

MOTORHOME CHASSIS

OPERATION & MAINTENANCE MANUAL



RV CHASSIS

SHYFTGROUP

Spartan RV Chassis

OPERATION AND MAINTENANCE MANUAL
for
MOTORHOME CHASSIS

Every effort has been made to ensure accuracy and quality in publication of this document. At the time of printing, content is the most current available.

Due to technological advancements, continuous improvement of our products and the products of our component suppliers, Spartan RV Chassis reserves the right to change specifications without notification.

Spartan RV Chassis
1000 Reynolds Road
Charlotte, MI 48813
USA
(517) 543-6400

www.spartanrvchassis.com

Dear Valued Spartan Owner:

Everyone at Spartan would like to express a sincere thank you for your recent purchase of a premium motorhome featuring our custom engineered and manufactured chassis.

This manual describes the proper use and maintenance of your chassis, which will help assure your safety and years of trouble-free operation. Please take the time to read all sections of the manual in detail. This is information that every owner-operator should know.

Component information from certain suppliers is available on the USB flash drive provided for your chassis. This information may be useful in understanding special features, maintenance requirements, and operating instructions for many of the major components and systems that are part of your chassis.

Once again, “Thank You” for selecting a premium motorhome featuring a world-class custom chassis from Spartan. If at any time you have questions about your chassis, please contact Spartan Customer & Product Support at (800) 543-4277 Option 1 or visit our web site at www.spartanrvchassis.com.

Sincerely,

Spartan RV Chassis

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Not all information contained in this manual may pertain to your vehicle. If you have any questions about the operation of your chassis or the manual, please contact Spartan Customer & Product Support (800) 543-4277 Option 1.

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1.0 INTRODUCTION

THIS MANUAL SHOULD ALWAYS REMAIN WITH THE VEHICLE AND BE EASILY ACCESSIBLE TO THE OPERATOR AND THE SERVICE CENTER.

INTRODUCTION

The Chassis Operation and Maintenance Manual is intended to enhance the overall vehicle ownership experience by providing the end-user with important information to safely operate the chassis, and realize optimum performance from the chassis systems.

Before operating the chassis, read this manual and any other instructional material provided by the Final Stage Manufacturer and/or Dealer. If for any reason the information in this manual seems unclear, or if you have a question regarding your chassis, please contact Spartan Customer & Product Support at one of the numbers listed below. We welcome your comments on how we can better serve you by improving our products and services.

CUSTOMER & PRODUCT SUPPORT

SPARTAN RV CHASSIS CUSTOMER & PRODUCT SUPPORT GROUP (800) 543-4277

FAX (517) 543-9264

SPARTAN RV CHASSIS SERVICE PARTS (800) 722-3025

SAFETY ALERTS

Safety alerts are presented in this manual with the following symbol describing the safety risks and potential outcome for each type of alert.



This symbol is used to address practices not related to personal injury.



A hazardous condition exists that may result in minor to moderate injury, property damage or destruction if instructions are not strictly observed.



A potentially hazardous condition exists that may result in death or serious injury, property damage, or destruction if instructions are not strictly observed.

CHASSIS / BODY INTERFACE

As a custom manufacturer of cab and chassis products, Spartan is committed to providing a high quality product to our customers. Spartan works closely with Final Stage Manufacturers to ensure system integrity is preserved and the retail purchaser are presented with a quality product. It is important to understand that not all information in this manual will apply to every unit manufactured since some features are optional.

Refer to the appropriate Final Stage Manufacturer’s literature for additional information. Guidelines for Body interface requirements are provided to our Final Stage Manufacturer’s as published in the Motorhome Body Builders Manual.

MAINTENANCE RECORDS

It is the owner's responsibility to keep accurate maintenance and repair records, including receipts. Should the lack of required maintenance be the reason for repair, a warranty claim will not be accepted. Spartan reserves the right to request your maintenance and repair records for verification of compliance with required maintenance practices and intervals. Maintenance interval and record keeping information is available in the Appendix of this manual.

Spartan recommends that the maintenance and repair records/receipts be maintained in your permanent records and transferred to any subsequent vehicle owner. Acceptable records include itemized bills, dealer work orders, owner's vehicle log, and service facility receipts, which **must** state the date service was performed, mileage (kilometers), Vehicle Identification Number, and service performed.

REPORTING SAFETY DEFECTS

If you believe that your vehicle has a defect, which could cause a crash, injury, or death, you should immediately advise the Spartan Customer & Product Support Group, the **National Highway Traffic Safety Administration (NHTSA), and/or Environmental Protection Agency.**

NHTSA cannot become involved with individual issues between the customer and the dealer or any Shyft Group subsidiary. However, if **NHTSA** receives similar complaints, an investigation may be opened to study the possibility of a safety defect that may exist in a group of vehicles. Should a defect be confirmed, a recall or remedy campaign may be ordered.

To contact the NHTSA:

Call the Auto Safety Hotline toll free at (888) 327-4236

OR

Write to:

**U.S. Department of Transportation,
National Highway Traffic Safety Administration,
Office of Defects Investigation,
NVS-216, 1200 New Jersey Avenue SE
Washington, DC 20590**

OR

File a complaint online @ <http://www-odi.nhtsa.dot.gov/ivoq/>

To contact the Environmental Protection Agency:

Write to:

**Director Field Operations and Support Division
Environmental Protection Agency
401 M Street SW
Washington, DC 204620
Attention: Warranty Claim**

CALIFORNIA PROPOSITION 65 WARNING

**CALIFORNIA
Proposition 65**

⚠ WARNING: Breathing diesel engine exhaust exposes you to chemicals known to the State of California to cause cancer and birth defects or other reproductive harm.

- Always start and operate the engine in a well-ventilated area.
- If in an enclosed area, vent the exhaust to the outside.
- Do not modify or tamper with the exhaust system.
- Do not idle the engine except as necessary.

For more information go to www.P65warnings.ca.gov/diesel.

2.0 GENERAL INFORMATION

If you have a question regarding your chassis, or this manual, please contact the Spartan Customer & Product Support Group at (800) 543-4277 Option 1.

SPARTAN RV CHASSIS LIMITED WARRANTY

For information regarding the warranty for your chassis, please refer to the warranty document provided with your welcome packet or visit our website @ www.spartanrvchassis.com/warranty.

VEHICLE IDENTIFICATION NUMBER

Every chassis manufactured by Spartan is assigned a unique VIN (Vehicle Identification Number) that is used as both the chassis and vehicle serial number. It is displayed, at minimum, on a certification label provided by the final manufacturer. Refer to the Final Stage Manufacturer's literature for certification label location and additional VIN information.

When filing a warranty claim, submitting a complaint, or general inquiries, you will need to provide the last eight digits of the vehicle identification number (VIN) as stated on the label.

CHASSIS / VEHICLE WEIGHT INFORMATION

It is important for the vehicle operator to understand the weight rating terminology as described below. For safety and proper chassis function, it is critical that:

- ◆ The actual, fully loaded vehicle weights are known for each tire position. Refer to the Gross Axle Weight section of this manual for additional information.
- ◆ The axle and tire/wheel weight ratings are not exceeded.
- ◆ Proper tire pressures are maintained. For the most current tire inflation information, refer to the respective tire manufacturer's website for downloadable inflation tables.

Michelin Website: <http://www.michelinrvtires.com/michelinrv/index.jsp>

- ◆ The major chassis components supporting the vehicle are not to be changed or replaced by components with lower ratings (e.g. tires).

In Section 7 of this manual, a weight record worksheet is provided to assist with properly weighing your vehicle and recording important data.

GROSS VEHICLE WEIGHT RATING (GVWR)

The GVWR is the **rating** established by Spartan as the maximum weight of the vehicle (including cargo, passengers, liquids, etc.) that the components of the vehicle are designed to support. This rating excludes any towed item.

GROSS VEHICLE WEIGHT (GVW)

The GVW is the total **actual** weight of a fully loaded vehicle. This includes the vehicle, cargo, passengers, and any liquids/fuels. This weight excludes any towed item. The GVW **must** not exceed the GVWR.

GROSS AXLE WEIGHT RATING (GAWR)

The GAWR is the maximum weight **rating** that an axle assembly is designed to support. Axle assembly components include the axle, suspension, tires, wheels, and brakes.

GROSS AXLE WEIGHT (GAW)

The GAW is the total **actual** weight supported by a single axle, when the vehicle is fully loaded. The GAW of each axle **must** not exceed the corresponding GAWR for the axle. Weight distribution on an axle **must** be as equal side-to-side as possible to avoid overloading one side. Therefore, individual wheel position weights **must** be taken to avoid this condition. If the weight on one side of an axle exceeds the weight on the other side of that same axle by more than 5% of the total axle rating (GAWR), it is necessary to redistribute the load appropriately. For example, if the GAWR of one axle on your vehicle is 10,000 LB, 5% of that is 500 LB. This means that the actual weight difference between the left and right side of the axle **must** be within 500 LB. In addition, the actual weight on one side of a single axle **must** never exceed 50% or one half of the GAWR for that axle, which would be 5,000 LB for the preceding example. Refer to the axle manufacturer's literature for additional information.

GROSS COMBINATION WEIGHT RATING (GCWR) AND TOWING

The GCWR is the maximum total weight **rating** allowed for a vehicle and any attachment, such as a trailer or towed vehicle. To determine the total allowable weight for a towed item, subtract the GVWR from the GCWR.

The minimum rating of both drop ball mount and receiver ball **must** be equal to or greater than towed vehicle rated capacity. Allowable extension and drop combinations are shown in Table 2-1. Exceeding these dimensions will cause the hitch to be overloaded beyond rated limits at maximum hitch capacity refer to FIG. 2-2.

When towing, two safety chains **must** be used with both chains and hooks capable of rated towing limit. To clarify, total safety chain capacity **must** be double the rated towing limit.

The maximum recommended tongue load (vertical load) on the ball drop is 10% of rated towing capacity. Load redistribution will be required if tongue load is exceeded even if rated pulling capacity (horizontal) is not exceeded.

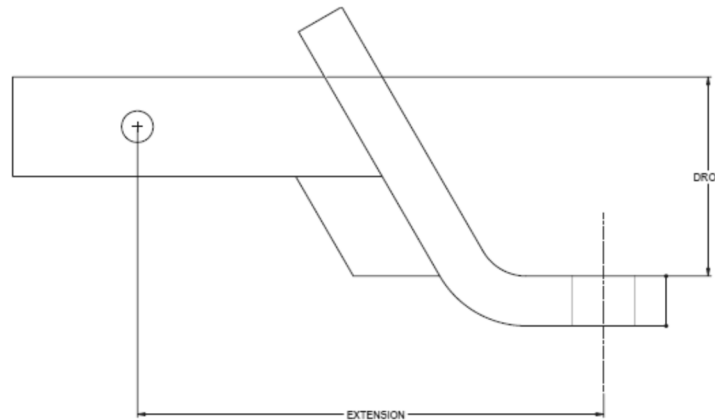
The use of weight distribution bars is not recommended unless specifically noted on the WEIGHT DISTRIBUTING RATING label on the hitch.

The chassis braking system is rated for operation at the GVWR – **NOT** the GCWR. Separate functional brake systems should be used for safe control of towed vehicles or trailers. It is important for you to understand if there are any government (federal, state, local, or other) regulations that apply to weight restrictions for the areas you plan to travel. Government restrictions could affect the size and weight of the towed item and whether an auxiliary braking system is required.

Table 2-1
Allowable ball mount extension and drop.

Gross Trailer Weight Rating	Extension	Drop
15,000 LB or below	Up to 10.00"	0.00"- 4.00"
Above 15,000 LB	Up to 8.50"	0.00"- 4.00"

FIG 2-2



WHEN YOUR VEHICLE NEEDS SERVICE

You should advise the service facility that this manual includes important inspection and maintenance information. It should be made accessible to the technician when inspection, maintenance, and/or service are needed.

CAUTION

Inherent dangers exist when performing work on a chassis. To reduce risk of personal injury, engage the services of a professional technician at an authorized service facility.

CAUTION

When performing vehicle inspections or maintenance, always wear protective clothing, safety glasses, and follow all component manufacturer safety guidelines.

GENERAL SAFETY PRECAUTIONS

- ◆ Always wear protective clothing and safety glasses.
- ◆ **Do not** wear jewelry, loose, or torn clothing.
- ◆ Always engage the park brake unless noted otherwise.
- ◆ Always use wheel chocks.
- ◆ Never work on the vehicle when the engine is running.
- ◆ **Do not** work on a vehicle supported **ONLY** by hydraulic leveling jacks or floor jacks. Always use properly rated jack stands, lifts, or hoists on firm, level ground.
- ◆ Follow the component manufacturer's safety instructions.

IF YOUR VEHICLE NEEDS TO BE TOWED

Please be prepared to provide the following vehicle information:

- Gross Vehicle Weight (GVW)
- Gross Axle Weight Front (GAWF)
- Overall height of vehicle at ride height (including A/C, satellite, etc.)
- Overall length of vehicle
- Front overhang measurement (center front wheel to front of coach)
- Ground to coach body measurement at front tire
- Type of front suspension (straight axle or IFS)
- Steer axle tire size
- Is coach capable of holding air?



Please request towing service provider to:

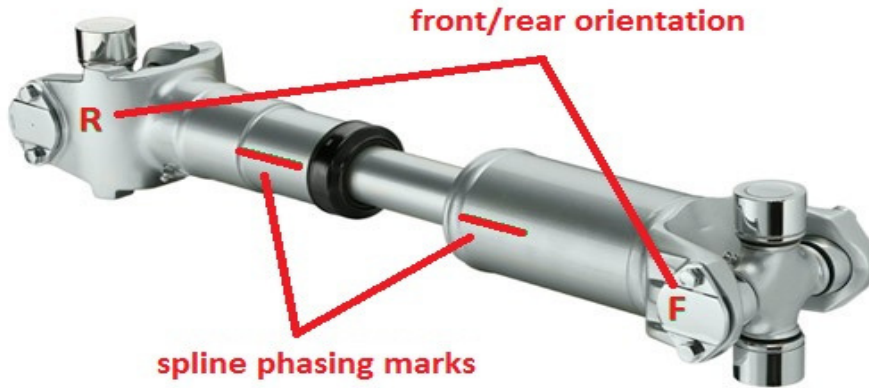
Flat bed or Low boy:

- Verify approach angle to load vehicle will not damage body throughout loading process
- Remove rear stone guard before loading vehicle
- Measure total height of coach once loaded onto trailer

Tow Truck: Wheel lift **is preferred** but frame/cradle lift is acceptable

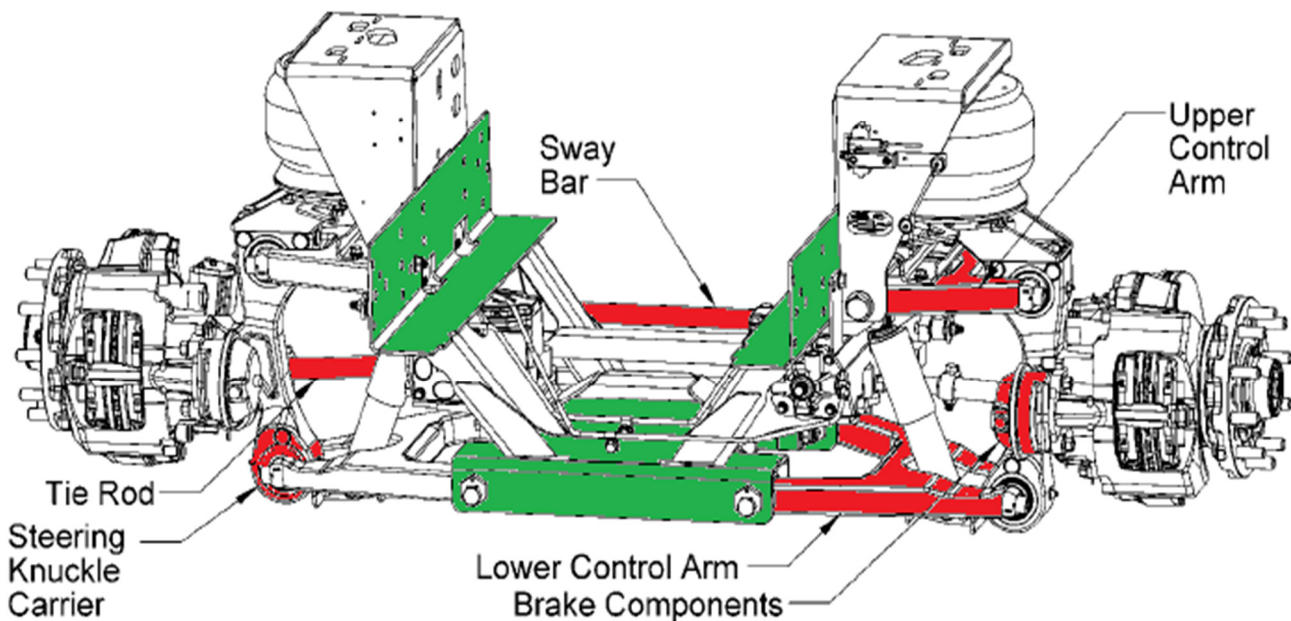
- ALWAYS tow vehicle from the front.
- Remove rear stone guard before loading vehicle
- Verify air suspension will hold air (never tow vehicle with air springs deflated)
- Verify front tow mounting will not damage other vehicle components
- Mark driveshaft to indicate spline phasing and front – rear orientation before removal
- Completely remove driveshaft before towing
- Provide auxiliary air source from tow truck to vehicle being towed

- Verify parking brakes will stay released, if not, the spring brakes will need to be caged
- Ignition switch in vehicle must be in OFF position while towing.



