



SERVICE AND REPAIR MANUAL



AMBUSH

632313

ISSUED DECEMBER 2012

REVISED JUNE 2014

SAFETY

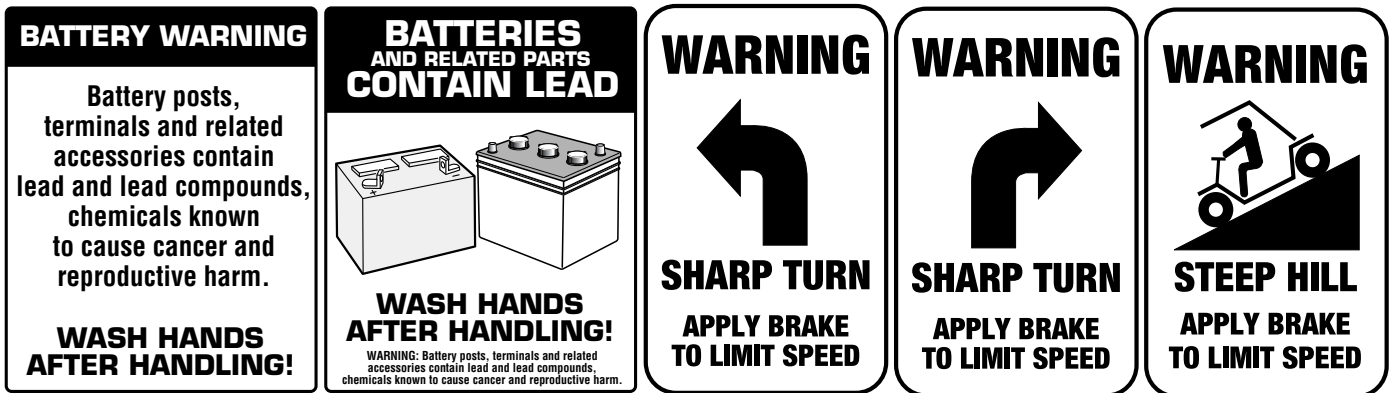
Read and understand all labels located on the vehicle. For any questions on any of the information, contact a representative for clarification.

Always replace any damaged or missing labels.

On steep hills it is possible for vehicles to coast at greater than normal speeds encountered on a flat surface. To prevent loss of vehicle control and possible serious injury, speeds should be limited to no more than the maximum speed on level ground. (See vehicle specification.) Limit speed by applying the service brake.

Catastrophic damage to the drive train components due to excessive speed may result from driving the vehicle above specified speed. Damage caused by excessive speed may cause a loss of vehicle control, is costly, is considered abuse and will not be covered under warranty.

If the vehicle is to be used in a commercial environment, signs similar to the ones illustrated should be used to warn of situations that could result in an unsafe condition.



NOTES, CAUTIONS AND WARNINGS

NOTICE

Address practices not related to personal injury.



CAUTION

Indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.



WARNING

Indicates a hazardous situation which, if not avoided, could result in death or serious injury.



DANGER

Indicates a hazardous situation which, if not avoided, will result in death or serious injury.



WARNING

Battery posts, terminals and related accessories contain lead and lead compounds. Wash hands after handling.

(NOTES, CAUTIONS AND WARNINGS CONTINUED ON INSIDE OF BACK COVER)

TECHNICIAN'S REPAIR AND SERVICE MANUAL

HYBRID UTILITY VEHICLES

AMBUSH

Starting Model Year 2013

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. Bad Boy Buggies prohibits and disclaims responsibility for any such modifications or any other alteration which would adversely affect the safety of the vehicle.

BB Buggies Inc. 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 BB Buggies Inc., and therefore is subject to change without notice.

BB Buggies Inc. 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.

TO CONTACT US

Bad Boy Buggies
1451 Marvin Griffin Rd.
Augusta, GA. 30906

FAX: 855-256-9900

E-mail: info@badboybuggies.com

**For parts and repair contact your local dealer. To locate a local dealer please go online to our website:
www.BADBOYBUGGIES.com**

NOTES

To obtain a copy of the limited warranty applicable to the vehicle, call or write a local distributor, authorized Branch or the Warranty Department with vehicle serial number and manufacturer code.

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

Overfilling battery may void the warranty.

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).

For winter storage, the batteries must be clean, fully charged and disconnected from any source of electrical drain. The battery charger and the controller are both sources of electrical drain. Unplug the battery charger DC plug from the vehicle receptacle.

As with all electric vehicles, the batteries must be checked and recharged as required or at a minimum of 30 day intervals.

Refer to the 'Prolonged Storage' section within the BATTERIES AND CHARGER section of this manual.

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SAFETY INFORMATION

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

This manual has been designed to assist the owner-operator 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 and/or property damage, the following instructions must be carefully observed:

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 the owner-operator read this entire manual paying particular attention to the CAUTIONS and WARNINGS contained therein. It is further recommended that employees and other operators be encouraged to do the same.

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

E-Z-GO Division of Textron 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.

E-Z-GO Division of Textron 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 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 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.

With electric powered vehicles, be sure that all electrical accessories are grounded directly to the battery (-) post. **Never use the chassis or body as a ground connection.**

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.

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.

Always read and observe all warnings and operation instruction labels affixed to the vehicle.

Always follow all safety rules established in the area where the vehicle is being operated.

Always reduce speed to compensate for poor terrain or conditions.

SAFETY INFORMATION

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

Always apply service brake to control speed on steep grades.

Always maintain adequate distance between vehicles.

Always reduce speed in wet areas.

Always use extreme caution when approaching sharp or blind turns.

Always use extreme caution when driving over loose terrain.

Always use extreme caution in areas where pedestrians are present.

MAINTENANCE

Always maintain your vehicle in accordance with the manufacturer's periodic service schedule.

Always ensure that mechanics performing repairs are trained and qualified to do so.

Always follow the manufacturer's directions if you do any maintenance on your 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.

Always 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 batteries or cover exposed terminals with an insulating material.

Always check the polarity of each battery terminal and be sure to rewire the batteries correctly.

Always use specified replacement parts. Never use replacement parts of lesser quality.

Always use recommended tools.

Always 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.

Always support the vehicle using wheel chocks and safety stands. Never get under a vehicle that is supported by a jack. Lift the vehicle in accordance with the manufacturer's instructions.

Never attempt to maintain a vehicle in an area where exposed flame is present or persons are smoking.

Always be aware that a vehicle that is not performing as designed is a potential hazard and must not be operated.

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.

Always 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.

Always replace damaged or missing warning, caution or information labels.

Always keep complete records of the maintenance history of the vehicle.

SAFETY INFORMATION

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

VENTILATION

Hydrogen gas is generated in the charging cycle of batteries and is explosive in concentrations as low as 4%. Because hydrogen gas is lighter than air, it will collect in the ceiling of buildings necessitating proper ventilation. Five air exchanges per hour is considered the minimum requirement.

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

Always use a dedicated circuit for each battery charger. Do not permit other appliances to be plugged into the receptacle when the charger is in operation.

Chargers must be installed and operated in accordance with charger manufacturers recommendations or applicable electrical code (whichever is more restrictive).

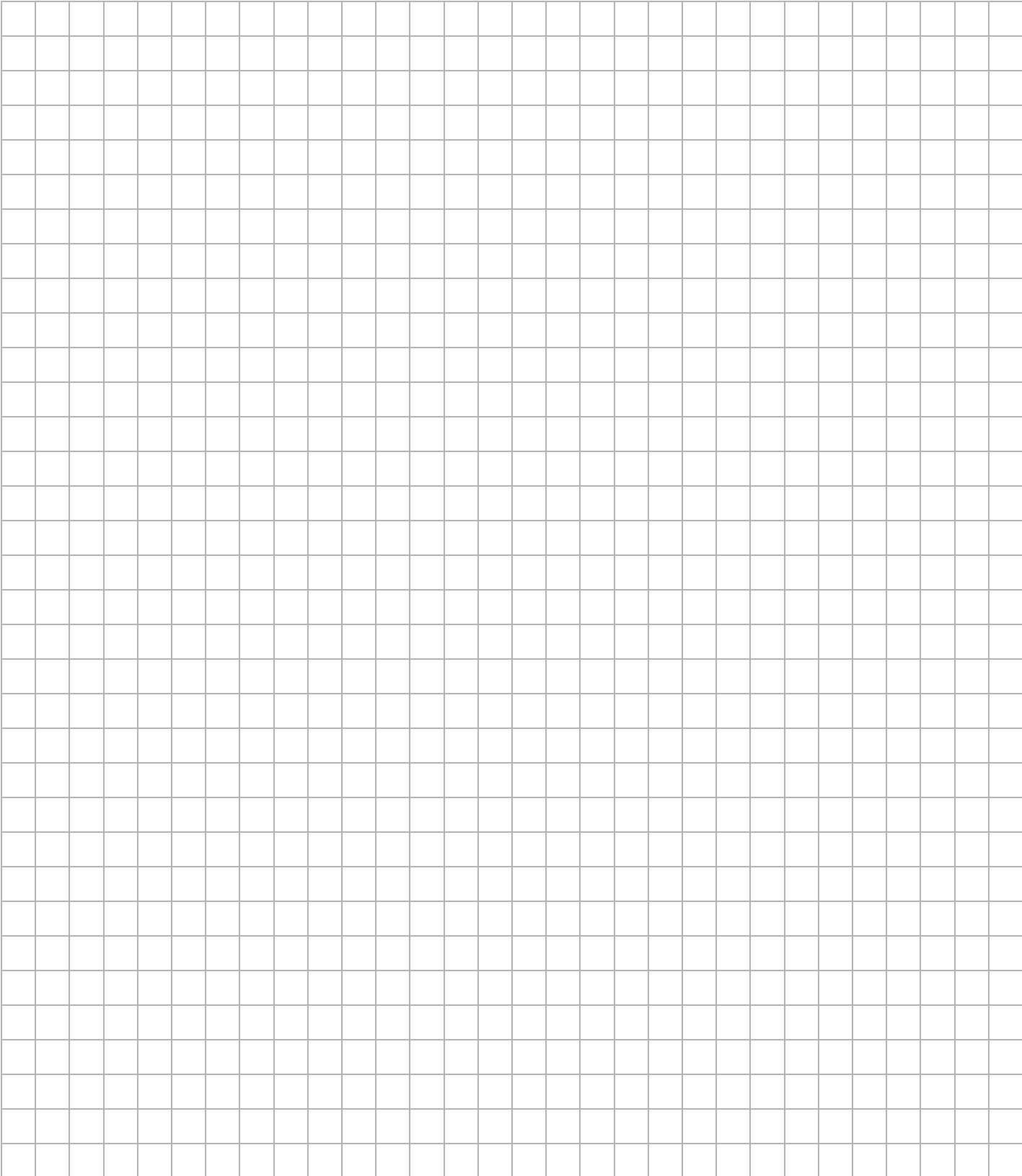
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GENERAL INFORMATION & ROUTINE MAINTENANCE

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

NOTES:

A large grid of graph paper for taking notes. The grid consists of 20 columns and 30 rows of small squares, providing a structured area for handwritten notes.

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

SERIAL NUMBER AND VIN PLATE LOCATION

The serial number (1) and the VIN number are present at two different locations on the vehicle.

Serial number (1) is present below the driver seat, on a label attached to the chassis of the vehicle and also on a label attached to the steering column of the vehicle. (Ref. Fig. 1 on page A-1) and (Ref. Fig. 2 on page A-1)

VIN number (2) is present below the passenger seat, on a label attached to the chassis of the vehicle and also on the plate rivetted to the top of the cowl on the driver side. (Ref. Fig. 2 on page A-1) and (Ref. Fig. 3 on page A-1)

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

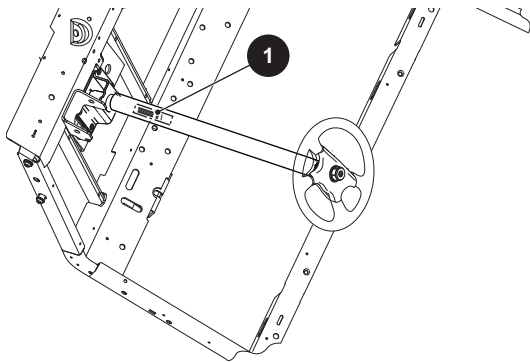


Fig. 1 Serial Number on the Steering Column

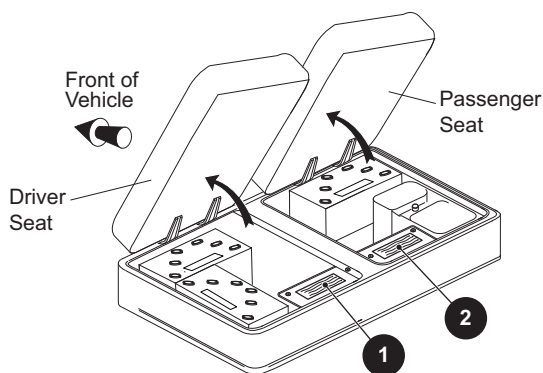


Fig. 2 Serial Number and VIN Number Under The Driver And Passenger Seats.

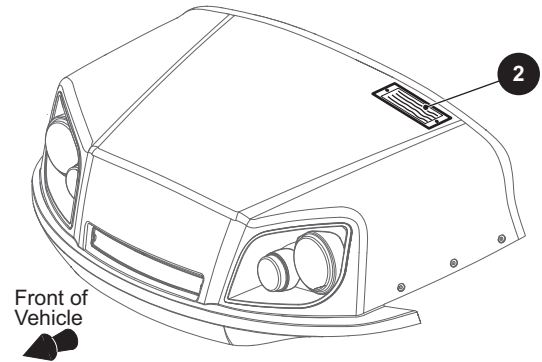


Fig. 3 VIN Number on the Cowl



STARTING THE VEHICLE WITH A DISCHARGED STARTING 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 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 additional lights and/or a strobe light that is 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. If the vehicle battery has become discharged, it must be charged with a 12V charger rated at 10 amp or less. Observe all instructions provided by the manufacturer of the charger.

GENERAL INFORMATION & ROUTINE MAINTENANCE

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

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 notes, 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 gas powertrain failure or motor disintegration in the electric powertrain, 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 (Ref. Fig. 4 on page A-2).

Vehicle batteries must be fully charged before initial use.

ITEM	SERVICE OPERATION
Battery	Gas engine starter battery & electric motor battery pack
Seats	Remove protective plastic covering
Brakes	Check operation and adjust if necessary
	Check hydraulic brake fluid level
	Establish new vehicle braking distance
Tires	Check pressure
Fuel	Fill tank with correct fuel
Engine	Check oil level (Initial change after 5 - 8 hours)

Fig. 4 Initial Service Chart

TOWING

WARNING

This vehicle is not designed to be towed.

It is recommended that the vehicle be moved by placing the entire vehicle on a trailer, flatbed truck or other suitable transport.

ROUTINE MAINTENANCE

This vehicle will give years of satisfactory service, providing it receives regular maintenance. Refer to the Periodic Service Schedule for appropriate service intervals (Ref. Fig. 7 on page A-8). Refer to 'Lubrication' in FRONT AXLE, SUSPENSION AND STEERING section for appropriate lubrication locations.

GENERAL INFORMATION & ROUTINE MAINTENANCE

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



CAUTION

Do not use more than three (3) 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.

Putting more than three pumps of grease in a grease fitting could damage grease seals and cause premature bearing failure.

NOTICE

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

POWERTRAIN MAINTENANCE

Access the powertrain by raising or removing seats. Full access to powertrain may be obtained by raising the truck bed. Some service procedures may require the vehicle be lifted. Refer to 'LIFTING THE VEHICLE' in Section B for proper lifting procedure and safety information.



WARNING

Always install a positive stop to prevent severe injury that could result if the load bed lift mechanism should unexpectedly fall.

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

To prevent accidental starting, remove and ground spark plug wires and disconnect battery at negative terminal before servicing.

For maintenance procedures relating to the engine, speed control, fuel system, transmission, and rear axle or suspension, refer to the particular section. 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.

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

TIRES

NOTICE

Standard tires for this vehicle are uni-directional and should never be moved from one side of vehicle to the other. Left side tires should always remain on the left side of the vehicle. Right side tires should always remain on the right side of the vehicle. Uni-directional tires have an arrow on the sidewall indicating direction of rotation when moving forward.

Tire condition should be inspected and inflation pressures checked per the Periodic Service Schedule when tires are cool. Be sure to install the valve dust cap after checking or inflating tire. For additional information, refer to WHEELS AND TIRES section.

LIGHT BULB REPLACEMENT

Refer to ELECTRICAL SYSTEM for information regarding light bulb replacement.

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.

GENERAL INFORMATION & ROUTINE MAINTENANCE

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

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 will accelerate 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 its removal, taking care not to chip or otherwise damage paint.

VEHICLE CARE PRODUCTS

There are several products, available through a local distributor, an authorized Branch, or the Service Parts Department, to help maintain the vehicle. Among them are:

- Touch-up paint specially formulated to match vehicle colors for use on both metal and TPE (plastic) bodies. (P/N 28140-G**, 28432-G** and 75831-G01)
- 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 75500-G01)
- White Lithium Grease designed to provide lubrication protection in areas where staining or discoloring is a problem, or in areas of extreme temperature ranges. (P/N 75502-G01)
- Penetrant/Lubricant, a 4-in-1 product that penetrates the most stubborn of frozen parts, lubricates leaving a light lubricating film, prevents corrosion by adhering to wet or dry surfaces and displaces moisture, sealing against future moisture return. (P/N 75503-G01)

- Multi-purpose Cleaner and Degreaser that contains natural, environmentally safe solvents. (P/N 75504-G01)
- 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 75505-G01)
- Battery Cleaner that promotes easy, non-violent neutralization of battery acids and battery acid crystals. The resulting sodium salts are water soluble and easily washed away. (P/N 75506-G01)
- Biodegradable Cleaner that cleans the toughest dirt and heavy soils by breaking down grease to be easily wiped or rinsed away. (P/N 75507-G01)
- Multi-purpose Value Pack sampler package including 4 ounce (118 ml) aerosol cans of Battery Protector, Penetrant/Lubricant, White Lithium Grease, and Carburetor and Choke Cleaner. (P/N 75508-G01)
- Use plastic cleaner and plexi polish to remove minor scratches from windshield.

CANOPY TOP AND WINDSHIELD



WARNING

The canopy 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. For additional information, refer to WEATHER PROTECTION section.

GENERAL INFORMATION & ROUTINE MAINTENANCE

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

TRAILERING

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.

Remove windshield before trailering.

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

If the vehicle is to be transported on a trailer at highway speeds, the windshield and top must be removed and the seat bottoms 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.

PROLONGED STORAGE

Battery Set and Gas Starting Battery

During periods of storage, the batteries will need attention to keep them maintained and prevent discharge. In high temperatures the chemical reaction is faster, while low temperatures cause the chemical reaction to slow down. A vehicle that is stored at 90° F (32° C) will lose 0.002 of specific gravity each day. If a fully charged battery has a specific gravity of 1.275, and the battery is allowed to sit unused, it will become partially discharged. When it reaches 1.240, which it will do in less than twenty days, it should be recharged. If a battery is left in a discharged state, sulfating takes place on and within the plates. This condition is not reversible and will cause permanent damage to the battery. In order to prevent damage, the battery should be recharged. A hydrometer can be used to determine the specific gravity and therefore the state of charge of a battery.

Gas Engine

WARNING

To prevent serious injury or death resulting from a possible explosion:

Do not handle fuel in an area that is not adequately ventilated. Do not smoke near the fuel tank or refuel near open flame or electrical items which could produce a spark.

Store vehicle in a clean, dry area. Do not store in same area as a stove, furnace, water heater, or other appliance that uses a pilot light or has a device that can create a spark.

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

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

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 a prolonged storage period (30 days or more) calls for a few simple steps to prevent a build up of varnish and gum in the carburetor and corrosion in the engine. Turn the Key Switch to OFF position, and leave the Forward/Reverse switch in the NEUTRAL position during storage.

- Perform all required routine maintenance per the Periodic Service Schedule.
- Properly inflate the tires to recommended pressure (psi) stated on sidewall of tires.

GENERAL INFORMATION & ROUTINE MAINTENANCE

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

- Place the Forward/Reverse switch in the NEUTRAL position.
- Turn the fuel shut-off valve to the closed (OFF) position.
- With proper ventilation, run engine until the remaining fuel in carburetor and fuel lines is depleted and the engine stalls.
- Remove spark plug and pour about 1/2 oz. (15 ml) of SAE 10 - 30 weight oil or the cylinder fogging oil. Rotate the crankshaft by hand several times, then install the spark plug.
- Do not engage the park brake, but secure the car from rolling.
- While engine is still warm, change oil.
- Clean body, chassis and engine of debris, mud, chaff or grass.

HARDWARE

Periodically, the vehicle should be inspected for loose fasteners. Use care when tightening fasteners. Refer to the

Technician's Repair and Service Manual for specific torque values.

Generally, three classes of standard hardware and two classes of metric hardware are used in the vehicle. Grade 5 hardware can be identified by the three marks on the hex head and grade 8 hardware is identified by six marks on the head. Metric hardware is marked on the head with 8.8 or 10.9. Unmarked hardware is Grade 2. (Ref. Fig. 5 on page A-6).

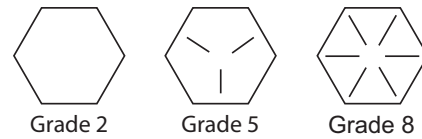


Fig. 5 Bolt Grades

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

GENERAL INFORMATION & ROUTINE MAINTENANCE

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

PERIODIC SERVICE SCHEDULE

✓ - CHECK C&A - CHECK & ADJUST CL - CLEAN R - REPLACE

REMARKS	Before each use DAILY	WEEKLY	20 hrs 100 miles/160 kms MONTHLY	60 hrs 300 miles/500 kms QUARTERLY	125 hrs 600miles/1000 kms SEMI-ANNUAL	250 hrs 1200miles/2000 kms ANNUAL	5 YEARS	PAGE
Tires - pressure, condition of tires & rims	✓	✓	✓	✓	✓	✓		
Hardware - loose or missing	✓	✓	✓	✓	✓	✓		
Reverse Warning Indicator	✓	✓	✓	✓	✓	✓		
Overall Vehicle Condition	✓	✓	✓	✓	✓	✓		
Battery Pack - state of charge, condition, loose terminals, corrosion, hold down & hardware	✓	✓	CL	CL	CL	CL		
Brake Pedal - smooth operation	✓	✓	✓	✓	✓	✓		
Brakes - check fluid level in master cylinder						✓		
Brakes - aggressive stop test			C&A	C&A	C&A	C&A		
Park Brake - operation, does it hold on a hill	✓	✓	C&A	C&A	C&A	C&A		
Accelerator - smooth operation	✓	✓	✓	✓	✓	✓		
Charger / Receptacle - inspect charger connector and receptacle at each charge	✓	✓	✓	✓	✓	✓		
Wiring - loose connections, broken or missing insulation			✓	✓	✓	✓		
Carburetor Linkage - attachment			C&A	C&A	C&A	C&A		
Carburetor						CL		
Direction Selector - attachment and mechanism			C&A	C&A	C&A	C&A		
Cooling Fan - build up of debris inside blower housing		C&A	C&A	C&A	C&A	C&A		
Engine Oil ** - oil level		C&A	C&A	C&A	C&A	C&A		
Engine Oil **& Filter - drain and change					R	R		
Engine - noise, vibration, acceleration, oil leaks			C&A	C&A	C&A	C&A		
Valves - check cold - Ref: Repair & Service Manual						C&A		
Cylinder Head & Pistons - remove carbon							CL	
Choke Cable - smooth movement & adjustment			C&A	C&A	C&A	C&A		
Cooling Fan - build-up of foreign matter inside housing & fins			CL	CL	CL	CL		
Steering Assembly - excessive play, loose or missing hardware			✓	✓	✓	✓		
Tie Rods - excessive play, bent rods, loose or missing hardware			✓	✓	✓	✓		
Axle - fluid level, oil leakage, noise, loose or missing hardware			✓	✓	✓	✓		

GENERAL INFORMATION & ROUTINE MAINTENANCE

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

REMARKS	Before each use DAILY	WEEKLY	20 hrs 100 miles/160 kms MONTHLY	60 hrs 300 miles/500 kms QUARTERLY	125 hrs 600miles/1000 kms SEMI-ANNUAL	250 hrs 1200miles/2000 kms ANNUAL	5 YEARS	PAGE
Axles - drain & replace fluid							R	
Rear Suspension - shock oil leakage, worn bushings, loose or missing hardware				✓	✓	✓		
Front Suspension - strut oil leakage, excessive play in hubs or kingpins, worn bushings, loose or missing hardware			✓	✓	✓	✓		
Front Wheel Alignment - unusual tire wear				C&A	C&A	C&A		
Throttle/Governor Linkage - operation & governed speed				✓	✓	✓		
Air Filter Element - check & replace as necessary					✓	✓		
Drive Belt - cracks, frayed, excessive wear					✓	✓		

Fig. 7 Periodic Service Schedule

NOTICE

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

Change oil after first 8 hours, then after every 50 hours.

Change oil every 25 hours when operating under heavy load or in higher temperatures.

Clean more often under dusty conditions or when airborne debris are present. Clean foam pre-cleaner first and replace paper cartridge if dirty. Replace even if it shows signs of damage.

CAPACITIES AND REPLACEMENT PARTS

REPLACEMENT PART NUMBERS	
Oil Filter	See Appendix A, Briggs & Stratton Operator's Manual
Air Filter	See Appendix A, Briggs & Stratton Operator's Manual
Spark Plug	See Appendix A, Briggs & Stratton Operator's Manual
Starter/Generator Belt	p/n 75690G01
LED Headlight Bulb	p/n 619101
Turn Signal Bulb	p/n 619102
Taillight Bulb	#1157 p/n 21759G1

Fig. 9 Replacement Part Numbers

CAPACITIES	
Fuel Tank / Fuel	5.3 gal (20 liters) / 87 Octane Min.
Engine Oil	48 oz. synthetic oil 5W30
Front Axle Oil	13.8 oz. 90 wt. gear oil
Rear Axle Oil	48 oz. SAE 30 wt. oil
Brake Fluid	DOT 3

Fig. 8 Capacities

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SAFETY

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

NOTES:

A large grid of graph paper, consisting of approximately 30 columns and 40 rows of small squares, intended for taking notes.

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

NOTES, CAUTIONS, WARNINGS AND DANGERS

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

NOTICE

A NOTE 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.

DANGER

Indicates a hazardous situation which, if not avoided, will result in death or serious injury.

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

WARNING

To prevent severe injury or death resulting from improper servicing techniques, do not attempt any type of servicing operations before reading and understanding all notes, cautions and warnings in this manual.

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 and understand the entire relevant manual section (chapter) before attempting any inspection or service.

SAFETY

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

BEFORE SERVICING THE VEHICLE

Before attempting to inspect or service a vehicle, be sure to read and understand 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 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.

The parking 'PARK' brake should always be set, except for cases where the powertrain must be allowed to rotate or service is being performed on the brake system.

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

Additional Warnings

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.

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

Never confuse the hoses to and from the fuel pump. Verify that the carburetor and pulse lines are correctly installed before starting the engine (see FUEL SYSTEM section).

Hydrogen gas is generated in the charging cycle of batteries and is explosive in concentrations as low as 4%. Because hydrogen gas is lighter than air, it will collect in the ceiling of buildings necessitating proper ventilation. Five air exchanges per hour is considered the minimum requirement.

Be sure that the key switch is off and all electrical accessories are turned off before starting work on vehicle.

Batteries should always be removed before any servicing or repairs that could generate sparks.

Never disconnect a circuit under load at a battery terminal.

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



Batteries are heavy. Use proper lifting techniques when moving them. Always lift the battery with a commercially available battery lifting device. Use care not to tip batteries when removing or installing them; spilled electrolyte can cause burns and damage.

The electrolyte in a storage battery is an acid solution which can cause severe burns to the skin and eyes. Treat all electrolyte spills to the body and eyes with extended flushing with clear water. Contact a physician immediately.



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

Any electrolyte spills should be neutralized with a solution of 1/4 cup (60 ml) sodium bicarbonate (baking soda) dissolved in 1 1/2 gallons (6 liters) of water and flushed with water.



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.

CAUTION

Overfilling batteries may result in electrolyte being expelled from the battery during the charge cycle. Expelled electrolyte may cause damage to the vehicle and storage facility.

Refer to BATTERIES AND BATTERY CHARGER section for removal and installation of the batteries.

LIFTING THE VEHICLE

Tool List	Qty.
Floor jack	1
Jack stands	4
Chocks	4

WARNING

To reduce the possibility of severe injury or death from a vehicle falling from a jack:

Always place chocks in front and behind the wheels not being raised.

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.

SAFETY

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

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 (Ref. Fig. 1 on page B-4).

Remove payload from vehicle before lifting. No person(s) should be in or on the vehicle while lifting.

To raise the entire vehicle, install the wheel chocks in front and behind each front wheel (Ref. Fig. 2 on page B-4).

Center the jack under rear differential skid plate, raise the vehicle and position jack stands under the frame just in front of each pair of leaf spring mounting brackets welded to the frame.

Lower jack and test stability of the vehicle on two jack stands.

Place the jack under the center front skid plate, raise the vehicle and position jack stands under each front frame rail just behind the front cross piece.

Lower jack and test stability of vehicle on all four jack stands.

To lower the vehicle reverse the lifting sequence.

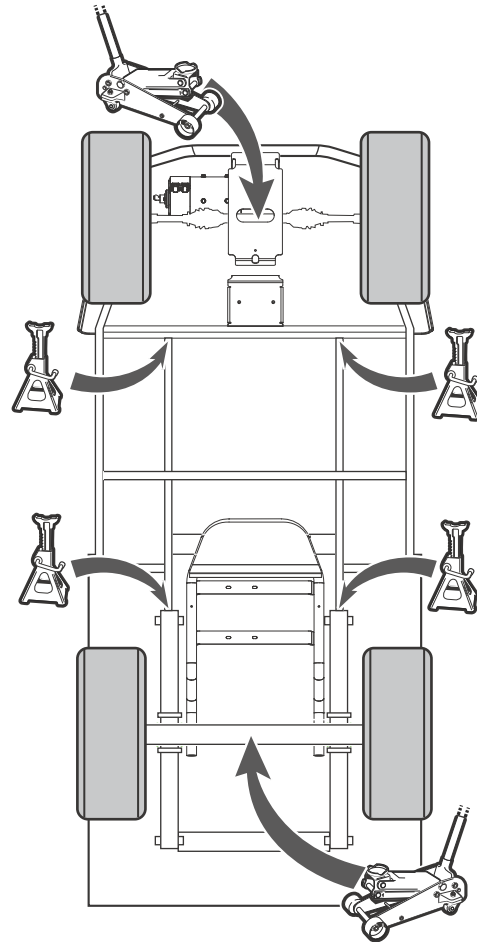


Fig. 1 Lifting the Vehicle

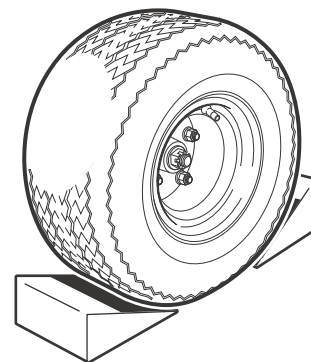


Fig. 2 Wheel Chocks

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

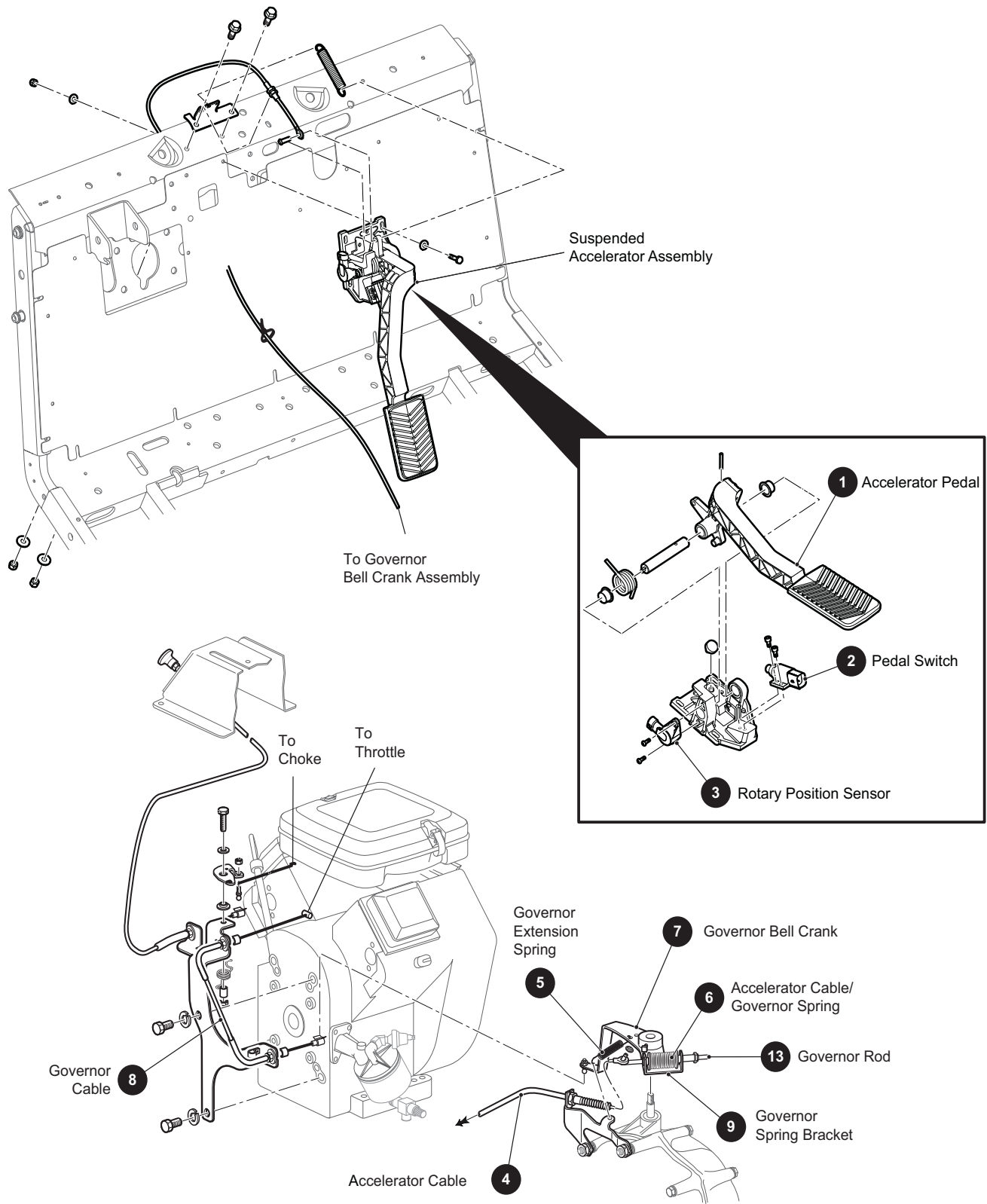


Fig. 1 Accelerator Components

ACCELERATOR

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



ACCELERATOR, GOVERNOR AND CARBURETOR LINKAGE

System Operation

NOTICE

The linkages that control the accelerator mechanism, governor and carburetor 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.

When the accelerator pedal (1) is depressed, the accelerator cable (4) is pulled towards the pedal and towards front of the vehicle, against the resistance offered by the governor spring (6) in compression (Ref. Fig. 1 on page C-1).

As the accelerator pedal moves down, the micro switch (2) under the pedal is pushed and it activates the ignition circuit.

The rear end of the accelerator cable is joined to the governor rod (13) which is connected to governor spring (9) in a bracket.

When the accelerator cable is pulled towards the pedal by depression on the pedal, the governor spring (6) compresses until it overcomes the resistance exerted by the governor mechanism. As the accelerator cable/governor spring overcomes these forces, the governor bellcrank (7) moves and the motion is transferred through the governor cable (8) to the throttle lever on the carburetor.

As the force on the pedal is released or relaxed, an extension spring connecting the governor bell crank and accelerator cable bracket brings back the bell crank into normal position.

Governor Operation

Until the vehicle reaches its governed speed, the vehicle will continue to accelerate in relation to the accelerator pedal (1) position. When the governed speed is reached, the ground speed governor in the rear axle assembly operates against the accelerator cable/governor spring and closes the carburetor until the correct governed speed is achieved (Ref. Fig. 1 on page C-1).

It is the force of the accelerator cable/governor compression spring in response to accelerator pedal and governor bellcrank position which controls the position of the carburetor throttle plate. The compression spring provides cushioning of sudden changes in throttle linkage position to provide smooth power transmission.



ACCELERATOR, ROTARY POSITION SENSOR

Rotary position sensor helps to determine the speed of the vehicle in the electric powertrain mode. Rotary position sensor (3) is connected through the main harness to electronic speed control system of the vehicle. When there is no pressure applied on the accelerator pedal (1), the rotary position sensor remains in the neutral position. As the pedal is depressed, the magnitude of deflection in the rotary sensor is transferred to the electronic speed control system of the vehicle which controls the speed of the motor that transmits power to the electric power train module in the vehicle. For more information See 'Electronic Speed Control' in section 'J' (Electrical section) of this manual.



WARNING

Tampering with or adjusting the speed control system to go beyond factory specified speed will void the warranty, is dangerous, could cause a loss of vehicle control and possible injury or death.



CAUTION

If the governor requires service, the service must be performed by an authorized service branch or distributor who will reseal the governor after calibration.

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 affect the performance characteristics of the vehicle but they should be investigated only after confirming the linkage adjustment.

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

GOVERNOR CABLE ADJUSTMENT PROCEDURE

Tool List	Qty.
Wrench, 1/2"	2

Properly adjusted, the cable should be short enough to be slightly loose but not too short to be pulling on the lever when at rest (Ref. on page C-3).

To permit proper cable adjustment, the cable length may be increased/decreased at its mounting bracket. This is accomplished by moving the cable housing forward/backward at the bracket attachment to increase/decrease the amount of available cable.

To decrease amount of available cable, loosen the nuts on either side of the bracket and move the cable away from the lever. Once correct length is achieved, tighten the nuts.

To increase amount of available cable, loosen the nuts on either side of the bracket and allow the cable to move closer to the lever. Once correct length is achieved, tighten the nuts.

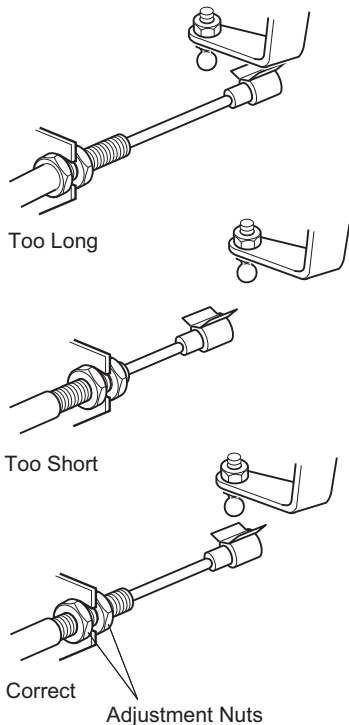


Fig. 2 Governor Cable Adjustment

ACCELERATOR/GOVERNOR CABLE ADJUSTMENT

Tool List	Qty.
Wrench, 3/8"	1

WARNING

Remove the negative (-) starter battery cables at the battery to prevent the vehicle moving and the possible personal injury that may result. Refer to section 'B' of this manual for additional cautions and warnings.

Loosen the adjustment nuts on the accelerator cable bracket. Tighten front adjustment nut till governor bellcrank begins to pivot. Back off adjustment nut 1 turn and tighten rear adjustment nut. As a final check, with the gas pedal up, the accelerator cable must be slightly loose between the accelerator cable bracket and the governor spring assembly.

CAUTION

The function of the carburetor and governor system may be impaired if no movement is evident.

If, after adjusting accelerator cable, the vehicle backfires (indicating carburetor is not closing fully) or shows a lack of performance (indicating carburetor is not opening fully), an adjustment to the accelerator cable is required.

Loosen the adjustment nuts on each end of the governor cable. With governor bellcrank at rest, tighten the outside upper adjustment nut till the throttle lever begins to lift off the carburetor throttle stop. Back off adjustment nut 1 1/2 turns and tighten the inside upper adjustment nut. Tighten the nuts at the lower end of cable. Pull cable to check that throttle lever has full travel (i.e. contacts throttle stop in both full open and full closed throttle plate position).

Check choke function and adjust choke cable if required. See 'Choke Cable Installation and Adjustment' in the FUEL SYSTEM section.

If, after performing the cable adjustments, the vehicle performance is still not satisfactory, proceed to the pedal box and accelerator pedal area for adjustments.

ACCELERATOR

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



GOVERNOR COMPRESSION SPRING ADJUSTMENT

Tool List	Qty.
Wire cutter	1
Pliers.....	1
Wrench, 3/8"	1

WARNING

Tampering with or adjusting the speed control system to go beyond factory specified speed will void the warranty, is dangerous, could cause a loss of vehicle control and possible injury or death.

CAUTION

If the governor requires service, the service must be performed by an authorized service branch or distributor who will reseal the governor after calibration.

NOTICE

Tampering or removal of governor seal by anyone other than authorized service or branch personnel will void warranty.

Hold the governor compression spring adjuster rod (13) when turning the governor adjuster (10). Failure to hold the rod will cause the accelerator cable to twist which may cause premature failure.

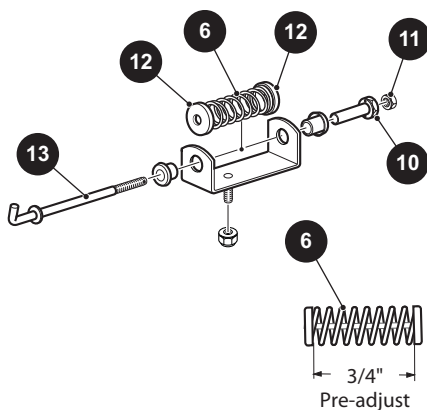


Fig. 3 Governor Spring Adjustment

Cut and remove safety seal. Hold governor adjuster (10) and loosen the jam nut (11) (Ref. Fig. 3 on page C-4).

Pre-adjust governor compression spring (6) by holding governor rod (13) and rotating governor adjuster (10) until a dimension of 3/4" is achieved between the inside of the cup washers (12). This dimension is a starting point and may be further adjusted after a road test.

Tighten the jam nut (11) and perform road test. See 'Road Test' on page C- 4.

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:

$$\text{Rate (in MPH)} = (\text{Distance in feet} \div 5280) \div (\text{Time in seconds} \div 3600)$$

or

$$\text{Rate (in KPH)} = (\text{Distance in meters} \div 1000) \div (\text{Time in seconds} \div 3600)$$

For example:

$$(300 \text{ ft.} \div 5280) \div (13.6 \text{ sec.} \div 3600) = 15 \text{ MPH}$$

or

$$(100 \text{ m} \div 1000) \div (15 \text{ sec.} \div 3600) = 24 \text{ KPH}$$

If the speed is not within the specified speed range, stop the vehicle and adjust the governor compression spring. Tightening the spring results in a speed increase while loosening it will result in a speed decrease. Repeat road test and adjustment procedure until the factory recommended governed speed is achieved.

Install new safety seal on governor after calibrating the vehicle.

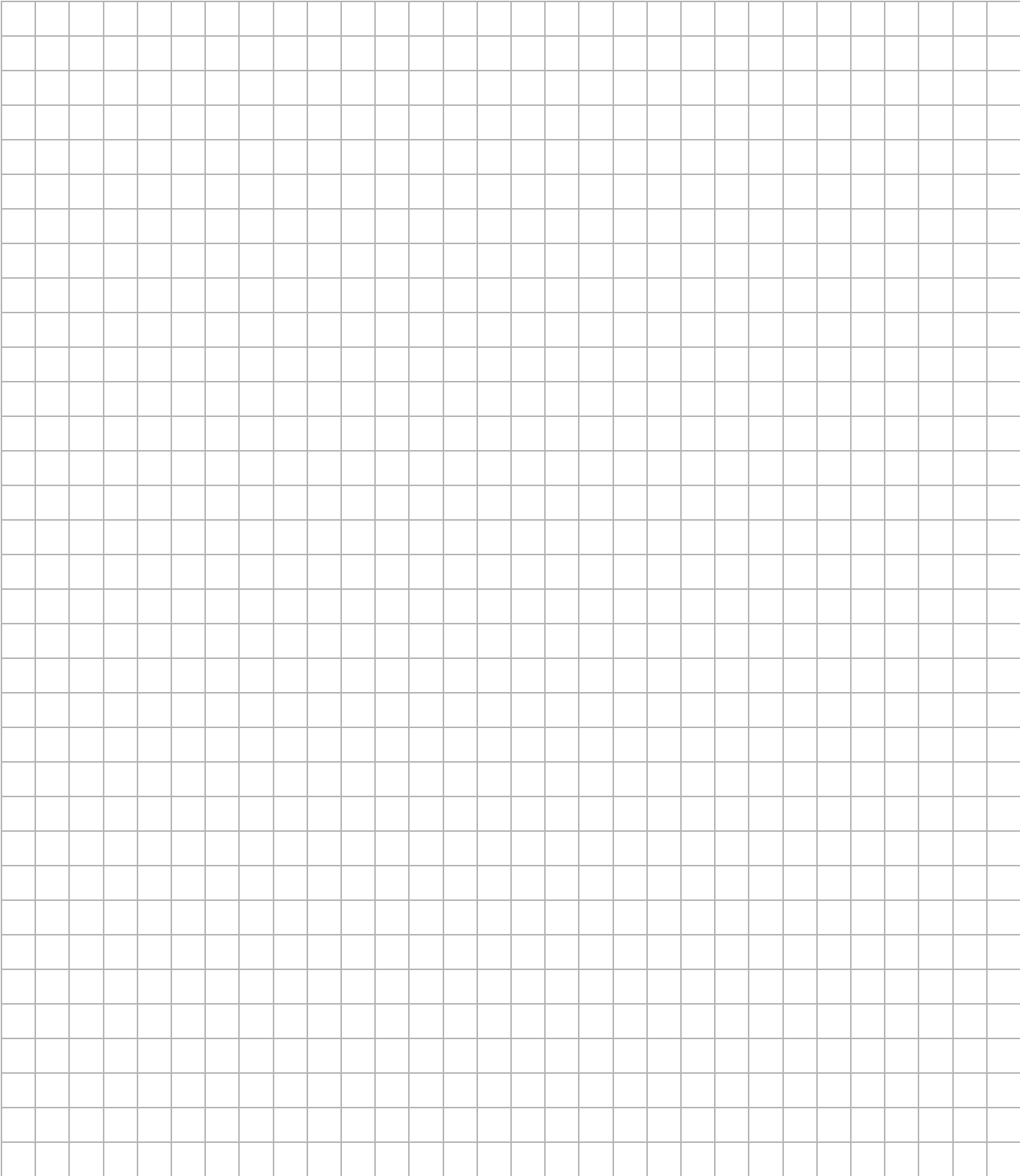
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BATTERIES AND BATTERY CHARGER

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

NOTES:

A large grid area for taking notes, consisting of 30 columns and 30 rows of small squares.

BATTERIES AND BATTERY CHARGER

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

SAFETY

NOTICE

Always observe the following warnings when working on or near batteries:

WARNING

To prevent battery explosion that could result in severe personal injury or death, keep all smoking materials, open flame or sparks away from the batteries.

Hydrogen gas is formed when charging batteries. Do not charge batteries without adequate ventilation. A 4% concentration of hydrogen gas is explosive.

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.



Batteries are heavy. Use proper lifting techniques when moving them. Always lift the battery with a commercially available battery lifting device. Use care not to tip batteries when removing or installing them;

spilled electrolyte can cause burns and damage.

The electrolyte in a storage battery is an acid solution which can cause severe burns to the skin and eyes. Treat all electrolyte spills to the body and eyes with extended flushing with clear water. Contact a physician immediately.



Always wear a safety shield or approved safety goggles when adding water or charging batteries.

Any electrolyte spills should be neutralized with a solution of 1/4 cup (60 ml) sodium bicarbonate (baking soda) dissolved in 1 1/2 gallons (6 liters) of water and flushed with water.

Overfilling batteries may result in electrolyte being expelled from the battery during the charge cycle. Expelled electrolyte may cause damage to the vehicle and storage facility.

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.



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.

BATTERY

A battery is defined as two dissimilar metals immersed in an acid. If the acid is absent or if the metals are not dissimilar, a battery has not been created. The batteries most commonly used in these vehicles are lead acid.

A battery does not store electricity, but is able to produce electricity as the result of a chemical reaction which releases stored chemical energy in the form of electrical energy. The chemical reaction takes place faster in warm conditions and slower in cold conditions. Temperature is important when conducting tests on a battery and test results must be corrected to compensate for temperature differences.

As a battery ages, it still performs adequately except that its capacity is diminished. Capacity describes the time that a battery can continue to provide its design amperes from a full charge.

A battery has a maximum life, therefore good maintenance is designed to maximize the available life and reduce the factors that can reduce the life of the battery.

BATTERIES AND BATTERY CHARGER

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

Battery Removal And Installation



Starter Battery Removal and Installation

Tool List

	Qty.
Insulated wrench, 1/2"	1
Socket, 1/2"	1
Extension, 12"	1
Ratchet	1
Battery carrier	1
Torque wrench, ft. lbs.	1
Torque wrench, in. lbs.	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 Section 'A'.

WARNING



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.

out' a battery, which could result in an explosion and severe personal injury or death.

To gain access to the starter battery, remove the DC/DC convertor. See "DC/DC Convertor Replacement" on page D-3

Turn vehicle key 'OFF' and remove. Insure all optional electrical accessories are turned OFF.

Remove hardware from the negative (-) cable before removing the positive (+) cable. Remove the two bolts (3) and nuts (4) from the battery hold down (2) and remove the battery (1) (Ref. Fig. 1 on page D-2). Be sure to remove all corrosion from terminals and hardware. See 'PERIODIC SERVICE SCHEDULE' in Section A.

If the battery has been kept clean and any acid in the battery rack area neutralized as recommended, no corrosion to the battery rack or surrounding area should be present. Any corrosion found should be immediately removed with a putty knife and a wire brush. The area should be washed with a solution of sodium bicarbonate (baking soda) and water and thoroughly dried before priming and painting with a corrosion resistant paint.

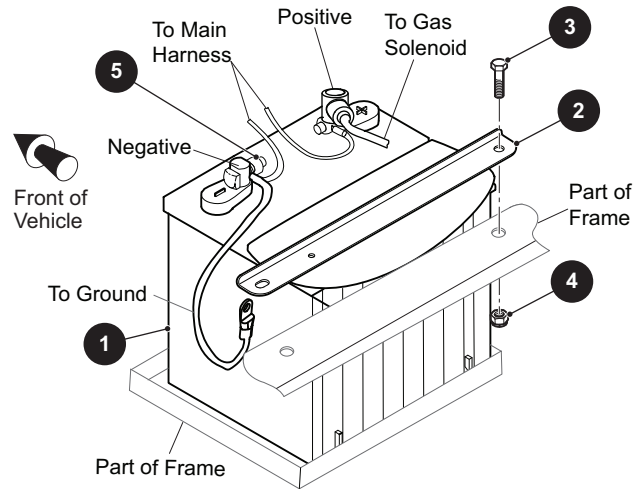


Fig. 1 Starter Battery Removal

Install battery in reverse order of removal. Connect the positive (+) battery cable first. Connect negative (-) battery cable last.

Use care to connect the battery wires as shown (Ref. Fig. 1 on page D-2). Ensure that all battery terminals are installed with crimp up. Tighten the battery terminal hardware and the battery hold down hardware to torques values as specified below. Do not over-torque the terminal stud nut. This will cause a "mushroom" effect on the battery post which will prevent the terminal nut from being properly tightened. Protect the battery terminals and battery wire terminals with a commercially available protective coating.

Item	Torque Specification
4	15 - 18 ft. lbs. (20.33-24.40 Nm)
5	10 - 15 ft. lbs. (13.55-20.33 Nm)

WARNING

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

After installing battery, coat terminals with commercially available terminal protectant.

BATTERIES AND BATTERY CHARGER

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

DC/DC Convertor Replacement

Tool List	Qty.
Insulated wrench, 1/2"	1
Phillips screwdriver.....	1
Wrench, 3/8".....	1
Socket, 3/8"	1
Ratchet.....	1
Torque wrench, ft. lbs.	1

WARNING

To prevent personal injury, disconnect negative (-) battery cables using an insulated wrench before servicing vehicle.

Turn vehicle key 'OFF' and remove.

Remove the round connector from the DC/DC convertor (11). (Ref. Fig. 2 on page D-3).

Remove the screws (12), flat washers (13) and lock nuts (14) that secure the DC/DC convertor (11) to the frame.

Install the DC/DC convertor (11) in reverse order of removal. Tighten the locknuts (14) to torque specified below.

Item	Torque Specification
14	3.6 - 4.2 ft. lbs. (4.9 - 5.7 Nm)

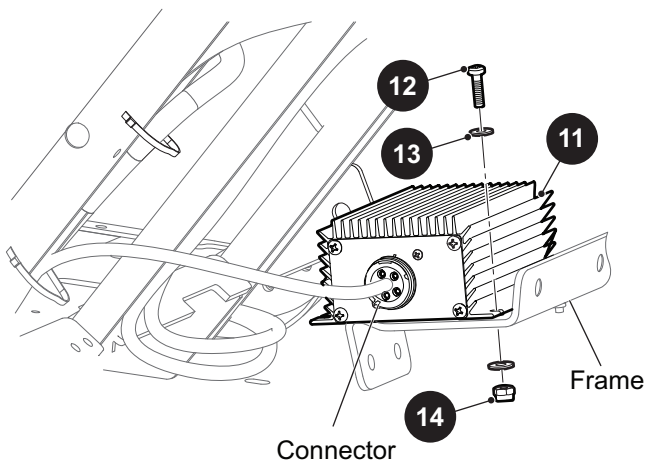


Fig. 2 DC/DC Convertor



Electric Powertrain Batteries Removal and Installation

Tool List	Qty.
Insulated wrench, 9/16"	1
Socket, 9/16"	1
Extension.....	1
Ratchet	1
Battery carrier	1
Torque wrench, ft. lbs.....	1
Torque wrench, in. lbs.....	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 Section 'A'.

WARNING



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.

Turn vehicle key 'OFF' and remove. Insure all optional electrical accessories are turned OFF.

Remove hardware from the negative (-) cable before removing the positive (+) cable. Remove the bolt (7) and nut (8) from the battery hold down (9) and remove the batteries (6) using battery carrier (Ref. Fig. 3 on page D-4). Be sure to remove all corrosion from terminals and hardware and wash battery tray (10). See 'PERIODIC SERVICE SCHEDULE' in Section A.

If the batteries have been cleaned and any acid in the battery rack area neutralized as recommended, no corrosion to the battery racks or surrounding area should be present. Any corrosion found should be immediately removed with a putty knife and a wire brush. The area should be washed with a solution of sodium bicarbonate (baking soda) and water and thoroughly dried before priming and painting with a corrosion resistant paint.

Installation of the battery is in the reverse order of removal. Place the batteries (6) in the battery racks (10). Replace the battery hold down (9) and tighten the battery hold down bolt (7) and nut (8) to 12-15 ft. lbs.

BATTERIES AND BATTERY CHARGER

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

(15-20 Nm) tight enough to prevent movement of the battery, but not to cause distortion of the battery cases. Inspect all wires and terminals. Clean any corrosion from the battery terminals or the wire terminals with a solution of sodium bicarbonate (baking soda) and brush clean if required.

Use care to connect the battery wires as shown (Ref. Fig. 4 on page D-4). Ensure that all battery terminals are installed with crimp up. Tighten the battery terminal hardware to 8 - 9 ft. lbs. (10.8 - 12.2 Nm) torque. Do not over-torque the terminal stud nut. This will cause a "mushroom" effect on the battery post which will prevent the terminal nut from being properly tightened. Protect the battery terminals and battery wire terminals with a commercially available protective coating.

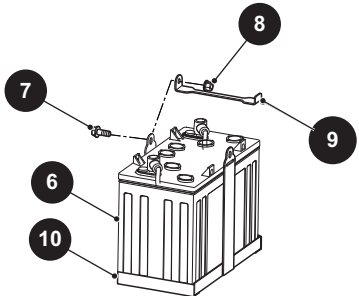


Fig. 3 Electric Powertrain Batteries Removal

WARNING

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

After installing battery, coat terminals with commercially available terminal protectant.

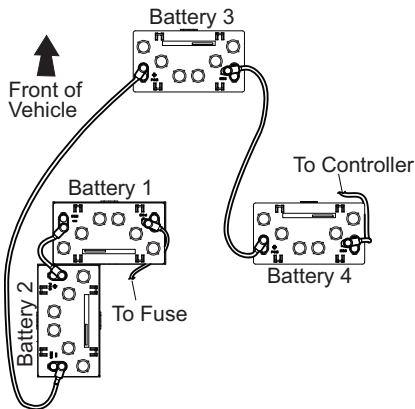


Fig. 4 Battery Connections

BATTERY MAINTENANCE

Tool List	Qty.
Insulated wrench, 9/16"	1
Socket, 9/16"	1
Ratchet	1
Battery carrier	1
Hydrometer	1
Battery protective spray	1

At each Charging Cycle

WARNING

To reduce the possibility of fire, never attach a battery charger to a vehicle that is to be unattended beyond the normal charging cycle. Overcharging could cause damage to the vehicle batteries and result in extreme overheating. The charger should be checked after 24 hours and unplugged after the charge cycle is complete.

Before charging the batteries, inspect the plug of the battery charger and vehicle receptacle housing for dirt or debris.

Charge the batteries after each days use.

Monthly

- Inspect all wiring for fraying, loose terminations, corrosion or deterioration of insulation.
- Check that the electrolyte level is correct and add suitable water as required.
- Clean the batteries and wire terminations.

Electrolyte Level and Water

The correct level of the electrolyte is 1/2" (13 mm) above the plates in each cell (Ref. Fig. 5 on page D-5).

This level will leave approximately 1/4" - 3/8" (6 - 10 mm) of space between the electrolyte and the vent tube. The electrolyte level is important since any portion of the plates exposed to air will be ruined beyond repair. Of equal importance is too much water which will result in electrolyte being forced out of the battery due to gassing and the increase in volume of the electrolyte that results from the charging cycle.

BATTERIES AND BATTERY CHARGER

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

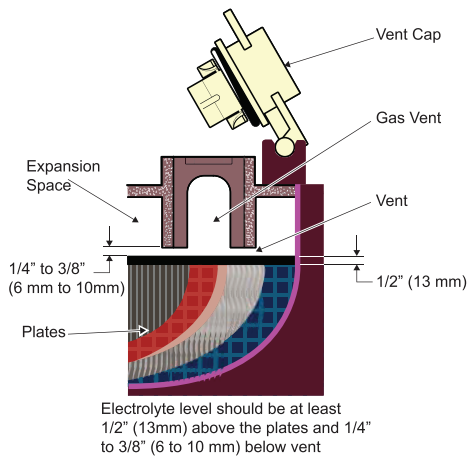


Fig. 5 Correct Electrolyte Level

CAUTION

Do not overfill batteries. The charging cycle will expel electrolyte and result in component damage.

A battery being charged will 'gas' with the majority of the gassing taking place at the end of the charging cycle. This gas is hydrogen which is lighter than air. Water and sulfuric acid droplets will be carried out of the battery vents by the hydrogen gas; however, this loss is minimal. If the battery electrolyte level is too high, the electrolyte will block the vent tube and the gas will force it out of the vent tube and battery cap. The water will evaporate but the sulfuric acid will remain where it can damage vehicle components and the storage facility floor. Sulfuric acid loss will weaken the concentration of acid within the electrolyte and reduce the life of the battery.

Over the life of the battery, a considerable amount of water is consumed. It is important that the water used be pure and free of contaminants that could reduce the life of the battery by reducing the chemical reaction. The water must be distilled or purified by an efficient filtration system. Water that is not distilled should be analyzed, and if required, a filtration installed to permit the water to meet the requirements of the water purity table (Ref. Fig. 6 on page D-5).

Impurity	Parts Per Million
Color	Clear
Suspended	Trace
Total Solids	100
Calcium & Magnesium Oxides	40
Iron	5
Ammonia	8
Organic & Volatile Matter	50
Nitrites	5
Nitrates	10
Chloride	5

Fig. 6 Water Purity Table

Even if the water is colorless, odorless, tasteless and fit for drinking, the water should be analyzed to see that it does not exceed the impurity levels specified in the table.

Automatic watering devices such as the one included in the Battery Maintenance Kit (P/N 25587-G01) can be used with an approved water source (Ref. Fig. 7 on page D-5). These watering devices are fast and accurate to use and maintain the correct electrolyte level within the battery cells.

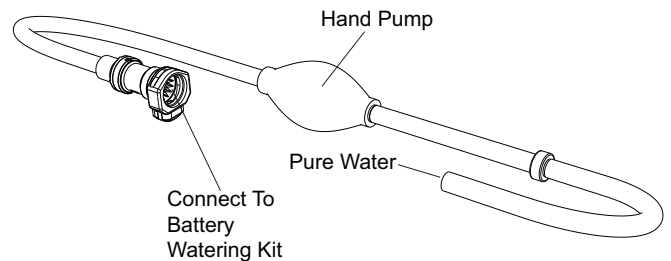


Fig. 7 Hand Pump for Watering the Batteries

NOTICE

The watering device should only be used if the electrolyte level is less than 1/2" (13 mm) above top of plates.

BATTERIES AND BATTERY CHARGER

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

Cleaning Batteries

When cleaning the outside of the batteries and terminals, do not use a water hose without first spraying with a solution of sodium bicarbonate (baking soda) and water to neutralize any acid deposits.

Use of a water hose without first neutralizing any acid, will move acid from the top of the batteries to another area of the vehicle or storage facility where it will attack the metal structure or the concrete/asphalt floor. After hosing down the batteries, a residue will be left on the batteries which is conductive and will contribute to the discharge of the batteries.

CAUTION

To prevent battery damage, be sure that all battery caps are tightly installed.

The correct cleaning technique is to spray the top and sides of the batteries with a solution of sodium bicarbonate (baking soda) and water. This solution is best applied with a garden type sprayer equipped with a non metallic spray wand. The solution should consist of 1/4 cup (60 ml) of sodium bicarbonate (baking soda) mixed with 1 1/2 gallons (6 liters) of clear water (Ref. Fig. 8 on page D-6). In addition to the batteries, special attention should be paid to metallic components adjacent to the batteries which should also be sprayed with the sodium bicarbonate (baking soda) solution.

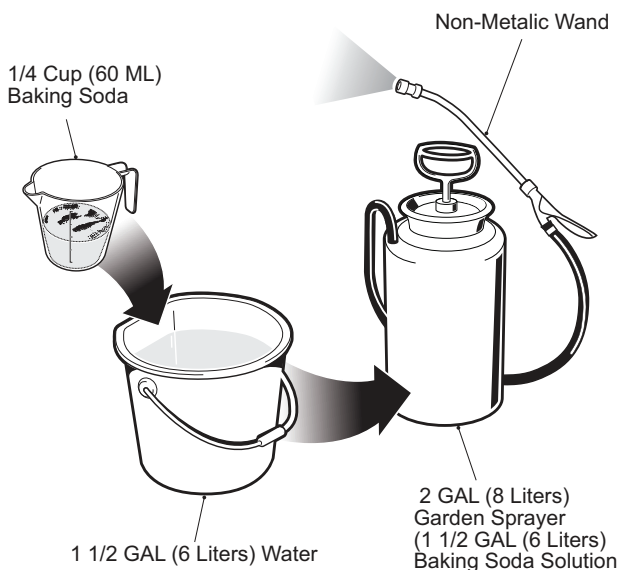


Fig. 8 Preparing Acid Neutralizing Solution

Allow the solution to sit for at least three minutes; use a soft bristle brush or cloth to wipe the tops of the batteries

in order to remove any residue that could cause the self discharge of the battery. Rinse the entire area with low pressure clear water. All of the items required for complete battery cleaning and watering are contained in the Battery Maintenance Kit (P/N 25587-G01).

Cleaning should take place once a month or more often under extreme conditions.

Prolonged Storage

Battery charger, controller and other electronic devices need to be disconnected since they will contribute to the premature discharge of batteries.

During periods of storage, the batteries will need attention to keep them maintained and prevent discharge.

In high temperatures the chemical reaction is faster, while low temperatures cause the chemical reaction to slow down. A vehicle that is stored at 90° F (32° C) will lose 0.002 of specific gravity each day. If a fully charged battery has a specific gravity of 1.275, and the battery is allowed to sit unused, it will become partially discharged. When it reaches 1.240, which it will do in less than twenty days, it should be recharged. If a battery is left in a discharged state, sulfating takes place on and within the plates. This condition is not reversible and will cause permanent damage to the battery. In order to prevent damage, the battery should be recharged. A hydrometer (P/N 50900-G1) can be used to determine the specific gravity and therefore the state of charge of a battery.

In winter conditions, the battery must be fully charged to prevent the possibility of freezing (Ref. Fig. 9 on page D-7). A fully charged battery will not freeze in temperatures above -75° F (-60° C). Although the chemical reaction is slowed in cold temperatures, the battery must be stored fully charged, and disconnected from any circuit that could discharge the battery. For portable chargers, disconnect the charging plug from the vehicle receptacle. For on-board chargers, disconnect the charging harness from the batteries. The batteries must be cleaned and all deposits neutralized and removed from the battery case to prevent self discharge. The batteries should be tested or recharged at thirty day minimum intervals.

BATTERIES AND BATTERY CHARGER

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

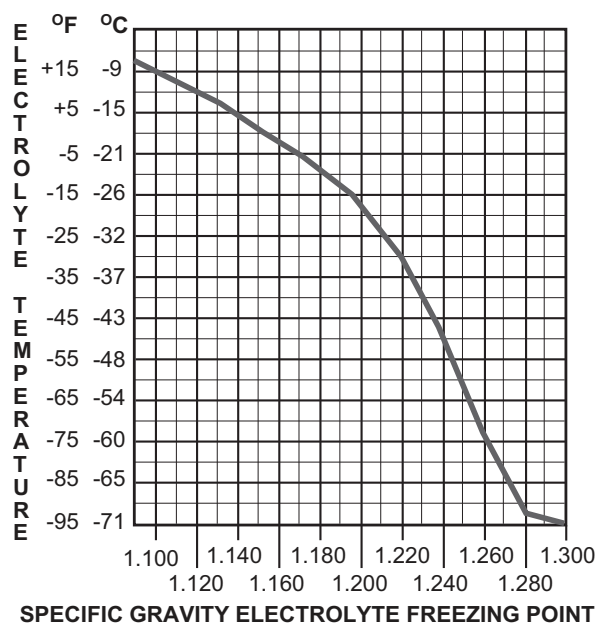


Fig. 9 Freezing Point of Electrolyte

48V Battery Set Charging

The battery charger is designed to fully charge the battery set. If the batteries are severely deep cycled, some automatic battery chargers contain an electronic module that may not activate and the battery charger will not function. Automatic chargers will determine the correct duration of charge to the battery set and will shut off when the battery set is fully charged. Always refer to the instructions of the specific charger used.

Before charging, the following should be observed:



CAUTION

Do not overfill batteries. The charging cycle will expel electrolyte and result in component damage.

- The electrolyte level in all cells must be at the recommended level and cover the plates.
- The charging must take place in an area that is well ventilated and capable of removing the hydrogen gas that is generated by the charging process. A minimum of five air exchanges per hour is recommended.
- The charging connector components are in good condition and free from dirt or debris.

- The charger connector is fully inserted into the vehicle receptacle.
- The charger connector/cord set is protected from damage and is located in an area to prevent injury that may result from personnel running over or tripping over the cord set.
- The charger is automatically turned off during the connect/disconnect cycle and therefore no electrical arc is generated at the DC plug/receptacle contacts.

AC Voltage

Battery charger output is directly related to the input voltage. If multiple vehicles are receiving an incomplete charge in a normally adequate time period, low AC voltage could be the cause and the power company should be consulted.

BATTERIES AND BATTERY CHARGER

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

TROUBLESHOOTING

In general, troubleshooting will be done for two distinct reasons. First, a battery that performs poorly and is outside of the manufacturer's specification should be identified in order to replace it under the terms of the manufacturer's warranty. Different manufacturers have different requirements. Consult the battery manufacturer or the manufacturer's representative for specific requirements.

The second reason is to determine why a particular vehicle does not perform adequately. Performance problems may result in a vehicle that runs slowly or in a vehicle that is unable to operate for the time required.

A new battery must mature before it will develop its maximum capacity. Maturing may take up to 100 charge/discharge cycles. After the maturing phase, the older a battery gets, the lower the capacity. The only way to determine the capacity of a battery is to perform a load test using a discharge machine following manufacturer's recommendations.

A cost effective way to identify a poorly performing battery is to use a hydrometer to identify a battery in a set with a lower than normal specific gravity. Once the particular cell or cells that are the problem are identified, the suspect battery can be removed and replaced. At this point there is nothing that can be done to salvage the battery; however, the individual battery should be replaced with a good battery of the same brand, type and approximate age.

Hydrometer

A hydrometer (P/N 50900-G1) is used to test the state of charge of a battery cell (Ref. Fig. 10 on page D-8). This is performed by measuring the density of the electrolyte, which is accomplished by measuring the specific gravity of the electrolyte. The greater the concentration of sulfuric acid, the more dense the electrolyte becomes. The higher the density, the higher the state of charge.

⚠ WARNING

To prevent battery explosion that could result in severe personal injury or death, never insert a metal thermometer into a battery. Use a hydrometer with a built in thermometer that is designed for testing batteries.

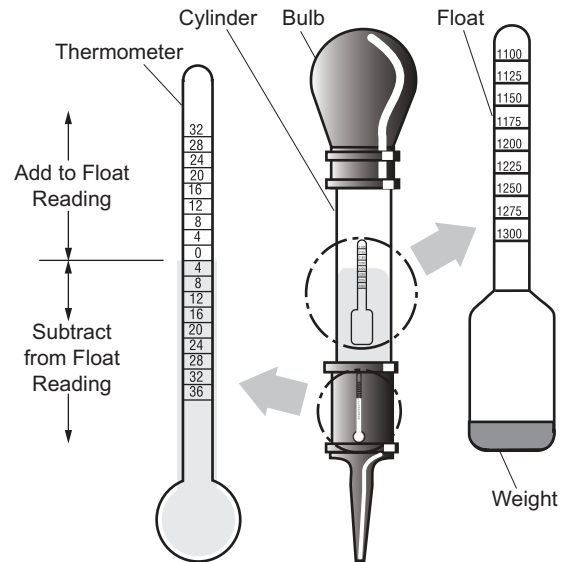


Fig. 10 Hydrometer

Specific gravity is the measurement of a liquid that is compared to a baseline. The baseline is water which is assigned a base number of 1.000. The concentration of sulfuric acid to water in a new vehicle battery is 1.280 which means that the electrolyte weighs 1.280 times the weight of the same volume of water. A fully charged battery will test at 1.275 - 1.280 while a discharged battery will read in the 1.140 range.

NOTICE

Do not perform a hydrometer test on a battery that has just been watered. The battery must go through at least one charge and discharge cycle in order to permit the water to adequately mix with the electrolyte.

The temperature of the electrolyte is important since the hydrometer reading must be corrected to 80° F (27° C). High quality hydrometers are equipped with an internal thermometer that will measure the temperature of the electrolyte and will include a conversion scale to correct the float reading. It is important to recognize that the electrolyte temperature is significantly different from the ambient temperature if the vehicle has been operated.

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

Using a Hydrometer

1. Draw electrolyte into the hydrometer several times to permit the thermometer to adjust to the electrolyte temperature and note the reading. Examine the color of the electrolyte. A brown or gray coloration indicates a problem with the battery and is a sign that the battery is nearing the end of its life.
2. Draw the minimum quantity of electrolyte into the hydrometer to permit the float to float freely without contacting the top or bottom of the cylinder.
3. Hold the hydrometer in a vertical position at eye level and note the reading where the electrolyte meets the scale on the float.
4. Add or subtract four points (.004) to the reading for every 10° F (6° C) the electrolyte temperature is above or below 80° F (27° C). Adjust the reading to conform with the electrolyte temperature, e.g., if the reading indicates a specific gravity of 1.250 and the electrolyte temperature is 90° F (32° C), add four points (.004) to the 1.250 which gives a corrected reading of 1.254. Similarly if the temperature was 70° F (21° C), subtract four points (.004) from the 1.250 to give a corrected reading of 1.246 (Ref. Fig. 11 on page D-9).
5. Test each cell and note the readings (corrected to 80° F or 27° C). A variation of fifty points between any two cell readings (example 1.250 - 1.200) indicates a problem with the low reading cell(s).

As a battery ages the specific gravity of the electrolyte will decrease at full charge. This is not a reason to replace the battery, providing all cells are within fifty points of each other.

Since the hydrometer test is in response to a vehicle exhibiting a performance problem, the vehicle should be recharged and the test repeated. If the results indicate a weak cell, the battery or batteries should be removed and replaced with a good battery of the same brand, type and approximate age.

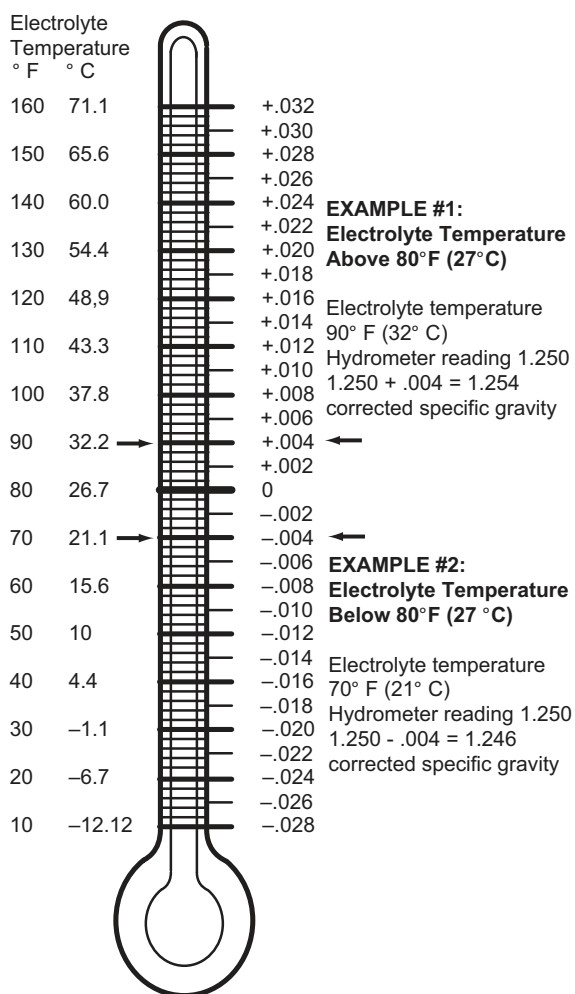


Fig. 11 Hydrometer Temperature Correction



48V BATTERY CHARGER

Charger Description

The Powerwise QE 48V charger is automatic and is designed specifically for charging electric vehicle batteries.

When the charger is plugged into a vehicle's charger receptacle it will automatically turn on and the charger's LED will start flashing GREEN to indicate the battery is charging.

When the LED is GREEN continuously the batteries are fully charged.

BATTERIES AND BATTERY CHARGER

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

Portable Charger Installation

WARNING

Use charger only on 48 volt battery systems. Other usage may cause personal injury and damage. Lead acid batteries may generate explosive hydrogen gas during normal operation. Keep sparks, flames, and smoking materials away from batteries. Provide adequate ventilation during charging. Never charge a frozen battery. Study all battery manufacturers' specific precautions such as recommended rates of charge and removing or not removing cell caps while charging.

DANGER

Risk of electric shock. Connect charger power cord to an outlet that has been properly installed and grounded in accordance with all local codes and ordinances. A grounded outlet is required to reduce risk of electric shock – do not use ground adapters or modify plug. Do not touch uninsulated portion of output connector or uninsulated battery terminal. Disconnect the DC supply before making or breaking the connections to the battery while charging.

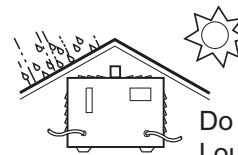
Do not open or disassemble charger.

Do not operate charger if the AC supply cord is damaged or if the charger has received a sharp blow, been dropped, or otherwise damaged in any way – refer all repair work to qualified personnel. Not for use by children.

Portable chargers are shipped with the vehicle. Prior to vehicle or charger operation, chargers must be removed and mounted on a platform or wall above the ground to permit maximum air flow around and underneath the charger. For optimum performance and shortest charge times, place the charger in an area with adequate ventilation. The charger should also be placed in an area that will be relatively free of dirt, mud, or dust since accumulations within the fins of the charger will reduce their heat-dissipating qualities. Optimal cooling also occurs when the charger is placed on a horizontal

surface with the fins vertical. More airflow from below the charger will help cool the fins, so placement above open areas or areas with cut-outs for airflow is desirable. If the charger is operated in an outdoor location, rain and sun protection must be provided. As the charger may get hot during operation, the charger must be placed such that risk of contact by people is reduced. Wall mount or shelf mount using #10-M5 screws. The charger's status display must be visible to the user.

Provide Protection From Elements



Do Not Block
Louvered Airways

 NEMA 15 - 5R Grounded AC Receptacle
110 - 120 VAC. Dedicated 15 AMP Circuit

Locations outside the US and Canada: Reference appropriate local electrical code and charger manufacturer recommendations for AC power requirements
Ref Pci 15

Fig. 12 Charger Installation

The charger may remain plugged into the AC outlet. To charge the vehicle refer to the instruction labels on the charger. Insert the polarized DC plug completely into the vehicle receptacle. The charger will automatically start a few seconds after the plug is in place. The charger will automatically stop when the batteries are fully charged and the DC plug can be removed to permit use of the vehicle.

NOTICE

Looping the DC cord through the steering wheel when charging serves as a good reminder to store the cord out of the way when finished with charging. The DC plug can be damaged by driving over or catching the cord on the vehicle when driving away.

WARNING

An ungrounded electrical device may become a physical hazard that could result in an electrical shock or electrocution.

BATTERIES AND BATTERY CHARGER

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

Understanding the Charger

When the charger is plugged into the vehicle's charger receptacle, the charger will automatically turn on and the charger's LED will start flashing GREEN to indicate the batteries are charging.

Once a minimum battery voltage of 2 volts per cell (Vpc) is reached, the charger's output current will change from a full current charge to the trickle rated charging current. The length of charge time will vary by how depleted the batteries are, the input AC voltage, and/or charger ambient temperatures. The charger's LED will give a SHORT flash if the charge is less than 80% and a LONG flash if the charge is greater than 80%. If the charger's LED is a steady GREEN the batteries are fully charged and the charger may be unplugged, although not necessary. The charger may be left plugged in for long periods of time to maintain the batteries charge level.

If a fault occurred anytime during the charging, the charger's LED will quickly flash RED. The specific fault is indicated by the number of RED flashes that occur, there will be a pause and then the flashes will repeat again. There are several possible conditions that will generate errors. Some errors will require human intervention to first resolve the problem and then reset the charger by unplugging the DC cord from the vehicle. If the AC voltage is interrupted and restored, the charger will turn back on automatically.

LED DISPLAY INFORMATION

LED Operation Codes:

SHORT GREEN FLASH = less than 80% charged
LONG GREEN FLASH = more than 80% charged
SOLID GREEN = 100% charged
RED FLASH = fault code

LED Fault Code:

RED FLASH: Light turns on briefly, but does not flash after that - check for valid AC voltage.

ONE RED FLASH: One flash, a pause and then again one flash and a pause - Charge Enable Fault: poor contact in the DC connector or dirty contacts or Battery Temperature Fault: battery temperature is greater than 122° F (50° C) or less than 14° F (-10° C).

TWO RED FLASHES: Two flashes, a pause and then again two flashes and a pause - Battery Voltage Fault: Battery pack is less than 36.0 Volts or more than 67.2 Volts. Battery pack is too discharged or over charged for the charger to work.

THREE RED FLASHES: Three flashes, a pause and

then again three flashes and a pause - Battery Charge Time-out: Charge time exceeded. This may indicate a problem with the battery pack or that the charger output current was severely reduced due to high ambient temperatures.

FOUR RED FLASHES: Four flashes, a pause and then again four flashes and a pause - Battery Fault: Charge time exceeded. This indicates a problem with the battery pack voltage not reaching the required nominal level within the maximum time allowed.

SIX RED FLASHES: Six flashes, a pause and then again six flashes and a pause - Charger Fault: An internal fault has been detected. If this fault is displayed again after unplugging the charger's DC power cord and plugging it back in, the charger must be taken to a qualified service center.

MAINTENANCE INSTRUCTIONS

1. For flooded lead-acid batteries, regularly check the water levels of each battery cell after charging and add distilled water as required to the level specified by the battery manufacturer. Follow the safety instructions recommended by the battery manufacturer.
2. Make sure the charger connections to the battery terminals are tight and clean. Check for any deformations or cracks in the plastic parts. Check the charger harness for chaffing and rubbing. Inspect all wiring for fraying, loose terminals, chaffing, corrosion or deterioration of the insulation.
3. Keep the cooling fins free of dirt and debris, do not expose the charger to oil, dirt, mud or to direct heavy water spray when cleaning equipment.
4. Inspect the plug of the battery charger and the vehicle receptacle housing for dirt or debris. Clean the DC connector monthly or more often if needed.

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

GENERAL

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 the table in Section A.

WARNING

To prevent possible injury or death from battery explosion, batteries should always be removed before any servicing that will generate sparks.

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 an internal component. As extra protection, it is recommended that a protective piece of sheet metal be placed between any component 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 the rivet head be removed in order to push out shank of rivet. The rivet head is easily removed by drilling into it with a sharp drill bit that is slightly larger than the shank of the rivet (Ref Fig. 1 on page E-1). Care must be exercised when drilling to prevent the drill from being forced through body panels 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.

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 following illustrations indicate the assembly methods for the various components.

