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Logistics Operations School
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Training Command
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AOM 6408

STUDENT OUTLINE

MAINTAIN HMMWVA2 FRONT SUSPENSION AND GEARED HUB ASSEMBLY

LEARNING OBJECTIVES

1. Terminal Learning Objectives:

a. Given a HMMWVA2, TM 9-2320-280-20-1&2, LO 9-2320-280-12, tools, supplies, and replacement parts, perform organizational maintenance on the front suspension system, per the references. (6.4.14)

b. Given a HMMWVA2, TM 9-2320-280-20-1&2, LO 9-2320-280-12, tools, supplies, and replacement parts, perform organizational maintenance on the geared hub assembly, per the references. (6.4.15)

c. Given a HMMWVA2, TM 9-2320-280-20-1&2, LO 9-2320-280-12, tools, supplies, and replacement parts, perform organizational maintenance on the halfshaft assembly, per the references. (6.4.16)

2. Enabling Learning Objectives :

a. Given a HMMWVA2, TM 9-2320-280-20-1&2, LO 9-2320-280-12, tools, supplies, and replacement parts, per the references:

(1) disassemble front suspension system, (6.4.14a)

(2) inspect disassembled components of the front suspension system for serviceability, (6.4.14b)

(3) assemble front suspension system using serviceable components. (6.4.14c)

b. Given a HMMWVA2, TM 9-2320-280-20-1&2, LO 9-2320-280-12, tools, supplies, and replacement parts, per the references:

(1) replace the geared hub spindle seal and (6.4.15a)

(2) adjust the geared hub spindle bearing. (6.4.15b)

c. Given a HMMWVA2, TM 9-2320-280-20-1&2, LO 9-2320-280-12, tools, supplies, and replacement parts, per the references:

(3) remove halfshaft assembly, (6.4.16a)

(4) disassemble halfshaft assembly, (6.4.16b)

(5) inspect disassembled components of the halfshaft assembly for serviceability, (6.4.16c)

(6) lubricate halfshaft joints, (6.4.16d)

(7) assemble halfshaft, using serviceable components, and (6.4.16e)

(8) install the halfshaft assembly. (6.4.16f)

OUTLINE:

1. INTRODUCTION TO THE FRONT SUSPENSION AND GEARED HUB ASSEMBLY

a. System Overview

(1) The suspension system consists of upper and lower control arms pivoting on rubber bushings. The lower control arms are attached to frame crossmembers. Upper control arms are attached to frame brackets. These control arms are connected to geared hubs through pivoting ball joints.

(2) A coil spring is located between the lower control arm and a formed seat on the frame rail, the lower control arm is the load carrying member.

(3) Double acting shock absorbers mounted inside of the coil springs are attached to the lower control arm and connected with the frame.

(4) A stabilizer bar is used on the front suspension to control vehicle sway when cornering.

b. Identification of Suspension System Components. The front suspension, is an independent coil spring-type system. Major components of the system are:

- (1) Upper and lower ball joints.
- (2) Upper and lower control arms.
- (3) Geared hubs.
- (4) Axle halfshafts.
- (5) Coil springs.
- (6) Shock absorbers.
- (7) Stabilizer bar.
- (8) Tie rods/radius rods.

(9) Components at the rear wheel are identical except for the absence of steering system components and the addition of a radius rod which replaces the tie rod.

a. Geared Hub

(1) Geared hubs are attached to the control arms by ball joints at each axle end.

(2) Geared hubs are mounting point for the tire-wheel assemblies and serve as front and rear wheel spindles. The geared hub is also a final drive gear box providing gear reduction to increase torque to the tire-wheel assembly.

b. Axle Halfshaft

(1) Axle halfshafts extend from the differential to the geared hub.

