REPAIR AND SERVICE MANUAL

TRACKER

699322- A
Issued May 2019

SAFETY

For any questions on material contained in this manual, contact an authorized representative for clarification.

Read and understand all labels located on the vehicle. Always replace any damaged or missing labels.

The following symbols appear throughout this manual and on your vehicle. Your safety is involved when these symbols are used. Become familiar with their meanings before reading the manual.

⚠ DANGER **DANGER indicates a hazardous situation that, if not avoided, will result in death or serious injury.**

⚠ WARNING **WARNING indicates a hazardous situation, if not avoided, could result in death or serious injury.**

⚠ CAUTION **CAUTION indicates a hazardous situation that, if not avoided, could result in minor or moderate injury.**

⚠ WARNING **Failure to comply with the warnings in this manual can result in severe injury or death.**

⚠ WARNING **Read this entire manual carefully before operating this vehicle. Do not attempt to operate this vehicle until you have thorough knowledge of the controls and features.**

⚠ WARNING **Regular inspections and maintenance, along with good operating techniques, will help ensure your safe enjoyment of the capabilities and reliability of this vehicle.**

MANUFACTURER'S INTENDED USE

This vehicle is designed and manufactured in the United States of America (USA). The standards and specifications listed in the following text originate in the USA unless otherwise indicated.

EXHAUST EMISSION

The exhaust emissions of this vehicle's engine complies with regulations set forth by the Environmental Protection Agency (EPA) of the United States of America (USA) at time of manufacture. Significant fines could result from modifications or tampering with the engine, fuel ignition or air intake systems.

BATTERY PROLONGED STORAGE

Batteries discharge over time. The rate of discharge changes according to the ambient temperature, the age and condition of the batteries.

Completely charged batteries will not freeze in winter temperatures unless the temperature is less than -75°F (- 60°C).

BATTERY DISPOSAL

Lead-acid batteries are recyclable. Return discarded batteries to distributor, manufacturer or lead smelter for recycling. For neutralized spills, put residue in acid-resistant containers with absorbent material such as sand. Dispose in accordance with local, state and federal regulations for acid and lead compounds. Contact local or state environmental authorized people for the disposal information.

(NOTICE, CAUTION AND WARNING CONTINUED ON INSIDE OF BACK COVER)

SERVICE AND REPAIR MANUAL

GASOLINE POWERED GOLF CAR

TRACKER LS2

Starting Model Year 2020

Never modify the vehicle in any way that will alter the weight distribution of the vehicle, decrease its stability or increase the speed beyond the factory specifications. Such modifications can cause serious personal injury or death. The manufacturer prohibits and disclaims responsibility for any such modifications or any other alteration which would adversely affect the safety of the vehicle.

The manufacturer reserves the right to incorporate engineering and design changes to products in this manual, without obligation to include these changes on units sold previously.

The information contained in this manual may be revised periodically by the manufacturer, and therefore is subject to change without notice.

THE MANUFACTURER DISCLAIMS LIABILITY FOR ERRORS IN THIS MANUAL, and SPECIFICALLY DISCLAIMS LIABILITY FOR INCIDENTAL AND CONSEQUENTIAL DAMAGES resulting from the use of the information and materials in this Manual.

These are the original instructions as defined by 2006/42/EC.

MANUFACTURER INFORMATION:

Textron Specialized Vehicles, Inc.

1451 Marvin Griffin Road

Augusta, Georgia, USA 30906-3852

Dealer: 800-296-4804

Consumer: 877-394-6727

www.trackeroffroad.com

This vehicle has been designed and manufactured in the United States of America (USA) as a 'World Vehicle'. The Standards and Specifications listed in the following text originate in the USA unless otherwise indicated.

The use of non Original Equipment Manufacturer (OEM) approved parts may void the warranty.

Tampering with or adjusting the governor to permit vehicle to operate at above factory specifications will void the vehicle warranty.

When servicing engines, all adjustments and replacement components must be per original vehicle specifications in order to maintain the United States of America Federal and State emission certification applicable at the time of manufacture.

BATTERY PROLONGED STORAGE

All batteries will self discharge over time. The rate of self discharge varies depending on the ambient temperature and the age and condition of the batteries.

A fully charged battery will not freeze in winter temperatures unless the temperature falls below -75° F (-60° C).

Read all of SAFETY and this section before attempting any procedure. Pay particular attention to Notices, Cautions, Warnings and Dangers.

SAFETY INFORMATION

This manual has been designed to assist in maintaining the vehicle in accordance with procedures developed by the manufacturer. Adherence to these procedures and troubleshooting tips will ensure the best possible service from the product. To reduce the chance of personal injury or property damage, the following must be carefully observed:

⚠ CAUTION ***Certain replacement parts can be used independently and/or in combination with other accessories to modify the vehicle to permit the vehicle to operate at or in excess of 20 mph on public streets or roads. When a vehicle is modified in any way by the Distributor, Dealer or customer to operate at or in excess of 20mph, UNDER FEDERAL LAW the modified product will be a Low Speed Vehicle (LSV) subject to the strictures and requirements of Federal Motor Vehicle Safety Standard 571.500. In these instances, pursuant to Federal law the Distributor or Dealer MUST equip the product with headlights, rear lights, turn signals, seat belts, top, horn and all other modifications for LSV's mandated in FMVSS 571.500, and affix a Vehicle Identification Number to the product in accordance with the requirements of FMVSS 571.565. Pursuant to FMVSS 571.500, and in accordance with the State laws applicable in the places of sale and use of the product, the Distributor, Dealer or customer modifying the vehicle also will be the Final Vehicle Manufacturer for the LSV, and required to title or register the vehicle as mandated by State law.***

Information on FMVSS 571.500 can be obtained at Title 49 of the Code of Federal Regulations, section 571.500, or through the Internet at the website for the U.S. Department of Transportation - at Dockets and Regulation, then to Title 49 of the Code of Federal Regulations (Transportation).

The manufacturer will NOT approve Distributor, Dealer or customer modifications converting the vehicles into LSV's.

The manufacturer, in addition, recommends that all products sold as personal transportation vehicles BE OPERATED ONLY BY PERSONS WITH VALID DRIVERS LICENSES, AND IN ACCORDANCE WITH APPLICABLE STATE REQUIREMENTS. This restriction is important to the SAFE USE AND OPERATION of the product.

GENERAL

Many vehicles are used for a variety of tasks beyond the original intended use of the vehicle; therefore, it is impossible to anticipate and warn against every possible combination of circumstances that may occur. No warnings can take the place of good common sense and prudent driving practices.

Good common sense and prudent driving practices do more to prevent accidents and injury than all of the warnings and instructions combined. The manufacturer strongly suggests that all users and maintenance personnel read this entire manual paying particular attention to the CAUTIONS and WARNINGS contained therein.

If you have any questions regarding this vehicle, contact your closest representative or write to the address on the back cover of this publication, Attention: Product Service Department.

The manufacturer reserves the right to make design changes without obligation to make these changes on units previously sold and the information contained in this manual is subject to change without notice.

The manufacturer is not liable for errors in this manual or for incidental or consequential damages that result from the use of the material in this manual.

This vehicle conforms to the current applicable standard(s) for safety and performance requirements.

These vehicles are designed and manufactured for off-road use. They do not conform to Federal Motor Vehicle Safety Standards of the United States of America (USA) and are not equipped for operation on public streets. Some communities may permit these vehicles to be operated on their streets on a limited basis and in accordance with local ordinances.

Refer to GENERAL SPECIFICATIONS for vehicle seating capacity.

Never modify the vehicle in any way that will alter the weight distribution of the vehicle, decrease its stability or increase the speed beyond the factory specification. Such modifications can cause serious personal injury or death. Modifications that increase the speed and/or weight of the vehicle will extend the stopping distance and may reduce the stability of the vehicle. Do not make any such modifications or changes. The manufacturer prohibits and disclaims responsibility for any such modifications or any other alteration which would adversely affect the safety of the vehicle.

SAFETY INFORMATION

Read all of SAFETY and this section before attempting any procedure. Pay particular attention to Notices, Cautions, Warnings and Dangers.

Vehicles that are capable of higher speeds must limit their speed to no more than the speed of other vehicles when used in a golf course environment. Additionally, speed should be further moderated by the environmental conditions, terrain and common sense.

GENERAL OPERATION

Always:

- Use the vehicle in a responsible manner and maintain the vehicle in safe operating condition.
- Read and observe all warnings and operation instruction labels affixed to the vehicle.
- Follow all safety rules established in the area where the vehicle is being operated.
- Reduce speed to compensate for poor terrain or conditions.
- Apply service brake to control speed on steep grades.
- Maintain adequate distance between vehicles.
- Reduce speed in wet areas.
- Use extreme caution when approaching sharp or blind turns.
- Use extreme caution when driving over loose terrain.
- Use extreme caution in areas where pedestrians are present.

MAINTENANCE

Always:

- Maintain the vehicle in accordance with the manufacturer's SCEDULED MAINTENANCE CHART.
- Ensure that repairs are performed by those that are trained and qualified to do so.
- Follow the manufacturer's maintenance procedures for the vehicle. Be sure to disable the vehicle before performing any maintenance. Disabling includes removing the key from the key switch and removal of a battery wire.

Read all of SAFETY and this section before attempting any procedure. Pay particular attention to Notices, Cautions, Warnings and Dangers.

- Insulate any tools used within the battery area in order to prevent sparks or battery explosion caused by shorting the battery terminals or associated wiring. Remove the battery or cover exposed terminals with an insulating material.
- Use specified replacement parts. Never use replacement parts of lesser quality.
- Use recommended tools.
- Determine that tools and procedures not specifically recommended by the manufacturer will not compromise the safety of personnel nor jeopardize the safe operation of the vehicle.
- Support the vehicle using wheel chocks and jack stands. Never get under a vehicle that is supported by a jack. Lift the vehicle in accordance with the manufacturer's instructions.
- Empty the fuel tank or plug fuel hoses to prevent fuel leakage.
- Maintain the vehicle in an area away from exposed flame or persons who are smoking.
- Be aware that a vehicle that is not performing as designed is a potential hazard and must not be operated.
- Test drive the vehicle after any repairs or maintenance. All tests must be conducted in a safe area that is free of both vehicular and pedestrian traffic.
- Replace damaged or missing warning, caution or information labels.
- Keep complete records of the maintenance history of the vehicle.

The manufacturer cannot anticipate all situations, therefore people attempting to maintain or repair the vehicle must have the skill and experience to recognize and protect themselves from potential situations that could result in severe personal injury or death and damage to the vehicle. Use extreme caution and, if unsure as to the potential for injury, refer the repair or maintenance to a qualified mechanic.

VENTILATION

Always store gasoline vehicles in a well ventilated area. Ventilation prevents gasoline fumes from accumulating.

Never fuel a vehicle in an area that is subject to flame or spark. Pay particular attention to natural gas or propane water heaters and furnaces.

Never work around or operate a vehicle in an environment that does not ventilate exhaust gases from the area. Carbon monoxide is a dangerous gas that can cause unconsciousness and is potentially lethal.

Read all of SAFETY and this section before attempting any procedure. Pay particular attention to Notices, Cautions, Warnings and Dangers.

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GENERAL INFORMATION AND ROUTINE MAINTENANCE

SERIAL NUMBER PLATE

Two serial number and manufacture date code labels are on the vehicle. One is on the body below the front, driver side of the seat. The other two are located on the chassis under the seat. The serial number is also engraved on the flat portion of the frame rail.

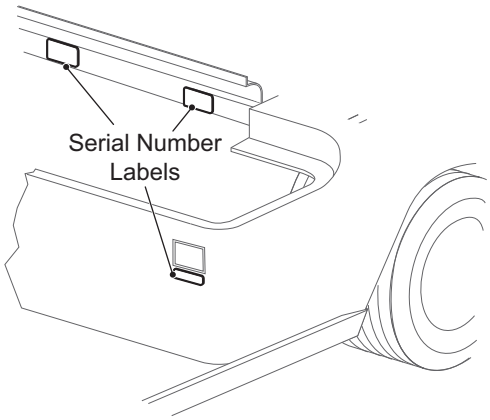


Fig. 1 Serial Number Plate & Location

Design changes take place on an ongoing basis. In order to obtain correct components for the vehicle, the manufacture date code, serial number and vehicle model must be provided when ordering service parts.

STARTING THE VEHICLE WITH A DISCHARGED BATTERY

⚠WARNING ***Do not attempt to 'jump start' a vehicle using another vehicle.***

The vehicle is equipped with a starter/generator. When starting the engine, the starter/generator functions as a starter and with the engine running, it functions as a generator.

With the short running times associated with this kind of vehicle, the generator is more than adequate to maintain the battery charge level. The generator is not designed to charge a discharged battery.

Since the engine stops when the accelerator is released, **jump starting should not be attempted**.

If the vehicle is equipped with lights and/or accessories that are used when the vehicle is not in motion, the starter/generator may not be adequate to maintain battery charge. In this situation, the battery may require charging with a 12V 10 amp max charger.

Observe all instructions provided by the manufacturer of the charger.

SERVICING THE VEHICLE

⚠WARNING ***To prevent severe injury or death, resulting from improper servicing techniques, observe the following Warnings:***

Do not attempt any type of servicing operations before reading and understanding all notice, cautions and warnings in this manual.

Any servicing requiring adjustments to be made to the powertrain while the motor is running must be made with both drive wheels raised.

Wear eye protection when working on the vehicle. In particular, use care when working around batteries, or using solvents or compressed air.

To reduce the possibility of causing an electrical arc, which could result in a battery explosion, turn off all electrical loads from the batteries before removing any heavy gauge battery wires.

To prevent the possibility of motor disintegration, never operate vehicle at full throttle for more than 4 - 5 seconds while vehicle is in a "no load" condition.

It is in the best interest of both vehicle owner and servicing dealer, to carefully follow the procedures recommended in this manual. Adequate preventative maintenance, applied at regular intervals, is the best guarantee for keeping the vehicle both dependable and economical.

In any product, components will eventually fail to perform properly as the result of normal use, age, wear or abuse.

It is virtually impossible to anticipate all possible component failures or the manner in which each component may fail.

A vehicle requiring repair indicates the vehicle is no longer functioning as designed and should be considered potentially hazardous. Use extreme care when working on a vehicle. When diagnosing, removing or replacing any components that are not operating properly, consider the safety of yourself and those around you, should the component move unexpectedly.

Some components are heavy, spring loaded, highly corrosive, explosive, may produce amperage or reach high temperatures. Gasoline, carbon monoxide, battery acid and hydrogen gas could result in serious bodily injury to the technician/mechanic and bystanders, if not treated with the utmost caution. Be careful not to place hands, face, feet or body in a location that could expose them to

injury should an unforeseen dangerous situation occur.

Always use the appropriate tools listed in the tool list and wear approved safety equipment.

Before a new vehicle is put into operation, it is recommended the items shown in the INITIAL SERVICE CHART be performed.

ITEM	SERVICE OPERATION
Battery	Charge battery
Seats	Remove protective plastic covering
Brakes	Check operation and adjust if necessary
	Establish new vehicle braking distance
Tires	Check pressure Tire size : 20X10X10 - (26-32 Psi) : 10X7 - (18 Psi)
Fuel	Fill tank with correct fuel
Engine	Check oil level

Fig. 2 Initial Service Chart

FUEL

⚠ WARNING ***To decrease the risk of severe injury or death from improper fuel handling:***

Do not smoke near the fuel tank.

Do not add fuel near open flame or electrical items that can cause a spark.

Always handle gasoline in a well ventilated area.

Always wear eye protection to protect against splashed fuel and fuel vapors.

Inspect the fuel cap, tank and other components for leaks or damage that can cause a hazardous condition.

⚠ CAUTION ***Oxygenated or reformulated gasoline, is mixed with alcohols or ethers. Excessive amounts of these blends can damage the fuel system or cause performance problems. If any operating problems occur, use gasoline with a lower percentage of alcohol or ether.***

Use clean regular grade unleaded fuel. The Ethanol blend fuel up to 10% is permitted.

Do not use gasoline that contains methanol.

High altitude or heavy use/load applications can benefit from higher octane gasoline.

FUEL TANK

The fuel tank is located under the seat, on the passenger side of the vehicle. Fill tank with fresh, clean, automotive grade, unleaded, 87 octane (minimum) gasoline. Heavy use/load applications may benefit from higher octane gasoline. The fuel tank is designed to allow for fuel expansion and does not require space below the bottom of the filler neck.

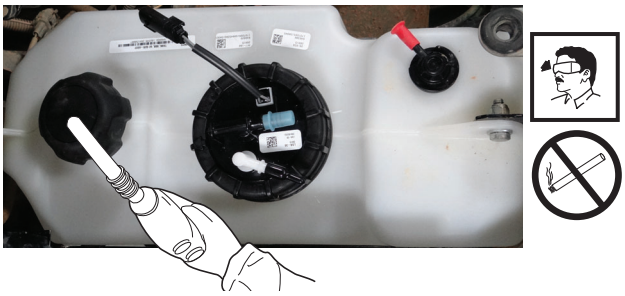


Fig. 3 Fuel Tank

⚠ WARNING ***When refueling, inspect the fuel tank cap for leaks or breaks in the housing that could result in fuel spillage.***

To prevent a possible explosion, do not smoke near the fuel tank or refuel near open fire or electrical items which could produce a spark.

Always wear safety glasses while refueling to prevent possible injury from gasoline or gasoline vapor.

Do not handle fuel in an area that is not adequately ventilated. Do not permit anyone to smoke in an area where vehicles are being fueled.

TOWING

⚠ WARNING ***To prevent personal injury, do not ride on vehicle being towed. Do not attempt to tow the vehicle with ropes, chains or any device other than a factory approved tow bar. Towing a disabled vehicle can be dangerous and requires extra caution. Attempting to tow with devices other than an approved tow bar may result in severe personal injury or death.***

⚠ CAUTION ***Place direction selector in neutral. The neutral lock should be used to lock the direction selector in position. This will reduce the possibility of it moving into 'F' (for -ward) or 'R' (reverse) while being towed, causing possible damage to the rear axle.***

Use extra caution when towing vehicle. Do not tow a single vehicle at speeds in excess of 12 mph (19 kph). Towing the vehicle at above recommended speed may result in personal injury and/or damage to vehicle and other property.

To operate neutral lock:

1. Turn the key switch to the OFF position.
2. Place the direction selector in the R (reverse) position.
3. Remove the seat.
4. Pull out (1) and rotate (2) the neutral lock pin handle so that the pointed portion of the handle is over the side of the direction selector cam.
5. Move the direction selector lever towards the area between the F (forward) position and the R (reverse) position. During that motion, the pin will snap into the hole in the direction selector mounting bracket, preventing any movement of the lever. When in this position, the direction selector remains locked in the neutral position.

⚠ WARNING ***Spring loaded mechanism. To prevent possibility of fingers becoming pinched in the direction selector mechanism, hold direction selector lever when releasing neutral lock pin handle.***

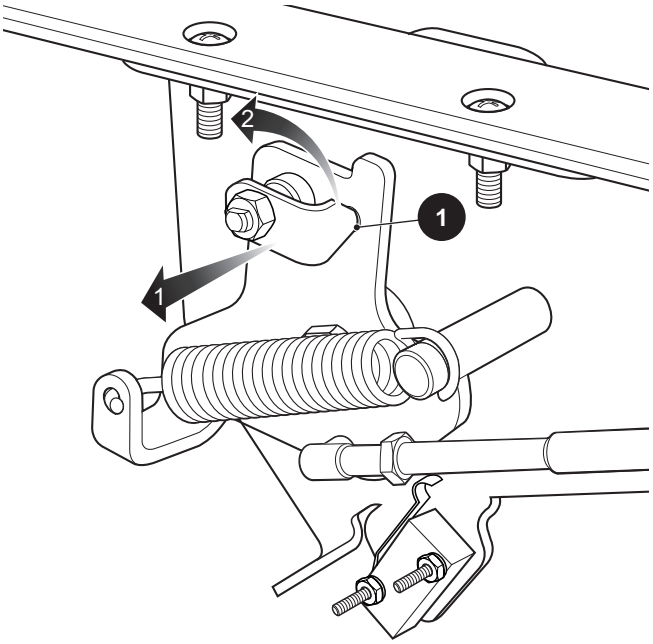


Fig. 4 Neutral Lock

To activate the direction selector pull the neutral lock pin handle out and rotate until the pointed portion of the handle fits into the hole (3) in the direction selector cam.

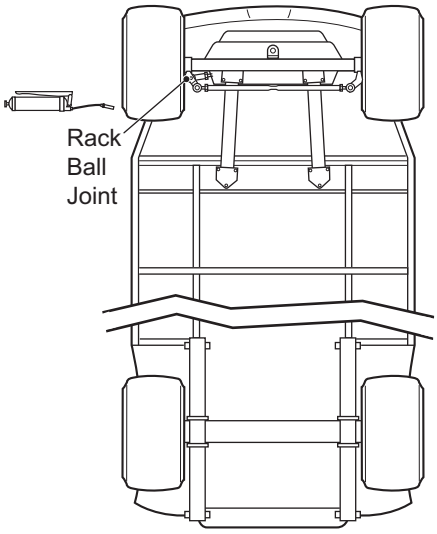
ROUTINE MAINTENANCE

This vehicle will give years of satisfactory service, providing it receives regular maintenance. Refer to SCEDULED MAINTENANCE CHART section for appropriate service intervals.

NOTICE: Some maintenance items must be serviced more frequently on vehicles used under severe driving conditions.

Periodic lubrication of the steering is recommended.

⚠ CAUTION ***Do not use more than three pumps of grease in each grease fitting at any one time. Excess grease may cause grease seals to fail or grease migration into areas that could damage components.***



View from Underside of Vehicle

Fig. 5 Lubrication Points

POWERTRAIN MAINTENANCE

Access the powertrain by raising or removing seat. Some service procedures may require the vehicle be lifted. Refer to LIFTING THE VEHICLE in the SAFETY section for proper lifting procedure and safety information.

For maintenance procedures relating to the engine, speed control, fuel system, transmission, rear axle, or suspension, refer to that particular section in this manual. See the TABLE OF CONTENTS for section location.

BRAKES

After the vehicle has been put into service, it is recommended that the brakes be checked by periodically conducting a brake performance test.

⚠ WARNING ***To prevent severe injury or death resulting from operating a vehicle with improperly operating brake system, the braking system must be properly maintained. All driving brake tests must be done in a safe location with regard for the safety of all personnel.***

NOTICE: .Over time, a subtle loss of performance may take place. Therefore, it is important to establish the standard with a new vehicle.

For test method and brake service, refer to MECHANICAL BRAKES section.

TIRES

Tire condition should be inspected on a daily basis. Inflation pressures should be checked on a weekly basis when the tires are cool. Be sure to reinstall valve dust cap after checking or inflating tire. For additional information, refer to WHEELS AND TIRES section.

TRANSPORTING THE VEHICLE

⚠ WARNING ***To prevent personal injury to occupants of other highway vehicles, be sure that the vehicle and contents are adequately secured to trailer.***

Do not ride on vehicle being trailered.

Maximum speed with top is 50 mph (80 kph).

If the vehicle is to be transported on a trailer at highway speeds, the seat bottom secured. Always check that the vehicle and contents are adequately secured before trailering the vehicle. The rated capacity of the trailer must exceed the weight of the vehicle (see GENERAL SPECIFICATIONS for vehicle weight) and load. Lock the parking brake and secure the vehicle to the trailer using ratchet tie downs.

WINTER OR PROLONGED STORAGE

⚠ WARNING ***Keep hands, clothing and jewelry away from moving parts. Use care not to contact hot objects. Raise the rear of the vehicle and support on jack stands before attempting to run the engine.***

Preparing the engine for winter or a prolonged storage calls for a few simple steps to prevent build up of varnish and gum in the fuel system and corrosion in the engine.

Place the direction selector in the neutral position and engage the neutral lock (Ref. Fig. 4). Add fuel stabilizer to the tank in accordance with the manufacturer's recommendations. Disconnect the fuel line from the engine **at the fuel tank**. With proper area of ventilation, start the engine and allow to run until the engine stops due to lack of fuel. Remove the air filter and spray a commercial fogging or cylinder oil into the fuel system while operating the starter for 2 - 3 seconds. Reinstall the air filter and reattach the fuel line to the tank.

CARE AND CLEANING OF THE VEHICLE

⚠ CAUTION ***When pressure washing vehicle, do not use pressure in excess of 700 psi. To prevent cosmetic damage, do not use any abrasive or reactive solvents to clean plastic parts.***

It is important that proper techniques and cleaning materials be used.

Normal cleaning of vinyl seats and plastic or rubber trim requires the use of a mild soap solution applied with a sponge or soft brush and wipe with a damp cloth.

Removal of oil, tar, asphalt, shoe polish, etc. will require the use of a commercially available vinyl/rubber cleaner.

The painted surfaces of the vehicle provide attractive appearance and durable protection. Frequent washing with lukewarm or cold water is the best method of preserving the painted surfaces.

Do not use hot water, strong soap or harsh chemical detergents.

Rubber parts should be cleaned with non-abrasive household cleaner.

Occasional cleaning and waxing with non-abrasive products designed for 'clear coat' automotive finishes will enhance the appearance and durability of the painted surfaces.

Corrosive materials used as fertilizers or for dust control can collect on the underbody of the vehicle. These materials could cause corrosion of underbody parts. It is recommended that the underbody be flushed occasionally with plain water. Thoroughly clean any areas where mud or other debris can collect. Sediment packed in closed areas should be loosened to ease it's removal, taking care not to chip or otherwise damage paint.

NOTICE: If the engine does not start or runs improperly after washing, remove the spark plug wire (by pulling the spark plug boots, never the wires) and blow them dry. Reinstall the wires. Remove moisture from coil by blowing across top.

VEHICLE CARE PRODUCTS

To help maintain the vehicle, the manufacturer has several products, available through a local Distributor, an authorized Branch, or the Service Parts Department, among them are:

- Touch-up paint specially formulated to match vehicle colors for use on both metal and TPE (plastic) bodies (P/N 28432G**).
- Multi-purpose Battery Protectant formulated to form a long-term, flexible, non-tacky, dry coating that will not crack, peel or flake over a wide temperature range (P/N 606312).
- Multi-purpose Hand Cleaner is an industrial strength cleaner containing no harsh solvents, yet gently lifts grease off hands. May be used with or without water (P/N 607636).

HARDWARE

Periodically the vehicle should be inspected for loose fasteners. Fasteners should be tightened in accordance with the Torque Specifications table (Ref. Fig. 6). Use care when tightening fasteners and refer to the sections in this manual for specific torque values.

Generally, two grades of hardware are used in the vehicle. Grade 5 hardware can be identified by the three marks on the hexagonal head. Unmarked hardware is Grade 2 (Ref. Fig. 6).

TORQUE SPECIFICATIONS

ALL TORQUE FIGURES ARE IN FT. LBS. (Nm)
Unless otherwise noted in text, tighten all hardware in accordance with this chart.
This chart specifies 'lubricated' torque figures. Fasteners that are plated or lubricated when installed are considered 'wet' and require approximately 80% of the torque required for 'dry' fasteners.

BOLT SIZE	1/4"	5/16"	3/8"	7/16"	1/2"	9/16"	5/8"	3/4"	7/8"	1"
Grade 2	4 (5)	8 (11)	15 (20)	24 (33)	35 (47)	55 (75)	75 (102)	130 (176)	125 (169)	190 (258)
Grade 5	6 (8)	13 (18)	23 (31)	35 (47)	55 (75)	80 (108)	110 (149)	200 (271)	320 (434)	480 (651)
Grade 8	6 (8)	18 (24)	35 (47)	55 (75)	80 (108)	110 (149)	170 (230)	280 (380)	460 (624)	680 (922)
BOLT SIZE	M4	M5	M6	M8	M10	M12	M14			
Class 5.8 (Grade 2)	1 (2)	2 (3)	4 (6)	10 (14)	20 (27)	35 (47)	55 (76.4)			
Class 8.8 (Grade 5)	2 (3)	4 (6)	7 (10)	18 (24)	35 (47)	61 (83)	97 (131)			
Class 10.9 (Grade 8)	3 (4)	6 (8)	10 (14)	25 (34)	49 (66)	86 (117)	136 (184)			

Fig. 6 Torque Specifications

RECOMMENDED FAULT TESTS

Ignition System

1. Disconnect the two pin connection from the ignition Coil. Turn the key to the ON position. Within 10 seconds, measure the voltage between the terminal #2 and the battery ground. Voltage should measure the same as the battery voltage.
2. Disconnect the two pin connection from the ignition coil. Measure for continuity between the terminal #2 at the ignition coil and the terminal #8 at the ECM.
3. Measure the spark plug gap. Make sure the gap is correct.
4. Replace the spark plug.
5. Replace the spark plug cap.
6. Reconnect the high tension lead, the ignition coil and the spark plug cap. Make sure the screw engages the center wires in high tension lead.
7. Check all connections. With the engine running, wiggle each connection. If the engine stops running or runs poorly, check for wire damage.
8. Replace the wiring harness.
9. Replace the ignition coil.
10. Measure the resistance between the IGN module mounting bolt and the high tension lead at the spark plug connection in the cap. Reading should be 13.7~14.7 kΩ.

Fuel Pump

1. Turn the key to the ON position.
2. Within 10 seconds, measure the voltage between terminal #1 at the fuel pump connection and the battery ground.
3. Verify input voltage to the pump is 9.0 to 15.0 VDC.

Read all of SAFETY and this section before attempting any procedure. Pay particular attention to Notices, Cautions, Warnings and Dangers.

Notes:

Read all of SAFETY and this section before attempting any procedure. Pay particular attention to Notices, Cautions, Warnings and Dangers.

Notes:

SAFETY

NOTICE, CAUTIONS AND WARNINGS

Throughout this manual, the following **NOTICE, CAUTIONS**, **WARNINGS and DANGERS** are used. For the protection of all personnel and the vehicle, be aware of and observe the following:

NOTICE: A NOTICE indicates a condition that should be observed.

⚠ CAUTION ***A CAUTION indicates a condition that may result in damage to the vehicle or surrounding facilities.***

⚠ WARNING ***A WARNING indicates a hazardous condition which could result in serious injury or death.***

IMPORTANT SAFETY WARNING

In any product, components will eventually fail to perform properly as the result of normal use, age, wear or abuse.

It is virtually impossible to anticipate all possible component failures or the manner in which each component may fail.

Be aware that a vehicle requiring repair indicates that the vehicle is no longer functioning as designed and therefore should be considered potentially hazardous. Use extreme care when working on any vehicle. When diagnosing, removing or replacing any components that are not operating correctly, take the time to consider the safety ramifications if the component should move unexpectedly.

Some components are heavy, spring loaded, highly corrosive, explosive or may produce high amperage or reach high temperatures. Gasoline, carbon monoxide, battery acid and hydrogen gas could result in serious bodily injury to the technician/mechanic and bystanders if not treated with utmost caution. Be careful not to place hands, face, feet or body in a location that could expose them to injury should an unforeseen situation occur.

Always use the appropriate tools listed in the tool list and wear approved safety equipment.

MODIFICATIONS TO VEHICLE

Do not modify the vehicle in any manner that will change the weight distribution of the vehicle.

⚠ WARNING ***Changes to the weight distribution or the center of gravity may make the vehicle unstable or prone to roll over which could result in injury or death to the operator or passenger(s).***

GENERAL MAINTENANCE

When any maintenance procedure or inspection is performed, it is important that care be exercised to insure the safety of the technician/mechanic or bystanders and to prevent damage to the vehicle.

Always read the **entire** relevant manual section (chapter) before attempting any inspection or service.

BEFORE SERVICING THE VEHICLE

Before attempting to inspect or service a vehicle, be sure to read the following warnings:

⚠ WARNING ***To prevent personal injury or death, observe the following:***

Before working on the vehicle, remove all jewelry (rings, watch, necklaces, etc.).

Be sure that no loose clothing or hair can become caught in the moving parts of the powertrain.

Use care not to contact hot objects.

Before attempting to operate or adjust the powertrain, the rear of the vehicle must be raised and supported on jack stands.

Wear OSHA approved clothing and eye protection when working on anything that could expose the body or eyes to potential injury. In particular, use care when working with or around batteries, compressed air or solvents.

Always turn the key switch to 'OFF' and remove the key before disconnecting a live circuit.

When connecting battery cables, pay particular attention to the polarity of the battery terminals. Never confuse the positive and negative cables.

Set the parking 'PARK' brake before performing any work on the vehicle.

If repairs are to be made that will require welding or cutting, the battery and fuel tank must be removed and the fuel system drained.

⚠ WARNING ***To prevent explosion that could result in severe personal injury or death, keep all smoking materials, open flame or sparks away from gasoline and batteries.***

Never operate the starter with the spark plugs removed unless the ignition system has been disabled and the engine/exhaust are cold. Fuel expelled from the cylinders could be ignited by the ignition system or

the hot exhaust system.

Never work on an engine that is hot.

Never test the ignition system without either connecting the spark plug lead to a tester or spare grounded spark plug.

If the spark function is to be observed at the spark plug, be sure to install a spare spark plug into the open cylinder before operating the starter.

Ensure that no fuel vapors are present that could be ignited by the test spark.

Never test the function of a fuel pump in the vicinity of a hot engine or other source of flame or combustion.

Wrap wrenches with vinyl tape to prevent the possibility of a dropped wrench from 'shorting out' a battery, which could result in an explosion and severe personal injury or death.

Aerosol containers of battery terminal protectant must be used with extreme care. Insulate metal container to prevent can from contacting battery terminals which could result in an explosion.

⚠WARNING ***To prevent illness or death, observe the following:***

Never work around or operate a vehicle in an environment that does not ventilate exhaust gases from the area.

Exhaust gas (carbon monoxide) is deadly.

Carbon monoxide is an odorless gas that is formed as a natural part of the incomplete combustion of hydrocarbon fuels. Carbon monoxide is a dangerous gas that can cause unconsciousness and is potentially lethal.

The following are symptoms of carbon monoxide inhalation:

•Dizziness

•Vomiting

•Intense headache

•Muscular twitching

•Weakness and sleepiness

•Throbbing in temples

If experiencing any of these symptoms, get fresh air immediately.

Battery Removal and Installation

Tool List	Qty.
Insulated Wrench, 1/2"	1
Socket, 1/2"	1
Extension, 12"	1
Ratchet	1
Battery Carrier	1

NOTICE: In the following text, there are references to removing/installing bolts etc. Additional hardware (nuts, washers, etc.) that is removed must always be installed in its original position unless otherwise specified. Non-specified torques are as shown in table contained in the General Information and Routine Maintenance section.

At the battery, remove hardware from the **negative** (-) cable before removing the **positive** (+) cable. Remove the bolt from the battery hold down and remove the battery (Ref. Fig. 1).

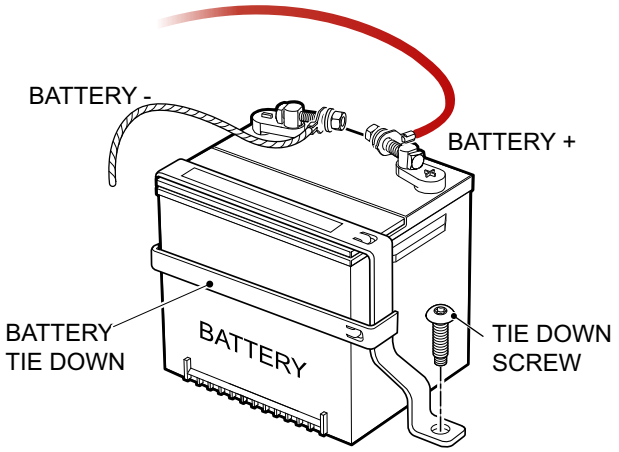


Fig. 1 Battery Removal

Connect the positive (+) battery cable first. **Connect negative (-) battery cable last.**

Be sure to remove all corrosion from terminals and hardware. After installing battery, coat terminals with commercially available terminal protectant.

Read all of SAFETY and this section before attempting any procedure. Pay particular attention to Notices, Cautions, Warnings and Dangers.

LIFTING THE VEHICLE

Tool List	Qty.
Floor Jack	1
Jack Stands	4
Chocks	4

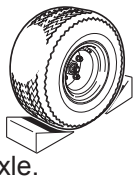
Some servicing operations may require the front, rear or the entire vehicle to be raised.

⚠ WARNING ***To prevent possible injury or death resulting from a vehicle falling from a jack, be sure the vehicle is on a firm and level surface. Never get under a vehicle while it is supported by a jack. Use jack stands and test the stability of the vehicle on the stands. Always place chocks in front and behind the wheels not being raised. Use extreme care since the vehicle is extremely unstable during the lifting process.***

⚠ CAUTION *When lifting the vehicle, position jacks and jack stands only on the areas indicated.*

To raise the entire vehicle:

1. Install chocks in front and behind each front wheel (Ref. Fig. 2).
2. Center the jack under the rear frame crossmember.
3. Raise the vehicle and place a jack stand under the outer ends of the rear axle.



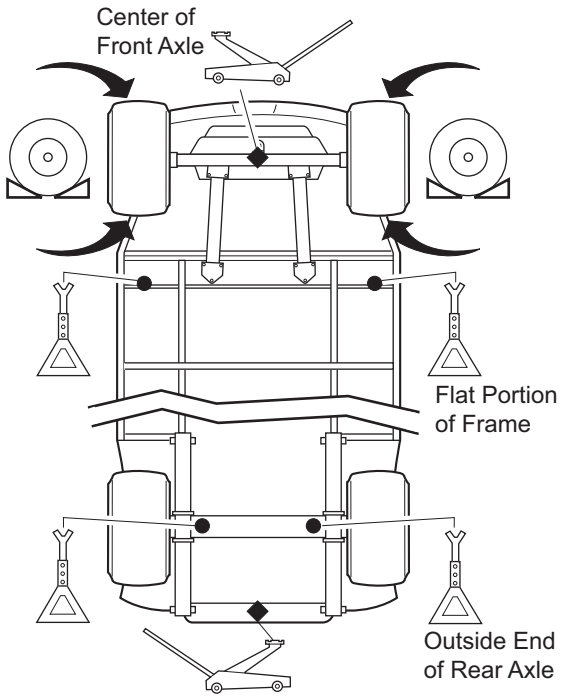


Fig. 2 Lifting the vehicle

4. Lower the jack and test the stability of the vehicle on the two jack stands.
5. Place the jack at the center of the front axle. Raise the vehicle and place jack stands under the frame crossmember as indicated.
6. Lower the jack and test the stability of the vehicle on all four jack stands.
7. If only the front or rear of the vehicle is to be raised, place the chocks in front and behind each wheel not being raised in order to stabilize the vehicle.
8. Lower the vehicle by reversing the lifting sequence.

Read all of SAFETY and this section before attempting any procedure. Pay particular attention to Notices, Cautions, Warnings and Dangers.

Notes:

Read all of SAFETY and this section before attempting any procedure. Pay particular attention to Notices, Cautions, Warnings and Dangers.

BODY

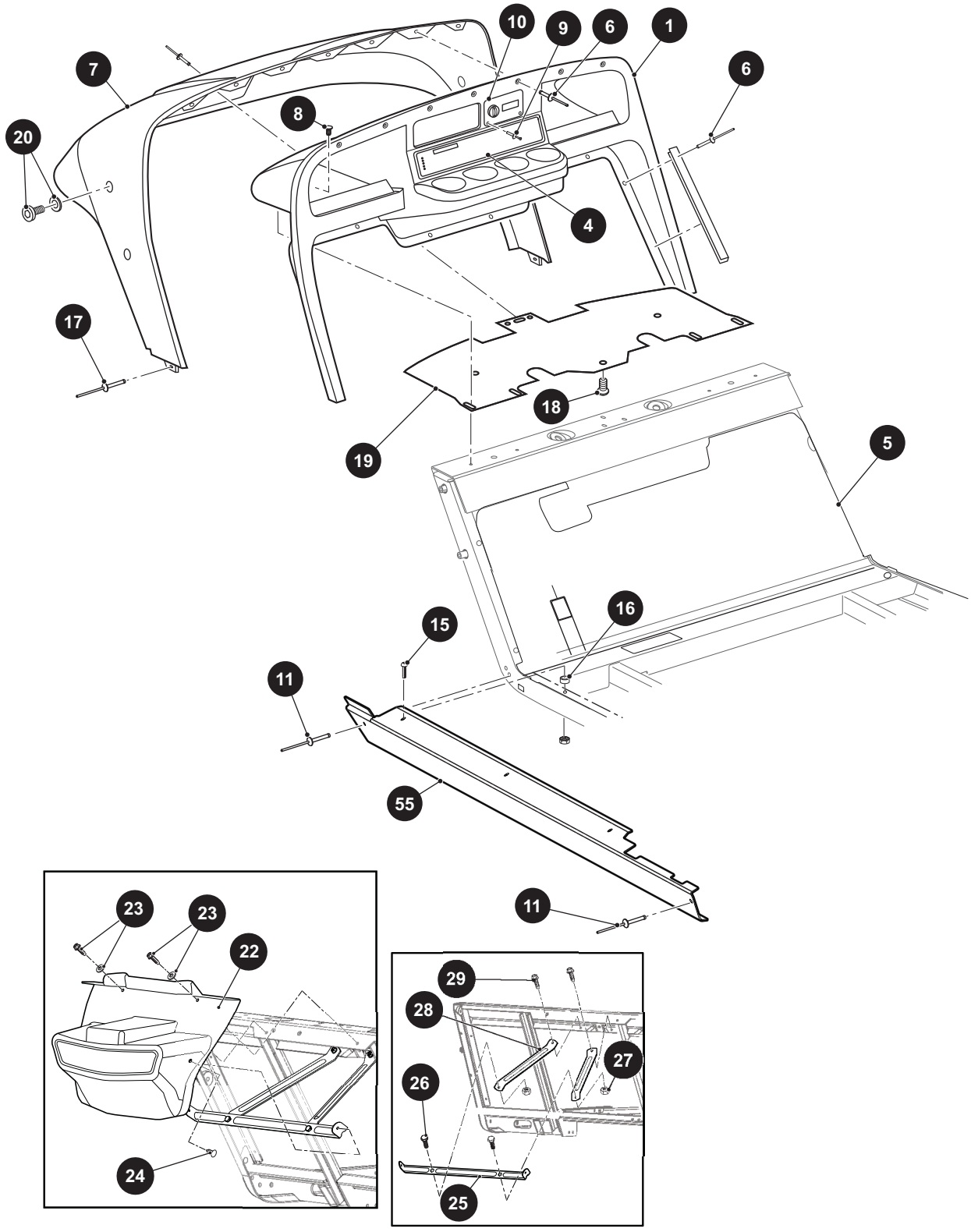


Figure 1 Body Components (Front)

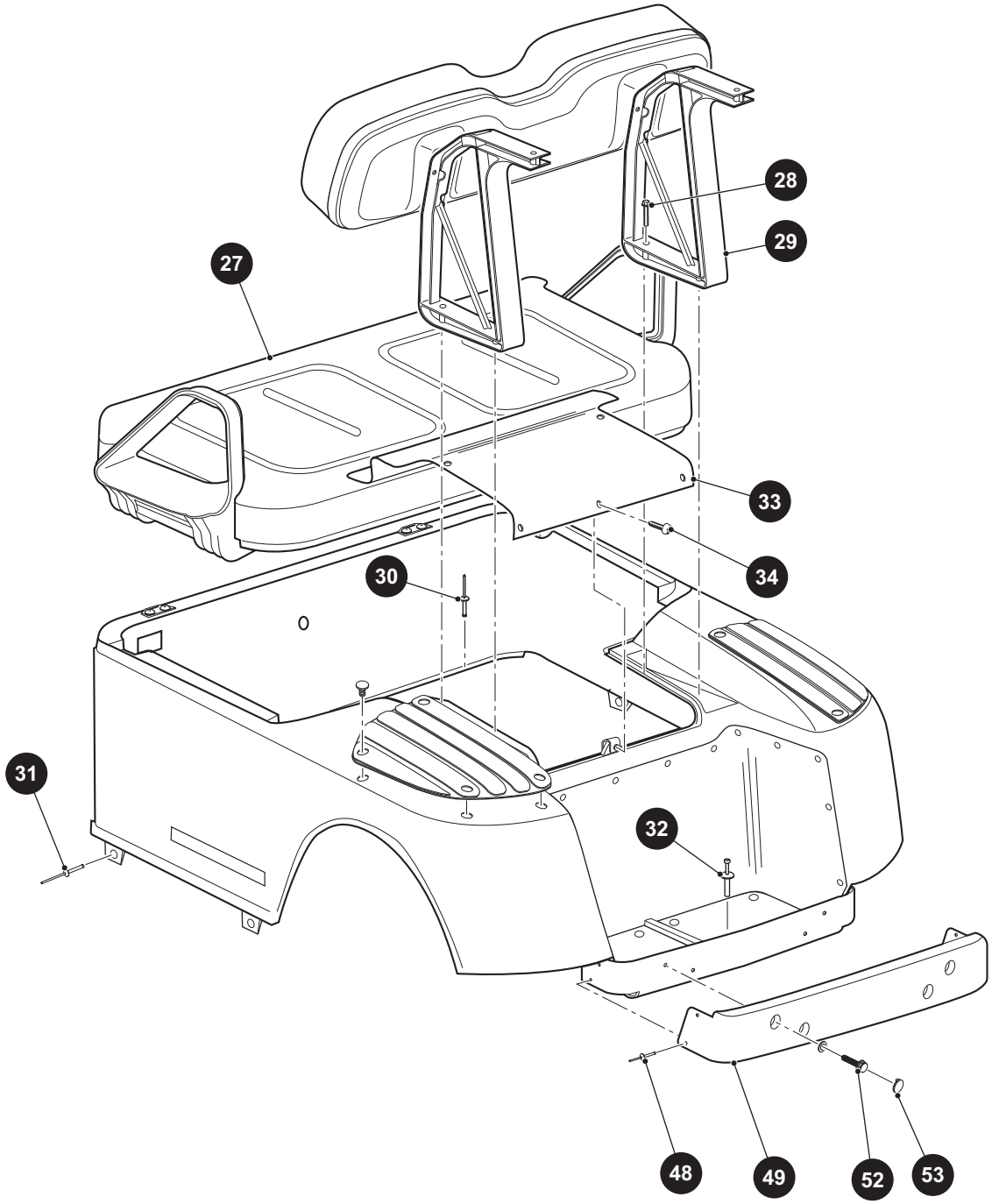


Figure 2 Body Components (Rear)

Read all of SAFETY and this section before attempting any procedure. Pay particular attention to Notices, Cautions, Warnings and Dangers.

NOTICE: In the following text, there are references to removing/installing bolts, etc. Additional hardware (nuts, washers, etc.) that are removed must always be installed in their original positions unless otherwise specified. Non-specified torques are as shown in the table in the General Information and Routine Maintenance section.

General

⚠WARNING To prevent possible injury or death from battery explosion, batteries should always be removed before any servicing that could generate sparks or repairs that require welding or cutting.

It is important to use a sharp drill bit when removing the rivets on the side of the vehicle. Extreme care must be used when drilling out the rivets located in the front of the body and the bottom side of the body. Excessive pressure could result in the drill bit being forced through the body panel and penetrating a component, including the fuel tank. As extra protection, it is recommended that a protective piece of sheet metal be placed between the battery and the rivet. Use of a drill depth stop will provide additional protection.

In general, body component replacement can be accomplished with a minimum of specialized tools. Most body components are held in place with conventional removable hardware (nuts, bolts, washers and screws). Some components are mounted with 'pop' rivets which require that the rivet head be removed in order to push out the shank of the rivet. The rivet head is easily removed by drilling into the head with a **sharp** drill bit that is **slightly** larger than the shank of the rivet (Ref. Figure 3). Care must be exercised when drilling to prevent the drill from being forced through the plastic body components where it could damage components located immediately behind the rivet. The best way to prevent this from occurring is to use a sharp drill bit that requires very little pressure to cut successfully and to place a piece of protective sheet metal between the surface being drilled and components directly behind it.

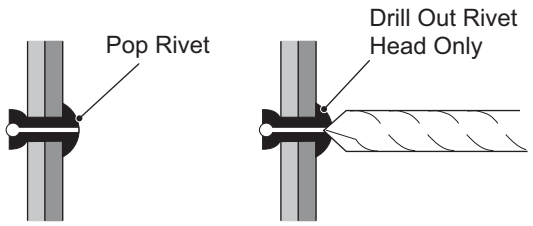


Figure 3 Drill Out Metal Rivet

BODY COMPONENT REPLACEMENT

The body components can be replaced by removing the securing hardware, replacing the component and securing with hardware in the same orientation as removed. The illustrations on the following pages indicate the assembly methods for the various components.

Instrument Panel Replacement

Tool List	Qty.
Electric/air drill	1
Drill bit, 7/32"	1
Wrench, 5/16"	1
Phillips screwdriver	1
Pop Rivet Tool	1

NOTICE: The instrument panel may be removed without removing the cowl or may be removed as part of the cowl.

When installing a replacement instrument panel, a new console safety label (4) **MUST** be ordered and placed on the new instrument panel. When ordering a replacement instrument panel, provide vehicle serial number to the Service Parts Representative who will provide the correct part number for the safety label.

⚠WARNING To prevent the possibility of injury due to lack of vehicle information, the correct safety label must be on the instrument panel at all times.

1. Using an insulated wrench, disconnect the battery cable at the negative (-) battery terminal.
2. Pull the front of the floor mat (5) up to expose the rivets (6) that secure the instrument panel to the floor.
3. Drill out the rivets attaching the bottom of the instrument panel to the floor and across the top of the instrument panel attaching it to the cowl (7).
4. Remove the four screws (8) located within the instrument panel pockets**.**
5. The instrument panel may now be pulled away from the cowl.
6. Remove the drive rivets (9) securing the ignition switch plate (10) to the instrument panel.
7. Rotate the ignition switch plate and push it through the instrument panel opening, freeing the panel for removal.
8. Reassembly is the reverse order of disassembly and will require new rivets.

BODY

Read all of SAFETY and this section before attempting any procedure. Pay particular attention to Notices, Cautions, Warnings and Dangers.

Cowl Replacement

Tool List	Qty.
Electric/air drill	1
Drill bit, 7/32"	1
Wrench, 5/16"	1
Phillips screwdriver	1
Pop Rivet Tool	1
Duct tape	1
Allen key, 3/16"	1

1. Drill out the rivets (6) across the top of instrument panel (1) attaching it to the cowl (7) (Ref. Figure 1).
2. Remove the rivet (11) at the front and back of each rocker panel (14).
3. Remove the rocker panel (14) by following the instructions from See the *Rocker Panel Replacement on page 16*.
4. Drill out the rivets (17) securing the sides of the cowl to the frame.
5. From underneath the cowl, remove the ratchet fastener (18) attaching the center of the splash panel (19) to the frame cross member.
6. Remove the four screws (8) located within the instrument panel pockets.
7. Remove the bolts and washers (20) from the sides of the cowl and lift the cowl assembly from the vehicle.
8. Reassembly is the reverse order of disassembly and will require new rivets. The bolts and washers (20) reinstalled into the cowl should be tightened to 8 - 12 ft. lbs.

Front Fascia Replacement

Tool List	Qty.
Wrench, 7/16"	1
Pry bar	1

1. The front Fascia (22) need not to be removed to replace any other body components (See Figure 1).
2. If the front Fascia is damaged, remove hardware (23) securing the front Fascia to frame.
3. Remove the two rivets (24) securing the front Fascia to the shield brackets (25).
4. If the shield bracket (25) is damaged, remove bolts (26) and nuts (27) securing it to the shield brace (28) after removing the front Fascia (22).
5. If the shield brace (28) is damaged, remove bolts (29, 26) and nuts (27) securing it to the frame and shield bracket (25) after removing the front Fascia (22).
6. Install replacement front Fascia in reverse order of disassembly.

Rocker Panel Replacement

Tool List	Qty.
Phillips screwdriver	1
Wrench, 7/16"	1
Electric/Air drill	1
Drill bit, 7/32"	1
Pop Rivet Tool	1

1. Remove the rocker panel with sill plates (14, 55) by removing the hardware (15) securing them to the frame (Ref. Figure 1).
2. As the rocker panel is removed, be sure to catch the spacers (16) under each rocker panel for reuse when rocker panels are reinstalled.
3. To remove the rocker panel, remove the rivets (11) at the front and rear of the rocker panel (14). Unsnap the rocker panel (14) from the vehicle frame.
4. Replace rocker panel in reverse order of disassembly.
5. Align the replacement rocker panel with spacers in place and install hardware.