The chassis frame and suspension cradle shown below in **Green** are the proper lift points for towing.

Do Not attach tow apparatus (hooks, chains, straps, etc.) to suspension upper and lower control arms, sway bar and brackets, brake components, tie rods, steering arms, or steering knuckle carrier assemblies.



Driveshaft installation after towing

- Re-install drive shaft using marks made during removal, install new straps and torque bolts.

1/4 - 28 =	13-18 LB-FT
5/16 - 24 =	30-35 LB-FT
3/8 - 24 =	45-60 LB-FT
1/2 - 20 =	115-135 LB-FT

3.0 CHASSIS GETTING STARTED

GETTING STARTED

NOTICE

Do not engage starter for more than 30 seconds or damage to the starting motor can result. Wait 2 minutes between each attempt to start.

Use Ultra-Low Sulfur Diesel Fuel Only.

Usage of biodiesel or any other alternative fuel is subject to the standards and guidelines of the engine manufacturer. Before using, please contact your engine manufacturer for current information to determine if warranty is affected.

NOTICE

DO NOT overfill fuel or DEF tank.

GENERAL START-UP AND PARKING PROCEDURES

It is critical that the driver has in-depth knowledge of all chassis controls before operating the vehicle. The following information is a general description of the procedures for starting and parking the vehicle. The remainder of the information in this manual should be read and understood prior to operating the vehicle.

Refer to the engine operation manual for additional engine starting/operating instructions. Specific information may apply for particular engine models and/or if conditions other than normal exist.

Starting the Vehicle

- ◆ Perform all pre-trip inspections as listed in the appendix of this manual.
- ◆ Perform any additional or pre-trip inspections as described by the Final Stage Manufacturer.
- ◆ Check around vehicle for any obstructions and for a clear driving area.
- ◆ Ensure park brake is applied and the transmission is in 'neutral' position.
- ◆ Adjust seat, mirrors, steering column, and steering wheel so you can safely operate all controls.
- ◆ Turn the mechanical key switch to the 'ON' position **OR** if equipped, depress the push button start switch twice (See Keyless Start in section 4). Check to see that all warning lights and audible alarms are functioning. **Do not** depress the accelerator pedal.
- ◆ Wait for the 'WAIT TO START' lamp to go out.
- ◆ Turn the mechanical key switch to the 'START' position and release when engine starts **OR** if equipped, depress brake pedal and depress the push button start switch until engine starts. **Do not** engage starter for more than 30 seconds. **Do not** depress accelerator pedal until after the engine starts.
- ◆ Check that engine and transmission gauges are within the proper operating range by ensuring all warning indicator lamps and alarms are off.
- ◆ Check air gauges to ensure air pressure has built up to at least 100 PSI.
- ◆ Check that service brake is applied when pedal is depressed.
- ◆ Select the "D" position for the transmission.
- ◆ Check that the parking brake operates by ensuring the vehicle is prevented from moving under light throttle while the parking brakes are applied.
- ◆ With the brake pedal depressed, release the parking brake.

- ◆ Check the service brake operation by moving forward at a slow speed in a clear, unobstructed area, and depress the brake pedal until the vehicle comes to a stop. Check for a 'pull' to one side, delay in ability to stop, or any unusual feel or noises.
- ◆ Move forward slowly to check that the steering feels normal and the vehicle is under full control.

Parking the Vehicle

- ◆ Bring vehicle to a safe stop and apply parking brake.
- ◆ Place transmission in neutral and turn the engine 'off'.

BEFORE YOU GET BEHIND THE WHEEL

We have assembled this manual with your safety and that of others in mind. You are operating a vehicle of significant size and weight that requires both pre-trip and daily inspections. Please review this section thoroughly, which will help you understand your role in keeping yourself and others safe on the road.

Chassis components and systems require regular maintenance and inspections to ensure safe operation, maintain optimal chassis performance, and minimize operating costs. Many pre-trip inspections and the associated corrective actions are not difficult, but require knowledge of safety precautions to prevent injury. We caution you that even simple procedures, such as checking and adjusting air pressure in your tires, present hazardous conditions if correct preparations have not been made.

THROUGHOUT THIS MANUAL, WE REGULARLY REFER THE READER TO THE MANUFACTURER'S LITERATURE FOR FURTHER INFORMATION. IT IS IMPORTANT THAT YOU READ THE MAINTENANCE INFORMATION LOCATED IN THE APPENDIX OF THIS MANUAL. THE INFORMATION IS NOT MEANT TO OVERRIDE COMPONENT MANUFACTURER RECOMMENDATIONS AND DOES NOT INCLUDE ALL THE MANUFACTURERS RECOMMENDED MAINTENANCE INTERVALS / INSPECTIONS, WHICH IS WHY YOU SHOULD READ THE MATERIAL LOCATED ON THE USB FLASH DRIVE FOR YOUR CHASSIS. PLEASE CONTACT SPARTAN CUSTOMER & PRODUCT SUPPORT AT (800) 543-4277 OPTION 1 IF YOU CANNOT LOCATE SPECIFIC CHASSIS COMPONENT INFORMATION OR IF INFORMATION SEEMS UNCLEAR.

CHASSIS STORAGE AND PERIODS OF NON-USE

If your vehicle is **not** driven for more than 30 days, maintenance requirements may change. Some types of fluid degrade under certain conditions and some components require special attention during and after long intervals of non-use. **Note: Periods of inactivity which exceed 3 months in conjunction with ambient temperatures greater than, or equal to, 86° F (30° C) may cause degradation of the diesel exhaust fluid (DEF). DEF must be drained, properly discarded, and replaced. Simply topping off the DEF may impact emissions performance. Please review the Final Stage Manufacturer's Manual and the following chassis component manufacturer's literature for storage guidelines specific to your circumstances:**

- ◆ Battery
- ◆ Engine
- ◆ Transmission
- ◆ Wheels
- ◆ Tires

In addition, the vehicle should be safely secured on the leveling jacks in accordance with the Final Stage Manufacturer instructions.

CHASSIS SAFETY INSPECTIONS AND MAINTENANCE



Always, at a minimum, have the checklist items inspected before operating your vehicle. Failure to perform a pre-trip safety inspection and correcting any

identified problems prior to travel may result in personal injury, and/or damaged property and equipment.

The information in this section is intended to provide you with a basic understanding of how the chassis systems of your vehicle should be properly inspected before traveling. It is intended to compliment the manufacturer recommendations.

RECOMMENDED DAILY DRIVER'S INSPECTION

In addition to the pre-trip inspections, several important items should be checked on a daily basis during chassis operation. The following information is the recommended procedure for inspecting your vehicle on a daily basis.

Start the engine and run at normal idle speed for approximately 3 minutes until the air system pressure builds up to a minimum of 100 PSI. Shut the engine off and perform the following checks:

- 1) Check tires when they are cold (3 hours without use) for proper air pressure and any road damage.

For your safety, and to optimize the ride quality, handling, and tire wear of your vehicle, we strongly recommend weighing each wheel position of your vehicle in a fully loaded condition, and setting tire pressures based on those weights. The best source for the correct pressures is the tire manufacturer's website.

If you **do not** know the actual weights of your vehicle, tires should be inflated to the pressures shown on your chassis data tag, which is typically located in the driver's compartment. It is also located on the vehicle certification label provided by the Final Stage Manufacturer. Refer to the Final Stage Manufacturer's literature for certification label location.

Tire pressures **must** be monitored closely to assure safe operation of the vehicle. Spartan recommends checking tire pressure daily when the vehicle is being driven. It is important to understand that a change in weight distribution or the amount of weight added or removed from the vehicle may require a change to tire pressures. Refer to the Gross Axle Weight section of this manual.

Note- An improperly inflated tire will NOT be evident from a visual inspection.

- 2) Complete a walk-around of the entire vehicle and check for:

- ◆ Fluid Leaks- both on the chassis components (e.g. wheels) and on the ground.

Note- Water dripping during and following A/C use is normal.

- ◆ Unusual noises such as air leaks.
- ◆ Proper height of the vehicle to ensure air springs are inflated and vehicle is not leaning.
- ◆ Any damaged or loose components.

- 3) Open the engine compartment and visually check for:

- ◆ Loose, missing, or damaged drive belts.
- ◆ Fluid Leaks- both on the engine components and on the ground.
- ◆ Fluid Levels for engine oil, coolant, and hydraulic fluid.
- ◆ Any damaged or loose components.

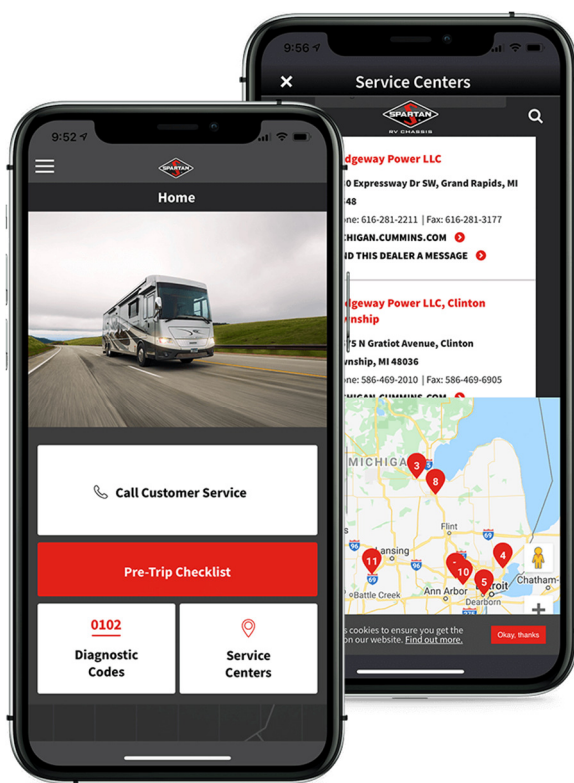
- 4) If your chassis is equipped with manual drain valves on the air tanks, they should be purged daily.
- 5) Check service brake operation at a slow speed.
- 6) Check park brake operation in a low gear.

CHASSIS PRE-TRIP INSPECTION

Before the vehicle is driven, verify that the chassis is in good working condition by having a pre-trip inspection completed. For your convenience, this information has been condensed into a checklist on page 64 of this manual, which can be duplicated and utilized each time a pre-trip inspection is done. It is important to understand that pre-trip inspections should also be performed as part of regularly scheduled maintenance.

If any system or component does not pass inspection, it should be corrected before operating the vehicle. Corrective action may require referral to an authorized service facility and/or the appropriate manufacturer's publication. If for any reason, a referenced publication is not available, please contact Spartan Customer & Product Support at (800) 543-4277 Option 1.

SPARTAN CONNECTED CARE APP



[Connected Care® App.](#)

The Spartan RV Chassis Connected Care® mobile app puts owners in touch with on-the-go access to:

- Quick links to service and support
- Pre-trip inspection checklists
- An integrated service center locator
- Maintenance schedules
- Diagnostic code search
- Key Spartan RV Chassis contact information
- Spartan RV Chassis' show and rally schedule
- Plus more!

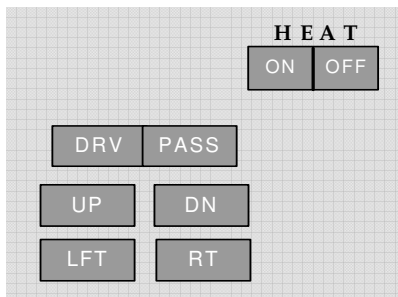
4.0 ELECTRICAL

ELECTRICAL

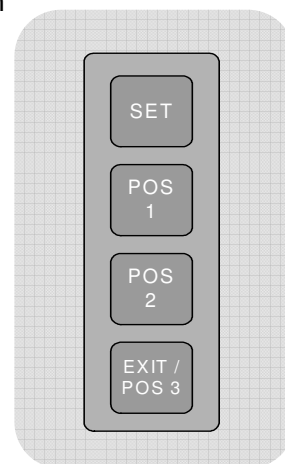
MEMORY OPTIONS

The Final Stage Manufacturer determines the design and location of the memory option panel. In general, 4 buttons are used to set and recall specific positioning for a group of driver controls.

The driver controls that may be set using the memory option include the tilt/telescopic steering column, seat base/back, outside rear view mirrors, and the brake/accelerator pedals.



Separate buttons or switches are available to manually set and adjust each driver control. The Final Stage Manufacturer determines the design and location of the control panel.



There are 3 SET buttons available for programming memory settings. The “POS 1” and “POS 2” buttons

are normally for 2 separate driver settings, while the “EXIT/POS 3” button is utilized for setting options to allow the driver to exit/enter the driver’s seat comfortably when the vehicle is parked. Position 3 can additionally be used for a 3rd driver, as all functions can be set.

Each adjustable driver control has a separate device or set of devices. Some controls are located on the component and some are determined by the manufacturer when designing the vehicle.

- ◆ The tilt and telescoping column/steering wheel tilt forward/rearward.
- ◆ The driver’s seat base moves forward/rearward, up/down, and the seat back reclines.
- ◆ The brake/throttle pedals move together forward/rearward.
- ◆ The memory switches for mirror positioning separately control mirror movement left/right and tilting up/down, for the right and left outside rear-view mirrors.

Set Driver “POS 1” and “POS 2” Memory:

- 1) Position each driver control to the desired location.
- 2) Press and hold the SET button and then press “POS 1” or “POS 2” to save the associated settings.

To Set EXIT/ “POS 3” Memory:

- 1) Position each driver control to a location where it is comfortable for the driver to exit the driver’s seat.
- 2) Press and hold the SET button, and then press “EXIT/POS3.”

To Recall Settings:

Press the appropriate “position” button to set controls to the locations associated with that button.

ENGINE CONTROLS

Ignition Switch

The ignition switch turns on accessory power and starts the engine. Refer to GETTING STARTED section for additional start-up information.

To start the engine under normal starting conditions with mechanical key switch:

- ◆ Turn the key to the 'ON' position and check to see that all warning lights and audible alarms are functioning. **Do not** depress the accelerator pedal.
- ◆ Wait for the 'WAIT TO START' lamp to go out.
- ◆ Turn the key to the 'START' position and release when engine starts. **Do not** depress accelerator pedal until after the engine starts.

If your motorhome is equipped with Spartan's push button keyless start system (PKS), please refer to Keyless Start information below.

Keyless Start

On models equipped with keyless start, a push-button ignition switch is used in place of a mechanical key switch to turn on, start, and turn off the vehicle. An electronic key fob that utilizes Radio Frequency Identification (RFID) technology allows the keyless start system to verify only an authorized operator can turn on or start the vehicle.

An antenna mounted behind the dash communicates with the electronic key fob when attempting to turn on or start the vehicle. The electronic key fob must be within 3-4 feet of the dash to allow for the antenna to locate the key fob.

The push-button ignition switch can be used to change between the different operational modes, similar to a mechanical key switch. The different modes are:

OFF – Vehicle electrical power is off.

ACCESSORY – Accessory devices such as the radio and HVAC controls are active and can be utilized.

IGNITION – All electrical devices necessary to start and operate the vehicle, including all accessory devices, are active and can be utilized.

START – The engine starter motor is actively engaged in starting the engine. During engine starting, accessory devices are deactivated to provide maximum electrical power to the starter motor.

RUN – After the engine starts, all accessory and ignition devices are active. The vehicle can be driven.

The push-button ignition switch includes a LED indicator lamp that provides feedback to the driver during ACCESSORY and IGNITION modes. To help reduce driver distraction, the lamp is not illuminated during RUN mode.

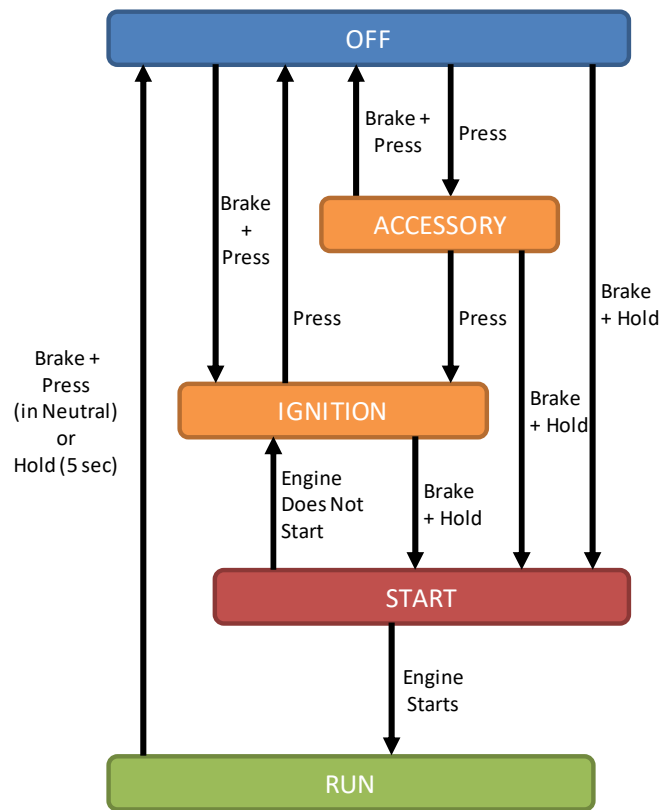
AMBER LAMP – When the system is in ACCESSORY or IGNITION mode, the push-button lamp will be AMBER to indicate the vehicle electrical power is on.

