TAYLOR-DUNN®

The Best Way
To Go
About Your
Business

Models Inlcuded:
C0-426-48FE

FedEx®

MANUAL MC-425-03
FedEx Spec #055152000

Operation, Troubleshooting and Replacement Parts Manual

Revision: B

Serial number Starting: 164548

TAYLOR-DUNN SERVICE CENTER

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

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

B2-48 With 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

Table of Contents

TAYLOR - DUNN

Introduction

Contents

ABOUT THIS MANUAL

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

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

Included in this manual are:

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

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

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

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

WHO SHOULD READ THIS MANUAL

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

RESPONSIBILITIES

Of the Owner...

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

Of the Operator...

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

Of the Service Personnel...

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

Of the Passengers ...

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

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 with in a caution.

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

HOW TO IDENTIFY YOUR VEHICLE

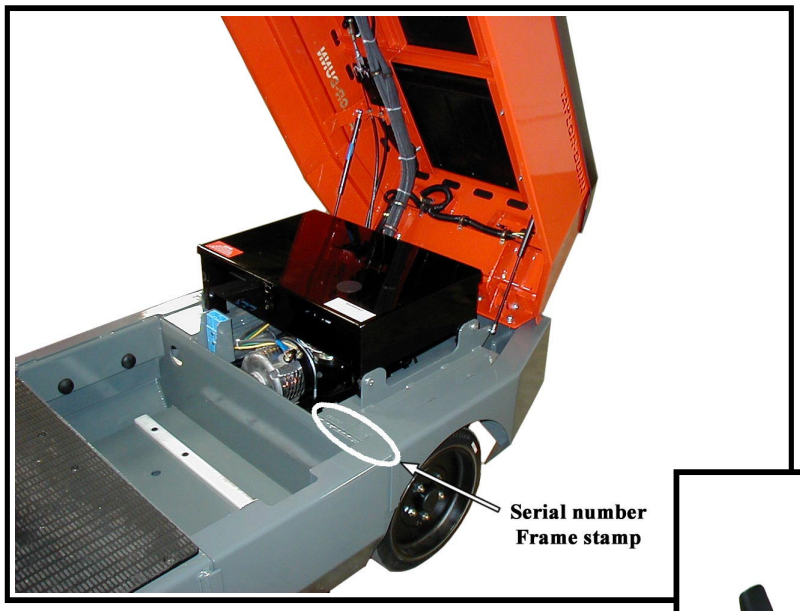
This manual applies to vehicles with the same model and serial numbers listed on the front cover.

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

⚠WARNING

This vehicle is not designed to be driven on public roads or highways. It is available in maximum designed speed of 9 mph. Do not exceed the maximum designed speed. Exceeding the maximum designed speed may result in steering difficulty, motor damage, and/or loss of control. Do not exceed locally imposed speed limits. Do not tow this vehicle at more than 5 mph.

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 Stake Side Dump Bed Option

SC1-00 Stock Chaser

E4-55 Sit Down Tow Tractor

C4-25 Sit Down Tow Tractor

Safety Rules and Operating Instructions

TABLE OF CONTENTS

STANDARD SPECIFICATIONS TOW TRACTOR

ITEM	SPECIFICATION
Occupancy	Driver only, no passengers
Dimensions	2388 L x 1016 W x 1422 H Millimeters 94 L x 40 W x 56.00 H Inches Length includes hitch
Turning Radius	1879 Millimeters (74 inches)
Dry Weight (Without Battery)	816 kg (1,800 lbs)
Battery Compartment Dimensions	813 L x 470 W x 610 H Millimeters 32 L x 18.5 W x 24 H inches
Battery Specifications:	
Battery Type	Exide Model 24-E85D-9 (504174D)
Weight	617 kg (1361 lbs)
Voltage	48
Connector	SB 350 Blue
Lead Length	762 millimeters (30 inches)
Position	A
Cover	No
Charger Specifications:	
Charger Type	Exide D1-24-600
AC Input Volts	208 /240/480 Single Phase
AC Input Amps	45 / 40 / 20
Towing Capacity (draw bar pull)	136 kg (300 lb) Normal 907 kg (2000 lb) Ultimate
Electrical System	Solid State Speed Control, 500 Amp
Transmission	Helical Gear, Oil Bath, Automotive Type Hypoid Differential
Motor, DC Separately Excited Field	12 kW (16.3 Horse Power) for 5 min
Maximum Speed (unloaded)	14.5 kph (9 mph)
Brakes	Four Wheel Hydraulic Disc, Hand Operated Park Brake
Steering	Automotive Steering 24:1
Tires	4.00 X 8 Soft Solid, Split Rims
Instrumentation	Smart View Display (Battery Status Indicator, Hour Meter, System Status Monitor), ON-OFF Switch, Horn Switch, Forward/Reverse Switch, Headlight Switch, Battery Disconnect Switch, Hi-Low Speed Switch
Light Accessories	Headlight, Tail/Brake/Reverse Light

This vehicle conforms to requirements for Type E vehicles as described in O.S.H.A. Standard Section 1910.178 (Powered Industrial Trucks) and with all applicable portions of the American National Standard for Operator Controlled Industrial Tow Tractors (ANSI B56.9).

SAFETY RULES AND GUIDELINES

It is the responsibility of the owner of this vehicle to assure that the operator understands the various controls and operating characteristics of this vehicle while also obeying he following safety rules and guidelines (reference American National Standards Institute Operator Controlled Industrial Tow Tractors ANSI B56.9).

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

- Do not drive this vehicle unless you are a qualified and trained operator.

⚠WARNING

This vehicle is not designed to be driven on public roads or highways. It is available in maximum designed speed of 9 mph. Do not exceed the maximum designed speed. Exceeding the maximum designed speed may result in steering difficulty, motor damage, and/or loss of control. Do not exceed locally imposed speed limits. Do not tow this vehicle at more than 5 mph.

⚠WARNING

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

- 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 or slippery.
- Drive slowly when driving on an incline.
- This vehicle may overturn easily if turned sharply while driven at high speeds, or 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.

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. Unplug the main battery connector.

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.

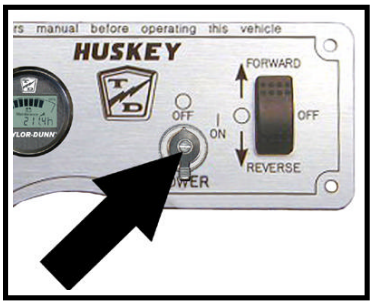
Driver Qualifications

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 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.

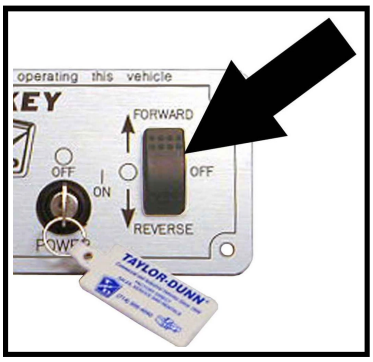
VEHICLE CONTROLS



ON-OFF Switch

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

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

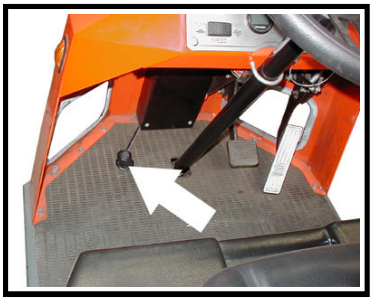


Forward-Off-Reverse Switch

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

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

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

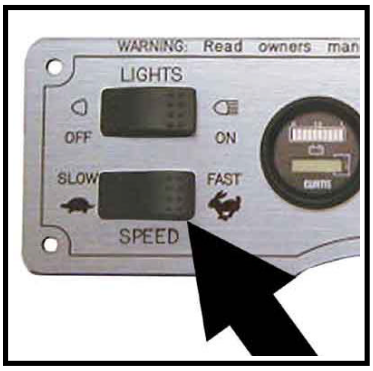


Horn Switch

The horn switch is located on the floorboard to the left of the steering column. The switch is foot operated. Depress the switch to sound the horn, release it to turn it off.

Headlights/Tail Lights

The headlights and tail lights are controlled by the vehicle ON-OFF switch. The lights will be ON when the switch is ON and OFF when the switch is OFF



Hi-Low Switch

The high-low switch is located on the lower left of the instrument panel. Push on the left side of the switch (turtle) for slow speed. Push on the right side of the switch (rabbit) for normal speed.

Accessory Switch (Optional)

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

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.

Reverse or Motion Alarm

The reverse alarm is located in the electronics compartment mounted in the speed control panel enclosure. 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.

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.

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.

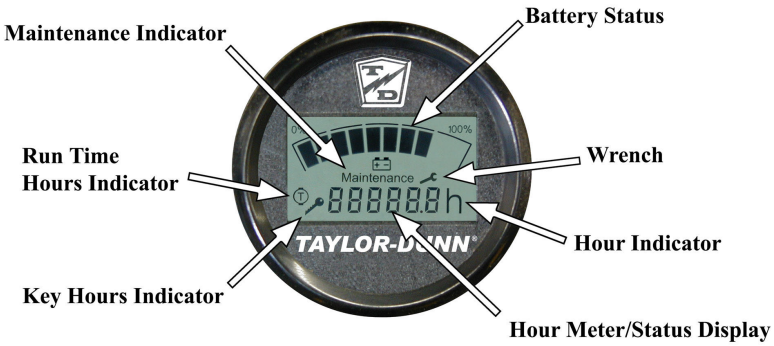
Park Brake

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

Battery Disconnect Switch

The battery disconnect switch is located to the right of the driver seat (red knob). To disconnect the battery from the control system, push down on the knob. Pull up on the knob to reconnect the battery.

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.

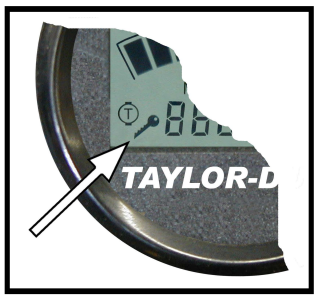
At 90%, all segments will flash and the vehicles speed will be reduced. At this time, the vehicle should be removed from service for charging. Discharging beyond 90% will result in damage to the batteries that will shorten the battery life-span.

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.

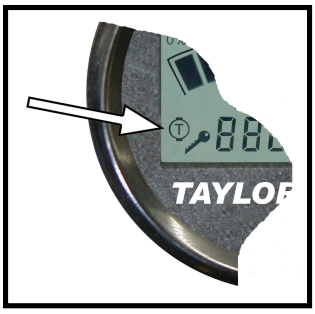
Run Time Hours is the accumulated length of time that the vehicles has been in operation. Time is accumulated when the FS-1 switch in the accelerator module is closed.

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



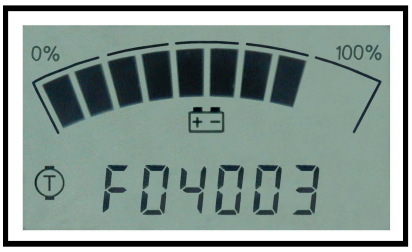
Key Hours icon

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

VEHICLE OPERATIONAL GUIDELINES

Safety Guidelines

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

Starting:

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

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

While driving:

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

Loading and Unloading

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

Towing Loads:

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

Parking

Before leaving the vehicle:

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

In addition:

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

Towing This Vehicle

⚠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.

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.

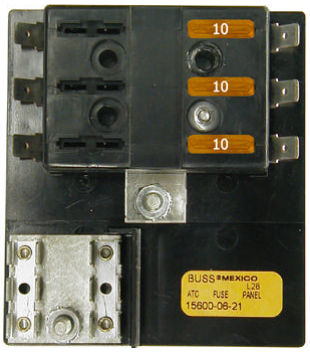
Use another driver to steer this vehicle while it is being towed. Be sure the driver uses the brakes when the towing vehicle slows or stops. Do not tow the vehicle faster than 5 m.p.h. or its maximum designed speed, whichever is lower.

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

FUSE PANEL

The fuse panel is located under the access cover on the front cowl. In addition, there are main circuit breakers located in the electrical control box located behind the battery.

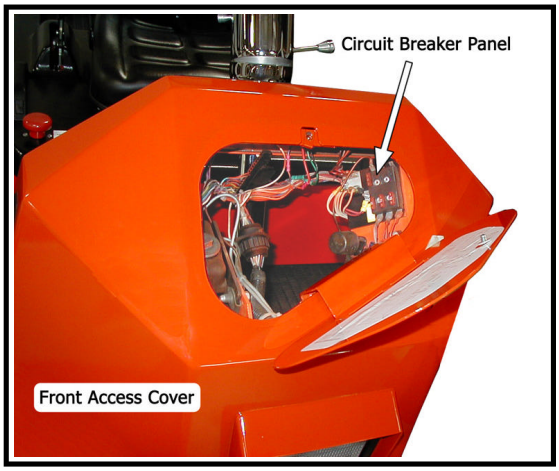
Circuit BreakerPanel



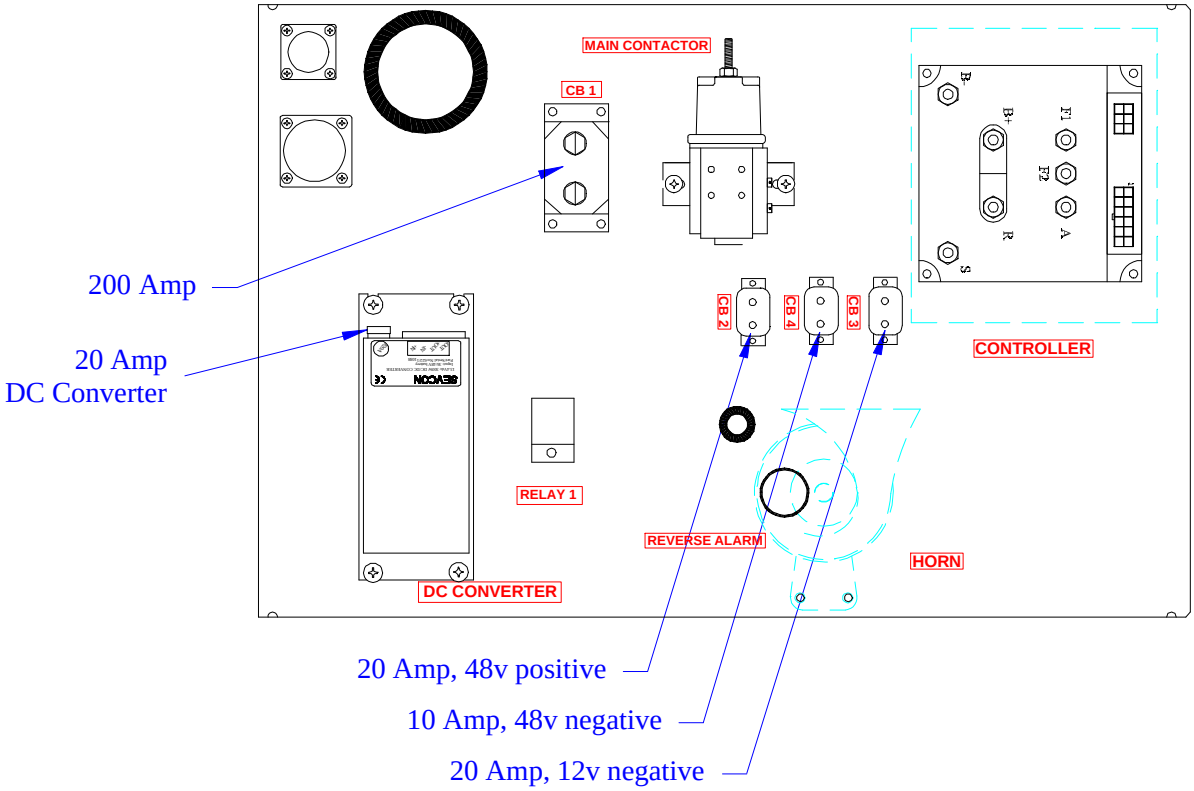
Accessory output

Lights and reverse alarm

Brake lights and horn



Electrical Control Box



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

Refer to the Charger Supplement at the end of this section..

New Battery Break in

A new battery requires a break in period of up to 40-cycles. The battery will not have full capacity during this break in period and may require longer charging times.

To obtain the maximum battery life:

Charge the battery only after a normal discharge as indicated on the Battery Status Indicator (BSI). Failure to follow this guideline could result in the battery entering an overcharge state, which will reduce the life of the battery. If you find it necessary to charge the battery before it is completely discharged we recommend waiting until it is 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 battery 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 level once a week. Do not charge the battery if the battery electrolyte level is low. Charging when the electrolyte level is low will damage the battery and shorten the lifespan. Only authorized personnel should perform battery maintenance including maintaining the battery electrolyte level. Refer to ***Battery Service*** 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 battery too deep. Both circumstances will shorten the life of the battery.

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

PERIODIC MAINTENANCE CHECKLIST

Maintenance Item[2,3]	Weekly (20hrs)	Monthly (80hrs)	Quaterly (250hrs)	Semi - Annual (500hrs)	Annualy (1000hrs)
Check Condition of Tires and Tire Pressure	●				
Check All Lights, Horns, Beepers and Warning Devises	●				
Check and Fill Battery	●				
Check Brake System		●			
Check Steering System		●			
Check for Fluid Leaks		●			
Lubricate Vehicle			●		
Clean and Tighten All Wire Connections			●		
Wash and Service the Battery			●		
Check Park Brake				●	
Check Motor Brushes and Blow Out Motor				●	
Check Front Wheel Bearings				●	
Check Rear Axle Oil				●	
Change Rear Axle Oil					●
Check and Tighten all Nuts and Bolts					●
Clean and Repack Front Wheel Bearings					●

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

⚠WARNING

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

Daily Visual inspection:

Tire condition and pressure.

External frame damage (body).

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

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

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

Inspect for leaking fluids or grease.

MAINTENANCE GUIDELINES FOR SEVERE DUTY APPLICATIONS

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

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

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

- Extreme temperature.
- Bumpy, dusty, or ill maintained roads.
- Excessively wet areas.
- Corrosive or contaminated areas.
- Frequent loading of vehicle at/near capacity.
- Use on multiple shifts.

2. Any deficiencies found during an inspection should corrected before the vehicle is returned to service.
3. Battery water level should be inspected on a weekly schedule.

CHARGER SUPPLEMENT

Exide D1-24-600

NOTE: The information contained in the following pages was obtained from the charger manufacturer (Exide). Contact the manufacturer for questions or more information.

YUASA, INC.

SECTION 28.40

Installation and Operating Instructions for
The Single Phase Solid State Charger

YUASA-EXIDE D1/SD1 SINGLE PHASE CHARGER

SAVE THESE INSTRUCTIONS!

LOOK FOR THIS SYMBOL TO POINT OUT SAFETY PRECAUTIONS. IT MEANS: *BECOME ALERT—YOUR SAFETY IS INVOLVED.* IF YOU DO NOT FOLLOW THESE SAFETY INSTRUCTIONS, INJURY OR PROPERTY DAMAGE CAN OCCUR.

1. IMPORTANT OPERATING AND SAFETY INSTRUCTIONS
INSTRUCTIONS IMPORTANTES CONCERNANT LA SÉCURITÉ.

(a) Before using the battery charger, read all the instructions and caution markings on the battery charger, the battery, and all the products using the battery.

(b) Do not touch uninsulated parts of the DC output connector or the battery terminals, as there is a possibility of electrical shock. *Risque de chocks électriques. Ne pas toucher les parties non isolées du connecteur de sorti ou les bornes non isolées de l'accumulateur.*

(c) Batteries produce hydrogen gas while operating, which can explode if ignited. Never smoke, use an open flame, or create sparks near the battery. Ventilate the area well when the battery is charging in an enclosed place.

(d) Lead-acid batteries contain sulfuric acid, which may cause burns. Do not get in eyes, on skin, or clothing. If contact with the eyes occurs, flush immediately with clean water for 15 minutes and obtain medical attention.

(e) Connect or disconnect the battery plug only when the charger output is off to prevent arcing or burning.

(f) Only qualified personnel should program or service this equipment.

(g) De-energize all AC and DC power connections before servicing this unit. If injury does occur, apply standard treatment for electrical shock and, if necessary, consult with a physician.

(h) The charger is not for outdoor use. Do not expose the charger to rain or snow. *Ne pas exposer à la pluie.*

(i) This charger is factory set to charge lead-acid batteries. It may be programmed for wet or sealed batteries by a qualified YUASA service representative. *Utiliser pour charger uniquement les accumulateurs du type lead-acid. D'autres types d'accumulateurs pourraient éclater et causer des blessures ou domages.*

(j) Do not operate the charger if it has received a sharp blow, been dropped, or otherwise damaged. Take it to a qualified service center.

(k) Do not disassemble the charger. Have the charger examined by a YUASA service representative, or a local qualified service center. Incorrect reassembly of the charger may result in an explosion, electrical shock, or fire.

2. INTRODUCTION

The YUASA-EXIDE D1/SD1 single phase battery charger is a convection cooled, solid state, SCR regulated charger designed to make battery charging simple. The type of charger, D1 or SD, is dependent upon the control module setup used in the charger. The charger can be factory set to charge wet or sealed batteries and also may be configured by a YUASA technician.

The charger has an "I-E-I" profile which is high rate constant current (start region), constant voltage (plateau region), and low rate constant current (finish region). Constant start and finish current rates are found in Tables 1 and 2. The plateau region is defined by two voltage points; 80% point (knee 1) where the start region changes into the plateau region, and the finish point (knee 2) where the plateau region changes into the finish region. The two points are factor set at 2.38 volts per cell for the 80% point and 2.42 volts per cell for the finish point for wet D1 settings. The knee 1 value for SD1 sealed is 2.37 volts per cell, and knee 2 value for SD1 sealed is 2.40 volts per cell. If values other than these are required, contact your YUASA service representative.

The charger has an equalize feature used to equalize batteries. An equalize cycle is periodically used to lengthen the charge time on batteries to increase the gassing and the mixture of the chemicals in a battery. Press the green EQUALIZE button to change a normal charge cycle into an equalize charge cycle. A blinking equality light indicates the present cycle or next charge cycle will be an equalized cycle. Contact your YUASA service representative for information on how often your batteries should be equalized.

3. RECEIVING CHARGER

Unpack the charger and examine it for possible in-transit damage. If any damage is found, report it as a claim to the carrier.

4. LOCATION AND INSTALLATION OF CHARGER

Proper installation of the charger is important to achieve good charger performance and to prevent damage to the charger and batteries. The charger should be located in a clean, cool, dry, and well ventilated area. To permit free air flow for convection cooling, allow four inches (4") minimum between the charger and any wall, six inches (6") from other equipment, and never store anything beneath the charger.

⚠WARNING: DO NOT PLACE THE CHARGER ON OR NEAR FLAMMABLE MATERIALS. POSITION THE CHARGER ON A FOUNDATION OF STONE, BRICK, CONCRETE, OR GROUNDED METAL.

5. AC ELECTRICAL SUPPLY

The charger must be connected to a single-phase power source. The AC power source input frequency for most units is 60 ±3% hertz. Some units may be operated at both 50 ±3% and 60 ±3% hertz. Check the charger label or contact your YUASA service representative for proper AC power source. The AC input voltage (±10%) is dependent on the charger model as there are two types: 208/240/480 Vac or 120/208/240 Vac. The AC input wire size, dependent on the charger model and the AC input voltage, can be obtained from Tables 1 and 2. Table 1 is for 208/240/480 Vac models and Table 2 is for 120/208/240 Vac models. AC input lines must be installed by a qualified electrical contractor.

5.1 AC Fuse Mounting

From Table 1 or 2 locate the proper type and rating AC fuse size to insert for fuses F1 and F2 (cartridge type fuses). Fuses with an ampere rating of 30 amps or less are smaller and may require the usage of the fuse reducers supplied with the charger. Insert the fuses into the fuse mounted located on the inner panel.

Note: All input fuses are time delay, 600-volt, at the amp rating specified.

5.2 Configuration of Jumpers

Locate the AC tap strip found inside the charger on the inner panel. Figures 1 and 2 illustrate the correct way to configure the AC jumpers based on the AC voltage range. Figure 1 is for 208/240/480 Vac models and Figure 2 is for 120/208/240 Vac models. Use the instructions on the inner panel of the charger to configure the AC jumpers. Connect the jumpers as shown in the figure and torque the screws to 18-inch pounds for proper connection.

⚠WARNING: IMPROPER JUMPER CONNECTION MAY CAUSE SEVERE DAMAGE TO THE CHARGER AND BATTERY.

⚠WARNING: WHEN CHANGING THE AC VOLTAGE JUMPERS, BE SURE TO CHANGE THE RED WIRE AS SHOWN BELOW.

TABLE 1

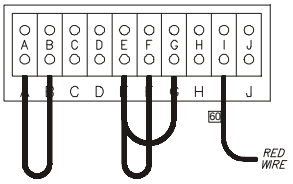
			208 VAC INPUT			240 VAC INPUT			480 VAC INPUT		
D1 Model	DC Start Current	DC Finish Current (Wet)	Fuse Size (FRS)	AC Wire Size (AWG)	Input Current	Fuse Size (FRS)	AC Wire Size (AWG)	Input Current	Fuse Size (FRS)	AC Wire Size (AWG)	Input Current
6-450B	72	20	15	12	10.0	12	12	9.0	6	12	4.5
6-550B	88	25	15	12	12.0	15	12	11.0	8	12	5.5
6-680B	109	31	20	10	14.5	20	12	13.0	10	12	6.5
12-380B	61	17	25	10	16.0	20	10	14.0	10	12	7.0
12-550B	88	25	30	8	22.0	25	10	19.0	15	12	9.5
12-680B	109	31	35	8	27.0	30	10	22.0	15	12	12.0
12-750B	120	34	40	6	30.0	35	8	26.0	20	10	13.0
12-850B	136	38	45	6	33.0	40	6	29.0	20	10	14.0
18-600B	96	27	50	6	35.0	40	6	31.0	20	10	15.0
18-800B	128	36	60	6	45.0	60	6	38.0	30	10	19.0
24-600B	96	27	60	6	45.0	60	6	40.0	30	10	20.0

TABLE 2

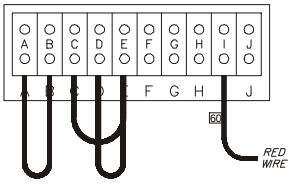
			120 VAC INPUT			208 VAC INPUT			240 VAC INPUT		
D1 Model	DC Start Current	DC Finish Current (Wet)	Fuse Size (FRS)	AC Wire Size (AWG)	Input Current	Fuse Size (FRS)	AC Wire Size (AWG)	Input Current	Fuse Size (FRS)	AC Wire Size (AWG)	Input Current
6-450A	72	20	20	12	16.0	12	12	9.0	10	12	8.0
6-550A	88	25	25	12	18.5	15	12	11.0	12	12	9.5
12-380A	61	17	35	10	25.0	20	10	15.0	20	12	13.0

FIGURE 1

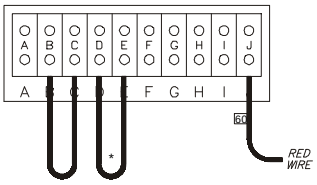
208 VAC JUMPER SETTING



240 VAC JUMPER SETTING



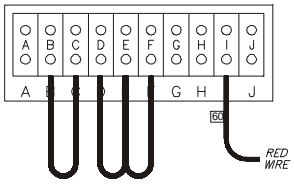
480 VAC JUMPER SETTING



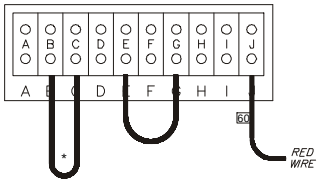
* PUT EXTRA JUMPER IN PARALLEL

FIGURE 2

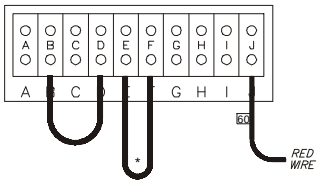
120 VAC JUMPER SETTING



208 VAC JUMPER SETTING



240 VAC JUMPER SETTING



* PUT EXTRA JUMPER IN PARALLEL

5.3 AC VOLTAGE CONNECTIONS

To connect the input AC voltage, route the AC conduit through the desired knockout hole. Route the AC wiring to terminal lugs L1 and L2 located above the AC fuses. **For proper connection, torque the screws to 35-inch pounds.**

⚠WARNING: IMPROPERLY CONNEC-TED AC VOLTAGE CONDUCTORS CAN CAUSE AN ELECTRICAL FIRE.

Connect the AC ground to the terminal lug located to the left of the AC fuses.

⚠WARNING: DO NOT OPERATE THE CHARGER WITHOUT PROPER GROUNDING. IMPROPER GROUNDING CAN RESULT IN THE RISK OF AN ELECTRIC SHOCK.

6. DC OUTPUT

The DC charging cable has a commonly used battery plug or receptacle. The polarity of the charger plug must be the same as the battery connector. The BLACK DC cable must be connected to the battery negative (-), and the RED DC cable must be connected to the battery positive (+). The charger will not operate in a reversed polarity condition. The DC output fuse (F3) is a fast-acting fuse used to protect the silicon controlled rectifiers (SCRs). USE ONLY IDENTICAL REPLACEMENT FUSES OBTAINABLE FROM YOUR YUASA SERVICE REPRESENTATIVE.

The charger should NOT be used to charge cell sizes greater than the maximum cell size on the nameplate. If the battery's AH rating is larger than the AH rating specified on the charger's nameplate, contact your YUASA service representative. Your service representative may be able to reconfigure the charger to the larger AH rating.

7. D1/SD1 OPERATION

⚠CAUTION: MAKE SURE THE BATTERY PACK IS A RECHARGEABLE DEEP-CYCLE BATTERY SYSTEM WITH THE PROPERLY RATED VOLTAGE FOR THIS CHARGING SYSTEM.

⚠DANGER: TO PREVENT ELEC-TRICAL SHOCK, DO NOT TOUCH UNINSULATED PARTS OF THE CHARGER DC OUTPUT CONNECTOR, BATTERY CONNECTOR, OR BATTERY TERMINALS. MAKE SURE ALL ELECTRICAL CONNECTORS ARE IN GOOD WORKING CONDITION. DO NOT USE CONNECTORS THAT ARE CRACKED, CORRODED OR DO NOT MAKE ADEQUATE ELECTRICAL CONTACT. USE OF A DAMAGED OR DEFECTIVE CONNECTOR MAY RESULT IN A RISK OF OVERHEATING OR ELECTRIC SHOCK.

⚠WARNING: CHARGER IS NOT TO BE USED WHILE THE EQUIPMENT IS OPERATING.

⚠ATTENTION: Ne pas utilizer le charger pendant que l'equipment est en marche.

⚠WARNING: LEAD-ACID BATTERIES GENERATE GASES WHICH CAN BE EXPLOSIVE. TO PREVENT ARCING OR BURNING NEAR BATTERIES, DO NOT DISCONNECT DC CHARGING CORD FROM BATTERIES WHEN THE CHARGER IS OPERATING. IF THE CHARGE CYCLE MUST BE INTERRUPTED, PRESS THE STOP/TEST BUTTON TO TERMINATE THE CHARGE CYCLE BEFORE DISCONNECTING THE DC OUTPUT CORD FROM THE BATTERIES. KEEP SPARKS, FLAME, AND SMOKING MATERIALS AWAY FROM BATTERIES.

⚠WARNING: ALWAYS SHIELD EYES WHEN WORKING NEAR BATTERIES. DO NOT PUT WRENCHES OR OTHER METAL OBJECTS ACROSS BATTERY TERMINAL OR BATTERY TOP. ARCING OR EXPLOSION OF THE BATTERY CAN RESULT!

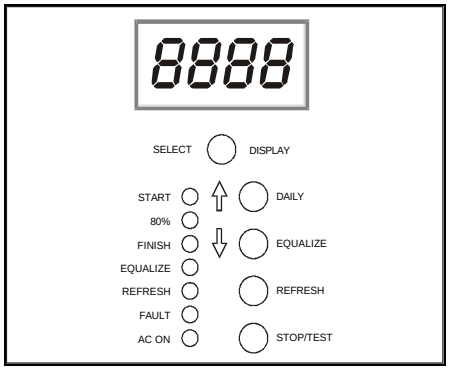
⚠CAUTION: TO AVOID DAMAGE TO THE CHARGER CORD AND BATTERY CONNECTOR, DISCONNECT BY GRASPING THE PLUG HANDLE OR BODY AND PULLING IT STRAIGHT OUT OF THE BATTERY CONNECTOR. DO NOT PULL ON THE CHARGER CORD. DO NOT TWIST, ROCK OR PULL THE PLUG SIDEWAYS.

⚠WARNING: DO NOT LEAVE THE DC OUTPUT CONNECTOR PLUGGED IN WHILE UNATTENDED FOR MORE THAN TWO (2) DAYS. SEVERE OVER-CHARGING AND DAMAGE TO THE BATTERIES MAY RESULT IF THE CHARGER DOES NOT TURN OFF.

7.1 USER INTERFACE

The D1 (see Figure 3) contains a four digit display, 7 LEDs for indicators, and 5 push buttons for operating the charger. Programmable display and charger operating options are also features available on the D1.

Figure 3



7.1.1 FRONT PANEL

To interact with the user, the D1 control module uses 5 push buttons and 7 LEDs (Light Emitting Diodes). Tables 3 and 4 describe the push button and the LED functions respectively.

Table 3

Push Button	Description
Select/Display	Selects what will be seen on the display. Also used to change charger parameters and save changes in program mode.
Daily	Starts or restarts a Daily charge cycle. It can convert an Equalize charge cycle to a Daily charge cycle if the 3-hour Equalize mode has not yet begun. It also is used to increase the display value in program mode.
Equalize	Starts or restarts an Equalize charge cycle. It can convert a Daily charge cycle to an Equalize charge cycle. It also is used to decrease the display when in program mode.
Refresh	Starts a Refresh charge, or adds a Refresh charge to a completed Daily or Equalize charge cycle.
Stop/Test	Interrupts a charge in progress. If there is no DC voltage present, it tests the LEDs and the display by lighting then for as long as the push button is held down. Used to exit program mode.

Table 4

LEDs	Description
Start	Blinks when DC voltage is present. Lights and remains on when a charge cycle begins.
80%	Lights and remains on after the gassing voltage point begins.
Finish	Lights and remains on when Finish current mode begins.
Equalize	Blinks when the current cycle is an Equalize charge cycle. Lights steady when the 3 hour Equalize mode begins.
Refresh	Blinks when Refresh is active. Lights steady when the refresh charge cycle begins.
Fault	Lights when a fault occurs. The display will show the fault code. Fault codes are described in Table 6.
AC on	Lights steady when AC power is applied to the charger.

7.1.2 DISPLAY MODE

A four digit display interacts with the user to show information such as: cycle counter, equalize counter, current, voltage, amphours and time. With no battery connected to the charger, the display will alternate between "C=XX" and “E=XX" which are cycle counter and equalize Counter (see programming options for detailed information).

While the charger is outputting current or reads "OFF", the display can be set to show: charger current, volts per cell, AH returned, and time on charge.

To see specific values on the display, press the DISPLAY push button. The display will show "dX", where X is a number between 1 and 5. Table 5 describes what each number corresponds to and the format type which is used to distinguish between different types of data. Each time the DISPLAY push button is pressed, X increments. Releasing the push button will cause the data corresponding to the X to display. After the DISPLAY push button is released wait approximately 20 seconds for the display to start cycling through the data at about three second intervals.

The display mode is factory set to "d1", so when the charger is outputting current, the display will show charger current only. Change the display number if more information is desired.

Table 5

Display Number	What is Displayed	Format
1	Charger current in amps.	XXX.X
2	Volts per cell (v/c)	X.XXX
3	Current and v/c	
4	AH returned, v/c, and current	XXXX
5	Time on charge, v/c, current, AH.	X.X.X.X

7.1.3 FAULT MONITOR

The charger is constantly monitored for fault conditions. If a fault occurs, the charge in progress is terminated, all data for that charge is lost, and the charger's display shows the fault code. Table 6 describes the fault codes.

A fault is cleared by pressing the STOP push button. Determine the cause of the fault and correct it before restarting the charge cycle.

Table 6

Fault Code	Description
E1	Battery current less than expected.
E3	Output current exceeds expected by over 10%.
E4	Voltage greater than 3.000 v/c.
E7	Failed to complete the charge cycle within the allotted time.

7.2 PROGRAMMABLE OPTIONS

There are three options which you can modify by entering the programming mode:

F1 Delay Start Option

F2 Equalize Counter Option

F3 Automatic/Manual Start Option

With no battery connected to the charger, and the display alternating between "C=XX" and "E=XX", press and hold down the DISPLAY and DAILY push buttons at the same time. After approximately 5 seconds, the display will contain only dashes (disregard the display until it contains only dashes). When the dashes display, release all the push buttons. The display should contain F1.

You can now modify the options. Use the UP and DOWN arrow push buttons to select the desired option to modify. Press the SELECT push button and that option number's variable will be displayed.

To change a variable number on the display, use the UP and DOWN arrow push buttons until the desired number is displayed, then press SELECT to save the new number.

Holding the UP or DOWN arrow push buttons down increases the speed the numbers change. To exit the programming mode, press the STOP push button. If the STOP push button is pressed while an option variable number is displayed, the number will not be saved when programming mode is exited.

7.2.1 DELAY START (F1)

This option is only functional when the charger is set to Automatic Start (option F3).

The Delay Start option allows you to delay the start of the charge. It can be set from a minimum of 0 minutes (0.0.0.0) to a maximum of 20 hours (2.0.0.0). Delay Start immediately begins counting down when a battery is connected to the charger. If the Delay Start option is set to 0, charging will begin when a battery is connected to the charger.

EXAMPLE: TO SELECT 2 MINUTES, ENTER "0.0.0.2" ON THE DISPLAY. WHEN YOU CONNECT THE BATTERY, THE DISPLAY WILL COUNT DOWN IN 1 MINUTE INCREMENTS.

RANGE IS 0.0.0.0 TO 2.0.0.0

FACTORY SETTING IS 0.0.0.0

7.2.2 EQUALIZE COUNTER (F2)

This option is only functional when the charger is set to Automatic Start (option F3). The Equalize Counter option determines which charge cycle will be an equalize cycle. For example, if the Equalize Counter is set to 5 (E=05 is shown on the display), every fifth charge cycle will be an Equalize charge cycle. The Equalize counter can be programmed with a number from 0 to 20.

If this option is set to 1, an equalize will automatically occur every charge cycle when the charger is in Automatic mode. If this option is set to 0, automatic equalize is disabled. You will have to press the equalize push button to begin an equalize charge cycle.

The Cycle counter increments each time a charge cycle successfully completes, unless the time spent in Start current mode is less than one hour. When the Cycle counter "C=XX" and the Equalize counter "E=XX" contain the same value, and Equalize charge cycle is performed, and the Cycle counter is reset to 1 after the charge cycle is terminated and the battery is disconnected.

RANGE 150 T0 20.

FACTORY SETTING IS 5.

7.2.3 AUTOMATIC/MANUAL START (F3)

The Automatic/Manual start option determines if a charge cycle will be performed in Automatic or Manual mode. The following lists what will happen when your charger is operating in Automatic (1) mode.

1. Actual charging will begin after the time specified in Delay Start (option F1) elapses.
2. If the Equalize Counter option (option F2) is not 0, then an Equalize charge cycle will be automatically performed as specified by that option.
3. A Refresh charge cycle will occur if the battery is left connected to the charger for longer than 12 hours (Refresh Wait Period), after the charge cycle has completed.

If this option is set to Manual (2), the charge cycle will not begin after the battery is connected to the charger until you press either the DAILY or EQUALIZE push button. The following lists what to expect when operating your charger in Manual mode.

1. Charging will begin as soon as you press the DAILY or EQUALIZE push button (when a battery is connected to the charger).
2. To begin a Refresh charge cycle (when a charge cycle has completed and the display contains "OFF"), press the REFRESH push button. The Refresh charge cycle will begin immediately.

RANGE IS 1 T0 2.

