

Section 5 Assembly

8. Carefully push the carrier into position. Tighten the four fasteners two or three turns each in a pattern opposite each other. Refer to **Figure 125**.
9. Repeat step 8 until the four fasteners are tightened to the correct torque value. Refer to the Torque Chart on page 72. **T**
10. Install the other fasteners and washers that hold the carrier in the axle housing. Tighten fasteners to the correct torque value. Refer to the Torque Chart on page 72. **T**
11. Connect the driveline universal joint to the pinion input yoke or flange on the carrier.
12. Install the gaskets and axle shafts into the axle housing and carrier. The gasket and flange of the axle shafts **must** fit flat against the wheel hub. **Figure 126**.

Straight Holes, Nuts and Hardened Washers

1. Clean the mating surfaces of the axle shaft and the wheel hub.
2. If silicone gasket material is used, apply a 1/8-inch diameter bead of the gasket material around the mating surface of the hub and around the edge of each fastener hole in that surface.
3. Install the gasket and the axle shaft into the housing. The gasket and the flange of the axle shaft **MUST** fit flat against the wheel hub. Refer to **Figure 126**.
4. Install the Grade 8 nuts and hardened washers on the stud. (Lock washers are an acceptable alternative.) Tighten the stud nuts to the torque specified in **Chart 3**.

Chart 3

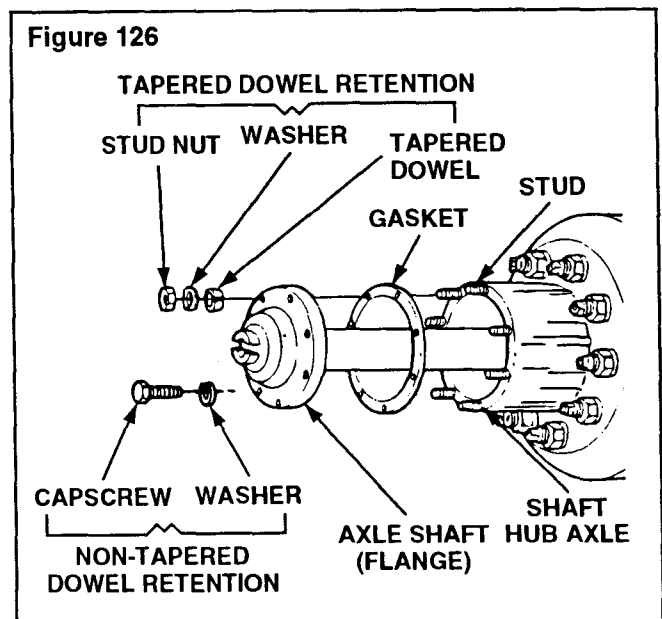
Shaft-to-Hub Torque Fastener Chart—Non-tapered Dowel Applications

Fastener	Thread Size	Torque Value — Grade 8 Nuts lb-ft (N•m) T	
		Plain Nut	Lock Nut
Stud Nut (Axle Shaft)	62-18 .75-16	150-230 (244-312) 310-400 (420-542)	130-190 (203-258) 270-350 (366-475)
Studs	All	Install the course thread end of stud into hub and tighten to last thread.	

Section 5 Assembly

Tapered Dowel, Hardened Washer and Hardened Nut


1. Clean the mating surfaces of the axle shaft and the wheel hub.
2. If silicone gasket material is used, apply a 1/8-inch diameter bead of the gasket material around the mating surface of the hub and around the edge of each fastener hole in that surface.
3. Install the gasket and the axle shaft into the housing. The gasket and the flange of the axle shaft **MUST** fit flat against the wheel hub. Refer to Figure 126.



4. Install solid tapered dowels over each stud and into the flange of the axle shaft. Use a punch or a drift and hammer, if necessary.
5. Install the Grade 8 nuts and hardened washers on the stud. (Lock washers are an acceptable alternative.) Tighten the stud nuts to the torque specified in Chart 4.

Chart 4

Shaft-to-Hub Torque Fastener Chart — Tapered Dowel Applications

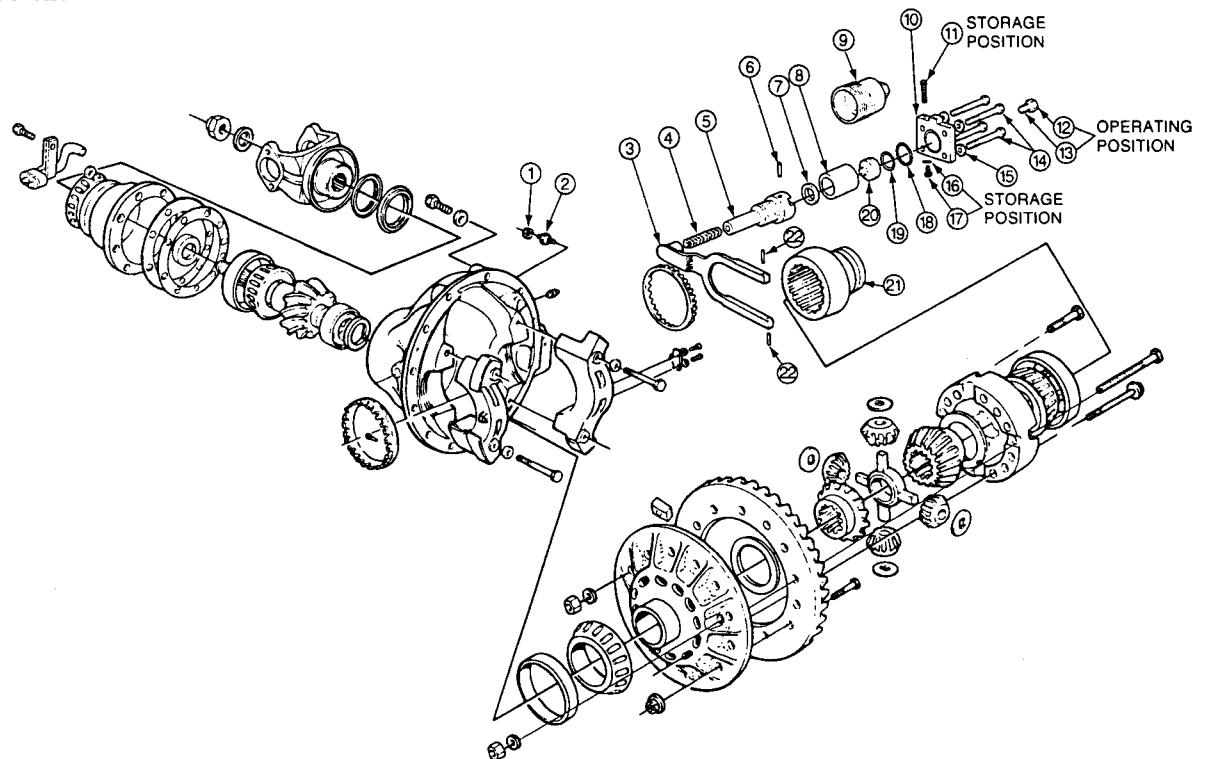
Fastener	Thread Size	Torque Value — Grade 8 Nuts lb-ft (N•m) 	
		Plain Nut	Lock Nut
Stud Nut (Axle Shaft)	.44-20	50-75 (81-102)	40-65 (67-88)
	.50-20	75-115 (115-156)	65-100 (102-136)
	.56-18	110-165 (176-224)	100-145 (149-197)
	.62-18	150-230 (244-312)	130-190 (203-258)
Studs	All	Install the course thread end of stud into hub and tighten to last thread.	

Section 6

Driver-Controlled Main Differential Lock

Driver-Controlled Main Differential Lock Assembly

Figure 127



1. Lock Nut — Sensor Switch
2. Sensor Switch
3. Shift Fork
4. Shift Shaft Spring
5. Shift Shaft
6. Spring Retaining Pin
7. Flat Washer (or silastic as reqd.)
8. Air Cylinder Tube

9. Screw-In Differential Lock
10. Cylinder Cover
11. Capscrew — Manual Actuation
12. Washer
13. Plug Gasket
14. Cover Capscrews
15. Washers

16. Plug Gasket
17. Cover Plug
18. Cover Copper Gasket
19. Piston O-Ring
20. Piston
21. Shift Collar
22. Shift Fork Roll Pins

Some Rockwell drive axle models have a DCDL or a driver-controlled main differential lock. This differential lock is operated by a carrier-mounted, air-actuated shift unit. When activated, the shift unit moves a sliding collar which is installed on the splines of the axle shaft. When engaged, the collar locks the axle shafts together with a second set of splines on the differential case. When the DCDL is engaged, there is no differential action. **Figure 127.**

NOTE:

The Rockwell carrier models with driver-controlled differential lock equipment are manufactured in metric dimensions and sizes. When these carriers are serviced, it is important to use the correct metric size tools on the fasteners. Refer to the metric Torque Chart at the back of this manual.



CAUTION

If the vehicle must be towed to a service facility with the drive axle wheels on the ground, it is necessary to remove the axle shafts before the vehicle is towed, or internal axle damage will result.

1. Remove the axle shafts before the vehicle is towed. Refer to Section 10, Vehicle Towing Instructions on page 77.
2. Install the axle shafts after the vehicle is towed. Refer to Section 10, Vehicle Towing Instructions.
3. If the differential carrier must be removed from the axle housing, use the following procedures.

Section 6

Driver-Controlled Main Differential Lock

Removing the Differential Carrier from Axle Housing

Before the differential carrier can be removed or installed, the differential lock **must** be shifted into and held in the locked (engaged) position. The locked position gives enough clearance between the shift collar and the axle housing to permit the removal or installation of the carrier.

NOTE:

If the axle shafts were removed for towing with the differential in the unlocked (disengaged) position, install the right-hand axle shaft into the housing before removing the differential carrier. Follow the procedures in Section 10 starting with "After Towing or Drive-Away," page 85.

To shift into the locked position, use the "Manual Engaging" methods.

Axle Setup for DCDL Disassembly

1. Remove the drain plug from the bottom of the housing and drain the lubricant.
2. Raise the right-hand wheel of the drive axle off the floor with a hoist or jack.



WARNING

Do not start the vehicle engine and engage (lockout) the DCDL with one wheel raised from the floor. When the DCDL is engaged, power will go to the wheel on the floor causing the vehicle to move.

3. Place a jack stand under the right-hand spring seat to hold the vehicle in the raised position.



WARNING

Do not work under a vehicle supported only by a jack. Jacks can slip or fall over resulting in serious personal injury. Always use safety stands.

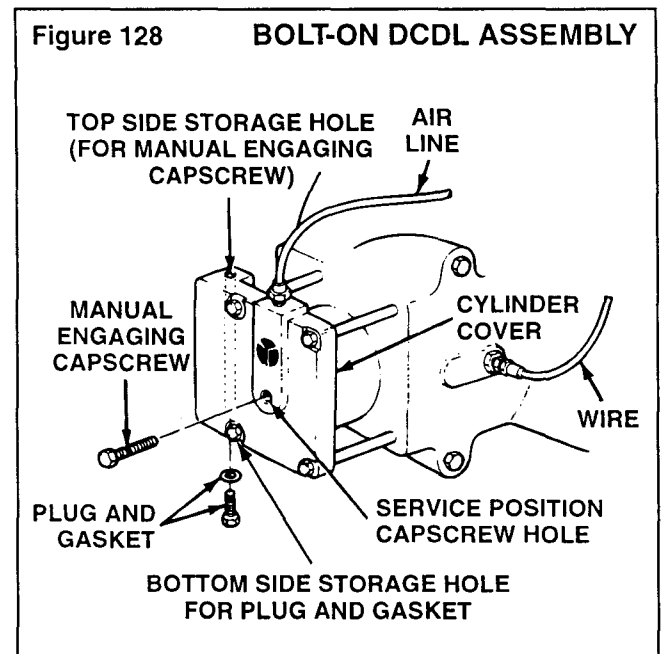
4. Disconnect the driveline from the pinion input yoke.
5. Disconnect the vehicle air line from the differential lock actuator assembly.

DCDL Assembly Manual Engaging Methods

Bolt-On DCDL Style Differential Lock Cylinder

Use the following manual engaging method to lock out the bolt-on DCDL assembly. **Figure 128.**

1. Follow steps 1-5 of "Axle Setup for DCDL Disassembly."



2. Remove the plug and gasket from the hole in the center of the cylinder cover.
3. Remove the manual engaging cap screw from the top storage hole in the cylinder cover.
4. Install the plug and gasket into the bottom storage hole in the cylinder cover.

NOTE:

The storage hole for the plug and gasket is located on the opposite side of the cylinder cover where the storage hole for the manual engaging capscrew is located.

5. Install the manual engaging capscrew into the threaded hole in the center of the cylinder cover.
6. Turn the manual adjusting capscrew to the right until the head is approximately 1/4 to 1/2 inch from the cylinder cover. **Do not** turn the capscrew beyond its normal stop. If the 1/4 to 1/2 service position of the capscrew is achieved, the main differential lock is completely engaged.

Section 6

Driver-Controlled Main Differential Lock

CAUTION

There will be a small amount of spring resistance felt when you turn in the manual engaging capscrew. If a high resistance is felt before reaching the locked (engaged) position, STOP TURNING THE CAPSCREW, or the cover and capscrew threads will be damaged.

A high resistance on the capscrew indicates that the splines of the shift collar and the differential case half are not aligned or engaged. To align the splines use the following procedure:

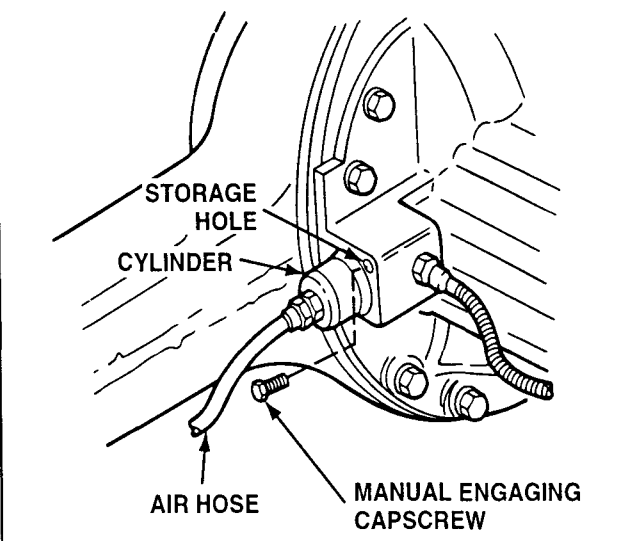
- a. Rotate the drive pinion or right-hand wheel to align the splines of the shift collar and case half while you turn in the manual engaging capscrew.
 - b. When a normal amount of spring resistance is felt on the capscrew, the splines are engaged. Continue to turn in the manual engaging capscrew until the head is approximately 1/4 inch from the cylinder cover.
7. Remove the carrier from the axle housing as described in steps 1-7 on page 8.

Screw-in DCDL Style Differential Lock Cylinder

Use the following manual engaging method to lockout the Screw-In DCDL assembly.

1. Follow steps 1-5 of the "Axle Setup for DCDL Disassembly."
2. Remove the manual engaging capscrew from the storage hole in the carrier casting, adjacent to the cylinder. **Figure 129.**
3. Remove air line and fitting and install the manual engaging capscrew into the threaded hole in the center of the cylinder cover.
4. Turn the manual adjusting capscrew to the right until the head is approximately 1/4 inch from the cylinder cover. **Do not** turn the capscrew beyond its normal stop. The capscrew is now in the service position and the main differential lock is completely engaged.
5. Remove the carrier from the axle housing as described in steps 1-7 on page 8.