GREEN LAMP – The push-button lamp will be GREEN to indicate an authorized key fob has been found. As a safety precaution, the operator must depress the service brake pedal before attempting to start the engine (see below for complete starting procedure). When the brake pedal is depressed, the system searches for the presence of an authorized key fob. If an authorized key fob is found, the LED lamp will be solid GREEN as long as the brake pedal is depressed. The solid GREEN lamp indicates the engine can be started.

If an authorized key fob is not found, the lamp will flash GREEN three times to indicate the missing key fob. The brake pedal must be released and depressed again once an authorized key fob is moved within the range of the antenna.

System Operation:

(Refer to the diagram)



To turn vehicle power on:

- 1) Press the button once to turn on ACCESSORY mode (requires authorized key fob).
- 2) Press the button a second time to turn on IGNITION mode.
- 3) Press the button a third time to turn electrical power back off.

Alternate power on method:

- 1) Press the button once while the brake pedal is depressed to go straight to IGNITION mode (requires authorized key).

To start the engine:

The engine can be started from OFF, ACCESSORY, or IGNITION modes

- 1) Assure the park brake is applied, and the transmission is in neutral.
- 2) Depress the brake pedal
- 3) GREEN lamp comes on to indicate presence of an authorized key.
- 4) Press and HOLD the button to crank the engine
- 5) Once the engine starts, release the button and brake pedal.

If the button or the brake pedal are released before the engine starts, the system will stay in IGNITION mode.

Cold weather start:

For cold weather starts, the engine will perform a pre-heat cycle in IGNITION mode that aids in starting. The Wait-To-Start indicator in the dash will be on while the pre-heat cycle is active.

- 1) Press the button twice to activate IGNITION mode OR press the button once while depressing the brake pedal to go straight to IGNITION mode.
 - a. The Wait-to-Start indicator will turn on, indicating the pre-heat cycle is active.
- 2) Wait for the indicator to turn off
- 3) Depress the brake pedal
- 4) GREEN lamp comes on to indicate presence of an authorized key fob.
- 5) Press and HOLD the button to crank the engine.
- 6) Once the engine starts, release the button and brake pedal.

Turn off the engine:

- 1) Bring the vehicle to a stop.
- 2) Apply the park brake
- 3) Place the transmission in neutral
- 4) Depress the brake pedal
- 1) Press the button
 - a. Engine turns off

The transmission must be in neutral and the brake pedal must be depressed to turn the vehicle off in this manner. This prevents turning the engine off by accidentally pressing the button while driving.

In case of an emergency, the engine can be turned off regardless of transmission gear or brake pedal position:

- 1) HOLD the button for 5 seconds.

This method turns the engine off regardless of transmission gear and brake pedal position. Use only if the engine cannot be shut down normally.

Brake Override

The keyless start system requires a signal from the air brake system as part of the authentication process for the key fob. If the air brake system has low air pressure (IE < 4 PSI), the key fob may not be authenticated by depressing the service brake pedal. If depressing the service brake does not turn the push button lamp GREEN,

a remote override switch (if equipped) must be depressed to authenticate the key fob. Depressing this momentary switch will cause the system to look for the key fob and will turn the push button lamp GREEN if an authorized key fob is found. This switch must be held while starting the engine. The override switch is located under the dash to the left of the steering column next to the green diagnostic connector. If the push button has three GREEN flashes or no light at all, contact Spartan Customer & Product Support (800) 543-4277 Option 1.

Fob performance & battery life

Electronic signals emitted from cell phones, wireless chargers, and other vehicle system control units may interfere with Fob signals and prevent Fob from entering sleep mode if the Fob is in close proximity to the aforementioned devices. To help ensure optimal Fob performance and battery life, it is recommended to keep the Fob at least 5 – 6 inches away from other electronic devices such as cell phones, wireless chargers, and vehicle system control units.

Refer to the engine operation manual for additional engine starting/operating instructions. Specific information may apply for particular engine models and/or if conditions other than normal exist.

Accelerator Pedal

When depressed, the accelerator pedal increases the engine speed and thus the speed of the vehicle. The pedal is located on the driver's side floor or suspended on a vertical support under the dash to the right of the brake pedal.

Certain chassis models are equipped with an adjustable pedal system. With this system, the driver may easily adjust the accelerator and brake pedal for the most comfortable position. Refer to the Final Stage Manufacturer's literature for location and operation of the controls to operate the system.

Cruise Control and Idle Control

The cruise control switches may be located in the dash as switches, on the steering wheel control pods, or integrated into the turn signal lever on the steering column. Refer to the Steering Wheel and Column Controls section in this manual and the Final Stage Manufacturer's literature to identify their location.



DO NOT use the cruise control function during inclement weather, adverse road conditions, or in heavy traffic.

The cruise functions are **cancelled** when the brake pedal is applied.

Cruise control functions operate as follows:

Press and Release:

‘ON’
‘OFF’
‘SET/COAST’

‘RES/ACCEL’

‘CANCEL’
(steering wheel only)

To:

Activate the cruise system.
Deactivate the cruise system.
Set: Sets cruise speed at the speed the vehicle is traveling when applied.
Coast: Decreases the set cruise speed when control is pressed and held.
Res: Resets to the previously set cruise speed if cruise has been cancelled and still ‘on.’
Accel: Increases set cruise speed when control is pressed and held.
Cancels cruise functions.

Idle Control

Your chassis is equipped with control systems for the high idle function. To set a high idle speed, first put the engine at idle, the transmission in neutral, and engage the park brake. Then activate the cruise system by turning it ‘ON’. **DO NOT** depress the accelerator or brake pedal.

Version A

1. Obtain the initial high idle setting by pressing and releasing either the ‘SET’ or ‘RESUME’ control.
2. Increase engine speed by pressing and holding The ‘SET’ control. A maximum RPM is pre-set.
3. Lower the engine speed by pressing and holding the ‘RESUME’ control. A minimum RPM is pre-set.
4. To return to the initial high idle speed, press and And release the ‘RESUME’ button.

These functions may be canceled by turning the cruise system ‘OFF’, depressing the brake pedal, or pressing the ‘CANCEL’ control (steering wheel only).

For additional information about setting the idle speed, refer to the engine operation manual.

STEERING WHEEL AND COLUMN CONTROLS

Hazard Warning System

The hazard warning system is a combination of four-way flashers, which are activated by pulling outward on the slide switch located on the bottom side of the Douglas Autotech column or pulling outward on the slide switch located under turn signal stalk on the ZF column. Push the slide switch inward to deactivate the flashers. Refer to FIG. 4-1 & 4-2.

The flashers will not flash during braking. In addition, when the hazard warning flashers are on, the turn signals will not operate.

Turn Signal Lever, High/Low Headlamp Beam, (Non-Smart Wheel Only) Cruise/Idle Control

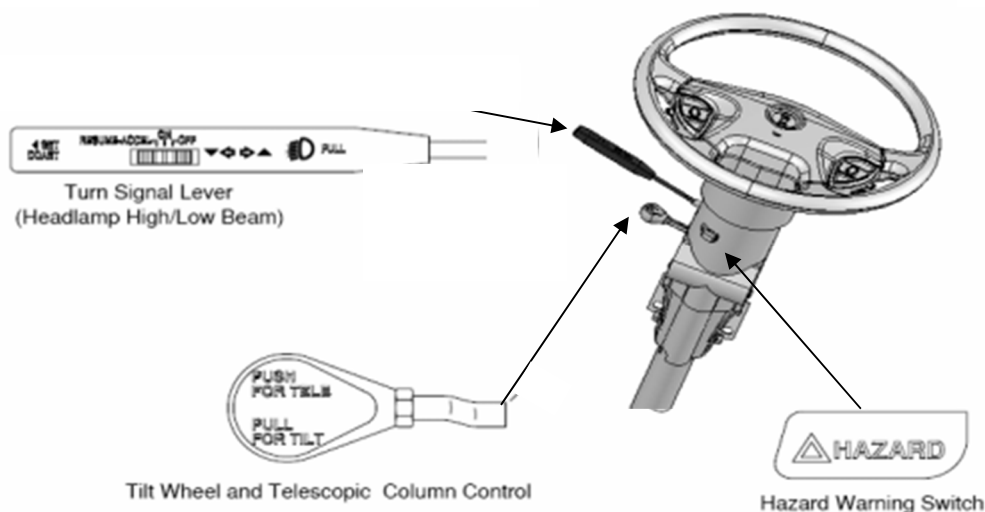
Moving the lever clockwise activates the right turn signal. Moving the lever counterclockwise activates the left turn signal. Pull the lever upward to switch the headlamps between low beam and high beam. Refer to FIG. 4-1. Refer to the Engine Controls section of this manual for operating information about the cruise and idle control functions.

Tilt and Telescope Column Controls

The tilt and telescope column functions allow positioning of the steering wheel for driver preference. The column position may be adjusted via manual levers or via electric power assist, depending on model. Refer to FIG. 4-1 & 4-2.

The manual tilt & telescope adjustment lever for the Douglas Autotech column is located below the turn signal lever. Pull the lever up with your left hand while using your right hand to move the steering column to desired tilt position. Push the lever down with your left hand while using your right hand to move the steering column to desired telescope position (pull up or push down on steering wheel). Release the hand lever to lock steering column in desired position.

The manual tilt & telescope adjustment lever for the ZF column is a foot operated lever located near the floor on the left side of the steering column. Depress the foot lever with your left foot while moving the steering column to desired tilt & telescope position (pull up or push down on steering wheel). Release the foot lever to lock steering column in desired position.





ZF Steering Column Controls w/ Manual Adjust

FIG. 4-2

The power tilt & telescope adjustment switches may be located on the dash or on the steering wheel, depending on model.

STEERING WHEEL CONTROLS

Refer to FIG. 4-2 thru 4-6.

NOTICE

Do not push buttons on the steering wheel while turning the ignition switch from the off to the on position. If button is pushed, recycle ignition without pressing buttons.

Headlamp Flash (If equipped)

When the headlamps are 'OFF' and this button is pressed, the headlamps will turn on for as long as the button is held. The opposite occurs if the headlamps are 'ON.'



Daytime Running Lamps

The daytime running lamps can be turned off by applying the parking brake or by turning the ignition 'OFF.'

Marker Lamp Flash (If equipped)

When the marker lamps are 'ON' and this button is pressed, the marker lamps will turn 'OFF' for as long as the button is held. The opposite occurs if the marker lamps are 'OFF.'



Cruise and Idle Control Functions (If equipped)

The four buttons on the lower left side are the cruise control and idle control buttons. Refer to the Engine Controls section of this manual for additional information.



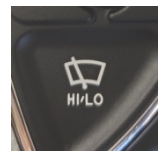
Wiper Control Functions

The four buttons on the lower right side are the wiper control buttons.



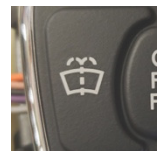
Wiper High / Low

Press to activate wipers. When initially turned on, the wipers will be at low speed. Pressing the button, a second time shifts the wipers to high speed. Every time the button is pressed, the wipers alternate between low and high speed.



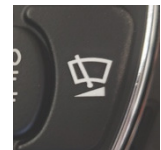
Wiper Wash

Press to pump and squirt fluid onto the windshield. If pressed when the wipers are off, the wipers will complete approximately 3 cycles and then turn off again.



Wiper Variable Display

If the button is pressed one time, and not pressed again within 30 seconds, the wipers will 'pulse' – completing only one cycle and repeat every 30 seconds. If the button is pressed a second time within 30 seconds, an ongoing delay wipe function will occur. The delayed time interval between wipe cycles will equal the time interval between when the button was pressed the first and second time. Initiation of any other wiper function will override the variable setting.



Dash Navigation Control Functions (If equipped)

Certain vehicles may be equipped with steering wheel controls for a digital instrument cluster. Refer to the manufacturer's literature for additional information.



Power Tilt Column Adjustment (If equipped)

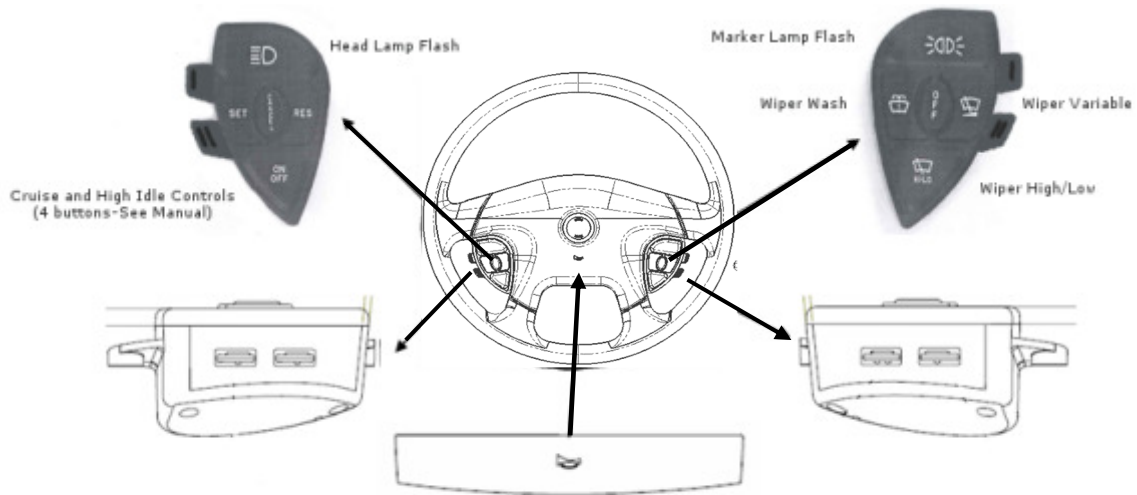
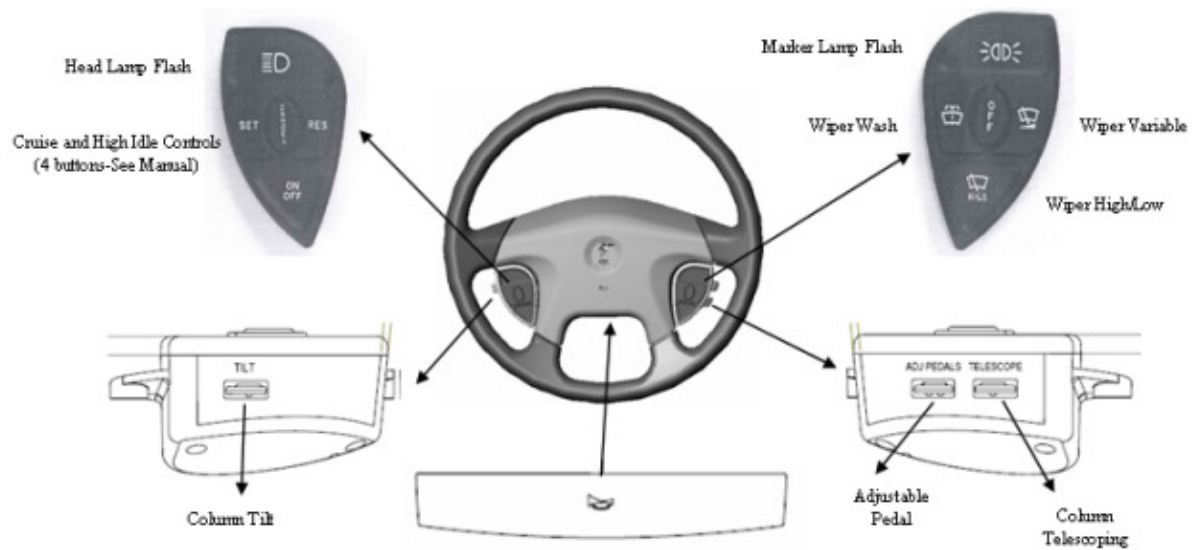
Press down or pull up to adjust tilt of column up or down.

Power Telescope Column Adjustment (If equipped)

Press down or pull up to adjust column height up or down.

Pedal Position Adjustment (If equipped)

Press down or pull up to move adjustable pedals forward or backward.



Note: For more information about radio controls, refer to the applicable supplier information in the manual.

Phone Control Functions (If equipped)

Certain models are equipped with steering wheel mounted controls for answering, declining, and ending phone calls if a phone is connected with the vehicle's infotainment center via Bluetooth®. There are two variants of steering wheel controls offered to control phone function. Reference FIG 4-4 and 4-5.

Answer call: Select the green phone button to answer incoming calls.

Decline call: Select the red phone button to decline incoming calls.

End call: Select the red phone button to end calls.

Note: Additional information is available in the GIC manual on the USB flash drive.