Body Replacement

Tool List	Qty.
Electric/air drill	1
Drill bit, 7/32"	1
Socket, 3/8"	1
Socket, 7/16"	1
Socket, 9/16", deepwell	1
Ratchet, 3/8" drive	1
Wrench, 3/8"	1
Wrench, 7/16"	1
Wrench, 9/16"	1
Pop Rivet Tool	1
Phillips screwdriver	1
Pry bar	1

NOTICE: Prior to removing the rear body, the foot rest, must be removed. See the applicable paragraphs for instructions for replacement of those items.

1. Remove the rocker panels as described above.
2. Remove seat from body (27) (Ref. Figure 2).

⚠ WARNING To prevent possible injury or death from battery explosion, batteries should always be removed before any servicing that could generate sparks or repairs that require welding or cutting.

It is important to use a sharp drill bit when removing the rivets on the side of the vehicle. Extreme care must be used when drilling out the rivets located in the front of the body and the bottom side of the body. Excessive pressure could result in the drill bit being forced through the body panel and penetrat-

ing a battery. As extra protection, it is recommended that a protective piece of sheet metal be placed between the battery and the rivet. Use of a drill depth stop will provide additional protection.

3. Remove hardware (28) attaching seat back supports (29) to body.
4. At the front of the rear body, remove the rivets (30) securing the rear body to the frame and floorboard area.
5. Drill out the heads of the large head rivets (31) that secure the bottom of the body panel to the side of the vehicle.
6. Remove the rivets (32) that secure the floor of the bagwell area to the frame underneath.
7. Remove the body.
8. If the access cover (33) is to be reused, remove the hardware (34) securing the access cover to the body panel.
9. Remove the access cover.
10. Installation of rear body is in the reverse order of disassembly using new rivets.
11. Install the bolts (28) into the seat supports (29) and tighten to 21 - 25 ft. lbs.

⚠WARNING .The foot rest is heavy and awkward to handle. To prevent possible personal injury, it is strongly recommended that adequate help or a lifting device be used to remove the foot rest from the vehicle.

Rear Bumper Replacement

Tool List	Qty.
Electric/Air drill	1
Drill bit, 7/32"	1
Flat tip screwdriver	1
Allen wrench, 7/32"	1

1. Drill out rivets (48) located at each end of the rear bumper (49) (Ref. Figure 2).
2. Carefully remove the plugs (53) with a screwdriver.
3. Remove the shoulder bolts (52) underneath the plugs.
4. Remove the rear bumper.
5. To replace the bumper, place the rear bumper against the rear body panel and tighten the shoulder bolts (52) to 9 - 12 ft. lbs. torque (Ref. Figure 2).
6. Replace the plugs.
7. Using the existing holes in the frame as a guide, drill holes in the bumper from underneath the vehicle and install new rivets.

PAINTING

Follow the paint manufacturer's recommendations for specific painting procedures and information.

⚠WARNING All painting must be done in an area with adequate ventilation to safely disperse harmful vapors.

Wear eye protection and respirator, following manufacturer's instructions, to protect from overspray and airborne mist.

⚠CAUTION Provide protection from overspray to vehicle and surrounding area.

Minor Scratches

For minor scratches, the manufacturer suggests the following steps be taken to repair the Durashield™ body:

1. Thoroughly clean the surface to be repaired with alcohol and dry.
2. Touch up damaged area with sequential coats (two coats minimum recommended, allowing 30 - 45 minutes between coats, increasing to 45 - 60 minutes in higher humidity) using brush on touch-up paint, until coating layer is visible, slightly above the surface of the part.
3. Use 400 grit "wet" sand paper to blend touch up area level with the rest of the part being repaired. Use a polishing compound (3M Finesse or automotive grade) to renew gloss and to further blend and transition newly painted surface.
4. Clean with alcohol and dry.
5. (Optional but recommended) Follow this process with clear coat to renew and protect depth of finish.
6. Wax or polish with Carnauba base product, available at any automotive parts distributor.

Larger Scratches

For larger scratches, the manufacturer suggests the following steps be taken to repair the Durashield™ body:

1. Thoroughly clean the surface to be repaired with alcohol and dry.
2. Mask the area to be painted (common masking tape is adequate) prior to repair and use aerosol type touch-up paint.
3. Apply spray touch up paint in light even overlapping strokes. Multiple coats may be applied to provide adequate coverage and finish. Always remember to shake the can for a minimum of one minute to mix the paint and achieve the best color match.
4. After painting, allow to dry overnight. Smooth the mask lines using 400 grit "wet" sand paper to blend touch up area level with the rest of the part being repaired. Use a polishing compound (3M Finesse or

automotive grade) to renew gloss and to further blend and transition newly painted surface.

5. Clean with alcohol and dry.
6. (Optional but recommended) Follow this process with clear coat to renew and protect depth of finish.
7. Wax or polish with Carnauba base product, available at any automotive parts distributor.

Complete Panel Repair

In situations where large panels or areas must be painted, touch up paint is not recommended. In such cases professional painting or panel replacement is called for. The manufacturer suggests body panel replacement be considered as a cost effective alternative to painting. If the decision to repaint is taken, the task can be accomplished by any paint and body shop with experience in painting 'TPE' panels. TPE is a common material in modern automobile bodies and all body shops should be familiar with the materials and processes required.

The finish will include an application of a primer coat, a base color coat and a clear coat. The manufacturer does not supply these materials due to the variety of paint manufacturers and the preferences of the individual painter.

Most paint manufacturers can perform a computer paint match to assure accurate color matching.

Read all of SAFETY and this section before attempting any procedure. Pay particular attention to Notices, Cautions, Warnings and Dangers.

Notes:

Read all of SAFETY and this section before attempting any procedure. Pay particular attention to Notices, Cautions, Warnings and Dangers.

Notes:

Read all of SAFETY and this section before attempting any procedure. Pay particular attention to Notices, Cautions, Warnings and Dangers.

WHEELS AND TIRES

Follow the tire maintenance procedures as instructed in this manual and on the labels on the vehicle.

Always use the approved size and type of replacement tires. See Vehicle Specifications for the proper tire type and size.

⚠WARNING ***Worn, improperly inflated, improper sized, or incorrectly installed tires will affect vehicle handling and could cause an accident resulting in severe injury or death.***

Inflate all tires to the same pressure. Operating with unequal or incorrect pressure can adversely affect steering and handling and could cause an accident resulting in severe injury or death.

To decrease the risk of tire explosion, do not exceed the tire inflation rating on the tire sidewall. Make sure the tires are properly inflated at all times of operation. See Tire Pressure on page 11.

To decrease the risk of tire explosion, inflate small amounts of air into the tire at intervals to allow the bead to seat properly. Because of the low volume of the small tires, over inflation can occur in seconds. Never exceed the tire inflation pressure rating on the tire sidewall when seating a bead. Protect your face and eyes when you remove a valve core.

When you remove the wheels, use only sockets made for impact wrenches to decrease the risk of injury by a broken socket.

Do not use tires with a low rated pressure. Do not use tires that have a recommended tire inflation pressure less than the tire inflation pressure recommended in the owner's manual.

Do not over inflate the tires. Excess pressure can cause the tire to separate from the wheel or cause a tire explosion.

Tire Pressure

Maintaining correct tire inflation pressure is essential for safe vehicle operation. You can vary the inflation pressure, within the recommended range to suit the condition of the terrain.

TIRE PRESSURE RANGE	TERRAIN CONDITIONS	RECOMMENDATION
18 - 22 psi (124 - 152 kPa)	hard surfaces or pavement	Inflate to higher pressure within the range; never exceed maximum pressure indicated.
	soft terrain or turf	Inflate to lower pressure within the range to reduce potential damage to the terrain or turf.

TIRE REPAIR

Tool List **Qty.**

Lug Wrench, 3/4" 1
Impact Wrench 1
Impact Socket, 3/4" 1
Torque Wrench, ft. lbs 1

NOTICE: Tire plug tools and plugs are available at automotive outlets. The tire does not have to be removed from the wheel to install the tire plug.

Use a tire plug to repair small holes in the tread part of the tire. For large holes or holes/cuts in the tire sidewall, the tire must be replaced.

1. Remove the wheel from the vehicle. See *Wheel Removal* on page 22.
2. Locate the leak in the tire.
    i. If the tire is very low or flat, fully inflate the tire.
    ii. Brush soapy water over the surface of the tire. Air bubbles will be visible where the air is leaking from the tire.
    iii. Mark the hole with chalk.
4. Install the plug according to the manufacturer's instructions.
5. Install the wheel on the vehicle. See *Wheel Installation* on page 22.
6. Fully inflate the tire. See *Tire Pressure* on page 11.

Tire Replacement

Tire replacement requires a tire mounting machine, and must be done by a qualified tire center or an authorized dealer.

WHEEL

⚠WARNING ***Worn, improperly inflated, improper sized, or incorrectly installed tires will affect vehicle handling and could cause an accident resulting in severe injury or death.***

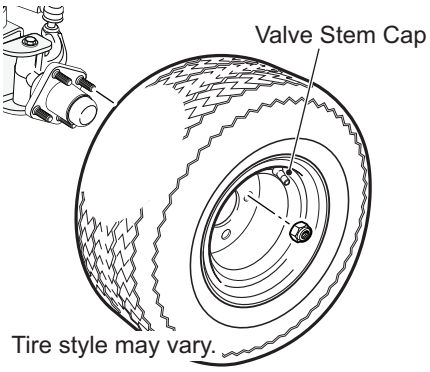
WHEELS AND TIRES

Read all of SAFETY and this section before attempting any procedure. Pay particular attention to Notices, Cautions, Warnings and Dangers.

⚠ CAUTION ***To decrease the risk of component damage, do not tighten the lug nuts to more than the torque specified below.***

Check the lug nuts for tightness at the intervals indicated in the See the *SCHEDULED MAINTENANCE CHART on page 141*.

Wheel Removal



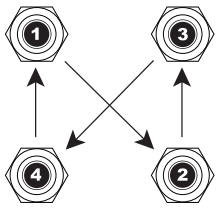
1. Lift the vehicle. See *LIFTING THE VEHICLE* on page 11.
2. Remove the lug nuts.
3. Remove the tire from the vehicle.

Wheel Installation

NOTICE: To decrease the risk of component damage, do not tighten the lug nuts to more than the specified torque.

NOTICE: Always install lug nuts using a cross sequence pattern to ensure the even seating of the wheel against the hub.

Lug Nut Tightening Pattern



1. Install the wheel on the hub with lug nuts. Make sure the valve stem is to the outside.
2. Finger tighten the lug nuts.
3. Using the cross tightening pattern shown to the right, tighten the lug nuts to 65 - 85 ft. lbs. (88 - 115 Nm). Tighten in increments of 20 ft. lbs. (27 Nm).

Read all of SAFETY and this section before attempting any procedure. Pay particular attention to Notices, Cautions, Warnings and Dangers.

Notes:

Read all of SAFETY and this section before attempting any procedure. Pay particular attention to Notices, Cautions, Warnings and Dangers.

Notes:

BRAKE SYSTEM

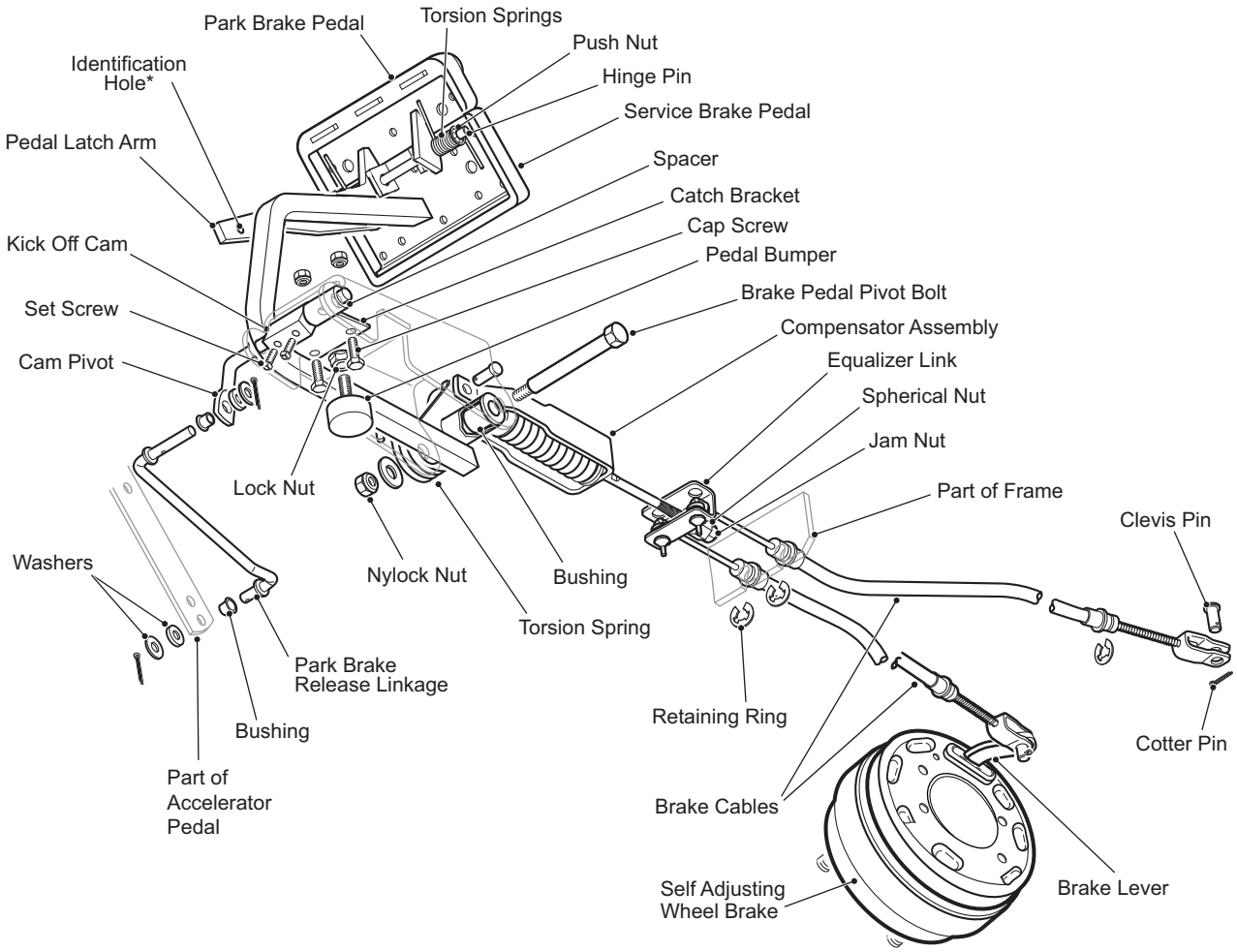


Figure 1 Mechanical Brake System

General Description

This vehicle is equipped with a mechanically activated rear drum brake system. The brake system consists of a service brake and parking brake pedal, parking brake release linkage, compensator assembly, equalizer link, brake cables and self adjusting wheel brake assemblies (Figure 1).

Although the brake system is similar to an automobile, it is **different in important ways**. The system operates in a very severe environment. Fertilizer, dust, grass clippings, tree roots and other objects can cause corrosion and physical damage to the brake components. Unlike automotive hydraulic brakes, mechanical brakes depend on the travel of the brake cables to move the brake shoes against the brake drums. The travel of the brake cables is governed by the brake pedal. If the cables cannot travel far enough to absorb the slack (free travel) in the system and still apply the shoes to the drums, the braking effort at the wheel brake will not be adequate. The self adjusting mechanism in the wheel brakes requires enough cable travel at the wheel brake to work reliably. When the brake is released, there must be slack in the system so the brakes will release fully and the adjusters will function. Free pedal travel, pedal force, shoe to drum clearance and braking capability are closely related. It is very important to maintain the proper relationships to assure braking performance and the best wheel brake adjustment.

How the Service Brake Works

Pressing the service brake pedal pulls the compensator assembly and equalizer link, which are connected to the brake cables (Figure 1). The first part of the pedal travel removes slack from the system. Continued motion of the brake pedal pulls both the left and right brake cables. Each brake cable pulls a brake lever which pushes the rear brake shoe against the brake drum. When the rear

shoe contacts the brake drum, it can no longer move rearward. Additional pedal (and cable) travel causes the actuator bracket (moving anchor) to move and applies force to the front shoe, pushing it against the brake drum. The force applied to the front and rear shoes is approximately equal. As the shoes contact the moving brake drum, the shoes try to move in the direction of drum rotation. This movement results in the typical brake shoe wear patterns.

Equalizer Link

The equalizer link balances braking between the driver and passenger sides of the vehicle. Variations in wheel brake adjustment, cable friction and manufacturing tolerances may cause the equalizer to be slightly misaligned. This misalignment is normal.

Automatic Adjuster Mechanism

⚠ CAUTION ***Never manually adjust the brakes at the star wheel. Doing so will cause permanent damage to the adjuster assembly and result in a gradual loss of brakes.***

The wheel brakes are equipped with an automatic adjuster mechanism that is designed to compensate for brake shoe wear and eliminate the need for manual brake shoe adjustment. The brake adjuster is activated by movement of the lever attached to the brake cable.

How the Parking Brake Works

The parking brake is operated by a smaller pedal which extends across the top of the service brake pedal. It is attached to the service brake pedal with a hinge pin and is spring loaded (Figure 2).

Pressing the parking brake pedal moves the latch arm against the catch bracket attached to the chassis. As the parking brake is pressed, the service brake is applied until the notch in the latch arm engages with the catch bracket. The service brake pedal is held in the applied (down) position by the catch bracket.

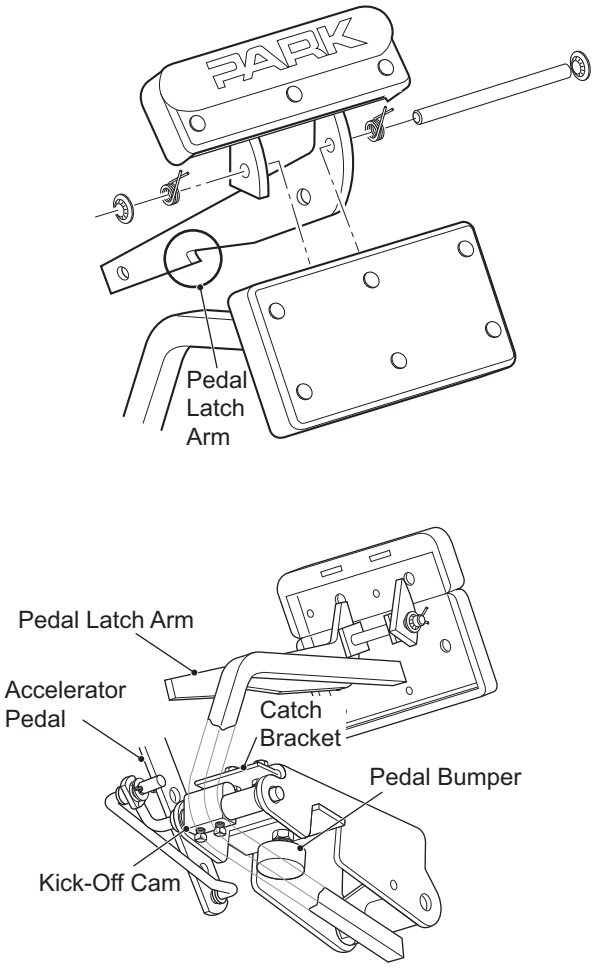


Figure 2 Parking Brake and Kick-Off Mechanism

The latch arm is held in position by the tension in the brake linkage. The Parking Brake can be released by two methods:

1. Pressing the service brake, which permits the spring loaded Parking Brake pedal to return to its original position, disengaging the latch arm from the catch bracket. This is the preferred method which minimizes wear on components.
2. Pressing the accelerator pedal rotates the kick-off cam which forces the pedal latch arm to move away from the catch bracket. The spring loaded Parking Brake pedal returns to its original position, releasing the brake.

Compensator Assembly

The compensator assembly contains a spring, which is compressed until the stop tube within the spring is engaged and the linkage becomes solid (Figure 3). The brake compensator assembly applies a spring load to the parking brake system and insures that the parking brake remains under tension whenever it is engaged.

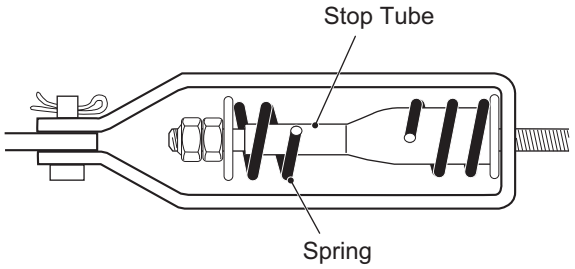


Figure 3 Compensator Assembly

Kick-Off Actuating Linkage

The kick-off actuating linkage may require periodic adjustment to compensate for the normal wear. Replacement of any linkage components will also require an adjustment.

Read all of SAFETY and this section before attempting any procedure. Pay particular attention to Notices, Cautions, Warnings and Dangers.

FAULT TEST FLOWCHART

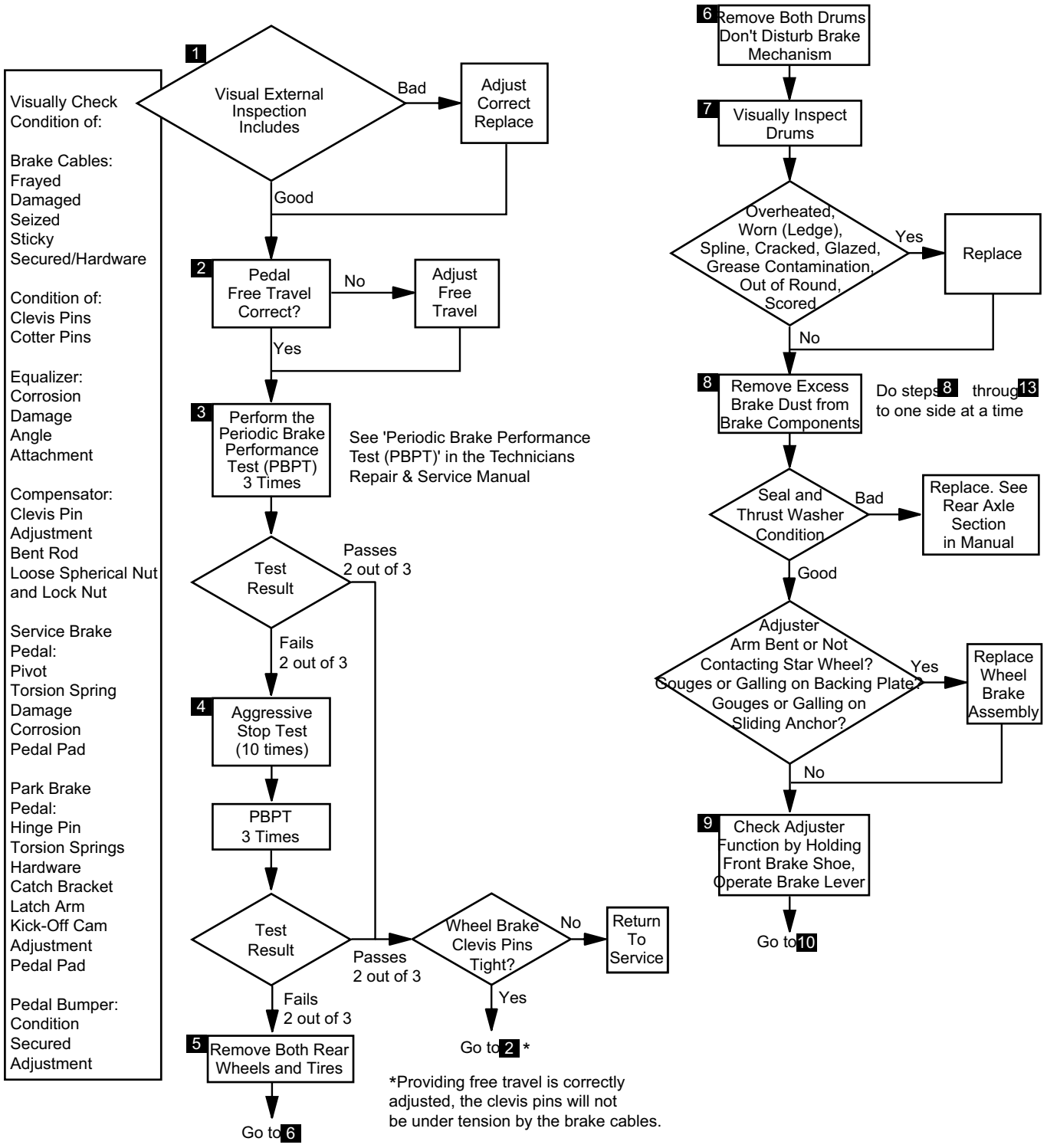
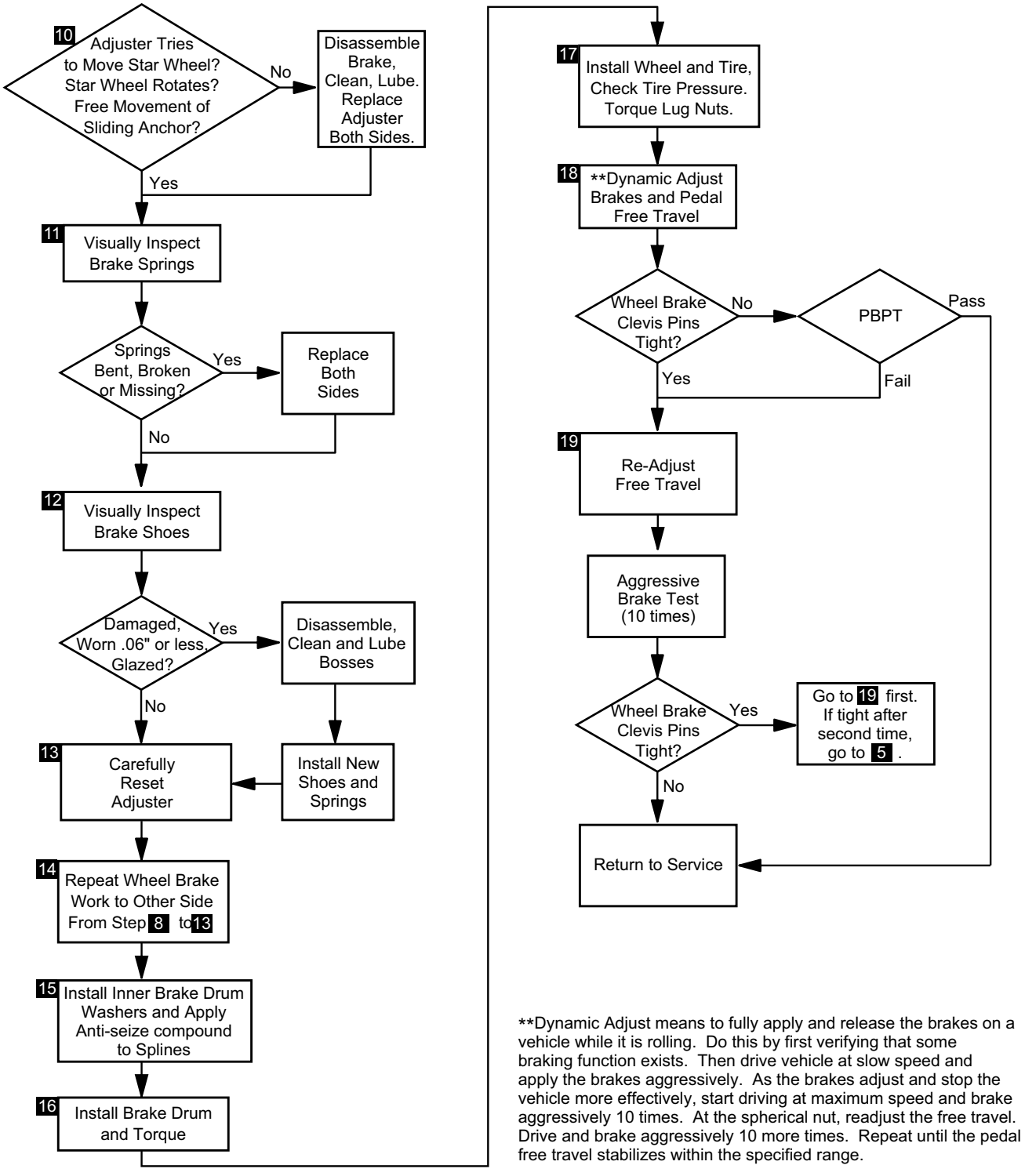


Figure 4 Fault Test Flowchart

Read all of SAFETY and this section before attempting any procedure. Pay particular attention to Notices, Cautions, Warnings and Dangers.



**Dynamic Adjust means to fully apply and release the brakes on a vehicle while it is rolling. Do this by first verifying that some braking function exists. Then drive vehicle at slow speed and apply the brakes aggressively. As the brakes adjust and stop the vehicle more effectively, start driving at maximum speed and brake aggressively 10 times. At the spherical nut, readjust the free travel. Drive and brake aggressively 10 more times. Repeat until the pedal free travel stabilizes within the specified range.

Figure 5 Fault Test Flowchart

FAULT TEST TABLE

Refer to the following fault test table only after the thorough visual inspection, Periodic Brake Performance Test (PBPT), and Aggressive Stop Test is performed (Figure 6).

Figure 6 Fault Test Table

Condition	Possible Cause	Correction
Fails Brake Performance Test by stopping in a longer distance than normal	Wheel brake failure due to severely worn or damaged components	Replace all severely worn or damaged components
	Brake pedal not returning Brake not adjusting	Check for binding of brake pedal Check brake pedal free travel Check brake cables Check brake adjusters Check pedal pivot
	Brake shoes wet	Check again when shoes are dry
	Brake cables damaged or sticky	Check brake cable and replace if sticky or damaged
	Brake shoes severely worn	Replace
	Brake shoes glazed	Sand shoes with emery cloth provided that shoes have .06" (1.5 mm) min. material
	System not adjusted properly	Check and adjust per manual
	End of brake cable loose from anchor brackets	Check and repair
	Cracked brake drum	Replace
In excess of 1 1/8" (2.9 cm) free pedal travel (Soft Pedal)	Low pedal force at parking brake latch	Adjust per manual
	Brake cables damaged	Replace
	Brake return bumper out of adjustment	Adjust per manual
	End of brake cable loose from anchor brackets	Check and repair
	Wheel brake failure due to severely worn or damaged components	Replace all severely worn or damaged components
	System not adjusted properly	Adjust per Manual
Starting 2001 Model Year - Less than 7/8" (2.2 cm) free pedal travel (Hard Pedal) Prior to 2001 Model Year - Less than 2" (5 cm) free pedal travel (Hard Pedal)	High pedal force at parking brake latch	Adjust per Manual
	Brake cables damaged or sticky	Check brake cable and replace if sticky or damaged
	System not adjusted properly	Check and adjust per manual
	Wheel brake failure due to severely worn or damaged components	Replace all severely worn or damaged components

Read all of SAFETY and this section before attempting any procedure. Pay particular attention to Notices, Cautions, Warnings and Dangers.

Figure 6 Fault Test Table

Condition	Possible Cause	Correction
Neither wheel locks when park brake is latched. (Note: At full speed the wheels may not lock, but should brake aggressively).	Incorrect compensator spring adjustment	Return to factory specification
	Excessive brake pedal free travel	Adjust per manual
Unequal braking (one wheel locks while other rotates)	Wheel not locking is not adjusting	Check brake operation of wheel that is **not** locking
	Sticky/dragging cable	Check for brake lever return Check that brake levers return at equal rate - (Indication of dragging cable)
	Cracked brake drum	Replace
	Brake shoes wet or glazed	Check again when shoes are dry
	Rusted or sticky brake pivot hardware	Replace
Neither wheel locks	Brake system requires complete adjustment	Adjust entire system
	Brake pedal not returning	Check for binding of brake pedal Check brake pedal free travel
Grabbing brakes (oversensitive)	Moisture has caused surface rust on drums	Apply moderate force to pedal while at maximum level ground speed to remove rust until condition is relieved.
	Brake Pivot binding	Check and replace poor components
Parking brake hard to latch	Inadequate free play	Adjust pedal free travel at spherical nut and check that wheel brake actuators are returning fully
	Sticky/dragging cable	Check for brake lever return Check that brake levers return at equal rate - (Indication of dragging cable)
	Dragging shoes	Check wheel brakes
Parking brake will not stay latched	Excessive wear	Check for worn latch mechanism

Read all of SAFETY and this section before attempting any procedure. Pay particular attention to Notices, Cautions, Warnings and Dangers.

FAULT TESTING AND INSPECTION

New Vehicles

A new vehicle will undergo an initial break-in of components including brake cables and brake shoes. In this break-in period, it is not uncommon for the brake pedal free travel (and the effort required to latch the parking brake) to change. The timing of this change varies with terrain and the driving habits of the operator(s). When this occurs, the brake linkage should be adjusted. See the *Adjusting Brake Pedal Free Travel.* After this initial period, no further adjustments should be required until routine maintenance is scheduled.

Fault Testing and Inspection Procedures

To fault test the mechanical brake system, inspect the brake pedal and linkage to find worn or damaged parts per the Fault Test Flowchart (Figure 5). Then, perform the Periodic Brake Performance Test to evaluate system performance. Based on the results of the inspection and tests, refer to the Troubleshooting Table (Figure 6) to evaluate symptoms and repairs. If required, disassemble the wheel brake to locate and correct internal faults.

Instructions for removal or replacement of parts and adjustments referred to in this section of the manual are described in detail under See the *MAINTENANCE AND REPAIRS.*

⚠ CAUTION ***Satisfactory brake performance does not eliminate the need for routine brake testing and inspection as shown in the SCEDULED MAINTENANCE CHART section. Continued proper brake operation depends on periodic maintenance.***

Brake Pedal and Linkage Inspection

1. **Inspect brake pedal return bumper.**
   Be sure that the brake pedal is contacting the pedal return bumper when released, that the bumper is in good condition and that a 1/4 - 3/8" (6 - 9.5 mm) gap exists between the brake pedal arm and the setscrew heads of the kick-off cam (Figure 7). Replace or adjust the pedal bumper if required. See the *Pedal Bumper Adjustment.*

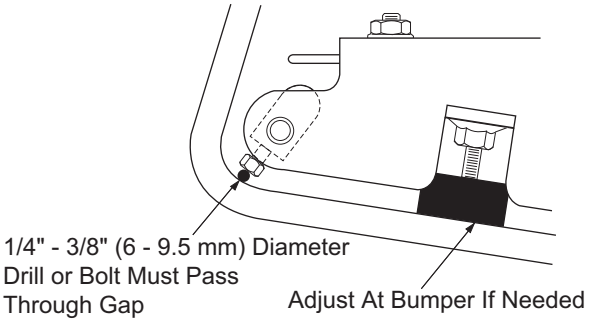


Figure 7 Brake Pedal Bumper Inspection

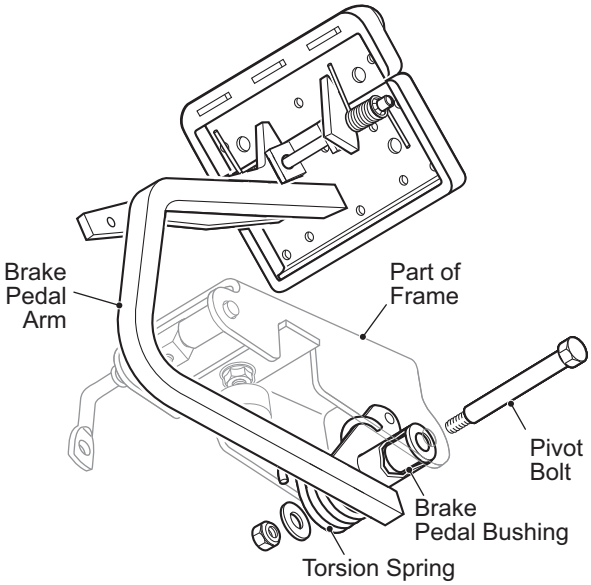


Figure 8 Brake Pedal Inspection

2. **Check brake pedal return.**
   Apply the brake pedal and release. Check that the brake pedal arm rests against the pedal bumper when released. Check that the torsion spring is hooked around both the pedal and the frame and is in good condition. If the pedal does not return fully or is sluggish, the brake pedal bushings and pivot bolt should be inspected (Figure 8). Replace pedal, spring, bushings and bolt as required. See the *Brake Pedal Removal and Installation.*

3. **Check the brake pedal free travel.**
   Brake pedal free travel is the distance the pedal moves from rest to the point at which the brake shoes first contact the brake drums. This should not be confused with the light resistance that is felt as the brake pedal is pressed enough to remove slack from the compensator and cables. Too much pedal free travel may indicate wheel brakes not adjusting, wear in the cables and linkages or initial break-in of components.

Not enough pedal free travel may indicate improper adjustment of the wheel brake or the brake linkage. Either condition can prevent the brakes from adjusting properly.

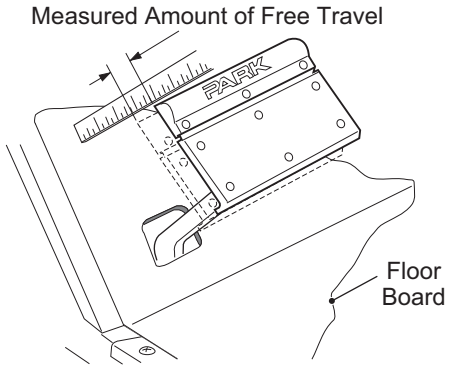


Figure 9 Check for Excessive Free Travel

NOTICE: Adjustment of free travel depends on manufacturing date.

The correct brake pedal free travel setting varies depending on the date of manufacture. Older models (latch arm without a 1/4" (6 mm) diameter hole in the lower portion (Figure 8)) should be set to 2" – 2 1/4" (5 - 6.5 cm) free travel. Starting model year 2001 (with a 1/4" (6 mm) diameter hole in the lower end of the latch arm), free travel should be set to 7/8" - 1 1/8" (2.2 - 2.9 cm) (Figure 9).

The parking brake latching force may be checked as a verification after setting brake pedal free travel. The preferred method of checking parking brake latching force is to place a 'bathroom' scale on the service and parking brake pedals. Using both feet, press the scale down evenly against the parking brake pedal until it latches. The parking brake should latch between 65 and 75 lbs. (29 - 34 kg) indicated on the scale (2.).

Adjust brake pedal free travel as described in MAINTENANCE AND REPAIRS if required.

4. **Inspect the brake cables.**
   Inspect for damage to the outer cable, fraying of the inner cable or lack of free motion when the pedal is applied and released. Inspect the brake cable supports to be sure the cables are properly secured. If any of these conditions are found, replace both cables and equalizer as a set.
5. **Check the clevis pins.**
   Check clevis pins attaching the brake cables to the brake lever. They must be loose when the brake pedal has been released (Figure 18). If the clevis pins are not loose, but brake pedal free travel is correctly adjusted and the brake cables move freely, the problem is likely in the wheel brake.
6. **Inspect the brake cable equalizer linkage.**
   Inspect for signs of corrosion, damage, wear or excessive misalignment (Figure 10). Replace if corrosion, damage, or wear is found.
7. **Inspect the compensator assembly.**
   Inspect for damage, corrosion or wear. Replace the complete assembly if problems are found. In general, no adjustment will be needed, as the spring assembly is factory calibrated. With the parking brake disengaged check that the compensator spring length is 3 15/16" (10 cm) (Figure 10). If an adjustment is required, it should be made at the nuts at the spring facing the front of the vehicle. Tighten the jam nut firmly after adjusting.

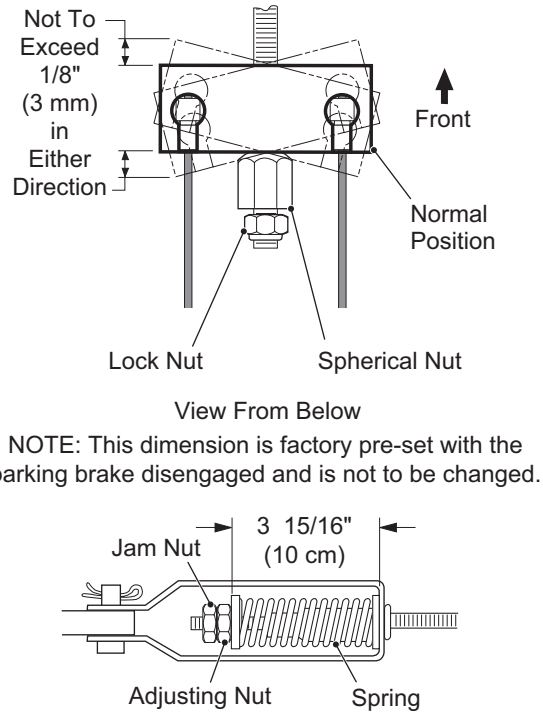


Figure 10 Equalizer and Compensator

8. **Inspect parking brake pedal hinge.**
   Check for broken or rusted springs and correct retention of the hinge pin. Operate parking brake pedal to confirm smooth operation of the hinge mechanism (Figure 11).

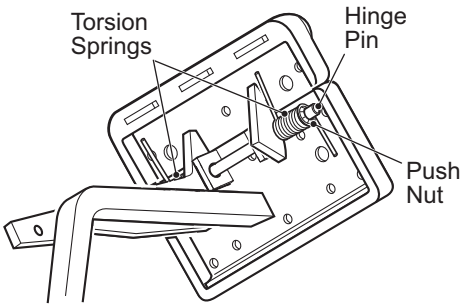


Figure 11 Parking Brake Pedal Hinge Inspection

9. **Check the condition and operation of the parking brake latching mechanism.**
   The parking brake should latch firmly and release as soon as the accelerator pedal is pressed.

⚠WARNING ***To prevent serious injury or death from the use of worn parking brake components, do not attempt to renew worn components. The parking brake latch arm, kick-off cam and catch bracket are hardened parts. Do not grind or file them as doing so will cause the parts to lose their hardness characteristics. New parts must be used.***

10. **Inspect catch bracket and latch arm.**
    Replace if showing signs of wear or damage (Figure 12).
11. **Inspect the parking brake kick-off cam.**
    Look for wear and for correct adjustment. With the parking brake engaged and fully latched, there must be no gap between the top of the cam and the latch arm. Adjust the kick-off cam (3) if required (Figure 12). It is very important that the correct setscrews are used to hold the kick-off cam to the pivot rod. Use of longer screws prevents correct adjustment of pedal bumper (pedal travel) and may prevent the brakes from adjusting properly.
12. **Inspect kick-off cam linkage and bushings.**
    Check for wear and damage. The kick-off cam pivot and bushings should move freely and be free of corrosion. The kick-off cam should rotate when the accelerator pedal is pressed.

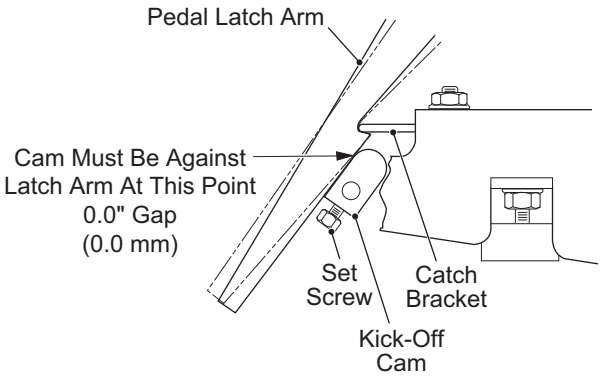


Figure 12 Kick-Off Cam Inspection

Periodic Brake Performance Test (PBPT)

⚠WARNING ***To prevent severe injury or death resulting from operating a vehicle with improperly operating brake system, the braking system must be properly maintained. All driving brake tests must be done in a safe location with regard for the safety of all personnel.***

The Periodic Brake Performance Test (PBPT) should be performed regularly (see SCEDULED MAINTENANCE CHART section of this manual) as an evaluation of braking system performance. It is useful as a method of identifying subtle loss of performance over time and as part of troubleshooting a problem vehicle.

Before performing this test, inspect the brake pedal and linkage and correct any problems found including adjusting the brake pedal free travel if required.

The purpose of this test is to compare the braking performance of the vehicle to the braking performance of new or “known to be good” vehicles or to an established acceptable stopping distance (see below). Actual stopping distances will be influenced by weather conditions, terrain, road surface condition, actual vehicle weight (accessories installed) and vehicle speed. No specific braking distance can be reliably specified. The test is conducted by latching the parking brake to eliminate different pedal pressures and to include the affects of linkage misadjustment. Significant changes or differences in braking performance will be evident due to mis-adjustment.

Establish the acceptable stopping distance by testing a new or “known to be good” vehicle and recording the stopping location or stopping distance. For fleets of vehicles, several vehicles should be tested when new and the range of stopping locations or distances recorded.

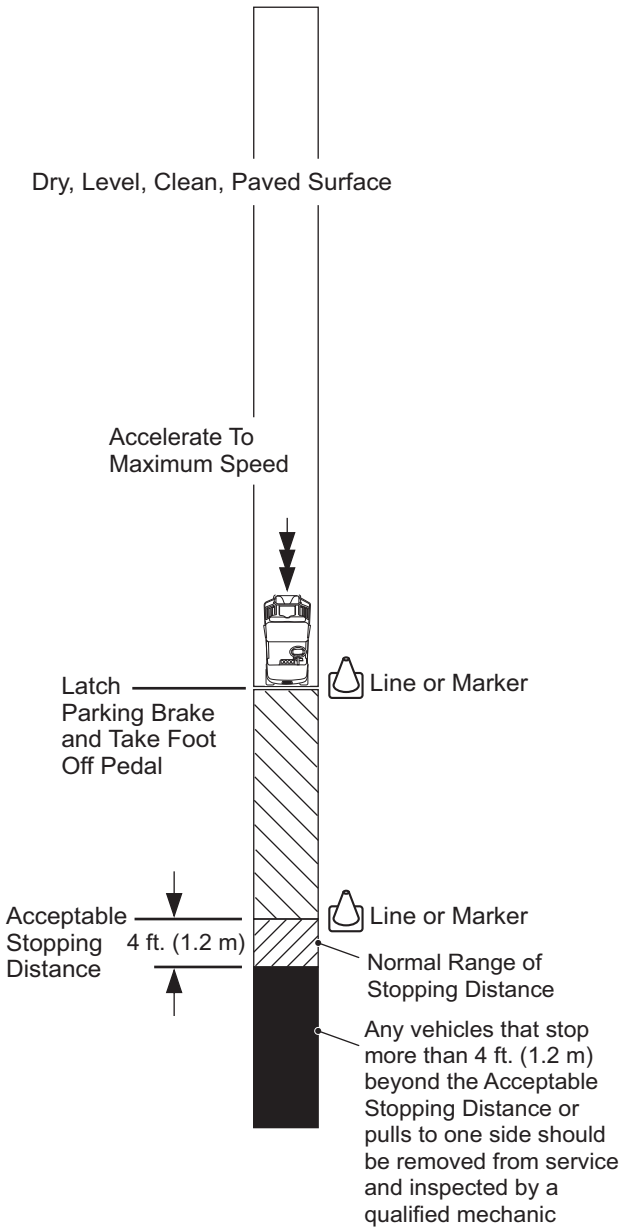


Figure 13 Periodic Brake Performance Test

NOTICE: Over time, a subtle loss of performance may take place; therefore, it is important to establish the standard with a new vehicle.

Drive the vehicle at maximum speed on a flat, dry, clean, paved surface (Figure 13). Quickly press the brake pedal to latch the parking brake at the line or marker in the test area and remove foot from pedal. The vehicle should stop aggressively. The wheel brakes may or may not lock. Observe the vehicle stopping location or measure the vehicle stopping distance from the point at which the brakes were latched. The vehicle should stop within the "normal" range of stopping distances. If the vehicle stops more than 4 ft. (1.2 m) beyond the acceptable stopping distance or pulls to one side, the vehicle has failed the test.

Repeat test two more times.

If the vehicle fails to pass two of three Periodic Brake Performance Tests, perform the Aggressive Stop Test 10 times as described below, then repeat the Periodic Brake Performance Test three more times (second set of three).

If the vehicle passes two of three Periodic Brake Performance Tests, check that the clevis pins at the brake levers are loose. If they are loose, return vehicle to service. If they are tight, adjust free travel. See the *Adjusting Brake Pedal Free Travel.* Then repeat the Periodic Brake Performance Tests. If vehicle fails, remove from service and refer to 'Wheel Brake Inspection', to evaluate the reason for failure.

Aggressive Stop Test

WARNING ***To prevent serious injury or death, all brake tests must be done in a safe location with regard for the safety of all personnel.***

Always conduct a visual inspection and evaluate pedal travel before operating a vehicle to verify some braking function is present.

The purpose of this test is to attempt to fully expand and release the brake adjusters on a vehicle which has failed the first set of Periodic Brake Performance Tests. It is important that the technician/mechanic exercise care and perform the test in a non-congested area with regard for the safety of all personnel.

To perform an Aggressive Stop Test, equally load both sides of the vehicle (Figure 13) and apply maximum force and travel to the service brake pedal while moving. Do not latch the parking brake. Do this a total of 10 times with the first few at slow speed. If brake function is adequate or improves, increase speed for the remaining tests. Before the end of the tests, both wheels should lock at approximately the same time and slide straight.

NOTICE: The brake adjuster mechanism must expand and release fully to function. Under light usage this may not occur, even though the vehicle stops acceptably. The adjuster functions most consistently with aggressive braking.

Wheel Brake Inspection

⚠WARNING ***Wear a dust mask and eye protection whenever working on wheel brakes. Do not use pressurized air to blow dust from brake assemblies. Replace both brake shoes on both wheels if one or more shoes are worn below .06" (1.5mm) thickness at any point.***

⚠CAUTION ***Do NOT touch any of the wheel brake mechanism except as instructed.***

Do NOT use a commercial brake cleaner unless the entire brake has been disassembled.

1. Remove the brake drums.
   Do not disturb adjuster mechanisms. Remove excess dust and dirt from the drum with a brush.

⚠WARNING ***The drum must not be turned to "true" a worn friction surface. Turning will make the drum too thin causing drum failure and a loss of brakes which could cause severe injury or death.***

2. Inspect the brake drum.
   Look for a blue coloration or blistered paint that would indicate that it has overheated. Check for evidence of scoring. Check for excessive wear indicated by the friction surface being significantly worn and leaving a ledge of unworn drum. Inspect the splines for galling, wear and corrosion. If any of these problems are found, the drum must be replaced.
3. Remove any accumulated brake dust from the wheel brake assembly with a brush.
4. Visually inspect the axle seal for oil leakage and the condition of the thrust washer. If oil is present, see REAR AXLE section.
5. Verify the inner brake drum washer is present and check its condition. Replace if damaged or missing.

⚠WARNING ***If one wheel brake assembly requires replacement, the second must also be replaced.***

⚠CAUTION ***Use care when handling the adjuster arm. Too much force will damage the adjuster and require that both wheel brake assemblies be replaced.***

6. Visually check the condition and operation of the adjuster mechanism.
   Inspect the brake lever for damage or wear. Test the adjuster function as follows:
   Push the front brake shoe in the direction of the rear of the vehicle and hold in position.
   Operate the brake lever.
   Observe the brake adjuster arm and note if the arm engages the star wheel and attempts to rotate it (Figure 14).

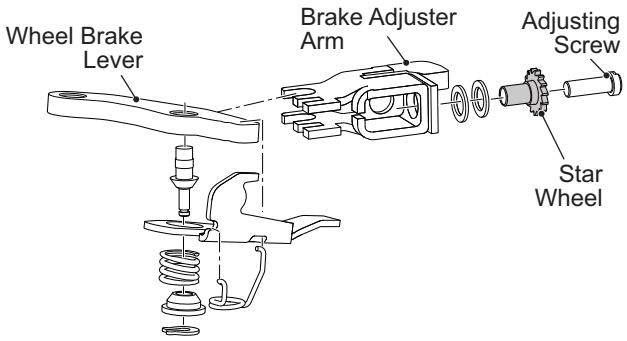


Figure 14 Adjuster Mechanism

   If the adjuster arm **engages and turns** the star wheel, proceed. If the arm **fails to engage** the star wheel, it has been damaged and both wheel brake assemblies must be replaced.
   If the adjuster arm engages the star wheel but **fails to rotate it**, the adjuster assemblies must be replaced with new color-coded adjusters. Note the location of the two Teflon coated washers (Figure 21).
7. Check the condition and operation of the moving anchor assembly (Figure 21).
   Operate the brake lever to check for free motion. The adjuster assembly and brake lever should move smoothly from front to back on the backing plate. If the moving anchor assembly is damaged or binds against the backing plate, replace both of the wheel brake assemblies.

