REPAIR AND SERVICE MANUAL

TRACKER OFF ROAD™

Gasoline EFI Vehicle

699331-A
Issued July 2019

SAFETY

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

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

This vehicle is an off road vehicle. Familiarize yourself with all laws and regulations concerning the operation of this vehicle in your area.

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

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

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

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

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

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

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

Manufacturer's Intended Use

This vehicle is designed and manufactured for off road use only. Use on public streets, roads or highways is illegal in most areas and increases the risk of an accident involving other vehicles and people. This vehicle does not meet FMVSS (Federal Motor Vehicle Safety Standards) for public street, road or highway use.

Check all laws and regulations before choosing an area to operate your vehicle.

Noise Control System

Do not modify the engine, intake or exhaust components. Modifications to these components can affect compliance with ROHVA1-2016 and local noise level requirements. Modifications to these components can also affect the emissions control system.

Spark Arrestor And Use On Public Lands

This vehicle has a spark arrester that was tested and qualified to be in compliance with the USFS standard 5100-1. Federal law requires that this spark arrester be installed and functional when the vehicle is operated on public lands.

Off road vehicle operation on public lands in the USA is regulated by 43 CFR 420. Violations are subject to monetary penalties. Go to www.www.gpo.gov/fdsys to see federal regulations.

REPAIR AND SERVICE MANUAL

SVX 1000

4X4 ALL TERRAIN VEHICLE

MODEL YEAR 2020

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

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

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

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

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

Dealer: 800-296-4804
Consumer: 877-394-6727

www.trackeroffroad.com

GENERAL INFORMATION

This vehicle has been designed and assembled in the United States of America (USA). The Standards and Specifications listed in the following text originate in the USA unless otherwise indicated.

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

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

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

BATTERY PROLONGED STORAGE

Batteries self-discharge over time. The rate of self-discharge varies depending on the ambient temperature, the age and condition of the battery.

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

For winter storage, the battery must be clean, fully charged and disconnected from any source of electrical drain.

BATTERY DISPOSAL

Lead-acid batteries are recyclable. Return whole scrap batteries to distributor, manufacturer or lead smelter for recycling. For neutralized spills, place residue in acid-resistant containers with absorbent material, sand or earth and dispose of in accordance with local, state and federal regulations for acid and lead compounds. Contact local and/or state environmental officials regarding disposal information.

TABLE OF CONTENTS

TABLE OF CONTENTS

TABLE OF CONTENTS

TABLE OF CONTENTS

TABLE OF CONTENTS

TABLE OF CONTENTS

TABLE OF CONTENTS

SAFETY INFORMATION

The purpose of this manual is to assist in the maintenance of the vehicle in accordance with procedures developed by the manufacturer. Following these procedures 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

Since vehicles are used for a variety of tasks beyond their intended use, it is impossible to anticipate and warn against every possible combination of circumstances that may occur. Responsible driving practices help to prevent accidents and injury more than warnings and instructions can provide.

Anyone operating the vehicle must read the entire owner's manual provided with the purchase of the vehicle, paying particular attention to the CAUTIONS, WARNINGS and DANGERS within.

For any questions or concerns, contact your dealer.

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

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

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

This vehicle is designed and manufactured for off road use. It does not conform to Federal Motor Vehicle Safety Standards and is not intended for operation on public streets.

See the *GENERAL SPECIFICATIONS on page 169* for vehicle seating capacity. Do not exceed number of occupants indicated.

⚠WARNING ***Never modify the vehicle in any way that will alter the weight distribution of the vehicle, decrease it's stability, increase the speed or extend the stopping distance beyond the factory specification. Such modifications can result in serious personal injury or death.***

Modifications that increase the speed and/or weight of the vehicle will increase the braking 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.

Speed must be moderated to account for the environmental conditions and terrain encountered.

GENERAL OPERATION

ALWAYS:

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

SAFETY INFORMATION

MAINTENANCE

ALWAYS:

- Replace damaged or missing warning, caution or information labels.
- Maintain the vehicle according to the manufacturer's periodic service schedule. See *SCHEDULED MAINTENANCE CHART* on page 174.
- Ensure that repairs are performed by trained and qualified persons.
- Follow the manufacturer's maintenance procedures.
- Use insulated tools near the battery to prevent sparks or battery explosion.
- Check the polarity of the battery terminals and be sure to rewire the battery correctly.
- Use specified replacement parts. Never use replacement parts of lesser quality.
- Use recommended tools.
- Determine that tools and procedures not specifically recommended by the manufacturer will not compromise the safety of personnel, nor jeopardize the safe operation of the vehicle.
- Lift the vehicle in accordance with the manufacturer's instructions. Chock the wheels and support the vehicle with safety stands. Never get under a vehicle that is supported by a jack alone.
- Never service a vehicle in an area where exposed flame is present or persons are smoking.
- Be aware that a vehicle that is not performing properly is a potential hazard and must not be operated.
- Test drive vehicle after repairs or maintenance in a safe area, free of vehicular and pedestrian traffic.
- Keep complete records of the maintenance history of the vehicle.

VENTILATION

ALWAYS:

- Store the vehicle in a well ventilated area to prevent gasoline fumes from accumulating.
- Fuel the vehicle in an area free from flame or sparks. Pay particular attention to natural gas or propane water heaters and furnaces.
- Service or operate the vehicle in a well ventilated area to prevent the accumulation of exhaust gases.

GENERAL INFORMATION AND ROUTINE MAINTENANCE

VEHICLE IDENTIFICATION

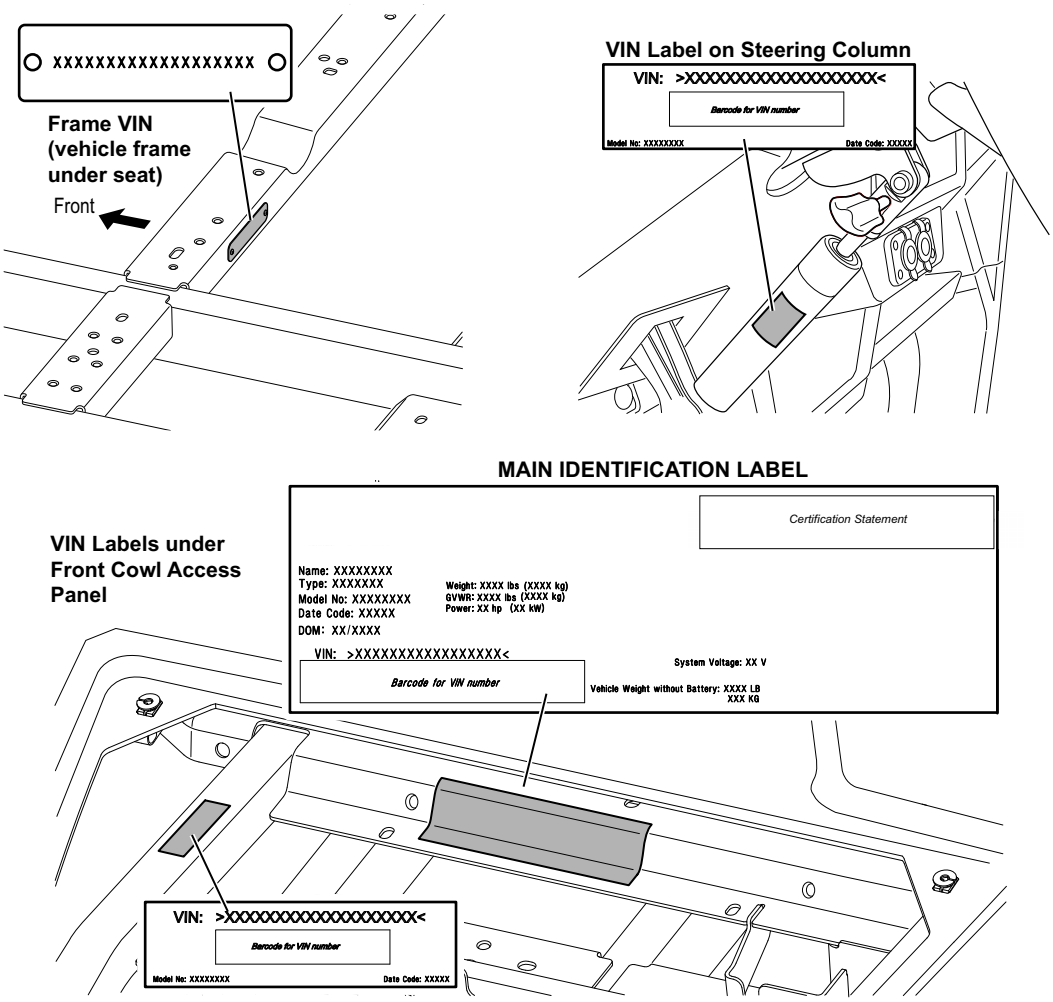


Fig. 1 VIN Location

The VIN number plates are located on the vehicle where shown above (See Fig. 1).

Design changes take place on an ongoing basis. The information on these labels must be provided to obtain correct replacement components for the vehicle.

GENERAL INFORMATION & ROUTINE MAINTENANCE

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

STARTING THE VEHICLE WITH A DISCHARGED BATTERY

The stator is not designed to charge a discharged battery.

If the vehicle is equipped with additional lights and/or a strobe light that is used when the vehicle is not in motion, the stator may not be adequate to maintain battery charge. If the vehicle battery has 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.

SERVICING THE VEHICLE

⚠WARNING ***Do not perform any type of servicing operations before reading and understanding all notes, cautions, warnings and dangers in this manual.***

Any servicing requiring adjustments to be made to the powertrain while the engine is running must be made with all four wheels raised off the ground.

Wear eye protection when working on the vehicle. Use extra care when working around the battery, 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 battery before removing any heavy gauge battery wires.

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

Before a new vehicle is put into operation, the items shown in the INITIAL SERVICE CHART must be performed (See Fig. 2).

ITEM	SERVICE OPERATION
Battery	Fully charge battery.
Seats	Remove protective plastic covering.
Brakes	Check operation, adjust if necessary. Check hydraulic brake fluid level.
Tires	Check air pressure, adjust if necessary. See GENERAL SPECIFICATIONS for tire pressure.
Fuel	Fill with correct fuel. See RECOMMENDED LUBRICANTS AND FLUIDS.
Engine	Check oil level.

Fig. 2 Initial Service Chart

ROUTINE MAINTENANCE

This vehicle will give years of satisfactory service, if it receives regular maintenance.

NOTICE: To prolong vehicle life, some maintenance items must be serviced more frequently on vehicles used under severe driving conditions such as extreme temperatures, extreme dust/debris conditions, or frequent use with maximum load.

POWERTRAIN MAINTENANCE

Access the powertrain by raising or removing the truck bed and the seat bottom. Full access to powertrain may be obtained by removing the skid plate and body panels. Some service procedures may require the vehicle to be lifted. See "LIFTING THE VEHICLE" on page 19.

⚠WARNING ***Always install a positive stop to prevent severe injury that could result if the truck bed lift mechanism should unexpectedly fail.***

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

To prevent accidental starting, disconnect the negative battery cable before servicing.

For maintenance procedures relating to the engine, fuel system, transmission, and rear axle or suspension, refer to the particular section. See the TABLE OF CONTENTS for section location.

BRAKES

This vehicle is equipped with four-wheel hydraulic disc brakes. Check the fluid level at intervals specified in the SCHEDULED MAINTENENCE CHART. If fluid leaks are noticed or the brake pedal seems soft, check the fluid level immediately. If the brake pedal is soft, the brake system should be bled to remove air from the brake lines. See "BLEEDING AND FLUSHING" on page 68.

After the vehicle is put into service, the brakes must be checked by periodically conducting a brake performance test.

⚠WARNING ***To prevent severe injury or death resulting from operating a vehicle with an improperly operating brake system, the brake 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.

GENERAL INFORMATION & ROUTINE MAINTENANCE

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

TIRES

NOTICE: The standard tires on this vehicle are uni-directional. The front tires are narrower than the rear tires. Tires must not be moved or rotated from their original position.

- Tire condition must be inspected.
- Inflation pressures must be checked while the tires are cool. See *GENERAL SPECIFICATIONS* on page 169.
- Be sure to install the valve dust cap after checking or inflating a tire. See *WHEEL AND TIRE SERVICE* on page 59.

LIGHT BULB REPLACEMENT

See *LIGHTS* on page 145.

CARE AND CLEANING OF VEHICLE

Keeping the vehicle clean is not only beneficial to its appearance, but can also help extend the life of various components.

Washing the Vehicle

⚠ CAUTION ***To prevent damage, do not use a pressure washer or abrasive solvents to clean this vehicle.***

- Use an automotive type cleaner or mild soap to wash the vehicle. Harsh cleaners can scratch the finish.
- Do not use a pressure washer to wash your vehicle. High water pressure can damage components.
- Use clean or new cloths and pads for washing. Reused cloths and pads can contain dirt particles that will scratch the finish.
- Cleaning vinyl seats and plastic or rubber trim requires the use of a mild soap solution applied with a sponge or soft brush. Wipe with a damp cloth.
- Clean any areas where mud or other debris can collect. Loosen sediment packed in closed areas to ease it's removal, taking care not to chip or otherwise damage paint.
- Removal of oil, tar, asphalt, etc. requires the use of a commercially available vinyl/rubber cleaner.
- Start engine and let it run for a few minutes to dry any water that may have entered the engine or exhaust system.

NOTICE: Some products, including insect repellents and chemicals, will damage plastic surfaces. Do not allow these types of products to contact the vehicle.

1. With an automotive type wash cloth, wash from the top of the vehicle to the bottom.
2. To prevent the soap from drying on the vehicle, rinse with clean water frequently.
3. To prevent water spots, dry with a chamois before the water dries.

The manufacturer does not recommend the use of a pressure washer. High pressure water can damage components, chip paint and remove labels. If the use of a pressure washer cannot be avoided, do not direct the water stream at the following items:

- Engine
- wheel bearings
- body panels
- radiator
- labels and decals
- transmission seals
- switches and controls
- brakes
- electrical components and wiring

Polishing the Vehicle

- Do not use medium to heavy duty compounds on the finish.
- Use clean or new cloths and pads for polishing. Old or reused cloths and pads can contain dirt particles that will scratch the finish.

CANOPY AND WINDSHIELD

⚠ WARNING ***The canopy does not provide protection from rollover or falling objects.***

The windshield does not provide protection from tree limbs or flying objects.

The canopy and windshield are designed for weather protection only. See *WEATHER PROTECTION* on page 55.

Roll over protection is provided by the ROPS. See *ROLL-OVER PROTECTION SYSTEM (ROPS)* on page 43.

GENERAL INFORMATION & ROUTINE MAINTENANCE

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

TRANSPORTING THE VEHICLE

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

Do not ride on a vehicle being transported.

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.

Always check that the vehicle and contents are secured before transporting the vehicle. The rated capacity of the trailer must exceed the weight of the vehicle (See *GENERAL SPECIFICATIONS* on page 169. Place the shifter in the P (park) position and remove the key from the vehicle. Secure the vehicle to the trailer using ratchet tie downs.

PROLONGED STORAGE

Battery

During periods of storage, the battery must be maintained to prevent discharge. If a battery is left in a discharged state, sulfating will cause permanent damage to the battery. To prevent damage, the battery should be recharged.

Engine

⚠WARNING ***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 the vehicle in a clean, dry area. Do not store in the same area as a stove, furnace, water heater, or other appliance that uses a 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 while refueling to prevent possible eye injury from gasoline or gasoline vapor.

Keep hands, clothing and jewelry away from moving parts. Do not contact hot objects. Raise the vehicle and support on jack stands before attempting to run the engine.

Preparing the engine for a prolonged storage period of 30 days or longer requires some simple steps to prevent varnish, gum and corrosion in the throttle body and in the engine.

1. Perform all periodic routine maintenance per the periodic service schedule.
2. Place the shifter in the P (park) position.
3. Add a commercially available fuel stabilizer to the fuel tank. Follow the manufacturer's mixing instructions.
4. Start the engine and let it run for several minutes in a well ventilated area to allow the fuel stabilizer to be mixed through the fuel system.
5. Turn the key switch to the OFF position and remove the key.
6. Remove both ignition coils from the plugs.
7. Remove both spark plugs.
8. Add a conventional cylinder fogging oil or one ounce of 30 weight oil to each spark plug hole.
9. Inspect the spark plugs prior to installation.
10. Rotate the engine several times with the starter. This will allow the fogging oil to coat the cylinders.
11. Install spark plugs. Replace with new plugs if needed.
12. Install the ignition coils onto the spark plugs.

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

HARDWARE

Periodically inspect the vehicle for loose fasteners. Fasteners must be tightened carefully and in accordance with the Torque Specifications table (Ref. Fig. 3) or as specified in text.

Three classes of standard hardware and three classes of metric hardware are used on the vehicle.

- Grade 2 hardware is unmarked.
- Grade 5 hardware can be identified by the three marks on the hexagonal head.
- Grade 8 hardware is identified by six marks on the head.

The class specification is marked on metric hardware.

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. 3 Torque Specifications

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

Notes:

SAFETY

NOTICES, CAUTIONS, WARNINGS AND DANGERS

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

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

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

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

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

A vehicle in need of repair 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. Exposure to battery acid and hydrogen gas could result in serious bodily injury to the technician/mechanic and bystanders. Be careful not to place hands, face, feet or body in a location that could expose them to injury should an unexpected 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 can make the vehicle unstable or prone to rollover, which could result in injury or death to the operator or passengers.***

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 notices, cautions and warnings in this manual.***

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

BEFORE SERVICING THE VEHICLE

Before inspecting or servicing a vehicle, read and understand the following warnings:

⚠ WARNING ***Before working on the vehicle, remove all jewelry.***

Make sure that clothing or hair cannot become caught in the moving parts of the powertrain.

Do not 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 shifter must always be placed in the P (park) position, 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 battery and fuel tank must be removed and the fuel system drained.

To prevent an explosion that could result in severe injury or death, keep all smoking materials, open flame or sparks away from gasoline and battery.

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 can ignite by the ignition system or the hot exhaust system.

Never work on a hot engine.

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

If the spark function is to be observed at the spark plug, 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.

Verify that the fuel lines are correctly installed before starting the engine. See the FUEL SYSTEM section.

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

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

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 the battery when removing or installing; spilled electrolyte can cause burns and damage.

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

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

Electrolyte spills must be neutralized with a solution of 1 tablespoon (15 ml) sodium bicarbonate (baking soda) dissolved in 1 quart (1 liter) of water and then flushed with water.

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

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.

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

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.

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

LIFTING THE VEHICLE

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

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

Place shifter in the P (park) position.

Always place chocks in front and behind the wheels.

Be sure the vehicle is on a firm and level surface.

Never get under a vehicle while it is supported only by a jack.

Use jack stands and test the stability of the vehicle on the stands.

The vehicle is extremely unstable during the lifting process.

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

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

NOTICE: If under-vehicle access is required, remove the skid plates prior to beginning the lifting process.

Lifting Front of Vehicle

1. Chock the rear wheels to keep the vehicle from rolling backward (Ref. Fig. 2).
2. Put a jack under the center of the vehicle frame at the differential mounting plate (Ref. Fig. 1).
3. Raise the vehicle with the jack.
4. Install a jack stand under each side of the vehicle frame just behind the front wheels.
5. Lower the vehicle until it rests on the jack stands.
6. Remove the jack.
7. Confirm that the vehicle is stable on the jack stands before proceeding with any service.

Lifting Rear of Vehicle

1. Chock the front wheels to keep the vehicle from rolling forward (Ref. Fig. 2).
2. Put a jack under the center of the vehicle frame at the hitch mounting plate (Ref. Fig. 1).
3. Raise the vehicle with the jack.
4. Install a jack stand under each side of the vehicle frame just in front of the rear wheels.
5. Lower the vehicle until it rests on the jack stands.
6. Remove the jack.
7. Confirm that the vehicle is stable on the jack stands before proceeding with any service.

Lowering Vehicle

1. Make sure chocks are still in place on any wheels that remain on the ground.
2. Put the jack in the same location that was used to raise the vehicle.
3. Raise the vehicle enough to remove the jack stands. Remove the jack stands from underneath the vehicle.
4. Slowly lower the vehicle to the ground and remove the jack.

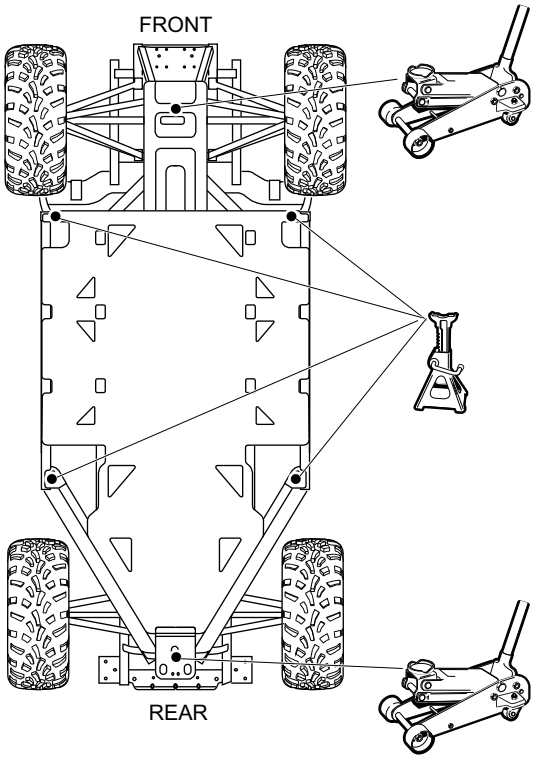


Fig. 1 Lifting the Vehicle

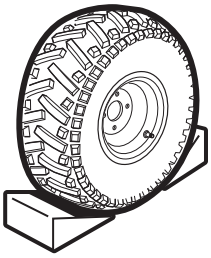


Fig. 2 Wheel Chocks

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

Notes:

BODY

GENERAL

NOTICE: Hardware that is removed must always be installed in its original position unless otherwise specified. See HARDWARE on page 15.

Body components can be replaced with a minimum of special tools. Most body components are secured with removable plastic rivets and standard hardware.

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 over spray and airborne mist.

NOTICE: Provide protection from over spray to vehicle and surrounding area.

Repairing Scratches

To repair minor scratches, the following steps must be taken:

1. Thoroughly clean the surface to be repaired with alcohol and allow to dry.
2. Use a brush to apply a minimum of two coats of touch up paint to the damaged area. Allow 30 - 45 minutes between coats; increase to 45 - 60 minutes in higher humidity. The painted area must be slightly higher than the surface of the part.
3. Use 400 grit "wet" sand paper to blend painted area level with the rest of the part being repaired.
4. Use a polishing compound (3M Finesse or automotive grade) to renew gloss and to further blend and transition newly painted surface.
5. Clean with alcohol and allow to dry.
6. Optional but recommended; Apply clear coat to renew and protect depth of finish.
7. Wax or polish with a Carnauba base product, available at any automotive parts distributor. Do not wax flat finishes.

To repair large scratches, the following steps must be taken:

1. Thoroughly clean the surface to be repaired with alcohol, and allow to dry.
2. Apply tape to the area surrounding the damaged area to prevent over spray of paint.
3. Shake the aerosol paint a minimum of one minute to mix thoroughly and achieve the best color match.
4. Apply paint in light even overlapping strokes. Multiple coats can be applied to provide adequate coverage and finish.
5. Allow paint to dry overnight.
6. Use 400 grit "wet" sand paper to blend painted area level with the surface of the part being repaired.
7. Use a polishing compound (3M Finesse or automotive grade) to renew gloss and to further blend and transition newly painted surface.
8. Clean with alcohol, and allow to dry.
9. Optional but recommended; Apply clear coat to renew and protect depth of finish.
10. Wax or polish with Carnauba base product, available at any automotive parts distributor. Do not wax flat finishes.

Complete Panel Repair

If large panels or areas must be painted, touch up paint is not recommended. In such cases, professional painting or panel replacement is necessary. Body panel replacement is sometimes more cost effective than painting. Painting can be done by any body panel repair shop with experience in painting Thermoplastic Elastomer (TPE) panels. TPE is a common material in modern automobile body panels, and all body panel repair 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.

Decal Replacement

Tool List	Qty.
Alcohol	AR
Clean Lint Free Cloth	1
Squeegee	1

When replacing decals on the body panels:

1. Prepare the surface by cleaning with alcohol and a clean cloth. Allow the surface to dry.
2. Peel away the decal backing and apply to the surface.
3. Use a squeegee to smooth out the decal and remove any air pockets trapped under the decal. A needle can be used to puncture any remaining air pockets that cannot be otherwise removed.

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

Cowl Removal

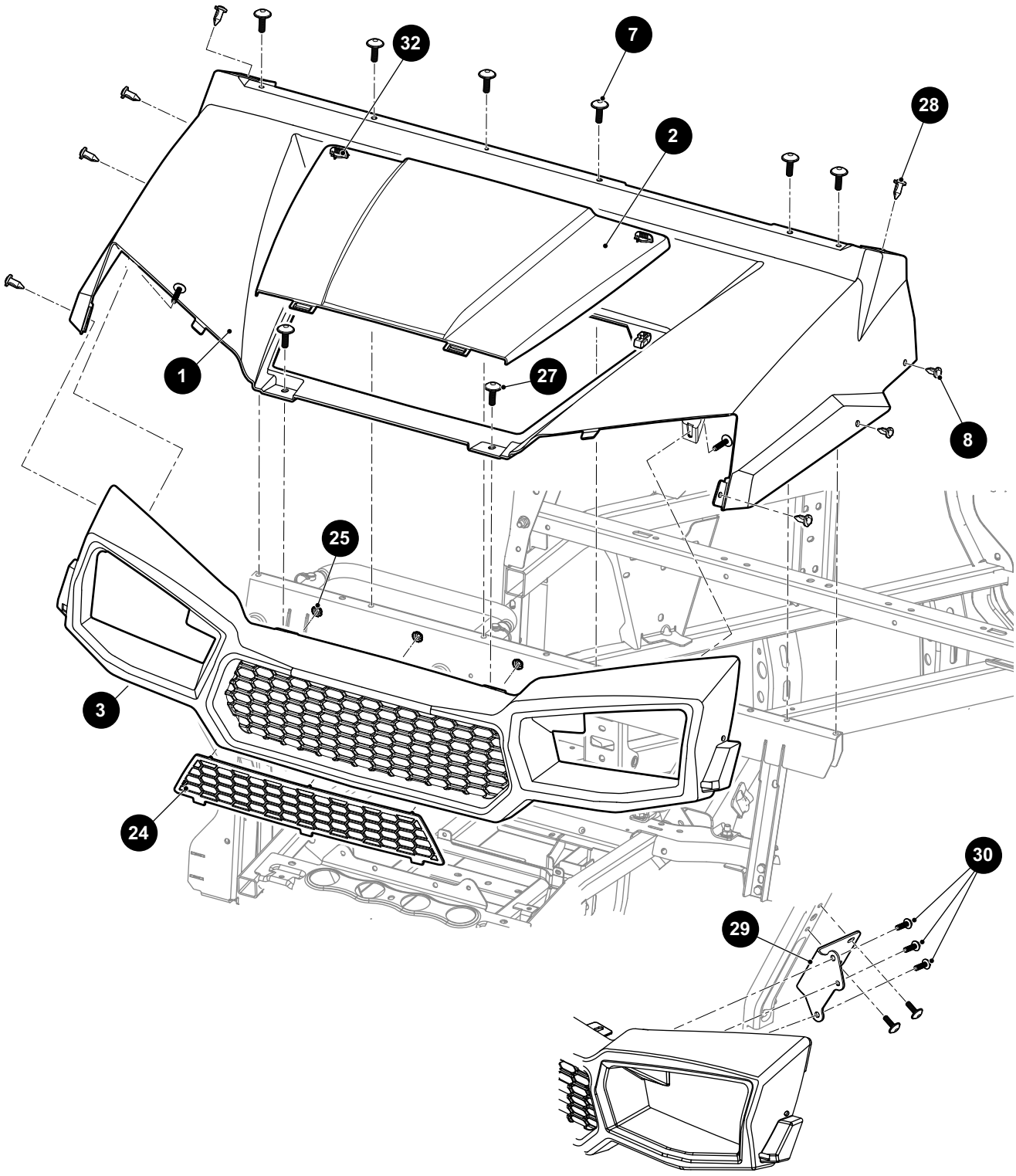


Fig. 1 Cowl and Front Fascia

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

Tool List	Qty.
Ratchet	1
Torx Bit, T30	1
Pry Bar	1
Screwdriver, Flat Tip	1

1. Unlock the quarter-turn fasteners (32) on the hood (2). Open the hood and pull up and back to remove (See Fig. 1).
2. Remove the nuts (25) that secure the grill (24) to the front fascia (3). Remove the grill.
3. Remove the bolts (30) that secure the sides of the fascia to the mounting brackets (29).
4. Disconnect the headlights from the wire harness.
5. Remove the plastic rivets (8) and screws (27) that secure the fascia to the cowl (1). Remove the fascia from the vehicle.
6. Remove screws (7) and plastic rivets (8) that secure the cowl (1) to the frame. Remove the cowl.
7. Installation is the reverse order of removal.

Dash Removal

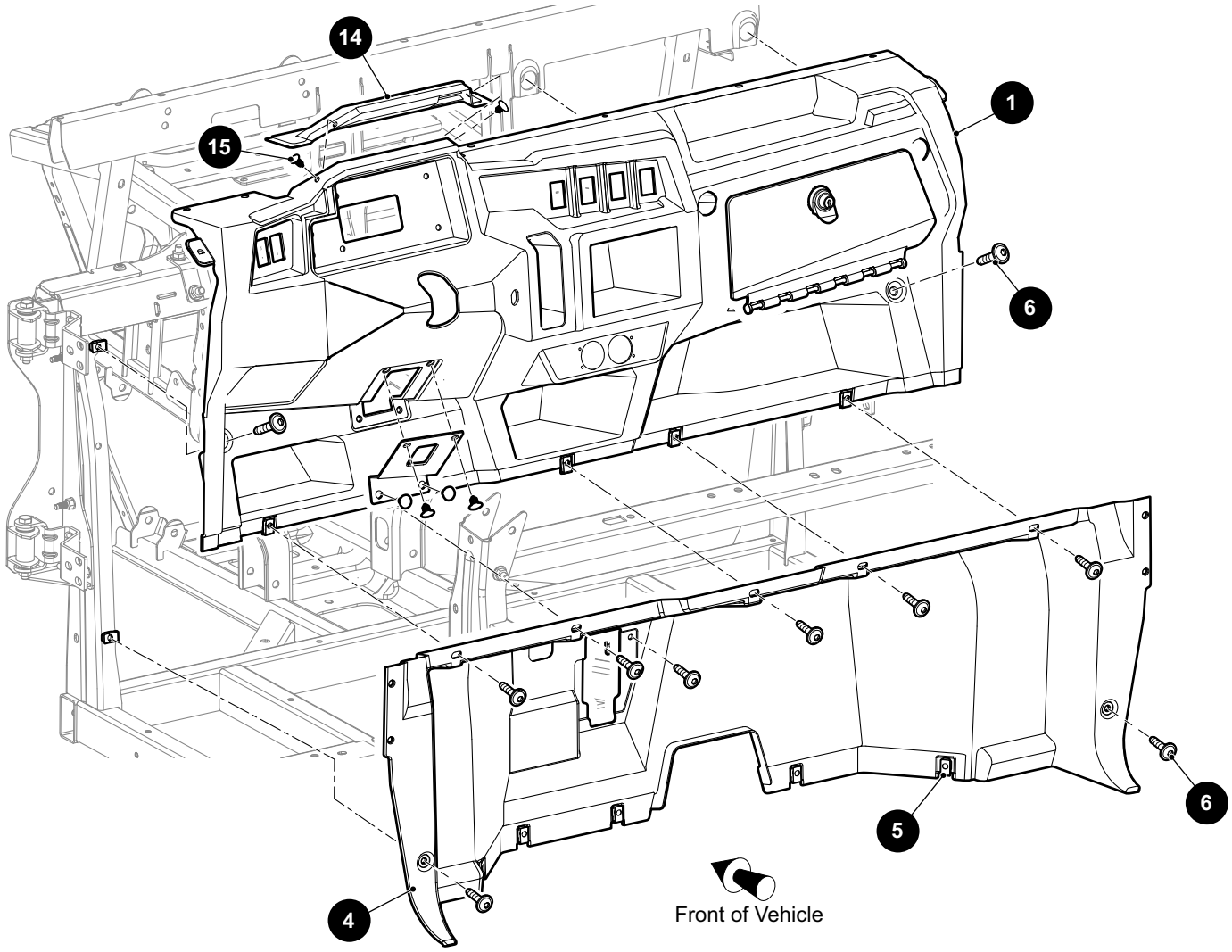


Fig. 2 Dash and Front Bulkhead

Tool List	Qty.
Pry Bar	1
Screwdriver, Phillips Head	1
Ratchet	1
Torx Bit, T30	1
Wrench, 13mm	1

1. Remove the cowl. See *Cowl Removal* on page 22.
2. Remove plastic ratchet fasteners (15) that secure the display cover (14) to the dash (1). Remove the cover (See Fig. 2).
3. Remove the instrument display, USB outlet, key switch and control switches. See *ELECTRICAL SYSTEM* on page 143.

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

4. Remove the passenger hand hold. See *FRAME* on page 37.
5. Remove the rocker panel. See *SEATING* on page 31.
6. Remove the quarter panels and fender liners. See *Quarter Panel and Front Fender Liner Removal* on page 27.
7. Remove the steering wheel and adjustment strut. See *Steering Wheel Replacement* on page 83.
8. Loosen the jam nut and remove the shifter knob.
9. Remove the floorboards. See *Floorboards* on page 30.
10. Remove the bolts (6) the secure the front bulkhead (4) to the bottom of the dash (1).
11. Remove the bolts (6) that secure the dash to the frame.
12. Remove the dash from the vehicle.
13. Installation is the reverse order of disassembly.

Standard Brush Guard Removal

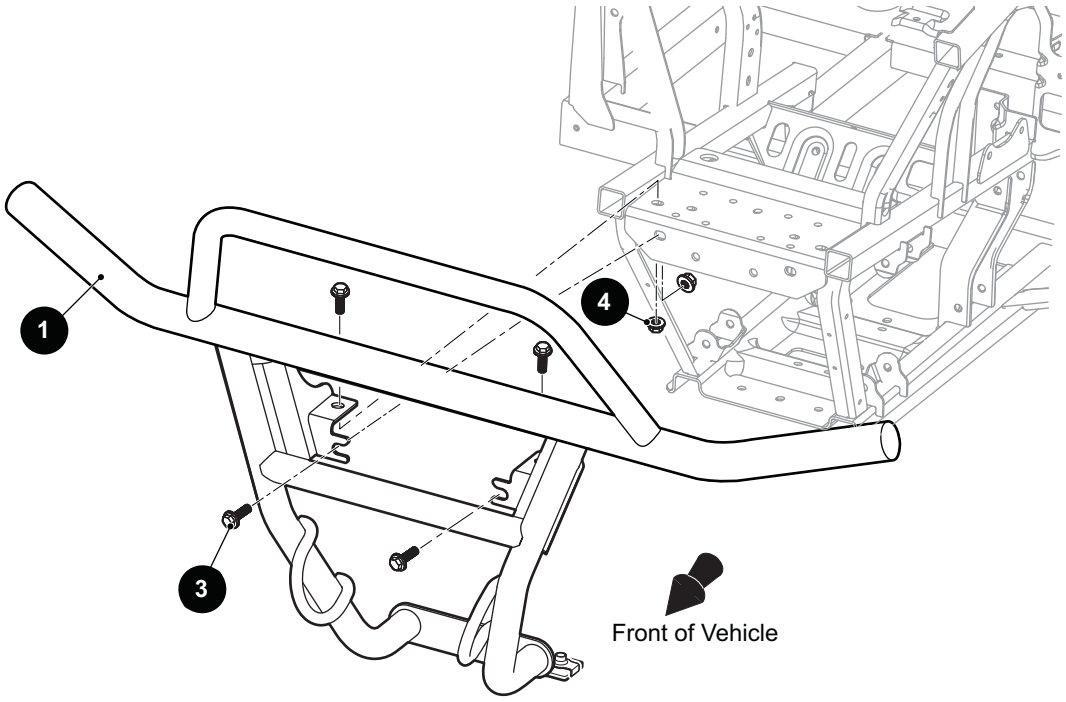


Fig. 3 Standard Brush Guard

Tool List	Qty.
Ratchet	1
Socket, 17mm	1
Wrench, 17mm	1
Torque Wrench, ft. lbs	1

1. Remove two bolts (3) and nuts (4) that secure the brush guard (1) to the bracket (2) (See Fig. 3).
2. Remove four bolts (3) and nuts (4) that secure the brush guard (1) to the frame.
3. Remove the brush guard.
4. Installation is the reverse order of removal.
5. Tighten the hardware to torque specified below.

Item	Torque Specification
3	30 - 33 ft. lbs. (40 - 45 Nm)

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

Premium Brush Guard Removal

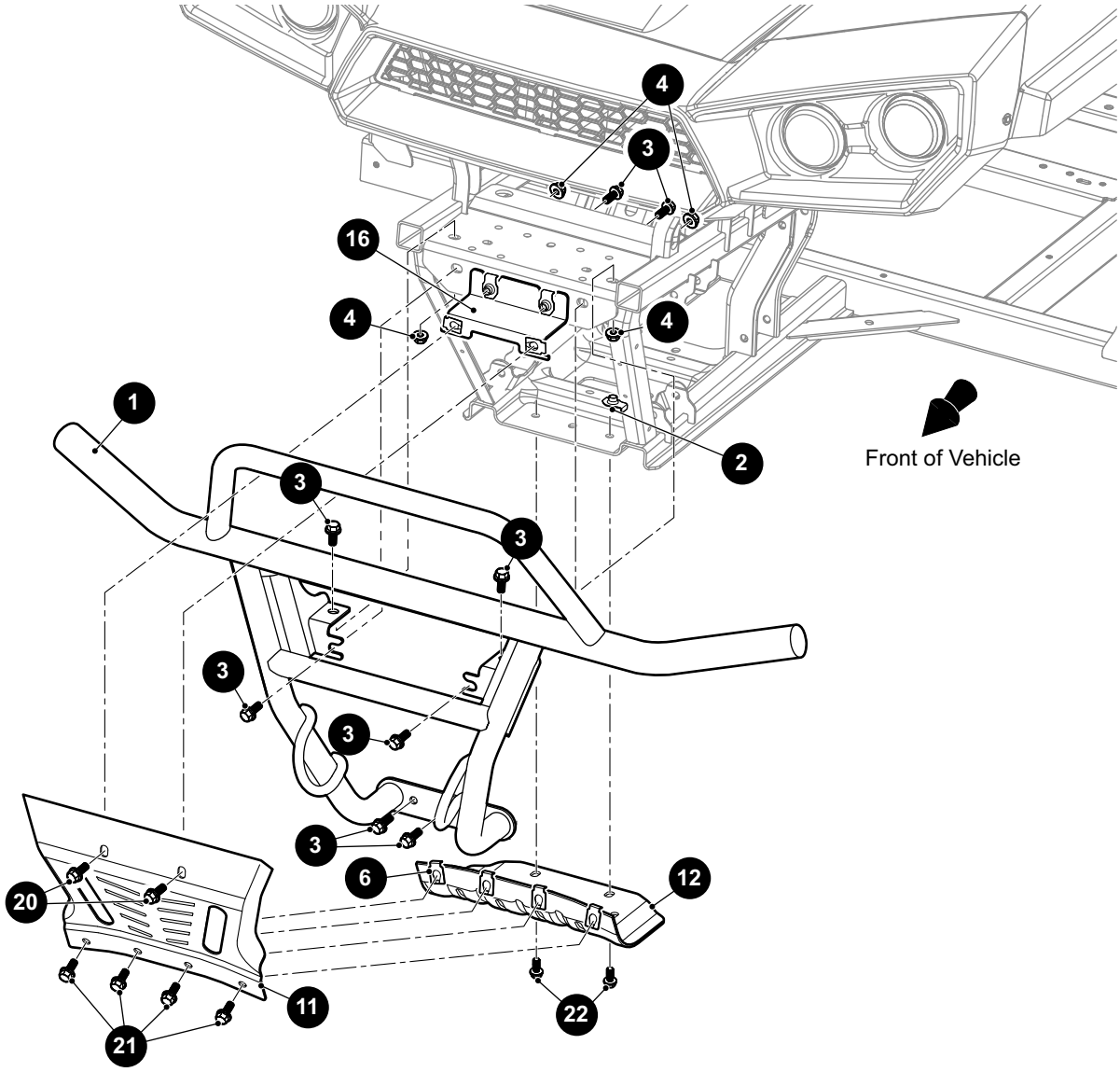


Fig. 4 Premium Brush Guard

Tool List	Qty.
Ratchet	1
Socket, 17mm	1
Wrench, 17mm	1
Torque Wrench, ft. lbs.	1

1. Remove the two bolts (20) that secure the upper shield (11) to the shield mounting bracket (16) (See Fig. 4).
2. Remove the four bolts (21) that secure the upper shield (11) to the lower shield (12). Remove the upper shield (11).
3. Remove the two bolts (22) that secure the lower shield (12) to the frame. Remove the lower shield (12).
4. Remove the bolts (3) and nuts (4) that secure the brush guard (1) to the bracket (2).
5. Remove the bolts (3) and nuts (4) that secure the brush guard (1) to the frame.
6. Remove the brush guard.
7. Installation is the reverse order of removal.
8. Tighten the hardware to torque specified below.

Item	Torque Specification
3, 20, 21, 22	30 - 33 ft. lbs. (40 - 45 Nm)

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

Plate Brush Guard Removal

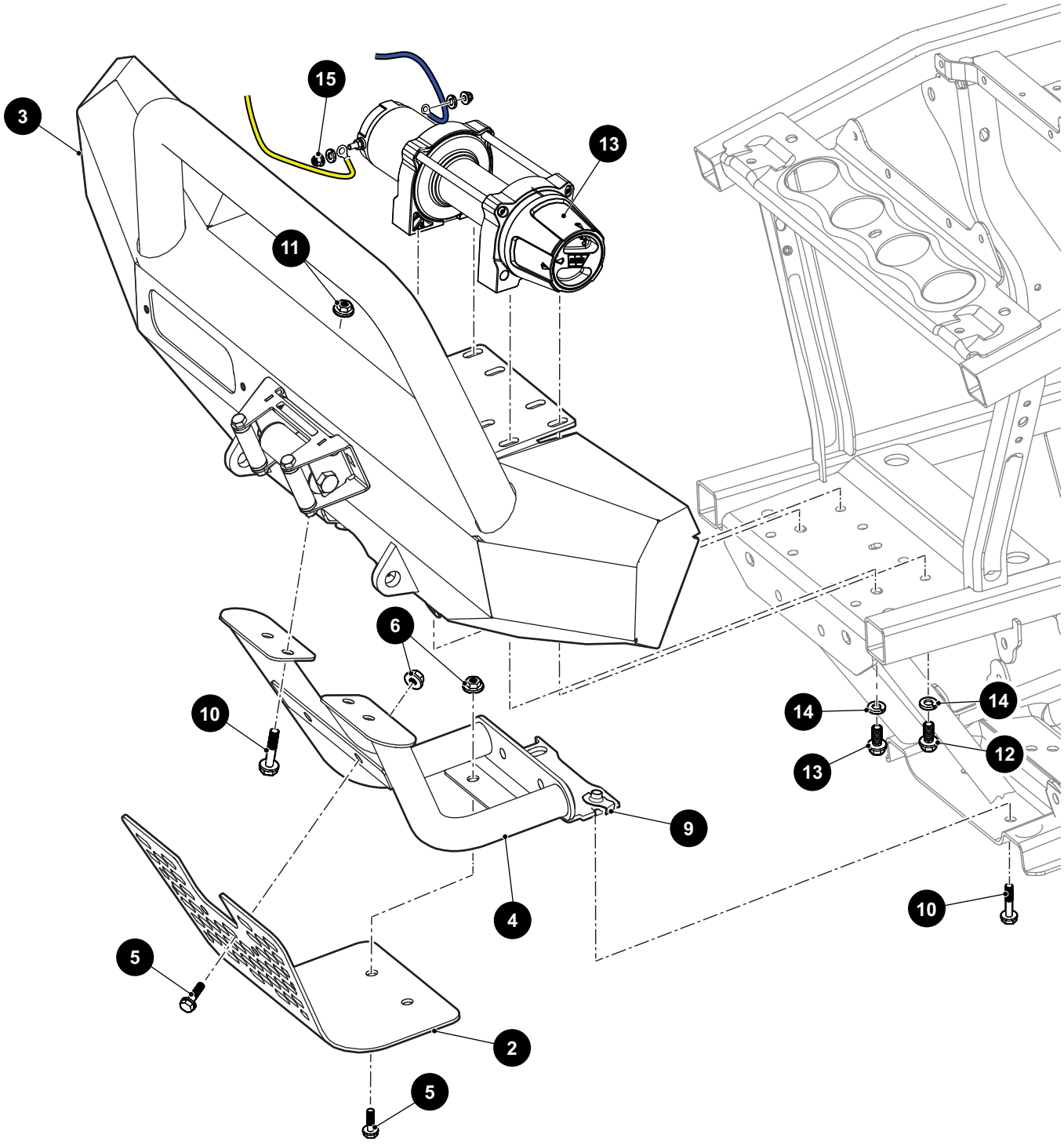


Fig. 5 Plate Brush Guard

Tool List	Qty.
Ratchet	1
Socket, 17mm	1
Socket, 10mm	1
Wrench, 17mm	1
Wrench, 10mm	1
Torque Wrench, ft. lbs.	1
Torque Wrench, in. lbs.	1

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

1. Remove the bolts (5) and nuts (6) that secure the shield (2) to the lower guard (4). Remove the shield (2).
2. Remove the bolts (10) and nuts (11) that secure the lower guard (4) to the plate brush guard (3).
3. Remove the bolts (10) that secure the lower guard to the vehicle frame. Remove the lower guard (4).
4. Remove the nuts (15) that secure the winch wires.
5. Remove the bolts (12) and lock washers (14) that secure the wench (13) and the plate brush guard to the vehicle.
6. Remove the winch.
7. Remove the plate brush guard.
8. Installation is the reverse order of removal.
9. Tighten the hardware to torque specified below.

Item	Torque Specification
10, 11, 5,6	30 - 33 ft. lbs. (40 - 45 Nm)
12, 13	12 ft. lbs. (16 Nm)
15	50 in. lbs. (5.7 Nm)

Rocker Panel Removal

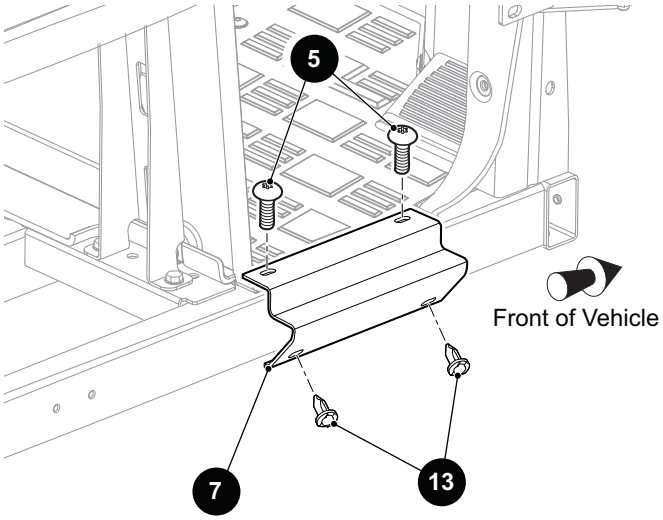


Fig. 6 Rocker Panel

Tool List **Qty.**

Screwdriver, Flat Tip 1
Torx Bit, T30 1
Ratchet 1

1. Remove the two screws (5) that secure the rocker panel (7) to the frame (See Fig. 6).
2. Remove the two plastic rivets (13) that secure the rocker panel to the frame. Remove the rocker panel.
3. Installation is the reverse order of removal.

Side Panel and Rear Fender Liner Removal

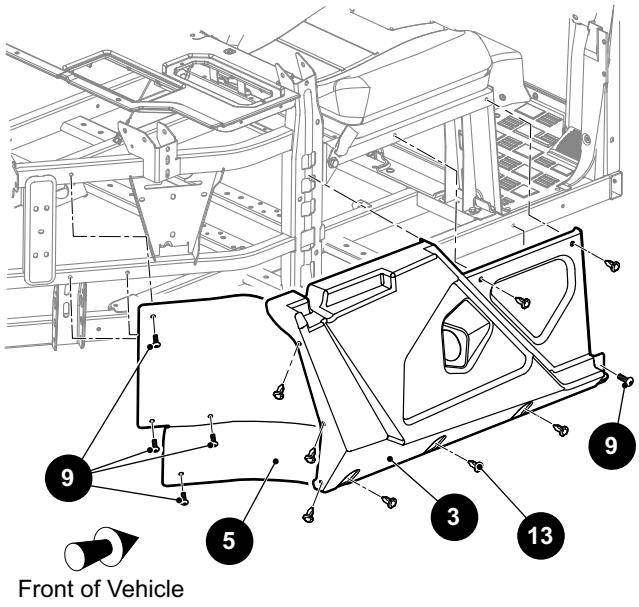


Fig. 7 Side Panel and Rear Fender Liner

Tool List **Qty.**

Screwdriver, Flat Tip 1
Torx Bit, T30 1
Ratchet 1

1. Remove the rocker panel. See *SEATING* on page 31.
2. Remove the screw (9) and plastic rivets (13) that secure the side panel (3) to the frame (See Fig. 7). Remove the side panel.
3. Remove the screws (9) that secure the rear fender liner (5) to the frame. Remove the rear fender liner.
4. Installation is the reverse order of removal.

Quarter Panel and Front Fender Liner Removal

Tool List **Qty.**

Screwdriver, Flat Tip 1
Torx Bit, T30 1
Ratchet 1

1. Remove the rocker panel. See *SEATING* on page 31.
2. Remove the door. See *Door Removal* on page 28.
3. Remove the plastic rivets (13) and screw (9) that secure the front fender liner (11) to the quarter panel (1) (See Fig. 8). Remove the front fender liner.
4. Remove the plastic rivets (14) and screws (10) that secure the quarter panel to the frame. Remove the quarter panel.

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

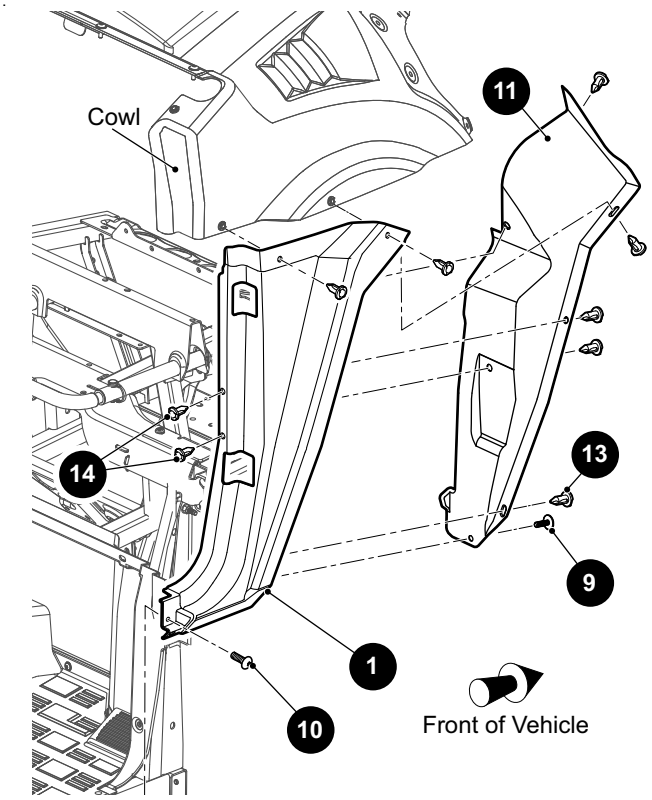


Fig. 8 Quarter Panel and Front Fender Liner

Door Removal

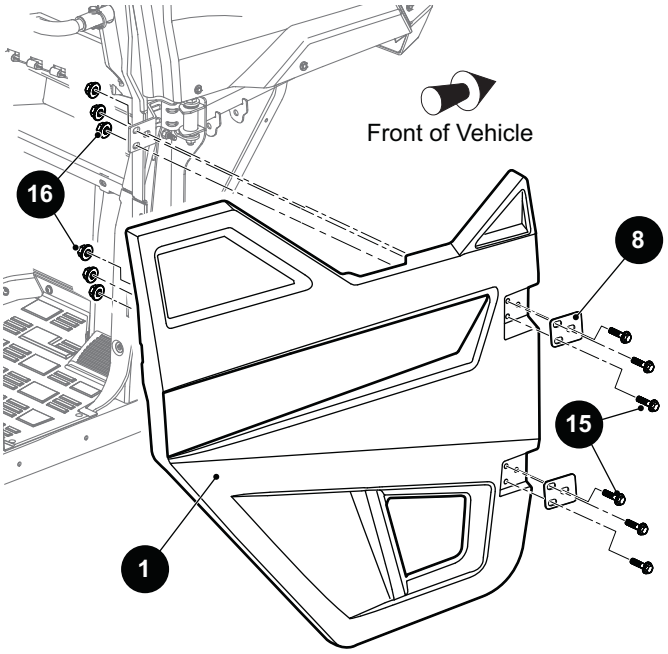


Fig. 9 Door

Tool List **Qty.**

Ratchet 1
Socket, 15mm 1
Wrench, 15mm 1
Torque Wrench, ft. lbs. 1

1. Remove the bolts (15), nuts (16) and hinge plate (8) that secure the door (1) to the upper and lower door hinges (See Fig. 9).
2. Remove the door from the vehicle.
3. Installation is the reverse order of removal.
4. Tighten the hardware to torque specified below.

Item	Torque Specification
15, 16	22 - 26 ft. lbs. (30 - 35 Nm)

5. Adjust the position of the striker plate or door as needed after installation to allow the doors to latch properly.

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

Door Handle and Latch Assembly Removal

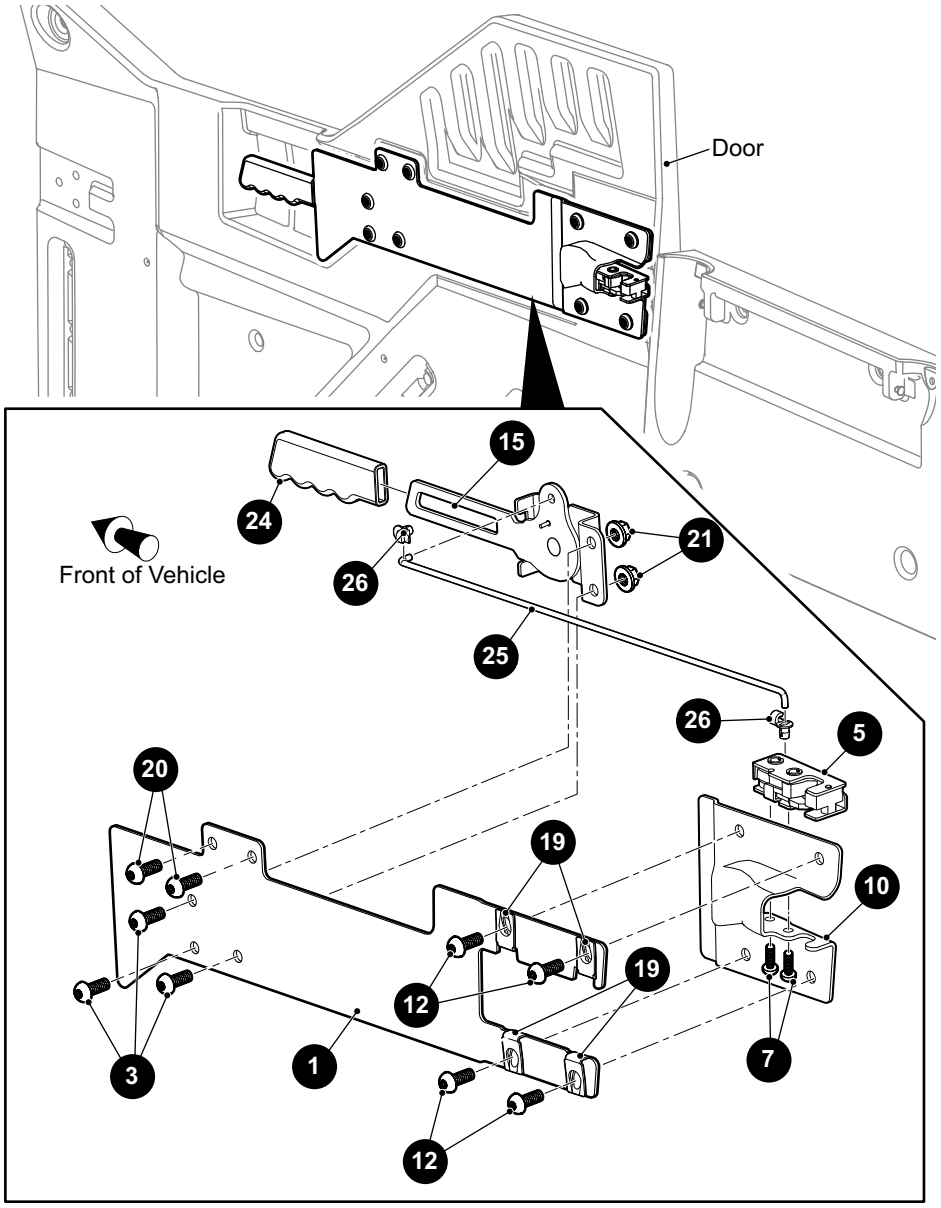


Fig. 10 Door Handle and Latch Assembly

Tool List	Qty.
Ratchet	1
Torx Bit, T30	1
Torx Bit, T27	1
Socket, 15mm	1
Wrench, 15mm	1
Torque Wrench, ft. lbs.	1

1. Remove the screws (20) that secure the cover plate (1) to the door (See Fig. 10).
2. Remove the screws (12) that secure the cover plate (1) to the latch mount bracket (10) and to the door.
3. Remove the door handle assembly.
4. Remove the screws (3) and nuts (21) that secure the cover plate to the door lever assembly.
5. Remove the screws (7) that secure the latch mechanism to the latch mount bracket (10).
6. The push rod (25) can be removed by twisting the clips (26) to the open position.
7. Installation is the reverse order of removal.
8. Tighten the hardware to torque specified below.

Item	Torque Specification
3, 12, 20, 21	11 - 15 ft. lbs. (15 - 20 Nm)
7	5 - 6 ft. lbs. (7 - 8 Nm)

Striker Plate Removal

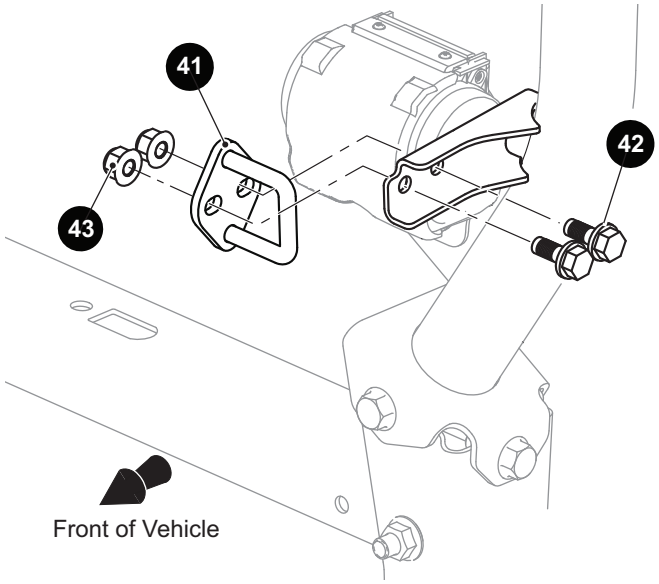


Fig. 11 Striker Plate

Tool List **Qty.**

Socket, 7/16” 1
Ratchet 1
Wrench, 7/16” 1
Torque Wrench, ft. lbs..... 1

1. Remove the bolts (42) and nuts (43) that secure the striker plate (41) to the ROPS tube (See Fig. 11).
2. Installation is the reverse order of removal.
3. Adjust the position of the striker plate or door as needed after installation to allow the doors to latch properly.
4. Tighten the hardware to the torque specified below:

Item	Torque Specification
42, 43	15 - 18 ft. lbs. (20 - 25 Nm)

Floorboards

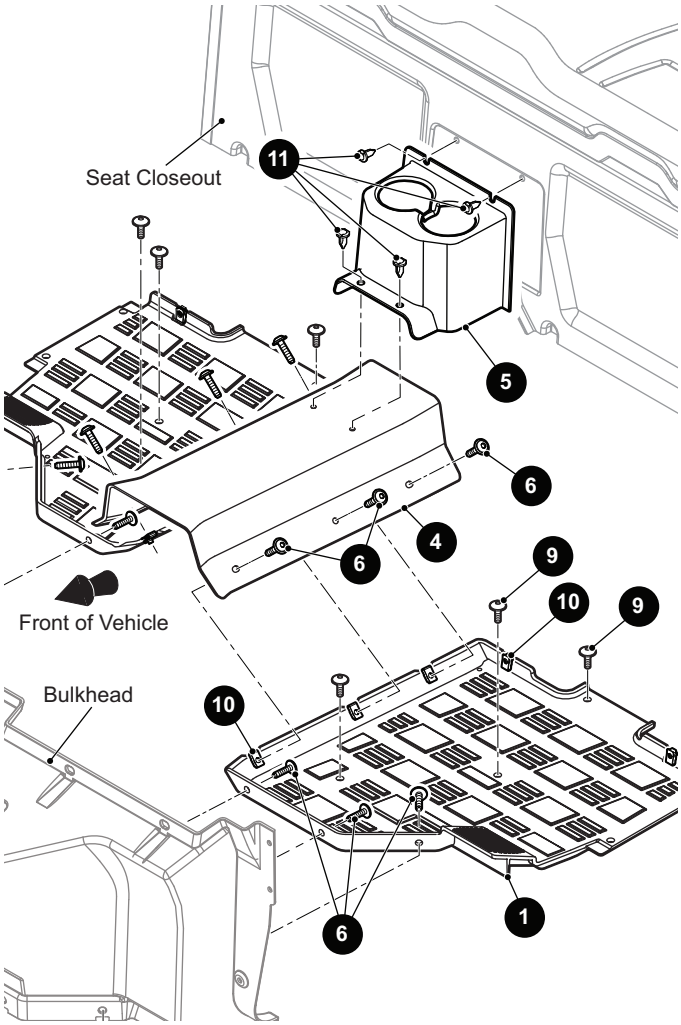


Fig. 12 Floorboards

Tool List **Qty.**

Screwdriver, Flat Tip 1
Torx Bit, T30..... 1
Ratchet 1

1. Remove the rocker panel. See *SEATING* on page 31.
2. Remove the plastic rivets (11) that secure the cup holder (5) to the seat closeout and the prop-shaft cover (4) (See Fig. 12). Remove the cup holder.
3. Remove the screws (6) that secure the prop-shaft cover (4) to the floorboards. Remove the cover.
4. Remove the screws (9) that secure the floorboards to the frame.
5. Remove the screws (6) that secure the floorboards to the bulkhead. Remove the floorboards.
6. Installation is the reverse order of removal.

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

SEATING

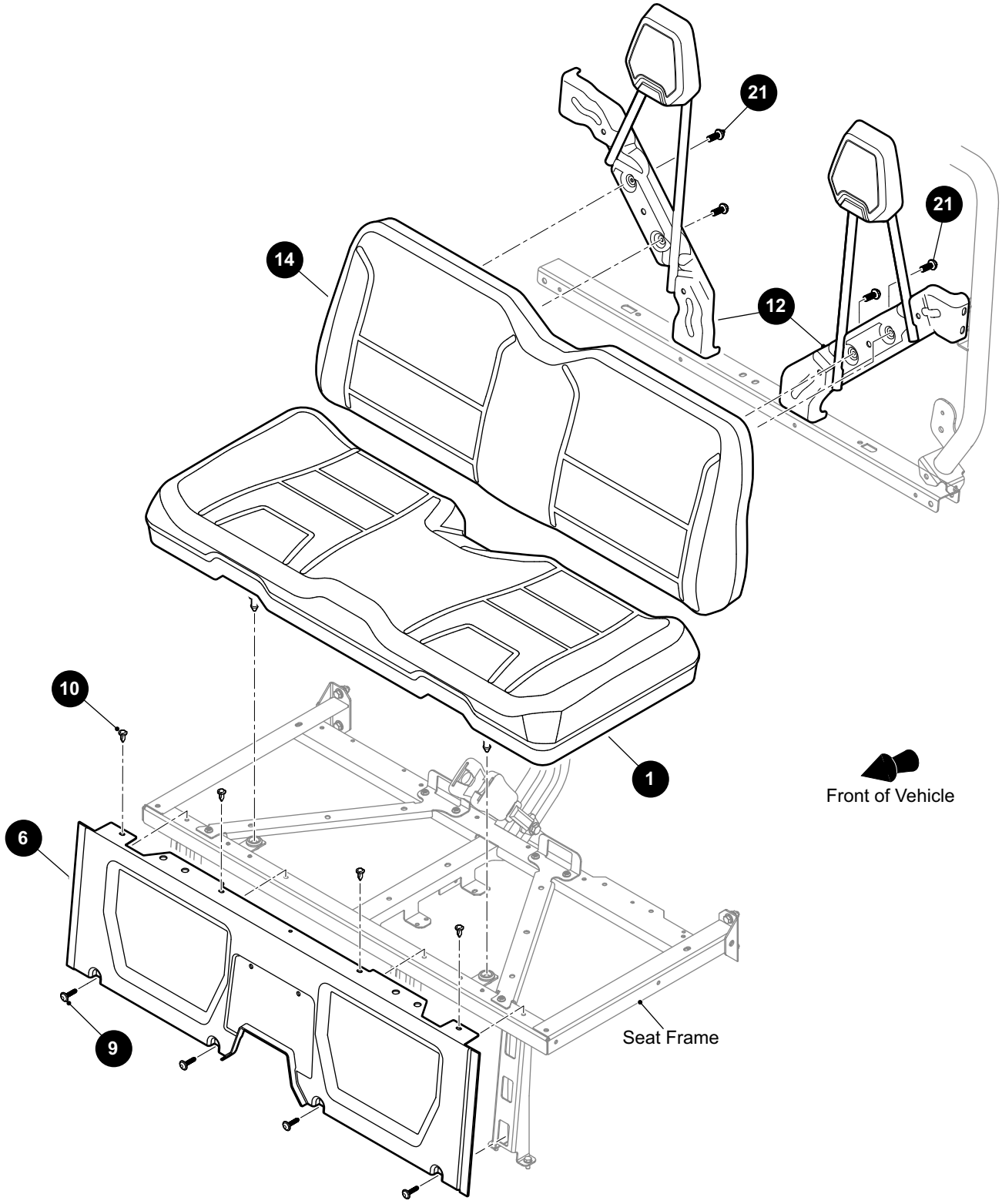


Fig. 13 Seat Components

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

Seat Bottom Removal

1. The seat bottom (1) is removed by grasping the front edge of the seat bottom and pulling up and out of the vehicle. (See Fig. 13)
2. To install the seat bottom, align the alignment pins on the bottom, front of the seat bottom with the rubber grommets on the seat frame. Push the seat bottom down into place.

Seat Back Removal

Tool List **Qty.**

Ratchet 1
Torx Bit, T45 1
Torque Wrench, in. lbs. 1

1. Remove the four bolts (21) that secure the seat back (14) to the seat back supports (12) (See Fig. 13).
2. Remove the seat back from the vehicle.
3. Installation is the reverse of removal.
4. Tighten the hardware to the torque specified below:

Item	Torque Specification
21	15 - 20 in. lbs. (20 - 27 Nm)

Seat Closeout Removal

Tool List **Qty.**

Ratchet 1
Torx Bit, T30 1
Screwdriver, Flat Tip 1

1. Remove the four bolts (9) that secure the bottom of the seat closeout (6) to the seat frame (See Fig. 13).
2. Remove the four plastic rivets (10) that secure the top of the seat closeout (6) to the seat frame.
3. Remove the seat closeout from the vehicle.
4. Installation is the reverse of removal.