FACTORY SETTING IS 1 (AUTOMATIC)

7.3 NORMAL OPERATION

The D1 is shipped factory set for Automatic Start, Time-Voltage Charge termination, and Automatic Equalize every fifth cycle. The following is a brief description of this operation.

With no battery connected, apply AC power to the charger. The LEDs will blink momentarily, then the AC ON LED will remain on, and the display will alternate between "C=xx" and "E=yy" where xx represents the Charge counter and yy the Equalize counter.

Connect the battery to be charged. If the Automatic Start feature is active, the START LED will light, the charger will start outputting Start rate current, and the display will begin to show the charger amps. Automatic Start can be delayed by programming a value, other than "0.0.0.0" (HH:MM), in the Delay Start option. You can set the Delay Start option to delay the start of the charge cycle for up to 20 hours, in 1 minute increments.

When the 80% (Gassing Voltage) point is reached, the 80% LED will light, (the START LED remains on) and charge current will begin to taper.

After the 80% point is reached charging will continue for 3 hours for D1 (wet) and 6 hours for SD1 (sealed) before shutoff. If charging current reaches finish rate before shutoff the FINISH LED will light (the START and 80% LEDs remain on), and charging will continue for the allotted time. If no Equalize charge is to be applied to the battery, the charger will stop and the display will read "OFF" (the START, 80%, and FINISH LEDs remain on). To display charge data press the DISPLAY button.

If the battery is to receive an Equalize charge, the charge cycle continues for 3 more hours and then stops with the display reading "OFF".

When the battery is disconnected, only the AC ON LED stays on, and the display will read "C=xx+1" and "E=yy". The Cycle counter is incremented by 1 each time a charge cycle completes, unless the time spent in Start Rate is less than 1 hour. If the time spent in Start Rate is less than one hour, then the Cycle counter will not increment.

The Automatic Equalize feature is active when Automatic/Manual Start option is set to automatic. When the Cycle counter equals the Equalize counter, an Equalize charge cycle will be performed (indicated by the EQUALIZE LED blinking), and the Cycle counter will be reset to 1. The EQUALIZE LED will light steady once the 3 hour Equalize charge period begins.

If you press the EQUALIZE push button during a Daily charge cycle, it will become an Equalize charge cycle. If you press the DAILY push button during an Equalize charge cycle (but before Equalize mode begins), it will become a Daily charge cycle.

If the battery remains connected to the charger for 12 hours (Factory default setting) after termination, a Refresh charge will be given to it. A Refresh charge is 20 minutes of charge. The REFRESH LED will blink during the 12 hour delay, then light steady when the charge is being given and blink when done.

AC power failures, loss of a phase, or brownout conditions are detected by the control circuitry. If this occurs, present charger operating conditions are saved. If a battery is connected when the AC “failure" occurs, its charge cycle status is saved. If a battery is connected when AC power returns, the charger program checks to see if there is saved

status, and if so, assumes that the connected battery is the same battery that was connected when power "failed" and tries to restart the charge cycle where interrupted. The FAULT light will remain ON. Therefore, it is important to only cycle the power to a charger with no battery connected, so that erroneous charges are not applied to batteries (unless you want to continue charging the same battery).

8. CHARGE TIME

The amount of time a battery charges will vary depending on the depth-of-discharge (DOD). A normal charge cycle will be terminated one of two ways; Time-Voltage (three hours) after the 80% point or DV/DT (when the charger senses a very small change in battery voltage during its sampling time period). Time-Voltage is the factory default shutoff mode. Normal charge cycles will usually not exceed ten hours. If a D1 control module is set for sealed batteries, the Time-Voltage is six hours and the Equalize is nine hours after the 80% point for terminations.

An equalize charge cycle for wet batteries will terminate six hour after 80% has been reached. Both normal and equalize charge cycles will terminate if they extend beyond the maximum allowed time of 14 hours.

9. MAINTENANCE

The charger requires minimal maintenance. It should be kept clean and all connections tight. BE SURE THE CHASSIS IS SECURELY GROUNDED. Twice a year or as often as the cleanliness of the area may dictate, the louvers should be vacuumed and the interior thoroughly blown with dry air.

10. PARTS LIST

The following is a list of parts found in the various model D1/SD1 chargers. When replacing a part, USE ONLY ORIGINAL FACTORY REPLACEMENT PARTS of the correct size and rating.

CHARGER MODEL	6/450B	6/550B	6/680B	12/380B	12/550B	12/680B	12/750B	12/850B	18/600B	18/800B	24/600B
INPUT VOLTAGE RANGE	18880	18890	18900	18910	18920	18930	18940	18950	18960	18970	18980
208/240/480	12V	12V	12V	24V	24V	24V	24V	24V	36V	36V	48V
LARGE TRANSFORMER ASSY.	18885S	18895S	18905S	18915S	18925S	18935S	18945S	18955S	19965S	18975S	18985S
SMALL TRANSFORMER ASSY.	18845S	18845S	18845S	18845S	18845S	18845S	18845S	18845S	18845S	18845S	18845S
SCR ASSY.	13716S	13716S	12948S	13716S	13716S	12948S	12948S	12948S	13716S	12948S	13716S
CASE, BASE PANEL, D1	25007S	24453S	25008S	25009S	24478S	24481S	25202S	25332S	25196S	25382S	25304S
CASE, INNER PANEL	25003S	24457S	25004S	25006S	24479S	24482S	25201S	25331S	25198S	25408S	25307S
DC CORD BUSHING	02008S	02008S	02009S	02008S	02008S	02009S	02009S	02009S	02009S	02009S	02009S
DC FUSE (F3)	04898S	10910S	10910S	10905S	10910S	10901S	10901S	17678S	10910S	10901S	10901S
FUSE (F1, F2)	T15A	T15A	T20A	T25A	T30A	T35A	T40A	T45A	T50A	T60A	T60A
WIRED FOR 208	25708S	25708	04931S	25709S	10252S	05165S	04930S	25711S	05173S	05290S	05290S
FUSE (F1, F2)	T12A	T15A	T20A	T20A	T25A	T30A	T35A	T40A	T40A	T60A	T60A
WIRED FOR 240	25707S	25708S	04931S	04931S	25709S	10252S	05165S	04930S	04930S	052905S	05290S
FUSE REDUCER (F1, F2)	-	-	-	-	-	04938S	-	-	-	-	-
FUSE (F1, F2)	T6A	T8A	T10A	T10A	T15A	T15A	T20A	T20A	T20A	T30A	T30A
WIRED FOR 480	25703S	25704S	25706S	25706S	25708S	25708S	04931S	04931S	04931S	10252S	10252S
FUSE REDUCER (F1, F2)	-	-	-	-	-	04938S	04938S	04938S	04938S	04938S	04938S
FUSEHOLDER (F1, F2)	13366S	13366S	13366S	13366S	13366S	12869S	12869S	12869S	12869S	12869S	12869S
HEATSINK	13619S	13619S	12688S	13619S	13619S	12688S	12688S	12688S	13619S	12688S	13619S
TAP STRIP, 7 POLE	17716S	-	-	-	-	-	-	17716S	17716S	17716S	17716S
TAP STRIP, 12 POLE	23346S	23346S	23346S	23346S	23346S	23346S	23346S	-	-	-	-
TAP STRIP, 2 POLE	19242S	-	-	-	-	-	-	19242S	19242S	19242S	19242S
CONTACTOR MODULE KIT	24693K	24693K	24693K	24693K	24693K	24693K	24693K	24693K	24693K	24693K	24693K

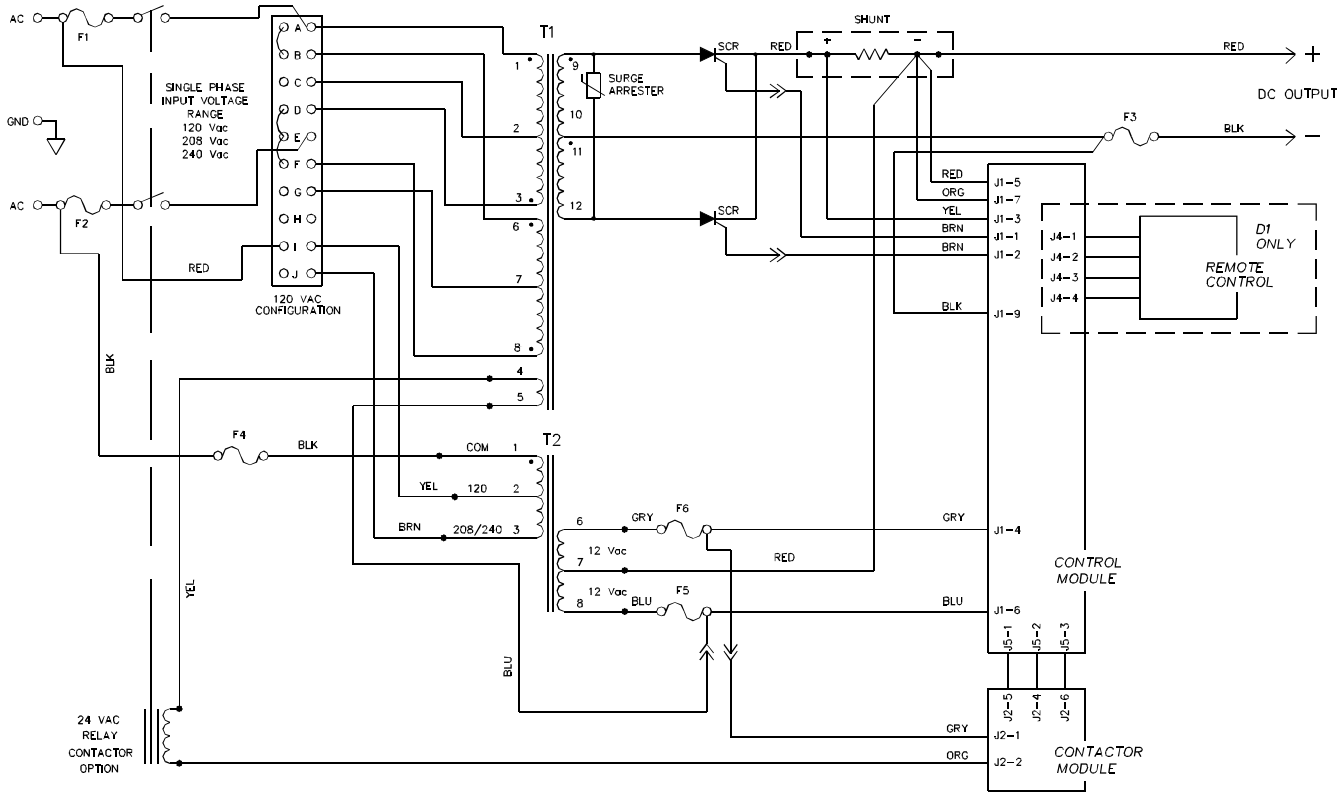
CHARGER MODEL INPUT VOLTAGE RANGE 120/208/240	6/450-1 18990 12V	6/550-1 19000 12V	12/380-1 19010 24V
LARGE TRANSFORMER ASSY.	18995S	19005S	19015S
SMALL TRANSFORMER ASSY.	18575S	18575S	18575S
SCR ASSY.	13716S	13716S	13716S
CASE, BASE PANEL, D1	25383S	25384S	25386S
CASE, INNER PANEL	25404S	25406S	25407S
DC CORD BUSHING	02008S	02008S	02008S
DC FUSE (F3)	04898S	10910S	10905S
FUSE (F1, F2)	T20A	T25A	T35A
WIRED FOR 120	04931S	25709S	05165S
FUSE (F1, F2)	T12A	T15A	T20A
WIRED FOR 208	25707S	25708S	04931S
FUSE REDUCER (F1, F2)	04938S	04938S	04938S
FUSE (F1, F2)	T10A	T12A	T20A
WIRED FOR 240	25706S	25707S	04931S
FUSE REDUCER (F1, F2)	-	-	04938S
FUSEHOLDER (F1, F2)	13366S	13366S	12869S
HEATSINK	13619S	13619S	13619S
TAP STRIP, 12 POLE	23346S	23346S	23346S
CONTACTOR MODULE KIT	24693K	24693K	24693K

*Included with door assembly

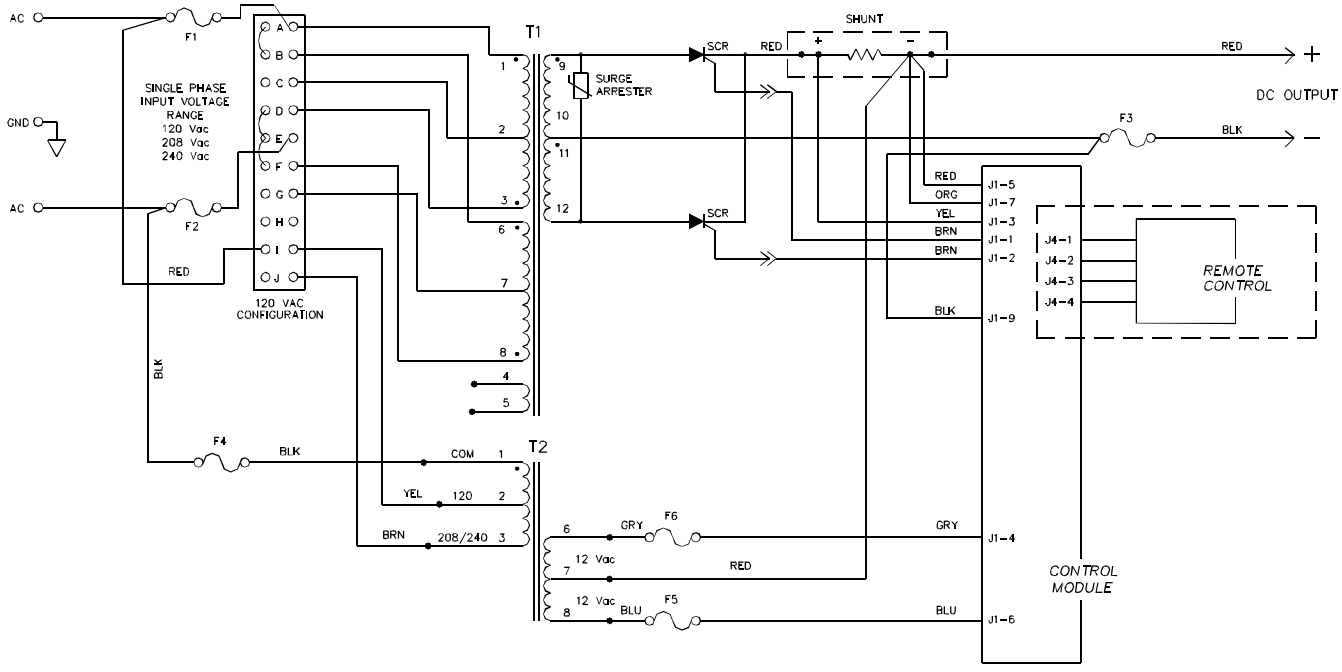
COMMON PARTS	
CASE, FRONT PANEL	24449S
CASE, BACK PANEL	24452S
CASE, SIDE PANEL	24451S
CASE, TOP PANEL	15002S
CASE, DOOR ASS'Y	27612S
RUBBER DOOR BUMPER	13592S
DOOR HANDLE	22851S
DOOR LATCH	17689S
BEZEL ASS'Y, D1 *	18278S
CONTROL MODULE, D1	19185S
TRANSFORMER MOUNTING RAIL	22952S
REMOTE CONTROL, D1	25737S
SHUNT	12867S
VARISTOR ASSY.	24278S
HEATSINK MOUNTING PLATE	19476S
SHUNT INSULATOR	12947S
INNER PANEL BUSHING, BLACK	03792S
AC GROUND LUG	14998S
FUSEHOLDER (F4)	17842S
FUSE, 1 AMP (F4)	04630S
FUSE INSULATOR	12616S
FUSE, 3 AMP (F5, F6)	04688S
FUSEHOLDER (F6, F7)	24407S
WIRE JUMPER (Set of 6)	17869S

11. SYSTEM SCHEMATICS

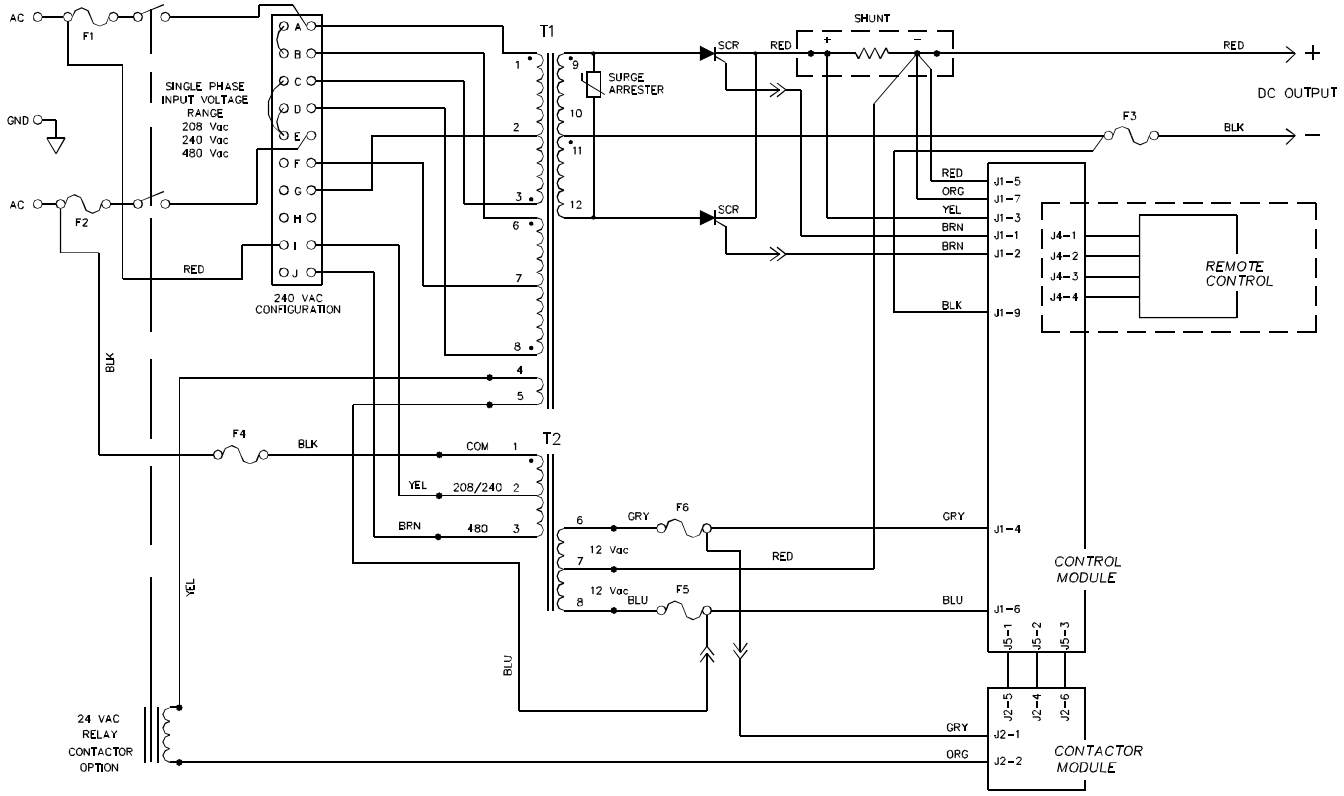
11.1 SYSTEM SCHEMATIC FOR 120/208/240 MODELS W/ AC CONTACTOR



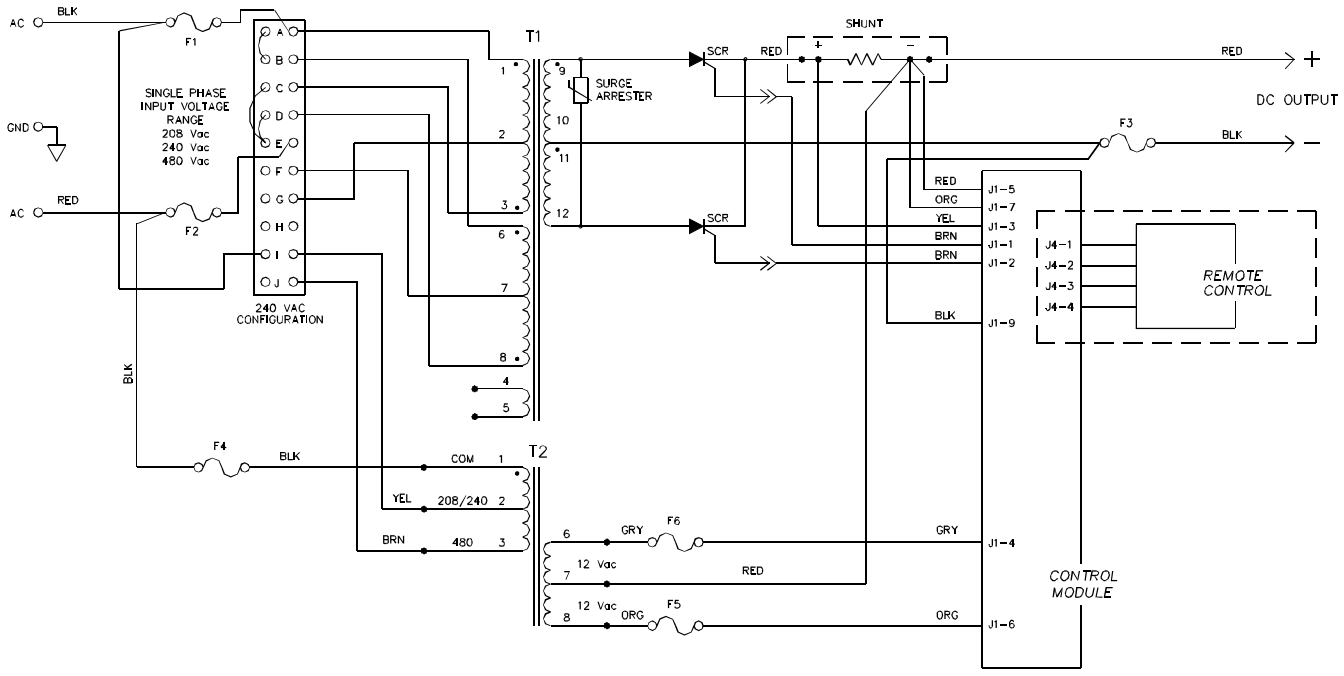
11.2 SYSTEM SCHEMATIC FOR 120/208/240 MODELS W/O AC CONTACTOR



11.3 SYSTEM SCHEMATIC FOR 208/240/480 MODELS W/ AC CONTACTOR



11.4 SYSTEM SCHEMATIC FOR 208/240/480 MODELS W/O AC CONTACTOR



TAYLOR - DUNN

General Maintenance

TABLE OF CONTENTS

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 ON-OFF switch is in the "OFF" position.

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. Unplug the main battery connector.

⚠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.

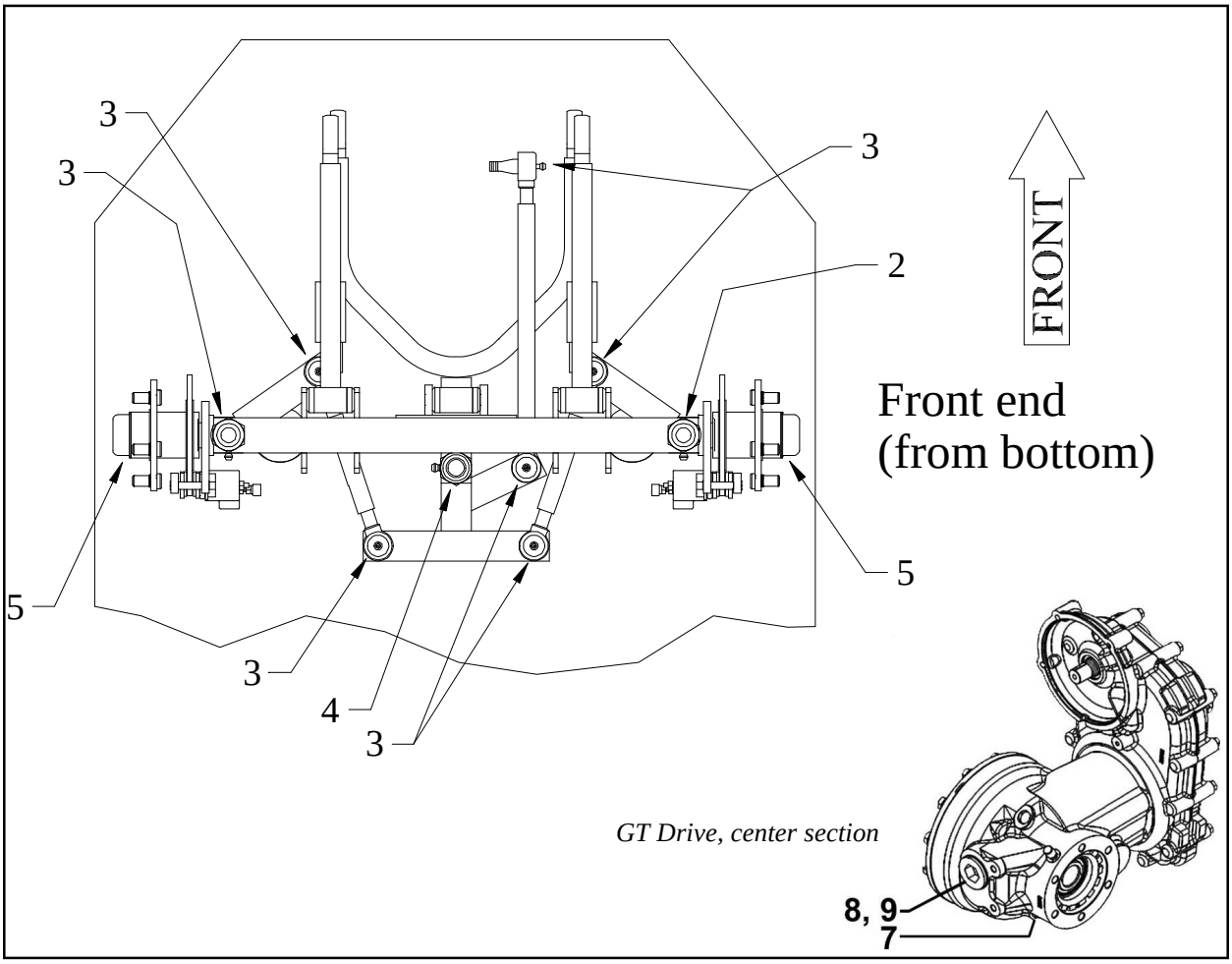
MAINTENANCE SCHEDULE

Refer to the maintenance schedules in section Safety Rules and Operating instructions.

TROUBLESHOOTING GUIDE

Symptom	Probable Cause
Steering Pulls in One Direction	Front End Out of Alignment
	Low Tire Pressure
Hard Steering	Dry Lube Points in Steering Linkage
	Damaged King Pin/Ball Joint
	Low Tire Pressure
Excessive Steering Play	Worn Ball Joints
	Mis-Adjusted or Worn Steering Gear
	Loose Steering Linkage
Lack of Power or Slow Operation	Brakes or Parking Brakes Dragging
	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	-	-	-
2	King Pin	2	General Purpose Grease
3	Ball Joints	6	General Purpose Grease
4	Idler Pivot	1	General Purpose Grease
5	Front Wheel Bearings	2	High Temperature Wheel Bearing Grease
6	-	-	-
7	Drive Drain Plug	1	
8	Drive Level Plug	1	
9	Drive Fill Plug	1	SAE 75W90 Synthetic Hypoid Gear Oil
10	-	-	

Front Axle Service

TABLE OF CONTENTS

INSPECT THE FRONT WHEEL BEARINGS AND KING PIN

⚠WARNING

1. Make sure the key-switch is in the "OFF" position.
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. Unplug the main battery connector.

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.

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

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

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

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

9. Lower the vehicle.
10. Reconnect the main battery connector.
11. Remove the blocks from behind the wheels.
12. Release the park brake and test drive the vehicle.

ADJUST FRONT WHEEL BEARINGS

⚠WARNING

1. Make sure the key-switch is in the "OFF" position.
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. Unplug the main battery connector.

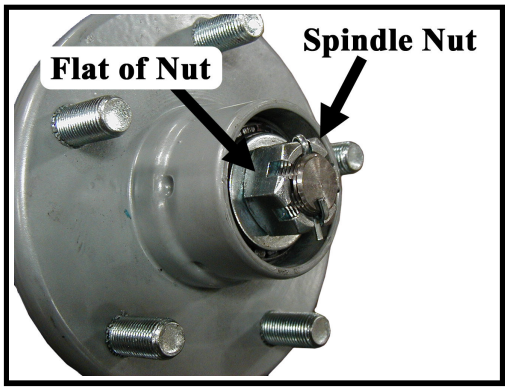
6. Raise the front of the vehicle and support with jack stands.

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

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



Hub with Dust Cap Removed

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

FRONT AXLE REMOVAL AND INSTALLATION

Removal

⚠WARNING

1. Make sure the key-switch is in the "OFF" position.
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. Unplug the main battery connector.

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

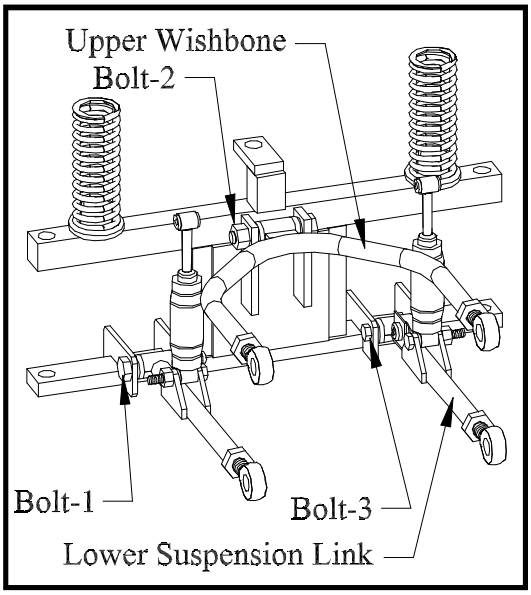
⚠WARNING

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 both front wheels. Refer to ***Tires and Wheels*** section for information regarding removing the front wheels.
8. Tie up or support the front axle so it can not fall out of the vehicle.
9. Disconnect the drag link ball joint or rod end from the steering pivot on the front axle assembly.

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

10. Disconnect the hydraulic brake lines from the brake bodies.
11. Remove the three bolts holding the front axle beam to the upper wishbone and the two lower suspension links and remove the axle from the vehicle.



Viewed from front

Installation

⚠WARNING

1. Make sure the key-switch is in the "OFF" position.
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. Unplug the main battery connector.

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. Install the front axle in reverse order of removal.

   NOTE: Use all new cotter pins.

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

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

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

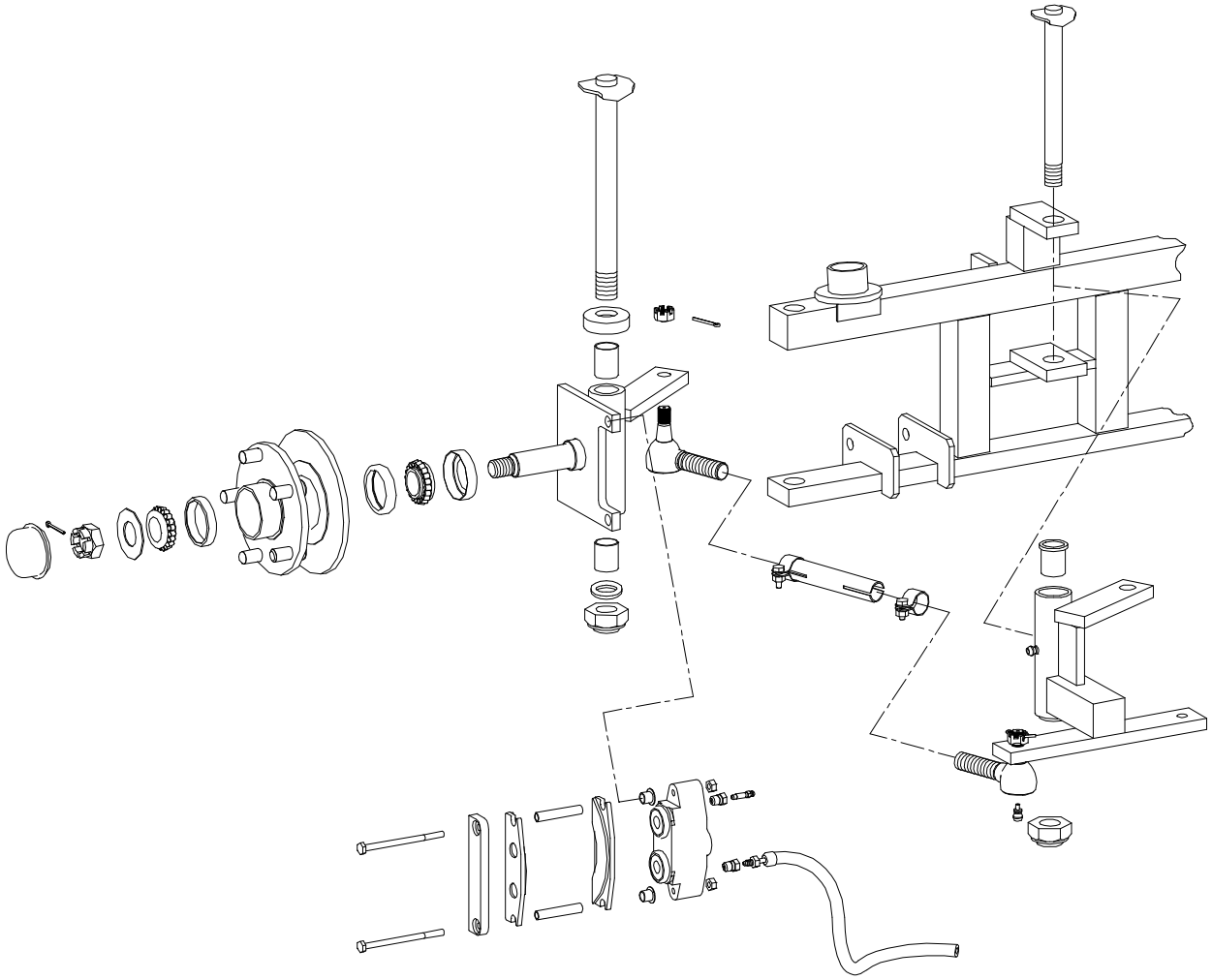
FRONT AXLE DISASSEMBLY

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

Replace the Steering Knuckle

Replace the King Pins and Bushings

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



View from rear

REPLACE FRONT WHEEL BEARINGS

⚠WARNING

1. Make sure the key-switch is in the "OFF" position.
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. Unplug the main battery connector.

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

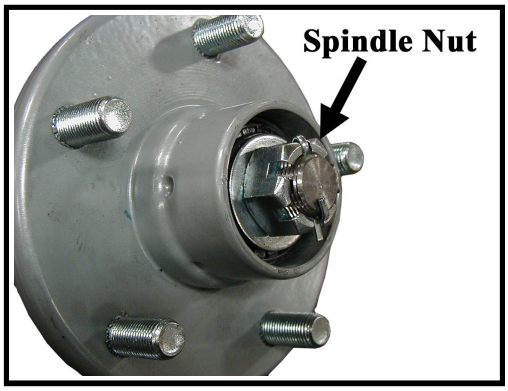
⚠WARNING

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 tire/wheel assembly from the hub. Refer to ***Replace the Steering Knuckle*** for information regarding removing the steering knuckle.
8. Remove the hub dust cap, cotter pin, and spindle nut.
9. Remove the hub from the steering knuckle.

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

   NOTE: Catch the outer bearing as it falls out.

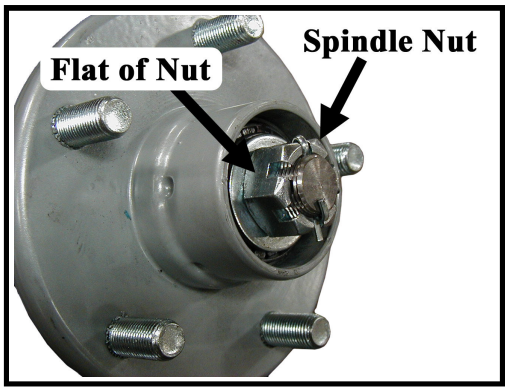


Hub with Dust Cap Removed

10. Thoroughly clean all grease from the inside of the hub and the bearings.
11. Inspect and replace the races and bearings as a set.

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

12. Assemble in reverse order, using new grease seals.
    a. Pack inner and outer bearings with grease.
    b. While rotating the hub, tighten the spindle nut to 30 ft-lbs. This seats the bearings.
    c. Back off the spindle nut one flat until the hub turns, but is not loose.
    d. Install a new cotter pin.



Hub with Dust Cap Removed

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

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

15. Lower the vehicle.
16. Reconnect the main battery connector.
17. Remove the blocks from behind the wheels.
18. Release the park brake and test drive the vehicle.

REPLACE THE KING PINS AND BUSHINGS

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

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

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

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

⚠WARNING

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

⚠WARNING

1. Make sure the key-switch is in the "OFF" position.
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. Unplug the main battery connector.

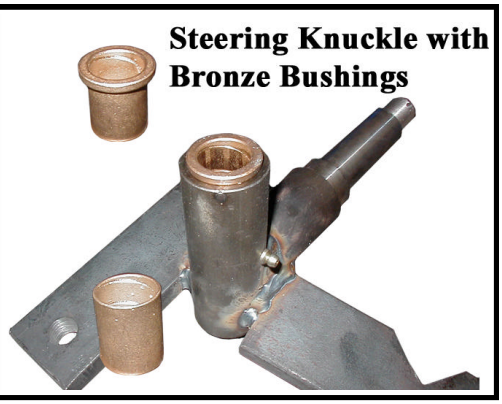
6. Raise the front of the vehicle and support with jack stands.

⚠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.

Axle End with Metal Backed Teflon Bushings

Axle End with Bronze Bushings



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

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

8. Press the king pin bushings out from the axle or steering knuckle.
9. Press new bushings into the axle or steering knuckle.
10. Ream or broach bronze bushings to 0.8755 - 0.8765 inches.
11. Inspect the king pin for damage or wear. If any damage or wear is noted then the pin must be replaced.

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

12. Reassemble in reverse order.

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

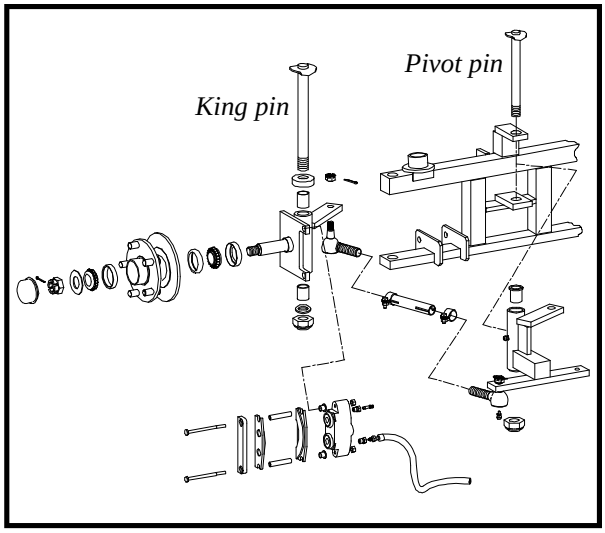
    NOTE: It is recommended that the thrust washers or bearing be replaced whenever replacing the king pin bushings. Refer to the **Replacement Parts** *section for the orientation of the bearing or washers in your vehicle.*

13. Grease the bushings (bronze only).
14. Lower the vehicle.
15. Reconnect the main battery connector.
16. Remove the blocks from behind the wheels.
17. Release the park brake and test drive the vehicle.

REPLACE THE PIVOT PIN AND BUSHINGS

The procedure to replace the pivot pin is the same as the king pin procedure.

Ream or broach the bronze pivot bushings to 0.878 - 0.880 inches.