⚠WARNING ***A backing plate assembly that shows any indication of galling or gouging is not repairable and must be replaced with a new wheel brake assembly. Always replace wheel brake assemblies in pairs.***

8. Inspect the backing plate.
   Inspect for gouges, galling or other damage, particularly where the backing plate is contacted by the brake shoes and by the moving anchor assembly. Replace both backing plates if any gouges or galling is found.
9. Measure the brake shoe thickness.
   Measure at the most worn area. Brake shoe thickness must never be less than .06" (1.5 mm) at any point on the shoe. It is normal for the shoes to show more wear at the leading and trailing edges (Figure 15). If the brake shoe thickness is approaching .06" (1.5 mm), it is recommended that the shoes be replaced. It is recommended that the brake shoe

springs and brake adjusters be replaced when installing new brake shoes.

10. Inspect the brake shoe springs.
    Be sure that they are not broken or damaged and are correctly installed. The springs must be inserted with the light spring at the bottom. The long hook is installed down through the rear brake shoe. The heavier top spring is installed with the spring hooks facing up. The heavy top spring is installed with both spring hooks installed down through the brake shoes (Figure 16). Repeat procedure at the opposite wheel brake.
11. Check/adjust brake pedal free travel.
    Whenever the brake system is serviced or requires a parts replacement, the brake pedal free travel must be checked and adjusted. See the *Adjusting Brake Pedal Free Travel.* This includes all linkage and wheel brake components.

The pattern of normal brake shoe wear is shown in quadrant 'A', 'B', 'C' & 'D' with quadrant 'A' showing the most wear. Quadrant 'B' will show the second most wear.

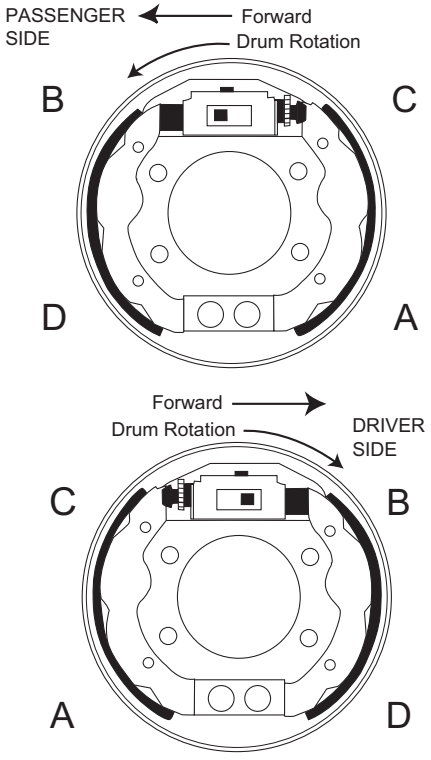


Figure 15 Brake Shoe Wear

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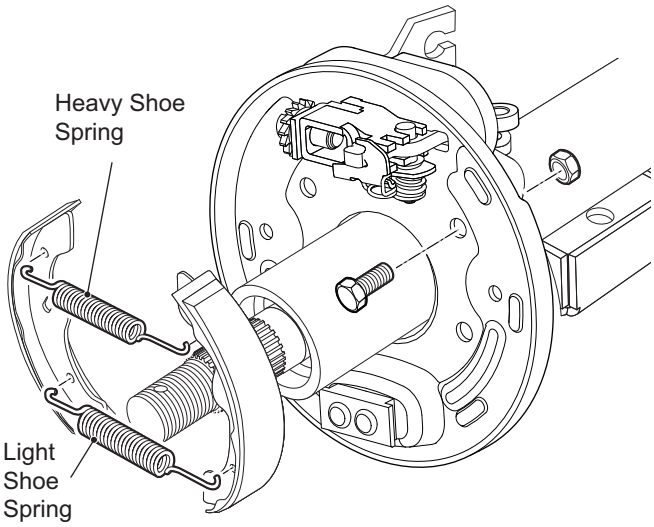


Figure 16 Orientation of Brake Shoe Springs

MAINTENANCE AND REPAIRS

Tool List	Qty.
Hydraulic Floor Jack	1
Scale	1
Jack Stands	4
Wheel Chocks	4
Socket, 1/2"	1
Socket, 3/4"	1
Socket, 11/16"	1
Socket, 15/16"	1
Socket, 1 1/8"	1
Socket, 1/4"	1
Torque Wrench, ft. lbs.	1
Torque Wrench, in. lbs.	1
Extension, 6"	1
Ratchet	1
Open End Wrench, 1/4"	1
Open End Wrench, 1/2"	1
Open End Wrench, 5/8"	1
Straight Blade Screwdriver	1
Straight Blade Screwdriver, narrow	1
Pliers	1
Vernier/Dial Calipers	1
Plastic Tipped Hammer	1
Puller (P/N 15947G1)	1
Pry Bar	1
Dust Mask	1
Emery Cloth	1

Read all of SAFETY and this section before attempting any procedure. Pay particular attention to Notices, Cautions, Warnings and Dangers.

Parts Replacement vs. Repair

Some maintenance or repair tasks can take considerable labor to do correctly. Assessment of the condition of worn components is critical to the operation of the brake system. In some cases, component replacement may be more cost effective than the removal, cleaning, inspection and reassembly of the component(s).

Adjusting Brake Pedal Free Travel

⚠ CAUTION ***Brake pedal free travel MUST be checked and adjusted any time that the brake system is serviced or when parts are replaced.***

Brake pedal free travel is the distance the pedal travels from rest to the point at which the brake cables start to move the brake levers. This should not be confused with the light resistance that is felt as the brake pedal is pressed enough to remove slack from the compensator and cables. Correct adjustment of free travel is essential to proper brake function. Too much pedal free travel will limit braking capability. Too little pedal free travel may cause the brakes to drag (not fully released). Either condition can prevent the brakes from adjusting properly.

⚠ WARNING ***This procedure is intended to adjust the brakes and seat brake system components. The brake system may not be effective for the first few applications of the brake pedal.***

1. Pre-adjust service brake pedal free travel to the correct setting by loosening the jam nut and adjusting the spherical nut (Figure 17). Tighten the jam nut to 10 - 11 ft. lbs. (14 - 15 Nm).

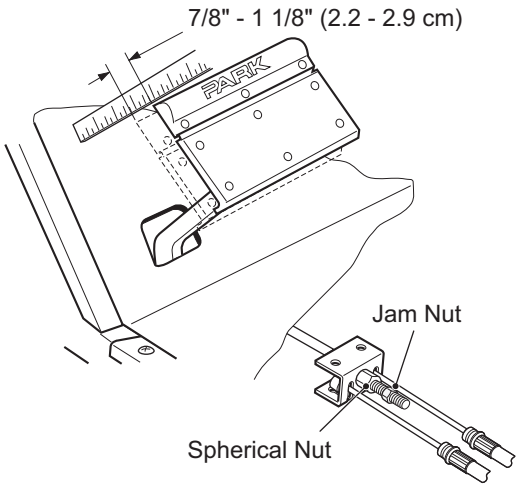


Figure 17 Free Travel Adjustment

2. The brake pedal free travel should be set to 7/8" - 1 1/8" (2.2 - 2.9 cm).
3. Press the brake pedal aggressively 4 - 6 times to establish known free travel.

⚠ WARNING ***All brake tests must be done in a safe location with regard for the safety of all personnel.***

4. In a safe location free from people and vehicles, drive the vehicle at reduced speed and apply the brakes aggressively. As the brakes adjust and stop the vehicle, start driving at maximum speed and brake aggressively 10 times.
5. At the spherical nut, adjust the free travel as noted above.
6. Drive again and brake aggressively 10 times.
7. Repeat the previous step(s) until the pedal free travel does not change during the aggressive braking.
8. Check to see that the clevis pins attaching the brake cables to the brake levers are loose (Figure 18). If they are not loose, inspect system again and correct as required.
9. If the clevis pins are loose, tighten jam nut to 10 - 11 ft. lbs. (14 - 15 Nm) at the spherical nut.

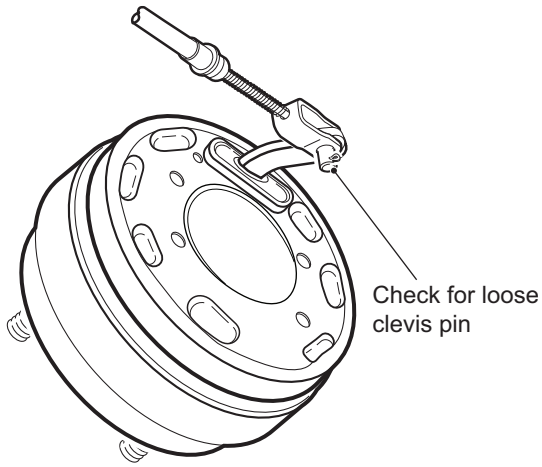


Figure 18 Check Clevis Pins

10. The parking brake latching force can be checked as verification after setting brake pedal free travel. To check parking brake latching force, place a 'bathroom' scale on the service and parking brake pedals. Using both feet press the scale down against the parking brake pedal until it latches. The parking brake should latch between 65 and 75 lbs. (29 - 34 kg) indicated on the scale (Figure 19).

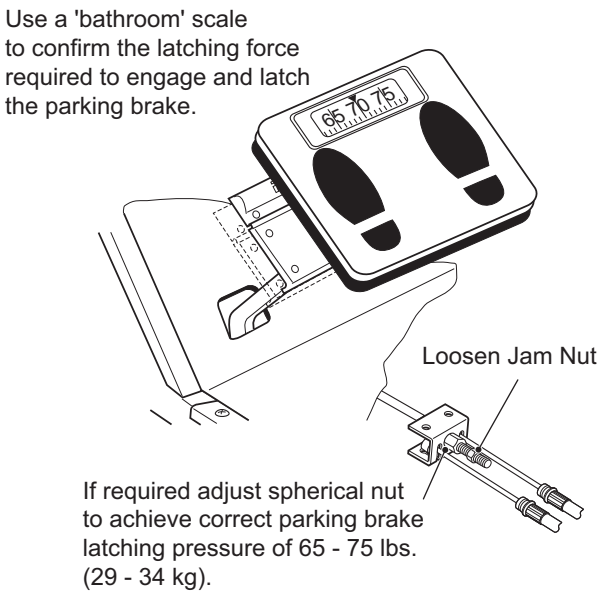


Figure 19 Checking Parking Brake Latching Pressure

11. Perform the Periodic Brake Performance Test as described and return the vehicle to service if brake performance is satisfactory.

Brake Drum Removal and Installation

1. Remove the dust cap (1) to gain access to the castellated nut (2) and the cotter pin (3) (Figure 20).

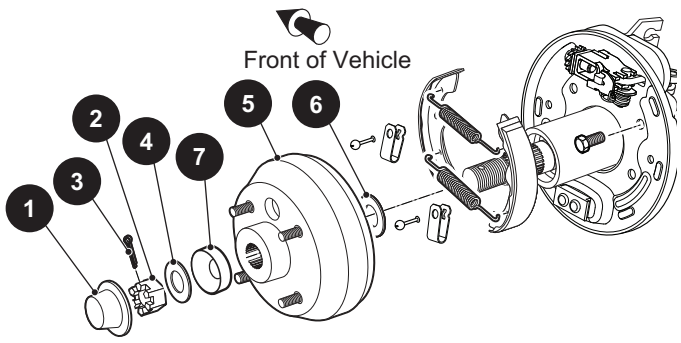


Figure 20 Brake Assembly

2. Remove the cotter pin and castellated nut as shown.

NOTICE: Do not apply the brake when removing the nut as the shoes may not fully retract preventing removal of the brake drum.

3. Remove washer (4) and spindle cap adapter (7).
4. Slide the brake drum (5) from the axle shaft. If required, tap the drum with a plastic faced hammer to loosen it from the axle shaft or use drum puller (P/N 15947G1).

⚠ CAUTION ***Use care when raising the adjuster arm. Too much force will damage the adjuster and require that both wheel brake assemblies be replaced.***

5. If the drum does not slide from the brake assembly, the brake shoes must be retracted. Rotate the hub so that the hole in the drum is in the six o'clock position which is directly over the brake mechanism. Use a small straight blade screwdriver to raise the adjuster arm **just above** the star wheel.
6. Loosen the star wheel to retract the brake shoes and remove the brake drum.

NOTICE: Pay particular attention to the location of the inner brake drum washer (6) inside the brake drum, which may be on the axle shaft or attached to the rear of the drum hub. This washer must be reinstalled when the brake is reassembled.

7. To install the brake drum, clean the axle shaft and the splines on the brake drum to remove dirt, grease and foreign matter.
8. Apply a small amount of anti-seize compound to the axle spline.
9. Install the inner brake drum washer (6) and slide the brake drum (5) into place. Check to ensure the nose of drum hub is beyond the end of the axle splines. If not, remove drum and install one additional inner brake drum washer (total of 2) to obtain required spacing.

⚠ CAUTION ***Do not back off nut to install cotter pin.***

10. Install the remaining hardware and tighten the nut to 80-90 ft. lbs. (108 - 122 Nm) torque. Continue to tighten until a new cotter pin can be installed through the castellated nut and the hole in the axle. Maximum torque is 140 ft. lbs. (190 Nm).

Wheel Brake Service

Wheel brake service consists of disassembly, cleaning, inspection, lubrication and re-assembly of the wheel brake. Worn or damaged components must be replaced. Wheel brake service is required periodically as a preventive maintenance measure (see SCEDULED MAINTENANCE CHART section). The wear rate of brake shoes and required service intervals will vary based on usage, terrain and other conditions. It is recommended that wheel brake service be performed periodically on a sample of vehicles within the service fleet to establish the most efficient and effective service interval.

1. Remove the brake drum as described in 'Brake Drum Removal and Installation'.

Read all of SAFETY and this section before attempting any procedure. Pay particular attention to Notices, Cautions, Warnings and Dangers.

⚠ WARNING ***Wear eye protection and a mask when cleaning brake components. Do not use compressed air to remove brake dust from brake assembly.***

⚠ CAUTION ***Do NOT use a commercial brake cleaner unless the entire brake has been disassembled.***

2. Remove any accumulated brake dust with a brush.
3. Remove the brake shoes. See the *Brake Shoe Removal.*
4. Clean backing plate with a commercial brake cleaner. Allow to dry completely.

⚠ CAUTION ***It is important that the friction areas between the backing plate and the brake shoes be lubricated. Be careful not to allow lubricant to contact the braking portion of the brake shoes or the friction surface of the brake drum. Use only recommended lubricants.***

5. Lubricate the backing plate friction points of the shoes and surfaces with Multi Purpose Grease (MPG) lubricant (Figure 21).

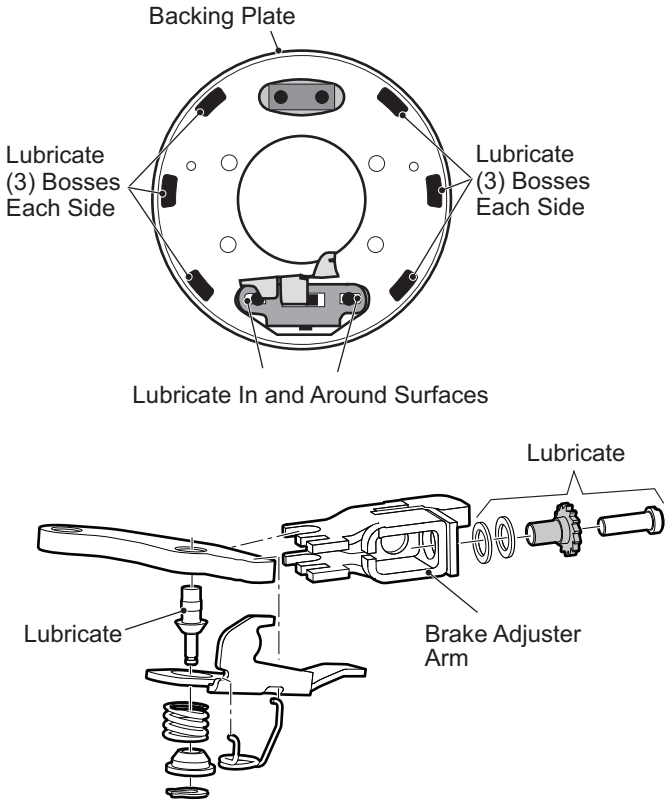


Figure 21 Wheel Brake Lubrication Points

6. Install the actuator components, adjuster components and brake shoes See the *Brake Shoe Installation.* If the brake shoes and drum are not to be replaced, sand the friction surfaces lightly with emery cloth to remove any foreign material.

⚠ CAUTION ***Be sure that the adjusting screw is screwed into the star wheel nut until only 1 - 2 threads are exposed. If the brake shoes are replaced, replace the brake springs and the adjuster components.***

7. Replace the springs one side at a time, using the other side as a guide.
8. Install brake drum as described in 'Brake Drum Removal and Installation'.
9. Repeat on other side of vehicle.
10. Adjust the brake pedal free travel. See the *Adjusting Brake Pedal Free Travel.*

Backing Plate/Entire Wheel Brake Assembly Removal and Installation

11. Remove the four bolts (1) and lock nuts (2) securing the wheel brake backing plate to the flange on the axle tube (Figure 22).

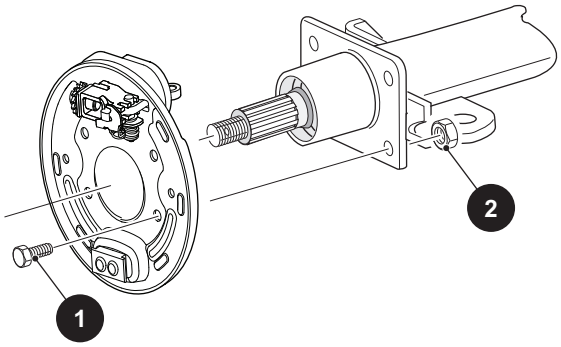


Figure 22 Backing Plate Removal and Installation

12. Remove the clevis pin securing the brake cable to the brake lever.
13. Installation is the reverse of removal. Connect the brake cable to the wheel brake with the clevis pin installed from the top down and a new cotter pin. Install the brake assembly or backing plate to the axle tube flange. Install new hardware (locknut should only be used once) and tighten to 23 - 28 ft. lbs (31 - 38 Nm) torque.

Read all of SAFETY and this section before attempting any procedure. Pay particular attention to Notices, Cautions, Warnings and Dangers.

Brake Shoe Removal

NOTICE: It is recommended that when brake shoes are replaced, the adjusters and springs also be replaced. It is good practice to do one side at a time, using the other side for reference.

1. Using a pair of pliers, compress the brake shoe retainer springs (1) at the open end of the spring. While holding the tension pin (2) with a second set of pliers, turn the retainer spring 1/4 turn to align the slot in the spring retainer with the flats in the tension pin. Remove the brake shoe retainer springs.
2. Grasp the brake shoes (3) in the center and tilt them outwards and away from the back mounting plate. This will release the tension in the brake springs(4). Remove the brake springs and remove the brake shoes (Figure 25).
3. Inspect brake shoes. If a brake shoe has less than 0.40 lining material thickness AT ANY POINT on either shoe then both shoes MUST be replaced.
4. Check for free lateral (front and back) movement of the adjusting mechanism and for free movement of the 'star' wheel. Remove the boot on the brake lever. Clean any accumulated brake dust from the backing plate and adjuster mechanism using a brush or air hose.
5. If the brake is removed for axle bearing and seal replacement, the bolts and nuts securing the brake assembly to the rear axle must be removed. When reinstalling brake mounting bolts, tighten to 23 - 35 ft.lbs torque.
6. Clean backing plate with a commercial brake cleaner. Allow to dry completely. Lubricate friction points of shoes and moving anchor with Multi Purpose Grease (MPG) lubricant (Figure 21).

Read all of SAFETY and this section before attempting any procedure. Pay particular attention to Notices, Cautions, Warnings and Dangers.

Brake Shoe Installation

The brake shoe end is pointed and engages the backside of the adjuster.There is a 17L stamped into brake shoe (Figure 23).

Figure 23 Brake Shoe '17L'

The brake shoe end is squared off and engages the screw end of the adjuster. The brake shoe is stamped with '17T into the shoe (Figure 24).

1. Install the brake shoes using the reverse order of disassembly and secure with the brake shoe retainer springs and brake shoe return springs.

Figure 24 Brake Shoe '17T'

2. Clean the axle shaft to remove grease, dirt and all foreign matter.
3. Insert a straight blade screwdriver between the adjusting lever and the adjusting mechanism.
4. Rotate the star wheel counter clockwise until the shoes have retracted sufficiently to permit the brake drum to be installed.
5. Install washer (5), brake drum (6), washer (8) castellated nut (9), and tighten the axle nut to 80 - 90 ft. lbs. (108 - 122 Nm) torque. Continue to tighten until a new cotter pin (10) can be installed through the castellated nut and the hole in the axle. Maximum torque 140 ft. lbs. (190 Nm).
6. Install the brake drum. See the *Brake Drum Removal and Installation.*
7. Repeat on other side of vehicle.
8. Adjust the brake pedal free travel. See the *Adjusting Brake Pedal Free Travel.*

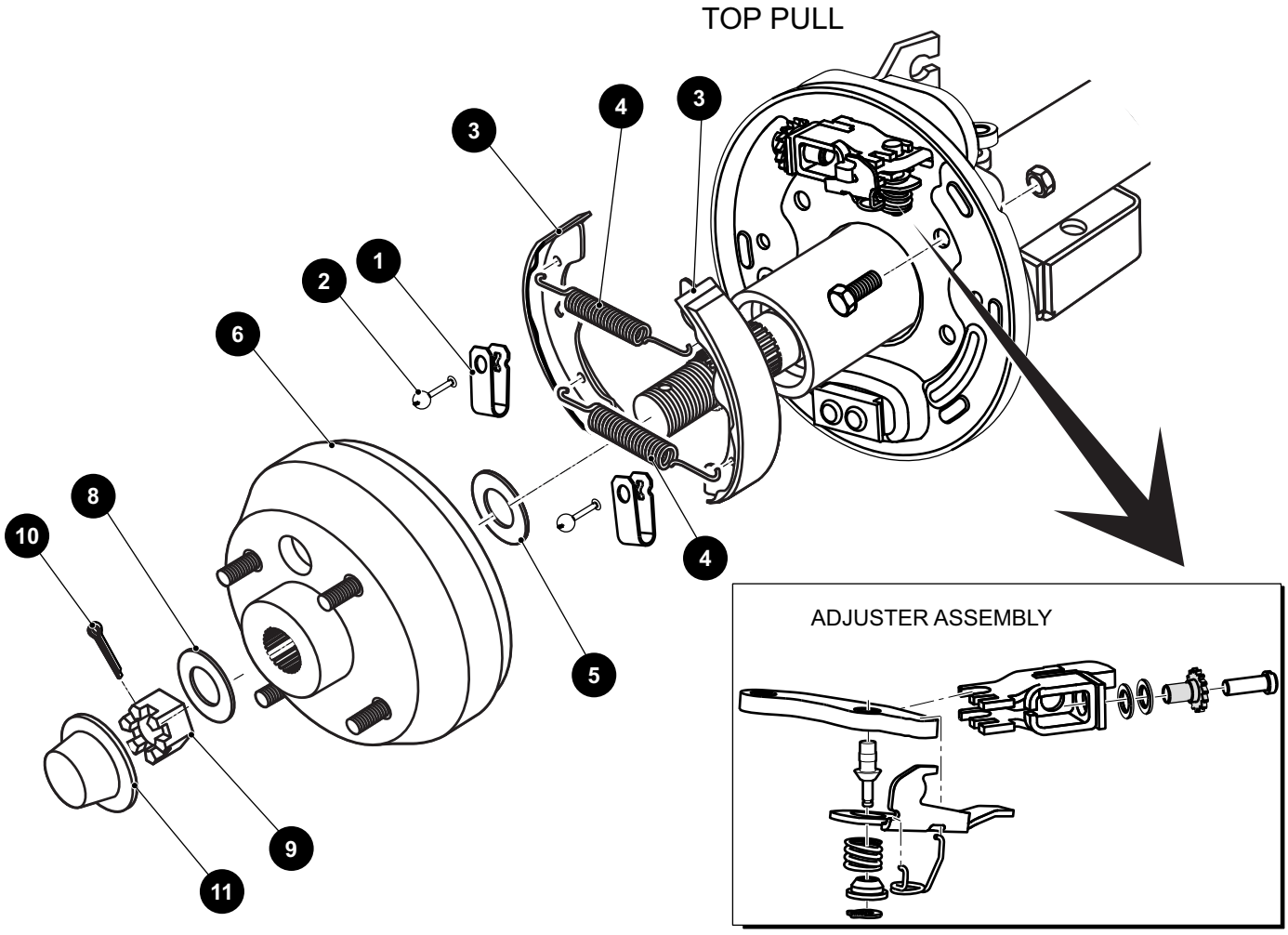


Figure 25 Brake Shoes and Springs

Brake Cable and Equalizer Assembly Removal and Installation

NOTICE: The brake cables and equalizer are only serviceable as a complete assembly.

Remove the cotter pins and clevis pins connecting the brake cables to the brake levers. Remove the retaining rings connecting the brake cables to their brackets at the axle (rear of cable) and at the frame (front of cable). Loosen and remove the jam nut and the spherical nut on the equalizer link (Figure 26). Inspect the hardware and replace if needed. Remove the brake cable and equalizer assembly and discard.

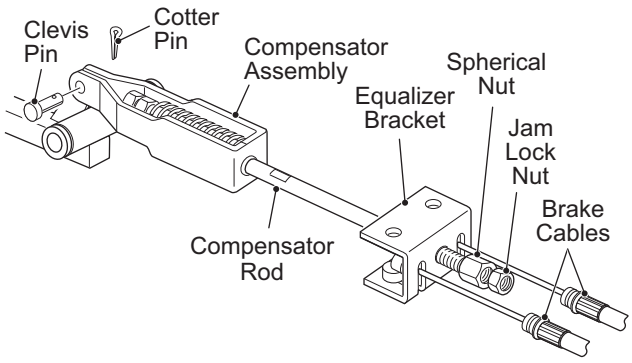


Figure 26 Brake Cable, Equalizer and Compensator

Slide the equalizer link of the new assembly over the compensator rod. Loosely install the spherical nut and new locking jam nut. Insert the cables into the frame and axle brackets. Install new retaining rings. Connect the

cables to the brake levers using new clevis pins and new cotter pins.

Adjust the brake pedal free travel. See the *Adjusting Brake Pedal Free Travel.*

Compensator Assembly, Removal and Installation

Disconnect the compensator assembly from the brake pedal by removing the cotter pin and clevis pin (Figure 26).

Loosen and remove the jam nut and the spherical nut connecting the compensator rod to the equalizer link. Remove the compensator assembly.

Installation is the reverse of removal. Use new cotter pins in the clevis pin.

Adjust the brake pedal free travel. See the *Adjusting Brake Pedal Free Travel.*

Brake Pedal Removal and Installation

Disconnect the compensator assembly (1) from the brake pedal by removing the cotter pin (2) and the clevis pin (3). Unplug the wiring harness on models equipped with brake lights. Unhook the torsion spring (4) by inserting a thin blade screwdriver between the small hook and the bracket. Move the hook back and to the side to release the torsion spring (Figure 27). Remove the lock nut (5), the shoulder bolt (6) and remove the brake pedal.

Inspect the shoulder bolt for corrosion that could cause binding. This bolt and both bushings (7) must be replaced with new ones if corrosion or wear is found.

Brake pedal installation is in the reverse order of disassembly. Tighten the nut (5) to 25 - 29 ft. lbs. (34 - 39 Nm) torque and use a new cotter pin when installing the compensator assembly. Connect brake light wiring harness, if equipped.

Adjust the brake pedal free travel. See the *Adjusting Brake Pedal Free Travel.*

Check for proper brake light operation if equipped.

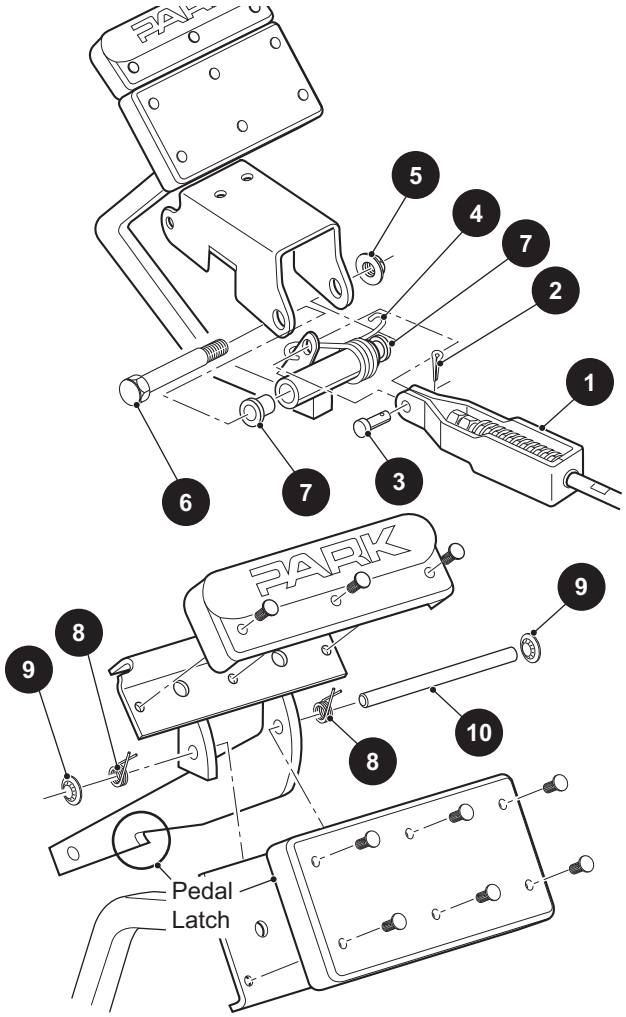


Figure 27 Brake Pedal Removal and Installation

Parking Brake Catch Bracket Removal and Installation

Remove the driver side front wheel to gain access to the brake pedal release mechanism.

⚠WARNING ***To prevent serious injury death resulting from the use of worn parking brake components, to not attempt to re-new worn components. The catch bracket is a hardened part. Do not grind or file it as doing so will cause the part to lose its hardness characteristics. A new part must be used.***

Remove the two bolts (1) and nuts (2) which secure the catch bracket. Replace the catch bracket with a new one, replace and tighten the hardware to 85 - 95 in. lbs. (10 - 11 Nm) torque (Figure 28).

If required, adjust the kick-off cam (3). See the *Parking Brake Kick-Off Cam Removal.*

Install wheel. See WHEELS AND TIRES section.

Read all of SAFETY and this section before attempting any procedure. Pay particular attention to Notices, Cautions, Warnings and Dangers.

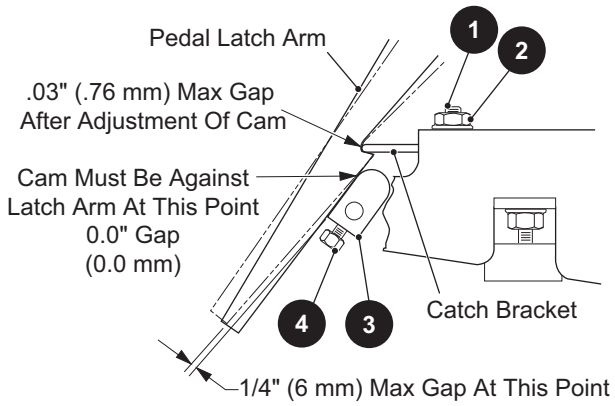


Figure 28 Catch Bracket and Latch Arm

Parking Brake Pedal Removal and Installation

Note the location and orientation of the two torsion springs (8). Remove the push nut (9) and pin (10) (Figure 27) and remove the parking brake pedal. Some models may use two push nuts on the pin.

⚠WARNING ***To prevent serious injury or death resulting from the use of worn parking brake components, to not attempt to re-new worn components. The parking brake arm latch is a hardened part. Do not grind or file it as doing so will cause the part to lose its hardness characteristics. A new part must be used.***

Installation is in the reverse order of disassembly. Use a new push nut (or push nuts).

If required, adjust the kick-off cam (3). See the *Park Brake Linkage and Kick-Off Cam.*

Pedal Bumper Adjustment

Loosen bumper lock nut and adjust the bumper by rotating it (Figure 29). The brake pedal must contact the pedal bumper when pedal is released and the dimension from the top of the pedal arm to the setscrew heads in the kick-off cam should be approximately 1/4" - 3/8" (6 - 9.5 mm).

Tighten the lock nut to 12 - 14 ft. lbs. (16 - 19 Nm).

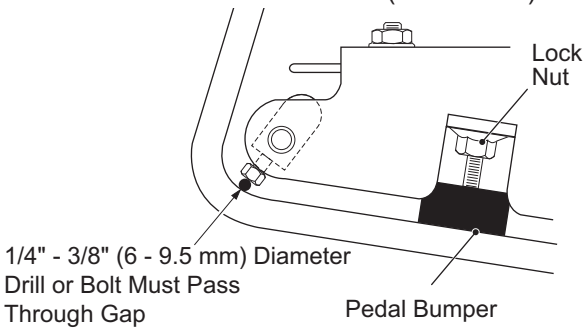


Figure 29 Pedal Bumper Adjustment

Parking Brake Release Linkage Removal and Replacement

Remove the cotter pin (2), washers (3) and bushings (4) from linkage rod (1). Remove the linkage rod (Figure 30).

Inspect the bushings (4). If they are worn replace them with new ones.

Installation is in the reverse order of disassembly.

If required, adjust the kick-off cam (6). See the *Parking Brake Kick-Off Cam Removal.*

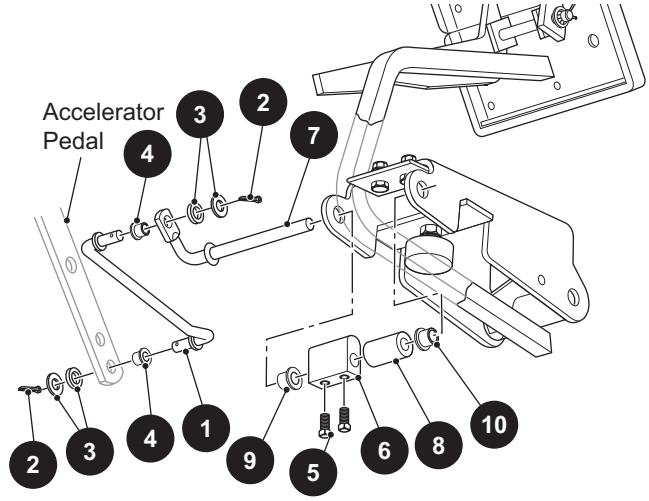


Figure 30 Park Brake Linkage and Kick-Off Cam

Parking Brake Kick-Off Cam Removal

1. Disconnect the parking brake release linkage as described above.
2. Loosen the two setscrews (5) from the cam (6) and remove the cam pivot (7), cam and spacer (8) (Figure 30).
3. Inspect the bushings (9,10) and spacer. If they are worn, replace them with new ones.
4. Installation is in the reverse order of disassembly.
5. With the parking brake engaged and fully latched, there must be no gap between the top of the cam and the latch arm.
6. To adjust the kick-off cam (6), engage the parking brake and loosen the two cam setscrews (5) and rotate the cam until it contacts the latch arm.
7. Tighten the setscrews to 45 - 55 in. lbs. (5 - 6 Nm) torque. Always use new epoxy patch setscrews when replacing the kick-off cam.

Read all of SAFETY and this section before attempting any procedure. Pay particular attention to Notices, Cautions, Warnings and Dangers.

Notes:

FRONT SUSPENSION AND STEERING

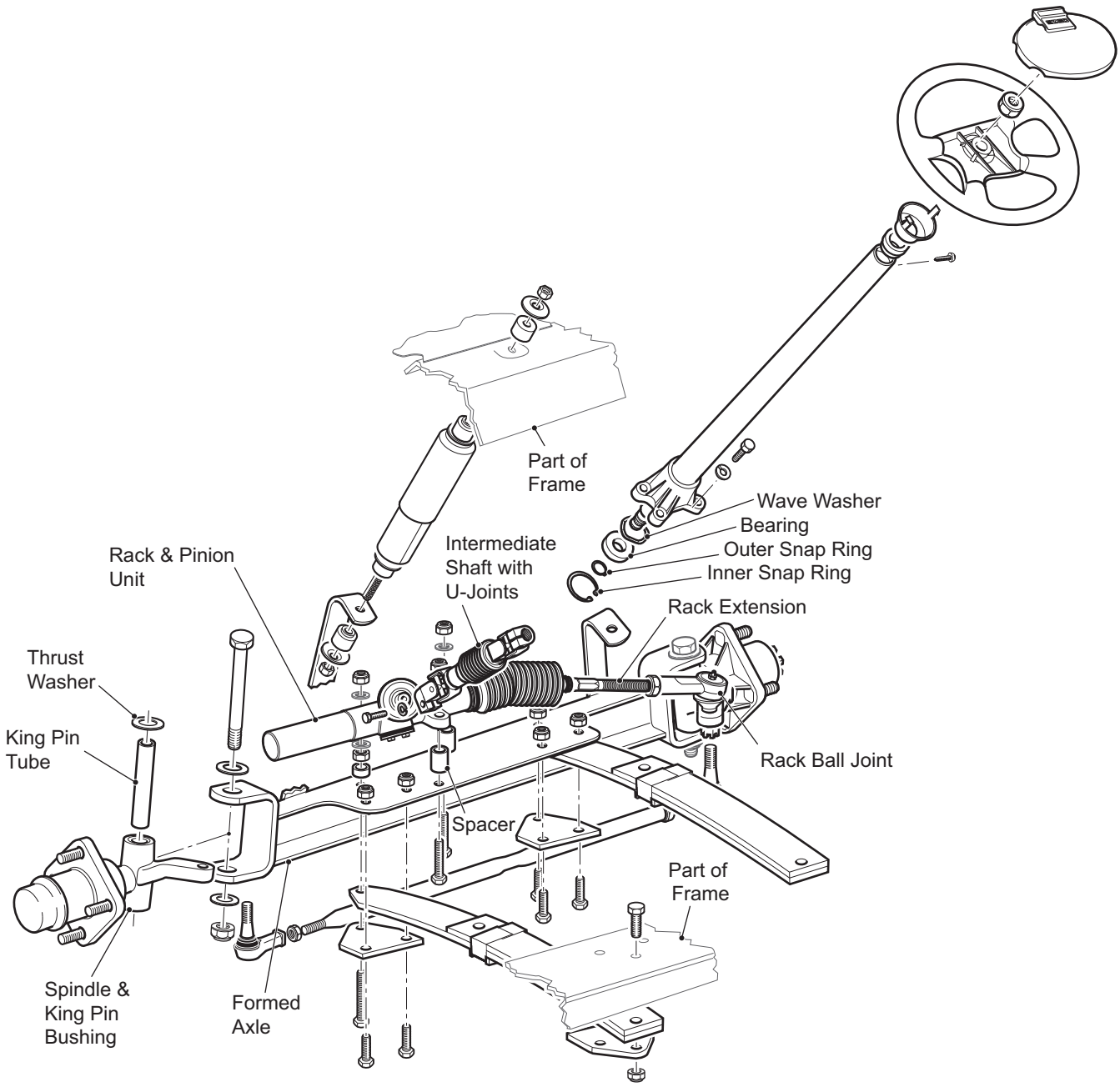


Fig. 1 Steering and Front Suspension

FRONT SUSPENSION AND STEERING

Read all of SAFETY and this section before attempting any procedure. Pay particular attention to Notices, Cautions, Warnings and Dangers.

MAINTENANCE

NOTICE: In the following text, there are references to removing/installing bolts etc. Additional hardware (nuts, washers etc.) that is removed must always be installed in its original position unless otherwise specified. Non-specified torque specifications are as shown in the table contained in GENERAL INFORMATION AND ROUTINE MAINTENANCE Section.

Routine maintenance of the front suspension and steering consists of:

- periodic inspections for loose, worn or damaged components
- alignment checks
- lubrication of ball joints and wheel bearings

Maintain the correct adjustment of the front bearings and repack them in accordance with the SCEDULED MAINTENANCE CHART section or if a bearing replacement is required. Routine examination of the tires will provide indications if an alignment is required.

Lubrication

Tool List **Qty.**

Grease Pump 1
Shop Towels ..... AR

Grease the rack ball joint (1) (Ref. Figure 2) per THE SCEDULED MAINTENANCE CHART section. Wipe off old grease that is forced out of the rubber boot.

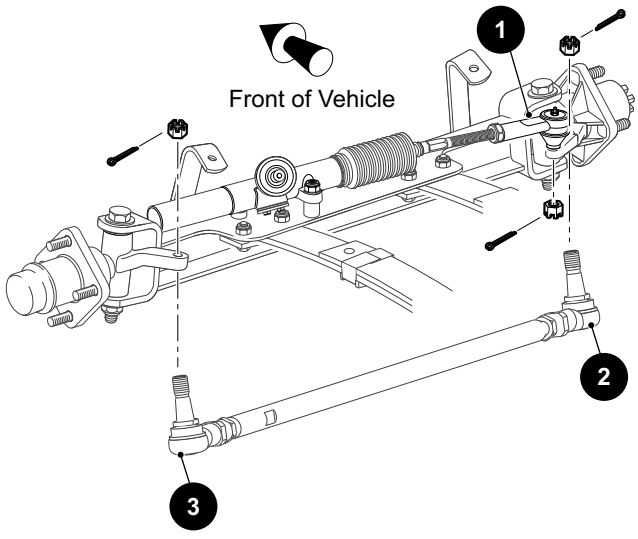


Figure 2 Lubrication Points

Wheel Bearing and King Pin Bushing Inspection

⚠WARNING ***To prevent possible injury or death resulting from a vehicle falling from a jack, follow the lifting procedure in SAFETY section of this manual. Be sure the vehicle is on a firm and level surface. Never get under a vehicle while it is supported by a jack. Use jack stands and test the stability of the vehicle on the stands before starting any repair procedure. Always place chocks in front and behind the wheels not being raised. Use extreme care since the vehicle is extremely unstable during the lifting process.***

1. Lift the front of the vehicle and support on jack stands as per the SAFETY section.
2. Rotate the front wheel and feel for any roughness.
3. While holding spindle with one hand, grasp bottom of tire with other hand and rock tire back and forth on spindle.

NOTICE: Some minor rocking movement of tire is normal.

If excess movement is detected, the wheel bearing may require repacking and adjusting or replacement. See the *Wheel Bearing Packing on page 48* See the *Wheel Bearing Adjustment on page 49*

If the wheel bearing is satisfactory, a worn spindle bearing, which is not a serviceable item, is indicated and the spindle must be replaced. See the *Spindle Replacement on page 58*

Wheel Bearing Packing

Tool List **Qty.**

Grease Pump.....1
Bearing Packer (Recommended).....1

1. Remove the hub from the spindle and disassemble. See the *Wheel Bearing and Race Replacement on page 54*.
2. Clean all bearings, grease seal, hub and dust cap in solvent and dry thoroughly. Inspect for signs of damage. Pitting or a blue coloration of the rollers will require replacement of the bearing. If the roller portion of the bearing is to be replaced, the race must also be replaced. See the *Wheel Bearing and Race Replacement on page 54*.
3. The front wheel bearings are the tapered roller type and must be packed with grease at installation or any time the bearing is removed for inspection. It is recommended that a bearing packer attached to a grease gun be used; however, manual packing is acceptable if done correctly. To pack a bearing manually requires that a dab of grease be placed in the palm of the hand and the bearing be dipped in the grease. Force the grease up through and around all

of the rollers until the entire bearing is saturated in grease.

4. Assemble the hub and install on the spindle. See the *Hub Replacement on page 53*

NOTICE: Once hub is placed onto spindle and before outer wheel bearing is installed, fill the area between the inner and outer wheel bearings about 1/2 - 3/4 full with grease.

Wheel Bearing Adjustment

Tool List **Qty.**

Socket, 1 1/2" 1
Ratchet 1
Torque Wrench, ft. lbs. 1
Adapter 1
Torque Wrench, in. lbs. 1

1. If performing a wheel bearing adjustment only, lift and support front of vehicle per the SAFETY section.
2. Remove dust cap (1) and cotter pin (2) and loosen castellated nut (3).
3. If performing a wheel bearing adjustment as part of another procedure, make sure the wheel is mounted to the hub hand tight with lug nuts (4) and hub is loosely retained on spindle (5) with castellated nut (Ref. Figure 3).
4. Seat bearings by rotating wheel while tightening castellated nut until slight resistance is felt.
5. Rotate the wheel 2 - 3 more turns to displace excess grease. If required, tighten castellated nut (3) again until slight resistance is felt. If the cotter pin hole in the spindle (5) aligns with a slot in the castellated nut, insert a new cotter pin (2). If the hole does not align, the castellated nut must be **loosened** to align with the **closest available** slot in the nut.
6. Check for smooth and free rotation of the wheel and an absence of play when the wheel is grasped by the outside of the tire. Bend the cotter pin (2) against the flats of the castellated nut (3).
7. Replace the dust cap (1) and lower vehicle per SAFETY section.
8. If completing a wheel bearing adjustment as part of another procedure, tighten front wheels per WHEELS AND TIRES section.

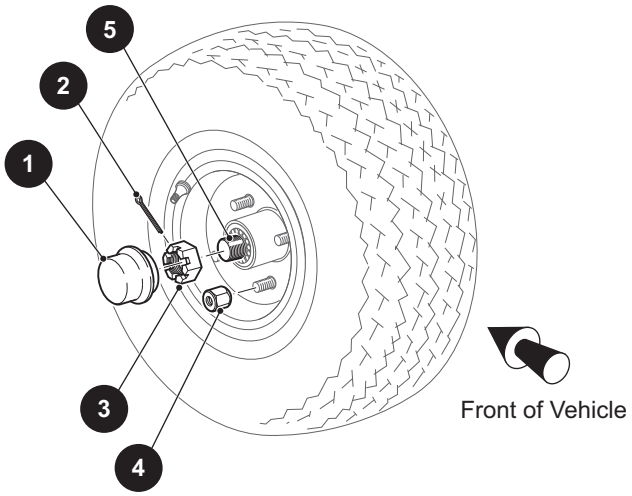


Figure 3 Bearing Adjustment

Wheel Alignment

Tool List **Qty.**

Tape Measure 1
Chalk 1
Wrench, 9/16" 1
Wrench, 3/4" 1
Crowfoot Socket, 3/4" 1
Torque Wrench, ft. lbs. 1
Socket, 13 mm 1
Ratchet 1
Torque Wrench, in. lbs. 1

1. Lift the front of the vehicle and support on jack stands as per SAFETY section. Confirm the alignment of the front springs. See the *Front Spring Replacement on page 52*
2. Rotate each wheel and scribe a chalk line around the circumference of the tire at the center of the tread pattern. Lower vehicle and, with tires in the straight ahead position, roll it forward approximately five feet in order to allow the tires to take their normal running position.
3. Measure the distance between the chalk lines at both the front and rear of the tires (Ref. Figure 4). The measurement taken at the front of the tires should be 0" - 1/8" (0 - 3 mm) less than the rear.

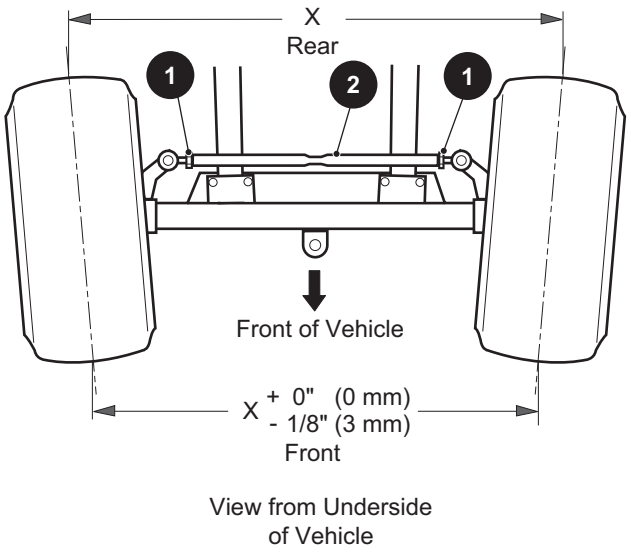


Figure 4 Wheel Alignment

NOTICE: To hold threaded tube while loosening jam nut, use a wrench on the center, flat section of tube.

NOTICE: The tie rod has different threads on each end. The end with the groove in the threaded tube has left hand threads while the end without the groove has conventional right hand threads.

4. To adjust the wheel alignment, loosen the tie rod jam nuts (1) and turn the tie rod (2) until the correct alignment is achieved. Tighten jam nuts to 36 - 40 ft. lbs. (49 - 54 Nm) torque.
5. Test drive the vehicle and confirm the steering wheel is correctly centered. If it is not centered, disconnect the intermediate shaft from the steering shaft and center the steering wheel (Ref. Figure 5).
6. Reconnect intermediate the shaft and tighten the bolt to 155 - 215 in. lbs. (180 - 250 kg cm) torque.

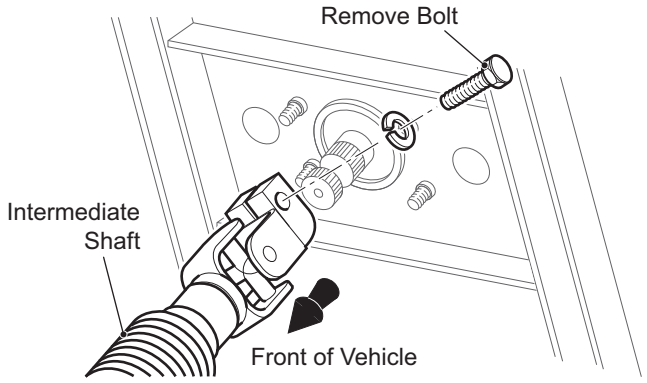


Figure 5 Disconnect Intermediate Shaft to Center Steering Wheel

Read all of SAFETY and this section before attempting any procedure. Pay particular attention to Notices, Cautions, Warnings and Dangers.

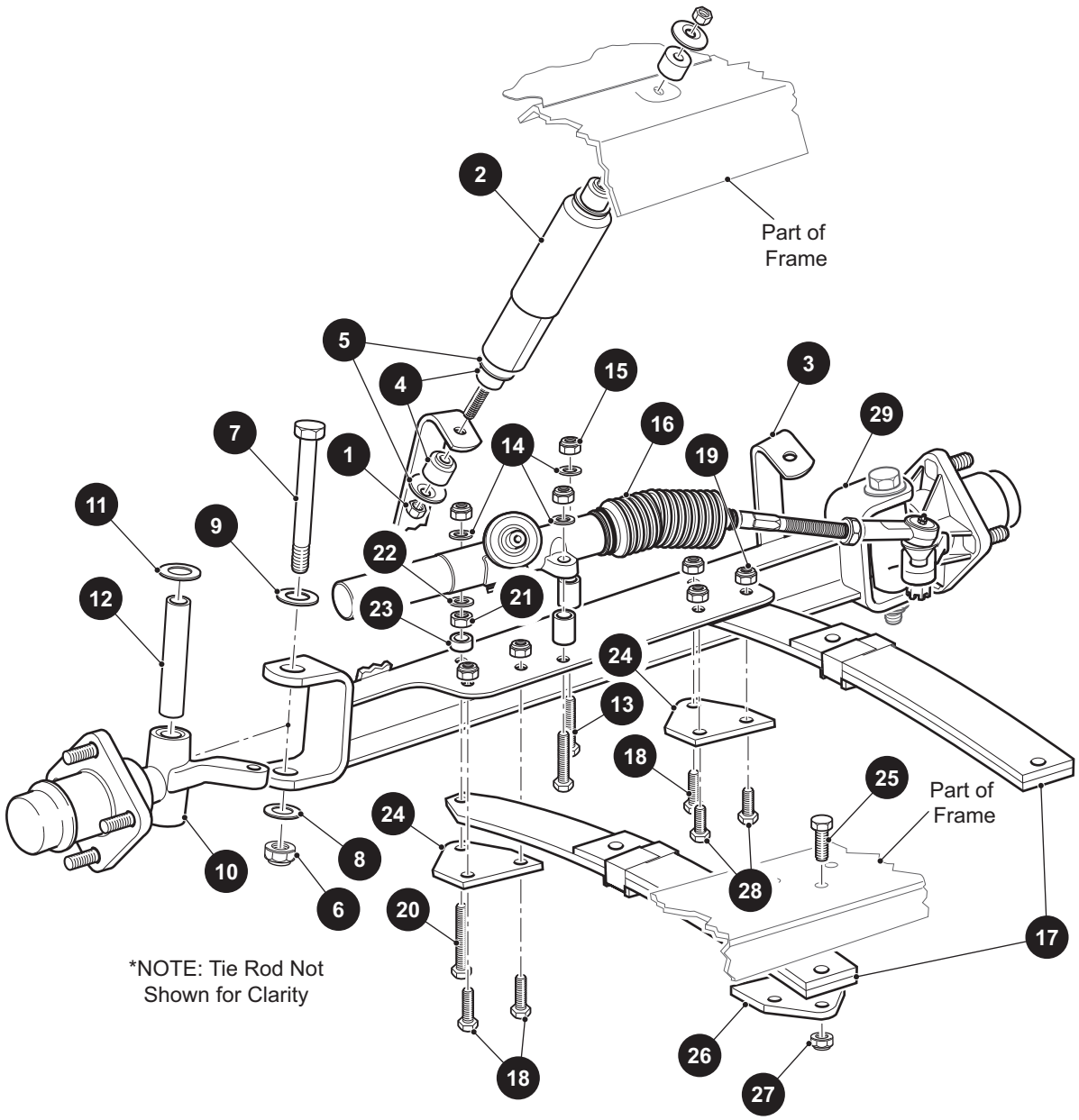


Fig. 6 Front Suspension Components

Front Shock Absorber Replacement

Tool List **Qty.**

Wrench, 9/16"..... 1

1. Remove the nut (1) from the bottom of the shock absorber(2) at the front axle (3)(Ref. Fig. 6)
2. Compress shock absorber to clear the mounting bracket.
3. Loosen the nut securing the top of the shock absorber to the vehicle frame and then rotate the shock absorber while holding the nut in place with a wrench.
4. Remove the shock absorber.
5. Installation of shock absorber is reverse of disassembly.
6. Mounting nuts should be tightened until rubber bushings (4) expand to diameter of shock absorber washers (5).