Paddle switch functions



- Vol + : Increase radio volume
- Vol - : Decrease radio volume
- Mode : Change radio source
- 🔇 : Mute radio volume

- Nav : Activate navigation mode
- ▶|| : Play and pause
- ▶▶ : Next, or forward
- ◀◀ : Previous, or reverse

Steering Wheel with Phone and Radio Controls
FIG. 4-4



Paddle switch functions



Vol +/- : Increase or decrease radio volume
Tilt : Tilt steering column up or down

Pedals : Move pedals forward or back
Telescope: Telescope steering column up or down

Steering Wheel with Phone, Column Adjustment, and Pedal Adjustment Controls
FIG. 4-5



Paddle switch functions



Vol +/- : Increase or decrease radio volume

Steering Wheel with Phone and Radio Volume Controls

FIG. 4-6

Tri-Pod Steering Wheel Controls (If equipped)

Certain models are equipped with Tri-Pod steering wheel mounted controls. Specific controls layouts are dependent upon coach model. Refer to illustrations below for layout representative of your coach.



LH Control POD

Headlamp flash
 Cruise control resume / increase
 Cruise control On / Off
 Cruise control set / decrease
 Cruise control cancel

Center Control POD

GIC display screen view selection (Normal – Navigation – Camera)
 GIC display Home
 OK (i.e. select)
 Scroll UP
 Media source
 Media previous
 GIC display Back
 Scroll DOWN
 Media next

RH Control POD

Marker lamp flash
 Wiper speed Hi / Lo
 Wiper wash
 Wiper Automatic mode / Off
 Air horn enable / disable



LH Paddle Switches

Phone decline / end
 Phone answer
 Engine brake On / Off
 Engine brake level (L-M-H)



RH Paddle Switches

Media volume increase
 Media volume decrease
 Media On / Off
 Media mute



LH Control POD

- Headlamp flash
- Cruise control resume / increase
- Cruise control On / Off
- Cruise control set / decrease
- Cruise control cancel

Center Control POD

- Phone decline / end
- Day shade Up
- Media mute
- Night shade Up
- Phone answer
- Engine brake On / Off
- Day shade Down
- Night shade Down
- Engine brake level (L-M-H)

RH Control POD

- Marker lamp flash
- Wiper wash
- Wiper Off
- Wiper intermittent
- Wiper speed Hi / Lo



LH Paddle Switches

- Pedal adjust In
- Pedal adjust Out
- Media next
- Media previous



RH Paddle Switches

- Media volume increase
- Media volume decrease
- Navigation screen
- Media source



LH Control POD

- Phone answer / decline / end
- Wiper wash
- Wiper Off
- Wiper intermittent
- Wiper speed Hi / Lo

Center Control POD

- Headlamp flash
- Media source
- Media mute
- Media volume increase
- Marker lamp flash
- Media previous
- Play / pause
- Media volume decrease
- Media next

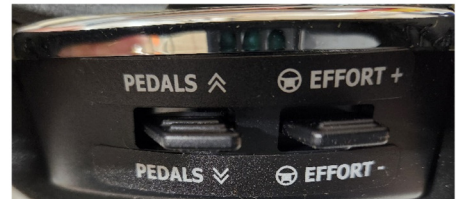
RH Control POD

- Scroll Up
- Home
- OK
- Back
- Scroll Down



LH Paddle Switches

N/A



RH Paddle Switches

- Steering effort increase
- Steering effort decrease
- Pedal adjust In
- Pedal adjust Out



LH Control POD

- Phone answer / decline / end
- Wiper wash
- Wiper Off
- Wiper intermittent
- Wiper speed Hi / Lo

Center Control POD

- Headlamp flash
- Media source
- Media mute
- Media volume increase
- Marker lamp flash
- Media previous
- Play / pause
- Media volume decrease
- Media next

RH Control POD

- Scroll Up
- Home
- OK
- Back
- Scroll Down



LH Paddle Switches

- Steering column telescope In
- Steering column telescope Out
- Steering column tilt Up
- Steering column tilt Down



RH Paddle Switches

- Steering effort increase
- Steering effort decrease
- Pedal adjust In
- Pedal adjust Out

Heated Steering Wheel (If equipped)

Certain models are equipped with a heated steering wheel. A switch to activate the heated steering wheel is located on the dash.



TELLTALES

A panel in the dash, with display symbols similar to those shown in FIG. 4-7, is typically supplied by Spartan and installed by the Final Stage Manufacturer as part of the completed vehicle. When a specific condition is detected, the corresponding symbol will illuminate and an alarm may sound to alert the driver of the condition. It is important to understand the details of each warning symbol by reading the appropriate chassis system section and component manufacturer’s literature. For instance, by reviewing the section in the ‘engine’ operation manual describing electronic fault codes, the operator will have a better understanding of the specific reasons for the activation of an engine related symbol numbers shown in FIG. 4-7. Not all telltale indicators shown in this section are included with every Spartan chassis. Some telltales may represent optional use equipment or supplied by the Final Stage Manufacturer.

CRITICAL SYSTEM TELLTALES

While all telltale symbols are important, some are more significant in that they are meant to alert the driver to take immediate action due to the potential failure of an important system.

Symbol	Description	Symbol	Description
	Turn Signal		High Idle
	Wait to Start		Check Transmission
	Automatic Traction Control (ATC)		Transmission Range Inhibit
	Low Coolant		Adaptive Cruise Control
	Water in Fuel		Collision Mitigation System
	Seatbelt		Not at Ride Height
	Diesel Particulate Filter (DPF)		Marker Lights
	High Exhaust System Temperature (HEST)		Cruise Control
	High Beams		Malfunction Indicator Lamp (MIL)
	Auxiliary Brake		Check Engine
	Anti-Lock Brake System (ABS)		Stop Engine
	Park Brake		Low Tire Pressure
	Restricted Air Filter		High Transmission Temperature
	Diesel Exhaust Fluid (DEF)		Low Fuel

ADDITIONAL TELLTALES

Additional telltales such as the brake warning light or audible alarms are explained in each of the system specific sections where applicable. Refer to the Final Stage Manufacturer's literature for further information or contact Spartan Customer & Product Support at (800) 543-4277 Option 1.

GAUGES

The following information provides a basic description of the different types of gauges associated with chassis systems that may be supplied by Spartan. The illustrations and descriptions shown here may not be presentative of final graphics of a display and are here for reference only. Not all gauges shown in this section are included with every Spartan chassis. Some gauges may be optional use equipment or supplied by the Final Stage Manufacturer. The gauge illustrations are standard gauges, metric gauges may be available.

AIR PRESSURE GAUGE

A vehicle with full air brakes has two air pressure gauges. Each gauge is attached to an independent air system and has a warning indicator light, which is also referred to as the brake warning light.

The primary air system, also referred to as system #1 (Rear Air), operates the service brakes on the rear axle. The secondary air system, or system #2 (Front Air), operates the brakes on the front axle.

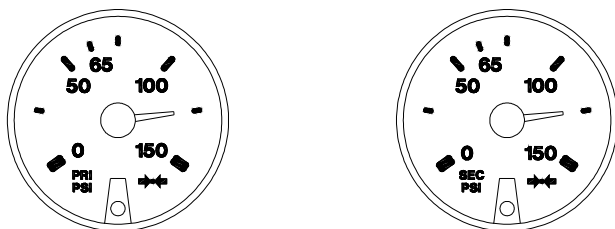
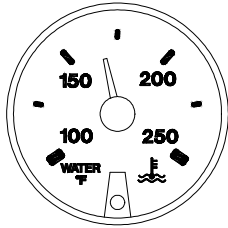


FIG. 4-8

The normal air operating pressure is 100 to 140 PSI, which is pre-set at the factory. Before moving the vehicle, be sure both gauges are within the normal operating range. If the air system pressure cannot be maintained, and/or a malfunction occurs, the driver is alerted by the warning indicator lamps and audible alarms if present. If any warning indicator lamps or audible alarms are active, refer to applicable manufacturer's manual, and contact an authorized service facility or Spartan Customer & Product Support at (800) 543-4277 Option 1.

ENGINE COOLANT TEMPERATURE GAUGE



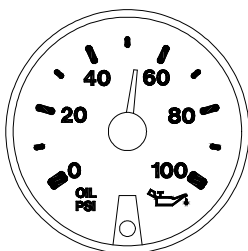
ENGINE FUEL LEVEL GAUGE



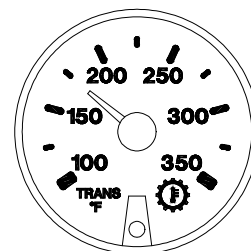
The level of fuel in the fuel tank is shown with this gauge. Reserve fuel capacity below empty varies by chassis model.

FIG. 4-10

ENGINE OIL PRESSURE GAUGE



TRANSMISSION FLUID TEMPERATURE GAUGE



VOLTMETER

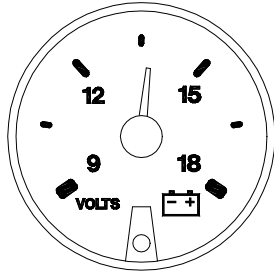
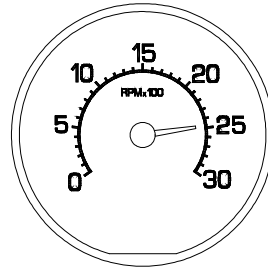
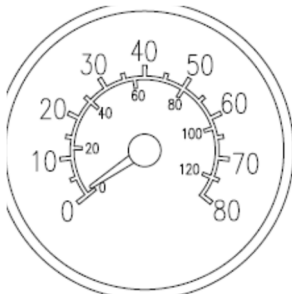


FIG. 4-12

TACHOMETER



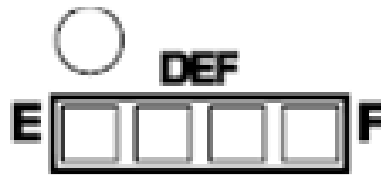
SPEEDOMETER



The vehicle's speed is shown with this gauge

FIG. 4-14

DIESEL EXHAUST FLUID LEVEL GAUGE



The vehicle's level of DEF in tank is shown here. Located in the bottom of Engine Fuel Gauge.

FIG. 4-15

DIESEL EXHAUST FLUID

The chart below explains each of the indicator levels you might see on the DEF indicator.

% of Fluid Needed (Less Than or Equal To)	LED Indication	Message on LCD	Additional Notifications	Audible Alarm (active when DEF trigger is present)
100%				
75%				
50%				
25%				
10%		"LOW DIESEL EXHAUST FLUID"	DEF Lamp - solid on & Amber in color Check Engine Lamp - Flashing 30s at key up & Amber in color	Gauge Audible Alarm becomes active, but it is acknowledgeable.
2.5%		"LOW DIESEL EXHAUST FLUID - URGENT"*	DEF Lamp - solid on & Amber in color Check Engine Lamp - Flashing 30s at key up & Amber in color	Gauge Audible Alarm becomes active, but it is acknowledgeable.
0%		"ENGINE DERATED - DEF REQUIRED"***	DEF Lamp - flash on & off at 1 Hz & Amber in color Check Engine Lamp - solid on & Amber in color MIL Lamp - solid on & Amber in color	Gauge Audible Alarm becomes active, but it is acknowledgeable.
0%		"SPEED RESTRICTED - DEF REQUIRED"****	DEF Lamp - flash on & off at 1 Hz & Amber in color Check Engine Lamp - solid on & Amber in color MIL Lamp - solid on & Amber in color Stop Engine Lamp - solid on & Red in color	Gauge Audible Alarm becomes active, but it is acknowledgeable.
*Engine Performance Derate begins at 25%				
**Engine Performance Torque Derate to 40% ramped at 1% per minute				
***Speed restriction will limit to 1000rpm, 5 MPH vehicle speed, & 40% Torque Derate				

SPARTAN CONNECTED COACH (IF EQUIPPED)

Some chassis are equipped with a digital instrumentation cluster. For detailed information, please refer to the instrumentation manufacturer's manual on the USB flash drive provided for your chassis.

SPARTAN ADVANCED PROTECTION SYSTEM (APS) (IF EQUIPPED)

The Spartan APS system is a select package of features that deliver unparalleled driver safety and peace of mind. Not all vehicle models may be equipped with each feature of APS. The motor coach manufacturers select which features are offered for each model. Please inquire with your dealer to review and understand the features available for your specific motorhome.

Collision Mitigation System (CMS)

Collision Mitigation System (CMS) utilizes a forward-looking radar in the front cap that monitors objects in front of the equipped coach. When the following distance becomes too close, the system will alert the driver through the inherent Collision Warning System (CWS). If the following distance continues to decrease, the system will use the engine throttle, engine brake, and if required, the vehicle brakes to reduce the severity of a collision. This system is only operational when the vehicle speed is between 15 and 77 MPH (24 and 124 KPH) **and** when there are no CMS, Electronic Stability Control (ESC), or Antilock Braking System (ABS) faults present. This feature is enabled through the use of WABCO's OnGuard™ system which Spartan has integrated onto certain motorhome chassis. For further instructions please refer to the OnGuard™ overall owner's manual.



This system is intended to mitigate the potential of a collision and does not prohibit them. The driver should not rely on this system to prevent collisions and should remain diligent in their driving and use more traditional safety systems. (E.g. brakes, seatbelts, etc...).



Any obstructions to the radar can impair or disable the system. DO NOT place objects that could cover the radar beam on the front of the vehicle and make sure the radar cover is free of snow or ice before driving.

Adaptive Cruise Control (ACC)

Adaptive Cruise Control (ACC) utilizes a forward-looking radar in the front end cap of the motorhome that is intended to detect moving vehicles in front of the motorhome. When cruise control is set and the coach gets too close to such a vehicle, the system will automatically slow the coach to match speed with the leading vehicle. Once the lane ahead is clear, the system will automatically allow the motorhome's speed to return back to the originally set cruise speed. This feature is enabled through the use of WABCO's OnGuard™ system which Spartan has integrated certain components required by the system onto certain motorhome chassis. Full integration is completed by the manufacturer of the motorhome.

Electronic Stability Control (ESC)

The Electronic Stability Control (ESC) system is a functional extension of the Antilock Braking System. The system continually monitors the vehicle for understeer, oversteer, and roll conditions. When detected, the system uses the engine throttle, engine brake, transmission gear selection, and foundation brakes to help bring the coach back under control. This feature is enabled through the use of WABCO's Electronic Stability Control. The ESC system requires a precise calibration at the factory. Certain changes to the vehicle during normal travel or maintenance may require the calibration to be performed again. Contact Spartan Customer & Product Support for more information.

These include, but are not limited to:

- Steering wheel replacement or realignment
- Maintenance involving the Steering Angle Sensor (SAS)
- Maintenance involving the steering gear, linkage, or other steering related components
- Wheel alignment or wheel track adjustment

- Different diameter tires

Automatic Traction Control (ATC)

Some vehicles may be equipped with ATC, which helps with acceleration on slippery surfaces and reduces drive wheel over-spin. For further instructions refer to the ABS driver tips pamphlet located in the component manufacturer's literature.

Anti-lock Braking System (ABS)

Every chassis is equipped with ABS, which is a system designed to improve driver control and vehicle stability during braking by helping to prevent wheel lock-up. **DO NOT** rapidly 'pump' the brakes (press and release the brake pedal) during brake application or the ABS will not respond as designed.

The ABS functions are monitored separately from the service brake functions. If the ABS warning light stays illuminated, this is an indication that there is a malfunction with the ABS. The vehicle may have lost all or part of the anti-lock functions. This does not mean that the vehicle is without braking capability. The service brakes will function independent of the ABS, but operating the vehicle without ABS may affect the operator's ability to control the vehicle during braking on slippery surfaces or during emergency stops. If this occurs, the vehicle should be taken to a service center as soon as possible.

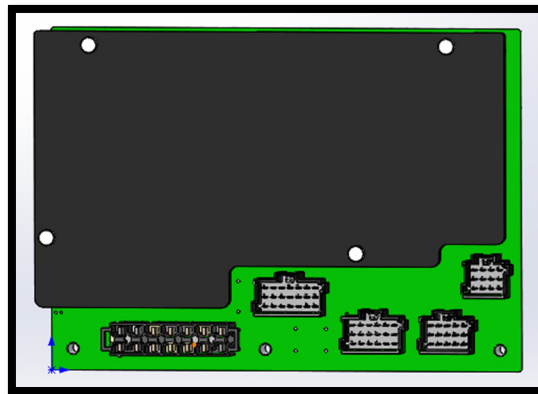
ELECTRICAL

NOTICE

Do not handle electrical components after having handled diesel exhaust fluid.

Chassis Batteries

Inspect batteries for any sign of loose connections or corrosion at the terminals. Assure the battery is securely mounted. The battery manufacturer's manual, included in this manual, contains information about the proper care of the batteries equipped on your chassis. Batteries **must** be maintained in accordance with the recommendations on the battery manufacturer's manual to ensure full battery life. Your vehicle may be equipped with an onboard battery charger for purpose of maintaining the battery's charge level during periods of inactivity. If your chassis is not equipped with such a battery charger, you **must** provide a means of keeping the batteries properly charged during periods of inactivity.