(2) Halfshafts transmit driving power from the differential to the geared hub. The halfshaft has three major parts: A plunge joint secured to the axle differential output flange with a fixed joint secured to the geared hub; and the shaft connecting the two joints. The joints are protected with rubber boots to allow continual lubrication of the joints. The inboard plunge joint accommodates the in and out motion of the

axle halfshaft and allows torque to be transmitted through various angles. The outboard fixed joint transmits torque through various steering angles to the geared hub.

c. Ball Joints. Ball joints connect the geared hub to a control arm. They pivot, allowing a change of angle between the geared hub and control arms during suspension/steering movement.

d. Tie/Radius Rods

(1) A tie rod extends from the steering linkage to the geared hub. On the rear suspension the radius rod extends from the frame to the geared hub.

(2) The tie rod and attached ball joints transmit steering or turning movement from steering linkage to the geared hub. On the rear suspension, a radius rod locks the rear wheels into a straight ahead position.

e. Stabilizer Bar

(1) A stabilizer bar is located in the front suspension system.

(2) The stabilizer bar is transverse mounted on the frame rail to the rear of the lower control arms. The bar is attached with rubber bushings and clamps and connected to the lower arms by link bolts with rubber bushings at both ends. The stabilizer bar provides added roll resistance by counteracting independent motion of either side of the front suspension.

f. Control Arms

(1) An upper control arm is attached to frame rails and the upper ball joint. The lower control arm is attached to frame rails and the lower ball joint.

(2) Control arms serve to control movement of the geared hub through pivoting ball joints. Control arms pivot on rubber bushings located at the frame attachments.

g. Coil Springs

(1) Coil springs are mounted between the lower control arm and a frame mounted bracket.

(2) Coil springs support the weight of the vehicle and maintain proper ride height. Springs serve to dampen harsh suspension action.

h. Shock Absorbers

(1) Shock absorbers are mounted inside the coil springs and attached to the lower control arm and frame.

(2) Heavy-duty shock absorbers work with the coil springs to dampen movement of the body, frame and wheel. The shock absorbers are called double acting because they dampen motion in both directions of suspension travel.

4. REPAIR HMMWVA2 FRONT SUSPENSION AND GEARED HUB ASSEMBLY

a. Remove Tire-Wheel Assembly

(1) Always apply the parking brake and chock the tire opposite the wheel being removed. Avoid removing the wheel when the vehicle is on sloping terrain. Injury to personnel or damage to equipment may result.

(2) Loosen the lug nuts but do not remove them.

(3) Raise and support the vehicle.

(4) Remove the lug nuts securing the wheel to the geared hub and remove the wheel.

b. Remove Halfshaft Assembly

(1) Remove the access plug from the geared hub.

(2) Remove halfshaft retaining capscrew and lockwasher securing the halfshaft to the geared hub.

(3) Remove capscrews and lockwashers securing the halfshaft to the rotor.

(4) Remove halfshaft.

c. Disassemble Halfshafts

- (1) Remove two boot clamps securing the boots to the plunge joint and inner joint.
- (2) Remove two boot clamps securing the boots to the shaft.
- (3) Clamp the shaft in a soft jaw vise.
- (4) Using a slide hammer, remove inner joint from the shaft.
- (5) Remove the retaining ring and spacer.
- (6) Using a slide hammer, remove fixed joint from the shaft.
- (7) Remove retaining ring and spacer.
- (8) Remove the boots from the shaft.

d. Clean and Inspect the Halfshaft

- (1) Use drycleaning solvent to clean all metallic parts. Remember, drycleaning solvent is highly flammable.
- (2) Inspect the shaft for cracks and distortion. Replace the shaft if it is cracked or distorted.
- (3) Inspect splined end of the shaft for damage. Replace it if it is damaged.
- (4) Inspect boots for cracks, breaks, tears, or other damage. Replace any that are cracked, broken, torn or damaged.
- (5) Inspect outer joint and inner joint for pitting or rough joint operation. Replace the joints if they are pitted or unserviceable.

e. Assemble the Halfshaft

- (1) Clamp shaft in a soft jaw vise.
- (2) Install inner boot onto the shaft.
- (3) Pack inner joint with lithium grease.

