

⚠ WARNING

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

⚠ WARNING

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

SKIN CONTACT

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

EYE CONTACT

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

INGESTION

Get medical attention immediately.

⚠ 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 wheels to prevent vehicle movement.
5. Disconnect the main positive and negative cables at the batteries.

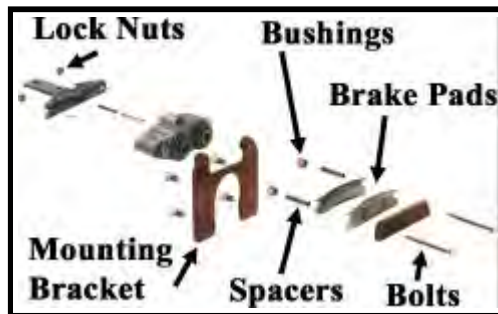
6. Release the park brake.
7. Raise the wheel off of the ground and support with jack stands.

⚠ 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. 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 contaminants left in the brake system could lead to brake failure and result in severe bodily injury and/or property damage.

⚠ WARNING

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

SKIN CONTACT

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

EYE CONTACT

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

INGESTION

Get medical attention immediately.

⚠ WARNING

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

6. Remove the brake body from the vehicle.

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

7. Pull the pistons out of 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 severe bodily injury and/or property damage.

8. Remove the piston rubber boot.
9. Remove the piston o-ring from inside of the brake body.
10. Inspect and replace parts as required.

11. Lubricate the brake parts with clean brake fluid from a sealed container.
12. Install the o-rings into the brake body. Make sure that the o-rings are installed into the second groove and that they are not twisted.



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



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



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





REPLACE THE MASTER CYLINDER

⚠ WARNING

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

SKIN CONTACT

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

EYE CONTACT

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

INGESTION

Get medical attention immediately.

⚠ WARNING

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

NOTE: Most vehicle configurations do not require lifting the vehicle to remove the master cylinder.

6. If required, raise the vehicle and support with jack stands.

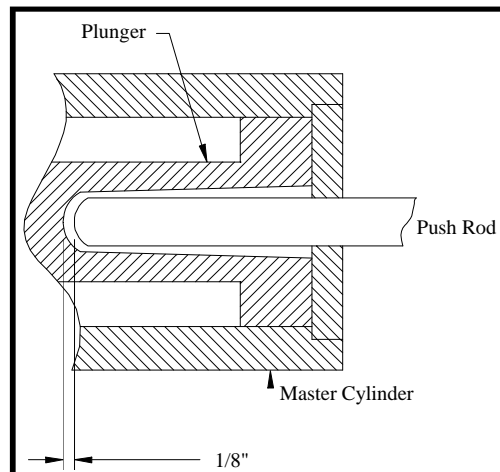
⚠ WARNING

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.

7. Place a drain pan under the master cylinder.
8. Disconnect the brake line(s) to the master cylinder and pump out the fluid in the master cylinder by depressing the pedal several times.
9. Remove the master cylinder bolts and remove the master cylinder from the vehicle.



10. Install in reverse order.
11. Adjust the master cylinder push rod so that it is approximately 1/8 inch away from the master cylinder plunger when the brake pedal is up.
12. Fill the master cylinder with brake fluid from a sealed container.
13. Pump the brake pedal a short distance of one to two inches until no bubbles are seen coming from the inlet ports inside of the master cylinder chamber.
14. If the vehicle was raised, lower it to the ground.
15. Bleed the brakes. Refer to ***Bleed the Brakes*** section for information regarding bleeding the brakes.
16. Reconnect the main positive and negative cables at the batteries.
17. Remove the blocks from behind the wheels.
18. Release the park brake and test drive the vehicle.



Cutaway of typical master cylinder showing the push rod clearance

⚠ 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.

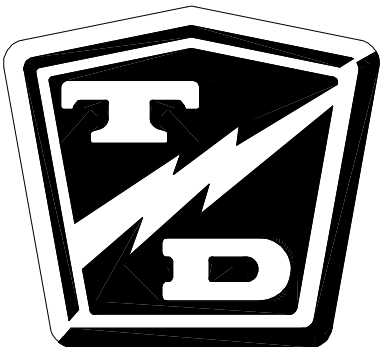
Reassemble in reverse order.

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

Motor Service

TABLE OF CONTENTS

Inspecting the Motor Brushes	2
Motors with internal cooling fans	2
Motor Removal and Installation	3
Motor Inspection	3
Replacing the Brushes or Armature Bearing	7
Repairing the Commutator	8
Service Limits	10





INSPECTING THE MOTOR BRUSHES

Motors with internal cooling fans

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

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



Typical motor with cooling fan indicated by the arrow

⚠ 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.



Typical brush and brush holder

MOTOR REMOVAL AND INSTALLATION

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

MOTOR INSPECTION

Disassembly

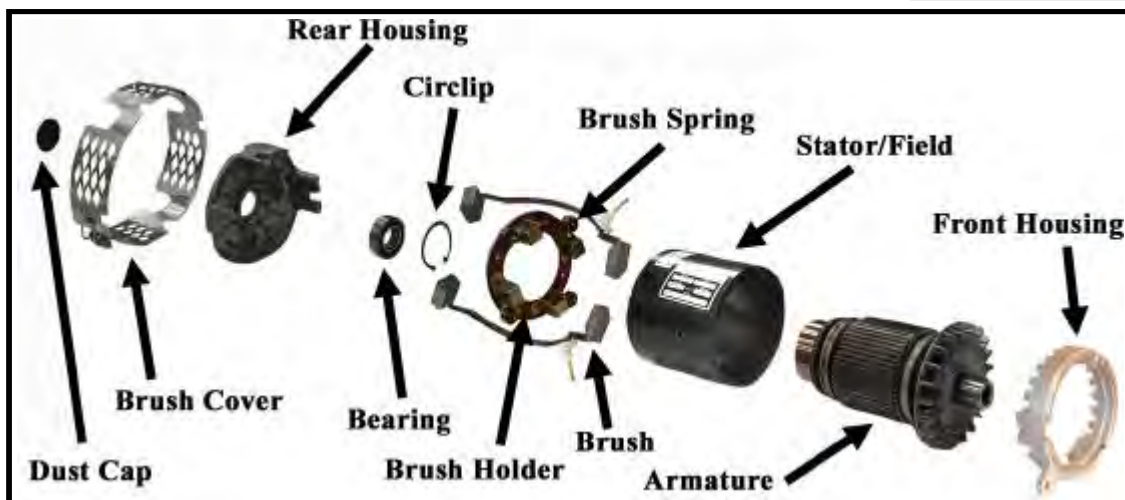
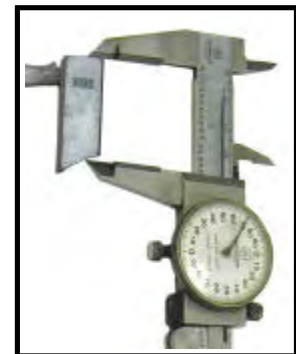
1. Remove the motor from the vehicle. See the **Transmission** section for information on removing the motor.
2. Remove the brush cover and pull the brushes out away from the commutator.
3. Remove the dust cap from the rear motor housing.
4. Place the motor in a press, and press the armature out of the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

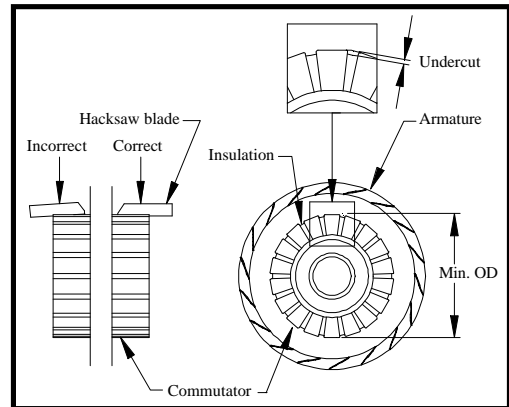
Inspection

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



Typical burn mark on a shorted armature

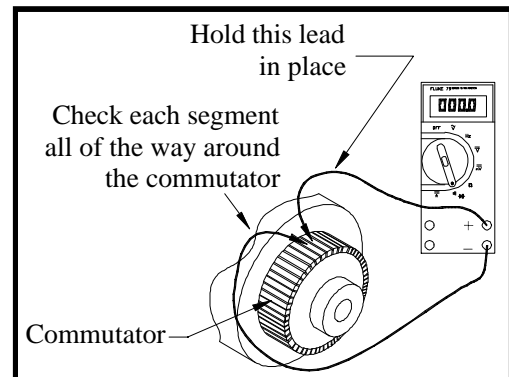
7. Visually inspect the armature windings for burnt insulation. Burnt insulation is a direct result of motor overheating and could lead to a shorted armature.

- 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.

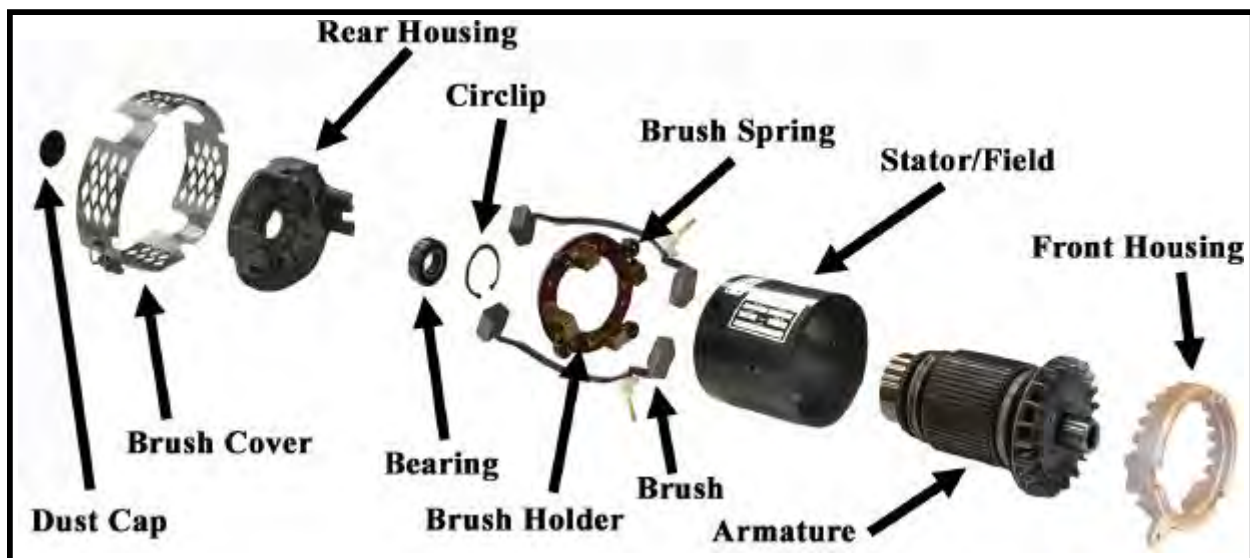
8. Using a growler, test the armature for shorts.
 - If the armature is shorted, then we recommend that the armature or motor be replaced.

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 or field resistance is not within specification then the motor must be repaired or replaced.





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.*

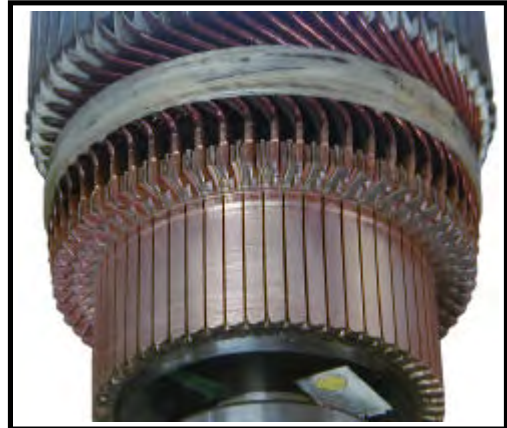
*NOTE: The motor must be removed from the vehicle for this procedure. Refer to **Transmission Service** section for information on removing the motor.*





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.



Example of freshly cut commutator

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.



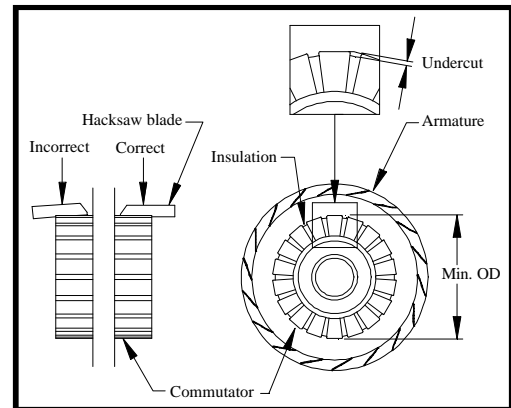
5. Thoroughly clean all copper debris from between the commutator segments.
6. Measure the commutator undercut depth in 5-places around the commutator. If any one of the measurements is less than the minimum undercut depth specified in **Service Limits**, then the commutator must be undercut.
7. While still in the lathe, smooth the commutator with fine emery cloth.



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.



Example of freshly cut commutator



SERVICE LIMITS

Motor Specification Number	Undercut Depth		Commutator Diameter (min)		Brush Length (min)		Resistance (Ohms@75° F)	
	mm	inches	mm	inches	mm	inches	Armature	Field
70-054-40 (XP-1672)	0.635	0.025	69.85	2.75	15.87	0.625	.0116	1.20
70-054-41 (XP-1789)	0.635	0.025	69.85	2.75	15.87	0.625	0.011	0.43
70-057-40 (DV1-4003)	0.635	0.025	69.85	2.75	15.87	0.625	0.008	0.58

Transmission

TABLE OF CONTENTS

Check Oil Level	2
Change Oil	3
Motor Removal and Installation	4
Rear Hub or Rotor	5
Removing and Installing the Rear Axles	6
Transmission Assembly	8
Remove and Install	8
Disassembly and Reassembly of the Primary Reduction Gear Case	10
Disassembling the 3rd Member	13
Assembling the 3rd Member	16
Pinion Bearing Preload	19
Pinion Gear Shimming Instructions	20
Setting the Pinion Gear Depth	20



GT Transmission Assembly



CHECK OIL LEVEL

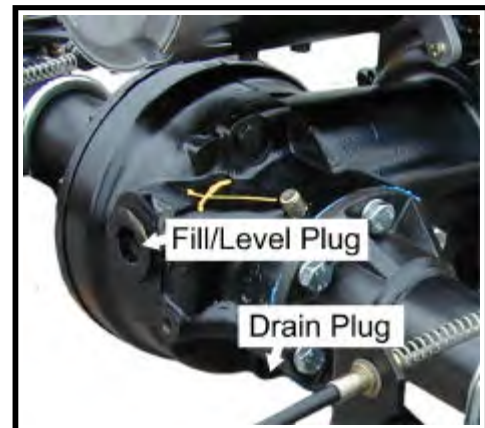
The oil flows freely between the main gear case (3rd member) and the primary reduction gear case. It is only necessary to check the oil level of the 3rd member.

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.



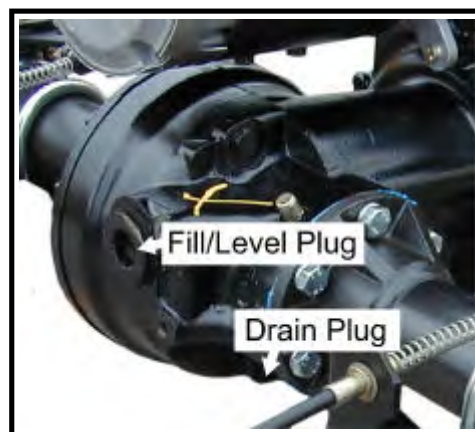


CHANGE OIL

⚠ 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

*NOTE: Some applications will require removing the drive assembly from the vehicle to remove the motor. Refer to **Removing and Installing the Drive Assembly** for information on removing the drive assembly.*

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).
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 94-421-34 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.



Support bracket u-bolt



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.

⚠ 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 off of the ground.

⚠ 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.

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.
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. Torque the axle hub bolt to 275 ft-lbs.
 - d. 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.
12. Release the park brake and test drive the vehicle.

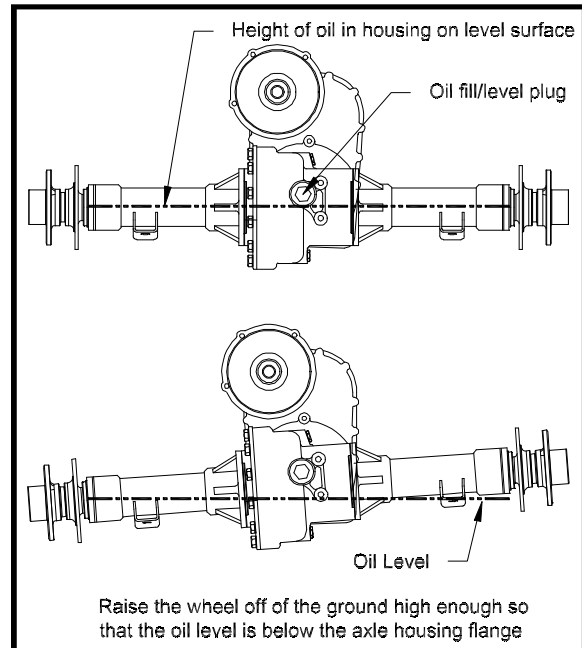




REMOVING AND INSTALLING THE REAR AXLES

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

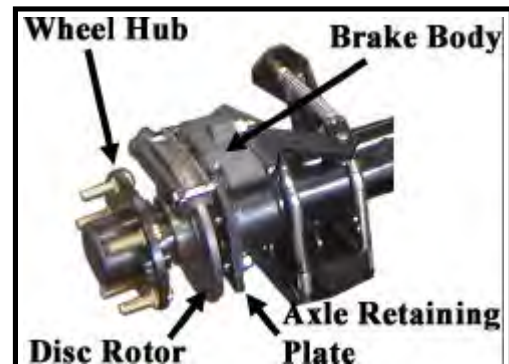
1. Make sure the key-switch is in the "OFF" position, then remove the key.
2. Place the forward-reverse switch in the center "OFF" position.
3. Set the park brake.
4. Place blocks under the front wheels to prevent vehicle movement.
5. Disconnect the main positive and negative cables at the batteries.

6. If required, drain the oil from the 3rd member.
7. Raise the rear of the vehicle and support with jack stands.

⚠ 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. Release the park brake.
9. Remove the tire and wheel assembly. Refer to section **Tires and Wheels** for information regarding removing the tire and wheel assembly.
 - a. If the axle shaft, hub or bearing is to be replaced then remove the hub bolt, wheel hub and disc rotor at this time.
10. Remove the four bolts attached to the axle retaining plate.





11. Remove the axle retaining plate and brake body assembly as one unit.
12. Secure the brake body assembly, do not let it hang by the brake hose.
13. Pull the axle out of the housing.
14. Inspect all bearings for roughness or play, replace as needed.
15. Install in reverse order, lubricate the o-ring.

NOTE: Be sure not to damage the o-ring.

16. Use new bolts for the axle retaining plate.

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.

17. If the wheel hub was removed, install the hub and rotor. Torque the hub bolt to 275 ft-lbs.
17. Fill with oil to the level of the fill plug threads. Refer to ***Changing the Differential Oil.***
18. Lower the vehicle.
19. Set the park brake.
20. Reconnect the main positive and negative cables at the batteries.
21. Remove the blocks from behind the wheels.
22. Release the park brake and test drive the vehicle.





TRANSMISSION ASSEMBLY

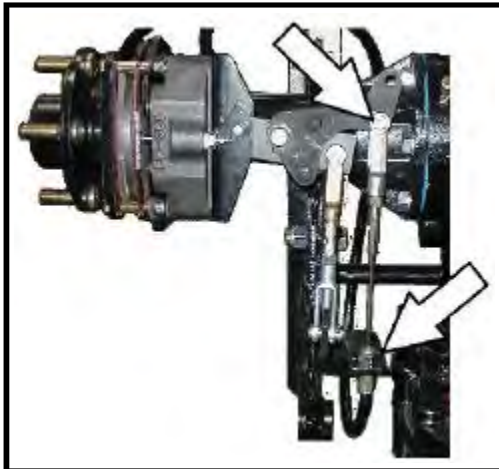
Remove and Install

⚠ WARNING

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

6. Disconnect the motor cables.

7. Disconnect the park brake cable from the brake arm and the swing arm mount.



Brake linkage up to serial # 155559



Brake linkage after serial # 155559

8. Disconnect the brake hose from the t-fitting on the swing arm.





9. Remove the nuts from the rear suspension bushing bolts.



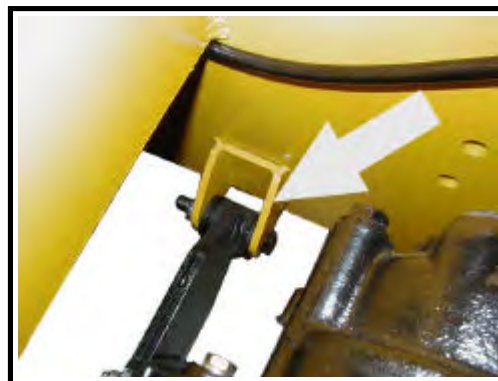
10. Raise the rear of the vehicle and support with jack stands.

NOTE: Do not raise the vehicle so high to where the rear wheels come off of the ground.

⚠ WARNING

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

11. Remove the swing arm pivot bolts and roll the transmission assembly out from under the vehicle.



12. Install the transmission assembly in reverse order of removal.
 - a. Bleed the brake system. Refer to section **Brake Service** for information regarding bleeding the brakes.
 - b. Adjust the park brake. Refer to section **Brake Service** for information regarding adjusting the park brake.
13. Lower the vehicle.
14. Set the park brake.
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.





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.

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

⚠ 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.

7. 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.
8. If required, remove the drive assembly from the vehicle

*NOTE: Refer to **Removing and Installing the Drive Assembly** for information on removing the drive from the vehicle.*

9. Remove the motor only if the entire drive is to be disassembled.

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



Oil Drain Plug

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

⚠ 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.



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.

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

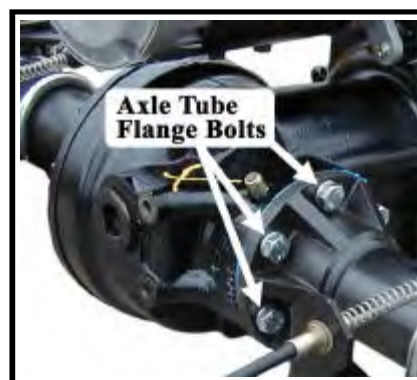
⚠ WARNING

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.

7. Remove the complete drive from the vehicle.

*NOTE: Refer to **Removing and Installing the Drive Assembly** for information on removing the 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.





Maintenance, Service, and Repair

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.





Maintenance, Service, and Repair

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.



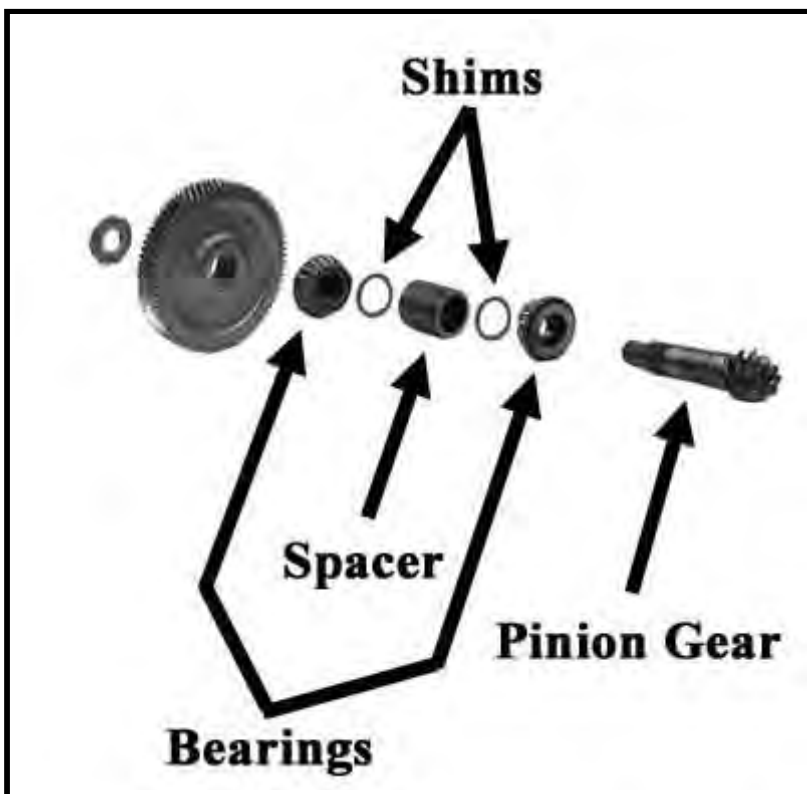


Pinion Bearing Preload

*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.