Figure 129 THREADED SHIFT ASSEMBLY

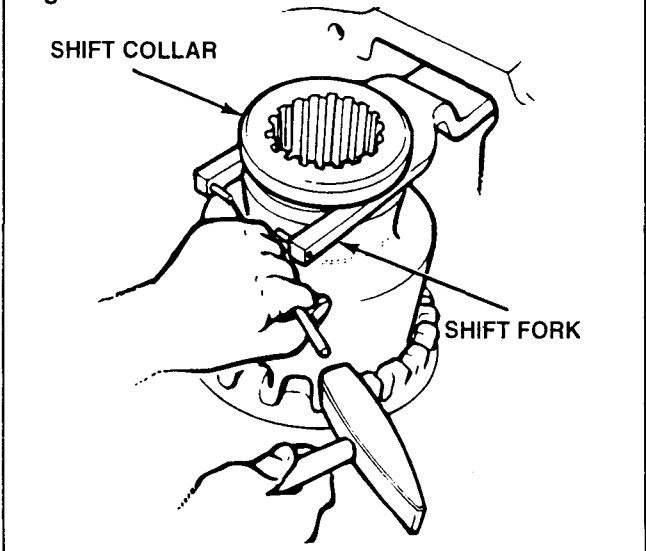


Removal of the Differential and Gear Assembly

Removing the Differential Lock Sliding Collar

1. Carriers **with** roll pins: tap out the two retainer roll pins* until they are level with the inner face of the shift fork. Release the differential lock if it is manually engaged. **Figure 130.**
2. For carriers **without** roll pins: snap out collar from fork.

Figure 130



3. If required, remove the DCDL assembly at this time.

**Some Rockwell carriers do not have these described parts.*

Section 6

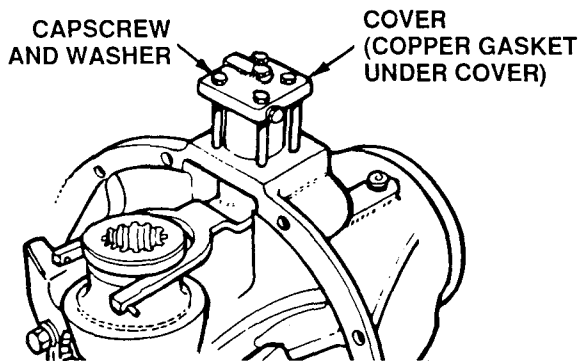
Driver-Controlled Main Differential Lock

Bolt-On DCDL Style Differential Lock Cylinder

- a. Remove the sensor switch and lock nut.
- b. Remove the four capscrews and washers that hold the cylinder cover to carrier. Remove the cylinder cover and copper gasket. **Figure 131.**

Figure 131

BOLT-ON DCDL SHIFT ASSEMBLY



- c. Remove the shift unit-cylinder and piston. Remove the O-ring from the piston.
- d. Remove the shift shaft from the shift fork. The shaft may be secured with liquid adhesive or pre-applied adhesive material. To break down these secured fasteners, follow the recommended procedure from "Removing Dri-Loc® Fasteners" on page 22.
- e. Remove the shift shaft spring and flat washer. Some models use silastic seal instead of the flat washer.
- f. Remove the shift fork.

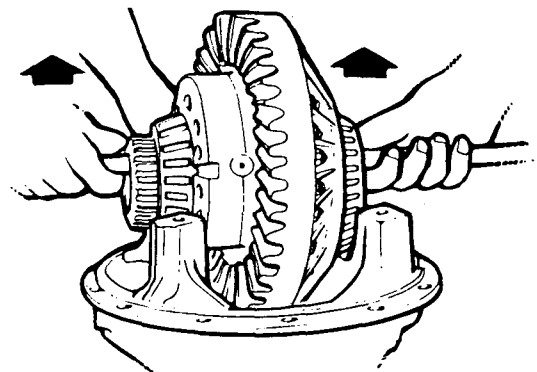
NOTE:

On some bolt-on DCDL assemblies, a roll pin is installed in the shift shaft and is used as a stop for the shift shaft spring. It is not necessary to remove this roll pin during a normal disassembly.

Screw-In DCDL Style Differential Lock Cylinder

- a. Remove sensor switch.
- b. Remove cylinder by turning hex nut at top of cylinder with a wrench. The cylinder may be secured to the carrier casting with Loctite® or equivalent pre-applied liquid adhesive. To break down these secured fasteners follow the heating procedure presented in "Removing Dri-Loc® Fasteners" on page 22.
- c. Remove shift shaft, spring, and shift fork.
4. Remove the cotter keys*, pins* or lock plates* that hold the two bearing adjusting rings in position. Use a small drift and hammer to remove pins. Each lock plate is held in position by two capscrews.
5. Match mark one bearing cap and one carrier leg so that these parts will be assembled in the correct positions. Remove the bearing cap capscrews and washers, the bearing caps and the adjusting rings.
6. Lift the differential and gear assembly from the carrier. Tilt the assembly as required to permit the ring gear to clear the support for the pinion spigot bearing. **Figure 132.**

Figure 132



FURTHER DISASSEMBLY OF THESE CARRIERS IS THE SAME AS AXLES WITHOUT THE DRIVER-CONTROLLED MAIN DIFFERENTIAL LOCK. TO CONTINUE DISASSEMBLY, FOLLOW THE PROCEDURES STARTING ON PAGE 10.

PREPARE PARTS FOR ASSEMBLY, ADJUSTMENTS, AND CARRIER ASSEMBLY (UP TO THE POINT OF "INSTALL DIFFERENTIAL CARRIER INTO AXLE HOUSING" ON PAGE 55) ARE ALSO THE SAME FOR BOTH AXLES.

*Some Rockwell carriers do not have these described parts.

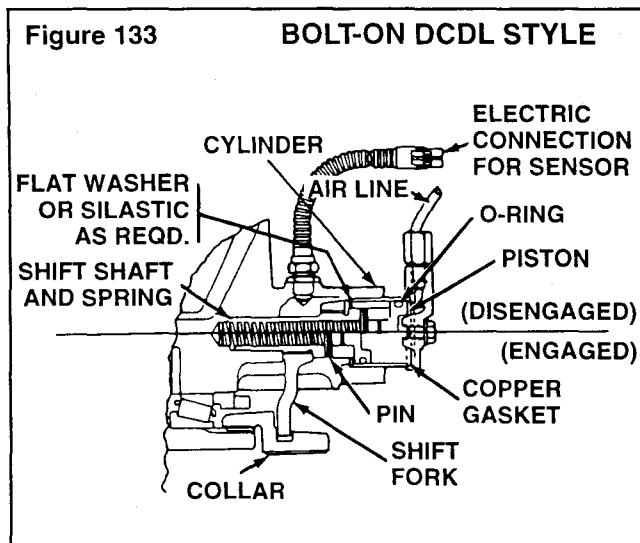
Section 6

Driver-Controlled Main Differential Lock

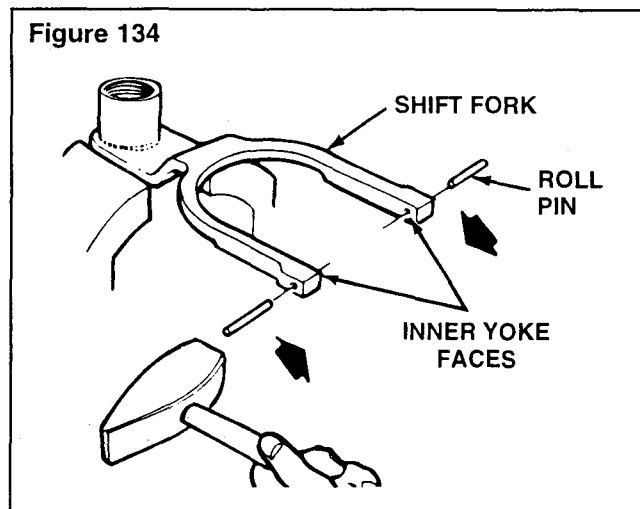
Installation of the DCDL Assembly into Carrier

Bolt-On DCDL Style Differential Lock Assembly

Install the differential shift assembly after the differential carrier is assembled and the gear and bearing adjustments are made. Parts of the bolt-on style shift assembly are shown in **Figure 133**.

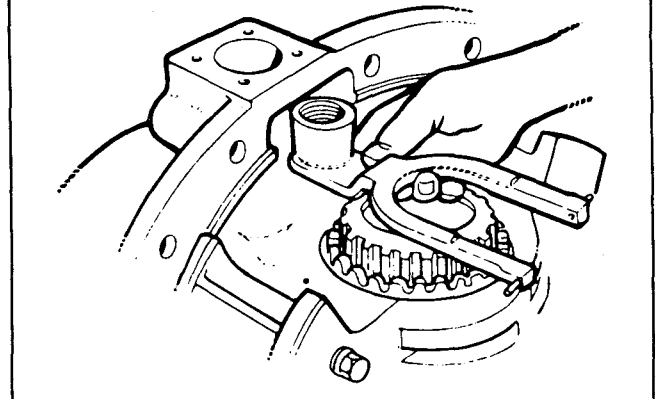


1. On carrier models with shift fork roll pins, install the two roll pins into the ends of the shift fork. Tap the pins into position until they are level with the inner yoke face. **Figure 134**. Do not install completely at this time.



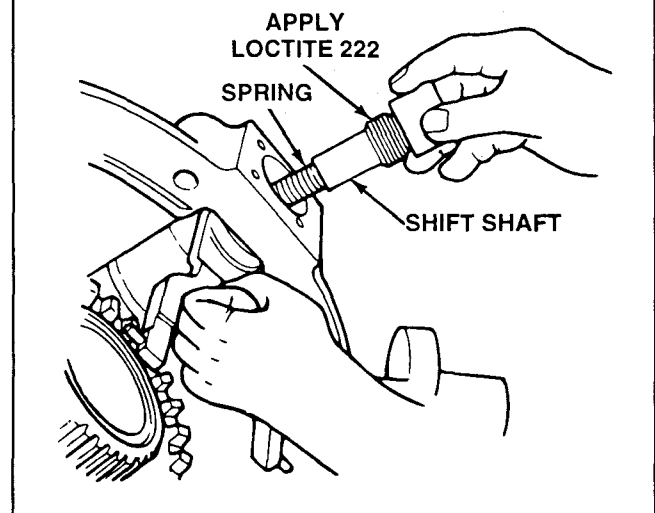
2. On models without roll pins, snap fork into position.
3. Apply Loctite 222 (purple) (Rockwell Part No. 2297-B-6112) to the threads of the shift shaft.
4. Install the shift fork into its correct position in the carrier case. **Figure 135**.

Figure 135



5. Hold the shift fork in position and install the shift shaft spring into the shift shaft opening in the carrier, through the shift fork bore and into the bore for the shift shaft spring. **Figure 136**.

Figure 136

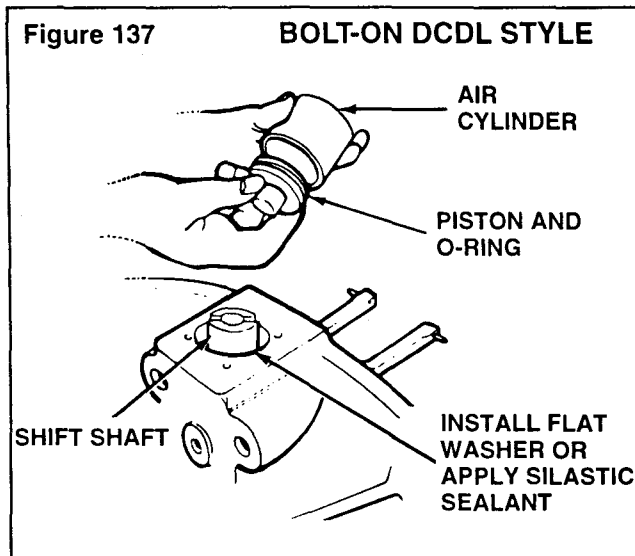


6. Slide the shift shaft over the spring and install the shaft into the shift fork. Tighten from 20 to 25 lb-ft (27-34 N•m) torque. **T**

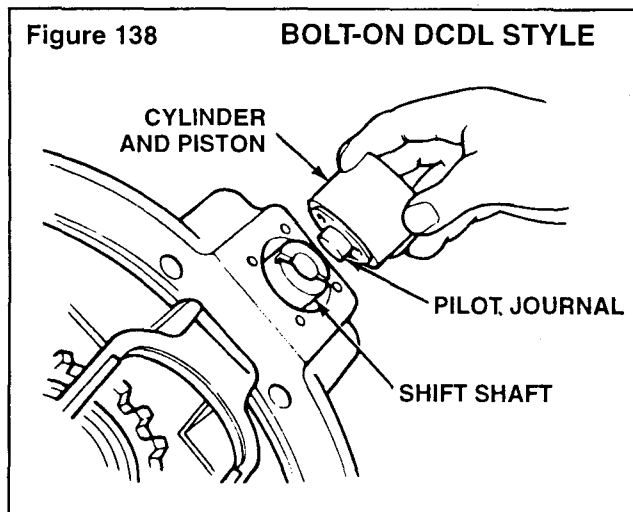
Section 6

Driver-Controlled Main Differential Lock

7. Install the flat washer (when used) or apply silastic sealant (Rockwell Part No. 1199-Q-2981) to the bottom of the cylinder bore. **Figure 137.**
8. Install the O-ring into its groove on the piston. Lubricate the O-ring with axle lubricant. Install the piston into the air cylinder. **Figure 137.**

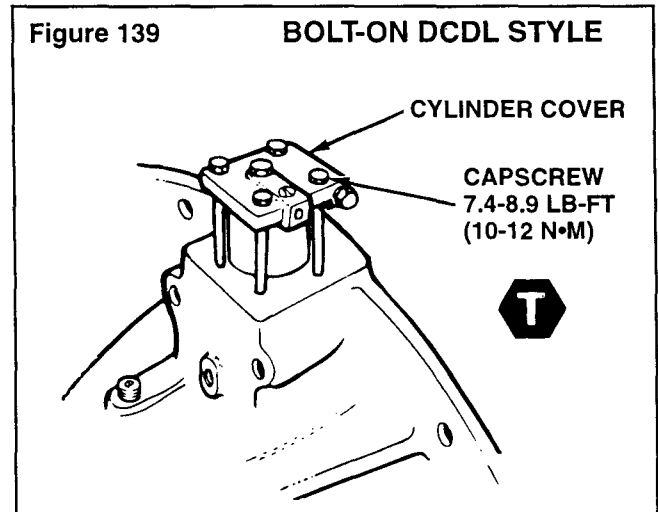


9. Install the cylinder into the housing bore. Make sure that the pilot journal on the piston is against its bore on the shift shaft. **Figure 138.**

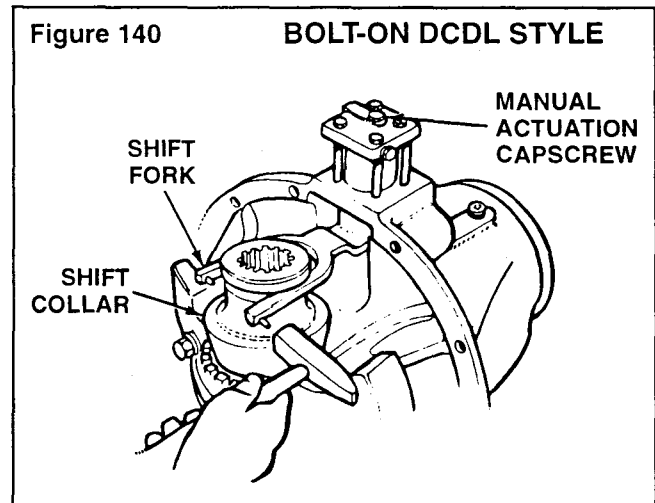


10. Install the copper gasket into its bore on the inside of the cylinder cover. Place the cover in position over the cylinder so that the air intake port will point up when the carrier is installed into the housing. Install the cover with the four attaching capscrews and washers. Tighten from 7.4 to 8.9 lb-ft (10-12 N•m) torque. **Figures 133 and 139.** **T**

11. Slide the shift collar into the fork and engage the shift collar splines with the splines of the differential case. Use the manual actuation capscrew to move the shift collar splines into the differential case splines. Refer to "Manual Engaging Method" on page 66.