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

EXTENDED CAB

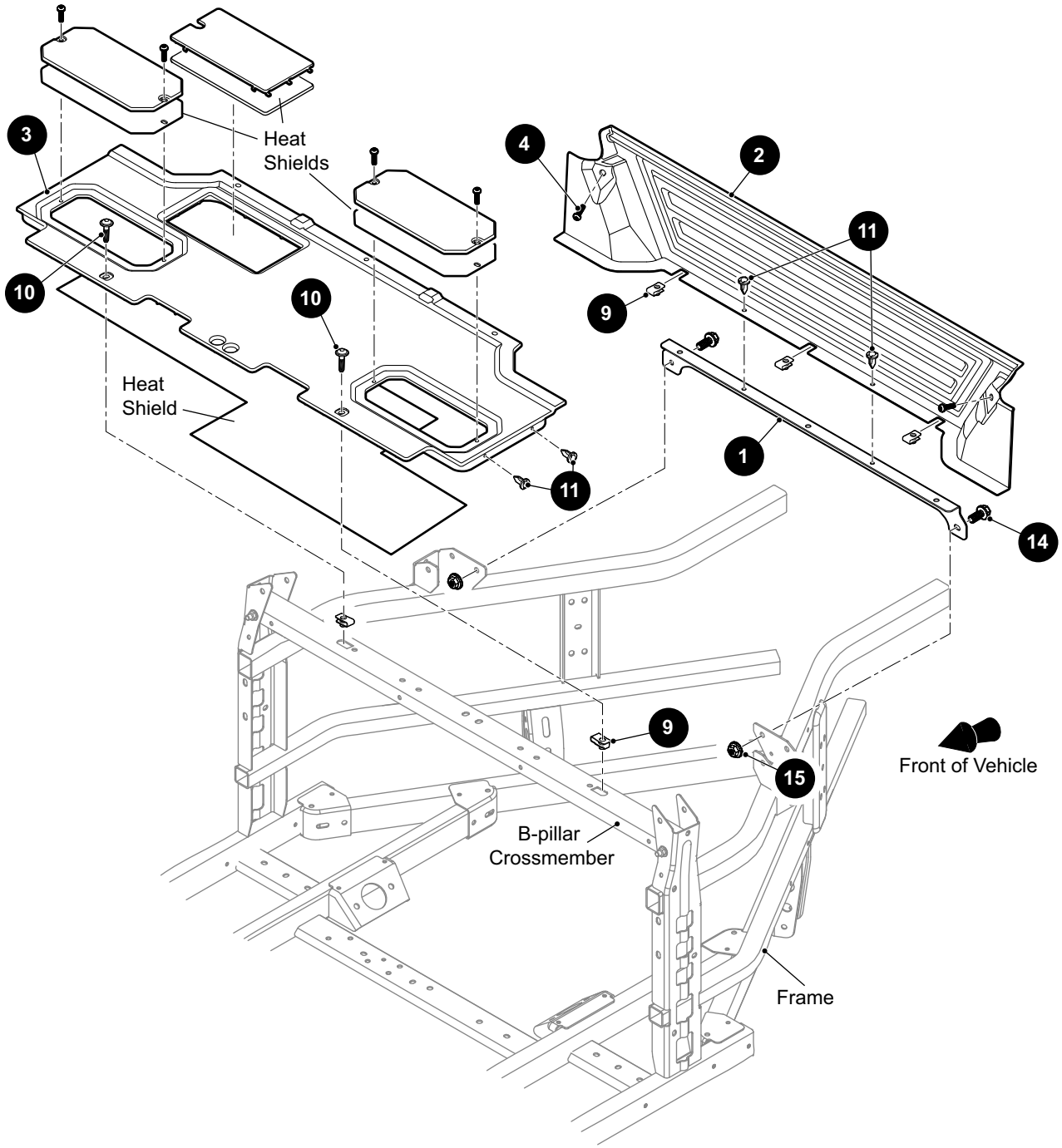


Fig. 14 Extended Cab Components

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

Cargo Tray Removal

Tool List **Qty.**

Ratchet 1
Torx Bit, T30 1
Screwdriver, Flat Tip 1
Torque Wrench, in. lbs. 1

1. Remove the plastic rivets (11) that secure the edges of the cargo tray (3) to the side panels (See Fig. 14).
2. Remove the screws (10) that secure the cargo tray to frame and the cab closeout panel (2). Lift the cargo tray out of the vehicle.
3. Installation is the reverse order of removal.

NOTICE: Make sure that the heat shields are attached to the cargo tray components before installation.

4. Tighten the hardware to the torque specified below:

Item	Torque Specification
10	44 - 72 in. lbs. (5 - 8 Nm)

Closeout Panel Removal

Tool List **Qty.**

Ratchet 1
Torx Bit, T30 1
Screwdriver, Flat Tip 1
Torque Wrench, in. lbs. 1

1. Remove the screws (4) that secure the top edges of the closeout panel (2) to the ROPS tubes (See Fig. 14).
2. Remove the plastic rivets (11) that secure the panel (2) to the bracket (1). Remove the closeout panel.
3. Installation is the reverse order of removal.
4. Tighten the hardware to the torque specified below:

Item	Torque Specification
4	44 - 72 in. lbs. (5 - 8 Nm)

Extended Cab Door Removal

Tool List **Qty.**

Ratchet 1
Torx Bit, T30 1
Screwdriver, Flat Tip 1
Torque Wrench, in. lbs. 1

1. Remove hinge covers (30) from the hinges (37) (See Fig. 15).
2. Remove the screws (40) that secure the hinges (37) to the door panels (33). Remove the door panel (33) from the vehicle.
3. Installation is the reverse order of removal.
4. Tighten the hardware to the torque specified below:

Item	Torque Specification
40	13 - 20 in. lbs. (1.5 - 2.3 Nm)

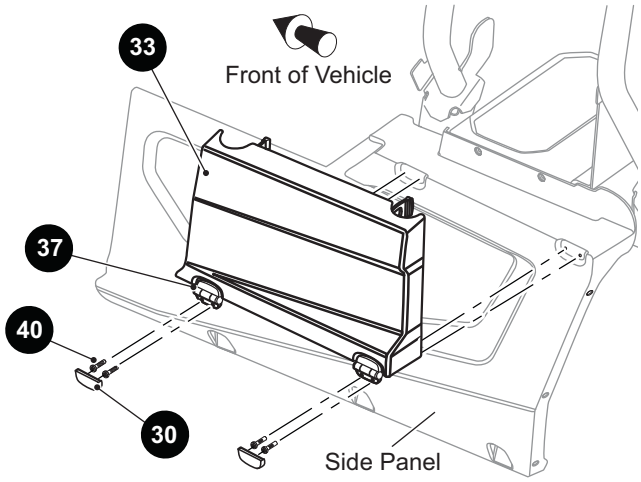


Fig. 15 Extended Cab Doors

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

Skid Plate Removal

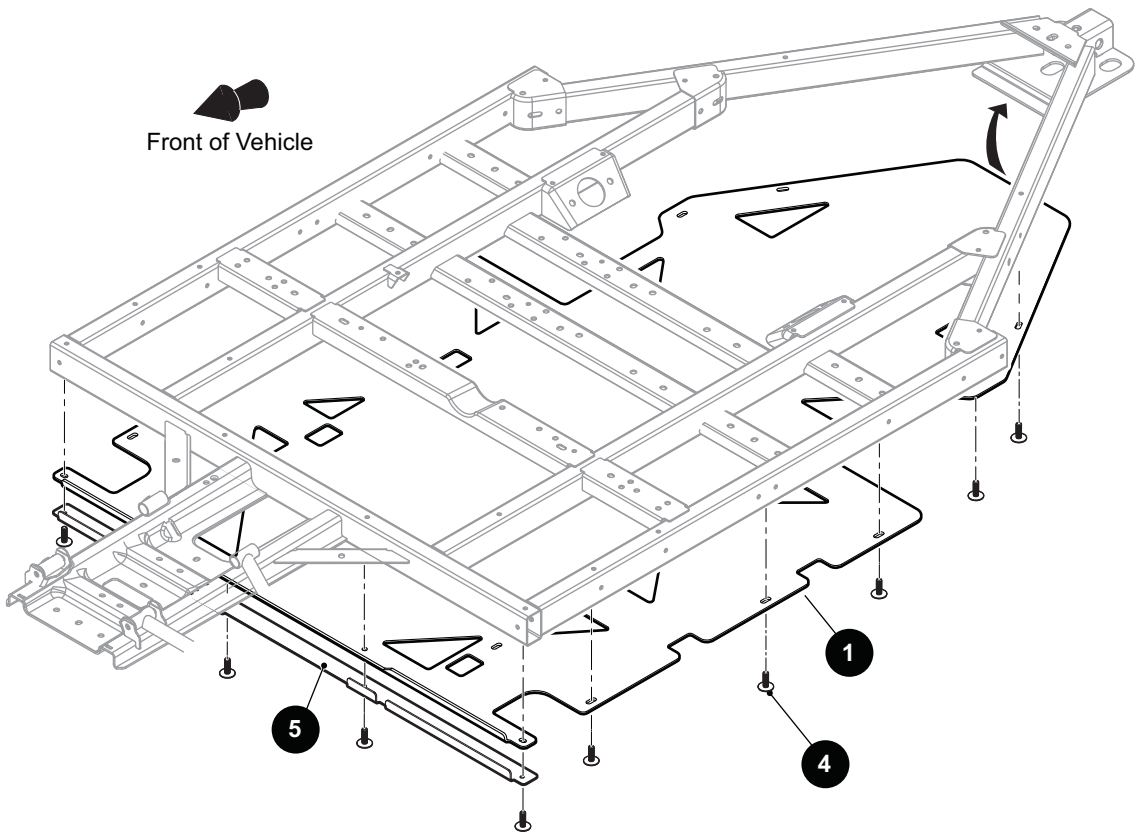


Fig. 16 Skid Plate

Tool List	Qty.
Ratchet	1
Torx Bit, T30	1
Torque Wrench, in lbs	1

1. Remove the screws (4) that secure the skid plate (1) and the bracket (5) to the bottom of the frame (See Fig. 16).
2. Remove the bracket (5).
3. Slide the rear of the skid plate forward and down off the rear frame weldment.
4. Installation is the reverse order of removal.
5. Tighten the hardware to the torque specified below:

Item	Torque Specification
4	20 - 44 in. lbs. (2 - 5 Nm)

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

Notes:

FRAME

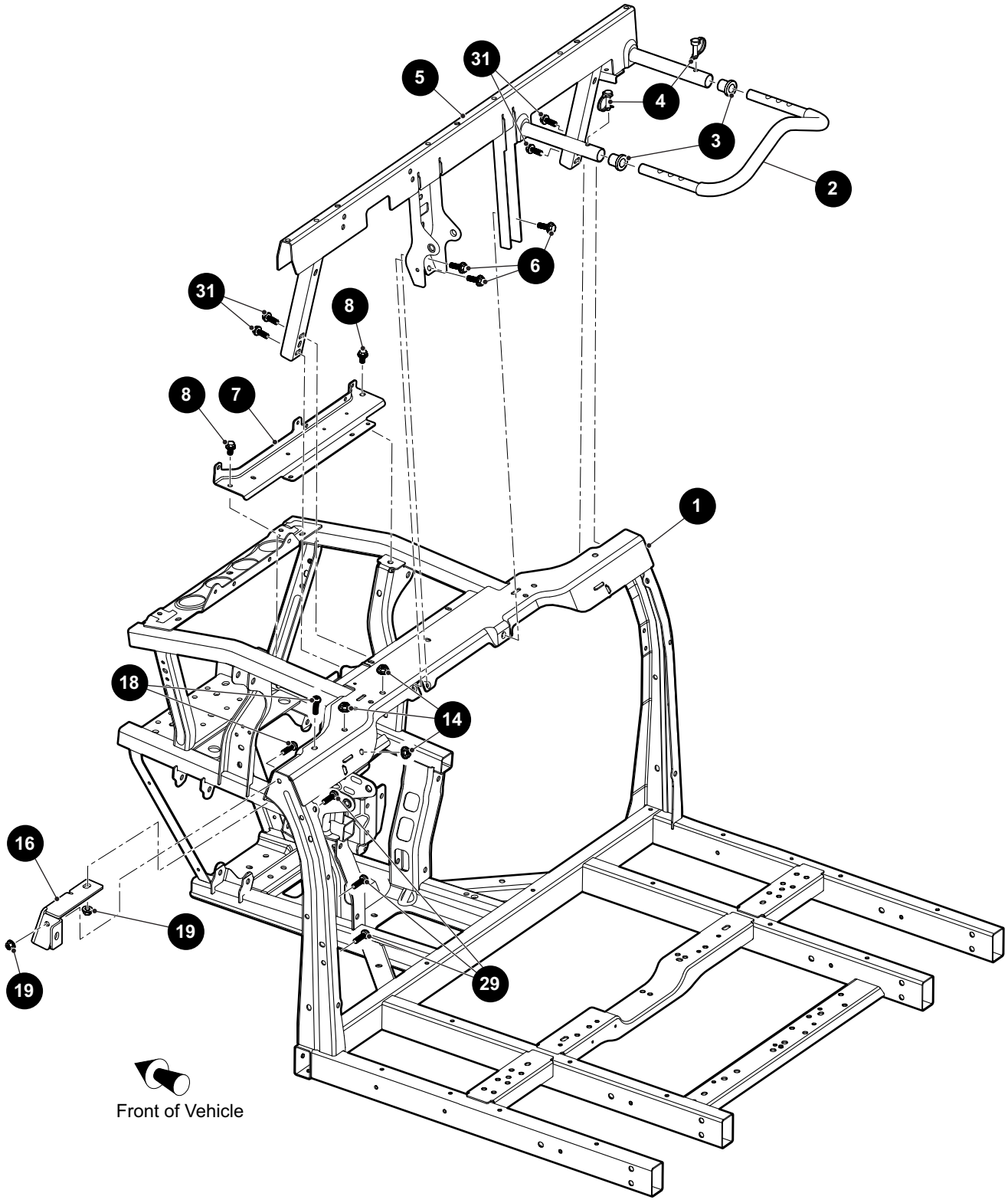


Fig. 1 Front Frame Section

FRAME

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

GENERAL

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

To access the frame components, the body panels must be removed. See the *BODY on page 21*.

Dash Support Removal

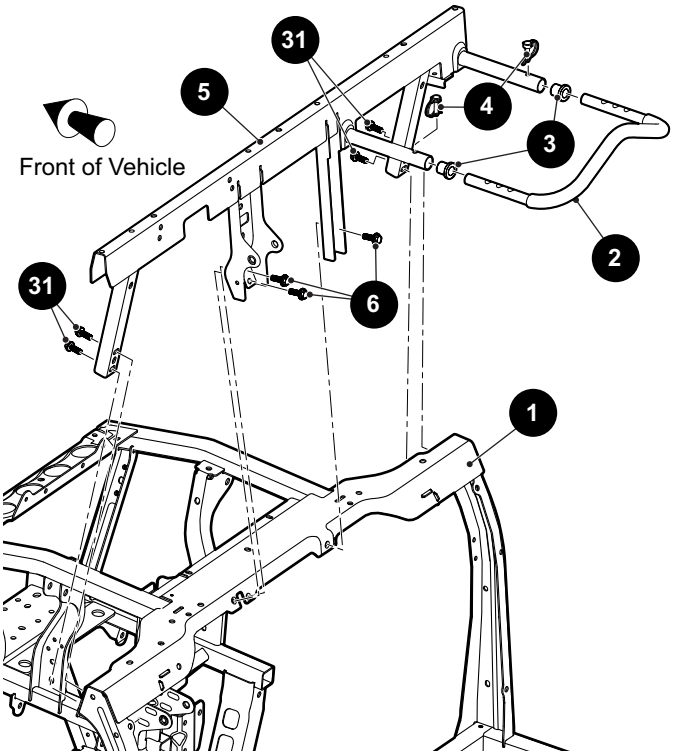


Fig. 2 Dash Support and Hand Hold

Tool List	Qty.
Ratchet	1
Socket, 13mm	1
Socket, 17mm	1
Wrench, 13mm	1
Wrench, 17mm	1
Torque Wrench, ft. lbs.	1

1. Remove the bolts (31) that secure the outer legs of the dash support (5) to each side of the frame (1) (Ref. Fig. 3).
2. Remove bolts (6) that secure the inner legs of the support to the frame.
3. Remove the dash support from the frame.
4. Installation is in the reverse order of removal.
5. Tighten hardware to the torque specified below:

Item	Torque Specification
6	15 - 18 ft. lbs. (20 - 24 Nm)
31	15 - 18 ft. lbs. (20 - 24 Nm)

Hand Hold Removal

1. Release and remove the pins (4) that secure the handhold (2) into the dash support. (See Fig. 2)
2. Pull the hand hold out of the dash support tubes.
3. Installation is the reverse order of removal. Make sure that the bushings (3) are in place before installation.

Front Shock Tower Brace Removal

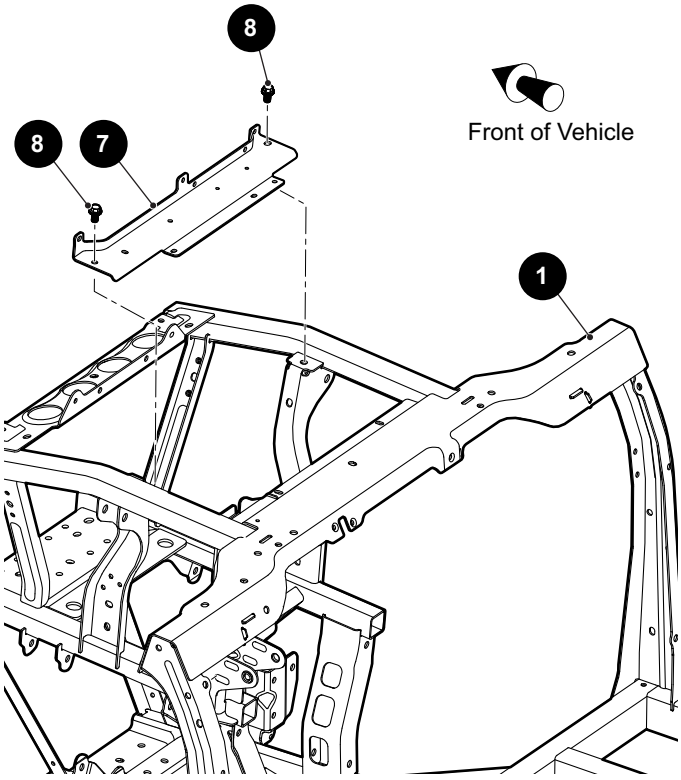


Fig. 3 Shock Tower Brace

Tool List	Qty.
Ratchet	1
Socket, 13mm	1
Socket, 17mm	1
Wrench,13mm	1
Wrench, 17mm	1
Torque Wrench, ft. lbs.	1

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

1. Remove the bolts (8) that secure the front shock tower brace (7) to the frame (1) (Ref. Fig. 4). Remove the brace.
2. Installation is in the reverse order of removal.
3. Tighten hardware to the torque specified below:

Item	Torque Specification
8	15 - 18 ft. lbs. (20 - 24 Nm)

Rear Shock Tower Brace Removal

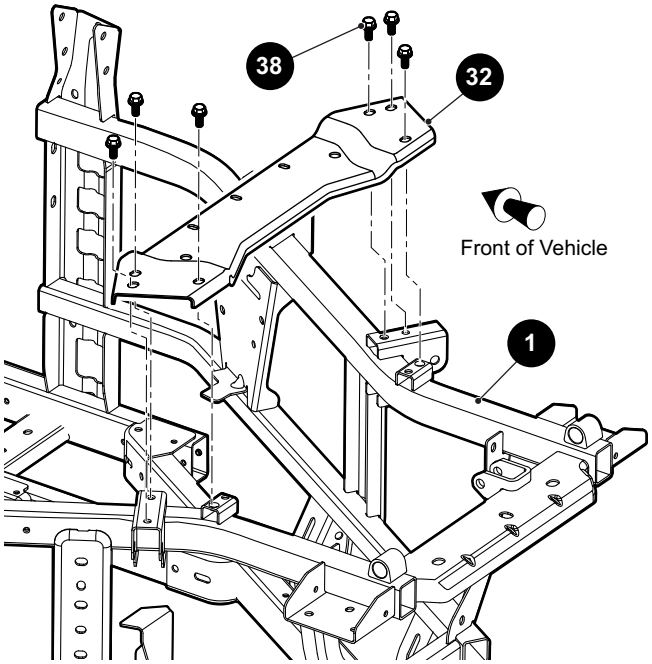


Fig. 4 Rear Shock Tower Brace

Tool List	Qty.
Ratchet	1
Socket, 17mm	1
Wrench, 17mm	1
Torque Wrench, ft. lbs.	1

1. Remove the bolts (38) that secure the rear shock tower brace (32) to the frame (1) (Ref. Fig. 5). Remove the brace.
2. Installation is in the reverse order of removal.
3. Tighten hardware to the torque specified below:

Item	Torque Specification
38	15 - 18 ft. lbs. (20 - 24 Nm)

FRAME

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

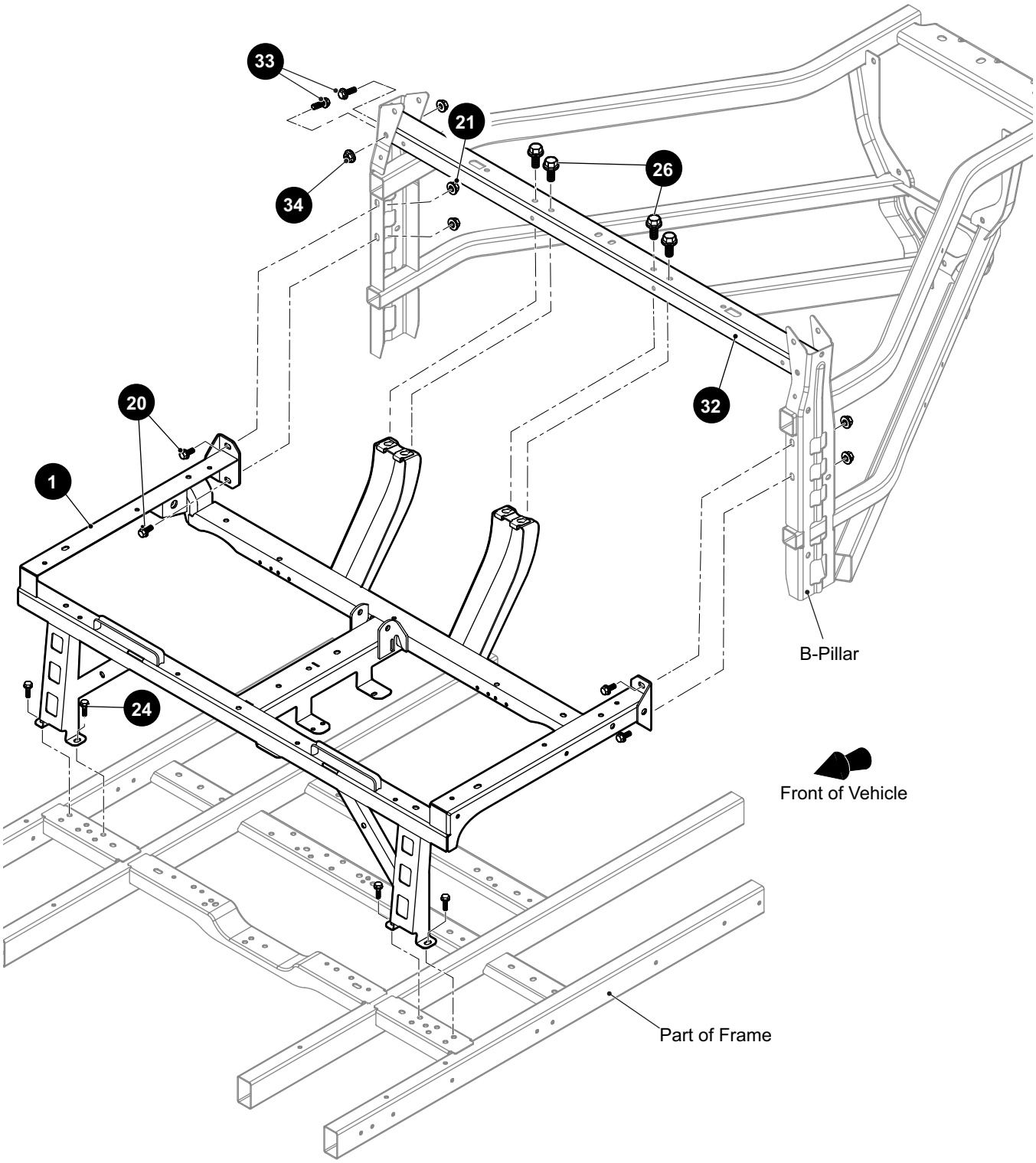


Fig. 5 Seat Frame

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

Seat Frame Removal

Tool List **Qty.**

Ratchet 1
Socket, 13mm..... 1
Socket, 17mm..... 1
Wrench,13mm 1
Wrench, 17mm 1
Torque Wrench, ft. lbs..... 1

1. Remove the bolts (26) that secure the seat frame (1) to the B-Pillar crossmember (32).
2. Remove the bolts (20) and nuts (21) that secure the seat frame (1) to the frame B-pillars on each side of the vehicle frame.
3. Remove the bolts (24) that secure the legs of the seat frame (1) to the vehicle frame. Remove the seat frame from the vehicle.
4. Installation is in the reverse order of removal.
5. Tighten hardware to the torque specified below:

Item	Torque Specification
24	15 - 16 ft.lbs. (20 - 22 Nm)
20, 21, 26	30 - 33 ft. lbs. (40 - 45 Nm)

B-Pillar Crossmember Removal

Tool List **Qty.**

Ratchet 1
Socket, 13mm..... 1
Socket, 17mm..... 1
Wrench,13mm 1
Wrench, 17mm 1
Torque Wrench, ft. lbs..... 1

1. Remove the bolts (26) and nuts that secure seat frame (1) to the B-pillar crossmember (32) (Ref. Fig. 6).
2. Remove the bolts (33) and nuts (34) that secure the ends of the crossmember (32) to the top of the B-pillars of the vehicle frame. Remove the crossmember.
3. Installation is in the reverse order of removal.
4. Tighten hardware to the torque specified below:

Item	Torque Specification
26	30 - 33 ft.lbs. (40 - 45 Nm)
33, 34	30 - 33 ft.lbs. (40 - 45 Nm)

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

Notes:

ROLLOVER PROTECTION SYSTEM (ROPS)

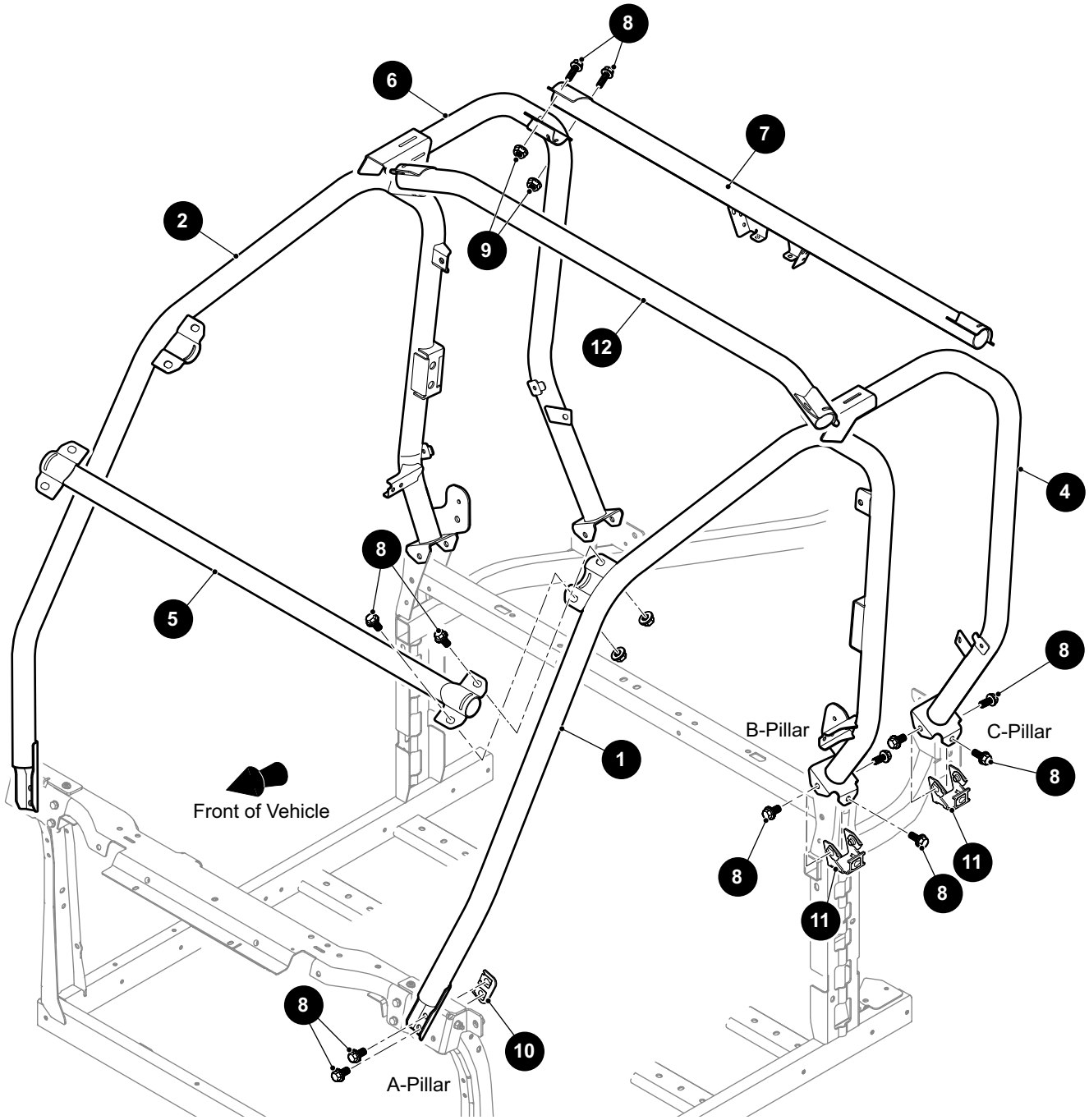


Fig. 1 ROPS Components

ROLLOVER PROTECTION SYSTEM

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

⚠WARNING ***The ROPS hardware and components must be assembled properly and all hardware tightened to the torques specified for the ROPS to provide occupant protection during a rollover.***

Do not drill holes in the ROPS components or modify the ROPS in any way.

Removing the ROPS as a Complete Unit

Tool List **Qty.**

Socket, 15mm....1
Ratchet....1
Wrench, 15mm....1
Torque Wrench, ft. lbs....1

1. Disconnect CHMSL (Center High Mounted Stop Light) wire connection at the bottom of the passengers side C-pillar.
2. Remove the bolts (8) and the nuts (9) that secure the ROPS side tubes (1 and 2) to the seat back supports (24) (Ref. Fig. 1).
3. Remove the bolts (8) and the mounting plate (10) that secure the front of the ROPS side tubes (1 and 2) to the A-pillar of the frame.
4. Remove the bolts (8) and the mounting plate (11) that secure the rear of the ROPS side tubes (1 and 2) to the B-pillar of the frame.
5. Remove the bolts (8) and the mounting plate (11) that secure the extended cab tubes (4 and 6) to the C-pillar of the frame.
6. With the aid of an assistant, lift the ROPS off the vehicle.
7. Installation is the reverse order of removal.

NOTICE: Loosen all ROPS hardware before installation to allow the mounting holes to align properly.

8. Tighten hardware to the torque specified below:

Item	Torque Specification
8	37 - 41 ft. lbs. (50 - 55 Nm)

INSTALLING ROPS COMPONENTS

NOTICE: Loosen all ROPS hardware before installation to allow the mounting holes to align properly.

ROPS Side Tube Installation

Tool List **Qty.**

Socket, 15mm....1
Ratchet....1
Wrench, 15mm....1

1. Remove the cargo tray and cab closeout panel. See the BODY section.
2. Position the driver side ROPS tube (1) as shown (Ref. Fig. 1). Secure the front of the side ROPS tube (1) to the vehicle frame A-pillar with bolts (8) and mounting plate (10). Finger tighten hardware to allow for adjustment.
3. Attach the other end of the driver side ROPS tube (1) to the B-pillar. Secure with bolts (8) and mounting bracket (11). Finger tighten hardware to allow for adjustment.
4. Repeat the above steps for installing the passenger side ROPS tube (2).

ROPS Extended Cab Tubes Installation

Tool List **Qty.**

Socket, 15mm....1
Ratchet....1
Wrench, 15mm....1

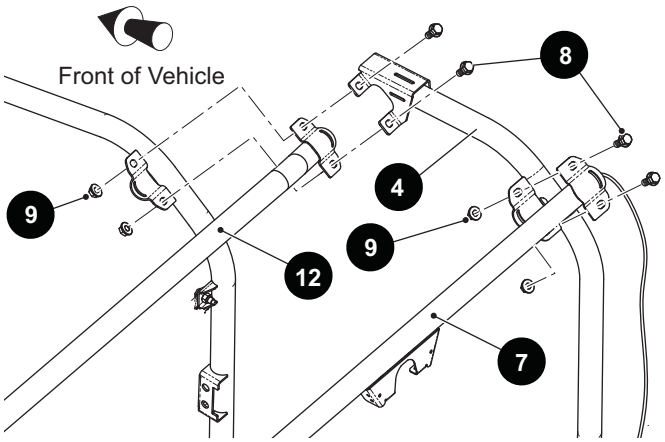


Fig. 2

1. Position the lower end of the extended cab ROPS tube (4) over the driver side C-pillar of the vehicle frame and secure with bolts (8) and nuts (9) (Ref. Fig. 1). Finger tighten hardware to allow for adjustment.
2. Repeat the above steps for installing the passenger side extended cab ROPS tube (6).
3. Do not install the top bracket hardware of the extended cab ROPS tube (4 and 6) until the rear cross-tube (12) has been installed (Ref. Fig. 2).

Rear Cross-tube Installation

Tool List **Qty.**

Socket, 15mm....1
Ratchet....1
Wrench, 15mm....1

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

1. Slide the ends of the cross-tube (12) in between the ROPS tube mounting brackets (1 and 4) and align the mounting holes of all three brackets (Ref. Fig. 1)(Ref. Fig. 2). From the top, insert bolts (8) into the mounting holes, and secure with lock nuts (9). Finger tighten bolts to allow for adjustment.
2. Repeat the above steps to secure the other end of the rear cross-tube to the driver side ROPS tubes (2 and 6).

CHMSL and Extended Cab Cross-tube

Tool List **Qty.**

Socket, 15mm 1
Socket, Phillips Head Bit, #2 1
Ratchet 1
Wrench, 15mm 1
Wrench, 8mm 1
Torque Wrench, ft. lbs. 1

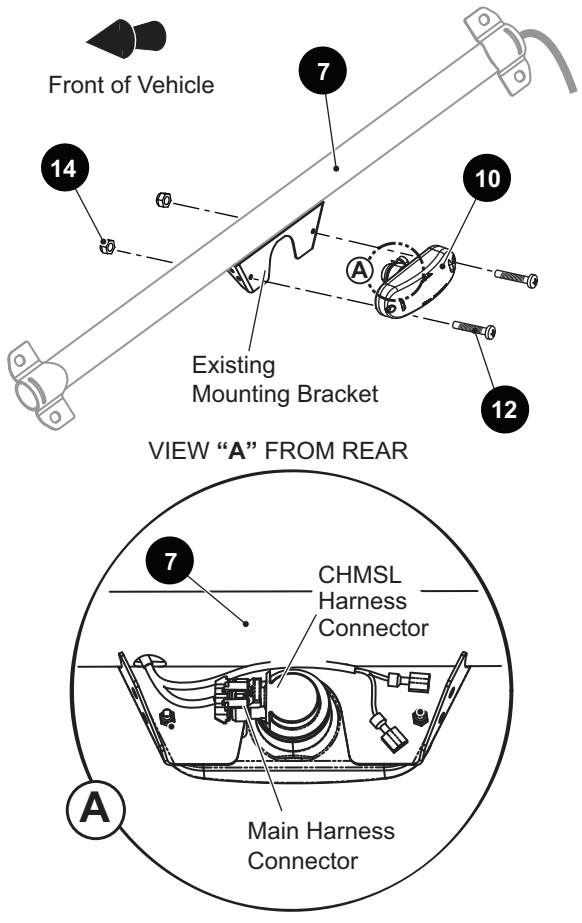


Fig. 3 CHMSL

1. Mount the Center High Mount Stop Light (CHMSL) (10) to the existing mounting bracket on the center of the extended cab cross-tube (7) (Ref. Fig. 3). Make sure the wiring is on the same side as the exposed wiring harness of the cross-tube. Align the mounting holes of the CHMSL (10) and the mounting bracket. Insert screws (12) from the front face of the CHMSL. Secure with lock nuts (14).
2. Tighten hardware to the torque specified below:

Item	Torque Specification
12	2 - 3 ft. lbs. (3 - 4 Nm)

3. Connect the CHMSL wiring harness to the exposed main harness coming from the extended cab ROPS tube (7).
4. Align the mounting holes on the CHMSL back cover (11) with the mounting bracket holes and secure with removable rivets (13) (Ref. Fig. 4).

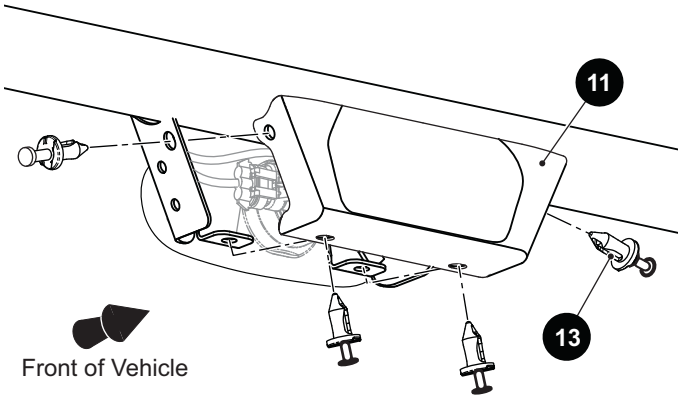


Fig. 4 CHMSL Back Cover

5. Position the extended cab cross-tube (7) as shown. Route the end of the wiring harness down through the top hole in the passenger side extended cab ROPS tube (4) and down through the vertical ROPS tube (Ref. Fig. 5). Connect the CHMSL harness to the rear harness as shown. Use a cable tie to secure any excess wiring to the vehicle frame.

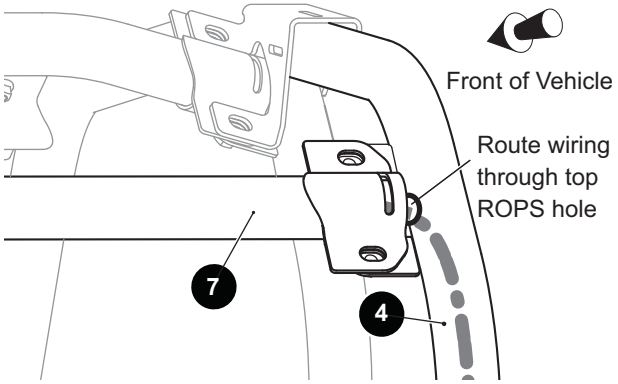


Fig. 5 CHMSL Wiring

6. Once the wiring has been inserted into the extended cab ROPS tube, align the mounting bracket holes of the extended cab cross-tube (7) to the corresponding mounting bracket of the extended cab ROPS tube (4). Secure with bolts (8) and lock nuts (9). Finger tighten bolts to allow for adjustment.
7. Repeat the above step to secure the extended cab cross-tube to the driver side extended cab ROPS tube.

Front Cross-tube Installation

Tool List **Qty.**

Socket, 15mm....1
Ratchet....1
Wrench, 15mm....1

1. Position the cross-tube (5) onto the top mounting brackets of the driver and passenger side ROPS tubes (Ref. Fig. 6).
2. Align the holes of both mounting brackets and secure with bolts (8) and lock nuts (9). Finger tighten bolts to allow for adjustment.

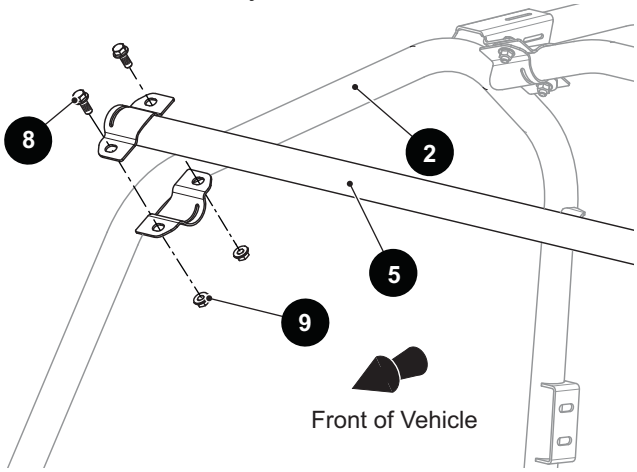


Fig. 6 Front Cross-tube

ROPS Cross Bar and Supports Installation

Tool List **Qty.**

Socket, 15mm....1
Ratchet....1
Wrench, 15 mm....1

1. Position the ROPS cross bar (21) as shown (Ref. Fig. 7).
2. Align the mounting holes on the cross bar (21) with the corresponding holes in the ROPS side tubes.
3. Secure with bolts (24) and u-nuts (23).
4. Finger tighten hardware to allow for adjustment.
5. Position supports (22) as shown (Ref. Fig. 7).
6. Secure the top of supports (22) to brackets on cross bar (21) with bolts (25) and nuts (27). Finger tighten bolts to allow for adjustment. Do not secure bottom of support until the seat belt retractor is installed (Ref. Fig. 9).

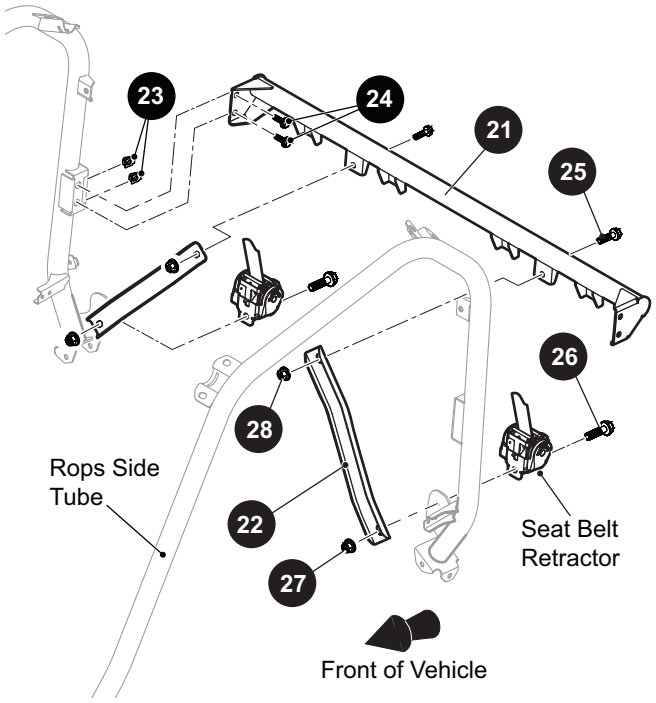


Fig. 7 Cross Bar and Supports

Tighten ROPS Hardware

Tool List **Qty.**

Socket, 15mm....1
Ratchet....1
Wrench, 15mm....1
Torque Wrench, ft. lbs....1

1. After all the ROPS components are installed, tighten hardware to the torque specified below in the following order (see previous figures for reference):

Item	Torque Specification
8	37 - 41 ft. lbs. (50 - 55 Nm)

   a. Tighten the seat back support (24, 25) to ROPS tubes (2, 1) and the vehicle frame.
   b. Tighten the ROPS tubes (1, 2) and extended cab ROPS tubes (3, 4) to the vehicle frame.

c. Tighten the front cross-tube (5), rear cross-tube (6), and extended cab cross-tube (7) to the side ROPS tubes (1 - 4).

SEATBELT INSTALLATION

Tool List **Qty.**

Socket, 7/16” 1
Ratchet 1
Wrench, 7/16” 1
Torque Wrench, ft. lbs. 1

1. Attach the pillar loop of the seatbelt to the mounting bracket at the top of the ROPS tube (2) with bolt (16) from the front to back (Ref. Fig. 8). Secure with lock nut (15). Guide the belt down to prevent twisting the belt. Make sure the flat side of the seatbelt retractor is flush against the bracket toward the front of the vehicle.
2. Align mounting hole of support (22) with the hole in the ROPS tube (2). Attach the seatbelt retractor to the bracket at the bottom of the ROPS tube (2) (Ref. Fig. 9).
3. Insert the tab on the back of the seatbelt retractor through the corresponding hole in the bracket to prevent the retractor from rotating.
4. Secure the seatbelt retractor to the bracket by inserting the bolt (18) through the mounting hole in the retractor and through the ROPS tube (2) and support (22). Secure the bolt with lock nut (19).
5. Secure the seat belt anchors (39) to the seat frame with bolts (36), washers (37) and nuts (38) (Ref. Fig. 10).
6. Secure the seat belt latches (34) to the center of the seat frame with bolts (32) and nuts (30).
7. Tighten hardware to the torque specified below:

Item	Torque Specification
15, 16, 18, 19	48 - 52 ft. lbs. (65 - 71 Nm)
36, 38	44 - 55 ft. lbs. (60 - 75 Nm)
30, 32	48 - 52 ft. lbs. (65 - 71 Nm)

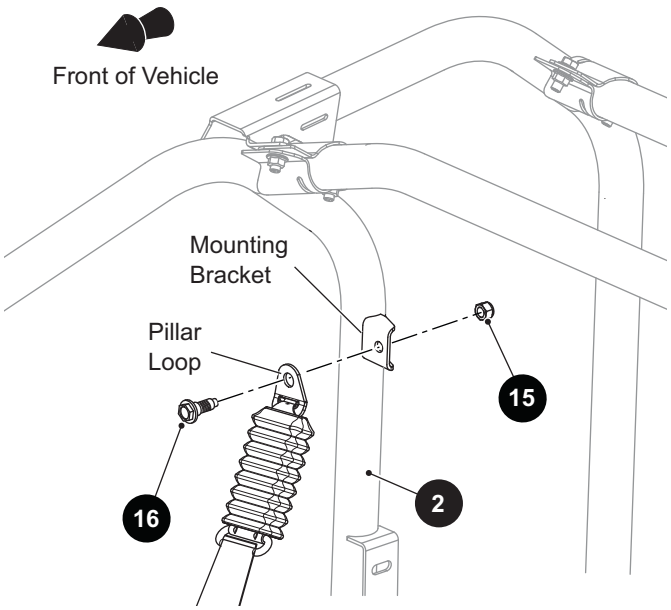


Fig. 8 Seat Belt

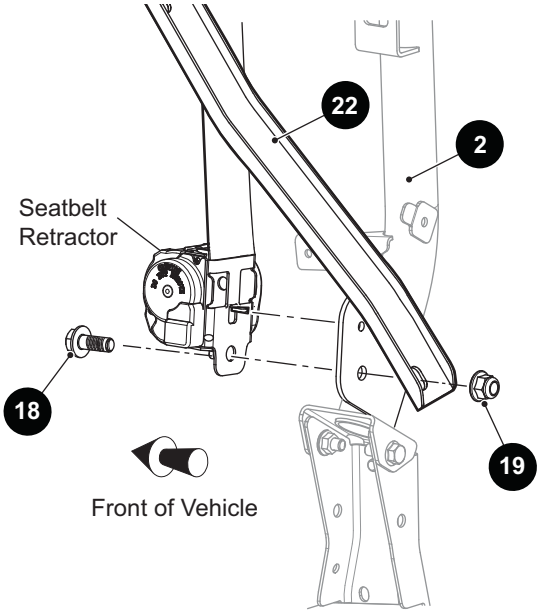


Fig. 9 Seat Belt Retractor

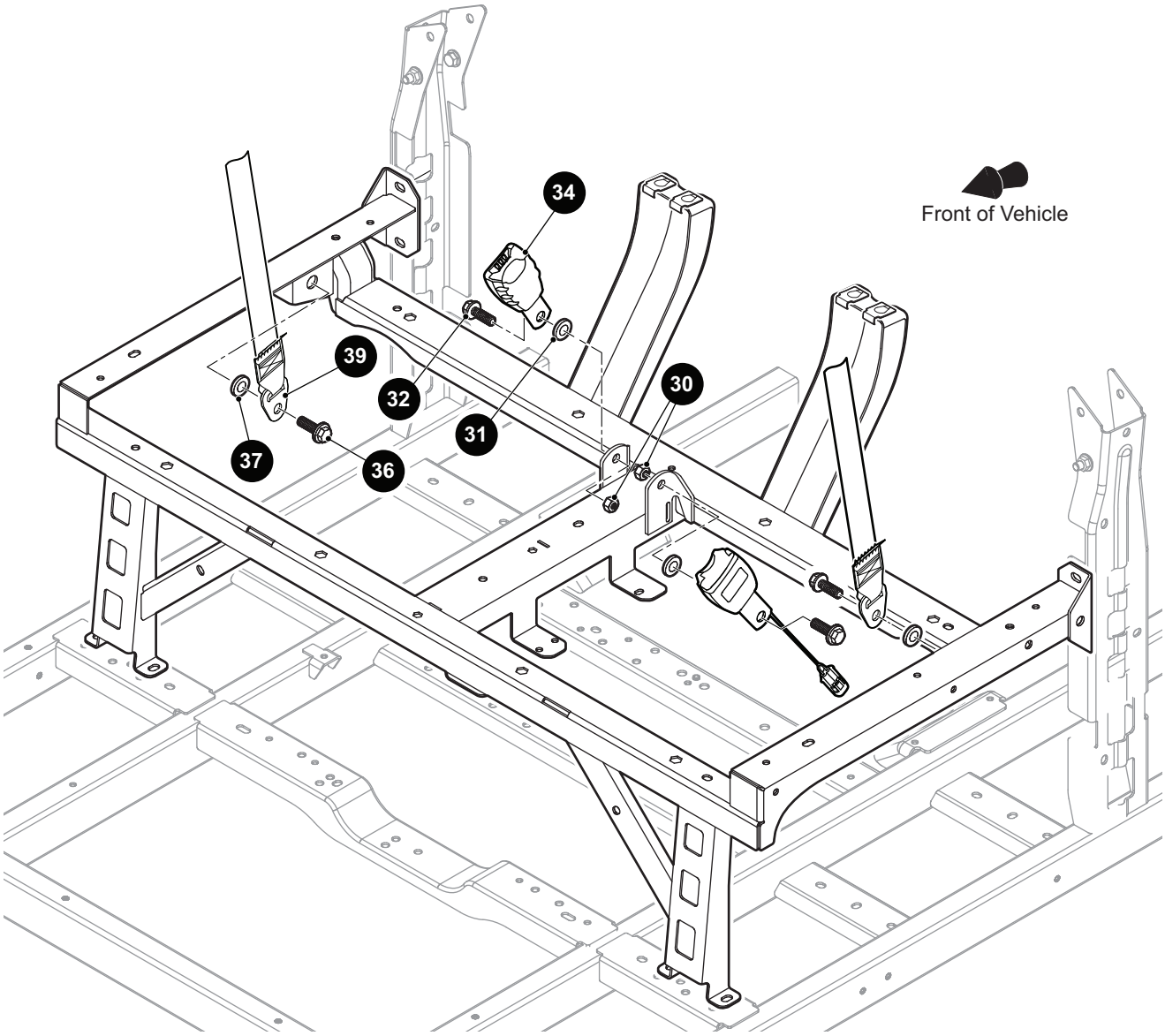


Fig. 10 Lower Seat Belt

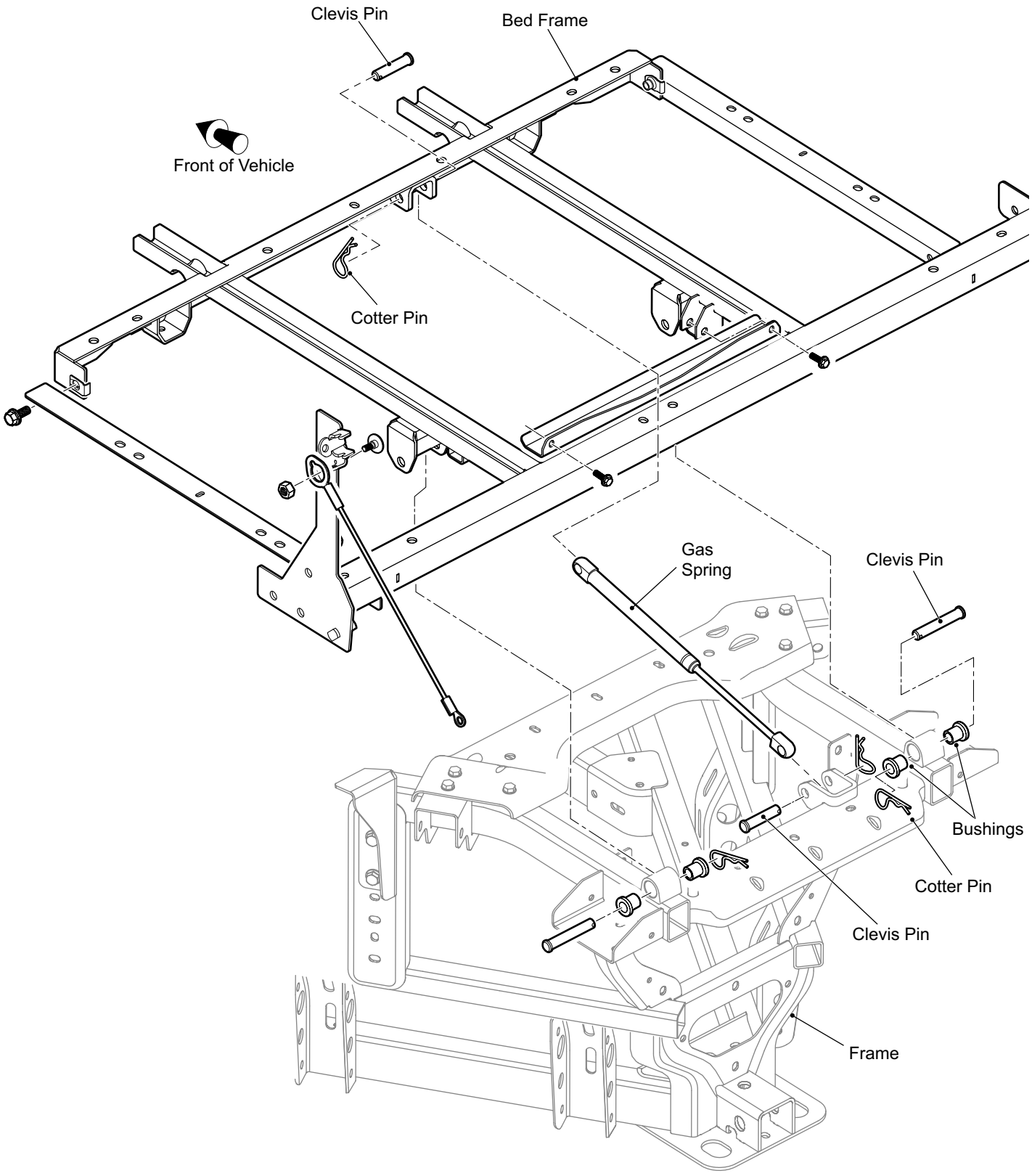
Read all of SAFETY and this section before attempting any procedure. Pay particular attention to Notices, Cautions, Warnings and Dangers.

Notes:

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

Notes:

TRUCK BED


Clevis Pin
Bed Frame
Front of Vehicle
Cotter Pin
Gas
Spring
Clevis Pin
Bushings
Cotter Pin
Clevis Pin
Frame

TRUCK BED

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

TRUCK BED REMOVAL

Tool List	Quantity
Back Brace	2
Ratchet	1
Socket, 10mm	1

WARNING ***The truck bed is heavy and difficult to handle. To prevent possible personal injury, it is strongly recommended that an assistant or adequate lifting device be used to remove the truck bed from the vehicle.***

To safely remove the bed from the vehicle:

1. Release the bed latch and lift the truck bed until the gas springs are fully extended.
2. With a person on each side of the bed, remove the cotter pin and clevis pin that connect the gas springs to truck bed. Swing the gas springs down to rest on the frame.
3. Lower the truck bed.
4. Remove the cotter pins and clevis pins from the truck bed pivots.
5. Remove the bed from the vehicle.
6. Install the truck bed in the reverse order of disassembly.

NOTICE: Make sure the pivot bushings are in place before installing the bed.

Make sure the heat shields are attached before installation.

Decal Replacement

Tool List	Qty.
Alcohol	AR
Clean Lint Free Cloth	1
Squeegee	1

When replacing decals on the body panels:

1. Prepare the surface by cleaning with alcohol and a clean cloth. Allow the surface to dry.
2. Peel away the decal backing and apply to the surface.
3. Use a squeegee to smooth out the decal and remove any air pockets trapped under the decal. A needle can be used to puncture any remaining air pockets that cannot be otherwise removed.

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

Notes:

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

Notes:

WEATHER PROTECTION

GENERAL

⚠ WARNING ***The canopy does not provide protection from falling objects.***

The windshield does not provide protection from tree limbs or flying objects.

The canopy and windshield are designed for weather protection only.

Clean with water and a clean cloth. Minor scratches can be removed with a commercial plastic polish or Plexus plastic cleaner available from the service parts department.

CANOPY

Tool List	Qty.
Deep Well Socket, 15 mm	1
Wrench, 15 mm	1
Torx Bit, T27	1
Socket Extension	1
Hex Bit, 6 mm	1
Torque Wrench, ft. lbs.	1
Ratchet	1

Installing Canopy Mounting Brackets

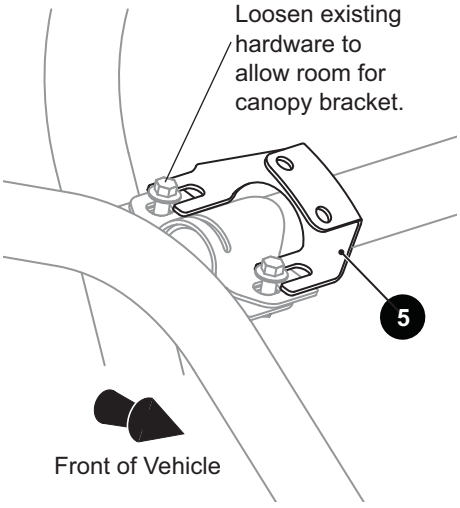


Fig. 1 Canopy Mounting Brackets

1. Loosen the ROPS (Roll Over Protection System) hardware at each of the four upper corner brackets (Ref. Fig. 1). Do not remove the bolts completely.
2. Slide the passenger side front canopy mounting bracket (5) underneath the bolt heads at the front passenger side of the ROPS.
3. Finger tighten the hardware to allow for adjustment.
4. Repeat the above step to install the other three mounting brackets (4, 6, 7) to the corresponding ROPS brackets on the front driver side, rear driver side, and rear passenger side ROPS brackets.

WEATHER PROTECTION

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

Installing Canopy Clamps

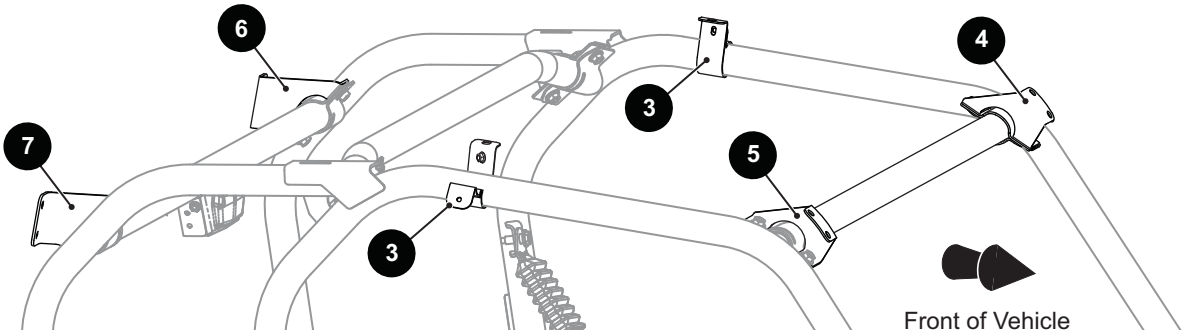


Fig. 2 Canopy Mounting Clamps

1. Place canopy clamps (3), with the hinged side facing out, onto each side ROPS tube (Ref. Fig. 2).
2. Close the hinges around the ROPS tubes and secure with Torx bolts (11) and washers (12) (Ref. Fig. 3).
3. Finger tighten hardware to allow for adjustment.

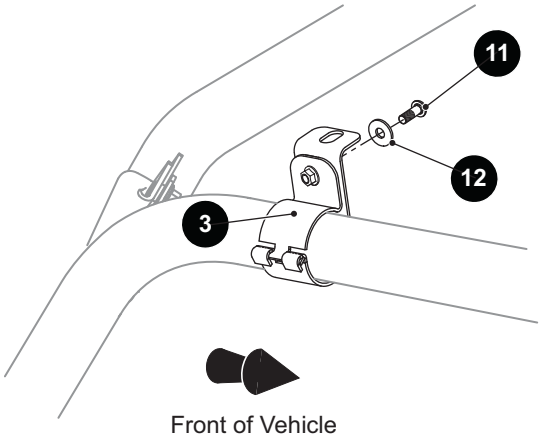


Fig. 3 Secure Canopy Clamp

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

Installing the Canopy

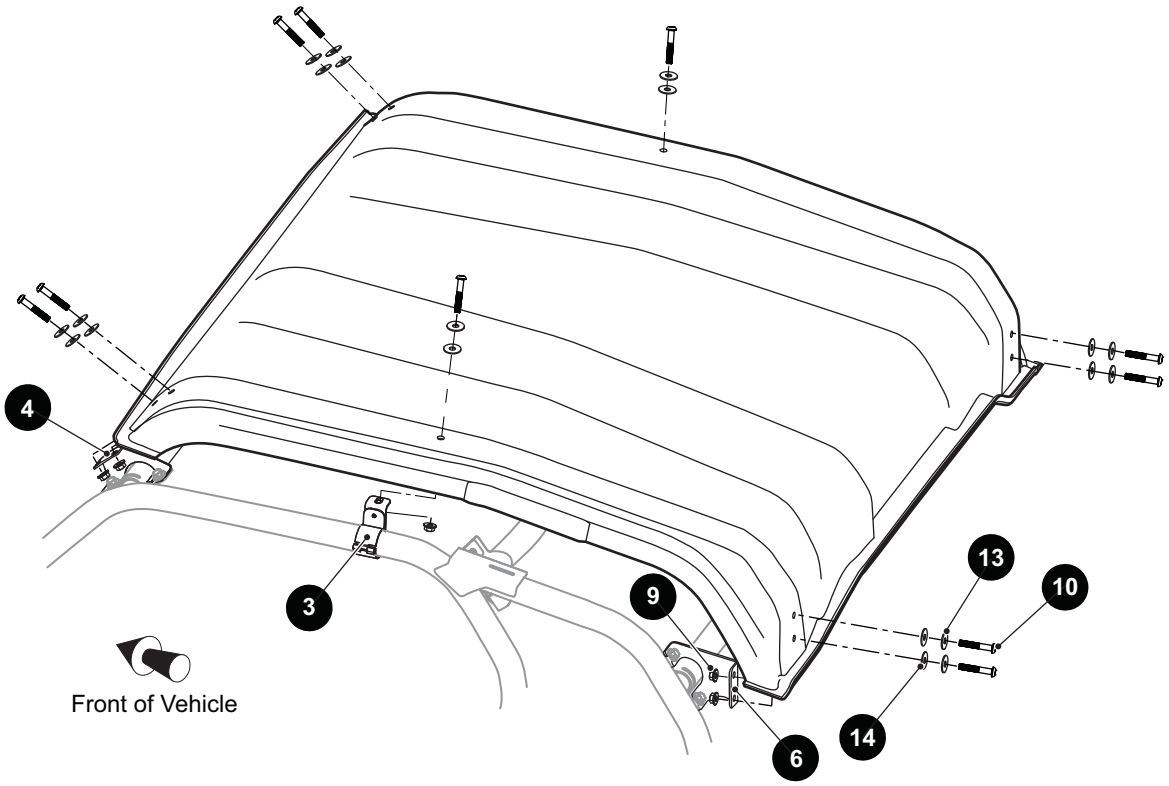


Fig. 4 Canopy

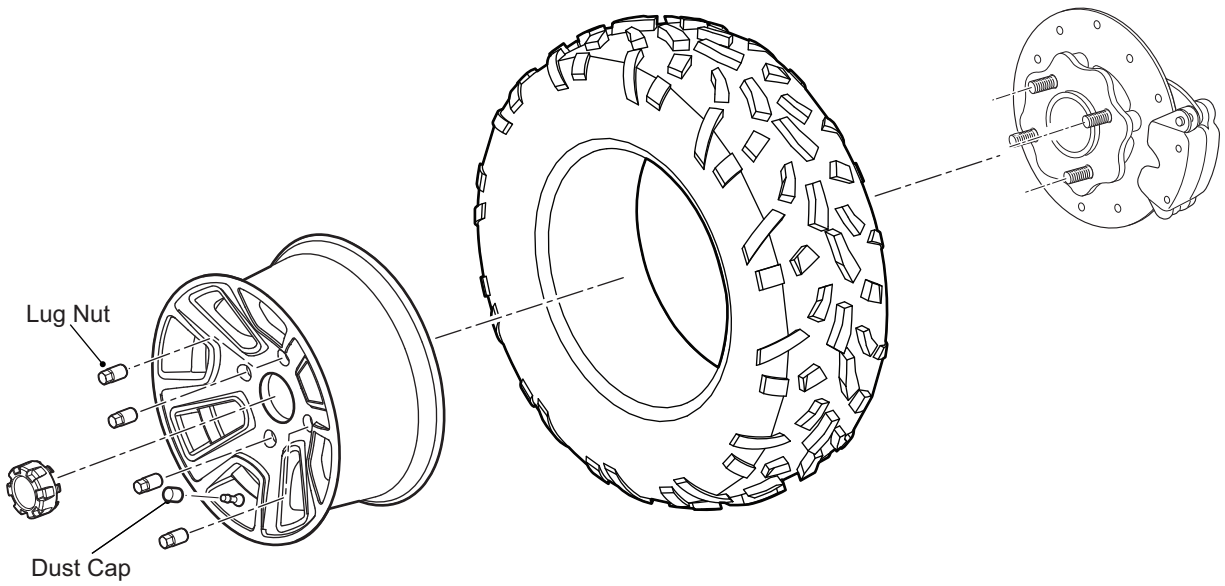
1. Align the mounting holes on the canopy with the holes in the mounting brackets (4-7) and canopy clamps (3) (Ref. Fig. 2) (Ref. Fig. 4).
2. Slide the canopy clamps (3) along the ROPS tube so they are aligned with the canopy mounting holes.
3. When the canopy clamps are aligned with the canopy mounting holes, tighten the canopy clamp bolts (11) to a torque mentioned in below table.
4. Secure the canopy to the clamps and brackets with Torx bolts (10), washer (13), rubber washer (14) and lock nuts (9).
5. Finger tighten hardware to allow for adjustment. After all hardware has been installed, tighten to a torque of 13 - 15 ft. lbs. (17 - 20 N-m).
6. Tighten all ROPS hardware to a torque mentioned in below table.
7. Removal of the canopy is in the reverse order of installation.

Item	Torque Specification
11	7 - 9 ft. lbs. (10 - 12 Nm)
Hardware (ROPS)	30 - 33 ft. lbs. (40 - 45 Nm)

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

Notes:

WHEELS AND TIRES



(Style of wheel and tire may differ from shown.)

Valve stem must always be to the outside of the wheel.

Always replace the valve stem dust cap.

Fig. 1 Wheels and Tires

WHEEL AND TIRE SERVICE

⚠WARNING ***To prevent injury caused by a broken socket, use only sockets designed for impact wrench use. Never use a conventional socket.***

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

Always use approved size and type of replacement tires. See *GENERAL SPECIFICATIONS* on page 169.

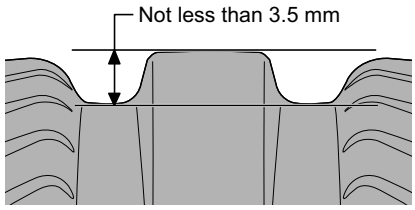
⚠WARNING ***Worn, improperly inflated, improper sized, or incorrectly installed tires will affect vehicle handling and could cause an accident resulting in severe injury or death.***

To decrease the risk of tire explosion, do not exceed the tire inflation rating on the tire sidewall. Make sure the tires are properly inflated at all times of operation. See GENERAL SPECIFICATIONS on page 169.

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

Tire Tread Depth

Replace the tires when the tread depth is worn to 3.5 mm or less.



Tire Repair

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

1. Remove the wheel from the vehicle.
2. Locate the leak in the tire.
   a. If the tire is very low or flat, fully inflate the tire.
   b. Brush soapy water over the surface of the tire. Air bubbles will be visible where the air is leaking from the tire.
   c. Mark the hole with chalk.

4. Install the tire plug according to the manufacturer's instructions.
5. Install the wheel on the vehicle.
6. Fully inflate the tire. See *GENERAL SPECIFICATIONS* on page 169.

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

Tire Replacement

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

Wheel Removal

Tools List	Qty.
Lug Wrench, 19mm	1
Impact Wrench	1
Impact Socket, 19mm	1
Torque Wrench, ft. lbs.	1

1. Lift the vehicle. See *LIFTING THE VEHICLE* on page 19.
2. Remove the lug nuts.
3. Remove the wheel from the hub.

Wheel Installation

⚠ CAUTION ***Do not tighten lug nuts to more than 100 ft. lbs. (135 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.

The rear tires are wider than the front tires. Make sure you reinstall the wheels in their correct position.

1. 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 (uni-directional tires require the arrow indicating direction of rotation to be pointing forward when moving forward).
2. Finger tighten the lug nuts in a cross sequence pattern (Ref. Fig. 2).

Lug Nut Tightening Pattern

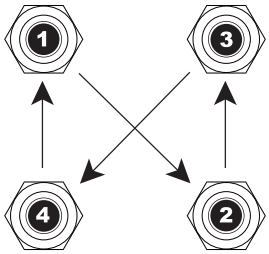


Fig. 2

3. Then, tighten the lug nuts to the torque value in 20 ft. lbs. (27 Nm) increments following the same cross sequence pattern.