FRONT SUSPENSION AND STEERING

Read all of SAFETY and this section before attempting any procedure. Pay particular attention to Notices, Cautions, Warnings and Dangers.

Front Axle Replacement

Tool List	Qty.
Ratchet	1
Socket, 3/4"	1
Wrench, 9/16"	1
Wrench, 3/4"	1
Plastic Faced Hammer	1
Shop Towels	AR
Wire	AR
Wrench, 5/8"	1
Wrench, 11/16"	1
Socket, 9/16"	1
Socket, 5/8"	1
Torque Wrench, ft. lbs.	1

1. Loosen front wheels. Lift and support front of vehicle per the SAFETY section and remove front wheels.
2. Remove hardware (1, 4, 5) securing shock absorbers (2) to front axle (3) (Ref. Fig. 6).
3. On the driver side, remove lock nut (6) and washer (8) from bolt (7) and discard nut. Pull bolt (7) and washer (9) from spindle (10) and separate spindle from axle. Remove thrust washer (11) and king pin tube (12) from spindle, wrap towel around spindle and let spindle rest on ground.
4. Repeat at passenger side letting rack ball joint (29) rest on front spring to support spindle.

⚠ WARNING ***To prevent possible injury from falling steering components, secure rack and pinion unit (16) to front springs with wire. This will prevent the intermediate shaft connecting the rack and pinion unit to the steering column from pulling apart due to the weight of the steering system.***

NOTICE: The intermediate shaft is assembled with the universal joints set 90° out of phase with each other.

5. Remove hardware (13 - 15) securing rack and pinion unit (16) to front axle and discard lock nuts (15). Move rack and pinion unit back to rest on top of front springs (17). Secure rack and pinion unit to spring with wire to prevent pulling apart intermediate shaft.
6. Remove the three 1 3/4" long bolts (18), two 1 1/2" long bolts (28), spring plate (24) and five lock nuts (19) securing axle to springs and discard lock nuts.
7. At the 3 1/2" long bolt (20) securing front of left spring, note location of washer (22) and remove it from end of bolt. Remove nut (21), 3 1/2" long bolt (20), spring plate (24) and spacer (23) and retain them for assembly at their original locations.

⚠ CAUTION ***To prevent stress and possible damage to the rack and pinion unit, the axle must first be mounted to the springs with the hardware (20 - 23) installed in its original location (Ref. Fig. 6).***

8. To prevent damage to bellows (16), the two 1 1/2" long bolts (28) must be installed in their original location.
9. Front axle installation is the reverse order of disassembly using new lock nuts (15, 19). All hardware (18 - 24, 28) must be installed in its original location (Ref. Fig. 6).
10. Tighten leaf spring and rack and pinion unit hardware (13 - 15,18 - 21, 28) to 35 - 50 ft. lbs (50 - 70 Nm) torque.
11. Install thrust washers (11), king pin tubes (12), spindles, washers (9) and bolts (7). Tighten new lock nuts (6) to 56 - 70 ft. lbs. (75 - 95 Nm) torque. Check that spindle turns freely on king pin tube after tightening.
12. Tighten shock absorber mounting hardware until rubber bushings expand to diameter of shock absorber washer.
13. Install front wheels per the WHEELS AND TIRES section and lower vehicle per the SAFETY section.
14. Check front wheel alignment and adjust if necessary. See the *Wheel Alignment on page 49*.

Front Spring Replacement

Tool List	Qty.
Jack Stands	4
Ratchet	1
Socket, 3/4"	1
Socket, 5/8"	1
Wrench, 5/8"	1
Torque Wrench, ft. lbs.	1
Tape Measure	1

NOTICE: Failure of a single spring will result in overstressing the other spring; therefore, replace front springs as a set.

The following procedure will replace one spring at a time.

1. Loosen front wheels. Lift and support front of vehicle per the SAFETY section. In addition, support front axle with jack stands. Remove front wheels.
2. To detach driver side spring:
3. Fully loosen the two rack and pinion unit lock nuts (15), one near the bellows and one on the rear side of the rack and pinion unit, until only one thread is engaged (Ref. Fig. 6). Remove the lock nut (15) and washer (14) from the
4. long bolt (20) and discard lock nut. The rack and pinion unit is now loose.

5. Remove the two 1 3/4" long bolts (18) and lock nuts (19) securing driver side spring to axle and discard lock nuts (19).
6. Hold nut (21) with wrench and loosen long bolt (20). Note location of washer (22) and thread long bolt out as far as possible to remove the washer, nut and spacer (23). Then pull long bolt and spring plate (24) from axle and spring. Retain above items (20 - 24) for assembly at their original locations.
7. Pull upper driver side of floor mat out of plastic trim retainer and away from floor. Locate and remove hardware (25 - 27) securing rear of spring (17) to vehicle frame and discard lock nuts (27).

⚠ CAUTION *To prevent stress and possible damage to the rack and pinion unit, the driver side spring must be mounted to the axle with the hardware (20 - 23) installed in its original location (Ref. Fig. 6).*

8. Driver side spring installation is the reverse order of disassembly making sure to install the long bolt (20), spring plate (24), spacer (23), nut (21) and washer (22) in their original locations. Use new lock nuts (15, 19, 27) to secure the rack and pinion unit (16), two short bolts (18) and rear bolts (25).
9. To detach passenger side spring:
10. Remove the hardware (18, 19, 24, 28) securing the front of the passenger side leaf spring (17) to the axle (3) and discard lock nuts (19) (Ref. Fig. 6).
11. Pull upper passenger side of floor mat out of plastic trim retainer and away from floor. Locate and remove hardware (25 - 27) securing rear of spring (17) to vehicle frame and discard lock nuts (27).
12. Using new lock nuts (19, 27), install passenger side spring in the reverse order of disassembly.

NOTICE: After the springs are replaced, the axle will need to be aligned to the frame. Unless the axle has been replaced, wheel alignment will not be affected; however, it is always good practice to check wheel alignment any time the front-end components are replaced or adjusted.

13. When front springs are replaced, the front axle must be aligned to the frame. The distance from the center bolt at rear of left spring to the center bolt at front of right spring must be the same as the distance from the center bolt at rear of right spring to the center bolt at front of left spring (Ref. Figure 7). Tighten the spring hardware (21, 19, 27) first and rack and pinion unit hardware (15) next to 35 - 50 ft. lbs. (50 - 70 Nm) torque.

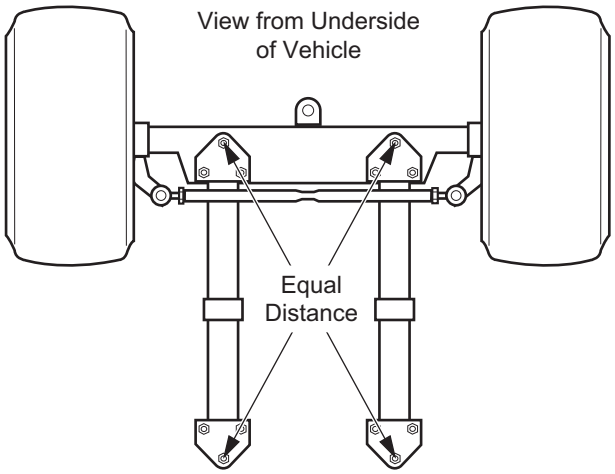


Figure 7 Front Axle Alignment

14. Replace upper portion of floor mat in plastic trim retainers. Install front wheels per WHEELS AND TIRES section and lower vehicle per SAFETY section.
15. Check front wheel alignment and adjust if necessary. See the *Wheel Alignment on page 49*.

Hub Replacement

Tool List	Qty.
Socket, 3/4"	1
Ratchet	1
Straight Blade Screwdriver	1
Ball Peen Hammer	1
Needle Nose Pliers	1
Socket, 1 1/2"	1
Wheel Bearing Grease	AR
Seal Driver	1

1. Loosen front wheel(s). Lift and support front of vehicle per SAFETY section and remove front wheel(s).
2. Remove the dust cap (1), cotter pin (2) and castellated nut (3) (Ref. Figure 8).
3. While holding outer wheel bearing (4) in place, slide hub (5) from spindle (6) and discard.

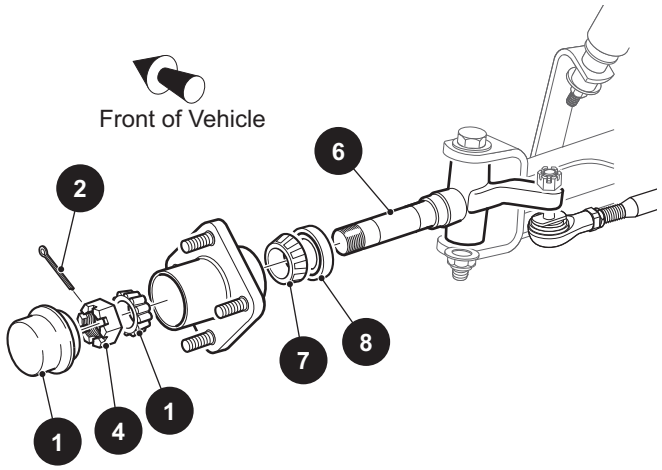


Figure 8 Hub Replacement

4. Clean spindle and new hub thoroughly with solvent.
5. Pack new bearings with grease. See the *Wheel Bearing Packing on page 48*. Apply a light coat of grease to inner race and place inner wheel bearing (7) in hub. Orient new grease seal (8) so the flange side of the seal is facing into the bore. Tap gently into place until seal is flush with end of hub. Lubricate lips of seal and spindle with grease (Ref. Figure 9).

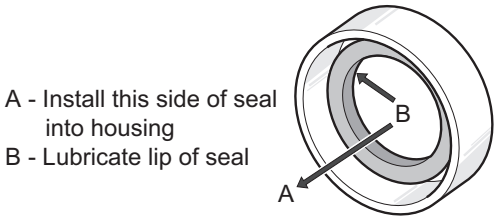


Figure 9 Seal Installation

6. Place new hub onto spindle and fill the area between the two wheel bearings about 1/2 - 3/4 full with grease and apply a light coating to the outer bearing race.
7. Install outer wheel bearing (4) and secure hub loosely with castellated nut. Place wheel onto hub and hand tighten lug nuts.
8. Adjust bearing. See the *Wheel Bearing Adjustment on page 49*
9. Replace the dust cap (1).
10. Lower vehicle per the SAFETY section and tighten front wheel(s) per the WHEELS AND TIRES section.

Wheel Bearing and Race Replacement

Tool List	Qty.
Non-ferrous Punch	1
Ball Peen Hammer	1
Bearing Driver	1

1. Remove hub (1) from spindle (Ref. Figure 10). See the *Hub Replacement on page 53*.
2. Remove the grease seal (3), inner wheel bearing (4) and bearing races (5) by tapping, through the other side of hub, the bearing race using a hammer and a soft non-ferrous punch. Tap race in a circular pattern while moving from side to side to avoid damaging bore of hub.

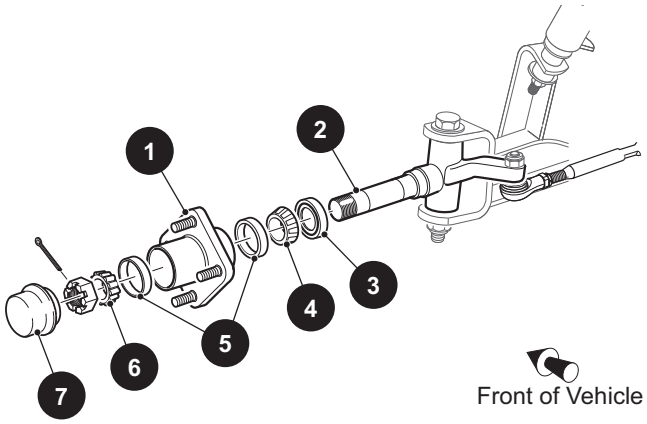


Figure 10 Wheel Bearing Replacement

3. Clean outer wheel bearing (6), inner wheel bearing (4), hub and dust cap (7) in solvent and dry thoroughly. Inspect for signs of damage. Pitting or a blue coloration of the rollers requires replacement of the bearing. If the roller portion of the bearing is to be replaced, the race must also be replaced.
4. To install race (5), make sure bore of hub (1) is clean and place new race over bore of hub. Evenly tap with hammer and bearing driver to drive race fully in bore. Repeat on other side of hub.
5. Clean spindle (2) and pack new bearings with grease. See the *Wheel Bearing Packing on page 48*.
6. Install inner wheel bearing (4) and new grease seal in hub and mount hub to spindle. See the *Hub Replacement on page 53*. Adjust bearing. See the *Wheel Bearing Adjustment on page 49*. Replace the dust cap (7).
   Lower vehicle per the SAFETY section and tighten front wheel(s) per the WHEELS AND TIRES section.
7. Lower vehicle per the SAFETY section and tighten front wheel(s) per the WHEELS AND TIRES section.

Read all of SAFETY and this section before attempting any procedure. Pay particular attention to Notices, Cautions, Warnings and Dangers.

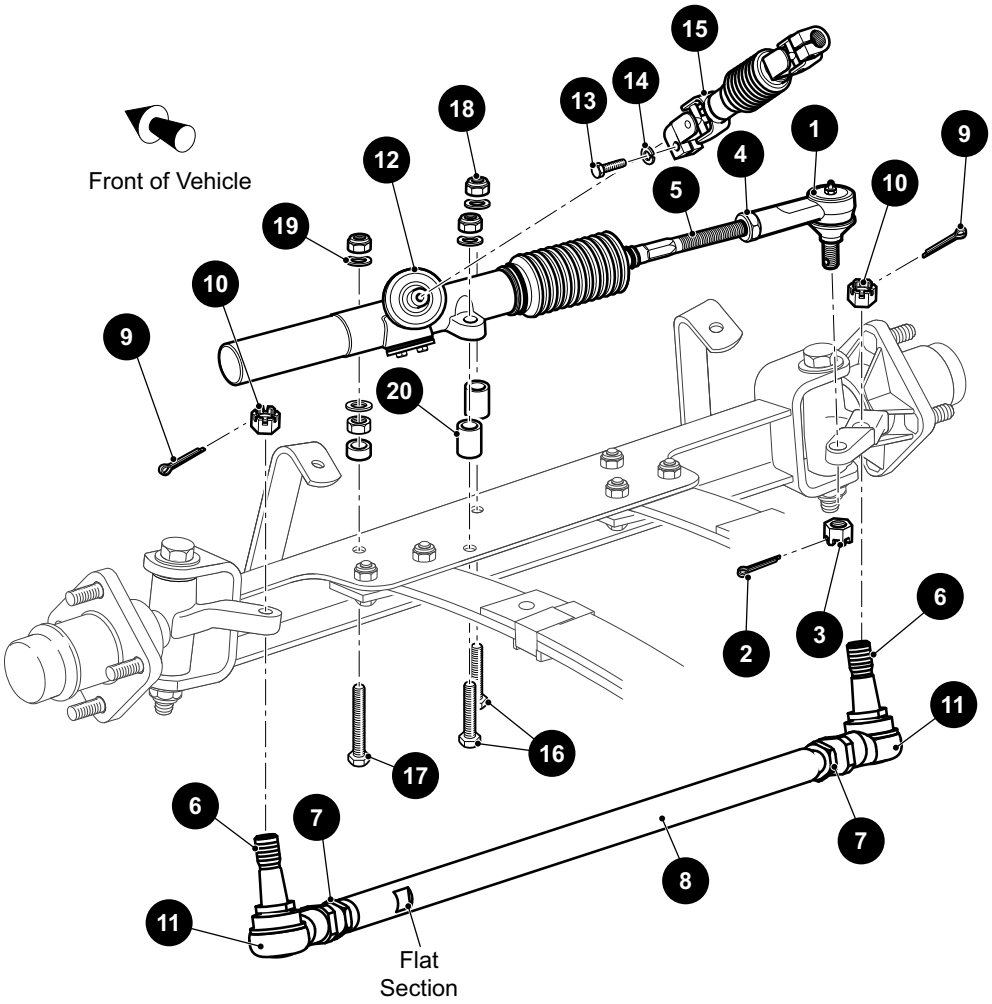


Fig. 11 Steering Components

Rack Ball Joint Replacement

Tool List	Qty.
Needle Nose Pliers	1
Wrench, 11/16"	1
Ball Joint Separator	1
Plastic Faced Hammer	1
Tape Measure	1
Wrench, 3/4"	1
Torque Wrench, ft. lbs.	1
Socket, 11/16"	1

1. To remove rack ball joint (1), loosen passenger side front wheel and lift and support front of vehicle per SAFETY section (Ref. Fig. 11).
2. Remove passenger side front wheel and turn steering wheel fully to the left.
3. Remove the cotter pin (2) and loosen the castellated nut (3) until rack ball joint (1) threads are protected. Using a ball joint separator as a lever, apply pressure to ball joint and tap nut with plastic faced hammer to release ball joint from passenger side spindle arm. Remove nut from ball joint and ball joint from spindle arm.
4. To install new rack ball joint close to its correct position, measure amount of threads exposed from jam nut (Ref. Figure 12).

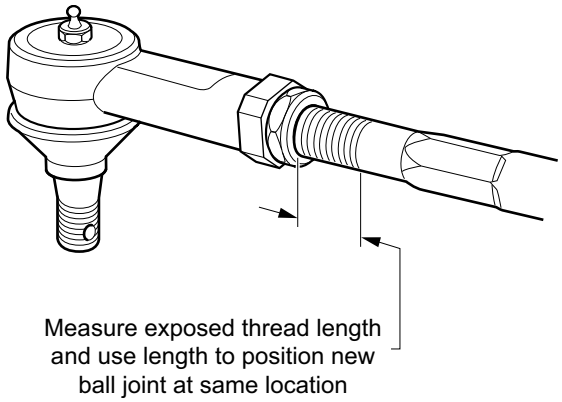


Figure 12 Rack Ball Joint Installation

5. Loosen jam nut (4) and remove rack ball joint from rack extension (5).
6. Using measurement made earlier, thread jam nut and new rack ball joint to previous location on rack extension and set jam nut hand tight.
7. Attach rack ball joint to spindle arm. Tighten castellated nut (3) to 36 ft. lbs. (50 Nm) torque and continue to tighten as needed to insert new cotter pin (2). Maximum torque is 50 ft. lbs. (70 Nm).

⚠ CAUTION ***After replacing or servicing steering components, always verify that an 1/8" gap exists between large hex of rack extension and rack and pinion unit when steering is turned fully to the right forcing passenger spindle arm against front axle (Ref. Figure 19).***

8. Check for proper rack extension-to-rack and pinion unit clearance before tightening jam nut (4) to 35 - 45 ft. lbs. (47 - 61 Nm) torque. See the *Checking/Adjusting Rack Extension-to-Rack and Pinion Unit Clearance on page 60*
9. Install passenger side front wheel per WHEELS AND TIRES section and lower vehicle per SAFETY section.
10. Check front wheel alignment and adjust if necessary. See the *Wheel Alignment on page 49*.

Tie Rod Inspection/Replacement

Tool List	Qty.
Tape Measure	1
Wrench, 3/4"	1
Wrench, 9/16"	1
Needle Nose Pliers	1
Wrench, 11/16"	1
Ball Joint Separator	1
Plastic Faced Hammer	1
Socket, 11/16"	1
Torque Wrench, ft. lbs.	1
Crowfoot Socket, 3/4"	1

1. Grasp the tie rod (8) at ball joints (6) and check for any vertical motion which would indicate a worn condition and require replacement (Ref. Fig. 11).
2. To remove tie rod, loosen wheel(s) and lift and support front of vehicle per SAFETY section.
3. Remove front wheel.
4. To install new tie rod ball joint close to its correct position, measure distance to center of ball joint from jam nut (Ref. Figure 13).

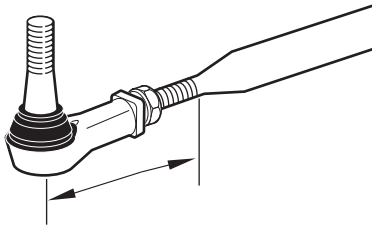


Figure 13 Tie Rod Replacement

Loosen jam nut (7) at threaded tube (8).

NOTICE: To hold threaded tube while loosening jam nut, use a wrench on the center, flat section of tube (Ref. Figure 13).

NOTICE: The tie rod has different threads on each end. The end with the groove in the threaded tube has left hand threads (clockwise to loosen) while the end without the groove has conventional right hand threads (counter-clockwise to loosen) (Ref. Figure 13).

5. Remove cotter pin (9) and loosen castellated nut (10) until tie rod ball joint (6) threads are protected. Using a ball joint separator as a lever, apply pressure to ball joint and tap nut with plastic faced hammer to release tie rod from spindle arm. Remove nut to drop tie rod from spindle arm.
6. Unscrew tie rod ball joint and jam nut from threaded tube.
7. To install ball joint, first thread on new jam nut and then, using measurement made earlier, screw ball joint to previous location in threaded tube. Set jam nut hand tight.

NOTICE: The distance to center of tie rod ball joint from jam nut on both ends of threaded tube should be the same.

8. Install rubber boot (11) and attach tie rod to spindle. The castellated nut (10) should be tightened to a **minimum** of 36 ft. lbs. (50 Nm) torque and continue

tightening as required in order to insert a new cotter pin. Maximum torque is 50 ft. lbs. (70 Nm).

9. Install front wheel(s) per WHEELS AND TIRES section and lower vehicle per SAFETY section.
10. A worn tie rod is likely to have caused incorrect wheel alignment. Check front wheel alignment and adjust if necessary. See the *Wheel Alignment on page 49*.
11. Jam nut should be tightened to 36 - 40 ft. lbs. (49 - 54 Nm) torque.

Bellows Replacement

Tool List	Qty.
Needle Nose Pliers	1
Wrench, 11/16"	1
Ball Joint Separator	1
Plastic Faced Hammer	1
Tape Measure	1
Wrench, 3/4"	1
Wire Cutters	1
Wire Tie, 8" long	1
Torque Wrench, ft. lbs.	1
Socket, 11/16”	1

1. To replace bellows (1) (Ref. Figure 14), first loosen passenger side front wheel and lift and support front of vehicle per SAFETY section.

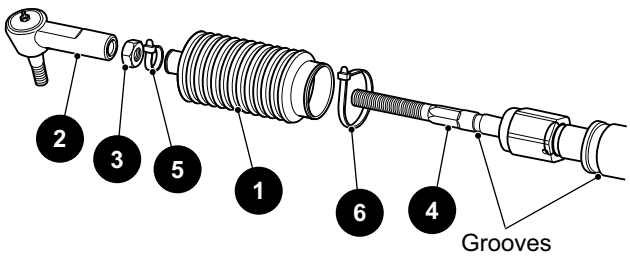


Figure 14 Bellows Replacement

2. Remove passenger side front wheel and turn steering wheel fully to the left.
3. Remove rack ball joint (2) and jam nut (3) from rack extension(4). See the *Rack Ball Joint Replacement on page 55*
4. Cut wire ties (5,6) and slide bellows off rack extension. Install new bellows aligning small end over groove in rack extension and secure with new wire tie (5). Leave large end loose until rack extension-to-rack and pinion unit clearance is checked or adjusted.
5. Install jam nut (3) and rack ball joint (2) on rack extension (4) and reattach to spindle arm. See the *Rack Ball Joint Replacement on page 55*

⚠ CAUTION ***After replacing or servicing steering components, always verify that an 1/8" gap exists between large hex of rack extension and rack and pinion unit when steering is turned fully to the right forcing passenger spindle arm against front axle.***

6. Check for proper rack extension-to-rack and pinion unit clearance before tightening jam nut (3) to 35 - 45 ft. lbs. (47 - 61 Nm) torque. See the *Checking/Adjusting Rack Extension-to-Rack and Pinion Unit Clearance on page 60*.
7. Install passenger side front wheel per WHEELS AND TIRES section and lower vehicle per SAFETY section.
8. Check front wheel alignment and adjust if necessary. See the *Wheel Alignment on page 49*.

Pinion Seal Replacement

Tool List	Qty.
Vice	1
Straight Blade Screwdriver, small	1
Ball Peen Hammer	1
Sandpaper, 600 grit	AR
Shop Towel	AR
Wheel Bearing Grease	AR
Socket, 1 1/2”	1

⚠ CAUTION ***Secure rack and pinion unit in vice by the mounting ears only. The rack and pinion unit is made of aluminum and can be damaged if held otherwise.***

1. To access the pinion seal, remove rack and pinion unit from vehicle. See the *Rack and Pinion Unit Replacement on page 60* Anchor in vice by clamping on the mounting ears of the rack and pinion unit.
2. Slide a small straight blade screwdriver between lip of seal and pinion and pry top portion of seal up to remove (Ref. Figure 15).

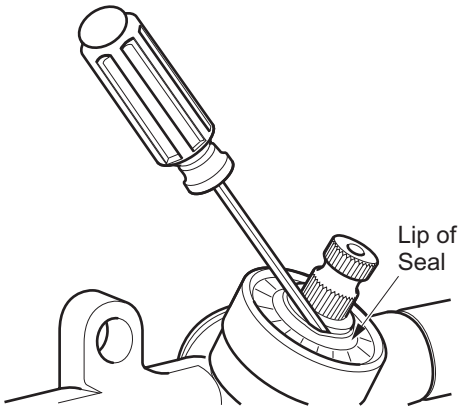


Figure 15 Pinion Seal Replacement

3. Use screwdriver to lift inner portion of seal up and off pinion.
4. Check pinion surface for roughness and sand lightly if needed.
5. Wipe bore clean and lubricate pinion and lip of seal with grease.

NOTICE: The bore has a positive stop to correctly locate the seal during installation.

6. Place seal over pinion and tap carefully with socket and hammer to start seal straight in bore. Drive seal fully into bore until it stops and wipe clean of any excess grease.
7. Attach rack and pinion unit to front axle. See the *Rack and Pinion Unit Replacement on page 60*.

Spindle Replacement

Tool List	Qty.
Needle Nose Pliers	1
Wrench, 11/16"	1
Ball Joint Separator	1
Plastic Faced Hammer	1
Wrench, 3/4"	1
Socket, 3/4"	1
Socket, 11/16"	1
Torque Wrench, ft. lbs.	1

⚠ CAUTION ***The spindle bearings are designed to be used "dry". Lubrication attracts dirt and will ruin the bearings. Do not apply grease to the spindle bearings.***

1. Loosen front wheel. Lift and support front of vehicle per the SAFETY section and remove front wheel.
2. Remove cotter pin (1) and loosen castellated nut (2) until tie rod ball joint (3) threads are protected (Ref. Figure 16). Using a ball joint separator as a lever, apply pressure to ball joint and tap nut with plastic faced hammer to release tie rod from spindle arm (4). Remove nut from tie rod and tie rod from spindle arm.
3. If removing passenger side spindle, repeat previous step for rack ball joint.
4. Remove lock nut (5) and washer (7) from bolt (6) and discard nut. Pull bolt (6) and washer (8) from spindle and separate spindle from axle. Remove thrust washer (9) and king pin tube (10) from spindle.

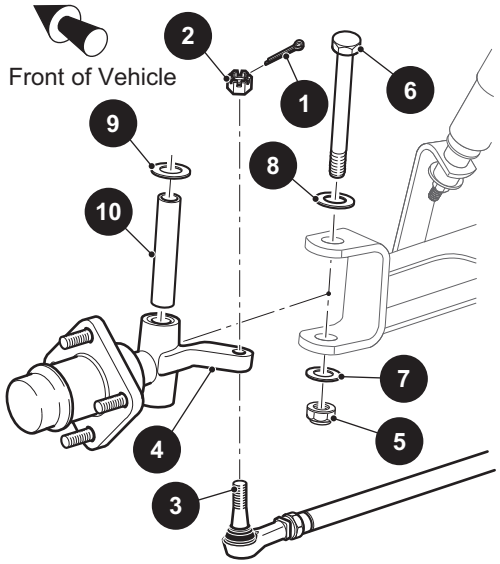


Figure 16 Spindle Replacement

5. Spindle installation is the reverse order of disassembly.

NOTICE: The thrust washer (9) is located on top of spindle between spindle and front axle.

6. Tighten new lock nut (5) to 56 - 70 ft. lbs. (75 - 95 Nm) torque. Check that spindle turns freely on king pin tube after tightening.
7. Tighten castellated nut (2) to 36 ft. lbs. (50 Nm) torque and continue to tighten as needed to insert new cotter pin. Maximum torque is 50 ft. lbs. (70 Nm).
8. Install front wheels per the WHEELS AND TIRES section and lower vehicle per the SAFETY section.
9. Check front wheel alignment and adjust if necessary. See the *Wheel Alignment on page 49*.

Read all of SAFETY and this section before attempting any procedure. Pay particular attention to Notices, Cautions, Warnings and Dangers.

Rack and Pinion Unit Disassembly and Inspection

Tool List	Qty.
Vice	1
Socket, 3/8"	1
Ratchet	1
Wrench, 11/16"	1
Wrench, 3/4"	1
Wire Cutter	1
Retaining Ring Pliers	1
Shop Towel	AR
CITGO Lithoplex MP No. 2 grease	AR
Wire Tie, 8" long	1
Wire Tie, 10" long	1
Torque Wrench, in. lbs.	1

NOTICE: The rack and pinion gears are not serviceable items. If they are found to be damaged or excessively worn, a new rack and pinion unit must be installed.

⚠ CAUTION ***Secure rack and pinion unit in vice by the mounting ears only. The rack and pinion unit is made of aluminum and can be damaged if held otherwise.***

1. Remove rack and pinion unit from vehicle. See the *Rack and Pinion Unit Replacement on page 60* Anchor in vice by clamping on the mounting ears of the unit.
2. Disassemble rack and pinion unit (1) by first removing screw (13) and tensioner (2) to relieve pressure on rack (3) and pinion (4) (Ref. Figure 17). Loosen jam nut (5) and remove rack ball joint (6) from rack extension (7). Cut wire ties (8, 14) securing bellows (9) and slide bellows off rack extension. Pull rack (3) from unit (1). Remove pinion seal (10). See the *Pinion Seal Replacement on page 57* Remove internal retaining ring (11) from rack and pinion unit and pull out pinion (4) and ball bearing (12) as an assembly.

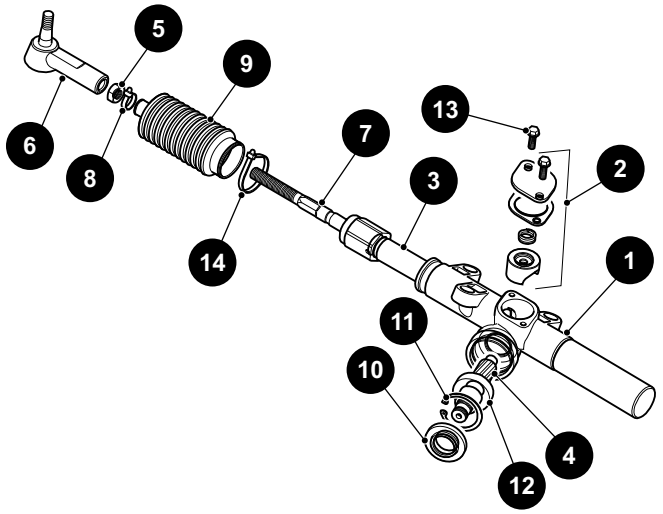


Figure 17 Rack and Pinion Unit Disassembly

3. Clean rack, pinion and housing. Inspect gear teeth, bearing surfaces and grease seal surfaces of rack and pinion for excessive wear or damage. If any is found, the rack and pinion unit **must be** replaced as an assembly. See the *Rack and Pinion Unit Replacement on page 60*
4. If rack and pinion pass inspection, clean them, tensioner and housing thoroughly and lubricate for assembly. Use grease specified in tool list.
5. Assemble rack and pinion unit by first installing pinion in reverse order of removal making sure to lubricate pinion seal lip prior to installing seal. See the *Pinion Seal Replacement on page 57* Insert rack into rack and pinion unit. Turn pinion clockwise to help pull rack in if necessary. Install bellows and secure to rack extension with wire tie (8). **Do not** secure large end of bellows to rack and pinion unit until instructed to do so after setting proper rack extension-to-rack and pinion unit clearance. Install tensioner and tighten bolts (13) to 100 - 120 in. lbs. (115 - 138 kg cm) torque. Thread jam nut and rack ball joint to original location on rack extension and set jam nut hand tight.
6. Install rack and pinion unit on vehicle. See the *Rack and Pinion Unit Replacement on page 60*

⚠ CAUTION ***After replacing or servicing steering components, always verify that an 1/8" gap exists between large hex of rack extension and rack and pinion unit when steering is turned fully to the right forcing passenger spindle arm against front axle.***

7. Set proper rack extension-to-rack and pinion unit clearance. See the *Checking/Adjusting Rack Extension-to-Rack and Pinion Unit Clearance on page 60*.

Rack and Pinion Unit Replacement

Tool List	Qty.
Socket, 13 mm	1
Ratchet	1
Needle Nose Pliers	1
Wrench, 11/16"	1
Ball Joint Separator	1
Plastic Faced Hammer	1
Wrench, 5/8"	1
Socket, 5/8"	1
Ratchet	1
Torque Wrench, ft. lbs.	1
Socket, 11/16"	1
Torque Wrench, in. lbs.	1

1. To remove rack and pinion unit (12) (Ref. Fig. 11), loosen front wheels and lift and support front of vehicle per SAFETY section. Remove front wheels.
2. Remove bolt (13) and washer (14) securing intermediate shaft (15) to rack and pinion unit (12).
3. Remove cotter pin (2) and loosen castellated nut (3) until rack ball joint (1) threads are protected. Using a ball joint separator as a lever, apply pressure to ball joint and tap nut with plastic faced hammer to release ball joint from passenger side spindle arm. Remove nut from ball joint and ball joint from spindle arm.
4. Remove the three lock nuts (18) securing rack and pinion unit to front axle and discard nuts. The rack and pinion unit can now be removed from vehicle. Retain washers (19), spacers (20) and the two bolts (16) for assembly.
5. Replace rack and pinion unit in reverse order of removal.
6. Use new lock nuts (18) and tighten them to 35 - 50 ft. lbs. (50 - 70 Nm) torque.
7. Tighten castellated nut (3) to 36 ft. lbs. (50 Nm) torque and continue to tighten as needed to insert new cotter pin. Maximum torque is 50 ft. lbs. (70 Nm).
8. Tighten bolt (13) securing intermediate shaft to pinion to 155 - 215 in. lbs. (180 - 250 kg cm) torque.

⚠ CAUTION ***After replacing or servicing steering components, always verify that an 1/8" gap exists between large hex of rack extension and rack and pinion unit when steering is turned fully to the right forcing passenger spindle arm against front axle.***

9. Set the proper rack extension-to-rack and pinion unit clearance. See the *Checking/Adjusting Rack Extension-to-Rack and Pinion Unit Clearance on page 60*
10. Install the front wheels per the WHEELS AND TIRES section and lower vehicle per the SAFETY section.
11. Check front wheel alignment and adjust if necessary. See the *Wheel Alignment on page 49*.

Checking/Adjusting Rack Extension-to-Rack and Pinion Unit Clearance

Tool List	Qty.
Wrench, 11/16"	1
Wrench, 3/4"	1
Wrench, 1/2"	1
Wire Cutter	1
Washer, 1/8" thick	1
Crowfoot Socket, 3/4"	1
Torque Wrench, ft. lbs.	1
Wire Tie, 10" long	1

Check for proper rack extension-to-rack and pinion unit clearance by first turning steering wheel fully to the right. The rear spindle arm on the passenger side **must rest against** the front axle (Ref. Figure 18). If it does not, all adjustment is made at the rack ball joint (6) (Ref. Figure 17). Loosen jam nut (5) at rack ball joint and use wrench to thread shaft of rack extension (7) further into rack ball joint. This will provide more travel for the steering wheel to be turned to the right.

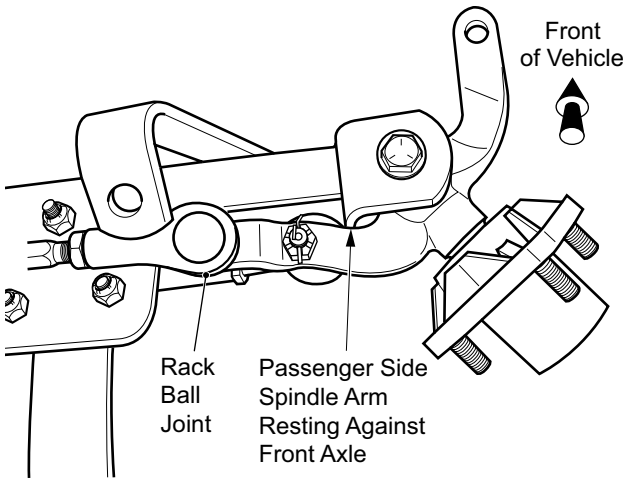


Figure 18 Spindle Contact with Front Axle

1. With the spindle arm resting against the front axle, cut the wire tie (14) securing the bellows (9) to the rack and pinion unit (1). Slide the bellows away from the rack and pinion unit to expose the large hex of the rack extension. A 1/8" gap should exist between the large hex and the end of the rack and pinion unit.

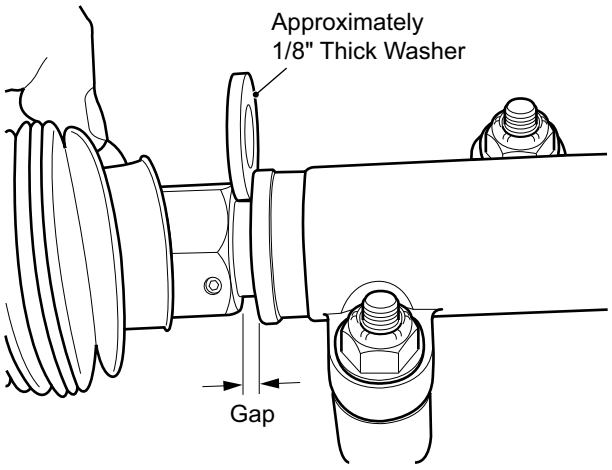


Figure 19 Checking Gap

2. Adjust, using a 1/8" thick washer as a gauge, by turning the shaft of the rack extension with a wrench to create the 1/8" gap.
3. Tighten the jam nut (5) to 35 - 45 ft. lbs. (47 - 61 Nm) torque.
4. Secure the bellows to the rack and pinion unit with a new wire tie (14).

Steering Wheel Replacement

Tool List	Qty.
Socket, 15/16"	1
Ratchet	1
Plastic Faced Hammer	1
Ball Peen Hammer	1
Anti-seize Compound	1
Torque Wrench, ft. lbs.	1

NOTICE: To maintain correct orientation when replacing steering wheel, first turn wheels straight ahead.

⚠ CAUTION ***To prevent damage to the clipboard, perform the following removal procedure. Do not use a screwdriver to push or pry the retaining tabs.***

1. From the front side of the steering wheel (4), remove the clipboard (5) by first pulling straight up on the bottom of the clipboard to release the two bottom retaining tabs.
2. Using your thumb for leverage as shown, reach from behind the steering wheel with fingertips to first pull down, and then push up to release the two top clipboard retaining tabs (Ref. Figure 20).

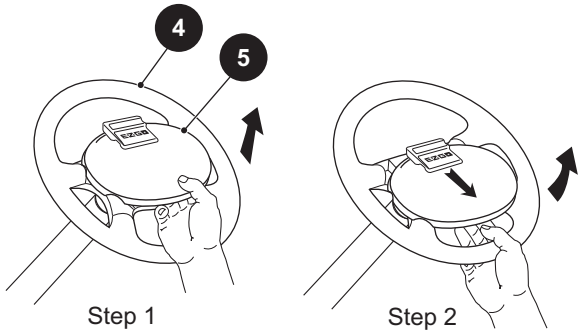


Figure 20 Clipboard Removal

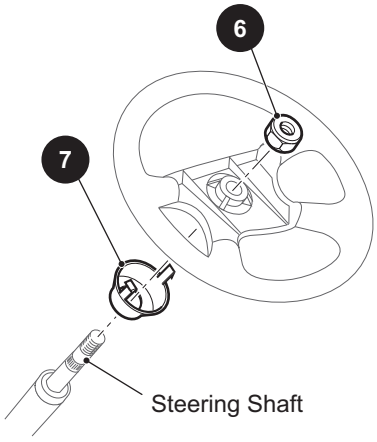


Figure 21 Steering Wheel Replacement

3. Loosen the steering wheel retaining nut (6) two to three turns (Ref. Figure 21). DO NOT REMOVE NUT AT THIS TIME. Apply upward pressure to the steering wheel. Place a plastic faced hammer against the steering wheel nut and strike the plastic faced hammer sharply with a ball peen hammer.

⚠ CAUTION ***Do not strike steering nut or end of steering shaft directly with ball peen hammer. Internal damage to rack and pinion unit can result.***

4. When the steering wheel is loosened, remove the retaining nut. Remove the steering wheel.
5. Assemble the replacement steering wheel by aligning the retaining tabs on the rear collar hub (7) with slots in the back of the steering wheel. Squeeze tabs to allow insertion of the hub. **Do not force**. Squeeze the hub on the top and bottom to fully seat.
6. Replace steering wheel by first lightly coating the splines of the steering shaft with a commercially available anti-seize compound. With the vehicle wheels in the straight ahead position, align the steering wheel on the steering shaft and slide wheel on

shaft. Tighten the steering wheel nut (6) to 15 - 20 ft. lbs. (20 - 27 Nm) torque.

7. Inspect the four retaining tabs on the clipboard (5) for white stress lines (Ref. Figure 20). If stress lines are present, replace clipboard. Install by carefully pressing, first the top two, then the bottom two retaining tabs into the matching slots in steering wheel.

Steering Shaft and Column Replacement

Tool List	Qty.
Ratchet	1
Socket, 3/4"	1
Socket, 13 mm	1
Ratchet	1
Socket, 9/16"	1
Snap Ring Pliers	1
Bearing Separator	1
Gear Puller	1
Arbor Press	1
Bearing Driver set	1
Torque Wrench, ft. lbs.	1
Torque Wrench, in. lbs.	1
Wheel Bearing Grease	AR

1. To remove the steering shaft (4) (Ref. Figure 23), remove the steering wheel. See the *Steering Wheel Replacement on page 61*.
2. Loosen the front wheels. Lift and support the front of the vehicle per the SAFETY section.
3. Remove the front wheels.
4. Remove the bolt (1) and washer (2) that secures the intermediate shaft (3) to the steering shaft (4).

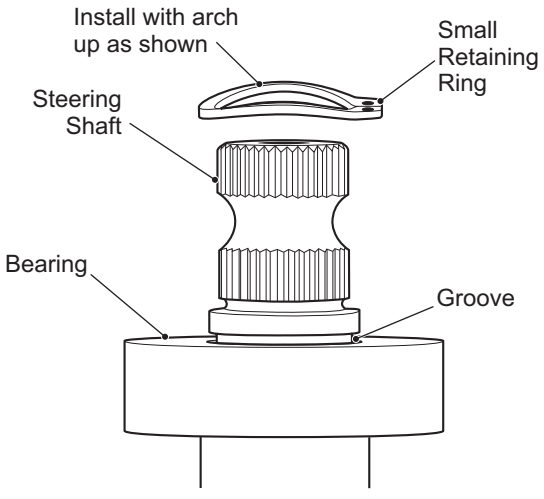


Figure 22 Small Retaining Ring Orientation

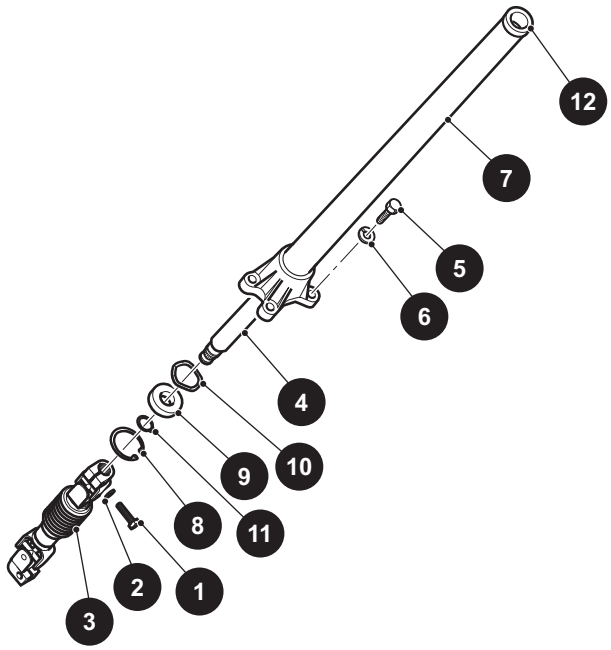


Figure 23 Steering Shaft and Column

5. Remove the four bolts (5) and washers (6) that secure the steering column (7) to the chassis and remove the column.
6. Remove the large retaining ring (8) on the bottom end of the column.
7. Pull the shaft and bearing (9) out as an assembly. Slide the wave washer (10) out of the bottom end of the steering column. Retain for reuse.
8. Remove the small retaining ring (11) and press the bearing from the steering shaft.
9. To assemble the steering shaft, press the new bearing onto the shaft until it stops against the shoulder.
10. With the small retaining ring oriented with the arch facing up, slide the ring onto the shaft as far as possible using snap ring pliers (Ref. Figure 22).
11. Use fingers to push the retaining ring fully into the groove.
12. Slide the wave washer into the base of the steering column.
13. To install the steering shaft and bearing assembly, apply wheel bearing grease to the lip of the seal in the bushing (12) at the top of the column.

14. Press the steering shaft and bearing assembly into the column base. Secure with the large retaining ring making sure it is fully seated in the groove of the column.
15. Place the steering column on the vehicle and tighten the column mounting bolts (5) to 29 ft. lbs. (39 Nm) torque.
16. Tighten the bolt (1) securing the intermediate shaft to the steering shaft to 156 - 216 in. lbs. (180 - 250 kg cm) torque.
17. Install the front wheel(s) per the WHEELS AND TIRES section.
18. Lower vehicle per the SAFETY section
19. Install the steering wheel. See the *Steering Wheel Replacement on page 61*.

Read all of SAFETY and this section before attempting any procedure. Pay particular attention to Notices, Cautions, Warnings and Dangers.

Notes:

REAR SUSPENSION

NOTICE: In the following text, there are references to removing/installing bolts etc. Additional hardware (nuts, washers etc.) that are removed must always be installed in their original positions unless otherwise specified. Non specified torque specifications are as shown in the table contained in the General Information and Routine Maintenance Section.

General

Tool List	Qty.
Wheel Chocks	4
Jack Stands	4
Floor Jack	1
Wrench, 1/2"	1
Wrench, 9/16"	1
Wrench, 3/4"	1
Socket, 1/2"	1
Socket, 9/16"	1
Socket, 9/16", Deepwell	1
Extension, 3"	1
Ratchet	1
Torque Wrench, ft. lbs.	1

The rear suspension consists of the rear axle and attachments that secure it to the springs and shock absorbers (Ref. Fig. 1). In addition the rear axle is secured to the rear of the engine by means of a casting that is bolted to the engine and mounted to the rear axle with 'U' bolts. This section is confined to the removal and replacement of the springs and shock absorbers. Rear axle shaft removal is covered in REAR AXLE section.

Shock Absorber Removal

1. Raise the rear of the vehicle in accordance with the instructions provided in SAFETY section of this manual and support the rear of the vehicle on the outer ends of the rear bumper.
2. Remove the bottom shock absorber nut (1) (Ref. Fig. 1).
3. Compress the shock absorber (2) and remove the top shock absorber nut (3).
4. Remove the shock absorber.
5. Shock absorber installation is in the reverse order of disassembly except that the shock absorber nuts (1,3) must be tightened until the shock absorber bushings (4) expand to the diameter of the shock absorber washer (5).

Rear Spring Removal

⚠ WARNING ***To reduce the possibility of personal injury, follow the lifting procedure in the SAFETY section of this manual. Place wheel chocks in front and behind the front wheels and check the stability of the vehicle on the jack stands before starting any repair procedure. Never work on a vehicle that is supported by a jack alone.***

NOTICE: If both springs are to be replaced and the rear axle is not to be removed, it is important to remove and replace one spring at a time. Springs must be replaced in sets. Never replace just one.

1. Remove the bottom shock absorber nut (1) (Ref. Fig. 1).
2. Place a floor jack under the center section of the rear axle (6) and raise enough to place a second set of jack stands under the axle tubes.
3. With both the rear axle and the frame supported, the 'U' bolt (7) and the hardware (8) can be removed.
4. Remove the rear spring shackle assembly (9) and the front spring mounting hardware (10).
5. Remove the spring (11).
6. Spring installation is in the reverse order of disassembly.

NOTICE: When installing the rear spring shackles, be sure that the cupped side of the shackle plate faces the spring.

7. The shock absorber nuts (1,3) must be tightened until the shock absorber bushings (4) expand to the diameter of the shock absorber washer (5) (Ref. Fig. 1).
8. Tighten the front spring hardware (10) to 21 - 25 ft. lbs. (28 - 34 Nm) torque.
9. Tighten all other hardware to 18 - 20 ft. lbs. (24 - 30 Nm) torque.

REAR SUSPENSION

Read all of SAFETY and this section before attempting any procedure. Pay particular attention to Notices, Cautions, Warnings and Dangers.