- (4) Install spacer and retaining ring on the shaft.
- (5) Aline splines and push the inner joint onto the shaft until the joint snaps into place.
- (6) Secure inner boot to the inner joint and shaft with boot clamps.
- (7) Install outer boot on the shaft.
- (8) Pack outer joint with lithium grease.
- (9) Install spacer and retaining ring on the shaft.
- (10) Aline splines and push outer joint onto the shaft until the joint snaps into place.
- (11) Secure outer boot to the outer joint and shaft with clamps.

f. Remove Tie Rod; Front Only

- (1) Remove cotter pin and slotted nut securing tie rod to the center link.
- (2) Remove cotter pin, slotted nut, and washer securing tie rod to the geared hub.
- (3) Remove tie rod.

g. Remove Radius Rod; Rear Only

- (1) Remove cotter pin, slotted nut and washer securing radius rod to the geared hub.
- (2) Remove locknut, washer, capscrew and washer securing radius rod to the bracket.
- (3) Remove radius rod from the geared hub and bracket.

h. Remove Stabilizer Bar and Bar Link

- (1) Remove four locknuts, washers, and two clamps securing stabilizer bar to the frame bracket.

(2) Remove capscrew and two washers securing bar link to the lower control arm.

(3) Remove locknuts and washers securing bar links to the stabilizer bar. Remove bar links and pins from the stabilizer bar and frame bracket.

(4) Remove the stabilizer bar bushing from the stabilizer bar.

i. Remove the Geared Hub-Ball Joint Assembly

(1) Position a container under the geared hub to catch the fluid.

(2) Remove drain plug from the geared hub and allow fluid to drain. After unit is drained, reinstall the drain plug.

(3) Remove the front steering stop if removing a front geared hub; remove the rear air lift bracket if removing a rear geared hub.

(4) Remove capscrew and washer securing the vent line bracket and clamp to the geared hub.

(5) Loosen the clamp and disconnect vent line from the geared hub.

(6) Place a support under the geared hub. The geared hub must be supported during removal and installation. Failure to support the geared hub may cause injury to personnel or damage to equipment.

(7) Remove locknuts, capscrews, and washers securing lower ball joint to the lower control arm.

(8) Remove locknuts, capscrews, and washers securing boot retainer, ball joint retainer, and upper ball joint to the upper control arm.

(9) Lower the support and remove geared hub.

(10) Place and secure the geared hub in a vise.

(11) Remove cotter pin and slotted nut securing upper ball joint to the geared hub. Remove upper ball joint.

(12) Remove cotter pin and slotted nut securing lower ball joint to the geared hub. Remove lower ball joint.

j. Replace Geared Hub Input Seal

(1) Removal.

(a) Remove four capscrews, washers, drive gear retainer and shim gaskets from the geared hub. Shim gaskets must be reused to maintain proper drive gear bearing adjustment.

(b) Install drive gear retainer in a soft jawed vise and remove the input seal with a brass punch.

(2) Installation.

(a) Using an input seal installer and driver handle, install the input seal in drive gear retainer so that radius on the outer diameter of input seal faces towards the inside of the geared hub.

(b) Install shim gaskets and drive gear retainer in the geared hub and secure them with vent line bracket.

(c) Tighten capscrews.

(d) Coat lip of the input seal with lubricating oil.

k. Replace the Geared Hub Spindle Seal

(1) Removal.

(a) Have a container to catch the oil and remove drain plug from the geared hub and drain the oil. Reinstall the drain plug.

(b) Remove capscrews and washers securing steering arm cover to the geared hub, and push the steering arm cover away from the geared hub.

(c) Bend locktab on the lockwasher away from the locknut.

(d) Remove locknut, lockwasher, and keyed washer from the spindle.

(e) Remove spindle, spacers and bearings from the geared hub.

(f) Remove spindle seal from the geared hub.

(g) Inspect spindle for rough or corroded sealing surfaces. Replace geared hub if the spindle is damaged.

(h) Inspect bearings for damage. The geared hub must be replaced if either bearing is damaged.

(2) Installation.

(a) Install spindle seal into the geared hub, using a driver handle and spindle seal installer. Coat the seal with lubricating oil once it is installed.

(b) Install spacer and spindle in the geared hub.