Item	Torque Specification
Lug Nut	85 - 100 ft. lbs. (115 - 135 Nm)

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

Notes:

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

Notes:

BRAKES

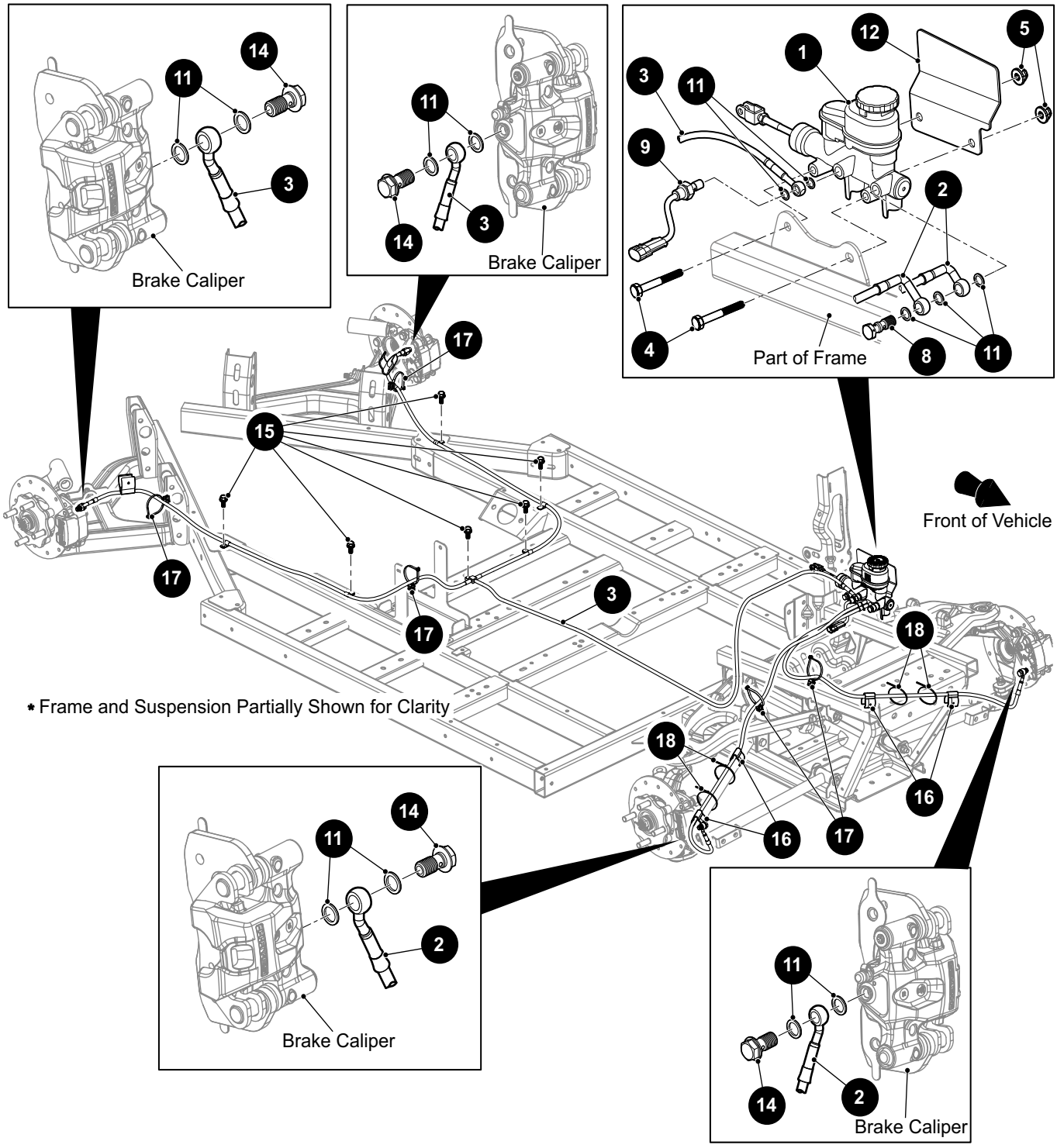


Fig. 1 Brake System

BRAKES

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

MAINTENANCE

Daily Brake Performance Inspection

NOTICE: To ensure correct braking performance, all periodic maintenance, inspections and procedures must be performed. See SCHEDULED MAINTENANCE CHART on page 174. A brake performance test must be performed daily. The entire brake system must be serviced in accordance with the SCHEDULED MAINTENANCE CHART.

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

This vehicle has front and rear hydraulic disc brakes. Perform scheduled maintenance on the brake system at the intervals indicated in the Scheduled Maintenance Chart.

Check the brake fluid level before each operation. Test the brakes for function before each use.

Press the brake pedal. The pedal should have some initial free play, and then become resistant. This indicates proper performance.

If the brake pedal has a soft feel or loses resistance, perform a brake system inspection.

Brake System Inspection

1. Check brake fluid level.
2. Check the brake system for fluid leaks.
3. Check the brake pedal for excessive travel or a spongy feel.
4. Check the brake calipers for looseness.
5. Check the brake pads for wear or damage. Replace the brake pads if worn to 3/64 inch (1 mm) or less (Ref. Fig. 2).

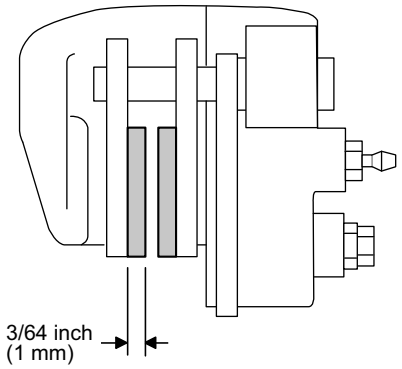


Fig. 2 Check Brake Pad Wear

6. Check the brake rotors for cracks, corrosion, warping or other damage.
7. Clean any grease found on the brake discs with an approved brake cleaner or alcohol.

⚠WARNING ***Never apply WD-40 or any petroleum product to the brake discs. These products are flammable and can also reduce the friction between the brake pad and caliper and increase the possibility of an accident that can result in severe injury or death.***

Do not allow brake fluid to contact the brake pads. If the brake pads become wet with brake fluid, they must be replaced.

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

If the brake pedal has a soft feel, bleed the brakes to remove air from the brake system.

A brake pedal that loses resistance indicates a leak in the hydraulic system:

1. Check brake fluid level. If the fluid is low, inspect the system for leaks.
   a. Check for leaks by applying pressure to the pedal gradually and steadily.
   b. If pedal sinks very slowly to the floor, the system has a leak along the brake lines or at the hydraulic cylinder. If no external leaks are apparent, the problem is likely inside the master cylinder.
3. If leaks are found, repair the leaks in the brake system, or repair or replace the master cylinder.
4. Bleed the brakes to remove air from the brake system.

NOTICE: Do not allow brake fluid to contact painted surfaces.

Brake Fluid

⚠WARNING ***When adding or changing brake fluid, always use brake fluid from an unopened bottle. After opening a bottle of brake fluid, always discard the unused portion. Do not store, or use from an opened bottle. Brake fluid rapidly absorbs moisture from the air. The moisture causes the boiling temperature of the brake fluid to drop. This can lead to premature brake fade and the possibility of an accident that can result in severe injury or death.***

The brake fluid reservoir is located under the cowl near the driver side front wheel. Remove the panel from the cowl to access the reservoir.

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

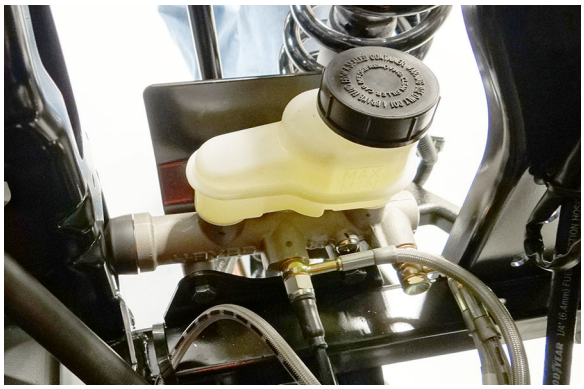


Fig. 3 Check Brake Fluid Level

In addition to the scheduled maintenance interval for changing the brake fluid, the brake fluid must also be changed in the following conditions:

- the fluid becomes contaminated
- the fluid level falls BELOW the MIN mark
- the type and brand of the fluid in the reservoir are unknown

1. Park the vehicle on a level surface.
2. Check the brake fluid level in the reservoir (Ref. Fig. 3). The fluid level should be between the upper MAX and lower MIN lines.
3. If the level is *below* the upper MAX line, add brake fluid:
   a. Clean any dirt and debris from around the reservoir cap and remove the cap.
   b. Add DOT 4 brake fluid until it reaches the upper MAX line.
   c. Reinstall the cap.
   d. Clean any spilled brake fluid from the area.
   e. Dispose of the unused portion of the brake fluid.
6. Press and hold the brake pedal fully down for a few seconds.
7. Check for fluid leakage around the fittings.

MASTER CYLINDER

The master cylinder is mounted to the frame, under the cowl on the driver side of the vehicle. The master cylinder will eventually require replacement due to deterioration of the cylinder seals (cups). Fluid will leak past the cups and show as an external leak. A common symptom is a soft brake pedal, meaning that it goes all the way to the floor. The rubber parts wear with use and deteriorate with age or fluid contamination. Corrosion or deposits formed in the cylinder bore, due to moisture or dirt in the hydraulic system may cause 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 detected on the master cylinder, replace it with a new one.

Master Cylinder Replacement

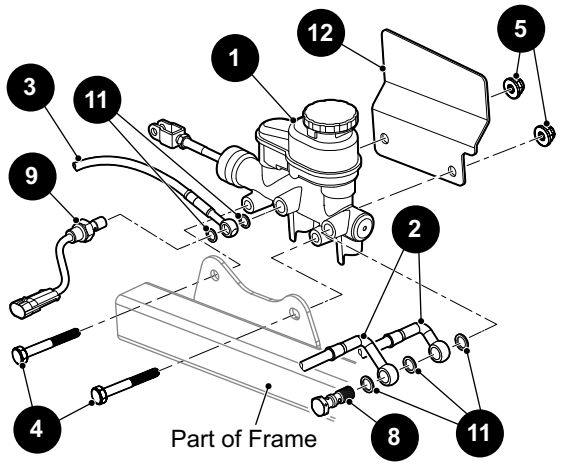


Fig. 4 Master Cylinder

Tool List	Qty.
Drain Pan	1
Shop Cloths	AR
Needle Nose Pliers	1
Wrench, 13mm	2
Wrench, 14mm	1
Ratchet	1
Socket, 13mm	1
Socket, 14mm	1
Torque Wrench, ft. lbs.	1

WARNING ***DO NOT re-use crush (11) washers (Ref. Fig. 4).***

NOTICE: When replacing the master cylinder, it is likely that brake fluid will leak from the master cylinder. Do not allow brake fluid to contact the painted body components of the vehicle. Clean off immediately if contact is made.

1. Turn the key to the OFF position, and remove it from the switch.
2. Place a drain pan under the master cylinder (1) (Ref. Fig. 4).
3. Clean the area around the master cylinder to prevent dirt and grease from contaminating the hydraulic system.
4. Disconnect the front brake lines (2) from the master cylinder (1) by removing banjo bolt (8) and crush washers (11).

NOTICE: Do not reuse crush washers. Always replace with new ones.

5. Disconnect the rear brake lines (3) by unplugging and removing the brake pressure switch (9).
6. Remove the cotter pin and clevis pin from the brake pedal.
7. Remove two hex head bolts (4) and nuts (5) that secure the master cylinder and shield (12) to the frame. Remove the master cylinder and shield from the vehicle.
8. Installation of master cylinder is the reverse of removal.
9. Tighten hardware to the torque values specified below:

Item	Torque Specification
4, 5	24 - 26 ft.lbs. (32 - 35 Nm)
8	20 - 22 ft.lbs. (27 - 30 Nm)
9	20 - 22 ft.lbs. (27 - 30 Nm)

10. Fill the master cylinder with DOT 4 brake fluid and bleed the brake system.
11. After bleeding the brake system, check for leaks along all lines and at the master cylinder.

Brake Pad Replacement

Tool List **Qty.**

Ratchet 1
Torx driver, T45 1
Socket, 14mm 1
Socket, 12mm 1
Wrench, 14mm 1
Torque Wrench, ft. lbs 1

Replace brake pads as a full set on both front and rear wheels. To remove the brake pads, lift and support the vehicle as instructed in the SAFETY section.

1. Remove the wheel. See *Wheel Removal* on page 62.
2. Remove the jam screw (24) and discard.
3. Remove the two bolts (15) and lock washers (16) that secure the caliper assembly (17) to the spindle (18) (Ref. Fig. 5). Swing the caliper free from the spindle and the rotor.

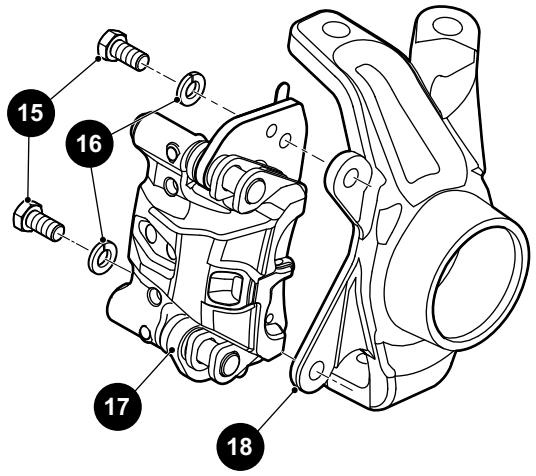


Fig. 5 Brake Caliper Removal

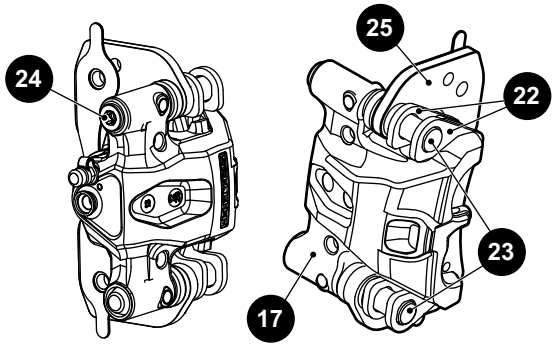


Fig. 6 Brake Pad Replacement

4. Compress pistons by pushing the mounting bracket (25) inward against the caliper body (17).
5. Remove the brake pads (outermost pad first) from the slide pins (23) (Ref. Fig. 6).
6. Push the pistons back into the caliper body.
7. Install the new brake pads (22) in the reverse order of removal.
8. Place the caliper assembly (17) onto the rotor with the rotor in between the two brake pads (22).
9. Align the mounting holes on the caliper assembly with the corresponding holes on the spindle. Secure with two bolts (15) and nuts (16).
10. Install a new jam screw (24).
11. Tighten the hardware to the torques specified below.

Item	Torque Specification
15	30 - 35 ft.lbs. (40 - 48 Nm)
24	8 - 10 ft.lbs. (11 - 14 Nm)

12. Replace the wheel. See *Wheel Installation* on page 62.
13. Pump the brake pedal until firm resistance is felt.
14. Check the brake fluid level. Add fluid as required.

⚠WARNING ***Hard braking without properly burnishing the new brake pads can result in a loss of braking ability which can cause serious injury or death. Burnish the brake pads by braking moderately for the first fifty stops. Avoid hard braking during this period.***

Rotor Replacement

Tool List **Qty.**

Ratchet 1
Socket, 13mm 1
Torque Wrench, ft. lbs. 1

NOTICE: Do not turn the rotor (disc brake hub) to remove grooves or high spots.

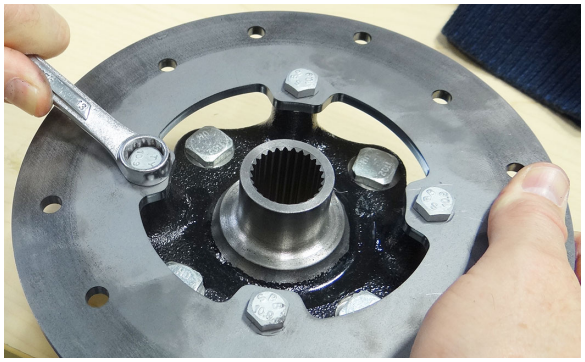


Fig. 7 Rotor Replacement

NOTICE: If the rotor (disc) has deep grooves or gouges, it must be replaced. If the pad contact area has worn the rotor to a thickness less than .200" +/- .005", the rotor must be replaced.

If the rotor needs replacement, the caliper and pads must be moved to access the rotor. See *Brake Pad Replacement*.

1. To remove the rotor, lift and support the vehicle. See *LIFTING THE VEHICLE* on page 19.
2. Remove the wheel. See *Wheel Removal* on page 60.
3. Remove the hub from the axle. See *Front Hub Removal* on page 74.
4. Remove the four bolts that secure the rotor to the hub. Remove the rotor (Ref. Fig. 7).
5. Installation is the reverse order of removal.
6. Add Loctite thread locker to the rotor bolts before installation.
7. Tighten the rotor bolts in a cross sequence to the torque specified below:

Item	Torque Specification
Rotor Bolts	28 - 30 ft. lbs. (38 - 40 Nm)

BLEEDING AND FLUSHING

Tool List **Qty.**

Shop Towels ..... AR
Hose ..... AR
Clean Container 1
Brake Fluid, DOT 4 ..... AR
Wrench, 1/4" Box End 1
Crowfoot Wrench, 1/4" 1
Torque Wrench, in. lbs. 1
Socket, 1/4" 1

Bleeding

The brake hydraulic system must be free of air to function properly.

The brake pedal and master cylinder acts as a hydraulic pump to remove air and brake fluid from the system.

Bleed the hydraulic system at all wheels if:

- The 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 calipers, all wheel calipers served by the disconnected line or hose must be bled.

Bleeding Sequence

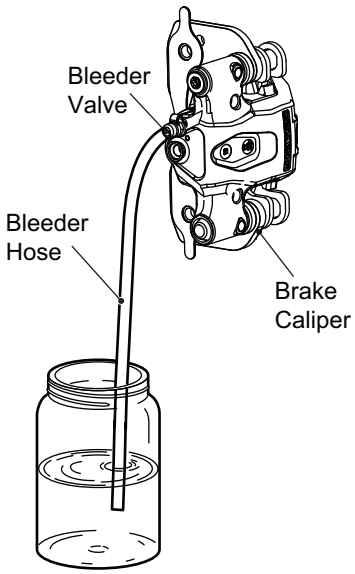


Fig. 8 Bleeder Valve

Bleed at each caliper in the following succession:

1. Passenger side rear wheel
2. Driver side rear wheel
3. Passenger side front wheel
4. Driver side front wheel caliper

⚠WARNING ***Never use excess brake fluid or return it to the original container. Dispose of brake fluid properly.***

NOTICE: An assistant is necessary to perform this procedure.

Use a clean cloth to clean the master cylinder reservoir and caliper bleeder valves. Clean each fitting before opening to prevent contamination of the system.

Fill the master cylinder reservoir to MAX line with new brake fluid before starting, and after bleeding is complete.

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

The following steps apply to one bleeder valve. Repeat at the bleeder valve of each wheel.

1. Attach a bleeder hose to the bleeder valve (Ref. Fig. 8). Put the other end of the hose in a glass container partially filled with brake fluid.

NOTICE: Be sure that the free end of the hose is submerged in brake fluid. This shows air bubbles as they come out of the system, and prevents air from being 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 valve.

⚠CAUTION ***Do not force the brake pedal to the floor. The operating rod can be forced into the master cylinder where it can damage internal components.***

3. If the brake pedal goes to the floorboard without removing all of the air bubbles, close the bleeder valve and release the brake pedal slowly. Repeat steps 1 and 2.

NOTICE: The bleeder valve at the brake caliper must be closed at the end of each stroke, and before the brake pedal is released to ensure that air cannot enter the system. It is also important that the brake pedal be returned to the full released position.

4. When fluid coming from the submerged end of the hose is clear and free of bubbles, close the bleeder valve and release the brake pedal. Tighten the bleeder valve to the maximum torque value specified below.

Item	Torque Specification
Bleeder Valve	38 in. lbs. (4 Nm)

Flushing the Brake System

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

Flushing is similar to bleeding except that a greater amount of brake fluid is discharged from each bleeder point to make sure that all of the dirty or contaminated fluid is removed.

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

BRAKE AND ACCELERATOR PEDALS

Brake Pedal Removal and Installation

Tool List	Qty.
Needle Nose Pliers	1
Socket, 9/16”	1
Ratchet	1
Wrench, 3/4”	1
Torque Wrench, ft. lbs.	1

1. Disconnect the brake pedal from the master cylinder push-rod by removing cotter pin (9) and clevis pin (10) from the brake pedal (Ref. Fig. 9).

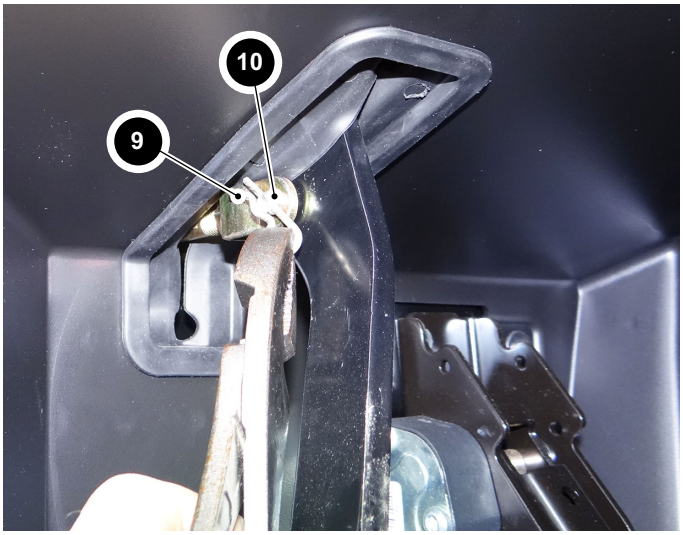


Fig. 9 Disconnect Brake Pedal

2. Remove pivot bolt (6), bushings (11) and lock nut (7) (Ref. Fig. 10).
3. Remove pedal.
4. Brake pedal installation is the reverse order of removal.
5. Tighten bolt (6) and nut (5) to the torque specified below.

Item	Torque Specification
6, 7	18 - 22 ft. lbs. (24 - 30 Nm)

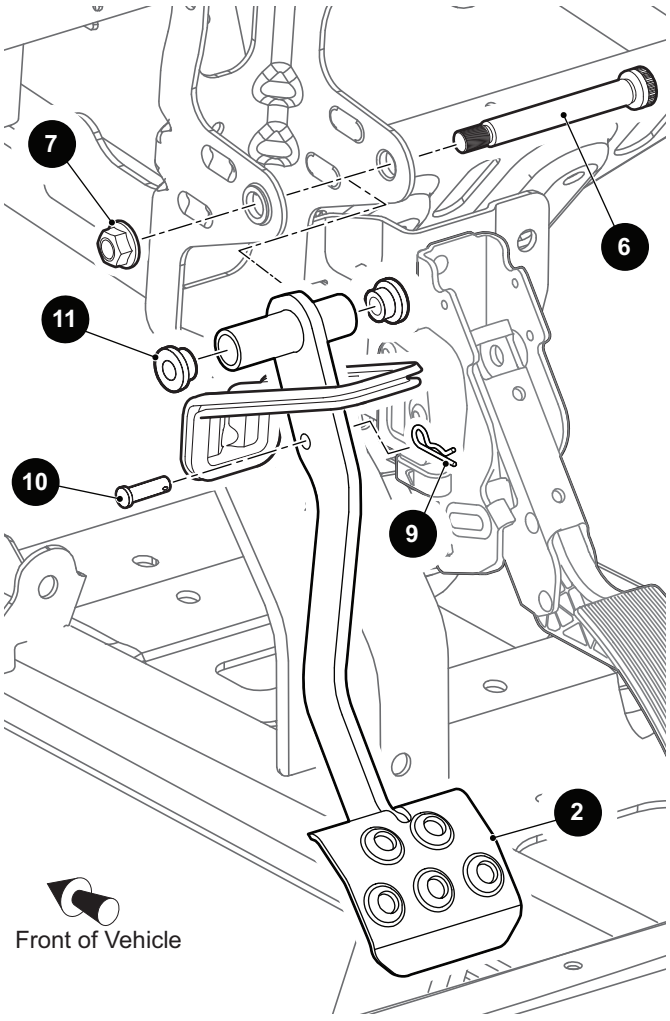


Fig. 10 Brake Pedal Removal

Accelerator Pedal Removal

Tool List	Qty.
Ratchet	1
Socket, 10mm	1
Wrench, 10mm	1
Torque Wrench, ft. lbs.	1

1. Disconnect the accelerator wire from the harness.
2. From under the vehicle, remove the two nuts that secure the accelerator pedal to the vehicle frame (Ref. Fig. 11).
3. Remove the pedal.
4. Installation is the reverse of removal.
5. Tighten nuts to the torque specified below.

Item	Torque Specification
15	9 - 10 ft. lbs. (12 - 14 Nm)

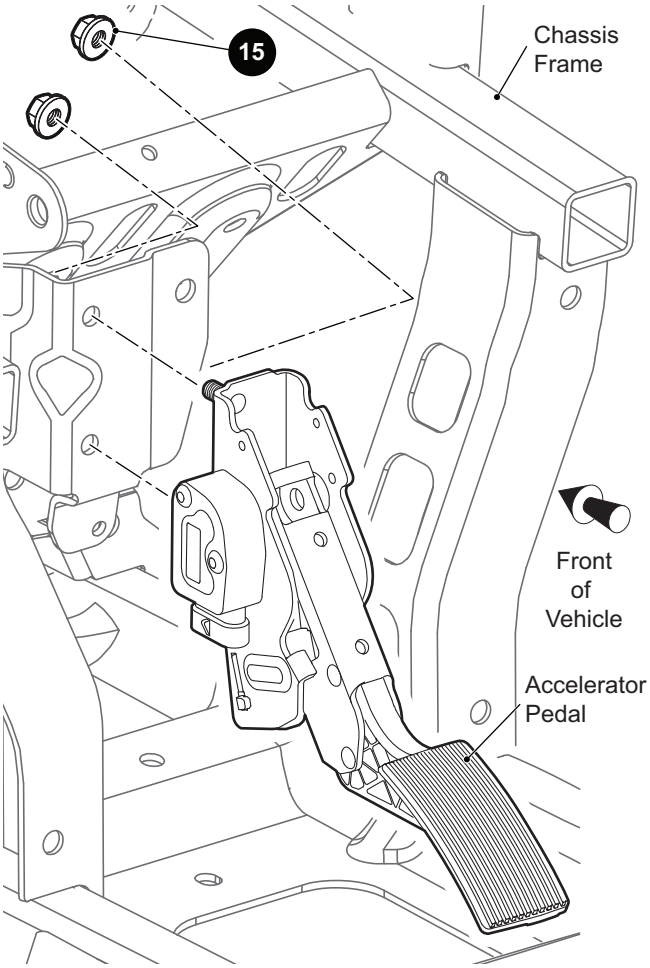


Fig. 11 Accelerator Pedal

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

Notes:

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

Notes:

FRONT CV SHAFT, SUSPENSION AND STEERING

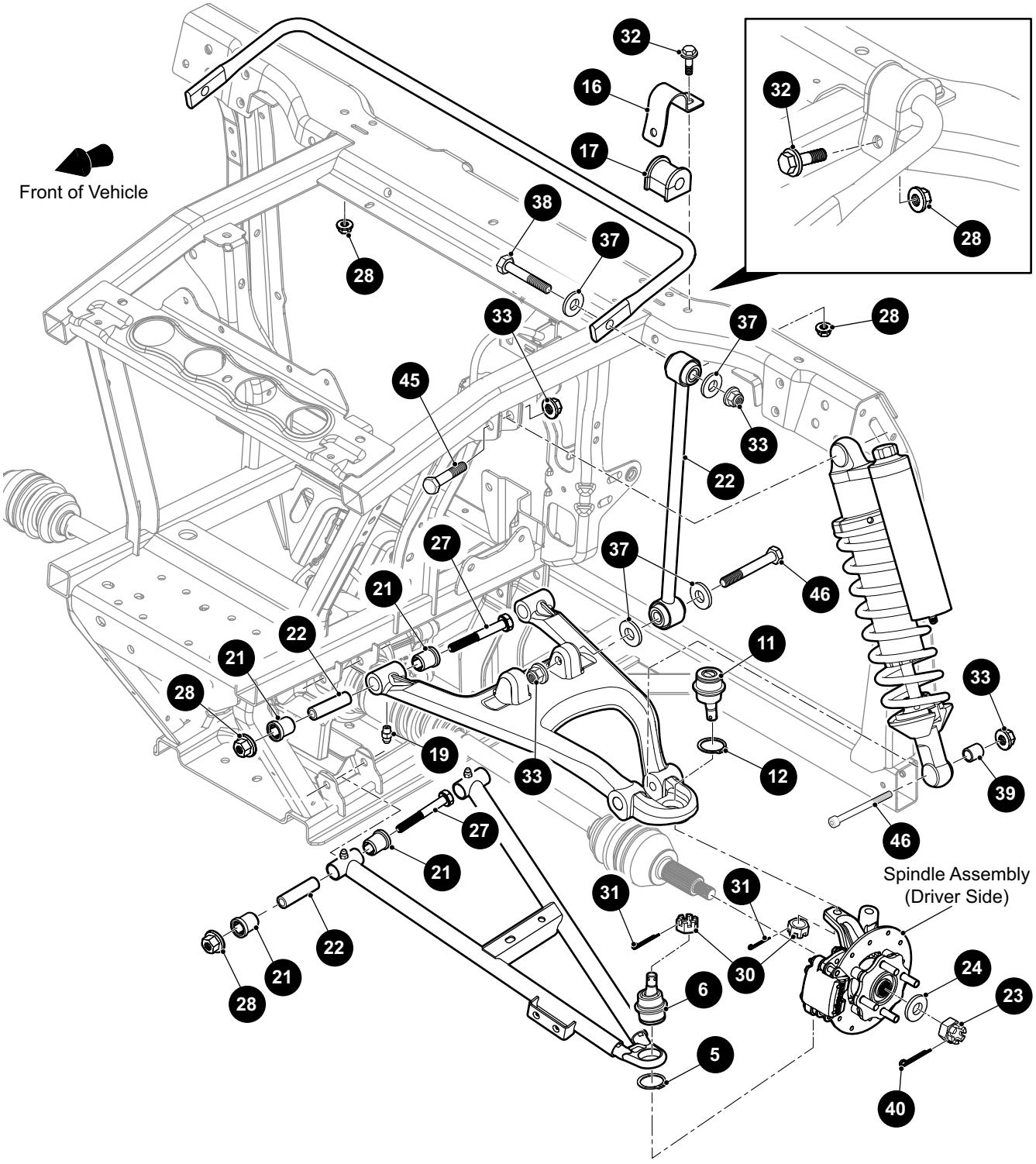


Fig. 1 Front Suspension Components

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

FRONT SUSPENSION

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

⚠WARNING ***To reduce the possibility of personal injury, follow the lifting procedure. See LIFTING THE VEHICLE on page 19.***

Maintenance

See *RECOMMENDED LUBRICANTS AND FLUIDS* on page 176.

Lubrication points can be found on the upper and lower control arms. Use a maximum of three pumps of grease per fitting.

Routine examination of the tires will indicate if a wheel alignment is required.

The rod ends are sealed and do not require lubrication. The steering unit is also sealed and requires no additional lubrication.

Wheel Bearing Test

To check for worn wheel bearings, perform the following procedure:

NOTICE: The axle nut must be installed at the proper torque for the wheel bearing test to be accurate.

1. Lift and support the vehicle. See *LIFTING THE VEHICLE* on page 19.
2. Grasp the wheel at the top and bottom of the tire.
3. Apply firm back and forth pressure on the wheel. If any movement is noted, the wheel bearing must be pressed out of the spindle and replaced.

Front Hub Removal

Tool List	Qty.
Wheel Chocks	4
Floor Jack	1
Jack Stands	4
Plastic Hammer	1
Needle Nose Pliers	1
Impact Wrench	1
Impact Socket, 27mm	1
Torque Wrench, ft. lbs	1

1. Lift and support the vehicle. See *LIFTING THE VEHICLE* on page 19.
2. Remove front wheel. See *Wheel Removal* on page 60.
3. Remove the brake calipers from the rotor. See *Brake Pad Replacement* on page 66.
4. At the center of the hub, remove the cotter pin (40), axle nut (23) and washer (24) from the axle (Ref. Fig. 2)(Ref. Fig. 3).

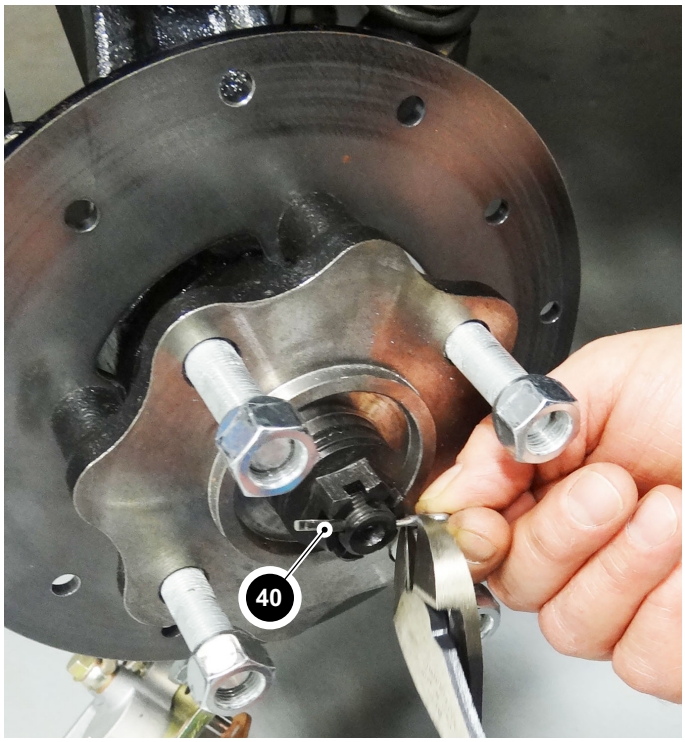


Fig. 2 Remove Cotter Pin

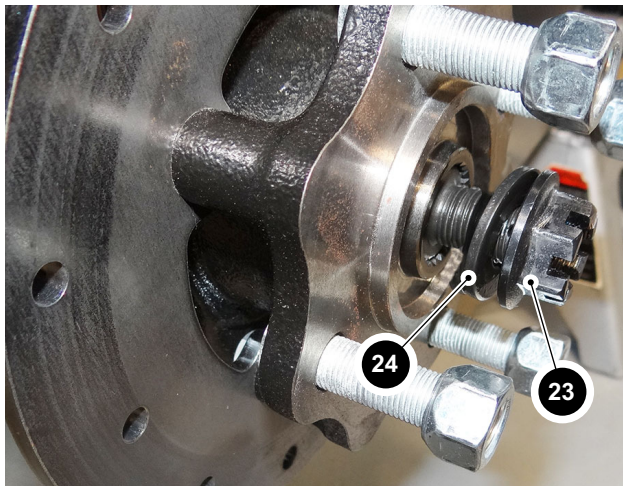


Fig. 3 Remove Axle Nut and Washers

5. Tap the hub with a plastic hammer while applying outward pressure until the hub slides off the splines of the axle (Ref. Fig. 4).

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

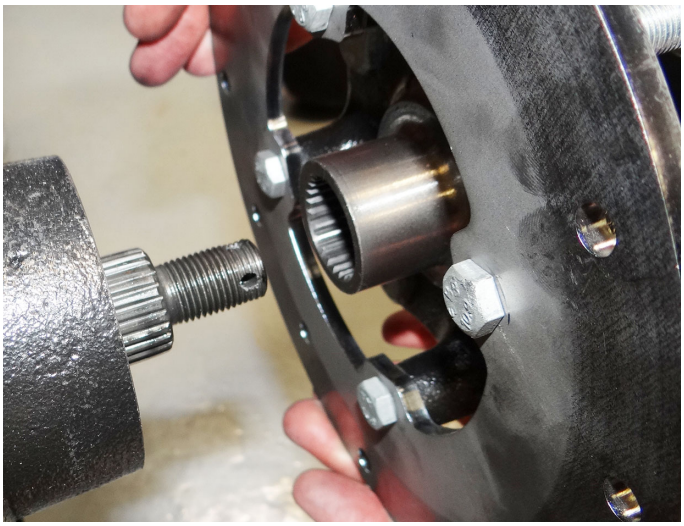


Fig. 4 Remove the Hub

6. The installation of the hub is the reverse of disassembly.
7. Clean the splines of the hub and axle and apply anti-seize before installation.
8. Tighten the hardware to the torque values specified below:

Item	Torque Specification
23	181 - 199 ft. lbs. (245 - 270 Nm)

Front Spindle Removal

Tool List **Qty.**

Wheel Chocks 4
Floor Jack 1
Jack Stands 4
Plastic Hammer 1
Needle Nose Pliers 1
Ratchet 1
Socket, 17mm 1
Socket, 19mm 1
Wrench, 17mm 1
Wrench, 19mm 1
Impact Wrench 1
Impact Socket, 24mm 1
Torque Wrench, ft. lbs. 1

1. Lift and support vehicle. See *LIFTING THE VEHICLE* on page 19.
2. Remove the front wheel. See *Wheel Removal* on page 60.
3. Remove the brake calipers from the rotor. See *Brake Pad Replacement* on page 66.
4. Remove the hub. See *Front Hub Removal* on page 74.
5. Remove the nut (2) that secures the spindle to the steering rack ball joint (3) (Ref. Fig. 5)(Ref. Fig. 6). Tap the spindle assembly with a hammer to separate it from the ball joint.

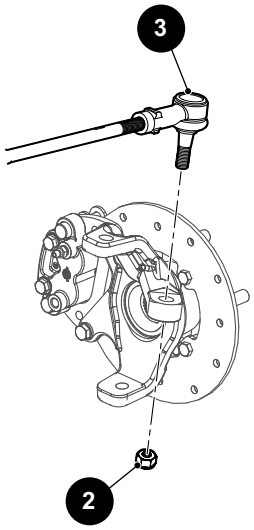


Fig. 5

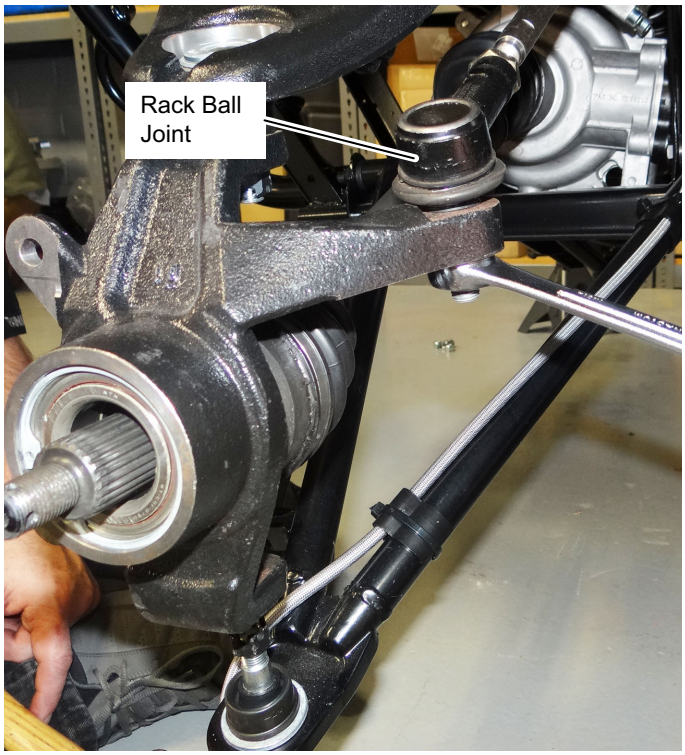


Fig. 6 Rack Ball Joint

Fig. 7 Ball Joint Separation

Fig. 8 Tap Spindle with Hammer

Remove the cotter pin (31) and castle nut (30) that secure the spindle to the upper control arm (Ref. Fig. 9). Tap the spindle assembly downward with a hammer to separate it from the ball joint (Ref. Fig. 8).

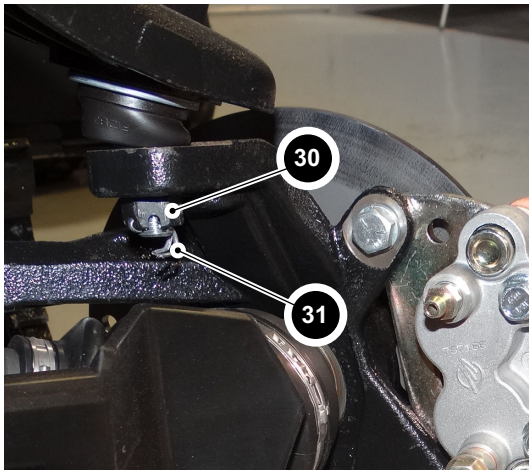


Fig. 9 Spindle Nut and Cotter Pin

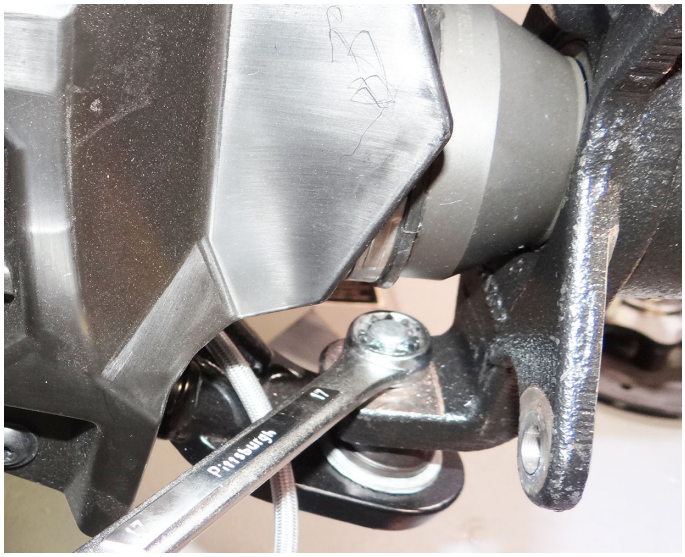


Fig. 10 Remove Spindle Hardware

6. Remove the cotter pin (31) and castle nut (30) that secure the spindle to the lower control arm (Ref. Fig. 10). Tap the spindle assembly downward with a hammer to separate it from the ball joint.
7. Slide the spindle assembly off of the CV axle splines.
8. The installation of the spindle assembly is the reverse of disassembly.
9. Tighten the hardware to the torque values specified below:

Item	Torque Specification
2	17 - 20 ft. lbs. (23 - 27 Nm)
30	18 - 22 ft. lbs. (24 - 30 Nm)

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

FRONT AXLE

CV Shaft Replacement

Tool List	Qty.
Pry Bar	1
Drain Pan	1

⚠ CAUTION ***Inspect the front axle (CV shaft) for contamination, especially if there are any torn CV boots around the axle. Replace the front axle if any contamination is found.***

1. Lift and support vehicle. See *LIFTING THE VEHICLE* on page 21.
2. Remove the front wheel. See *Wheel Removal* on page 62.
3. Remove the brake calipers from the rotor. See *Brake Pad Replacement* on page 68.
4. Remove the hub. Refer to See *Front Hub Removal* on page 74.
5. Remove the front spindle assembly. See *Front Spindle Removal* on page 75.
6. Hold the axle in a straight line while pushing inwards while holding the center shaft.
7. In one quick jerking motion, pull outwards on the CV.
8. If the CV is difficult to remove or stuck, use two pry bars on opposite sides of the CV while maintaining even pressure on the each side. Pay close attention to not damage any components while prying.
9. Make sure that the hog ring is in place on the CV shaft splines (Ref. Fig. 11).

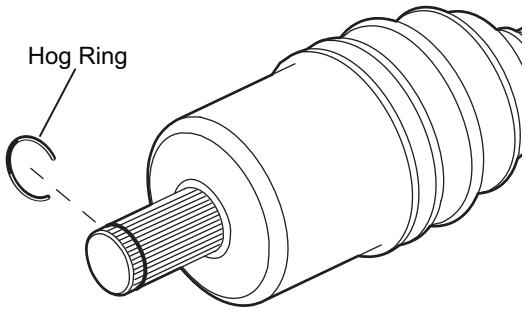


Fig. 11 Hog Ring

10. Apply anti-seize to the splines of the replacement CV shaft prior to installation.

CV Joint Boot Replacement

Tool List	Qty.
Needle Nose Pliers	1
Wire Cutters	1
CV Joint Clamp Tool	1

1. Remove the front axle assembly. See *CV Shaft Replacement* on page 77.
2. Inspect the inner and outer CV joint boots (28) for damage.
3. Cut the CV joint boot clamps (29) and (30) and remove the CV joint boot (28).
4. Replace the new boot in reverse order of removal.
5. Install new boot clamps (Ref. Fig. 12).

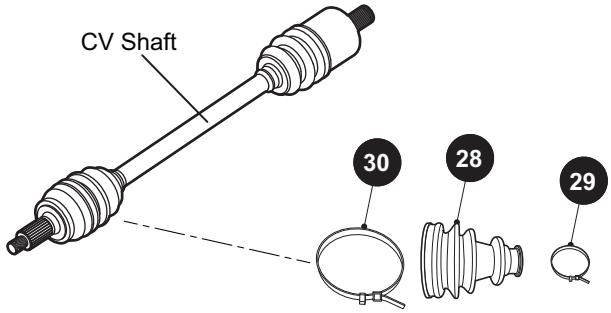


Fig. 12 CV Joint Boot

Front Strut Assembly Replacement

Tool List	Qty.
Wheel Chocks	4
Floor Jack	1
Jack Stands	4
Wrench, 18mm	1
Wrench, 19mm	1
Torque Wrench, ft. lbs.	1
Socket, 18mm	1
Socket, 19mm	1
Ratchet	1

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

1. Lift and support the vehicle. See *LIFTING THE VEHICLE* on page 19.
2. Remove the front wheel. See *Wheel Removal* on page 60.
3. Remove the brake calipers from the rotor. See *Brake Pad Replacement* on page 66.
4. Remove the nut (33) and bolt (45) that secure the top of the strut assembly to the vehicle frame (Ref. Fig. 13).

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

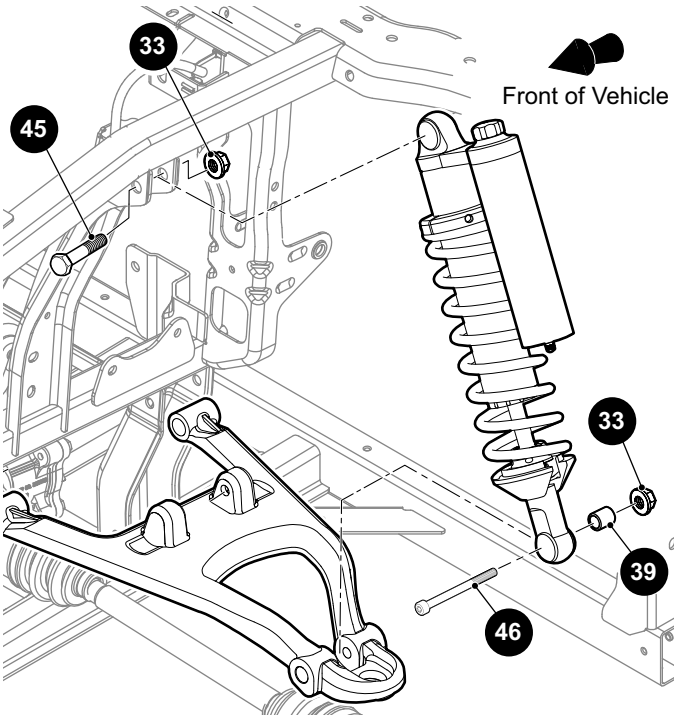


Fig. 13 Upper Strut Bolt

5. Remove the nut (33), spacer (39) and bolt (46) that secure the bottom of the strut assembly to the lower control arm (See Fig. 1) (Ref. Fig. 14).

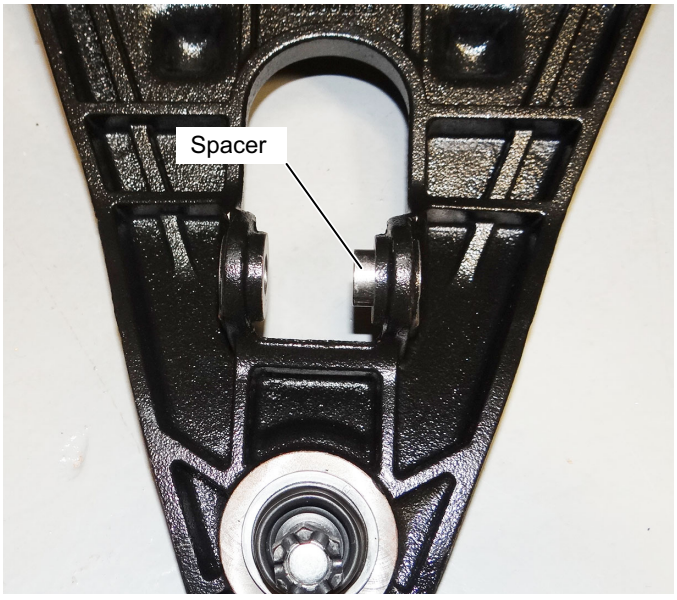


Fig. 14 Upper Control Arm Spacer

6. Remove the strut assembly from the vehicle.
7. The installation of the strut assembly is the reverse of disassembly.
8. Tighten the hardware to the torque values specified below:

Item	Torque Specification
33, 45, 46	70 - 77 ft. lbs. (95 - 105 Nm)

Lower Control Arm Assembly Replacement

Tool List **Qty.**

Wheel Chocks....4
Floor Jack....1
Jack Stands....4
Plastic Faced Hammer....1
Wrench, 15mm....1
Wrench, 17mm....1
Socket, 15mm....1
Socket, 17mm....1
Ratchet....1
Torque Wrench, ft. lbs....1

1. Lift and support vehicle. See *LIFTING THE VEHICLE* on page 19.
2. Remove the front wheel. See *Wheel Removal* on page 60.
3. Remove the brake calipers from the rotor. See *Brake Pad Replacement* on page 66.
4. Remove the front spindle. See *Front Spindle Removal* on page 75.
5. Remove the nuts (28) and bolts (27) that secure each side of the lower control arm to the vehicle frame (Ref. Fig. 16).

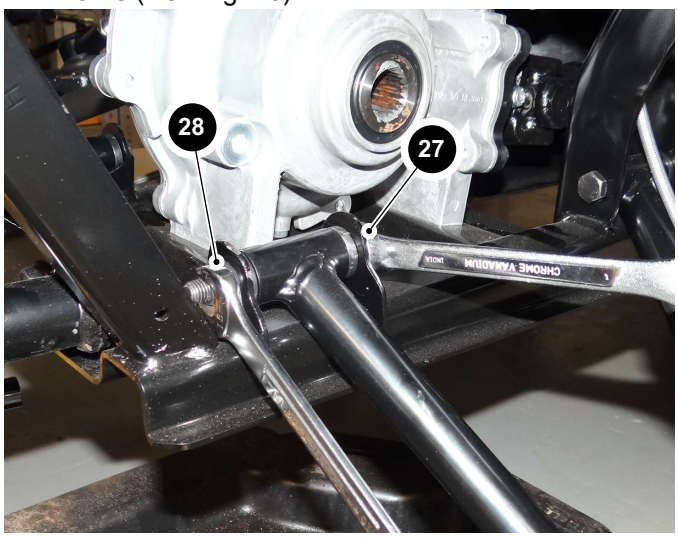


Fig. 15 Lower Control Arm Removal

6. Remove the lower control arm from the vehicle.
7. Installation of lower control arm assembly is the reverse of removal.

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

NOTICE: Make sure bushings (21) and spacers (22) are in place in the lower control arm before installation (See Fig. 1).

8. Tighten the hardware to the torque values specified below:

Item	Torque Specification
27, 28	40 - 44 ft. lbs. (54 - 60 Nm)

Upper Control Arm Assembly Replacement

Tool List **Qty.**

Wheel Chocks 4
Floor Jack 1
Jack Stands 4
Plastic Faced Hammer 1
Wrench, 15mm 1
Wrench, 17mm 1
Wrench 18mm 1
Wrench 19mm 1
Socket, 15mm 1
Socket, 17mm 1
Socket,18mm 1
Socket, 19mm 1
Ratchet 1
Torque Wrench, ft. lbs. 1

1. Lift and support vehicle. See *LIFTING THE VEHICLE* on page 19.
2. Remove the front wheel. See *Wheel Removal* on page 60.
3. Remove the brake calipers from the rotor. See *Brake Pad Replacement* on page 66.
4. Remove the front spindle. See *Front Spindle Removal* on page 75.
5. Remove front strut assembly. See *Front Strut Assembly Replacement* on page 77.

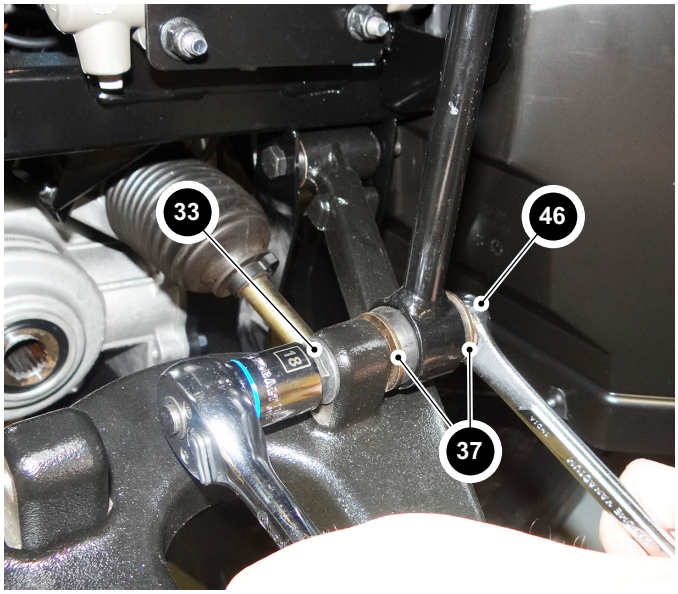


Fig. 16 Stabilizer Bar Linkage

6. Remove the nut (33), washers (37) and bolt (46) that secure the stabilizer link to the upper control-arm (Ref. Fig. 17). Check the rubber bushings for deterioration.

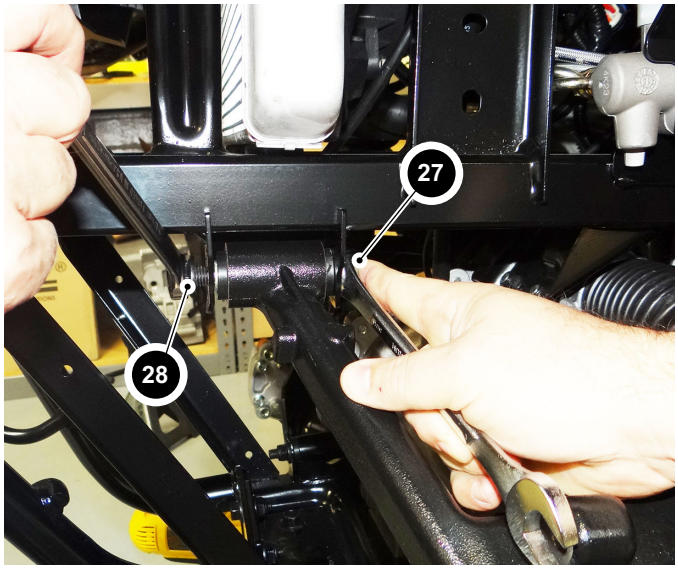


Fig. 17 Upper Control Arm Removal

7. Remove the nuts (28) and bolts (27) that secure each side of the upper control arm to the vehicle frame (Ref. Fig. 18).
8. Remove the upper control arm from the vehicle.

Installation of upper control arm assembly is the reverse of removal.

NOTICE: Make sure bushings (21) and spacers (22) are in place in the upper control arm before installation (See Fig. 1).

9. Tighten the hardware to the torque values specified below:

Item	Torque Specification
27, 28	40 - 44 ft. lbs. (54 - 60 Nm)
33, 46	70 - 77 ft. lbs. (95 - 105 Nm)

Stabilizer Bar Removal

Tool List **Qty.**

Ratchet 1
Socket, 18mm 1
Socket, 17mm 1
Wrench, 18mm 1
Wrench, 17mm 1
Torque Wrench, ft. lbs 1

1. Remove bolts (38), washers (37) and nuts (33) securing the stabilizer bar ends to the stabilizer bar linkages (Ref. Fig. 1).
2. Remove bolts (32) and nuts (28) that secure the stabilizer bar bracket to the vehicle frame.
3. Remove the stabilizer bar.
4. Installation is the reverse of removal.
5. Tighten the hardware to the torque values specified below:

Item	Torque Specification
38, 33	70 - 77 ft. lbs. (95 - 105 Nm)
32, 28	30 - 33 ft. lbs. (40 - 45 Nm)

FRONT DIFFERENTIAL

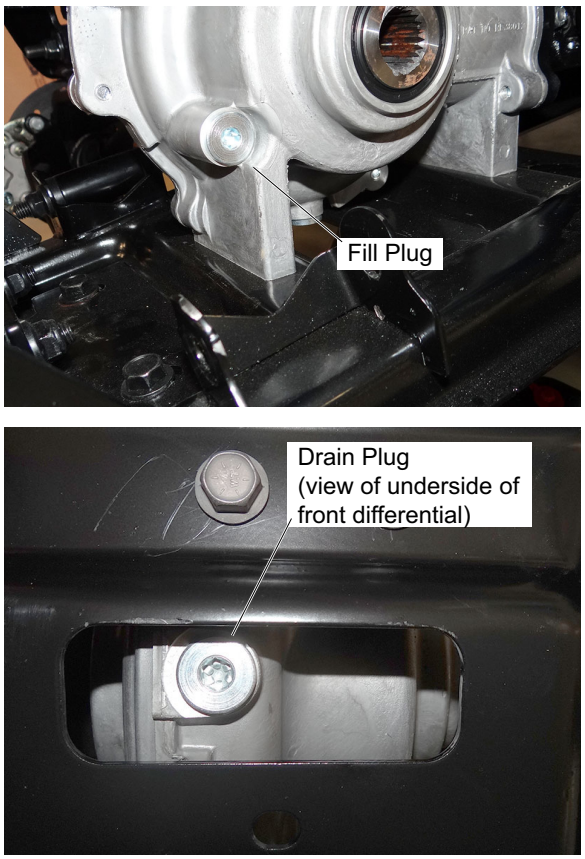


Fig. 18 Fill and Drain Plugs

Check and replace the front differential oil at the intervals indicated. See *SCHEDULED MAINTENANCE CHART* on page 174.

Front Differential Oil Check

Tool List **Qty.**

Rag ..... AR
Drain Pan 1
Ratchet 1
Ratchet Extension 1
Hex Bit, 8mm 1

NOTICE: Check the front differential oil at the Initial Service and then at regular intervals indicated. See SCHEDULED MAINTENANCE CHART on page 174.

Clean the areas around the fill and drain plugs with a clean rag.

Remove the fill plug and inspect the oil for water or any other contamination. If the oil is contaminated, it must be replaced.

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

Front Differential Oil Replacement

Tool List **Qty.**

Rag ..... AR
Drain Pan 1
Ratchet 1
Ratchet Extension 1
Hex Bit, 8mm 1

1. Clean the areas around the fill and drain plugs with a clean rag.
2. Place a drain pan under the front differential.
3. Remove the drain plug from the bottom of the front differential and allow the oil to drain completely (Ref. Fig. 19).
4. Install the drain plug.
5. Remove the fill plug.
6. Add oil to full capacity. See *RECOMMENDED LUBRICANTS AND FLUIDS* on page 176.
7. Install the fill plug. Check for leaks.

Front Differential Replacement

Tool List **Qty.**

Wheel Chocks 4
Floor Jack 1
Jack Stands 4
Ratchet 1
Socket, 13mm 1
Socket, 14mm 1
Wrench, 13mm 1
Wrench, 14mm 1
Pliers 1
Screwdriver, Flat Tip, Large 1
Torque Wrench, ft. lbs. 1

⚠WARNING ***To prevent injury caused by inadvertent movement of the differential, a second person is required to support and assist in removing the differential.***

1. Lift and support the vehicle. See *LIFTING THE VEHICLE* on page 19.
2. Remove the front wheel. See *Wheel Removal* on page 60.
3. Remove the CV shaft. Refer to *CV Shaft Replacement*.
4. Remove the vent line (Ref. Fig. 20). Disconnect the differential power connection.
5. Remove the bolt (1) and nut (2) that secure the prop shaft to the differential.
6. Remove four bolts (3) that secure the front differential to the frame. Carefully slide the differential off of the prop-shaft splines and remove from the vehicle.
7. Installation of the differential is in the reverse order of removal.
8. Tighten the hardware to the torque values specified below:

Item	Torque Specification
1, 2	16 - 22 ft. lbs. (12 - 16 Nm)
3	27 - 31 ft. lbs. (37 - 42 Nm)

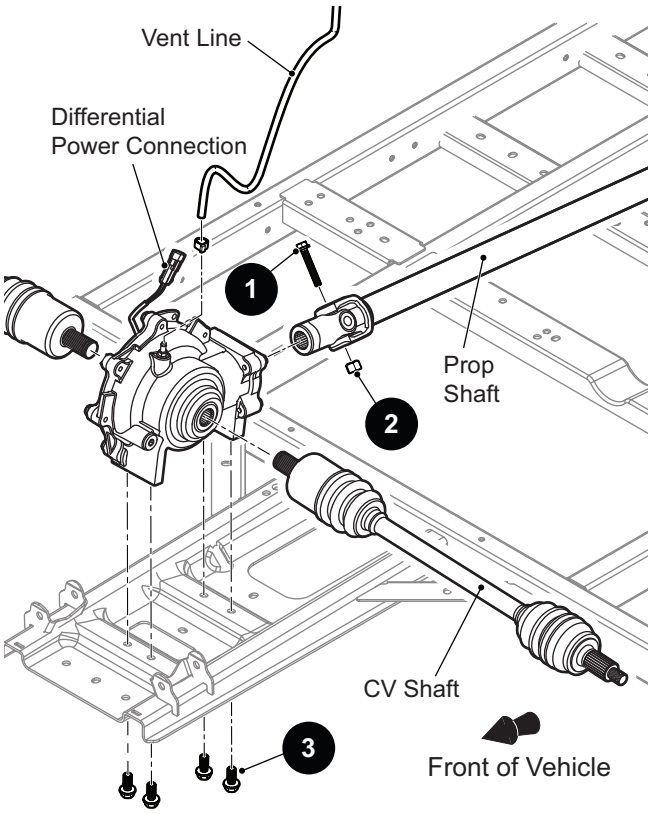


Fig. 19 Front Differential Replacement

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

STEERING

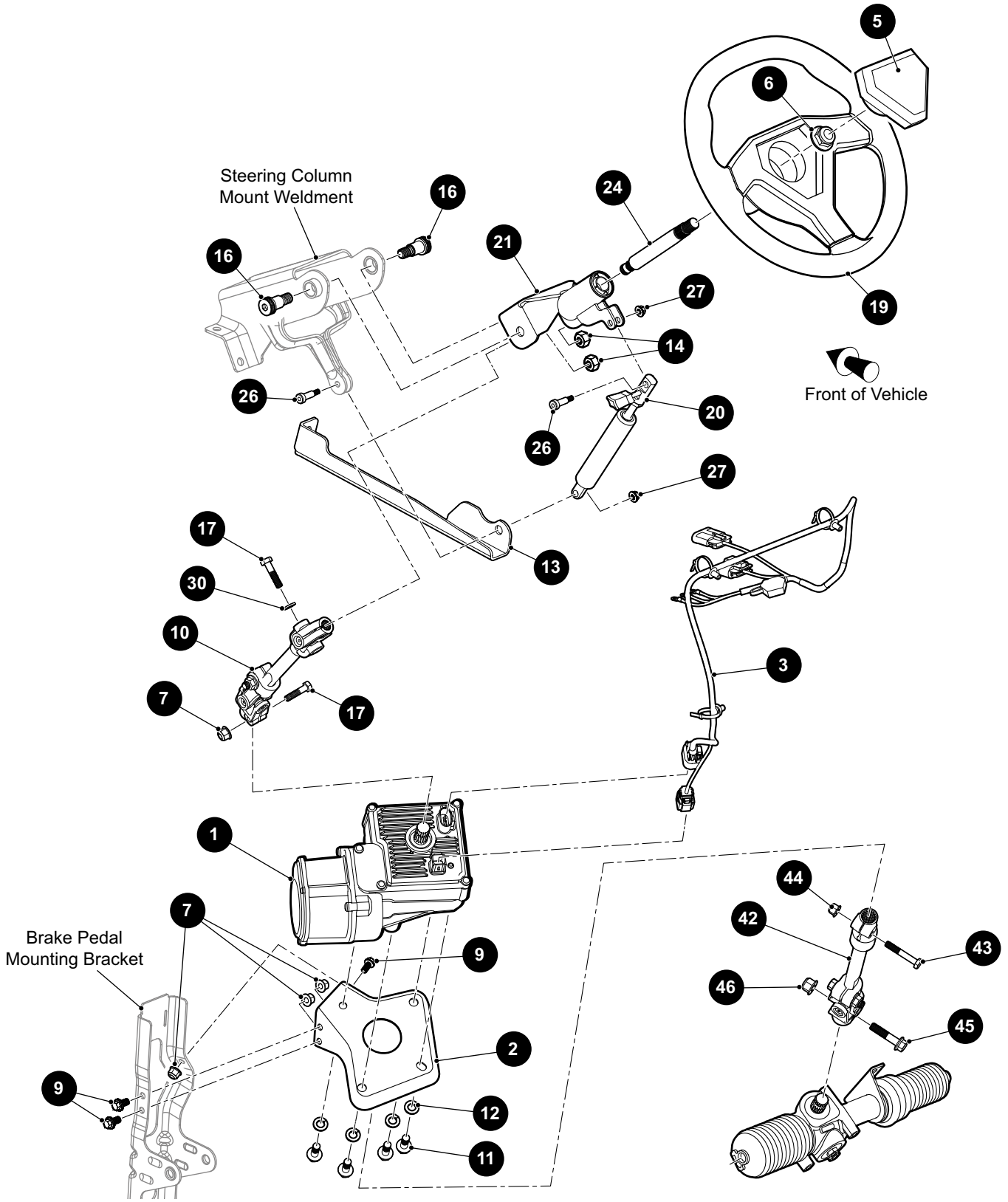


Fig. 20 Steering Components

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

Steering Wheel Replacement

Tool List	Qty.
Paint Marker	1
Socket, 24mm	1
Ratchet	1
Hammer	1
Ball Peen Hammer	1
Torque Wrench, ft. lbs.	1
Anti-Seize Compound	AR

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

Mark the orientation of the steering wheel to the steering shaft for proper alignment during assembly.

To prevent damage to the steering wheel cover, perform the following removal procedure. Do not use a screwdriver to pry the cover off.

1. Remove the steering wheel cover (5) by pulling it straight up (See Fig. 20) (See Fig. 21).

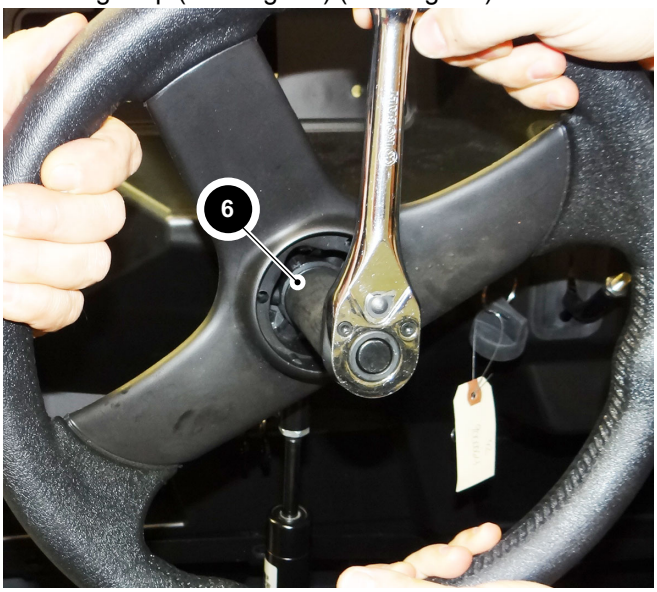


Fig. 21 Steering Wheel Nut Removal

2. Remove the lock nut (6) securing the steering wheel to the steering shaft (Ref. Fig. 23).

NOTICE: To prevent damage to the steering shaft, do not use excessive force to strike the steering shaft with the ball peen hammer.

3. With the aid of an assistant, place a ball peen hammer against the steering shaft end (24) and strike the hammer with another hammer while applying upward pressure to the steering wheel (Ref. Fig. 24) (See Fig. 23).
4. Remove the steering wheel (Ref. Fig. 25).

Fig. 22 Steering Wheel Separation

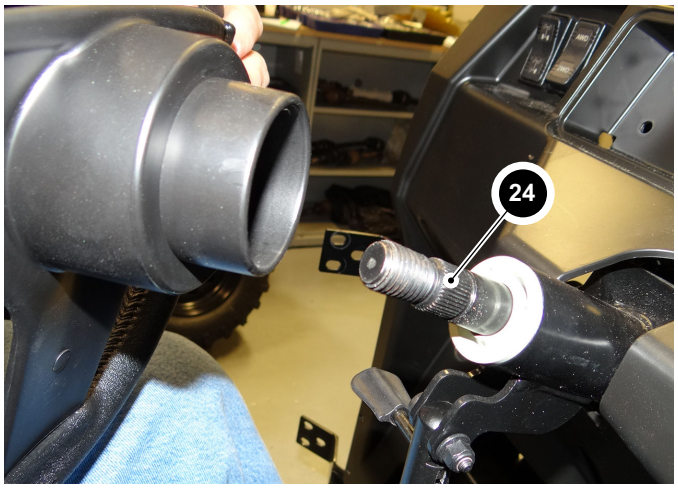


Fig. 23 Steering Wheel Removal

5. Before installing the steering wheel, lightly coat the splines of the steering shaft with (24) anti-seize compound (See Fig. 23).
6. With the wheels in the straight ahead position, align the steering wheel on the steering shaft (24) and slide the steering wheel onto the shaft.
7. Tighten the lock nut to the torque value specified below:

Item	Torque Specification
6	20 - 22 ft. lbs. (27 - 30 Nm)

8. Install the steering wheel cover.

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

Steering Column Removal

Tool List	Qty.
Paint Pen	1
Ratchet	1
Hex Bit Socket, 5/16”	1
Wrench, 10mm	1
Socket, 14mm	1
Socket, 17mm	1
Wrench, 14mm	1
Wrench, 17mm	1
Torque Wrench, ft. lbs	1

NOTICE: Mark the orientation of the steering components for proper alignment during assembly.