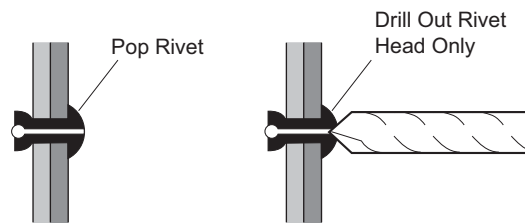


Fig. 1 Drill Out Metal Rivet

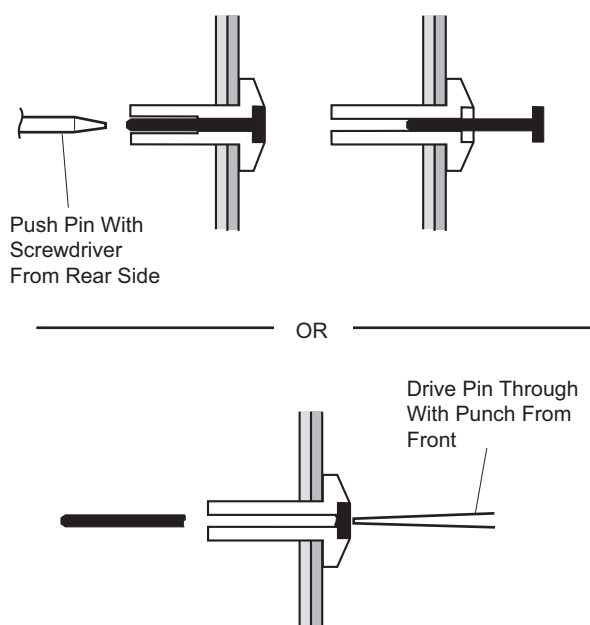


Fig. 2 Drive Rivet Removal

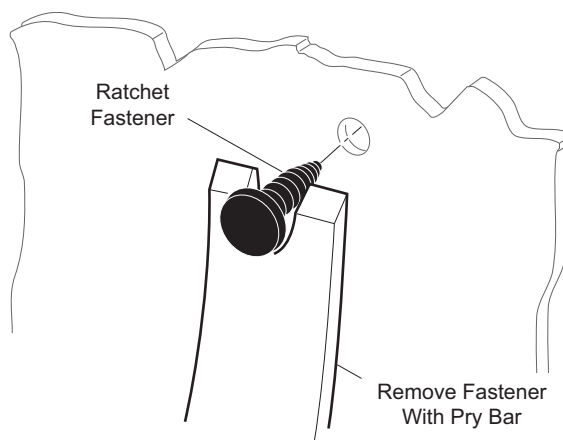


Fig. 3 Removing Ratchet Fasteners

BODY

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

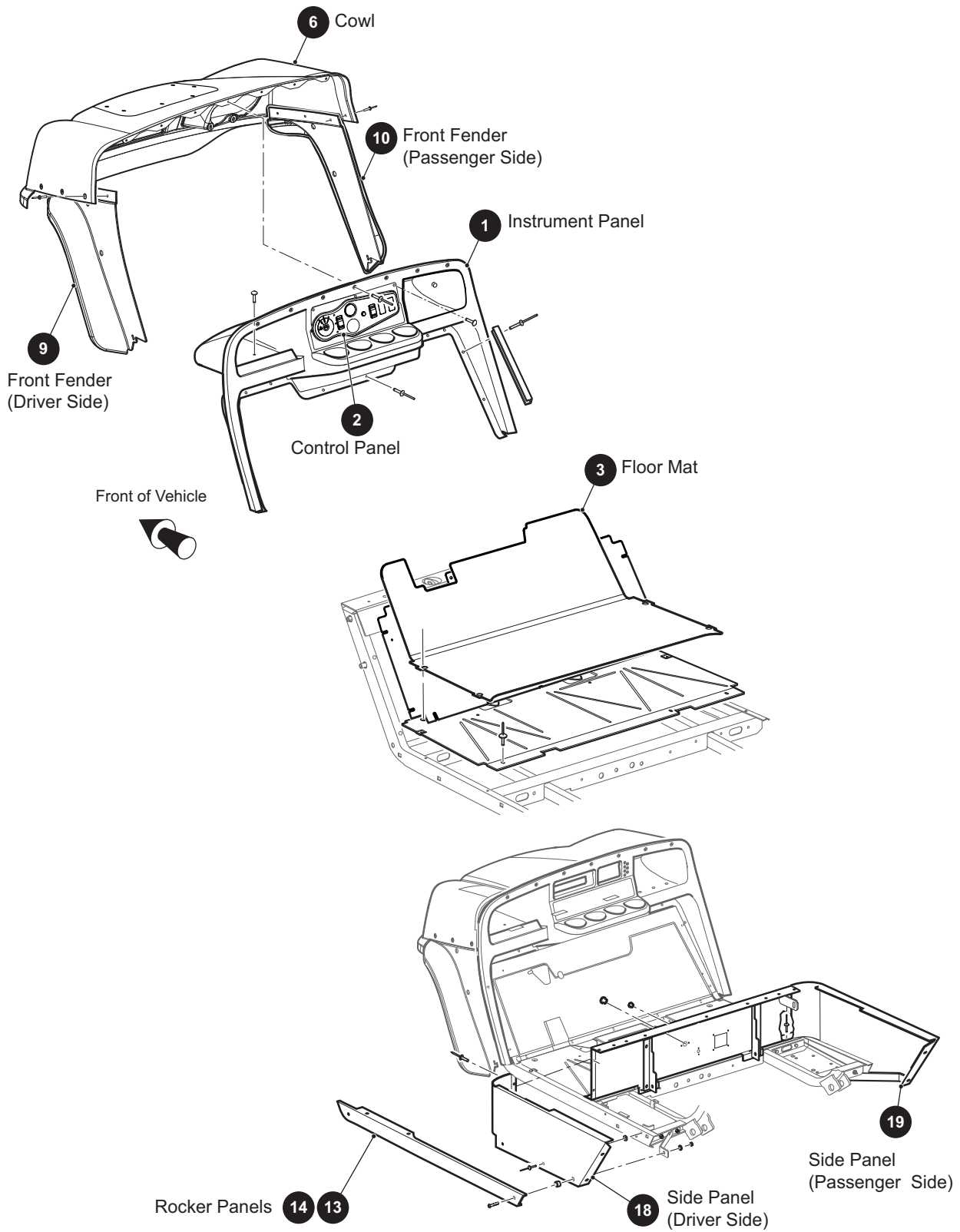


Fig. 4 Body Components (Front)

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

Instrument Panel Replacement

Tool List	Qty
Drill	1
Drill bit, #10	1
Pry bar	1
Punch, small	1
Hammer	1
Rivet gun	1

NOTICE

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

WARNING

To prevent personal injury, disconnect negative (-) battery cables before servicing vehicle.

Pull front of floor mat (3) up, to expose rivets (4) that secure instrument panel (1) to floor (Ref Fig. 5 on page E-3). Drill out four rivets (4) (that attach the instrument panel to floor) and seven rivets (5) (that attach instrument panel to the cowl (6)).

Pry out four ratchet fasteners (7) located within instrument panel storage compartments.

Remove the control panel (2). See "Control Panel Replacement" on page E-3.

Pull instrument panel away from the cowl.

Assemble in reverse order of disassembly

Control Panel Replacement

Tool List	Qty
Phillips screwdriver	1

NOTICE

The control panel may be removed without removing the Instrument panel.

WARNING

To prevent personal injury, disconnect negative (-) battery cables before servicing vehicle.

Remove the three phillips head screws (8) that secure the control panel (2) to the instrument panel (1) (Ref Fig. 5 on page E-3).

Remove the connections from the main harness to the gauges and switches in the control panel.

Pull control panel away from the instrument panel.

Assemble in reverse order of disassembly.

When installing a replacement control panel, a new label (11) (Ref Fig. 5 on page E-3) must be ordered and replaced on the new control panel.

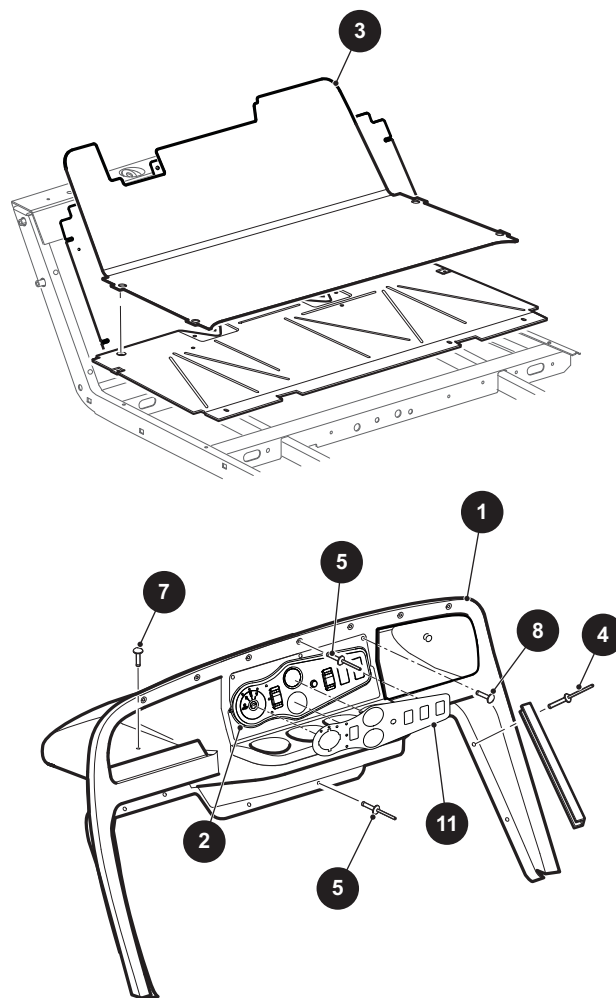


Fig. 5 Instrument Panel / Control Panel

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

Cowl Replacement

Tool List	Qty
Drill	1
Drill bit.....	1
Punch, small.....	1
Rivet gun	1
Hammer.....	1

NOTICE

Cowl can also be removed along with the front fenders.

WARNING

To prevent personal injury, disconnect negative (-) battery cables before servicing vehicle.

Remove front bumper. See "Front Bumper Replacement" on page E-4.

Drill out seven rivets (5), across top of instrument panel (1) (attaching instrument panel and the cowl) and drill out six rivets (12) (3 on each side of the cowl attaching the front fenders to the cowl). (Ref Fig. 6 on page E-4).

Lift cowl up to access headlights connections and unplug.

Remove cowl assembly from vehicle and transfer lights to new cowl.

Assemble in reverse order of disassembly using new rivets.

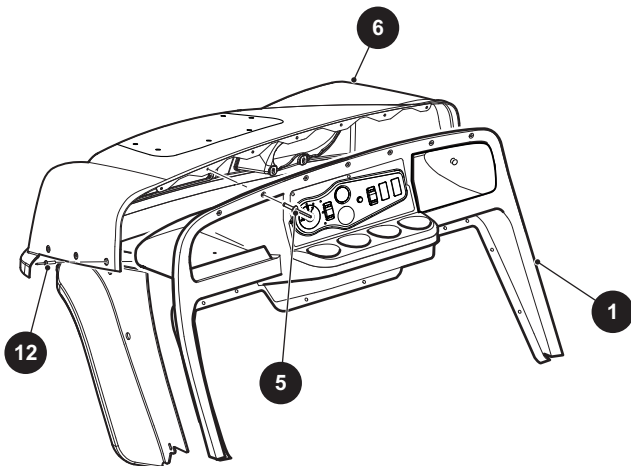


Fig. 6 Cowl

Front Bumper Replacement

Front bumper is a part of lower OPS, see Section P "Lower OPS Replacement".

Rocker Panel Replacement

Tool List	Qty.
Phillips screwdriver	1
Socket 3/8".....	1
Ratchet	1

Remove four phillips head screws (15) securing each end of rocker panels (13, 14) to vehicle (Ref Fig. 7 on page E-4). Save hardware for reuse and note the location of each spacer (16) to ensure proper placement.

Remove rocker panels (13, 14). Replacement is the reverse order of disassembly, making sure hardware and spacers are replaced in the appropriate locations.

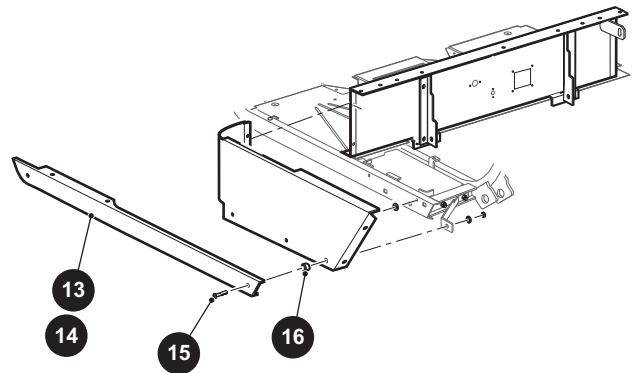


Fig. 7 Rocker Panels

Seat Filler Panel Replacement

Tool List	Qty.
Drill.....	1
Drill bit.....	1
Rivet gun.....	1

Drill out eight rivets (17) securing seat filler panel (20, 21) to side panel (18, 19) (Ref Fig. 8 on page E-5).

Remove seat filler panel (20, 21).

Install using new rivets.

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

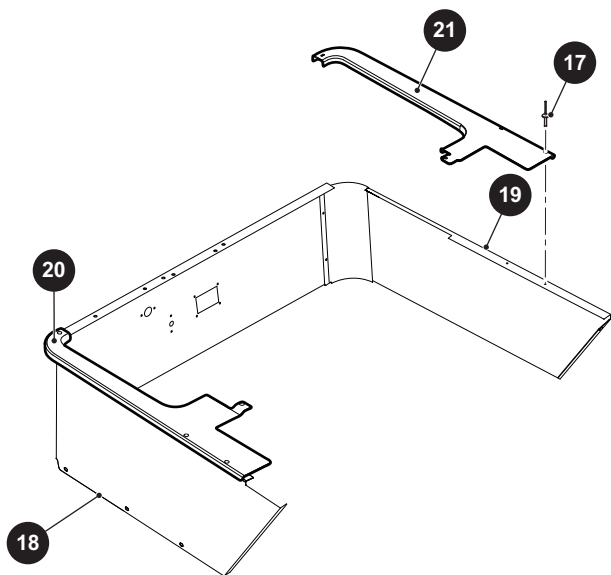


Fig. 8 Seat Filler

Side Panel Replacement

Tool List

	Qty.
Drill	1
Drill bit, 1/4"	1
Socket, 7/16"	1
Ratchet	1
Wrench, 7/16"	1
Rivet gun	1

To replace either driver or passenger side panel, first remove rocker panels. See 'Rocker Panel Replacement' on page E-4.

Remove the seat filler panel. See 'Seat Filler panel Replacement' on page E-4.

Remove the four bolts (22) securing side panel (18, 19) to rear fender (23, 24), retain hardware (25, 26) (Ref Fig. 9 on page E-5) for reuse during installation.

CAUTION

To prevent piercing the fuel tank when using a drill, place a piece of protective sheet metal between the tank and the panel being removed.

If replacing passenger side panel (19), Remove passenger seat filler panel. See 'Seat Filler Panel Replacement' on page E-4.

Place a piece of sheet metal between fuel tank and seat support panel (28) before drilling out rivets (27) attaching side panel to seat support panel.

Drill out rivets (27) securing side panel to seat support panel (28) (Ref Fig. 9 on page E-5).

Drill out rivets (29) securing side panel to frame (Ref Fig. 9 on page E-5). Retain the washers (30) behind side panel for reuse during installation.

Remove side panel.

Install in reverse order of disassembly using new rivets.

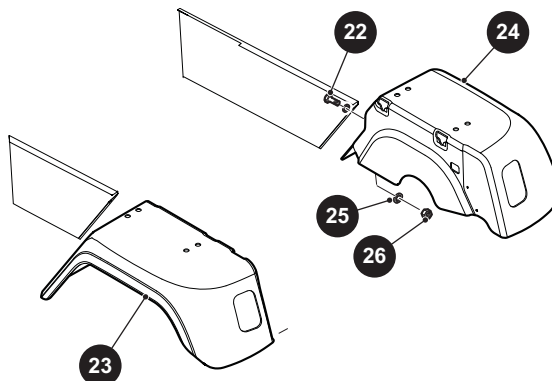
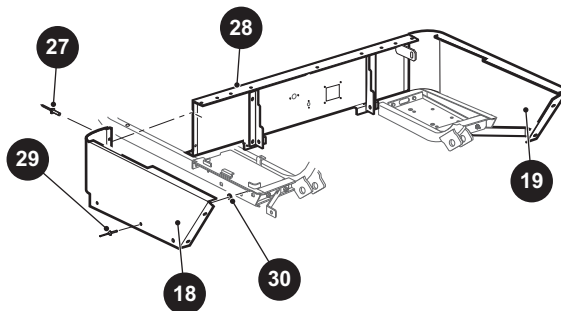
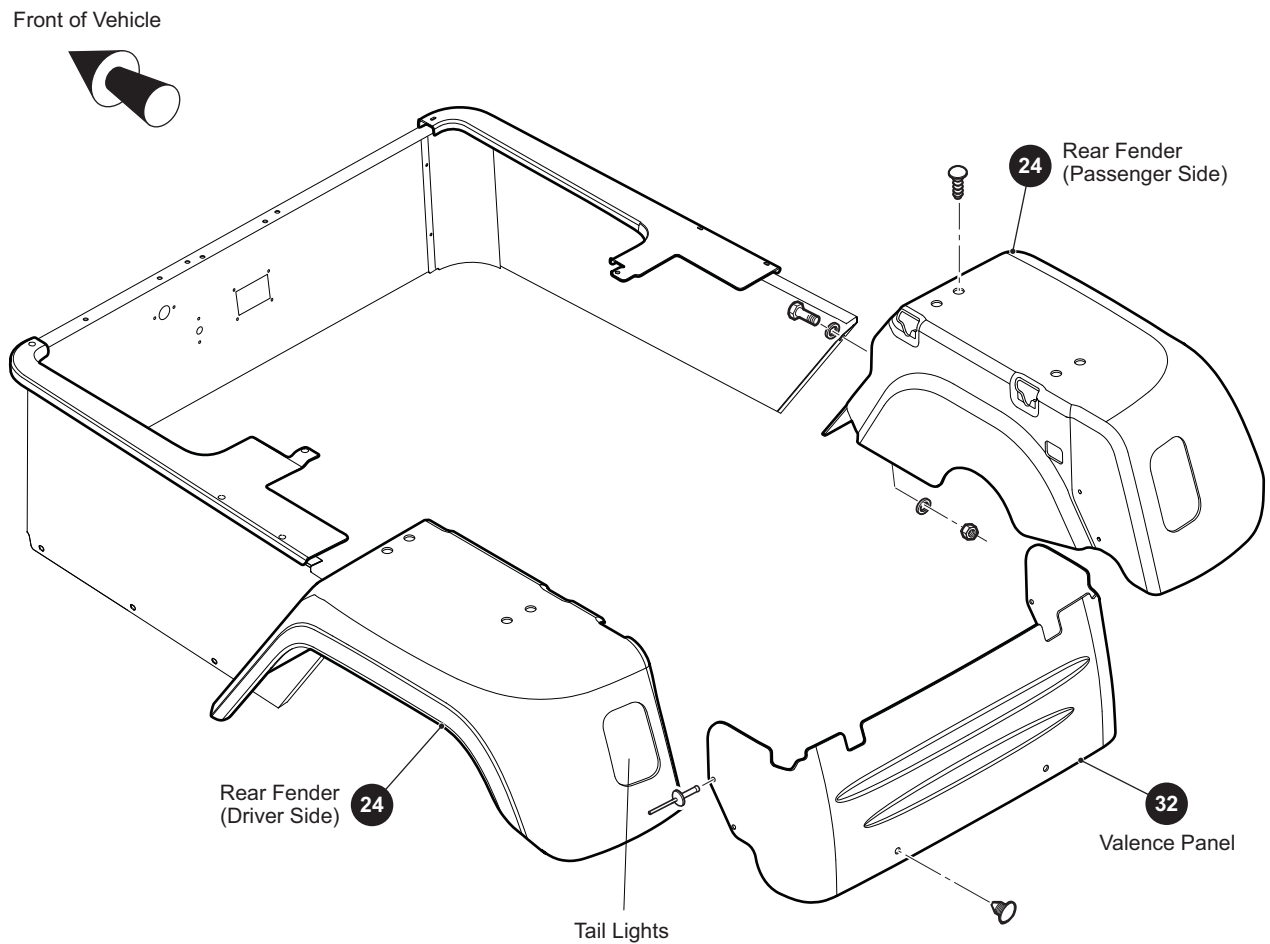


Fig. 9 Side Panels

BODY

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



**Fig. 10 Body Components (Rear),
(For Vehicles With Flip Seat)**

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

Rear Fender Replacement (for vehicles with flip seat)

Tool List	Qty.
Socket, 7/16"	1
Ratchet	1
Wrench, 7/16"	1
Drill	1
Drill bit, #10	1
Pry bar	1
Rivet gun	1

Unplug the tail light leads from the wiring harness.

Remove tail lights by pushing on the small tabs around perimeter of tail lights enabling them to be pushed out of rear fenders (23, 24) (Ref Fig. 11 on page E-7). Retain tail lights for use at fender installation.

Drill out two rivets (31) on side of valance panel (32) securing it to rear fender.

Remove four bolts (22) securing rear fender to side panel and frame. Retain the hardware (25, 26) for reuse during installation.

Remove the eight ratchet fasteners (35) securing rear fenders to frame.

Remove rear fender from vehicle.

Replacement is the reverse order of rear fender removal. Tail light should be replaced in rear fender with wiring at top of tail light.

Valance Panel Replacement (only for vehicles with flip seat)

Tool List	Qty.
Drill.....	1
Drill bit, #10.....	1
Pry bar	1
Rivet gun.....	1

Drill out two rivets (31) on each side of valance panel (32) securing it to rear fenders (23, 24) (Ref Fig. 12 on page E-7). Remove ratchet fasteners (36) securing the valance panel to the vehicle.

Remove the valance panel.

Install in reverse order of disassembly using new rivets.

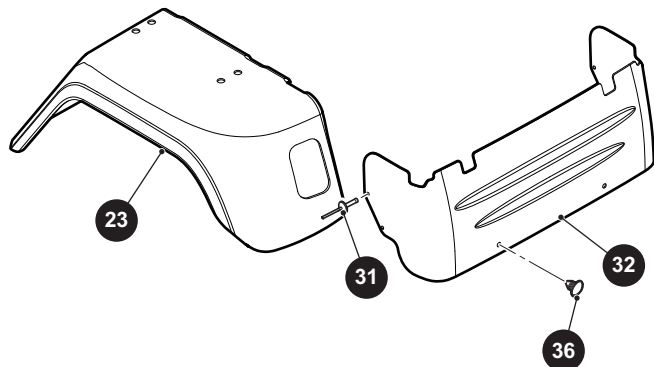


Fig. 12 Valance Panel

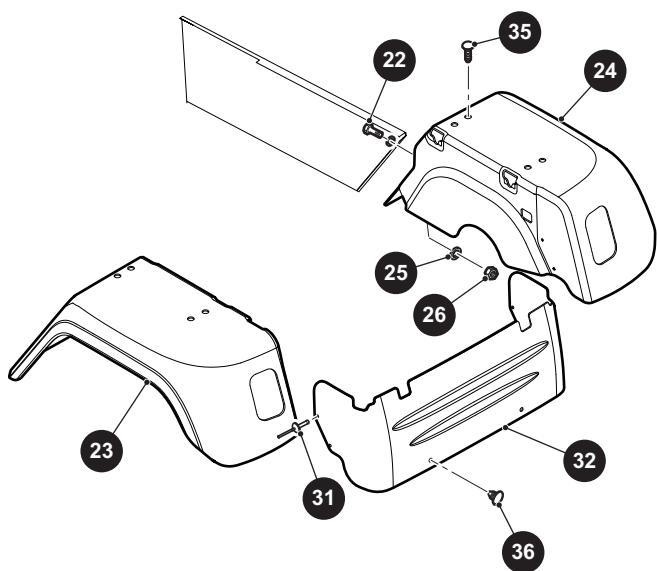
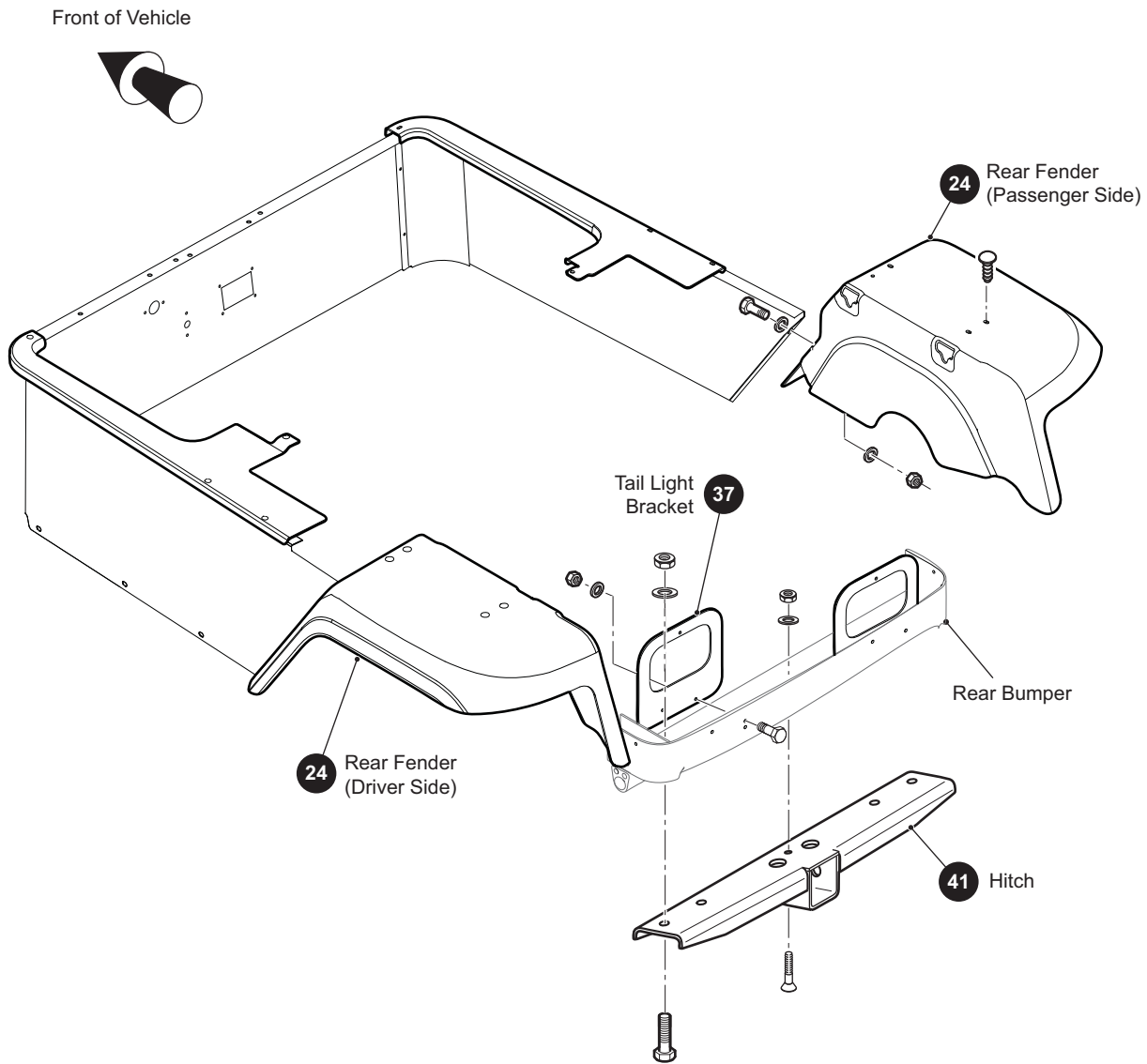


Fig. 11 Rear Fender

BODY

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



**Fig. 13 Body Components (Rear)
(For Vehicles With Truck Bed)**

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

Rear Fender Replacement (for vehicles with Truck Bed)

Tool List	Qty.
Socket, 7/16"	1
Ratchet	1
Wrench, 7/16"	1
Drill	1
Drill bit, #10	1
Pry bar	1
Rivet gun	1

Unplug the tail light leads from the wiring harness. Remove tail lights by pushing on the small tabs around perimeter of tail lights enabling them to be pushed out of tail light brackets (37) (Ref Fig. 14 on page E-9). Retain tail lights for use at fender installation.

Remove four bolts (38) securing tail light brackets (37) to rear bumper.

Remove four bolts (22) securing rear fender to side panel and frame. Retain the hardware (25, 26) for reuse during installation.

Remove the eight ratchet fasteners (35) securing rear fender to frame.

Remove rear fender from vehicle.

Replacement is the reverse order of rear fender removal. Tail light should be replaced in rear fender with wiring at top of tail light.

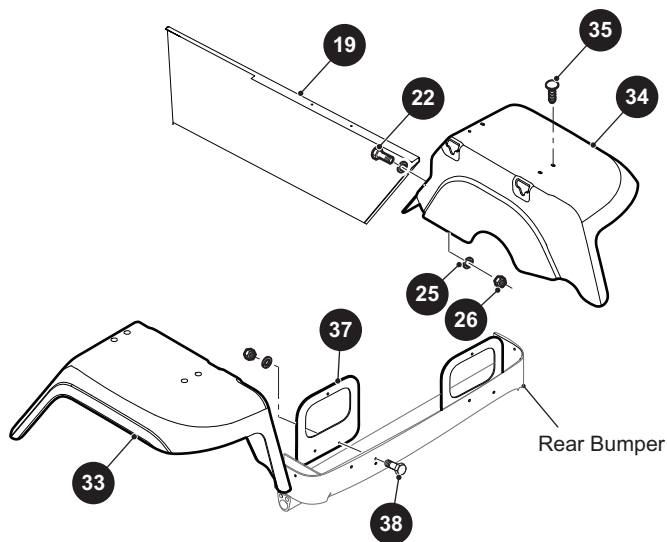


Fig. 14 Rear Fender

Hitch Replacement (only for vehicles with Truck Bed)

Tool List	Qty.
Socket, 5/8", 1/2"	1
Ratchet	1
Wrench, 5/8"	1
Flat screwdriver	1

Remove four bolts (39) and one flat head screw (40) securing hitch receiver (41) to rear bumper (Ref Fig. 15 on page E-9). Retain the hardware (42, 43, 44, 45) for reuse during installation.

Remove hitch receiver.

Install in reverse order of disassembly. Refer to Section A "GENERAL INFORMATION & ROUTINE MAINTENANCE" for the torque values to be maintained for the hardware during installation.

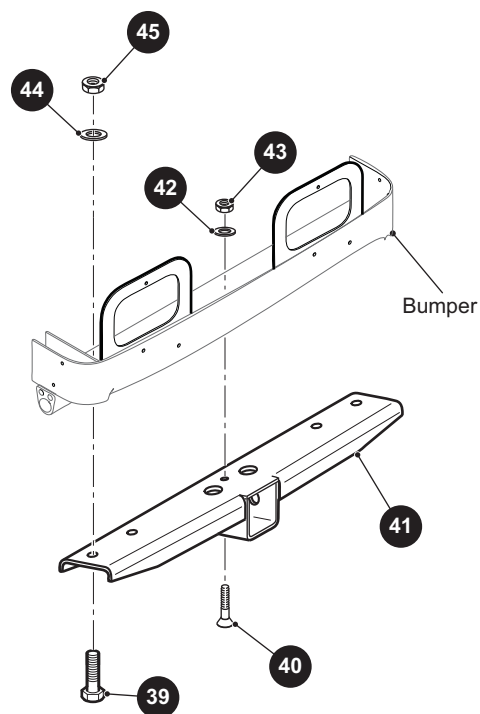


Fig. 15 Hitch

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

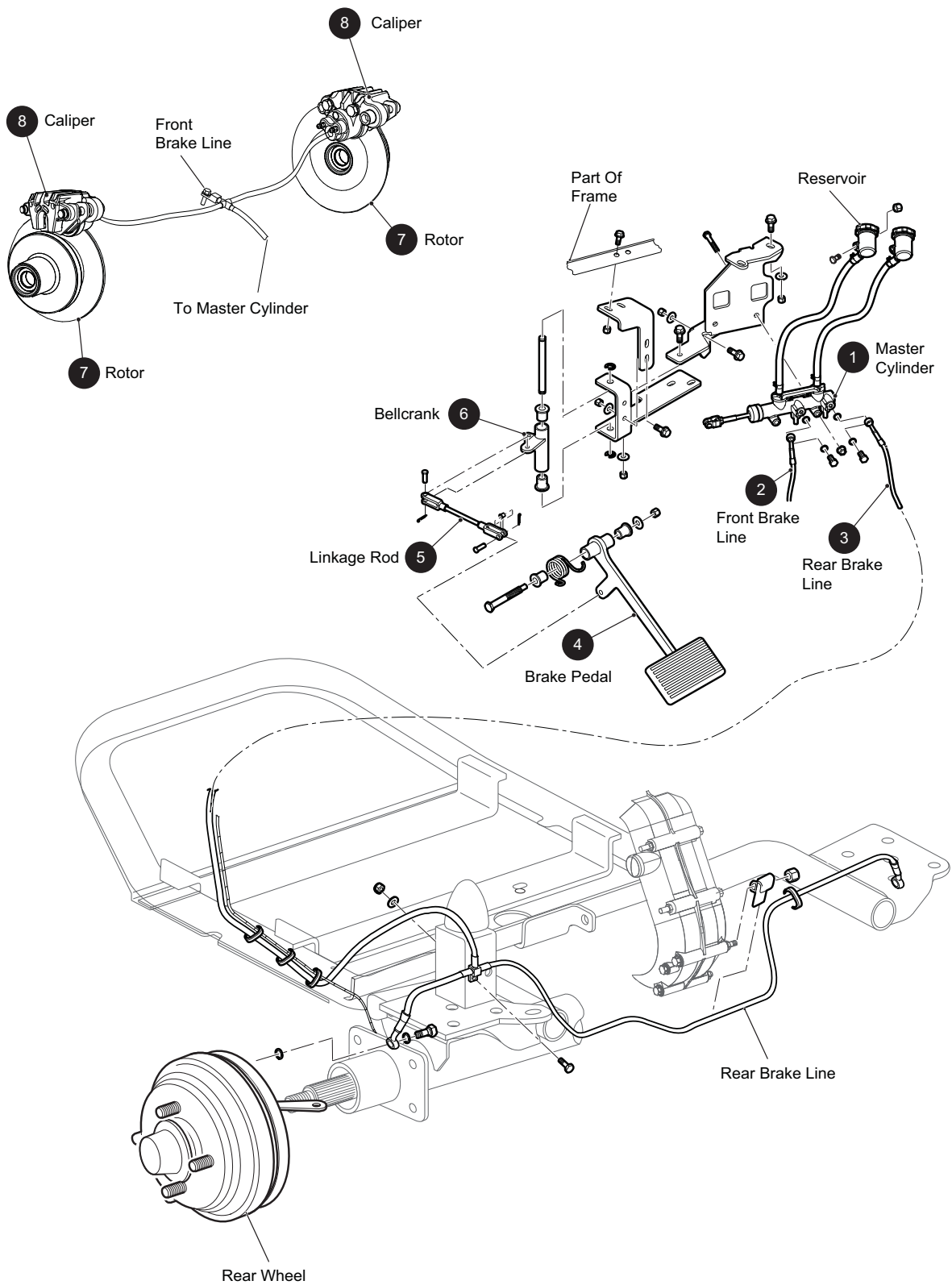


Fig. 1 Hydraulic Brake System Components

BRAKES

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

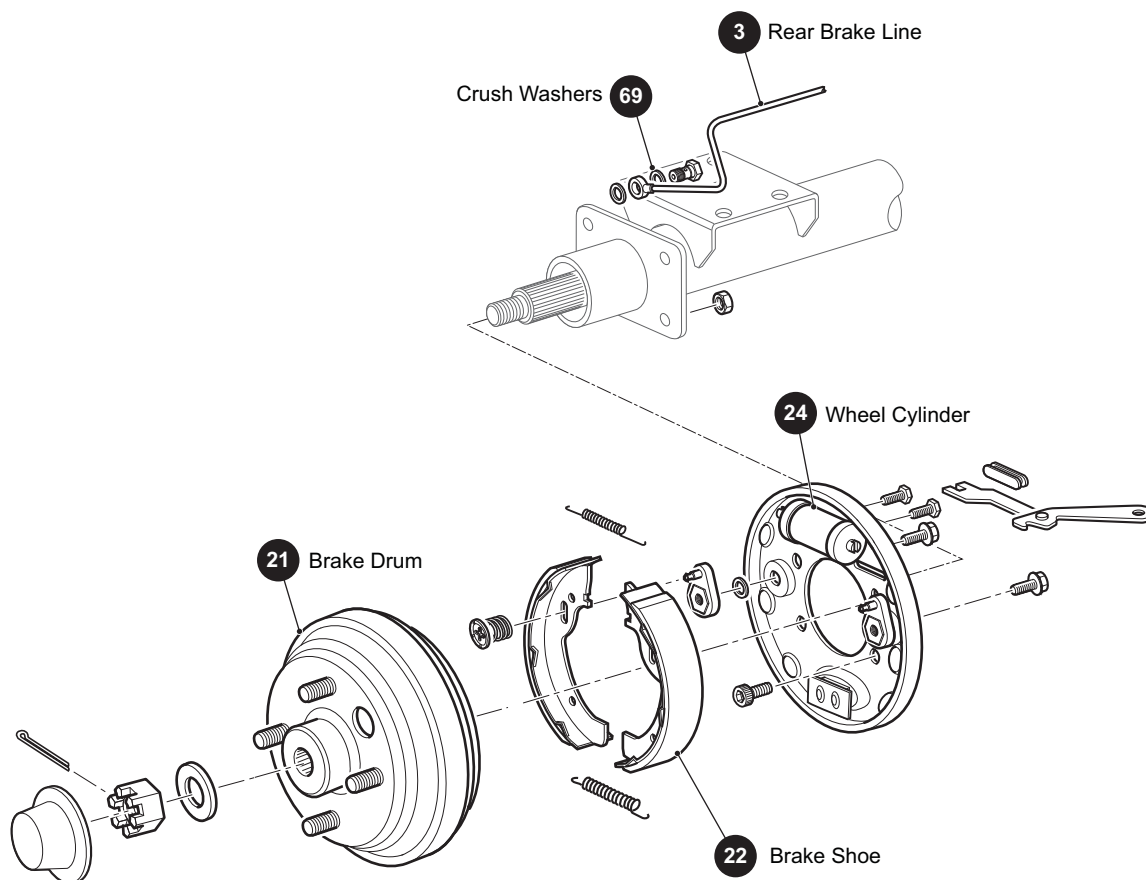


Fig. 2 Rear Wheel Brake Components

GENERAL

How the Hydraulic System Works

A hydraulic system actuates the front and rear brakes. The system transmits the power required to activate the friction surfaces (brake shoes/brake pads) of the braking system from the pedal to the individual brake units at each wheel (Ref Fig. 1 on page F-1).

The hydraulic system operates as follows:

When at rest, the entire system is full of brake fluid. Upon application of pressure on the brake pedal, fluid trapped in front of the master cylinder piston is forced through the brake lines to the wheel cylinders. Here, it forces the pistons outwards against the brake shoes/brake pads which in turn contact the brake drum or disk brakes. Upon release of the brake pedal, a spring located inside the master cylinder immediately returns the piston to the normal position. The brake shoe return springs retract the brake shoes/brake pads and wheel

cylinders which returns the brake fluid to its original position within the master cylinder.

Rear Wheel Brake

The 160 x 30mm hydraulic brake is a leading-trailing design. The shoes are held to the backing plate by hold-down springs, pins, and spring retainers. The shoes are fitted to the anchor at the bottom and secured by a lower shoe to shoe spring. At the top, the shoe web rests on the wheel cylinder piston. The shoes are held to the wheel cylinder pistons by the upper shoe to shoe spring (Ref Fig. 2 on page F-2).

The wheel cylinders are of the double piston design, permitting even distribution of force to each shoe. There are no links. Shoes rest directly on the piston ends. Wheel cylinders incorporate external boots.

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

The rear brake includes a parking feature consisting of a lever and strut. The lever is applied by a cable attached to the parking brake lever (hand operated). The parking brake is used to retain the vehicle when stationary. It may also be used as an emergency brake in the event of hydraulic system failure.

Front Wheel Brake

The frictional surfaces on the front brakes, two brake pads are bolted to the brake calliper which has a built in mechanism of piston that can move the brake pads upon hydraulic pressure activation from the master cylinder/ brake pedal (similar to the rear brakes). The brake pads are mounted on to the calliper separated by a distance between the pads that is just enough for the disc rotor hub to move freely in between the pads.

Pressure application on the brake pedal activates the hydraulic system, generating a movement of disc pads towards the disc rotor hub that is freely rotating between the pads. The contact of the brakes pads with the disc increase the frictional force interrupting the rotary motion of the disc.

Upon release of pressure from the brake pedal, a spring loaded in the callipers, pulls the brake pads to initial position releasing the frictional force on the rotor hub allowing it to rotate freely.

The intensity of the braking is determined by the fluid pressure and the surface contact area of the pads with the disc, hence it is very important to have regular maintenance checks performed for the brake pads and discs for effective braking.

MAINTENANCE

Daily Brake Performance Test

WARNING

Wear a dust mask and eye protection whenever working on wheel brakes. Do not use pressurized air to blow dust from brake.

NOTICE

To assure correct braking performance, all periodic maintenance, inspections and procedures must be performed as indicated in the Periodic Service Schedule in Section A of this manual. It is important that a Daily Brake Performance Test be performed and the entire brake system be serviced in accordance with the Periodic Service Schedule.

NOTICE

The brake system must be bled whenever any part of the brake system has been replaced.

Depress brake pedal. The pedal should have some free play and then become hard. A brake pedal that has no free travel, excessive free travel or a spongy feel indicates a brake inspection is required. A brake pedal that falls after it is applied indicates a leak in the master or wheel cylinders. Check brake fluid level. Adjust brakes if required and inspect system for fluid leaks.

Brake System Inspection

Brake failure usually occurs as either a gradual decrease in braking effect from the shoe material/disc pads being worn away, a loss of braking at one wheel or a sudden and complete failure with no brakes working except the parking brake.

Should the brakes at one wheel become ineffective while the brakes at the other wheel functions properly, inspect the entire brake assembly and inspect the brake for evidence of a leaking or inoperative wheel cylinder assembly.

NOTICE

Care should be taken to prevent brake fluid from coming into contact with the brake shoes. If the brake shoes should become wet with hydraulic fluid, remove the brake drum and wipe the brake shoes and drum until they are dry.

Complete brake failure usually indicates a loss of hydraulic fluid pressure.

The hydraulic system may be checked for leaks by applying pressure to the pedal gradually and steadily. If the pedal sinks very slowly to the floor, the system has a leak. This is not to be confused with a springy or spongy feel due to the compression of air within the lines.

Check for leaks along all lines and at brake assembly. If no external leaks are apparent, the problem is inside the master cylinder.

CAUTION

Do not allow brake fluid to contact painted surfaces. Wipe off immediately.

After making any repairs to hydraulic lines, wheel cylinders or master cylinder, the brakes must be bled to remove any trapped air. A bleeder valve is located at each of the rear wheel cylinder for this purpose. See "BLEEDING AND FLUSHING" on page F- 9.

BRAKES

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

MASTER CYLINDER

Just like any other brake part, the master cylinder will eventually require replacement. The usual reason for a master cylinder failure is the cylinder seals (cups) deteriorate. Fluid leaks past the cups and shows as an external leak. A common symptom is a 'spongy' brake pedal that goes all the way to the floor when all the other brake components are in good condition. The rubber parts wear with usage or deteriorate with age or fluid contamination. Corrosion or deposits formed in the cylinder bore due to moisture or dirt in the hydraulic system may result in wear of the cylinder bore or related parts. Do not try to remove corrosion or deposits with a cylinder hone. If corrosion or deposits are present, discard master cylinder and replace with new one.

Brake Fluid

NOTICE

Hydraulic brake systems must be totally flushed if the fluid becomes contaminated with water, dirt or other corrosive chemicals. To flush, bleed the entire system until all brake fluid has been replaced with fresh DOT 3 standard automotive brake fluid.

It is important to maintain proper fluid levels in the master cylinder. The fill cap (67) for the cylinder is located behind the control panel. To gain access to the fill cap remove the control panel, refer to BODY section for removal and installation of Control Panel. To prevent contamination when checking fluid, wipe off any dirt from fill cap before removing it. Reservoir fluid level should be checked per 'PERIODIC SERVICE SCHEDULE' in Section A. When required, clean brake fluid should be added to maintain fluid level 1/4 (6 mm) from top of reservoir. Use fresh DOT 3 standard automotive brake fluid.

Master Cylinder Replacement

Tool List

	Qty.
Insulated wrench, 1/2"	1
Catch pan	1
Needle nose pliers.....	1
Wrench, 9/16"	2
Wrench, 1/2"	1
Wrench, 7/16"	1

WARNING

Wrap wrenches with vinyl tape to prevent the possibility of a dropped wrench 'shorting out' a

battery, which could result in an explosion and severe personal injury or death.

CAUTION

During this process, it is likely that brake fluid will leak from the master cylinder. Avoid allowing brake fluid to contact the painted body components of the vehicle. Wipe off immediately.

Turn vehicle key to 'OFF' and remove. Insure all optional electrical accessories are turned OFF. At the starting battery, remove the negative (-) cables. Cover top of battery with a cloth or non-conductive material to prevent the possibility of a dropped wrench or metal object from 'shorting out' the battery.

Clean the area around the master cylinder (1) to prevent dirt and grease from contaminating the hydraulic system.

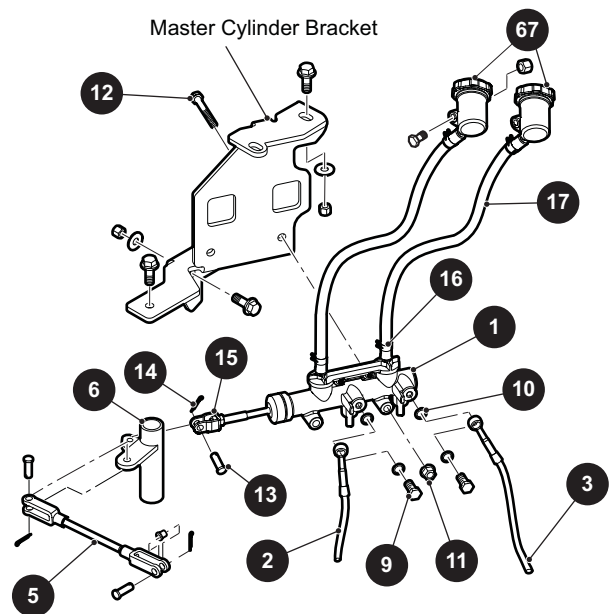


Fig. 3 Master Cylinder

Remove two banjo bolts (9) and disconnect front brake line (2) and rear brake line (3) from the master cylinder (1). Provide a catch pan for the released brake fluid. Remove clip anchoring flexible brake hose to the master cylinder (1) (Ref Fig. 3 on page F-4).

Using needle nose pliers remove the cotter pin (14) and clevis pin (13) and disconnect push rod clevis yoke (15) from upper arm of bellcrank (6) in front of master cylinder. Disconnect linkage rod (5) clevis yoke from lower arm of bellcrank (6) to allow bellcrank to swing out of the way. Pull clevis yoke and push rod out of master cylinder (1).

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

Remove two lock nuts (11) and two bolts (12) and remove master cylinder (1) from master cylinder bracket.

Mount master cylinder to master cylinder bracket using new lock nuts. Do not reuse original lock nuts. Tighten the lock nuts to the torques values as specified below:

Item	Torque Specification
11	14 - 18 ft. lbs. (18.9 - 24.4 Nm)

Insert push rod into master cylinder.

Install both clevis yokes back onto bellcrank using clevis pins (13) and new cotter pins (14).

Reconnect the brake lines.

⚠ WARNING

To prevent brake failure resulting from contaminated brake fluid, never reuse any excess fluid or return to the original container. Dispose of brake fluid properly.

Fill reservoir with DOT 3 brake fluid and bleed brake system. See "BLEEDING AND FLUSHING" on page F-9.

After bleeding brake system, check for leaks along all lines and at master cylinder.

REPLACEMENT OF WEAR ITEMS

Brake Pads Replacement for the Disc Brakes.

Tool List	Qty.
Wrench, 3/8"	1
Socket, 3/8"	1
Ratchet	1
Channel lock pliers	1
Torque wrench, ft. lbs.	1

Brake pads should always be replaced as a full set on both front wheels. To remove the brake pads, raise and support the vehicle per 'Lifting the Vehicle' in the SAFETY section.

1. Remove the wheel. Refer to WHEELS AND TIRES section.
2. Remove hex head bolts securing the calliper (18) to the Rotor hub.

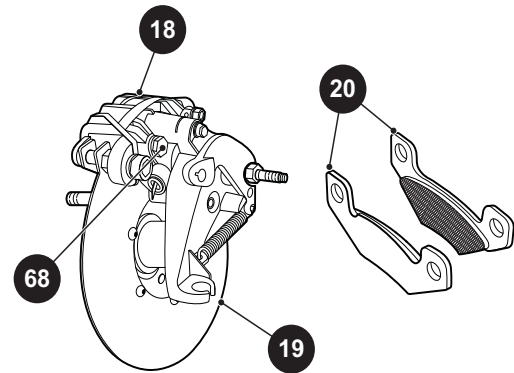


Fig. 4 Disc Brakes

3. Swing the calliper (18) free from the rotor (19).
4. Using channel lock pliers compress the side of the callipers with the O-Ring. Remove the brake pads (20) one at a time.
5. Compress the calliper piston. once the piston is compressed it will stay in position. until the brake pedal is pressed.
6. Compress the side with the O-Ring and hold while installing the new pads (20). Once both pads are installed release pressure on the O-Ring.
7. Separate disc pads (20) and place caliper (18) over the rear flange of the rotor (19).
8. Install the hex head bolts, finger tight. Tighten the bolts to the torques values as specified below:

Item	Torque Specification
68	20 - 22 ft. lbs (27.11 - 29.82 Nm)

9. Replace wheel and tighten lug nuts as specified in the Wheels and Tires section of this manual.

Front Rotor Replacement

NOTICE

The rotor (disc brake hub) is not designed to be turned to eliminate grooves or high spots.

If the rotor (disc hub) has deep grooves or gouges, it must be replaced. If the pad contact area has worn the rotor to a thickness of .120" or less, the rotor must be replaced.

If the rotor must be replaced, the caliper and pads must be swung out of the way to gain access to the rotor See "REPLACEMENT OF WEAR ITEMS" on page F- 5.

For Hub Replacement, Wheel Bearing and Race Replacement, Wheel Bearing Packing and Wheel

BRAKES

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

Bearing Adjustment procedures, see FRONT SUSPENSION AND STEERING.

Spindle Replacement

See FRONT SUSPENSION AND STEERING.

Rear Brake Drum Removal and Installation

Tool List	Qty.
Slip joint pliers	1
Needle nose pliers.....	1
Socket, 1 1/8"	1
Ratchet	1
Plastic faced hammer	1
Drum puller (P/N 15947-G1).....	1
Wrench, 7/16"	1
Torque wrench, ft. lbs.	1

WARNING

The drum must not be turned to 'true' a worn friction surface. Turning will make the drum too thin causing drum and brake failure which could cause severe injury or death.

Wear a dust mask and eye protection whenever working on wheel brakes. Do not use pressurized air to blow dust from brake.

NOTICE

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

Remove spindle cap (26) to gain access to the castellated nut (27) and the cotter pin (28) (Ref Fig. 5 on page F-6). Remove outer brake drum washer (29).

Slide the brake drum (21) from the axle shaft. If required, tap the drum (21) with a plastic faced hammer to loosen it from the axle shaft or use drum puller (P/N 15947-G1).

If brake shoes (22) interfere with drum removal, rotate adjuster bolt (30) on back side of backing plate (25) towards the axle to retract shoes and remove brake drum (21).

To install the brake drum (21), clean the axle shaft and the splines on the brake drum to remove dirt, grease and foreign matter. Apply a small amount of anti-seize compound to the axle spline. Slide the brake drum (21) into place. Check to insure the nose of drum hub is beyond the end of the axle splines. If not, the brake drum is incorrect and must be replaced with a new drum.

CAUTION

Do not back off castellated nut to install cotter pin.

Install the remaining hardware and tighten the following hardware to the torque values as specified below:

Item	Torque Specification
27	70 - 140 ft. lbs (94.90 - 189.81 Nm)

Tighten the castle nut (27), until a new cotter pin (28) can be installed through the castellated nut. Do not torque more than the maximum torque specified.

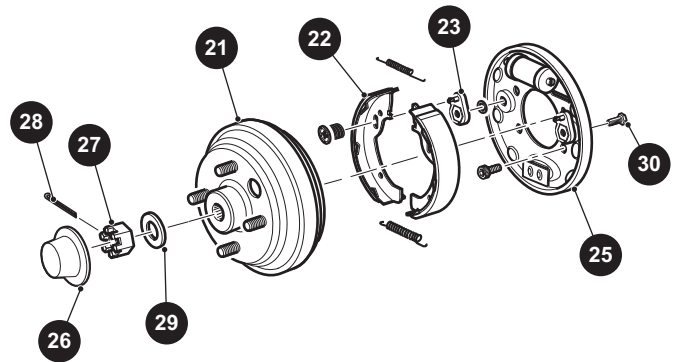


Fig. 5 Brake Drum

REAR WHEEL BRAKE SERVICE

Tool List	Qty.
Socket, 3/4"	1
Ratchet	1
Wheel cylinder clamp.....	1
Pliers.....	1
Wrench, 9/16"	1
Wrench, 10 mm.....	1
Torque wrench, ft. lbs.....	1

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.

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

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.

Be sure that the parking brake is released.

Loosen rear wheel lug nuts and lift rear of vehicle per Section B.

Remove wheel and drum. See "Rear Brake Drum Removal and Installation" on page F- 6. Remove excess dust and dirt from the drum with a brush.

Remove any accumulated brake dust from the wheel brake assembly with a brush (Ref Fig. 6 on page F-7).

Install wheel cylinder clamp, then unhook upper and lower shoe to shoe springs (33 and 34).

Remove parking brake strut and lever (39).

Remove shoe hold-down springs (33 and 34) and remove shoes (22).

If the wheel cylinder (37) must be removed, begin by loosening and removing the brake line from the back of the wheel cylinder. Next remove the wheel cylinder bolts (38) and remove the wheel cylinder from the backing plate (25).

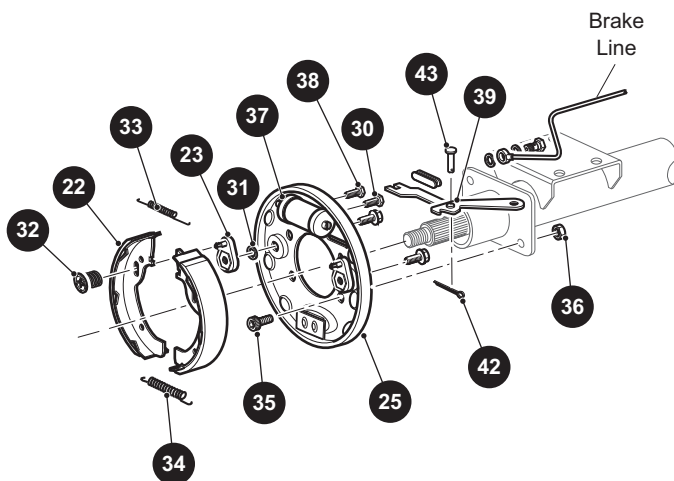


Fig. 6 Wheel Brake Service

Cleaning and Inspection

WARNING

The drum must not be turned to 'true' a worn friction surface. Turning will make the drum too thin causing drum and brake failure which could cause severe injury or death.

Wear a dust mask and eye protection whenever working on wheel brakes. Do not use pressurized air to blow dust from brake.

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.

Visually inspect the axle seal for oil leakage and the condition of the thrust washer. If oil is present, see REAR AXLE section.

Clean the backing plate with an approved cleaner for this purpose.

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.

Inspect the backing plate (25). Inspect for gouges, galling or other damage, particularly where the backing plate is contacted by the brake shoes (22). Be sure shoe ledges are smooth and free of rough edges. Replace both wheel brake assemblies if any gouges or galling is found (Ref Fig. 6 on page F-7).

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. 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

BRAKES

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

Check springs (33 and 34) for loss of tension and damage. Replace weak springs and any damaged or badly worn parts.

Check adjuster operation (23). Insure that each adjuster will move with approximately 30 - 50 in. lbs. (3.4 - 5.6 Nm) of torque. If adjusters are frozen, badly worn or loose, replace the adjuster assembly. See "Replacing an Adjuster" on page F- 8.

Replace the wheel cylinder (37) if there is any sign of leakage.

Insure that the parking lever and strut assembly (39) can be easily moved by hand. If necessary, this assembly can be serviced as follows:

Disassemble by removing the retaining hardware (43 and 42) from the strut assembly (39). Wire brush contact surfaces to remove any corrosion and contaminants. Lightly grease the pin and contact surfaces before re-assembly.

WARNING

Insure that the retaining clip is completely seated in its' groove when finished. Failure to do so could result in a non-functioning parking brake if the clip comes off.

Reassembly

Apply a light coat of high temperature lubricant to shoe support points on the backing plate, to adjuster pin, and to anchor.

Position the adjusters so that the pins are at the 12 o'clock position.

If the wheel cylinder (37) was removed, install it now into the backing plate (25). Insert the wheel cylinder mounting bolts (38). Reconnect the brake fluid line using new crush washers (69) and tighten the banjo bolts (44). Tighten the hardware to the torques values as specified below:

Item	Torque Specification
38	120 in. lbs. (13.55 Nm)
44	124 - 177 in. lbs. (14.01 - 19.99 Nm)

Position shoes (22) on backing plate (25) and install hold-down springs.

Install parking brake strut with tab on strut engaged in brake shoe web.

Place upper end of shoe webs against wheel cylinder (37), and install upper shoe-to-shoe spring (33). Remove wheel cylinder clamp.

Install lower shoe-to-shoe spring (34).

Install wheel and drum. See "Rear Brake Drum Removal and Installation" on page F- 6.

Pre-adjust shoes by rotating adjuster nut away from the axle until shoes contact drum and then back off just enough to eliminate drag.

Replacing an Adjuster

Replace the adjuster assembly if the adjuster requires more than 50 in. lbs. (5.6 Nm) torque to rotate.

Secure the adjuster arm with locking pliers and remove the bolt on the back side of the backing plate with a wrench or socket. The bolt may shear off which is acceptable. Remove and discard all adjuster components. Clean the backing plate surfaces that contact with the adjuster.

Prepare to install the new adjuster by applying a light coat of grease to the belleville washer. Install the washer (31) onto the adjuster arm with arch up as shown in the illustration (Ref Fig. 7 on page F-8).

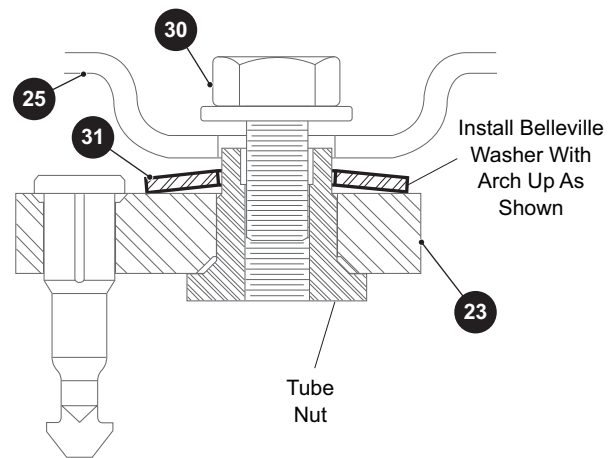


Fig. 7 Belleville Washer Installation

Apply thread locking compound to the bolt (30).

Insert the nose of the tube nut into the backing plate (25). Install the bolt (30) into the tube nut. Tighten to the torque values as specified below:

Item	Torque Specification
30	110 - 120 in. lbs. (12.42 - 13.55 Nm)

Although not strictly necessary, it is recommended to replace both adjusters (23) if one is found to require replacement.

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

Adjustment

Adjust brake shoes until a light drag is felt while rotating the wheel.

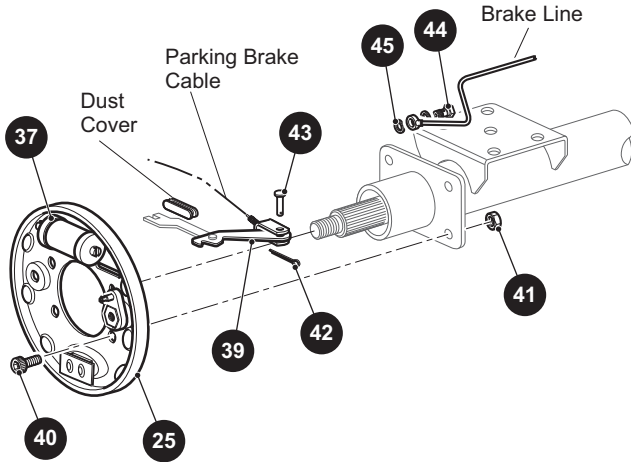


Fig. 8 Rear Wheel Brake Assembly

Rear Wheel Brake Assembly Replacement

Tool List	Qty.
Socket, 3/4"	1
Ratchet	1
Wheel chocks	4
Hydraulic floor jack	1
Jack stands	4
Socket, 1/4" hex bit	1
Socket, 1/2"	1
Socket, 9/16"	1
Needle nose pliers	1
Torque wrench, in. lbs.	1
Torque wrench, ft. lbs.	1

WARNING

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

Wear a dust mask and eye protection whenever working on wheel brakes. Do not use pressurized air to blow dust from brake assemblies.

Be sure that the parking brake is released.

Loosen rear wheel lug nuts and lift the vehicle per Section B.

Remove wheel and drum. See "Rear Brake Drum Removal and Installation" on page F- 6.

Loosen the four allen head bolts (40) and lock nuts (41) securing the wheel brake backing plate (25) to the flange on the axle tube (Ref Fig. 5 on page F-6). Remove banjo bolt (44) to detach brake line from wheel cylinder (37). Remove the four allen head bolts (40) and lock nuts (41) and discard.

Remove the cotter pin (42) and clevis pin (43) securing the park brake cable to the park brake lever (39).

Installation is the reverse of removal. Connect the brake cable to the park brake lever (39) with the clevis pin (43) installed from the top down and a new cotter pin (42). Loosely install wheel brake assembly to axle tube flange using new hardware. Attach brake line to wheel cylinder using new copper gaskets (45). Tighten the hardware to the torques values as specified below:

Item	Torque Specification
44	124 - 177 in. lbs. (14.01 - 19.99 Nm)
41	23 - 27 ft. lbs. (31.18 - 36.60 Nm)

BLEEDING AND FLUSHING

Tool list	Qty.
Shop towels	A/R
Hose	A/R
Clean container	1
Brake fluid, DOT 3	A/R
Wrench, 1/4" box end	1
Crowfoot wrench, 1/4"	1
Torque wrench, in. lbs.	1

Bleeding

The brake hydraulic system must be free of air to function properly. Any air in the system is compressed when pressure is applied, and the result is a springy, spongy brake pedal.

Air may enter the system if any of the hydraulic parts are disconnected or if the brakes are operated with the master cylinder fluid very low.

The process of removing any air that may be trapped in the hydraulic system is known as bleeding the brakes.

Bleeding requires the use of the brake pedal and master cylinder as a hydraulic pump to expel air and brake fluid from the system when a bleeder screw is opened.

Bleed the complete hydraulic system at both wheels if:

BRAKES

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

- Primary brake line was disconnected from the flexible brake hose
- Air was introduced into the system through low fluid level in master cylinder reservoir.

If a line or hose was disconnected at any fitting located between the master cylinder and the wheel cylinders, then all wheel cylinders served by the disconnected line or hose must be bled.

Bleeding Sequence

Bleed at each wheel cylinder in succession, beginning with the passenger side wheel, which is farthest from the master cylinder, and then the driver side wheel.

! WARNING

Never reuse any excess fluid or return to the original container. Dispose of brake fluid properly.

NOTICE

An assistant will be necessary to perform this procedure.

Use a clean cloth to wipe off the master cylinder reservoir and wheel cylinder bleeder valves (Ref Fig. 9 on page F-10). Clean each fitting before opening to prevent contaminating the system.

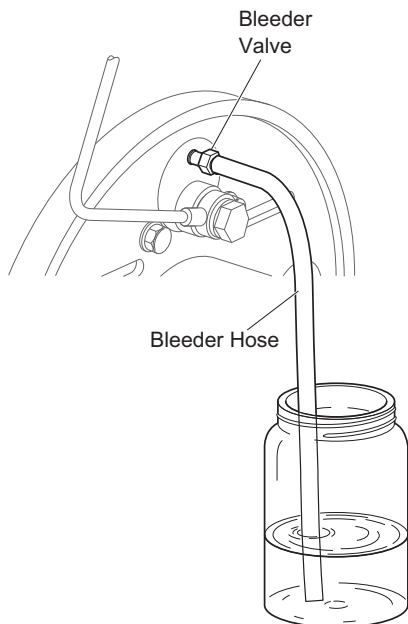


Fig. 9 Bleeder Valve

Fill master cylinder reservoir to within 1/4" (6 mm) of top with new brake fluid before starting and after bleeding is completed.

Check the master cylinder fluid level frequently during bleeding and keep the reservoirs at least one-half full.

The following steps apply to one bleeder screw and should be repeated at both bleeder points.

1. Attach a bleeder hose to the bleeder screw. Place the other end of the hose in a glass jar partially filled with brake fluid (Ref Fig. 9 on page F-10).

NOTICE

Be sure that the free end of the hose is submerged in brake fluid. This helps to show up air bubbles as they come out of the system, and prevents air from being accidentally sucked into the system through the bleeder screw.

2. Apply moderate (40 - 50 lbs. [18 - 23 kg]), steady pressure on the brake pedal, and open the bleeder screw.

! CAUTION

Do not force brake pedal to floor. The operating rod jam nut could be forced into master cylinder where it could damage internal components.

3. If the brake pedal goes to the floorboard without removing all of the air bubbles, close the bleeder screw and release the brake pedal slowly. Then repeat Steps 2 and 3.

NOTICE

The bleeder valve at the wheel cylinder must be closed at the end of each stroke and before the brake pedal is released to insure that air cannot enter the system. It is also important that the brake pedal be returned to full 'up' position.

4. When fluid coming from the submerged end of the hose is clear and free of bubbles, close the bleeder screw and release the brake pedal. Tighten bleeder screw to a maximum torque of 38 in. lbs. (4.3 Nm).

Flushing

The process of removing old brake fluid to rid the system of water, mineral oil or other contaminants is called flushing the hydraulic system.

The flushing procedure is the same as bleeding except that a greater quantity of brake fluid is discharged from each bleeder point to be sure that all of the dirty or contaminated fluid is removed.

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

BRAKE PEDAL REMOVAL AND INSTALLATION

Tool List	Qty.
Needle nose pliers.....	1
Straight blade screwdriver	1
Socket, 9/16"	1
Ratchet	
Wrench, 3/4"	1
Torque wrench, ft. lbs.	1

Disconnect the linkage rod (5) from the brake pedal (4) by removing the cotter pin (53) and the clevis pin (51). Retain bushing (52) for reuse. Unhook the torsion spring (49) 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 (Ref Fig. 10 on page F-11).

Remove the lock nut (46), the shoulder bolt (50) and remove the brake pedal (4).

Inspect the shoulder bolt (50) for corrosion that could cause binding. This bolt (50) and both bushings (48) must be replaced with new ones if corrosion or wear is found.

Brake pedal installation is in the reverse order of disassembly.

Use a new cotter pin (53) when installing the linkage rod (5). Tighten the following hardware to the torques values as specified below:

Item	Torque Specification
46	25 - 29 ft. lbs. (33.89 - 39.31 Nm)

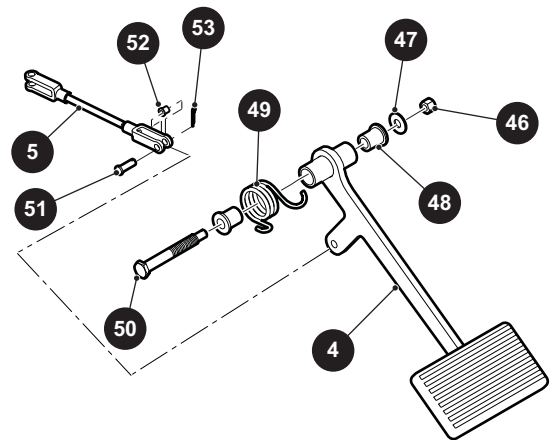


Fig. 10 Brake Pedal Removal and Installation

BRAKES

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

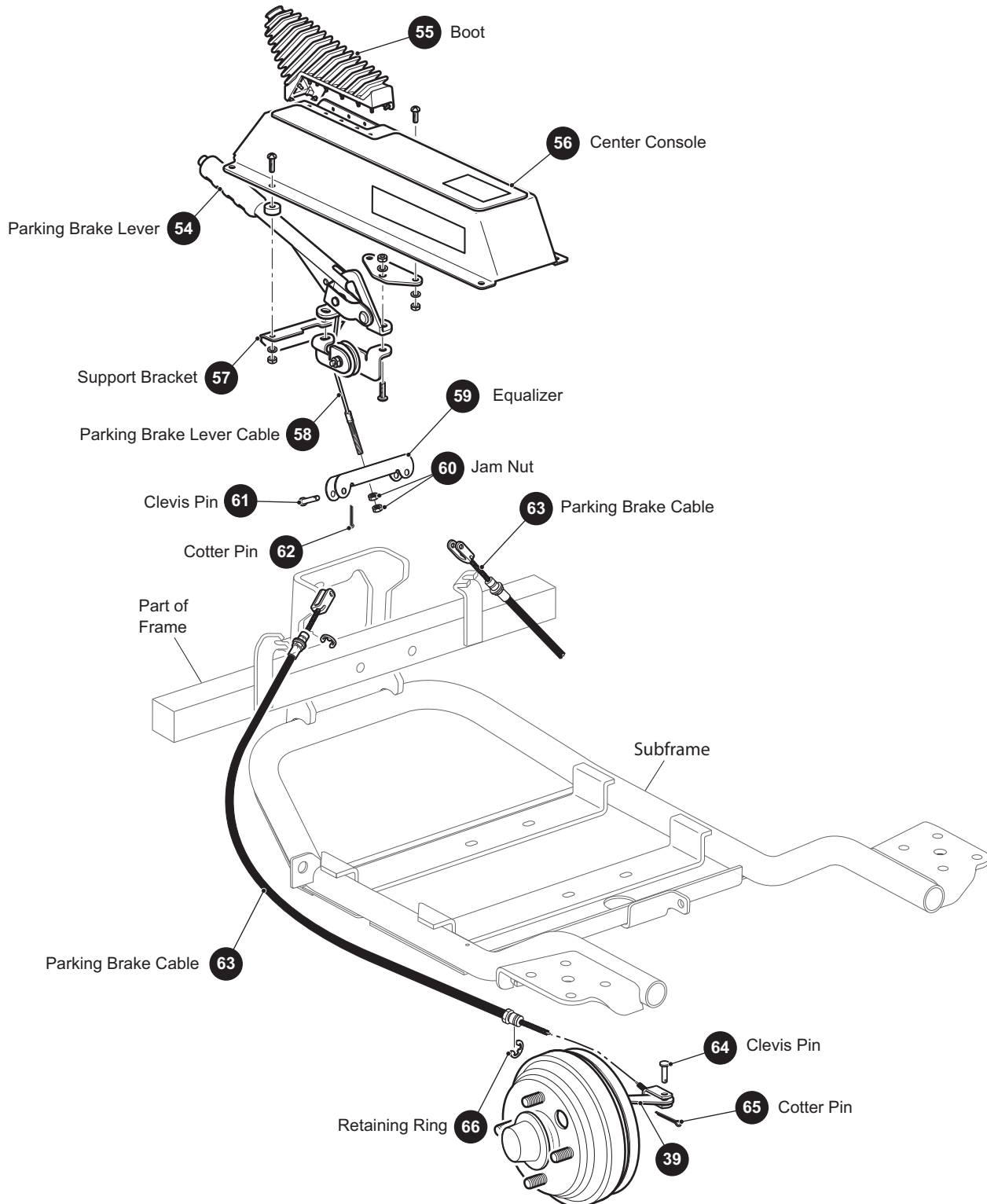


Fig. 11 Park Brake Components

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

PARKING BRAKE

The rear brake includes a parking feature consisting of a wheel brake lever and strut. The wheel brake lever is applied by a cable attached to the parking brake lever. The parking brake is used to retain the vehicle when stationary. It may also be used as an emergency brake in the event of hydraulic system failure.

The hand operated parking brake lever is located at the right side of the driver in the console between the front seats (Ref Fig. 11 on page F-12).

Lubrication



When lubricating parking brake, be sure to use the recommended dry spray lubricant. Commercial grease can attract dirt and accelerate wear.

The hand operated parking brake lever requires periodic lubrication with a dry graphite or molybdenum disulfide lubricant. Raise the lever and spray into the underside to access the pivot arm and ratchet mechanism of the parking brake. See Section A - Periodic Service Schedule for recommended lubrication schedule.

Adjustment

The parking brake adjustment is made at the equalizer (59) on the end of the parking brake lever cable (58) located under the front seats (Ref Fig. 11 on page F-12).

Loosen jam nut (60) at the end of parking brake lever cable (58).

Rotate the other jam nut (60) up or down the threaded end of cable and reconnect to equalizer (59) to check tension. Correct tension is when, at the sixth click of the hand operated parking brake lever (54), vehicle movement is prevented while under a load on a typical area slope. Readjust if necessary.

Tighten jam nut (60) firmly to secure.

Cable Replacement

Tool List

Qty.

- Needle nose pliers 1
- Straight blade screwdriver 1

Cables should be replaced when they become worn, frayed or damaged. Cable replacement consists of first removing the cotter (65) and clevis pins (64) securing the cable (63) to the equalizer (59) and wheel brake levers (39). Then remove the retaining rings (66) securing the cable to the frame and subframe. Install new cable in reverse order of removal and adjust parking brake system per instructions above (Ref Fig. 11 on page F-12).

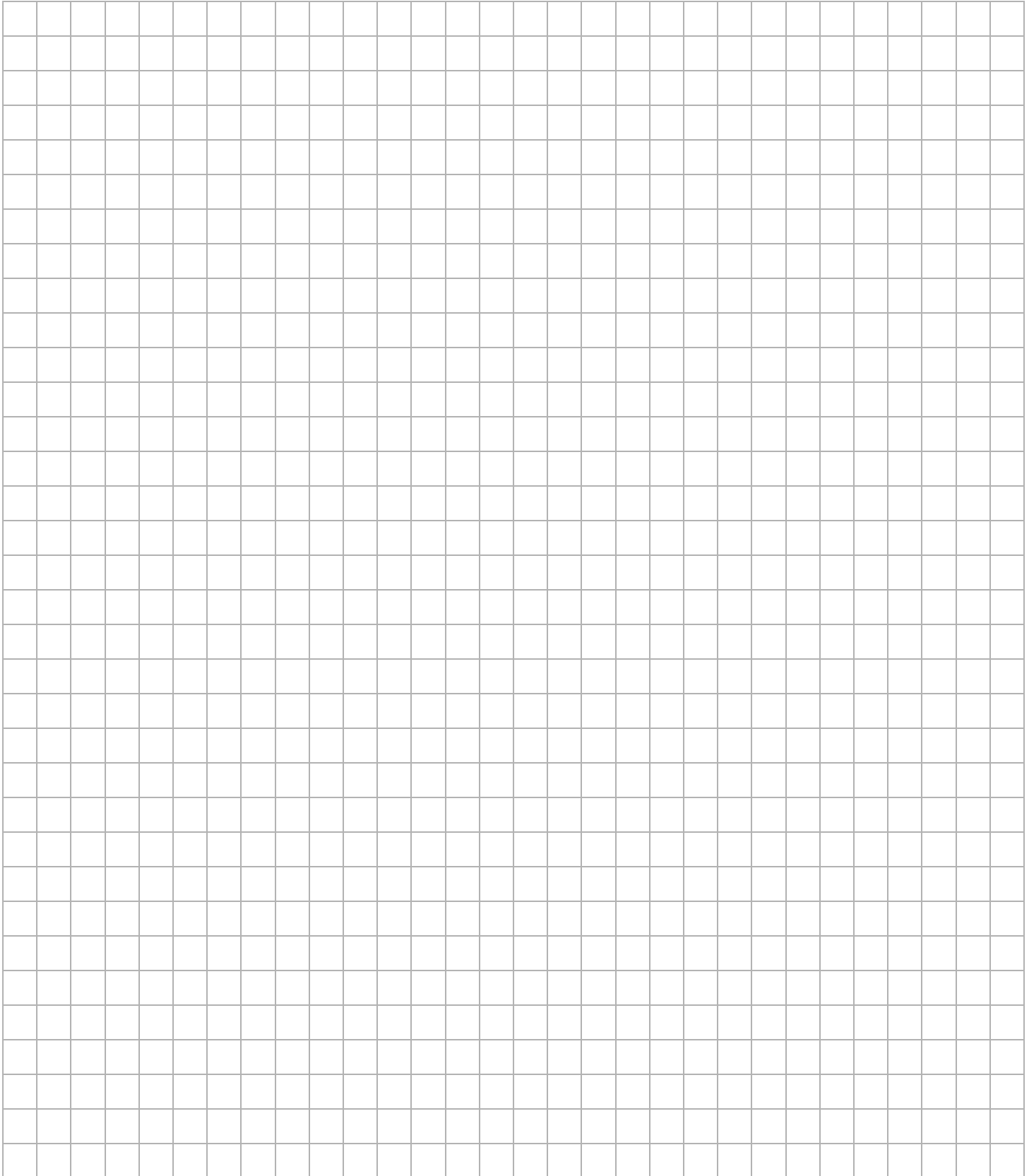
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CONTINUOUSLY VARIABLE TRANSMISSION (CVT)

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

NOTES:

A large grid of graph paper for taking notes, consisting of approximately 28 columns and 30 rows of squares.

CONTINUOUSLY VARIABLE TRANSMISSION (CVT)

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

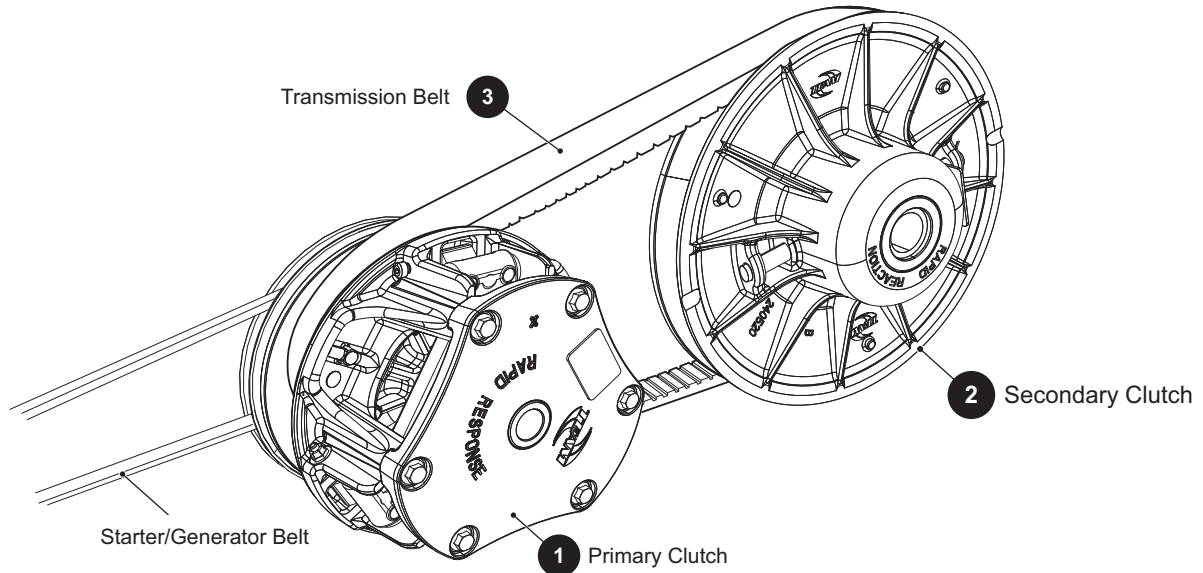


Fig. 1 Continuously Variable Transmission (CVT)

GENERAL

Power transmission from the engine to the rear axle is by means of a continuously variable transmission (CVT). The CVT consists of two matched clutch units joined by a transmission belt (Ref. Fig. 1 on page G-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 depressed, the engine speed is increased which causes the cams (weights) within the centrifugal primary clutch (1) to move outwards and force the moveable sheave inwards. The transmission belt (3) is engaged by the clutch sheaves and begins to rotate. At this point, the ratio between primary and secondary clutch (2) is approximately 3:1.

As the engine speed continues to rise, the primary clutch (1) sheave continues to move inwards forcing the transmission belt (3) to the outer diameter of the primary clutch sheaves which increases the speed of the belt.

The ratio is greatly decreased and provides maximum speed.

When the accelerator is released, the engine speed is decreased and the cams exert less pressure on the moveable sheave which is forced outwards against the cams by a compression spring. The transmission belt (3) disengages from the clutch sheave when engine speed is reduced to the point where the cams exert less force than the spring.

Secondary Clutch

The secondary clutch sheaves are closed at rest which results in the transmission belt (3) being held at the outer diameter of the secondary clutch (2). The secondary clutch (2) has no weights but is held closed by a torsion spring which is joined to the moveable secondary assembly.

As the transmission belt (3) starts to rotate, the secondary clutch (2) starts to rotate. As the speed of the primary clutch (1) increases and the belt starts to climb the sheaves, the secondary clutch (2) responds by being forced open in order to permit the belt to ride lower in the secondary clutches sheaves. The sheaves overcome the pressure exerted by the torsion spring and cam.

CONTINUOUSLY VARIABLE TRANSMISSION (CVT)

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

As the secondary clutch (2) 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 moving the moveable sheave against the torque ramps. The movement of the transmission belt overcomes some of the centrifugal force exerted by the cams in the primary clutch. This forces the belt lower into the primary clutch which increases the drive ratio. This 'downshifting' applies more torque to the rear axle without an appreciable change to the engine speed since the governor opens the carburetor in direct response to the reduction in ground speed.

Equilibrium

The CVT functions because the primary and secondary clutches maintain equilibrium. Clutch sets are tuned to the vehicle that they are designed to operate. Changes in vehicle weight or desired performance characteristics require that both clutches be tuned to the needs of the vehicle and remain compatible with each other.

Primary Clutch Removal

Tool List	Qty.
Plastic faced hammer	1
Socket, 5/8"	1
Ratchet	1
Clutch puller (P/N 630784)	1
Impact socket, 3/4"	1
Impact wrench (air or electric)	1
Thread locking adhesive	AR
Torque wrench, ft. lbs.	1
Strap wrench	1

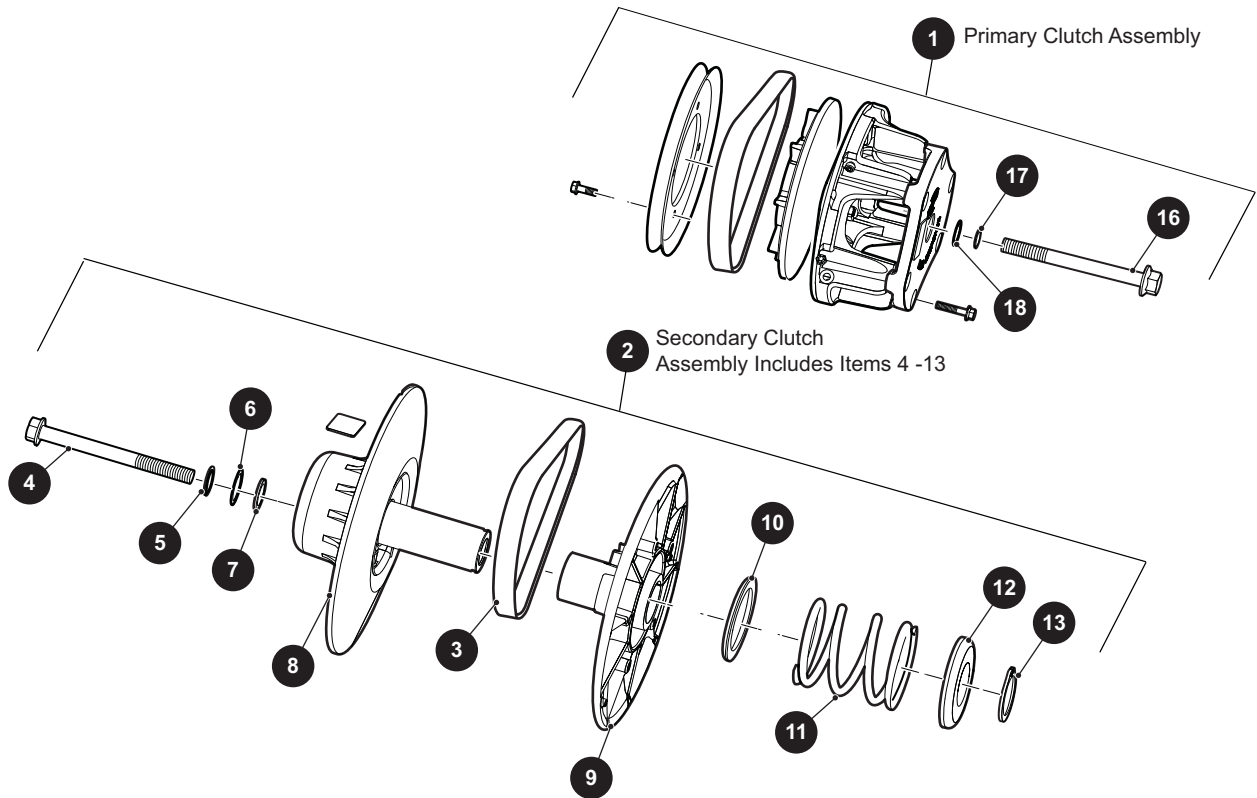


Fig. 2 CVT Components

CONTINUOUSLY VARIABLE TRANSMISSION (CVT)

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

WARNING

To prevent burns and other possible injuries:

Disable the electrical system before attempting to remove the transmission belt to prevent the engine from inadvertently starting.

Be sure that the engine and exhaust components have cooled before attempting any service.

Do not allow 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.