REPLACE THE STEERING KNUCKLE

⚠WARNING

1. Make sure the key-switch is in the "OFF" position.
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. Unplug the main battery connector.

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

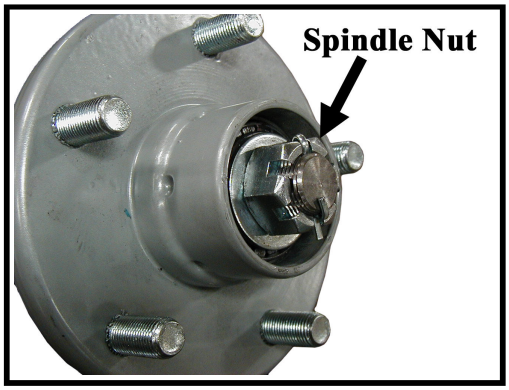
⚠WARNING

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 tire/wheel assembly. Refer to ***Tires and Wheels*** section for information regarding removing the tire/wheel assembly.
8. Remove the hub bearing cap, cotter pin and nut, then remove the hub from the steering knuckle.

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

   NOTE: Catch the outer bearing as it falls out.



Hub with Dust Cap Removed

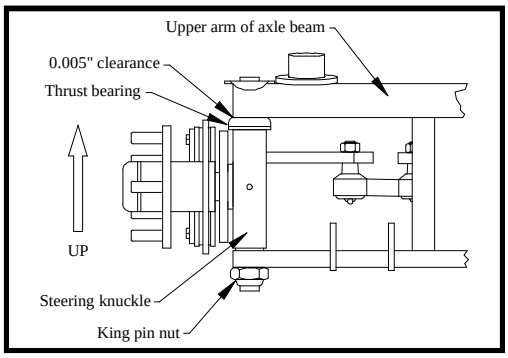
9. Remove the drag link and/or tie rod from the steering knuckle. Refer to ***Replace the Ball Joints, Tie Rods, Drag Link*** in this section for information regarding removal of the drag link or tie rod.
10. While supporting the knuckle, remove the king pin and thrust bearing.
11. Remove the knuckle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

12. Thoroughly clean and/or replace all bearings, nuts, washers, and bushings.

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

13. Assemble in reverse order.
14. Pack the thrust bearing with grease.
15. Tighten the king pin nut until there is 0.005" clearance between the top of the thrust bearing and the upper arm of the axle beam.

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



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

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

18. Lower the vehicle.
19. Reconnect the main battery connector.
20. Remove the blocks from behind the wheels.
21. Release the park brake and test drive the vehicle.

Steering Component Service

TABLE OF CONTENTS

FRONT END ALIGNMENT

Inspection, Axle Centers

⚠WARNING

1. Make sure the ON-OFF switch is in the "OFF" position.
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. Unplug the main battery connector.

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

⚠WARNING

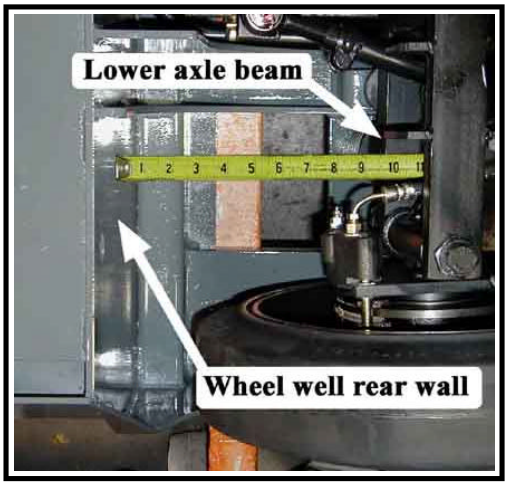
Always use a lifting strap, hoist, and jack stands, of adequate capacity to lift and support the vehicle. Failure to use lifting and support devices of rated load capacity may result in severe bodily injury.

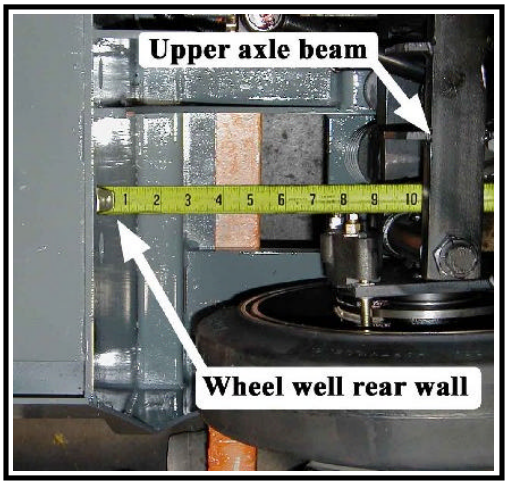
7. Measure the distances from the rear of the lower axle beam to the rear wall of the wheel well on both sides of the axle beam next to the steering knuckle. Adjust the lower suspension links so that the distance is between 10-1/8 to 10-3/8 inches.

   NOTE: The difference between the left and right measurement should be no more than 1/8 inch.

8. Measure the distances from the rear of the upper axle beam to the rear wall of the wheel well on both sides of the axle beam next to the steering knuckle. Adjust the upper wishbone link so that the distance is 1/2 inch less than the lower measurement.

   NOTE: Do not continue with the front end alignment until the axle centers are properly adjusted.





Center the Wheels

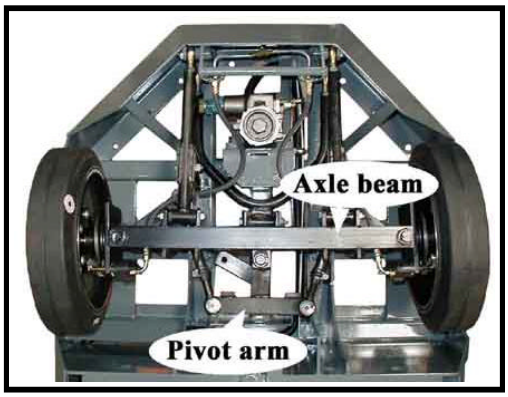
9. Center the steering gear and tie it off so that it cannot rotate.

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

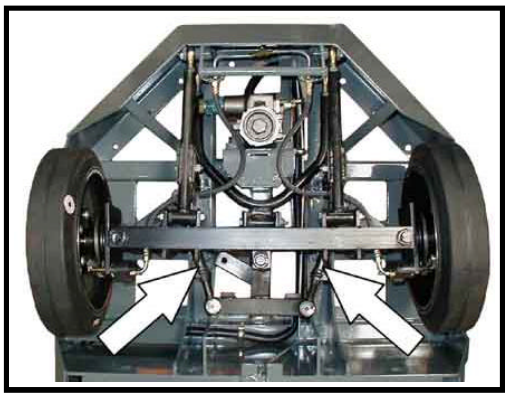
⚠WARNING

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.

11. Loosen the ball joint clamps on the drag link.
12. Adjust the drag link so that the steering pivot arm is parallel with the axle beam.
13. Position the ball joint clamps as shown and tighten to 28-32 ft lbs.



14. Loosen the ball joint clamps on the left and right tie rods.
15. Position a straight edge along the right side of the vehicle and adjust the right side tie rod so that the front wheel is parallel with the rear wheel.



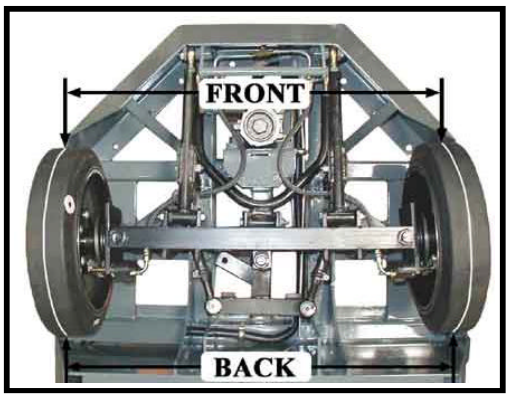
Tie rods

Toe In

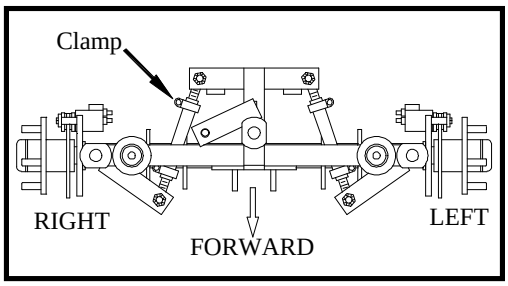
16. Using a piece of chalk, mark a line around the center of both front tires.

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

17. Measure the distance between the lines at the front of the tires.
18. Measure the distance between the lines at the rear of the tires.



19. Adjust the left side tie rod so that the distance at the front and rear of the tires is the same.
20. Position the ball joint clamps as shown and tighten to 28-32 ft lbs.



⚠WARNING **Clamps positioned so that they contact other components may result in steering failure and loss of control of the vehicle causing severe bodily injury and/or property damage.**

21. Reconnect the main battery connector.
22. Untie the stering wheel.
23. Rotate the steering wheel from a full left turn to a full right turn and make sure that the ball joint clamps do not contact any other component.
24. Remove the blocks from behind the wheels.
24. Release the parking brake and test drive the vehicle.

INSPECT BALL JOINTS

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

⚠WARNING

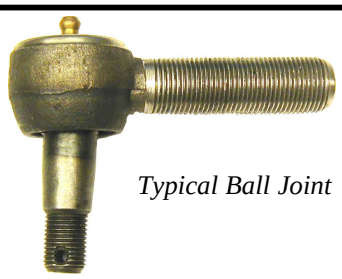
1. Make sure the ON-OFF switch is in the "OFF" position.
2. Place the forward-reverse switch in the center "OFF" position.
3. Set the park brake.
4. Place blocks under the rear wheels to prevent vehicle movement.
5. Unplug the main battery connector.

6. Tie off the front wheels so that they 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 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 wheels.
10. Reconnect the main battery connector.
11. Remove the blocks from behind the wheels.
12. Release the parking brake and test drive the vehicle.



Typical Ball Joint

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 ON-OFF switch is in the "OFF" position.

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. Unplug the main battery connector.

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

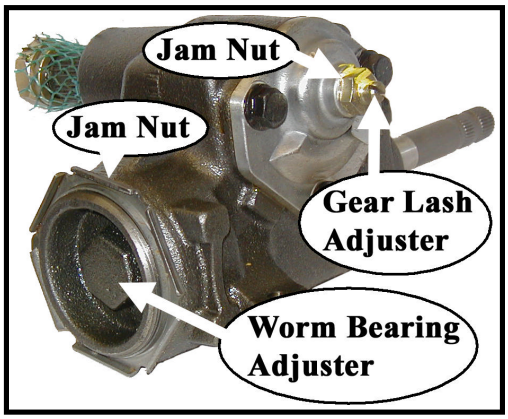
⚠WARNING

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 battery connector.
16. Remove the blocks from behind the wheels.
17. Release the parking brake and test drive the vehicle.

REMOVE THE STEERING COLUMN

⚠WARNING

1. Make sure the ON-OFF switch is in the "OFF" position.
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. Unplug the main battery connector..

6. Remove the steering wheel cap.
7. Remove the three screws holding the steering wheel to the adaptor and remove the steering wheel.

⚠CAUTION

The steering wheel adaptor is soft metal. Do not use a hammer to remove the steering wheel adaptor.

8. Remove the adaptor nut and the adaptor. It may require a puller to remove the adaptor from the shaft.
9. Remove the steering column u-bolt holding the column to the frame.
10. Slide the column up off of the steering shaft.
11. Remove the setscrew holding the u-joint to the steering gear input shaft.
12. Pull the steering shaft off of the steering gear input shaft.
13. Install the shaft in reverse order.

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

14. Reconnect the main battery connector.
15. Remove the blocks from behind the wheels.
16. Release the parking brake and test drive the vehicle.

REPLACE THE STEERING GEAR

⚠WARNING

1. Make sure the ON-OFF switch is in the "OFF" position.
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. Unplug the main battery connector.

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 setscrew holding the u-joint to the steering gear input shaft.
8. Remove the pitman arm.
9. Support the steering gear so that it cannot fall out of the vehicle.
10. Remove the bolts holding the steering gear to the vehicle frame and remove the steering gear from the vehicle.
11. Install in reverse order. Torque the pitman arm nut to 75-100 ft-lbs. Apply thread locking compound to the steering shaft allen head screws.

⚠WARNING

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

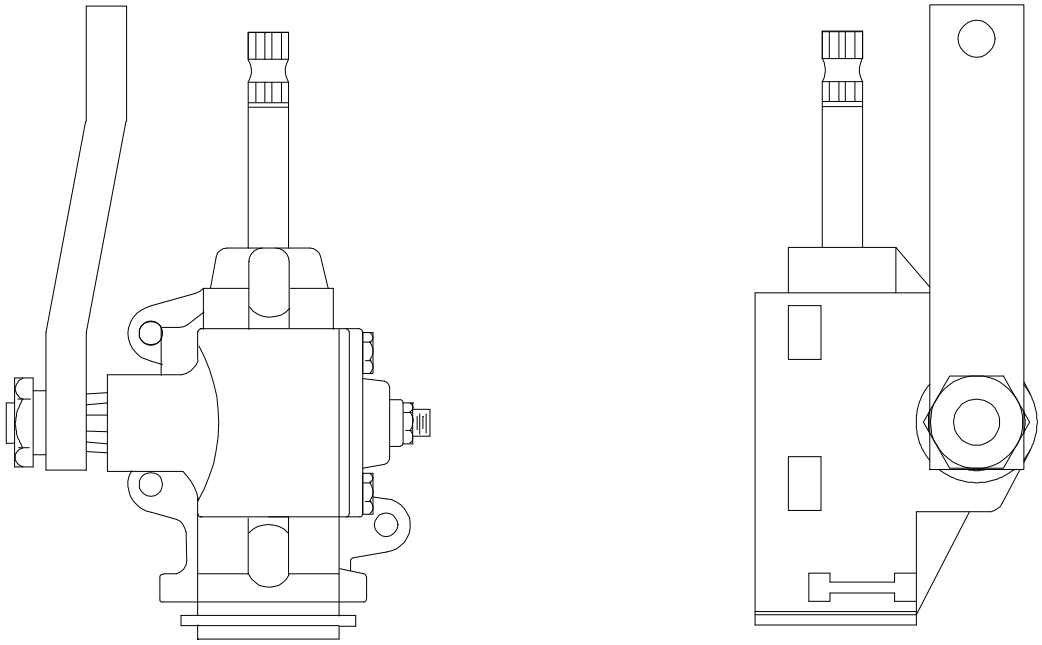
12. Reconnect the main battery connector.
13. Remove the blocks from behind the wheels.
14. Release the parking brake and test drive the vehicle.

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 SHAFT ALIGNMENT

1. Center the steering gear. Refer to ***Center the Steeing Gear*** for information regarding centering the steering gear.
2. Install the pitman arm parallel with the input shaft orientated as shown in the illustration.



REPLACE THE BALL JOINTS, TIE RODS, AND DRAG LINK

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 Ball Joint

⚠WARNING

1. Make sure the ON-OFF switch is in the "OFF" position.
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. Unplug the main battery connector.

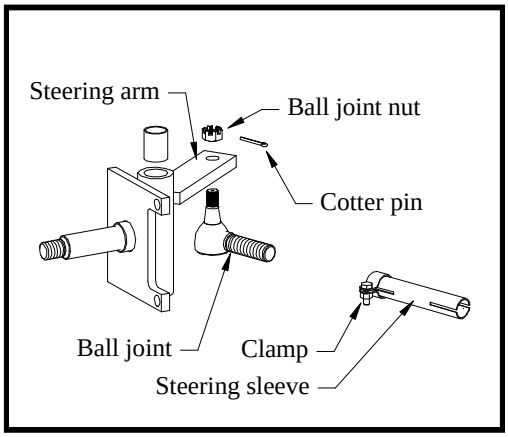
6. Raise the front of the vehicle and support with jack stands.

⚠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.
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 battery connector., remove the blocks from the wheels, and test drive.

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 ON-OFF switch is in the "OFF" position.
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. Unplug the main battery connector.

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.

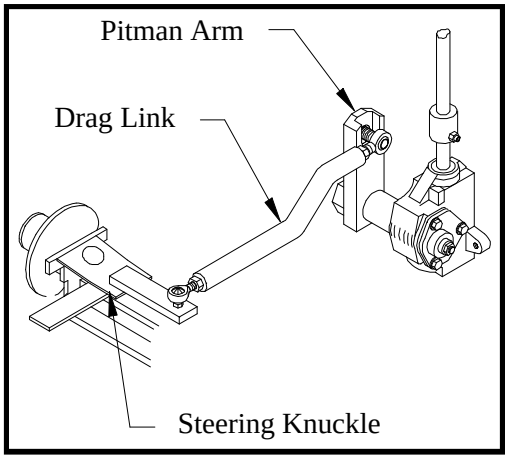
7. Remove the ball joints or rod ends from the steering knuckle and pitman arm.

   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.*

11. Lower the vehicle.
12. Reconnect the main battery connector.
13. Remove the blocks from behind the wheels.
14. Release the park brake and test drive the vehicle.



Typical Drag Link

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 ON-OFF switch is in the "OFF" position.
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. Unplug the main battery connector.

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.

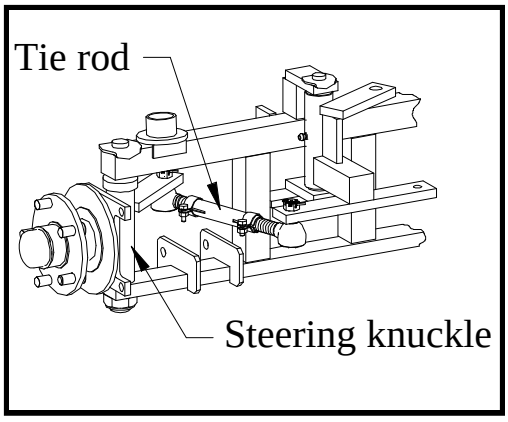
7. Remove the ball joints or rod ends from the steering knuckles.

   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.*

11. Lower the vehicle.
12. Reconnect the main battery connector.
13. Remove the blocks from behind the wheels.
14. Release the park brake and test drive the vehicle.



Front Axle Assembly (left side shown)

REPAIR THE STEERING GEAR

Disassembly

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

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

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

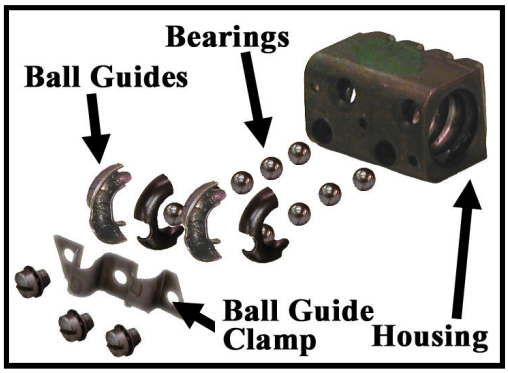
1. Center the steering gear.
   A. Turn the steering shaft all of the way in one direction.
   B. While counting the rotation, turn the steering shaft all of the way in the opposite direction.
   C. Turn the steering shaft 1/2 the number of turns in the original direction.
2. Remove the worm bearing adjuster locking ring and the worm bearing adjuster.

3. Remove the side cover/pitman shaft assembly by removing the three side cover bolts and then pulling the assembly out of the housing.

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

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

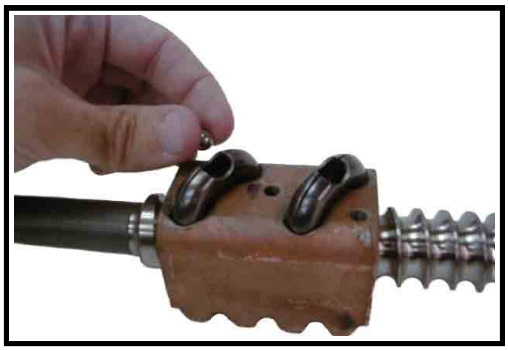
8. The ball nut assembly consists of two sets of ball bearings that recirculate in two channels in the ball nut housing. The bearings may fall out once the bearing guides are removed. Be careful not to lose any of the bearings.
9. Remove the ball guide clamps, ball guides and all of the ball bearings.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



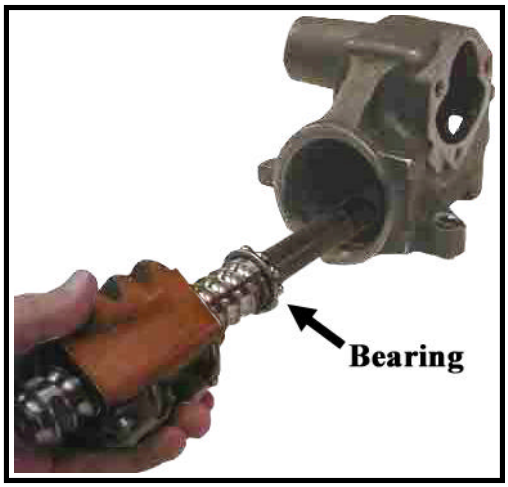
Reassembly

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

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

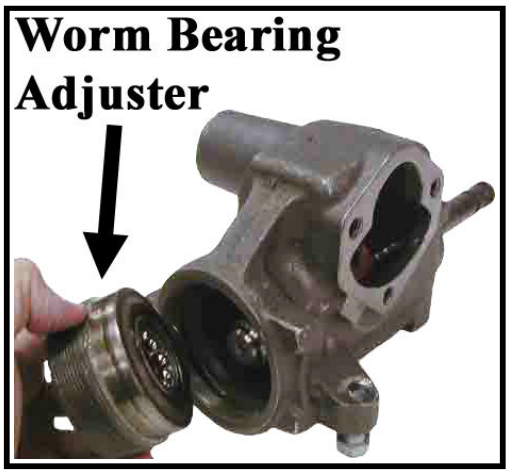


9. Place the upper worm bearing on the worm shaft and install the worm shaft/ball nut assembly into the housing being careful not to damage the worm shaft seal.



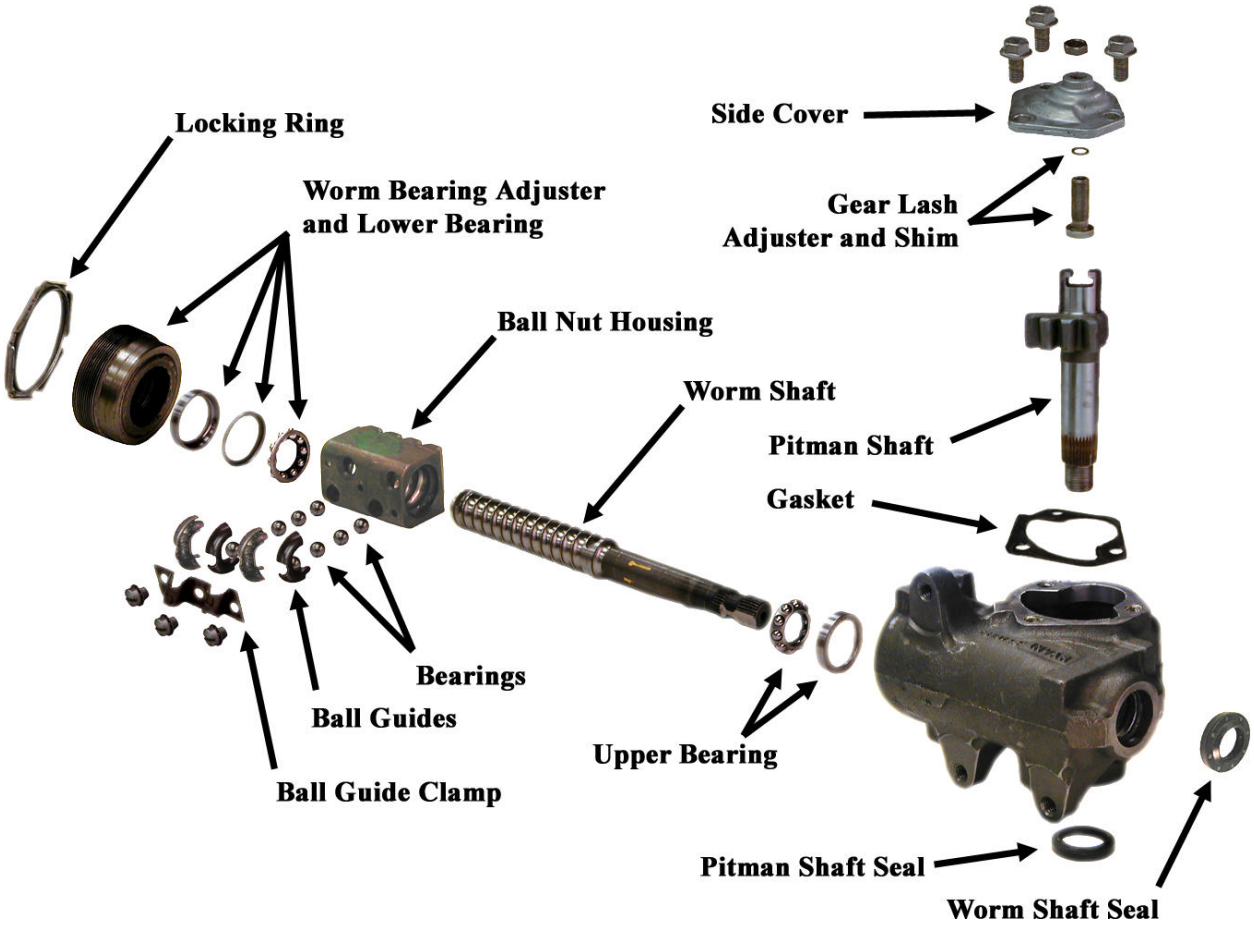
10. Install the assembled worm bearing adjuster into the housing and tighten just enough to remove all play in the worm shaft.
11. Install, but do not tighten the worm bearing adjuster lock nut.
12. Rotate the worm shaft to center the ball nut in the housing.
13. Place a new gasket onto the housing and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

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



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

Exploded View of Steering Gear



TAYLOR - DUNN

Brake Service

TABLE OF CONTENTS

INSPECT THE SERVICE BRAKE

Disc Brake Pads

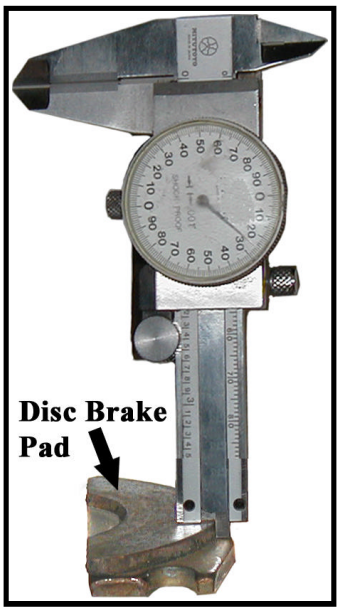
⚠WARNING

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

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

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

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



Disc Brake Rotor

⚠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.

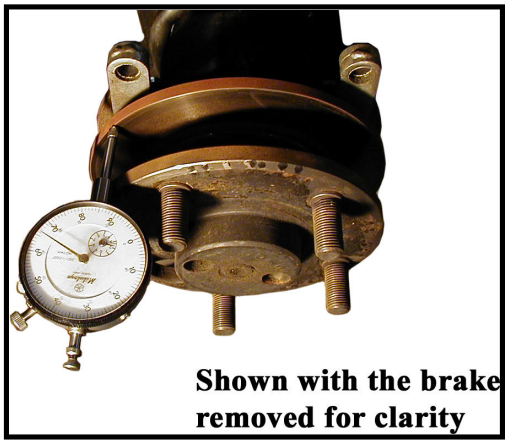
NOTE: The front brake rotor is an integral part of the front hub. If the brake rotor is worn beyond its service limits, then the front hub must be replaced. Refer to **Front Axle Service** *for information on replacing the front hub.*

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, 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.

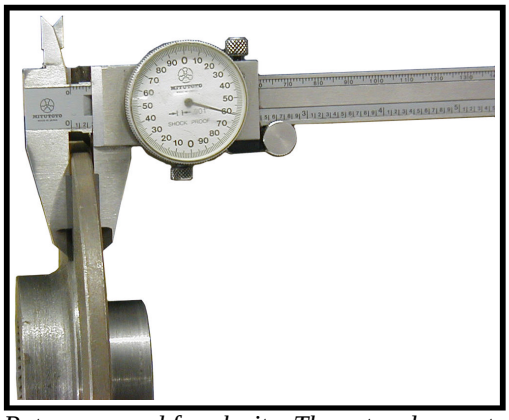


Shown with the brake removed for clarity

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

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

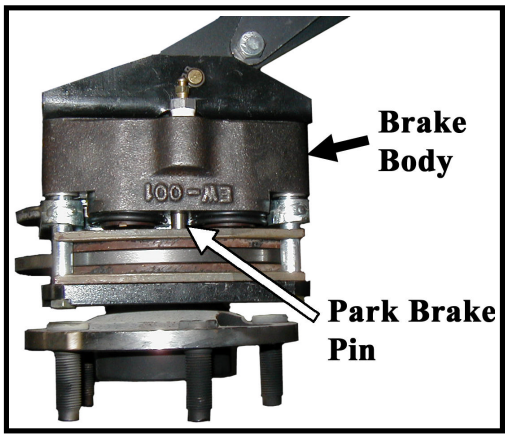
⚠WARNING

1. Make sure the ON-OFF switch is in the "OFF" position.
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. Unplug the main battery connector.

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.*

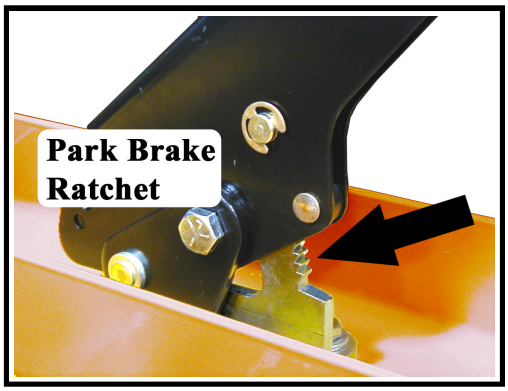
9. Inspect all brake cables and linkages for any signs of damage, wear, or missing cotter pins.



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.*

11. Reconnect the main battery connector.
12. Remove blocks from behind the wheels.
13. Release the parking brake and test drive the vehicle.



⚠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 property damage and/or severe bodily injury.

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.

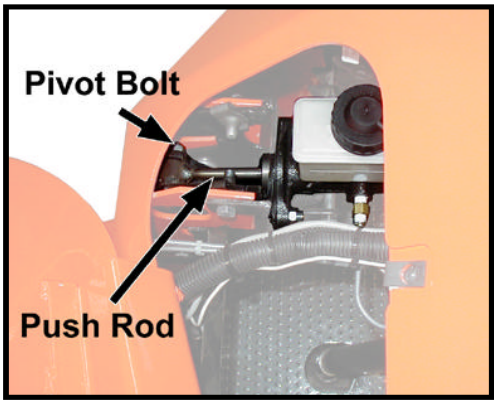
If you are experiencing a low brake pedal or lack of braking power, the entire brake system should be inspected.

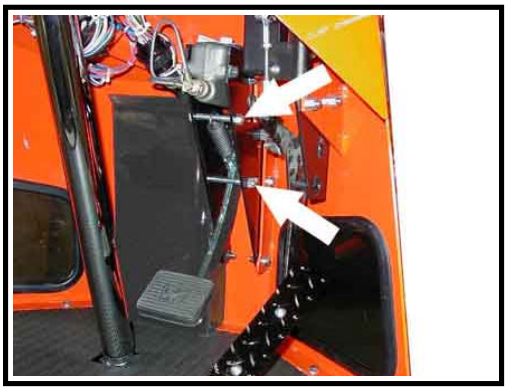
ADJUST THE BRAKE LINKAGE

⚠WARNING

1. Make sure the ON-OFF switch is in the "OFF" position.
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. Unplug the main battery connector.

6. Tighten the master cylinder push rod pivot bolt so that the push rod may pivot freely with no side play. See the illustration to the right.





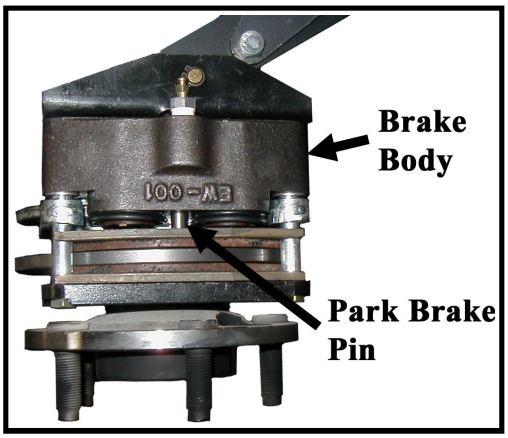
7. Tighten the spring mounting bolt and the pedal stop bolt so that one thread shows beyond the locknut. See arrows in the illustraition to the left.

8. Tight the brake pedal pivot bolt so that the brake pedal moves freely with no side play.
9. Reconnect the main battery connector.
10. Remove blocks from behind the wheels.
11. Release the park brake and test drive the vehicle.

ADJUST THE PARKING BRAKE

Wheel Park Brake

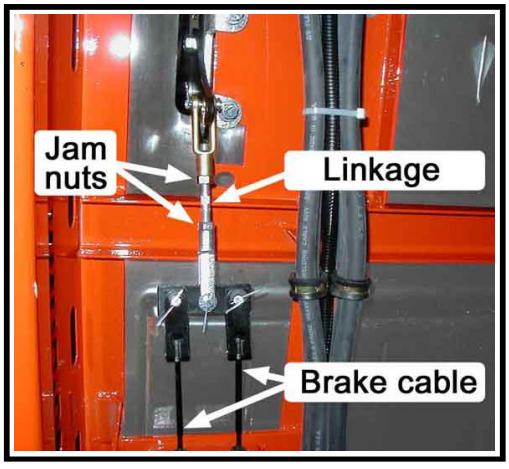
The parking brake is actuated through a pin in the center of the rear left and right brake body on the rear axles.



⚠WARNING

1. Make sure the ON-OFF switch is in the "OFF" position.
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. Unplug the main battery connector.

6. Release the park brake.
7. Loosen the jam nuts on the park brake linkage.
8. Adjust the linkage to remove all slack for the park brake cables.
9. Tighten the jam nuts on the park brake linkage.
10. Set the park brake.
11. Reconnect the main battery connector.
12. Remove blocks from behind the wheels.
13. 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 ON-OFF switch is in the "OFF" position.**
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. **Unplug the main battery connector.**

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 battery connector.
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 ON-OFF switch is in the "OFF" position.

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. Unplug the main battery connector.

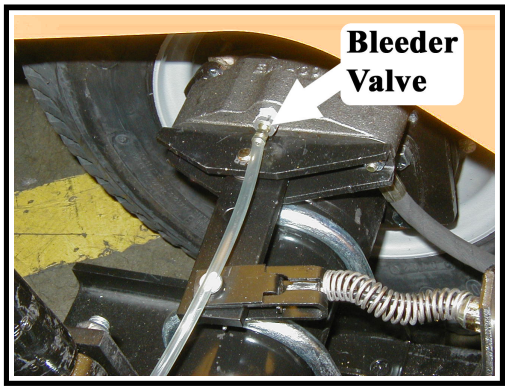
6. Thoroughly clean the area around the master cylinder cap and remove the cap.

7. Add brake fluid from a new sealed container to the master cylinder. Fill to 1/4” from the top of the master cylinder chamber.

⚠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 property damage or severe bodily injury.

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 battery connector.
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 ON-OFF switch is in the "OFF" position.
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. Unplug the main battery connector.

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 battery connector.
22. Release the park brake and test drive the vehicle.

REPLACE THE PARKING BRAKE LINING

⚠WARNING

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

Wheel Park Brake

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

REPLACE FRONT BRAKE PADS

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

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

⚠WARNING

1. Make sure the ON-OFF switch is in the "OFF" position.

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. Unplug the main battery connector.

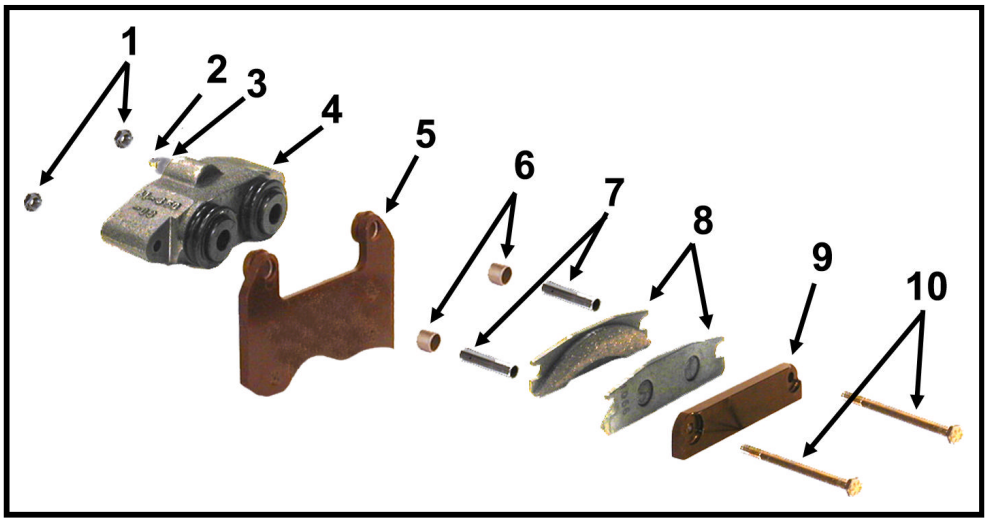
6. Thoroughly clean the area around the master cylinder cap.
7. Remove fluid from the master cylinder until it is 1/2 full.

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

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



NOTE: Refer to the illustration above for the following steps.

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

REPLACE REAR BRAKE PADS

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 ON-OFF switch is in the "OFF" position.
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. Unplug the main battery connector.

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

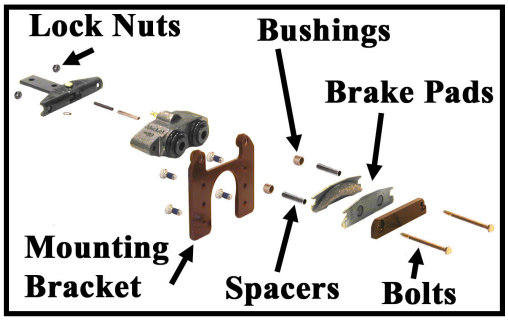
6. Thoroughly clean the area around the master cylinder cap.
7. Remove fluid from the master cylinder until it is 1/2 full.

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 battery connector.
24. Remove the blocks from behind the wheels.
25. Release the park brake and test drive the vehicle.

REPLACE THE WHEEL CYLINDER

Disc Brake Body Assembly (front or rear)

⚠WARNING

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 ON-OFF switch is in the "OFF" position.

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.

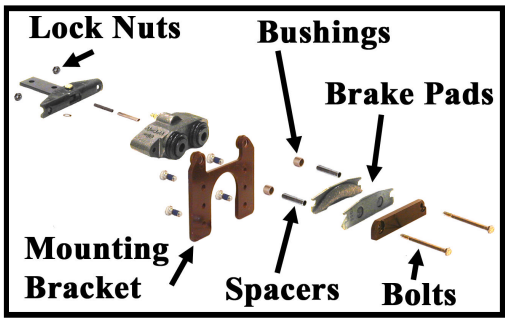
5. Unplug the main battery connector.

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 battery connector.
17. Lower the wheel to the ground.
18. Remove the blocks from behind the wheels.
19. Release the park brake and test drive the vehicle.

REPAIR THE BRAKE BODY

⚠WARNING

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

⚠WARNING

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

SKIN CONTACT

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

EYE CONTACT

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

INGESTION

Get medical attention immediately.

⚠WARNING

1. Make sure the ON-OFF switch is in the "OFF" position.

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. Unplug the main battery connector.

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 property damage and/or severe bodily injury.

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.