(c) Install spacer, bearing, keyed washer, lockwasher, and locknut onto the spindle.

(d) Tighten locknut to 35-45 foot-pounds while rotating the spindle back and forth to seat the bearings.

(e) Loosen and retighten the locknut to 25 foot-pounds.

(f) Determine which locktab on the lockwasher aligns with a slot in the lockwasher. Bend the locktab into the slot.

(g) Clean sealing surfaces on the geared hub and steering arm cover. Apply flange sealant to the steering arm cover and install it onto the geared hub.

(h) Apply sealing compound to capscrew threads and secure the steering arm cover to the geared hub with four washers and capscrews.

(i) Remove fill plug and washer from the geared hub and fill with GO 80/90; refer to the Lubrication Instructions.

(j) Install washer and fill plug into the geared hub.

l. Remove the Upper Control Arm. Remove capscrews, locknuts, and washers securing the upper control arm to brackets and remove upper control arm. Remove capscrew securing clamp and vent line to the upper control arm.

m. Remove Coil Spring, Shock Absorber, and Lower Control Arm

(1) Before you begin this task you should be aware of certain safety precautions.

(a) The lower support arm must be supported during the performance of this maintenance task.

(b) Leave the shock absorber inside the coil spring to prevent the spring from falling, shifting, or being released under pressure and injuring personnel.

(2) Place a hydraulic jack under the lower control arm.

(3) Remove the shock absorber pin, washer, and nut securing the shock absorber to the spring seat bracket.

(4) Depress shock absorber with a hammer handle and slowly lower the support arm. Release the pressure from the spring.

(5) Continue to lower support arm until top of the spring is free from the upper spring seat bracket.

(6) Remove capscrews, lockwashers, and washers securing shock absorber and bracket to the lower control arm. Remove shock absorber and bracket. Discard lockwashers.

(7) Remove locknuts, washers, and capscrews securing lower control arm. Discard locknuts.

(8) Note alinement of the shock absorber and bracket for installation reference. It may even be desirable to trace the angle of alinement on a piece of cardboard for installation reference.

(9) Remove pin, locknut, and washer securing the bracket to the shock absorber and remove the bracket. Discard the locknuts.

n. Install Lower Control Arm, Coil Spring and Shock Absorber

(1) Secure bracket to the shock absorber with pin, washer and locknut. Check alinement of shock absorber and bracket. Tighten locknut to 300 foot-pounds

(2) Install shock absorber and bracket to lower control arm with capscrews, lockwashers, and washers.

(3) Install lower control arm to lower bracket with locknuts, washers, and capscrews. Place a hydraulic jack under the lower control arm.

(4) Install coil spring over the shock absorber onto lower control arm, making sure end of the coil spring fits into the spring pocket of lower control arm.

(5) Raise lower control arm until the coil spring seats into upper spring seat bracket.

(6) Pry shock absorber into the bracket and secure it with pin, washer, and locknuts. Tighten locknuts to specifications.

(7) On front control arms, capscrew heads are toward rear of the vehicle. On the rear control arms, capscrew heads are toward the front of the vehicle.

o. Install Upper Control Arm. Install upper control arm to brackets and secure with two capscrews, washers, and locknuts.

p. Install the Geared Hub-Ball Joint Assembly

(1) Install upper ball joint onto the geared hub and secure it with a slotted nut.

(2) Install lower ball joint to the geared hub and secure it with slotted nut.

(3) The geared hub must be supported during removal and installation. Failure to support the geared hub may cause injury to personnel or damage to equipment.

(4) Place a support under the geared hub.

(5) Install geared hub and upper ball joint on upper control arm. Make sure upper ball joint is placed above the upper control arm, and that the boot retainer and ball joint retainer are placed below upper control arm.

(6) Secure upper ball joint to upper control arm with four washers, capscrews, and locknuts.

CAUTION

Do not loosen slotted nut to install the cotter pin. This may result in damage to equipment.

(7) Tighten slotted nut securing upper ball joint to the geared hub and install a cotter pin.

(8) Install lower ball joint and geared hub onto lower control arm, making sure lower ball joint is below the lower control arm.