1. Remove the steering wheel.
2. Remove the bolt (17) and washer (30) that secure the steering shaft (10) to the steering wheel shaft (24) (Ref. Fig. 21)(Ref. Fig. 26).

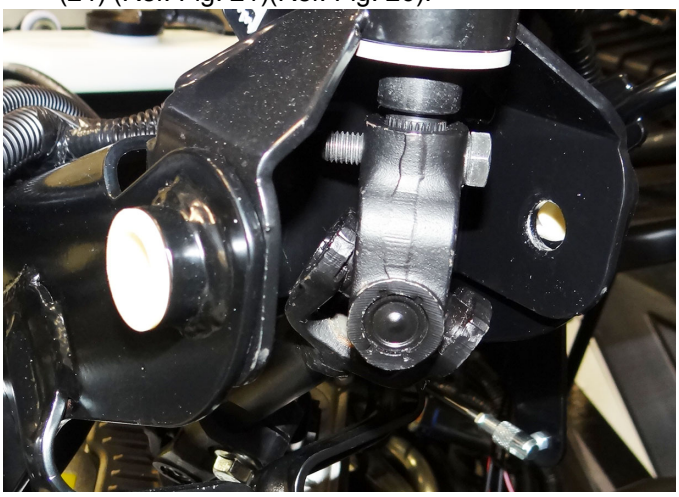


Fig. 24 Steering Column

3. Remove the bolts (26) and nuts (27) that secure the tilt adjuster (20) to the vehicle. Remove the tilt adjuster.
4. Remove the bolts (16) and nuts (14) that secure the steering column assembly to the vehicle. Remove steering column (Ref. Fig. 27).

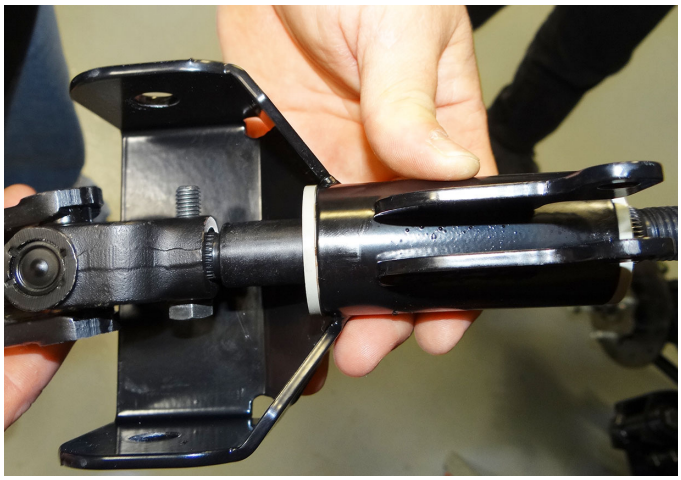


Fig. 25 Steering Column Assembly

5. The steering wheel shaft (24), and bushings may be removed for inspection or replacement at this point.
6. Installation is the reverse order of removal.

NOTICE: To prevent binding, make sure that the bolt (16) passes through the groove on the steering column shaft.

7. Tighten the hardware to the torque values specified below:

Item	Torque Specification
17	22 - 26 ft. lbs. (30 - 35 Nm)
26, 27	4 - 5 ft. lbs. (5 - 7 Nm)
16, 14	18 - 22 ft. lbs. (25 - 30 Nm)

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

Electric Power Assist System (EPAS)

Tool List	Qty.
Paint Pen	1
Socket, 13mm	1
Socket, 17mm	1
Ratchet	1
Ratchet Extension	1
Wrench, 13mm	1
Wrench, 17mm	1
Torque Wrench, ft. lbs.	1

NOTICE: Mark the orientation of the steering components for proper alignment during assembly.

1. Disconnect the two wire harness connections on the EPAS unit (Ref. Fig. 29).

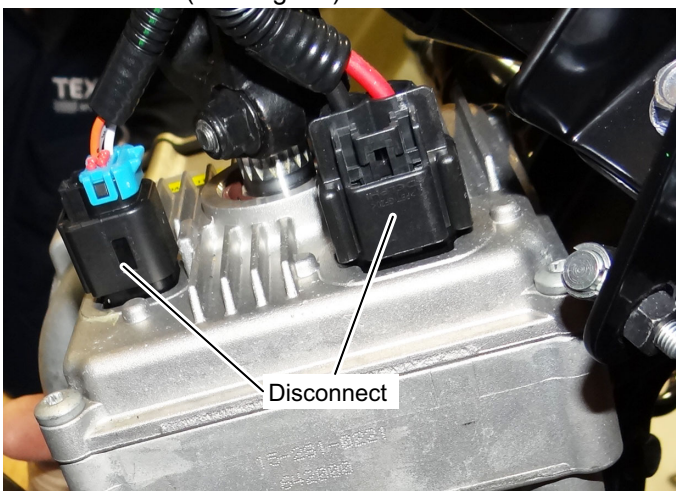


Fig. 26 EPAS Harness Connectors

2. Remove the bolt (17) and nut (7) that secure the upper steering shaft (10) to the EPAS unit (1) (Ref. Fig. 30) (Ref. Fig. 22).
3. Remove the bolt (43) and nut (44) that secure the lower steering shaft (42) to the EPAS unit (1) (Ref. Fig. 31).
4. Remove the bolts (9) and nuts (7) that secure the EPAS unit and mounting plate (2) to the vehicle frame (Ref. Fig. 22).

NOTICE: To prevent binding, make sure that the bolt (16) passes through the groove on the steering column shaft.

5. Remove the EPAS unit from the vehicle.

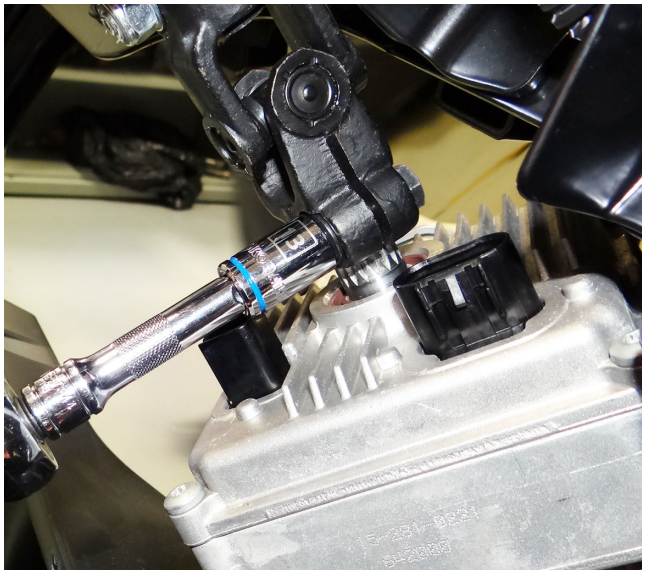


Fig. 27 EPAS Steering Shaft

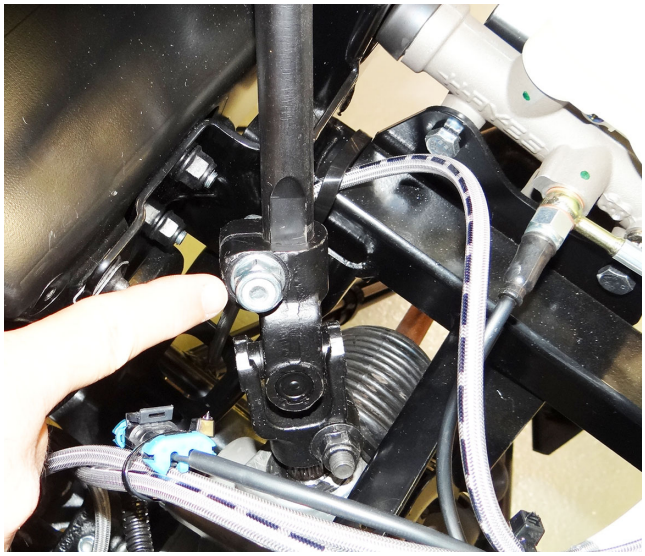


Fig. 28 Lower Steering Shaft

6. Installation of the EPAS unit is the reverse order of removal.
7. Tighten the hardware to the torque values specified below:

Item	Torque Specification
17, 7	22 - 26 ft. lbs. (30 - 35 Nm)
46, 45	22 - 26 ft. lbs. (30 - 35 Nm)
9, 7	22 - 26 ft. lbs. (30 - 35 Nm)

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

Steering Rack Replacement

Tool List	Qty.
Paint Pen	1
Allen Wrench, 6mm	1
Wrench, 13mm	1
Straight Blade Screwdriver	1
Socket, 13mm	1
Ratchet	1
Torque Wrench, ft. lbs.	1

NOTICE: Mark the orientation of the steering components for proper alignment during assembly.

1. Remove the nuts (2) that secure the steering rack ball joints (3) to the spindles. Refer to *Front Spindle Removal*.
2. Remove the nut (28) and bolt (29) securing the steering shaft yoke to the steering rack (Ref. Fig. 32).

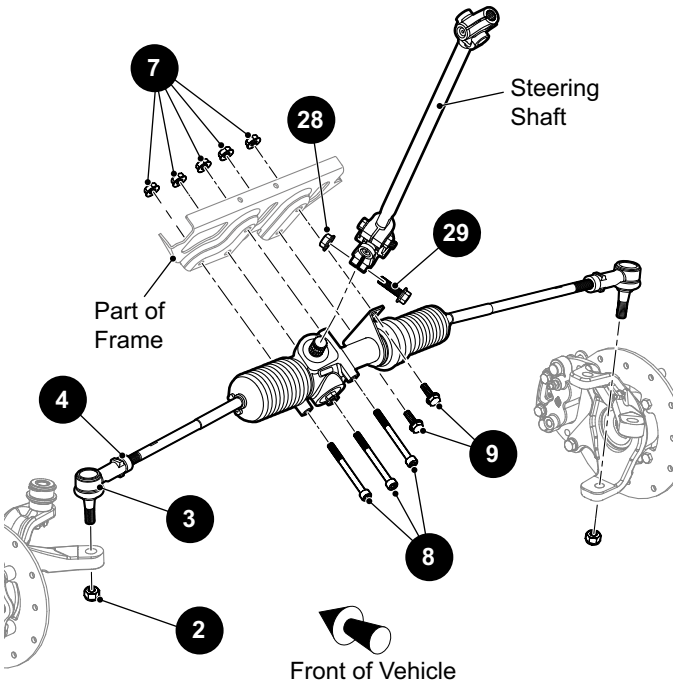


Fig. 29 Steering Rack

3. Remove the three socket head bolts (8) and two hex bolts (9) and nuts (7) attaching the steering rack assembly to the frame.
4. Steering rack replacement is the reverse order of removal.
5. Tighten nuts to the torque values specified below:

Item	Torque Specification
7, 8, 9	17 - 20 ft. lbs. (23 - 27 Nm)

Rack Ball Joint Replacement

Tool List	Qty.
Wrench, 17mm	2

1. Remove the nut (2) that secures the rack ball joint (3) to the spindle. See *Spindle Removal*.
2. Remove the rack end ball joint (3) from the steering rack by loosening the jam nut (4) and un-threading the ball joint off the rack (Ref. Fig. 32).

NOTICE: Count the number of turns required to remove each ball joint. This will allow the ball joints to be replaced near their original position to aid in wheel alignment.

3. Installation is the reverse order of removal.

NOTICE: Wheel alignment is required after installation. See Wheel Alignment.

4. Tighten the hardware to the torque values specified below:

Item	Torque Specification
2	17 - 20 ft. lbs. (23 - 27 Nm)

MAINTENANCE

Consistent routine maintenance of the front suspension and steering consists of routine lubrication. See *SCHEDULED MAINTENANCE CHART* on page 174. Use only recommended lubricants.

Examination of the tires will provide indications that an alignment is required.

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
Measuring Tape	1
Wrench, 17mm	2

1. To center the steering unit in the middle of its travel, turn the steering wheel to the left until the steering stop is reached.
2. Rotate the wheel to the right while counting the number of turns required to contact the right steering stop. Divide the number of turns by two. This indicates the number of steering wheel turns required to achieve center.

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

3. Roll the vehicle forward 10 feet (3 meters). Measure the center tread distance at the front of the tires (Ref. Fig. 33). Measure as close to parallel with the front lower frame of the vehicle as possible.

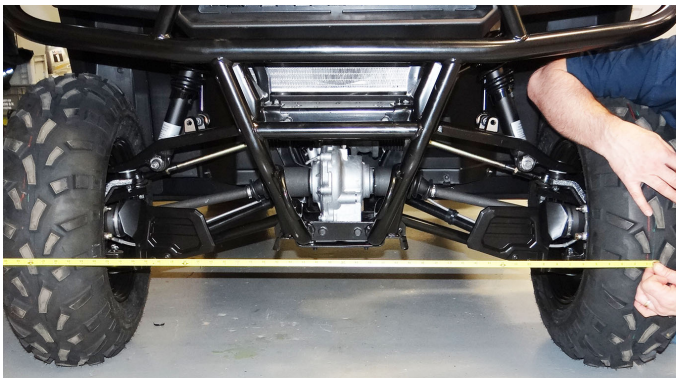


Fig. 30 Wheel Alignment Front of Front Tires

4. Similarly, measure the center tread distance on the rear of the front tires. The correct measurement is 0 to 1/8 inch (0 - 3.2mm) toe in.

NOTICE: Counting threads or measuring thread distance are both acceptable methods to equalize tie rod length.

5. To adjust the wheel alignment, loosen the tie rod jam nut (42), holding the hex form on the tie rod (44) (Ref. Fig. 34).

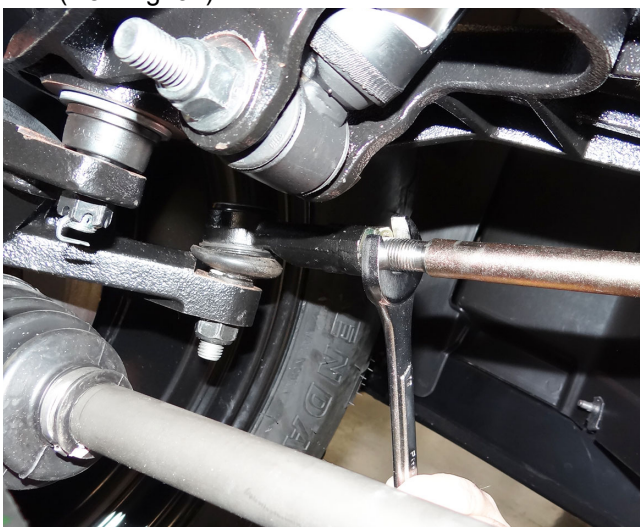


Fig. 31 Wheel Alignment

6. If the tie rods or ends have been replaced, adjust both rods the same distance prior to reinstalling them on the vehicle. After adjustment, tighten the jam nut (42) to the torque value specified below:

Item	Torque Specification
42	20 - 25 ft. lbs. (27 - 34 Nm)

7. Test drive the vehicle and confirm that the steering wheel is correctly centered. If not, remove the steering wheel and rotate it to the correct position.

STEERING WHEEL

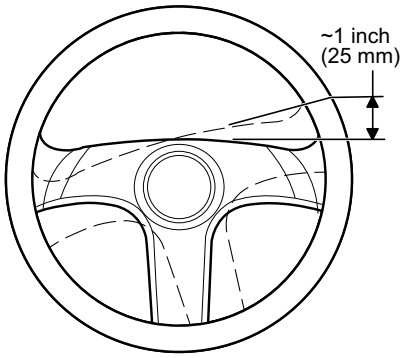


Fig. 32 Steering Wheel Play

Perform scheduled maintenance on the steering system. See *SCHEDULED MAINTENANCE CHART* on page 174.

Inspect the steering operation before each use using the following procedure:

1. Park the vehicle on a level surface.
2. Lightly turn the steering wheel to the left and then to the right.
3. There should be ~1 inch (25 mm) of free play (Ref. Fig. 35).
4. If there is excessive play, unusual noises, or the steering feels rough, have the steering system inspected by your dealer.

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

SHOCK ADJUSTMENT

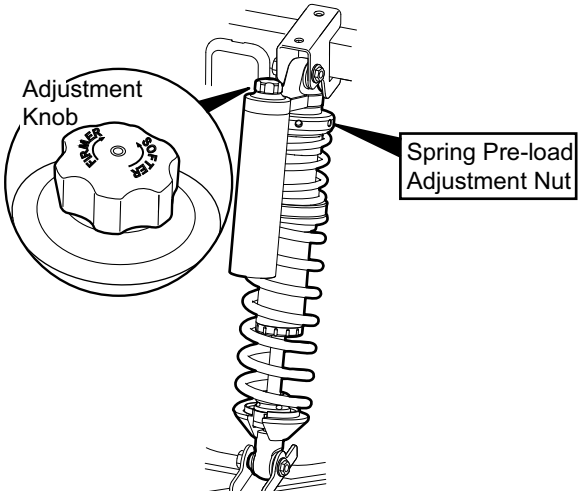


Fig. 33 Compression Adjustment

The shock absorbers can be adjusted to suit specific needs and preferences.

To adjust compression, rotate the adjustment knob:

- to the right for a firmer ride
- to the left for a softer ride

The spring pre-load nut can be adjusted on the shock absorber springs to suit your needs. A shock adjustment tool is recommended.

To adjust, rotate the adjustment nut (Ref. Fig. 33):

- to the right to increase spring pre-load (ride height)
- to the left to decrease spring pre-load (ride height)

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

Notes:

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

Notes:

REAR AXLE AND SUSPENSION

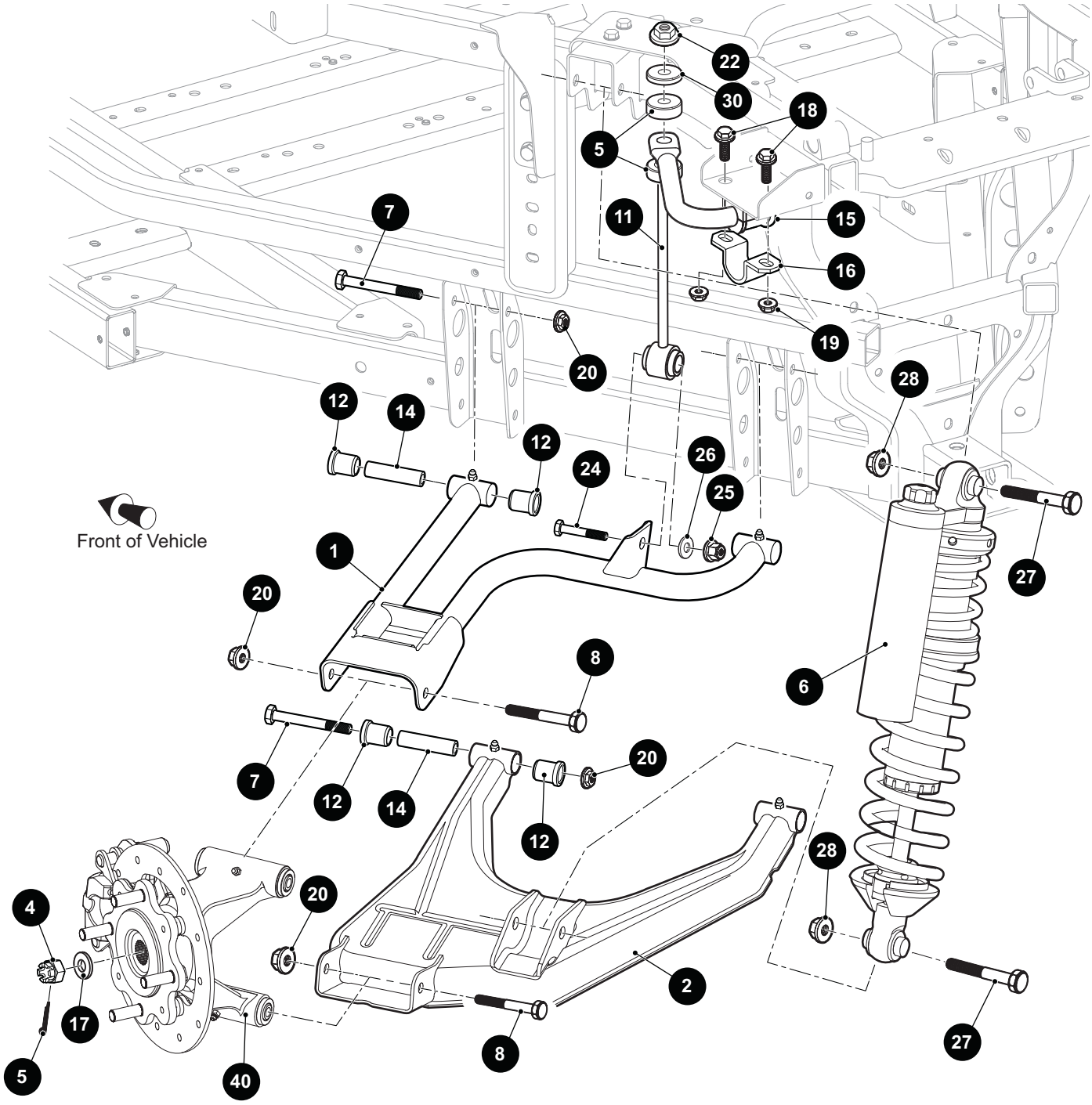


Fig. 1 Rear Suspension Components

REAR SUSPENSION

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

Maintenance

See *SCHEDULED MAINTENANCE CHART* on page 174. Use only the recommended lubricants. See *RECOMMENDED LUBRICANTS AND FLUIDS* on page 176.

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

Lubrication points are located on the upper and lower control arms and the spindle. Use a maximum of three pumps of grease per fitting.

Wheel Bearing Test

To check for worn wheel bearings, perform the following procedure:

NOTICE: The axle nut must be installed at the proper torque for the wheel bearing test to be accurate.

⚠WARNING ***To reduce the possibility of personal injury, follow the lifting procedure in SAFETY section of this manual.***

1. Lift and support the vehicle. See *LIFTING THE VEHICLE* on page 19.
2. Grasp the wheel at the top and bottom of the tire.
3. Apply firm back and forth pressure on the wheel. If any movement is noted, the wheel bearing must be pressed out of the spindle and replaced.

Hub Removal

Tool List	Qty.
Wheel Chocks	4
Floor Jack	1
Jack Stands	4
Hammer, Plastic	1
Needle Nose Pliers	1
Impact Wrench	1
Impact Socket, 27mm	1
Torque Wrench, ft. lbs	1
Anti-seize Compound	AR

1. Lift and support the vehicle. See *LIFTING THE VEHICLE* on page 19.
2. Remove the rear wheel. See *Wheel Removal* on page 60.
3. Remove the brake calipers from the rotor. See *Brake Pad Replacement* on page 66.
4. At the center of the hub, remove the cotter pin (5), axle nut (4) and washer (17) from the axle. (Ref. Fig. 2)(Ref. Fig. 3)

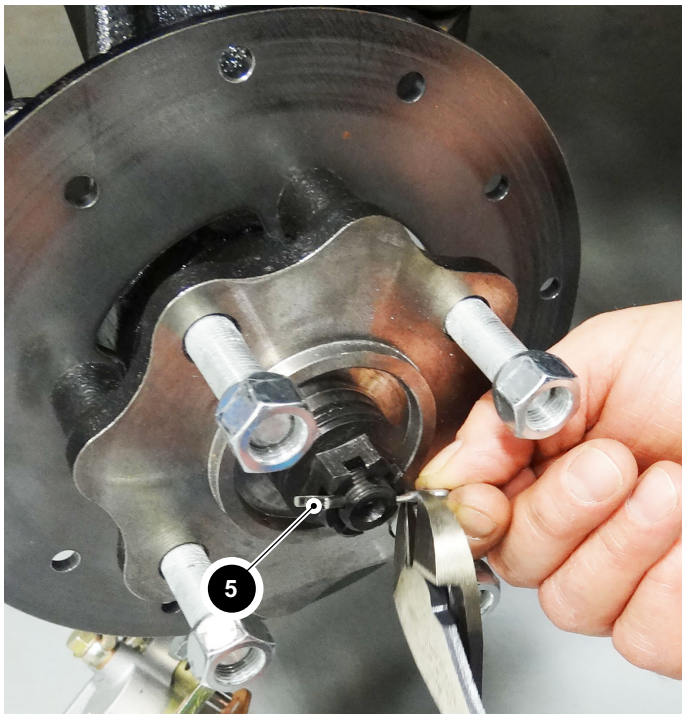


Fig. 2 Cotter Pin

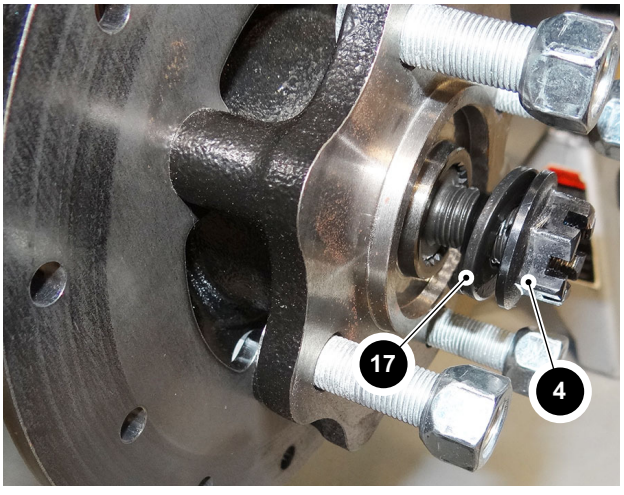


Fig. 3 Axle Nut and Washer

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

5. Tap the hub with a plastic hammer while applying outward pressure until the hub slides off the splines of the axle (Ref. Fig. 4).

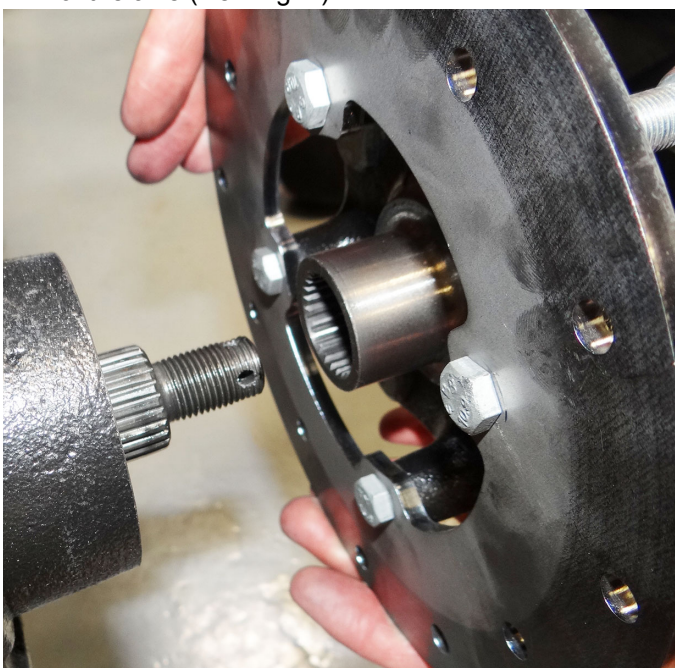


Fig. 4 Remove Hub

6. Clean the splines of the hub and axle and apply anti-seize compound before installation.
7. The installation of the hub is the reverse of disassembly.
8. Tighten the hardware to the torque values specified below:

Item	Torque Specification
4	180 - 199 ft. lbs. (245 - 270 Nm)

9. Install a new cotter pin through the axle nut and axle. Bend the cotter pin (5) around the axle to secure (See Fig. 2).

Rear Spindle Removal

Tool List **Qty.**

Wheel Chocks 4
Floor Jack 1
Jack Stands 4
Hammer 1
Needle Nose Pliers 1
Ratchet 1
Socket,17mm 1
Socket, 19mm 1
Wrench, 17mm 1
Wrench, 19mm 1
Torque Wrench, ft. lbs. 1

1. Lift and support vehicle. See *LIFTING THE VEHICLE* on page 19.
2. Remove the rear wheel. See *Wheel Removal* on page 60.
3. Remove the brake caliper from the rotor. See *Brake Pad Replacement* on page 66.
4. Remove the hub. See *Hub Removal* on page 92.

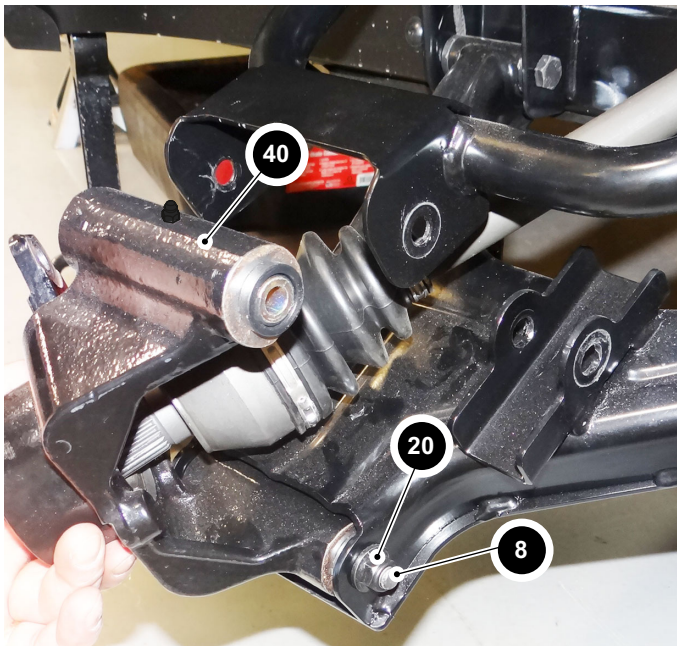


Fig. 5 Spindle

5. Remove the bolt (8) and nut (20) that secure the spindle (40) to the upper control arm (1) (Ref. Fig. 1) (Ref. Fig. 5).
6. Remove the bolt (8) and nut (20) that secure the spindle (40) to the lower control arm (2) (See Fig. 1) (Ref. Fig. 6). Slide the spindle assembly off the CV axle splines.

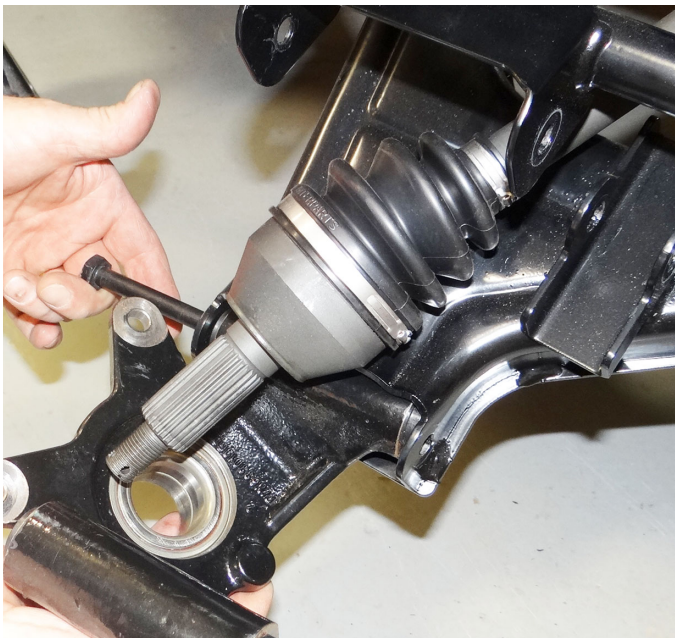


Fig. 6 Remove Spindle

7. Remove the spindle assembly from the vehicle.
8. The installation of the spindle assembly is the reverse of disassembly.
9. Tighten the hardware to the torque values specified below:

Item	Torque Specification
8, 20	40 - 44 ft. lbs. (54 - 60 Nm)

CV Shaft Replacement

Tool List **Qty.**

Pry Bar.....1
Drain Pan.....1
Anti-seize Compound .....AR

NOTICE: Inspect the axle (shaft) for contamination, especially if the CV boots are torn. Replace the rear axle if any contamination is found.

1. Lift and support vehicle. See *LIFTING THE VEHICLE* on page 21.
2. Remove the rear wheel. See *Wheel Removal* on page 62.
3. Remove the brake calipers from the rotor. See *Brake Pad Replacement* on page 68.
4. Remove the hub. See *Hub Removal* on page 92.
5. Remove the spindle assembly. See *Rear Spindle Removal* on page 93.
6. Hold the axle in a straight line while pushing inwards while holding the center shaft.
7. In one quick jerking motion, pull outwards on the CV.
8. If the CV is difficult to remove or stuck, use two pry bars on opposite sides of the CV while maintaining even pressure on the each side. Pay close attention to not damage any components while prying.
9. Make sure that the hog ring is in place on the CV shaft splines (Ref. Fig. 7).

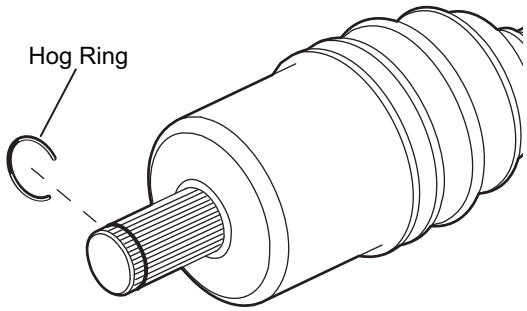


Fig. 7 Hog Ring

10. Apply anti-seize compound to the splines of the replacement CV shaft prior to installation.

CV Joint Boot Replacement

Tool List **Qty.**

Needle Nose Pliers 1
Wire Cutters.....1

1. Remove the rear axle assembly. See *CV Shaft Replacement* on page 94.
2. Inspect the inner and outer CV joint boots (28) for damage.
3. Cut the CV joint boot clamps (29) and (30).
4. Remove the CV joint boot (28).
5. Replace the new boot and clamps in the reverse order of removal (Ref. Fig. 8).

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

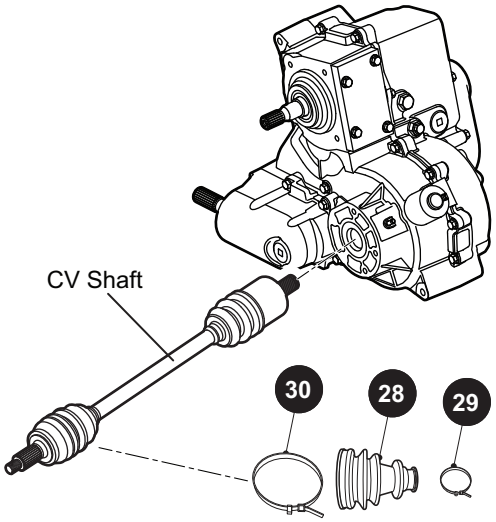


Fig. 8 CV Boot Replacement

Rear Strut Assembly Replacement

Tool List	Qty.
Wheel Chocks	4
Floor Jack	1
Jack Stands	4
Wrench, 18mm	1
Wrench, 19mm	1
Torque Wrench, ft. lbs.	1
Socket, 18mm	1
Socket, 19mm	1
Ratchet	1

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

1. Lift and support vehicle. See *LIFTING THE VEHICLE* on page 19.
2. Remove the rear wheel. See *Wheel Removal* on page 60.
3. Remove the nut (28) and bolt (27) that secure the top of the strut assembly (6) to the vehicle frame (Ref. Fig. 1)(Ref. Fig. 10).

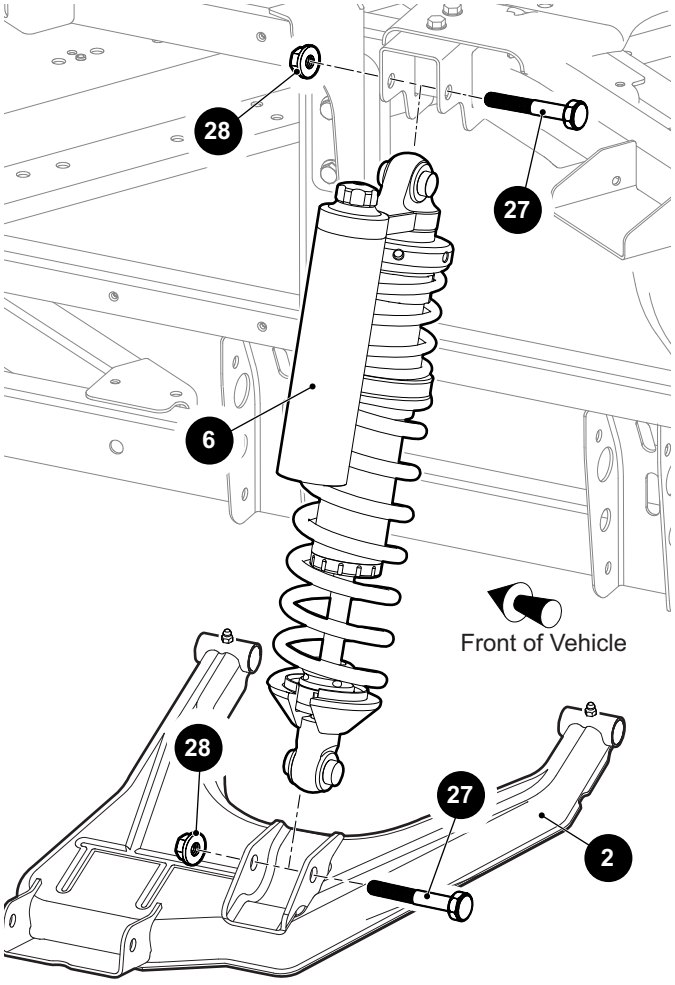


Fig. 9 Remove Strut

4. Remove the nut (28) and bolt (27) that secure the bottom of the strut assembly to the lower control arm (2)(Ref. Fig. 9).
5. Remove the strut assembly from the vehicle.
6. The installation of the strut assembly is the reverse of disassembly.
7. Tighten the hardware to the torque values specified:

Item	Torque Specification
27, 28	70 - 77 ft. lbs. (95 - 105 Nm)

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

Lower Control Arm Assembly Replacement

Tool List	Qty.
Wheel Chocks	4
Floor Jack	1
Jack Stands	4
Plastic Faced Hammer	1
Wrench, 15mm	1
Wrench, 17mm	1
Socket, 15mm	1
Socket, 17mm	1
Ratchet	1
Torque Wrench, ft. lbs.	1

1. Lift and support vehicle. See *LIFTING THE VEHICLE* on page 19.
2. Remove the rear wheel. See *Wheel Removal* on page 60.
3. Remove the brake calipers from the rotor. See *Brake Pad Replacement* on page 66.
4. Remove the hub. See *Hub Removal* on page 92.
5. Remove the rear spindle. See *Rear Spindle Removal* on page 93.
6. Remove the rear strut assembly. See *Rear Strut Assembly Replacement* on page 95.
7. Remove the nuts (20) and bolts (7) that secure each side of the lower control arm (2) to the vehicle frame (Ref. Fig. 1)(Ref. Fig. 11).

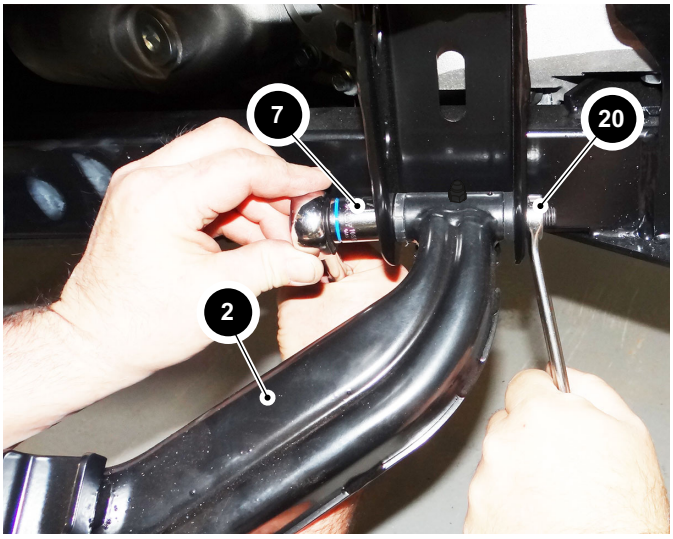


Fig. 10 Lower Control Arm

8. Remove the lower control arm from the vehicle.
9. Installation of lower control arm assembly is the reverse of removal.
10. Tighten the hardware to the torque values specified below:

Item	Torque Specification
7, 20	40 - 44 ft. lbs. (54 - 60 Nm)

Upper Control Arm Assembly Replacement

Tool List	Qty.
Wheel Chocks	4
Floor Jack	1
Jack Stands	4
Plastic Faced Hammer	1
Wrench, 15mm	1
Wrench, 17mm	1
Wrench 18mm	1
Wrench 19mm	1
Socket, 15mm	1
Socket, 17mm	1
Socket,18mm	1
Socket, 19mm	1
Ratchet	1
Torque Wrench, ft. lbs.	1

1. Lift and support vehicle. See *LIFTING THE VEHICLE* on page 19.
2. Remove the wheel. See *Wheel Removal* on page 60.
3. Remove the brake calipers from the rotor. See *Brake Pad Replacement* on page 66.
4. Remove the hub. See *Hub Removal* on page 92.
5. Remove the rear spindle. See *Rear Spindle Removal* on page 93.
6. Remove the rear strut assembly. See *Rear Strut Assembly Replacement* on page 95.
7. Remove the nut (25), washer (26) and bolt (24) that secure the stabilizer link (11) to the upper control arm (1) (Ref. Fig. 1). Check the rubber bushings for deterioration.

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

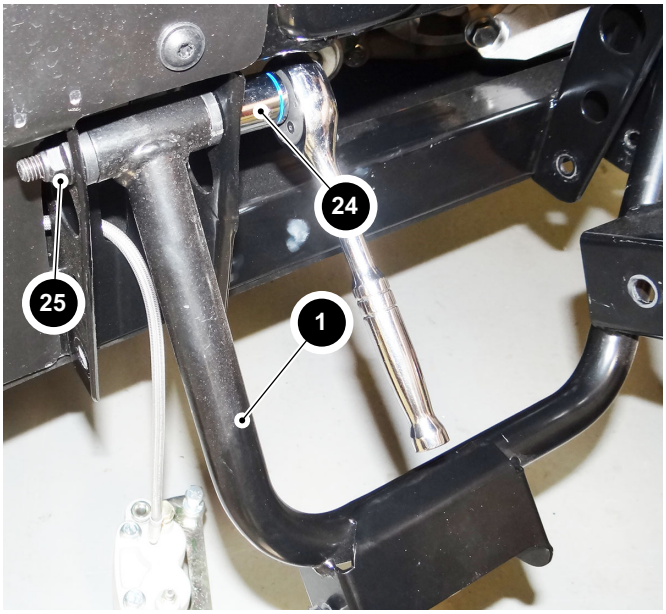


Fig. 11 Upper Control Arm

8. Remove the nuts (20) and bolts (7) that secure each side of the upper control arm (1) to the vehicle frame (Ref. Fig. 12).
9. Remove the upper control arm from the vehicle.
10. Installation of upper control arm assembly is the reverse of removal.
11. Tighten the hardware to the torque values specified:

Item	Torque Specification
24, 25	70 - 77 ft. lbs. (95 - 105 Nm)
7, 20	40 - 44 ft. lbs. (54 - 60 Nm)

Stabilizer Bar Removal

Tool List **Qty.**

Ratchet 1
Socket, 19mm 1
Socket, 15mm 1
Wrench, 19mm 1
Wrench, 15mm 1
Torque Wrench, ft. lbs. 1

1. Lift and support vehicle. See *LIFTING THE VEHICLE* on page 19.
2. Remove the rear wheels. See *Wheel Removal* on page 60.
3. Remove nuts (22), washers (30) and bushings (35) that secure each side of the stabilizer bar (31) to the stabilizer links (11).
4. Remove bolts (18) and nuts (19) that secure the stabilizer bar brackets (16) to each side of the frame. Remove the stabilizer bar.
5. With the stabilizer bar removed, inspect the bushings (15) for damage or deterioration. Replace if necessary.
6. Installation of upper control arm assembly is the reverse of removal.

NOTICE: The nut (22) is to be tightened by turning it 20 complete turns.

7. Tighten the hardware to the torque values specified:

Item	Torque Specification
22	20 Turns
18, 19	30 - 33 ft. lbs. (40 - 45 Nm)

REAR DIFFERENTIAL

Oil Change

Tool List **Qty.**

Rag 1
Drain Pan 1
Ratchet 1
Socket, 1/2” 1
Torx Bit, T30 1
Allen Wrench, 5mm 1
Torque Wrench, ft. lbs. 1

NOTICE: The rear differential has two chambers; top and bottom.

You may choose to remove the truck bed, side panel and/or skid plate for full access to the rear differential fill and drain plugs See BODY on page 21.

1. Clean the areas around the fill and drain plugs with a clean rag.
2. Remove the oil drain plug located on the bottom of the differential and allow the oil to drain completely (Ref. Fig. 13).
3. Replace the drain plug and tighten to 10 ft. lbs. (14 Nm) torque.
4. Remove the fill plug.
5. Add 6.1 oz. (180 ml) of oil. **See *RECOMMENDED LUBRICANTS AND FLUIDS*** on page 176.
6. Replace the fill plug and tighten to 10 ft. lbs. (14 Nm) torque. Check for leaks.

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

Rear Differential Oil Check

NOTICE: Check the rear differential oil in the upper and lower chambers at the Initial Service and then at the regular intervals indicated.

1. Remove the fill plug and inspect the oil in each chamber for water or any other contamination. If the oil is contaminated, it must be replaced.

Rear Differential Oil Replacement (Upper Chamber)

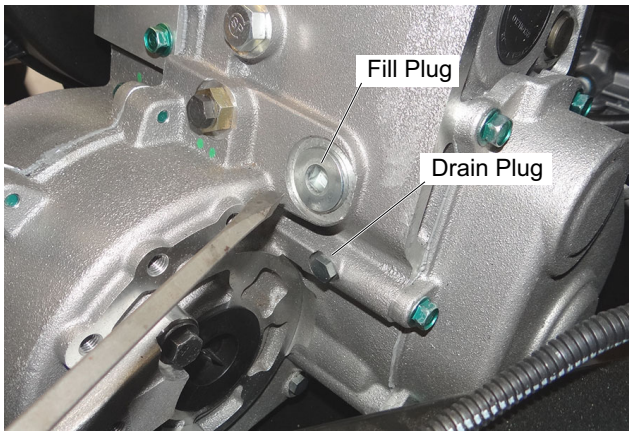


Fig. 12 Fill and Drain Plugs

2. Remove the drain plug from the upper chamber of the differential and allow the oil to drain completely.
3. Install the drain plug.
4. Remove the fill plug.
5. Add oil to full capacity or until the oil level is 3/8 - 1/2 in. (10 to 13 mm) below the bottom of the fill hole.

NOTICE: See RECOMMENDED LUBRICANTS AND FLUIDS on page 176.

6. Install the fill plug.

Rear Differential Oil Replacement (Lower Chamber)

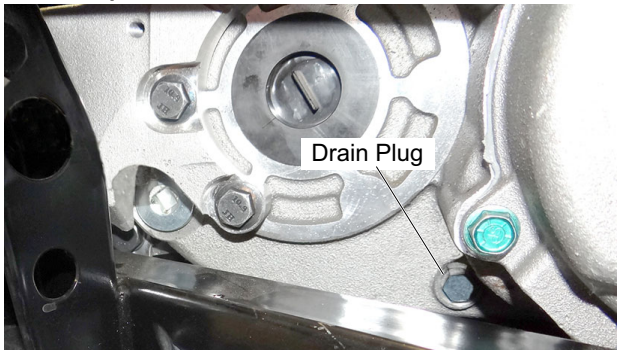


Fig. 13 Drain Plug

NOTICE: The rear differential is shown above with the axle removed and the axle hole plugged.

1. Remove the drain plug from the lower chamber of the differential and allow the oil to drain completely (Ref. Fig. 14).
2. Replace the drain plug.

NOTICE: The lower chamber will be filled by adding oil through the PTO fill plug, and then adding more oil through the vehicle speed sensor to bring the level to full capacity.

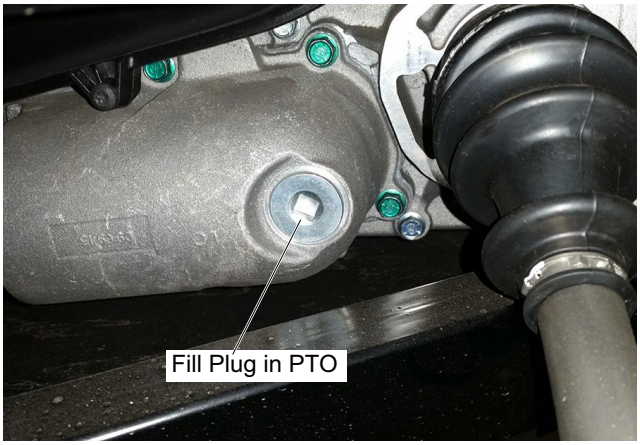


Fig. 14 Fill Plug

NOTICE: See RECOMMENDED LUBRICANTS AND FLUIDS on page 176.

1. Remove the fill plug from the PTO (driver side of vehicle) (Ref. Fig. 15).
2. Add oil until it is level with the bottom of the fill plug.
3. Install the fill plug.

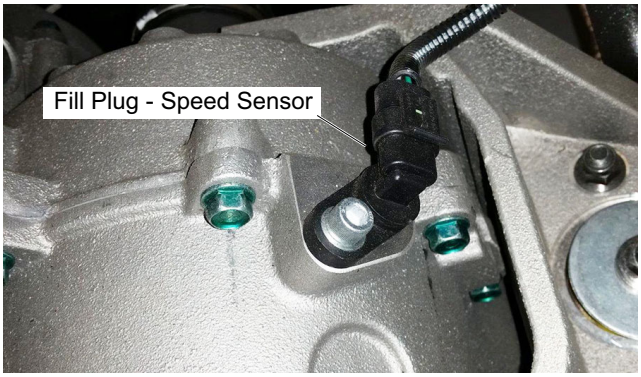


Fig. 15 Fill Plug at Speed Sensor

4. Remove the speed sensor (Ref. Fig. 16).
5. To fill the lower chamber to capacity, add an additional 22 oz. (650 ml) through the speed sensor hole.
6. Replace the speed sensor.

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

Rear Differential Replacement

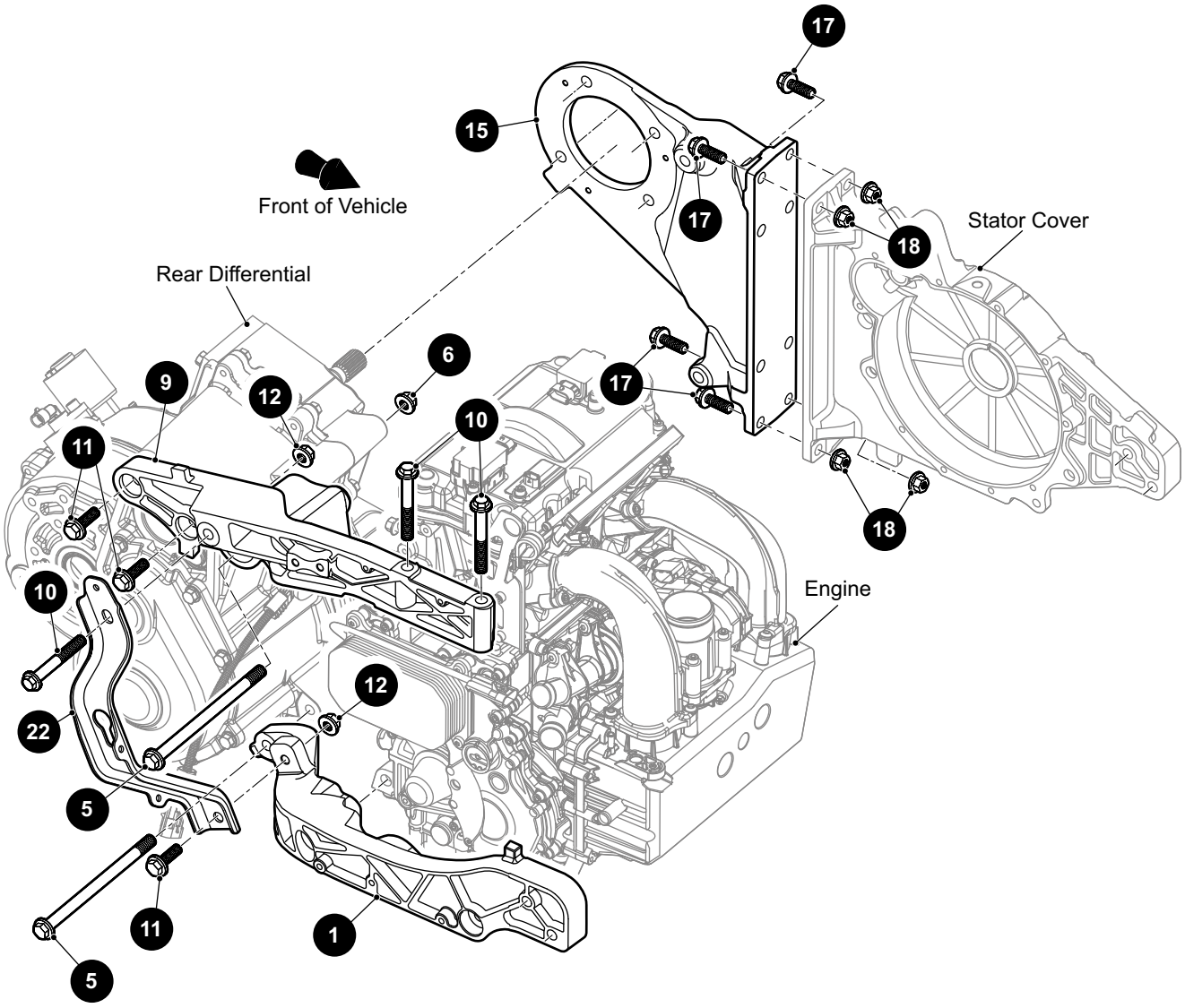


Fig. 16 Rear Differential Mounting Brackets

Tool List	Qty.
Wheel Chocks	4
Floor Jack	1
Jack Stands	4
Ratchet	1
Socket, 13mm	1
Socket, 15mm	1
Wrench, 13mm	1
Wrench, 15mm	1
Pliers	1
Screwdriver, Flat Tip, Large	1
Ratchet Strap	1
Torque Wrench, ft. lbs.	1
Hoist	1

⚠ WARNING ***To prevent injury caused by inadvertent movement of the differential, a second person is required to support and assist in the removal of the differential.***

1. Remove the rear seat, skid plate, side panels and fender liner. See *BODY* on page 21.
2. Remove the truck bed. See *TRUCK BED* on page 51.
3. Remove the muffler and heat shields. See *EXHAUST SYSTEM REMOVAL* on page 123.
4. Remove the rear frame cross-member. See *FRAME* on page 37.

5. Remove the CVT clutches, air hoses and belt. See *CONTINUOUSLY VARIABLE TRANSMISSION (CVT)* on page 105.
6. Remove the prop-shaft. See *Prop-shaft Removal* on page 112.
7. Lift and support the vehicle. See *LIFTING THE VEHICLE* on page 19.
8. Remove the rear wheels. See *Wheel Removal* on page 60.
9. Remove the CV shaft. See *CV Shaft Replacement* on page 94.
10. Disconnect the differential vent hoses (Ref. Fig. 18).

Fig. 17 Disconnect Vent Hoses

11. Remove the bolts (10 and 11) and nuts (12) that secure the shifter bracket (22) to the differential brackets (1 and 9) (Ref. Fig. 17)(Ref. Fig. 20).
12. Disconnect the shifter linkage (Ref. Fig. 19) (Ref. Fig. 20).

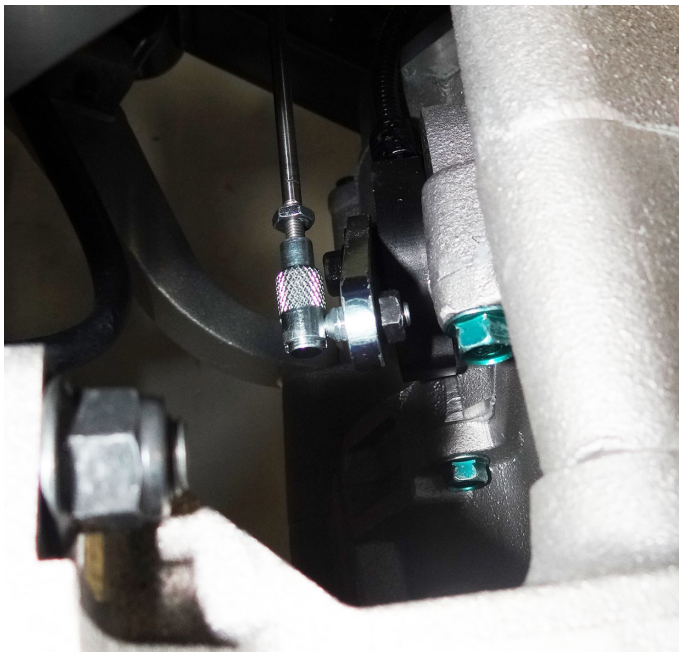


Fig. 18 Shifter Linkage

Fig. 19 Remove Shifter Bracket

13. Disconnect the speed sensor wire (Ref. Fig. 22).

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

Fig. 20 Disconnect Speed Sensor

14. Disconnect the differential lock wire (Ref. Fig. 21).

Fig. 21 Disconnect Differential Lock

15. Use a ratchet strap to secure the engine to the rear upper ROPS crossbar for support.
16. Remove the bolts (5, 10 and 11) and nuts (6) that secure the upper passenger side differential bracket to the engine and differential (Ref. Fig. 17).
17. Remove the bolt (5) and nut (6) from the lower differential mounting bracket (1).

Fig. 22 Remove Differential Bracket

18. Remove the four bolts (17) and nuts (18) that secure the driver side differential bracket (15) to the engine stator cover (See Fig. 16)(See Fig. 22)(Ref. Fig. 25).

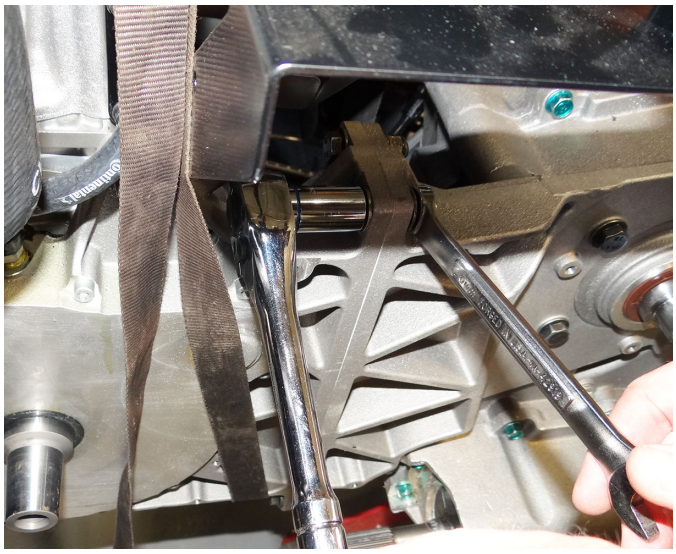


Fig. 23 Differential Mounting Bolts

19. Remove the bolt (28), washer (29), isolator assembly (23) and nut (30) that secure the differential to the rear engine mount (See Fig. 16)(Ref. Fig. 26).

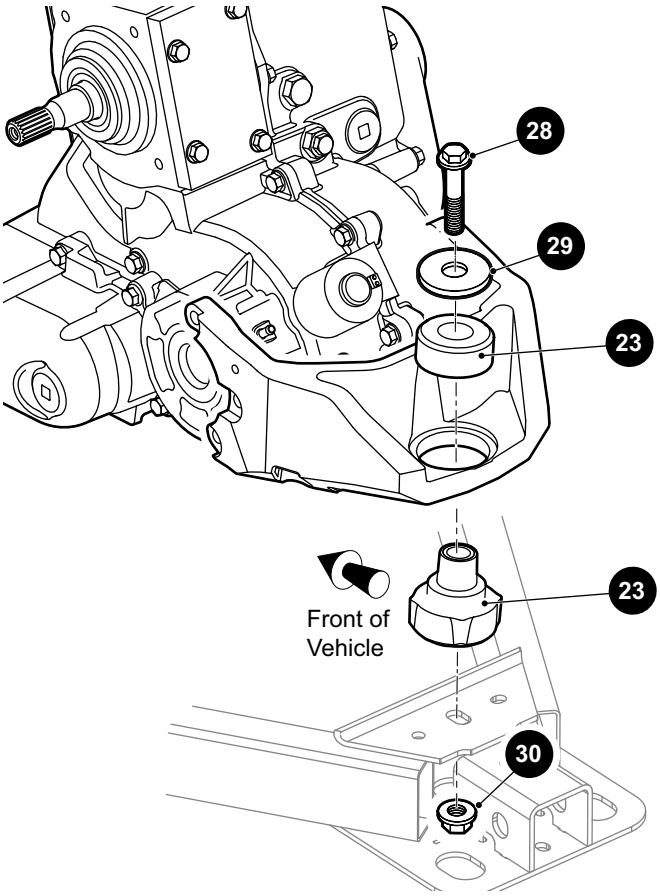


Fig. 24 Rear Engine Mount

20. With the aid of an assistant, hoist the rear differential up and out of the vehicle.
21. Installation of the differential is in the reverse order of removal.
22. Tighten the hardware to the torque values specified:

Item	Torque Specification
5	33 - 37 ft. lbs. (45 - 50 Nm)
10	33 - 37 ft. lbs. (45 - 50 Nm)
11	33 - 37 ft. lbs. (45 - 50 Nm)
17	33 - 37 ft. lbs. (45 - 50 Nm)
25	50 - 53 ft. lbs. (68 - 72 Nm)
28, 30	34 - 38 ft. lbs. (46 - 52 Nm)

Adjusting the Shift Lever Cable

Tool List **Qty.**

Wrench, 18mm 2

Move the shift lever (2) through it's entire range from the P (park) position to the H (high) position. If the shift lever contacts the instrument panel in either the P or H position, adjustment is required.

The shift lever cable (3) can be adjusted in or out at the selector bracket by turning the jam nuts (19) (Ref. Fig. 27). If further adjustment is required, the rear of the cable at the transmission can be adjusted (Ref. Fig. 28).

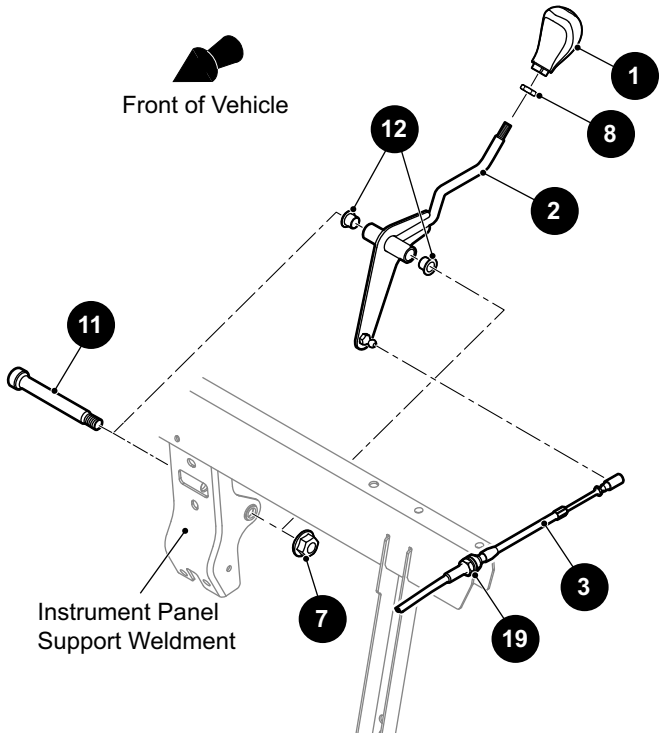


Fig. 25 Shift Lever

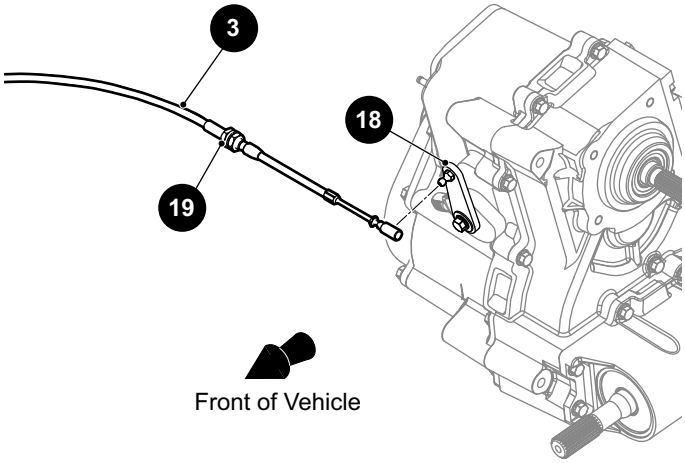


Fig. 26 Shift Cable

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

Notes:

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

Notes:

CONTINUOUSLY VARIABLE TRANSMISSION (CVT)

GENERAL

Power is transfered from the engine to the rear axle by the Continuously Variable Transmission (CVT). The CVT consists of two matched clutch units joined by a transmission belt. The engine mounted primary clutch is a centrifugal unit that responds to engine speed. The rear axle mounted secondary clutch is a load sensing unit.

CLUTCHES

Primary Clutch

When the accelerator is pressed, the engine speed increases which causes the cam weights within the centrifugal primary clutch to move outward. This forces the movable sheave inward. The transmission belt is engaged by the clutch sheaves and begins to rotate. At this point, the ratio between primary and secondary clutch is approximately 3:1.

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

When the accelerator is released, the engine speed decreases and the cams exert less pressure on the movable sheave, which is forced outward against the cams by a compression spring. The transmission belt 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 being held at the outer diameter of the secondary clutch. The secondary clutch has no weights but is held closed by a torsion spring which is joined to the movable secondary assembly.

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

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

Increased Load

When a vehicle traveling at governed speed begins to climb a grade or is subjected to other increased load conditions, a change in wheel speed is detected by the clutch system and the transmission belt seeks a position where it can achieve adequate friction to overcome the load change. The belt moves outward on the secondary clutch, which closes due to the torsion spring moving the movable 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 ‘down shifting’ applies more torque to the rear axle without a significant change to the engine 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.

CONTINUOUSLY VARIABLE TRANSMISSION (CVT)

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

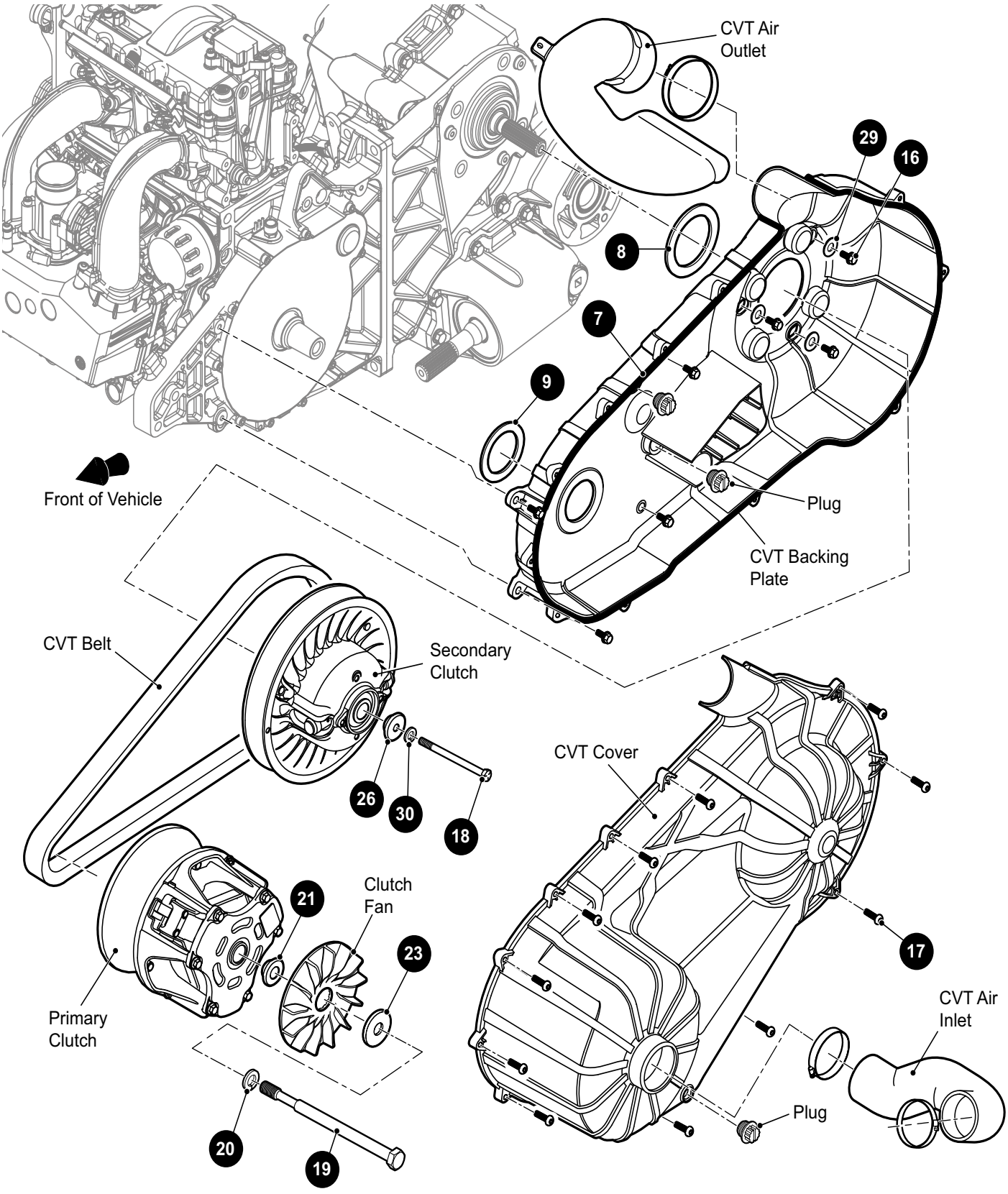


Fig. 1 CVT Components

CVT BELT

Tool List	Qty.
Torx Bit, T30	1
Strap Wrench	1
Pry-bar	1
Screwdriver, Flat Tip	1
Plastic Faced Hammer	1
Socket, 10mm	1
Ratchet	1
Strap Wrench	1
Clutch Puller	1
Impact Socket, 22mm	1
Impact Wrench	1
Thread Locking Adhesive	AR
Torque Wrench, ft. lbs.	1

⚠WARNING ***To prevent the engine from inadvertently starting, disable the electrical system before attempting to remove the CVT belt.***

Be sure that the engine and exhaust components are cool 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.