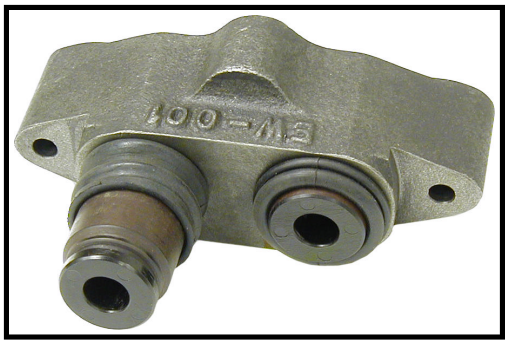
⚠CAUTION

Failure to lubricate using DOT 5 silicon brake fluid may result in corrosion in the brake body leading to seized pistons and dragging brakes.

11. Lubricate all brake parts with clean **DOT 5** silicon brake fluid from a sealed container.
12. Install the o-rings into the brake body. Make sure that the o-rings are installed into the second groove and that they are not twisted.

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

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



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

REPLACE THE MASTER CYLINDER

⚠WARNING

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

SKIN CONTACT

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

EYE CONTACT

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

INGESTION

Get medical attention immediately.

⚠WARNING

1. Make sure the ON-OFF switch is in the "OFF" position.

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. Unplug the main battery connector.

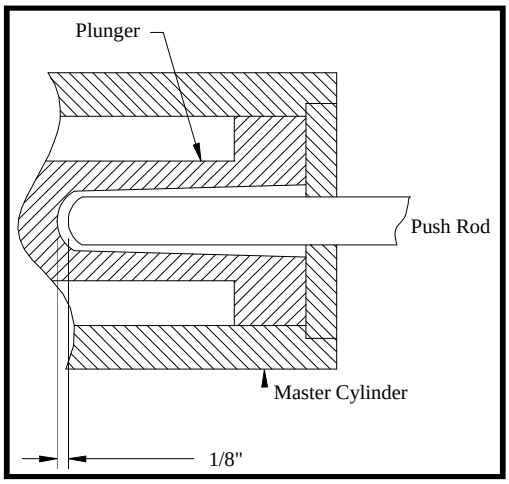
NOTE: Most vehicle configurations do not require lifting the vehicle to remove the master cylinder. Lifting the vehicle may not be required.

⚠WARNING

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

6. If required, raise the vehicle and support with jack stands.
7. Place a drain pan under the master cylinder.
8. Disconnect the brake line(s) to the master cylinder and pump out the fluid in the master cylinder by depressing the pedal several times.
9. Remove the master cylinder bolts and remove the master cylinder from the vehicle.

10. Install in reverse order.
11. Fill the master cylinder with brake fluid from a sealed container.
12. 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.
13. If the vehicle was raised, lower it to the ground.
14. Bleed the brakes. refer to ***Bleed the Brakes*** section for information regarding bleeding the brakes.
15. Reconnect the main battery connector.
16. Remove the blocks from behind the wheels.
17. 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 contaminates from entering the master cylinder.

TAYLOR - DUNN

Throttle Linkage

TABLE OF CONTENTS

THROTTLE LINKAGE ADJUSTMENTS

⚠WARNING

1. Make sure the ON-OFF switch is in the "OFF" position.

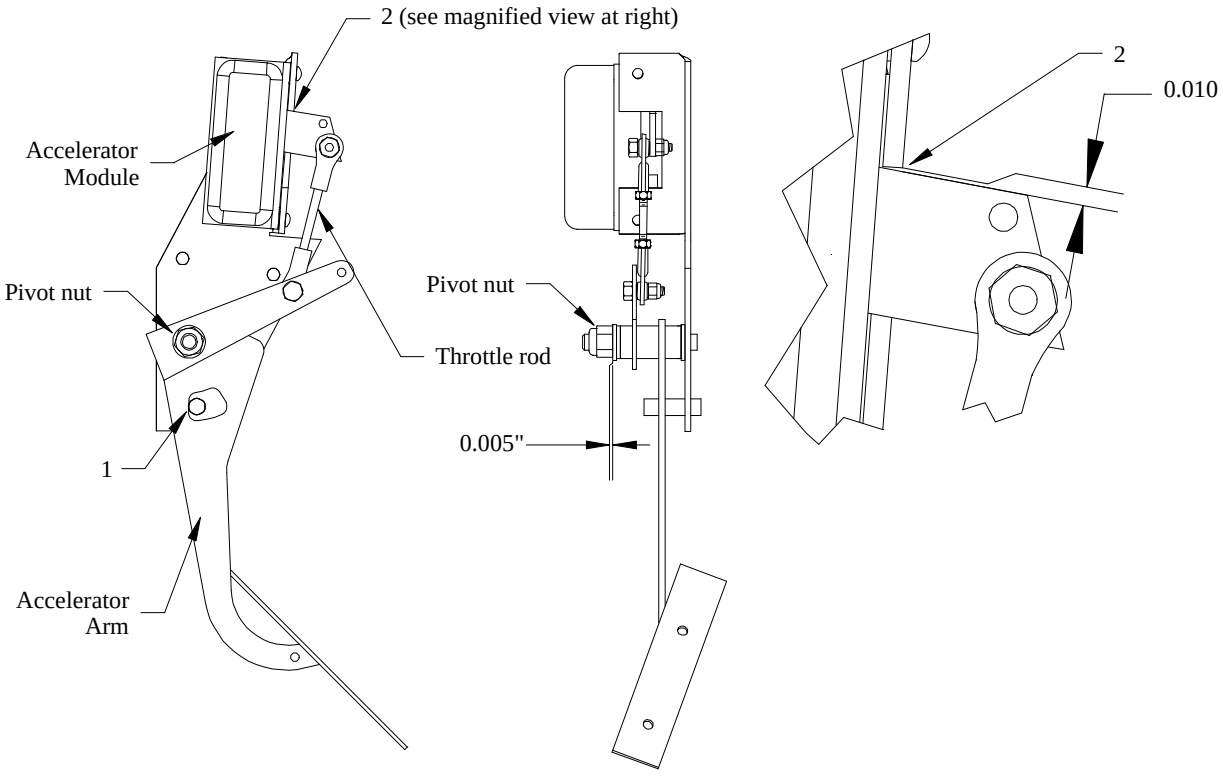
2. Place the forward-reverse switch in the center "OFF" position.

3. Set the park brake.

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

5. Unplug the main battery connector.

6. Adjust the accelerator pedal arm pivot nut so that there is 0.005" clearance between the nut and flat washer.
7. Make sure the accelerator pedal arm is in the fully released position. See arrow 1 in the illustration.
8. Adjust the throttle rod so that the accelerator module arm has 0.010" clearance between the arm and the accelerator module bracket. See arrow 2 in the illustration.
9. Reconnect the main battery connector.
10. Remove the blocks from the wheels and test drive the vehicle.



Motor Service

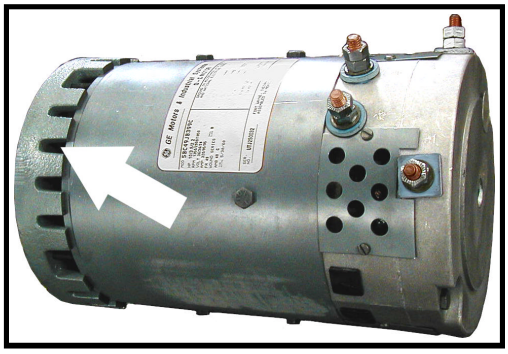
TABLE OF CONTENTS

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 ON-OFF switch is in the "OFF" position.

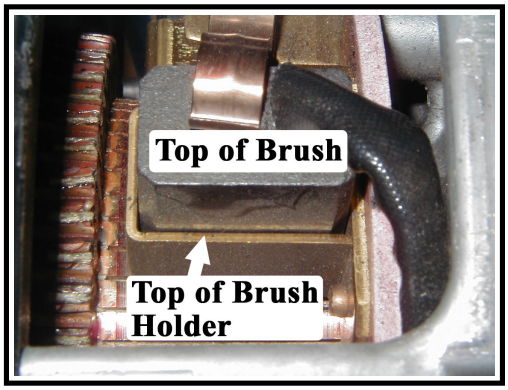
2. Place the forward-reverse switch in the center "OFF" position.

3. Set the park brake.

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

5. Unplug the main battery connector.

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 battery connector.
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.

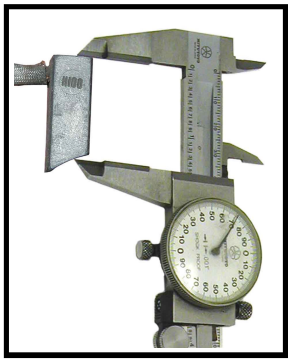
MOTOR INSPECTION

Disassembly

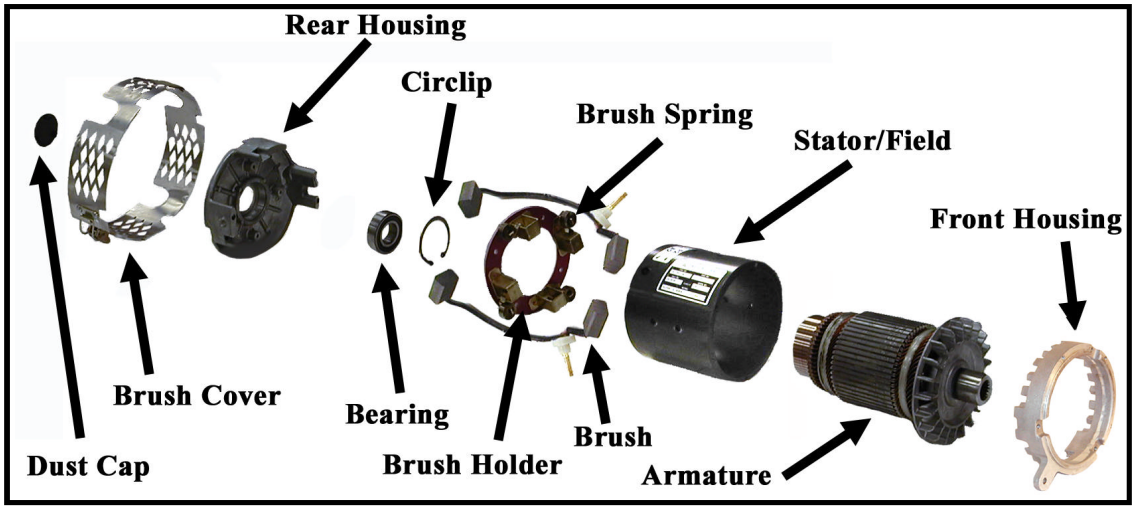
1. Remove the motor from the vehicle. See the ***Transmission*** section for information on removing the motor.
2. Remove the brush cover and pull the brushes out away from the commutator.
3. Remove the dust cap from the rear motor housing.
4. Place the motor in a press, and press the armature out of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

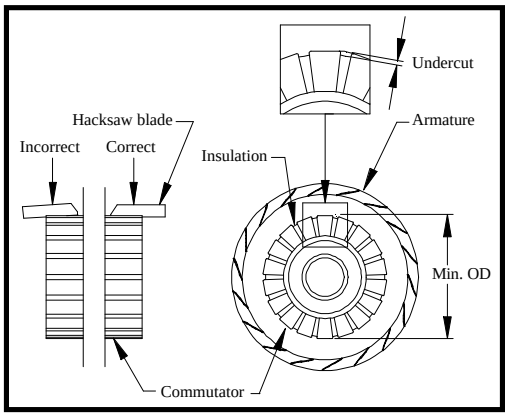


1. Measure the length of each motor brush.
   - If any one brush is less than or equal to the service limit specified in section ***Service Limits***, then all four brushes should be replaced. Refer to ***Replacing the Brushes*** section for information regarding replacing the motor brushes.

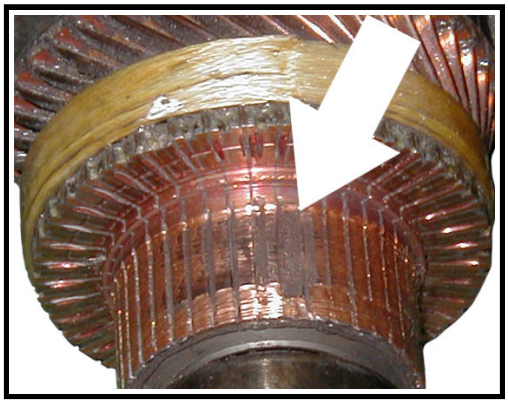


2. Measure the diameter of the commutator.
   - If the commutator is less than the minimum diameter specified in section ***Service Limits,*** then the motor must be replaced.

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



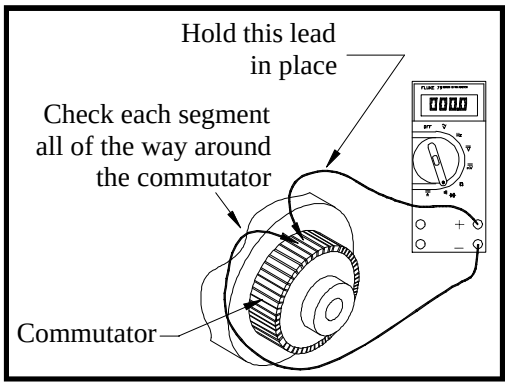
5. Inspect the commutator for burn marks.
   - Burn marks and/or raised commutator segments 90 or 180 degrees apart is evidence of a shorted armature. A tool called a growler is required to reliably test for a shorted armature.
6. Inspect the commutator for raised segments. Raised segments could be a result of a stalled motor or shorted armature. A tool called a growler is required to reliably test for a shorted armature.
   - If the armature is not shorted then the raised segments can be removed by machining the commutator. Do not machine the commutator past the minimum diameter specified in ***Service Limits*** section. Refer to ***Repair Commutator*** section for information regarding machining the commutator.



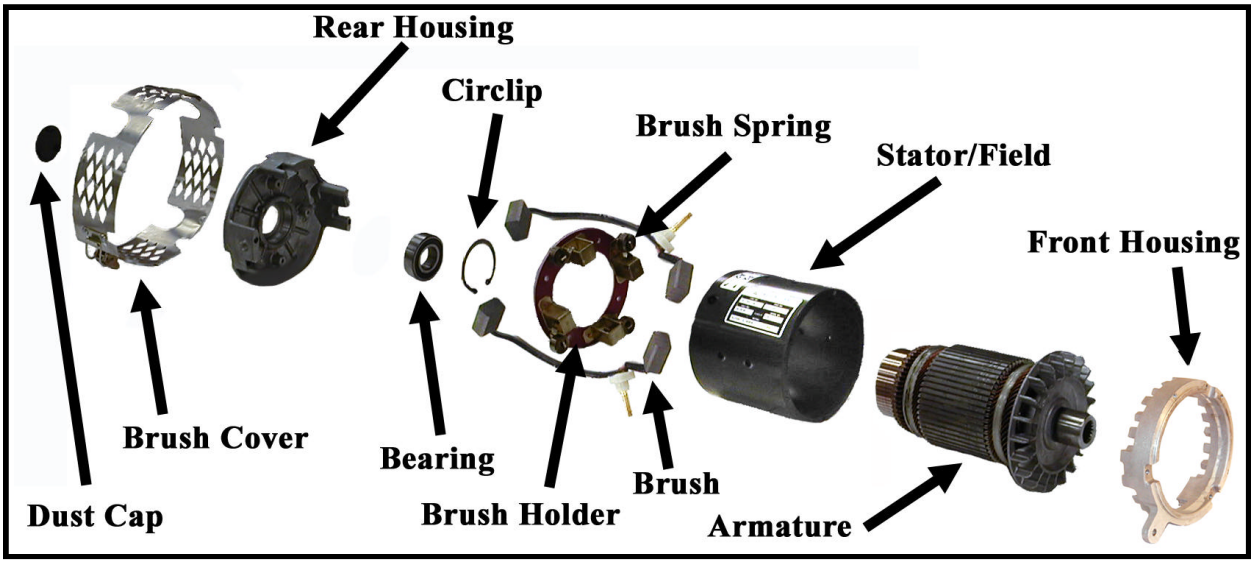
Typical burn mark on a shorted armature

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 of 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

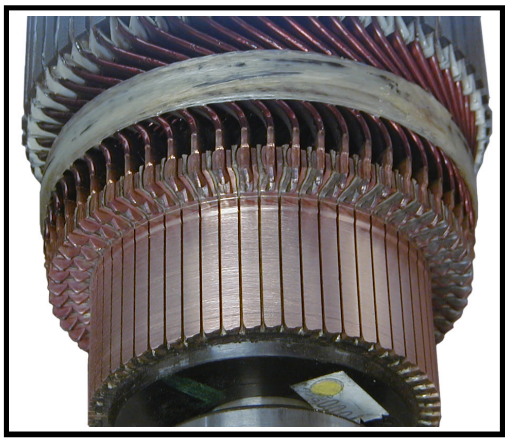
NOTE: It is recommended that all four brushes be replaced as a set.

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.*

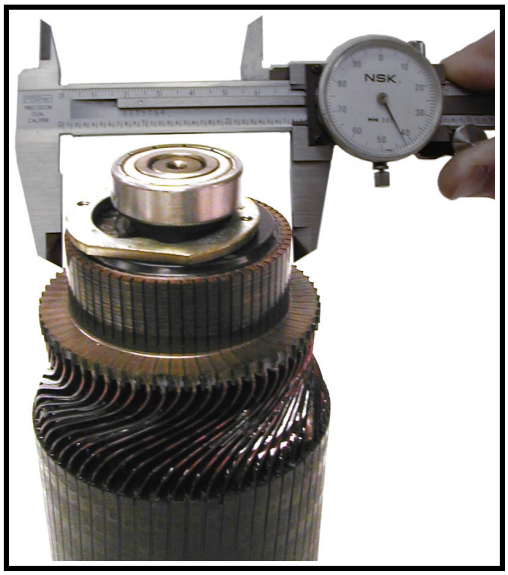
REPAIRING THE COMMUTATOR

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.

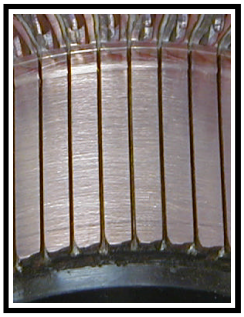


Example of freshly cut commutator

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.



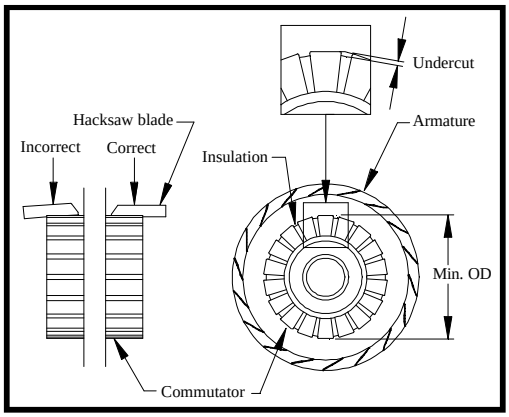
5. Thoroughly clean all copper debris from between the commutator segments.
6. Measure the commutator undercut depth in 5-places around the commutator. If any one of the measurements is less than the minimum undercut depth specified in ***Service Limits***, then the commutator must be undercut.
7. While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



Properly undercut and cleaned commutator segments

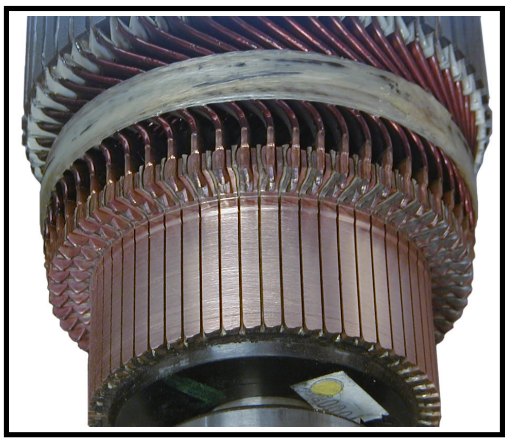
Undercutting the commutator

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

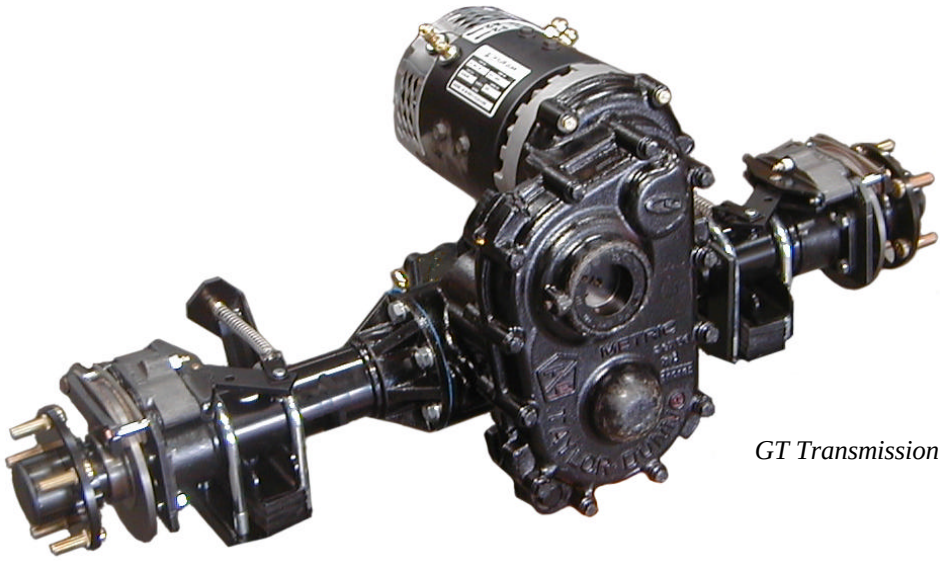
SERVICE LIMITS

Motor Specification Number	Undercut Depth		Commutator Diameter (min)		Brush Length (min)		Resistance (Ohms@75° F)	
	mm	inches	mm	inches	mm	inches	Armature	Field
70-057-40 (DV1-4003)	0.635	0.025	69.85	2.75	15.87	0.625	0.008	0.58

TAYLOR - DUNN

Transmission

TABLE OF CONTENTS



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 ON-OFF switch is in the "OFF" position.

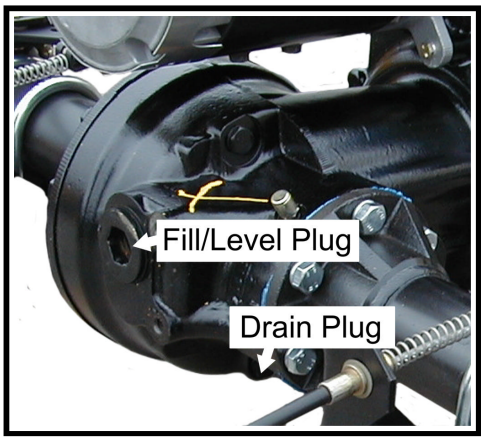
2. Place the forward-reverse switch in the center "OFF" position.

3. Set the park brake.

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

5. Unplug the main battery connector.

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 battery connector.
11. Remove the blocks from the wheels.
12. Release the park brake and test drive the vehicle.

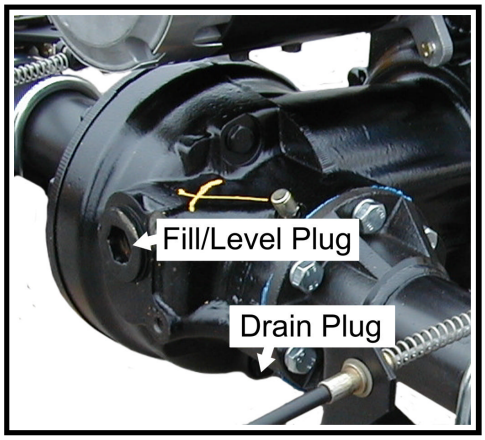


CHANGE OIL

⚠WARNING

1. Make sure the ON-OFF switch is in the "OFF" position.
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. Unplug the main battery connector.

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 battery connector.
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 ON-OFF switch is in the "OFF" position.

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.

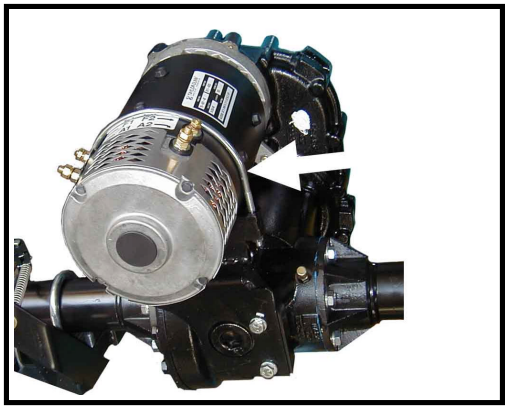
5. Unplug the main battery connector.

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 grease to the splines on the transmission input shaft only.



Support bracket u-bolt

10. Reconnect the main battery connector.
11. Remove the blocks from behind the wheels.
12. Release the park brake and test drive the vehicle.

REAR HUB OR ROTOR

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

⚠WARNING

1. Make sure the ON-OFF switch is in the "OFF" position.
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. Unplug the main battery connector.

6. Raise the wheel off of the ground.

⚠WARNING

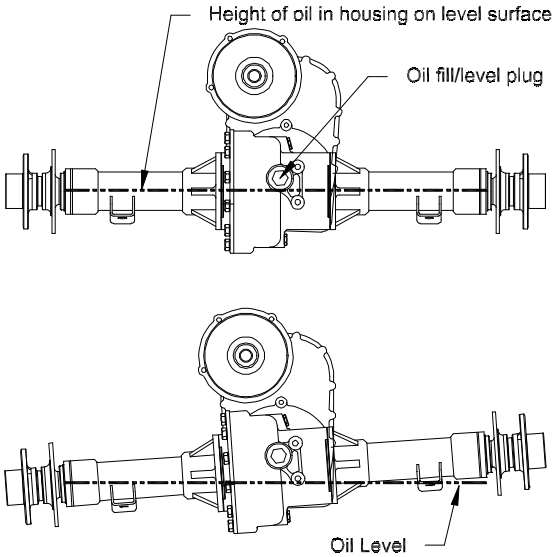
Always use a lifting strap, hoist, and jack stands, of adequate capacity to lift and support the vehicle. Failure to use lifting and support devices of rated load capacity may result in severe bodily injury.

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 battery connector.
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.



Raise the wheel off of the ground high enough so that the oil level is below the axle housing flange

⚠WARNING

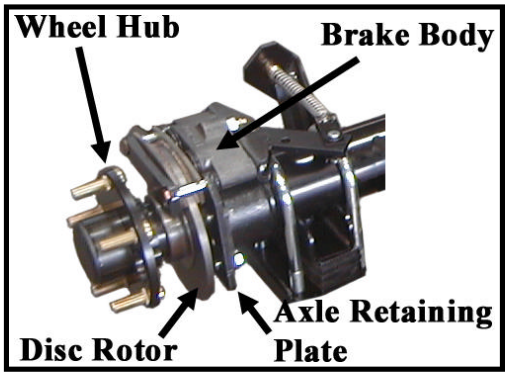
1. Make sure the ON-OFF switch is in the "OFF" position.
2. Place the forward-reverse switch in the center "OFF" position.
3. Set the park brake.
4. Place blocks under the rear wheels to prevent vehicle movement.
5. Unplug the main battery connector.

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 battery connector.
21. Remove the blocks from behind the wheels.
22. Release the park brake and test drive the vehicle.

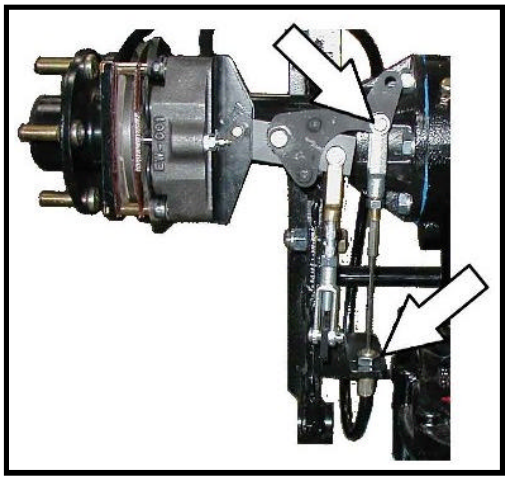
TRANSMISSION ASSEMBLY

Remove and Install

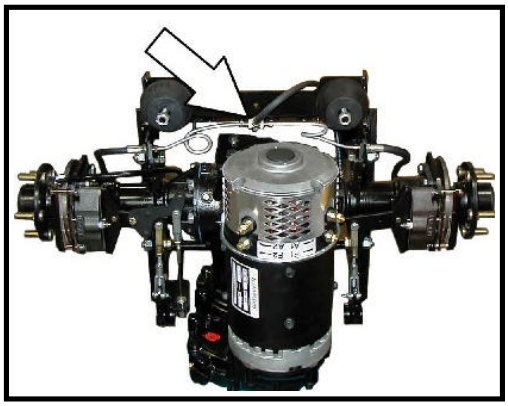
⚠WARNING

1. Make sure the ON-OFF switch is in the "OFF" position.
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. Unplug the main battery connector.

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



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



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

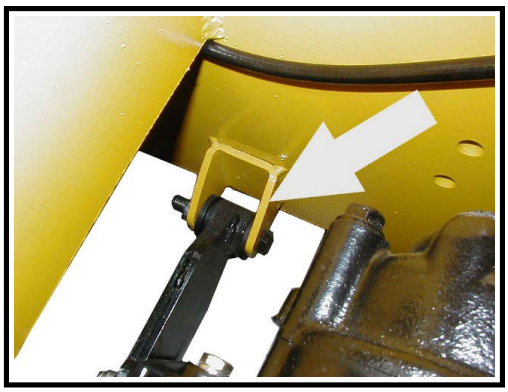
10. Raise the rear of the vehicle and support with jack stands.

    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 battery connector.
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 ON-OFF switch is in the "OFF" position.
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. Unplug the main battery connector.

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

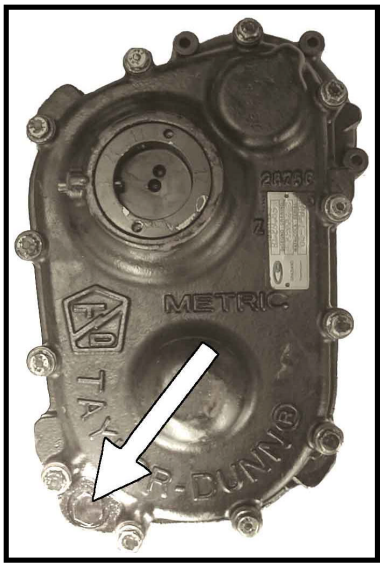
⚠WARNING

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.*

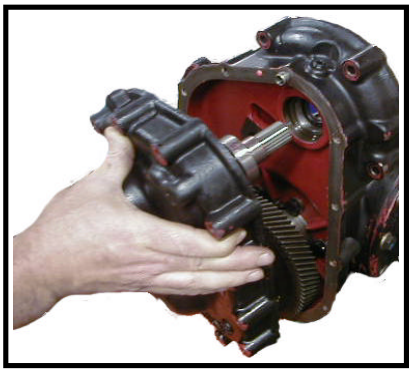


Oil Drain Plug

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 battery connector.
23. Remove the blocks from behind the wheels.
24. Test drive the vehicle.

DISASSEMBLING THE 3RD MEMBER

⚠WARNING

1. Make sure the ON-OFF switch is in the "OFF" position.
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. Unplug the main battery connector.

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

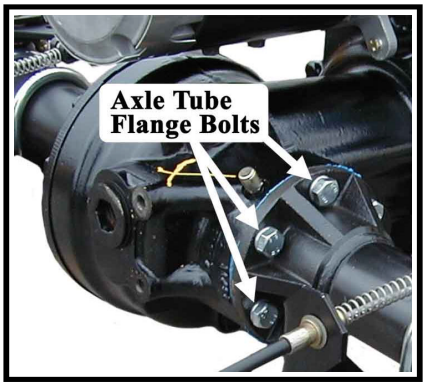
⚠WARNING

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.

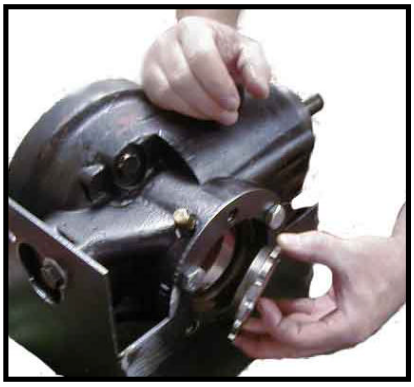
13. Remove the carrier bearing adjusting nut roll pin and adjusting nut from the side plate.

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



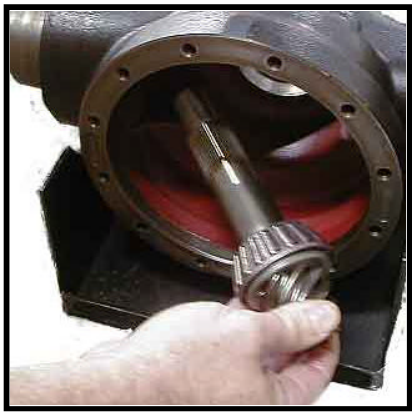
17. Remove the carrier bearing race from the 3rd member housing.

18. Remove the front bearing from the input shaft.

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

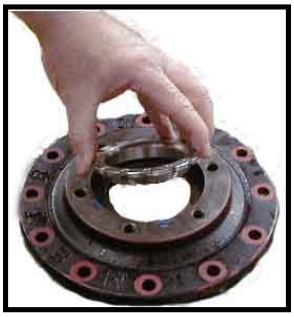
19. Remove the input shaft's shims and spacer.

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.

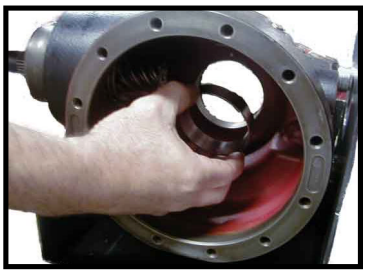


Cover

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.

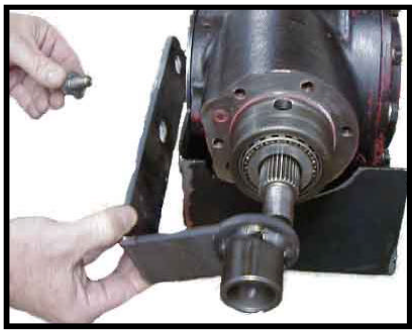
   NOTE: Rotate the carrier assembly whenever adjusting the ring nuts.

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.

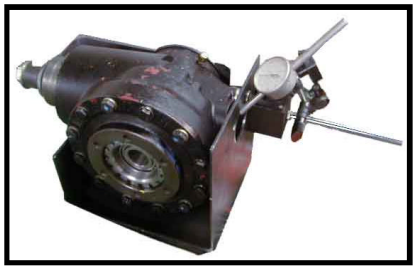
⚠CAUTION

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 <u>housing</u> carrier bearing race ring nuts and tighten the <u>cover</u> carrier bearing race ring nut equally.

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

⚠CAUTION

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

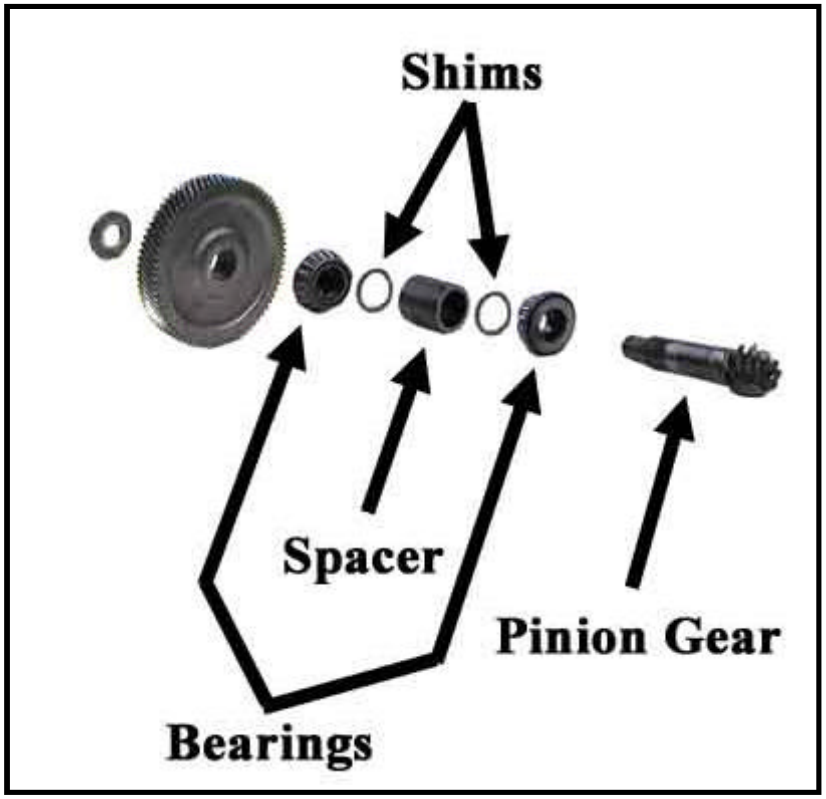
17. Install the locking roll pins into the housing and cover to lock the ring nuts in place.
18. Remove the pinion gear holding tool.
19. Install the primary reduction gear case, axles and housings, motor, and install the complete drive onto the vehicle.
20. Fill the drive with oil. Refer to the ***Lube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

Pinion Bearing Preload

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

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

   NOTE: Add shims to decrease torque.



PINION GEAR SHIMMING INSTRUCTIONS

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

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

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.

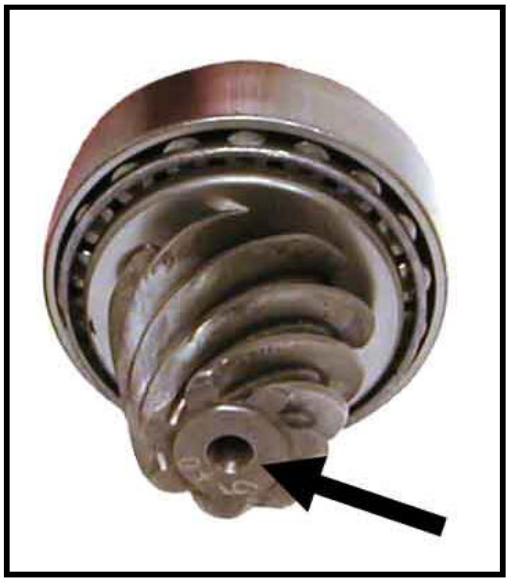
A = The distance in millimeters from the face of the pinion gear to the top of the inner pinion bearing race (see below)

B = 54.

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

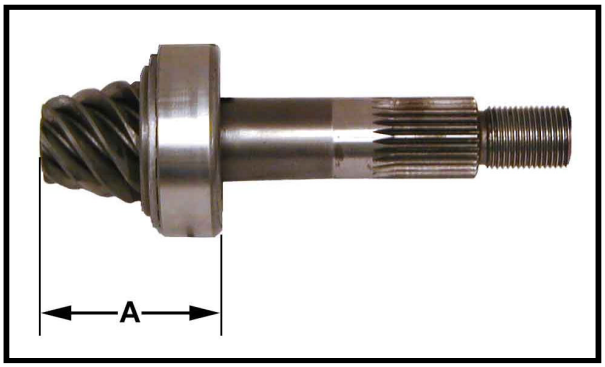
D = The number on the edge of the differential side plate farthest from the input shaft (see next page).

