Installation Instructions

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Sheppard™ Steering Gear Installation

NOTE: This document provides general guidelines for removing and installing steering gears. Follow the vehicle manufacturer's guidelines for specific instructions on removing and installing the steering gear on your vehicle.

⚠ IMPORTANT

Sheppard™ Power Steering Gears are manufactured and tested for proper operation prior to shipment. Every effort has been made to ensure they will provide you with many miles of trouble-free, safe operation. To protect your investment and comply with your warranty, it is important that these instructions be closely followed.

⚠ CAUTION

Steering gears are heavy and awkward to handle. It is easy to get fingers pinched or to drop the steering gear when handling it. Maintain a clean work area and plan the removal and installation ahead of time.

REMOVING AND REINSTALLING A STEERING GEAR

NOTE: When a power steering gear or power steering pump is replaced, the oil and oil filter in the power steering system should be changed. All lines and fittings should be flushed of any possible contaminants. Use the type of fluid specified by the vehicle manufacturer or 15W40 engine oil if none is specified.

NOTE: If a power steering pump has been replaced, it should be tested to ensure that its pressure and oil flow are the same as originally specified by the vehicle manufacturer.

1. Remove the steering column universal joint from the steering gear input shaft and secure the column out of the way. **NOTE:** Sheppard recommends inspecting the column and u-joints for looseness or binding.
2. If the new steering gear has a pitman arm already installed, remove the cotter pin from the castle nut on the draglink, and the draglink from the pitman arm. Secure the draglink out of the way, or;
3. Using an appropriate pitman arm puller, remove the pitman arm. The draglink does not have to be removed from the pitman arm.
4. Disconnect and cap all the hoses from the steering gear. Do not allow contaminants to enter the hoses. **NOTE:** If the hoses are leaking or hard and brittle, replace them.
5. Transfer the hose fittings from the old steering gear to the new one. Replacing the o-rings is recommended.
6. Clean the steering gear of grease and oil before removing it.
7. Hold the gear securely while the frame mounting bolts are removed, and remove the steering gear.
8. Ensure the mounting bolts are the correct length for the replacement steering gear. (As models are updated, sometimes the thickness of the gear mounting pads can change.)
9. Inspect the frame rail for straightness. A wavy or distorted frame will cause the steering gear to bind once mounted.
10. Install the steering gear on the vehicle. Care should be taken to ensure the mounting bracket or steering gear is not distorted when the bolts are tightened. This condition could cause the gear to bind. Torque the bolts in an alternating pattern to the vehicle manufacturer's specs.
11. Install the steering column or intermediate shaft to the steering gear input shaft, ensuring the clamp bolt is torqued to the vehicle manufacturer's specification.
12. If required, install the pitman arm. Torque the retainer as stamped on the retainer. Take care not to move the arm more than 2 in. in either direction unless the draglink has been installed or the piston will prematurely set the auto relief plungers.
13. Install the draglink on the pitman arm if required (except slave gears) and torque the fastener to the vehicle manufacturer's specification. **NOTE:** Slave gears should not have the draglink installed until the bleeding procedure is performed.
14. Attach all hoses to the gear or gears. *Refer to the Dual Steering Gear Systems section of this manual* for proper routing of dual steer systems. **NOTE:** On Sheppard™ M-Series™ gears, the inlet and outlet ports are staggered. The inlet port is always the one closest to the output shaft.
15. Fill the power steering system with an approved fluid. Start the engine and let it run at idle speed. **DO NOT RUN THE VEHICLE WITHOUT FLUID IN THE RESERVOIRS.**
16. Set the auto relief plungers or adjust the manual relief plungers to obtain proper wheel cut.

NOTE: If you cannot turn the steering all the way until the stops contact the axle in each direction with the steer tires off the ground, the pitman arm may be mistimed.

17. Bleed the gear(s) of any air.
18. Double check all fasteners, fittings, hose routings for leaks. Top off the fluid and return the vehicle to service. **NOTE:** The steering angle sensor may need recalibrated prior to returning the vehicle to service.

NOTE: Sheppard recommends the power steering system fluid and filter be changed according to the vehicle manufacturer's guidelines. Regular preventive maintenance is essential to the life of the steering system.

RELIEF PLUNGERS

See Figure 1. A plunger is placed in each end of all Sheppard™ steering gears (with the exception of slave gears) to unload steering system pressure prior to the axle stops contacting the axle. One is located in a small hole in the bearing cap cover next to the input shaft. The other plunger is on the opposite end of the steering gear and may be in a hole in the cover, or in the hole in the end of a boss sticking out from the cover. The hole may be covered with a plastic plug or cap. Both the auto and manual plungers have a slotted head for a screwdriver and look alike. They both will be located on either the inner or outer side of the steering gear's center line.