(9) Secure lower ball joint onto the lower control arm with four washers, capscrews, and locknuts.

(10) Tighten slotted nut securing the lower ball joint to the geared hub and install the cotter pin.

(11) Remove the support from under the geared hub.

(12) Connect the vent line to the geared hub.

(13) Secure the vent line and clamp to the geared hub with the washer and capscrew.

(14) Tighten the drainplug.

(15) Install the front steering stop or the rear air lift bracket.

q. Install Stabilizer Bar and Bar Link

(1) Install stabilizer bar bushing onto stabilizer bar.

(2) Install stabilizer bar onto frame brackets and secure it with two clamps, four washers and nuts.

(3) Install pins in bar links.

(4) Install the bar links to stabilizer bar and secure with washers and locknuts.

(5) Install bar links to the lower control arms. Secure each with washers and a capscrew. The hub may have to be raised to allow installation of the bar link to lower control arm.

r. Install the Tie Rod; Front Only

(1) Install tie rod to the center link and secure it with a slotted nut. Tighten slotted nut to specifications. Do not loosen slotted nut to install the cotter pin. Failure to do this may result in damage to equipment.

(2) Install tie rod to the geared hub and secure it with a washer and slotted nut.

(3) Install a cotter pin in each slotted nut.

s. Install the Radius Rod; Rear Only

(1) Install radius rod to its bracket and secure it with a capscrew, two washers and locknut. Do not loosen the slotted nut to install the cotter pin. Failure to do this may result in damage to equipment.

(2) Install radius rod to geared hub and secure it with a washer and a slotted nut, install the cotter pin.

(3) Tighten locknut securing radius rod to the frame bracket.

t. Install Halfshaft

(1) Install halfshaft into the geared hub.

(2) Apply thread locking sealant to the halfshaft retaining capscrew and secure halfshaft to geared hub with a lockwasher and halfshaft retaining capscrew.

(3) Install washer access plug in the geared hub.

(4) Apply thread locking sealing compound to the capscrew threads and install halfshaft to the output flange and secure it with lockwashers and capscrews.

u. Lubricate the Geared Hub

(1) Remove fill plug and washer from the geared hub.

(2) Fill geared hub with lubricant to the proper level; refer to LO 9-2320-280-12.

(3) Install washer and fill plug into the geared hub.

v. Lubricate Radius Rod, Tie Rod and Upper Ball Joint

w. Install the Tire-Wheel Assembly

(1) Install wheel on the geared hub and secure it with the lug nuts.

(2) Remove support and lower the vehicle.

(3) Tighten lug nuts to specifications in the tightening sequence in paragraph 8-3 of TM 9-2320-280-20-2.

5. DIAGNOSE A MALFUNCTIONING SUSPENSION, GEARED HUB, AND HALFSHAFT ASSEMBLY

a. If you encounter wheel vibration or poor stability in a HMMWVA2, the malfunction may be caused by:

(1) loose lug nuts, incorrect tire pressure.

(2) cuts, gouges, cracks, or sidewall damage in the tires.

(3) Bent or damaged wheel, or a damaged geared hub.

b. Another malfunction you may see is uneven tire wear. This may be caused by:

(1) incorrect tire pressure, improper toe adjustment.

(2) Leaking shock absorbers or steering components may be worn or loose.

c. To isolate the cause of a noisy suspension we would:

(1) Check coil springs for damage.

(2) Check suspension and steering components.

(3) Check for a damaged geared hub.

d. Another problem you may encounter is excessive noise in the geared hub. To isolate this malfunction, the mechanic should:

(1) Check oil level in the geared hub.

(2) Check geared hub for output spindle end play.

(3) Check halfshaft retaining capscrew to be sure it is tight.

e. A noise coming from the halfshaft may be isolated by:

(1) Inspecting halfshaft for damaged boots and boot clamps at both ends.

(2) Checking halfshaft for correct mounting.

(3) Checking halfshaft joints for play or looseness.

REFERENCES:

TM 9-2320-280-20-1

TM 9-2320-280-20-2

LO 9-2320-280-12