NOTICE: Do not use the brake and throttle at the same time. Doing so may damage the CVT system and impair functioning of the vehicle.

CVT Belt Break-in

The CVT belt break-in period is the first hour of operation on each new belt.

During the CVT belt break-in period, follow the same guidelines as described for engine break-in operation. See *Engine Break-In* on page 116.

CVT Belt Inspection

The CVT is located under the driver side of the truck bed (Ref. Fig. 2). Remove the bed, rear fender liner, side panel and skid plate to access the clutch cover.

1. Remove the air outlet and inlet hoses from the CVT cover.
2. Remove the CVT cover screws (17) and the CVT cover to access the CVT belt.
3. Inspect the belt. The CVT belt will require service if 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.

Check and replace the CVT belt at the intervals indicated. See *SCHEDULED MAINTENANCE CHART* on page 174. See *REPLACEMENT OF MAINTENANCE ITEMS* on page 176.

CVT Belt Replacement

To replace the CVT belt:

1. Use a 5/16” - 24 bolt as a clutch removal tool. Insert the 5/16” - 24 bolt into one of the four threaded holes in the side of the secondary clutch.
2. Thread the bolt inward to spread the clutch sheaves apart. At this point the belt will become loose enough to be rolled off the edge of the clutch (Ref. Fig. 3).
3. A new belt can be rolled on with the same method.

Remove the 5/16” - 24 bolt.

NOTICE: To increase the life of a CVT drive belt that is to be reused, make sure to install it in the same orientation that it was in before it was removed.

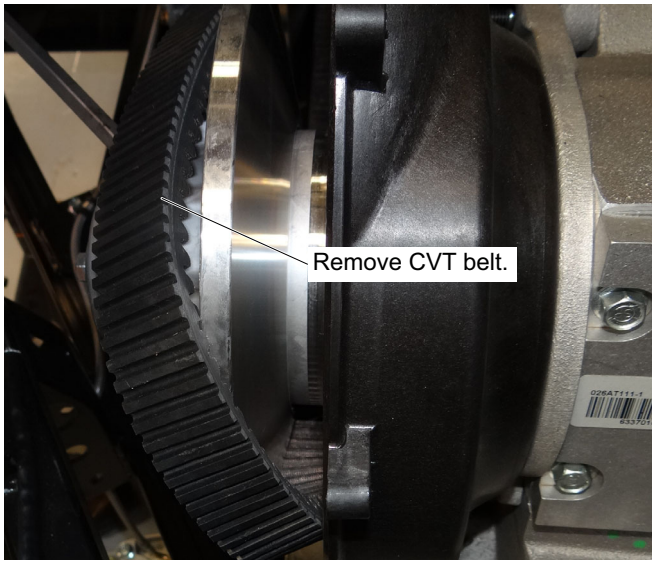


Fig. 2 Removing the CVT Belt

Primary Clutch Removal

Tool List	Qty.
Torx Bit, T30	1
Screwdriver, Flat Tip	1
Strap Wrench	1
Pry Bar	1
Plastic Faced Hammer	1
Socket, 10mm	1
Ratchet	1
Clutch Puller Tool	1
Impact Socket, 22mm	1
Impact Wrench	1
Thread Locking Adhesive	AR
Torque Wrench, ft. lbs.	1

NOTICE: To prevent damage to the clutch during removal or installation, be careful not to damage the machined surfaces of the clutch while using a pry bar.

1. Remove the CVT belt. See *CVT Belt Replacement* on page 107.
2. Use a pry bar or a strap wrench to prevent the primary clutch from turning. Remove bolt (19), lock washer (20), flat washer (23), clutch fan (22) and fan washer (21) from the engine crankshaft (Ref. Fig. 4).

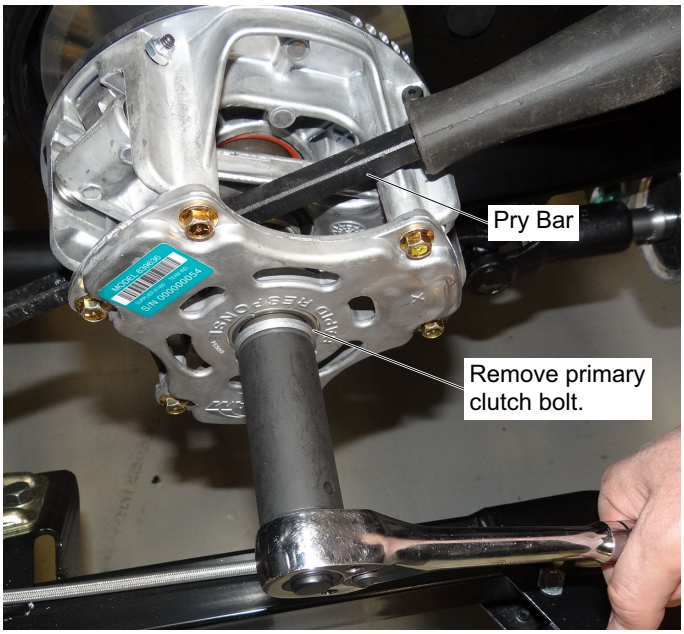


Fig. 3 Primary Clutch Removal

3. Insert the clutch puller tool and tighten (clockwise) which will remove the clutch from the engine crankshaft (Ref. Fig. 5).

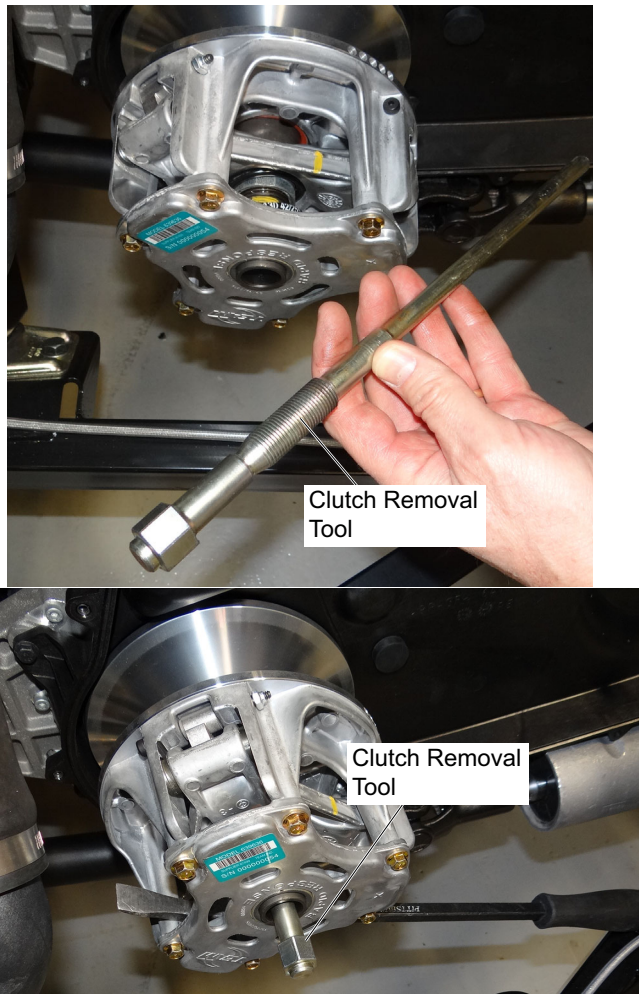


Fig. 4 Clutch Tool

Primary Clutch Installation

NOTICE: To prevent damage to the clutch, be sure to remove all grease from the body of the clutch. Grease penetrating the seal may cause premature clutch failure or belt slip.

1. Clean both the engine crankshaft and the primary clutch bore. Slide the clutch onto the crankshaft.
2. Install the fan washer (21), clutch fan (22) flat washer (23), lock washer (20) and bolt (19).
3. Use a strap wrench to hold the clutch when tightening bolt (19).
4. Tighten bolt (19) to the torque value specified:

Item	Torque Specification
19	68 - 72 ft. lbs. (92 - 97 Nm)

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

Secondary Clutch Removal

Tool List	Qty.
Torx Bit, T30	1
Screwdriver, Flat Tip	1
Strap Wrench	1
Plastic Faced Hammer	1
Socket, 10mm	1
Ratchet	1
Strap Wrench	1
Impact Socket, 22mm	1
Impact Wrench	1
Thread Locking Adhesive	AR
Torque Wrench, ft. lbs.	1

1. Remove the screws (17) that secure the clutch cover to the backing plate. Remove the clutch cover.
2. Remove the CVT belt.
3. Remove the secondary clutch bolt (18), lock washer (30) and retaining washer (26). Slide the clutch from the rear differential input shaft (Ref. Fig. 6).

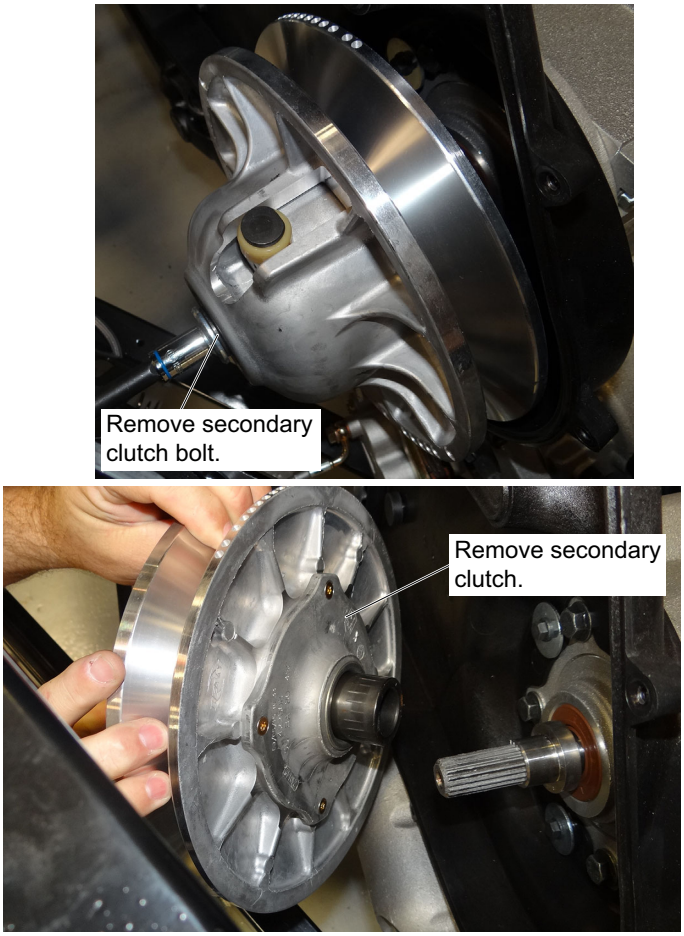


Fig. 5 Secondary Clutch Removal

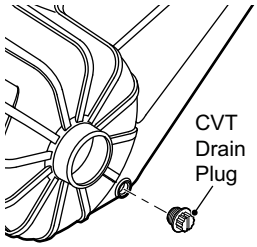
Secondary Clutch Installation

1. Coat the rear axle input shaft with a light coat of anti-seize compound and slide the clutch onto the shaft.
2. Install the clutch bolt (18) and tighten to the torque value specified:

Item	Torque Specification
18	23 - 27 ft. lbs. (31 - 36 Nm)

Draining the CVT

If water gets into the CVT, use the following procedure to dry it out before operating:



1. Park the vehicle on a level surface and move the gear shifter to the P (park) position.
2. Remove the drain plug from the bottom of the CVT cover.
3. Allow the water to drain completely.
4. After all of the water has drained out, replace the drain plug.
5. Start the engine.
6. Allow the vehicle to idle for 20 - 30 seconds to remove moisture from the clutch system.
7. Apply the brakes.
8. Move the gear shifter to L (low) range.
9. Test for belt slippage. If the belt slips, repeat the process.
10. Take the vehicle to your dealer for service as soon as possible.

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

Notes:

PROP-SHAFT

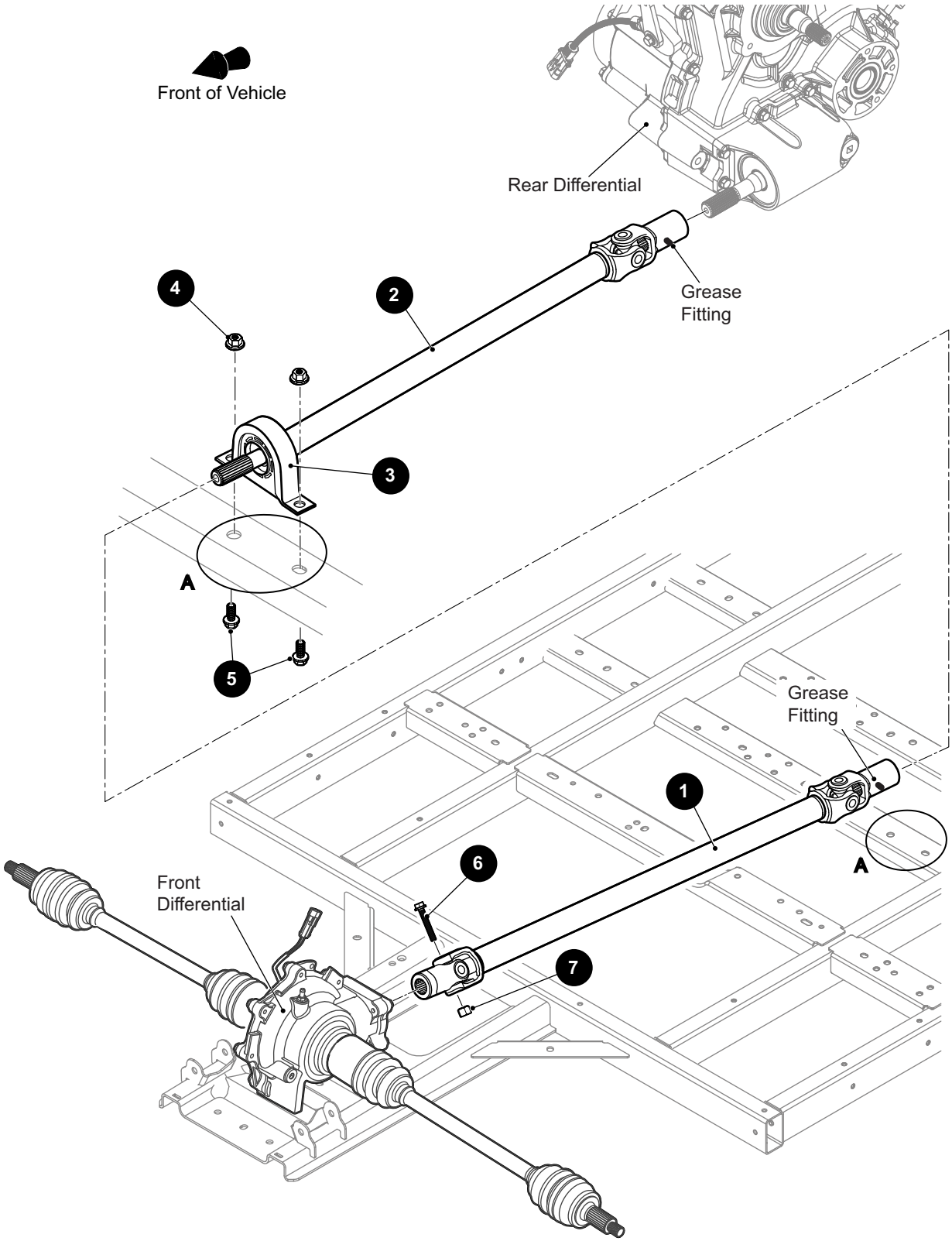


Fig. 1 Front and Rear Prop-Shaft

PROP-SHAFT

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

GENERAL

Power from the engine is transferred to the front differential by the use of a prop-shaft system.

Prop-shaft Maintenance

Check the U-joints at the ends of the prop-shafts for excessive play or loose hardware.

Check the mid-shaft bearing for excessive play and for smooth rotation.

Clean and lubricate the prop-shaft splines, U-joints and bearings yearly or after the vehicle has been driven through water deep enough to submerge the prop-shaft. Grease fittings are provided at the rear U-joint of each shaft. See *RECOMMENDED LUBRICANTS AND FLUIDS* on page 176.

The prop-shaft components must be serviced periodically for optimum engine life and performance. See *SCHEDULED MAINTENANCE CHART* on page 174.

Prop-shaft Removal

Tool List	Qty.
Torx Bit, T30	1
Ratchet	1
Socket, 15mm	1
Wrench, 15mm	1
Screwdriver, Flat Tip, Large	1
Rag	1
Wheel Chocks	1
Torque Wrench, ft. lbs.	1

1. Place the vehicle on a flat level surface.
2. Move shifter to the P (park position) and remove the key from the vehicle.
3. Chock the wheels to prevent the vehicle from rolling.
4. Remove the skid plate. See *Skid Plate Removal* on page 35.

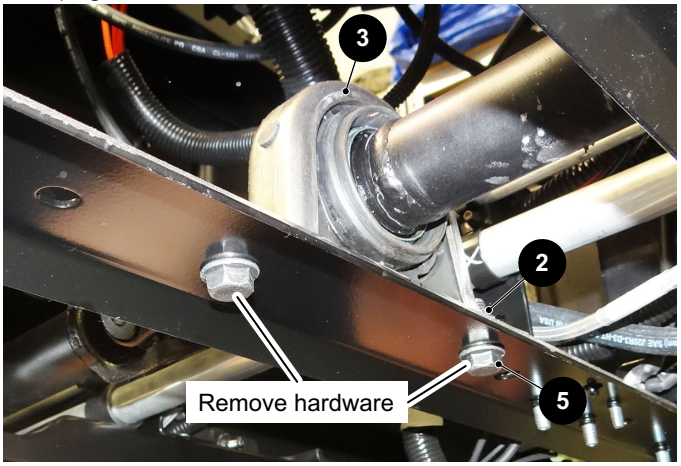
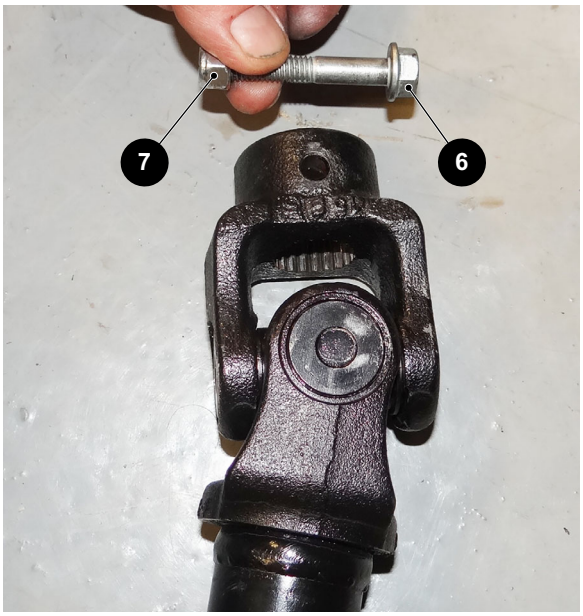


Fig. 2 Mid-Shaft Bearing

5. Remove the nut (4) and bolt (5) securing each side of the mid-shaft bearing (3) to the frame (Ref. Fig. 1) (Ref. Fig. 2).
6. Remove bolt (6) and lock nut (7) from the front of the front prop-shaft (1) where it connects the front differential (See Fig. 1) (Ref. Fig. 3).



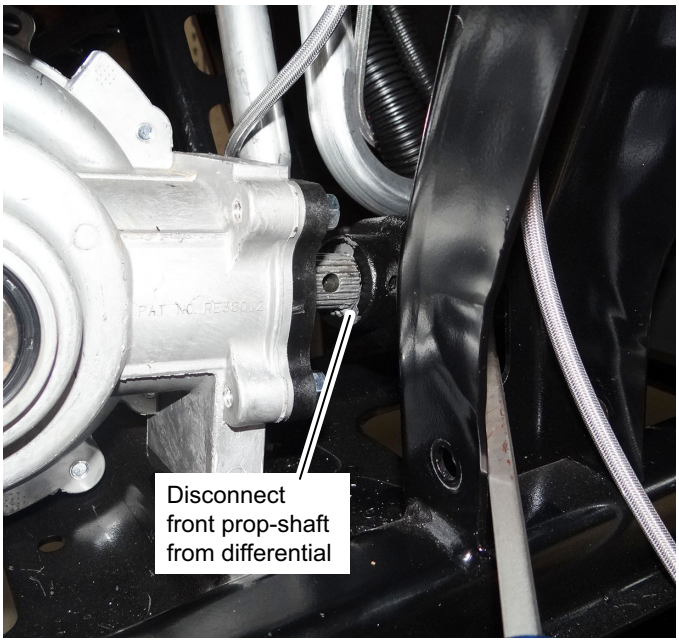


Fig. 3 Disconnect Front Prop-Shaft

7. Slide front prop-shaft off the front differential.
8. Slide rear prop-shaft off of the rear differential (Ref. Fig. 4).

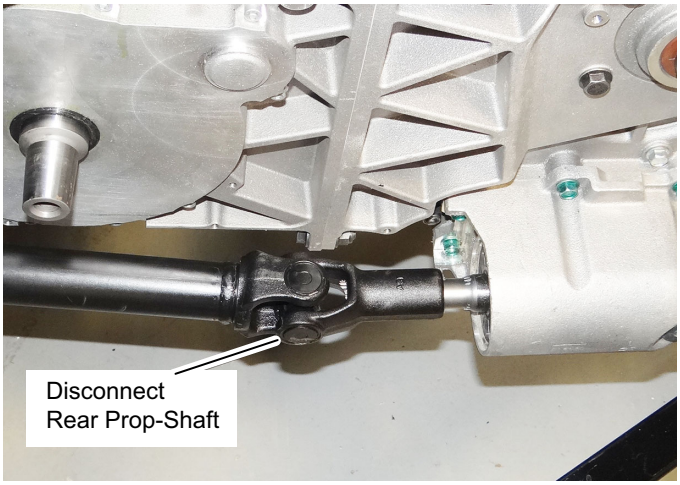


Fig. 4 Disconnect Rear Prop-Shaft

9. Remove the front and rear prop-shafts from the vehicle.
10. Installation is the reverse of removal. Clean the prop-shaft, gearbox and differential splines with a clean rag. Apply anti-seize to the splines before installation.
11. Tighten the hardware to the torque values specified:

.

Item	Torque Specification
4, 5	45 - 50 ft. lbs. (61 - 68 Nm)
6, 7	12 - 16 ft. lbs. (16 - 22)

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

Notes:

ENGINE

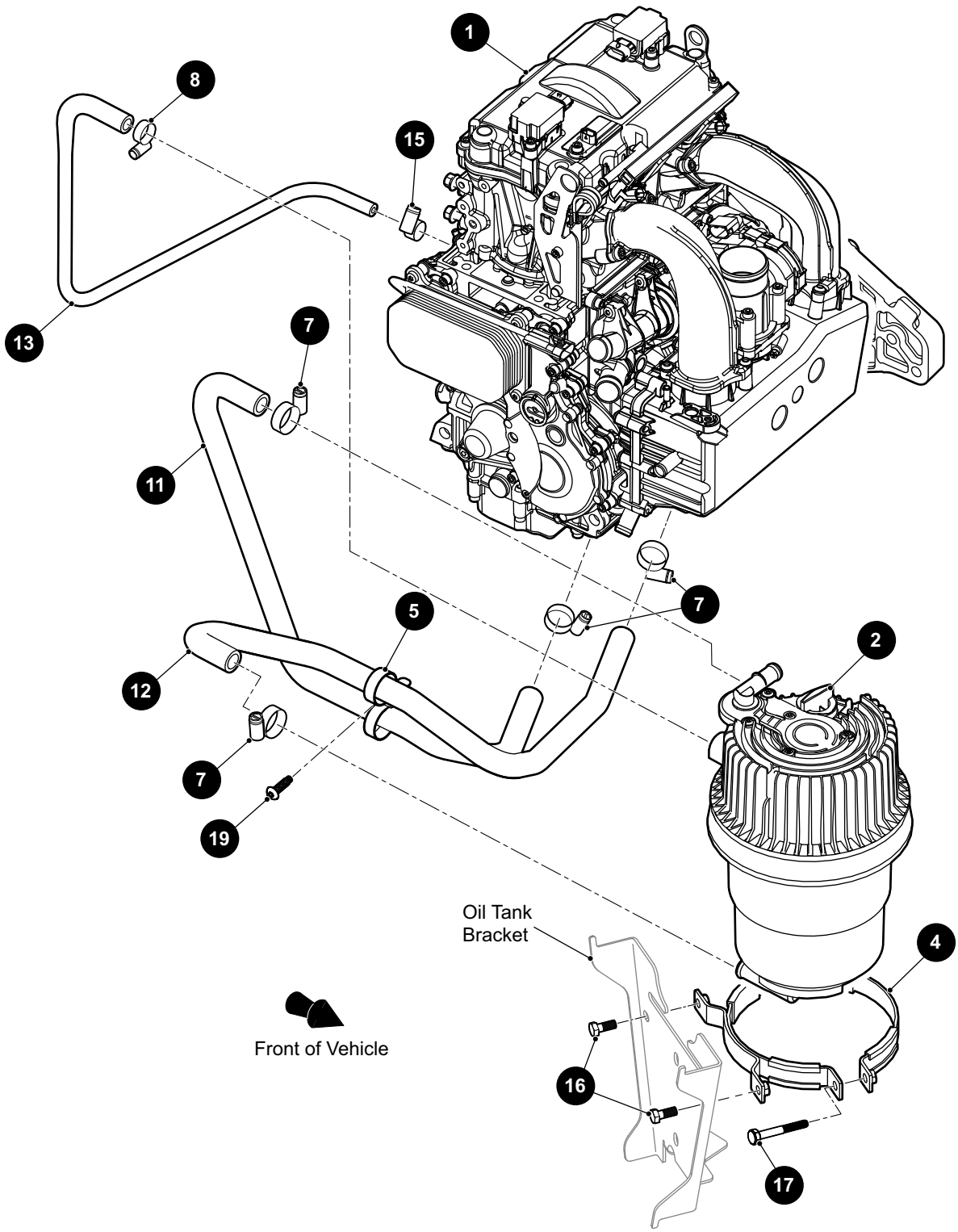


Fig. 1 Engine

ENGINE

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

GENERAL

NOTICE: For detailed engine repair and service procedures, see Textron Motors Repair Manuals TD410035_RLF and TD410035_SHB.

ENGINE DESCRIPTION

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

Engine Specifications

See *GENERAL SPECIFICATIONS* on page 169.

ENGINE BREAK-IN

Correct operation of the engine during the break-in period is essential to the performance, reliability and life of the engine.

The engine break-in period is:

- the first 5 operating hours of a new engine
- the first 5 operating hours of an engine that has been completely disassembled
- the first few minutes until the engine is warm at each operation

During these break-in periods, operate the vehicle in the following manner:

- Avoid engine speeds over 6000 rpm.
- Avoid long periods of idle time.
- Avoid long operating times at low engine speed.
- Avoid long operating times at the same engine speed.
- Avoid long operating times with a full load.
- Vary the engine speed during operation.
- Apply quick bursts of acceleration after the engine has warmed up.

ENGINE MAINTENANCE

Access the engine by raising or removing the truck bed and/or removing the rear seat. Some service procedures may require the vehicle to be lifted. See *LIFTING THE VEHICLE* on page 19.

ENGINE OIL

NOTICE: The use of an incorrect grade of engine oil can damage the engine. Always use the recommended grade. Do not mix engine oils of different grades or viscosity.

NOTICE: Your engine features a dry sump lubrication system. Engine oil is pumped from the oil tank into the engine while the engine is operating. When the engine is turned off, some oil flows slowly from the engine back into the oil tank. Check the oil level immediately after turning off the engine.

Monitor the oil level. A rise in oil level can indicate contaminants collecting in the oil sump or crankcase. Change the oil immediately if the level begins to rise. Monitor the oil level closely. If it continues to rise, discontinue operation and determine the cause of the oil level increase or take the vehicle to your dealer.

Engine Oil Type and Capacity

NOTICE: See RECOMMENDED LUBRICANTS AND FLUIDS on page 176.

NOTICE: Do not use special additives in recommended oil.
Do not mix oil with gasoline.

Checking the Engine Oil Level

Tool List	**Qty.**
Clean Cloth	AR

The vehicle must be on a level surface.

1. Use a cloth to clean the top of the oil tank and the top of the dipstick. This is necessary to prevent debris from falling into the oil tank.
2. Start the engine and let it run until it is warm (approximately five (5) minutes).
3. Turn off the engine.
4. Remove the dipstick from the oil tank (Ref. Fig. 2).

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

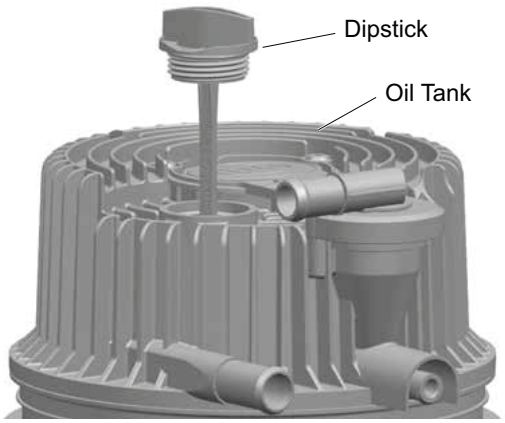


Fig. 2 Engine Oil Tank and Dipstick

5. To get an accurate oil level reading, wipe the oil from the dipstick and insert it back into the oil tank. Do not tighten the dipstick.
6. Remove the dipstick from the tank again and check the level. The oil level must be in the area between the MIN and MAX markings on the dipstick (Ref. Fig. 3).

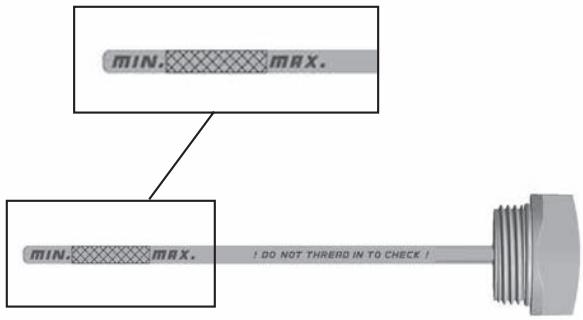


Fig. 3 Dipstick

NOTICE: The lack of oil or a low oil level can damage the engine.

7. If the oil level is below the MIN line, add engine oil into the dipstick hole until the level is between MIN and MAX.

NOTICE: Excessive oil can damage the engine.

8. If the oil level is above the MAX line, pump out the excessive oil with a siphon pump.
9. When the level is correct, replace and tighten the dipstick.

CHANGING ENGINE OIL AND FILTER

Tool List	Qty.
Ratchet	1
Socket, 13mm	1
Universal Strap Wrench	1
Funnel	1
Pliers	1
Oil Drain Pan	1
Clean Cloth	AR
Torque Wrench, ft. lbs	1

For maximum performance and longevity, replace the engine oil after the first 20 hours of operation. After the initial oil change, it must be changed per the Scheduled Maintenance Chart. See *SCHEDULED MAINTENANCE CHART* on page 174. See *RECOMMENDED LUBRICANTS AND FLUIDS* on page 176.

⚠ CAUTION ***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.***

Remove Engine Oil

1. Start the engine and let it run until it is warm.
2. Turn off the engine.

⚠ CAUTION ***Wear protective gloves to prevent scalding from hot engine oil.***

3. Remove the engine oil.
   a. Put a drain pan under the oil tank.

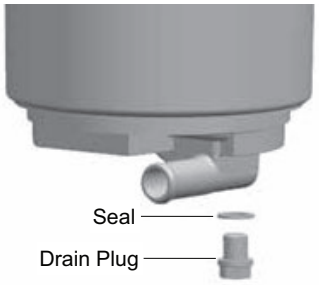


Fig. 4 Oil Tank Drain Plug and Seal

   b. Remove the drain plug and seal (Ref. Fig. 4).
   c. Allow the oil to completely drain from the tank into the pan.

⚠ WARNING ***Make sure you remove the correct (15Amp service) fuse to prevent the engine from starting. Removing the wrong relay or fuse can allow the engine to start when the key is turned.***

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

NOTICE: Starting the engine after the oil is drained can cause serious engine damage.

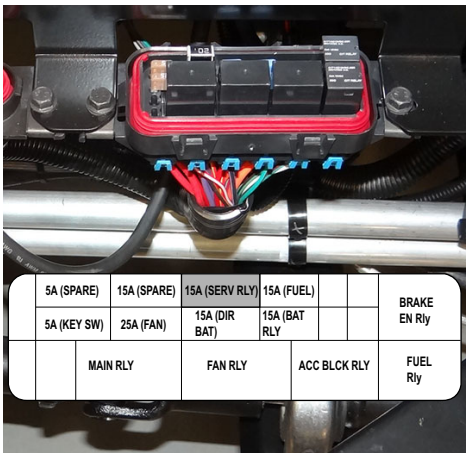


Fig. 5 Service Fuse

d. Remove the 15Amp service fuse in the main fuse box under the driver seat. Removing this fuse will interrupt the power supply circuit to the ignition coil, injectors and O_2 sensor so that the engine will turn over without starting (Ref. Fig. 5).

e. Turn the key to activate the starter for five seconds. As the engine turns over, oil is pumped out of the engine.

f. Let the oil drain until it stops and then repeat two more times to remove the remaining oil from the tank.

g. When all of the oil is pumped out of the tank, replace the seal and reinstall the drain plug. Tighten the plug to 13.3 - 14.8 ft.lb (18 - 20 Nm).

Replace the Oil Filter

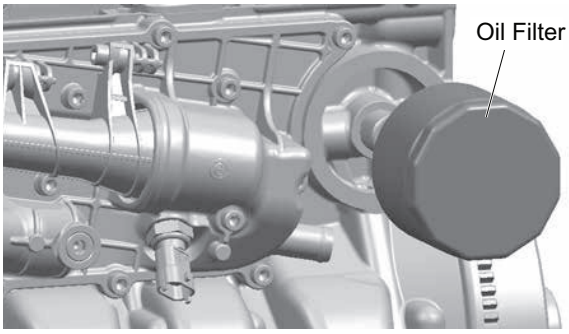


Fig. 6 Replace Oil Filter

Tool List	Qty.
Universal Strap Wrench	1
Oil Drain Pan	1
Clean Cloth	AR

1. Remove the oil filter with universal strap wrench (Ref. Fig. 6).
2. Clean the engine sealing surface with a clean cloth (Ref. Fig. 7).

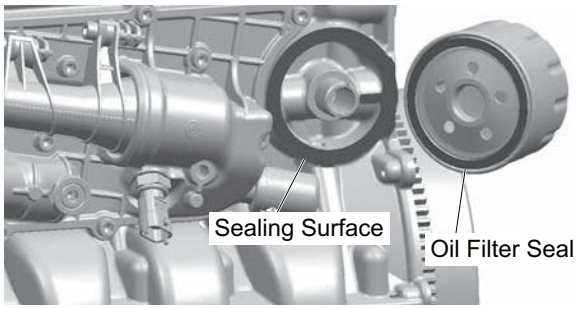


Fig. 7 Oil Filter

3. Lightly coat the new oil filter seal with clean engine oil.
4. Install the oil filter and tighten to 7.4 ft.lb (10 Nm).

Refill Engine Oil

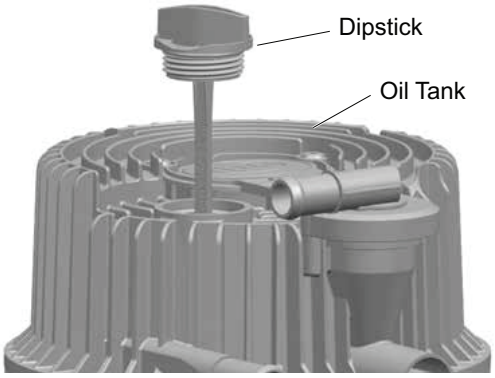


Fig. 8 Add Oil

NOTICE: Do not overfill or under fill the engine. Low or excessive oil can damage the engine.

The use of an incorrect grade of engine oil can damage the engine. Always use the recommended grade. Do not mix engine oils of different grades or viscosity.

1. Add new engine oil into the dipstick hole. Install the dipstick.
2. Replace the 15 Amp service fuse.
3. Verify that the oil level is correct.
4. Clear the service counter for the service light.
5. Clear the trouble codes.
6. Test drive the vehicle and check for leaks.

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

AIR FILTER MAINTENANCE

The air filter must be serviced for optimum engine life and performance. See *SCHEDULED MAINTENANCE CHART* on page 174.

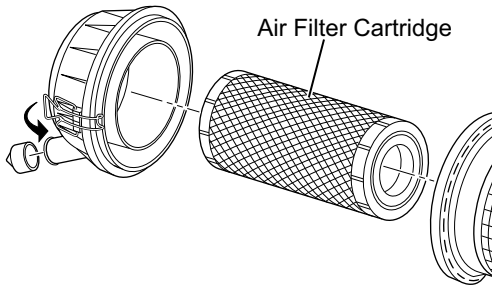


Fig. 9 Air Filter

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

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

1. Remove the seat bottom to access the air filter housing that is located below the driver seat.
2. Unlatch the cover to access the air filter cartridge.
3. Remove the filter from the housing (Ref. Fig. 9).
4. Inspect the filter. Replace if dirty or at the first sign of filter paper deterioration. Light dust or debris may be removed by lightly tapping out the dust. Do not use compressed air on the filter.
5. Check for loose, clogged or damaged air intake hoses.
6. If necessary, vacuum or wipe out any loose dirt or debris from the air cleaner housing and cover.
7. Reinstall or replace the filter. **Make sure the filter is fully seated in the housing.**
8. Replace the cover and secure with latches.
9. Replace the seat bottom.

SPARK PLUGS

Tool List	Qty.
Allen Wrench, 5mm	1
Spark Plug Socket, 16mm	1
Ratchet	1
Ratchet Extension	1
Feeler Gauge	1
Anti-seize Compound	AR
Torque Wrench, ft. lbs	1

1. With the engine cool, remove and inspect the spark plugs. See *SCHEDULED MAINTENANCE CHART* on page 174.

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.

2. Clean and gap the spark plugs to 0.028 - 0.032" (0.69 - 0.84mm) (Ref. Fig. 10). If a plug has been burned beyond 0.032" (0.84 mm) or if the porcelain insulator is cracked, both plugs should be replaced.

NOTICE: See REPLACEMENT OF MAINTENANCE ITEMS on page 176.

3. Lightly coat the threads with anti-seize compound.
4. Tighten spark plugs to 16.2 - 23.6 ft. lbs. (22 - 32 Nm) torque.

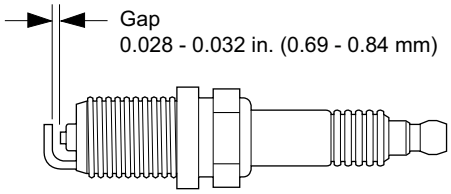


Fig. 10 Spark Plug Gap

NOTICE: Do not sand blast spark plugs. Clean with a scraper or a wire brush by hand, and wash in a commercial solvent.

Use care not to over tighten the plug. Over tightening can damage the aluminum cylinder head threads.

Spark Plug Inspection and Replacement

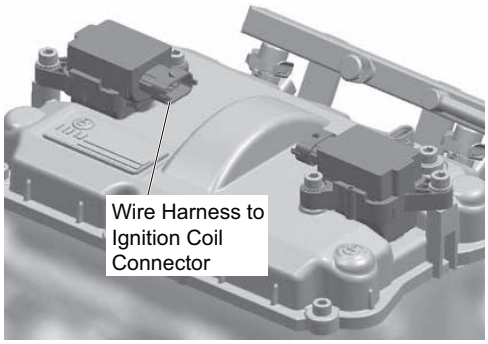


Fig. 11 Ignition Coils

Remove the spark plugs when the engine is cold.

1. Disconnect the engine from the power supply.
2. Disconnect the wire harness connectors from the ignition coils (Ref. Fig. 11).

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

3. Remove the bolts and washers securing the ignition coils to the engine (Ref. Fig. 12).

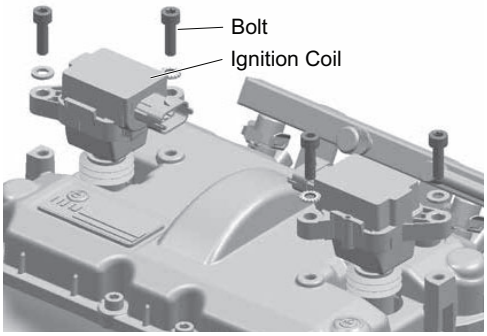


Fig. 12 Remove Ignition Coil

4. Pull straight up on the ignition coils to remove them from the engine.
5. Remove the spark plugs with a spark plug socket (Ref. Fig. 13).

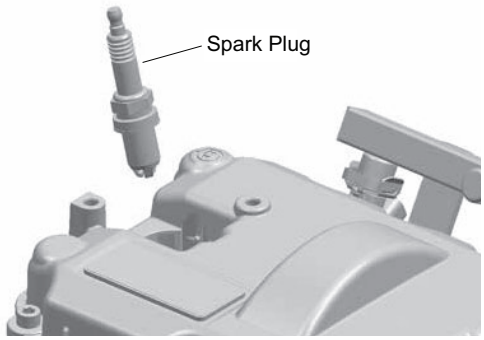


Fig. 13 Spark Plug

6. If the electrodes are extremely sooty, clean carefully with a wire brush.
7. Determine the condition of the spark plugs by checking the gap with a feeler gauge. The gap must be within the range indicated in the illustration.
   - If both spark plugs are within the range, reinstall them.
   - If the gap on either spark plug is not within the correct range, replace both spark plugs with new ones. Always replace spark plugs in pairs.
8. Apply a light film of ant-seize on the threads of the spark plugs. Install the spark plugs and tighten to 16.2 - 23.6 ft.lb (22 - 32 Nm).
9. Insert the ignition coils.
10. Replace the serrated washers with new ones. Install the bolts, washers and serrated lock washers and tighten to 5.9 - 7.4 ft.lb (8 - 10 Nm).
11. Reconnect the wire harness to the ignition coils.
12. Reconnect the power supply to the engine.
13. Clear the service counter for the service light (See vehicle Owner's Manual).

ENGINE COMPRESSION TEST

⚠WARNING ***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.***

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:

1. Lift the entire vehicle. See THE SAFETY section for the procedure to lift the vehicle.
2. Place the shifter in the P (park) position.
3. Run the engine until it reaches normal operating temperature and then turn it off.
4. Remove the engine service fuse to disable the fuel injectors, coils and the oxygen sensor.
5. Remove the air filter to eliminate the possibility of a restricted air passage.
6. A good, well charged battery should be used. A weak battery may not provide the correct cranking speed.
7. Install a compression tester. Follow the tester manufacturer's instructions for use.
8. Turn the engine over. Make sure the reading is normal per the engine manual compression specifications. If the compression reading is low, check for correct valve adjustment. If the valves are properly adjusted, the cause may be valve damage or a head gasket leak, etc. ***See Textron Motors Repair Manual TD409135_RLF and Service Manual TD409135_SHB.***

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

ENGINE REMOVAL

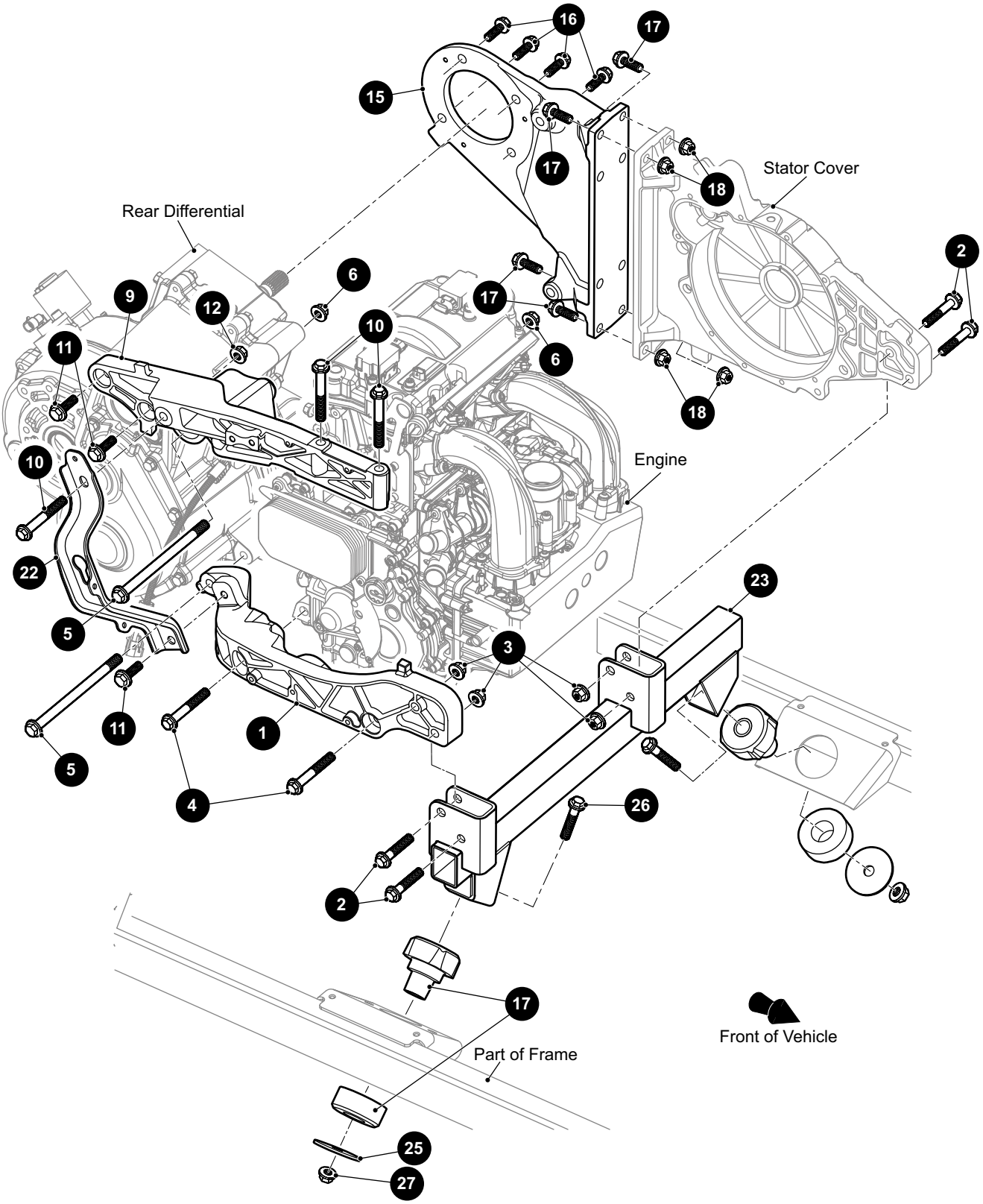


Fig. 14 Engine Mounting Components

ENGINE

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

Tool List	Qty.
Hoist	1
Ratchet	1
Socket, 10mm	1
Socket,19mm	1
Wrench, 19mm	1

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

Note the location of wires, wire ties and clamps before removal. 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 cable before beginning engine removal procedure.***

See the appropriate sections of this manual to remove or disconnect the following components:

- Truck Bed - See *TRUCK BED REMOVAL* on page 52.
- Rear Wheels - See *Wheel Removal* on page 60.
- Body Panels - See *BODY* on page 21.
- Skid Plate - See *Skid Plate Removal* on page 35.
- Prop Shaft - See *Prop-shaft Removal* on page 112.
- Muffler and Exhaust - See *EXHAUST SYSTEM REMOVAL* on page 123.
- Rear Frame Crossmember - See *Rear Shock Tower Brace Removal* on page 39.
- CV Shafts - See *CV Shaft Replacement* on page 77.
- Oil Tank - See *ENGINE* on page 115.
- Clutch - See *CONTINUOUSLY VARIABLE TRANSMISSION (CVT)* on page 105.
- Transmission/rear Differential - See *Rear Differential Replacement* on page 99.

Disconnect:

- Battery Cables - See *Battery Removal* on page 145.
- Fuel Line - See *FUEL SYSTEM* on page 137.
- Main Wire Harness - See *ELECTRICAL SYSTEM* on page 143.
- Engine Ground Wire - See *ELECTRICAL SYSTEM* on page 143.
- Starter Wire - See *ELECTRICAL SYSTEM* on page 143.
- Air Intake Hose - See *AIR INTAKE* on page 127.
- Coolant Hoses - See *COOLING SYSTEM* on page 131.
- Oxygen Sensor - See *EXHAUST SYSTEM REMOVAL* on page 123.
- Shifter Cable - See *Adjusting the Shift Lever Cable* on page 102.

Remove the lock nut (27), washer (25) and bolt (26) that secure the engine to each side of the frame (Ref. Fig. 14).

⚠WARNING ***The following step involves lifting substantial weight, and requires the use of a hoist.***

Use a hoist to remove the engine. With a person on each side of vehicle, rotate and lean engine back, and carefully maneuver engine out of vehicle.

Engine installation is the reverse order of removal. Replace all lock nuts with new lock nuts.

Tighten the engine to the sub frame mounting hardware to the torque specified below.

Item	Torque Specification
26, 27	68 - 72 ft. lbs. (92 - 98 Nm)

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

EXHAUST SYSTEM REMOVAL

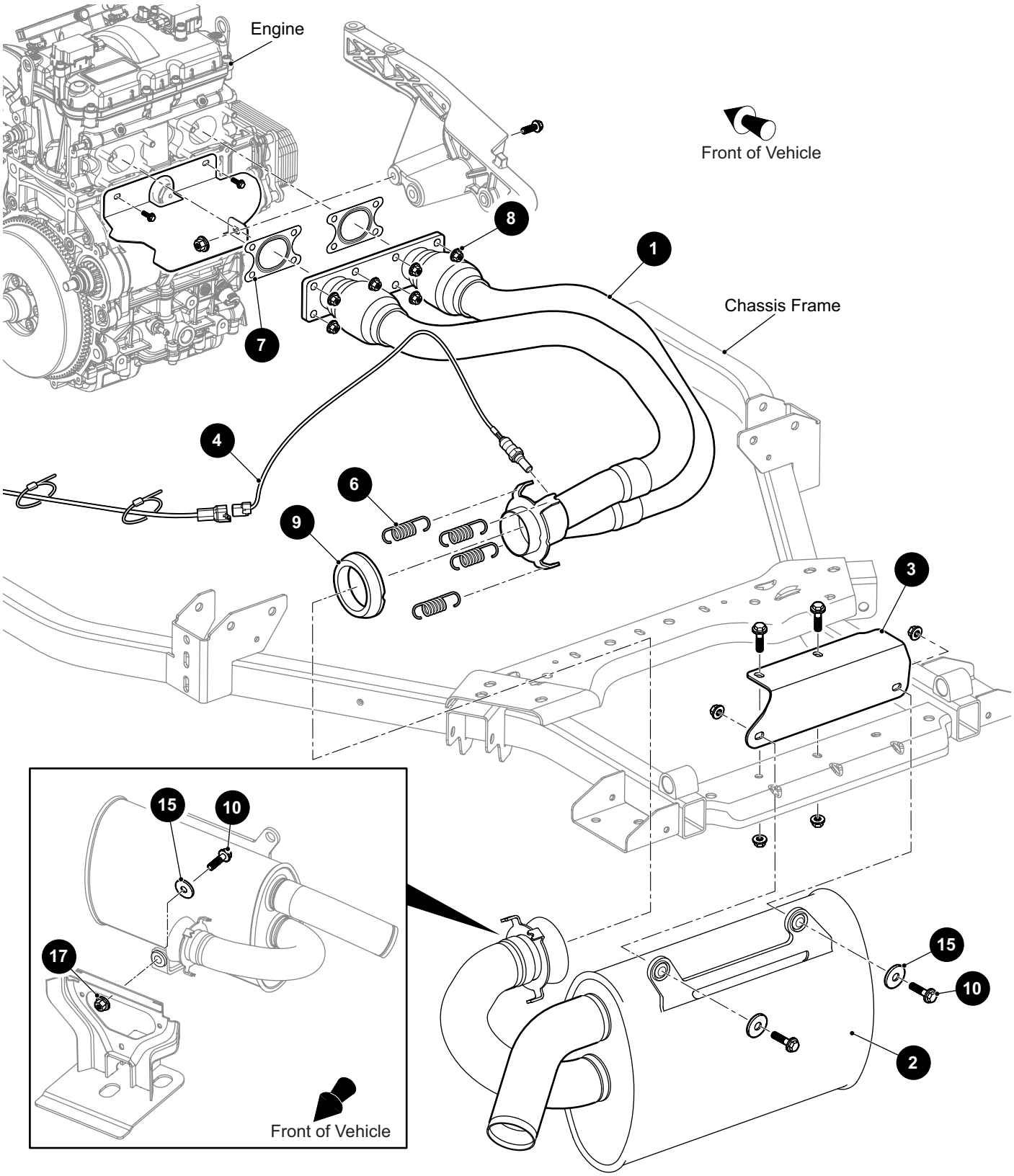


Fig. 15 Exhaust System

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

Tool List	Qty.
Spring Hook	1
Ratchet	1
Socket, 19mm	1
Socket, 14mm	1
Wrench, 19mm	1
Wrench, 17mm	1
Wrench, 14mm	1
Torque Wrench, ft. lbs	1

⚠ CAUTION ***The normal operating temperature of the exhaust system is very high. Never work around or attempt to service any part of the exhaust system until it has cooled.***

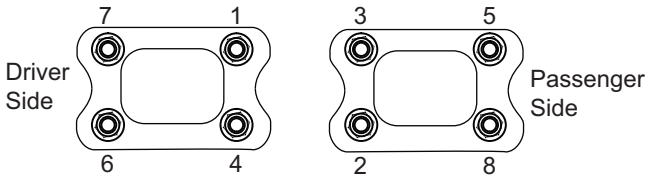
NOTICE: Hardware that is removed must always be installed in their original positions unless otherwise specified. Non specified torque figures are as shown in the table contained in GENERAL INFORMATION & ROUTINE MAINTENANCE Section.

1. Remove the truck bed from the vehicle. See *TRUCK BED REMOVAL* on page 52.
2. Remove the four springs (6) that secure the muffler (2) to the exhaust header (1) (Ref. Fig. 15).
3. Remove the bolt (10), washer (15) and nut (17) that secure the muffler to the rear of the frame.
4. Remove the bolts (10), washers (15) and bolts (17) that secure the muffler (2) to the support bracket (3). Remove the muffler from the vehicle.
5. Disconnect the oxygen sensor (4).
6. Remove the nuts (8) that secure the exhaust header (1) to the engine. Remove the manifold and gaskets (7) from the engine.

NOTICE: When replacing the exhaust header (1), new exhaust gaskets (7) must be used.

7. Install new exhaust manifold gaskets (7) onto the engine studs.
8. Place the exhaust header onto the engine studs. Secure the manifold to the engine with nuts (8).

NOTICE: The exhaust header nuts (8) must be torqued in three stages in a cross-pattern sequence (See Fig. 16).



Exhaust Manifold Torque sequence:
1st: 6 ft. lbs. (8 Nm)
2nd: 12 ft. lbs. (16.5 Nm)
3rd: 18 ft. lbs. (24.5 Nm)

Fig. 16 Exhaust Manifold Installation

9. Install the exhaust header and muffler in the reverse order of removal. Use new gasket (9). Tighten the hardware to the torque values specified.

Item	Torque Specification
10, 17	11 - 15 ft. lbs. (15 - 20 Nm)

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

Notes:

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

Notes:

AIR INTAKE

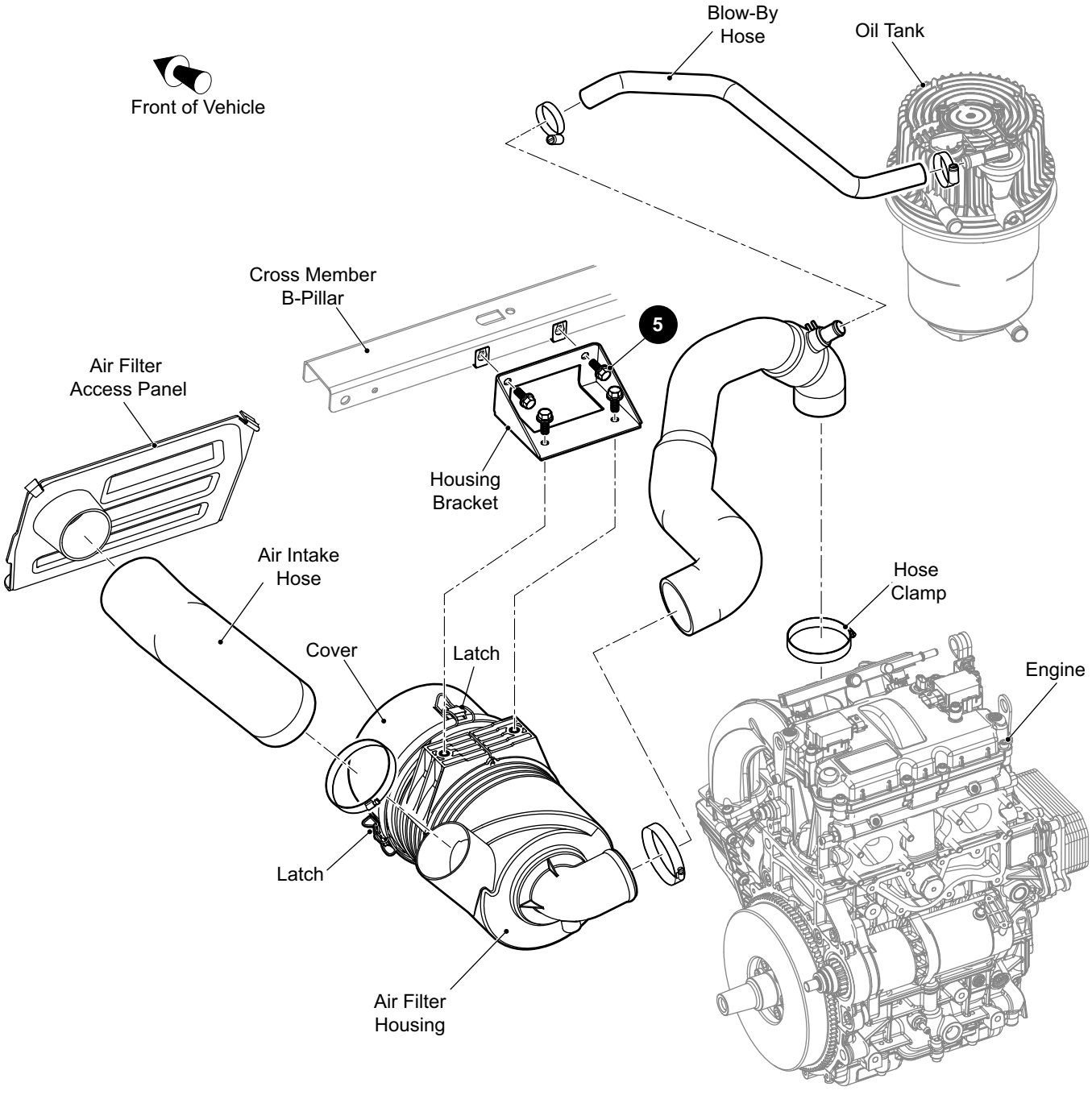


Fig. 1 Air Intake Components

ENGINE AIR INTAKE

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

Air Filter Maintenance

The air filter must be serviced for optimum engine life and performance. See *SCHEDULED MAINTENANCE CHART* on page 174.

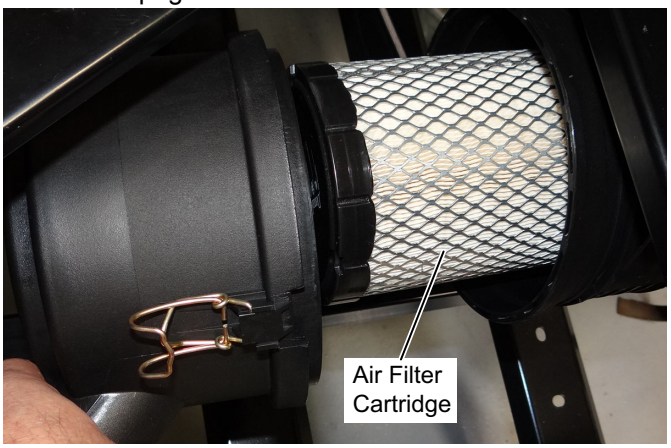


Fig. 2 Air Filter

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

NOTICE: The paper air filter cartridge is a dry unit. Do not use oil on the cartridge.

1. Remove the access panel located behind the driver side seat (Ref. Fig. 1).
2. Unlatch the cover to access the air filter cartridge (Ref. Fig. 3).
3. Remove the filter from the housing (Ref. Fig. 2).
4. Inspect the filter. Replace if dirty or at the first sign of filter paper deterioration. Light dust or debris may be removed by lightly tapping out the dust. Do not use compressed air on the filter.
5. If necessary, vacuum or wipe out any loose dirt or debris from the air cleaner housing and cover.
6. Check for loose, clogged or damaged air intake hoses.
7. Reinstall or replace the filter. **Make sure it is fully seated in the housing.**
8. Replace the cover and secure with latches.
9. Replace the access panel.

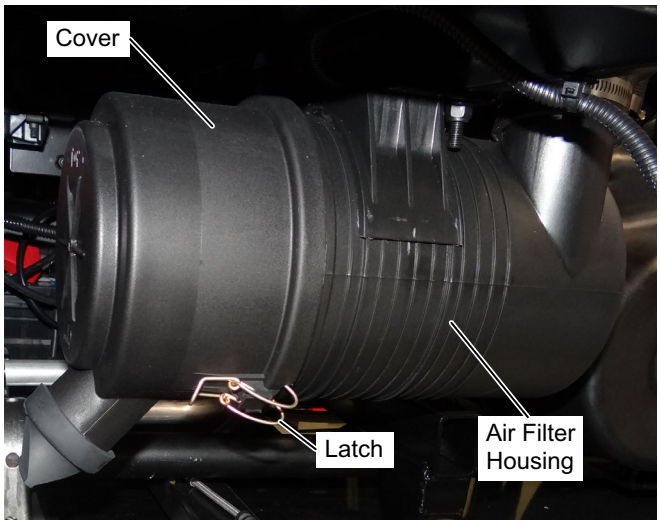


Fig. 3 Air Filter Housing

Air Filter Housing Removal

Tool List	**Qty.**
Screwdriver, Flat Tip	1
Ratchet	1
Socket, 10mm	1
Wrench, 10mm	1

To remove the air filter housing:

1. Remove the air filter access panel.
2. Loosen the air hose clamps and slide the hoses off of the housing (Ref. Fig. 1)(Ref. Fig. 3).
3. Remove the two bolts (5) that secure the housing to the mounting bracket.
4. Remove the housing.
5. Installation is the reverse of removal.

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

Notes:

ENGINE AIR INTAKE

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

Notes:

COOLING SYSTEM

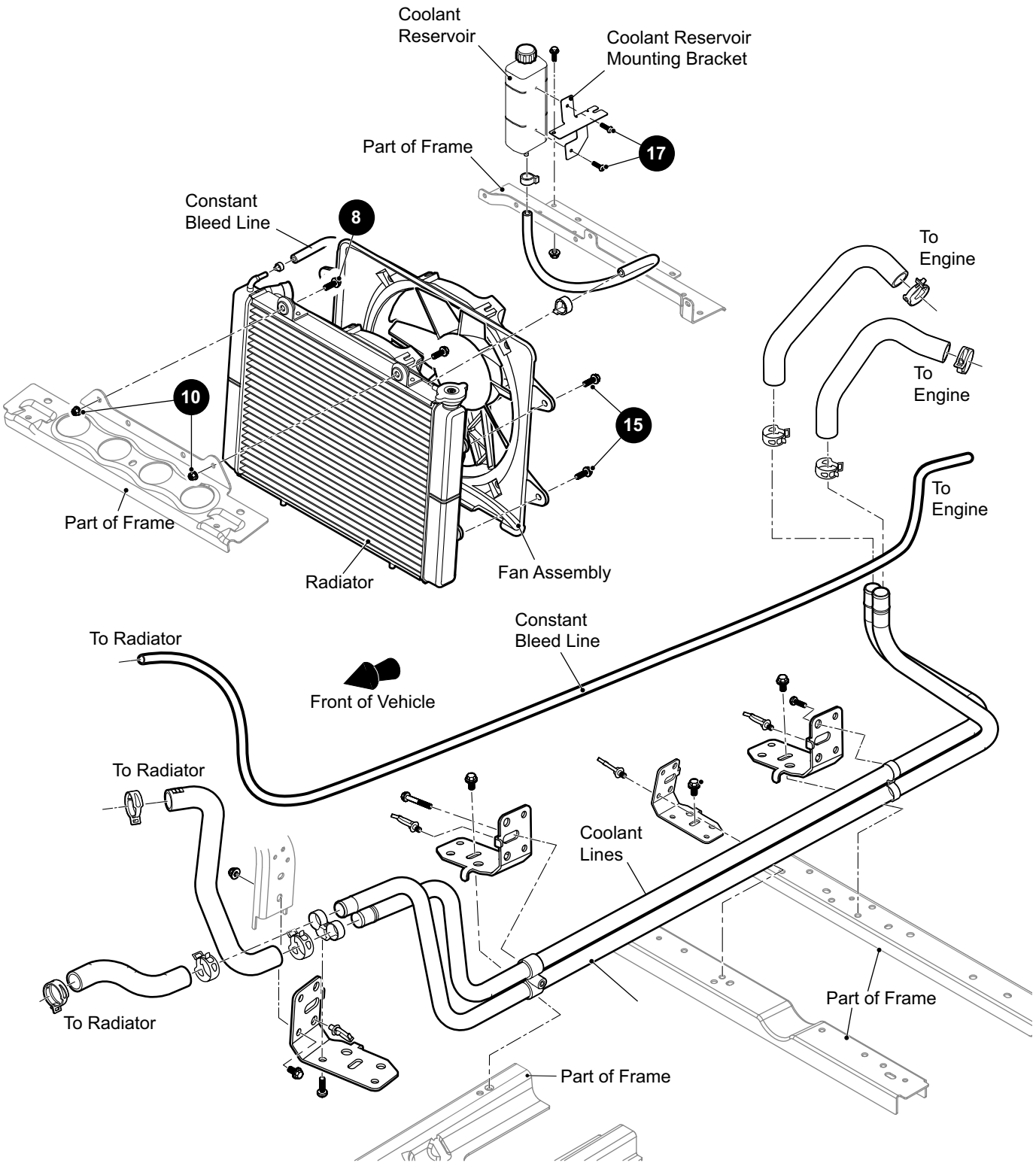


Fig. 1 Cooling System Components

COOLING SYSTEM

NOTICE: Hardware that is removed must always be installed in its original position unless otherwise specified. If torque values are not specified, refer to the Torque Specifications Table. See SCHEDULED MAINTENANCE CHART on page 174.

Coolant

The use of incompatible coolant will cause insufficient cooling of the engine. Combining different coolants can trigger a chemical reaction and cause loss of effectiveness. The recommended coolants listed have been tested for compatibility by the engine manufacturer. Verify compatibility of any coolant not recommended in the list before use. See *RECOMMENDED LUBRICANTS AND FLUIDS* on page 176.

⚠ CAUTION ***Adding tap water to the coolant will cause mineral deposits to accumulate in the system. This can cause reduced coolant flow and lead to overheating the engine.***

An incorrect mixing ratio reduces the cooling capacity. When topping off coolant, do not change the mixing ratio.

The engine coolant is a 50/50 mixture of anti-freeze and distilled water.

The vehicle requires Ethylene Glycol coolant that is silicate and nitrate-free and suitable for aluminum engines:

See *GENERAL SPECIFICATIONS* on page 169. See *RECOMMENDED LUBRICANTS AND FLUIDS* on page 176.