Remove the transmission belt (3). See "Removing the Transmission Belt" on page G-4. Remove the starter/generator belt per STARTER/GENERATOR section.

Remove the bolt (16), lock washer (18) and flat washer (17) (Ref. Fig. 2 on page G-2). Insert a greased clutch puller and tighten (clockwise) using an impact wrench which will remove the clutch from the engine crankshaft.

NOTICE

In some extreme cases, the clutch may 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.

Primary Clutch Installation

CAUTION

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 or belt slip.

Do not install the bolt (16) with an impact wrench.

In order to hold the clutch, do not use a pry bar inserted through the drive clutch as this may damage the components.

Clean both the engine crankshaft and the primary clutch bore. Slide the clutch onto the engine crankshaft and rotate the clutch while lightly pushing the moveable sheave in and out several times to seat the clutch with the tapered crankshaft (Ref. Fig. 2 on page G-2).

Install the lock washer (17) and the large flat washer (18) onto the bolt (16).

Use a strap wrench to hold the clutch when necessary.

Apply thread locking adhesive to the threads of the bolt and install. Tighten the bolt to the torque value specified below:

Item	Torque Specification
16	40 ft. lbs. (54.23 Nm)

Secondary Clutch Removal

Tool List Qty.

External snap ring pliers	1
Socket, 5/8"	1
Ratchet	1
Phillips screwdriver	1
Thread locking adhesive.....	AR
Socket, phillips screwdriver bit.....	1
Torque wrench, in. lbs.....	1
Anti-seize compound	AR
Torque wrench, ft. lbs.....	1

Remove the transmission belt (3). See "Removing the Transmission Belt" on page G-4.

Remove the clutch bolt (5), lock washer (6), flat washer (7) and clutch washer (8) and slide the clutch from the rear axle input shaft.

Secondary Clutch Repair

NOTICE

Parts must be reassembled in same position as their original position. Mark all components to facilitate accurate reassembly.

Some minor field repairs may be made to the secondary clutch. Remove the external retaining ring (13), the spring retainer (12), the spring (11), inner spring retainer (10) and moveable sheave (11) of the secondary clutch assembly (2) (Ref. Fig. 2 on page G-2).

Inspect the shaft for signs of wear and inspect the bushings for signs of deterioration. If there is wear to the point of causing vibration, the clutch must be replaced.

Secondary Clutch Assembly

Assemble the moveable sheave (9) of the secondary clutch assembly (2), to the stationary sheave (8) and insert the inner spring retainer (10), spring (11), outer spring retainer (12) and external retaining ring (13) onto the shaft of stationary sheave (8) (Ref. Fig. 2 on page G-2).

CONTINUOUSLY VARIABLE TRANSMISSION (CVT)

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

Secondary Clutch Installation

Coat the rear axle input shaft with a light coating of anti-seize compound and slide the clutch onto the shaft (Ref. Fig. 2 on page G-2). Install the clutch washer (7), flat washer (6) and lock washer (5) to the clutch bolt (4) and apply thread locking adhesive to the threads of the clutch bolt. Install the clutch bolt (4) and tighten to the torque value specified below:

Item	Torque Specification
4	14 - 17 ft. lbs. (18.98 - 23.04 Nm)

TRANSMISSION BELT

Removing the Transmission Belt

With the vehicle on level ground, remove the transmission belt (3) by pulling the belt upwards which will cause the secondary clutch sheaves to open and loosen the belt tension (Ref. Fig. 3 on page G-4). The belt may then be rolled off the secondary clutch.

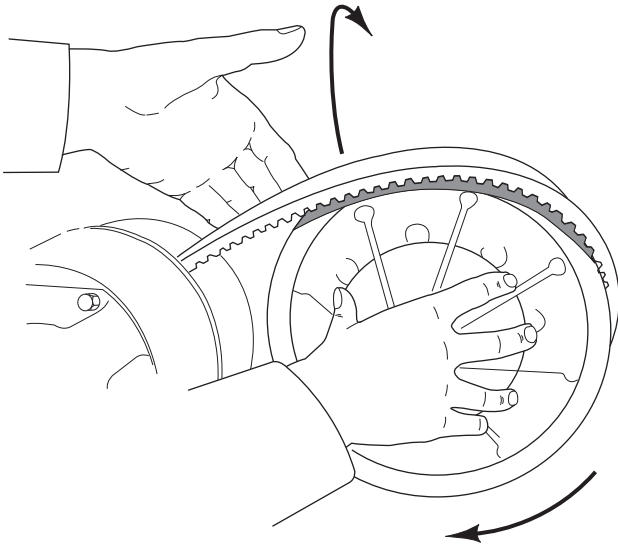


Fig. 3 Removing the Transmission Belt

Transmission Belt Service

The transmission belt will require no service unless the vehicle has been operated in an extremely dusty or muddy location in which case it should be washed with plain water. If the belt becomes frayed or badly worn, it must be replaced.

STORAGE

If the vehicle is to be out of service for an extended period of time, the clutches should not be coated with any protecting spray. The primary clutch sheaves may develop some surface rust which will be removed within a few minutes of running time. The secondary clutch is aluminum and requires no treatment.

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DIRECTION SELECTOR

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

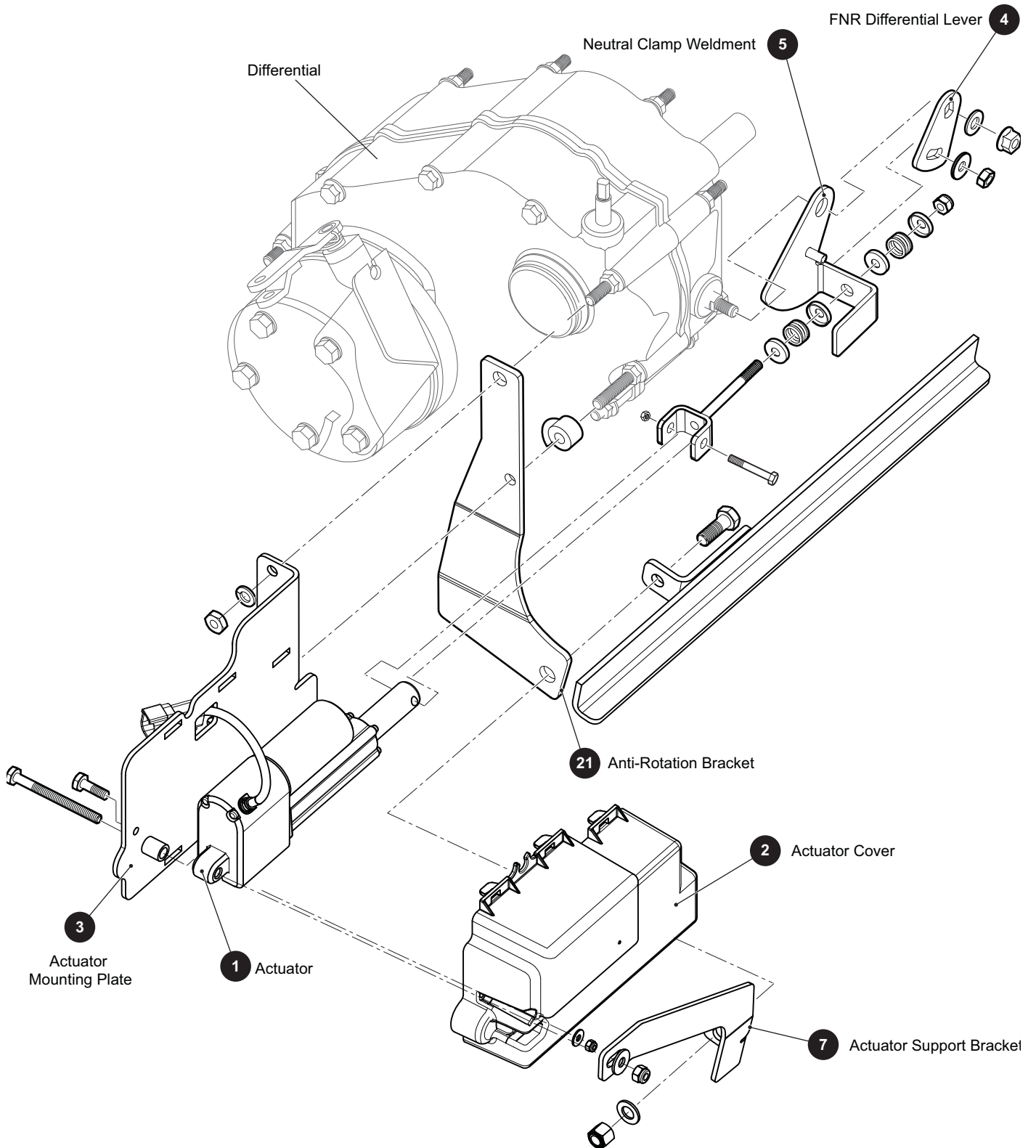


Fig. 1 Direction Selector Components

DIRECTION SELECTOR

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

DIRECTION SELECTOR

FNR Actuator Replacement

Tools List	Qty.
Wrench, 7/16"	1
Wrench, 9/16"	1
Wrench, 1/2"	1
Phillips screwdriver	1
Socket, 7/16"	1
Socket, 9/16"	1
Socket, 1/2"	1
Ratchet	1
Torque wrench, in. lbs.....	1
Torque wrench, ft. lbs.	1

NOTICE

Always observe the following warnings when working on or near batteries:

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(s) must be removed before starting work on vehicle.



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.

Prior to removing the direction selector from the body, the battery negative (-) cable(s) must be disconnected to prevent the possibility of electrical spark or 'shorting out' the battery, either of which could result in an explosion and severe personal injury or death.

Remove connection from main harness to the actuator (1).
Remove the anti-rotation bracket. Refer to "Anti-Rotation Bracket Replacement" on page H-3.

Remove the bolt (10) securing the actuator cover (2) to the actuator mounting bracket (3). Retain the washer (11) and nut (12) for reuse (Ref. Fig. 2 on page H-2).

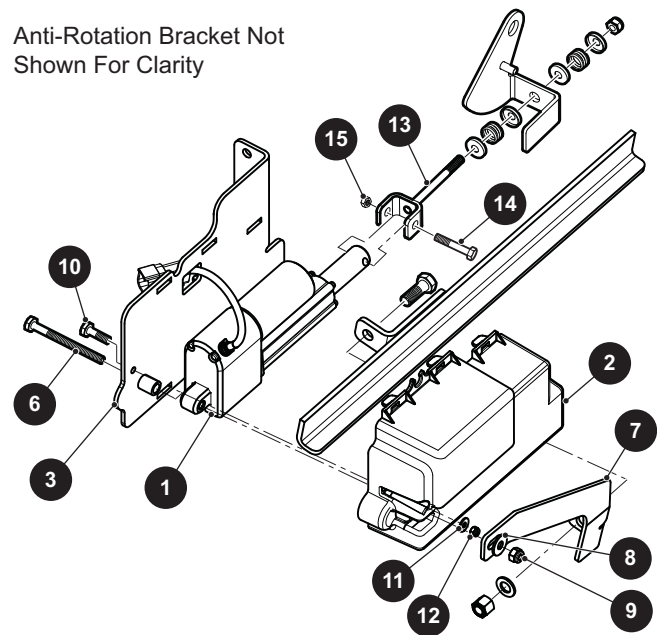
Remove the bolt (6) securing the actuator (1) to the actuator mounting bracket (3) and actuator support bracket (7). Retain the washer (8) and nut (9) to ensure proper placement.

Remove the bolt (14) and locknut (15) securing the clevis rod (13) to the actuator (1).

Assemble in reverse order of disassembly.

Tighten the hardware to torque values specified below:

Item	Torque Specification
10	20 - 26 in. lbs (2.25 - 3.00 Nm)
6	18 in. lbs. (2.03 Nm)
15	6 - 8 ft. lbs. (8.13 - 10.84 Nm)



Anti-Rotation Bracket Not Shown For Clarity

Fig. 2 FNR Actuator

FNR Differential Lever Replacement

Tools List	Qty.
Socket, 7/16"	1
Wrench, 7/16"	1
Ratchet	1
Torque wrench, in. lbs.....	1
Torque wrench, ft. lbs.	1

Remove nut (16) and washer (17) securing the differential lever (4) and neutral clamp weldment (5) to the differential (Ref. Fig. 3 on page H-3). Retain the hardware to ensure

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

proper placement.

Remove nut (18) and washer (19) securing the differential lever (4) to the neutral clamp weldment (5). Remove nut (20) securing clevis rod (15) to neutral clamp weldment (5).

Retain the hardware to ensure proper placement.

Assemble in reverse order of disassembly.

Tighten the hardware to torque values specified below:

Item	Torque Specification
16	13 - 17 ft. lbs (17.62 - 23.04 Nm)
18	5 - 6 ft. lbs. (6.77 - 8.13 Nm)

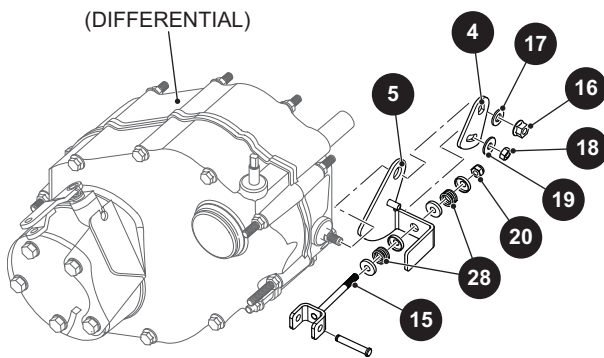


Fig. 3 Differential Lever

Anti-Rotation Bracket Replacement

Tools List	Qty.
Wrench, 9/16"	1
Socket, 9/16"	1
Ratchet	1
Torque wrench, in. lbs.	1
Torque wrench, ft. lbs.	1

Remove nuts (23), washers (22), and spacer (24) securing the anti-rotation bracket (21) to the differential (Ref. Fig. 4 on page H-3).

Remove the bolt (26), washer (26) and nut (27) securing the anti-rotation bracket (21) to the actuator support bracket (7) and the frame.

Assemble in reverse order of disassembly.

Tighten the hardware to torque values specified below:

Item	Torque Specification
23	13 - 17 ft. lbs (17.62 - 23.04 Nm)
27	20 - 22 in. lbs. (2.25 - 2.50 Nm)

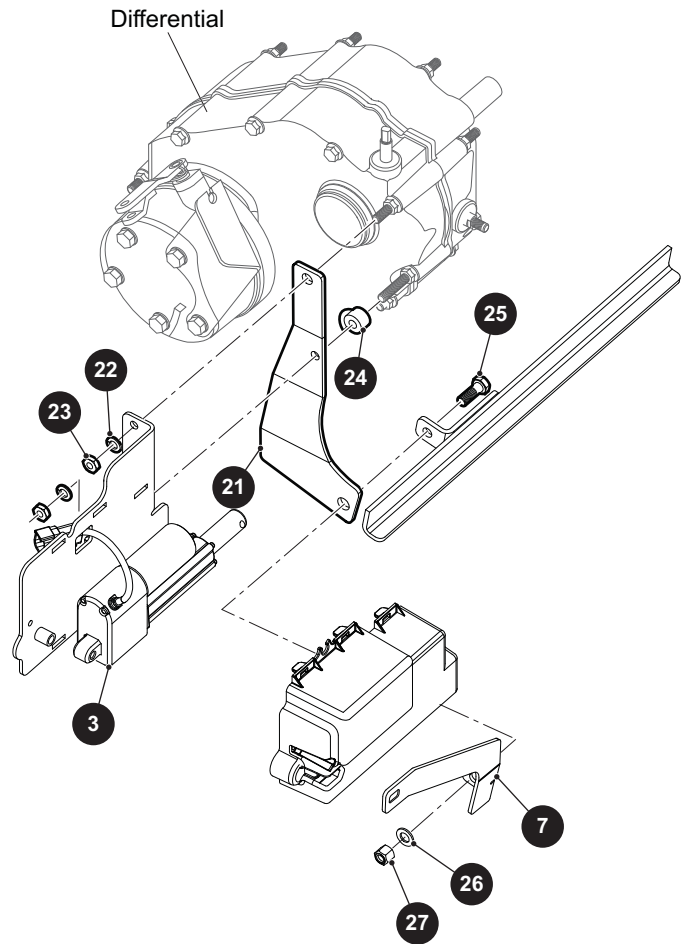


Fig. 4 Anti-Rotation Bracket

DIRECTION SELECTOR

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

Adjusting the FNR System

Tools List	Qty.
Wrench, 7/16"	1
Socket, 7/16"	1
Ratchet	1
Torque wrench, ft. lbs.	1

NOTICE

Always observe the following warnings when working on or near batteries:

⚠ 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(s) must be removed before starting work on vehicle.



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.

Put the vehicle in GAS mode, and in NEUTRAL position.

Remove nut (18) and washer (19) securing the differential lever (4) to the neutral clamp weldment (5) (Ref. Fig. 3 on page H-3).

Rotate the FNR differential lever (4) back and forth, feeling for the FWD and REV detents in the differential (Ref. Fig. 5 on page H-4). Once these are located, center the bracket between these two points. If the detents cannot be felt, refer to "TROUBLESHOOTING" on page H-5. Tighten the nut (18) in the centered position.

Rotate the FNR differential lever (4) back and forth, feeling for the FWD and REV detents in the differential (Ref. Fig. 5 on page H-4). Once these are located, center the bracket between these two points. If the detents cannot be felt, refer to "TROUBLESHOOTING" on page H-5. Tighten the nut (18) in the centered position.

Tighten the hardware to torque values specified below:

Item	Torque Specification
18	5 - 6 ft. lbs. (6.77 - 8.13 Nm)



FWD Detent



FNR Centered



REV Detent

Fig. 5 FNR System Adjusting

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

Checking the FNR System

Tools List	Qty.
Wrench, 7/16"	1
Socket, 7/16"	1
Ratchet	1
Torque wrench, ft. lbs.	1

With the vehicle in GAS mode, put the vehicle in FWD. Wait for the actuator (1) to shift, then rotate the clutch belt until the differential goes into forward. Note the compression and tension on the springs (28) (Ref. Fig. 3 on page H-3). If it does not shift, refer to "Fault Code Description" on page H-6.

Put the vehicle into REV. Wait for the actuator to shift, then rotate the clutch belt until the differential goes into reverse. Note the compression and tension on the springs (28). If it does not shift, refer to "TROUBLESHOOTING" on page H-5.

Put the vehicle into NEUTRAL. Rotate the clutch belt to make sure the shift occurred.

Cycle through the different modes a few times and confirm that the differential is put into the correct gear. If any problems occur, or if the amount of compression is different when the vehicle is in REV or FWD, refer to "TROUBLESHOOTING" on page H-5.

TROUBLESHOOTING

- Can't locate detents during FNR adjustment:
 - Check and make sure the assembly of the anti rotation, upper and lower actuator mounting bracket are correct. Make sure the vehicle differential and actuator are both in neutral. If this does not solve the issue. Center the FNR adjustment bracket and check the FNR system See "Checking the FNR System" on page H-5. Make adjustments as needed.

- Vehicle will shift into REV, but not FWD:
 - Loosen the adjustment nut (18) and rotate the FNR differential lever (4) to bias the system forward. (counter clockwise).

NOTICE

Do not push the FNR differential lever (4) all the way to one side, but move and test in small increments.

- Vehicle will shift into FWD, but not REV.
 - Loosen the adjustment nut (18) and rotate the FNR differential lever (4) to bias the system towards reverse (clockwise).

NOTICE

Do not push the FNR differential lever (4) all the way to one side, but move and test in small increments.

- Vehicle makes ticking noises in Neutral.
 - Usually this means the vehicle is adjusted to far in the FWD direction. See the "Vehicle will shift into FWD, but not REV" section for fix.
- Springs have unequal tension when they are in the FWD position compared to REV.
 - If the springs are compressed more in FWD than REV, refer to the "Vehicle will shift into FWD, but not REV" step to bias the system more in reverse. See the "Vehicle will shift into REV, but not FWD" step if the springs have more compression in REV than in FWD.
- Vehicle will not shift into gear properly, and LED indicator lights on the dash are flashing.
 - Refer to the following table for the fault code description. See "Fault Code Description" on page H-6.

DIRECTION SELECTOR

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

Fault Code Description

LED Code	Description	Possible Cause
1-1	Watchdog Reset	No Longer Visible
1-2	Invalid Direction Switch Input	This means the powertrain controller is receiving two or more 48V signals from the key switch, for example the controller believes that the user is asking for Forward and Reverse at the same time, or any combination of F, N, or R. This could be a bad key switch. Unplug the powertrain controller and probe pins 3 (reverse), and 4 (forward). If the vehicle is in F, pin 4 will have 48V on it, R pin will have 48V, and N neither pin will have 48V.
1-3	Invalid Mode Switch Input	This means the powertrain controller is receiving two or more 48V signals from the mode switch. This could be a bad mode switch. Unplug the controller and probe pins 1 (gas), 2 (electric), and 24 (both). Make sure only one of these signals into the powertrain controller have 48V on them at a time, depending on what position the mode switch is in.
1-4	Actuator feedback out of range (High)	This could mean that the potentiometer on the actuator has been damaged, destroyed, water intrusion at the connector is shorting it out. The actuator should be unplugged and using an ohmmeter the 10K potentiometer should be read across the yellow and black pins. Then measure yellow to red, and black to red, and these should equal the 10K that was measured across the yellow and black. If the potentiometer cannot be read then the actuator needs to be replaced.
2-1	Actuator feedback out of range (Low)	
2-2	Actuator Extend Failed	If Extend and Retract fail are fault being shown, the actuator should be inspected, making sure the FNR lever and all of the assembly are not binding anywhere. If there is no binding and the actuator is not trying to move at all, then the 3 Amp fuse in the 48 V line going to the powertrain controller needs to be checked.
2-3	Actuator Retract Failed	
2-4	High Pedal Disable	This means the vehicle was started with the pedal being pressed, and the key needs to be cycled with the pedal up. If the pedal is not pressed and the HPD fault is shown, the plunger switch on the pedal may be unplugged.

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

GAS POWERTRAIN ELECTRICAL SYSTEM

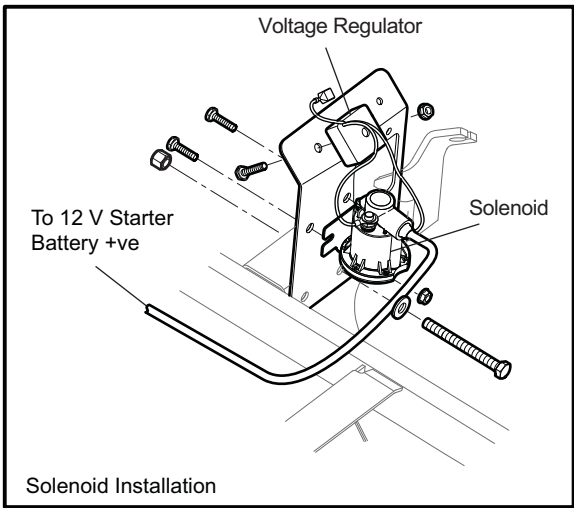
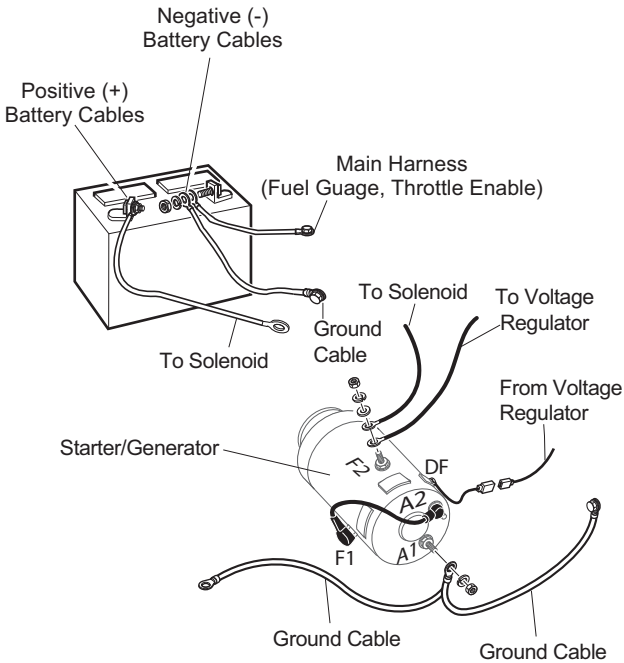


Fig. 1 Electrical System Components

ELECTRICAL

ELECTRICAL Read all of Section B and this section before attempting any procedure. Pay particular attention to Notices, Cautions, Warnings

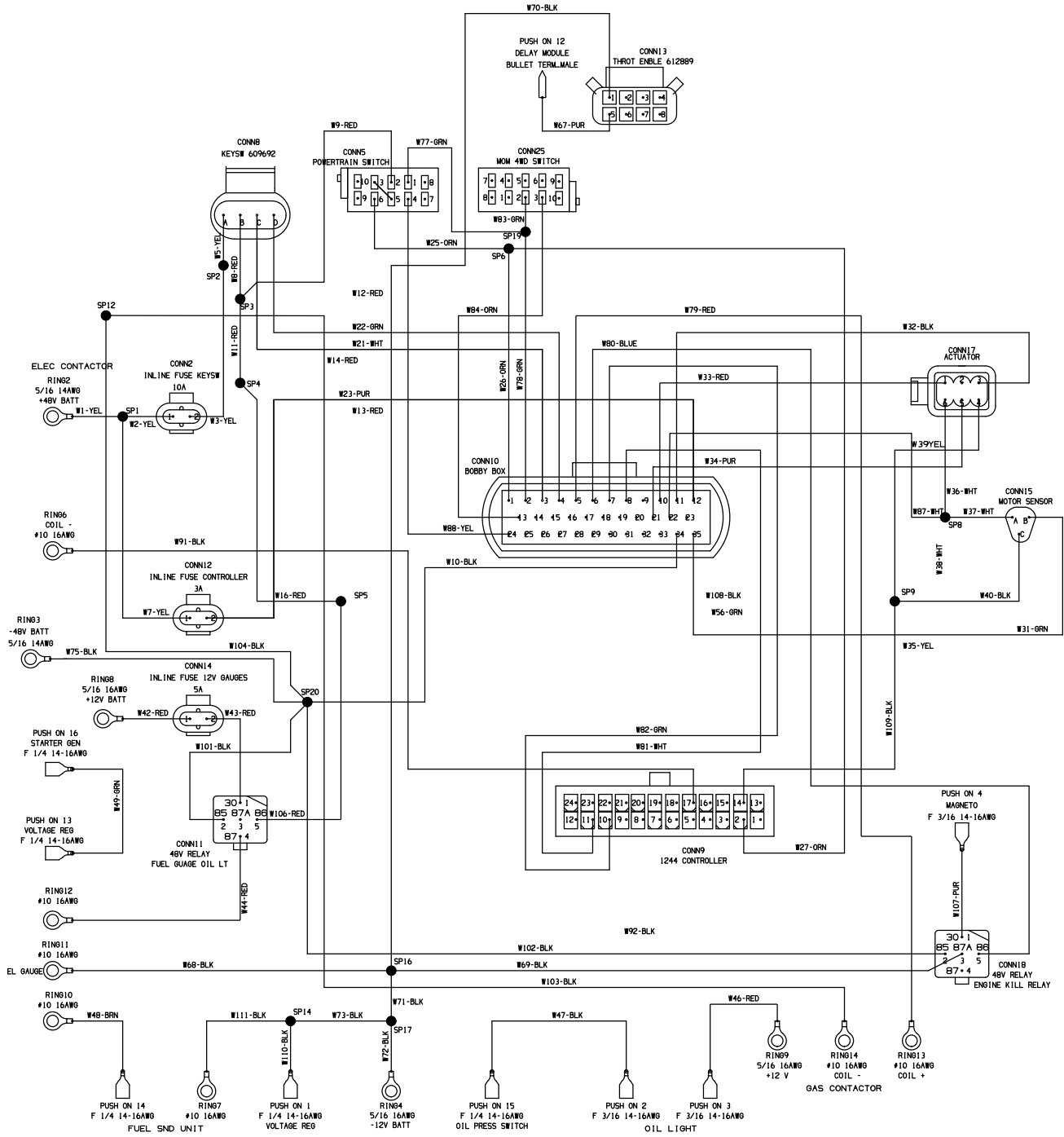


Fig. 2 Gas Powertrain And 4WD Electrical Schematic

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

Circuits and Controls

The electrical system is a 12 volt negative ground system consisting of:

- Battery
- Starter/generator
- Voltage Regulator
- Solenoid
- Fuses
- Key Switch

These components comprise the Starting and Charging Circuits Electrical System Components, on Page J-1.

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 vehicle lifted or the Key switch placed in neutral mode.

Follow the lifting procedure in Section B 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.

This section will assist in troubleshooting the vehicle electrical system and accessory wiring. To troubleshoot the ignition electrical system, refer to the Briggs & Stratton engine Operating & Maintenance Instructions (Form No. 274272) supplied with the vehicle. For more in-depth assistance, refer to the Repair Manual for Vanguard™ VTwin Overhead Valve engine (Part No. 272144).

Testing Gas Engine Starting Circuit

WARNING

To prevent the possibility of injury resulting from vehicle inadvertently starting, the drive belt must be removed or entire vehicle must be lifted (see procedure in Section B).

Tool List	Qty.
DVOM.....	1

If the gas engine does not start, proceed as follows:

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.
3. Check for loose wires at all terminal connections.
4. Check the complete electrical system for correct circuitry. Gas Powertrain And 4WD Electrical Schematic, on Page J-2
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. Refer to Component Testing in TROUBLESHOOTING section.
7. Check the starting solenoid operation. Turn the key switch to the 'ON' position.
 - (a) Place the DVOM (set to appropriate DC volts scale) negative (-) probe on terminal A of the solenoid. Place 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.

Refer to Testing A Solenoid For Continuity, on Page J-17

Testing Engine 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 entire vehicle must be lifted (see procedure in Section B).

The charging circuit consists of a starter/generator, voltage regulator and battery Electrical System Components, on Page J-1. The solenoid must be functional in order to start the vehicle, but is not considered part of the charging circuit.

If the battery charge is inadequate (less than 11 VDC) while under load, proceed as follows:

1. Check the battery voltage and inspect for loose or corroded terminal posts and connections. Check electrolyte level.

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

2. Check charging circuit component terminals for proper, clean, tight connections.
3. Check for charging voltage as follows:
 - (a) Lift the entire vehicle (see procedure to lift the vehicle in Section B) so that all wheels are free to rotate.
 - (b) 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.
 - (c) Attach the DC voltmeter across the regulator's red and black leads.
 - (d) Start the engine and accelerate to governed speed.
 - (e) The meter should read higher than before starting the engine. In a reasonable amount of time, the reading should settle between 14 and 15 volts, indicating the regulator is functioning properly.
 - (f) If no increase over battery voltage is observed, there is a malfunction in the charging circuit.
 - (g) 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.
 - (h) While engine is running and 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.
 - (i) If the above procedures do not correct the problem, check for faults in the vehicles wiring harness and/or generator.

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.

Batteries that are new or have been stored must be fully charged before being tested or placed in vehicle.



CAUTION

Do not overcharge battery.

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.

VOLTAGE TEST FOR STARTING BATTERY



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.

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

MAIN HARNESS

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.

⚠ CAUTION

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 must be replaced. See "Headlight Bulb Replacement" on page 9.

2. Check condition of the 48V batteries set.
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 white (WHT) wire attached. Place the black probe (-) on the battery post with the black (BLK) 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.

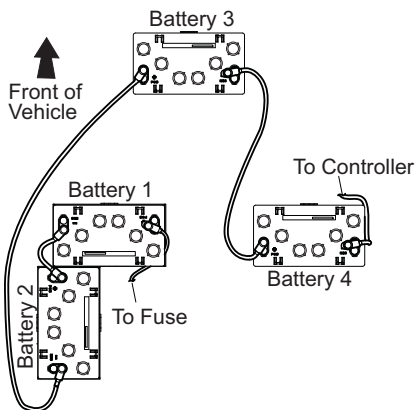


Fig. 3 48V Battery Set Connections

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 power (white) 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
Visually inspect the fuses and check continuity if necessary and replace if required.

⚠ CAUTION

Use of incorrect fuse rating can damage electrical components.

ELECTRICAL

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

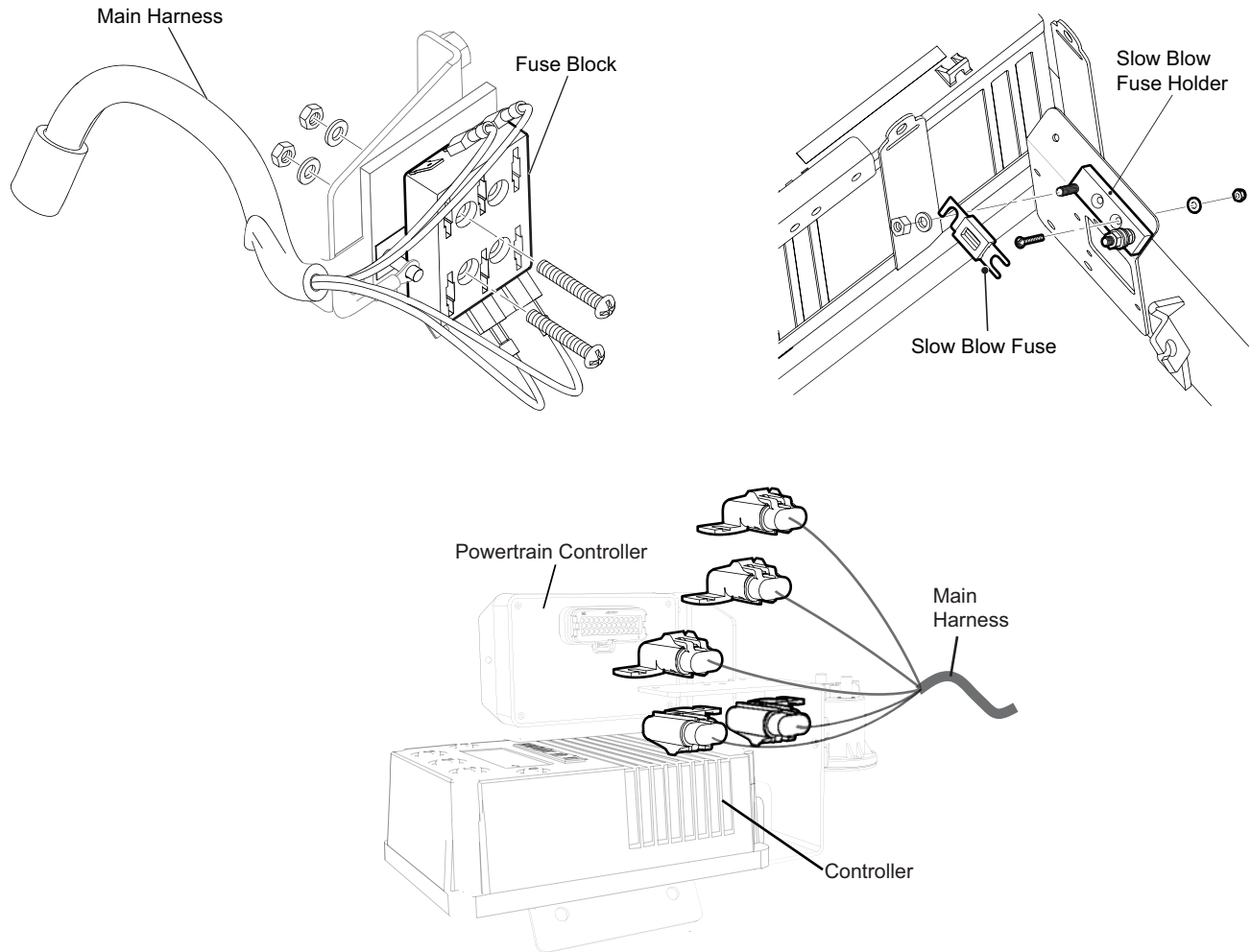


Fig. 4 Inline Fuses

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

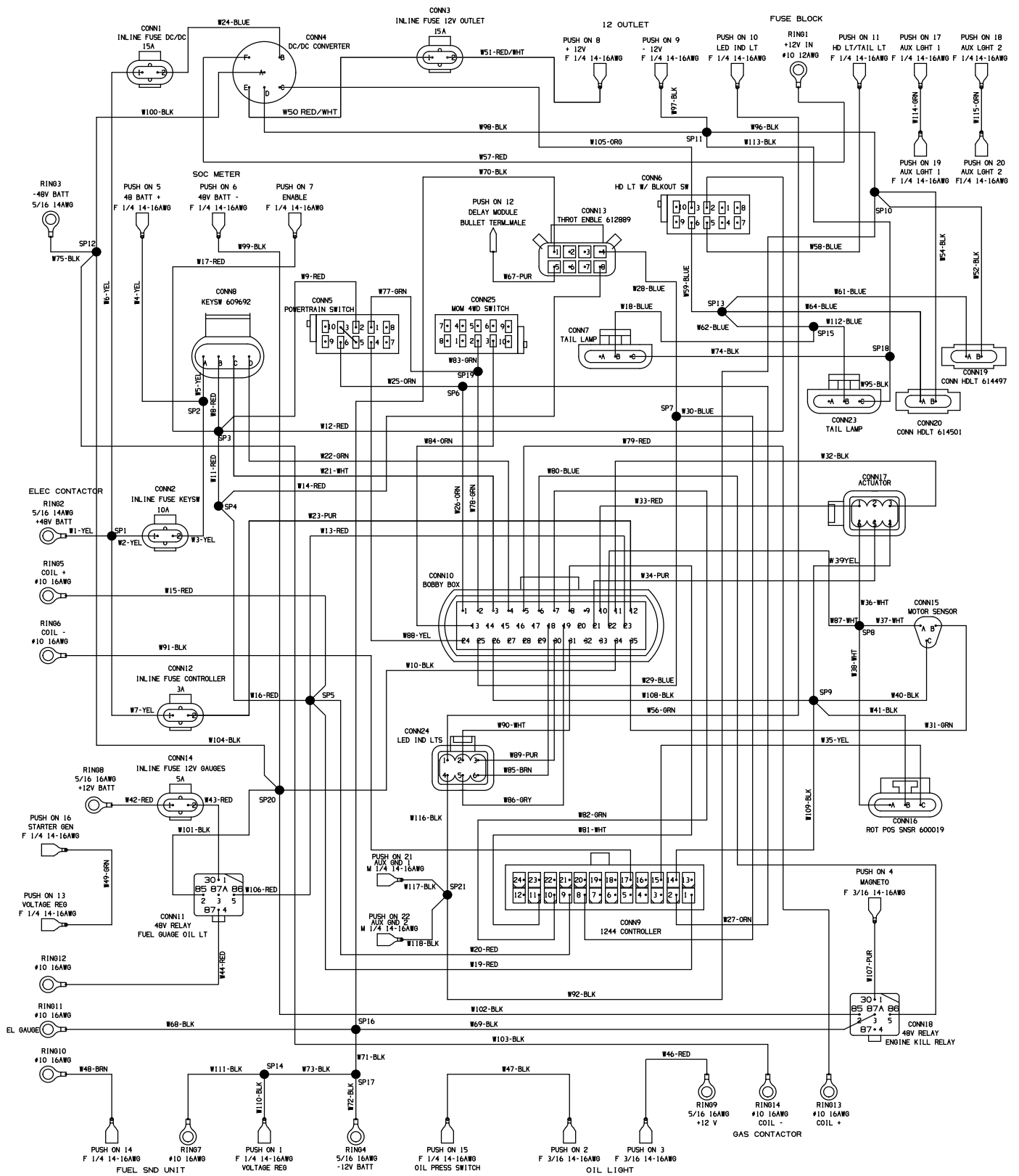


Fig. 5 Main Harness Wiring Diagram

ELECTRICAL

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

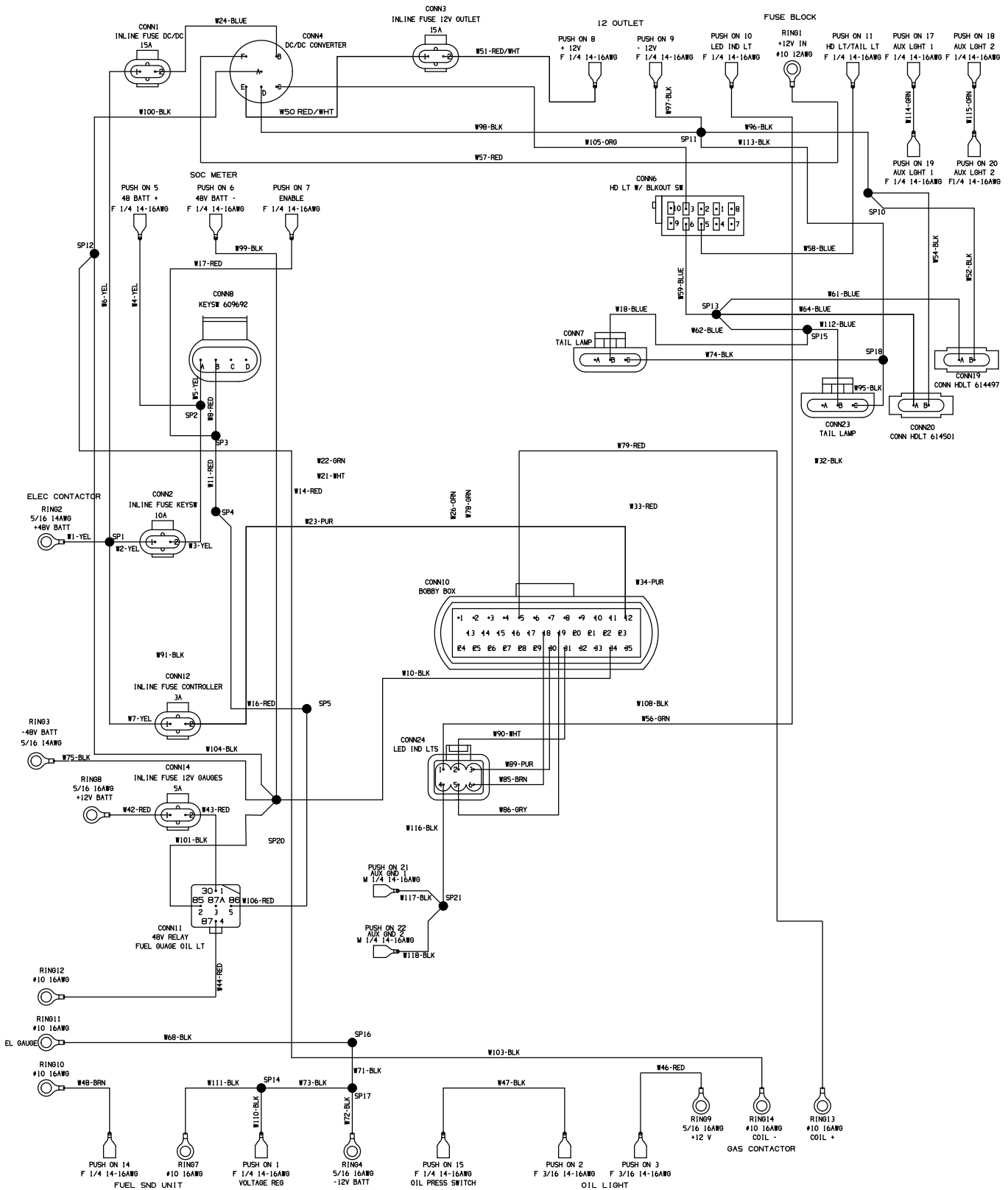


Fig. 6 Accessory Wiring Diagram

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

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 schematic (Ref. Accessory Wiring Diagram on page J-8) 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 electricity flow must be corrected, whether by repairing or replacing the wire, the switch or accessory.

Headlight Bulb Replacement

NOTICE

Following Procedure is applicable for vehicles with Halogen Head lights.

Tool List	Qty.
Wrench, 10 mm	1



CAUTION

To reduce the possibility of premature bulb failure, do not touch new bulbs with bare fingers. Use clean, dry tissue or paper towel to handle the glass portion of the bulb.

For vehicles equipped with halogen head lights mounted in the cowl, locate bulb socket (1) on backside of light and turn bulb socket a quarter turn counterclockwise to unlock and pull out bulb and socket.

Insert new bulb and rotate socket (1) a quarter turn clockwise to secure. Headlight and Tail Lamp Replacement, on Page J-10

NOTICE

Following Procedure is applicable for vehicles with LED Head lights.

LED head lamps are designed for a long life and do not fail often. In case of failure the complete head light assembly is to be replaced and replacement for the single LED lamp failed is not possible. Refer to Service Parts Manual for the part number of the LED Head Lamp.

To replace the LED headlight assembly (18), locate the nuts (2) in back of the headlight assembly, underneath the cowl that secures the front part of the light to the rear housing Headlight and Tail Lamp Replacement, on Page J-10.

Remove the nuts allowing the LED head light assembly (18) to be removed from the outside of the cowl.

Disconnect the wires.

Replace with a new LED headlight assembly and assemble in the reverse order of removal.

Taillight Bulb Replacement

To replace the taillight bulb or the brake lamps, roll the rubber bezel from around the edge of the taillight and remove the lens. Replace with new bulb and replace the lens removed. Headlight and Tail Lamp Replacement, on Page J-10.

Headlight and taillight bulbs and fuses are available from a local Distributor, an authorized Branch or the Service Parts Department.

ELECTRICAL

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

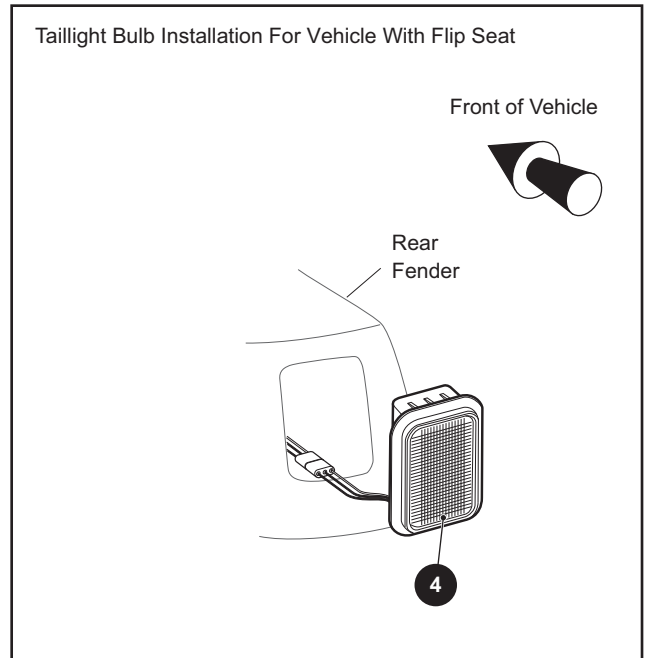
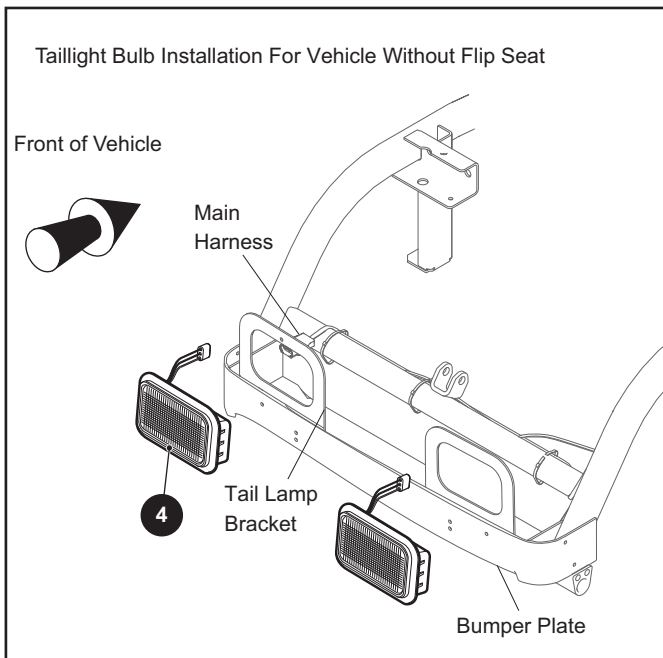
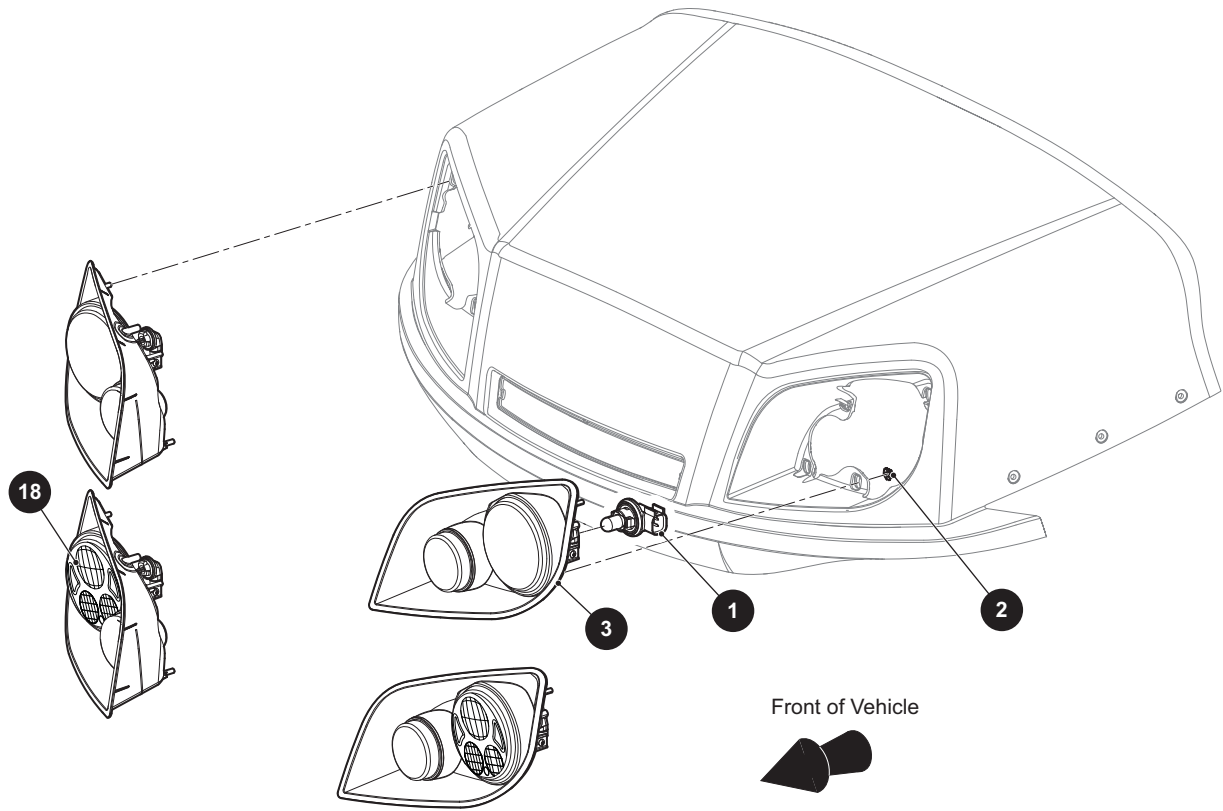


Fig. 7 Headlight and Tail Lamp Replacement

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

ELECTRONIC SPEED CONTROL

Speed Sensor

The speed sensor uses a sealed sensor to read the impulses of a ring magnet attached to the armature shaft of the motor Speed Sensor, on Page J-11. Magnetic pulses are converted into electrical signals which the controller uses to determine the motor speed.

Refer to "Component Testing" in TROUBLESHOOTING section for testing the speed sensor and replace if necessary.

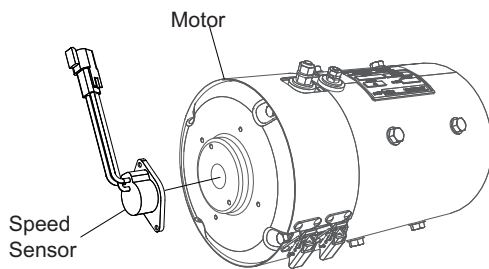


Fig. 8 Speed Sensor

Rotary Position Sensor

Rotary position sensor helps to determine the speed of the vehicle in the electric powertrain mode. Rotary position sensor is connected through the main harness to electronic speed control system of the vehicle. When there is no pressure applied on the accelerator pedal the rotary position sensor remains in the neutral position. As the pedal is depressed the magnitude of deflection in the rotary sensor is transferred to the electronic speed control system of the vehicle which controls the speed of the motor that transmits power to the electric powertrain module in the vehicle Rotary Position Sensor Replacement, on Page J-14.

Controller

The controller is a solid state unit that activates a solenoid and controls the function of the vehicle by responding to inputs from the rotary position sensor, motor speed sensor and many other units. The controller and solenoid are located under the cowl at the front of the vehicle Controller and Solenoid, on Page J-11.

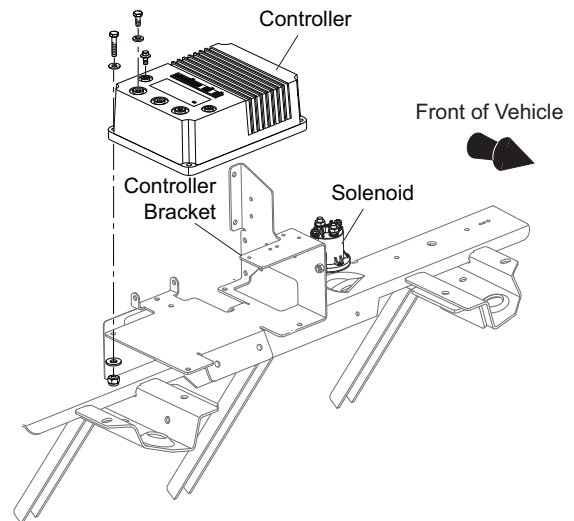


Fig. 9 Controller and Solenoid

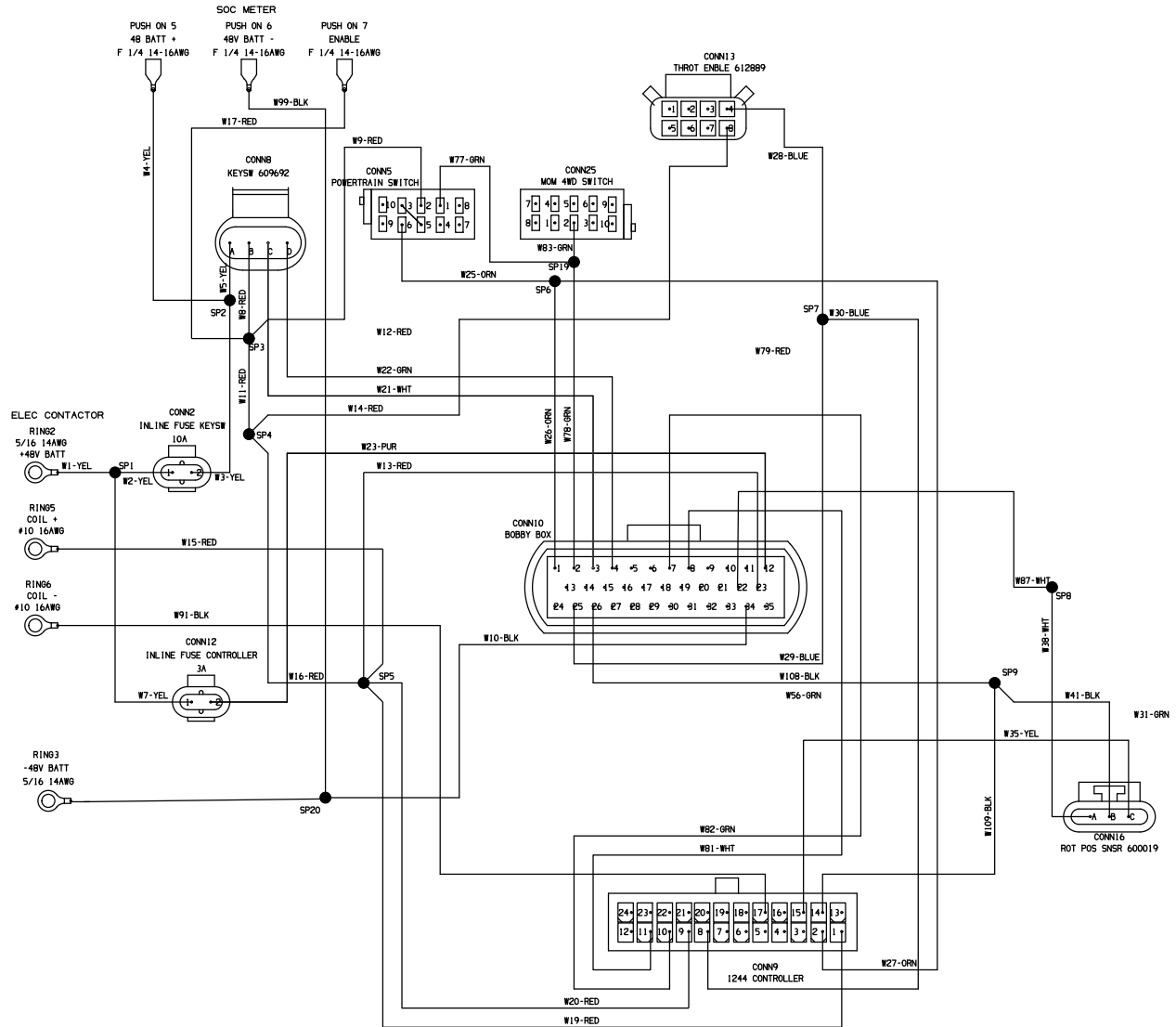
The main wire harness, rotary position sensor, and speed sensor are connected to the controller through a 24 pin plug. The rotary position sensor is connected to the controller through a two pin plug on main wire harness. The speed sensor is connected to the controller through a three pin plug on main wire harness.

The controller is wired to the batteries and develops a regulated power supply for the rotary position sensor. As the pedal is depressed the magnitude of deflection in the rotary sensor varies the voltage which is fed back to the controller which interprets the change in voltage and supplies the appropriate power to the motor.

The rotary position sensor unit and the controller are both solid state units that contain no user serviceable parts. The testing procedures are designed to test the basic functionality of the power and control wiring systems. Once the functionality of the wiring has been confirmed, the remaining tests are used to identify which of the components (controller or rotary position sensor) must be replaced.

ELECTRICAL

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



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

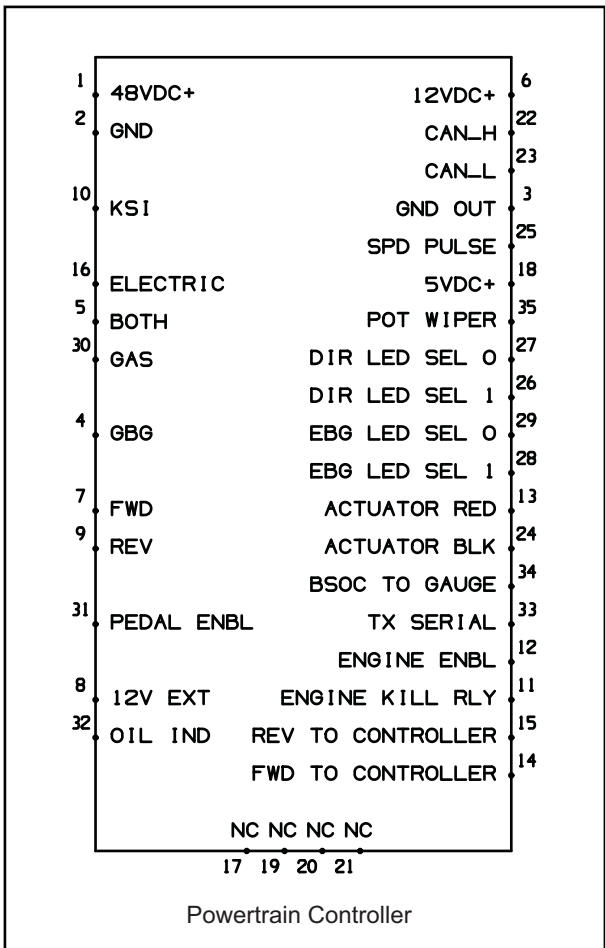
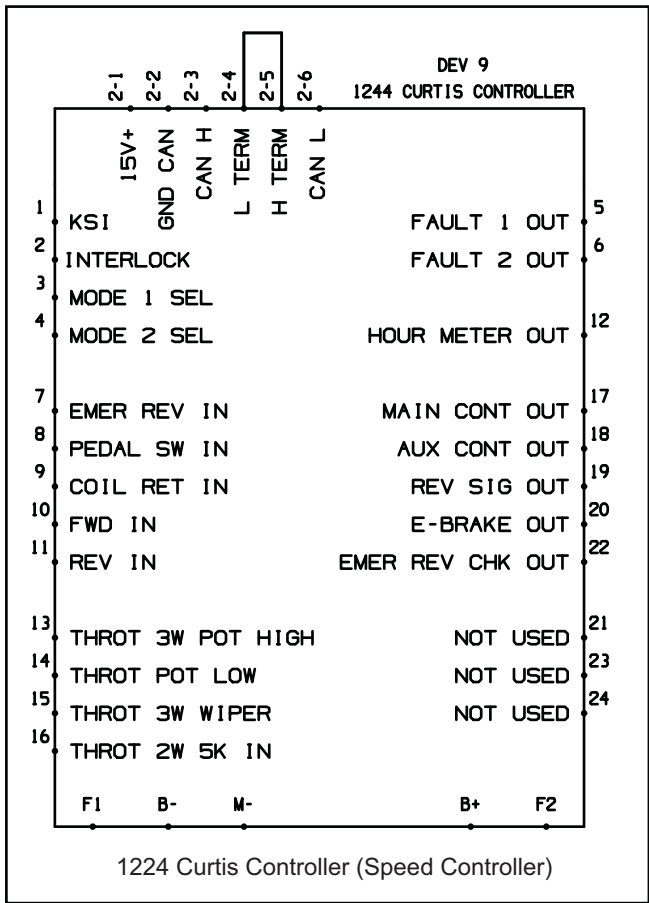


Fig. 11 Powertrain Controller and Speed Controller

ELECTRICAL

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

Rotary Position Sensor Replacement

Tool List	Qty.
Phillips screwdriver	1

WARNING

To prevent electrical shock, the BL- wire must be removed before discharging the controller by shorting the B+ and B- terminals of the controller with a large screwdriver. Be sure to hold screwdriver by the insulated portion.

Using an insulated wrench, remove the BL- wire from the battery.

Remove the connector from the rotary position sensor (5) Rotary Position Sensor Replacement, on Page J-14. Remove the screws (6) to remove the rotary position sensor (5) from the accelerator pedal bracket.

Replace the new rotary position sensor (5) in reverse order of removal.

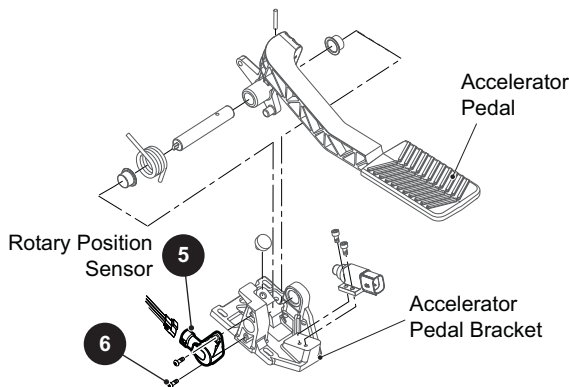


Fig. 12 Rotary Position Sensor Replacement

Controller Replacement

Tool List	Qty.
Socket, 7/16"	1
Socket, 13/32"	1
Ratchet	1
Extension, 6"	1
Wrench, 7/16"	1
Wrench, 13/32"	1
Insulated wrench, 1/2"	1
Torque wrench, ft. lbs	1

WARNING

To prevent electrical shock, the BL- wire must be removed before discharging the controller by shorting the B+ and B- terminals of the controller with a large screwdriver. Be sure to hold screwdriver by the insulated portion.

NOTICE

Note the location of the wiring on the controller before removing wiring from controller.

Using an insulated wrench, remove the BL- wire from the battery.

Remove the bolts (11 and 13) and flat washers (12) and remove the connectors from controller (7) Controller Removal, on Page J-15.

Remove bolts (8), washers (9) and locknuts (10) and remove the controller (7) from the controller bracket.

Mount new controller (7) and reconnect wiring. Tighten the following hardware to the torque values as specified below:

Item	Torque Specification
10	21 - 25 ft. lbs. (28.47 - 33.89 Nm)
11	8 - 9 ft. lbs. (10.85 - 12.20 Nm)
13	6.63 - 8.11 ft. lbs. (9 - 11 Nm)

Reconnect the BL- battery cable.

Solenoid Replacement

Tool List	Qty.
Socket, 7/16"	1
Socket, 3/8"	1
Ratchet	1
Insulated wrench, 1/2"	1
Torque wrench, ft. lbs	1

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

NOTICE

Note the location of the wiring on the controller before removing wiring from solenoid. Using an insulated wrench, remove the BL- wire from the battery.

Disconnect the wires from solenoid (14). Remove the bolt (15), washer (16) and locknut (17) and remove the solenoid (14) from the controller bracket Solenoid Replacement, on Page J-15.

Mount new solenoid (14) and reconnect wiring. Tighten the following hardware to the torque values as specified below:

Item	Torque Specification
17	6.63 - 8.11 ft. lbs. (9 - 11 Nm)

Reconnect the BL- battery cable.

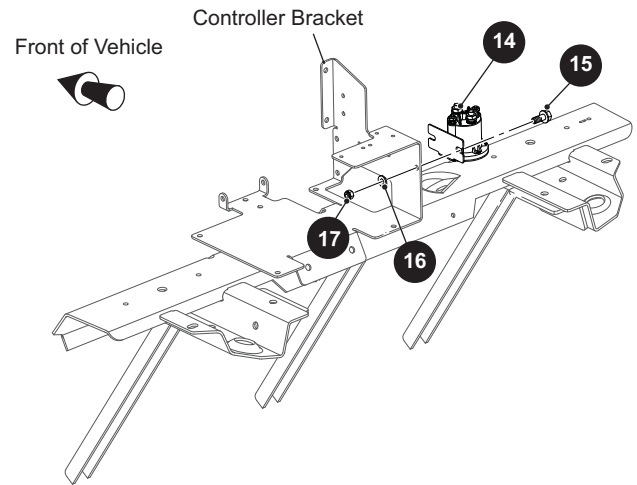


Fig. 13 Solenoid Replacement

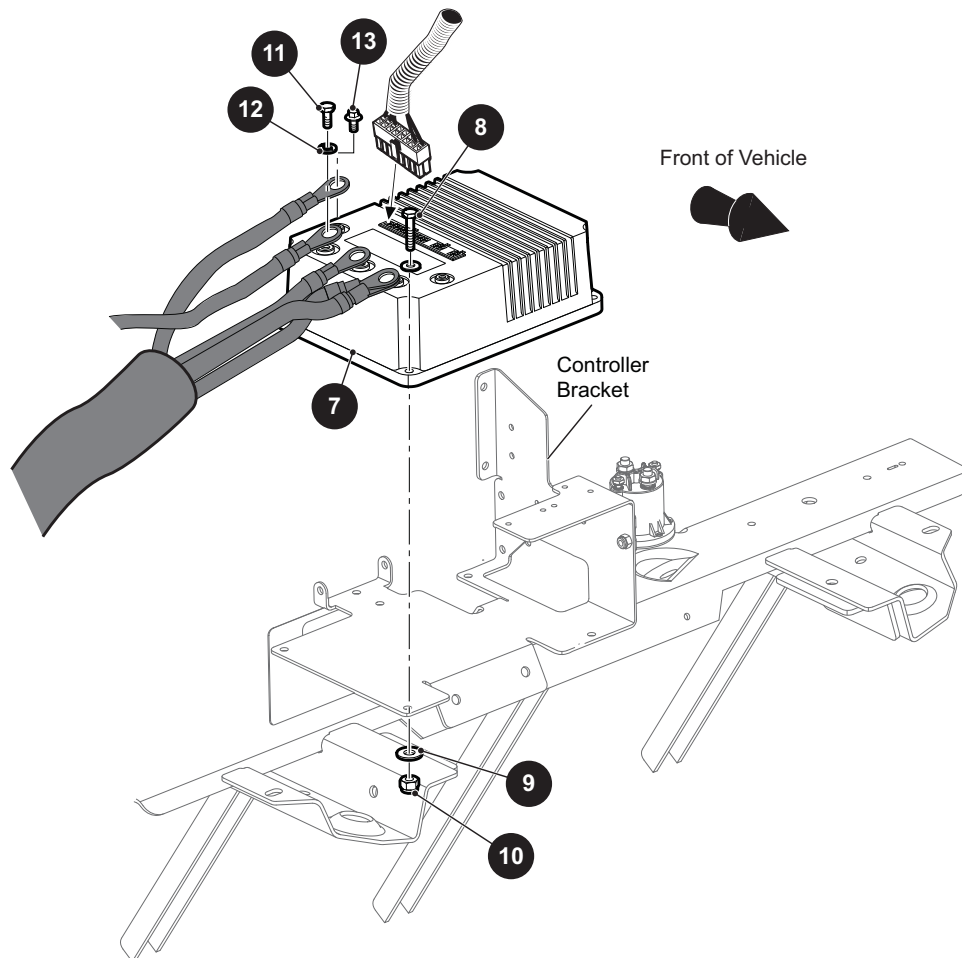


Fig. 14 Controller Removal

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

TROUBLESHOOTING

General

In order to effectively troubleshoot the circuits that include the headlights, taillights and gauges, 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. Gas Powertrain And 4WD Electrical Schematic, on Page J-2, Main Harness Wiring Diagram, on Page J-7, Accessory Wiring Diagram, on Page J-8, Electric Powertrain Electrical Schematic, on Page J-12 and Powertrain Controller and Speed Controller, on Page J-13.

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 on 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.

Testing Battery Voltage

It is important to determine the condition of the battery set before proceeding with any electrical troubleshooting. An open voltage test is of little use since a battery that has deteriorated to the point of requiring replacement can still show eight volts or higher in an open voltage test. If there is any doubt as to the adequacy of the battery set, charge the batteries and perform a load test using a discharge machine following manufacturer's instructions. If batteries are satisfactory, recharge battery set.

With the adequacy of the batteries confirmed, use a DVOM connected directly to the battery terminal posts to determine the open voltage of the set. In the following tests, this voltage level will be used as a reference. Some loss due to resistance of wires and connectors may be indicated by readings that could be up to one volt less than the reference voltage. No reading indicates an "open" condition and the battery wires should be inspected for a broken or disconnected wire or component.

Continuity Check

WARNING

To prevent possible injury or death resulting from a battery explosion, use an insulated wrench and remove the BL- wire from the battery to disconnect electrical power to vehicle.

Before attempting to perform a continuity check, turn the key switch to 'OFF' and place the direction selector in neutral.

Turn the key switch to 'OFF' and place the direction selector in neutral before disconnecting power by removing the BL- connection to the battery. Always use insulated wrenches when working on batteries. To check for continuity, set the DVOM to the K Ω setting and select 'Continuity'. The meter will give an audible signal when it detects continuity. If the meter does not have a continuity setting, set it to K Ω , the meter will indicate "0" when it detects continuity.

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

Testing A Switch For Continuity

Place one probe on one contact of the switch, place the second probe on the second terminal of the switch
Continuity Check of Switch, on Page J-17.

Actuating a normally open (NO) switch will cause the DVOM to show "0" or give an audible indication when the switch is operated. A normally closed (NC) switch will cause the meter to show "0" or give an audible indication when the probes are attached without activating switch. The audible indicator will stop and the meter display will indicate a value greater than "0" when the switch is activated.

The change in display or audible indicator demonstrates that the switch is functioning.

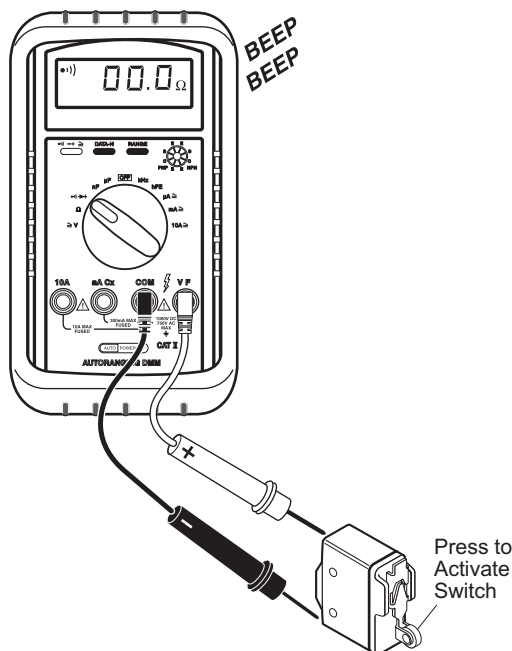


Fig. 15 Continuity Check of Switch

Testing A Solenoid For Continuity

Place one probe on one of the large terminals and the other probe on the second large terminal
Continuity Check of Solenoid, on Page J-17. If the meter shows "0" or gives an audible indication, the solenoid terminals are "welded" closed and the solenoid must be replaced.

If the continuity test indicates that contacts are not "welded" and the wiring to the solenoid coil is good, the coil has failed and the solenoid must be replaced.

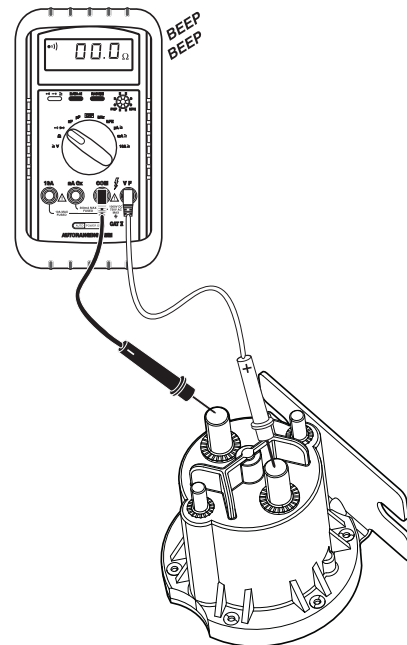


Fig. 16 Continuity Check of Solenoid

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

Exhaust Pipes Not Shown For Clarity

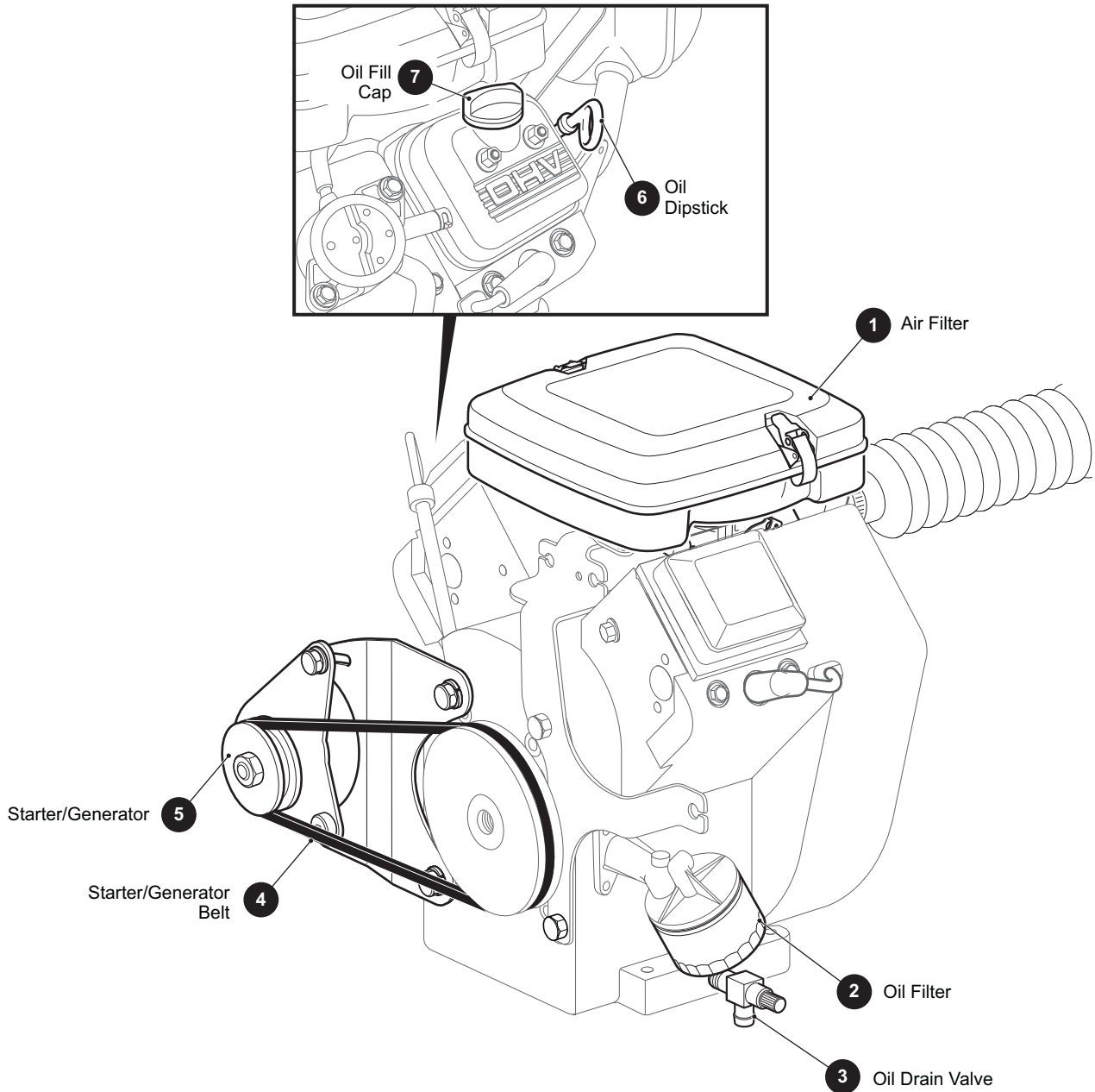


Fig. 1 Engine - General

ENGINE

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

GENERAL

This section describes procedures for performing regular maintenance, preparing vehicle to test engine condition and replacing engine. For engine condition testing and repair procedures, Briggs & Stratton Repair Manual (P/N 272144) for Vanguard™ V-Twin Overhead Valve engine is available.

POWERTRAIN MAINTENANCE

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

Removing Debris

⚠ WARNING

Engine parts should be kept clean to reduce risk of overheating and ignition of accumulated debris which could result in severe injury.

After every off road use, allow the engine to cool and then check for a build up of dirt and debris in the air intake and cooling fins. Dirt and debris may clog the engine's air cooling system. Clean areas shown to prevent engine damage (Ref. Fig. 2 on page K-2). Keep linkages, springs and controls clean. To prevent fire, keep area around muffler free of any combustible material.

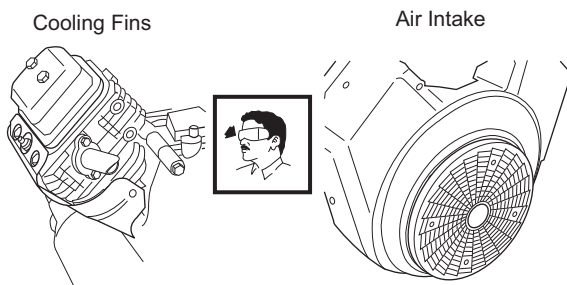


Fig. 2 Cleaning Air Intake

Oil Capacity

Engine oil capacity is approximately 1 1/2 quarts (1.4 liters) when changing oil and filter.

Oil Recommendations

The oil must be high quality detergent oil classified "For Service SF, SG, SH, SJ" or higher. Do not use special additives and do not mix oil with gasoline. The selection of oil viscosity is dependent upon the climate in which the vehicle will be used. Most vehicles require SAE 30 oil; however, vehicles used in cold climates will require a multi-viscosity oil (Ref. Fig. 3 on page K-2).

Synthetic oil meeting ILSAC GF-2, API certification mark and API service symbol with "SJ/CF ENERGY CONSERVING" or higher, is an acceptable oil at all temperatures. **Use of synthetic oil does not alter required oil change intervals.**

NOTICE

Do not use special additives in recommended oil.

Do not mix oil with gasoline.

⚠ CAUTION

Air cooled engines run hotter than automotive engines. The use of non-synthetic multi-viscosity oils (5W-30, 10W-30, etc.) in temperatures above 40° F (4° C) will result in higher than normal oil consumption. When using a multi-viscosity oil, check oil level more frequently.

SAE 30 oil, if used below 40° F (4° C) will result in hard starting and possible engine bore damage due to inadequate lubrication.

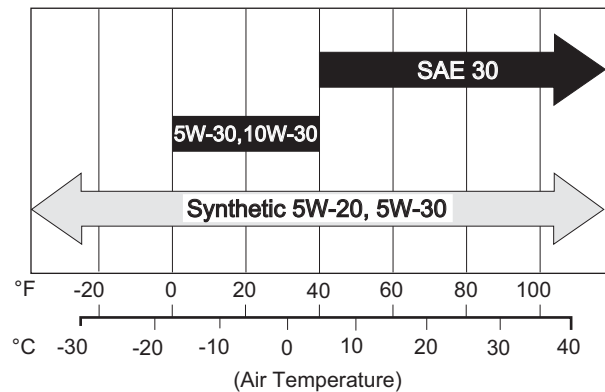


Fig. 3 Oil Viscosity Chart

Checking the Oil Level

Tool List

Clean cloth.....2

Check oil level daily before starting the engine. The vehicle must be on a level surface with the parking brake

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

engaged. Use a cloth to wipe clean the oil dipstick handle and oil fill cap (7) (Ref. Fig. 4 on page K-3). This is necessary to prevent debris from falling into the engine.

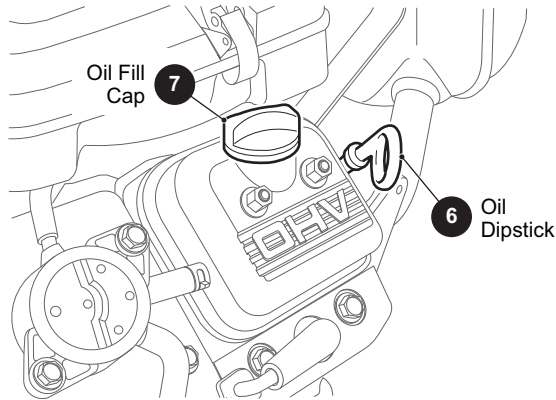


Fig. 4 Cleaning the Top of the Engine

Remove the dipstick (6) and wipe off the entire area indicated with a clean cloth (Ref. Fig. 5 on page K-3).

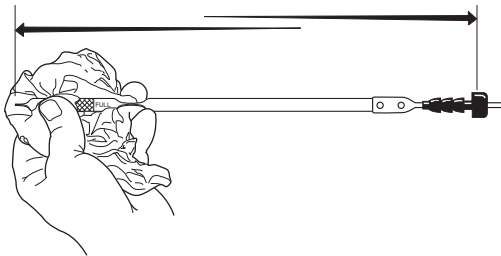


Fig. 5 Clean Entire Dipstick

Insert the dipstick (6) fully into the dipstick tube and remove. Examine the level of oil on the dipstick. Oil should be at the FULL mark (Ref. Fig. 6 on page K-3).

If oil is required, remove oil fill cap (7) and add oil slowly to bring level to the FULL mark. Do not overfill.

Replace dipstick (6) fully into the dipstick tube and firmly replace the oil fill cap (7).

NOTICE

When adding oil between oil changes, do not mix brands and viscosity grades of oil.

Both the oil dipstick (6) and fill cap (7) must be in place before operating the engine. Failure to install the dipstick (6) and fill cap (7) will result in oil becoming contaminated and/or oil being discharged into the engine compartment.

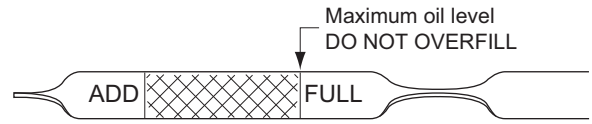


Fig. 6 Check Oil Level on Dipstick

Changing the Oil

Tool List	Qty.
Pliers.....	1
Oil drain pan	1
Clean cloth.....	2

For maximum performance and longevity, the engine oil should be replaced after the first five (5) to eight (8) hours of operation. After the initial oil change, it should be changed per the Periodic Service Schedule in Section A.

! 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 the engine warm. Park the vehicle on a level surface, engage the parking brake and remove the key. Place a drain pan under the engine. Wipe the oil fill cap (7) clean with a cloth and remove the cap (Ref. Fig. 4 on page K-3).