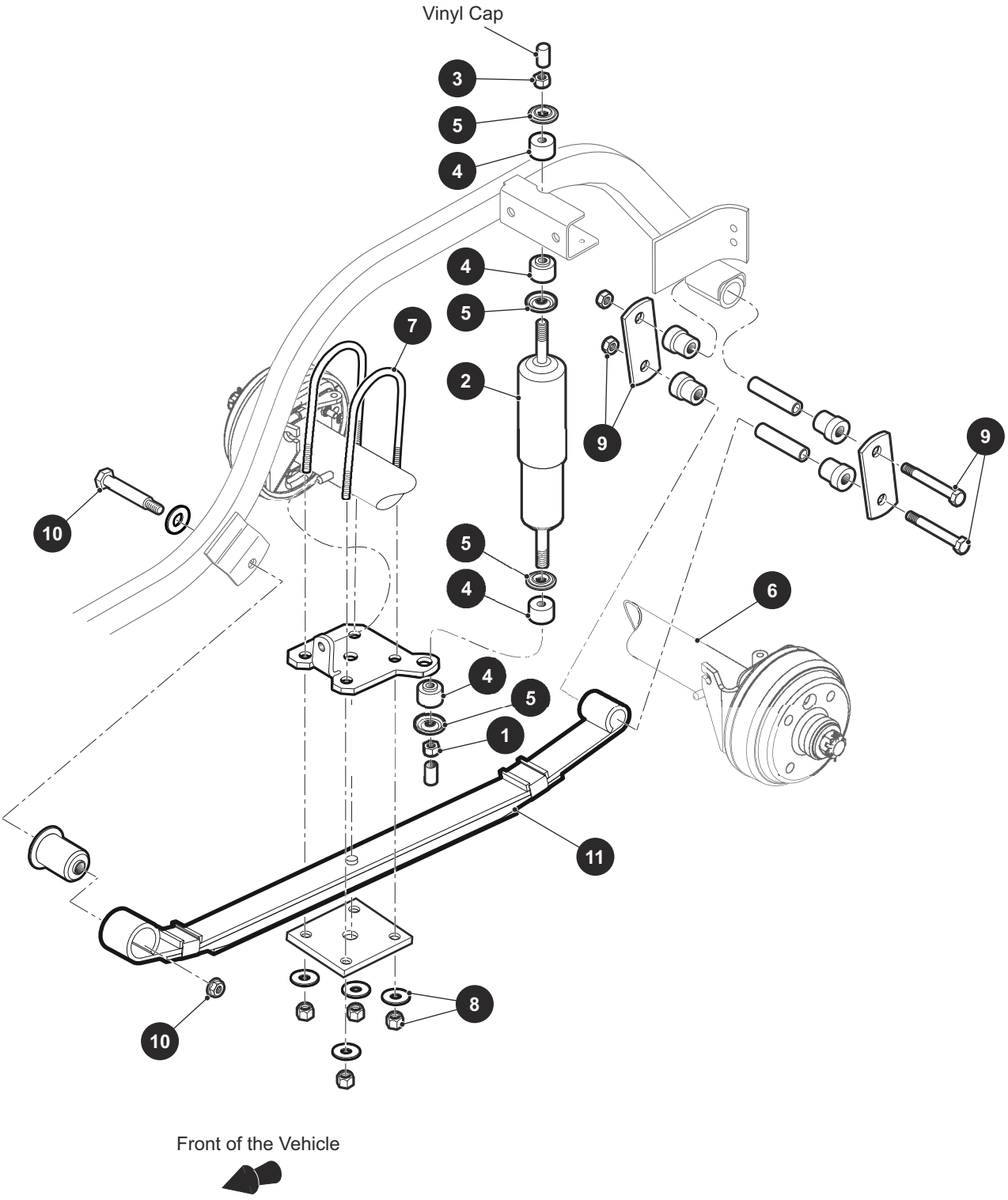


Fig. 1 Rear Suspension

Read all of SAFETY and this section before attempting any procedure. Pay particular attention to Notices, Cautions, Warnings and Dangers.

REAR AXLE REMOVAL

Tool List	Qty.
Lug Wrench, 3/4"	1
Impact Wrench	1
Impact Socket, 3/4"	1
Torque Wrench, ft. lbs.	1
Socket, 3/4"	1
Ratchet	1
Thread Locking Sealant	A/R
Wrench, 12mm	1
Wheel Chocks	4
Jack Stands	4
Floor Jack	1
Wrench, 1/2"	1
Wrench, 9/16"	1
Wrench, 3/4"	1
Socket, 1/2"	1
Socket, 9/16"	1
Socket, 9/16", Deepwell	1
Extension, 3"	1
Ratchet	1
Torque wrench, ft. lbs.	1

⚠WARNING ***To reduce the possibility of personal injury, follow the lifting procedure in SAFETY section of this manual. Place wheel chocks in front and behind the front wheels and check the stability of the vehicle on the jack stands before starting any repair procedure. Never work on a vehicle that is supported by a jack alone.***

1. Raise the rear of the vehicle in accordance with the instructions per the SAFETY section of this manual and support the rear of the vehicle on the outer ends of the rear bumper.
2. Remove the tires. See WHEELS AND TIRES section.
3. Remove the muffler. See the ENGINE section.
4. Remove the triangular bracket supporting the differential to the engine frame.
5. Remove the ‘U’ bolts holding axle to engine frame.
6. Remove the drive belt and driven clutch (see CLUTCHES section).
7. Remove the F/R shifter bracket nut and loosen the cable nuts.
8. Remove the cable and bracket from the differential.
9. Remove the accelerator cable from the accelerator bracket and take off the push nut holding the cable on the governor and remove the cable. See the SPEED CONTROL section.
10. Remove the linkage rod off of the governor.
11. Remove the shock absorbers (see removal elsewhere in this section).
12. Remove the clevis pin from both brake cables where they attach to the wheel brake levers.
13. Remove the brake cable from the brakes.
14. Remove the retaining rings at either end of the outer brake cable and move cables out of the way of the axle.
15. Place a floor jack under the center section of the rear axle and raise just enough to place a second set of jack stands under the axle tubes.
16. With both the rear axle and the frame supported, the ‘U’ bolt and the hardware can be removed from the spring.
17. Raise the back of the vehicle and take the springs loose at the rear shackle.
18. Slide rear axle out of vehicle.
19. Rear axle installation is in the reverse order of removal.
20. Pay particular attention to placement of axle in the engine frame support. See ‘Engine Installation’ in the ENGINE section.

Read all of SAFETY and this section before attempting any procedure. Pay particular attention to Notices, Cautions, Warnings and Dangers.

Notes:

REAR AXLE

The rear axle is provided with a lubricant level check plug located on the driver side at the rear of the housing (Ref. Fig. 2). Unless leakage of rear axle lubricant is evident, an annual lubricant check is sufficient

For further axle information, see Four Cycle Transaxle Shop Rebuild and Service Parts Manual.

Refer to REAR SUSPENSION section for axle removal.

NEUTRAL LOCK

To prevent the driven clutch from turning the rear wheels during service operations and to prevent wear to the belt while being towed, a neutral lock is located on the direction selector.

The neutral lock is located on the direction selector. To operate neutral lock located on the direction selector, first turn the key switch to 'OFF', place direction selector in 'R' and remove seat. Pull out (1) and rotate(2) the neutral lock pin handle so that the pointed portion of the handle is over the side of the direction selector cam (Ref. Fig. 2). Move direction selector lever towards the area between 'F' and 'R'. During that motion, the pin will snap into the hole in the direction selector mounting bracket, preventing any movement of the lever. When in this position, the direction selector remains locked in the neutral position. To activate the direction selector, pull the neutral lock pin handle out and rotate until the pointed portion of the handle fits into the hole (3) in the direction selector cam.

⚠WARNING ***Spring loaded mechanism. To prevent possibility of fingers becoming pinched in the direction selector mechanism, hold direction selector lever when releasing neutral lock pin handle.***

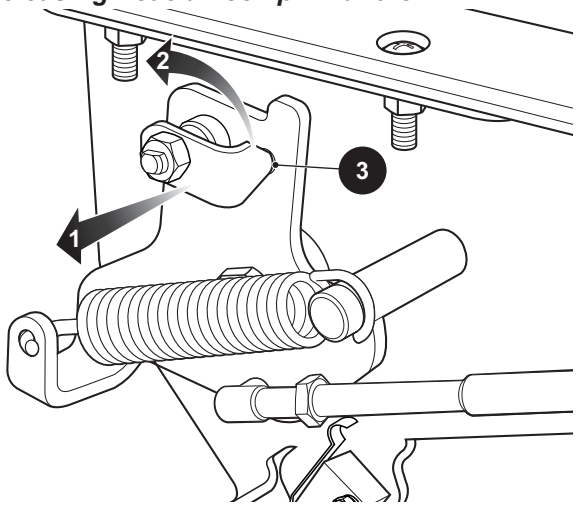


Fig. 1 Neutral Lock (Direction Selector)

Checking the Lubricant Level

Tool List	Qty.
Socket, 13 mm	1
Ratchet	1
Funnel	1

Clean the area around the check and fill plugs. Remove the check plug. The correct lubricant level is **just** below the bottom of the threaded hole. If lubricant is to be added, remove the fill plug and add lubricant using a funnel. Add lubricant slowly until lubricant starts to seep from the check plug hole. Install the check plug and the fill plug. In the event that the lubricant is to be replaced, a drain plug is provided at the bottom of the differential housing. Capacity of axle is 51 ounces (1.5 liters).

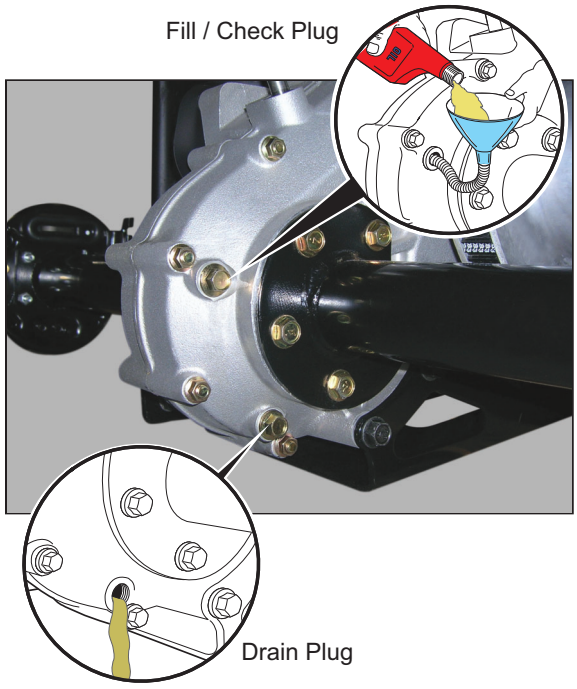


Fig. 2 Add, Check and Drain Rear Axle Lubricant

REAR AXLE DISASSEMBLY

⚠ CAUTION ***The rear axle is a precision assembly, and therefore any repair or replacement of parts must be done with extreme care in a clean environment. Before attempting to perform any service on the axle, read and understand all of the following text and illustrations before disassembling the unit.***

Handle all gears with extreme care since each is part of a matched set. Damage to one will require replacement of the entire set or result in an unacceptably high noise level.

Snap rings must be removed/installed with care to prevent damage of bearings, seals and bearing bores.

NOTICE: It is recommended that whenever a bearing, seal or 'O' ring is removed, it be replaced with a new one regardless of mileage. Always wipe the seals and 'O' rings with a light oil before installing.

⚠ WARNING ***To reduce the possibility of personal injury, follow the lifting procedure in SAFETY section of this manual. Place wheel chocks in front and behind the front wheels and check the stability of the vehicle on the jack stands before starting any repair procedure. Never work on a vehicle that is supported by a jack alone.***

Axle Shaft Removal and Disassembly

Tool List	Qty.
Arbor Press	1
Bearing Separator	1
Needle Nose Pliers	1
Internal Snap Ring Pliers	1
Slide Hammer, P/N 18753G1	1

1. Remove the brake drum. See the BRAKES section.
2. Remove the outer snap ring from the axle tube (Ref. Fig. 3).

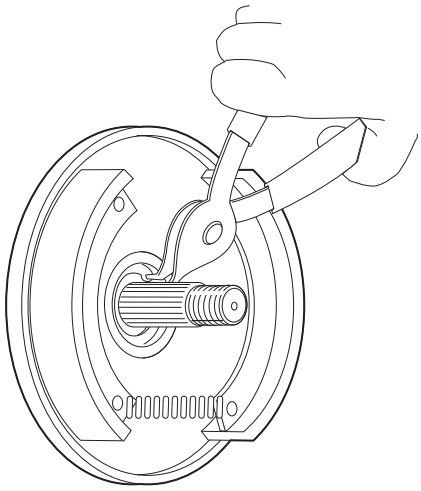


Fig. 3 Removing/Installing Outer Snap Ring

3. Attach a slide hammer to the axle shaft thread and remove the axle and bearing from the axle tube (Ref. Fig. 4).

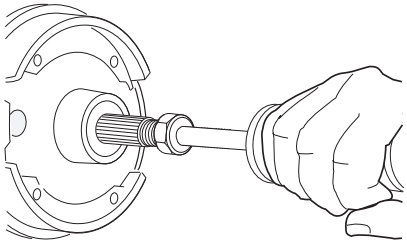


Fig. 4 Removing/Installing Axle Shaft

4. Remove the bearing by supporting the inner race on an arbor press bed and applying pressure to the threaded end of the axle shaft (Ref. Fig. 5).

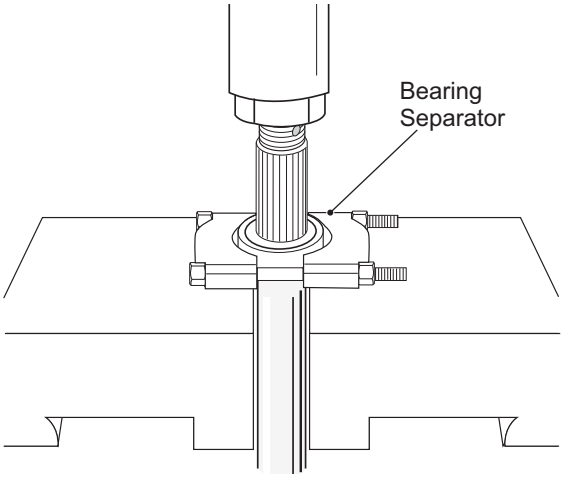


Fig. 5 Pressing Bearing from Axle Shaft

Read all of SAFETY and this section before attempting any procedure. Pay particular attention to Notices, Cautions, Warnings and Dangers.

Axle Shaft Seal Removal and Replacement

Tools List **Qty.**

Internal Snap Ring Pliers 1
Seal Puller 1
Plastic Faced Hammer 1
Ratchet 1
Torque Wrench, ft. lbs. 1
Socket, 14mm 1

1. Use snap ring pliers to remove the bearing retaining ring (1) from the end of axle tube (2). (Ref. Fig. 6).
2. Carefully pull axle shaft (3) and bearing out of the tube.
3. Using a 14 mm socket, remove the hardware (4) attaching the axle tube to the casing and carefully lift the tube from the casing studs.
4. Using seal puller, remove axle shaft seal (5) from casing.

⚠ CAUTION ***Use care to prevent damage to the inner surface of axle tube at the sealing area.***

5. Replace the seal by lightly tapping around the circumference with a plastic faced hammer. Tighten bolts (4) to 26 - 31 ft. lbs. (35 - 42 Nm) torque.

Axle Shaft Replacement

1. Carefully insert the axle shaft and bearing through the oil seal.
2. Rotate the shaft until the spline engages with the differential side gears.
3. Install the outer snap ring.
4. Coat the outboard spline of the axle with an anti-seize compound.
5. Install the brake hub and drum, thrust washer and nut (Ref. Fig. 7).
6. Tighten the castellated axle nut to 70 ft. lbs. (95 Nm) torque minimum. Continue to tighten until the slot in the nut aligns with the cotter pin hole.
7. Secure with a new cotter pin

.

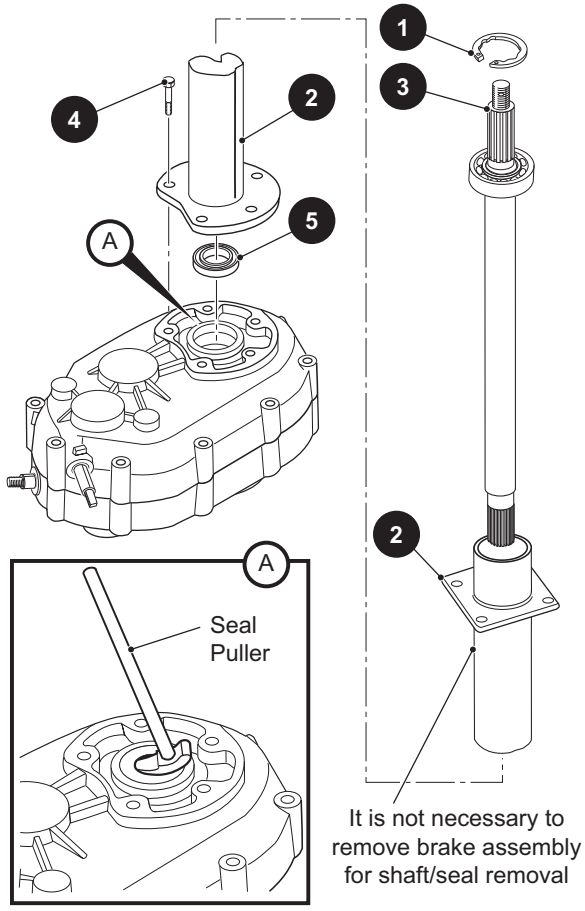


Fig. 6 Removing/Installing Seal

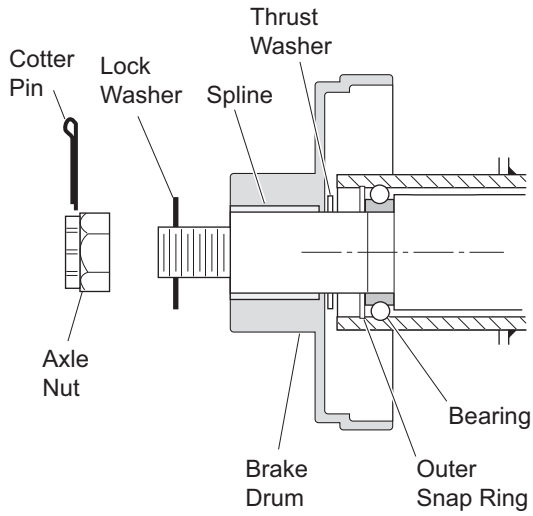


Fig. 7 Cut Away of Outer Bearing and Brake Drum

Read all of SAFETY and this section before attempting any procedure. Pay particular attention to Notices, Cautions, Warnings and Dangers.

Notes:

ENGINE

For further engine information, see Engine Shop Rebuild and Service Parts Manual.

POWERTRAIN MAINTENANCE

Access the powertrain by raising or removing seat. Some service procedures may require the vehicle be lifted. Refer to LIFTING THE VEHICLE in the SAFETY section for proper lifting procedure and safety information.

Checking the Oil Level

⚠ CAUTION ***Do not overfill engine. Too much oil may cause smoking or allow oil to enter the air filter enclosure.***

NOTICE: Vehicles with the leaf springs mounted on top of the rear axle will have an oil dipstick with an 'H' stamped into the top.

The oil should be checked with the engine warm. The vehicle should be on a level surface with the parking (PARK) brake engaged. Allow adequate time for oil to drain into the crankcase before checking.

Remove the oil dipstick and wipe off the entire area with a lint free cloth (Ref. Fig. 1).

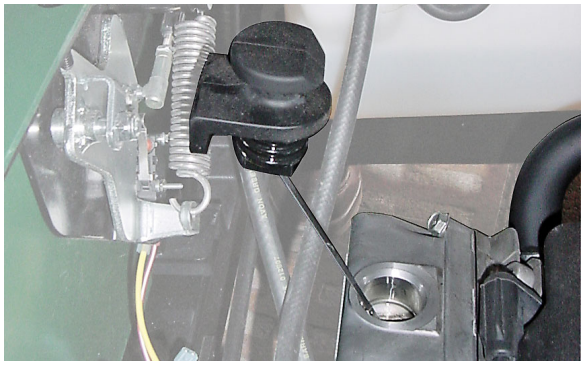


Fig. 1 Oil Dipstick

Insert the dipstick **fully** into the dipstick opening and remove. Examine the level of the oil on the dipstick.

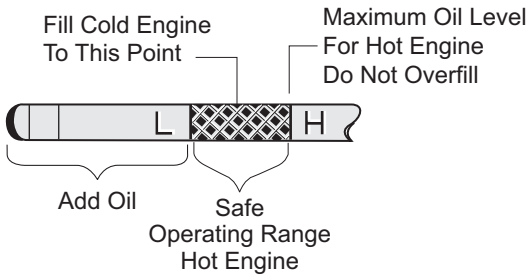


Fig. 2 Check Oil Level on Dipstick

The engine can be operated safely as long as oil is within the safe operating range as indicated on the dip stick. **Do not operate vehicle if oil level is below the safe area indicated on the dipstick.**

Oil should be added to bring the level into the safe operating range. Remember that oil expands as it gets hot, **Do not overfill** (Ref. Fig. 2). Check that the oil cap is firmly in place.

NOTICE: When adding oil between oil changes, do not mix brands and viscosity grades of oil.Both the oil dipstick and fill cap must be in place before operating the engine. Failure to install the dipstick and fill cap will result in oil becoming contaminated and/or oil being discharged into the engine compartment.

Changing the Oil

Tool List	Qty.
Socket, 19 mm	1
Ratchet	1
Extension, 8"	1
Oil Drain Pan	1
Oil Filter Wrench	1

For maximum performance and longevity, the engine oil should be replaced after the first 8 hours of operation. After the initial oil change, it should be changed every 125 hours of operation or semi-annually, whichever comes first.

The selection of oil is dependent upon the service that the vehicle will perform. Most vehicles require 10W-30 oil, whereas vehicles used at capacity or near capacity load applications will utilize 10W-40 oil after a break-in period of 8 hours (Ref. Fig. 3).

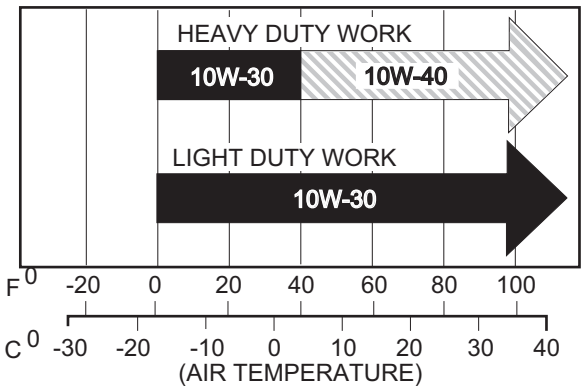


Fig. 3 Oil Viscosity Chart

Read all of SAFETY and this section before attempting any procedure. Pay particular attention to Notices, Cautions, Warnings and Dangers.

NOTICE: If vehicle is to be stored over winter months, it can be stored with old oil left in engine. The oil should be changed as part of spring maintenance. This will remove any moisture that has accumulated during storage.

⚠WARNING ***Be aware that engine fluids may be hot and contact to the skin may cause severe burns. Wear rubber gloves to protect skin from exposure to the old oil and degreaser.***

The oil should be changed with engine warm. Park vehicle on a level surface, engage parking brake and remove key. Place a drain pan under engine. Wipe top of the engine clean with a cloth (Ref. Fig. 4). Remove the oil fill cap.

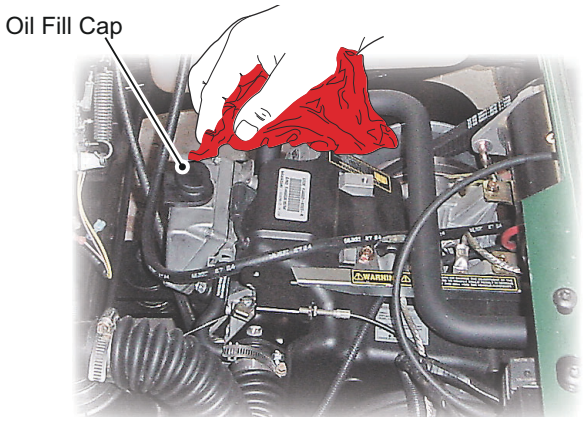


Fig. 4 Cleaning Top of Engine

⚠WARNING ***Be careful of hot oil when drained. It may be hot enough to burn you.***

Place the oil drain pan under the oil drain plug (1) found at the rear of the engine base. Remove the drain plug (1), allow the oil to drain into the drain pan.

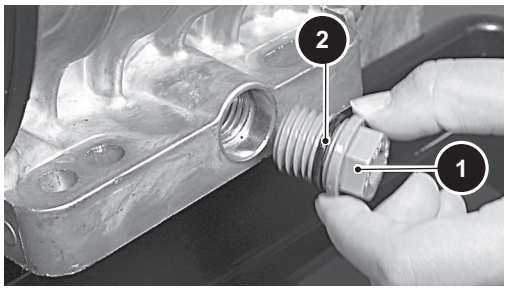


Fig. 5 Oil Drain Plug

Before installing the drain plug clean the area around the drain plug mount with a lint free cloth and inspect the drain plug (1) for damage; replace if necessary (Ref. Fig. 5). If the 'O' ring (2) on the drain plug is damaged replace it with a new one and tighten to the specified torque.

ITEM	TORQUE SPECIFICATION
1	61 in. lbs (7 Nm)

At the first oil change, **small** metal chips and lint may be found. This is normal, resulting from the break-in period. Inspect the filter at every oil change. The presence of large metal chips could indicate possible damage to the engine.

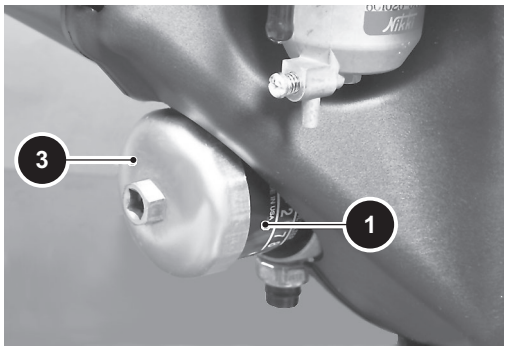


Fig. 6 Remove Oil Filter

Clean the area around filter. Place the oil drain pan under the filter area. Using a filter wrench, strap wrench or other suitable filter wrench (3), remove the filter (4) from the engine and allow the oil to drain into the oil drain pan (Ref. Fig. 6). The 'O' ring (5) may remain on engine (6) or filter (7) (Ref. Fig. 7).

Inspect the filter to make sure the 'O' ring is not left on the engine surface (6), if the 'O' ring has remained on the engine surface remove it and discard with the filter.

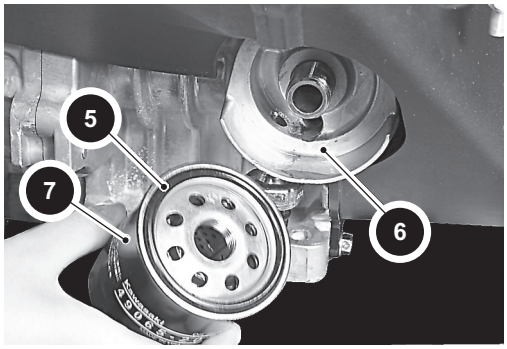


Fig. 7 Inspect Oil Filter

Inspect the new oil filter for any defects, apply engine oil to the 'O' ring seal and install the new oil filter onto the engine until the seal contacts mounting surface of the engine. Then turn the filter 2/3 to 3/4 rotation by hand. Pour in the specified type and amount of oil.

Oil capacity is 1.4 quarts (1.3 liters). Add slightly less than 1.4 quarts (1.3 liters) to allow for possible residual oil left in engine. The oil must be high quality oil that meets or exceeds API SF, SG, CC standards (Ref. Fig. 3). Check oil level on dipstick. Oil should be slightly below 'H' to allow for expansion. If necessary, continue to add oil slowly and allow time for oil to flow down into engine. Check oil level on dipstick. **Do NOT overfill.**

⚠ CAUTION ***Do NOT overfill engine. Too much oil may cause smoking or allow oil to enter the air filter enclosure.***

NOTICE: Both the oil dipstick and fill cap must be in place before operating the engine. Failure to install the dipstick and fill cap will result in oil being discharged into the engine compartment.

As a final check, check the oil level again with the vehicle on level ground. Like all liquids, oil increases in volume when warm. The full 'H' mark on the dipstick is calibrated for an engine at operating temperature. When the engine is cold, the oil will be below the 'H' mark. The engine can be operated safely as long as the oil is within the safe operating range as indicated on the dipstick. **Do NOT operate vehicle if oil level is below the safe area indicated on the dipstick.**

AIR FILTER INSPECTION/REPLACEMENT

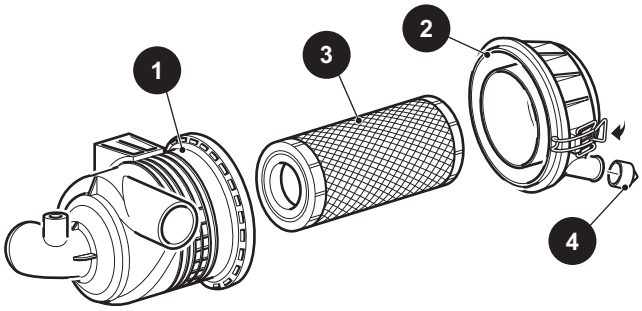


Fig. 8 Air Filter Assembly

NOTICE: The air filter assembly on the vehicle is a dry unit. Do not use oil on the filter element or any part of the unit.

The air cleaner may be accessed by raising the seat. Unsnap two clips that secure the cover (2) to the canister (1) and remove the cover. Remove the air filter element (3) and clean the inside of the cover, canister and dust collector. Inspect the air filter element (3) and replace it in accordance with the SCEDULED MAINTENANCE CHART section. Install the air filter element (3) and replace the cover (2). Be sure the cover is properly seated and all clips are fastened securely.

Cleaning the Air Filter Element

⚠ CAUTION ***Do NOT use compressed air to clean the air filter. Doing so will damage the filter and will damage the engine.***

If the element is in acceptable condition, loose dirt may be removed by tapping the filter lightly. Do NOT use oil on the filter element or any part of the unit. Install the element in the same way it was removed, being sure that the cover clips are fastened securely.

STARTER/GENERATOR BELT TENSION

Tool List	**Qty.**
Belt Tension Gauge	1
Wrench, 13 mm	1
Wrench, 14 mm	2
Wrench, 15 mm	1
Ratchet	1
Socket, 13 mm"	1
Socket, 15 mm	1

The starter/generator belt tension should be checked after the first 15 - 20 hours and set to 17 - 18 lbs. (75 - 80 N).

⚠ WARNING ***At no time during installation of belt, should the belt tension exceed 36 lbs (160 N).***

⚠ CAUTION ***At the time of installation, the belt must not be rolled over the installed edges of the starter/generator or drive clutch pulleys. Excessive stretch in belt may cause cord failure.***

NOTICE: A loose belt can cause audible vibration and squeal.

Tighten a **new** starter/generator belt to 25 - 29 lbs. (110 - 130 N) tension when a gauge is applied half way between the two pulleys (Ref. Fig. 9).

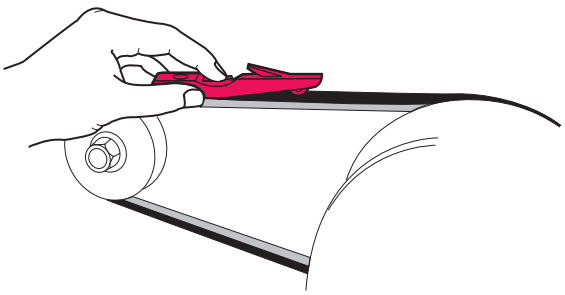


Fig. 9 Checking Belt Tension with Gauge

Although not as accurate, a **new** belt may be pressed with a finger. A maximum deflection of 3/8" (10 mm) is acceptable (Ref. Fig. 10).

Read all of SAFETY and this section before attempting any procedure. Pay particular attention to Notices, Cautions, Warnings and Dangers.

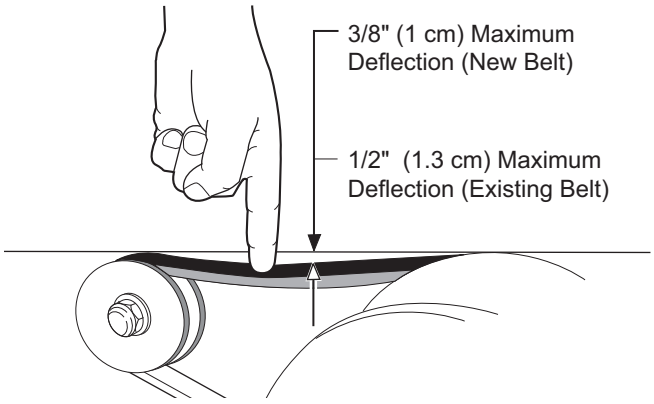


Fig. 10 Checking Belt Tension with Finger

Re-tighten an **existing** belt to 17 - 18 lbs. (75 - 80 N) tension using the same technique. A maximum deflection of 1/2" (13 mm) is acceptable.

Adjusting the Belt

Loosen the two pivot bolts (13) and nuts (14) on the starter/generator. Using two 14 mm wrenches; hold the lower nut (11) and loosen the upper nut (12) on the starter/generator adjusting bolt.

Move the lower nut (11) up or down the adjustment bolt until proper belt tension is achieved. Hold the lower nut (11) in place and tighten the upper jam nut (12) against it the lower nut to the specified torque value (Ref. Fig. 11).

Fig. 11 Adjusting the Belt Tension

Using a socket and open end wrench, tighten the starter/generator pivot bolts (13) and nuts (14) to the specified torque value.

ITEM	TORQUE SPECIFICATION
12, 14	30 - 35 ft. lbs (40 - 48 Nm)

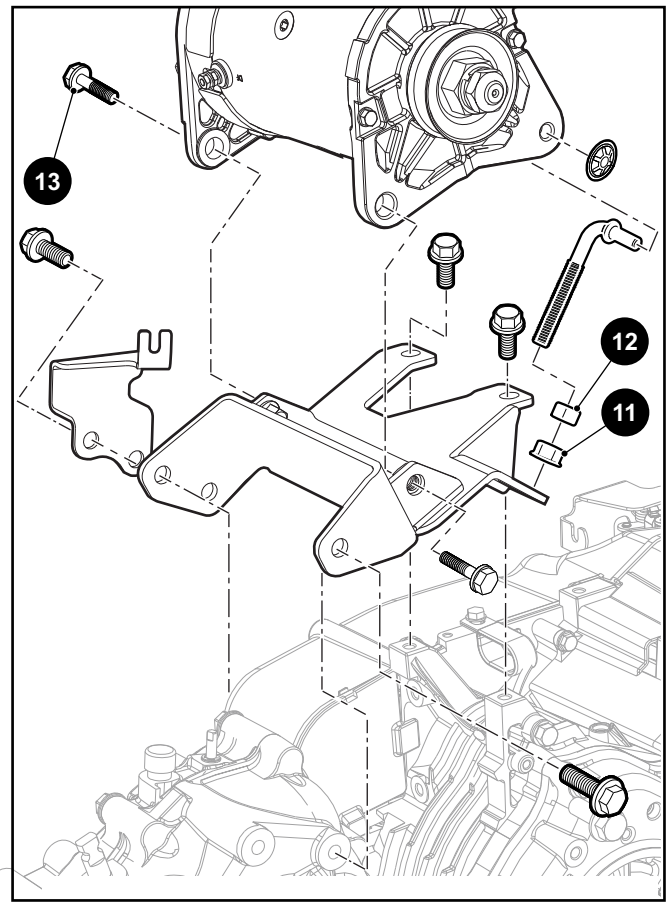


Fig. 12 Starter/Generator

STARTER/GENERATOR REPLACEMENT *(REF. FIG. 12)*

Tool List	Qty.
Wrench, 8 mm	1
Wrench, 10 mm	1
Wrench, 13 mm	1
Wrench, 14 mm	2
Wrench, 15 mm	1
Ratchet	1
Socket, 13 mm	1
Socket, 15 mm	1
Torque wrench, ft. lbs.	1

⚠WARNING ***To prevent possibility of personal injury, disconnect negative (-) battery cable before beginning starter/generator removal.***

Remove the wiring from the starter/generator. Loosen the jam nut (11) and the adjusting nut (12) securing the starter/generator adjuster until the starter/generator belt

can be removed from the drive clutch. Remove the starter/generator pivot bolts (13) and lift starter/generator from the vehicle.

Install the starter/generator pivot bolts (13) and hardware loosely in place and install the belt. Tighten a new starter/generator belt per 'Starter/Generator Belt Tension' earlier in this section.

Tighten jam nut (12) and the pivot bolts (13) and nuts (14) to the specified torque shown in the torque table earlier in this section.

Install the wiring and tighten the terminals firmly into place. Reconnect the battery.

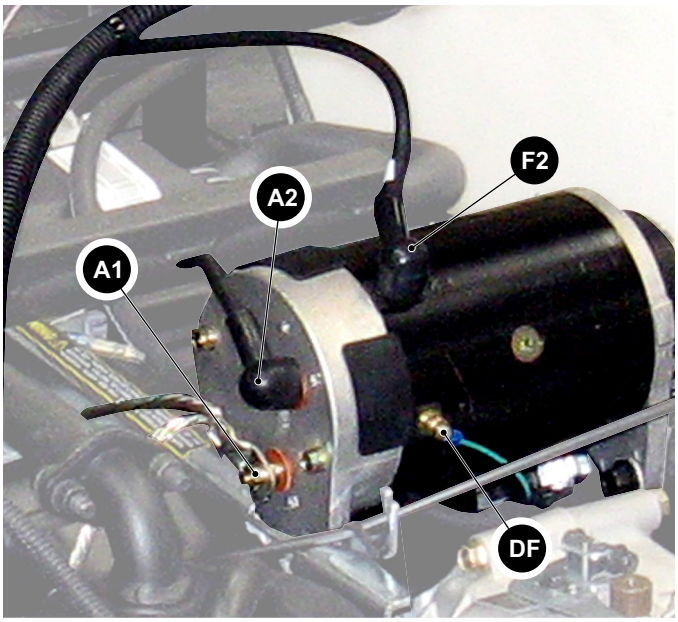


Fig. 13 Starter/Generator Wire Connections

FROM	TO
A1	Ground
A2	Terminal F1 on Starter/Generator
F1	Terminal A2 on Starter/Generator
F2	Terminal A on Solenoid
DF	Green wire to Voltage Regulator

Fig. 14 Starter/Generator Wiring Table

COOLING SYSTEM CLEANING

At least once a year, or more often under adverse conditions, the cooling system should be cleaned. Cleaning will assure an adequate supply of air to the cooling fins. Compressed air may be used for routine cooling system maintenance.

Operation in wet or damp weather or overly fresh cut grass may result in a variety of debris accumulating and adhering to the internal shroud and fins of the cooling system.

SPARK PLUG

Tool List	Qty.
Spark Plug Socket,13/16"	1
Feeler Gauge, wire type	1
Ratchet & Extension	1
Torque Wrench, ft. lbs	1

This engine uses Spark Plug NGK BPR2ES with a gap of .028" - .031" (.70 - .80 mm). Using a 13/16" spark plug socket or wrench, remove the spark plug at 125 hours or semi-annually and clean and re-gap. The spark plug should be properly gapped (Ref. Fig. 15) and replaced in the cylinder head, tighten to the specified torque.

ITEM	TORQUE SPECIFICATION
Spark Plug	16 ft. lbs (22 Nm)

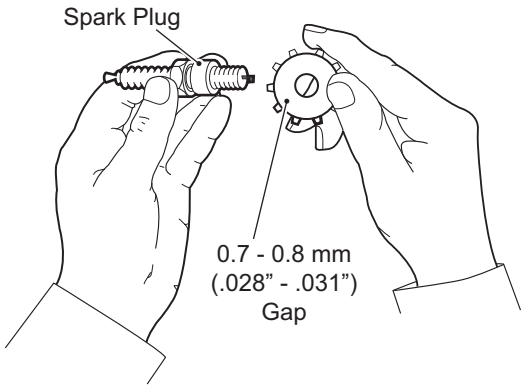


Fig. 15 Gapping the Spark Plug

Fouled spark plugs are indicated by a wet, black appearance. This could be caused by a dirty air filter element or other restrictions in the air intake system. Incorrectly adjusted valves, spark plug wires which are in poor condition or poor quality fuel could also contribute to the problem.

⚠ CAUTION ***Use care not to over-tighten the plug. Over-tightening can cause damage to the aluminum cylinder head threads.***

ENGINE

Read all of SAFETY and this section before attempting any procedure. Pay particular attention to Notices, Cautions, Warnings and Dangers.

FOUR CYCLE ENGINE

Engine Specifications

Engine Model	FJ400-D
Type	Four Cycle, Overhead Valve
Number Of Cylinders	1
Displacement	401 cc
Rated Horsepower	13 hp
Spark Plug Type	NGK BPR2ES
Spark Plug Gap	.028" - .031" (.70 - .80 mm)
Cooling	Forced Air Cooled
Oil Filter	Cartridge Type Full Flow Filter
Oil Pump	Positive Displacement Pump

Engine Description

The engine is an air cooled, 4-stroke, overhead valve, single cylinder gasoline engine. It incorporates a pressure fed lubrication positive displacement oil pump with a cartridge type full flow oil filter and a counter rotating balance shaft.

CYLINDER HEAD

Compression Measurement

Tool List	Qty.
Ratchet	1
Spark Plug Socket	1
Extension 6"	1
Compression Gauge & Adapter (20 kgf/cm^2)	1

Before measuring compression, do the following:

- Be sure the battery is fully charged.
- Thoroughly warm up the engine so that engine oil between the piston and cylinder wall will help seal compression as it does during normal running.
- Stop the engine.

Disconnect the spark plug cap (3) and remove the spark plug (4) keeping the engine throttle fully open.

Attach the compression gauge (1) to the adapter (2) and insert firmly into the plug hole.

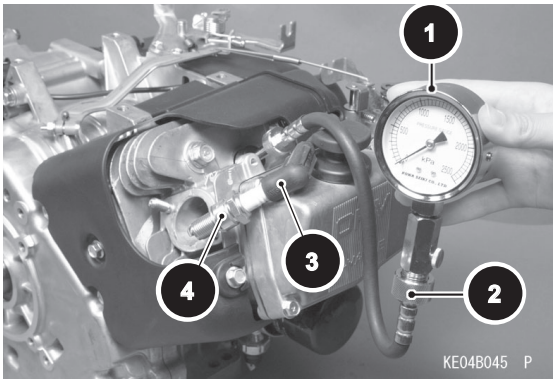


Fig. 16 Compression Gauge

Place the spark plug cap (3) on the removed spark plug (4) and ground the spark plug to the engine.

⚠WARNING ***To prevent possibility of personal injury or fire, do not ground the spark plug in proximity to the plug hole. Keep the plug as far away as possible from the plug hole. Fuel drawn into the cylinder will be expelled through the spark plug opening and could be ignited by the ignition system or another source, resulting in a fire.***

Using the starter motor, turn the engine over with the throttle fully open until the compression gauge stops rising.

Cylinder Compression should be between 9 - 11 kgf/cm^2 (128-156 psi).

If the compression is higher than 9 kgf/cm^2 (128 psi) the piston rings, cylinder and valves are probably in good condition.

If the compression is over 11 kgf/cm^2 (156 psi), check the following:

1. Carbon build-up on the piston crown and cylinder head - clean off any carbon on the piston crown and cylinder head.
2. Cylinder head gasket - use only the proper gasket. The use of a gasket of incorrect thickness will change the compression.
3. Valve guides and piston rings - rapid carbon accumulation in the combustion chamber may be caused by worn valve guides and/or worn piston oil rings. This may be indicated by white exhaust smoke.

If cylinder compression is lower than 9 kgf/cm^2 (128 psi), check the following:

1. Gas leakage around the cylinder head - replace the damaged head gasket and check the cylinder head for warp.

Read all of SAFETY and this section before attempting any procedure. Pay particular attention to Notices, Cautions, Warnings and Dangers.

2. Condition of the valve seating.
3. Valve clearance.
4. Piston/cylinder wear, piston seizure.
5. Piston ring, piston ring groove.

Rocker Cover Removal

Tool List	Qty.
Ratchet	1
Extension 6"	1
Socket, 10 mm	1

1. Remove the four bolts (5) securing the rocker cover.
2. Remove the rocker cover (2) and the gasket.

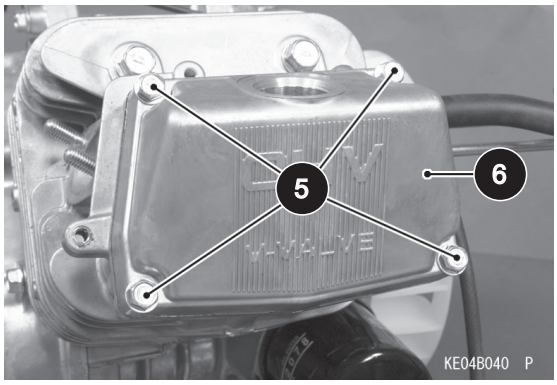


Fig. 17 Rocker Cover

Valve Clearance Inspection

Tool List	Qty.
Allen Bit, 3 mm	1
Ratchet	1
Extension 6"	1
Feeler Gauge	1
Wrench, 14 mm	1
Torque Wrench, in. lbs	1

NOTICE: Valve clearance must be checked when the engine is cold (at room temperature).

With the rocker cover removed, Place the piston at TDC of the compression stroke turning the crankshaft in its rotational direction.

Then check the valve clearance with a feeler gauge (7), measure the valve clearance between the rocker arm (8) and the valve stem end.

Valve Clearance (when cold): Inlet, Exhaust 0.10 - 0.15 mm (0.004 - 0.006 in.)

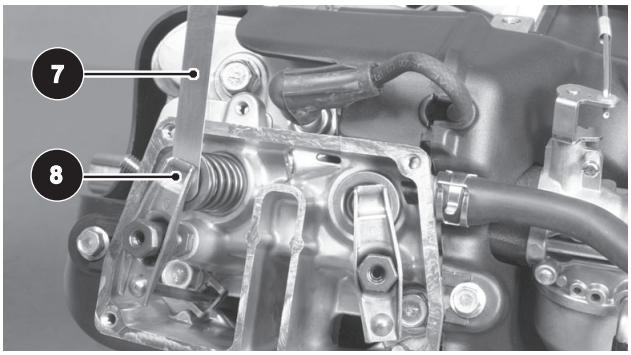


Fig. 18 Measure Valve Clearance

If the valve clearance is incorrect, adjust it.

Valve Clearance Adjustment

Turn the crankshaft to the proper direction until the piston is at TDC of the compression stroke.

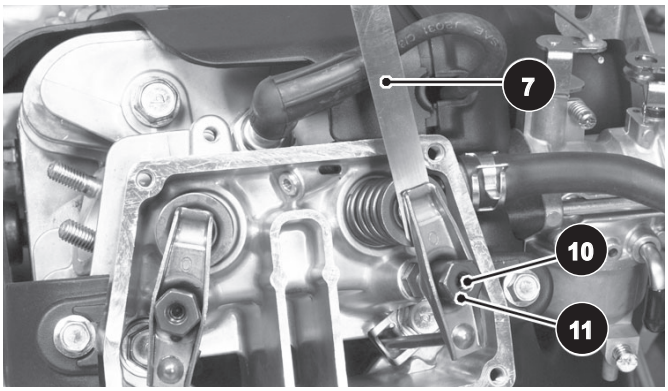


Fig. 19 Valve Clearance Adjustment

Valve Clearance (when cold): Inlet, Exhaust 0.10 - 0.15 mm (0.004 - 0.006 in.)

Loosen the lock screw (10) using the 3 mm Allen bit and the adjusting nut (11). Insert the feeler gauge (7) between the rocker arm and the valve stem end and move the adjusting nut (11) until the feeler gauge begins to bind between the rocker arm and the valve stem end.

Hold the adjusting nut (11) in place using a wrench and tighten the lock screw (10) to the specified torque.

ITEM	TORQUE SPECIFICATION
10	61 in. lbs (6.9 Nm)

⚠ CAUTION ***Do NOT over-tighten.***

Remeasure any clearance that was adjusted. Readjust if necessary.

Replace the Rocker Cover (6), gasket and the four bolts (5). Tighten the bolts to secure the cover in place.

ENGINE

Read all of SAFETY and this section before attempting any procedure. Pay particular attention to Notices, Cautions, Warnings and Dangers.

ENGINE REMOVAL

Tool List	Qty.
Socket, 10 mm	1
Socket, 12 mm	1
Socket, 14 mm	1
Socket, 1/2"	1
Socket, 5/8"	1
Impact Socket, 19 mm	1
Wrench, 8 mm	1
Wrench, 10 mm	1
Wrench, 12 mm	1
Wrench, 13 mm	1
Wrench, 14 mm	2
Wrench, 15 mm	1
Wrench, 19 mm	1
Combo Wrench, 19 mm	1
Pliers	1
Extension 6"	1
Ratchet	1
Flat Ratchet	1
Impact Tool	1
Straight Blade Screwdriver	1
Drip Pan	1

This section covers the removal and installation of the engine, for information on rebuilding the engine please see the Engine Shop Rebuild Manual for this vehicle.

NOTICE: In the following text, there are references to removing/installing bolts etc. Additional hardware (nuts, washers etc.) that are removed must always be installed in their original positions unless otherwise specified. Non specified torque specifications are as shown in the table contained in the General Information and Routine Maintenance section.

This operation will remove the engine through the top of the engine compartment. The weight of the engine exceeds normal OSHA limits for one person; therefore, a second person or an engine hoist will be needed to remove the engine. If a hoist is employed, it will be necessary to remove the sun top.

1. Disconnect Battery ground wire.
2. Disconnect air hose at throttle body.
3. Jack up rear of vehicle as directed in the SAFETY Section of this manual. Use jack stands for stability.
4. Remove the drive belt by rotating clutch toward rear of vehicle when the belt is slipped off the top of the clutch. Remove belt from vehicle.
5. Disconnect the 'DF' wire from the starter using 8mm wrench, lay harness out of the way
6. Remove the ground strap from the Starter/Generator using a 10 mm socket.
7. Disconnect the F2 power cable from the top of the starter.
8. Starter/Generator (See Starter/Generator Replacement in this section).
9. Remove the ground strap at the crankcase using the 10 mm socket. Route ground strap through bracket and under the throttle rod and cover.
10. Disconnect the fuel line from the injector, use drip pan to catch any fuel leakage.
11. Remove throttle rod cover using a 6" extension and a 10 mm socket. Remove the throttle rod at the throttle plate using a pliers to pop the retaining tab from the throttle rod and lift throttle rod out of hole. Remove throttle rod at rear by rotating 45 degrees from the bracket and lift through the bracket slot and remove rod from vehicle.
12. Remove both bolts from starter/generator bracket using a 15 mm wrench.
13. Remove the 12mm hardware that secures the header flange to the muffler flange.
14. Remove the four 15 mm bolts from the engine support bracket connecting the engine to the differential and the engine to the inner frame.
15. Remove the 15 mm bolts from the bottom of the skid plate. Access the forward two nuts through the oil drain access hole.

Controls and Wiring

Disconnect the 12 pin engine-harness connector joining the main harness to the engine harness.

Removing the Engine from the Vehicle

NOTICE: Place suitable blocks under the engine frame for support. the alignment of the frames and simplify engine installation.

NOTICE: It is not necessary to remove the muffler as part of the engine removal.

Read all of SAFETY and this section before attempting any procedure. Pay particular attention to Notices, Cautions, Warnings and Dangers.

Engine Installation

⚠ CAUTION ***It is important to follow the assembly sequence recommended for mounting hardware.***

1. With the assistance of a hoist or another person, lower the engine into position over the engine support castings.
2. Install one rear horizontal and one front bottom engine bolt through the casting and engine and lightly snug in place.
3. Install the remaining horizontal engine bolts and finger tighten. Remove the front bottom bolt and reinstall the skid plate finger tight.
4. Tighten the bottom and horizontal mounting bolts to 45 ft. lbs. (60 Nm) torque.
5. The remaining installation is in the reverse order of disassembly using standard torque specifications.

DRIVE CLUTCH REMOVAL

⚠ WARNING ***To prevent the possibility of personal injury, use only impact sockets when using an impact wrench.***

Insert a clutch puller bolt (p/n 608429) into the clutch and hand tighten for several turns.

Remove the clutch by driving it off with the impact wrench and the clutch puller bolt.

NOTICE: In some extreme cases, the clutch will be resistant to removal In stubborn cases the clutch removal tool should be removed and the cavity filled with grease. Install the clutch puller and use the impact wrench to drive off the clutch. The combination of hydraulic pressure (grease) and the impact wrench will remove the most stubborn clutch. To prevent damage to the clutch, be sure to remove all grease from the body of the clutch since grease penetrating the seal may cause premature clutch failure.

It is not necessary to remove the engine to remove the clutch. Refer to the **CONTINUOUSLY VARIABLE TRANSMISSION (CVT)** section for removal and installation.

Read all of SAFETY and this section before attempting any procedure. Pay particular attention to Notices, Cautions, Warnings and Dangers.