12. Hold the shift collar in the locked (engaged) position. If employed, tap in the two roll pins in the shift fork ends until they are level with the outer yoke faces. **Figure 140.**



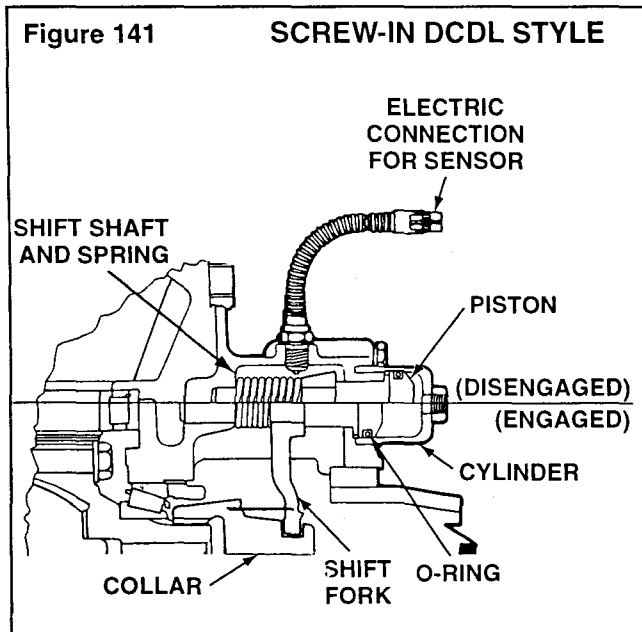
13. While the shift collar is still in the locked position, place the sensor switch (with the jam nut loosely attached) into its hole.
14. Connect a battery/bulb tester to the sensor switch and rotate the switch into its hole until contact with the shift fork causes the testing light to go on. Turn the switch one additional revolution and tighten the jam nut from 26 to 33 lb-ft (34-45 N•m) torque. **T**

Section 6

Driver-Controlled Main Differential Lock

Screw-In DCDL Style Differential Lock Assembly

Install the differential shift assembly after the differential carrier is assembled and the gear and bearing adjustments are made. Parts of the screw-in DCDL style shift assembly are shown in **Figure 141**.

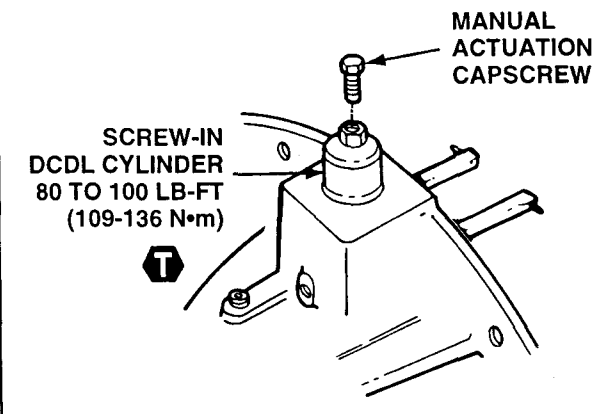


1. Install shift spring and fork into the correct position in the carrier case. To facilitate assembly, compress the spring slightly while installing the fork.
2. Install the shift shaft into the shaft bore of the carrier. Slide the shaft through the shift fork bore and shift spring I.D.
3. Inspect piston O-ring. Replace O-ring if there is any evidence of cuts, cracks, abrasion or wear.
4. Lightly lubricate O-ring and DCDL cylinder bore with the same lubricant used in the axle housing.
5. Install piston/O-ring assembly into the DCDL cylinder. Slide piston to the port end of the cylinder.
6. Coat DCDL cylinder threads with Loctite® 518 Gasket Eliminator.
7. Screw DCDL cylinder in place and tighten from 80 to 100 lb-ft (109-136 N•m) torque. **T**

Figure 142.

Figure 142

SCREW-IN DCDL STYLE



8. Snap the shift collar into the fork and engage the shift collar splines with the splines of the differential case. Use the manual actuation cap screw to move the shift collar splines into the differential case splines. Refer to "Manual Engaging Method" on page 66.
9. Install sensor switch into its hole. Tighten from 25 to 35 lb-ft (35-45 N•m). **T**
10. Connect a battery/bulb tester to the sensor switch. With the DCDL engaged per instructions in step 8, the tester light should go on. If the light does not go on, perform the following steps:
 - a. Verify fork position — Is it aligned with sensor switch when in engaged position?
 - b. Loose connection — Is the electrical wiring connector tightly seated?
 - c. Sensor switch position — Is it fully seated against spotface of carrier?

If light fails to go on after these inspections, the sensor switch should be replaced.

Section 6



Driver-Controlled Main Differential Lock

Differential Lock Assembly Cover Plates


NOTE:

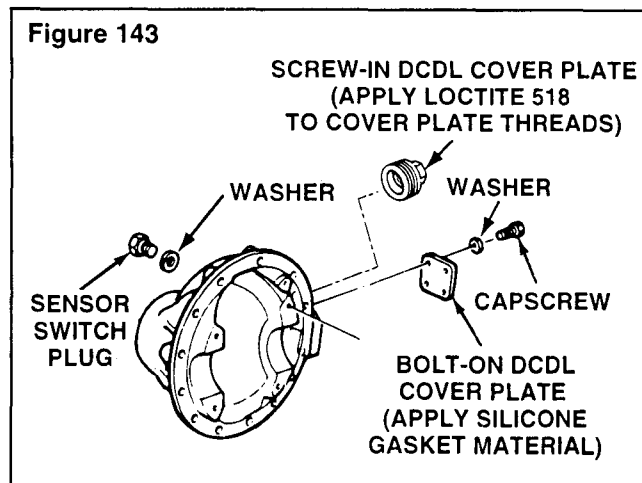
For carriers without the differential lock (less air shift), assemble the sensor switch plug and cover plate as follows:

Bolt-On DCDL Cover Plate Assemblies

1. Install the washer and plug into the hole for the sensor switch. Tighten the plug from 45 to 55 lb-ft (60-74 N•m). **Figure 144.** 
2. Apply silicone gasket material to the cover plate mounting surface on the carrier. Refer to procedures on page 24.
3. Install the four washers and capscrews. Tighten the capscrews from 7.4 to 8.9 lb-ft (10-12 N•m). **Figure 143.** 

Screw-In DCDL Cover Plate Assemblies

1. Apply Loctite® 518 liquid adhesive to the plate threads.
2. Install the bolts and washers and tighten plate into carrier opening from 7.5 to 9.0 lb-ft (10-12 N•m). 



NOTE:

When the carrier is to be installed into the axle housing, the shift collar must be held in the engaged position. This can be done using the manual engaging bolt (refer to "Manual Engaging Method" on page 66). Failure to keep the differential in the locked (engaged) position will make it impossible to install the carrier assembly into the axle housing.

After the carrier is installed into the axle housing, shift the differential into the unlocked (disengaged) position to permit the installation of the right-hand axle shaft.

Installing the Carrier into Axle Housing

WARNING

Be careful when using cleaning solvent. Follow the solvent manufacturer's instructions for safe use and to prevent serious personal injury.

1. Clean the inside of the axle housing and the mounting surface where the carrier fastens. Use a cleaning solvent and rags to remove the dirt. Blow dry the cleaned areas with compressed air. (Refer to procedures on page 18.)
2. Inspect the axle housing for damage. If necessary, repair or replace the housing. (Refer to procedures on pages 21-22.)
3. Inspect for loose studs in the mounting surface of the housing where the carrier fastens. Remove and replace any studs where required.
4. Install the differential carrier into the housing, using the following Manual Engaging Method.

Section 6

Driver-Controlled Main Differential Lock

Manual Engaging Method

1. Align the splines of the shift collar and the differential case half. This can be done by hand or by installing the right-hand axle shaft through the shift collar and into the side gear.
2. Install the manual engaging capscrew into the threaded hole in the center of the cylinder cover.
3. Turn the manual adjusting capscrew to the right until the distance from the head of the capscrew is approximately 1/4 to 1/2 inch from the cylinder cover. **Do not** turn the capscrew beyond its normal stop. When the capscrew head is in the service position 1/4 to 1/2 inch from top of DCDL, the main differential lock is manually engaged.

CAUTION

There will be a small amount of spring resistance felt when you turn in the manual engaging capscrew. If a high resistance is felt before reaching the locked (engaged) position, STOP TURNING THE CAPSCREW.

A high resistance on the capscrew indicates that the splines of the shift collar and the differential case half are not aligned or engaged.

Lift the shift collar as required and rotate to align the splines of collar and case half while turning the manual engaging capscrew inward. When the normal amount of spring resistance is again felt on the capscrew, the splines are engaged. Continue to turn in the manual engaging capscrew until the 1/4 to 1/2 inch service position is achieved.

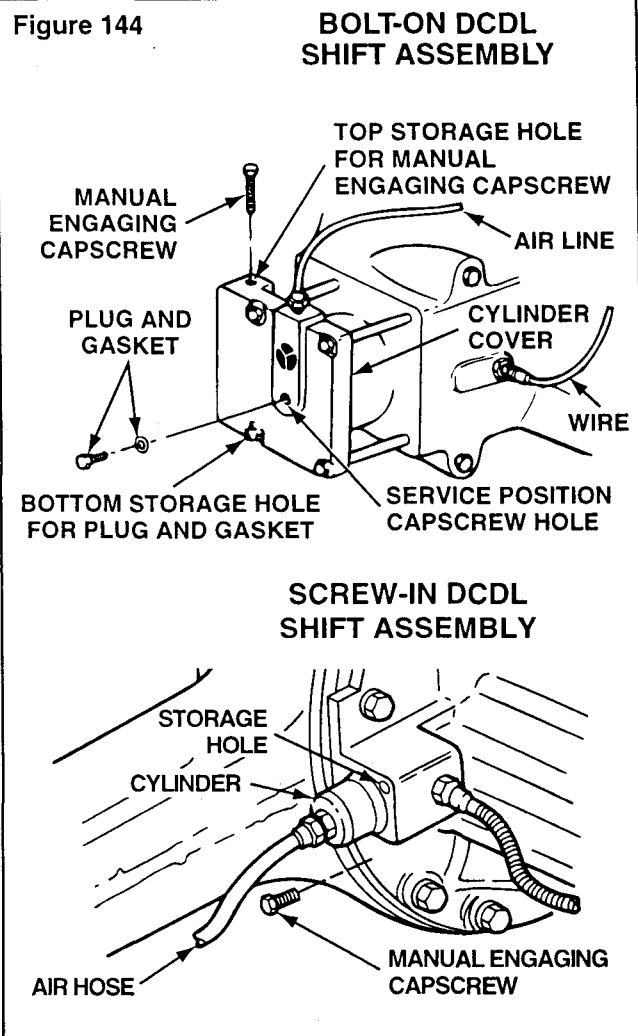
4. Clean both the DCDL actuator and the housing mounting surfaces.
5. Apply silicone gasket material to the cleaned housing surface for the DCDL actuator. Refer to page 24 "Application of Three Bond 1216 or Equivalent Silicone Gasket Material."
6. Remove the short plug and gasket from the storage hole of the DCDL.
7. Remove the long manual engaging capscrew from the center of the DCDL.


NOTE:

When the manual engaging capscrew is removed from the service position in the center of the DCDL actuator, the main differential lock is disengaged.

8. Clean the plug, gasket, cylinder cover, and threaded service position hole in the center of the DCDL cylinder cover.
9. Install the short plug* and gasket* into the service position hole in the center of the DCDL. Install the manual engaging capscrew into the DCDL storage hole. Refer to **Figure 144**.

Figure 144



10. Tighten the plug* from 44 to 55 lb-ft (60-75 N•m) torque. Tighten the manual engaging capscrew from 22 to 28 lb-ft (30-38 N•m) for bolt-on DCDL style cylinders and from 7 to 11 lb-ft (10-15 N•m) for screw-in type shifters. 
11. Connect the vehicle air line to the differential lock actuator assembly.
12. Install the electrical connection on the sensor switch located in the carrier, below the actuator assembly.

Section 6

Driver-Controlled Main Differential Lock

13. Install the right and left-hand axle shafts. Follow the procedures from "Before Towing or Drive-Away" in Section 10, Vehicle Towing Instructions, on page 77.
14. Remove the jack stand from under the drive axle and lower the vehicle to the floor.
15. Proceed to "Inspect the Differential Lock."

Inspect the Differential Lock

1. Shift the vehicle transmission to neutral and start the engine to get the system air pressure to the normal level.

WARNING

Do not start the vehicle engine and engage the transmission with one wheel raised from the floor. When the differential is in locked (engaged) position, power will go to the wheel on the floor and cause the vehicle to move.

2. Place the differential lock switch (in the cab of the vehicle) in the unlocked (disengaged) position.
3. Drive the vehicle at 5 to 10 mph (8-16 km/h) and inspect the differential lock indicator light. The light must be off when the switch is in the unlocked (disengaged) position.
4. Continue to drive the vehicle and place the differential lock switch in the locked (engaged) position. Let up on the accelerator to remove the driveline torque and permit the shift. The light must be on when the switch is in the locked position.

NOTE:

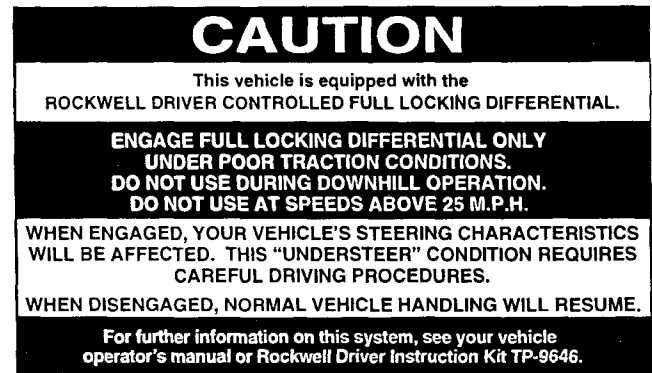
If the indicator light remains "on" with the switch in the unlocked position, the differential is still in the locked position. Check to make sure that the manual engaging capscREW was removed from the cylinder cover of the actuator assembly. Refer to steps 6 through 12 of "Manual Engaging Method" starting on page 66.

Driver Caution Label

Check to see that the "Driver Caution" label is installed in the vehicle cab. The caution label must be placed in a location that is easily visible to the driver. A recommended location is on the instrument panel, next to the differential lock switch and lock indicator light. **Figure 145.**

Driver Caution labels (TP-86101) are available from Rockwell Heavy Vehicle Systems, Inc., Troy, Michigan.

Figure 145



Traction Control Video Package

The package, entitled *Traction Controls*, contains two videos — the all-new *Splitting the Difference* and *Driver-Controlled Full Locking Main Differential*.

Driver-Controlled Full Locking Main Differential is one of the industry's best videos on the operation of the main differential. The video explains in full detail how this system works and further discusses the advantages of Rockwell's unique traction control device — DCDL. Testimonials from a large North American fleet support the ease of use of the DCDL.

Also included in the package are several technical pieces to supplement the videos by providing detailed instructions on operating the DCDL and IAD, driver instructions and the difference between the two systems.

A copy of the video package may be obtained for \$50.00 by requesting item number T-95125V from Rockwell Automotive, Literature Distribution, 35000 Industrial Road, Livonia, Mich. 48150, or call Rockwell at 800-535-5560. Each video is available individually as well, *Splitting the Difference* (T-87127V) and *Driver-Controlled Full Locking Main Differential* (T-9007V).

Section 7

Lubrication

NOTE:

For complete information on lubricating drive axles and carriers, refer to Rockwell Maintenance Manual No. 1.

Refer to the following **Charts 5, 6 and 7** for standard information on lubricants, schedules and capacities.