Clean the area around the oil drain valve (3) (Ref. Fig. 7 on page K-3). Open the valve (3) and allow the oil to drain through the hole in the engine mounting plate. Close valve (3) once oil has drained.

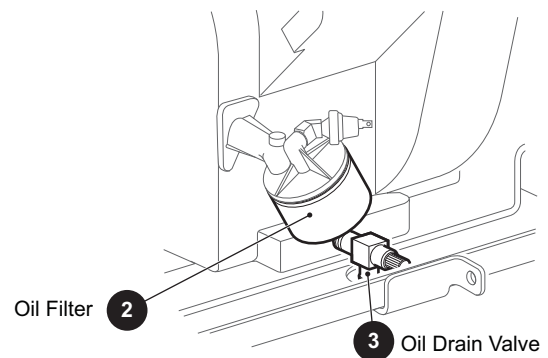


Fig. 7 Remove Oil Filter

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

Add 1 quart (1 liter) of oil. Start and drive vehicle at a slow speed long enough to warm the oil. Stop and turn off vehicle on a level surface and wait 30 seconds for the oil to settle to the bottom of the engine. Check for leaks. Slowly add more oil to bring level to the FULL mark on dipstick. Do not overfill.

Replace dipstick (6) fully into the dipstick tube and firmly replace the oil fill cap (7).

Changing the Oil Filter

Tool List	Qty.
Oil filter wrench, to fit 3" (76 mm) oil filter.....	1
Oil drain pan	1
Clean cloth.....	2

Clean the area around the oil filter (2) and oil drain valve (3). Drain engine oil per "Changing the Oil" on page K-3 and remove oil filter (2) (Ref. Fig. 7 on page K-3). Make sure the seal came off with filter (2) and is not stuck to the engine.

Wipe around the sealing surface of filter mount with a clean, lint free cloth. Lightly oil the seal on the new filter with fresh, clean oil. Screw filter on by hand until the seal contacts the filter mount. Tighten 1/2 to 3/4 turn more. Refill engine with new oil per "Changing the Oil" on page K-3.

AIR FILTER MAINTENANCE

The air filter is a dual filter cleaner, equipped with a foam pre-cleaner over a conventional paper cartridge. The filters must be serviced per the Periodic Service Schedule in Section A for optimum engine life and performance.

CAUTION

To prevent engine damage, be careful not to let debris fall into the carburetor when servicing the air cleaner.

To prevent water entering air cleaner and causing starting or engine problems, replace air cleaner cover making sure the entire flange around the bottom of the cover fits over the top edge of the air cleaner base. Secure with the spring clips.

Access the filters by unsnapping the spring clip on each side of the air cleaner and removing the air cleaner cover (8) (Ref. Fig. 8 on page K-4). If necessary, vacuum or wipe out any loose dirt or trash from the air cleaner base (13).

Pre-Cleaner Service

Carefully remove pre-cleaner (12) from cartridge (11) and wash it in liquid detergent and water. Rinse. Dry by squeezing pre-cleaner (12) in a clean cloth. Saturate with engine oil and squeeze with a clean absorbent cloth to remove all **excess** oil. Install pre-cleaner (12) over cartridge (11). Replace air cleaner cover (8) making sure that the entire flange around the bottom of the cover fits over the top edge of the air cleaner base. Secure with the spring clips.

Cartridge Service

Unscrew the knob (9) securing the cartridge (11) to the air cleaner base (13) and remove plate (10). Remove cartridge (11) and inspect. Replace if too dirty to clean or at the first sign of filter paper deterioration. Clean cartridge (11) by gently tapping on a flat surface.

CAUTION

Do not use petroleum solvents, pressurized water, or compressed air to clean cartridge. Doing so will damage the cartridge and will damage the engine.

NOTICE

The paper cartridge is a dry unit. **Do not** use oil on the cartridge.

Install cartridge, plate, knob, and pre-cleaner.

Replace air cleaner cover making sure that the entire flange around the bottom of the cover fits over the top edge of the air cleaner base. Secure with the spring clips.

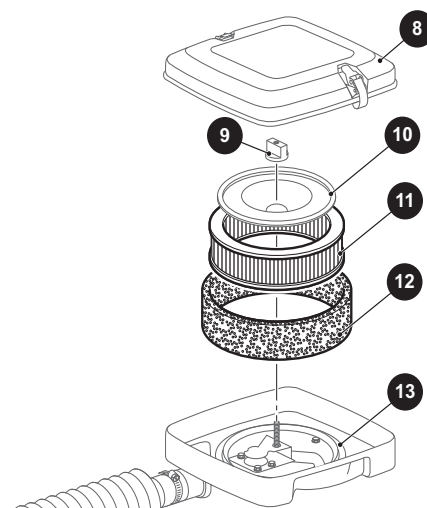


Fig. 8 Air Cleaner

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

SPARK PLUGS

Tool List	Qty.
Spark plug socket, 5/8"	1
Ratchet	1
Plug gauge, wire type	1
Anti-seize compound	AR
Torque wrench, ft. lbs	1

Remove and inspect the spark plugs per the Periodic Service Schedule located in Section A. 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. Clean and gap to .030" (.76 mm). If a plug has been burned beyond .035" (.89 mm) or the porcelain is cracked, it should be replaced (Ref. Fig. 9 on page K-5).

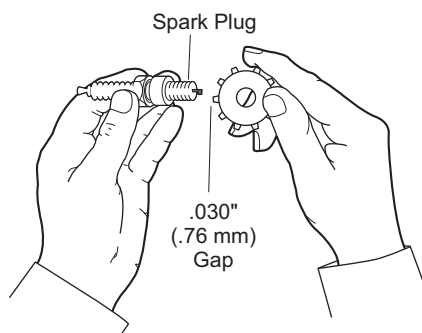


Fig. 9 Gapping the Spark Plug

NOTICE

Do not sand blast spark plugs. They should be cleaned by scraping or wire brushing by hand and washing in a commercial solvent.

Spark plugs should be properly gapped to .030" (.76 mm) (CHAMPION RC12YC), given a light coat of anti-seize compound and tightened to 15 ft. lbs. (20 Nm) torque.

CAUTION

Use care not to overtighten the plug. Overtightening can damage the aluminum cylinder head threads.

ENGINE DESCRIPTION

The engine is a four cycle air cooled, V block, twin cylinder, overhead valve unit. It incorporates pressure lubrication, and a replaceable oil filter.

The OHV V-Twin engine uses a Magnetron[®] ignition consisting of an ignition armature with a self-contained transistor module. Two armatures are used with a flywheel containing a permanent magnet.

Engine Specifications

Engine model	303440
Type	Four cycle, overhead valve
Number of cylinders	2 (V block)
Displacement	480 cc
Rated horsepower	16 hp (11.9 kw)
Spark plug type	Champion RC12YC
Spark plug gap030" (.76 mm)
Cooling	Fan
Oil Filter	Replaceable, Spin-off

Engine Operation

To understand the operation of a four cycle engine, it is easiest to consider a single cylinder.

The first cycle (stroke) takes place with the piston moving down and the intake valve open. Fuel is drawn into the combustion chamber from the carburetor and through the intake valve and is known as the intake stroke. As the piston reaches the BDC (Bottom Dead Center) of its travel and starts to move upwards, the second cycle begins. The intake valve closes which seals the combustion chamber since the exhaust valve is already closed and causes the fuel air mixture to be compressed as the piston rises. This is known as the compression stroke. Just before the piston reaches TDC (Top Dead Center) the spark plug fires which causes a rapid burning of the air fuel mixture. The temperature rises rapidly which causes the air fuel mixture to expand. The piston has been carried through TDC by centrifugal force and is now forced downwards into the third, or power stroke by the expanding gases. As the piston reaches BDC it enters the fourth cycle. The exhaust valve opens and the piston rises forcing burned gases from the combustion chamber in what is known as the exhaust stroke. As the piston moves through TDC and starts down, the first cycle is repeated.

The camshaft is gear driven from the crankshaft. The ignition timing is controlled by an electrical pulse received from a magnet mounted on the crankshaft flywheel. The ignition timing is not adjustable.

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

ENGINE TESTING

Tool List	Qty.
Heat resistant gloves	1
Pliers.....	1
Compression gauge	1
Spark plug socket, 5/8"	1
Ratchet	1

To properly prepare for a compression test:

- Lift the entire vehicle. See Section B "LIFTING THE VEHICLE" for the procedure to lift the vehicle.
- If possible, run vehicle long enough to bring the engine to normal operating temperature.
- Engage the key switch to neutral position.
- Disconnect fuel line from fuel tank and plug line to prevent contamination. Run engine until it stops from lack of fuel.
- Remove the air filter to eliminate the possibility of a restricted air passage.
- A good, well charged battery should be used. Weak batteries may not provide the correct cranking speed.

- Starter belts that drag or slip will affect the compression reading. Adjust belt as necessary. Refer to belt adjustment in the STARTER GENERATOR section.

WARNING

To prevent possibility of personal injury, never operate without magneto being grounded. Any 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.

- Ground magneto by attaching a wire lead, with alligator clips, from the terminal with the white wire (located on fan cover at side of engine) to the ground cable bolted to the frame.
- Follow procedure to check compression as outlined in the Briggs & Stratton® Repair Manual (P/N 272144) for Vanguard™ V-Twin Overhead Valve engine.

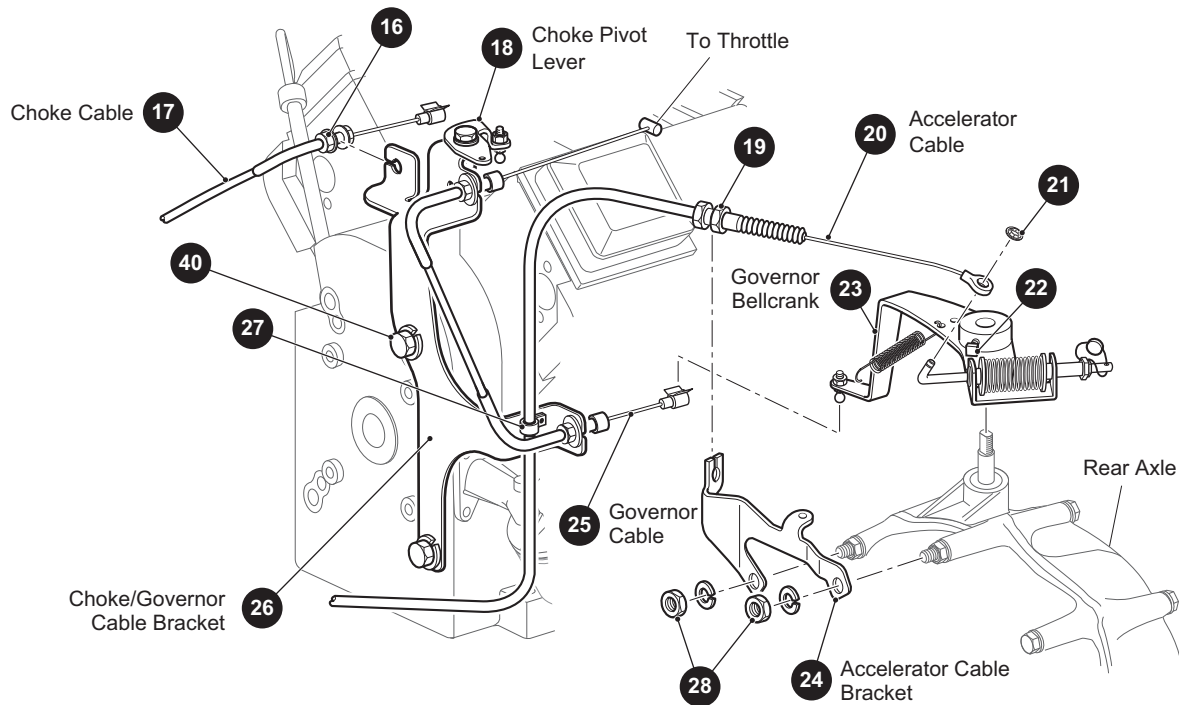


Fig. 10 Disconnect Accelerator, Governor, and Choke Cables

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

ENGINE REMOVAL

Tool List	Qty.
Masking tape	AR
Back brace	2
Insulated wrench, 1/2"	1
Oil drain pan	1
Socket, 1/2"	1
Ratchet	1
Clutch puller (P/N 630784)	1
Pliers	1
Wrench, 1/2"	2
Utility knife	1
Needle nose pliers.....	1
Straight blade screwdriver	1
Socket, 12mm	1
Wrench, 1/4"	1
Socket, deep well, 10mm	1
Shop towel, clean	AR
Plug, for fuel line.....	1
Cap, for fuel pump	1
Wrench, 10mm	1
Wrench, 3/4"	1
Socket, 1/4" hex bit	1
Impact wrench	1
Impact socket, 5/8"	1
Impact socket, 3/4"	1
Socket, 6mm hex bit.....	1
Socket, 5/8"	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 torque figures are as shown in the table contained in Section A.

Note the location of wires, wire ties and clamps before removal and always install them in their original location. Use of masking tape to label wires is recommended.

Remove Truck bed. Refer to TRUCKBED section.

If engine is to be repaired, not replaced, wash engine and chassis to remove dirt build-up.

WARNING

To prevent the possibility of personal injury, disconnect the negative (-) battery cables before starting engine removal.

Disconnect negative (-) cables from battery to prevent electrical shorts that could cause an explosion (Ref. Fig. 13 on page K-8).

Drain oil from engine.

Loosen clamp and remove muffler from the bracket. See "MUFFLER REPLACEMENT" on page K-10.

Remove drive belt and driven clutch. See CONTINUOUSLY VARIABLE TRANSMISSION section.

Remove push nut (21) securing end of accelerator cable (20) to governor. To maintain cable adjustment, loosen only the back jam nut (19) anchoring accelerator cable (20) to accelerator cable bracket (24) and remove cable (Ref. Fig. 10 on page K-6). Release clamp (27) securing cable to choke/governor cable bracket (26) and pull accelerator cable (20) down from between bracket (26) and governor cable (25) to clear engine.

Pry governor cable (25) off ball stud on lower end of governor bellcrank (23) located between engine and differential (Ref. Fig. 10 on page K-6). Remove two nuts (28) mounting accelerator cable bracket (24) to differential. Loosen two setscrews (22) and pull governor bellcrank assembly (23) and accelerator cable bracket (24) from differential.

Pry choke cable (17) off ball stud of choke pivot lever. To maintain cable adjustment, loosen only the back nut (16) anchoring choke cable (17) to choke/governor cable bracket (26), remove cable and moor between seat back supports (Ref. Fig. 10 on page K-6).

Disconnect remote air hose from air cleaner. Remove air cleaner cover (8) and filter (11). Remove five bolts that mount air cleaner base to engine, disconnect crankcase breather hose and remove base. Secure a clean towel over carburetor with a rubber band to prevent any debris falling into engine.

At rear axle, remove cotter pin (31) and clevis pin (32) connecting differential lock cable (29) to differential lock arm. To maintain cable adjustment, loosen only the back nut (30) anchoring differential lock cable (29) to bracket (33) and remove cable (Ref. Fig. 11 on page K-8).

Disconnect wire from oil pressure switch, located above oil filter, and free from any wire ties or clamps anchoring it to engine.

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

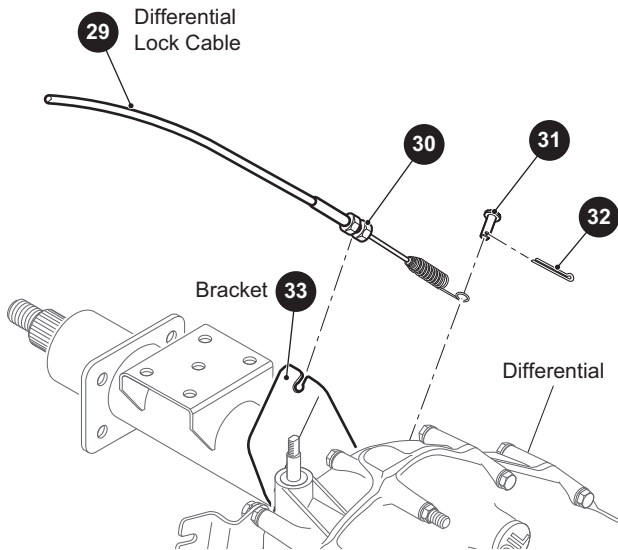


Fig. 11 Disconnect Differential Lock Cable

⚠ WARNING

To prevent a possible explosion, do not smoke near the fuel tank or in an area where gasoline is being handled. Do not perform procedures involving the fuel system near open fire or electrical items which could produce a spark.

Do not handle gasoline in an area that is not adequately ventilated.

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

Do not smoke and wear eye protection before opening the fuel system. Provided ventilation is adequate, remove and plug fuel line (35) from fuel pump (34) and cap fuel pump nipple (Ref. Fig. 12 on page K-8).

Detach ground cable from starter/generator (36) and engine block (Ref. Fig. 13 on page K-8). Discard lock nut (37) but retain bolt (39) and washers (38) for engine installation.

At starter/generator terminal F2, disconnect black power cable running from solenoid to starter (Ref. Fig. 13 on page K-8).

Disconnect green wire of chassis harness from starter/generator lead (Ref. Fig. 13 on page K-8).

Disconnect the two white wires, located at side of fan cover, from the engine stop terminal and ignition control module (Ref. Fig. 12 on page K-8).

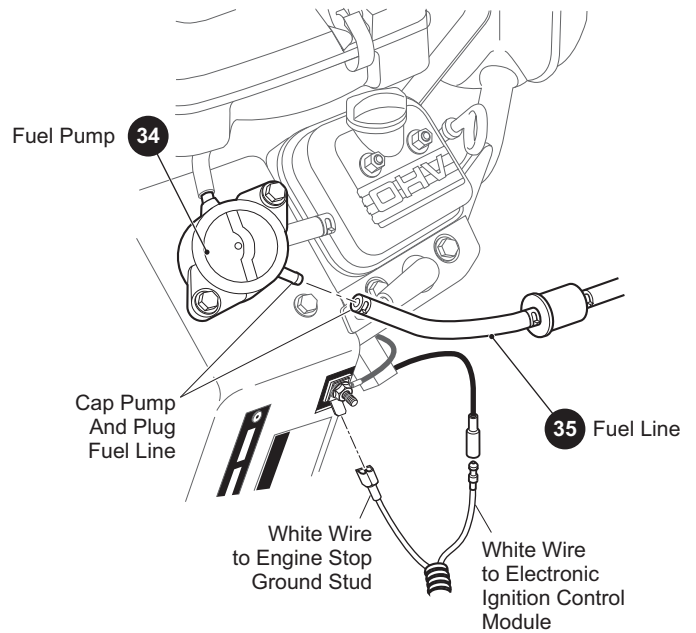


Fig. 12 Disconnect White Engine Stop Wire, Ignition Control Module and Fuel Line

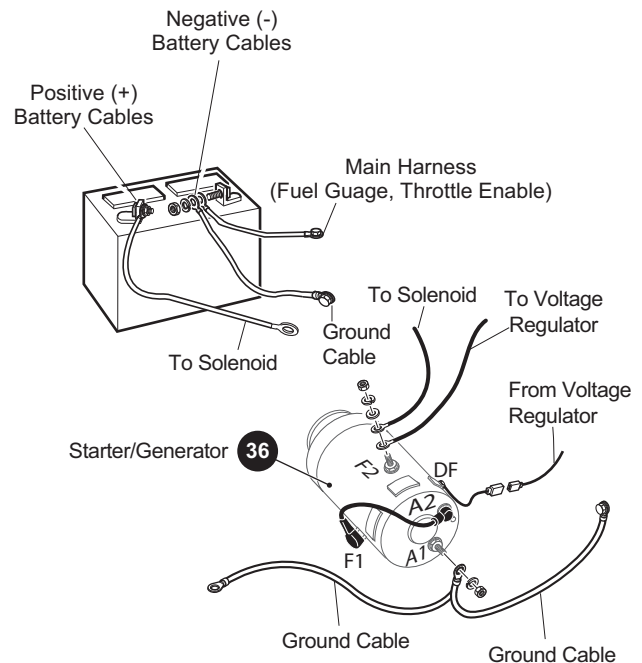


Fig. 13 Disconnect Starter and Ground Cables

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

Loosen and remove starter/generator belt. See STARTER/GENERATOR section.

Remove drive clutch. See CONTINUOUSLY VARIABLE TRANSMISSION section.

Remove three remaining bolts securing engine to subframe. Discard lock nuts but retain bolts and washers for engine installation.

NOTICE

The engine will be lifted out between differential and wide crossmember of frame.

WARNING

The following step involves lifting substantial weight. Two people are recommended. Use of a personal back support brace and proper lifting technique is required to prevent personal injury.

Wear a personal back support brace and use proper lifting technique before lifting engine. With a person on each side of vehicle, rotate and lean engine back to position the muffler down, where the driven clutch was, and carefully maneuver engine out of vehicle.

If replacing engine:

- Remove starter/generator and its mounting brackets from old engine.
- Remove choke/governor cable bracket from old engine. Detach governor cable and choke link from carburetor.
- Remove oil drain valve and clamp from fan cover of old engine. Retain for use on new engine.

ENGINE INSTALLATION

Tool List	Qty.
Socket, 5/8"	1
Socket, 6mm hex bit.....	1
Ratchet	1
Teflon tape.....	AR
Crowfoot wrench, 1/4"	1
Torque wrench, ft. lbs	1
Torque wrench, in. lbs	1
Socket, 1/2"	1
Wrench, 1/2"	2

If installing a replacement engine:

- Attach starter/generator. See STARTER/GENERATOR section.
- Attach governor cable and choke link to carburetor and secure choke/governor cable bracket to new engine using existing hardware. Tighten bolts to the torque values specified below:

Item	Torque Specification
40	260 - 280 in. lbs. (29 - 32 Nm)

- Apply teflon tape to threads of oil drain valve and install so that nipple is pointed away from oil filter at approximately the 4 to 5 o'clock position. Attach clamp to fan cover using existing bolt.

WARNING

The following step involves lifting substantial weight. Two people are recommended. Use of a personal back support brace and proper lifting technique is required to prevent personal injury.

Wear a personal back support brace and use proper lifting technique before lowering engine into vehicle. With a person on each side of vehicle, install engine in reverse order of removal replacing all lock nuts with new lock nuts.

Tighten engine to subframe mounting hardware to 20 ft. lbs. (30 Nm) torque.

Tighten drive clutch bolt to torque specified in CONTINUOUSLY VARIABLE TRANSMISSION section.

Tighten starter/generator belt. See STARTER/GENERATOR section.

Tighten starter terminal nuts to specified torque. See STARTER/GENERATOR section.

If differential lock cable adjustment is required, adjust per REAR AXLE section.

If choke cable adjustment is required, adjust per FUEL SYSTEM section.

Tighten two governor bellcrank assembly setscrews to the torque values specified below:

Item	Torque Specification
22	70 - 84 in. lbs. (8 - 9 Nm)

ENGINE

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



CAUTION

A new push nut must be used when installing the accelerator cable to the governor.

Secure end of accelerator cable (20) to governor bellcrank (23) with new push nut (21). If accelerator cable (20) adjustment was lost, adjust per SPEED CONTROL section.

Tighten driven clutch bolt to torque specified in CONTINUOUSLY VARIABLE TRANSMISSION section.

Install muffler to the bracket and tighten the clamp. See "MUFFLER REPLACEMENT" on page K-10.

Check oil level in engine and adjust as needed. See "POWERTRAIN MAINTENANCE" on page K-2.

Reconnect negative (-) battery cables and tighten hardware to 60 in. lbs. (7 Nm).

MUFFLER REPLACEMENT

Tool List

Qty.

Masking tape	AR
Insulated wrench, 1/2"	1
Socket, 1/2"	1
Socket, 13 mm.....	1
Wrench, 1/2"	1
Ratchet	1
Pliers.....	1
Torque wrench, in. lbs.....	1
Torque wrench, ft. lbs.	1



WARNING

The normal operating temperature of the exhaust system is very high. Therefore, never work around or attempt to service any part of the exhaust system until it is cooled.

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 figures are as shown in the table contained in Section A.

Note the location of wires, wire ties and clamps before removal and always install them in their original location. Use of masking tape to label wires is recommended.



WARNING

To prevent the possibility of personal injury, disconnect the negative (-) battery cables before starting engine removal.

Disconnect negative (-) cables from battery to prevent electrical shorts that could cause an explosion.

Remove the truck bed or rear seat assembly from the vehicle. Refer to TRUCKBED section.

Loosen the nuts (54) on pipe clamp (43) and remove the tail pipe (42) from the muffler (1).

Loosen the pipe clamp (45) and that holds the header pipe (44) to the muffler (41).

Remove the bolts (46), flat washers (47), and locknuts (48) and remove the muffler (41) from the muffler mounting bracket (47).

Remove the bolts (50) and gaskets (51) that attaches the header pipe (44) to the engine. Remove the header pipe (44) from the vehicle.

To remove the muffler mounting bracket (47) from the vehicle, remove the nut (53) and washers (52).

(Ref. Fig. 14 on page K-11)

Install the muffler in reverse order of removal. While installing use new gaskets (51) and tighten the hardware to the torque specified below.

Item	Torque Specification
46	14 - 18 ft. lbs. (18.98-24.40 Nm)
50	135 - 165 in. lbs. (15.25-18.64 Nm)
53	13 - 16 ft. lbs. (17.62-21.69 Nm)
54	10 - 12 ft. lbs. (13.55-16.26 Nm)

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

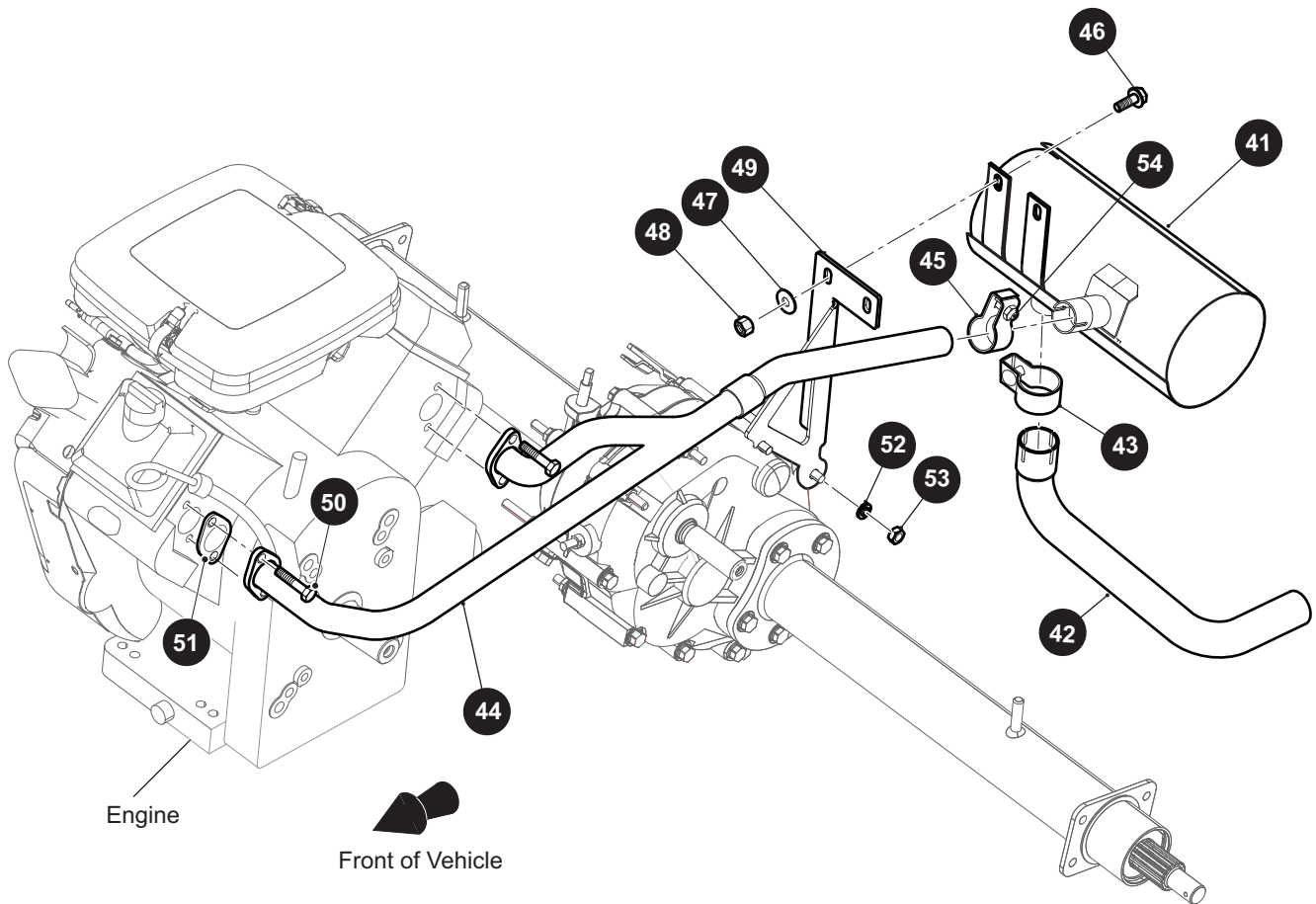


Fig. 14 Exhaust Replacement

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FRONT AXLE, FRONT SUSPENSION AND STEERING

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

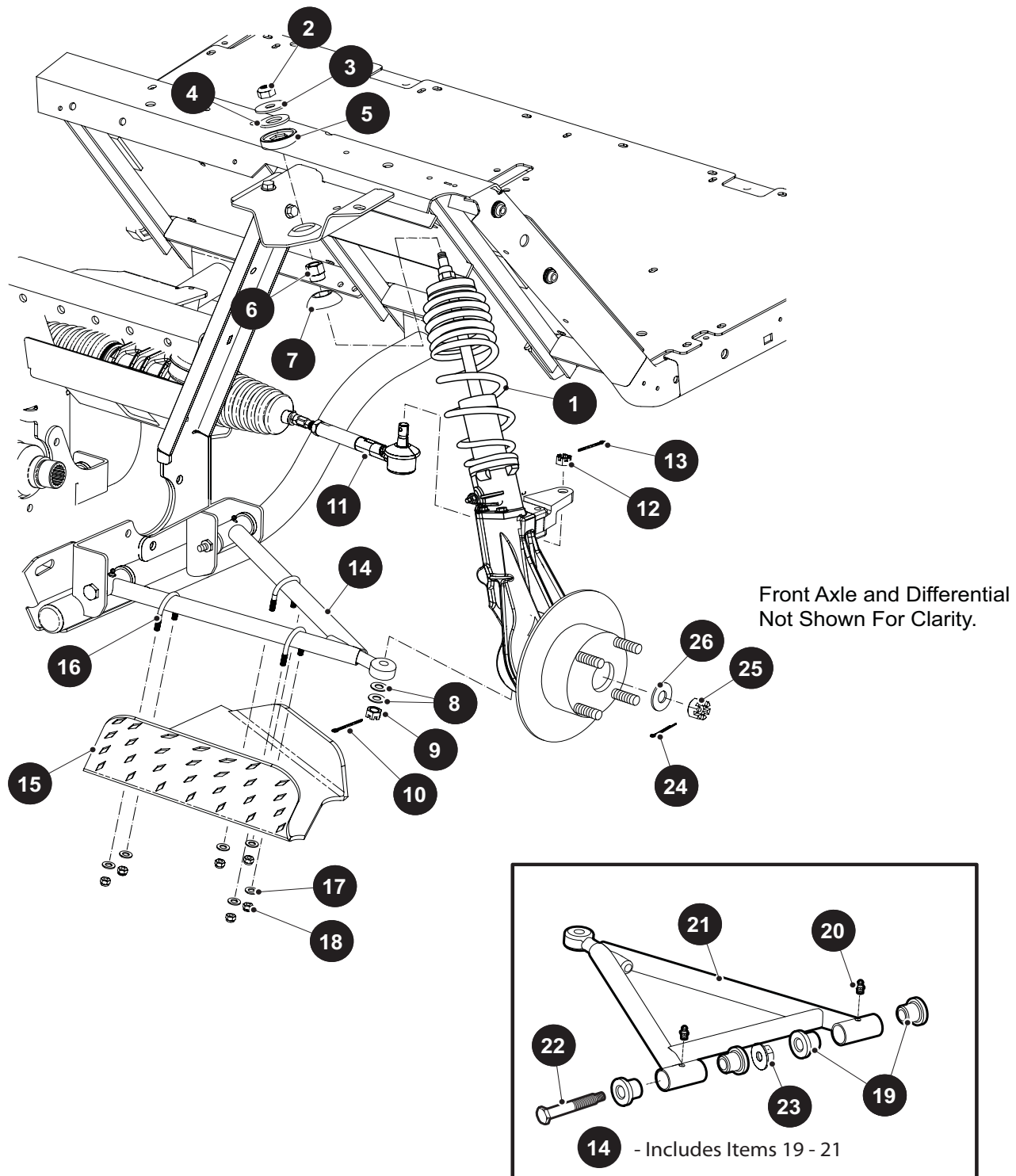


Fig. 1 Front Suspension Replacement

FRONT AXLE, FRONT SUSPENSION AND STEERING

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

FRONT 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 original positions unless otherwise specified. Non-specified torque values are as shown in the table contained in Section A.

WARNING

To reduce the possibility of personal injury, follow the lifting procedure in Section B 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.

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

See Lubrication Chart and Periodic Service Schedule in Section A. Be sure to use only the recommended lubricants.

Routine examination of the tires will provide indications if an alignment is required.

Lubrication points can be found on the lower A-arm and on the lower strut. Use no more than 3 shots of grease per fitting. The tie rod ends are sealed and do not require lubrication. The steering unit is also sealed and requires no additional lubrication.

Front Strut Assembly Replacement

Tool List	Qty.
Wheel chocks	4
Floor jack	1
Jack stands.....	4
Plastic faced hammer	1
Wrench, 3/4"	1
Impact wrench	1
Torque wrench, ft. lbs.	1
Socket, 3/4"	1
Ratchet	1

Inspect the strut cartridge for leaks at the seal. Replace if leakage is found.

Lift and support vehicle per SAFETY section.

Remove the front wheel. Refer to WHEELS AND TIRES section.

Remove the brake calipers from the rotor. Refer to BRAKES section.

Remove the cotter pin (13) and nut (12) at the steering rack assembly (11) end (Ref. Fig. 1 on page L-1).

Remove the cotter pin (24), castle nut (25), and flat washer (26) from the front axle end.

Remove the cotter pin (10), nut (9), and flat washers (8) from the bottom of the front strut assembly (1) at the A-arm assembly (14). Bump the A-arm assembly downward with a plastic hammer to separate it from the ball joint. Slide the front axle out of the front strut assembly.

Remove the nut (2), washers (3) and (4), spring retaining nut (6), and male and female strut bushings (5) and (7) securing the top of the strut assembly (1) to the vehicle frame.

Remove the strut assembly from the vehicle.

The installation of the strut assembly is the reverse of disassembly.

During installation tighten the following hardware to the torques values as specified below:

Item	Torque Specification
12	30-36 ft. lbs. (40.67-48.80 Nm)
9	12-14 ft. lbs. (16.26-18.98 Nm)
2, 6	14-16 ft. lbs. (18.98-21.69 Nm)

A-Arm Assembly Replacement

Tool List	Qty.
Wheel chocks	4
Floor jack	1
Jack stands.....	4
Plastic faced hammer	1
Wrench, 3/4"	1
Wrench, 7/16"	1
Wrench, 9/16"	1
Socket, 3/4".....	1
Socket, 7/16".....	1
Socket, 9/16".....	1
Ratchet	1
Torque wrench, ft. lbs.....	1

Remove the front wheel. Refer to WHEELS AND TIRES section.

FRONT AXLE, FRONT SUSPENSION AND STEERING

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

Remove the cotter pin (10), nut (9), and flat washers (8) from the bottom of the front strut assembly (1) at the A-arm assembly (14) (Ref. Fig. 1 on page L-1).

Remove the U-bolts (16), flat washers (17), and locknuts (18) to remove the stick stopper (15) from the A-arm assembly (14).

Remove the shoulder bolt (22), plugs (19), and locknuts (23) to remove the A-arm (21) from the vehicle.

Installation of A-arm assembly is the reverse of removal.

During installation tighten the following hardware to the torque values as specified below:

Item	Torque Specification
23	32-37 ft. lbs. (43.38-50.16 Nm)
18	8-10 ft. lbs. (10.84-13.55 Nm)
9	12-14 ft. lbs. (16.26-18.98 Nm)

FRONT AXLE

Front Axle Replacement

Tool List	Qty.
Wheel chocks	4
Floor jack.....	1
Jack stands	4
Impact wrench	1
Impact socket, 3/4"	1
Wrench, 3/4".....	1
Plastic faced hammer.....	1
Socket, 9/16"	1
Wrench, 9/16"	1
Torque wrench, ft. lbs.	1
Pry bar.....	1
Ratchet.....	1



CAUTION

Inspect the front axle (shaft) for contamination, especially if there are any torn CV boots around the axle. Replace the front axle if any contamination is found.

Lift and support front of vehicle per SAFETY section.

Remove the front wheel. Refer to WHEELS AND TIRES section.

Remove the brake calipers from the rotor. Refer to BRAKES section.

Remove the cotter pin (13) and nut (12) at the end of the steering rack assembly (11) (Ref. Fig. 1 on page L-1).

Remove the cotter pin (24), castle nut (25), and flat washer (26) from the end of the front axle (27) (Ref. Fig. 1 on page L-1) and (Ref. Fig. 2 on page L-3).

Remove the cotter pin (10), nut (9), washers (8) and bump down the A-Arm assembly below the strut assembly (1) to separate the A-Arm assembly from the strut assembly (1) (Ref. Fig. 1 on page L-1).

Slide out the front axle (27) from the front strut assembly.

Remove the front axle (27) from the differential using a pry bar.

Front axle installation is in the reverse order of removal.

During installation tighten the following hardware to the torque values as specified below:

Item	Torque Specification
12	30-36 ft. lbs. (40.67-48.80 Nm)
25	100 - 110 ft. lbs. (135.58-149.13 Nm)
9	12-14 ft. lbs. (16.26-18.98 Nm)

NOTICE

Replacing the axle will also require that the front wheels be aligned. See "Wheel Alignment" on page L-7.

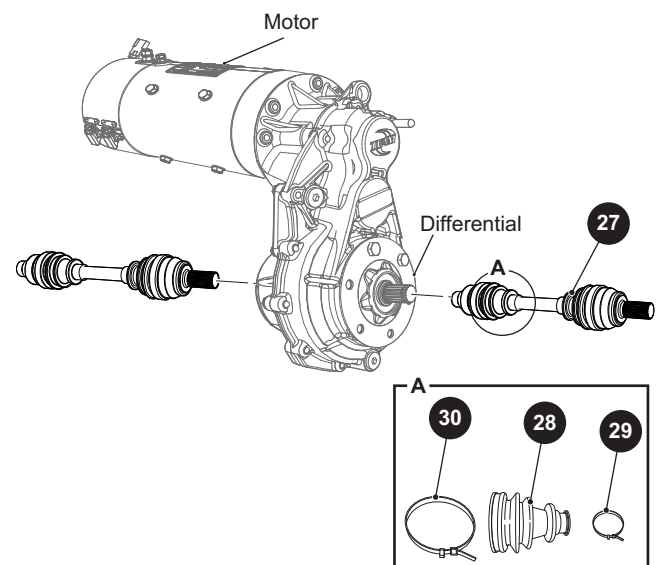


Fig. 2 Front Axle Removal

FRONT AXLE, FRONT SUSPENSION AND STEERING

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

CV Joint Boot Replacement

Tool List

Needle nose pliers..... 1

Remove the front axle assembly. See "Front Axle Replacement" on page L-3.

Inspect the inner and outer CV joint boots (28) for damage (Ref. Fig. 2 on page L-3).

Cut to remove the CV joint boot clamps (29) and (30) and remove the CV joint boot (28).

Replace the new boot in reverse order of removal.

STEERING

Steering Wheel Replacement

Tool List

Phillips screwdriver 1

Socket, 15/16" 1

Ratchet 1

Plastic faced hammer 1

Ball peen hammer 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 hub cover, perform the following removal procedure. Do not use a screwdriver to push or pry the retaining tabs.

From the front side of the steering wheel (33), remove the steering wheel cover (31) by first pulling straight up on the bottom of the steering wheel cover to release the two bottom retaining tabs. Then first pull down, and then push up to release the two top retaining tabs (Ref. Fig. 3 on page L-4).

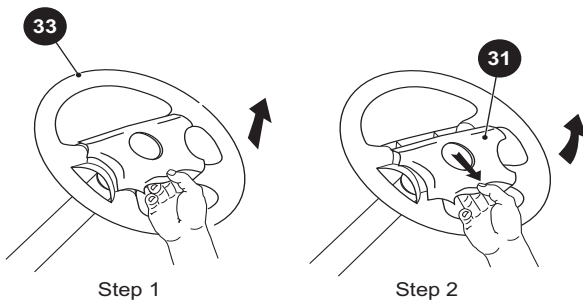


Fig. 3 Steering Wheel Cover Removal

Loosen the locknut (32) two to three turns. DO NOT REMOVE NUT AT THIS TIME. Apply upward pressure to the steering wheel (33). Place a plastic faced hammer against the locknut (32) and strike plastic faced hammer sharply with a ball peen hammer (Ref. Fig. 4 on page L-4).

CAUTION

Do not strike the steering nut or the end of the steering shaft directly with the ball peen hammer.

When steering wheel (33) is loosened, remove lock nut (32) and remove steering wheel (33).

If installing new steering wheel (33), assemble the steering wheel by aligning the retaining tabs on the steering wheel cover (31) with slots in back of steering wheel. Squeeze tabs to allow insertion of steering wheel cover. Do not force. Squeeze steering wheel cover on top and bottom to fully seat.

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 locknut to the torque value specified below:

Item	Torque Specification
32	20 - 25 ft. lbs. (27.11-33.89 Nm)

Inspect the four retaining tabs on the steering wheel cover (31) for white stress lines. If stress lines are present, replace steering wheel cover. Install by carefully pressing, first the top two, then the bottom two retaining tabs into the matching slots in steering wheel (33) (Ref. Fig. 4 on page L-4).

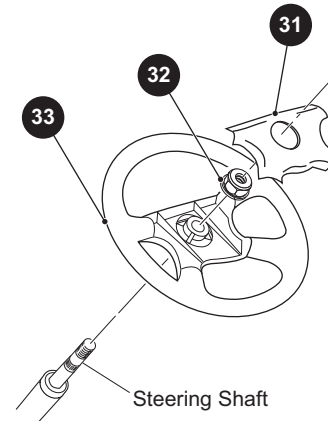


Fig. 4 Steering Wheel Removal

FRONT AXLE, FRONT SUSPENSION AND STEERING

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

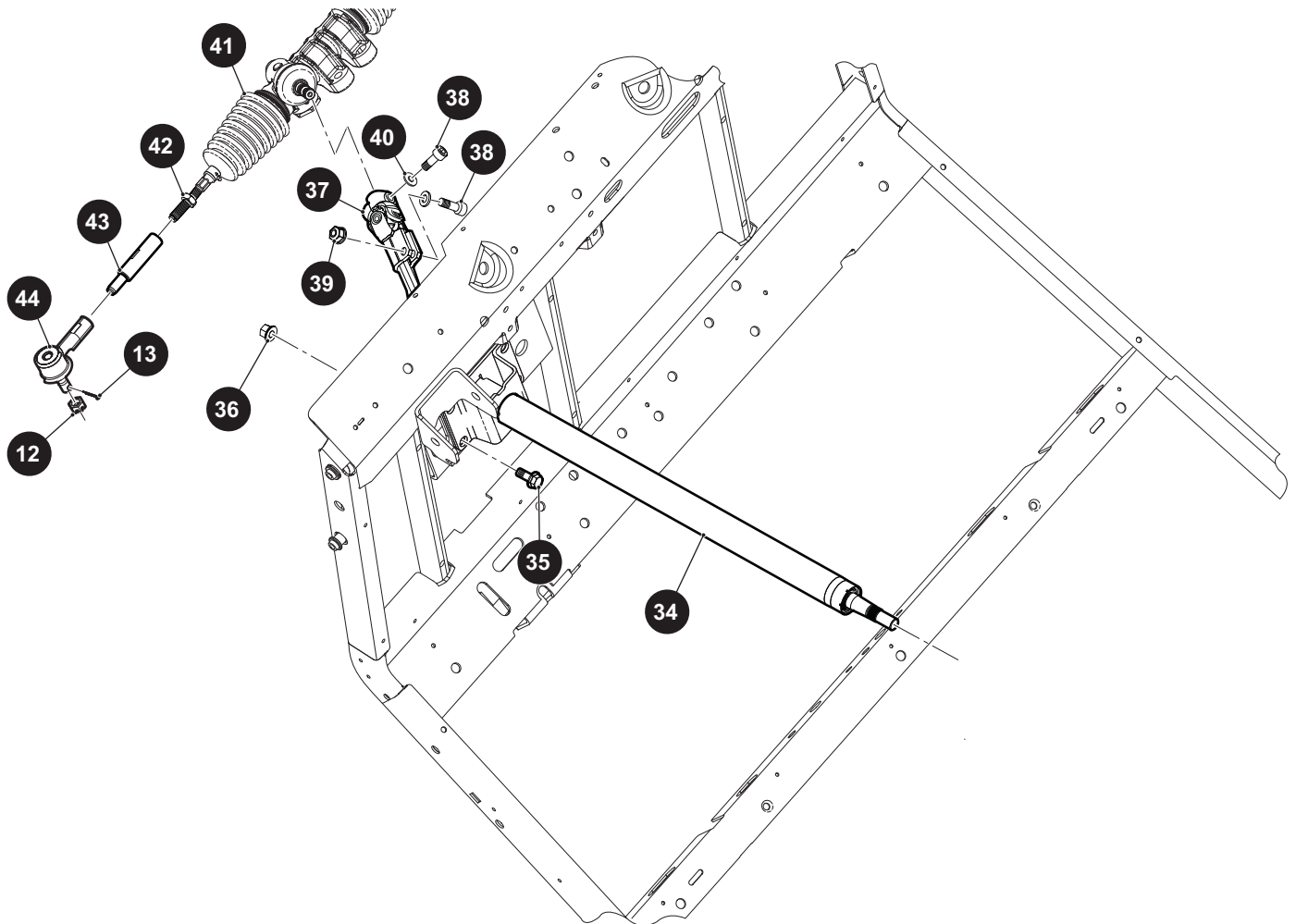


Fig. 5 Steering Components

Steering Column Replacement

Tool List	Qty.
Socket, 5/16"	1
Socket, 5/8"	1
Socket, 19/32"	1
Ratchet	1
Wrench, 19/32"	1
Wrench, 5/8"	1
Wrench, 5/16"	1
Torque wrench, ft. lbs.	1

Remove the steering wheel. See "Steering Wheel Replacement" on page L-4.

Remove the four bolts (35) and locknuts (36) that secure the steering column (34) to the frame (Ref. Fig. 5 on

page L-5). Remove the yoke bolts (38), lock washers (40) and nut (39) to remove the steering yoke (37) from the steering column (34) and steering rack (41).

Replace steering column (34) in reverse order of removal.

During installation tighten the following hardware to the torque values as specified below:

Item	Torque Specification
35	25-35 ft. lbs. (33.89-47.45 Nm)
38	22-27 ft. lbs. (29.82-36.60 Nm)

FRONT AXLE, FRONT SUSPENSION AND STEERING

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

Steering Rack Replacement

Tool List

	Qty.
Wrench, 9/16"	1
Needle nose pliers.....	1
Wrench 11/16"	1
Ball joint separator.....	1
Plastic faced hammer	1
Straight blade screwdriver	1
Socket, 9/16"	1
Socket, 11/16".....	1
Ratchet	1
Torque wrench, ft. lbs.	1

Remove the steering column from the steering rack (41). See "Steering Column Replacement" on page L-5.

Remove the cotter pin (13) and nut (12) from the front strut assembly (Ref. Fig. 5 on page L-5).

Remove the three bolts (46) and nuts (45) attaching the steering rack assembly (41) to the frame.

Rack replacement is the reverse order of removal.

Tighten nuts to the torque values specified below:

Item	Torque Specification
45	25-35 ft. lbs. (33.89-47.45 Nm)

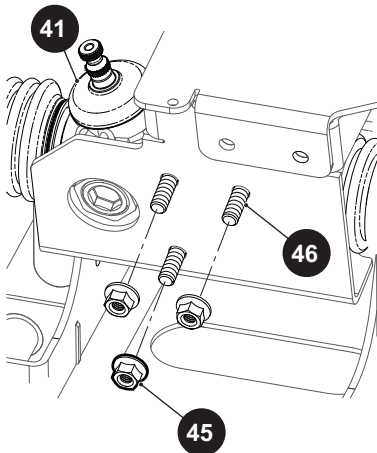


Fig. 6 Steering Rack Replacement

Rack Ball Joint Removal And Installation

Tool List

	Qty.
Wrench, 17mm	1
Torque wrench, ft. lbs.	1
Crows foot, 17mm	1

For steering rack ball joint (44) replacement, the steering rack (41) must be removed from the steering assembly in order to properly adjust the rack/ball joint

length. See "Steering Rack Replacement" on page L-6. Removed the rack end ball joint (44) from the steering rack (41) by loosening the jam nut (42) and removing the spacer (43) (Ref. Fig. 5 on page L-5).

Installation of rack ball joint is as follows:

Clean the threads. Apply primer (LOCTITE LOCQUIC PRIMER T, #7471) and thread locking adhesive (LOCTITE RED #271) to rack ball end before attachment to steering rack (41). Assemble the spacer (43), to each tie rod (44). Set the jam nuts (42) at 5/8" distance from the opposite end of the tie rod. Thread the tie rod and spacer assemblies (43 and 44) onto inner tie rods until they reach the jam nuts (42). The tie rod orientation must be as shown (Ref. Fig. 7 on page L-6). During Installation, tighten the following hardware to the torque values specified below:

Item	Torque Specification
42, 44 (including the spacer (43))	20-25 ft. lbs. (27-34 Nm)

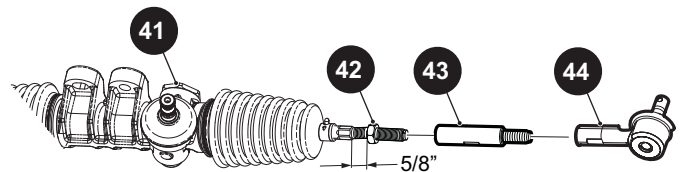


Fig. 7 Rack Ball Joint Installation

MAINTENANCE

Good routine maintenance of the front suspension and steering consists of routine lubrication (See Lubrication Chart and the Periodic Service Schedule in Section A). Be sure to use only the recommended lubricants. Maintain the correct adjustment of the front bearings and repack them in accordance with the periodic service schedule or if a bearing replacement is required. Routine examination of the tires will provide indications that an alignment is required.

Lubrication

Tool List

	Qty.
Grease gun	1

Lubrication points can be found on the lower A-arm and on the lower strut.

Grease per periodic service schedule at the lubrications points indicated (Ref. Fig. 8 on page L-7) and (Ref. Fig. 9 on page L-7).

FRONT AXLE, FRONT SUSPENSION AND STEERING

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

CAUTION

Do not use more than three (3) shots 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.

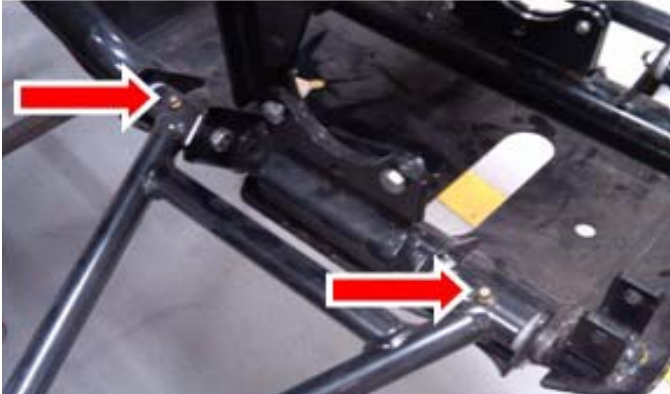


Fig. 8 Lubrication Points on A-Arm



Fig. 9 Lubrication Points on Strut Bottom

NOTICE

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

Wheel Alignment

Tool List	Qty.
Floor jack.....	1
Jack stands	2
Wheel chocks.....	4
Tape measure.....	1
Wrench, 17mm.....	2

Center the steering unit in the middle of its travel.

This may be accomplished by pushing the vehicle forward 5 feet and allowing the unit to center itself or turn the steering wheel to the left until the stop is

contacted. Rotate the wheel to the right while counting the number of turns required to contact the right hand stop. Divide the number of turns by two. This will indicate the number of steering wheel turns to achieve center.

With the vehicle on the floor, measure the center tread distance at the front of the tires. Measure as close to parallel with the front differential as possible (Ref. Fig. 10 on page L-7).

Now measure the center tread distance on the rear of the front tires. The measuring tape should be routed just under the frame rails. The correct measurement is 0" to 1/8" toe in (Ref. Fig. 11 on page L-7).

To adjust the wheel alignment, turn to loosen the tie rod jam nut (42), holding the hex form on the tie rod (44).

If tie rods or ends have been replaced; adjust both rods the same distance prior to reinstalling on the vehicle. Counting threads or measuring thread distance are two methods to equalize tie rod length.

Test drive the vehicle and confirm that the steering wheel is correctly centered. If not, remove steering wheel and rotate it to the correct position.



Fig. 10 Wheel Alignment Front of Front Tires



Fig. 11 Wheel Alignment Rear of Front Tires

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

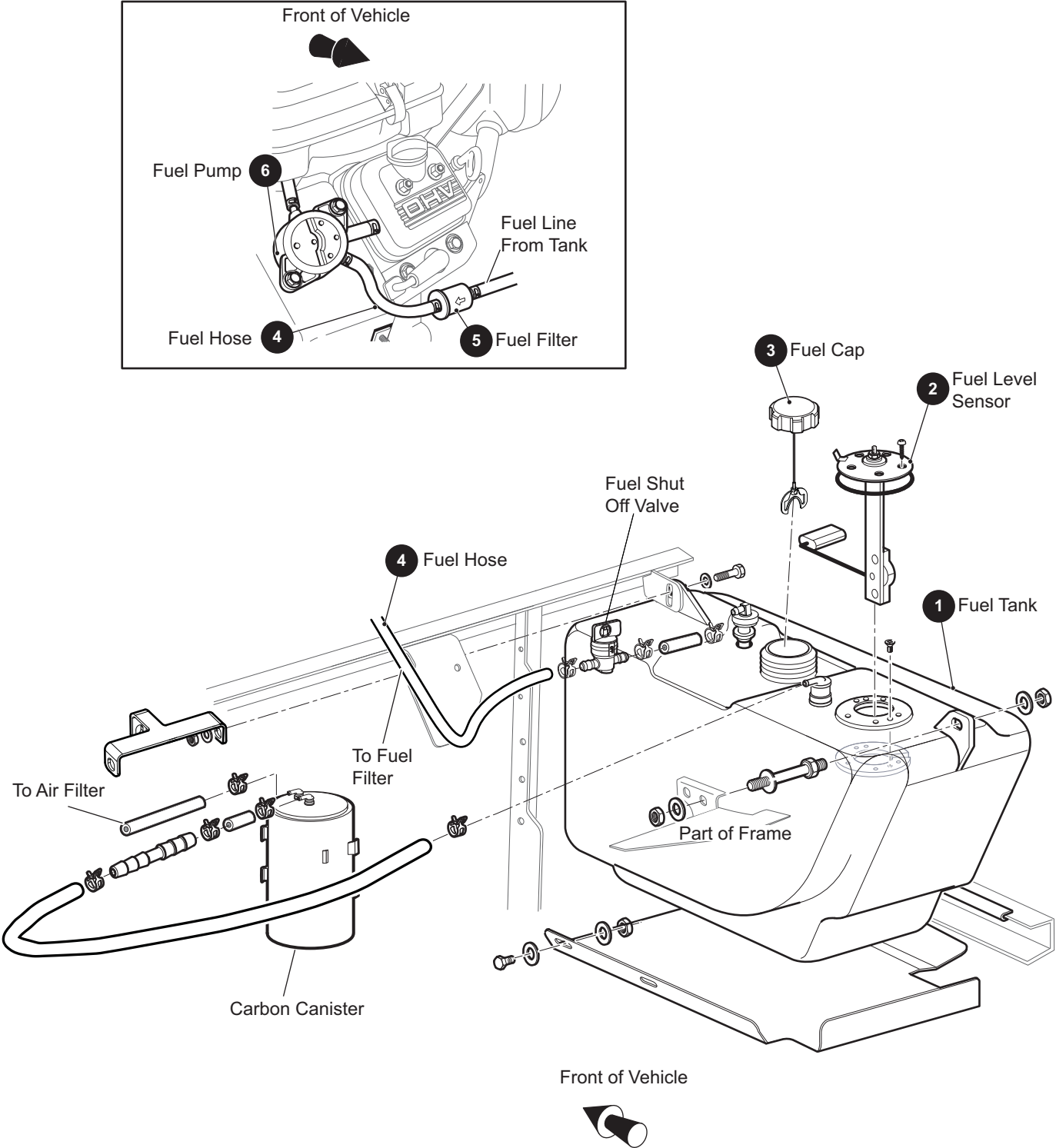


Fig. 1 Fuel System Components

FUEL SYSTEM

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

GENERAL

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 Section A.

The fuel system consists of a fuel tank (1), fuel lines (4), fuel filter (5), fuel pump (6), and carburetor (Ref. Fig. 1 on page M-1). For fuel pump or carburetor service, refer to the Briggs & Stratton Engine Manual (P/N 272144) for Vanguard™ V-Twin Overhead Valve engines.

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 which 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 cap is located under the passenger seat (Ref. Fig. 2 on page M-2). Fill tank with fresh, clean, automotive grade, unleaded, 87 octane (minimum) gasoline. Leaded gasoline may be used if it is commercially available and if unleaded is unavailable.

Do not use gasoline which contains methanol.

Do not mix oil with gasoline.

⚠ CAUTION

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. Leave at least 1" (2.5 cm) space below bottom of filler neck (Ref. Fig. 2 on page M-2).

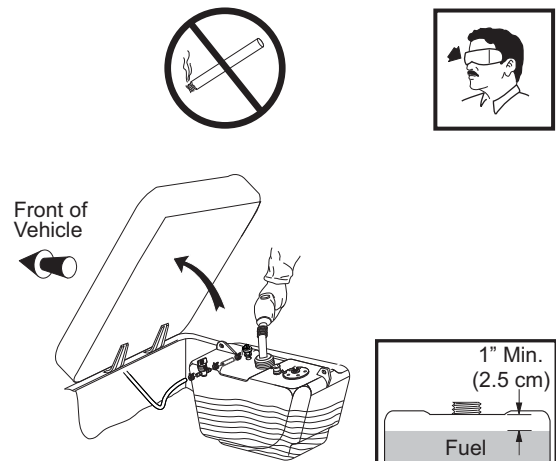


Fig. 2 Fuel Tank Location

FUEL SYSTEM COMPONENT SERVICE AND REPLACEMENT

⚠ WARNING

To prevent personal injury resulting from explosion or fire:

Check for clogged or kinked hoses. Clogged or kinked carburetor hoses are not only detrimental to the proper operation and performance of the vehicle, but can also be a safety hazard in the case of fuel leaking on a hot engine.

Tests that involve fuel flow should be avoided if at all possible. If a test to determine fuel/vapor presence or flow is required, the ignition system must be disabled. Ground the magneto in order 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 cables before servicing fuel system.

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

The fuel filter, tank, hoses and cap should be checked frequently for leaks or signs that the cap vent or filter has become clogged. The filter should be replaced periodically. See 'Periodic Service Schedule' in Section A.

Fuel Lines and Filters

Tool List	Qty.
Pliers	1

Fuel is supplied to the fuel pump (6) and carburetor through flexible fuel hoses (4). An in-line filter (5) is installed in the hose between the fuel tank (1) and fuel pump (6).

⚠ CAUTION

The filters are marked with a flow direction arrow. Be sure that the arrow points towards the fuel pump.

To replace fuel filter (5), turn fuel shut off valve to closed position, move clamps (14) off ends of filter (5) and pull filter up higher than the fuel pump (6) to reduce the amount of gas that will spill (Ref. Fig. 3 on page M-3). Remove hose (4) coming from fuel tank (1) first and plug. Remove filter (5) from hose going to fuel pump (6) and discard.

NOTICE

Orient direction of new fuel filter according to FLOW arrow on side of filter.

Install new fuel filter in reverse order of removal. Turn fuel shut off valve to open position (Ref. Fig. 1 on page M-1).

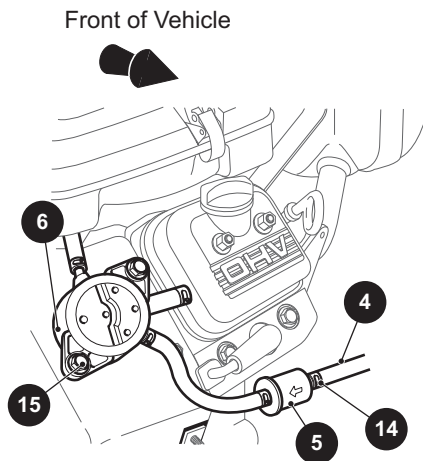


Fig. 3 Fuel Pump

Fuel Pump

Tool List	Qty.
Pliers.....	1
Wrench, 10mm	1

Raise passenger seat.

Disconnect fuel hose coming from fuel filter (5).

Remove pump mounting hardware (15) and disconnect pump (6) from hoses going to carburetor and valve cover.

Remove pump (6) from vehicle.

Install new fuel pump (6) in reverse order of removal.

Fuel Tank

Tool List	Qty.
Phillips screwdriver	1
Pliers.....	1
Wrench, 3/8"	2
Wrench, 1/2"	2

Raise passenger seat.

Remove seat filler panel. See BODY AND TRUCKBED section.

Disconnect fuel hose and gauge wires from tank.

Remove tank mounting hardware and tank from vehicle.

Install new fuel tank in reverse order of removal.

CHOKE SYSTEM

The choke functions to make initial starting of the engine easier in cold weather conditions. The choke plate restricts the air flow into the carburetor which richens the air/fuel ratio.

Choke Operation

Pull choke knob out to operate choke. Check that cable operates smoothly and that cable returns when the knob is released. The motion should be smooth throughout the entire operating range. If there is any binding or sharp bends, the choke cable assembly and linkage must be inspected and parts replaced as necessary.

FUEL SYSTEM

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

NOTICE

Do not attempt to lubricate the choke cable. Lubricant tends to retain dirt on the moving parts which will cause premature deterioration of the cable.

Choke Cable Removal

Tool List	Qty.
Wrench, 1/2"	1
Wrench, 5/8"	1
Straight screwdriver, small.....	1

Pry choke cable off ball stud of choke pivot lever (8) (Ref. Fig. 4 on page M-4). Loosen jam nuts (9) securing choke cable (7) to bracket (10) and remove. At the center console, loosen setscrew (13) securing knob (12) to end of cable and remove knob (12). Remove nut (11) securing end of cable to console and remove choke cable (7) from vehicle.

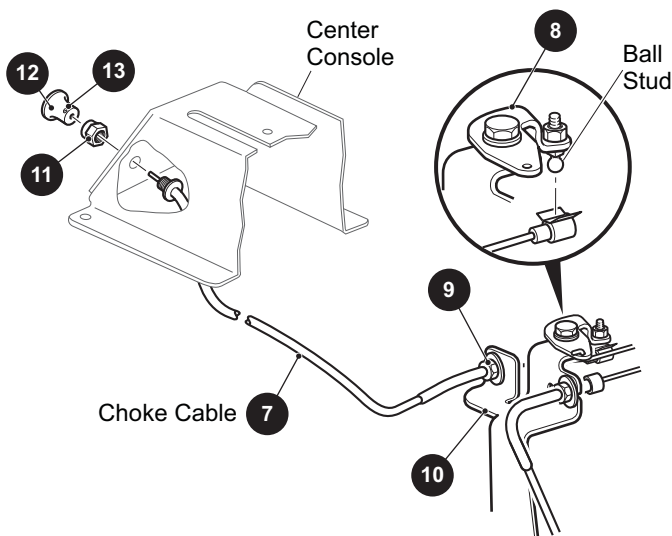


Fig. 4 Choke Cable

Choke Cable Installation and Adjustment

From below the console, feed the choke cable (7) through the hole in the console and secure end of cable with nut (9) (Ref. Fig. 4 on page M-4). Place knob (12) on end of cable (7) and firmly tighten setscrew (13) to retain knob (12). At other end of choke cable (7), place cable in slot of bracket (10) with a jam nut (9) and washer on each side of bracket (10). Snap ball stud into socket on end of choke cable (7).

Remove air cleaner cover and filter cartridge to see choke plate in carburetor. Adjust the position of the cable (7) in the bracket (10) using the jam nuts (9) until

the choke plate fully opens and closes using the knob. Check the cable to be sure that there are no sharp bends or kinks in the cable before firmly tightening the jam nuts.

CARBURETOR

Tool List	Qty.
Pliers.....	1
Insulated wrench, 1/2"	1
Wire lead with alligator clips.....	1

To properly prepare for carburetor service:

- Disconnect fuel hose at fuel filter and plug ends to prevent contamination. Empty carburetor by running engine until it stops from lack of fuel.
- Disconnect negative (-) cables from battery to prevent electrical shorts that could ignite fuel vapors.
- Wash engine and chassis to remove dirt build-up, especially the underside of the wide frame cross-member directly above the air cleaner.
- Ground magneto by attaching a wire lead, with alligator clips, from the terminal with the white wire (located on fan cover at side of engine) to the ground cable bolted to the frame.
- Follow carburetor removal and service procedures outlined in the CARBURETION section of the Briggs & Stratton® Repair Manual (P/N 272144) for Vanguard™ V-Twin Overhead Valve engine.

PROLONGED STORAGE

For information on preparing vehicle for prolonged storage, refer to the GENERAL INFORMATION AND ROUTINE MAINTENANCE section.

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

GENERAL

CAUTION

Do not hold vehicle on hill by using accelerator and motor. Leaving the motor in a stalled condition for more than 3-4 seconds will raise the commutator bars resulting in unacceptable noise and accelerated brush wear and cause permanent damage to motor.

Disassembly of the motor is not recommended except to replace a worn or noisy bearing. If the motor is disassembled, it should be cleaned of any dirt buildup and the brush length checked. Replace brushes if required.

Neither the motor housing nor armature is available as service items, therefore in the unlikely event of a failure in either of these components, the entire motor must be replaced.

Motor Removal

WARNING

Disconnect the negative (-) battery cable with an insulated wrench before attempting to remove wires from the motor (see safety procedures in SAFETY section of this manual). The shorting of motor wires could cause an explosion.

Tool List	Qty.
Insulated wrench, 9/16"	1
Chalk or paint pen	1
Socket, 7/16"	1
Ratchet	1
Internal snap ring pliers	1

Using an insulated wrench, disconnect the negative (-) battery cable from the battery (Ref. Fig. 1 on page N-1). Remove all wires from motor.

Mark both the axle and motor housings to permit realignment during reassembly of motor to rear axle (Ref. Fig. 2 on page N-1).

Remove the snap ring (13) and remove the speed sensor (12) from the motor end cover (8) (Ref. Fig. 3 on page N-2).

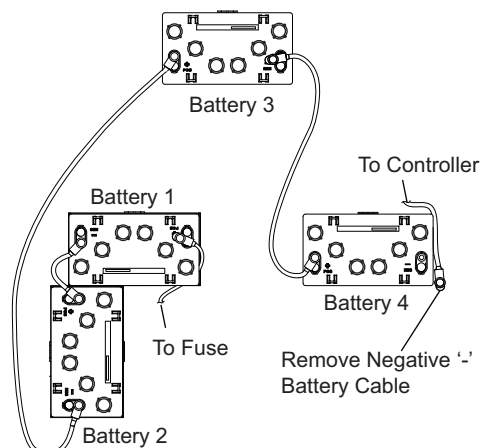


Fig. 1 Disconnect Battery Cable

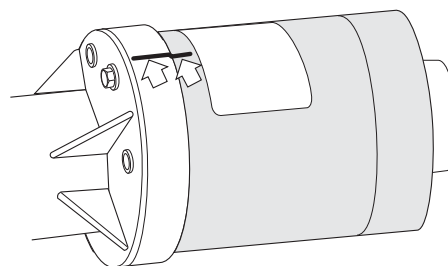


Fig. 2 Mark Axle and Motor

CAUTION

Take care not to damage the splines when removing and reassembling the motor to the rear axle housing.

Remove the three bolts that secure the motor to the axle housing and carefully slide the motor straight out from the axle splines.

Motor Disassembly

Tool List	Qty.
Straight blade screwdriver	1
Ratchet	1
Socket, 3/8"	1
Plastic faced hammer	1

Remove the magnet on the end of the armature by carefully removing the snap rings and attaching screw.

Remove bolts (14) that hold the commutator end cover (8) to the motor housing (2).

Pull on commutator end cover to remove armature (1) and cover (as an assembly) from the housing. A light tap on the end cover may be necessary to loosen.

MOTOR

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

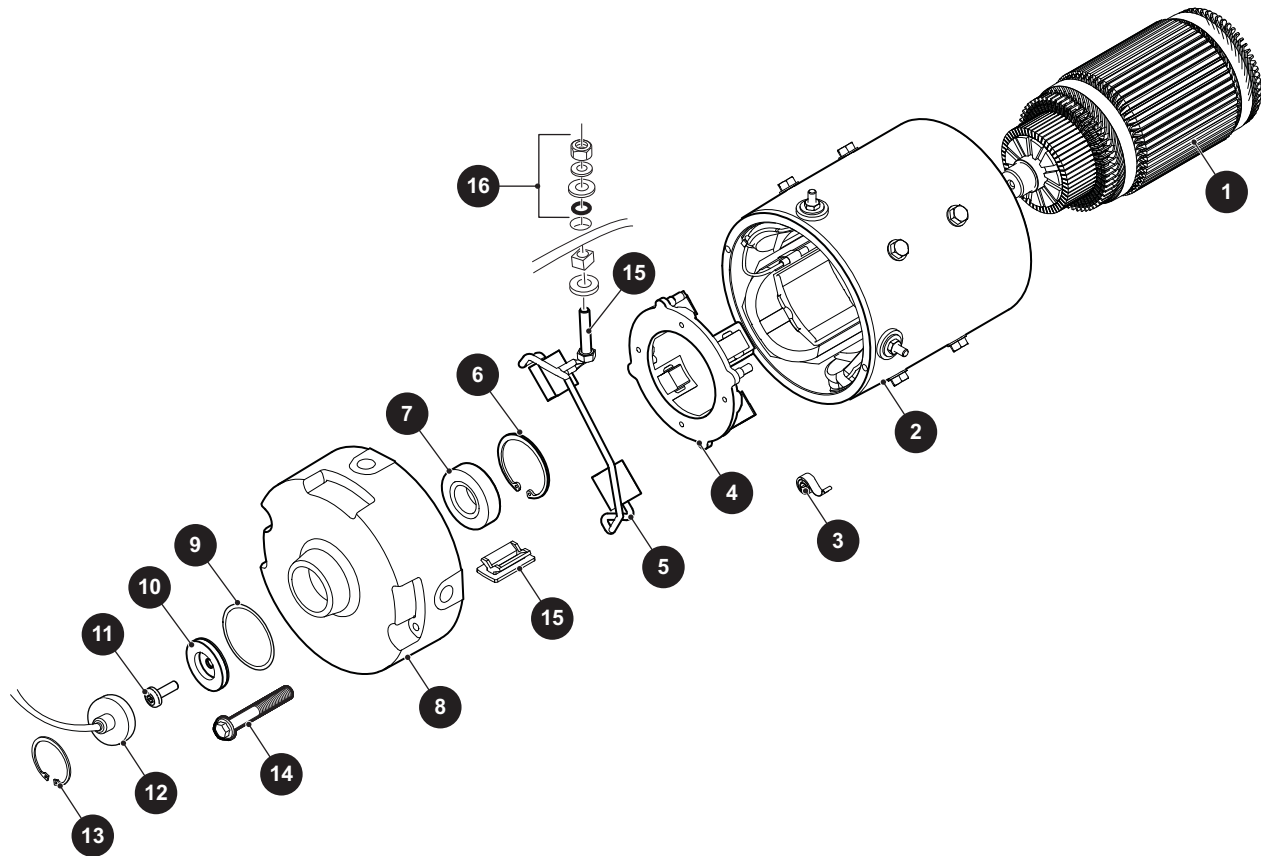


Fig. 3 Motor Components

Bearing Replacement

Tool List	Qty.
Heat gun or lamp	1
Arbor press	1
Bearing driver set	1
Snap ring pliers.....	1

⚠ CAUTION

Do not use a torch to heat the commutator end cover. Only a moderate amount of heat should be applied. Excessive heat will damage the end cover and bearing.

Proper support must be given to the commutator end cover during press operations. Inadequate and/or uneven support will cause the end cover to fracture.

To aid disassembly, heat only the commutator end cover (8) before attempting removal of the armature (1).

Once heated, place the commutator end cover/armature assembly in press, giving as much support to the end cover as possible, and press the armature out of the bearing (7).

Push back each brush until its spring (3) is resting against the side of the brush. This keeps the brushes out of the way during bearing replacement (Ref. Fig. 5 on page N-3).

Remove internal snap ring (6) and heat the commutator end cover (8) again. Press bearing (7) out from commutator end cover (8).

⚠ CAUTION

When installing bearing into end cover, apply pressure against the bearing's outer race to avoid bearing damage.

Press the new bearing (7) into the commutator end cover (8) using heat again to aid installation.

Install the snap ring (6).

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

NOTICE

If brushes are to be replaced, proceed now to "Brush Replacement" on page N-3 before installing the armature.

For proper location, the armature (1) has a positive stop feature.



CAUTION

When installing armature into the bearing/end cover assembly, support the bearing's inner race to avoid damage.

Press the armature (1) into the new bearing (7) using moderate heat to aid installation.

Release brushes against commutator. Ensure the springs are seated against the rear of the brushes and are able to move freely.

Brush Replacement

Tool List	Qty.
Wrench, 1/2"	1
Ratchet	1
Socket, 5/16"	1

Brushes should be measured as shown and replaced when the minimum dimension of 0.62" (16 mm) is reached (Ref. Fig. 4 on page N-3).

Remove brush terminal hardware (16) at A1 and A2 (Ref. Fig. 3 on page N-2).

Remove screws securing brush plate (4). Remove brushes, rigging and brush plate.

Pull back each brush until each of the springs (3) rest against the side of its brush (Ref. Fig. 5 on page N-3).

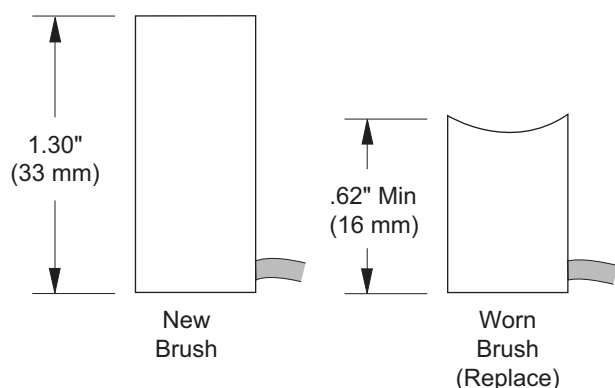


Fig. 4 Brush Wear

Remove brushes and replace with new brush replacement kit. Locate springs against the side of each brush.

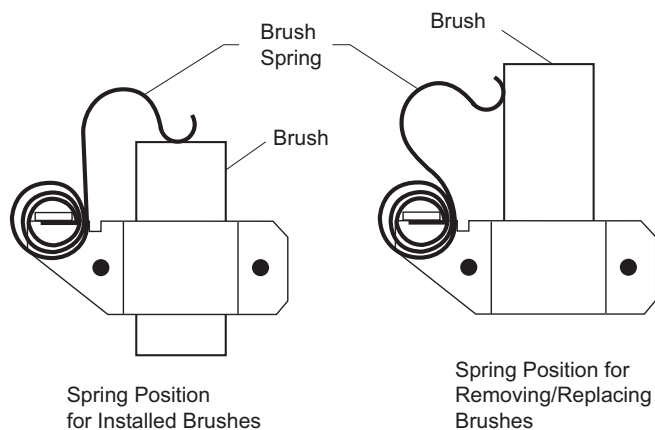


Fig. 5 Securing Brushes

Install terminals and brush plate using reverse order of removal. Install armature (commutator end) through brush plate and press into new bearing using moderate heat to aid installation. Position brushes against commutator. Ensure the springs are seated against the rear of the brushes and are able to move freely.

Motor Assembly

Tool List	Qty.
Socket, 3/8"	1
Ratchet	1
Torque wrench, in. lbs.	1

Align the commutator end cover (8) with the holes in the motor housing (2) and assemble (Ref. Fig. 3 on page N-2). Secure the commutator end cover (8) to the motor housing with bolts (14) and tighten to 90 in. lbs. (10 Nm) torque. Attach o-ring (9), ring magnet (10) to armature shaft with screw (11). Tighten the screw (11) to torque values specified below. Insert speed sensor and secure with the snap ring (13) (Ref. Fig. 3 on page N-2).

Item	Torque Specification
11	18 - 23 in. lbs. (2.03 - 2.59 Nm)

Motor Tests

Refer to Section-T, TROUBLESHOOTING, for the procedure to test the motor.

MOTOR

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

Motor Installation

Tool List	Qty.
Socket, 7/16"	1
Ratchet.....	1
Torque wrench, in. lbs.....	1

Be sure that a bumper spline is installed between the motor input pinion shaft and splines. Apply a small quantity of molybdenum grease to the male portion of the spline. Carefully mate the motor spline with the input shaft of the rear axle. Align the orientation marks and install the mounting hardware. Tighten to 168 in. lbs. (19 Nm) torque (Ref. Fig. 2 on page N-1).

Attach the four motor wires to motor (Ref. Fig. 6 on page N-4). Tighten the nuts to the torque values specified below:

Item	Torque Specification
16	66 in. lbs. (7.45 Nm)

Install speed sensor in end cover.

Motor Terminal	Wire Marker	From
F1	F1	Controller "F1"
F2	F2	Controller "F2"
A1	A1	Controller "A1"
A2	A2	Solenoid

Fig. 6 Motor Wiring

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

SEATING

Front Seats Removal and Installation

Tool List	Qty.
Phillips screwdriver.....	4
Drill	1
Drill bit, 7/32"	1
Punch, small.....	1
Hammer.....	1
Rivet gun	1

To remove the driver or passenger seat bottom (1), lift and tilt the seat towards the front of the vehicle to access the hinge below the seat, remove the three screws (2) securing the seat bottom to hinge (3) (Ref. Fig. 1 on page P-1).

To replace damaged hinge (3), drill out the rivets (4) to remove the hinges (3) from the frame.

Install the seat bottom in reverse order of disassembly.

NOTICE

Complete seat removal and replacement is not necessary in some of the repair procedures. Remove and replace the seat bottom or seat back assembly only as instructed in the repair.

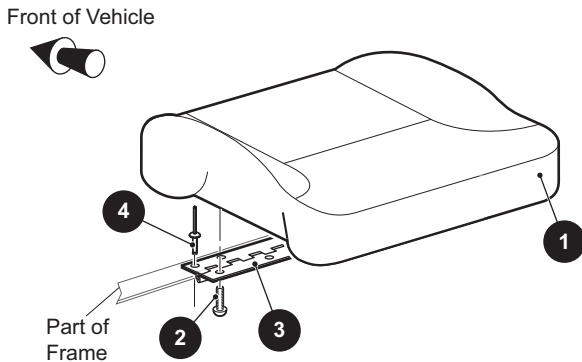


Fig. 1 Front Seat Bottom Removal

WARNING

To prevent personal injury caused by the seat back assembly falling, replace only one seat back at a time

To remove a seat back assembly (7), remove four screws (5) and lock washers (6) securing seat back assembly (7) to lower OPS (Ref. Fig. 2 on page P-1).

To remove the seat back cushion (9), remove the screws (10) and lock washers (11) securing the back rest cushion (9) to the seat back plate (8).

Install the seat back assembly (7) in the reverse order of disassembly.

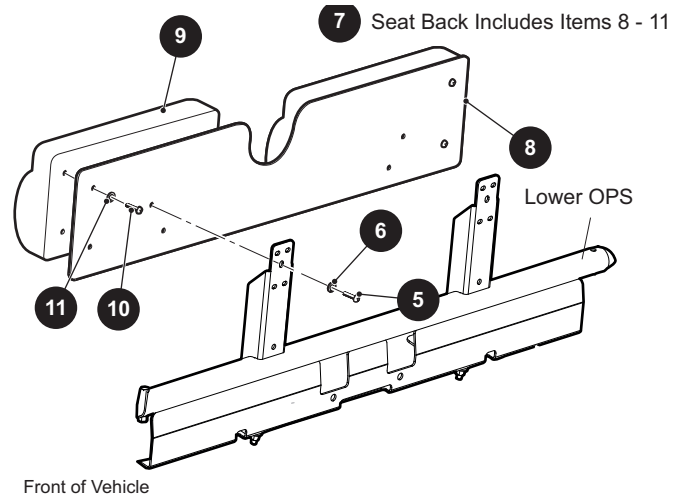


Fig. 2 Front Seat Back Rest Removal

Rear Seats Removal and Installation

NOTICE

Rear seat is optional in this vehicle. The following procedure is applicable if the rear seat is installed in the vehicle.

Tool List	Qty.
Ratchet	1
Socket, 3/4".....	1
Socket, 3/8".....	1
Socket, 5/8".....	1
Socket, 7/16".....	1
Socket, 9/16".....	1
Wrench, 7/16".....	1
Phillips screwdriver	1
Torque wrench, ft. lbs.....	1
Torque wrench, in. lbs.....	1

Remove the bolts (13) and locknuts (14) securing the armrest (12) to the seat frame (19). Remove the bolts (15), flat washers (16) and locknuts (17) and remove the armrests (12) from the rear seat.

Remove the bolts (21), flat washers (22) and locknuts (23) to remove the seat frame bracket (20) from the seat frame (19) (Ref. Fig. 3 on page P-2).

Remove the bolts (24), flat washers (25), bushings (26) and lock nuts (27) and lift the rear seat assembly from the vehicle.