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

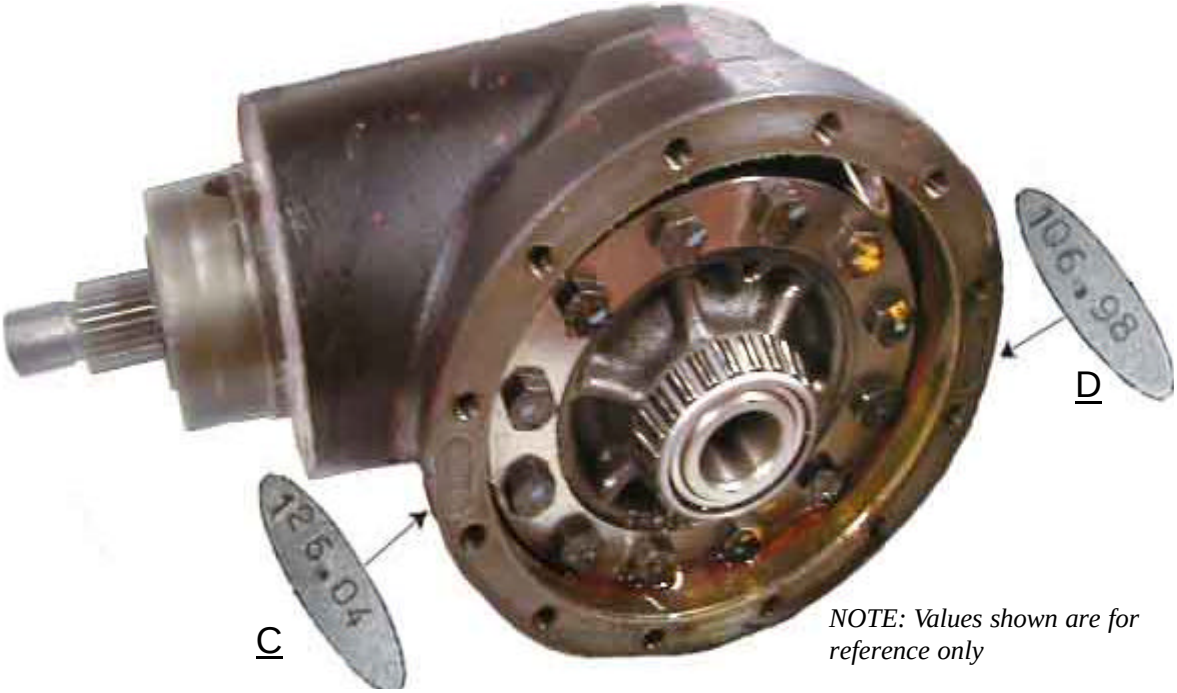


Face of pinion gear

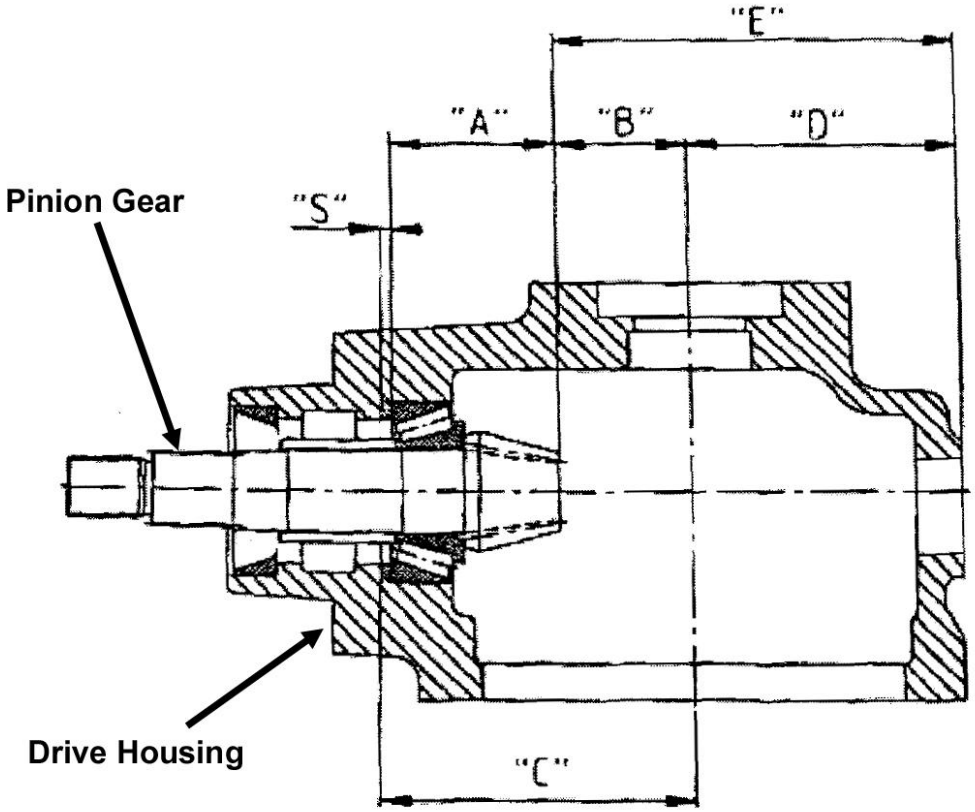
Once a shim has been selected and the pinion gear is installed, confirm that: **E - D = B + (DV)**



Number on face of pinion gear



NOTE: Values shown are for reference only



TAYLOR - DUNN

Suspension

TABLE OF CONTENTS

REPLACE THE REAR SPRINGS

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

⚠WARNING

1. Make sure the ON-OFF switch is in the "OFF" position.
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. Unplug the main battery connector.

6. Remove the upper shock mounting bolt from the rear shocks.
7. Raise the rear wheels off of the ground just enough so that the springs 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 the springs.
9. Install new springs in reverse order.
10. Reconnect the main battery connector.
11. Remove the blocks from behind the wheels.
12. Release the parking brake and test drive the vehicle.

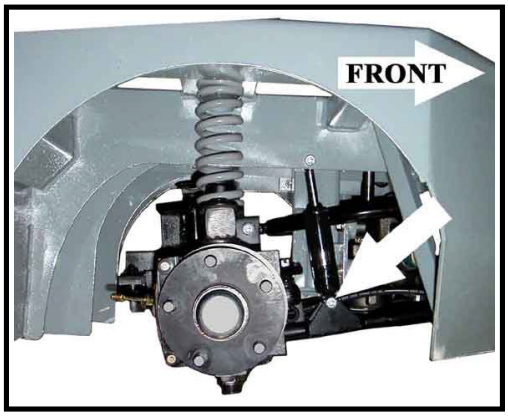
REPLACE THE FRONT SPRINGS

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

⚠WARNING

1. Make sure the ON-OFF switch is in the "OFF" position.
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. Unplug the battery connector.

6. Remove the lower shock mounting bolt from the front shocks.



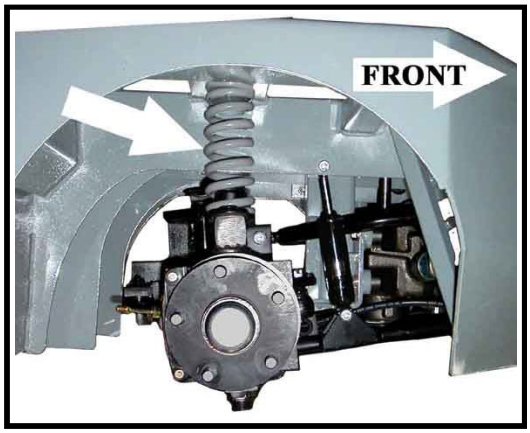
Lower shock bolt. Wheel removed for illustration only.

7. Raise the front wheels off of the ground just enough so that the springs 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 the springs.
9. Install new springs in reverse order.
10. Reconnect the main battery connector.
11. Remove the blocks from behind the wheels.
12. Release the parking brake and test drive the vehicle



Front spring

REPLACE THE SHOCKS

Front or Rear

It is recommended to replace all four front shock as a set.

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

⚠WARNING

1. Make sure the ON-OFF switch is in the "OFF" position.
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. Unplug the main battery connector.

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

⚠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

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

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

A. Inspect the shaft where it enters the shock body for any signs of leakage. If any sign of leakage is seen, then the shock must be replaced.

B. Inspect the upper and lower shock bushings. If any signs of damage or wear are seen, then the shock must be replaced.

9. Install the shock in reverse order.
10. Lower the vehicle.
11. Reconnect the main battery connector.
12. Remove the blocks from behind the wheels.
13. Release the parking brake and test drive the vehicle.

Tires and Wheels

TABLE OF CONTENTS

TIRE INSPECTION (SOFT SOLID TIRES)

⚠WARNING

1. Make sure the ON-OFF-switch is in the "OFF" position.

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. Unplug the main battery connector.

6. Inspect the tread depth.
7. Tires are worn and should be replaced when the tread depth is 1/16" (1.5 mm) or less.
8. Reconnect the main battery connector.
9. Remove the blocks from behind the wheels.
10. Release the parking brake and test drive the vehicle.

REPLACE THE TIRE

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.*

Replacing the Soft Solid tire may require a press to remove or install the tire.

1. Remove the bolts around the perimiter of the wheel.
2. Separtate the two halves of the split rim from the tire.
3. Install in reverse order.

REPLACE THE REAR TIRE/ WHEEL

⚠WARNING

1. Make sure the ON-OFF-switch is in the "OFF" position.

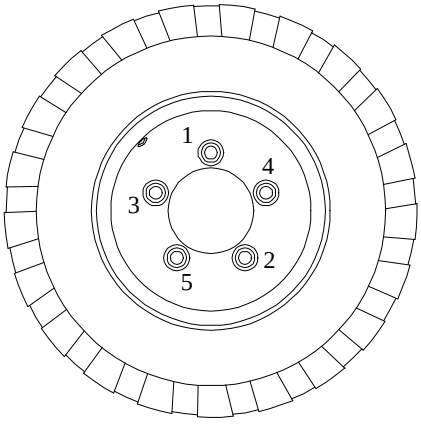
2. Place the forward-reverse switch in the center "OFF" position.

3. Set the park brake.

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

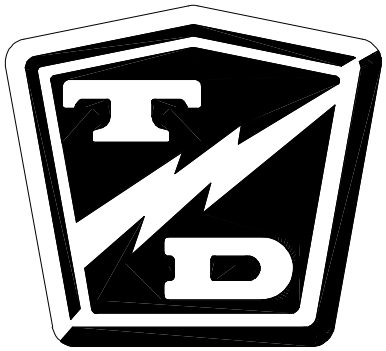
5. Unplug the main battery connector.

6. Raise the wheel to be replaced off of the ground and support with jack stands.
7. Remove the 5 wheel nuts and remove the wheel.
8. Install in reverse order.
9. Following the pattern shown below, cross tighten the wheel nuts in two stages as follows:
   1st stage to approximately 20 ft-lbs.
   2nd stage to 80-90 ft-lbs.
10. Reconnect the main battery connector.
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.



Battery Service

TABLE OF CONTENTS



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 ON-OFF switch is in the "OFF" position.

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. Unplug the main battery connector.

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

TESTING

Specific Gravity

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

⚠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.

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⚠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 ON-OFF switch is in the "OFF" position.

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. Unplug the main battery connector.

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

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

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

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

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

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.

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 battery at the end of a charging cycle. If the electrolyte is below the top of the battery plates then fill just enough to cover the plates and then top off when the charging cycle is complete.

⚠WARNING

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

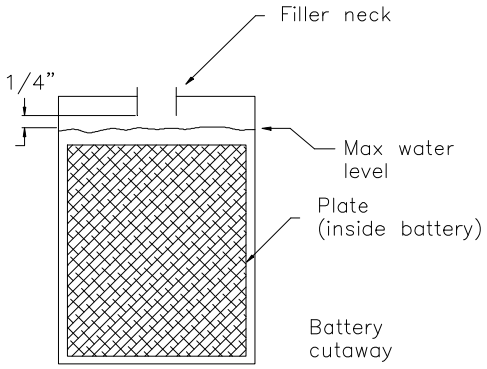
1. Make sure the ON-OFF switch is in the "OFF" position.
2. Place the forward-reverse switch in the center "OFF" position.
3. Set the park brake.
4. Place blocks under the rear wheels to prevent vehicle movement.
5. Unplug the main battery connector.

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

⚠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.

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 main battery connector.



CHARGING

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

REMOVING

⚠WARNING

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

⚠WARNING

1. Make sure the ON-OFF switch is in the "OFF" position.

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. Unplug the main battery connector.

⚠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.

6. Thoroughly clean the battery and battery compartment. Refer to ***Cleaning*** in this section for information regarding cleaning the batteries.
7. Using a hoist or forklift equipped with a proper battery lifting device (see next page), slowly raise the battery out of the vehicle.
8. Inspect the battery compartment for signs of corrosion.
9. If minimal signs of corrosion are seen, then the damaged paint should be stripped off and the entire battery compartment cleaned and repainted.

10. If there are excessive signs of corrosion, then it may be necessary to replace some of the frame members or completely rebuild the battery compartment.
11. Inspect the battery cables and terminals. If any of the cables or terminals show signs of corrosion, then they must be repaired or replaced.
12. Install the battery in reverse order.
13. Remove the blocks from the wheels and test drive.

Typical battery lifting beam

Typical forklift attachment to use with the lifting beam

STORAGE AND RETURNING TO SERVICE

⚠CAUTION

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

Storage

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

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

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

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

Storage Temperature (ºF)	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 severe bodily injury and/or property damage.

⚠WARNING

1. Make sure the ON-OFF switch is in the "OFF" position.

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. Unplug the main battery connector.

⚠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.

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

Sevcon Control System Troubleshooting

TABLE OF CONTENTS

⚠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.
- Test harness, Taylor-Dunn #75-089-00

Important Notes and Instructions

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

Definitions:

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

Terminology used:

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

DURING ALL TESTS

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

⚠CAUTION **Turn the ON-OFF switch OFF BEFORE disconnecting the batteries. Disconnecting the batteries with the ON-OFFswitch ON may corrupt the controller programming resulting in a fault code 1 (see fault table).**

⚠WARNING **Turn the ON-OFF switch OFF then disconnect the battery during any maintenance or before disconnecting any electrical component or wire. Failure to do so may cause severe bodily injury and/or property damage.**

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

START TROUBLESHOOTING HERE

⚠CAUTION

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

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

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

Do not continue unless the indicator shows a charged battery.

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

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

Test 1. CHECKING THE CONTROL LOGIC INPUTS

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

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

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

Perform the following tests:

TEST 1.1

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

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

TEST 1.2:

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

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

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

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

⚠CAUTION

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

⚠WARNING

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

TEST 1.3:

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

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

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

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

TEST 1.4:

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

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

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

If all of the above is in working order, then the logic card may have failed.

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

STOP

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

TEST 1.5:

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

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

TEST 1.6:

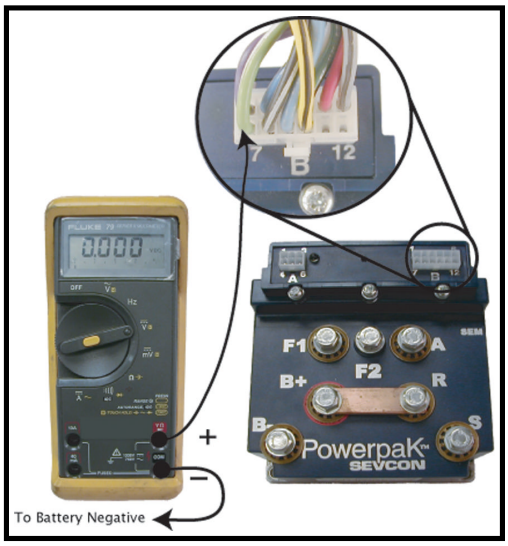
Test the voltage at pin #7 on the 12-pin logic card connector.

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

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

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

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



⚠CAUTION

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

⚠WARNING

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

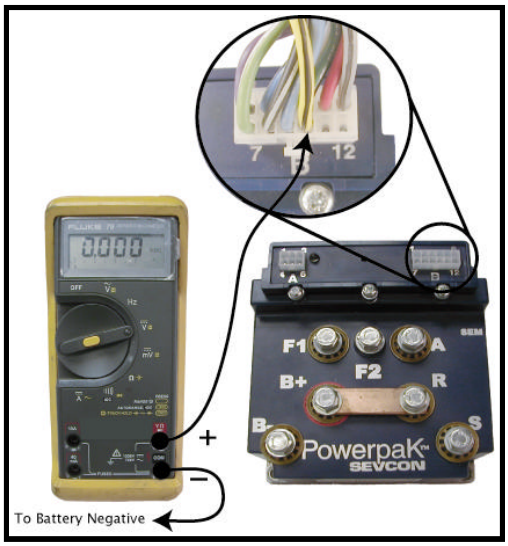
TEST 1.7:

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

Perform the following tests:

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

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



TEST 1.8:

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

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

TEST 1.9:

Depress the accelerator pedal fully.

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

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

Test 2. TESTING THE MOTOR

⚠WARNING

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

⚠WARNING

Unplug the main battery connector during any maintenance or before disconnecting any electrical component or wire. Failure to do so may cause property damage and/or serious bodily injury.

TEST 2.1:

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

If the resistance is within the values given in the motor specification table, then skip ahead to test #2.2. (The motor specification can be found in Section 3 under "Motor Repair").
If the resistance is not within specification, then repair or replace the motor.

Test continuity from F1 to the frame of the motor.

Any reading other than an open circuit indicates a short in the motor.
Stop trouble shooting here and repair the problem. When the repair is completed, completely retest the vehicle before lowering the drive wheels to the ground.

TEST 2.2:

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

If the resistance is less than 1 Ohm, then go to test #2.3.
If the resistance is greater than 1 Ohm , then the armature circuit is out of specification.
Stop trouble shooting here and repair the problem. When the repair is completed, completely retest the vehicle before lowering the drive wheels to the ground.

TEST 2.3:

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

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

TEST 2.4:

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

Repair any open wires then test drive the vehicle.

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

⚠WARNING

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

⚠CAUTION

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

Test 3. THE VEHICLE RUNS IN ONE DIRECTION ONLY

Test 3.1:

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

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

Place the forward and reverse switch in the FORWARD direction.

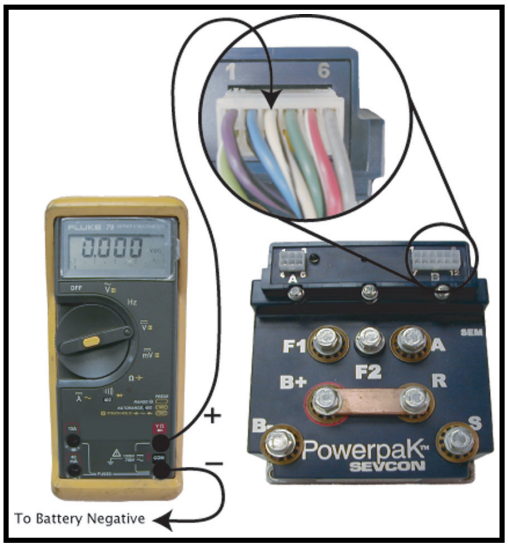
Test the voltage at pin #2 on the 12 pin logic card connector.

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

TEST 3.2:

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

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



⚠CAUTION

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

TEST 3.3:

Place the forward and reverse switch in the REVERSE direction.

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

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

TEST 3.4:

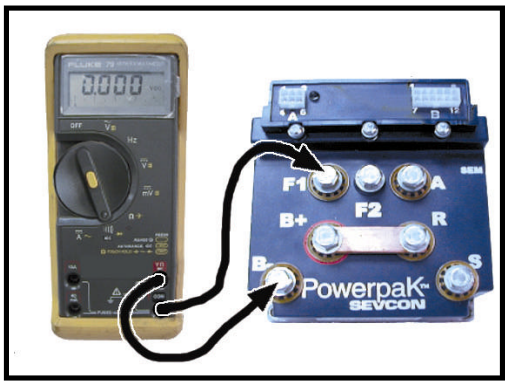
Test the voltage at pin #2 on the 12 pin logic card connector.

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

TEST 3.5

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

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



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

TEST 3.6

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

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

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

⚠CAUTION

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

STOP

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

⚠WARNING

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

Test 4. KEY FAULT

TEST 4.1:

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

Perform the following tests:

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

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

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

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

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

Circuit Breaker

TEST 4.2:

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

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

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

⚠WARNING

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

TEST 4.3:

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

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

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

TEST 4.4:

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

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

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

STOP

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

⚠WARNING

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

⚠CAUTION

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

Test 5. CONTACTOR COIL FAULT

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

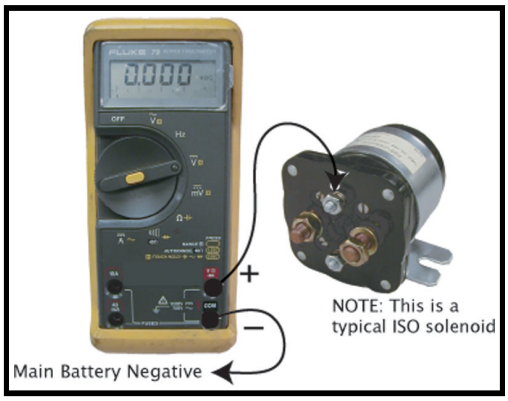
Turn the key switch ON and perform the following tests:

TEST 5.1:

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

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

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

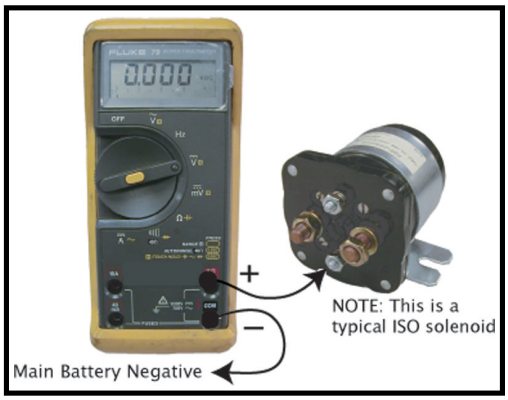


TEST 5.2:

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

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

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



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

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

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

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

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

B+ Terminal on the Sevcon controller

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

⚠WARNING

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

⚠CAUTION

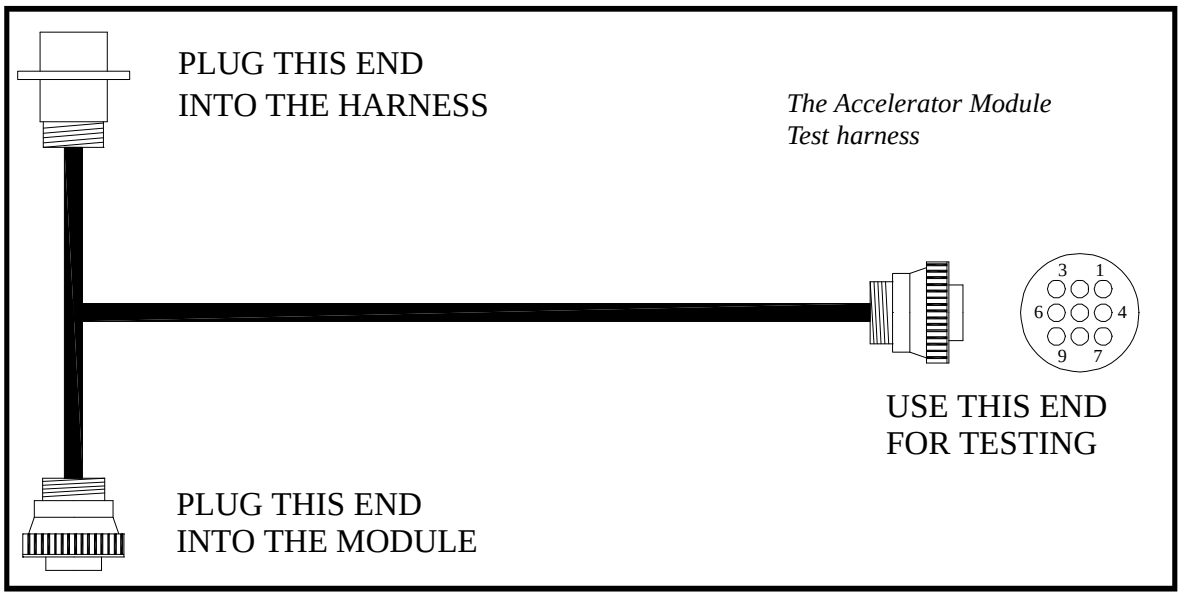
This troubleshooting guide is written in sequential order. All tests must be performed in the order that they are written. Starting in the middle or skipping sections when not instructed to do so may lead to invalid test results.

Test 6. ACCELERATOR MODULE FAULT

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

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

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



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

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

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

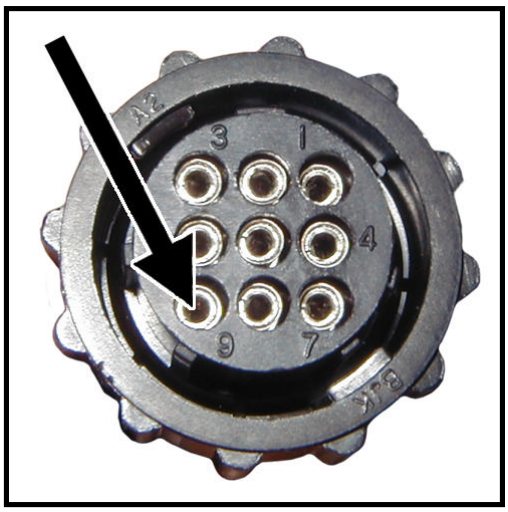
TEST 6.1:

Accelerator pedal released.

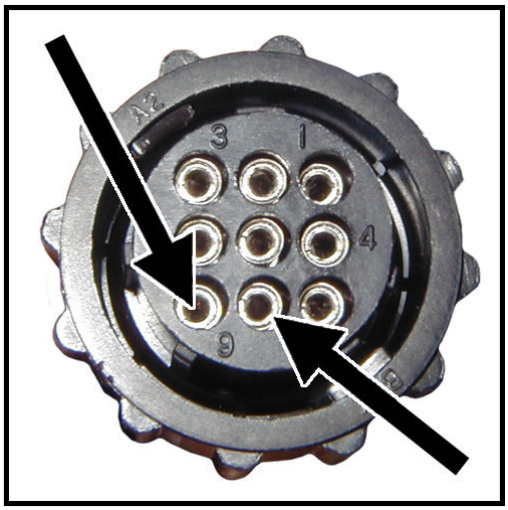
Test the voltage from pin #9 to battery positive.

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

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



TEST 6.2:



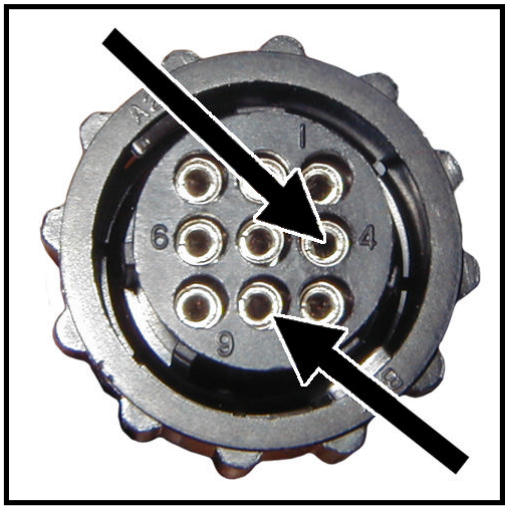
Accelerator pedal released.

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

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

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

TEST 6.3:



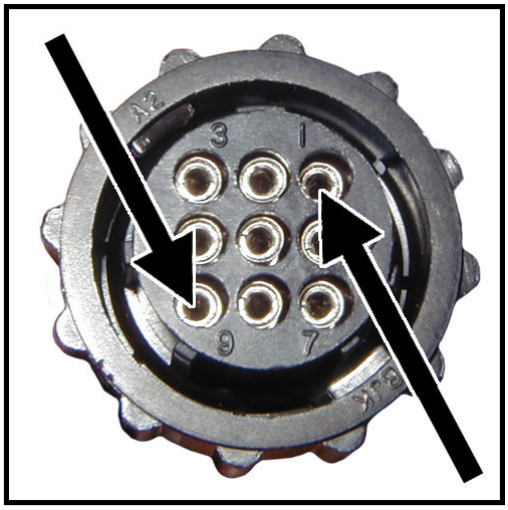
Accelerator pedal released.

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

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

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

TEST 6.4:



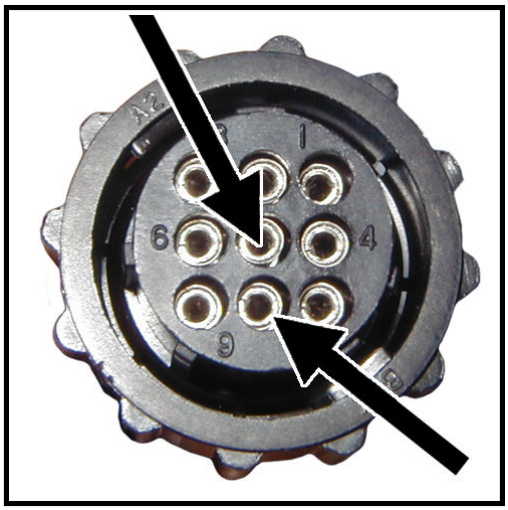
Accelerator pedal released.

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

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

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

TEST 6.5a:



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

Accelerator pedal released.

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

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

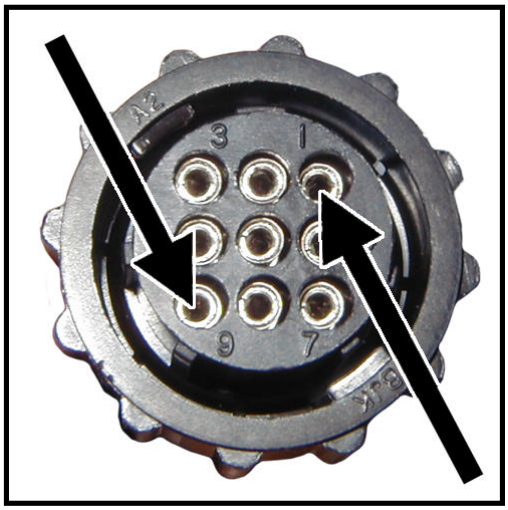
TEST 6.5b:

Accelerator pedal depressed.

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

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

TEST 6.6:



Accelerator pedal depressed.

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

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

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

TEST 6.7:

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

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

Test 7. FORWARD AND REVERSE SWITCH FAULT

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

TEST 7.1:

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

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

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

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

TEST 7.2:

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

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

If the voltage equals battery volts, skip ahead to test #7.4.
If the voltage does not equal battery volts, then the F&R switch has failed.

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

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

TEST 7.3:

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

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

If the voltage equals battery volts, skip ahead to test #7.4.
If the voltage does not equal battery volts, then the F&R switch has failed.

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

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

TEST 7.4:

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

STOP

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

⚠CAUTION

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

Test 8. ANTI-ROLLOFF FAULT

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

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

To test the Anti-rolloff feature:

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

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

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

TEST #8.1

Read the motor field current on the Ammeter.

If the field current is greater than specified in the Motor Specification table (see Drive Motor 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.

Sevcon Logic Voltage Reference Table

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

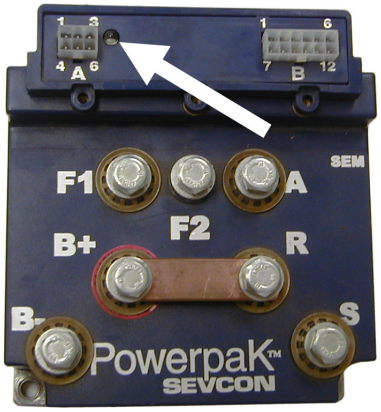
* - All voltages made referencing main negative unless specified otherwise

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

Status LED Code Table

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

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



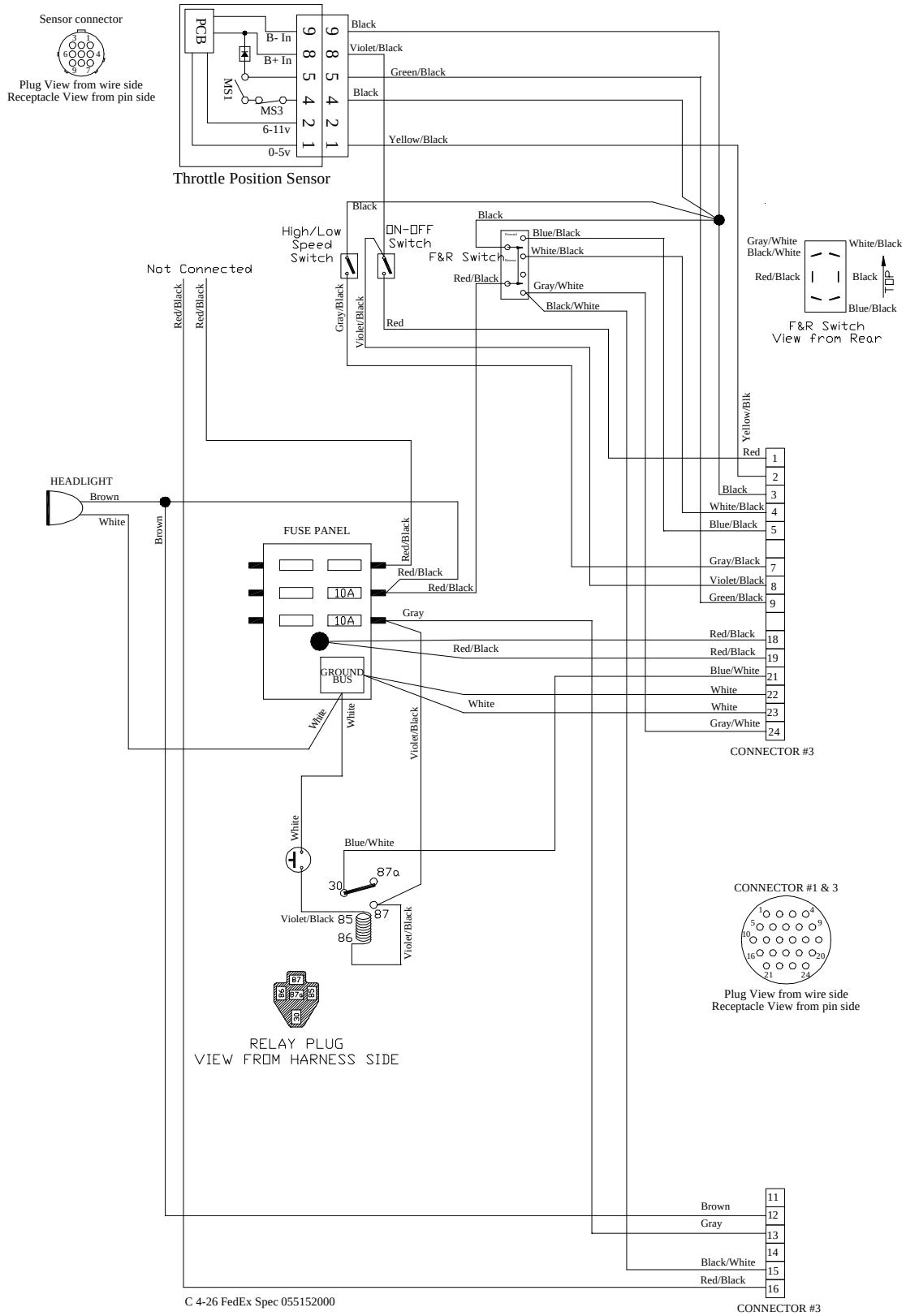
LED Status Light

Wire Diagrams

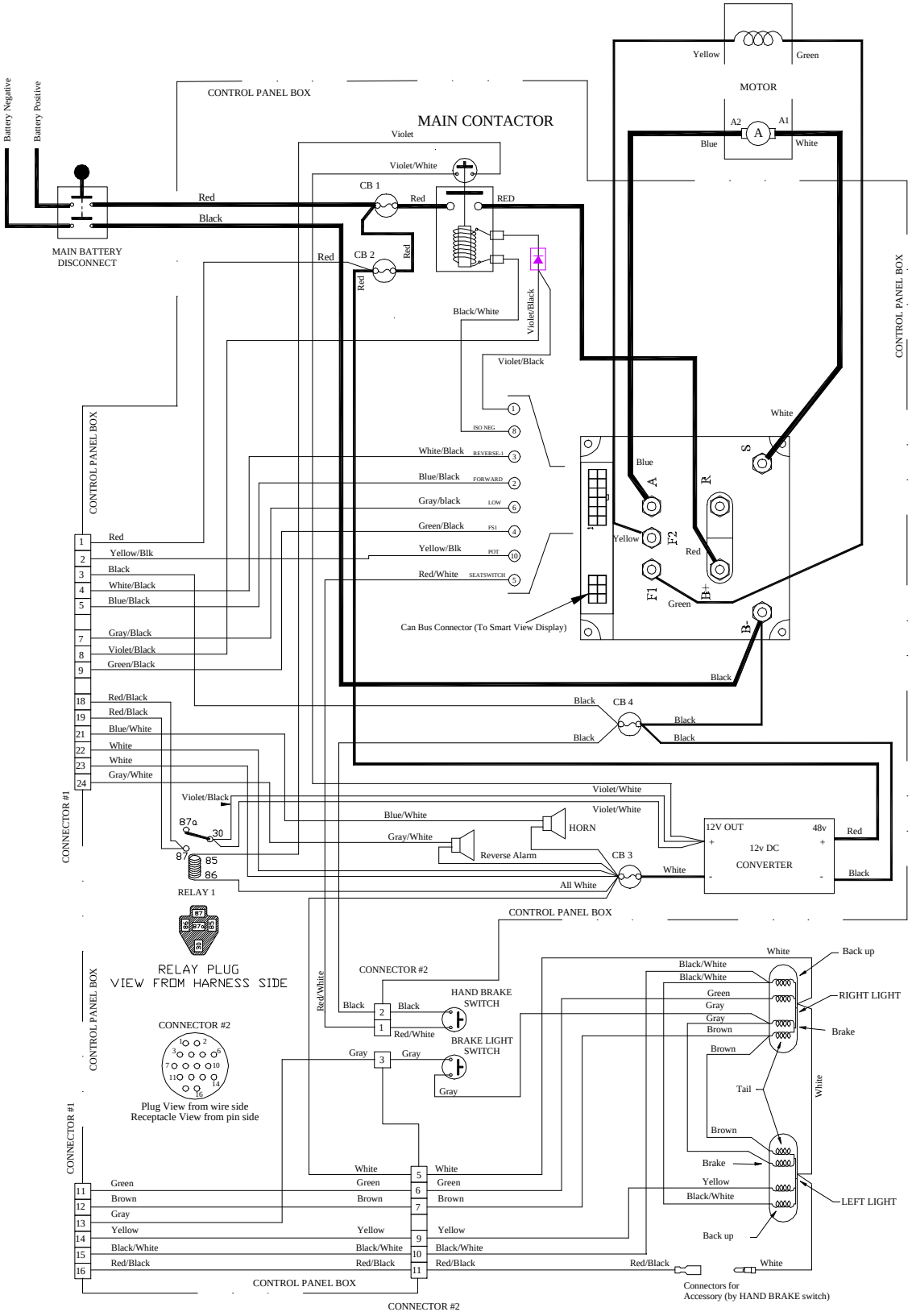
TABLE OF CONTENTS

Refer to the Vehicle Documentation CD for a full size color illustration of the wire diagram.

DASH


Sensor connector
Plug View from wire side
Receptacle View from pin side
PCB
B- In
B+ In
MS1
MS3
6-11v
0-5v
9 8 5 4 2 1
Throttle Position Sensor
Black
Violet/Black
Green/Black
Yellow/Black
High/Low Speed Switch
ON-OFF Switch
F&R Switch
Not Connected
Red/Black
Gray/Black
Violet/Black
Red
Blue/Black
White/Black
Gray/White
Black/White
Gray/White
Black/White
Red/Black
Black
Blue/Black
TOP
F&R Switch
View from Rear
Yellow/Blk
HEADLIGHT
Brown
White
FUSE PANEL
10A
10A
GROUND BUS
Gray
Blue/White
Violet/Black
Green/Black
Red/Black
Blue/White
White
Gray/White
CONNECTOR #3
30
87a
87
85
86
RELAY PLUG
VIEW FROM HARNESS SIDE
CONNECTOR #1 & 3
Plug View from wire side
Receptacle View from pin side
Brown
Gray
Black/White
Red/Black
CONNECTOR #3
C 4-26 FedEx Spec 055152000

CONTROL PANEL



Charger Troubleshooting

The charger supplied with this vehicle is From EnerSys. The model number of the charger can be found in the ***Specifications*** page in the ***Safety Rules and Operating Instructions*** section.