Reservoir Coolant Level

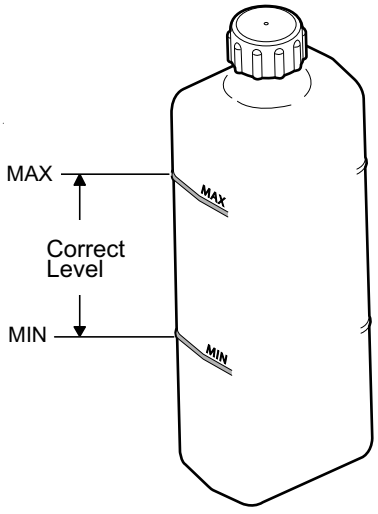


Fig. 2 Coolant Reservoir

Check the coolant level when the engine is cold.

1. Verify that the coolant level in the reservoir is between the MIN and MAX lines (Ref. Fig. 2).
2. If the level is below the MIN line, add coolant.
3. Remove the cap from the coolant reservoir.
4. Add coolant until the level is between the MIN and MAX lines.
5. Replace the cap.
6. Start the engine and allow it to idle for 10 seconds.
7. Recheck the level to make sure it is correct.

NOTICE: If coolant runs low often, or if the coolant reservoir runs completely dry, check for leaks within the cooling system.

Radiator Coolant Level

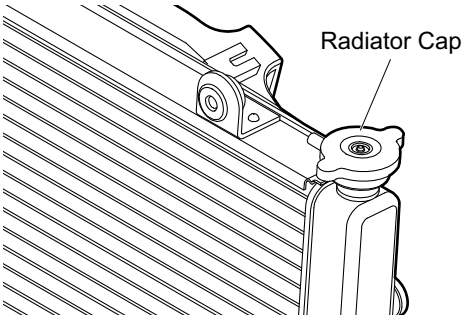


Fig. 3 Radiator Cap

NOTICE: The following procedure is only to be used for filling a radiator that has not run completely dry. Refer to coolant replacement if the radiator has been completely emptied.

If the coolant reservoir has run dry, the coolant level in the radiator must be checked.

⚠ WARNING ***Steam from the radiator can cause burns if the pressure cap is removed when the engine is warm or hot. Do not remove the radiator pressure cap while the engine is warm of hot. Always allow the engine to cool before removing the pressure cap.***

Check the coolant level when the engine is cold.

1. Slowly remove the radiator pressure cap (Ref. Fig. 3).
2. Observe the coolant level through the opening. The coolant level should be level with the filler neck.
3. Use a funnel and slowly add coolant if it is low.

NOTICE: Make sure the engine speed is held at 1900 - 2200 rpm for 15 - 20 seconds so the water pump has enough force to push all the air out of the system. If the engine is allowed to idle, the water pump seal and valve shaft seals can be damaged.

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

4. Run the engine at 1900 - 2200 rpm for 15 - 20 seconds to push the air out of the system.
5. Reinstall the radiator cap.

Coolant Replacement

Tool List	Qty.
Drain Pan	1
Pliers	1
Funnel	1

⚠ WARNING ***To prevent serious burns, do not remove the radiator cap when the engine is hot. Allow the engine and coolant to cool before servicing.***

1. Place a drain pan under the radiator.
2. Remove the radiator cap.
3. Use pliers to remove pressure from the lower radiator hose clamp while sliding the clamp away from the hose connection (Ref. Fig. 4). Carefully pull the radiator hose off the lower radiator outlet. Allow the coolant to drain into a drain pan.

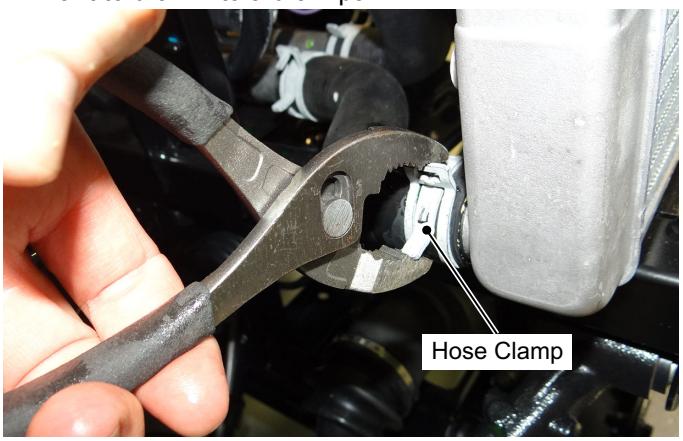


Fig. 4 Remove Lower Radiator Hose

4. After the coolant has drained, reconnect the lower radiator hose and clamp.
5. Chock the rear wheels. Lift and support the front of the vehicle as shown in the SAFETY section.
6. Disconnect the coolant bleed/overflow line from the top of the radiator on the passenger side.
7. Route the bleed/overflow line as low as possible into a waste container.
8. Add fresh coolant mix to the radiator until a steady stream of coolant flows into the waste container without bubbles.
9. Connect the bleed/overflow line to its original position at the top passenger side of the radiator.
10. Fill the coolant reservoir to the MAX line.
11. Remove the jack stands and lower the front of the vehicle per the SAFETY section.
12. Start the engine and allow the engine to warm up.

⚠ CAUTION ***Make sure the engine speed is held at 1900 - 2200 rpm for 15 - 20 seconds so the water pump has enough force to push all the air out of the system. If the engine is allowed to idle, the water pump seal and valve shaft seals can be damaged.***

13. Run the engine at 1900 - 2200 rpm for 15 - 20 seconds to push the air out of the system.
14. If the coolant level drops in the radiator (when the thermostat activates), add more coolant until full.
15. Replace the radiator cap.
16. Add additional coolant to the reservoir as required.
17. Check for leaks.

Coolant Reservoir Removal

Tool List	Qty.
Ratchet	1
Socket, 10mm	1
Wrench, 10mm	1
Bucket	1

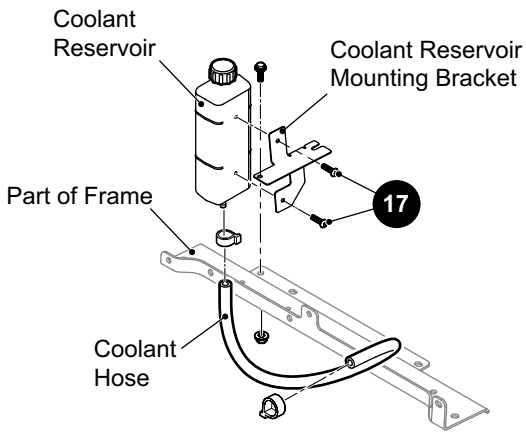


Fig. 5 Coolant Reservoir Removal

1. Drain the coolant from the reservoir.
2. Remove the coolant hose from the bottom of reservoir.
3. Remove the bolts (17) that secure the reservoir to the mounting bracket mounting bracket (Ref. Fig. 5).
4. Remove the reservoir.
5. Installation is the reverse order of disassembly.

Radiator and Cooling Fan

Do not install unauthorized accessories in front of the radiator or behind the cooling fan that could obstruct or deflect air flow. Interference with air flow can lead to overheating and cause engine damage.

COOLING SYSTEM

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

Proper radiator maintenance is important to help prevent engine damage or failure. Check and clean the radiator fins at the intervals indicated. See *SCHEDULED MAINTENANCE CHART* on page 174.

NOTICE: Do not use a high pressure hose to wash the vehicle. Water from a high pressure hose could damage the radiator cooling fins.

Radiator Removal

Tool List	Qty.
Drain Pan	1
Pliers	1
Ratchet	1
Socket, 10mm	1
Wrench, 10mm	1
Funnel	1

1. Allow the engine and cooling system to cool.
2. Remove the cowl from the vehicle. See *Cowl Removal* on page 22.
3. Remove the constant bleed line from the spout located above the upper radiator hose connection (See Fig. 8).
4. Remove the lower coolant hose and drain the coolant. See “Coolant Replacement” on page 137.
5. Use pliers to remove pressure from the upper radiator hose clamp while sliding the clamp away from the hose connection (Ref. Fig. 7). Carefully pull the radiator hose off of the upper radiator outlet
6. Remove the coolant reservoir. See *Coolant Reservoir Removal* on page 133.
7. Remove the bolts securing the front fuse block to the vehicle. Move the fuse block out of the way (Ref. Fig. 7).
8. Disconnect the wire from the radiator fan (Ref. Fig. 7).
9. Remove the four bolts (15) securing the fan assembly to the radiator (Ref. Fig. 6). Lift the fan assembly out of the vehicle. Be careful not to damage the radiator fins.

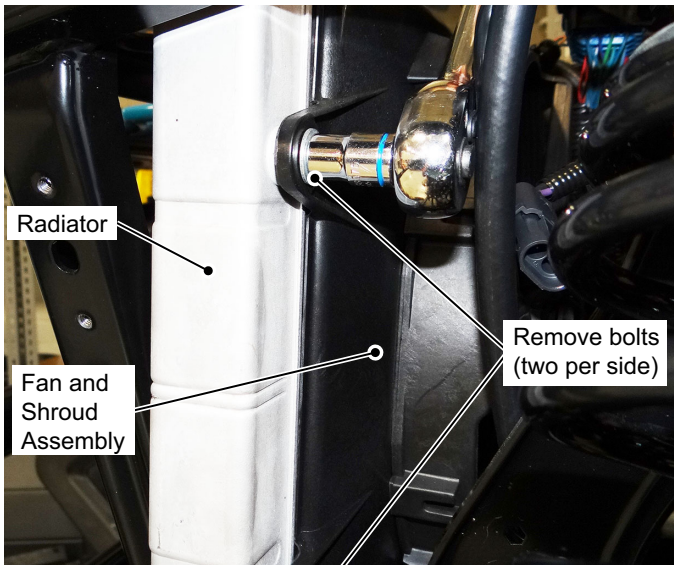


Fig. 6 Remove Fan Assembly Hardware

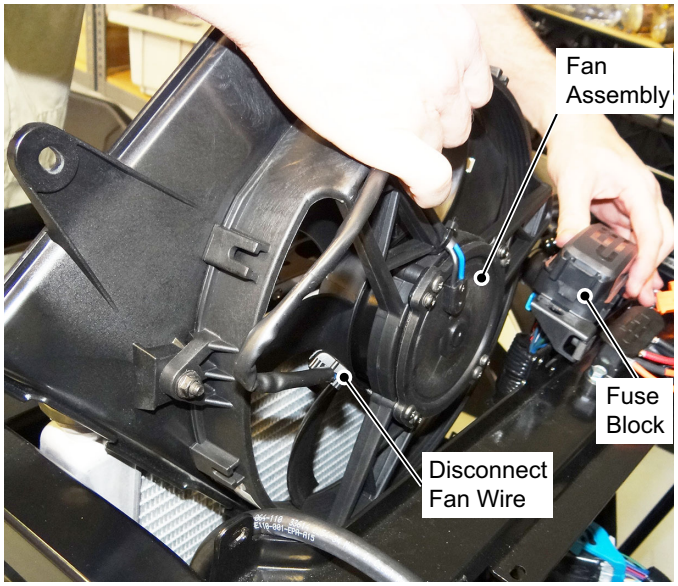


Fig. 7 Fuse Block

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

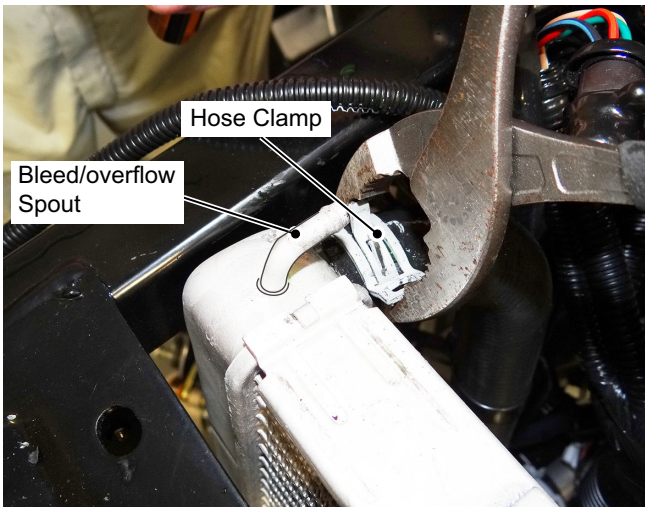
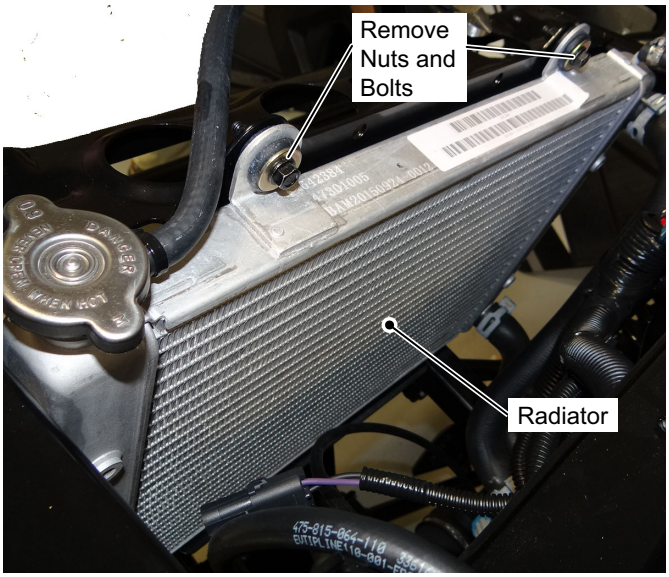


Fig. 8 Remove Radiator Hoses

10. Remove the two bolts (8) and nuts (10) that secure the radiator to the frame (Ref. Fig. 9). Lift the radiator up and out of the vehicle.



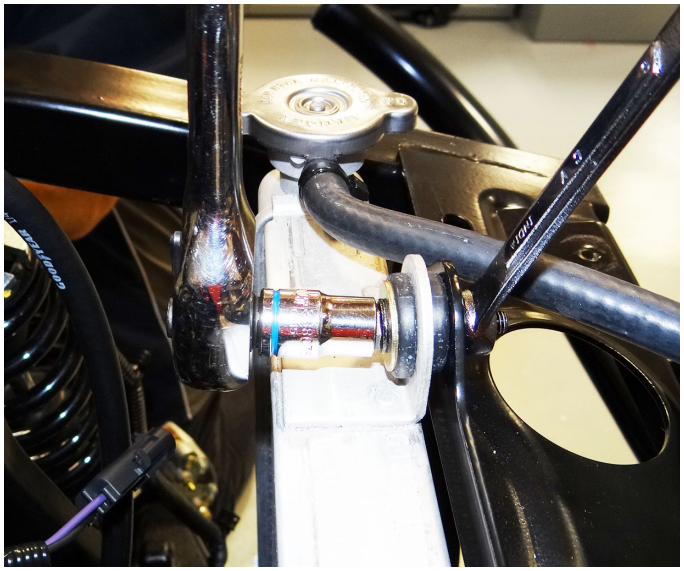


Fig. 9

11. Installation is the reverse of disassembly.

Thermostat and Water Pump

See Engine Manual TD410035_RLF.

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

Notes:

FUEL SYSTEM

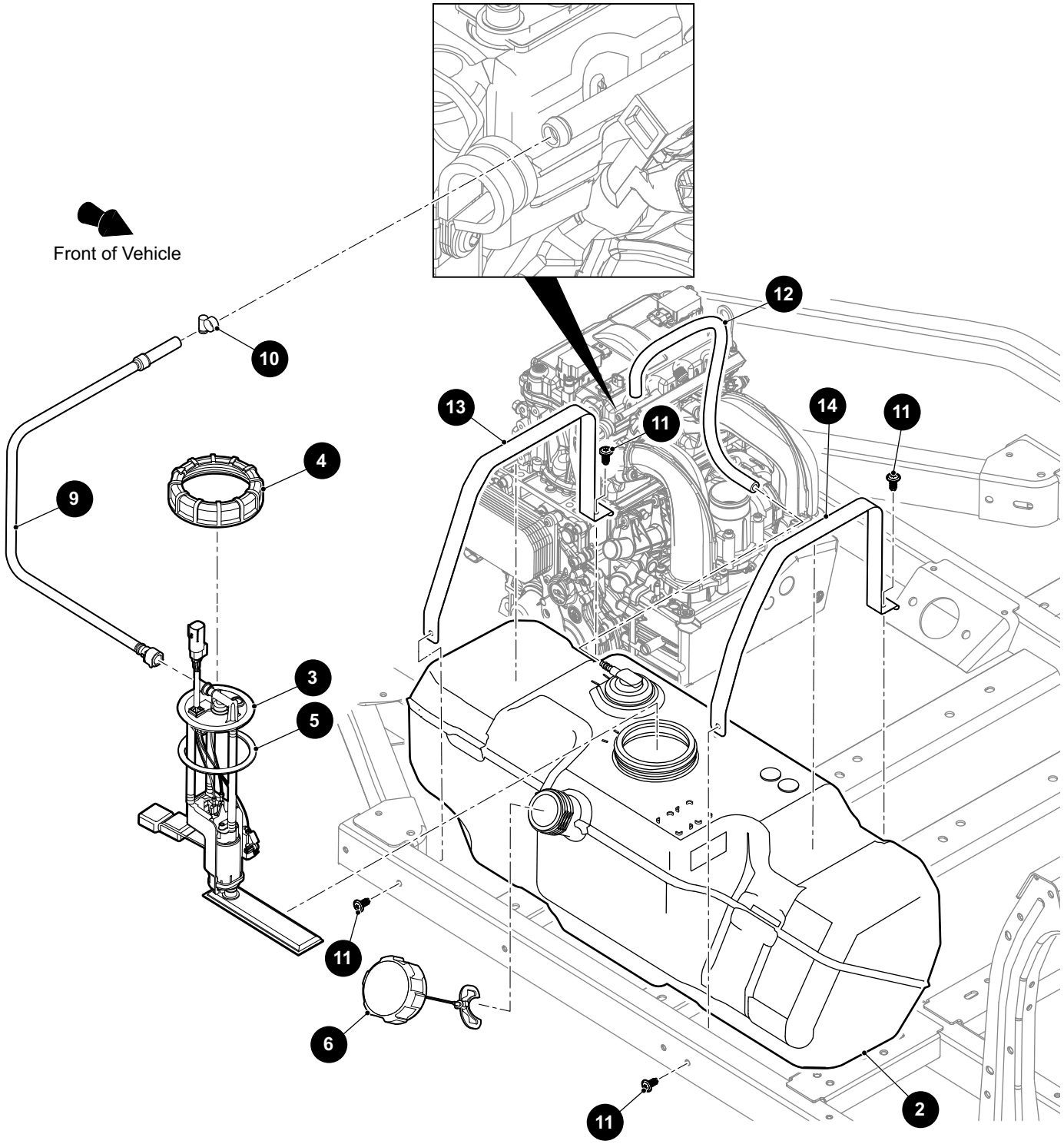


Fig. 1 Fuel System Components

FUEL SYSTEM

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

GENERAL

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

An electric fuel pump (3) supplies fuel from the fuel tank (2) to the engine injection system through the fuel line (9) (See Fig. 1). The fuel filter is located in the fuel tank along with the fuel pump.

FUEL

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

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

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

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

The fuel tank cap (6) is located on the right side of the vehicle. Fill the tank with fresh, 87 octane (minimum) gasoline. See *RECOMMENDED LUBRICANTS AND FLUIDS* on page 176.

Do not use fuel with ethanol content greater than 10% or methanol (MTBE) greater than 15%.

Do not mix oil with gasoline.

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

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

FUEL SYSTEM SERVICE

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

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

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

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

The fuel tank (2), fuel line (9), vent tube (12) and fuel tank cap (6) should be checked frequently for leaks, clogs or damage (See Fig. 1).

Fuel Pressure

The fuel pressure can be checked with a fuel pressure gauge at the schrader valve on the fuel rail (Ref. Fig. 1). The pressure should read between 56 and 60 psi.

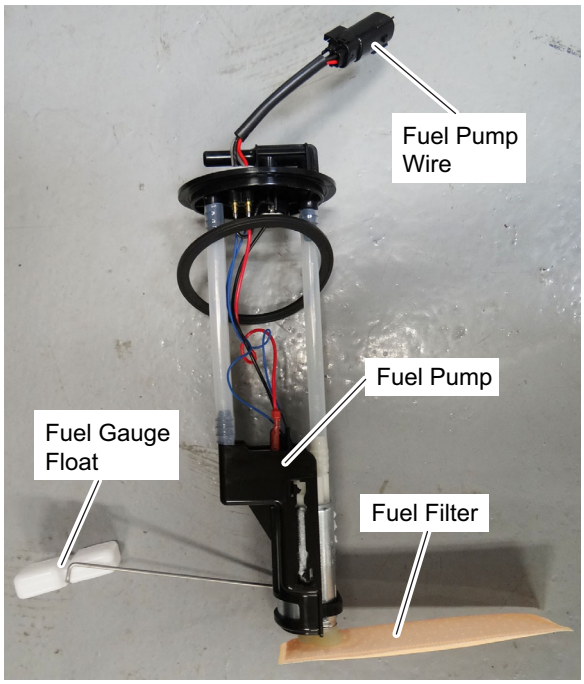


Fig. 2 Fuel Pump and Filter Assembly

Fuel Tank Removal

Tool List	Qty.
Ratchet	1
Torx Bit, T30	1
Drain Pan	1
Siphon pump	1
Fuel Container	1

1. Disconnect the negative (-) battery cable with an insulated wrench.

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

2. Remove the side panels, cup holder, prop-shaft covers, seat wrap panel, rear seat and rear seat frame. See the BODY and FRAME sections.
3. Remove the fuel from the tank with a siphon pump that is safe for use with gasoline.

NOTICE: Always dispose of fuel safely.

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

Fig. 3 Fuel Pump Wire

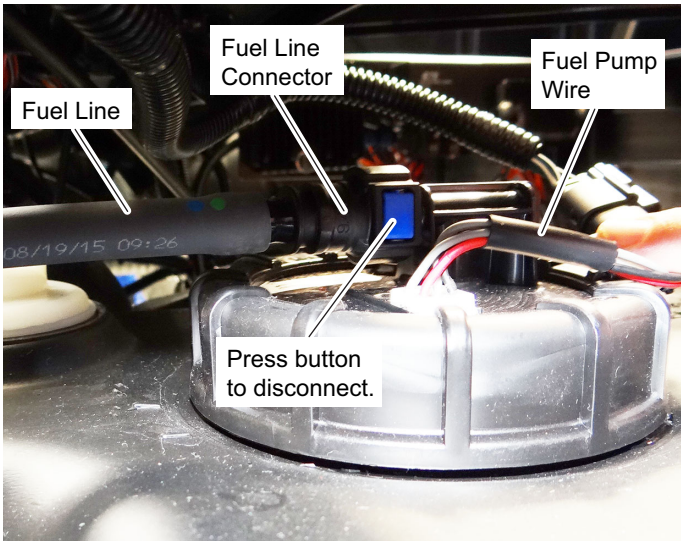


Fig. 4 Fuel Tank Connections

5. Disconnect the fuel line from the tank by pressing the button on the fuel line connector while pulling the connector away from the tank (See Fig. 4). Plug the fuel line to prevent fuel leakage.
6. Remove the hold down straps (See Fig. 5).

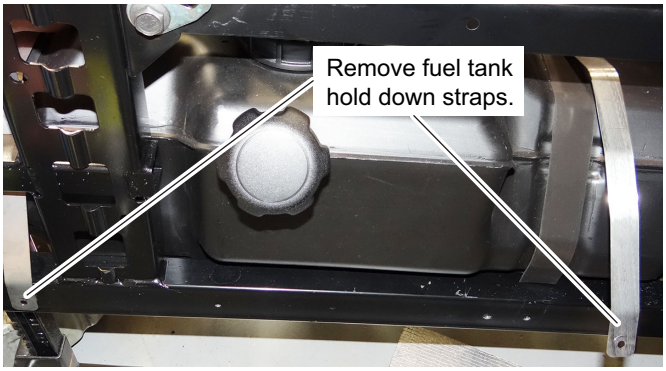


Fig. 5 Fuel Tank Removal

7. Remove the fuel tank.
8. Installation is in reverse order of removal.

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

Fuel Pump Assembly

Tool List	**Qty.**
Strap Wrench	1

NOTICE: The electric fuel pump, fuel filter, float and fuel gauge sending unit are integrated into one complete assembly (See Fig. 2). If any of these components fail, the complete assembly must be replaced.

1. Remove the fuel tank. *See Fuel Tank Removal* on page 138.
2. Remove the pump assembly (3) by removing the hold-down ring (4) and gasket (5) (See Fig. 1).
3. Pull the fuel pump assembly up and out of the fuel tank.
4. With the fuel pump assembly removed, inspect the hold-down ring seal (5) for damage. Replace as necessary.
5. Installation is in the reverse order of disassembly.

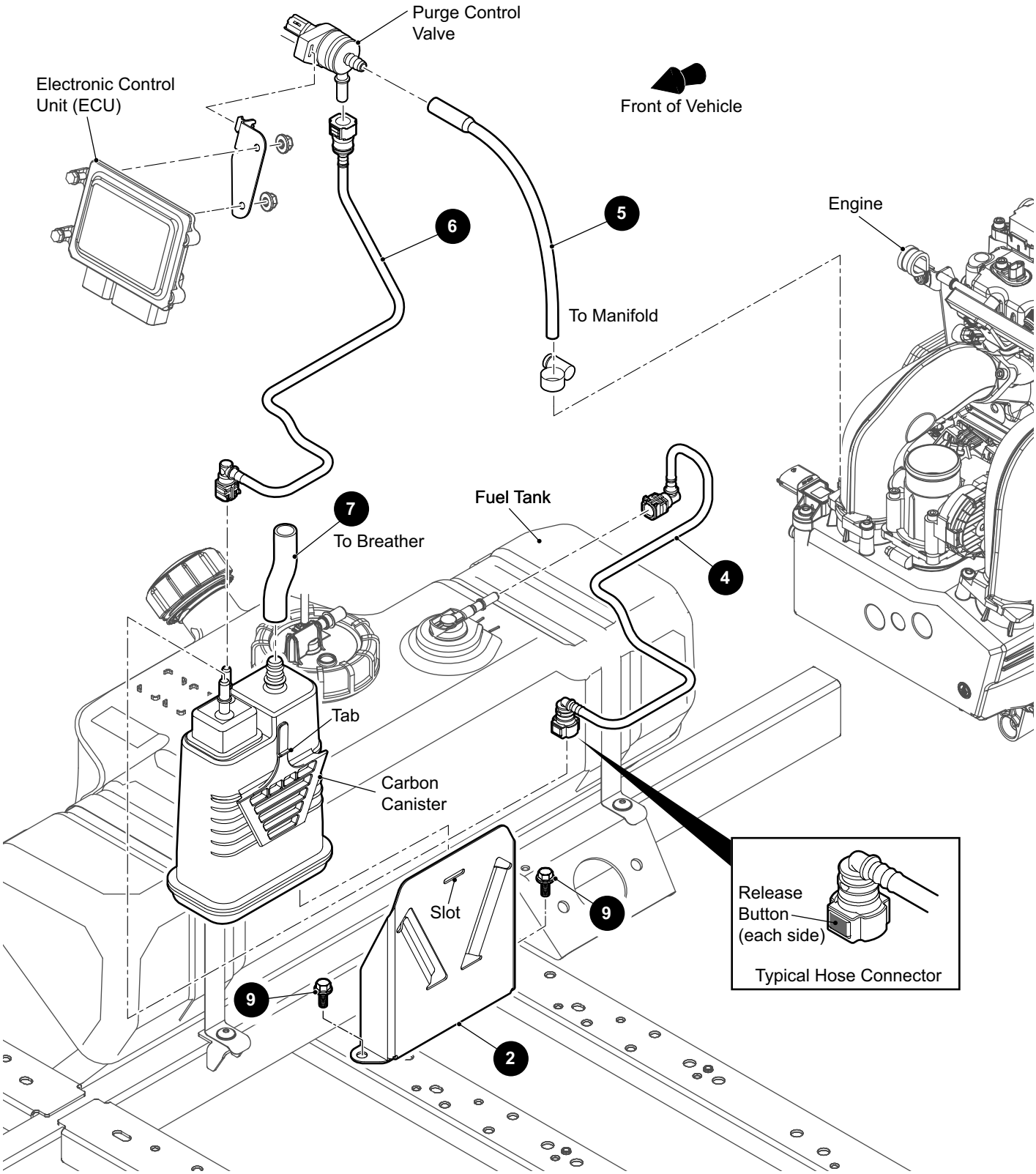


Fig. 6 Carbon Canister

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

Carbon Canister Replacement

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

1. Push in the release button on the connector on hose (4) from the top of the carbon canister and disconnect.
2. Push in the release button on the connector on hose (6) from the top of the carbon canister and disconnect.
3. Disconnect hose (7) from the canister.
4. Remove two screws (9) that secure the carbon canister bracket (2) to the vehicle frame.
5. Remove the bracket and carbon canister from the vehicle.
6. Replace with a new carbon canister in the reverse order of removal.

NOTICE: Make sure the tab located on the carbon canister aligns with the slot in the canister mounting bracket during canister installation.

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

Notes:

ELECTRICAL SYSTEM

MAIN HARNESS

Power Supply

Tool List **Qty.**

DVOM 1

1. Check for loose wires at each terminal connection or worn insulation and bare wires touching the frame.

NOTICE: Bare wires may cause a short circuit.

If 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.

2. Check the condition of the 12V battery.

   Check for adequate battery voltage (nominal 12 VDC) by setting DVOM to 30 VDC range and place the red probe (+) on the battery post with the RED 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 battery should be recharged before proceeding with the test.

NOTICE: Due to the resistance of the wires involved within the harness, voltage readings may be somewhat lower than battery voltage. A reading of 1 volt below battery voltage is acceptable.

3. Check the power wire.

   Firmly attach the black probe (-) to the battery post with the BLACK wire attached and the red probe (+) to the power RED wire terminal at the starter. A reading of battery voltage indicates that the power wire is in good condition.

4. Check the starter.

   Inspect the starter for continuity and functionality. replace if required.

NOTICE: The power wire supplies power to the fuse block.

5. Check fuses.

   Visually inspect the fuses. Check continuity if necessary. Replace if required.

NOTICE: Use of fuses with incorrect ratings can damage electrical components.

Circuits and Controls

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

- battery
- stator
- voltage regulator
- solenoid controller
- starter
- fuses and relays
- key switch

These components comprise the starting and charging circuits.

⚠WARNING ***To prevent injury or death from inadvertent movement of vehicle, all tests performed requiring the starter or the engine to rotate must be performed with the vehicle lifted or the shifter placed in the P (park) position or the drive belt must be removed.***

Follow the lifting procedure in SAFETY Section of this manual.

Testing Engine Starting Circuit

Tool List **Qty.**

DVOM 1

If the engine does not start, proceed as follows:

1. Check the battery for a voltage reading 12.2 and 12.5 volts. Inspect for loose or dirty battery post connections.
2. Check for blown fuses. Replace if necessary.
3. Check for loose wires at all terminal connections.
4. Check the complete electrical system for correct circuitry.
5. Inspect for worn insulation or bare wires touching the frame. Bare wires will cause a short circuit.
6. Check for continuity through the key switch. Refer to the FAULT TESTING section.
7. Check the starter operation.
   a. Turn the key switch to the ON position.
   b. Place the DVOM (set to appropriate DC volts scale) negative (-) probe on terminal A of the starter. Place positive (+) probe on terminal B. The DVOM should indicate approximately 12V.

c. Turn the key to the START position. The DVOM will indicate “0” voltage if the starter contacts are closed.

d. If “0” voltage is not indicated while the key is turned to the START position, replace the starter.

VOLTAGE TEST FOR 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.***

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.

NOTICE: Do not overcharge the battery.

Battery voltage can be checked using a voltmeter. Attach the negative (-) lead of the DVOM to the ground terminal of the battery. Attach the positive (+) lead to the positive battery terminal. The voltage reading should be 12 volts or above. If the reading is below 12 volts, the battery requires either charging or replacement.

BATTERY

This vehicle has a sealed battery, which requires no maintenance except to keep it corrosion-free, and to test for functionality.

The sealed battery is filled with electrolyte and sealed at the factory. Never pry the seal strip off, or add fluid to the battery.

Inspect the battery terminals at the intervals indicated in the Scheduled Maintenance Chart. Clean and tighten as needed.

Battery Cleaning

⚠WARNING ***Use insulated wrenches to prevent direct contact of a wrench with the battery terminals. Direct contact of a bare wrench with the battery terminals can cause an explosion resulting in severe injury or death.***

⚠CAUTION ***Always wear eye protection when charging the battery.***

To decrease the risk of damage to electrical components surrounding the battery while cleaning, do not use a pressure washer.

1. Remove corrosion with a wire brush.
2. Wash with a solution of:
   - 1 tsp. (5 ml) baking soda
   - 1 cup (236 ml) water
3. Rinse with tap water and dry with shop towels.
4. After the battery is clean and dry, coat with a commercially available battery terminal spray.

Battery Charging

⚠WARNING ***Do not overcharge the battery. Overcharging the battery can cause overheating and possible explosion, resulting in severe injury or death.***

NOTICE: Use a battery charger that is designed for charging sealed batteries.

Keep battery fully charged.

Heavy use of accessories can drain the battery and leave insufficient charge to start the vehicle.

The sealed battery is a 12 Volt starter battery that supplies power to the starter and accessories. A starter starts the engine and an internal generator charges the battery while the engine is running. Due to heavy use of accessories, the battery can become discharged even if the engine is running and the generator is operating.

It is important to keep the battery fully charged. Since the battery is sealed, a voltmeter or multimeter is required to check voltage.

1. Check the battery voltage with a voltmeter or multimeter.
   - If the voltage measured is 12.8 V or higher, the battery is fully charged and requires no further action.
   - If the voltage measured is less than 12.8 V, recharge the battery.
2. Charge the battery with a charger designed for sealed batteries. Follow the instructions supplied with the manufacturer of the charger.

Battery Storage

NOTICE: A battery will self-discharge over time. The rate of discharge varies depending on ambient temperature, age and condition of the battery. Check the battery each month during storage and charge as needed to maintain full charge.

A full charge will prevent the battery from freezing in winter conditions.

If the vehicle is going to be out of operation for three (3) months or longer, do the following:

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

1. Remove the battery from the vehicle.
2. Make sure the battery is fully charged.
3. Store it out of the sun, in a cool, dry place.
4. Check battery voltage each month during storage and recharge as needed to maintain a full charge.

Battery Removal

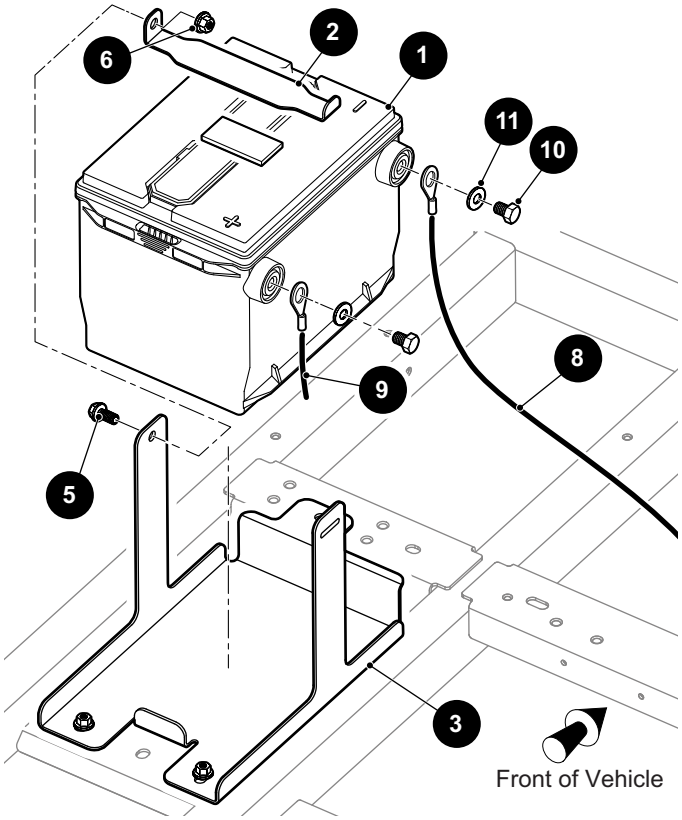


Fig. 1 Battery

Tool List	Qty.
Insulated Wrench, 1/2”	1
Socket Wrench	1
Socket, 13mm	1
Wrench, 13mm	1

1. Remove the rear seat bottom.
2. Use an insulated wrench to remove bolts (10) and washers (11) that secure the battery cables (8 and 9) to the battery (1) (Ref. Fig. 1).
3. Remove the bolt (5) and nut (6) from the battery tray (3). Remove the battery hold-down bracket (2).
4. Lift the battery up and out of the vehicle.
5. Installation is the reverse order of removal.

LIGHTS

- Clean the lights frequently to maximize visibility.
- Replace burned out bulbs promptly.
- Always make sure the headlights are adjusted properly.

⚠ WARNING ***Do not operate this vehicle at night or in low light if any bulbs are burned out. Poor lighting reduces visibility that could cause an accident resulting in severe injury or death.***

Headlight Bulb Replacement

Tool List	Qty.
Screwdriver, Flat Tip	1

⚠ CAUTION ***Light components can get hot if they have been in operation. Allow the lights to cool before servicing to prevent burns to the skin.***

1. Disconnect the LED headlight assembly from the wire harness.
2. Remove the three adjustment screws (25) and springs (23) that secure the headlight assembly to the vehicle (Ref. Fig. 2).

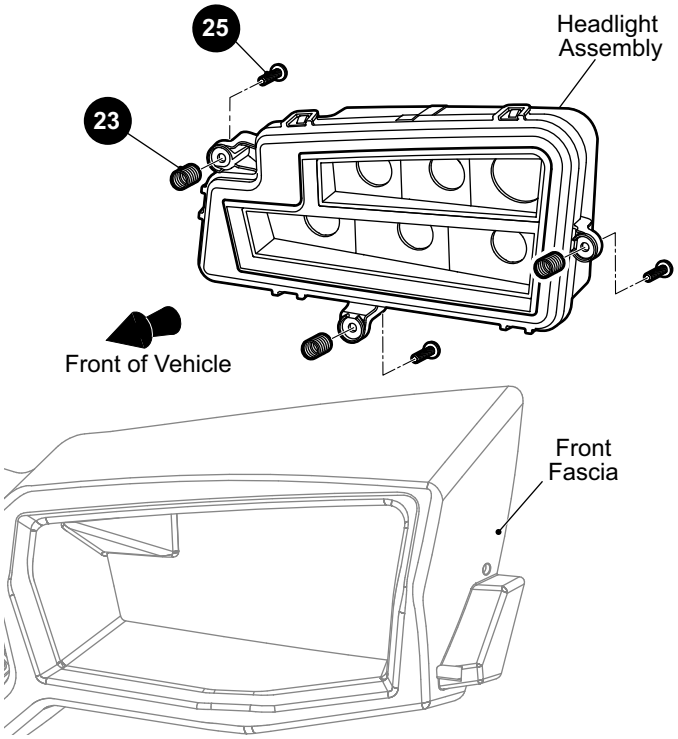


Fig. 2 Headlight Bulb Replacement

3. Secure the replacement headlight assembly in place with the three adjustment screws (25) and springs (23).

4. Connect the headlight wire to the wire harness.
5. Adjust the headlight beam (See below).

Headlight Beam Adjustment

Tool List	Qty.
Screwdriver, Flat Tip	1

1. Park the vehicle on a flat surface adjacent to a vertical wall. The front of the vehicle should be approximately 25 ft. (7.6 m) from the wall (Ref. Fig. 3).
2. Measure the distance from the ground to the center of the headlight.
3. Mark the wall at the measured height.
4. Turn the key to the ON position.
5. Press the headlight switch to activate the headlights.
6. With a rider sitting in the vehicle, the brightest part of the headlight beam should be 8 in. (20 cm) below the mark on the wall.
7. Check both headlights in low and high (if equipped) beam settings.
8. If a headlight needs to be adjusted, remove three plastic rivets (25) and the rear cover (23).
9. Locate the three adjustment screws (25) in the back of the headlight (See Fig. 2). Turn the screws to adjust vertically and horizontally.
10. Repeat steps until the headlight is properly adjusted.
11. Replace cover (23) and secure with plastic rivets (25).

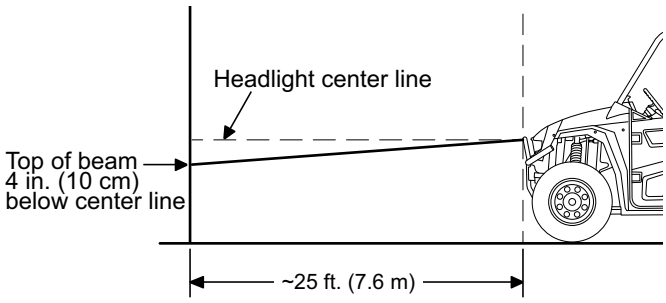


Fig. 3 Headlight Beam Adjustment

Brake Light Bulb Replacement

Tool List	Qty.
Screwdriver, Flat Tip	1

⚠ CAUTION ***Light components can get hot if they have been in operation. Allow the lights to cool before servicing to prevent burns to the skin.***

NOTICE: Do not touch a halogen bulb with bare fingers. Oil from skin leaves a reside that causes a hot spot and will diminish the life of the bulb.

NOTICE:

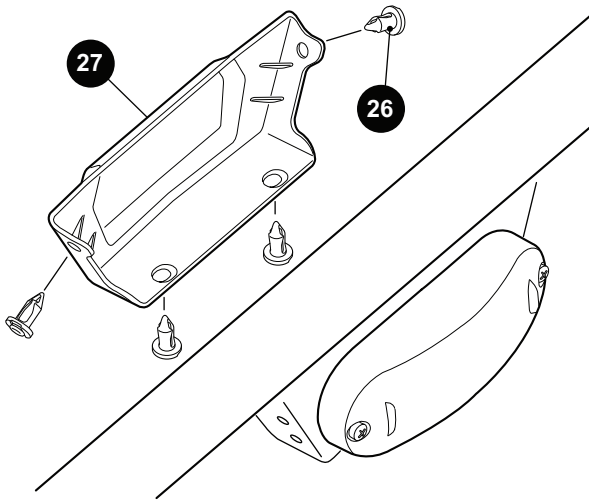


Fig. 4 Brake Light

1. Remove the four plastic rivets (26) that secure the back cover (27) to the back of the light (Ref. Fig. 4). Remove the back cover.
2. Rotate the bulb and pull it from the light housing.
3. Disconnect the bulb from the wire harness.
4. Connect the new bulb to the wire harness.
5. Insert the bulb and turn to secure in place.
6. Install the cover and secure with the plastic rivets.

Information Display Removal

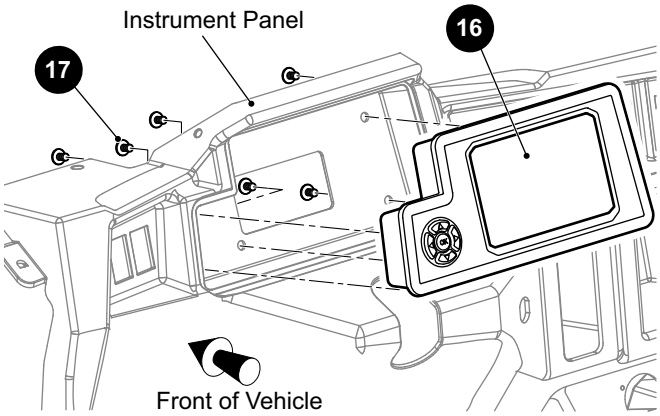


Fig. 5 Information Display

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

Tool List	Qty.
Ratchet	1
Torx Bit, T30	1

1. Disconnect the harness from the back of the information display (16).
2. Remove screws (17) that secure the information display to the instrument panel (Ref. Fig. 5).
3. Installation is the reverse order of removal.

Engine Control Unit (ECU)

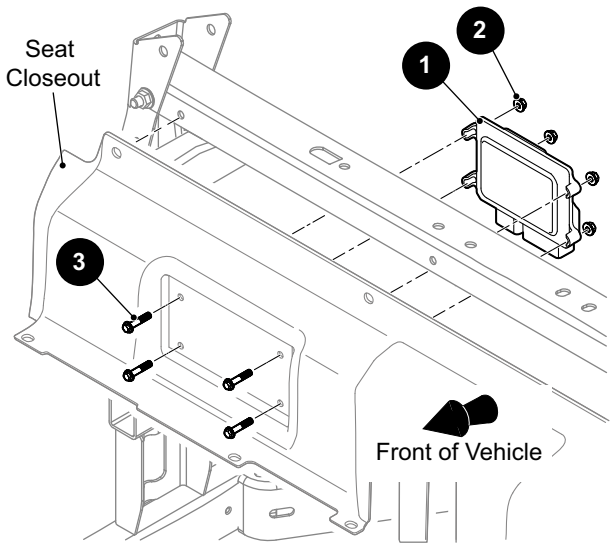


Fig. 6 Engine Control Unit (ECU)

Tool List	Qty.
Ratchet	1
Torx Bit, T30	1

1. Disconnect the harness from the bottom of the engine control unit (ECU) (1).
2. Remove the bolts (3) and nuts (2) that secure the ECU to the seat closeout panel (Ref. Fig. 6). Remove the ECU.
3. Installation is the reverse order of removal.

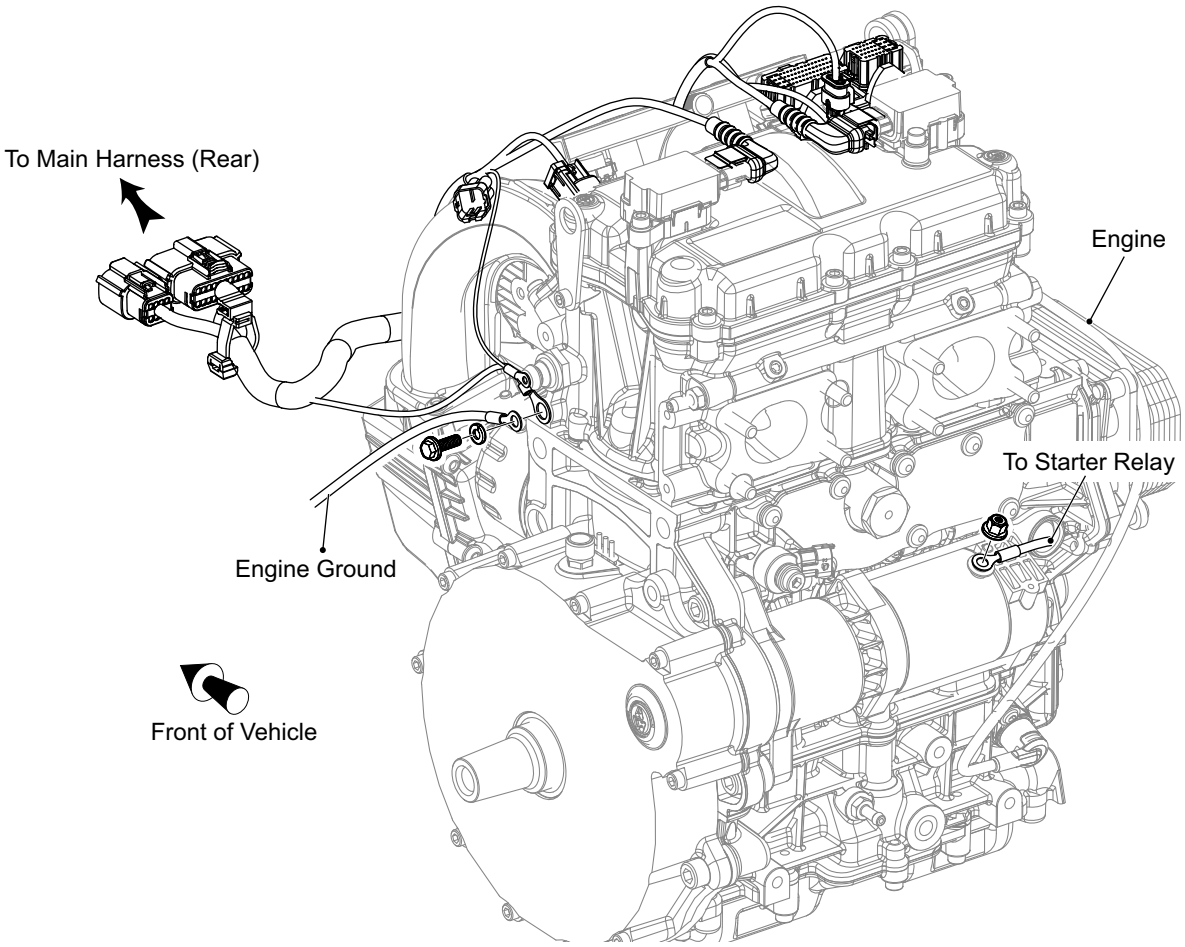


Fig. 7 Engine Electrical Connections

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

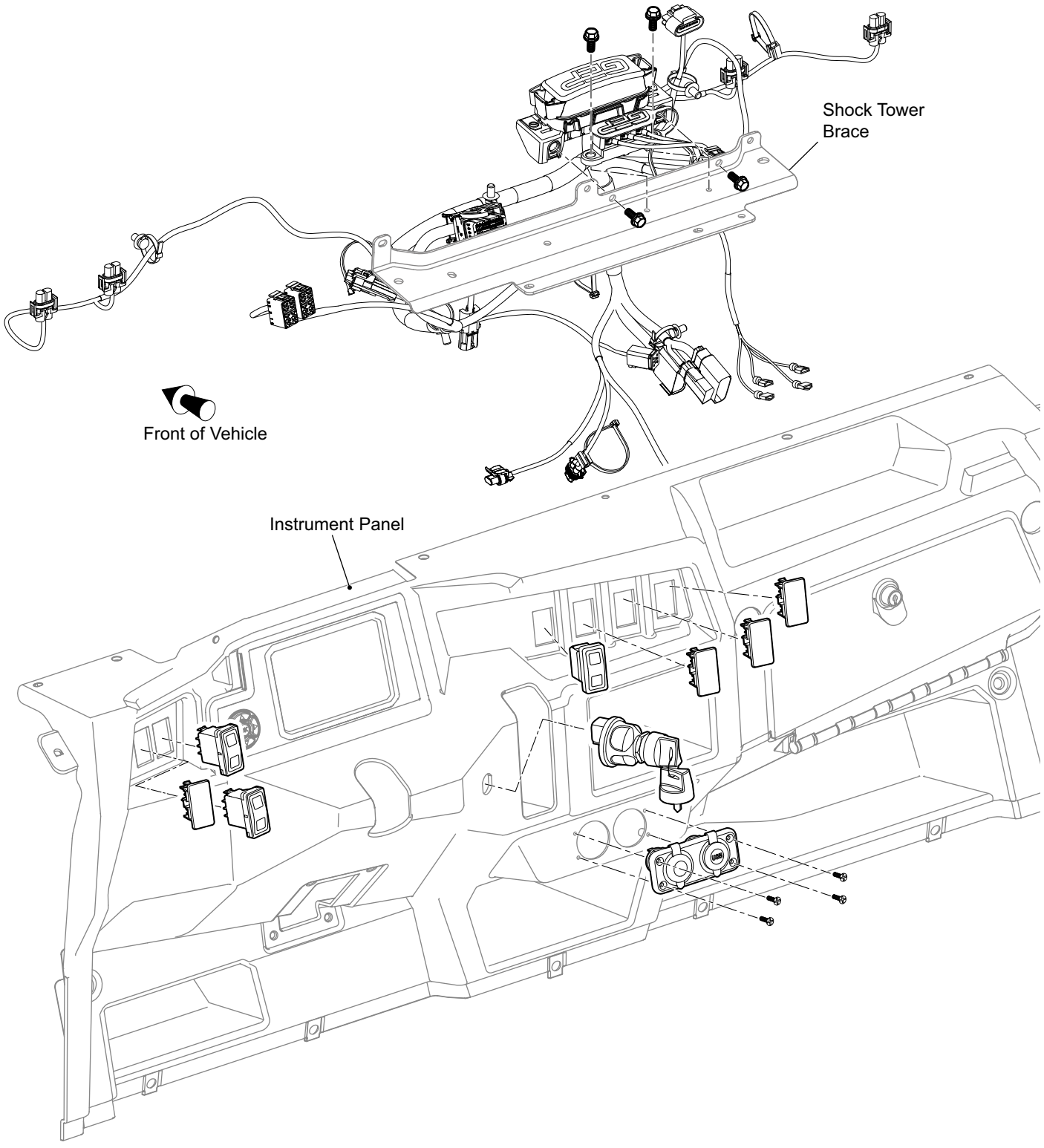


Fig. 8 Dash Electrical Components

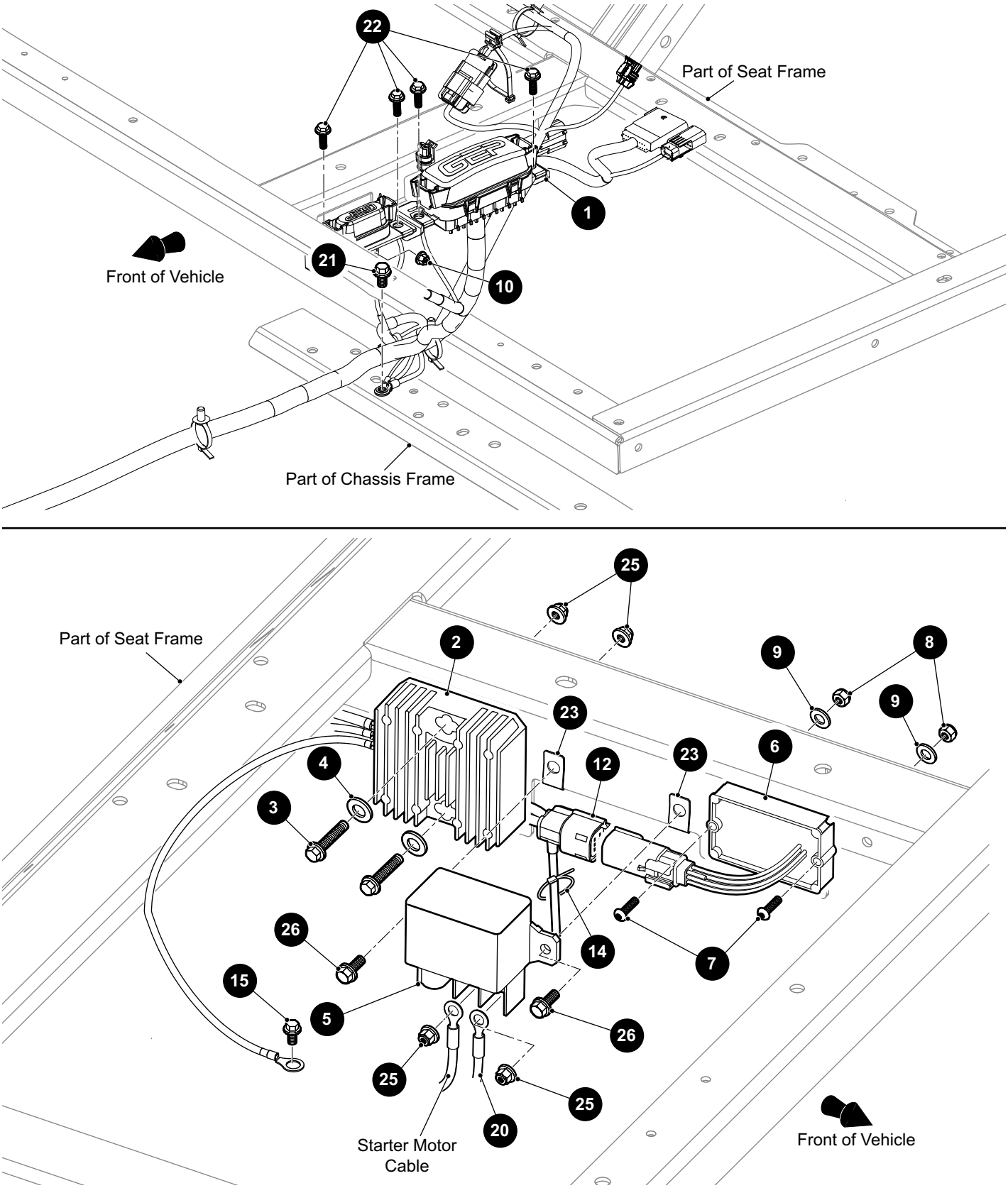

22
Part of Seat Frame
1
Front of Vehicle
21
10
Part of Chassis Frame
Part of Seat Frame
25
2
9
8
9
23
6
4
12
23
3
26
14
7
15
5
26
25
25
20
Starter Motor
Cable
Front of Vehicle

Fig. 9

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

Voltage Regulator Removal

Tool List **Qty.**

Wrench, Insulated, 1/2” 1
Ratchet 1
Socket, 10mm 1
Wrench, 10mm 1

1. Using an insulated wrench, disconnect the wire from the voltage regulator (2) from the negative (-) battery terminal.
2. Disconnect the remaining wires from the wire harness.
3. Remove bolts (3), washers (4) and nuts (25) that secure the voltage regulator (2) to the rear seat frame. Remove the voltage regulator.
4. Installation is in the reverse order of removal.

Starter Relay Removal

Tool List **Qty.**

Ratchet 1
Socket, 10mm 1

1. Remove the nuts (25) securing the starter motor wires to the starter relay (5). Remove the wires from the relay terminals.
2. Remove the bolts (26) that secure the starter relay (5) to the rear seat frame. Remove the starter relay.
3. Installation is in the reverse order of removal.

Solenoid Controller Removal

Tool List **Qty.**

Ratchet 1
Socket, 15mm 1
Screwdriver, Phillips Head 1

1. Disconnect the wire from the solenoid controller (6).
2. Remove screws (7), washers (9) and nuts (8) that secure the solenoid controller (6) to the rear seat frame. Remove the solenoid controller.
3. Installation is in the reverse order of removal.

ELECTRICAL SYSTEM

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

WIRING DIAGRAMS

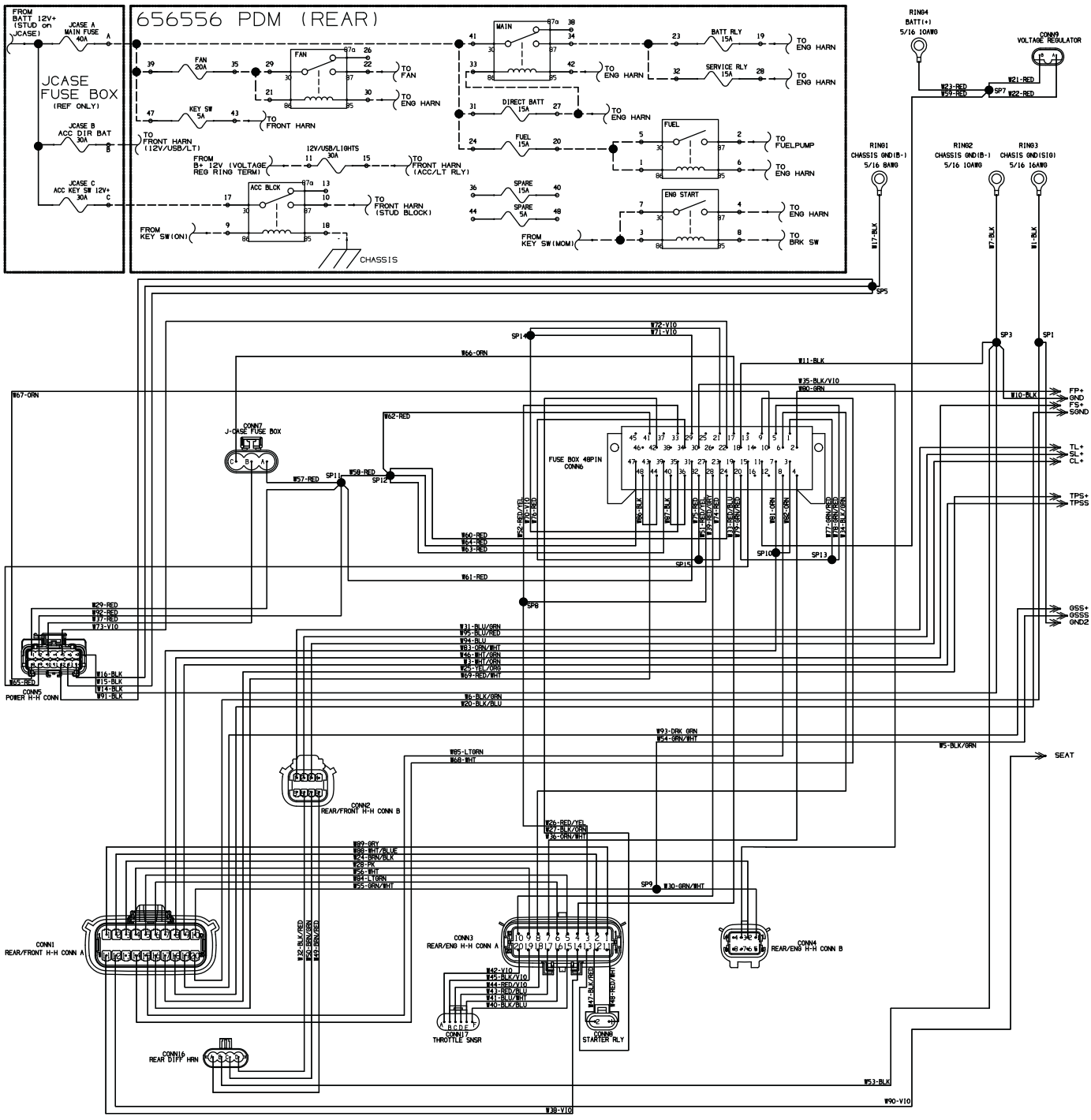
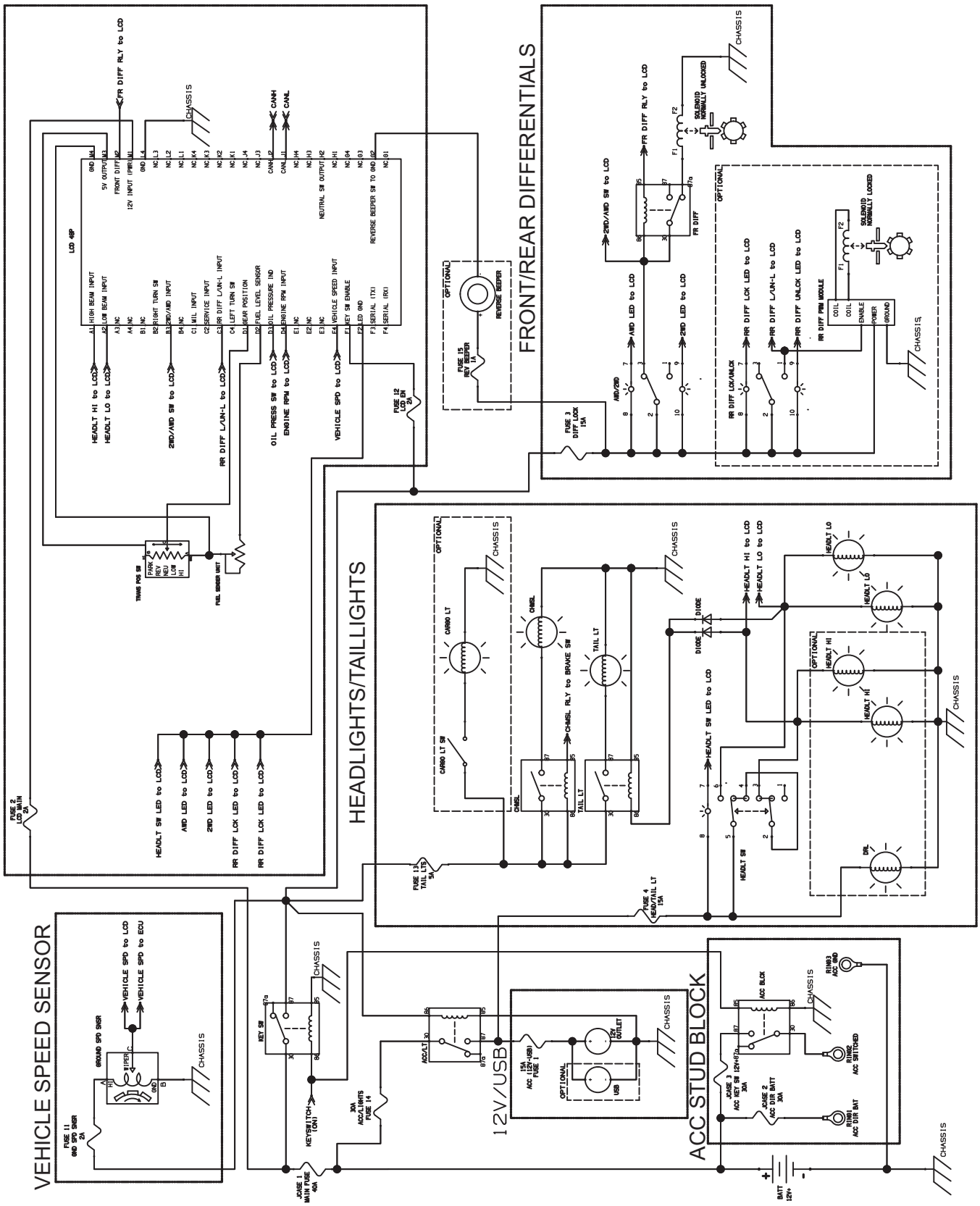
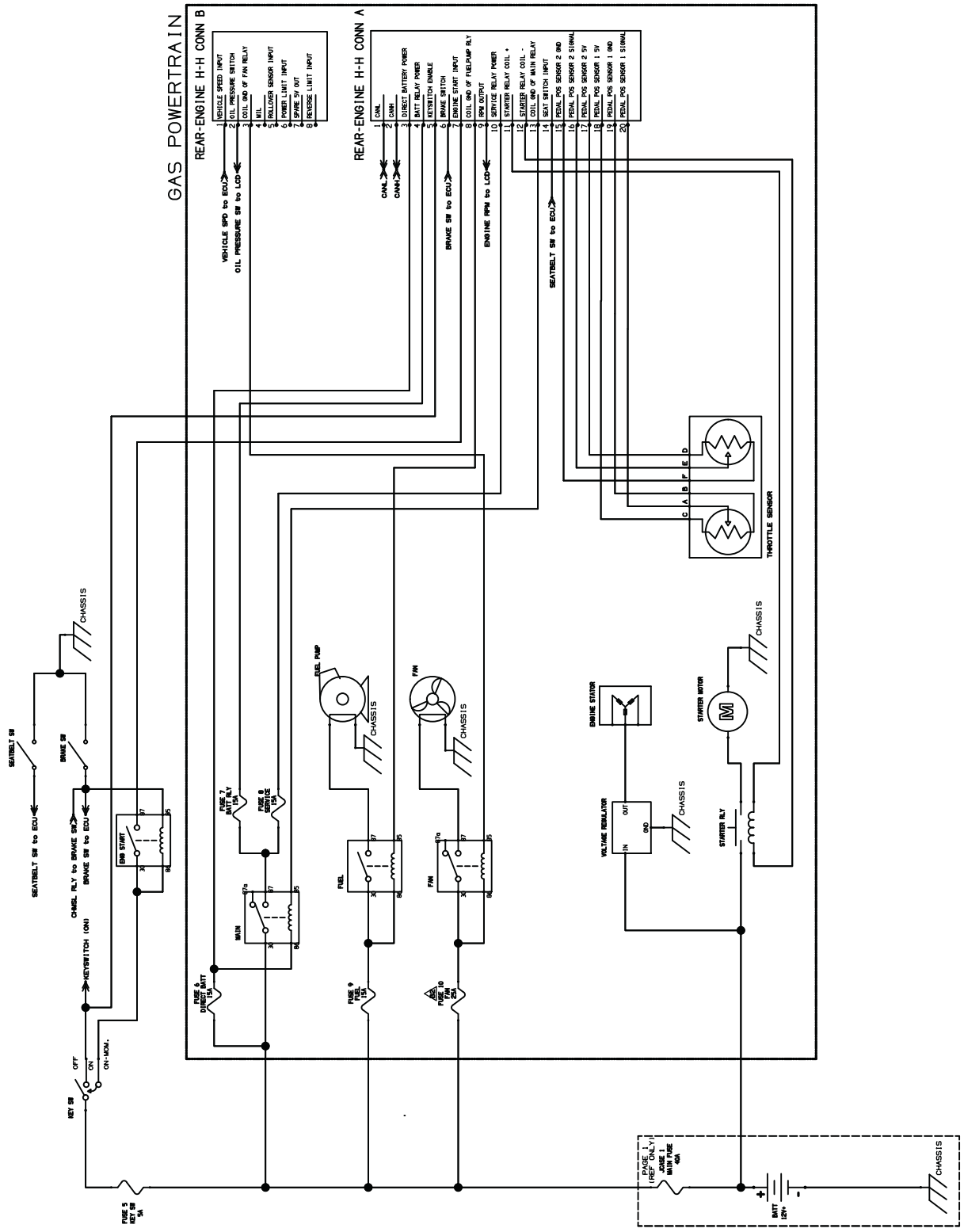


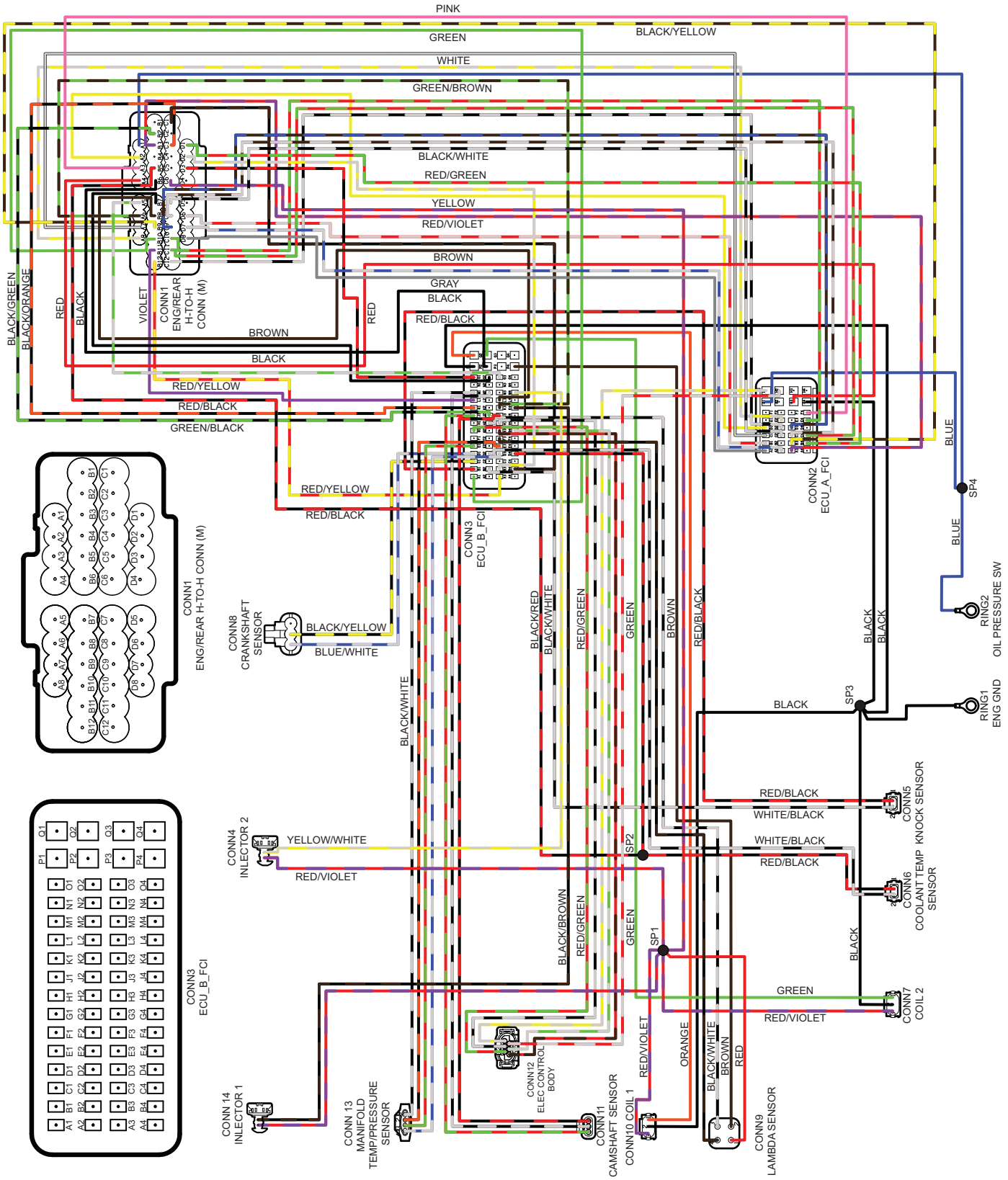
Fig. 10 Rear Harness


LCD
FRONT/REAR DIFFERENTIALS
HEADLIGHTS/TAILLIGHTS
VEHICLE SPEED SENSOR
12V/USB
ACC STUD BLOCK
CHASSIS
FR DIFF RLY to LCD
CANH
CANL
HEADLT HI to LCD
HEADLT LO to LCD
2WD/AMD SW to LCD
RR DIFF L/UN-L to LCD
OIL PRESS SW to LCD
ENGINE RPM to LCD
VEHICLE SPD to LCD
REVERSE BEEPER SW TO GND
2WD/AMD SW to LCD
AMD LED to LCD
2ND LED to LCD
FR DIFF RLY to LCD
SOLENOID NORMALLY UNLOCKED
SOLENOID NORMALLY LOCKED
RR DIFF LOCK LED to LCD
RR DIFF L/UN-L to LCD
RR DIFF UNLOCK LED to LCD
RR DIFF PRN MODULE
HEADLT SW LED to LCD
AMD LED to LCD
2ND LED to LCD
RR DIFF LCK LED to LCD
RR DIFF LCK LED to LCD
CHMSL RLY to BRAKE SW
HEADLT SW LED to LCD
HEADLT HI to LCD
HEADLT LO to LCD
DIODE
CARGO LT
CARGO LT SW
CHMSL
TAIL LT
HEADLT LO
HEADLT HI
HEADLT SW
DRL
VEHICLE SPD to LCD
VEHICLE SPD to ECU
GROUND SPD SNSR
WIPER
KEY SW
KEYSWITCH (ON)
ACC/LT
15A ACC 12V-USB FUSE 1
12V OUTLET
USB
ACC BLOCK
ACC SWITCHED
ACC DIR BATT
BATT 12V+
FUSE 1 MAIN FUSE 40A
FUSE 2 LCD MAIN 5A
FUSE 3 DIFF LOCK 15A
FUSE 4 HEAD/TAIL LT 15A
FUSE 11 GND SPD SNSR 2A
FUSE 12 LCD BK 2A
FUSE 13 TAIL LTS 5A
FUSE 15 REV BEEPER 1A
30A ACC/LIGHTS FUSE 14
TRANS POS SW
FUEL SENDER UNIT
OPTIONAL

ELECTRICAL SYSTEM

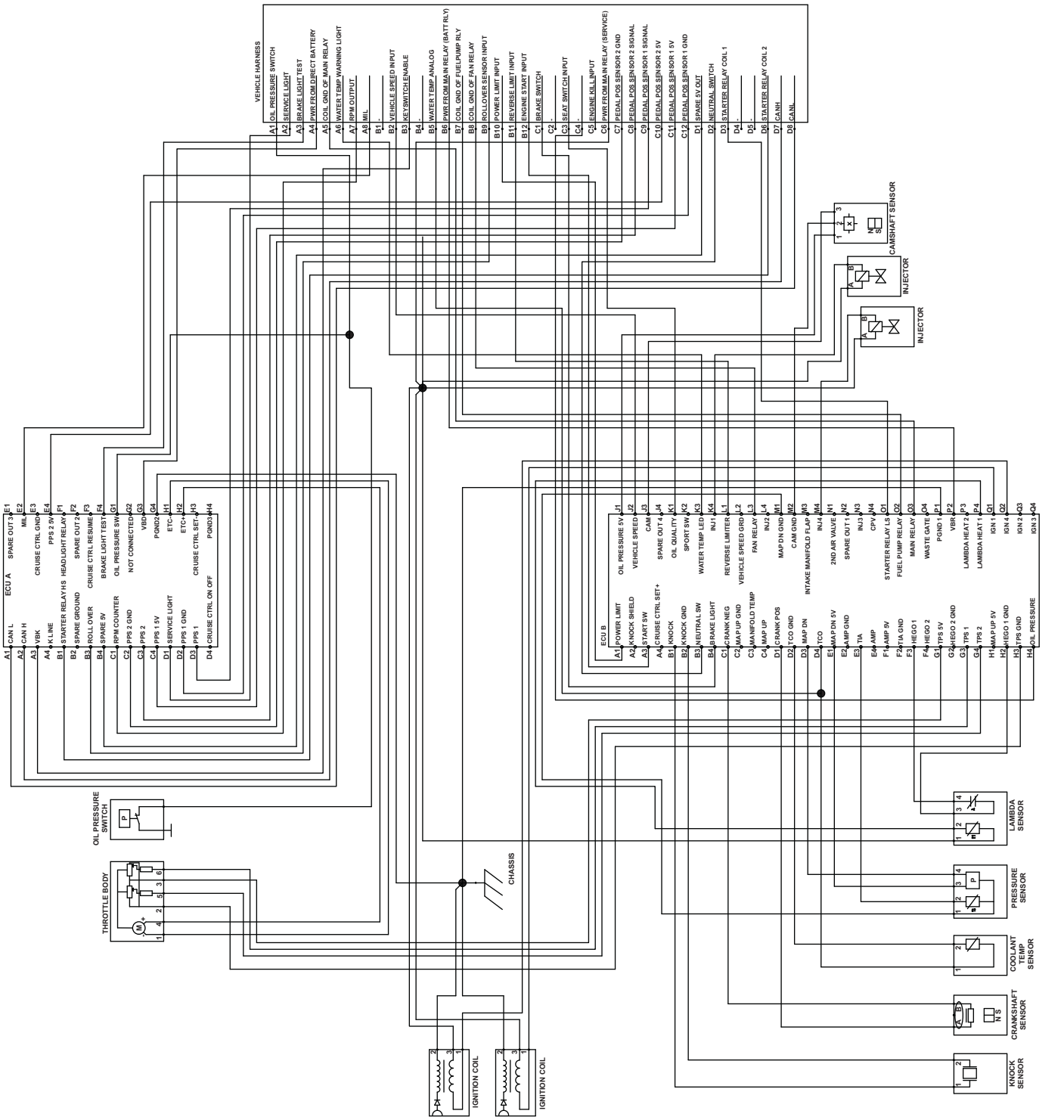
Read all of SAFETY and this section before attempting any procedure. Pay particular attention to Notices, Cautions, Warnings and Dangers.