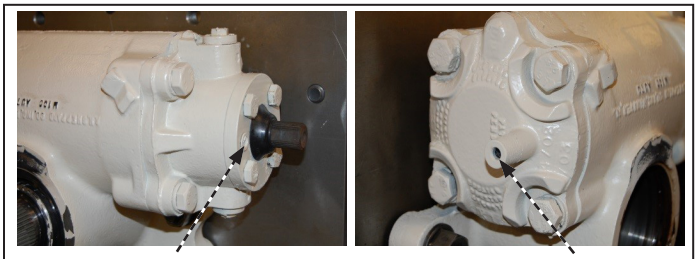

Figure 1 – Bearing Cap and Cylinder Head Plungers

NOTE: Auto plungers are identified with a "3" in the model number (i.e. M100PMX3™, HD94PAB31™, SD110PM31™). The word "Auto" may or may not be cast into the housing. *See Figure 2.*

Figure 2 – "Auto" Casting Example

NOTE: Manual plungers are identified with a "1" in the model number (i.e. M100PCL1R™, M110PHM11™, XD120PB1™) and will not have the word "Auto" anywhere on the housing.

The plungers prevent the power steering pump from operating at maximum relief pressure at the end of steering travel. When properly adjusted, the relief plungers reduce system temperature and excessive stress on the mechanical components of the steering system by preventing the axle stops from contacting the axle under full pump pressure.

NOTE: After a steering gear is built and tested by Sheppard, the relief plungers are set all the way in. When the gear is installed on a vehicle, it will have minimum steering travel until the relief plungers are properly set. This applies to new and remanufactured steering gears, with manual or auto relief plungers.

⚠ CAUTION

Failure to set or adjust the relief plungers may result in damage to the steering system and chassis. Plungers must be set or adjusted on all replacement steering gears.

AUTOMATIC (AUTO) PLUNGERS

Follow the procedure below to set auto plungers.

1. Raise the steer tires off the ground.
2. Start the engine and let it run at idle speed. Ensure the axle stops are set at the vehicle manufacturer's spec. If no spec is available, set the stops for maximum wheel cut with a minimum of 1-in. clearance between the tire and any part of the chassis. Ensure the pitman arm has clearance to any hard part.

⚠ CAUTION

Ensure the pitman arm and draglink do not form a straight line at full turn angle. This condition is called "toggle" and will prevent the steer tires from returning to center.

3. Set the auto plungers by turning the steering wheels from side to side until the axle stops contact the axle. This allows the piston in the steering gear to contact the auto plunger assembly and push it back to its set position. The stops MUST contact the axle. **NOTE:** Pull hard on the steering wheel.
4. Return the steer tires to the ground. Turn the steering wheel completely from stop to stop. Normally you will see a small gap between the axle stop and the axle.

NOTE: If the axle stops contact the axle (with the wheels on the ground) and load the power steering pump or begin twisting the chassis, the auto plungers have been pushed out too far and must be reset.

- Auto plungers are reset by tapping them in with a ¼-in. punch and small hammer until you feel the plunger bottom out in the bore. Be careful not to score the plunger bore. Scoring the bore will cause a leak which cannot be repaired. **TO AVOID DAMAGE TO THE BEARING CAP AND ROTARY VALVE, DO NOT USE EXCESSIVE FORCE TO DRIVE IN THE PLUNGERS.** The head of the plunger will be between 1-1 ⅛ in. deep in the plunger hole when it is bottomed out. After the auto plungers are reset, *set them by following steps 1 through 4.*

5. Once the relief plungers are set, no further adjustment is necessary unless tire size or wheel offset is changed. Return the vehicle to service.

MANUAL PLUNGERS

Steering gears have manual plungers if you can back them out of the plunger hole with a skinny, flat-bladed screwdriver.

Manual plungers are turned all the way in from the factory for minimum wheel cut. Adjust the plungers *IN* to *DECREASE* wheel cut; adjust the plungers *OUT* to *INCREASE* wheel cut.

NOTE: Some vehicles have a ½-in. nut welded to the end of the cylinder head plunger so it may be adjusted. Gears with an integral miter on the bearing cap will have a square-cut plunger head so it may be adjusted.

1. Start the engine and let it run at idle speed. Ensure the axle stops are set for maximum wheel cut with a minimum of 1-in. clearance between the tire and any part of the chassis.
2. With the full weight of the vehicle on the ground, turn the steer tires full left. Check the gap between the axle stop and the axle on the left steer tire. If it is greater than ⅛ in., adjust the plunger *OUT* (counterclockwise). Adjust the plunger in the end of the gear which the piston has moved toward. If the stop is touching the axle, try turning the plunger *IN*, then recheck it.

NOTE: Accumulation may occur under the tires. It may be necessary to move the vehicle prior to rechecking.