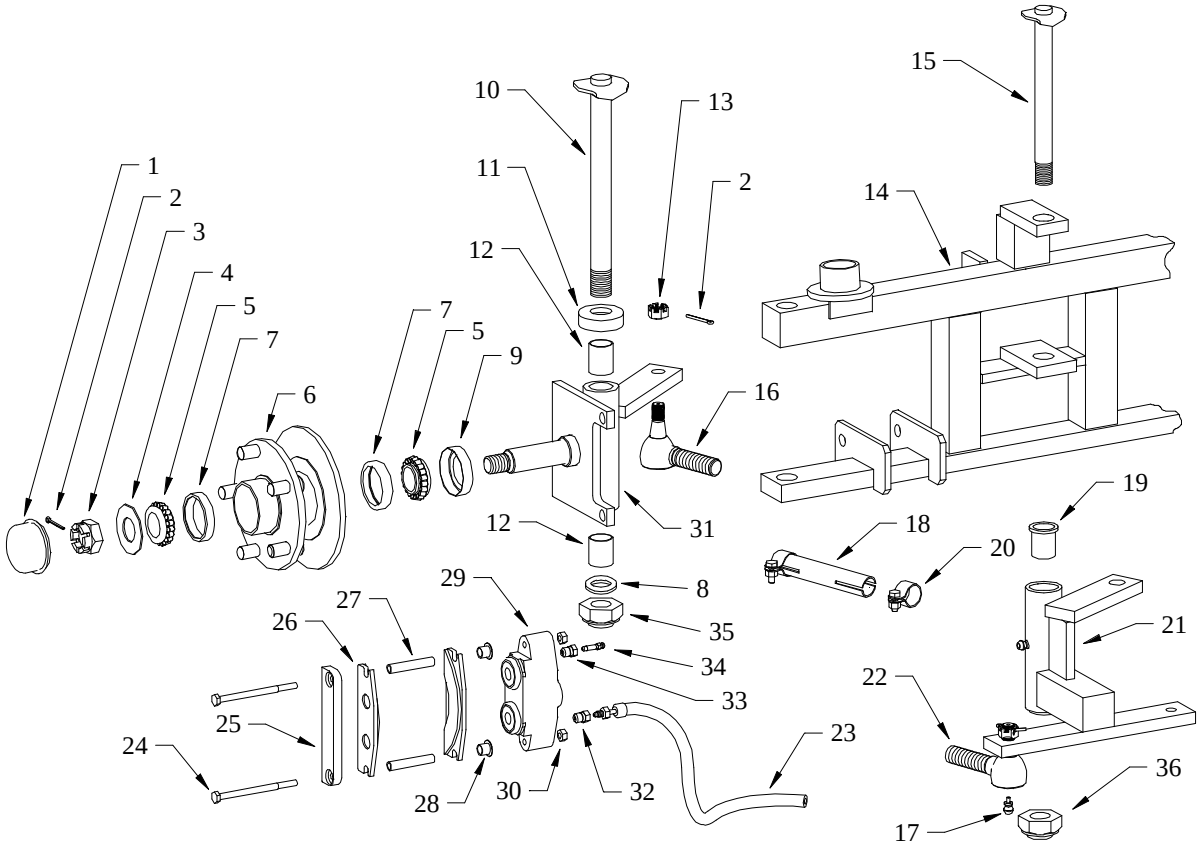
Refer to the documentation supplied with the charger or contact the charger manufacturer for more information.

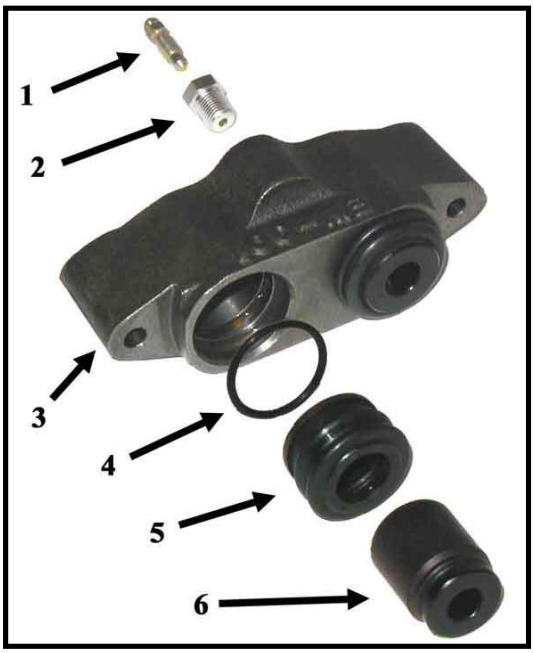
Refer to manufacturers web site for contact information:
http://www.enersysmp.com/

Illustrated Parts

TABLE OF CONTENTS

Front Axle, Steering and Brakes

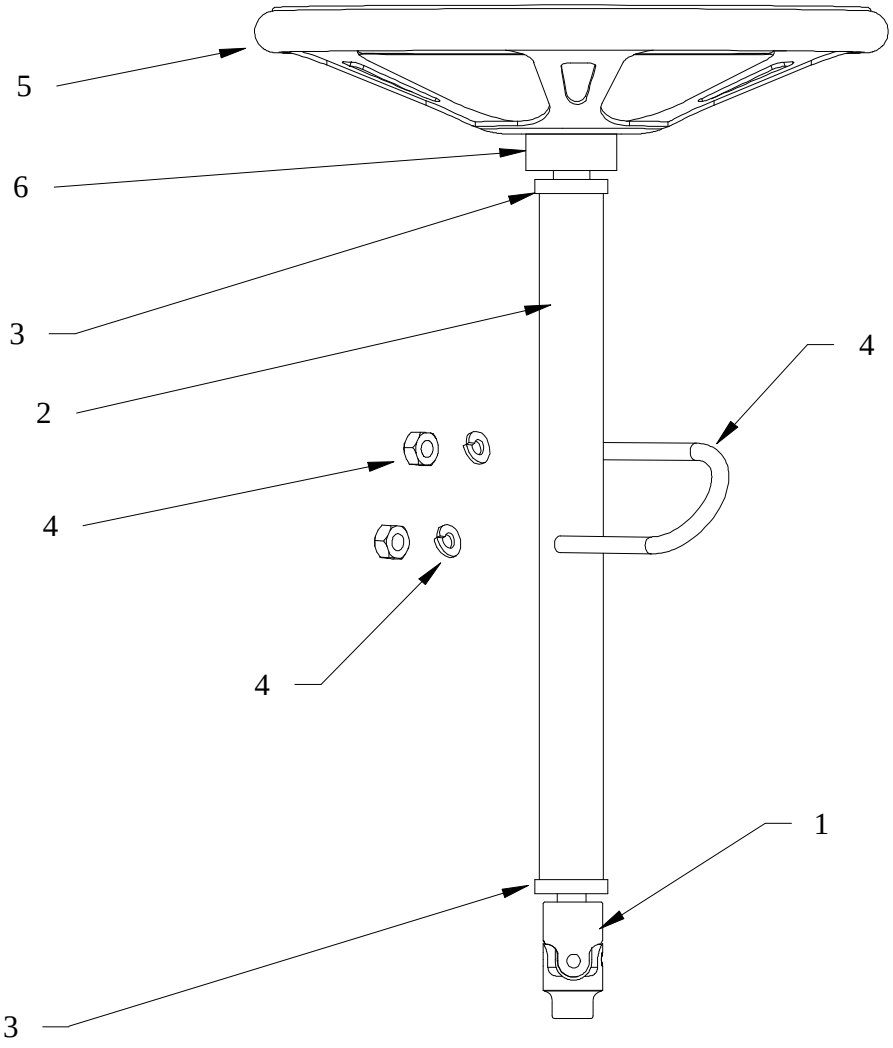


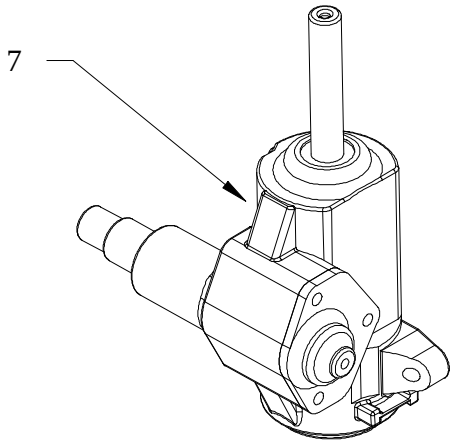


Brake Body			
ITEM #	PART #	DESCRIPTION	QTY
1	99-588-00	Bleeder screw	2
2	99-588-01	Bleeder adapter	2
3	41-350-45	Brake body, left	1
	41-350-45	Brake body, right	1
4	80-713-00	O-ring	4
5	41-350-09	Boot	4
6	41-350-10	Piston	4

Front Axle, Steering and Brakes			
ITEM #	PART #	DESCRIPTION	QTY
1	92-104-01	Bearing cap	2
2	88-527-14	Cotter pin	8
3	88-239-85	3/4 NF Hex slotted nut	2
4	88-228-61	3/4 SAE Flat washer	2
5	80-017-00	Bearing	4
6	12-158-11	Wheel hub	2
7	80-103-00	Race	4
8	88-268-61	7/8 Flat washer	2
9	45-338-00	Grease seal	2
10	21-015-15	King pin	2
11	80-309-00	Thrust bearing	2
12	32-204-10	Bushing	4
13	88-159-85	1/2 NF Hex slotted nut	4
14	15-425-10	Axle beam	1
15	21-015-20	Pivot pin	1
16	86-501-98	Ball joint, left hand thread	3
17	87-074-00	Grease fiting	6
18	18-020-30	Steeing link	2
19	32-200-00	Bushing	2
20	86-510-00	Ball joint clamp	6
21	14-425-07	Steering pivot	1
22	86-501-99	Ball joint, right hand thread	3
23	See Brake Lines	Brake hose	2
24	88-067-21	1/4 x 3-3/4 Hex bolt, grade 8	4
25	41-350-51	Secondary plate	2
26	41-348-70	Brake pad	4
27	41-348-57	Spacer	4
28	32-240-41	Bushing	4
29	41-350-30	Brake body assembly (see previous page for components)	2
30	88-069-82	1/4 NC Hex lock nut, grade 8	4
31	14-425-05	Steering knuckle, left	1
	14-425-06	Steering knuckle, right	1
32	See brake lines	1/8 pipe - 3/16 tube adaptor	2
33	99-588-01	Bleeder adaptor	2
34	99-588-00	Bleeder	2
35, 36	88-289-81	7/8 NF Thin pattern lock nut	2
Not Shown	41-886-00	1/8 pipe plug used on #29	2
Not Shown	18-035-00	Drag link	1

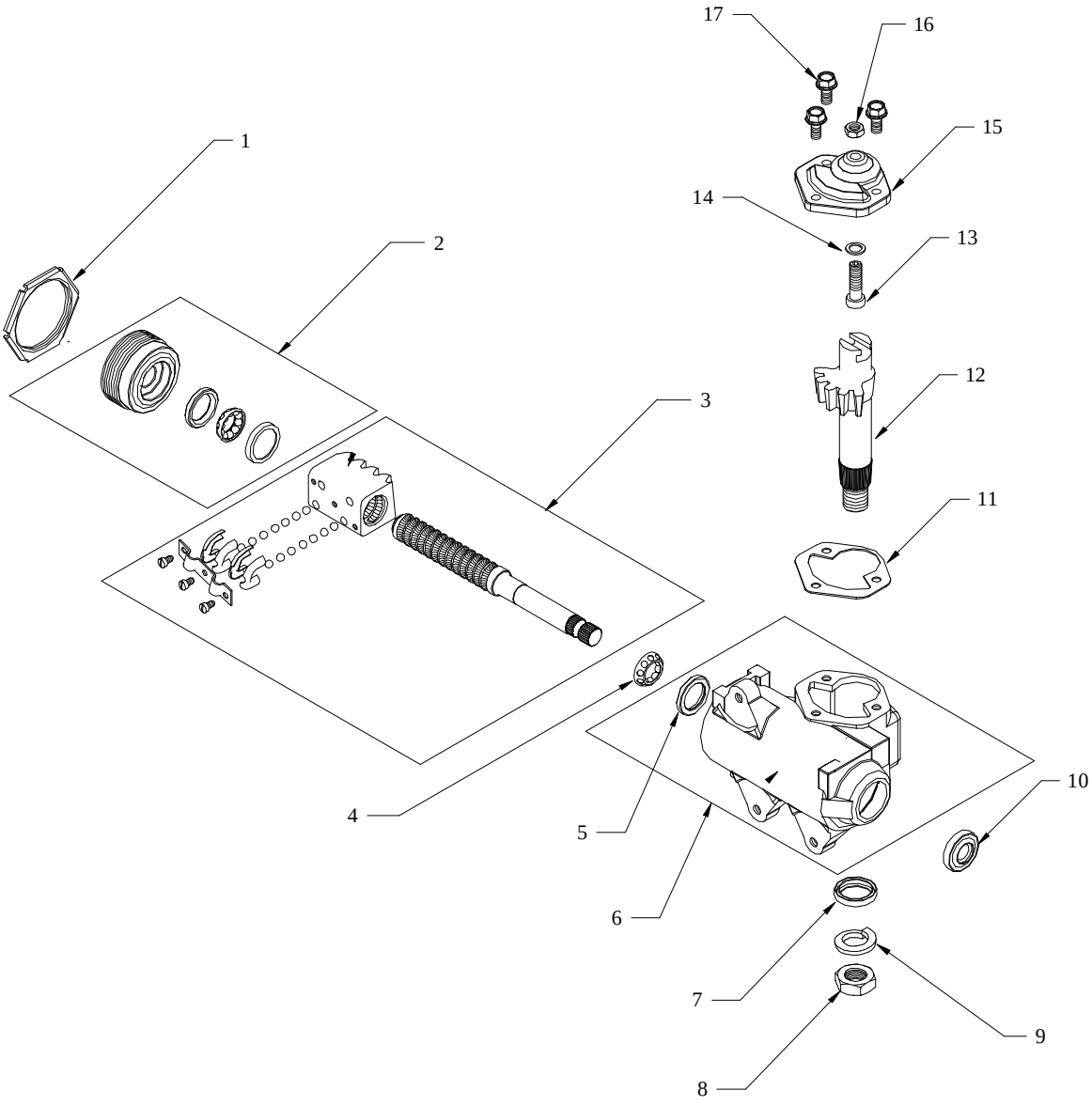
Steering Column and Linkage





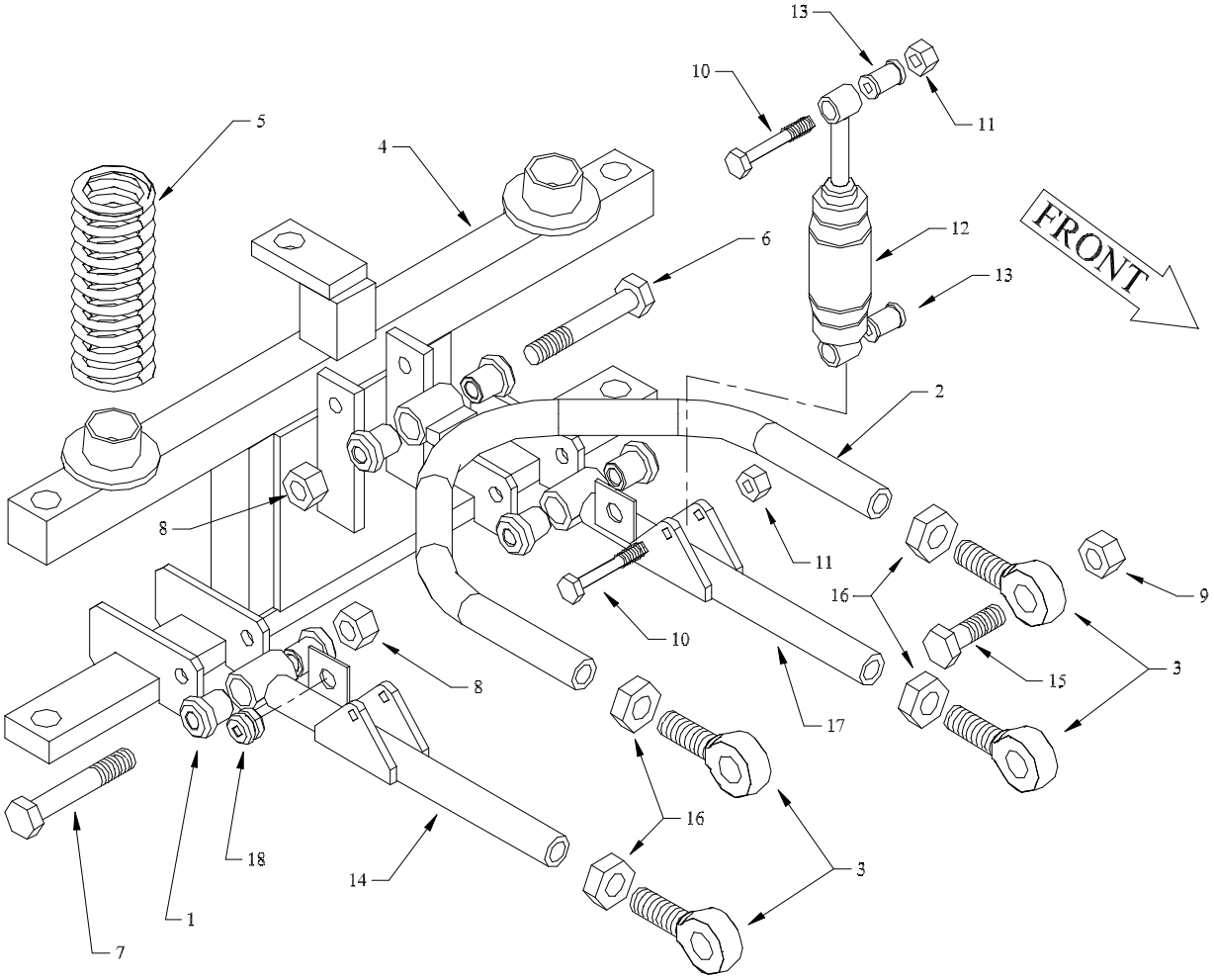
Steering Column			
ITEM #	PART #	DESCRIPTION	QTY
1	18-426-00	Steering shaft	1
2	18-426-05	Steering column tube	1
3	80-400-10	Bearing	2
4	96-123-45	U-bolt (includes nuts)	1
5	19-005-17	Steering wheel	1
6	19-005-00	Adaptor, Steering wheel (includes shaft nut, steering wheel bolts and cap)	1
7	18-308-21	Steering gear	1
Not Shown	18-108-00	Pitman arm	1
	88-120-15	7/16NC x 1-1/2 Hax bolt, grade 5 (steering gear mounting)	3
	88-279-82	7/8NF Thin pattern nut (pitman arm)	1
	88-262-62	7/8 Split lock nut (pitman arm nut)	1

Steering Gear



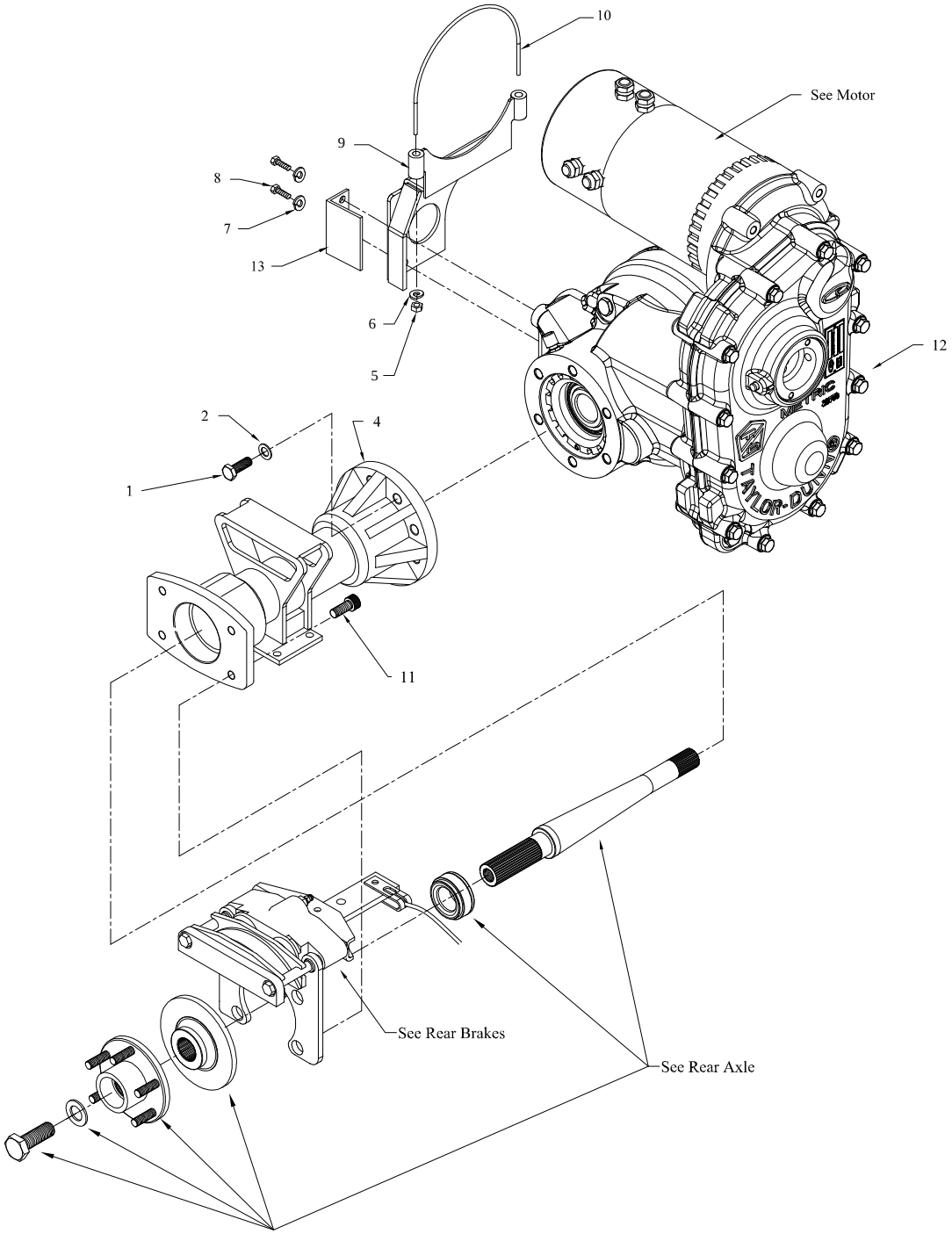
Steering Gear (18-308-21)			
ITEM #	PART #	DESCRIPTION	QTY
1	18-308-70	Locknut	1
2	18-308-71	Adjuster assembly	1
3	18-308-72	Worm assenbly	1
4	18-308-23	Upper worm bearing	1
5	18-308-22	Upper worm bearing race	1
6	18-308-77	Housing	1
7	18-308-78	Seal, pitman shaft	1
8	18-308-80	Nut, pitman shaft	1
9	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

Front Suspension



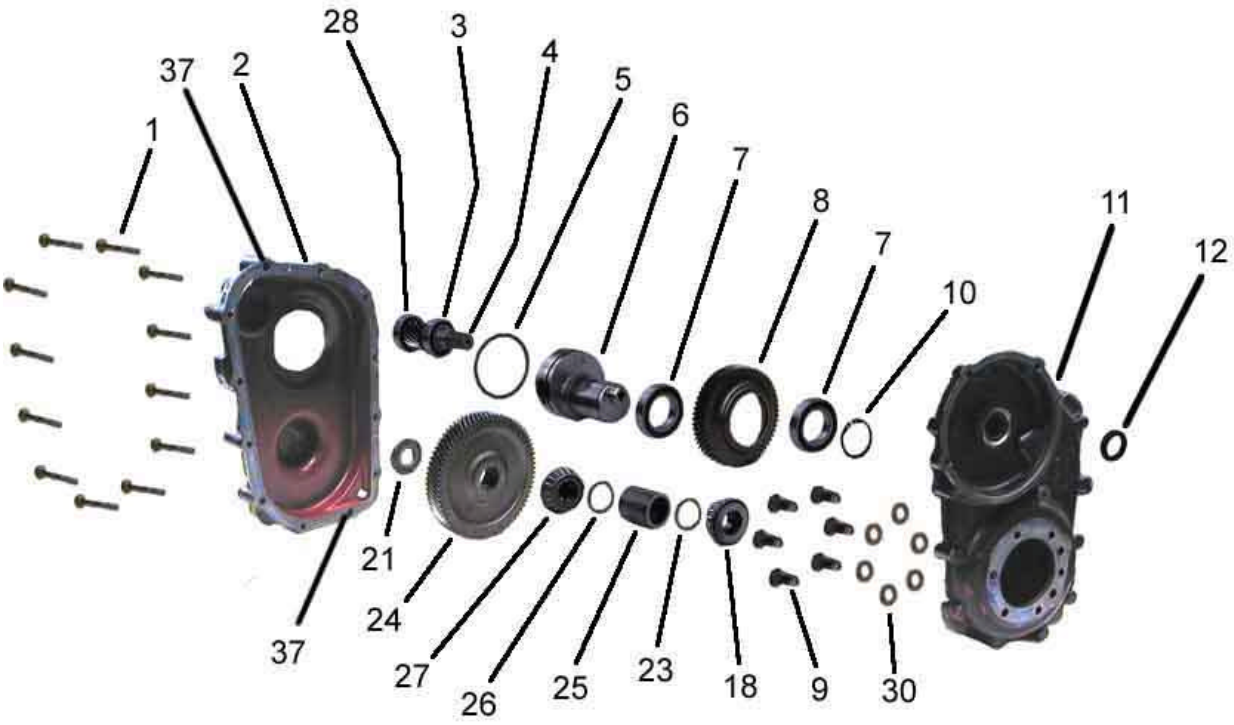
Front Suspension			
ITEM #	PART #	DESCRIPTION	QTY
1	32-214-50	Bushing	6
2	00-425-00	Wishbone link	1
3	86-521-99	Rod end	4
4	See Front Axle	Axle beam	1
5	85-142-00	Spring	2
6	96-240-00	1/2 NC x 4 Hex bolt	1
7	88-140-22	1/2 NC x 3-1/2 Hex bolt	2
8	88-149-81	1/2 NC Lock nut	3
9	88-189-82	5/8 NC Then pattern lock nut	4
10	88-101-16	3/8 NC x 2 Hex bolt, grade 5	4
11	88-109-81	3/8 NC Hex lock nut	4
12	86-007-00	Shock	2
13	32-207-10	Bushing	4
14	00-425-15	Right side lower link	1
15	88-180-18	5/8 x 2-1/2 NC Hex bolt	4
16	88-199-82	5/8 NF Thin pattern hex nut	4
17	00-425-01	Left side lower link	1
18	98-607-10	Grommet	2
Not Shown	98-753-15	Rubber bump stop	2

Transmission Assembly



Transmission Assembly			
ITEM #	PART #	DESCRIPTION	QTY
1	89-113-30	12 x 1.75 x 30mm Hex bolt, class 8.8	12
2	89-113-60	12mm Split lock washer	12
3	-	-	-
4	41-290-60	Axle tube	2
5	88-099-80	5/16 NF Hex nut	2
6	88-088-62	5/16 Split lock washer	2
7	88-128-62	7/16 Split lock washer	2
8	89-111-27	10 x 1.5 x 30mm Hex bolt	2
9	70-456-10	Rear motor support bracket	1
10	96-114-10	U-bolt	1
11	96-327-10	Hex socket bolt	8
12	44-440-83	Transmission center section assembly with 24:1 gears (no motor)	1
13	K26-700-03	Lubrication tag	1

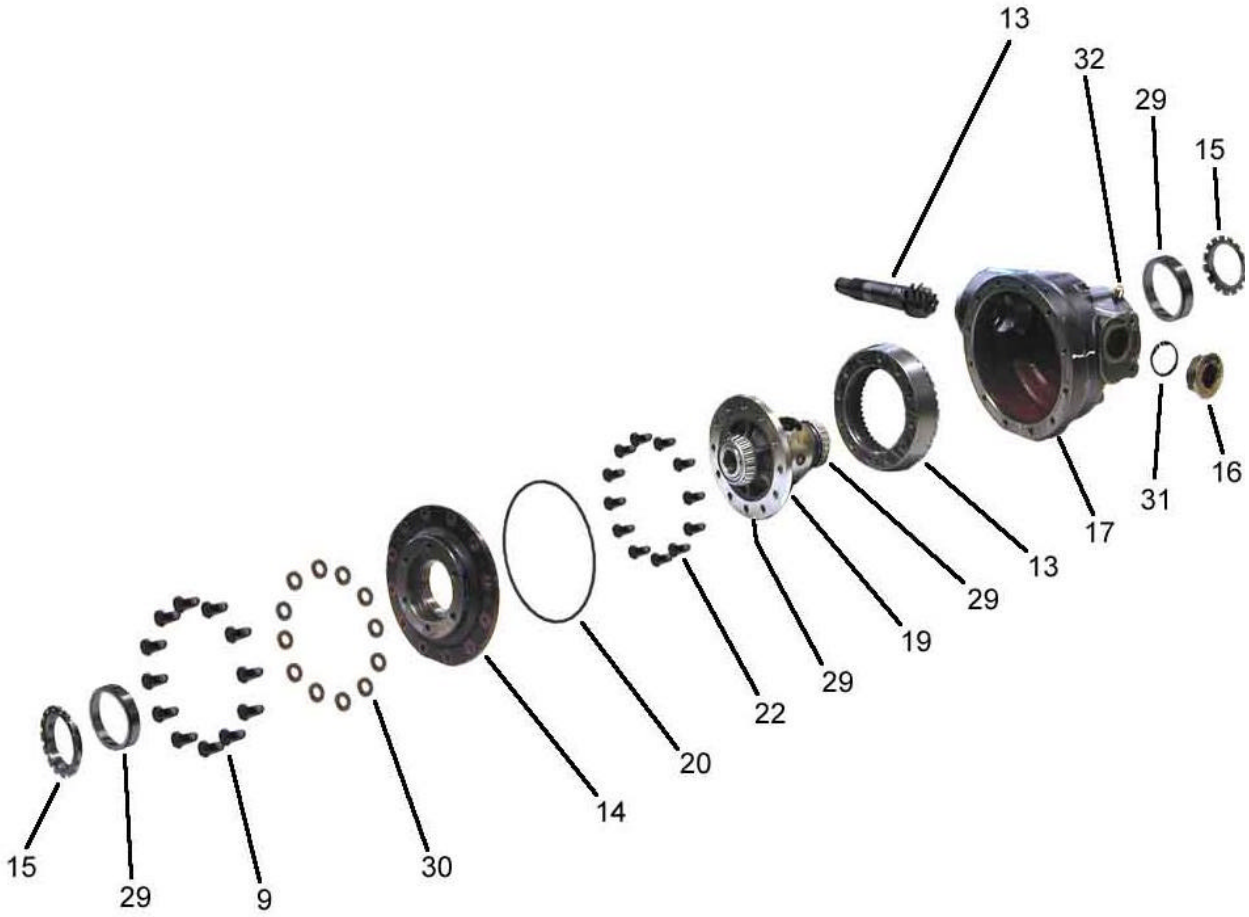
Transmission Gear Case



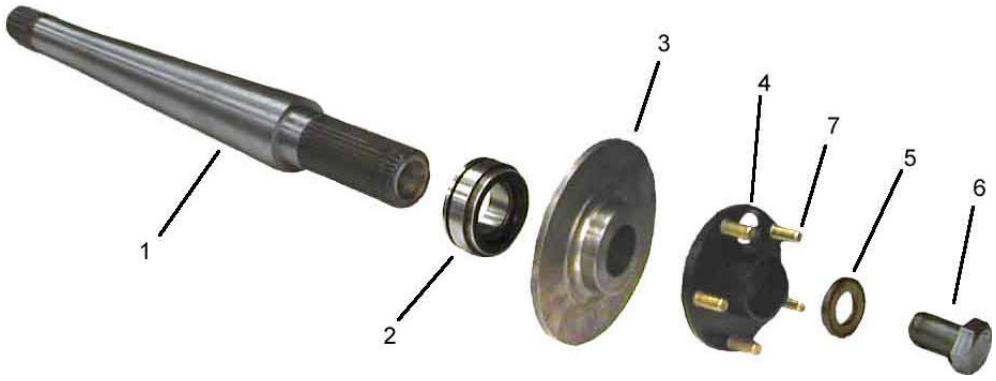
Note 1: Spacer 23 is available in increments of .05mm starting at 3.9mm. 3.9mm spacer is part number GT-3287213. Add 10 to the part number for every 0.05mm over 3.9. For example, if 4.55mm is needed: 4.55-3.9 = .65mm over, 0.65/.05 = 13, 13*10 = 130. Part number for 4.5mm spacer is 3287213+130 = 3287343.

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-3287523	Input shaft, 24:1	1
5	GT-71982	O-ring	1
6	GT-3287503	Eccentric shaft	1
7	GT-72005	Bearing	2
8	GT-3287493	Idler gear	1
9	GT-70302	M10 x 30 Bolt	6
10	GT-71715	Snap ring	1
11	GT-3287553	Gear case housing	1
12	GT-72019	Seal	1
18	GT-71979	Bearing	1
21	GT-3273633	Pinion nut	1
23	See Note 1, previous page	Spacer	1
24	GT-3287463	Output gear, 24:1	1
25	GT-328	Spacer, 46.100mm	1
	GT-328	Spacer, 46.100mm	0 or 1
	GT-328	Spacer, 46.125mm	0 or 1
	GT-328	Spacer, 46.150mm	0 or 1
	GT-328	Spacer, 46.175mm	0 or 1
26	GT-3287903	Shim, 0.100mm	0 or 1
	GT-3287883	Shim, 0.400mm	0 or 1
	GT-3287893	Shim, 0.500mm	0 or 1
	GT-3287853	Shim, 0.600mm	0 or 1
	GT-3287863	Shim, 0.700mm	0 or 1
	GT-3287873	Shim, 0.800mm	0 or 1
27	GT-71068	Bearing	1
28	GT-72022	Bearing	1
30	GT-70299	10mm Washer	6
37	GT-3252633	Dowel pin	2

Transmission Differential Case



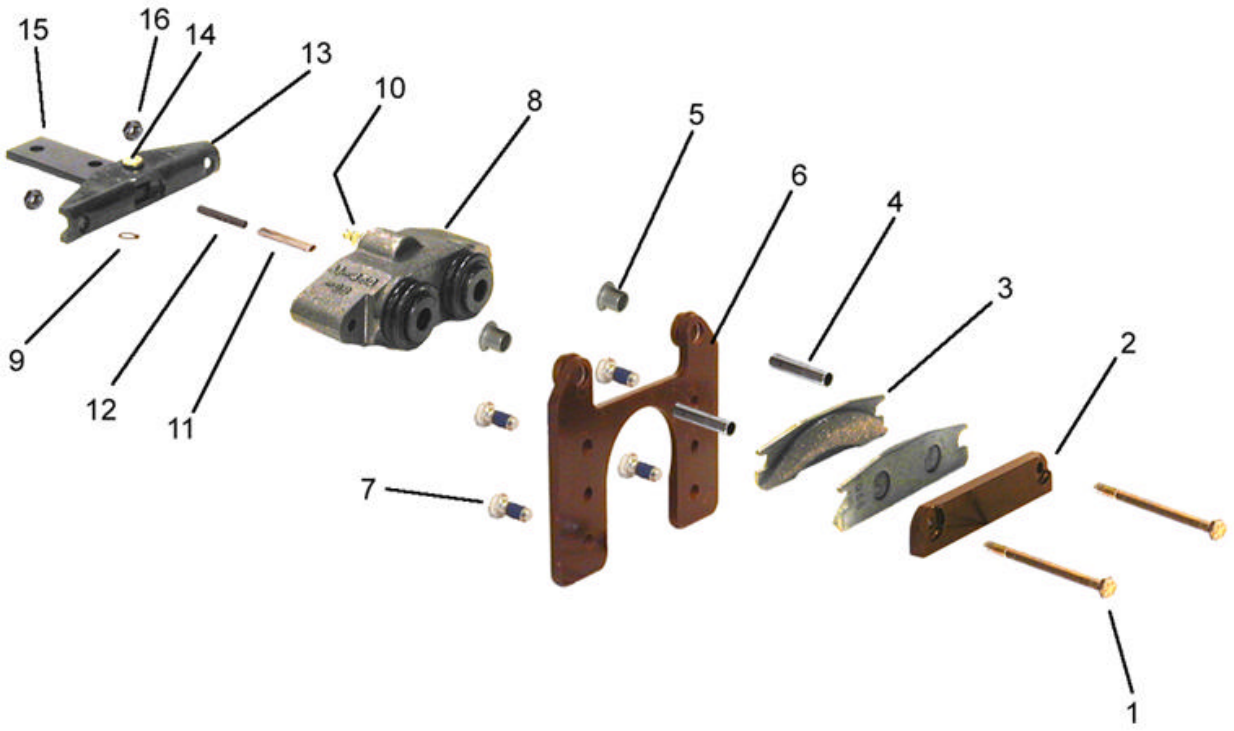
Rear Axle



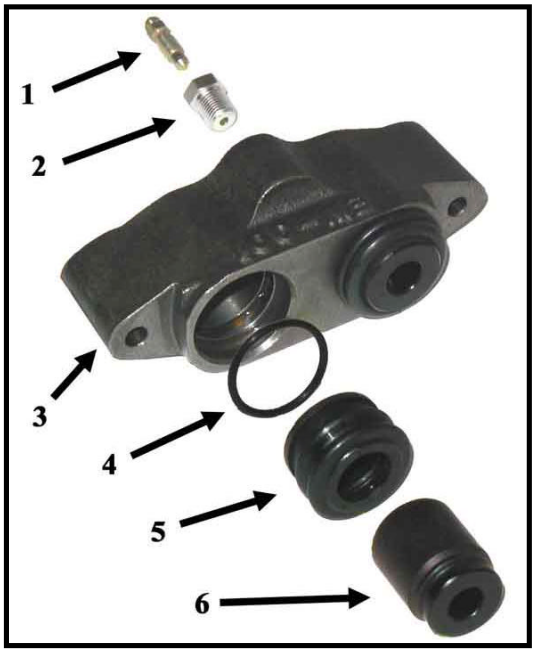
Transmission Differential Case			
ITEM #	PART #	DESCRIPTION	QTY
9	GT-70302	M10 x 30 Bolt	12
13	GT-3287183	Ring and pinion gear set	1
14	GT-3297193	Differential case cover	1
15	GT-3287133	Adjusting ring	2
16	GT-70417	Fill/Level plug	1
17	GT-3287113	Differential housing	1
19	GT-3287143	Differential case	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