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.

A = The distance in millimeters from the face of the pinion gear to the top of the inner pinion bearing race (see below)

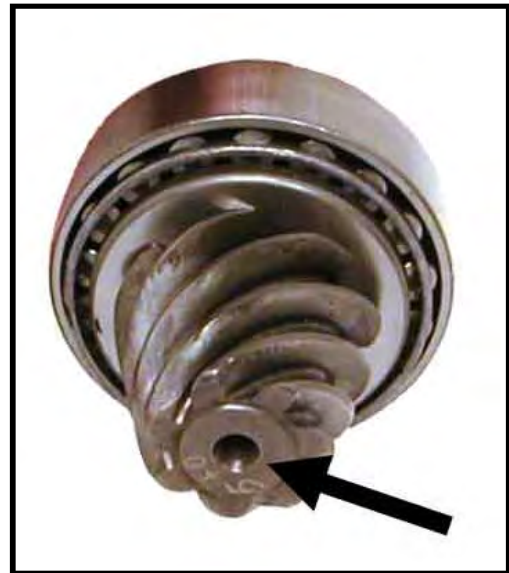
B = 54.

C = The number on the edge of the differential side plate closest to the input shaft (see next page).

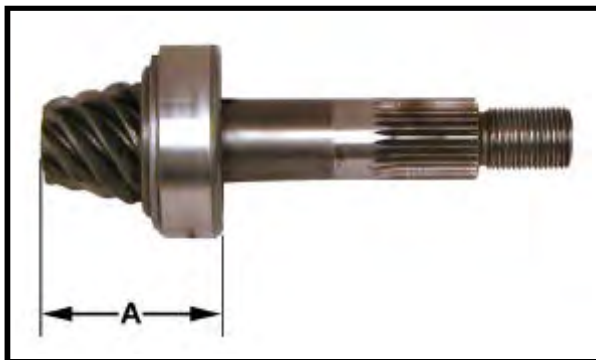
D = The number on the edge of the differential side plate farthest from the input shaft (see next page).

E = The distance in millimeters from the rear of the drive housing to the face of the pinion gear (see next page).

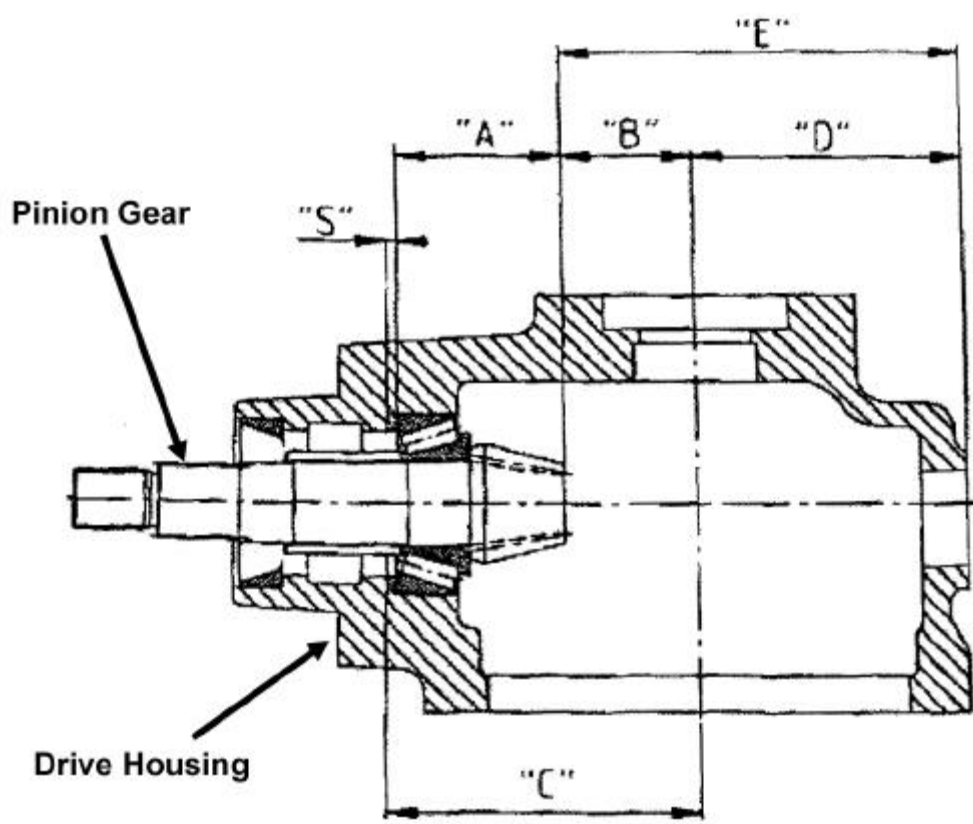
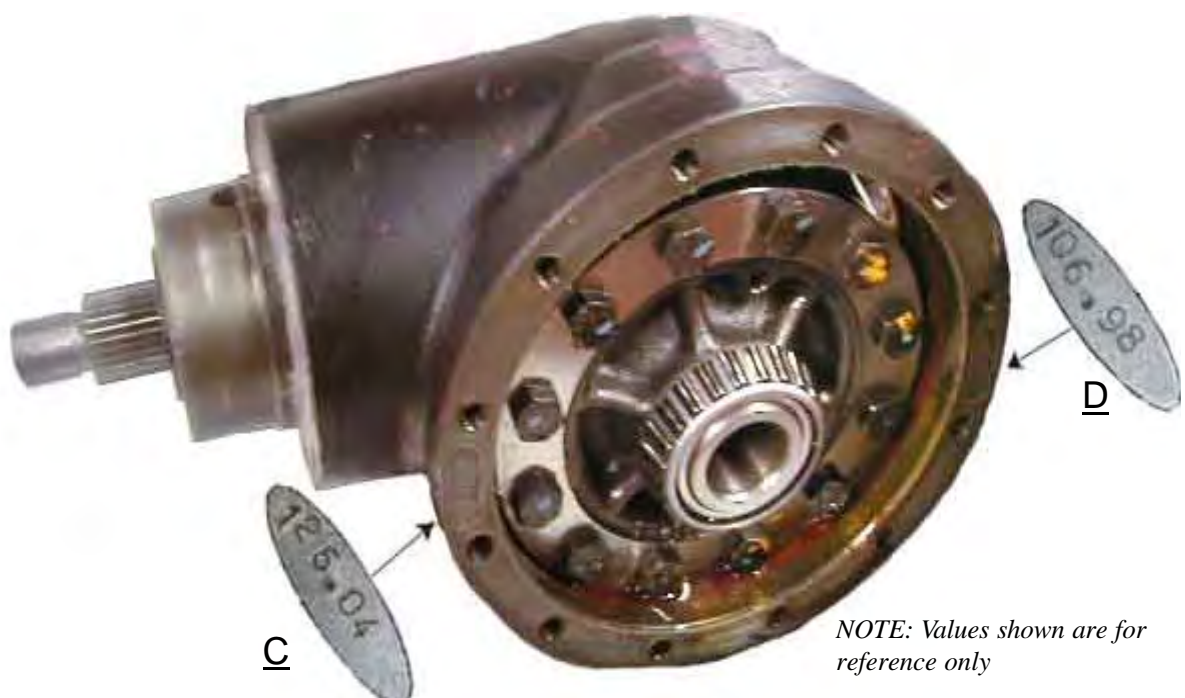
Once a shim has been selected and the pinion gear is installed, confirm that: **E - D = B + (DV)**



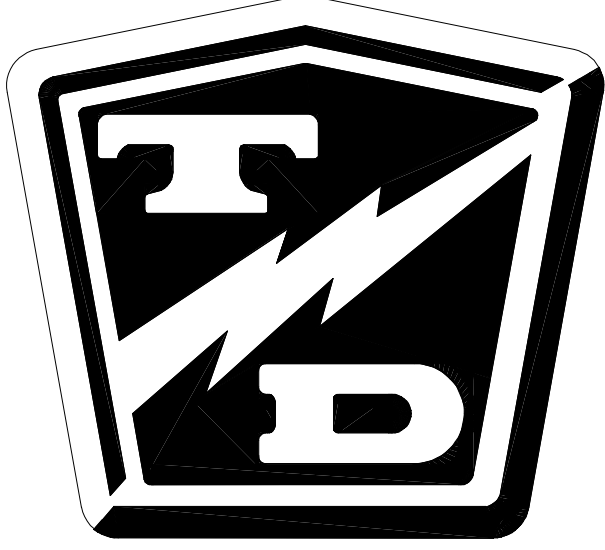
Face of pinion gear



Number on face of pinion gear



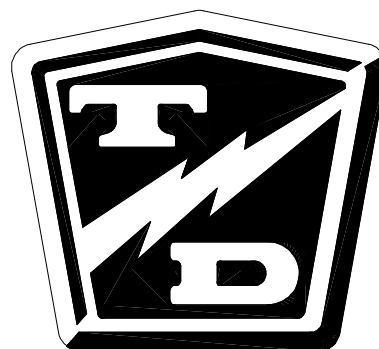
TAYLOR - DUNN



Suspension

TABLE OF CONTENTS

Replace the Rear Springs	2
Rubber Springs (bushings)	2





REPLACE THE REAR SPRINGS

Rubber Springs (bushings)

If a spring has failed or is fatigued, then it is recommended that both rear springs are 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. 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 nuts and washers from the spring bolts.

⚠ CAUTION

Some vehicle configurations may require disconnecting the motor cables. If the motor cables are not long enough to raise the vehicle without stretching the cables then they must be disconnected from the motor. Stretching the cables may result in damage to the electrical system. Refer to section **Motor Service** for information regarding removing the motor cables.

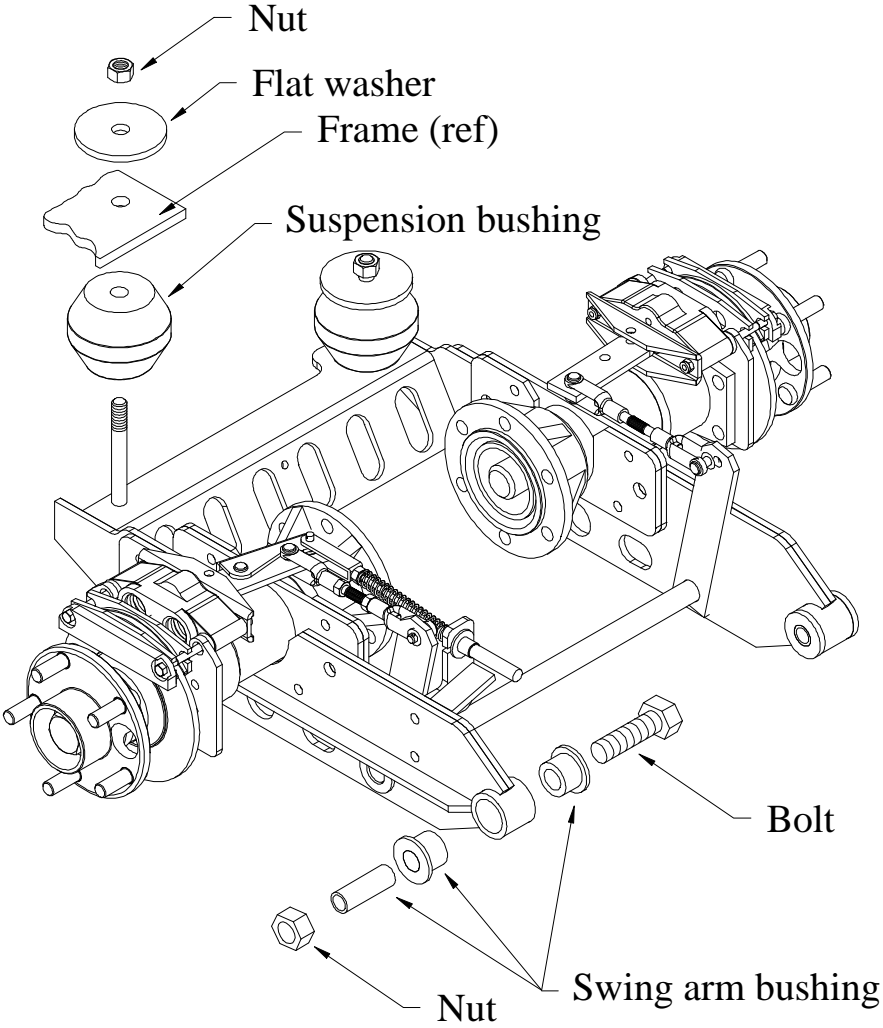
7. Raise the rear of the vehicle just high enough so that the springs bushings can be removed and support with jack stands.

⚠ WARNING

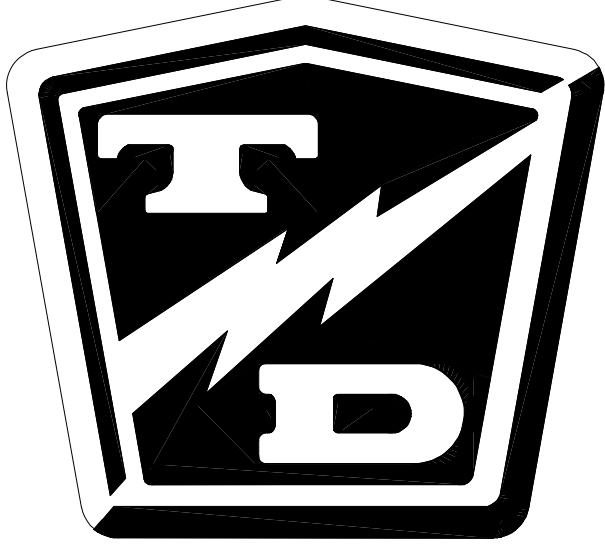
Always use a lifting strap, hoist, and jack stands, of adequate capacity to lift and support the vehicle. Failure to use lifting and support devices of rated load capacity may result in severe bodily injury.

8. Remove and install the new bushings.
9. Lower the vehicle and carefully guide the spring bolts into the holes in the frame.
10. Install the nuts and washers on the spring bolts.
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





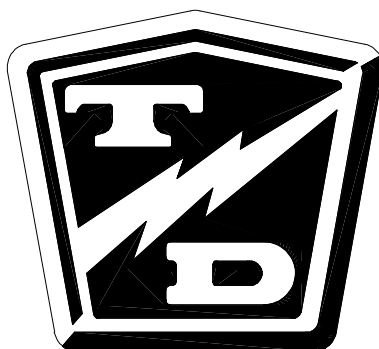
TAYLOR - DUNN



Tires and Wheels

TABLE OF CONTENTS

Tire Inflation	2
Tire Inspection	2
Replace the Front Tire/Wheel	3
Replace the Rear Tire/Wheel	3
Repair the Tire	4
Replace the Tire	5





TIRE INFLATION

⚠ WARNING

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

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

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

Tire pressures must be checked when the tire is cold.



TIRE INSPECTION

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





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

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

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

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

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

REPLACE THE FRONT TIRE/WHEEL ASSEMBLY

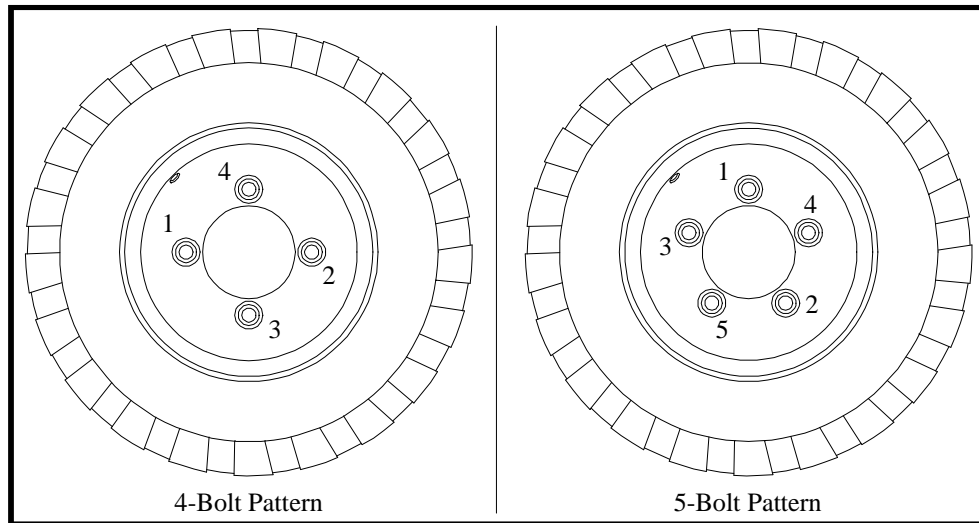
Refer to **Front Axle Service** for information on removing the front wheel.

REPLACE THE REAR TIRE/WHEEL ASSEMBLY

WARNING

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

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



Pattern for tightening the wheel nuts

⚠ WARNING

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

REPAIR THE TIRE

⚠ WARNING

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

NOTE: This is for Pneumatic tires only. solid rubber, soft-solid (Man-Toter) and foam filled tires are not repairable. If they are damaged they must be replaced.

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

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

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

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

REPLACE THE TIRE (PNEUMATIC)

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

⚠ WARNING

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

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

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

Always use a new valve stem when replacing a tire.

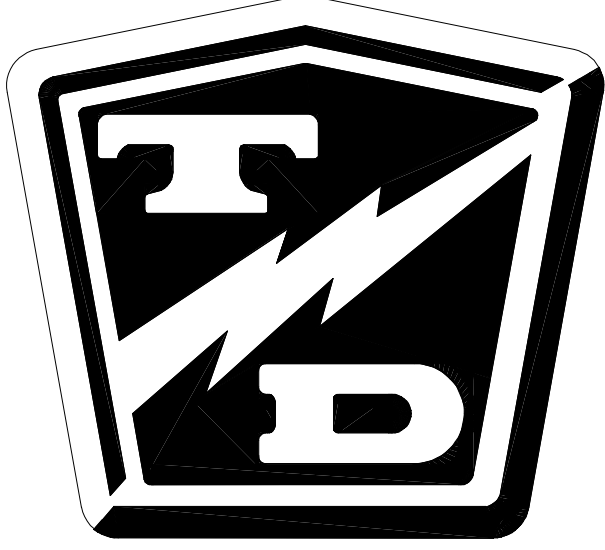
1. Remove the tire from the wheel.
2. Cut the old valve stem off of the wheel.
3. Remove the valve stem cap from the new valve stem.
4. Lubricate the valve stem with liquid soap.
5. Install a new valve stem using a valve stem tool.

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

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



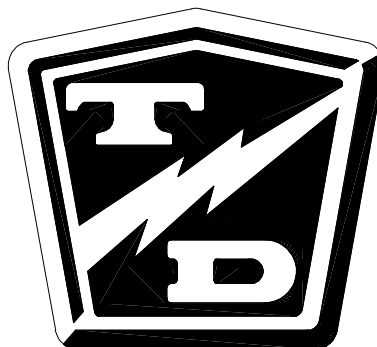
TAYLOR - DUNN



Battery Service

TABLE OF CONTENTS

Cleaning	2
Testing	3
Watering	5
Charging	6
Replacing (6-volt batteries only)	7
Moist Charge Batteries	9
Storage and Returning to Service	10
Storage	10
Returning to Service	11





CLEANING

⚠ WARNING

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

⚠ WARNING

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

⚠ WARNING

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

⚠ CAUTION

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

⚠ WARNING

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

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



TESTING

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

⚠ WARNING

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

⚠ WARNING

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

⚠ WARNING

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

⚠ 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.

Load Test (6-volt batteries only)

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

1. Clean the batteries. Refer to ***Cleaning the Batteries*** section for information on cleaning the batteries.
2. Load test each battery using a battery load test meter (available at most auto parts distributors). Follow the instructions provided with the test meter.

- If any battery fails the load test, then it should be replaced.

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

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



Specific Gravity Test

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

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

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

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

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

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

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

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

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

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



Typical Hydrometer Float



WATERING

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

WARNING

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

WARNING

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

WARNING

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

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

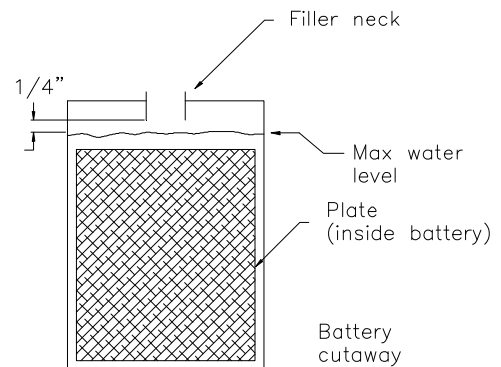
Do not overfill the batteries. Over filling the batteries may cause the batteries to boil over and result in severe bodily injury or property damage.



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



CHARGING

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



REPLACING (6-VOLT BATTERIES ONLY)

⚠ WARNING

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

⚠ 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 serious bodily injury.

⚠ WARNING

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

⚠ WARNING

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

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

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



Maintenance, Service, and Repair

7. Remove the battery hold downs.
8. Inspect the battery hold downs for corrosion. If any signs of corrosion are seen then the battery hold downs should be replaced.
9. Remove all battery jumpers from both posts of the battery or batteries being replaced.

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

10. Remove the batteries from the vehicle.

WARNING

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

11. Inspect the battery compartment for signs of corrosion.
12. If minimal signs of corrosion are seen, then the damaged paint should be stripped off and the entire battery compartment prepped and repainted.
13. If there are excessive signs of corrosion, then it may be necessary to replace some of the frame members or completely rebuild the battery compartment.
14. Inspect the main positive and negative cables and terminals, charger cables and terminals and 12-volt tap wiring. If any of the terminals or wires show signs of corrosion, then they must be repaired or replaced.
15. Install the batteries in reverse order. Refer to the **Illustrated Parts List** for battery cable routing.
16. It is recommended to replace the battery terminal hardware when replacing the batteries.
17. Torque the terminal hardware to 7-8 ft.-lbs.
18. Tighten the hold downs so that the batteries are secure but not so tight as to deform the batteries.

CAUTION

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

19. Remove the blocks from the wheels and test drive.



Moist Charge Batteries

⚠ 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 property damage and or serious

⚠ 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 serious bodily injury.

⚠ WARNING

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

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

⚠ CAUTION

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

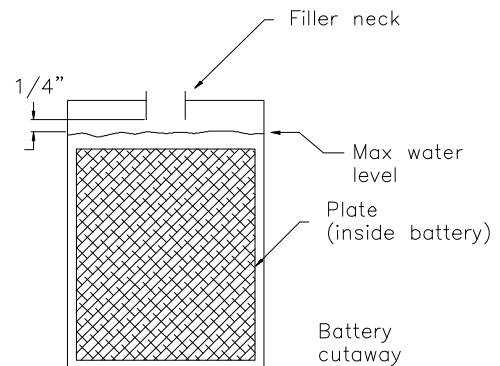
⚠ WARNING

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.



Maintenance, Service, and Repair

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



⚠ CAUTION

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

STORAGE AND RETURNING TO SERVICE

Storage

⚠ 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.

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

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

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

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

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

Returning to Service

⚠ WARNING

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

⚠ 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 serious bodily injury.

⚠ WARNING

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

⚠ WARNING

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

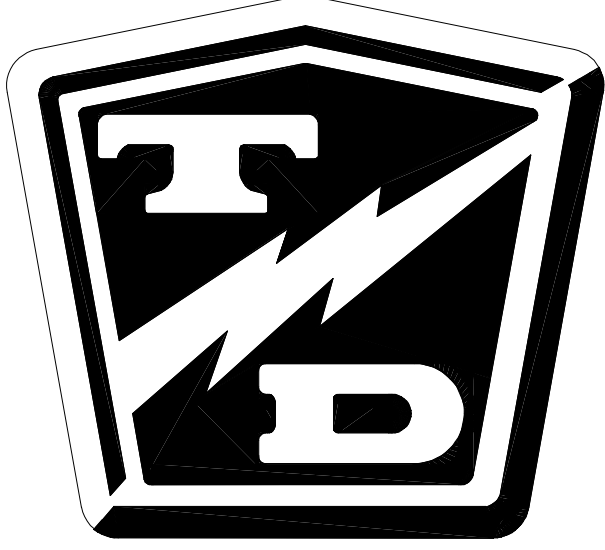
6. Thoroughly clean the batteries and battery compartment. Refer to **Cleaning** in this section for information regarding cleaning the batteries.