Chart 5

Lubricant Cross Reference (Viscosity) and Temperature Chart

Rockwell Lubricant Specification	Description	Cross Reference	Minimum Outside Temperature	Maximum Outside Temperature
O-76-A	Hypoid Gear Oil	GL-5, S.A.E. 85W/140	+10°F (-12.2°C)	...**
O-76-B	Hypoid Gear Oil	GL-5, S.A.E. 80W/140	-15°F (-26.1°C)	...**
O-76-D	Hypoid Gear Oil	GL-5, S.A.E. 80W/90	-15°F (-26.1°C)	...**
O-76-E	Hypoid Gear Oil	GL-5, S.A.E. 75W/90	-40°F (-40°C)	...**
O-76-J	Hypoid Gear Oil	GL-5, S.A.E. 75W	-40°F (-40°C)	+35°F (+1.6°C)
O-76-L	Hypoid Gear Oil	GL-5, S.A.E. 75W/140	-40°F (-40°C)	...**
** There is no upper limit on these outside temperatures, but the axle sump temperature <i>must never exceed</i> 250°F (+121°C).				

Chart 6

Rear Drive Axle Oil Change Intervals and Specifications^①

APPLIES TO ALL REAR AXLES EXCEPT THE "ADVANCED LUBE" REAR AXLES.

On-Highway Operation Intervals				Off-Highway Operation Intervals ②				Rockwell Specifications (Military)	Oil Description	Outside Temperature			
Initial Oil Change	Inspect Oil Level	Petroleum Oil Change	Synthetic Oil Change	Initial Oil Change	Inspect Oil Level	Petroleum Oil Change ③	Synthetic Oil Change			F°		C°	
										Min.	Max.	Min.	Max.
3,000 miles (4,800 km)	3,000 miles (4,800 km), once a month or the fleet maintenance interval (whichever comes first)	If annual mileage is less than 100,000 miles (160,000 km) change oil once a year.	250,000 miles (400,000 km)	1,000 miles (1,600 km)	1,000 miles (4,800 km)	If annual mileage is less than 60,000 miles (96,000 km) change oil twice a year.	50,000 miles (80,000 km)	O-76A, Gear Oil (PRF-L-2105-E)	GL-5, SAE 85W/140	10	None	-12	None
								O-76D, Gear Oil (PRF-L-2105-E)	GL-5, SAE 80W/90	-15	None	-26	None
								O-76E, Gear Oil (PRF-L-2105-E)	GL-5, SAE 75W/90	-40	None	-40	None
								O-76J, Gear Oil (PRF-L-2105-E)	GL-5, SAE 75W	-40	35	-40	2
								O-76L, Gear Oil (PRF-L-2105-E)	GL-5, SAE 75W/140	-40	None	-40	None
								O-76M, Full Synthetic Gear Oil (PRF-L-2105-E)	GL-5, SAE 75W/140	-40	None	-40	None
		O-76N, Full Synthetic Gear Oil (PRF-L-2105-E)				GL-5, SAE 75W/90		-40	None	-40	None		
		If annual mileage is more than 100,000 miles (160,000 km), change oil every 100,000 miles (160,000 km).				If annual mileage is more than 60,000 miles (96,000 km), change oil every 30,000 miles (48,000 km).							

NOTES:

- ① If oil pump and filter is used, change filter every 100,000 miles (160,000 km). Inspect oil level. Add correct oil as required.
- ② Includes heavy-duty on-highway and on/off-highway applications.
- ③ For continuous heavy-duty operation, inspect oil level every 1,000 miles (1,600 kilometers).

Section 7 Lubrication

“Advanced Lube” Rear Drive Axle without Oil Pump and Filter Oil Change Intervals and Specifications^①

APPLIES TO TANDEM REAR AXLES MANUFACTURED AFTER JANUARY 1, 1993 EQUIPPED WITH
“MEMBRANE” TYPE BREATHERS AND ADVANCED MATERIAL TRIPLE-LIP SEALS.

On-Highway Operation Intervals			On-/Off-Highway Operation Intervals ②			Rockwell Specifications (Military)	Oil Description	Outside Temperature			
Inspect Oil Level	Petroleum Oil Change ③	Synthetic Oil Change ④	Inspect Oil Level ⑤	Petroleum Oil Change ③	Synthetic Oil Change ④			F°		C°	
								Min.	Max.	Min.	Max.
3,000 miles (4,800 km), once a month or the fleet maintenance interval (whichever comes first)	100,000 miles (160,000 km)	250,000 miles (400,000 km)	3,000 miles (4,800 km) or 200 hours of operation	40,000 miles (64,000 km)	80,000 miles (128,000 km)	O-76A, Gear Oil (PRF-L-2105-E)	GL-5, SAE 85W/140	10	None	-12	None
						O-76D, Gear Oil (PRF-L-2105-E)	GL-5, SAE 80W/90	-15	None	-26	None
						O-76E, Gear Oil (PRF-L-2105-E)	GL-5, SAE 75W/90	-40	None	-40	None
						O-76J, Gear Oil (PRF-L-2105-E)	GL-5, SAE 75W	-40	35	-40	2
						O-76L, Gear Oil (PRF-L-2105-E)	GL-5, SAE 75W/140	-40	None	-40	None
						O-76M, Full Synthetic Gear Oil (PRF-L-2105-E)	GL-5, SAE 75W/140	-40	None	-40	None
						O-76N, Full Synthetic Gear Oil (PRF-L-2105-E)	GL-5, SAE 75W/90	-40	None	-40	None

NOTES:

- ① If a No-Spin differential is installed, oil (petroleum or synthetic) must be changed at minimum interval of 64,000 km (40,000 miles) or a maximum interval of 50,000 miles (80,000 km).
- ② Also applies to heavy-duty on-highway applications. Does not apply to off-highway applications.
- ③ For petroleum oil with extended drain additives, use the “Synthetic Oil Change” interval.
- ④ Applies to semi-synthetic oils and full-synthetic oils. For a list of approved synthetic oils, refer to Rockwell Maintenance Manual No. 1.
- ⑤ For continuous heavy-duty operation, inspect the oil level every 1,000 miles (1,600 km). Add the correct oil as required.

Tandem “Advanced Lube” Rear Drive Axle with Oil Pump and Filter Oil Change Intervals and Specifications^{①②}

APPLIES TO TANDEM REAR AXLES MANUFACTURED AFTER JANUARY 1, 1993 EQUIPPED WITH
“MEMBRANE” TYPE BREATHERS AND ADVANCED MATERIAL TRIPLE-LIP SEALS.

On-Highway Operation Intervals			On-/Off-Highway Operation Intervals ③			Rockwell Specifications (Military)	Oil Description	Outside Temperature			
Inspect Oil Level	Petroleum Oil Change ④	Synthetic Oil Change ⑤	Inspect Oil Level ⑥	Petroleum Oil Change ④	Synthetic Oil Change ⑤			F°		C°	
								Min.	Max.	Min.	Max.
3,000 miles 4,800 km) once a month or the fleet maintenance interval (whichever comes first)	100,000 miles (160,000 km)	500,000 miles (800,000 km)	3,000 miles (4,800 km) or 200 hours of operation	50,000 miles (80,000 km)	100,000 miles (160,000 km)	O-76A, Gear Oil (PRF-L-2105-E)	GL-5, SAE 85W/140	10	None	-12	None
						O-76D, Gear Oil (PRF-L-2105-E)	GL-5, SAE 80W/90	-15	None	-26	None
						O-76E, Gear Oil (PRF-L-2105-E)	GL-5, SAE 75W/90	-40	None	-40	None
						O-76J, Gear Oil (PRF-L-2105-E)	GL-5, SAE 75W	-40	35	-40	2
						O-76L, Gear Oil (PRF-L-2105-E)	GL-5, SAE 75W/140	-40	None	-40	None
						O-76M, Full Synthetic Gear Oil (PRF-L-2105-E)	GL-5, SAE 75W/140	-40	None	-40	None
						O-76N, Full Synthetic Gear Oil (PRF-L-2105-E)	GL-5, SAE 75W/90	-40	None	-40	None

NOTES:

- ① Replace oil filter every 100,000 miles (160,000 km). Inspect oil level. Add specified oil as required.
- ② If No-Spin differential is installed, oil (petroleum or synthetic) must be changed at minimum interval of 40,000 miles (64,000 km) or a maximum interval of 50,000 miles (80,000 km).
- ③ Applies to heavy-duty on-highway applications and to on/off highway applications. Does not apply to off-highway applications.
- ④ For petroleum oil with extended drain additives, use the “Synthetic Oil Change” interval.
- ⑤ Applies to semi-synthetic oils. For list of approved synthetic oils, refer to Rockwell Maintenance Manual No. 1.
- ⑥ For continuous heavy-duty operation, inspect oil level every 1,000 miles (1,600 km). Add correct oil as required.

Section 7

Lubrication

Chart 7

Lubricant Capacities

Use the following lubricant capacities as a guide only. The capacities are measured with the drive pinion in the horizontal position. When the angle of the drive pinion changes, the lubricant capacity of the axle will change.

Axle Model	Capacity	
	U.S. Pints	Liters
Single Drive Axles		
RF-7-120	15.3	7.2
RF-9-120	15.3	7.2
RF-12-120	15.3	7.2
RF-16-145	36.4	17.2
RF-21-156	27.9	13.2
RF-21-160	43.7	20.7
RF-21-355	28.0	13.2
RF-21-185	39.3	18.6
RF-23-185	39.3	18.6
RS-13-120	15	7.2
RS-15-120	15	7.2
RS-16-145	33.6	15.9
RS-17-140	32	15.4
RS-17-145	33.6	15.9
RS-19-145	36	17.3
RS-21-145	35	16.9
RS-21-160	39.5	18.7
RS-23-160	43/41	20.7/19.5
RS-23-180	39	18.6
RS-23-185	39	18.6
RS-23-186	39	18.6
RS-25-160	39	18.6
RS-26-160	51	24.2
RS-26-180	38	18.3
RS-26-185	38	18.3
RS-30-180	38	18.3
RS-30-185	38	18.3

Axle Model	Capacity	
	U.S. Pints	Liters
Rear Axle Of Tandems		
RT-34-140 (RR-17-140)	35	16.9
RT-34-145 (RR-17-145 rear)	36	17.1
RT-40-140 (RR-20-140)	35	16.9
RT-40-145 (RR-20-145 rear)	36	17.3
RT-44-145 (RR-22-145 rear)	35	16.9
RT-46-160 (RR-23-160 rear)	43/41	20.7/ 19.5
RT-52-160 (RR-26-160 rear)	51	24.2
RT-48-180 (RR-24-180 rear)	39	18.6
RT-52-180 (RR-26-180 rear)	39	18.3
RT-58-180 (RR-29-180 rear)	39	18.3

* Includes 1 pint (0.97 liter) for each wheel end and with drive pinion angle at 3°.

Section 8

Fastener Torque Information

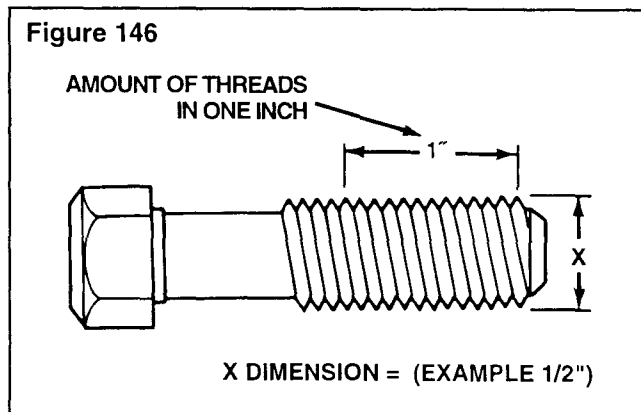
Torque Values for Fasteners

General Information

1. The torque values in **Chart 8** are for fasteners that have a light application of oil on the threads.
2. If the fasteners are dry, increase the torque values by ten percent (10%).
3. If the fasteners have a heavy application of oil on the threads, decrease the torque values by ten percent (10%).
4. If you do not know the size of the fastener that is being installed, measure the fastener. Use the following procedure.

American Standard Fasteners

- a. Measure the diameter of the threads in inches, dimension X. **Figure 146.**



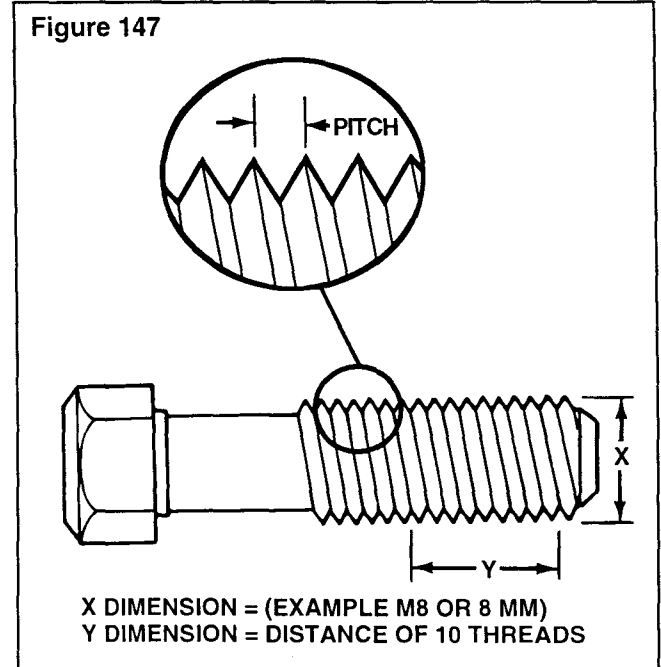
- b. Count the amount of threads there are in one inch (1.0 inch). **Figure 146.**

Example

- American Standard size fastener is .50-13.
 - 0.50 is the diameter of the fastener in inches or dimension X.
 - 13 is the amount of threads in one inch (1.0 inch).

Metric Fasteners

- a. Measure the diameter of the threads in millimeters (mm), dimension X. **Figure 147.**



- b. Measure the distance of ten (10) threads, point to point in millimeters (mm), dimension Y. Make a note of dimension Y. **Figure 147.**
- c. Divide dimension Y by ten (10). The result will be the distance between two threads or pitch.

Example

- Metric size fastener is M8 x 1.25.
 - M8 is the diameter of the fastener in millimeters (mm) or dimension X.
 - 1.25 is the distance between two threads or pitch.
- 5. Compare the size of fastener measured in step 4 to the list of fasteners in **Chart 8** to find the correct torque value.