Typical Front Fuse Box

Fuse Panels/Boxes

Refer to FIG. 4-16 and FIG. 4-17. A fuse box contains fuses for the electrical circuits of your vehicle. As manufactured, fuse boxes are attached to Power Distribution Center (PDC) panels. Generally, there are front and rear PDCs that are permanently installed by the Final Stage Manufacturer. Refer to the Final Stage Manufacturer's literature for specific location(s) of the PDC panels.

Visually inspect the front and rear fuse boxes for blown fuses or corrosion. Never replace a 'blown' fuse with a higher rated amperage fuse; use a fuse with the same rating. Should replacement fuses repeatedly malfunction, take your vehicle to the nearest authorized service facility, contact Spartan RV Chassis Customer & Product Support at (800) 543-4277 Option 1, or the appropriate Final Stage Manufacturer customer service department.

Powertrain/Chassis Fuse Locations

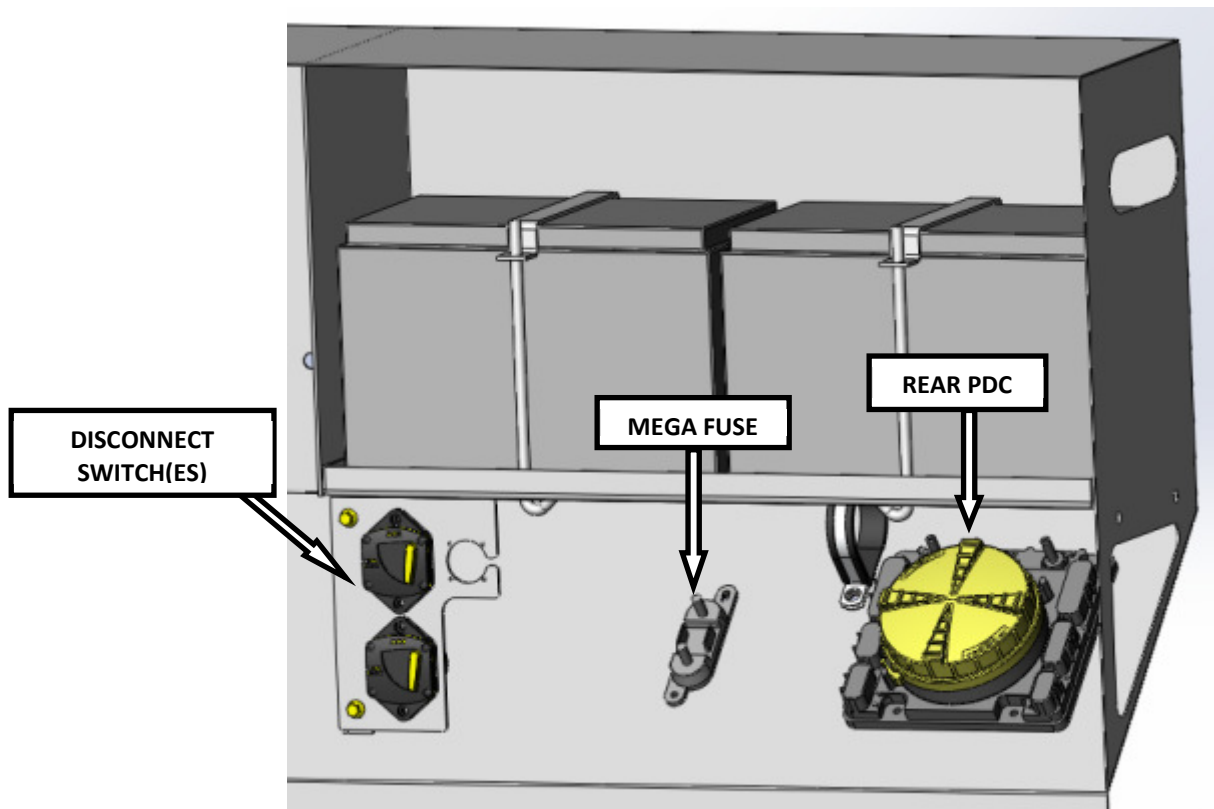
A typical chassis will have a Chassis Service Center located at the right rear of the vehicle which will contain the rear Power Distribution Center (PDC), a chassis electrical disconnect switch, and a single Mega[®] fuse. Your chassis may also contain an optional second disconnect switch as shown in FIG. 4-17.

The single Mega[®] fuse (typically 125A) provides direct battery power to the rear PDC (J1 stud). The upper disconnect switch has built-in circuit protection rated at 150A and provides battery power to the rear PDC (J3 stud), Front PDC, and the ICM. Activating this disconnect switch removes battery power from the listed items.

Note: this switch will inhibit the coach from starting and/or running if the internal circuit breaker has tripped or the switch has been manually switched off.

The rear PDC provides fuses and relays for items such as, but not limited to, the Engine Control Module (ECM), TCM, and Anti-lock Brake System (ABS).

The optional lower disconnect switch is installed for the final stage manufacturer use. Consult the final stage manufacturer for detailed information.



The following components or systems due to OBD/emissions system certification **shall not** be modified.

- ◆ Vehicle speed sensor
- ◆ Coolant level sensor
- ◆ Ambient air temperature sensor
- ◆ Vehicle accelerator pedal
- ◆ Malfunction Indicator Lamp (MIL)
- ◆ 9-pin diagnostic Interface connector
- ◆ OBD designated connector- green cap marked “OBD,” or an uncapped green 9-pin diagnostic connector.



- ◆ Any component/system of the aftertreatment.

Owner-Operator:

- ◆ **SHALL NOT** install object(s) that will result in abnormal temperature to occur on the emissions control system.
- ◆ **SHALL NOT** restrict access to fill tube or label for the DEF tank.
- ◆ **SHALL NOT** install anything that will cause the designated OBD, 9-pin Diagnostic Interface, connector to be covered or obstructed.
- ◆ **SHALL** maintain proper clearance of their add-on devices to the high temperature components of the emissions control systems. Refer to applicable section in engine manufacturer’s manual.
- ◆ **SHALL** take unit to an authorized service center once incorrect Diesel Exhaust Fluid has been detected.

Malfunction Indicator Lamp (MIL) (If Equipped)

The MIL may illuminate when the ECM detects any failure that could affect tail pipe emissions. Certain failures, which may occur, could result in the illumination of the MIL. If you experience a MIL event, please contact an authorized service facility or Spartan Customer & Product Support at (800) 543-4277 Option 1.

For additional information, please refer to applicable manufacturer’s manual.

Headlights

Headlamp Switch

The headlamps can be turned on by the headlamp switch. In the first position, the switch will activate the marker, tail, identification, center, and clearance (ICC) lamps. The second position will activate the headlamps. While the headlamps are active, the turn signal lever can be pulled towards the driver to toggle between high and low beam operation. While vehicle ignition is on, an indicator in the instrument panel will be active whenever the high beam lamps are on.

The headlamps can be turned on by the rotary style headlamp switch. In the first clockwise position, the switch will activate the marker, tail, identification, center, and clearance (ICC) lamps. The second clockwise position will activate the headlamps. While the headlamps are active, the turn signal lever can be pulled towards the driver to toggle between high and low beam operation. While vehicle ignition is on, an indicator in the instrument panel will be active whenever the high beam lamps are on.

Daytime Running Lamps (DRL)

When the park brake is released, the low beam lamps or LED lights will activate as daytime running lamps. This is dependent on the option installed. The high beam lamps will not operate while the DRLs are active.

Fog Lamps

The fog lamps can be turned on by the fog lamp switch or by pulling the center of the rotary style headlight switch. Fog lamps will only operate when the marker lamps or the headlamps are on. The fog lamps will not operate while the high beam lamps are active.

Headlamps with Wipers

The headlamps and marker lamps will come on whenever the wiper system is active and the park brake is released. The wiper system will activate the headlamps in low, high, or intermittent mode. The wiper wash function will not activate the headlamps. While the headlamp system is activated by the wipers, the high beams or the fog lamps may be used.

Headlamp Flash

The headlamps can be flashed for signaling purposes by pressing the headlamp flash switch. This switch is located with the steering wheel controls or as a separate switch on the dash, depending on vehicle configuration. This switch will only operate when the ignition system is in the accessory or ignition/run mode.

Marker Flash

The marker lamps can be flashed for signaling purposes by pressing the marker flash switch. This switch is located with the steering wheel controls. This switch will only operate when the ignition system is in the accessory or ignition/run mode.

Automatic Headlamps (if equipped)

On models equipped with automatic headlamps, low ambient light levels will activate the headlamp system. A sensor located in the dash detects the amount of ambient light. The headlamps will turn on in this manner only when the ignition system is in the accessory or ignition/run mode. While the headlamps are activated by the Auto Headlamp system, the high beams or the fog lamps may be used. With the rotary style headlamp switch, to activate on the Automatic Headlamp system, turn the switch counterclockwise to the symbol with the A in the middle. To deactivate the Automatic Headlamp system, turn the switch to the “O” symbol.

The Auto Override switch can be used to inhibit this function. When the Auto Override switch is in the ON position, the headlamps will not come on automatically due to low ambient light levels. If the headlamps were active due to low ambient light levels, turning this switch on will deactivate the headlamps. The Auto Override switch will not inhibit operation of the daytime running lamps, and it will not prevent the headlamps activating with wipers.

Turning the headlamp switch to the Marker or ON position will also override the automatic operation of the headlamps.

5.0 ENGINE

ENGINE

The power train of this vehicle is equipped with certain components that may be warrantable against defects or mis-builds for a period of five years, 100,000 miles, or 3,000 engine hours, whichever occurs first. If a defect or mis-build is identified in components in the power train, contact Spartan Customer & Product Support at (800) 543-4277 Option 1.

Problems with any of the following can result in engine damage, overheating, and/or reduced engine performance.

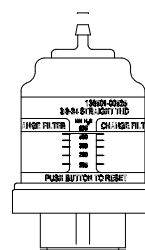
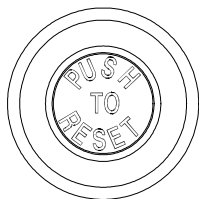
Air Intake Tubing

Inspect for wear points, loose connections, tubing damage, or punctures that could cause leaks.

Airflow Restriction Gauge

The airflow restriction gauge indicates that the air filter needs servicing and can be reset after it has been serviced. The gauge measures the vacuum at the air filter, and is located on the engine side of the air filter system, as the air filter gathers dirt, the vacuum increases. Refer to the manufacturer's literature for further details. A typical airflow restriction gauge is shown in FIG 5-1 with an example of a reset button.

Check the airflow restriction by the reading on the gauge. Change the air filter as necessary and reset gauge.



Coolant Hoses, Pipes/Tubes, Clamps

Inspect for wear points, loose connections, leaks, damage, or punctures.

Radiator/Charge Air Cooler

Inspect for wear points, loose connections, tubing damage, or punctures that could cause leaks.

Engine Cooling Fan

Check for nicks, cracks, loose or bent blades, loose rivets, or any other type of damage.



Do not attempt to repair or continue use of a damaged fan blade. This could cause component failure, personal injury and/or property damage.

Engine Coolant Level

Coolant level in the reservoir should be at or above the sight glass when the engine is cold. Refer to FIG. 5-2. Use the fluid specified on the component label. Never mix different types of coolant.

⚠ WARNING

Never remove radiator cap or surge tank cap while coolant is hot. Remove cap slowly when coolant is at ambient temperature. A sudden release of pressure from a heated cooling system can result in serious personal injury from burst of hot coolant. Do not add cold coolant to a hot engine as serious damage to the engine could occur.

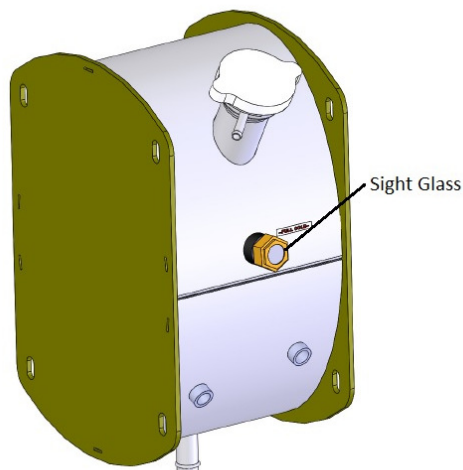


FIG. 5-2

Coolant Maintenance

Regularly maintained coolant and filters are critical to the performance and durability of the engine. Refer to the engine manufacturer's documentation for intervals required to check/maintain the coolant level, intervals to flush coolant, change filters, and procedures to service the coolant systems.

NOTICE

Failure to maintain appropriate engine coolant mixture could result in emissions critical component failure.

Fuel/Water Separator

If water is present, open drain valve until fluid drains from the drain tube; drain filter sump until clear fuel is visible. Drain fluid into a container and not on the ground. For additional information, refer to the engine operation manual.

⚠ WARNING

Drained fluid may contain toxic material; dispose of in compliance with local environmental regulations.

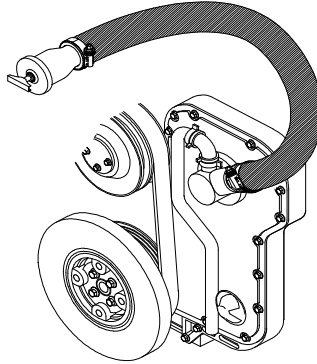
Engine Drive and Accessory Belts

Check for adequate belt tension and unusual belt wear or shiny spots. In the absence of a gauge to check belt tension, apply a firm force to the belt (approximately 30 LB) halfway between the 2 pulleys. The belt should press in no more than 1/2".

Lubricating Oil

Check and correct oil level if necessary. The vehicle should be level with the engine off. Pull dipstick from the dipstick tube, wipe oil off dipstick, and reinsert into dipstick tube. Ensure dipstick is fully seated before removing to check oil level on dipstick. Fill if necessary.

Refer to the engine operation manual for oil fill instructions. If the primary engine oil fill location cannot be accessed as described in the manual, an auxiliary fill tube is installed for ease of serviceability and is identified as such. Refer to FIG. 5-3.



MECHANICAL FAN DRIVE GEAR BOX

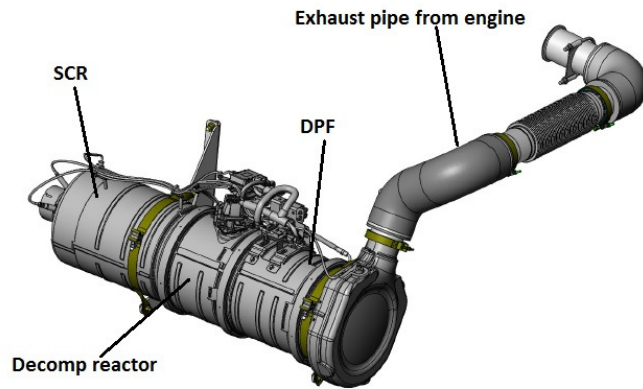
The gearbox is located behind the fan assembly on K3 & K4 chassis. Refer to Maintenance Schedule at the end of this manual for information about the maintenance intervals.



During regeneration, exhaust gas temperature could reach 800°C (1500°F) and exhaust system surface temperature could exceed 700°C (1300°F).

AFTERTREATMENT SYSTEM

The aftertreatment system consist of four components: selective catalytic reduction (SCR) device, diesel particulate filter (DPF), decomposition reactor, and a diesel exhaust fluid (DEF) dosing module as shown in FIG. 5-4 & 5-5. The aftertreatment system cannot be modified in any way. For additional information, refer to the engine operation manual.



Aftertreatment, single module

FIG. 5-4

Diesel Exhaust Fluid (DEF)

Diesel Exhaust Fluid (DEF), a key element in the SCR process, is a solution of purified water and 32.5% automotive-grade urea. When combined with the heat of the exhaust stream and the SCR device, DEF helps convert NO_x into harmless nitrogen and water vapor. DEF is non-toxic and non-flammable and it will not harm people, animals, equipment, or the environment when handled properly.

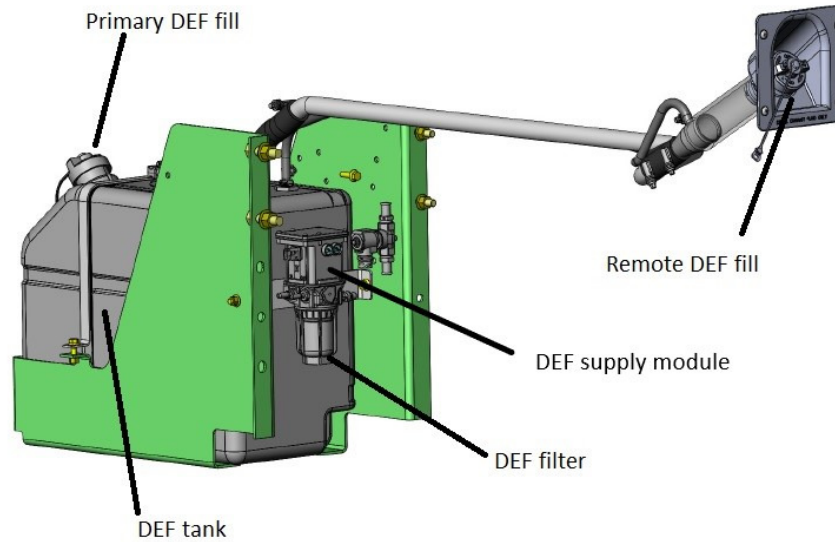


FIG. 5-5

NOTICE

Do not remove primary DEF fill cap while filling DEF tank from remote fill side. This could result in overfilling of DEF tank and spilling DEF.