⚠ 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.

7. Check the electrolyte level and charge the batteries. Refer to **Watering** in this section for information regarding checking the electrolyte level.
8. Test the batteries. Refer to **Testing** section for information on testing the batteries.
9. The batteries are now ready to be put back into service.

TAYLOR - DUNN



Sevcon Control System Troubleshooting

Includes Power Pak and Micro Pak controllers

TABLE OF CONTENTS

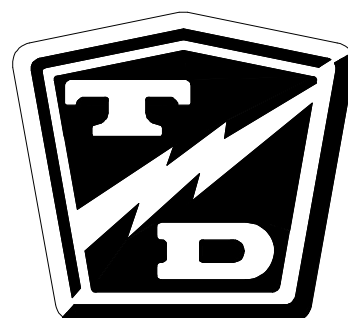
Test Equipment Required:	2
Definitions:	2
Terminology used:	2
Important Notes and Instructions	2
Identifying Your Controller	3
Start Troubleshooting Here	4
Test 8. Anti-Rolloff Fault	15
Test 9. Electric Motor Brake	16
Logic Voltage Reference Table	18
Status LED Code Table	19
Smart View Fault Codes	20

⚠ CAUTION

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

⚠ CAUTION

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 Equipment Required:

- Digital multimeter (DMM) with diode test function, FLUKE 79 model shown.
- Throttle Module Analyzer, Taylor-Dunn part number 62-027-32

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 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).

⚠ 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.

Important Notes and Instructions

- This troubleshooting procedure is for the Sevcon Power Pak and Micro Pak motor speed controllers as equipped in standard vehicles. Troubleshooting may not be valid for vehicles equipped with special order speed control options.
- For additional troubleshooting information, use the handheld system analyzer part number 62-027-61 or the computer system analyzer (PCpaK) part number 62-027-63. See note below.
- 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.

Note: The PCpaK application is also capable of uploading new controller parameters to the controller. Controller parameter sets are available from Taylor-Dunn. Individual parameters cannot be changed.

⚠ 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.

Identifying Your Controller



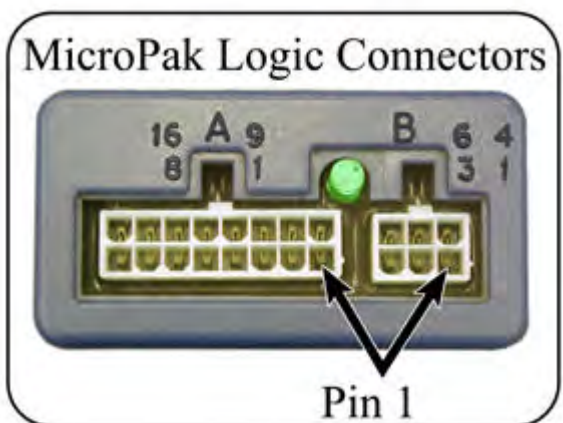
PowerPak Controller



MicroPak Controller



PowerPak Logic Connector



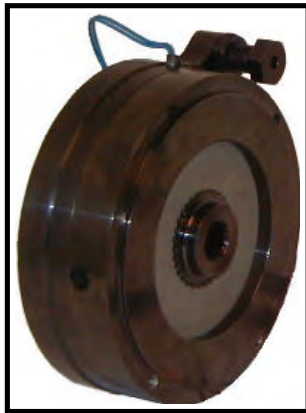
Pin 1



START TROUBLESHOOTING HERE

⚠ CAUTION

If your vehicle 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.

⚠ 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.

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

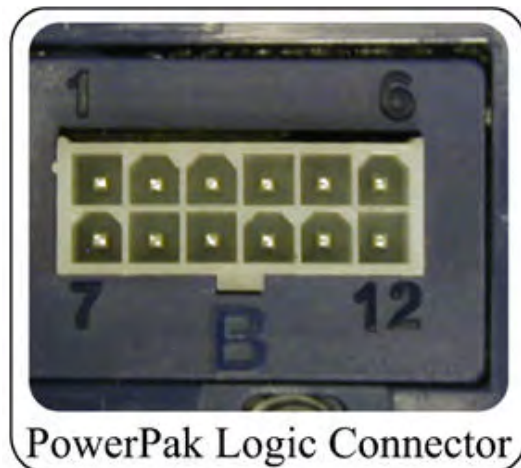
Do not continue unless the indicator shows a charged battery.

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

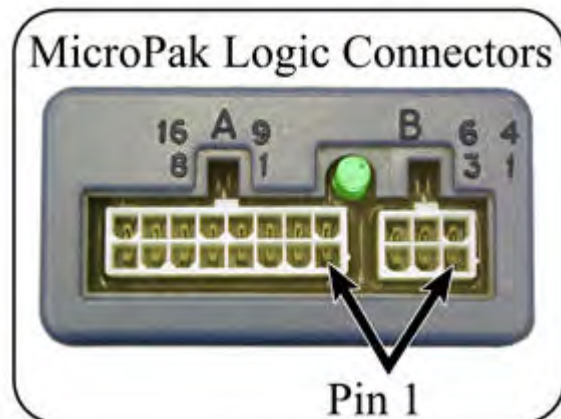
If the vehicle runs slow in forward, but otherwise runs normal, then skip ahead to test #1.3.

⚠ 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.



PowerPak Logic Connector





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 Test #5.

If the voltage does not start at 24 volts, then go to Test #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.

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.

===== **STOP** =====

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.

TEST 1.7:

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

Perform the following tests:

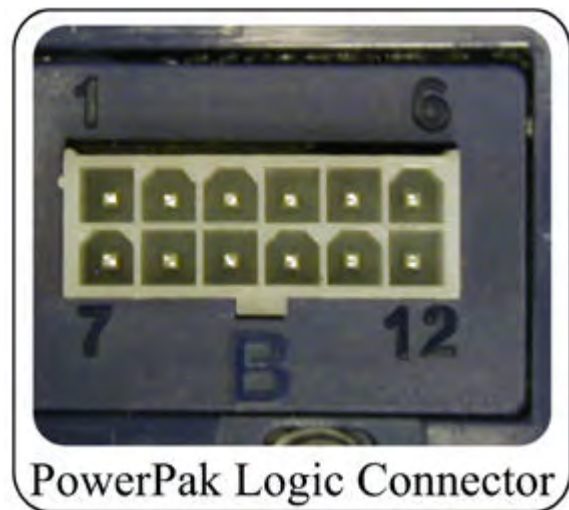
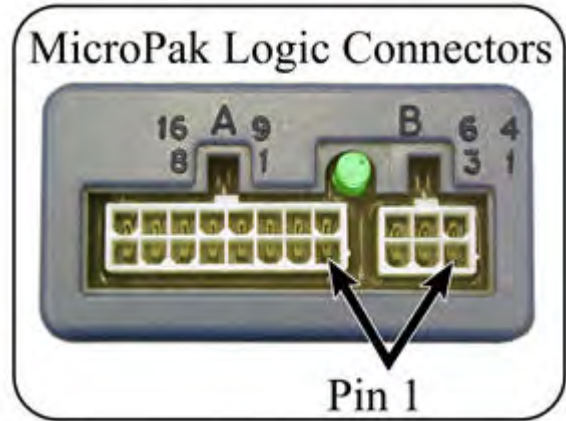
Test the voltage at pin #10 on the 12-pin logic card connector.

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

⚠ 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 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.

NOTE: Special and expensive motor testing equipment is required in order to accurately measure motor armature or field resistance. In most cases, this equipment is not required in order to determine if a motor is faulty. The majority of motor failures are due to an open circuit in the field or armature windings. If the symptom of the vehicle is "not running with NO motor current" then a simple continuity test of each winding is all that is required to determine if the motor is at fault.

TEST 2.1:

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

If the resistance is close to 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 test indicates an open circuit, 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.



Motor shown in illustrations is typical of a standard motor. The terminal configuration of your motor may be different.

===== STOP =====

TEST 2.2:

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

If the resistance is close to values given in the motor specification table, then go to test #2.3.

If the test indicates high resistance or an open circuit, then repair or replace 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.



===== STOP =====



Electrical Troubleshooting

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.

STOP



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.

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 it is likely that the internal directional control transistors have failed, test the transistors at Test 3.5 and 3.6. 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.

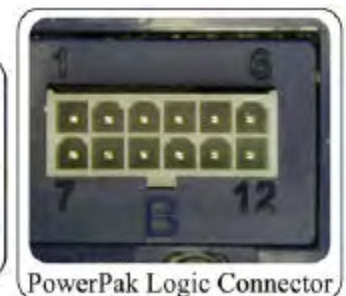
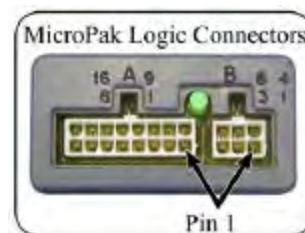
Using the diode test function on your meter, connect the positive lead to the B- terminal on the controller.

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.

===== 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 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 (see below).

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.

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.



Typical Circuit Breaker

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.

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:

Broken Wire: Check the wire from pin #8 in the 12-

pin logic card connector to the contactor coil negative terminal for open circuits.

Welded Solenoid Contacts: 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.

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

The control logic may have failed.



===== 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 6. ACCELERATOR MODULE FAULT

⚠ 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.

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

Position the power switch to the 0-5 volt range. All but the power lamp should be OFF. If the FS-1, FS-3 or OV lamp (Over Voltage) are ON, then the module is faulty.

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

The voltage on the digital display should vary with the position of the module arm, starting at 0-volts and ending at approximately 5-volts.

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

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

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



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



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.



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.



⚠ 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 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.



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.

⚠ 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 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 programming 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.

⚠ 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.

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

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.



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	–

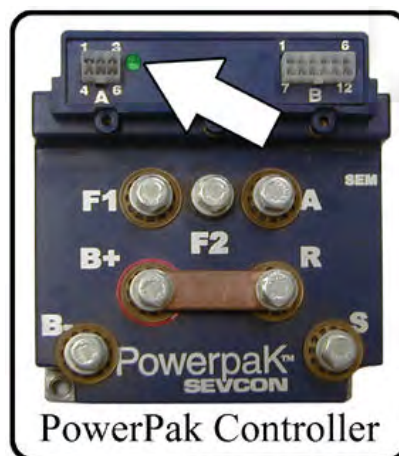
* - All voltages made referencing main negative unless specified otherwise

** - 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 Instructions))
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





Smart View Fault Codes

Level 5 Faults (F05xxx)

F05000 "Contactor Over Current"

This fault occurs when too much current is going into the line contactor coil circuit. This could be a result of a shorted contactor coil, short in the wiring, or faulty logic card.

F05004: "VA Fail"

This is a result of a low voltage on an internal voltage regulator. Can also be caused by a low key switch input voltage. If the key switch input is within specifications, then replace the controller.

F05006: "MOSFET Short Circuit"

Also can be a result of an open motor armature circuit. Confirm the motor armature and wires to the motor are good. If motor and wires are good, then replace the controller.

F05008: "Power Up Traction Welded"

Normally due to line contactor welded closed resulting in a high voltage at B+. This fault is generated when the differential voltage between the key switch input and the B+ terminal is less than approximately 6-volts.

F05009: "Shorted MOSFET"

Normally due to internal short in controller. Also could be result of shorted motor or wiring. Remove the wire from the controller terminal "S". If fault clears then the short is in the motor or wiring.

F05046: "Line Contactor Did Not Close"

Normally due to open circuit to the controller B+ terminal. Check wiring, contactor, main Circuit Breaker.

NOTE: Controller B+ terminal must be within 1.5 volts of Pin 1 after contactor closes.

All other level 5 faults are a result of an internal failure in the Sevcon controller and cannot be repaired. The controller must be replaced.

Level 4 Faults (F04xxx)

F04001: "Contactor Welded"

High voltage at power up to the controller B+ terminal. Check wiring, contactor, and pre-charge resistor on the contactor.

F04002: "Steer Pot"

Steer Pot currently not used and this fault should not occur. Check wiring.

F04003: "Sequence Fault"

Start-up switches not operated in the correct order or fault in start-up switches or wiring. Refer to operator section for correct operating sequence of switches.

F04004: "Two Directions Selected"

Both Forward and Reverse selected at the same time. Check F&R switch and wiring.

F04005: "SRO"

Start-up switches not operated in the correct order or fault in start-up switches or wiring. Refer to operator section for correct sequence of switches. Normally a result of F&R selected before start switch is turned on.

F04006: "Traction Seat"

Seat or foot interlock switch open. Check interlock switch, wiring.

F04007: "Inch Switch"

Inch switch ON at power up; both switches selected at same time; inching attempted with seat interlock, F&R switch, or FS-1 closed.

F04008: "Steer"

Steer Function currently not used and this fault should not occur. Check wiring.

F04009: "Low Battery"

Low voltage at Pin 1 of controller connector. Normally a result of discharged batteries. Check wiring, start switch, interlock switches, batteries.

F04010: "High Battery"

High voltage at Pin 1 of controller connector. Check for correct voltage battery installed, check controller parameters.

F04011: "Personality Range"

One or more controller personalities are out of range. Correct parameters must be uploaded to the controller.

F04012: "Personality CRC"

Controller personalities are corrupted. Could be a result of a damaged logic card. Attempt uploading new parameters. If upload fails, then controller must be replaced.

F04013: "Capacitor high"



Level 2 Faults (F02xxx)

F02000: "Accelerator"

Wiring to throttle module is open or faulty throttle module.

F02001: "Accelerator (power up)"

Throttle module FS-1 switch is closed (pedal depressed) or wiring shorted when start switch is turned on.

Throttle module output high when start switch is turned on.

F02002: "Belly Switch"

Belly Switch currently not used and this fault should not occur. Check wiring.

F02003: "Open Field"

Not used.

F02004: "Open Field (L)"

Not used.

F02005: "Open Field ((R))"

Not used.

Level 1 Faults (F01xxx)

Most Level 1 faults are a result of operator error or operation of the vehicle.

F01000: "Power Steer Overheat"

Not used.

F01001: "Traction Motor Brush Wear"

Not used.

F01002: "Pump Motor Brush Wear"

Not used.

F01003: "Power Steer Motor Brush Wear"

Not used.

F01004: "BDI Cutout"

Low voltage at Pin 1 of controller connector. Normally a result of discharged batteries. Check wiring, start switch, interlock switches, batteries. NOTE: Fault will not reset until batteries successfully complete a charge cycle and battery voltage is above reset threshold.

F01005: "Traction Block Overheat"

Controller has overheated. Allow controller to cool off.

F01006: "Traction Motor Hot"

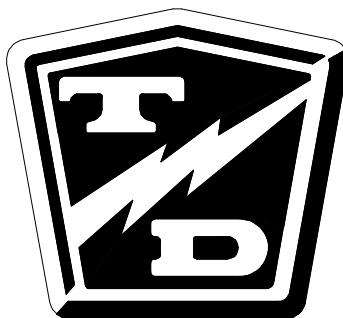
Not used.

F01007: "Pump Motor Hot"

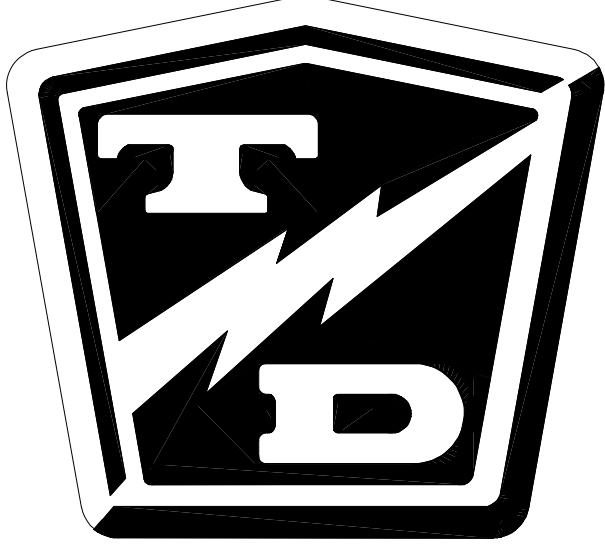
Not used.

F01008: "Encoder Wiring"

Motor speed encoder faulty, faulty wiring., or incorrect controller parameters.



TAYLOR - DUNN



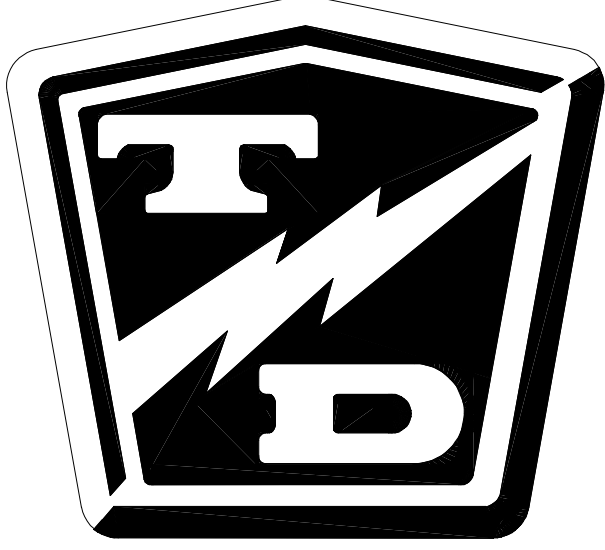
Charger Troubleshooting

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.



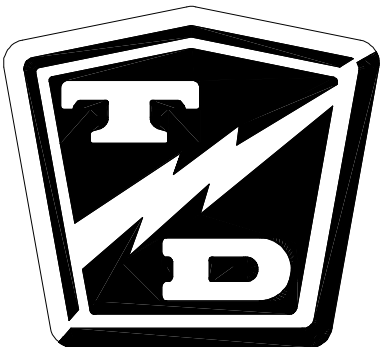
TAYLOR - DUNN



Wire Diagrams

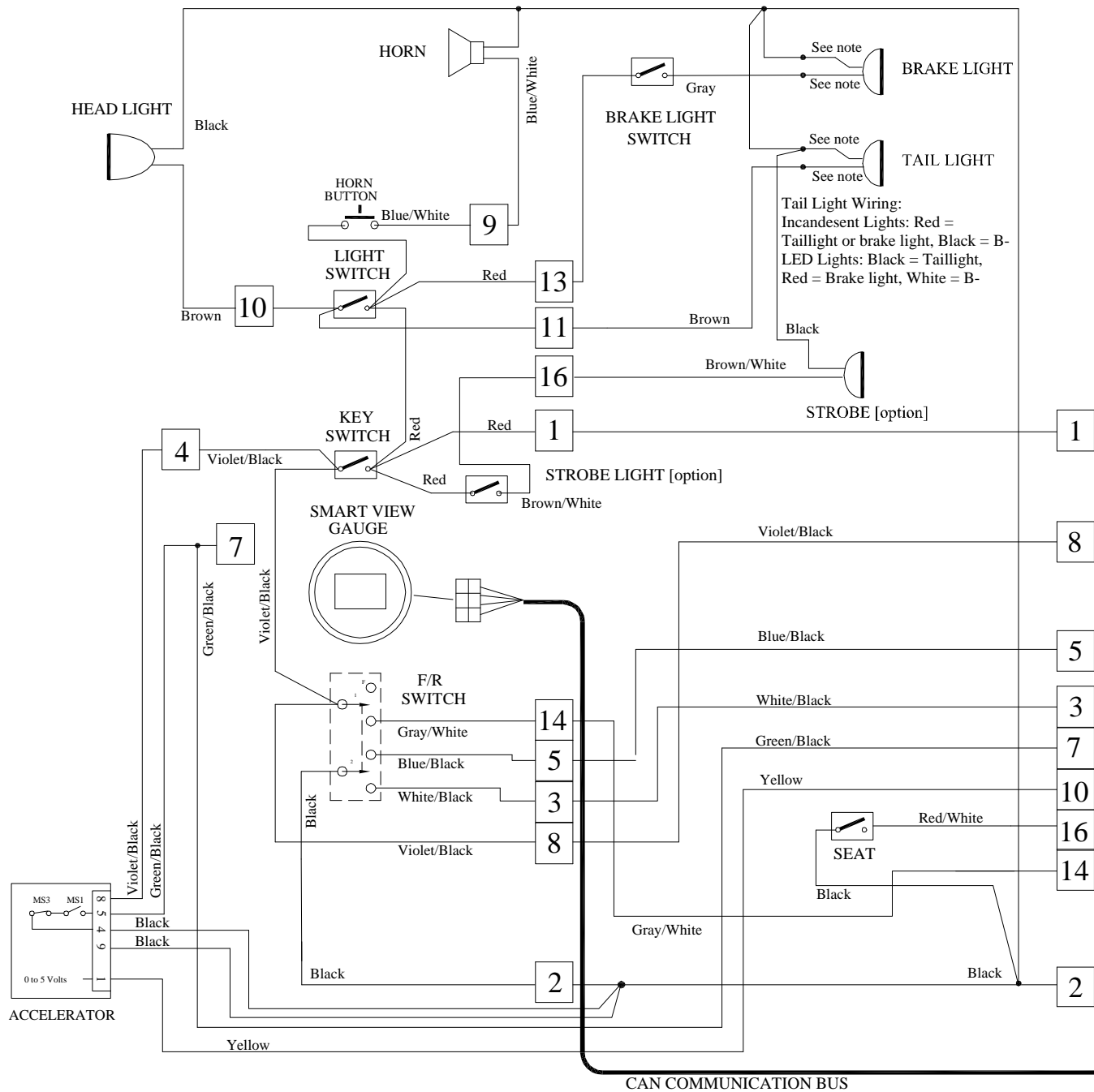
TABLE OF CONTENTS

Chassis	2
Control Panel	3
Accelerator Module Detail	4

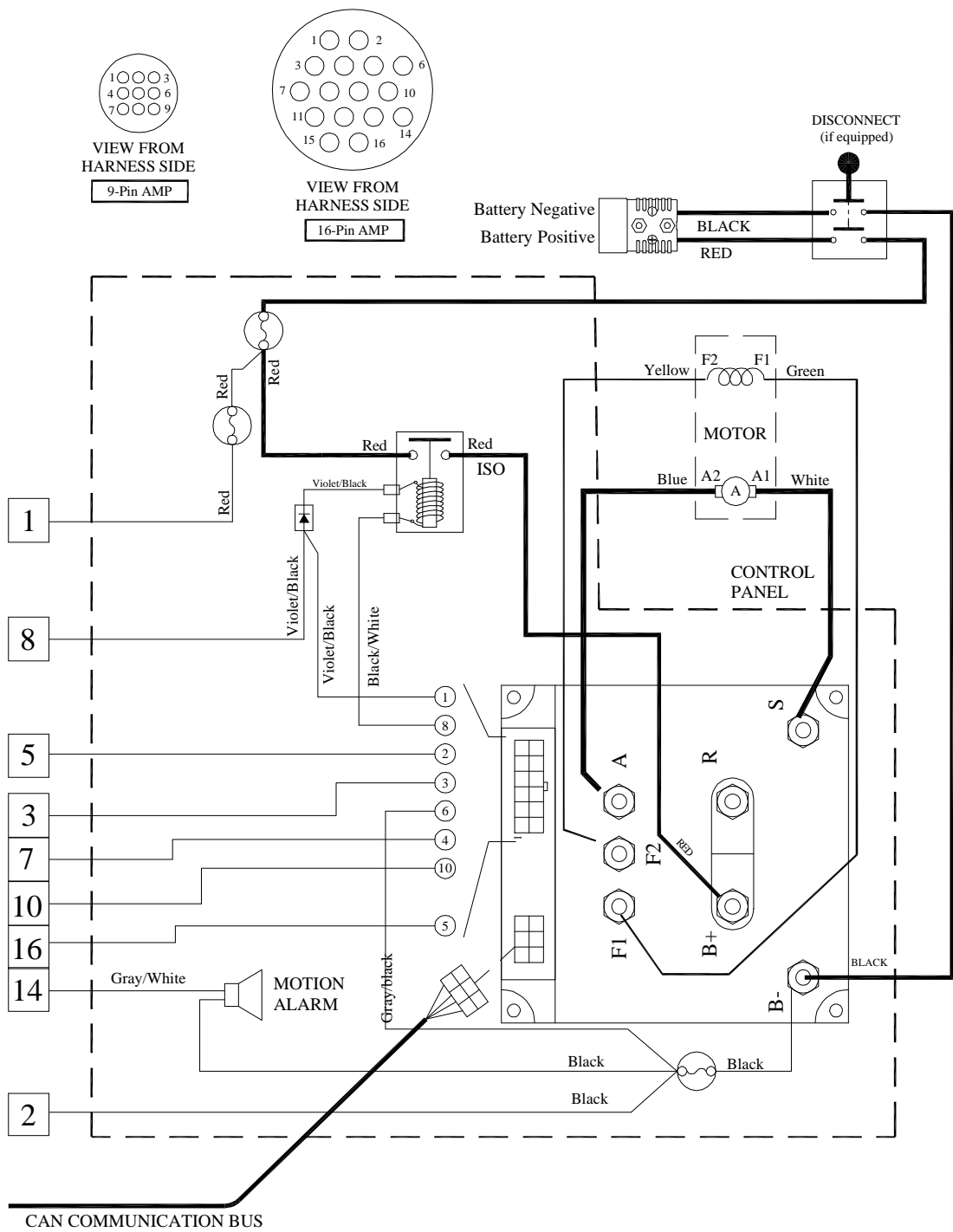




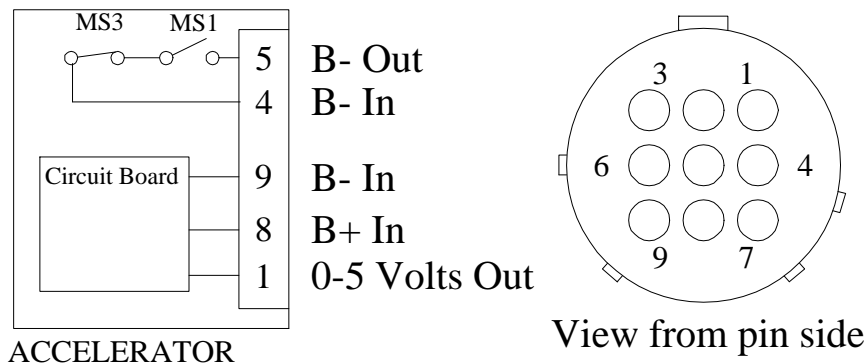
CHASSIS



CONTROL PANEL



ACCELERATOR MODULE DETAIL



MS1 = Accelerator start switch

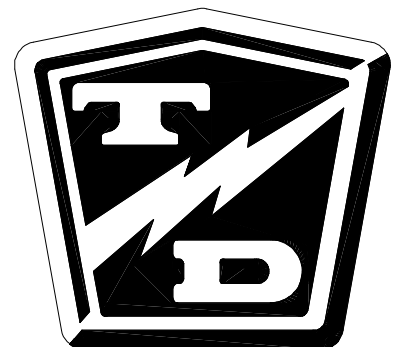
MS3 = Return spring interlock switch

This information is for reference only. The accelerator module should be replaced as a component, there are no serviceable parts in the accelerator module.