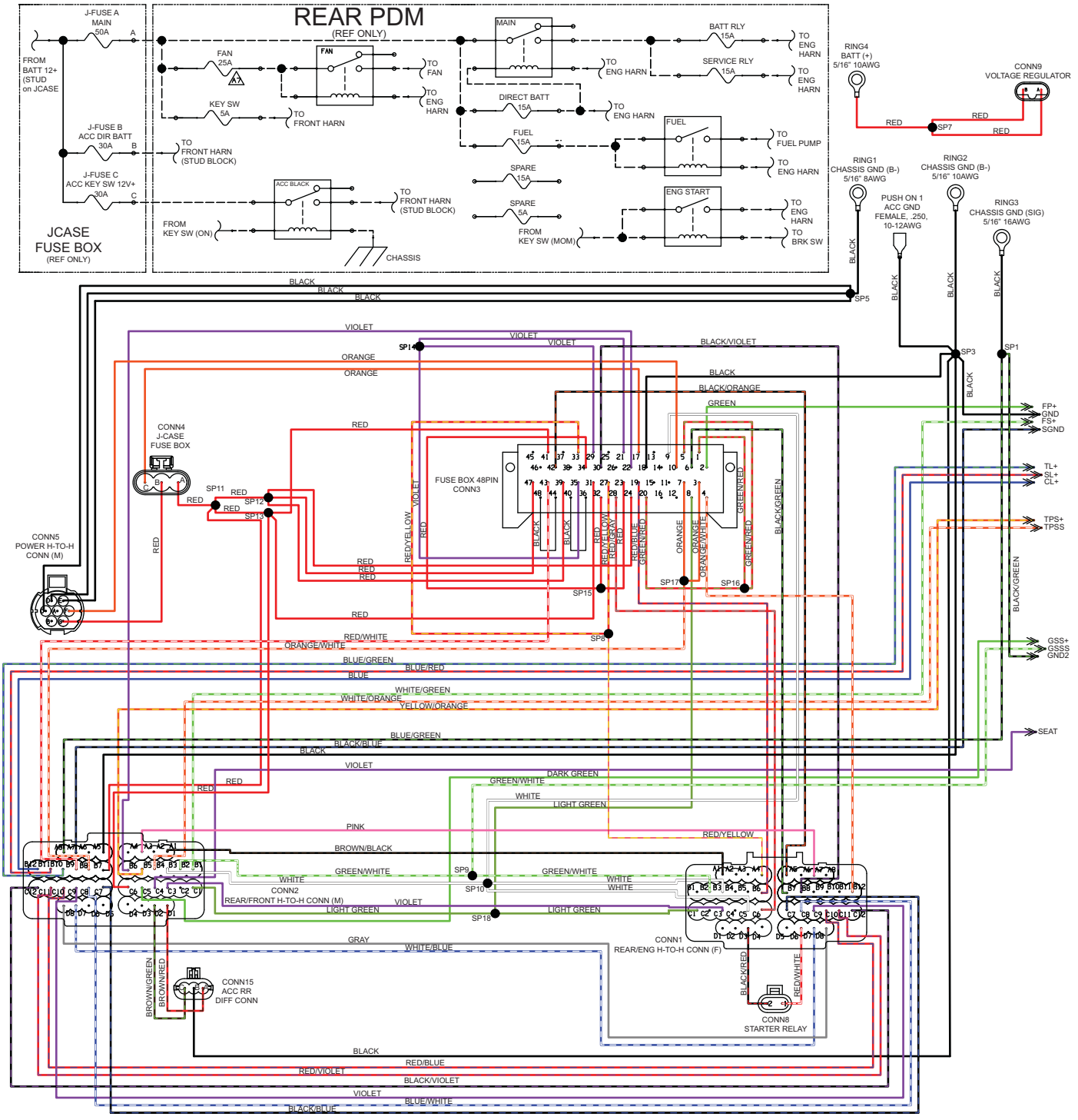



PINK
GREEN
BLACK/YELLOW
WHITE
GREEN/BROWN
BLACK/WHITE
RED/GREEN
YELLOW
RED/VIOLET
BROWN
GRAY
BLACK
RED/BLACK
BLACK/GREEN
BLACK/ORANGE
RED
BLACK
VIOLET
CONN1 ENG/REAR H-TO-H CONN (M)
BROWN
BLACK
RED/YELLOW
RED/BLACK
GREEN/BLACK
RED
CONN2 ECU_A_FCI
BLUE
SP4
RING2 OIL PRESSURE SW
CONN1 ENG/REAR H-TO-H CONN (M)
CONN3 ECU_B_FCI
CONN8 CRANKSHAFT SENSOR
BLACK/YELLOW
BLUE/WHITE
BLACK/RED
BLACK/WHITE
RED/GREEN
GREEN
BROWN
RED/BLACK
BLACK
BLACK
SP3
RING1 ENG GND
BLACK
BLACK/WHITE
RED/BLACK
WHITE/BLACK
CONN5 KNOCK SENSOR
CONN4 INLECTOR 2
YELLOW/WHITE
RED/VIOLET
SP2
WHITE/BLACK
RED/BLACK
CONN6 COOLANT TEMP SENSOR
BLACK/BROWN
RED/GREEN
GREEN
SP1
BLACK
GREEN
RED/VIOLET
CONN7 COIL 2
CONN3 ECU_B_FCI
CONN12 ELEC CONTROL BODY
RED/VIOLET
ORANGE
BLACK/WHITE
BROWN
RED
CONN 14 INLECTOR 1
CONN 13 MANIFOLD TEMP/PRESSURE SENSOR
CONN11 CAMSHAFT SENSOR
CONN10 COIL 1
CONN9 LAMBDA SENSOR

ELECTRICAL SYSTEM

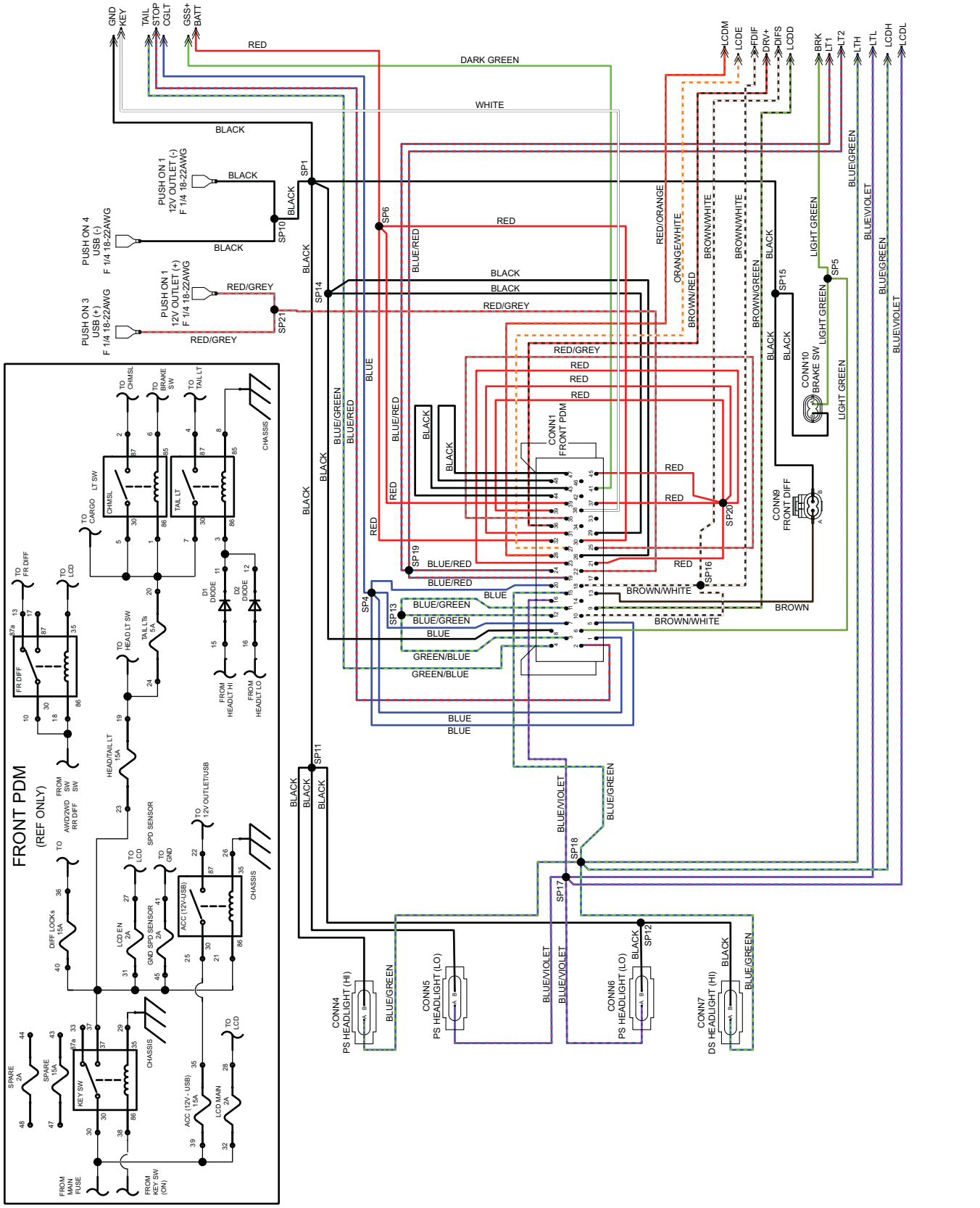
Read all of SAFETY and this section before attempting any procedure. Pay particular attention to Notices, Cautions, Warnings and Dangers.



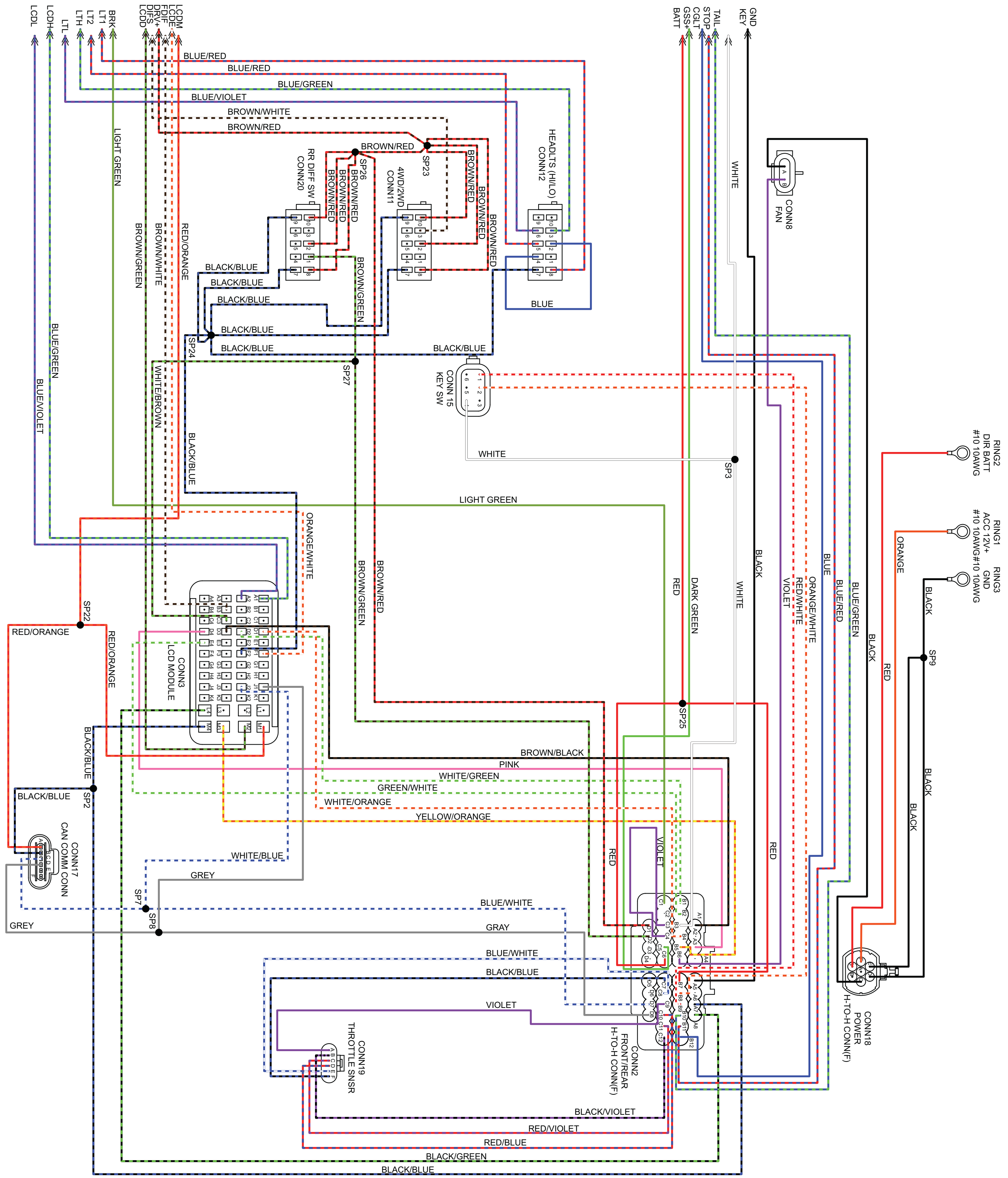

REAR PDM
(REF ONLY)
JCASE
FUSE BOX
(REF ONLY)
J-FUSE A
MAIN
50A
FROM
BATT 12+
(STUD
on JCASE
J-FUSE B
ACC DIR BATT
30A
J-FUSE C
ACC KEY SW 12V+
30A
FAN
25A
KEY SW
5A
TO
FRONT HARN
TO
FRONT HARN
(STUD BLOCK)
FROM
KEY SW (ON)
ACC BLACK
CHASSIS
TO
FAN
TO
ENG
HARN
MAIN
DIRECT BATT
15A
FUEL
15A
SPARE
15A
SPARE
5A
FROM
KEY SW (MOM)
BATT RLY
15A
SERVICE RLY
15A
FUEL
ENG START
TO
ENG HARN
TO
FUEL PUMP
TO
BRK SW
RING4
BATT (+)
5/16" 10AWG
CONN9
VOLTAGE REGULATOR
RING1
CHASSIS GND (B-)
5/16" 8AWG
RING2
CHASSIS GND (B-)
5/16" 10AWG
RING3
CHASSIS GND (SIG)
5/16" 16AWG
PUSH ON 1
ACC GND
FEMALE, .250,
10-12AWG
SP1
SP3
SP5
SP7
SP8
SP9
SP10
SP11
SP12
SP13
SP14
SP15
SP16
SP17
SP18
CONN4
J-CASE
FUSE BOX
CONN5
POWER H-TO-H
CONN (M)
FUSE BOX 48PIN
CONN3
CONN2
REAR/FRONT H-TO-H CONN (M)
CONN1
REAR/ENG H-TO-H CONN (F)
CONN15
ACC RR
DIFF CONN
CONN8
STARTER RELAY
FP+
GND
FS+
SGND
TL+
SL+
CL+
TPS+
TPSS
GSS+
GSSS
GND2
SEAT
BLACK
BLACK/VIOLET
BLACK/ORANGE
GREEN
VIOLET
ORANGE
RED
RED/YELLOW
RED/BLUE
RED/GRAY
GREEN/RED
BLACK/GREEN
ORANGE/WHITE
RED/WHITE
ORANGE/WHITE
BLUE/GREEN
BLUE/RED
BLUE
WHITE/GREEN
WHITE/ORANGE
YELLOW/ORANGE
BLACK/BLUE
GREEN/WHITE
DARK GREEN
WHITE
LIGHT GREEN
PINK
BROWN/BLACK
WHITE
WHITE
LIGHT GREEN
GRAY
WHITE/BLUE
BROWN/GREEN
BROWN/RED
BLACK/RED
RED/VIOLET
BLACK/VIOLET
BLUE/WHITE
BLACK/BLUE

ELECTRICAL SYSTEM

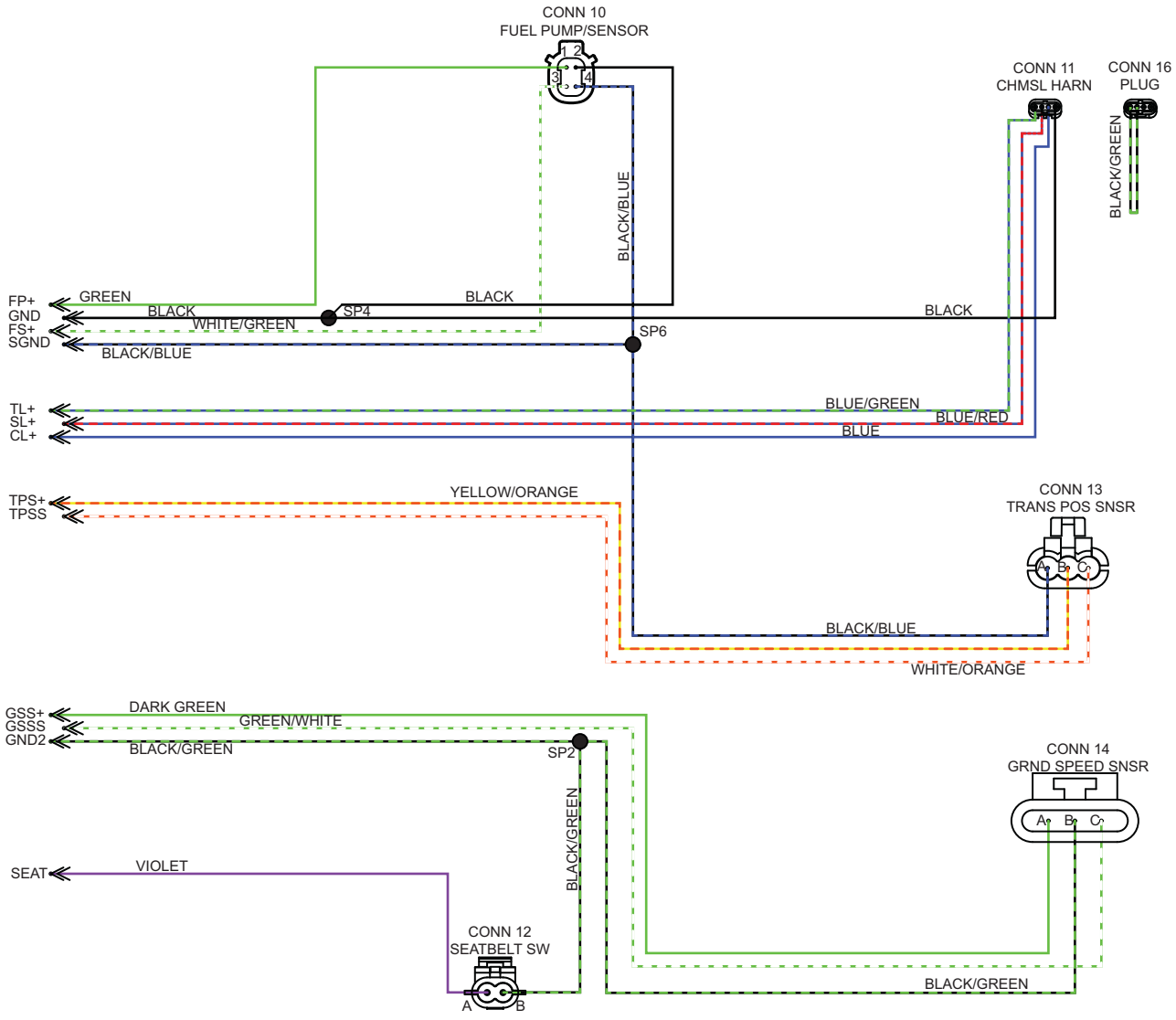
Read all of SAFETY and this section before attempting any procedure. Pay particular attention to Notices, Cautions, Warnings and Dangers.



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



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



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

Notes:

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

Notes:

FAULT TESTING

General

To effectively troubleshoot the electrical circuits that include the headlights, brake light and the information display, etc, the technician must be able to use the wiring diagram and a Digital Voltage Ohm Meter (DVOM).

Voltmeter

⚠WARNING ***Before performing any test of wiring components, disconnect the battery cables from the battery posts to prevent electrical shock or explosion. See SAFETY on page 17.***

Electrical tests of the wiring for continuity may be made with a DVOM (Digital Volt Ohm Meter). Always follow the meter manufacturer's recommendations and instructions for the use and care of the meter. For the purpose of this section, the red probe (+) and black probe (-) are used. Set the meter selector to the ohms scale and check continuity between each circuit component.

Continuity Check

⚠WARNING ***To prevent possible injury or death resulting from a battery explosion, use an insulated wrench and remove the negative (-) cable from the battery to disconnect electrical power to vehicle.***

Turn the key switch to the OFF position. Place the direction selector in the P (park) position before disconnecting power by removing the negative (-) connection to the battery.

To check for continuity, set the DVOM to the KΩ 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 KΩ, the meter will indicate "0" when it detects continuity.

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.

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.

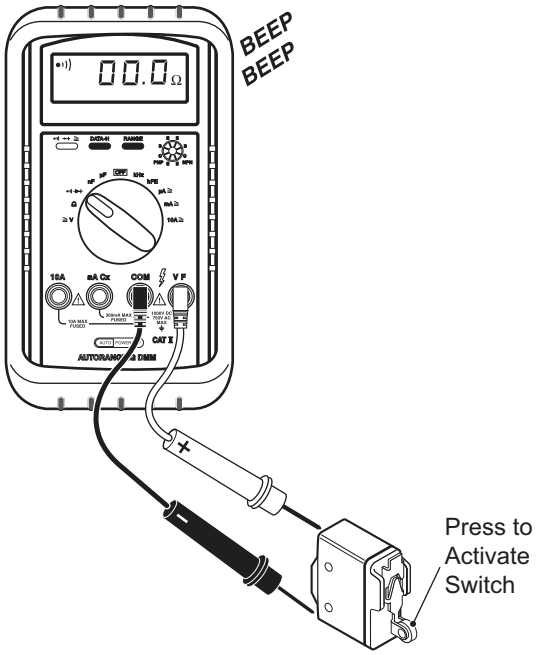


Fig. 1 Continuity Check of Switch

Testing the Ignition System

Locate the spark plugs and remove plug boot.

Use a spark plug tester between the plug boot and the spark plug. Turn the key to engage the starter. A steady spark should be observed. If spark is not adequate, inspect the coil and the spark plug wire.

Testing Fuses

Check all the fuses to make sure that components are properly powered.

If the fuse appears to be blown, replace the fuse.

FAULT TESTING

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

DIAGNOSTICS

This vehicle is equipped with an on-board computer diagnostic system that stores diagnostic trouble codes (or fault codes). Trouble codes are stored when a sensor in the vehicle reports a reading that is outside the normal/accepted range.

Trouble codes identify a particular problem area and provides a guide as to where a fault might be occurring within the vehicle.

NOTICE: A complete list of codes can be found in Appendix A.

To enter the selectable displays:

1. Make sure the key is in the OFF position.
2. Press and hold the OK button on the display control pad while turning the ignition key to the ON position. Turning the key past the ON position and starting the engine will exit the display.
3. Release the OK button.
4. Use UP and DOWN on the control pad to scroll through the top level displays.

Display 1 - FAULTS - Engine

NOTICE: Only the CLEAR option in this menu is editable.

1. With FAULTS (with engine symbol) displayed, press the RIGHT arrow to enter the fault codes display.

2. Press UP or DOWN to scroll through three fault code displays:

A

B

(example code)

C

(example code)

- Display A indicates no trouble code. No further action required.
- Display B indicates a historical (HIST on right) trouble code.
- Display C indicates an active (ACTI on right) trouble code.

3. Press DOWN to scroll through additional trouble codes if there are any. CLEAR will be the last display.

4. Press the OK button to enter the edit mode (wrench displays). LEFT and RIGHT arrows toggle YES and NO.
   - Select NO and press OK to exit edit mode without clearing codes.
   - Select YES and press OK to clear codes.
5. Press LEFT arrow to return to top level display.

Display 2 - FAULTS - EPAS

NOTICE: Only the CLEAR option in this menu is editable.

1. With FAULTS (with EPAS symbol) displayed, press the RIGHT arrow to enter the fault codes menu.

2. Press UP or DOWN to scroll through fault code displays:

A

B

(example code)

3. Display A indicates no trouble code. No further action required.

C

(example code)

D

- Display B indicates a historical (HIST on right) trouble code.
- Display C indicates an active (ACTI on right) trouble code.
- Display D indicates vehicle not EPAS equipped or the EPAS is disabled.

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

4. Press DOWN to scroll through additional trouble codes if there are any. CLEAR will be the last display.

5. Press the OK button to enter the edit mode (wrench displays). LEFT and RIGHT arrows toggle YES and NO.

- Select NO and press OK to exit edit mode without clearing codes.
- Select YES and press OK to clear codes.

6. Press LEFT arrow to return to top level display.

Powertrain Performance

CONDITION	POSSIBLE CAUSE	CORRECTION
STARTER DOES NOT TURN	Weak or bad battery	Charge or replace as necessary.
	Terminals are loose or corroded	Clean and tighten.
	Poor wiring connections	Repair or replace wire and/or connections.
	Faulty ignition switch	Repair or replace wire switch, and/or connections.
	Blown fuses	Investigate cause and replace fuses.
	Solenoid faulty	If no audible 'click' is heard, check power and ground. Replace solenoid if power and ground are good.
	Starter terminals are loose or corroded	Tighten or clean.
	Leads are broken or faulty ground	Repair or replace.
	Bad relay	If no audible click is heard, replace engine start relay.
STARTER TURNS SLOWLY	Terminals are loose or corroded	Re-tighten or clean.
	Weak battery	Charge battery.
	Leads are nearly broken or connections are faulty	Check for any defect of leads at bend or joint. Replace leads or repair connections.
	Mechanical problem inside starter	Replace starter.
	Internal engine damage	Inspect and repair.
	Crankcase over filled with oil	Drain and fill to recommended level with approved oil.

Fig. 2 Powertrain Performance Troubleshooting

FAULT TESTING

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

CONDITION	POSSIBLE CAUSE	CORRECTION
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. See GENERAL SPECIFICATIONS.
	No spark at spark plugs. Broken or disconnected spark plug wiring	Check and replace if required. See GENERAL SPECIFICATIONS.
	Spark plugs fouled	Clean or replace.
	Incorrect spark plug	Check that spark plugs are the correct type. See GENERAL SPECIFICATIONS.
	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.
	Dirt or water in fuel line or throttle body	Clean lines and throttle body.
	Clogged fuel filter	Check and replace if required.
	Engine flooded	Clean/or replace spark plugs.
	Engine fuel starved	Check fuel line.
	Clogged air filter	Wash or replace as required.
	Plugged muffler or pipe	Repair or replace.
POOR LOW SPEED PERFORMANCE	Plugged gas tank vent	Clean or repair.
	Fuel pump faulty	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.
	Faulty thermostat	Replace.
ENGINE OVERHEATING	Coolant hose leak	Tighten hoses connections. Replace hoses.
	Damaged Radiator	Repair or replace.
	Faulty water pump	Repair or replace.
	Low coolant level	Add coolant. See GENERAL SPECIFICATIONS.
	Faulty radiator fan	Repair or replace.
	Damaged or plugged muffler	Clean, 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. See GENERAL SPECIFICATIONS.
	Wrong spark plug gap	Replace with correct spark plug. See GENERAL SPECIFICATIONS.
	Faulty ignition system	Check and repair if required.
	Poor quality gasoline	Use correct fuel, check bulk storage tank for proper storage and handling. See GENERAL SPECIFICATIONS.
	Air leak allowing dirt to enter system	Repair or replace air intake hose.

Fig. 2 Powertrain Performance Troubleshooting (Continued)

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

CONDITION	POSSIBLE CAUSE	CORRECTION
THROTTLE BODY FLOODS ENGINE	Fuel contamination	Clean fuel system/throttle body.
	Clogged air filter element	Clean or replace.
EXCESSIVE EXHAUST SMOKE	Wrong oil weight	Replace with recommended oil. See GENERAL SPECIFICATIONS.
	Dirty oil	Replace. See GENERAL SPECIFICATIONS.
	Crankcase overfilled with oil	Drain and fill to recommended level. See GENERAL SPPECIFICATIONS.
	Piston rings worn or broken	Replace.
	Valves worn	Replace.
	Valve seals or valve guides worn	Replace.
BACKFIRING	Faulty plug wires	Replace.
	Faulty ignition system	Check and repair if required.

Fig. 2 Powertrain Performance Troubleshooting (Continued)

STARTER FAULT TESTING

CONDITION	POSSIBLE CAUSE	CORRECTION
STARTER IS NOISY	Bolts are loose	Tighten to correct torque.
	Starter has foreign matter inside	Clean starter interior.
	Bearings are faulty	Replace.
	Bearings contain foreign matter	Replace.

Fig. 3 Starter/Generator Troubleshooting

SUSPENSION AND STEERING FAULT TESTING

CONDITION	POSSIBLE CAUSE	CORRECTION
UNEVEN TIRE WEAR	Incorrect tire pressure	Inflate to recommended pressure. See GENERAL SPECIFICATION.
	Improper alignment (Incorrect toe in)	Align front tires.
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	Brake system.
	Suspension component failure	Repair.
	Alignment incorrect	Align.

Fig. 4 Suspension and Steering Troubleshooting

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

Notes:

GENERAL SPECIFICATIONS

GENERAL SPECIFICATIONS CHART

Item	Specification
Maximum Weight Capacity (includes weight of operator, passenger, cargo, accessories)	1200 lbs. (544 kg)
Seating Capacity	2 person
Dry Weight	1755 lbs. (796 kg)
Curb Weight	1891 lbs. (858 kg)
Rollover Protection System (ROPS)	Certified ISO 3471 per ANSI/ROHVA 1
Fuel Capacity	~9 gal. (34 L)
Engine Oil Capacity	~3 qt. (2.8 L)
Coolant Capacity	~8 qt. (7.6 L)
Overall Length	126 in. (320 cm)
Overall Width	64 in. (163 cm)
Overall Height (no canopy)	77 in. (196 cm)
Overall Height (with canopy)	78.5 in. (199 cm)
Wheelbase	85.2 in. (210 cm)
Track Width (front)	55 in. (140 cm)
Track Width (rear)	55 in. (140 cm)
Ground Clearance (no load)	13 in. (33 cm)
Cargo Box (L x W x H)	32 in. x 49 in. x 12 in. (81 cm x 124 cm x 30 cm)
Extended Cab (L x W)	17 in. x 49.5 in. (43 cm x 126 cm)
Cargo Box Load Capacity *	600 lbs. (272 kg)
Extended Cab Load Capacity *	170 lbs. (77 cm)

* *California Load Capacity (Bed and Extended Cab combined) is 600 lbs. (272 kg).*

Towing Capacity (rear, if equipped)	2000 lbs. (907 kg)
Hitch Tongue Capacity (rear, if equipped)	150 lbs. (68 kg)
Towing Capacity (front)	1000 lbs. (453 kg)
Hitch Tongue Capacity (front)	100 lbs. (45 kg)
Engine Type	Naturally aspirated 4-stroke gasoline, parallel twin with balance shaft and single overhead camshaft (SOHC)
Engine Weight (without oil and coolant)	132 lbs. (60 kg)
Displacement	957 cc
Number of Cylinders	2
Bore x Stroke	92 mm x 72 mm
Compression Ratio	11.5:1
Starter System	Electric
Fuel System	Sequential multi-point manifold injection
Ignition System	3-position key; electrical starter
Throttle Body	Electronically controlled
Spark Plug	Champion RC7PYCBX (2)
Electrical System	12 V

GENERAL SPECIFICATIONS

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

Item	Specification
Battery	Single, 12 V starter
Lubrication System	Dry sump
Cooling	Liquid
Shift Type	Single lever on console
Gear Reduction (L)	28.03:1
Gear Reduction (R)	25.49:1
Gear Reduction (H)	10.24:1
Drive Ratio (front)	3.81:1
Transmission	Continuous Variable Transmission (CVT)
Steering	Self-compensating rack and pinion (EPAS)
Tire Size, standard, front and rear	28 x 10-14 ITP Ultracross
Tire Pressure, front and rear	12 psi (83 kPa)
Wheels, standard	Cast aluminum
Brakes	Foot activated, 4-wheel hydraulic disc
Headlights	High/Low LED with LED accent light
Taillight	Center high mounted stop light (CHMSL) 7W Halogen
Brake Light	27W Halogen
Maximum Weight Capacity (includes weight of operator, passenger, cargo, accessories)	1200 lbs. (544 kg)
Seating Capacity	2 person
Dry Weight	1755 lbs. (796 kg)
Curb Weight	1891 lbs. (858 kg)

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

Notes:

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

Notes:

SCHEDULED MAINTENANCE

Consistent inspection, adjustment and lubrication of some components are necessary to maintain your vehicle so that it remains in safe and reliable condition. See *SCHEDULED MAINTENANCE CHART* on page 174.

Inspect, clean, lubricate, adjust and replace parts as necessary. Use original or equivalent replacement parts.

Record the maintenance items performed along with details.

NOTICE: Service and adjustments are important for safe and reliable vehicle operation. If not familiar with safe service and adjustment procedures, have your dealer perform the operations.

Initial Service Requirements

Perform the additional inspection or maintenance at the initial service interval indicated, in addition to regular intervals. The initial service is required for optimum performance and reliability.

- engine oil and filter
- valve lash
- front differential oil
- rear differential oil

Severe Use Conditions

Vehicles subjected to heavy or severe use must be inspected and serviced more frequently than those of normal use patterns.

The following conditions are considered severe use:

- frequent or prolonged use in a dusty environment
- prolonged low speed operation
- prolonged heavy load operation
- frequent use or immersion in mud, water or sand
- short trips in cold weather
- extended idle
- racing or high RPM use

SCHEDULED MAINTENANCE

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

SCHEDULED MAINTENANCE CHART

Perform all services at the maintenance interval reached first. It is recommended, but not required, that all service items are performed by an authorized dealer. The owner (“you”) is responsible for ensuring that scheduled maintenance is performed. You may choose any qualified repair shop or person to maintain, replace or repair emission control devices and systems with OEM or equivalent parts. See *Emissions Limited Warranty* for information related to emission related components and systems.

S **–**Indicates operations that need to be performed on vehicles subjected to severe use.

	Item	Interval (perform at interval that comes first)			Remarks
		Hours	**Calendar**	**Miles (km)**	
	Engine oil and filter	Initial Service			Replace oil and filter between first 12 and 25 hours or 250 miles (402 km).
	Valve Lash	Initial Service			Check and adjust between first 12 and 25 hours or 250 miles (402 km). See engine manual or take to dealer.
	Front differential oil	Initial Service			Check oil between first 12 and 25 hours.
	Rear differential oil	Initial Service			Check oil between first 12 and 25 hours.
S	Air filter		Weekly		Inspect. Replace as needed.
S	Brake pads	10	Monthly		Inspect. Replace as needed.
	Battery	20	Monthly		Inspect terminals. Clean as needed.
	Prop shaft	50	3 Months		Inspect and lubricate.
S	General lubrication	50	3 Months	500 (800)	Lubricate all fittings, pivots, cables, etc. where required.
	Shift linkage	50	6 Months		Inspect, lubricate and adjust.
	Steering	50	6 Months	500 (800)	Inspect. Replace if excessive play is found.
S	Front suspension	50	6 Months	500 (800)	Inspect. Replace if wear or leaks are detected.
S	Rear suspension	50	6 Months	500 (800)	Inspect. Replace if wear or leaks are detected.
	Throttle body, air intake ducts and flange	50	6 Months	500 (800)	Inspect for proper sealing. Clean as required.
	CVT belt	50	6 Months	500 (800)	Inspect. Replace as needed.
	Spark arrester	50	6 Months	500 (800)	Inspect and clean as required.
	Cooling system	50	6 Months		Inspect coolant strength seasonally.
S	Oil lines, fasteners	50	6 Months		Inspect for leaks and loose fittings.
S	Front differential oil (Inspection)	100	6 Months	1000 (1600)	Inspect for leaks and contamination; change if required. Also change yearly.
S	Rear differential oil (Inspection)	100	6 Months	1000 (1600)	Inspect for leaks and contamination; change if required. Also change yearly.
S	Engine oil and filter	100	Yearly	1500 (2400)	Change when preparing for storage (no operation for 90 days).
	Valve lash	100	Yearly	2800 (4500)	See engine manual or take to dealer.
	Fuel system	100	Yearly	1000 (1600)	Check for leaks at tank cap, lines, throttle body. Replace with OEM parts if needed.

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

	Item	Interval (perform at interval that comes first)			Remarks
		Hours	Calendar	Miles (km)	
S	Radiator and cooling fan	100	Yearly		Inspect; clean exterior surfaces.
	Cooling system		Yearly		Pressure test system.
S	Cooling system	100	Yearly		Inspect for leaks.
S	Engine mounts	100	Yearly		Inspect. See repair manual for replacement.
	Exhaust muffler	100	Yearly		Inspect. See repair manual for replacement.
S	Front differential oil (Replacement)		Yearly		Replace at interval and also after immersion.
S	Rear differential oil (Replacement)		Yearly		Replace at interval and also after immersion.
S	Wiring	100	Yearly		Inspect for wear, routing, security. Apply dielectric grease to connectors subjected to water, mud, etc.
S	Clutches	100	Yearly	1000 (1600)	Clean and inspect. Replace worn parts.
	Wheel bearings	100	Yearly		Inspect. Replace as needed.
	Coolant		24 Months		Completely drain and replace with new mixture.
S	Spark plug	200	24 Months	5600 (9000)	Replace.
	Valve lash	200		5600 (9000)	Inspect. Adjust as needed.
S	Fuel lines		24 Months		Replace. See repair manual.
	Brake fluid	200	24 Months		Change.
	Toe adjustment				Inspect periodically. Adjust when parts are replaced.
	Item	**Interval** (perform at interval that comes first)			**Remarks**
		Hours	**Calendar**	**Miles (km)**	
	Engine oil and filter	Initial Service			Replace oil and filter between first 12 and 25 hours or 250 miles (402 km).
	Valve Lash	Initial Service			Check and adjust between first 12 and 25 hours or 250 miles (402 km). See engine manual or take to dealer.
	Front differential oil	Initial Service			Check oil between first 12 and 25 hours.
	Rear differential oil	Initial Service			Check oil between first 12 and 25 hours.
S	Air filter		Weekly		Inspect. Replace as needed.
S	Brake pads	10	Monthly		Inspect. Replace as needed.
	Battery	20	Monthly		Inspect terminals. Clean as needed.
	Prop shaft	50	3 Months		Inspect and lubricate.
S	General lubrication	50	3 Months	500 (800)	Lubricate all fittings, pivots, cables, etc. where required.
	Shift linkage	50	6 Months		Inspect, lubricate and adjust.

SCHEDULED MAINTENANCE

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

Item		Interval (perform at interval that comes first)			Remarks
		Hours	Calendar	Miles (km)	
	Steering	50	6 Months	500 (800)	Inspect. Replace if excessive play is found.

RECOMMENDED LUBRICANTS AND FLUIDS

Item	Capacity	Lubricants/Fluids		Notes
Engine oil	~3 qt. (2.8 L)	Mobil 1 0W40 Full Synthetic, ACX 0W40 or equivalent, meeting at least API SJ or ACEA A3/B3		See page 118.
Engine Coolant	~8 qt. (7.6 L)	Ethylene Glycol, silicate- and nitrate-free coolant suitable for aluminum engines		See page 133.
		Mixing ratio 50% water/50% coolant		
		Approved coolants	Chevron Havoline Coolant	
			Valvoline Zerex	
Fuel	~9 gal. (34 L)	Unleaded; 87 octane min; 91, 92 or 93 octane recommended 10% ethanol content max.		See page 137.
Brake fluid		DOT 4 brake fluid		See page 64.
Front differential oil	6 oz. (180 ml)	Mobil 424 recommended; Mobil Fluid LT or equivalent suitable		See page 81.
Rear differential oil (upper chamber)	22.0 oz. (650 ml)	Mobil 80W90 or equivalent		See page 98.
Rear differential oil (lower chamber)	94.7 oz. (2.8 L)	Mobil 80W90 or equivalent		See page 98.
Prop shaft		Universal joint grease or equivalent		Locate fittings on two u-joints and apply grease

REPLACEMENT OF MAINTENANCE ITEMS

These items or their equivalents can be purchased through your dealer, directly from manufacturer or any other qualified source.

Air filter	663655
Engine oil filter	105041
Spark Plug	RC7PYCBX (Champion)
CVT Belt	642176

NOTICE: A qualified repair shop or person of the owner's choosing may maintain, replace, or repair emission control devices and systems with original or equivalent replacement parts. However, warranty, recall and all other services paid for by manufacturer must be performed at an authorized service center.

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

Notes:

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

Notes:

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

APPENDIX A

FAULT CODES

DIAGNOSTIC MANUAL

APPENDIX A

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

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

EPAS FAULT CODES

Code	Name	Description	Notes	Bridge State
C1000	Over Current	This fault monitors the bridge currents to detect railed current signals. This fault is non-recoverable.	A power toggle will recover this fault if the hardware is not damaged.	Bridge Off
C1001	Excessive Current Error	This fault monitors our current control algorithm to check if we are correctly controlling the bridge. This fault is non-recoverable.	A power toggle will recover this fault if the hardware is not damaged.	Bridge Off
C1002	Torque Sensor Range	This fault monitors the torque sensor signals to check that they remain in the usable range. This fault is non-recoverable.	A power toggle will recover this fault if the hardware is not damaged.	Bridge Off
C1003	Torque Sensor Linearity	This fault monitors the linearity of the torque signals. This fault is non-recoverable.	A power toggle will recover this fault if the hardware is not damaged.	Bridge Off
C1004	Rotor Encoder Communication	This fault will set on a failure to communicate with the rotor encoder chip. This fault is non-recoverable.	A power toggle will recover this fault if the hardware is not damaged.	Bridge Off
C1005	Battery Voltage Low	This fault will set if the battery voltage drops below 8.5V. Recovery will occur at 9V.		Bridge Off
C1006	Battery Voltage High	This fault will set if the battery voltage rises above 16.5V. Recovery will occur at 16V.		Bridge Off
C1007	Temperature High	This fault will set if the unit temperature rises above 110°C. Recovery will occur at 105°C.		25% Reduction
C1008	Temperature Over	This fault will set if the unit temperature rises above 120°C. Recovery will occur at 115°C.		Bridge Off
C1009	Vehicle Speed Digital Loss	This fault will set when no vehicle speed pulses have been seen even though the engine RPM has been above the clutch engagement calibration for longer than the clutch timeout calibration. Recovery will occur if a vehicle speed pulse is seen within 10s of the fault setting, otherwise the fault is non-recoverable.	This fault is only checked for the “discrete” signal type selection. RPM is used to estimate speed.	25% Reduction
C1010	Vehicle CAN Loss	This fault will set if the vehicle message has not been received for the period set by the CAN Timeout calibration. Recovery will occur once the message has been received again.	This fault is only checked for the “CAN” and “CAN (No RPM)” signal type selections.	Bridge Off
C1011	Unused			
C1012	Engine RPM CAN Loss	This fault will set if the engine RPM message has not been received for the period set by the CAN Timeout calibration. Recovery will occur once the message has been received again.	This fault is only checked for the “CAN” signal type selection.	Bridge On

APPENDIX A

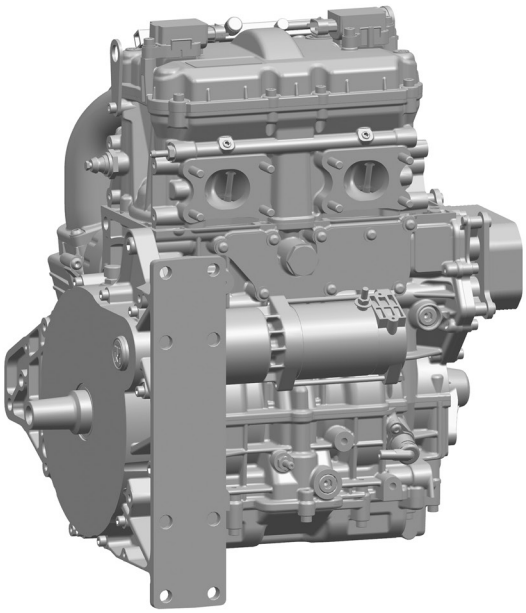
Read all of SAFETY and this section before attempting any procedure. Pay particular attention to Notices, Cautions, Warnings and Dangers.

C1013	EEPROM	This fault will set on a failure to communicate with the EEPROM chip. This fault is non-recoverable.	A power toggle will recover this fault if the hardware is not damaged.	Bridge Off
C1014	CAN Bus	This fault will set on a failure to transmit or receive a CAN message. This fault is non-recoverable.	A power toggle will recover this fault if the hardware is not damaged.	Bridge Off
C1015	Load Failure	This fault will set if the bootloader was unable to attempt the jump to the application code. This fault is only recoverable via a re-flash.	This fault is from the bootloader only.	Bridge Off
C1016	Boot Count	This fault will set if the bootloader attempted the jump to the application, but failed multiple times. This fault is only recoverable via a re-flash.	This fault is from the bootloader only.	Bridge Off
C1017	Engine RPM Plausibility	This fault will set if the engine hasn't been determined as running, but the vehicle speed exceeds 10MPH.	This fault is only checked for the “discrete” signal type selection.	Bridge Off
C1018	Vehicle Speed Plausibility	This fault will set if consecutive speed readings jump more than the Plausibility Max Delta Calibration. This fault is non-recoverable.	This fault is only checked for the “discrete” signal type selection.	25% Reduction
C1019	Vehicle Speed Digital Disconnect	This fault will set due to a current mirror circuit not detecting a sensor as connected. This fault is non-recoverable.	This fault is only checked for the “discrete (no RPM)" signal type selection. Open collector speed sensor can have issues with this circuit.	Bridge Off
C1020	Timeout	This is a battery saving feature that will shutdown the unit after 5 minutes of power with no engine RPM. Recovery will occur on detection of a running engine.		Bridge Off
C1021	Rotor Encoder Variance	This fault monitors the rotor encoder position to detect errors between the absolute and incremental position interfaces. This fault is non-recoverable.	A power toggle will recover this fault if the hardware is not damaged.	Bridge Off
C1022	Dual Loss	This fault will set if both the vehicle speed and engine RPM are detected as faulted. This fault is non-recoverable.	A power toggle will recover this fault if the hardware is not damaged.	Bridge Off
C1023	Gate Voltage Low	This fault monitors the gate voltages to prevent linear region FET operation. This fault is non-recoverable.	A power toggle will recover this fault if the hardware is not damaged.	Bridge Off
C1024	Unused			
C1025	Manufacturing Data CRC	This fault monitors the data written by the manufacturing line that is needed for the unit to operate correctly. This fault is non-recoverable.	This can only be fixed by returning the unit to Globe Motors.	Bridge Off
C1026	Application CRC	This fault will set if the bootloader calculated CRC doesn't match the known good application CRC to prevent jumping to a corrupt application space. This fault is recoverable via a re-flash.	This fault is from the bootloader only.	Bridge Off
C1027	Vehicle Speed CAN Error	This fault will set if the vehicle speed message data indicates error. Recovery will occur on the reception of a valid value	This fault is only checked for the “CAN” and “CAN (No RPM)” signal type selections. RPM is used to estimate speed.	25% Reduction

C1028	Engine RPM CAN Error	This fault will set if the engine RPM message data indicates error. Recovery will occur on the reception of a valid value.	This fault is only checked for the “CAN” signal type selection.	Bridge On
C1029	Vehicle Speed Max	This fault will set if a speed is detected above the vehicle speed max calibration for longer than the max time calibration.	This fault is only checked for the “CAN”, “CAN (no RPM), “discrete”, and “discrete (NO RPM)” signal type selection. RPM is used to estimate speed.	25% Reduction
C1030	Engine RPM Max	This fault will set if an RPM is detected above the engine RPM max calibration for longer than the max time calibration.	This fault is only checked for the “CAN” and “discrete” signal type selection.	Bridge On
C1031	Unused			

Notes:

TEXTRON MOTORS



DIAGNOSTIC MANUAL

4-Stroke Engine
MPE 850 OFF-ROAD

This diagnostic manual is valid for the following engine models:

– 409135 I2 846 UTV NA-80

TD409135_DHB
Rev A
17.12.2015
en_English

Read the introductory chapter before performing the task on the engine.
Pay particular attention to the safety messages.

Textron Motors GmbH

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Germany

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Table of contents

1 About this document

This diagnostic manual was designed to help you operate the engine safely and reliably.

Observe the following information:

– Read the service manual before you begin working.
– Always you also need the engine’s repair manual and the vehicle manufacturer's documentation.
– Some figures in this diagnostic manual are general illustrations and may differ from the actual engine.

1.1 Meaning of the symbols and signal words

Item	Meaning
NOTICE	The signal word *NOTICE* indicates potential property damage.
Information	The signal word **Information** indicates specific features and recommendations.

1.2 Change management

Textron Motors GmbH strives to make continual improvements as part of the ongoing technical development of its products. Therefore descriptions in the diagnostic manual can be changed or added. All changes are described in the chapter Overview of revisions.

Observe the following information:

– Always use the most current diagnostic manual from the protected area on our website www.textronmotors.com.

2 Safety

This engine is state-of-the-art and built according to recognized safety-technical regulations. Ignoring the information in this diagnostic manual may result in personal injury or property damage.

This diagnostic manual is solely intended for use in a workshop authorized by Textron Motors or the vehicle manufacturer. All work on the engine must be performed by appropriately trained personnel.

Before beginning any work, trained personnel authorized to work on the engine must have access to the complete documentation of the engine. Make sure that trained personnel have read and understand all introductory chapters and in particular, the chapter on safety.

Observe all generally applicable laws and regulations in addition to the information in this diagnostic manual:

– accident prevention
– environmental protection
– handling of hazardous materials
– personal safety equipment
– traffic laws

2.1 Meaning of the safety alert symbol and signal words

Item	Meaning
	The safety alert symbol draws your attention to possible dangers.
WARNING	The signal word **WARNING** indicates a potentially dangerous situation that may lead to a serious or fatal injury.
CAUTION	The signal word **CAUTION** indicates a potentially dangerous situation that may lead to a minor or moderately severe injury.

2.2 Important safety messages

Operate the engine

Operating the engine during diagnostic work poses a safety risk to persons.

- ► Pay particular attention to the safety messages in the vehicle manufacturer‘s documentation.
- ► All diagnostic tasks on the engine must be performed by appropriately trained personnel.
- ► Operate the engine during the diagnostic work only if it is absolutely necessary.
- ► Only connect the power supply to the engine if it is absolutely necessary.
- ► Always be aware that engines requiring diagnostic work may not be in expected condition.

Defective parts

Defective engine components can cause serious engine damage and can pose a safety risk to persons.

- ► Check all components before installation.
- ► Always replace defective components.

Spare parts

All the components in your engine have been carefully tested and fulfill strict quality and safety requirements.

- ► Textron Motors offers spare parts to the highest quality. Ensure that equivalent spare parts corresponds with this quality requirements.

Add-on parts and modifications

Engine modifications may pose a safety risk to persons.

- ► Do not install add-on parts or modify the engine.

Protective equipment

Missing protective equipment poses a safety risk to persons.

- ► Attach all protective equipment after completing the service tasks.

Tools

Unsuitable tools pose a safety risk to persons.

- ► Use tools listed in chapter 3 **Tools and accessories** or equivalent tools.

Hot engine components

Engine components become extremely hot during operation.

- ► Do not touch any engine components during operation.
- ► Turn off the engine and wait until the components have cooled before making contact.

Engine exhaust gases

Engine exhaust gases contain carbon monoxide (CO). Inhalation of carbon monoxide can deprive the body of oxygen and result in organ damage or death by asphyxiation.

► Never operate the engine in enclosed spaces.

Fuel, engine oil and coolant handling

Engine fluids pose a health risk.

► Always read the manufacturer‘s instructions.

► Always wash your hands immediately after working on or around an engine.

Engine fluids are hazardous to the environment.

► Never allow engine fluids to escape into the groundwater, water courses or sewage system. Always dispose of engine fluids according to applicable regulations.

Danger of slipping on spilled fluids.

► Always use a filler neck or funnel when filling the engine with fluids.

► Always clean up any spilled engine fluids immediately.

Fuel

Fuel is highly flammable. Vapors may ignite and cause an explosion.

► Do not smoke in the vicinity of the engine and do not allow open flames or sparks near the engine or the fuel system.

► Always turn off the engine before fueling.

► Never fill with fuel while the engine is running.

► Do not start the engine if you smell fuel or see a fuel leak.

► Fuel on hot surfaces can cause fires.

► In the event of a fire, use foam, dry chemical or carbon dioxide fire extinguishers. Do not extinguish with water.

Engine oil

Engine oil is flammablew and can emit toxic gases.

► Do not smoke in the vicinity of the engine and do not allow open flames or sparks near the engine.

► Engine oil on hot surfaces can cause fires.

► In the event of a fire, use foam, dry chemical or carbon dioxide fire extinguishers. Do not extinguish with water.

California Proposition 65

This engine und engine exhaust contains chemicals known to the State of California to cause cancer, birth defects, or other reproductive harm.

3 Tools and accessories

3.1 Textron Motors diagnostic case

Textron Motors offers a diagnostic case that contains the following parts. Visit our website www.textronmotors.com for more information.

Figure	Description
	Textron Motors diagnostic interface module
	Diagnostic cable

Figure	Description
	USB cable
	Data on USB flash drive: Textron Motors Diagnostic Software (english) Manual (german and english)

3.2 Equipment workshop

In addition to the diagnostic case, the following test and diagnostic tools are required. The figures are only examples of suitable test and diagnostic tools and available from specialist retailers.

Figure	Description
	Digital-multimeter

Figure	Description
	Oil pressure tester with M10x1 adapter

4 Lights in vehicle

The following lights are supported by the engine management system. Read the service manual and vehicle manufacturer‘s documentation for more information.

– Oil pressure warning light
– Malfunction indicator light (MIL)
– Temperature warning light

4.1 Oil pressure warning light

Description	Cause	Remedy
Illuminates a few seconds when the engine is started.	There is no malfunction. The oil pressure warning light Illuminates until the required oil pressure is achieved.	–
Illuminates while the engine is running.	*NOTICE!* Oil pressure too low. Serious engine damage due to insufficient lubrication.	► Switch off the engine immediately. ► Check the oil pressure. (See chapter 6 Test procedures at engine.) ► Check the switch oil pressure. ► Check the oil pressure warning light and wiring. (See the vehicle manufacturer‘s documentation.)

4.2 Temperature warning light

Description	Cause	Remedy
Flashes.	*NOTICE!* The Coolant temperature is too high. Serious engine damage caused by overheating.	► Display the trouble codes. (See chapter 5.1 Displaying trouble codes.)

4.3 Malfunction indicator light (MIL)

Description	Cause	Remedy
Illuminated for a few seconds when the ignition is switched on.	There is no malfunction. Self test of the light.	–
Not illuminated when the ignition is switched on.	The malfunction indicator light (MIL) or wiring is defective.	► Check the wire harness. (See the vehicle manufacturer‘s documentation.) ► Check the malfunction indicator light (MIL) and wiring. (See the vehicle manufacturer‘s documentation.)
Flashes when the ignition is on and the engine is running.	Emission-related malfunction. There is at least one trouble code saved in the control unit.	► Display the trouble codes. (See chapter 5.1 Displaying trouble codes.)
Illuminates when the ignition is on and the engine is running.	Malfunction. There is at least one trouble code saved in the control unit.	

5 Troubleshooting with trouble codes

5.1 Displaying trouble codes

Information! Trouble codes can be displayed with the Textron Motors Diagnostic Tool.

► Connect the notebook to the engine und start Textron Motors Diagnostic Software. (See the vehicle manufacturer‘s documentation and Textron Motors Diagnostic Tool manual.)

5.2 Description of trouble codes

Trouble code	Displayed fault Trouble code description Possible consequences	Affected part/system ► Possible consequences/remedy
P0011	Camshaft Position not Valid Invalid signal at the sensor camshaft.	Sensor camshaft ► Check the valve timing. (See the vehicle manufacturer‘s documentation.) ► Check wiring in the wire harness to the affected part. (See the vehicle manufacturer‘s documentation.) ► Replace the affected part. (See the vehicle manufacturer‘s documentation.)
P0016	Crankshaft Position – Camshaft Position Correlation - Synchronisation Loss The signals sensor crankshaft and sensor camshaft are not synchronous. Rough engine running. Engine does not start or stalls.	Sensor crankshaft ► Check wiring in the wire harness to the affected part. (See the vehicle manufacturer‘s documentation.) ► Replace the affected part. (See the vehicle manufacturer‘s documentation.) ► Check the crankshaft reluctor. (See chapter 6 Test procedures at engine.)
P0018	Camshaft Position Spike Detected Additional signal at the sensor camshaft. Loss of power.	Sensor camshaft ► Check valve springs and rocker arms. ► Check wiring in the wire harness to the affected part. (See the vehicle manufacturer‘s documentation.) ► Replace the affected part. (See the vehicle manufacturer‘s documentation.)
P0030	HO2S Heater Control Circuit Open Sensor 1 Open circuit at part or wire harness. Loss of power. Rough engine running.	Sensor lambda 1 ► Check wiring in the wire harness to the affected part. (See the vehicle manufacturer‘s documentation.) ► Replace the affected part. (See the vehicle manufacturer‘s documentation.)

Trouble code	Displayed fault Trouble code description Possible consequences	Affected part/system ► Possible consequences/remedy
P0031	HO2S Heater Control Circuit Low Sensor 1	Sensor lambda 1
	Short circuit to ground at part or wire harness. Loss of power. Rough engine running.	► Check wiring in the wire harness to the affected part. (See the vehicle manufacturer‘s documentation.) ► Replace the affected part. (See the vehicle manufacturer‘s documentation.)
P0032	HO2S Heater Control Circuit High Sensor 1	Sensor lambda 1
	Short circuit to plus at part or wire harness. Loss of power. Rough engine running.	► Check wiring in the wire harness to the affected part. (See the vehicle manufacturer‘s documentation.) ► Replace the affected part. (See the vehicle manufacturer‘s documentation.)
P0101	Mass Air Flow Calculation Plausibility Error	Sensor intake manifold pressure/temperature
	Implausible values in air mass calculation. Loss of power. Starting difficulties.	► Check wiring in the wire harness to the affected part. (See the vehicle manufacturer‘s documentation.) ► Replace the affected part. (See the vehicle manufacturer‘s documentation.) ► Leak air in the intake system can cause the fault. Check the intake system. **WARNING! The throttle body is a safety critical component. Improper repair or cleaning of the throttle body may endanger the safety of persons. Always replace a defective throttle body.** ► Corrosion or soiling in the throttle body can cause the fault. Check the throttle body.
P0107	Manifold Absolute Pressure Sensor Circuit Low	Sensor intake manifold pressure/temperature
	Open circuit or short circuit to ground at part or wire harness. Loss of power. Starting difficulties.	► Check wiring in the wire harness to the affected part. (See the vehicle manufacturer‘s documentation.) ► Replace the affected part. (See the vehicle manufacturer‘s documentation.)

Trouble code	Displayed fault Trouble code description Possible consequences	Affected part/system ► Possible consequences/remedy
P0108	Manifold Absolute Pressure Sensor Circuit High Short circuit to plus at part or wire harness. Loss of power. Starting difficulties.	Sensor intake manifold pressure/temperature ► Check wiring in the wire harness to the affected part. (See the vehicle manufacturer‘s documentation.) ► Replace the affected part. (See the vehicle manufacturer‘s documentation.)
P0112	Intake Air Temperature Sensor 1 Circuit Low Short circuit to ground at part or wire harness. Loss of power. Starting difficulties.	Sensor intake manifold pressure/temperature ► Check wiring in the wire harness to the affected part. (See the vehicle manufacturer‘s documentation.) ► Replace the affected part. (See the vehicle manufacturer‘s documentation.)
P0113	Intake Air Temperature Sensor Circuit High/ Open Open circuit or short circuit to plus at part or wire harness. Loss of power. Starting difficulties.	Sensor intake manifold pressure/temperature ► Check wiring in the wire harness to the affected part. (See the vehicle manufacturer‘s documentation.) ► Replace the affected part. (See the vehicle manufacturer‘s documentation.)
P0116	Engine Coolant Temperature Sensor Stuck Signal Measured data implausible. The fan runs continuously.	Sensor coolant temperature ► Check wiring in the wire harness to the affected part. (See the vehicle manufacturer‘s documentation.) ► Replace the affected part. (See the vehicle manufacturer‘s documentation.)
P0117	Engine Coolant Temperature Circuit Low Short circuit to ground at part or wire harness. The fan runs continuously.	Sensor coolant temperature ► Check wiring in the wire harness to the affected part. (See the vehicle manufacturer‘s documentation.) ► Replace the affected part. (See the vehicle manufacturer‘s documentation.)