NOTICE

Do not overfill DEF tank.

6.0 TRANSMISSION

TRANSMISSION

Fluid Level

Inspect and correct transmission fluid level at cold fill line. Refer to the transmission operation manual for more detailed information and fluid specifications.

TRANSMISSION SHIFT SELECTOR

The transmission shift selector is permanently installed by the Final Stage Manufacturer. It is either a 'pushbutton' or a 'lever' style. The drive "D" and reverse "R" positions should be used for normal driving. The neutral "N" position should be used when the vehicle is stationary or parked (with the park brake engaged).

Refer to the transmission operation manual for detailed explanations of each function and operating procedures. The transmission manual describes the selector positions, operating ranges, temperatures, and offers driving tips.



Transmission Shift Inhibit

Some coach models are equipped with a transmission shift inhibit feature that requires the service brake to be applied prior to shifting the transmission into gear. If your coach is equipped with this feature, you must depress the service brake pedal in order to shift the transmission into gear.

7.0 AXLES, WHEELS, & TIRES

TIRES AND WHEELS



Exceeding the tire speed rating, an overloaded wheel position, and/or an improperly inflated tire could cause component failure or loss of vehicle control, resulting in serious injury, death, and property damage.

Air Pressure

Check, and adjust if necessary, the inflation pressure in each tire according to the actual vehicle weight and the guidelines provided by the tire manufacturer. Tire pressures **must** be monitored closely to assure safe operation of the vehicle. Spartan recommends checking tire pressure daily before the vehicle is driven. Always check inflation pressure when tires are cold.

For the most current tire inflation information refer to the respective manufacturer's website for inflation tables.

Michelin Website: <http://www.michelinrvtires.com/michelinrv/index.jsp>

For your safety, and to optimize the ride quality, handling, and tire wear of your motorhome, we strongly recommend weighing individual wheel positions of your motorhome in your fully loaded condition, and setting tire pressures based on those weights. The best source for the correct pressures is the tire manufacturer's website listed above.

If you **do not** know the axle weights of your motorhome, tires should be inflated to the pressures shown on your chassis data tag, which is typically located in the driver's compartment. It is also located on the vehicle certification label provided by the Final Stage Manufacturer. Refer to the Final Stage Manufacturer's literature for certification label location.

It is important to understand that a change in weight distribution or the amount of weight added or removed from the vehicle may require a change to tire pressures. Refer to the Gross Axle Weight section of this manual and the appropriate website address stated above.

Condition

Check the condition of the tires daily. Look for any bumps, blisters, cuts, punctures, cracks, uneven wear, check for proper inflation, and tread depth. Replace tire on front axle when tread is worn to 4/32" (3.2 mm). Replace tire on rear axle when tread is worn to 2/32" (1.6 mm). If there are signs of abnormal tire wear, take vehicle to an authorized service center to have the axles and steering system inspected for worn or damaged components and proper alignment.

TIRE SPEED RATING

Vehicle should not be operated at speeds above the lowest tire speed rating on the vehicle. Refer to the tire manufacturer's information to determine the specific speed rating for your tires.

ROLLING RESISTANCE

Rolling resistance of the tires is critical to greenhouse gas emissions and fuel economy of the vehicle. This vehicle was originally built with tires that are appropriately rated for the weight capacity they may be expected to carry. When replacing tires, it is critical to consider tires with similar tread patterns and the same load capacity as those of which the vehicle was originally equipped. Should you have questions regarding replacement tires, please contact Spartan or your nearest tire distributor.

TIRE PRESSURE MONITORING SYSTEM (TPMS)

Your Spartan may be equipped with an active tire pressure and temperature **monitoring** system. At the push of a button, the system provides the driver with real-time tire pressure and temperature data for each tire on the coach. The system will also alert the driver of low tire pressure, high tire pressure, and high tire temperature conditions. This system is expandable to monitor towed vehicles or trailers as well. For additional information on features and operation of the control, please refer to GIC guide included on the USB flash drive.

NOTE: Tire pressure baseline pressures are set at the factory according to the GAWR for each axle. If tire pressure sensors are replaced or repositioned on the vehicle, a special programming tool may be required to program the new baseline pressure and sensor location into the system.

WHEEL CLEANING

Aluminum wheels should be rinsed with high pressure water to remove debris, grit, and dirt particles prior to scrubbing. Use only a mild soap and water solution to wash the wheels. Rinse and dry to avoid water spots.

DO NOT attempt to polish Accuride Accu-Shield® or Alcoa Dura-Bright® wheels this may result in damage to the wheel finish.

Refer to information on the USB flash drive for additional maintenance and care tips for aluminum wheels.

WHEEL NUTS

Remove wheel nut covers and check that all wheel nuts are in place and secured. Refer to the wheel manufacturer's information is located on the USB flash drive provided for your chassis, or visit a certified service facility to ensure wheel nut torque is checked/maintained within the recommended guidelines based on mileage and time factors.

Re-tightening should occur only after the 50-150 miles are covered in normal driving conditions. This practice ensures that the opportunity for over-tightening is minimized. There is little benefit from re-tightening wheel nuts prior to reaching this service threshold, since joint relaxation may only be partial. If audits of initial installation torque are desired, they should be performed as shortly after the initial tightening as possible and should determine the breakaway torque values (the amount of torque required to just begin movement of the nut in the tightening direction.)

The use of manual torque wrenches **must** be carefully monitored. Dial type torque wrenches are preferred. Click-style wrenches may not be as accurate as dial-type and could be affected by hand position. Regardless of type of wrench used care **must** be exercised so that 450-500 FT-LB torque is actually applied.

Re-tightening of wheel nuts should be accomplished "cold" and not with excessively hot brakes. A good rule of thumb for checking this is to re-tighten only after the wheel disc and nuts are cool enough for continuous skin contact only.

AXLES

Hub Covers

Removal of hub covers is necessary to verify wheel bearing oil levels in the front (steer) axle and tag axle. To remove the hub cover, remove the hub cover knob in the center of the hub cover by rotating it counter clockwise

using the installation/removal tool (RW2GNT). Once the knob is removed, slide the cover off of the mounting bracket.

To reinstall hub cover slip it over the mounting bracket making sure that tangs on the bracket engage holes in cover. Install hub cover knob stud through center hole in hub cover and rotate clockwise until first indent is felt. Using installation/removal tool, turn knob an additional 5-6 indents. Refer to FIG. 7-1.

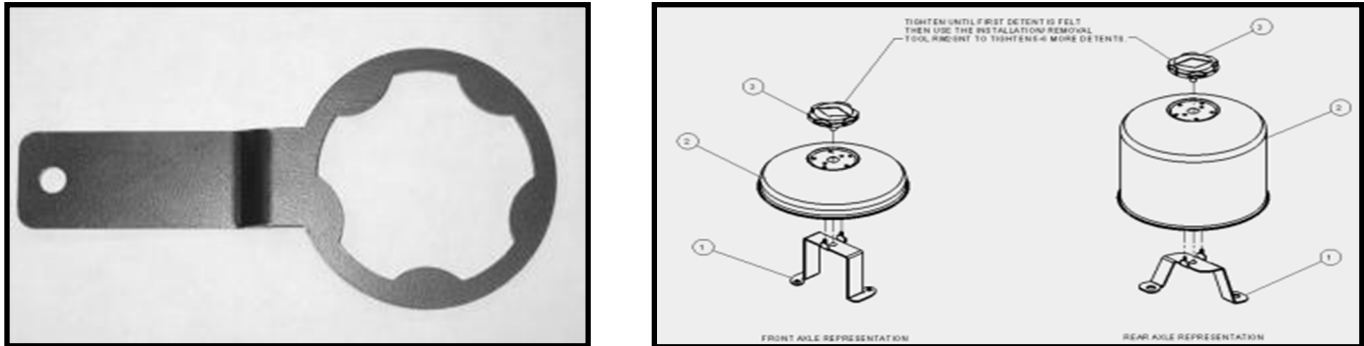


FIG. 7-1

Front Axle

Check for leaks. Check, and adjust if necessary, the fluid level to the manufacturer’s specification using the proper fluid recommended by the axle manufacturer. The axle manufacturer’s maintenance information is located on the USB flash drive provided for your chassis. Check that U-bolts are secure and there are no visible signs of looseness or movement.

Rear Axle

Check for leaks. Check, and adjust if necessary, fluid level to the manufacturer’s specifications using the proper fluid recommended by the axle manufacturer. The axle manufacturer’s maintenance information is located on the USB flash drive provided for your chassis. Check that U-bolts are secure and there are no visible signs of looseness or movement.

8.0 STEERING, BRAKES, & SUSPENSION

CHASSIS SYSTEMS

Not all controls described in this section are included with every chassis. Some controls may be optional equipment. For supplemental operating information relevant to the completed vehicle, refer to the Final Stage Manufacturer's literature and the respective component manufacturer's literature.



Understanding the function of the operator controls is critical to safe driving. Systems and components must be inspected and maintained as recommended by the manufacturers. Refer to the pre-trip and maintenance sections for further information.

AIR SUSPENSION DUMP SYSTEMS

Chassis Suspension Dump Systems (optional)

There are two types of chassis suspension dump systems:

1. If a leveling jack system is present, a suspension dump system specific to the jack system is operated by a set of leveling jack controls. The leveling jack system and controls are installed by the Final Stage Manufacturer and located in the dash area.

As designed, the leveling jack system cannot be operated unless the park brake is set. If you find that the leveling jack system is operational without the park brake being set, contact Spartan Customer & Product Support immediately and take your vehicle to the nearest authorized service center.

Refer to the Final Stage Manufacturer's operational manual and the leveling jack manual to understand the procedures and controls for the leveling jack system.

2. A full chassis dump system is available that may also include a leveling jack dump system. The chassis dump system is manually activated by pressing and holding the momentary switch in the dash area which is installed by the Final Stage Manufacturer. Re-inflation to adjusted ride height begins when switch is released. Refer to the Final Stage Manufacturer's operation manual for specific location and description of controls.

There is a lockout feature to prevent activation at or above 8 MPH for the air suspension. Once the lock-out feature is enabled, the full chassis dump system cannot be activated until vehicle speed reaches 5 MPH or less.

Tag Axle Suspension Dump System

A Spartan chassis equipped with a tag axle suspension dump system is capable of providing better traction than a chassis without a tag axle suspension dump system. When air is depleted from the tag axle suspension, more weight is distributed to the drive axle, thus increasing the traction capability. The dump system is controlled manually (optional).

Manual Control

Manual operation of the tag axle dump system is optional. When present, the control is a momentary switch that is installed by the Final Stage Manufacturer in the dash area. Refer to the Final Stage Manufacturer's operation manual for specific location and description.

The tag axle suspension dump system is activated by pressing and holding the switch. There is a lockout feature to prevent activation at or above 8 MPH. Once the lock-out feature is enabled, the dump system cannot be activated until vehicle speed is 5 MPH or less. Re-inflation to adjusted ride height begins when switch is released.

Automatic Control

The tag axle suspension dump system is activated automatically when the vehicle's transmission is placed in reverse and begins re-inflation to adjusted ride height when the transmission is taken out of reverse. Not all final stage manufactures offer this option.

Valid® Trueline Leveling System

Certain chassis built by Spartan are equipped with Valid® Trueline Leveling System. This electronically based system is designed to maintain normal vehicle ride height control automatically and provide a means for manually lower or raise the ride height through a customized interface. Refer to the manufacturer's literature for operation of the controls to operate the system.

Valid® Auto Level Mode

Certain chassis built by Spartan are equipped with Valid® Trueline Leveling System and include an auto level feature. This electronically based system is designed for this application to maintain a predetermined vehicle ride height automatically and provide a means to manually lower or raise the ride height through a customized interface. Many of the user settings are available only when operating below certain speeds or when the parking brake is applied. Refer to the manufacturer's literature for operation of the controls to operate the system.

Suspension fill after leveling jack retract

Prior to retracting leveling jacks, start the engine to build up air pressure in the air system until the air dryer purges. This will help ensure sufficient air pressure is available to initiate inflation of the air suspension when the leveling jacks are retracted. Note: Without sufficient air pressure, the air suspension may not inflate when leveling jacks are retracted.

BRAKE SYSTEM AND CONTROLS

The brake system of the vehicle is designed to function safely and predictably over a wide range of road and driving conditions.

Service Brakes

Service brakes are applied when the brake pedal (also referred to as the treadle) is depressed. The brake pedal is located on the driver's side floor, to the left of the accelerator pedal or suspended on a vertical support under the dash.

Full Air Brake System

The full air brake system consists of two independent air systems. The primary system (system #1) operates the service brakes on the rear axle while the secondary system (system #2) operates the service brakes on the front axle. An air pressure gauge and a warning light monitor each air system independently.

If there is a malfunction in either system, the other system is not affected. If the air pressure falls below approximately 35 PSI, the parking (or emergency) brakes are activated automatically. If the air brake warning indicators are activated, the vehicle **must** be brought to a safe stop and the brake system serviced before resuming operation.

Parking Brakes (Spring Brakes)

The parking brake control is used to activate/deactivate the application of the parking brakes. When applied, an indicator light on the dash illuminates. For air brake systems, the control is a yellow, diamond-shaped, push/pull knob typically located on the dash. Refer to FIG. 8-1.

The knob automatically pops out when the air system pressure descends to approximately 35 PSI. In addition, the system will not allow the parking brakes to be released unless air system pressure is approximately 60 PSI.



FIG. 8-1



DO NOT use auxiliary brakes in inclement weather, when driving surface is slippery, or in heavy traffic.

Some chassis models are equipped with an auxiliary brake device such as an VGT brake or engine brake that is designed to supplement the service brakes during downhill travel when braking is required to slow the vehicle. An auxiliary brake may decrease the demand on the service brakes, but should never be used as the primary means of stopping the vehicle. Under certain conditions with slippery road surfaces, auxiliary brakes should be turned off to assure there is no loss of vehicle control. If the auxiliary brake is used it automatically activates your trailer brake lights. Refer to the manufacturer's literature for detailed information relative to operator controls, functions, and applications.

BRAKES

Parking Brake Operation

Refer to section above a description of the park brake control mechanism. Park vehicle, engage parking brake, and slowly accelerate in a low gear to check that the parking brake holds.

Park Brake Release Inhibit

Some coach models are equipped with a park brake release inhibit feature that requires the service brake to be applied prior to releasing the park brake. If your coach is equipped with this feature, you must depress the service brake pedal in order to release the park brake.

Service Brake Operation

Depress the service brake pedal, and then release the parking brake mechanism. Be sure all warning indicators and lamps are off. Accelerate forward at a slow speed in a clear, unobstructed area, and then depress the brake pedal until the vehicle comes to a stop. Check for any 'pull' to one side, delay in ability to stop, or any unusual feel or noises.

COMPRESSED AIR SYSTEM



Always ensure the air pressure is removed from the air system before disconnecting any component. Pressurized air can cause severe personal injury.

Air System/Air Dryer Operation

Start the vehicle and allow engine to idle. The air dryer purges when the air system is fully charged and air is exhausted from the air dryer. Generally, this can be heard as a brief release of air, at the rear of the vehicle. The air dryer manufacturer's maintenance information is located on the USB flash drive provided for your chassis.

For your convenience, the air system may be inflated through a Schrader valve available on most chassis models either at the air dryer or the air governor.

Moisture Ejectors and Air Tank Drain Valves

Manual moisture ejectors and air tank drain valves should be purged daily. Automatic moisture ejectors should be checked for proper operation during routine maintenance using the manual drain mechanism as shown in FIG. 8-2. Chassis are typically equipped with lanyard cables attached to the drain valves. Generally, the lanyard cables are located ahead of the front axle on passenger side of coach. However, the location may vary depending on chassis configuration.

Lanyard cables are color coded to identify which air tank they are connected to:

- Silver (Clear) = Wet tank
- Green = Primary tank (i.e. system 1) for rear brakes
- Red = Secondary tank (i.e. system 2) for front brakes & auxiliary systems

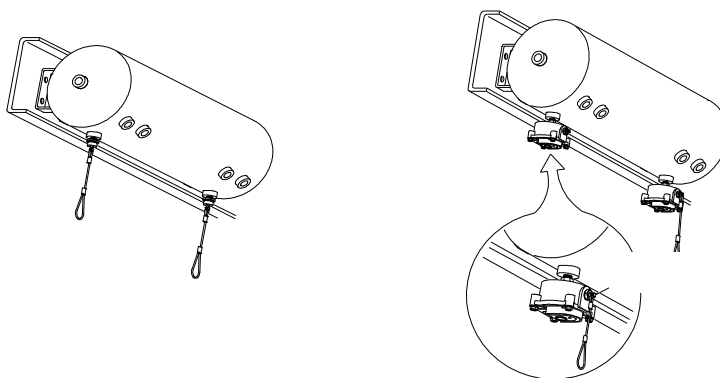


FIG. 8-2

The drain valves must be purged in the following sequence:

- 1st Silver (Clear)
- 2nd Green
- 3rd Red

Safe Haul™

Vehicles equipped with Spartan's Safe Haul™ system provide a proportional air signal for towed vehicle supplemental braking systems. The female quick-connect fitting for the Safe Haul™ system is located next to the trailer hitch receiver on the motorhome chassis. The Spartan Safe Haul™ system is intended for use during dinghy or flat towing of a passenger vehicle (IE car, truck, SUV) with hydraulic brakes and equipped with a supplemental braking system that requires an air signal to actuate the towed vehicle brakes. The Safe Haul™ system is not intended for use as an air source for trailer brake systems.