Notes:

SPEED CONTROL

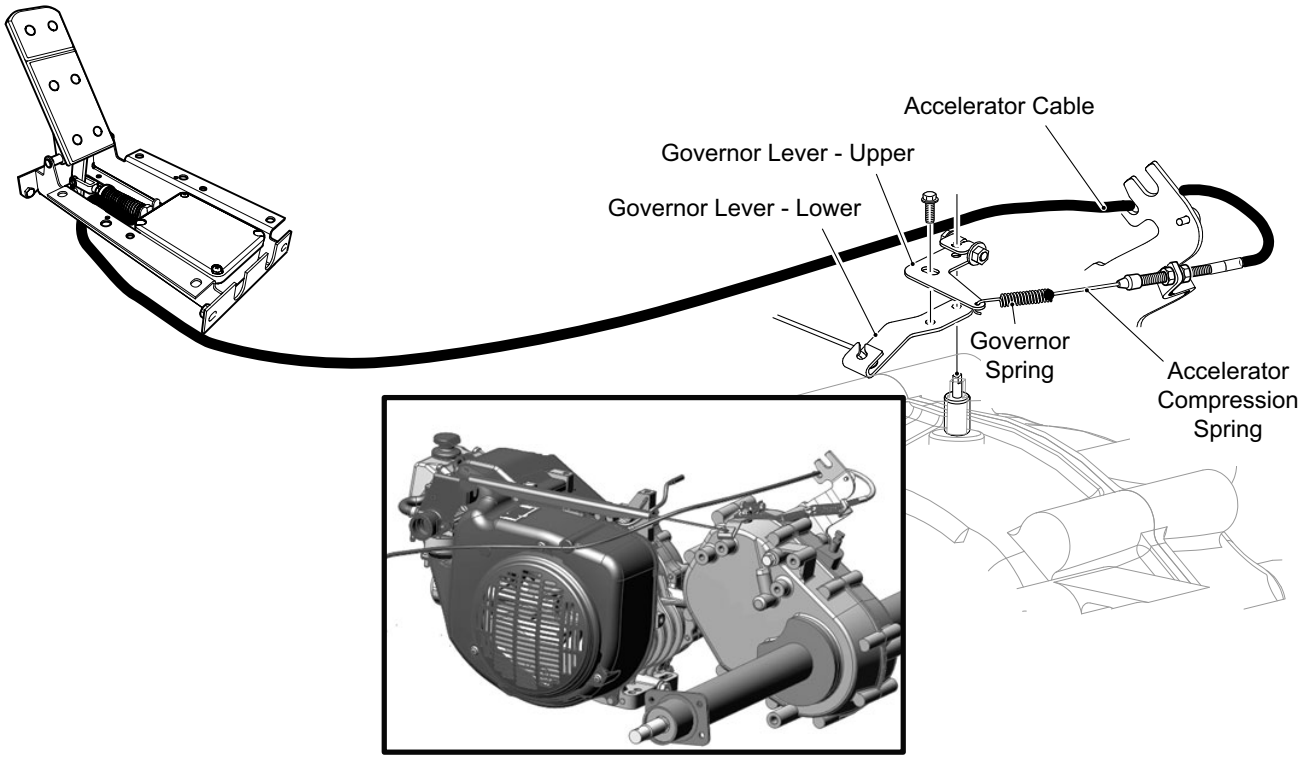


Fig. 1 Accelerator and Speed Control System

NOTICE: The linkages that control the accelerator mechanism and governor are designed to operate as an integrated assembly. Any adjustment to one portion of the system will have an effect on the other components within the system. In the following text, there are references to removing and installing bolts and other fasteners. Additional hardware (nuts, washers, etc.) that are removed must always be installed in their original positions unless otherwise specified. Non-specified torques are shown in the table in the General Information and Routine Maintenance section.

⚠WARNING ***To prevent possible injury or death, follow the lifting procedure in the SAFETY section of this manual. Place wheel chocks in front and behind the rear wheels. Check the stability of the vehicle on the jack stands before starting any repair procedure. Never work on a vehicle that is supported by a jack alone.***

SYSTEM OPERATION

Pedal Box Operation

As the accelerator pedal is pressed, the accelerator rod moves towards the rear of the vehicle by overcoming the resistance of the accelerator return spring (Ref. Fig. 1).

As the accelerator pedal moves, the parking brake is released, the micro switch closes and activates the starter-generator.

The rear end of the accelerator rod is joined to the micro switch cam which connects to the accelerator cable.

As the micro switch cam moves to the rear it pulls the accelerator cable, which pulls against the governor spring.

When the accelerator cable pulls against the accelerator cable/governor spring, the spring extends until it overcomes the resistance exerted by the governor mechanism. As the governor spring overcomes these forces, the governor arm moves and the motion is transferred through linkage rod to the throttle plate.

Governor Operation

Until the vehicle reaches its governed speed, the it will continue to accelerate in relation to the accelerator pedal position. When governed speed is reached, the ground speed governor in the rear axle assembly operates against the governor spring and closes the throttle plate until the correct governed speed is achieved (Ref. Fig. 1).

It is the force of the governor spring in response to accelerator pedal and governor arm position which controls the position of the throttle plate. This spring cushions sudden changes in throttle linkage position to provide smooth power transmission.

SPEED CONTROL

Read all of SAFETY and this section before attempting any procedure. Pay particular attention to Notices, Cautions, Warnings and Dangers.

⚠WARNING ***Driving above governed speed could cause a loss of vehicle control and possible injury or death.***

Tampering with or adjusting the governor or other speed control components will void the warranty.

TROUBLESHOOTING

Erratic acceleration and performance that does **not** include a notable increase in governed speed, may indicate the need for a linkage adjustment.

Symptoms that include an increase in governed speed indicate:

- a possible governor failure within the rear axle
- worn components in the governor system
- improper adjustment of linkage system

NOTICE: Other factors may effect the performance characteristics of the vehicle but they should be investigated only after confirming the linkage adjustment.

SPEED CONTROL

Tool List	Qty.
Phillips Screwdriver	1
Flat Blade Screwdriver	1
Needle Nose Pliers	1
Slip Joint Pliers	1
Open End Wrench, 10 mm	2
Ratchet	1
Socket, 15 mm	1
Torque Wrench, in. lbs	1
Torque Wrench, ft. lbs	1
Drill, 1/4"	1
Drill Bit, 3/16"	1
Pop Rivet Tool	1

⚠WARNING ***Remove the negative (-) battery cable at the battery to prevent the vehicle moving and the possible personal injury that may result. Refer to the SAFETY section of this manual for additional cautions and warnings.***

NOTICE: Be sure to follow the sequence indicated when making linkage adjustments.

Accelerator Cable Removal at Governor

To remove the accelerator cable (9) from the governor, loosen the nuts (13) securing the cable to the accelerator cable bracket (14) at the rear axle and unhook the spring from the upper governor lever (15).

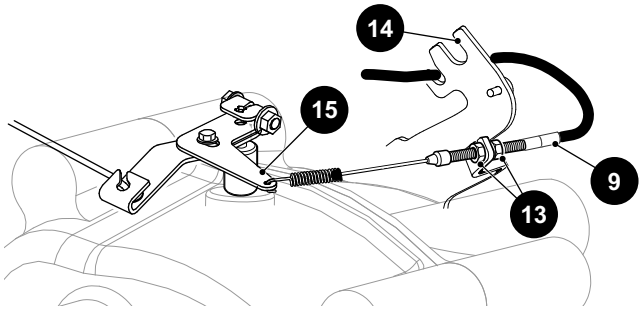


Fig. 2 Accelerator Cable at Governor

Accelerator Cable Removal at Pedal Box

To access the accelerator cable, remove the rocker panel (4), lift the floor mat (5) and remove the access cover (6) from the floor. Remove the screws (7) and cover (8) from the pedal box.

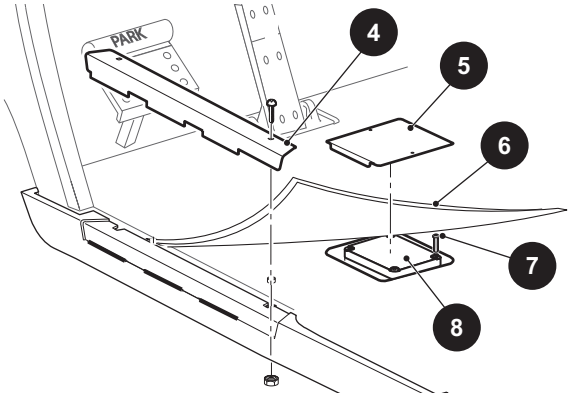


Fig. 3 Pedal Box Access

To remove the accelerator cable socket from the accelerator pedal box (11), remove the box cover (8) and unsnap the cable end (9) from the micro switch cam (10). With a pair of pliers, pinch the cable fitting to compress the sides sufficient to push cable fitting through accelerator pedal box.

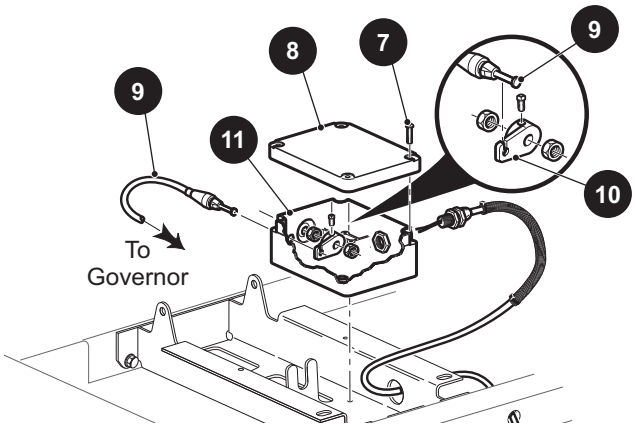


Fig. 4 Accelerator Cable at Pedal Box

Read all of SAFETY and this section before attempting any procedure. Pay particular attention to Notices, Cautions, Warnings and Dangers.

Accelerator Cable Installation

To install the accelerator cable, proceed in reverse order. (Ref. Fig. 2)(Ref. Fig. 3)(Ref. Fig. 4)

Accelerator Cable Adjustment *(Ref. Fig. 2)*

ITEM	TORQUE SPECIFICATION
3	30 - 33 ft. lbs (40 - 44 Nm)
13	35 - 44 in. lbs (4 - 5 Nm)

To adjust the accelerator cable, position the cable in the accelerator cable bracket at the rear axle so that the throttle is fully closed while allowing 1" travel at the top of the accelerator pedal. Once correctly positioned, tighten the cable securing nuts (13) on the bracket.

Throttle Rod Removal

To remove the throttle rod from the throttle plate (Ref. Fig. 5), twist the plastic connector (1) counterclockwise away from the throttle rod, line up the slot with the tabs on the rod and remove the rod from the throttle lever by lifting up (2).

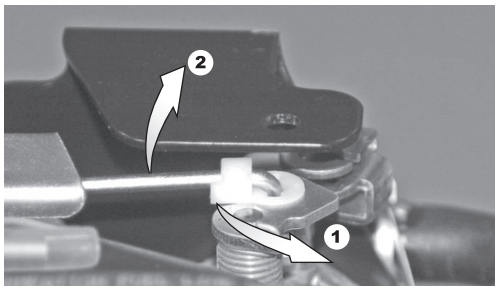


Fig. 5 Throttle Rod Removal

Throttle Rod Adjustment

To adjust the throttle rod (17), loosen the bolt (18) between the two governor levers and rotate lower governor lever (19) counter-clockwise until the throttle plate is fully open and rotate upper governor lever (20) counter-clockwise until it stops then tighten bolt that locks the governor levers in position.

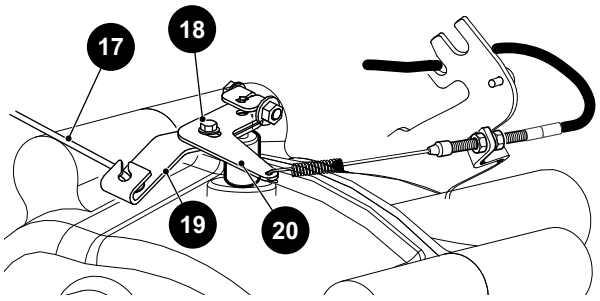


Fig. 6 Throttle Rod Adjustment

ITEM	TORQUE SPECIFICATION
18	60 - 72 in. lbs (7 - 8 Nm)

PEDAL BOX ADJUSTMENTS

Tool List **Qty.**

Needle Nose Pliers 1
Phillips Screwdriver 1
Open End Wrench, 9/16" 1
Open End Wrench, 1/2" 1
Open End Wrench, 7/16" 1
Open End Wrench, 3/8" 1
Allen Wrench, 1/8" 1

NOTICE: If any adjustments are made in the pedal box or accelerator area, it is necessary to go back and perform the speed control cable adjustment again. This must be done because any adjustment made in the pedal box or accelerator area will inadvertently affect the cables.

Accelerator Pedal Arm Adjustment

Lift front of vehicle using procedures and safety information in the SAFETY section.

Confirm the accelerator pedal arm (1) contacts the accelerator pedal bracket (2) when in the released position (Ref. Fig. 7). If there is no contact, loosen the jam nut (3) and rotate the rod (4) until contact is made.

NOTICE: Note that the factory applies a thread sealant to the accelerator rod threads before threading the rod into the clevis.

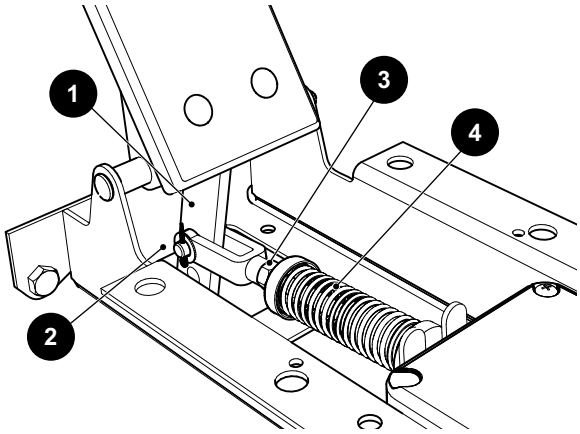


Fig. 7 Accelerator Pedal Arm Adjustment

Micro Switch Adjustment

When the system is in correct adjustment, the micro switch in the accelerator pedal box will click when the top of the accelerator pedal moves approximately 1/2" - 5/8" (13 - 16 mm). The accelerator cable (as seen at the rear axle) should have some slack present and not show any movement until after the micro switch clicks.

To access the micro switch, remove the rocker panel, lift the floor mat and remove the access cover from the floor (Ref. Fig. 3). Remove the screws (8) and cover (7) from the pedal box (Ref. Fig. 8).

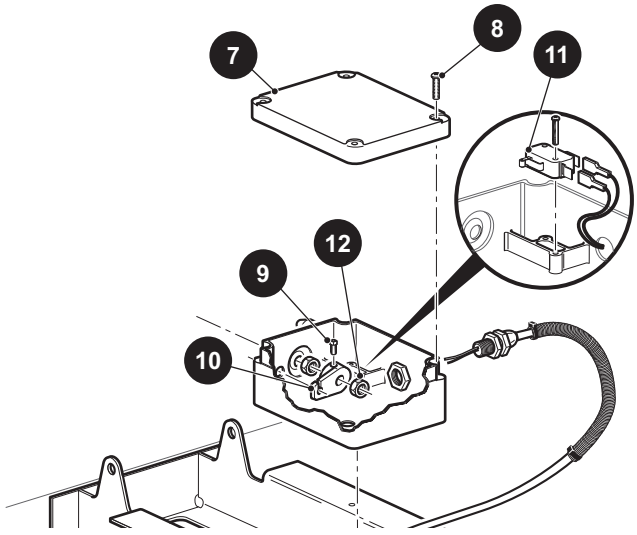


Fig. 8 Pedal Box Micro Switch

Loosen the setscrew (9) in cam (10) using an 1/8" Allen wrench. Loosen the jam nut (12) and move the cam to adjust as needed (Ref. Fig. 8). Adjust to permit 1/2" - 5/8" (13 - 16 mm) of accelerator pedal travel before the micro switch (11) clicks. Measure the distance at the top of the pedal with the pedal arm contacting the pedal bracket. Making sure the setscrew in the cam does not contact the micro switch actuator. Tighten the setscrew (9) and the jam nut (12) to the specified torque.

ITEM	TORQUE SPECIFICATION
9	45 - 55 in. lbs (5 - 6 Nm)
12	10 - 11 ft. lbs (14 - 15 Nm)

Be sure the accelerator pedal moves smoothly and the accelerator cable pulls smoothly on the governor arm.

Replace the cover on the pedal box. Tap lightly to set the cover before installing screws. Replace the access cover on the floor. Replace floormat and rocker panel.

Road Test

Install the negative (-) battery cable.

Test drive the vehicle and confirm that the compression spring adjustment results in the maximum governed speed specified in the GENERAL SPECIFICATIONS section. Determine speed by measuring the time it takes to travel a known set distance with vehicle at maximum speed. Enter time and distance into this formula to calculate speed: **Rate (in MPH) = (Distance in feet / 5280) / (Time in seconds / 3600)** or **Rate (in KPH) = (Distance in meters / 1000) / (Time in seconds / 3600)**. For example: (300 ft. / 5280) / (13.6 sec. / 3600) = 15 MPH or (100 m / 1000) / (15 sec. / 3600) = 24 KPH. If the speed is not within the specified speed range, stop the vehicle and adjust the governor compression spring as described in procedure above.

Repeat the test and adjustment until the factory recommended governed speed is achieved. Tightening the spring results in a speed increase while loosening it will result in a speed decrease.

Read all of SAFETY and this section before attempting any procedure. Pay particular attention to Notices, Cautions, Warnings and Dangers.

Notes:

Read all of SAFETY and this section before attempting any procedure. Pay particular attention to Notices, Cautions, Warnings and Dangers.

Notes:

FUEL SYSTEM

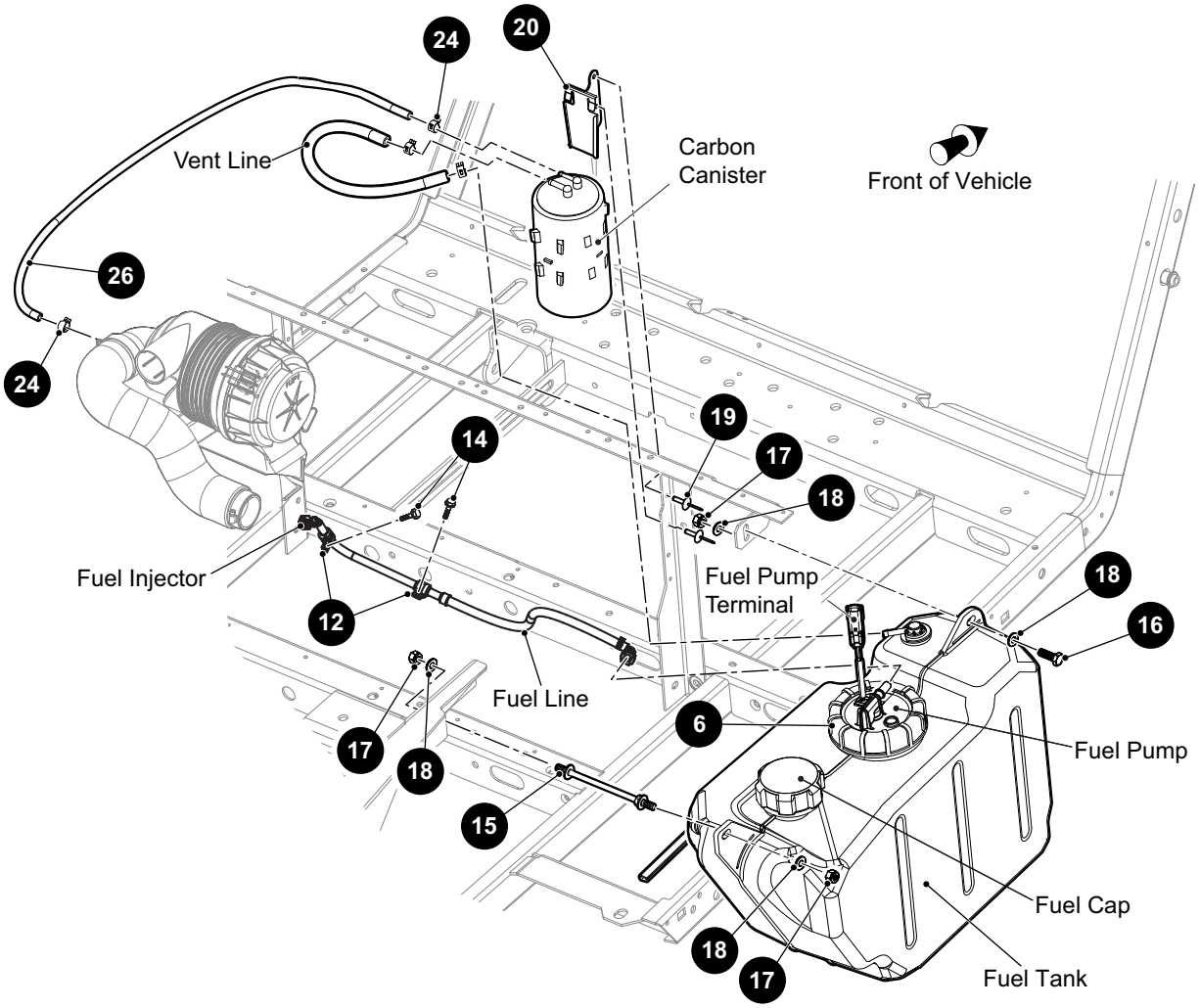


Fig. 1 Fuel System

FUEL SYSTEM

Read all of SAFETY and this section before attempting any procedure. Pay particular attention to Notices, Cautions, Warnings and Dangers.

GENERAL

NOTICE: Hardware that is removed must always be installed in its original position unless otherwise specified. If torque values are not specified, refer to the Torque Specifications Table. See TORQUE SPECIFICATIONS on page 15.

An electric fuel pump supplies fuel from the fuel tank to the engine injection system through the fuel line (See Fig. 1). The fuel filter is located in the fuel tank along with the fuel pump.

FUEL

⚠WARNING ***To prevent serious injury or death resulting from a possible explosion, do not smoke near the fuel tank or refuel near open flame or electrical items that could produce a spark.***

Always wear safety glasses while refueling to prevent possible eye injury from gasoline or gasoline vapor.

When refueling, inspect the fuel cap for leaks or breaks that could result in fuel spillage.

Do not handle fuel in an area that is not adequately ventilated. Do not permit anyone to smoke in an area where vehicles are being fueled.

The fuel tank is located under the seat on the passenger side of the vehicle. Fill the tank with fresh, 87 octane (minimum) gasoline. See *RECOMMENDED LUBRICANTS AND FLUIDS* on page 178.

Do not use fuel with ethanol content greater than 10%.

Do not mix oil with gasoline.

NOTICE: Some fuels, called oxygenated or reformulated gasoline, are gasoline blended with alcohols or ethers. Excessive amounts of these blends can damage the fuel system or cause performance problems. If any undesirable operating symptoms occur, use gasoline with a lower percentage of alcohol or ether.

Do not over fill the fuel tank. Allow adequate space for the expansion of gasoline.

FUEL SYSTEM SERVICE

⚠WARNING ***A clogged or kinked fuel line can be a safety hazard if fuel leaks onto a hot engine.***

Tests that involve fuel flow should be avoided if possible. If a test to determine fuel/vapor presence or flow is required, the ignition system must be disabled to prevent an ignition spark that could ignite the fuel/vapor. Never permit smoking or an open flame in an area that contains fuel/vapor. Clean up all fuel spills immediately.

Never attempt to repair a damaged or leaking fuel tank. It must be replaced.

Disconnect the negative (-) battery cable before servicing the fuel system.

The fuel tank, fuel line, vent line and fuel tank cap should be checked frequently for leaks, clogs or damage (See Fig. 1).

Fuel Tank Removal

Tool List	Qty.
Wrench, 5/16"	1
Socket, 5/16"	1
Ratchet	1
Drain Pan	1
Siphon pump	1
Fuel Container	1

1. Disconnect the negative (-) battery cable with an insulated wrench.
2. Remove the fuel from the tank with a siphon pump that is safe for use with gasoline.

NOTICE: Always dispose of fuel safely.

3. Press the tab to disconnect the fuel pump wire located at the top of the fuel tank (See Fig. 2).

Fig. 2 Fuel Pump Wire

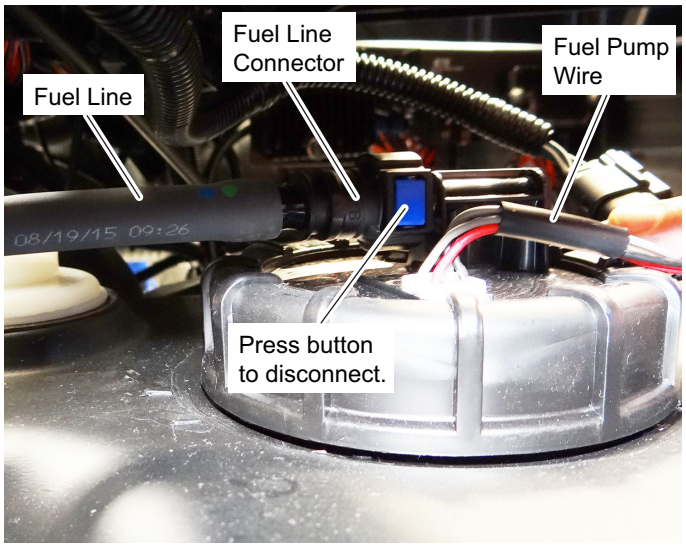


Fig. 3 Fuel Tank Connections

4. Disconnect the fuel line from the tank by pressing the button on the fuel line connector while pulling the connector away from the tank (See Fig. 3). Plug the fuel line to prevent fuel leakage.
5. Disconnect the tube (12) to the carbon cannister.
6. Remove the forward hex nut (17), washers (18), and bolt (16).
7. Remove the rear nut (17), washers (18) and spacer (15).
8. Remove the tank from the engine compartment.
9. Installation is in reverse order of removal (Ref. Fig. 1).
10. Remove the fuel tank.
11. Installation is in reverse order of removal.

NOTICE: Make sure that the fuel line and vent line are not kinked or restricted by wire ties, etc.

Fuel Pump Assembly

Tool List **Qty.**

Strap Wrench 1

NOTICE: The electric fuel pump, fuel filter, float and fuel gauge sending unit are integrated into one complete assembly (See Fig. 4). If any of these components fail, the complete assembly must be replaced.

1. Remove the fuel tank. *See Fuel Tank Removal* on page 90.
2. Remove the pump assembly (3) by removing the hold-down ring (6) and gasket (5) (See Fig. 4).
3. Pull the fuel pump assembly up and out of the fuel tank.
4. With the fuel pump assembly removed, inspect the hold-down ring seal (4) for damage. Replace as necessary.
5. Installation is in the reverse order of disassembly.

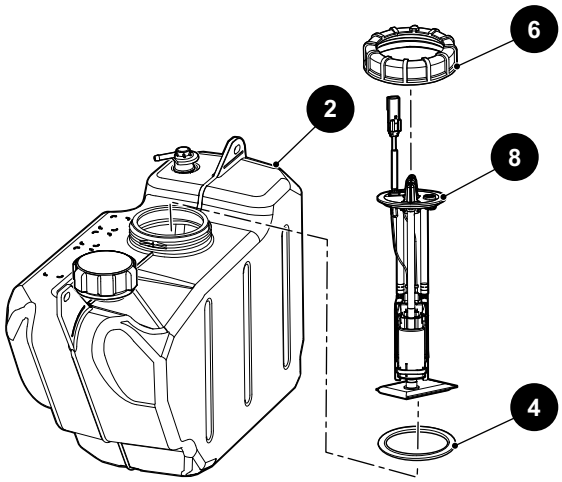


Fig. 4 Fuel Pump

FUEL INJECTOR REMOVAL

Tool List **Qty.**

Socket, 5/16" 1
Socket, 10mm 1
Torx Bit, T21 1
Ratchet 1
Drip Pan 1

1. Disconnect the negative (-) battery cable.
2. Remove the air intake hose.
3. Remove the throttle guard.
4. Disconnect the wire terminal from the injector.
5. Remove the screw (14) that secures the fuel line to the engine.
6. Disconnect the fuel line from the fuel injector. Use a drip pan to catch any fuel that may leak from the fuel line, dispose of the spent fuel properly.
7. Remove the bolt that secures the fuel injector to the engine.
8. Remove the injector from the engine.
9. Installation is in reverse order of removal (Ref. Fig. 1).

CARBON CANISTER

Tool List **Qty.**

Flat Blade Screwdriver 1

1. To remove the carbon canister (22), disconnect the EVAP hose (12) from the carbon cannister (22) (Ref. Fig. 1).
2. Disconnect the fuel line hose (26) from the carbon canister (22).
3. Press the tabs on the mounting bracket (20) and slide the canister upward.
4. To install the carbon canister (22), position the canister ears above the mounting bracket (20) and push against the bracket and slide the canister (22) onto the bracket past the tabs.
5. Install EVAP hose (12) on the tube closest to the mounting bracket.
6. Install the fuel line hose (26) on the remaining tube.

MALFUNCTION INDICATOR LIGHT (MIL)

The EFI system uses Diagnostic Trouble Codes to report issues. Both active and stored faults are reported by the Engine Control Module (ECM).

- Active Faults – These are faults that have been triggered since the key switch was last turned to the ON position.
- Stored Faults – These are faults that are no longer active. These faults have not been triggered since the key switch was last turned to the ON position. They were active at one time but were stored when the key switch was turned to the OFF position sometime in the past.

These faults can be read from the MIL located under the front seat. A series of flashes indicates each fault code. A description of how to read codes from the MIL is detailed below. More information about each fault can be obtained from a service technician with the proper equipment.

Follow the below procedure to read, active and store vehicle faults from the MIL:

1. Lock the vehicle's direction selector in Neutral.
2. View the MIL by removing the front seat bottom.
3. Turn the key switch to the ON position
4. Observe the sequence of flashes. Each code is separated by five seconds of solid illumination.
   a. Single-digit fault codes display as a sequence of one-second flashes, with the number of flashes matching the code value (e.g. 8 flashes for MIL code 8).
   b. Double-digit fault codes display as a combination of 0.3-second flashes for the tens place and 1-second flashes for the ones place.
   c. Active faults are displayed first, then stored faults are displayed.
   d. Active faults are displayed whether the engine is running or not. Stored faults only display when the engine is not running.

If there are no active or stored faults, the MIL will illuminate continuously (no flashes) to demonstrate functionality.

The ECM will enter sleep mode after 60 minutes of inactivity. If the key switch is in the ON position and the MIL is not illuminated, press and release the accelerator pedal to wake the system and reveal any active fault codes.

MIL Flash Code	Fault	Recovery Steps
1	Temp Sensor Disconnected / Failure	1. Check that the sensor is connected. 2. If connected, contact an authorized service rep.
2	Throttle Position Sensor Failure	1. Contact an authorized service rep.
4	O_2 Sensor Disconnected / Failure	1. Check that the sensor is connected. 2. If connected, contact an authorized service rep.
5	High Battery Voltage	1. Verify battery voltage is between 10-16 VDC. 2. If voltage is over 16 VDC, contact an authorized service rep.
5	Low Battery Voltage	1. Verify battery voltage is between 10-16 VDC. 2. If the voltage is below 10 VDC, replace the battery. 3. If the fault persists, contact an authorized service rep.
SOLID	Safeties Active	1. Press and release the accelerator pedal. 2. If the fault is still present while the accelerator pedal is pressed, contact an authorized service rep.

Read all of SAFETY and this section before attempting any procedure. Pay particular attention to Notices, Cautions, Warnings and Dangers.

MIL Flash Code	Fault	Recovery Steps
8	Engine Running Rich / Lean	1. Verify that the air filter is not clogged. 2. If the fault persists, contact an authorized service rep.
22	Limp Home	1. Contact an authorized service rep.

WALBRO IRIS TSV SERVICE TOOL EFI DIAGNOSTICS

Communication Module

The Diagnostic USB Communication Module is used for communicating with the ECM real-time as shown in Figures 1 and 2 below.

Fig. 5 USB Communication Module ready for ECM programming

Fig. 6 USB Communication Module with LED indicators on bottom right

The LED Indicators:

- PWR – White – Indicates Battery Power to the Module
- USB – Green – Indicates connected to the PC USB
- CON – Yellow – Indicates they key switch is powered on
- PRG – Red – Indicates the module and ECM are in
- program mode

Jumper Harness

Figures 3 and 4 below show the jumper harness that connects between the engine and vehicle.

Fig. 7 Jumper harness

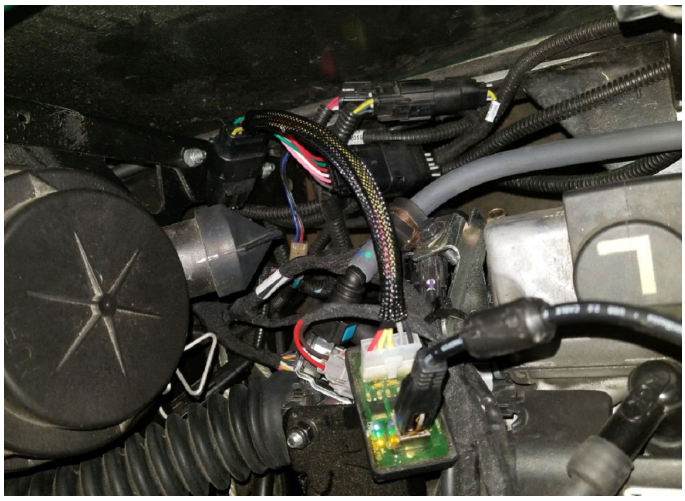


Fig. 8 Jumper harness installed in vehicle

Connect to Vehicle

1. Prepare the vehicle:
   a. Ensure the vehicle's parking brake is on.
   b. Remove the vehicle seat.
   c. Ensure the FNR selector is in the neutral lock-out position.
4. Disconnect the 12-pin connector between the engine harness and the vehicle harness.

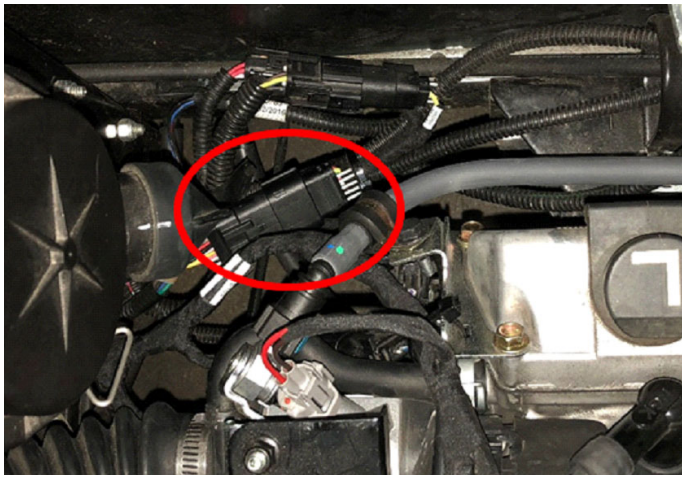


Fig. 9 Engine Compartment 12-Pin Connector

5. Connect the diagnostic jumper harness to each of its mating 12-pin connectors. Ensure there is a positive latch that locks them together.
6. Route the USB cable out of the engine compartment. Make sure it does not contact sharp corners or get pinched

Download software file from TSV Connect

Connect to the ECU

1. On your computer, launch the IRIS tool.

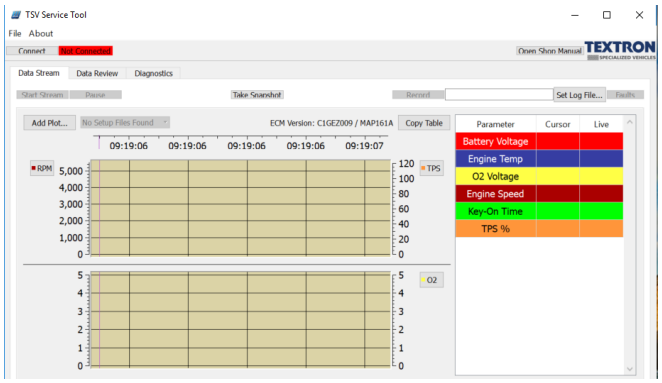


Fig. 10 IRIS Tool Home Screen

2. Turn the vehicle key to the "ON" position.
3. Plug the USB cable into your computer's USB port.
4. Click the "Connect" button at the top left of the IRIS tool.
   i. If an error appears, close the error, and try to connect again.
2. Press "Start Stream" (under the "Connect" button) to begin streaming live data from the ECM.

Parameters for Viewing

The following is a list of parameters available for viewing, along with a short description of what each parameter represents:

- Battery Voltage – Shows the battery voltage.
- Engine Temp – Shows the engine temperature sensed from the engine temp sensor.
- O2 Voltage – This is the raw voltage output from the oxygen sensor.
- RPM – This displays the current engine speed in RPM.
- Key-On Time – Time in seconds since the key was turned on.
- TPS % - Displays (in %) the position of the throttle plate.

Streaming must be active to read these values from the ECM (press "Start Stream").

Record Log File

1. Engine data can be recorded and viewed afterward for troubleshooting.
2. Navigate to the Data Stream tab
3. Ensure streaming is active (press "Start Stream" if not already pressed). If not, it is possible to collect an empty log file with no indications of the error.
4. Click the "Set Log file..." button
5. Navigate to the folder you want to save the log into, name the file, and click OK.
6. To start recording, click Record (near "Set Log File..." button)
7. To stop recording, click Record again.

View Log File

1. To view recorded data, navigate to the Data Review tab.
2. In the top-left corner, click File->Open
3. Find and select the log file in question. Click Open.
4. The green bar at the bottom of the screen shows the loading status of the file. When loading large files, it

sometimes stops moving at certain points. This is normal.

5. An empty plot will appear. To show data traces, right-click in the tan plot area and select a channel from the “Available Data” flyout menu. Repeat until all desired channels are selected.
6. Additional plots can be added to display channels separately. Use the “Add Plot” button in the top-left corner to create a new empty plot.
7. To change the vertical axis range, right-click and select an option from the “Scale Behavior” flyout menu. “Manual” allows exact min and max values to be entered.

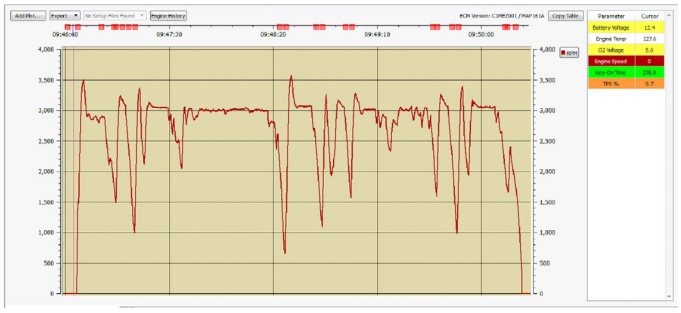


Fig. 11 Data Review

8. The scroll wheel allows zooming in and out of the plot. The area to be focused on is determined by the cursor position (hover over the area of interest while scrolling).
9. The Engine History button shows the Stored Faults as they would have appeared when the log was taken.
10. The ECM version when the log was taken is shown in the top-right.
11. The time scale is shown at the top in hh:mm:ss format. A more precise value is shown next to the cursor as it moves across the plot. Hint: calculating a time difference is best accomplished by referring to the Key-on Time variable instead of the time of day.
12. Green and red squares may appear on the time scale at the top, as seen in Figure 7. These are diagnostic indicators. Hovering the cursor over each square reveals the event information and precise time stamp. Examples: “Safeties Active” (indicating pedal up/grounded kill line), “Temp Sensor Disconnected”, “Limp Home Mode”. The “Safeties Active” fault is typically not an indication of an issue. It only signifies that the accelerator pedal has been released, which signals to the ECM to stop injecting fuel.
13. Multiple log files can be opened simultaneously by using File->Open again. The different logs will occupy individual tabs, shown at the bottom of the screen.

Update ECM

WARNING ***Before starting the update procedure:***

Make sure the laptop is plugged into a charger.

Ensure the USB cable is routed in so that there is no risk of it coming unplugged.

Ensure the computer does not go to sleep/hibernate or shut down during the update.

Any of the scenarios in the warning above has a chance to corrupt the ECU, requiring removal and replacement of the entire throttle body assembly.

1. Select “Load Engine Config” from the File menu.

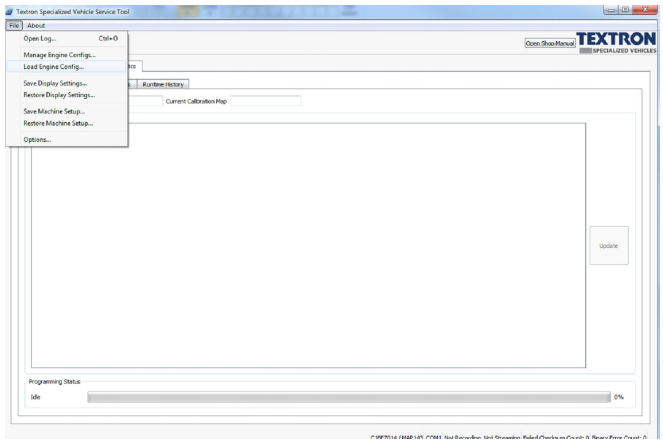


Fig. 12 IRIS Tool File Menu

2. Navigate to the location of the downloaded map update. Select and open the appropriate map.

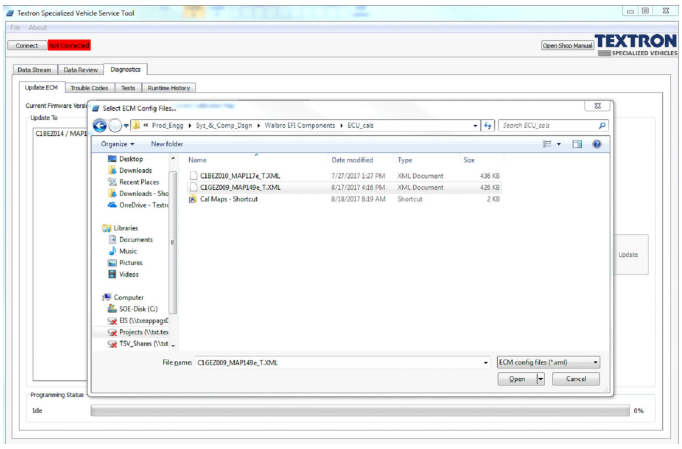


Fig. 13 ECM Selection Window

3. Click “OK” to load the map.

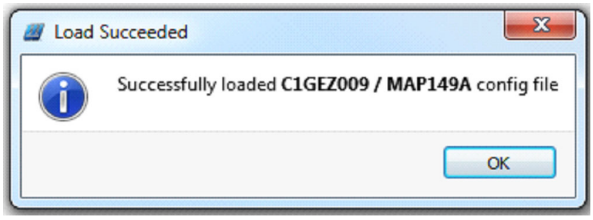


Fig. 14 Completion of ECM Map Loading

4. Stop streaming (Data Stream tab).
5. Navigate to the “Update ECM” tab, used to update the ECM Software. Update procedure as follows:
   a. Select the desired file and then click the “Update” button.

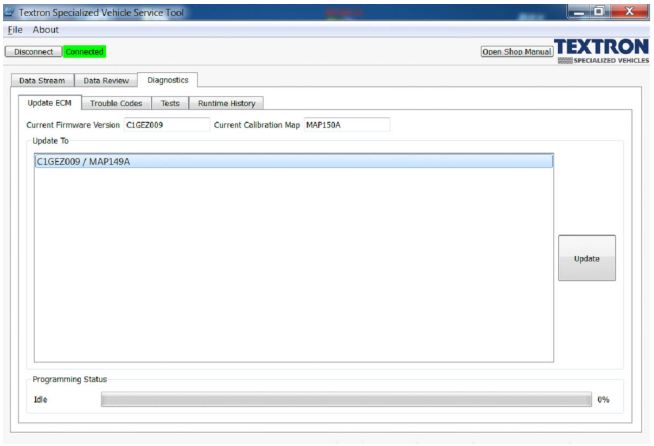


Fig. 15 IRIS Tool Update ECM Tab

   b. Verify the red LED is on to indicate that the ECM is in program mode. Cycle the key power, and then press “OK”.

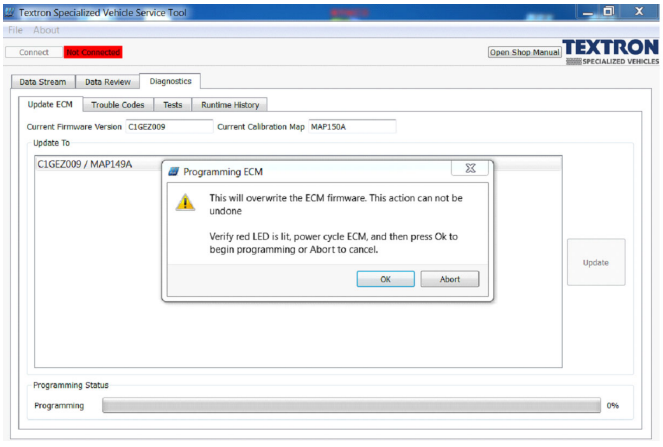


Fig. 16 Programing ECM Window

   c. The Status Bar at the bottom of the IRIS tool “Update ECM” tab window will start showing programming progress. The yellow LED on the USB Communication module will pulse during programming.

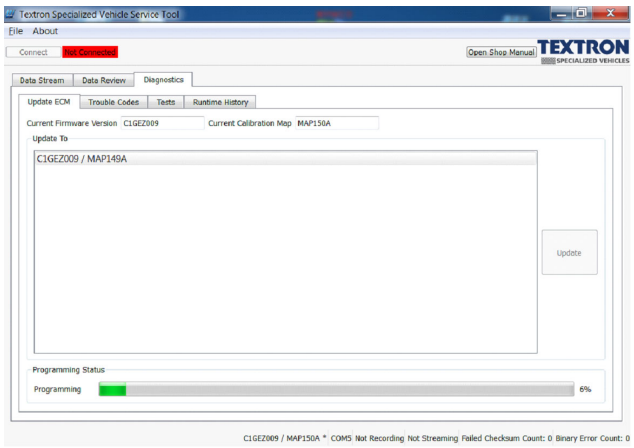


Fig. 17 IRIS Update ECM Window

   d. A message will pop up indicating the programming is finished. You will need to cycle the key power again and then click “OK” in the pop up window.

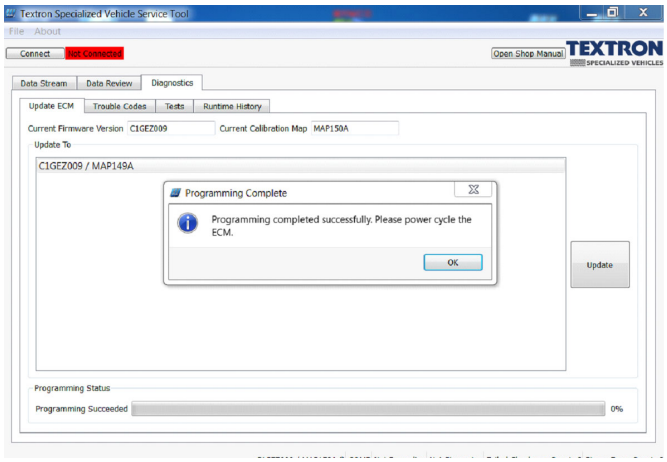


Fig. 18 Successful Program Update Window

Troubleshooting

If there is an error encountered, such as lost communication or a time-out:

- Click “OK” and click the “Connect” button in the IRIS window.
- If it will not reconnect after multiple attempts, turn off the key, remove the USB cable, turn on the key, and reinsert the USB cable to the laptop, and click the “Connect” button in the IRIS window.
- If it still will not reconnect, the ECU is corrupted. The throttle body assembly must be removed and replaced with a new functioning unit.

Read all of SAFETY and this section before attempting any procedure. Pay particular attention to Notices, Cautions, Warnings and Dangers.

Fault Check

The Walbro EFI system uses Diagnostic Trouble Codes to report issues. Both active and stored faults are reported by the ECM.

- Active Faults – These are faults that have been triggered since the key was last switched to the “ON” position.
- Stored Faults – These are faults that are no longer active. These faults have not been triggered since the key was last switched to the “ON” position. They were active at one time but were stored when the key was turned to the “OFF” position sometime in the past.

A more detailed description and basic troubleshooting can be found by clicking on the faults when they appear on the Diagnostics->Trouble Codes tab in the software.

These faults can be read from the MIL typically located under the vehicle’s seat. A series of flashes indicates each fault code. A description of how to read codes from the MIL is found in the vehicle owner’s manual and service manual. Note that the MIL will not operate when the diagnostic dongle is connected to the vehicle. In this case, the faults are instead passed to the diagnostic software.

Follow the below procedure to view active and stored vehicle faults in the software:

1. Turn the vehicle key to the “ON” position.
2. Press Start Stream.

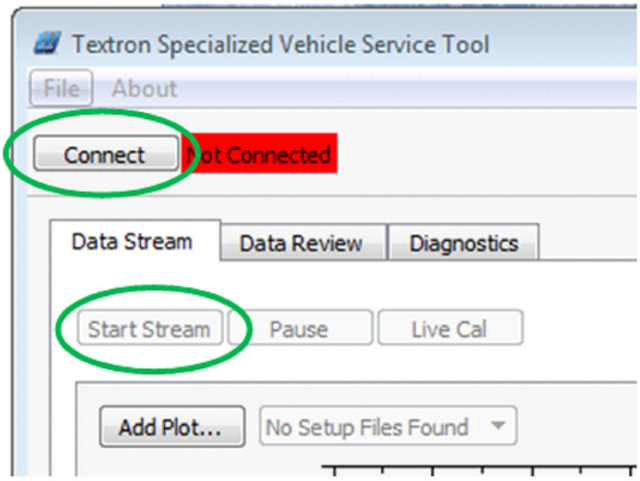


Fig. 19 Connect and Start Stream Buttons

3. Navigate to the Diagnostics Tab.
4. Navigate to the Trouble Codes sub-tab

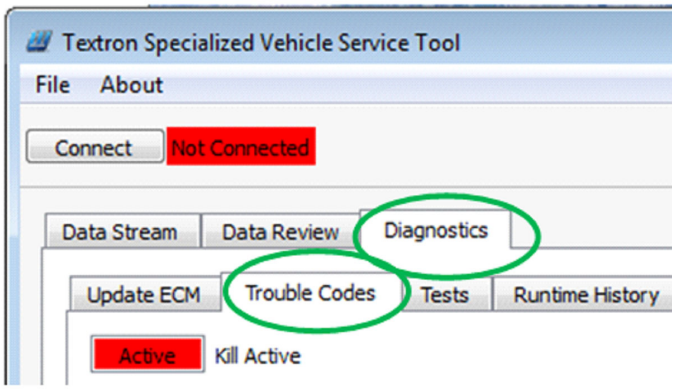


Fig. 20 Trouble Codes Tab

5. Press “Request Stored Faults” at bottom.

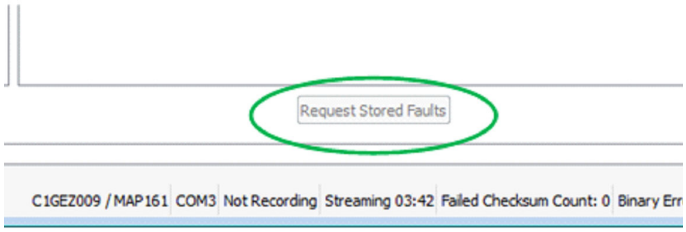


Fig. 21 Requested Stored Faults Button

6. Now the software displays the Active Faults and Stored Faults in the area shown.

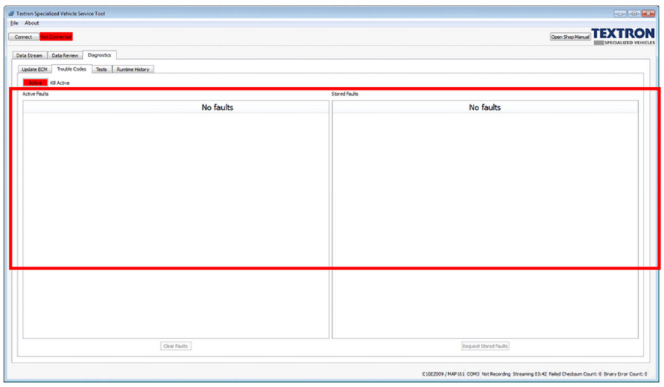


Fig. 22 Fault Codes Display Area

7. Current ECM hours are found on the Diagnostics tab and Runtime History sub-tab in a field called Engine Hours in the top left (see Figure 19). Hours are reported on initial software connection. If the vehicle is run any significant amount while connected, the software should be disconnected and reconnected to refresh the hour count. This hour reading should correlate closely with the reading of a vehicle’s hour meter, if installed, since both record pedal-down

time. However, if the throttle-body/ECM assembly is replaced, the hour count will be restarted from zero.