OPERATOR PROTECTION SYSTEM

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

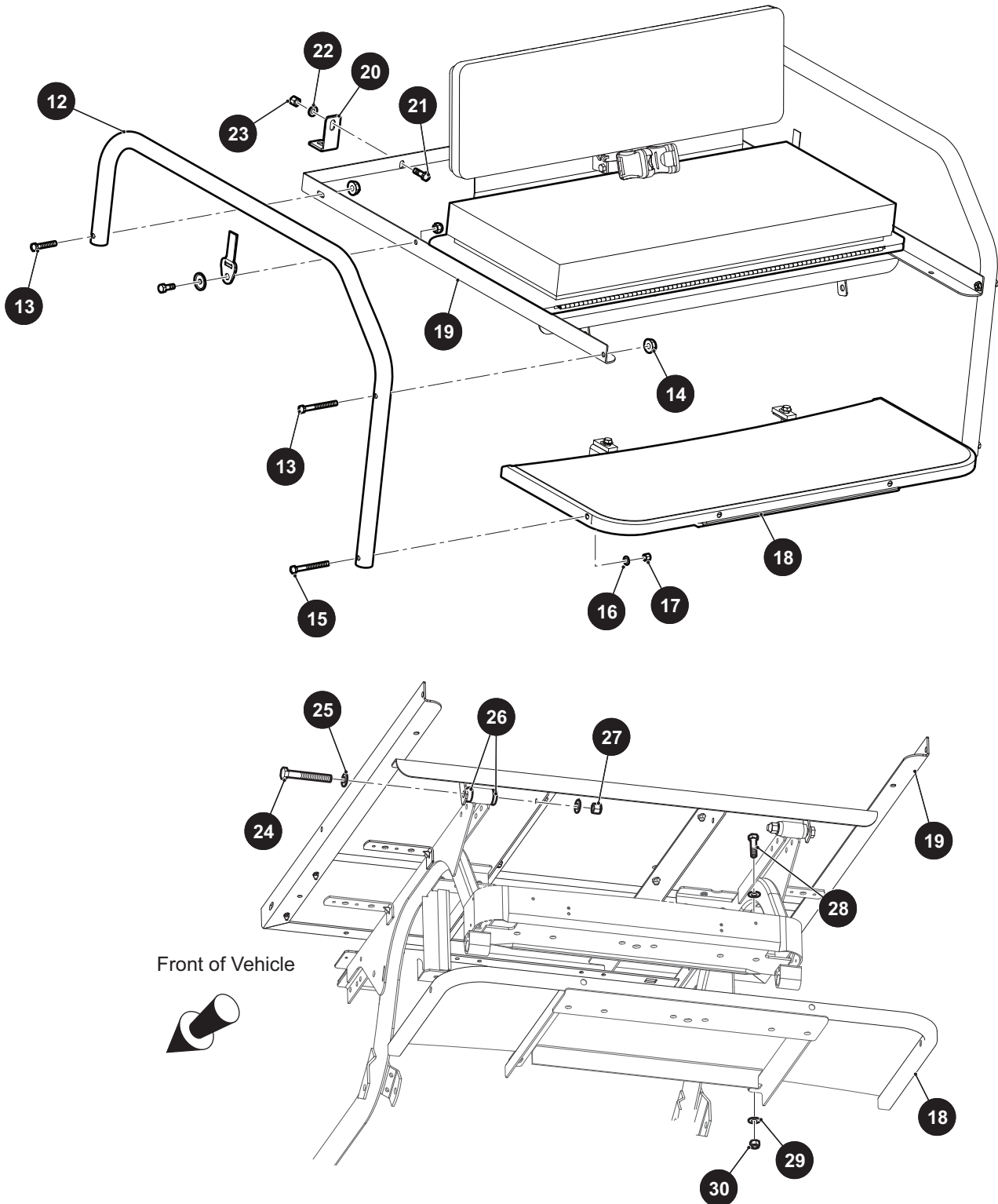


Fig. 3 Rear Seat Removal

OPERATOR PROTECTION SYSTEM

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

Remove the bolts (28), flat washers (29), and locknuts (30) to remove the footrest (18) from the vehicle

Remove the bolts (32), flat washers (33), and locknuts (34) to remove the rear deck board (31) from the seat frame (19) (Ref. Fig. 5 on page P-4).

Tilt the rear seat assembly 180 degrees around the hinge (38) along with the seat back rest, to gain access to the hardware beneath the seat.

Remove the screws (40), flat washers (41), and locknuts (42), to remove the seat bottom assembly from the seat frame(19) along with the hinged deck board assembly (35).

To free seat bottom assembly (49) from the hinged deck board assembly (35), remove the screws (54), flat washers (55), and rubber bumper (56).

If necessary disassemble the seat bottom assembly (49) by removing the staples (53) and separate the seat bottom plywood (52), seat bottom foam (51), and seat bottom vinyl (50) (Ref. Fig. 4 on page P-3).

Remove screws (44) and locknuts (45) to separate the seat back rest weldment (43) from the hinged deck board (36).

Remove the screws (47) and lock washers (48) to free the seat back rest cushion (46) and seat back rest weldment (43).

Installation of the rear seat assembly is in the reverse order to removal.

During installation tighten the following hardware to the torques values as specified below:

Item	Torque Specification
14, 17, 23, 27	21 - 25 ft lbs. (28.47 - 33.89 Nm)
30, 34, 47, 54	45 - 55 ft lbs. (61.01 - 74.56 Nm)
42, 45	8 - 10 ft lbs. (10.84 - 13.55 Nm)

(Ref. Fig. 3 on page P-2), (Ref. Fig. 4 on page P-3) and (Ref. Fig. 5 on page P-4).

49 Seat Bottom Assembly Includes Items 50- 53

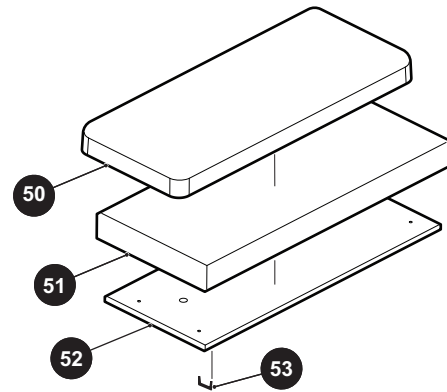


Fig. 4 Rear Seat Bottom Assembly

OPERATOR PROTECTION SYSTEM

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

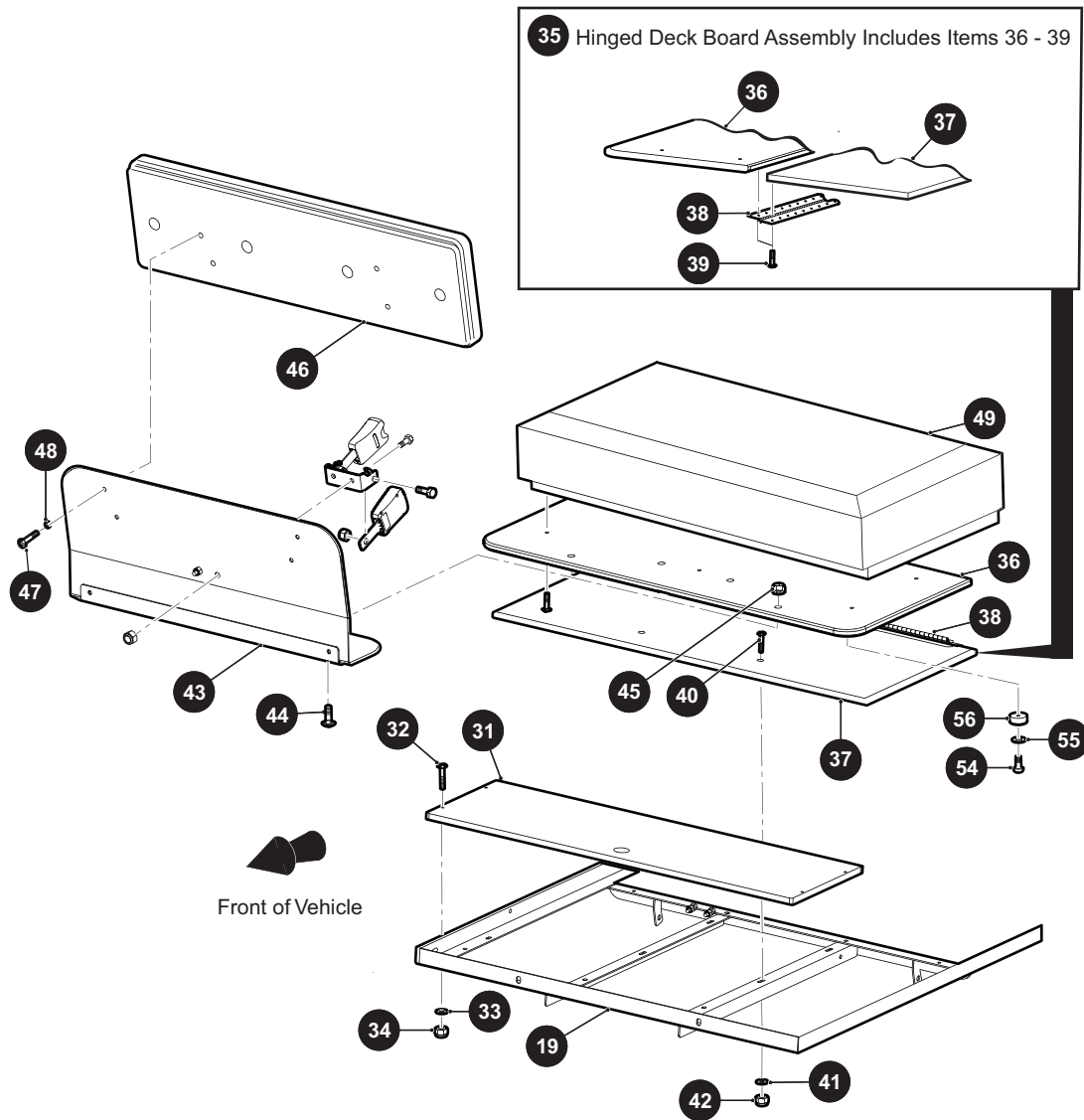


Fig. 5 Rear Seat Components

Front Seat Belt Removal And Installation

Tool List	Qty.
Socket, 5/8"	1
Ratchet	1
Wrench, 5/8"	1
Torque wrench, ft. lbs.	1

Pull to remove the seat belt support caps (57) and remove the bolts (58) and nuts (59) to remove the upper seat belt supports (60) on both the driver and passenger sides. Remove the seat belt retractors (61) by removing

the bolts (62) and nuts (63). Remove the lower seat belt supports (64) by removing the bolts (65) and nuts (66) (Ref. Fig. 6 on page P-5).

Install the seat belts in reverse order to removal. Tighten the hardware to the torque values specified below:

Item	Torque Specification
59, 66	21-25 ft lbs. (28.47 - 33.89 Nm)
63	45-55 ft lbs. (61.01 - 74.56 Nm)

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

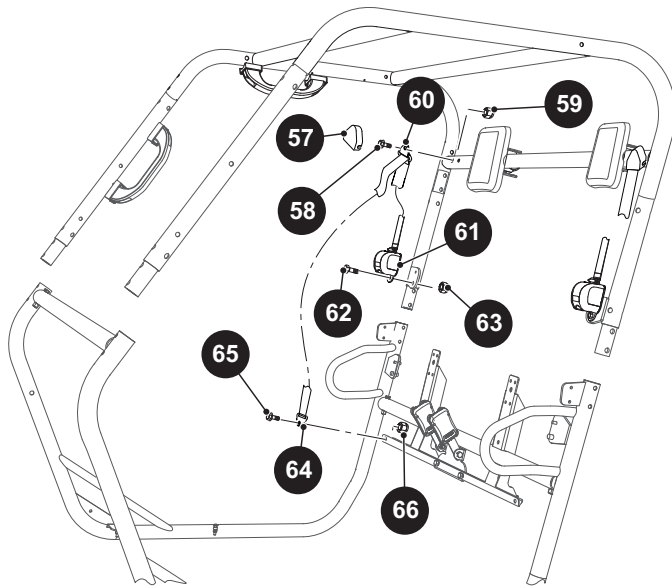


Fig. 6 Front Seat Belt Removal

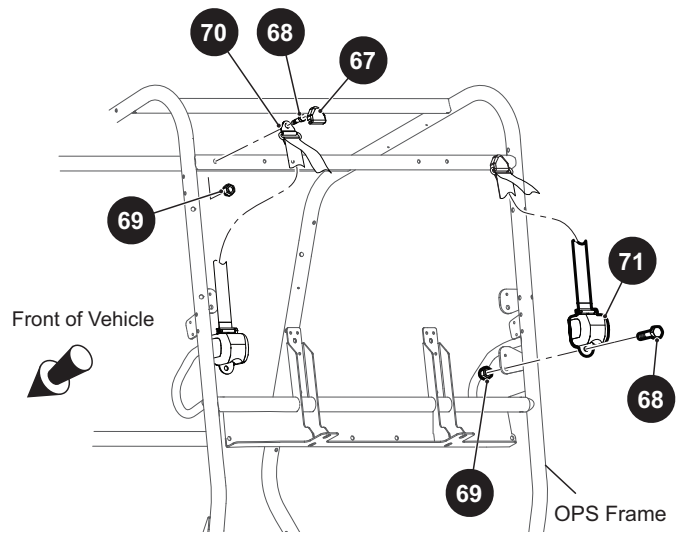


Fig. 7 Rear Seat Belt Removal

Rear Seat Belt Removal And Installation

NOTICE

Rear seat is optional in this vehicle. The following procedure is applicable if the rear seat is installed in the vehicle.

Tool List	Qty.
Socket, 5/8"	1
Ratchet	1
Wrench, 5/8"	1
Torque wrench, ft. lbs.	1

Pull to remove the rear seat belt support caps (67) and remove the bolts (68) and nuts (69) to remove the upper seat belt supports (70) on both the driver and passenger sides. Remove the seat belt retractors (71) by removing the bolts (68) and nuts (69) (Ref. Fig. 7 on page P-5).

Remove the lower seat belt supports (122) by removing the bolts (120), washers (121) and nuts (119) (Ref. Fig. 8 on page P-5)

Install the rear seat belts in reverse order to removal. Tighten the hardware to the torque values specified below:

Item	Torque Specification
69	21 - 25 ft lbs. (28.47 - 33.89 Nm)
119	45 - 55 ft lbs. (61.01 - 74.56 Nm)

(Ref. Fig. 7 on page P-5).

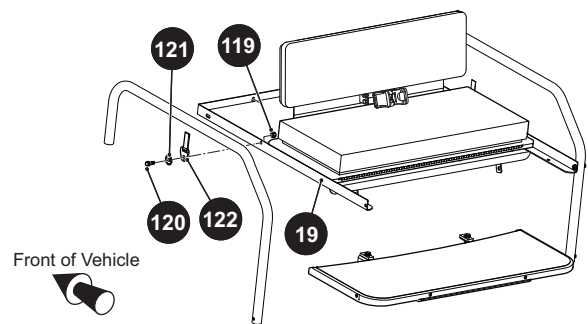


Fig. 8 Rear Seat Belt Lower Support Removal

Front Seat Belt Buckle Latch Replacement

Tool List	Qty.
Socket, 5/8"	1
Ratchet	1
Wrench, 5/8"	1
Torque wrench, ft. lbs.	1

Remove the bolts (73) and lock nuts (74) to remove the seat belt buckle latch (72) from the front seat belt bracket (75) (Ref. Fig. 9 on page P-6).

To remove the front seat belt bracket (75), remove the bolts (123) and nuts (124) that hold the bracket to the lower OPS frame.

Install the front seat belt buckle latch (72) and the front seat belt bracket (75) in reverse order of removal (Ref. Fig. 9 on page P-6). Tighten the hardware to the torque values specified below:

OPERATOR PROTECTION SYSTEM

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

Item	Torque Specification
74, 124	45 - 55 ft lbs. (61.01 - 74.56 Nm)

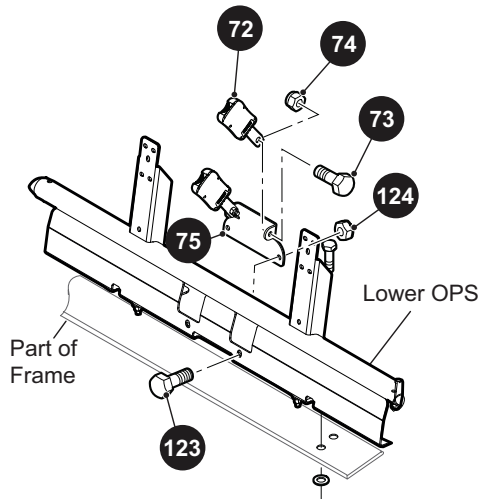


Fig. 9 Front Seat Belt Buckle Latch Removal

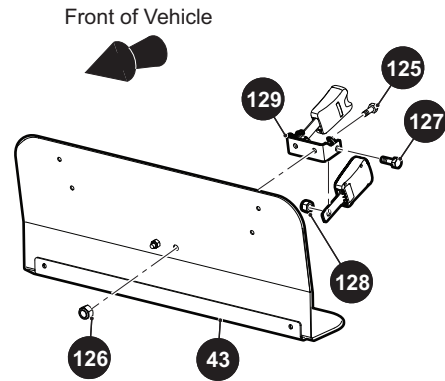


Fig. 10 Rear Seat Buckle Latch Removal

Install the rear seat belt buckle latch and the rear seat belt bracket (129) in reverse order of removal (Ref. Fig. 10 on page P-6). Tighten the hardware to the torque values specified below:

Item	Torque Specification
126, 128	45 - 55 ft lbs. (61.01 - 74.56 Nm)

Rear Seat Belt Buckle Latch Replacement

NOTICE

Rear seat is optional in this vehicle. The following procedure is applicable if the rear seat is installed in the vehicle.

Tool List	Qty.
Socket, 5/8"	1
Ratchet	1
Wrench, 5/8"	1
Torque wrench, ft lbs.	1

The rear seat buckle latch is bolted to seat back rest weldment (43) (Ref. Fig. 3 on page P-2)

To remove the rear seat buckle latch, remove bolts (127) and nuts (128) from the rear seat belt bracket (129) (Ref. Fig. 10 on page P-6).

To remove the rear seat belt bracket (129), remove the bolts (125) and nuts (126) that hold the bracket to the rear seat back rest weldment (43) (Ref. Fig. 10 on page P-6).

UPPER OPERATOR PROTECTION SYSTEM

Head Rest Removal And Installation

Tool List	Qty.
Socket, 7/16".....	1
Ratchet	1
Wrench, 7/16"	1
Torque wrench, ft lbs.....	1

Remove the lock nuts (76), clamps (77), plastic clamps (78) to remove the driver and passenger headrests (79) (Ref. Fig. 11 on page P-6).

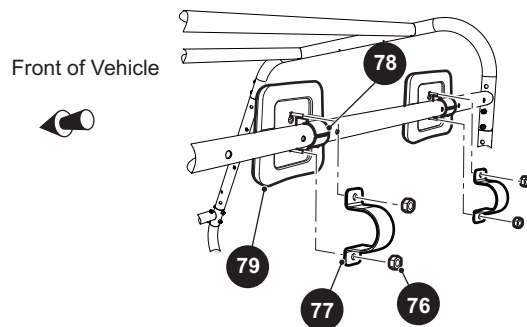


Fig. 11 Headrest Removal

OPERATOR PROTECTION SYSTEM

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

Install the headrests in reverse order of removal. Tighten the hardware to the torque values specified below:

Item	Torque Specification
76	8 - 10 ft. lbs. (10.84 - 13.55 Nm)

Grab Handle Removal And Installation

NOTICE

Grab handle replacement can be done as necessary.

Tool List	Qty.
Phillips screwdriver.....	1

Remove the screws (81) on the grab handle mount (82) to remove the two grab handles (80) on the passenger side (Ref. Fig. 12 on page P-7).

Install the grab handles in reverse order of removal.

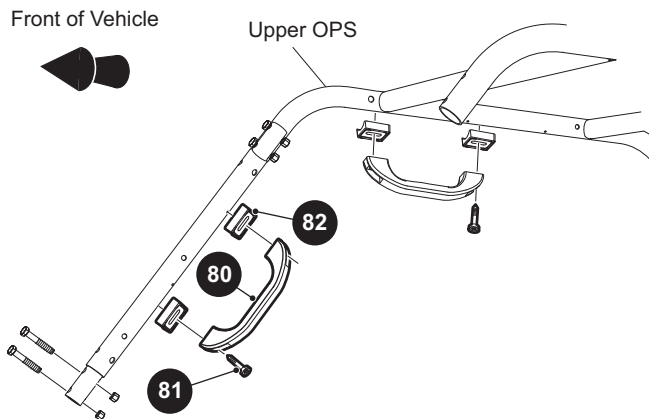


Fig. 12 Grab Handle Removal

Upper OPS Frame Removal And Installation

Tool List	Qty.
Ratchet.....	1
Wrench, 9/16".....	1
Socket, 9/16".....	1
Torque wrench, ft. lbs.	1

Remove canopy top. Refer to WEATHER PROTECTION section.

Remove the windshield. Refer to WEATHER PROTECTION section.

Remove front seat belts. Refer to "Front Seat Belt Removal And Installation" on page P-4.

If rear seats are installed on the vehicle, remove the rear seat belts. Refer to "Rear Seat Belt Removal And Installation" on page P-5

WARNING

The following step involves lifting substantial weight. Two people are recommended. Use of a personal back support brace and proper lifting technique is required to prevent personal injury.

Remove the eight bolts (87) and lock nuts (88) that attach the upper OPS frame to lower OPS frame.

Remove the eight bolts (90) and lock nuts (91) to free the front connectors (83 and 84), rear connectors (85 and 86) and the upper weld unit (89) (Ref. Fig. 13 on page P-8).

Install the upper OPS in reverse order of removal. During installation, assemble the front connectors (83 and 84) first and then install the rear connectors (85 and 86).

Coating the connector tube ends with antiseize will help in preventing squeaks during operation.

Tighten the following hardware to the torques values as specified below:

Item	Torque Specification
88, 91	21 - 25 ft lbs. (28.47 - 33.89 Nm)

OPERATOR PROTECTION SYSTEM

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

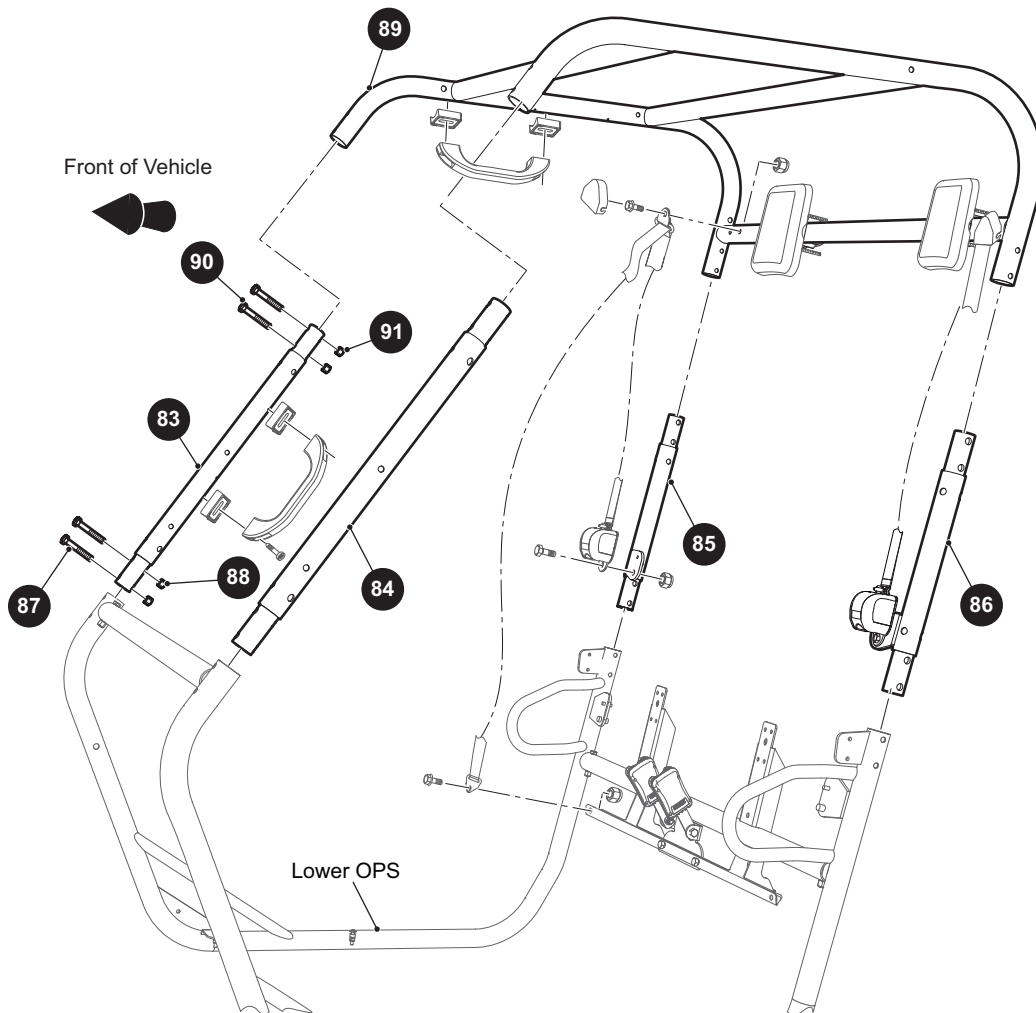


Fig. 13 Upper OPS Removal

LOWER OPERATOR PROTECTION SYSTEM

Front Bumper Weldment Removal And Installation

Tool List	Qty.
Socket, 1/2"	1
Ratchet	1
Wrench, 1/2"	1
Torque wrench, ft. lbs.	1

Remove the bolts (93), flat washers (94) and locknuts (95) to remove free the winch plate (92) from the front bumper (96) (Ref. Fig. 14 on page P-9).

Remove the bolts (97), flat washers (98) and lock nuts (99) from the front bumper (96). Remove bolts (100), flat washers (101), lock washers (102) and spacers (103) to remove the front bumper (96) from the vehicle.

Install the front bumper in reverse order of removal. Tighten the hardware to the torques values as specified below:

Item	Torque Specification
100, 95, 99	15 - 19 ft.lbs. (20.33 - 25.76 Nm)

OPERATOR PROTECTION SYSTEM

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

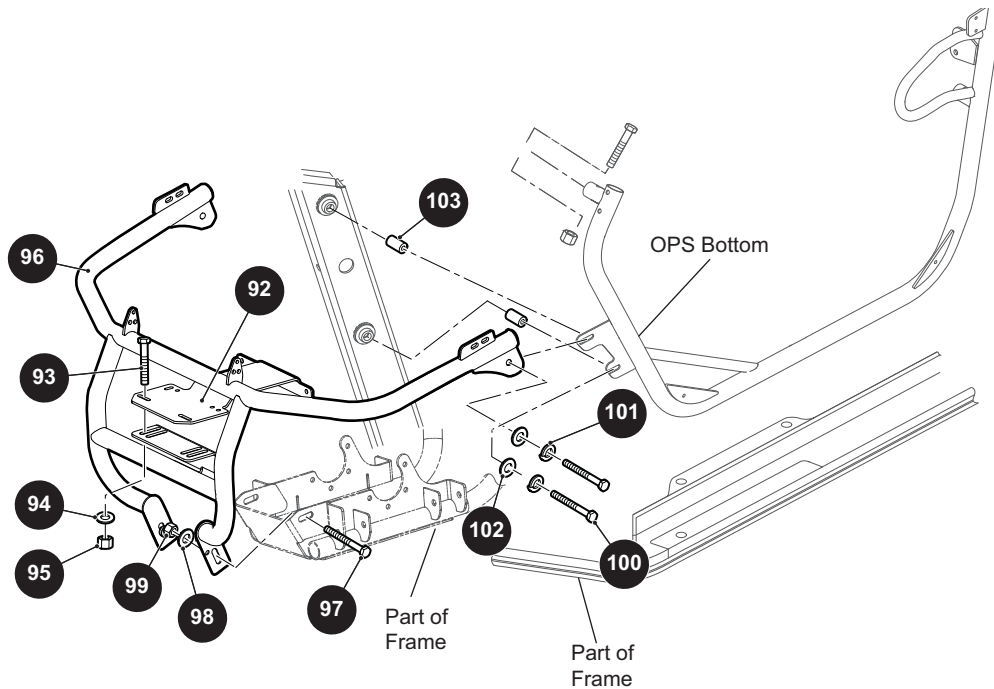


Fig. 14 Front Bumper Removal

Lower OPS Rear Weldment Removal And Installation

Tool List	Qty.
Ratchet	1
Socket, 5/8"	1
Socket, 7/16"	1
Socket, 9/16"	1
Socket, 1/2"	1
Wrench, 7/16"	1
Torque wrench, ft. lbs.	1
Torque wrench, in. lbs.	1

Remove upper OPS frame from the lower OPS. See "Upper OPS Frame Removal And Installation" on page P-7.

Remove front seat back rest. Refer to "Front Seats Removal and Installation" on page P-1.

Remove front seat belts. Refer to "Front Seat Belt Removal And Installation" on page P-4.

If rear seats are installed on the vehicle, remove the rear seat belts. Refer to "Rear Seat Belt Removal And Installation" on page P-5

Remove front seat belt buckle latch. "Front Seat Belt Buckle Latch Replacement" on page P-5.

If rear seats are installed on the vehicle, remove the rear seats buckle latch. Refer to "Rear Seat Belt Buckle Latch Replacement" on page P-6

Remove the bolts (110) and lock nuts (111) that holds the OPS seat support (106) to the passenger and driver side OPS bottom (112 and 113) (Ref. Fig. 15 on page P-10).

Remove the bolts (107), flat washers (108), and lock nuts (109) and remove the OPS seat support (106) from the vehicle.

Remove the bolts (115) and lock nuts (116) to remove the front crossbar tube (114) from OPS bottoms (112 and 113).

Install the lower OPS frame in reverse order to removal. During installation tighten the following hardware to the torques values as specified below:

Item	Torque Specification
109, 111, 116	21 - 25 ft. lbs. (28.47 - 33.89 Nm)
118	45 - 55 in. lbs. (61.01 - 74.56 Nm)

OPERATOR PROTECTION SYSTEM

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

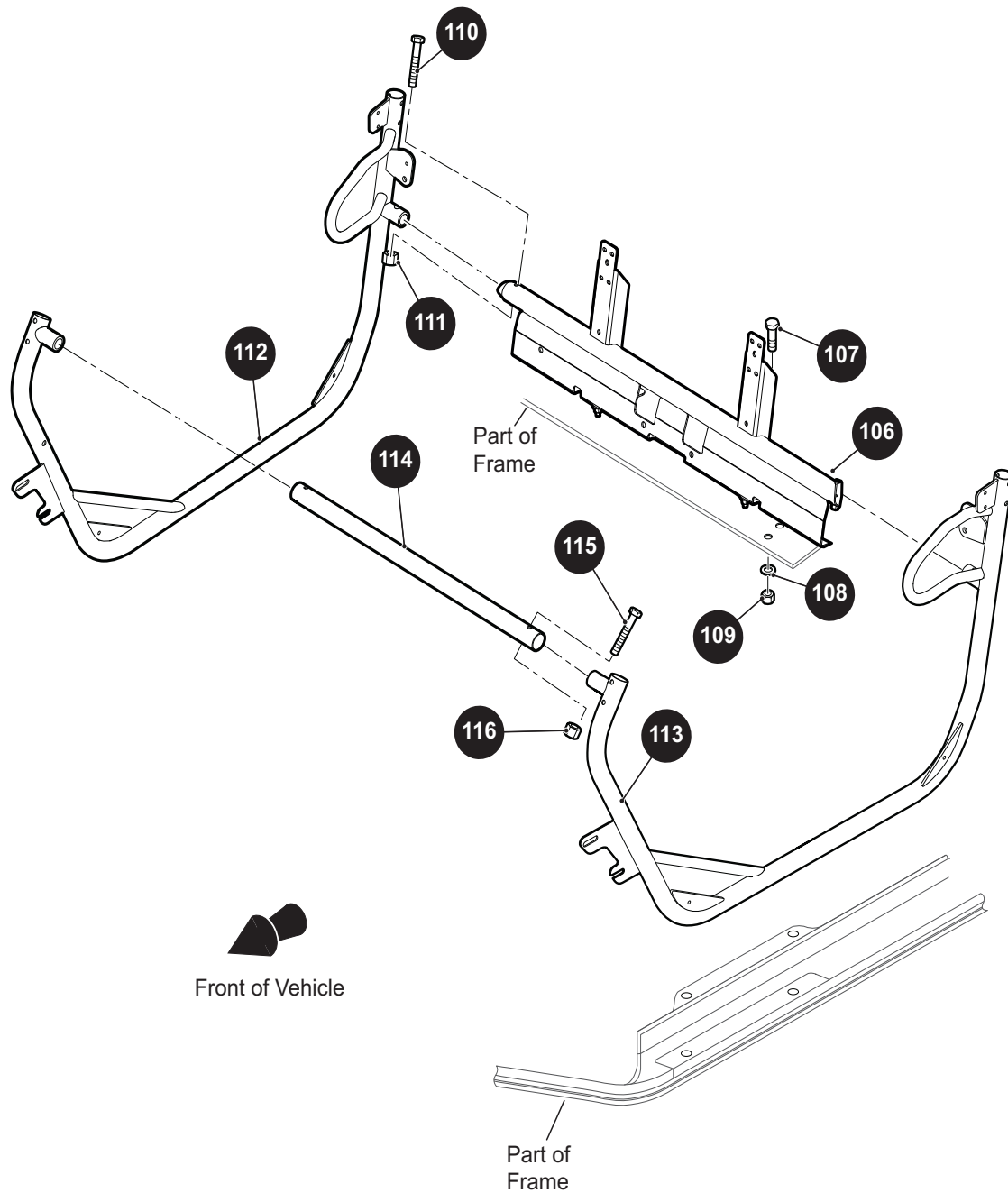


Fig. 15 Lower OPS Rear Weldment Removal

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Larger Scratches	Q-1
Complete Panel Repair	Q-1

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

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:

- I. Thoroughly clean the surface to be repaired with alcohol and dry.
- II. 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.
- III. 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.
- IV. Clean with alcohol and dry.
- V. (Optional but recommended) Follow this process with clear coat to renew and protect depth of finish.
- VI. 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:

- I. Thoroughly clean the surface to be repaired with alcohol and dry.
- II. Mask area to be painted (common masking tape is adequate) prior to repair and use aerosol type touch-up paint.
- III. 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.
- IV. 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.
- V. Clean with alcohol and dry.
- VI. (Optional but recommended) Follow this process with clear coat to renew and protect depth of finish.
- VII. 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.

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REAR AXLE AND SUSPENSION

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

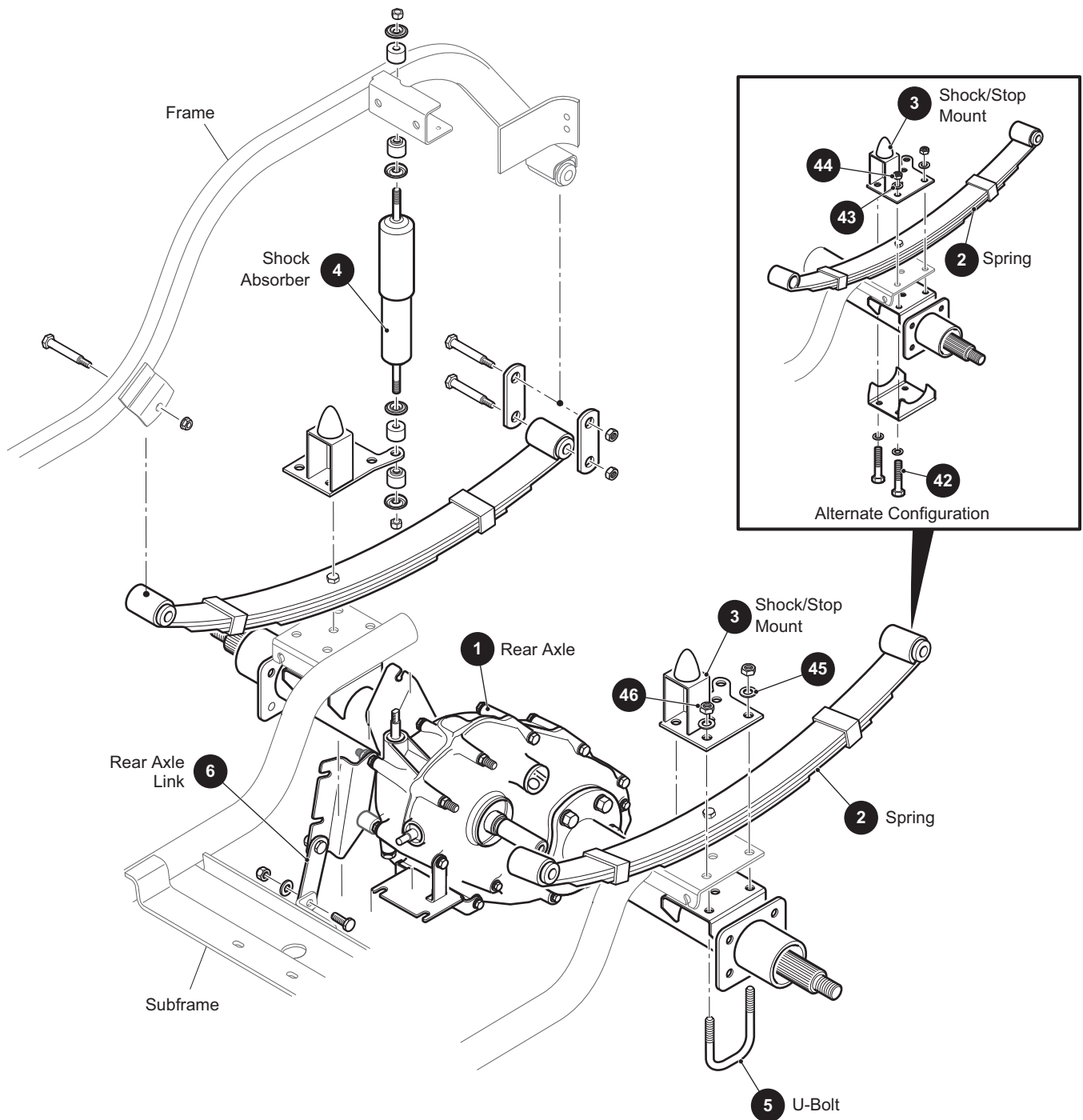


Fig. 1 Rear Axle and Suspension Components

REAR AXLE AND SUSPENSION

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

REAR AXLE

Maintenance

The rear axle (1) is provided with a lubricant level check plug located on the driver side at rear of housing. Unless leakage is evident, an annual lubricant check is sufficient.

Checking the Lubricant Level

Tool List	Qty.
Wrench, 1/2"	1
Funnel.....	1

Clean area around check plug (7) and fill plug (9).
Remove check plug (7) (Ref. Fig. 2 on page R-2).

The correct lubricant level is just below the bottom of the threaded hole. If lubricant is to be added, remove the fill plug (9) and add lubricant (SAE 30 oil) using a funnel. Add lubricant slowly until lubricant starts to seep from the check plug (7). Install the check plug (7) and the fill plug (9). In the event that the lubricant is to be replaced, a drain plug (8) is provided at the bottom of the differential housing. Capacity of axle is 48 oz. (1.4 liters).

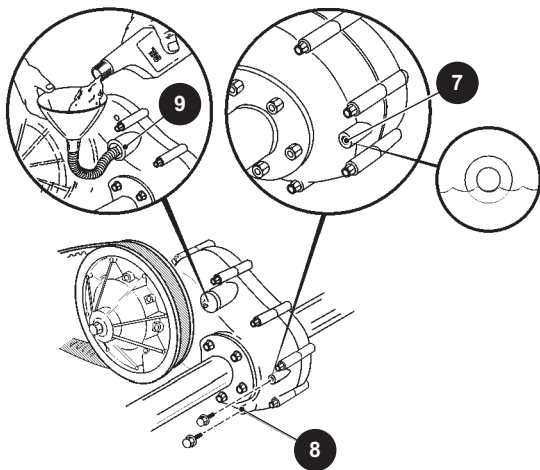


Fig. 2 Check, Add or Drain Rear Axle Lubricant

Differential Lock Cable Adjustment

Tool List	Qty.
Wrench, 1/2"	2

With lever in the unlocked position, loosen jam nuts (11 and 12) at bracket (10) (Ref. Fig. 3 on page R-2).

Tighten front jam nut (11) until arm on differential lock unit begins to pivot.

Back off front jam nut (11) one turn and hold while tightening rear jam nut (12).

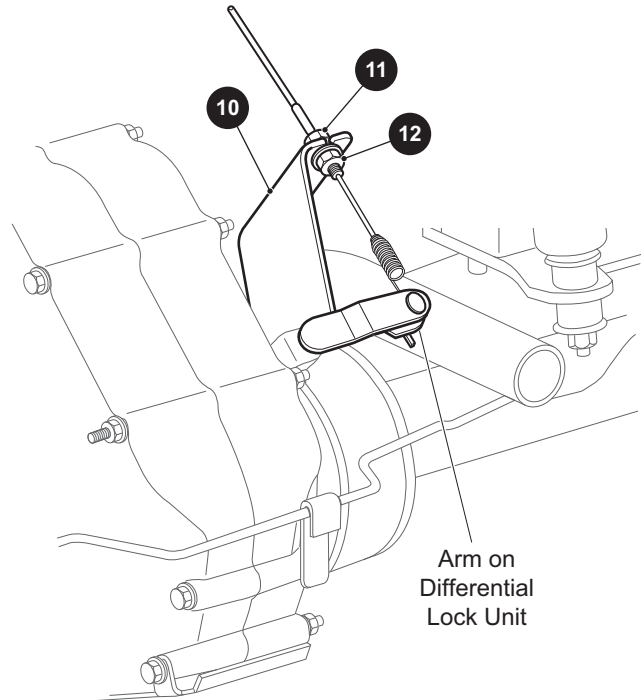


Fig. 3 Differential Lock Cable Adjustment

Rear Axle Removal

Tools List	Qty.
Lug wrench, 3/4"	1
Wheel chocks	4
Jack stands	4
Floor jack	1
Socket, 1 1/8"	1
Ratchet	1
Needle nose pliers	1
Socket, 1/4" hex bit	1
Socket, 1/2"	1
Wrench, 9/16"	1
Wrench, 1/2"	1
Straight blade screwdriver	1
Socket, 15/32"	1
Wrench, 1/4"	1
Socket, 9/16"	1
Wrench, 3/4"	1
Torque wrench ft. lbs.	1
Anti-seize compound	AR
Crowfoot wrench, 9/16"	1
Torque wrench, in. lbs.	1
Thread locking sealant	AR

REAR AXLE AND SUSPENSION

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

Remove truck bed per TRUCK BED section.

WARNING

To reduce the possibility of personal injury, follow the lifting procedure in Section B of this manual. Place wheel chocks in front and behind each wheel not being raised 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.

Loosen lug nuts at rear wheels and lift entire vehicle according to lifting procedure in SAFETY section.

Remove rear wheels and brake drums. Refer to WHEELS AND TIRES and BRAKES section.

Disconnect parking brake cables (13) by first removing cotter pins (16) and clevis pins (15) from actuating levers and then retaining rings (14) from brake cable brackets (Ref. Fig. 4 on page R-3).

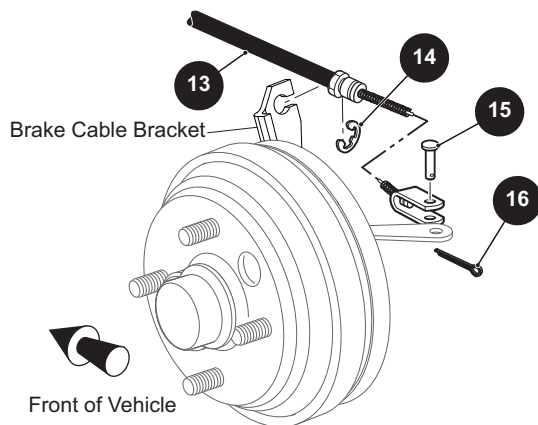


Fig. 4 Disconnect Parking Brake Cables

Disconnect hydraulic brake lines (19) at backing plates by removing banjo bolts (17) and copper gaskets (18) (Ref. Fig. 5 on page R-3). Remove the rear hydraulic brake line (19), running across rear axle (1), from clamp (20) on rear axle. Bleeding the hydraulic brakes is required after any hydraulic part is removed or replaced.

Remove muffler bracket from the axle. Refer to MUFFLER REPLACEMENT in Section K.

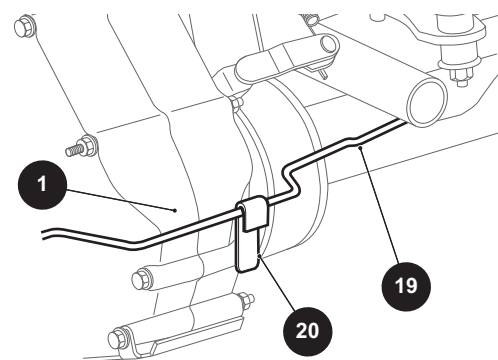
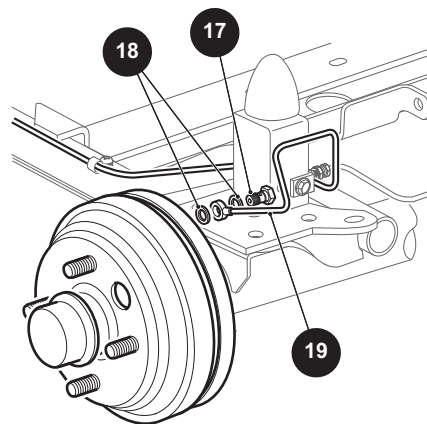


Fig. 5 Disconnect Brake Lines

Remove drive belt and secondary clutch. See CONTINUOUSLY VARIABLE TRANSMISSION section.

Remove push nut (21) securing end of accelerator cable (22) to governor (23). To maintain cable adjustment, loosen only the rear jam nut (24) anchoring accelerator cable (22) to accelerator cable bracket (25) and remove accelerator cable (22) (Ref. Fig. 6 on page R-4).

Remove governor cable (26) from ball stud on lower end of governor bellcrank (23) located between engine and differential (Ref. Fig. 6 on page R-4). Remove two nuts (27) and washers (28) mounting accelerator cable bracket (25) to differential. Loosen two setscrews (29) and pull governor bellcrank assembly (23) and accelerator cable bracket (25) from differential.

At differential, remove cotter pin (30) and clevis pin (31) connecting differential lock cable (32) to differential lock arm (Ref. Fig. 7 on page R-4). To maintain cable adjustment, loosen only the rear jam nut (12) anchoring differential lock cable (32) to bracket (10) and remove differential lock cable.

REAR AXLE AND SUSPENSION

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

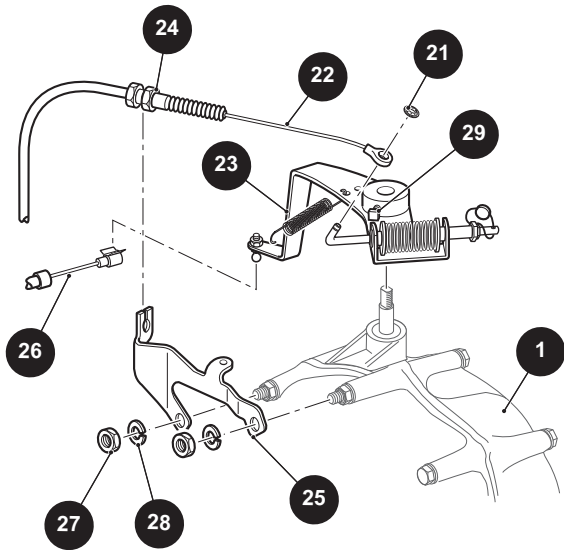


Fig. 6 Disconnect Accelerator Cable and Governor

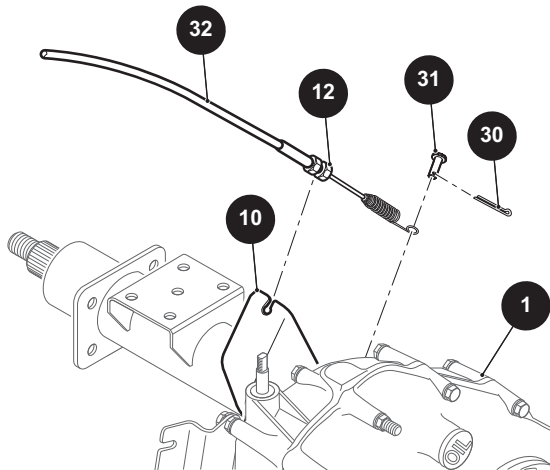


Fig. 7 Disconnect Differential Lock Cable

Remove the FNR actuator (direction selector) from the differential. Refer to DIRECTION SELECTOR section.

Remove bolt (33), washer (34) and nut (35) securing anti-rotation bracket (6) to the frame (Ref. Fig. 8 on page R-4).

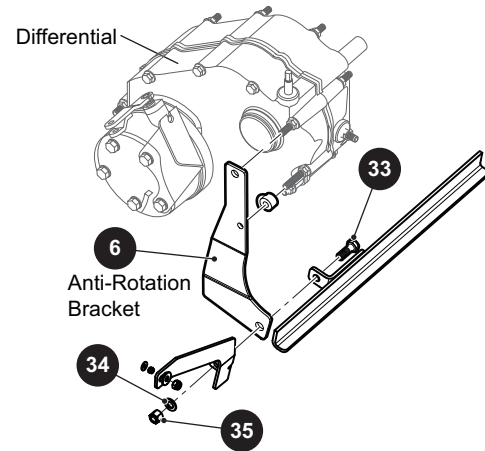


Fig. 8 Detach Differential Link

! WARNING

The differential makes the rear axle assembly top heavy and may tend to rotate when separated from springs. To reduce possibility of personal injury while removing rear axle, be sure to support differential when removing the 'U' bolts.

If no lifting device is available, a second person should hold the rear axle in the correct position until the bolts securing rear axle are removed. Both persons should remove the rear axle assembly.

Place floor jack under center section of rear axle and raise it just enough to take weight off springs. With both rear axle and frame properly supported, remove the bolts (5 or 42), washers (43 or 45) and nuts (44 or 46) mounting axle to sub frame (Ref. Fig. 9 on page R-6).

Lower rear axle and pull it out from under side of vehicle.

Rear Axle Installation

Rear axle installation is in the reverse order of disassembly. During installation, use new lock nuts and tighten the following hardware to the torque values as specified below:

Item	Torque Specification
44, 46	30 - 35 ft. lbs. (40.67 - 47.45 Nm)
29	70 - 84 in. lbs. (7.90 - 9.49 Nm)
17	11 - 15 ft. lbs. (14.91 - 20.33 Nm)
35	20 - 22 in. lbs. (2.25 - 2.50 Nm)

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

Tighten secondary clutch bolt to torque specified in CONTINUOUSLY VARIABLE TRANSMISSION section.

Install muffler bracket to the axle. Refer to MUFFLER REPLACEMENT in Section K.

Bleed brake system before installing truck bed. See BRAKES section.

REAR SUSPENSION

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 Section A.

General

Tool List	Qty.
Wheel chocks	4
Jack stands	4
Floor jack.....	1
Wrench, 9/16".....	1
Socket, 9/16"	1
Socket, 9/16", deepwell.....	1
Extension, 3"	1
Ratchet.....	1
Wrench, 3/4".....	1
Wrench, 5/8".....	1
Torque wrench, ft. lbs.	1

The rear suspension consists of the rear axle (1) and attachments that secure it to the sub frame, springs (2) and shock absorbers (4) (Ref Fig. 1 on page R-1). This section is confined to the removal and replacement of the springs (2) and shock absorbers (4).

Shock Absorber Removal

Raise the truck bed.

Raise the rear of the vehicle in accordance with the instructions provided in Section B of this manual and support the rear of the vehicle on the outer ends of the rear bumper.

Remove the bottom shock absorber nut (36), washers (37), and bushings (38) (Ref Fig. 9 on page R-6).

Compress the shock absorber (4) and remove the top shock absorber nut (39), washers (37), and bushings (38).

Remove the shock absorber (4).

Shock Absorber Installation

Shock absorber (4) installation is in the reverse order of disassembly except that the shock absorber nuts (36 and 39) must be tightened until the shock absorber bushings (38) expand to the diameter of the shock absorber washer (37).

Rear Spring Removal

WARNING

To reduce the possibility of personal injury, follow the lifting procedure in section B 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.

Remove the bottom shock absorber nut (36) (Ref Fig. 9 on page R-6).

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. With both the rear axle and the frame supported, the bolts (5 or 42) and shock/stop mount (3) can be removed.

Remove the rear spring shackle assembly and the front spring mounting hardware (40 and 41).

Remove the spring (2).

Rear Spring Installation

Spring installation is in the reverse order of disassembly.

The shock absorber nuts (36 and 39) must be tightened until the shock absorber bushings (38) expand to the diameter of the shock absorber washer (37) (Ref Fig. 9 on page R-6).

tighten the following hardware to the torque values as specified below:

Item	Torque Specification
41	18 - 23 ft. lbs. (24.40 - 31.18 Nm)
43	10 - 15 ft. lbs. (13.55 - 20.33 Nm)

REAR AXLE AND SUSPENSION

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

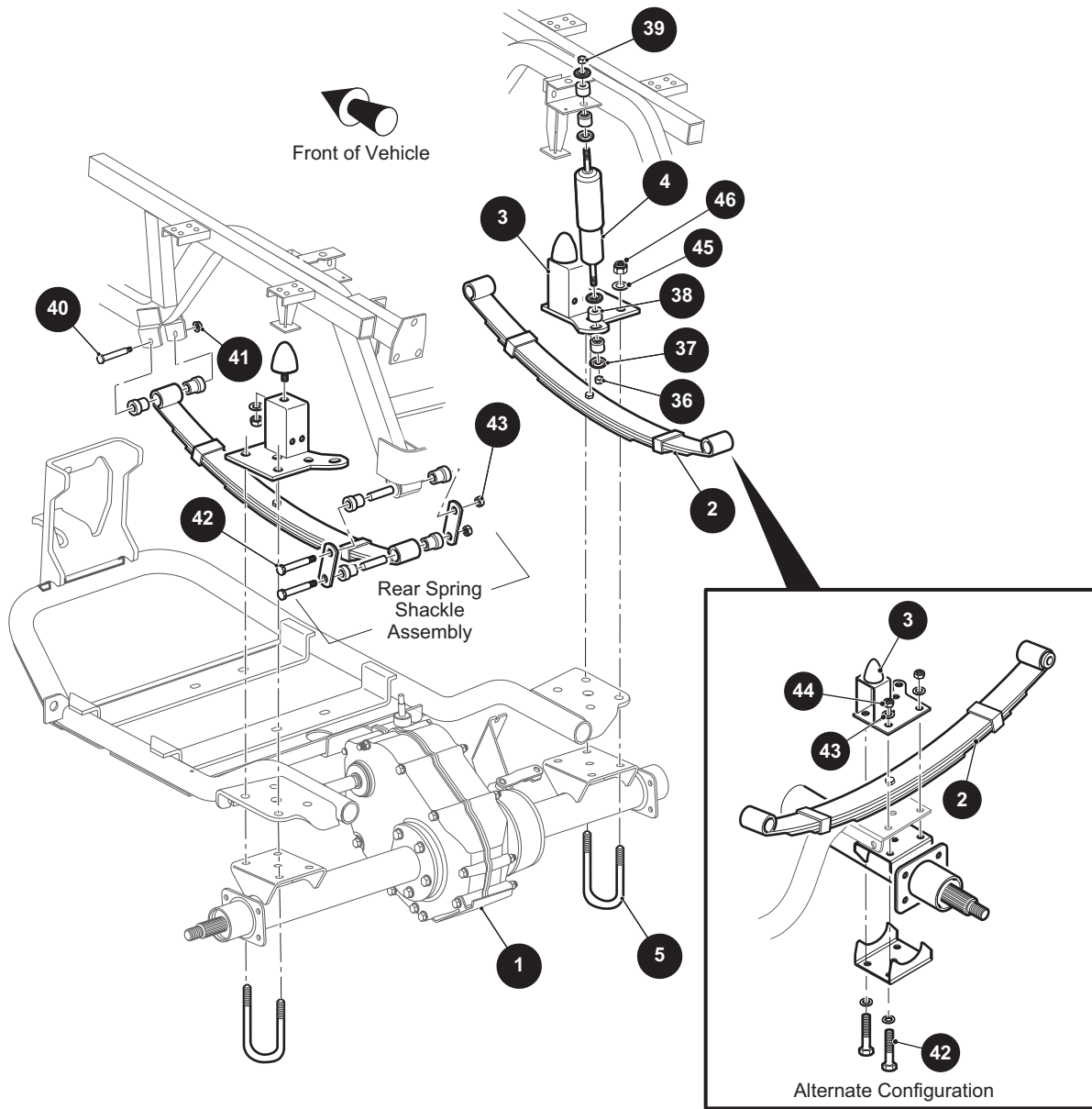


Fig. 9 Rear Suspension

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

STARTER/GENERATOR

Starter Mode

When starting the engine, the field coils are in series with the armature and the starter/generator operates as a motor. 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 Mode

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.

STARTER/GENERATOR BELT TENSION

Tool List	Qty.
Belt tension gauge.....	1
Wrench, 3/4".....	1
Wrench, 1/2".....	2
Ratchet.....	1
Socket, 3/4".....	1
Socket, 1/2".....	1
Pry bar.....	1

The starter/generator belt tension should be checked after the first 15 - 20 hours of operation and set to 75 - 80 lbs (34 - 36 kg).

WARNING

At no time during installation of belt, should the belt tension exceed 160 lbs (73 kg).

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 110 - 130 lbs. (50 - 59 kg) tension when a gauge is applied half way between the two pulleys (Ref. Fig. 1 on page S-1).

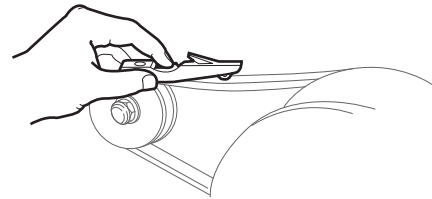


Fig. 1 Checking Belt Tension with Gauge

Although not as accurate, the belt may be depressed with a finger. A maximum deflection of 3/8" (1 cm) is acceptable for a new belt (Ref. Fig. 2 on page S-1).

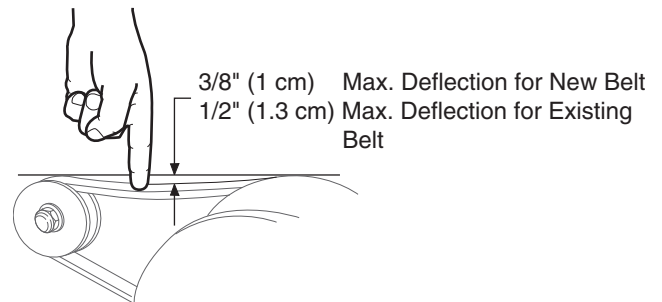


Fig. 2 Checking Belt Tension with Finger

Re-tighten an existing belt to 75-80 lbs. (34-36 kg) tension using the same technique. A maximum deflection of 1/2" (1.3 cm) is acceptable.

STARTER GENERATOR

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

Adjusting Belt Tension

Loosen front and back pivot bolts (3) of starter/generator (Ref. on page S-2).

Loosen adjusting bolt (2). Use pry bar to force starter/generator towards front of vehicle until proper belt tension is achieved. Hold starter/generator in place and tighten adjusting bolt (2).

Tighten pivot bolts (3) to 25 ft. lbs. (35 Nm) torque.

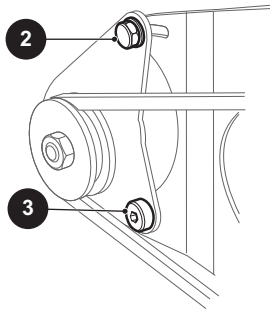


Fig. 3 Adjusting the Belt Tension

STARTER GENERATOR REPLACEMENT

Starter/Generator Removal

Tool List	Qty.
Insulated wrench, 1/2"	1
Socket, 25/64"	1
Socket, 1/2"	1
Socket, 1/4" hex bit.....	1
Socket, 3/4"	1
Ratchet	1
Torque wrench, in. lbs.....	1
Pry bar	1
Belt tension gauge.....	1
Torque wrench, ft. lbs.	1

⚠ WARNING

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

Disconnect negative (-) cables from battery to prevent electrical shorts that could cause an explosion (Ref. Fig. 4 on page S-2).

Disconnect wires from starter/generator (1) (Ref. Fig. 5 on page S-3). Loosen adjusting bolt (2) and pivot bolts (3) securing starter/generator (1) and remove starter/

generator belt (4). Remove adjusting bolt (2) and pivot bolts (3) and remove starter/generator from vehicle.

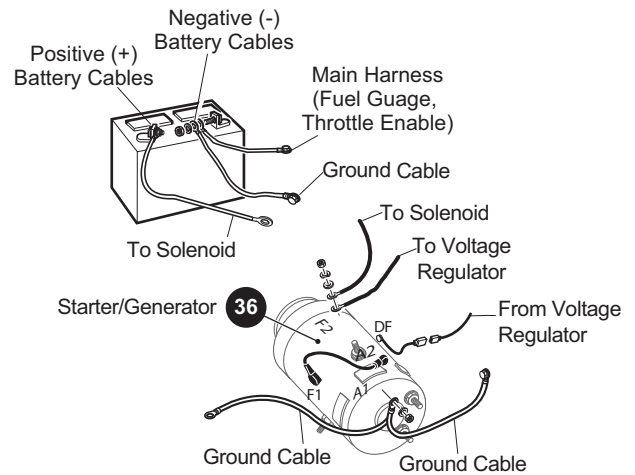


Fig. 4 Disconnect Starter and Ground Cables

Starter/Generator Installation

Align starter/generator between mounting brackets on engine and loosely install pivot hardware. Attach wires to their original locations (Ref. Fig. 6 on page S-3).

Tighten terminal nuts to the following torques:

- A1, A2, F1, F2 - torque to 43 - 52 in. lbs. (50 - 60 kg/cm)
- DF - torque to 26 - 35 in. lbs. (30 - 40 kg/cm)

Install belt (4) and adjusting hardware. Adjust belt tension. See "Starter/Generator Disassembly" on page S-3.

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

Reconnect negative (-) battery cables and tighten hardware to 60 in. lbs. (7 Nm).

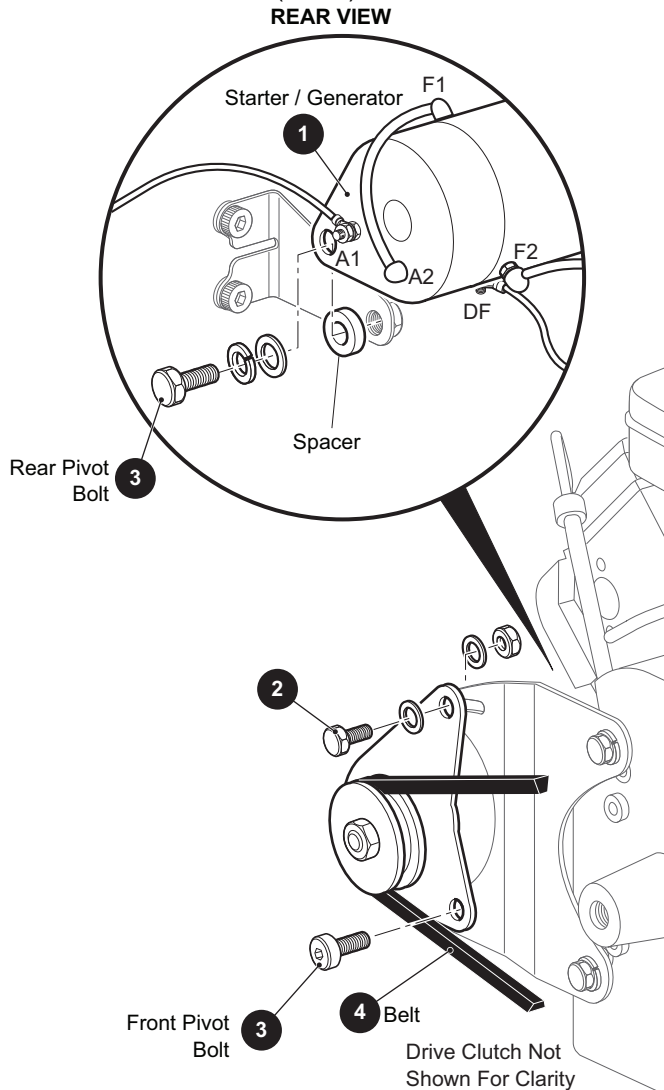


Fig. 5 Starter/Generator Mounting

FROM	TO
A1	Ground
A2	F1 (On Starter/Generator)
F1	A2 (On Starter/Generator)
F2	A on Solenoid
DF	Green from Voltage Regulator

Fig. 6 Starter/Generator Wiring

Starter/Generator Disassembly

Tool List

	Qty.
DVOM.....	1
Wrench, 15/16"	1
Wrench, 3/8"	1
Wrench, 1/4"	1
Wrench, 3/16"	1
Socket, 3/8"	1
Phillips screwdriver	1
Two jaw puller	1
Straight blade screwdriver	1
Ratchet	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 (5) and remove the pulley nut (6). Remove the pulley (5), screws (8) and front cover (3) (Ref. Fig. 7 on page S-4).

Remove the brush covers (9) 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. 9 on page S-5). Remove the through bolts (10) and the rear cover (11). Remove the frame (7) and field coils (12). 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 on page S-5).

Starter/Generator Inspection

1. Inspect the commutator for wear or damage (Ref. Fig. 9 on page S-5).
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.

STARTER GENERATOR

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

Testing of Starter/Generator

Tool List

DVOM..... 1

Place the negative probe of the DVOM on the chassis ground and positive probe on the F2 terminal of the starter generator and attempt to start the vehicle in gas mode:

- (a) If voltage is observed on the DVOM and the starter/generator still does not start, then inspect or replace the starter/generator.
- (b) If voltage is not observed on the DVOM, then inspect starting solenoid and other wiring connections. Refer to TROUBLESHOOTING section for the procedure to test a solenoid.

(Ref. Fig. 6 on page S-3) for starter/generator wiring.

Starter/Generator Repair

Tool List

DVOM..... 1

Torque wrench, ft. lbs. 1

Torque wrench, in. lbs..... 1

Clean cloth..... 1

Socket, 5 mm..... 1

Socket, 6 mm..... 1

Socket, 10 mm..... 1

Socket, 24 mm..... 1

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. Clean all parts to be reinstalled and reassemble in the reverse order of disassembly. Tighten bolts and nuts to the following values:

- 5 mm - torque to 15 - 21 in. lbs. (17 - 24 kg cm)
- 6 mm - torque to 30 - 43 in. lbs. (35 - 50 kg cm)
- 10 mm - torque to 52 - 74 in. lbs. (60 - 85 kg cm)
- 24 mm - torque to 33 - 40 ft. lbs. (45 - 54 Nm)

Tighten terminal nuts to the following torques:

- DF - torque to 26 - 35 in. lbs. (30 - 40 kg cm)
- F1 - F2 - torque to 43 - 52 in. lbs. (50 - 60 kg cm)

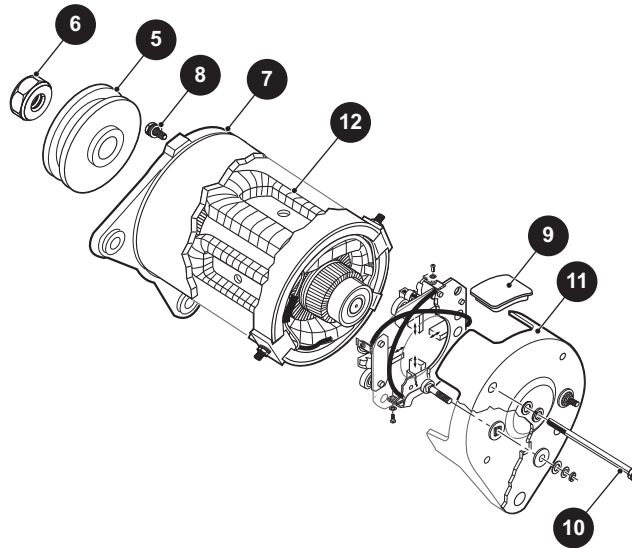


Fig. 7 Starter / Generator

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

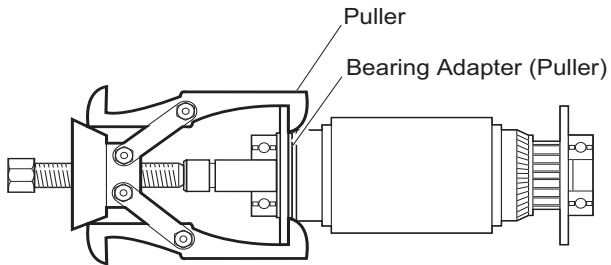


Fig. 8 Bearing Removal

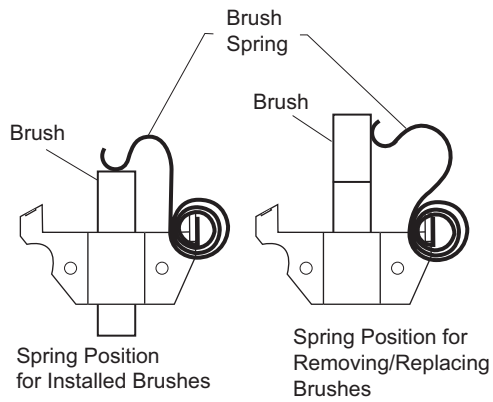


Fig. 9 Starter/Generator Brush Removal

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

GAS POWERTRAIN TROUBLESHOOTING

Engine Troubleshooting

For engine troubleshooting, diagnostic and repair procedures, refer to Briggs & Stratton® Repair Manual (P/N 627655) for Vanguard™ V-Twin Overhead Valve Engine.

Gas Powertrain Performance

Condition	Possible Cause	Correction
STARTER DOES NOT TURN	Weak or bad battery	Recharge or replace as necessary
	Terminals are loose or corroded	Clean and retighten
	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 micro switch	Check and adjust if no 'click' is heard. Replace if adjustment does not work
	Starter/generator terminals are loose or corroded	Tighten or clean
	Leads are broken or faulty ground	Check for breaks at bend or joint. Replace or repair leads
	Field coils are open	Repair or replace
	Armature coil is open	Repair or replace

Fig. 1 Gas Powertrain Performance Troubleshooting

TROUBLESHOOTING

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

Condition	Possible Cause	Correction
STARTER TURNS SLOWLY	Terminals are loose or corroded	Retighten 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 leads or repair connections
	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 VEHICLE 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 protectorate 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 plugs. Broken or disconnected spark plug wiring	Check and replace if required
	Spark plugs fouled	Clean or replace
	Incorrect spark plug gap/type	Set gap correctly
	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
	Main jet blocked	Clean or replace jet
	Throttle lever motion restricted	Check all linkages and repair
	Dirt or water in fuel line or carburetor	Clean lines and carburetor. Replace filter
	Clogged fuel filter	Check and replace if required
	Engine flooded	Push choke in. Clean/or replace spark plugs
	Engine fuel starved	Use choke and push in as soon as engine runs smoothly
	Air intake tube is blocked	Repair or clean
	Clogged air filter	Wash or replace as required
Plugged muffler or pipe	Repair or replace	

Fig. 1 Gas Powertrain Performance Troubleshooting

Read all of Section B 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
	Choke on	Push choke in
	Fuel pump faulty	Repair or replace
	Insufficient fuel level	Add fuel
	Spark plug fouled	Clean or replace
POOR MIDRANGE OR HIGH SPEED PERFORMANCE	Spark plug fouled	Clean or replace
	Dirty air filter	Clean or replace
	Brake(s) dragging	Perform brake maintenance
	Governor mis-adjusted	Adjust
ENGINE OVERHEATING	Foreign matter in cylinder fins and blower housing	Clean
	Damaged blower housing or fins	Repair or replace
	Damaged or plugged muffler	Repair or replace
	Inadequate oil supply	Check oil system, inspect oil pump, change oil, fill to correct level
REPEATED SPARK PLUG FOULING	Wrong spark plug type	Replace with correct spark plug
	Wrong spark plug gap	Check and adjust if required
	Faulty ignition system	Check and repair if required
	Poor quality gasoline	Use correct fuel, check bulk storage tank for proper storage and handling
	Air leak allowing dirt to enter system	Repair
	Choke sticking closed	Repair
	Wrong main jet for conditions (high altitude operations)	Replace with correct altitude jet for conditions
CARBURETOR FLOODS ENGINE	Inlet valve/seat dirty	Clean or replace
	Fuel contamination	Clean fuel system/carburetor
	Incorrect float level	Adjust
	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
	Piston rings worn or broken	Replace
	Valves worn	Replace
	Valve seals or valve guides worn	Replace

Fig. 1 Gas Powertrain Performance Troubleshooting

TROUBLESHOOTING

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

Condition	Possible Cause	Correction
BACKFIRING	Accelerator limit switch out of adjustment	Adjust
	Loose muffler or leaking gasket	Repair
	Carburetor throttle lever motion restricted	Repair
	Carburetor throttle lever not closing fully	Adjust
	Throttle stop preventing throttle from closing fully	Adjust
	Carburetor throttle valve spring weak or broken	Replace
	Incorrect adjustment of accelerator, governor and carburetor linkages	Adjust
	Carburetor throttle lever shaft bent	Replace or rebuild carburetor
	Governor torsion spring weak or broken	Replace
	Faulty plug wires	Replace
	Faulty ignition system	Check and repair if required
ERRATIC, SURGING, OR SUDDEN CHANGE IN GOVERNED SPEED	Governor bracket spring dragging	Clean and/or oil
	Problem with adjustment of accelerator, governor and carburetor linkage	Adjust
	Bent governor arm	Repair or replace
	Bent governor shaft	Replace
	Governor failure within the rear axle	Repair

Fig. 1 Gas Powertrain Performance Troubleshooting

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

Starter/Generator Troubleshooting

Condition	Possible Cause	Correction
STARTER IS NOISY	Bolts are loose	Tighten to correct torque
	Starter/generator has foreign matter inside	Clean starter/generator interior
	Bearings are faulty	Replace
	Bearings contain foreign matter	Replace
	Bearing needs grease	Replace
BATTERY HAS TO BE RECHARGED REGULARLY	Load (i.e. number of accessories operating at one time) exceeds generator output	Reduce load to meet generator output
	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
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
	Field coil is shorted or broken	Repair or replace

Fig. 2 Starter/Generator Troubleshooting

TROUBLESHOOTING

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

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
STIFF STEERING	Water has entered steering box and may freeze in cold conditions	Remove steering column, pinion and bearing and remove water before adding grease; Inspect gasket for good seal
	Excessive grease in steering box has migrated into steering rack bellows	Raise the vehicle and observe the rack bellows while moving the steering from lock to lock Any distortion of the bellows may indicate that an excess of grease has built up in the bellows Remove the bellows and remove excess grease
	Insufficient lubricant in king pins, tie rod ends, idler bushing, rack tensioner or steering box	Add one shot of lubricant to each grease fitting and operate steering from lock to lock. Do not over grease If steering does not return to acceptable condition proceed to next step
	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
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

Fig. 3 Suspension And Steering Troubleshooting

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

CURTIS CONTROLLER

General

The Curtis handheld Programmer is used for programming, testing, troubleshooting, tuning, diagnosing and parameter adjustments for speed controller and auxiliary devices (Ref. Fig. 4 on page T-7).



Fig. 4 Curtis Handheld Programmer

⚠ WARNING

Plug the Curtis handheld programmer into Curtis programmer port only. If plugged into the wrong port, voltage from other interface circuits may result in permanent damage to the programmer.



Fig. 5 Curtis Programmer Port

Insert the Molex plug into the receptacle on the face of the controller. The status light will flash if a fault is detected (Ref. Fig. 5 on page T-7).

Navigation



A blinking square on the left edge indicates the position of the cursor and the blinking square moves up or down when up or down navigation key is pressed. Press the right arrow on the navigation key to display a column of sub-menus and

again press down the right arrow for more than one level of sub-menus to be displayed. Press the left arrow once or more on the navigation key to display the main menu.

Changing Data Value



Press the Data Increase or Data Decrease key to change the value of the parameter.

Bookmark



To set a position in the Menu, hold a Bookmark Key down for four seconds, until the Bookmark set screen is displayed. To jump to a selected Bookmark position, press the appropriate Bookmark Key.

Main Menu Definitions

- PROGRAM - Shows vehicle profile setting and adjust-ability.
- MONITOR - Shows vehicle real-time diagnostics.
- FAULTS - Shows active and past faults.
- FUNCTIONS - Shows parameter setting uploads and downloads.
- INFORMATION - Shows controller information
- PROGRAMMER SETUP - Shows handheld informa-tion and adjustment.

TROUBLESHOOTING

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

Menu	Submenu 1	Submenu 2	Data Range	Default Value	Units	Hand Held Access	
Program	M1 - ACC Rate		.1 - 5.0	0.5	Seconds	Dealer	
	M2 - ACC Rate		.1 - 5.0	1.5			
	M3 - ACC Rate		.1 - 5.0	1.5			
	M4 - ACC Rate		.1 - 5.0	1.5			
	Decel Rate						
				.1 - 5.0	0.5		Seconds
	M1 - Brake Rate		.1 - 5.0	1.3	Seconds		
	M1 - Brake Rate		.1 - 5.0	1			
	M1 - Brake Rate		.1 - 5.0	1			
M1 - Brake Rate		.1 - 5.0	1				
Monitor	Throttle		-100-100	-	%	Dealer	
	Arm Current		0-400	-	A		
	Field Current		0-50	-	A		
	Field PWM		0-100	-	%		
	Batt Voltage		0-48	-	V		
	Cap Voltage		0-48	-	V		
	Heat Sink Temp			-	C		
	Fwd Input		ON/OFF	-	-		
	Rev Input		ON/OFF	-	-		
	Mode			1	-		
	Interlock		ON/OFF	-	-		
	Pedal Input		ON/OFF	-	-		
	EMR Rev Input		ON/OFF				
	Motor RPM			-	RPM		
	Main Contactor		ON/OFF	-			
	Aux Contactor		ON/OFF	-			
	Rev Output		ON/OFF	-			
	Brake Output		ON/OFF	-			
	Fault 1 Output		ON/OFF	-			
	Fault 2 Output		ON/OFF	-			
	Control State			0-13	-		
	Spare 1		ON/OFF	-			
Modsel 1 (Mode Select)		ON/OFF	-				
Modsel 2 (Mode Select)		ON/OFF	-				
Spare Analog				1020			

Fig. 6 CURTIS Hand Held Controller Main/Sub Menus

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

Faults	System Faults		Display active faults.			Dealer
	Fault History		Display past faults.			
	Clear fault History		Clear past faults.			
Functions	Settings	Get Settings From Controller	OK/ABORT	-	-	
		Write Settings to Controller	OK/ABORT	-	-	
		Reset All Settings	YES/NO	-	-	
Controller Information	Model Number	-	Display the controller model number			
	Hardware Version		Display the controller hardware version			
	Protocol Version	-	Display the controller protocol version.			
	Serial Number	-	Display the controller serial number.			
	Mfg Date Code	-	Display controller date of manufacture			
	Hand Held Version	-	Display controller parameter block version			
	OS Version	-	Display the controller operating system			
	Build Number	-	Display the controller OS build number			
	Supervisor Version	-	Display the controller supervisor version			
	Supervisor Build Number	-	Display the controller supervisor build			
Programmer Setup	Program	LCD Contrast	-150 - 150	0	-	
		Language	English	English	-	
		Set Security Code	Display security code creation.			
	Faults	Fault History	Display fault history of the handheld.			
		Clear Fault History	YES/NO	-	-	
	Information	OEM Info	Display OEM information.			
		Reconfigured	Display reconfigure status.			
		Model Number	Display handheld model number.			
		Serial Number	Display handheld serial number.			
		Manufacture Date	Display handheld manufacture date.			
		Software Version	Display handheld software version.			
		Hardware Version	Display handheld hardware version.			
		MC - Protocol Ver.	Display MC-Protocol version.			
		ES - Protocol Ver.	Display ES-Protocol version.			
	S - Protocol Ver.	Display S-Protocol version.				
Device Type	Display device type.					

Fig. 6 CURTIS Hand Held Controller Main/Sub Menus

TROUBLESHOOTING

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

Fault Code Chart

LED Code	1311 Display	Explanation	Controller Response	Possible Cause
1,2	HW Fail safe 1-2-3	Self test or watch dog fault	Vehicle Disabled	1. Replace the controller.
1,3	M- Shorted	M- shorted to B-	Vehicle Disabled	1. Check motor for shorted condition. 2. Check motor wire short to frame. 3. Check M- to B- wire short together. 4. Replace the controller.
	Field Open	Field winding fault	Vehicle Disabled	1. Check motor field wire connection. 2. Check for broken wire. 3. continuity test the motor to find cause.
	Arm Sensor	Armature current sensor fault	Vehicle Disabled	1. Check motor for shorted condition. 2. Check motor wire short to frame. 3. Replace the controller.
	FLD Sensor	Field current sensor fault	Vehicle Disabled	1. Check motor for shorted condition. 2. Check motor wire short to frame. 3. Replace the controller.
2,1	Throttle Fault 1	Throttle signal out of range	Vehicle Disabled	1. Throttle sensor input wire open. 2. Throttle input wire shorted to B+ or B-. 3. Throttle sensor defective.
	Throttle Fault 2	Throttle low signal out of range	Vehicle Disabled	1. Throttle sensor input wire open. 2. Throttle input wire shorted to B+ or B-. 3. Throttle sensor defective.
2,2	SRO	Static Return to Off fault	Vehicle Disabled	1. Improper sequence of KSI, interlock, and direction selector. 2. Interlock or direction switch circuit open. 3. Sequencing delay too short.
2,3	HPD	High Pedal Disable Sequence Fault	Vehicle Disabled	1. Throttle sensor cycled out of range during start up. 2. Accelerator pedal stuck out of range. 3. Check pedal travel and % range on hand held.
3,1	Contact DRVR OC	Contact coil has been shorted	Vehicle Disabled	1. Check solenoid wiring for shorts. 2. Check for voltage drop to solenoid primary circuit. 3. Bench test the solenoid.

Fig. 7 Fault Code Chart

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

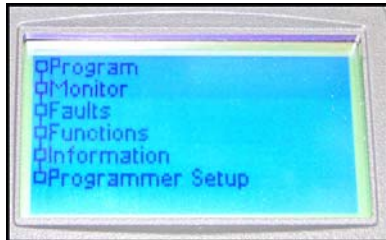
3,2	Main Contact Welded	Main contactor welded	Reduced performance	<ol style="list-style-type: none"> 1. Main contactor (solenoid) is stuck closed. 2. Check for short in contactor primary circuit. 3. Check for miswired contactor.
3,3	Precharge Fault	Internal controller voltage is too low at start up.	Vehicle Disabled	<ol style="list-style-type: none"> 1. Check for controller wiring errors. 2. Check for shorted controller wiring on B+ and B-. 3. Replace the controller.
3,4	Missing Contactor	Contactors not detected in the circuit	Vehicle Disabled	<ol style="list-style-type: none"> 1. Check contactor primary circuit wiring. 2. Check for open contactor coil. 3. Replace the contactor.
	Main Contact DNC	Contactors did not close	Vehicle Disabled	<ol style="list-style-type: none"> 1. Check for bad contactor wire connection. 2. Check for bad harness. 3. Bench test the contactor. 4. Replace the contactor.
4,1	Low Battery Voltage	Battery voltage too low to operate.	Reduced performance	<ol style="list-style-type: none"> 1. Check battery pack voltage. 2. Check contactor secondary circuit voltage. 3. Check controller wiring for proper voltage.
4,2	Overvoltage	Voltage too high promoting controller shut down.	Vehicle Disabled	<ol style="list-style-type: none"> 1. Verify battery pack voltage. 2. Verify battery charger voltage. 3. Verify wire disconnect while regen braking.
4,3	Thermal Cutback	Controller over heats	Reduced performance	<ol style="list-style-type: none"> 1. Verify heat sink temperature is >85° C. 2. Reduce mechanical loading. 3. Check controller mounting & debris. 4. Verify excessive slow speed operation.

Fig. 7 Fault Code Chart

TROUBLESHOOTING

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

Curtis Handheld Diagnostic Tool Function

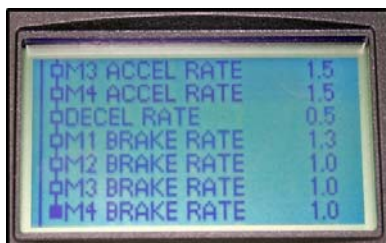


The first screen observed will be the menu options list.



The M1 acceleration rate is the only one used on the Ambush. The 0.5 value represents the time required to go from 0% output to 100% output.

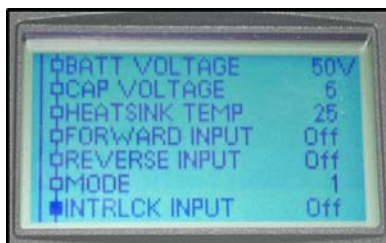
Decel Rate is the time required for the controller to respond to a decrease in applied throttle.



The M1 Brake rate is the only one used on the Ambush. The 1.3 value represents the time required to go from 0% regen current to 100% regen current when regen braking is requested.



The Monitor selection shows controller inputs and outputs. It is helpful to operate the vehicle and verify the values. For Monitor values (Ref. Fig. 3 on page T-9) to determine the operational state.



Battery voltage shows the energy at the key switch input.

CAP voltage shows energy at the controller B+.

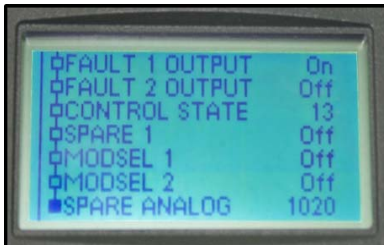
Always test the vehicle on a full charge.

Fig. 8 Hand Held Tool Function

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



EMR REV Input, AUX Cont, and Brake Output are not used on the Ambush.