Safe Haul™ quick connect

STEERING

Hydraulic System

Refer to FIG. 8-3. Check, and adjust if necessary, the level of hydraulic fluid in the hydraulic reservoir indicated with the dipstick. Always use the appropriate fluid as indicated on the reservoir label. Check for leaks or wearing of hoses.



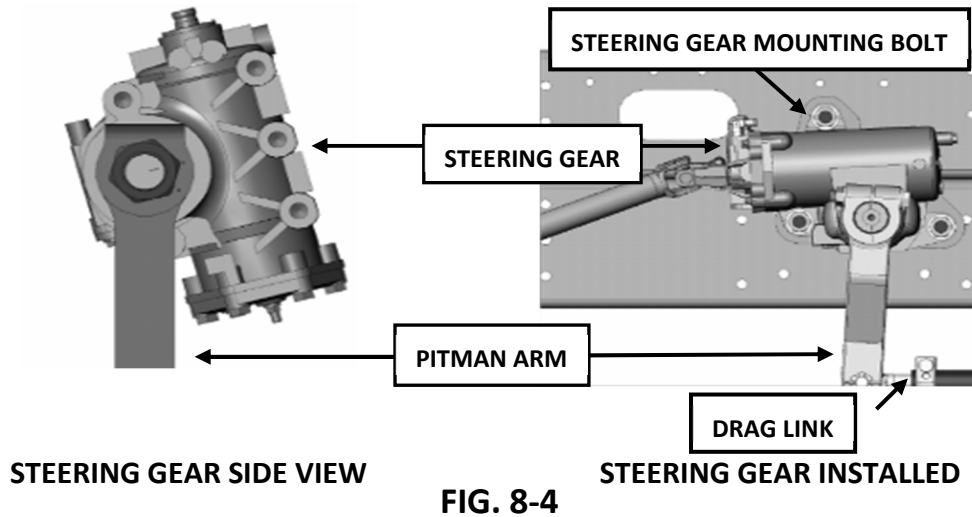
HYDRAULIC FLUID RESERVOIR

FIG. 8-3

Steering Gear / Linkage

Check for any loose, cracked, or damaged steering components (e.g. linkage). Be sure to inspect for loose steering gear mounting bolts, draglink nuts, or pitman arm pinch bolt. Refer to FIG. 8-4.

Note: The steering gear may be positioned differently than shown.



SUSPENSION

Air Springs / Ride Height

Inspect for unusual wear or damage. Check air springs for proper inflation and that the vehicle is not leaning to either side. Check ride heights. Refer to the maintenance guide found in Appendix.

Shocks

Inspect for unusual wear, damage, or leaks.

APPENDIX A

MAINTENANCE, CHECKLIST, AND SCHEDULE

CHASSIS MAINTENANCE

Regular maintenance will help avoid problems and prolong the life of the chassis. The information presented in the Chassis Maintenance Guide at the end of this section is not meant to override component manufacturer recommendations. Applying the information in these manuals and literature for each chassis system will ensure your chassis is maintained properly.

Maintenance interval requirements vary between applications and by system. The intervals depend heavily upon usage, driving techniques, operating environment, and frequency of operation. To fully understand the maintenance requirements for your chassis, you should be familiar with the component manufacturer's maintenance information.

CHASSIS MAINTENANCE GUIDE / RECORDKEEPING

Extra copies of blank worksheets have been included for your convenience. We encourage you to make additional copies as needed.

- ◆ Page 76 is a Vehicle Weight Worksheet provided to record important weight data.
- ◆ Page 77 is a Chassis Service and Maintenance Record provided to document the history of all maintenance information for the vehicle.
- ◆ Page 78 is a Pre-Trip Inspection list.
- ◆ Page 79 - 80 is a Chassis Maintenance Guide.




Professional technicians at an authorized service facility should perform scheduled chassis maintenance, inspections/corrections, and service repairs. To locate an authorized service facility, contact Spartan Customer & Product Support at (800) 543-4277 Option 1.

VEHICLE WEIGHT

Vehicle Weight Worksheet

A Vehicle Weight Worksheet on page 76 should be completed at full traveling weight. Heavy items should be distributed evenly side-to-side and as low as possible in the vehicle. It is important that the loaded weight of each wheel position be known to ensure that the GAWR and GVWR are not exceeded. Refer to Section 2 of this manual.

Vehicle weight worksheet

<p>Front tire, driver's side</p> <p>Tire MFG: _____</p> <p>Tire tread: _____</p> <p>Tire Size: _____</p> <p>Tire Load Range (LR): _____</p> <p>Tire DOT Date: _____</p> <p>Tire single max load rating: _____ @ _____</p> <p>Scale weight: _____</p>	<p>Front axle</p> <p>Gross Axle Weight Rating (GAWR): _____</p> <p>Actual front axle weight (GAW): _____</p> <p>Tire pressures set to: _____</p> <p>Date: _____</p>	<p>Front tire, passenger's side</p> <p>Tire MFG: _____</p> <p>Tire tread: _____</p> <p>Tire Size: _____</p> <p>Tire Load Range (LR): _____</p> <p>Tire DOT Date: _____</p> <p>Tire single max load rating: _____ @ _____</p> <p>Scale weight: _____</p>
		
<p>Drive tire, outer dual, driver's side</p> <p>Tire MFG: _____</p> <p>Tire tread: _____</p> <p>Tire Size: _____</p> <p>Tire Load Range (LR): _____</p> <p>Tire DOT Date: _____</p> <p>Tire dual max load rating: _____ @ _____</p> <p>Scale weight: _____</p>	<p>Drive axle</p> <p>Gross Axle Weight Rating (GAWR): _____</p> <p>Actual drive axle weight (GAW): _____</p> <p>Tire pressures set to: _____</p> <p>Date: _____</p>	<p>Drive tire, outer dual, passenger's side</p> <p>Tire MFG: _____</p> <p>Tire tread: _____</p> <p>Tire Size: _____</p> <p>Tire Load Range (LR): _____</p> <p>Tire DOT Date: _____</p> <p>Tire dual max load rating: _____ @ _____</p> <p>Scale weight: _____</p>
<p>Drive tire, inner dual, driver's side</p> <p>Tire MFG: _____</p> <p>Tire tread: _____</p> <p>Tire Size: _____</p> <p>Tire Load Range (LR): _____</p> <p>Tire DOT Date: _____</p> <p>Tire dual max load rating: _____ @ _____</p>		
<p>Tag tire, driver's side</p> <p>Tire MFG: _____</p> <p>Tire tread: _____</p> <p>Tire Size: _____</p> <p>Tire Load Range (LR): _____</p> <p>Tire DOT Date: _____</p> <p>Tire single max load rating: _____ @ _____</p> <p>Scale weight: _____</p>	<p>Tag axle</p> <p>Gross Axle Weight Rating (GAWR): _____</p> <p>Actual tag axle weight (GAW): _____</p> <p>Tire pressures set to: _____</p> <p>Date: _____</p>	<p>Tag tire, passenger's side</p> <p>Tire MFG: _____</p> <p>Tire tread: _____</p> <p>Tire Size: _____</p> <p>Tire Load Range (LR): _____</p> <p>Tire DOT Date: _____</p> <p>Tire single max load rating: _____ @ _____</p> <p>Scale weight: _____</p>
		

Units of Measure:

- | | | |
|---------------------------------|--------|----------|
| | Weight | Pressure |
| <input type="checkbox"/> US | LB | PSI |
| <input type="checkbox"/> Metric | Kg | KPA |

Towing	
Gross Combined Weight Rating (GCWR):	_____
Coach hitch rating:	_____
Actual towed vehicle/trailer weight (GAW):	_____
Gross Combined Weight (GCW)*:	_____
Date:	_____

*GCW = front axle GAW + drive axle GAW + tag axle GAW + towed vehicle/trailer GAW

CHASSIS SERVICE AND MAINTENANCE RECORD

Owner's Name _____ Date of 1st Retail Purchase _____

Vehicle Identification Number _____

DATE	MAINTENANCE PERFORMED	ACTUAL MILEAGE	FACILITY NAME	COMMENTS

PRE-TRIP INSPECTION ITEMS

AREA COMPONENT		INSPECTION
<input type="checkbox"/>	FRONT AXLE WHEEL BEARINGS	check oil level
<input type="checkbox"/>	TAG AXLE WHEEL BEARINGS	check oil level
<input type="checkbox"/>	REAR AXLE	check for leaks
<input type="checkbox"/>	PARK BRAKE	check operation
<input type="checkbox"/>	SERVICE BRAKES	check operation
<input type="checkbox"/>	AIR TANKS WITH MANUAL EJECTORS	remove moisture
<input type="checkbox"/>	AIR TANKS WITH AUTOMATIC EJECTORS	check operation
<input type="checkbox"/>	AIR DRYER OPERATION	check exhaust, drain supply tank, and operation
<input type="checkbox"/>	BATTERIES/BATTERY CABLES	check for corrosion, loose connections
<input type="checkbox"/>	VISUAL INSPECTION OF FUSE PANELS	check for corrosion, blown fuses
<input type="checkbox"/>	AIR INTAKE PIPING/TUBING	check for loose, punctured or worn pieces
<input type="checkbox"/>	AIR CLEANER AIRFLOW RESTRICTION GAUGE	restriction indicator reading
<input type="checkbox"/>	ENGINE COOLING FAN	check for nicks, cracks, loose pieces
<input type="checkbox"/>	MECHANICAL FAN DRIVE GEAR BOX	check for leaks
<input type="checkbox"/>	ENGINE OIL	check fluid level
<input type="checkbox"/>	ENGINE COOLANT LEVEL	check coolant level
<input type="checkbox"/>	ENGINE DRIVE AND ACCESSORY BELTS	check for wear
<input type="checkbox"/>	DIESEL EXHAUST FLUID (DEF) LEVEL	check fluid level (if stored refer to chassis storage and periods of non-use section for further information).
<input type="checkbox"/>	FUEL/WATER SEPARATOR	drain checking for presence of water
<input type="checkbox"/>	RADIATOR AND CHARGE AIR COOLER	presence of debris/damage
<input type="checkbox"/>	COOLANT HOSES, PIPES, AND CLAMPS	check for leaks, loose clamps, chafing
<input type="checkbox"/>	CHECK EXHAUST PIPING & MUFFLER	check that all components are secure
<input type="checkbox"/>	CRANKCASE BREATHER TUBE	check for blockage
<input type="checkbox"/>	HYDRAULIC STEERING SYSTEM	check for leaks
<input type="checkbox"/>	HYDRAULIC RESERVOIR	check fluid level
<input type="checkbox"/>	STEERING WHEEL	check for excessive play
<input type="checkbox"/>	FRONT AIR SPRINGS	check wear and/or leaks
<input type="checkbox"/>	REAR AIR SPRINGS	check wear and/or leaks
<input type="checkbox"/>	FRONT SHOCKS	inspect for leaks and that all components are secure
<input type="checkbox"/>	REAR SHOCKS	inspect for leaks and that all components are secure
<input type="checkbox"/>	RIDE HEIGHT	check level
<input type="checkbox"/>	TRANSMISSION FLUID	check fluid level
<input type="checkbox"/>	TIRES	check for wear and damage, check and adjust air pressure (refer to tire manufacturer's manual for recommended air pressure settings)
<input type="checkbox"/>	WHEELS*	wheel nuts/torque to 450-500 FT-LB

***Wheel nuts – tighten after first 50 miles & 50 miles after each time a wheel is serviced.**

**** Pre-trip inspection check list is also available on the Spartan Connected Care app.**

2,500 Miles or Every 3 Months (whichever occurs first)	
<input type="checkbox"/>	Lubricate brake slack adjusters and brake camshaft tubes
<input type="checkbox"/>	Lubricate tie rod ends
<input type="checkbox"/>	Lubricate king pins on passive steer tag axle
<input type="checkbox"/>	Lubricate snubber end of centering mechanism on passive steer tag axle

5,000 Miles or Every 3 Months (whichever occurs first)	
<input type="checkbox"/>	Lubricate drive shaft – grease – NLGI #2 or Equiv. when motorhome is in regular use. NOTE: If motorhome is stored, lube driveshaft annually.
<input type="checkbox"/>	Lubricate engine cooling fan drive shaft (chassis with mechanical driven engine cooling fan) – grease- NLGI #2 or Equiv. when motorhome is in regular use. NOTE: If motorhome is stored, lube fan drive shaft annually.
<input type="checkbox"/>	Check all belts and tensioners - Retention Belts If Necessary - initially at 3 months or 5,000 miles whichever comes first.
<input type="checkbox"/>	Check all hoses and clamps including CAC system – initially at 3 months or 5,000 miles whichever comes first.

20,000 Miles or Every 12 Months (whichever occurs first)		
<input type="checkbox"/>	Replace engine oil and filter	
<input type="checkbox"/>	Replace fuel filters	
<input type="checkbox"/>	Replace coolant filter (only applicable to Cummins X12 & X15 engines)	
<input type="checkbox"/>	Check all belts and tensioners - Retention Belts If Necessary	
<input type="checkbox"/>	Check all hoses and clamps including CAC system	
<input type="checkbox"/>	Drain gear box for engine cooling fan. Clean magnetic pipe plug in the bottom of the reducer at each oil change.	SHC 75W90 Synthetic Oil
<input type="checkbox"/>	Replace spin-on (external) hydraulic filter element and refill reservoir (chassis with hydraulic drive engine cooling fan)	AW-46 hydraulic oil
<input type="checkbox"/>	Check engine coolant* - test/adjust as necessary. Refer to chart below.	
<input type="checkbox"/>	Clean radiator and CAC from debris	
<input type="checkbox"/>	Clean and re-apply battery terminal protection.	
<input type="checkbox"/>	Check and adjust front and rear suspension ride height and perform overall inspection.	Reference suspension manufacturer's manual
<input type="checkbox"/>	Lubricate steering linkages and steering shafts	Grease- NLGI #2 or Equiv.
<input type="checkbox"/>	Air cleaner MUST be replaced when the restrictor indicator shows restriction, or annually, whichever occurs first.	
<input type="checkbox"/>	Clean all heat exchanger cores (i.e. radiator, charge air cooler, hydraulic oil cooler, a/c condenser)	

30,000 Miles or Every 24 Months (whichever occurs first)		
<input type="checkbox"/>	Service air dryer	Reference air dryer manufacturer's manual
<input type="checkbox"/>	Replace Desiccant Cartridge	Reference air dryer manufacturer's manual
<input type="checkbox"/>	Drain hydraulic reservoir, replace the internal filter element, and refill reservoir.	AW-46 hydraulic oil

200,000 Miles		
<input type="checkbox"/>	Change DEF filter	Reference engine manufacturer's manual

Coolant Intervals*	12 months	24 months	36 months	48 months	60 months	72 months
Extended Life Coolant	check	check	add extender	check	check	replace

Extended Life Coolant (ELC): check coolant quality by taking a sample from the surge tank and visually inspecting for any deposits. If color is close to the original color and no deposits are found, coolant is suitable to be run to the next maintenance interval. If coolant quality checks OK, check freeze point and adjust as necessary. Refer to chart above*.

For additional maintenance information refer to provided supplier literature.