Illustrated Parts

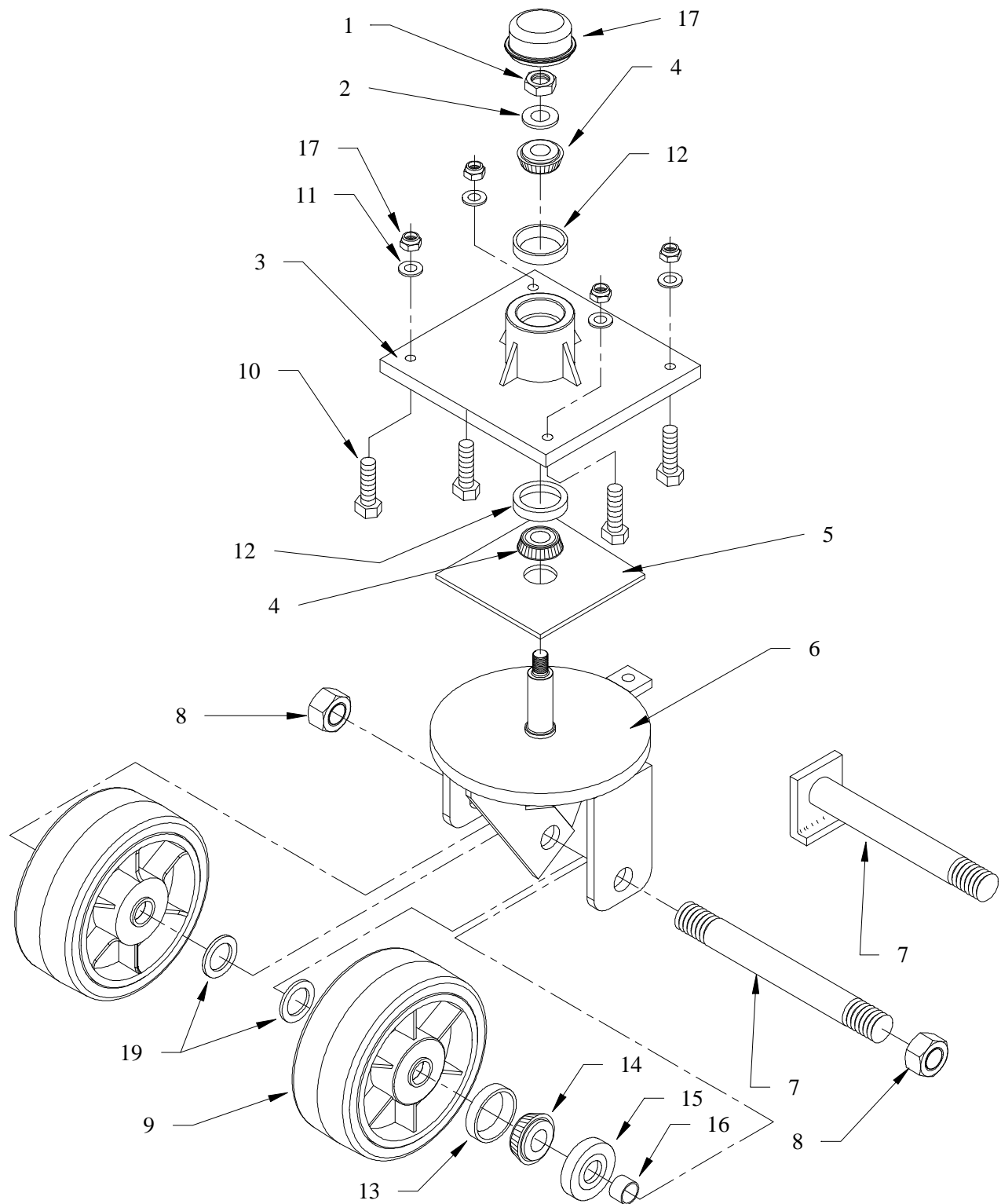
TABLE OF CONTENTS

Front Axle and Fork	2
Steering Linkage	4
Steering Column (standard)	6
Steering Column (tilt)	8
Steering Gear Assembly	10
Transmission Primary Gear Case	12
Transmission Differential Case	14
Rear Axle	14
Rear Brakes	16
Rear Suspension	18
Motor	20
Master Cylinder	22
Hydraulic Brake Lines	24
Park Brake linkage	
Serial # up to 155559	26
Park Brake linkage	
Serial # After 155559	26
Wheels and Tires (rear)	28
Instrument Panel (dash)	30
Resetting the Smart View Display	31
Speed Control Panel	32
Miscellaneous Electrical and Wiring	34
Lights and Horn	36
Battery Compartment	38
Driver Seat	40
Miscellaneous Frame Components	42
Hitches	42
Decals	44
Mirrors	46
Strobe Light Option	48
Electric Motor Brake	50





Front Axle and Fork



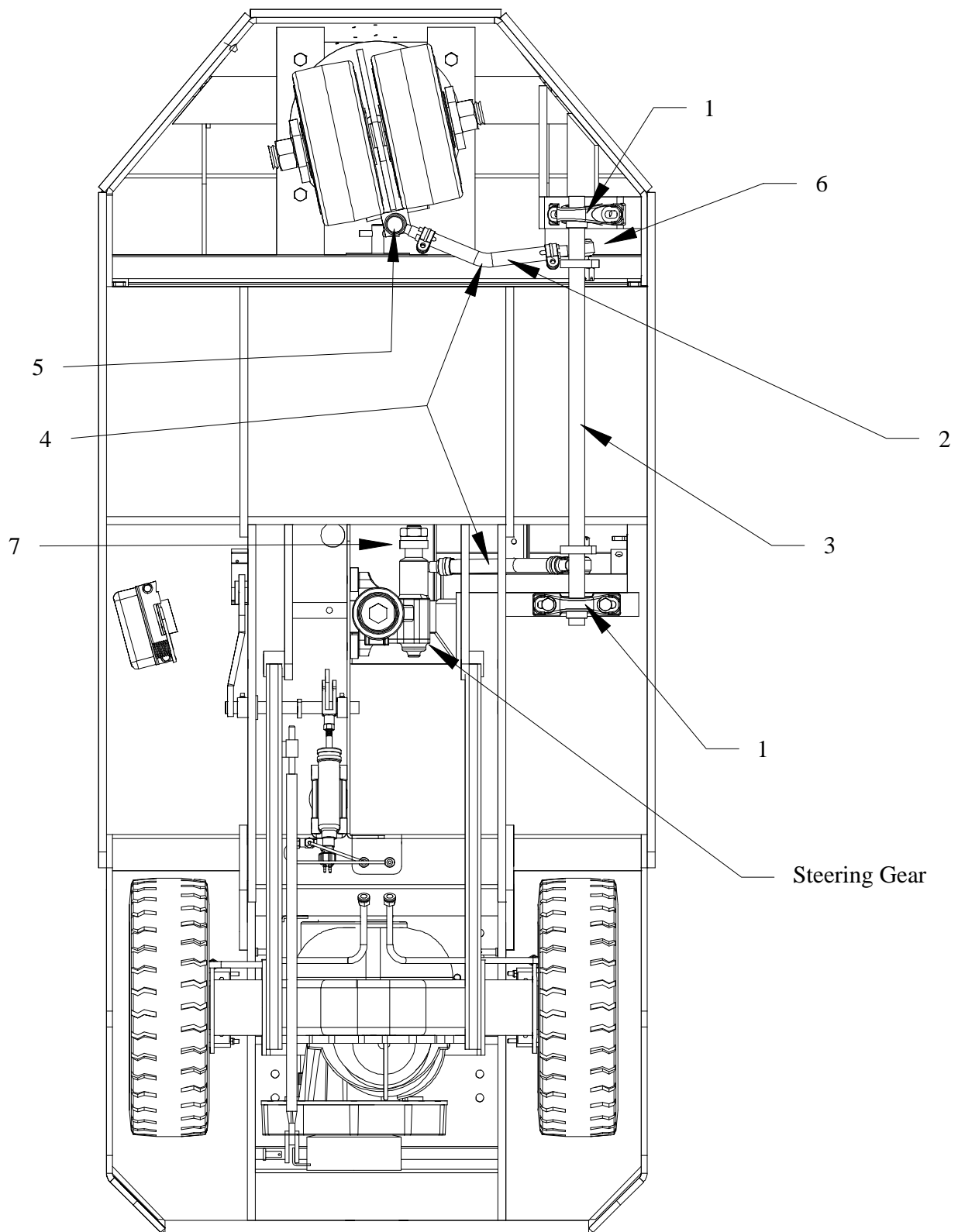
Front Axle and Fork			
ITEM #	PART #	DESCRIPTION	QTY
1	88-229-81	3/4NC Hex nut	1
2	88-228-60	3/4 Cut flat washer	1
3	14-319-05	Caster Plate	1
4	80-011-00	Bearing, fork collar	1
5	03-455-12	Spacer sheet	1
6	14-087-10	Fork	1
7	15-002-00	Axle shaft	1
	15-002-05	Axle shaft with flange	1
8	88-389-88	1-1/4NC Lock nut, use with 15-002-00 axle	2
	88-389-86	1-1/4NC Lock nut, use with 15-002-05 axle	1
9	**13-904-06	Wheel (includes 13, 14, 15, 16)	2
10	88-151-15	1/2 x 1-3/4 NF Hex bolt, grade 8	4
11	88-148-61	1/2 SAE Flat washer	4
12	80-102-00	Race, Fork collar	2
13	**80-102-00	Race, wheel	4
14	**80-011-00	Bearing, wheel	4
15	**	Seal, axle	4
16	**	Spacer, axle	4
17	88-159-84	1/2NF Nylon lock nut	4
18	92-105-00	Fork bearing cap	1
19	**16-400-00	Spacer	2

* - Not available at time of printing.

** - Serial number range 183560 through 183613 were assembled with alternate front wheel assemblies. Replacement bearings (14), races (13), seals (15), and spacers (16, 19) are not available for these wheel assemblies. The wheel must be replaced as an assembly. The standard wheel assembly (9) is a direct replacement for the alternate wheels but both wheels must be replaced as a set along with the spacers (16, 19).

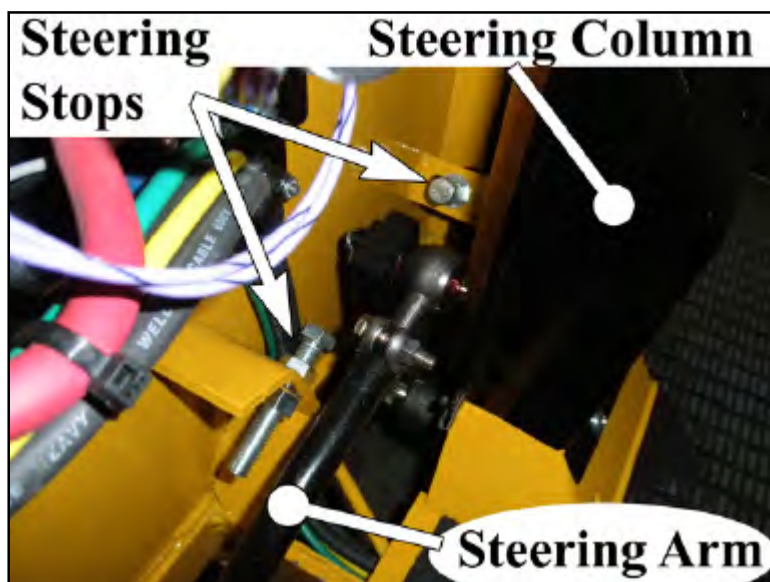


Steering Linkage



Steering Linkage			
ITEM #	PART #	DESCRIPTION	QTY
1	84-004-00	Pillow bearing	2
2	18-028-12	Steering link assembly with ball joints	1
3	18-146-03	Steering jack shaft without steering stops,used after serial number 155599	1
	18-146-04	Steering jack shaft with integral steering stops, used up to serial number 155599	1
4	18-028-12	Drak link assembly with ball joints	2
5	86-501-98	Ball joint	2
6	86-501-99	Ball joint	2
Not shown	86-510-00	Ball joint clamp	4
7	18-640-10	Pitman arm	1

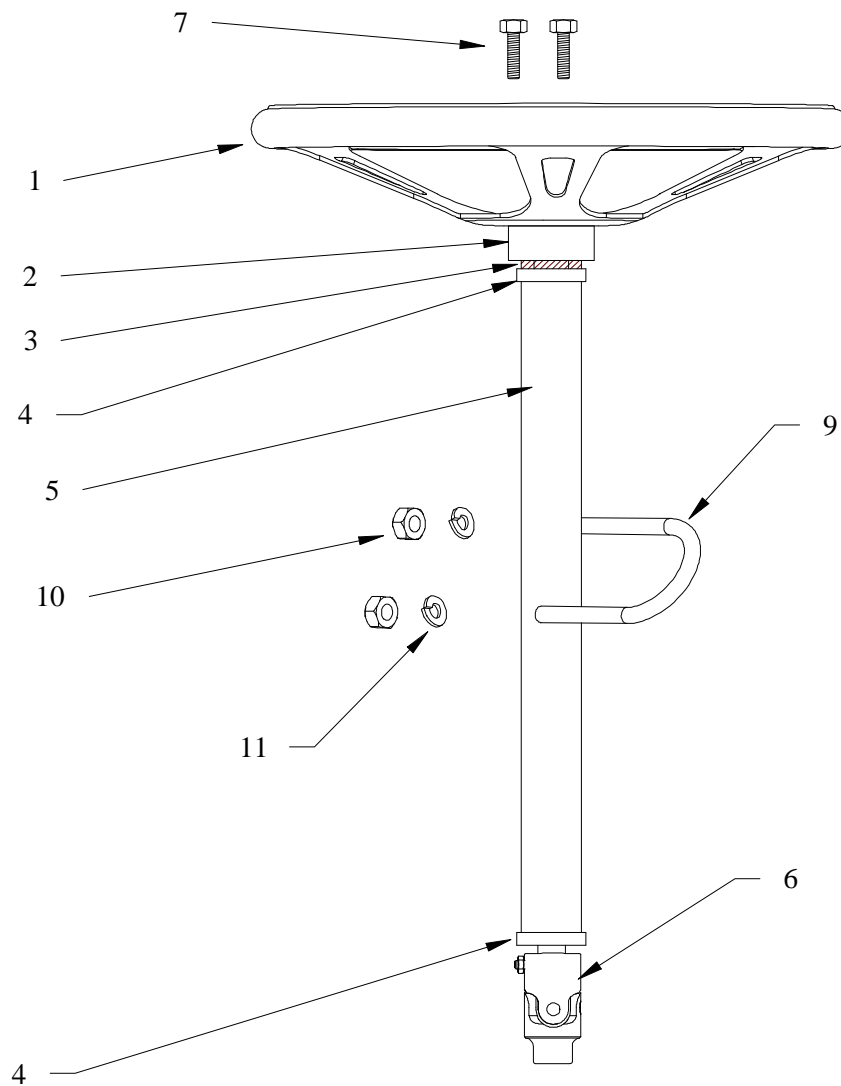
Steering Stops used after S/N 155599



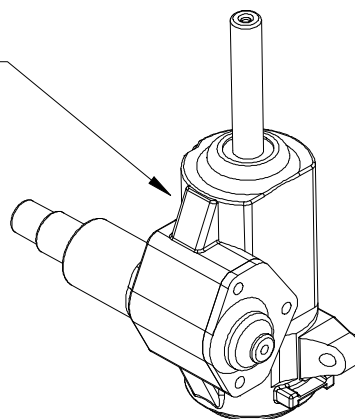
Steering Stops			
ITEM #	PART #	DESCRIPTION	QTY
-	88-140-21	Bolt	2
-	88-149-80	Nut	4



Steering Column (standard)



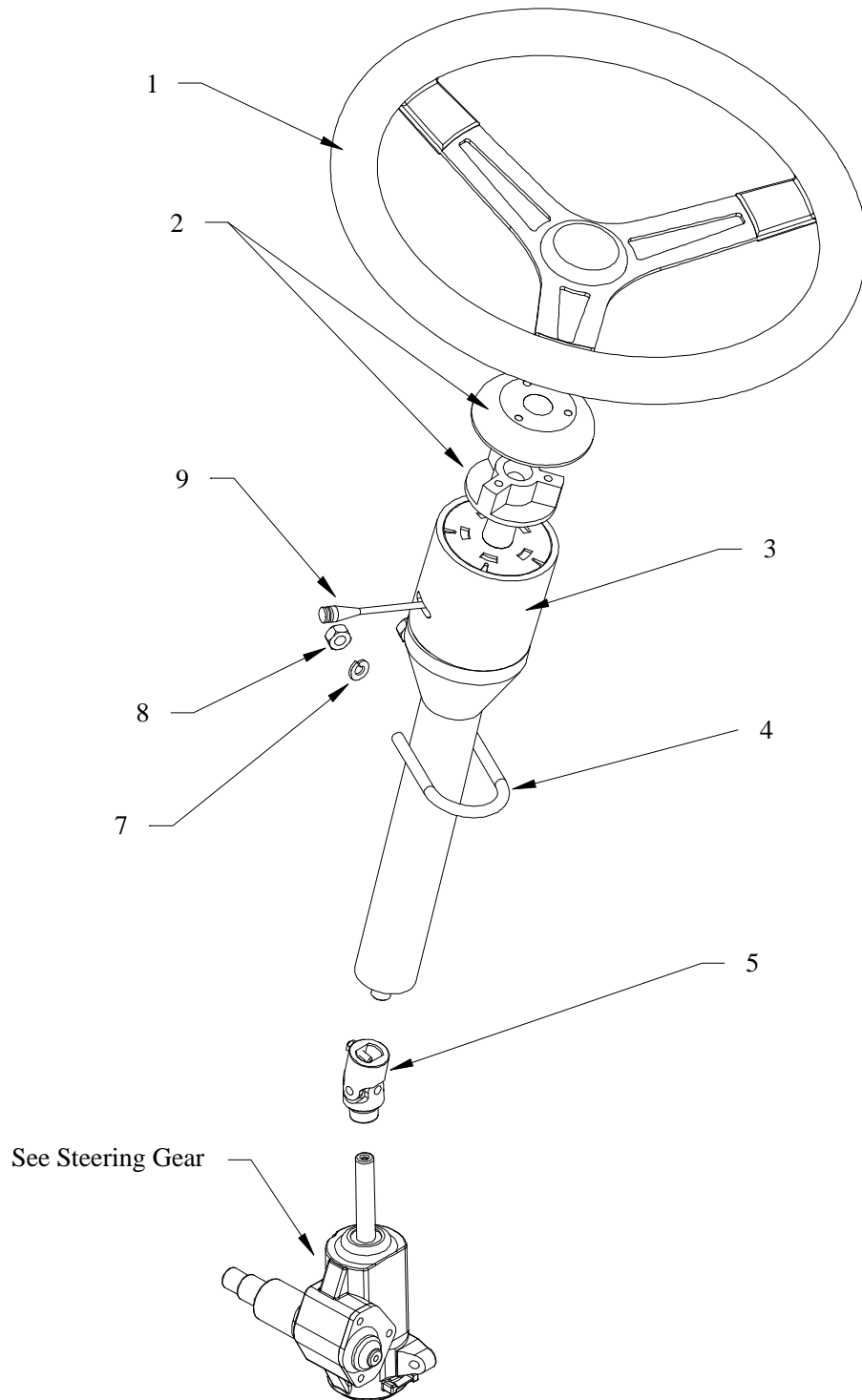
See Steering Gear



Steering Column			
ITEM #	PART #	DESCRIPTION	QTY
1	19-005-17	Steering sheel	1
2	20-455-02	Steering shaft	1
3	97-200-00	Dust washer	1
4	32-455-00	Bushing	2
5	20-455-03	Steering column	1
6	18-308-04	U-joint	1
7	88-060-10	1/4 x 3/4 Hex bolt, grade 5	3
8	-	-	-
9	96-123-45	3/8 x 2 x 2-5/8 U-bolt	1
10	88-109-80	3/8NC Hex nut	2
11	88-108-62	3/8 Split lock washer	2