⚠ CAUTION

The plungers are fine thread so it may take several turns to get them properly adjusted. Do not back the head of the plunger out past flush with the end of the hole. The plunger could be ejected from the gear. The plunger can be shortened if necessary.

3. Turn the steer tires full right and adjust the opposite plunger for the gap at the right side axle stop using the same procedure defined in steps 1 and 2.
4. Once the relief plungers are set, no further adjustment is necessary. Return the vehicle to service.

BLEEDING AIR FROM THE STEERING GEARS

Most single steering gears can be bled simply by turning the steering wheel all the way from stop to stop after the gear has been installed, lines connected, system filled with fluid, and relief plungers set. Some gears require bleeding through a bleeder screw. Dual gear systems require a special procedure. *See Figure 3 and refer to the Single Gear and Dual Gear System Bleeding Procedures on page 4.*

SELF-BLEEDING GEAR - SECTOR BORE BELOW PISTON

GEAR WITH BLEEDER PLUG - SECTOR BORE ABOVE PISTON

BLEEDER PLUG

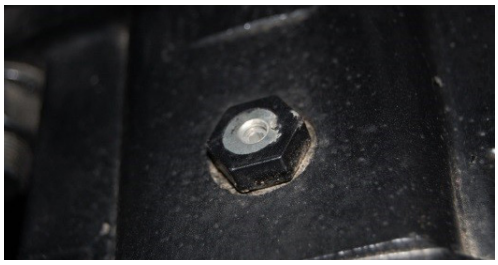

Figure 3 – Bleeder Examples

SINGLE GEAR SYSTEM BLEEDING PROCEDURE

If the gear is mounted with the bulge in the housing for the sector shaft hanging below the piston cylinder:

1. With the weight of the vehicle on the ground, start the engine and let it run at idle speed.
2. Turn the steering wheel from stop to stop three (3) times. Hold the steering wheel under pressure for about five (5) seconds when you reach the end of travel in each direction. Re-center the steering to complete the bleeding process.

If the gear is mounted with the bulge in the housing for the sector shaft sitting above the piston cylinder:

1. With the weight of the vehicle on the ground, start the engine and let it run at idle speed.
2. Locate the ¾-in. bleeder plug on the sector housing. Locate the ⅛-in. Allen set screw and loosen three to four (3 - 4) turns. **NOTE:** Do not remove the set screw completely **NOTE:** Many newer model gears do not have the bleeder plug, even if they are mounted in this manner. Instead, there is a bleed passage cast into the housing which allows the air to be carried to the bearing cap. Bleed this type of gear using the steps for sector shafts hanging below the piston cylinder.
3. With the bleeder still open, turn the wheels all the way to the right then shut the bleeder. Turn the wheels all the way back to the left and repeat the procedure four (4) more times.

NOTE: THE BLEEDER SHOULD ONLY BE OPEN AS YOU ARE TURNING TO THE RIGHT. If it is open when turning to the left, air will be forced back into the system.

4. Re-center the steering to complete the bleeding process. **NOTE:** Do not allow the reservoir to run dry at any time. Bleeding is complete when the steering operates smoothly from stop to stop, turning in both directions.

DUAL GEAR SYSTEM BLEEDING PROCEDURE

1. With the weight of the vehicle on the ground, start the engine and let it run at idle speed. The draglink should be connected to the pitman arm on the main gear, but not connected to the slave gear.
2. Turn the steering wheel all the way to the left until the steer tires stop moving and hold pressure on the steering wheel until the pitman arm on the slave gear moves its full travel. It should move in the opposite direction of the pitman arm on the main gear. It may be necessary to place a jack under the steer axle in order for the steer tires to turn more easily. Keep holding pressure on the steering wheel for 15 seconds after the slave gear stops moving.
3. Turn the steering wheel all the way to the right until the axle stop contacts the axle and hold pressure on the steering wheel until the pitman arm on the slave gear moves its full travel. Keep applying pressure on the steering wheel for 15 seconds after the slave gear stops moving.
4. Repeat the procedure three (3) more times or until there is no air in the system and the slave gear moves freely.

NOTE: Pressure must be kept on the steering wheel to keep the valve open, sending fluid to the slave gear. When pressure is released, the valve returns to neutral and no pump pressure is sent to the steering gears.

5. Turn the steering wheel until the pitman arm on the slave gear lines up with the draglink and install the draglink. **Do not move the pitman arm on the slave gear by hand. Air may be drawn into the system.**
6. Cycle the steering wheel from stop to stop. If a catch is noted, look for bleeder plugs on the steering gears. If the gear is mounted with the bulge in the housing for the sector shaft sitting above the piston cylinder, follow the procedure outlined for bleeding a single gear with the bulge in the housing for the sector shaft sitting above the piston cylinder. If both gears have bleeder plugs, open the bleeder only when the piston is moving toward the bleeder.

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