**** Recommended preventative maintenance schedule is also available on the Spartan Connected Care app.**

K1 chassis lubrication points

<u>Lubrication point #</u>	<u>Lubrication point description</u>	<u>Notes</u>
1	Upper steering shaft, upper U-joint	
2	Upper steering shaft, slip	
3	Upper steering shaft, lower U-joint	
4	Lower steering shaft, upper U-joint	
5	Lower steering shaft, slip	
6	Lower steering shaft, lower U-joint	
7	Steering gear output shaft	
8	Steering drag link @ pitman arm	<i>(Beam axle only)</i>
9	Steering drag link @ steer arm	<i>(Beam axle only)</i>
10	Front axle, LH upper king pin	
11	Front axle, LH lower king pin	
12	Front axle, LH upper carrier bearing	<i>(IFS only)</i>
13	Front axle, LH lower carrier bearing	<i>(IFS only)</i>
14	Front axle, LH tie rod @ steer arm	
15	Front axle, LH tie rod @ relay rod	<i>(IFS only)</i>
16	Front axle, RH upper king pin	
17	Front axle, RH lower king pin	
18	Front axle, RH upper carrier bearing	<i>(IFS only)</i>
19	Front axle, RH lower carrier bearing	<i>(IFS only)</i>
20	Front axle, RH tie rod @ steer arm	
21	Front axle, RH tie rod @ relay rod	<i>(IFS only)</i>
22	Front axle, LH brake camshaft tube	<i>(Air drum brake only)</i>
23	Front axle, LH brake slack adjuster	<i>(Air drum brake only)</i>
24	Front axle, RH brake camshaft tube	<i>(Air drum brake only)</i>
25	Front axle, RH brake slack adjuster	<i>(Air drum brake only)</i>
26	Rear axle, LH brake camshaft tube	<i>(Air drum brake only)</i>
27	Rear axle, LH brake slack adjuster	<i>(Air drum brake only)</i>
28	Rear axle, RH brake camshaft tube	<i>(Air drum brake only)</i>
29	Rear axle, RH brake slack adjuster	<i>(Air drum brake only)</i>
30	Drive shaft, U-joint @ drive axle	
31	Drive shaft, slip	
32	Drive shaft, U-joint @ transmission	

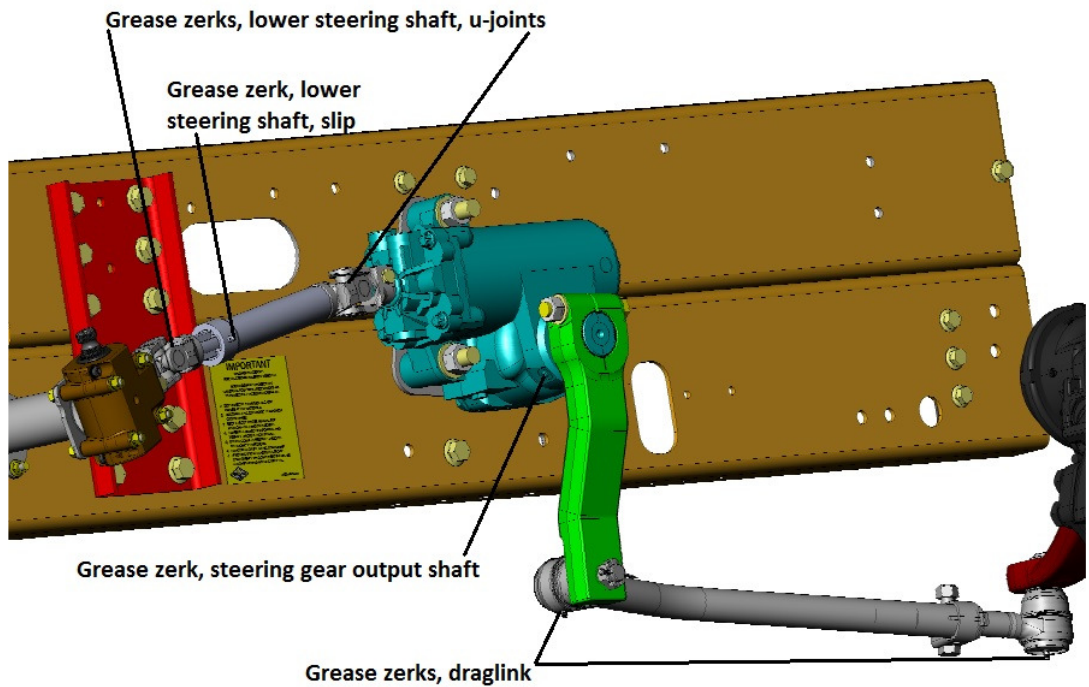
K2 chassis lubrication points

<u>Lubrication point #</u>	<u>Lubrication point description</u>	<u>Notes</u>
1	Upper steering shaft, upper U-joint	
2	Upper steering shaft, slip	
3	Upper steering shaft, lower U-joint	
4	Lower steering shaft, upper U-joint	
5	Lower steering shaft, slip	
6	Lower steering shaft, lower U-joint	
7	Steering gear, master, output shaft	
8	Steering gear, slave, output shaft	<i>(IFS2000 only)</i>
9	Steering drag link @ pitman arm	<i>(Beam axle only)</i>
10	Steering drag link @ steer arm	<i>(Beam axle only)</i>
11	Front axle, LH upper king pin	
12	Front axle, LH lower king pin	
13	Front axle, LH upper carrier bearing	<i>(IFS only)</i>
14	Front axle, LH lower carrier bearing	<i>(IFS only)</i>
15	Front axle, LH tie rod @ steer arm	
16	Front axle, LH tie rod @ relay rod	<i>(IFS only)</i>
17	Front axle, RH upper king pin	
18	Front axle, RH lower king pin	
19	Front axle, RH upper carrier bearing	<i>(IFS only)</i>
20	Front axle, RH lower carrier bearing	<i>(IFS only)</i>
21	Front axle, RH tie rod @ steer arm	
22	Front axle, RH tie rod @ relay rod	<i>(IFS only)</i>
23	Front axle, LH brake camshaft tube	<i>(Air drum brake only)</i>
24	Front axle, LH brake slack adjuster	<i>(Air drum brake only)</i>
25	Front axle, RH brake camshaft tube	<i>(Air drum brake only)</i>
26	Front axle, RH brake slack adjuster	<i>(Air drum brake only)</i>
27	Rear axle, LH brake camshaft tube	<i>(Air drum brake only)</i>
28	Rear axle, LH brake slack adjuster	<i>(Air drum brake only)</i>
29	Rear axle, RH brake camshaft tube	<i>(Air drum brake only)</i>
30	Rear axle, RH brake slack adjuster	<i>(Air drum brake only)</i>
31	Tag axle, LH upper king pin	<i>(Passive Steer Tag Axle only)</i>
32	Tag axle, LH lower king pin	<i>(Passive Steer Tag Axle only)</i>
33	Tag axle, LH tie rod @ steer arm	<i>(Passive Steer Tag Axle only)</i>
34	Tag axle, RH upper king pin	<i>(Passive Steer Tag Axle only)</i>
35	Tag axle, RH lower king pin	<i>(Passive Steer Tag Axle only)</i>
36	Tag axle, RH tie rod @ steer arm	<i>(Passive Steer Tag Axle only)</i>
37	Tag axle, LH brake camshaft tube, outer	<i>(Air drum brake only)</i>
38	Tag axle, LH brake camshaft tube, inner	<i>(Air drum brake only)</i>
39	Tag axle, LH brake slack adjuster	<i>(Air drum brake only)</i>

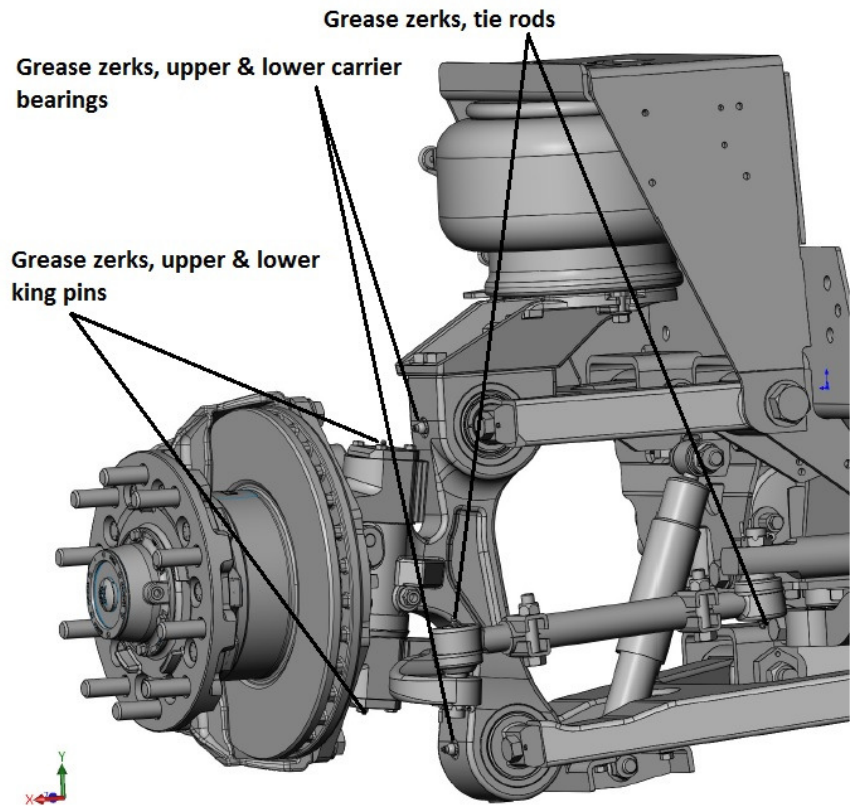
40	Tag axle, RH brake camshaft tube, outer	<i>(Air drum brake only)</i>
41	Tag axle, RH brake camshaft tube, inner	<i>(Air drum brake only)</i>
42	Tag axle, RH brake slack adjuster	<i>(Air drum brake only)</i>
43	Drive shaft, U-joint @ drive axle	
44	Drive shaft, slip	
45	Drive shaft, U-joint @ transmission	

K3 & K4 chassis lubrication points

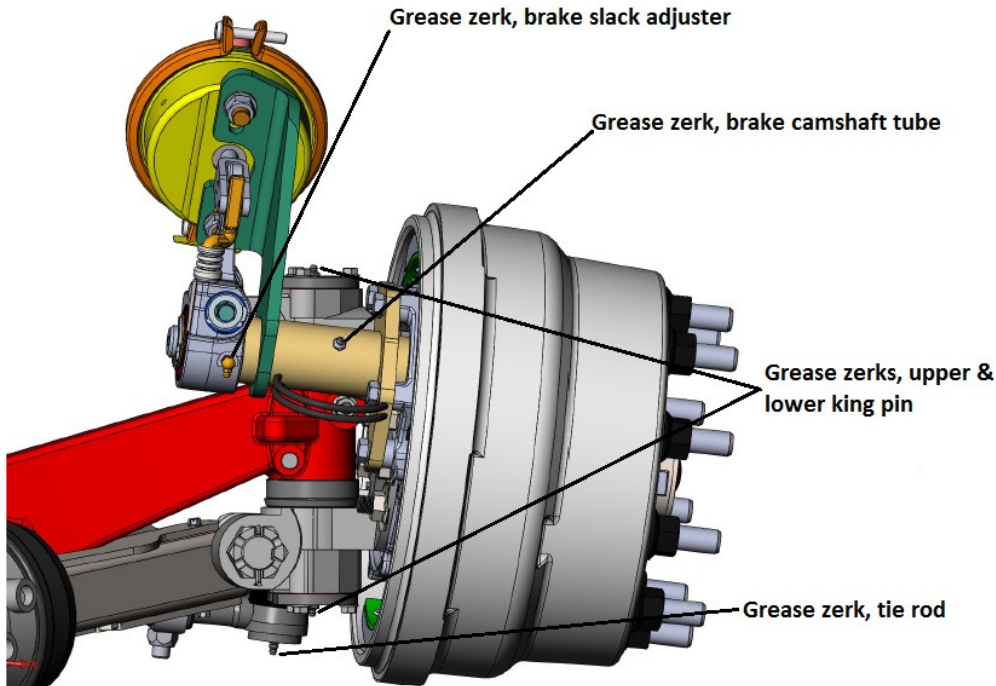
<u>Lubrication point #</u>	<u>Lubrication point description</u>	<u>Notes</u>
1	Upper steering shaft, upper U-joint	
2	Upper steering shaft, slip	
3	Upper steering shaft, lower U-joint	
4	Lower steering shaft, upper U-joint	
5	Lower steering shaft, slip	
6	Lower steering shaft, lower U-joint	
7	Steering gear, master, output shaft	
8	Steering gear, slave, output shaft	
9	Front axle, LH upper king pin	
10	Front axle, LH lower king pin	
11	Front axle, LH upper carrier bearing	
12	Front axle, LH lower carrier bearing	
13	Front axle, LH tie rod @ steer arm	
14	Front axle, LH tie rod @ relay rod	
15	Front axle, RH upper king pin	
16	Front axle, RH lower king pin	
17	Front axle, RH upper carrier bearing	
18	Front axle, RH lower carrier bearing	
19	Front axle, RH tie rod @ steer arm	
20	Front axle, RH tie rod @ relay rod	
21	Tag axle, LH upper king pin	<i>(Passive Steer Tag Axle only)</i>
22	Tag axle, LH lower king pin	<i>(Passive Steer Tag Axle only)</i>
23	Tag axle, LH tie rod @ steer arm	<i>(Passive Steer Tag Axle only)</i>
24	Tag axle, RH upper king pin	<i>(Passive Steer Tag Axle only)</i>
25	Tag axle, RH lower king pin	<i>(Passive Steer Tag Axle only)</i>
26	Tag axle, RH tie rod @ steer arm	<i>(Passive Steer Tag Axle only)</i>
27	Drive shaft, U-joint @ drive axle	
28	Drive shaft, slip	
29	Drive shaft, U-joint @ transmission	
30	Drive shaft, fan system, slip	



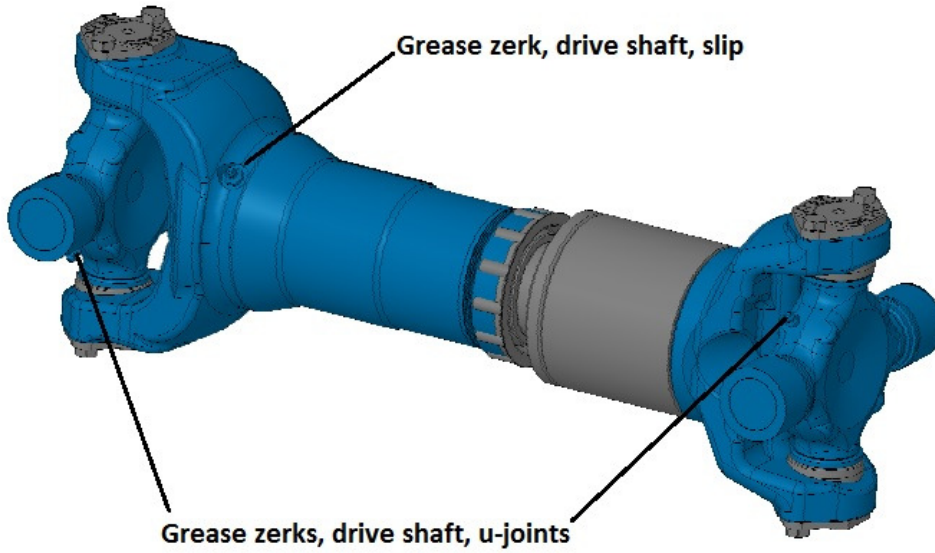
Lower steering shaft, steering gear output shaft, and draglink lube point example



Independent Front Suspension lube point example



Beam axle w/ air drum brake lube point example



Drive shaft lube point example

CHASSIS RIDE HEIGHT SPECIFICATIONS

The unit must be parked on a level surface.

K1 SERIES CHASSIS

INDEPENDENT FRONT SUSPENSION (IFS):

W&C IFS: 18.13" Measuring the distance between the centers of the shock mounting eyes.

ZF IFS: 10.00" Measuring the height of the air spring.

FRONT SUSPENSION (I-BEAM AXLE):

AIRTEK 12K: 7.50" Measuring the height of the air spring.

AIRTEK 14.6K: 7.75" Measuring the height of the air spring.

REAR SUSPENSION:

HTB: 8.50" Measuring from bottom of chassis frame rail to center of axle housing.

PRIMAAX: 8.25" Measuring from bottom of chassis frame rail to center of axle housing.

K2 SERIES CHASSIS

INDEPENDENT FRONT SUSPENSION (IFS):

Model 2000:	9.25"	Measuring the height of the air spring.
ProTec:	14.33"	Measuring the distance between the centers of the shock mounting eyes.
Model 1700:	9.25"	Measuring the height of the air spring.
ZF IFS:	10.00"	Measuring the height of the air spring.

FRONT SUSPENSION (I-BEAM AXLE):

AIRTEK 12K:	7.50"	Measuring the height of the air spring.
AIRTEK 14.6K:	7.75"	Measuring the height of the air spring.
Model 1600:	24.66"	Measuring the distance between the centers of the shock mounting eyes.

REAR SUSPENSION:

240AR:	8.25"	Measuring from bottom of chassis frame rail to center of axle housing.
HTB:	8.50"	Measuring from bottom of chassis frame rail to center of axle housing.
PRIMAAX:	8.25"	Measuring from bottom of chassis frame rail to center of axle housing.
RD2000:	8.25"	Measuring from bottom of chassis frame rail to center of axle housing.
RD2400:	8.25"	Measuring from bottom of chassis frame rail to center of axle housing.

K3 SERIES CHASSIS

INDEPENDENT FRONT SUSPENSION (IFS):

Model 2000: 9.25" Measuring the height of the air spring.

ProTec: 14.33" Measuring the distance between the centers of the shock mounting eyes.

REAR SUSPENSION:

RD2300: 8.25" Measuring from bottom of chassis frame rail to center of axle housing.

K4 SERIES CHASSIS

INDEPENDENT FRONT SUSPENSION (IFS):

Model 2000: 9.25" Measuring the height of the air spring.

ProTec: 14.33" Measuring the distance between the centers of the shock mounting eyes.

REAR SUSPENSION:

RD2300: 8.25" Measuring from bottom of chassis frame rail to center of axle housing.

AC4-20: 3.5" Measuring the distance between the axle cradle and the bottom of the frame.

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