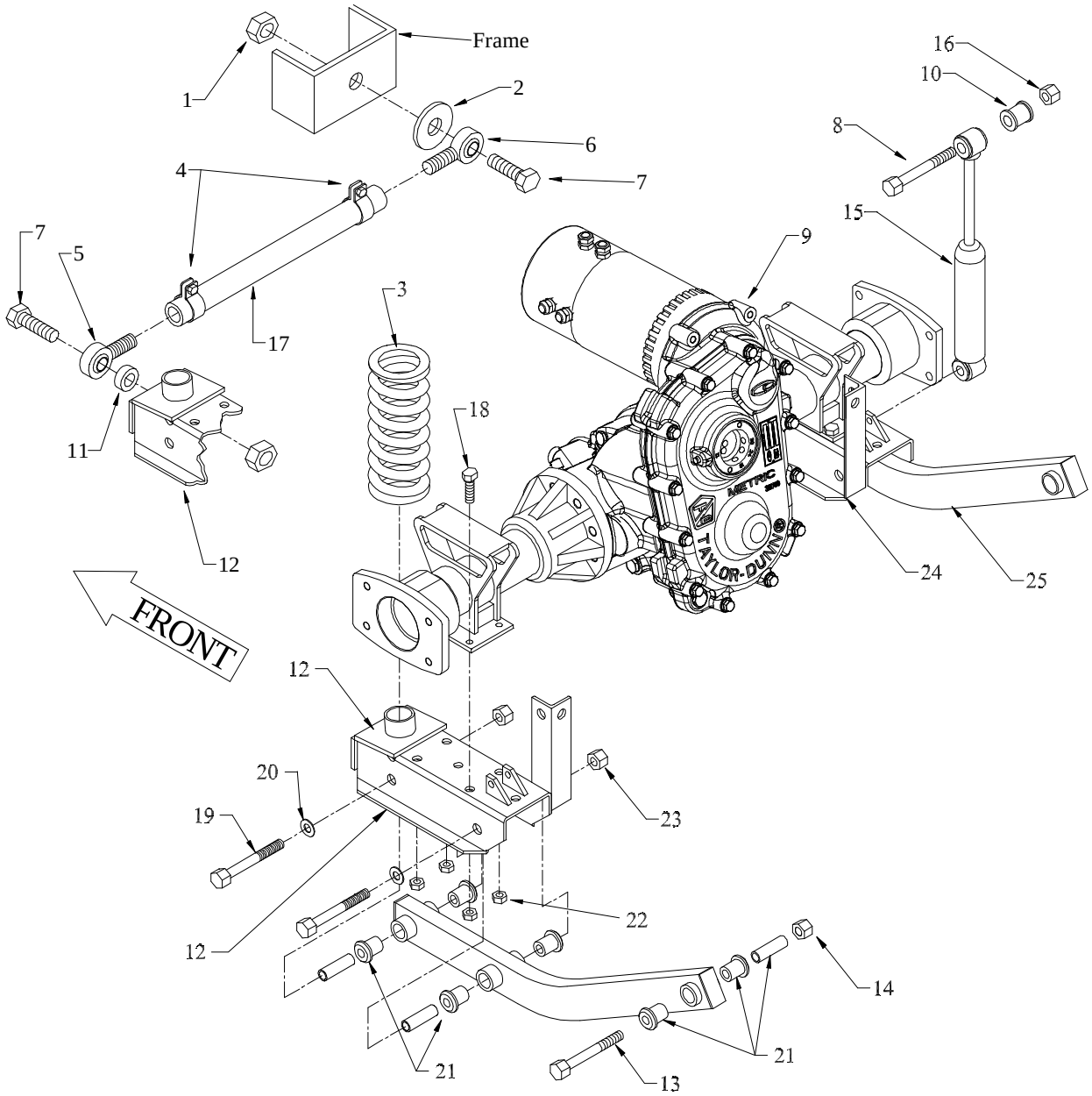
Brake Body Assembly



Rear Brakes			
ITEM #	PART #	DESCRIPTION	QTY
1	88-067-21	1/4 NC 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 bracket	2
7	96-327-10	3/8 x 3/4 NF Hex bolt, grade 5 with thread locking compound	8
8	41-350-68	Brake body assembly	2
9	88-840-11	Retaining ring	2
10	See Brake Body Assembly	Bleeder	2
11	32-220-03	Bushing	2
12	41-350-56	Park brake pin	2
13	41-350-12	Park brake lever mounting bracket	2
14	41-350-52	Clevis pin	2
	88-100-00	WASHER, .341 ID X .105 THICK	4
15	41-350-53	Park brake arm	2
16	88-069-82	1/4 NC Hex nut, grade 8	4

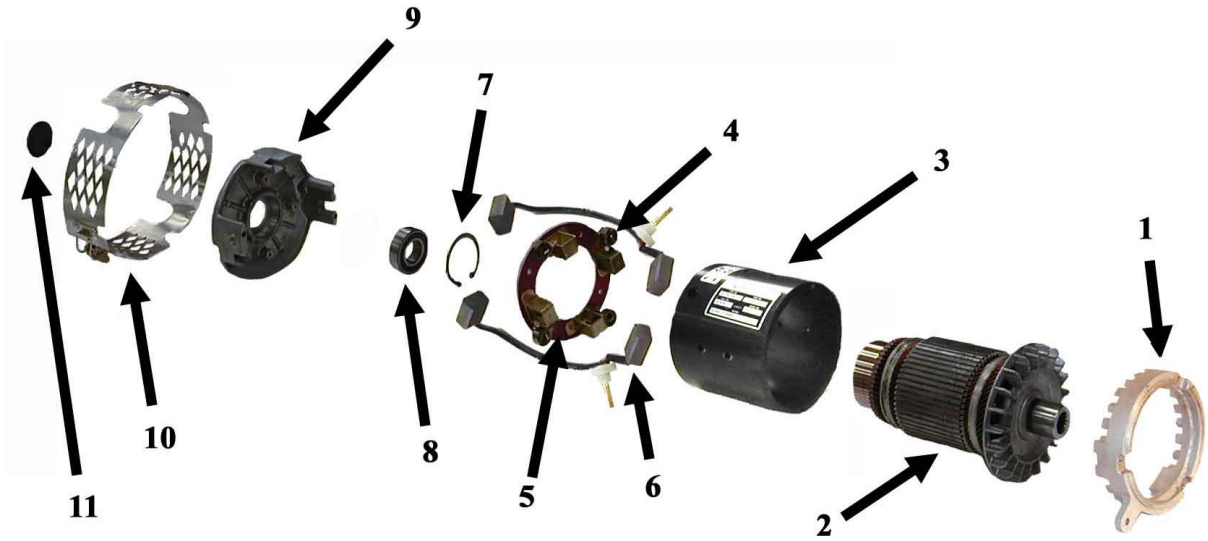
Brake Body			
ITEM #	PART #	DESCRIPTION	QTY
1	99-588-00	Bleeder screw	2
2	99-588-01	Bleeder adapter	2
3	41-350-43	Brake body, left	1
	41-350-44	Brake body, right	1
4	80-713-00	O-ring	4
5	41-350-09	Boot	4
6	41-350-10	Piston	4

Rear Suspension



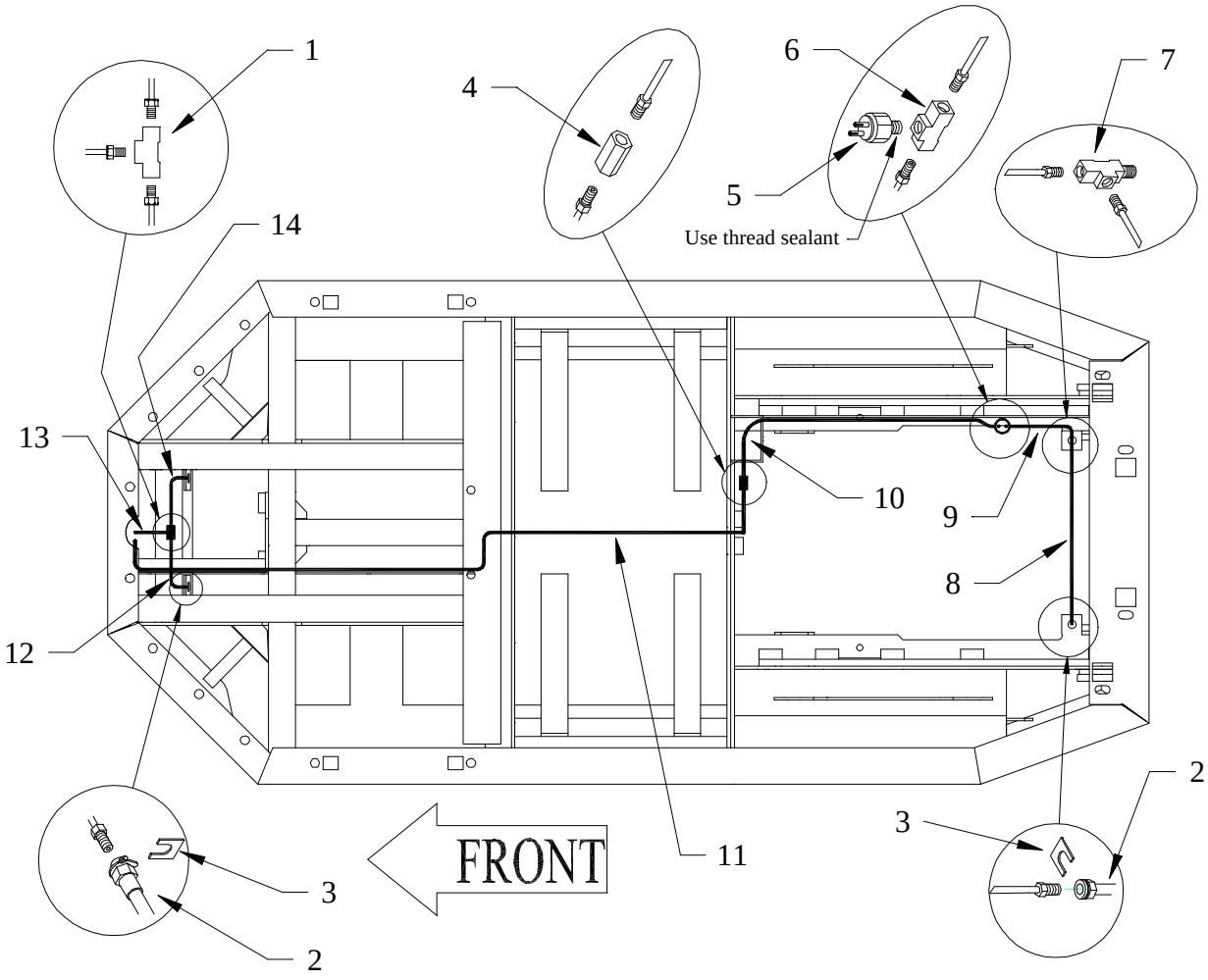
Rear Suspension			
ITEM #	PART #	DESCRIPTION	QTY
1	88-189-82	5/8NC Thin pattern lock nut	2
2	88-188-61	5/8 SAE Flat washer	1
3	85-142-00	Spring	2
4	86-510-00	Ball joint clamp	2
5	86-521-98	Rod end (left)	1
6	86-521-99	Rod end (right)	1
7	88-180-15	5/8NC x 1-3/4 Hex bolt	2
8	88-100-15	3/8NC x 1-3/4 Hex bolt	4
9	K25-600-23	Complete drive assembly	1
10	32-207-10	Busjing	4
11	17-108-00	Spacer	1
12	K25-600-14	Spring mount (left)	1
13	K4N-BO-002	9/16NC x 4-1/2 Hex bolt, grade 5	2
14	88-169-81	9/16NC Lock nut	2
15	86-007-00	Shock	2
16	88-109-81	3/8NC Lock nut	8
17	41-402-10	Panard bar	1
18	88-101-13	3/8NC x 1-1/4 Hex bolt, grade 5	8
19	K4N-BO-002	9/16NC x 4-1/2 Hex bolt, grade 5	4
20	88-188-61	5/8 SAE flat washer	8
21	32-249-01	Bushing, rubber	12
	32-249-02	Sleeve, steel	6
22	88-109-81	3/8NC Lock nut	8
23	88-149-81	1/2NC Lock nut	4
24	K25-600-15	Spring mount (right)	1
25	00-426-04	Suspension link	2
Not Shown	98-753-15	Rubber bump stop	2

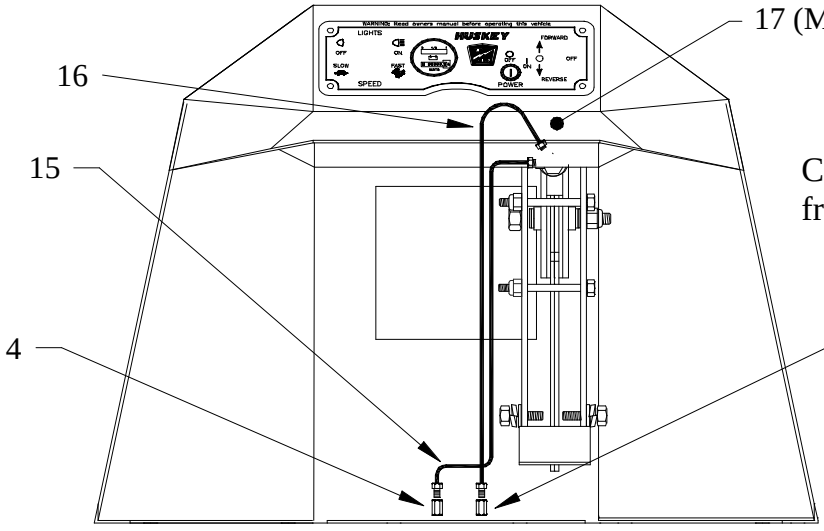
Motor



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

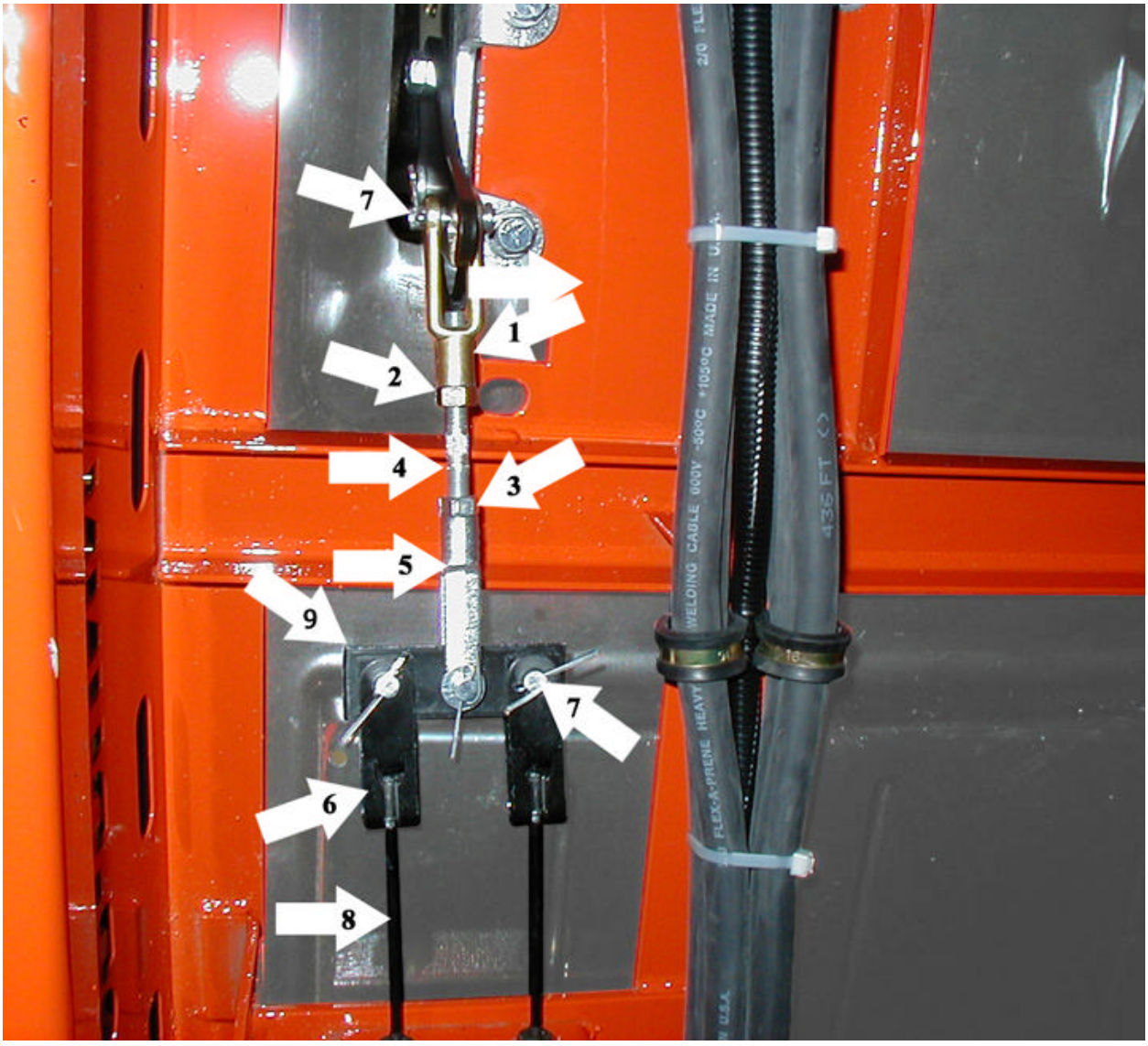
Brake Lines

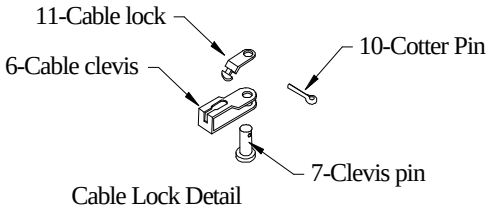

1
4
6
7
5
Use thread sealant
14
13
10
9
8
12
2
3
FRONT
11
3
2


17 (Master Cylinder)
16
15
4
4
Cowl view
from rear

Brake Lines			
ITEM #	PART #	DESCRIPTION	QTY
1	99-564-00	T-fitting	1
2	99-580-10	Brake hose	2
3	99-576-00	Brake hose clip	4
4	99-575-00	Coupler	3
5	71-110-00	Brake light switch	1
6	99-591-00	Brake light switch adaptor	1
7	99-559-00	T-fitting	1
8	99-604-66	Brake line	1
9	99-600-58	Brake line	1
10	99-605-26	Brake line	1
11	99-609-26	Brake line	1
12	99-600-57	Brake line	1
13	99-604-65	Brake line	1
14	99-600-56	Brake line	1
15	99-605-28	Brale line	1
16	99-605-27	Brake line	1
17	See Brake Linkage (foot brake)	Master cylinder	
Not shown	99-575-32	Adapter, 3/16 tube to 10mm flare), used on master cylinder	2
Not Shown	99-575-10	Brake hose adaptor, 3/16 tube to 1/8 pipe, used on wheel cylinders	4

Brake linkage (parking brake)

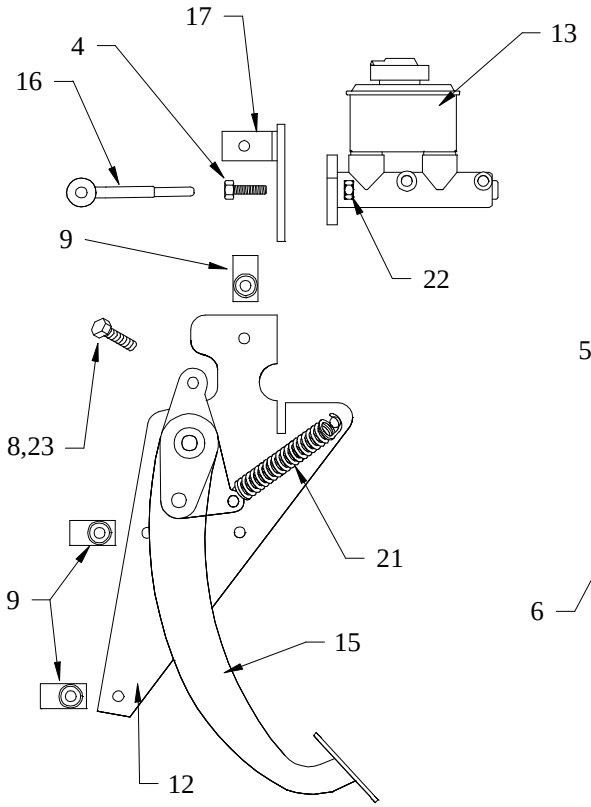




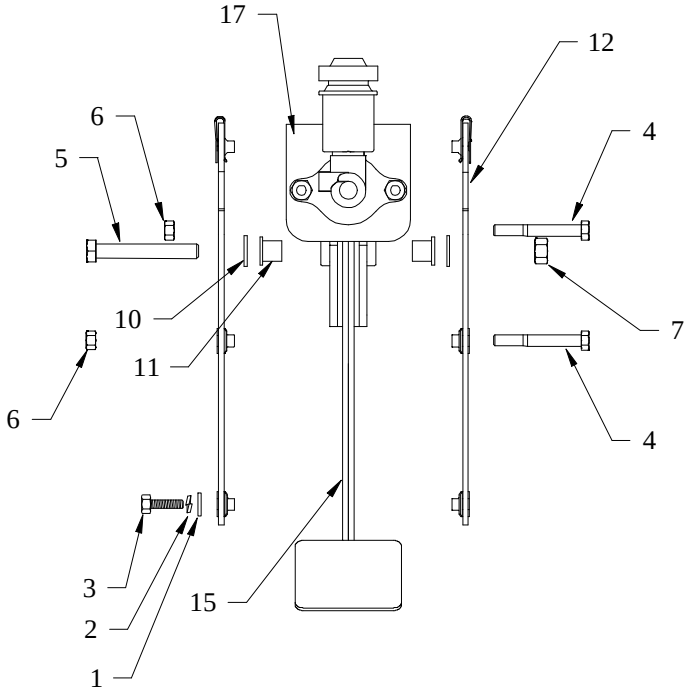
Cable Lock Detail

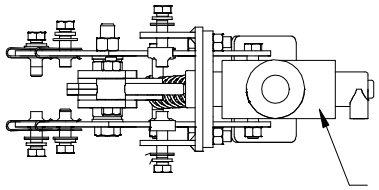
Brake Linkage			
ITEM #	PART #	DESCRIPTION	QTY
1	96-765-00	Clevis, left hand thread	1
2	88-099-81	5/16NF Hex nut, left hand thread	1
3	88-099-80	5-16NF Hex nut	1
4	96-343-00	Link	1
5	96-763-00	Clevis, right hand thread	1
6	96-754-00	Clevis	2
7	96-773-00	Clevis pin	4
8	96-827-17	Brake cable	2
9	04-380-08	Equalizer	1
10	88-517-11	3/32 x 1 Cotter pin for #7	4
11	96-826-09	Cable lock	4

Brake linkage (foot brake)

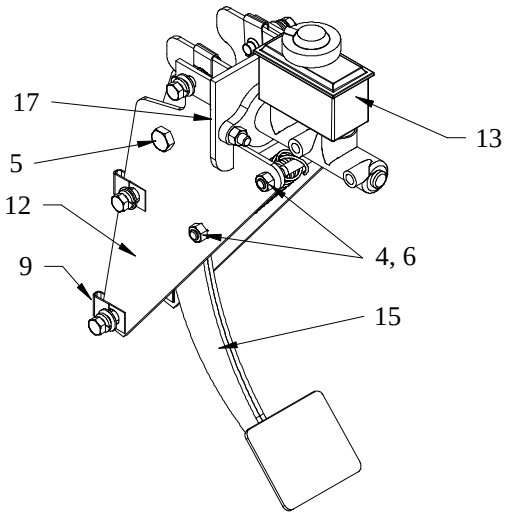


Left side plate removed for clarity



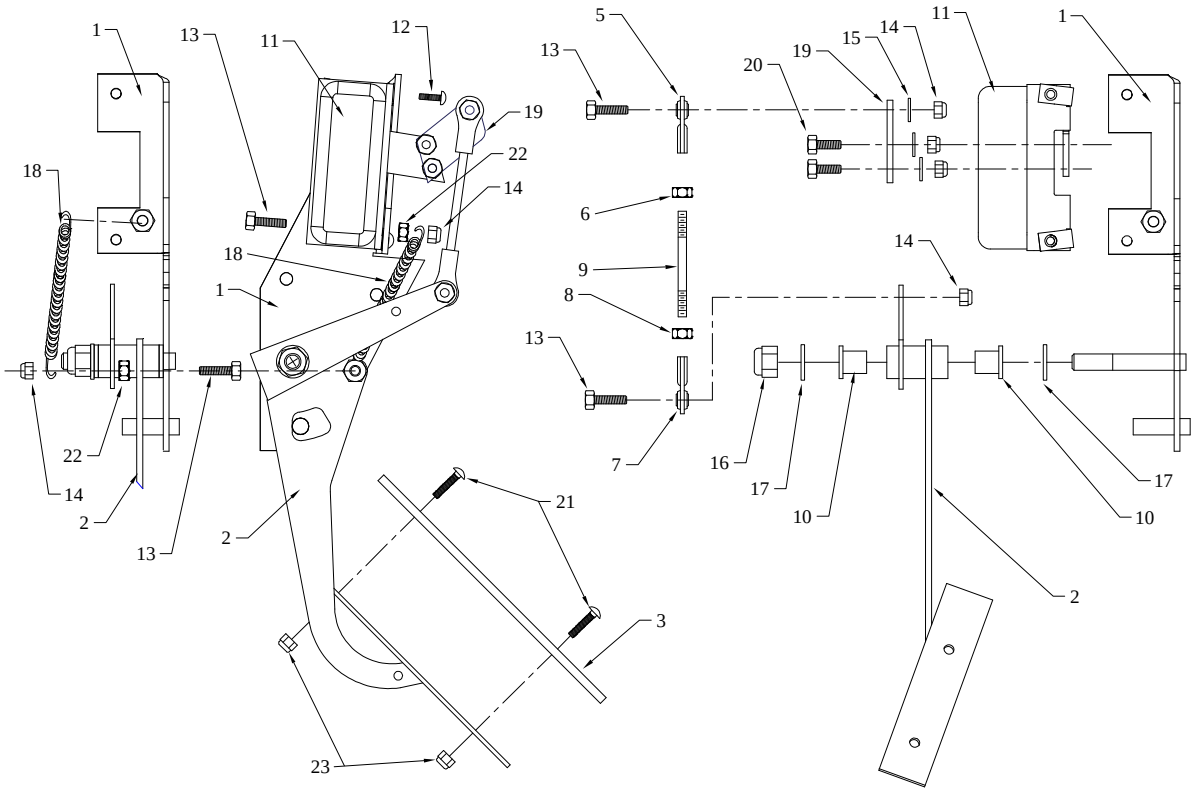


Assembled view from top



Brake Linkage			
ITEM #	PART #	DESCRIPTION	QTY
1	88-108-61	3/8 SAE Flat washer	6
2	88-108-62	3/8 Split lock washer	6
3	88-101-13	3/8NC x 1-1/4 Hex bolt	6
4	88-101-21	3/8NC x 3 Hex bolt, Grade 5	2
5	88-140-22	1/2NC x 3 Hex bolt	1
6	88-109-81	3/8NC Hex lock nut	2
7	88-149-81	1/2NC Hex lock nut	1
8	88-100-15	3/8NC x 1-3/4 Hex bolt	1
9	97-211-30	Blind nut	6
10	88-148-61	1/2 SAE Flat washer	2
11	32-215-00	Bushing	2
12	41-426-00	Mounting plate	2
13	99-511-20	Master cylinder	1
14	-	-	-
15	41-426-11	Brake pedal	1
16	00-426-06	Push rod	1
17	00-426-05	Master cylinder mounting bracket	1
18	-	-	-
19	-	-	-
20	-	-	-
21	85-250-00	Spring	1
22	-	-	-
23	88-109-81	3/8 NC Lock nut	1

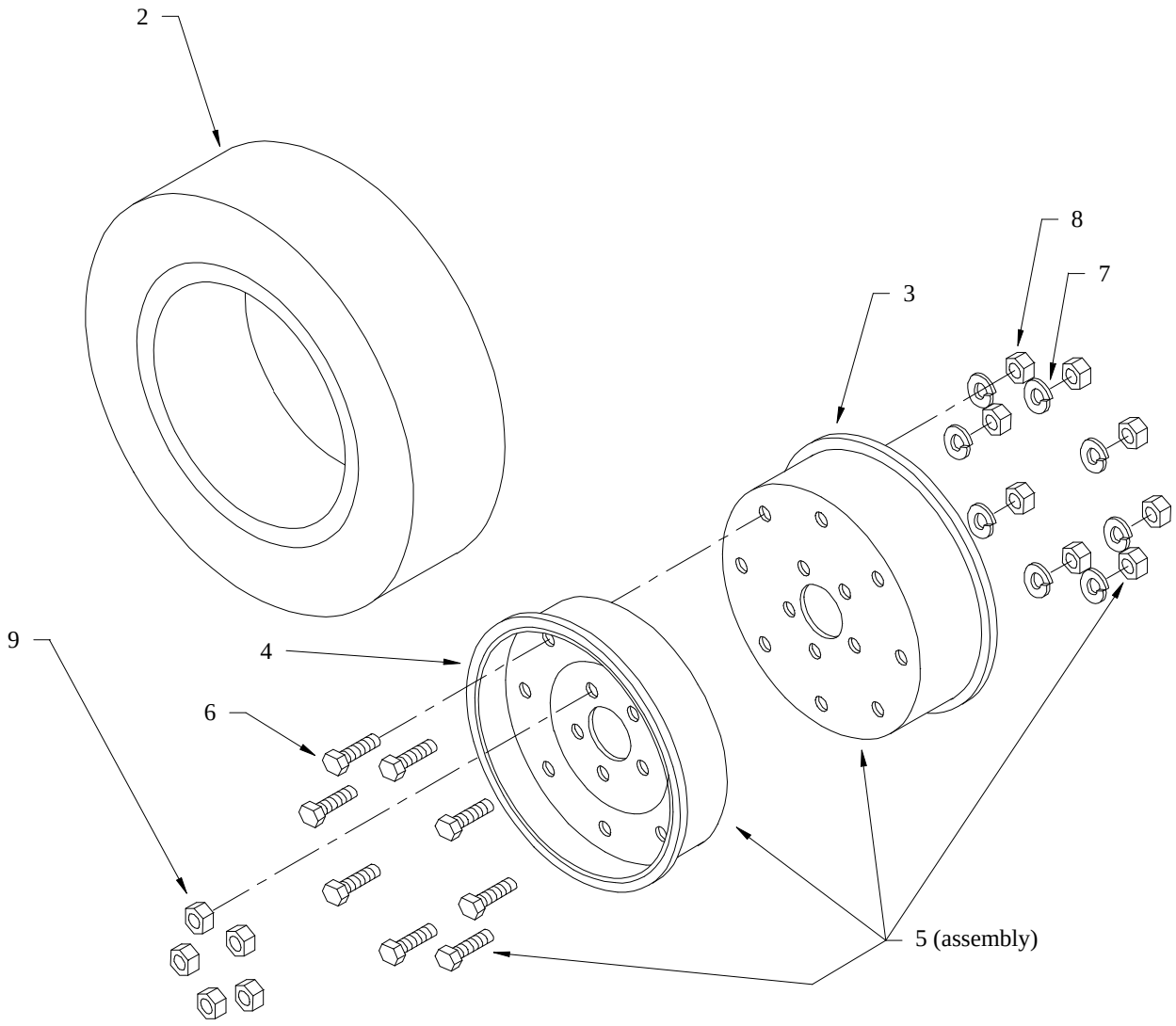
Throttle linkage



Throttle Linkage			
ITEM #	PART #	DESCRIPTION	QTY
1	00-425-21	Mounting bracket	1
2	00-425-09	Accelerator pedal arm	1
3	*01-110-38	*Accelerator pedal pad	1
4	-	-	-
5	86-503-98	Rod end, left hand thread	1
6	97-211-00	1/4NF Hex nut, left hand thread	1
7	86-503-99	Rod end, right hand thread	1
8	88-079-80	1/4NF Hex nut	1
9	50-002-13	Link	1
10	32-215-00	Bushing	2
11	62-033-48	Accelerator module	1
12	88-065-11	1/4NC x 1 Phillips truss head screw	2
13	88-060-11	1/4NC x 1 Hex bolt	2
14	88-069-81	1/4NC Nylon locknut	6
15	88-068-61	1/4 SAE Flat washer	2
16	88-159-84	1/2NF Nylon lock nut	1
17	88-148-61	1/2 SAE Flat washer	1
18	85-295-00	Spring	1
19	62-033-28	Bracket	1
20	88-060-09	1/4NC x 3/4 Hex bolt	2
21	*88-065-09	*1/4NC x 3/4 Phillips truss head screw	2
22	88-069-87	1/1NC KEPS nut	2
23	*88-069-81	*1/4NC Nylon locknut	2

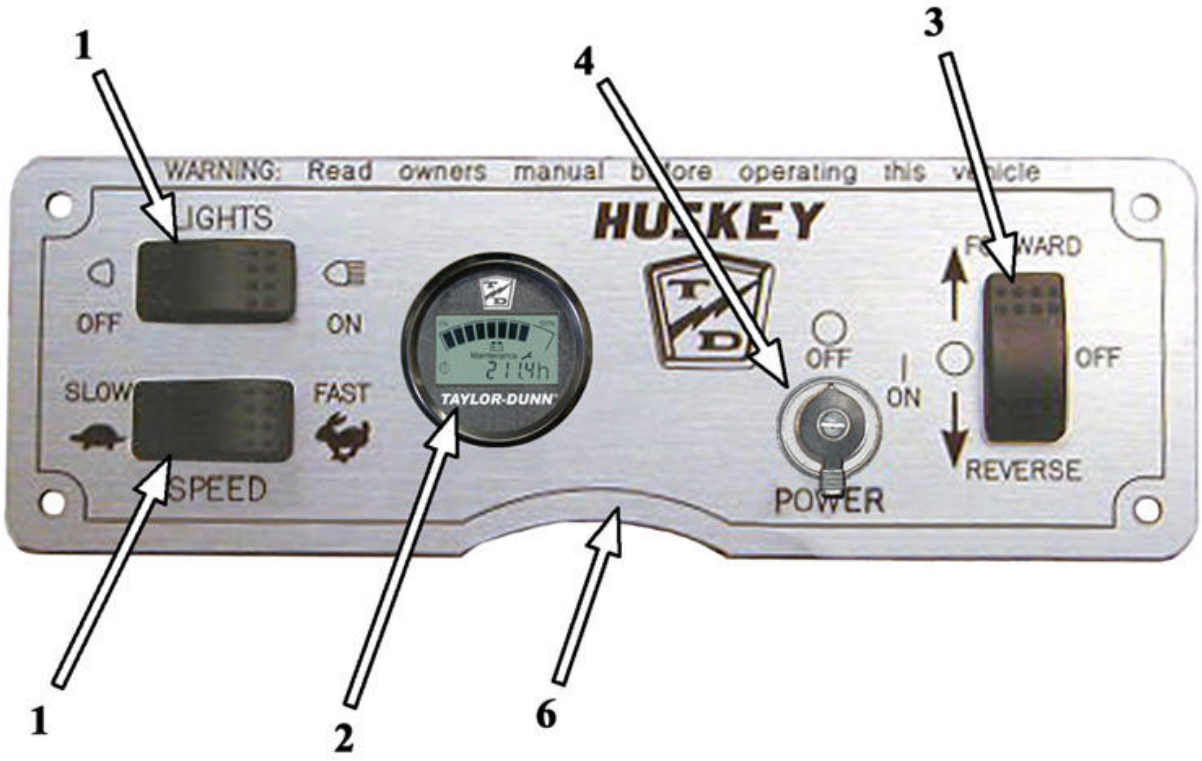
** - Accelerator pedal pad (#3) no longer used after serial number 164547. The pad is now included with the accelerator pedal arm (#2)*

Wheels and Tires



Wheels and Tires		
ITEM #	PART #	DESCRIPTION
2	Tires	
	K4-074-90	Tire, 4.00 x 8 Soft Solid, Lug
	Split Rim Wheels	
3	12-042-12	Inner Wheel (12-bolt)
4	12-042-13	Outer Wheel (12-bolt)
5	12-042-00	Wheel Assembly, 3.75 bead width (includes #3a, #4a, #6, #7, #8
6	88-110-09	3/8 x 3/4-NF Hex Bolt, grade 5
7	88-109-62	3/8 Split Lock Washer
8	88-119-80	3/8-NF Hex Nut
9	97-236-00	Wheel Nut
	Tire and Wheel Assemblies	
	13-734-35	4.00 x 8 Soft Solid Lug

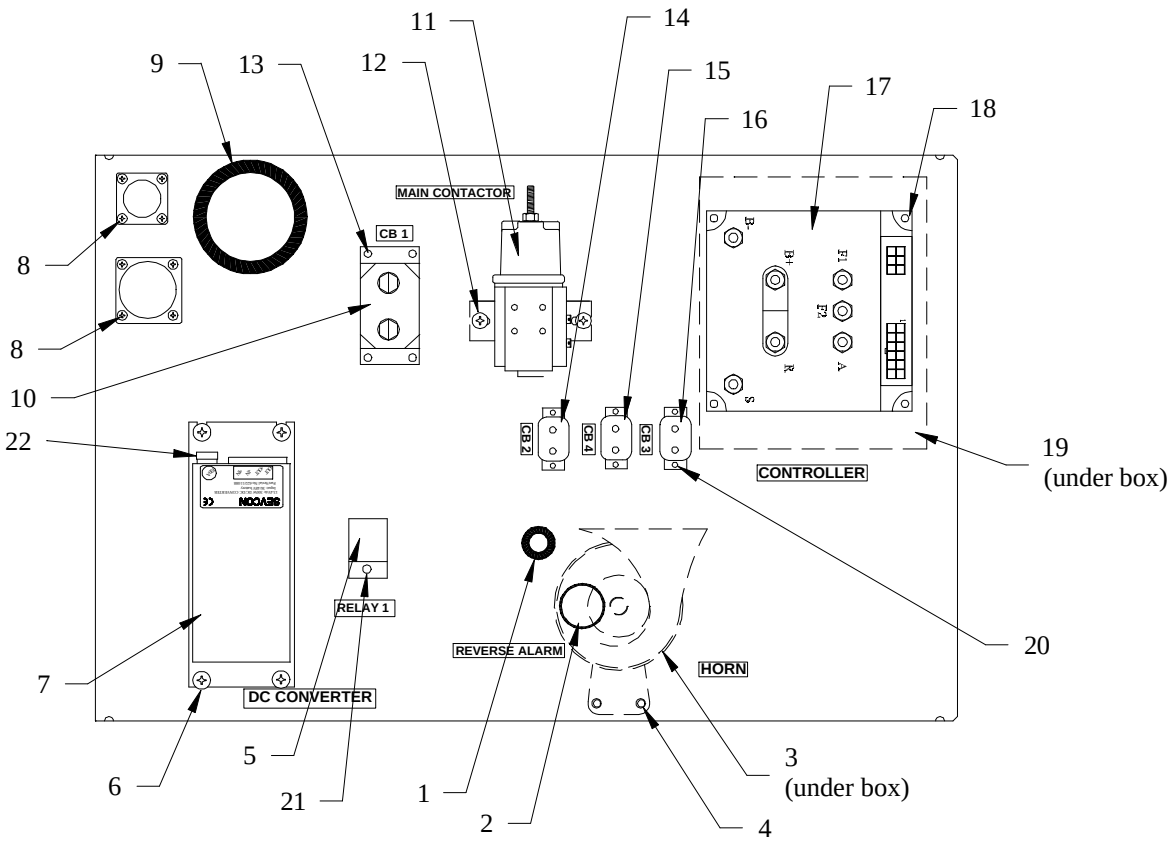
Instrument Panel (dash)



Instrument Panel			
ITEM #	PART #	DESCRIPTION	QTY
1 (top)	-	*Not used, use 71-039-21 to cover hole	1
1 (bottom)	71-039-11	High / Low speed switch	1
2	74-010-00	Smart view display	1
3	71-039-02	Forward and Reverse switch	1
4	500128	Ignition switch	1
	K25-300-19	Spacer	1
5	-	-	-
6	K25-300-18	Dash panel	1
Not shown	97-211-20	1/4NC Blind nut (dash mounting)	4
Not shown	88-065-09	1/4NC x 3/4 Truss head machine screw (dash mounting)	4

* - Lights controlled by the key switch.