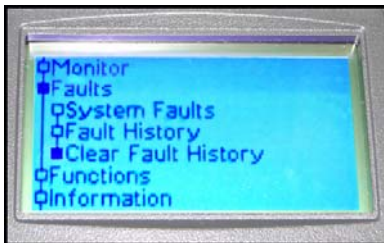


The only two values used on this screen is Fault 1 Output and Control State. Control State indicates the condition of the controller at the time of testing.



Faults is the next menu selection that can be viewed. If a fault is detected at the time of testing, it will be viewed under system faults. See pages (Ref. Fig. 5 on page T-11) for a list of faults.

Fault history shows faults encountered by the controller in the past. It will list in run time hours when the fault occurred.



It is a good practice to clear the fault history after the vehicle has been repaired.



The functions menu selection allows the retrieval of program settings. Writing settings to a controller lets the technician move program settings from one controller to another.



The technician has the option to reset original program settings as long as the hand held is not disconnected from the controller.

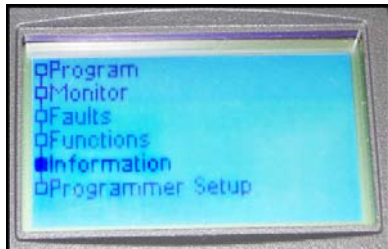
Fig. 8 Hand Held Tool Function

TROUBLESHOOTING

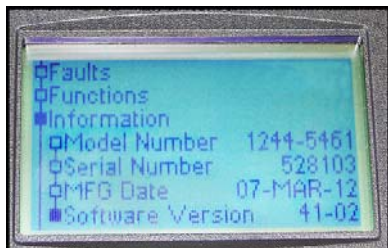
Read all of Section B and this section before attempting any procedure. Pay particular attention to Notices, Cautions, Warnings and Dangers.



The technician will be prompted whenever setting changes are made.



The information menu selection gives general information about the speed controller.



Controller information will be required for trouble – shooting, warranty, and any software updates.



Programmer setup allows the technician to change back lighting, establish a password, and retrieve programmer faults.

Fig. 8 Hand Held Tool Function

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

ELECTRICAL TROUBLESHOOTING

Powertrain Controller Diagnostic Faults

The power-train controller on this vehicle has a self diagnostic feature. The LED lights will flash a code if a

fault is detected. The first number of the code will be flashed by the key switch LED. The second number of the code will be flashed by the mode switch after a short pause (Ref. Fig. 9 on page T-15).



Fig. 9 Instrument Panel - Fault Codes

LED Code	Description	Possible Cause
1 – 2	Invalid Direction Switch Input	The power train controller will flash this fault when it receives conflicting signals from the key switch. Check the key switch circuit.
1 – 3	Invalid Mode Switch Input	The power train controller will flash this fault when it receives conflicting signals from the mode switch. Check the mode switch circuit.
1 – 4	Actuator Feedback out of range (High)	Check the potentiometer on the actuator for damage or water intrusion at the connector that may cause it to short out. With the actuator unplugged and using an ohmmeter, the 10k potentiometer should be read across the yellow and black pins. Then measure yellow to red, and black to red. Those two values should equal the 10k that was measured across the yellow and black. If the potentiometer cannot be read then the actuator needs to be replaced.
2 – 1	Actuator Feedback out of range (Low)	
2 – 2	Actuator Extend Failed	If Extend and Retract failure are the faults being shown; the actuator should be inspected. Make sure the FNR lever and all of the assembly are not binding anywhere. If there is no binding and the actuator is not trying to move at all; then check the 3 Amp fuse in the 48V line going into pin 12 of the power train control box.
2 – 3	Actuator Retract Failed	
2 – 4	High Pedal Disable	This fault indicates the vehicle was started with the pedal being pressed. The key needs to be cycled with the pedal up. If the pedal is not pressed and the HPD fault is still shown; check the throttle switch and it's connections.

TROUBLESHOOTING

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

COMPONENT TESTING

Voltmeter

WARNING

Before performing any test of wiring components, disconnect the battery cables from the battery posts to prevent electrical shock or explosion (Refer to Safety section).

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 27481-G01). The actual model may vary depending on availability. The DVOM (digital volt ohm meter) as shown in Fig. 10, page T-16 is representative only. Any DVOM may be used, however the controls, displays 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 meter. For the purpose of this section, the red probe as (+) and black probe as (-) are used. 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 (∞).



Fig. 10 Digital Voltmeter

Fuses - Testing

Check all the fuses to make sure that components are properly powered (Ref. Fig. 11 on page T-16).

If the fuse appears to be blown, replace the fuse.



Fig. 11 Fuses

NOTICE

To perform any test on the components located on the control panel, Control Panel has to be removed to gain access to the individual component circuit terminals. Refer to BODY section for control panel removal and replacement.

Key Switch - Testing

Turn the key to the forward position. Place positive meter probe on the A pin of the switch, and place the negative meter probe on the C pin. Full continuity should be observed on the multi-meter (Ref. Fig. 13 on page T-17).

With the key turned in opposite direction, place the negative meter probe on the D pin of the switch. Meter should read full continuity.

If continuity can be read on all three pins in the same key direction (Forward), then replace the switch.

NOTICE

This test can also be performed using the hand held tool and scrolling down to the direction functions in the Monitor Menu.

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

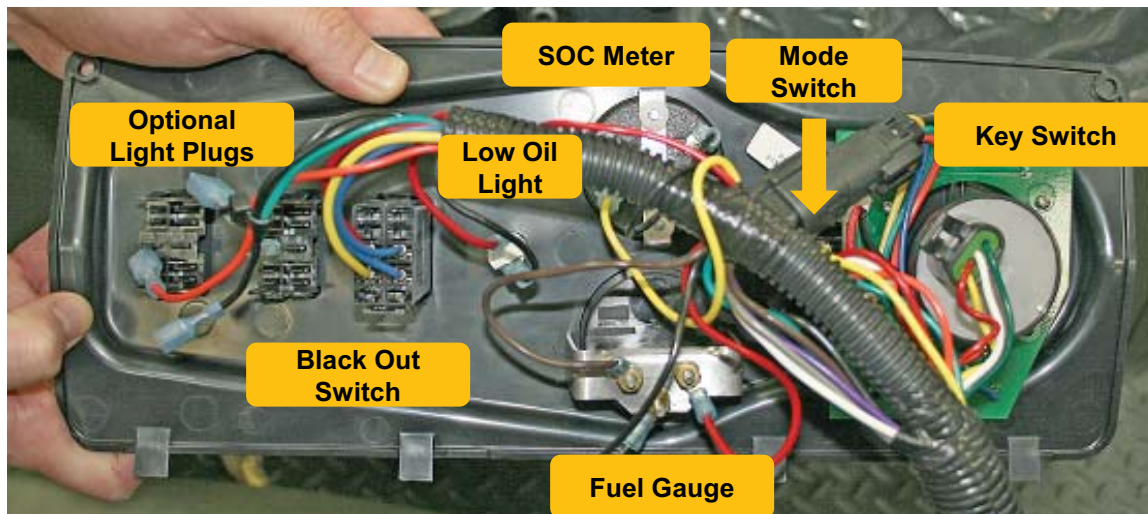


Fig. 12 Control Panel Back

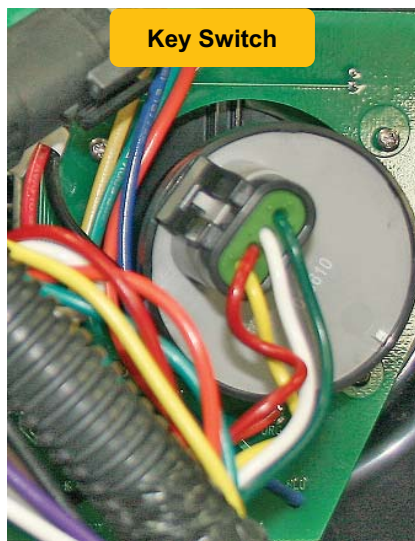


Fig. 13 Key Switch

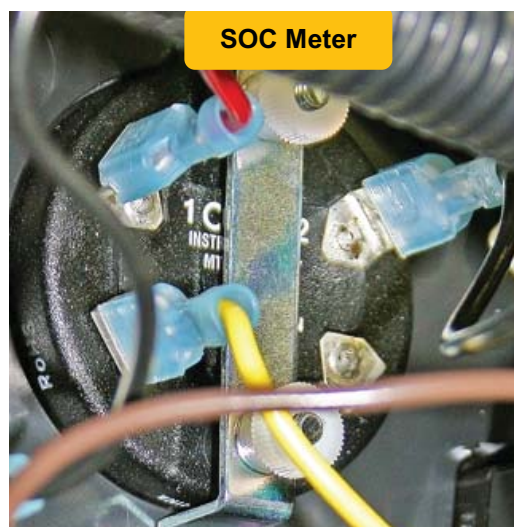


Fig. 14 SOC Meter

State Of Charge (SOC) Meter - Testing

Place the positive meter probe on the red terminal and place the negative probe of DVOM on the black terminal of the SOC meter (Ref. Fig. 14 on page T-17). Battery voltage should be observed. If not; check the batteries and harness.

The yellow wire is a 0 – 5V circuit that will range with state of charge.

Fuel Gauge - Testing

Place the positive meter probe on the red wire terminal of fuel gauge and place the black meter probe of DVOM on the black meter terminal (Ref. Fig. 15 on page T-18). 12V should be observed. If not, check starting battery voltage or harness connection.

The brown wire is a 0 – 5V circuit that will range with the float in the fuel tank.

TROUBLESHOOTING

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

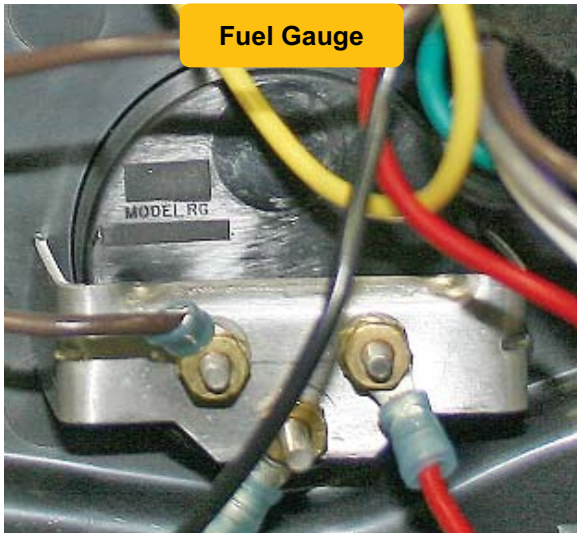


Fig. 15 Fuel Gauge

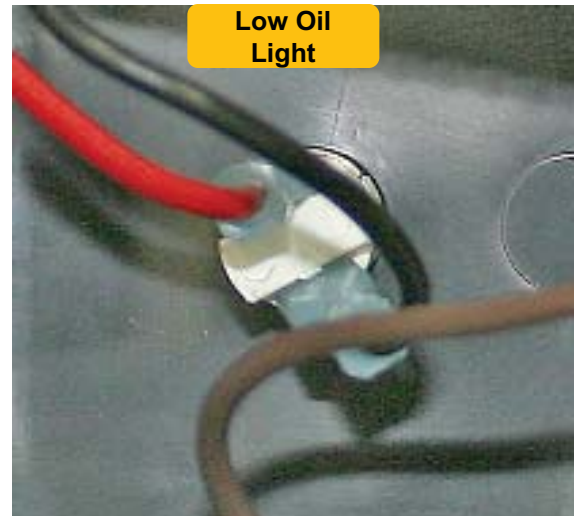


Fig. 16 Low Oil Indicator

Low Oil Indicator (Light) - Testing

Turn the key to gas mode, place the positive meter probe on the red wire terminal of the low oil indicator and place the negative meter probe of the DVOM on a chassis ground (Ref. Fig. 16 on page T-18). 12V should be observed. If not; check battery voltage and harness connections.

The black wire connects to the sending unit. A ground is provided by the sender if the oil pressure is low.

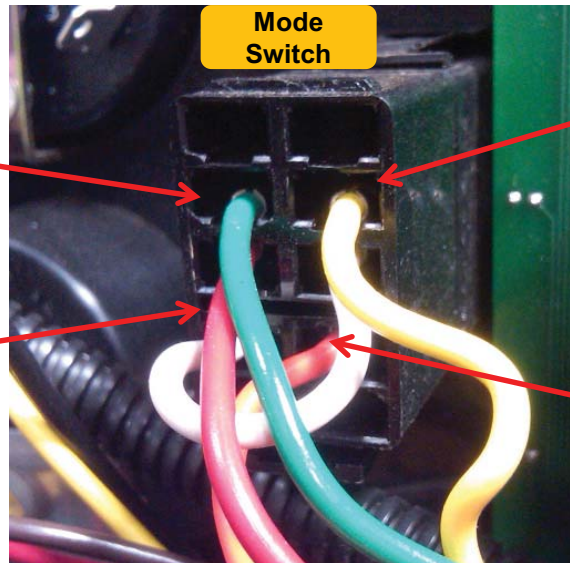
Powertrain Control Switch - Testing

Figure 17 on page T-18 gives the various voltages to be verified on the different terminals on the powertrain control switch.

Place the negative volt meter Probe on B- of the controller of the negative 48V battery terminal and use the positive meter probe to check the voltages by switching circuits.

Green wire connection should have 48V with the key in the on position and in gas mode.

Red wire connection should have 48V with the key in the on position.



Yellow wire connection should have 48V with the key in the on position and in 4WD mode.

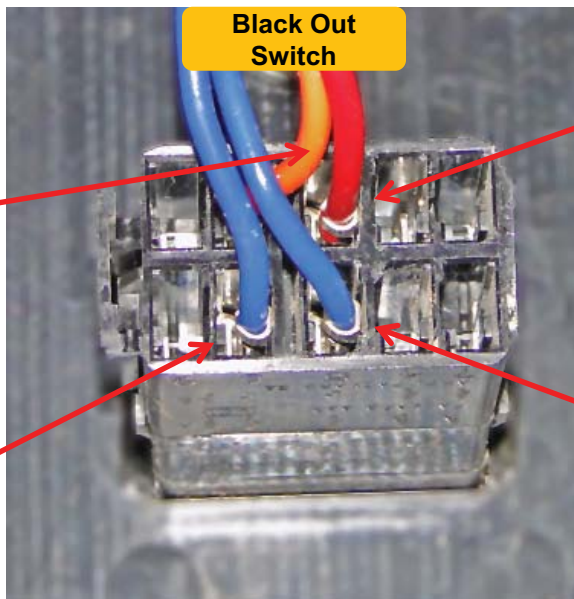
Brown wire connection should have 48V with the key in the on position and in electric mode.

Fig. 17 Power Train Control Switch

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

Orange wire connection should have 48V with the key in the on position and the black out switch in the off and on positions. This terminal will show 0V in the off and blackout position. This terminal will show 12V in the on position.

Blue wire connection should have 0V with the key in the on position and the black out switch in the off and blackout positions.



Red wire connection should have 48V with the key in the on position and the black out switch in all positions.

Blue wire connection should have 12V with the key in the on position and the black out switch in off and on positions. This terminal will show 0V in the blackout position.

Fig. 18 Blackout Switch

Black Out Switch - Testing

Figure 18 on page T-19 gives the various voltages to be verified on the different terminals on the blackout switch.

Place the negative volt meter probe on B- of the controller of the negative 48V battery terminal and use the positive meter probe to check the voltages by switching circuits.

Electronic Speed Controller's Solenoid - Testing

Electronic speed controller's solenoid has to be checked for energy as follows:

(Ref. Fig. 19 on page T-20)

1. Turn the key to electric or 4WD mode and depress the accelerator pedal

Place the positive meter probe on the red wire primary circuit terminal and place the negative meter probe of the DVOM on the black wire primary circuit terminal. 48V should be observed on the meter

NOTICE

This test can also be performed through the hand held device. Check the Monitor Menu for the solenoid driver circuit. If it reads "Main contactor ON" then check wiring and connections to the solenoid. If it reads "Main contactor OFF", then check all controller inputs.

2. Place the negative meter probe on controller B- or the negative 48V battery terminal and place the positive probe on the secondary circuit battery side terminal. 48V should be observed. If not; check battery voltage and wiring.
3. Turn the key to electric or 4WD mode and depress the accelerator pedal.

Place the positive meter probe on the secondary circuit controller side terminal. 48V should be observed with the vehicle in gear, the mode switch in Electric or 4WD and the accelerator depressed. If not; check all controller inputs then replace the contactor. If 48V is observed without closing the input switches; replace the solenoid as it is welded.

TROUBLESHOOTING

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

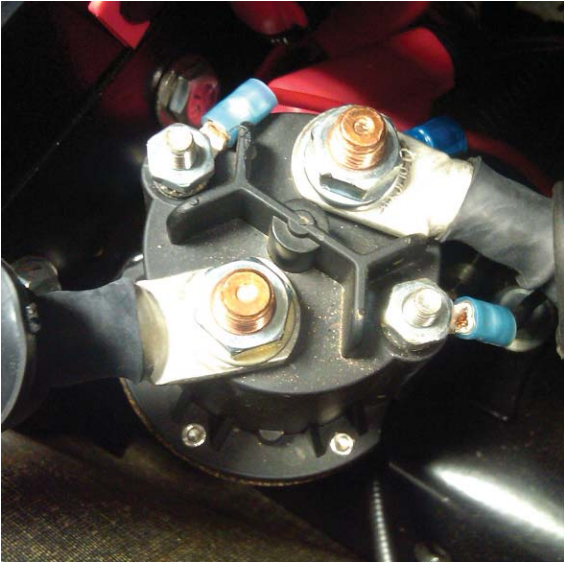


Fig. 19 Solenoid

NOTICE

The solenoid testing can also be performed using the hand held tool and scrolling down to the Monitor Menu. Check inputs and outputs for change in status. Also check for contactor related faults in the faults menu.

Electronic Speed Sensor - Testing

NOTICE

Check the motor speed sensor while the connector is plugged in.

(Ref. Fig. 20 on page T-20).

Turn the key to electric or 4WD mode.

Place the positive meter probe in the red wire terminal connection and the negative meter probe of DVOM in the black wire connection. 5V should be observed. If not; check the wiring and the signal from the powertrain controller. If the wiring and signal from the powertrain are good then, replace the speed sensor.

Place the negative meter probe in the black wire terminal connection and the positive meter probe of DVOM in the green wire terminal connection. 0 – 5V flash signal should be observed, when the motor armature is rotated slowly. If not, check the sensor magnet in the motor then replace the speed sensor.



Fig. 20 Speed Sensor and Converter Plug

DC To DC Converter Plug Testing

The DC to DC converter plug should be checked periodically for dirt and debris (Ref. Fig. 21 on page T-20). Voltage can be verified at the accessory light harness for correct operation.



Fig. 21 DC - DC Converter Plug

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

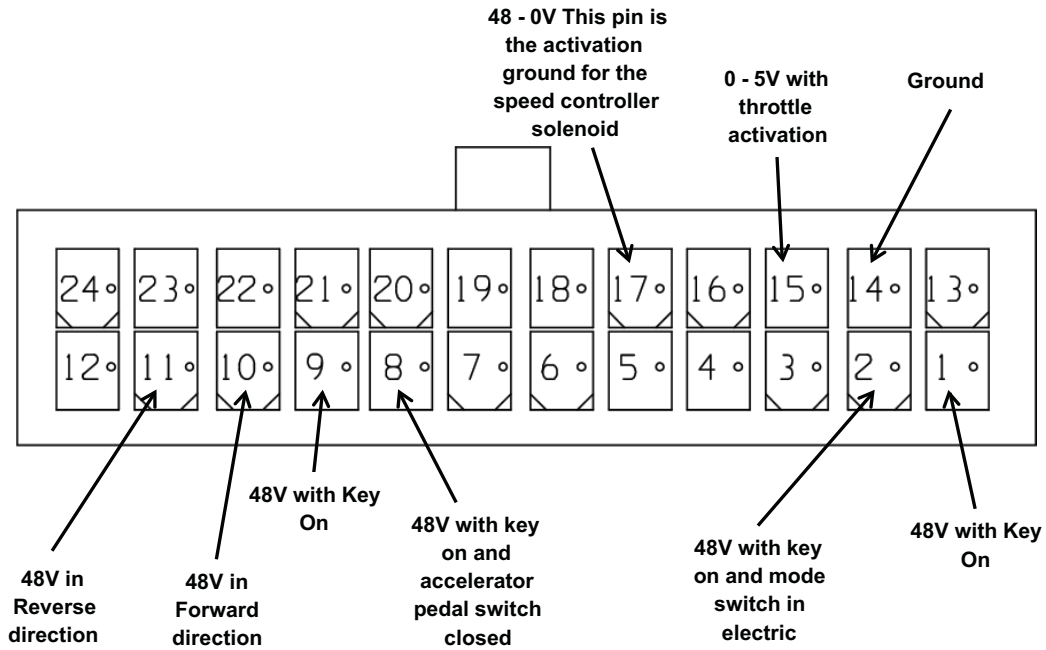


Fig. 22 Speed Controller Pin Connector

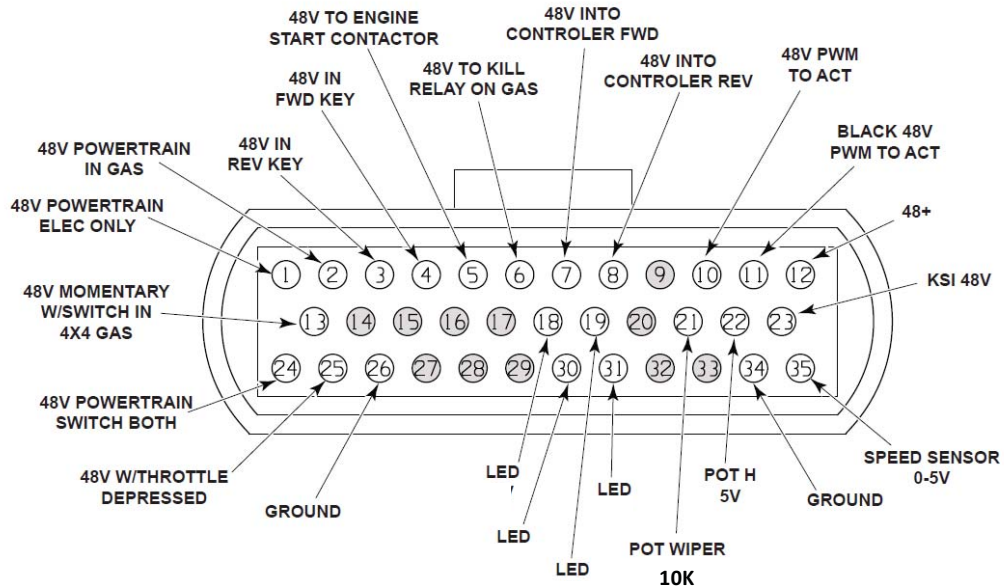


Fig. 23 Powertrain Controller Pin Connector

TROUBLESHOOTING

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

Electronic Speed Controller Pin Connectors - Testing

Figure 22 on page T-21 gives the various pin voltages to be verified on the different pins of Electronic Speed Controller.

Place the negative volt meter probe on the negative 48V battery terminal and use the positive volt meter probe to verify the voltages as given in Figure 22 on page T-21. Activate the switch in the circuit to allow current to energize the pin

Powertrain Controller Pin Connectors - Testing

Figure 23 on page T-21 gives the various pin voltages to be verified on the different pins of Powertrain Controller.

Place the negative volt meter probe on the negative 48V battery terminal and use the positive volt meter probe to verify the voltages as given in as listed in Figure 23 on page T-21.

Activate the switch in the circuit to allow current to energize the pin.

Motor - Testing

Disconnect all the wires from the motor terminals A1, A2, F1, and F2 posts (Ref. Fig. 24 on page T-22).

1. Test for continuity from the A1 to the A2 posts, if not found motor is bad.
2. If continuity exists from terminal A1 to A2, check for the absence of continuity between A1 to the aluminum end cap of the motor.
3. Then check for absence of continuity from the A2 post to the aluminum end cap of the motor.
4. Ensure that there is no continuity between the A and F terminals.



Fig. 24 Motor

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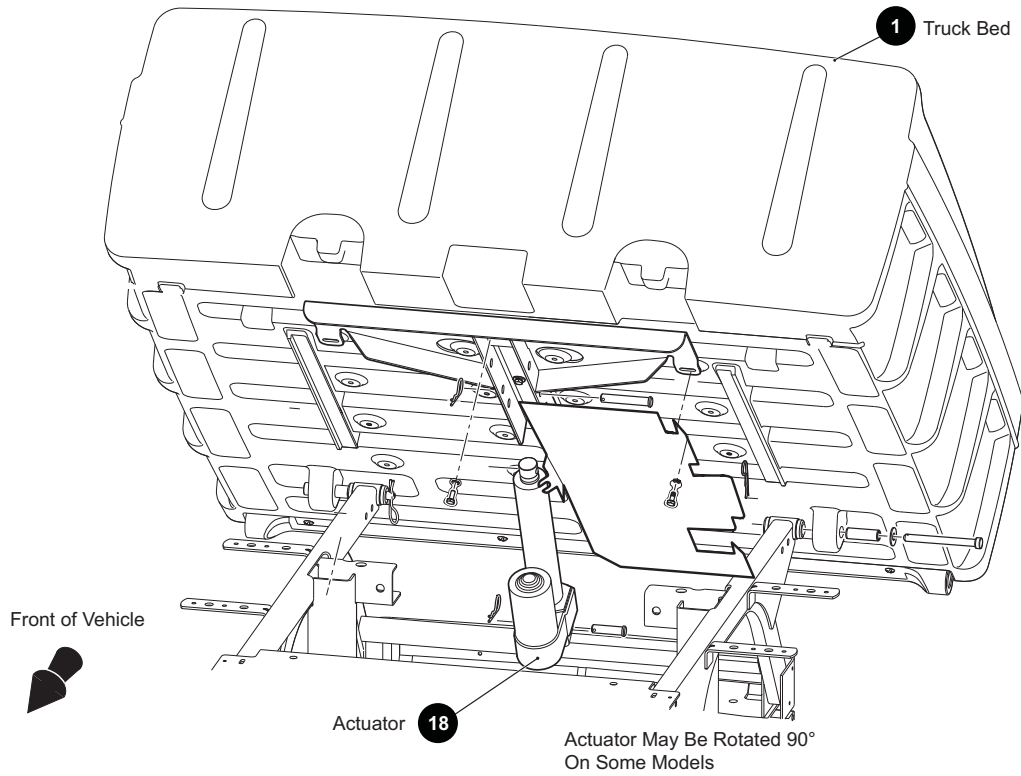
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Fig. 3 Truck Bed Replacement (Manual Lift)	U-3
Fig. 4 Truck Bed Replacement (Electric Lift)	U-4

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

Rotomold Truck Bed - Electric Lift



Rotomold Truck Bed - Manual Lift

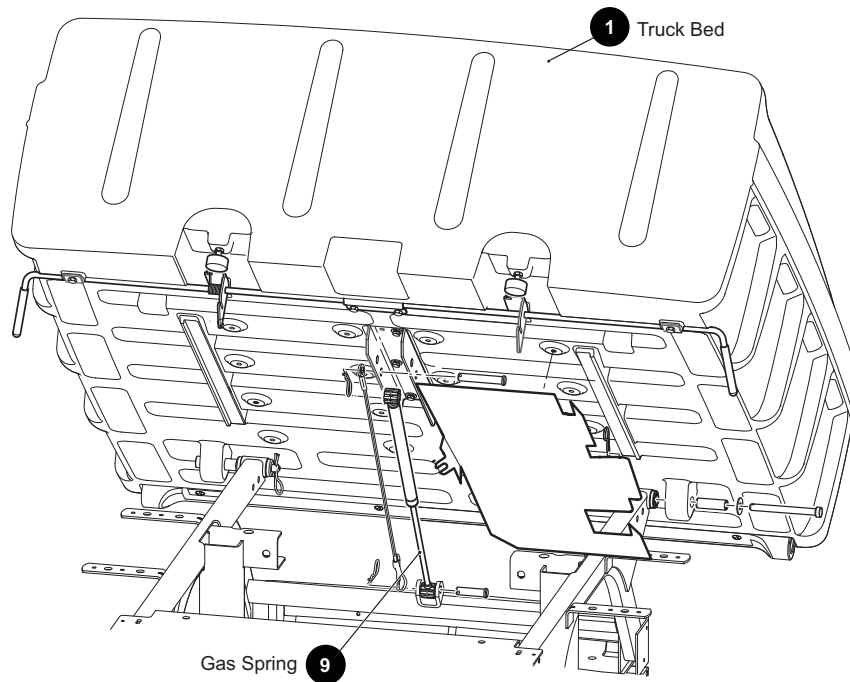
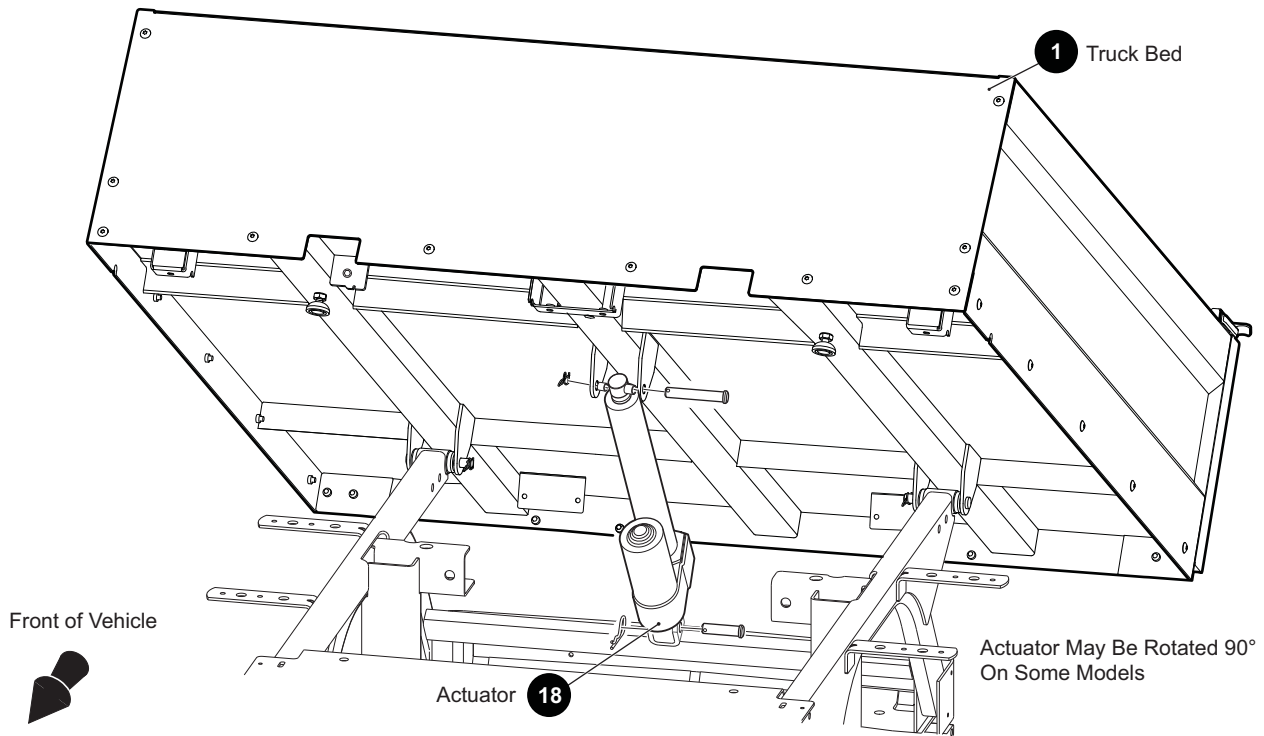


Fig. 1 Rotomold Truck Bed - Components

TRUCK BED

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

Aluminum Truck Bed - Electric Lift



Aluminum Truck Bed - Manual Lift

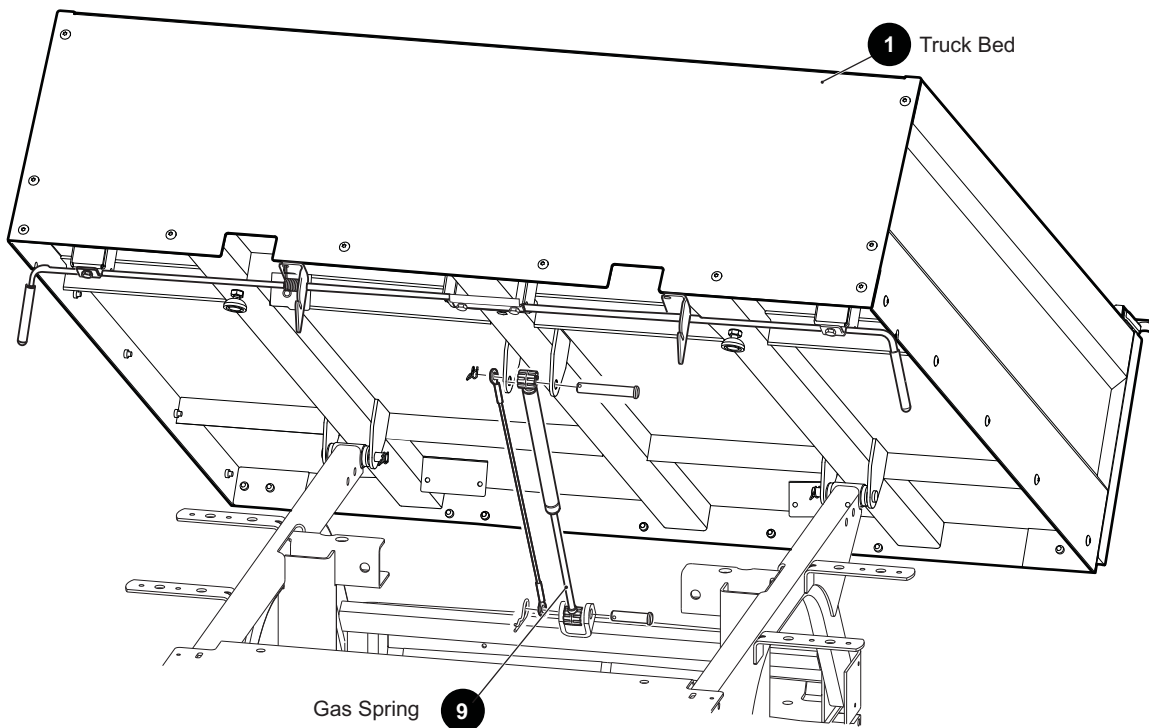


Fig. 2 Aluminum Truck Bed - Components

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

TRUCK BED REPLACEMENT (MANUAL LIFT)

Tool List	Qty.
Back brace	2
Needle nose pliers.....	1

WARNING

The truck bed is heavy and awkward to handle. To prevent possible personal injury, it is strongly recommended that an assistant or adequate lifting device be used to remove truck bed from vehicle.

Release the latch and raise the truck bed by lifting. With a person on each side of bed, remove cotter pin (12) and clevis pin (11) that connect the gas spring (9) and bed tether cable (10) to truck bed (1) and swing the gas spring (9) and bed tether cable (10) down to rest on rear axle (Ref. Fig. 3 on page U-3).

NOTICE

If removing bed to replace engine, remove the gas spring (9) for additional clearance.
 Lower the truck bed.
 Remove cotter pins (8) and clevis pins (4) from the truck bed (1). Retain the flat washers (5) and bushings (6,7) for reuse.
 Remove bed from vehicle.
 Install truck bed in reverse order of disassembly.

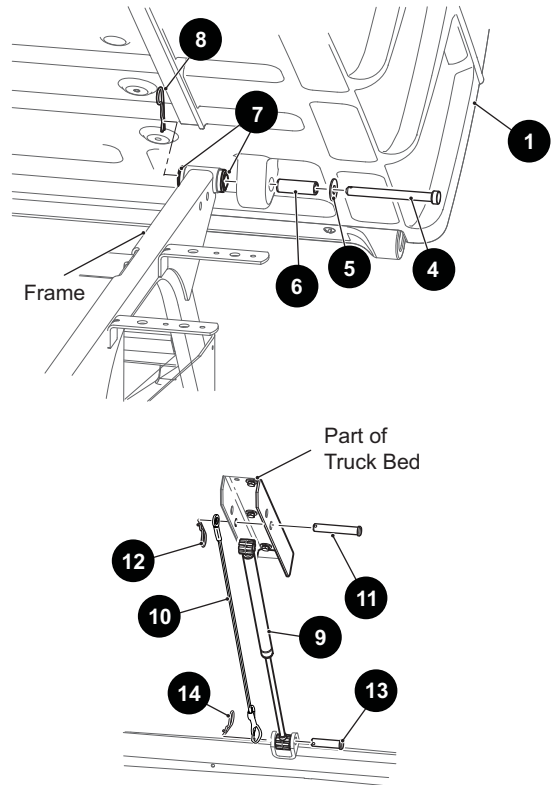


Fig. 3 Truck Bed Replacement (Manual Lift)

TRUCK BED

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

TRUCK BED REPLACEMENT (ELECTRIC LIFT)

Tool List	Qty.
Back brace.....	2
Needle nose pliers.....	1

WARNING

The truck bed is heavy and awkward to handle. To prevent possible personal injury, it is strongly recommended that an assistant or adequate lifting device be used to remove truck bed from vehicle.

Raise bed using electric lift toggle switch.

With a person on each side of bed, remove cotter pin (16), spacers (17) and clevis pin (15) that connect electric lift actuator (18) to truck bed (1) and swing actuator down to rest on rear axle.

NOTICE

If removing bed to replace engine, remove electric lift actuator (18) for additional clearance. Unplug main harness lead and pull out cotter pin (19) and clevis pin (20) connecting actuator to frame.

Lower the bed.

Remove cotter pins (8) and clevis pins (4) from bed located under tailgate (Ref. Fig. 4 on page U-4).

Remove bed from vehicle.

Install truck bed in reverse order of disassembly.

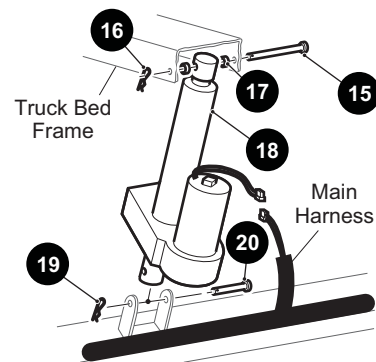
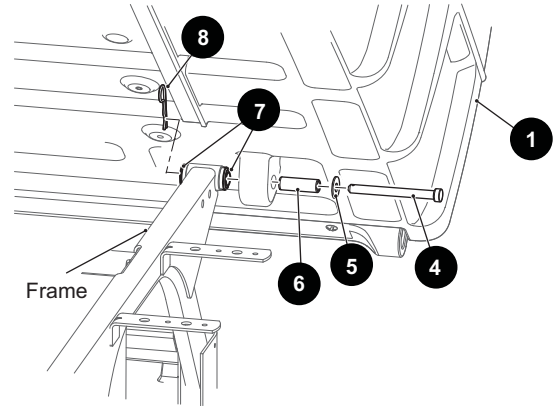


Fig. 4 Truck Bed Replacement (Electric Lift)

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Fig. 2 Split Windshield	V-3
Fig. 3 Full Windshield	V-4

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

GENERAL

WARNING

The canopy top does not provide protection from roll over or falling objects.

The windshield does not provide protection from tree limbs or flying objects.

The canopy top and windshield are designed for weather protection only.

Clean with lots of water and a clean cloth. Minor scratches may be removed using a commercial plastic polish or Plexus plastic cleaner available from the service parts department.

Trailer

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.

Remove windshield before trailering.

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

If the vehicle is to be transported on a trailer at highway speeds, the windshield and canopy top must be removed and the seat bottoms 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.

CANOPY TOP

Canopy Top Removal

Tool List	Qty.
-----------	------

Phillips screwdriver	1
----------------------------	---

Remove screws (2) and washers (3) from the clamps (4) to free the canopy top (1) from the upper OPS (Ref. Fig. 1 on page V-1).

Installation of the canopy top (1) is in the reverse order of removal.

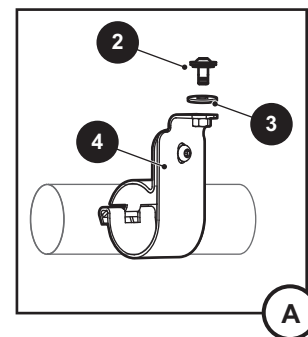
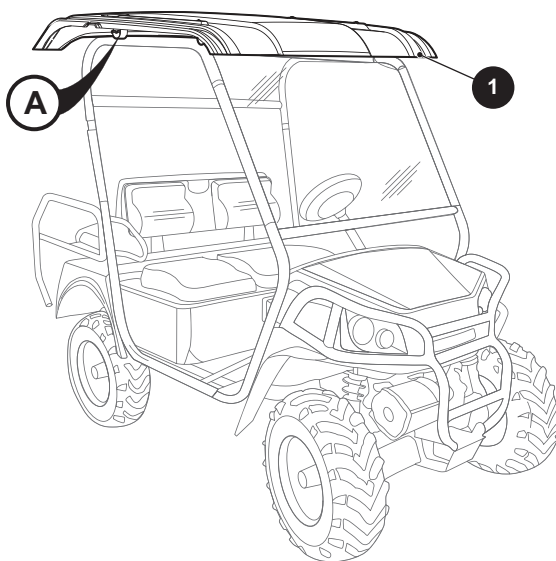


Fig. 1 Canopy Top

WEATHER PROTECTION

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

SPLIT WINDSHIELD

Split Windshield Removal

Tool List	Qty.
Socket, 7/16"	1
Socket, 3/8"	1
Socket, 9/16"	1
Socket, 1/2"	1
Ratchet	1
Wrench, 7/16"	1
Wrench, 3/8"	1
Wrench, 9/16"	1
Wrench, 1/2"	1
Phillips screwdriver	1

Remove the canopy top. See "Canopy Top Removal" on page S-1.

Remove the bolts (7), washers (8), windshield grommets (9) and nut (10) from the clamp (6) (Ref. Fig. 2 on page V-3).

Remove the textile straps (19) holding the windshield to the upper OPS.

Pull to remove the velcro attachment of the textile skirt place holder (11) which will now free the split windshield assembly (5) completely from the vehicle.

NOTICE

If the bottom of the split windshield is bolted to the Upper OPS frame then perform the following additional procedure to remove the split windshield.

Remove the bolt (20), bumper (21), crush sleeve (22), gromet (23), washer (24) and nut (25) (Ref. Fig. 2 on page V-3)



CAUTION

Take care not to warp windshield when raising and lowering the top section of windshield.



CAUTION

During installation do not over-tighten or squeeze windshield grommets (9).

Installation of the split windshield assembly (5) is in reverse order to removal.

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

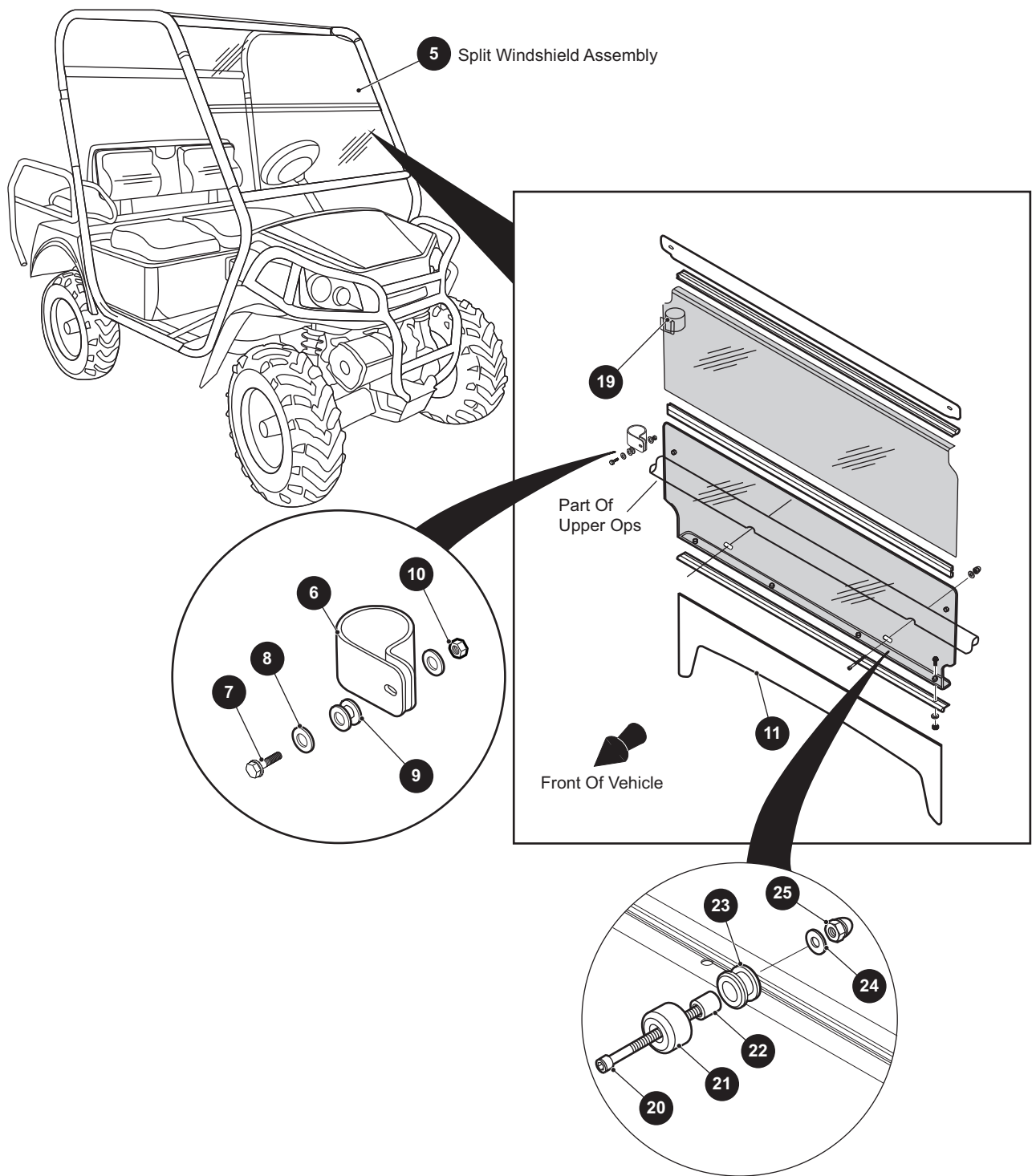


Fig. 2 Split Windshield

WEATHER PROTECTION

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

FULL WINDSHIELD

Full Windshield Removal

Remove the canopy top. See “Canopy Top Removal” on page S-1.

Remove the bolts (14), washers (15), windshield grommet (16) and nut (17) from the clamp (13) (Ref. Fig. 3 on page V-4).

Pull to remove the velcro attachment of the textile skirt-place holder (18) which will now free the full windshield assembly (12) completely from the vehicle.



CAUTION

During installation do not over-tighten or squeeze windshield grommets (16).

Installation of the full windshield assembly (12) is in reverse order to removal.

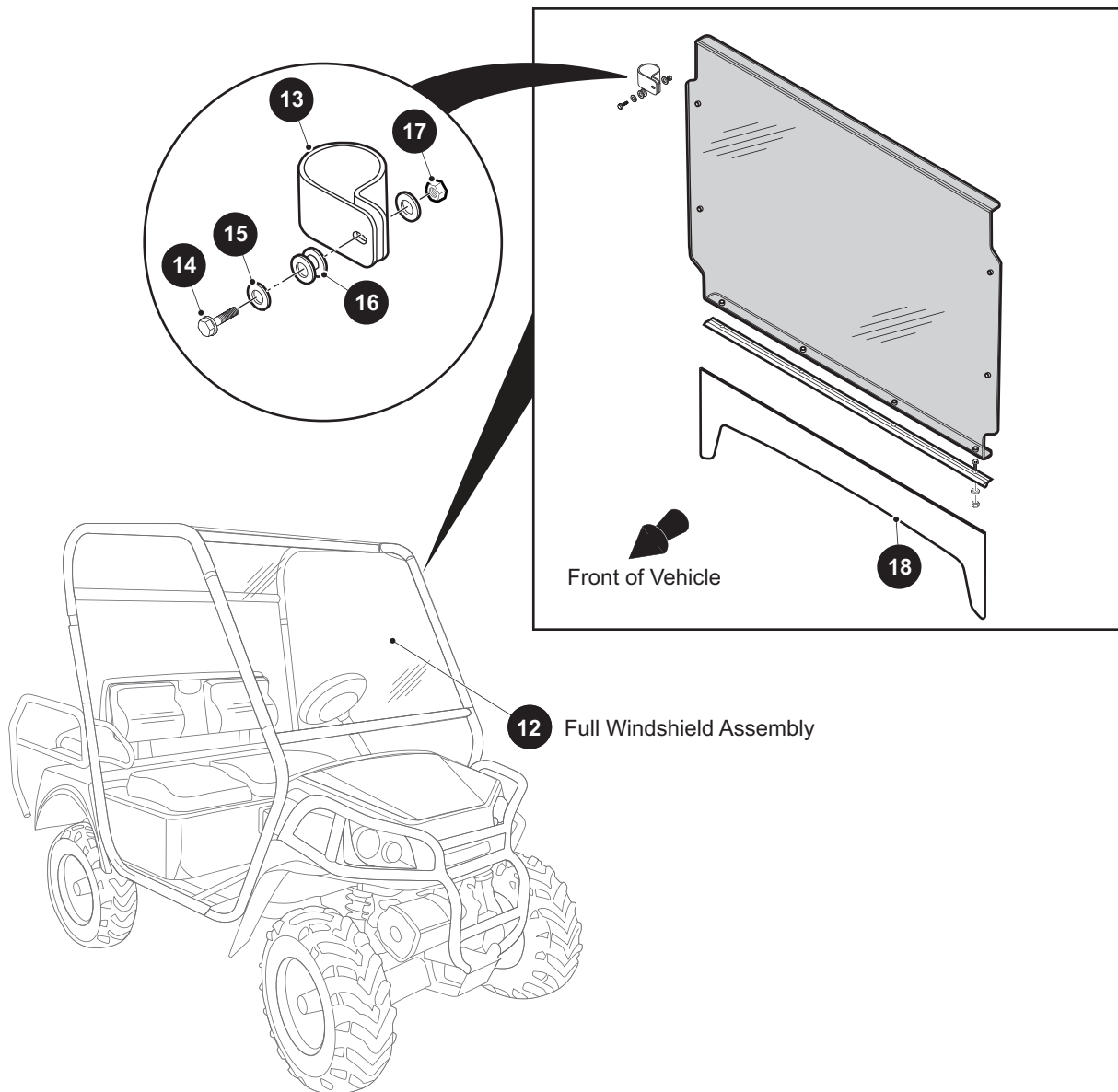


Fig. 3 Full Windshield

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Fig. 1 Wheels and Tires	W-1

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

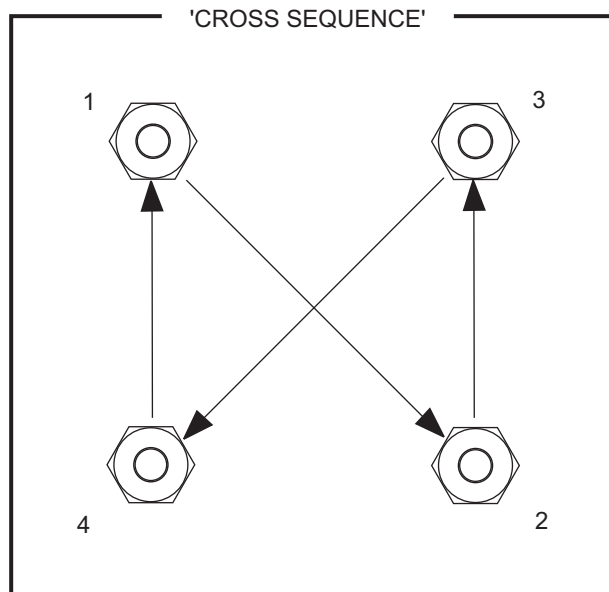
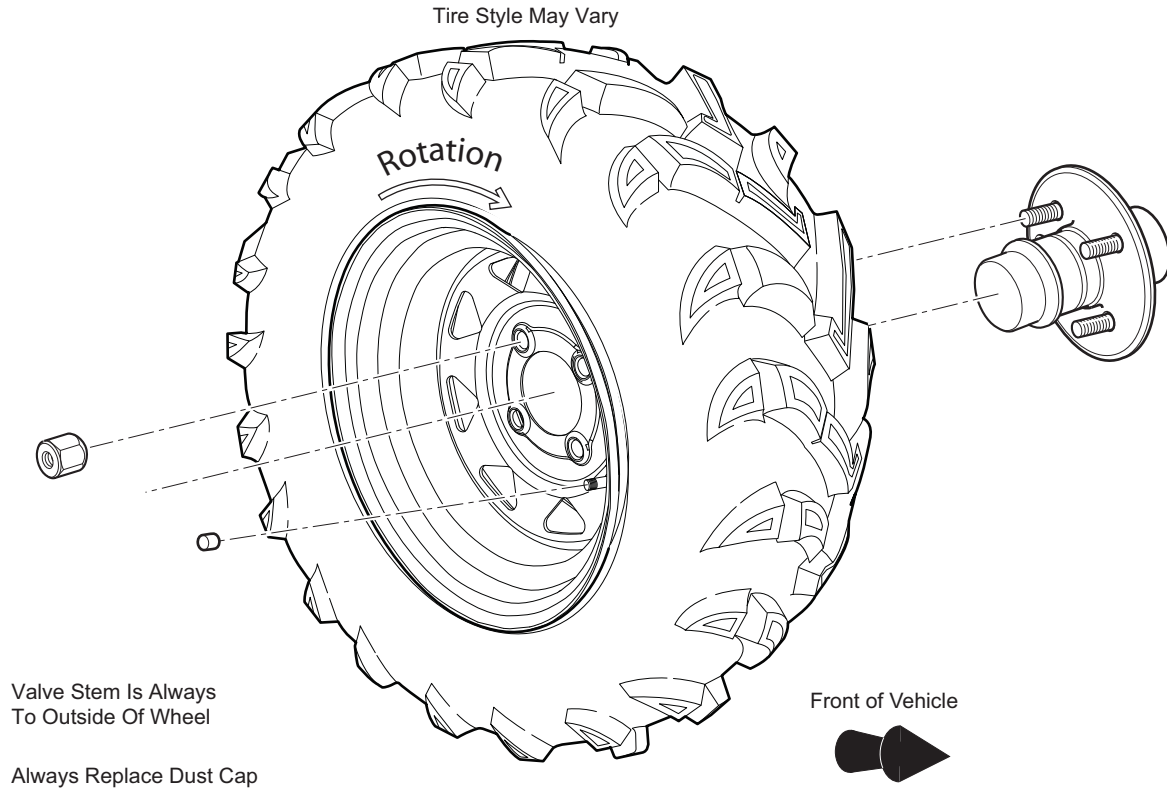


Fig. 1 Wheels and Tires

WHEELS AND TIRES

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

WHEEL AND TIRE SERVICE

NOTICE

Standard tires for this vehicle are uni-directional and should never be moved from one side of vehicle to the other. Left side tires should always remain on the left side of the vehicle. Right side tires should always remain on the right side of the vehicle. Uni-directional tires have an arrow on the sidewall indicating direction of rotation when moving forward.

Tools List	Qty.
Lug wrench, 3/4"	1
Impact socket, 3/4"	1
Torque wrench, ft. lbs.	1

WARNING

To prevent injury caused by a broken socket, use only sockets designed for impact wrench use. Never use a conventional socket.

This vehicle comes standard with uni-directional tires. Tire condition should be inspected and inflation pressures checked per the Periodic Service Schedule when the tires are cool. Be sure to install the valve dust cap after checking or inflating. When removing wheels with an impact wrench, use only impact sockets. Regular sockets are not designed for impact pressures exerted by power tools.

WARNING

A tire explosion can cause severe injury or death. Never exceed inflation pressure rating on tire side wall.

To prevent tire explosion, pressurize tire with small amount of air applied intermittently to seat beads. Never exceed the tire manufacturer's recommendation when seating a bead. Protect face and eyes from escaping air when removing valve core.

Use caution when inflating tires. Due to the low volume of these small tires, over inflation can occur in a matter of seconds. Over inflation could cause the tire to separate from the wheel or cause the tire to explode, either of which could cause personal injury.

Tire inflation will depend on the type of tires fitted but under no condition should inflation pressure be higher than recommended on the tire sidewall. Standard and optional tires should be inflated to pressure designated in GENERAL SPECIFICATIONS section. If pressure is not designated in GENERAL SPECIFICATIONS, inflate to pressure designated on tire sidewall. All four tires should have the same pressure for optimum handling characteristics. Do not overinflate. Due to the low volume of these small tires, over inflation can occur in a matter of seconds. Be sure to install the valve dust cap after checking or inflating.

Tire Repair

The vehicle is fitted with low pressure tubeless tires mounted on one piece rims.

Generally, the most cost effective way to repair a flat tire resulting from a puncture in the tread portion of the tire is to use a commercial tire plug.

NOTICE

Tire plug tools and plugs are available at most automotive parts outlets and have the advantage of not requiring the tire be removed from the wheel.

If the tire is flat, raise vehicle and remove wheel. Refer to 'Lifting the Vehicle' in Section B for proper lifting procedure and safety information. Inflate tire to maximum recommended pressure. Immerse tire in water to locate the leak and mark with chalk. Insert tire plug in accordance with manufacturer's specifications.

If the tire is to be removed or mounted, the tire changing machine manufacturer's recommendations must be followed in order to minimize the possibility of personal injury. Be sure to position tire on wheel correctly. Arrow on tire indicates rotation when moving forward.

WARNING

To prevent injury, be sure mounting/demounting machine is anchored to floor. Wear OSHA approved safety equipment when mounting/demounting tires.

Follow all instructions and safety warnings provided by the mounting/demounting machine manufacturer.

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

Wheel Installation



CAUTION

Do not tighten lug nuts to more than 75 ft. lbs. (101.68 Nm) torque.

NOTICE

It is important to follow the 'cross sequence' pattern when installing lug nuts. This will assure even seating of the wheel against the hub.

With the valve stem to the outside, mount the wheel onto the hub with lug nuts. Be sure to position the wheel on hub correctly with arrow indicating direction of rotation when moving forward. Finger tighten lug nuts in a 'cross sequence' pattern (Ref. Fig. 1 on page W-1). Then, tighten lug nuts to 65 - 75 ft. lbs. (88.12 - 101.68 Nm) torque in 20 ft. lbs. (27.11 Nm) increments following the same 'cross sequence' pattern.

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GENERAL SPECIFICATION

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



MODEL: BAD BOY BUGGIES - AMBUSH
TYPE: GAS / ELECTRIC PARALLEL DRIVE VEHICLE
MODEL YEAR: 2013
Part No.: 626640



PRODUCT SPECIFICATION

CONFIGURATION HIGHLIGHTS

Engine: 16 hp (11.9 kW) rated, 4 cycle, 29.2 ci (480 cc) V-Twin, air-cooled Vanguard

- **Valve Train:** Overhead valve
- **Lubrication:** Pressurized oil system, spin-on oil filter
- **Balancer:** Internal counter rotating balance shaft
- **Fuel System:** Fixed float bowl with remote pulse fuel pump
- **Ignition:** Electronic spark/magneto
- **Air Cleaner:** Replaceable dry cartridge w/permanent pre-filter

Electrical: Starter/Generator, solid-state regulator, 12 Volt maintenance free battery (525 CCA, 60 minute reserve)

Drive Train Gas: Automatic, continuously variable transmission (CVT). Locking rear axle (Operator selectable from center console)

Drive Train Elec: 48 V DC (8 Brush) With Speed Sensor

Brakes: 4 wheel hydraulic brakes (Disc Front, Drum Rear). Hand operated park brake located in center console

Transaxle: Differential with helical gears, ground speed governor, forward/reverse

Seating: Two bucket seats

Cargo Bed: Roto-molded cross-linked polyethylene. Lifts for access to powertrain. Removable hinged multi-position tailgate requires no latch mechanism

PRODUCT OVERVIEW

Dimensions		Vehicle Power Cont.	
Overall Length	115.5 in (293.4 cm)	Gear Selection	Forward-Reverse
Overall Width	54.5 in (138.4 cm)	Front Axle Ratio	12.44:1
Overall Height	53 in (134.6 cm) Top of steering wheel 75.5 in (192 cm) with OPS	Rear Axle Ratio	13.32:1 Fwd; 14.01 Rev
Wheel Base	79.5 in (202 cm)	Performance	
Front Wheel Track	43.75 in (111 cm)	Seating Capacity	2 Persons
Rear Wheel Track	43.25 in (110 cm)	Curb Weight	1700 lb (772 kg)
Gnd Clearance @ Differential	7.5 in (19 cm)	Bed Load Capacity	500 lb (225 kg)
Cargo Box Width (inside)	44.0 in (112 cm)	Vehicle load capacity	800 lb (360 kg)
Cargo Box Length (inside)	36.0 in (91 cm)	Outside Clearance Circle	29 ft (8.8 m)
Cargo Box Depth (inside)	10.5 in (27 cm)	Speed (Level Ground)	2WD Elec : 16 mph ± 0.5 mph (25.7 kph ± 0.8 kph) 4WD : 24.5 mph ± 0.5 mph (39.4 kph ± 0.8 kph)
Cargo Box Capacity	9.6 cu ft (0.27 m ³)	Towing Capacity	500 lb (225 kg)
Cargo Box Material	Roto-molded polyethylene	Steering & Suspension	
Vehicle Power		Steering	Self-compensating rack and pinion
Power Source	GAS: 4 cycle, 29.2 ci (480 cc) Elec: 48V DC motor	Front Suspension	Independent Mc Pherson Strut
Valve Train	V Twin Cylinder OHV	Rear Suspension	Leaf springs with hydraulic shock absorbers
Horsepower (kW)	GAS 16 hp (11.9 kW) rated Elec 20.6 hp (15.4 kW) pk	Service Brake	4 wheel hydraulic (disc front, drum rear)
Electrical System	Starter/Generator, solid-state regulator	Parking Brake	Hand Operated
Battery (Qty, Type)	One 12 Volt maintenance free for starter / gen 4x12 V for Elec Drive	Front Tires	MudLite 25x10-12 Uni-Directional
Key or Pedal Start	Pedal Start	Rear Tires	MudLite 25x10-12 Uni-Directional
Air Cleaner	Dry cartridge w/permanent pre-filter	Body & Chassis	
Lubrication	Pressurized oil system	Frame	Welded steel with DuraShield™ powder coat
Oil Filter	Spin-on oil filter	Front Body & Finish	Injection Molded TPO
Cooling System	Air cooled	Rear Body & Finish	Steel. Base coat/clear coat
Fuel Capacity	5.3 gallon (20 L) tank	Standard Color	Matte Black
Differential	Helical gears with manual lock-up (Rear Only)		

Some items shown may be optional equipment

2013 Bad Boy Buggies - Ambush
 Released: June 2012
 Revised:

Specifications are subject to change without notice
 * Field installed accessories may require installation charges

GENERAL SPECIFICATION

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

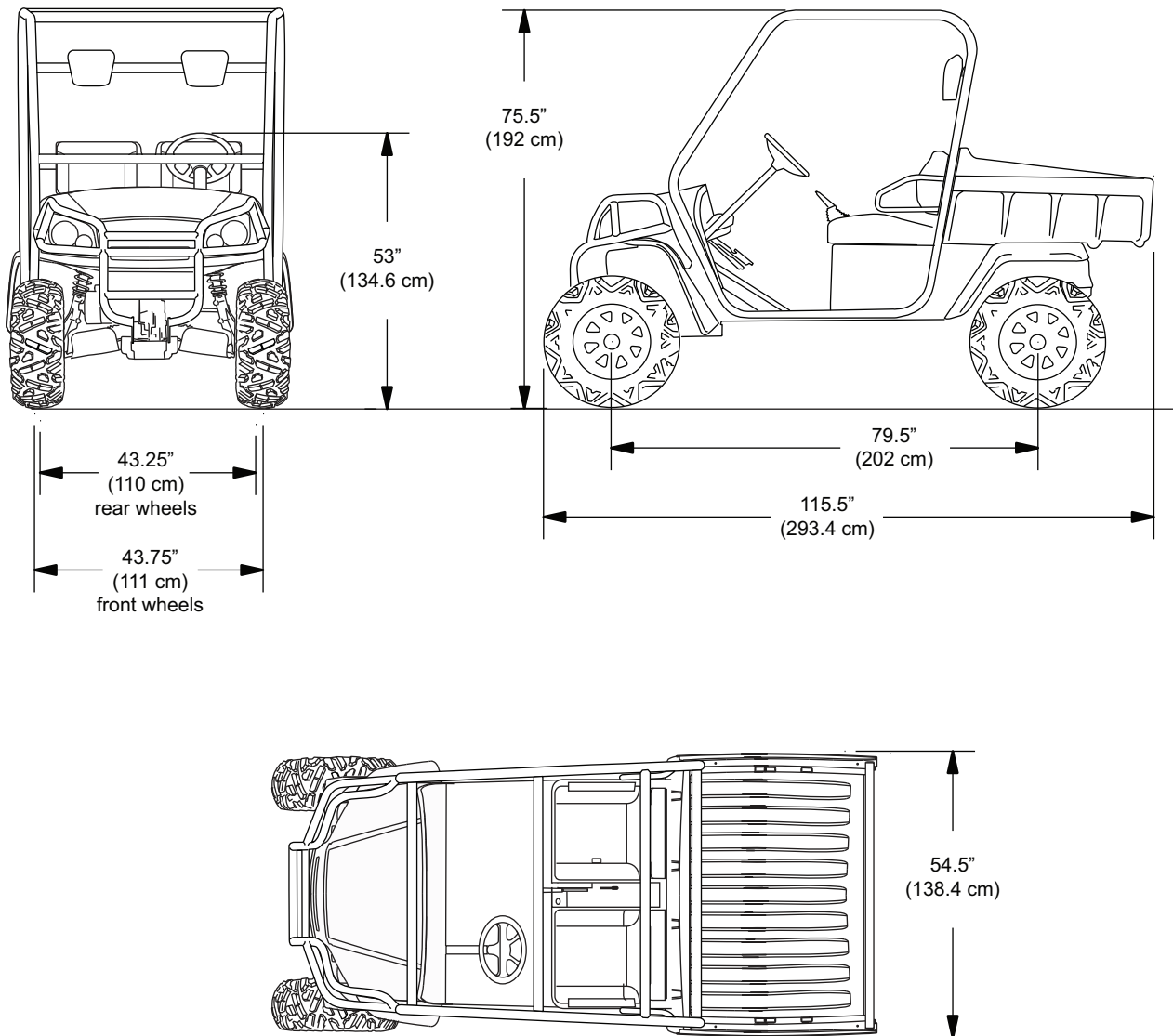
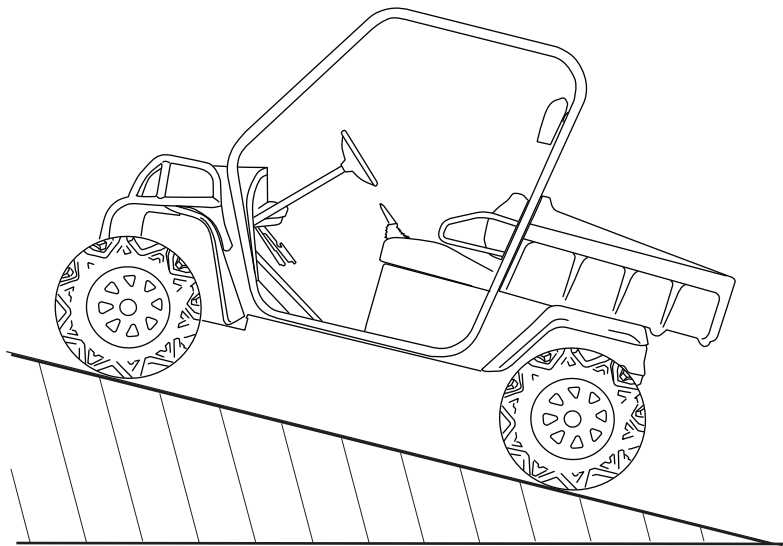


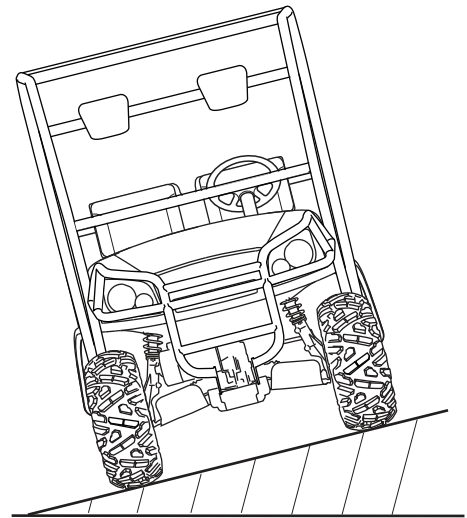
Fig. 1 Vehicle Dimensions

GENERAL SPECIFICATION

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



Maximum Recommended Ramp Grade
25% or 14° Max.



Maximum Recommended Side Tilt
25% or 14° Max.

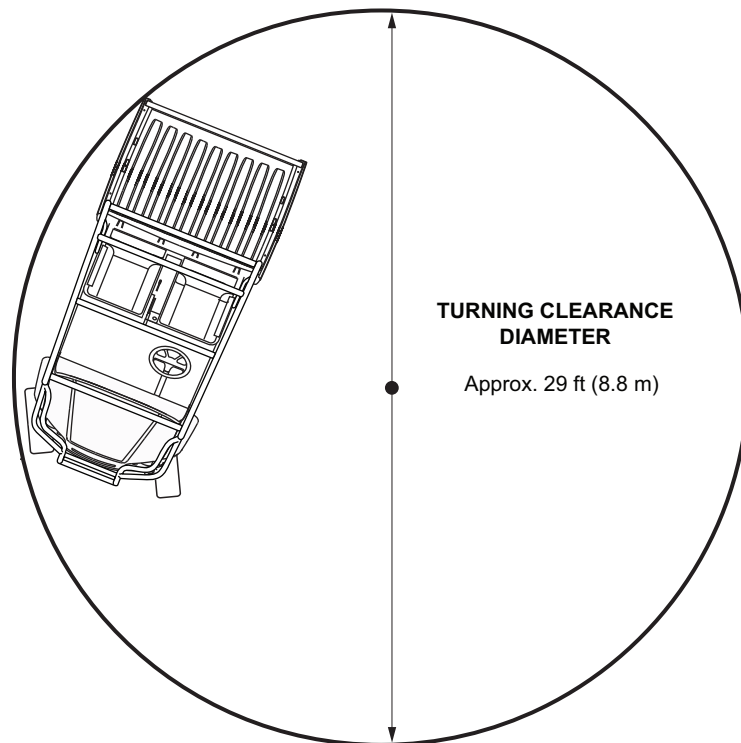


Fig. 2 Vehicle Incline Specification and Turning Clearance Diameter

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

EMISSION CONTROL SYSTEM WARRANTY STATEMENT

(Owner's Defect Warranty Rights and Obligations)

Refer to the Briggs & Stratton® Operating & Maintenance Instructions, provided with vehicle, for Emission Control System Warranty information.

ENGINE OWNER WARRANTY POLICY

Refer to the Briggs & Stratton® Operating & Maintenance Instructions, provided with vehicle, for Engine Warranty information.

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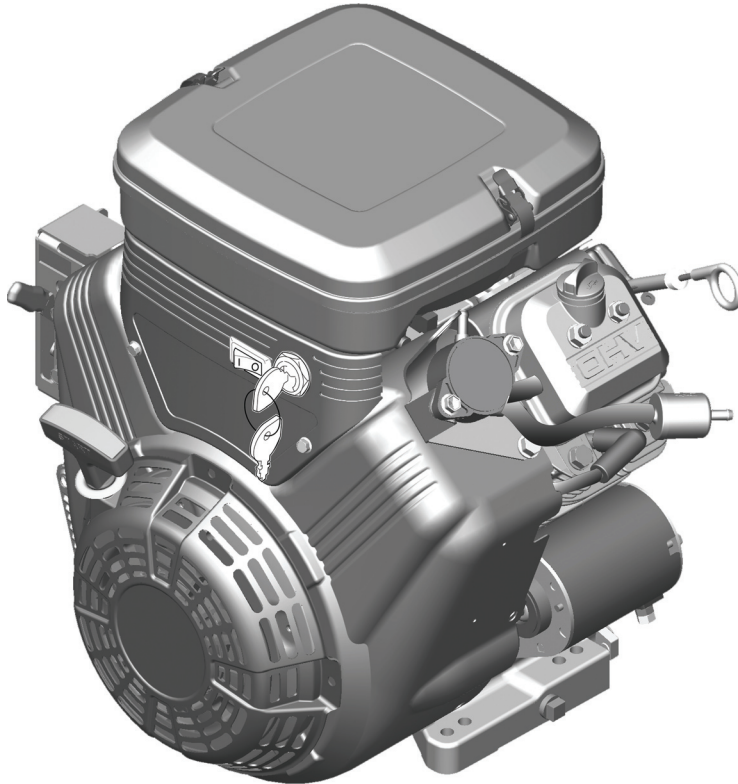


COMMERCIAL POWER

- en** *Operator's Manual*
- es** *Manual del Operario*
- fr** *Manuel de l'opérateur*



Model 290000	Vanguard™ Gasoline	Model 350000	Vanguard™ Gasoline
Model 300000	Vanguard™ Gasoline	Model 380000	Vanguard™ Gasoline



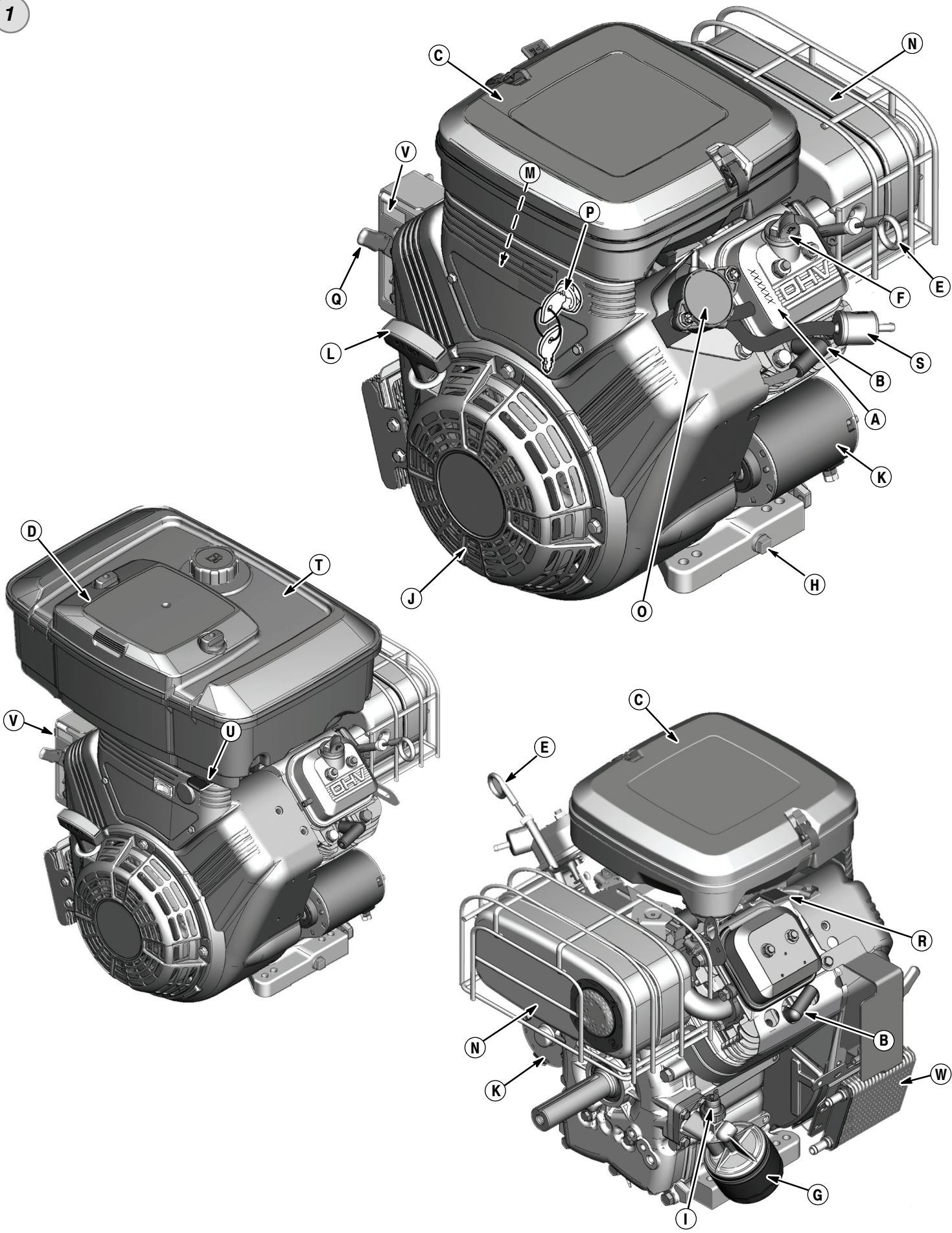
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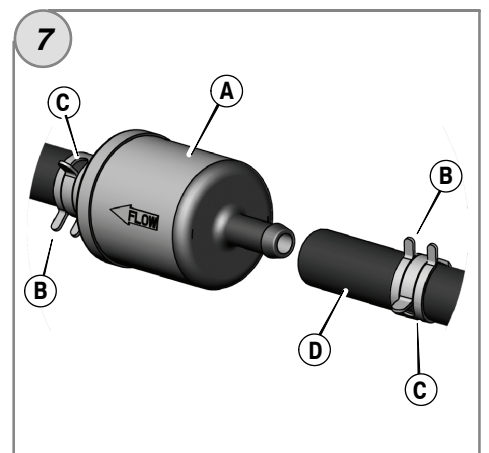
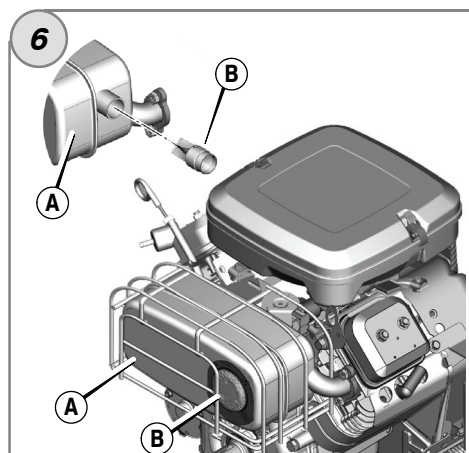
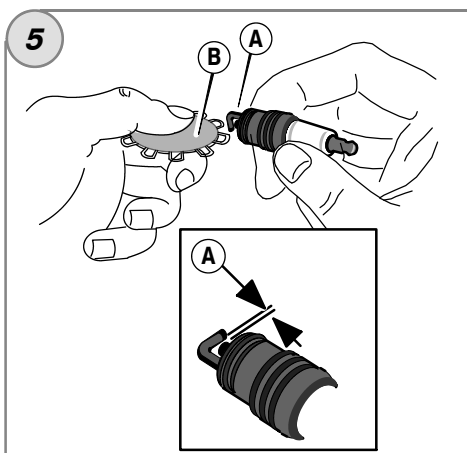
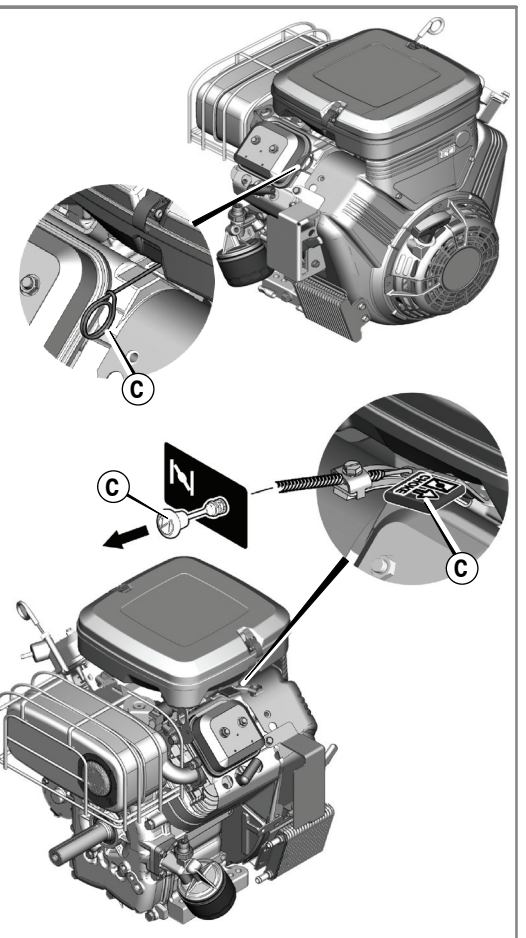
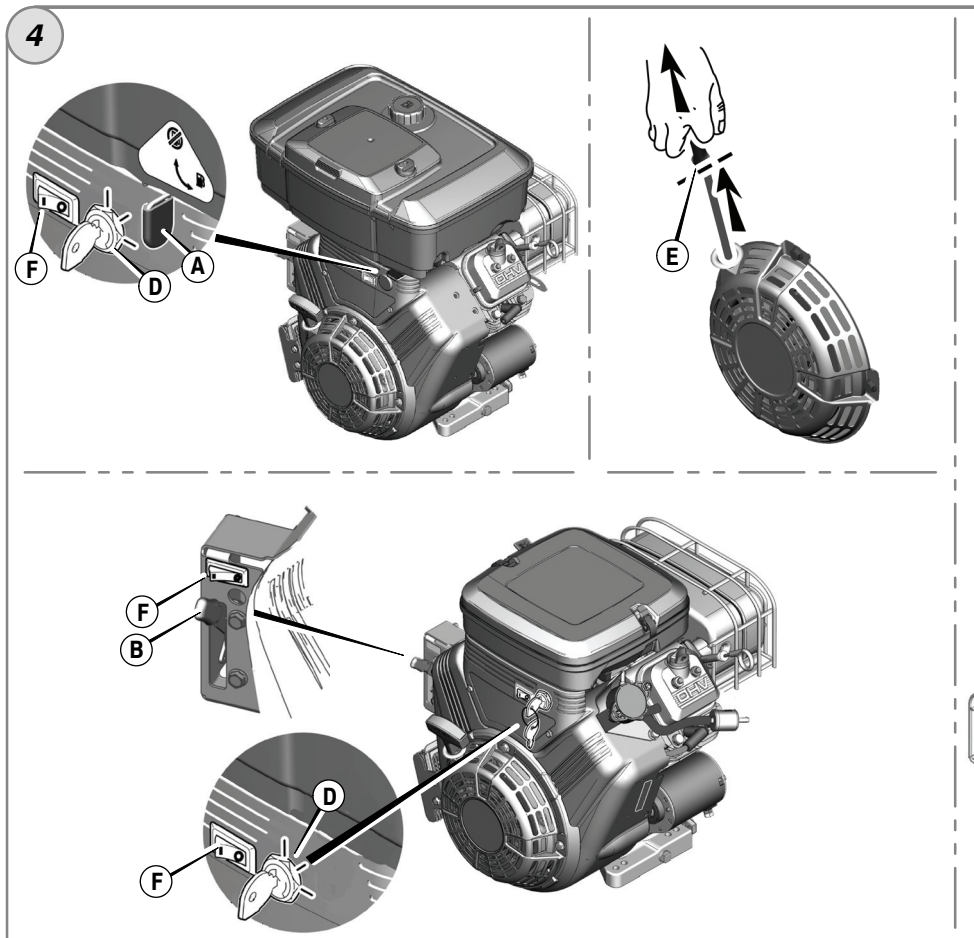
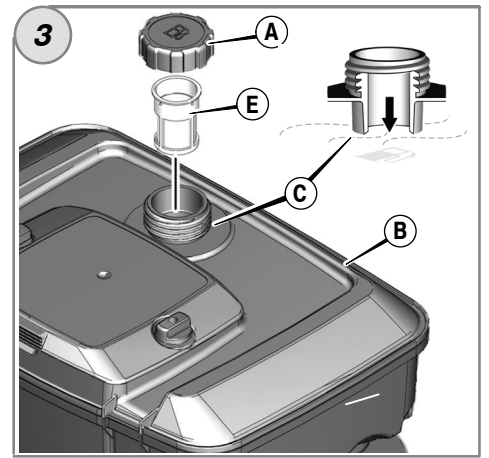
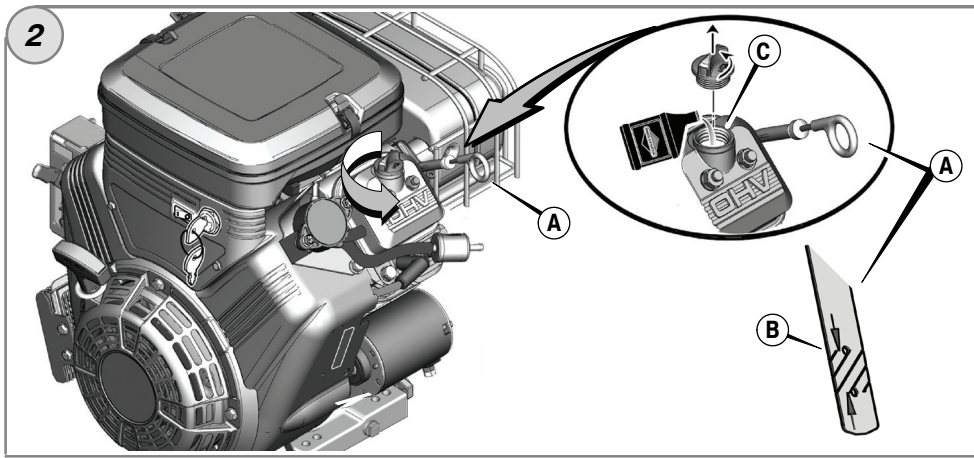
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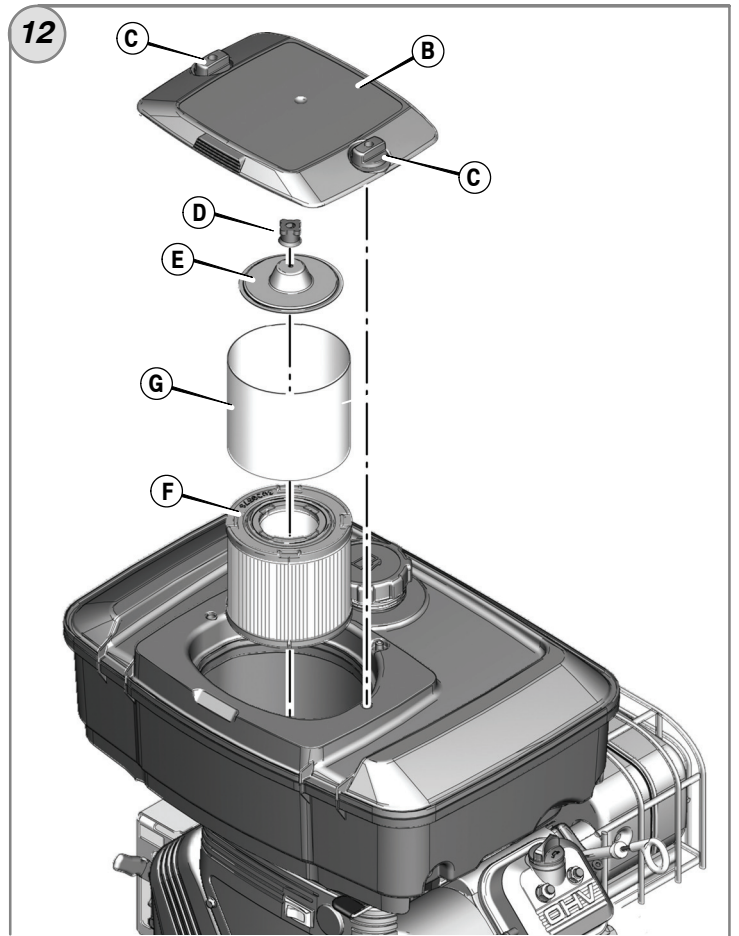
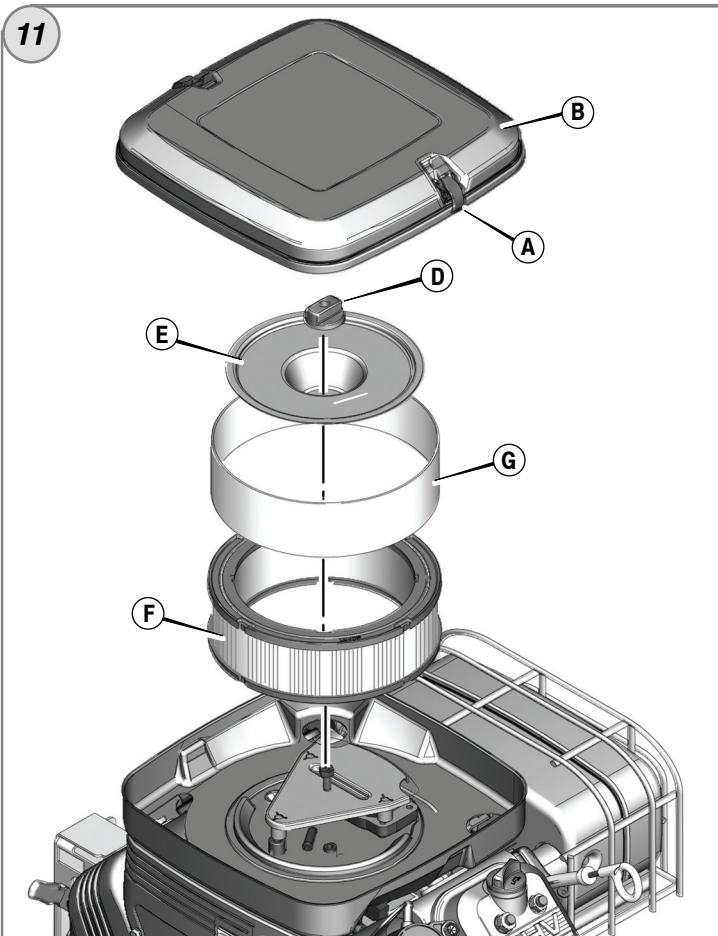
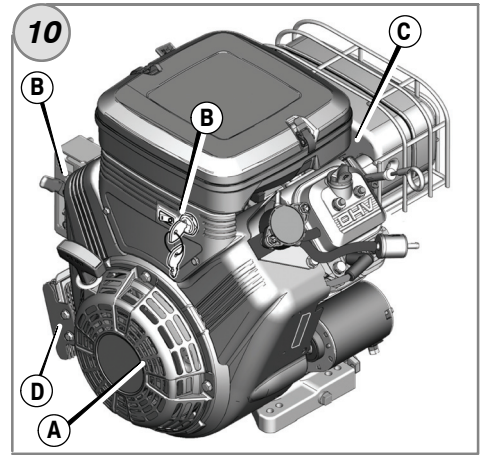
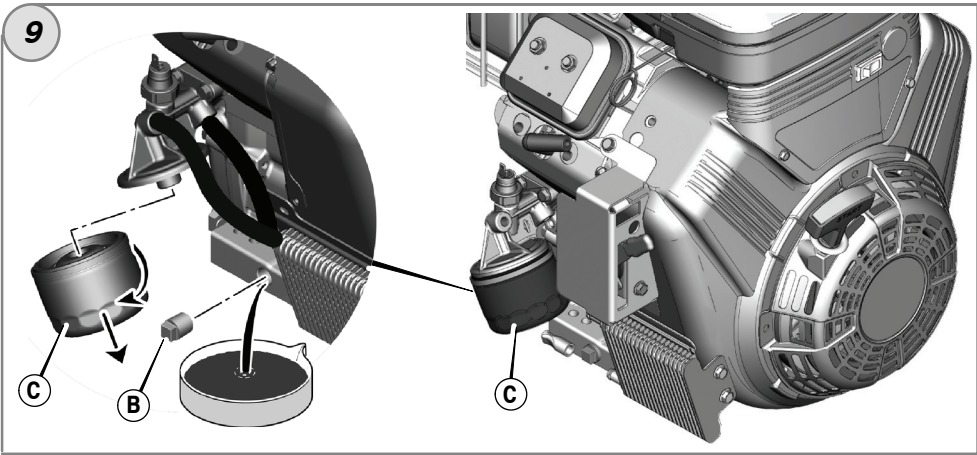
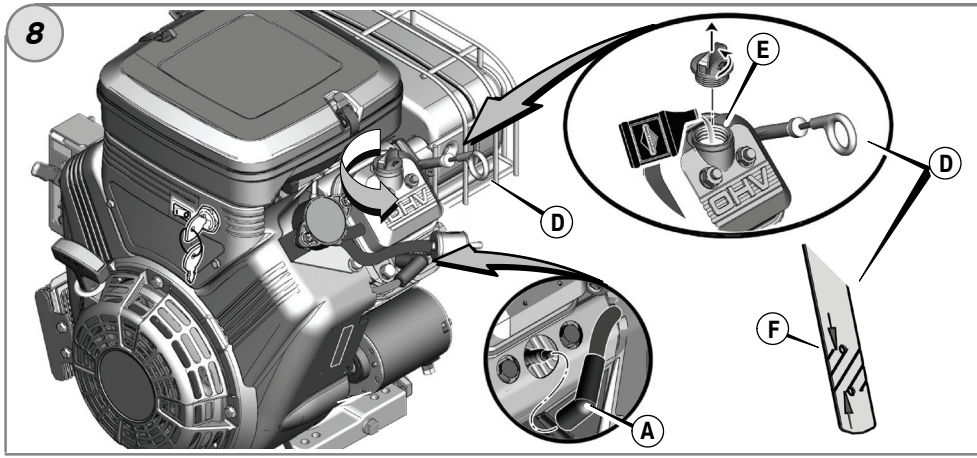
English
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Español
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General Information

This manual contains safety information to make you aware of the hazards and risks associated with engines and how to avoid them. It also contains instructions for the proper use and care of the engine. Because Briggs & Stratton Corporation does not necessarily know what equipment this engine will power, it is important that you read and understand these instructions and the instructions for the equipment. **Save these original instructions for future reference.**

For replacement parts or technical assistance, record below the engine model, type, and code numbers along with the date of purchase. These numbers are located on your engine (see the **Features and Controls** page).