Section 8

Fastener Torque Information

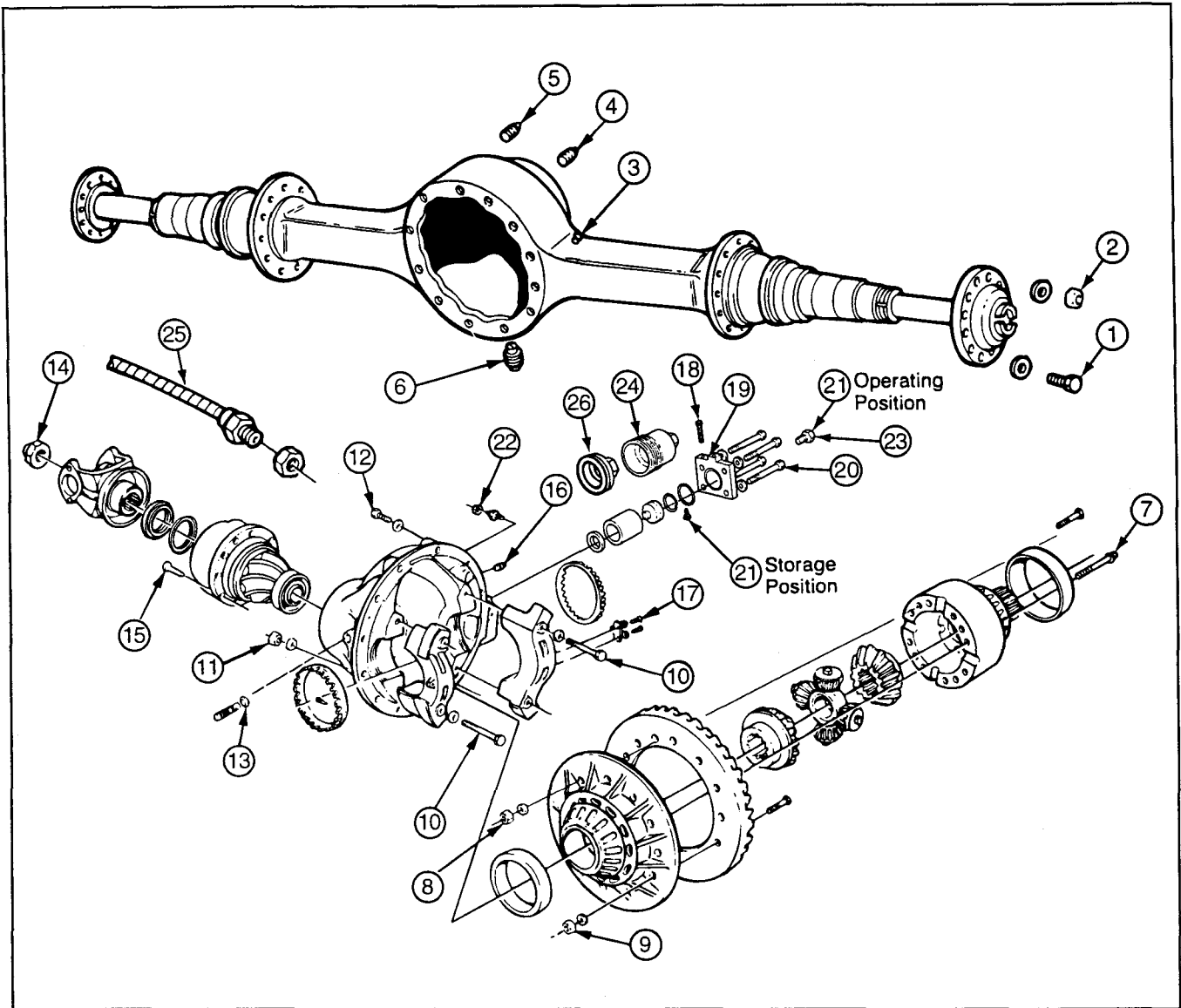




Chart 8
Torque Chart

Fastener		Thread Size	Torque Value lb-ft (N•m) 	
1.	*Capscrew, Axle Shaft	.31-24	18-24	(24-33)
		.50-13	85-115	(115-156)
2.	*Nut, Axle Shaft Stud	Plain Nut		
		.44-20	50-75	(68-102)
		.50-20	75-115	(102-156)
		.56-18	110-165	(149-224)
		.62-18	150-230	(203-312)
		Lock Nut		
		.44-20	40-65	(54-88)
		.50-20	65-100	(88-136)
		.56-18	100-145	(136-197)
		.62-18	130-190	(176-258)

Section 8

Fastener Torque Information


Chart 8 (Continued)

Fastener		Thread Size	Torque Value lb-ft (N•m) 	
3.	Breather	.38-18	20 minimum (27 minimum)	
4.	*Plug, Oil Fill (Housing)	.75-14	35 minimum (47.5 minimum)	
5.	*Plug, Heat Indicator	.50-14	25 minimum (34 minimum)	
6.	Plug, Oil Drain	.50-14	25 minimum (34 minimum)	
7.	Capscrew, Differential Case	.38-16	35-50	(48-68)
		.44-14	60-75	(81-102)
		.50-13	85-115	(115-156)
		.56-12	130-165	(176-224)
		.62-11	180-230	(244-312)
		Grade 10.9 Flange Head M12 x 1.75	85-103	(115-140)
		Grade 10.9 Standard Hex Head M12 x 1.75	74-96	(100-130)
		Grade 12.9 Standard Hex Head M12 x 1.75	105-125	(143-169)
8.	*Nut, Differential Case Bolt	Grade 12.9 Flange Head M16 x 2	203-251	(275-340)
		Grade 12.9 Standard Head M16 x 2	220-310	(300-420)
		.50-13	75-100	(102-136)
		.50-20	85-115	(115-156)
		.62-11	150-190	(203-258)
		.62-18	180-230	(244-312)
9.	*Nut, Ring Gear Bolt	M12 x 1.75	74-96	(100-130)
		M16 x 2	220-310	(300-420)
		.50-13	75-100	(102-136)
		.50-20	85-115	(115-156)
		.62-11	150-190	(203-258)
		.62-18	180-230	(244-312)
		M12 x 1.25	66-81	(90-110)
		M12 x 1.75	77-85	(104-115)
10.	Capscrew, Bearing Cap	Flange Head M16 x 1.5	192-214	(260-190)
		Standard Hex Head M16 x 1.5	196-262	(265-355)
		.56-12	110-145	(149-197)
		.62-11	150-190	(203-258)
		.75-10	270-350	(366-475)
		.88-14	360-470	(488-637)
11.	Nut, Housing to Carrier Stud	.88-9	425-550	(576-746)
		M16 x 2	181-221	(245-300)
		M20 x 2.5	347-431	(470-585)
		M22 x 2.5	479-597	(650-810)
		.44-20	50-75	(68-102)
		.50-20	75-115	(102-156)
12.	Capscrew, Carrier to Housing	.56-18	110-165	(149-224)
		.62-18	150-230	(203-312)
		.44-14	50-75	(68-102)
		.50-13	75-115	(102-156)
		.56-12	110-165	(149-224)
		.62-11	150-230	(203-312)
		.75-10	270-400	(366-542)
		M12 x 1.75	74-89	(100-120)
		M16 x 2	181-221	(245-300)


Section 8

Fastener Torque Information


Chart 8 (Continued)

Fastener		Thread Size	Torque Value lb-ft (N•m) 	
13.	*Jam Nut, Thrust Screw	.75-16	150-190	(203-258)
		.88-14	150-300	(203-407)
		1.12-16	150-190	(203-258)
		M22 x 1.5	148-210	(200-285)
		M30 x 1.5	236-295	(320-400)
14.	Nut, Drive Pinion	.88-20	200-275	(271-373)
		1.0-20	300-400	(407-542)
		1.25-12	700-900	(949-1220)
		1.25-18	700-900	(949-1220)
		1.50-12	800-1100	(1085-1491)
		1.50-18	800-1100	(1085-1491)
		1.75-12	900-1200	(1220-1627)
		M32 x 1.5	738-918	(1000-1245)
		M39 x 1.5	922-1132	(1250-1535)
		M45 x 1.5	996-1232	(1350-1670)
15.	Capscrew, Bearing Cage	.38-16	30-50	(41-68)
		.44-14	50-75	(68-102)
		.50-13	75-115	(102-156)
		.56-12	110-165	(149-224)
		.62-11	150-230	(203-312)
		M12 x 1.75	70-110	(90-150)
16.	*Plug, Oil Fill (Carrier)	.75-14	25 minimum (34 minimum)	
		1.5-11.5	120 minimum (163 minimum)	
		M24 x 1.5	35 minimum (47 minimum)	
17.	*Capscrew, Lock Plate	.31-18	20-30	(27-41)
		M8 x 1.25	21-26	(28-35)

Torque Values are for Carriers with Bolt-On DCDL Style Differential Lock Cylinders

Fastener		Thread Size	Torque Value lb-ft (N•m) 	
18.	Capscrew, Manual Actuation (Storage Position)	M10 x 1.5	15-25	(20-35)
19.	Adapter, Air Cylinder	M12 x 1.5	22-30	(30-40)
20.	Capscrew, Air Cylinder Cover	M6 x 1	7-12	(10-16)
21.	Capscrew/Plug, Air Cylinder Cover (Operating Position) (Storage Position)	M10 x 1.5	15-25	(20-35)
			15-25	(20-35)
22.	Lock Nut, Sensor Switch	M16 x 1	25-35	(35-45)

Torque Values are for Carriers with Screw-In DCDL Style Differential Lock Cylinders



Fastener		Thread Size	Torque Value lb-ft (N•m) 	
23.	Capscrew, Manual Actuation (Storage Position)	M10 x 1.25	7-11	(10-15)
24.	Air Cylinder	M60 x 2.0	80-100	(109-136)
25.	Sensor Switch	M16 x 1.0	25-35	(35-45)
26.	Screw-In DCDL Cylinder Plug or Cap	M60 x 2.0	80-100	(109-136)

Section 9

Adjustments and Specifications

Drive Pinion Bearings — Preload

Page

Specification	New bearings — 15 to 25 lb-in (1.7-2.8 N•m) torque  Used bearings — 15 to 25 lb-in (1.7-2.8 N•m) torque 	33
Adjustment	Preload is controlled by the thickness of the spacer between bearings. — To increase preload install a thinner spacer — To decrease preload install a thicker spacer	


Drive Pinion — Depth in Carrier

Specification	Install the correct amount of shims between the bearing cage and carrier. To calculate, use old shim pack thickness and new and old pinion cone numbers.	37-39
Adjustment	Change the thickness of the shim pack to get a good gear tooth contact pattern.	

Hypoid Gear Set — Tooth Contact Patterns (Hand Rolled)

Specification	Conventional gear set — Toward the toe of the gear tooth and in the center between the top and bottom of the tooth Generoid gear set — Between the center and toe of the tooth and in the center between the top and bottom of the tooth	50
Adjustment	Tooth contact patterns are controlled by the thickness of the shim pack between the pinion bearing cage and carrier and by ring gear backlash — To move the contact pattern lower, decrease the thickness of the shim pack under the pinion bearing cage — To move the contact pattern higher, increase the thickness of the shim pack under the pinion bearing cage — To move the contact pattern toward the toe of the tooth, decrease backlash of the ring gear — To move the contact pattern toward the heel of the tooth, increase backlash of the ring gear	

Main Differential Bearings — Preload


Specification	15 to 35 lb-in (1.7-3.9 N•m) torque  or Expansion between bearing caps — RS-140, RS-145 and RS-160 carrier models — 0.002 to 0.009 inch (0.050-0.229 mm) — All other carrier models — 0.006 to 0.013 inch (0.15-0.33 mm)	46
Adjustment	Preload is controlled by tightening both adjusting rings after zero end play is reached.	

Section 9

Adjustments and Specifications

Main Differential Gears — Rotating Resistance

Page

Specification	50 lb-ft (68 N•m) torque applied to one side gear 	44
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Ring Gear — Backlash

Specification	<p>Ring gears that have a pitch diameter of less than 17 inches (431.8 mm)</p> <ul style="list-style-type: none"> — Range: 0.008 to 0.018 inch (0.20-0.46 mm) 0.0120 inch (0.300 mm) for a new gear set <p>Ring gears that have a pitch diameter of 17 inches (431.8 mm) or greater</p> <ul style="list-style-type: none"> — Range: 0.010 to 0.020 inch (0.25-0.51 mm) 0.015 inch (0.380 mm) for a new gear set 	49
Adjustment	<p>Backlash is controlled by the position of the ring gear. Change backlash within specifications to get a good tooth contact pattern.</p> <ul style="list-style-type: none"> — To increase backlash, move the ring gear away from the drive pinion — To decrease backlash, move the ring gear toward the drive pinion 	

Ring Gear — Runout

Specification	0.008 inch (0.200 mm) maximum	48
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DCDL Sensor Switch — Installation

Specification	<p>Shift the differential to the locked position.</p> <p>Tighten the sensor switch into the carrier until the test light comes on.</p> <p>Tighten the sensor switch one additional turn and tighten lock nut to correct torque value.</p>	63 steps 13 and 14
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Spigot Bearing — Peening on the Drive Pinion

Specification	<p>Apply 6,614 lb (3,000 kg) load on a 0.375 inch or 10 mm ball.</p> <p>Peen the end of the drive pinion at a minimum of five points.</p> <p>Softening of the pinion stem end by heating may be required.</p>	29 30
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Section 10

Vehicle Towing Instructions

TYPE OF AXLE:

- **SINGLE AXLE**, with Driver Controlled Main Differential Lock (DCDL — Screw-In DCDL [threaded] shift assembly)
- **TANDEM AXLE**, with Driver Controlled Main Differential Lock (DCDL — Screw-In DCDL [threaded] shift assembly) and with Inter-Axle Differential (IAD)

These instructions are for vehicles equipped with Rockwell single or tandem rear drive axles.

The instructions supersede all other instructions for the purpose of transporting vehicles for service or new vehicle drive-away dated before April 1995, including those contained in Rockwell Maintenance Manuals.

When transporting a vehicle with the wheels of one or both drive axles on the road, it is possible to damage the axles if the wrong procedure is used before transporting begins. Rockwell recommends that you use the following procedure.

Before Towing or Drive-Away



WARNING

To prevent serious eye injury, always wear safe eye protection when performing vehicle maintenance or service.



WARNING

Do not work under a vehicle unless the parking brake is engaged. The vehicle can move and cause serious personal injury if the parking brake is not applied before maintenance tasks are begun.

1. Apply the vehicle parking brakes using the switch inside the cab of the vehicle.
2. Shift the transmission into neutral and start the vehicle's engine.
3. Shift the DCDL and the IAD to the unlocked (disengaged) positions using the switches inside the cab of the vehicle. The indicator lights in the cab will go off.
4. Stop the engine.

NOTE:

Remove only the axle shaft(s), shown in Chart 9 at this time, from the axle(s) that will remain on the road when the vehicle is transported. Continue with step 5.

Chart 9

Single Axles
Remove the left-hand (road side) axle shaft
Tandem Axles
Forward Axle: Remove the right-hand (curb side) axle shaft
Rear Axle: Remove the left-hand (road side) axle shaft

5. Remove the stud nuts or capscrews and the washers from the flange of the axle shaft.
Figure 148.

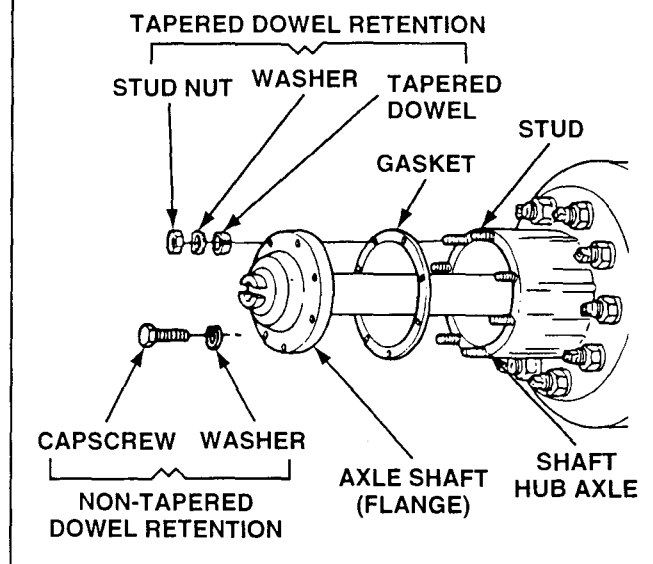


CAUTION

Do not use a chisel or wedge to loosen the axle shaft and tapered dowels. Using a chisel or wedge can result in damage to the axle shaft, the gasket and seal, and/or the axle hub.