Trouble code	Displayed fault Trouble code description Possible consequences	Affected part/system ► Possible consequences/remedy
P0118	Engine Coolant Temperature Circuit High/ Open Open circuit or short circuit to plus at part or wire harness. The fan runs continuously.	Sensor coolant temperature ► Check wiring in the wire harness to the affected part. (See the vehicle manufacturer‘s documentation.) ► Replace the affected part. (See the vehicle manufacturer‘s documentation.)
P0121	Throttle Position 1 to Mass Air Flow Plausibility Error	Sensor intake manifold pressure/temperature ► Possible consequences/remedy as described for trouble code P0101.
P0122	Throttle Position Sensor 1 Circuit Low Open circuit or short circuit to ground at part or wire harness. Unusual or no throttle response.	Throttle body ► Check wiring in the wire harness to the affected part. (See the vehicle manufacturer‘s documentation.) ► Replace the affected part. (See the vehicle manufacturer‘s documentation.)
P0123	Throttle Position Sensor 1 Circuit High/Open Short circuit to plus at part or wire harness. Unusual or no throttle response.	Throttle body ► Check wiring in the wire harness to the affected part. (See the vehicle manufacturer‘s documentation.) ► Replace the affected part. (See the vehicle manufacturer‘s documentation.)
P0128	Coolant Thermostat Stuck Open Coolant temperature increase is implausible.	Thermostat ► A permanently open or stuck thermostat can cause the fault. Check the thermostat. (See chapter 6 Test procedures at engine.)
P0130	O2 Sensor Circuit Open Sensor 1 Open circuit at part or wire harness. Loss of power. Rough engine running.	Sensor lambda 1 ► Check wiring in the wire harness to the affected part. (See the vehicle manufacturer‘s documentation.) ► Replace the affected part. (See the vehicle manufacturer‘s documentation.)

Trouble code	Displayed fault Trouble code description Possible consequences	Affected part/system ► Possible consequences/remedy
P0131	O2 Sensor Circuit Low Sensor 1	Sensor lambda 1
	Short circuit to ground at part or wire harness. Loss of power. Rough engine running.	► Check wiring in the wire harness to the affected part. (See the vehicle manufacturer‘s documentation.) ► Replace the affected part. (See the vehicle manufacturer‘s documentation.)
P0132	O2 Sensor Circuit High Sensor 1	Sensor lambda 1
	Short circuit to plus at part or wire harness. Loss of power. Rough engine running.	► Check wiring in the wire harness to the affected part. (See the vehicle manufacturer‘s documentation.) ► Replace the affected part. (See the vehicle manufacturer‘s documentation.)
P0133	O2 Sensor Circuit Slow Response Sensor 1	Sensor lambda 1
	Sensor lambda 1 regulation too slow. Loss of power. Rough engine running.	► The part is defective caused by aging. Replace the affected part. (See the vehicle manufacturer‘s documentation.)
P0171	Fuel System Too Lean	Sensor lambda 1
	Fueling too lean. The lambda control works outside of permissible limits. Loss of power. Rough engine running. The engine stalls.	► A leaky intake system or exhaust system can cause the fault. Check the intake system and exhaust system. ► A too low fuel pressure can cause the fault. Check the fuel pressure. (See the vehicle manufacturer‘s documentation.) ► Blocked injectors can cause the fault. Check the injectors. ► Replace the affected part. (See the vehicle manufacturer‘s documentation.)

Trouble code	Displayed fault Trouble code description Possible consequences	Affected part/system ► Possible consequences/remedy
P0172	Fuel System Too Rich	Sensor lambda 1
	Fueling too rich. The lambda control works outside of permissible limits. Loss of power. Rough engine running. The engine stalls.	► A too high fuel pressure can cause the fault. Check the fuel pressure. (See the vehicle manufacturer‘s documentation.) ► Leaky injectors can cause the fault. Check the injectors. ► Replace the affected part. (See the vehicle manufacturer‘s documentation.)
P0201	Cylinder 1 Injector Circuit Open	Injector 1st cylinder
	Open circuit at part or wire harness. Engine does not start. Rough engine running.	► Check wiring in the wire harness to the affected part. (See the vehicle manufacturer‘s documentation.) ► Replace the affected part. (See the vehicle manufacturer‘s documentation.)
P0202	Cylinder 2 Injector Circuit Open	Injector 2nd cylinder
	Open circuit at part or wire harness. Engine does not start. Rough engine running.	► Check wiring in the wire harness to the affected part. (See the vehicle manufacturer‘s documentation.) ► Replace the affected part. (See the vehicle manufacturer‘s documentation.)
P0217	Engine Coolant Over Temperature Condition	Cooling system
	Coolant temperature is too high. The engine speed is limited. The temperature warning light flashes.	► An insufficient coolant level or leaks can cause the fault. Check the coolant circuit. ► Check the cylinder head gasket. ► A permanently close or stuck thermostat can cause the fault. Check the thermostat. (See chapter 6 Test procedures at engine.)

Trouble code	Displayed fault Trouble code description Possible consequences	Affected part/system ► Possible consequences/remedy
P0219	Engine Overspeed Condition	No defect
	Engine speed > 9000 min^{-1} [rpm].	*NOTICE!* Subsequent damage are possible. ► Avoid situations where the speed can exceed the maximum speed.
P0221	Throttle Position 2 to Mass Air Flow Plausibility Error	Sensor intake manifold pressure/temperature ► Possible consequences/remedy as described for trouble code P0101.
P0222	Throttle Position Sensor 2 Circuit Low/Open	Throttle body
	Open circuit or short circuit to ground at part or wire harness. Unusual or no throttle response.	► Check wiring in the wire harness to the affected part. (See the vehicle manufacturer‘s documentation.) ► Replace the affected part. (See the vehicle manufacturer‘s documentation.)
P0223	Throttle Position Sensor 2 Circuit High	Throttle body
	Short circuit to plus at part or wire harness. Unusual or no throttle response.	► Check wiring in the wire harness to the affected part. (See the vehicle manufacturer‘s documentation.) ► Replace the affected part. (See the vehicle manufacturer‘s documentation.)
P025A	Fuel Pump Module Control Circuit/Open	Relay fuel pump
	Open circuit at part or wire harness. Engine does not start or stalls.	► Check wiring in the wire harness to the affected part. (See the vehicle manufacturer‘s documentation.) ► Replace the affected part. (See the vehicle manufacturer‘s documentation.) ► Check the fuel pump and wiring. (See the vehicle manufacturer‘s documentation.)

Trouble code	Displayed fault Trouble code description Possible consequences	Affected part/system ► Possible consequences/remedy
P025C	Fuel Pump Module Control Circuit Low	Relay fuel pump
	Short circuit to ground at part or wire harness. Engine does not start or stalls.	► Check wiring in the wire harness to the affected part. (See the vehicle manufacturer‘s documentation.) ► Replace the affected part. (See the vehicle manufacturer‘s documentation.) ► Check the fuel pump and wiring. (See the vehicle manufacturer‘s documentation.)
P025D	Fuel Pump Module Control Circuit High	Relay fuel pump
	Short circuit to plus at part or wire harness. Engine does not start or stalls.	► Check wiring in the wire harness to the affected part. (See the vehicle manufacturer‘s documentation.) ► Replace the affected part. (See the vehicle manufacturer‘s documentation.) ► Check the fuel pump and wiring. (See the vehicle manufacturer‘s documentation.)
P0261	Cylinder 1 Injector Circuit Low	Injector 1st cylinder
	Short circuit to ground at part or wire harness. Engine does not start. Rough engine running.	► Check wiring in the wire harness to the affected part. (See the vehicle manufacturer‘s documentation.) ► Replace the affected part. (See the vehicle manufacturer‘s documentation.)
P0262	Cylinder 1 Injector Circuit High	Injector 1st cylinder
	Short circuit to plus at part or wire harness. Engine does not start. Rough engine running.	► Check wiring in the wire harness to the affected part. (See the vehicle manufacturer‘s documentation.) ► Replace the affected part. (See the vehicle manufacturer‘s documentation.)

Trouble code	Displayed fault Trouble code description Possible consequences	Affected part/system ► Possible consequences/remedy
P0264	Cylinder 2 Injector Circuit Low	Injector 2nd cylinder
	Short circuit to ground at part or wire harness. Engine does not start. Rough engine running.	► Check wiring in the wire harness to the affected part. (See the vehicle manufacturer‘s documentation.) ► Replace the affected part. (See the vehicle manufacturer‘s documentation.)
P0265	Cylinder 2 Injector Circuit High	Injector 2nd cylinder
	Short circuit to plus at part or wire harness. Engine does not start. Rough engine running.	► Check wiring in the wire harness to the affected part. (See the vehicle manufacturer‘s documentation.) ► Replace the affected part. (See the vehicle manufacturer‘s documentation.)
P0300	Random/Multiple Cylinder Misfire Detected	Ignition system
	Misfire detected. Combustions were failed. Engine splutters.	► Check wiring in the wire harness to the following parts parts. Ignition coils, injectors and engine control unit. (See the vehicle manufacturer‘s documentation.) ► Check the spark plugs and replace if necessary. (See the service manual.) ► Replace the ignition coils. (See the vehicle manufacturer‘s documentation.) ► Replace the injectors. (See the vehicle manufacturer‘s documentation.) ► Replace the engine control unit. (See the vehicle manufacturer‘s documentation.)
P0314	Single Cylinder Misfire (Cylinder not Specified)	Ignition system
		► Possible consequences/remedy as described for trouble code P0300.

Trouble code	Displayed fault Trouble code description Possible consequences	Affected part/system ► Possible consequences/remedy
P0315	Crankshaft Position – Camshaft Position Correlation - Gap Position Incorrect The sensor crankshaft signal is undetermined. Engine does not start.	Sensor crankshaft ► Check wiring in the wire harness to the affected part. (See the vehicle manufacturer‘s documentation.) ► Replace the affected part. (See the vehicle manufacturer‘s documentation.) ► Check the crankshaft reluctor. (See chapter 6 Test procedures at engine.)
P0325	Knock Sensor 1 Signal out of Range The sensor knock signal is insufficient Loss of power.	Sensor knock ► Check bolting of the affected part. (See the vehicle manufacturer‘s documentation.) ► Check wiring in the wire harness to the affected part. (See the vehicle manufacturer‘s documentation.) ► Replace the affected part. (See the vehicle manufacturer‘s documentation.)
P0326	Knock Sensor Range Error	Sensor knock ► Possible consequences/remedy as described for trouble code P0325.
P0336	Crankshaft Position Sensor Missing Signal No signal at the sensor crankshaft. Engine does not start.	Sensor crankshaft ► Check wiring in the wire harness to the affected part. (See the vehicle manufacturer‘s documentation.) ► Replace the affected part. (See the vehicle manufacturer‘s documentation.)
P0341	Camshaft Signal Missing No signal at the sensor camshaft. The engine speed is limited.	Sensor camshaft ► Check wiring in the wire harness to the affected part. (See the vehicle manufacturer‘s documentation.) ► Replace the affected part. (See the vehicle manufacturer‘s documentation.)

Trouble code	Displayed fault Trouble code description Possible consequences	Affected part/system ► Possible consequences/remedy
P0344	Camshaft Position Signal Timeout	Sensor camshaft
	During operation implausible signals occur at the sensor camshaft.	► Check if the affected part is unusually dirty. ► Check the cam spike at rocker arm. (See chapter 6 Test procedures at engine.) ► Check wiring in the wire harness to the affected part. (See the vehicle manufacturer‘s documentation.) ► Replace the affected part. (See the vehicle manufacturer‘s documentation.)
P0351	Ignition Coil 1 Control Circuit Low/Open	Ignition coil 1st cylinder
	Open circuit or short circuit to ground at part or wire harness. Rough engine running. Engine does not start or stalls.	► Check wiring in the wire harness to the affected part. (See the vehicle manufacturer‘s documentation.) ► Replace the affected part. (See the vehicle manufacturer‘s documentation.)
P0352	Ignition Coil 2 Control Circuit Low/Open	Ignition coil 2nd cylinder
	Open circuit or short circuit to ground at part or wire harness. Rough engine running. Engine does not start or stalls.	► Check wiring in the wire harness to the affected part. (See the vehicle manufacturer‘s documentation.) ► Replace the affected part. (See the vehicle manufacturer‘s documentation.)
P0370	Crankshaft Position Signal Spike Detected	Sensor crankshaft
	Erratic signal at the sensor crankshaft. Engine does not start.	► Check wiring in the wire harness to the affected part. (See the vehicle manufacturer‘s documentation.) ► Replace the affected part. (See the vehicle manufacturer‘s documentation.)
P0372	Crankshaft Position Signal Teeth Missing	Sensor crankshaft
	Erratic signal at the sensor crankshaft. Engine does not start.	► Check wiring in the wire harness to the affected part. (See the vehicle manufacturer‘s documentation.) ► Replace the affected part. (See the vehicle manufacturer‘s documentation.)

Trouble code	Displayed fault Trouble code description Possible consequences	Affected part/system ► Possible consequences/remedy
P0373	Crankshaft Position Sensor Intermittent/Erratic Pulses Detected Erratic signal at the sensor crankshaft. Engine does not start.	Sensor crankshaft ► Check wiring in the wire harness to the affected part. (See the vehicle manufacturer‘s documentation.) ► Replace the affected part. (See the vehicle manufacturer‘s documentation.)
P500	Vehicle Speed Sensor Signal Error Malfunction in the circuit of the vehicle speed sensor.	Vehicle speed sensor ► Check the vehicle speed sensor and wiring. (See the vehicle manufacturer‘s documentation.)
P0606 P060B P060C	Internal Monitoring Error Internal Control Module A/D Processing Performance Internal Monitoring_3 Error	– ► Contact the vehicle manufacturer or Textron Motors directly.
P0615	Starter Relay Circuit Open Open circuit at part or wire harness. The engine does not crank.	Relay starter ► Check wiring in the wire harness to the affected part. (See the vehicle manufacturer‘s documentation.) ► Replace the affected part. (See the vehicle manufacturer‘s documentation.)
P0616	Starter Relay Circuit Low Short circuit to ground at part or wire harness. The engine does not crank.	Relay starter ► Check wiring in the wire harness to the affected part. (See the vehicle manufacturer‘s documentation.) ► Replace the affected part. (See the vehicle manufacturer‘s documentation.)
P0617	Starter Relay Circuit High Short circuit to plus at part or wire harness. The engine does not crank.	Relay starter ► Check wiring in the wire harness to the affected part. (See the vehicle manufacturer‘s documentation.) ► Replace the affected part. (See the vehicle manufacturer‘s documentation.)

Trouble code	Displayed fault Trouble code description Possible consequences	Affected part/system ► Possible consequences/remedy
P061A	Internal Monitoring of Torque Error	–
		► Contact the vehicle manufacturer or Textron Motors directly.
P061B	Internal Monitoring - Torque Intervention Excessive	Throttle body
		► Check wiring in the wire harness to the affected part. (See the vehicle manufacturer‘s documentation.) ► Replace the affected part. (See the vehicle manufacturer‘s documentation.)
P061C	Internal Engine Speed Monitoring Error	–
		► Contact the vehicle manufacturer or Textron Motors directly.
P0626	Alternator Voltage Too High	Voltage regulator/Generator
	Charging voltage too high.	► Check the voltage regulator. (See chapter 6 Test procedures at engine.) ► Check the generator. (See chapter 6 Test procedures at engine.)
P0638	Auto Configuration Throttle Input - Error upper return spring check	Throttle body
		► Check wiring in the wire harness to the affected part. (See the vehicle manufacturer‘s documentation.) ► Replace the affected part. (See the vehicle manufacturer‘s documentation.)
P063A	Auto Configuration Throttle Input - Adaptation condition exceeded	Throttle body
		► Check wiring in the wire harness to the affected part. (See the vehicle manufacturer‘s documentation.) ► Replace the affected part. (See the vehicle manufacturer‘s documentation.)

Trouble code	Displayed fault Trouble code description Possible consequences	Affected part/system ► Possible consequences/remedy
P063B	Auto Configuration Throttle Input - Limp home adaptation is out of range	Throttle body ► Check wiring in the wire harness to the affected part. (See the vehicle manufacturer‘s documentation.) ► Replace the affected part. (See the vehicle manufacturer‘s documentation.)
P063C	Auto Configuration Throttle Input - Lower mechanical stop adaptation is out of range	Throttle body ► Check wiring in the wire harness to the affected part. (See the vehicle manufacturer‘s documentation.) ► Replace the affected part. (See the vehicle manufacturer‘s documentation.)
P063D	Auto Configuration Throttle Input - Lower position is not reached	Throttle body ► Check wiring in the wire harness to the affected part. (See the vehicle manufacturer‘s documentation.) ► Replace the affected part. (See the vehicle manufacturer‘s documentation.)
P063E	Auto Configuration Throttle Input - Error lower return spring check	Throttle body ► Check wiring in the wire harness to the affected part. (See the vehicle manufacturer‘s documentation.) ► Replace the affected part. (See the vehicle manufacturer‘s documentation.)
P063F	Auto Configuration Throttle Input - Upper position is not reached	Throttle body ► Check wiring in the wire harness to the affected part. (See the vehicle manufacturer‘s documentation.) ► Replace the affected part. (See the vehicle manufacturer‘s documentation.)

Trouble code	Displayed fault Trouble code description Possible consequences	Affected part/system ► Possible consequences/remedy
P0641	Sensor Reference Voltage 1 Circuit Low	5 V power supply from engine control unit
	Open circuit at 5 V power supply from engine control unit. Affected connections 32-pol C4, E4, B4. The power supply is outside from 5 V +/-1 V.	► Check the connected parts and wiring. (See the vehicle manufacturer‘s documentation.) ► Replace the engine control unit. (See the vehicle manufacturer‘s documentation.)
P0642	Pedal Position Sensor Supply Voltage Error	5 V power supply from engine control unit
	Short circuit to ground at 5 V power supply from engine control unit. Affected connections 32-pol C4, E4, B4. The power supply is outside from 5 V +/-1 V.	► Check the connected parts and wiring. (See the vehicle manufacturer‘s documentation.) ► Replace the engine control unit. (See the vehicle manufacturer‘s documentation.)
P0643	Sensor Reference Voltage 1 Circuit High	5 V power supply from engine control unit
	Short circuit to plus at 5 V power supply from engine control unit. Affected connections 32-pol C4, E4, B4. The power supply is outside from 5 V +/-1 V.	► Check the connected parts and wiring. (See the vehicle manufacturer‘s documentation.) ► Replace the engine control unit. (See the vehicle manufacturer‘s documentation.)
P0651	Sensor Reference Voltage 2 Circuit Low	5 V power supply from engine control unit
	Open circuit at 5 V power supply from engine control unit. Affected connections 64-pol E1, F1, G1, H1, J1. The power supply is outside from 5 V +/-1 V.	► Check the connected parts and wiring. (See the vehicle manufacturer‘s documentation.) ► Replace the engine control unit. (See the vehicle manufacturer‘s documentation.)
P0653	Sensor Reference Voltage 2 Circuit High	5 V power supply from engine control unit
	Short circuit to plus at 5 V power supply from engine control unit. Affected connections 64-pol E1, F1, G1, H1, J1. The power supply is outside from 5 V +/-1 V.	► Check the connected parts and wiring. (See the vehicle manufacturer‘s documentation.) ► Replace the engine control unit. (See the vehicle manufacturer‘s documentation.)

Trouble code	Displayed fault Trouble code description Possible consequences	Affected part/system ► Possible consequences/remedy
P0658	Main Relay Supply Voltage Low	Battery
	The battery voltage is too low. Engine does not start or stalls.	► Check wiring in the wire harness between ECU 64pol-P2 and relay main. (See the vehicle manufacturer‘s documentation.) ► Check the battery cable. (See the vehicle manufacturer‘s documentation.) ► Recharge the battery. (See the vehicle manufacturer‘s documentation.) ► Replace the battery. (See the vehicle manufacturer‘s documentation.)
P0659	Main Relay Supply Voltage High	Battery
	The battery voltage is too high. Engine does not start or stalls.	► Replace the battery. (See the vehicle manufacturer‘s documentation.)
P0685	ECM Main Relay Control Circuit Open	Relay main
	Open circuit at part or wire harness. The engine cranks, but does not start.	► Check wiring in the wire harness to the affected part. (See the vehicle manufacturer‘s documentation.) ► Replace the affected part. (See the vehicle manufacturer‘s documentation.)
P0686	ECM Main Relay Control Circuit Low	Relay main
	Short circuit to ground at part or wire harness. The engine cranks, but does not start.	► Check wiring in the wire harness to the affected part. (See the vehicle manufacturer‘s documentation.) ► Replace the affected part. (See the vehicle manufacturer‘s documentation.)
P0687	ECM Main Relay Control Circuit High	Relay main
	Short circuit to plus at part or wire harness. The engine cranks, but does not start.	► Check wiring in the wire harness to the affected part. (See the vehicle manufacturer‘s documentation.) ► Replace the affected part. (See the vehicle manufacturer‘s documentation.)

Trouble code	Displayed fault Trouble code description Possible consequences	Affected part/system ► Possible consequences/remedy
P0691	Fan 1 Control Circuit Low	Relay fan
	Short circuit to ground at part or wire harness.	► Check wiring in the wire harness to the affected part. (See the vehicle manufacturer‘s documentation.) ► Replace the affected part. (See the vehicle manufacturer‘s documentation.)
P0692	Fan 1 Control Circuit High	Relay fan
	Short circuit to plus at part or wire harness.	► Check wiring in the wire harness to the affected part. (See the vehicle manufacturer‘s documentation.) ► Replace the affected part. (See the vehicle manufacturer‘s documentation.)
P1604	ECU Internal Warm Restart Failure	–
		► Contact the vehicle manufacturer or Textron Motors directly.
P2100	Throttle Actuator Control Motor Circuit/Open	Throttle body
	Open circuit at part or wire harness. Unusual or no throttle response.	► Check wiring in the wire harness to the affected part. (See the vehicle manufacturer‘s documentation.) ► Replace the affected part. (See the vehicle manufacturer‘s documentation.)
P2101	Throttle Actuator Control Motor Circuit Temperature Warning	Throttle body
	The temperature is too high. Loss of power.	**WARNING! The throttle body is a safety critical component. Improper repair or cleaning of the throttle body may endanger the safety of persons. Always replace a defective throttle body.** ► A stiff mechanism of the throttle body can cause the fault. Check the throttle body. ► A too high ambient temperature at the engine control unit can cause the fault. Check the ambient conditions.

Trouble code	Displayed fault Trouble code description Possible consequences	Affected part/system ► Possible consequences/remedy
P2102	Throttle Actuator Control Motor Circuit Low	Throttle body
	Short circuit to ground at part or wire harness. Unusual or no throttle response.	► Check wiring in the wire harness to the affected part. (See the vehicle manufacturer‘s documentation.) ► Replace the affected part. (See the vehicle manufacturer‘s documentation.)
P2103	Throttle Actuator Control Motor Circuit High	Throttle body
	Short circuit to plus at part or wire harness. Unusual or no throttle response.	► Check wiring in the wire harness to the affected part. (See the vehicle manufacturer‘s documentation.) ► Replace the affected part. (See the vehicle manufacturer‘s documentation.)
P2118	Throttle Actuator Control Motor Range Error	Throttle body
	The throttle body is blocked. Unusual or no throttle response.	**WARNING! The throttle body is a safety critical component. Improper repair or cleaning of the throttle body may endanger the safety of persons. Always replace a defective throttle body.** ► Small components in the intake area, corrosion or soiling can cause the fault. Check the throttle body.
P2119	Throttle Actuator Control Performance Error	Throttle body
	Implausible values of the sensors. Unusual or no throttle response.	**WARNING! The throttle body is a safety critical component. Improper repair or cleaning of the throttle body may endanger the safety of persons. Always replace a defective throttle body.** ► A tight throttle body can cause the fault. Check the throttle body. ► Check wiring in the wire harness to the affected part. (See the vehicle manufacturer‘s documentation.) ► Replace the affected part. (See the vehicle manufacturer‘s documentation.)

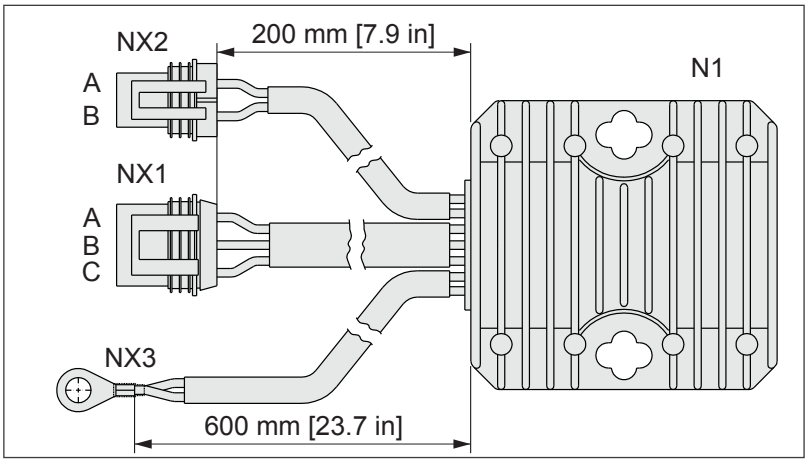
Trouble code	Displayed fault Trouble code description Possible consequences	Affected part/system ► Possible consequences/remedy
P2122	Pedal Position Sensor 1 Circuit Low/Open	Throttle request unit
	Open circuit or short circuit to ground at part or wire harness. Unusual or no throttle response.	► Check wiring in the wire harness to the affected part. (See the vehicle manufacturer‘s documentation.) ► Replace the affected part. (See the vehicle manufacturer‘s documentation.)
P2123	Pedal Position Sensor 1 Circuit High	Throttle request unit
	Short circuit to plus at part or wire harness. Unusual or no throttle response.	► Check wiring in the wire harness to the affected part. (See the vehicle manufacturer‘s documentation.) ► Replace the affected part. (See the vehicle manufacturer‘s documentation.)
P2127	Pedal Position Sensor 2 Circuit Low/Open	Throttle request unit
	Open circuit or short circuit to ground at part or wire harness. Unusual or no throttle response.	► Check wiring in the wire harness to the affected part. (See the vehicle manufacturer‘s documentation.) ► Replace the affected part. (See the vehicle manufacturer‘s documentation.)
P2128	Pedal Position Sensor 2 Circuit High	Throttle request unit
	Short circuit to plus at part or wire harness. Unusual or no throttle response.	► Check wiring in the wire harness to the affected part. (See the vehicle manufacturer‘s documentation.) ► Replace the affected part. (See the vehicle manufacturer‘s documentation.)
P2135	Throttle Position Sensor Plausibility Error	Throttle body
	Implausible values of the sensors. Unusual or no throttle response.	► Check wiring in the wire harness to the affected part. (See the vehicle manufacturer‘s documentation.) ► Replace the affected part. (See the vehicle manufacturer‘s documentation.)

Trouble code	Displayed fault Trouble code description Possible consequences	Affected part/system ► Possible consequences/remedy
P2138	Pedal Position Sensor Plausibility Error	Throttle request unit
	Implausible values of the sensors. Unusual or no throttle response.	► Check wiring in the wire harness to the affected part. (See the vehicle manufacturer‘s documentation.) ► Replace the affected part. (See the vehicle manufacturer‘s documentation.)
P2301	Ignition Coil 1 Control Circuit High	Ignition coil 1st cylinder
	Short circuit to plus at part or wire harness. Rough engine running. Engine does not start or stalls.	► Check wiring in the wire harness to the affected part. (See the vehicle manufacturer‘s documentation.) ► Replace the affected part. (See the vehicle manufacturer‘s documentation.)
P2304	Ignition Coil 2 Control Circuit High	Ignition coil 2nd cylinder
	Short circuit to plus at part or wire harness. Rough engine running. Engine does not start or stalls.	► Check wiring in the wire harness to the affected part. (See the vehicle manufacturer‘s documentation.) ► Replace the affected part. (See the vehicle manufacturer‘s documentation.)

6 Test procedures at engine

6.1 Checking voltage regulator

N1	Voltage regulator
NX1	3-pole connection at stator generator (yellow wires)
NX2	2-pole connection at battery cable (red wires)
NX3	Connection engine ground inner diameter 8 mm (black wires)



► Check all electrical contacts for corrosion and proper mechanical connection.

► Make a diode test with all relevant wires:

Diode test with multimeter:

Diode tester probe		
Plus (red)	Ground (black)	Test result
NX2-A	NX1-A	No continuity is permitted
	NX1-B	
	NX1-C	
NX2-B	NX1-A	
	NX1-B	
	NX1-C	
NX3	NX1-A	Continuity is required
	NX1-B	
	NX1-C	

Cross checking:

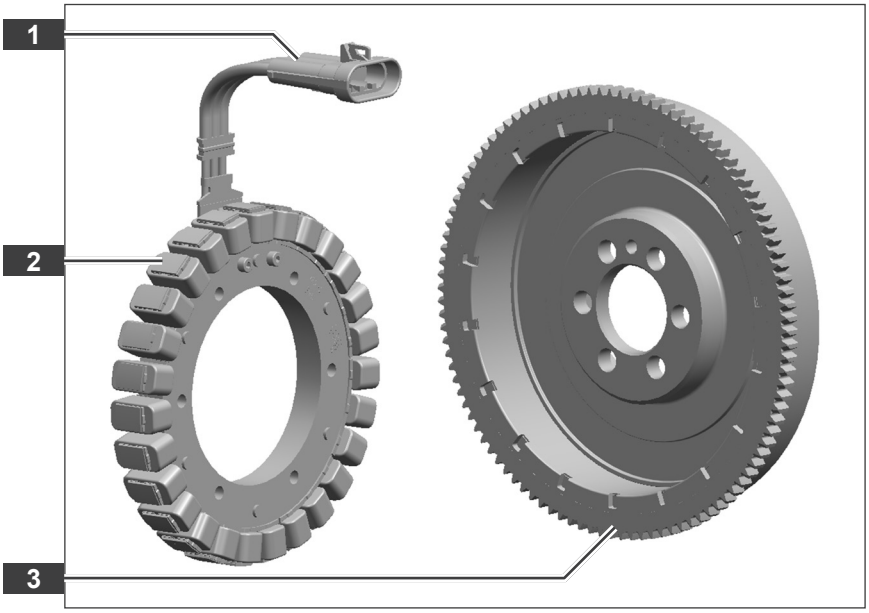
Diode tester probe		
Ground (black)	Plus (red)	Test result
NX2-A	NX1-A	Continuity is required
	NX1-B	
	NX1-C	
NX2-B	NX1-A	
	NX1-B	
	NX1-C	
NX3	NX1-A	No continuity is permitted
	NX1-B	
	NX1-C	

► If the wires are defective, replace the voltage regulator.

6.2 Checking generator

G1 Generator
Stator 2
Rotor 3

GX1 3-pole connection at stator generator (yellow wires) 1



► Check all electrical contacts for corrosion and proper mechanical connection.

► Make a continuity test with all relevant wires:

Continuity test with multimeter:

		GX1-			Engine ground
		A	B	C	
GX1-	A		d	d	–
	B			d	–
	C				–
Engine ground					

d Continuity is required (Resistance 0,3 ohm ±0,1 ohm at 20 °C)

– No continuity is permitted

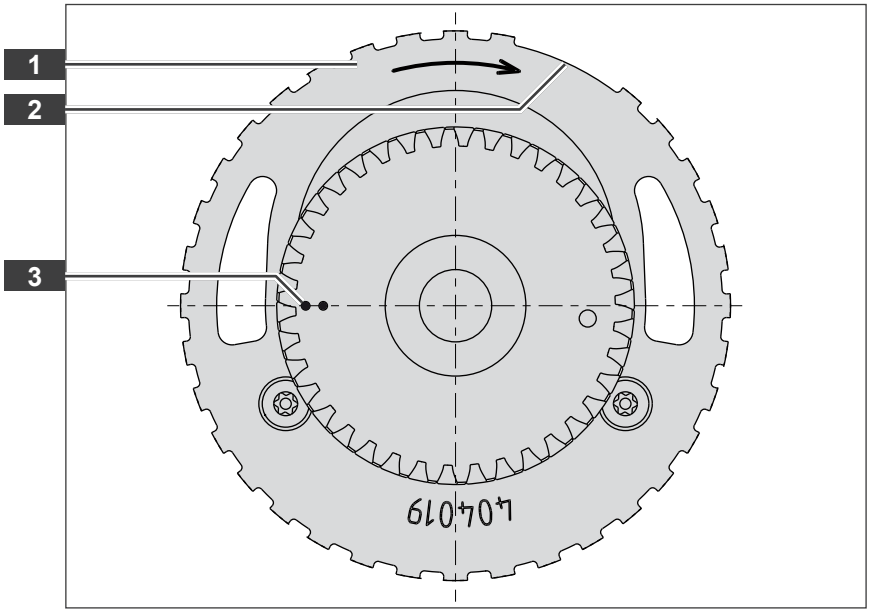
► If the wires are defective, replace the stator.

► Perform a visual inspection of the rotor.

► If mechanical defects are present, for example at the internal magnets, replace the rotor.

6.3 Checking crankshaft reluctor

– Crankshaft reluctor 1
– Gap (2 missing teeth) 2
– Marking for valve timing 3

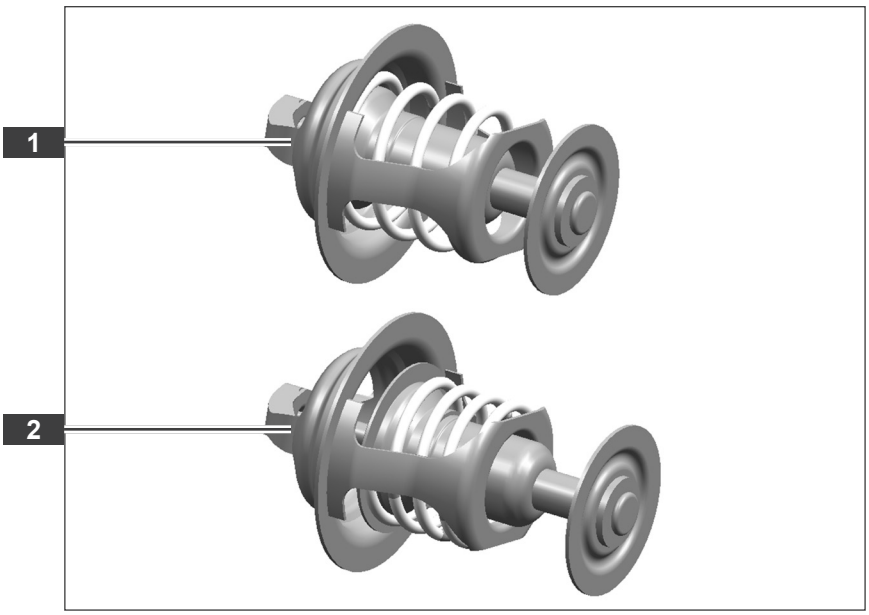


► Perform a visual inspection of the crankshaft reluctor.
► If mechanical defects are present, for example at the teeth, replace the crankshaft.

6.4 Checking thermostat

Information! The thermostat is fitted with a wax element. Opening temperature from 82 °C [179 °F] The thermostat is fully open at 88 °C [190 °F]

– Thermostat closed 1
– Thermostat opened 2

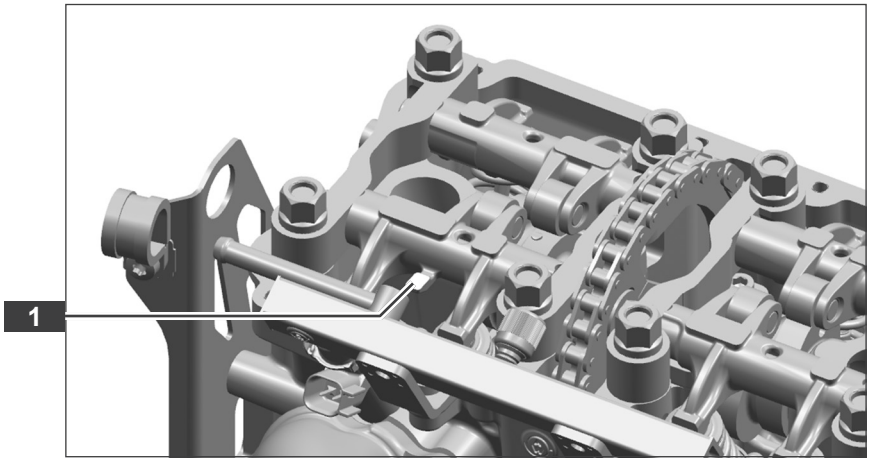


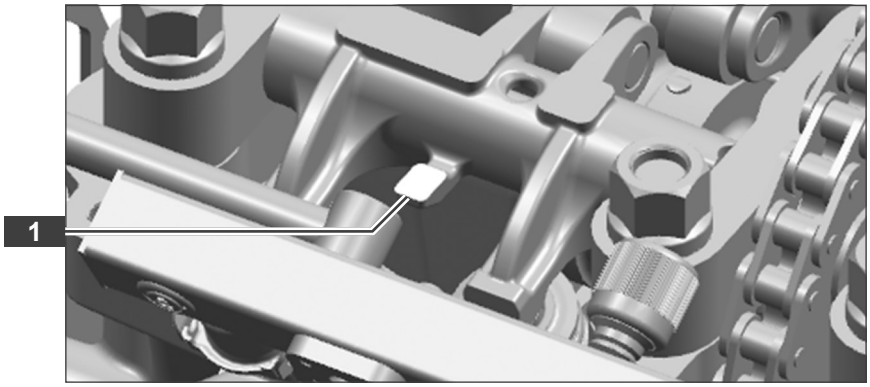
► Perform a visual inspection of the thermostat.

► If the thermostat is opened at temperatures below 82 °C [179 °F], replace the thermostat.

6.5 Checking cam spike at rocker arm

– Cam spike at rocker arm 1



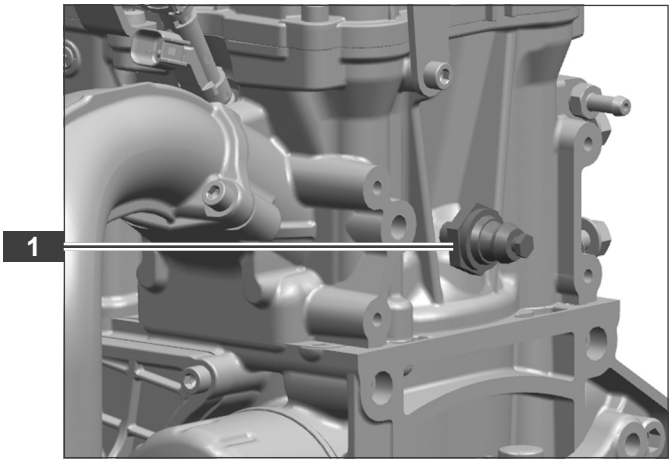


► Perform a visual inspection of the cam spike at rocker arm.

► If mechanical defects are present, replace the rocker arm.

6.6 Checking oil pressure

Information! Limited by the oil pressure valve the maximum oil pressure is 5,5 bar.



► Warm up the engine. (See the manufacturer‘s documentation.)

► Unscrew the switch oil pressure 1.

CAUTION! Scalding caused by hot engine oil. Wear protective gloves.

► Screw in the adapter M10x1 for oil pressure tester according to the manufacturer's instructions.

Tightening torque:
9 Nm +2 Nm [6.6 lbf ft +1.5 lbf ft]

► Start the engine and run the engine at idle.

► Measure oil pressure with oil pressure tester according to the manufacturer's instructions.

Required oil pressure while idle:
Minimum 1,5 bar
Maximum 5,5 bar +0,5 bar

► Increase engine speed.

The oil pressure increases immediately.
Required oil pressure at 3000 min^{-1} [RPM]:
Minimum 2,5 bar
Maximum 5,5 bar +0,5 bar

► Unscrew the adapter M10x1.

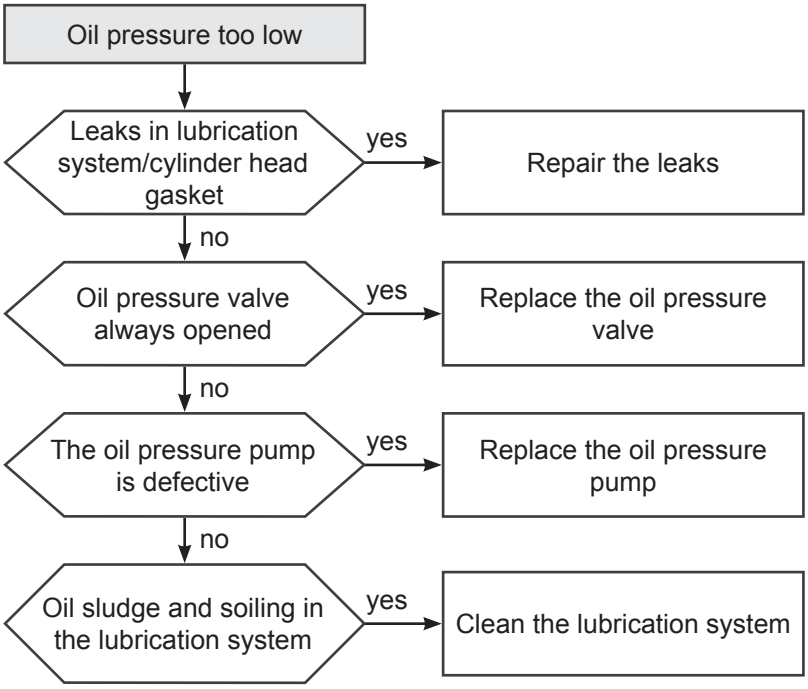
NOTICE! Loss of engine oil due to leaks. If you have unscrewed the plug, the TufLock coating is not completely effective any more.

► Apply Loctite 542 to the thread of the switch oil pressure.

► Screw in the switch oil pressure.

Tightening torque:
9 Nm +2 Nm [6.6 lbf ft +1.5 lbf ft]

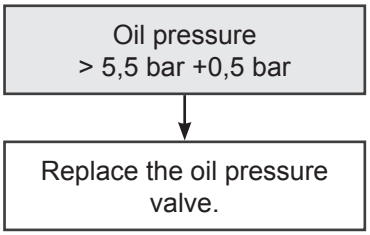
6.6.1 Troubleshooting guide too low oil pressure



See the repair manual.

See the repair manual.

6.6.2 Troubleshooting guide too high oil pressure

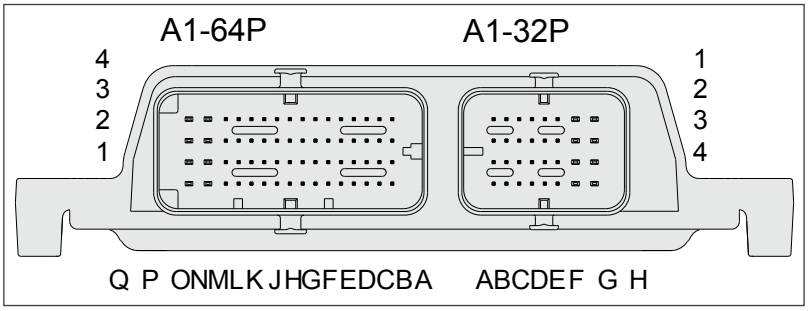


See the repair manual.

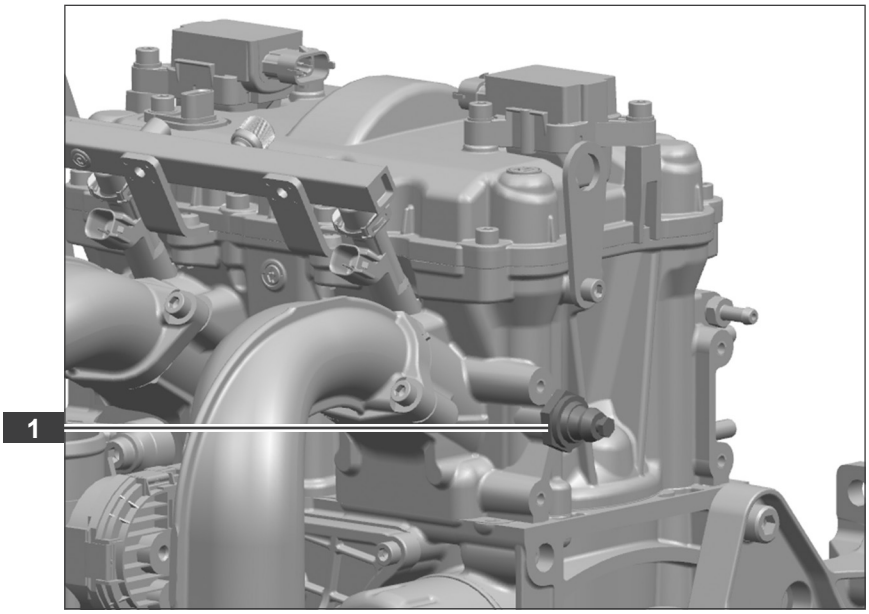
7 Components overview

– Engine control unit (additional part)

Connector pin assignment:

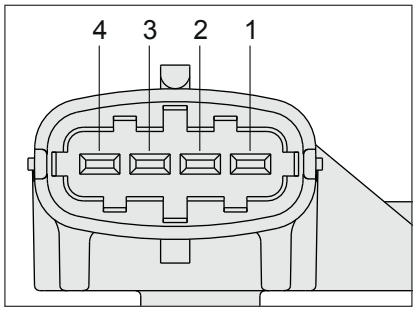


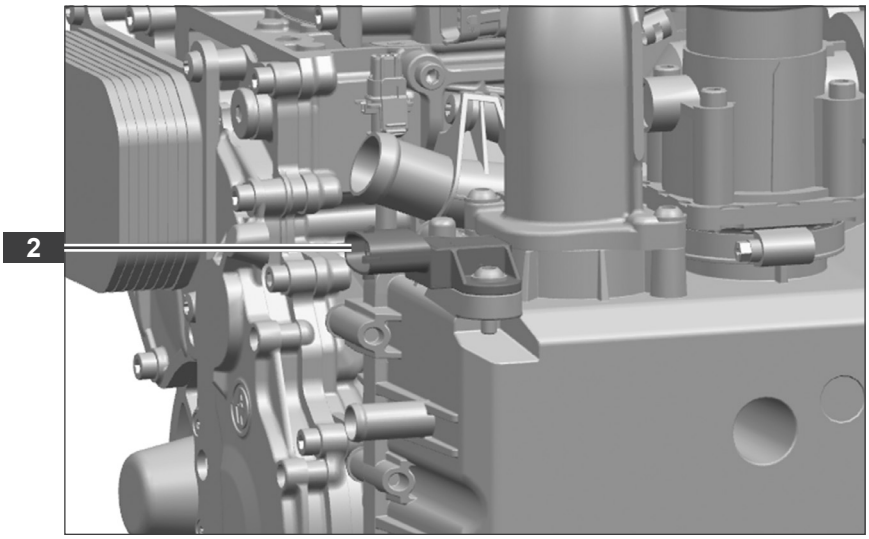
– Switch oil pressure 1



– Sensor intake manifold pressure/temperature 2

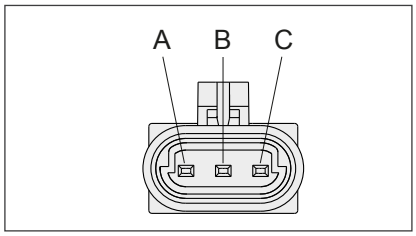
Connector pin assignment:

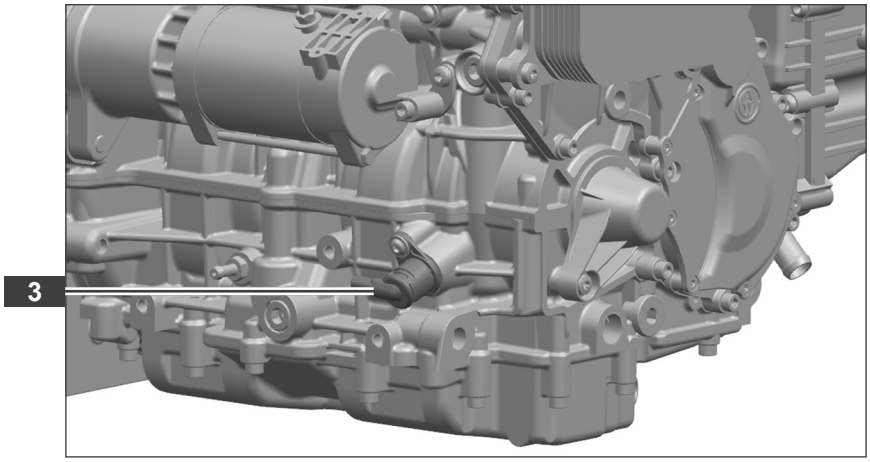




– Sensor crankshaft **3**

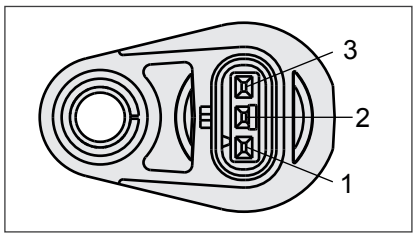
Connector pin assignment:

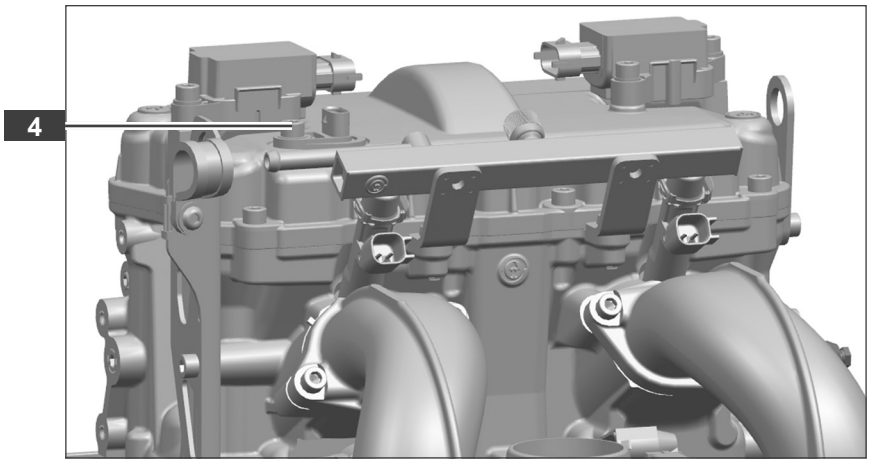




– Sensor camshaft **4**

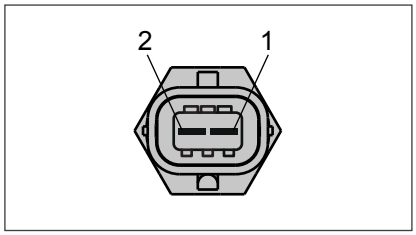
Connector pin assignment:

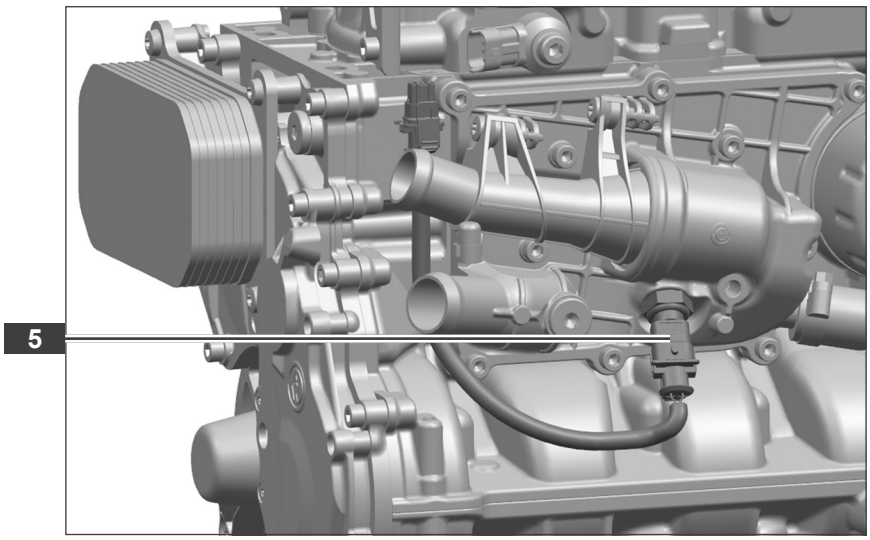




– Sensor coolant temperature **5**

Connector pin assignment:

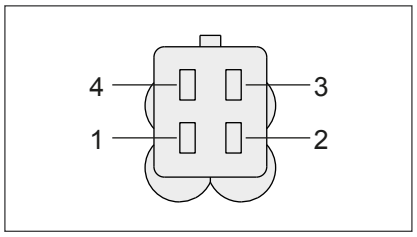


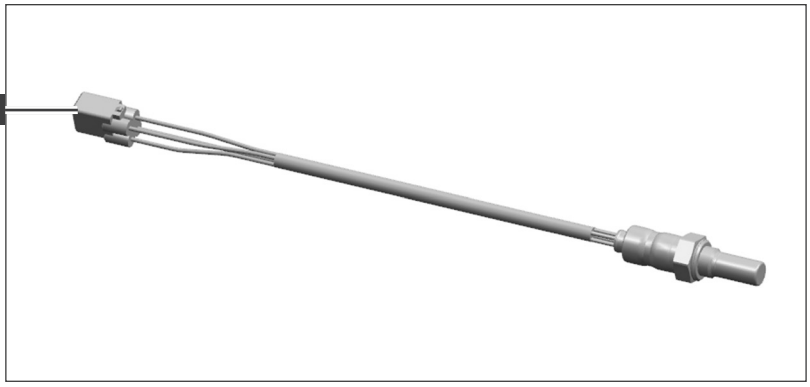


The intake manifold is not shown in the figure.

– Sensor Lambda 1 6
(additional part)

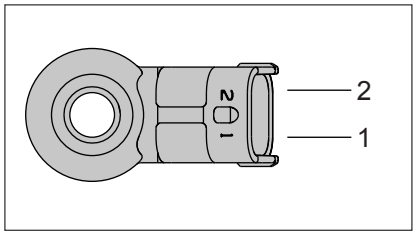
Connector pin assignment:

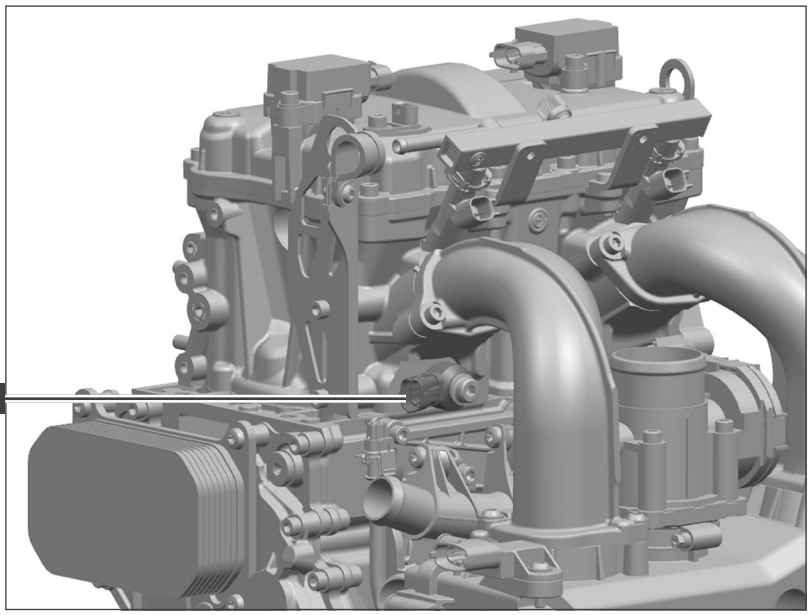




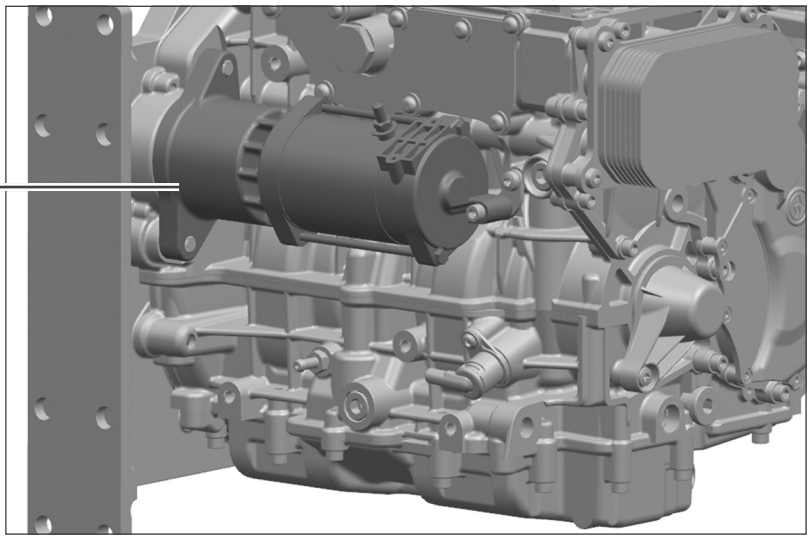
– Sensor knock 7

Connector pin assignment:

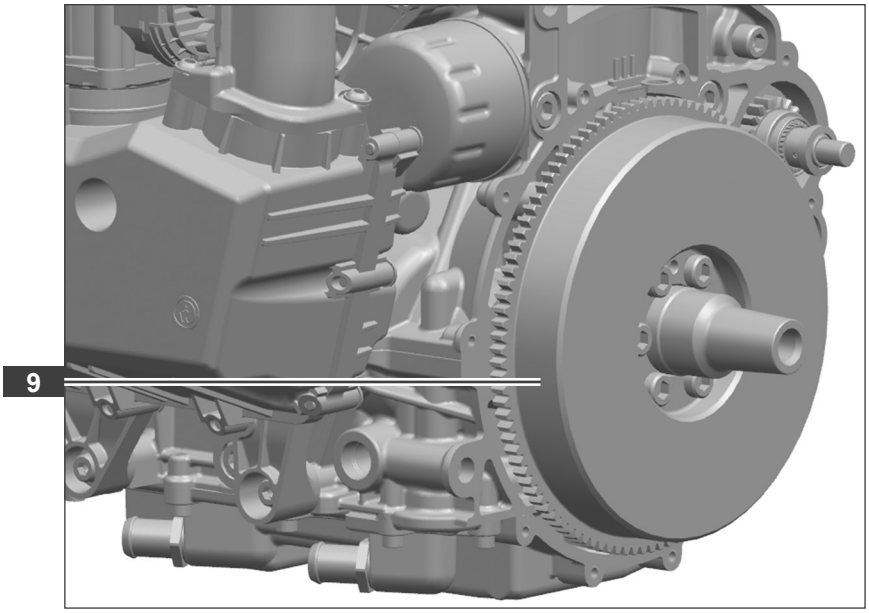




– Starter 8

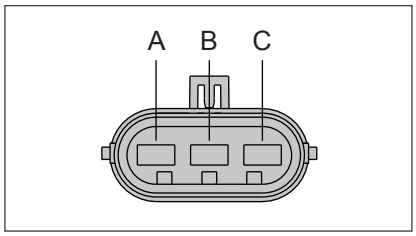


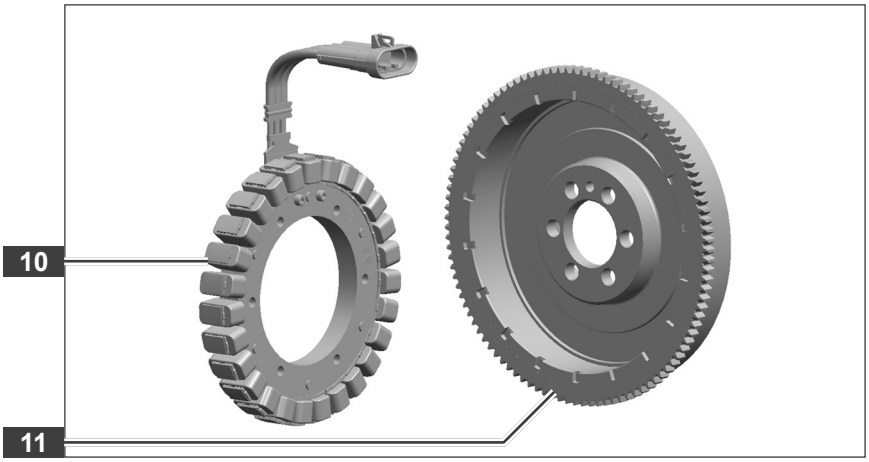
– Generator 9



– Stator 10
– Rotor 11

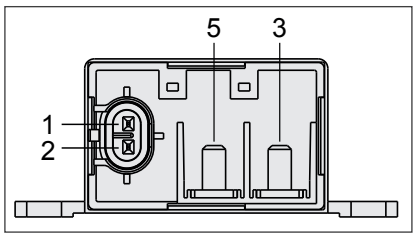
Connector pin assignment stator:

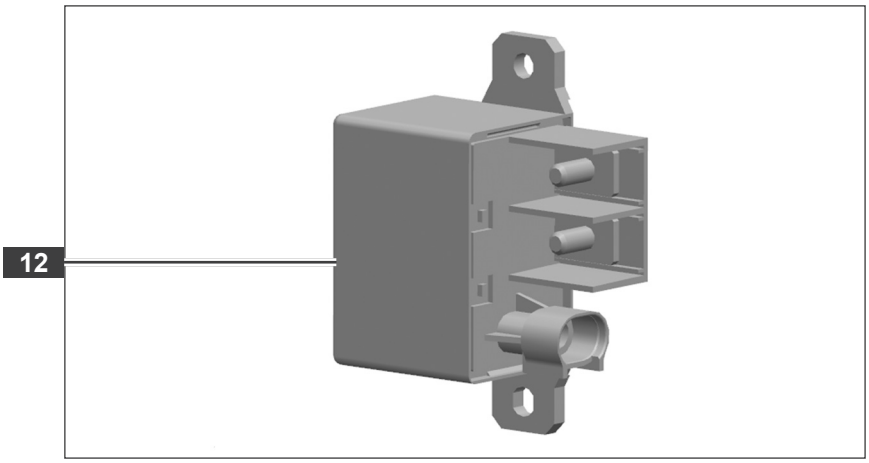




– Relay starter 12
(additional part)

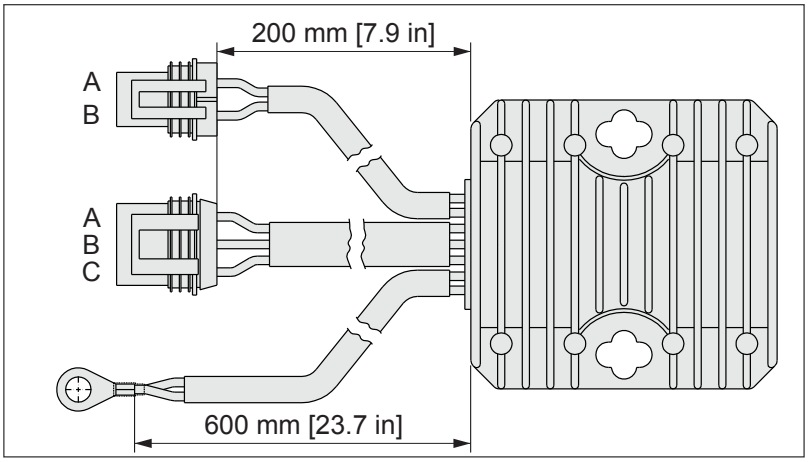
Connector pin assignment:





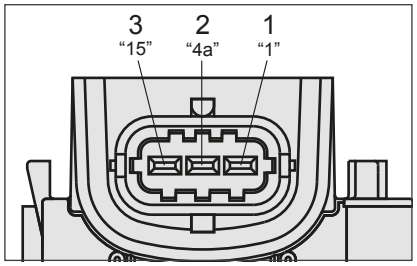
– Voltage regulator (additional part)

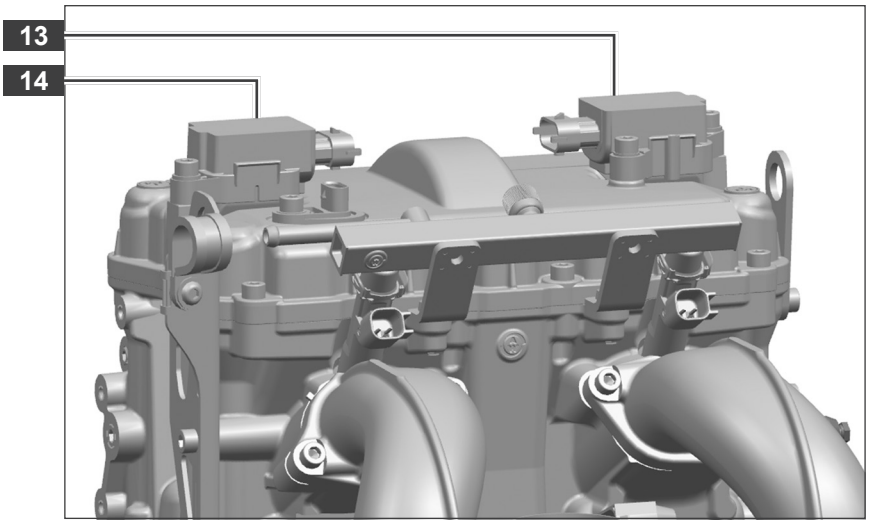
Connector pin assignment:



– Ignition coil 1st cylinder 13
– Ignition coil 2nd cylinder 14

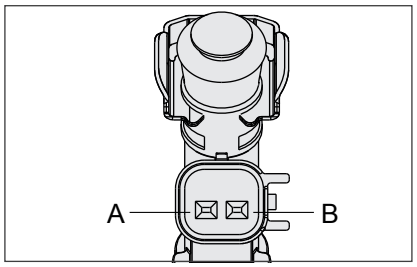
Connector pin assignment:

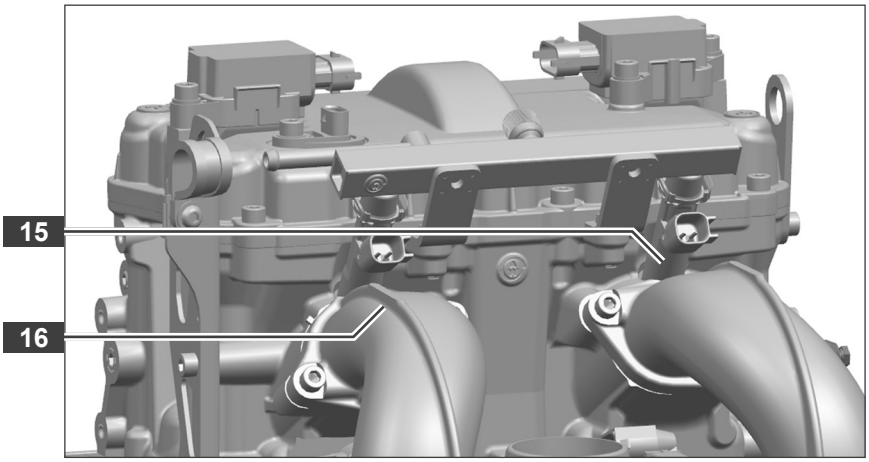




– Injector 1st cylinder 15
– Injector 2nd cylinder 16

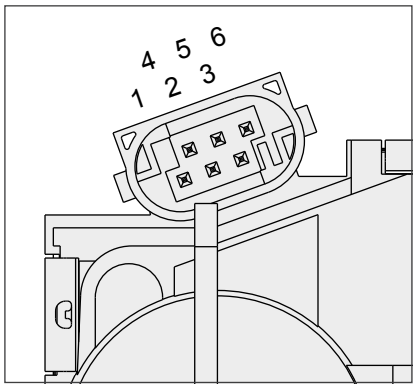
Connector pin assignment:

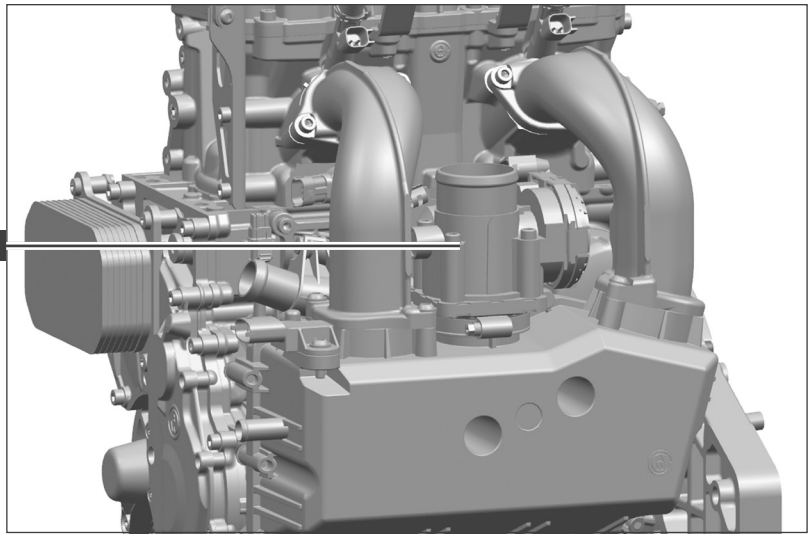




– Throttle body 17

Connector pin assignment:





Appendix

Overview of revisions

Revision	Date	Chapter	Description	Note
Rev A	17.12.2015	–	1st edition diagnostic manual	–

Index

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