Date of purchase: _____
MM/DD/YYYY

Engine model: _____
Model: Type: Code:


Power Rating


The gross power rating for individual gas engine models is labeled in accordance with SAE (Society of Automotive Engineers) code J1940 (Small Engine Power & Torque Rating Procedure), and rating performance has been obtained and corrected in accordance with SAE J1995 (Revision 2002-05). Torque values are derived at 3060 RPM; horsepower values are derived at 3600 RPM. The gross power curves can be viewed at www.BRIGGSandSTRATTON.COM. Net power values are taken with exhaust and air cleaner installed whereas gross power values are collected without these attachments. Actual gross engine power will be higher than net engine power and is affected by, among other things, ambient operating conditions and engine-to-engine variability. Given the wide array of products on which engines are placed, the gas engine may not develop the rated gross power when used in a given piece of power equipment. This difference is due to a variety of factors including, but not limited to, the variety of engine components (air cleaner, exhaust, charging, cooling, carburetor, fuel pump, etc.), application limitations, ambient operating conditions (temperature, humidity, altitude), and engine-to-engine variability. Due to manufacturing and capacity limitations, Briggs & Stratton may substitute an engine of higher rated power for this Series engine.


Operator Safety


SAFETY AND CONTROL SYMBOLS



The safety alert symbol  is used to identify safety information about hazards that can result in personal injury. A signal word (DANGER, WARNING, or CAUTION) is used with the alert symbol to indicate the likelihood and the potential severity of injury. In addition, a hazard symbol may be used to represent the type of hazard.

 **DANGER** indicates a hazard which, if not avoided, **will result in death or serious injury.**

 **WARNING** indicates a hazard which, if not avoided, **could result in death or serious injury.**

 **CAUTION** indicates a hazard which, if not avoided, **could result in minor or moderate injury.**

NOTICE indicates a situation that **could result in damage to the product.**

WARNING

Certain components in this product and its related accessories contain chemicals known to the State of California to cause cancer, birth defects, or other reproductive harm. Wash hands after handling.

WARNING


The engine exhaust from this product contains chemicals known to the State of California to cause cancer, birth defects, or other reproductive harm.

WARNING

Briggs & Stratton Engines are not designed for and are not to be used to power: fun-karts; go-karts; children's, recreational, or sport all-terrain vehicles (ATVs); motorbikes; hovercraft; aircraft products; or vehicles used in competitive events not sanctioned by Briggs & Stratton. For information about competitive racing products, see www.briggsracing.com. For use with utility and side-by-side ATVs, please contact Briggs & Stratton Engine Application Center, 1-866-927-3349. Improper engine application may result in serious injury or death.

NOTICE: This engine was shipped from Briggs & Stratton without oil. Before you start the engine, make sure you add oil according to the instructions in this manual. If you start the engine without oil, it will be damaged beyond repair and will not be covered under warranty.

WARNING

 **Fuel and its vapors are extremely flammable and explosive. Fire or explosion can cause severe burns or death.**

When Adding Fuel

- Turn engine off and let engine cool at least 2 minutes before removing the fuel cap.
- Fill fuel tank outdoors or in well-ventilated area.
- Do not overfill fuel tank. To allow for expansion of the fuel, do not fill above the bottom of the fuel tank neck.
- Keep fuel away from sparks, open flames, pilot lights, heat, and other ignition sources.
- Check fuel lines, tank, cap, and fittings frequently for cracks or leaks. Replace if necessary
- If fuel spills, wait until it evaporates before starting engine.

When Starting Engine

- Ensure that spark plug, muffler, fuel cap and air cleaner (if equipped) are in place and secured.
- Do not crank engine with spark plug removed.
- If engine floods, set choke (if equipped) to OPEN/RUN position, move throttle (if equipped) to FAST position and crank until engine starts.

When Operating Equipment

- Do not tip engine or equipment at angle which causes fuel to spill.
- Do not choke the carburetor to stop engine.
- Never start or run the engine with the air cleaner assembly (if equipped) or the air filter (if equipped) removed.

When Changing Oil

- When you drain the oil from the top oil fill tube, the fuel tank must be empty or fuel can leak out and result in a fire or explosion.

When Tipping Unit for Maintenance

- When performing maintenance that requires the unit to be tipped, the fuel tank must be empty or fuel can leak out and result in a fire or explosion.


When Transporting Equipment

- Transport with fuel tank EMPTY or with fuel shut-off valve OFF.

When Storing Fuel Or Equipment With Fuel In Tank

- Store away from furnaces, stoves, water heaters or other appliances that have pilot lights or other ignition sources because they can ignite fuel vapors.

WARNING

 **Starting engine creates sparking. Sparking can ignite nearby flammable gases. Explosion and fire could result.**

- If there is natural or LP gas leakage in area, do not start engine.
- Do not use pressurized starting fluids because vapors are flammable.



WARNING



Engines give off carbon monoxide, an odorless, colorless, poison gas. Breathing carbon monoxide can cause nausea, fainting or death.

- Start and run engine outdoors.
- Do not start or run engine in enclosed area, even if doors or windows are open.



WARNING



Rapid retraction of starter cord (kickback) will pull hand and arm toward engine faster than you can let go.

Broken bones, fractures, bruises or sprains could result.

- When starting engine, pull the starter cord slowly until resistance is felt and then pull rapidly to avoid kickback.
- Remove all external equipment/engine loads before starting engine.
- Direct-coupled equipment components such as, but not limited to, blades, impellers, pulleys, sprockets, etc., must be securely attached.



WARNING



Rotating parts can contact or entangle hands, feet, hair, clothing, or accessories.

Traumatic amputation or severe laceration can result.

- Operate equipment with guards in place.
- Keep hands and feet away from rotating parts.
- Tie up long hair and remove jewelry.
- Do not wear loose-fitting clothing, dangling drawstrings or items that could become caught.



WARNING



Running engines produce heat. Engine parts, especially muffler, become extremely hot.

Severe thermal burns can occur on contact.



Combustible debris, such as leaves, grass, brush, etc. can catch fire.

- Allow muffler, engine cylinder and fins to cool before touching.
- Remove accumulated debris from muffler area and cylinder area.
- It is a violation of California Public Resource Code, Section 4442, to use or operate the engine on any forest-covered, brush-covered, or grass-covered land unless the exhaust system is equipped with a spark arrester, as defined in Section 4442, maintained in effective working order. Other states or federal jurisdictions may have similar laws. Contact the original equipment manufacturer, retailer, or dealer to obtain a spark arrester designed for the exhaust system installed on this engine.



WARNING



Unintentional sparking can result in fire or electric shock.



Unintentional start-up can result in entanglement, traumatic amputation, or laceration.



Fire hazard

Before performing adjustments or repairs:

- Disconnect the spark plug wire and keep it away from the spark plug.
- Disconnect battery at negative terminal (only engines with electric start.)
- Use only correct tools.
- Do not tamper with governor spring, links or other parts to increase engine speed.
- Replacement parts must be of the same design and installed in the same position as the original parts. Other parts may not perform as well, may damage the unit, and may result in injury.
- Do not strike the flywheel with a hammer or hard object because the flywheel may later shatter during operation.

When testing for spark:

- Use approved spark plug tester.
- Do not check for spark with spark plug removed.

Features and Controls

Compare the illustration **1** with your engine to familiarize yourself with the location of various features and controls.

- A. Engine Identification
Model Type Code
- B. Spark Plug
- C. Air Cleaner (without Fuel Tank)
- D. Air Cleaner (with Fuel Tank)
- E. Dipstick
- F. Oil Fill
- G. Oil Filter (optional)
- H. Oil Drain Plug
- I. Oil Pressure Sensor
- J. Finger Guard
- K. Electric Starter
- L. Rewind Starter (optional)
- M. Carburetor
- N. Muffler (optional)
- O. Fuel Pump
- P. Starter Switch *
- Q. Throttle Control *
- R. Choke Control *
- S. Fuel Filter (optional)
- T. Fuel Tank (optional)
- U. Fuel Shut Off (optional) *
- V. Stop Switch (optional) *
- W. Oil Cooler (optional)

* Some engines and equipment have remote controls. See the equipment manual for location and operation of remote controls.

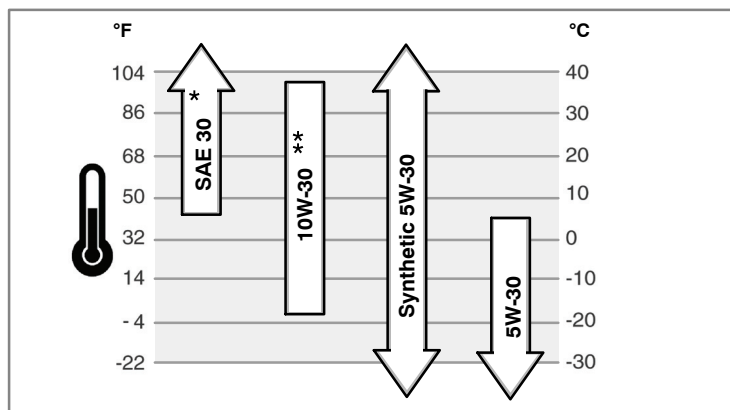
Operation

Oil capacity (see the **Specifications** section)

Oil Recommendations

We recommend the use of Briggs & Stratton Warranty Certified oils for best performance. Other high-quality detergent oils are acceptable if classified for service SF, SG, SH, SJ or higher. Do not use special additives.

Outdoor temperatures determine the proper oil viscosity for the engine. Use the chart to select the best viscosity for the outdoor temperature range expected.



* Below 40°F (4°C) the use of SAE 30 will result in hard starting.

** Above 80°F (27°C) the use of 10W-30 may cause increased oil consumption. Check oil level more frequently.

How To Check/Add Oil - Figure 2

Before adding or checking the oil

- Place engine level.
 - Clean the oil fill area of any debris.
1. Remove the dipstick (A) and wipe with a clean cloth (Figure 2).
 2. Fully insert the dipstick.

en

3. Remove the dipstick and check the oil level. It should be at the top of the full indicator (B) on the dipstick.
4. If low, add oil slowly into the engine oil fill (C). **Do not overfill.** After adding oil, wait one minute and then recheck the oil level.
5. Fully insert the dipstick.

Oil Pressure

If the oil pressure is too low, a pressure switch (if equipped) will either stop the engine or activate a warning device on the equipment. If this occurs, stop the engine and check the oil level with the dipstick.

If the oil level is below the ADD mark, add oil until it reaches the FULL mark. Start the engine and check for proper pressure before continuing to operate.

If the oil level is between the ADD and FULL marks, **do not start** the engine. Contact an Authorized Briggs & Stratton Dealer to have the oil pressure problem corrected.

Fuel Recommendations

Fuel must meet these requirements:

- Clean, fresh, unleaded gasoline.
- A minimum of 87 octane/87 AKI (91 RON). High altitude use, see below.
- Gasoline with up to 10% ethanol (gasohol) is acceptable.

CAUTION: Do not use unapproved gasolines, such as E15 and E85. Do not mix oil in gasoline or modify the engine to run on alternate fuels. Use of unapproved fuels will damage the engine components and **void the engine warranty.**

To protect the fuel system from gum formation, mix a fuel stabilizer into the fuel. See **Storage.** All fuel is not the same. If starting or performance problems occur, change fuel providers or change brands. This engine is certified to operate on gasoline. The emissions control system for this engine is EM (Engine Modifications).

High Altitude

At altitudes over 5,000 feet (1524 meters), a minimum 85 octane/85 AKI (89 RON) gasoline is acceptable. To remain emissions compliant, high altitude adjustment is required. Operation without this adjustment will cause decreased performance, increased fuel consumption, and increased emissions. See an authorized Briggs & Stratton Dealer for high altitude adjustment information.

Operation of the engine at altitudes below 2,500 feet (762 meters) with the high altitude kit is not recommended.

How To Add Fuel - Figure 3



WARNING



Fuel and its vapors are extremely flammable and explosive. Fire or explosion can cause severe burns or death.



When Adding Fuel

- Turn engine off and let engine cool at least 2 minutes before removing the fuel cap.
- Fill fuel tank outdoors or in well-ventilated area.
- Do not overfill fuel tank. To allow for expansion of the fuel, do not fill above the bottom of the fuel tank neck.
- Keep fuel away from sparks, open flames, pilot lights, heat, and other ignition sources.
- Check fuel lines, tank, cap, and fittings frequently for cracks or leaks. Replace if necessary
- If fuel spills, wait until it evaporates before starting engine.

1. Clean the fuel cap area of dirt and debris. Remove the fuel cap (A, Figure 3).
2. Fill the fuel tank (B) with fuel. To allow for expansion of the fuel, do not fill above the bottom of the fuel tank neck (C).
3. Reinstall the fuel cap.

How To Start The Engine - Figure 4



WARNING



Rapid retraction of starter cord (kickback) will pull hand and arm toward engine faster than you can let go.

Broken bones, fractures, bruises or sprains could result.

- When starting engine, pull the starter cord slowly until resistance is felt and then pull rapidly to avoid kickback.



WARNING



**Fuel and its vapors are extremely flammable and explosive.
Fire or explosion can cause severe burns or death.**

When Starting Engine

- Ensure that spark plug, muffler, fuel cap and air cleaner (if equipped) are in place and secured.
- Do not crank engine with spark plug removed.
- If engine floods, set choke (if equipped) to OPEN/RUN position, move throttle (if equipped) to FAST position and crank until engine starts.



WARNING






**Engines give off carbon monoxide, an odorless, colorless, poison gas.
Breathing carbon monoxide can cause nausea, fainting or death.**

- Start and run engine outdoors.
- Do not start or run engine in enclosed area, even if doors or windows are open.

NOTICE: This engine was shipped from Briggs & Stratton without oil. Before you start the engine, make sure you add oil according to the instructions in this manual. If you start the engine without oil, it will be damaged beyond repair and will not be covered under warranty.

Note: Some engines and equipment have remote controls. See the equipment manual for location and operation of remote controls.

1. Check the oil level. See the **How To Check/Add Oil** section.
2. Make sure equipment drive controls, if equipped, are disengaged.
3. Turn the fuel shut-off valve (A), if equipped, to the on position (Figure 4).
4. Push the stop switch (F), if equipped, to the on position.
5. Move the throttle control (B) to the fast  position. Operate the engine in the fast  position.
6. Move the choke control (C) to the choke  position.

Note: Choke is usually unnecessary when restarting a warm engine.

7. **Rewind Start:** Turn the key switch (D), if equipped, to the run position.
8. **Rewind Start:** Firmly hold the starter cord handle (E). Pull the starter cord handle slowly until resistance is felt, then pull rapidly.

Note: If the engine does not start after repeated attempts, go to VanguardEngines.com or call 1-800-999-9333 (in USA).




WARNING: Rapid retraction of the starter cord (kickback) will pull your hand and arm toward the engine faster than you can let go. Broken bones, fractures, bruises or sprains could result. When starting engine, pull the starter cord slowly until resistance is felt and then pull rapidly to avoid kickback.

9. **Electric Start:** Turn the electric start switch (D) to the on/start position.

Note: If the engine does not start after repeated attempts, go to VanguardEngines.com or call 1-800-999-9333 (in USA).

NOTICE: To extend the life of the starter, use short starting cycles (five seconds maximum). Wait one minute between starting cycles.

10. As the engine warms up, move the choke control (C) to the run  position.

How To Stop The Engine - Figure 4




WARNING



**Fuel and its vapors are extremely flammable and explosive.
Fire or explosion can cause severe burns or death.**

- Do not choke the carburetor to stop engine.

1. With the throttle control (B) in the slow  position, turn the key switch (D) to the off position (Figure 4). Remove the key and keep in a safe place out of the reach of children.
2. Push the stop switch (F) to the off position.
3. After the engine stops, turn the fuel shut-off valve (A), if equipped, to the closed position.

Maintenance

We recommend that you see any Briggs & Stratton Authorized Dealer for all maintenance and service of the engine and engine parts.

NOTICE: All the components used to build this engine must remain in place for proper operation.



WARNING: When performing maintenance that requires the unit to be tipped, the fuel tank must be empty or fuel can leak out and result in a fire or explosion.

Emissions Control

Maintenance, replacement, or repair of the emissions control devices and systems may be performed by any non-road engine repair establishment or individual.

However, to obtain "no charge" emissions control service, the work must be performed by a factory authorized dealer. See the Emissions Warranty.



WARNING



Unintentional sparking can result in fire or electric shock.



Unintentional start-up can result in entanglement, traumatic amputation, or laceration.



Fire hazard

Before performing adjustments or repairs:

- Disconnect the spark plug wire and keep it away from the spark plug.
- Disconnect battery at negative terminal (only engines with electric start.)
- Use only correct tools.
- Do not tamper with governor spring, links or other parts to increase engine speed.
- Replacement parts must be of the same design and installed in the same position as the original parts. Other parts may not perform as well, may damage the unit, and may result in injury.
- Do not strike the flywheel with a hammer or hard object because the flywheel may later shatter during operation.

When testing for spark:

- Use approved spark plug tester.
- Do not check for spark with spark plug removed.

Maintenance Chart

First 5 Hours

- Change oil

Every 8 Hours or Daily

- Check engine oil level
- Clean area around muffler and controls

Every 100 Hours or Annually

- Clean or change air filter *
- Clean pre-cleaner (if equipped) *
- Change engine oil and filter
- Replace spark plug
- Check muffler and spark arrester

Every 250 Hours or Annually

- Check valve clearance. Adjust if necessary.

Every 400 Hours or Annually

- Change air filter
- Replace fuel filter
- Clean air cooling system *
- Clean oil cooler fins *

* In dusty conditions or when airborne debris is present, clean more often.

Carburetor Adjustment

Never make adjustments to the carburetor. The carburetor was set at the factory to operate efficiently under most conditions. However, if adjustments are required, see a Briggs & Stratton Authorized Dealer for service.

NOTICE: The manufacturer of the equipment on which this engine is installed specifies the top speed at which the engine will be operated. **Do not exceed** this speed.

How To Replace The Spark Plug - Figure 5

Check the gap (A, Figure 5) with a wire gauge (B). If necessary, reset the gap. Install and tighten the spark plug to the recommended torque. For gap setting or torque, see the **Specifications** section.

Note: In some areas, local law requires using a resistor spark plug to suppress ignition signals. If this engine was originally equipped with a resistor spark plug, use the same type for replacement.

Inspect Muffler And Spark Arrester - Figure 6



WARNING



Running engines produce heat. Engine parts, especially muffler, become extremely hot.

Severe thermal burns can occur on contact.



Combustible debris, such as leaves, grass, brush, etc. can catch fire.

- Allow muffler, engine cylinder and fins to cool before touching.
- Remove accumulated debris from muffler area and cylinder area.
- It is a violation of California Public Resource Code, Section 4442, to use or operate the engine on any forest-covered, brush-covered, or grass-covered land unless the exhaust system is equipped with a spark arrester, as defined in Section 4442, maintained in effective working order. Other states or federal jurisdictions may have similar laws. Contact the original equipment manufacturer, retailer, or dealer to obtain a spark arrester designed for the exhaust system installed on this engine.

Remove accumulated debris from muffler area and cylinder area. Inspect the muffler (A, Figure 6) for cracks, corrosion, or other damage. Remove the spark arrester (B), if equipped, and inspect for damage or carbon blockage. If damage is found, install replacement parts before operating.



WARNING: Replacement parts must be of the same design and installed in the same position as the original parts. Other parts may not perform as well, may damage the unit, and may result in injury.

How To Change The Oil - Figure 8 9

Used oil is a hazardous waste product and must be disposed of properly. Do not discard with household waste. Check with your local authorities, service center, or dealer for safe disposal/recycling facilities.

Remove Oil

1. With engine off but still warm, disconnect the spark plug wire (A) and keep it away from the spark plug (Figure 8).
2. Remove the oil drain plug (B, Figure 9). Drain the oil into an approved container.
3. After the oil has drained, install and tighten the oil drain plug.

Change The Oil Filter (if equipped)

Some models are equipped with oil filter. For replacement intervals, see the **Maintenance** chart.

1. Drain the oil from the engine. See **Remove Oil** section.
2. Remove the oil filter (C) and dispose of properly. See Figure 9.
3. Before you install the new oil filter, lightly lubricate the oil filter gasket with fresh, clean oil.
4. Install the oil filter by hand until the gasket contacts the oil filter adapter, then tighten the oil filter 1/2 to 3/4 turns.
5. Add oil. See **Add Oil** section.
6. Start and run the engine. As the engine warms up, check for oil leaks.
7. Stop the engine and check the oil level. It should be at the top of the full indicator (F) on the dipstick (Figure 8).

Add Oil

- Place engine level.
 - Clean the oil fill area of any debris.
 - See the **Specifications** section for oil capacity.
1. Remove the dipstick (D) and wipe with a clean cloth (Figure 8).
 2. Pour the oil slowly into the engine oil fill (E). **Do not overfill.** After adding oil, wait one minute and then check the oil level.
 3. Install and tighten the dipstick.
 4. Remove the dipstick and check the oil level. It should be at the top of the full indicator (F) on the dipstick.
 5. Install and tighten the dipstick.

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How To Service The Air Filter - Figure 11 12



WARNING



Fuel and its vapors are extremely flammable and explosive. Fire or explosion can cause severe burns or death.



- Never start or run the engine with the air cleaner assembly (if equipped) or the air filter (if equipped) removed.

NOTICE: Do not use pressurized air or solvents to clean the filter. Pressurized air can damage the filter and solvents will dissolve the filter.

Two types of air filter systems are shown. See the **Maintenance Chart** for service requirements.

1. **Models without Fuel Tank:** Open the latches (A) and remove the cover (B). See Figure 11.
2. **Models with Fuel Tank:** Remove the knob (C) and the cover (B). See Figure 12.
3. Remove the nut (D) and the retainer (E). See Figure 11 and 12.
4. Remove the air filter (F).
5. Remove the pre-cleaner (G), if equipped, from the air filter.
6. To loosen debris, gently tap the air filter on a hard surface. If the air filter is excessively dirty, replace with a new air filter.
7. Wash the pre-cleaner in liquid detergent and water. Then allow it to thoroughly air dry. **Do not** oil the pre-cleaner.
8. Assemble the dry pre-cleaner to the air filter.
9. Install the air filter and secure with retainer and nut.
10. Install and secure the cover.

How To Replace The Fuel Filter - Figure 7



WARNING



Fuel and its vapors are extremely flammable and explosive. Fire or explosion can cause severe burns or death.



- Keep fuel away from sparks, open flames, pilot lights, heat, and other ignition sources.
- Check fuel lines, tank, cap, and fittings frequently for cracks or leaks. Replace if necessary.
- Before replacing the fuel filter, drain the fuel tank or close the fuel shut-off valve.
- Replacement parts must be the same and installed in the same position as the original parts.
- If fuel spills, wait until it evaporates before starting engine.

1. Before replacing the fuel filter (A, Figure 7), if equipped, drain the fuel tank or close the fuel shut-off valve. Otherwise, fuel can leak out and cause a fire or explosion.
2. Use pliers to squeeze tabs (B) on the clamps (C), then slide the clamps away from the fuel filter. Twist and pull the fuel lines (D) off the fuel filter.
3. Check the fuel lines for cracks or leaks. Replace if necessary.
4. Replace the fuel filter with an original equipment replacement filter.
5. Secure the fuel lines with the clamps as shown.

Note: Engines equipped with a factory mounted fuel tank may have a fuel tank strainer (E), see Figure 3.

How To Clean The Air Cooling System - Figure 10



WARNING



Running engines produce heat. Engine parts, especially muffler, become extremely hot.



Severe thermal burns can occur on contact.

Combustible debris, such as leaves, grass, brush, etc. can catch fire.

- Allow muffler, engine cylinder and fins to cool before touching.
- Remove accumulated debris from muffler area and cylinder area.

NOTICE: Do not use water to clean the engine. Water could contaminate the fuel system. Use a brush or dry cloth to clean the engine.

This is an air cooled engine. Dirt or debris can restrict air flow and cause the engine to overheat, resulting in poor performance and reduced engine life.

Use a brush or dry cloth to remove debris from the finger guard (A). Keep linkage, springs and controls (B) clean. Keep the area around and behind the muffler (C) free of any combustible debris (Figure 10). Make sure that the oil cooler fins (D) are free of dirt and debris.

Storage



WARNING



Fuel and its vapors are extremely flammable and explosive.
Fire or explosion can cause severe burns or death.

When Storing Fuel Or Equipment With Fuel In Tank

- Store away from furnaces, stoves, water heaters or other appliances that have pilot lights or other ignition sources because they can ignite fuel vapors.

Fuel System

Fuel can become stale when stored over 30 days. Stale fuel causes acid and gum deposits to form in the fuel system or on essential carburetor parts. To keep fuel fresh,

use **Briggs & Stratton Advanced Formula Fuel Treatment & Stabilizer**, available wherever Briggs & Stratton genuine service parts are sold.

For engines equipped with a FRESH START® fuel cap, use **Briggs & Stratton FRESH START®** available in a drip concentrate cartridge.

There is no need to drain gasoline from the engine if a fuel stabilizer is added according to instructions. Run the engine for 2 minutes to circulate the stabilizer throughout the fuel system before storage.

If gasoline in the engine has not been treated with a fuel stabilizer, it must be drained into an approved container. Run the engine until it stops from lack of fuel. The use of a fuel stabilizer in the storage container is recommended to maintain freshness.

Engine Oil

While the engine is still warm, change the engine oil.

Troubleshooting

Need Assistance? Go to VanguardEngines.com or call **1-800-999-9333**.

Specifications

Engine Specifications	
Model	290000
Displacement	29.23 ci (479 cc)
Bore	2.677 in (68 mm)
Stroke	2.598 in (66 mm)
Oil Capacity	46 - 48 oz (1.36 - 1.42 L)

Engine Specifications	
Model	300000
Displacement	29.23 ci (479 cc)
Bore	2.677 in (68 mm)
Stroke	2.598 in (66 mm)
Oil Capacity	46 - 48 oz (1.36 - 1.42 L)

Engine Specifications	
Model	350000
Displacement	34.78 ci (570 cc)
Bore	2.835 in (72 mm)
Stroke	2.756 in (70 mm)
Oil Capacity	46 - 48 oz (1.36 - 1.42 L)

Engine Specifications	
Model	380000
Displacement	38.26 ci (627 cc)
Bore	2.972 in (75.5 mm)
Stroke	2.756 in (70 mm)
Oil Capacity	46 - 48 oz (1.36 - 1.42 L)

Tune-up Specifications *	
Model	290000, 300000
Spark Plug Gap	0.030 in (0.76 mm)
Spark Plug Torque	180 lb-in (20 Nm)
Armature Air Gap	0.008 - 0.012 in (0.20 - 0.30 mm)
Intake Valve Clearance	0.004 - 0.006 in (0.10 - 0.15 mm)
Exhaust Valve Clearance	0.004 - 0.006 in (0.10 - 0.15 mm)

Tune-up Specifications *	
Model	350000, 380000
Spark Plug Gap	0.030 in (0.76 mm)
Spark Plug Torque	180 lb-in (20 Nm)
Armature Air Gap	0.008 - 0.012 in (0.20 - 0.30 mm)
Intake Valve Clearance	0.004 - 0.006 in (0.10 - 0.15 mm)
Exhaust Valve Clearance	0.004 - 0.006 in (0.10 - 0.15 mm)

* Engine power will decrease 3.5% for each 1,000 feet (300 meters) above sea level and 1% for each 10° F (5.6° C) above 77° F (25° C). The engine will operate satisfactorily at an angle up to 15°. Refer to the equipment operator's manual for safe allowable operating limits on slopes.

Common Service Parts

Service Part	Part Number
Air Filter - with fuel tank	393957
Air Filter - except model 380000	394018
Air Filter - model 380000	692519
Air Filter Pre-cleaner - with fuel tank	271794
Air Filter Pre-cleaner - except model 380000	272490
Air Filter Pre-cleaner - model 380000	692520
Oil - SAE 30	100028
Oil Filter - 6 cm long	492932
Oil Filter - 9 cm long	491056

Service Part	Part Number
Fuel Filter - with fuel tank	808116
Fuel Filter - with fuel pump	691035
Fuel Filter - without fuel pump	298090
Fuel Additive	5041
Resistor Spark Plug	491055
Long Life Platinum Spark Plug	5066
Spark Plug Wrench	19374
Spark Tester	19368

✓ We recommend that you see any Briggs & Stratton Authorized Dealer for all maintenance and service of the engine and engine parts.

LIMITED WARRANTY

Briggs & Stratton warrants that, during the warranty period specified below, it will repair or replace, free of charge, any part that is defective in material or workmanship or both. Transportation charges on product submitted for repair or replacement under this warranty must be borne by purchaser. This warranty is effective for and is subject to the time periods and conditions stated below. For warranty service, find the nearest Authorized Service Dealer in our dealer locator map at BRIGGSandSTRATTON.COM. The purchaser must contact the Authorized Service Dealer, and then make the product available to the Authorized Service Dealer for inspection and testing.

There is no other express warranty. Implied warranties, including those of merchantability and fitness for a particular purpose, are limited to one year from purchase, or to the extent permitted by law. All other implied warranties are excluded. Liability for incidental or consequential damages are excluded to the extent exclusion is permitted by law. Some states or countries do not allow limitations on how long an implied warranty lasts, and some states or countries do not allow the exclusion or limitation of incidental or consequential damages, so the above limitation and exclusion may not apply to you. This warranty gives you specific legal rights and you may also have other rights which vary from state to state and country to country **.

STANDARD WARRANTY TERMS * ▲

Brand/Product Type	Consumer Use	Commercial Use
Vanguard™ ■	3 years	3 years
Commercial Turf Series™	2 years	2 years
Extended Life Series™; I/C®; Intek™ I/C®; Intek™ Pro; Professional Series™ with Dura-Bore™ Cast Iron Sleeve; 850 Series™ with Dura-Bore™ Cast Iron Sleeve; Snow Series MAX™ with Dura-Bore™ Cast Iron Sleeve All Other Briggs & Stratton Engines Featuring Dura-Bore™ Cast Iron Sleeve	2 years	1 year
All Other Briggs & Stratton Engines	2 years	90 days

* These are our standard warranty terms, but occasionally there may be additional warranty coverage that was not determined at time of publication. For a listing of current warranty terms for your engine, go to BRIGGSandSTRATTON.COM or contact your Briggs & Stratton Authorized Service Dealer.

** In Australia – Our goods come with guarantees that cannot be excluded under the Australian Consumer Law. You are entitled to a replacement or refund for a major failure and for compensation for any other reasonably foreseeable loss or damage. You are also entitled to have the goods repaired or replaced if the goods fail to be of acceptable quality and the failure does not amount to a major failure. For warranty service, find the nearest Authorized Service Dealer in our dealer locator map at BRIGGSandSTRATTON.COM, or by calling 1300 274 447, or by emailing or writing to salesenquiries@briggsandstratton.com.au, Briggs & Stratton Australia Pty Ltd, 1 Moorebank Avenue, Moorebank, NSW, Australia, 2170.

▲ Home Standby Generator applications: 2 years consumer warranty only. No commercial warranty. This warranty does not apply to engines on equipment used for prime power in place of a utility. **Engines used in competitive racing or on commercial or rental tracks are not warranted.**

■ Vanguard installed on standby generators: 2 years consumer use, no warranty commercial use. Vanguard installed on utility vehicles: 2 years consumer use, 2 years commercial use. Vanguard 3-cylinder liquid cooled: see Briggs & Stratton 3/LC Engine Warranty Policy.

The warranty period begins on the date of purchase by the first retail consumer or commercial end user, and continues for the period of time stated in the table above. "Consumer use" means personal residential household use by a retail consumer. "Commercial use" means all other uses, including use for commercial, income producing or rental purposes. Once an engine has experienced commercial use, it shall thereafter be considered as a commercial use engine for purposes of this warranty.

No warranty registration is necessary to obtain warranty on Briggs & Stratton products. Save your proof of purchase receipt. If you do not provide proof of the initial purchase date at the time warranty service is requested, the manufacturing date of the product will be used to determine the warranty period.

About Your Warranty

Briggs & Stratton welcomes warranty repair and apologizes to you for being inconvenienced. Any Authorized Service Dealer may perform warranty repairs. Most warranty repairs are handled routinely, but sometimes requests for warranty service may not be appropriate. To avoid misunderstanding which might occur between the customer and the dealer, listed below are some of the causes of engine failure that the warranty does not cover.

Normal wear: Engines, like all mechanical devices, need periodic parts service and replacement to perform well. Warranty will not cover repair when normal use has exhausted the life of a part or an engine. Warranty would not apply if engine damage occurred because of misuse, lack of routine maintenance, shipping, handling, warehousing or improper installation. Similarly, warranty is void if the serial number of the engine has been removed or the engine has been altered or modified.

Improper maintenance: The life of an engine depends upon the conditions under which it operates, and the care it receives. Some applications, such as tillers, pumps and rotary mowers, are very often used in dusty or dirty conditions, which can cause what appears to be premature wear. Such wear, when caused by dirt, dust, spark plug cleaning grit, or other abrasive material that has entered the engine because of improper maintenance, is not covered by warranty.

This warranty covers engine related defective material and/or workmanship only, and not replacement or refund of the equipment to which the engine may be mounted. Nor does the warranty extend to repairs required because of:

- 1 Problems caused by parts that are not original Briggs & Stratton parts.
- 2 Equipment controls or installations that prevent starting, cause unsatisfactory engine performance, or shorten engine life. (Contact equipment manufacturer.)
- 3 Leaking carburetors, clogged fuel pipes, sticking valves, or other damage, caused by using contaminated or stale fuel.

- 4 Parts which are scored or broken because an engine was operated with insufficient or contaminated lubricating oil, or an incorrect grade of lubricating oil (check and refill when necessary, and change at recommended intervals). OIL GARD may not shut down running engine. Engine damage may occur if oil level is not properly maintained.
- 5 Repair or adjustment of associated parts or assemblies such as clutches, transmissions, remote controls, etc., which are not manufactured by Briggs & Stratton.
- 6 Damage or wear to parts caused by dirt, which entered the engine because of improper air cleaner maintenance, re-assembly, or use of a non-original air cleaner element or cartridge. At recommended intervals, clean and/or replace the filter as stated in the Operator's Manual.
- 7 Parts damaged by over-speeding, or overheating caused by grass, debris, or dirt, which plugs or clogs the cooling fins, or flywheel area, or damage caused by operating the engine in a confined area without sufficient ventilation. Clean engine debris at recommended intervals as stated in the Operator's Manual.
- 8 Engine or equipment parts broken by excessive vibration caused by a loose engine mounting, loose cutter blades, unbalanced blades or loose or unbalanced impellers, improper attachment of equipment to engine crankshaft, over-speeding or other abuse in operation.
- 9 A bent or broken crankshaft, caused by striking a solid object with the cutter blade of a rotary lawn mower, or excessive v-belt tightness.
- 10 Routine tune-up or adjustment of the engine.
- 11 Engine or engine component failure, i.e., combustion chamber, valves, valve seats, valve guides, or burned starter motor windings, caused by the use of alternate fuels such as, liquified petroleum, natural gas, gasoline formulated with ethanol greater than 10%, etc.

Warranty service is available only through Briggs & Stratton Authorized Service Dealers. Locate your nearest Authorized Service Dealer in our dealer locator map on BRIGGSandSTRATTON.COM or by calling 1-800-233-3723.

The California Air Resources Board, U.S. EPA, and Briggs & Stratton (B&S) are pleased to explain the emissions control system warranty on your Model Year 2012-2013 engine/equipment. In California, new small off-road engines and large spark ignited engines less than or equal to 1.0 liter must be designed, built, and equipped to meet the State's stringent anti-smog standards. B&S must warrant the emissions control system on your engine/equipment for the periods of time listed below provided there has been no abuse, neglect, or improper maintenance of your engine or equipment.

Your emissions control system may include parts such as the carburetor or fuel injection system, fuel tank, ignition system, and catalytic converter. Also included may be hoses, belts, connectors, sensors, and other emissions-related assemblies.

Where a warrantable condition exists, B&S will repair your engine/equipment at no cost to you including diagnosis, parts, and labor.

Manufacturer's Warranty Coverage:

Small off-road engines and large spark ignited engines less than or equal to 1.0 liter are warranted for three years. If any emissions-related part on your engine/equipment is defective, the part will be repaired or replaced by B&S.

Owner's Warranty Responsibilities:

- As the engine/equipment owner, you are responsible for the performance of the required maintenance listed in your owner's manual. B&S recommends that you retain all receipts covering maintenance on your engine/equipment, but B&S cannot deny warranty solely for the lack of receipts or your failure to ensure the performance of all scheduled maintenance.
- As the engine/equipment owner, you should however be aware that B&S may deny you warranty coverage if your engine/equipment or a part has failed due to abuse, neglect, improper maintenance, or unapproved modifications.
- You are responsible for presenting your engine/equipment to a B&S distribution center, servicing dealer, or other equivalent entity, as applicable, as soon as a problem exists. The warranty repairs should be completed in a reasonable amount of time, not to exceed 30 days. If you have any questions regarding your warranty rights and responsibilities, you should contact B&S at (414) 259-5262.

Briggs & Stratton Emissions Control Warranty Provisions

The following are specific provisions relative to your Emissions Control Warranty Coverage. It is in addition to the B&S engine warranty for non-regulated engines found in the Operator's Manual.

1. Warranted Emissions Parts

Coverage under this warranty extends only to the parts listed below (the emissions control systems parts) to the extent these parts were present on the B&S engine and/or B&S supplied fuel system.

- Fuel Metering System
 - Cold start enrichment system (soft choke)
 - Carburetor and internal parts
 - Fuel pump
 - Fuel line, fuel line fittings, clamps
 - Fuel tank, cap and tether
 - Carbon canister
- Air Induction System
 - Air cleaner
 - Intake manifold
 - Purge and vent line
- Ignition System
 - Spark plug(s)
 - Magneto ignition system
- Catalyst System
 - Catalytic converter
 - Exhaust manifold
 - Air injection system or pulse valve
- Miscellaneous Items Used in Above Systems
 - Vacuum, temperature, position, time sensitive valves and switches
 - Connectors and assemblies

2. Length of Coverage

For a period of three years from date of original purchase, B&S warrants to the original purchaser and each subsequent purchaser that the engine is designed, built, and equipped so as to conform with all applicable regulations adopted by the Air Resources Board; that it is free from defects in material and workmanship that could cause the failure of a warranted part; and that it is identical in all material respects to the engine described in the manufacturer's application for certification. The warranty period begins on the date the engine is originally purchased.

The warranty on emissions-related parts is as follows:

- Any warranted part that is not scheduled for replacement as required maintenance in the owner's manual supplied, is warranted for the warranty period stated above. If any such part fails during the period of warranty coverage, the part will be repaired or replaced by B&S at no charge to the owner. Any such part repaired or replaced under the warranty will be warranted for the remaining warranty period.
 - Any warranted part that is scheduled only for regular inspection in the owner's manual supplied, is warranted for the warranty period stated above. Any such part repaired or replaced under warranty will be warranted for the remaining warranty period.
 - Any warranted part that is scheduled for replacement as required maintenance in the owner's manual supplied, is warranted for the period of time prior to the first scheduled replacement point for that part. If the part fails prior to the first scheduled replacement, the part will be repaired or replaced by B&S at no charge to the owner. Any such part repaired or replaced under warranty will be warranted for the remainder of the period prior to the first scheduled replacement point for the part.
 - Add on or modified parts that are not exempted by the Air Resources Board may not be used. The use of any non exempted add on or modified parts by the owner will be grounds for disallowing a warranty claim. The manufacturer will not be liable to warrant failures of warranted parts caused by the use of a non exempted add on or modified part.
3. Consequential Coverage
- Coverage shall extend to the failure of any engine components caused by the failure of any warranted emissions parts.
4. Claims and Coverage Exclusions

Warranty claims shall be filed according to the provisions of the B&S engine warranty policy. Warranty coverage does not apply to failures of emissions parts that are not original equipment B&S parts or to parts that fail due to abuse, neglect, or improper maintenance as set forth in the B&S engine warranty policy. B&S is not liable for warranty coverage of failures of emissions parts caused by the use of add-on or modified parts.

Look For Relevant Emissions Durability Period and Air Index Information On Your Small Off-Road Engine Emissions Label

Engines that are certified to meet the California Air Resources Board (CARB) small off-road Emissions Standard must display information regarding the Emissions Durability Period and the Air Index. Briggs & Stratton makes this information available to the consumer on our emissions labels. The engine emissions label will indicate certification information.

The **Emissions Durability Period** describes the number of hours of actual running time for which the engine is certified to be emissions compliant, assuming proper maintenance in accordance with the Operating & Maintenance Instructions. The following categories are used:

Moderate:
Engine is certified to be emissions compliant for 125 hours of actual engine running time.

Intermediate:
Engine is certified to be emissions compliant for 250 hours of actual engine running time.

Extended:
Engine is certified to be emissions compliant for 500 hours of actual engine running time. For example, a typical walk-behind lawn mower is used 20 to 25 hours per year. Therefore, the **Emissions Durability Period** of an engine with an **intermediate** rating would equate to 10 to 12 years.

Briggs & Stratton engines are certified to meet the United States Environmental Protection Agency (USEPA) Phase 2 or Phase 3 emissions standards. The Emissions Compliance Period referred to on the Emissions Compliance label indicates the number of operating hours for which the engine has been shown to meet Federal emissions requirements.

For engines less than 225 cc displacement.
Category C = 125 hours, Category B = 250 hours, Category A = 500 hours

For engines of 225 cc or more displacement.
Category C = 250 hours, Category B = 500 hours, Category A = 1000 hours

Información General

Este manual contiene información de seguridad para que usted tome conciencia de los peligros y riesgos asociados con los motores, y cómo evitarlos. También contiene instrucciones para el uso y cuidado apropiados del motor. Ya que Briggs & Stratton Corporation no conoce necesariamente cuál equipo impulsará este motor, es importante que usted lea y entienda estas instrucciones y las instrucciones del equipo. **Guarde estas instrucciones para consultarlas en el futuro.**

Para conseguir repuestos o asistencia técnica registre los números de modelo, tipo y código de su motor junto con la fecha de compra. Estos números los encuentra localizados en su motor (consulte la página de **Características y Controles**).

Fecha de compra: _____

MES/DIA/AÑO

Modelo del motor: _____

Modelo:

Tipo:

Código:


Clasificación de Potencia


La clasificación de potencia total para los modelos individuales de motores a gas se etiqueta de acuerdo con el código J1940 de SAE (Sociedad de Ingenieros Automotrices) (Procedimiento de Clasificación de Potencia & Torque del Motor Pequeño) y la clasificación de desempeño se ha obtenido y se ha corregido de acuerdo con SAE J1995 (Revisión 2002-05). Los valores de Torque se derivan a 3060 RPM; los valores de potencia se derivan a 3600 RPM. Las curvas de potencia bruta se puede ver en www.BRIGGSandSTRATTON.COM. Los valores netos de potencia se toman con escape y filtro de aire instalado mientras que los valores de potencia total se recogen sin estos accesorios. La potencia total real del motor puede ser mayor que la potencia neta del motor y estar afectada por, entre otras cosas, condiciones ambientales de operación y variabilidad de motor a motor. Dado el amplio conjunto de productos en los cuales son puestos los motores, el motor a gas podría no desarrollar la potencia total nominal cuando sea usado en una parte dada del equipo acoplado. Esta diferencia se debe a una variedad de factores que incluyen, sin limitarse a, la avierdad de componentes del motor (filtro de aire, sistema de escape, sistema de carga, sistema de enfriamiento, carburador, bomba de combustible, etc.), limitaciones de la aplicación, condiciones ambientales de operación (temperatura, humedad, altitud), y a la variabilidad de motor a motor. Debido a las limitaciones de fabricación y capacidad Briggs & Stratton puede sustituir un motor de potencia nominal más alta por esta Serie de motor.


Seguridad del Operario


SÍMBOLOS DE SEGURIDAD Y CONTROL



El símbolo de aviso de seguridad  se utiliza para identificar la información de seguridad relacionada con los peligros que pueden ocasionar lesiones personales. Se señala con una palabra (PELIGRO, ADVERTENCIA o PRECAUCIÓN) con el símbolo de aviso para indicar la probabilidad de una lesión y su gravedad potencial. Además, un símbolo de peligro puede ser utilizado para representar el tipo de peligro.

 **PELIGRO** indica un peligro que si no es evitado, **ocasionará la muerte o heridas graves.**

 **ADVERTENCIA** indica un peligro que si no es evitado, **podría ocasionar la muerte o heridas graves.**

 **PRECAUCIÓN** indica un peligro que, si no es evitado, **podría ocasionar lesiones menores o moderadas.**

NOTIFICACIÓN indica una situación que **podría ocasionar daños al producto.**

ADVERTENCIA

Ciertos componentes en este producto y sus accesorios relacionados contienen químicos que el Estado de California considera que ocasionan cáncer, defectos congénitos y otros daños en el aparato reproductivo. Lávese las manos después de manejarlos.

ADVERTENCIA

La descarga de escape que expela este motor por este producto contiene químicos conocidos para el Estado de California que pueden ocasionar cáncer, defectos de nacimiento u otros daños que pueden ser perjudiciales para la reproducción.


ADVERTENCIA

Los motores Briggs & Stratton no están diseñados ni deben ser utilizados para impulsar karts para diversión/recreo, vehículos para niños, recreacionales o vehículos deportivos todo terreno (ATVs), bicicletas motorizadas, aerodeslizadores, productos para aviación o vehículos para uso en eventos competitivos no autorizados por Briggs & Stratton. Para información acerca de productos para carreras de competencia refiérase a www.briggsracing.com. Para la utilización con ATVs utilitarios y "lado a lado," por favor póngase en contacto con Briggs & Stratton Engine Application Center, 1-866-927-3349. La aplicación inadecuada del motor puede tener como resultado lesiones graves o incluso la muerte.

NOTIFICACIÓN: Este motor fue despachado de Briggs & Stratton sin aceite. Antes de darle arranque al motor, asegúrese de agregar aceite de acuerdo con las instrucciones de este manual. Si da arranque al motor sin que éste tenga aceite, se dañará hasta tal punto que no podrá ser reparado y no será cubierto por la garantía.

ADVERTENCIA

 **El combustible y sus vapores son extremadamente inflamables y explosivos.**

 **Un incendio o una explosión pueden causar graves quemaduras o la muerte.**

Quando Aprovechone con Combustible

- Apague el motor y deje que el motor se enfríe por lo menos 2 minutos antes de remover la tapa de combustible.
- Llene el tanque de combustible en exteriores o en un área bien ventilada.
- No llene demasiado el tanque de combustible. Para permitir la expansión del combustible no llene por encima de la parte inferior del cuello del tanque de combustible
- Mantenga el combustible a distancia de chispas, llamas abiertas, testigos piloto, calor y otras fuentes de encendido.
- Compruebe con frecuencia si existen grietas o fugas en las mangueras de combustible, el tanque, la tapa y en los accesorios. Cámbielos si es necesario
- Si se derramó combustible, espere hasta que se haya evaporado antes de darle arranque al motor.

Quando le de Arranque al motor

- Asegúrese que la bujía, el mofle, la tapa de combustible y el filtro de aire (si está equipado) estén en su lugar, y firmemente asegurados.
- No haga girar el motor si removió la bujía.
- Si el motor se inunda, ajuste el estrangulador (si está equipado) en la posición OPEN/RUN, coloque el acelerador (si está equipado) en la posición FAST y haga girar el motor hasta que de arranque.

Quando Opere El Equipo

- No incline el motor ni el equipo a un ángulo que pueda ocasionar derrames de combustible.
- No use el estrangulador para detener el motor.
- Nunca arranque u opere el motor si removió el conjunto del filtro de aire (si está equipado) o el filtro de aire (si está equipado).

Quando cambie el aceite

- Si drena el aceite desde el tubo superior de llenado de aceite, el tanque de combustible debe estar vacío o de lo contrario podría presentarse una fuga de combustible que podría ocasionar un incendio o una explosión.

Al inclinar la unidad para trabajos de mantenimiento

- Al realizar trabajos de mantenimiento que requieran inclinar la unidad, el tanque de combustible debe estar desocupado o podría haber una fuga de combustible y generar un incendio o una explosión.

Quando Transporte el Equipo

- Transpórtelo con el tanque de combustible VACÍO o con la válvula de paso de combustible en la posición OFF.

Quando Almacene el Combustible o el Equipo con Combustible en el Tanque

- Almacene a distancia de hornos, estufas, calentadores de agua u otros aparatos que utilicen testigos piloto u otras fuentes de encendido ya que estos pueden encender los vapores combustibles.



ADVERTENCIA



Dar arranque al motor crea chispeo.
El chispeo puede encender los gases inflamables cercanos.
Podría ocurrir una explosión o un incendio.



- Si hay una fuga de gas natural o gas propano LP en el área, no le de arranque al motor.
- No use líquidos de arranque presurizado ya que los vapores son inflamables.



ADVERTENCIA



Los motores emiten monóxido de carbono, un gas venenoso que carece de olor y de color.

Respirar monóxido de carbono puede ocasionar náuseas, desmayos o la muerte.

- Dele arranque al motor y opérela en exteriores.
- No le de arranque al motor ni lo opere en un área encerrada, aun cuando las puertas o las ventanas se encuentren abiertas.



ADVERTENCIA



La retracción rápida de la cuerda de arranque (contragolpe) le halará la mano y el brazo hacia el motor más rápido de lo que usted la pueda dejar ir.

Podrían ocasionarse roturas de huesos, fracturas, moretones o torceduras.

- Cuando le de arranque al motor, hale lentamente la cuerda hasta que se sienta resistencia y después hálela rápidamente para evitar un contragolpe.
- Remueva todas las cargas externas del equipo/motor antes de darle arranque al motor.
- Los componentes de acople directo del equipo tal como, pero sin limitarse a, cuchillas, impulsores, poleas, dientes de piñones, etc. se deben asegurar firmemente.



ADVERTENCIA



Las partes rotantes pueden tener contacto o enredar las manos, los pies, el cabello, la ropa o los accesorios.

Puede producirse una traumática amputación o una grave laceración.

- Opere el equipo con los protectores en su lugar.
- Mantenga sus manos y sus pies a distancia de las partes rotantes.
- Recójase el cabello largo y quítese las joyas.
- No use ropa floja, tiras que cuelguen ni artículos que puedan ser agarrados.



ADVERTENCIA



El funcionamiento de los motores produce calor. Las partes de los motores, especialmente el mofle, se calientan demasiado.

Pueden ocurrir graves quemaduras a causa de su contacto.



Desechos combustibles, tal como hojas, grama, maleza, etc. pueden alcanzar a encenderse.

- Deje que el mofle, el cilindro y las aletas del motor se enfríen antes de tocarlos.
- Remueva los desechos acumulados en el área del mofle y en el área del cilindro.
- Usar u operar el motor en un terreno que contenga bosques, arbustos o pasto es una violación al Código de Recursos Públicos de California, Sección 4442, a menos que el sistema de escape esté equipado con un atrapachispas, según se define en la Sección 4442, mantenido en excelente estado de funcionamiento. Otros estados o jurisdicciones federales pueden tener leyes similares. Contacte al fabricante, comerciante o distribuidor del equipo original para obtener un atrapachispas diseñado para el sistema de escape instalado en este motor.



ADVERTENCIA



Un chispeo involuntario puede producir un incendio o una descarga eléctrica.



Una puesta en marcha involuntaria puede ocasionar un enredo, una amputación traumática o una laceración.



Peligro de incendio

Antes de hacer ajustes o reparaciones:

- Desconecte el cable de la bujía y mántegalo a distancia de la bujía.
- Desconecte la batería en la terminal negativa (únicamente motores con arranque eléctrico).
- Use únicamente las herramientas correctas.
- No manipule los resortes del regulador, las varillas u otras partes para incrementar la velocidad del motor.
- Los repuestos deben ser del mismo diseño y ser instalados en la misma posición que tenían las partes originales. Es posible que otros repuestos no funcionen tan bien, dañen la unidad y hasta pueden ocasionar lesiones.
- No golpee la volante con un martillo ni con un objeto pesado ya que la volante podría astillarse más adelante durante la operación.

Cuando compruebe chispa:

- Utilice un probador aprobado.
- No compruebe chispa si removió la bujía.

Características y Controles

Compare la ilustración **1** con su motor para que se familiarice con la ubicación de las diversas características y controles.

A. Identificación del motor
Modelo, Tipo y Código. Ejemplo:

- B.** Bujía
- C.** Filtro de aire (sin tanque de combustible)
- D.** Filtro de aire (con tanque de combustible)
- E.** Varilla Indicadora Nivel de Aceite
- F.** Llenado de Aceite
- G.** Filtro de Aceite (opcional)
- H.** Tapón Drenaje Aceite
- I.** Sensor de Presión de Aceite
- J.** Protector de Dedos
- K.** Arranque eléctrico
- L.** Arranque retráctil (opcional)
- M.** Carburador
- N.** Mofle (opcional)
- O.** Bomba de Combustible
- P.** Suiche de Arranque *
- Q.** Control del Acelerador *
- R.** Control del estrangulador *
- S.** Filtro de Combustible (opcional)
- T.** Tanque de Combustible (opcional)
- U.** Cierre de combustible (opcional) *
- V.** Suiche de parada (opcional) *
- W.** Enfriador del aceite (opcional)

* Algunos motores y equipos tienen controles remotos. Vea el manual del equipo para la ubicación y operación de los controles remotos.

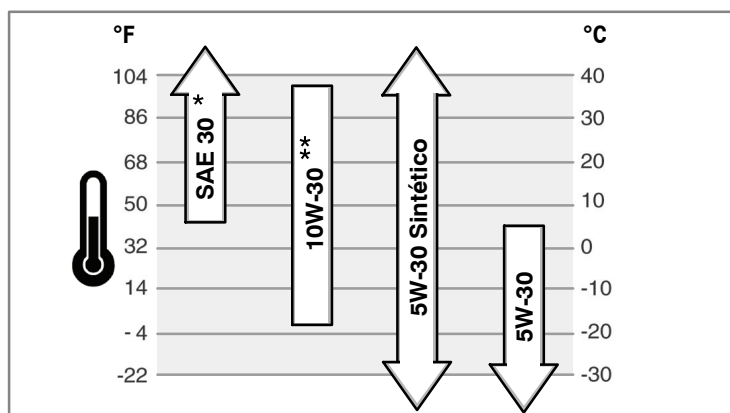
Operación

Capacidad de aceite (vea la sección de **Especificaciones**)

Recomendaciones de Aceite

Se recomienda el uso de aceites Certificados por la Garantía Briggs & Stratton para mejor rendimiento. Otros aceites detergentes de alta calidad son aceptables si están clasificados para servicio SF, SG, SH, SJ o superior. No utilice aditivos especiales.

Las temperaturas exteriores determinan la viscosidad del aceite apropiada para el motor. Utilice el cuadro para seleccionar la mejor viscosidad para el rango de temperatura exterior esperado.



* El uso de aceite SAE 30 a temperaturas inferiores a 40°F (4°C) producirá dificultad de arranque.

** El uso de aceite 10W-30 a temperaturas superiores a 80°F (27°C) puede producir un incremento en el consumo de aceite. Compruebe el nivel de aceite con mayor frecuencia.

Cómo verificar/Añadir aceite - Figura 2

Antes de aprovisionar con aceite o de comprobar el nivel de aceite

- Coloque el motor a nivel.
- Limpie el área de llenado de aceite de todo desecho.

es

1. Remueva la varilla indicadora de nivel de aceite (**A**) y límpiela con un trapo limpio (Figura 2).
2. Inserte completamente la varilla indicadora de nivel de aceite.
3. Remueva la varilla indicadora de nivel de aceite y compruebe el nivel de aceite. El aceite debe llegar arriba del indicador de (**B**) en la varilla indicadora de nivel de aceite.
4. Si el nivel de aceite es bajo, añada aceite lentamente por dentro del tubo de llenado de aceite (**C**). **No llene excesivamente.** Después de aprovisionar con aceite, espere un minuto y después vuelva a comprobar el nivel de aceite.
5. Inserte completamente la varilla indicadora de nivel de aceite.

Presión de Aceite

Si la presión de aceite es muy baja, un suiche de presión (si está equipado) detendrá el motor o activará un dispositivo de advertencia en el equipo. Si esto ocurre, detenga el motor y compruebe el nivel de aceite con la varilla indicadora de nivel de aceite.

Si el nivel de aceite está por debajo de la marca ADD, agregue aceite hasta que alcance la marca FULL. De arranque al motor y compruebe que tenga la presión correcta antes de continuar la operación.

Si el nivel de aceite está entre las marcas ADD y FULL, **no de arranque** al motor. Contacte un Distribuidor Autorizado Briggs & Stratton para corregir el problema de presión de aceite.

Recomendaciones para el Combustible

El combustible debe cumplir con estos requerimientos:

- Gasolina limpia, fresca y libre de plomo.
- Un mínimo de 87 octanos/87 AKI (91 RON). Para uso a alta altitud vea a continuación.
- El uso de gasolina hasta con el 10% de ethanol (gasohol) es aceptable.

PRECAUCIÓN: No use gasolina que no haya sido aprobada, tal como E15 ó E85. No mezcle el aceite con la gasolina, ni modifique el motor para operarlo con combustibles alternos. La utilización de combustibles inapropiados dañará los componentes del motor e **invalidará la garantía del motor.**

Para proteger el sistema de combustible de la formación de depósitos de goma, mézclele un estabilizador de combustible cuando le añada combustible. Consulte el aparte: **Bodegaje.** Todos los combustibles no son los mismos. Si se presentan problemas de arranque o de rendimiento cambie de proveedor de combustible o de marca. Este motor está certificado para operar con gasolina. El sistema de control de emisiones para este motor es EM (Modificaciones del Motor).

Alta Altitud

A alturas superiores a 5,000 pies (1524 metros), es aceptable una gasolina con un mínimo de 85 octanos/85 AKI (89 RON). Es necesario realizar ajustes para uso en altura para seguir cumpliendo con los límites de emisiones. Si no se realiza este ajuste, podría disminuir el desempeño y aumentar el consumo de combustible y las emisiones. Para obtener información sobre el ajuste para uso en altura, consulte con un Distribuidor de Servicio Autorizado Briggs & Stratton.

No se recomienda operar el motor a altitudes inferiores a 2.500 pies (762 metros) con el kit para alta altitud.

Cómo agregar combustible - Figura 3



ADVERTENCIA



El combustible y sus vapores son extremadamente inflamables y explosivos.



Un incendio o una explosión pueden causar graves quemaduras o la muerte.

Cuando Aprovisione con Combustible

- Apague el motor y deje que el motor se enfríe por lo menos 2 minutos antes de remover la tapa de combustible.
- Llene el tanque de combustible en exteriores o en un área bien ventilada.
- No llene demasiado el tanque de combustible. Para permitir la expansión del combustible no llene por encima de la parte inferior del cuello del tanque de combustible
- Mantenga el combustible a distancia de chispas, llamas abiertas, testigos piloto, calor y otras fuentes de encendido.
- Compruebe con frecuencia si existen grietas o fugas en las mangueras de combustible, el tanque, la tapa y en los accesorios. Cámbielos si es necesario
- Si se derramó combustible, espere hasta que se haya evaporado antes de darle arranque al motor.

1. Limpie el área de la tapa de combustible de polvo y desechos. Retire la tapa de combustible (**A**). (Figura 3).
2. Llene el tanque de combustible (**B**) con combustible. Para permitir la expansión de la gasolina, no lo llene por encima de la parte inferior del cuello del tanque de combustible (**C**).
3. Re-instale la tapa de combustible.

Cómo Darle Arranque al Motor - Figura 4



ADVERTENCIA



La retracción rápida de la cuerda de arranque (contragolpe) le halará la mano y el brazo hacia el motor más rápido de lo que usted la pueda dejar ir.

Podrían ocasionarse roturas de huesos, fracturas, moretones o torceduras.

- Cuando le de arranque al motor, hale lentamente la cuerda hasta que se sienta resistencia y después hálela rápidamente para evitar un contragolpe.



ADVERTENCIA



El combustible y sus vapores son extremadamente inflamables y explosivos.



Un incendio o una explosión pueden causar graves quemaduras o la muerte.

Cuando le de Arranque al motor

- Asegúrese que la bujía, el mofle, la tapa de combustible y el filtro de aire (si está equipado) estén en su lugar, y firmemente asegurados.
- No haga girar el motor si removió la bujía.
- Si el motor se inunda, ajuste el estrangulador (si está equipado) en la posición OPEN/RUN, coloque el acelerador (si está equipado) en la posición FAST y haga girar el motor hasta que de arranque.



ADVERTENCIA



Los motores emiten monóxido de carbono, un gas venenoso que carece de olor y de color.



Respirar monóxido de carbono puede ocasionar náuseas, desmayos o la muerte.


- Dele arranque al motor y opérelo en exteriores.
- No le de arranque al motor ni lo opere en un área encerrada, aun cuando las puertas o las ventanas se encuentren abiertas.

NOTIFICACIÓN: Este motor fue despachado de Briggs & Stratton sin aceite. Antes de darle arranque al motor, asegúrese de aprovisionar con aceite de acuerdo con las instrucciones de este manual. Si le da arranque al motor sin que esté provisto de aceite, éste se dañará más allá de la reparación y no será cubierto por la garantía.

Nota: Algunos motores y equipos tienen controles remotos. Vea el manual del equipo para la ubicación y operación de los controles remotos.

1. Compruebe el nivel de aceite. Vea la sección **Cómo Comprobar/Aprovisionar con Aceite**.
2. Asegúrese de que los controles de accionamiento del equipo, si está equipado, se encuentren desengranados.
3. Gire la válvula de cierre de combustible (A), si está equipado, hacia la posición on (Figura 4).
4. Mueva el suiche de parada (F), si está equipado, a la posición on.

5. Mueva el control del acelerador (B) hacia la posición fast . Opere el motor con el control del acelerador en la posición fast .

6. Mueva la palanca del estrangulador (C) hacia la posición choke .

Nota: Generalmente el estrangulador no es necesario cuando se enciende un motor caliente.

7. **Arranque retráctil:** Gire el suiche de llave (D), si está equipado, hacia la posición run.

8. **Arranque retráctil:** Sostenga firmemente la manija de la cuerda de arranque (E). Jale lentamente la cuerda de arranque hasta que se sienta resistencia, después júlela rápidamente.

Nota: Si el motor no arranca después de varios intentos, visite VanguardEngines.com o llame al 1-800-999-9333 (en los EE.UU.).




ADVERTENCIA:

La retracción rápida de la cuerda de arranque (contragolpe) le halará la mano y el brazo hacia el motor más rápido de lo que usted la pueda dejar ir. Podrían ocasionarse roturas de huesos, fracturas, moretones o torceduras. Cuando le de arranque al motor, hale lentamente la cuerda hasta que se sienta resistencia y después hálela rápidamente para evitar un contragolpe.

9. **Arranque eléctrico:** Gire el suiche del arranque eléctrico (D) hacia la posición on/Start.

Nota: Si el motor no arranca después de varios intentos, visite VanguardEngines.com o llame al 1-800-999-9333 (en los EE.UU.).

NOTIFICACIÓN: Para prolongar la duración del arrendador, utilice ciclos de arranque cortos (máximo de cinco segundos). Espere un minuto entre ciclos de arranque.

10. A medida que el motor se calienta, mueva el control del estrangulador (C) a la posición run .

Cómo Detener el Motor - Figura 4



ADVERTENCIA




El combustible y sus vapores son extremadamente inflamables y explosivos.



Un incendio o una explosión pueden causar graves quemaduras o la muerte.

- No use el estrangulador para detener el motor.

1. Mueva el control del acelerador (B) hacia la posición slow , gire el suiche de llave (D) hacia la posición off (Figura 4). Retire la llave y guárdela en un lugar seguro fuera del alcance de los niños.

2. Mueva el suiche de parada (F), si está equipado, a la posición off.

3. Después de que se detenga el motor, gire la válvula de cierre de combustible (A), si está equipado, a la posición cerrada.

Mantenimiento

Recomendamos contactar un Distribuidor Autorizado Briggs & Stratton para todo lo relacionado con el mantenimiento y el servicio del motor y sus partes.

NOTIFICACIÓN: Todos los componentes utilizados para fabricar este motor deben mantenerse en su lugar para una correcta operación.



ADVERTENCIA: Al realizar trabajos de mantenimiento que requieran inclinar la unidad, el tanque de combustible debe estar desocupado o podría haber una fuga de combustible y generar un incendio o una explosión.

Control de Emisiones

El mantenimiento, cambio o reparación de los dispositivos y sistemas del control de emisiones pueden ser realizados por cualquier establecimiento o persona que repare motores todo terreno. Sin embargo, para obtener servicio de control de emisiones "sin costo", la labor debe ser realizada por un distribuidor autorizado por la fábrica. Vea la Garantía de Emisiones.



ADVERTENCIA



Un chispeo involuntario puede producir un incendio o una descarga eléctrica.



Una puesta en marcha involuntaria puede ocasionar un enredo, una amputación traumática o una laceración.



Peligro de incendio

Antes de hacer ajustes o reparaciones:

- Desconecte el cable de la bujía y mántegalo a distancia de la bujía.
- Desconecte la batería en la terminal negativa (únicamente motores con arranque eléctrico).
- Use únicamente las herramientas correctas.
- No manipule los resortes del regulador, las varillas u otras partes para incrementar la velocidad del motor.
- Los repuestos deben ser del mismo diseño y ser instalados en la misma posición que tenían las partes originales. Es posible que otros repuestos no funcionen tan bien, dañen la unidad y hasta pueden ocasionar lesiones.
- No golpee la volante con un martillo ni con un objeto pesado ya que la volante podría astillarse más adelante durante la operación.

Cuando compruebe chispa:

- Utilice un probador aprobado.
- No compruebe chispa si removió la bujía.

Cuadro de Mantenimiento

Las Primeras 5 horas

- Cambie aceite

Cada 8 Horas o Diariamente

- Compruebe el nivel de aceite del motor.
- Limpie el área alrededor del mofle y los controles

Cada 100 horas o anualmente

- Limpie o cambie el filtro de aire *
- Limpie el pre-filtro (si está equipado) *
- Cambie el aceite y el filtro del motor
- Cambie la bujía
- Compruebe el mofle y el atrapachispas

Cada 250 horas o anualmente

- Compruebe la tolerancia de la válvula. Ajuste si es necesario.

Cada 400 horas o anualmente

- Cambie el filtro de aire
- Reemplace el filtro de combustible
- Limpie el sistema de enfriamiento de aire *
- Limpie las aletas del refrigerador de aceite *

* Limpie con mayor frecuencia en condiciones de mucho polvo o cuando el aire contenga muchas partículas.

Ajuste del Carburador

Nunca le haga ajustes al carburador. El carburador ha sido ajustado de fábrica para operar eficientemente bajo la mayoría de las condiciones. Sin embargo, si se requiere que éste sea ajustado, consulte cualquier Distribuidor de Servicio Autorizado Briggs & Stratton.

NOTIFICACIÓN: El fabricante del equipo en el cual es instalado el motor especifica la velocidad máxima en la cual será operado el motor. **No exceda** esta velocidad.

Cómo reemplazar la bujía - Figura 5

Compruebe el entrehierro (A, Figura 5) con un calibrador de alambre (B). Si es necesario, reajuste el entrehierro. Instale y apriete la bujía al par de apriete recomendado. Para el ajuste del entrehierro o el par de apriete, consulte la sección de **Especificaciones**.

Nota: En algunas áreas, las leyes locales requieren el uso de una bujía con resistencia para suprimir las señales de encendido. Si este motor vino originalmente equipado con una bujía con resistencia, utilice el mismo tipo de bujía para el cambio.

Inspección del Mofle y el Atrapachispas - Figura 6



ADVERTENCIA



El funcionamiento de los motores produce calor. Las partes de los motores, especialmente el mofle, se calientan demasiado.

Pueden ocurrir graves quemaduras a causa de su contacto.



Desechos combustibles, tal como hojas, grama, maleza, etc. pueden alcanzar a encenderse.

- Deje que el mofle, el cilindro y las aletas del motor se enfríen antes de tocarlos.
- Remueva los desechos acumulados en el área del mofle y en el área del cilindro.
- Constituye una violación del Código de Recursos Públicos de California, Sección 4442, el utilizar u operar el motor en terrenos cubiertos con bosques, maleza o grama, a menos que el sistema de escape esté equipado con un atrapachispas, tal como se define en la Sección 4442, mantenido en correcto orden de funcionamiento. Otros estados pueden tener leyes similares. Póngase en contacto con el fabricante, minorista o distribuidor del equipo original para obtener un atrapachispas diseñado para el sistema de escape instalado en este motor.

Remueva los desechos acumulados en el área del mofle y en el área del cilindro. Inspeccione el mofle (A, Figura 6) en busca de grietas, corrosión u otros daños. Remueva el atrapachispas (B), en caso de estar equipado, e inspeccione en búsqueda de daños u obstrucciones de carbón. Si se encuentran daños, instale los repuestos antes de operar.



ADVERTENCIA: Los repuestos deben ser del mismo diseño y ser instalados en la misma posición que tenían las partes originales. Es posible que otros repuestos no funcionen tan bien, dañen la unidad y hasta pueden ocasionar lesiones.

Cómo cambiar el aceite - Figura 8 9

El aceite usado es un producto de desecho peligroso y se debe disponer de éste adecuadamente. No lo descarte en la basurera de la casa. Verifique con sus autoridades locales, con el centro de servicio, o con su distribuidor para obtener información acerca de las facilidades seguras para su destrucción/reciclaje.

Remoción del Aceite

1. Con el motor apagado pero aún caliente, desconecte el cable de la bujía (A) y manténgalo a distancia de la bujía (Figura 8).
2. Remueva el tapón de drenaje de aceite (B, Figura 9). Drene el aceite a un recipiente aprobado.
3. Después de haber drenado el aceite del motor, instale y apriete el tapón de drenaje de aceite.

Cambie el Filtro de Aceite (si está equipado)

Algunos modelos están equipados con un filtro de aceite. Para saber cada cuánto requiere ser reemplazado, consulte el cuadro de **Mantenimiento**.

1. Drene el aceite del motor. Consulte la sección **Remoción del Aceite**.
2. Remueva el filtro de aceite (C) y deséchelo de manera adecuada. Vea la Figura 9.
3. Antes de instalar el nuevo filtro de aceite, lubrique un poco el empaque del filtro de aceite con aceite fresco y limpio.
4. Instale manualmente el filtro de aceite de hasta que el empaque haga contacto con el adaptador del filtro de aceite, luego apriete el filtro de aceite dándole 1/2 a 3/4 de giro.
5. Añada aceite. Consulte la sección **Aprovisionamiento de Aceite**.
6. De arranque y opere el motor. A medida que el motor se caliente compruebe si hay fugas de aceite.
7. Detenga el motor y compruebe el nivel de aceite. El aceite debe llegar arriba del indicador de (F) en la varilla indicadora de nivel de aceite (Figura 8).

Aprovisionamiento de Aceite

- Coloque el motor a nivel.
 - Limpie el área de llenado de aceite de todo desecho.
 - Consulte la sección de **Especificaciones** para la capacidad de aceite.
1. Remueva la varilla indicadora de nivel de aceite (D) y límpiela con un trapo limpio (Figura 8).
 2. Vierta el aceite lentamente por dentro del tubo de llenado de aceite (E). **No lo llene excesivamente.** Después de aprovisionar con aceite, espere un minuto y vuelva a comprobar el nivel de aceite.
 3. Coloque y ajuste la varilla indicadora.
 4. Remueva la varilla indicadora de nivel de aceite y compruebe el nivel de aceite. El aceite debe llegar arriba del indicador de (F) en la varilla indicadora de nivel de aceite.
 5. Coloque y ajuste la varilla indicadora.

Cómo mantener el filtro de aire - Figura 11 12



ADVERTENCIA



El combustible y sus vapores son extremadamente inflamables y explosivos.



Un incendio o una explosión pueden causar graves quemaduras o la muerte.

- Nunca arranque u opere el motor si removió el conjunto del filtro de aire (si está equipado) o el filtro de aire (si está equipado).

NOTIFICACIÓN: No use aire a presión ni solventes para limpiar el filtro. El aire a presión puede dañar el filtro y los solventes pueden disolverlo.

Se muestran dos tipos de sistemas de filtro del aire. Consulte el **Cuadro de Mantenimiento** para los requerimientos de servicio.

1. **Modelos sin tanque de combustible:** Abra los seguros (A) y remueva la tapa (B). Vea la Figura 11.
2. **Modelos con tanque de combustible:** Remueva la perilla (C) y la tapa (B). Vea la Figura 12.
3. Remueva la tuerca (D) y el retenedor (E). Vea la Figura 11 y 12.
4. Remueva el filtro de aire (F).
5. Remueva el pre-filtro (G), si está equipado, del filtro de aire.
6. Para aflojar los desechos, golpee suavemente el filtro sobre una superficie dura. Si el filtro está excesivamente sucio, reemplácelo por un filtro nuevo.
7. Lave el pre-filtro en detergente líquido y agua. Luego permita que se seque completamente al aire. **No** aceite el pre-filtro.

8. Instale el pre-filtro seco sobre el filtro de aire.
9. Instale el filtro de aire y asegúrelo con el retenedor y la tuerca.
10. Instale y asegure la cubierta.

Cómo reemplazar el filtro de combustible - Figura 7



ADVERTENCIA



El combustible y sus vapores son extremadamente inflamables y explosivos.

Un incendio o una explosión pueden causar graves quemaduras o la muerte.

- Mantenga el combustible a distancia de chispas, llamas abiertas, testigos piloto, calor y otras fuentes de encendido.
- Compruebe con frecuencia si existen grietas o fugas en las mangueras de combustible, el tanque, la tapa y en los accesorios. Cámbielos si es necesario.
- Antes de reemplazar el filtro, drene el tanque de combustible o cierre la válvula de paso de combustible.
- Los repuestos deben ser iguales e instalarse en la misma posición que tenían las partes originales.
- Si se derramó combustible, espere hasta que se haya evaporado antes de darle arranque al motor.

1. Antes de reemplazar el filtro de combustible (A, Figura 7), si está equipado, drene el tanque de combustible o cierre la válvula de paso de combustible. De no hacerlo, se podría presentar una fuga de combustible y generar un incendio o una explosión.
2. Utilice alicates para agarrar las pestañas (B) en las abrazaderas (C), luego aleje las abrazaderas del filtro de combustible. Gire y hale las mangueras de combustible (D) separándolas del filtro de combustible.
3. Revise las mangueras de combustible para comprobar si hay grietas o fugas. Reemplácelas en caso de ser necesario.
4. Reemplace el filtro de combustible con un filtro de repuesto genuino.
5. Asegure las mangueras de combustible con las abrazaderas según lo indicado.