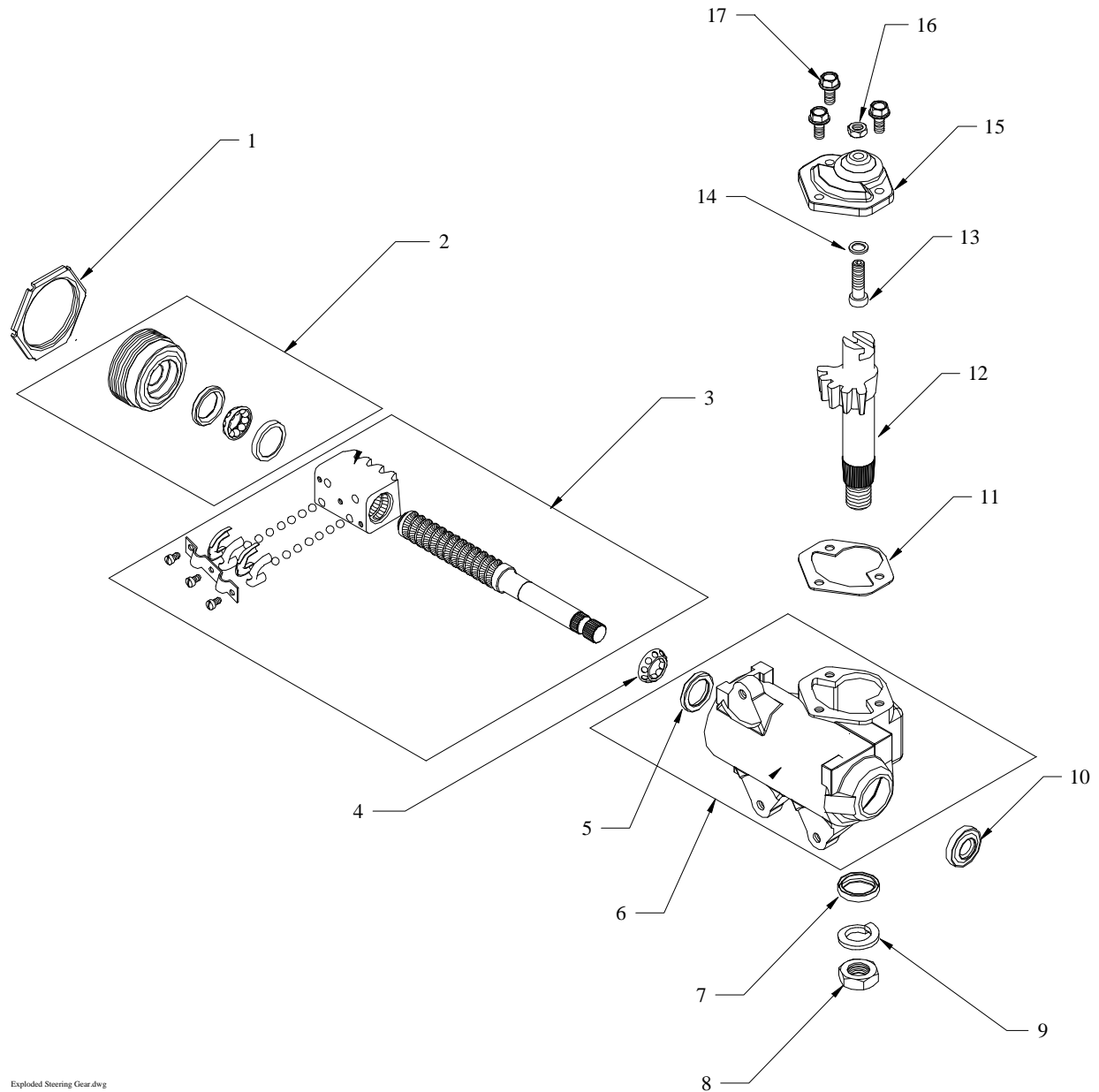
Steering Column (tilt)



Tilt Steering Column			
ITEM #	PART #	DESCRIPTION	QTY
1	19-005-17	Steering wheel	1
2	19-005-00	Steering adapter	1
3	18-414-80	Tilt steering assembly	1
4	96-123-45	U-bolt	1
5	18-308-04	U-joint	1
6	-	-	-
7	88-108-62	3/8 Split lock washer	2
8	88-109-80	3/8NC Hex nut	2
9	18-414-60	Lever kit	1



Steering Gear Assembly

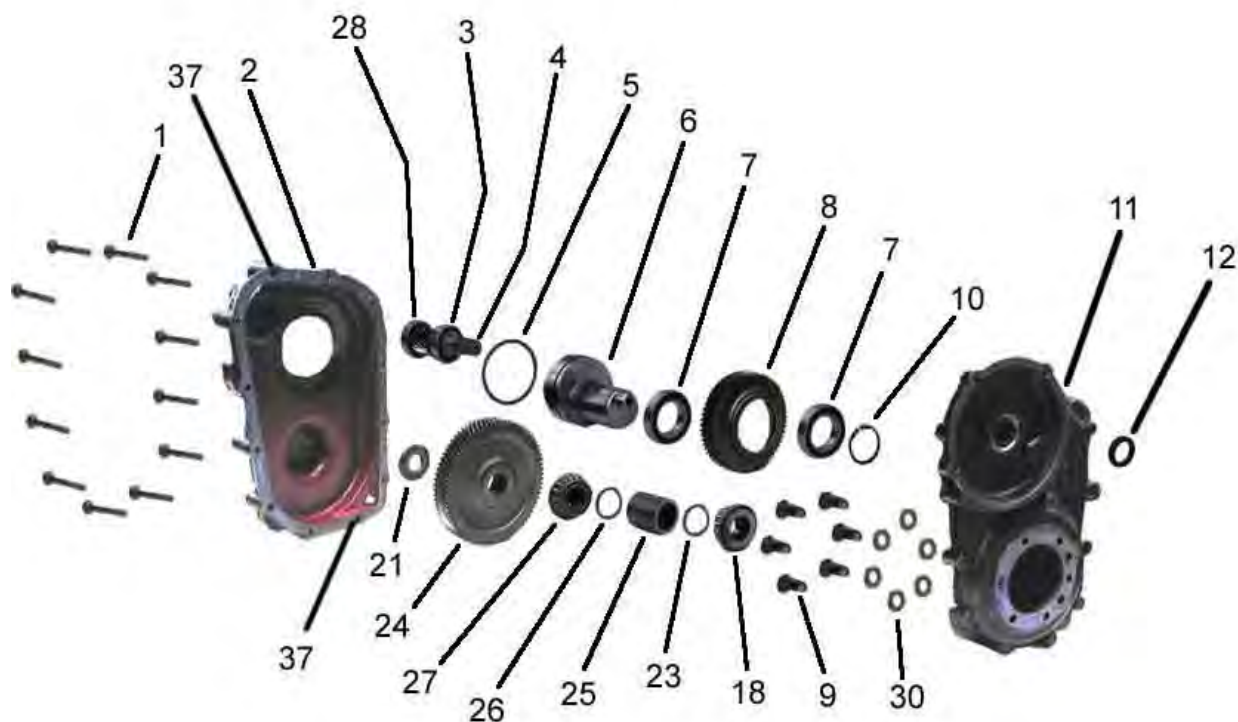


Exploded Steering Gear.dwg

Steering Gear Assembly (18-308-21)			
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



Transmission Primary Gear Case

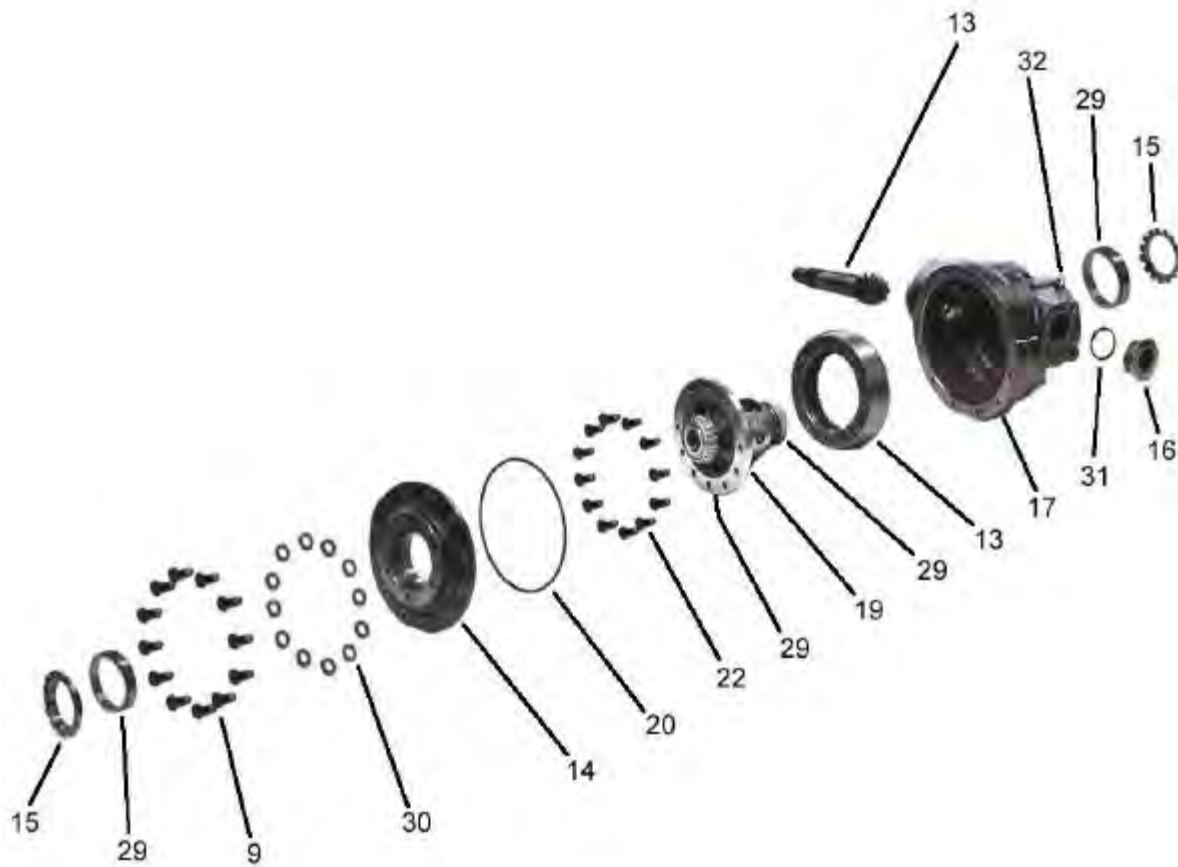


Note 1: Spacer 23 is available in increments of .05mm starting at 3.9mm. 3.9mm spacer is part number GT-3287213. Add 10 to the part number for every 0.05mm over 3.9. For example, if 4.55mm is needed: $4.55 - 3.9 = .65\text{mm over}$, $0.65 / .05 = 13$, $13 * 10 = 130$. Part number for 4.5mm spacer is $3287213 + 130 = 3287343$.

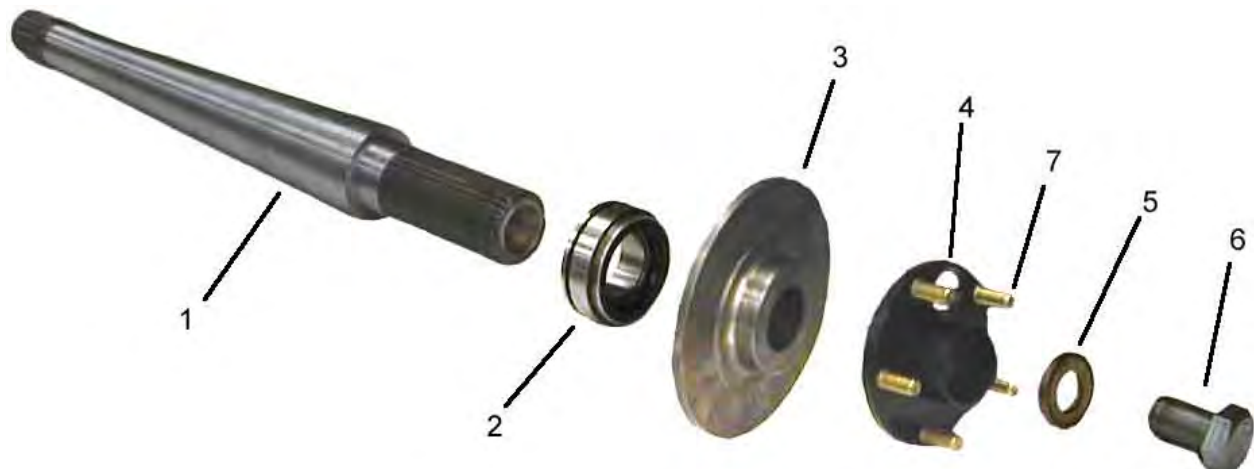
Transmission Gear Case			
ITEM #	PART #	DESCRIPTION	QTY
1	GT-71682	M8 x 60 bolt	12
2	GT-3287563	Gear case cover	1
3	GT-71259	Bearing	1
4	GT-3287513	Input shaft, 30:1	0 or 1
	GT-3287523	Input shaft, 24:1	0 or 1
	GT-3287533	Input shaft, 18:1	0 or 1
	GT-3287543	Input shaft, 12:1	0 or 1
5	GT-71982	O-ring	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	0 or 1
	GT-3287463	Output gear, 24:1	0 or 1
	GT-3287473	Output gear, 18:1	0 or 1
	GT-3287483	Output gear, 12:1	0 or 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



Transmission Differential Case



Rear Axle

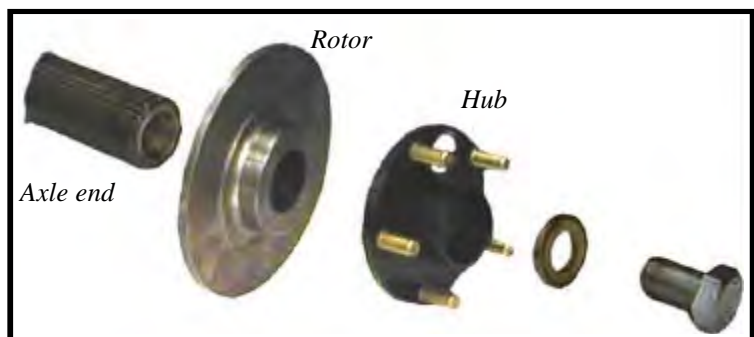
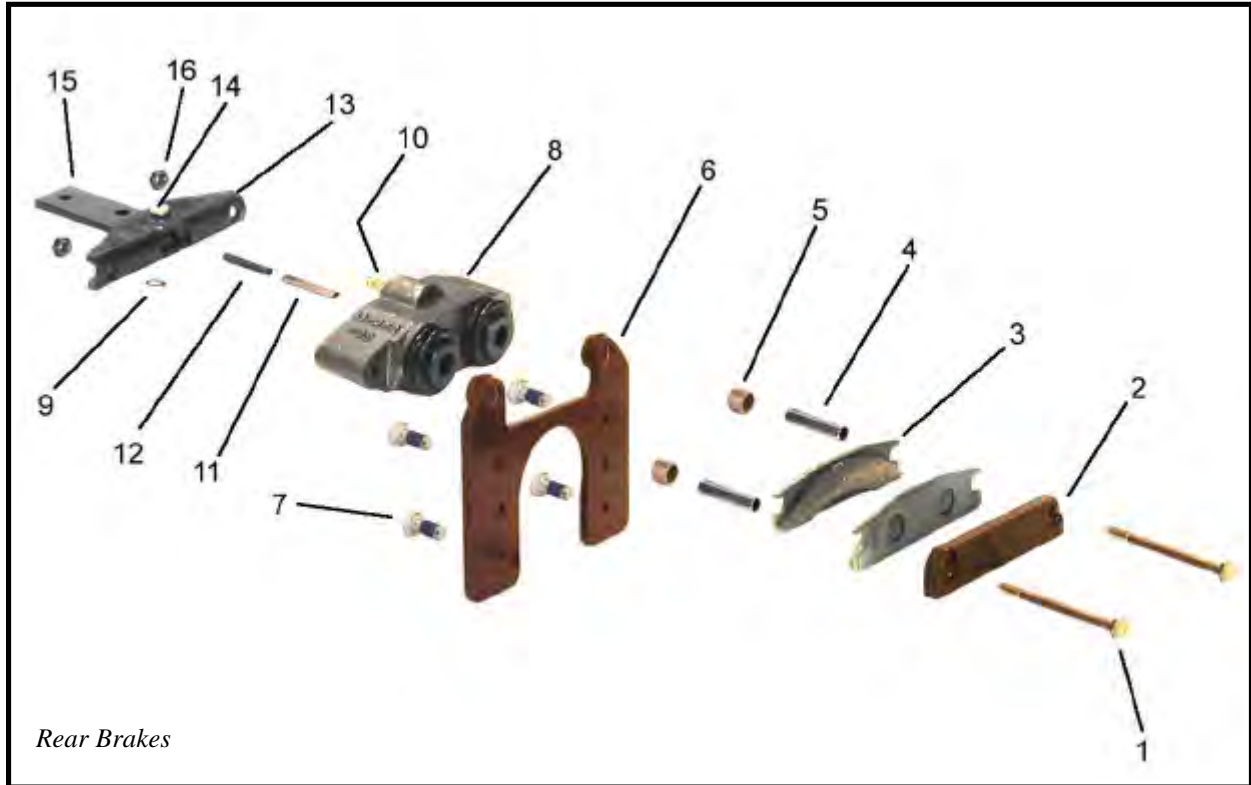


Transmission Differential Case			
ITEM #	PART #	DESCRIPTION	QTY
9	GT-70302	M10 x 30 Bolt	12
13	GT-3287183	Ring and pinion gear set	1
14	GT-3297193	Differential case cover	1
15	GT-3287133	Adjusting ring	2
16	GT-70417	Fill/Level plug	1
17	GT-3287113	Differential housing	1
19	GT-3287143	Differential case	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			
ITEM #	PART #	DESCRIPTION	QTY
1	41-154-30	Axle shaft	2
2	80-505-20	Bearing	2
3	41-490-11	Disc brake rotor	2
4	41-172-21	Hub	2
5	88-268-63	Flat washer	2
6	88-268-30	7/8-14 x 1.5 Bolt, grade 5	2
7	96-329-10	Wheel stud	10
Not shown	92-104-10	Hub cover	2



Rear Brakes



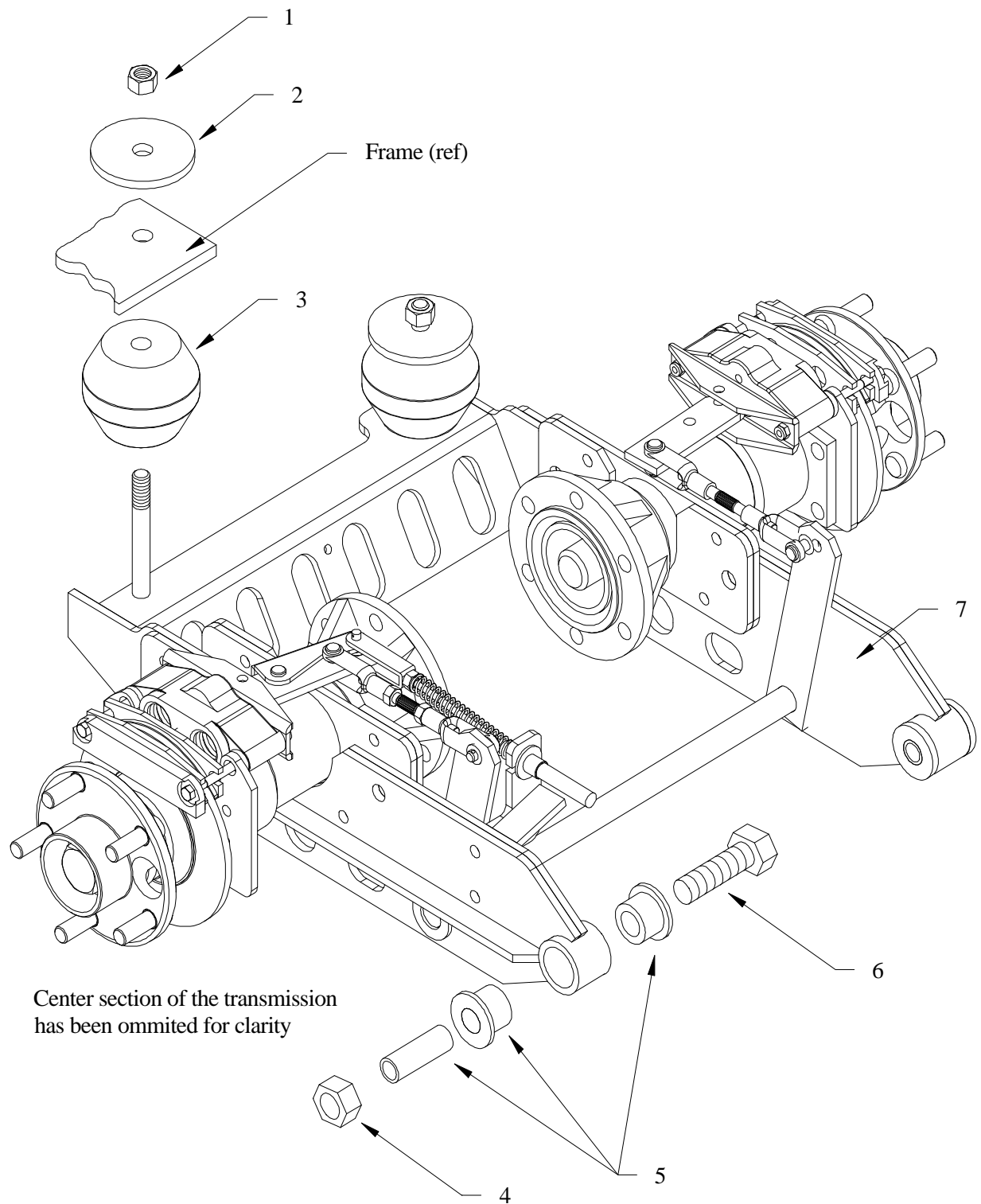
See Rear Axle

Rear Brakes			
ITEM #	PART #	DESCRIPTION	QTY
1	88-067-21	1/4NC x 3-3/4 Hex bolt, grade 8	4
2	41-350-51	Secondary plate	2
3	41-348-70	Brake pad	4
4	41-348-57	Spacer	4
5	32-240-41	Bushing	4
6	41-350-28	Mounting plate	2
7	96-327-10	Axle retaining bolt	8
8	See Brake Body	Brake body assembly	2
9	88-840-11	Clip	2
10	See Brake Body	Bleeder	2
Not shown	99-588-01	Bleeder adapter	2
11	32-220-03	Bushing	2
12	41-350-56	Pin	2
13	41-350-12	Bracket	2
14	41-350-52	Pin	2
15	41-350-53	Arm	2
16	88-069--82	1/4NC Hex lock nut, grade 8	4
Not shown	88-100-00	Spacers for park brake arm	4

Brake Body			
ITEM #	PART #	DESCRIPTION	QTY
1	99-588-00	Bleeder screw	2
2	99-588-01	Bleeder adapter	2
3	41-350-43	Brake body, left	1
	41-350-44	Brake body, right	1
4	80-713-00	O-ring	4
5	41-350-09	Boot	4
6	41-350-10	Piston	4