Speed Control Panel



Speed Control Panel			
ITEM #	PART #	DESCRIPTION	QTY
1	98-603-00	Grommet	1
2	73-005-04	Reverse beeper	1
3	73-004-20	Horn	1
4	88-838-06	#14 x 1/2 Pan head sheet metal screw	2
5	71-303-01	Relay	1
6	88-838-06	#14 x 1/2 Pan head sheet metal screw	4
7	73-012-30	DC-DC converter, used after serial #151469	1
8	88-818-02	#8 x 1/4 Pan head sheet metal screw	8
9	98-599-20	Grommet	1
10	79-844-20	200A Circuit breaker	1
11	71-210-13	Line contactor (includes auxiliary switch)	1
	71-210-11	Mounting bracket	1
	69-068-60	680 Ohm resistor (across contacts)	1
	*	Auxiliary switch	1
12	88-838-06	#14 x 1/2 Pan head sheet metal screw	2
13	88-818-06	#8 x 1/2 Pan head sheet metal screw	4
14	79-840-20	20A Circuit breaker	1
15	79-840-00	10A Circuit breaker	1
16	79-840-20	20A Circuit breaker	1
17	62-400-10	Motor speed control	1
18	88-060-13	1/4NC x 1-1/4 Hex bolt	4
	88-068-61	1/4 SAE flat washer	4
	88-069-81	1/4NC Nylon lock nut	4
19	62-400-13	Heat sink	1
	94-422-21	Heat sink paste 13.5 oz. tube	-
20	88-818-06	#8 x 1/2 Pan head sheet metal screw	6
21	88-818-06	#8 x 1/2 Pan head sheet metal screw	1
22	79-823-12	Fuse, 20A (DC-DC converter)	1
Not shown	98-451-20	Gasket, control box lid (by the foot)	6'
	00-425-05	Control box with lid	1
	97-211-30	3/8NC Blind nut, control box mounting	4
	88-108-62	3/8 Split lock washer, control box mounting	4
	88-101-13	3/8 x 1-1/4 Hex bolt, grade 5, control box mounting	4

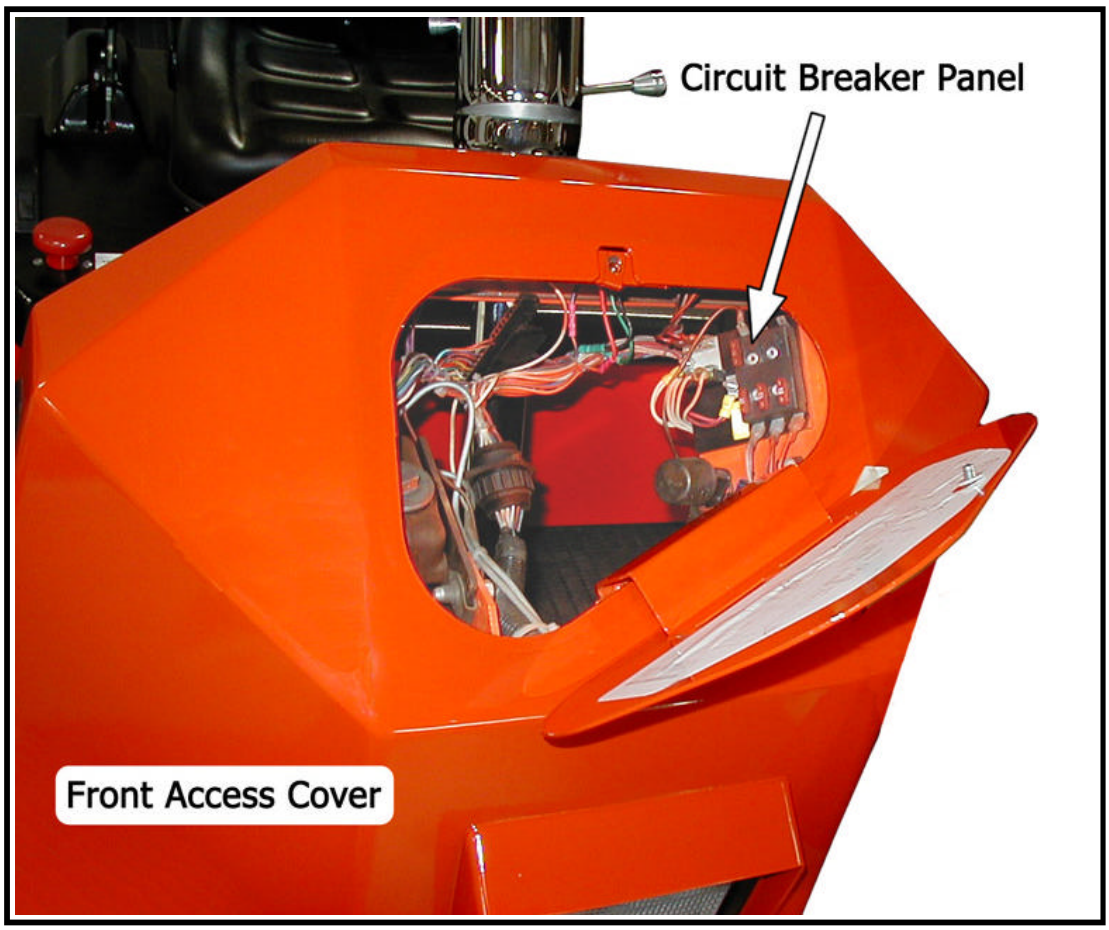
* - Not Available at Time of Printing

Miscellaneous Electrical

Miscellaneous Wire Harness Clamps

Miscellaneous Electrical			
ITEM #	PART #	DESCRIPTION	QTY
Not Shown	75-152-42	Chassis Control Harness	1
	75-152-49	Dash Harness	1
	75-152-43	Tail light harness	1
	75-152-37	Control Panel Harness	1
	94-422-10	Dielectric grease for harness connectors	
	75-152-91	Smart view display cable	1
	75-152-45	Power harness	1
	98-599-15	Plastic grommet for 1.75 hole	
	98-599-20	Plastic Grommet for 2.5 hole	
	71-303-01	Horn relay (mounted behind dash)	1
	502136	Horn switch (floorboard)	1
	71-134-50	Switch, park brake interlock	1
1	-	-	-
2	96-650-01	Wire Harness Clip, stick on	
3	96-642-00	Wire harness Clip, push mount	
4	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	
5			
6	96-640-00	Clamp, 3/16 Push Mount	
7	96-624-00	Clamp, 1/4 Jiffy Clip	
	96-625-00 (not shown)	Clamp, 5/16 Jiffy Clip	
8	96-626-00	Clamp, 7/8 Jiffy Clip	)

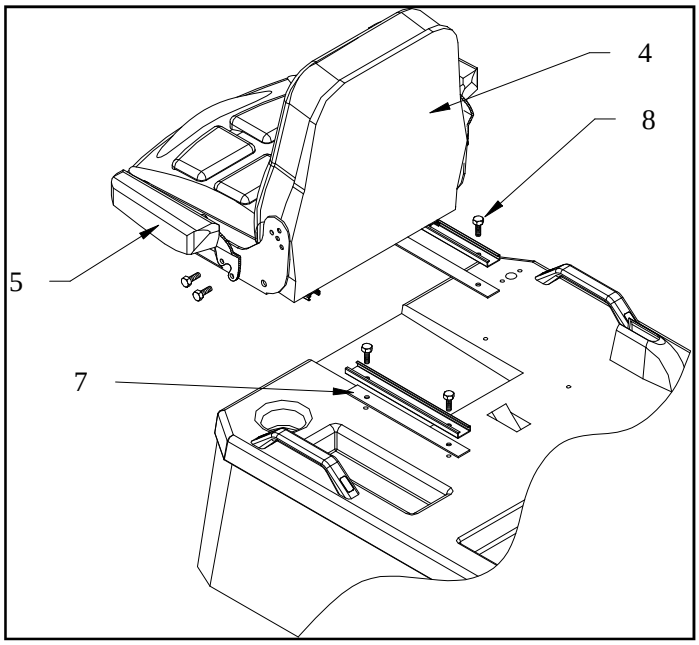
Lighting System



Lighting System			
ITEM #	PART #	DESCRIPTION	QTY
-	72-025-03	Headlight	1
-	72-082-01	Headlight bulb	1
-	72-025-20	Tail light	1
-	97-211-15	Tail light mounting screw	4
-	88-034-13	Tail light mounting nut	4
-	72-082-02	Tail light/Brake light bulb (1157)	2
-	72-082-00	Back up/Turn signal bulb	4
-	79-820-03	Circuit Breaker, 10A	3
-	78-010-30	Circuit Breaker, panel	1

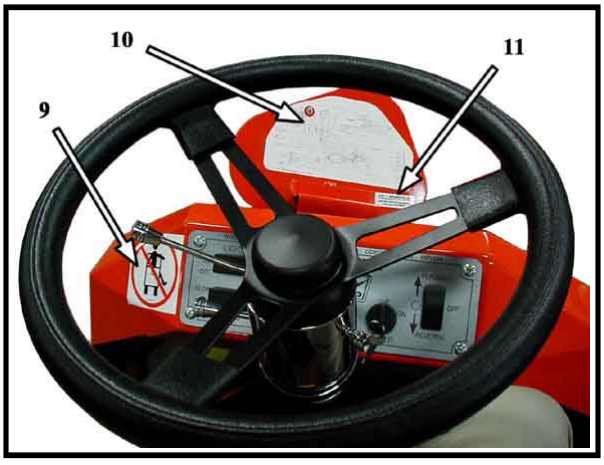
Seat Cushions and Deck

Seat Cushions and Deck			
ITEM #	PART #	DESCRIPTION	QTY
1	71-124-00	Battery disconnect switch	1
2	51-344-80	Park brake handle	1
3	95-512-00	Deck handle	2
4	90-160-70	Seat assembly	1
5	90-160-60	Arm rest kit	1
6	00-425-13	Deck cover	1
7	90-160-71	Seat spacer	2
8	88-080-13	5/16NC x 1-1/4 Hex bolt	4
	88-089-81	5/16NC Lock nut	4
	88-088-60	5/16 Cut flat washer	4



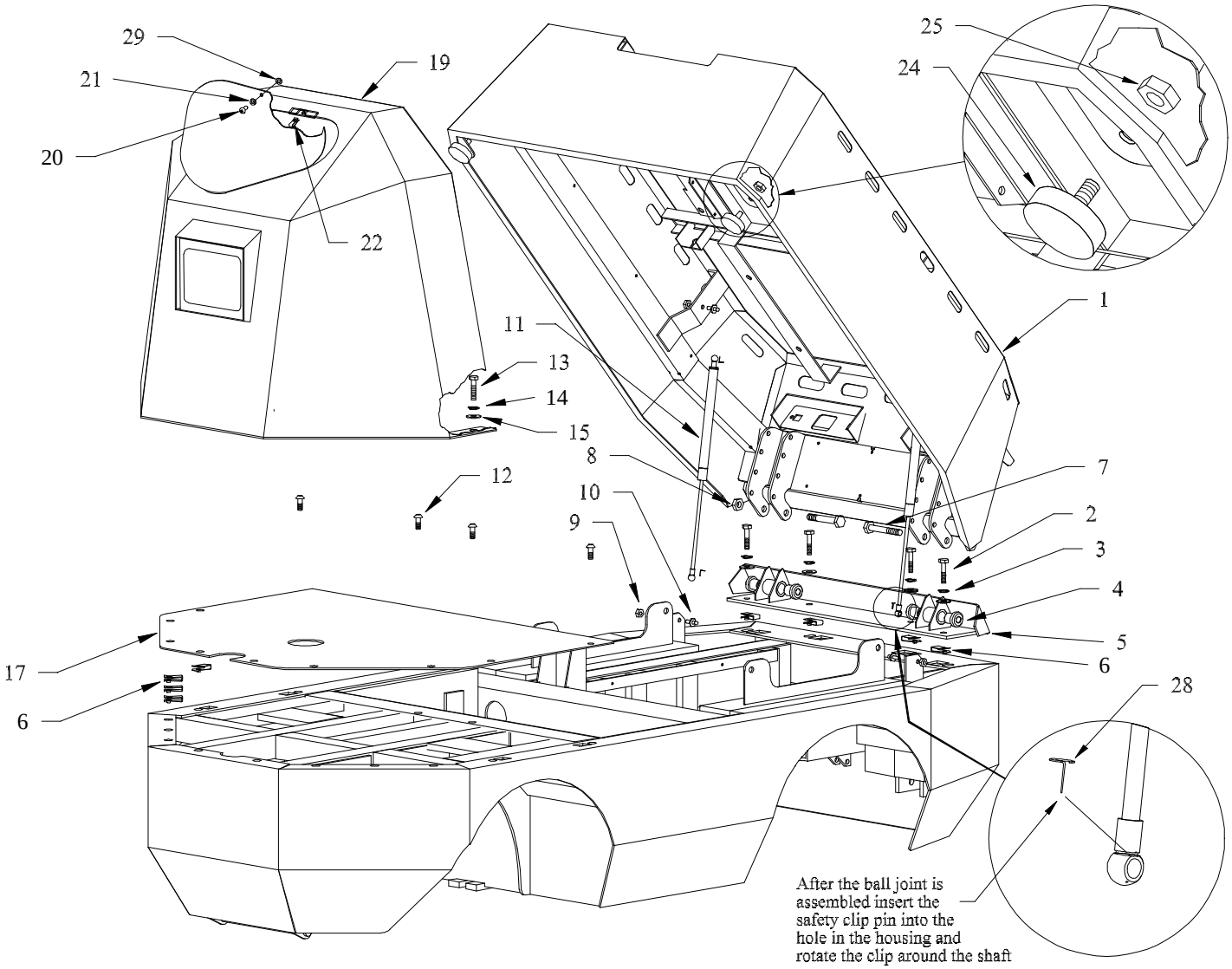
Seat Mounting

Decals



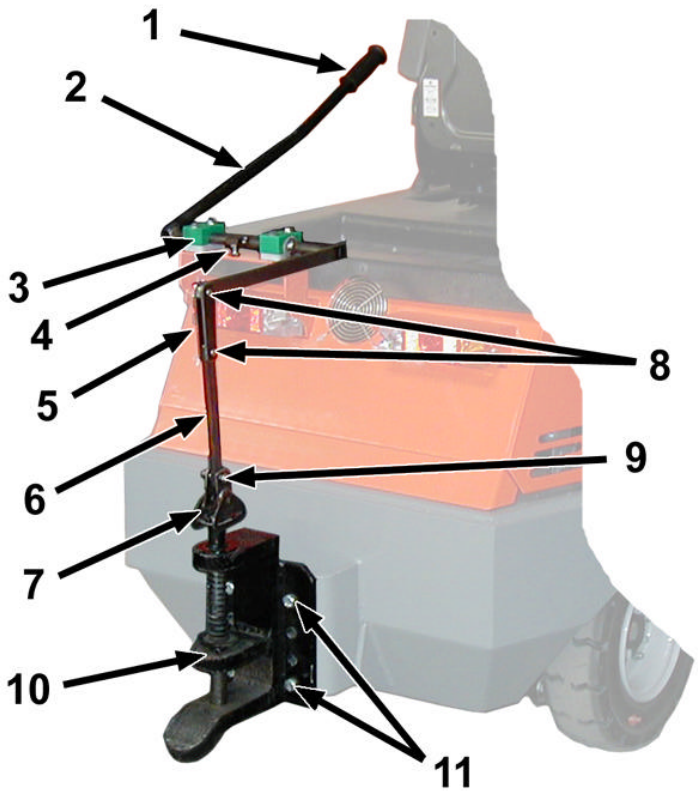
Decals			
ITEM #	PART #	DESCRIPTION	QTY
1	94-319-00	Disconnect the battery	1
2	94-376-00	Battery disconnect switch	1
3	94-373-12	Data plate (decal)	1
4	94-313-20	Safety waring	1
5	94-313-00	Explosive gases	1
6	94-309-00	Park brake warning	1
7	94-384-01	Not a motor vehicle	1
8	94-384-14	When leaving vehicle	1
9	94-301-44	Keep arms and legs inside	1
10	K25-300-17	Wire diagram, front	1
11	94-301-41	DOT 3 brake fluid	1
Not Shown	K25-300-16	Wiring decal, inside control box	1
	94-331-10	FedEx logo	2

Frame Components



Frame Components			
ITEM #	PART #	DESCRIPTION	QTY
1	00-426-02	Battery cover (not painted)	1
2	88-100-14	3/8 x 1-1/2 Hex bolt	4
3	88-108-62	3/8 Split lock washer	4
4	32-214-50	Bushing	4
5	00-425-16	Mounting bracket (not painted)	1
6	97-211-30	3/8 blind nut	18
7	96-240-00	1/2NC x 4 Hex bolt	2
8	88-149-81	1/2NC lock nut	2
9	88-089-81	5/16NC lock nut	4
10	85-195-01	Gas spring mount	4
11	85-195-00	Gas spring	2
12	96-245-05	3/8NC Button head socked screw	4
13	88-100-14	3/8NC x 1-1/2 Hex bolt	10
14	88-106-62	3/8 Split lock washer	10
15	88-108-61	3/8 SAE Flat washer	10
16	-	-	-
17	00-426-03	Floorboard	1
18	94-201-00	T/D emblem	1
19	00-426-01	Front cowl	1
20	88-065-12	1/4NC x 1 Truss head machine screw	1
21	97-169-10	Nylon washer	1
22	97-211-20	1/4NC Blind nut	1
23	88-567-91	Push clip	3
24	98-753-12	Bumper	2
25	88-109-81	3/8NC lock nut	2
26	-	-	-
27	-	-	-
28	85-195-02	Retaining clip	4
29	96-245-20	Retaining washer	1
Not shown	K4-083-63	Reflector, Red up to S/N 164550	
	K4-083-64	Reflector, Amber up to S/N 164550	
	502142	Reflector, Red starting S/N 164551	
	502143	Reflector, Amber starting S/N 164551	
	00-426-03	GUARD,WIRE	1
	00-425-11	MNT,WIRE GUARD	1

Hitch and Hitch Release



Front Bumper

Hitch and Hitch Release			
ITEM #	PART #	DESCRIPTION	QTY
1	98-351-00	HAND GRIP	1
2	00-426-10	HITCH RELEASE,WLDMT,HUSKY	1
3	84-006-00	Pillow block (upper)	2
	02-426-00	Pillow block (lower)	2
	88-080-18	5/16 X 2-1/2NC HEX HD SCR	4
	88-088-61	5/16 SAE WASHER	8
	88-089-81	5/16 NC LOCK NUT	4
4	88-100-12	3/8-24 NFX1-1/4,HHCS SAE GRD 8	1
	88-119-82	3/8 NC HEAV HEX NUT,PLAIN	1
5	01-426-33	Link, middle	2
6	01-426-32	Link, bottom	1
7	01-426-31	CLIP, HITCH	2
8	96-772-00	PIN,CLEVIS,3/8 X 1 1/8 IN.	2
	88-527-11	1/8 X 1 STEEL COTTER PIN	2
9	96-772-00	PIN,CLEVIS,3/8 X 1 1/8 IN.	1
	88-527-11	1/8 X 1 STEEL COTTER PIN	1
10	503479	E-HITCH ASSY 1-1/4 PIN W/RAMP	1
11	88-151-16	1/2X2 NF HEX HD SCREW,GR-5	8
	88-159-61	1/2 WASHER, HEAVY DUTY	8
	88-159-84	LOCKNUT,NY-LOCK, 1/2-20 NF	8

Front Bumper			
ITEM #	PART #	DESCRIPTION	QTY
-	01-426-10	Bumper	1
-	88-199-87	5/8NC x 2 Carraige bolt	8
-	88-188-66	5/8 Flat washer (between bumper and frame)	8
-	88-199-88	5/8NC Hex lock nut	8

Charger

ITEM #	PART #	DESCRIPTION	QTY
	K4G-CH-002	Battery Charger	1

Battery

ITEM #	PART #	DESCRIPTION	QTY
	K4G-BA-002	Battery	1

Appendixes

Contents

APPENDIX A: SPECIAL TOOLS

DESCRIPTION	PURPOSE	PART NUMBER
Test Light	Used for testing electrical circuits. Powered by the truck batteries, switchable for 12, 24, 36, and 48 volts.	62-027-00
Accelerator Test Harness	Used to test the solid state accellerator module part number series 62-033-XX.	62-027-31
Sevcon® Handset Analyzer (read only)	Used to test the Sevcon® control systems and reset the Smart View display (includes instructions).	62-027-61
Sevcon® Handset Analyzer with Speed Adjust Capability	Same as 62-027-61 (above) plus allows a limited range of speed adjustment.	62-027-62
Disc Brake Boot Installation Tool	Used to install the rubber boot on all disc brake bodies.	41-350-13
Pin Removing Tool	Used to remove pins and sockets from AMP connectors.	75-440-55
Pin Removing Tool	Used to remove pins and sockets from MOLEX connectors.	75-442-55
Hydrometer	Used to check the specific gravity of battery electrolyte.	77-200-00
Battery Filler	Used to safely add water to batteries.	77-201-00

APPENDIX B: SUGGESTED TORQUE LIMITS FOR STANDARD HARDWARE

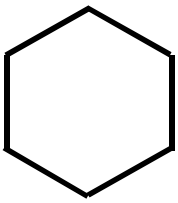
HARDWARE IDENTIFICATION

Standard Head Markings

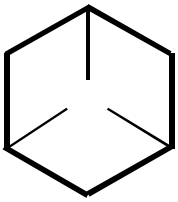
NOTE: Torque value used should be for lowest grade of hardware used. If a grade 2 nut is used on a grade 8 bolt, use grade 2 torque value.

NOTE: Toque values specified are for clean dry threads.

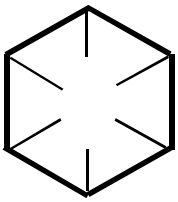
Hex Bolts



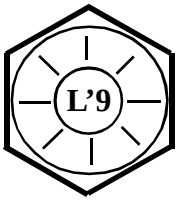
S.A.E. Grade 2



S.A.E. Grade 5



S.A.E. Grade 8



L'9

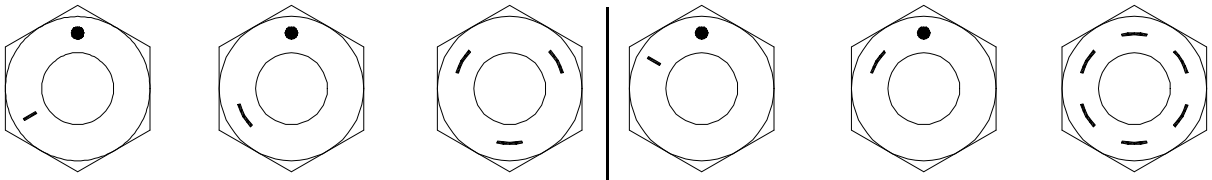
Other Bolts

Truss Head, grade 2

Carriage Bolt, grade 2 (unless marked as above)

Hex Nuts

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

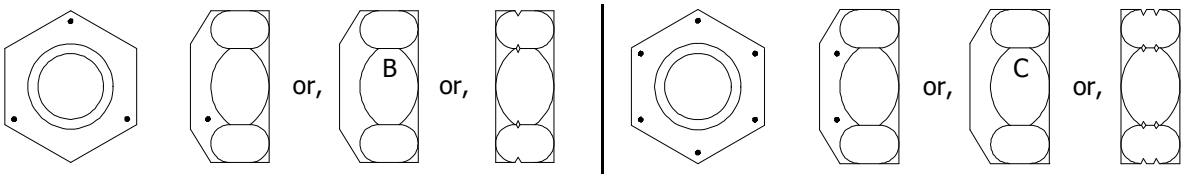


S.A.E. Grade 5 | *S.A.E. Grade 8*

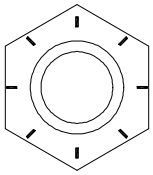
Hex Lock Nuts (stover)

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

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



S.A.E. Grade B | *S.A.E. Grade C*



Grade L'9

Other Nuts

Other nuts used by Taylor-Dunn® should be treated as S.A.E. grade A

Suggested Torque Values (non-critical hardware)

Diameter and TPI	Grade 2 Tightening Torque (ft-lb)	Grade 5 Tightening Torque (ft-lb)	Grade 8 Tightening Torque (ft-lb)	L'9 Tightening Torque (ft-lb)
1/4-20	4-7	7-10	10-14	11
1/4-28	5-8	8-12	11-16	12
5/16-18	9-14	14-21	20-29	22
5/16-24	10-15	15-23	22-33	25
3/8-16	16-24	25-37	35-52	40
3/8-24	18-27	28-42	40-59	45
7/16-14	26-38	40-59	56-84	65
7/16-20	29-43	44-66	62-93	70
1/2-13	39-59	60-90	85-128	95
1/2-20	44-66	68-102	96-144	110
9/16-12	56-84	87-131	123-184	140
9/16-18	63-94	97-146	137-206	160
5/8-11	78-117	120-180	170-254	195
5/8-18	88-132	136-204	192-288	225
3/4-10	138-207	213-319	301-451	350
3/4-16	154-231	238-357	336-504	390
7/8-9	222-334	344-515	485-728	565
7/8-14	245-367	379-568	534-802	625
1-8	333-500	515-773	727-1091	850
1-14	373-560	577-866	815-1222	930
1.125-7	472-708	635-953	1030-1545	1700
1.125-12	530-794	713-1069	1156-1733	1850
1.25-7	666-999	896-1344	1454-2180	2950
1.25-12	738-1107	993-1489	1610-2414	3330

SUGGESTED TORQUE VALUES *(critical hardware)*

Torque Table

Group	Description	Torque Range Ft-Lbs	In-Lbs	Nm
Brakes				
	Brake bolt (disc brake body)	11 - 11	132 - 132	15 - 15
	Brake line tube nut fittings	12 - 13	144 - 156	16.3 - 17.7
	Brake spider bolts (Dana 160mm hyd brakes)	25 - 35	300 - 420	34 - 47.6
	Brake spider bolts (Dana 160mm mech brakes)	15 - 19	180 - 228	20.4 - 25.8
	Brake spider bolts (Dana 7x1-3/4 brakes)	16 - 20	192 - 240	21.8 - 27.2
Electrical				
	Battery terminals	8 - 9	96 - 108	10.9 - 12.2
Front Axle				
	Front spindle nut	-	-	-
	Note: Refer to maintenance section in the service manual			
	King pin	-	-	-
	Note: Refer to maintenance section in the service manual			
Rear Axle/Transmission				
	3rd member Gear case cover (GT drive)	45 - 50	540 - 600	61.2 - 68
	Axle bolt (GT drive)	275 - 275	3300 - 3300	374 - 374
	Axle hub nut (Dana)	95 - 115	1140 - 1380	129.2 - 156.4
	Axle tube to center section (Dana F-N-R)	25 - 35	300 - 420	34 - 47.6
	Carrier cap bolts (Dana)	100 - 120	1200 - 1440	136 - 163.2
	Differential Cover plate (Dana H12)	18 - 25	216 - 300	24.5 - 34
	Drain plug (Dana H12)	25 - 40	300 - 480	34 - 54.4
	Drain plug (GT drive)	21 - 25	252 - 300	28.6 - 34
	Gear case to 3rd member (GT drive)	18 - 20	216 - 240	24.5 - 27.2
	Motor mounting (GT/Dana)	6.5 - 7	78 - 84	8.8 - 9.5
	Pinion nut (F2/F3)	175 - 175	2100 - 2100	238 - 238
	Pinion nut (GT drive)	154 - 169	1848 - 2028	209.4 - 229.8
	Ring gear (Dana)	35 - 45	420 - 540	47.6 - 61.2
	Wheel lug nut	75 - 90	900 - 1080	102 - 122.4
Steering				
	Ball joint clamp	28 - 32	336 - 384	38.1 - 43.5
	Ball joint nut	40 - 45	480 - 540	54.4 - 61.2
	Pitman nut (18-308-21 steering gear)	75 - 100	900 - 1200	102 - 136
	Pitman nut (18-308-25 steering gear)	181 - 217	2172 - 2604	246.2 - 295.1
	Rod end nut	20 - 25	240 - 300	27.2 - 34
	Steering shaft pinch bolt	24 - 26	288 - 312	32.6 - 35.4
	Steering wheel nut (18-308-21 steering gear)	28 - 32	336 - 384	38.1 - 43.5
	Steering wheel nut (18-308-25 steering gear)	72 - 86	864 - 1032	97.9 - 117
Suspension				
	Leaf spring hangers	-	-	-
	Note: Refer to maintenance section in the service manual			

APPENDIX C: BRAKE LINING HANDLING PRECAUTIONS

⚠WARNING

Taylor-Dunn does not currently supply asbestos fiber-brake pads/shoes with any vehicle. However, there is the possibility that the original brake pads/shoes were replaced with aftermarket pads/shoes containing asbestos. Since this possibility does exist, the brake pads/shoes should be handled as if they do contain asbestos.

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

Do not grind, sand, break, or chisel the brake pads/shoes, as this will cause unnecessary dust, possibly releasing asbestos fibers in the air.

Always wear protective clothing and a respirator when working on the brake pads/shoes or their associated components.

Inhaled asbestos fibers have been found to cause cancer and respiratory diseases.

Do not drive the vehicle if any worn or broken part is detected in any part of the brake system. The cause of the damage must be repaired immediately.

APPENDIX D: MANUFACTURER PART NUMBER CROSS REFERENCE

Component:	Vendor Part Number:	Vendor Name:
17-108-00	2X569 (3PER PKG)	GRAINGER INC
18-308-21	7842236	WAT DIRECCIONES, C/O RIC
19-005-00	3162	SPEED WAREHOUSE
19-005-17	677	SPEED WAREHOUSE
32-240-40	06DU06	RYERSON TULL
32-240-41	06FDU08	GARLOCK BEARINGS
41-348-70	39529	AUSCO PRODUCTS INC
41-350-10	PLENCO 06553	C & H MOLDING INC
44-440-83	3.28683.3	GRAZIANO TRANSMISSION SPA
45-338-00	0753600	TITAN TIRE CORPORATION
500128	C/H 956-3124	TIGER MFG CORP
502136	FCS-1	T-H MARINE SUPPLIES INC
51-344-80	H29A01A06A1P	CLYDESDALE JONES & CO
70-057-40	DV1-4003	ADVANCED D C MOTORS INC
71-039-02	VJDAS00B-AZC00-000	WES-GARDE COMPONENTS
71-039-11	V151S00B-AZC00	WES-GARDE COMPONENTS
71-039-21	VHP	WES-GARDE COMPONENTS
71-110-00	CH# 8629	COLE HERSEE CO
71-124-00	ED252 1	CURTIS INSTRUMENTS INC
71-134-50	P2798B00	CLYDESDALE JONES & CO
71-210-11	13220825/2028-551A	CURTIS INSTRUMENTS INC
71-210-13	13220672	CURTIS INSTRUMENTS INC
71-303-01	0332209150	WES-GARDE COMPONENTS
72-025-20	0332122	JW SPEAKER CORP
73-005-04	64F335	NEWARK ELECTRONICS
73-012-30	622/11088	SEVCON INC
74-010-00	604/60017	SEVCON INC
75-152-91	184/21970-4.9M	SEVCON INC
78-010-30	15600-06-21	PARTS PACIFIC
79-820-03	221-10-0-00 ATC	COOPER BUSSMANN INC
79-840-00	121A10-B2P-HA	COLE HERSEE CO
79-840-20	121A20-B20-HA	COOPER BUSSMANN INC
79-844-20	7855-7-200	TEXAS INSTRUMENTS INC
80-017-00	L44643	FIT BEARING
80-309-00	T88	TIMKEN CORPORATION
80-400-10	ASF107-1D	FREEWAY CORPORATION
80-505-20	RW-902-2834	GREEN BEARING
85-195-00	GS-7199	SERVICE PLUS DISTRIBUTORS INC
85-195-01	BS-1005	SERVICE PLUS DISTRIBUTORS INC
85-195-02	SC-1006	SERVICE PLUS DISTRIBUTORS INC
86-007-00	61022240X	ARVIN RIDE CONTROL PRODUCTS
86-501-98	86-501-98	JOSEPH INDUSTRIES INC
86-501-99	98-200-00	JOSEPH INDUSTRIES INC
86-510-00	C5469-H	MASON FORGE & DIE INC
86-521-98	PML-10 G	ALINABAL INC
86-521-99	PM 10G	ALINABAL INC
89-113-30	M1230D9338	Not available at time of printing
89-113-60	M12D127B	EXCELL ENG INC
90-160-60	126288	GRAMMER INC
92-104-01	1428600	TITAN TIRE CORPORATION

APPENDIX E: SUGGESTED SPARE PARTS LIST

Component	*Description*	**Qty*
12-158-10	HUB,W/DISC,5 STUD,1 IN BRG	2
13-734-35	TIRE,SFTSLD,4X8,MONO,LUG,5H>	4
32-200-00	BSHNG,7/8IDX1OD,FLG,W/GROOVE	2
32-204-10	BUSHING,BRONZE,7/8 IDX1-1/8 OD	4
32-240-41	BEARING FLNGED,BAKED TFLON 3/8	6
41-348-70	PAD,DISC BRAKE	8
41-490-11	BRAKE ROTOR, 36 TOOTH SPLINE	1
45-338-00	SEAL,1.25 ID,1.983 OD.395W	1
500128	SWITCH,IGNITION,KEYLESS	1
502136	SWITCH, FOOT/HORN	1
62-030-21	ACCELERATOR,ASSEMBLY,0-5V,C425	1
62-400-10	CONTROLLER,SEM,PWRPAK500A24/48	1
70-057-40	MOTOR, 5.7/11.5/16.3HP,SEM,19T	1
71-039-02	SWITCH,CONTURA,F/R SELECTOR	1
71-039-11	SWITCH,CONTURA,ON/OFF SELECTOR	1
71-110-00	SWITCH,BRAKE LIGHT,HYD.	1
71-124-00	SWITCH,EMERGENCY DISCONNECT	1
71-134-50	SWITCH KIT,FOR 5134480/85	1
71-210-13	CONTACTOR,ISO,SW200A,24V,AUX C	1
71-303-01	RELAY,SPDT,12V COIL,20/30A	2
72-025-03	HEADLITE ASSY	1
72-025-20	TAIL LIGHT, STOP,TURN,TAIL,BU	2
73-004-20	HORN,12V,SHORT MOUNT,PWR PANEL	1
73-005-04	ALARM,PULSE,6-16VDC,80-95DB	1
73-012-30	DC-DC CONV,36-48V,13.4V,300W	1
79-820-03	CIRCUIT BREAKER,ATC,10 AMP	3
79-840-00	CIRCUIT BREAKER,10 AMP,AUTO	1
79-840-20	CIRCUIT BREAKER,20A AUTO-RESET	2
79-844-20	CIR BRKR,200A,AUTO RESET	1
80-017-00	1 IN. ID TAPERED BRG	3
80-309-00	7/8 IN. THRUST BRG	2
80-400-10	3/4 IN. SEALED BALL BRG	2
80-505-20	BALL BRG,RR AXLE,2.83OD,1.53ID	1
85-142-00	SPRING, COMP, 2.59 OD X 6.25	2
85-195-00	SPRING,GAS CHARGED,BALL ENDS	2
86-007-00	SHOCK ABSORBER, 8.375 EYE-EYE	4
86-501-98	BALL JOINT,F1 & P2,LEFT,W/ZERK	3
86-501-99	BALL JOINT,F1& P2,RIGHT,W/ZERK	3
86-521-98	ROD END,5/8,MALE,LEFT	1
86-521-99	ROD END,5/8,MALE,RIGHT	5
94-422-10	GREASE,ELECTRICAL,DOW CORN'G#4	**
94-422-21	HEATSINK 340 PASTE,13.5OZ	**

** - Quantity indicated is what is used on one vehicle. Quantity to be kept on hand as spare parts to be determined by the end user taking into account the total number of vehicles in service.*

*** - Quantity required varies or is not defined.*

APPENDIX D: MANUFACTURER PART NUMBER CROSS REFERENCE

Component:	Vendor Part Number:	Vendor Name:
17-108-00	2X569 (3PER PKG)	GRAINGER INC
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19-005-17	677	SPEED WAREHOUSE
32-240-40	06DU06	RYERSON TULL
32-240-41	06FDU08	GARLOCK BEARINGS
41-348-70	39529	AUSCO PRODUCTS INC
41-350-10	PLENCO 06553	C & H MOLDING INC
44-440-83	3.28683.3	GRAZIANO TRANSMISSION SPA
45-338-00	0753600	TITAN TIRE CORPORATION
500128	C/H 956-3124	TIGER MFG CORP
502136	FCS-1	T-H MARINE SUPPLIES INC
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71-124-00	ED252 1	CURTIS INSTRUMENTS INC
71-134-50	P2798B00	CLYDESDALE JONES & CO
71-210-11	13220825/2028-551A	CURTIS INSTRUMENTS INC
71-210-13	13220672	CURTIS INSTRUMENTS INC
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72-025-20	0332122	JW SPEAKER CORP
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74-010-00	604/60017	SEVCON INC
75-152-91	184/21970-4.9M	SEVCON INC
78-010-30	15600-06-21	PARTS PACIFIC
79-820-03	221-10-0-00 ATC	COOPER BUSSMANN INC
79-840-00	121A10-B2P-HA	COLE HERSEE CO
79-840-20	121A20-B20-HA	COOPER BUSSMANN INC
79-844-20	7855-7-200	TEXAS INSTRUMENTS INC
80-017-00	L44643	FIT BEARING
80-309-00	T88	TIMKEN CORPORATION
80-400-10	ASF107-1D	FREEWAY CORPORATION
80-505-20	RW-902-2834	GREEN BEARING
85-195-00	GS-7199	SERVICE PLUS DISTRIBUTORS INC
85-195-01	BS-1005	SERVICE PLUS DISTRIBUTORS INC
85-195-02	SC-1006	SERVICE PLUS DISTRIBUTORS INC
86-007-00	61022240X	ARVIN RIDE CONTROL PRODUCTS
86-501-98	86-501-98	JOSEPH INDUSTRIES INC
86-501-99	98-200-00	JOSEPH INDUSTRIES INC
86-510-00	C5469-H	MASON FORGE & DIE INC
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86-521-99	PM 10G	ALINABAL INC
89-113-30	M1230D9338	Not available at time of printing
89-113-60	M12D127B	EXCELL ENG INC
90-160-60	126288	GRAMMER INC
92-104-01	1428600	TITAN TIRE CORPORATION

B2-48 With Dump Bed Option

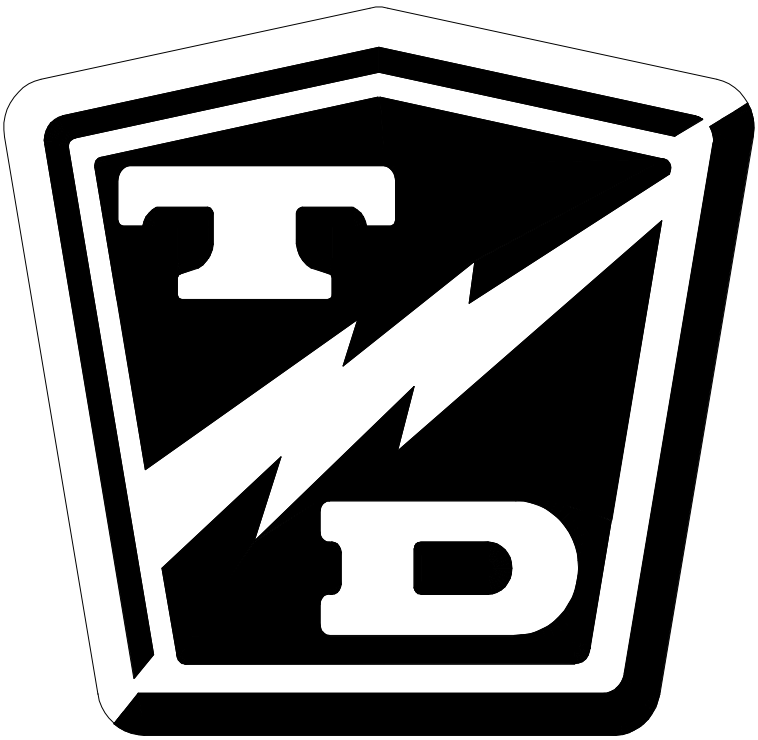
B2-10 Ambulance

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



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