6. Loosen the tapered dowels, if used, in the flange of the axle shaft using one of the two following methods. **Figure 148.**

Figure 148



Section 10

Vehicle Towing Instructions

Brass Drift Method:

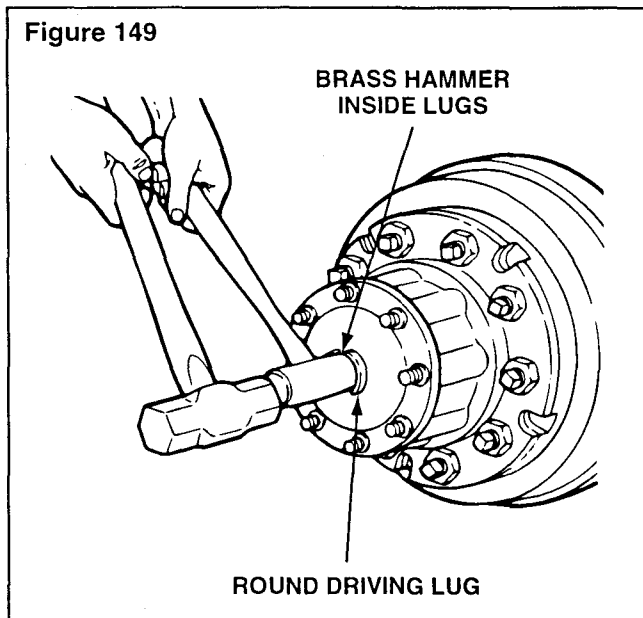
WARNING

Wear safe eye protection. Do not directly strike or hit the round driving lugs on the flange of the axle shaft. Striking the lugs can cause them to break off from the axle shaft hub resulting in serious personal injury.

NOTE:

A 1.5 inch (38.1 mm) diameter brass hammer can be used as a drift.

- a. Hold a 1.5 inch (38.1 mm) diameter brass drift against the center of the axle shaft flange, inside the round driving lugs. **Figure 149.**



- b. Hit the end of the drift with a large hammer (5 to 6 pounds, 2.3 to 2.7 kg) to loosen the axle shaft and tapered dowels from the hub. **Figure 149.**

Air Hammer Vibration Method:

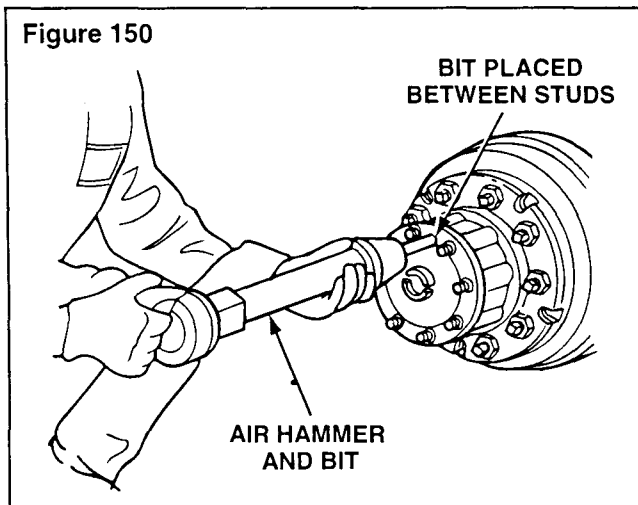
WARNING

Wear safe eye protection when using an air hammer. Power tools and components can loosen and break and cause serious personal injury.

- a. Use an air hammer, such as Chicago Pneumatic CP-4181-PULER, or equivalent, with a round hammer bit to loosen the axle shaft and dowels.

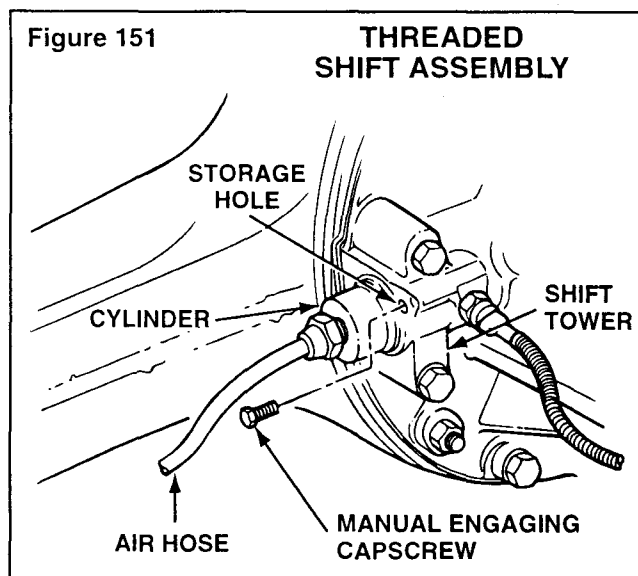
- b. Place the round hammer bit against the axle shaft flange between the studs, at different points around the flange. Operate the air hammer at each location and loosen the axle shaft and tapered dowels from the hub. **Figure 150.**

Figure 150



7. Identify each axle shaft that is removed from the axle assembly so they can be installed in the same location after transporting or repair is completed. (Example: Match mark a mating axle shaft and hub.)
8. Remove the tapered dowels, gasket (if used) and the axle shaft from the axle assembly. **Figure 148**, page 77.
9. Disconnect the air hose from the shift cylinder. **Figure 151.**

Figure 151



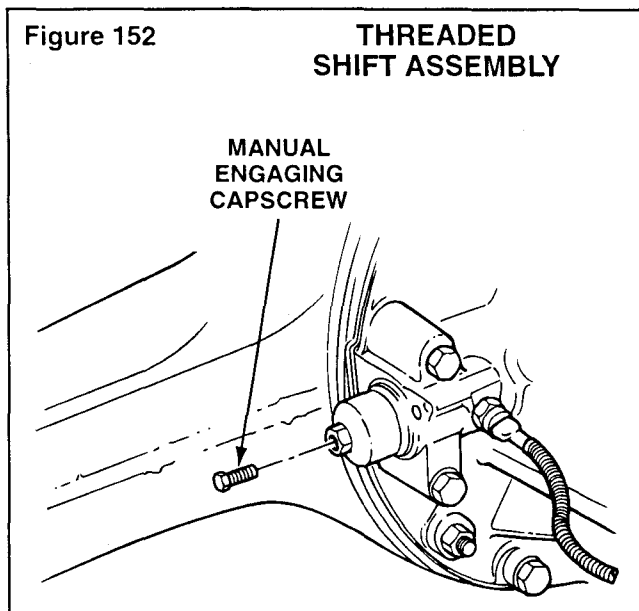
Section 10

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10. Remove the manual engaging capscrew from the storage hole. The storage hole of threaded shift assemblies is located in the shift tower of the carrier, next to the cylinder. **Figure 151.**
11. Lock (engage) the main differential using the Manual Engaging Method.

Manual Engaging Method:

- a. Install the manual engaging capscrew into the threaded hole in the center of the cylinder. **Figure 152.**

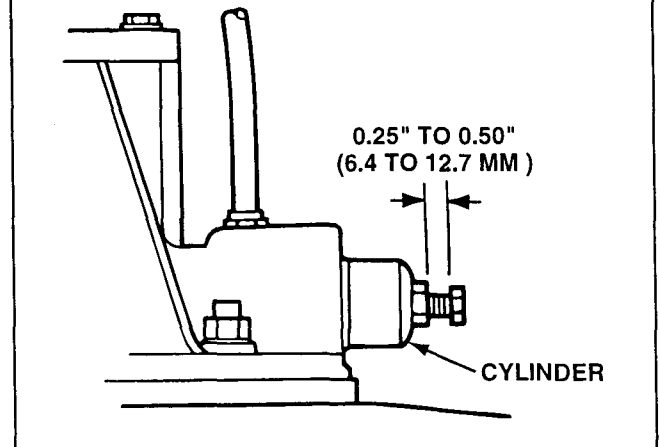


CAUTION

When you turn the capscrew in step b and you feel a high resistance, **STOP TURNING THE CAPSCREW.** A high resistance against the capscrew indicates that the splines of the shift collar and differential case are not aligned. Damage to the threads of the cylinder and capscrew will result. To align the splines, continue with steps c, d and e.

- b. Turn the capscrew to the right until the head is approximately 0.25 to 0.50 inch (6.4-12.7 mm) from the cylinder. The capscrew is now in the service position and the main differential is locked (engaged). **Figure 153.** When turning the capscrew you will feel a small amount of resistance. This is normal. If you feel a high resistance before achieving the 0.25 to 0.50 inch distance between the capscrew head and cylinder, **stop turning the capscrew** and continue with steps c, d and e.

Figure 153



- c. Rotate the main driveline or the IAD a small amount by hand.
 - d. Turn the manual engaging capscrew again to the right. If you still feel a high resistance, **stop turning the capscrew.**
 - e. Repeat steps c and d until you feel a low resistance on the capscrew. Continue with step b.
12. Remove the remaining axle shaft(s) from the axle(s) that will remain on the road when the vehicle is transported. Follow steps 5 through 8, pages 77 and 78.
 13. Install a cover over the open end of each hub where an axle shaft was removed. This will prevent dirt from entering the bearing cavity and loss of lubricant.

NOTE:

If an air supply will be used for the brake system of the transported vehicle, continue with steps 14 and 15, otherwise continue with step 16.

14. Connect an auxiliary air supply to the brake system of the vehicle that is being transported. Before moving the vehicle, charge the brake system with the correct amount of air pressure to operate the brakes. Refer to the instructions supplied by the manufacturer of the vehicle for procedures and specifications. If an auxiliary air supply is not used, continue with step 16.
15. When the correct amount of air pressure is in the brake system, release the parking brakes of the vehicle that is being transported. Step 16 is not required.

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WARNING

When you work on a spring (parking) brake, carefully follow the service instructions of the chamber manufacturer to manually compress the spring. Sudden release of a compressed spring can cause serious personal injury.

- If there are spring (parking) brakes on the axle(s) that will remain on the road when the vehicle is transported, and they cannot be released by air pressure, manually compress and lock each spring so that the brakes are released. Refer to the manufacturer's instructions.

After Towing or Drive-Away

WARNING

- To prevent serious eye injury, always wear safe eye protection when performing vehicle maintenance or service.*
- Do not work under a vehicle unless the parking brake is engaged. The vehicle can move and cause serious personal injury if the parking brake is not applied before maintenance tasks are begun.*

- If an auxiliary air supply was used, apply the vehicle parking brakes using the switch inside the cab of the vehicle. If an auxiliary air supply was not used, begin with step 2.

WARNING

When you work on a spring (parking) brake, carefully follow the service instructions of the chamber manufacturer to manually release the spring. Sudden release of a compressed spring can cause serious personal injury.

- Apply the vehicle spring (parking) brakes by manually releasing each spring that was compressed before transporting started. Refer to manufacturer's instructions.
- Disconnect the auxiliary air supply, if used, from the brake system of the vehicle that was transported. Connect the vehicle's air supply to the brake system.
- Remove the covers from the hubs.

NOTE:


Install only the axle shaft(s) shown in Chart 10 at this time. These axle shafts have a double row of splines that engage with splines of the side gear and shift collar in the main differential. Figure 154. Continue with step 5.

Chart 10

Single Axles
Install the right-hand (curb side) axle shaft
Tandem Axles
Forward Axle: Install the left-hand (road side) axle shaft
Rear Axle: Install the right-hand (curb side) axle shaft

- Install the gasket, if used, and axle shaft into the axle housing and carrier in the same location it was removed from. The gasket and flange of the axle shaft must be flat against the hub. Rotate the axle shaft and/or the driveline as necessary to align the splines and the holes in the flange with the studs in the hub. **Figure 148**, page 77.
- Install the dowels, if used, over each stud and into the tapered holes of the flange.
- Install the washers and capscrews or stud nuts. Determine the size of the fasteners and tighten the capscrews or nuts to the corresponding torque value shown in **Chart 11** below.

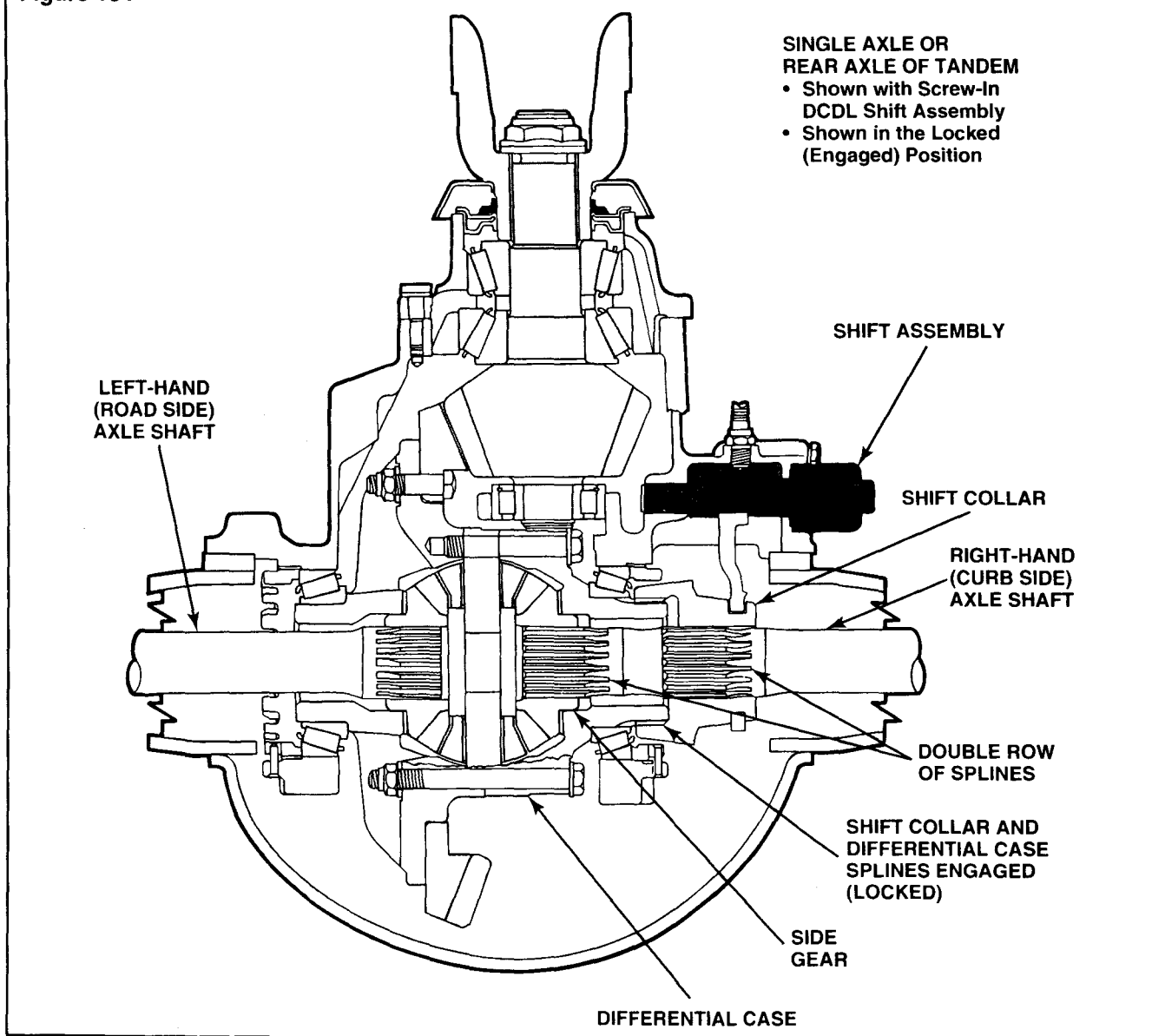
Chart 11



	Thread Size	Torque Value lb-ft (N•m) 
Capscrews:	0.31"-24	18 to 24 (24-33)
	0.50"-13	85 to 115 (115-156)
Stud Nuts: (plain nuts)	0.44"-20	50 to 75 (68-102)
	0.50"-20	75 to 115 (102-156)
	0.56"-18	110 to 165 (149-224)
	0.62"-18	150 to 230 (203-312)
	0.75"-16	310 to 400 (420-542)
(lock nut)	0.44"-20	40 to 65 (54-88)
	0.50"-20	65 to 100 (88-136)
	0.56"-18	100 to 145 (136-197)
	0.62"-18	130 to 190 (176-258)
	0.75"-16	270 to 350 (366-475)

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Figure 154



8. Unlock (disengage) the DCDL by removing the manual engaging capscrew from the shift assembly.
9. Install the manual engaging capscrew into the storage hole. The storage hole of threaded shift assemblies is located in the shift tower of the carrier next to the cylinder. Tighten to 15 to 25 lb-ft (20-35 N•m). **Figure 151**, page 78. 
10. Connect the air hose to the shift cylinder. Tighten to 22 to 30 lb-ft (30-40 N•m). 
11. Install the remaining axle shaft into the axle housing and carrier. Follow steps 5 through 7.
12. Inspect the lubricant level in the axles and hubs where the axle shafts were removed. Add the correct type and amount of lubricant if necessary. For information about lubrication, refer to the Rockwell Maintenance Manual, MM No. 1, Lubrication, or refer to the Lubrication Section of the Rockwell Maintenance Manual for the axle model you are working with.