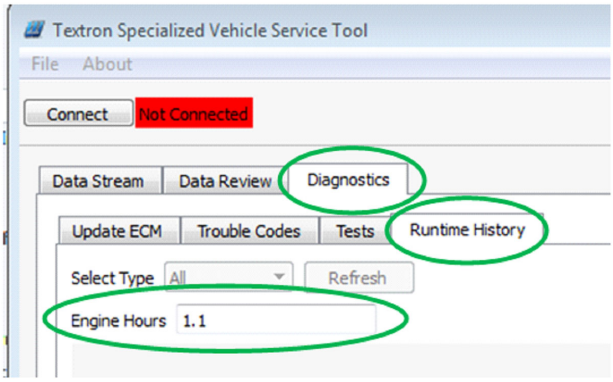


Fig. 23 Engine Hours Display

Active Faults may be cleared to determine when/if the fault recurs under observation. Stored Faults cannot be cleared.

Active Faults do not become Stored Faults until after a key cycle or 60-minute inactivity timeout. For instance, if during a run, Engine Running Lean and Limp Home Mode faults are thrown, regardless of the number of instances seen in the log, their occurrence will only increment the Stored Fault counter once when the key is cycled.

Pedal Kill Check

The accelerator-pedal system contains a kill switch that sends a signal to the ECM to shut off fuel when the pedal is released. This provides better stop/start performance and prevents accidental running when the pedal is up. If the throttle hangs open for any reason, the engine will still shut down when the pedal is released.

To test this system, follow this procedure:

1. Ensure the neutral lockout is engaged, the key is in the “ON” position, the software is connected, and streaming is active.
2. Navigate to the Diagnostics-> Trouble Codes section, as shown.

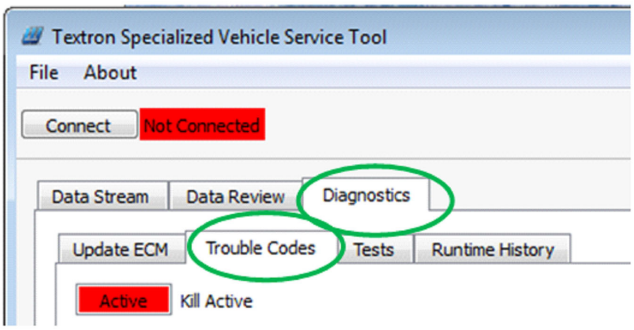


Fig. 24 Trouble Codes Tab

3. Note the condition of the “Kill Active” light, shown directly under the Trouble Codes tab.
4. With the pedal in the resting (“up”) position, the kill indicator should display “Active”.
5. When pedal moved away from the resting position, the kill indicator should show “Not Active”. Warning: if the key is on, the engine will start during this step! Ensure the FNR selector is locked in Neutral and area is safe.

Tests

Diagnostic Tests are available for troubleshooting the EFI system. These can be accessed by navigating to Diagnostics->Tests

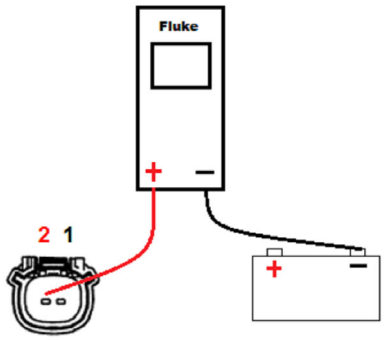
These are the three tests available:

- Test Injector – Injector is pulsed 10 times over 11 seconds, unless manually turned off.
- Test Ignition – Ignition is pulsed 10 times over 11 seconds, unless manually turned off.
- Test Fuel Pump Relay – This test runs for 20 seconds, unless manually turned off.

RECOMMENDED FAULT TESTS

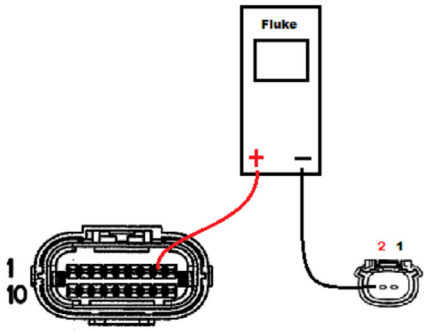
Ignition System

1. Disconnect the two pin connection from the ignition Coil. Turn the key to the ON position. Within 10 seconds, measure the voltage between the terminal #2 and the battery ground. Voltage should measure the same as the battery voltage.



2. Disconnect the two pin connection from the ignition coil. Measure for continuity between the terminal #2 at the ignition coil and the terminal #8 at the ECM.

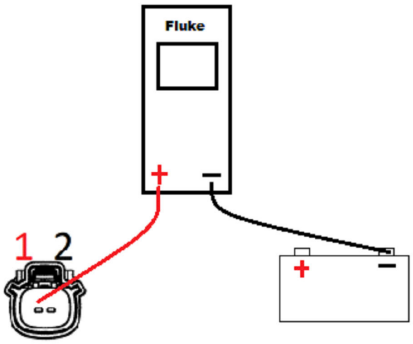
Read all of SAFETY and this section before attempting any procedure. Pay particular attention to Notices, Cautions, Warnings and Dangers.



3. Measure the spark plug gap. Make sure the gap is correct.
4. Replace the spark plug.
5. Replace the spark plug cap.
6. Reconnect the high tension lead, the ignition coil and the spark plug cap. Make sure the screw engages the center wires in high tension lead.
7. Check all connections. With the engine running, wiggle each connection. If the engine stops running or runs poorly, check for wire damage.
8. Replace the wiring harness.
9. Replace the ignition coil.
10. Measure the resistance between the IGN module mounting bolt and the high tension lead at the spark plug connection in the cap. Reading should be 13.7~14.7 kΩ.

Fuel Pump

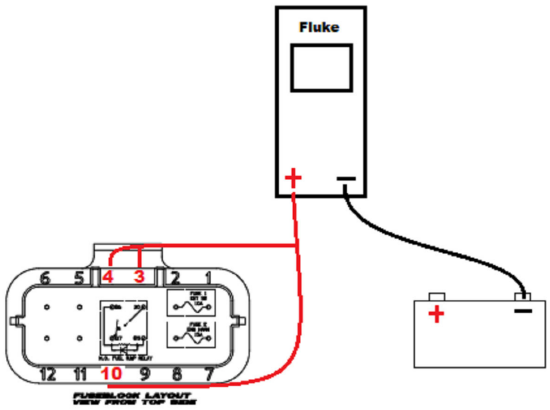
1. Turn the key to the ON position. Within 10 seconds, measure the voltage between terminal #1 at the fuel pump connection and the battery ground. Verify input voltage to pump is 9.0 to 15.0 VDC.



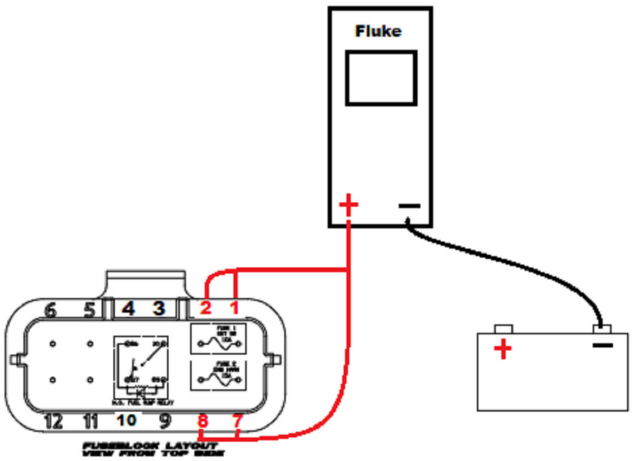
2. Verify at least 1.0 amp of current is available. Use jumper wire (with in-line 5 amp fuse) to connect the fuel pump to the battery positive terminal.
3. Verify that there is sufficient fuel in the fuel tank.
4. Verify that the fuel filter is not contaminated with debris.
5. Swap the fuel filter/hose with a new filter and rubber hose.
6. Verify the outlet hose is not pinched, kinked or leaking.
7. Verify that the fuel tank vent is operational.
8. Verify that fuel pressure is 2.75 to 3.75 Bar (39.9~54.4 psi).
9. Change the entire PFA.

Other

1. Turn the key to the ON position. Within 10 seconds, measure the voltage between the terminal at the ECR relay connection and the battery ground. Voltage should measure same as battery voltage.



2. Replace the TBA (with ECM).
3. Tighten screws.
4. Replace the injector.
5. Verify the injector resistance is 12.0±0.6Ω.
6. Verify that the injector O-ring is not damaged.
7. Replace the engine temperature sensor.
8. Replace the air cleaner.
9. Replace fuel.
10. Clean out or replace the fuel line.
11. Turn the key to the ON position. Within 10 seconds, measure the voltage between the terminals at Fuse #1, then terminals at the Fuse #2 connection and battery ground. Voltage should measure the same as the battery voltage.


Fluke
+
−
6 5 4 3 2 1
12 11 10 9 8 7
+
−

Read all of SAFETY and this section before attempting any procedure. Pay particular attention to Notices, Cautions, Warnings and Dangers.

Notes:

Read all of SAFETY and this section before attempting any procedure. Pay particular attention to Notices, Cautions, Warnings and Dangers.

Notes:

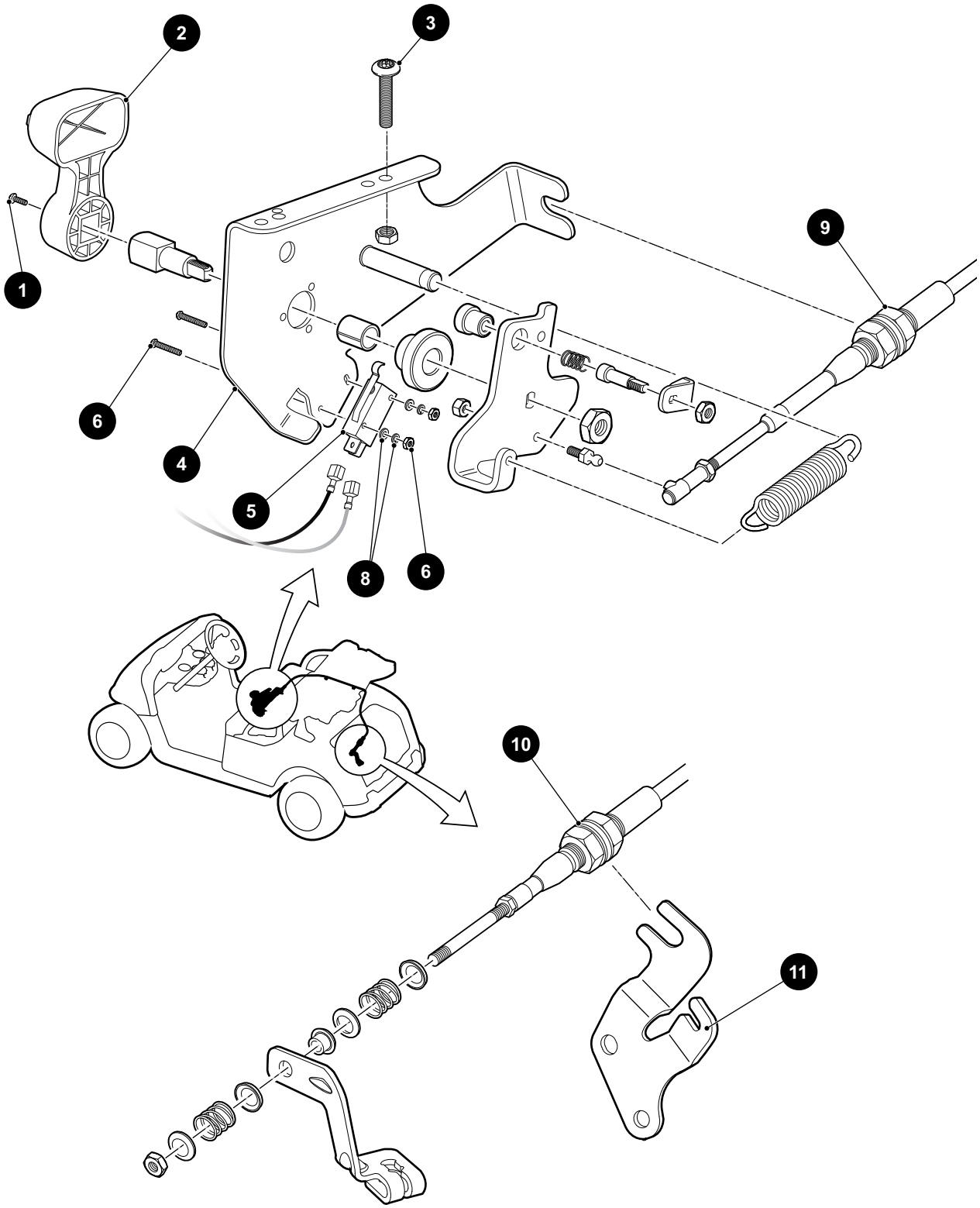


Figure 1 Direction Selector

DIRECTION SELECTOR

Before removing a suspected faulty micro switch, ensure the electrical wires are firmly attached and the wire is in good condition.

Direction Selector Removal

Tools List	Qty.
Wrench, 7/16"	2
Wrench, 5/16"	1
Phillips Screwdriver	1
Digital Volt Ohm Meter (DVOM)	1

⚠WARNING ***To prevent an electrical arc that could cause an electrical explosion, be sure that the key switch is off and all electrical accessories are turned off before starting work on vehicle.***

Never disconnect a circuit under load at a battery terminal.

The battery negative (-) cable must be removed before starting work on vehicle.

Use insulated wrenches to prevent the possibility of a dropped wrench from 'shorting out' a battery, which could result in an explosion and severe personal injury or death.

1. Disconnect the negative (-) battery cable.
2. Remove the screw (1) securing the handle (2) to the direction selector shaft, and remove the handle (Figure 1).
3. Loosen the hardware (3) attaching the direction selector bracket (4) to the seat frame and remove the direction selector from the body.

Replacing a Micro Switch

1. To replace a micro switch (5), remove the attaching hardware (Figure 1).
2. Carefully remove the two electrical wires from the switch.
3. Reattach the wires to the new switch.
4. Connect the wires attaching to the switch.
5. Install the screws (6), nuts (7) and washers (8) securing the switch to the assembly.
6. Tighten hardware to 8 - 11 in. lbs. (0.7 - 0.9 Nm) torque.

Shift Cable Adjustment

The shift cable is sealed and does not require lubrication.

Adjust the threaded fitting (9) at the forward cable mount while selector is in the 'REVERSE' position until the direction selector cam contacts both stops, or contacts the reverse stop and maintains no more than an 1/8" gap at the 'FORWARD' stop. If further adjustment is necessary, adjust the threaded fitting (10) at the rear axle cable mount (11).

Lubricate the direction selector, linkage and related moving parts periodically.

Neutral Lock Operation

The neutral lock is located on the direction selector. To operate neutral lock located on the direction selector, first turn the key switch to the OFF position, place the direction selector in the R position (reverse) and remove the seat. Pull out (1) and rotate (2) the neutral lock pin handle so that the pointed portion of the handle is over the side of the direction selector cam (Figure 2). Move the direction selector lever towards the area between the F (forward) and the R (reverse) positions. During that motion, the pin will snap into the hole in the direction selector mounting bracket, preventing any movement of the lever. When in this position, the direction selector remains locked in the neutral position.

⚠WARNING ***Spring loaded mechanism. To prevent possibility of fingers becoming pinched in the direction selector mechanism, hold direction selector lever when releasing neutral lock pin handle.***

To activate the direction selector, pull the neutral lock pin handle out and rotate until the pointed portion of the handle fits into the hole (3) in the direction selector cam.

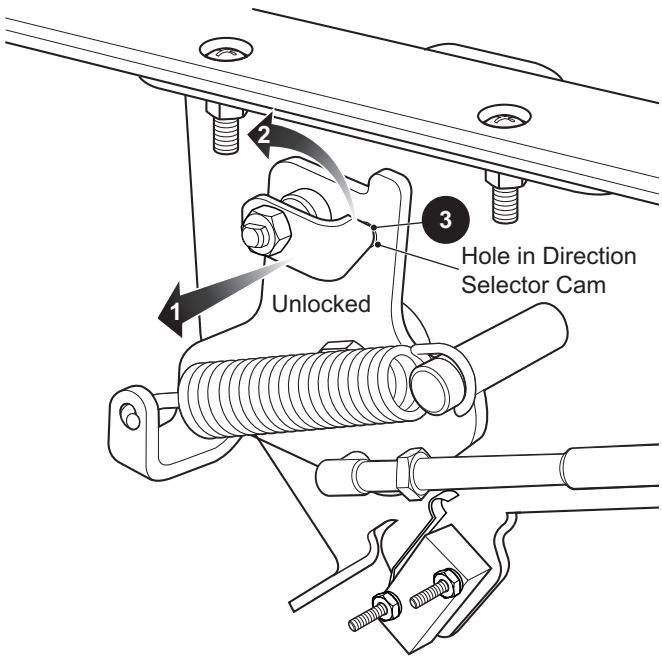


Figure 2 Neutral Lock

Read all of SAFETY and this section before attempting any procedure. Pay particular attention to Notices, Cautions, Warnings and Dangers.

Notes:

Read all of SAFETY and this section before attempting any procedure. Pay particular attention to Notices, Cautions, Warnings and Dangers.

Notes:

CONTINUOUSLY VARIABLE TRANSMISSION (CVT)

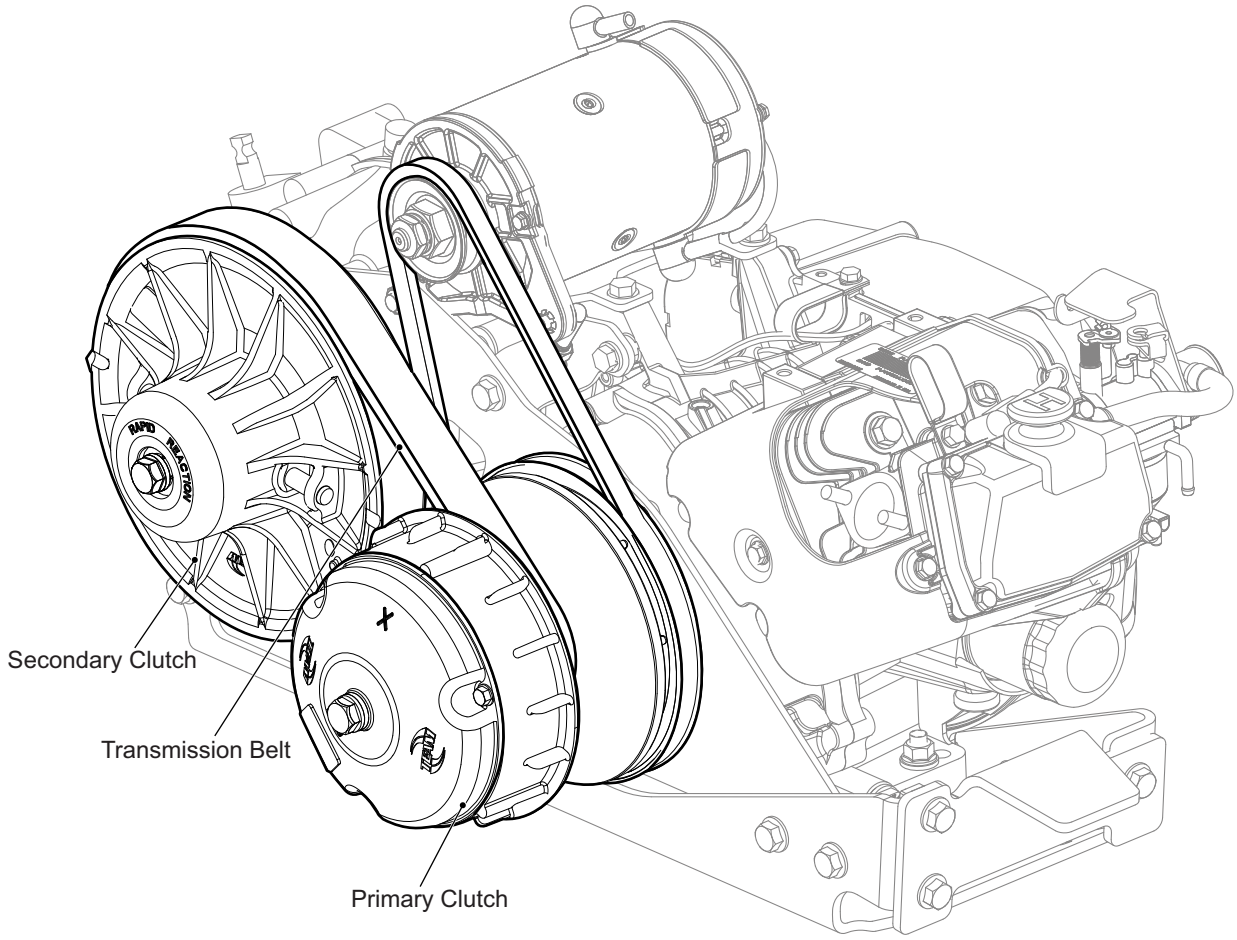


Fig. 1 Continuously Variable Transmission System (CVT)

GENERAL

The power transmission from the engine to the rear axle is with a continuously variable transmission (CVT). The CVT has two matched clutch units joined by a transmission belt (Ref. Fig. 1). The engine mounted primary clutch is a centrifugal unit that responds to engine speed and the rear axle mounted secondary clutch is a load sensing unit.

CLUTCHES

Primary Clutch

When the accelerator is pressed, the engine speed is increased which causes the cams (weights) within the centrifugal primary clutch to move outwards and force the movable sheave inwards. The transmission belt is engaged by the clutch sheaves and begins to rotate.

As the engine speed continues to increase, the primary clutch sheave continues to move inwards forcing the transmission belt to the outer diameter of the primary clutch sheaves, which increases the speed of the belt. The ratio is greatly decreased and supplies maximum speed.

When the accelerator is released, the engine speed decreases and the cams apply less pressure on the movable sheave, which is forced outwards against the cams by a compression spring. The transmission belt disengages from the clutch sheave when engine speed is decreased to the point where the cams apply less force than the spring.

Secondary Clutch

The secondary clutch sheaves are closed at rest which results in the transmission belt being held at the outer diameter of the secondary clutch. The secondary clutch has no weights but is held closed by a torsion spring which is joined to the movable secondary assembly.

As the transmission belt starts to rotate, the secondary clutch starts to rotate. As the speed of the primary clutch

increases and the belt starts to climb the sheaves, the secondary clutch responds by being forced open in order to permit the belt to ride lower in the secondary clutch sheaves. The sheaves overcome the pressure applied by the torsion spring and cam.

As the secondary clutch slows, the belt rides lower in the primary clutch sheaves. The secondary clutch compensates by closing in response to the torsion spring and cam.

Increased Load

When a vehicle traveling at governed speed begins to climb a grade or is subjected to other increased load conditions, a change in wheel speed is detected by the clutch system and the transmission belt seeks a position where it can achieve adequate friction to overcome the load change.

The belt moves outwards on the secondary clutch which closes due to the torsion spring that moves the movable sheave against the torque ramps. The movement of the transmission belt overcomes some of the centrifugal force applied by the cams in the primary clutch.

This forces the belt lower into the primary clutch which increases the drive ratio. This down-shifting applies more torque to the rear axle without an appreciable change to the engine speed since the governor opens the throttle in direct the response to the decrease in ground speed.

Equilibrium

The CVT functions because the primary and secondary clutches maintain equilibrium. The clutch sets are adjusted to the vehicle that they are designed to operate. Changes in vehicle weight or desired performance characteristics require that both clutches be adjusted to the needs of the vehicle and stay compatible with each other.

Removing the Transmission Belt

With the vehicle on level ground, remove the transmission belt by pulling the belt to the top which will cause the secondary clutch sheaves to open and loosen the belt tension (Ref. Figure. 2).

The belt can be moved off to the secondary clutch.

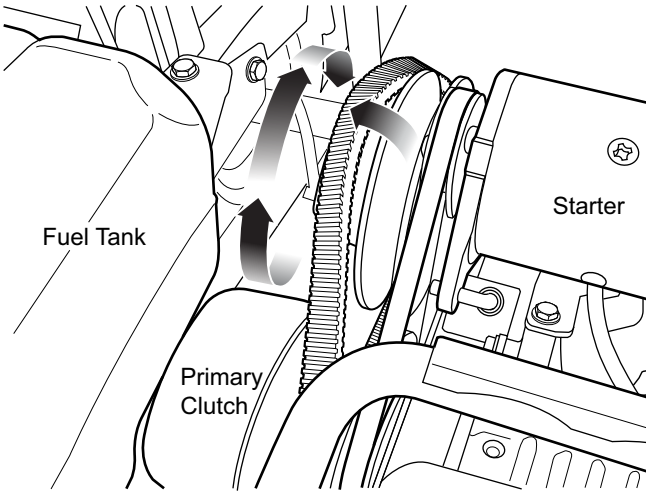


Figure. 2 Removing the Transmission Belt

Transmission Belt Service

The transmission belt will require no service unless the vehicle has been operated in an very dusty or muddy location in which case it must be washed with plain water. If the belt becomes frayed or badly worn, it must be replaced.

Primary Clutch Removal

Tool List	Qty.
Plastic Faced Hammer	1
Clutch Puller, (P/N 608429)	1
Wrench, 18 mm	1
Socket, 18 mm	1
Impact Socket, 19 mm	1
Impact Wrench (Air or Electric)	1
Ratchet	1
Extension, 8”	1
Thread Locking Adhesive	AR
Torque Wrench, ft. lbs.	1

⚠ WARNING ***To decrease the risk of burns and other injuries:***

Disconnect the negative (-) battery cable to keep the engine from accidentally starting before removing the transmission belt.

Make sure that the engine and exhaust components have become cool before you work on the vehicle.

Do not allow the fingers to become trapped between the belt and clutch sheave.

Use only sockets designed for use with an impact wrench. Never use a socket intended for use with hand tools.

1. Remove the CVT belt (1) (Ref. Fig. 3).
2. Remove the Starter/Generator belt (Refer to Starter/ Generator Removal in ENGINE section).
3. Remove the bolt (2) from the center of the primary clutch (Ref. Fig. 3).
4. Raise the vehicle frame with the floor jack and allow the power-train to drop so that the clutch puller bolt clears the spring hanger.
5. Remove the front eye-bolt from the spring hanger.
6. Install the clutch puller bolt using the impact tool and universal joint.
7. Remove the primary clutch from the shaft.
8. Remove the clutch puller bolt.

NOTICE: In some case the clutch can not separate from the crankshaft. Remove the clutch puller and fill the cavity with grease. Replace the clutch puller and tighten it with the impact wrench. The combined mechanical and hydraulic effect will remove the clutch. Remove all excess grease.

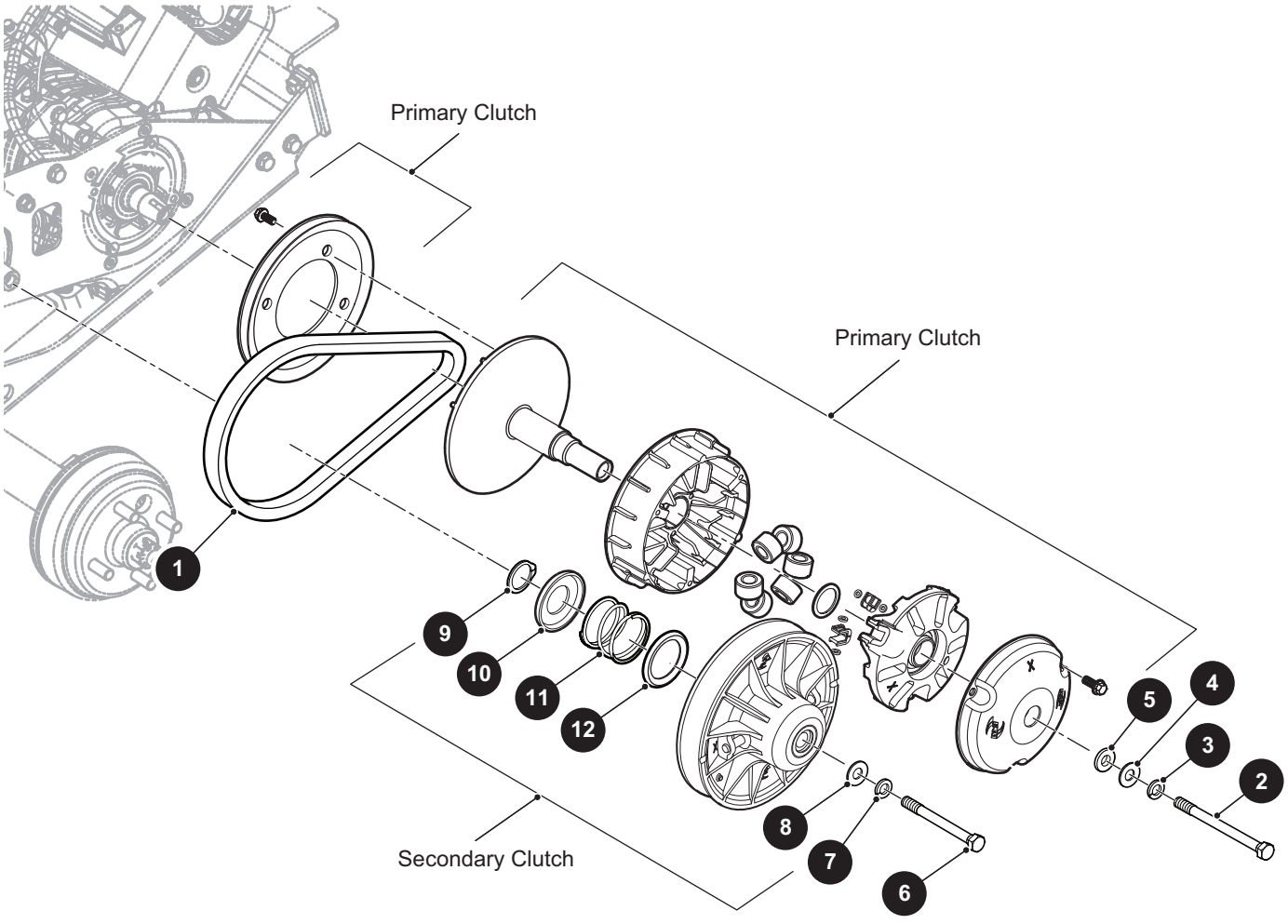


Fig. 3 CVT Components

Primary Clutch Installation

⚠ CAUTION ***To decrease the risk of damage to the clutch, be sure to remove all grease from the body of the clutch since grease penetrating the seal can cause premature clutch failure or belt slip.***

Do not install the bolt (2) with an impact wrench.

To hold the clutch, do not use a pry bar inserted through the drive clutch as this may damage the components.

1. Clean both the engine crankshaft and the primary clutch bore.
2. Slide the clutch onto the engine crankshaft and rotate the clutch while lightly pushing the movable sheave in and out several times to seat the clutch on the tapered crankshaft (Ref. Fig. 3).
3. Install the lock washer (3), conical washer (4) and clutch washer (5) onto the clutch bolt (2).
4. Apply thread locking adhesive to the threads of the clutch bolt (2) and install. Tighten the bolt to the torque value specified below.

2	55 - 62 ft. lbs. (74 - 84 Nm)

Secondary Clutch Removal

Tool List	Qty.
Plastic Faced Hammer	1
Clutch Puller, (P/N 608429)	1
External Snap Ring Pliers	1
Wrench, 18 mm	1
Socket, 18 mm	1
Impact Socket, 19 mm	1
Impact Wrench	1
Ratchet	1
Thread Locking Adhesive	AR
Phillips Screwdriver	1
Torque Wrench, ft. lbs.	1

1. Remove the transmission belt (1) See “Removing The Transmission Belt”.
2. Remove the passenger side hub cap if equipped and remove the wheel and tire assembly.
3. Set park brake and place direction selector in F to place tension on clutches.
4. Access the secondary clutch from the passenger side of the vehicle and remove the bolt (6), lock washer (7) and conical washer (8) from the secondary clutch.
5. Install the clutch puller bolt until it bottoms out.
6. Remove the clutch, then remove the clutch puller bolt and slide the clutch from the rear axle input shaft.

Secondary Clutch Repair

NOTICE: The parts must be assembled again in same position as their original position. Mark all components to facilitate accurate reassembly. Some small field repairs may be made to the secondary clutch.

1. Remove the retaining ring (9) and remove the outer spring retainer (10) (Ref. Fig. 3).
2. Remove the spring (11), inner retainer spring (12) and the movable sheave (13).
3. Inspect the shaft for indications of wear and inspect the bushings for indications of damage. If there is wear to the point of causing vibration, the clutch must be replaced.

Secondary Clutch Assembly

1. Assemble the movable sheave (13) to the fixed sheave (14) and insert the spring (11) and inner retainer spring (12) in the pilot hole in the movable sheave (Ref. Fig. 3).
2. Insert the other end of the spring in the outer retainer spring (10) and rotate counterclockwise 140° before engaging the splines and inserting the retaining ring (9).

Secondary Clutch Installation

1. Apply a layer of anti-seize compound on the rear axle input shaft and slide the clutch on to the shaft.
2. Install lock washer (7) and conical washer (8) to the clutch bolt (6) and apply thread locking adhesive to the threads of the clutch bolt.
3. Install the clutch bolt and tighten to the torque value specified below.

6	55 - 62 ft. lbs. (74 - 84 Nm)

STORAGE

If the vehicle is to be out of service for an extended period of time, the clutches must not be coated with a protecting spray. The primary clutch sheaves can develop some surface rust that is removed within a few minutes of running time. The secondary clutch is aluminum and does not need any maintenance.

Notes:

Notes:

ELECTRICAL SYSTEM

The electrical system is a 12 volt negative ground system (Ref. Fig. 1) consisting of a:

- Battery
- Starter/generator
- Voltage regulator
- Solenoid
- Fuse
- Key switch

⚠ WARNING ***To prevent injury or death from inadvertent movement of vehicle, all tests performed requiring starter/generator or engine to rotate must be performed with the rear wheels raised (see the SAFETY section) or the neutral lock engaged (see the General Information and Routine Maintenance section).***

Follow the lifting procedure in the SAFETY section and the General Information and Routine Maintenance section of this manual. Place wheel chocks in front of and behind the front wheels. Check the stability of the vehicle on the jack stands before starting any repair procedure. Never work on a vehicle that is supported by a jack alone.

STARTER

When starting the engine, the field coils are in series with the armature and the starter/generator operates as a motor (Ref. Fig. 1). This circuit is controlled by a key switch, fuse, accelerator limit switch and a solenoid. With the key in the **'ON'** position, battery current is available to the accelerator limit switch which remains open until the accelerator pedal is pressed. When the pedal is pressed, the plunger on the switch is released, the contacts close and the ignition circuit is energized. Battery current then energizes the solenoid which closes the contacts and energizes the starter circuit. The starter/generator now functions as a starter to start the engine.

GENERATOR

When the engine is running, the starter/generator functions as a generator. This is used for charging the battery and for the ignition system. Generated output is controlled by the voltage regulator at 14.25 - 14.75 V, without regard to engine speed. However, the charging current will vary depending on the condition of the battery. If it is fully charged, current is controlled at 3 to 5 amps.

WIRING

⚠ WARNING ***Before performing any test of wiring components, disconnect the battery cables from the battery posts to prevent electrical shock or explosion.***

Electrical tests of the wiring for continuity may be made with a DVOM (Digital Volt Ohm Meter) available through the Service Parts Department (P/N 27481G01). Any DVOM may be used, however the controls, displays and features may vary depending on the make and model. Set the meter selector to the ohms scale and check continuity between each circuit component as indicated. Example: If a switch is open or if there is a break in the wiring, the meter will display a visual signal. If an analog meter is used it will read infinity (∞).

TESTING IGNITION CIRCUIT

NOTICE: This section assumes the fuel system is functioning and that the engine is receiving fuel.

Tool List	Qty.
DVOM	1
Spark plug (NGK BPR2ES)	1
Spark plug tester	1

⚠ WARNING ***To prevent possibility of personal injury, never operate the starter unless both spark plugs are installed or the ignition system is disabled. Fuel drawn into the cylinders will be expelled through the spark plug opening and could be ignited by the ignition system or another source, resulting in a fire.***

The engine incorporates an induction type ignition system driven by the ECM.

The engine can be stopped by turning the key switch to the **OFF** position. When the accelerator pedal is released, the second limit switch contacts close, signaling the ECM to deactivate the ignition coil and fuel injector.

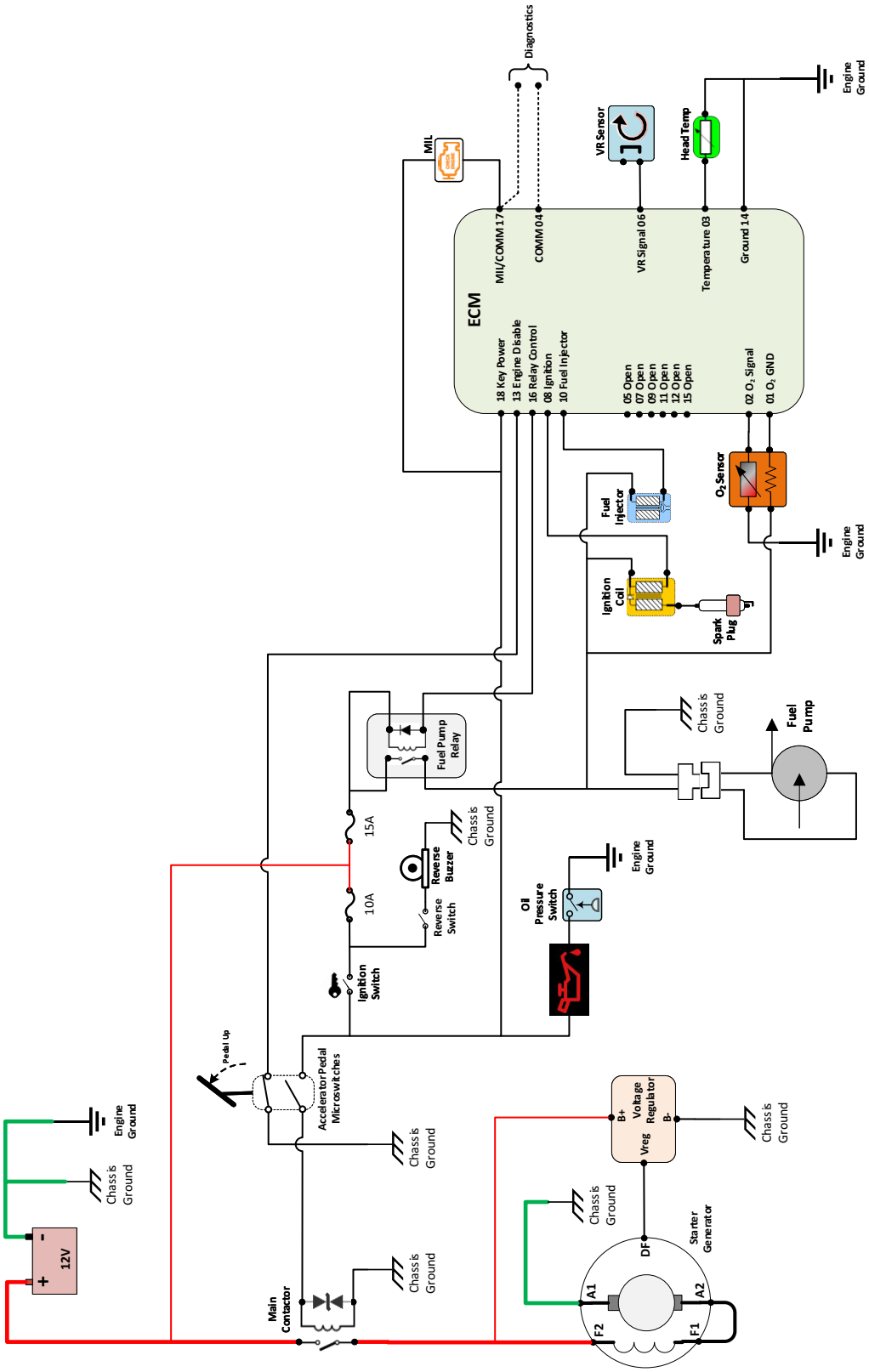


Fig. 1 Electrical System Wiring Diagram

⚠ CAUTION ***Do not arc spark plug wire to ground. Connect to a known good spark plug and ground plug to a clean metal surface (muffler, cylinder, etc.). Permanent damage may be caused to the coil or igniter if the plug is not grounded properly.***

Ensure no fuel vapors are present that could be ignited by the spark test.

If the engine will **not** run, but the starter will turn the engine, proceed as follows:

1. Check for loose terminals, wires and connections.
2. Check for an electrical discharge through the spark plug wire as follows: Using a spark plug that is known good, and with a spark plug installed in the cylinder, place on a clean grounded engine surface, (muffler, cylinder, etc.). Turn over the engine with the starter. Look for a blue electrical arc at the spark plug electrode.
3. If there is either a weak arc or no arc, try a new spark plug, then check the condition and the tightness of the spark plug wire. Plug wires can be checked by substituting them with good ones.
4. Replace the plug if necessary. Gap the spark plug .028" - .030" (.71 - .76 mm) using a wire type spark plug gauge.

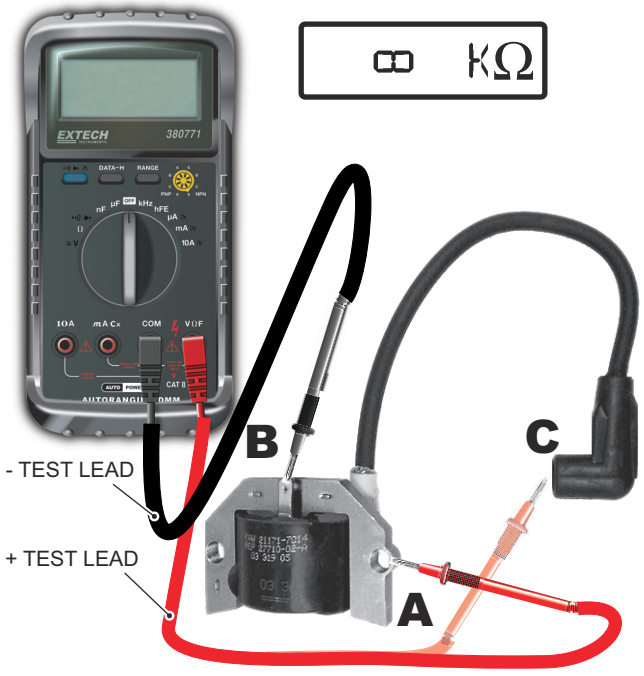


Fig. 2 Resistance Between B - A and B - C

A normal reading with the negative lead on C and the positive lead on A would be: 2 - 18 KΩ.

A normal reading with the negative lead on C and the positive lead on B would be: 10 - 30 KΩ.

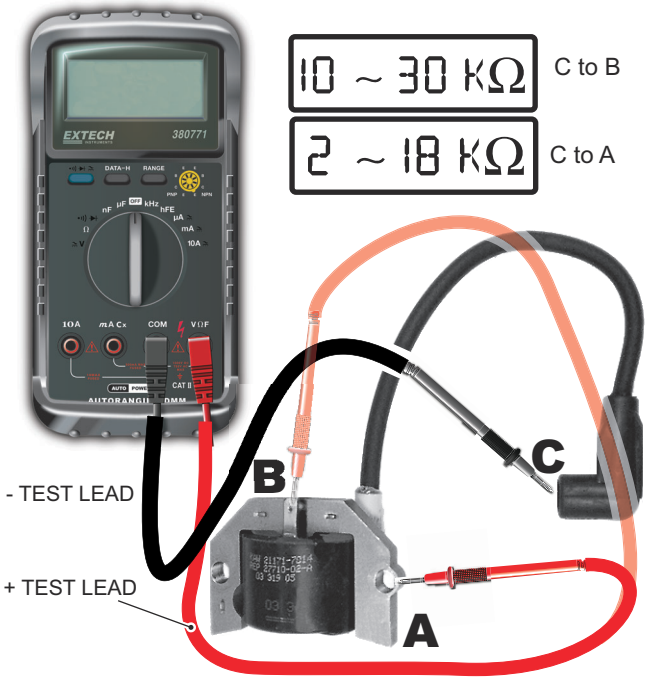


Fig. 3 Resistance Between C - B and C - A

TESTING STARTING CIRCUIT

⚠ WARNING ***To prevent the possibility of injury resulting from vehicle inadvertently starting, disconnect battery for steps 1 through 8 (see the SAFETY section).***

Tool List	**Qty.**
DVOM	1

If the engine will **not** turn over, proceed as following (Ref. Fig. 1):

1. Check the battery for a voltage reading which should be between 12.2 and 12.5 volts. Inspect for loose or dirty battery post connections.
2. Check for a blown in line fuse and replace if necessary with a 7 amp fuse.
3. Check for loose wires at all terminal connections.
4. Check the complete electrical system for correct circuitry.
5. Inspect for worn insulation or bare wires touching the frame. Bare wires will cause a short circuit.
6. Check for continuity through the key switch. Set the DVOM to the ohms (Ω) scale. Detach wires. Place positive (+) probe on one terminal and negative (-)

probe on the other terminal. The reading on the meter should be “0” Ω with the switch key in the **ON** position and a visual signal (∞) with the switch in the **OFF** position. If the meter does not register, replace the switch. Reconnect the wires.

7. Turn the key switch to **OFF.**

(a) Place one probe of the DVOM (set to ohms scale) on the red wire at the solenoid. Place the other probe on the key switch terminal with the blue wire.

(b) Press the accelerator and observe the DVOM. A reading of less than 2 Ω indicates a good limit switch. A reading of greater than 2 Ω indicates that the switch terminals should be checked. A reading of infinity a visual signal (•) indicates that the switch must be replaced. Connect the battery.

8. Check the starting solenoid operation. Turn the key switch to the **ON** position.

(a) Place the DVOM (set to the appropriate DC volts scale) negative (-) probe on terminal “A” of the solenoid. Place the positive (+) probe on terminal “B”. The DVOM should indicate approximately 12 V.

(b) Press the accelerator pedal. The DVOM will indicate “0” voltage if the solenoid contacts are closed.

(c) If “0” voltage is not indicated while the accelerator pedal is pressed, replace the solenoid.

TESTING CHARGING CIRCUIT

Tool List	**Qty.**
DVOM	1

⚠WARNING ***To prevent the possibility of injury resulting from vehicle inadvertently starting, the drive belt must be removed or both rear wheels raised (see procedure in the SAFETY section.***

The charging circuit consists of a starter/generator, voltage regulator and battery (Ref. Fig. 1). The solenoid must be functional in order to start the vehicle, but is not considered part of the charging circuit.

1. If the battery charge is inadequate (less than 11 VDC), proceed as follows:

(a) Check the battery voltage and inspect for loose or corroded terminal posts and connections. Check electrolyte level.

b) Check charging circuit component terminals for proper, clean, tight connections.

c) Check for charging voltage as follows:

1) Raise the vehicle (see procedure in the SAFETY section) so that both rear wheels are free to rotate.

2) With the engine off, measure the voltage at the battery’s terminals by placing the negative (-) probe on the negative (-) post and the positive (+) probe on the positive (+) post of the battery. Note the reading.

3) Attach the DC voltmeter across the regulator’s red and black leads.

4) Start the engine and accelerate to governed speed.

5) The meter should read higher than before starting engine. In a reasonable amount of time, the reading should settle between 14 and 15 volts, indicating the regulator is functioning properly.

6) If no increase over battery voltage is observed, there is a malfunction in the charging circuit.

7) If the reading is **above** 15 volts, check to assure the wiring harness and generator field winding (green lead) is not grounded. If it is not, replace the regulator.

8) If the reading is **below** 14 volts, disconnect the regulator’s green field wire from the system harness. Temporarily connect the green field wire to ground. If the voltage rises above its prior reading, replace the regulator.

9) If the above procedures do not correct the problem, check for faults in the vehicles wiring harness and/or generator.

Inspection

1. Inspect the commutator for wear or damage.
2. Inspect the brush assembly for wear and damage to the brush holder insulators. Check the brushes for length, approximately 11/16" (17 mm) or to the line marked on the brush and signs of carbonization.
3. Inspect the armature for distortion or broken wires.
4. Inspect the field coil insulators and lead wire.
5. Check the bearings for free rotation and lack of end play on shaft. Replace if necessary.

Read all of SAFETY and this section before attempting any procedure. Pay particular attention to Notices, Cautions, Warnings and Dangers.

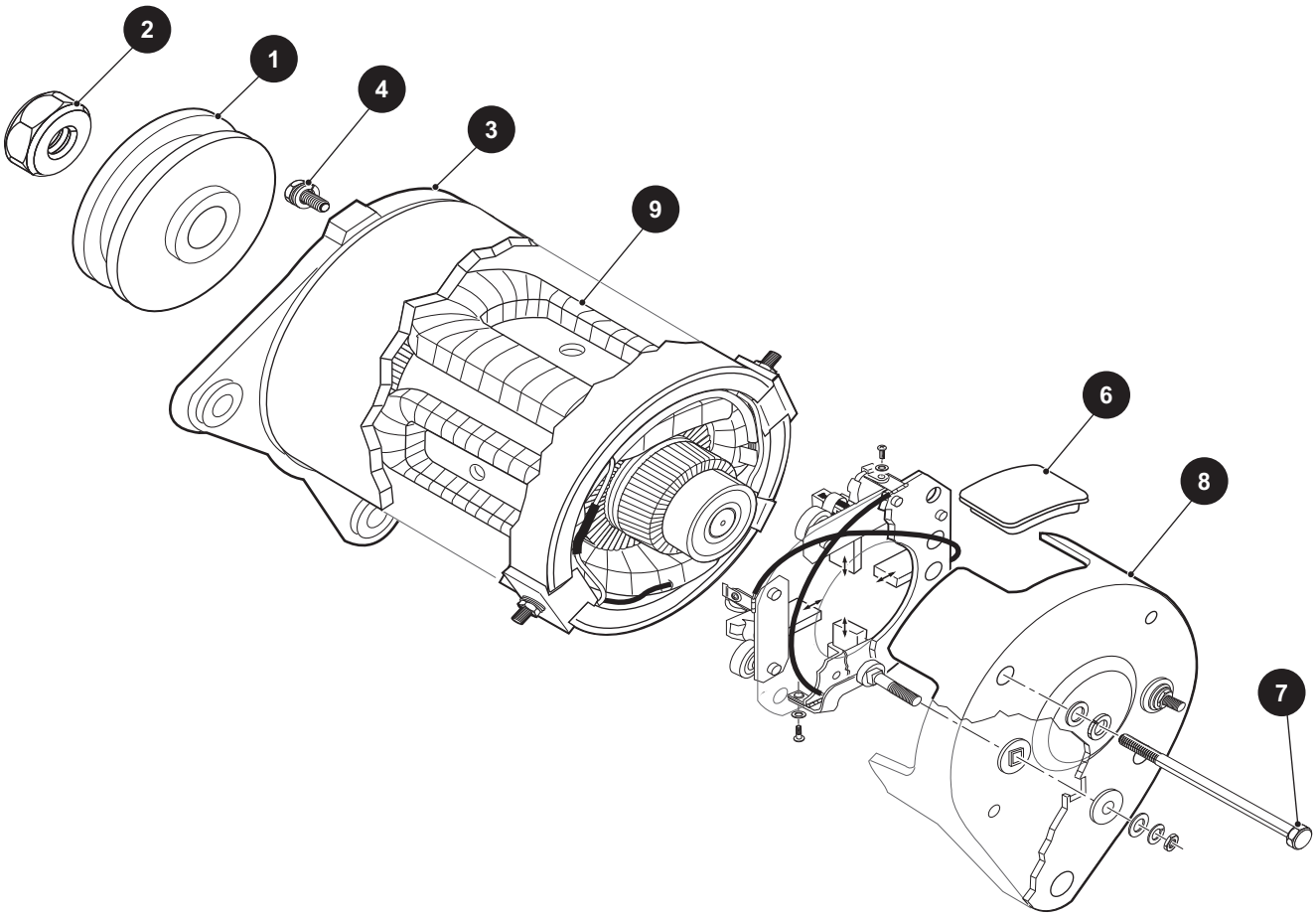


Fig. 6 Starter/Generator

STARTER/GENERATOR

Starter/Generator Removal

See ENGINE section.

Disassembly

Tool List	Qty.
DVOM	1
Wrench, 24 mm	1
Wrench, 10 mm	1
Wrench, 6 mm	1
Wrench, 5 mm	1
Socket, 10 mm	1
Phillips Screwdriver	1
Two Jaw Puller	1
Straight Blade Screwdriver	1
Ratchet	1
Torque Wrench, ft. lbs.	1
Torque Wrench, in. lbs.	1
Clean Cloth	1

NOTICE: In general, starter/generator service is best performed by trained motor technicians who have the knowledge and equipment to overhaul the unit. Some checks and repairs however, can be accomplished by a skilled mechanic. Make your own evaluation of the equipment and skills available before starting disassembly.