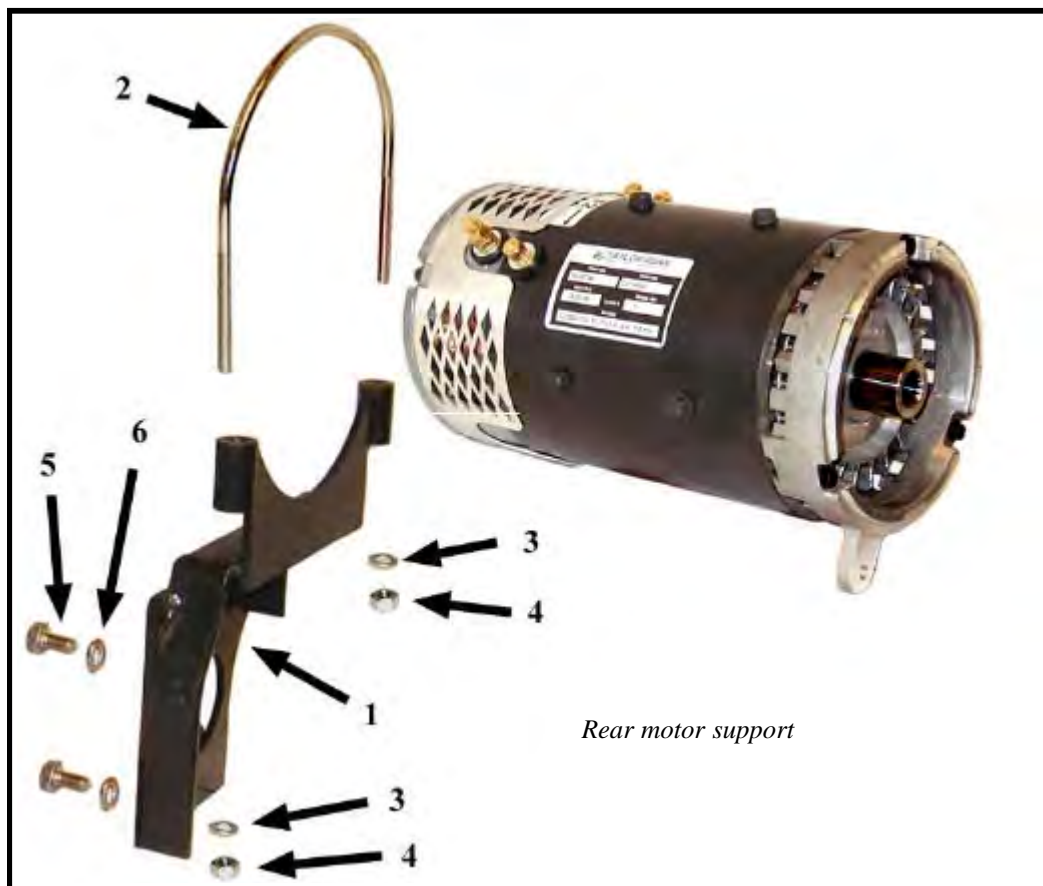
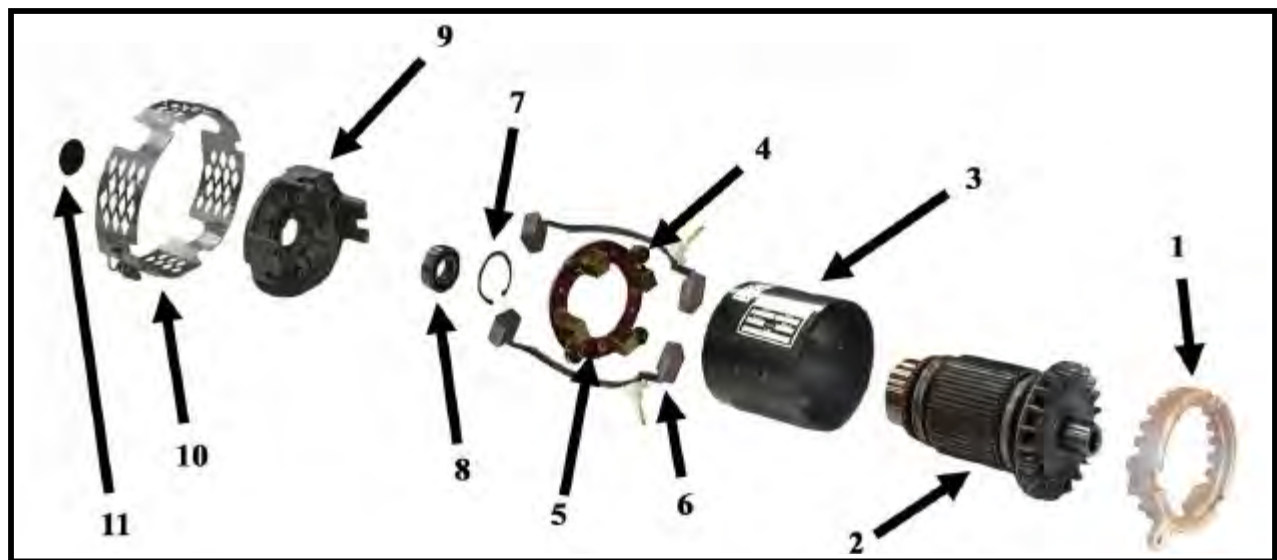
Rear Suspension



Rear Suspension			
ITEM #	PART #	DESCRIPTION	QTY
1	88-149-81	Hex nut	2
2	01-455-61	Washer	2
3	02-455-07	Rubber suspension	2
4	88-149-81	1/2NC Hex lock nut	2
5	32-249-00	Bushing	2
6	88-140-22	1/2NC x 3-1/2 Hex bolt	2
7	02-455-20	Swing arm, up to serial # 155559	1
	00-455-05	Swing arm, after serial # 155559	1



Motor



70-057-40 Motor Spec # DV1-4003			
ITEM #	PART #	DESCRIPTION	QTY
1	70-421-10	Front housing	1
2	70-400-10	Armature	1
3	70-209-40	Field assembly	1
4	85-403-00	Brush spring	4
5	70-173-00	Brush holder	1
6	70-170-30	Brush pair	2
7	70-417-00	Bearing retainer	1
8	80-212-00	Bearing	1
9	70-421-30	Rear housing	1
10	70-421-40	Brush cover	1
11	95-930-00	Dust cap	1

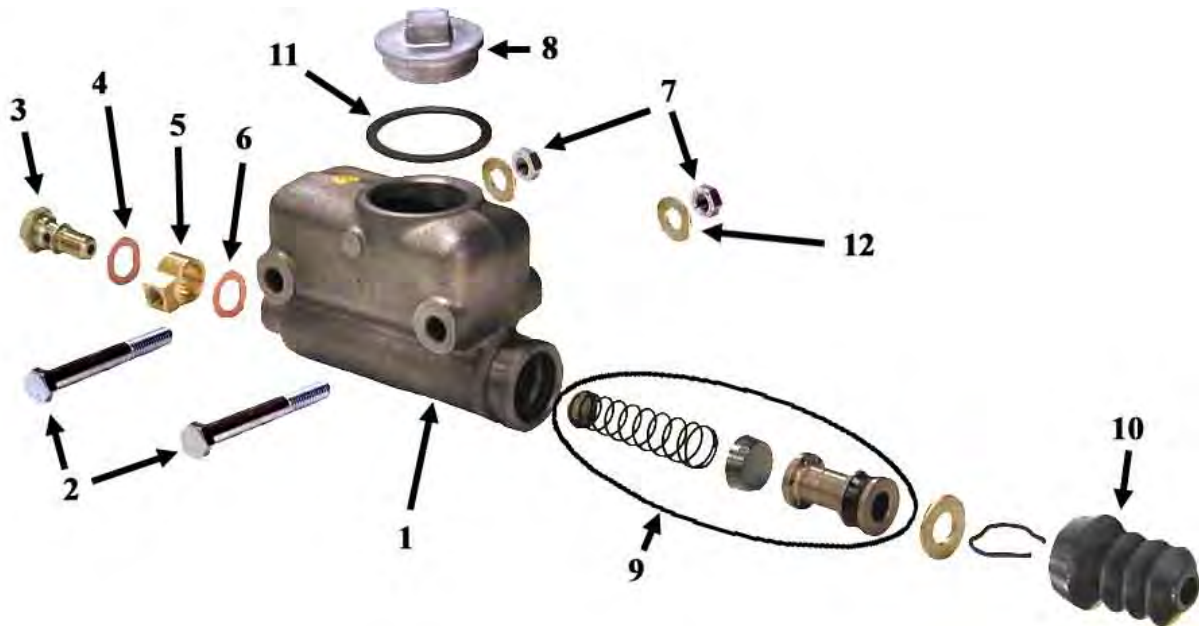
70-054-41 Motor Spec # XP-1789 and DY2-4001			
ITEM #	PART #	DESCRIPTION	QTY
1	70-421-10	Front housing	1
2	70-400-00	Armature	1
3	*	Field assembly	1
4	70-412-20	Brush spring	4
5	70-170-00	Brush holder	1
6	70-109-00	Brush pair	2
7	70-417-00	Bearing retainer	1
8	80-212-00	Bearing	1
9	70-421-20	Rear housing	1
10	70-421-00	Brush cover	1
11	95-930-00	Dust cap	1

Rear Motor Support used with 70-057-41 Motor			
ITEM #	PART #	DESCRIPTION	QTY
1	70-456-10	Lower bracket	1
2	96-114-10	U-bolt	1
3	88-088-62	5/16 Split lock washer	2
4	88-099-80	5/16NF Hex nut	2
5	89-111-27	M10 -1.5 x 20 Hex bolt	2
6	88-128-62	7/16 Split lock washer	2

* - Not available at time of printing.



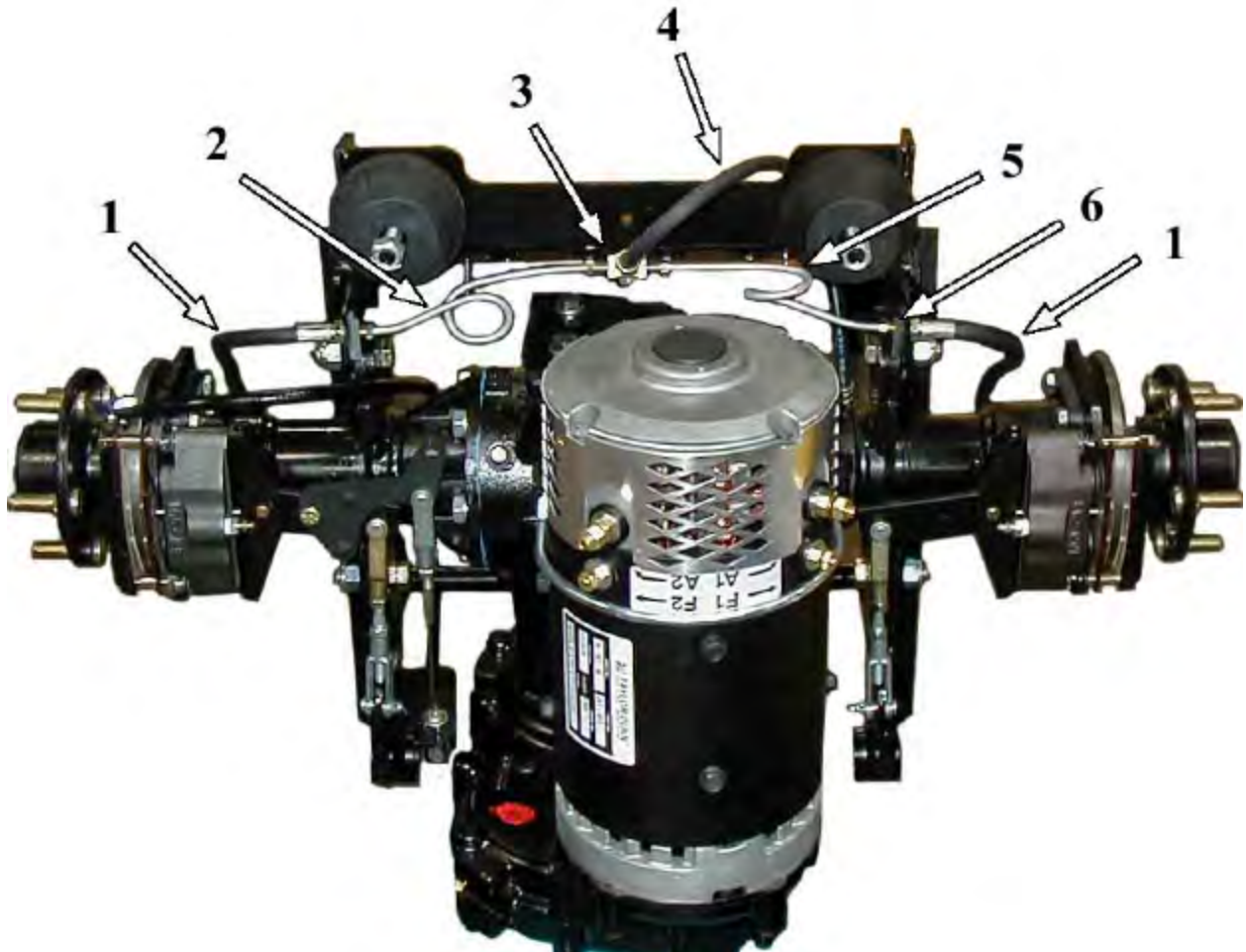
Master Cylinder



Master Cylinder			
ITEM #	PART #	DESCRIPTION	QTY
1	99-511-00	Master cylinder (includes 8, 9, 10, 11)	1
2	88-101-20	3/8NC x 3 Hex bolt, grade 5	2
3	99-578-00	Hydraulic fitting	1
4	99-572-00	Copper washer	1
5	99-566-00	Banjo fitting	1
6	99-571-00	Copper washer	1
7	88-109-81	3/8NC Hex lock nut	2
8	99-510-52	Cap	1
9	99-511-00	Rebuild kit	1
10	99-511-51	Rubber boot	1
11	99-510-53	Gasket	1
12	88-108-61	3/8 SAE Flat washer	2
Not shown	71-110-00	Brake light switch (mounted to item #3)	1
	85-250-00	Brake pedal return spring	1
	01-455-60	Master cylinder pusgrod, used up to serial #156015	1
	50-009-00	Master cylinder pusgrod, used starting serial #156016	1



Hydraulic Brake Lines



*Item #7 located inside of #3
Actual size 3/8" long*

Hydraulic Brake Lines			
ITEM #	PART #	DESCRIPTION	QTY
1	99-580-20	Brake hose	2
2	99-600-58	Brake line	1
3	99-563-00	T-fitting	1
4	99-580-40	Brake hose to master cylinder	1
5	99-600-58	Brake line	1
6	99-576-00	Brake hose clip	2
7	99-574-00	Spacer	1

A photograph of a mechanical assembly, likely a fuel system component, with numbered callouts 1 through 9 pointing to various parts. The assembly includes a cylindrical component on the left, a central vertical rod, and various connecting arms and valves. The callouts are: 1 points to a valve or actuator on the right; 2 points to a component above it; 3 points to a small valve or fitting; 4 points to a vertical rod or pipe; 5 points to a component below the rod; 6 points to a component at the bottom; 7 points to a component on the right side; 8 points to a component on the right side; 9 points to a component on the left side.

A 3D CAD model of a mechanical assembly, likely a valve actuator. The model is shown in a perspective view. A green component is visible on the left, and a yellow component is on the right. The assembly is mounted on a base. Numbered callouts (1-9) point to various parts: 1 points to a green component, 2 points to a yellow component, 3 points to a yellow component, 4 points to a yellow component, 5 points to a yellow component, 6 points to a yellow component, 7 points to a yellow component, 8 points to a yellow component, and 9 points to a yellow component.

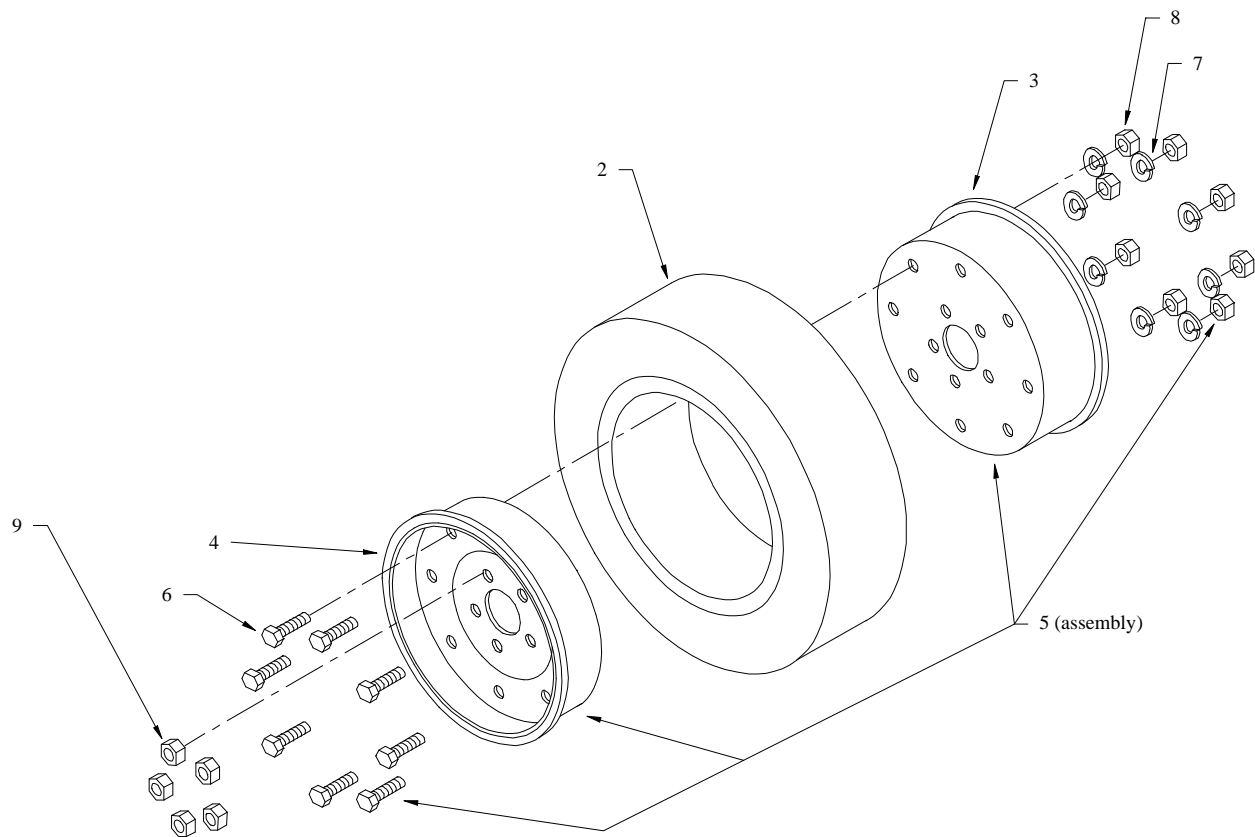
Park Brake Linkage up to S/N 155559			
ITEM #	PART #	DESCRIPTION	QTY
1	96-763-00	Clevis	1
2	41-350-55	Parking brake arm extension	1
3	-	-	-
4	50-002-19	Cross shaft link	2
5	96-763-00	Clevis (RH thread)	2
6	96-773-00	Clevis pin	8
Not shown	88-527-11	Cotter pin for #6	8
7	88-099-80	5/16NF Hex nut	3
8	96-820-25	Parking brake cable	1
9	88-081-10	5/16NC x 7/8 Hex bolt, grade 8	1
Not shown	88-089-81	5/16NC lock nut for bolt #9	1
Not shown	51-344-80	Parking brake handle	1
Not shown	85-295-00	Park brake arm return spring	1

Park Brake Linkage After S/N 155559			
ITEM #	PART #	DESCRIPTION	QTY
1	96-763-00	Clevis	1
2	96-765-00	Clevis, left hand thread	2
3	00-455-04	Cable mounting bracket	1
4	50-002-22	Cross shaft link	2
5	96-763-00	Clevis, right hand thread thread	3
6	96-773-00	5/16 x 1 Clevis pin	5
Not shown	88-527-11	1/8 x 1 Cotter pin	5
7	88-099-81	5/16NF Hex nut, left hand thread	3
8	96-820-25	Parking brake cable	1
9	88-099-80	5/16NF Hex nut	3
Not shown	51-344-80	Parking brake handle	1
Not shown	85-295-00	Park brake arm return spring	1
Not shown	06-210-03	Mounting clip for return spring	1



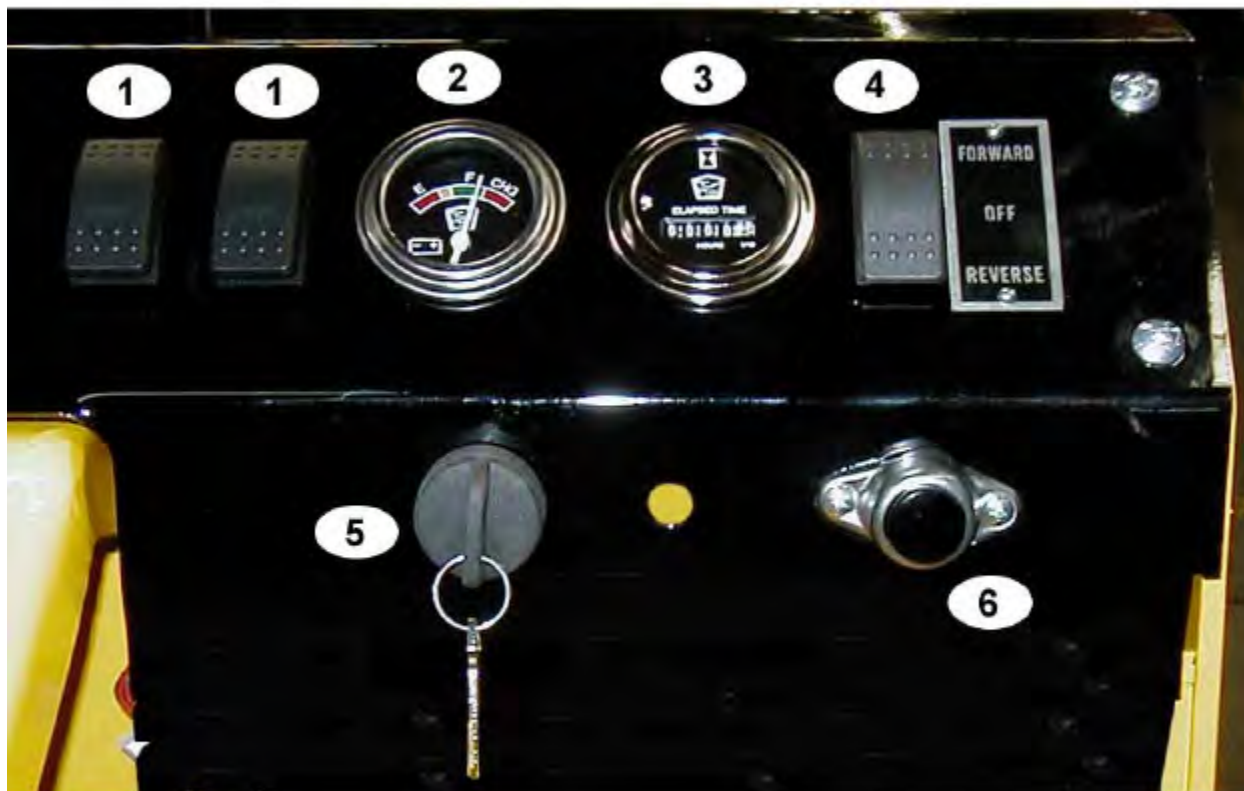
Wheels and Tires (rear)

See Front Axle and Fork for the front wheels



Wheels and Tires			
ITEM #	PART #	DESCRIPTION	QTY
2	Tires		
	10-074-00	4.00 x 8 Soft solid (Man-Toter)	2
	10-074-10	4.00 x 8 Soft solid (Man-Toter), Non-marking	2
	10-076-00	4.80 x 8, Load range C	2
	Split Rim Wheels		
3a	12-042-12	Inner Wheel (12-bolt)	4
4a	12-042-13	Outer Wheel (12-bolt)	4
5a	12-042-00	Wheel Assembly, 3.75 bead width (includes #3a, #4a, #6, #7, #8	2
6	88-110-09	3/8 x 3/4-NF Hex Bolt, grade 5	4
7	88-109-62	3/8 Split Lock Washer	4
8	88-119-80	3/8-NF Hex Nut	4
9	97-236-00	Wheel Nut	10
Not shown	11-030-00	Tube	2
	Tire and Wheel Assemblies		
	13-739-10	4.80 x 8, Load range C, split rim	2
	13-734-40	4.80 x 8, Man-Toter	2
	13-734-41	4.80 x 8, Man-Toter, non-marking	2

Instrument Panel (dash)



PMT/C maintenance meter



Curtis 900 Battery Status



Smart View Display

Instrument Panel			
ITEM #	PART #	DESCRIPTION	QTY
1	71-039-11	Accessory switch	1
1a	71-039-21	Plastic plug for empty accessory switch hole	
2	74-009-10	Battery status indicator (analog)	1
	74-009-12	Battery status indicator (bargraph, shown at bottom)	1
	74-010-00*	Smart view display*	1
3	74-000-00	Hour meter	1
	74-018-20	PMT/C Maintenance meter	1
	M7-010-01	User manual for the PMT/C meter	
4	71-039-02	Forward and reverse switch	1
5	71-120-10	Key switch (includes 5a)	1
5a	71-120-90	Key for #5	
6	71-501-00	Horn switch	1

* - 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.