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Vehicle Towing Instructions

TYPE OF AXLE:

- **SINGLE AXLE**, with Driver Controlled Main Differential Lock (DCDL — Bolt-On DCDL shift assembly)
- **TANDEM AXLE**, with Driver Controlled Main Differential Lock (DCDL — Bolt-On DCDL shift assembly) and with Inter-Axle Differential (IAD)

These instructions are for vehicles equipped with Rockwell single or tandem rear drive axles.

The instructions supersede all other instructions for the purpose of transporting vehicles for service or new vehicle drive-away dated before April 1995, including those contained in Rockwell Maintenance Manuals.

When transporting a vehicle with the wheels of one or both drive axles on the road, it is possible to damage the axles if the wrong procedure is used before transporting begins. Rockwell recommends that you use the following procedure.

Before Towing or Drive-Away



WARNING

To prevent serious eye injury, always wear safe eye protection when performing vehicle maintenance or service.



WARNING

Do not work under a vehicle unless the parking brake is engaged. The vehicle can move and cause serious personal injury if the parking brake is not applied before maintenance tasks are begun.

1. Apply the vehicle parking brakes using the switch inside the cab of the vehicle.
2. Shift the transmission into neutral and start the vehicle's engine.
3. Shift the DCDL and the IAD to the unlocked (disengaged) positions using the switches inside the cab of the vehicle. The indicator lights in the cab will go off.
4. Stop the engine.

NOTE:

Remove only the axle shaft(s), shown in Chart 12 at this time, from the axle(s) that will remain on the road when the vehicle is transported. Continue with step 5.

Chart 12

Single Axles
Remove the left-hand (road side) axle shaft
Tandem Axles
Forward Axle: Remove the right-hand (curb side) axle shaft
Rear Axle: Remove the left-hand (road side) axle shaft

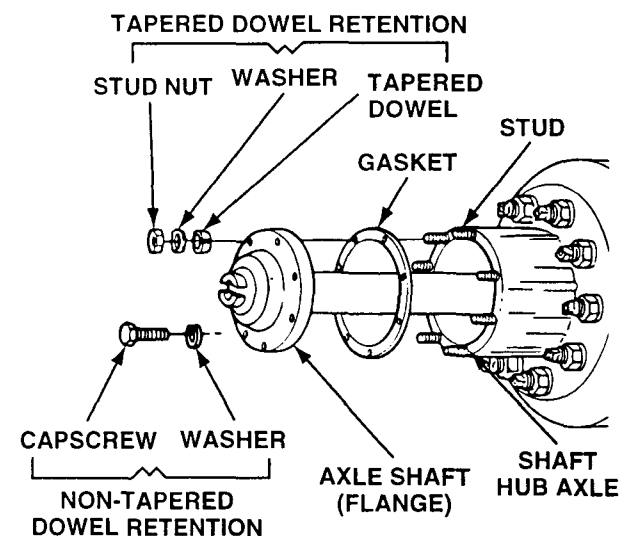
5. Remove the stud nuts or capscrews and the washers from the flange of the axle shaft. **Figure 155.**
6. Loosen the tapered dowels, if used, in the flange of the axle shaft using one of the two following methods. **Figure 155.**



CAUTION

Do not use a chisel or wedge to loosen the axle shaft and tapered dowels. Using a chisel or wedge can result in damage to the axle shaft, the gasket and seal, and/or the axle hub.

Figure 155



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Brass Drift Method:

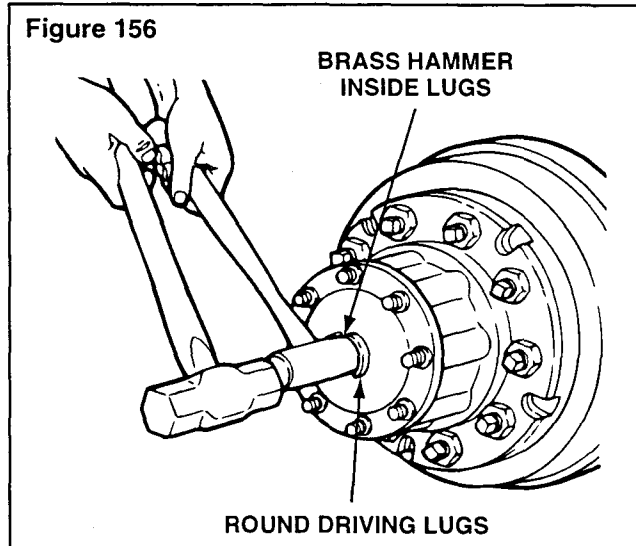
WARNING

Wear safe eye protection. Do not directly strike or hit the round driving lugs on the flange of the axle shaft. Striking the lugs can cause them to break off from the axle shaft hub resulting in serious personal injury.

NOTE:

A 1.5 inch (38.1 mm) diameter brass hammer can be used as a drift.

- a. Hold a 1.5 inch (38.1 mm) diameter brass drift against the center of the axle shaft flange, *inside the round driving lugs*. **Figure 156.**



- b. Hit the end of the drift with a large hammer (5 to 6 pounds, 2.3 to 2.7 kg) to loosen the axle shaft and tapered dowels from the hub. **Figure 156.**

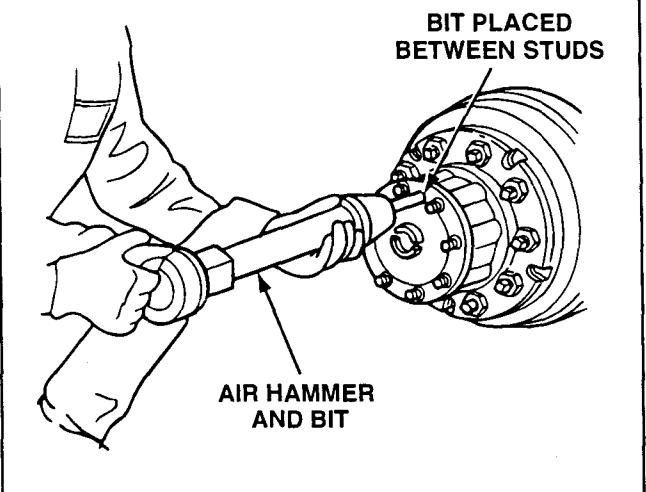
Air Hammer Method:

WARNING

Wear safe eye protection when using an air hammer. Power tools and components can loosen and break and cause serious personal injury.

- a. Use an air hammer, such as Chicago Pneumatic CP-4181-PULER, or equivalent, with a round hammer bit to loosen the axle shaft and dowels.
- b. Place the round hammer bit against the axle shaft flange between the studs, at different points around the flange. Operate the air hammer at each location and loosen the axle shaft and tapered dowels from the hub. **Figure 157.**

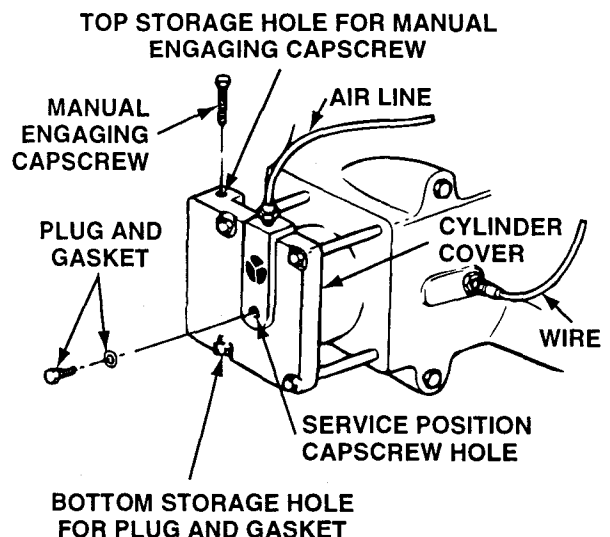
Figure 157



7. Identify each axle shaft that is removed from the axle assembly so they can be installed in the same location after transporting or repair is completed. (Example: Match mark a mating axle shaft and hub.)
8. Remove the tapered dowels, gasket (if used) and the axle shaft from the axle assembly. **Figure 158.**
9. Remove the manual engaging capscrew from the storage hole. The storage hole of bolt-on DCDL shift assemblies is located in the top side of the shift cylinder cover. **Figure 158.**

Figure 158


BOLT-ON DCDL SHIFT ASSEMBLY



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10. Remove the plug and gasket from the center of the shift cylinder cover. Install the plug and gasket into the bottom side storage hole of the shift cylinder cover (opposite end of the storage hole for the manual engaging capscrew). Tighten to 15 to 25 lb-ft (20-35 N•m) torque.

Figure 158. 

11. Lock (engage) the main differential using one of the two following methods: Air Pressure Method or Manual Engaging Method.

Air Pressure Method:

- a. Install the manual engaging capscrew into the threaded hole in the center of the cylinder cover. Turn the capscrew to the right 3 to 5 turns. **Figure 159.**
- b. Shift the transmission into neutral and start the vehicle's engine. Let the engine idle to increase the pressure in the air system. **Do not release the parking brakes.**
- c. Shift the main differential to the locked (engaged) position using the switch inside the cab of the vehicle. When the differential is locked, the indicator light in the cab will go on. If the light does not go on it will be necessary to rotate the main driveline or the IAD by hand until the main differential is locked and the indicator light goes on.

NOTE:

When the shift collar is completely engaged with the splines of the main differential case, the differential is locked and the driveline cannot be rotated. Figure 161, page 86.

- d. While the differential is held in the locked position by air pressure, turn the manual engaging capscrew to the right until you feel resistance against the piston. **Stop turning the capscrew.**
- e. Place the main differential lock switch in the unlocked (disengaged) position.
- f. Stop the engine. Continue with step 12.

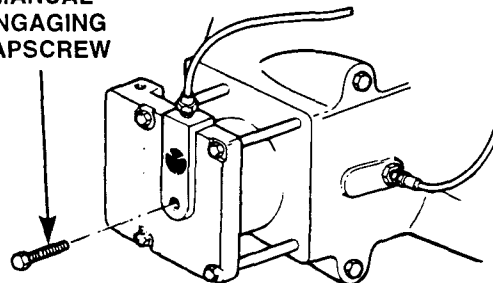
Manual Engaging Method:

- a. Install the manual engaging capscrew into the threaded hole in the center of the cylinder cover. **Figure 159.**

Figure 159

BOLT-ON DCDL SHIFT ASSEMBLY

MANUAL
ENGAGING
CAPSCREW



CAUTION

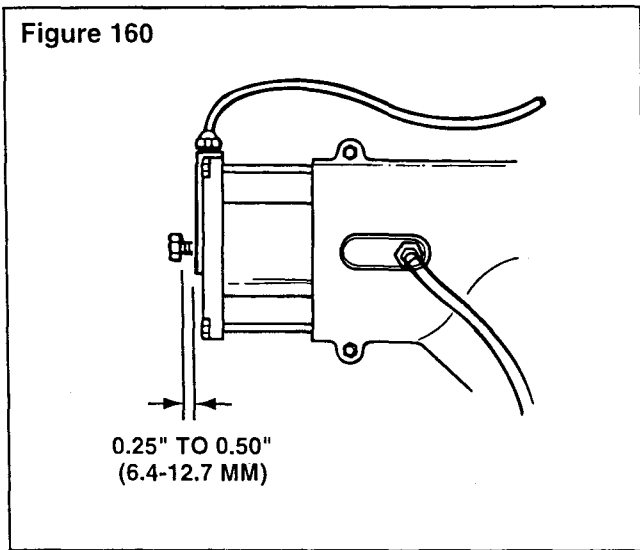
When you turn the capscrew in step b and you feel a high resistance, STOP TURNING THE CAPSCREW. A high resistance against the capscrew indicates that the splines of the shift collar and differential case are not aligned. Damage to the threads of the cylinder cover and capscrew will result. To align the splines, continue with steps c, d and e.

- b. Turn the capscrew to the right until the head is approximately 0.25 to 0.50 inch (6.4-12.7 mm) from the cylinder cover. The capscrew is now in the service position and the main differential is locked (engaged). **Figure 160.** When turning the capscrew you will feel a small amount of resistance. This is normal. If you feel a high resistance before achieving the 0.25 to 0.50 inch distance between the capscrew head and cylinder, **stop turning the capscrew** and continue with steps c, d and e.

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Figure 160



- c. Rotate the main driveline or the IAD a small amount by hand.
 - d. Turn the manual engaging capscrew again to the right. If you still feel a high resistance, **stop turning the capscrew**.
 - e. Repeat steps **c** and **d** until you feel a low resistance on the capscrew. Continue with step **b**.
12. Remove the remaining axle shaft(s) from the axle(s) that will remain on the road when the vehicle is transported. Follow steps 5 through 8, pages 82 and 83.
 13. Install a cover over the open end of each hub where an axle shaft was removed. This will prevent dirt from entering the bearing cavity and loss of lubricant.

NOTE:

If an air supply will be used for the brake system of the transported vehicle, continue with steps 14 and 15, otherwise continue with step 16.

14. Connect an auxiliary air supply to the brake system of the vehicle that is being transported. Before moving the vehicle, charge the brake system with the correct amount of air pressure to operate the brakes. Refer to the instructions supplied by the manufacturer of the vehicle for procedures and specifications. If an auxiliary air supply is not used, continue with step 16.
15. When the correct amount of air pressure is in the brake system, release the parking brakes of the vehicle that is being transported. Step 16 is not required.



WARNING

When you work on a spring (parking) brake, carefully follow the service instructions of the chamber manufacturer to manually compress the spring. Sudden release of a compressed spring can cause serious personal injury.

16. If there are spring (parking) brakes on the axle(s) that will remain on the road when the vehicle is transported, and they cannot be released by air pressure, manually compress and lock each spring so that the brakes are released. Refer to the manufacturer's instructions.

After Towing or Drive-Away



WARNING

- *To prevent serious eye injury, always wear safe eye protection when performing vehicle maintenance or service.*
- *Do not work under a vehicle unless the parking brake is engaged. The vehicle can move and cause serious personal injury if the parking brake is not applied before maintenance tasks are begun.*

1. If an auxiliary air supply was used, apply the vehicle parking brakes using the switch inside the cab of the vehicle. If an auxiliary air supply was not used, begin with step 2.



WARNING

When you work on a spring (parking) brake, carefully follow the service instructions of the chamber manufacturer to manually release the spring. Sudden release of a compressed spring can cause serious personal injury.

2. Apply the vehicle spring (parking) brakes by manually releasing each spring that was compressed before transporting started. Refer to manufacturer's instructions.

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3. Disconnect the auxiliary air supply, if used, from the brake system of the vehicle that was transported. Connect the vehicle's air supply to the brake system.
4. Remove the covers from the hubs.

NOTE:

Install only the axle shaft(s) shown in Chart 13 at this time. These axle shafts have a double row of splines that engage with splines of the side gear and shift collar in the main differential. Continue with step 5. Figure 161.