Nota: Los motores equipados con una tanque de combustible instalado en la fábrica pueden tener un filtro del tanque de combustible (E), vea la Figura 3.

Cómo Limpiar el Sistema de Enfriamiento de Aire - Figura 10



ADVERTENCIA



El funcionamiento de los motores produce calor. Las partes de los motores, especialmente el mofle, se calientan demasiado.

Pueden ocurrir graves quemaduras a causa de su contacto.



Desechos combustibles, tal como hojas, grama, maleza, etc. pueden alcanzar a encenderse.

- Deje que el mofle, el cilindro y las aletas del motor se enfríen antes de tocarlos.
- Remueva los desechos acumulados en el área del mofle y en el área del cilindro.

NOTIFICACIÓN: No use agua para limpiar el motor. El agua podría contaminar el sistema de combustible. Utilice un cepillo o un trapo seco para limpiar el motor.

Este es un motor enfriado por aire. Las suciedades o los desechos pueden restringir el flujo de aire y ocasionar recalentamiento en el motor, produciendo un desempeño pobre y una vida del motor reducida.

Utilice un cepillo o un trapo seco para remover los desechos del protector de dedos (A). Mantenga las varillas, los resortes y los controles (B) limpios. Mantenga el área alrededor y por detrás del mofle (C) libre de todo desecho combustible (Figura 10). Asegúrese que las aletas del refrigerador de aceite (D) estén libres de mugre y de desechos.

Bodegaje



ADVERTENCIA



El combustible y sus vapores son extremadamente inflamables y explosivos.

Un incendio o una explosión pueden causar graves quemaduras o la muerte.

Quando Almacene el Combustible o el Equipo con Combustible en el Tanque

- Almacene a distancia de hornos, estufas, calentadores de agua u otros aparatos que utilicen testigos piloto u otras fuentes de encendido ya que estos pueden encender los vapores combustibles.

Sistema de Combustible

El combustible puede pasarse si se lo almacena por más de 30 días. El combustible pasado provoca la formación de depósitos de ácido y goma en el sistema de combustible o en partes esenciales del carburador. Para mantener el combustible fresco, utilice el **Estabilizador y tratamiento de combustible con fórmula avanzada de Briggs & Stratton**, disponible donde se venden partes de servicio legítimas de Briggs & Stratton.

Para motores equipados con una tapa de combustible FRESH START®, utilice el estabilizador de combustible **FRESH START®** de Briggs & Stratton, disponible en forma de cartucho concentrado de goteo.

Si el estabilizador se agrega de acuerdo a las instrucciones, no es necesario drenar la gasolina del motor. Haga andar el motor durante 2 minutos par hacer circular el estabilizador por el sistema de combustible antes de proceder al almacenamiento.

Si la gasolina en el motor no ha sido tratada con un estabilizador de combustible, debe ser drenada a un recipiente aprobado. Deje que el motor opere hasta que se detenga por la falta de combustible. Se recomienda el uso de un estabilizador de combustible en el recipiente de almacenamiento para mantener la frescura.

Aceite del Motor

Cambie el aceite del motor mientras que el motor se encuentre todavía caliente.

Detección de Fallas

¿Necesita Asistencia? Vaya a VanguardEngines.com o marque el teléfono **1-800-999-9333**.

Especificaciones

Especificaciones del Motor	
Modelo	290000
Desplazamiento	29,23 in ³ (479 cm ³)
Diámetro Interno del Cilindro	2,677 in (68 mm)
Carrera	2,598 in (66 mm)
Capacidad de Aceite	46 - 48 oz (1,36 - 1,42 L)

Especificaciones del Motor	
Modelo	300000
Desplazamiento	29,23 in ³ (479 cm ³)
Diámetro Interno del Cilindro	2,677 in (68 mm)
Carrera	2,598 in (66 mm)
Capacidad de Aceite	46 - 48 oz (1,36 - 1,42 L)

Especificaciones del Motor	
Modelo	350000
Desplazamiento	34,78 in ³ (570 cm ³)
Diámetro Interno del Cilindro	2,835 in (72 mm)
Carrera	2,756 in (70 mm)
Capacidad de Aceite	46 - 48 oz (1,36 - 1,42 L)

Especificaciones del Motor	
Modelo	380000
Desplazamiento	38,26 in ³ (627 cm ³)
Diámetro Interno del Cilindro	2,972 in (75,5 mm)
Carrera	2,756 in (70 mm)
Capacidad de Aceite	46 - 48 oz (1,36 - 1,42 L)

Especificaciones de Ajuste *	
Modelo	290000, 300000
Entrehierro de la Bujía	0,030 in (0,76 mm)
Torque de la Bujía	180 lb-in (20 Nm)
Entrehierro Inducido	0,008 - 0,012 in (0,20 - 0,30 mm)
Tolerancia de la Válvula de Admisión	0,004 - 0,006 in (0,10 - 0,15 mm)
Tolerancia de la Válvula de Escape	0,004 - 0,006 in (0,10 - 0,15 mm)


Especificaciones de Ajuste *	
Modelo	350000, 380000
Entrehierro de la Bujía	0,030 in (0,76 mm)
Torque de la Bujía	180 lb-in (20 Nm)
Entrehierro Inducido	0,008 - 0,012 in (0,20 - 0,30 mm)
Tolerancia de la Válvula de Admisión	0,004 - 0,006 in (0,10 - 0,15 mm)
Tolerancia de la Válvula de Escape	0,004 - 0,006 in (0,10 - 0,15 mm)

* La potencia del motor disminuirá 3.5% por cada 1,000 pies (300 metros) sobre el nivel del mar y un 1% por cada 10° F (5.6° C) por encima de 77° F (25° C). El motor operará satisfactoriamente a un ángulo de hasta 15°. Refiérase al manual del operador del equipo para obtener información acerca de los límites de operación permitidos en pendientes.

Partes de Servicio Comunes

Parte de Servicio	Numero de parte
Filtro de aire - con tanque de combustible	393957
Filtro de aire - excepto el modelo 380000	394018
Filtro de aire- modelo 380000	692519
Pre-filtro filtro de aire - con tanque de combustible	271794
Pre-filtro filtro de aire - excepto el modelo 380000	272490
Pre-filtro filtro de aire - modelo 380000	692520
Aceite - SAE 30	100028
Filtro de Aceite - 6 cms de largo	492932
Filtro de Aceite - 9 cms de largo	491056

Parte de Servicio	Numero de parte
Filtro de combustible -con tanque de combustible	808116
Filtro de combustible -con bomba de combustible	691035
Filtro de combustible - sin bomba de combustible	298090
Aditivo de Combustible	5041
Bujía con Resistencia	491055
Bujía de Platino de Larga Vida	5066
Llave de Bujía	19374
Probador de Chispa	19368

 Recomendamos que contacte a cualquier Distribuidor de Servicio Autorizado Briggs & Stratton para todo lo relacionado con el mantenimiento y el servicio del motor y sus partes.

GARANTIA LIMITADA

Briggs & Stratton Corporation garantiza que durante el período de garantía especificado más adelante reparará o reemplazará, sin costo alguno, cual(es)quier parte(s) del motor considerada(s) como defectuosas en material, mano de obra o ambos. Los gastos de transporte del producto sometido a reparación o cambio bajo esta Garantía deben ser abonados por el comprador. Esta garantía tiene vigencia y está sujeta a los períodos y condiciones establecidos a continuación. Para recibir servicio de garantía, contacte el Distribuidor de Servicio Autorizado más cercano en nuestro mapa de localización de distribuidores en BRIGGSandSTRATTON.COM. El comprador debe ponerse en contacto con el Distribuidor de Servicio Autorizado, y luego poner el producto a disposición del Distribuidor de Servicio Autorizado para la inspección y pruebas.

No existe ninguna otra garantía expresa. Las garantías implícitas, incluso aquellas de mercantilidad o adaptabilidad para un fin determinado quedan limitadas a un año a partir de la fecha de compra o a la extensión permitida por la ley, quedando excluidas todas las demás garantías implícitas. La responsabilidad por daños fortuitos o consecuentes bajo cualquier y todas las garantías queda excluida en la medida que dicha exclusión sea permitida por la ley. Algunos países o estados no contemplan limitaciones en cuanto a la duración de una garantía implícita, y otros países o estados no permiten la exclusión o limitación de daños consecuentes o incidentales, en cuyo caso la limitación y la exclusión anteriores pueden no ser aplicables para usted. Esta garantía le da derechos legales específicos, pudiendo tener a su vez otros derechos que varían de un estado a otro y de un país a otro **.

TÉRMINOS ESTÁNDAR PARA GARANTÍA * ▲

Marca/Tipo de Producto	Uso Privado	Uso Comercial
Vanguard™ ■	3 años	3 años
Serie comercial para césped™	2 años	2 años
Serie Larga Vida™ ; I/C®; Intek™ I/C®; Intek™ Pro;™ Serie Professional™ con Funda de Hierro Colado Dura-Bore™ ; Serie 850™ con Funda de Hierro Colado Dura-Bore™ ; Serie Snow MAX™ con Funda de Hierro Colado Dura-Bore™ Todos los otros motores Briggs & Stratton que incorporan Funda de Hierro Colado Dura-Bore™	2 años	1 año
Todos los otros motores Briggs & Stratton	2 años	90 días

- * Éstos son nuestros términos de garantía estándares, pero de vez en cuando puede existir una cobertura adicional de la garantía que no fue determinada en el momento de la publicación. Para obtener un listado de los términos de garantía corrientes para su motor, vaya a BRIGGSandSTRATTON.COM o póngase en contacto con su Distribuidor de Servicio autorizado de Briggs & Stratton.
- ** En Australia - Nuestros productos cuentan con garantías que no pueden ser excluidas en virtud de la Ley del Consumidor de Australia. Usted tiene derecho a un reemplazo o un reembolso en caso de una falla grave y a una compensación por cualquier pérdida o daño razonablemente previsible. Usted también tiene derecho a que se le reparen o reemplacen los productos si no son de calidad aceptable y la falla no tiene como consecuencia una falla grave. Para el servicio en garantía, ubique el Distribuidor de Servicio Autorizado más cercano en nuestro mapa de ubicación de distribuidores en BRIGGSandSTRATTON.COM, o llamando al 1300 274 447, o enviando un correo electrónico o una carta a salesenquiries@briggsandstratton.com.au, Briggs & Stratton Australia Pty Ltd, 1 Moorebank Avenue, Moorebank, NSW, Australia, 2170.
- ▲ Aplicaciones de Generadores Domésticos: 2 años como garantía del consumidor solamente. No hay garantía comercial. Esta garantía no se aplica a motores en equipos usados para energía principal en lugar de un servicio. **Los motores usados en eventos competitivos o en pistas comerciales o de renta no están cubiertos por la garantía.**
- Vanguard instalado en generadores standby: 2 años de uso por el consumidor, la garantía solo aplica para generadores en uso privado. Vanguard instalado en vehículos de servicio: 2 años de uso por el consumidor, 2 años para uso comercial. Para Vanguard de 3 cilindros enfriado por líquido: ver la Póliza de Garantía para Motor 3/LC de Briggs & Stratton.

El período de garantía comienza a partir de la fecha en la cual lo compró el consumidor detallista original o usuario final comercial, y continúa por el período de tiempo establecido en la tabla anterior. "Uso privado" significa uso doméstico personal por el consumidor detallista original. "Uso Comercial" significa todos los otros usos, incluyendo fines comerciales o que produzcan ingresos o renta. Una vez que el motor haya experimentado uso comercial, será considerado en adelante como motor de uso comercial para fines de esta garantía.

No es necesario registrar la garantía para obtener servicio en los productos Briggs & Stratton. Guarde su recibo de compra. Si no aporta la prueba de la fecha de compra inicial, se utilizará la fecha de fabricación del producto para determinar el período de garantía.

Acerca de su Garantía

Briggs & Stratton recibe con agrado las reparaciones en garantía y le pide disculpas por las molestias causadas. Cualquier Distribuidor de Servicio Autorizado puede efectuar reparaciones en garantía. La mayoría de las reparaciones en garantía se gestionan normalmente, pero a veces las solicitudes para servicio de garantía pueden no ser las apropiadas. Para evitar cualquier malentendido que pudiera presentarse entre el cliente y el distribuidor, se enumeran a continuación algunas de las causas de fallas del motor que la garantía no cubre.

Desgaste Normal: Los motores necesitan, como todos los dispositivos mecánicos, el cambio y el servicio periódico de las partes para desempeñarse bien. La garantía no cubrirá la reparación cuando el uso normal haya agotado la vida de una parte o del motor. La garantía no podría aplicarse si el daño del motor ocurrió debido a abuso, falta del mantenimiento habitual, transporte, manejo, bodegaje o instalación inapropiados. De igual manera se invalidará la garantía si el número serial del motor ha sido removido o si el motor ha sido alterado o modificado.

Mantenimiento Incorrecto: La vida útil de un motor depende de las condiciones bajo las cuales opere el motor y del cuidado que éste reciba. Algunas aplicaciones, tales como cultivadoras, bombas y máquinas cortacésped rotantes, se utilizan con mucha frecuencia en condiciones de mucho polvo o en condiciones muy sucias, las cuales pueden hacer que parezca un desgaste prematuro del motor. Tal desgaste, cuando es ocasionado por suciedad, polvo o por el hecho de limpiar la bujía con chorro de arena, o porque otro material abrasivo haya entrado al motor debido a un mantenimiento no apropiado, no será cubierto por la garantía.

Esta garantía cubre únicamente, material defectuoso y/o mano de obra relacionados con el motor, y no el cambio o reembolso del equipo en el cual haya sido montado el motor. Ni extenderá la garantía a reparaciones requeridas debido a:

- 1 **Problemas ocasionados por el uso de partes que no sean partes originales Briggs & Stratton.**
- 2 Controles del equipo o instalaciones que impidan el arranque, ocasionando un rendimiento poco satisfactorio del motor, o que acorten la vida del motor. (Contacte al fabricante del equipo.)
- 3 Carburadores con fugas, conductos de combustible obstruidos, válvulas atascadas u otros daños causados por el uso de combustible contaminado o pasado.

- 4 Partes que se hayan rayado o reventado por operar el motor con aceite lubricante insuficiente o contaminado, o por el uso del grado de viscosidad de aceite incorrecto (compruebe el nivel de aceite y termine de aprovisionar cuando sea necesario, y cambie aceite según los intervalos recomendados.) El dispositivo protector del aceite OIL GARD no se puede apagar durante la operación del motor. Se podrían presentar daños en el motor si el nivel de aceite no se mantiene correctamente.
- 5 Reparación o ajuste de partes asociadas o conjuntos tales como embragues, transmisiones, controles remoto, etc., los cuales no son fabricados por Briggs & Stratton.
- 6 Daño o desgaste de partes causado por la entrada de suciedades al motor debido al mantenimiento incorrecto del filtro de aire, montaje incorrecto, o por el uso de un elemento o cartucho para el filtro de aire que no sea original. Limpie y/o cambie el filtro según los intervalos recomendados de acuerdo a lo establecido en el Manual del Operador.
- 7 Partes dañadas por velocidad excesiva o recalentamiento causado por residuos de grama, desechos o suciedades los cuales taponan u obstruyen las aletas de enfriamiento, o el área de la volante, o por daños causados por operar el motor en un área confinada sin la suficiente ventilación. Limpie los desechos del motor según los intervalos recomendados de acuerdo a lo establecido en el Manual del Operador.
- 8 Partes del motor o del equipo quebradas por vibración excesiva causada por un montaje flojo del motor, cuchillas de corte flojas, cuchillas o impulsores flojos o no balanceados, fijación incorrecta del equipo al cigüeñal del motor, velocidad excesiva u otro abuso en la operación.
- 9 Un cigüeñal deformado o quebrado causado por golpear con un objeto sólido la cuchilla de corte de una máquina cortacésped rotante, o por tensión excesiva de las correas en v.
- 10 Afinación o ajuste de rutina del motor.
- 11 Descuido del motor o de los componentes del motor, es decir, cámara de combustión, válvulas, asientos de válvulas, guías de válvulas o bobinados del motor de arranque quemados, causado por el uso de combustibles alternos tales como, gas propano, gas natural, gasolina con un contenido de etanol mayor del 10%, etc.

El servicio de garantía está disponible solamente a través de los Distribuidores de Servicio Autorizados por Briggs & Stratton. Póngase en contacto con su Distribuidor de Servicio Autorizado más cercano en nuestro mapa de localización de distribuidores en BRIGGSandSTRATTON.COM, o llamando al 1-800-233-3723.

La Junta de Recursos Ambientales de California (CARB), la U.S. EPA y Briggs & Stratton (B&S) se complacen en explicarles la garantía del sistema de control de emisiones en su motor/equipo Modelo 2012-2013. En California, los motores pequeños todo terreno y los motores grandes con encendido por chispa de menos que o igual a 1,0 litros nuevos deben ser diseñados, fabricados y equipados para cumplir los estrictos estándares anti-smog del Estado. B&S debe garantizar el sistema de control de emisiones en su motor/equipo por el período de tiempo listado abajo, teniendo en cuenta que no haya habido abuso, negligencia o mantenimiento incorrecto en su motor o equipo.

Su sistema de control de emisiones incluye partes tales como: el carburador o sistema de inyección de combustible, el tanque de combustible, el sistema de encendido y el convertidor catalítico. También puede incluir mangueras, correas, conectores y otros conjuntos relacionados con el sistema de control de emisiones.

Siempre que exista una condición de garantía, B&S reparará su motor/equipo sin ningún costo para usted incluyendo el diagnóstico, las partes y la mano de obra.

Cobertura de la garantía del fabricante:

Los motores pequeños todo terreno y los motores grandes con encendido por chispa de menos que o igual a 1,0 litros se garantizan durante un período de tres (3) años. Si alguna de las partes relacionadas con emisiones en su motor/equipo se encuentra defectuosa, la parte será reparada o reemplazada por B&S.

Responsabilidades del Propietario de la Garantía:

- Como propietario del motor/equipo, usted es responsable de que se lleve a cabo el mantenimiento requerido el cual se indica en su manual del propietario. B&S le recomienda guardar todos sus recibos que cubran el mantenimiento en su motor/equipo, pero B&S no solo puede negar la garantía por la falta de recibos sino por su omisión al asegurar la realización de todo el mantenimiento programado.
- Como propietario del motor/equipo, usted tiene que darse cuenta que B&S puede negarle la cobertura de la garantía si su motor/equipo o una de sus partes ha fallado debido a abuso, negligencia, mantenimiento incorrecto o modificaciones no aprobadas.
- Usted tiene la responsabilidad de llevar su motor/equipo a un centro de distribución de B&S, concesionario de servicio, o entidad equivalente, según el caso, tan pronto como exista un problema. Las reparaciones bajo garantía deben realizarse dentro de un período razonable, no superior a 30 días. Si usted tiene alguna pregunta sobre sus derechos y responsabilidades en cuanto a garantía, debe ponerse en contacto con B&S al (414) 259-5262.

Provisiones de la Garantía del Sistema de Control de Emisiones de Briggs & Stratton Corporation

Las siguientes son provisiones específicas relativas a la Cobertura de la Garantía del Sistema de Control de Emisiones. Es un agregado a la garantía del motor B&S para los motores no-regulados que figuran en el Manual del Operador.

1. Partes relacionadas con emisión garantizadas

La cobertura bajo esta garantía se extiende únicamente a las partes listadas abajo (partes de los sistemas de control de emisiones) en el grado en que estas partes estaban presentes en el motor B&S y/o el sistema de combustible suministrado por B&S.

- a. Sistema de Medición de Combustible
 - Sistema de Enriquecimiento de Arranque en Frío (estrangulación suave)
 - Carburador y Partes Internas
 - Bomba de Combustible
 - Tubo de combustible, aditamentos tubo de combustible, abrazaderas
 - Tanque de combustible, cubierta y correa de sujeción
 - Filtro de carbón
- b. Sistema de Inducción de Aire
 - Filtro de Aire
 - Múltiple de Admisión
 - Manguera de purga y ventilación
- c. Sistema de Encendido
 - Bujía(s)
 - Sistema de Encendido con Magneto
- d. Sistema Catalizador
 - Convertidor Catalítico
 - Múltiple de Escape
 - Sistema de Inyección de Aire o Válvula de Pulsación
- e. Items Varios Usados en los Sistemas Anteriores
 - Vacío, Temperatura, Posición, Válvulas Sensitivas de Tiempo y Suiches
 - Conectores y Conjuntos

2. Duración de la Cobertura

Durante un período de tres (3) años a partir de la fecha original de compra, B&S garantiza al comprador original y a cada comprador subsiguiente que el motor ha sido diseñado, construido y equipado de manera que cumpla con todas las normas adoptadas por la Junta de Recursos Ambientales de California (CARB); que está libre de defectos de materiales y mano de obra que podrían causar la falla de una pieza garantizada; y que es idéntico en todos los aspectos importantes al motor descrito en la solicitud para certificación del fabricante. El período de garantía comienza en la fecha de la compra original del motor.

La garantía sobre las partes relacionadas con las emisiones es la siguiente:

- Cualquier parte garantizada la cual no esté programada para cambio de acuerdo con el mantenimiento requerido en el manual del propietario está garantizada durante el período de garantía antes mencionado. Si una parte tal falla durante el período de cobertura de la garantía, la pieza será reparada o sustituida por B&S sin costo alguno para el propietario. Cualquier parte reparada o sustituida de acuerdo con la garantía, estará garantizada por el resto del período de la garantía.
- Cualquier parte garantizada que esté programada únicamente para la inspección periódica en el manual del propietario suministrado está garantizada durante el período de garantía antes mencionado. Cualquier parte reparada o sustituida de acuerdo con la garantía, estará garantizada por el resto del período de la garantía.
- Cualquier parte garantizada la cual esté programada para cambio de acuerdo con el mantenimiento requerido en el manual del propietario suministrado está garantizada por el período previo al primer punto de reemplazo programado para esa parte. Si la parte falla antes del primer reemplazo programado, la pieza será reparada o sustituida por B&S sin costo alguno para el propietario. Cualquier pieza reparada o sustituida de acuerdo con la garantía, se garantizará por el resto del período con anterioridad al primer punto de reemplazo programado para esa pieza.
- Las partes adicionales o modificadas que no estén exentas por la Junta de Recursos Ambientales no pueden ser utilizadas. El uso de cualquier accesorio no exento o de partes modificadas por el propietario será motivo para desestimar una reclamación de garantía. El fabricante no se hace responsable por las fallas de partes garantizadas causadas por la utilización de un accesorio no exento o una parte modificada.

3. Cobertura Consecuente

La cobertura se extenderá hasta la falla de cualquiera de los componentes del motor ocasionada por la falla de cualesquier partes relacionadas con emisión que se encuentren bajo garantía.

4. Reclamos y Exclusiones de la Cobertura

Los reclamos de la garantía se completarán de acuerdo con las provisiones de la política sobre garantía del motor B&S. La cobertura de la garantía estará excluida para fallas de las partes relacionadas con emisiones que no sean partes originales B&S o para partes que fallen debido a abuso, negligencia o mantenimiento incorrecto según se establece en la política de garantía del motor B&S. B&S no se hace responsable de cubrir fallas de partes relacionadas con emisiones ocasionadas por el uso de partes adicionales o partes modificadas.

Busque el Período de Durabilidad de Emisiones y la Información del Índice de Aire Pertinentes en la Etiqueta de Emisiones de su Motor Pequeño Todo Terreno

Los motores que son certificados porque cumplen con las Normas de Emisiones para motores pequeños todo terreno de la Junta de Recursos Ambientales de California (CARB) deben mostrar la información referente al Período de Durabilidad de Emisiones y al Índice de Aire. Briggs & Stratton hace que esta información esté disponible para el consumidor en nuestras etiquetas de emisiones. La etiqueta de emisiones del motor indicará la información de certificación.

El **Período de Durabilidad de Emisiones** describe el número de horas del tiempo real de operación para el cual el motor tiene certificación de conformidad de emisiones, asumiendo un mantenimiento apropiado de acuerdo con las Instrucciones de Mantenimiento y Operación. Se utilizan las siguientes categorías:

Moderado:

El motor tiene certificación de conformidad de emisiones por 125 horas del tiempo real de operación del motor.

Intermedio:

El motor tiene certificación de conformidad de emisiones por 250 horas del tiempo real de operación del motor.

Extendido:

El motor tiene certificación de conformidad de emisiones por 500 horas del tiempo real de operación del motor. Por ejemplo, una máquina cortacésped típica de arrastrar es usada de 20 a 25 horas por año. Por lo tanto, el **Período de Durabilidad de Emisiones** de un motor con una **clasificación intermedia** debería ser equivalente de 10 a 12 años.

Se certifica que los motores Briggs & Stratton cumplen con las normas de emisiones Fase 2 o Fase 3 de la Agencia de Protección Ambiental de los Estados Unidos (USEPA). El Período de Conformidad de Emisiones al cual se refiere la Etiqueta de Conformidad de Emisiones indica el número de horas de operación para las cuales el motor ha demostrado que cumple con los requerimientos Federales sobre emisiones.

Para motores con un desplazamiento inferior a 225 cc.
Categoría C = 125 horas, Categoría B = 250 horas, Categoría A = 500 horas

Para motores con un desplazamiento de 225 cc o superior.
Categoría C = 250 horas, Categoría B = 500 horas, Categoría A = 1000 horas



Informations générales

Ce manuel contient des informations concernant la sécurité visant à attirer l'attention des usagers sur les dangers et les risques associés aux moteurs. Il contient aussi des instructions d'utilisation et d'entretien appropriées à ce moteur. Briggs & Stratton Corporation ne sachant pas forcément sur quel équipement ce moteur est monté, il est important de lire et de comprendre ces instructions ainsi que celles concernant l'équipement utilisé. **Conserver ces instructions originales pour un usage ultérieur.** Pour obtenir des pièces de rechange ou une assistance technique, reporter ici les numéros de Modèle, Type et Code du moteur ainsi que la date d'achat. Ces numéros sont situés sur le moteur (voir la page **Caractéristiques et commandes**).

Date d'achat: _____

JJ/MM/AAAA

Modèle de moteur: _____

Modèle:

Type:

Code:

Puissance théorique

La puissance théorique brute pour chaque modèle de moteur à essence est indiquée conformément à la norme J1940 (procédure de calcul de la puissance et du couple des petits moteurs) de la SAE (Society of Automotive Engineers) et les performances théoriques ont été obtenues et corrigées selon SAE J1995 (révision 2002-05). Les valeurs de couple sont définies à 3060 tr/min et les valeurs de puissance sont définies à 3600 tr/min. Vous trouverez les courbes de puissance brute sur www.BRIGGSandSTRATTON.COM. Les valeurs nettes de puissance sont établies avec l'échappement et le filtre à air installés tandis que les valeurs brutes de puissance sont définies sans ces accessoires. La puissance brute réelle du moteur sera supérieure à la puissance nette et est influencée notamment par les conditions ambiantes de fonctionnement et les variations d'un moteur à l'autre. Compte tenu de la grande variété de machines sur lesquelles nos moteurs sont utilisés, il se peut que le moteur à essence ne développe pas sa puissance brute théorique une fois qu'il est monté sur une machine particulière. Cette différence s'explique par un grand nombre de facteurs, tels que (liste non limitative), les accessoires (filtre à air, échappement, admission, refroidissement, carburateur, pompe à essence, etc.), les limites d'utilisation, les conditions ambiantes d'utilisation (température, humidité, altitude) et les variations d'un moteur à l'autre. Pour des raisons de fabrication et de capacité limitées, Briggs & Stratton est susceptible de remplacer un moteur par une version plus puissante pour ces moteurs de série.

Sécurité de l'utilisateur

SYMBOLES DE SÉCURITÉ ET DE COMMANDE



Le symbole d'alerte de sécurité est utilisé pour identifier des informations sur des risques qui peuvent entraîner des blessures. Un mot (DANGER, AVERTISSEMENT, ATTENTION) est utilisé avec le symbole d'alerte pour indiquer le risque de blessure. En outre, un signal de danger peut être utilisé pour représenter le type de risque.

DANGER indique un risque qui, s'il n'est pas éliminé, **entraînera la mort ou des blessures très graves.**

AVERTISSEMENT indique un risque qui, s'il n'est pas éliminé, **pourrait entraîner la mort ou des blessures très graves.**

ATTENTION indique un risque qui, s'il n'est pas éliminé, **pourrait entraîner des blessures mineures ou légères.**

AVIS indique une situation qui **pourrait endommager l'appareil.**



AVERTISSEMENT

Certains composants de ce produit et de ses accessoires contiennent des produits chimiques connus dans l'État de Californie pour provoquer des cancers et des troubles de la procréation. Se laver les mains après chaque manipulation.



AVERTISSEMENT

Les gaz d'échappement de ce moteur contiennent des substances chimiques pouvant causer des cancers, des malformations fœtales ou d'autres problèmes de fécondation.



AVERTISSEMENT

Les moteurs Briggs & Stratton ne sont pas conçus et ne doivent pas être utilisés pour alimenter les karts de loisir, les véhicules tout-terrain à destination des enfants ou usage récréatif ou sportif, les motocyclettes, les aéroglisseurs, les aéroplanes ou les véhicules utilisés au cours de compétitions non approuvées par Briggs & Stratton. Pour plus d'informations sur les produits destinés à la compétition, prière de consulter www.briggsracing.com. Pour une utilisation avec les véhicules tout-terrain utilitaires et biplace côte à côte (SSV), prière de contacter Briggs & Stratton Engine Application Center, 1-866-927-3349. Une application inappropriée du moteur peut entraîner des blessures graves ou mortelles.

AVIS: Ce moteur a été expédié par Briggs & Stratton sans huile. Avant de le démarrer, s'assurer d'avoir fait le plein d'huile selon les instructions de ce manuel. Si le moteur est démarré sans huile, il sera endommagé irrémédiablement et ne sera pas couvert par la garantie.



AVERTISSEMENT



Le combustible et ses vapeurs sont extrêmement inflammables et explosifs.



Un incendie ou une explosion peut entraîner des blessures très graves ou même la mort.

Pour faire le plein

- Couper le moteur et le laisser refroidir au moins 2 minutes avant d'ouvrir le bouchon du réservoir.
- Remplir le réservoir de carburant à l'extérieur ou dans un local extrêmement bien ventilé.
- Ne pas trop remplir le réservoir. Pour permettre la dilatation du carburant, ne pas remplir plus haut que le bas du col du réservoir.
- Maintenir le carburant à l'écart des étincelles, des flammes directes, des veilleuses, de la chaleur et des autres sources d'étincelles.
- Contrôler que les durites, le réservoir, le bouchon et les raccords de carburant ne présentent ni fissures ni fuites. Remplacer si nécessaire.
- Si du carburant a été renversé, attendre son évaporation complète avant de démarrer le moteur.

Pour démarrer le moteur

- S'assurer que la bougie, le bouchon du réservoir de carburant et le filtre à air sont le cas échéant montés et solidement fixés.
- Ne pas faire tourner le moteur avec la bougie enlevée.
- Si le moteur est noyé, placer le starter (le cas échéant) sur OPEN/RUN, amener l'accélérateur sur FAST et lancer le moteur jusqu'à ce qu'il démarre.

Lors de l'utilisation de l'équipement

- Ne pas faire basculer le moteur ou l'équipement au-delà d'un angle qui provoquerait le renversement du carburant.
- Ne pas actionner le starter pour arrêter le moteur.
- Ne pas démarrer ou faire fonctionner un moteur sans filtre à air ou avec le filtre à air enlevé (le cas échéant).

Vidange d'huile

- Pour vidanger l'huile du tube de remplissage, le réservoir de carburant doit être vide. Le carburant risque sinon de couler et de provoquer un incendie ou une explosion.

En cas de basculement de l'unité pour l'entretien

- S'il est nécessaire de basculer l'unité au cours de l'entretien, le réservoir de carburant doit être vide, sinon le carburant risque sinon de couler et de provoquer un incendie ou une explosion.

Pour transporter l'équipement

- Transporter avec le réservoir de carburant VIDE et le robinet de carburant en position FERMÉE.

Pour stocker du carburant ou l'équipement avec un réservoir plein

- Les ranger loin des chaudières, cuisinières, chauffe-eau ou tout autre appareil comportant une veilleuse ou une source susceptible de produire une étincelle, car ils pourraient enflammer les vapeurs de carburant.



AVERTISSEMENT



Le démarrage du moteur produit des étincelles. Les étincelles peuvent enflammer les gaz inflammables à proximité. Ceci pourrait provoquer une explosion ou un incendie.

- S'il y a une fuite de gaz naturel ou de GPL à proximité, ne pas démarrer le moteur.
- Ne pas utiliser de liquides de démarrage sous pression car leurs vapeurs sont inflammables.



AVERTISSEMENT



Les moteurs produisent du monoxyde de carbone, qui est un gaz toxique inodore et invisible.

L'inhalation de monoxyde de carbone peut provoquer des nausées, un évanouissement et entraîner la mort.

- Démarrer et faire fonctionner le moteur à l'extérieur.
- Ne pas démarrer ou faire fonctionner le moteur dans un local fermé, même si les portes et les fenêtres sont ouvertes.



AVERTISSEMENT



La rétraction rapide de la corde de lanceur (retour brutal) tirera votre main et votre bras vers le moteur beaucoup plus vite que vous ne pourrez les laisser partir.

Ceci pourrait entraîner des fêlures, des fractures, des ecchymoses ou des foulures.

- Pour démarrer le moteur, tirer lentement sur la corde jusqu'à sentir une résistance et tirer alors rapidement afin d'éviter l'effet de rétraction.
- Retirer tout équipement extérieur/charge avant de démarrer le moteur.
- Les composants directement couplés à l'équipement, tels que lames, turbines, poulies, engrenages, etc. sans que cette liste soit limitative, devront être fermement arrimés.



AVERTISSEMENT



Les pièces en rotation peuvent toucher ou saisir les mains, les pieds, les cheveux, les vêtements ou les accessoires.

Le résultat peut en être une amputation ou une lacération grave.

- Ne faire fonctionner l'équipement qu'avec les protections en place.
- Ne pas approcher les mains ou les pieds des pièces en mouvement.
- Attacher les cheveux longs et retirer les bijoux.
- Ne pas porter de vêtements amples, de ceintures larges pendantes ou tout vêtement pouvant être saisi.



AVERTISSEMENT



Un moteur en marche produit de la chaleur. Les pièces du moteur, et plus particulièrement le silencieux, deviennent extrêmement chaudes. Les toucher peut provoquer des brûlures sévères.

Les débris combustibles comme les feuilles, l'herbe, les broussailles peuvent s'enflammer.

- Laisser le silencieux, le cylindre du moteur et les ailettes refroidir avant de les toucher.
- Retirer les débris accumulés autour du silencieux et du cylindre.
- La Section 4442 du California Public Resource Code (Code des ressources publiques de Californie) interdit l'utilisation ou le fonctionnement du moteur dans des espaces recouverts de forêts, de broussailles ou d'herbe sauf si le système d'échappement est équipé d'un pare-étincelles, tel que défini dans la Section 4442, en bon état de fonctionnement. D'autres états ou juridictions fédérales peuvent appliquer des lois similaires. Contacter le fabricant, le distributeur ou le fournisseur d'origine de l'équipement pour obtenir un pare-étincelles conçu pour le système d'échappement installé sur ce moteur.



AVERTISSEMENT



Une étincelle accidentelle peut provoquer un incendie ou un choc électrique.



Un démarrage accidentel peut causer un étranglement, l'amputation ou la lacération d'un membre.

Risque d'incendie



Avant d'effectuer des réglages ou des réparations

- Débrancher le fil de bougie et l'attacher à bonne distance de la bougie.
- Débrancher le câble Négatif de la batterie (seulement pour les moteurs à démarrage électrique).
- N'utiliser que les outils corrects.
- Ne pas modifier les ressorts du régulateur, les tringles et autres pièces pour augmenter le régime du moteur.
- Les pièces de rechange doivent être strictement identiques et être installées dans la même position que les pièces d'origine. Des pièces autres risquent de ne pas fonctionner aussi bien, d'endommager l'unité et d'entraîner des blessures.
- Ne pas taper sur le volant moteur avec un marteau ou un objet dur cela pourrait entraîner une rupture ultérieure du volant pendant que le moteur fonctionne.

Contrôle de l'étincelle

- Utiliser un contrôleur homologué.
- Ne pas contrôler l'étincelle avec la bougie retirée.

Caractéristiques et commandes

Comparer l'illustration **1** avec le moteur pour se familiariser avec l'emplacement des différents composants et commandes.

- A. Identification du moteur
Modèle Type Code
- B. Bougie
- C. Filtre à air (sans réservoir de carburant)
- D. Filtre à air (avec réservoir de carburant)
- E. Jauge à huile
- F. Remplissage d'huile
- G. Filtre à huile (en option)
- H. Bouchon de vidange
- I. Capteur de pression d'huile
- J. Protège-doigts
- K. Démarreur électrique
- L. Lanceur à rappel automatique (en option)
- M. Carburateur
- N. Silencieux d'échappement (en option)
- O. Pompe d'alimentation
- P. Contacteur du démarreur *
- Q. Commande d'accélération *
- R. Commande de starter *
- S. Filtre à carburant (en option)
- T. Réservoir de carburant (en option)
- U. Robinet d'alimentation d'essence (en option) *
- V. Bouton d'arrêt (en option) *
- W. Refroidisseur d'huile (en option)

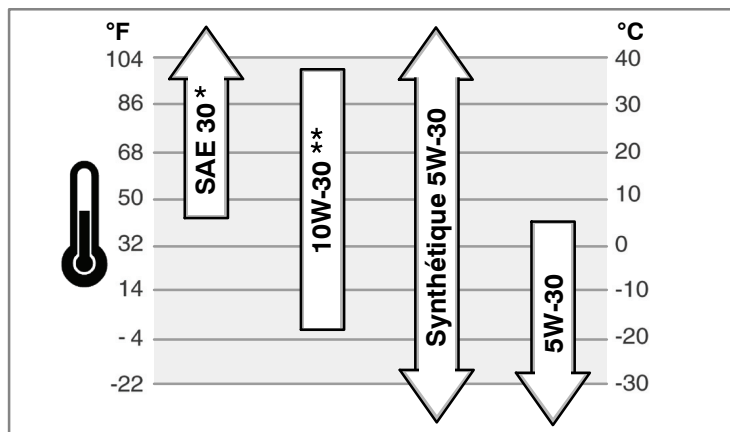
* Certains moteurs et équipements disposent de commandes à distance. Consulter le manuel de l'équipement concernant l'emplacement et le fonctionnement de ces commandes.

Fonctionnement

Capacité d'huile (voir la section **Spécifications**)

Recommandations concernant l'huile

Nous recommandons l'utilisation des huiles certifiées par la garantie Briggs & Stratton pour obtenir les meilleures performances. D'autres huiles détergentes sont acceptables si elles sont classées SF, SG, SH, SJ ou supérieur. Ne pas utiliser d'additifs pour huile. La température extérieure détermine la viscosité de l'huile. Utiliser le tableau pour sélectionner la viscosité qui correspond à la gamme de température attendue.



* L'emploi d'huile SAE 30 au-dessous de 4°C rend le démarrage difficile.

** L'utilisation d'une huile 10W-30 à des températures supérieures 27°C entraînera une consommation d'huile supérieure à la normale. Vérifier le niveau d'huile plus souvent.

Vérification/Plein d'huile - Figure 2

Avant de vérifier ou de faire le plein d'huile

- Mettre le moteur de niveau.
 - Nettoyer le pourtour de l'orifice de remplissage de tout débris.
1. Sortir la jauge (A) et nettoyer avec un chiffon propre (Figure 2).
 2. Introduire la jauge à fond.
 3. Retirer la jauge et vérifier le niveau. L'huile doit être au ras de l'indicateur de niveau maximum (B) de la jauge.
 4. S'il est plus bas, verser doucement de l'huile dans l'orifice de remplissage du moteur (C). **Ne pas trop remplir.** Après avoir ajouté de l'huile, attendre une minute et vérifier le niveau d'huile.

5. Introduire la jauge à fond.

Pression d'huile

Si la pression de l'huile est trop basse, un contacteur de pression (le cas échéant) arrête le moteur ou active un dispositif sonore sur l'équipement. Dans ce cas, arrêter le moteur et vérifier le niveau d'huile avec la jauge.

Si le niveau d'huile est situé au-dessous du repère ADD, verser de l'huile jusqu'au repère FULL. Démarrer le moteur et vérifier que la pression est correcte avant de continuer.

Si le niveau d'huile est situé entre les repères ADD et FULL, **ne pas démarrer** le moteur. Contacter un Réparateur Agréé Briggs & Stratton pour corriger le problème de pression de l'huile.

Recommandations concernant le carburant

Le carburant doit répondre aux critères suivants:

- Essence fraîche, propre, sans plomb.
- Un indice minimum d'Octane de 87/87 AKI (91 RON). En cas d'utilisation en altitude, voir ci-après.
- L'essence contenant jusqu'à 10 % d'éthanol (bioéthanol) est acceptable.

ATTENTION: ne pas utiliser d'essence non approuvée, comme la E15 et la E85. Ne pas mélanger d'huile à l'essence ni modifier le moteur pour fonctionner avec des carburants alternatifs. L'utilisation de carburants non autorisés endommagera le moteur et **annulera la garantie moteur.**

Pour protéger le système d'admission d'essence contre la formation de gomme, mélanger un stabilisateur à l'essence. Voir le **stockage**. Tous les carburants ne sont pas les mêmes. En cas de difficultés à démarrer ou de problèmes de fonctionnement, changer de fournisseur ou de marque d'essence. Ce moteur est certifié pour fonctionner à l'essence. Le système de contrôle des émissions de ce moteur est EM (Modifications Moteur).

Haute altitude

À des altitudes supérieures à 1524mètres, une essence ayant un indice minimum de 85 octane/85 AKI (89 RON) est acceptable. Pour rester conforme aux normes d'émissions, un réglage pour haute altitude est nécessaire. Le fonctionnement sans effectuer ce réglage entraîne une réduction de la performance et une augmentation de la consommation d'essence et des émissions. Consulter un Réparateur Agréé Briggs & Stratton pour plus d'informations sur le réglage pour haute altitude.

Le fonctionnement du moteur à une altitude inférieure à 762mètres avec le kit haute altitude n'est pas recommandé.

Plein d'essence - Figure 3



AVERTISSEMENT



Le combustible et ses vapeurs sont extrêmement inflammables et explosifs.



Un incendie ou une explosion peut entraîner des blessures très graves ou même la mort.

Pour faire le plein

- Couper le moteur et le laisser refroidir au moins 2 minutes avant d'ouvrir le bouchon du réservoir.
- Remplir le réservoir de carburant à l'extérieur ou dans un local extrêmement bien ventilé.
- Ne pas trop remplir le réservoir. Pour permettre la dilatation du carburant, ne pas remplir plus haut que le bas du col du réservoir.
- Maintenir le carburant à l'écart des étincelles, des flammes directes, des veilleuses, de la chaleur et des autres sources d'étincelles.
- Contrôler que les durites, le réservoir, le bouchon et les raccords de carburant ne présentent ni fissures ni fuites. Remplacer si nécessaire.
- Si du carburant a été renversé, attendre son évaporation complète avant de démarrer le moteur.

1. Nettoyer le pourtour du bouchon d'essence de la poussière et des débris. Enlever le bouchon d'essence (A, Figure 3).
2. Faire le plein (B) de carburant. Pour permettre la dilatation du carburant, ne pas remplir au-delà du bas du col de remplissage (C).
3. Remettre le bouchon du réservoir en place.

Démarrage du moteur - Figure 4



AVERTISSEMENT



La rétraction rapide de la corde de lanceur (retour brutal) tirera la main et le bras de l'opérateur vers le moteur beaucoup plus vite qu'il ne pourra les laisser partir.

Ceci pourrait entraîner des fêlures, des fractures, des ecchymoses ou des foulures.

- Pour démarrer le moteur, tirer lentement sur la corde jusqu'à sentir une résistance et tirer alors rapidement afin d'éviter l'effet de rétraction.



AVERTISSEMENT



Le combustible et ses vapeurs sont extrêmement inflammables et explosifs.



Un incendie ou une explosion peut entraîner des blessures très graves ou même la mort.

Pour démarrer le moteur

- S'assurer que la bougie, le bouchon du réservoir de carburant et le filtre à air sont le cas échéant montés et solidement fixés.
- Ne pas faire tourner le moteur avec la bougie enlevée.
- Si le moteur est noyé, placer le starter (le cas échéant) sur OPEN/RUN, amener l'accélérateur sur FAST et lancer le moteur jusqu'à ce qu'il démarre.



AVERTISSEMENT



Les moteurs produisent du monoxyde de carbone, qui est un gaz toxique inodore et invisible.



L'inhalation de monoxyde de carbone peut provoquer des nausées, un évanouissement et entraîner la mort.


- Démarrer et faire fonctionner le moteur à l'extérieur.
- Ne pas démarrer ou faire fonctionner le moteur dans un local fermé, même si les portes et les fenêtres sont ouvertes.

AVIS: Ce moteur a été expédié de chez Briggs & Stratton sans huile. Avant de le démarrer, s'assurer d'avoir fait le plein d'huile selon les instructions de ce manuel. Si le moteur est démarré sans huile, il sera endommagé irrémédiablement et ne sera pas couvert par la garantie.

Remarque: Certains moteurs et équipements disposent de commandes à distance. Consulter le manuel de l'équipement concernant l'emplacement et le fonctionnement de ces commandes.

1. Vérifier le niveau d'huile. Voir la section **Vérification/Plein d'huile**.
2. Le cas échéant, s'assurer que l'entraînement de l'équipement est débrayé.
3. Placer le robinet d'essence (A), le cas échéant, sur la position ON (Figure 4).
4. Mettre l'interrupteur d'arrêt (F), s'il existe, en position ON.

5. Déplacer la commande d'accélération (B) sur la position FAST . Faire fonctionner l'équipement en position FAST .

6. Placer le starter (C) sur la position STARTER .

Remarque: Le starter est généralement superflu pour redémarrer un moteur chaud.

7. **Lanceur:** Tourner le contacteur à clé (D), le cas échéant, sur la position RUN.
8. **Lanceur:** Prendre en main la poignée du lanceur (E). Tirer lentement sur la corde jusqu'à sentir une résistance, puis tirer rapidement.

Remarque: Si le moteur ne démarre pas après plusieurs tentatives, consulter le site VanguardEngines.com ou appeler le 1-800-999-9333 (aux États-Unis).




AVERTISSEMENT: La rétraction rapide de la corde de lanceur (retour brutal) tirera la main et le bras de l'opérateur vers le moteur beaucoup plus vite qu'il ne pourra les laisser partir. Ceci pourrait entraîner des fêlures, des fractures, des ecchymoses ou des foulures. Pour démarrer le moteur, tirer lentement sur la corde jusqu'à sentir une résistance et tirer alors rapidement afin d'éviter l'effet de rétraction.

9. **Démarrateur électrique:** Mettre le contact du démarreur électrique (D) sur la position ON/START.

Remarque: Si le moteur ne démarre pas après plusieurs tentatives, consulter le site VanguardEngines.com ou appeler le 1-800-999-9333 (aux États-Unis).

AVIS: Pour préserver l'usage du démarreur, ne l'utiliser que pendant des cycles courts (cinq secondes maximum). Attendre une minute avant de recommencer.

10. Au fur et à mesure du réchauffement du moteur, ramener le starter (C) sur la position RUN .

Arrêt du moteur - Figure 4



AVERTISSEMENT




Le combustible et ses vapeurs sont extrêmement inflammables et explosifs.



Un incendie ou une explosion peut entraîner des blessures très graves ou même la mort.

- Ne pas actionner le starter pour arrêter le moteur.

1. Placer la commande d'accélération (B) sur la position SLOW , tourner le contacteur à clé (D) sur la position OFF (Figure 4). Retirer la clé et la conserver dans un endroit sûr, hors de la portée des enfants.

2. Mettre l'interrupteur (F), le cas échéant, en position OFF.

3. Quand le moteur est arrêté, placer le robinet d'essence (si équipé) (A) en position fermée.

Entretien

Nous recommandons de voir un Réparateur Agréé Briggs & Stratton pour tout l'entretien de votre moteur et l'acquisition de pièces.

AVIS: Tous les composants de ce moteur doivent rester à leur place d'origine pour que le moteur fonctionne correctement.



AVERTISSEMENT: S'il est nécessaire de basculer l'unité au cours de l'entretien, le réservoir de carburant doit être vide, sinon le carburant risque sinon de couler et de provoquer un incendie ou une explosion.

Contrôle des émissions

L'entretien, le remplacement ou la réparation des dispositifs et des systèmes de contrôle des émissions gazeuses peut être effectué par tout établissement ou individu spécialisé dans la réparation des moteurs autres que les moteurs automobiles. Néanmoins, pour que les réparations soient prises en charge par Briggs & Stratton au titre de la garantie, l'intervention doit être effectuée par un Réparateur Agréé. Voir la garantie des émissions.



AVERTISSEMENT



Une étincelle accidentelle peut provoquer un incendie ou un choc électrique.



Un démarrage accidentel peut causer un étranglement, l'amputation ou la lacération d'un membre.



Risque d'incendie



Avant d'effectuer des réglages ou des réparations

- Débrancher le fil de bougie et l'attacher à bonne distance de la bougie.
- Débrancher le câble Négatif de la batterie (seulement pour les moteurs à démarrage électrique).
- N'utiliser que les outils corrects.
- Ne pas modifier les ressorts du régulateur, les tringles et autres pièces pour augmenter le régime du moteur.
- Les pièces de rechange doivent être strictement identiques et être installées dans la même position que les pièces d'origine. Des pièces autres risquent de ne pas fonctionner aussi bien, d'endommager l'unité et d'entraîner des blessures.
- Ne pas taper sur le volant moteur avec un marteau ou un objet dur cela pourrait entraîner une rupture ultérieure du volant pendant que le moteur fonctionne.

Contrôle de l'étincelle

- Utiliser un contrôleur homologué.
- Ne pas contrôler l'étincelle avec la bougie retirée.

Tableau d'entretien

Après les 5 premières heures

- Vidanger l'huile

Toutes les 8 heures ou chaque jour

- Vérifier le niveau d'huile du moteur.
- Nettoyer aux alentours du silencieux et des commandes

Toutes les 100 heures ou une fois par an

- Nettoyer ou changer le filtre à air *
- Nettoyer le pré-filtre (le cas échéant) *
- Vidanger l'huile moteur et changer le filtre
- Remplacer la bougie
- Inspecter le silencieux d'échappement et l'écran pare-étincelles

Toutes les 250 heures ou une fois par an

- Contrôler le jeu des soupapes. Régler si nécessaire.

Toutes les 400 heures ou une fois par an

- Changer le filtre à air
- Remplacer le filtre à carburant
- Nettoyer le système de refroidissement par air *
- Nettoyer les ailettes du refroidisseur d'huile *

* Nettoyer plus souvent dans des conditions d'utilisation en atmosphère poussiéreuse ou chargée de débris aériens.

Réglage du carburateur

Ne pas procéder à des réglages inutiles du carburateur. Il a été réglé en usine pour fonctionner efficacement dans la plupart des applications. Néanmoins, si des réglages sont nécessaires, les confier à un Réparateur Agréé Briggs & Stratton.

AVIS: Le fabricant de l'équipement sur lequel est monté ce moteur a spécifié le régime maximum à vide d'utilisation du moteur. **Ne pas dépasser** ce régime maximum.


Remplacement de la bougie - Figure 5


Vérifier l'écartement des électrodes (A, Figure 5) avec une jauge à fil (B). Le cas échéant, régler l'écartement. Remettre la bougie et la serrer au couple recommandé. Pour régler l'écartement et trouver le couple de serrage, voir la section **Spécifications**.

Remarque: Dans certains pays, la législation impose l'emploi de bougies à résistance pour supprimer les parasites de l'allumage. Si ce moteur était équipé d'une bougie avec résistance, utiliser le même type de bougie lors de son remplacement.

Inspection du silencieux d'échappement et de l'écran pare-étincelles - Figure 6


AVERTISSEMENT

 Un moteur en marche produit de la chaleur. Les pièces du moteur, et plus particulièrement le silencieux, deviennent extrêmement chaudes. Les toucher peut provoquer des brûlures sévères.

 Les débris combustibles comme les feuilles, l'herbe, les broussailles peuvent s'enflammer.

- Laisser le silencieux, le cylindre du moteur et les ailettes refroidir avant de les toucher.
- Retirer les débris accumulés autour du silencieux et du cylindre.
- La Section 4442 du California Public Resource Code (Code des ressources publiques de Californie) interdit l'utilisation ou le fonctionnement du moteur dans des espaces recouverts de forêts, de broussailles ou d'herbe sauf si le système d'échappement est équipé d'un pare-étincelles, tel que défini dans la Section 4442, en bon état de fonctionnement. D'autres états ou juridictions fédérales peuvent appliquer des lois similaires. Contacter le fabricant, le distributeur ou le fournisseur d'origine de l'équipement pour obtenir un pare-étincelles conçu pour le système d'échappement installé sur ce moteur.

Retirer les débris accumulés autour du silencieux et du cylindre. Inspecter le silencieux (A, Figure 6) à la recherche de fissures, de corrosion ou autre dommage. Enlever le pare-étincelles (B), le cas échéant, et inspecter s'il est endommagé ou obstrué par des dépôts de carbone. En présence de pièces endommagées, les remplacer avant toute utilisation.

 **AVERTISSEMENT:** Les pièces de rechange doivent être strictement identiques et être installées dans la même position que les pièces d'origine. Des pièces autres risquent de ne pas fonctionner aussi bien, d'endommager l'unité et d'entraîner des blessures.

Changement d'huile - Figure 8 9

L'huile usagée est un produit dangereux. S'en débarrasser correctement. Ne pas la jeter avec les ordures ménagères. Vérifier le lieu de collecte ou de recyclage avec les autorités locales, le/centre de services ou le vendeur.

Vidange de l'huile

1. Quand le moteur est arrêté mais encore chaud, débrancher le fil de bougie (A) et l'éloigner de la bougie (Figure 8).
2. Retirer le bouchon de vidange (B, Figure 9). Vidanger l'huile dans un récipient approuvé.
3. Quand l'huile a été vidangée, remettre le bouchon de vidange. Le serrer.

Changer le filtre à huile (le cas échéant)

Certains modèles sont équipés d'un filtre à huile. Pour connaître les intervalles de maintenance, se reporter au **Tableau d'entretien**.

1. Vidanger l'huile du moteur. Voir la section **Vidange de l'huile**.
2. Enlever le filtre à huile (C) et le jeter correctement. Voir Figure 9.
3. Avant d'installer le nouveau filtre à huile, lubrifier légèrement le joint du filtre avec de l'huile neuve.
4. Installer le filtre à huile à la main jusqu'à ce que le joint soit au contact de l'adaptateur du filtre puis visser le filtre de 1/2 à 3/4 tours.
5. Ajouter de l'huile. Voir la section **Faire le plein d'huile**.
6. Démarrer puis faire tourner le moteur. Lorsque le moteur chauffe, détecter les éventuelles fuites d'huile.
7. Arrêter le moteur et vérifier le niveau d'huile. L'huile doit être au ras de l'indicateur de niveau maximum (F) de la jauge (Figure 8).


Faire le plein d'huile

- Mettre le moteur de niveau.
 - Nettoyer le pourtour de l'orifice de remplissage de tout débris.
 - Voir la capacité d'huile dans la section **Spécifications**.
1. Sortir la jauge (D) et nettoyer avec un chiffon propre (Figure 8).
 2. Verser doucement l'huile dans l'orifice de remplissage (E). **Ne pas trop remplir.** Après avoir fait le plein d'huile, attendre une minute et revérifier le niveau d'huile.
 3. Installer et serrer la jauge.
 4. Retirer la jauge et vérifier le niveau. L'huile doit être au ras de l'indicateur de niveau maximum (F) de la jauge.
 5. Installer et serrer la jauge.

Entretien du filtre à air - Figure 11 12

AVERTISSEMENT

 Le combustible et ses vapeurs sont extrêmement inflammables et explosifs.

 Un incendie ou une explosion peut entraîner des blessures très graves ou même la mort.

- Ne pas démarrer ou faire fonctionner un moteur sans filtre à air ou avec le filtre à air enlevé (le cas échéant).

AVIS: Ne pas utiliser d'air comprimé ni de solvant pour nettoyer le filtre à air. L'air comprimé peut endommager le filtre, les solvants le dissoudre.


Deux types de systèmes de filtre à air sont illustrés. Se reporter au **Tableau d'entretien** pour connaître les conditions de service.

1. **Modèles sans réservoir de carburant:** Ouvrir les languettes (A) et retirer le couvercle (B). Voir Figure 11.
2. **Modèles avec réservoir:** Retirer l'écrou papillon (C) et le couvercle (B). Voir Figure 12.
3. Retirer l'écrou (D) et le support (E). Voir Figures 11 et 12.
4. Retirer le filtre à air (F).
5. Retirer le pré-filtre (G), le cas échéant, du filtre à air.
6. Pour le nettoyer, le tapoter doucement contre une surface dure. Si le filtre à air est excessivement encrassé, le remplacer par un neuf.
7. Nettoyer le pré-filtre dans de l'eau additionnée de détergent liquide. **Ne pas graisser** le pré-filtre.
8. Assembler le pré-filtre sec sur le filtre à air.
9. Installer le filtre à air et le fixer avec un support et un écrou.
10. Installer et fixer le couvercle.

Remplacement du filtre à essence - Figure 7

AVERTISSEMENT

 Le combustible et ses vapeurs sont extrêmement inflammables et explosifs.

 Un incendie ou une explosion peut entraîner des blessures très graves ou même la mort.


- Maintenir le carburant à l'écart des étincelles, des flammes directes, des veilleuses, de la chaleur et des autres sources d'étincelles.
- Contrôler que les durites, le réservoir, le bouchon et les raccords de carburant ne présentent ni fissures ni fuites. Remplacer si nécessaire.
- Avant de remplacer le filtre à essence, vidanger le réservoir d'essence ou fermer le robinet d'essence.
- Les pièces de rechange doivent être d'origine et installées de la même façon que les pièces précédentes.
- Si du carburant a été renversé, attendre son évaporation complète avant de démarrer le moteur.


1. Avant de remplacer le filtre à carburant (A, Figure 7), s'il existe, vidanger le réservoir de carburant ou fermer le robinet d'essence. Dans le cas contraire, le carburant risque de couler et provoquer un incendie ou une explosion.
2. Utiliser des pinces pour serrer les languettes (B) sur les colliers (C) puis retirer les colliers du filtre à carburant. Tourner puis ôter les Durits (D) du filtre à carburant.
3. Vérifier que les Durits ne présentent ni fissures ni fuites. Les remplacer si nécessaire.
4. Remplacer le filtre à carburant par un filtre d'origine.
5. Fixer les Durits avec les colliers comme indiqué.

Remarque: Les moteurs équipés d'un réservoir à essence monté en usine peuvent comporter une crépine (E), cf. Figure 3.

Nettoyage du système de refroidissement par air - Figure 10

AVERTISSEMENT

 Un moteur en marche produit de la chaleur. Les pièces du moteur, et plus particulièrement le silencieux, deviennent extrêmement chaudes. Les toucher peut provoquer des brûlures sévères.

 Les débris combustibles comme les feuilles, l'herbe, les broussailles peuvent s'enflammer.

- Laisser le silencieux, le cylindre du moteur et les ailettes refroidir avant de les toucher.
- Retirer les débris accumulés autour du silencieux et du cylindre.

AVIS: Ne pas utiliser d'eau pour nettoyer le moteur. L'eau peut contaminer le système d'alimentation en essence. Utiliser une brosse ou un chiffon sec pour nettoyer le moteur. Ce moteur est refroidi par air. De la poussière ou des débris peuvent affecter le débit d'air et faire chauffer le moteur, ce qui réduit ses performances et sa durée de vie.

Utiliser une brosse ou un chiffon sec pour enlever les débris du protège doigts (A). Nettoyer les biellettes, les ressorts et les commandes (B). Ne pas laisser les débris combustibles s'accumuler autour et derrière le silencieux d'échappement (C) (Figure 10). Vérifier que les ailettes du refroidisseur d'huile (D) sont exemptes de saletés et de débris.

Stockage



AVERTISSEMENT



Le combustible et ses vapeurs sont extrêmement inflammables et explosifs.



Un incendie ou une explosion peut entraîner des blessures très graves ou même la mort.

Pour stocker du carburant ou l'équipement avec un réservoir plein

- Les ranger loin des chaudières, cuisinières, chauffe-eau ou tout autre appareil comportant une veilleuse ou une source susceptible de produire une étincelle, car ils pourraient enflammer les vapeurs de carburant.

Système d'alimentation

L'essence peut s'éventer lorsqu'elle est conservée plus de 30 jours. L'essence périmée provoque la formation de dépôts d'acide et de gomme dans le système d'alimentation ou sur des pièces essentielles du carburateur. Pour maintenir l'essence propre, utiliser le **formule avancée de stabilisation et de traitement de l'essence de Briggs & Stratton** disponible dans tous les points de vente des pièces de rechange Briggs & Stratton d'origine.

Pour les moteurs équipés d'un bouchon d'essence FRESH START®, utiliser le stabilisateur **FRESH START® de Briggs & Stratton** disponible en cartouche de concentré à écoulement progressif.

Il n'est pas nécessaire de vidanger l'essence du moteur si un stabilisateur est ajouté conformément aux instructions. Faire fonctionner le moteur pendant 2 minutes pour faire circuler le stabilisateur dans le système d'alimentation avant le remisage.

Si l'essence n'a pas été traitée avec un stabilisateur, elle doit être vidangée dans un récipient approuvé. Faire fonctionner le moteur jusqu'à ce qu'il s'arrête en panne sèche. L'utilisation d'un stabilisateur d'essence dans le réservoir de stockage est recommandée pour en conserver la fraîcheur.

Huile moteur

Pendant que le moteur est encore chaud, changer l'huile du moteur.

Dépannage

Besoin d'aide? Aller sur VanguardEngines.com ou appeler au 1-800-999-9333.

Spécifications

Spécifications du moteur	
Modèle	290000
Cylindrée	29,23 ci (479 cc)
Alésage	2,677 in (68 mm)
Course	2,598 in (66 mm)
Capacité d'huile	46 - 48 oz (1,36 - 1,42 L)

Spécifications du moteur	
Modèle	300000
Cylindrée	29,23 ci (479 cc)
Alésage	2,677 in (68 mm)
Course	2,598 in (66 mm)
Capacité d'huile	46 - 48 oz (1,36 - 1,42 L)

Spécifications du moteur	
Modèle	350000
Cylindrée	34,78 ci (570 cc)
Alésage	2,835 in (72 mm)
Course	2,756 in (70 mm)
Capacité d'huile	46 - 48 oz (1,36 - 1,42 l)

Spécifications du moteur	
Modèle	380000
Cylindrée	38,26 ci (627 cc)
Alésage	2,972 in (75,5 mm)
Course	2,756 in (70 mm)
Capacité d'huile	46 - 48 oz (1,36 - 1,42 l)

Spécifications de réglage *	
Modèle	290000, 300000
Écartement des électrodes	0,030 in (0,76 mm)
Couple de serrage de la bougie	180 lb-in (20 Nm)
Entrefer bobine	0,008 - 0,012 in (0,20 - 0,30 mm)
Jeu de soupape d'admission	0,004 - 0,006 in (0,10 - 0,15 mm)
Jeu de soupape d'échappement	0,004 - 0,006 in (0,10 - 0,15 mm)

Spécifications de réglage *	
Modèle	350000, 380000
Écartement des électrodes	0,030 in (0,76 mm)
Couple de serrage de la bougie	180 lb-in (20 Nm)
Entrefer bobine	0,008 - 0,012 in (0,20 - 0,30 mm)
Jeu de soupape d'admission	0,004 - 0,006 in (0,10 - 0,15 mm)
Jeu de soupape d'échappement	0,004 - 0,006 in (0,10 - 0,15 mm)

* La puissance du moteur décroît de 3,5% par 300 mètres d'altitude au-dessus du niveau de la mer et de 1% par 5,6° C au-delà de 25° C. Le moteur fonctionne normalement jusqu'à 15° d'inclinaison. Voir le manuel d'utilisation de l'équipement pour les limites autorisées de fonctionnement en pente.

Pièces d'entretien courant ✓

Pièce d'entretien	Référence
Filtre à air - avec réservoir de carburant	393957
Filtre à air - sauf modèle 380000	394018
Filtre à air - modèle 380000	692519
Pré-filtre du filtre à air - avec réservoir de carburant	271794
Pré-filtre du filtre à air - sauf modèle 380000	272490
Pré-filtre du filtre à air - modèle 380000	692520
Huile - SAE 30	100028
Filtre à huile - 6 cm long	492932
Filtre à huile - 9 cm long	491056

Pièce d'entretien	Référence
Filtre à essence - avec réservoir de carburant	808116
Filtre à essence - avec pompe à essence	691035
Filtre à essence - sans pompe	298090
Additif pour l'essence	5041
Bougie à résistance	491055
Bougie en platine longue durée	5066
Clé à bougie	19374
Éclateur	19368

✓ Nous recommandons de voir un Réparateur Agréé Briggs & Stratton pour tout l'entretien du moteur et de ses pièces.

GARANTIE LIMITÉE

Briggs & Stratton garantit que, pendant la période de garantie spécifiée ci-dessous, il remplacera ou réparera gratuitement toute pièce du moteur présentant un défaut de matière ou de fabrication ou les deux. Tous les frais de transport du produit destiné à être remplacé ou réparé au titre de la présente garantie restent à charge de l'acheteur. Cette garantie est applicable pendant la période et aux conditions prévues dans le présent document. Pour toute intervention sous garantie, cherchez le Réparateur Agréé Briggs & Stratton le plus proche dans la liste des Réparateurs Agréés sur notre site Internet BRIGGSandSTRATTON.COM. L'acheteur doit contacter le Réparateur Agréé puis mettre le moteur ou le produit à sa disposition pour inspection et essais.

Il n'existe aucune autre garantie expresse. Les garanties implicites, y compris celles de la valeur marchande et d'adaptation à un objectif particulier, sont limitées à un an à partir de la date d'achat ou à la période légale admise. Toute autre garantie implicite est exclue. Notre responsabilité pour les dégâts provoqués par l'équipement ou les dommages-intérêts accessoires est exclue dans la limite des exclusions autorisées par la loi. Certains pays ou États/provinces n'autorisent aucune restriction sur la durée d'une garantie implicite, et certains pays ou États/provinces n'autorisent pas l'exclusion ou la limitation des dommages accessoires ou indirects. Par conséquent, les restrictions et exclusions décrites ci-dessus pourraient ne pas s'appliquer dans certains cas. La présente garantie accorde légalement à l'utilisateur certains droits spécifiques auxquels peuvent également s'ajouter d'autres droits qui varient d'un pays ou d'un État à l'autre**.

CONDITIONS DE GARANTIE STANDARD * ▲

Marque/Type de produit	Usage privé	Usage professionnel
Vanguard™ ■	3 ans	3 ans
Commercial Turf Series™	2 ans	2 ans
Extended Life Series™ ; I/C®; Intek™ I/C®; Intek™ Pro;™ Professional Series™ avec chemise en fonte Dura-Bore™ ; 850 Series™ avec chemise en fonte Dura-Bore™ ; Snow Series MAX™ avec chemise en fonte Dura-Bore™ Tous les autres moteurs Briggs & Stratton comportant une chemise en fonte Dura-Bore™	2 ans	1 an
Tous les autres moteurs Briggs & Stratton	2 ans	90 jours

* Ces conditions sont nos conditions de garantie standard. Néanmoins, dans certains cas, nos produits peuvent bénéficier d'une couverture supplémentaire qui n'était pas déterminée au moment de la publication. Pour consulter les conditions de garantie actuelles de votre moteur, rendez-vous sur BRIGGSandSTRATTON.COM ou contactez le Réparateur Agréé Briggs & Stratton.

** En Australie - Nos produits disposent de garanties qui ne peuvent être exclues dans le cadre du droit de la consommation australien. Vous êtes en droit de bénéficier d'un remplacement ou d'un remboursement pour une défaillance majeure, ou d'un dédommagement pour toute autre perte ou tout autre dommage raisonnablement prévisible. Vous êtes aussi en droit de bénéficier de la réparation ou du remplacement des produits si ceux-ci s'avèrent ne pas être de qualité acceptable et si la défaillance n'est pas majeure. Pour toute intervention sous garantie, cherchez le Réparateur Agréé Briggs & Stratton le plus proche en consultant la liste des Réparateurs sur BRIGGSandSTRATTON.COM, en composant le 1300 274 447, en envoyant un message électronique à salesenquiries@briggsandstratton.com.au, ou en écrivant directement à Briggs & Stratton Australia Pty Ltd, 1 Moorebank Avenue, Moorebank, NSW, Australie, 2170.

▲ Groupes électrogènes stationnaires: 2ans de garantie en usage privé. Pas de garantie en usage professionnel. Les équipements utilisés pour une alimentation principale en remplacement du réseau public d'électricité ne sont pas couverts par la présente garantie. **Les moteurs utilisés en compétition ou avec un but d'exploitation commerciale ou de location ne sont pas garantis.**

■ Vanguard installés sur les groupes électrogènes stationnaires: 2ans de garantie en usage privé, pas de garantie en usage professionnel. Vanguard installés sur des véhicules utilitaires: 2ans de garantie en usage privé, 2ans de garantie en usage professionnel. Vanguard 3cylindres refroidis à eau: consulter l'application de la garantie sur les moteurs Briggs & Stratton 3/LC.

La période de garantie débute à la date d'achat par l'acheteur particulier initial ou l'utilisateur professionnel final et continue pendant la période indiquée dans le tableau ci-dessus. «Usage privé» signifie utilisation pour l'entretien de sa résidence personnelle par un acheteur particulier. «Usage commercial» couvre toutes les autres utilisations, y compris dans un but commercial, de rentabilité ou de location. Dès qu'un moteur a servi à un usage commercial, il sera considéré comme moteur à usage commercial dans le cadre de la présente garantie.

Pour tous les équipements fabriqués par Briggs & Stratton, l'enregistrement de la garantie n'est pas obligatoire pour qu'elle prenne effet. Conserver le reçu comme preuve d'achat. Si, lors d'une demande d'intervention sous garantie, la date initiale d'achat ne peut être fournie, la date de fabrication du produit sert de référence pour déterminer la période de garantie.

Au sujet de la garantie

Briggs & Stratton se fera un plaisir d'effectuer une réparation en garantie tout en déplorant les inconvénients qu'elle peut vous occasionner. Tout Réparateur Agréé peut effectuer des réparations en garantie. La plupart des réparations en garantie sont effectuées sans discussion mais il peut arriver que la demande de réparation en garantie soit injustifiée. Afin d'éviter tout malentendu entre les propriétaires de moteurs et les Réparateurs Agréés Briggs & Stratton, nous indiquons ci-après quelques-unes des causes de défaillance des moteurs pour lesquelles le remplacement ou la réparation ne sont pas couverts par la garantie.

Usure normale: Les moteurs, comme tous les dispositifs mécanisés, nécessitent un entretien régulier et le remplacement des pièces d'usure pour fonctionner correctement. Cette garantie ne couvre pas la réparation de pièces ou d'équipements usés par un usage normal. La garantie ne s'applique pas quand la défaillance du moteur est due à un abus, un manque d'entretien courant, l'expédition, la manutention, l'entreposage ou une mauvaise installation. Il en va de même si le numéro de série du moteur a été éliminé ou que le moteur a été modifié ou trafiqué.

Entretien inadéquat: La longévité d'un moteur dépend des conditions dans lesquelles il est utilisé et de l'entretien qu'il reçoit. Certaines applications, comme les motoculteurs, les pompes et les tondeuses, sont souvent utilisées dans un environnement poussiéreux ou sale, ce qui peut être la cause d'une usure pouvant paraître prématurée. Une telle usure, lorsqu'elle est consécutive à l'entrée de poussière, sable ou autre produit abrasif à cause d'un mauvais entretien, n'est pas couverte par la garantie.

Cette garantie couvre uniquement les pièces défectueuses et/ou la main d'œuvre et pas le remplacement ou le remboursement de l'équipement sur lequel est monté le moteur. La garantie ne s'applique pas non plus aux réparations dues à :

- 1 Des problèmes provoqués par l'emploi de pièces non d'origine Briggs & Stratton.
- 2 Les commandes de l'équipement ou les dispositifs qui empêchent le démarrage, perturbent le fonctionnement du moteur ou abrègent sa durée de vie. (Contactez le fabricant de l'équipement.)
- 3 Les fuites de carburateur, l'obstruction des Durits d'alimentation, le gommage des soupapes ou autres dommages provoqués par une essence contaminée ou trop vieille.

- 4 Les pièces qui seraient rayées ou cassées du fait du fonctionnement du moteur avec un manque d'huile ou d'une huile polluée, ou encore d'un indice de viscosité de l'huile inadéquat (vérifier et refaire le niveau quand c'est nécessaire et vidanger aux périodes recommandées). Le dispositif OIL GARD peut ne pas couper un moteur en marche. Le moteur peut être endommagé si le niveau d'huile n'est pas maintenu régulièrement.
- 5 La réparation ou le réglage de pièces ou d'un groupe de pièces associées tels que les embrayages, transmissions, commandes à distance, etc., qui ne sont pas fabriqués par Briggs & Stratton.
- 6 Les dommages ou l'usure de pièces provoqués par la pénétration de poussière due au manque d'entretien ou au mauvais montage du filtre à air ou à l'emploi d'un élément ou d'une cartouche de filtre à air non d'origine. Aux intervalles recommandés, nettoyer et/ou remplacer le filtre comme indiqué dans le manuel d'utilisation.
- 7 Les pièces endommagées suite à un surrégime ou une surchauffe provoqués par l'obstruction des ailettes de refroidissement et de la zone du volant par des débris d'herbe ou de la poussière ou par l'utilisation du moteur dans un local fermé insuffisamment ventilé. Nettoyer les débris aux intervalles recommandés comme indiqué dans le manuel d'utilisation.
- 8 Le bris de pièces du moteur ou de l'équipement dû à des vibrations excessives résultant d'un serrage insuffisant des boulons de fixation du moteur, d'une lame ou d'une turbine desserrée ou mal équilibrée, d'une mauvaise adaptation de l'équipement sur le vilebrequin du moteur, d'un surrégime ou d'une mauvaise utilisation.
- 9 Vilebrequin faussé ou cassé suite au choc de la lame d'une tondeuse rotative sur un corps dur, ou d'une courroie trapézoïdale trop tendue.
- 10 Réglage ou mise au point normale du moteur.
- 11 La défaillance du moteur ou des pièces du moteur, telles que la chambre de combustion, les soupapes, sièges de soupapes, guides de soupapes ou bobinages du démarreur grillés, suite à l'emploi de carburants de substitution tels que du pétrole liquéfié, du gaz naturel, de l'essence formulée avec de l'éthanol à plus de 10 %, etc.

Les interventions sous garantie ne sont effectuées que par les Réparateurs Agréés de Briggs & Stratton. Recherchez-les dans la liste des Réparateurs Agréés Briggs & Stratton sur notre site Internet BRIGGSandSTRATTON.com ou en composant le 1-800-233-3723.

Le California Air Resources Board (CARB), l'U.S. EPA et Briggs & Stratton (B&S) ont le plaisir de vous expliquer la garantie du système de contrôle des émissions pour votre moteur/équipement fabriqué 2012-2013. En Californie, les petits moteurs à usage non routier et les gros moteurs à explosion d'un litre ou moins, neufs, doivent être conçus, fabriqués et équipés pour répondre aux normes sévères anti-effet de serre de l'État. B&S doit garantir le système de contrôle des émissions de votre moteur/équipement pendant des durées indiquées ci-après, en supposant que le moteur ou l'équipement n'ait pas fait l'objet d'abus, de négligence ou d'un mauvais entretien.

Le système de contrôle des émissions peut comprendre des pièces comme le carburateur ou le système d'injection de carburant, le réservoir de carburant, le système d'allumage et le convertisseur catalytique. Des durites, des courroies, des connecteurs, des capteurs et d'autres assemblages impliqués dans les émissions peuvent aussi en faire partie.

Si la condition de garantie est remplie, B&S réparera gratuitement votre moteur/équipement y compris le diagnostic, les pièces et la main-d'œuvre.

Couverture de la garantie du fabricant:

Les petits moteurs à usage non routier et les gros moteurs à explosion d'un litre ou moins sont garantis pendant une période de trois (3) ans. Si une pièce liée aux émissions de votre moteur/équipement est défectueuse, Briggs & Stratton la réparera ou la remplacera.

Dispositions de la garantie du système de contrôle des émissions de Briggs & Stratton

Suivent les dispositions particulières de la couverture de la garantie du système de contrôle des émissions. Elles viennent en complément de la garantie des moteurs B&S pour les moteurs non réglementés qui se trouve dans le manuel d'utilisation.

1. Pièces relatives au contrôle des émissions garanties

La couverture au titre de cette garantie ne s'étend qu'aux pièces énumérées ci-dessous (celles du système de contrôle des émissions) dans la mesure où ces pièces étaient présentes sur le moteur B&S et/ou le circuit d'alimentation prévu par B&S.

- a. Système de dosage du carburant
 - Système d'enrichissement pour démarrages à froid (starter)
 - Carburateur et pièces internes
 - Pompe à carburant
 - Durit et raccords de carburant, colliers
 - Réservoir de carburant, bouchon et câble d'attache
 - Réservoir à charbon activé
- b. Système d'admission d'air
 - Filtre à air
 - Collecteur d'admission
 - Conduite de vidange et de mise à l'air
- c. Système d'allumage
 - Bougie(s)
 - Système d'allumage par volant magnétique
- d. Système catalytique
 - Convertisseur catalytique
 - Collecteur d'échappement
 - Système d'injection d'air ou soupape d'impulsion
- e. Pièces diverses utilisées dans les systèmes ci-dessus
 - Soupapes et contacteurs de dépression, de température, de position et de durée
 - Raccords et assemblages

2. Durée de la couverture

Pendant une période de trois (3) ans à compter de la date de l'achat initial, B&S garantit à l'acheteur initial et à chaque acheteur suivant que le moteur est conçu, fabriqué et équipé de manière à être en conformité avec toutes les réglementations applicables adoptées par l'Air Resources Board, qu'il est exempt de tout défaut de matière ou de construction susceptible d'entraîner la défaillance d'une pièce garantie et qu'il est matériellement identique en tous points au moteur décrit dans la demande de certification du fabricant. La période de garantie démarre à la date de l'achat initial du moteur.

Responsabilités du propriétaire au titre de la garantie:

- En tant que propriétaire d'un moteur/équipement, vous êtes responsable de l'entretien nécessaire indiqué dans le manuel d'utilisation. B&S recommande de conserver toutes les factures de maintenance de votre moteur/équipement mais B&S ne peut renier la garantie uniquement à cause de l'absence de factures ou parce que tous les entretiens n'ont pas été effectués en temps prévu.
- En tant que propriétaire d'un moteur/équipement, vous devez néanmoins savoir que B&S peut refuser d'appliquer la garantie si la défectuosité de votre moteur/équipement ou d'une partie de celui-ci est due à un abus, une négligence, un entretien non correct ou des modifications non approuvées.
- Vous avez la responsabilité de confier votre moteur/équipement à un centre de distribution, un Réparateur Agréé ou toute entité équivalente de B&S, selon la solution applicable, dès que le problème apparaît. Les réparations effectuées sous garantie doivent l'être en un temps raisonnable qui ne doit pas excéder trente (30) jours. Si vous avez des questions concernant vos droits et vos responsabilités au titre de la garantie, contactez B&S au (414) 259-5262.

La garantie sur les pièces liées aux émissions est comme suit:

- Toute pièce garantie dont le remplacement n'est pas prévu dans le cadre de la maintenance obligatoire indiquée dans le manuel d'utilisation fourni est garantie pendant la période susmentionnée. Si cette pièce se révélait être défectueuse au cours de la période de garantie, elle serait réparée ou remplacée par B&S sans aucun frais pour le propriétaire. La pièce ainsi réparée ou remplacée sera garantie pour la période restante.
- Toute pièce garantie dont seule une inspection régulière est prévue dans le manuel d'utilisation fourni est garantie pendant la période susmentionnée. La pièce réparée ou remplacée dans le cadre de la garantie sera garantie pour la période restante.
- Toute pièce garantie dont le remplacement est prévu dans le cadre de la maintenance obligatoire indiquée dans le manuel d'utilisation fourni est garantie pendant la période précédant le premier remplacement prévu de cette pièce. Si cette pièce se révélait être défectueuse avant le premier remplacement prévu, elle serait réparée ou remplacée par B&S sans aucun frais pour le propriétaire. La pièce ainsi réparée ou remplacée sera garantie pour la période restante précédant le premier remplacement prévu de ladite pièce.
- Les pièces ajoutées ou modifiées qui ne sont pas exemptées par l'Air Resources Board ne peuvent être utilisées. L'utilisation par le propriétaire de pièces ajoutées ou modifiées non exemptées sera un motif de rejet de toute réclamation. Le fabricant ne peut en aucun cas être tenu de garantir les défaillances de pièces garanties dues à l'utilisation de pièces non exemptées ajoutées ou modifiées.

3. Couverture des conséquences

La présente couverture s'étend à la défaillance de tout composant du moteur due à la défaillance d'une pièce liée aux émissions garantie.

4. Réclamations et exclusions de garantie

Les réclamations sous garantie seront présentées selon les dispositions de la police de garantie des moteurs de B&S. La garantie ne couvre pas les défaillances de pièces liées aux émissions qui ne sont pas des pièces B&S d'origine ou les défaillances de pièces qui ont fait l'objet d'abus, de négligence ou d'un mauvais entretien ainsi qu'indiqué dans la police de garantie des moteurs de B&S. B&S n'est pas tenu de couvrir la garantie des défaillances des pièces liées aux émissions dues à l'utilisation de pièces rajoutées ou modifiées.

Consultez les informations sur la période de durabilité des émissions et l'indice d'air sur l'étiquette d'émissions du petit moteur à usage non routier

Les moteurs qui sont certifiés conformes à la norme d'émissions relatives aux petits moteurs à usage non routier du California Air Resources Board (CARB) doivent afficher l'information concernant la période de durabilité des émissions et l'indice d'air. Cette information est indiquée sur les étiquettes apposées sur les moteurs par Briggs & Stratton. L'étiquette du moteur indique les informations de certification.

La **période de durabilité des émissions** indique le nombre d'heures d'utilisation normale pour lequel le moteur est certifié conforme aux normes d'émissions sous réserve d'un entretien approprié tel qu'indiqué dans le manuel d'utilisation et d'entretien. Les catégories suivantes sont utilisées:

Modéré:
le moteur est certifié conforme pour 125 heures d'utilisation normale.

Intermédiaire:

le moteur est certifié conforme pour 250 heures d'utilisation normale.

Étendu:
le moteur est certifié conforme pour 500 heures d'utilisation normale. Par exemple, une tondeuse à conducteur marchant classique est utilisée 20 à 25 heures par an. Par conséquent, la **période de durabilité des émissions** d'un moteur de catégorie **intermédiaire** équivaldrait à une douzaine d'années.

Les moteurs Briggs & Stratton sont certifiés conformes aux normes environnementales d'émissions de la United States Environmental Protection Agency (U.S. EPA) Phase 2 ou Phase 3. La période de conformité d'émissions mentionnée sur les étiquettes indique le nombre d'heures d'utilisation pour lequel le moteur est en conformité avec les normes fédérales.

Pour les moteurs de cylindrée inférieure à 225 cm³.
Catégorie C = 125 heures, catégorie B = 250 heures et catégorie A = 500 heures.

Pour les moteurs de plus de 225 cm³.
Catégorie C = 250 heures, catégorie B = 500 heures et catégorie A = 1000 heures.



THE POWER WITHIN™

SAFETY

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 park brake, move direction selector to neutral, 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 park 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

Read and understand the following text and warnings before attempting to service vehicle:

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 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. Exposure to 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.

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 no loose clothing or hair can contact moving parts.

Use care not to touch hot objects.

Lift the entire vehicle and support on jack stands before attempting to run or adjust powertrain.

Wear eye protection when working on or around the 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.



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To locate a local dealer please go online to our website:
www.BADBOYBUGGIES.COM

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