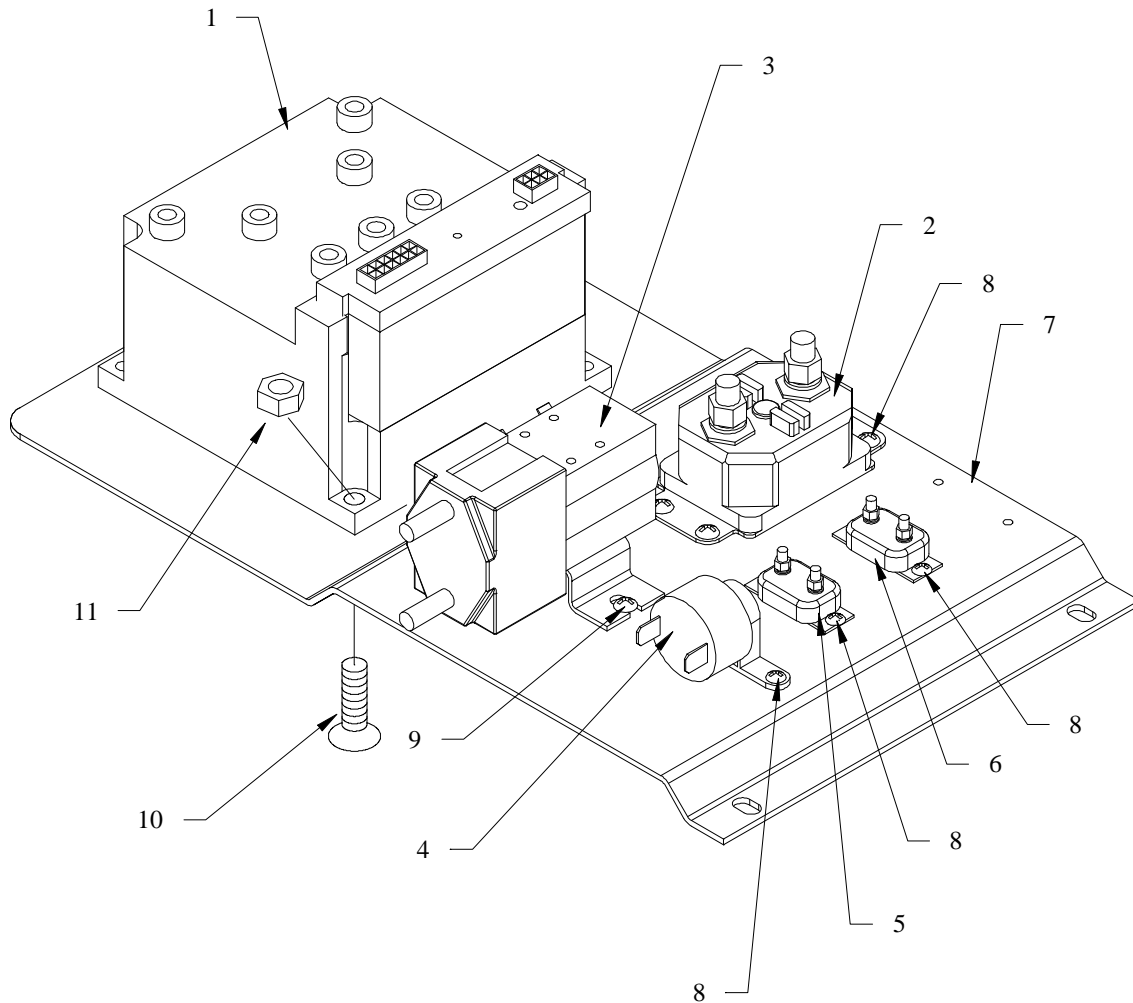
The Smart View Display will only work with the Sevcon control system.

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.



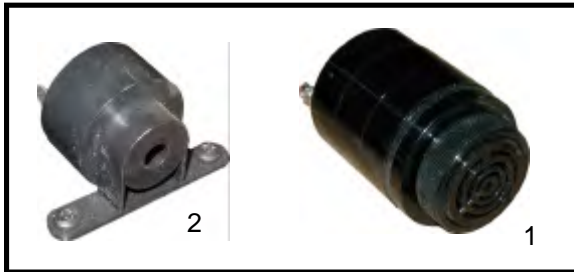
Speed Control Panel



Control Panel			
ITEM #	PART #	DESCRIPTION	QTY
1	62-400-00	Speed controller	1
2	79-844-20	Circuit breaker	1
3	71-300-02	Contactor	1
	71-300-01	Mounting bracket for contactor	1
4	73-005-01	Reverse/Motion alarm	1
5	79-840-00	Circuit breaker	1
6	7-840-00	Circuit breaker	1
7	01-200-05	Mounting plate	1
8	88-818-06	#8 screw	10
9	88-838-06	#14 screw	2
10	88-067-13	1/4NC x 1-1/4 Oval head bolt	6
11	88-069-81	1/4NC Hex lock nut	6



Miscellaneous Electrical and Wiring



Motion Alarms



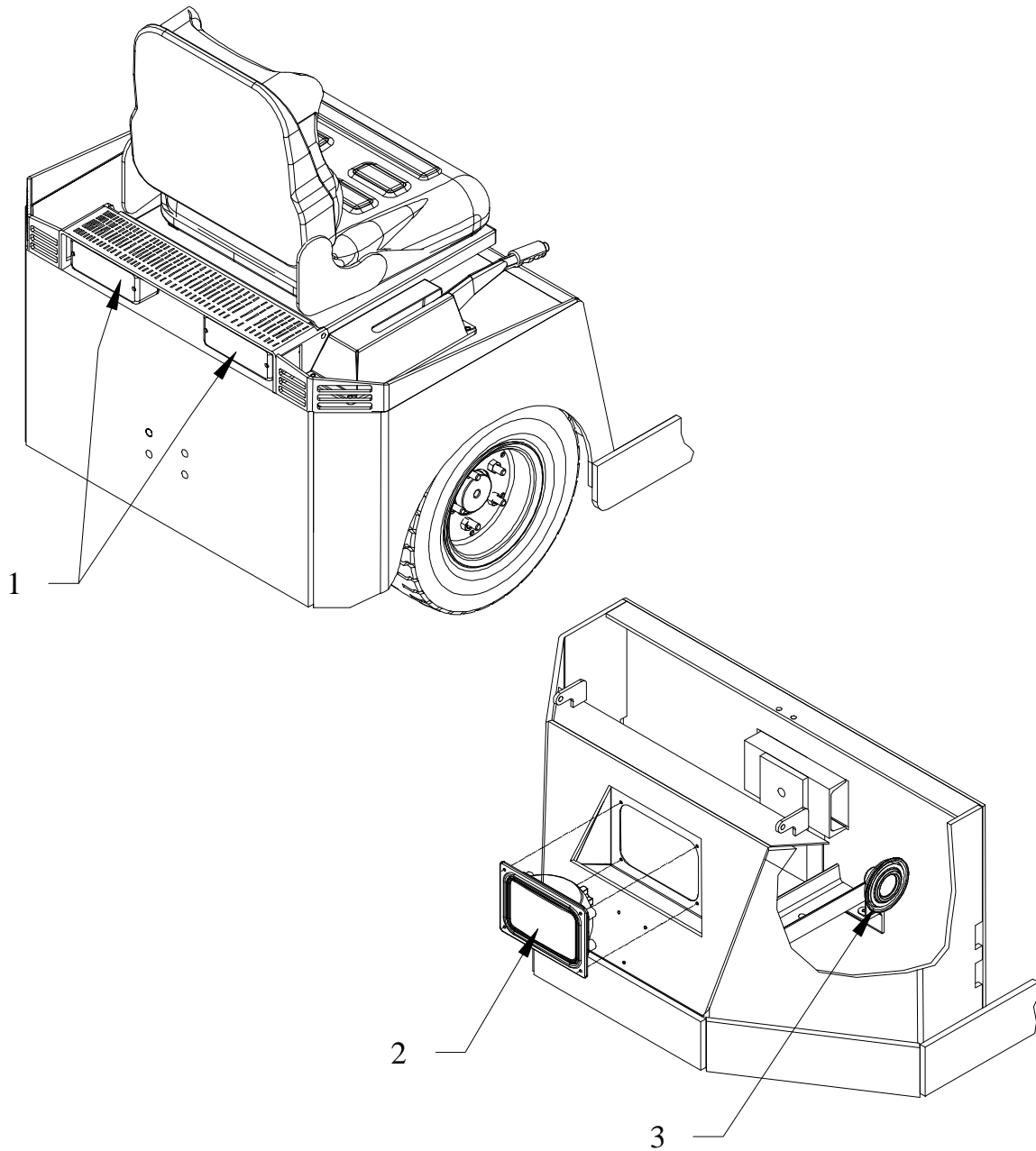
Miscellaneous Wire Harness Clamps



Miscellaneous Electrical			
ITEM #	PART #	DESCRIPTION	QTY
Not Shown	75-152-50	Chassie Control Harness	1
Not Shown	75-152-51	Control Panel Harness	1
Not Shown	75-152-53	Power Harness	1
Not Shown	75-152-52	Dash Harness	1
Not Shown	98-599-15	Plastic grommet for 1.75 hole	
Not Shown	98-599-20	Plastic Grommet for 2.5 hole	
1	73-005-05	Reverse Warning alarm	1
2	96-650-01	Wire Harness Clip, stick on	
3	96-642-00	Wire harness Clip, push mount	
4	62-033-48	Accelerator Module	1
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15	96-640-00	Clamp, 3/16 Push Mount	
16	96-629-80 (not shown)	Clamp, Rubber Lined 3/16 ID	
	96-630-00 (not shown)	Clamp, Rubber Lined 5/8 ID	
	96-630-50 (not shown)	Clamp, Rubber Lined 5/8 ID (.265 mounting hole)	
	96-631-00 (not shown)	Clamp, Rubber Lined 3/4 ID	
	96-631-10 (shown)	Clamp, Rubber Lined 1.0 ID	
	96-631-15 (not shown)	Clamp, Rubber Lined 1-1/2 ID	
17	96-624-00	Clamp, 1/4 Jiffy Clip	
	96-625-00 (not shown)	Clamp, 5/16 Jiffy Clip	
18	96-626-00	Clamp, 7/8 Jiffy Clip	



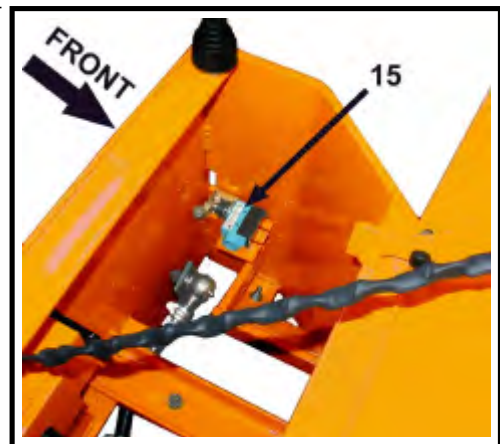
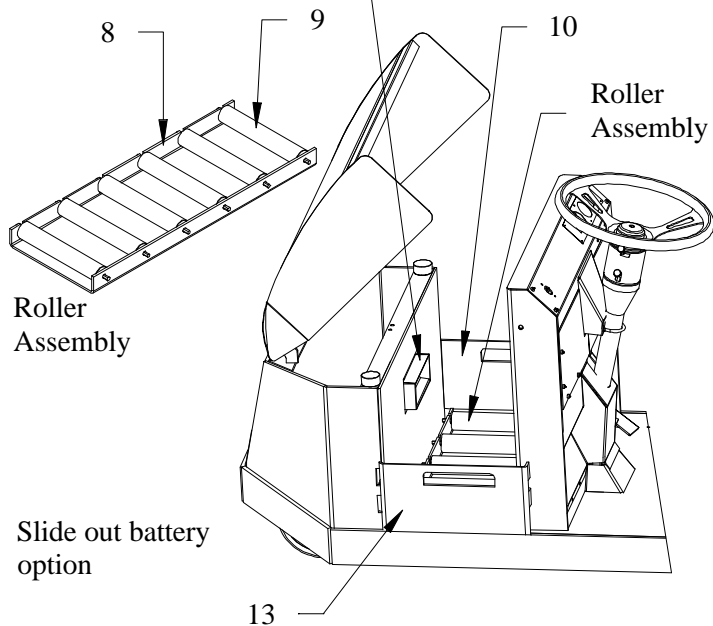
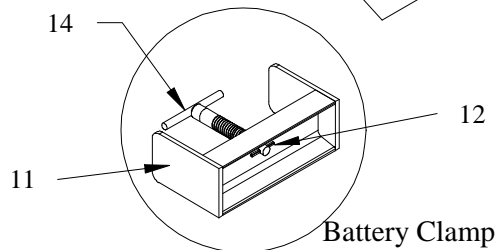
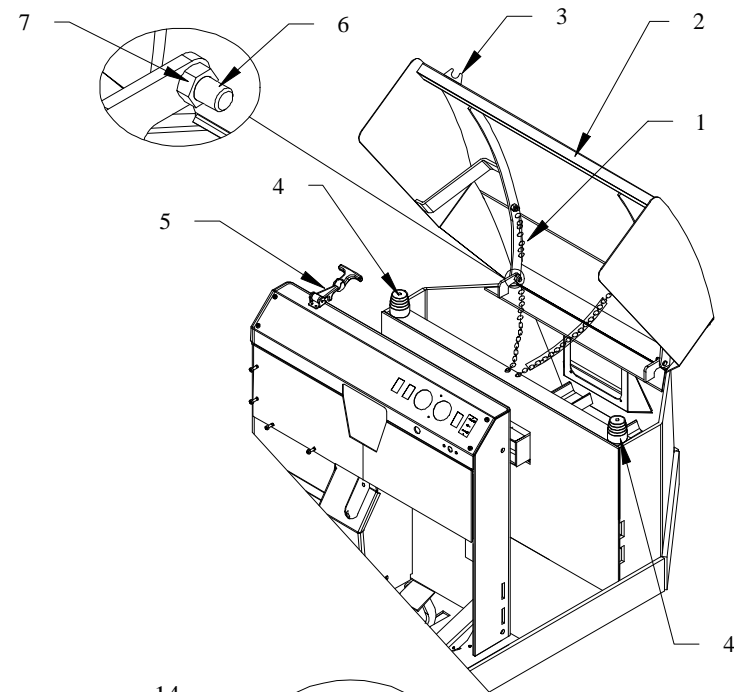
Lights and Horn



Lights and Horn (24-volt)			
ITEM #	PART #	DESCRIPTION	QTY
1	72-034-05	Tail light, Incandescent, up to serial # 171906	1 or 2
	72-022-05	Taillight, LED, starting serial # 173996	1 or 2
Not shown	72-080-00	Replacement bulb	1 or 2
Not shown	88-014-19	#6 x 2-3/4 Round head slotted machine screw (tail light)	2 or 4
Not shown	88-019-80	6-32 Hex nut (tail light)	2 or 4
Not shown	88-028-62	#8 lock washer (tail light)	2 or 4
2	72-025-03	Head light	1
Not shown	72-080-00	Replacement bulb	1
Not shown	88-734-08	Pop rivet for head light	4
3	73-001-00	Horn	1
Not shown	88-060-09	1/4NC x 3/4 Hex bolt (Horn)	1
Not shown	88-068-61	1/4 SAE Flat washer (Horn)	1
Not shown	88-069-81	1/4NC Nylon lock nut (Horn)	1



Battery Compartment



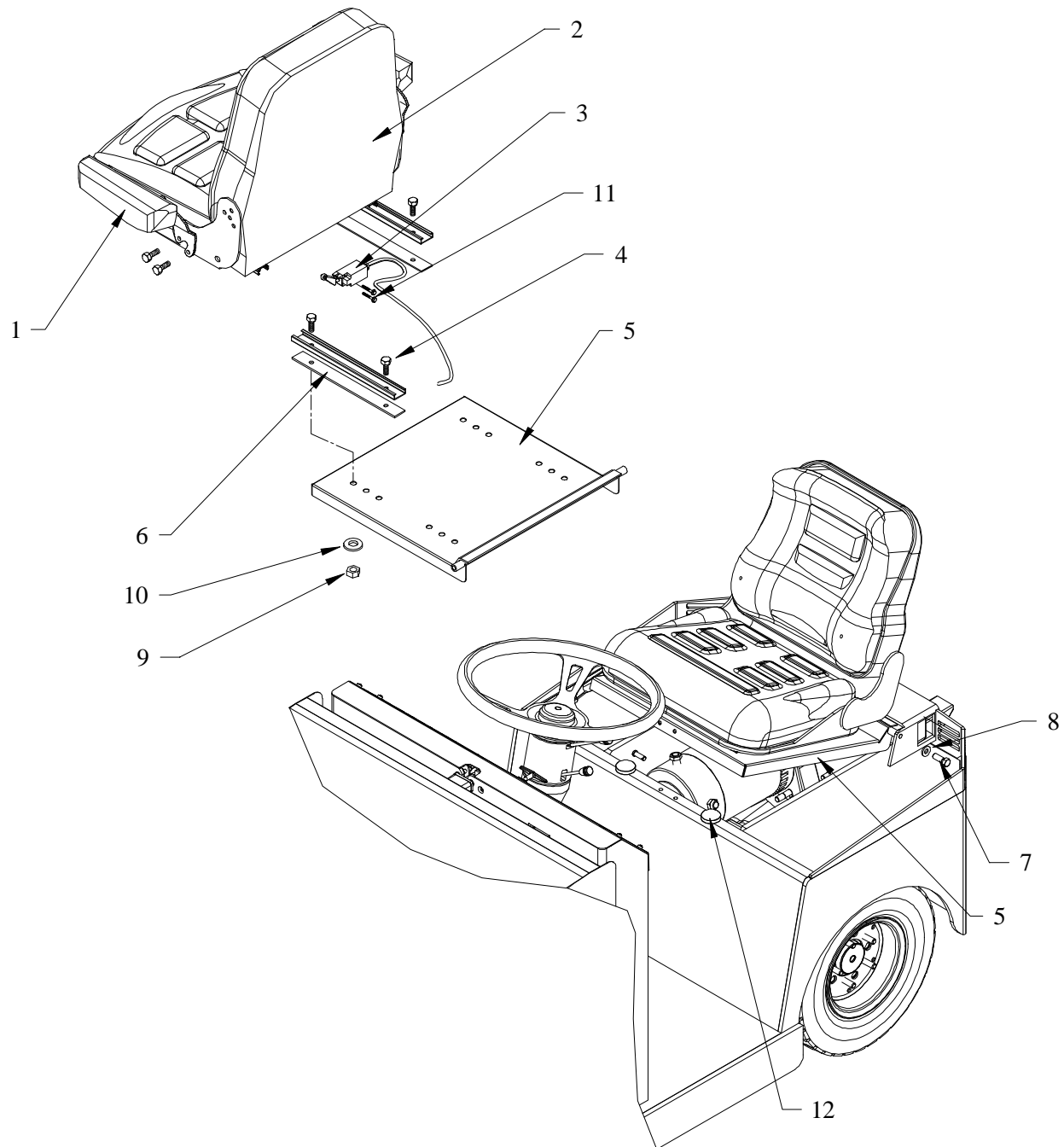
Door interlock switch
Left side shown

*Installation of the slide out battery
option requires an interlock switch on
each door*

Battery Compartment			
ITEM #	PART #	DESCRIPTION	QTY
1	30-550-12	Chain	2
	98-455-20	Chain insulation	4'
2	00-455-21	Hood, used up to serial #151822	1
	02-455-22	Hood, used starting with serial #151823	1
3	97-308-10	Latch bracket	1
4	98-753-15	Bump stop, used up to serial #151822	2
	98-753-12	Bump stop, used starting with serial #151823	2
5	97-308-00	Latch	1
6	96-301-10	Shoulder bolt	2
7	88-109-81	3/8NC Hex lock nut	2
8	01-455-85	Roller bracket	1
9	30-172-12	Roller	1
10	01-455-87	Side door (right)	1
11	03-455-07	Battery clamp	1
12	88-690-00	Roll pin	1
13	01-455-86	Side door (left)	1
14	03-455-08	Clamp screw	1
15	71-137-00	Side door interlock switch	2
Not shown	75-152-22	Interlock switch harness	1



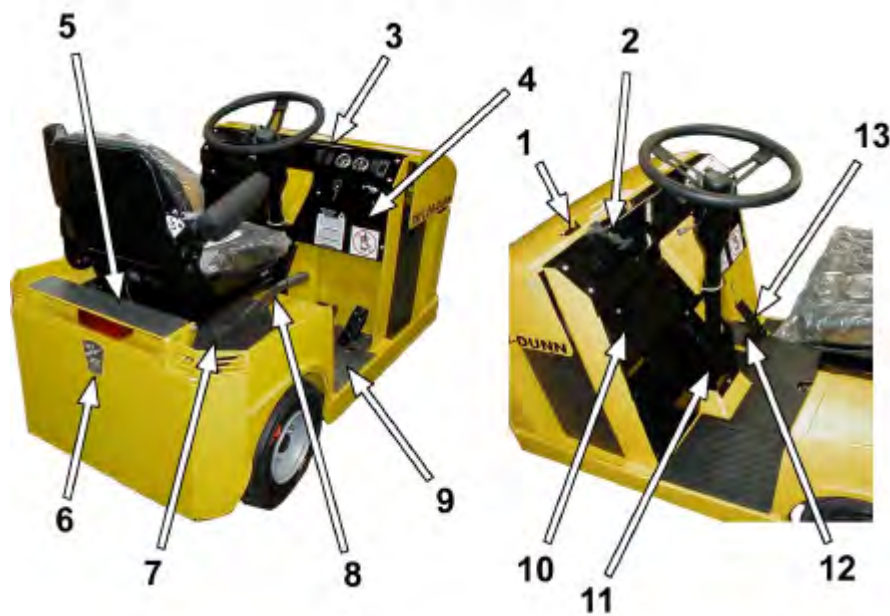
Driver Seat



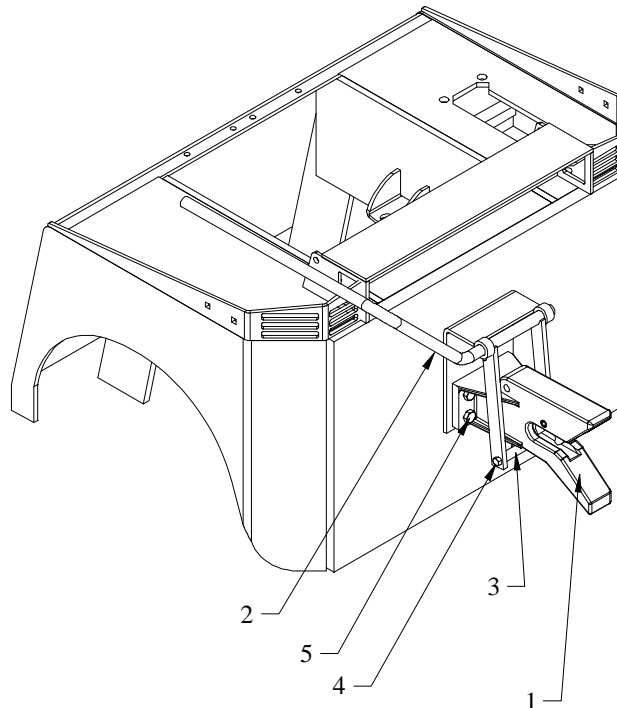
Driver Seat			
ITEM #	PART #	DESCRIPTION	QTY
1	90-160-60	Arm rest kit	1
2	90-160-70	Seat assembly , standard (does not include #1)	1
	90-160-75	Seat assembly ,cloth (does not include #1)	
3	71-102-20	Interlock switch	1
4	88-080-13	5/16 x 1-1/4 Hex bolt	4
5	00-455-20	Seat mounting plate	1
6	90-160-71	Seat spacer	2
7	88-130-10	7/16NF x 7/8 Hex bolt	2
8	88-128-60	7/16 Flat waser	2
9	88-089-81	5/16NC Hex lock nut	4
10	88-088-60	5/16 Cut flat washer	4
11	88-025-12	8-32 x 1-1/4 Type F thread machine screw	2
12	98-753-12	Bump stop	2