Chart 13

Single Axles

Install the right-hand (curb side) axle shaft

Tandem Axles

Forward Axle:

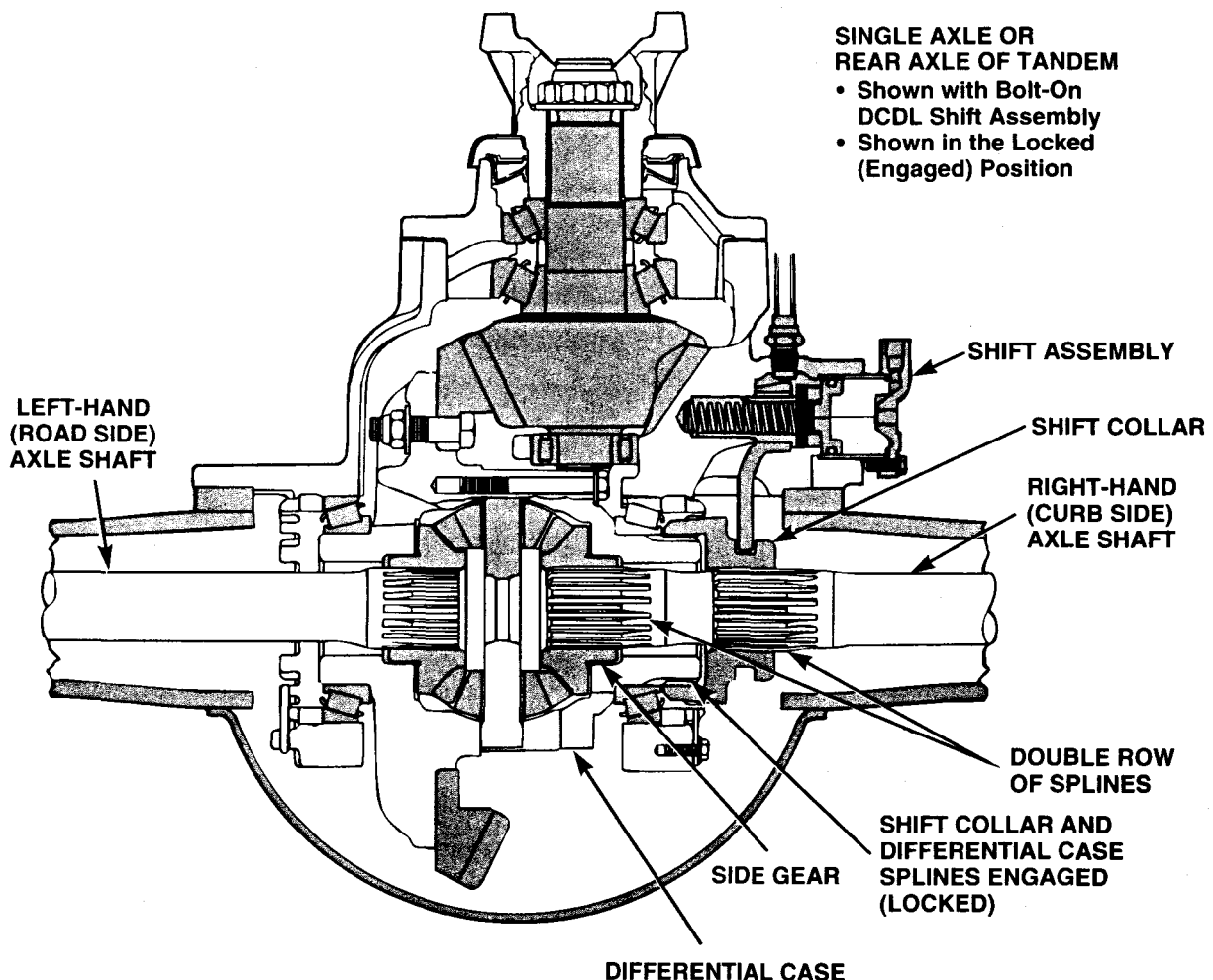
Install the left-hand (road side) axle shaft

Rear Axle:

Install the right-hand (curb side) axle shaft

5. Install the gasket, if used, and axle shaft into the axle housing and carrier in the same location it was removed from. The gasket and flange of the axle shaft must be flat against the hub. Rotate the axle shaft and/or the driveline as necessary to align the splines and the holes in the flange with the studs in the hub. **Figure 155**, page 82.

Figure 161






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6. Install the dowels, if used, over each stud and into the tapered holes of the flange.
7. Install the washers and capscrews or stud nuts. Determine the size of the fasteners and tighten the capscrews or nuts to the corresponding torque value shown in **Chart 14** below.

Chart 14

	Thread Size	Torque Value lb-ft (N•m) 
Capscrews:	0.31"-24	18 to 24 (24-33)
	0.50"-13	85 to 115 (115-156)
Stud Nuts: (plain nuts)	0.44"-20	50 to 75 (68-102)
	0.50"-20	75 to 115 (102-156)
	0.56"-18	110 to 165 (149-224)
	0.62"-18	150 to 230 (203-312)
	0.75"-16	310 to 400 (420-542)
(lock nut)	0.44"-20	40 to 65 (54-88)
	0.50"-20	65 to 100 (88-136)
	0.56"-18	100 to 145 (136-197)
	0.62"-18	130 to 190 (176-258)
	0.75"-16	270 to 350 (366-475)

8. Unlock (disengage) the DCDL by removing the manual engaging capscrew from the shift assembly.
9. Install the manual engaging capscrew into the storage hole. The storage hole of bolt-on DCDL shift assemblies is located in the top side of the shift cylinder cover. Tighten to 15 to 25 lb-ft (20-35 N•m). **Figure 158**, page 83. 
10. Remove the plug and gasket from the storage hole. Install the plug and gasket into the threaded hole in the center of the shift cylinder cover. Tighten from 15 to 25 lb-ft (25-30 N•m). 
11. Install the remaining axle shaft into the axle housing and carrier. Follow steps 5 through 7, pages 86 and 87.
12. Inspect the lubricant level in the axles and hubs where the axle shafts were removed. Add the correct type and amount of lubricant if necessary. For information about lubrication, refer to the Rockwell Maintenance Manual, MM No. 1, Lubrication, or refer to the Lubrication Section of the Rockwell Maintenance Manual for the axle model you are working with.

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Vehicle Towing Instructions

TYPE OF AXLE:

- SINGLE AXLE, without Driver Controlled Main Differential Lock (DCDL)
- TANDEM AXLE, without Driver Controlled Main Differential Lock (DCDL), with Inter-Axle Differential (IAD)

These instructions are for vehicles equipped with Rockwell single or tandem rear drive axles.

The instructions supersede all other instructions for the purpose of transporting vehicles for service or new vehicle drive-away dated before April 1995, including those contained in Rockwell Maintenance Manuals.

When transporting a vehicle with the wheels of one or both drive axles on the road, it is possible to damage the axles if the wrong procedure is used before transporting begins. Rockwell recommends that you use the following procedure.

Before Towing or Drive-Away



WARNING

To prevent serious eye injury, always wear safe eye protection when performing vehicle maintenance or service.



WARNING

Do not work under a vehicle unless the parking brake is engaged. The vehicle can move and cause serious personal injury if the parking brake is not applied before maintenance tasks are begun.

1. Apply the vehicle parking brakes using the switch inside the cab of the vehicle.

NOTE:

Single Axle continue with step 5. Tandem Axle continue with step 2.

2. Shift the transmission into neutral and start the vehicle's engine.
3. Shift the IAD to the unlocked (disengaged) position using the switch inside the cab of the vehicle. The indicator light in the cab will go off.
4. Stop the engine.

NOTE:

Remove both axle shafts from the axle(s) that will remain on the road when the vehicle is transported. Continue with step 5 for both axle shafts.

5. Remove the stud nuts or capscrews and the washers from the flange of the axle shaft. Figure 162.

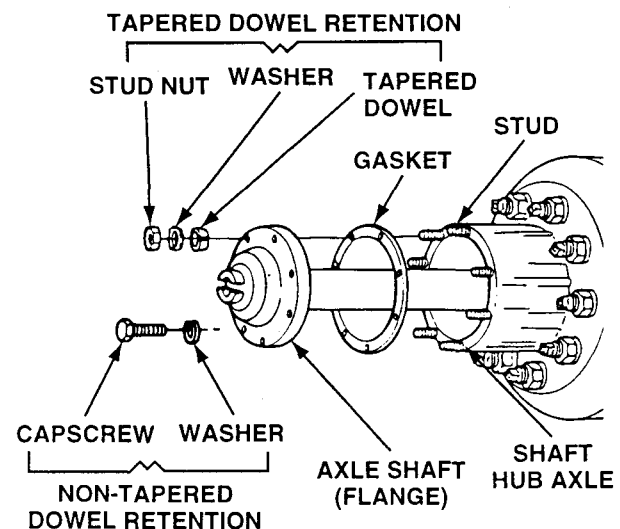


CAUTION

Do not use a chisel or wedge to loosen the axle shaft and tapered dowels. Using a chisel or wedge can result in damage to the axle shaft, the gasket and seal, and/or the axle hub.

6. Loosen the tapered dowels, if used, in the flange of the axle shaft using one of the two following methods. Figure 162.

Figure 162



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Brass Drift Method:

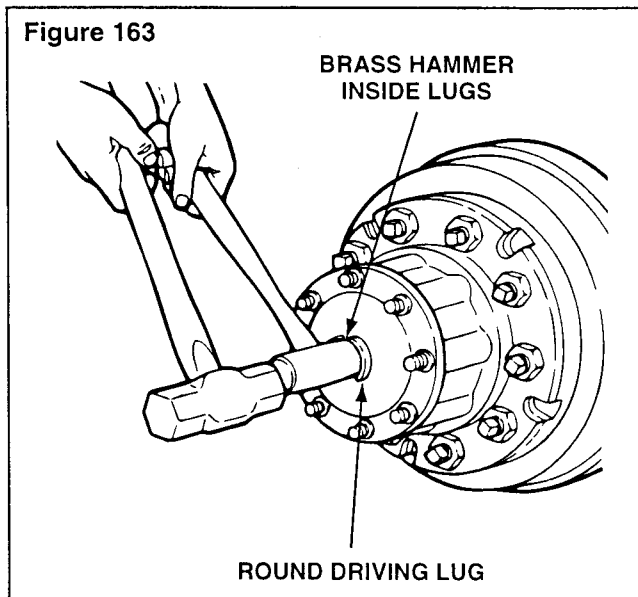
WARNING

Wear safe eye protection. Do not directly strike or hit the round driving lugs on the flange of the axle shaft. Striking the lugs can cause them to break off from the axle shaft hub resulting in serious personal injury.

NOTE:

A 1.5 inch (38.1 mm) diameter brass hammer can be used as a drift.

- a. Hold a 1.5 inch (38.1 mm) diameter brass drift against the center of the axle shaft flange, *inside the round driving lugs*. **Figure 163.**



- b. Hit the end of the drift with a large hammer (5 to 6 lbs, 2 to 3 kg) to loosen the axle shaft and tapered dowels from the hub. **Figure 163.**

Air Hammer Vibration Method:

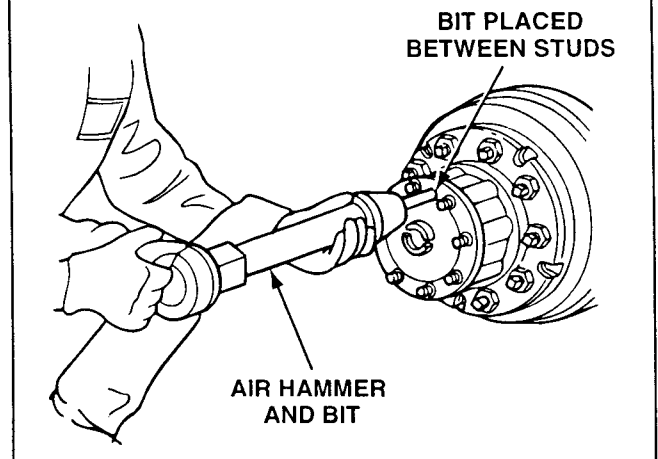
WARNING

Wear safe eye protection when using an air hammer. Power tools and components can loosen and break and cause serious personal injury.

- a. Use an air hammer, such as Chicago Pneumatic CP-4181-PULER, or equivalent, with a round hammer bit to loosen the axle shaft and dowels.

- b. Place the round hammer bit against the axle shaft flange between the studs, at different points around the flange. Operate the air hammer at each location and loosen the axle shaft and tapered dowels from the hub. **Figure 164.**

Figure 164



7. Identify each axle shaft that is removed from the axle assembly so they can be installed in the same location after transporting or repair is completed. (Example: Match mark a mating axle shaft and hub.)
8. Remove the tapered dowels, gasket (if used) and the axle shaft from the axle assembly. **Figure 162,** page 88.
9. Install a cover over the open end of each hub where an axle shaft was removed. This will prevent dirt from entering the bearing cavity and loss of lubricant.

NOTE:

If an air supply will be used for the brake system of the transported vehicle, continue with step 10 and 11, otherwise continue with step 12.

10. Connect an auxiliary air supply to the brake system of the vehicle that is being transported. Before moving the vehicle, charge the brake system with the correct amount of air pressure to operate the brakes. Refer to the instructions supplied by the manufacturer of the vehicle for procedures and specifications. If an auxiliary air supply is not used, continue with step 12.
11. When the correct amount of air pressure is in the brake system, release the parking brakes of the vehicle that is being transported. Step 12 is not required.

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Vehicle Towing Instructions

WARNING

When you work on a spring (parking) brake, carefully follow the service instructions of the chamber manufacturer to manually compress the spring. Sudden release of a compressed spring can cause serious personal injury.

12. If there are spring (parking) brakes on the axle(s) that will remain on the road when the vehicle is transported, and they cannot be released by air pressure, manually compress and lock each spring so that the brakes are released. Refer to the manufacturer's instructions.

After Towing or Drive-Away

WARNING

To prevent serious eye injury, always wear safe eye protection when performing vehicle maintenance or service.

WARNING

Do not work under a vehicle unless the parking brake is engaged. The vehicle can move and cause serious personal injury if the parking brake is not applied before maintenance tasks are begun.

1. If an auxiliary air supply was used, apply the vehicle parking brakes using the switch inside the cab of the vehicle. If an auxiliary air supply was not used, begin with step 2.

WARNING

When you work on a spring (parking) brake, carefully follow the service instructions of the chamber manufacturer to manually release the spring. Sudden release of a compressed spring can cause serious personal injury.


2. Apply the vehicle spring (parking) brakes by manually releasing each spring that was compressed before transporting started. Refer to manufacturer's instructions.
3. Disconnect the auxiliary air supply, if used, from the brake system of the vehicle that was transported. Connect the vehicle's air supply to the brake system.
4. Remove the covers from the hubs.

NOTE:

Continue with steps 5 through 7 to install all axle shafts.

5. Install the gasket, if used, and axle shaft into the axle housing and carrier in the same location it was removed from. The gasket and flange of the axle shaft must be flat against the hub. Rotate the axle shaft and/or the driveline as necessary to align the splines and the holes in the flange with the studs in the hub. **Figure 162**, page 88.
6. Install the dowels, if used, over each stud and into the tapered holes of the flange.
7. Install the washers and capscrews or stud nuts. Determine the size of the fasteners and tighten the capscrews or nuts to the corresponding torque value shown in **Chart 15** below.

Chart 15

	Thread Size	Torque Value lb-ft (N•m) 
Capscrews:	0.31"-24	18 to 24 (24-33)
	0.50"-13	85 to 115 (115-156)
Stud Nuts: (plain nuts)	0.44"-20	50 to 75 (68-102)
	0.50"-20	75 to 115 (102-156)
	0.56"-18	110 to 165 (149-224)
	0.62"-18	150 to 230 (203-312)
	0.75"-16	310 to 400 (420-542)
(lock nut)	0.44"-20	40 to 65 (54-88)
	0.50"-20	65 to 100 (88-136)
	0.56"-18	100 to 145 (136-197)
	0.62"-18	130 to 190 (176-258)
	0.75"-16	270 to 350 (366-475)

8. Inspect the lubricant level in the axles and hubs where the axle shafts were removed. Add the correct type and amount of lubricant if necessary. For information about lubrication, refer to the Rockwell Maintenance Manual, MM No. 1, Lubrication, or refer to the Lubrication Section of the Rockwell Maintenance Manual for the axle model you are working with.