Hold the pulley (1) and remove the pulley nut (2). Remove the pulley, screws (4) and front cover (3) (Ref. Fig. 6).

Remove the brush covers (6) by prying out with a screwdriver. Pull up on the brush springs and move to the side of brushes, slide the brushes out approximately 1/4" (6 mm) (Ref. Fig. 7). Remove the through bolts (7) and the rear cover (8). Remove the frame and field coils (9). Remove the 5 mm screws from the brush holder and 6 mm nuts from A1 and A2 terminals. Remove the brush holder. If the bearing needs to be replaced, use an automotive style two jaw puller to remove the bearing from armature (Ref. Fig. 8).

Read all of SAFETY and this section before attempting any procedure. Pay particular attention to Notices, Cautions, Warnings and Dangers.

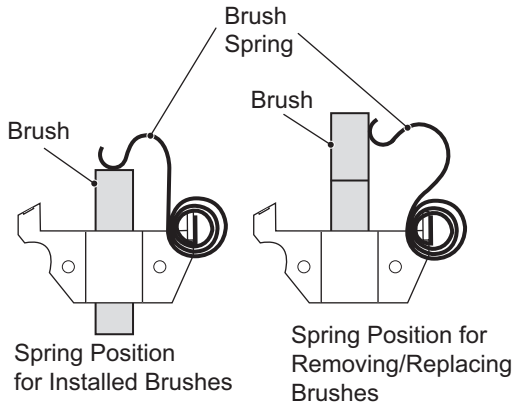


Fig. 7 Starter/Generator Brush Removal

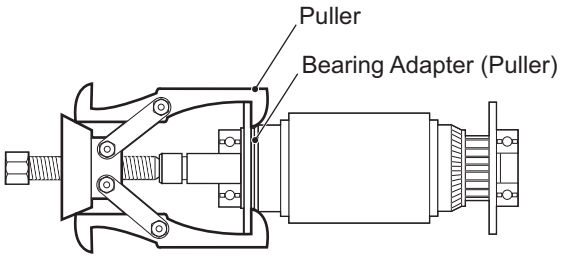


Fig. 8 Bearing Removal

Repair and Replacement

1. Commutator - Clean with a soft, clean cloth.
2. Replace any damaged or cracked brush holders or brushes worn to less than 11/16" (17 mm) in length or to the line marked on the brush.
3. Test the insulation between the core and the commutator segments and shaft with a circuit tester. If continuity is indicated, the insulation is defective and the armature must be replaced.
4. With the brushes removed, using a DVOM, check the field coils for continuity between 'F1' and 'F2' and 'DF' and 'F1'. If an open circuit exists, replace the field coils. Check for continuity between all four terminals and the frame (outer shell). If continuity is indicated, the field coils are grounded against the frame and the field coils must be replaced.
5. Clean all parts to be reinstalled and reassemble in the reverse order of disassembly. Tighten bolts and nuts to the following values:

- 4 mm - torque to 15 - 21 in. lbs. (17 - 24 kg/cm)
- 5 mm - torque to 30 - 43 in. lbs. (35 - 50 kg/cm)
- 6 mm - torque to 52 - 74 in. lbs. (60 - 85 kg/cm)
- 14 mm - torque to 33 - 40 ft. lbs. (45 - 55 Nm)

Tighten **terminal nuts** to the following torques:

- F1 - F2 - torque to 43 - 52 in. lbs. (50 - 60 kg/cm)
- DF - torque to 26 - 35 in. lbs. (30 - 40 kg/cm)

BATTERY VOLTAGE TEST

Battery voltage can be checked using a voltmeter. Attach the negative (-) lead of the DVOM to the ground terminal of the battery. The positive (+) lead is then attached to the positive battery terminal. The voltage reading obtained should be 12 volts or above. If the reading is below 12 volts, the battery requires either charging or replacement.

⚠ WARNING ***Hydrogen gas formed during battery charging is explosive and can cause personal injury or death. Avoid any electrical spark or open flame near battery.***

NOTICE: If the temperature of the battery or the ambient temperature is below 60° F (15° C), the capacity of the battery will be less. It will require more time to charge. A cold battery will build up voltage and more rapidly reduce the charging rate.

NOTICE: Batteries that are new or have been stored must be fully charged before being tested or placed in vehicle.

⚠ CAUTION ***Do not overcharge battery.***

STORAGE OF BATTERY

A battery that is removed from service for storage must be cared for as follows:

For battery removal see 'Battery Removal' in SAFETY section. Charge fully. Cover terminals with petroleum jelly to prevent oxidation (use commercially available battery protectant when installed in vehicle). Store in a cool place not below 32° F (0° C) or above 80° F (27° C) Battery should be charged every 30 days using a 2 amp trickle charger.

DVOM (DIGITAL VOLT OHM METER)

The DVOM shown (Ref. Fig. 9) is representative only, the actual model may vary depending on availability, and is available through the Service Parts Department as P/N 27481G01. For the purpose of this section, the red probe (+) and black probe (-) are used. Any DVOM may be used, however the controls, displays, accuracy and features may vary depending on the make and model. Always follow the meter manufacturer's recommendations and instructions for the use and care of the meter.

Read all of SAFETY and this section before attempting any procedure. Pay particular attention to Notices, Cautions, Warnings and Dangers.

Fig. 9 DVOM

TROUBLESHOOTING

In order to effectively troubleshoot the circuits that include the horn, lighting, brake/turn signals and gages, the technician must be able to use the wiring diagram and a DVOM.

The wiring diagram shows the path followed by a voltage or signal from its origination point to its destination. Each wire is indicated by color and is divided into the main harness and the dash harness (Ref.).

The technician should use simple logic troubleshooting in order to reduce the number of steps required to isolate the problem.

Example 1: If the vehicle will not start and none of the lights function (or burn dimly) the battery should be tested before trying to troubleshoot the lighting circuit.

Example 2: If a problem occurs in the lighting circuit that results in only one of the headlights not working, there is no reason to check battery wiring or the fuse since it is obvious that voltage is present. Since bulbs will burn out over time, the obvious place to start is at the headlight that is not functioning. If power is present at the connector and the ground wiring is satisfactory, the only possibilities that exist are a burned out bulb or a poor contact between the connectors and the headlight.

If power is not present but the other headlight functions, a wiring problem is indicated between the two headlights.

In some cases where battery voltage is expected, the easiest way to test the circuit is to set the DVOM to DC volts and place the negative (-) probe of the DVOM to the negative battery terminal. Move the positive (+) probe to each wire termination starting at the battery and working out to the device that is not working. Be sure to check both sides of all switches and fuses.

When no battery voltage is found, the problem lies between the point where no voltage is detected and the last place that voltage was detected. In circuits where no voltage is expected, the same procedure may be used except that the DVOM is set to continuity. Place the negative (-) probe on a wire terminal at the beginning of the circuit and work towards the device that is not working with the positive (+) probe. When continuity is no longer indicated, a failed conductor or device is indicated

POWER SUPPLY

Tool List **Qty.**

DVOM 1

1. Check for loose or bare wires

Check for loose wires at each terminal connection and for worn insulation or bare wires touching the frame. **Bare wires may cause a short circuit**.

NOTICE: If any DVOM readings indicate a faulty wire, it is recommended that the condition of the terminals and wire junction be examined. A faulty wire should be replaced with one of the same gauge and color and wired between the correct components and wire tied to the harness bundle. The faulty wire should be cut back close to the harness and the ends protected with vinyl electrical tape.

2. Check battery condition

Check for adequate battery volts (nominal 12 VDC) by setting DVOM to 30 VDC range and place the red probe (+) on the battery post with the green wire attached. Place the black probe (-) on the battery post with the black wire attached. A reading of 11 VDC or greater indicates adequate battery condition. No reading indicates (a) a poor connection between the probes and the battery terminals; (b) a faulty DVOM. A voltage reading below 11 volts indicates poor battery condition and the vehicle should be recharged before proceeding with the test.

NOTICE: Due to the resistance of the wires involved within the harness, voltage readings may be somewhat lower than battery voltage. A reading of 1 volt below battery voltage is acceptable.

3. Check power wire

Firmly attach the black probe (-) to the battery post with the black wire attached and the red probe (+) to the green wire terminal at the fuse block. A reading of

battery voltage indicates that the power wire is in good condition.

NOTICE: The power wire supplies power to the entire fuse block.

4. Check fuse

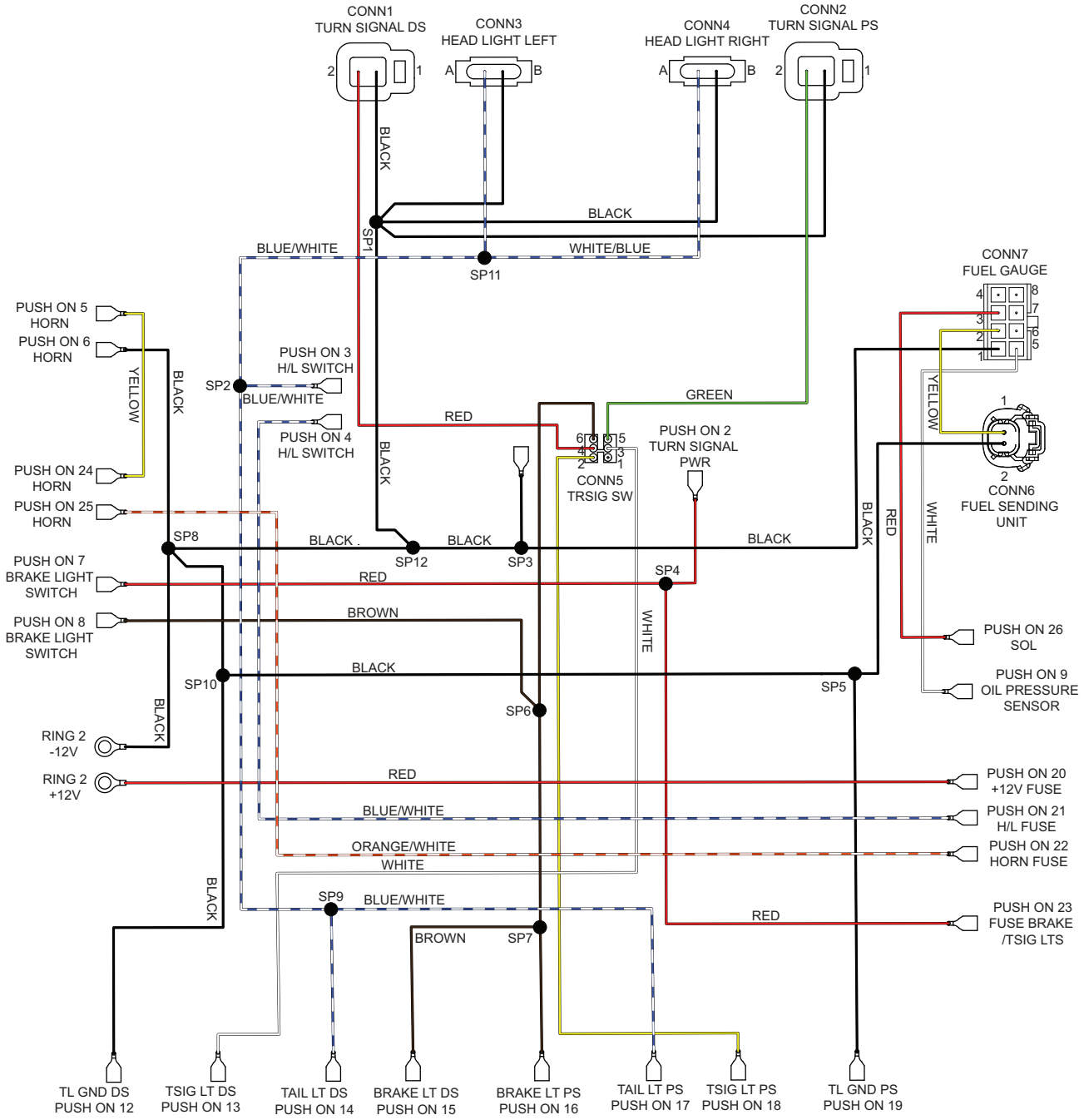
Place the red probe (+) to each wire terminal on the fuse block. A reading of battery voltage indicates that the fuse is in good condition. No reading indicates a faulty fuse; replace with a good 15 amp fuse.

ACCESSORY WIRING

After determining that there is power to the fuse panel, and the fuse is good, continue checking the circuit using the procedures previously used to check the power supply, i.e. loose or rusted connections, bare wires, continuity of the wiring from terminal to terminal, operating condition of switch, etc.

Use the wiring diagram (Ref.) to check correct wiring and wire routing. If there is power at the fuse end of the wire, there must also be power at the other end of the wire at the switch or electrical accessory, and eventually at the ground connection. Electricity must flow from the fuse panel through the full length of the circuit to the ground connection. Any interruption of electrical flow must be corrected, whether by repairing or replacing the wire, the switch or accessory

Read all of SAFETY and this section before attempting any procedure. Pay particular attention to Notices, Cautions, Warnings and Dangers.



Accessory Wiring Diagram

Read all of SAFETY and this section before attempting any procedure. Pay particular attention to Notices, Cautions, Warnings and Dangers.

Notes:

WEATHER PROTECTION

SUN TOP AND WINDSHIELD

⚠ WARNING ***The top does not provide protection from roll over or falling objects.***

The windshield does not provide protection from tree limbs or flying objects.

The top and windshield are designed for weather protection only.

Clean with water and a clean cloth. Minor scratches may be removed using a commercial plastic polish or Plexus plastic cleaner available from Service Parts.

Transporting Vehicle

⚠ WARNING ***To reduce the possibility of severe injury or death while transporting vehicle:***

Secure the vehicle and contents.

Never ride on vehicle being transported.

Always remove windshield before transporting vehicle.

Maximum speed with sun top installed is 50 mph (80 kph).

If the vehicle is to be transported at highway speeds, the sun top must be removed and the seat bottom secured. When transporting vehicle below highway speeds, check for tightness of hardware and cracks in sun top at mounting points. Always remove windshield when transporting. Always check that the vehicle and contents are adequately secured before transporting. The rated capacity of the trailer or truck must exceed the weight of the vehicle (see GENERAL SPECIFICATIONS for vehicle weight) and load. Lock the park brake and secure the vehicle using ratchet tie downs.

SUN TOP

Tool List	Qty.
Plastic faced mallet	1
Wrench, 1/2"	2
Wrench, 9/16"	2
Hex wrench, 7/32"	1
Straight blade screwdriver	1

Rear Struts Installation

1. Using a plastic faced hammer, tap end caps (5) into the top of the rear struts (3, 4) (Ref. Fig. 1) (See Detail B and D).
2. Place washer (7) onto bolt (6) and insert bolt through the top hole in the seat back support (3 - 4 threads). Place the teflon washer (8) on the end of the bolt. This teflon washer is needed to prevent squeaking.
3. Insert rear strut (3) through the square hole in the top of the seat back support and push the bolt through the top hole in the rear strut.
4. Place washer (7) and lock nut (9) on the end of the bolt just enough to prevent the bolt from falling out.
5. At the lower hole, slide a teflon washer (8) between rear strut and seat back support and align holes.
6. Insert bolt (6) with washer (7) through lower hole and secure with washer (7) and lock nut (9).
7. *Finger tighten hardware to allow for adjustment.*
8. Repeat procedure with rear strut (4) at passenger side of vehicle.

Front Strut Installation

1. Remove and discard the four bolts from the front cowl (See Detail A).
2. At the upper hole (both sides of vehicle), install the front strut (2) with bolt (15) and lock washer (14) on the outside of strut, a spacer (13) and a washer (12) between the front cowl and strut.
3. *Finger tighten hardware to allow for adjustment.*
4. At the lower hole, secure the strut with bolt (15) and lock washer (14) on the outside of strut, and two washers (12) between the front cowl and strut as shown.
5. *Finger tighten hardware to allow for adjustment.*

Sun Top Installation

1. Place sun top onto struts.
2. At front of vehicle, secure sun top loosely with bolts (11), washers (18), spacers (20), washers (18) and lock nuts (19).
3. *Finger tighten hardware to allow for adjustment (See Detail C).*
4. At rear of vehicle, insert bolts (10), washers (18), spacers (20), washers (18) and lock nuts (19) (See Detail D).
5. Tighten all hardware to 13 - 15 ft. lbs. (18 - 20 Nm) torque.

6, 10, 11, 15	13 - 15 ft. lbs. (18 - 20 Nm)

WEATHER PROTECTION

Read all of SAFETY and this section before attempting any procedure. Pay particular attention to Notices, Cautions, Warnings and Dangers.

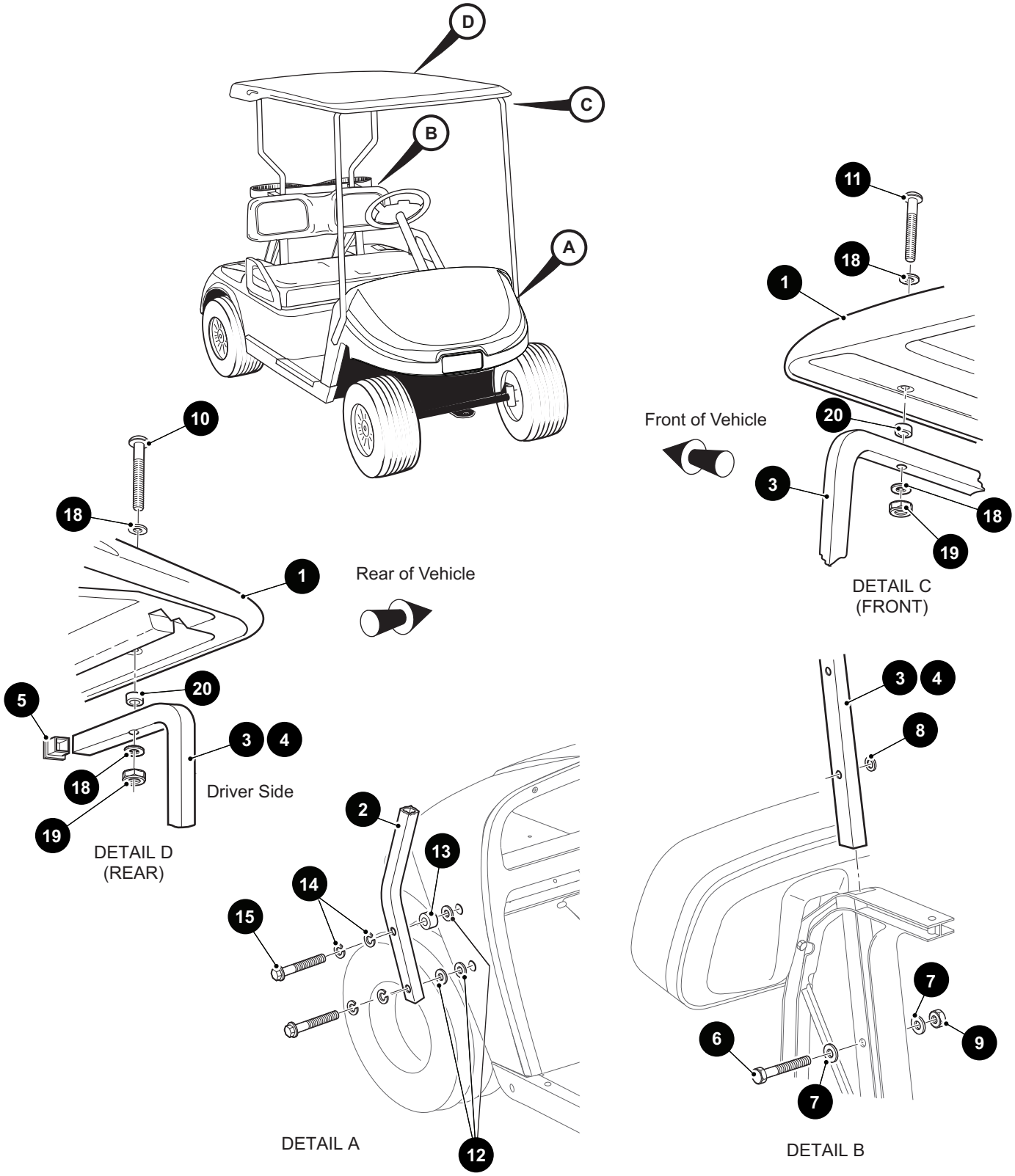


Fig. 1 Sun Top

Read all of SAFETY and this section before attempting any procedure. Pay particular attention to Notices, Cautions, Warnings and Dangers.

SPILT WINDSHIELD

Tool List	Qty.
Plastic faced mallet	1
Wrench, 7/16"	1
Phillips screwdriver	1

1. Remove protective covering from the windshield (2) (Ref. Fig. 1).
2. Install sash (3) on each side of the lower section of windshield. Using a plastic faced mallet, gently tap sash to ensure windshield seats properly (See Detail A).

⚠ CAUTION **Take care not to warp windshield when raising and lowering the top section of windshield.**

3. To secure windshield when lowered, press edge of windshield firmly into lower latches (See Detail B).
4. Insert bolt (4) through washer (5), rubber grommet (6) and existing hole in front strut. Secure with washer (5)
5. and lock nut (7) (See Detail B). **Do not over-tighten or squeeze grommet.**
6. Place bottom section of windshield on rubber grommets and press the sash, starting at the bottom, onto the front strut so that it snaps into place (See Details B and C). Repeat for opposite side of windshield.
7. Swing the top section of windshield up and secure by hooking the upper round latch (8) on each side of strut to the upper windshield. Using a plastic faced mallet, gently tap the latch (8) to ensure windshield seats properly (See Detail D).

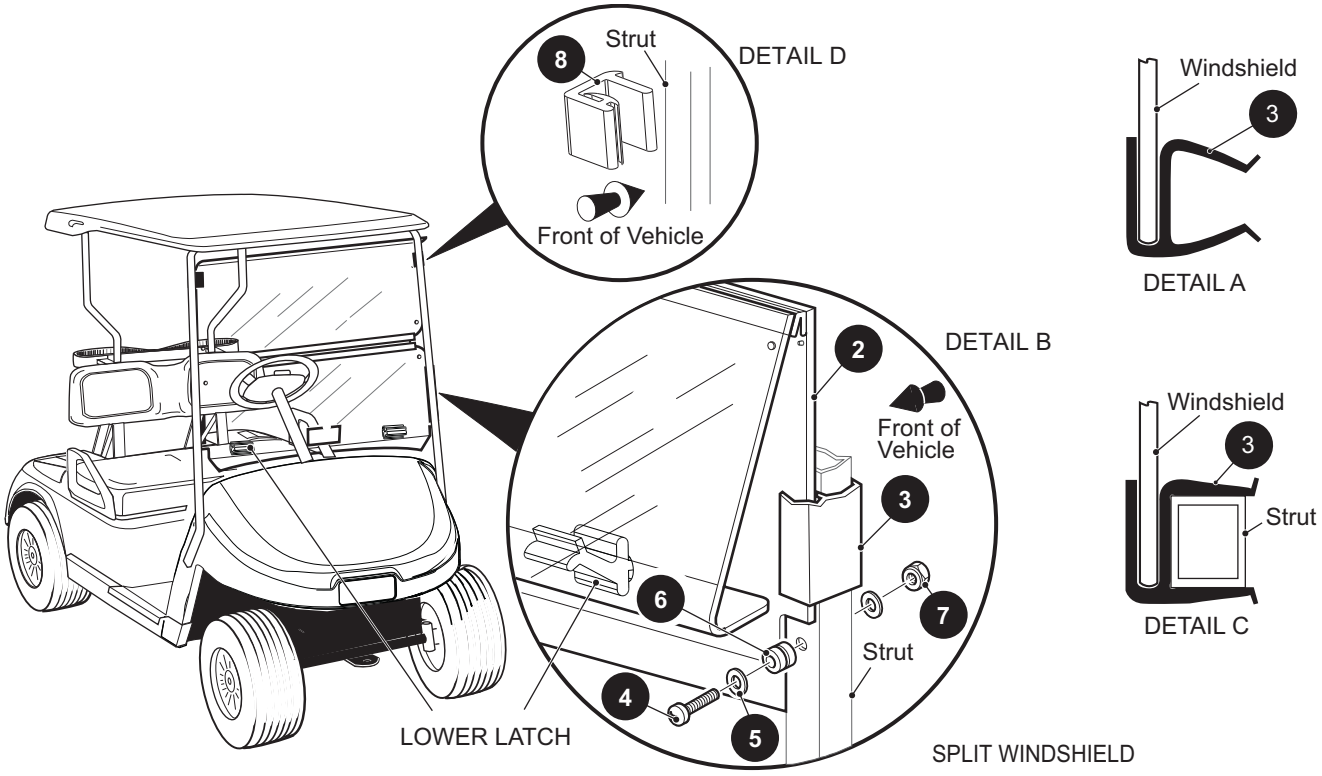


Fig. 1 Split Windshield

Read all of SAFETY and this section before attempting any procedure. Pay particular attention to Notices, Cautions, Warnings and Dangers.

Notes:

FAULT TESTING

Condition	Possible Cause	Correction
STARTER DOES NOT TURN	Weak or bad battery	Recharge or replace as necessary
	Terminals are loose or corroded	Clean and tighten
	Poor wiring connections	Repair or replace wire and/or connections
	Faulty Ignition Switch	Repair or replace wire and/or connections
	Blown fuse	Investigate cause and replace fuse
	Solenoid faulty	If no audible 'click' is heard, check power and ground. Replace solenoid if power and ground is good
	Accelerator switch	Check continuity
	Starter/generator terminals are loose or corroded	Tighten or clean
	Leads are broken or faulty ground	Check for breaks at bend or joint. Replace cable
	Field coils are open	Replace fields
	Armature coil is open	Replace armature
STARTER TURNS SLOWLY	Terminals are loose or corroded	Tighten or clean
	Weak battery	Charge battery
	Leads are nearly broken or connections are faulty	Check for any defect of leads at bend or joint. Replace wire leads
	Mechanical problem inside starter/generator	Check
	Internal engine damage	Inspect and repair
	Crankcase over filled with oil	Drain and fill to recommended level with approved oil
STARTER ROTATES BUT WILL NOT START OR HARD TO START	Weak Battery	Recharge or replace as necessary
	Corroded or loose battery connections	Clean and tighten battery connections. Apply a coat of battery protectant to terminals
	Check for adequate fuel level	Fill with correct grade gasoline to 1" (2.5 cm) below bottom of filler neck
	No spark at spark plug. Broken or disconnected spark plug wire	Check and replace if required
	Spark plug fouled	Clean or replace
	Broken or disconnected coil wires	Check or replace
	Incorrect spark plug gap/type	Set gap correctly

FAULT TESTING

Read all of SAFETY and this section before attempting any procedure. Pay particular attention to Notices, Cautions, Warnings and Dangers.

Condition	Possible Cause	Correction
	Fuel pump faulty	Repair or replace
	Fuel line clogged or clamp loose	Clean or replace if required
	Cracked or broken fuel line	Replace with new hose
	Throttle lever motion restricted	Check all linkages
	Dirt or water in fuel line	Clean lines. Replace filter
	Clogged fuel filter	Check and replace if required
	Engine flooded	Clean/or replace spark plugs
	Engine fuel starved	Check fuel lines, filter and pump.
	Air intake tube is blocked	Repair or clean
	Clogged air filter	Wash or replace as required
	Plugged muffler or pipe	Repair or replace
	Low compression in engine	Check and repair
ENGINE RUNS ROUGH OR LOSS OF POWER	Dirty or clogged air filter element	Replace as required
	Dirty or incorrectly gapped spark plug	Clean plug and set gap
	Faulty ignition wiring	Repair/replace correct wiring
	Spark plug wire	Test and replace if necessary
	Incorrect valve lash	Check and adjust if required
	Weak or damaged valve springs	Replace
	Damaged intake/exhaust valves	Replace
	Dirt or water in fuel line	Clean lines
	Plugged fuel tank vent	Clean or replace vent cap
	Muffler damaged or plugged	Repair or replace
	Fuel pump vent dirty	Clean and replace if required
	Fuel pump has a ruptured diaphragm	Replace
	Low compression	Check engine
	Poor quality of fuel	Drain and replace with correct clean fuel

Read all of SAFETY and this section before attempting any procedure. Pay particular attention to Notices, Cautions, Warnings and Dangers.

Condition	Possible Cause	Correction
POOR LOW SPEED PERFORMANCE	Plugged gas tank vent	Clean or repair
	Clutches not shifting out	Replace clutch/clutches
	Fuel pump faulty	Repair or replace
	Insufficient fuel level	Add fuel
	Air leak at throttle body gasket	Repair component
	Spark plug fouled	Clean or replace
	Incorrect valve lash	Check and adjust
	Belt slipping	Check belt & clutch surfaces Replace belt or clean clutches
	Faulty accelerator adjustment	Check and adjust
	Faulty governor adjustment	Check and adjust
POOR MIDRANGE OR HIGH SPEED PERFORMANCE	Spark plug fouled	Clean or replace
	Incorrect or plugged main jet	Check size for appropriate altitude. Clean
	Dirty air filter	Clean or replace
	Brake dragging	Perform brake maintenance
	Low compression	Check engine
	Governor not adjusted properly	Adjust
	Faulty accelerator adjustment	Check and adjust
	Faulty governor adjustment	Check and adjust
ENGINE OVERHEATING	Foreign matter in cylinder fins and blower housing	Clean
	Damaged blower housing or fins	Replace
	Damaged or plugged muffler	Repair or replace
	Inadequate oil supply	Check oil system, inspect oil pump, change oil, fill to correct level
	Heavy loads	Lighten load
	Incorrect Fuel	Use correct seasonal blend fuel. Do not use old fuel

FAULT TESTING

Read all of SAFETY and this section before attempting any procedure. Pay particular attention to Notices, Cautions, Warnings and Dangers.

Condition	Possible Cause	Correction
REPEATED SPARK PLUG FOULING	Wrong spark plug type	Replace with correct spark plug
	Wrong spark plug gap	Check and adjust if required
	Excessive ring blow by	Check/replace rings
	Poor quality gasoline	Use correct fuel, check bulk storage tank for proper storage and handling
	Air leak allowing dirt to enter system	Repair
	Wrong main jet for conditions (high altitude operations)	Replace with correct altitude jet for conditions
FLOODED ENGINE		
	Fuel contamination	Clean fuel system
	Clogged air filter element	Clean or replace
EXCESSIVE SMOKING	Wrong oil weight	Replace with recommended oil
	Dirty oil	Change
	Crankcase overfilled with oil	Drain and fill to recommended level
	Clogged PCV valve	Replace
	Piston rings worn or broken	Replace
	Valves worn	Replace
	Valve seals or valve guides worn	Replace
BACKFIRING	Accelerator limit switch out of adjustment	Adjust
	Loose muffler or leaking gasket	Repair
	Throttle lever motion restricted	Repair
	Throttle lever not closing fully	Adjust
	Throttle stop preventing throttle from closing fully	Adjust
	Incorrect adjustment of accelerator, governor and linkages	Adjust
	Throttle lever shaft bent	Replace
	Faulty plug wire	Replace

Read all of SAFETY and this section before attempting any procedure. Pay particular attention to Notices, Cautions, Warnings and Dangers.

Condition	Possible Cause	Correction
ERRATIC, SURGING, OR SUDDEN CHANGE IN GOVERNED SPEED	Damaged governor spring	Replace
	Problem with adjustment of accelerator, governor and linkage	Adjust
	Bent governor arm	Repair or replace
	Bent governor shaft	Replace
	Governor failure within the rear axle	Repair
FUEL DISTRIBUTION		
	Clogged fuel vents	Clean vents with solvent
	Faulty fuel pump	Clean vent screen.
	Faulty accelerator adjustment/function	Correct per the service manual
	Dirty or restricted air filter	Replace and clean air box
	High pressure in the fuel system	Check fuel cap for venting. Make sure fuel vent tubes are venting
MECHANICAL	Faulty Ignition system	Check ignition output per the service manual.
	Low or unbalanced compression	Perform compression or leak down test. Refer to the service manual for the specification.
	Poor valve sealing	Verify by compression or leak down test
OPERATION AND APPLICATION	Engine not reaching full temperature	Increase run time intervals to build higher cylinder temperature
	Continuous use at 1/4 throttle or less at low engine speed	Instruct operator
	Wide open throttle cranking	Instruct operator per operator's manual
	Long and continuous down hill use	Down hill use without the accelerator partially pressed will flood the cylinder with fuel due to no ignition present
	Poor fuel quality	Do not use old fuel. Add stabilizer for extended storage. Have fuel tested for contaminants.
	Use of summer blend fuel in the winter	Correct with fresh fuel

FAULT TESTING

Read all of SAFETY and this section before attempting any procedure. Pay particular attention to Notices, Cautions, Warnings and Dangers.

Condition	Possible Cause	Correction
POOR HIGH SPEED OPERATION	Fuel pump faulty	Replace fuel pump
	Dirt in fuel tank or hoses	Clean
	Clogged fuel filter	Clean fuel filter
	Dirty air filter	Clean/replace filter element
ABNORMAL COMBUSTION (FUEL MIXTURE)		
	Dirt in fuel tank, hoses or filter	Clean or replace
	Clogged air or fuel filter	Replace
	Poor fuel quality	Replace with fresh fuel
LOSS OF POWER (INSUFFICIENT FUEL)	Faulty fuel pump	Replace fuel pump
	Dirt in fuel tank or hoses	Clean
	Clogged fuel filter	Replace fuel filter
	Air leak in system	Check mounting hardware and gaskets. Repair or replace
LOSS OF POWER (INSUFFICIENT AIR)	Dirty air cleaner	Clean/replace filter element
	Throttle linkage	Adjust or Repair
	Blocked air inlet	Clean fuel filter
SURGING	Governor linkage	Refer to SPEED CONTROL section

STARTER / GENERATOR

Condition	Possible Cause	Correction
STARTER IS NOISY	Bolts are loose	Tighten
	Starter/generator has foreign matter inside	Clean starter/generator interior
	Bearings are faulty	Replace
	Bearings contain foreign matter	Replace
	Bearing needs grease	Replace

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Condition	Possible Cause	Correction
RECTIFICATION IS IMPERFECT	Load exceeds specification	Adjust load to specification
	Armature bent	Repair or replace if necessary
	Brushes are worn beyond limits	Replace
	Commutator is excessively rough	Smooth with emery cloth
	Incorrect voltage output	Check and replace any components if required
	Commutator is dirty with oil or dust	Clean with a cleaner and dry cloth
	Field coil is shorted or broken	Repair or replace
GENERATOR DOES NOT CHARGE	Corroded or loose battery connections	Clean and tighten battery connections
	Incorrect voltage regulator output	Replace
	Poor voltage regulator ground connection	Repair
	Open or short circuit	Repair or replace
	Faulty starter/generator	Repair starter/generator

SUSPENSION AND STEERING

Condition	Possible Cause	Correction
UNEVEN TIRE WEAR	Incorrect tire pressure	Inflate to recommended pressure
	Improper alignment (Incorrect toe in)	Align front tires
	Damaged or worn components	Replace
STIFF STEERING	Rusted or contaminated king pin sleeve or bushings	Replace or clean
	Bent rack	Remove rack and place on flat surface with rack teeth up; If a .015" (.381 mm) feeler gauge will pass under the rack, the rack must be replaced
PLAY IN STEERING	Steering wheel loose	Inspect splines - replace steering wheel if required; Tighten steering wheel nut
	Steering components worn	Replace
	Loose wheel bearings	Adjust or replace
VIBRATION	Steering components worn	Replace
	Loose wheel bearings	Adjust or replace
	Out of round tires, wheels, or brake drums	Inspect and replace if out of round
	Loose lug nuts	Tighten to 50 - 85 ft. lbs. (68 - 115 Nm)

FAULT TESTING

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Condition	Possible Cause	Correction
STEERING PULLS TO ONE SIDE	Incorrect tire pressure	Inflate to recommended pressure
	Dragging wheel brakes	Service brake system
	Suspension component failure	Repair
	Alignment incorrect	Align

BRAKE SYSTEM

FAILS BRAKE PERFORMANCE TEST BY STOPPING IN A LONGER DISTANCE THAN NORMAL	Wheel brake failure due to severely worn or damaged components	Replace all severely worn or damaged components
	Brake pedal not returning Brake not adjusting	Check for binding of brake pedal Check brake pedal free travel Check brake cables Check brake adjusters Check pedal pivot
	Brake shoes wet	Check again when shoes are dry
	Brake cables damaged or sticky	Check brake cable and replace if sticky or damaged
	Brake shoes severely worn	Replace
	Brake shoes glazed	Sand shoes with emery cloth provided that shoes have .06" (1.5 mm) min. material
	System not adjusted properly	Check and adjust per manual
	End of brake cable loose from anchor brackets	Check and repair
	Cracked brake drum	Replace
IN EXCESS OF 1" (2.5 CM) FREE PEDAL TRAVEL (SOFT PEDAL)	Low pedal force at parking brake latch	Adjust per manual
	Brake cables damaged	Replace
	Brake return bumper out of adjustment	Adjust per manual
	End of brake cable loose from anchor brackets	Check and repair
	Wheel brake failure due to severely worn or damaged components	Replace all severely worn or damaged components
	System not adjusted properly	Adjust per Manual
LESS THAN 3/4" (1.9 CM) FREE PEDAL TRAVEL (HARD PEDAL)	High pedal force at parking brake latch	Adjust per Manual
	Brake cables damaged or sticky	Check brake cable and replace if sticky or damaged
	System not adjusted properly	Check and adjust per manual
	Wheel brake failure due to severely worn or damaged components	Replace all severely worn or damaged components

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NEITHER WHEEL LOCKS WHEN PARK BRAKE IS LATCHED. (NOTE: AT FULL SPEED THE WHEELS MAY NOT LOCK, BUT SHOULD BRAKE AGGRESSIVELY).	Incorrect cable adjustment	Return to factory specification
	Excessive brake pedal free travel	Adjust per manual
UNEQUAL BRAKING (ONE WHEEL LOCKS WHILE OTHER ROTATES)	Wheel not locking is not adjusting	Check brake operation of wheel that is **not** locking
	Sticky/dragging cable	Check for brake lever return Check that brake levers return at equal rate - (Indication of dragging cable)
	Cracked brake drum	Replace
	Brake shoes wet or glazed	Check again when shoes are dry
	Rusted or sticky brake pivot hardware	Replace
NEITHER WHEEL LOCKS	Brake system requires complete adjustment	Adjust entire system
	Brake pedal not returning	Check for binding of brake pedal Check brake pedal free travel
GRABBING BRAKES (OVERSENSITIVE)	Moisture has caused surface rust on drums	Apply moderate force to pedal while at maximum level ground speed to remove rust until condition is relieved.
	Brake Pivot binding	Check and replace poor components

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Notes:

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GENERAL SPECIFICATIONS

Item	Specification
Overall Length	91in (231cm)
Overall Width	47 in (119 cm)
Overall Height (No Canopy)	46.5 in (118 cm)
Overall Height (With Canopy)	68 in (173 cm)
Wheel Base	66 in (168 cm)
Front Wheel Track	34.0 in (86 cm)
Rear Wheel Track	38.5 in (98 cm)
Ground Clearance (at Differential)	5.0 in (13 cm)
Horsepower (kW)	13.5 hp (10.1 kW) per SAE J1940 Standard
Dry Weight	610 lb (277 kg)
Curb Weight	650 lb (295 kg)
Vehicle Load Capacity	800 lb (363 kg)
Dash/IP Storage Capacity	1,123 in^3 (18,403 cm^3)
Outside Clearance Circle	19 ft (5.8 m)23.5 ft (7.2 m)
Turning Radius	9.5 ft (2.9 m)
Speed (Level Ground)	19 mph ± 0.5 mph (31 kph ± 0.80 kph)
Engine	Walbro 4-Cycle 24.5 in^3 (401 cc)
Valvetrain	Single Cylinder OHV
Electrical System	Starter / Generator. Solid State Regulator
Battery	12-Volt Maintenance-Free (525 CCA, 85 minute reserve)
Key or Pedal Start	Pedal
Air Cleaner	Replaceable Dry Cartridge
Lubrication	Pressurized Oil System
Oil Filter	Spin-On
Cooling System	Air Cooled
Max Fuel Volume	5.96 Gallon (22.6 L)
Fuel Pump Operating Pressure	43.5 psi (3 bar)
Fuel System	Closed-loop electronic fuel injection
Balancer	Internal Counter Rotating Balance Shaft
Ignition	Electronic Inductive Spark
Drivetrain	Automatic, Continuously Variable Transmission (CVT)
Transaxle	Differential with helical gears
Gear Selection	Forward - Reverse
Rear Axle Ratio	11.47:1 (Forward) 14.35:1 (Reverse)
Seating Capacity	2-Person
Towing Capacity	3 E-Z-GO Golf Cars with approved tow bars
Steering	Self-compensating reduction rack and pinion
Front Suspension	Leaf springs with hydraulic shock absorbers
Rear Suspension	Leaf springs with hydraulic shock absorbers
Brakes	Dual rear wheel mechanical self-adjusting drum
Parking Brake	Self-compensating, single point engagement

GENERAL SPECIFICATIONS

Read all of SAFETY and this section before attempting any procedure. Pay particular attention to Notices, Cautions, Warnings and Dangers.

Front and Rear Tires	K500 20 x 10 - 10 (6 ply rated)
Frame	Welded steel with DuraShield™ powder coat
Body and Finish	Injection Molded TPO
Standard Color	Black
Noise	Sound pressure; continued A-weighted equal to or less than 74 db(A)
Vibration, WBV	Highest RMS value of weighted acceleration is less than 2.5 m/s².
Vibration, HAV	Highest RMS value of weighted acceleration is less than 2.5 m/s².
	The uncertainty of measurement is 1.07 m/s².
	Measurement methods were applied per the ISO 2631 and ISO 5349 standards under conditions of typical vehicle surfaces.
Some items shown may be optional equipment	

Read all of SAFETY and this section before attempting any procedure. Pay particular attention to Notices, Cautions, Warnings and Dangers.

Notes:

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Notes:

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SCHEDULED MAINTENANCE CHART

Perform all services at the maintenance interval reached first.

S **–**Indicates operations that need to be performed on vehicles subjected to severe use.

E **–**Indicates emission-related services (Failure to do this maintenance will not void the emissions warranty but may affect emissions).

D **–**Indicates services that must be performed by an authorized dealer.

Item		Interval (perform at interval that comes first)		Remarks	Page
		Hours	Calendar		
	Steering	Pre-ride		Check for smooth and free operation.	
	Front suspension	Pre-ride		Inspect. Check for leaks and loose or missing hardware.	
	Rear suspension	Pre-ride		Inspect. Check for leaks and loose or missing hardware.	
	Tires	Pre-ride		Check condition and pressure.	11, 43
	Wheel lug nuts	Pre-ride		Check for loose or missing.	21
	Accelerator	Pre-ride		Check for smooth operation.	84
	Brake system	Pre-ride		Check for proper operation.	25
	Frame hardware	Pre-ride		Check for loose or missing.	
	Fuel and engine oil level	Pre-ride		Check for correct level.	143
	Air filter	Pre-ride		Inspect. Clean or replace as needed.	75
	Headlights and tail-lights	Pre-ride		Check operation. Replace bulbs as needed.	
	Reverse warning alarm	Pre-ride		Check operation.	
	Switches	Pre-ride		Check operation.	
	Fluid leakages	Pre-ride		Inspect entire vehicle for leaks	
	CVT belt	Pre-ride		Check condition.	
	Engine oil and filter	Initial Service		Replace oil and filter at first 50 hours of operation.	
	Starter/generator belt	Initial Service		Check between first 15 and 20 hours.	
	Wheels	Weekly		Check condition of rims, missing or loose lug nuts.	
S E	Air filter	Weekly		Inspect. Replace as needed.	
S	Cooling fins	Weekly		Check for build-up of dirt inside blower housing and fins; clean as necessary.	
S	Engine oil	Weekly		Check level; add as necessary.	
	Starter/generator belt	Weekly		Check condition.	
S	Brake shoes	10	Monthly	Inspect. Replace as needed.	
	Parking brake	20	Monthly	Conduct brake performance test; adjust as necessary	
	Wiring	20	Monthly	Inspect for loose connections, broken or missing insulation.	
	Direction selector	20	Monthly	Inspect attachment and mechanism; adjust as necessary.	
	Steering	20	Monthly	Check for excess play, loose or missing hardware.	
S	Tie rods	20	Monthly	Check for excess play, bent rods, loose or missing hardware.	

SCHEDULED MAINTENANCE

Read all of SAFETY and this section before attempting any procedure. Pay particular attention to Notices, Cautions, Warnings and Dangers.

Item		Interval (perform at interval that comes first)		Remarks	Page
		Hours	Calendar		
	Engine	20	Monthly	Check for unusual noise, vibration, acceleration, oil leaks.	
	Rear axle	20	Monthly	Check for leakage; add oil as required.	
S	General lubrication	50	3 Months	Lubricate all fittings, pivots, cables, etc. where required.	
	Throttle/governor linkage	50	3 Months	Check operation and governed speed.	
E	Fuel system	50	3 Months	Check for leakage at tank, cap, lines, filters, pump, fuel rail.	
	Front axle	50	3 Months	Check for damage, loose or missing hardware.	
	Parking brake	50	3 Months	Inspect linkage rods, latch arm, catch bracket. Lubricate with light oil (Do not lubricate cables or brake latch).	
S	Engine electrical system	50	3 Months	Check coil/spark plug wires for cracks or loose connections.	
S	Rear suspension	50	3 Months	Inspect shocks for leaks, worn bushings, loose or missing hardware.	
S	Front suspension	50	3 Months	Inspect strut for leaks. Check hubs and kingpins, for excessive play, worn bushings, loose or missing hardware.	
	Front wheel alignment	50	3 Months	Inspect for unusual tire wear; align if necessary.	
S	Battery	125	6 Months	Inspect terminals. Clean as needed.	
	King pins	125	6 Months	Check for excessive play and tightness of retaining nuts.	
	Rear axle	125	6 Months	Check for unusual noise, loose or missing hardware.	
S E	Air filter	125	6 Months	Inspect; clean as necessary.	
	CVT belt	125	6 Months	Inspect for cracks, fraying and excessive wear.	
	Direction selector	125	6 Months	Check for wear and smooth movement; lubricate shaft with light oil if necessary.	
	Steering	125	6 Months	Inspect bellows and pinion seal for damage and leakage.	
	Rack end ball joint	125	6 Months	Check for noise and loose or missing hardware.	
S	Air Filter	250	Yearly	Replace.	
S	Oil filter	250	Yearly	Replace (with oil change).	
S	Engine oil	250	Yearly	Replace. See for type and capacity.	
S	Rear axle	250-300	Yearly	Check fluid level; add if required.	
S	Front wheel bearings	250-300	Yearly	Check and adjust as necessary.	
S	Brakes	250-300	Yearly	Clean and adjust. Check brake shoe linings; replace if necessary.	
S	Muffler/exhaust system	250-300	Yearly	Check hardware. Inspect for leaks at head and muffler gaskets.	
	Valves - intake/exhaust	250-300	Yearly	Check cold.	
S E	Spark plug	250	Yearly	Replace and gap new.	
	Cylinder head and piston	500	5 years	Remove carbon.	

Read all of SAFETY and this section before attempting any procedure. Pay particular attention to Notices, Cautions, Warnings and Dangers.

Item		Interval (perform at interval that comes first)		Remarks	Page
		Hours	Calendar		
	Cylinder head and piston	500	5 years	Check valve seats for carbon buildup; clean if necessary.	
	Rear axle	500	5 years	Replace fluid.	

RECOMMENDED LUBRICANTS AND FLUIDS

Check and lubricate all components at the intervals shown in the *SCHEDULED MAINTENANCE CHART* beginning on page 141.

Item	Capacity	Lubricants/Fluids		Notes
Engine oil	1.3 qt. (1.25 L)	10W-30	Light duty use engines	
		10W-30	Heavy duty use in air temperatures below 40º F (4º C)	
		10W-40	Heavy duty use in air temperatures above 40º F (4º C) after 100 hour break-in period	
Fuel	5.96 Gallon (22.6 L)	Unleaded; 87 octane min 10% ethanol content max.		
Rear axle oil	51 oz. (1.5 L)	MOBIL 424		
Grease fittings		Universal joint grease or equivalent		Do not exceed 3 pumps of grease in each fitting.

REPLACEMENT OF MAINTENANCE ITEMS

These items or their equivalents can be purchased through an authorized dealer, directly from *E-Z-GO* or any other qualified source.

Item	Part Number
Oil Filter	607454
Air Filter	28463G01
Spark Plug (NGK BPR2ES)	607462
Starter/Generator Belt	630587
Clutch Belt	618630
15A Fuse	636455G13
10A Fuse	636455G12
Fuel Pump Relay	663593
Headlight Bulb	74004G02
Turn Signal Bulb	676687
Taillight Bulb	604311

Read all of SAFETY and this section before attempting any procedure. Pay particular attention to Notices, Cautions, Warnings and Dangers.

Notes:

NOTICE:Notice: Read the following warnings before attempting to operate the vehicle:

⚠WARNING *To prevent personal injury or death, observe the following:*

When vehicle is to be left unattended, engage parking brake, move direction selector to 'F' (forward) position, turn key to 'OFF' position and remove key.

Drive vehicle only as fast as terrain and safety considerations allow. Consider the terrain and traffic conditions. Consider environmental factors which effect the terrain and the ability to control the vehicle.

Avoid driving fast down hill. Sudden stops or change of direction may result in a loss of control. Use service brake to control speed when traveling down an incline.

Use extra care and reduced speed when driving on poor surfaces, such as loose dirt, wet grass, gravel, etc.

All travel should be directly up or down hills.

Use extra care when driving the vehicle across an incline.

Stay in designated areas and avoid steep slopes. Use the parking brake whenever the vehicle is parked.

Keep feet, legs, hands and arms inside vehicle at all times.

Avoid extremely rough terrain.

Check area behind the vehicle before operating in reverse.

Make sure the direction selector is in correct position before attempting to start the vehicle.

Slow down before and during turns. All turns should be executed at reduced speed.

Always bring vehicle to a complete stop before shifting the direction selector.

See GENERAL SPECIFICATIONS for vehicle load and seating capacity.

NOTICE:Notice: Read the following text and warnings before attempting to service vehicle:

Any product, components will eventually fail to perform properly as the result of normal use, age, wear or abuse.

It is virtually impossible to anticipate all possible component failures or the manner in which each component may fail.

Be aware that a vehicle requiring repair indicates that the vehicle is no longer functioning as designed and therefore should be considered potentially hazardous. Use extreme care when working on any vehicle. When diagnosing, removing or replacing any components that are not operating correctly, take time to consider the safety of yourself and others around you should the component move unexpectedly.

Some components are heavy, spring loaded, highly corrosive, explosive or may produce high amperage or reach high temperatures. Gasoline, carbon monoxide, battery acid and hydrogen gas could result in serious bodily injury to the technician/mechanic and bystanders if not treated with the utmost caution. Be careful not to place hands, face, feet or body in a location that could expose them to injury should an unforeseen situation occur.

NOTICE:Always use the appropriate tools listed in the tool list and wear approved safety equipment.

⚠WARNING *Before working on the vehicle, remove all jewelry (rings, watches, necklaces, etc.)*

Be sure that no loose clothing or hair can contact moving parts.

Use care not to touch hot objects.

Raise rear of vehicle and support on jack stands before attempting to run or adjust powertrain.

Wear eye protection when working on or around vehicle. In particular, use care when working around batteries, using solvents or compressed air.

Hydrogen gas is formed when charging batteries. Do not charge batteries without adequate ventilation.

Do not permit open flame or anyone to smoke in an area that is being used for charging batteries. A concentration of 4% hydrogen gas or more is explosive.

Engine exhaust gas (carbon monoxide) is deadly. Carbon monoxide is an odorless, colorless gas that is formed as a natural part of incomplete combustion of hydrocarbon fuels. Carbon monoxide is a dangerous gas that can cause unconsciousness and is potentially lethal.

The following are symptoms of carbon monoxide inhalation:

- *Dizziness*
- *Vomiting*
- *Intense headache*
- *Muscular twitching*
- *Weakness and sleepiness*
- *Throbbing in temples*

If any of these symptoms are experienced, get fresh air immediately. Never work around or operate a vehicle in an environment that does not ventilate exhaust gases from the area.

TRACKER

MANUFACTURER INFORMATION
Textron Specialized Vehicles Inc.
1451 Marvin Griffin Road
Augusta, GA, USA 30909-3852

Dealer: 800-296-4804
Consumer: 877-394-6772

www.trackeroffroad.com

Owner's Manuals and Repair Manuals are available from the manufacturer.