Miscellaneous Frame Components



Hitches

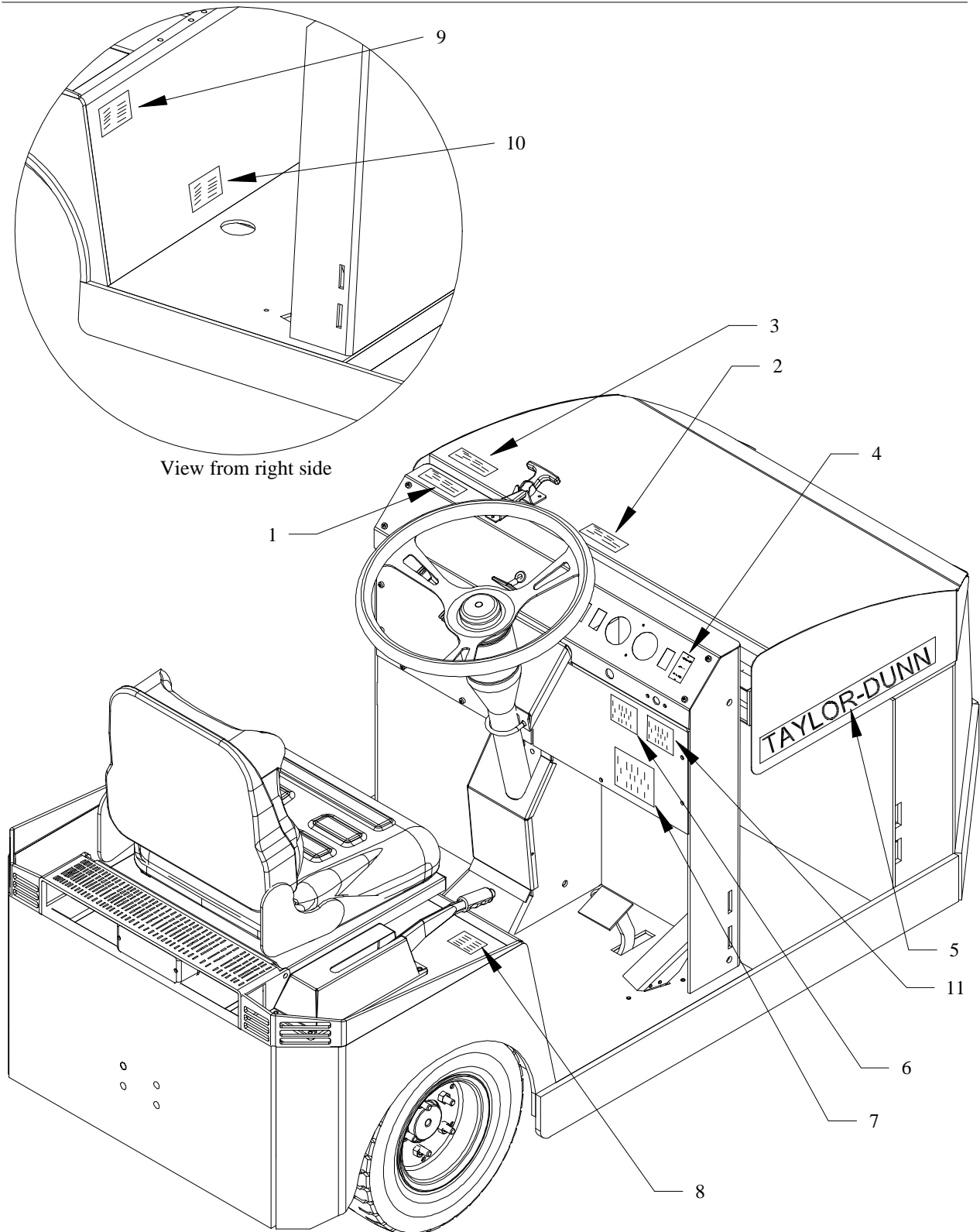


Miscellaneous Frame Components			
ITEM #	PART #	DESCRIPTION	QTY
1	See Battery Compartment	Hood holddown bracket	1
2	See Battery Compartment	Hood hold down Latch	1
3	03-455-00	Dash instument Panel	1
4	01-455-09	Right dash cover	1
5	03-455-11	Rear rubber pad	1
6	94-201-00	T/D emblem	2
7	03-455-05	Park brake handle cover	1
8	See Brake Linkage	Park brake handle	1
9	03-455-10	Floor mat	1
10	01-455-00	Left dash cover	1
11	01-455-51	Steering gear cover	1
12	98-200-00	Brake pedal pad	1
13	01-110-20	Accelerator pedal	1

Hitches			
ITEM #	PART #	DESCRIPTION	QTY
1	97-808-00	Automatic coupling hitch	1
2	00-455-10	Lever	1
	98-350-00	Grip (not shown)	1
3	03-455-13	Hitch release pivot	1
4	88-111-28	3/8NF x 6 Hex bolt	1
	88-119-81	3/8NF Hex lock nut	1
5	88-140-17	1/2 x 2-1/2 Hex bolt (used with auto. coupling hitch with driver release option	4
	88-140-14	1/2 x 1-1/2 Hex bolt (all other hitches)	4
5a	88-149-80	1/2NC Hex nut	4
5b	88-148-62	1/2 Split lock washer	4
Not shown	97-804-01	Pintle hitch	1
	97-806-10	Pin and Clevis hitch	1
	97-805-00	Bracket for ball hitch	1



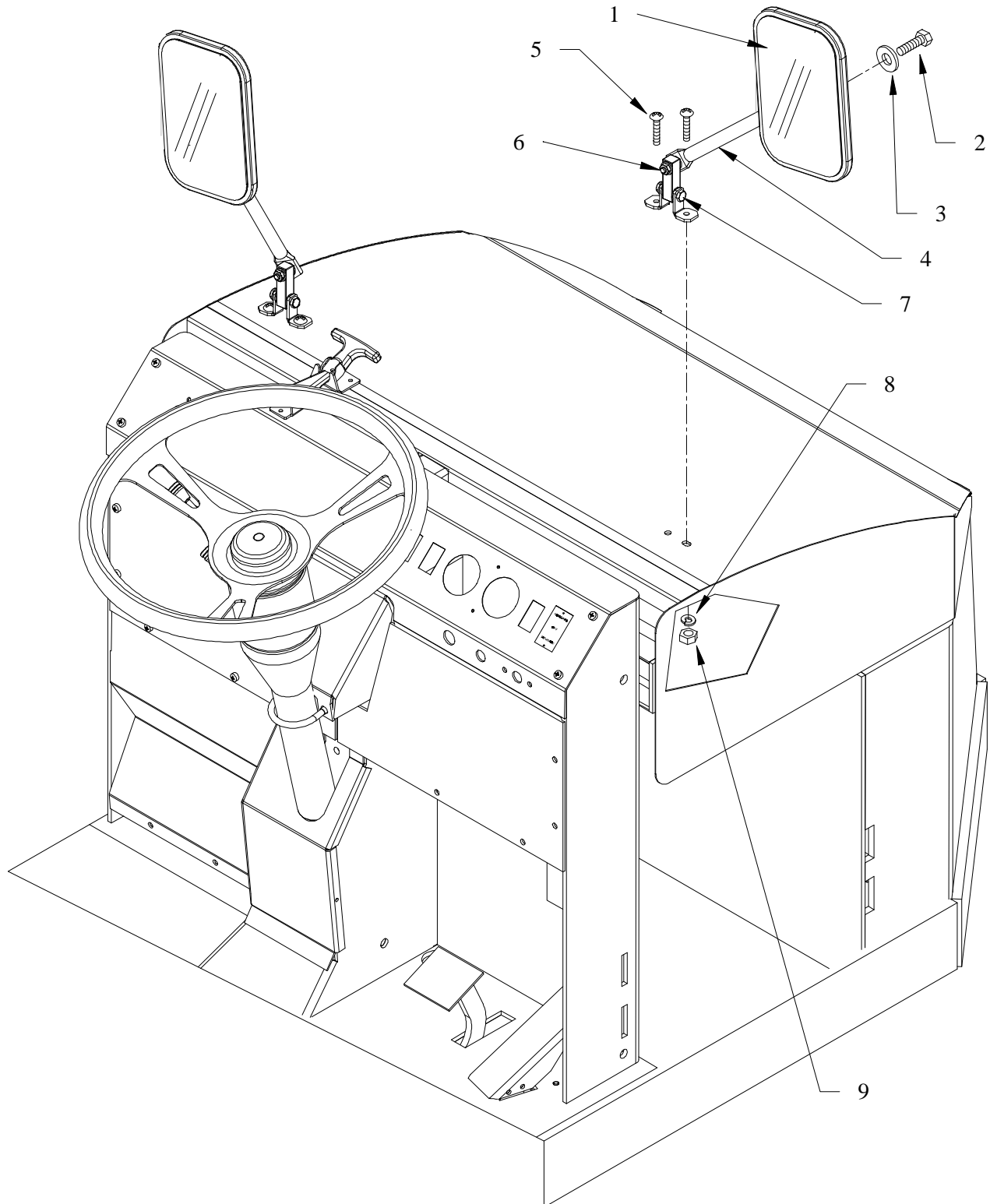
Decals



Decals			
ITEM #	PART #	DESCRIPTION	QTY
1	94-313-00	Battery warning	1
2	94-319-00	Battery disconnect waring	1
3	94-384-01	Not a motor vehicle	1
4	94-312-00	Forward and reverse plate	
5	94-301-09	TAYLOR DUNN decal	2
6	94-384-14	Warning "When leaving vehicle..."	1
7	94-313-20	Safety warning	1
8	94-309-00	Brake warning	1
9	94-373-09	Data plate	1
10	94-301-41	DOT 3 brake fluid	1
11	94-301-43	"Arma and Legs" warning	1



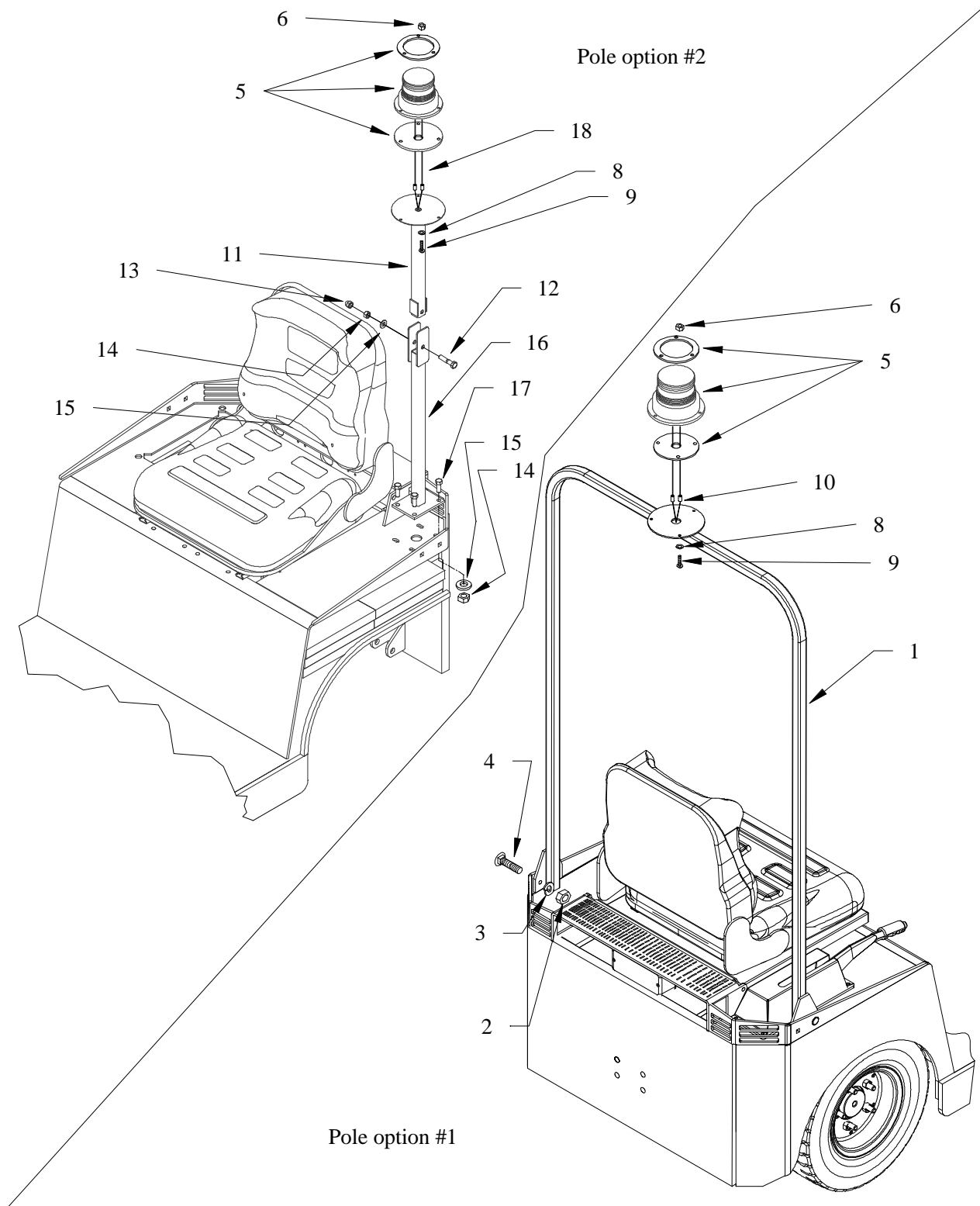
Mirrors



Mirrors			
ITEM #	PART #	DESCRIPTION	QTY
1	92-201-00	Mirror (includes 2 and 3)	2
2	Part of #1	Hex bolt	2
3	Part of #1	washer	2
4	92-202-00	Mounting bracket (includes 6 and 7)	2
5	88-065-08	1/4NC x 5/8 Truss head screw	4
6	Part of #4	Hex bolt	2
6a	Part of #4	Hex lock nut	2
7a	Part of #4	Hex bolt	2
7b	Part of #4	Hex lock nut	2
7c	Part of #4	Flat washer	4
8	88-068-62	1/4 Split lock washer	4
9	88-069-83	1/4NC acorn nut	4

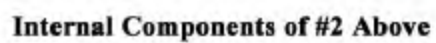


Strobe Light Option



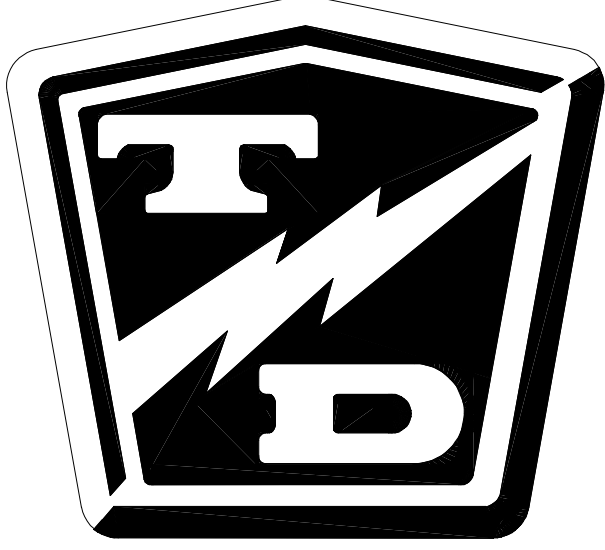
Strobe Light Options			
ITEM #	PART #	DESCRIPTION	QTY
1	72-023-35	Mounting pole	1
2	88-109-83	3/8NC Acorn nut	4
3	88-109-62	3/8 Split lock washer	4
4	88-102-13	3/8NC x 1-1/4 Carriage bolt	4
5	72-023-20	Strobe light	1
6	88-029-80	8-32 Hex nut	3
7	-	-	-
8	88-028-62	#8 Split lock washer	3
9	88-025-06	8-32 x 1/2 Machine screw	3
10	75-115-25	Harness (for #1 pole)	1
11	72-023-42	Upper pole	1
12	88-100-15	3/8 x 1-3/4 Hex bolt	1
13	88-109-83	3/8NC Acorn nut	1
14	88-109-80	3/8NC Hex nut	1
15	88-108-61	3/8 SAE Flat washer	1
16	72-023-44	Lower pole	1
17	88-100-11	3/8NC x 1 Hex bolt	4
18	75-106-25	Harness (for #2 pole)	1

Electric Motor Brake

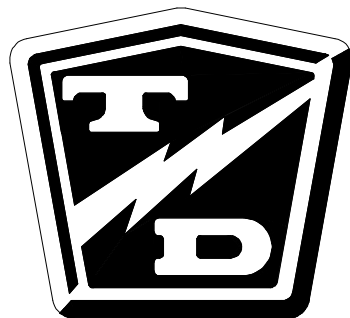


<i>AUTOMATIC DRIVER SEAT BRAKE</i>			
<i>ITEM #</i>	<i>PART #</i>	<i>DESCRIPTION</i>	<i>QTY</i>
1	88-067-22	Bolt, 1/4 X 2" NC, Grade (no brake option)	3
	88-067-29	Bolt, 1/4 X 4-1/4" NC, Grade 8 (brake option only)	3
2	41-355-00	Automatic Electric Brake Unit	1
3	See Motor	Motor (Typical)	1
4	96-114-10	U-Bolt, 5/16" NF, Motor Support	1
5	70-456-10	Motor, Support Bracket	1
	K66-600-03	Motor, Support Bracket (45°)	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			

TAYLOR - DUNN



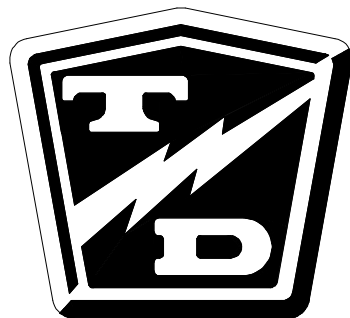
APPENDIX A-Special Tools



Special Tools

DESCRIPTION	PURPOSE	PART NUMBER
Pinion Seal Installation Tool	Used to install the pinion seal on all chain drive trucks with the band style brake or the speed sensor on the chain case cover.	43-201-50
Chain Case Centering Tool	Used to center the chain case on the pinion shaft on all chain drive trucks with the band style brake or the speed sensor on the chain case cover. Includes instructions.	41-532-50
Test Light	Used for testing electrical circuits. Powered by the truck batteries, switchable for 12, 24, 36, and 48 volts.	62-027-00
Accelerator Test Harness	Used to test the solid state accelerator module part number series 62-033-XX.	62-027-31
PMC Test Kit	Includes 62-027-00, 62-027-31, and supplementary troubleshooting manual M3-001-06. For controllers equipped with pins labeled KSI and #2 only.	62-027-60
Curtis PMC Handheld Programmer	Used to test and program the 62-215-00 PMC speed control used on early model C4-25 Huskey.	62-027-10
GE EV1 Analyzer	Used to test the GE EV1 speed control.	62-027-20
Disc Brake Boot Installation Tool	Used to install the rubber boot on all disc brake bodies.	41-350-13
Pin Removing Tool	Used to remove pins and sockets from AMP connectors.	75-440-55
Pin Removing Tool	Used to remove pins and sockets from MOLEX connectors.	75-442-55
Hydrometer	Used to check the specific gravity of battery electrolyte.	77-200-00
Battery Filler	Used to safely add water to batteries.	77-201-00
Retaining Plate Depressor	Used to hold down the retaining plate when disassembling the steering gear on trucks equipped with the tilt steering.	96-500-39
Fork Collar Weld Jig	Used when replacing the fork collar on models MX-600 and SS5-36.	96-500-40
Secondary Sheave Holder	Used to hold the secondary sheave (pulley) from turning on models R6-80 and B6-10 with the Yamaha drive.	96-500-14
Solder Kit For Field Stud	Used to solder the aluminum field wire to the field stud. For use on motors with soldered connections only.	70-210-63
Pinion Gear Holding Tool	Used to align the Pinion Gear and Case during assembly and disassembly.	96-500-42

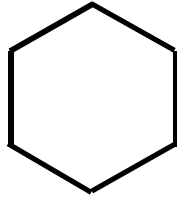
APPENDIX B-Torque Values



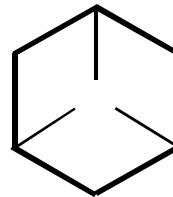
Recommended Torque Values Chart

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
3/8-16	16-24	25-37	35-52	25
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

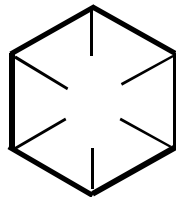
Head Markings



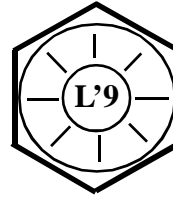
S.A.E. Grade 2



S.A.E. Grade 5

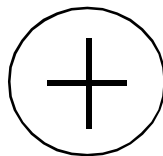


S.A.E. Grade 8

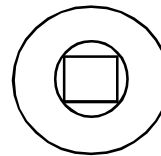


L'9

The following bolts are in accordance with Grade 2 torque values

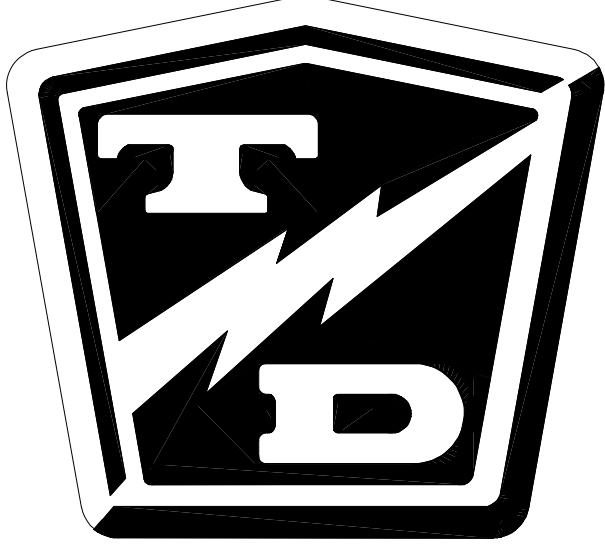


**Truss Head
1/4-20**

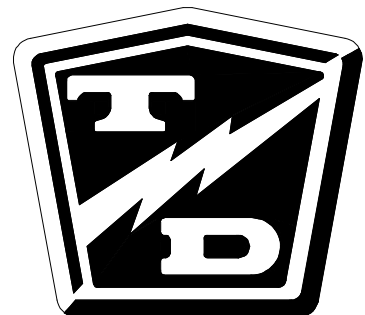


**Carriage Bolt
5/16-18 & 3/8-16**

TAYLOR - DUNN



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.

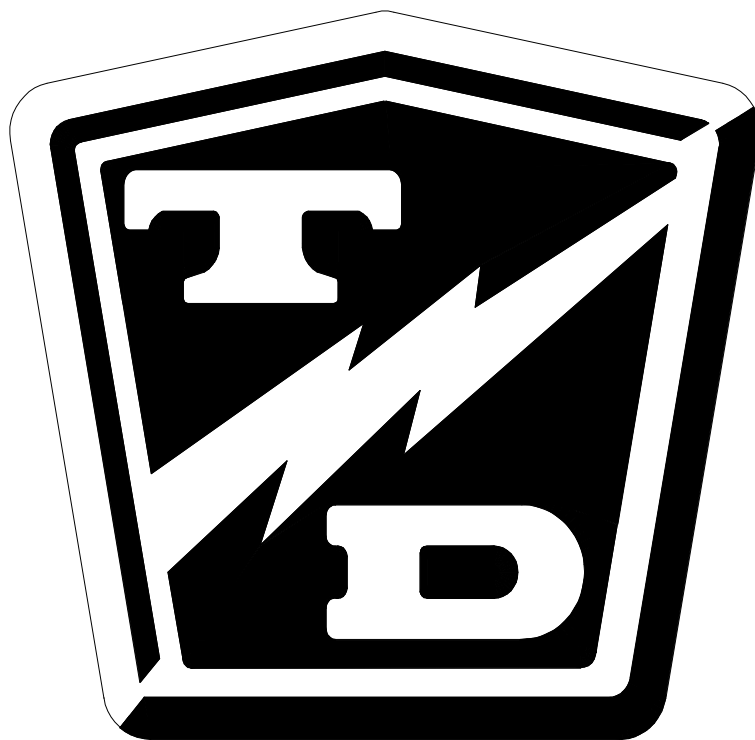
Never use compressed air or dry brush to clean the brake assemblies. Use an OSHA approved vacuum cleaner or any alternate method approved by OSHA to minimize the hazard caused by airborne asbestos fibers and brake dust.

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